Maritime University of Szczecin

Faculty of Marine Engineering

Department of Physics and Chemistry

Physics Laboratory

Laboratory Description

Verification of Ohm's law for DC (direct current) circuits

English version written by
dr Agata Kowalska

Szczecin 2017

Objectives:

- Getting acquainted with DC circuits.
- Checking the linear dependence of the current flowing through the resistor of applied voltage.
- Determination of resistance values of unknown resistors and their connections: series and parallel.

Questions and problems to solve:

- What is the electric current? What does is flow in metals, semiconductors, liquids and gases?
- Ohm's Law. How is it verified in the exercise?
- Resistance and resistivity. What does resistance of conductor depend on?
- Equivalent resistance in series and parallel connection of resistors.

Short description:

Ohm's Law can be verified if we demonstrate that the current flowing through a resistor or a connection of resistors is directly proportional to the applied voltage U

$$I = \frac{1}{R}U \tag{1}$$

where the inverse of the resistance is the proportionality constant.

We connect the electrical circuit according to the following diagram. The circuit should consist of a current power supply, a resistor and an ammeter.

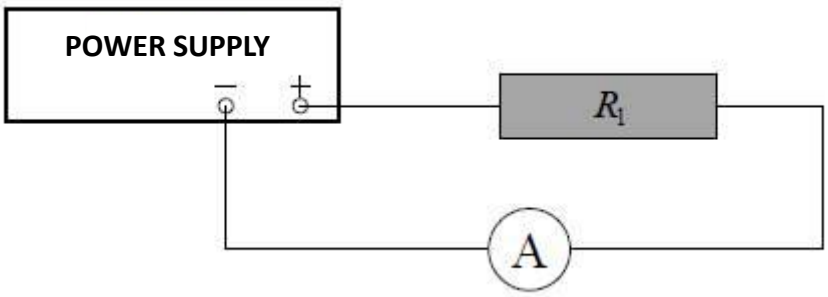

Fig. 1. Schematic view of the circuit used in the experiment

We vary the voltage of the power supply and measure the dependence of current I flowing through the resistor R_1 on the applied voltage U.

Afterward, we set up other circuits where we replace the resistor R_1 with:

1. the resistor R_2,
2. resistors R_1 and R_2 connected in series,
3. and resistors R_1 and R_2 connected in parallel.

Every time we measure the dependence of current *I* on voltage *U*.
In one graph we present a dependency *I(U)* for all examined circuits. Using a linear regression we find the resistance of individual resistors R_1 and R_2 as well as resistors connected in series and in parallel. Using formulas:

$$R_s' = R_1 + R_2, \tag{2}$$

$$R_R' = \frac{R_1 R_2}{R_1 + R_2} \tag{3}$$

we calculate the equivalent resistance of series and parallel connections. We compare resistance values R_S' and R_R' with values R_S and R_R obtained previously and draw the conclusions.

Literature:

1. Resnick R., Halliday D., Walker J., *Fundamentals of Physics*, John Wiley & Sons, INC (available editions).