

Rad Software

for the

GM-10/45/50/90/180 Radiation Detectors

(Note: This document should be viewed and printed in landscape mode)

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Overview

The GM-10, GM-45, GM-90, and GM-180 contain one or more thin window geiger mueller tubes, capable of detecting alpha, beta, and gamma / x-ray radiation. Each time a radiation particle enters the sensing window, it is detected, and the software on the attached computer is informed of this event. The GM-50 contains a tube sensitive only to gamma / x-ray radiation (and some very high energy cosmic rays).

The difference between the models is the size of the tube - the GM-45 has a much larger surface area tube (over 23 times as large). This means that it can detect many more particles, giving a better reading. The GM-90 and GM-180 contain two and four such tubes.

By adding up the number of detections per minute, the Counts Per Minute (CPM) is calculated and displayed. This number is a relative indicator of the amount of radiation present. This can also be converted into other measurement units, such as mR/hr, uSv/hr, etc for various gamma energies, with Cs137 and Co60 being the most common.

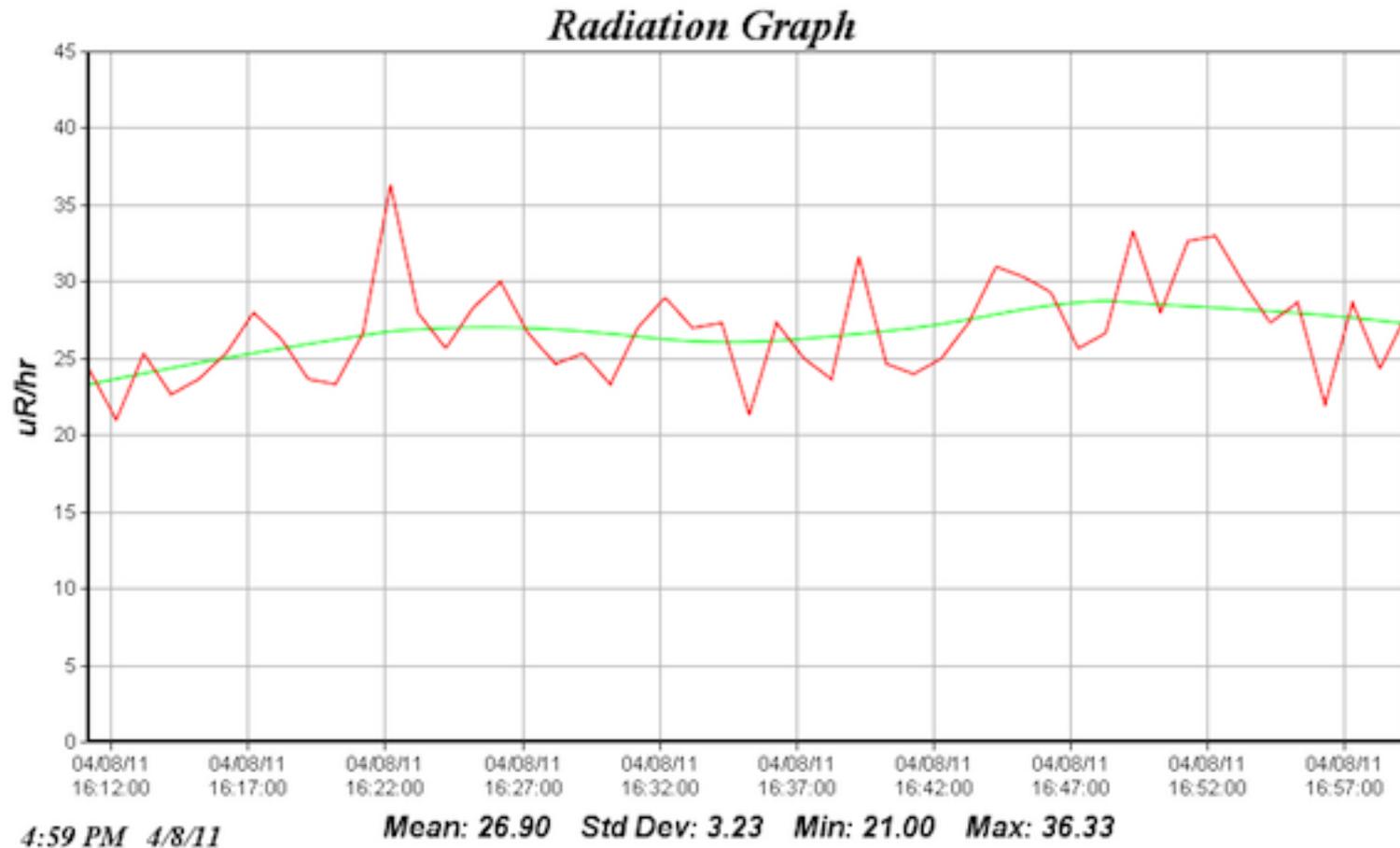
Due to various sources of radiation, both man-made (fallout from nuclear testing in the 1950's and 1960's) and natural (such as radon, cosmic rays, and the like), there is always some background radiation present.

This background radiation level varies, depending on your location, and even the local weather. There are also short term statistical variations. This means that the CPM will vary over a short period of time, centered over what can be considered the actual average value.

Since these detectors are self powered by the computer's serial port, no batteries or external power adapters are needed! You can operate them anywhere you can take your computer or laptop!

Included with the detectors is a copy of the Rad (Radiation Acquisition and Display) software package. Free updates to this software may be obtained from the web site, <http://www.blackcatsystems.com/GM/>

Please be sure to visit the GM-10/45 website frequently, to get software updates, and to read about the various uses for your radiation detector. We also welcome your comments, questions, and suggestions, our email address is info@blackcatsystems.com



Software Requirements

Macintosh

Mac OS X 10.4 or later

Available serial port (serial to USB adapter may be used)

USB Port for USB detectors

Windows

Windows 2000, XP, Vista, Windows 7

Available serial port (serial to USB adapter may be used)

USB Port for USB detectors

Installation

If using USB, the necessary drivers will need to be installed. Separate documentation describes this in detail, but basically Windows users should plug in the USB cable, the wizard will automatically start. Direct it to use the drivers from the CD-ROM. Macintosh users should run the installer program by double clicking on the appropriate dmg image file on the CD-ROM.

Windows users should run the Setup program on the CD-ROM. Macintosh users should copy the Rad software folder from the CD-ROM to your computer's hard drive. To run the program, double click on the Rad application icon. The first time you run the software, you'll need to enter the registration code, which came with your package. Quit the program using the Quit/Exit item under the File menu, then run it again.

Quick Startup

Plug the detector into a free serial port, or if it is a USB detector into a USB port. Start the Rad software. Go to the Setup pane, and select that port from the pop up menu. When the correct port is selected, the detector will be powered up (and you will hear a faint buzzing sound, which is completely normal).

By default, the software will update the counts per minute (CPM) in the main pane every second. The graph will be updated once a minute (this update rate may be changed, see the detailed instructions below).

Menus

File:Open Recording File

Creates a new window with a graph of readings from the recording file you select. It is useful to review previously stored readings.

File:Page Setup...

The usual page setup window, to prepare for printing.

File:Print

Allows you to print out the graphing window. The size of the printed window is proportional to the size of the window on your monitor. If the size of the printout is too small, try enlarging it in the Page Setup window, if your printer supports enlargement..

File:Quit

Quits the program.

File:Histogram From Graph

Creates a histogram from the data currently displayed in the graph window.

File:Histogram From File...

Allows you to specify a recording file, and creates a histogram from that data.

Edit:Copy Graph

Copies the graph image to the clipboard, so that it may be pasted into other applications, such as word processing documents.

Edit:Copy Data

Copies the data that makes up the graph image to the clipboard, so that it may be pasted into other applications, such as word

processing documents. If timestamp mode is selected, the data will be in two columns, the first will be a timestamp for each reading, the second will be the reading itself.

Edit:Clear

Clears the graph image, deletes all stored measurements.

Edit>Delete First Data Point

Deletes the first stored measurement in the graph. Note: You can control-click on any datapoint to delete it.

Edit:Default Window Size

Restores the main window to the default size.

