



Benefit of Large Memory Depth in modern Scopes

If someone is looking for a scope to buy, the key parameter Memory Depth is very often only the third or even fourth point on the decision list. In first sight everyone is thinking about Bandwidth, Sample and Acquisition Rate or Decoding options. But if some minutes are taken to think about the worth of for example a Sample Rate of 5 GS/sec or a Decoding Option without having enough memory available, it can immediately be seen how important it is to have a deep memory build in the Scope.

In this paper the relation of different parameters and the importance of Memory Depth will be explained and with the help of a practical example underpinned.

No one will disagree that if only short or fast signals or disturbances have to be displayed, the main focus will be on High Sample Rate and adequate Bandwidth (keyword Rise Time). But if the signal has to be monitored over a longer time period and if there are additionally some peaks or drop outs inner the signal which have to be analyzed, then it is absolutely necessary to have a deep memory or a corresponding combination of intelligent triggering and memory segmentation available.

The graphic below is based on the simple relation between Sample Rate, Time Base Settings and Memory Depth. This all can be written into the following mathematical formula:

$$\text{Sample Rate} * \frac{\text{Time}}{\text{div}} * \text{No. of Divisions} = \text{Acquisition Memory}$$

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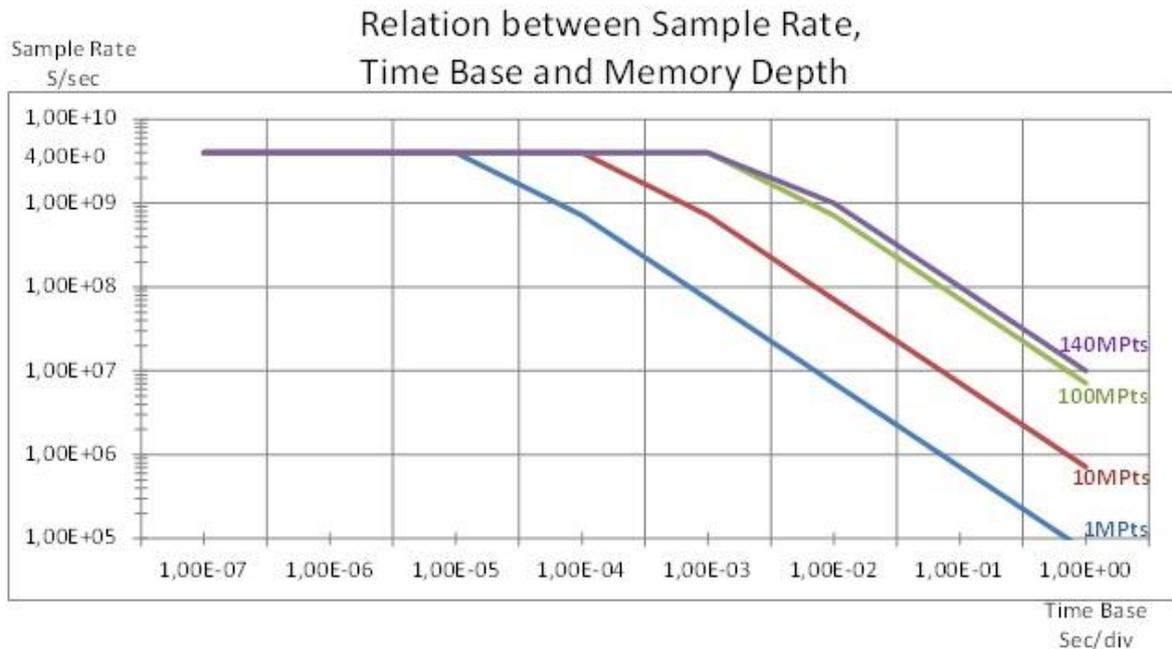
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Changing the formula over to:

$$\frac{\text{Time}}{\text{div}} * \text{No. of Divisions} = \frac{\text{Acquisition Memory}}{\text{Sample Rate}}$$

With this it can easily be seen that if a longer displayed time span should be realized, the only possibility is to lower the Sample Rate, because the maximum available Acquisition memory is fixed.

