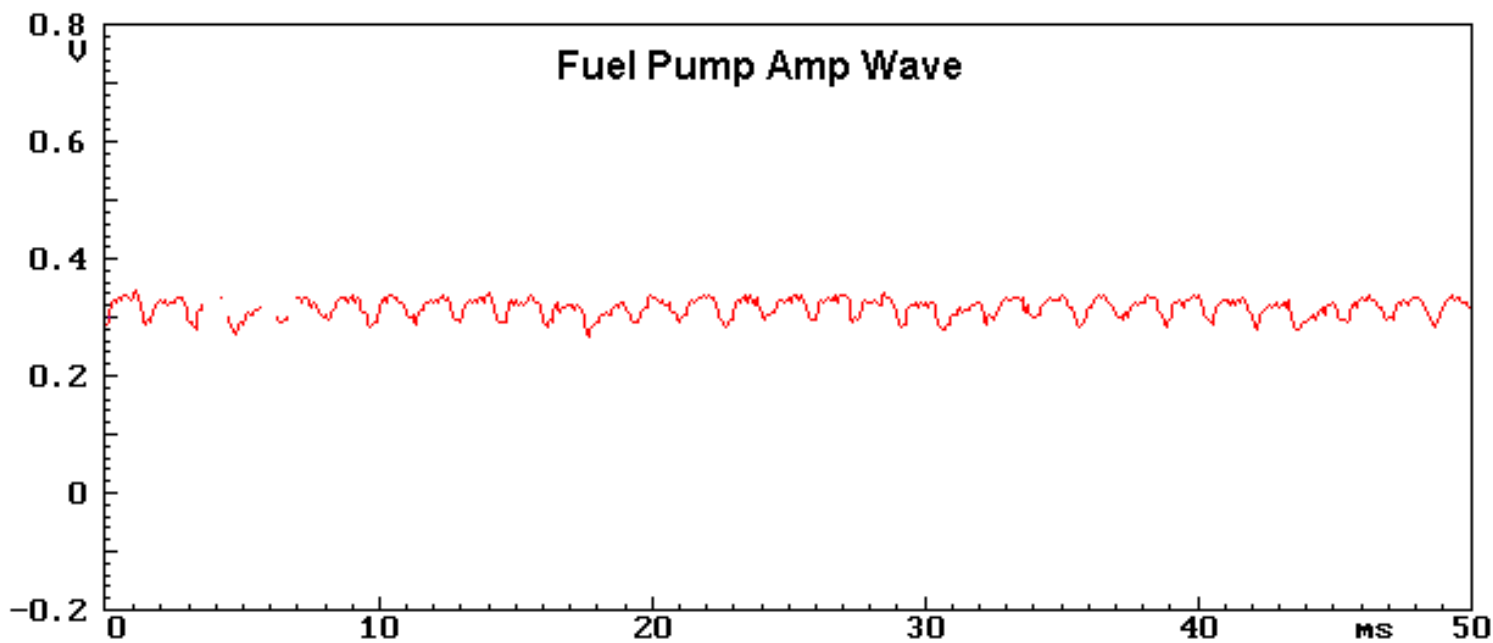


## Simple Things...

**FlatRaters Garage***Quick and Expensive Repairs***1991 S10 Pickup****4.3 L V6****178,000 Miles****1) Runs Rough****2) SES Lamp On**

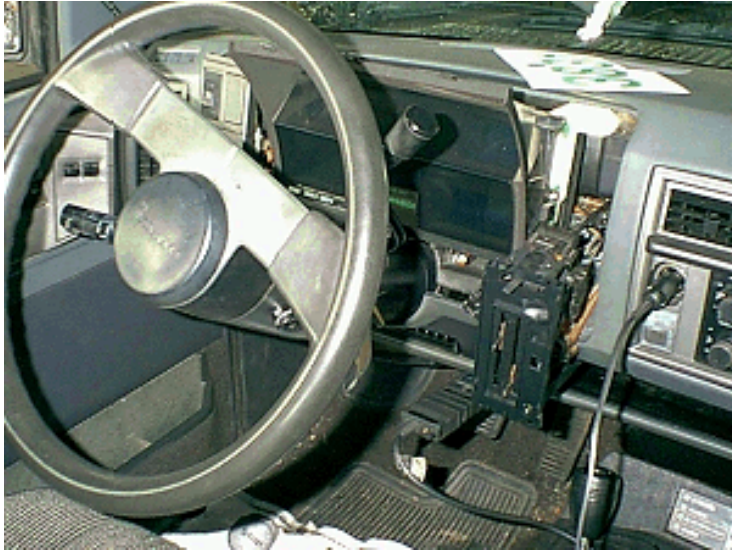
What a pile this is.... You can't see it well in this picture, but the paint is peeling everywhere, the interior is junk, and it runs terrible. I took it for a blast down the street before making my way to my service bay. When accelerating, it would fall **hard** on its face as if fuel pressure/volume was very low. **I also noticed that the motor mounts were wasted...**

Feeling sure that fuel pressure was low, I skipped the scanner and went straight for a fuel pump amp wave. Normal amp draw would be 3 to 4 amps for this TBI fuel system.



