Pranav Pandey

Enrollment Number – 9919102049

Batch – E4

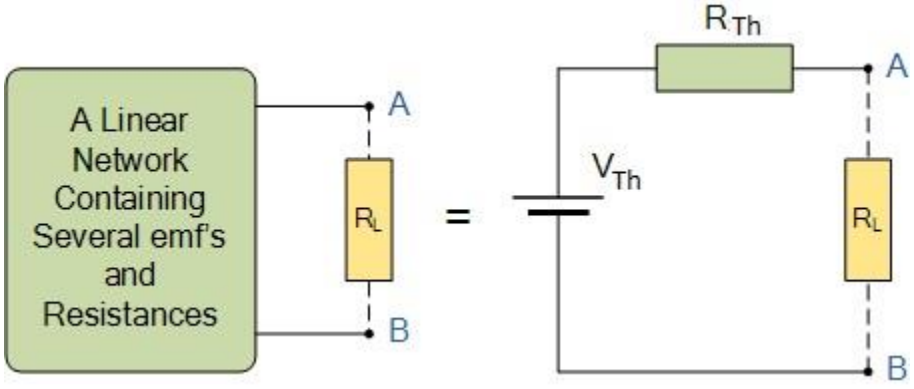
VLAB EXPERIMENT -7

Part 1(Thevenin's Theorem)

Aim : To study and verify the Thevenin's Theorem

Theory : Thevenin's Theorem states that *"Any linear circuit containing several voltages and resistances can be replaced by just one single voltage in series with a single resistance connected across the load".*

In other words, it is possible to simplify any electrical circuit, no matter how complex, to an equivalent two-terminal circuit with just a single constant voltage source in series with a resistance connected to a load.



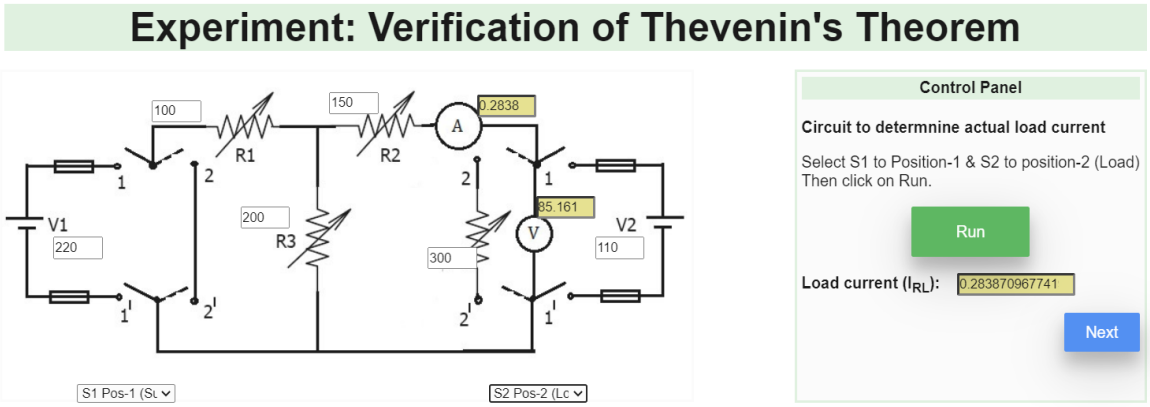
As far as the load resistor R_L is concerned, any complex ﷺone-portﷺ network consisting of multiple resistive circuit elements and energy sources can be replaced by one single equivalent resistance R_{Th} and one single equivalent voltage V_{Th}. $R_{Th}$is the source resistance value looking back into the circuit and V_{Th} is the open circuit voltage at the terminals.

