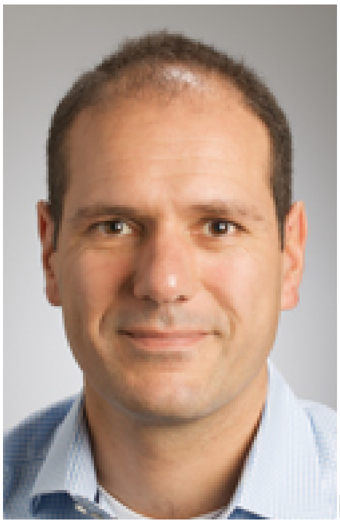
Five things you really want in a digital oscilloscope (but didn’t know you needed)

Faride Akretch, Tektronix

For anyone designing, manufacturing, or repairing electronic equipment, a digital storage oscilloscope is a must-have tool. It lets you see high-speed repetitive or single-shot signals across multiple channels to capture elusive glitches or transient events. An oscilloscope is equally as useful a tool for qualifying elements of a new design as it is for isolating problem components in an existing system under repair.

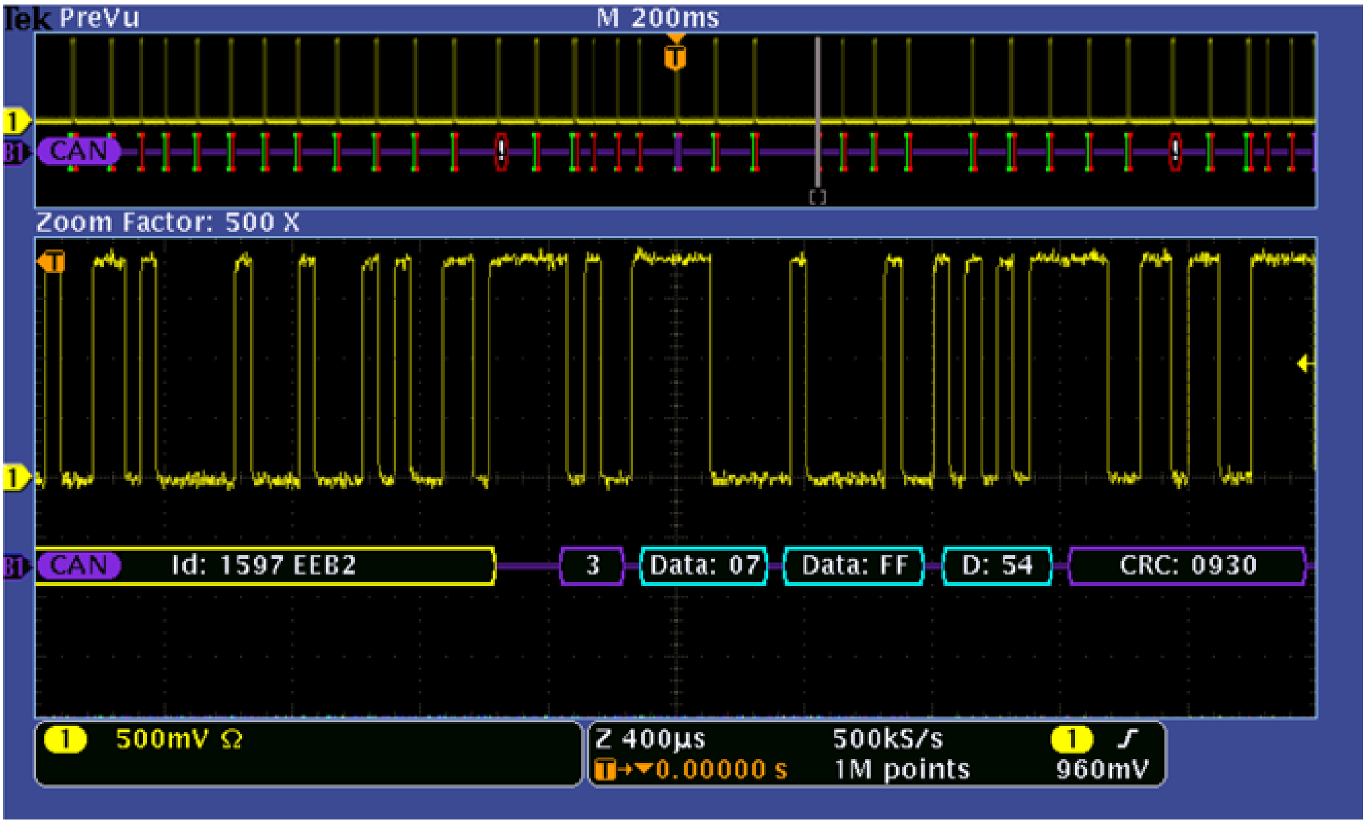
When it comes to evaluating oscilloscopes, many engineers focus on one specification: bandwidth. The assumption is generally that the faster oscilloscope is the better oscilloscope. And while bandwidth is an important thing to consider, it falls well short of telling the whole story or in ensuring that the oscilloscope you’re considering will truly meet your needs. With that in mind, here are five other things you’ll want to consider when choosing your next oscilloscope.