Oops, not what I expected.... Time to track down the Tech 1 and see what kind of data we have.... I found these codes stored:

- **DTC 22** Throttle Position Sensor signal voltage low
- **DTC 34** Manifold Pressure Sensor voltage low (high vacuum)
- **DTC 45** Oxygen Sensor -- Rich exhaust indicated



At this time, I started to look around inside more carefully.... As you can see, the dash is torn apart. There were aftermarket parts boxes laying on the floor.

Something evil has been here.... I have this gut feeling this pile is gonna drive me nuts. The odds are good, it doesn't usually take much to do that (bg)

Lets grab the Tech 1 and get started.

First, here is the scan data upon key up. (key on engine off) The data display is a bit screwed up because our Techline software has been screwed up for the last 10 or so versions. The XXXX is engine speed. Not so obviously, the Knock Signal is actually engine run time. As background, the TPS and the MAP sensor share a 5v reference from the ECM.

XXXXXXXXXXXXXXXXXXXX	0 RPM	Park/Neutral	P-N-
Throttle Pos	0.74 V	IAC	145
Coolant Temp	67 °F	Battery	10.7 V
MAP	96 KPa	Knock Signal	00:00:00
O2 Sensor	453 mV	Vehicle Spd	0 km/h
O2 X Counts	0	AIR Control	DOWN
Rich/Lean	Lean	TCC/VCC	OFF
Open/Closed	Open	4th Gear	OFF
Integrator	128	A/C Clutch	OFF
Block Learn	128	PROM ID	9851

Next, lets look at the idle scan data...

XXXXXXXXXXXXXXXXXXXX	1125 RPM	Park/Neutral	P-N-
Throttle Pos	0.74 V	IAC	86
Coolant Temp	67 °F	Battery	14.2 V
MAP	33 KPa	Knock Signal	01:30:44
O2 Sensor	462 mV	Vehicle Spd	0 km/h
O2 X Counts	14	AIR Control	DIVERT
Rich/Lean	Lean	TCC/VCC	OFF
Open/Closed	Open	4th Gear	OFF
Integrator	128	A/C Clutch	OFF
Block Learn	128	PROM ID	9851

I revved the engine a few times and nothing abnormal happened. Then I dropped it in gear and lightly power braked it. It started running very poorly and I saw this data

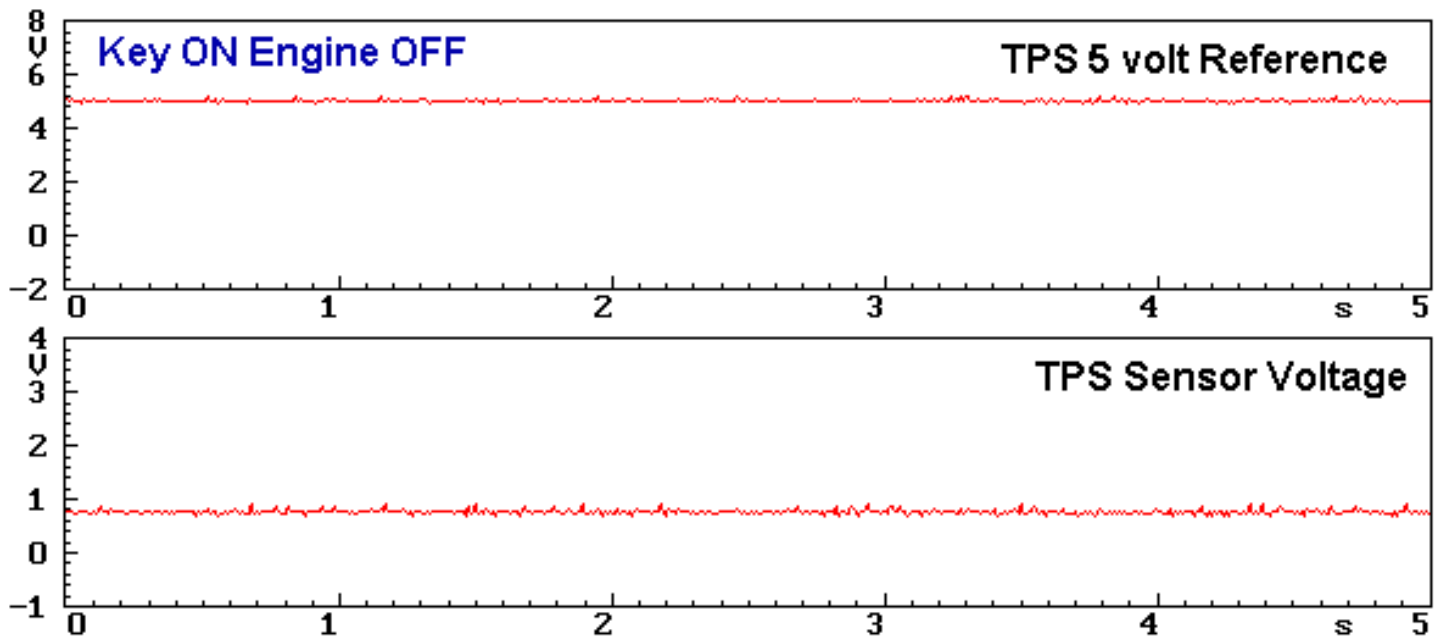
XXXXXXXXXXXXXXXXXXXX	925 RPM	Park/Neutral	P-N-
Throttle Pos	0.00 V	IAC	94
Coolant Temp	67 °F	Battery	14.1 V
MAP	11 KPa	Knock Signal	01:40:12
O2 Sensor	453 mV	Vehicle Spd	0 km/h
O2 X Counts	19	AIR Control	DOWN
Rich/Lean	Lean	TCC/VCC	OFF
Open/Closed	Open	4th Gear	OFF
Integrator	128	A/C Clutch	OFF
Block Learn	128	PROM ID	9851

