KU LEUVEN

FACULTY OF ENGINEERING TECHNOLOGY

CAMPUS GROUP T

Lab Report for Lab Electricity

Potentiometer

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Darius-Andrei Corlan
Valeria Jackson Sandoval
Djef Van Der Mynsbrugge
159E Team 2

Lab responsible:
Rob Houtmeyers

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1 INTRODUCTION

Describe briefly, clearly and yet precisely the goal of the experiment / measurements and the strategy with which you will achieve that goal.

2 BACKGROUND/ THEORY

Here we refer to the lab text and the lecture text. [1] [2]

3 METHOD & MATERIALS

Specifically for this experiment:

Include the diagrams of the experimental setup. Include any source citations, including immediately in the caption below the figure, and refer to your figures in the text.

Also provide a brief description of the measurements made.

3.1 Experimental Set-up unloaded potentiometer

3.2 Experimental Set-up potentiometer with fixed resistor

3.3 Experimental Set-up potentiometer with fixed load current

4 THE UNLOADED POTENTIOMETER

4.1 Measurement results

First add one or more sentences that already provide the main measurement results as text or refer to a table. Then add the measurement results in a compact and clear table, possibly clarified by appropriate graphs. If legibility is compromised due to the large number of measurement results, certain measurements in the table can also be included in the appendices. A table always has a caption above it and is numbered. Provide an informative, clear caption.

The header of a table consists of at least 2 lines:

- 1st line: the default symbol for the quantity
- 2nd line: the unit used in brackets, possibly preceded by a prefix or an appropriate power of 10. Only SI units are allowed.

Numbers are presented as simply as possible. Make a suitable choice of the unit and use prefixes such as mega or giga. Only significant figures are mentioned.

Avoid spreading a table over two pages. If a table does not fit on one page due to its size, repeat the header of the table on the next page.

Specifically for this experiment:

Create a clear table with measurements and calculated values. The table shows: the k-values, the measured voltages, the error on the measured voltages, the theoretically expected values of the voltage.

4.2 Graphs

Graphs follow the same layout method as figures. Make sure that charts are sufficiently large and legible. Think about the scale and the choice of units. Make sure that there is a scale along each axis: 3 to 10 graduation marks with round numbers at regular intervals (2 to 3 significant figures). Do not include readings along the axes. For each axis, place the symbol of the quantity plotted and in brackets the unit used. Make sure the readings themselves are clearly visible.

If possible, draw a line of best fit or a theoretical line through the measurement points (e.g. via a regression analysis or least squares method). Include the corresponding equation (and R^2) in the figure. Provide a legend with meaningful names if there are several curves on one graph. Centrally align the figures. And of course, provide an informative caption with a number which is referred to in the text.

Specifically for this experiment:

Draw a graph of the measured voltage in function of k. Draw the appropriate trend line and also put its equation on the graph.

4.3 Discussion

In this section, repeat the central questions / goals from the lab assignment and formulate an answer, possibly grouped per sub-experiment. Interpret your results and decide: has the purpose of the experiment been achieved? Try to explain any discrepancies. For example, discuss the following:

• Accuracy and precision of the measuring method (s): Which method affects the measurement error of the final result most significantly? What causes the biggest uncertainty?

• Correctness of the final result: Avoid terms such as "reasonably good" or "about"; either a measurement is correct with the expected value within the measurement error, or not.

• Give a final assessment of the obtained results in comparison with the results of others, for example from previous experiments, other students or previous literature.

If your research concerns a relationship between 2 or more physical quantities, describe the shape and strength of the relationship found and, as far as possible, explain the comparison with the theoretically expected relationship. Point out the slope of the line and / or its physical interpretation. Beware of terms such as "directly proportional", "inversely proportional", "exponentially increasing/ decreasing". These have one specific physical meaning; use it correctly!

Suggestions: If necessary, formulate tips for improving the measurement methods and / or alternative measurement setups. Be sure to give suggestions for better measuring methods or accuracy of the calculations if the test did not go as expected.

Specifically for this experiment:

In your discussion, you should include at least the answers to the following questions:

- What form does the chart take?

- Do the measured and theoretical values match within the measurement error?