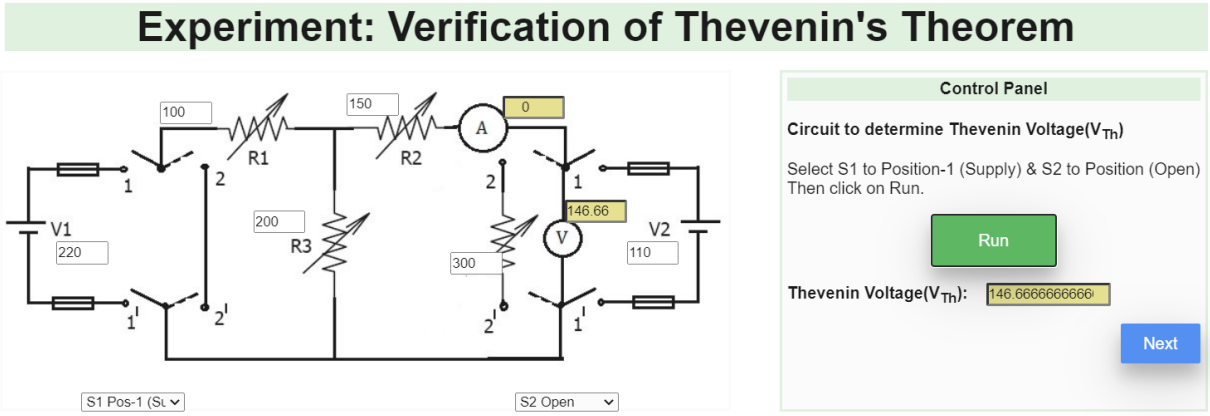
The basic procedure for solving a circuit using Thevenin's Theorem is as follows:

1. Remove the load resistor R_L or component concerned.
2. Find R_{Th} by shorting all voltage sources or by open circuiting all the current sources.
3. Find V_{Th} by the usual circuit analysis methods.
4. Find the current flowing through the load resistor R_L.

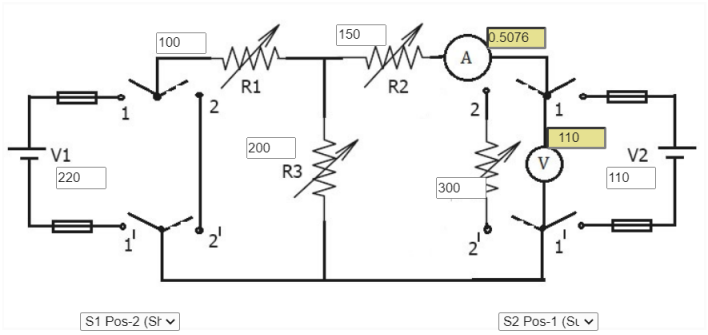
Observations :

For the first set of readings





Experiment: Verification of Thevenin's Theorem



Control Panel

Circuit to determine Thevenin Equivalent Resistance(R_{Th})

Select S1 to Position-2 (Short) & S2 to Position-1 (Supply). Then click on Run.

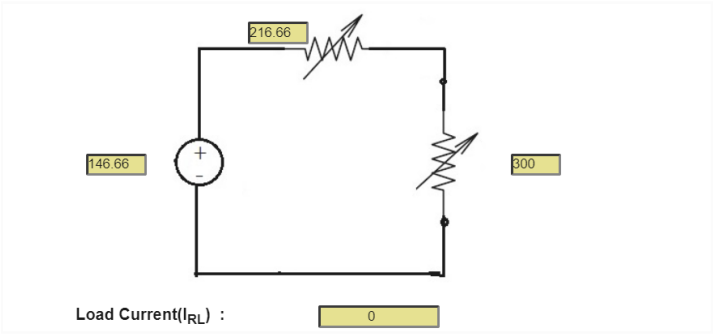
Run

Supply Voltage (V_2) : 110 & Supply Current: 0.5076

Norton Resistance (R_{Nort}): 216.6666666666

Next

Experiment: Verification of Thevenin's Theorem



Load Current(I_{RL}) : 0

Control Panel

Circuit to determine Load Current from Thevenin Equivalent Circuit

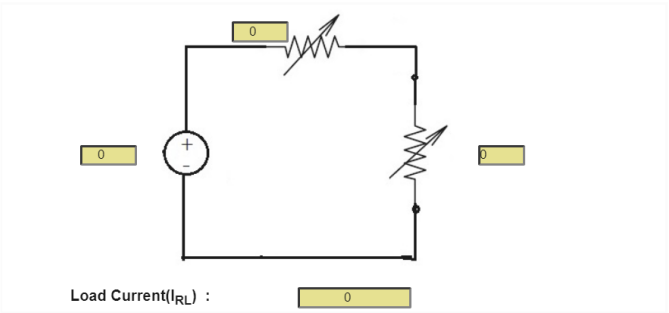
To obatin Load Current(I_{RL})) from Thevenin Equivalent Circuit obatined
Click on Run.