I shut the motor down and restarted it. The data went back to normal. Opening the hood, I jiggled the engine harness close to the TPS. No change... Then I power braked it again and it returned to running rough with the above data. I gently pulled the harness towards the front of the vehicle and it straightened out. When I released the harness, it returned to running poorly. I did this multiple times and MOST (but not all) of the time the engine would respond to this manipulation of the harness.

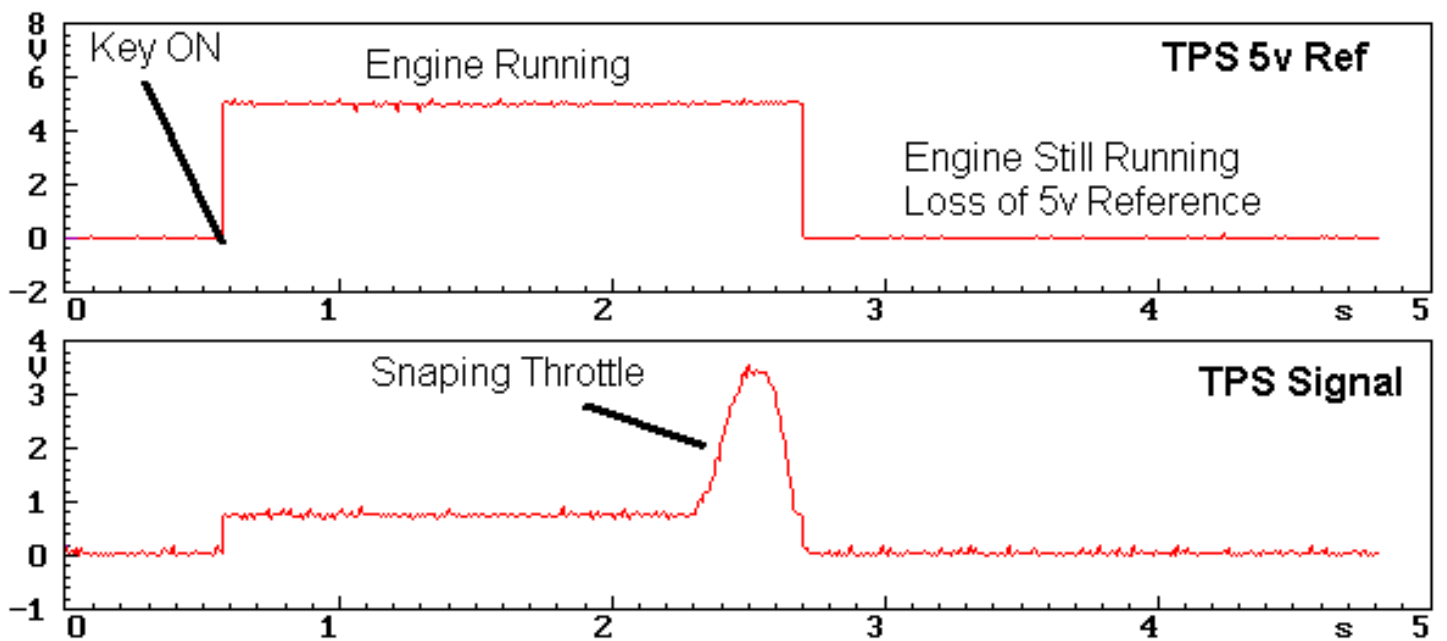
I shut the motor down and disconnected the ECM, MAP, and TPS. Using a latching continuity tester, I checked the 5v reference circuit for opens and shorts while manipulating the wiring in every way that I could. Nothing.... No short to ground and no opening of the circuit. This tester will catch a failure as short as 1 ms. Next, I pin checked (for terminal tension) and then visually checked the harness terminal to the ECM. The wire had a good connection to the terminal and the terminal tension was excellent.

I reconnected the ECM, left the MAP and TPS disconnected, and then started the engine and tried to power brake the engine while watching the voltage on the 5v reference circuit. Unfortunately, with the MAP and TPS disconnected, the engine would fall on its face so hard that I could not duplicate the condition properly.

