Long Term Fuel Trim: A Nod in the Right Direction

by ATRA Tech
members.atra.com
www.atra.com

A customer brings his car in to your shop with a shifting problem. Is it inside the transmission or outside, in one of the many computer systems or circuits that control virtually every operation in today's cars?

The problem is, it doesn't have a code. Faulty connections, slightly out-of-range sensors, and even computer problems can all hide within the range that's just close enough not to set a code, while being just bad enough to cause transmission issues.

Wouldn't it be great to have something you could check that would at least indicate whether you were dealing with a control problem or not? There is: Long Term Fuel Trim.

Understanding Fuel Trim

Fuel Trim has been available as a diagnostic tool since OBD-II first showed up on your scan tool. Fuel Trim is the term used to describe how the computer controls the amount of fuel being delivered to the engine. *Short Term* Fuel Trim is the moment-by-moment changes to fuel delivery, based on the signal from the primary oxygen sensor (or sensors).

When everything's working properly, Short Term Fuel Trim should vary up and down, generally -5 to +5. That tells you the computer is controlling fuel delivery based on the oxygen sensor feedback.

Long Term Fuel Trim is a different story. Long Term Fuel Trim is a learned response, created over a period of time. Its primary purpose is to shift overall fuel delivery up or down, to allow Short Term Fuel Trim to maintain a full range of control in each direction — from -100 to +100. That is, Short Term Fuel Trim has a range it can operate within. When the computer can no

Figure 1: By using the Global OBD II setting your scan tool will display fuel trim the same on every car you check. This'll give you a chance to become familiar with the readings.

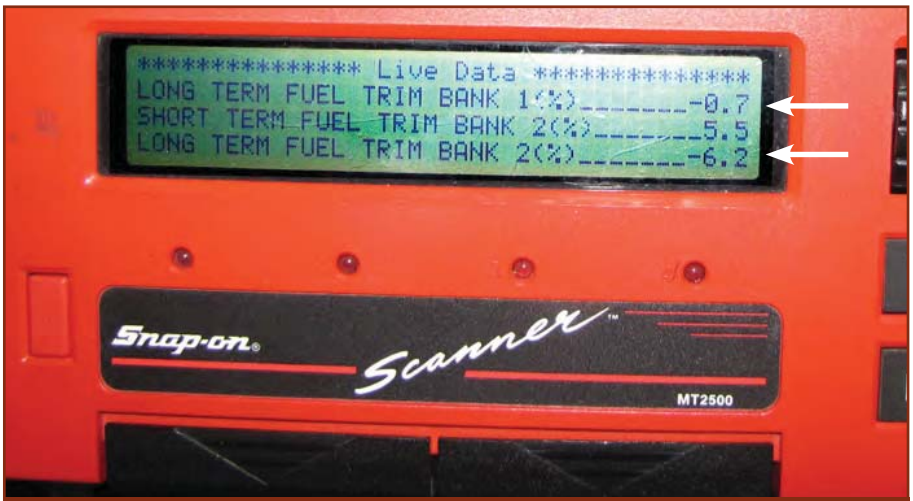


Figure 2a: This vehicle has a v-8 engine and reports bank 1 and bank 2. Notice bank 2 has a large disparity from bank 1, at -6.2. This could be caused by any number of problems: a leaking fuel injector, an O2 sensor, a bad spark plug or spark plug wire etc. But since it's only on one bank it would not be something that would affect both sides, like a MAS or TP sensor.

