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:

- ☑ ~~1. I can use consistent **color coding of wires when I build circuits on my breadboard** to aid in troubleshooting.~~
- ☑ ~~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~~
- ☑ ~~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~~
- ☑ ~~4. I can **change the THICKNESS** of my trace lines for easy viewing.~~
- ☑ ~~5. I **can change the background color of my oscilloscope output to white** and paste in an external document for easy viewing.~~
- ☑ ~~6. I **can label the measurement output clearly** with the circuit schematic component names~~

Q2.6 Build Operational Amplifier

I can provide power and measure the output of a working operational amplifier circuit

To prove my skills in using an operation amplifier I created a competitor using the OP484. I first looked up a circuit diagram of the op amp and found that pin 1 is output voltage, pin 2 is the inverting input (-in), pin 3 is the non-inverting input (+in), the op amp also has V+ (positive rail input), and V- (negative rail input) at pins 4 and 11 respectively. I imputed channel +W (pin 3) which generates a sinusoidal signal with an amplitude of 4 volts from 0 to 4 at 5 MHz. This signal is compared to a dc constant source of 1v from channel -W which is imputed into pin 2. V+ had 3 volts and V- was connected to ground. The purpose of this op amp was to work as a comparator where when the voltage of the sinusoidal wave is greater than the voltage of the constant dc voltage it would output 3 volts and 0 volts when less then the dc voltage. After connecting a resistor to the output voltage pin of the op amp and ground I was able to read the voltage using channels +1 and -1 on the adalm2000. The op amp ended up working just as intended as the voltage output was low or 0 volts when the sinusoid was below 1 volt and out putted a high when the waveform was above 1 volt. I did notice the output only got close to the 3 volts when it was set to the high position likely due to voltage being used up and lost to non conservative components. (Circuit schematic shown below)

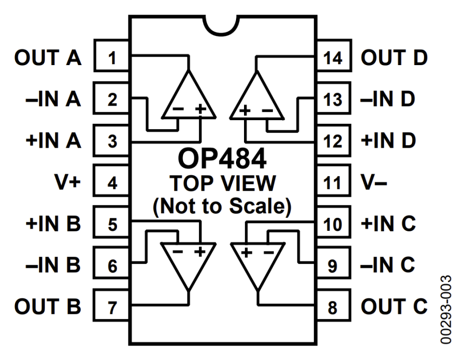

Figure 3. 14-Lead PDIP (P-Suffix) 14-Lead Narrow-Body SOIC (S-Suffix)

