Oscilloscope Tutorial

Lori Jackson

June 22, 2006

Using new equipment can be a very daunting task when the proper techniques are not presented. Thus, here is an explanation of how to use the common settings, buttons and measurements of a Tektronix TDS 7054 Digital Phosphor Oscilloscope.

The first, and most important thing to do before using the Oscilloscope is assure a pulse is able to be read by the machine. first, make sure the Oscilloscope is turned on. If there is a black grid with a squiggly line going through the middle, it is on and functional. The simplest way to check for the pulse is by attaching any length cord from channel one of the Oscilloscope to a pulse source. If there is no apparent change in the squiggly line, don’t worry, it just needs the parameters to be set (doing this is described below). Once the parameters have been properly set, there should be a clear pulse displayed on the screen. The Oscilloscope is now most assuredly functional.

This tutorial is intended only as a basic intro to using the Oscilloscope. For a more in depth description of the material presented here see the appendix.

1 Getting to know the buttons

**Autoset** While trying to determine the proper trigger controls, sometimes it is easier to press *autoset* rather than manually adjusting the scale. Usually it is still necessary to adjust at least one of the scales a little more, but this will at least give one a good idea of where it should be.

**Default Setup** Just as it sounds, returns the setting to the default (800ps/pt vs. 100mV).

**Print** Prints out page onto hp color laserjet 4600dn printer. It is not necessary to first pause the program, but pausing does help get a more precise picture.

**Cursors** Turns cursors on or off.

**FastAcq** Fast Acquisition continuously gathers data at rates comparable to analog oscilloscopes using Digital Phosphor Oscilloscope. Can acquire up to 400,000 waveforms per second. The color of each pixel represents the number of actual samples that the pixel represents.
Intensity  Changes intensity of the waveform.

1.1  Horizontal Buttons

Delay  Turns on horizontal delay. Delays the pulse and is adjusted by the position knob right next to it.

position  moves the pulse horizontally along axis.

Resolution  Changes number of acquired points in the waveform.

1.2  Trigger Buttons

The trigger function is a useful setting when one wishes to see the pulse on the screen of the oscilloscope. The trigger runs across the scope and waits for a specific event to occur before beginning the trace again. The trigger event is when the waveform reaches a point designated by one of the following buttons.

1.2.1  basic ways to set trigger parameters

Source  changes the channel from which the signal is triggered. Slope  changes the slope of the pulse to be positive or negative (inverted). If the slope of the pulse is triggered to look for a negative pulse, yet the pulse is positive, the output on the slope will not be the one desired. Level  adjusts the trigger position. For more trigger options press the Advanced button.

1.3  miscellaneous buttons

Top four knobs on left side of panel  The round knobs are to be used when the cursors are on. They adjust the position of the cursors. Fine  makes the increments smaller.

Run/Stop  Pauses the acquisition. Handy when wanting to print.

Single  Runs one acquisition each time the button is pressed.

2  Using the buttons

2.1  Cursors

Probably the most useful function of the oscilloscope is the cursor function. To turn on the cursors one can either use the cursor button on the front panel or press the mouse to, first, select the buttons option on the left side of the screen, then select cursors from the selection of buttons on the top of the page. Once the cursors have been turned on there are three basic ways to operate them:

-  with the mouse, clicking and dragging the cursors to the desired positions.
with the multipurpose knobs on the front panel. These knobs on the left side control moving the cursors left and right. The fine button makes smaller changes with these multipurpose knobs.

with the screen interface. First make sure the Touch Screen off button is not lit, this assures the touch screen option is functional. Then placing the cursors is as simple as using one’s finger to drag and position the cursors where desired.

2.1.1 Cursor Settings

Once the cursors have been turned on there are four settings one can have them on. These settings will appear in the bottom right side of the screen. Or, alternatively, they can be turned on using the cursors pull-down menu under cursor type. The types are as follows:

V-bars Places the cursors vertically on the screen. This is the default setting.

H-bars Places the cursors horizontally on the screen.

Screen Places both horizontal and vertical cursors in a box-like pattern enabling one to measure both the height and width of the pulse.

Waveform Places the cursors vertically, but unlike V-bar, H-bar and Screen, Waveform follows the wave instead of staying in a stationary position.

2.1.2 Cursor Readouts

Once the cursors have been placed, one might notice a series of numbers on the right side of the scope. These are the cursor measurements. On the screen, v-bar and waveform settings, there are four basic measurements being taken:

• \( t_1 \) which measures the time position on the graph where the cursor is located.

• \( t_2 \) Which is the same thing, but for cursor two.

• \( \Delta t \) measures the time between cursor one and two. If this is a negative number, just switch the placement of the cursors.

• \( 1/\Delta t \) is just as it looks; a measurement of the inverse of \( \Delta t \) which is the frequency (Hz).

These numbers are based on the placement of the cursors and are independent of the wave. Therefore they stay constant unless the cursor is moved. Below are the remaining cursor readouts that are not the same on each setting.

• The V-bar setting only measures the above mentioned four placements.

• The H-bar setting does not have the basic readouts above. Rather there are three others: \( V_1, V_2 \) and \( \Delta V \). These measure the voltage.
• The Screen Setting shows both the V-bar and H-bar measurements.

• As mentioned above the Waveform follows the path of the wave. Thus it is no surprise these numbers oscillate slightly as the wave moves. Beyond measuring the above mentioned time functions, Waveform also measures the voltage. But rather than measuring a stationary point like H-bar, Waveform takes the voltage as it is moving along the cursor.

As mentioned above, this tutorial was meant as nearly a basic overview of the Oscilloscope. Below is a more indepth description of some of the many functions of the machine.

References