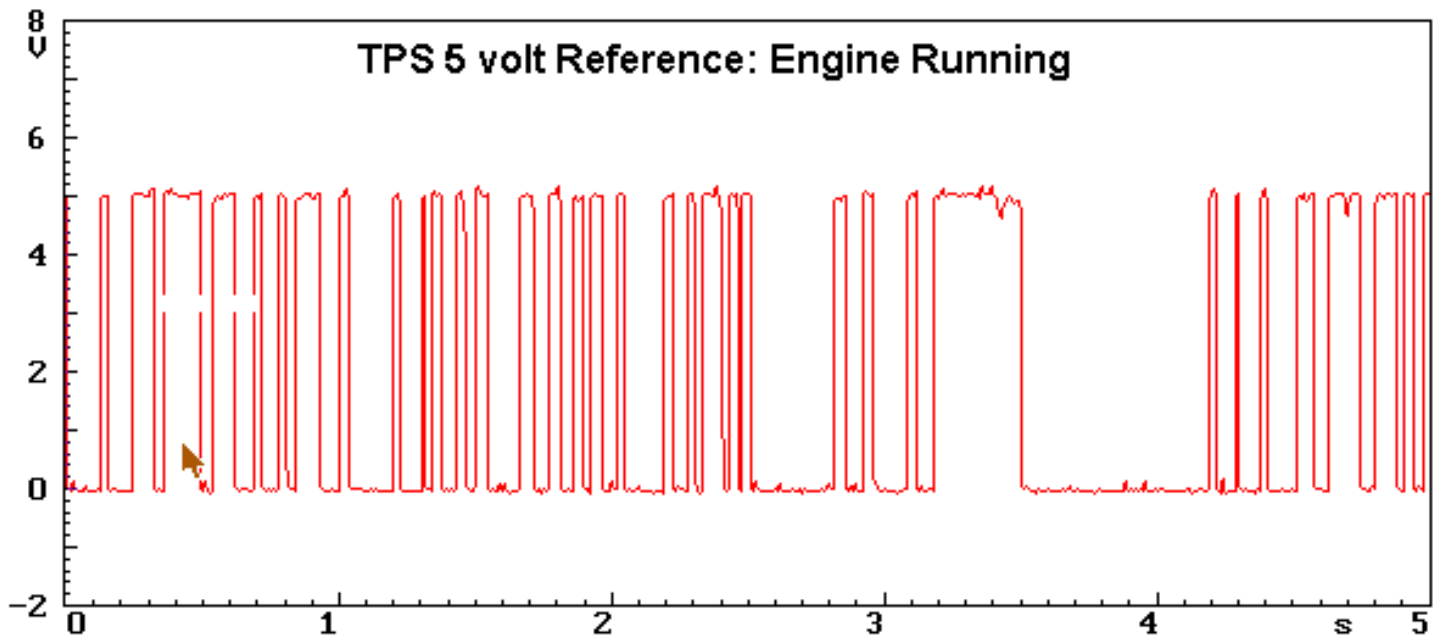
The engine wiring harness is very difficult to visually inspect with much of it sandwiched between the firewall and the heads, but after searching for quite a while, all I could find was a heater case bolt (sharp) lightly pushing against the harness as it came through the firewall from the passenger compartment. I pulled the harness away from the bolt, grabbed my scope, and took these shots



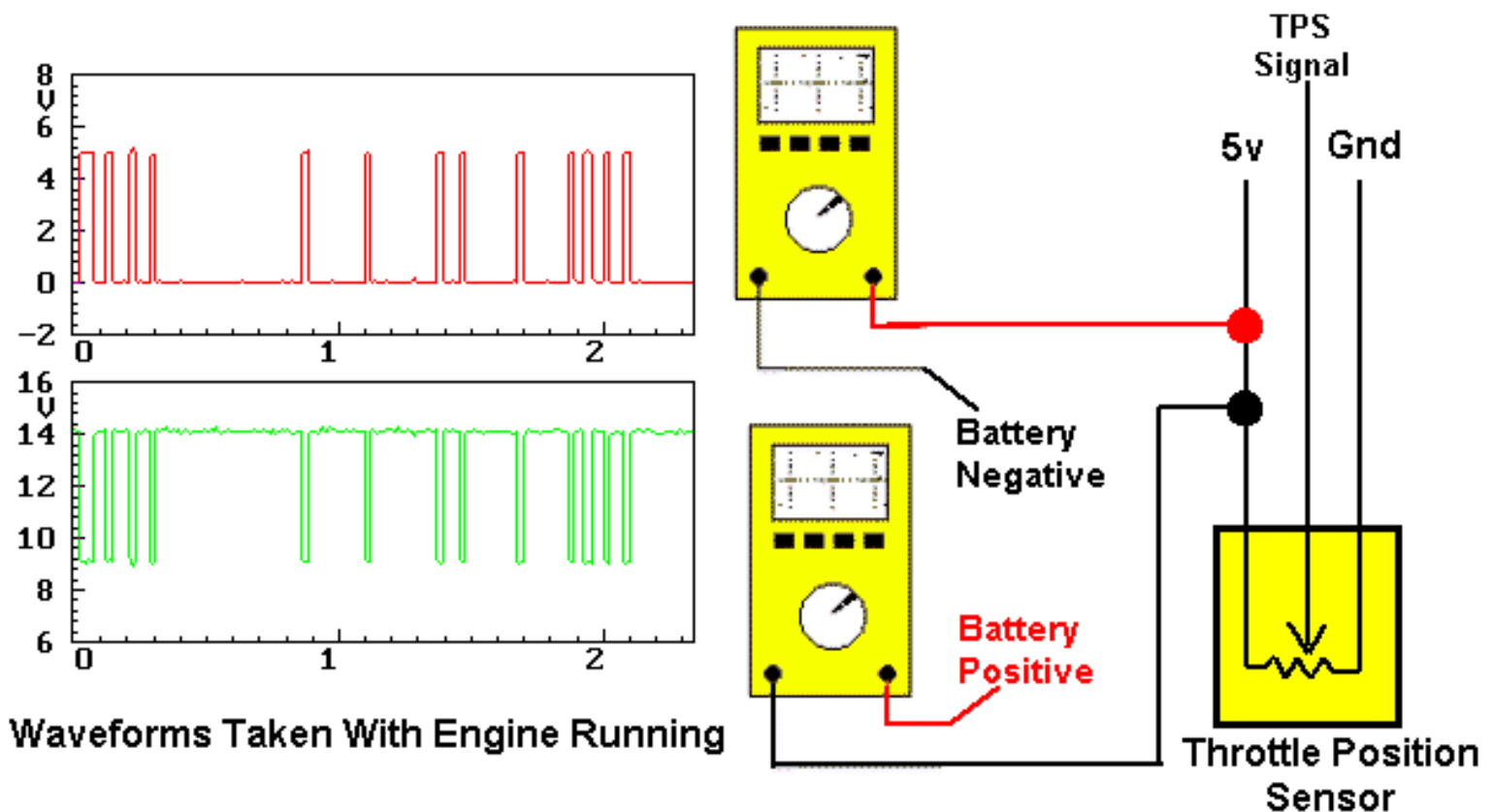
Now lets start the engine up and look again.



