

Geiger Muller Counter

Introduction

Your Geiger Muller Counter is supplied with the following:

- Plugtop power supply 9V, 1A
- Touch pen
- USB cable
- Software on line

To obtain the most from this manual it is recommended that you have the Geiger Muller Counter in front of you as you read the manual. The unit is powered by a 9V, 1A plugtop power supply which is connected to the right-hand side of the unit. On the left-hand side of the Geiger Muller Counter is a 6.35mm jack socket which is for connecting our Geiger Muller tube. Beside this socket is a micro USB socket for transferring data to a PC. On the back of the unit is a switch for the on/off control of the 'click' of the Geiger counter.

Operational Modes

On powering the Geiger Muller Counter a splash screen is displayed (Figure 1) followed by a Notes screen (Figure 2).



Figure 1

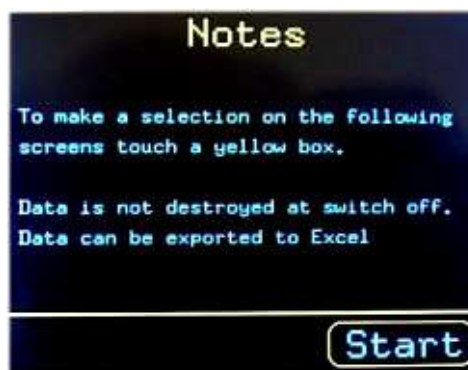


Figure 2

Touching the start button with your finger or touch pen displays the choices available on the Menu screen (Figure 3). Each of these 4 modes of operation is explained in the following sections.

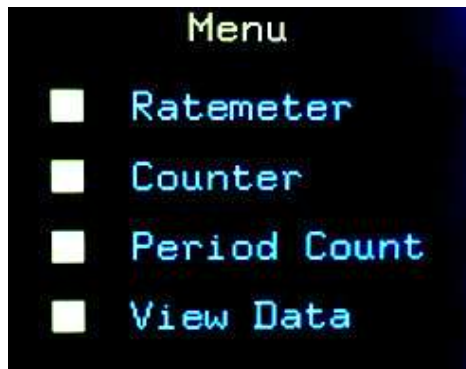


Figure 3

Ratemeter Mode

This mode is intended for investigating the properties of the different types of radiation. The Ratemeter Mode is ideally suited for displaying large values of counts/second. No results are stored using this mode.

Counter Mode

This is a flexible mode which is best suited to measuring the counts per minute. This count can be taken at different intervals – up to one hour apart. The reading is always taken at time zero. The interval between readings is the interval between the **start** of each reading. To illustrate this let's assume that we want to take the counts per minute every five minutes. The counting begins at time zero and at the end of one minute the count rate is recorded. This gives the count at time zero. Four minutes later the count starts again for one minute and at the end this minute, which is five minutes from the end of the first reading, the count is displayed. If continuous readings are required then the time between readings is set to one minute. Figure 4 shows this information on the user screen 'Counter Notes'.

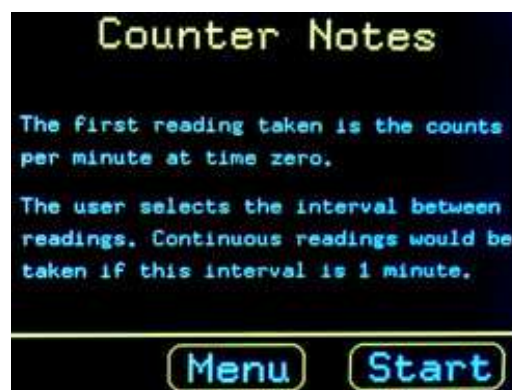


Figure 4

Note that readings are stored and will remain, even when power is removed. As the results are being stored, previous readings are over-written.

Figure 5 shows the Counter set up to take the counts per minute every three minutes.

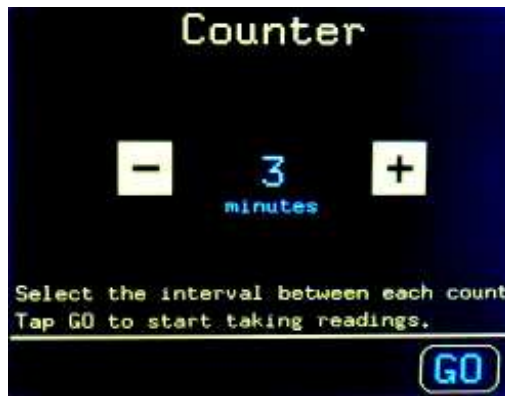


Figure 5

Tapping the '+' button increases the time interval in one-minute steps till ten. After that the steps are five-minute intervals until a maximum of sixty is reached where it resets to one.

