Electronic Fundamentals Part III

At the beginning of part I we said that electronics is based on the concepts of electricity and magnetism. In the first two parts we discussed some basic concepts associated with electricity. Now we will consider magnetism.

Earlier we saw that current flows in electronic components. Current flow is the movement of electrons. Electrons and voltage to cause them to flow can be produced by several different sources. Batteries, solar cells and generators are examples of voltage sources. Later in our series on electronic fundamentals we will discuss these other voltage sources. In this part we are going to consider magnetism. Generators use magnetism to product electricity. As we've said before electricity is the flow of electrons pushed by voltage.

Magnets have a magnetic field around and through them. When a wire is passed through this magnetic field a small electrical current flows in the wire provided that the two ends of the wire are connected to form a complete path or circuit for the electrons. The more turns of wire that is passed through the magnetic field the more current is produced. The amount of current is directly proportional to the turns of wire passing through the magnetic field. Twenty turns of wire produces twice the amount of current flow as ten turns. Also, the stronger the magnetic field produced by a magnet the more current will flow. Further, the faster the wire moves through the magnetic field the more current will be produced. To summarize for a moment, the number of turns of wire, the strength of the magnetic field and the speed the wire is moved through the magnetic field determines the amount of current flow. This combination of wire and magnet is called a generator. Generators vary from a few inches to many feet in size. The wiring or magnet is turned by an outside power source such as a gasoline motor for small generators or steam power produced from burning coal or oil or from water passing over or through a dam on a river. Please note that an alternator is a specialized form of a generator and uses the same principals just discussed to produce electricity.

Electricity passing through a wire also produces a magnetic field. As before the more turns of wire the stronger the magnetic field. This magnetic field can be used to open and close relays. When used in conjunction with magnets it can be used to produce mechanical work such as an electric motor.

Two turns of wire in close proximity can be used to pass current flow from one to the other. This flow is possible by applying voltage to one coil which produces a magnetic field cutting through the second coil thereby producing current flow in the second coil. The number of turns and their proximity to each other and several other smaller factors determines the amount of current flow. Remember there must be a movement of the magnetic field across a coil to product current flow. As there is no movement between the two coils just mentioned the current in the first coil must be somehow changing to cause the magnetic field to vary across the second coil. This is accomplished by applying an alternating or varying current to the first coil. Generators can produce alternating current. Oscillators which we will discussion in a later part is also another source of

alternating current. Batteries, solar cells and the like only produce direct current which cannot be used to cause current flow in the second or secondary coil of a transformer.

The voltage that drives current that is produced by magnetic fields cutting across several turns of wire do not all work together completely to reinforce each other to produce more voltage. While they are all summed together there is a small amount of back voltage produced. This back pushing, or just back voltage, must be considered when engineers design circuits. In circuits that operate at radio frequencies this back voltage can be used to block or pass certain frequencies. Thus magnetism has an influence on how radio frequencies are handled in electronic circuits.

Speakers and headphones also use magnetism. Small magnets inside them are attached to paper or metal cones. Voltage drives current through a coil of wire situated inside or outside the magnetic. This voltage is varied to correspond with an audio frequency representing voice, CW or other intelligible information. The magnetic field produced in the coil causes the magnet and cone assemble mentioned a moment ago to move at the driving audio frequency. This in turn causes the air around it to move or vibrate and we hear the audio information.

As you have seen magnetism is very essential to electronics. It produces electricity, causes relays to operate and it is necessary for transformers to operate. It's properties must be considered when designing radio frequency circuits and it causes speakers to operate . Electrical and magnetic principals are the basis of electronics.