WaveSurfer MXs-B WaveScan

TEN MINUTE TUTORIAL

January 11, 2012

Summary

WaveScan allows searching in a single acquisition using more than 20 different criteria. Or, set up a Scan condition and scan for an event over hours or even days.

WaveScan Advanced Search and Find Tool

WaveScan provides powerful isolation capabilities that hardware triggers can't provide. WaveScan provides the ability to locate unusual events in a single capture (i.e., capture and search), or "scan" for an event in many acquisitions over a long period of time. Select from more than 20 search modes to find events on any analog or digital channel or search for a pattern across multiple digital channels.
Since the scanning "modes" are not simply copies of the hardware triggers, the utility and capability is much higher. For instance, there is no "frequency" trigger in any oscilloscope, yet WaveScan allows for "frequency" to be quickly "scanned." This allows the user to accumulate a data set of unusual events that are separated by hours or days, enabling faster debugging. When used in multiple acquisitions, WaveScan builds on the traditional LeCroy strength of fast processing of data.

Equipment Required
WaveSurfer 104MXs-B oscilloscope (or other WaveSurfer Xs-B oscilloscope)
Passive Probe

Displays shown in the tutorial are based on the following initial setup on a WaveSurfer 104MXs-B oscilloscope scope:

1. Connect a passive probe from channel 1 to the Cal test point on the front panel; ground the probe to the adjacent ground terminal.
2. Recall the default setup: File pulldown > Recall Setup> Recall Default.
3. Turn off channel 2.
4. Auto Setup the scope: Press AutoSetup button on the front panel twice.

This completes the initial setup. The scope display should be similar to Figure 1.

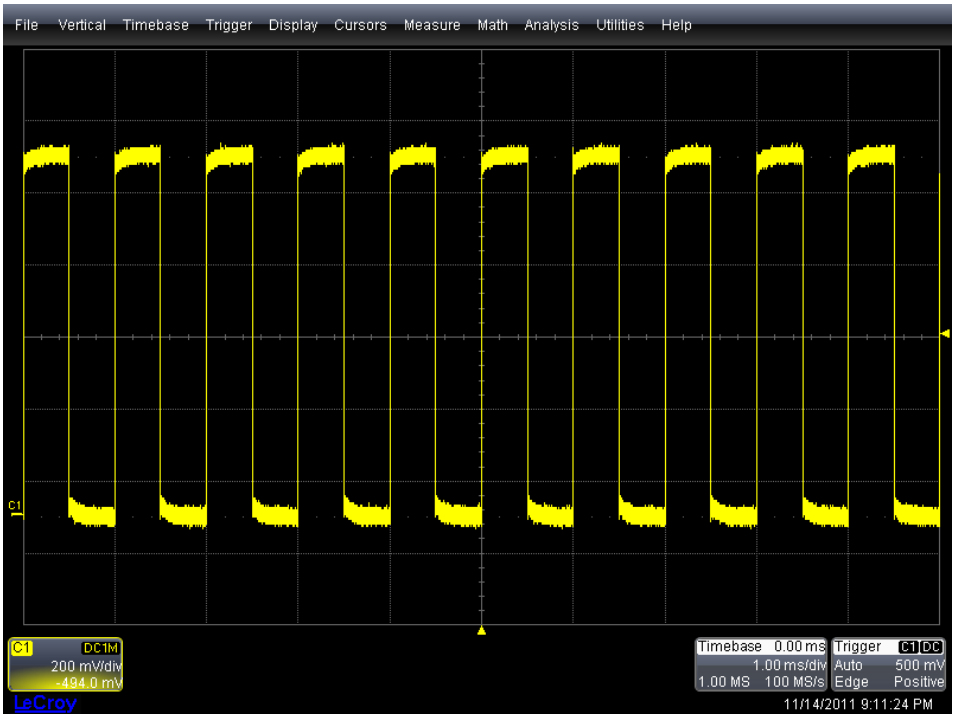

Figure 1: *The initial setup of the WaveSurfer 104 MXs-B oscilloscope*

At this point we can evoke WaveScan. In the WaveSurfer Xs series scopes WaveScan is accessed using the Analysis pull down menu. Analysis > select WaveScan from the pulldown.

