RAM R-200

Ruggedized Multi-Purpose Survey Meter

Basic Model

Operating Manual

Version 3.1 – October 2009
Document # PRIR73D0.DOC

Rotem Industries Ltd
Health Physics Instrumentation Dept.
Rotem Industrial Park
Mishor Yamin D.N Arava 86800 Israel
Tel. +972 8 656 4780/1 | Fax. +972 8 657 3252
Mail: sales@rotemi.co.il

ROTEM
Rotem Industries Ltd רותם תעשיות בע"מ
www.rotemi.co.il

רותם תעשיות בע"מ
בקרת קרינה
פארק תעשיות רותם
מישור ימין ד.נ. ערבה 86800
טל. 08 656 4780/1 | פקס. 08 657 3252
דוא"ל: sales@rotemi.co.il

Version / Revision Log for RAM R-200 / Operating Manual – Basic Model

Ver. / Rev.	Date	Revised Pages	Comments
1.0	November 2000		Doc. # PRIR73D0.DOC based on: a. PRIR51D9.DOC, ver 2.0-June 2000 b. DERA9912.DOC, Hebrew version Addition of **firmware option** in sections:
		14, 15, 16	3.14, 3.15, 3.16 and "Isoplates" in sec. 3.13
2.0	April 2001	1-3	Updated version, this log, table of contents
		all sections	Addition of PA-100M detector. Update of sections:
		12	3.2 - Battery Compartment
		13	3.6 – Audible Announcements
		13	3.8 – Alarms, 3.8f- Hardware fail- deleted
		21-22	Relocation: 3.14 → 3.17, 3.16 → 3.18
2.1	July 2002	all pages	Addition of RG-10 detector + updated corrections
3.0	March 2003	all pages	Updated version, this log, table of contents Addition of RMC (chap.4), RMV (chap.5), Configuration software (chap.6), Telescopic rod usage (3.17)
3.1	October 2009		RG42, RG10a

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

Table of Contents

1. General Description

1.1. The RAM R-200 System

RAM R-200 is a portable gamma survey meter designed for measuring wide-range gamma radiation fields. Measurements are performed by an internal detector containing two energy compensated GM tubes and four external probes: for beta/gamma contamination (**RG-12 or RG-10**), for high gamma radiation fields (**RG-40**) and for alpha contamination **(PA-100M)**. The **RAM R-200** can be used with a four-segment sturdy telescopic rod for monitoring with the external gamma probes.

The **RAM R-200** meter and its external detectors include embedded microprocessors, data memory, and data communication. An audible announcement is activated either by frequency fluctuations in accordance with the field strength or chirp for each measured pulse. The **RAM R-200**'s auto-ranging meter utilizes a combination display consisting of a smoothed digital readout for minimum fluctuations, and a two-decade analog bar graph for fast response.

1.2. The System Components

RAM R-200 Meter

- Meter
- Meter's carrying bag
- Carrying strap for meter or carrying bag

RAM R-200 system storage case

External Detectors

- RG-40, for γ fields
- RG-12, for β γ contamination fields
- RG-10, for β γ contamination fields
- PA-100M, for α contamination

Telescopic rod

- Short rod, 50 cm to 150 cm
- Long rod, 95 cm to 330 cm

Accessories

- Detector tester Model A-0070
- Meter lead attenuator
- RG-12, beta absorption plate
- RG-12, rubber cover
- RG-12, directive collimator

Cables

- Meter to detector
- Meter to PC
- Detector to PC adapter
- PA-100M to telescopic rod

System storage cases

- Pelican 1400 for meter and detector
- Pelican 1500 for meter and three detectors
- Pelican 1520 for meter, three detectors, and short telescopic rod
- SKB for meter, three detectors, and long telescopic rod

1.3. Future optional accessories

- Bar-code laser scanner
- GPS (Global Positioning System)
- Ruggedized (sealed, water-proof) probe for detecting contamination in liquids
- SMARTS compatible
- Wireless communication
- VMS–2000, a RAM R-200 based mobile radiation monitoring system.

1.4. RAM R-200 Meter

The **RAM R-200** meter is designed to monitor gamma radiation fields in the range of 0.1 μSv/h to 1 Sv/h (10 μR/h to 100 R/h). The meter includes: an internal probe, micro-processor based electronic card, touch panel with operating push-buttons, digital and analog bar-graph display (LCD), connector for PC and/or external detector connection, battery compartment and 9V battery connector.

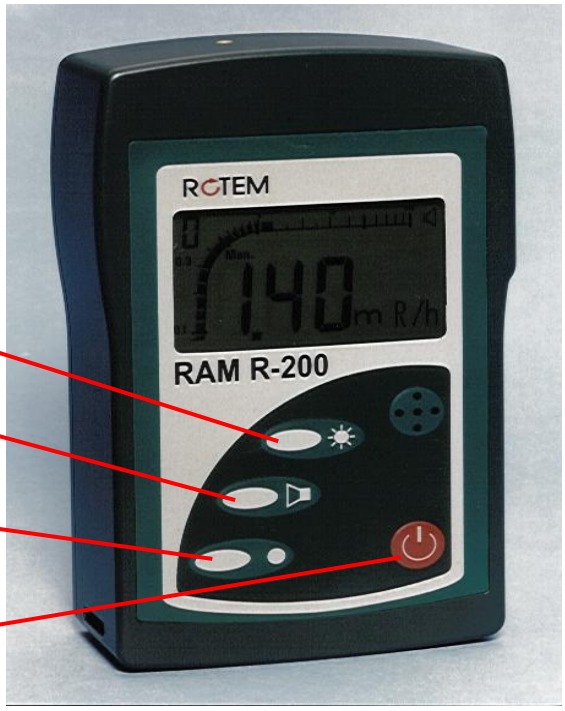
The meter is operated by four push-buttons:

ON/OFF

SPEAKER – audible alarm

LIGHT – display illumination

MODE – selects operation status



1.5. RG-40

The RG-40 external detector is designed for monitoring gamma fields in the range of 1mSv/h to 100 Sv/h (100 mR/h to 10000 R/h). The detector includes a 4G60M GM tube.
The electronic board contains: DC power supply, high voltage power supply, output signal processing circuit, microprocessor circuit, detector pulses, real time counters, operation status, and RS-232 communication adapter. Radiation measurement and Geiger status are transmitted via RS-232 communication channel to the RAM R-200 meter or to a PC.

1.6. RG-10, RG-10 and RG10A

The **RG-12** external detector is designed for monitoring beta-gamma contamination surfaces in the range of 1 ÷ 16,666 cps (1 ÷999 Kcpm). The detector is based on LND7231 End Window GM tube, effective area 6.4 cm², density 1.5/2.0 mg/ cm².

The **RG-10** external detector is designed for monitoring beta-gamma contamination surfaces in the range of 1 ÷ 16,666 cps (1 ÷999 Kcpm). The detector is based on NRC2006 Pancake GM tube, effective area 15.5 cm², density 1.5/2.0 mg/ cm².

The electronic board contains: DC power supply, high voltage power supply, detector output signal processing circuit, microprocessor circuit, detector pulses and real time counters, operation status circuit and RS-232 communication adapter.
The contamination measurement and the Geiger status are transmitted via RS-232 communication channel to the RAM R-200 meter or to a PC.

RG10A same specification as **RG10** but detector located at 30^0 from handl

1.7. RG-42

The **RG-42** external detector is designed for monitoring gamma radiation in the range of 0.01mR/h to 999mR/h. The detector is based on ZP1201-1202 GM tube.

The electronic board contains: DC power supply, high voltage power supply, detector output signal processing circuit, microprocessor circuit, detector pulses and real time counters, operation status circuit and RS-232 communication adapter.
A RS-232 communication channel use to communicate between detector to meter or detector to PC.

1.8. RP-11

The **RP-11** external detector is designed for monitoring high energy gamma radiation in the range of 0 to 50,000 cps . The detector is based on PMT and CsI 2"*2" SCINTLATOR.

The electronic board contains: DC power supply, high voltage power supply, detector output signal processing circuit, microprocessor circuit, detector pulses and real time counters, operation status circuit and RS-232 communication adapter.
A RS-232 communication channel use to communicate between detector to meter or

1.9. PA-100M

The PA-100M external detector is designed for surface monitoring of alpha contamination in the range of 0 to 50,000 cps. The detector has low background count-rate and is easy to decontaminate.
The electronic board contains: DC power supply, high voltage power supply, detector output signal processing circuit, microprocessor circuit, detector pulses and real time counters, operation status circuit and RS-232 communication adapter.
The sensor is a 100 cm^2 sensitive area atmospheric cell, made of aluminum, containing a thin anode wire. The cell surface is a 0.85 mg/cm^2 membrane of aluminized mylar, protected by a fine stainless-steel wire mesh. The cell holds a replaceable cartridge filled with hygroscopic silica gel for the reduction of humidity in the sensor. The proximity of the sensor and electronic circuits in the detector case results in an excellent signal-to-noise ratio.

The detector is protected against shock, vibration and humidity by a rugged aluminum casing. In order to prevent damage to the detector when working in contaminated areas, insert the open window plastic cover on the detector's bottom.

1.10. Telescopic rod

The telescopic rod enables monitoring of gamma radiation fields at hard to reach places, or in sites where the operator has to be at a safe distance from the measuring point. The rod includes a detector connector and mechanical fastening nut for the detector at its end. The rod also obtains an adequate RAM R-200 holder and a connector output for connecting to the meter's standard output. A curled cable within the rod transfers power supply and RS-232 communication between meter and detector.

Two types of telescopic rods are available:

- Short rod, 50 cm to 150 cm
- Long rod, 95 cm to 330 cm

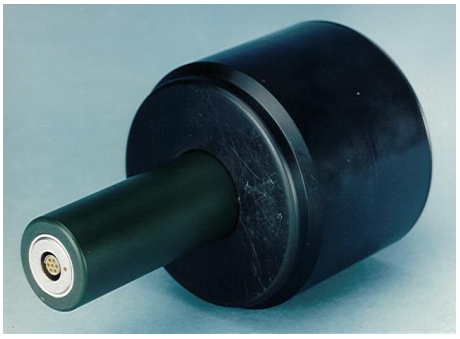
1.11. Lead attenuator

When using the RAM R-200 for monitoring gamma radiation, a lead attenuator can be placed on the meter's top to check the radiation direction.

1.12. Lead Collimator

When using the GM-12 for monitoring beta and gamma contamination, a lead collimator can be placed on the detector's top to check the contamination direction.

The collimator blocks 85% of the Eγ 662 keV energy source (^{137}Cs).