With the above image, I did not have to power brake the engine to cause the failure. All I did was snap the throttle with the transmission in park. I very gently pulled the harness (near the TPS) forward again and then when I released it, got the following



Ya know.... What we need here is an easy way to test whether we're losing the 5v reference or whether it is being grounded out. Does this do it? Why or why not?



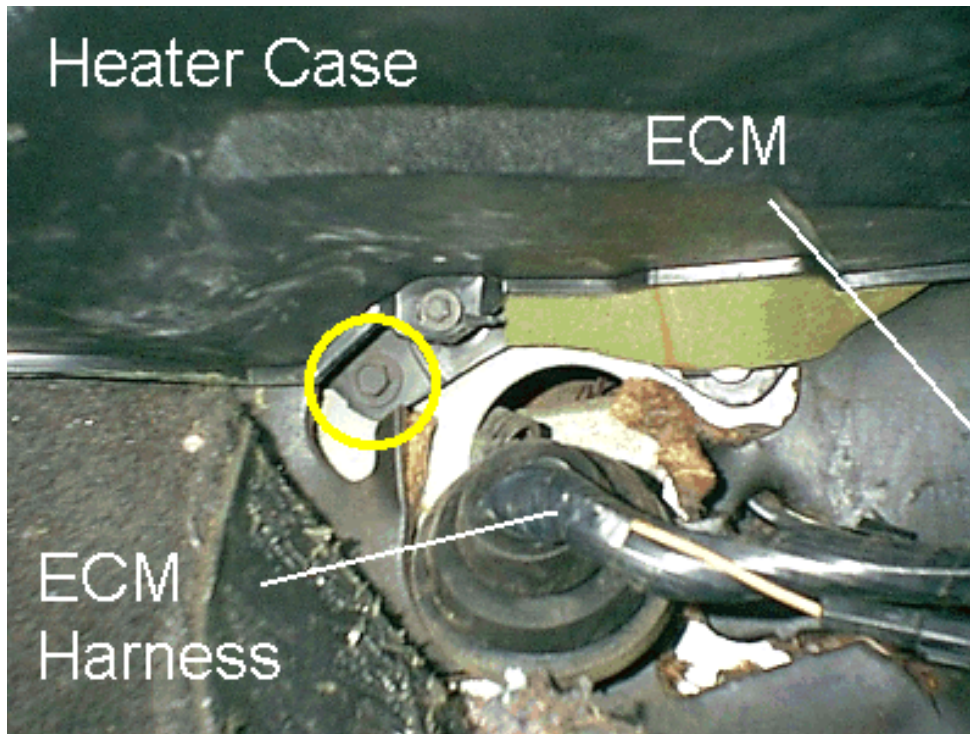
Sometimes, the easiest problems can drive you up the wall..

End Part One

From Saturday:

*Sometimes, the easiest problems can drive you up the wall....*

This was, in the end, a very simple problem. It was plain to see that I was losing my 5v reference to the TPS (throttle position sensor) and MAP (manifold absolute pressure) sensor. What I **assumed** at first was that the wire was grounding out when the engine torqued up due to the wasted motor mounts.



I spent a great deal of time trying to see the wiring behind the heads and above the transmission, looking for where the harness might be grounding out to no avail. The only possible point was here.