Click on the Enable checkbox in the WaveScan dialog box to turn WaveScan on.

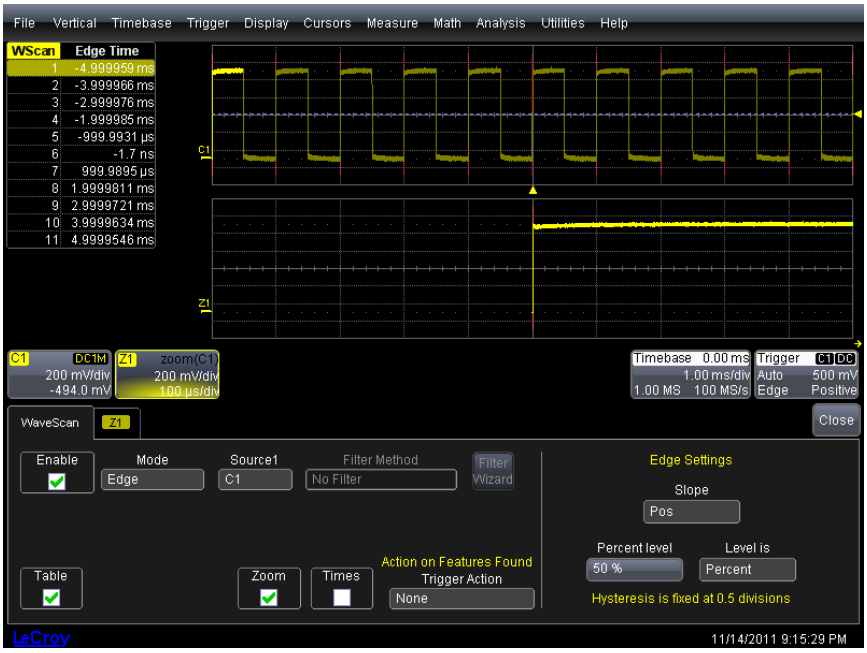

Figure 2: *WaveScan's default setup*

Figure 2 shows WaveScan's default setup. It is using Edge Mode which finds each edge in the source trace. Study the WaveScan dialog box. You will note it is set to find positive edges where the edge threshold is 50% of the signal amplitude. Each event (edge) meeting the criterion is highlighted with a red line. The locations of each edge are shown in a table in the upper left hand corner of the display. Note also that trace Z1, the zoom of trace C1 has also been turned on. This zoom trace is showing the source trace expanded horizontally by a factor of ten to one (10:1). The highlighted area on the source trace shows the specific edge being expanded.

Stop the acquisition update by pressing the Stop button in the Trigger area of the front panel.

Click or touch any entry in the WaveScan table. Note that the zoom trace source jumps to that pulse. The table entries are hyperlinked to the zoom setup so you can bring any WaveScan event into the zoom trace for closer study. Zoom controls on the front panel can be used to control the Zoom trace settings.

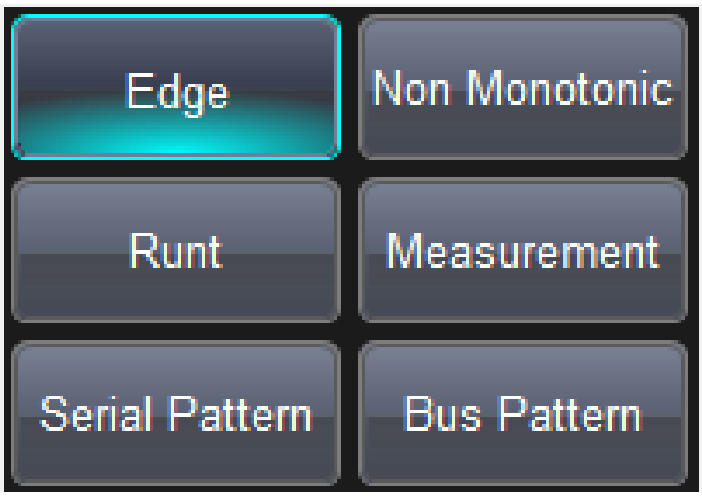

Figure 3

Click or touch the Mode field in the WaveScan dialog box. The mode selection popup will be displayed (Figure 3).

