
WaveAce Lab 1: Capturing Signals

Summary

This guide provides step by step instructions explaining how to use the WaveAce Oscilloscope.

The WaveAce Oscilloscope provides tools for viewing, measuring and analyzing digital, serial and analog waveforms. This guide will explain how to use the various tools built-in to WaveAce such as cursors, waveform magnifier and history mode.

Overview: The Capture Lab addresses the different acquisition modes found in modern digital oscilloscopes like the WaveAce.

A test at the end of the Lab allows you to check your knowledge.

It is recommended to start with this lab as the first part of your training.

Goal: Learn how to configure and use:

- Single Acquisition
- Normal Acquisition
- Auto Acquisition
- Roll Mode
- Equ (Equivalent) Time Mode
- Acquisition modes – Average and Peak Detect

In this Lab you will learn the differences between each of the acquisition modes and when they should be used.

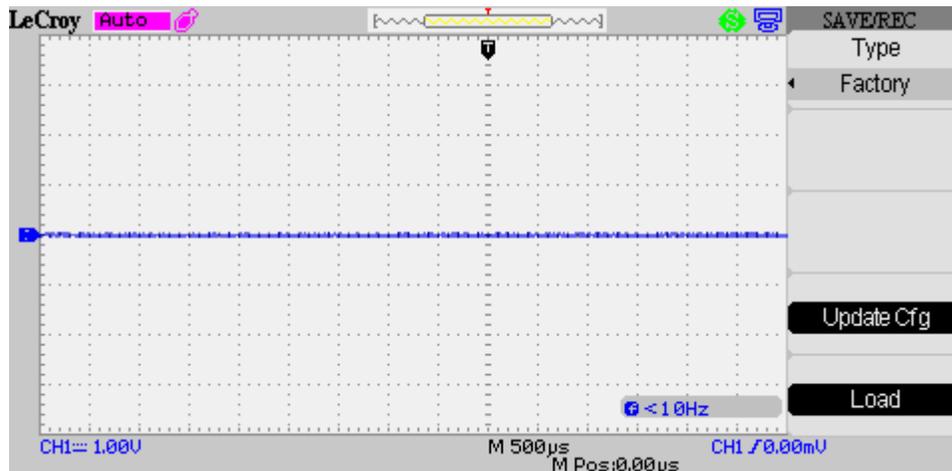
Required Equipment:

- 1 x WaveAce Oscilloscope.
- 1 x WaveAce passive probe.

Setup: Connect the probe to Channel 2 and the probe top to the calibrator (CAL) output loop on the front panel. Use the sprung hook accessory of the probe to clip to the CAL output loop.

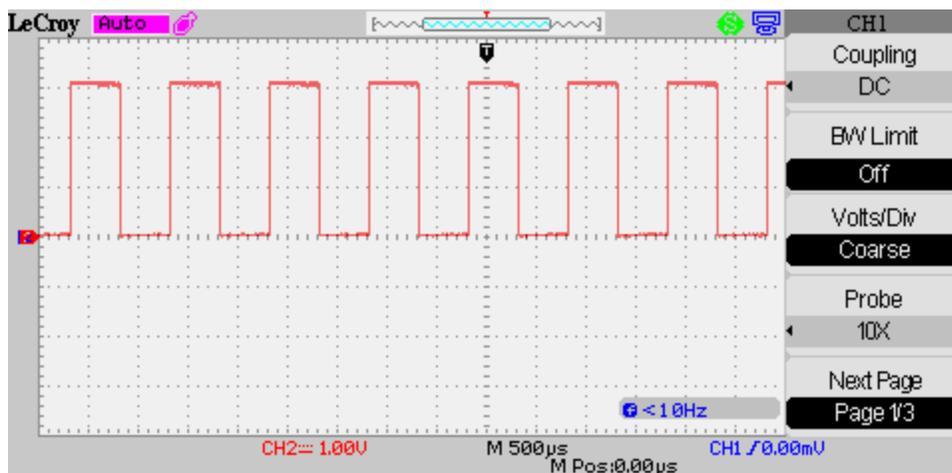
Note:(Screenshots below show a white background configuration of your WaveAce to save black ink in printing. This configuration is explained in Lab 2 – VIEW)

Step 1: Reset the scope configuration to the default factory settings using the front panel DEFAULT SETUP button. An alternative method is to use the front panel SAVE/RECALL button, then press the Type button until Factory is displayed and finally press the Load button.