Tabs within the Rad program

There are nine tabs, each of which is dedicated to a particular feature of the software:

Main

Setup

Graph

Statistics

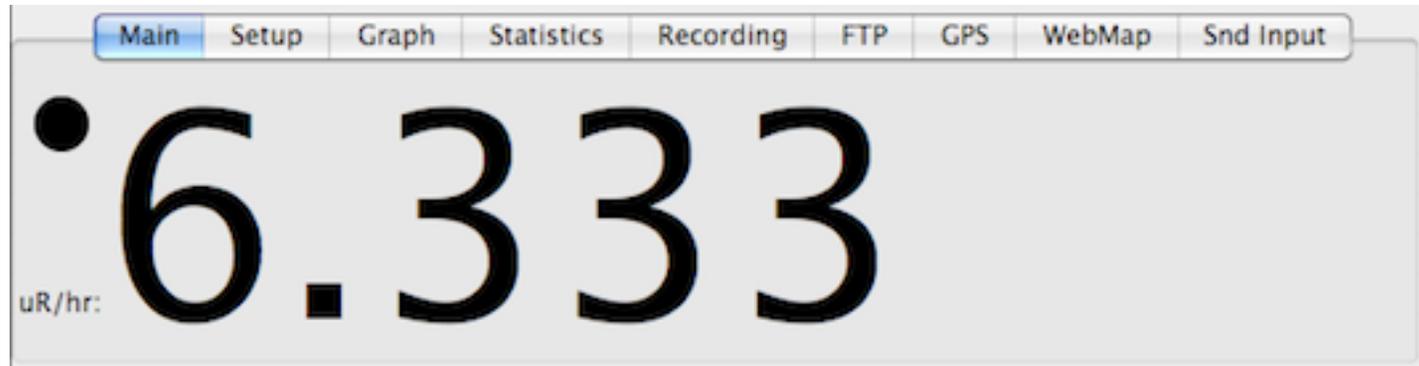
Recording

FTP

GPS

WebMap

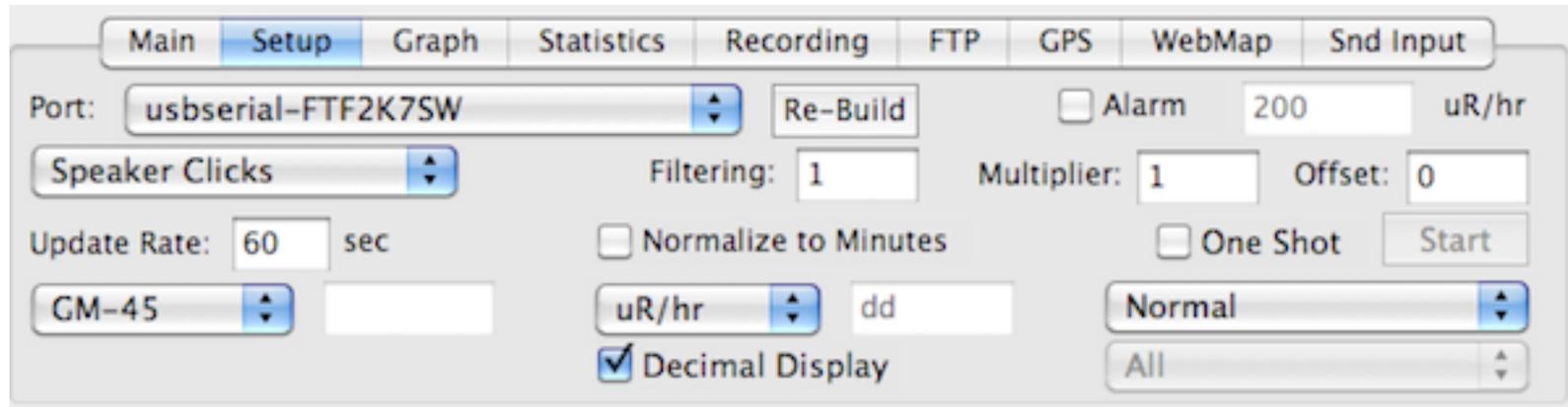
Main



Displays the current reading, by default as counts per minute (CPM), updated each second, averaged over the past minute.

A small indicator in the upper left corner blinks red each time a radiation particle is detected. The units can be changed in the setup tab.

Setup



Port

Used to select which of the computer's serial ports the detector is plugged into. An additional option, called "Dummy Data", allows the software to produce simulated readings without an actual detector connected. Click on the Re-Build button if you plug in a detector or serial/USB adapter after the software is already running. Clicking the Re-Build button will update the list of serial ports, in case one has been added since the program started. But it is best to quit and restart the program if you plug in a new USB/serial adapter.

Sound

A popup menu lets you select whether or not to produce clicks each time radiation is detected. On Windows machines, there is an additional option to use the built in speaker, rather than the sound card.

Alarm

When Alarm is checked, the software will compare the current reading against the value in the alarm box. When it exceeds it, a system beep sound will be generated. The exact sound will depend on what sound you have specified for the alert sound for your computer. The beep will be generated each time the graph is updated (see Update Rate in the Graph tab).

Filtering

A number from 0 to 1 applies filtering. 1 means no filtering, 0 means infinite filtering. 0.5 means each displayed reading is half of the newest reading, and half of the previous displayed value, etc.

Multiplier and Offset

Applied to the measurement, can be used for custom scaling purposes. The multiplier will be multiplied with the current reading, and then the offset will be added.

Update Rate

Specifies how often the graph is updated with a new reading, in seconds. A typical value is 60 seconds, so the graph updates once a minute. While it is possible to update at a faster rate, this results in each graphed value actually containing information that has already been graphed in previous points. The counts per minute are averaged during this period, so you will notice a ramp up until one update period has occurred. It is possible to select update rates less than 60 seconds. Readings will jump around much more when a shorter averaging period is used.

Normalize to Minutes

If checked, the reading will be normalized to a 60 second period. For example, if the update rate is 5 seconds, then the readings accumulated over 5 seconds will be multiplied by 12.

One Shot

If checked, the software will not continuously take readings. Instead, the Start button will become active, when clicked, the software will sample for the period of time specified as the update rate, display the new reading, then stop measuring. This is useful to take readings for a fixed time period.

Decimal Digits

Used to control the number of digits to the right of the decimal point in the numeric display on the Main tab.

Measurement Units

The first popup menu is used to select the type of detector: GM-10, GM-45, etc. The custom selection can be used, which then enables the field just to the right, allowing a number to be entered. This number is used to convert CPM readings into uR/hr values, based on the characteristics of the detector. For detectors in the popup menu, a value built into the software is used instead.

The second popup menu selects the desired units. The custom selection enables the field just to the right, where text can be entered naming the units, such as an abbreviation. This text is displayed in the reading on the first pane, as well as on the graph.

Interface Type

The choices here are Normal and Dual Channel. The latter should only be chosen if a Dual Channel interface is being used. In

that case, the second popup menu below will become enabled. The choices for that menu are:

Channel A - Count all detection events from the detector plugged into channel A

Channel B - Count all detection events from the detector plugged into channel B

Coincidence - Count all coincidence events (Channels A and B at exactly the same time)

Anti-Coincidence - Count all anti-coincidence events (Channels A or B but not both at exactly the same time)

All - Count all detection events, the sum of channels A and B

Graph

The screenshot shows a software configuration window with several tabs: Main, Setup, Graph (selected), Statistics, Recording, FTP, GPS, WebMap, and Snd Input. The Graph tab contains the following settings:

- X Axis Min: 0, Max: 0
- Y Axis Min: 0, Max: 0
- Title: GM-10 Readings
- X-Axis: Readings
- Enable graphing:
- History: 200
- Show trend:
- Wait 60 sec for first reading:
- Autoscale: (for both X and Y axes)
- Grid: (for both X and Y axes)
- Symbols on Graph:
- CPM Axis:
- Timestamps:
- Axis on Right:
- Timestamp Graph:
- 24 Hr Timestamp:

A "Clear Data" button is located at the bottom right of the window.

X Axis Min

The minimum, or leftmost, value for the x axis of the graph display.
There is a similar value for the Y axis.

X Axis Max

The maximum, or rightmost, value for the x axis of the graph display.
There is a similar value for the Y axis.

Autoscale

When checked, the minimum and maximum values for the axis are automatically set by the software.

Grid

When checked, a grid for the corresponding axis is drawn.

History

Specifies the maximum number of datapoints to display in the graph. When the number of points exceeds this value, old data is discarded, and the graph scrolls to the left.

Wait 60 sec for the first reading

Normally this is left checked. It instructs the software to wait 60 seconds (one minute) before graphing the first datapoint, otherwise an incorrect low value will be displayed, while the counts per minute (CPM) ramp up to the correct value.

Trend

When checked, a light gray trend line will be drawn through the datapoints, showing the best fit. This makes it easy to see what the overall trend is - whether radiation levels are increasing, decreasing, or remaining constant.