2. Technical Data

2.1. Meter + Internal Detector

Counting tubes*	ZP-1201, ZP-1313
Measuring range	0.1 μSv/h to 1 Sv/h 10 μR/h to 100 R/h
Energy range	60 to 1500 keV
Sensitivity	17 cps/mR*h^{-1} (ZP1201) 1.4 cps/mR*h^{-1} (ZP1313)
Accuracy	±10 % of reading, within the measuring range
Data logging	999 data records
Display	DigiLog (3 digits and 2 decades of analog bar-graph) Four Push-buttons: On/off, Light, Speaker, Mode
Measuring units	Sv/h, Sv, cpm, counts (R/h, R, cps - optional)
Power source	One 9-Volt alkaline cell 100 hours of continuous operation
Temperature range	Operation: -30°C to + 60°C (-22°F to 140°F) Storage: -30°C to + 70°C (-22°F to 158°F)
Humidity range	10% to 95% RH (non condensing)
Casing	Seawater resistant aluminum alloy, shock resistant
Dimensions	Length: 134 mm (5.3") Width: 80 mm (3.2") Height: 35 mm (1.4")
Weight	480 gr (1.06 lbs) (incl. cell)

Telescopic rod Length	**Long Rod**	**Short Rod**
Extended	Up to 330 cm (10.82 ft)	Up to 150 cm (4.91 ft)
Collapsed	Down to 95 cm (3.11 ft)	Down to 50 cm (1.64 ft)
Weight	1300 gr (2.9 lbs)	1000 gr (2.2 lbs)

Inputs / Outputs	FISHER connector type, DEE 103 A057 Communication between meter and external detectors Communication between meter or external detectors to PC

*For ambient dose equivalent mode the meter may be ordered with ZP1202 and ZP1314.

2.2. External Detectors

2.2.1. RG-40 (γ)

Counting tube	4G-60M
Measuring range	1 mSv/h to 100 Sv/h 100 mR/h to 10000 R/h
Energy range	60 to 1500 keV
Sensitivity	70 cps/mR∗h^{-1} (4G60M)
Temperature range	Operation: -30°C to + 60°C (-22°F to 140°F) Storage: -30°C to + 70°C (-22°F to 158°F)
Humidity range	10% to 95% RH (non condensing)
Casing	Aluminum, splash proof
Dimensions	Length: 152.5 mm (6.0") Width: ϕ30 mm (1.2")
Weight	190 gr (0.42 lbs)

RG-12 (α β γ)

Counting tube	LND 7231 (End Window)
Measuring range	1 to 16,666 cps
Energy range	E (β) > 200 keV
Sensitivity	β (^{90}Sr/ ^{90}Y) 2cps/Bqcm^{-2} γ (^{60}Co) 25 cps/ mRh^{-1}
Temperature range	Operation: -30°C to + 60°C (-22°F to 140°F) Storage: -30°C to + 70°C (-22°F to 158°F)
Humidity range	10% to 95% RH (non condensing)
Casing	Aluminum, splash proof
Dimensions	Length: 165 mm (6.5") Width: ϕ40 mm (1.6")
Weight	210 gr (0.46 lbs)

RG-10 (α β γ)

Counting tube	NRC 2006 (Pancake)

Measuring range	1 to 16,666 cps
Energy range	E (β) > 200 keV
Sensitivity	β (^{90}Sr/ ^{90}Y) 8.5 cps/Bqcm^{-2}
	γ (^{60}Co) 57 cps/ mRh^{-1}
Temperature range	Operation: -30°C to + 60°C (-22°F to 140°F)
	Storage: -30°C to + 70°C (-22°F to 158°F)
Humidity range	10% to 95% RH (non condensing)
Casing	Aluminum, splash proof
Dimensions	Length: 180 mm (7.2")
	Width: ϕ60 mm (2.4")
Weight	367 gr (0.67 lbs)

PA-100M (α)

Sensitive area	100 cm² (15.5 sq in)
Window thickness	0.85 mg/ cm^2 aluminized mylar
Probe efficiency (2π)	18%
Surface sensitivity ^{241}Am *	530 cpm per Bq/ cm²
Accuracy ^{241}Am	±15% of reading
Maximal count rate	3 x 10^6 cpm
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	Aluminum, splash proof
Dimensions	Length: 240 mm (9.5")
	Width: 75 mm (3")
	Height: 55 mm (2.2")
Weight	1000 gr (2.2 lbs)

***** The meter compensates the reading to 100%. The surface sensitivity, using a large area homogeneous ^{241}Am source, should be approximately 3000 cpm per Bq/ cm².

3. Operating Instructions

3.1. Starting-up

Press the **ON/OFF** push-button. When the meter is turned on, it carries out a short self-test procedure.

Data is displayed in the following sequence:

- all the segments are illuminated
- battery voltage value
- rate threshold value of internal detector
- dose threshold value of internal detector

Now the meter enters into the measuring mode. Ensure that the detector identification number appearing on the upper left side of the display and the measuring unit are adequate to the connected detector.

3.2. Battery Compartment

The battery compartment is located on the meter's back. To replace the battery untighten the two screws placed on the battery compartment cover until it is released, remove the cover, hold the meter with one hand (the battery faces upwards) and turn it down into your other hand palm, the battery comes out easily. Insert a new 9V alkaline battery in the right direction. The battery voltage is displayed each time the meter is turned on.

3.3. Measurements Display

Readings are displayed in digital and analog mode. The ranges in the bar graph are changed automatically and the units displayed correspond to both, the digital and analog display. The digital measurement is displayed by 3 digits and a decimal point.

If the reading is lower than the measuring range, the digital readout will blink on the display.

Connected det.#:
0 – internal det.
1 – RG-40
2 – RG-12
3 – RG-10
5 – PA-100M

Analog display

Digital display

Audible indication

Audible frequency relative to radiation field

Units

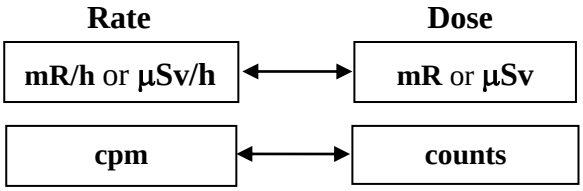
3.4. Display Illumination

To turn the light on/off perform a short press on the LIGHT push-button**.** After two minutes **t**he light turns off automatically.

3.5. Units Selection

The default unit for the internal detector and RG-40 is mR/h (μSv/h). A short press on the MODE push-button changes the unit to mR.

The default unit for RG-12, RG-10 and PA-100M is cpm (cps). Pressing on the MODE push-button changes the units to counts.



3.6. Audible Announcements

There are two kinds of audible announcements:

1. ***Audible frequency relative to the radiation field***. The first press on the SPEAKER push-button causes an automatic adaptation of the audible frequency to the human hearing. The second press on the SPEAKER push-button turns the audible announcement off.
2. ***Audible beeps relative to the radiation field***. A press on the SPEAKER push-button toggles the audible announcement on and off.

When the meter is turned on, the active audible announcement selection depends on the default set on the configuration software. Pressing the SPEAKER push-button during 3 seconds switches between the two audible announcements. Each push-button press is accompanied by an audible beep.

In case of threshold or failure alarms the audible alarm will be activated. To mute the audible alarms press the SPEAKER push-button.

3.7. Threshold

The meter memory includes two threshold values for the internal Geigers, one for accumulated dose and the other for dose rate, and a threshold value for each external detector. Each threshold value can be set via the PC configuration software.

3.8. Alarms

***a. Detector alarm*:**

The failure alarm is obtained in four cases:

1. Detector high voltage power supply is defective.
2. If an external detector is disconnected from the operating meter.
3. There are no pulse outputs from the active Geiger for long terms.
   Internal detector, RG-12, and RG-10: 90 seconds; RG-40: 15 minutes.
4. If during 30 seconds the meter switches between the internal high and the low Geigers five times successively.

In case of alarm, the **FAil** LCDs and the display illumination blink on the display, a continuous audible alarm is activated. To mute the audible alarm and stop the display illumination blinking, press the SPEAKER push-button.

***b. Battery alarm*:** If battery voltage decreases below 6.5V, the battery icon & the display illumination will blink on the display, and a continuous audible alarm will be activated.
To mute the audible alarm and stop the display illumination blinking, press the SPEAKER push-button.

c. Overflow alarm: If the meter's reading is above the meter/detector (software) maximum measuring range, or if the detector/meter is in a higher radiation field than its the measuring capacity (hardware), the **OFO** LCDs will be displayed.
If an external detector is connected and the overflow alarm is obtained, the identification number of the detector which measured the overflow will be displayed.

***d. Threshold alarm*:**

Threshold alarm for Dose Rate

If the Dose Rate reading exceeds threshold value, the **RATE ALARM** LCDs and the display illumination will blink on the display, and every other second an interrupted audible alarm will be activated.

Pressing the SPEAKER push-button mutes the audible alarm and stops the display illumination blinking. The **RATE ALARM** LCDs continue to be displayed until the reading decreases to 80% of the threshold value. If a threshold alarm is received and no acknowledgement is performed with the SPEAKER push-button, the alarms will not vanish even when the reading decreases under 80% of the threshold value.

Threshold alarm for Accumulated Dose

If the accumulated dose reading exceeds threshold value, the **DOSE ALARM** LCDs and the display illumination will blink on the display, and every other 100 msec an interrupted audible alarm will be activated.

Pressing the SPEAKER push-button mutes the audible alarm and stops the display illumination blinking. If the accumulated dose value increases above the set percentage, the audible announcement and display illumination alarms will be reactivated.

Disable / Enable Display of Accumulated Dose

With of the configuration software the user can set:

- Threshold dose value

- Disable / enable display of accumulated dose

In case the disable display dose is set, the meter does not display the dose value even if the MODE push- button is pressed. Nevertheless, the dose value is still updated. If the updated dose value is above the set threshold dose value, an audio/visual alarm will be activated.

Disable / Enable Rate Alarm

With of the configuration software the user can set:

- Threshold rate value

- Disable / enable rate alarm

In case the disable rate alarm is set and the rate value is above the set threshold rate value, a visual alarm will be activated but there will be no audio alarm.

e. Non-calibration Alarm

The calibration factors and calibration date are set via the PC calibration software. If the calibration date elapsed, a non-calibration alarm is activated each time the meter is turned on. The **CAL** LCDs and the display illumination will blink on the display, and a continuous audible alarm will be activated. To mute the alarm and enable display reading, press the SPEAKER push-button.

3.9. External Detectors

Four types of external detectors are available:

RG-12 for β γ contamination

RG-10 for β γ contamination

RG-40 for γ radiation

PA-100M for α contamination

a) Connect the detector to the meter via the detector cable. Beware to direct both red spots to the same position.

b) Turn the meter on. Data is displayed in the following sequence:
   - all the segments are illuminated
   - battery voltage value
   - rate threshold value of internal detector
   - dose threshold value of internal detector
   - detector threshold value

   Now the meter enters into the measuring mode.
   Ensure the detector identification number: "1" for RG-40, "2" for RG-12, "3" for RG-10, or "5" for PA-100M, appears on the upper left side of the display and the measuring unit is cpm.

c) Even when an external detector is connected to the meter, the meter still calculates the dose value of its internal Geigers.

d) The meter's alarm threshold is obtained even while the external detector is connected.

e) A long press on the MODE push-button enables the display of the internal detector reading. The reading is displayed while pressing the push-button.

f) RG-12 and RG-10 detectors monitor β and γ radiation. In order to block the beta radiation, use the beta absorption plate.

g) When RG-40 is connected to the meter, a short press on the MODE push-button displays the **meter's** dose value.

h) When RG-12, RG-10 OR PA-100 are connected to the meter, a short press on the MODE push-button will enter the COUNTS mode.

