OPERATING MANUAL

RAM-ION Ion Chamber

Wide Range Gamma, X-Ray, and Beta Radiation Measurement

Document # 15-00034
Revision 1
October 2008

MGP INSTRUMENTS

Revision Log

Revision	Date	Revised Pages	Comments
First edition	July 1993		Document # BM9310.WP.
2.0	May 1996		Document # BM9316.WP (disk N9).
2.0	May 1996	--	Document # PRIR61O9.DOC. WORD issue (translation from WP51). Letter size pages (instead of A4).
Rev 1.0	October 2008	All	Updated images and data. Removed SMARTS software references and Laser barcode functions

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1. RAM ION Meter

1.1 General Description

The RAM ION meter is a battery operated, auto ranging, portable ion chamber survey meter. The RAM-ION is designed for highly stable and accurate measurement of dose rates and integrated dose of gamma, x-ray, and beta radiation. The meter covers a measuring range of 0.1 mR/h up to 50 R/h (1 µSv/h to 500 mSv/h) in the dose-rate mode, and 1 µR up to 1000 R (0.01 µSv up to 10 Sv) in the integrated dose mode.

The RAM ION survey meter combines an ionization chamber vented to atmospheric pressure, and a micro-controller to offer optimal performances and special features.

The RAM ION is compact, one hand-held, lightweight, and rugged for easy use and maintenance.

The RAM ION is ideal for use in nuclear power plants, nuclear medicine, radiography, radiotherapy, life science laboratories, nuclear research centers, and for other industrial applications. The RAM ION with the communication options (data transfer and telemetry) provides a very simple and reliable method to collect /store/transfer monitored data and transmit real-time radiological data to a remote monitoring control center.

1.2 Features

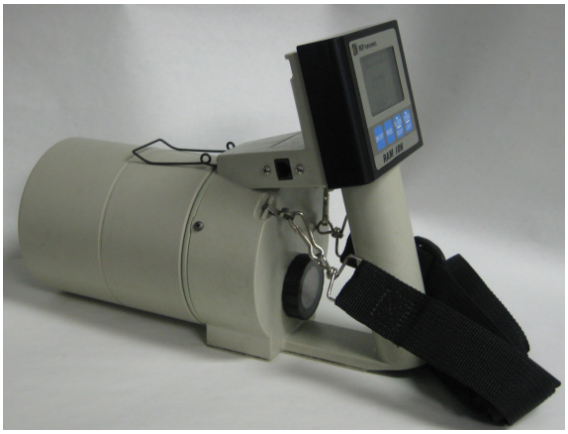
- Ion chamber survey meter with auto ranging digital display.
- Wide measuring range 0.1 mR/h to50 R/h (1 µSv/h to 500 mSv/h).
- Compact, one hand-held.
- Light-weight and easy to use.
- Dose rate and accumulated dose measurement.
- Freeze mode to record the highest dose rate.
- Configurable dose rate and dose alarms.
- Seletcable units - Sievert or Rem.
- Bar-code reader connection.
- Display illumination.
- Hot spot detection.
- Low battery, overflow, and detector fail alarms
- Optional integrated WRM2 Telemetry module
- Optional 700 mg/cm Tissue Equivalent Barrel .

RAM ION Open Window for Measuring Beta Radiation

1.3 Components for RAM ION

Survey Meter (mR/h)
RAM ION (no memory)
RAM ION with memory
RAM ION with memory and built- in laser scanner
RAM ION with memory for WRM applications
The survey meter can also be ordered with µSv/h reading units and ICRP-51 energy response
Accessories
Laser bar-code reader
Smart wand (light pen) bar-code reader
Computer cable interface (direct) with DB-25 on computer side
Ditto but with RS-232 built in converter
Computer cable interface (direct) with DB-9 on computer side
WRM2 Telemetry Interface Module
Memory board
Desiccant replacement cartridge
Beta cap
Strap
EPROM for WRM communication
Tissue Equivalent Barrel

RAM-ION shown with WRM2 Telemetry Module



RAM-ION shown with Tissue Equivalent Barrel (1000mg/cm2)

2. Technical Data

- **Measuring Range** — 0.1mR/h to 50R/h (1µSv/h to 500mSv/h)
- **Accuracy** — ±10% of reading, within the measuring range
- **Gamma Energy Dependence (^{137}Cs)** — Better than ±20% at 20 keV to 1.3 MeV
- **Angular Dependence (^{137}Cs)** — Less than ±5% (for ±120° of front direction)
- **Ion chamber Volume** — 500 cc
- **Chamber Wall and Cover Thickness** — 300 mg/cm²
1000 mg/cm2 with Tissue Equivalent Barrel
- **End Window Thickness** — 7 mg/cm²
- **Response Time** — 2 sec. for readings above 1mR/h
5 sec. for auto ranging change, from LOW RANGE to HIGH RANGE (2 sec. + 3 additional sec. for auto ranging delay).
- **Power Source** — Two 1.5V C-type cells
100 hours of continuous operation
Automatic battery check
- **Temperature Range** — Operation: 15°F to 122°F (-10°C to +50°C)
Storage: -5°F to 140°F (-20°C to +60°C)
- **Humidity Range** — Up to 95% RH (non condensing)
- **Casing** — Splash-proof plastic case
- **Dimensions** — Width: 10 cm (3.9")
Length: 25 cm (9.8")
Height: 19 cm (7.5")
- **Weight** — 850 g (1.9 lbs)

3. Operating Instructions

3.1 Starting-up

3.1.1 Insert two 1.5V C size cells into the batteries compartment. Be sure to position the positive (+) polarity towards the cover direction.

Note: To open the batteries compartment, use a coin in the cover slot and turn counter clock-wise.

Opening the Battery Compartment

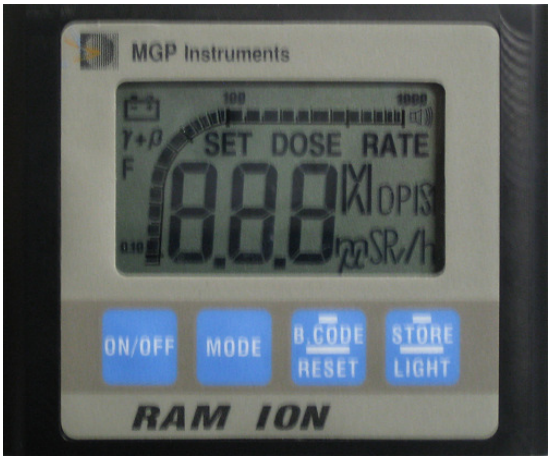
Inserting the Batteries

3.1.2 To turn the meter ON, press the ON/OFF push-button continuously, until an audible beep is sounded and the instrument reacts.

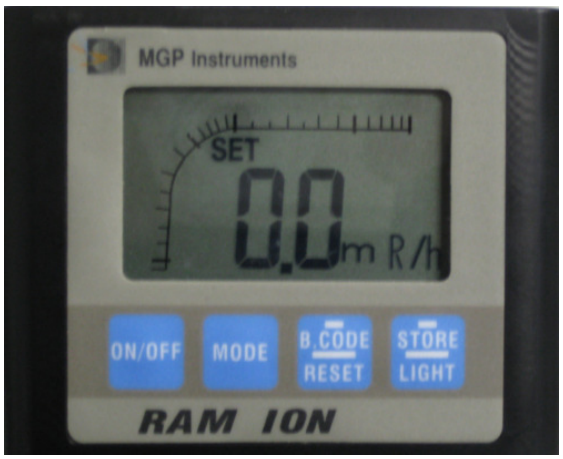
To turn the meter OFF, press the ON/OFF push-button continuously for at least one second, and then release. The actual turning OFF sequence will be performed after the push-button is released.

After turning the meter ON, the following steps will be automatically carried out:

- A short Built-In Test (BIT) displaying all the segments on the display, accompanied by a continuous audible beep for 2 seconds.



- Offset Adjustment. The SET segment and the reading blink on the display. The offset adjustment is carried out for 40 seconds. When offset adjustment is completed, the meter beeps twice.



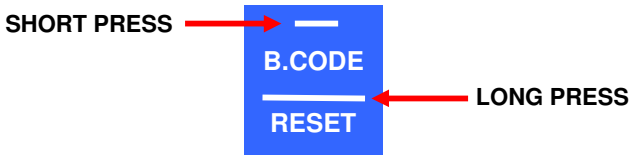
3.2 Operating Procedure

Note: Refer to the operating procedure block diagram in **Section 3.5.5**.

