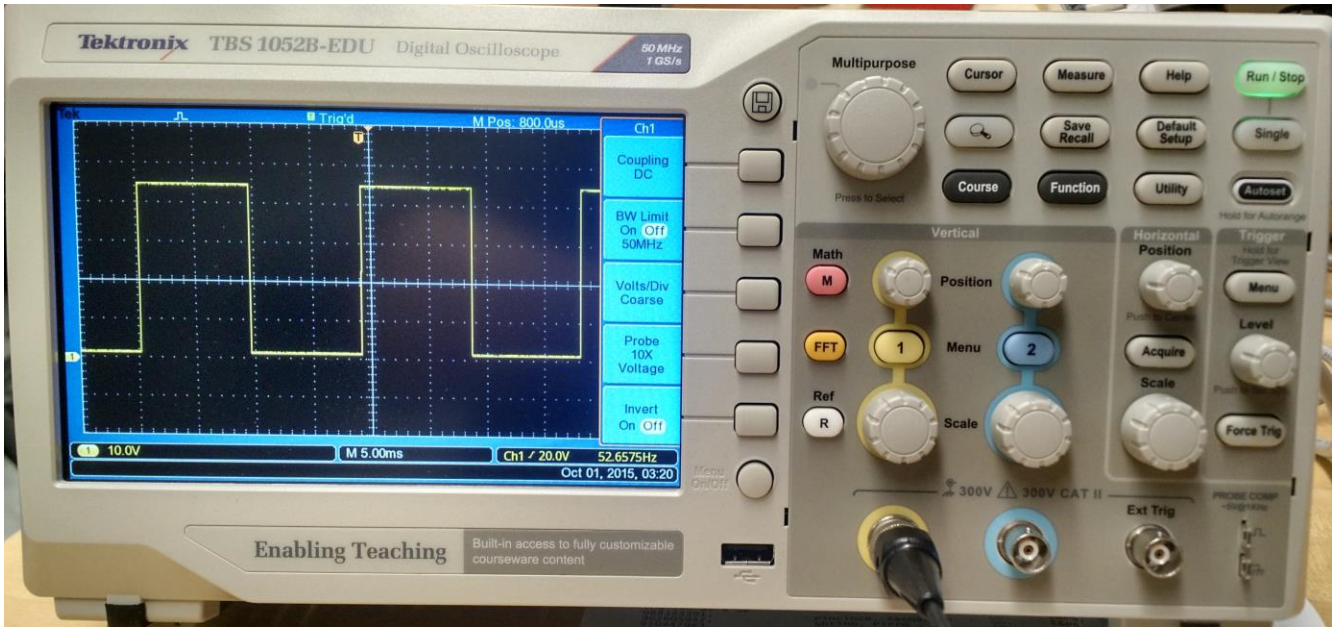
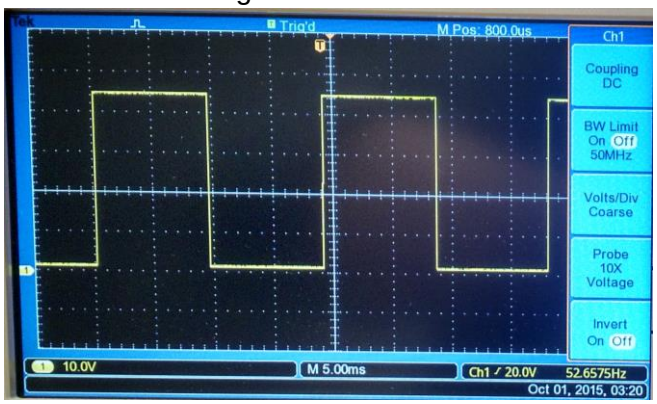
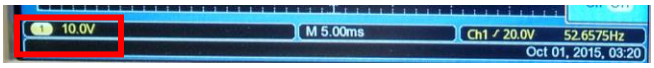
Basic Oscilloscope Tutorial



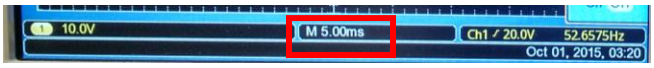
What is an Oscilloscope?

An oscilloscope provides a plot of voltage over time, allowing you to see how the voltage changes in time. This is especially useful when dealing with periodic waveforms. Before we get started take a look at the oscilloscope's display. The bold lines that intersect in the center of the display, the origin, are the X and Y axis. Notice the dotted white lines that form a grid pattern, these are referred to as divisions.

