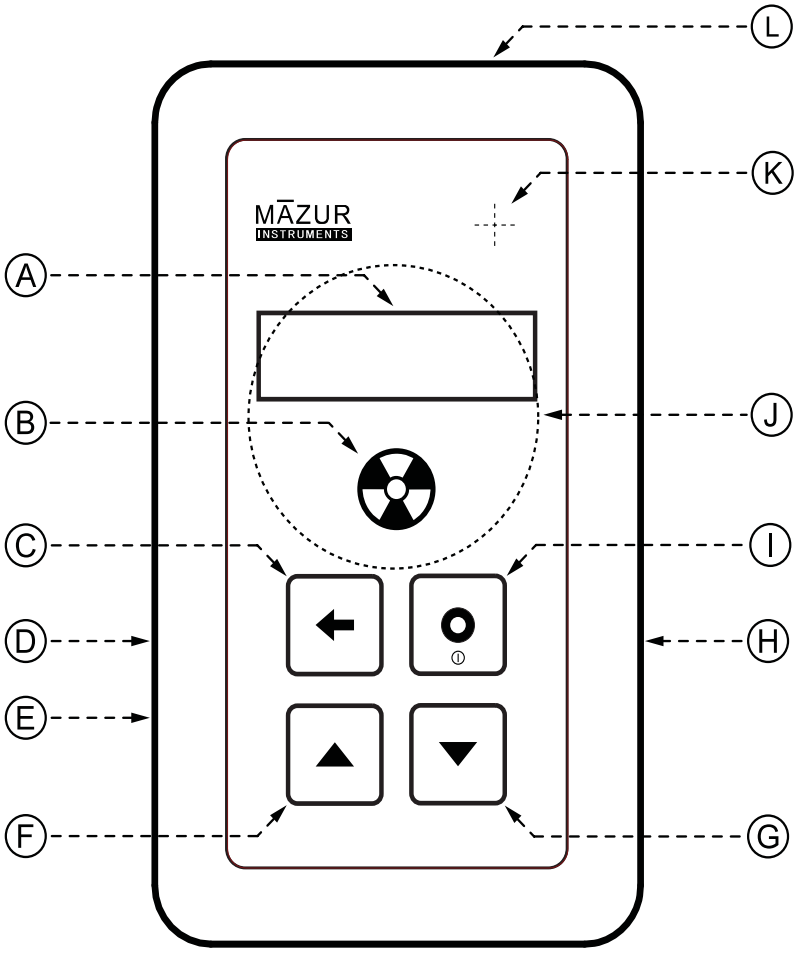
PRM-7000 / 8000 / 9000
Nuclear Radiation Monitor

Quick Start Guide

MĀZUR
INSTRUMENTS

1. Controls, Indicators and Connections



A	2-Line by 14-Character Backlit LCD
B	Radioactive Event LED Indicator
C	Back Key
D	External Audio and Data Jack
E	External DC Power Input Jack
F	Up Key
G	Down Key
H	Sound Port
I	Select/Power On Key
J	Geiger-Müller Pancake Tube Window **(PRM-9000 Only)**
K	Geiger-Müller Tube Gamma Detection Center Point **(Crosshair Printed on Bottom of PRM-7000 / 8000 Only)**
L	Geiger-Müller Tube Alpha Detection Window **(PRM-8000 Only)**

NOTE: Additional detailed information on the PRM Instrument, basic procedures and nuclear radiation in general is available in the Users Guide that can be downloaded from MazurInstruments.com

2. Using the PRM Instrument For the First Time

2.1 Powering On the PRM Instrument

Press and hold down [●] until the start up message and serial number is displayed on the LCD. After approximately three seconds the unit will default to the home screen and begin displaying the current measurement. The unit will beep every time it detects an ionized radiation particle.