Run

Finish

Final set of readings with observation Table :

Experiment: Verification of Thevenin's Theorem



Load Current(I_{RL}) : 0

Control Panel

Circuit to determine Load Current from Thevenin Equivalent Circuit

To obatin Load Current(I_{RL})) from Thevenin Equivalent Circuit obatined
Click on Run.

Run

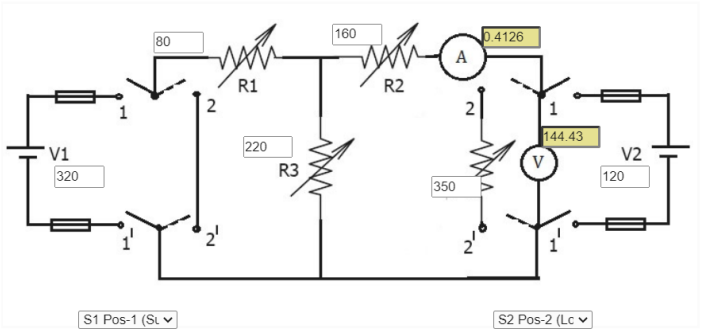
Finish

Observation Table

SL No.	Actual Load Current(I_{RL})	Load Voltage(V_L)	Load Resistance (R_L)=V_{RL}/I_{RL}	Thevenin Voltage(V_{Th})	Supply Voltage(V_2)	Ammeter Reading(I)	Thevenin Resistance $R_{Th}=V_2/I$	Load current (I_{RL})=$V_{Th}/(R_{Th}+R_L)$
1	0.2838709	85.161290	300	146.66666	110	0.5076923	216.66666	0.2838709
2								

2nd set of Readings :

Experiment: Verification of Thevenin's Theorem



Control Panel

Circuit to determnine actual load current

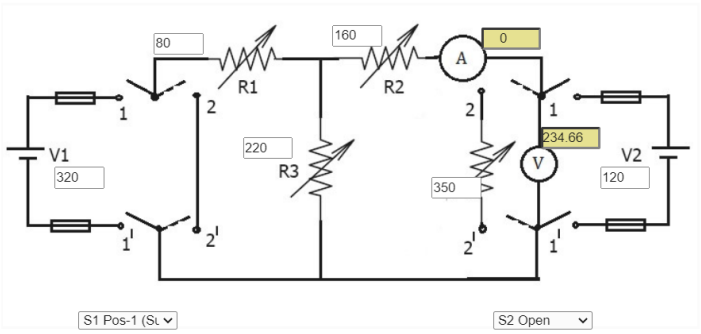
Select S1 to Position-1 & S2 to position-2 (Load) Then click on Run.

Run

Load current (I_{RL}): 0.412661195779

Next

Experiment: Verification of Thevenin's Theorem



Control Panel

Circuit to determine Thevenin Voltage(V_{Th})

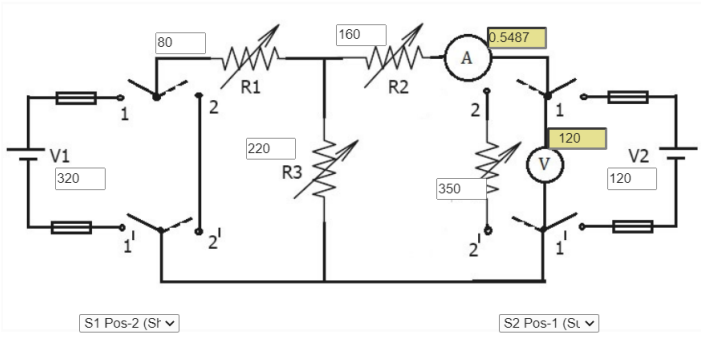
Select S1 to Position-1 (Supply) & S2 to Position (Open) Then click on Run.

