

Jeep Ignition Sync Problems

A combination of your senses, the right test equipment and reference materials and experience can make short work of seemingly tough diagnostic problems.



This issue's case study was contributed by Jerry Truglia.

Our problem vehicle is a 2000 Jeep Cherokee with an automatic transmission and 4.0L engine. The engine is hard to start and occasionally will not start at all. The basics, including battery, vacuum, spark and timing, have already been checked by another shop. A number of "known good" parts from an identical vehicle have also been substituted, with no improvement.

This article will demonstrate how some in our industry have come to rely too heavily on their scan tools, which can often lead a technician astray. Technicians need to be able to confirm that the data displayed on the scan tool screen is accurate. Scan tool data is, at best, second-hand data. The PCM receives data from its input sensors, interprets the data and then sends it on to the scan tool. I am sure you have experienced or at least heard of a scan tool that displayed a substituted value for a defective sensor. We need to confirm scan tool parameter identification data (PIDs) with our DMMs or lab scopes.

Remember, the best tools you have are the ones you carry around with you every day—your brain, eyes, ears and hands.

I started the Jeep diagnosis by cranking the engine while listening for anything unusual. The engine sounded like the timing was off. Take a look at the scan tool reading I got after hooking up to the vehicle. As you can tell by looking at Figure 1 on page 3, if I had used just my eyes, it would have been much harder to repair this vehicle. The scan tool showed SYNC was okay, along with crank (CKP) and cam (CMP) PID information. That's why it's important to use *all* of your senses.

I like to use more than one scan tool when I run into questionable results, so I connected a second scan tool to see if it would give me the same readings. I could not find the SYNC data in the second scanner's Chrysler enhanced data section. It did not exist on the PID list. The scanner manufacturer's helpline informed me that they left the crank and cam information out because the manufacturer did not supply the correct information when the scanner data was being compiled.

Next, I installed a third scan tool which displayed the correct information on crank, cam and sync. To confirm the sync data, I hooked up my lab scope to the crank and cam signal wires. Take a look at the "bad" and

"good" screen shots (Figures 2 and 3 on page 3). I always prefer to back up my diagnosis by using a scope to confirm scan tool PID data, especially when my experience and senses tell me one thing and the scan tool is saying something different.

Look carefully at the Jeep's crank and cam sensor waveforms in Figure 2's bad screen capture. Channel A in blue is the crank signal and Channel B in red is the cam sensor. Notice the vertical cursor lines, which make it easier to check for sync. This Jeep was way out of sync, as you can see by comparing the bad screen capture to the good screen capture in Figure 3. It's easy to know what's bad if you know what's good, which is why it's important to build a library of known-good waveforms and keep them handy for later reference. I call this comparison method *color form technology*. The explanation of what's wrong with Figure 2 follows.

This engine uses a flex plate/flywheel that has three groups of four notches arranged around its outer circumference to determine piston position (refer to the arrows in the flex plate/flywheel photo in Figure 4). These notches are read by the crank sensor as they pass beneath it. The trailing edge of the fourth notch in each group occurs four degrees before top dead center (TDC) of the corresponding piston.

The CMP sensor's Hall effect device generates a fuel sync signal. This signal is used in conjunction with the CKP to differentiate between fuel injection and spark events and to synchronize the fuel injectors with their respective cylinders.

When it is properly in sync, the cam sensor signal must begin and end in the gap between the three groups of four crank sensor pulses. You will notice in the bad screen capture that the cam sensor signal does not bracket the group of crank sensor signals as it should. Instead, it begins and ends during the crank

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Fine Tuning



Fine Tuning questions are answered by Mark Hicks, Technical Services Manager. Please send your questions to: Mark Hicks c/o Wells Manufacturing Corp., P.O. Box 70, Fond du Lac, WI 54936-0070 or e-mail him at technical@wellsmfcorp.com. We'll send you a very nice Wells golf shirt if your question is published. So please include your shirt size with your question.

Q: I am working on a 1997 Corvette. The steering column will not unlock and there is a light on the dash that says "Service Steering Column Lock." What does this mean and how do I correct the problem?