This detection is normal everywhere as background radiation exists everywhere. Your particular background radiation level is dependent on many factors including altitude. For example, in Castle Rock, Colorado a normal background radiation measurement is 0.022 mR/hr while in Miami, Florida a normal background radiation measurement would be in the 0.012 mR/hr range. For comparison, on an airplane, at cruising altitude of 40,000 feet, a typical reading would be in the vicinity of 0.400 mR/hr, or approximately 180 beeps per minute for the PRM-7000, 400 beeps per minute for the PRM-8000, or 1,400 beeps per minute for the PRM-9000. Additional information on background radiation and its measurement using the PRM Instrument can be found in the Users Guide, section 14.1 “Determining Background Radiation.” For more information on radiation units see the Users Guide, section 15.1 “Units.”

2.2 Muting the Beeper

The beeper is a vital indicator on the PRM Instrument. Changes in the rate of beeps will be the first indication of a radioactive object or area. However, it is oftentimes desirable to mute the beeper. To mute the beeper:

1. If the LCD display is off (power saving mode), press any key to wake up the PRM Instrument
2. Press [●] to display the “Main Menu”
3. Press [▲] two times to display the “Settings” menu
4. Press [●] to select the “Settings” menu
5. The first setting displayed is the beeper and the factory default is “Beeper: Medium”
6. Press [●] to rotate through the beeper settings until you reach “OFF”
7. Press [←] to move back to the “Main Menu” and press again to return to the home screen

2.3 Setting Desired Measurement Units

The PRM Instrument can display measurements in microrems per hour (µR/hr), millirems per hour (mR/hr), microSieverts per hour (µSv/hr), Counts per Second (CPS) or Counts per Minute (CPM). For more information on radiation units see the Users Guide, section 15.1 “Units.”

1. If the LCD display is off (power saving mode), press any key to wake up the PRM Instrument
2. From the home screen, press [●] to activate the “Main Menu”
3. Press [▲] once to move to “Set Units”
4. Press [●] key to select the “Set Units” menu
5. The current units will be displayed and pressing the [●] key will change the setting
6. Press [←] when complete to return to the “Main Menu”

2.4 Setting Time and Date

1. If the LCD display is off (power saving mode), press any key to wake up the PRM Instrument
2. Press [●] to display the “Main Menu”
3. Press [▲] two times to display the “Settings” menu
4. Press [●] to select the “Settings” menu
5. Press [▲] or [▼] to scroll through the settings. Stop at “Set Time/Date”
6. Press [●] to select and the time/date setting screen will be displayed
7. Press [▼] to move the cursor to the desired digit and [▲] to advance the digit
8. Once the desired time and date are entered, press [●] to save the setting

NOTE: The clock default time is 00:00:00 and the default date is 01/01/11. The clock will be reset to the default time when the user initiates a hardware reset or when the battery has been replaced. The clock will continue to function when the user powers down the device.

3. Power Management Settings

The power settings are outlined in the table below. The factory default for battery operation is “Lowest.” In this setting, the LCD will be turned off after 60 seconds of inactivity. While continuing to measure nuclear radiation, the unit will enter a sleep mode in order to conserve battery power. Once any key is pressed, the LCD will resume normal operation. In the “Lowest” setting the backlight will be turned off after 15 seconds. See Users Guide, section 8 “Selecting User Preferences (Settings)” for additional information.

Power Setting (Set in Settings)	**Time of Inactivity Until:**	
	LCD Off	**Backlight Off**
Lowest (Default)	60 Seconds	15 Seconds
Medium	10 Minutes	45 Seconds
High	Always On	Always On
Low Battery Condition	30 Seconds	2 Seconds

NOTE: While in sleep mode (LCD off), the PRM Instrument will continue to monitor and measure radiation including current, average, maximum, minimum and total-count values. Pressing any key will “wake-up” the LCD and operations will continue normally until the inactivity threshold of the selected power setting is exceeded.

4. Home Screen Operation

The home screen provides the user with the ability to quickly access measurement information with a single key press. The ▲ and ▼ keys allow the user to scroll through various displays as indicated in the table below. Pressing the ← key turns the LCD backlight on and off.

