Selecting an oscilloscope for use in Paranormal Research

Oscilloscopes have a long list of options that include many variations of useful, and for our case, not so useful options. The main thing that drives our ability to acquire an oscilloscope is *price.* With the popularity of E-Bay on the rise, you can find some excellent deals on lab grade equipment that you wouldn't ordinarily come across. But let's take a glance at the important things to consider when buying a scope.

1. **Bandwidth –** The basic and the most relevant parameter of an oscilloscope is the bandwidth of its vertical amplifiers. Typical scopes for general purpose use should have a bandwidth of at least 100 MHz, although much lower bandwidths are acceptable for audio-frequency applications. For example, if you are buying a scope to primarily analyze EVPs or EMF, a 20 MHz scope will do everything you need iot to do and more. If you plan to analyze Radio Frequency interference, you will need a lot more. A useful sweep range is from one second to 100 nanoseconds, with triggering and delayed sweep.

2. **Triggering –** The chief benefit of a quality oscilloscope is the quality of the trigger circuit. If the trigger is unstable, the display will always be fuzzy. The quality improves roughly as the frequency response and voltage stability of the trigger increase. For our purposes we certainly need stable triggering.

3. **Analog or Digital –** Analog oscilloscopes have been almost totally displaced by digital storage scopes with the exception of low bandwidth (below 60 MHz) applications. Greatly increased sample rates have eliminated the display of incorrect signals, known as "aliasing", that was sometimes present in the first generation of digital scopes. The used test equipment market, particularly on-line auction venues like E-Bay, typically has a wide selection of older analog scopes available for fairly reasonable prices. However it is becoming more difficult to obtain replacement parts for these instruments and repair services are generally unavailable from the original manufacturer. Just to give you sticker shock, there are laboratory grade digital oscilloscopes on the market that sell for over $20,000 dollars. The good news is, you won't need anything like that unless you are analyzing radar.

4. **Portability –** To me, this is second only to bandwidth. If you are using a scope as a sensor indicator, in other words say you have a Mag-Chek 95 Sensor, and you want to sweep a room for EMF fields where you can observe the frequencies of those fields, you will most likely want a hand held scope, and not a bench scope. There are many of these out there, starting at around $120.00 for a Velleman single trace model. If you want memory, or software capability to interface with a laptop or PC, you are

going to spend a lot more. Again, the more you pay, the more you get. Also, beware of scope meters. While they may be less expensive, they may not give you an accurate waveform. Many scope meters convert the AC voltage into a representation of a sine wave, not the actual wave form.

5. **Display –** Depending on your application needs, you may want a lit or back lit display. Since much of our work is done in total or near total darkness, this might be a good idea.

6. **Ruggedness –** We are operating in the field in conditions less than desirable. We should keep this in mind when purchasing any delicate piece of test equipment. Since we can't afford a MIL-Spec rated device, we have to look at construction. High impact styrene covered with a shock cover is good. This should also be a key factor when transporting it to a site. Get a padded case to carry it in, and if it is also waterproof, all the better.

7. **Update Rate –** Update rate directly impacts three key areas;

    - Resonsiveness to setting changes
    - Ability to show subtle detail
    - Ability to capture infrequent events.

    Digital scopes work by filling their memory buffer with signal detail, processing this data for displaying on the screen, then filling the buffer again. This repeat occurs typically much faster than the refresh rate of the LCD display, which is 60Hz. Multiple processed signal acquisitions are sent together to the display for real time viewing. However, while it is processing the previous acquisition, it is blind to changes that are occurring during the process. Some scope architectures enable a fast waveform update rate that minimizes dead time and allows the instrument to show subtle signal detail and infrequent events. Others may have fast update rates with shallow memory, or fast update rates with analog channels only, but when digital channels are turned on, the update rate may drop by 2,000x.

    An effective test of update rate test is to find a modulated signal, or one with jitter or an event that occurs infrequently. Turn on the scope-under-test's deep memory and both its analog and digital channels. Observe the waveforms on the display. How fast are they updated? Do the analog waveforms look identical to the way they look with only analog channels turned on? Change the time-base setting and see how quickly the scope updates.

8. **Set up and analysis time – A** good way to evaluate a scope's practical efficiency is to predefine several events that you normally need to capture, and time how long it takes you to make these measurements on each oscilloscope you are evaluating. Ask a colleague to run the same tests and you'll have your own usability study.

   Usability has two components—time to learn and time to relearn. Repeat the same measurements after a two day break and record your time.

I hope this helps you in picking out a very useful and little used tool in the field. We have been using hand held oscilloscopes for three years now, and we have had some very interesting discoveries.