The field next to the trend checkbox sets the tension or amount of curvature to the trend line. It can vary between 0 and 1. Setting it to 0 results in the trend exactly fitting all of the datapoints. Setting it to 1 produces a straight line (a linear fit). Experimentation will be required to find the optimum value for your particular situation, you can start with a value of 0.5. Each time you change the value, the trend will be re-drawn.

Clear Data

When clicked, the data in the graph is erased.

Timestamps

When checked, the x axis of the graph is the date/time of the reading.

Axis On Right

When checked, the y axis of the graph is displayed on the right side of the graph, rather than the left.

Symbols On Graph

When checked, small square symbols will be placed at each data point on the graph.

Timestamp Graph

When checked, the date and time of the last graph update are displayed in the lower left corner of the graph.

Enable graphing

When checked, each reading is displayed on the graph. Must be checked for the graph to update.

Title

The title of the graph is specified here.

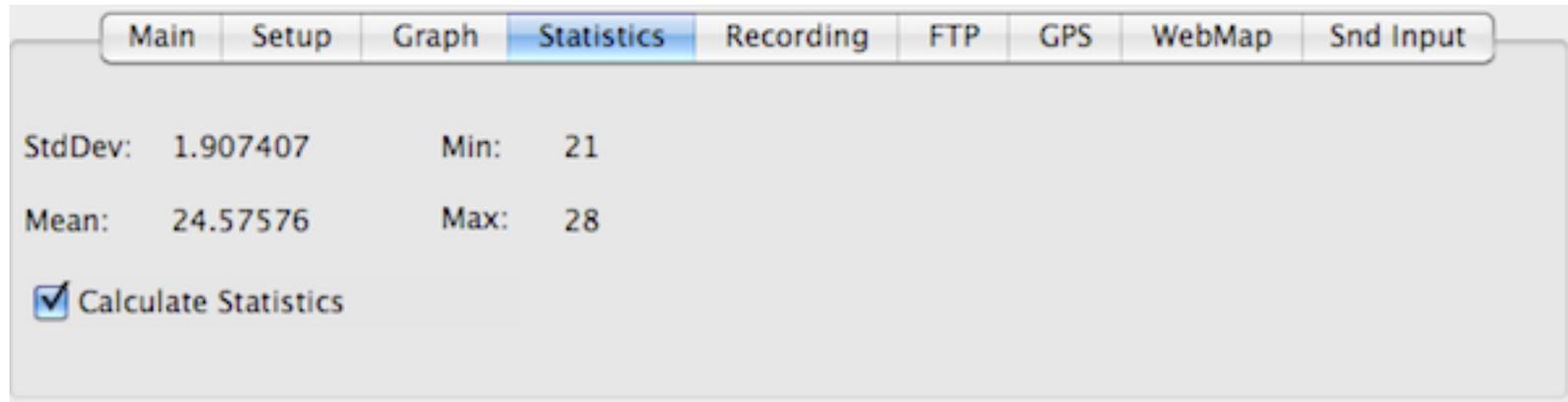
CPM Axis

Adds a second Y axis, scaled in CPM, regardless of the main Y axis scaling.

Fill

Fills the area under the graph with green.

Statistics



This pane shows statistics for the graphed data, namely the:

Mean

This is the average of all of the datapoints.

Min

This is the minimum graphed datapoint.

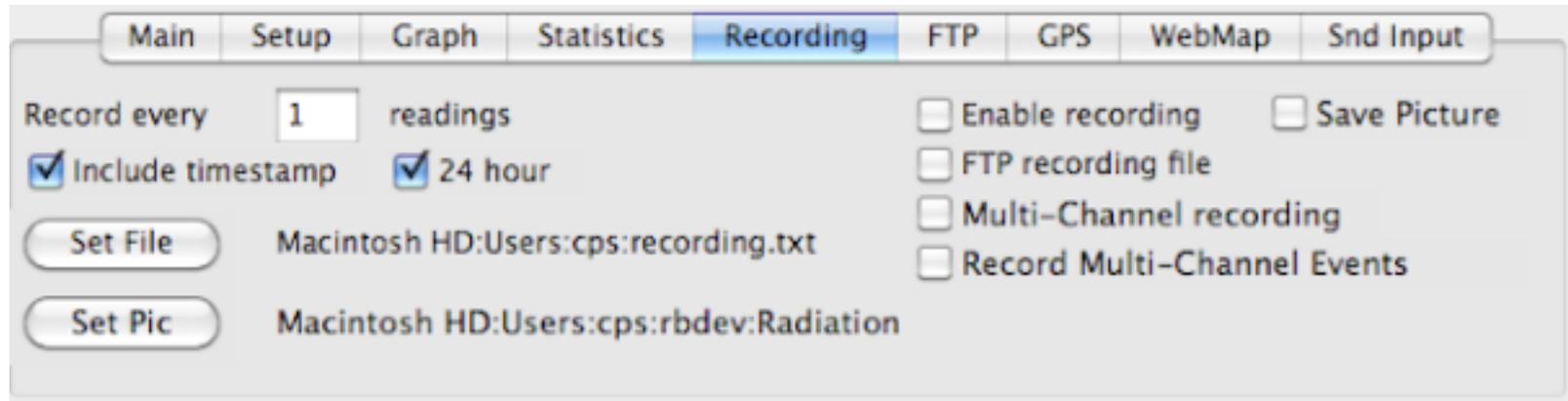
Max

This is the maximum graphed datapoint.

StdDev

This is the standard deviation of all of the datapoints. Typically, the standard deviation is approximately equal to the square root of the mean value. This is only true for truly random radiation events, and for long averaging periods. In most cases, the standard deviation displayed will be slightly above or below the square root of the mean. It will definitely be higher if there is an overall trend occurring, such as the background radiation levels increasing or decreasing.

Recording



The software can store readings in a text file, for use with other programs. Each line of text in the file contains one reading, optionally with a timestamp.

Record every __ readings

Specifies how often data is written to the file. Typically, this is set to 1, indicating that every time the graph is updated with new data, that data should be written to the file.

Set File

When clicked, the user is prompted to specify the name of the file that data is written to. The complete name and path to the specified file is displayed under this button.

Enable recording

When checked, data is written to the specified file.

Include timestamp

When checked, a timestamp is included on each line written to the file, making it easy to graph the data in another program, such as a spreadsheet.

24 Hour

When checked, timestamps are written in 24 hour format.

FTP recording file

When checked, every time a graph is uploaded to your ftp server (see the next section), the recording file is also uploaded.

Multi-Channel recording

When checked, three columns of data will be written to the recording file if a dual-channel interface is used. One column for each channel, and one for coincidences.

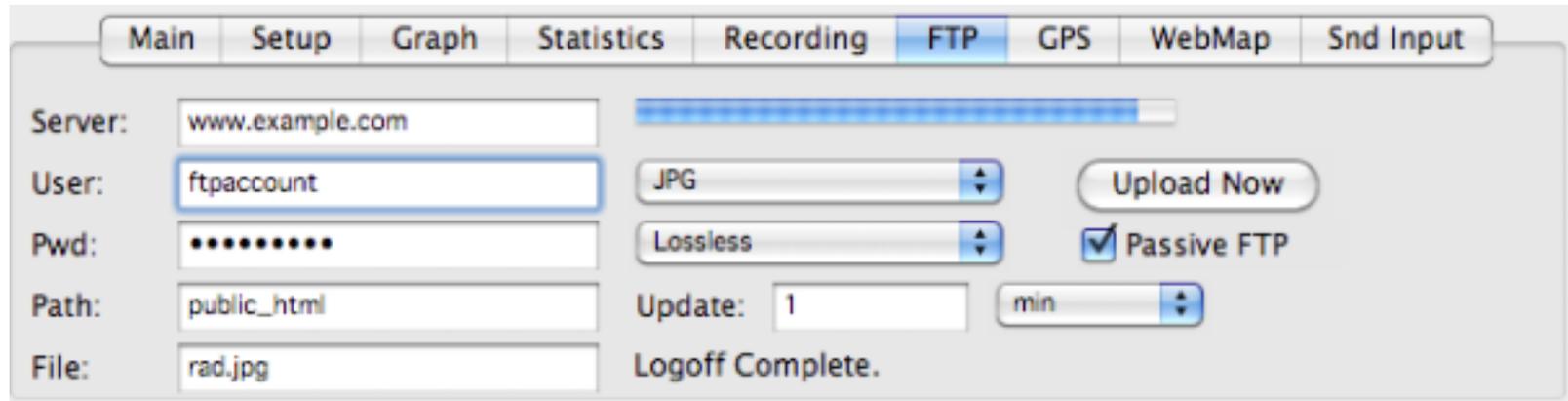
Record Multi-Channel Events

When checked, every time a detection even occurs, a line will be written to the text file EVENTS.TXT with a timestamp, and a 0 or a 1 in each data column, indicating whether or not there was a detection event for that channel. Note that due to the way modern multi-tasking operating systems run, there may be a delay of a second or two between when the event actually occurred, and the timestamp written to the file.