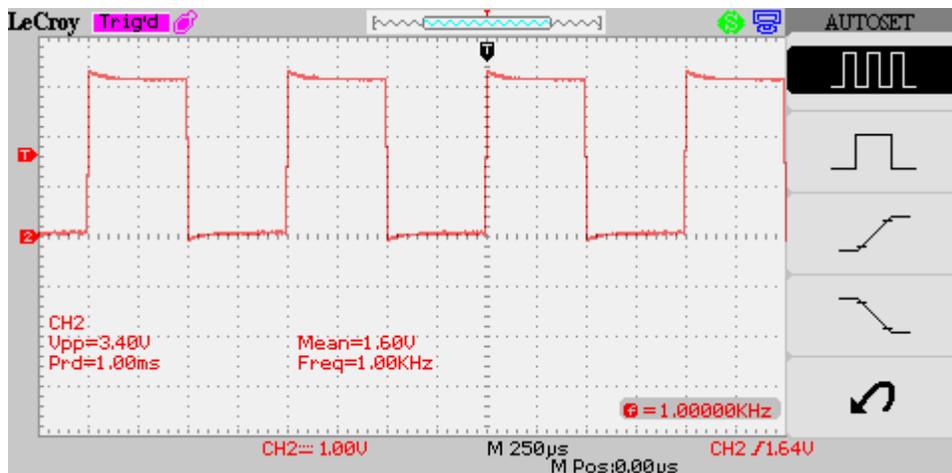


At any time the menu on the right-hand side of the screen can be removed/restored by pressing the front panel MENU ON/OFF button.

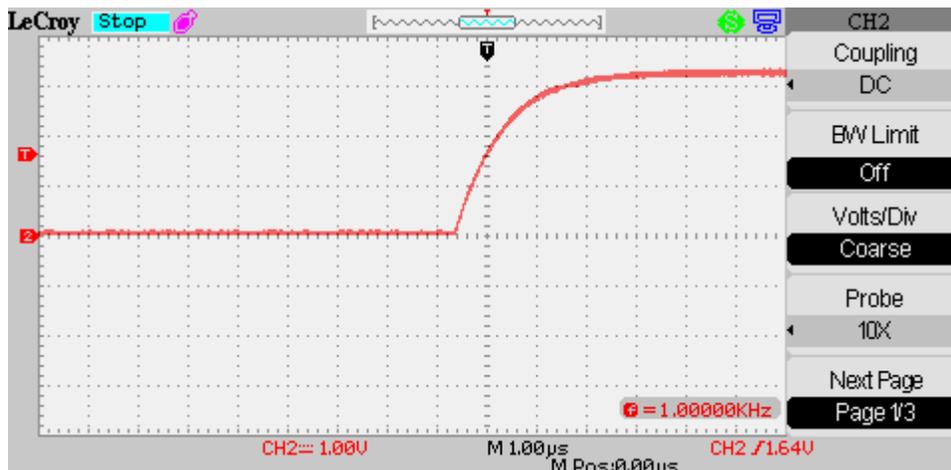
Step 2: Turn CH1 off and CH2 on by pressing the front panel CH1 and CH2 buttons. Pressing a channel button also displays the corresponding vertical settings. DC coupling on CH2 is selected by default. Check the slider switch on the probe is set to X10 and using the Probe button set 10X on the screen.



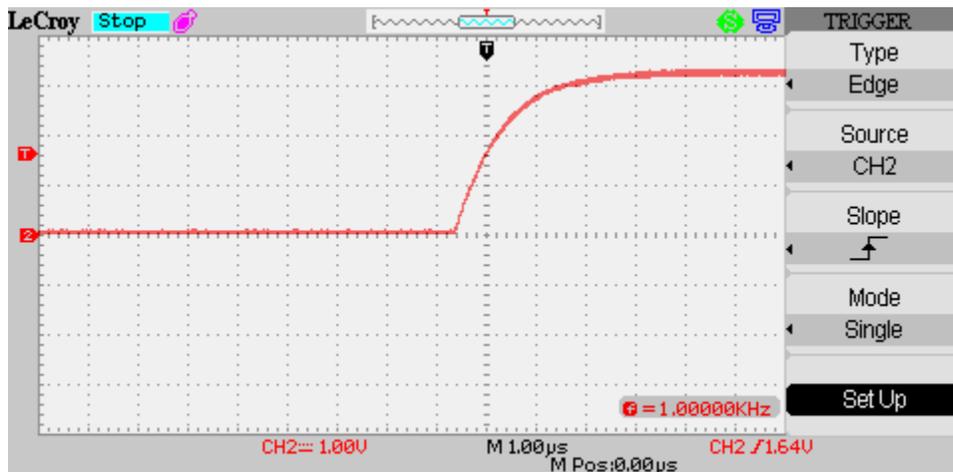
Step 3: Press the [blue] AUTO button on the front panel. Wait for a few seconds and you should have a triggered signal with a number of signal periods shown on the screen.



