January 21, 2024

Frank Martino - Proof of Skills Day 2

Q2 Experimental Measurements and Personal Instrumentation

Prove your skill set using ONE of the following: M1K board, Analog Discovery Board, or M2K board.

Each of the **Experimental Measurements and Personal Instrumentation** Objectives above should reflect the following goals:

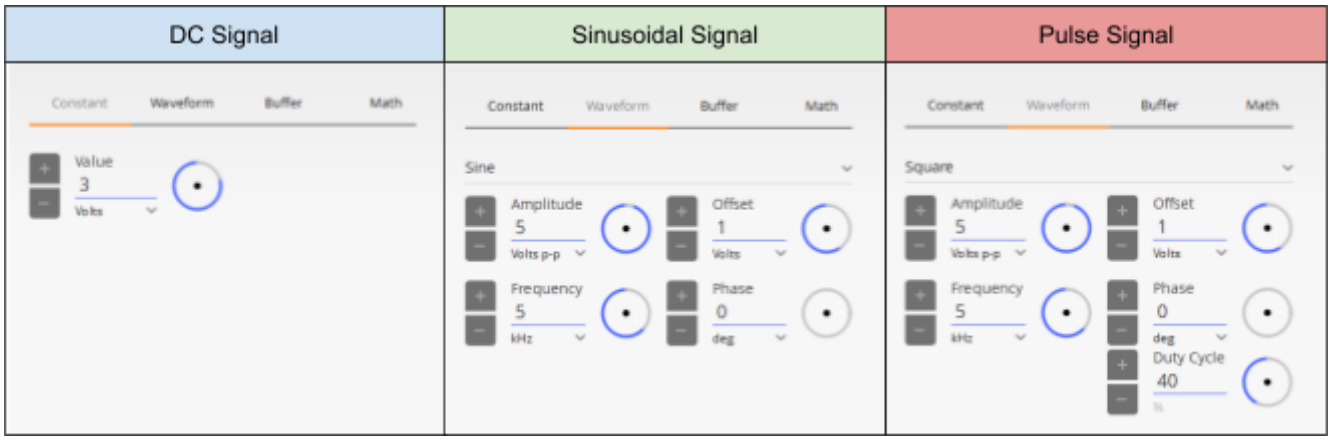
- [x] ~~1. I can use consistent **color coding of wires when I build circuits on my breadboard** to aid in troubleshooting.~~
- [x] ~~2. I can "zoom in" to an oscilloscope output by **changing the time scale (x-axis)** to show important parameters (for example, a sinusoid with 25 cycles would be easier to see if only 3-5 cycles were shown instead!) when needed~~
- [x] ~~3. I can "zoom in" to an oscilloscope output by **changing the voltage scale (y-axis)** to show important parameters (for example, a sinusoid with 500mV amplitude would be difficult to see with 5V/div…) when needed~~
- [x] ~~4. I can **change the THICKNESS** of my trace lines for easy viewing.~~
- [x] ~~5. I **can change the background color of my oscilloscope output to white** and paste in an external document for easy viewing.~~
- [x] ~~6. I **can label the measurement output clearly** with the circuit schematic component names~~

Q2.1 Generate DC, Sinusoid, and Pulsed Signal and Measure

I can use my instrumentation board's function generator to create a DC, sinusoid, and pulsed signal and measure with its oscilloscope directly (hint: no circuit necessary but need external wires!)

Signal Setup:

Below are three signal sources generated from the ADALM2000, DC, sinusoidal, and pulse that are measured using the built in oscilloscope from Scopy. The physical setup of the ADALM2000 and breadboard were the same for all signals where the waveform was generated from the W1 channel and grounded. Channels +1 and -1 read between those two wires (shown in figure below). Setting up the signal form on Scopy is very simple, there is a signal generator tab where the user can choose between constant or waveform. Constant creates a DC source and the user can input voltages (shown in figure below). A sinusoidal signal can be made by using the dropdown menu in the waveform section, and gives options like amplitude, offset, frequency, and phase. Similarly the pulse or square signal option allows the user to change the amplitude, offset, frequency, phase, and duty cycle.



