THE BASICS OF ELECTRONICS

While most aftermarket EFI systems are fairly user friendly, it is a good idea to brush up on your "basic electronics 101" in case anything goes wrong and you need to diagnose small problems. Most fuel-injection problems can easily be solved with even just a rudimentary understanding of electricity.

When working with aftermarket fuel injection systems, it is helpful to have a basic knowledge of electricity and its principals. However, it isn't required that you have a degree in electrical engineering to be able to install and use one.

In order to understand and use electronic fuel injection systems effectively, it is necessary to have at least a basic understanding of some of the general principles of electricity and electronic devices. This will allow you to easily set up your system and will greatly aid you in troubleshooting the little gremlins that will inevitably show up somewhere in your projects. It is not necessary for you to be an engineer or have a degree in computer programming or electronics to be able to successfully navigate your way through a modern EFI system. Most are very user friendly and can be easily manipulated to get the desired results. However, it certainly helps if you know how to use the basic testing equipment and diagnostic methods to ensure your electronic components are working properly.

This chapter will briefly cover the general principles of electricity and electronic devices, but if you wish to really dig in and grasp some of the more technical subjects, a trip to the local bookstore will provide access to any number of books covering topics from the basic principles all the way through to the most complex circuits and their functions. The subject of electricity is so broad itself that covering everything involved is well beyond the scope of this book. For now, we'll just

address the aspects that will directly relate to building and troubleshooting an EFI project.

Voltage

The volt is probably the most recognizable term in any discussion about electronics, though it is often misunderstood and misused. Basically, the voltage of any electrical circuit is a measurement of the electromotive force, or EMF, within that circuit. It is this force, or electrical pressure, that we are talking about. The potential amount of work that can be done in any situation depends on the amount of available force you have to get the job done with. The more work there is to accomplish during a given amount of time, the more force is required to do it. In electricity, voltage is our force. The more voltage we have, the more muscle we can flex when trying to get our mission accomplished. Technically, a volt is defined as the electromotive force that causes a current of one ampere through a resistance of one ohm.

In real life it might be easier to imagine a garden hose spraying water. The water pressure in the hose is similar to our volt. If the size of our hose stays the same and we require a higher volume of water from the hose, then we must increase the pressure. In much the same way if we increase the voltage in a circuit of constant resistance, the size of our hose in this case, we will see a corresponding increase in the current flow through the circuit. Voltage is to water pressure, what amperage is to water flow, and the resistance in ohms is comparable to the size of our garden hose. So as you can see, if you want an increase in amperage (or water flow), you either have to decrease resistance (increase hose size), or add voltage (increase water pressure). Also, amperage can and will be decreased by a drop in voltage or an increase in resistance.

Voltage, amperage, and resistance are interrelated, as we will see shortly, through a law of physics called Ohm's law.

Batteries can be used to store and create their own voltage. Technically, a volt is defined as the force that causes a current of one ampere through a resistance of one ohm.

Amperes

Amperage, or amps, as it is most commonly called, is the measurement of the flow of electrons through a circuit; the flow of water though our garden hose, if you will. When we induce voltage into a circuit of some resistance, we cause electricity to move through the circuit. How much electricity, or how many electrons flow through the circuit, is our amperage.

One amp is measured as the amount of electrical flow that happens in a circuit with one ohm of resistance when a pressure of one volt is applied to it.

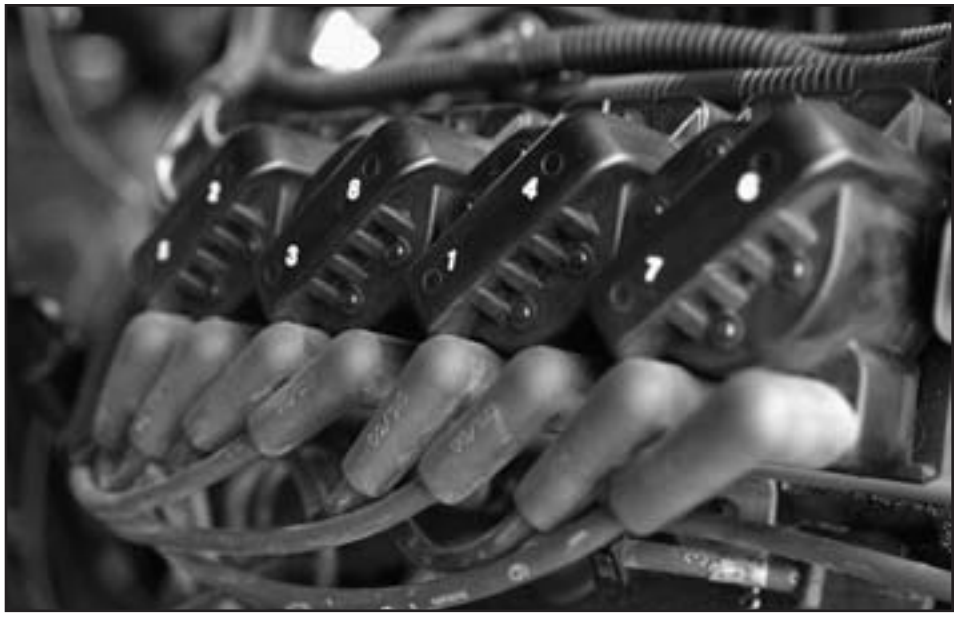
For example,

1 volt = 1 ohm x 1 amp, or V = O x A

Sometimes, the term amperage is referred to as inductance. The letter "I" is used to represent inductance or current. Likewise, at times resistance is used to refer to ohms, and is represented by the letter "R". Using these terms, our formula would look like this: V = R x I

I find it easy to remember this formula by associating the letters with other things. So, when I need to recall how to calculate a circuit's parameters using this particular formula, I just speak the phrase "Vermont equals Rhode Island" (V = R x I). However, I do realize that I am not the world's most entertaining author of unique acronyms, so I would encourage you to come up with whatever phrase you find that helps you remember the formula best!

If you look back again to our garden hose, you will see that if we can fill a one gallon bucket in one minute with a one inch diameter hose at a given pressure, then in order to fill the bucket faster, we need more flow of water from the hose. To achieve this, we can either keep the pressure the same and use a bigger diameter hose, or keep the hose



The ignition coils are used to store energy and send current, or amperage, to the spark plugs. One amp is the amount of electrical flow that happens in a circuit with a resistance of one ohm when a pressure of one volt is applied to it.