Step 4: Adjust timebase setting to 1 us/div using the Horizontal timebase control on the front panel. Press the front panel RUN/STOP button (LED goes red) to capture the data on the display. Pressing it a second time (LED goes green) will restart triggering. Press the front panel SINGLE button to select single acquisition mode. Now each time the RUN/STOP button is pressed a single acquisition will be performed.



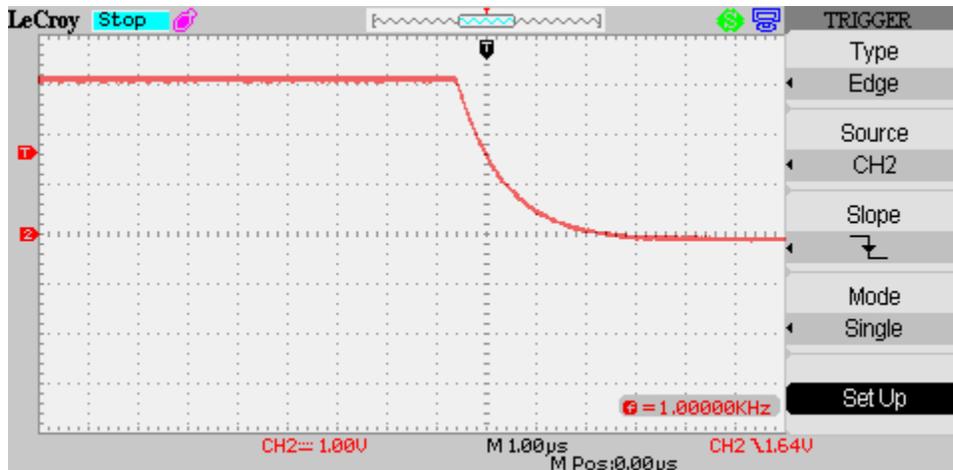
Step 5: Remove the probe from the CAL signal and on the front panel press TRIG MENU. Press the Slope button to select negative edge trigger and arm the scope by pressing RUN/STOP. As no trigger is available the RUN/STOP button will remain green with the Ready marker displayed at the top edge of the screen.



Re-connect the probe to the Cal signal to simulate an asynchronous pulse.

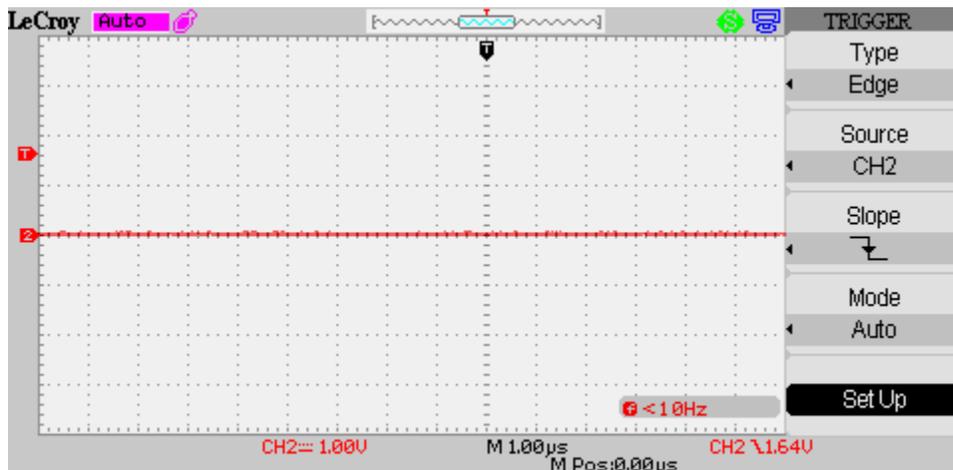
The scope should now trigger. The RUN/STOP button has changed to red and the marker displays Stop. If the edge displayed does not look like the above press RUN/STOP once more to capture a clean edge.

