



Tech Tip by InterMotive

Tools for Testing Electrical Circuits

Choosing the right test equipment for testing electrical circuits on today's vehicles has become a much more complex decision than it was twenty, or even ten years ago. Too often technicians make the decision of which tool to use based on whatever tool they are most comfortable using, or even the tool that was easiest to get to in their toolbox. When we are talking about testing basic electrical circuits (wiring and connections) on modern vehicles, the decision of which tool to use should be based upon the characteristics of the circuit being tested. Three important criteria to be considered are:

1. **What is the operating voltage of the circuit supposed to be?**
2. **What amount of current does the circuit usually carry when the circuit is working correctly?**
3. **Is the load device in the circuit sensitive to, or does it require, a specific (regulated) voltage to operate correctly?**

Three common pieces of test equipment for testing wiring and connections in a circuit are the conventional test light (circuit tester), the logic probe (sometimes referred to as an "electronic" test light), and the digital multimeter. Other test equipment might come into play when testing electronic systems, circuits, and components.

Using any one of these three common tools has its pros and cons. Take a quick look at how they compare when testing for power and grounds. We will assume that you are checking to see if a particular component has the power it needs and is properly grounded. Checking for power and ground is really a test of the integrity of the wiring in the circuit. As such, we will want to know if the wiring has "good continuity". A continuity check in and of itself would be a check to see if there is *some* connection to the power source or ground. "Good continuity" implies that the wiring and connections have low enough resistance to allow the component the current flow that it requires to operate correctly, as well as the proper supply voltage. That bit about "low enough resistance" is the tricky part.

- **Using a conventional test light** – This tool is nice in that it draws some current through the circuit (typically about .25 Amps), so that you are testing the circuit under load, while lighting up and indicating power. Keep in mind that this tool was originally designed for quick testing of basic 12-volt, medium current circuits. It meets-the-need for testing something like a taillight or turn signal circuit for power. Do you remember how to test the grounds with a test light?

Hint: Attach the test light clip to power; it will then light up when you touch the test light probe tip to a ground.

On the flip side, how bright will that light be when there is 12.0 volts versus 12.6 volts, or testing a 5-volt circuit? Where did that puff of smoke come from when I touched this wire here? Perhaps .25 amps was too much for that circuit!?

- **Using a logic probe** – This tool is usually set up to illuminate a red light with anything over 4.5 volts, and a green light for continuity to ground. There are some available that let you switch to have the red light turn on above 11.5 volts. This tool was originally designed to test low current electronic circuits. Unlike a conventional test light, it is safe to use on just about any circuit on a vehicle, and it is one of the quickest and easiest tools to use for making simple power and ground

continuity checks. Since it draws very little current, however, it may fall short of providing you with that indication of “good continuity”.

- **Using a digital multimeter** – This is considered the best tool for checking circuits. It can provide you with every reading that you may need in order to assess the integrity of a circuit’s wiring and connections. The best use of this tool involves taking available voltage and voltage drop readings with the typical current that the circuit uses flowing through the wiring and connections. That is actually saying quite a bit with regards to setting up a circuit to test and interpreting the readings correctly. Not that using a test light or logic probe does not require any training or experience, but a digital multimeter lends itself to misinterpreting test results, and it takes quite a bit of training and experience to use it effectively.

So what is the best choice for circuit testing? There is not a best choice for all situations and circuits. For quick testing of circuits, a logic probe is probably your best choice. For diagnostics of a circuit that you suspect has a problem you are better off using a digital multimeter. When in doubt, do not use a test light.

A technician should have all three of the above tools at their disposal, plus the knowledge and experience of how to properly use each one, and when. Until that knowledge and experience is obtained, a technician’s effectiveness in determining circuit integrity will be limited.

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