Electric Circuit Experiments

Basic Concept And Laws

1. Verify Kirchhoff's law

A report by

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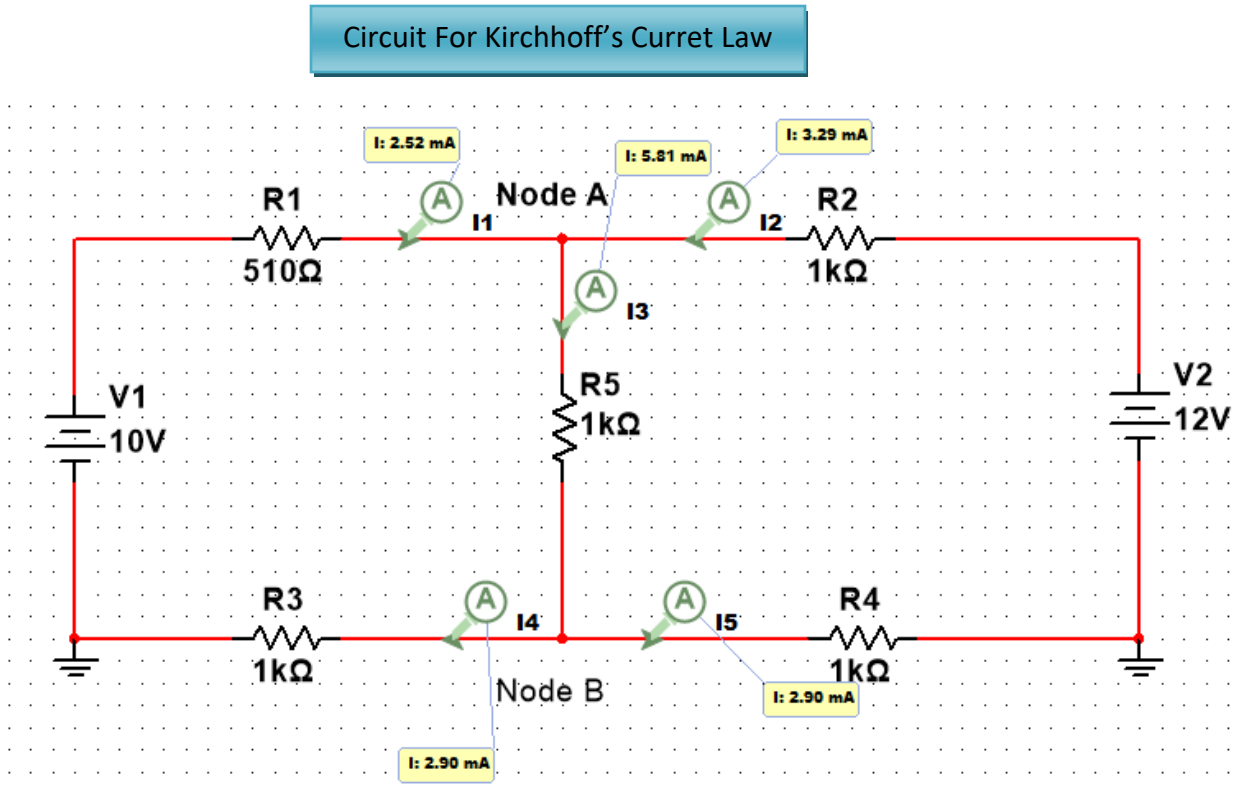
Experiment Principal: There are two laws of Kirchhoff; respectively Kirchhoff's Current Law (KCL) and Kirchoff's Voltage Law(KVL).

#1. Kirchhoff's current law states that, for any node (junction) in an electrical circuit, the sum of currents flowing into that node is equal to the sum of currents flowing out of that node; or equivalently: The algebraic sum of currents in a network of conductors meeting at a point is zero.

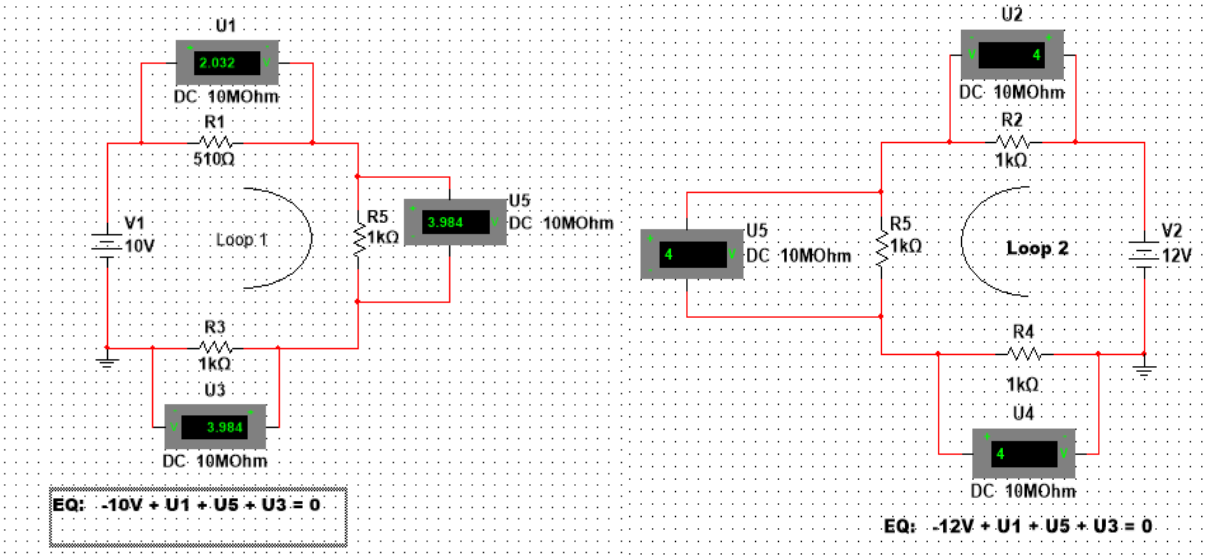
#2. Kirchhoff's voltage law states that the algebraic sum of the potential differences in any loop must be equal to zero.