←	Toggle Backlight On and Off
▲ or ▼	Move up and down through the eight screens: 1. Current Measurement 2. Average Measurement 3. Maximum Measurement 4. Minimum Measurement 5. Total Count Measured 6. Time/Date of Maximum Measurement 7. Current Time and Date 8. Elapsed Time Since Power Up, or Reset
⊙	Select Main Menu

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4.1 Current Measurement

This display indicates the current radiation measurement in the chosen measurement units. The user can select microrems per hour (µR/hr), millirems per hour (mR/hr), microSieverts per hour (µSv/hr), Counts per Second (CPS) or Counts per Minute (CPM). The default unit of measurement is mR/hr.

While powered on, the PRM Instrument takes measurements every second. At low levels of radiation (less than 6.00 mR/hr) these measurements are averaged across the number of seconds as determined by the **Low AvWin** setting.

The default setting is 20 seconds. In this setting the display will update with the average of the last 20 seconds of measurements. The setting can be changed to enable a quicker (shorter averaging period) response time at low levels. Quicker response times are useful for locating objects and/or areas which are the source of radiation levels that are above the normal background levels, see the Users Guide, section 8.9 “Low AvWin” for more information on the **Low AvWin** setting.

NOTE: Because of the random nature of background and low-level radiation, it is normal for the current measurement to vary while observing the display. Also note that the maximum value viewed on the current display is averaged over the **Low AvWin** setting of 5, 10 or 20 seconds. At low levels of less than 6.00 mR/hr, the maximum screen (discussed below) is the maximum value measured and averaged across one minute. It is normal that maximum values observed in the current measurement display will likely differ from those recorded in the maximum measurement display.

4.2 Average Measurement

This display indicates the average dose rate level that has been measured since the device was turned on, or since the average, maximum, minimum, total and elapsed time counters were reset.

This capability is very useful for determining the normal background radiation and together with maximum and minimum measurement displays (discussed below), for long-term monitoring of an area or an object.

The PRM Instrument is constantly counting all pulses from the Geiger tube and calculating the average by dividing the total count by the elapsed time and then compensating through the calibration solver to accurately represent the average in the selected dose rate units.

NOTE: The average, maximum, minimum and total counters, as well as the time/date of maximum and elapsed time registers, are reset by any of the following:

1. The unit is powered on
2. A hardware reset is performed
3. The user resets the counters from the utility menu
4. After the user performs a timed measurement. See Users Guide, section 6 “Performing a Timed Measurement (Timed Measure)”

4.3 Maximum Measurement

This display indicates the maximum level that has been measured since the device was turned on, or since the average, maximum, minimum, total and elapsed time counters have been reset. This capability provides valuable insight into one-time events or conditions that occur while the user is away from the device.

When a new maximum is recorded, the PRM Instrument notes the time and date and stores this information for later viewing by the user.

4.4 Minimum Measurement

This display indicates the minimum level that has been measured since the device was turned on, or since the average, maximum, minimum, total and elapsed time counters have been reset. This provides useful information as to the minimum value the device has measured.

NOTE: At low levels of less than 6.00 mR/hr, the maximum and minimum are averaged over one minute. At higher levels, the maximum and minimum are determined by measurements recorded every second.

4.5 Total Count Measured

This display indicates the total number of pulses from the Geiger tube recorded by the PRM Instrument since the device was turned on, or since the average, maximum, minimum, total and elapsed time counters have been reset. The value is uncompensated and indicates only the number of pulses detected by the device which corresponds to the number of times the audible click sounds, or the LED blinks.

4.6 Time/Date of Maximum Measurement

When a new maximum level is recorded, the PRM Instrument captures the time and date that the maximum occurred. This allows the instrument to capture and report transient maximums in radiation level that may occur within an otherwise normal background radiation environment. Time format on this screen is 24-hour hh:mm:ss and the date format is: MM:DD:YY.

