

# ELEC 361 Measurement and Analysis

## Lab 1. Introduction to NI Elvis Environment

In this lab you will familiarise yourself with the NI Elvis prototyping and instrument system, and play with some of its capabilities.

### References

- NI-ELVIS Series II (spiral bound laminated notes)

### Pre-lab work

Skim through the laminated notes on the NI-ELVIS Series II to familiarise yourself with the Elvis II system and the various instruments available.

### Lab tasks:

#### 1. LED Behaviour

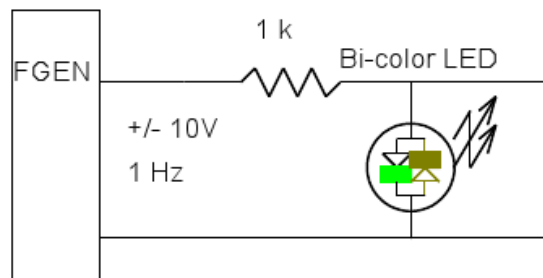
##### Using the Function Generator

Run the NI ELVIS instrument launcher.

Place a 1k resistor on the prototype area.

Connect one terminal to the Function Generator.

Connect the other terminal to LED 0.



Set the frequency to 1 Hz and amplitude 10 V.

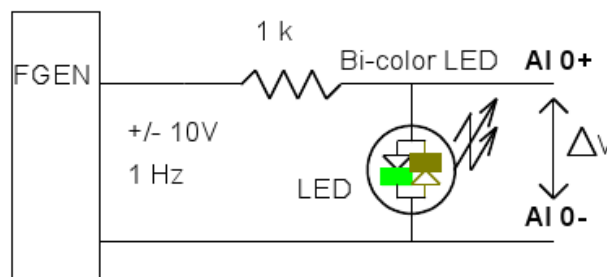
Use Sine, Triangle and Square wave sources.

What frequencies cause the LED to appear “on” continuously?

##### Using the Analog Input (AI) Channel

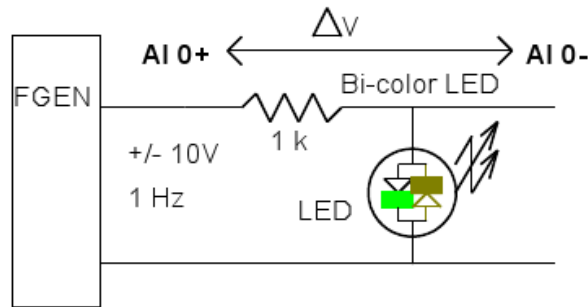
Connect the Analog Input Channel labeled AI 0+ and AI 0- as shown below.

Start the oscilloscope software.



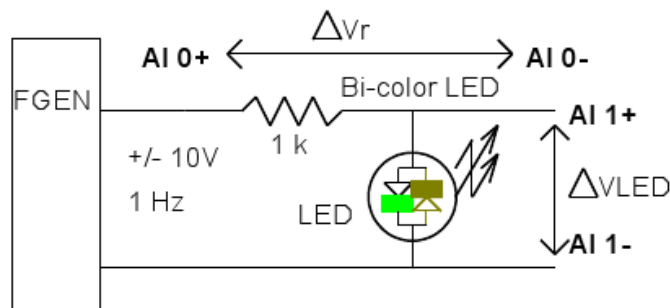
What does the waveform look like?

Each analog input (AI) channel has *differential* inputs. (This is a very useful feature.) Try the following connection.



Describe the waveform.

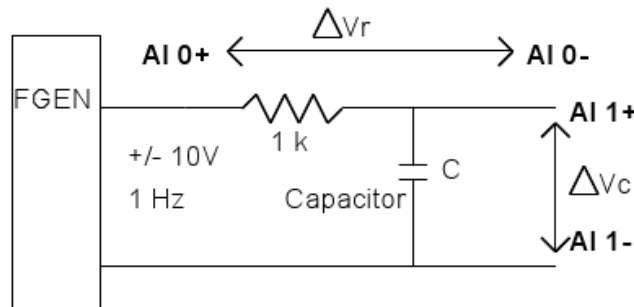
The ELVIS platform has 8 analog input channels. Try adding AI 1+ and AI 1- across the LED, as follows.



## 2. RC Behaviour

The LED experiment introduces the platform capability. We will now use the differential inputs to measure the electrical behaviour of an RC circuit.

Build the following RC circuit, for some suitable size of capacitor C.



What is the theoretical time constant and corner frequency for your RC circuit?

Apply a square wave stimulus.

Observe the waveforms at each channel. Explain low pass and high pass filter characteristics for the circuit.

Determine the RC time constant from your measurement of step response.

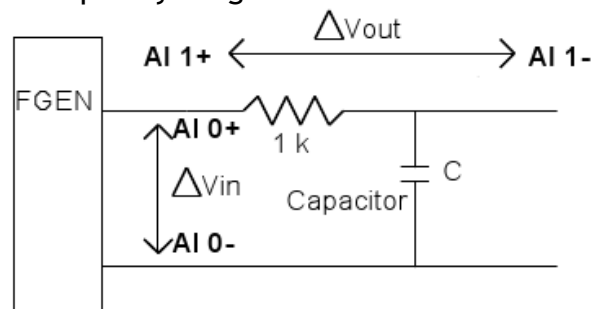
Use the Digital Multimeter (DMM) function and measure the values of R and C.

How close is the measured RC time constant to value determined from component values?

### 3. Bode Plot

A Bode plot displays the frequency response characteristics of the (transfer function of a) circuit. The Elvis platform can produce a Bode plot, by generating a sine wave at increasing frequencies and then displaying magnitude (in dB) and phase versus log frequency.

Connect the following circuit (AI 0 will generate a reference signal for AI 1) and produce a Bode plot over suitable frequency range.



Relate the frequency response to the previous time domain result.  
 Can you redraw the filter type as a more recognizable topology?  
 What will happen if you swap each channel?  
 What will happen if you reverse the polarity?

### 4. Dynamic Signal Analyzer (DSA)

The DSA displays signals in the frequency domain. (You can think of it as applying a Fast Fourier Transform to the time domain signal that is displayed by the oscilloscope.)

Run the DSA virtual instrument.  
 Connect FGEN to AI 0.  
 Set FGEN frequency to 1 kHz.  
 Reduce the DSA frequency span to display the spectrum.  
 Does the amplitude and frequency measured equal that set on FGEN?  
 Does FGEN have any spurious output?

### Non Linear Circuit Behaviour

Return to the LED circuit and use the DSA to report the spectrum.  
 Explain the spectrum - the idea of symmetry is useful here.

### Lab report

No write-up is required for this lab. However, you must record the lab in your lab book (and have it certified as complete). In particular, record screenshots of each measurement, and each virtual instrument.