1. Rise time — Accurate rise-time measurements are key to making accurate measurements in the time domain. Many logic families have faster rise times (edge speeds) than their clock rates suggest. A processor with a 20 MHz clock may well have signals with rise times similar to those of an 800 MHz processor. Rise times are important for studying square waves and pulses. Square waves are standard for testing amplifier distortion and timing signals for TVs and computers. Pulses may represent glitches or information bits — too slow a rise time for the circuit being tested could shift the pulse in time and give a wrong value.

2. Fast sample rate — The sample rate of an oscilloscope is similar to the frame rate of a movie camera. It determines how much waveform detail the scope can capture. To capture glitches you need speed. Nyquist said that a signal must be sampled at least twice as fast as its highest frequency component to accurately reconstruct it and avoid aliasing (showing artifacts that are not actually there). Nyquist however is an absolute minimum. What’s more, it applies only to sine waves and assumes a continuous signal. Glitches are by definition not continuous, and sampling at only twice the rate of the highest frequency component is usually not enough. A high sample rate increases resolution, ensuring that you'll see intermittent events. As a rule of thumb, look for a sample rate of at least 5x your circuit's highest frequency component.

3. Versatile triggering — All oscilloscopes provide edge triggering, and most offer pulse width triggering. But more advanced triggering capabilities can save you time and shorten the time to answer when working with more challenging signals. The wider the range of trigger options available the more versatile the scope. Some of the triggers available include A & B sequence triggering; video triggering on line/frame/HD signals, etc.; logic triggers such as slew rate, glitch, pulse width, time-out, runt, setup-and-hold; and communications triggers for serial and parallel buses.

4. Powerful waveform navigation and analysis — Searching for specific waveform errors can be like searching for a needle in a haystack. Tools that automate the process can be a big time saver. For instance, oscilloscopes with record lengths in the millions of points can show thousands of screens worth of signal activity, essential for examining complex waveforms. Capabilities such as search and mark speed up the process by letting you search through the entire acquisition and automatically mark every occurrence of an event you specified. Figure 1 shows an example of how placing marks on the waveform can assist in latency measurements on a CAN bus. Other capabilities include zoom and pan, play and pause, and advanced search.



5. Matching probes — Precision measurements start at the probe tip. The probe's bandwidth must match that of the oscilloscope, and must not overload the Device Under Test (DUT). Probes actually become a part of the circuit, introducing resistive, capacitive and inductive loading that alters the measurement. It’s important to have a range of probes available. To start with, select passive probes that have high bandwidth and low loading. Active ground-referenced probes offer one to four GHz bandwidth while active differential probes support 20 GHz or more. Adding a current probe enables the scope to calculate instantaneous power, true power, apparent power and phase. High voltage probes measure to 40kV peak. Specialty probes include logic, optical and environmental types.

Cost of ownership

Any scope you choose will need to fit within the constraints of a capital acquisition budget. While cost of ownership isn’t a feature per-se, it’s an important consideration. This means you should compare support options to see to whether they add value to your purchase or can help extend the scope’s useful life. On-site education and training, as well as design, system integration, project management, and other professional services can help maximize productivity and ensure reliable measurements. Support packages such as these, along with options like extended warranty can save money in the long term.

About the author

Faride Akretch, a technical market manager for Tektronix, has nearly 20 years of industry experience in Germany, Japan and the United States and has a held a variety of positions, including applicationsengineer and roles in product marketing and business and market development. He holds a master’s in electrical engineering/electronics from the Technical University of Berlin.

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