*Counters, Scalers, Ratemeters, SCAs, MCAs etc.

By George Dowell

So now we have our first Geiger Counter.

We know it's a GEIGER something because it has a Geiger-Mueller tube in it.
Good start.
But why is it a *"COUNTER"*?
Well it counts pulses right? Well sort of. It DETECTS pulses that's for sure, but does it COUNT them? Curiously, no it does not. Most instruments that we call Geiger COUNTERS are actually ****RATEMETERS****.**
What a Ratemeter does is give a needle deflection that is proportional to the rate at which it detects pulses. All that means is that using specially designed electronic circuits, the needle can tell you that you are seeing 200 Counts Per Minute (CPM) by looking at only a few second's worth of pulses. This is *fairly accurate*, and good enough for most applications that the home hobbyist is likely to encounter. Compare it to a nurse who listens to your heartbeat for 10 seconds and deduces how many beats per minute it is going.

Now the next level of complexity in instrumentation you are likely to run across is called a *"SCALER"*.
The way a scaler works, is that it actually has a timer, and you can usually set it for different time periods. Let's assume it is set for one second. The incoming pulses are counted, one at a time and each one increments a display by one number. In the old days there were many different electrical and electronic displays to show that number to you, but today the LED or LCD Digital display is universally used. At the end of the selected time period, you can look at the display and see how many counts were tabulated during the period. If the period is one minute, you can read CPM directly. You can see how that will give a *very accurate* CPM reading, but say you need even more precision than that. Well, how about setting the time period for 4 minutes, then dividing the reading by 4. The magnitude of accuracy becomes even greater.
Compare these two settings to counting the number of cars in a parking lot, one by one, or counting the number of tires in the parking lot and dividing by four.
There are many other reasons to use a scaler, which we will go into in more depth in another article, but I hope this review helps the beginner to understand some basic concepts.

In practical instruments, many times the Ratemeter and Scaler are combined into one, but it is not always the case. In the photo, the unit on the left is a Scaler/Ratemeter, and the one in the middle is just a Scaler. Both have the thumbwheel to set the time period, and a digital readout. The
combination unit also has a CPM scale on the meter. Hand-held and bench style combination versions are made by all the major manufacturers.

As we learned earlier, the G-M tube gives only one type or size of pulse for any radiation it sees. Another type of probe, the Scintillator class,
gives different amplitude pulses depending on the energy level of the radiation it sees (energy dependant probe). Using this fact, another
circuit can be added to the Scaler /Ratemeter, called the *"LOWER LEVEL DISCRIMINATOR"* , *"LLD"* or just *"DISCRIMINATOR"* and *"UPPER LEVEL DISCRIMINATOR"* , *"ULD"* or *"WINDOW"*, and then you have a Single Channel Analyzer or *"SCA"*. All the discriminator and WIndow do is give you control over the lower limit and upper limit of pulses that it recognizes, throwing out all those above or below the limits set. The pulses within this "window" then are the only ones tabulated. In a simple way this is the first step towards Gamma Spectroscopy, a means of identifying radionuclides.

A big step beyond the SCA is the *"MCA"* or Multi Channel Analyzer.With this tool, real isotope identification can be accomplished. Similar in basic function to the SCA, the MCA takes samples of pulse heights over a wide energy range and stores those results in many channels, up to 4000 or even 8000. By looking at all the channels at once the operator can determine in which energy bands there are more or less counts. Then by referring to standard charts the actual isotopes can be mapped and identified.


