Lab 6: Non-Ideal Sources

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ECEN 214-502

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Date Performed: 03/26/19

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Procedure

Task 1:

1. Create the circuit below with the resistor and capacitor values chosen from the prelab.

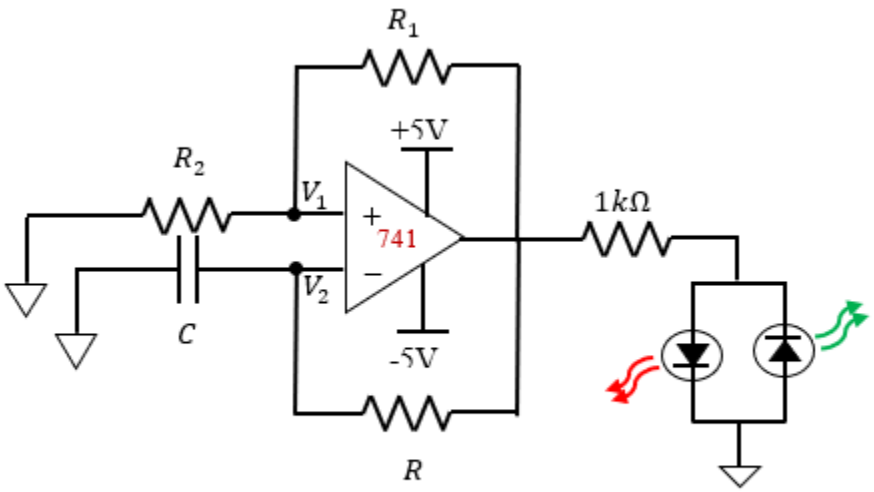


Figure 6.5 – A Flashing LED Circuit

2. Make sure the LEDs are switching off by flashing on and off by one second. If not, the component values are not correct and must be recalculated.
3. Use your oscilloscope on your AD2 to display both $V_1(t)$ and $V_2(t)$.
4. Adjust your vertical scale so that the waveforms occupy about 70% scale so that approximately two periods of the waveforms are shown.
5. Take a screenshot of the waveform.
6. Use the scope to measure
    a. Actual frequency of oscillation.
    b. Peak-to-peak voltage.
    c. Root-Mean-Square (RMS) Voltage.

Task 2:

1. Replace the two resistors R_1 and R_2 with a $10k\Omega$ potentiometer. The circuit should look the one below (a diagram of the potentiometer is also given).

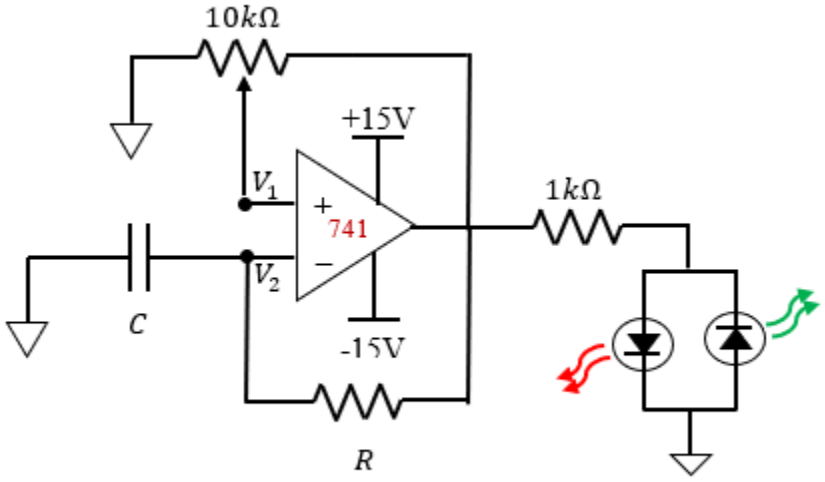
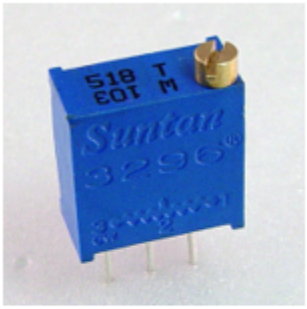
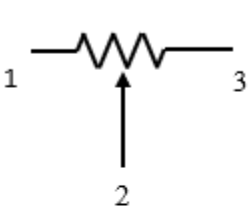
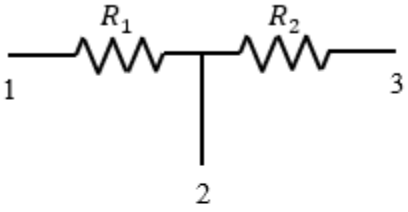


Figure 6.7 – Modified Flashing LED Circuit for Task 2.







