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MEASURE PARALLEL CIRCUIT

Measurement practice II.

FOR VEHICLE ENGINEER STUDENTS

Version: 1.1

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1. Introduction

In this measurement exercise we will verify Ohm's law and measure series DC circuits. We will also look at the use and wiring of current meters, voltmeters and resistance meters. The measurement results will be verified by simulation and calculation.

1.1 Objectives

- Knowledge of electrical wiring diagram;
- Studying behavior of parallel circuit;
- Current and voltage measurement in a circuit;
- Resistance measurement in a circuit;

1.2 Required instruments and components

- DC voltage supply (see Fig. 1.);
- resistor table (see Fig. 2.);
- digital multimeter (see Fig. 3.);
- measuring cables (to the digital multimeter).

Fig.1. Power supply (TP-2303)

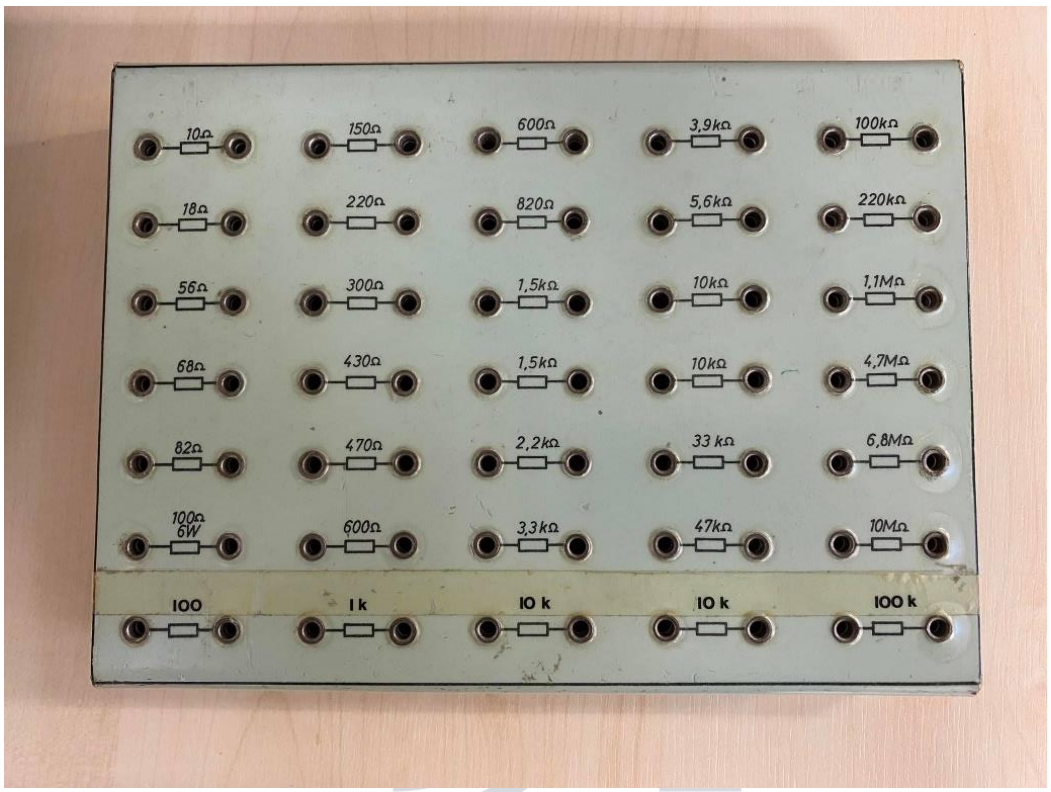

Fig.2 Resistor table

Fig.3. Digital multimeter

3. Measurement exercises

3.1 Resistance measure of parallel circuit

The parallel circuit diagram is shown in Fig.4. During the measurement, three resistors are connected in parallel. The value of the resistors can be chosen arbitrarily according to the following criteria: all resistors must be in the range 1.5 - 50 kΩ.
IMPORTANT! In all cases, the resistance is measured in a voltage and current free condition. The circuit must NOT be connected to the DC power supply!

The steps of measurement:

1. Prepare the necessary tools and instruments.
2. Build the circuit with tree kΩ size resistor!
3. Make sure that the multimeter is set to the correct measuring volume (resistance) and that the test leads are connected correctly.
4. Measure the total resistance of circuit and write the measured values down in the table!

