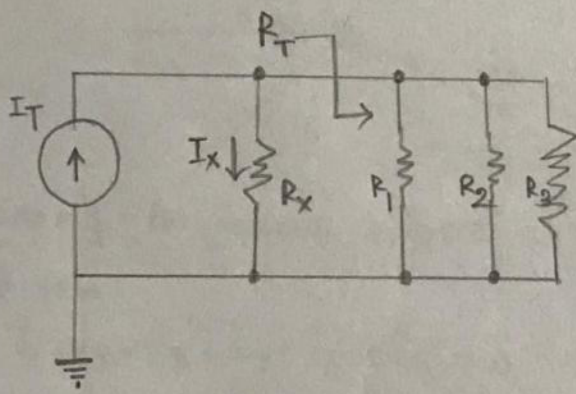
Objectives:

- Learn how to connect a parallel circuit on a breadboard.
- Validate the current divider rules.
- Verify Kirchhoff's current law.
- Verify KCL and KVL in Ladder circuit.

Theory:

Current division refers to the splitting of current between the branches of the divider. The current in the various branches of such a circuit will always devide in such a way as to minimize the total energy expended. The formula describing a current divider is similar in form to that for the voltage divider.



$$I_x = \frac{R_T}{R_x + R_T} \cdot I_T$$

The ratio of the total resistance to individual resistance is the same ratio as individual (branch) current to total current. This is known as the current divider formula, and it is a short-cut method for determining branch

Ladder diagrams are specialized schematics commonly used to document industrial control logic systems. They are called "ladder" diagrams because they resemble a ladder, with two vertical rails (supply power) and as many "rungs" (horizontal lines) as there are control circuits to represent.

An electronic color code is used to indicate the values or ratings of electronic components, usually for resistors, but also for capacitors, inductors, diodes and others. A separate code, the 25 pair color code, is used to identify wires in some telecommunications cables.

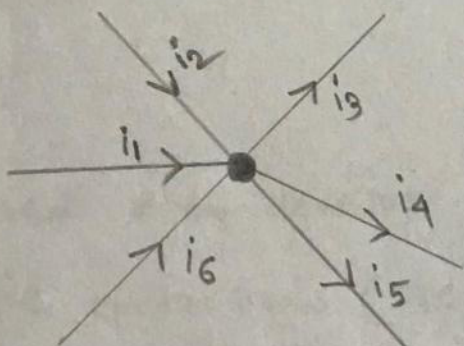
Ladder logic is used ~~b~~ to develop software for programmable logic controllers (PLCs) used in industrial control applications. The name is based on the observation that programs in this language resemble ladders, with two vertical rails and a series of horizontal rungs between them.

currents in a parallel circuit when the total current is known.

Kirchhoff's law developed by a german physicist Gustav Kirchhoff. The first law deals with the flow of current and is popularly known as Kirchhoff's current law (KCL) while the second one deals with the voltage drop in a closed network and is known as Kirchhoff's voltage law (KVL).

KCL states that "the algebraic sum of all the current at any node point or a junction of a circuit is zero.

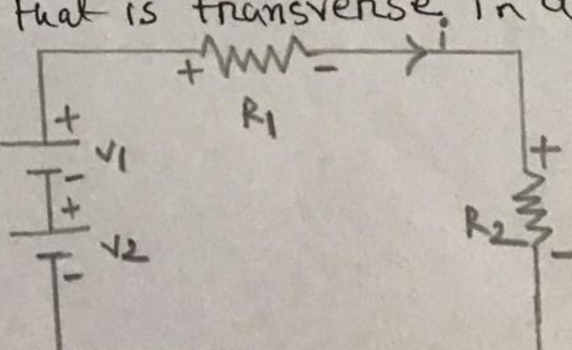
$\Sigma I = 0$



Considering the above figure as per the Kirchhoff's current law

$$i_1 + i_2 - i_3 - i_4 - i_5 + i_6 = 0$$

KVL states that the algebric sum of the voltages in any closed path of network that is transverse in a single direction is zero.