3.10. COUNTS Mode

a) To enter the COUNTS mode, press the MODE push-button. The cpm icon is deleted and the "COUNTS" icon is displayed. The LCDs show "0" and the bar-graph segments indicate the counting time in seconds. The audible beeps are activated.

b) To start counting press the SPEAKER push-button. The digital display is updated with the number of pulses received from the detector. The bar-graph segments indicate the rest of time left in seconds.

c) To stop the counting manually press the SPEAKER push-button. The meter calculates the counting from counts to cpm units and the result is displayed in the LCDs. The bar-graph segments indicate the rest of time left in seconds. The cpm icon is displayed.

d) The meter automatically stops the counting in two cases:

   1. When the count time reaches zero (default = 100 seconds).
   2. When the count result reaches the preset count value (default = 100 pulses).

   The meter calculates the counting from counts to cpm units and the result is displayed in the LCDs. The bar-graph segments indicate the rest of time left in seconds. The cpm icon is displayed.

e) To restart counting press the SPEAKER push-button.

f) To exit the COUNTS mode press the MODE push-button.

3.11. Measuring Data Storage

The meter has an internal memory that enables the storage of up to 999 records. A long press of about 3 seconds on the LIGHT push-button stores the record in memory and the left memory space is displayed. The long push-button pressing is accompanied by two beeps. The data record includes: displayed measured value, unit, detector identification number, date and time. To display the stored records and clear memory, see special functions.

3.12. Training Mode

This mode target is to train RAM R-200 operators in simulated high radiation fields, using low radiation sources. The configuration software enables entering the training mode and set a multiplication factor in order to increase artificially the meter readings. When the meter is in the training mode the **T** icon blinks alternately with the detector identification number.

Canceling of this mode can be performed in two ways:

1. Using the configuration software.
2. Using the Special Functions mode.

3.13. Flags (Isoplates) Mode

The configuration software can set ten measuring ranges (10 Isoplate points). Pressing a short press on the SPEAKER and MODE push buttons simultaneously performs the Enter/Exit Flags (Isoplates) Mode. When entering this mode, each Isoplate point value is displayed during two seconds. The Isoplate point number is displayed on the upper left corner of the display (instead of the detector number).

The first measuring range is from background reading to the first Isoplate point. The second measuring range is from the first Isoplate point to the second Isoplate point and so on. If the measured radiation increases from a lower range to a higher range, the up-wards arrow blinks on the display accompanied by three beeps. If the measured radiation decreases from a higher range to a lower range, the down-wards arrow blinks on the display accompanied by one beep and the activated Isoplate point number is displayed on the upper left corner of the display (instead of the detector number).

3.14. Push-buttons Function

Definitions:

Short press - Press a push-button and release within 2 seconds.

Long press - Press a push-button and hold at least for 2 seconds

Each press is accompanied by an audible beep.

Function	**Pressing mode**	**Push-buttons**
Meter on/off.	Short	ON/OFF
Meter - switches between rate and dose RG-12, RG-10, PA-100 - switch between rate and count RG-40 - switches between rate and meter's dose	Short	MODE
Speaker on/off	Short	SPEAKER
Light on/off	Short	LIGHT
Switches to internal detector when external detector is connected.	Long	MODE
Beeps or frequency audible indications	Long	SPEAKER
Stores the record.	Long	LIGHT
Enters Special Functions (SFx)	Long Simultaneously	MODE & LIGHT
Enters Flags Mode	Short Simultaneously	MODE & SPEAKER
Transmits saved record to PC via wireless communication (option – special firmware)	Short Simultaneously	LIGHT& SPEAKER

3.15. Special Functions

The Special Functions mode enables the operator to read data from the meter's memory and reset its parameters. This can be manually performed by the meter's push-buttons, see **Special Functions Flow Chart** following on.

RAM R-200 contains four types of Special Functions:

SF1 - Read and reset the data records stored in the meter's memory.

SF2 - Read and reset the accumulated dose value.

SF3 - Cancel training mode.

SF4 - Reset data records stored in the meter's memory, reset accumulated dose value, cancel training mode.

a) SF1 - Read and reset the data records

The meter has an internal memory that enables the storage of up to 200 records. For more details see in section 3.11.

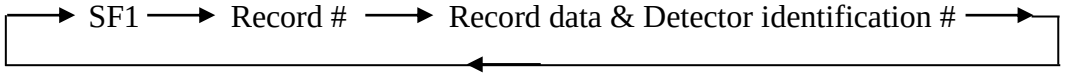
To read and reset the data records can be performed in two ways:

1. Via PC software.
2. Via SF1

To enter the SF1 mode, press the LIGHT and MODE push-buttons simultaneously during 5 seconds. The **S.F1** LCDs will be displayed instead of the measurement reading.

Read the data records

Each short press on the LIGHT push-button displays the data in the following sequence:



Reset the data records

A long press of about 3 seconds on the SPEAKER push-button displays the **S.F1** and **dEL** LCDs alternately. An additional short press on the SPEAKER push-button will reset the meter's memory.

Exiting the SF1 mode is performed either by turning the meter off or by four short pressings on the MODE push-button.

b) SF2 - Reset Dose

The accumulated dose value is kept in memory even if the meter has been turned off or if power has been lost. To reset the accumulated dose value perform the following steps:

To enter the SF2 mode, press the LIGHT and MODE push-buttons simultaneously during 5 seconds. The **S.F1** LCDs will be displayed instead of the measurement reading. An additional press on the MODE push-button will display the **S.F2** LCDs.

Display Dose Accumulated Value

A short press on the LIGHT push-button displays the dose accumulated value:

Reset the Dose Value

A long press of about 3 seconds on the SPEAKER push-button displays the **S.F2 & dEL** LCDs alternately. An additional short press on the SPEAKER push-button will reset the dose accumulated value.

Exiting the SF2 mode is performed either by turning the meter off or by three short pressings on the MODE push-button.

c) SF3 – Cancel Training Mode

Entering training mode is performed only through the configuration software.
Canceling of this mode can be performed in two ways:

1. Using the configuration software.
2. Using the Special Functions mode.

To enter SF3 mode, press the LIGHT and MODE push-buttons simultaneously during 5 seconds. **S.F1** LCDs will be displayed instead of the measurement reading. Two additional presses on the MODE push-button will display the **S.F3** LCDs.

Display Multiplying Factor

A short press on the LIGHT push-button displays the **Fxx** LCDs. The xx indicates the multiplying factor value:

Reset the Multiplying Factor

A long press of about 3 seconds on the SPEAKER push-button displays the **S.F3 & dEL** LCDs alternately. An additional short press on the SPEAKER push-button will reset the multiplying factor value and cancels the training mode.

Exiting the SF3 mode is performed either by turning the meter off or by two short pressings on the MODE push-button.

d) SF4 – Reset Data Records, Accumulated Dose Value and Cancel Training Mode

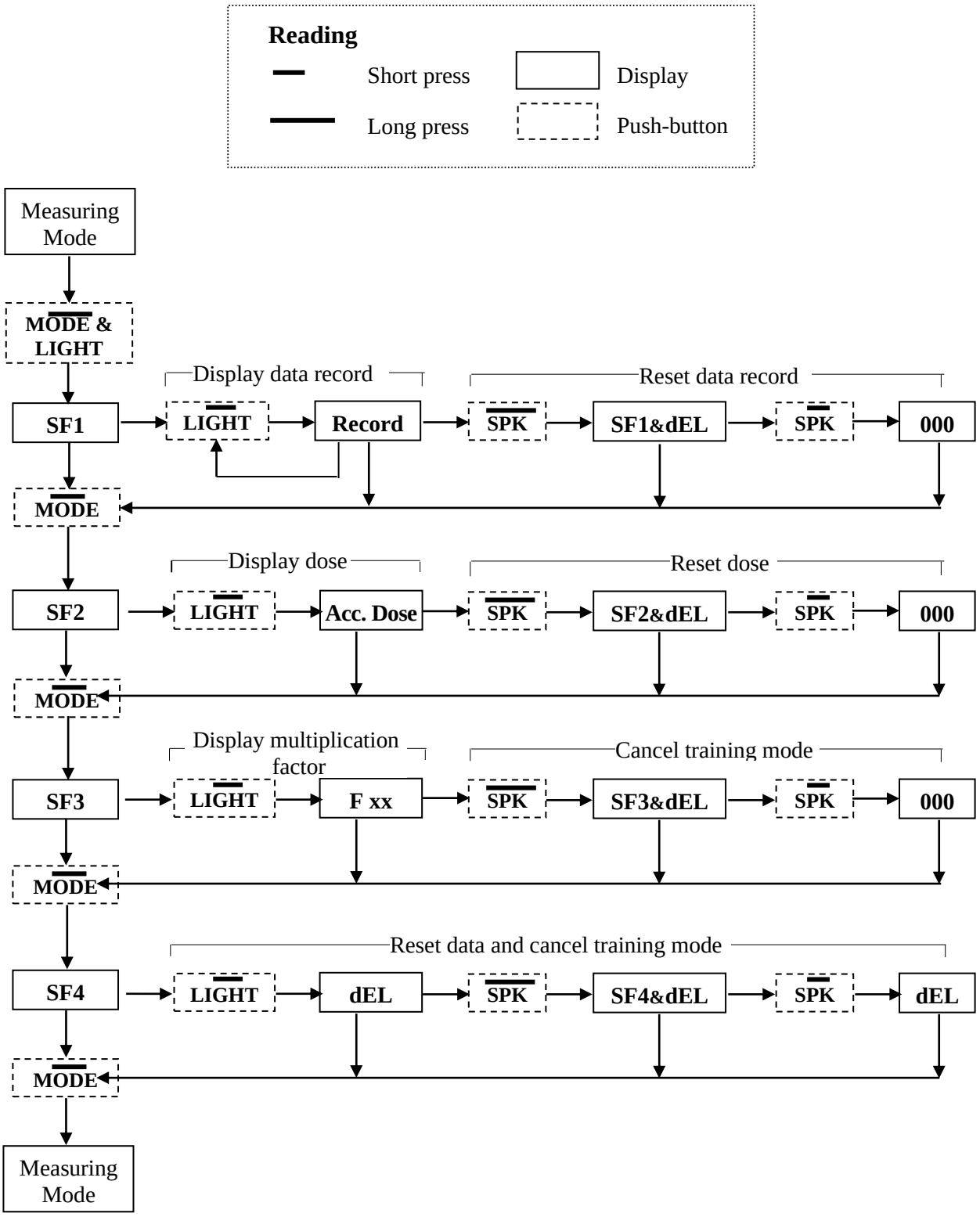
To enter the SF4 mode, press LIGHT and MODE push-buttons simultaneously during 5 seconds. The **S.F1** LCDs will be displayed instead of the measurement reading. Three additional presses on the MODE push-button will display the **S.F4** LCDs.

A short press on the LIGHT push-button displays the **dEL** LCDs.

A long press of about 3 seconds on the SPEAKER push-button displays the **S.F4 & dEL** LCDs alternately. An additional short press on the SPEAKER push-button will reset the data records, reset the accumulated dose and multiplying factor value and cancel training mode.