(a) (b) (c)

Figure 6.6 – (a) A typical potentiometer, (b) its schematic, and (c) an equivalent circuit.

2. Use your oscilloscope on your AD2 to display both $V_1(t)$ and $V_2(t)$.
3. Adjust the potentiometer until the circuit oscillates at a frequency of 2Hz.
4. Take a screenshot of the waveform.
5. Shut the circuit of and measure the corresponding R_1 and R_2 values of the potentiometer.

6. Record this data and calculate the voltage division ratio, γ.
7. Replace resistor R with one at half its value.
8. Measure and record the new frequency of oscillation.
9. Take a screenshot of the waveform.
10. Last repeat steps 3-6 with the new resistor value.

Data Tables

Task 1: Circuit Component and Measured Values

R_1	$2.5k\Omega$
R_2	$2.5k\Omega$
C	$10\mu F$
R	$100k\Omega$
$Peak2Peak$	$1.79V$
f	$1.026Hz$
$V_1\,RMS$	$888\,mV$
$V_2\,RMS$	$520\,mV$

Task 2A: Potentiometer Measurements

R_1	8.37Ω
R_2	$1.4k\Omega$
C	$10\mu F$
R	$100k\Omega$
$Peak2Peak$	$1.04V$
f	$1.95Hz$
$V_1\,RMS$	$521\,mV$
$V_2\,RMS$	$304\,mV$
$\gamma = \frac{R_2}{R_1 + R_2}$	0.143

Task 2B: Potentiometer Measurements

R_1	8.37Ω
R_2	$1.4k\Omega$
C	$10\mu F$
R	$100k\Omega$
$Peak2Peak$	$1.06V$
f	$3.8Hz$
$V_1\,RMS$	$527\ mV$
$V_2\,RMS$	$309\ mV$
$\gamma = \frac{R_2}{R_1 + R_2}$	0.143

Task 2C: Potentiometer Measurements

R_1	7.31Ω
R_2	2.37Ω
C	$10\mu F$
R	$50k\Omega$
$Peak2Peak$	$1.86V$
f	$2.05Hz$
$V_1\,RMS$	$930\ mV$
$V_2\,RMS$	$543\ mV$
$\gamma = \frac{R_2}{R_1 + R_2}$	0.244