WaveScan Mode Options
Modes are used to locate anomalies during acquisition.

Edge Mode - for detecting the occurrence of edges; selectable slope and level.

Non-monotonic Mode - for detecting threshold re-crosses; selectable slope, hysteresis, and level.

Runt - for detecting pulses that fail to cross a threshold; selectable polarity and thresholds

Measurement Mode - for filtering and performing parameter measurements

Serial Pattern – Searches from 2 to 64 bits; ideal for bursted patterns where a PLL cannot lock.

Bus Pattern – Searches from 2 to 64 bits; enhances MSO search capabilities. MSO's are Mixed Signal Oscilloscopes which offer 18 or 36 digital channels in addition to the 4 analog inputs.

In this tutorial we will use the edge and measurement modes as the primary examples.

Use the WaveScan Mode field and set WaveScan to the measurement mode. Touch or click the measurement field. Investigate the measurements which are available in the scroll list. Select Risetime.

Let's start by examining our waveform. Use the Measure pulldown menu and select Measurement setup.

Setup parameter P1 to measure the risetime of C1

Check the Show Table checkbox. The measurements are displayed under the grid area as shown in Figure 4. Check the Statistics checkbox. The measurement display will now show the statistics fields.

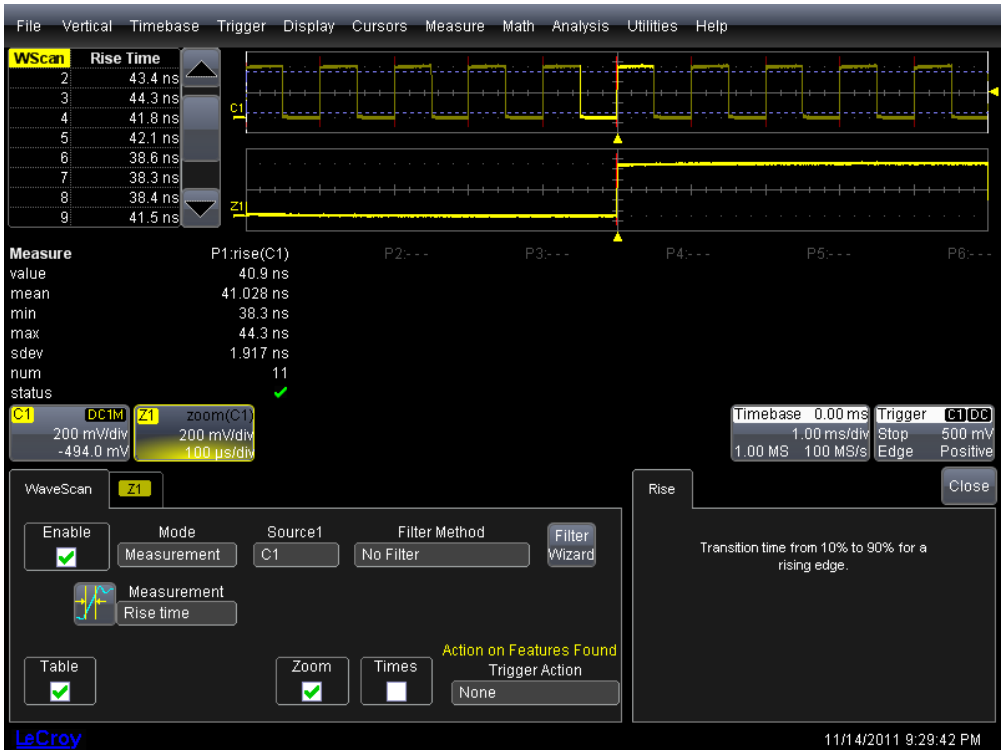

Figure 4: *The WaveScan measure mode using the risetime parameter*

At this point you should see the first parameter, P1, is reading the risetime of trace C1. We have eleven leading edges on the screen and the statistics include all eleven risetime values. The number (Num) readout for P1 should reflect this value. Additionally, we can read the mean, minimum (min), maximum (max), and standard deviation (sdev) of the 11 instances. The value field reads the last measured value and corresponds to the last value in the WaveScan table. Use the hyperlinks of the WaveScan table to find and display the min and max pulse risetimes. Note that the values you see on your scope for risetime will vary and will be scope bandwidth dependent. Do not expect to get the same values shown here, they will be similar but not identical.

