

CHAPTER 3



TOOLS AND EQUIPMENT



During the course of building your fuel-injection system, there are many specialized tools to help you along the way with everything from wire harness construction to troubleshooting a faulty sensor. Some equipment is very simple to use, while other pieces like the ones shown here are a bit more complex and take some special knowledge to use effectively.

In the course of building your custom EFI systems there will be many times that you will need to have access to some tools and diagnostic equipment. While in the building stages, you will need tools that help aid in the construction of the wire harness, and then once you have the system running,

there will inevitably be some problems that you will need some diagnostic equipment to find. Finally, in order to make your engine run well, you will need to data gathering equipment to ensure you are going in the right direction. In this chapter we will take a look at some of the tools and equipment you

will need to know how to use, and we discuss some basic procedures for using them.

While it will not be necessary for you to be an expert diagnostic technician, a “super tuner” with the laptop, or even be a veteran dynamometer operator, you will find that if you at least have a basic understanding of how these things work, it will make the overall project go much more smoothly.

DVOM

One of the most-often used tools in any EFI builder’s toolbox will be the DVOM, or digital volt and ohm meter. This is a multipurpose tool that will come in handy about a million times before you wear it out!

The typical DVOM has two test leads or probes coming out of it that can be connected to an electrical circuit for the purpose of testing the circuit for any number of the electrical properties that we talked about in the last chapter.

Most are capable of testing the resistance of a circuit, spark plug wire, or sensor. It can also be used to test voltage at just about any source. Most can read from just a few thousandths of a volt to up over 400 volts and commonly can read either AC or DC circuits. Also they can sense resistance values from down in the hundredths or



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even thousandths of an ohm to circuits that are basically infinite — usually when there is a short circuit, the DVOM will show a very high number in mega-ohms or millions of ohms!

This is a useful tool when testing the different sensor circuits for continuity in your EFI system. Many times a poor running engine has nothing to do with a poor calibration, but more to do with the fact that a sensor has malfunctioned or the wire harness has failed to deliver the signal from a particular sensor to the ECU. By using the two leads of the DVOM at each end of the wire from the sensor in question to the ECU, one can check the circuit's resistance to ensure there is a proper route for the signal to travel on.

Another good use is to test the operation of many of the sensors in the EFI system. Since most of these sensors rely on the basic principles of electronics like voltage and resistance, the DVOM is the perfect tool for investigation. For example, the ECU monitors the resistance value of the water temperature sensor to determine the right amount of correction factors to add or subtract from the base calibration maps when the engine temperature is outside the normal operating conditions. So, when the operation of this sensor is in question, we can use the DVOM to check the resistance values of the sensor

at a certain temperature and compare that information to published data from the sensor's manufacturer.

The throttle position sensor is yet another example of a common test for which the DVOM is required. This sensor is a linear potentiometer, which is a device that changes its resistance in proportion to the amount of travel it moves through. As the throttle opens, this sensor's resistance decreases and the voltage that travels across it increases, so it is a simple test to rotate the sensor and watch the values on the DVOM to make sure operates correctly.

There are many more uses for a good DVOM, and no serious EFI technician should be without one. The user's manual will normally have lots of useful information on how to use the meter efficiently and get the best results. These meters can be found reasonably priced and are readily available at most electronic stores and even hobby shops or hardware stores. There are still some older analog meters available, but I wouldn't recommend buying one, as they are not suited well for the small voltages and current flows of a modern EFI system.

TEST LIGHT

A test light is a very simple yet fast and accurate way to test for voltage on a circuit. Basically it is a device that has a probe on one end that can be used to quickly connect the light to a circuit. The other end of the test light usually has some length of wire and a means of quickly attaching to the end of the circuit to be tested, usually a ground source. If there is power available where the probe end of the light is touched, then it will travel up the probe and cause the bulb to light up, assuming you've made a good ground on the other end.

I find it very quick and easy to use a test light for checking the condition of automotive fuses. These fuses are almost always in an uncomfortable location to access and are difficult to visually inspect without removing them from the fuse panel.

I simply connect the alligator clip end of my test light to a ground source, and then touch the probe end to each side of the top of the fuse where the metal is exposed. If it lights the bulb on both sides of the fuse, then it is good. If



A test light is a very simple yet fast and accurate way to test for voltage on a circuit. Basically, it is a device that has a probe on one end and a small clamp on the other end. You can clamp one end to a ground and probe the circuit with the other. The bulb will light if voltage is present on the circuit.