Ted Walk
Walk Enterprises
Lothian, MD

A: Ted, this is a problem that has been plaguing Corvette owners for the past several years. GM incorporated an Electronic Lock System on 1997-2004 Corvette vehicles that is controlled by the body control module (BCM). When the ignition key is turned to the ON position, the BCM sends a signal to the steering column lock motor to unlock the column. The BCM then checks the line to verify operation. If the BCM detects non-operation, it will illuminate the Service Steering Column light on the dash.

This condition is usually caused by a defective Electronic Lock System, BCM, wiring or a low battery. There has also been a GM recall on this problem. A column lock bypass (CLB) kit is also available in the aftermarket as a preventive repair. This kit only works on later models with MN6 or MN12 systems and should only be used if the unlocking problem has not already occurred.

Q: We are working on a 2001 Mitsubishi Mirage Sedan ES with a 1.8L engine. We previously

replaced the engine in this vehicle because the original hydro-locked after driving through deep water. The replacement engine had a misfire that was corrected by replacing one of the coils. It ran great until now, but the replacement coil also has burned out. We have replaced the spark plugs, ignition wires, cap and rotor. What else could be causing these coils to burn out?

Peter Cappazzo
Tallahassee, FL

A: If the compression is not excessively high on either of the cylinders this coil fires, begin by looking at the circuit that controls the negative side of the coil. A PCM driver or transistor controls the negative side of the coil's primary windings. If this transistor is partially or intermittently shorted to ground at times other than when the PCM commands it, current will flow through the primary winding — increasing dwell time and shortening coil service life.

Results: After closer examination, it was determined that salt water had also entered the passenger compartment and the PCM shorting the coil driver. To prevent future problems, the entire wiring system should be scrutinized.

In the last *Counter Point*, we began the diagnosis of an intermittent ignition switch on a 2001 Chevrolet Impala. The switch would occasionally cut out the cruise control

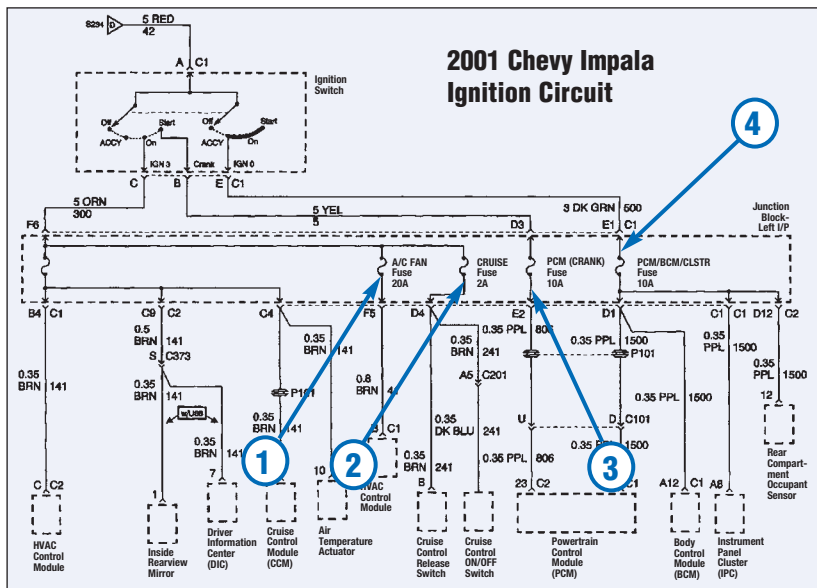
and blower motor. To reach the correct diagnosis, we took voltage measurements at two different switch terminals by connecting a DVOM to the fuse in each circuit. Because the ignition switch has one voltage source feeding the two circuits we were testing, we knew the switch was the problem when the voltage dropped in one circuit but not the other.

This article will explain how this test can be accomplished when only one meter is available. The analysis we are about to discuss is called a voltage drop test. A voltage drop test is a very easy and extremely accurate circuit test when the essentials are understood. A conventional resistance test, conducted with an ohmmeter, is an adequate method for checking ignition wires or coil windings, but should not be depended upon to test the primary wiring of a vehicle.