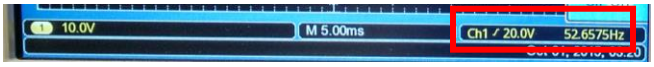




In the bottom left corner of the screen is a number that represents what each vertical division (the horizontal lines) is equivalent to in volts.



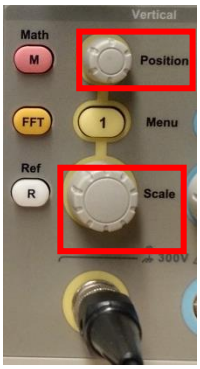
The number in the bottom middle similarly indicates the time that each horizontal division (the vertical lines) represents.



Lastly, on the bottom right is the trigger information. In order, it tells you: the channel being used to trigger, the trigger mode (whether it triggers on a rising edge, falling edge etc.), the voltage it triggers at and the triggering frequency (don't worry about this last one).

Basic Controls

Although this tutorial focuses on the use of the Tektronix TBS 1052B-EDU, that you have available in the lab, you will find most oscilloscopes implore the same basic controls and setup. Below are the most common controls that we will be using.



Vertical Position- This is used to shift the signal up and down on the display.

Vertical Scale- This controls the voltage scaling on the display (volts/division), ie: how many volts each vertical division represents.

Horizontal Position- This is used to shift the signal left and right on the display.

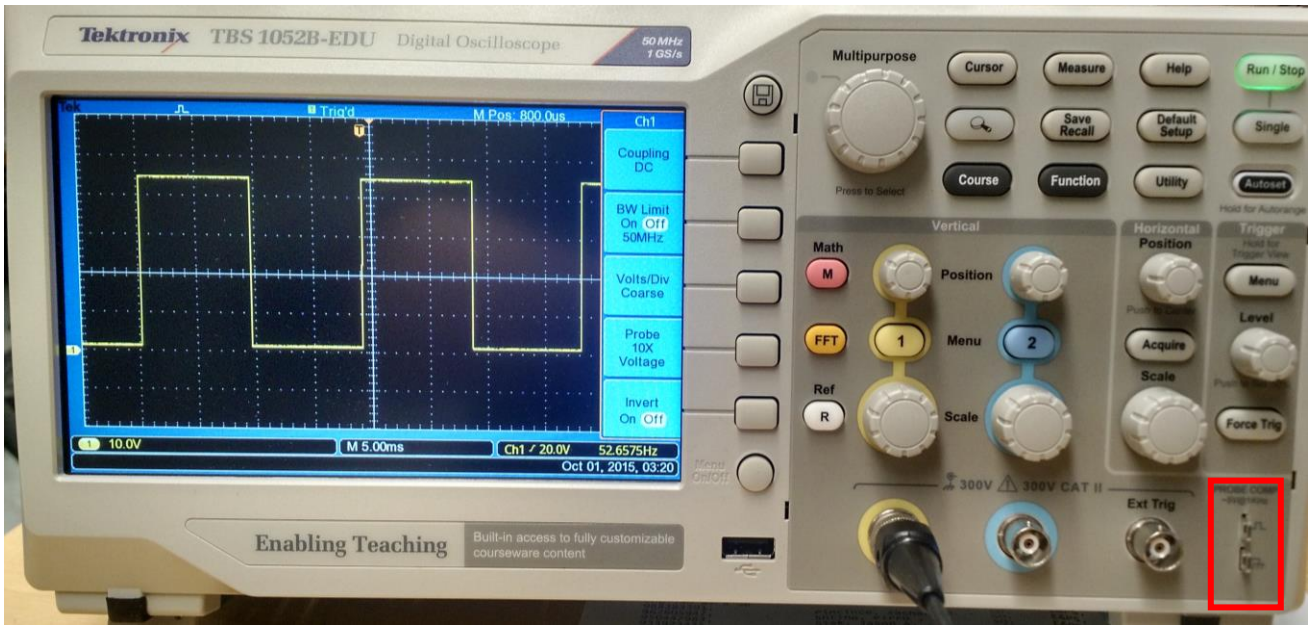
Horizontal Scale- This controls the time scale (seconds/division)

Trigger Level- The trigger is used to ‘hold’ the signal in the same position on the display. When the trigger is improperly set the waveform will appear to jump all over the place and will be impossible to measure. This is one of the most important controls to master on any oscilloscope.