The objective of this experiment is to verify the above rules.

Circuit:



Circuit For Kirchhoff's Voltage Law



Simulation Steps:

1. Open NI Multicim 14.0
2. Draw the circuit for Kirchhoff's Current Law.
3. Start simulation and put the data in the datasheet.
4. Draw the circuits of Kirchhoff's Voltage Law.
5. Start Simulation and put the data in the datasheet.

Simulation Data:

For KCL:

I_1	I_2	I_3	I_4	I_5
2.52mA	3.29mA	5.81mA	2.90mA	2.90mA

For KVL:

Data Of Loop 1

V_1	U_1	U_3	U_5
10V	2.032V	3.984V	3.984V

Data Of Loop 2

V_2	U_2	U_4	U_5
12V	4V	4V	4V

Analysis and conclusion:

In the circuit of KCL it is evedent that

In node A, $+I_1+I_2-I_3=0$ or, $+2.52 +3.29 -5.81=0$

In node B, $+I_3-I_4-I_5=0$ or, $+5.81 - 2.90 -2.90=0$

So, Kirchhoff's Current Law proves.

For the circuits of KVL, in the loop 1,

$$-10V + U1 + U5 + U3 = 0$$

$$\Rightarrow \quad 10V = 2.032V + 3.984V + 3.984V$$

$$\Rightarrow \quad 10V = 10V$$

In the loop 2,

$$-12V + U1 + U5 + U3 = 0$$

$$\Rightarrow \quad 12V = 4V + 4V + 4V$$

$$\Rightarrow \quad 12V = 12V$$

So, Kirchhoff's Voltage Law proves.

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2. Measure current in each branch.
Testify that for node A and B,
the algebraic sum of all branch current is zero.

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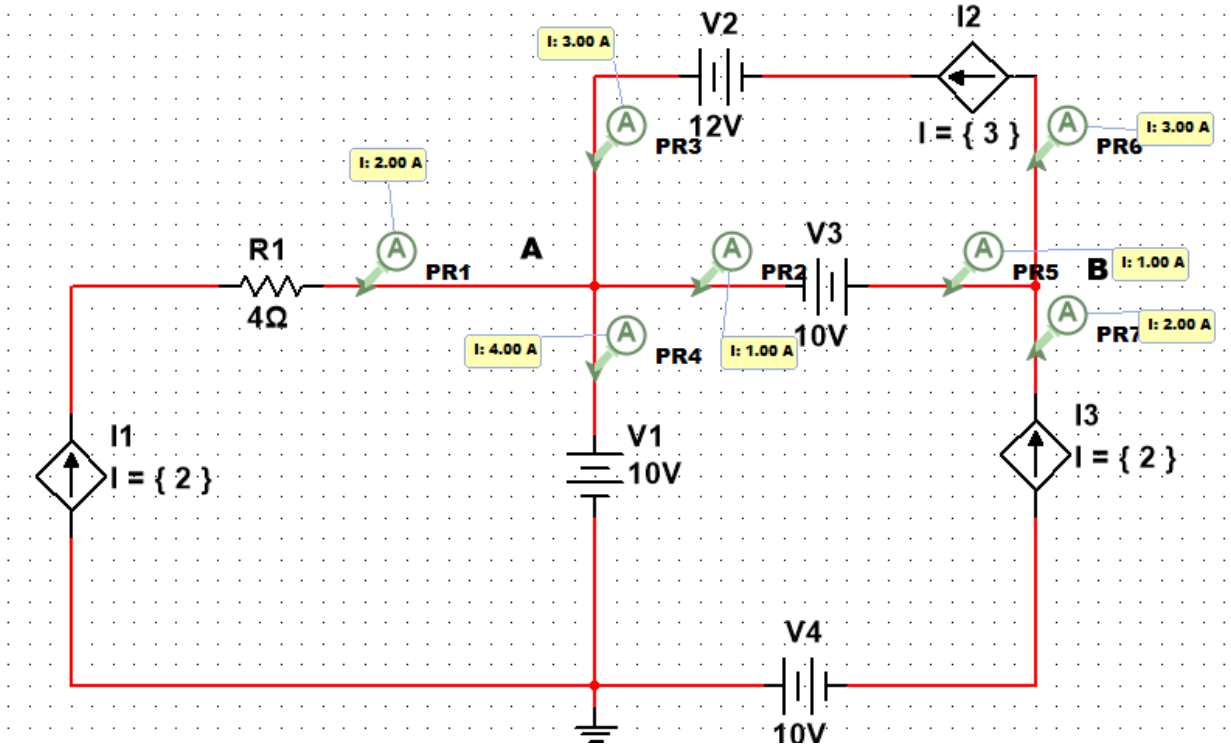
Circuit:



Datasheet:

Node A:

I_1	I_2	I_3	I_4
2A	1A	3A	4A

Node B

I_5	I_6	I_7
1A	3A	2A

Analysis:

The current law of Kirchhoff states, the algebric sum of incoming and outgoing current in a node of a circuit will be zero.

According to KCL, in node A, $+I_1 + I_3 - I_2 - I_4 = 0$

and in node B, $+ I_5 + I_7 - I_6 = 0$

Calculating data from the datasheet,

In node A, $+ 2 + 3 – 1 – 4 = 0$;

And in node B, $+ 1 + 2 – 3 = 0$.

From the calculation above it is evedent that in node A and node B the algebric sum of current is 0.