II. Build a Voltage Follower Op Amp Circuit

Setup the power supply to your breadboard as shown in Figure 2. Use 0.1 uF ceramic capacitors to filter noise from the power supply voltage sources. The JFET op amp LF351 or TL071 op amp datasheets give info on the pin number connections for your op amp circuit circuits.

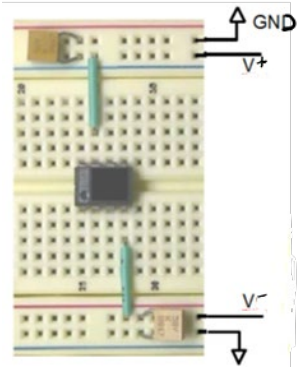

Figure 2. Power Supply Setup

Connect the +/- 15V power supply to the corresponding op amp pinouts. Construct the voltage follower circuit shown in Figure 3. When connecting signals and power supply voltages to your op amp chip, always disable the power supply and the signal generator until you have double checked your wiring.

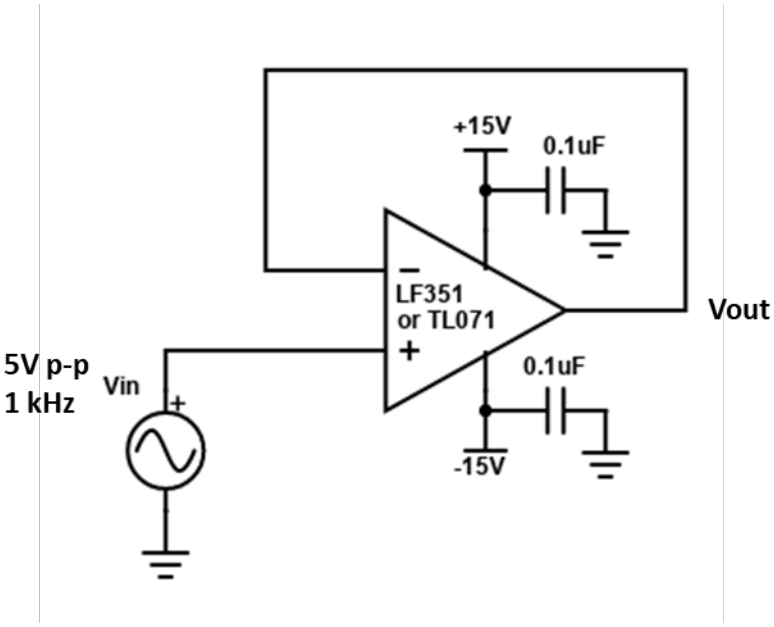

Figure 3. Voltage follower circuit

Once you have thoroughly checked your wiring connections, proceed with turning on the power supply +15 V and -15V.

Next, enable the function generator and apply the input signal of 5V p-p sine wave at 1kHz. Use the oscilloscope channels 1 and 2 to measure the trace input and output signals. Display both Ch1 and Ch2. Verify that your waveforms are similar in magnitude and frequency for input and output. Demonstrate the voltage follower circuit by showing both the input and output waveforms of your circuit to your TA.

Note: When removing the signals from your circuit, do the reverse order by disabling the oscilloscope, followed by the waveform generator and finally the power supplies.

Measure the Slew Rate

Read the spec rating for the LF351 or TL071 op amp slew rate. The slew rate is a measure of how fast the internal op amp circuitry responds to a rising or falling change in the input signal. The slew rate value has units of V/us, which is the slope of the signal as noted in Figure 4. It is typically the slope from the 10 to 90 % range of Vmin and Vmax.

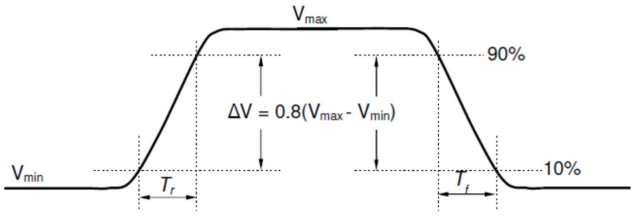

Figure 4. Slew rate is the slope of the rising or falling edge

Set the input waveform on the function generator to a square wave with 10V p-p and 1 kHz frequency and 50% duty cycle. Use channel 1 on the oscilloscope to verify the input Vin. Measure the response using channel 2. Demonstrate this result to your TA.

Increase the frequency until you see distortion in the output waveform. You should increase to at least 10x the initial frequency. The voltage rise and fall signals will have more of a slope as the frequency increases and there should be more distortion on the output waveform.

Zoom in and capture the rise and fall portion of the output wave. Use the cursor on the output waveform and measure its approximate 10-90% rise time (and 90-10% fall time) as defined in Figure 4. Compute the slew rate in V/us for both rising and falling outputs according to your measurements by taking the difference of voltages at the two points divided by the difference in time (in microseconds). Note that the oscilloscope will give you values for the 10-90% voltage levels using the display controls. Demonstrate the distorted waveform voltage follower result and your calculation of slew rate for both rise and fall time to your TA. Comment on why the response to rising and falling edges might be different and compare your measured slew rate with the data given in the spec sheet.