Save Picture

When checked, CPS

FTP



This pane configures the software to automatically upload an image of the graph to your ftp/webs server, so it may be displayed on your website. This allows you to make the graph of radiation data available on the web for others to look at, or for remote display applications.

You can specify how often to upload a new image, such as every hour. The progress indicator in the upper right of the pane will show how much longer until the next automated upload.

Please note that QuickTime version 4.0 or better is required to use this feature. QuickTime is available for free from Apple Computer, for both Macintosh and Windows systems. The URL is <http://quicktime.apple.com> Be sure to do a COMPLETE intallation of QuickTime, to make sure you get all the needed packages.

The trickiest part of setting up this feature is the path into which the image file will be stored on the remote server. You may need to contact your ISP to determine what this path is. Usually, public_html is the root of your website, and you can have additional directories from there.

Update

Controls how often to upload a new picture. Enter the time and select the appropriate units, such as 10 minutes, 1 hour, 30 seconds, etc. Off may be selected to disable uploading of images.

Server

Enter in the name of the server for uploads. You may have to ask your ISP for the name of the server to use.

User

Enter in the user login name to access the server.

Pwd

Enter in the password to access the server.

Path

This is the path to the directory into which the image file will be uploaded.

File

This is the name of the file which will be created, and uploaded.

Format

Select one of these three format types:

BMP

JPG

PNG

Compression

This specifies how much compression to be applied to JPG images. The more compression, the smaller the file, but the worse the picture quality.

Passive FTP

Enables passive FTP transfer mode. Useful if you have a firewall preventing active FTP from working.

Upload

Clicking this button will force a graph upload to occur.

WebMap

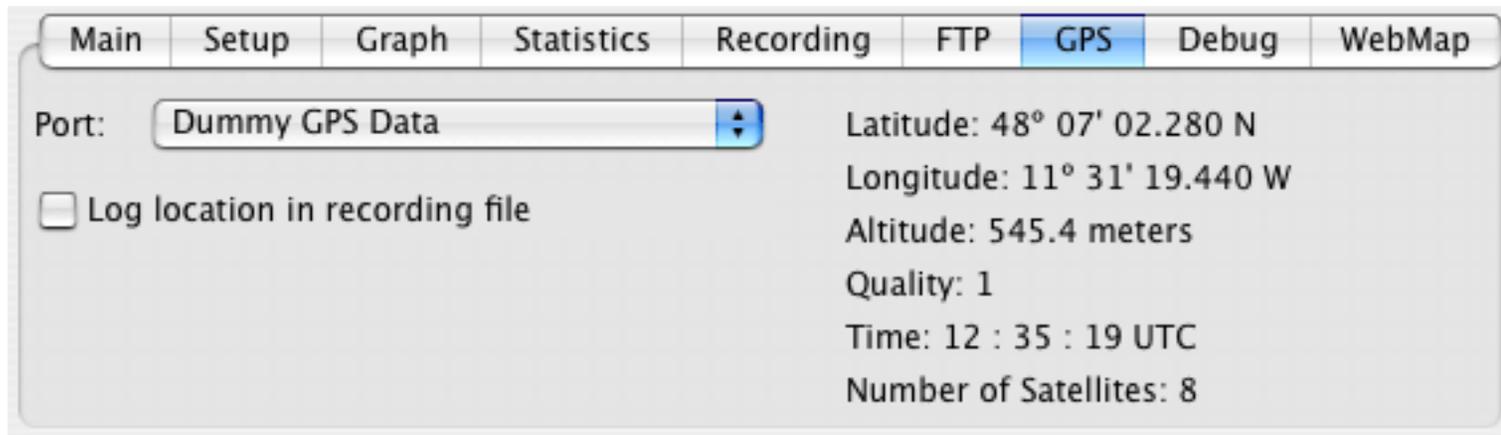


The image shows a screenshot of the Rad software interface, specifically the WebMap configuration window. The window has a menu bar at the top with the following options: Main, Setup, Graph, Statistics, Recording, FTP, GPS, WebMap (which is currently selected and highlighted in blue), and Snd Input. Below the menu bar, there is a checkbox labeled "WebMap" which is currently unchecked. To the right of the checkbox are three input fields: "Latitude:" with the value "39.7", "Longitude:" with the value "-77", and "Password:" which is empty. Below these fields is a label "Label:" followed by an empty input field.

WebMap is a unique feature to the Rad software. If your computer is connected to the internet, Rad can send your current readings and location to be displayed on a real time map. The URL for the map is <http://www.blackcatsystems.com/RadMap/map.html>

If you want to use WebMap, please contact us at info@blackcatsystems.com and we will send you a password. There is no charge to use the service. Just enter the password, as well as your latitude and longitude (south and west are negative, north and east are positive) and check the WebMap box. That's it!

GPS

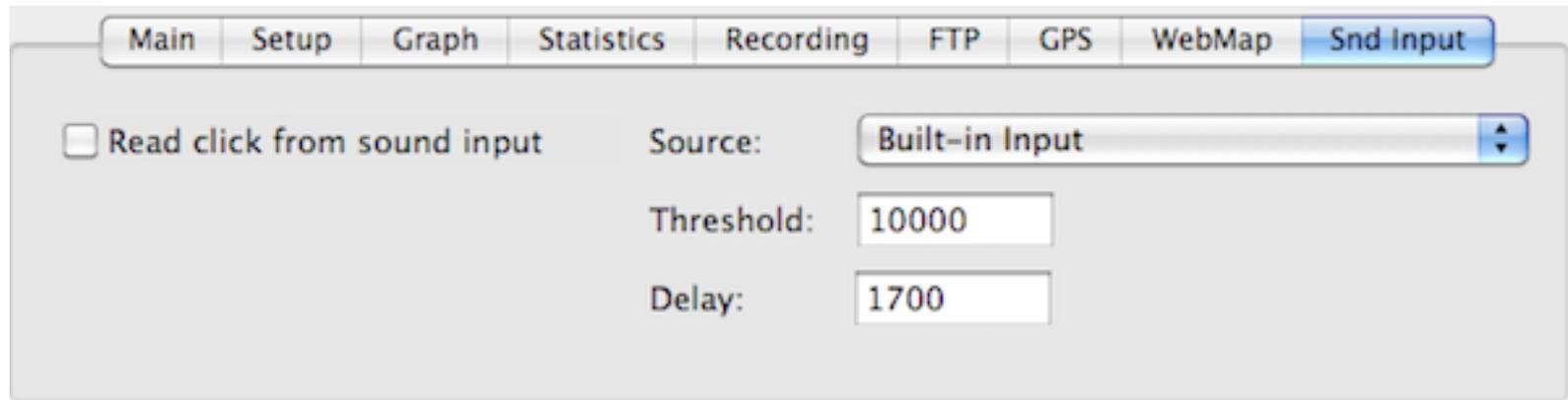


The pane lets you display the readings from a GPS device connected to your computer, as long as it sends data in the NMEA format. Select the serial port in the popup menu (which must be a different port than used for the radiation detector of course). The readings on the right will automatically update with each reading from the GPS device.

Log location in recording file

Checking this will cause the lat/lon location to be written to the recording file, so that a history of location, time, and radiation levels is recorded.

Snd Input



The pane lets you configure Rad to use your computer's sound input to receive clicks from a geiger counter. This allows you to use Rad with geiger counters made by other companies.

