TECH 3821
ADC0804 Analog-to-Digital Converter

ver 2.4

Name: _____

Partner: _____

In this lab you'll use the ADC0804 chip, which is an eight-bit successive approximation A/D converter using CMOS technology.

Since the ADC0804 has an 8-bit output, how many different digital output codes can it produce?

If we use 5 V as its reference voltage (V_{REF}), what is this ADC's step size? (The step size is the smallest analog input voltage that will produce a digital output code of $01.) Since you'll be using this number in many calculations below, record it to three significant digits: don't round it off to one or two digits.

If we use 5 V as its reference voltage (V_{REF}), what is this ADC's full-scale voltage? (This is the smallest analog input voltage that will produce a digital output code of $FF.)

In a spreadsheet, Calculate the output of the ADC (in Decimal, Binary and Hex) given the inputs on the table below (format the spreadsheet similar to the table shown)

	Predicted				Measured		
Input (V)	Dec	Binary	Hex	Input (V) (measured)	Dec	Binary	Hex
0.1							
0.2							
0.5							
0.7							
1							
1.5							
2							
2.5							
3							
4							
4.5							
5							

You can use the functions dec2bin() and dec2hex() to calculate the binary and hex values (please keep 8 places in the binary conversion)

Show the results to the instructor BEFORE PROCEEDING)

Instructor Sign off

The ADC0804 is a versatile chip that can be configured in many different ways, depending on how its pins are connected to each other and to external components. In this lab you'll use the ADC0804 in a self-clocking mode by using an external RC timing network. The device is optimized for a clock around 600 kHz and requires approximately 64 clock cycles per conversion. The clock frequency may be figured by the following equation:

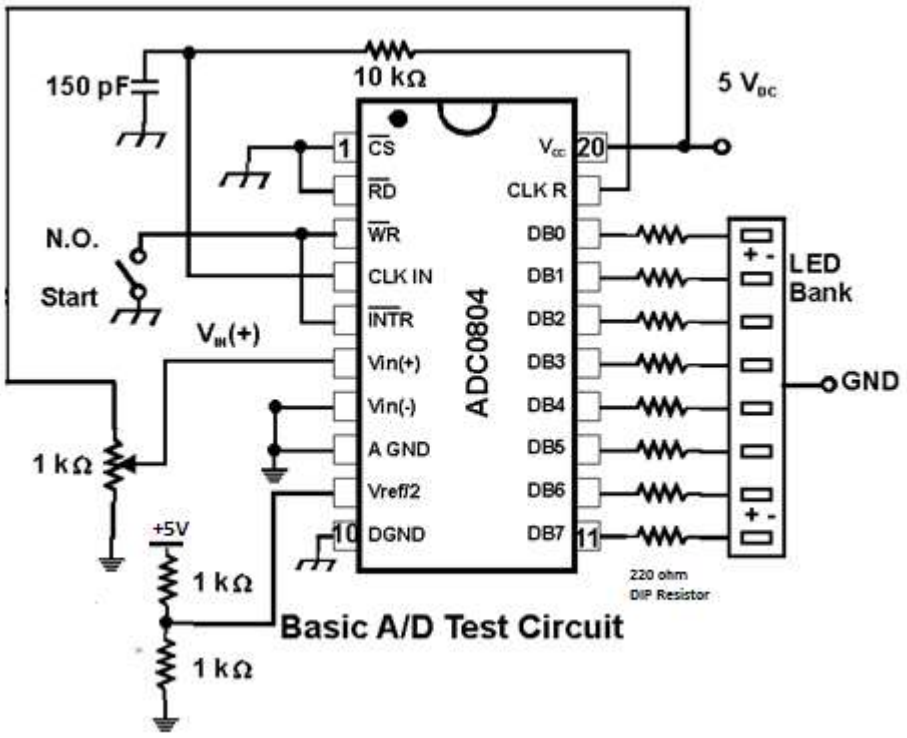
$$f_{CLK} = 1 / (1.1 * R * C)$$

Does this equation ring any bells? It should, since it is very similar to an equation that you used to calculate the timing of 555 multivibrator circuits, which also used external RC timing networks.

Conversions are initiated by pulsing the chip's ~WR line (pin 3) low. The conversion cycle begins when this line goes high again. ~WR must then remain high during the conversion or the process will be abandoned. When the conversion is complete the ~INTR line (pin 5) produces a low pulse to indicate an end-of-conversion (EOC).

In this circuit we've tied ~INTR and ~WR together, so that as soon as one conversion is completed, another one is immediately begun. Differential analog voltage inputs allow offsetting the analog zero input voltage value. This means that the Vin(-) input (pin 7) can be used to automatically subtract a fixed voltage value from the input reading. In addition, the VREF/2 input (pin 9) can be adjusted to allow converting a smaller analog voltage span to the full 8 bits of resolution. In this experiment, the VREF/2 input will be set at 2.5 volts. Therefore our reference voltage VREF is equal to 5 V.

Build the following circuit:



After the circuit is built:

To tell the chip to start performing conversions, momentarily set SW7 LOW, then set it back HIGH and leave it HIGH.

You should find that as you adjust the potentiometer, the LEDs change to show the digitized value of the input voltage.

Then carefully set your circuit's analog input voltage to each of these values, and record the digital output code that your circuit produces.

Now fill the the rest of the excel spreadsheet (try to get the input voltage as close to the required as possible, record the MEASURED VOLTAGE in the column provided).

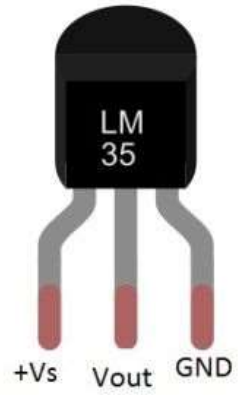
Graph the predicted and measured decimal values on an XY (scatter) Plot.

Graph the input voltage (measured) on the x axis and the dec output on the y axis using a XY (Scatter) Plot.

Demo the circuit to the instructor:

Instructor Sign off

Now replace the 1K pot with an LM 35 temperature sensor.



+Vs is +5v

Gnd is ground

Vout connect to one of the $V_{in}(+)$

Note: 10mV/C°

Read the ADC output and record, then show all the calculations necessary to convert the ADC value to °F:

Submit the excel file via online submission and hand in the lab hardcopy.

Parts of this lab were taken from:
http://www.physics.queensu.ca/~phys352/PHYS352_Lab6_2010.pdf
http://people.sinclair.edu/nickreeder/eet252/Labs/Lab06.pdf
https://www.instructables.com/id/Temperature-Level-Bar-Graph-Using-LM35-With-Arduin/