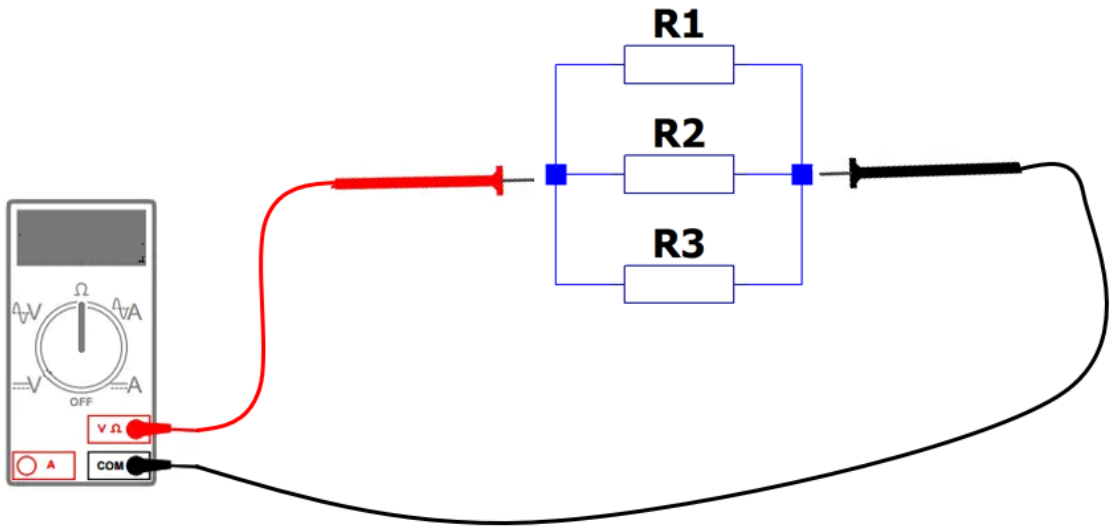

Fig.4. Measuring of circuit resistance

3.3 Voltage measure of parallel circuit

The circuit values are the same as for resistance measurement. The circuit diagram of this measurement is shown in Fig. 5.

The steps of measurement:

1. Prepare the necessary tools and instruments.
2. Set up the DC power supply to produce a 20V(DC)! Adjust the current limit to 0.5A!
3. Check the set voltage with a digital multimeter. Make sure that the multimeter is set to the correct measuring volume (voltage) and that the test leads are connected correctly. Build the circuit with tree kΩ size resistor!
4. Connect the circuit to the DC generator!
5. Measure the voltage of R1! Repeat the same for R2 and R3!
6. Write the measured values down in the table!

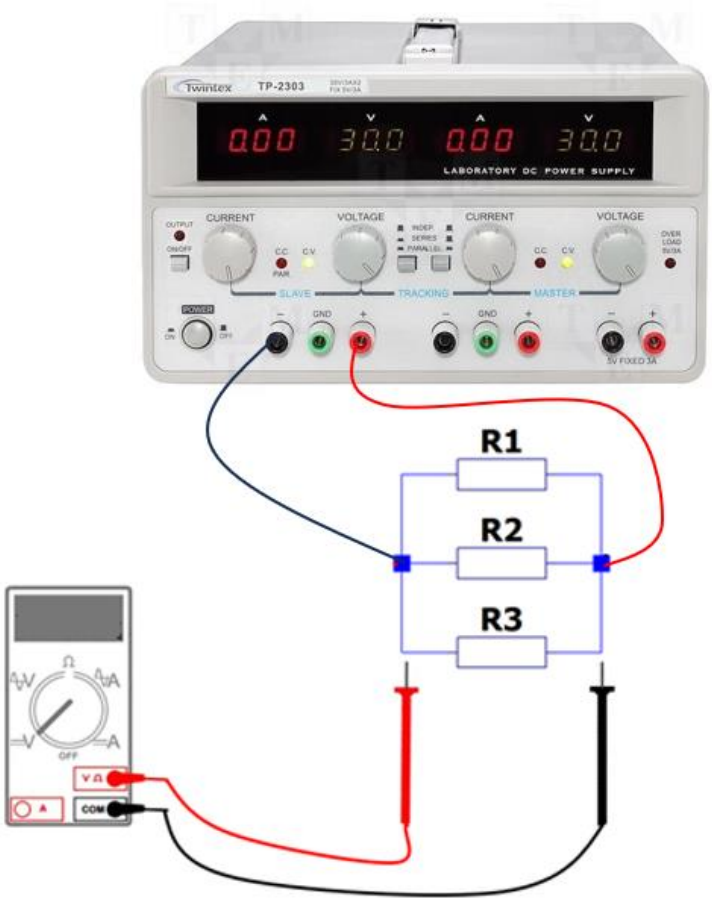

Fig.5. Measuring of voltage in parallel circuit

3.4 Current measure of parallel circuit

The measurement setup and circuit values are the same as for voltage measurement. The circuit diagram of this measurement is shown in Fig. 6.