3.2.1 Definitions:

SHORT PRESS - Pressing a push-button and releasing it before 2 seconds are elapsed. An audible beep is sounded after the push-button is released. Indicated on the keypad and in this document as a short line ▬

LONG PRESS - Pressing a push-button and holding it at least for 2 seconds or more. An audible beep is sounded after 2 seconds. Indicated on the keypad and in this document as a long line ▬▬



3.2.2 The RAM ION operates in one of the following **basic** modes:

Offset Adjustment - during the first 40 seconds, whenever the meter in turned on.

Measuring LOW RANGE (mR/h) - after offset adjustment is completed.

Measuring HIGH RANGE (R/h) - is automatically performed when in the low range the reading exceeds 250 mR/h (2.5 mSv/h), or manually performed by a long press on the MODE push-button.

Alarms Threshold Setting - entering / leaving this mode is performed by pressing the MODE and RESET push buttons simultaneously.

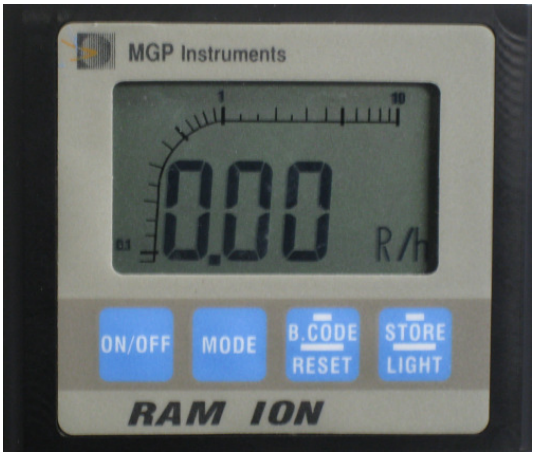
3.3 HIGH RANGE and LOW RANGE Modes of Operation

When the meter is set to the LOW RANGE mode, it operates as an auto ranging meter. Changing into HIGH RANGE at 250 mR/h (2.5 mSv/h) and back into LOW RANGE at 170 mR/h (1.7 mSv/h) is performed **automatically** according to the radiation reading level.

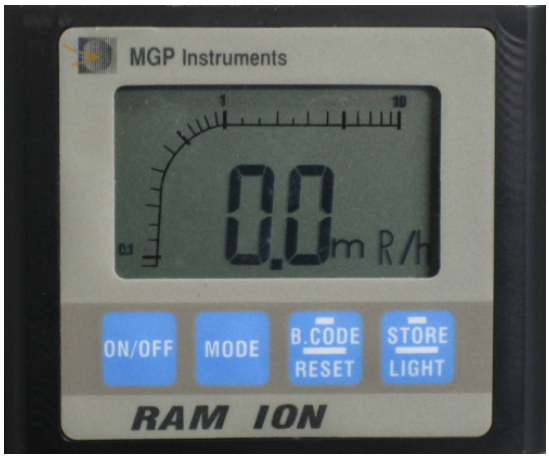
When the meter is manually set to the HIGH RANGE mode by a long press on MODE push-button, it will stay in this mode regardless of the radiation reading level. Another long press on MODE push-button returns the meter to the LOW RANGE mode, in case the reading is less than 170 mR/h (1.7 mSv/h).

Entering to the HIGH RANGE mode manually is normally performed to avoid the delay caused by the automatic change between low range and high range (about 3 seconds) when high radiation levels are expected.

In the HIGH RANGE, the units are expressed in R/h; in LOW RANGE, the units are expressed in mR/h.



High Range Mode Display



Low Range Mode Display

3.3.1 In DOSE RATE mode a long press on MODE push-button exchanges the measuring range:

MODE
Low measuring range ↔ High measuring range
mR/h (µSv/h) R/h (mSv/h)

3.3.2 In DOSE RATE mode mR/h (µSv/h), a short press on the MODE push-button displays DOSE reading.

DOSE RATE → DOSE

3.3.3 In DOSE mode, a short press or long press on the MODE push-button displays DOSE RATE reading.

DOSE → DOSE RATE

Dose Mode Display

3.4 Freeze and Reset Function

The FREEZE function enables the user to capture the highest reading without monitoring the display continuously. A **long** press on the RESET push-button while the meter is in DOSE RATE mode activates the Freeze function. The FREEZE mode is indicated by the blinking of the measuring units mR/h (µSv/h). A second **long** press on the RESET push-button cancels the Freeze function and resets the DOSE RATE.

3.4.1 In DOSE RATE mode, the first **long** press on the RESET push-button activates Freeze function, the second **long** press resets dose rate, and cancels the FREEZE function (see **Section 3.4**).

3.4.2 In DOSE mode, the first **long** press on the RESET push-button causes the blinking of the measuring units, the second **long** press **within 4 seconds** resets dose.

3.5 Alarms Threshold Setting

3.5.1 Press the MODE + RESET push-buttons simultaneously to enter the alarms threshold setting:
From DOSE RATE → to SET DOSE RATE ALARM
From DOSE → to SET DOSE ALARM
The segments SET DOSE RATE ALARM or SET DOSE ALARM are displayed.

Set Dose Rate Mode Display

Set Dose Mode Display

3.5.2 A short press on the RESET push-button changes the threshold value (in a cyclic order). The following threshold values may be selected:

DOSE RATE	**DOSE**
0.75 mR/h (7.5 µSv/h)	0.75 mR (7.5 µSv)
2.50 mR/h (25 µSv/h)	2.50 mR (25 µSv)
10.0 mR/h (100 µSv/h)	10.0 mR (100 µSv)
100 mR/h (1 mSv/h)	100 mR (1 mSv)
200 mR/h (2 mSv/h)	200 mR (2 mSv)
500 mR/h (5 mSv/h)	500 mR (5 mSv)
50 R/h (500 mSv/h)	999 R (9.99 Sv)

After the desired threshold value is selected, press the MODE + RESET push-buttons simultaneously in order to set the new threshold and leave the alarms threshold setting mode.

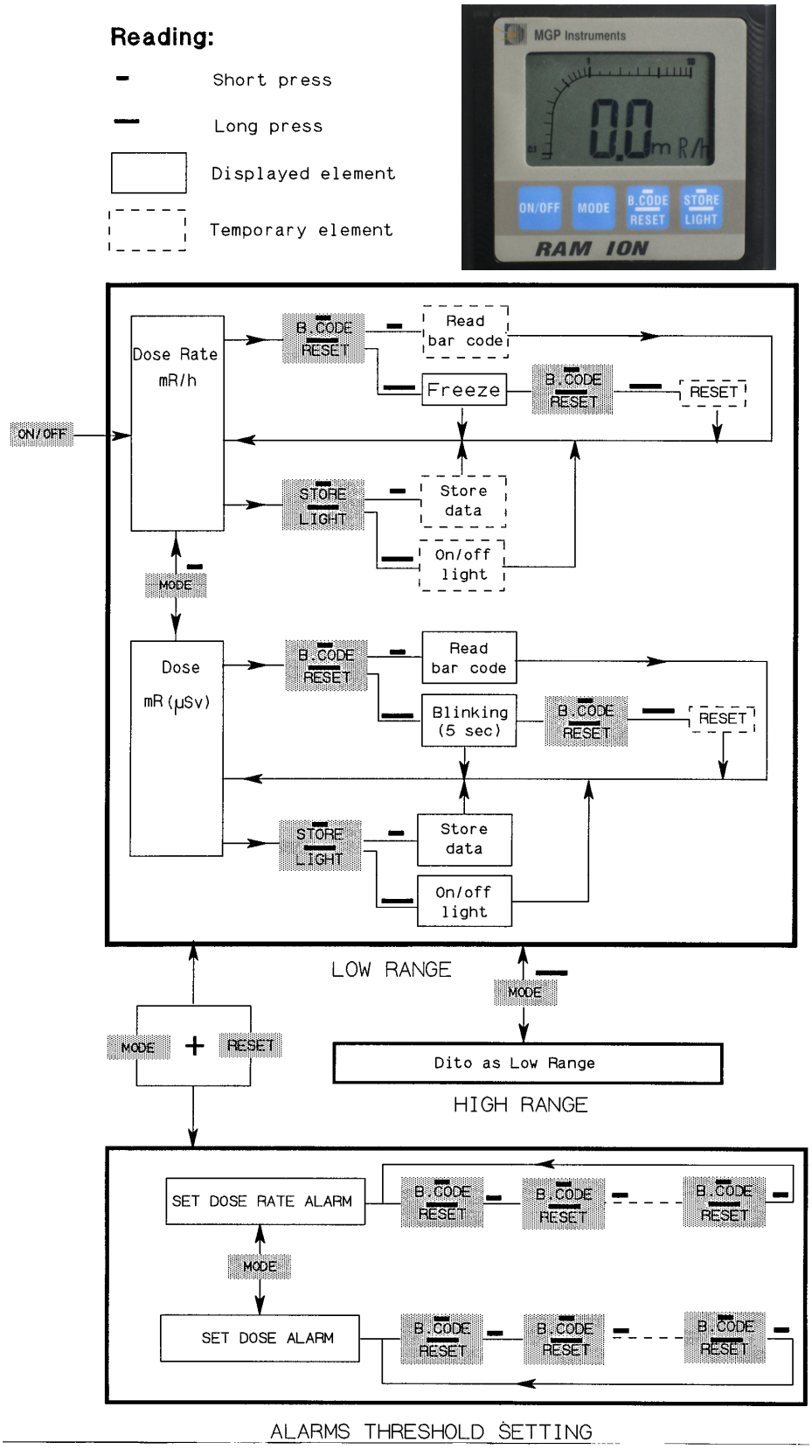
3.5.3 The MODE push-button is used to change between SET DOSE ALARM and SET DOSE RATE ALARM.

