



Geiger counter, detector

A little background

The term Geiger counter refers to a unit that is able to detect, count and display the number of ionizing particles passing through a specified area over a set period of time. This unit in its basic supplied form does not count actual particles; however, it does contain interface circuitry that will allow the unit to be connected to external counters (self-contained units) or to microcontrollers' such as the popular Arduino® units.

This Geiger detector while relatively simple, is an accurate and sensitive detector which uses a surplus GM Tube such as the popular SBM-20 or the CTC-5 tube and opens up a whole field of experiments, especially when using the interface port to connect to external equipment.

If you have purchased the unit with a tube included in the sale, this will have been pre-installed, if you purchased a unit without the tube supplied you will need to procure an SBM-20 tube or the less sensitive CTC-5 (also known as the STS-5) can be used. These tubes are now surplus and available from various Ukrainian or Russian eBay vendors. Electronic Goldmine located in the USA is another (all be it more expensive) source.

The PCB has a high voltage generator on the board and while this has been preset for the SBM-20 tube voltage, it is adjustable and an HV test point is available on the PCB to allow the voltage to be adjusted accurately.

First Use

If the unit with tube has been purchased it is ready to use out of the box, if you need to install a tube please refer to Appendix A for details on how to do this. Please note that the GM tubes used with this unit are quite fragile, in particular the glass metal bond between the tube body and the end caps can be easily broken. When installing or removing the tube, use gentle pressure, never force the tube to install or release by pushing or pulling at the center of the tube.

While going through these first steps, refer to the PCB plan view photo located in Appendix B to fully familiarize yourself with the unit's key features.



The unit will require a DC power supply of between 12 – 20 Volts and around 500mA. The connection plug on the PCB is center positive and sized 2.1 mm, this is a very common size and most power blocks are this size. Do be sure to check that the power supply is center positive. Before applying power make sure the power push switch is in the off position, which is fully out. Plug in the supply and press the power switch in it will latch into the on position.

The red LED located on the PCB will flash briefly and you should hear a click from the piezo buzzer. At this point and if no active source of radiation is close by the unit is effectively in standby mode. You will hear occasional clicks and the LED will flash for each click. This is caused by background radiation common everywhere on the planet.

The amount of background radiation differs across the USA, both the EPA and the NRC has many useful web pages on this subject. Typically background radiation in the USA comes from a variety of sources including Radon.

In the standby mode the unit will click for each decay particle detected accompanied by the LED flashing. You will note that the click/flash rate is random but if manually counted over a period of 1 minute should be between 12 and 20 clicks.

Interface Options

Refer to appendix C while reading this section. The PCB has a 5 pin header block located on the upper right hand side of the PCB, when the GM tube is located at the bottom of the unit. This header provides the following outputs;

Pin 1 – VCC, this will be whatever input DC voltage is being used

Pin 2 – 5 Volts regulated, max 100mA

Pin 3 – This gives access to the raw pulse data (not very clean/spikey)

Pin 4 – This is a clean squared pulse with a small delay applied (5v pp)

Pin 5 – GND

These 5 outputs allow a variety of interface options to be utilized. It is beyond the scope of this simple user guide to fully describe how to do this or provide software examples. This is left to you to accomplish.



Radiation Sources

To properly test any Geiger unit requires some sort of radiation source. A number of calibrated source materials are available and can be purchased on line for around \$90 - \$200 dependent on the type of source purchased.

Due in part to the cost associated with a calibrated source, it is often better to start with a lower cost item that is readily available. At the time of writing Vaseline glass marbles appear to be very popular, available and of reasonable cost (eBay has listings for this item). Vaseline glass is typically glass with an added impurity such as Uranium.

The photo below shows some of these marbles fluorescing under UV 'Black Light'. Note the two small marbles not fluorescing (arrowed) these do not contain sufficient Uranium required to be active under UV or to give a reading on a GM Detector.



Other low cost sources available on eBay and other online sources are sold as radioactive dirt or sand. Small amounts are low cost to purchase and prove good test sources.



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Appendix A

Install the GM Tube

Properly install the GM tube (or remove it) follow these steps;

1. Place the PCB component side up on a flat firm surface.
2. Orient the tube so that the + end is toward the clip marked Anode on the Left side of the PCB.
3. Hold the tube about 1" from the metal end cap and gently at an angle ease the cap into the clip.
4. Lower the tube until the opposite end is over the Right hand side clip.
5. Holding the tube near the end cap, ease it in to the clip.
6. DO NOT APPLY PRESSURE TO THE TUBE BODY
7. If the tube needs to further seated in the clips, apply gentle pressure to the end cap.
8. To remove reverse the above steps.