Step 6: Press the SINGLE button to revert to continuous mode and the marker now displays Trig'd. Using the front panel Horizontal Position control knob, position the falling edge to the left of center of the screen, as shown. The amount of delay is momentarily displayed on the screen.



Push in the Position knob to see the trigger point revert to the center of the screen.

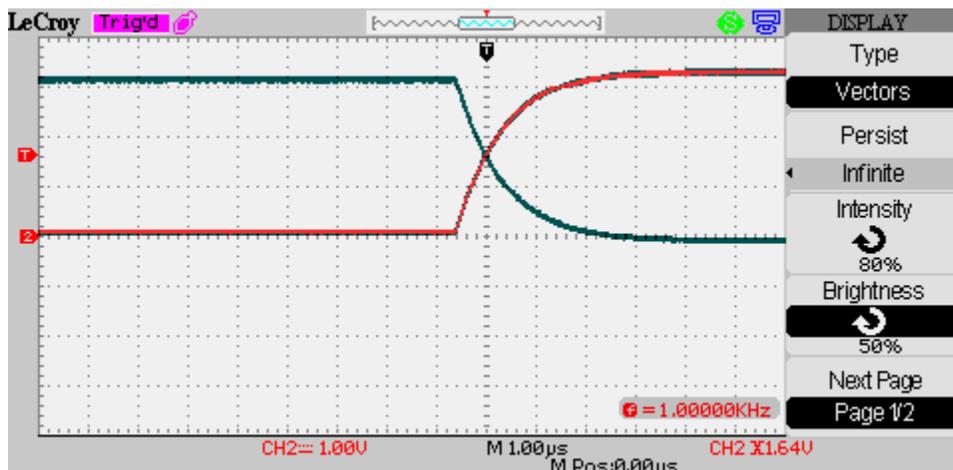
Step 7: Press the Mode button to select Normal trigger mode. The screen marker continues to show Trig'd. Remove the probe from the Cal signal, the scope stops triggering and the marker changes to Ready. Press the Mode button to select Auto trigger mode and the scope now triggers even without a signal present and the marker displays Auto.



Connect the probe to show the edge and the marker changes back to Trig'd.

Press the Slope button to select both edges. Now the scope is triggering on both edges. If Single mode is selected (either by using the Mode button or pressing the Front Panel SINGLE button), each time RUN/STOP is pressed it triggers on one of the edges and the previous data is erased. Press the Mode button to select Normal trigger.

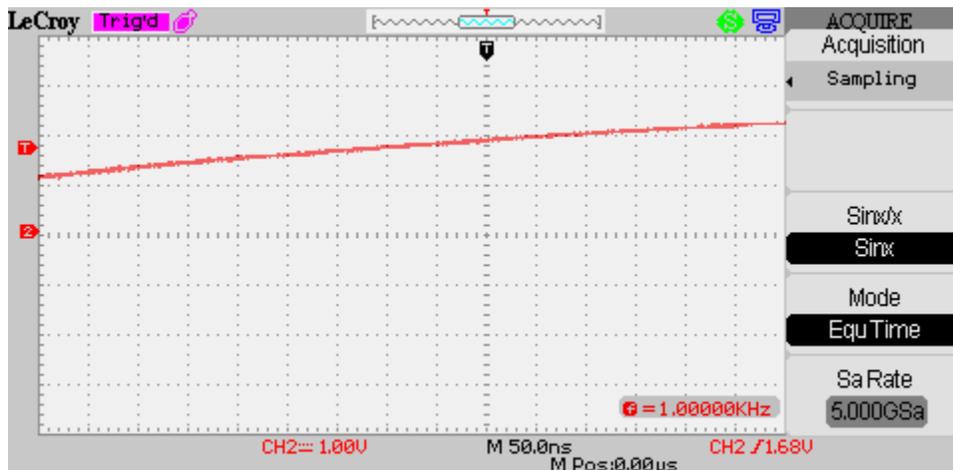
Press the front panel DISPLAY button and use the Persist button to select Infinite. The screen now maintains a record of all previous traces.