Configuration Instructions:

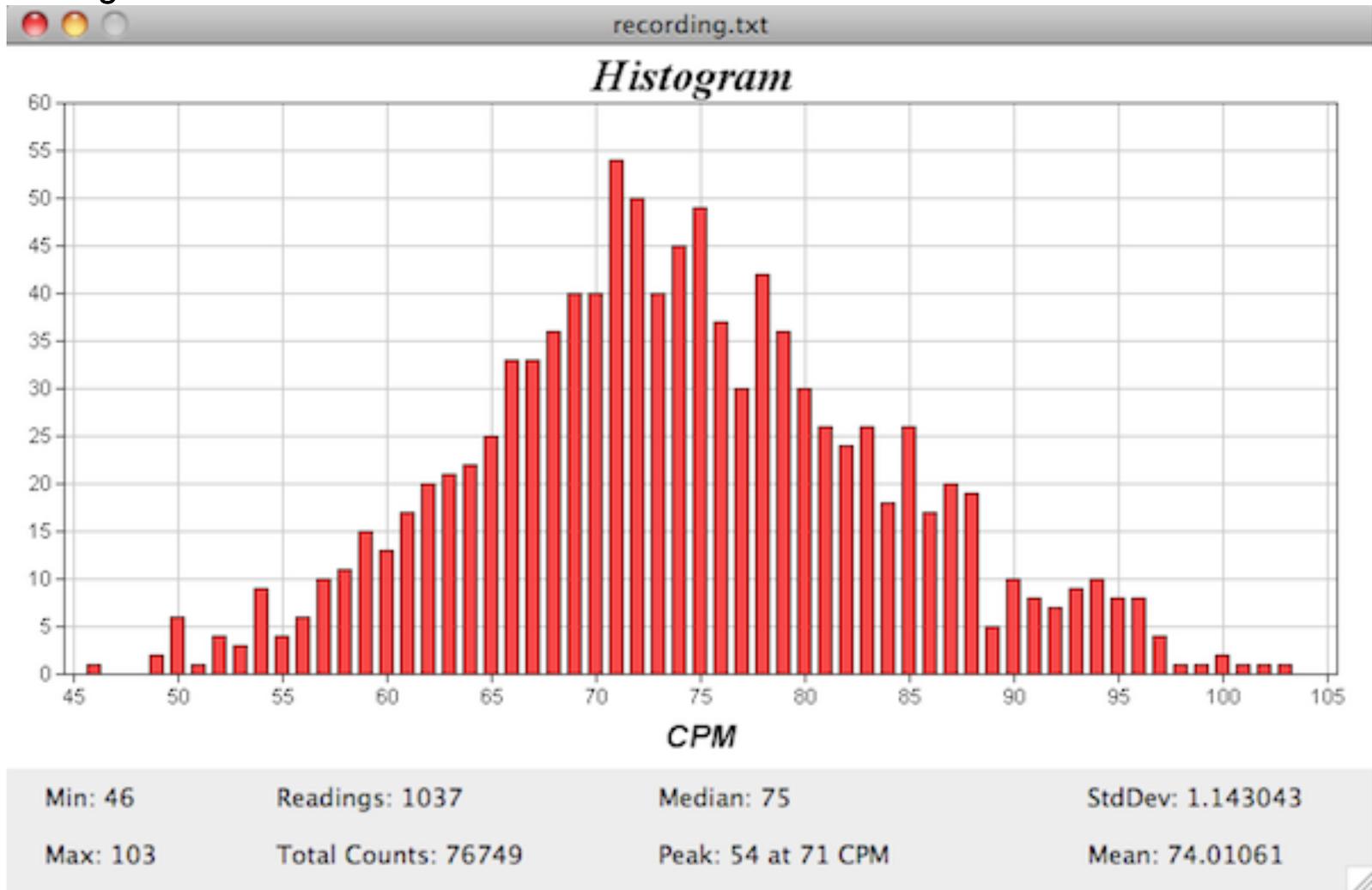
Go to the Snd Input tab, and check Read click from sound input to enable this. From this point on, the sound input will be used, and the serial port will be ignored.

From the popup menu to the right, select your sound input channel. It should display all available sound input sources.

Next the threshold needs to be set. This is the minimum required amplitude of the sound that will be treated as a valid click. It is an integer from 0 to 32768.

Next the delay needs to be set. This is the time period, in sound samples (the sample rate is 8 kHz) during which sound samples will be ignored. This should be set long enough that a single click is only counted once. If it is too short, you'll get multiple counts from one click. If it is too long, you'll miss clicks. You need to manually set this because there are far too many possible different sound waveforms that a click could have.

Histogram



A histogram can be created from either a recording file, or from the currently graphed data. If from the latter, it will be automatically updated each time there is a new reading. The minimum, maximum, median, and mean values are displayed, as well as the peak value, the standard deviation, the number of readings in the histogram, and the total counts.

Running Multiple Detectors on one Computer

It is possible to run multiple detectors on one computer, with Rad version 1.5.0 and later. In order to do this, you need to run one copy of Rad for each detector.

To do this, each copy of Rad must be in its own directory, and you must have a local copy of the Rad preferences file in the same folder as each of the copies of Rad. You can make a copy of this file, which is called "RadGM Prefs" and is located in the Windows folder for Windows systems, and the Preferences folder for MacOS systems. MacOSX systems have a separate Preferences folder for each user.

Rad will then read the local copy of the Preferences file, and use it. This allows you to specify a unique serial port to use for each copy of Rad, so that each copy communicates with one of the detectors.

Troubleshooting

1. Make sure the serial port select is not being used by other program (fax software, internet/modem, software, etc).
2. Make sure the serial cable is firmly connected and tight at both the computer and detector. if a USB/serial adapter is used, be sure to plug it into the computer before starting the Rad software.
3. It is normal to read about 10 to 15 counts per minute (CPM) from normal background radiation with a GM-10, higher values with other detectors. These values could be lower, or higher, depending upon the conditions at your location.
4. Be sure not to touch the detector tube at the end of the unit, or subject it to sharp shocks or drops. While the tube is protected by a mesh, it can easily be damaged. Such damage is not covered by the warranty.

Using Your Radiation Detector

There are many uses for your radiation detector. These include:

Monitoring background radiation levels

Detection of increased background levels due to radon

Detection of increased background levels due to man-made sources (fallout, nuclear power plant accidents, etc)

Detection of radioactive materials (both natural and man-made)

Monitoring background radiation levels

Background radiation levels vary throughout the world, due primarily to minerals in the local soil. Here at our location in central Maryland, USA, we typically see about 10 CPM with a GM-10. In the basements of homes with elevated radon levels, this can and does increase substantially.

A good suggestion is to monitor background conditions for a period of time, to see what typical values are measured at your location. That way, a baseline can be established for comparison purposes. If subsequent readings are significantly elevated above this baseline, then it is fair to assume that some event has occurred to raise background radiation levels.

It's quite common to see variations over the course of a day, or several days, as much background radiation is due to naturally occurring radioactive products (typically radon decay) which are blown in with the wind, and therefore are subject to changing weather conditions.

Common radioactive materials

There are many slightly radioactive materials found around the home. These include:

Sodium free salt - contains Potassium Iodide rather than Sodium Iodide. There is a naturally occurring isotope of Potassium which is slightly radioactive, emitting beta radiation. As a result, anything which contains Potassium is itself slightly radioactive. Placing the GM-10 next to a small pile of such salt substitute will show an elevated reading.

Smoke detectors - most contain a very small (1 microcurie) Americium 241 source, which emits both alpha rays (stopped by the plastic case) and gamma rays, some of which will be detected by the GM-10.

Uranium bearing materials - some older products (such as Fiesta ware dishware, vaseline glass, etc) contain small amounts

of uranium oxide, and are slightly radioactive. Many stone and brick building materials naturally contain small amounts of uranium and/or thorium and daughter products, and are also slightly radioactive.

Camping lamp mantles - some of the older ones contained thorium, and were quite active alpha emitters.

Experiments with the GM-10

Below you'll find examples of just a few of the many experiments that can be performed with the GM-10 radiation detector. Many of these are ideal hobbyist / science class / science fair experiments. If you have additional experiments you've performed, we'd enjoy hearing about them. Send details to us at support@blackcatsystems.com

Radioactive dust

Obtain some recently deposited dust from around the house. Two good examples are dust wiped from a TV set or monitor, or clothes dryer lint just after the clothes are done. Place the dust in front of the GM-10. If you have even the slightest amount of radon in your home (and most homes do), you will see elevated readings over background. This is due to the radon daughter products, primarily Pb_{214} and Bi_{214} . Each has a short half life, about half an hour, so the radiation levels fall off quite quickly. If plotted, a nice double exponential curve is obtained. For this to work, you need at least some level of radon in your home. Depending on your location, the level of radon varies. Some locations have almost no radon present in the soil.

