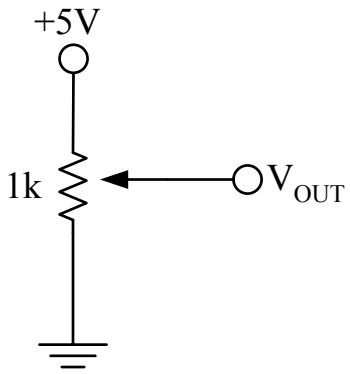
MIT Subject 2.017
Lab 3 Worksheet – Analog Interfacing

Goals:

- Start working with analog voltages, op-amps, and devices with analog output.
- Learn how to use the TT8 analog input functions.

1. Connect the 1k potentiometer on the proto-board as a voltage divider. Use a voltmeter to confirm that the output swings from 0V to 5V. Connect the output to an analog input of the TT8.

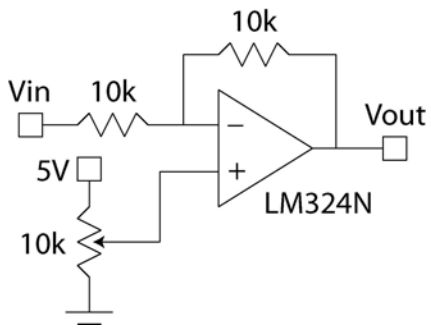


2. Write a program to read the potentiometer at a rate of 2 Hz and print the raw analog to digital values to the screen. You can use the *DelayMilliSecs()* or [*StopWatchStart(), StopWatchTime()*] commands to approximately control the timing.

3. What is the maximum voltage that produces a change in the A/D reading, and what is the numerical value that corresponds to this maximum voltage? What is the smallest numerical step in the A/D reading? What change in voltage does that correspond to? How many "steps" make up the range of the A/D converter? Does this agree with the description given in the manual?

4. Write a program to turn the TT8 into a voltmeter. It should read the A/D converter at 10 Hz and print the values to the screen. The printed values should be in volts.

5. Set-up the following op-amp circuit. The input to the circuit is the sine wave output of the proto-board's function generator. Adjust the function generator to give a 200 Hz output. Adjust the amplitude of the signal to be 2 volts peak to peak. Using the potentiometer in the op-amp circuit offset the sine wave so it is always above ground potential (the bottom of the trough of the wave should be at 0 volts). Use the oscilloscope to make these adjustments.



6. Now that V_{out} is in the TT8 A/D range, connect this to an analog input to the TT8. Write a program to take 5 seconds of readings of the sine wave at these sampling rates:
    a. 100 Hz
    b. 200 Hz
    c. 300 Hz
    d. 400 Hz
    e. 500 Hz

    Don't forget to confirm your sampling rates with the oscilloscope, e.g., using the digital pins from Lab 1.

7. Plot the data for all 5 sampling rates. What is the minimum sampling rate that reconstructs the true frequency of the sine wave?

Your lab notebook should contain:

Lab worksheet on the first page.
Code listing (or listings).
Notes on your electronics and the code.
Data plots.