Daedalon®

EN-15 Geiger Counter

The EN-15 Geiger Counter is designed to fulfill all of the measurement requirements of the Daedalon radioactivity experiments. It will provide excellent data for the EN-06 Absorber experiment and also with the EN-08 Student Beta Spectrograph. It generates the 900Vdc required for the smaller EN-01 Geiger Tube. The large 2cm high LED digits display the rate in counts per minute or continuous counting for weak sources which require more than a minute to collect enough data. The counter provides an audible chirp each time the tube counts. A front panel pilot light indicates that the tube is counting. Both of these count indicators are useful in setup. They indicate immediately that the tube is counting. The audio output can be disabled with a front panel button.

OPERATION

1. Connect the Geiger Counter to the correct line voltage. For safety, a line supply with a grounding pin should be used. the third wire ground is connected internally tot he instrument case. The circuit ground is connected to the same point.
2. the Geiger Counter supplies 450Vdc for the EN-01 Geiger Tube and 900Vdc for the EN-04 Geiger Tube. They are selected with a front panel button.
3. Turn on the Geiger counter using the switch on the front panel. The display will light up and show zeros if no signal is connected. No warm-up is required.
4. Choose the “RATE” mode using the front Mode button. In this position, the display shows the count race in counts per minute. Without a source near the tube, the display will show a count rate due to natural radioactivity. A typical background reading for the EN-+04 is 26 ±5CPM. The rate will be higher with the EN-04 than the EN-01 because the active volume of the larger tube is greater.
5. Mount the Geiger tube in the experiment and proceed with data collection. As an aid in setting up the experiment, counting is indicated both with an audible chirp and a pilot light. When a source is moved close to the tube, the increased frequency of chirps and/or flashes indicates the apparatus is properly connected and operating correctly. Since the counter updates every minute, it is time consuming to wait for it while setting up the apparatus. The audio response may be disabled with the audio button on the front panel.
6. For low activity sources,k you may desire to count for a longer period than the normal one minute. Using the mode button, choose the “CONTINUOUS” position, where the counter registers constantly. Use a clock to measure the time interval when calculation the count rate.
7. In the “CONTINUOUS” mode, the display is reset with the front panel “RESET” button. To start a measurement, press and hold the “RESET” button. When ready, release the button and start the clock. The display will show the count accumulating. When sufficient counts have been recorded or sufficient time elapsed, record the time and count.

CIRCUIT DESCRIPTION

The Geiger Counter counts, stores and displays the output in a single 74C925. The IC has a counter register and a latch register. The signal is counted, transferred to the latch and displayed. The counter reset, and the count repeated, while the latch displays the previous reading. the time base is derived by dividing the line frequency buy 36900 in a pair of 45181Cs. At the end of the 1 minute counting period, the next 17ms line cycle transfers the count to the latch, and the next 17ms cycle resets the counter and the divider. This pulse is stretched about 0.1ms to make sure there is a time for all resets to occur.

The input signal from either Geiger Tube connector is quenched with a 7.5MΩ resistor and sent to an input of a 74C14 Schmitt trigger. The output of the Schmitt trigger is sent to a 74C00 NAND gate, which the clock controls, and which gates the count signal, which is then sent to the count input of the 74C925. The output pulses are also sent to a pulse stretcher which stretches them to about .015 seconds long. The output of the stretcher turns on the “COUNTING” LED pilot light as well as the audio transducer. Without this stretching, the pulses are too short to be easily seen or heard at low count rates.

In the “CONTINUOUS” position, the time base is disabled and “RESET” is provided by connecting the counter reset to V_{cc} with the button. The latch is connected to V_{cc} so that the count is passed through continuously to the display. This is desirable so that the progress of the count can be seen.