Operation

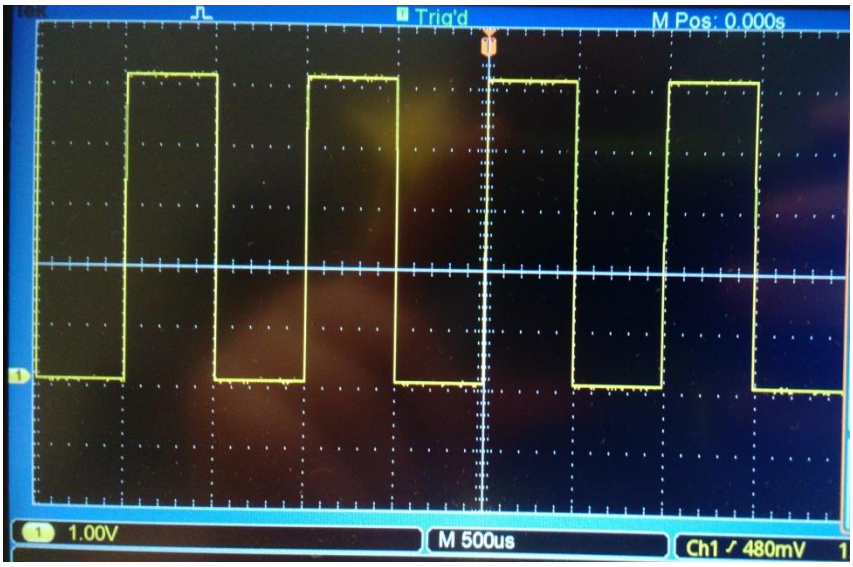
Now that we know the basic controls we can begin measuring signals. First turn the scope on by pushing the power button located on the top panel of the oscilloscope. Once the unit is fully powered up, plug the probe into channel 1.

Make sure that channel 1 is set to display, if it is not displaying press the button marked “1” located between the vertical scale and position knobs. To disable a channel press the button twice and the signal should disappear from the display.

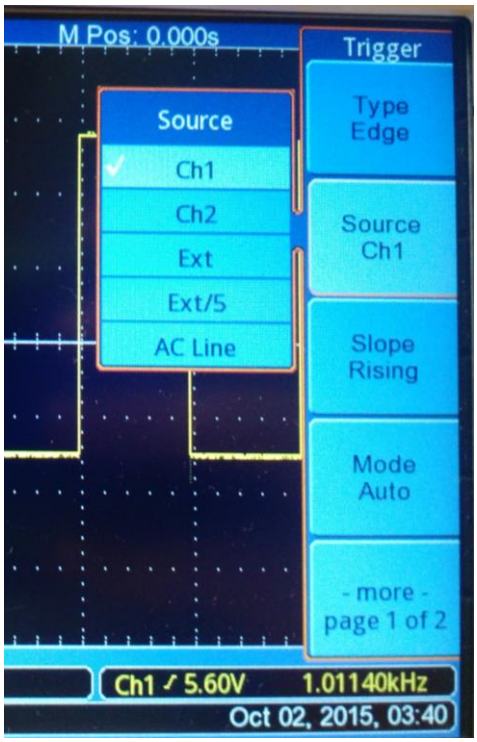


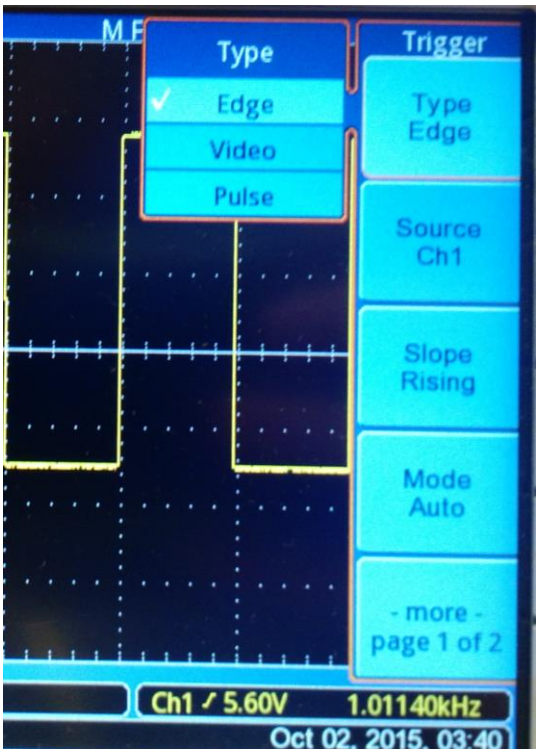
For this tutorial we will be measuring the 5 volt, 1 kHz square wave that the oscilloscope generates for probe testing. Place the hook part of the probe onto the top connection and the alligator clip onto the bottom connection.