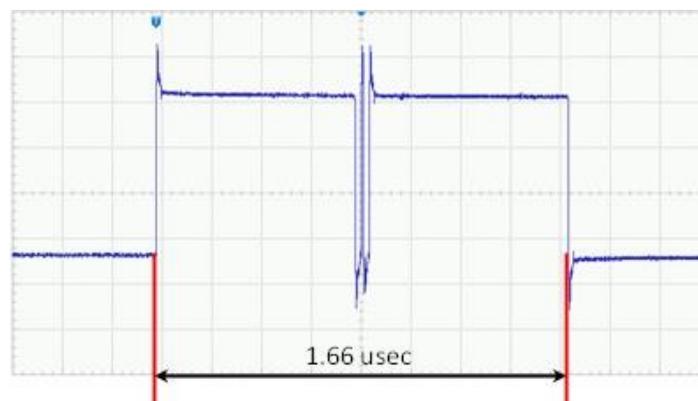


The graph shows the influence of having different size of memory. With enlarging the memory, the maximum displayed time with having the maximum Sample rate will also be enlarged. Let's pick out two examples from the graph:

1MPts Memory (blue line) allows a max. time span of 140usec @ max. SampleRate 4GS/sec

100MPts Memory (green line) allows a max. time span of 14msec still @ max. SampleRate of 4GS/sec

In the following part the benefit will be shown in a practical example. The used test signal contains 8 bursts. The time between two bursts is around 8 msec and each burst has the following shape:



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To capture all 8 Bursts with one single Acquisition we have to set the Time Base do 5msec / div.
Based on Rigols 14 Division wide screen we have a total visible time span of 70 msec.
The Edge Trigger is adjusted to rising edge with a level of 2 V and Single Acquisition is activated.

The waveform/burst sequence will be captured twice. Once with Memory Depth on Auto which leads to the 140MPts (standard on Rigol DS4000 Series) and once with manually limited Memory Depth of 1.4 MPts. Afterwards a zoom on one captured peak is done.

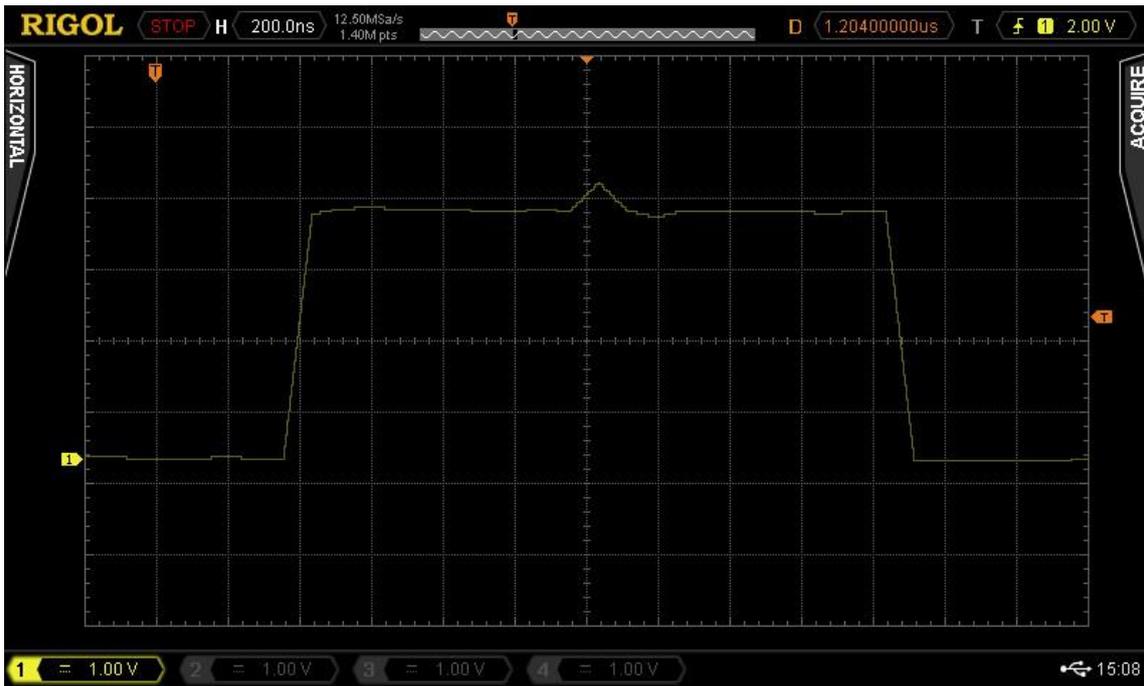
The first acquisition is done with the reduced Memory Depth. As a result of long displayed time and small memory depth the Sampling rate drops from 4GSa/sec down to 12.5MSa/sec. With this setting the used memory is at only 875kPts.