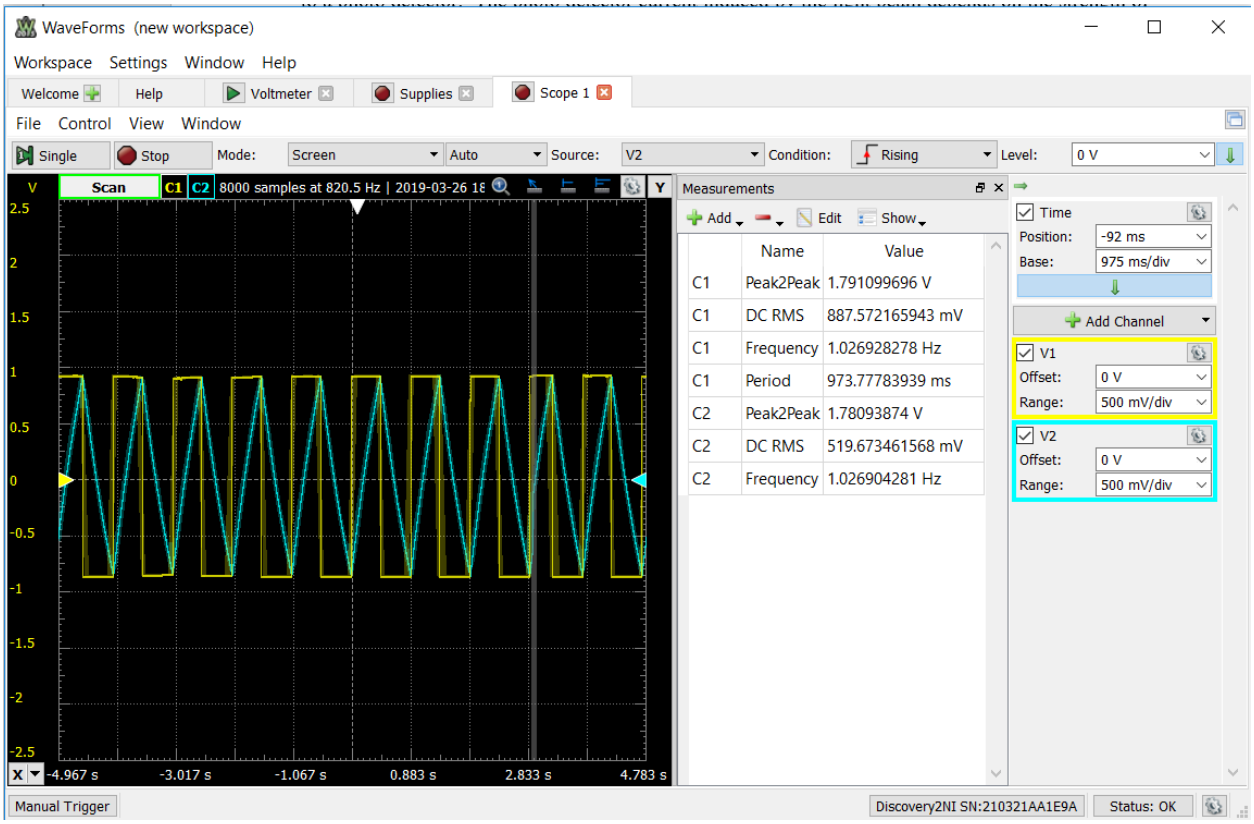
Sample Calculations:

$$\gamma = \frac{R_2}{R_1 + R_2}$$

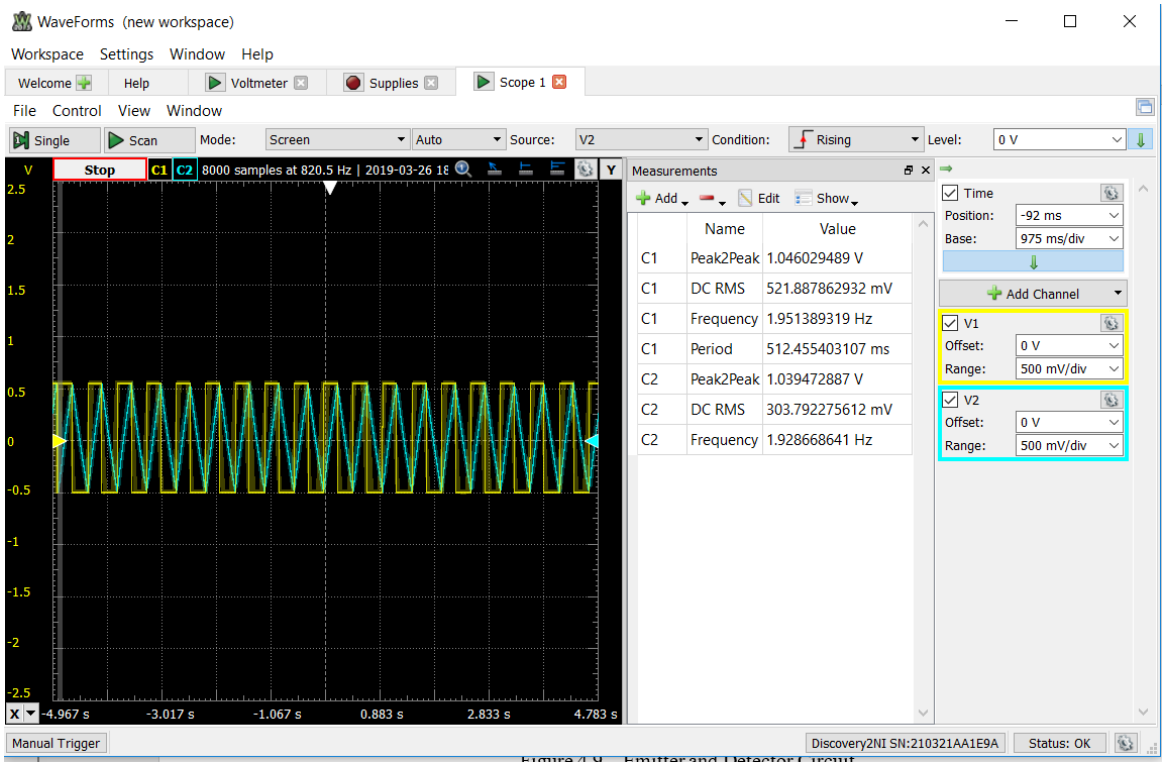
$$\%Error_1 = \left|\frac{Actual - Expermental}{Actual}\right| \times 100$$