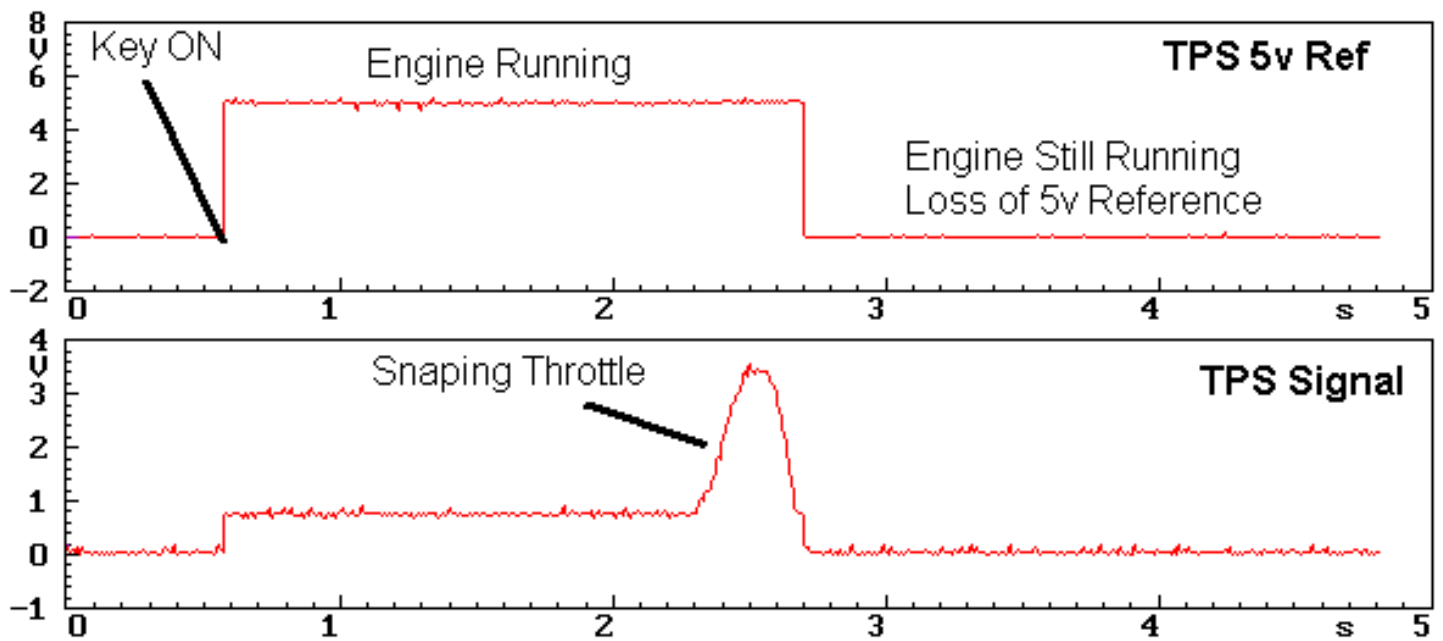
As the ECM harness goes through the firewall, it crosses over the HVAC case bolt that sticks out into the other side (holding the HVAC case to the body).

I found the HVAC case bolt protruding into the harness. Assuming it was grounding out the 5v reference wire, I moved the harness safely away.

Finding this problem with the bolt sticking into the harness somewhat explained this:

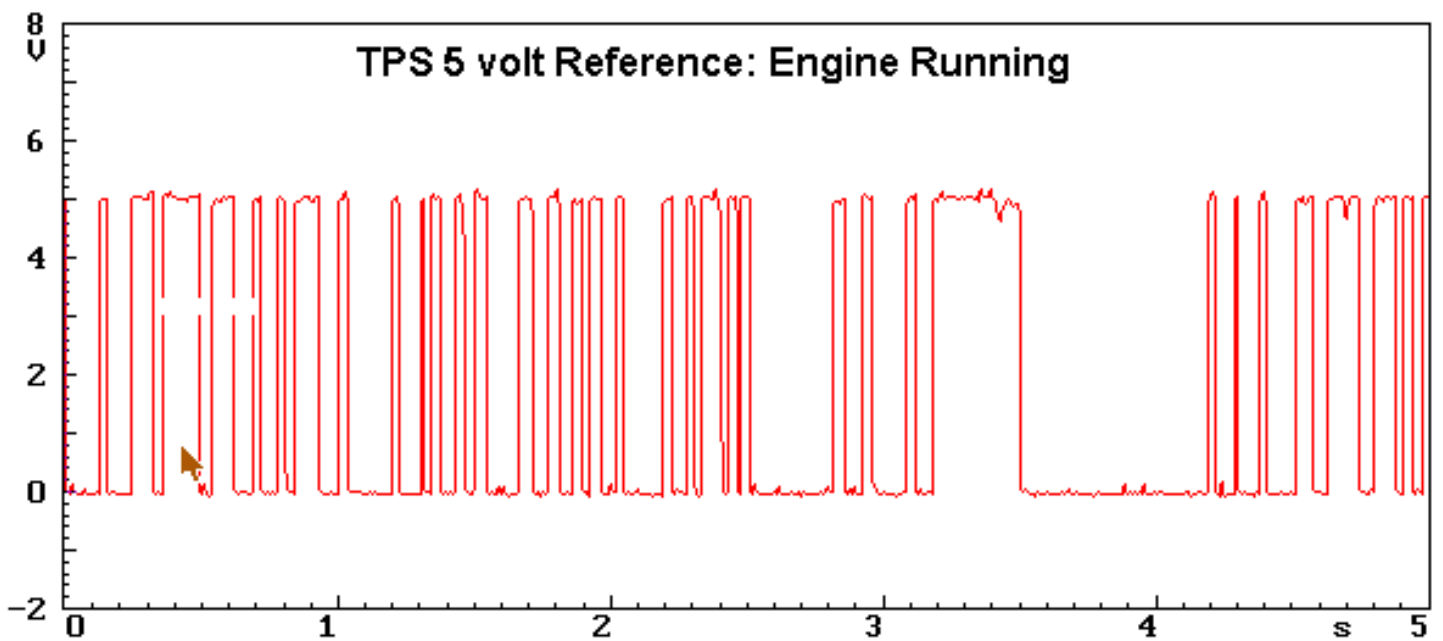
*I shut the motor down and restarted it. The data went back to normal. Opening the hood, I jiggled the engine harness close to the TPS. No change... Then I power braked it again and it returned to running rough with the above data. I gently pulled the harness towards the front of the vehicle and it straightened out. When I released the harness, it returned to running poorly. I did this multiple times and MOST (but not all) of the time the engine would respond to this manipulation of the harness.*