The steps of measurement:

1. Prepare the necessary tools and instruments.
2. Set up the DC power supply to produce a 20V(DC)! Adjust the current limit to 0.5A!
3. Check the set voltage with a digital multimeter. Make sure that the multimeter is set to the correct measuring volume and that the test leads are connected correctly. Build the circuit with tree kΩ size resistor!
4. Connect the circuit to the DC generator!
5. Measure the current between R1! Repeat the measurement R2 and R3. Write the measured values down in the table! Make sure that the multimeter is set to the correct measuring volume and that the test leads are connected correctly!

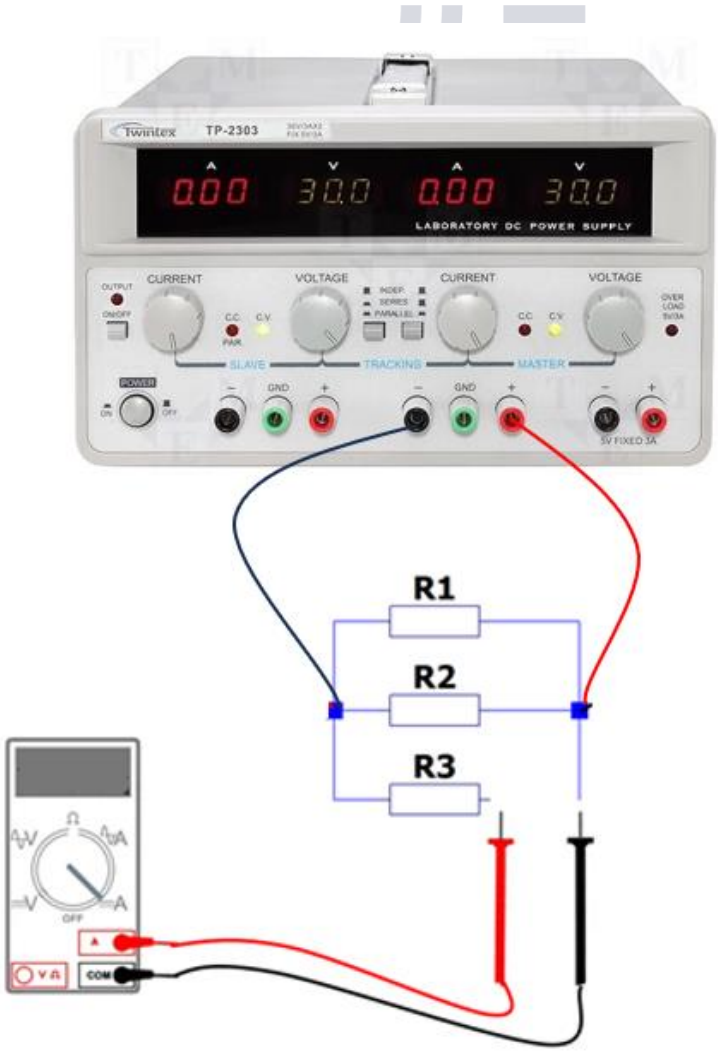

Fig.6. Measuring of current in series circuit

4. Measurement results

Selected resistances:
R1:
R2:
R3

Total resistance of circuit:

Measured voltage:
U_{R1}:
U_{R2}:
U_{R3}:

Measured current:
I_{R1}:
I_{R2}:
I_{R3}:

5. Conclusions

What is the voltage across each resistor?
Summarize the current measured on R1, R2 and R3 during the third measurement. What do you observe?
How does the total resistance depend on the value of the smallest resistance?

6. Homework

Check the measurement results by calculation (by hand on paper) and by Ltspice simulation. Make a measurement report from the measured results and the simulation. Keep the criteria in mind!
You need to include to the measurement report:

- calculated results (in equation form, or by hand form in photo);
- simulated form with Ltspice (circuit + results (DC operating point simulation));
- measurement results
    - First measurement results (resistance);
    - Second measurement results (voltage in table form);
    - Third measurement results (current in table form).