Run

Thevenin Voltage(V_{Th}): 234.6666666666

Next

Experiment: Verification of Thevenin's Theorem



Control Panel

Circuit to determine Thevenin Equivalent Resistance(R_{Th})

Select S1 to Position-2 (Short) & S2 to Position-1 (Supply). Then click on Run.

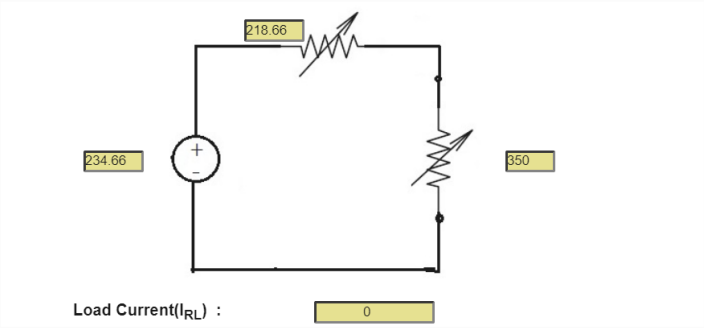
Run

Supply Voltage (V_2) : 120 & Supply Current: 0.5487

Norton Resistance (R_{Nort}): 218.6666666666

Next

Experiment: Verification of Thevenin's Theorem



Control Panel

Circuit to determine Load Current from Thevenin Equivalent Circuit

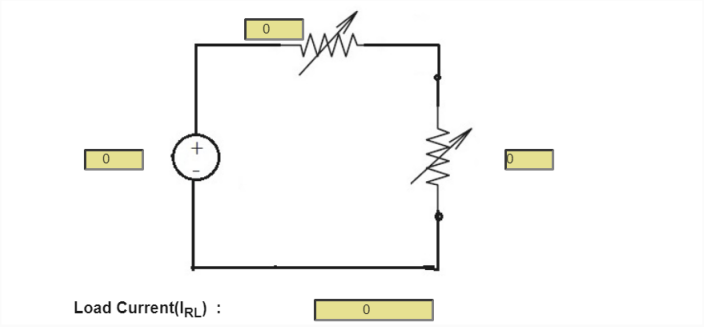
To obatin Load Current(I_{RL})) from Thevenin Equivalent Circuit obatined
Click on Run.

Run

Finish

The Final set of Readings with Observation Table :

Experiment: Verification of Thevenin's Theorem



Control Panel

Circuit to determine Load Current from Thevenin Equivalent Circuit

To obatin Load Current(I_{RL})) from Thevenin Equivalent Circuit obatined
Click on Run.

Run

Finish

Observation Table

SL No.	Actual Load Current(I_{RL})	Load Voltage(V_L)	Load Resistance (R_L)=V_{RL}/I_{RL}	Thevenin Voltage(V_{Th})	Supply Voltage(V_2)	Ammeter Reading(I)	Thevenin Resistance R_{Th}=V_2/I	Load current (I_{RL})=V_{Th}/(R_{Th}+R_L)
1	0.2838709	85.161290	300	146.66666	110	0.5076923	216.66666	0.2838709
2	0.4126611	144.43141	350	234.66666	120	0.5487804	218.66666	0.4126611

Observation Table :