Now with the harness away from the bolt and (as far as I could see) no other grounding problems, I was surprised to see that the problem was still present.



I was so sure I had found the problem.... There was NO WAY that harness was grounding out anywhere else.... I was sure that the 5v reference wire was not going open. After all, I had checked it with my latching continuity tester right? Wrong..... But we'll get to that in a minute.

As I sat there perplexed and pondering my navel, the 5v signal started doing this while the engine was just sitting there idling...



Can you guess what I started thinking? Yep, I started to believe that the ECM 5v circuit was failing in the ECM. After all, I had thoroughly checked the wiring.... If it hadn't been so easy to grab another ECM, I'd have been more careful. But at the time I had at least 10 ROs on my bench and the pressure was on to produce. With the problem still present with a new ECM installed, I realized how stupid I had been.

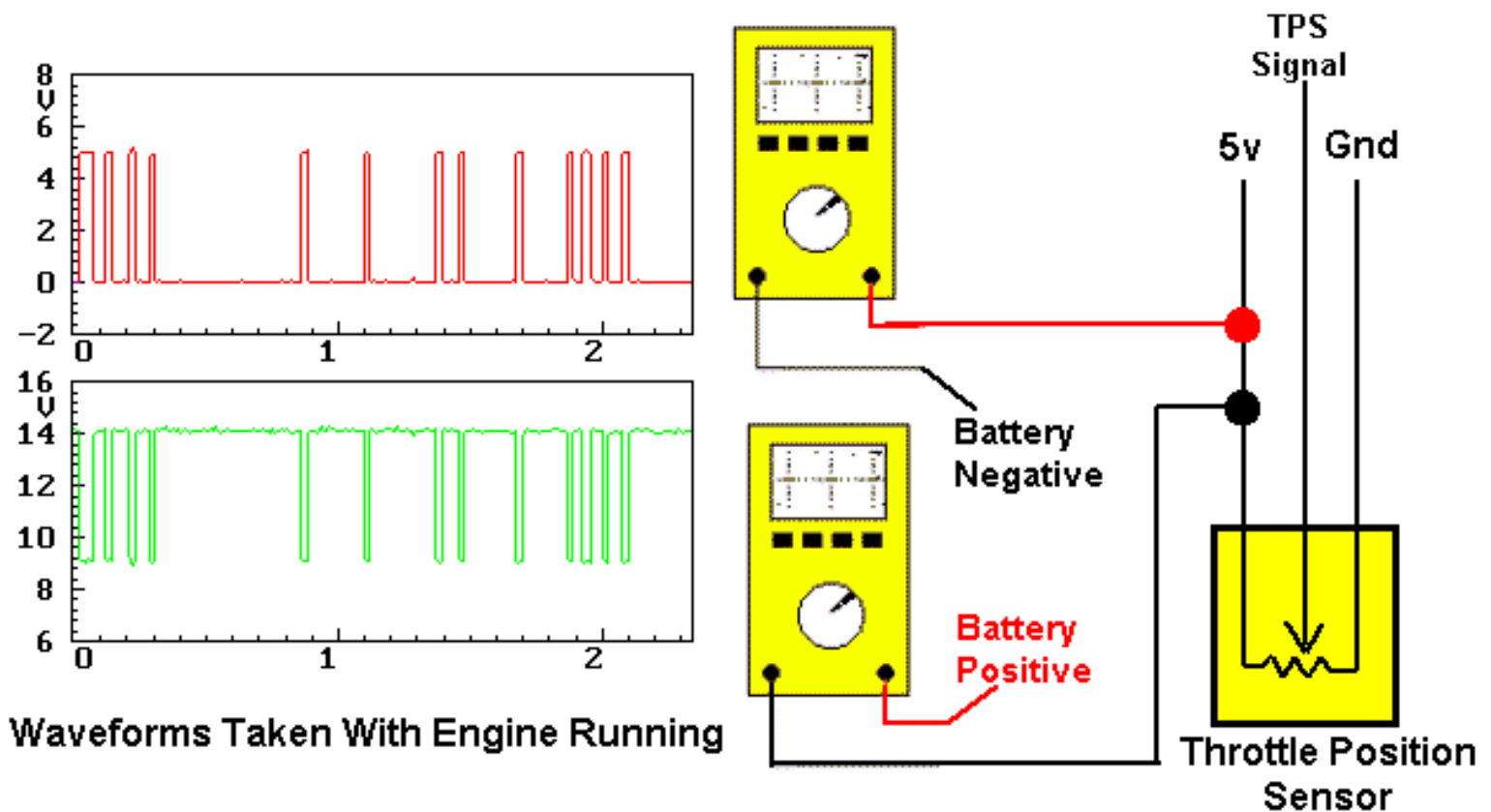
My continuity tester works by applying a very small current through the wiring being tested. If even the smallest

