**Experiment No. 04**

**Name of the Exp:** Verification of Thevenin's theorem.

**Objective:** To verify Thevenin's theorem with reference to a given circuit theoretically as well as experimentally.

**Theory:**

The Thevenin's theorem states that any two terminal linear bilateral network containing sources and passive elements can be replaced by an equivalent circuit consisting of a voltage source $V_{th}$ in series with a resistor $R_{th}$ where,

- Vth= The open circuit voltage (VOC) at the two terminals A & B.
- $R_{th}$ = The resistance looking into the terminals A and B of the network with all sources removed

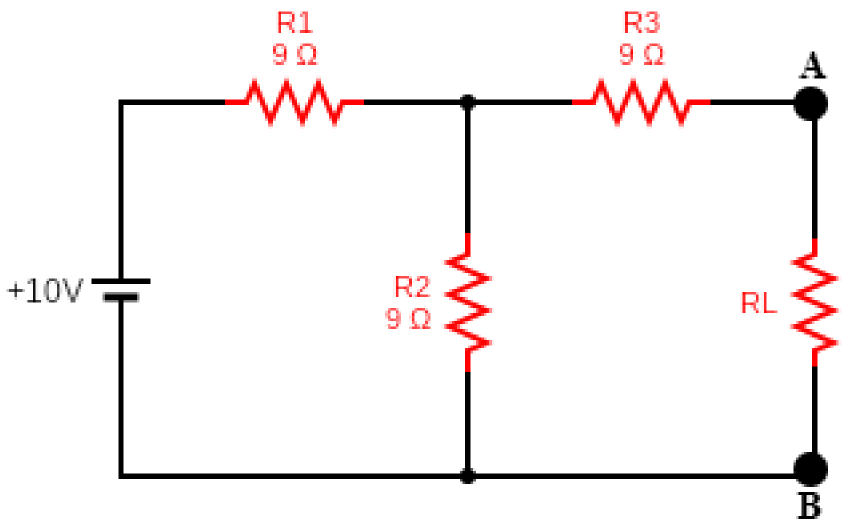


***Fig-1: Circuit diagram for Thevenin's theorem.***

**Apparatus:**

1. DC power supplies
2. Resistors
3. Digital Multi-meter
4. Bread Board
5. Connecting wires

**<u>Procedure</u>:**

1. Check the values of the resistor using multi-meter (ohm section of multi-meter). Record the values in Table -1.
2. Give the connection as per the circuit diagram shown in Fig.1.

**<u>Finding $V_{th}$ & $R_{th}$</u>:**

1. Remove the load resistance RL and find the open circuit voltage between terminals A & B. This voltage is Thevenin voltage i.e., $V_{th}$ = VOC.
2. Replace the voltage sources with short circuits. With RL removed from the circuit and measure $R_{th}$ using a multimeter OR,
3. Place a short circuit between terminals A & B and find the short circuit current ISC.
4. Divide the open circuit voltage by the short circuit current to find the Thevenin resistance $R_{th}$ i.e.,

