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Physics 4BL – Lab 1

Figure 1: A plot of the output voltage vs. theta data taken from turning the knob in the potentiometer. There is a clear linear correlation between theta and voltage, and the relationship is governed by the equation: y = (0.001284 ± 0.000003) x + (0.0006 ± 0.004). As the knob is turned at greater angles, the voltage output also increases accordingly. The uncertainties are fairly insignificant as well.

|  |  |  |
| --- | --- | --- |
|  | *Coefficients* | *Standard Error* |
| Intercept | 0.000637143 | 0.004446161 |
| X Variable 1 | 0.001283607 | 3.2295E-06 |

Table 1: Regression Analysis Data for Figure 1.

The intercept determines where the line starts. In other words, the intercept is the output voltage whenever the knob is turned all the way to one end. Theoretically, for this experiment, the voltage value should be around 0 V when the angle is also 0. The intercept in this case has a value of 0.0006, which is sufficiently small enough so as to model 0 V with limited error. The slope of the fit line governs the relationship between voltage and theta. In this case, whenever theta increases by a value of 1, voltage increases by a value of 0.001284. The slope is crucial for determining output voltages for even higher theta values.

Figure 2: A plot of the ratio between the output and input voltages vs. theta data taken from turning the knob in the potentiometer. There is a clear linear correlation between theta and voltage, and the relationship is governed by the equation: y = (0.000257 ± 0.000006) x + (0.0001 ± 0.0009). As the knob is turned at greater angles, the voltage ratio also increases accordingly. The uncertainties are fairly insignificant as well.

|  |  |  |
| --- | --- | --- |
|  | *Coefficients* | *Standard Error* |
| Intercept | 0.000127429 | 0.000889232 |
| X Variable 1 | 0.000256721 | 6.45899E-07 |

Table 2: Regression Analysis Data for Figure 2.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Angle | Difference | % Deviation | Max Deviation | Min Deviation |
| 0 | 0.0047 | 0.094 | 0.008 | 0.0014 |
| 180 | 0.00036 | 0.0072 |  |  |
| 360 | -0.0009 | -0.018 |  |  |
| 540 | 0.00014 | 0.0028 | Max % Deviation | Min % Deviation |
| 720 | 0.00214 | 0.0428 | 0.16 | 0.0028 |
| 900 | 0.00206 | 0.0412 |  |  |
| 1080 | 0.00168 | 0.0336 |  |  |
| 1260 | 0.00414 | 0.0828 |  |  |
| 1440 | 0.00358 | 0.0716 |  |  |
| 1620 | 0.00568 | 0.1136 |  |  |
| 1800 | 0.0066 | 0.132 |  |  |
| 1980 | 0.00732 | 0.1464 |  |  |
| 2160 | 0.008 | 0.16 |  |  |
| 2340 | 0.00782 | 0.1564 |  |  |

Table 3: Deviation Data between the fit line and the experimental data.

The minimum deviation calculated using the data taken and the fit equation was 0.00014, while the maximum deviation had a value of 0.008. The percentage deviations were relatively small as well, with the minimum having a value of 0.0028 and the maximum having a value of 0.16. These deviations clearly fall within the tolerance levels set forth by the manufacturer. This clearly shows that the potentiometer that was used was extremely accurate in its voltage breakdowns between the resistors. Good data can be taken from the potentiometer.