Select the Persist button again until Off is selected. The scope has now reverted to displaying single traces.

Note: AUTO trigger mode is useful when the trigger setup is not correct, as you can see a 'live' trace on the screen which allows adjustment.

Step 8: Adjust timebase setting to 50 ns/div and press the front panel ACQUIRE button to display the sampling options and note the sampling rate (Sa Rate). Select Equ Time using the Mode button. Although the sample rate increases to 5 GS/s, the display is now corrupted.



In the TRIG MENU change the trigger slope back to positive or negative edge triggering and the signal is correctly represented on the scope display.

Note: Why do we need Equivalent Time sampling mode? – Equ Time mode is only designed to be used for truly repetitive signals. When we trigger on both edges, we get both positive and negative slopes included, so the signal is not truly repeated each trigger. Once we use only rising or falling edges, then the signal is repeating itself from trigger to trigger and Equ Time mode works correctly.

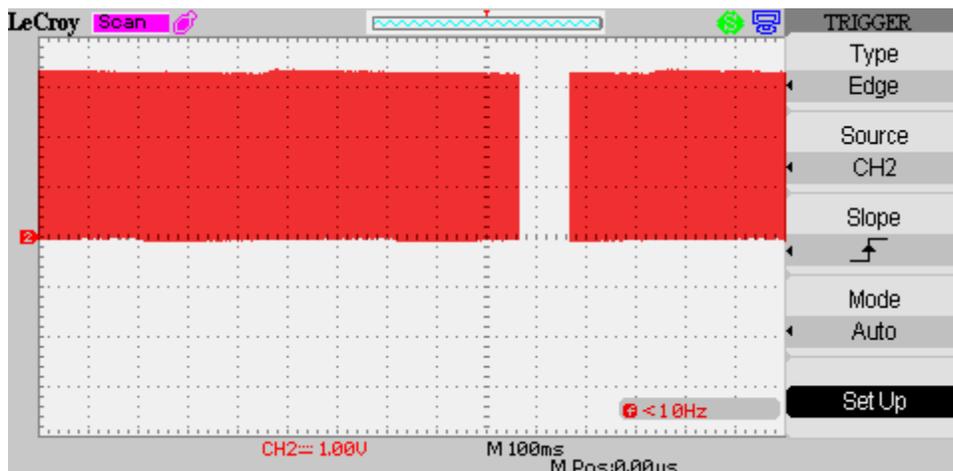
The advantage of Equ Time mode is that it provides higher sampling rates on the fastest timebases.

Step 9: Select each slower timebase in turn. For timebase settings of 100ms and slower we switch to roll mode acquisition (Scan is displayed on the top line of the screen) and the trace acts like a chart recorder, scrolling across the screen.

Select Normal trigger mode – how does the screen update change?

Now select Single trigger mode – how does the screen update change?

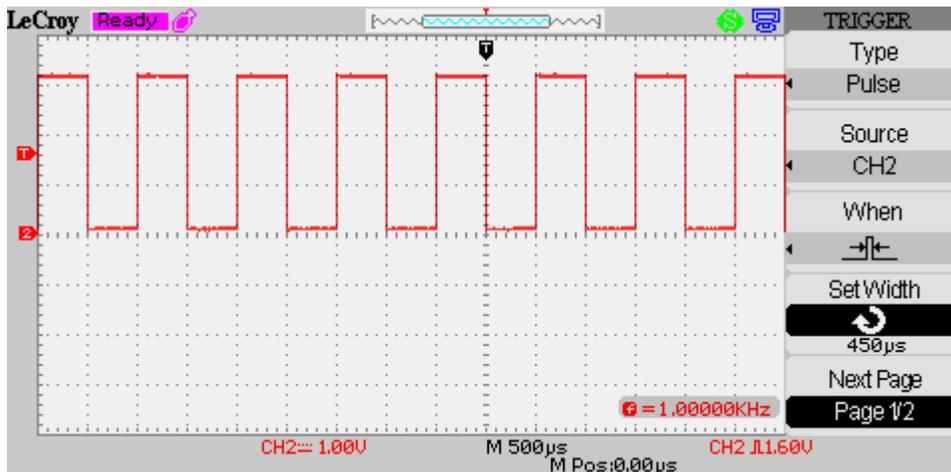
Return to Auto mode to compare. Notice that roll mode is only available when Auto trigger is selected.