Observation Table

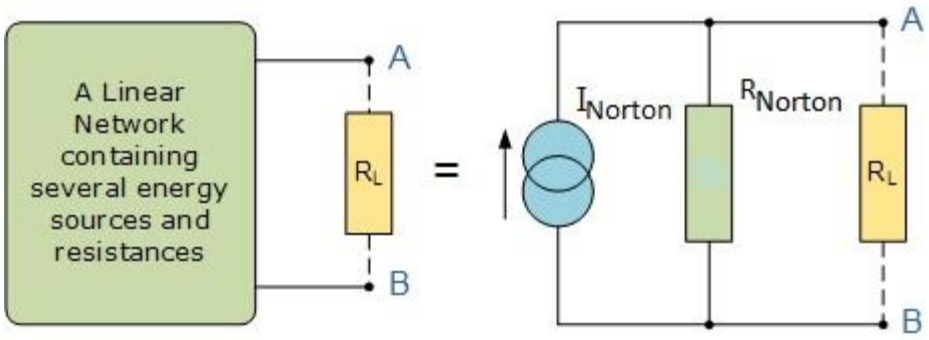
SL No.	Actual Load Current(I_{RL})	Load Voltage(V_L)	Load Resistance (R_L)=V_{RL}/I_{RL}	Thevenin Voltage(V_{Th})	Supply Voltage(V_2)	Ammeter Reading(I)	Thevenin Resistance $R_{Th}=V_2/I$	Load current (I_{RL})=$V_{Th}/(R_{Th}+R_L)$
1	0.2838709	85.161290	300	146.66666	110	0.5076923	216.66666	0.2838709
2	0.4126611	144.43141	350	234.66666	120	0.5487804	218.66666	0.4126611
3								
4								

Result : Hence, the Thevenin's Theorem is verified.

Part 2(Norton's Theorem)

Aim : To study and verify the Norton's Theorem

Theory : Nortons Theorem states that "*Any linear circuit containing several energy sources and resistances can be replaced by a single Constant Current generator in parallel with a Single Resistor*". Norton on the other hand reduces his circuit down to a single resistance in parallel with a constant current source.



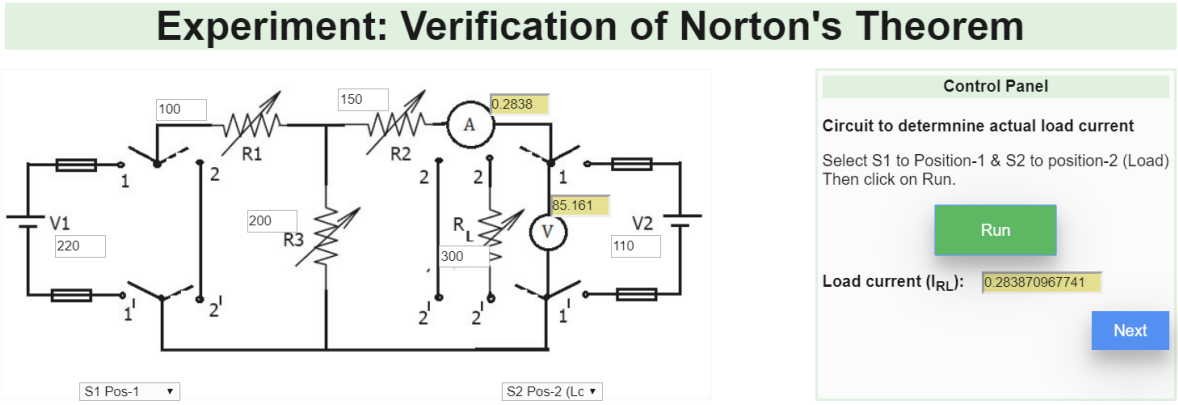
As far as the load resistance, R_L is concerned this single resistance, R_{Norton} is the value of the resistance looking back into the network with all the current sources open circuited and I_{Norton} is the short circuit current at the output terminals.