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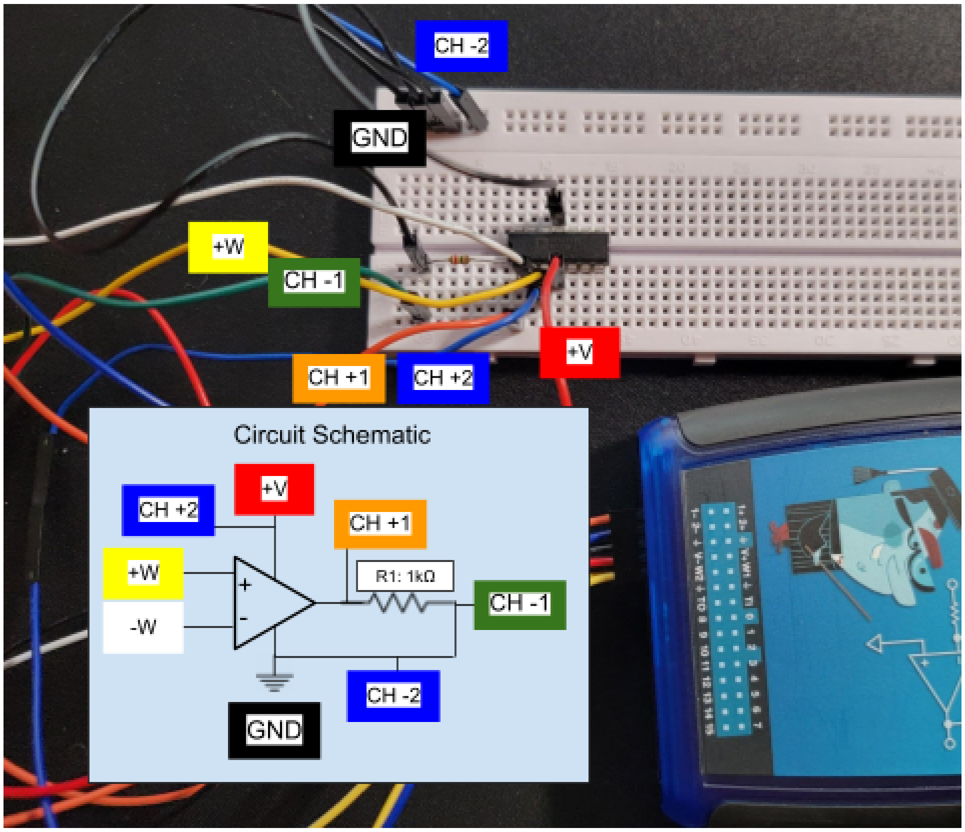
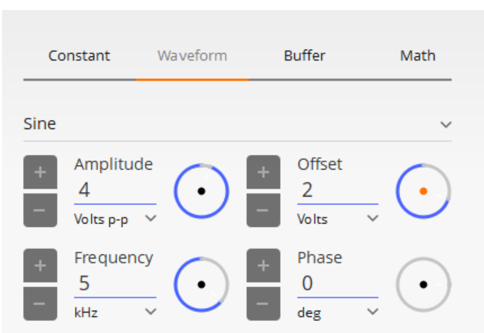
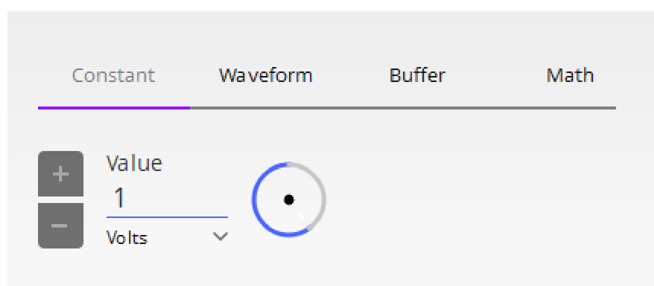
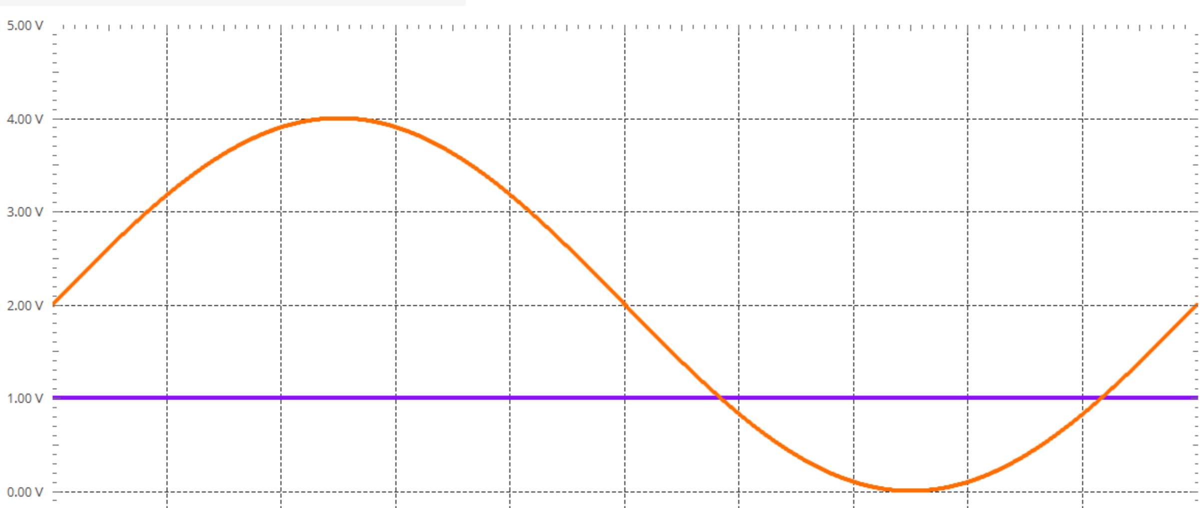


Below are the two waveforms imputed into the positive and negative input rails respectively. A graph of the waveforms generator is also shown below.