3.5.4 When the instrument is turned off, the accumulated dose value and threshold values are kept in an non-volatile memory.

3.5.5 Operating Procedure Block Diagram

Notes:

1. Definitions for short press and long press, see **Section 3.2.1.**
2. For RAM ION without memory board, a short press on the B.CODE\RESET and STORE\LIGHT push-buttons is the same as a long press.



ALARMS THRESHOLD SETTING

3.6 Display Illumination

A long press on the LIGHT push-button turns on/off the display back illumination. If the light is on, it will turn off automatically after **two minutes**.

3.7 Hot Spot Function

When a rapid change in the radiation field is detected, the hot spot function is activated, and a short beep is sounded.

3.8 Silica Gel Cartridge

If the silica gel color changes from blue to pink, t the hygroscopic material has becomes saturated and can not absorb additional humidity. Replace with new material (blue color).

Silica Gel Cartridge Removal

3.9 Push Button Function Table

Function	Press Mode	Push Button
Meter ON / OFF	Short	ON/OFF
Switch between dose and rate measuring units	Short	MODE
Switch between Auto Range and High Range Only.	Long	MODE
Operates laser bar-code reader, the **bAr.** LCD's are displayed. When the barcode is successfully read the **Go.** LCDs are displayed, accompanied with audible beeps. In case of an alarm condition (threshold or malfunction) the beeper is activated. Pressing the RESET push-button turns the beeper off.	Short	
In Dose Rate mode, the first press enters the Freeze mode, the second press returns to Dose Rate mode and resets the reading. In DOSE mode the first press on the RESET push-button causes the blinking of the measuring units, the second press **within 4 seconds** resets the dose.	Long	
Stores the reading value. Displays the left available memory space.	Short	
Displays back light illumination on/off.	Long	
Switching between Threshold Set mode and measurement mode.	Simultaneously	MODE & RESET
Selects threshold value.	Short	RESET
Clear data from the meter's internal memory.	Two (2) sequential Long presses (10 seconds)	

4. Alarms

4.1 Thresholds

4.1.1 If the measured field value exceeds DOSE RATE threshold setting, the DOSE RATE ALARM segment will blink and a discontinued beep indication will be sounded, until the measured field value is below 0.75 of threshold value.

4.1.2 If the measured accumulated dose value exceeds DOSE threshold setting, the DOSE ALARM segment will flash and a discontinued beep indication will be sounded.

4.1.3 Pressing the RESET push-button during alarm condition mutes the discontinued beep sound, but the alarm segment continues blinking.

Note: Cancellation of exceeding threshold message in DOSE mode will be obtained only after resetting the dose reading.

4.2 Malfunctions

4.2.1 In case of low battery voltage, the BAT. ALARM segment flashes and a beep indication is sounded to indicate 8 working hours are left till the meter is turned off automatically. If the low battery alarm is valid when turning the meter on, the meter will turn off automatically after 5 minutes.

WARNING: Before replacing batteries, ensure the RAM-ION is OFF.

4.2.2 If the ALARM segment blinks and Err reading is displayed, it means fault instrument.

4.2.3 The OFLO segment blinks on the display when the radiation field is over 50R/h.

5. RAM ION Memory Option

5.1 General Description

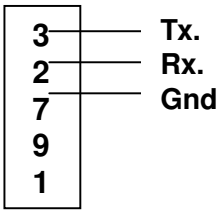
The memory board option provides a streamlined method to collect and store the measured data on site, in addition to the regular use of the RAM ION. The collected data is stamped by the measuring time, date and location. Time and date are stamped by a real time calendar\clock in the memory board. Location is stamped by using a bar code. A pen reader (wand HP-HBCR-8100) or a portable hand held laser scanner (e.g. symbol LS2020) may be used to read the bar-code.

RAM ION reading value accompanied with time, date, and bar-code information is stored in the data memory **only** when the LIGHT push-button is pressed. Reading of the bar code by itself does not mean the bar-code information is stored in the data memory. The information is stored in a temporary memory, until a reading value is stored accompanied with the **last** scanned bar code. RAM ION can store up-to 380 readings (which can optionally be increased to 1550 readings).

When the survey task is done, data can be downloaded to a computer (PC/AT compatible). This data can be used in different ways. The most streamlined way is to use the SMARTS program to save data and load it on a survey map. Data can also be interfaced to other programs and media.

5.2 Use of an External Laser Scanner

Hardware Requirements:

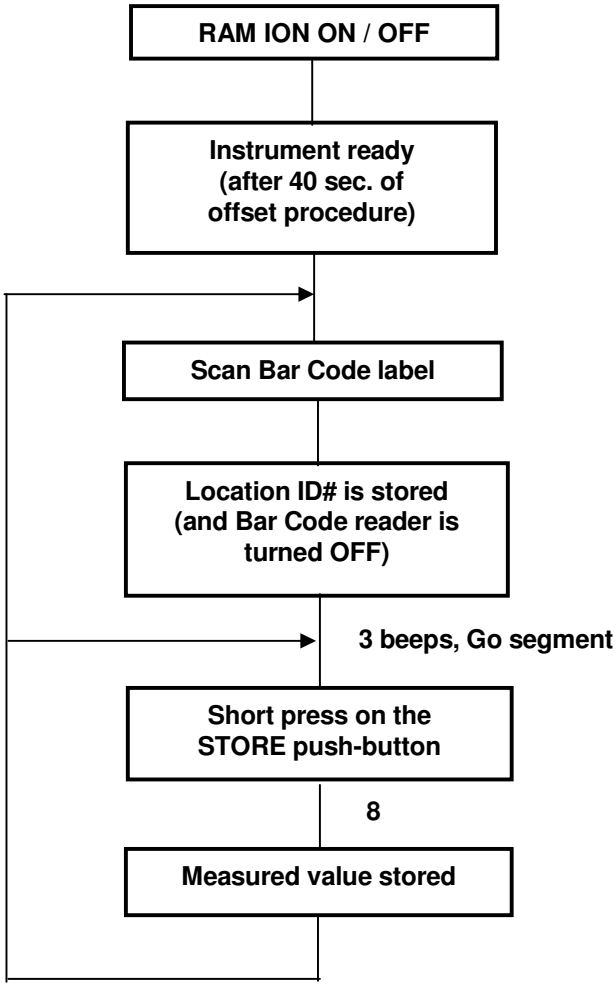


DB-9 Female on RAM ION

Communication Parameters:

Baud rate:	9600
Parity:	None
Hardware handshaking:	None
Software handshaking:	None
Stop bit:	One
Prefix:	None
Suffix:	CR/LF
Data format:	8 data bits (without parity)

To operate the **laser** scanner, just scan the bar-code. RAM ION should respond by 3 beeps for a successive bar-code reading and display the word GO. Then store the data value (by pressing the LIGHT push-button). RAM ION will respond by 8 beeps and display the amount of memory left. When reading the bar code using a pen (smart wand), the RESET push-button is used to power the pen reader. When using the laser scanner, only the self-powered laser scanner can be used.

