



CARQUEST Corporation is pleased to sponsor the 1993 *Import Service* Tech Tips section. Winners will be selected by *Import Service* editors and CARQUEST technical staff. CARQUEST will award each winning Tech Tip entrant with \$100 and a CARQUEST jacket.

A cash prize of \$2500 and three free months of Tech-Net service will be awarded at the end of the year to the entrant who submits the best 1993 Tech Tip. The first runner-up will receive \$1000.

So tear out those Tech Tip cards and start mailing your Tech Tips. We'll print the best ones each month. Everyone will benefit from the shared information.

This month's Tech Tips require a short additional introduction. All three rather lengthy tech tips involve the use of a digital multimeter (DMM). The DMM has become an essential tool for any technician who plans to diagnose and repair electrical and electronic problems on today's automobiles. We're pleased to see that our readers are finding their own uses for the DMM, including a couple you won't find in the instruction manual.

Two out of three of our winning tips involve voltage drop testing to find the source of electrical wiring problems. For more information and a comprehensive explanation of voltage drop testing, please refer to Vince Fischelli's "Eye In The Sky" feature article in this month's issue of *Import Service*.

## FOUND: POOR GROUNDS

**I would like to add to the Tech Tip on Subaru ECU grounds that was included in the November issue of *Import Service*. The tip recommended cleaning and tightening an ECU ground connection on the intake manifold to correct a no-start problem. I repaired a Subaru that had an ECU wiring harness ground connection that was clean and tight, but the rest of the wiring harness wasn't doing its job.**

Measuring only the voltage drop between a wiring

harness ground terminal and an engine ground may be misleading. After cleaning and tightening the ground connection, you will probably see a voltage drop of 0.1 volt or less. This would be fine if it were the total ground circuit voltage drop.

However, the ECU ground wire passes through several wiring harness connectors before it reaches the ECU. If this wire picks up as little as an additional 0.1 volt drop at each of these connectors, we may be over the voltage drop limit by the time the ground wire reaches the ECU.

Instead of measuring the voltage drop only at the intake manifold ground connector, also measure it at the ECU or at the data stream scan tool connector. This allows you to see the combined voltage drop for the whole ECU ground circuit. If the ECU is difficult to reach, the Subaru data stream connectors are conveniently located near the firewall on the left side of the engine compartment and can also be used as a test point.

The Subaru I repaired showed an acceptable 0.1 volt drop between the wiring harness ground terminal and the intake manifold. However, the total voltage drop measured between the wiring harness ground terminal at the ECU and the negative battery post was over 0.3 volt.

Like most automakers, Subaru crimps the wiring harness terminals to the individual wires in the wiring harness. These connections don't always conduct electricity as well as you might think. Often, simply soldering the crimp terminals to the wires will improve the connection enough to reduce the total voltage drop and correct any number of problems caused by poor grounds.

In my case, soldering each of the crimp terminals in the harness connectors between the engine ground and the ECU lowered the total ECU ground side voltage drop to 0.1 volt and corrected the car's problem.

Larry Tanzer  
Eltee Services  
Prior Lake, Minnesota

## DETECTING ELECTRICAL INTERMITTENTS

Tracking down intermittent wiring problems can be very difficult. The intermittent problem the customer describes may not occur for days, but you can be sure that it will as soon as you tell him to come pick up his car. A digital multimeter (DMM) with the ability to monitor current, resistance, or voltage while recording the minimum and maximum values measured can be used to make short work of these problems.

Use the following procedure to detect an intermittent wiring harness terminal connection, or to find a wire that has broken inside the insulation but is still intermittently completing the circuit:

- Set your DMM to DC VOLTS. A voltage drop test with the circuit powered up will allow much greater accuracy than a simple resistance test. Unless the wire is completely broken, the DMM's very high impedance on OHMS won't load the circuit enough to find the damaged wire or connector.
- Make sure the wiring harness is properly connected, then attach the DMM test leads to both sides of the suspected wiring harness connector.
- If you haven't narrowed it down to a single connector, begin by checking the complete circuit from one end to the other. Connect the DMM test leads to the wire at both ends of the circuit. This will allow the DMM to monitor the entire length of wire, including any harness connections it might include.
- Turn the ignition on to power up the circuit, then press the DMM's MIN MAX key to begin recording. The voltage indicated on the DMM should be very close to 0.0 volts. If it's much more than that, start looking now. Your intermittent connection has become intermittent right now.
- If the voltage drop reading looks normal, try to simulate the condition that may be causing the intermittent connection, whether by wiggling connections or wiring, test driving, or by performing other operations.
- If an open or increase in circuit resistance is caused by any of these activities, the DMM voltage drop reading will increase and the DMM will emit an alert tone for as long as the condition continues.
- Very sudden, short changes in circuit voltage drop will also cause the DMM to emit a 1/4 second tone as the DMM records the new MIN or MAX voltage reading. Listening for the DMM alert tone while manipulating the wiring harness can be very helpful for tracking down intermittent wiring connections.

Thomas Fontana  
North Shore Infiniti  
Deer Park, New York

## SETTING IGNITION DWELL

Setting the ignition dwell on older breaker point ignitions is a tedious and sometimes lengthy process. However, help is at hand if you have a remote starter switch and a digital multimeter (DMM). The DMM must have the ability to measure duty cycle as a percentage. I have a Fluke 88 Automotive Meter, but other DMMs with similar measurement functions can also be used.

Use the following procedure to adjust the point gap:

- Attach the red test lead to the DMM's VOLT/OHM/DIODE CHECK input and attach the black test lead to the COM input.
- Select the OHMS function with the DMM rotary switch, then press the PERCENT DUTY key.
- Disconnect the ignition point wire lead from the rest of the ignition system.
- Attach the DMM test lead of your choice to the ignition point wire lead, then attach the other DMM test lead to ground.
- Crank the engine using the remote starter switch. This will be a lot easier on the battery and you'll get a more accurate reading if the spark plugs have been removed.
- Adjust the points as necessary to achieve approximately a 50 percent duty cycle reading on the DMM. At 50 percent duty, the points are closed 50 percent of the time, and open the remaining 50 percent of the time.
- For most breaker point ignitions, a 50 percent duty cycle is the magic number. If you adjust the points to a 50 percent duty cycle, you'll have a 45 degree dwell for four cylinder engines, a 30 degree dwell for six cylinder engines, and a 22.5 degree dwell for eight cylinder engines.
- If your vehicle calls for a higher or lower dwell specification, adjust the points to move the duty cycle reading up or down a few percentage points. Increasing the point gap also increases the percentage of time the points are open, so the duty cycle and corresponding dwell angle readings will decrease.

Eric Shapiro  
Tom's Master Mechanics  
San Diego, California

**Editor's Note:** A chart for converting duty cycle percentage readings to dwell angle readings for three through eight cylinder engines is included in the user's manual of some DMMs. Some new DMM designs we've seen also include a dwell angle function. This saves you the trouble of converting from duty cycle to dwell angle when adjusting a point style ignition.