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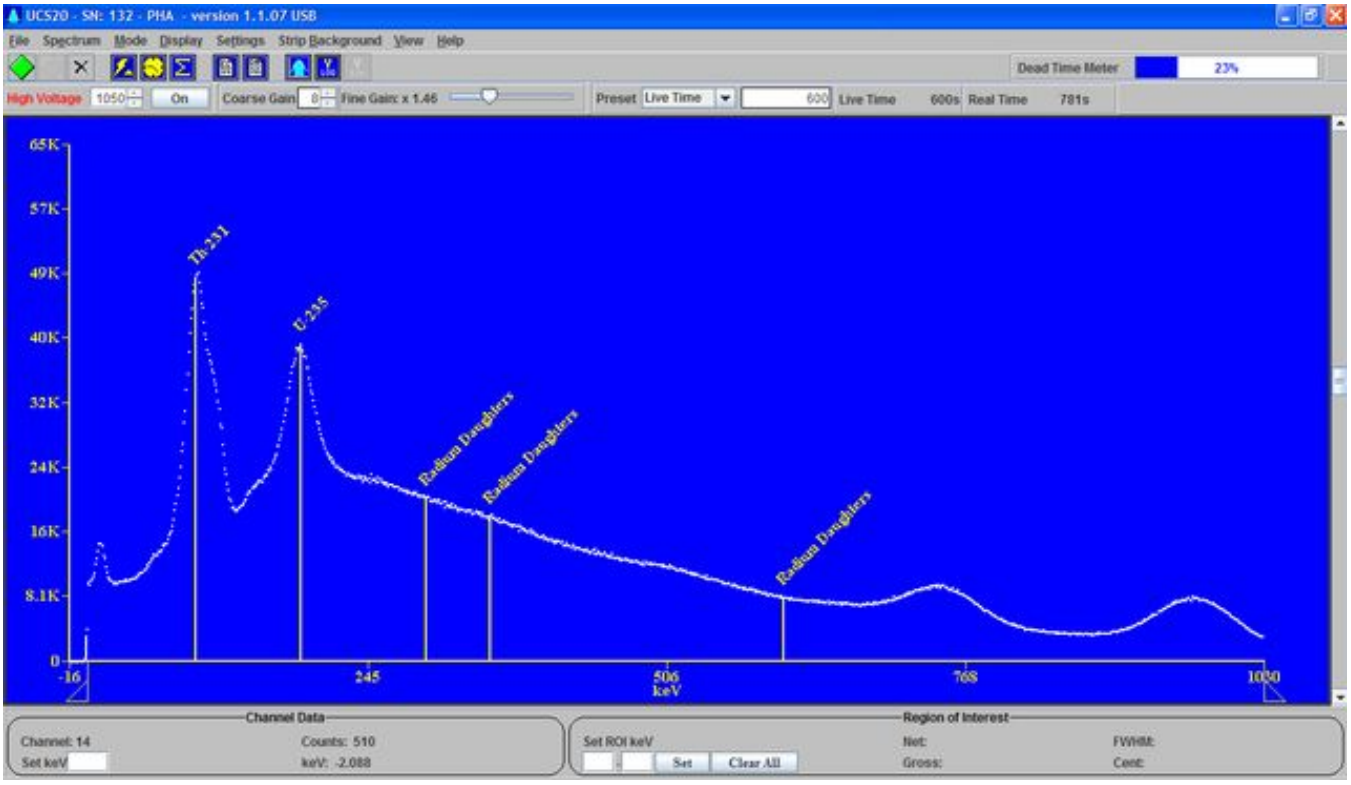
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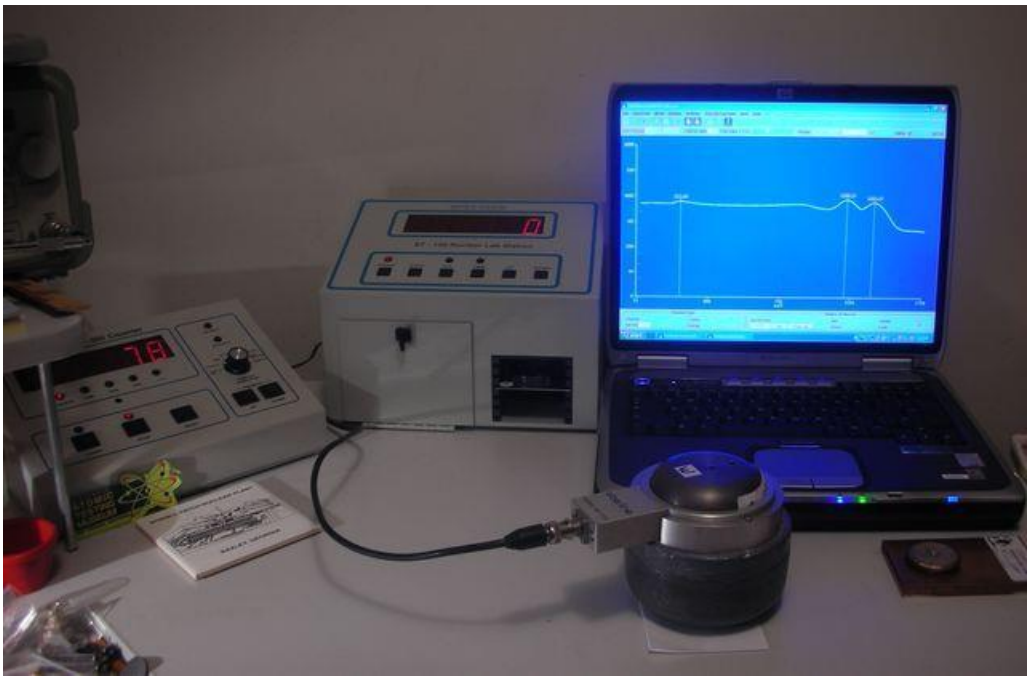

So we've learned that a COUNTER is actually an averaging ratemeter, and a SCALER is actually a counter. Ain't science grand?

A final note: by definition a *"SURVEY METER"* is ANY portable instrument that can detect and measure radioactivity. All those CDV 720's etc. fall into this broad category. They are NOT Geiger Counters.

In the above text, the first instance of an important word or phrase has bee *"CAPITALIZED, ITALICIZED and UNDERLINED"*. These are terms with which you will want to become familiar if you are not already. Depending upon your method of viewing this article, you may it may not see the underlining or italics. In all cases the capitalization should show through, so use that as a guide for future studies.

Have Fun

Geo

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