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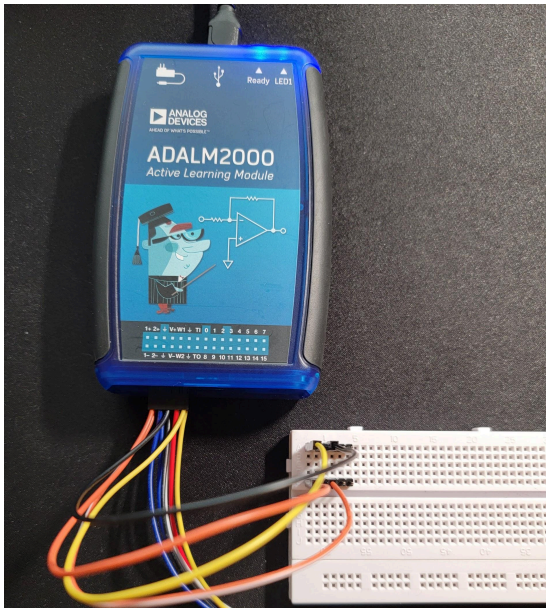
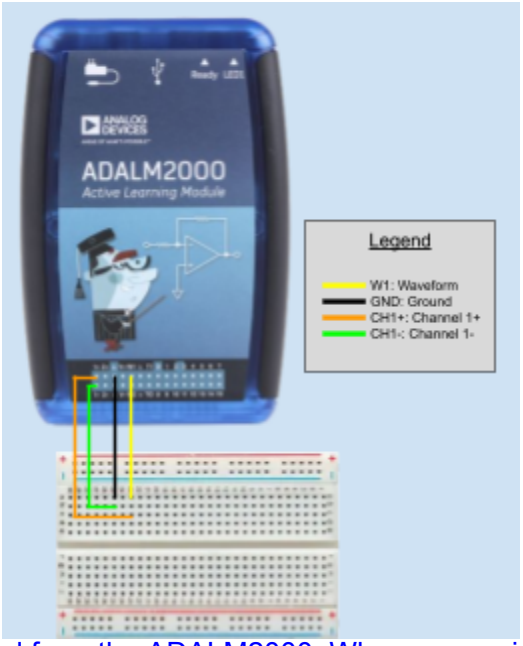
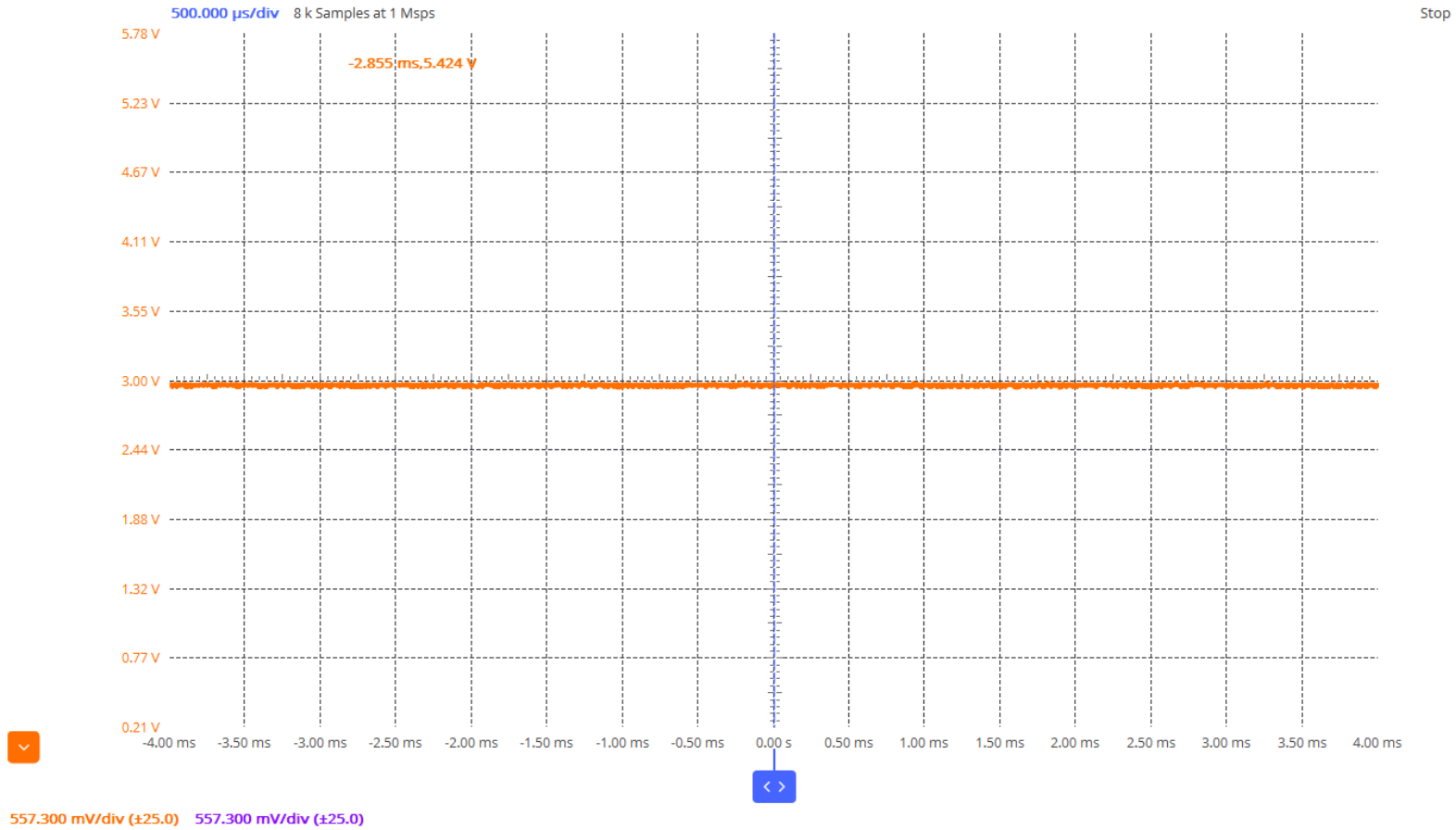




