Electronic Fundamentals Part IV

Sources of Electricity

In our last discussion we talked about magnetism. Generators make use of this principal to produce electricity. We will not repeat our discussion of generators here. We will discuss other sources of electricity.

Batteries is a very prominent source of electricity. While generators are capable of producing alternating current and direct current we should be aware that other sources of current can only product direct current. Examples of these other sources would be batteries, solar cells and fuel cells. We abbreviate alternating current as "AC" and direct current as "DC.

Batteries are divided into groups know as dry cells and storage cells. An example of a dry cell is a flashlight battery. A car battery is a storage cell. Generally speaking a dry cell is not rechargeable and a storage cell is rechargeable. Dry cells may also be know as primary cells and storage cells as secondary cells.

Dry cells have a paste like material that is inside a metal container. Inside this past material is a carbon rod that has a terminal attached for making a connection to a circuit that uses electricity. The metal container has another similar terminal attached to allow a complete circuit. The voltage of a dry or primary cell is always 1.5 volts. The voltage of a storage or secondary cell can vary from 1.2 volts per cell to 2.3 volts depending on that materials used to construct the cell.

All cells have a material inside that chemically reacts with metal plates either inside the battery or with the metal container. The result of this reaction is the production of electricity available at the batteries terminals. As this chemical reaction occurs the materials slowly change in chemical composition. This new material is not able to produce electricity and the batteries voltage and available current slowly decrease until it is so low it is not usable. At this point the battery is no longer usable and should be replaced.

Storage cells as we said are rechargeable. By applying a voltage to their terminals we are able to reverse the chemical process and restore the battery to it's original condition. Thereby, it is capable again or producing electricity. On a practical basis after several hundred charges the chemical reaction can no longer be reversed and the battery is no longer capable of supplying sufficient voltage and current.

Different types of storage cell can be made of several different types of materials. Each has it's on unique properties and produces different voltages. In some instances the battery sizes and voltages produced are near enough in size to dry cells that they can be used interchangeable. However, generally storage cells have lower voltage and we should verify they will function adequately in our equipment before we trust them for critical operations.

Recharging storage cells should be done only with equipment designed for that specific type of battery. Using the wrong equipment can result in damage to the battery or possibly can cause an electrical fire.

Always observe polarities when connecting batteries to a circuit and especially when you are connecting them to a charger to be charged. Again, this can damage them or the circuit or equipment they are connected to.

Solar cells produce DC voltage and have two terminals very similar to batteries. The difference is that sunlight or ambient light from overhead lights causes current flow in cells rather than a chemical reaction causing current to flow. These cells are usually made of a silicon compound that reacts to light. All precautions that apply to other types of cells applies to solar cells.

Fuel cells are a special type of cell usually produced by the government. It is used to supply spacecraft with electrical power. Oxygen and hydrogen are combined in a cell and produce electricity which is removed from the cell by two terminals as with other cells. Water is a byproduct of the process and must be removed from the cell for it to continue to function. The reason these are not used in mass is because of the requirements for storing the oxygen and hydrogen. Both are difficult to store in a pure form for an extended length of time. However, recently some progress has made in this area by combining these products with other chemicals and re resulting product is more stable.

Thermal couples is another example of a voltage source. It is considerable different from the cells previously discussed as it does not have a chemical reaction taking place between two terminals to produce electricity. Two dissimilar metals are directly joined and each is a terminal. Voltage flow across the junction of metals is directly influenced by heat. The more heat the more the voltage. The available current is very low across this junction. Typically, these are used more for heat measurement than voltage generation. However, for certain spacecraft with nuclear heaters thermal couples are used to produce electricity from the heat of the nuclear heaters.

This has been a short overview of voltage sources other than generators which we discussed in an earlier part. This also concludes our introductory overview of electronics. In the next several parts we will discuss capacitance, inductance and resistance and their relationship.