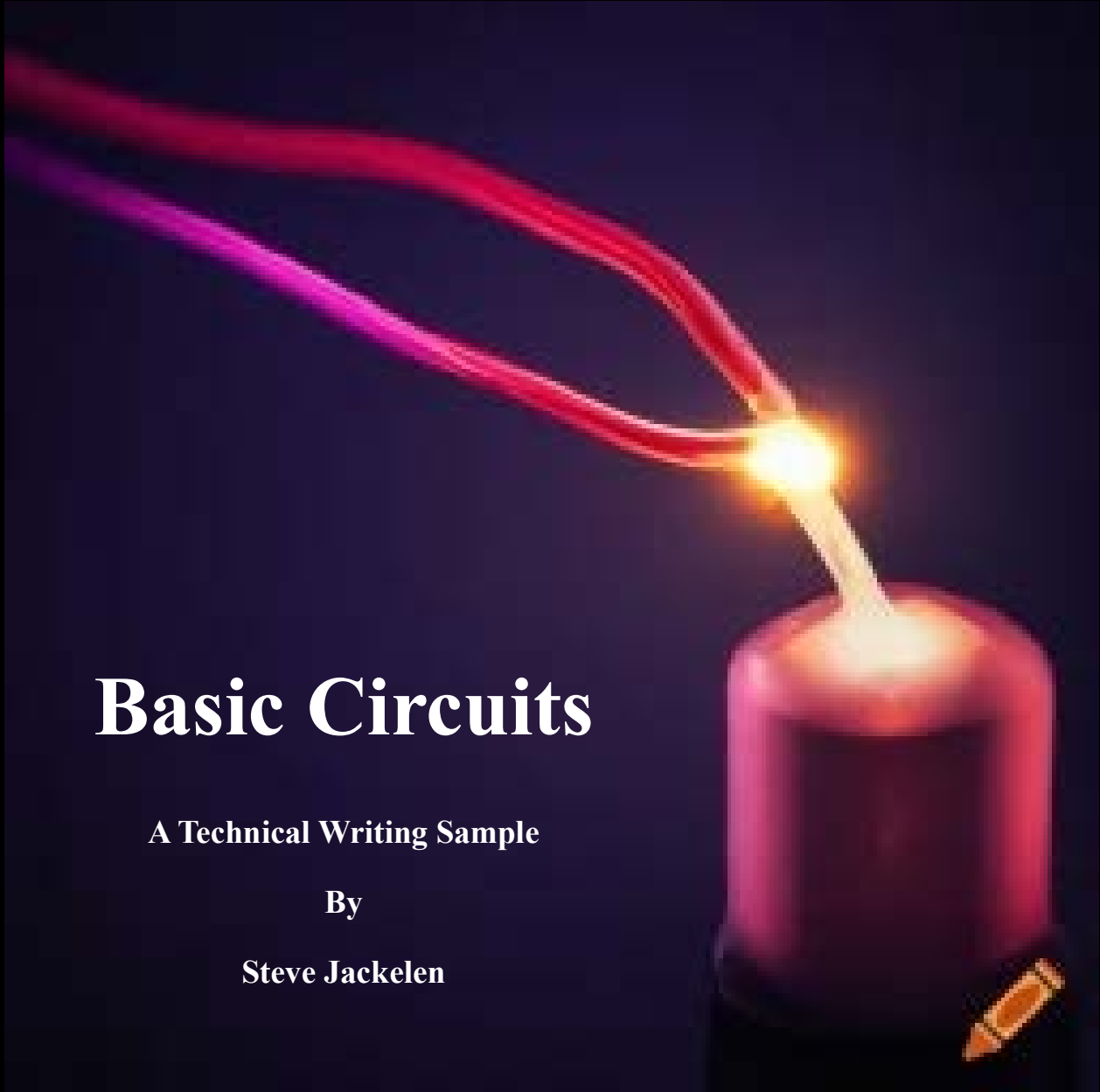


Basic Circuits

A Technical Writing Sample

By

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Basic Circuits

This tutorial will help describe the basics of a complete circuit. You will learn the difference between a power source, a resistor, and voltage and how they interact with each other. Other topics that will be covered include copper, electric current, and Ohm's Law.

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Introduction

Definition: A circuit is a closed path that allows electricity to flow from one point to another.

To give a visual representation of this definition look to Figure 1 below:

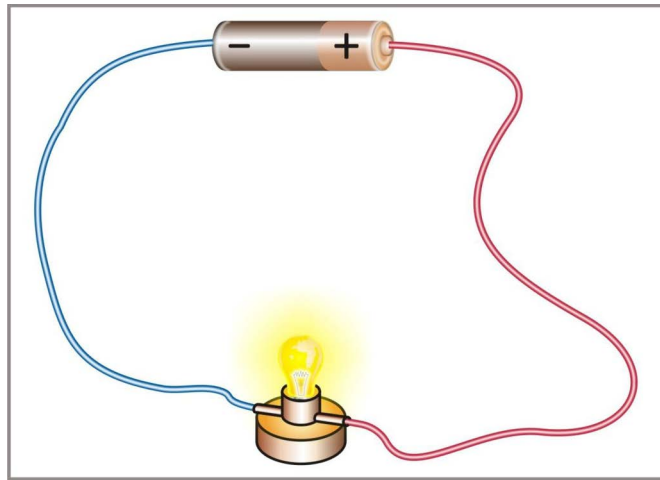


Figure 1: A Basic Complete Circuit

The wire for the circuit leaves the battery and continues to one end of the light bulb. Another wire leaves the light bulb and back to the battery. This is a complete circuit.

