Velleman Oscilloscope: Windows 7
by Mr. David Fritz
You should already have the software installed

The scope software should be able to find the USB scope.

Launch the scope control software.

Start > Programs > Velleman > PcLab2000LT
What if the software doesn’t find the scope?

• You may see a pop-up that says you are in Demo mode because the software did not find the scope.

Click Options > Hardware Setup > PCSGU250 > OK

• The software will find the scope and the blue light will illuminate on the front of the scope.
Remember this:

• sin(x) varies from -1 to +1
  so Bsin(x) varies from –B to +B and (for voltages) Vpp = 2B

• The Velleman PCSGU250 has an “Amplitude” measurement that is actually the same as Vpp for both the function generator and the oscilloscope.

  Amplitude on the scope ≠ B

• Note: You can measure the amplitude of a time-varying voltage signal using the DMMY64 using V~, but you won’t get the same answer.
  – The DMM assumes all time varying signals are sinusoids that has a frequency between 40Hz and 400Hz and there is no DC offset.
  – The magnitude displayed on the DMM is in $V_{RMS}$ (root mean squared volts) where

$$V_{RMS} = \frac{1}{T} \int_{0}^{T} [B \sin(\omega t)]^2 dt$$
Oscilloscope Basics

• The scope graphically displays a time varying voltage waveform.
  – Scopes only measure voltage, they do not measure current. If you have a known resistor, you can measure the voltage across it and then use Ohm’s Law to determine the current flowing through it.

• The scope can be used to determine waveform amplitude, frequency, period, phase, DC and AC components, noise, shape, etc.

• NOTE: The oscilloscope is designed to capture and display time varying waveforms – it is not the best instrument for measuring DC voltages. That is what your DMM is for!
Displaying the input waveform.

• An A→D converter captures a series data points on the waveform. The 8 bit samples provide a resolution of 256 possible voltage levels.

• These points are stored in memory and then displayed on the screen, using interpolation to smooth the waveform shape between data points.

• The accuracy and resolution depend on the vertical scale selected. For best measurement accuracy, you should always try to display the waveform as close to full scale as possible.
Main Oscilloscope Components

• **Vertical display controls**
  Scales the input voltage to set the size and position of the waveform.

• **Horizontal display controls**
  Sets the “sweep rate” (time / division) and adds a horizontal position control.

• **Trigger System and controls**
  If the horizontal sweep begins randomly, the waveform moves around.

  The trigger stabilizes the waveform by controlling where, on a waveform’s voltage and slope, the display trace begins each time.

• **This scope also has a built-in signal generator.**
The Velleman scope display

The blue curve is the measurement on Channel 1 of the scope and the red curve (not shown, which means the cables aren’t connected to anything) is the measurement on Channel 2.

To display the measured voltages, you must click Run.
Vertical controls

- Turn the channel display on & off (toggle the **On button**)
- Set the vertical scale (press desired scale on **Volts/Div.**)
- Set vertical position (**slide bar**)
- Set input coupling (select **buttons** at bottom)
- Set probe type (select **buttons** at bottom center)
  - use 1x for the black coax probes from Electronix Express.
  - use 1X or 10x for the probe supplied with Velleman scope
- Autoset can be friend or foe!
Scope Input Coupling

Input coupling may be:

- **DC Coupling** displays all of a signal, including any DC offset. True RMS measurement requires DC coupling.

- **AC coupling** strips the DC component from a waveform, leaving only the time varying portion of the signal.

- **GND** disconnects the input signal.
Horizontal controls

- To the right of the waveform display area is the Time/Div. horizontal scale setting buttons.
- The Run button enables the Horizontal display.
- The single button is used to display a single horizontal capture.
- Below the waveform display area is a slide bar to move the waveform sideways along the horizontal scale.
Trigger controls

• Turn the trigger on and off (use the buttons). If the trigger is off, the display will free run. Some times this looks okay, other times the display keeps jumping – which is when you definitely want to use the trigger.

• If the trigger is on and you see Waiting for trigger...

  Select the trigger source (buttons)

  Select whether to trigger on rising edge or falling edge of the waveform. (buttons)

  Adjust the trigger voltage level (slide bar) until you see Running.
Trigger markers tell you what the trigger is doing.

There are markers on the edges of the scope waveform display that correspond to the waveform’s

• trigger voltage level
• trigger time (appears when you move the horizontal position slide bar to display the waveform before the trigger occurred)
Visually measuring the waveform

On the scope display, Vmax, Vmin, Vpp, and period can be obtained by

• counting the number of divisions
• multiplying by the vertical scale for voltages
• multiplying by the horizontal scale for time period.
Measure the Waveform Parameters

• Click View > Waveform Parameters...
  This opens a pop-up for measurements.

• Click each box to place (or clear) a check for
  measurements you wish to include (or exclude).

DC Mean is approximately the DC offset
AC RMS is $V_{RMS}$ without the DC offset
AC + DC RMS is the True $V_{RMS}$
Amplitude is the same as Peak-to-Peak
“Waveform Parameters” Accuracy

• A waveform that vertically occupies most of display will have more measurement accuracy than a waveform that is small on the display.

• Best accuracy seems to require at least two waveforms horizontally.

• The measured values will be reasonably accurate as long as the scope display is running.

• If you see “?” after the value, the waveform measurement does not fit into the display window and is out of measurement range.

• If you have “Waiting for trigger” showing, any waveform changes will not appear in the display or Waveform Parameters measurements.
Using Cursors

To obtain data at specific points on the displayed voltage vs. time graphs, you can turn on the cursors by clicking on Markers (DSO) under View on the scope toolbar.
To find the difference in time between two points in time on a curve, position the two vertical lines by click-and-dragging each line to the appropriate point on the trace.

\[ dt \] is the absolute value of the difference in time between the two vertical cursors. \( 1/dt \) is the reciprocal of that difference in time, expressed in Hz.
To find the difference in voltage between two points on the same trace, position the two horizontal lines by click-and-dragging each line to the appropriate point on the trace.

\( dV \) is the absolute value of the difference in voltage between the two horizontal cursors. The two voltages in parenthesis after \( dV \) are the voltages used in the calculation of \( dV \).
You can use the cursors to find the difference in voltage between the two traces. However, you should make sure that the coupling on Channel 1 is the same as the coupling on Channel 2,

DC coupling on both channels will enable you to measure the difference in voltage between the two traces using ground as a reference voltage.

AC coupling will only allow you to determine the difference in the ac portion of each signal.

You should not use two different types of coupling.