4.7 Current Time and Date

This screen displays the time and date of the real time clock/calendar within the PRM Instrument. Time format is 24-hour hh:mm:ss and the date format is: MM/DD/YY.

4.8 Elapsed Time

This screen displays the elapsed time in days, hours, minutes and seconds since the last reset of the elapsed time registers. The elapsed time shows the time frame during which the average, minimum and maximum values have been established.

5. Powering Off the PRM Instrument

The PRM Instrument is intended to always be on. Power consumption is kept to a minimum using the power settings. To power down the unit press and hold down [⏻] while at the home screen until you are prompted to confirm that you want to power down the device. Press [▲] to confirm. Alternately, the unit can be powered down from the utilities submenu.

The clock will continue to keep time while the unit is powered down and all settings will be preserved. However, when the unit is powered back on, all counters (average, minimum, maximum, total and elapsed time) will be reset.

6. Using the Reset Switch of the PRM Instrument

In the unlikely event that the PRM Instrument becomes unresponsive, the device can be reset using a paper clip. A small hole is located just to the right of the power jack. Insert a paper clip into the hole to push the reset switch. The startup message will be displayed and all factory default settings will be in place.

Alternatively, to reset the device, remove the battery, wait 30 seconds and replace the battery. This will reset the device.

Please note that if the unit has been calibrated and calibration data is found on the device, at reset, the calibration data will be used.

7. Replacing the Internal Battery

To replace the battery perform the steps listed below:

1. Disconnect any external connections to the power connector and audio/data connector of the PRM Instrument.
2. Using a Phillips head screwdriver carefully remove the four screws located around the keypad while being careful not to scratch the case or keypad.

High Voltage is present inside the PRM Instrument. Avoid any contact with areas underneath or past the LCD towards the front of the device.

3. Remove the top part of the case and gently place it on its face being careful not to over extend the ribbon cable connecting the keypad to the main board of the PRM Instrument.
4. Disconnect the 9-Volt battery clip by moving the 9-Volt battery down in its bracket so that it covers the Mazur Instruments logo and then removing the clip from the battery.
5. From the terminal side of the battery, lift the battery out over the bracket that is securing the battery in place.
6. Wait 30 seconds for the system to completely de-energize.
7. Properly discard the used battery.
8. Orient the new battery so that it is positioned to mate with the battery clip and install the clip on the new battery, then use the side of the new battery to spread apart the bracket so that the battery is secured in place.
9. The PRM Instrument should display the startup message and serial number.
10. Be sure to fold the shield into place and gently secure the cover back into position.
11. Reinstall the four Phillips head screws to complete the procedure being careful not to over tighten the screws.

NOTE: If after battery replacement, the LCD display shows random characters, or if the instrument does not seem to be operating properly, reset the instrument as outlined in section 6 above.

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8. About Background Radiation

Background radiation is radioactivity from the environment where the instrument is present. There are three sources contributing to background radiation; terrestrial (from planet Earth), man-made and cosmic. Although background radiation is present everywhere, the concentrations and distributions are not constant. Certain materials have higher concentrations of background radiation, and varying environmental and physical conditions can result in accumulations of background radiation. See the Users Guide, section 14.1 “Determining Background Radiation” for additional information.

9. Measuring Background Radiation

Once the PRM Instrument is moved to a new area, a new background measurement should be established as follows:

1. Place the PRM Instrument away from items that could be radioactive, such as metals, pottery, granite countertops, etc. Ideally, locate the instrument in the center of the area that you want to monitor and locate it table height above the floor.
2. Reset the average counter values - see the Users Guide, section 9.1 “Resetting Counter Values (Reset Counters)” - or power-cycle the unit off and on to reset the counters.
3. Simply allow the unit to run overnight and the next morning, look at the average measurement and note the reading. This will be the normal background count.
4. While measuring, feel free to look at the average value to see the value it is moving towards, but do not move the unit from the current location until the background measurement is complete.

