1 Introduction

A potentiometer is an electrical component that can be used both as a variable resistor, and as a voltage divider. The aim of the experiments described in this report is to analyze the behaviour of the potentiometer.

2 Background/Theory

A potentiometer is a resistor that has three terminals. Two of the terminals constitute the full resistance value, while the third one is a sliding contact. Figure 1 displays the different contacts of the potentiometer.

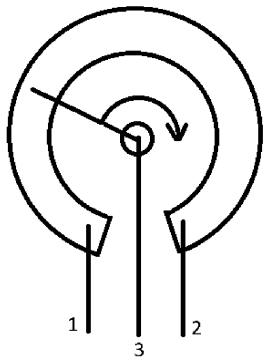

Figure 1: Drawing of a potentiometer with labeled terminals

The resistance between terminals 1 and 2 is constant, while the resistance between 1 and 3 is determined by the following equation:

$$R_{13} = kR \tag{1}$$

Since the potentiometer can be used as a voltage divider, the value of the potential difference between terminals 1 and 3 will be determined by:

$$V_{13} = kV_{tot} \tag{2}$$

When adding a load resistor in parallel to terminals 1 and 3, the voltage across them becomes:

$$V_{13} = \frac{kR_{13}}{R_{13} + k(1-k)R_p}V \tag{3}$$

3 Methods & Materials

3.1 Experimental Set-Up unloaded potentiometer

3.2 Experimental Set-Up with fixed resistor

3.3 Experimental Set-Up with fixed load current

4 The Unloaded Potentiometer

4.1 Measurement Results

Table 1 displays the measured voltage values in terms of k, also displaying the theoretical voltage.

Table 1: Measured and expected voltage in terms of K

k	*Measured V* V	ΔV V	*Expected V* V
0.1	0.302	0.009	0.296
0.2	0.594	0.009	0.592
0.3	0.89	0.017	0.888
0.4	1.184	0.014	1.184
0.5	1.481	0.013	1.480
0.6	1.776	0.021	1.775
0.7	2.076	0.023	2.071
0.8	2.365	0.024	2.367
0.9	2.663	0.025	2.663
1	2.957	0.031	2.959

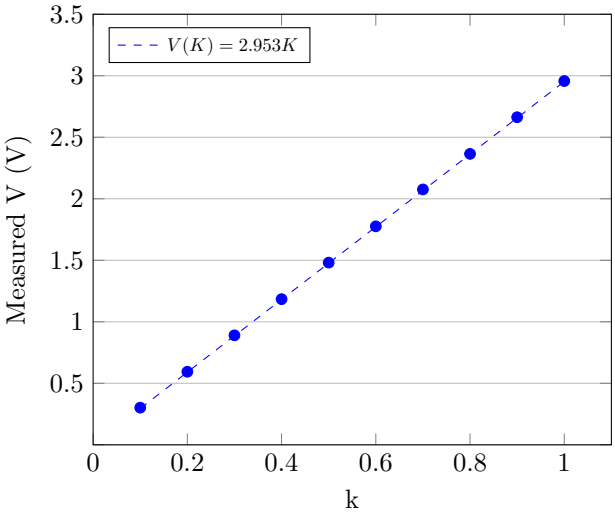

Figure 2: Velocity of the slat in terms of time

4.2 Graphs

Figure 4 displays the measured voltage in terms of K.

4.3 Discussion

The main goal of this experiment was to determine the effect of changing the k-value of the potentiometer on the voltage load of the varying resistance. When looking at the graphical representation of these values seen on figure 3, we see a linear relationship between the k-value and the voltage drop on the potentiometer. Analyzing the difference between the measured and expected voltage, we see that the measured values are accurate, as the difference between them and the expected values falls within the measurement error.

5 Potentiometer loaded with fixed resistor

5.1 Measurement results

Table 2 displays the measurements for K, the unloaded potentiometer value, both loads, with their measured and theoretical values, and percent deviations.

Table 2: Measured and theoretical load values in terms of K

k	*Unloaded V* V	*Load* 1 V	*Load* 1 *theoretical* V	*PD* 1 %	*Load* 2 V	*Load* 2 *theoretical* V	*PD* 2 %
0.1	3	0.274	0.156	75.85	0.253	0.111	56.02
0.2	3	0.514	0.329	56.27	0.451	0.239	46.98
0.3	3	0.739	0.522	41.46	0.628	0.388	38.28
0.4	3	0.957	0.740	29.32	0.809	0.562	30.53
0.5	3	1.184	0.987	20.00	0.993	0.770	22.47
0.6	3	1.433	1.269	12.97	1.21	1.022	15.55
0.7	3	1.717	1.594	7.74	1.47	1.334	9.27
0.8	3	2.039	1.973	3.35	1.801	1.730	3.97
0.9	3	2.448	2.421	1.11	2.268	2.249	0.86
1	3	2.952	2.959	0.24	2.948	2.959	0.37

5.2 Graphs

Figure 5 displays the voltage across the load resistor in terms of K, comparing them to the theoretical values, and the voltage drop on the unloaded potentiometer.

