Sabratha University
Engineering Faculty Sabratha
EEE-Departmant

Wheatstone Bridge

Author: Nedal Abdullah
ID: 1611100336

1. Objectives

The objectives of this experiment is to calculate the unknown resistor value using the Wheatstone bridge.

2. Equipment

a) power supply
b) Resistors
c) Variable Resistor
d) Wires
e) DMM
f) Connection Board

3. Circuit Diagram

The Figure 1 shows the circuit diagram for this experiment.

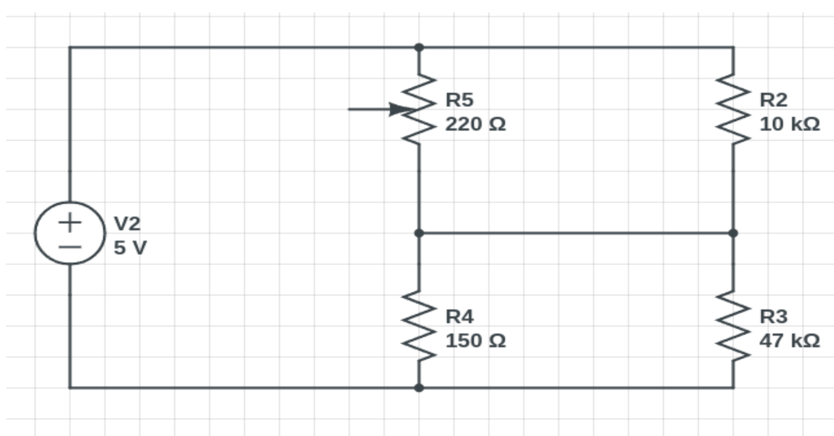

Figure 1

4. Theory

A bridge is a special class of circuits that can be used for measuring resistance, capacitance, or inductance. A resistance bridge is especially useful when a very accurate measurement of a resistance is required. The Wheatstone bridge or four arm bridge, invented by C. Wheatstone in 1843, is the most widely used resistance bridge for measuring resistance values.

Commercial Wheatstone bridges are accurate to about 0.1 percent, making the values of resistance obtained far more accurate than values obtained from many types of meters.

A Wheatstone bridge consists of a voltage source and two parallel voltage dividers, as shown in Figure 1. The bridge is said to be balanced when the voltage on the wire is Zero.

For the balanced condition, the voltage is divided in the path containing resistors R5 and R4 in the same ratio as in the path containing resistors R2 and R2 , which allows the unknown resistance R3 to be determined in terms of R5 , R4 and R2.

Now we can find R3 in Terms of R2 and R4 and R5 using The Voltage divider relation as shown in the next Formulas.

$$V1=E\left(\frac{R4}{R4+R5}\right)$$

Formula 1

$$V2=E\left(\frac{R3}{R3+R2}\right)$$

Formula 2

For the Balanced Condition the Formula 1 equal Formula 2

$$V1 = V2 = 0$$

Formula 3

and the Expression becomes as shown in Formula 4

$$\left(\frac{R4}{R4+R5}\right) = \left(\frac{R3}{R3+R2}\right)$$

Formula 4

and finally we got the equal ratio between the four resistor in the balanced case and its expressed in the Formula 5

$$\left(\frac{R3}{R2}\right) = \left(\frac{R4}{R5}\right)$$

Formula 5

5. Procedures

1) connect the circuit on the connection board as shown in the Figure 1.
2) power-off the power supply.
3) set the DMM in voltmeter mode by moving the DMM rotary to “V” and make sure it is on “20 V” mode.
4) Connect the DMM as shown in Figure 2 where the positive side goes to the “V” in the DMM and the negative side goes to the “COM” in the DMM.
5) close the circuit with the wires.
6) power-on the power supply.

7) Start changing the Value of the R5 resistor until we got zero reading on the DMM display.

8) Now remove the R5 from the connection board and measure the value of the resistance.

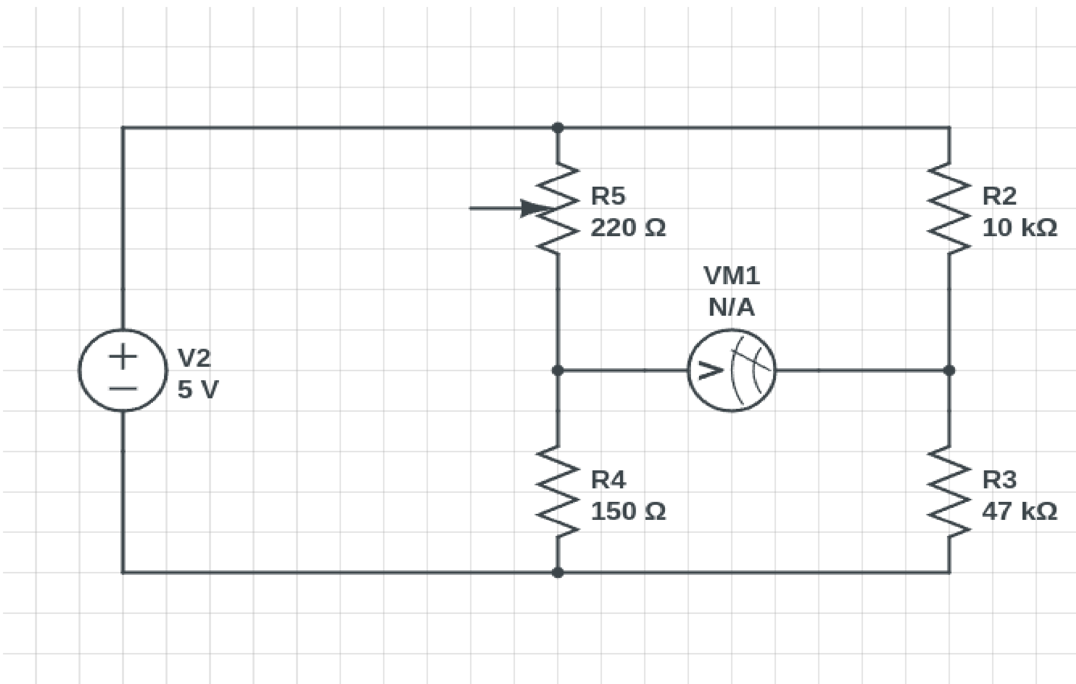

Figure 2

6. Observation Table

The Table 1 contain the measured readings and the theoretical values that been calculated using the Formula 5 and the error percentage.

R2(kΩ)	R3(kΩ)	R4(Ω)	Measured-Reading(Ω)	Theoretical-Values(Ω)	Error(%)
10	47	150	32.3	31.91	1.22

Table 1

7. Conclusion

we can conclude from our results that Wheatstone bridge is great method to measure the value of the unknown resistor with high accurate value and we got a good error percentage values for this experiment around (1.22%).

8. Resources

All the Resources for this experiment including the pdf file and the pictures and etc…, are available on Github Repository just scan the next QR Code to get the link for that Repository.

Scan Here