10. Area Measurement and Monitoring

The PRM Instrument is designed to be always-on monitoring the area where it is located. To assess an area, simply move through the screens (See section 4 above “Home Screen Operation”) of the unit and view the average, minimum and maximum values. Note the maximum value measured as well as the time and date that the maximum was recorded.

NOTE: Due to the random nature of radioactivity, it is normal to detect a maximum that is 2X to 3X the normal background radiation. Sustained increases in radiation will generally be reflected in an increased average.

The dose rate alarm can also be set to provide an alarm when the threshold set by the user is exceeded, See the Users Guide, sections 8.3 “Alarm On/Off” and 8.4 “Setting Alarm Threshold in mR/hr (mR/hr Alarm)” or 8.5 “Setting Alarm Threshold in uSv/hr (uSv/hr Alarm)”.

If an increase in the radiation of the area is suspected, re-establish the background count taking keen interest to the resulting average and maximum values as compared to the previously established norms for the area.

If increased radiation (indicating prior contamination) is suspected in a particular region within the area, take timed measurements of the same duration. For information on taking a timed measurement, see the Users Guide, section 6 “Performing a Timed Measurement (Timed Measure).”

Compare results of the timed measurement with the normal background and previous measurements to hone in on the source or location of the highest reading.

11. Measuring Objects

Refer to the following guidelines when measuring an object:

1. With the sensor window or crosshair pointing towards and located close to the object, slowly scan the object with the PRM Instrument noting obvious increases in the beep or LED-blink rate.
2. Think of the sensor window or crosshair as a camera lens that is “looking” at the object. Locating the window farther from the object increases the area that the PRM Instrument can “see,” but does so at a greater distance from the potential source of radiation.

NOTE: The user should locate the sensor window or crosshair at a distance from the object keeping in mind that the strength of a radiation emission decreases as the square of the distance from the source. For example, if the distance from the source is doubled, the emission will decrease by a factor of four. If the distance is tripled, the emission will decrease by a factor of nine. This is known as the *inverse square law*.

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3. If a suspected object, or part of an object is detected, locate the meter in close proximity and take a timed measurement to determine the specific measurement and the extent to which the measurement exceeds the normal background count of the area. See the Users Guide, section 6 “Performing a Timed Measurement (Timed Measure)” for information on taking a timed measurement.
4. If while performing guideline 1 above, no obvious increases are noticed, this does not mean that the object is completely free of radiation. Users should take timed measurement(s) of suspected objects and compare the result with the normal background radiation.

12. What Is a Safe Level of Radiation?

There continues to be much debate as to the safe level of radiation exposure. Opinions range from the position that there is no safe level of radiation exposure to complete acceptance of the limits established by the global collection of governments and agencies.

The matter remains largely a personal choice and Mazur Instruments offers no specific advice on what constitutes a safe level. The company will leave these discussions to the global collection of experts in the domain.

A list of web links is included below as a resource for the reader.

13. Additional Resources

13.1 Web Resources

American Nuclear Society Radiation Dose Chart
http://www.new.ans.org/pi/resources/dosechart/

Canadian Nuclear Safety Commission
http://www.nuclearsafety.gc.ca/

ENENews.com - Energy News
http://enenews.com/

Fairewinds Energy Education
http://fairewinds.com/

Health Physics Society
http://www.hps.org/

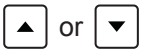
National Institutes of Health
http://www.nih.gov/

Nick's World Collection of Radiation Links
http://www.calytrix.biz/radlinks/

United States Environmental Protection Agency - Radiation Protection Division
http://www.epa.gov/radiation/

