

Baseline measurement: $\mu = 1.467$
 $STD = 0.002940$
 $n = 1001$

- Connect the Logger Pro device
- Take the 20s voltage reading of a battery to find the STD/error in the measurement device.
- Measure a $10k\Omega$ res. and three $47\mu F$ caps.
- Put probes across capacitor & record charge & discharge
- Put probes across resistor & record charge & discharge
- Graph data and fit the exp. function.
- Fit the data and extract the V_0 & RC
- Now replace the cap with two, parallel & series, collect data and see the diff

This lab is about measuring the resistance and capacitance of capacitors in an RLC circuit.

Resistor:
 $10.30 k\Omega \pm 1\%$

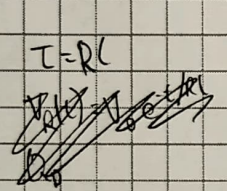
Cap 1:
 $43.5 \mu F$
 $\pm 2\%$

Cap 2:
 $48.0 \mu F$
 $\pm 2\%$

$$RC = 448.05 \text{ mFk}\Omega = 0.44805 \text{ s}$$

$$\delta_{RC} = RC \left(\left(\frac{\delta_R}{R} \right)^2 + \left(\frac{\delta_C}{C} \right)^2 \right)^{1/2} = 10 \text{ ms}$$

$$\delta_C = RC \left(\left(\frac{\delta_R}{R} \right)^2 + \left(\frac{\delta_{RC}}{C} \right)^2 \right)^{1/2} = 0.45 \pm 0.01 \text{ s}$$



$$V_C(t) = V_0 (1 - e^{-t/RC})$$

$$V_R(t) = V_0 e^{-t/RC}$$

(u)

V_0

(s) RC

	Charge Cap	Discharge Cap	Charge Res	Discharge Res
V_0	1.37602 ± 0.001	1.4447 ± 0.001	1.41141 ± 0.001	1.44972 ± 0.001
RC	0.47435 ± 0.0007	0.47524 ± 0.0006	0.47108 ± 0.0007	0.47221 ± 0.0007

$$\delta_{RC} = \left(\delta_{RC1}^2 + \delta_{RC2}^2 + \delta_{RC3}^2 + \delta_{RC4}^2 \right)^{1/2}$$

$$= 0.001$$

$$\mu_{RC} = 0.473 \pm 0.001$$

Parallel capacitors: $RC = 0.9083 \text{ s} \pm 0.0007$
 charging

$$C_{tot} = 43.5 + 43.0 = 86.5 \pm 1.2$$

$$RC = 0.89 \pm 0.02$$

Series capacitors: $RC = 0.2265 \text{ s} \pm 0.0007$
 charging

$$C_{tot} = 1/(1/43.5 + 1/43.0) = 21.6$$

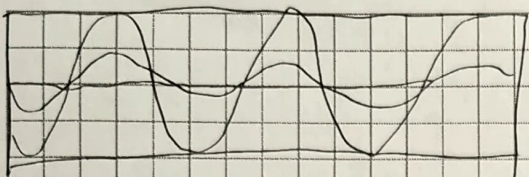
$$RC = 0.223$$

Part I

$$R = 0.97 k\Omega \pm 1\%$$

$$C = 0.446 \mu F \pm 2\%$$

Behn



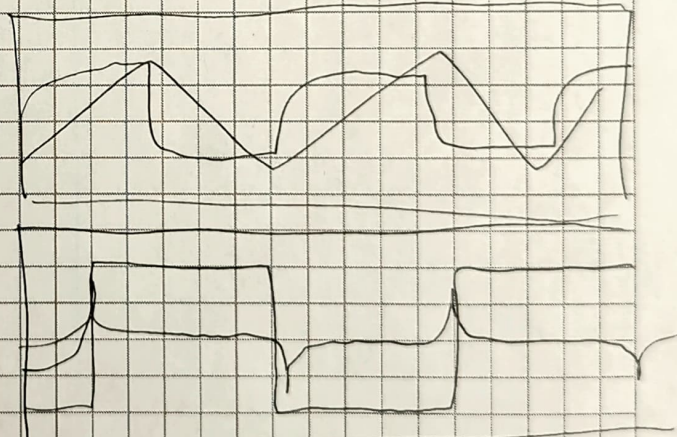
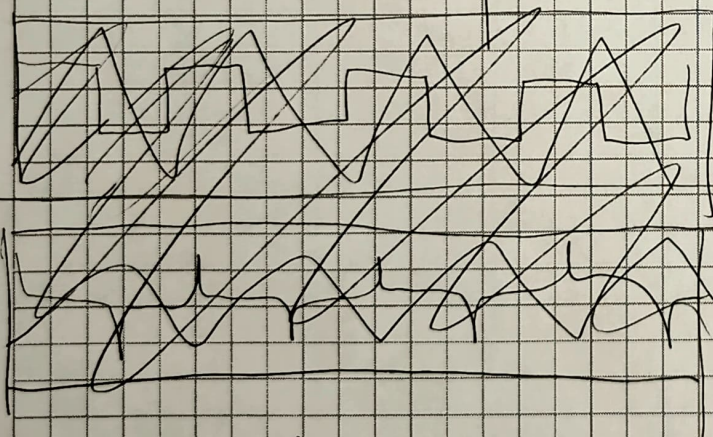
$$V_{pp} = 4.76 \text{ V}$$

$$F_{req} = 500.4 \text{ Hz}$$

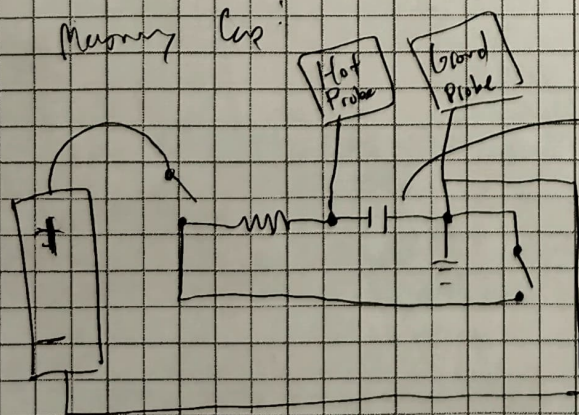
$$V_{pp} = 2.72 \text{ V}$$

$$F_{req} = 500.01 \text{ Hz}$$

Freq	V _{pp} (V)	measured freq (Hz)
10	5.00 ± 0.08	10.00
20	5.00 ± 0.08	20.00
50	4.88 ± 0.08	50.00
100	4.56 ± 0.08	100.0
200	4.08 ± 0.12	200.0
500	2.70 ± 0.08	500.2 Hz
1000	1.55 ± 0.01	1.00 kHz
2000	0.852 ± 0.016	2.00 kHz
5000	0.360 ± 0.004	5.00 kHz
10000	0.200 ± 0.01	10.00 kHz



Measuring Cap:



Double or put two in series for better in lab