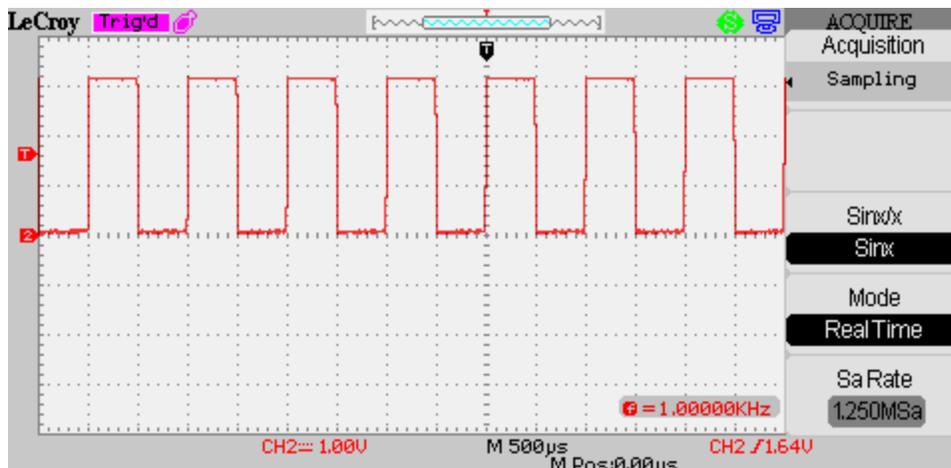
Step 10: Select Auto trigger mode and 500us/div to display several cycles of the waveform. Adjust the front panel trigger Level knob. The small T marker to the left of the screen shows the trigger level with respect to the signal and in Auto mode the scope triggers even when the level is outside the signal. Select Normal trigger mode and now the scope triggers only when the level is inside the signal.

Center the level with the front panel SET TO 50% button.

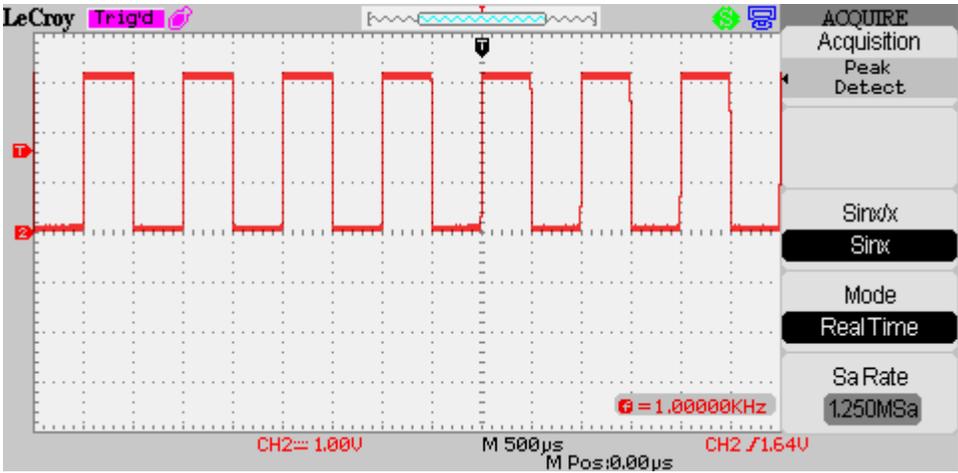
In the TRIG MENU select Pulse Type trigger and use the **When** menu button to select positive pulse width less than pulse width setting. Select Set Width and adjust the value to 450 us with the Intensity/Adjust knob. Observe that the scope stops triggering. Adjust to 550 us and the scope now triggers.



Step 11: Revert to Edge type trigger and Auto trigger mode. Press the ACQUIRE button. Under Acquisition Sampling is displayed. Note the level of noise on the top and bottom levels of the calibration signal.



Now press the Acquisition button and Peak Detect is displayed. Allow the scope to run for several seconds. Note the level of noise on the signal.



A sampling acquisition samples the waveform at uniform time intervals. A rapid variation in the signal such as a narrow pulse may therefore be missed. In Peak Detect the highest and lowest values in the signal are recorded so allowing even narrow pulses to be captured. Averaging is useful to reduce random noise. When using averaging you can also select the number of acquisitions to average. Higher values will give more noise reduction but the averaging will take longer.