Now that the probe is hooked up, set the vertical scale to 1 volt per division and use the position knob to move the signal down at least 2 divisions so that the entire signal is visible on the display. If the signal is moving all over the place don't worry, set the scales as instructed and we'll fix that in a bit.

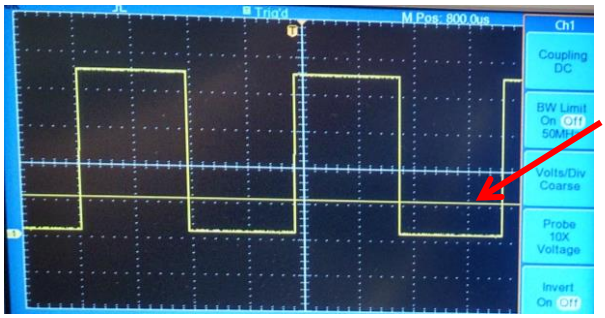


Use the horizontal scale to set the time per division to 500 microseconds.





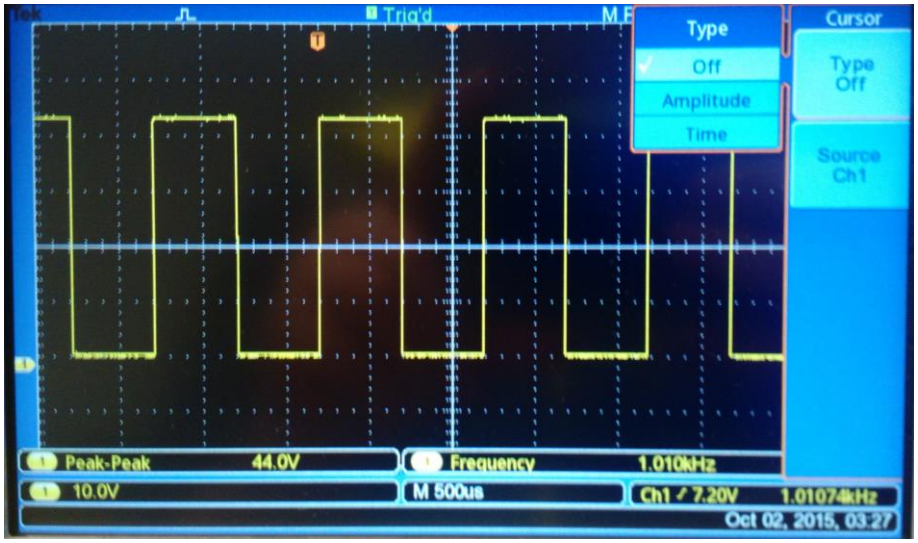
Using the Trigger->Menu button, select the source as channel 1 then set the trigger type to edge.



Use the trigger level knob to adjust the voltage that the scope triggers at you will notice a horizontal line moving up and down to indicate where the trigger is. To properly trigger, the line must pass through the signal at least once.

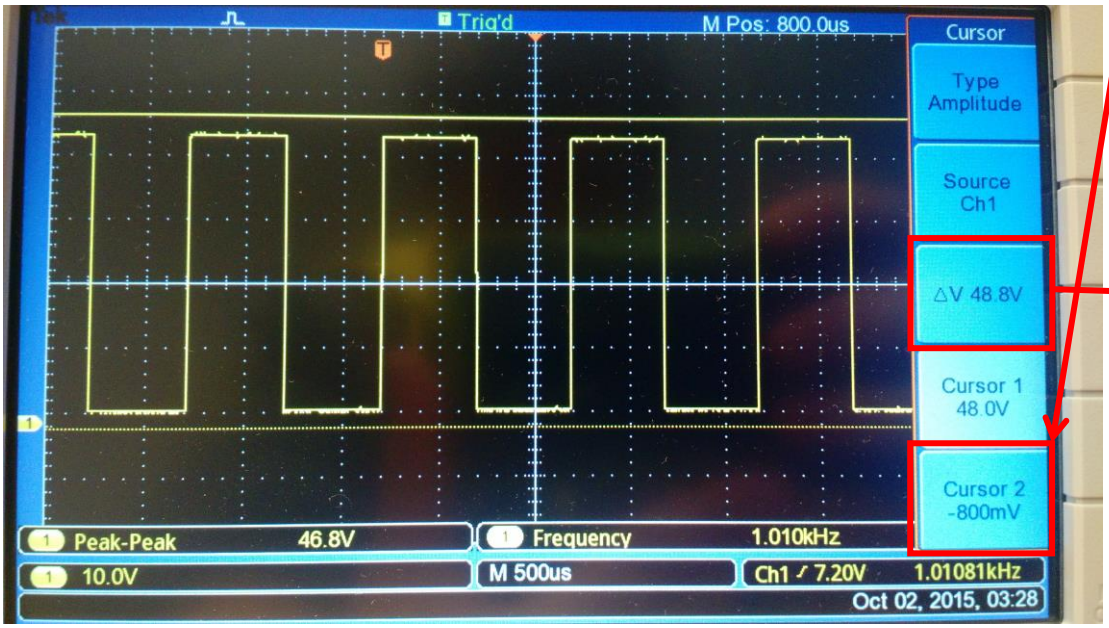
Now that your signal is properly triggered you can begin measuring. Let us find the peak to peak voltage of the signal. There are two main ways to do this: the first method is to use the cursors.