Touch or click on the Filter Method field in the WaveScan dialog box. The Filter Method pop up will appear (Figure 5). This shows the available search criteria for evaluating measured values. Select Rarest events. Let's use this filter to find the smallest risetime.

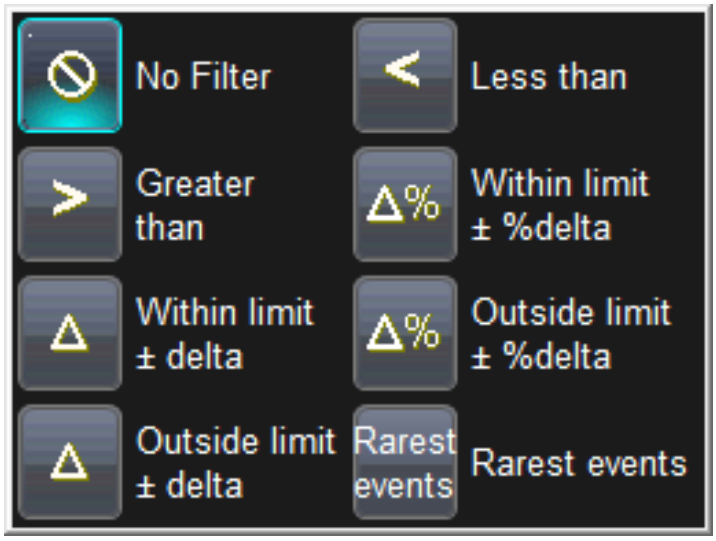

Figure 5: *The Filter Method pop up selections*

Touch or click on the Rarest Mode field and select smallest (Figure 6). Touch or click on # Rare Events and set the value to 1.

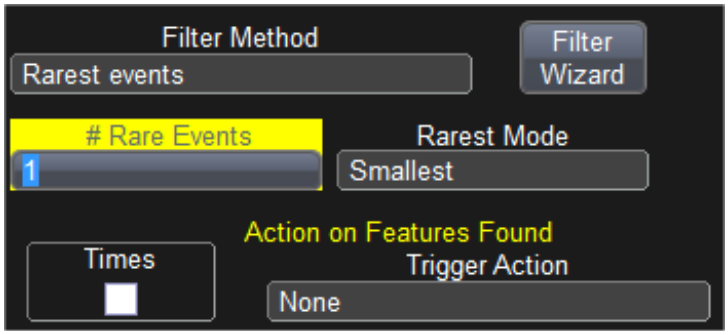

Figure 6: *Setup to find the smallest risetime*

The WaveScan table should now consist of a single entry as shown in Figure 7. Touch or click that table entry. The zoom trace Z1 will now contain the pulse with the smallest risetime.