Figure 6 displays the relationship between percent deviation and K.

5.3 Discussion

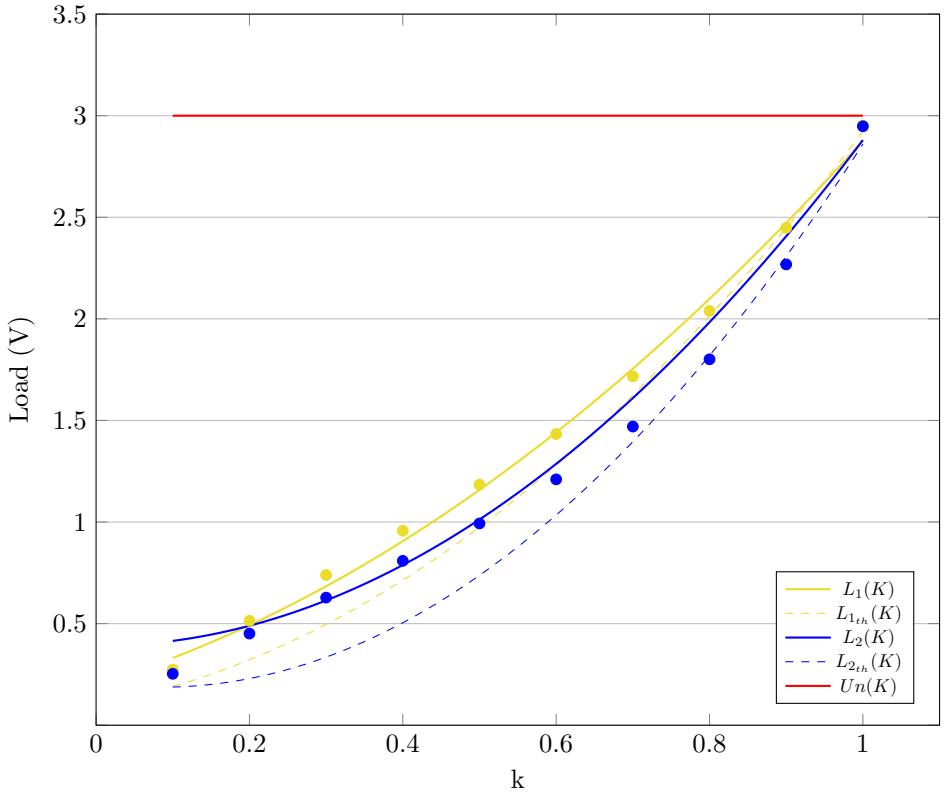

Figure 3: Loads in terms of k

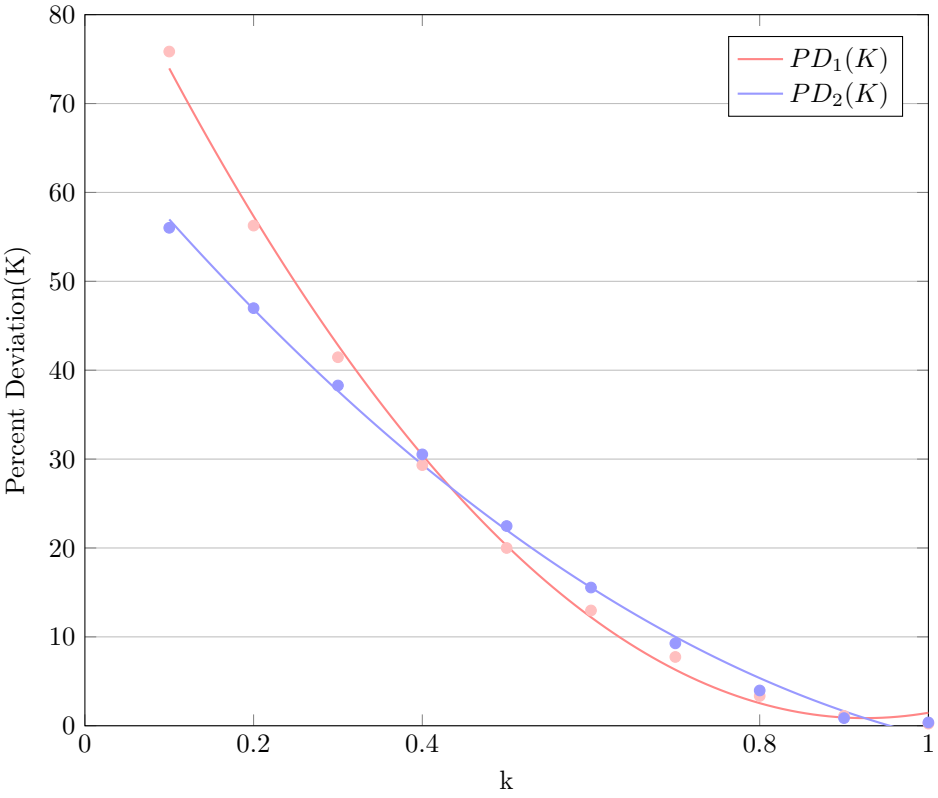

Figure 4: Percent deviation in terms of k