DC Signal:

Below is a 3 volt constant source generated from the ADALM2000. When measuring the 3 volts we see the oscilloscope only measures 2.951 volts. Wave was stretched and re-oriented for readability, the y axis was shrunk to see a shorter range around the 3 volts.

Period: --
Frequency: --
Peak-peak: 47.932 mV
Mean: 2.951 V



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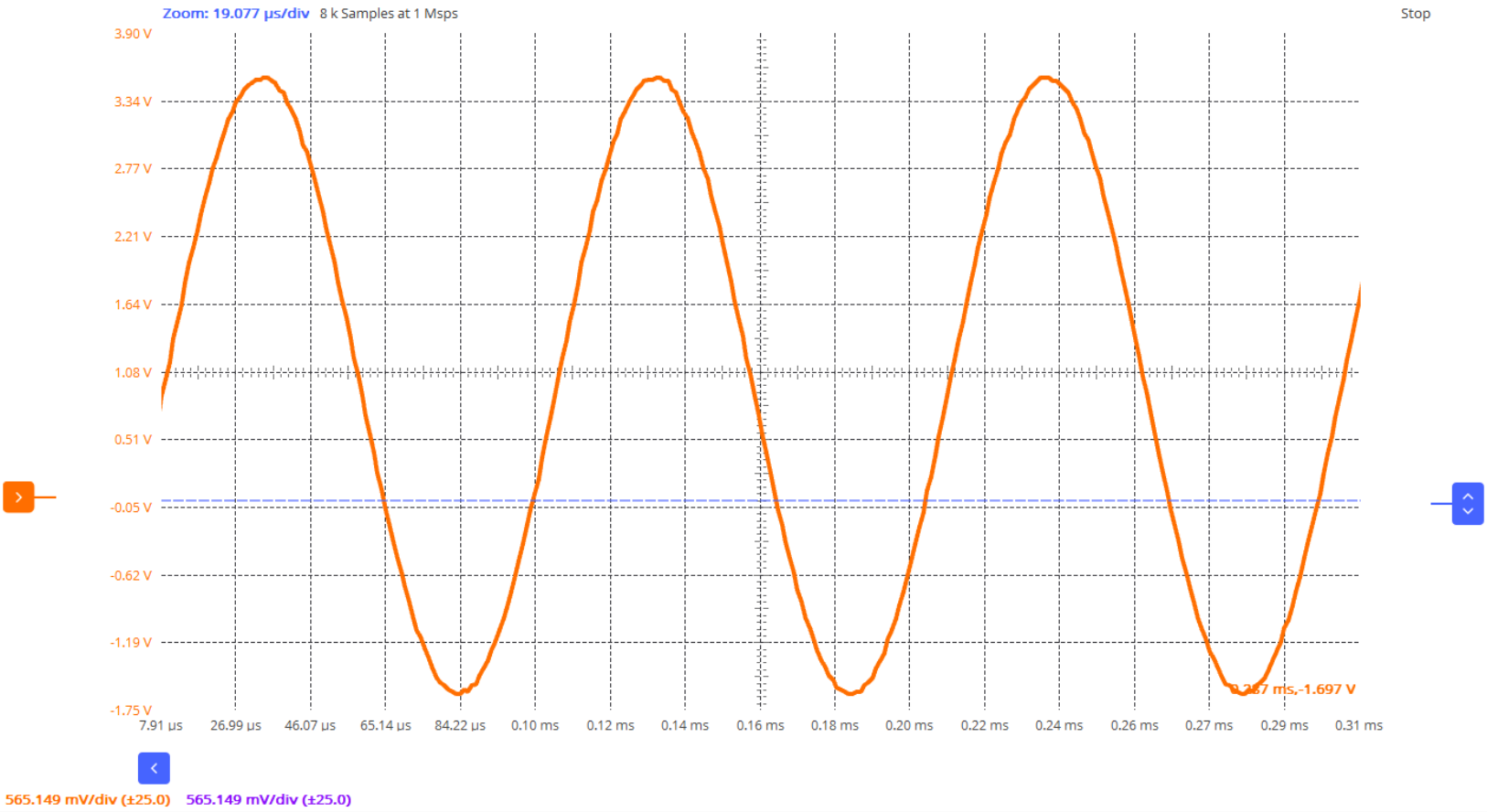
Sinusoidal Signal:

Below is a sinusoidal signal that varies between 3.5 and -1.5 volts giving it an amplitude of 5 volts. Its frequency is set to 10kHz with an offset of positive 1 volts. When looking at the graph on standard settings we would see that the waves are tightly close together and zoomed out, so I stretched both the x and y axis to show 3 waves and to allow its key features to be seen easily.

Period: 99.999 µs
Frequency: 10.000 kHz
Peak-peak: 5.177 V
Mean: 952.695 mV



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Pulse Signal:

Below is a pulse signal that has a 40% duty cycle meaning the voltage is at its maximum for 40% of a cycle and its minimum voltage for the remaining 60%. The signals maximum and minimum voltage were set to between 3.5 and -1.5 volts giving it an amplitude of 5 volts. SImilar to the last signal its frequency is set to 10kHz. For readability the graph was again stretched to only view 4 cycles and for its maximum and minimum voltages to take up most of the graph.