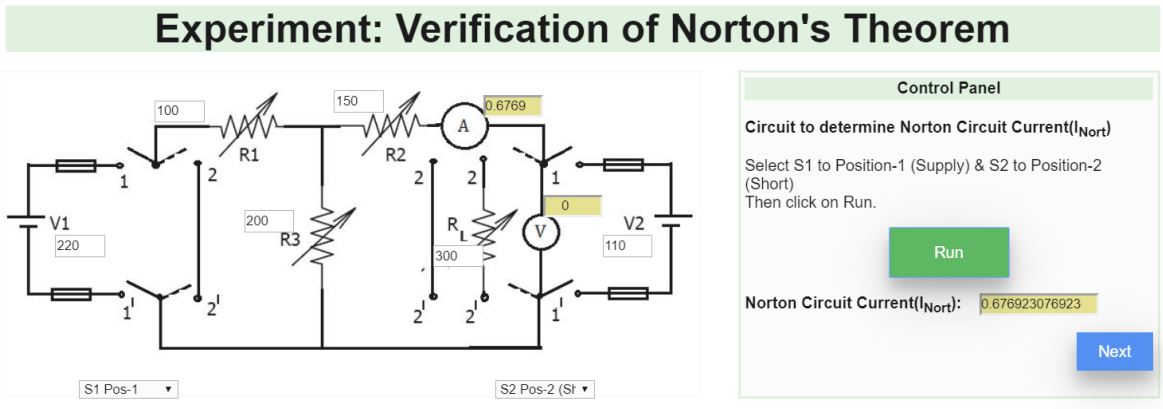
The basic procedure for solving a circuit using Nortons Theorem is as follows:

1. Remove the load resistor R_L or component concerned.
2. Find R_{Norton} by shorting all voltage sources or by open circuiting all the current sources.
3. Find I_{Norton} by placing a shorting link on the output terminals A and B.
4. Find the current flowing through the load resistor R_L.

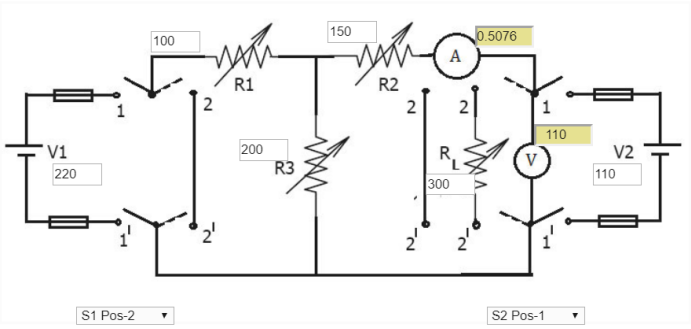
Observations :

For the 1st set of Observations :





Experiment: Verification of Norton's Theorem



Control Panel

Circuit to determine Norton Circuit Resistance(R_{Nort})

Select S1 to Position-2 (Short) & S2 to Position-1 (Supply). Then click on Run.

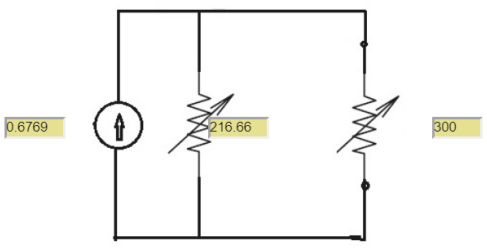
Run

Supply Voltage (V_2) : 110 & Supply Current : 0.5076

Norton Resistance (R_{Nort}): 216.6666666666

Next

Experiment: Verification of Norton's Theorem



Load Current(I_L) : 0

Control Panel

Circuit to determine Load Current from Norton Equivalent Circuit

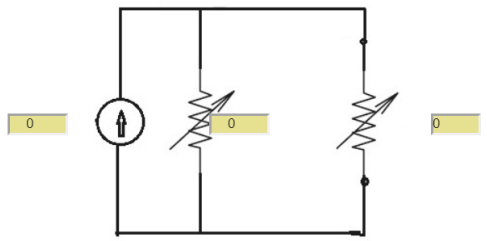
To obatin Load Current(I_{RL})) from Norton Equivalent Circuit obatined
Click on Run.

Run

Finish

The Final Set of Readings with Observation Table :

Experiment: Verification of Norton's Theorem



Load Current(I_L) : 0

Control Panel

Circuit to determine Load Current from Norton Equivalent Circuit

To obatin Load Current(I_{RL})) from Norton Equivalent Circuit obatined
Click on Run.

