Patented UltraVision Technology Enhances Signal Analysis

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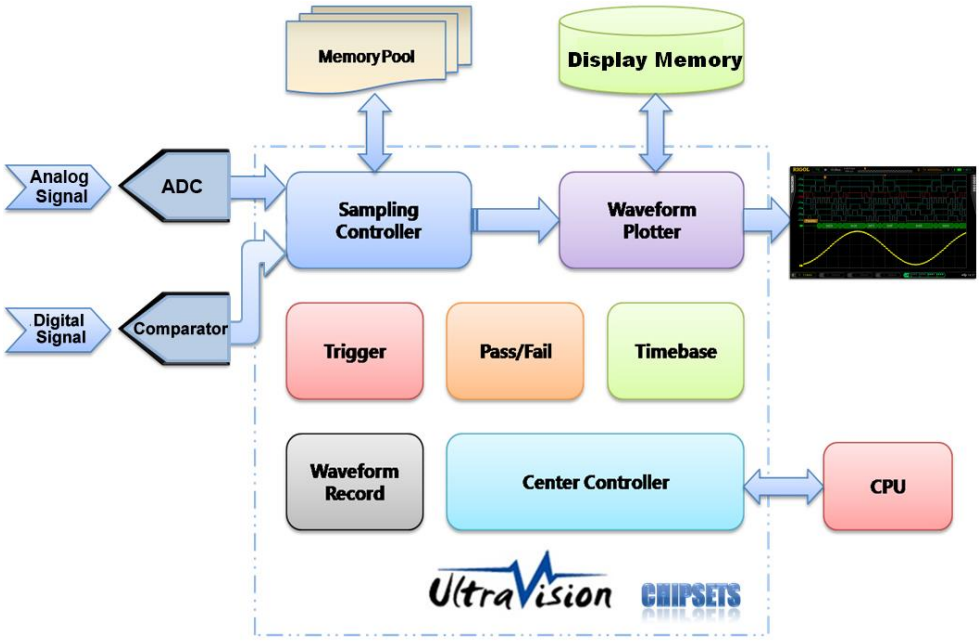
Rigol Measurement Instruments include specialized hardware which allows finding errors in signals faster and analyzing them more exactly. In addition, deep data memory allows fine data acquisition.

Rigol's **UltraVision Technology** is a hardware and software architecture accelerator which avoids burdening the embedded CPU by handling, calculating, and administering the huge amount of data produced by the fast A-to-D data conversion. A dedicated integrated sampling controller handles the data storage. The large data memory is directly connected with this sampling controller to achieve the most efficient data management. Additionally, a specially implemented waveform plotter function handles the data display together and the separate display data storage. Other functions such as Trigger, Pass/Fail decision, Record-Function control are also integrated in the hardware chipset, without needing processor resources. The design reduces the burden on the oscilloscope CPU to a minimum. This is needed to be able to realize a high waveform update rate, because every CPU interaction lowers this speed.

Rigol's **UltraVision Technology** is based on specialized hardware and intelligent software, using a custom-designed **UltraVision** chipset. The A/D converted data is handled by a hardware-based Sampling-Controller. A large memory bank is directly connected to this controller, so that the data storage is done without burdening the CPU. Each action processed by the CPU normally forms a "blindtime" and slows the waveform capture rate. Similarly, waveform display is handled by a special Waveform-Plotter hardware function, again without increasing the work load of the CPU.

Additional functions like Trigger, pass/fail-decision and waveform recording are implemented in hardware so that again the CPU is only minimally loaded with handling these functions. All this is done to maximize the waveform-acquisition rate. To enhance this high wave-repetition rate, the **UltraVision Technology** adds a multi-grading intensity display feature. On the screen, multiple waveforms are overlaid on each other. A different intensity is chosen depending on the frequency of display. This means that rarely-appearing signals are displayed less intensely (there are 256 grading steps available). With this functionality, it is possible to see in a single view how often errors or anomalies occur.

The following block diagram shows the operation of the **UltraVision** chipset (analog + digital) which is implemented in the latest Rigol oscilloscopes.



Another extremely important part of the **UltraVision** chipset is the huge data memory. With this it is possible to maintain the maximum sampling rate especially on longer Time/Division settings. This is very important if there is a need to acquire signals over longer time periods, but without losing any signal details.

Rigol also offers a Record-function as part of the **UltraVision Technology**. This function combines intelligent triggering with efficient data storage. The acquired signal is saved in single segments of the memory. The benefit is that only the rare, important events of interest are stored in the available memory without the irrelevant data.