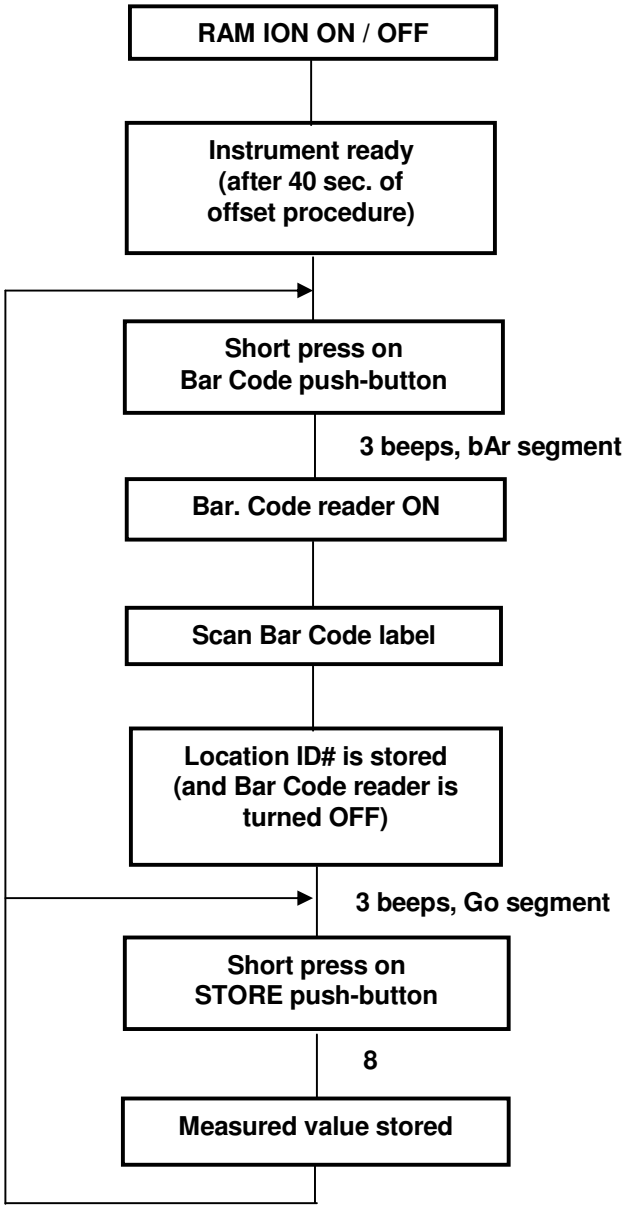


Laser Scanner Operating Procedure

5.3 Using a Smart Wand

A bar code reader (HP-HBCR-8100) can be used with the RAM ION to record the survey location by scanning a bar code label. Then, the reading data is stored in the RAM ION memory. Each data storage is accompanied by the date and time of the stored data.

After the survey task is finished, the RAM ION can be connected to an RS-232 port of a computer (PC/AT compatible) and the stored data can be dumped into the computer. When the "reading data" is stored into the RAM ION memory, it can be a rate value (mR/h) [uSv/h], the accumulated dose (mR) [uSv], or the peak reading by using the freeze function. In case the RAM ION activates an alarm (threshold or malfunction), it will also be stored.



Smart Wand Operating Procedure:

5.3.1 Connect the bar-code reader (Smart Wand) to the RAM ION.

5.3.2 Press the ON/OFF Push-button and wait for offset procedure (40 sec.).

5.3.3 To turn the bar-code reader on:

a. A short press on the B.CODE push-button turns the bar-code reader on.
b. Three short beeps will be sounded.
c. The **bAr** segment is displayed for 2 seconds.
d. A light should be visible at the tip of the wand.

5.3.4 To store information (location number) printed on a bar-code label:

a. Scan the bar-code label.
b. For a valid bar-code label three short beeps will be sounded, and the **Go** segment is displayed for 2 seconds.
c. The reading information (room number) will be stored in memory.
d. The wand will be turned off.

5.3.5 To store measurements under the stored bar-code number:

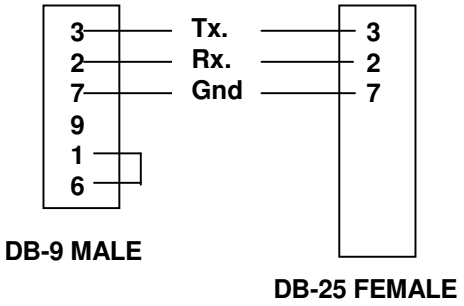
a. A short press on the STORE push-button stores the current measurement.
b. Eight short beeps will be sounded to indicate that the last measurement is stored.
c. The number of available memory entries is displayed during 2 seconds by three digits, and **m** segment which stands for memory. When **000 m** is displayed, it means no memory is left. In order to clear the memory, the stored data has to be dumped to a PC connected to the RAM ION (see Section 5.5).

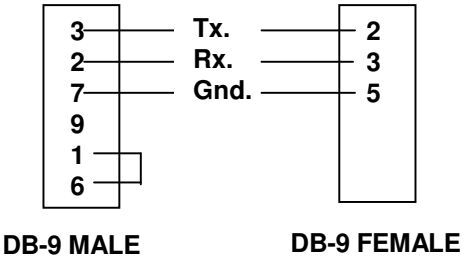
5.3.6 To store information under another bar-code number, return to Section 5.3.3.

Note: Measurements can be stored even without using the bar-code reader. The procedure is exactly as described in section 5.3.5. In this case the bar-code number is the last stored one.

5.4 Downloading Data to PC

5.4.1 Connect RAM ION to PC, COM-1 or COM-2 serial ports. Use the RAM ION special communication cable.





5.4.2 Use communication program of your choice.

- RION-IC.EXE to load data under DOS.
- SMARTS.EXE for SMARTS application.

6. Calibration Procedure

6.1 Electronic Calibration

6.1.1 Unscrew the three Phillips screws located on the round part of the plastic mold (Figure 6-1).

6.1.2 Disassemble RAM ION electronic housing.

6.1.3 Turn the RAM ION on.

6.1.4 In the electrometer board disconnect JMP 1, and connect a reference voltage of -20 volts between R10 (JMP1 side) and the common (GND) (Figure 6-2).

6.1.5 Adjust output frequency on U2/1 (R13) by TR11 to read 81.0 KHz (Figures 6-2, 6-3).

6.1.6 Disconnect the reference power supply (-20.00 V), and check that the output frequency is within 500 ±150Hz. If this result is not the case, the board has to be replaced.

6.1.7 Reconnect JMP1.

6.2 Manual Radiation Calibration

Note: The meter's calibration may be performed in two modes. The first mode is a manual calibration and the second mode is a computerized calibration utilizing the **RMC Software** (Section 6.3 below).

6.2.1 Put the RAM ION in a homogenous gamma radiation field. (The RAM ION should be placed at a distance of at least one meter from the source).

6.2.2 Calibration should be performed in a field of about 200mR/h (2.00mSv/h) when the RAM ION is in the low range (this is the default when the instrument is turned on).

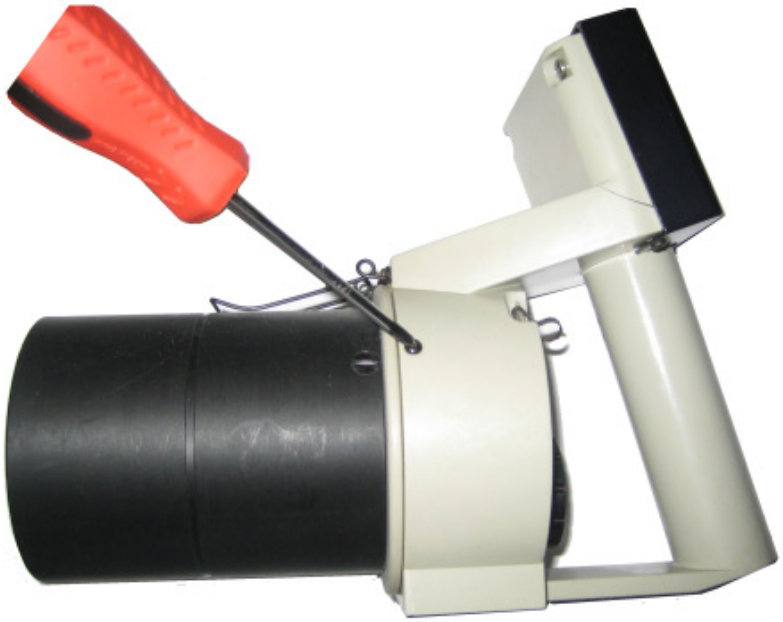
6.2.3 Verify that the RAM ION reading is according to the radiation field at the center of the RAM ION chamber.