Press the Cursor button.



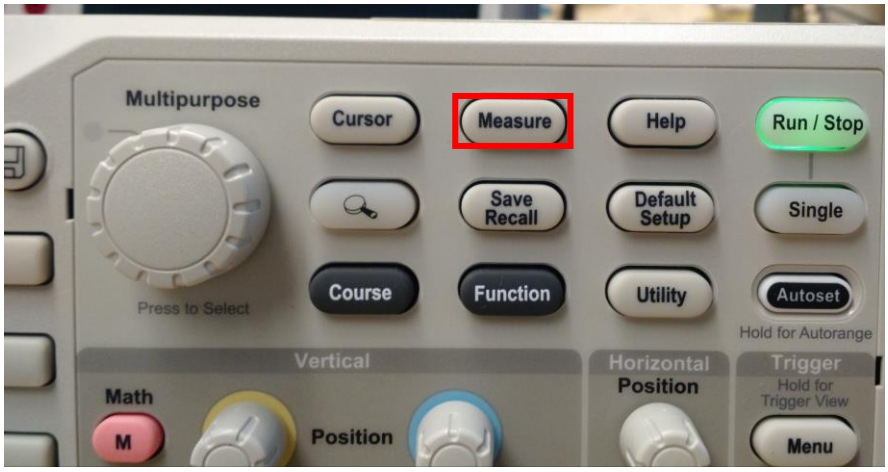
Select channel 1 as the source then make the cursor type “Amplitude”.

Use the Multipurpose knob to place the first cursor at the peak of your signal.

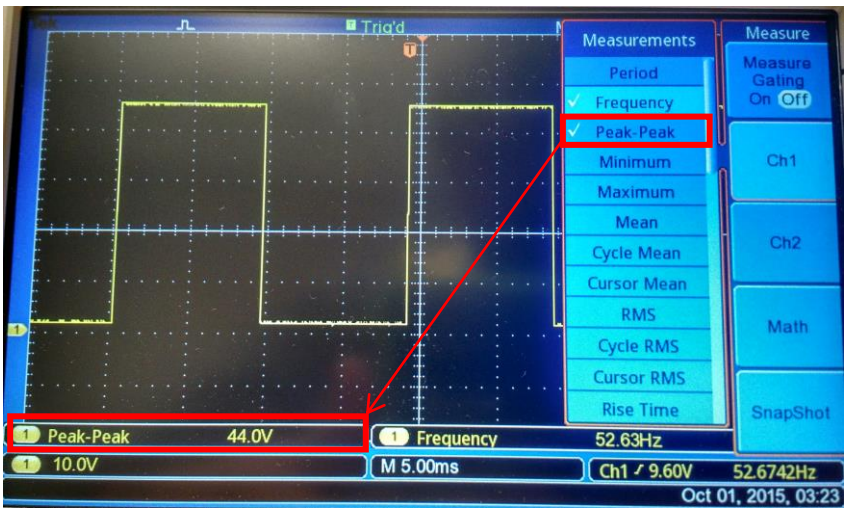


Next, select cursor 2 and place it at the bottom of your signal

This tells you the peak to peak voltage of your signal.



The second, easier method is to use the built in measurements. To do this, press the “Measure” button.



Select the channel you want to measure then use the multipurpose knob select “Peak-Peak”.
Each measurement you add will be displayed at the bottom of the display.

To save your measurements and everything on the display you can insert a flash drive into the usb port on the front of the scope and press the save button, or simply use your phone to take a picture.

This concludes the basic oscilloscope tutorial. For Additional Resources see:

https://learn.sparkfun.com/tutorials/how-to-use-an-oscilloscope - very useful, general oscilloscope tutorial.

http://www.tek.com/oscilloscope/tbs1000b-digital-storage-oscilloscope-manual/tbs1000b-and-tbs1000b-edu-series -For specific operation of the TBS 1052B-EDU