But why consider Signal Capture Rate? Unlike when all oscilloscopes were analog (no data handling or storage or other post processing) there was only a very short time when no trace is displayed on the CRT screen, when the electronic beam switches back from right to left. With digital oscilloscopes, a parameter appeared called "Blindtime", similar to the "beam return" time, but with a different cause. In digital scopes, the input signal is conditioned and converted by an analog-to-digital converter more or less in real-time; but then the data has to be handled and processed. While this is being done, the new input data cannot be captured. The time delay until new input data can again be stored is defined as "Blindtime". And this time is not negligible – it is even up to 99.9% in some instruments. This means that there is only 0.1% of the time for observing signals. All oscilloscope manufacturers try to reduce the "Blindtime" and increase the Signal Capture Rate using different technical approaches (e.g. using processors with higher performance). Rigol's tool for fighting "Blindtime" is the custom-designed **UltraVision** chip set to accelerate performance.

Waveform Capture Rate

The advantages of higher waveform capture rate can be explained in more detail in the following example: a 1MHz square wave signal with a rare glitch, occurring 10 times per second.

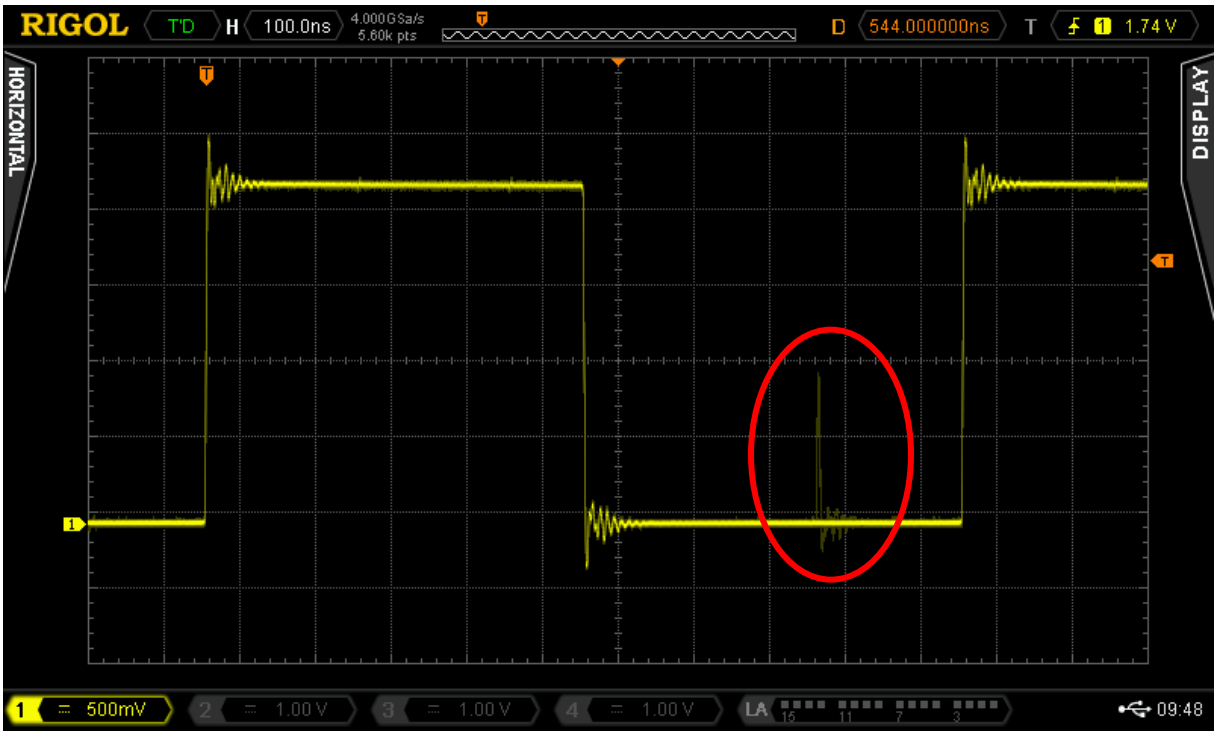
First, for a scope with a capture rate of 1,000wfm/sec, with time base set to 500nsec/div, the total displayed time (14 divisions screen) will be 7 µsec. If we assume that we have NO Blindtime then we see on average one glitch per 14,285 "screenshots", equivalent to a time of 14,285 x 7 µsec = 100msec (on average). With no Blindtime, we would have a capture rate of about 143,000 wfm/sec.

With a capture rate of only 1,000wfm/sec and without taking probability into account we will get an average time of 14.3 seconds until an error is seen on the screen. With this simple calculation, it is obvious what effect a higher waveform update rate will have on the time required to detect a rare error. A ten times faster Signal Capture Rate will lead theoretically to a ten times faster error display. With **UltraVision Technology**, Rigol is able to achieve refresh rates of up to 180,000 waveforms per second.