Exiting the SF4 mode is done either by turning the meter off or by a short press on the MODE push-button.

Special Functions Flow Chart



3.16. Detector Tester

The meter's and detectors' radiation response (not for calibration) can be checked by using the detector tester. The following readings are obtained with the detector tester:

RAM-R Meter	~60 μR/h
RG-12	~6.5 Kcpm
RG-10	~16 Kcpm
PA-100M	~1.5 Kcpm

In order to check RG-40, a high activity gamma source is required.

3.17. Telescopic Rod Usage

RAM R-200 can be operated with a long or short telescopic rod (see section 1.8). The telescopic rod is attached to the storage case cover and it is supplied with a carrying shoulder strap.

In order to use the telescopic rod insert the RAM R-200 meter into the leather bag that is attached to the telescopic rod. Match the external detectors, RG-10, RG-12 or RG-40, to the fastening clip located at the top of the telescopic rod. Ensure the detector connector is well connected to the telescopic rod connector and tighten the fastening screw.

The Telescopic rod with PA-100M detector

a) Insert the RAM R-200 meter into the leather bag attached to the telescopic rod.

b) Insert the supplied spiral cable through the PA-100M handle ring.

c) Connect the spiral cable to the connector at the end of the telescopic rod.

d) Attach the detector to the telescopic rod and tighten the fastening screw.

e) Connect the other end of the spiral cable to the PA-100M connector.

4. ROTEM Meter Calibration (RMC) Software

4.1. General Description

The computerized calibration program enables to calibrate the ROTEM Meter with a very efficient and easy process, via RS-232 communication.

The ROTEM Meters using the RMC software are: RAM R-200 and RAM R-200 detectors, RAM ION, RAM ION DigiLog, TelePole HR, TelePole WR, TelePole Internal Detector, and RAM SURF-B.

Calibration parameters stored in the meter's EEPROM memory:

- Meter serial number (up to 8 characters)
- Calibration factor
- Name of the operator (up to 12 characters)
- Calibration date
- Calibration due date

4.2. Installation Instructions

The calibration software is operated under MS-Windows 95 or later versions.
The program located in the Rotem Meter Calibration folder is a self-extracting file

1. Insert CDR into the drive.
2. Copy the RMC self-extracting file into a new folder of your choice (e.g. C:\Program Files\Rotem Meter Calibration
3. Run the RMC self-extracting file, by double clicking on it.
4. Create an icon for the RMC.EXE file in the Taskbar.

4.3. Communication Cables

4.3.1. Communication cables between instrument and computer

1. Connect the Fischer connector to the instrument.
2. Connect the D type connector to the Comm Port of the P.C.

4.3.2. Communication cables between detector and computer

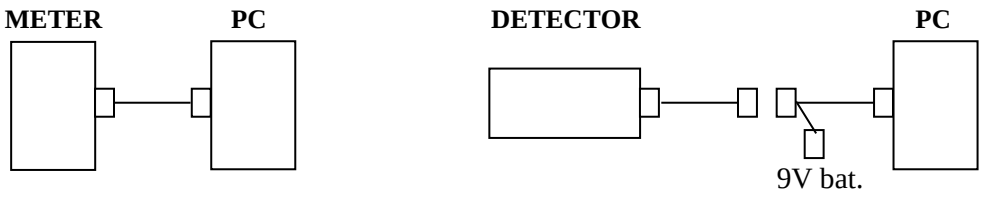
Two cables are needed: 1. Fischer connector to D-type female connector
2. D-type male connector to D-type female connector

(a) Connect the Fischer connector to the instrument.

(b) Connect the D type connector to cable (2).

(c) Connect the D type female connector (from cable 2) to the Comm. Port of the PC.

(d) Connect a 9V battery with the correct polarity to the clip on the cable.

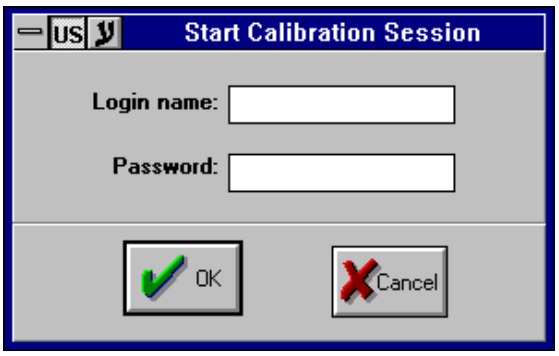


4.4. Operating Instructions

4.4.1. Run the calibration program via the **RMC.EXE** file (or icon)**.**

4.4.2. Enter **Login name** – Any name which will appear in the calibration documentation (up to 12 characters).

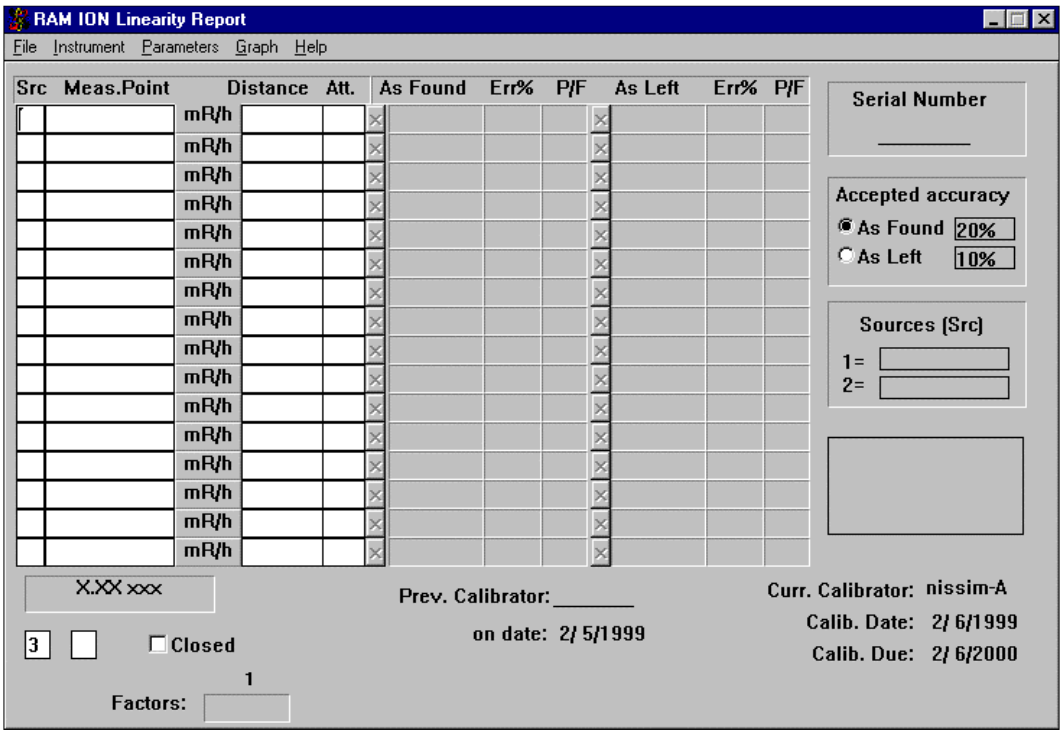
4.4.3. Enter **Password** – "**ram**" in small letters.



4.4.4. Click **OK**, the program enters the main window.

The caption in the main window (linearity report) displays the previous template. In the displayed template the operator executes the required missions to complete calibration and linearity.

4.4.5. To start the procedure, click **File/New Report.**



4.5. New Template & Parameters Setup

The template includes setup parameters, instrument parameters and readings. To select or create a new template, proceed as follows.

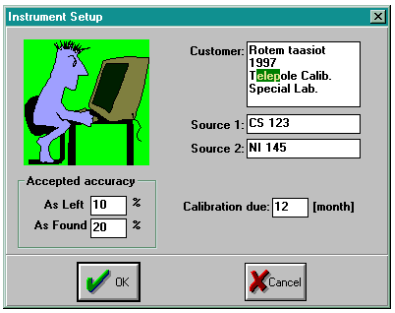
4.5.1. To select an existing template

The RMC program is supplied with a number of default templates. Click File/ Open template and select the required template.

4.5.2. To create a new template

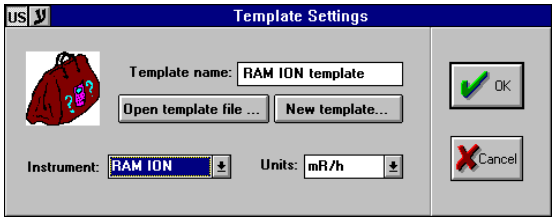
a) Fill the following parameters in the displayed template: Src (source), Measuring Point including units, Distance, and Attenuators. To select between mR/h and R/h, or cps and Kcps, or cpm and Kcpm, click each of the units columns.

b) Select **Parameters / Setup** from the pull down menu. Fill the following:
Customer - Enter header (up to 4 lines) for the calibration & linearity certificate.
Accepted accuracy:
As Left - Enter maximum allowed deviation
As Found - Enter maximum allowed deviation
Source 1 - Enter source type used in the calibration facility.
Source 2 - Enter source type used in the calibration facility.
Calibration due - Set the calibration interval.
Click **OK** to save data and quit.
Click **Cancel** to cancel data changes and quit.



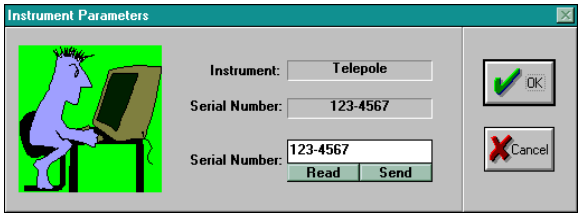
4.5.3. Select Parameters / Template from the pull down menu.

In the **Template Settings** window perform the following:
Template name - Fill new template name
Instrument - Select instrument type/ name
Units - Select units to be used in this template
New template - Save current template settings into a new file
Open template file - Select existing template without changing it



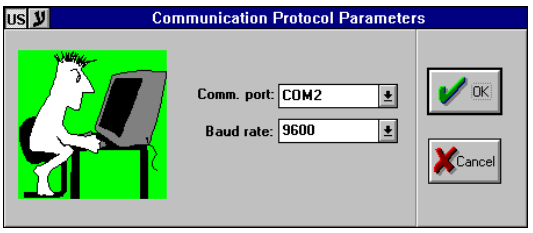
4.5.4. Set Meter Serial Number

Select **Parameters / Instrument** from the pull down menu.
To change the instrument **Serial Number** type the new serial number and click **Send.**



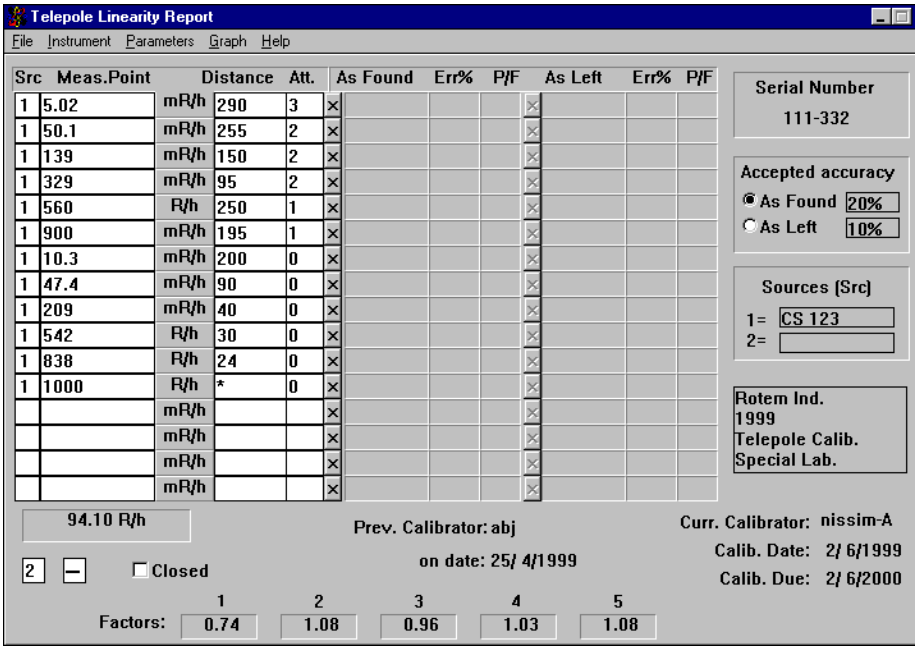
4.5.5. Set PC Communication Port

Select Parameters / Communication from the pull down menu.
Set the **Comm. port** connected to the meter.
Set **Baud rate** to 9600.