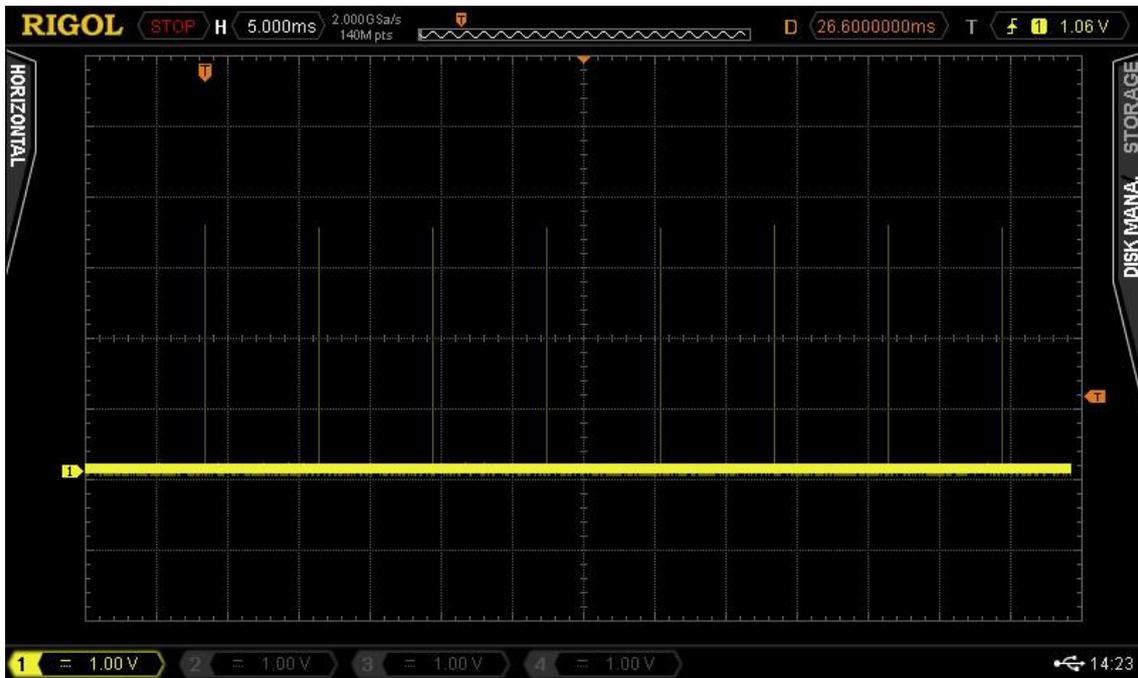
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Zoom into one of the bursts. It can be seen that the peak in the middle of the burst is totally lost.



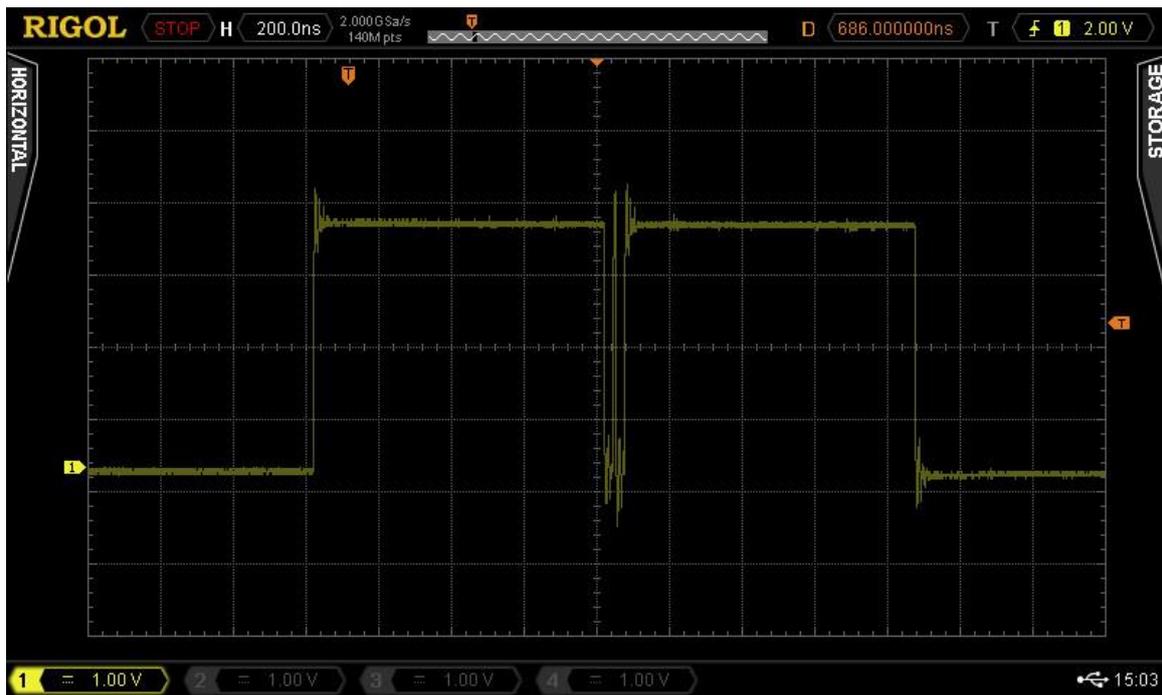
Same acquisition, done with Auto Memory depth, which mean maximum 140MPts. As a result of long displayed time and max memory depth the Sampling rate only drops from 4GSa/sec down to 2GSa/sec. With this setting the used memory is at 140MPts. The first look is the same as above but the zoomed view shows the difference very clearly.



