

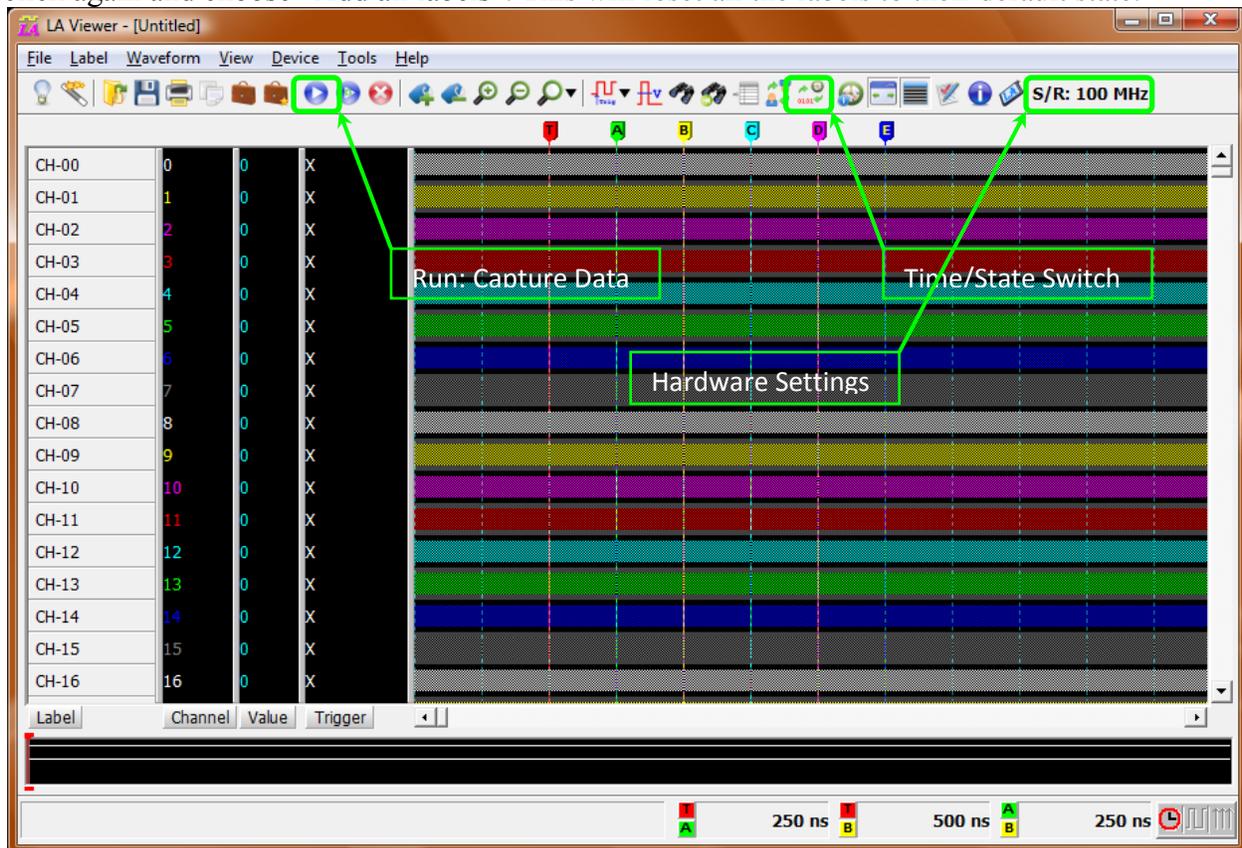
## LSA Tutorial

Starting Note: Assume that the 8-bit counter you designed in part 1 of the prelab is programmed on your BT-U board.

1) The first thing you need to do is connect a probe of the LSA to each of the pins you assigned your outputs to on the BT-U board. For this tutorial, you only need to connect the output bits of the counter, the RCO output, the clr\_n and enable inputs. Remember that the pins on the INSIDE of each of the headers are the ones connected to the FPGA.

**Also, you will need to connect one of the LSA probes labeled “gnd” to a ground pin your BT-U board.** This is common thing students forget, so if things aren’t working as you expect make sure the grounds are connected.

2) Start the “LA Viewer” program on the computer (You should have downloaded and installed the appropriate version from ‘Acute’ website: <http://www.acute.com.tw>). On the left side of the screen, you should see the default labels for each of the channels (CH-00, CH-01, etc...). You can change the label of a channel to be more descriptive by right clicking on it and choosing “Modify Label Name”. If a previous user has already modified the labels, you can reset them to the default by right clicking on one of the labels and choosing “Delete All Labels”. Then right click again and choose “Add all labels”. This will reset all the labels to their default state.



To capture data, click on the icon with the “Play” button. You should now see the captured data on the screen. To switch between a graphical waveform view and a text view, click the “Timing State Analysis Switch” button shown above.