6.2.4 In case the RAM ION reading differs in more than 5% from the true radiation field, adjust TR11 to obtain the required reading. Each fully clockwise turn of TR11 increases reading by 1.5%. TR11 can be accessed by unscrewing the silica-gel cartridge (Fig. 6-4).

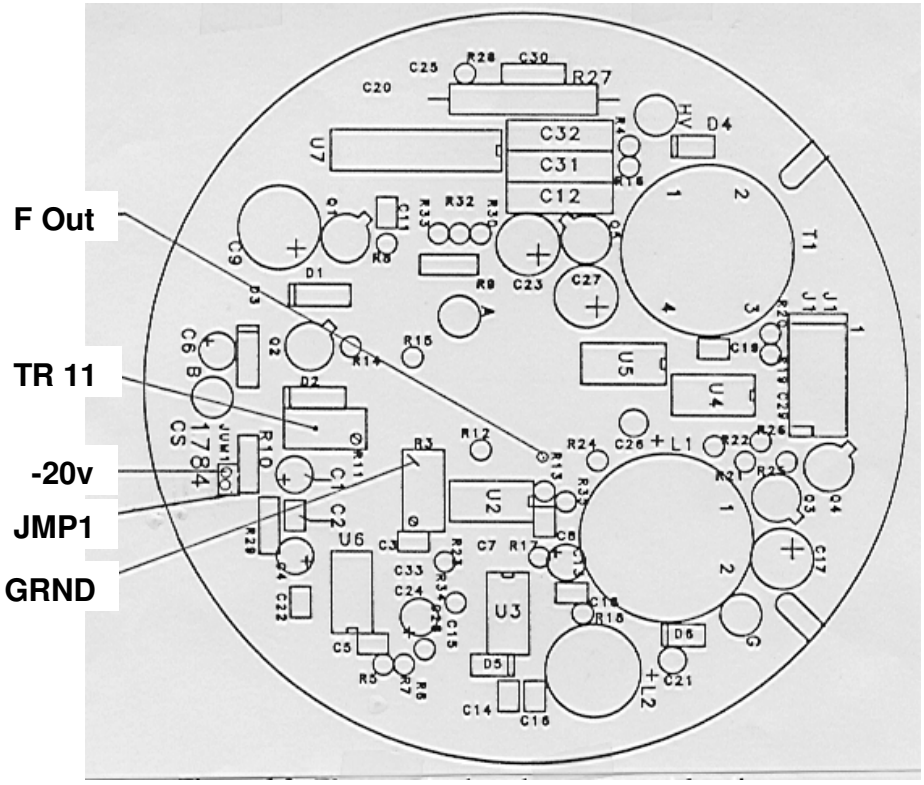
6.2.5 Check the linearity response. An example of the RAM ION linearity response with the following radiation levels follows:

- 7 mR/h (70 µSv/h)
- 22 mR/h (220 µSv/h)
- 197 mR/h (1,97 mSv/h) - Calibration point
- 2.6 R/h (26 mSv/h)
- 9.7 R/h (97 mSv/h)
- 29 R/h (290 mSv/h)
- 50 R/h (500 mSv/h) - Overflow check
- 100 R/h (1 Sv/h) - Overload check

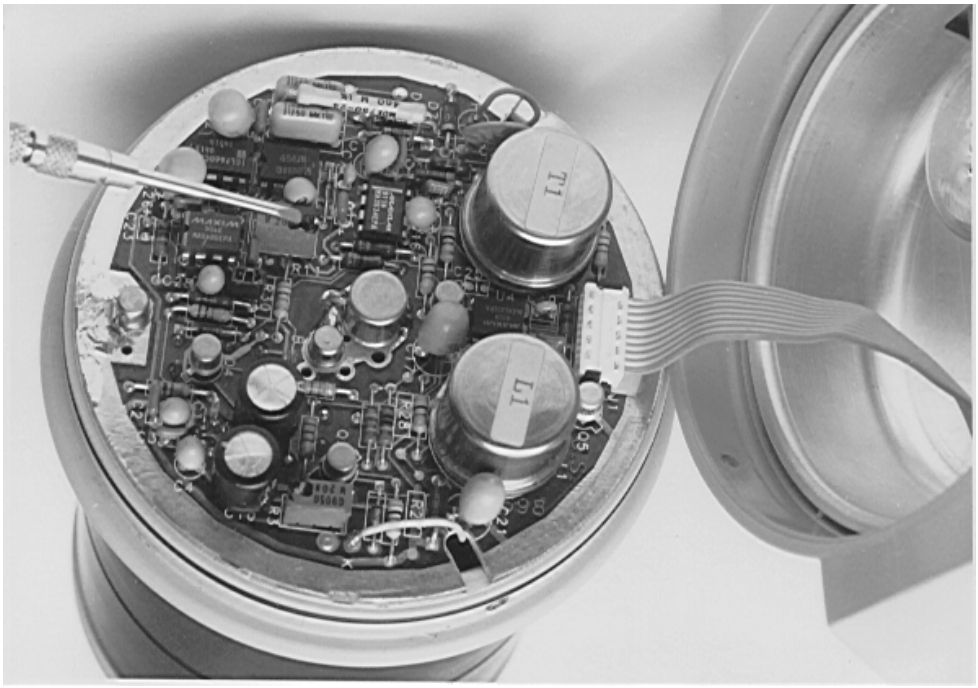
These are typical values only. The exact values are determined according to the exact radiation levels of the source (according to the source decay curve). For acquiring the exact values, please check the specific calibration certificate attached to each RAM ION instrument.



RAM ION Disassembly



Electrometer Board - Component Location



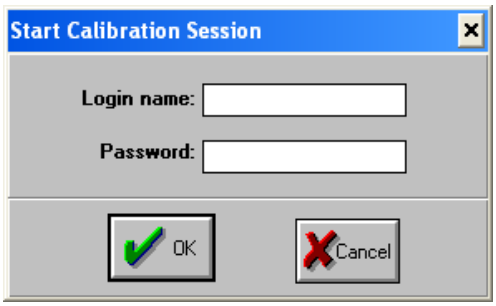
Electronic Adjustment

Radiation Adjustment

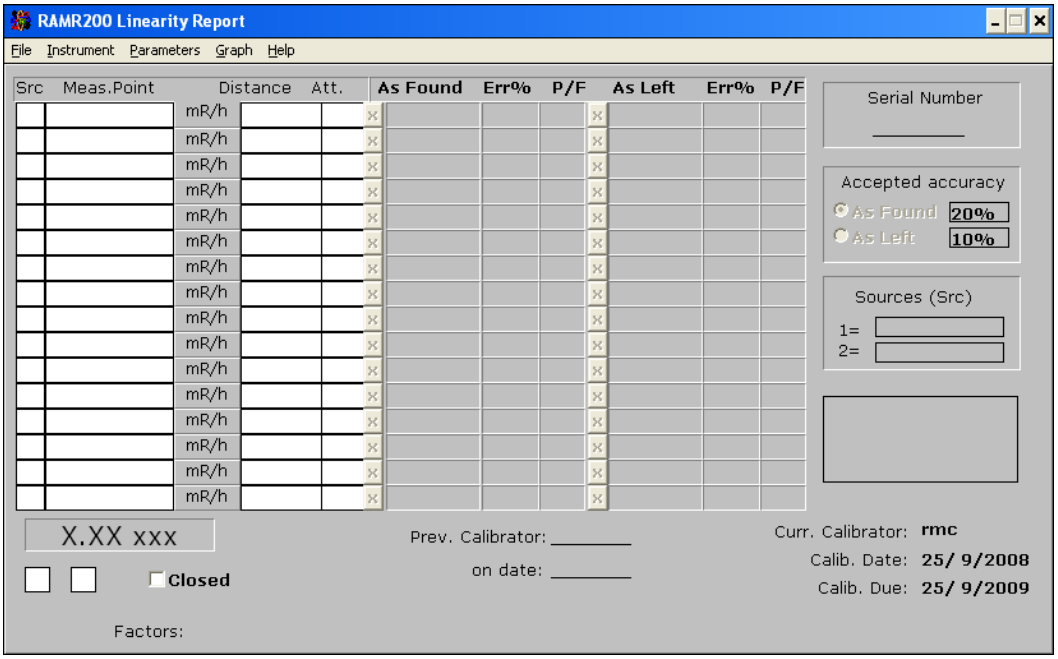
6.3 Computerized Radiation Calibration – RMC Software

6.3.1 Start RMC

1. Run the calibration program via the RMC.EXE file (or icon).
2. Enter Login name – Any name which will appear in the calibration documentation (up to12 characters).
3. Enter Password – “ram” in small letters.