4.6. Starting-up Calibration & Linearity Process

1. Connect the meter to the computer via the appropriate **Comm. port** (according to the selected port in the set up program), using the customized communication cable.
2. Turn the meter on.
3. Execute the RMC file.
4. Enter **User name** up to 12 characters.
5. Enter **Password,** type **ram** (in small letters).
6. To check and calibrate the instrument, first enter **Linearity** and check **As Found**. Then enter from the pull down menu to **Instrument/ Calibration.** After calibration is performed, return to **Linearity** and check **As Left**.

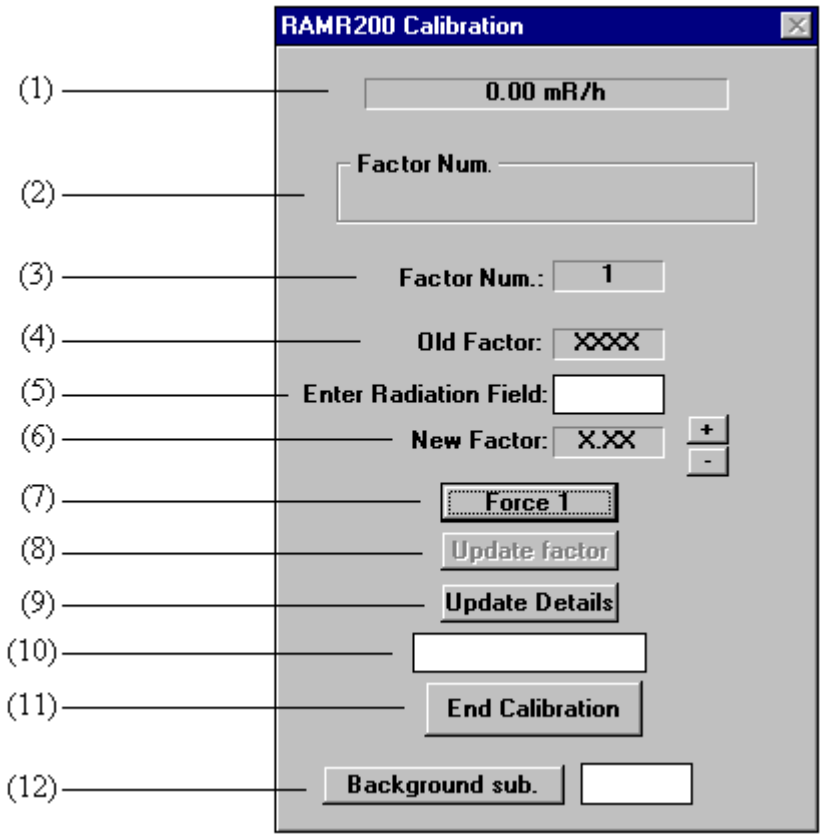


Note:

In case of computer / instrument communication failure or disconnection, the **Bad Communication Message** is displayed in the computer's display. Check the communication cable and/or Comm. port.

4.7. Calibration

Select **Instrument/Calibrate…** from the pull down menu. The calibration menu will be displayed.



(1) Instrument reading

(2) **Factor Num. -** Factor number for calibration. The listing in this screen depends on the amount of calibration points available from the instrument. If the "Auto" radio button is selected the software will recognize the filed value and allow for calibration of the pertinent point. If the calibrator wants to insert a factor into a specific range, he simply selects the field.

(3) **Factor Num. -** Current active factor number. This window will display the current active factor number and is especially useful in the Auto mode for reference purposes.

Instrument /Detector type	**Cal. factors***	**Recommended cal. point 20%**
RAM R-200 Internal det.	Four	F1 - 100 µSv/h F2 – 1.0 mSv/h F3 – 50 mSv/h F4 – 500 mSv/h
PA-100/M		F1 - 70 kcpm
RG-10		F1 - 72 kcpm F2 – 618 kcpm
RG-12		F1 - 101 kcpm F2 – 711 kcpm

* ***Note:*** The calibration factors are selected according to the detector's radiation field location. Only the displayed factor can be changed.

(4) **Old Factor: -** Previous calibration factor as saved (stored) in the instrument memory.

(5) **Enter Radiation Field: -** Factor can be changed in two modes:

a. Insert the measured field. The computer will calculate the new factor dependant on the radiation field and the old factor. The new factor value will be displayed on the **New Factor** box**.**

b. Using the ± boxes.

(6) **New Factor: -** The New Factor will be displayed and is a function of the actual current reading against the Radiation field that was typed into the window.

If the calculated factor value is lower than 0.6 or higher than 1.4, calibration will be not performed.

(7) **Force 1** – Select in case the operator wants to force the calibration factor to 1.00.

(8) After the factor changing, press Update Factor.
Ensure to obtain the status: **Factor Accepted**.

(9) **Update Details -** Press Update Details.

(10) Ensure to obtain Status: Details Accepted.

(11) **End Calibration** – Click to quit the calibration function and return to the main menu.

(12) **Background sub**. The meters' background readings differ from each other due to the Geigers different accuracy. The background subtraction function is used to reset the meters background readings in order to obtain optimal accuracy in low radiation range measurements.

Background subtraction is performed in two steps. Place the meter in a non-radiation site and then:

a) Type **0.00** in the text box; click on **Background sub.**

b) Type the meter's reading in the text box; click on **Background sub.**

The background subtraction resolution value is in mR/h or μSv/h units (0.01, 0.02...). This function is valid only for the meter and not for the external detectors.

4.8. Linearity

To enter the **Linearity Report** window press **File → New Report**. The **Linearity Report** window includes **As Found** and **As Left** columns. Before calibration and linearity check, perform the proceeding steps in the following order:

a) Check linearity in **As Found** column.

b) If linearity fail is obtained the instrument is defected and cannot be calibrated (**P/F - fail)**.

c) If linearity **As Found** is ok, calibrate the instrument.

d) Check linearity in **As Left** column.

In order to check linearity and perform calibration to other instrument, select **File →New report** on the pull down menu.

Linearity Report Window Description

Src – Type of source employed for calibration and linearity. The source type is defined in the set-up parameters.

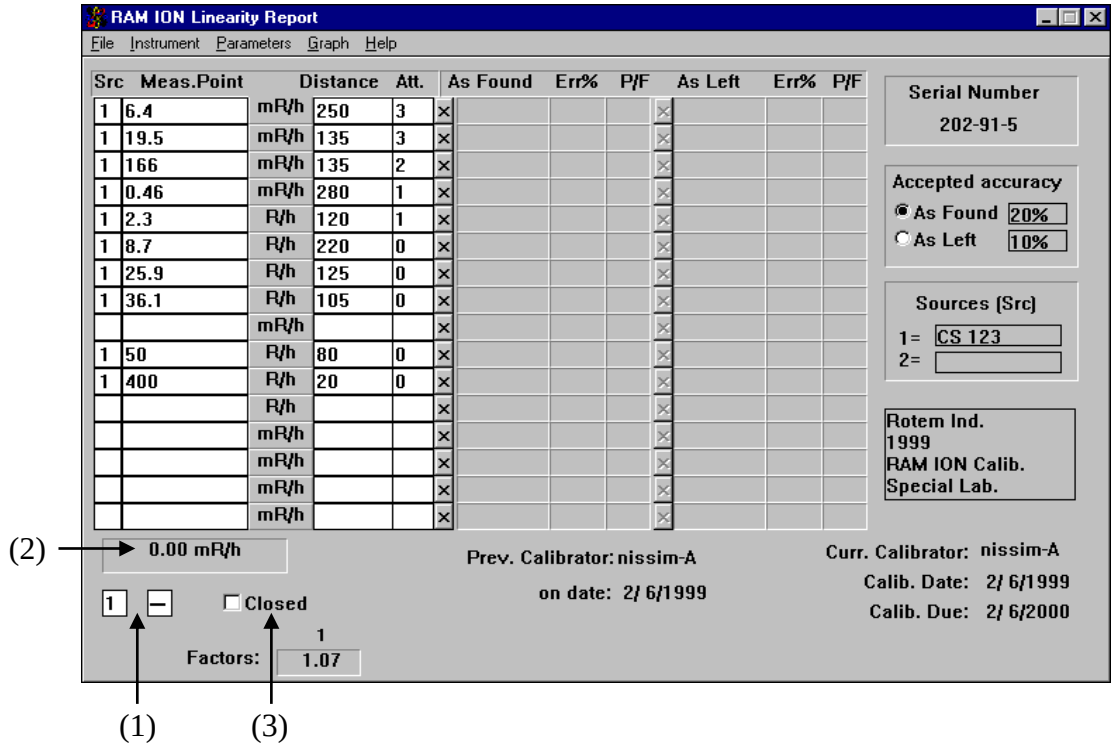
Meas.Point - Radiation field where linearity tests are performed.

Unit - Measurement units.

Distance and **Att. -** Distance between detector and source and attenuator number.

As Found - Instrument reading prior to calibration.

As Left - Instrument reading after calibration.



Err% - Reading deviation % between measuring point (calculated value) and meter reading.

P/F - Notifies that linearity checking is correct.

Serial Number - Instrument number, may be changed in **Parameters / Instrument**.

Accepted accuracy - Permitted deviation in % between the instrument reading and radiation. Defined in the **Parameters / Set up**.

Sources [Src] - Source type by which calibration and linearity were performed. Defined in the set-up parameters.

Rotem Ind.- Customer: Enter header (up to 4 lines) for the calibration & linearity certificate.

Curr. Calibrator - Present calibrator's name and calibration date.

Prev. Calibrator - Former calibrator's name and calibration date.

Factors - Factors' value.

(1) □ □ - Checking adequate connection between instrument and computer. If after the fifth time there is no communication, an alarm message is displayed.