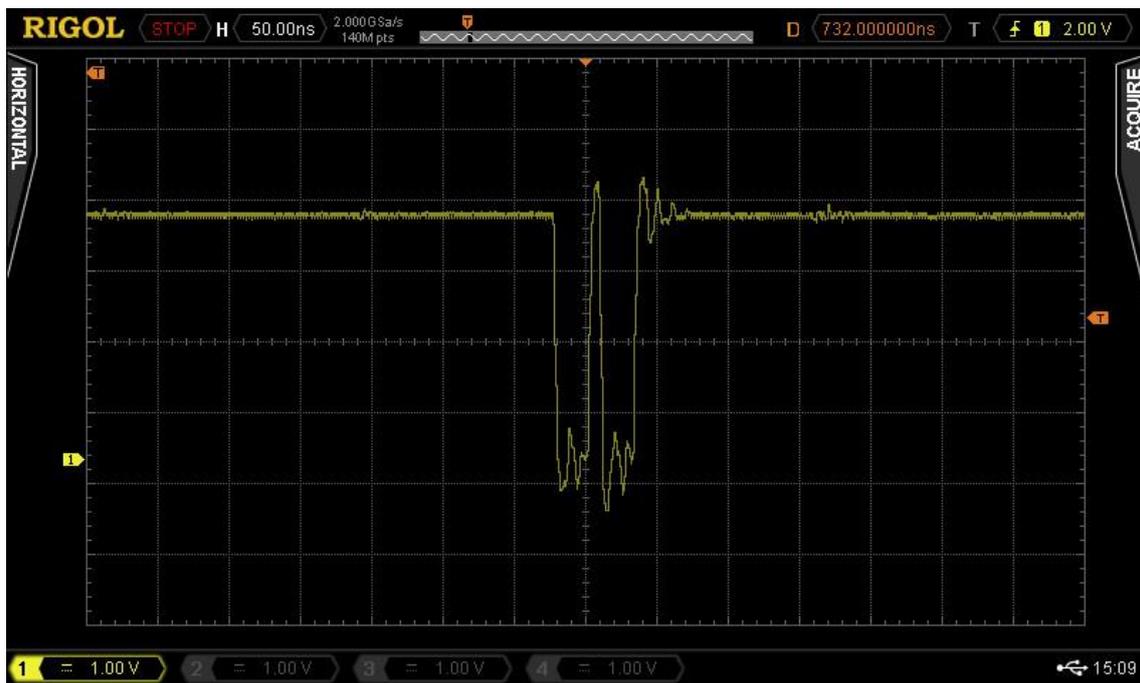
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Much more details are available. The burst is almost identical to the original one.



Even when we zoom in more we can still see a very excellent data resolution.



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Summary:

The Rigol DS4000 and DS6000 Scopes provide large memory depth of the shelf. This is a key feature which is absolutely necessary to achieve high accurate measurements. Acquiring longer time periods and being able to zoom into the signal without losing detailed information enable the engineer to verify the hardware design in a fast and proper way or dig into failure events and save time and money in the development phase. On top of this Rigol Technologies also provides a record function as a standard tool. Combining the large Memory, the Record function and intelligent triggering it is possible to capture selected signal details over minutes and being able to do a very detailed and accurate "offline" analysis afterwards. More details regarding the Record Function can be found in the Application Note "Decoding, Recording and Analyzing Serial Data Busses with Rigol DS4000 Series Oscilloscopes"

About RIGOL

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RIGOL is the fellow member of China Electronic Instrument Industry Association and the Informational Member of LXI Consortium. Our current product line consists of Digital Oscilloscopes, RF Spectrum Analyzers, Function/Arbitrary Waveform Generators, Digital Multimeters, Digital Programmable Power suppliers, Virtual Instruments and Chemical Analysis Systems, and much more.

RIGOL is an ISO9001:2000 Quality Management System and ISO14001:2000 Environmental Management System Certified company. Currently we offer our products and services in over 60 countries or regions on six continents utilizing more than 150 distributors and representatives.

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