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.
5. To Start the procedure, from the menu bar, click File, New Report



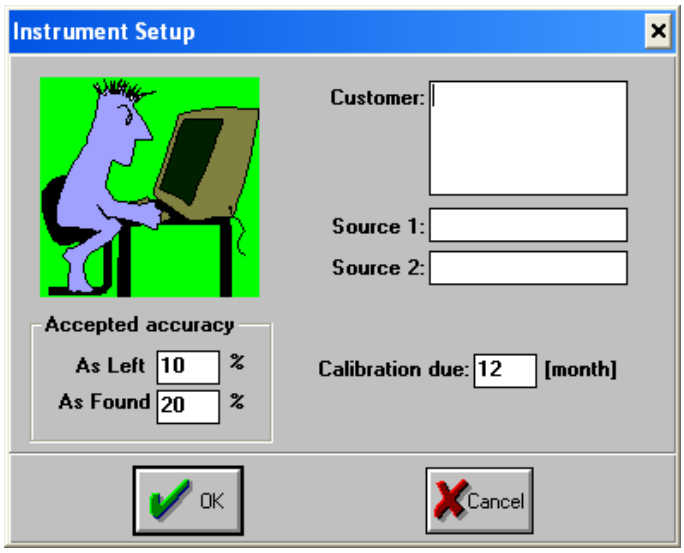
6.3.2 New Templates & Parameters Setup

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

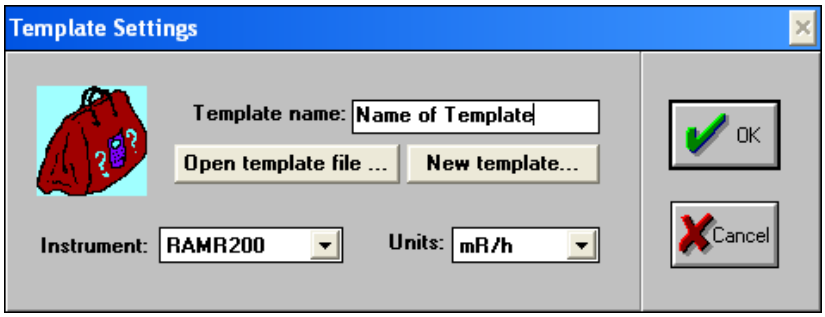
1. **Select an Existing Template:** The RMC program is supplied with a number of default templates. Click File/ Open template and select the required template.

2. **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.

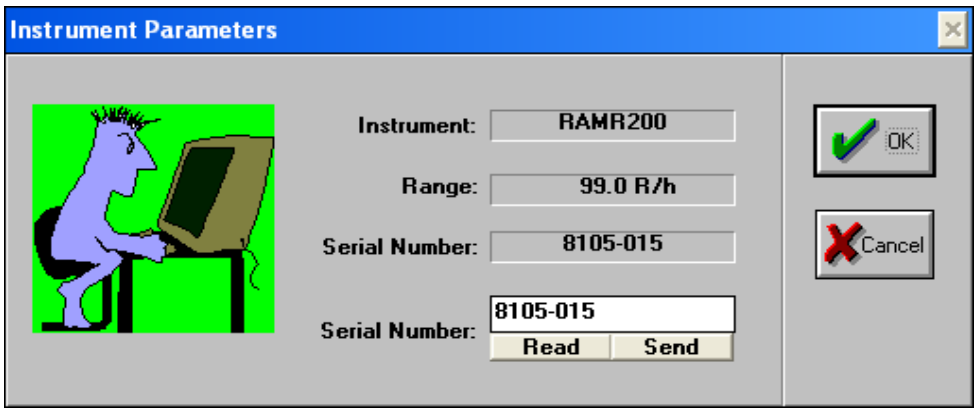
   b) Select Parameters / Setup from the pull down menu. Fill the following: Customer - Enter header (up to 4 lines) for the calibration & linearity certificate. Accepted accuracy:
   - As Left - Enter maximum allowed deviation
   - As Found - Enter maximum allowed deviation
   - Source 1 - Enter source 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.



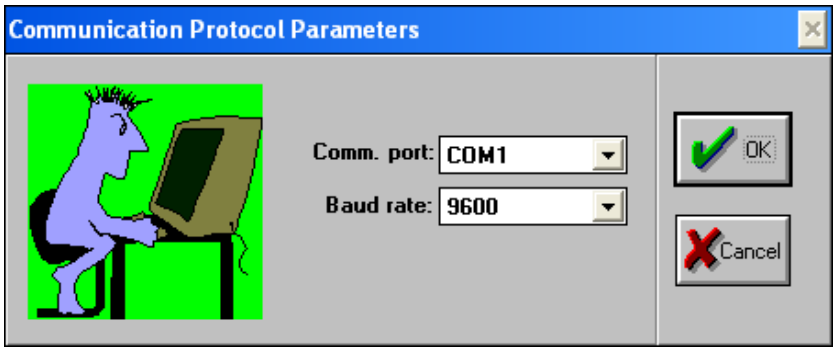
3. **Select Parameters/Template from Pull-down Menu:**
   In the Template Settings window perform the following:
   - Template name - Fill new template name
   - Instrument - Select instrument type/ name
   - Units - Select units to be used in this template
   - New template - Save current template settings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



4. **Set Meter Serial Number:**
Select Parameters / Instrument from the pull down menu. To change the instrument Serial Number, enter the new serial number and click Send.

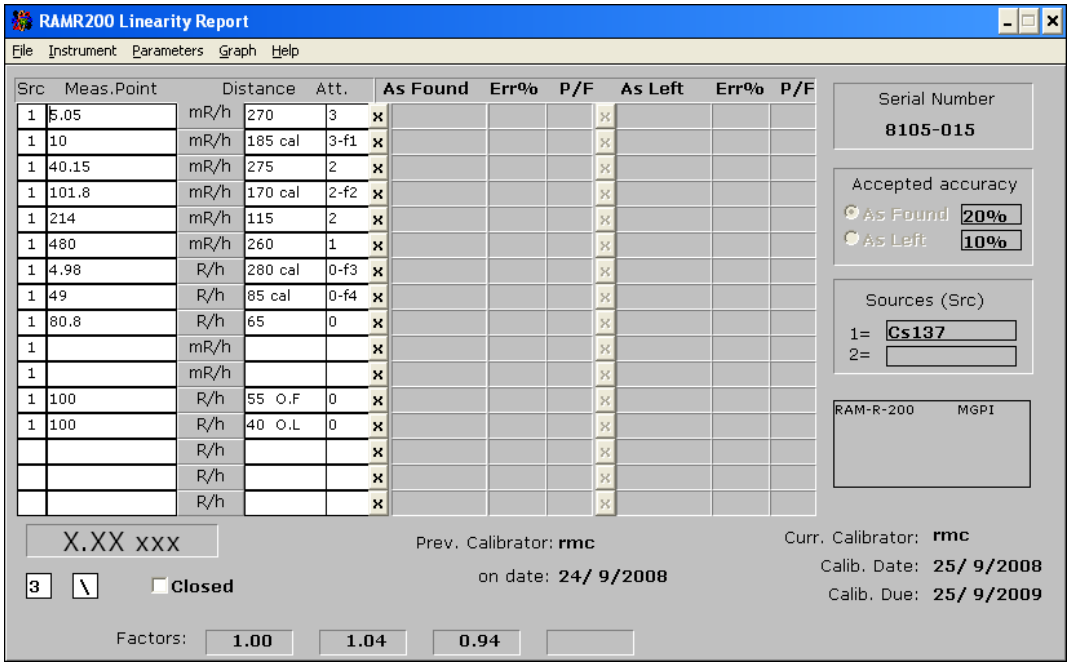


5. **Set Communication Port:**
Select Parameters / Communication from the pull down menu. Set the Comm. port connected to the meter. Set Baud rate to 9600.