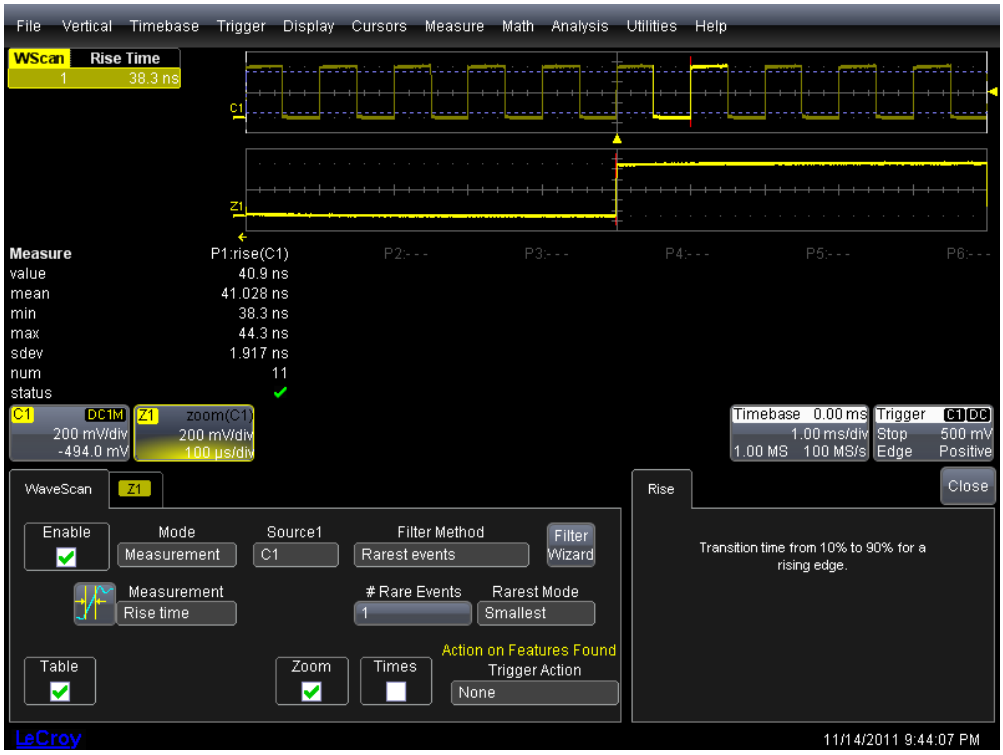

Figure 7: *Finding the smallest risetime using a filter*

WaveScan includes a Filter Wizard to aid in setting up the values in the measurement filter, shown in Figure 8.

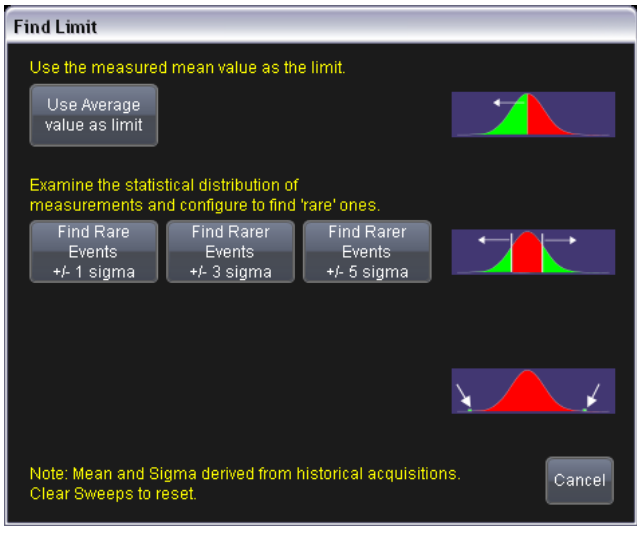

Figure 8: *The Filter Wizard uses measurement statistics to aid in setting up measurement filter values*

The filter wizard uses the statistics from the actual measurement. You can select to use the average or mean value of the measurements. The Find Rare, Rarer, and Rarer Events buttons set the filter limits to the mean ±1 standard deviation, mean ± 3 standard deviations, and mean ± 5 standard deviations. The Rarest events has to be set up manually by setting the filter to find the largest or smallest measured value.

So far we have been using WaveScan to search in a single acquisition. This is called search mode. If we allow the scope to acquire waveforms continuously in normal of auto trigger modes we can use WaveScan in the scan mode. We can then use a variety of actions to see any WaveScan event.

Clicking on or touching the Trigger Action field in the WaveScan dialog will bring up a pop up menu with seven choices as shown in Figure 9. Each of these allows the user to call attention to the event or store it for later study.

