



TR8 Fuel injection: That Pesky Throttle Position Sensor (or Throttle Pot)

Jim TenCate, Richard Connew, Gene Thompson

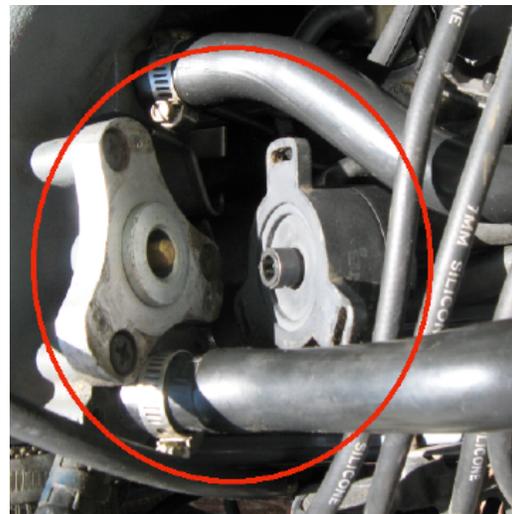
Introduction

The TR8 fuel injection system has a rather unusual sensor for Bosch systems of the day, a throttle position sensor. Rather than using standard Bosch throttle position switches (which indicate closed throttle and wide-open throttle) like in the TR7, Lucas and Bosch engineers added a potentiometer instead. The description from the Repair Operations Manual is pretty good: "A throttle switch forms part of the electronic control for the fuel injection system and provides the ECU with information on throttle operation conditions. It is located on the engine plenum chamber in line with the throttle input spindle. The switch is a simple electrical potentiometer (variable resistance) whose electrical signal to the ECU depends upon the position of the throttle spindle and hence the accelerator pedal. In addition to detecting a high voltage output from the switch at the full throttle position, and in consequence giving a full load fuel condition, the ECU will also detect changes in throttle position by the voltage output from the potentiometer. Using this together with information from the other sensors it will adjust the fuel input accordingly either for degrees of acceleration and deceleration for constant engine speed. When a sudden acceleration is signaled to the ECU by the throttle potentiometer, all injectors are pulsed to operate once simultaneously to ensure adequate engine response." The problem? These wear out and are no longer available. Here we report on some options.

The Problem

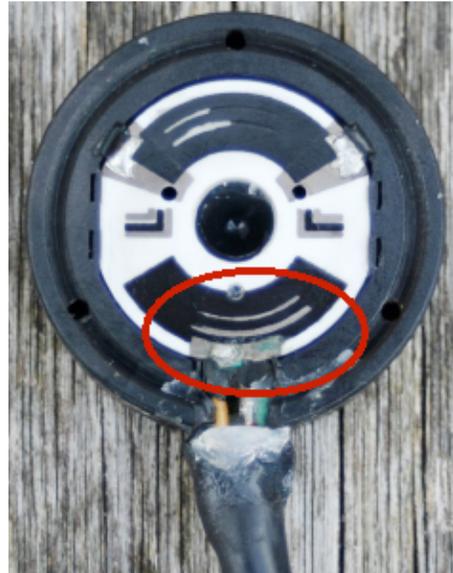
Gene's Thompson's write-up in the WedgeLab part of the old TR8CCA website (<http://www.team.net/TR8/tr8cca/wedgelab>) is perhaps the best description of what you feel driving with a bad TPS. Here's his excerpt: "**Surges while cruising on level ground.** Also called "trailer hitching" because it feels like you're towing a trailer and the hitch ball is too small. Your throttle potentiometer may be worn out. If it's a TR8 or older SD1, good luck, the pot is **No Longer Available**. The almost exact replacement from an XJS is also NLA. Sometimes you can do delicate surgery on the pot and shift the wiper's contact path, but it's fussy work and often doesn't last. Some ingenuity and a home-made mount may make the throttle pot from a '90 Corvette fit—or not."

So, if you're curious about what the potentiometer actually does on your car, disconnect yours from the throttle spindle on the throttle shaft. See the photo on the right. Start the car up, let it idle, and twist the pot around a bit. If it's working and not worn out, a twist from any position will give you a noticeable bump in RPM as the injectors fire all at once for that extra shot of gas. This happens all the time at most any RPM and, in general, makes the car more responsive.