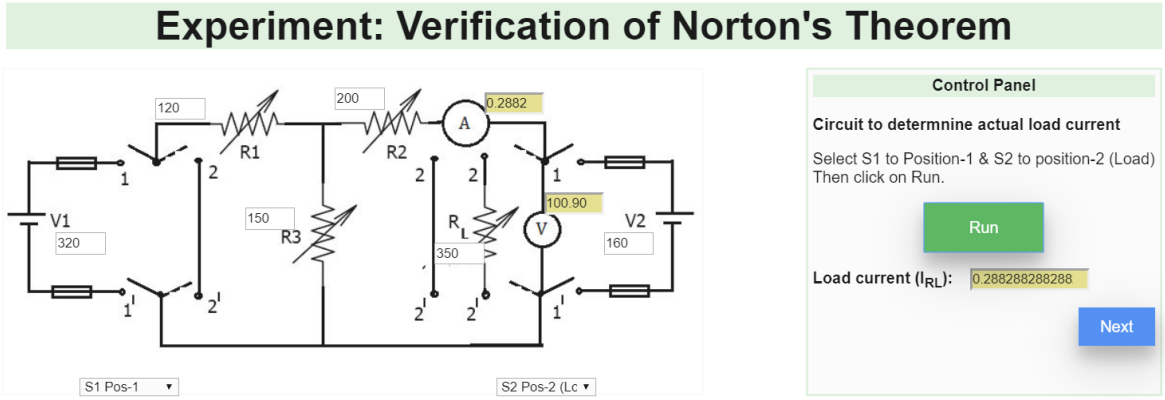
Run

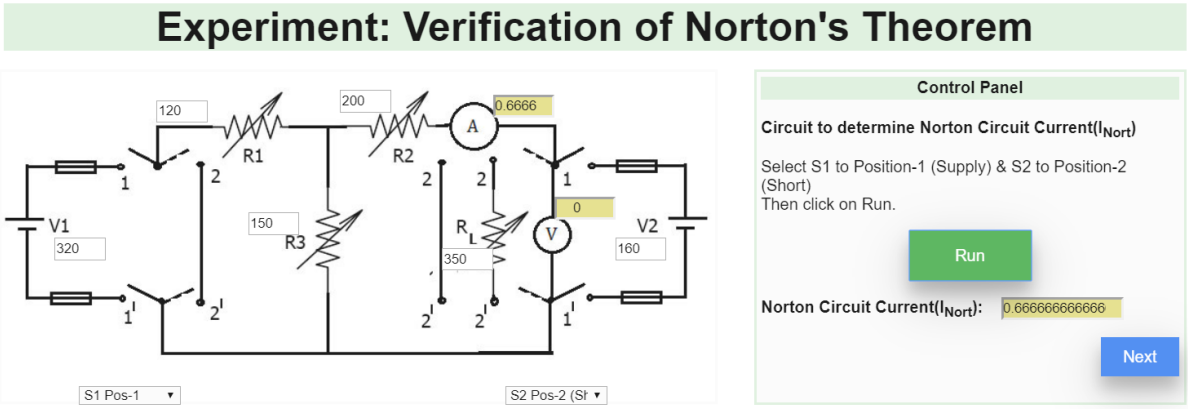
Finish

Observation Table

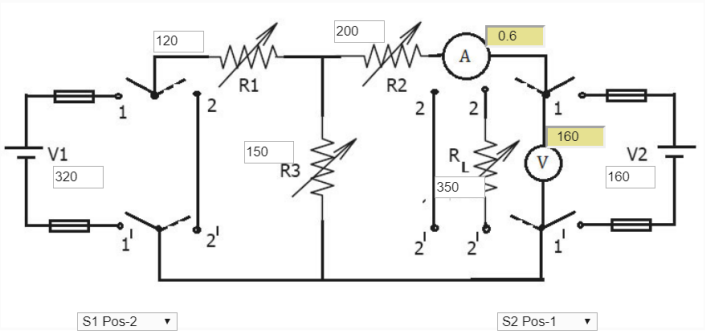
SL No.	Actual Load Current(I_{RL})	Load Voltage(V_L)	Load Resistance (R_L)=V_{RL}/I_{RL}	Norton Circuit current(I_{Nort})	Supply Voltage(V_2)	Ammeter Reading(I)	Norton Resistance R_{Norton}=V_2/I	Load current (I_{RL})=I_{Nort}*R_{Nort}/(R_{Nort}+R_L)
1	0.2838709	85.161290	300	0.6769230	110	0.5076923	216.66666	0.2838709

For the 2nd set of Observations :





Experiment: Verification of Norton's Theorem



Control Panel

Circuit to determine Norton Circuit Resistance(R_{Nort})

Select S1 to Position-2 (Short) & S2 to Position-1 (Supply). Then click on Run.