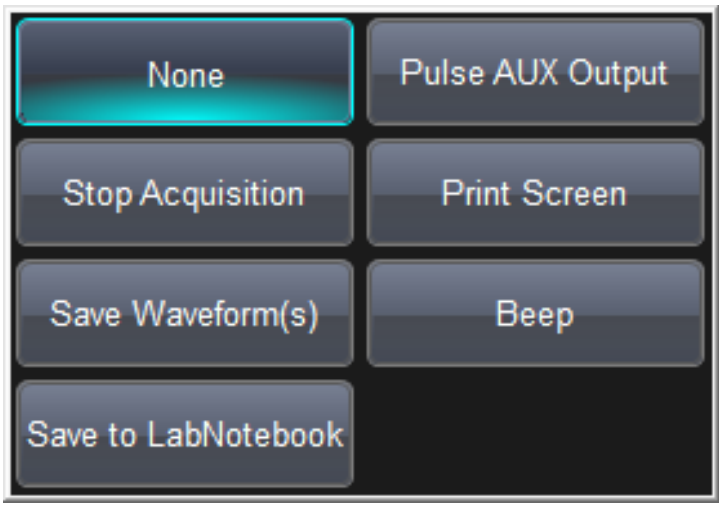

Figure 9: *The Trigger Action pop up selections*

Set up WaveScan Trigger Action to Stop Acquisition on a filter method that is outside a limit + delta. Use the Filter Wizard and select the center Find Rarer Events. This will set the limits to the mean ± 3 standard deviations. Press the Auto Trigger button in the trigger control group on the front panel. After a few seconds the acquisition will stop and the WaveScan table will have the single value, the pulse with the smallest risetime will be highlighted and shown in the zoom trace in Figure 10.

In this example the filter limits are 40.690723 ± 4.6229902 ns. In the example in Figure 10 the upper limit is 45.3137 ns and the scope stopped after finding a risetime of 46.0 ns.

This can be tried with other filter settings and actions in order to learn the capabilities of this feature.

Check the Times check box. Note that the WaveScan table will expand to show the location of the event in time by displaying the start and stop times of the edge with the 46 ns risetime.

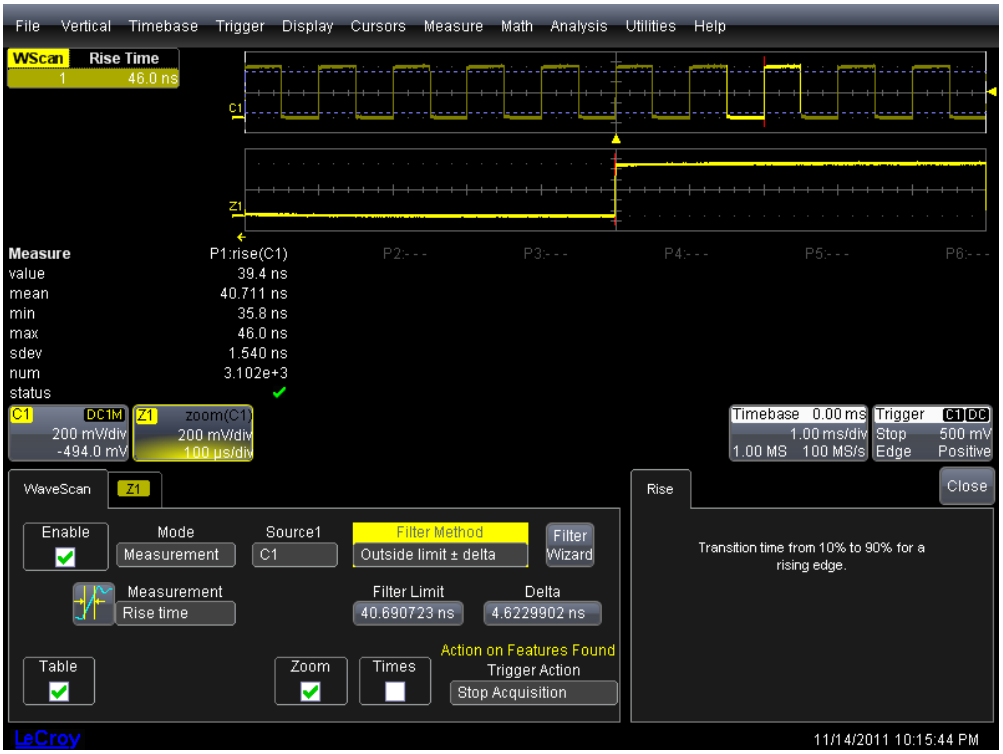

Figure 10: *An example of using the scan mode and stopping on a WaveScan event using a filter which is scanning for a risetime value outside of three standard deviations from the mean value*

This completes this ten minute tutorial.