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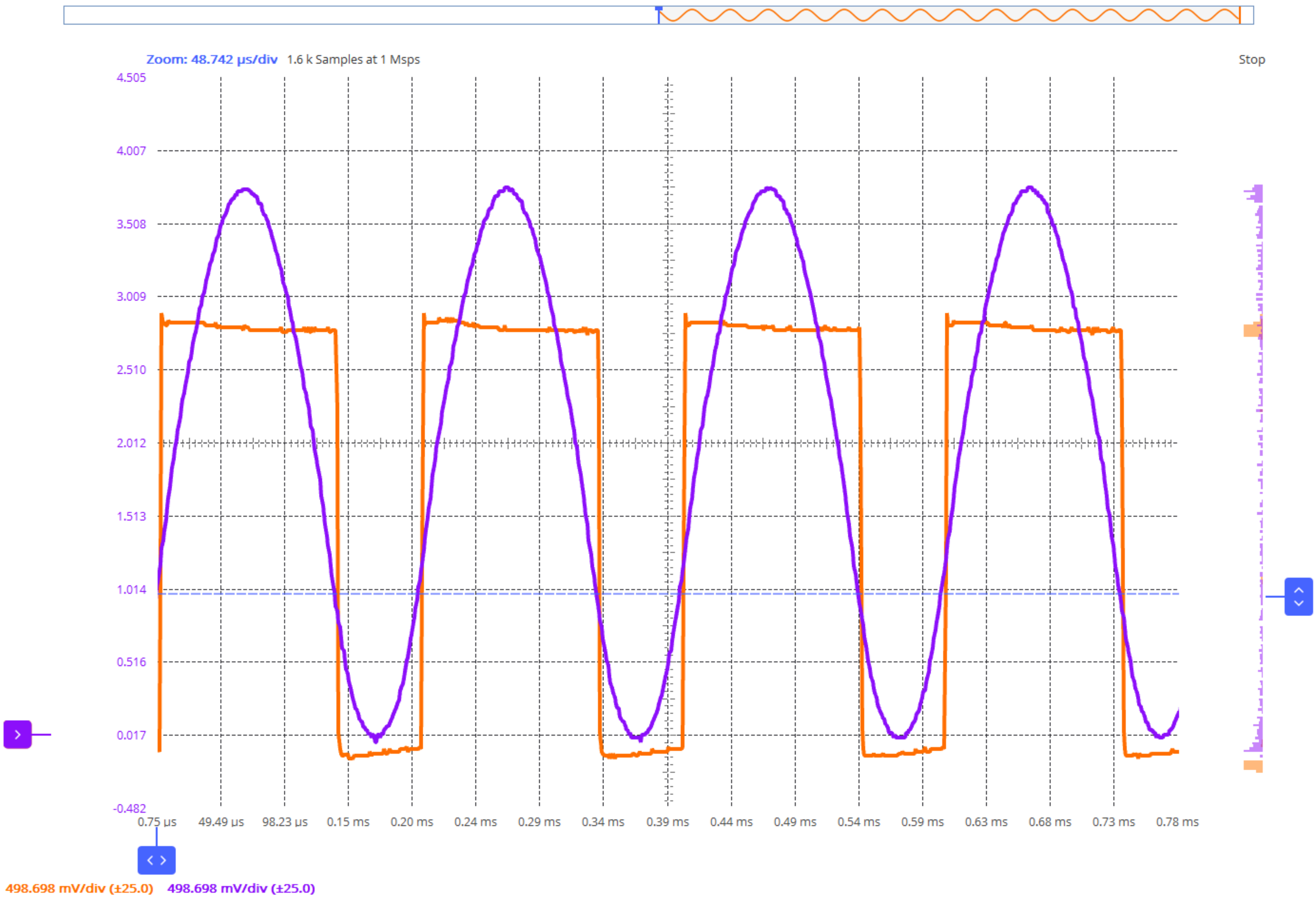

This graph shows the output of the op amp in orange, the non-inverting input in purple, and the blue dashed line shows the 1 volt source that acts as the threshold for the op amp to compare the purple wave too. As we can see from the graph above, when the voltage dips below 1 volt the orange wave drops to 0 and when above 1 volt the orange wave stays at the constant 3 volt high. This creates a pulse wave.