$$R_{th} = \frac{VOC}{ISC}$$

5. Record the results in Table 2.

**<u>Circuit diagram</u>:**

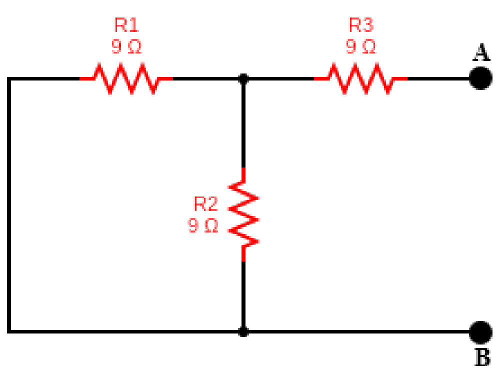


*Fig-2. For measuring the $R_{th}$ .*

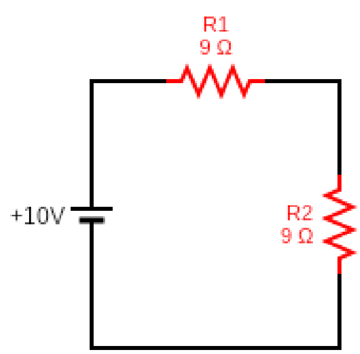


*Fig-3. For measuring the $V_{th}$ .*

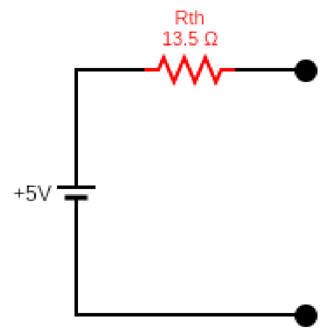


***Fig-4. Thevenin equivalent circuit after calculation.***

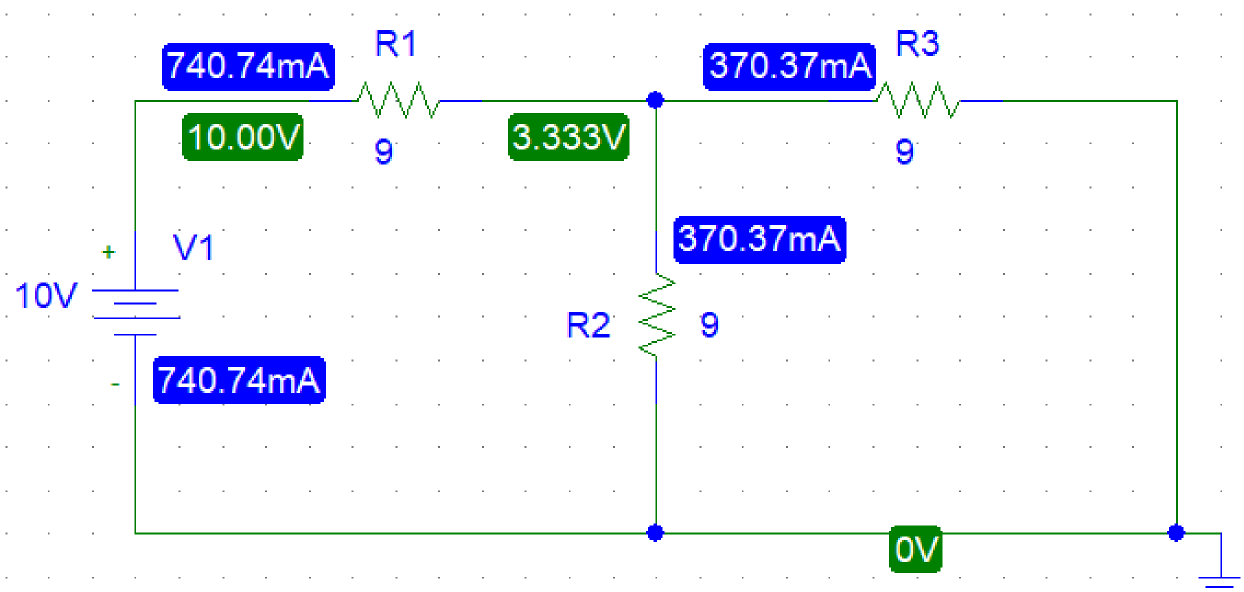


***Fig-5. For measuring $R_{th}$.***

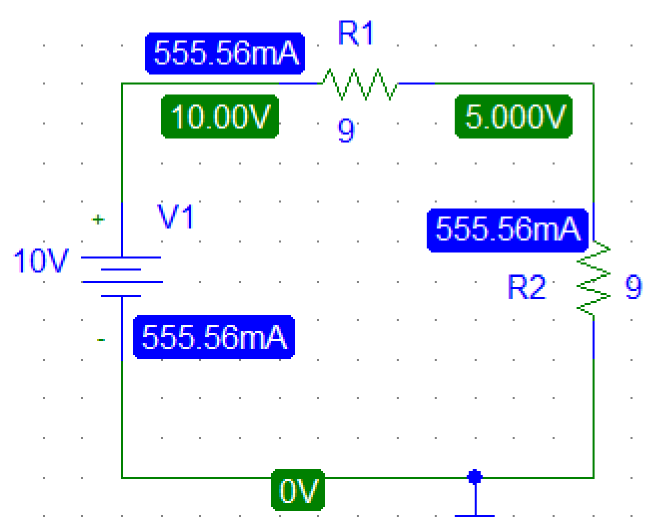


***Fig-6. For measuring $V_{th}$.***

**<u>Model calculation</u>:**

- **Theoretical value**

First, we are going to find the $V_{th}$ from fig-3 according to that circuit the $V_{th}$ is the same voltage as the voltage across $R_2$.

Applying the voltage divider rule we get,

$$V_{th} = \frac{V \times R_2}{R_1 + R_2} = \frac{10 \times 9}{9 + 9} = \frac{90}{18} = 5V$$

To determine the $R_{th}$ we must measure the resistance of the whole circuit from point A & B.

$$\frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{9} + \frac{1}{9} = \frac{9}{1+1} = 4.5\Omega$$

$$R_{(1+2)} + R_3 = 4.5 + 9 = 13.5\Omega$$

The $R_{th}$ is 13.5Ω

- **Measured value**

We can see from fig-5 the voltage across the $R_2$ is 5V. so

$$\therefore V_{th} = 5V$$

And from fig-4 the short circuited current is ISC = 0.37037A so the $R_{th}$ is

$$R_{th} = \frac{VOC}{ISC} = \frac{5}{0.37037} = 13.5\Omega$$

**<u>Observations</u>:**

**Table-1. Resistor value.**

| Resistors (Ω) | $R_1$ | $R_2$ | $R_3$ |
|---|---|---|---|
| Ohm meter reading | 9 | 9 | 9 |

**Table-2. Result for theoretical & measured value**

| No. of observation | $V_s$ (V) | $V_{th}$ (V) | | $R_{th}$ (Ω) | |
|---|---|---|---|---|---|
| | | TV | MV | TV | MV |
| 1 | 10 | 5 | 5 | 13.5 | 13.5 |

**Result:** We got the same result from theoretical & measured value. Thus, we can say that our measurement was correct.

**Precautions:**

1. Check for proper connections before switching ON the supply.
2. Take care of the reading of the apparatus.
3. The terminal of the resistance should be properly connected.