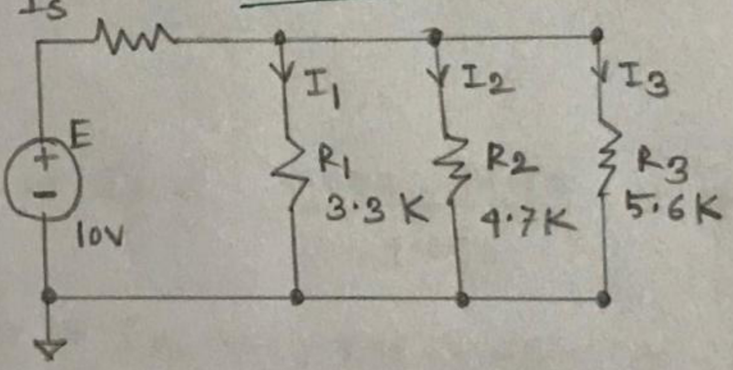
$-V_1 + (-V_2) + iR_1 + iR_2 = 0$

Apparatus:

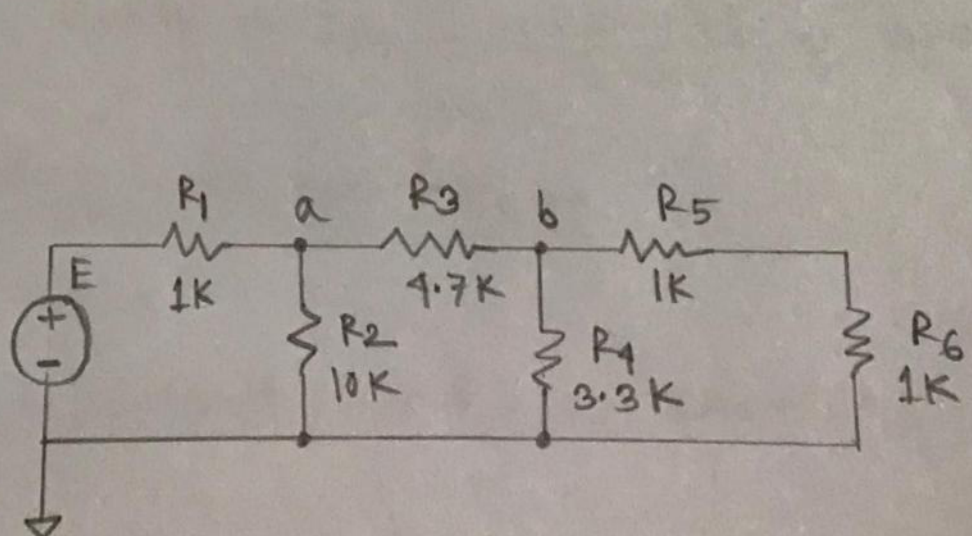
1. Trainer board
2. Resistors (1K, 3.3 KΩ, 4.7 KΩ, 5.6K, 10K)
3. Digital Multimeter (DMM)
4. Connecting wire

Circuit Diagram:

circuit: 1



circuit: 2



Calculating for Table 2:

% Error = (Theoretical value − Experimental value)/Theoretical value

Experimental readings

$I_S = 4.13\ mA$

$I_{R1} = 1.82\ mA$

$I_{R2} = 1.25\ mA$

$I_{R3} = 1.06\ mA$

Theoretical values

$I_S = 4.098\ mA$

$I_{R_1} = 1.788\ mA$

$I_{R2} = 1.256\ mA$

$I_{R3} = 1.05\ mA$

$$\% \text{ Error of } I_S = \frac{4.098 - 4.13}{4.098} = 0.781$$

$$\% \text{ Error of } I_{R_1} = \frac{1.788 - 1.82}{1.788} = 1.80$$

$$\% \text{ Error of } I_{R2} = \frac{1.256 - 1.25}{1.256} = 0.478$$

$$\% \text{ Error of } I_{R3} = \frac{1.05 - 1.06}{1.05} = 0.952$$

Calculating value for table 3:

$I_S = 4.13$

Sum of individual current: $I_{R_1} + I_{R2} + I_{R3} = 4.13$

Calculation for Table 4:

Theoretical Req = 2440.16

Experimental Req = 2418

$$\% \text{ Error} = \frac{2440.16 - 2418}{2440.16} = 0.908$$