Experiment No. 05

Name of the Exp: Verification of Norton’s theorem.

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

Theory:

The Norton’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 current source I_N in parallel with a resistor R_N where

- I_N = The short circuit current (ISC) at the two terminals A & B.
- R_N = The resistance looking into the terminals A and B of the network with all sources removed.

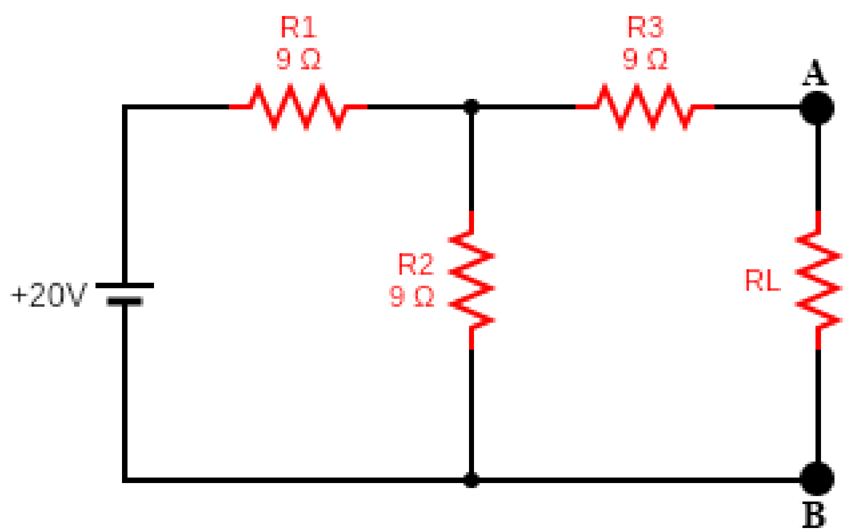

Fig-1. Circuit diagram for Norton's theorem.

Apparatus:

1. DC power supplies
2. Resistors
3. Multi meter
4. Bread board
5. Connecting wires

Procedure:

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.

Finding I_N & R_N:

1. Short the load resistance R_L and find the short circuit current between terminals A & B. This current is Norton current i.e., I_N = ISC.
2. Replace the voltage sources with short circuits and current sources with open circuit. With R_L removed from the circuit, measure R_N using a multimeter (Ammeter).
3. Record the results in Table 2.

Circuit Diagram:

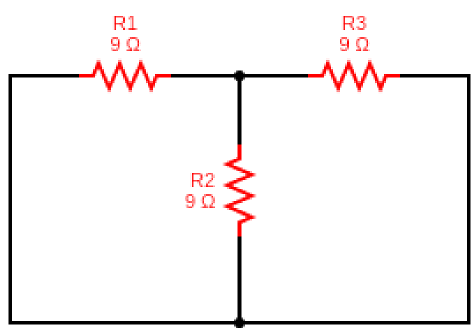

Fig-2. For measuring R_N

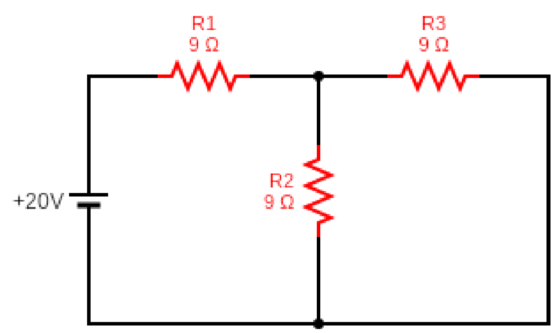

Fig-3. For measuring I_N

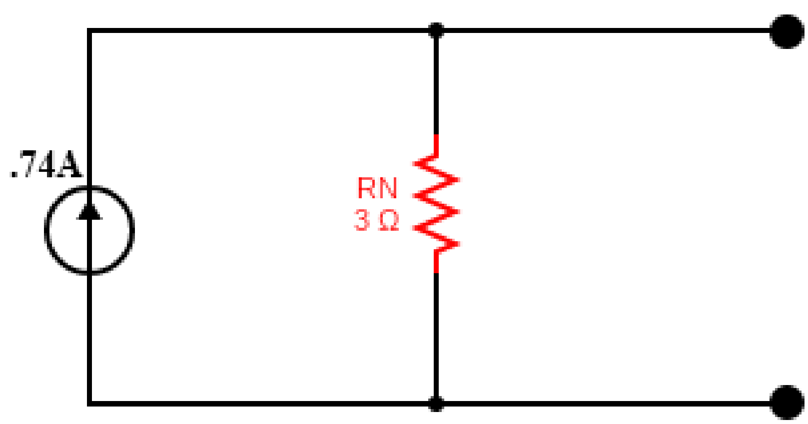

Fig-4. Norton's equivalence circuit

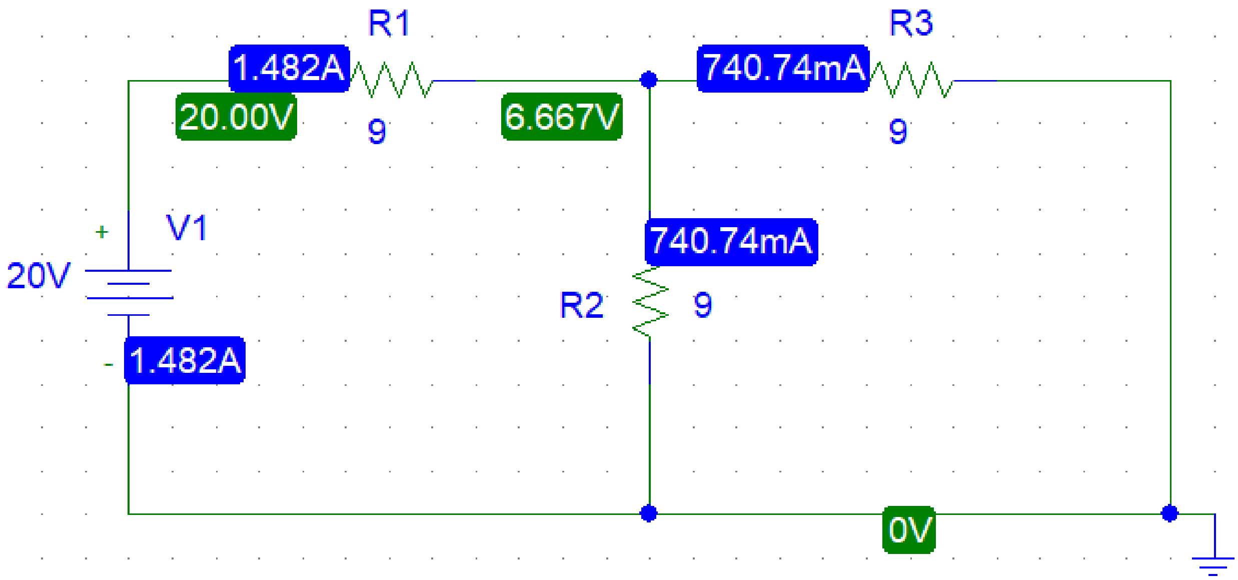

Fig-5. practical value of measuring I_N

<u>Model calculation</u>:

First, we are going to determine the value of R_N from fig-2

$$\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}=\frac{1}{9}+\frac{1}{9}+\frac{1}{9}=3\Omega$$

So, $R_N = 3\Omega$

Now we are going to measure the value of I_N from fig-3

Just because the R_3 resistance is in series with the point A & B terminal so the current through R_3 is going to be equal to I_N.

$$\frac{1}{R_2}+\frac{1}{R_3}=\frac{1}{9}+\frac{1}{9}=4.5\Omega$$

$$R_{(2+3)}+R_1=13.5\Omega$$

$$I=\frac{V}{R}=\frac{20}{13.5}=1.481A$$

Using current divider rule we get,

$$I_N=\frac{I\times R_2}{R_2+R_3}=\frac{1.481\times 9}{9+9}=.74A$$

Observation:

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)	R_N (Ω)		I_N (A)	
		TV	MV	TV	MV
	20	3	3	0.74	0.74

Result:

The theoretical & measured values of the circuit are same so it’s safe to say that our measurements are 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.