Figure 6 shows a Counter Mode screen while logging.



Figure 6

The latest completed count is shown in the middle of the screen. Directly below this is displayed the running total during the current logging minute. If the program is between logging minutes then this running total is not shown. To stop taking readings, touch and **hold the Stop button for at least one second** then lift your pen (finger). You will then be presented with some simple statistics, Figure 7. Selecting the Next button enables you to examine the readings individually, Figure 8. Holding down the '+' or '-' buttons enables you to quickly step through the readings. Selecting the Save button enables you to export the data to Excel – this is dealt with later in the manual. Up to 800 readings can be saved.



Figure 7



Figure 8

The Period Mode

In this mode each reading stored is the number of counts in a user selected time.

The Period Mode is intended for studying low level radiation. This could be from foods like bananas, Brazil nuts, potatoes ... It can also be used for carrying out wipe tests on work areas used for radioactivity measurements.

Selecting Period Mode from the Menu enables the length of the period to be set. This is done in a similar manner to selecting the time between counts in the Counter Mode (Figure 9).

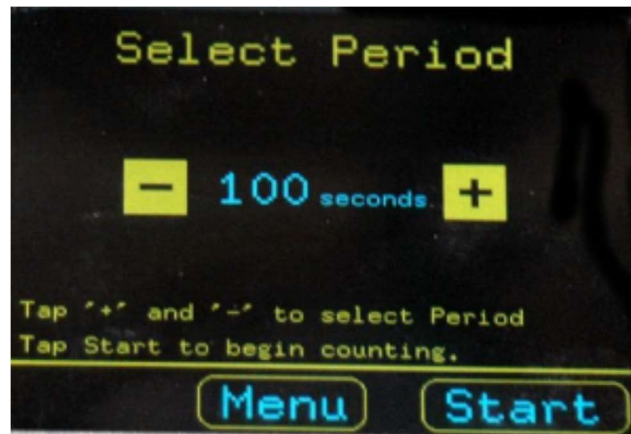


Figure 9

Note that the period changes from seconds to minutes after the 100 second period option. Figure 10 shows a screenshot during counting.



Figure 10

Touching and holding the Stop button takes you to the Statistics screen (Figure 11).

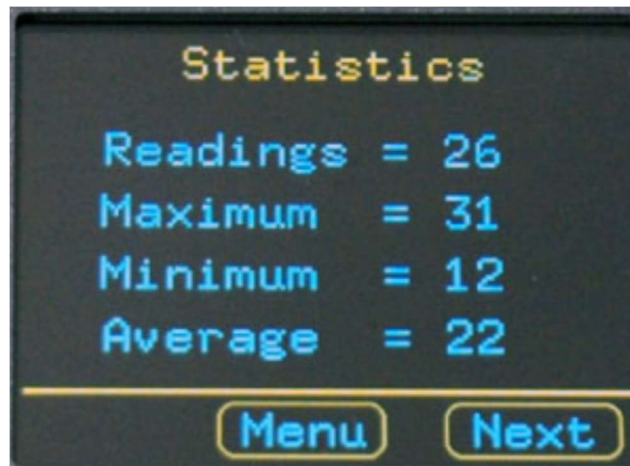


Figure 11

Selecting the Next button enables you to step through the readings (Figure 12). If you switch on and then select View Readings it may take some time to load the results from the long-term storage into the working memory – 30s for 800 readings to be transferred and for Excel to be opened.

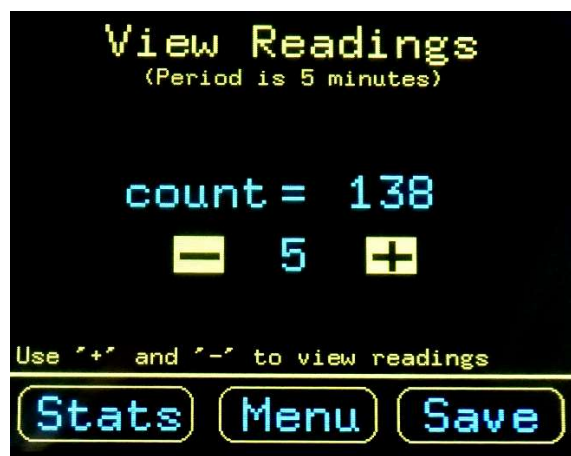


Figure 12

Export Readings to Excel

Select the Save button on the View Readings screen (Counter and Period modes are identical). You are then presented with the following instructions for setting up your PC. It is important that these instructions are carried out in order.