OK, what actually happens to it? With repeated throttle spindle motion over the years, the resistance track simply wears away. Richard has an article that shows just how badly his traces had become (located in the public section of www.tr7-tr8.com) and I've included a photo from his article at right. See those parallel tracks in the photo? They're not supposed to be there. The resistance track is worn right through. In fact, Richard reports that he tried to do the "delicate surgery" that Gene and others have suggested and simply failed. It was time to do something drastic. My car wasn't behaving too badly yet (and I might still try and repair my old TPS) but I decided to follow in Richard's shoes as well and maybe try Gene's other suggestion too.



The Solution(s)

The **first**, and maybe not so obvious solution is to simply disconnect the thing. There is a simple connector to pull apart and voila, your problem goes away. I really don't mean to sound silly here, it's actually quite safe and the car will run fine without it. Brian Ridley-Jones wrote me that a few years back when he was having trouble with his, Albert Tingey—who was one of the guys who actually worked on the Lucas/Bosch system for the TR7 and TR8 and is still around—advised him to disconnect a bad throttle pot rather than leaving it connected in place.

How does the car run *without* the TPS? I ran back and forth to work with mine for a few weeks and really didn't notice all that much difference, if any at all. Charles Beck tried disconnecting it on his SD1 and found that right after startup and for a few minutes afterwards his car was rather hesitant but, as it warmed up it was fine. Moreover, I went to my favorite stretch of deserted road—at 35 deg 48 min 46 sec North, 106 deg 14 min 20 sec West if you've got Google Earth and want to check it out—and did several 1000 to 5000 RPM runs, both with and without the TPS connected. Guess what? No difference. (I've got one of those inexpensive cigarette lighter "dyno" gizmos that listens to the whine of the engine electrical signals. The sound can be recorded and a plot made of RPM vs time. All my plots looked the same.) So, there's *no* difference in flat out acceleration with or without the TPS. (See <http://www.dynamic-dyno.com/index.html> to find out more about the dyno thing. I just bought the cable and record the sound with my laptop) I should mention that I live at around 7000 feet above sea level. My car normally has a lot less oxygen to work with. While most of you have to live with a system that runs lean, mine runs just fine, albeit with much lower power than at sea level. *Your* experiences may be somewhat different. Try it! Let us know.

The **second** solution is to take the sensor apart and try moving the wiper arm on the potentiometer to a different place on the resistance track. Fred Smith has had good luck



doing that, and others have too. I haven't tried to repair mine this way. I was too curious about fitting a new one. I won't go into that discussion here, we'll save that for later. Richard's article talks about the process somewhat as well. For those of you who absolutely want total, complete, absolute originality (I'm thinking of people like the Peter Rudge's and Bill Wood's of the wedge world), this is the only solution and you may need a couple of these to cobble together to make one work right.

A **third** solution is what we'll discuss here. There are alternative throttle potentiometers out there that can be made to work. The first one I'll discuss is the one both Richard and I have on our cars now. Richard Connew used one he got from S+S preparations (ask for Rick or Steve, UK telephone: 44 1706 874874, or steve@sspreparations.co.uk). It's a Lumenition part, TPS-001 and, as of this writing I'm afraid it's something like 60 pounds; I thought that was expensive when I bought it earlier this fall but now it's *much* more with the dollar so weak.

Another cheaper alternative TPS has been suggested by Gene Thompson but it definitely looks quite different from stock. I'll quote from his Email: "I just checked Autozone - it's a normally in-store-stocked item and they have it for \$32.99. I also checked the parts store I love to hate - Schucks/Kragen/Checker at www.partsamerica.com. They have it for \$32.99 also and popped up a handy application list if you want to go junkyarding (list available from the authors or from the archives of the WWWedge mailing list). Throttle Position Sensor: With Oem # 17123852." I followed Gene's advice and went down to my local Autozone and indeed found the part he mentioned (at a somewhat higher price here for some reason). It's a Wells/Duralast part, TPS140. If you go and ask for one, ask them for the Throttle Position Sensor for a 2002 Chevy Silverado 2500, *without* traction control. You can see pictures of the thing just by going on the web and searching almost any car parts website too.