Suppose we suspect a defective battery cable because the starter is turning slowly. The cable may be damaged and only eight strands of wire are still attached to the starter, but we can't see the problem because the damage is hidden beneath the wire sheath. If we were to attach ohmmeter leads to each end of this battery cable, we would read zero resistance and may assume the cable is good. The low resistance occurs because the ohmmeter's internal battery sends out a very weak current through one of its leads. It then calculates resistance by measuring how much of that current returns to the meter through the other lead. The small amount of current produced by the ohmmeter will have no problem passing through the cable's remaining eight strands of wire. A voltage drop test is a more reliable test, because it tests the circuit in operation and under load.

To perform a voltage drop test on the same battery cable, simply leave the DVOM leads on each end of the cable, just as if you are checking resistance and turn the meter dial to read DC volts. Then, energize the circuit by attempting to or by cranking the engine. If you read more than .5 volts on your meter at that time, the cable is defective. The current that cannot pass through the cable's damaged strands will use your meter as a path to ground and in turn be counted.

Refer to the wiring schematic at the bottom of this page. We can perform a voltage drop test across this circuit by connecting our meter to connections 1 or 2 and 4 in the fuse panel. The meter read 10.16 volts when the problem occurred, indicating a huge voltage drop across this circuit and proving the ignition switch was



defective. A fifth page with pictures of this test has been added to the PDF version of the Summer *Counter Point*. It's available for download at our website (www.wellsmfgcorp.com).

The first readers to submit the correct answer to this problem are:

Gary Dickson
Dickson Body and Paint
Johnstown, OH

Rollin D. Nelson
Nelson 7607 Automobile Service
Ord, NE

Geoff Emmett
Auto Care by Kenely
Orangevale, CA

Diagnose The Problem Win A Shirt

Q: I am working on a 2001 Chevrolet Impala with a 3.8L engine that has 82,000 miles on it. The customer's complaint is that the transmission will not shift and the vehicle will not go over 20 mph. When I test-drive the vehicle I can hear a sucking noise coming from the engine and it will not go any faster than 20 mph. I installed a vacuum gauge and it reads about 14 inches of mercury at idle.

But when I accelerate even lightly, the vacuum drops close to zero. A diagnostic trouble code (P0410), representing a problem with secondary air injection, is stored in the PCM's memory. Could the air pump or something else in the air pump system be causing this? If not what else could be wrong? How can I test for the problem?

Andy Kollman
Minneapolis, MN

If you have the answer, use the following contact information:

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Important Dates To Remember

The National Institute for Automotive Service Excellence (ASE) will offer certification tests for repair professionals and parts specialists on November

10th, 15th and 17th. If you've already registered for the tests, be sure to mark your calendar with these important test dates. Wells

Manufacturing Corp. encourages professionalism through technician certification. **WELLS**



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sensor signal groups. Look at the difference in the crank signal's three groups of four pulses in relationship to the cam signal in the good screen capture. It's noticeable that the group of crank sensor signals fits right into the cam sensor signal's rise and fall. However you chose to view it, the difference is clear. Remember, the scan tool PID reported that the system was in sync at the same time that I collected the bad screen capture.

Figure 1: First scanner PID readings.



Figure 2: Bad cam and crank sensor SYNC waveforms.

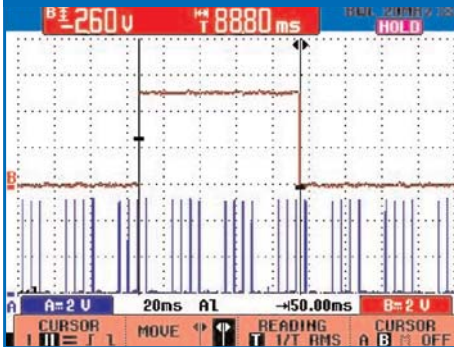
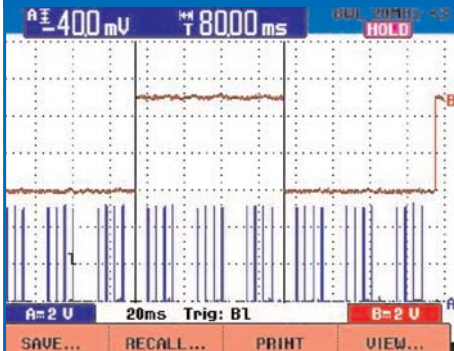


Figure 3: Good cam and crank sensor SYNC waveforms.