6.3.3 Starting-up Calibration & Linearity Process

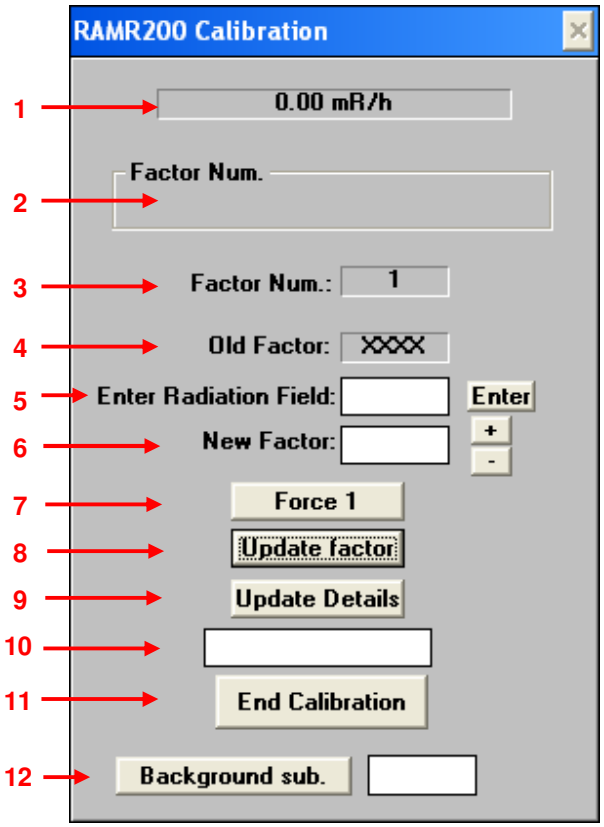
1. Connect the meter to the computer via the appropriate Comm. port (according to the selected port in the set up program), using the customized communication cable.
2. Turn the meter on.
3. Execute the RMC file.
4. Enter User name up to 12 characters.
5. Enter Password, type ram (in small letters).
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.



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.

6.3.4 Calibration

From the Menu Bar, select Instrument/Calibrate. The Calibration window is 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 field value and allow for calibration of the pertinent point. If the calibrator wants to insert a factor into a specific range, the calibrator 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	Factors	Recommended Cal. Point 20%
RAM-ION	One (1)	F1

* ***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.

Instrument/Detector Type	Factors	Calibration mode
RAM-ION	One (1)	a

(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.

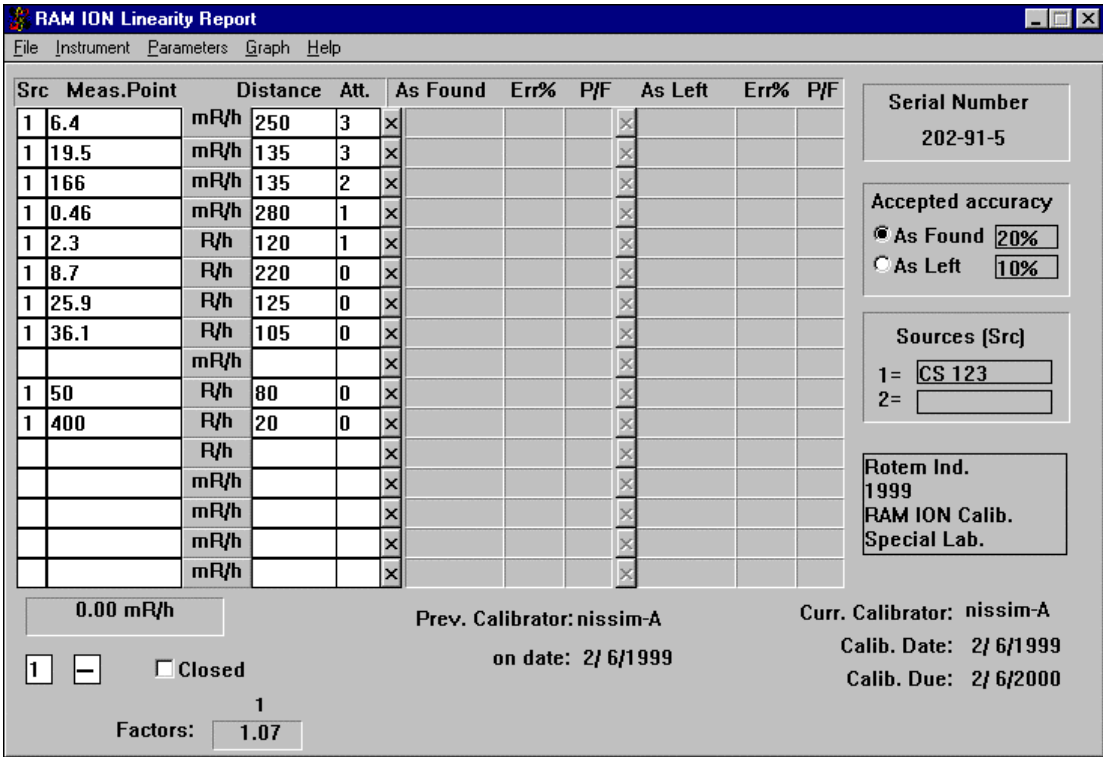
(11) End Calibration – Click to quit the calibration function and return to the main menu.

6.3.5 Linearity

From the Menu Bar, click **File**, then **New Report**, to open the **Linearity Report Window**. The Linearity Report window includes **As Found** and **As Left** columns. Before calibration and linearity check, perform the proceeding steps in the following order:

1. Check linearity in **As Found** column.
2. If linearity fail is obtained the instrument is defected and cannot be calibrated (**P/F - fail**).
3. If linearity **As Found** is ok, calibrate the instrument.
4. Check linearity in **As Left** column.

In order to check linearity and perform calibration to other instrument, from the Menu Bar, click **File** then **New Report** on the pull down menu.



* ***Note***: on the first linearity check, the RMC program force a save of the linearity file.

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 eading.

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 **Parameters** / **Set up.**

Text Box: 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 this point, 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 ✓ in the **Closed** text box will make the file "read only".

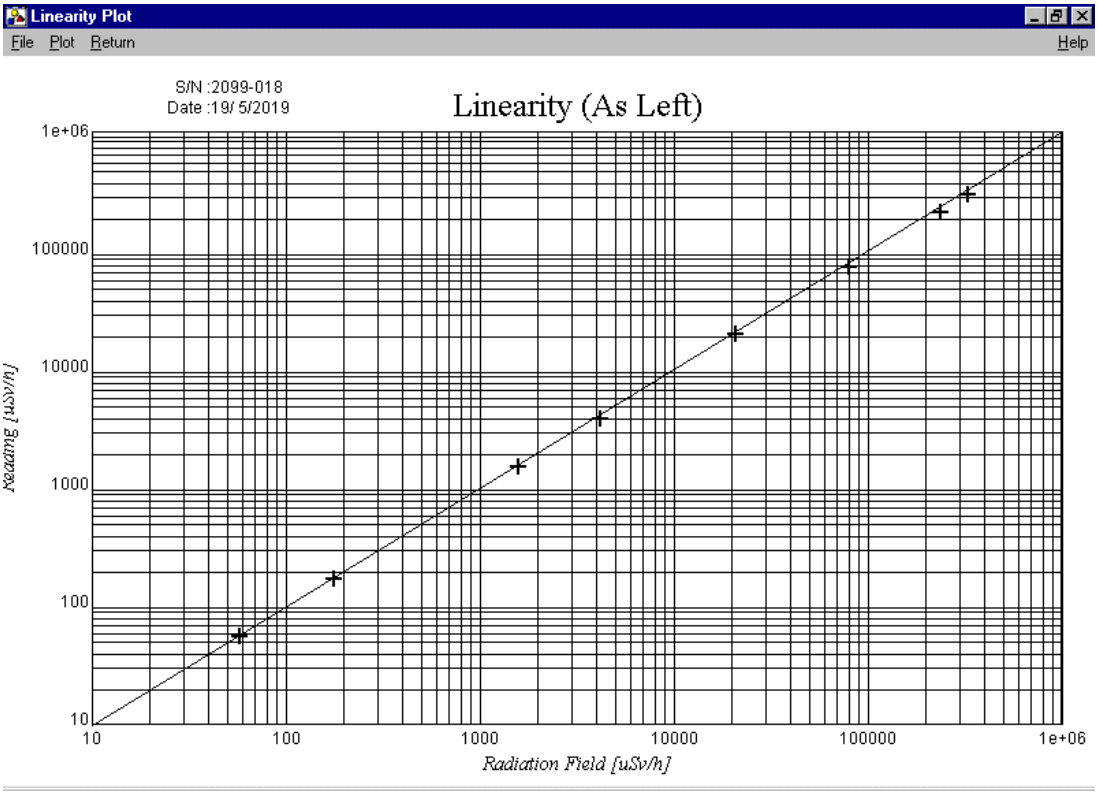
From this point, when entering the saved file marked ✓**Closed**, it will be impossible to perform any changes in the Linearity Report window.