Blocking radiation with absorbers

Place a safe low level radiation source, ideally a beta source (such as a small piece of vaseline glass, or even a small pile of potassium iodide (salt substitute from the grocery store)) in front of the GM-10 to get readings significantly above background levels. Place varies thickness of absorbing materials (such as pieces of paper) in between the source and GM-10, to block some of the radiation. If you record the thickness (actually the basis weight or mass per unit area) and CPM readings, you should obtain a nice exponential decay plot.

Revision History

July 9, 2011 - Version 3.1.0 beta 5 released

Move the green trend line to always be in front of the red data line in graphs.
Added a field to set the trend line tension

July 9, 2011 - Version 3.1.0 beta 3 released

Added the option to fill the area under the graph with green.
Removed the system tray icon display for Windows, due to a memory leak.

May 27, 2011 - Version 3.1.0 beta 2 released

Set histogram save file
Corrected glitch with corrupted saved graphs
Corrected cut off statistics text on graph
Fixed bug concernign FTPing the recording file
WebMap data not sent when in Dummy Data mode
Default graph title changed to "Radiation Readings"
Corrected problems with the scaling of the secondary CPM axis

May 7, 2011 - Version 3.1.0 beta 1 released

Added Histogram.
Added second Y axis.
Added X Axis title.
Several bug fixes.

April 7, 2011 - Version 3.0.0 released

New graphing library.

August 29, 2008 - Version 2.5.0 released

Added an option in the Edit menu to resize/position the window.
Rad Map data converted to uR/hr based on detector type.
Bug fix - multiplier and offset not working.
Bug fix - conversions to other units not always correctly applied.

October 7, 2007 - Version 2.4.5 released

Bug fix - manual axis scaling not working.

Bug fix - Option to auto-save graph image was saving the previous graph.

Bug fix - PNG images not always correctly written.

September 20, 2007 - Version 2.4.4 released

WebMap data is now adjusted to uR/hr based on the the detector type.

August 16, 2007 - Version 2.4.3 released

Bug fix, positioning the mouse in certain parts of the graph could stop the readings from updating.

July 10, 2007 - Version 2.4.2 released

Added option for using the internal speaker on a PC.

January 30, 2007 - Version 2.4.0 released

Added support for multi-channel detectors and interfaces.

December 30, 2006 - Version 2.3.0 released

Added FTP record file upload.

July 13, 2006 - Version 2.2.0 released

Improvements to GPS device support.

March 25, 2006 - Version 2.1.0 released

Added menu item to delete first data point

Added option to control-click a data point to delete it.

December 13, 2005 - Version 2.0.0 released

November 9, 2005 - Version 2.0.0b6 released

Added conversion to mR/hr, uR/hr, and uSv/hr units.

Added uploading of recording files via FTP.

July 25, 2005 - Version 2.0.0a4 released

Added WebRad and GPS features.

June 13, 2004 - Version 2.0.0a2 released

Fixes to graph display to prevent clipping.

Automatically looks for RECORDING.TXT file and will load it if it exists.

Added filtering.

Added multiplier and offset.

Added display of mean, min, max, and std dev on graphs

Hopefully uses less CPU time.

November 23, 2003 - Version 2.0.0a1 released

New ftp routine used.

May 10, 2003 - Version 1.5.0 released

Added alarm.

Added individual preferences files.

February 17, 2002 - Version 1.3.0 released

Added ability to print out graphs.

Fixed a bug which could cause a lockup if the program tries to ftp the graph and there was no response from the server.

November 4, 2001 - Version 1.1.0 released

October 7, 2001 - Version 1.0.0 released

GM-10 Specifications

Size: 4.25 by 2.6 by 1.2 inches (108 by 66 by 30 mm)

Weight: 3.6 ounces (102 grams)

Window: Mica, 1.75 mg/cm²
0.36 inch / 9.1 mm diameter

Radiation detected:

Alpha - Above 3 MeV

Beta - Above 50 keV

Gamma / X-Ray - Above 7 keV

Power requirements: Self powered from computer

Computer Hardware Requirements:

USB version - USB port

Serial versions - One available serial port

Computer Software Requirements:

Windows 95/98/2000/NT

Macintosh MacOS 7.6 to 9.2, OSX 10.1.2 or later

(USB runs in Classic under MacOSX)

Software Features:

Built in graphing

Ability to store data to disk for further analysis

User selectable integration times

Built in statistics package

Trend line may be superimposed over graphed data
"Geiger Counter" clicking may be enabled

Package includes:

GM-10 Unit

CD-ROM with software for both Windows and Macintosh

USB Version:

Built in USB cable

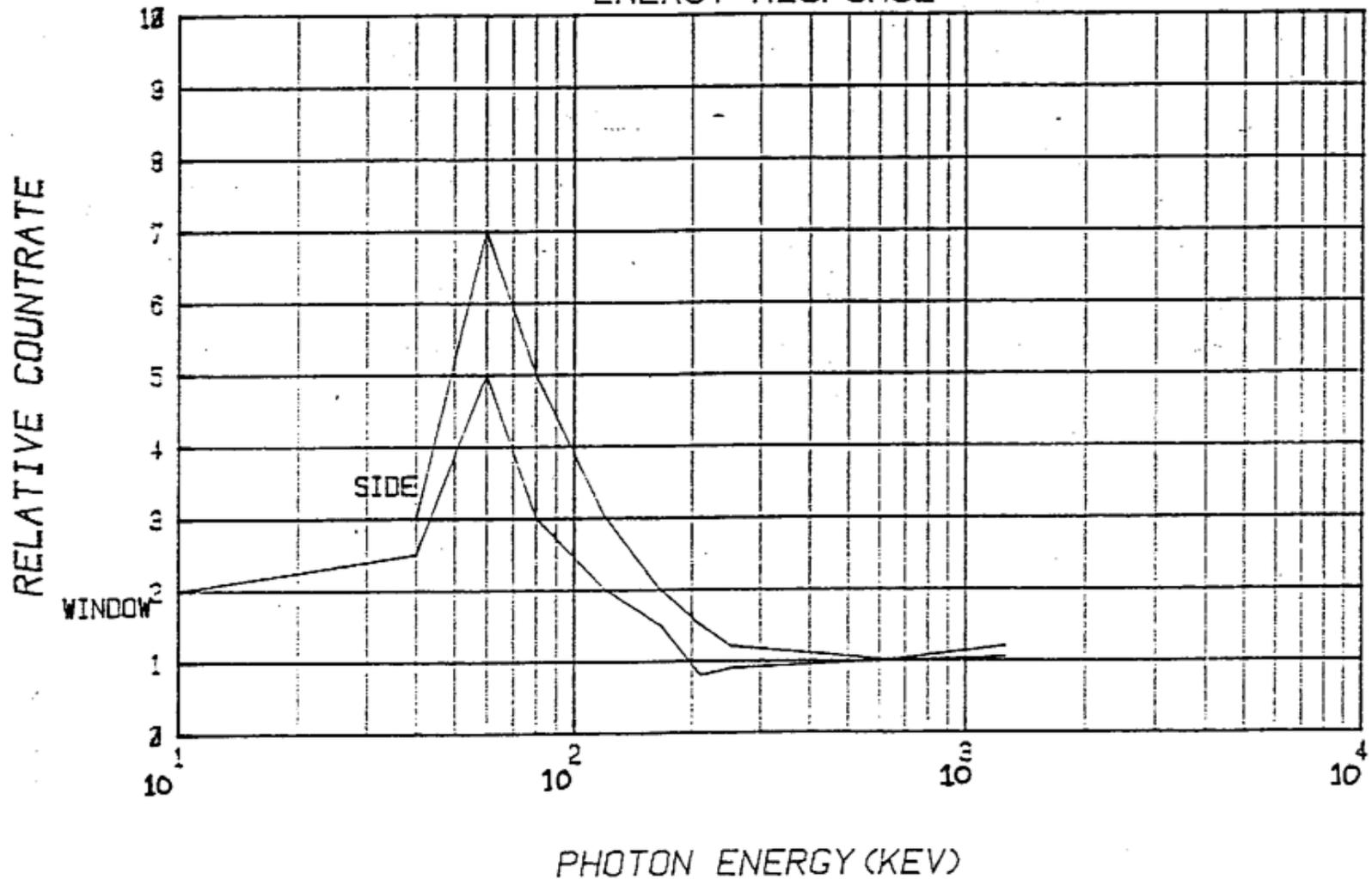
Serial version:

Appropriate serial cable - please order the correct
version for your system, three are available:

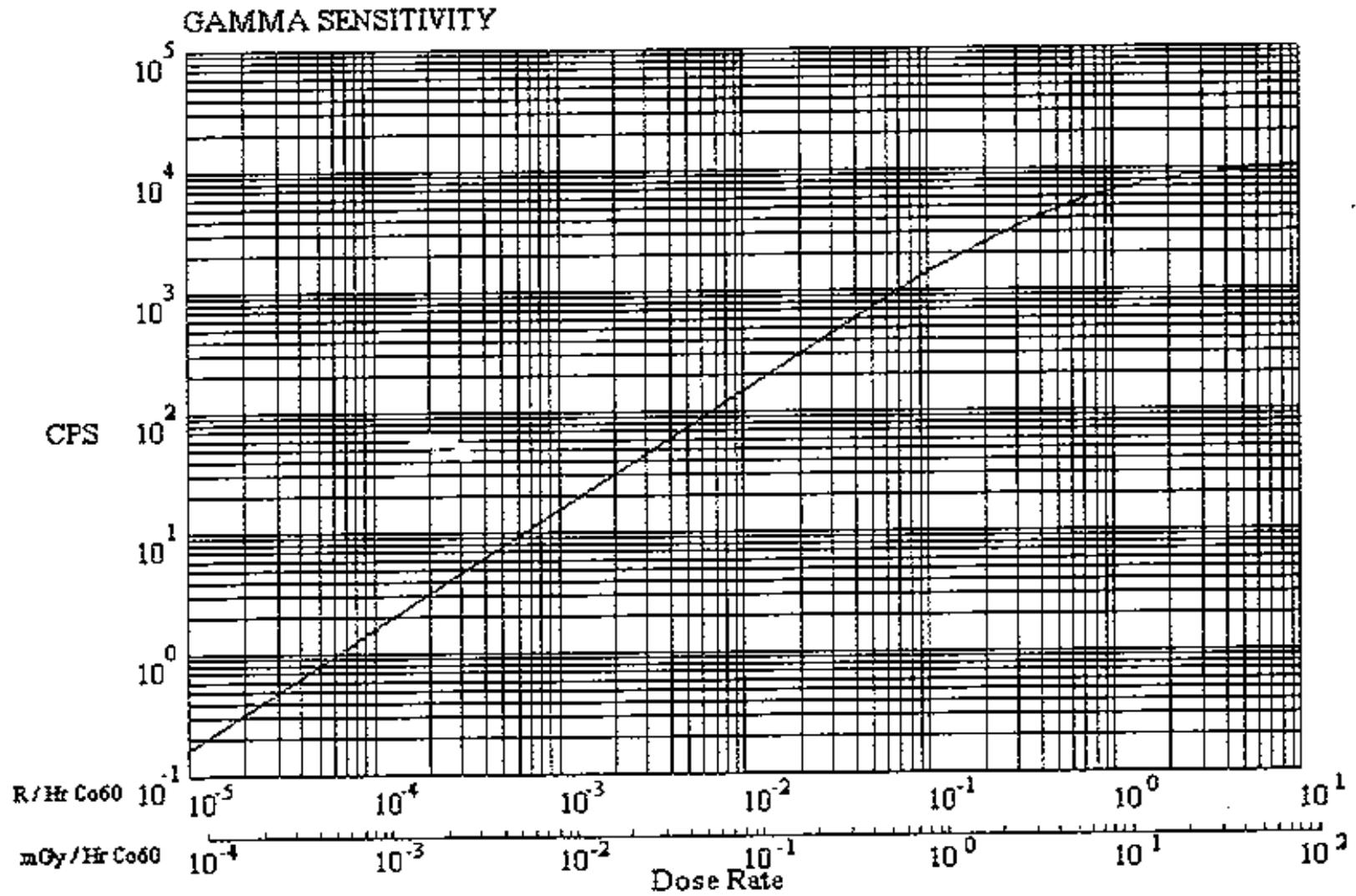
1. Windows with 9 pin serial port
2. Windows with 25 pin serial port
3. Macintosh with 8 pin serial port

Gamma Energy Response

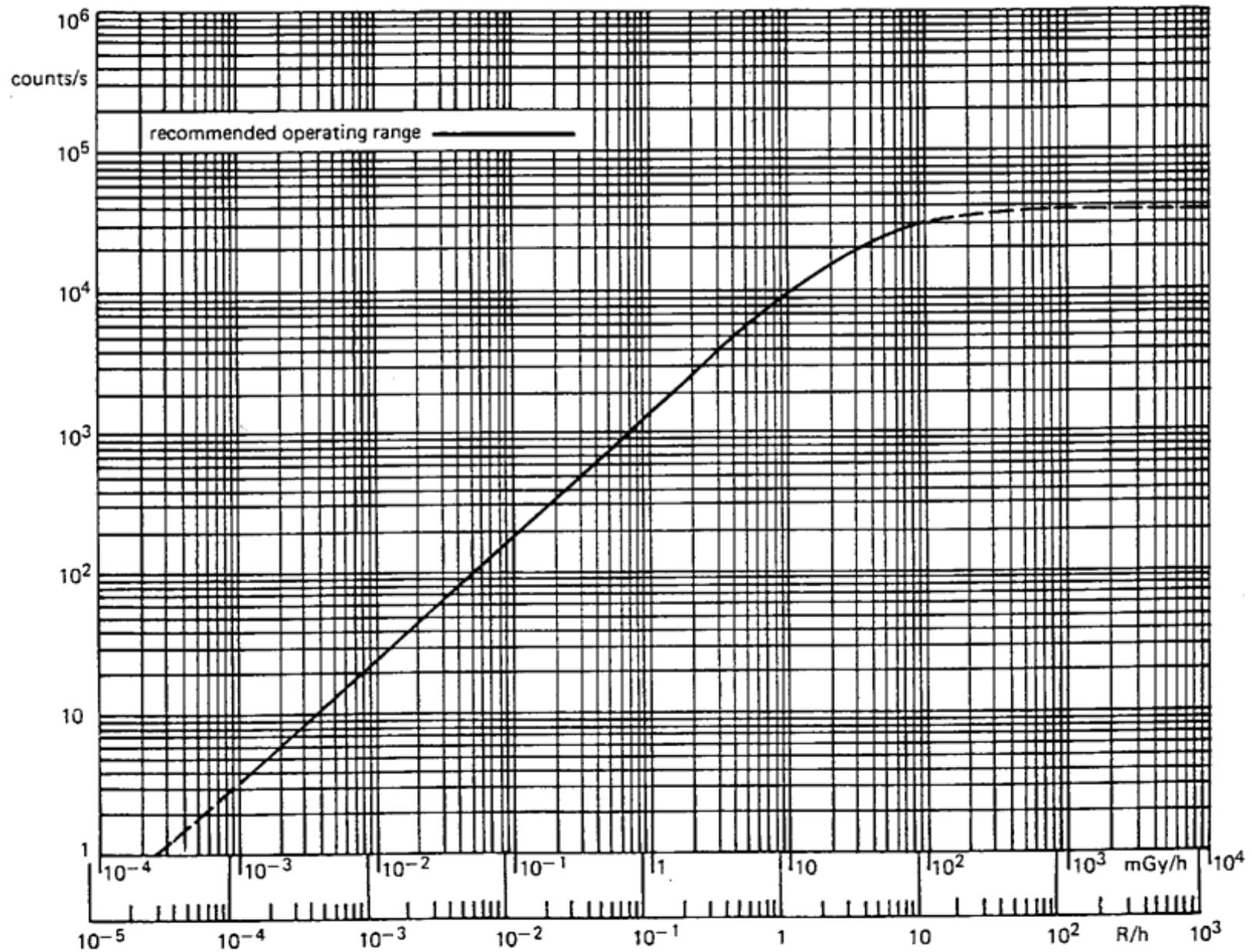
ENERGY RESPONSE



Cobalt 60 Sensitivity



Cesium 137 Sensitivity



Typical counting rate as a function of dose rate (^{137}Cs)

GM-45 Specifications

Size: 5.3 by 3.4 by 1.5 inches (135 by 86 by 38 mm)

Weight: 9.3 ounces (264 grams)

Window: Mica, 1.75 mg/cm²
1.75 inch / 44.5 mm diameter

Radiation detected:

Alpha - Above 3 MeV

Beta - Above 50 keV

Gamma / X-Ray - Above 7 keV

Power requirements: Self powered from computer

Computer Hardware Requirements:

USB version - USB port

Serial versions - One available serial port

Computer Software Requirements:

Windows 95/98/2000/NT

Macintosh MacOS 7.6 to 9.2, OSX 10.1.2 or later

(USB runs in Classic under MacOSX)