Copper

For all intents and purposes we'll assume that the wires in the circuit are made from copper, which is common in electrical engineering. The reasons copper is generally used are:

1. Heat resistant
2. High electrical conductivity
3. Inexpensive
4. Ductile
5. Thermal resistant

Electric Current

Definition: An electric current is a flow of charged particles, such as electrons or ions, moving through an electrical conductor or space. It is defined as the net rate of flow of electric charge through a surface.

In conventional current flow the positive charges flow from the positive end of the battery toward the negative end. However, in metals like copper the negatively charged electrons are the charge carriers and move from negative to positive. This is known as electron flow.

Electric current is measured in the International System of Units (SI) in Amperes (A) or amps. An amp is the flow of electric charge across a surface at the rate of one coulomb per second. On an electrical diagram, the flow of current is shown with the symbol i as shown in figure 2.

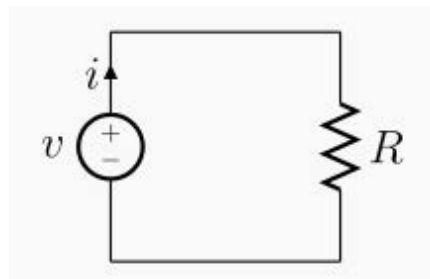


Figure 2: A Basic Electrical Circuit Diagram

Ohm's Law

Definition: Ohm's law states that the current through a conductor between two points is directly proportional to the potential difference across the two points.

In simplified terms, Ohm's law states that Voltage (V) is equal to the Current (I) multiplied by the Resistance (R). The equation can also be manipulated to find the current and the resistance. If you have two of the three variables you can calculate the other.

The equations for Ohm's law are shown below in Figure 3.

$$V = IR \quad I = \frac{V}{R} \quad R = \frac{V}{I}$$

Figure 3: Equations of Ohm's Law

Power Sources

In this section we'll go more in-depth on the topics of power sources, batteries, and voltage.

Power Sources

Definition: A power source is a source of power. In terms of electric power it is the rate at which electrical energy is transferred by an electric circuit; usually produced by electrical generators or batteries.

For a circuit to work it needs a power source. Common power sources include: power plants, engines, reactors, and batteries. For this tutorial we'll assume that each power source is a simple battery.

Power sources have their own symbols when drawn on electrical schematics and can be seen in Figure 4 below:

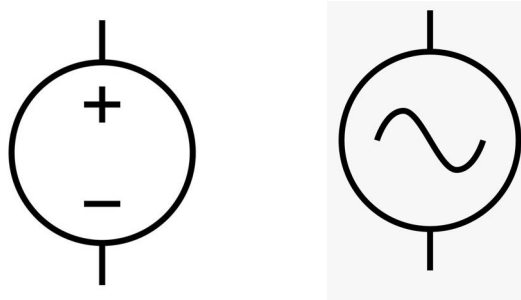


Figure 4: The symbols for DC and AC power sources.

Batteries

Definition: A container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power

A battery acts as the power source for many machines and household appliances. When these machines work it is because the battery is inserted into its designated slot and it completes the circuit.

Batteries consist of two terminals: the cathode and the anode. The cathode is the positive terminal, or the part of the battery marked with a positive (+) sign; while the anode is the negative terminal, or the part marked with a negative (-) sign.

The anode is the source of electrons that will flow through the circuit to the positive terminal. When the electrode materials are used once and discarded it is because the electrodes are irrevers-

ibly changed during discharge. This is typical for alkaline batteries which are used in portable electronics.

Rechargeable batteries can be used multiple times because the electrodes can be restored to their original charge using applied electric current, or reverse current. Lead-acid batteries are an example of rechargeable batteries and are used in laptops.

The symbol for batteries on electrical schematics is shown below in Figure 5:

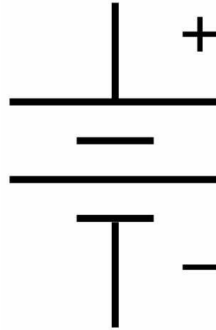


Figure 5: The symbol for a battery.

Voltage

Definition: An electromotive force or the potential difference between two points.

A volt, in the International System of Units, is labeled with a V. Voltage refers to the work needed per unit of charge to move a test charge between two points, which is why voltage is also referred to as electric pressure, electric tension, or (electric) potential difference.

The conventional current in a wire or resistor always flows from higher voltage toward lower voltage. Also, negatively charged objects are pulled towards higher voltages, while positively charged objects are pulled toward lower voltages.

To measure voltage in a circuit you can use a voltmeter.

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