6.3.6 Save, Load and Print Calibration & Linearity Certificate

1. **Save and Print Current Calibration and Linearity Certificate**
   a. Click **File** / **Save** for saving the Calibration and Linearity Certificate in a file.
   b. Click **File** / **Print** for Calibration and Linearity Certificate printout.
   c. Click **Graph** to display Linearity graph.
   d. Click **Plot** and select **Linearity** or **Relative Error** graph.

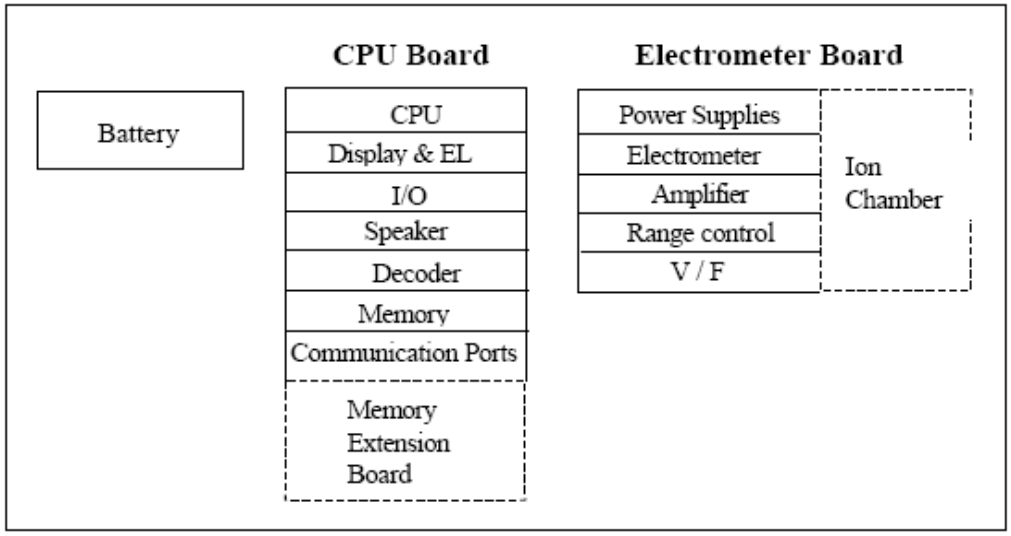
e. Click **File** / **Print** for Linearity graph printout.

2. **Load and Print Previous Calibration and Linearity Certificate**
   a. To load a previous Calibration and Linearity Certificate click **File**/ **Open**.
   b. Click to select the appropriate drive.
   c. Click to select the appropriate file.
   d. Click **File** / **Print** for Calibration and Linearity Certificate printout.
   e. Click **Graph** to display Linearity graph.
   f. Click **Plot** and select **Linearity** or **Relative Error** graph
   g. Click **File** / **Print** for Linearity graph printout.



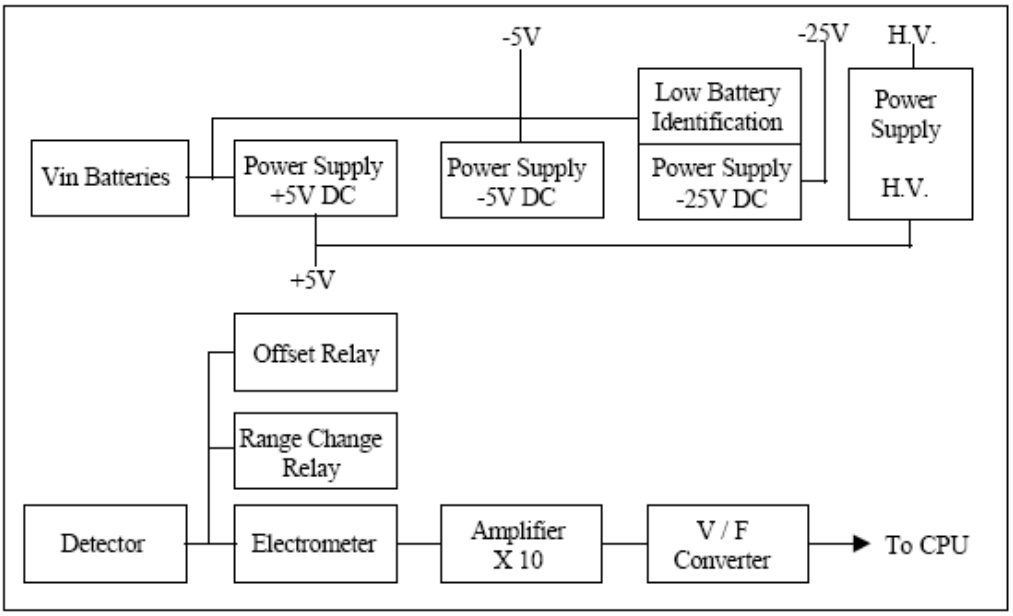
7. Electronic Block Diagrams

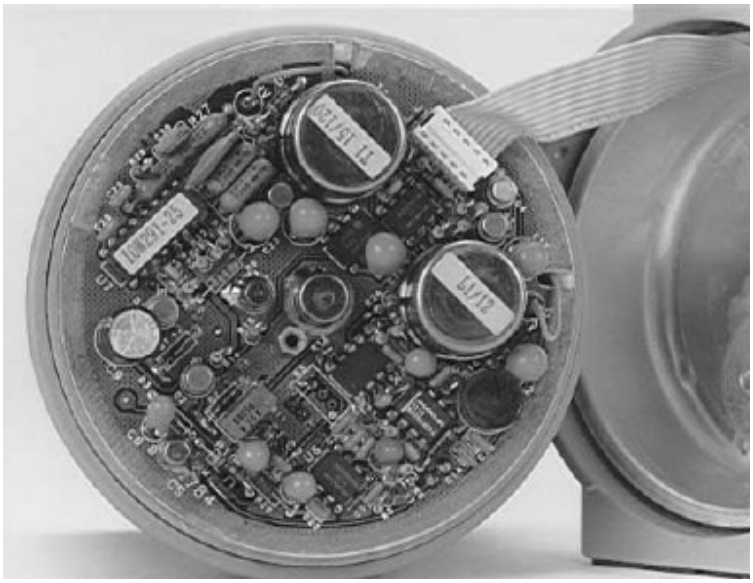
7.1 Block Diagram of RAM-ION



7.2 Electrometer Board

7.2.1 Electrometer Board Diagram





Electrometer Board – Component Side

7.2.2 Electrometer Board Description

The following section describes the Electrometer Board block diagram, (DRW #11730-7, PC #1784).
+5V DC Power Supply (U4) The +5V power supply is a dc/dc switching regulator. It provides dc power voltage to all the system circuits. Input voltage: 1.7V 3V dc Output voltage: +5V dc ±0.15 Ripple: lower than 50 mVpp -5V DC Power Supply (U5) The -5V power supply is a dc/dc switching regulator, which converts positive input voltage to negative of similar value. It supplies dc power voltage to the electrometer amplifier (U1). Output voltage: -5V dc ±0.2 Ripple: lower than 50 mVpp -25V DC Power Supply (U3) The -25V power supply is a dc/dc switching regulator. It supplies dc power voltage to the amplifier (U6). Output voltage: -25V dc ±1 Ripple: lower than 30 mVpp