(2) 0.00 mR/h - Instrument reading is updated every second.

(3) ☐ **Closed -** After checking the first reading by pressing **X** on the tested point line, it is recommended to perform **File → Save as**. From now on, the file is automatically updated and saved after checking of each tested point. As long as the **Closed** text box is not marked, it is possible to make changes while entering and exiting the file. At the end of the linearity check process, marking 3in the **Closed** text box will make the file "read only". From now on, when entering the saved file marked 3 **Closed**, it will be impossible to perform any changes in the **Linearity Report** window.

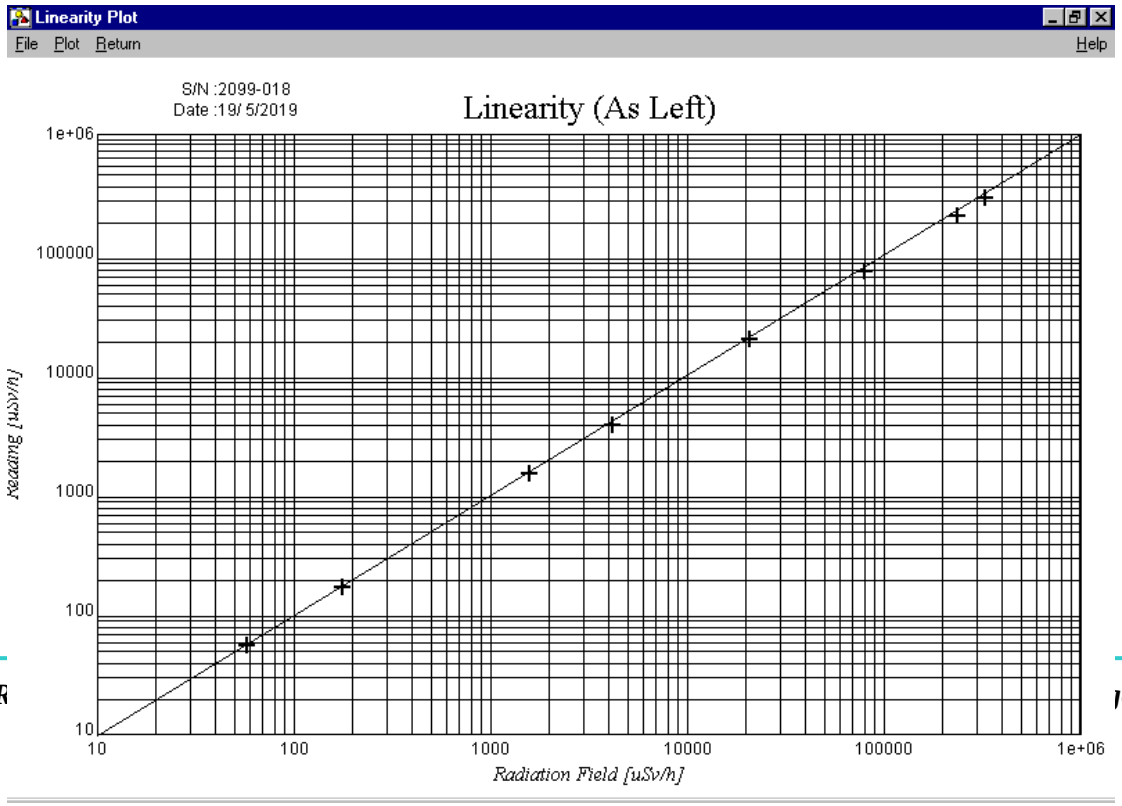
4.9. Save, Load and Print Calibration and Linearity Certificate

4.9.1. Save and Print Current Calibration and Linearity Certificate

1. Click **File / Save** for saving the Calibration and Linearity Certificate in a file.
2. Click **File / Print** for Calibration and Linearity Certificate printout.
3. Click **Graph** to display Linearity graph.
4. Click **Plot** and select **Linearity** or **Relative Error** graph.
5. Click **File / Print** for Linearity graph printout.

4.9.2. Load and Print Previous Calibration and Linearity Certificate

1. To load a previous Calibration and Linearity Certificate click File/ Open.
2. Double click to select the appropriate drive.
3. Double click to select the appropriate file.
4. Click File / Print for Calibration and Linearity Certificate printout.
5. Click Graph to display Linearity graph.
6. Click Plot and select Linearity or Relative Error graph.
7. Click File / Print for Linearity graph printout.



5. ROTEM Meter View (RMV) Software

5.1. General Description

Rotem **M**eter **V**iew Software (RMV) is a Windows 95 based program, aimed to download ROTEM's meters measurements to a PC.

Communication between meter and PC can be done in two modes:
On-line: The meter downloads the measured data in the PC at intervals time set by the user.
Off-line - Data is stored in the meter (up to 999 strings) and then downloaded into the PC.

Required Equipment:

- PC based WINDOWS 95/98 and RS-232 communication port.
- ROTEM's customized communication cable.
- ROTEM's meter.
- RMV software supplied by ROTEM on four 1.4 floppy disks or on one CD.

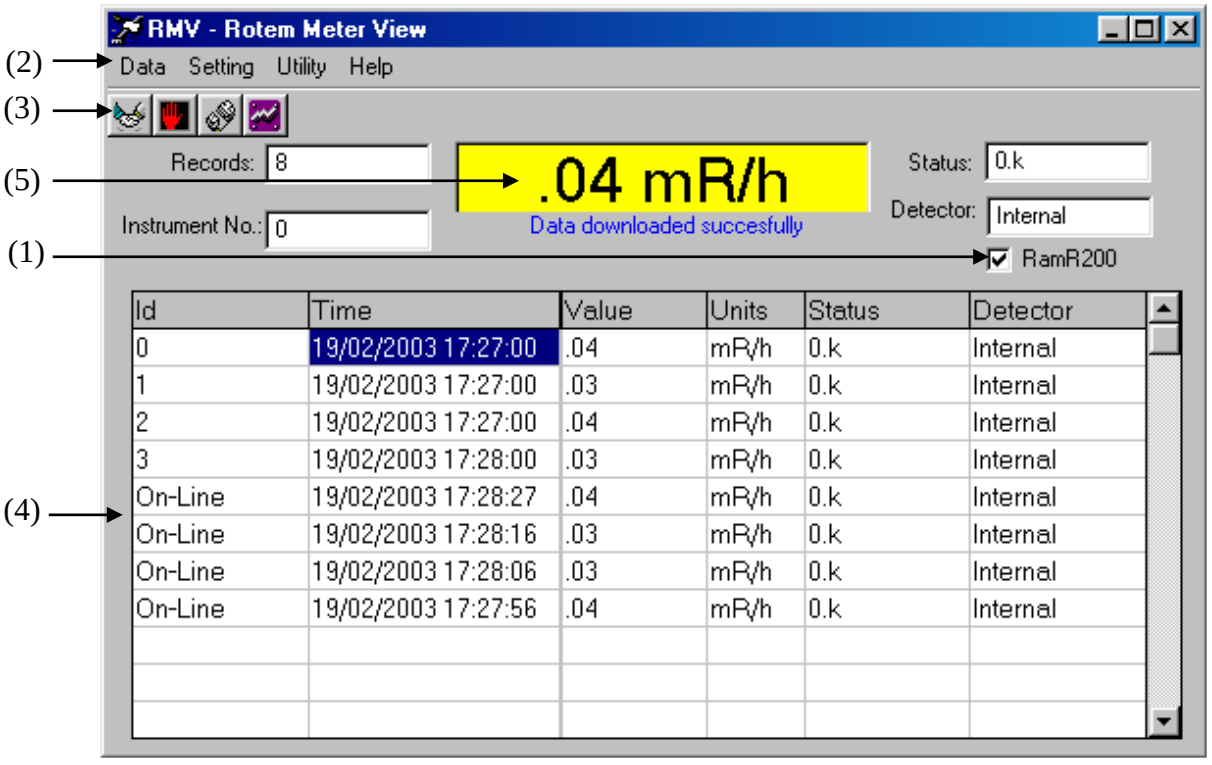
5.2. Software Installation

1. Insert the CDR into the CD drive.
2. Run the Setup program and follow the installation instructions.

5.3. Communication Cables

1. Connect the Fischer connector to the RAM R-200.
2. Connect the D type connector to Comm. port of the PC.

5.4. RMV Main Screen



(1) ✓R**amR200 –** The ✓sign is marked to initiate software in order to communicate with RAM R-200.

(2) ***Toolbar Functions:***

Data

- Start Online – PC receives downloaded records from the meter at set interval times
- Get Offline Data - PC receives downloaded records stored in the meter's memory.
- Get legend – Saved file legend.

Setting

- Online Interval – Set time intervals for online mode.
- Communication Port – Select PC communication port.
- Parameters:
Select threshold – Selects two threshold values in RMV software. Software checks if the downloaded records are above the selected threshold values and activates the alarms on PC.
Lost contact – In online mode, if the PC ceases to receive records from the meter, the lost contact alarm will be activated. The elapsed time (seconds) from the last record download until the alarm is activated can be set here. The lost contact time must be longer than the download interval time.

Utility

- Save – Save the downloaded record as a file.
- Send Time – The date and time of the meter is updated according to the date and time of the PC.
- Graph – Graph of downloaded records is displayed (minimum 8 records).
- Test – Communication test between meter and PC.

(3) ***Toolbar Icons*** *(left to right)**:***

- Start/Stop Online
- Mute PC Audio **Alarm** (for readings above set threshold values, see **Parameters**)
- Get Offline Data from Instrument
- Display Graph

(4) ***Downloaded Records Table***

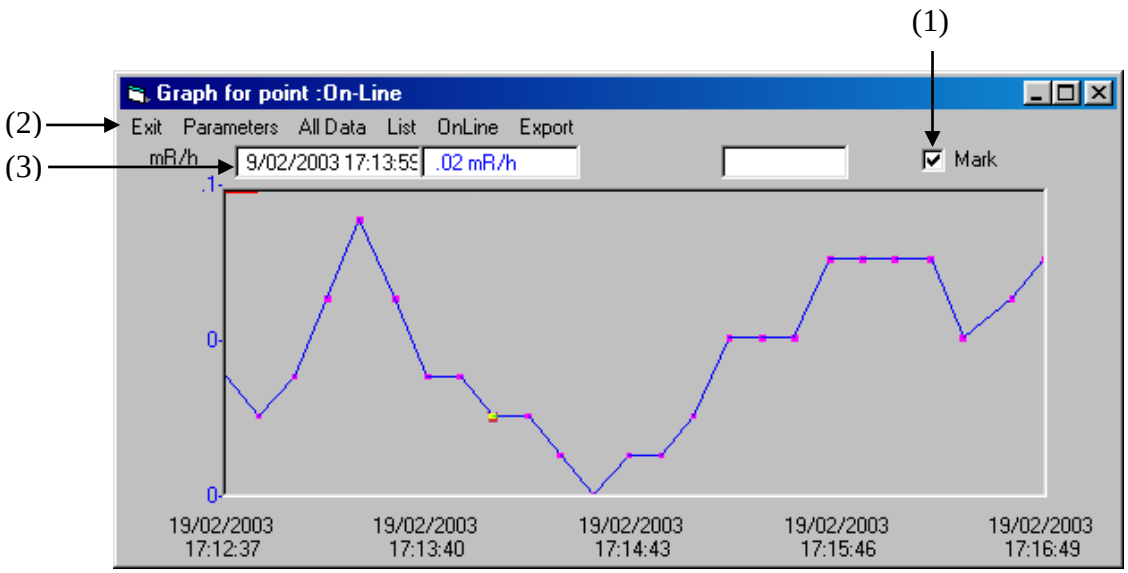
Id, 0, 1, 2, 3…- off-line downloaded records
On-Line – on-line downloaded records

(5) ***Last Downloaded Reading Text Box***

This text box can be displayed in four colors to represent four conditions:
Green – communication is ok and no over threshold alarm.
Blue – lost contact.
Yellow- downloaded reading is above first threshold alarm value.
Red - downloaded reading is above second threshold alarm value.