United States Nuclear Regulatory Commission (NRC)
http://www.nrc.gov/

14. PRM Instrument Menu Reference

	Select Main Menu
	Move up and down through the sub-menus: 1. Timed Measure This function allows users to take measurements over a defined amount of time. This is useful for detecting small amounts of contamination. 2. Set Units Users can select either µR/hr, mR/hr, µSv/hr, CPS or CPM measurement units. 3. Settings This sub-menu allows the user to customize the behavior of the PRM Instrument. Settings include those associated with the beeper, LED, dose-rate alarm, time/date, power settings as well as the control over the averaging performed at low dose rates. 4. Utilities This sub-menu includes functions to reset the measurement counters (Average, Minimum, Maximum, Total and Elapsed Time), perform a hardware reset, power down the device, load the factory calibration values, display the voltage of the battery and perform the calibration procedure. 5. Ext Audio/Data This sub-menu is used to control the behavior of the audio/data jack. The jack can output audio at three selectable volume levels, provide a pulse output compatible with third party software or output a serial data stream (optional cable required) on the minute for data collection using a PC. 6. Data Logging This sub-menu provides functions to control data logging to the internal logging memory in the PRM Instrument. 7. Language This allows the user to set the language to either English or Japanese
	Select the desired sub-menu. Repeat the process for navigating through the sub-menus
	Return to previous menu

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Sub-Menu Selection:DEFAULT	Description	Values - Press ⊙ to change/select
Timed Measure		
Start	Starts a timed measurement. The display will show the running average during the timed measurement and a count down of the minutes. The display will hold the final value until dismissed by the user.	
Length: 10min	Defines the length of the timed measurement in minutes.	1min, 5min, 10min, 20min, 30min, 60min, 90min
Set Units		
mR/hr	Sets desired dose rate measurement units	µR/hr, mR/hr, µSv/hr, CPS, and CPM
Settings		
Beeper: Medium	Sets beeper volume control	OFF, Low, Medium, High
LED: ON	Sets LED indicator on or off	ON, OFF
Alarm: OFF	Sets dose rate alarm on or off	ON, OFF
mR/hr Alarm **uSv/hr Alarm** **Set Time/Date**	Sets the dose rate measurement in mR/hr that will result in audible alarm Sets the dose rate measurement in uSv/hr that will result in audible alarm Set time and date in 24-hour format HH:MM:SS, MM:DD:YY	▼ to select digit ▲ to set digit value ⊙ save setting and exit ← exit without change
Bt-Pwr: Lowest	Sets battery Power Setting	Lowest, Medium, High
Ex-Pwr: High	Sets external Power Setting	Lowest, Medium, High
Low AvWin: 20s	Low range measurements are averaged over the number of seconds chosen in this setting.	20s, 10s, 5s

Sub-Menu Selection:DEFAULT	Description	Values - Press ⊙ to change/select
Utilities		
Reset Counters	Resets Current, Minimum, Maximum, Average, Total Count and Elapsed Time registers	
Hardware Reset	Resets device and clears all registers including Time and Date	
Power Down	Turns power off and shuts down all radiation monitoring functions	
Load Defaults	Loads factory calibration	**NOTE: This function will erase existing calibration data. Use with care.**
Display Bat/DC	Displays battery and external DC input voltages	
Calibrate	Enters the calibration routine. Two calibrated dose rates are required - 20mR/hr and 200mR/hr	**NOTE: Calibration should be performed by a certified lab with a certified Cs137 source.**
Ext Audio/Data		
Off	Provisions the external audio and data jack for use with either headphones or the optional USB interface cable. The Pulse Out setting can be used to interface the PRM Instrument to radiation graphing software or to other electronic equipment.	Off, Data, Audio:Low, Audio: Medium, Audio: High, and Pulse Out
Data Logging		
Every: Minute	Sets how often a measurement is stored in the data log memory	Minute or Hour
Start or Stop	Starts Logging, or Stops Logging	
Status	Shows the number of Records and Memory remaining during logging and after logging has been stopped.	
Send Data	Transmits log data in comma separated value format at 57,600 baud (requires data cable)	**NOTE: This command is visible only when logging is stopped.**
Language ゲンゴ		
English	Used to select either English or Japanese	English, Japanese

For Additional Information Download the
Users Guide From MazurInstruments.com

Mazur Instruments
200 South Wilcox Street #448
Castle Rock, CO 80104 USA

www.MazurInstruments.com

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