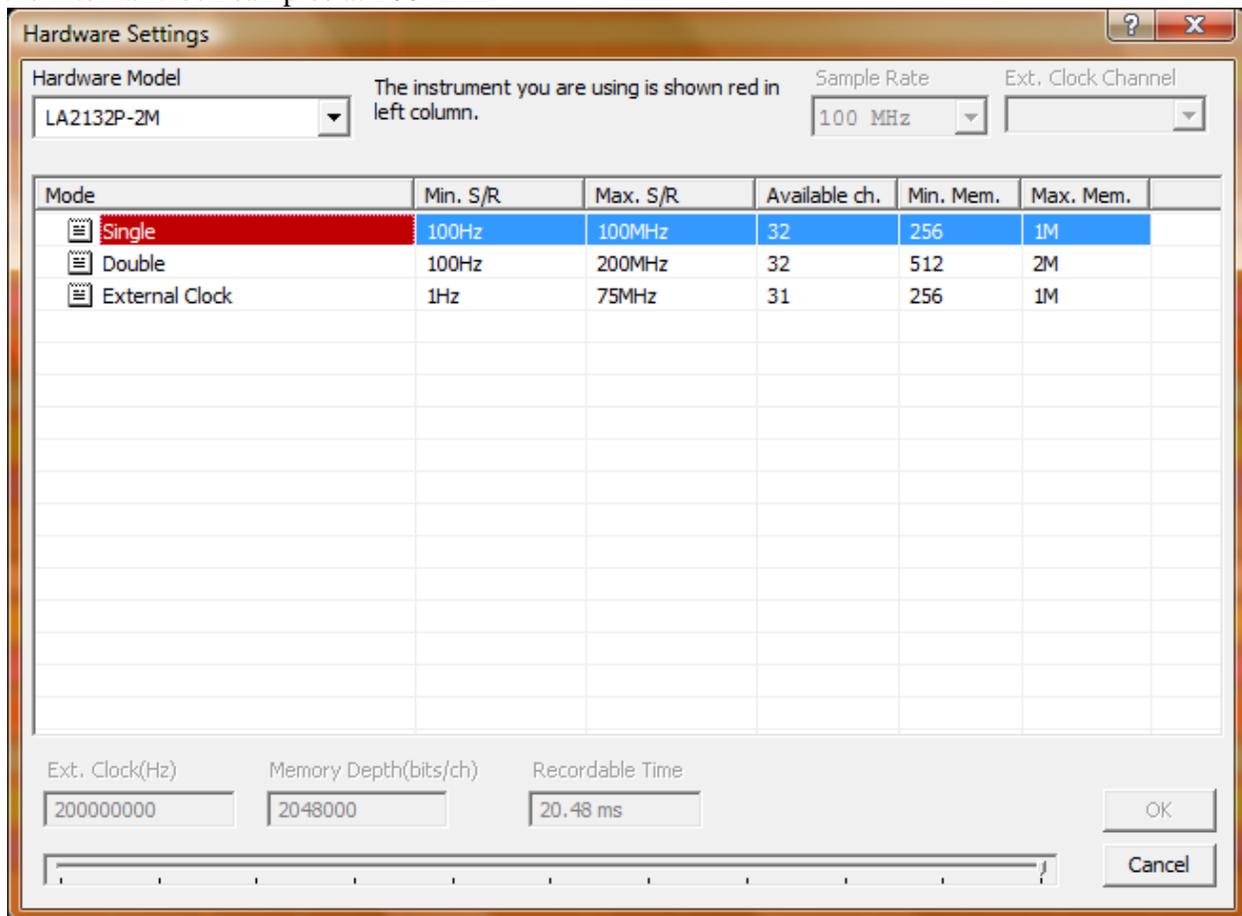
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3) Multiple signals can be combined into a group so they can be displayed together. This is useful for displaying count values or busses. To view the count value of your counter, right-click on one of the labels and choose “Combine Labels” from the menu. Enter a name for the group in the top text box. To add pins to the group, select a pin from the source list and click the right arrow to move it to the destination list. Maintain proper order for the LSB and MSB.

4) You can change the radix the group is displayed in by double-clicking the label name and choosing the radix you want it to be displayed in from the window that pops up. **Take a screenshot of the data you captured. Use the graphical waveform view.**

#### Clock Settings:

The LSA works by sampling the value of all the pins at fixed intervals. This interval can be based either off the internal clock of the LSA, or a pin on your BT-U board. For the LSA2132P, the internal clock samples at 100MHz.