5.5. Graph Screen

In order to display the graph press **utility → graph** or the **graph** toolbar icon in the **RMV** main screen. A graphical display of the downloaded records versus the time axis is shown below.



(1) **Mark** – The ✓ sign emphasizes the downloaded readings in red color dots on the graph.

(2) ***Toolbar Functions:***
Parameters – The graph resolution can be set.
All Data – A section in the graph can be zoomed-in by selecting a certain point on the graph, pressing there the mouse left key and dragging it to another desired point. To display back the whole graph, press **All Data**.
List – Pressing the **List** button displays a table containing the displayed readings from the zoomed-in graph or the All Data graph.
OnLine – Enables/disables automatic graph update.
Export – Saves the graph readings as a file.

(3) ***Text Box*** – Pressing the mouse left key anywhere on the graph will display the downloaded reading.

6. Configuration Software

6.1. General Description

The RAM R-200 Configuration Software is aimed to configure the various working parameters of the instrument.
The first screen serves to upload the existing parameters from the instrument; the second screen serves to download the new parameters into the instrument.

6.2. Installation Instructions

- To install the configuration software copy the *.exe file into a new directory.
- The configuration software operates under MS-Windows 95 or later versions.

6.3. Communication Cables

To connect between the RAM R-200 and the computer connect the Fischer connector to the meter and the D type connector to the PC Comm Port.

6.4. Set the Communication Port

Activate the configuration software and click **Detector→Communication port**, then select the appropriate Communication port from the displayed list.

6.5. Configuration Screen

When the configuration software is operated, the window is displayed without the parameters. In order to display the meter-stored parameters, click on **Current Config** tab and **Read Current Config** tab (screen 1). In order to update the meter parameters, click on the **New Config** tab (screen 2), fill the necessary parameters and then click **Write New Config.** The new configuration screen may be saved as a ***.cfg** file by clicking **file→Save as**.

Before updating any parameter in the **New Config** screen it is recommended to click on **Current Config** tab and **Read Current Config** tab or **file→load** in order to avoid updating of the meter with irrelevant parameters**.**

Screens Description

(1) Units – Selection of measurement units for radiation (meter and RG-40) and contamination (RG-10, RG-12, PA-100M).

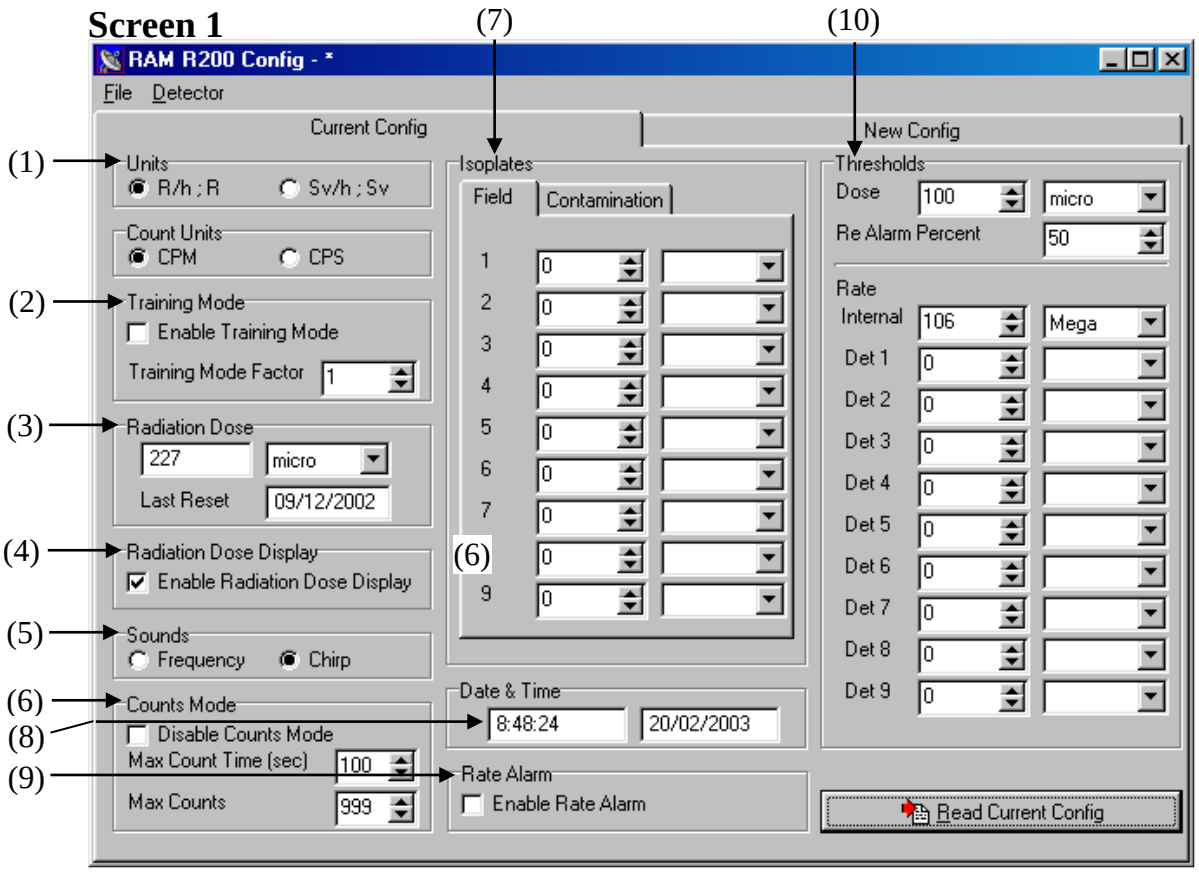
(2) Training Mode –A special mode aimed to train the user. The measured value can be multiplied by the user selectable factor.

(3) Radiation Dose – Display of current accumulated dose, measurement data and units of the meter. Displays date of the recent dose reset.

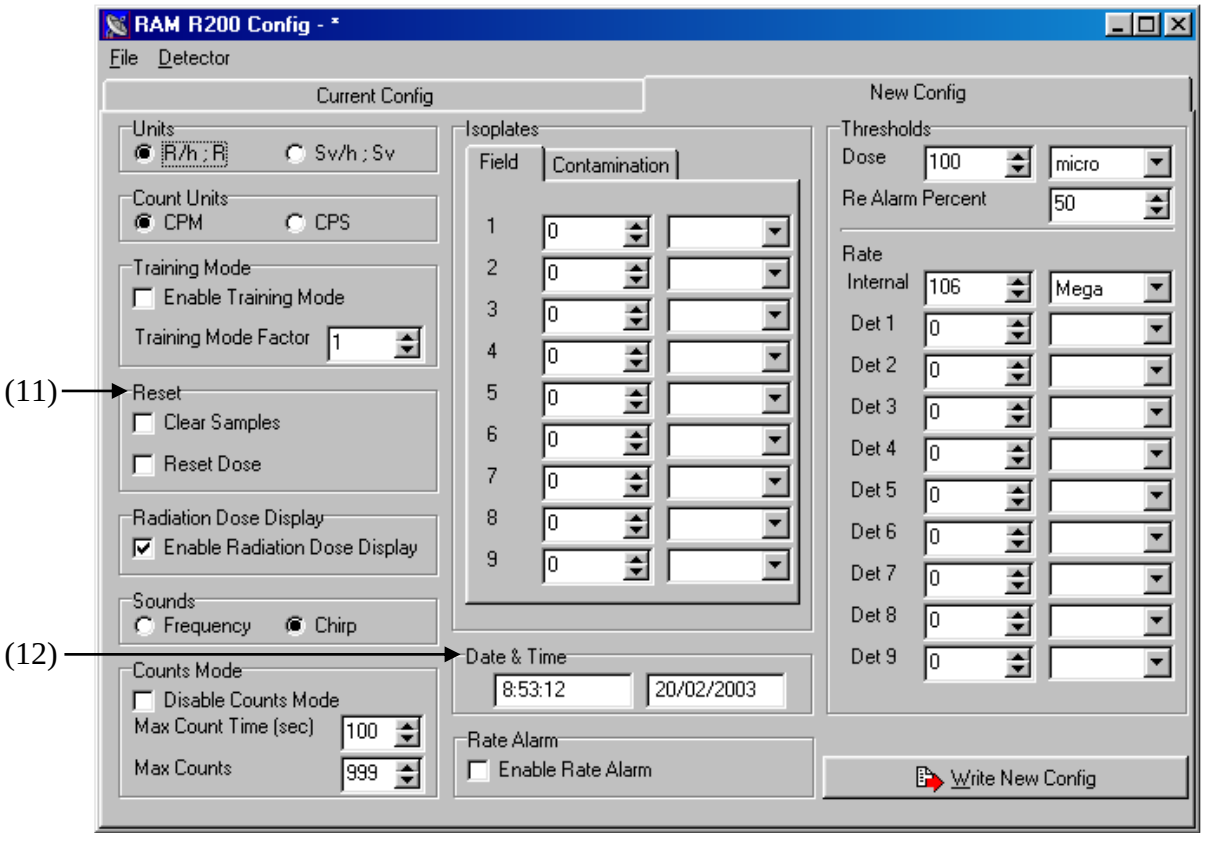
(4) Radiation Dose Display – Disable/enable display of the meter accumulated dose on the meter display.

(5) Sounds – Selection between frequency and chirp sound.

Screen 1



Screen 2



(6) Counts Mode – Disable/enable count mode.
If the count mode is enabled it is possible to set the maximum count time and the maximum count (see section 3.10).

(7) Isoplates – RAM R-200 enables to determine radiation isoplate levels of a measured area monitored simultaneously by a number of people. Isoplates levels values and isoplates units are set in the configuration software. For a detailed description of isoplates, see section 3.13.

(8) Date & Time – Meter current date and time.

(9) Rate Alarm – Disable/enable audio alarm for over threshold rate alarm.

(10) Thresholds:

- **Dose** – Selection of dose alarm threshold value and its units.
- **Re Alarm Percent – Re-alarm percent setting.**
  In case of over dose threshold an audio/visual alarm is obtained. The user can mute the audio alarm. If the dose value increases above the set percentage, the audio alarm will be activated again.

