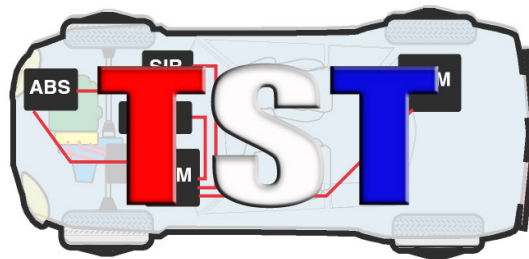


May 2010



Technicians Service Training

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June 14 - 17

Diagnostic Soup II

John Anello

Summer Break!

***Webcast Special coming
up in Late June, July
and August.***

Editor

Jerry "G" Truglia

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2002 Jeep Liberty 3.7L with Wrong Fuel Level Reading

We had a 2002 Jeep Liberty in our shop and the problem with the vehicle was that its fuel gauge went onto the empty indicator remarkably soon. Also, the instrument cluster displays for the vehicle's four wheel drive system worked backwards. For example, two-wheel-drive was engaged when 4-HI was illuminated and vice versa.



For the vehicle's four wheel drive system worked backwards. For example, two-wheel-drive was engaged when 4-HI was illuminated and vice versa.

We had some decent information from the customer to work with. First, filling up the vehicle with gas right after the indicator hit "empty" resulted in taking only nine gallons of gas in an 18 gallon tank. Also, we knew that the fuel level sensor was replaced.

So, we know that there is *definitely* a problem and that it is not caused by a faulty fuel level sensor.

If it's not the fuel level sensor, what could it be? Immediately we conjured up the idea that there is an issue with the PCM or the instrument panel.

(Con't on page 3)

Technicians Service Training

11 Lupi Plaza

Mahopac, NY 10541

Phone: (845) 628-6928

Fax: (845) 628-9109

Email:

Info@tstseminars.org

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Currently there are **TST chapters in Connecticut, Massachusetts, New Jersey, New York** and membership continues to grow. For more information you can call

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Technicians Service Training



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Our Goal & Mission Statement

- ***Keep our fellow technicians up to date with the latest technology.***
- ***Provide training seminars for a reasonable price.***
- ***Deliver information that the technician can use now.***
- ***Keep technicians informed of information affecting our industry.***
- ***Increase consumer awareness of what a good technician is.***

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TST membership includes special pricing on once a month week-day night seminars and the occasional full Saturday seminar. With a \$75.00 yearly membership, the monthly seminars are only \$65.00. TST classes are NOT sales or product seminars. The instructors that TST brings in are all “hands-on” industry experts with up to date, cutting edge knowledge that you can use in your shop the next day. That’s 65 dollars for a seminar in which you are able to learn something useful, for fixing those tough jobs that we all see on a regular basis. Our instructors are masters at making the complex understandable. Membership also includes a Monthly Newsletter full of real world technical articles, diagnostic case studies, and solutions to the kinds of problems you see in your bays each week.

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John Anello Auto Tech On Wheels www.autotechonwheels.com

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Jerry “G” Truglia National Instructor & owner of A.T.T.S. Inc.

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2002 Jeep Liberty 3.7L with Wrong Fuel Level Reading (con't from p. 1)

Why? Because what are the chances there are two separate issues causing a problem reflected on the instrument cluster?

Now, good technicians test and not guess, so we weren't going to just put a new PCM in it and hoped that it would work.

First, we plugged in different scan tools. We supposed that it was best to let the computers do the thinking for us, right?

The Launch was surprisingly good for a Euro-Asian tool, and following it up with the MODIS and the Pegisys we found that they all agreed that the fuel level was supposedly 21 percent. We got a little more information from the MODIS, because it showed us that the fuel level sensor voltage was 2.84 V. So, Snap-Off jokes aside, the MODIS gave us the most information on this particular Jeep.



After looking up the specifications, an empty fuel tank should have had 8.6 V while a full one should be 0.6V. So, if we took the 2.84 V fuel level sensor voltage as gospel truth, the fuel tank should have been at three-quarters.

Yet, we should have known better than make such an assumption. The fuel tank was probably at about 50 percent—NOT 75 percent like the voltage from the MODIS claimed nor the 21 percent that all the scan tools agreed on. The MODIS specifically had two contradicting values, so the only possible cause (assuming the scan tool is telling the truth) would be a bad PCM.

If it was a bad instrument panel, it would just have the wrong fuel level displayed instead of contradictory Parameter IDs. A PCM issue can display the wrong level on the dashboard and give the scan tool the wrong reading as well.