5 POTENTIOMETER LOADED WITH FIXED RESISTOR

5.1 Measurement results

Specifically for this experiment:

Clearly provide the measured values of the load resistances and the total resistance of the potentiometer.

Again create a clear table with measured values. The theoretical values are calculated from the measured values of the resistors used! Create a single table with the following columns and a correct lay-out.

k	unloaded measured	Load 1	Load 1 theoretical	Percentage deviation 1	Load 2	Load 2 theoretical	Percentage deviation 2

The percentage deviation is the deviation of the measured value with load (column 3 or 5) from the no-load situation (column 2).: $\frac{V_L - V_{unloaded}}{V_{unloaded}} \cdot 100\%$

5.2 Graphs

Specifically for this experiment:

Create one graph with three curves: two of the voltage across the load resistors in function of k and one of the voltage of the unloaded potentiometer. Also add the theoretical values using a thin curve.

Create a second graph showing the percentage deviations mentioned above as a function of k.

5.3 Calculations

Present the calculations of the measurements in an orderly manner. If several similar calculations are performed, give at least 1 complete, clearly worked out example calculation and an error calculation for all calculated quantities. Clearly indicate for which measurement value from the table the calculations are made. First work out the calculations using variables/symbols, only then enter the numbers. If necessary, provide explanations (for example, textually explain the mathematical technique used). Always put the final result in standard notation.

Specifically for this experiment:

For the measurement at k=0.5 and R_L=510 Ω, calculate the theoretically expected value. Then determine the error on this value taking into account the measurement errors of V_B,R_P,R_L. Also calculate the error on the measured value.

5.4 Discussion

Specifically for this experiment:

In your discussion you should at least (not exclusively) include the answers to the following questions:

- Does the measured value at k=0.5 correspond to the calculated value, taking into account the error on both values?

- Do the graphs of the measured and calculated values match?

- What form does the graph of the percentage deviation in function of k have? Where is it largest?

6 POTENTIOMETER WITH FIXED LOAD CURRENT

6.1 Measurement results

Specifically for this experiment:

Again create a clear table with measured values. Create a single table similarly as in the previous part.

k	unloaded measured	Load 1	Load 1 theoretical	Percentage deviation 1	Load 2	Load 2 theoretical	Percentage deviation 2

The percentage deviation is the deviation of the measured value with load (column 3 or 5) from the no-load situation (column 2).: $\frac{V_L - V_{unloaded}}{V_{unloaded}} \cdot 100\%$

6.2 Graphs

Specifically for this experiment:

Create one graph with three curves: two of the voltage for the different load currents as a function of k function of k and one of the voltage of the unloaded potentiometer. Also add the theoretical values using a thin curve.

Create a second graph showing the percentage deviations mentioned above as a function of k.

6.3 Calculations

Specifically for this experiment:

For the measurement at k=0.5 and R_L=510 Ω, calculate the theoretically expected value. Then determine the error on this value taking into account the measurement errors of V_B,R_P,R_L. Also calculate the error on the measured value.

6.4 Discussion

Specifically for this experiment:

In your discussion you should at least (not exclusively) include the answers to the following questions:

- Does the measured value at k=0.5 correspond to the calculated value, taking into account the error on both values?

- Do the graphs of the measured and calculated values match?

- What form does the graph of the percentage deviation in function of k have? Where is it largest?

7 CONCLUSION

Briefly repeat the most important finding and / or final assessment of the results obtained in comparison with results from previous experiments, from others or from literature. Do not put new information here.

8 OPTIONAL: PERSONAL REMARKS

Add this section only if you have any comments or if there were any significant technical shortcomings during the lab session. Page filling is not appreciated.

9 BIBLIOGRAPHY

Put the list of sources here. Use a reference manager. The default reference style is IEEE or APA. However, this can be deviated from for the various assignments if the teacher mentions this explicitly. So always check this carefully.

[1] J. Loeckx, “2 Potentiometer 21-22”, not published.

[2] C.K. Alexander en M.N.O. Sadiku, *Fundamentals of Electric Circuits*, International edition. NY, USA: Mc-Graw Hill Education: 2017

10 APPENDICES