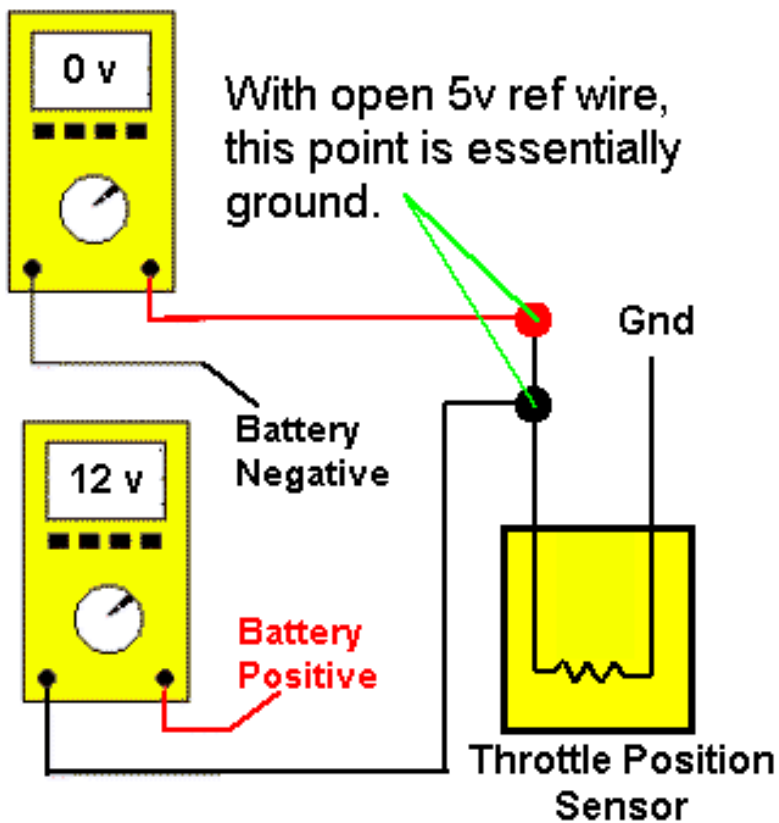
strand of wire was left intact (within the wires insulator) the tester would have never shown the wire to be open. The circuit should be tested while LOADED and I should have moved my test point to the ECM after finding no voltage at the TPS.

The actual problem with the 5v circuit was that under the right conditions, it would go open somewhere between the ECM and the TPS. Most likely, the HVAC bolt had protruded through the harness and partially cut the wire so that it could not carry a load at times. Since it was next to impossible to dig out the harness to verify, I just ran a completely new wire from the ECM to the TPS/MAP.

The killer is I knew better.... So why did I drag out the latching continuity tester? Because its been sitting in my box unused for years. I just had the urge to use it. Dumb move!

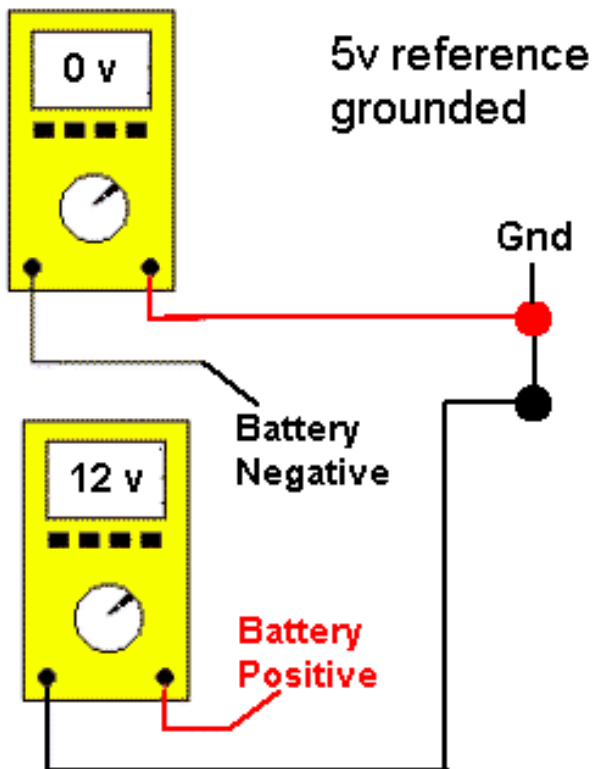
Now one thing I did for fun before I repaired the wiring and returned the ECM was this.....





I figured it would make this study a little more fun. Consider that whether the 5v circuit (above) becomes grounded or goes open, in a sense, it is always ground to the meter.

Here with the 5v wire OPEN, the circuit is also OPEN and therefore the test point is essentially ground.



And now with the 5v circuit grounded (as originally thought) the meters read the same.

See what an easy problem this should have been to track down? And how I managed to make it difficult? Don't we all do this sometimes? There are days when I believe I could fix almost anything. And then there are days like this.... Although removing the stress of having to work on 10 things at once would help, I still believe I'd do something like this again.... Live and learn. I usually learn more from my mistakes than my successes....

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