  For example, the original **Dose** threshold is set to 100 mR, and the **Re-Alarm Percent** is set to 10%, then the audio alarm will be activated again at 110 mR, etc.
- **Rate** – Set threshold rate alarm for the meter's internal detector and for the external detector.
  Internal – internal detector of the meter
  Det 1 – RG-40
  Det 2 – RG-12
  Det 3 – RG-10
  Det 5 – PA-100M

(11) Reset

- **Clear Samples -** clears the data record stored in the meter memory. (Up to 999 data records can be stored in the meter's memory.)
- **Reset Dose -** Reset meter dose value.

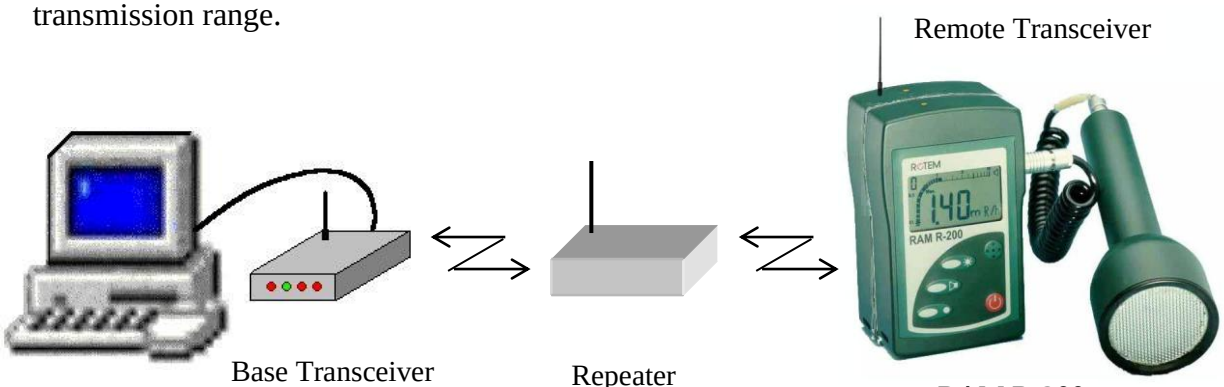
(12) Date & Time - Displays the computer's current date and time to update the meter date and time.

7. Options

7.1. Wireless Communication to a Computer

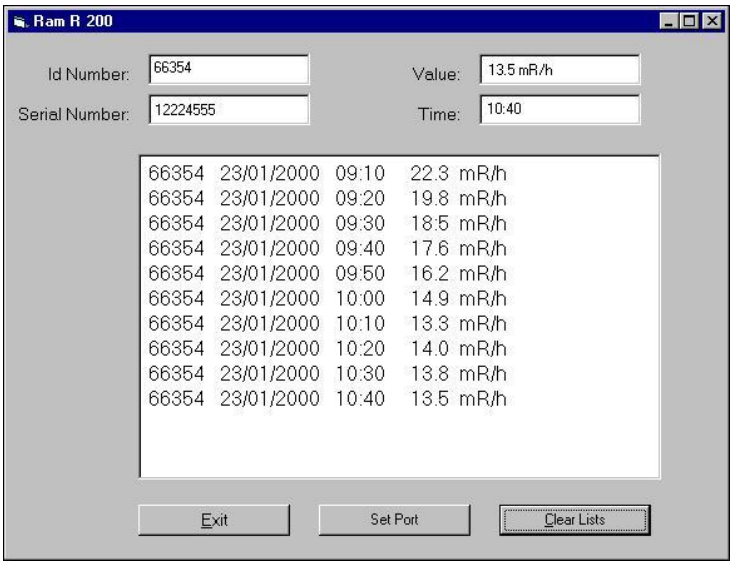
***Note:* For implementing this feature the firmware must be replaced.**

The RAM-R-200 can be used in a wireless mode, employing a WIT 2410 2.4GHz spread spectrum, with the optional addition of a remote transceiver connected to the meter and a base transceiver connected to the computer. A simple repeater can expand the system transmission range.



Data can be transmitted in three modes:

1. ***Automatic Mode –*** each time the user presses on the LIGHT push-button, data is transmitted into the computer.
2. ***Online Mode*** – data is automatically sent between 5 to 60 seconds (user selectable) to the computer.
3. ***Control Mode*** – In the event that the transceiver is not in the transmitting range, data is saved in the instrument memory and can be sent later when the range between the instrument and PC allows.



7.2. Special Functions (SF5) – Option

Note: For implementing these features the firmware must be replaced.

Setting Communication Mode (SF5)

Function	**Pressing mode**	**Push-buttons**
Enters Special Functions (SFx)	Long Simultaneously	MODE & LIGHT
Switches from SF1 to SF5	Short, 4 times	MODE
Switches from SF5 to **Aut** (Automatic Mode) Switches from Automatic Mode to **Cnt** (Control Mode) Switches from Control Mode to **OnL** (On line Mode)	Short	LIGHT
Aut blinks on the display. **Cnt** blinks on the display.	Long	SPEAKER
Aut or **Cnt** mode is set and saved in memory, display stops blinking.	Short	SPEAKER
Exit Special Functions.	Short	MODE

Setting Time Interval for On line Mode

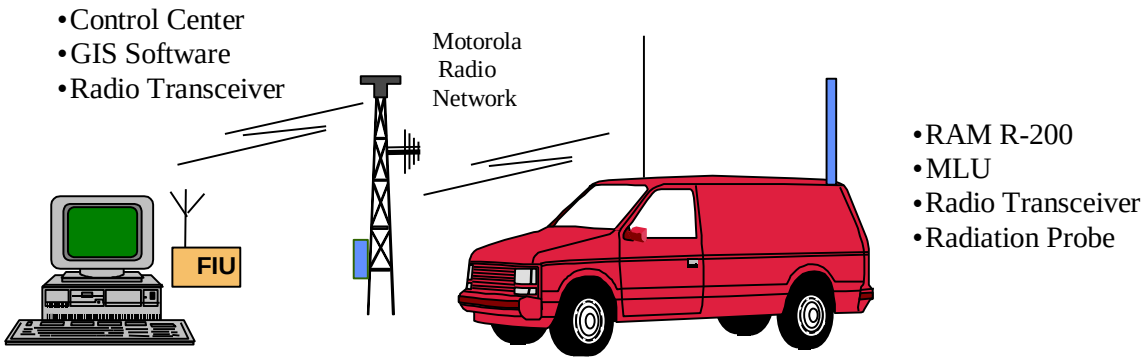
Function	**Pressing mode**	**Push-buttons**
Enters Special Functions (SFx)	Long Simultaneously	MODE & LIGHT
Switches from SF1 to SF5	Short, 4 times	MODE
Switches from SF5 to **Aut** (Automatic Mode) Switches from Automatic Mode to **Cnt** (Control Mode) Switches from Control Mode to **OnL** (On line Mode)	Short	LIGHT
Time interval is displayed.	Long	SPEAKER
Increases time interval by 1, from 5 to 60 seconds.	Short	LIGHT
OnL blinks on the display.	Long	SPEAKER
OnL mode is set and saved in memory, display stops blinking.	Short	SPEAKER
Exit Special Functions.	Short	MODE

Appendix 1

VMS-2000 – A RAM R-200 Based Mobile Radiation Monitoring System

The VMS-2000 is an advanced mobile radiation monitoring system comprising a network of mobile stations typically installed onboard vehicles. The stations transmit radiation measurements, acquired by the RAM R-200 survey monitor, along with position information to a central station. The mobile network's communications infrastructure is based on Motorola Mobile Logic Unit (MLU) devices, which are state-of-the-art reliable modems with an integrated GPS module.

Block Diagram of the VMS-2000 Central Station

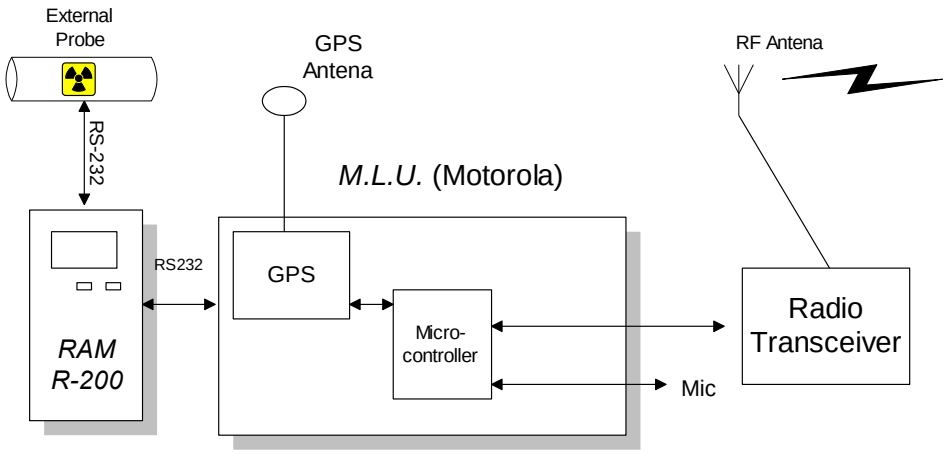


System Overview

A mobile system consists of the following components:

- RAM R-200 – survey radiation meter.
- A variety of optional external probes – RG-12/ RG-40/ WR-10/ WR-20.
- Motorola MLU reliable data communications equipment, including an internal GPS module. The MLU is responsible for diverse communication functions including handling the multiple-access RF network, error detection and message retransmissions.
- Motorola MDT214 Mobile Terminal – used for display and transmission of messages to and from the central station.
- A radio transceiver - a wide range of radio transceivers, corresponding to different bandwidths and frequency ranges, may be connected to the MLU. Future communication media will include GSM and satellite based transceivers.

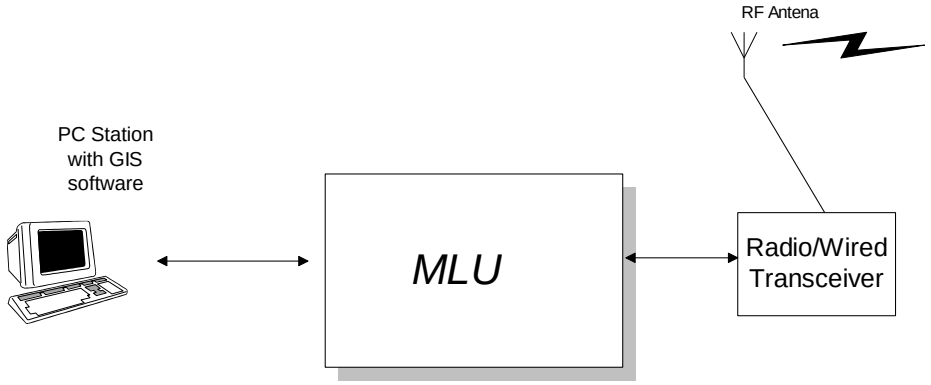
Block Diagram of a VMS-2000 Mobile Station



The central station is composed of the following components:

- Motorola MLU communication module
- A radio transceiver
- A PC running dedicated Windows GIS software

Block Diagram of a VMS-2000 Central Station



We are flexible in implementing custom-fit features in accordance with client requirements. ROTEM has extensive experience and knowledge in developing Windows based graphical information software, particularly in the field of radiation and environmental monitoring.