- 1) Connect the USB cable between the Geiger Muller Counter and your PC.
- 2) Launch the software on the PC. To do this you can click on the GMC Communicator shortcut icon on your desktop or select GMC Communicator from the Start menu. Your screen should then have displayed Figure 13 – it is important that you **do not click Start yet**.
- 3) Tap the GO button on the Geiger Muller Counter screen. Now click Start on the PC.



Figure 13



Figure 14

If you have carried out the above in the wrong order you can switch off and then start again – your data is stored in the Geiger Muller Counter. A maximum of 800 readings can be stored.

Note that when the PC software is installed it places a shortcut icon on your desktop, Figure 14.

Once all your readings are transferred to Excel you can manipulate and display the data with the tools available including adding columns, drawing graphs etc. Note that the data is automatically saved as a csv file in a folder called GMC Data. This folder is created the first time data is transferred. Each file is time and date stamped. It is recommended that you save your spreadsheet in your own folder with an appropriate name and format.

Possible Experiments

- 1) The most straight forward experiment is to measure the background radiation in a lab or house. Take the count over one minute and repeat a further three times. You will almost certainly get different answers each time due to the random nature of radioactive decay. An extension of this would be to take the counts/minute every 30 minutes and to leave it running for several days. Is there a pattern. Does the presence of several hundred people in a building affect the background count?
- 2) Rocks and building materials can release a radioactive gas called radon. This can accumulate in foundations and basements. If you have access to the foundations of your house you could record the count over long periods.
- 3) The half-life of radioactive materials e.g. protactinium can be investigated with the results exported to Excel and graphs drawn. Sources called protactinium generators are available commercially. There are 'make your own' recipes available online but you **must not do this in UK schools**.
- 4) Investigate the radioactivity of potassium salt. Some Supermarkets sell salt which contains potassium instead of sodium. A small percentage of potassium, called potassium -40 (should there be a space before the 40?) is naturally radioactive. About 100 grams will have measurable radioactivity if you, for example, take four counts of background radiation over one minute each and average them, then compare this to 4 counts taken with the GM tube a few millimetres away from the potassium salt. You will not be able to measure the half-life of this salt since it is over one billion years!
- 5) Measure the radioactivity associated with some foods: Brazil nuts, bananas, potatoes, avocados, carrots, beer. Some of these will take a very long counting period before you can determine that

the activity from the food is significantly above background. The best ones are bananas (potassium) and brazil nuts (radium).

- 6) Investigate a thoriated gas mantle which is used in some lanterns. A Geiger Counter should be able to detect the radiation from the thorium. The mantle should be kept in a sealed plastic bag. Some TIG welding rods contain thorium and will emit detectable radiation. The rods should not be cut, ground or sawn.
- 7) The GMC can be taken outside if it is powered using our battery pack. This would enable you to investigate the count in various parts of the environment – granite quarry, nuclear power station.

Technical Information

Plugtop power supply is 9V, 1A, centre positive.

Current supplied to Geiger Muller Counter with Geiger tube connected =140mA.

A maximum of 800 readings can be stored.

Uncertainty of readings

Rateometer Mode

Up to 1000 counts/s the uncertainty in reading is ± 1 .

>1000 counts/s and up to 10,000 count/s uncertainty is $\pm 0.13\%$

Counter Mode

Recommended for use up to 12,000 counts/minute. The uncertainty is $\pm 0.1\%$.

Period Mode

The Period Mode is best suited for low level radiation measurements. However, it functions well up to 5000 counts per minute. The uncertainty is ± 1 or 0.08% - whichever is the largest.

Associated Equipment

Geiger Muller F2-5135.75

Converter for DIN to 6.35mm Jack F1-2010.00. This unit converts the Geiger Muller tubes that were sold to support the ALBA Data Logger and the TSA & Counter. It should not be used with other manufacturers' Geiger Muller tubes.

Battery Pack B3-2000.00. The battery pack enables the Geiger Muller Counter to be taken outside. Using new good quality alkaline batteries, you should get at least six hours running the GM Counter with the Sound off and the GM tube attached.