(Con't on page 7)

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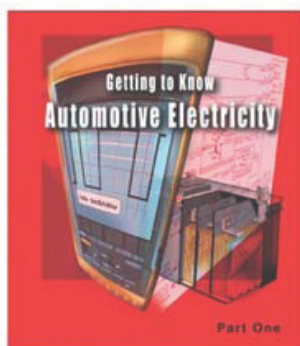
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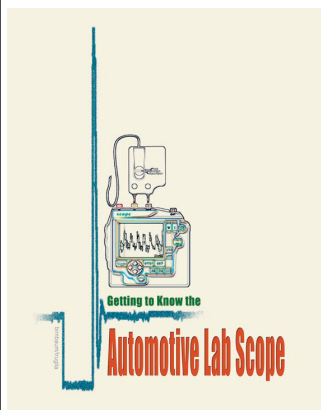
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2002 Jeep Liberty 3.7L (con't from p. 3)

However, we were afraid to blame the PCM so fast. What if we had a crazy situation, like a possible voltage drop on the fuel level sensor's feed or ground side of the circuit? If the PCM was not receiving the right voltage, then maybe the PCM was fine but reflecting an inaccurate value by mistake while at the same time the instrument panel was wacky too. It was improbable, but possible.

Before we moved onto testing the fuel level sending unit directly, we looked into the 4WD display issue to see if the instrument panel was nuts or not. None of the scan tools we had showed a PID for the four wheel drive switch position, so we had to pull out the switch to see if the switch was okay before condemning the PCM or instrument cluster. Using the specifications on ALL-DATA (following image courtesy of it), we found that the switch was faulty.

SENSOR POSITION	OPERATING MODE	SENSOR RESISTANCE (ohms)
1	2WD	1124-1243
2	4WD PART TIME	650-719
3	NEUTRAL	389-431
4	NEUTRAL	199-221
5	4WD LOW	57-64

- In 2WD (Sensor Position 1)
 - Specified Value: 1124-1243 ohms
 - Measured Value: 680 ohms
- In 4WD Part Time (Sensor Position 2)
 - Specified Value: 650-717 ohms
 - Measured Value: 1204 ohms
- In Neutral (Sensor Position 3)
 - Specified Value: 389-431 ohms
 - Measured Value: 400 ohms
- In 4WD Low (Sensor Position 5)
 - Specified Value: 57-64 ohms
 - Real Value: 60 ohms

The PCM was not to blame at all, nor the instrument panel! The switch was broken, as its ohms for 2WD were flip-flopped with the resistant measured on 4WD-HI.

(Con't on p. 9)

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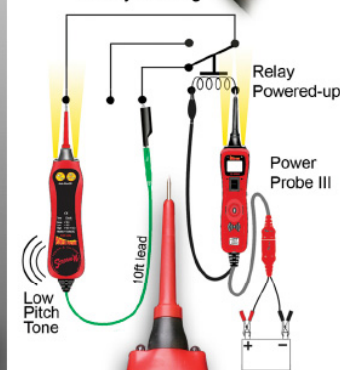
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2002 Jeep Liberty 3.7L with Wrong Fuel Level Reading (con't from page 7)

This vehicle did not have one overarching problem that explained the wrong displays on the instrument cluster—it had several!

Now that we solved the 4WD switch, we decided to measure the fuel tank level sensor directly. We knew it was brand new from a previous attempt at repair, but you never know whether or not a part is defective. We found that we had 4.8 V leaving the sender unit. This corresponded with our belief that the tank was actually half full even though it was reading otherwise. After all, 4.8 V is about half of 8.9 V. But, where did the 2.84 V come from? And, if the PCM thought it was receiving 2.84 V, why wasn't the gauge at 75 percent then?

We verified that 12 V was making it to the sensor by temporarily disconnecting it, and that the PCM was receiving the 4.8 V from the fuel level sending unit.

Being in denial that the PCM was to blame, we decided to make sure that the new fuel level sensor was indeed operational. We did this by using the specifications for ohms of resistance that the sensor would regularly have under different fuel level conditions and replicating it by placing resistors in place of the actual sensor.

At 5 ohms the fuel tank is full and at 270 ohms it is empty. We used the following resistors and got these results:

- 20 Ohm Resistor: Full Tank
- 30 Ohm Resistor: 7/8 of a tank
- 45 Ohm Resistor: 3/4 of a tank
- 62 Ohm Resistor: 1/2 of a tank
- 77 Ohm Resistor: Right below 1/2 a tank
- 94 Ohm Resistor: 1/4 of a tank
- 109 Ohm Resistor: 1/8 of a tank
- 124 Ohm Resistor: Tank at empty



The following, though tedious, proved that at half a tank of gas the gauge will read empty. We knew the PCM was receiving the right signal. So, the question was what was going out of the PCM.

(Continued on p. 11)

9 of the Top 10* "Check Engine" DTCs can be diagnosed with a Smoke Wizard.