Software Features:

Built in graphing

Ability to store data to disk for further analysis

User selectable integration times

Built in statistics package

Trend line may be superimposed over graphed data
"Geiger Counter" clicking may be enabled

Package includes:

GM-10 Unit

CD-ROM with software for both Windows and Macintosh

USB Version:

Built in USB cable

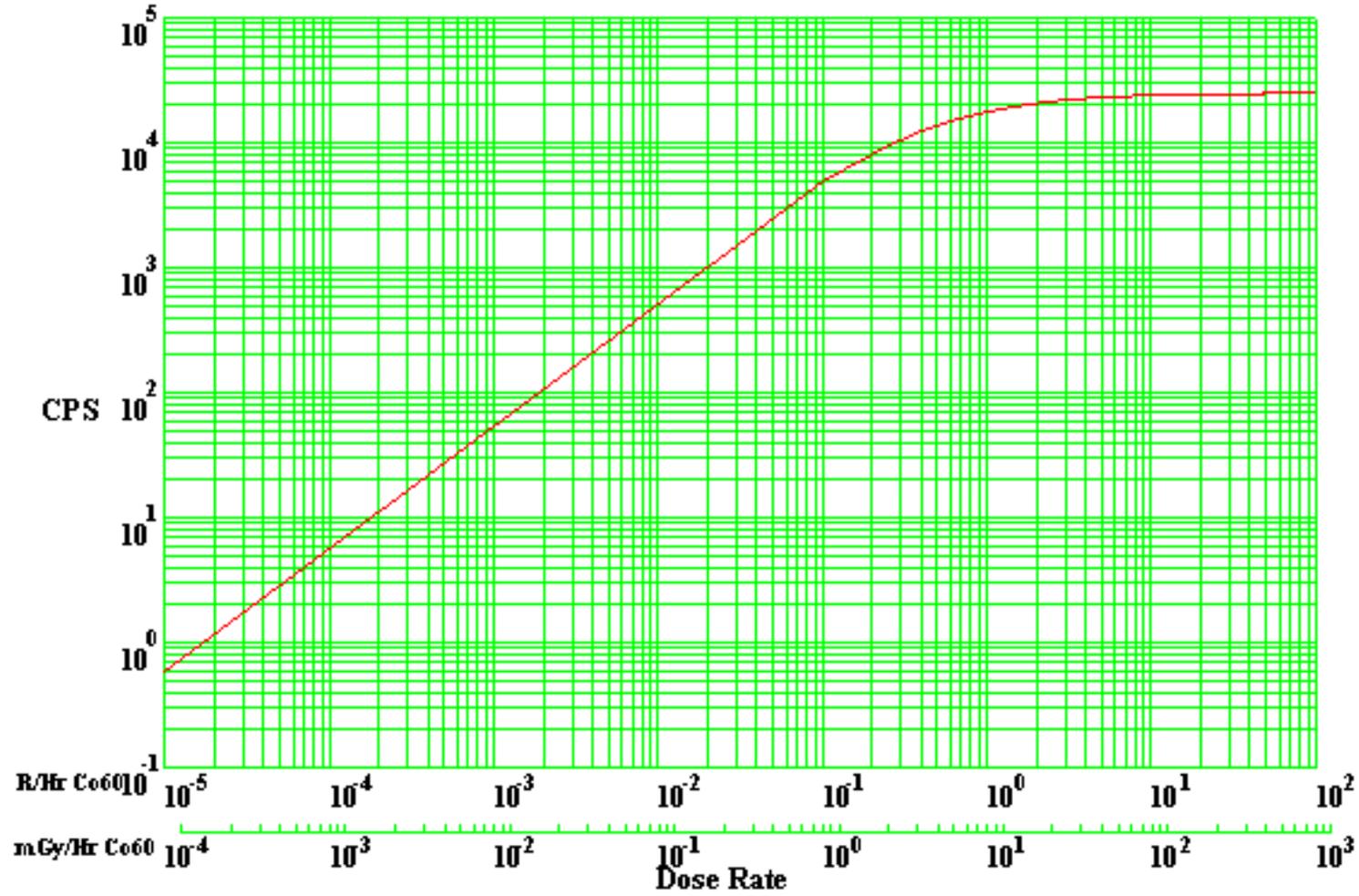
Serial version:

Appropriate serial cable - please order the correct version for your system, three are available:

1. Windows with 9 pin serial port
2. Windows with 25 pin serial port
3. Macintosh with 8 pin serial port

Cobalt 60 Sensitivity

GAMMA SENSITIVITY



Frequently Asked Questions

What computers/OS versions are required?

The GM-10/45 works with Windows and MacOS:

Macintosh:

- * MacOS 8 to 9.2, MacOSX native not yet supported, PPC required
- * Serial port required (USB/serial adapter, not included, may be used)
- * USB version also available

Windows:

- * Windows 98, ME, NT, 2000, XP. Most Windows 95 versions should work as well, except the first releases, which have serial port problems.
- * Serial port required for serial version.
- * USB version also available

Can I use a USB/serial adapter?

Yes! You can also use the USB version of the GM-10, now available.

We've tested the Keyspan USB Twin Serial Adapter on the Macintosh, and it works fine.

We've also tested the Keyspan High Speed USB Serial Adapter on Windows, and it too works

well.

How do I convert CPM to mR/hr?

Conversion of CPM (counts per minute) to mR/hr is dependent on the type and energy of the particles detected. That is, there is no one conversion factor.

Most radiation survey meters are calibrated to Cs137 (cesium). It turns out that the conversion factor for the GM-10 to convert CPM to uR/hr is very close to 1 (0.95, but 1 is close enough for most purposes). This means that 1000 CPM is about equal to 1 mR/hr for Cs137.

There is a [graph](#) available showing the relative sensitivity for other gamma energies. For example, at 60 keV (Americium 241) it is 7. So you would get about 7000 CPM for 1 mR/hr.

You may also wish to take a look at our page that [briefly describes the various units of radiation](#)

Can I use a GM-10 with Linux? What is the serial protocol?

While a software package for Linux for the GM-10 is not included, you can write your own.

Reading data from the GM-10 is very simple:

- * Open the serial port to receive data at 57600 baud, 8 data bits, 1 stop bit, no parity

- * Make sure the DTR line is asserted, to provide power to the GM-10. This is the normal state of the serial port after it has been opened., so normally you don't need to do anything.
- * Every time the GM-10 detects a radiation particle, it transmits one byte of data, the value is undefined.
- * Counting the number of bytes received over one minute will determine the CPM. Other averaging periods may be used as well
- * A rolling or sliding window average may give the best visual results. The GM-10 software updates every second, and averages over one minute, or another user-specified time period.

You can also connect the GM-10 to a microcontroller, if you are familiar with such interfacing. You'll need to apply power (12V) between the DTR (+) and Tx (-) lines, and count the pulses coming back on the Rx line. You may need to condition the voltages of the pulses coming back, which will typically vary between 1 and 11 volts, with a positive pulse (about 20 microeconds wide) for each particle of radiation detected.

What's the difference between the GM-10 and GM-45?

Essentially, the GM-45 has a much larger detector surface area, so it will give a higher reading (CPM) for a given intensity of radiation, compared to the GM-10. This is especially the case for alpha rays.

The GM-10 detector is a cylinder 2.125 inches long and 0.59 inches in diameter, with a active window diameter of 0.36 inches.

The GM-45 detector is called a "pancake" style, and has a 1.75 inch active window, and a length of 0.5 inches.

You can take a look at the [Specs](#) page for a full comparison between the two units.

Can I measure radon levels with the GM-10 or GM-45?

Not directly, but you can take indirect measurements which are influenced by the radon levels present. Radon undergoes an alpha decay, this alpha particle can be detected by the GM-10 and GM-45. Several of the daughter products of radon are also radioactive, with alpha and beta rays produced, these two are detected.

The reading from the GM-10 or GM-45 (in CPM) is comprised of both these radiations from radon, as well as background cosmic radiation levels. These background levels are usually fairly constant in a particular location, so that variations in the CPM readings are quite likely to be due to variations in the radon levels. That is, an increase in the CPM is likely to be due to an increase in the radon level.

Conversion to pCi/L of radon would be somewhat complicated. It maybe possible to take several measurements using the canisters which are sent into a lab for analysis, recording the readings from the GM-10/45 as well during each canister test. Comparing the CPM vs the pCi/L from the lab may allow a correlation between future CPM readings and estimated pCi/L concentrations of radon.

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