OK, so are either of these parts drop-in replacements? I'm afraid not. Some machining is required to make an adapter plate (or to modify the original plate) so one of these will fit. Actually, the original had a pretty silly adapter plate if you take the time to look at it, aluminum with a steel insert. Richard did the easy thing, just ground the existing adapter plate flatter and thinner, drilled and tapped in some new threaded holes to mount the sensor, redid the electrical connector and he was done. I had to be different. I got a piece of scrap 3/8 inch thick aluminum, cut it roughly to size (including trying to match the wacky shape of the original), drilled 3 new mounting holes to fit the plate to the plenum chamber and drilled out a center hole for the throttle shaft (the photo shows the roughed out adapter plate next to the original). I then drilled and tapped two more holes to mount the Lumenition TPS in place. Once I knew everything would fit, I took my trusty Dremel and carefully shaped and carved and fussed until the adapter plate looked almost just like the old one, except the new one is a curiously





scaled down version, thinner and smaller. It was as if I put the original in a shrinking machine. At first glance, you'd be hard pressed to tell it's not the original.

There's a wee bit more fussing you must do. The Lumenition pot doesn't quite fit on the existing throttle shaft spindle (and in fact, neither does the GM part). So, you either shave down the throttle spindle, or carefully file away the inside of the Lumenition part until it fits. For the GM part you'll have to put in a shim to make it fit the throttle shaft, which in this case is too *small* for the hole. For the Lumenition TPS, Richard sanded down the throttle spindle, I filed the TPS hole a bit bigger. A photo of what mine finally ended up looking like is shown right (looking through one of the "hood" louvres). Also visible on the adapter plate is one of the mounting holes for the GM TPS switch. I can theoretically fit either TPS to this adapter plate for future experiments.



Finally, there's also the matter of fitting the electrical connections. I hacked off the new plug, cleaned up the *original* plug, and soldered things back together. Richard used the new plug and its mate, these furnished with the Lumenition kit. Both solutions work fine, just depends on your preferences as to how the final wiring looks. What needs to be done to make GM part fit electrically? We still need to sort out the kind of weatherproof connector used and where you can get them. Perhaps we'll include this in a future article.



Frankly, this whole adapter plate "problem" is something we as a club could get behind and just have a whole bunch of them made to make this whole process easier. In fact, Richard originally suggested this. I used a small sabre saw with a metal blade to cut the Al piece to size, I also have a small drill press in my garage, a Dremel tool, and a set of taps, and a nearby hardware store where I can pick and choose between various screws and threads. I realize this is more work than most of you would like to do. A real kit with a TPS sensor already made to fit, an adapter plate, and all the required screws sure



would be nice. Then all you'd need to do would be to decide on how to do the electrical connection.

By the way, I have not yet tried out the GM part even though I have it here. The adapter plate I made will permit me to fit this (cheaper) GM TPS as well as the Lumenition part but I have yet to get motivated to find the right connector and actually try it out. By the way, the two pots do have slightly different total resistances from the original. This may actually matter as rotating the potentiometer into the right position and resistance (as suggested in the ROM) doesn't seem to be very well documented and is important. More experiments are coming.

Results and Summary

Setting the initial resistance on the TPS is a little hit or miss —the cold idle speed seems to care where the TPS is set. I haven't yet played around with this setting very much and there doesn't seem to be any good description of doing this on the web. The ROM tells you to use some Lucas “machine” to set it. We haven't explored that yet at all either. We have a little more work to do before our next report.

After driving around, what do I think? Generally I'd say the car now has a much smoother acceleration, and the car feels a bit punchier and more responsive than it did without the old TPS connected. The old TPS gave me curious flat spots which are now completely gone. Richard Connew has a modified ECU (with no lambda feedback) and he reports a *vastly* improved driving experience. I have noticed that my idle takes a long time to come down from the fast idle at start. That doesn't happen with the TPS disconnected. One final comment? I haven't tried the dyno yet, just driving around, shifting gears, starting from a stop light, things like that. It'll probably be hard to detect a difference but we'll see

Request for more information?

If anyone is interested in further details, please contact me by Email (tencate@mac.com). If we get enough interest, we may try and find someone to make up a kit and sell these via the club. Moreover, Gene has a diagram and description which I'll put on the WedgeLab site in case you want to try some experimentation yourself. Thanks to Fred Smith, Brian Ridley-Jones, and others on the WWWedge mailing list for helpful discussions too.

Stay tuned!

Jim, Richard, and Gene