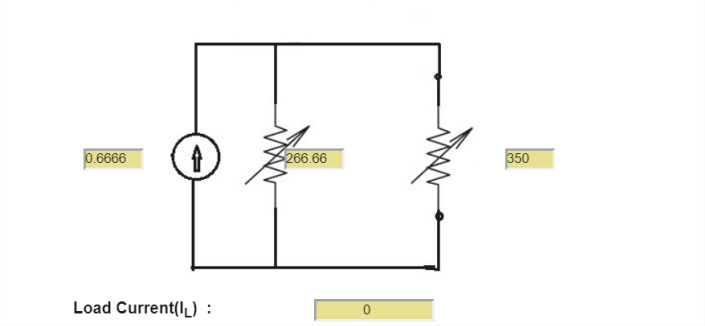
Run

Supply Voltage (V_2) : 160 & Supply Current : 0.6

Norton Resistance (R_{Nort}): 266.6666666666

Next

Experiment: Verification of Norton's Theorem



Load Current(I_L) : 0

Control Panel

Circuit to determine Load Current from Norton Equivalent Circuit

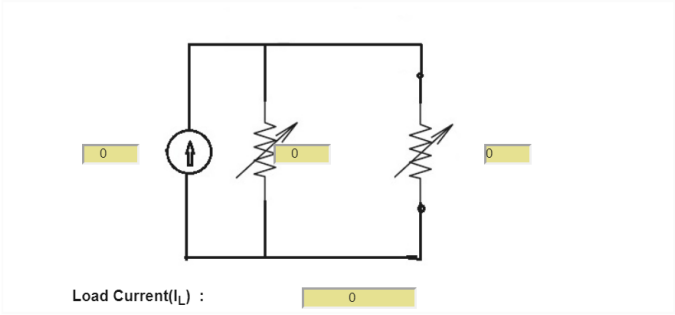
To obatin Load Current(I_{RL})) from Norton Equivalent Circuit obatined
Click on Run.

Run

Finish

For the Final set of Readings with Observation Table :

Experiment: Verification of Norton's Theorem



Load Current(I_L) : 0

Control Panel

Circuit to determine Load Current from Norton Equivalent Circuit

To obatin Load Current(I_{RL})) from Norton Equivalent Circuit obatined
Click on Run.

Run

Finish

Observation Table

SL No.	Actual Load Current(I_{RL})	Load Voltage(V_L)	Load Resistance $(R_L)=V_{RL}/I_{RL}$	Norton Ciucit current(I_{Nort})	Supply Voltage(V_2)	Ammeter Reading(I)	Norton Resistance $R_{Norton}=V_2/I$	Load current $(I_{RL})=I_{Nort}*R_{Nort}/(R_{Nort}+R_L)$
1	0.2838709i	85.161290:	300	0.6769230`	110	0.5076923i	216.66666i	0.2838709i
2	0.2882882i	100.90090i	350	0.6666666i	160	0.6	266.66666i	0.2882882i

Observation Table :

Observation Table

SL No.	Actual Load Current(I_{RL})	Load Voltage(V_L)	Load Resistance (R_L)=V_{RL}/I_{RL}	Thevenin Voltage(V_{Th})	Supply Voltage(V_2)	Ammeter Reading(I)	Thevenin Resistance R_{Th}=V_2/I	Load current (I_{RL})=V_{Th}/(R_{Th}+R_L)
1	0.2838709	85.161290	300	146.66666	110	0.5076923	216.66666	0.2838709
2	0.4126611	144.43141	350	234.66666	120	0.5487804	218.66666	0.4126611

Result : Hence, the Norton's theorem is verified.