5) By default, data capture is based on the internal clock of the LSA. You can choose what speed the internal clock should run at from the ‘Sample Rate’ drop down box. Capture the data several times with different clock speed settings to observe the results. **Take a screenshot of data captured with the internal clock at a different clock speed than you used in part 5. Use the graphical waveform view.**

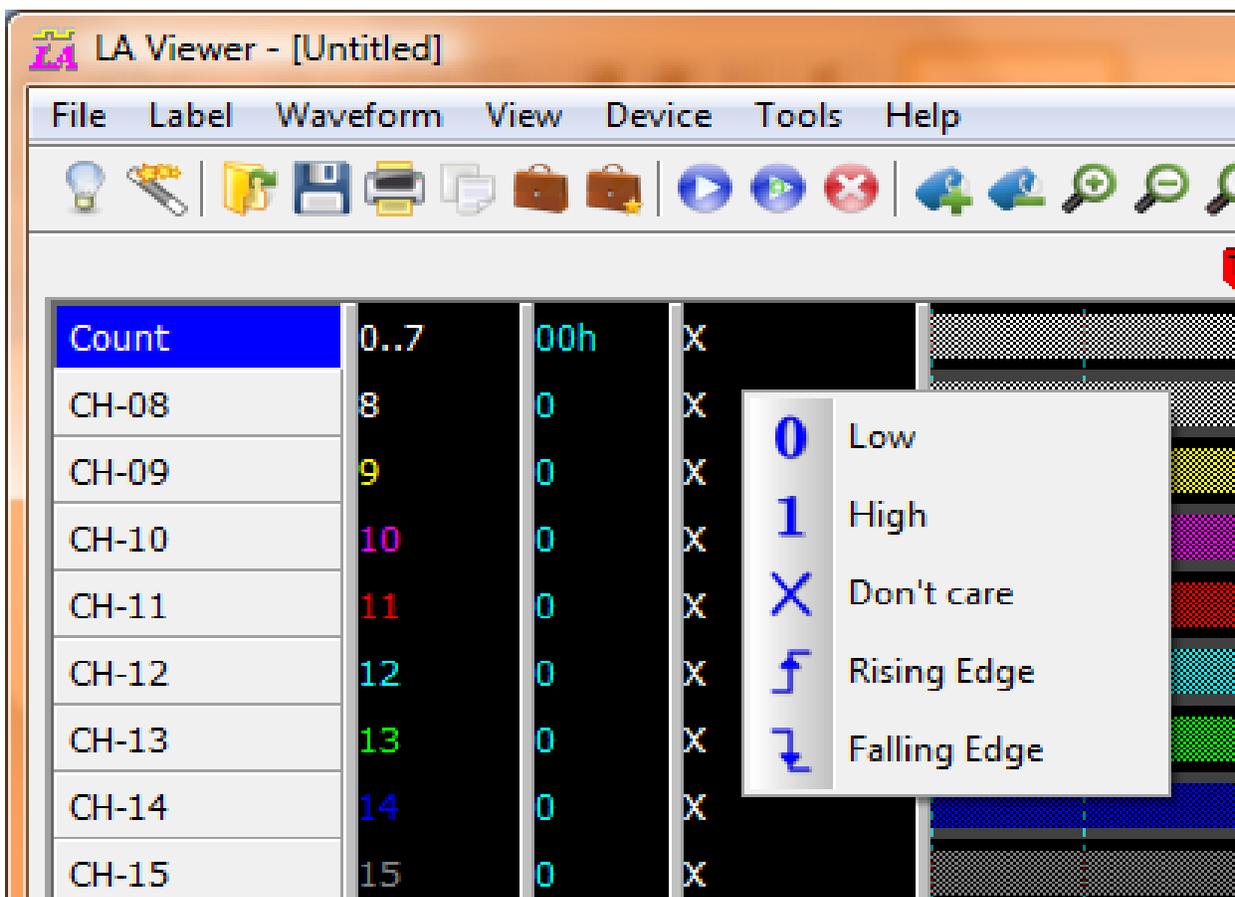
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6) The LSA can also sample the pins based on a clock signal provided from your board. This is useful to keep the LSA in sync with your design and is the most useful mode for this class. To use this mode, connect probe 31 of the logic analyzer to the pin on your BT-U board where you routed your clock signal. Then choose “CH31” in the “External Clock Channel” drop down box. **Take a screenshot of data captured using the board clock. Use the text view.**

Trigger Settings:

7) You can configure the LSA to begin capturing data based on how one of the signal changes. To do this, make sure that ‘Simple Trigger’ is selected in the ‘View’ tab (If it is not selected, you will not be able to see the trigger column). Then right click on the trigger column for the signal you want to use as the trigger and select the appropriate level/edge.

Right click on the group label from step 3 and select ‘Decompose’. Set a ‘Rising Edge’ trigger on output1. Combine the signals again to form the group. **Take a screenshot of data captured with this trigger setting. Use the graphical waveform view.**



8) You can configure the LSA to begin capturing data at an arbitrary point. For example you can capture data every time the count value reaches 5 or 9. To do this, right click on the trigger column of the output group and enter the value you want as your trigger. For example, a count of 5 can be 05h or 00000101b. **Capture data starting with a count value of FDh and take a screenshot. Use the graphical waveform view.**