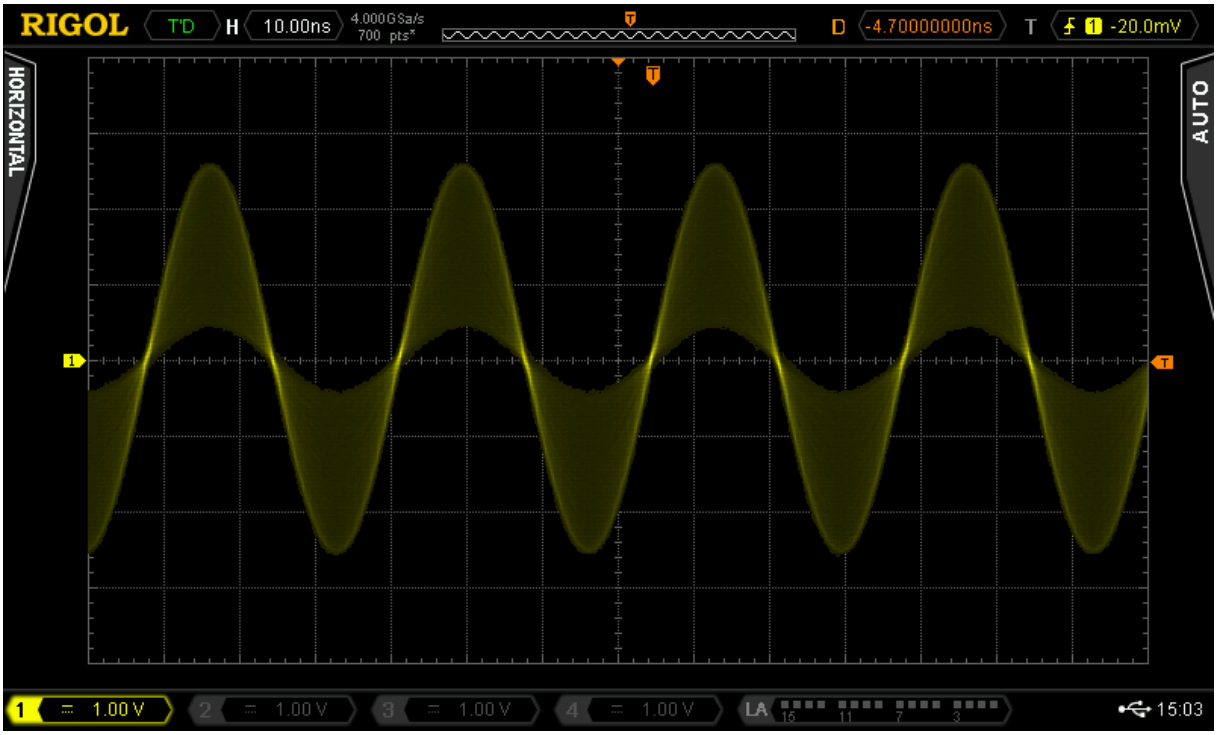
So there are two important advantages of a higher waveform acquisition rate: a) it helps to do the work more accurate and faster, to see anomalies or errors; secondly, it shortens the test or measurement time dramatically.

But having a high update rate is not the complete story. Why not? Imagine a waveform acquisition rate 50,000 wfrm/sec and a TFT-Display update rate of 50/sec (50Hz). This result in thousand waveforms per display update, which will be shown overlay on the screen. If every wave is displayed with the same color or same intensity it will not be possible to separate rare events from regular ones. **Ultravision**'s 256 stepped intensity display feature allows seldom-occurring signals to be displayed with less intensity on the screen compared to frequently-occurring signals. Thus, with **Ultravision**, it is possible to differentiate between seldom- and often-occurring signals, together with the additional advantages of the high waveform capture rate can be used.

So there is not just one curve on the display but a whole set of curves. To be able to extract as much information as possible, a more useful display is needed. To address this, **UltraVision Technology** provides a 256-level intensity display. The pixel intensity is set depending on the occurrence probability of a value. Thus it is possible to differentiate in just one view between often and seldom occurring points (e.g. errors or anomalies). The following picture shows a Clock Signal which has a rarely occurring spike. The error is displayed less intense compared to the clock signal itself (red mark)



Below: AM-Modulation – on 256 level intensity grading display



In addition, Rigol's **UltraVision Technology** also adds an extremely deep data memory. If there are peaks or drop outs in the waveform to be analyzed, a signal must be monitored over a long time period; then it is absolutely necessary to have a deep memory to allow zooming into signal detail which may only occur infrequently.

UltraVision Technology also provides a Record-function as standard feature. Combining this and the advanced trigger possibilities it is possible to achieve the maximum effective data storage. The acquired signals are stored in single segments of memory, so that rarely occurring, interesting trigger events are stored and not the irrelevant data.

Conclusion

UltraVision Technology hardware and software architecture accelerator has been employed on Rigol's latest oscilloscopes to avoid burdening the embedded CPU by handling, calculating, and administering the huge amount of data produced by the fast A-to-D data conversion. This has brought the performance of Rigol instruments to an extremely high level, and at affordable prices.