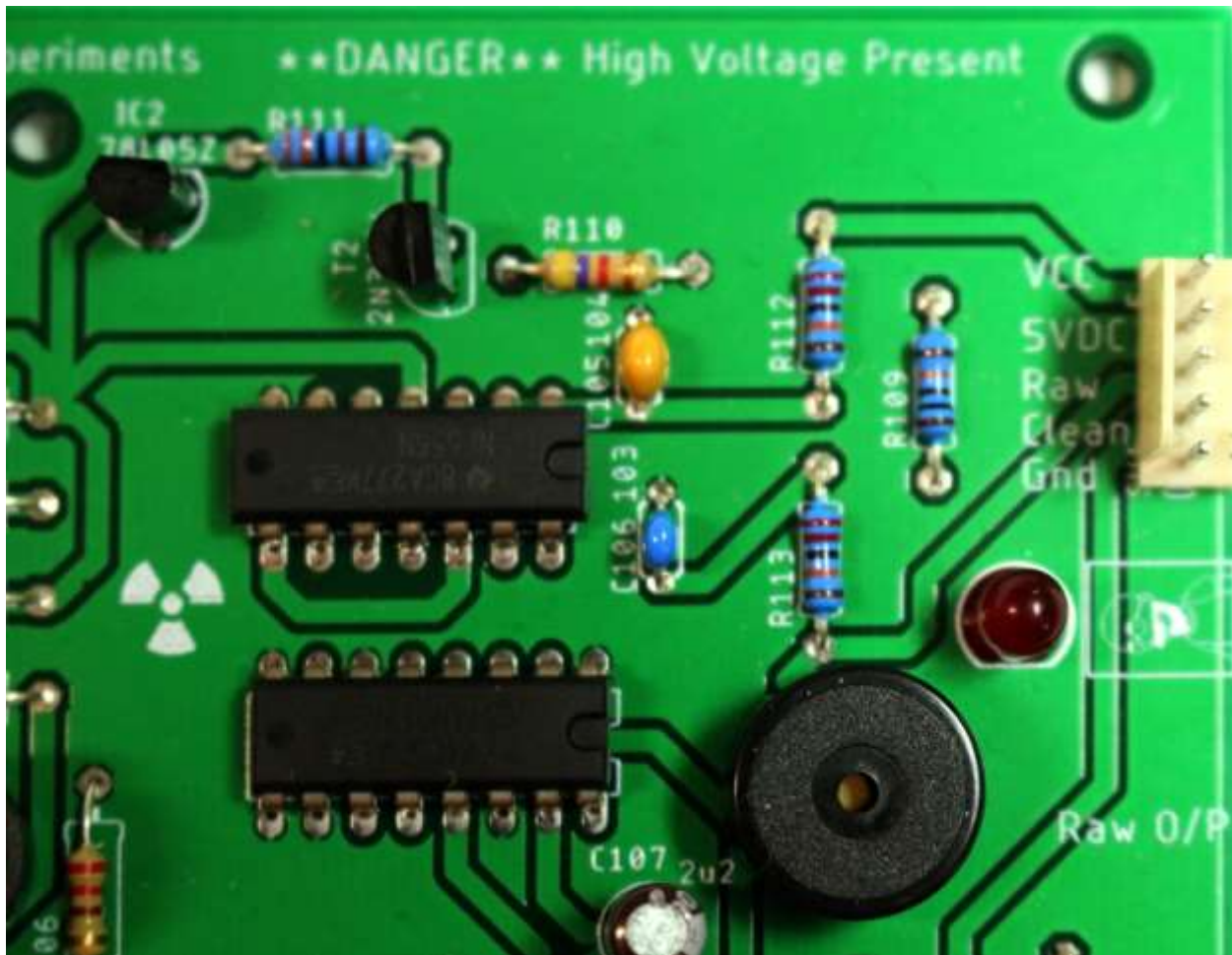
Appendix B

PCB Features





Photo of the output connector with Interface outputs notated





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Notes

1. The supplied tube is NOS, it could have dents and dings that are from long term storage, these dings do not affect the tube performance.
2. The board has a high voltage present on the board, be careful when working with the unit especially if the covers are removed while power is applied.
3. Radiation sources such as Vaseline glass or 'dirt' are uncalibrated and cannot be relied upon to provide calibration.
4. The HV can be adjusted by means of the HV Adj. Pot located just above the GM tube. Only adjust this while monitoring the HV voltage with a meter attached to the HV & Gnd pads. Random twiddling of this pot can cause damage to the tube.
5. The GM tubes are fragile and easily damaged handle with care.
6. For help contact us at : steve@electroresales.com