Screenshot

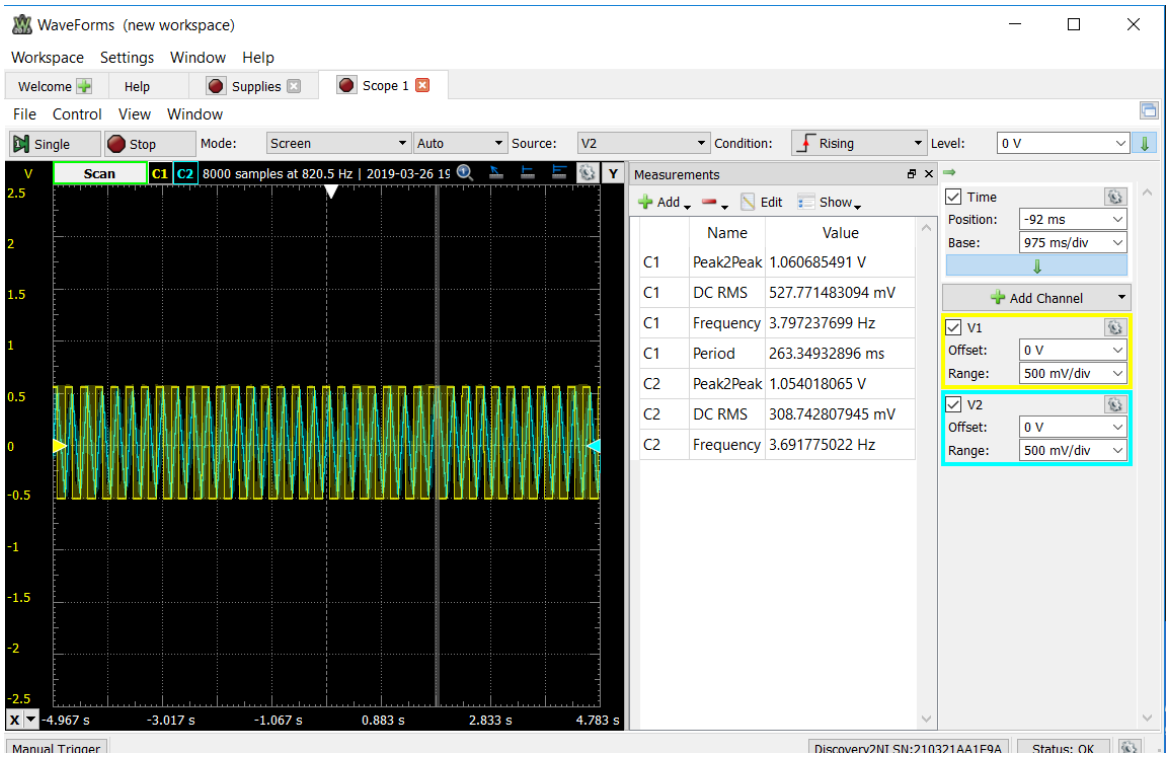
Task 1:



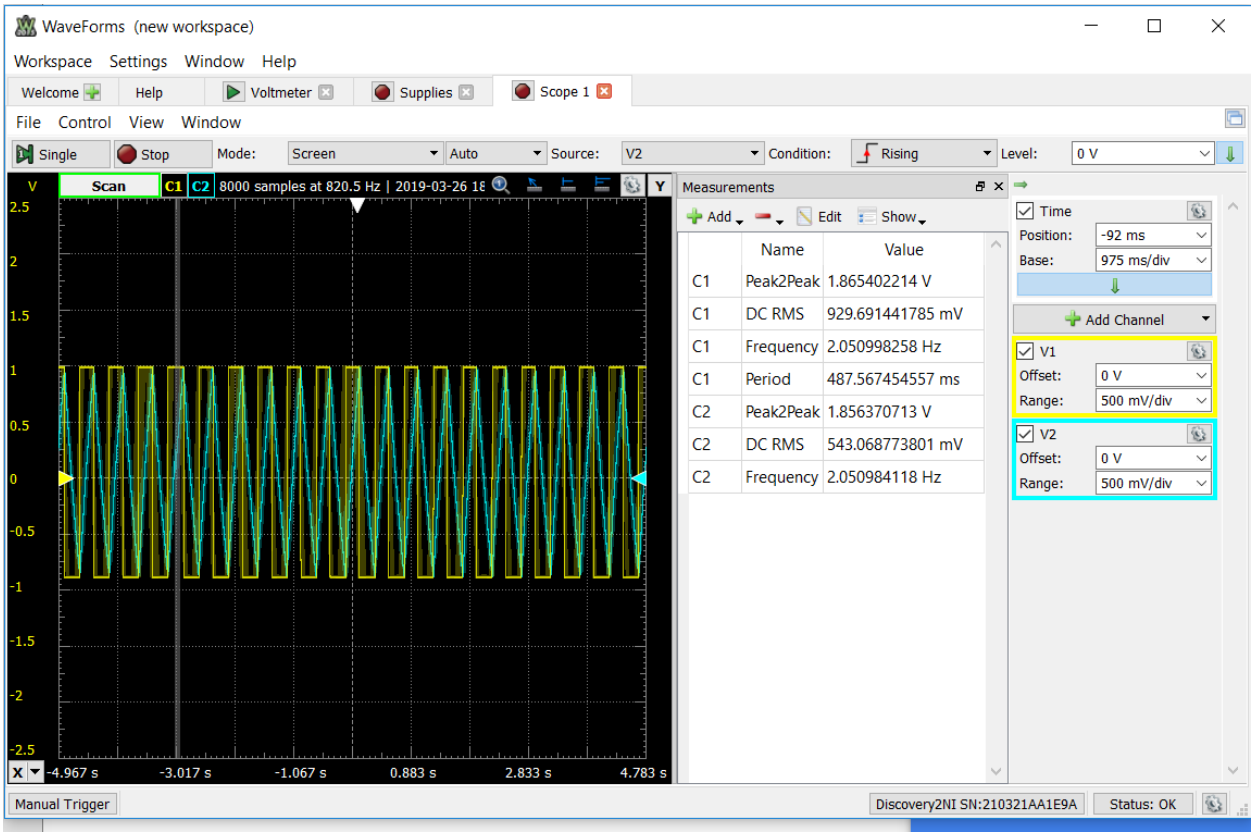
Task2A:



Task2B:



Task2C:


WaveForms (new workspace)
Workspace Settings Window Help
Welcome Help Voltmeter Supplies Scope 1
File Control View Window
Single Stop Mode: Screen Auto Source: V2 Condition: Rising Level: 0 V
Scan C1 C2 8000 samples at 820.5 Hz | 2019-03-26 18
2.5 2 1.5 1 0.5 0 -0.5 -1 -1.5 -2 -2.5
-4.967 s -3.017 s -1.067 s 0.883 s 2.833 s 4.783 s
Measurements
Add Edit Show
Name Value
C1 Peak2Peak 1.865402214 V
C1 DC RMS 929.691441785 mV
C1 Frequency 2.050998258 Hz
C1 Period 487.567454557 ms
C2 Peak2Peak 1.856370713 V
C2 DC RMS 543.068773801 mV
C2 Frequency 2.050984118 Hz
Time
Position: -92 ms
Base: 975 ms/div
Add Channel
V1
Offset: 0 V
Range: 500 mV/div
V2
Offset: 0 V
Range: 500 mV/div
Manual Trigger
Discovery2NI SN:210321AA1E9A
Status: OK