



The 1<sup>st</sup> order value of an Oscilloscope  
How we engineer our scopes at RIGOL Technologies.

It is always said that an Oscilloscope is a viewing tool. While correct, the following are three areas that contribute to viewing and how we engineered our oscilloscope.

- 1) Acquisition – You must have enough performance to accurately capture the signal. The acquisition is often looked at in terms of Bandwidth and sample rate.
  - a. RIGOL has designed a variety of front end signal conditioning circuits optimized for different bandwidths. Our highest bandwidth today is 300 MHz which is the highest in products under \$2000 USD.
  - b. Sample rate is sometimes confused based on different manufacturer's current capabilities. So what are the facts?
    - i. If you acquiring a signal only once i.e. single shot, you must have more than 2 times the sample rate as the bandwidth. This is according to Nyquist theorem and implies many perfect conditions not possible in the real world, thus you need > 2 times the higher bandwidth.
    - ii. Certain manufacturers would want you to believe you need 10 times the sample rate of the bandwidth of the scope. While this may be a nice thing to have, it is based more on a manufacturer's current technology than any real need.
    - iii. In reality, the correct answer is that sample rate should be between 3 and 4 times the bandwidth of the scope. Most scopes today employ a  $\sin x/x$  filter in lower end scopes and can do a good job of recreating the signal with 3 to 4 times higher sample rate than the bandwidth of the scope.
    - iv. Our scopes have been optimized for this performance allowing our customers to not spend too much for digitizing that will bring little incremental advantage.
- 2) Isolating Events – In general the real power of a digital scope is to isolate events and store them providing incredible power in troubleshooting. The cornerstone of isolating events is the powerful triggering in RIGOL Oscilloscopes.
  - a. Trigger modes – We have provided powerful triggering in all our scopes to allow our customers many options in isolating events, these triggers include:
    - i. Edge – The traditional trigger of triggering on a rising or falling edge.
    - ii. Pulse triggering – Allows the trigger to be set to a pulse either positive or negative and when present for greater than or less than a time that is user defined. This can accomplish tasks like Glitch triggering.
    - iii. Slope Triggering – Triggering when the slope of a signal transition is faster or slower than the user defined setting. Very useful in looking at tri state conditions.

- iv. Pattern Triggering – When using a RIGOL Mixed Signal Oscilloscope (MSO) you can trigger on a pattern of 1, 0 and don't care across up to 16 channels.
  - v. Alternate – We also provide a alternate trigger when the scope trigger on chan one and acquires chan one, then triggers on channel 2 and displays chan 2, this provides for a true dual time base where each channel can sample at different rates based on there set up.
  - b. All told we believe the triggering of the DS 1000 oscilloscope family is the most powerful in this range of products by any manufacturer.
- 3) Display – Display is the final part of a great viewing tool. We believe there are three critical areas of display:
- a. The display itself, we have chosen to use TFT color displays in all our products as they provide superior color, brightness and viewing angle to the standard and cheaper LCD display used by most manufacturers today.
  - b. Update rate – The speed with which an acquisition can occur provides the real time and responsive feel most customers desire in a scope. RIGOL invests in optimizing the update rate. Our DS 1000C and DS 100CD achieve ~ 1000 waveforms per second and is our newest DS 1000A we placed an additional FPGA in the scope to increase this to ~2000 waveforms per seconds.

The bottom line is that we at RIGOL take viewing signals serious and have invested engineering to provide what we feel is the best viewing scope in its class.



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