Maybe it should be called the "Smoke Wizard" Light

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2002 Jeep Liberty 3.7L (con't from page 9)

Questions:

1. Do you want seminars to continue in your area?

2. Do you find the seminars useful?

Please ask a fellow technician to come and check-out our seminars so we can continue to bring you the best available information each month.

We need your support:

*Thank you,
G Truglia*

Now, based upon what we know about the false measurement from the MODIS where the PCM perceived the fuel level sensor voltage to be at 2.8 V instead of 4.8 V as our actual measured value reflected, we can safely assume the PCM was to blame. After all, the PCM is getting the right signal, it is perceiving the signal incorrectly, AND on top of that its fuel level percentage and fuel level voltage contradict each other.

It is always nice to make sure that a scan tool is not giving a false reading, so we hooked up the Auto Enginuity. The Auto Enginuity on this Jeep had near factory capabilities, but it could not do any activation tests on any of the vehicle gauges. However, it did second the MODIS, telling us that fuel tank sensor voltage was about 3 V, far below our actual measured voltage.



So, we decided to get a junkyard PCM, reprogram it, and that fixed the problem.

The PCM was internally faulty because the fuel level sensor was good and there were no voltage drops on the circuit. The four wheel drive switch was faulty, teaching us that we should always test and not guess that a problem has a single cause. If we popped a PCM in right away and did not diagnose the switch AND/OR had a voltage drop on the fuel level sensor, we would have felt *really* lost in the forest as Bernie said.

So, to sum it up, everything has a reason. The instrument panel was fine, just a bad switch and a bad PCM were making it show us the wrong things.

Article by Craig Truglia and Kevin Quinlan

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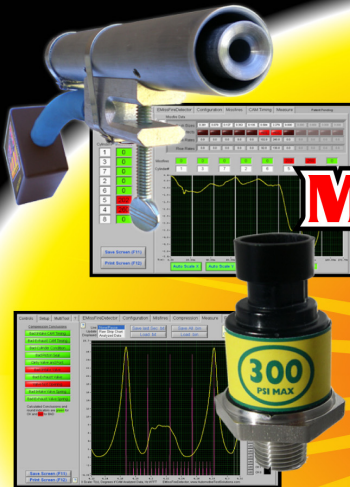
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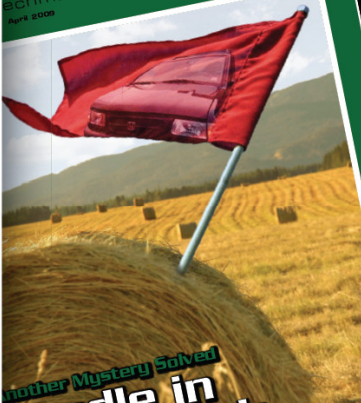


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April 2009



Another Mystery Solved
Needle in a Haystack

Business INSIDER

Inside the Insider

Five Ways to Limit Liability
By stepping out into the business world, every shop has exposure. While you cannot stop people from suing you can insulate your business, personal assets and wallet from your liability if you take some steps to protect yourself.
(Turn to page 1)

Human Potential
The mind is a strange and powerful tool. Psychologists tell us some very interesting things about its function. First, 90% of its activity is subconscious.
(Turn to page 1)

In Times Like These
Small business is the backbone of our economy. Businesses like ours
(Turn to page 3)

Sole Proprietorship
If you are getting started in a new business or a twenty year business ventures this question comes up on a regular basis. My answer to this dilemma has always been the same, it depends.
(Turn to page 6)

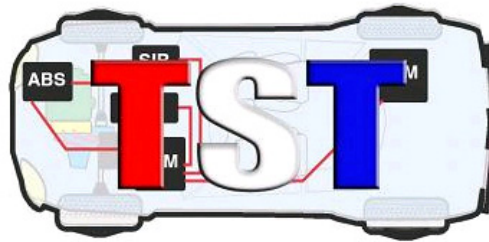
MT Business Insider Pricing Matrix
Businesses are based on percentages, but consumers look at prices. How do you reconcile your business' need to make a decent profit margin on parts with your customer's need to pay a fair price?
(Turn to page 8)

E Certification: The Competitive Advantage
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Five Ways to Limit Liability For Business Owners
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(Turn to page 1)

Human Potential Using What You've Got
The mind is a strange and powerful tool. Some very interesting things about its activity are subconscious. Let's define things within or without oneself. 90%! Think a best you are capable of achieving is still only 10%.
It's generally agreed that a human's learning ability is physical. Remember that a scrap of brain tissue no larger than a grain of rice contains more information than a computer the size of a Honda. Now consider that an average person's brain weighs about three pounds. How many ounces of yours do you actually use?

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