This out of sync condition occurs when the oil pump drive shaft binds inside the oil pump drive housing, causing the entire housing to rotate slightly. The cam position sensor is located at the top of the oil pump drive housing, where the old distributor, cap and rotor used to be located. In extreme cases, the oil pump drive shaft or its camshaft mating gears may break, causing a no-start condition. More commonly, the housing rotates slightly, causing the out of sync condition seen here. If the housing does not appear to be parallel with the block or shows other signs of movement, the fix is to install a new housing that's been properly prelubed.

Refer to a computer-based repair information system or a printed repair manual for the proper cam sensor setup and installation procedure. Use a drill bit to line up and set the cam sensor. The hole in the shaft needs to be aligned with the hole in the cam vane blade. After installing the new parts, check the sync with your scope to verify the repair. The older engines used a similar setup. However, this newer style ignition system uses a Hall effect crank sensor—not an AC-generating crank sensor.

It's not hard when you have the right diagnostic equipment (including the stuff you were born with), reference material and training. **WELLS**

Figure 4: Flywheel/flexplate showing timing notches.

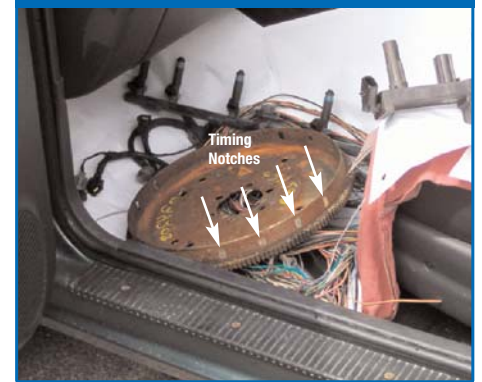
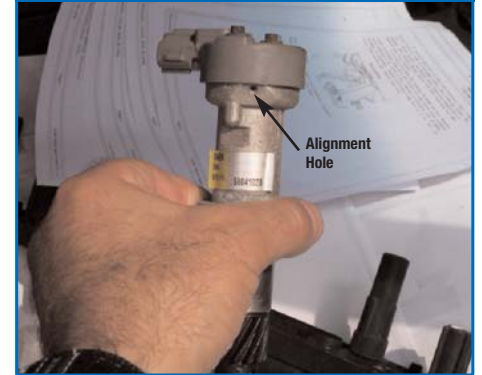


Figure 5: Cam position sensor atop oil pump drive housing. Arrow points to alignment hole.



This case study was provided to *Counter Point* by Jerry "G" Truglia. G is an experienced automotive instructor who has written many training classes and study guides. His company provides training programs and materials on OBD II and many other topics to automotive technicians, 11 state emissions programs and various associations. *Counter Point* looks forward to future contributions from G, as well as other driveability instructors. Thanks, G, for this great case study.

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Quality Points

Superior Coil Construction

One of the most common ignition coils is the GM two-tower DIS coil. There are two common causes when these coils fail. The secondary windings may short to the primary windings, or the secondary windings may short to the coil's grounded laminations. This is usually due to high secondary resistance (a defective ignition wire or spark plug). The high secondary resistance destroys the coil, and possibly the ignition control module (ICM), because there is no built-in protection to stop it.

When the coil's secondary windings become electrically charged, the current will discharge via the path of least resistance. If the intended path is blocked, the current uses the coil laminations or the primary windings to complete the path instead. This also stresses the ICM.



Wells has corrected this by placing a high dielectric sleeve, with lifts on its base, between the coil's primary and secondary windings. This greatly improves dielectric strength between the primary and secondary winding, and between the secondary windings and the laminations, preventing coil failure and greatly reducing ICM stress.

If a parts manufacturer does not use ingenuity and creativity to improve the quality of the products it sells, you are destined to replace failed components with new components that will fail again, and in the same way. You can depend on Wells to deliver components of the highest quality which address original design limitations. **WELLS**

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