Rex Diff and Gearbox

RDG

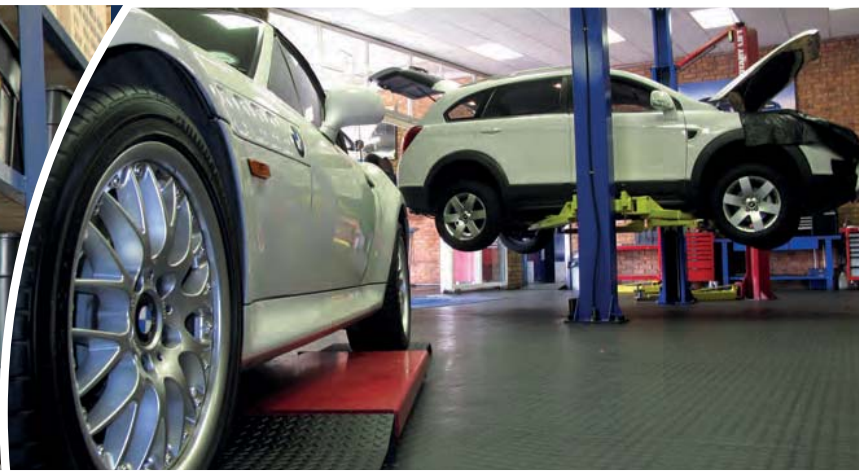
Specialists in Differential & Gearbox repairs nationwide ®

People **P r i d e** **Passion** Perfection

Rex Diff & Gearbox (RDG) is one of the leading specialists in Southern Africa for the repair, maintenance and supply of remanufactured service exchange differentials, gearboxes, propshafts, clutches and steering boxes



RDG MAKES ALL THE DIFFERENCE

SABS ISO 9001:2008 SABS SANS 10279 RMI ATRA AA

www.rdg.co.za

RDG Boksburg JHB	RDG Cape Town	RDG Durban	RDG Truck Jet Park	RDG Diff Jet Park	RDG Port Elizabeth
salome@rdg.co.za	fritz@rdg.co.za	dean@rdg.co.za	niel@rdg.co.za	dennis@rdg.co.za	marka@rdg.co.za
Tel: +27 11 823 4393/83	johanvb@rdg.co.za	mariam@rdg.co.za	dennis@rdg.co.za	Tel. +27 11 823 5850	elaine@rdg.co.za
Fax: +27 11 826 7342	Tel: +27 21 3851949	Tel: +27 31 569 6869	Tel : +27 11 826 2722	Fax. +27 86 632 9098	Tel: +27 41 586 3616
	Fax: +27 21 385 1862	Fax: +27 31 569 6872	Fax : +27 11 826 4193		Fax: +27 41 586 3615

Find us on Facebook: Rex Diff & Gearbox RSA
Rex Diff Sa (Rdg)

RDG is an approved Service Provider to most South African OE motor manufacturers and importers.

longer control fuel delivery adequately it's given a new range to operate under. Switching to this *new range* is a function of Long Term Fuel Trim.

What that means is that a problem in the computer system, such as a faulty MAP, MAF, or TP sensor, will usually show up as a shift in the Long Term Fuel Trim reading. According to Robert Moreau, technical marketing support coordinator for Sonnax, a normal Long Term Fuel Trim reading on most vehicles will range between about 0 to +7 if the system is operating properly.

Anything outside of this range should be a red flag; it indicates that something's out of specs in the computer system. What's more, if the Long Term Fuel Trim is within the accepted range, you can be pretty sure that everything outside the transmission is working the way it should.

Examining Long Term Fuel Trim

Let's look at how Robert recommends checking the Long Term Fuel Trim to help identify a problem in the computer system.

First, it's important to understand that this test procedure only works before anyone's played with the computer system. Once someone clears the computer's memory, all of the readings — including Long Term Fuel Trim — go back to baseline. The Long Term Fuel Trim won't be useful again until

Figure 2b: Here, we've added a vacuum leak and let it idle for about 15 minutes, to illustrate its effect on Long Term Fuel Trim. Long Term Fuel Trim went up 7 points on bank one and 7.8 on bank two. We're a long way from setting any codes but we're getting near that area where drivability problems begin to occur.

Figure 3: At 1,500 rpm the readings are in range. At a higher rpm that fuel leak has no affect on the system.

the vehicle has been driven through a complete drive cycle and the readiness codes have reset.

But assuming the system hasn't been altered by clearing the codes yet, the procedure for checking the Long Term Fuel Trim is simple:

- Connect your scan tool to the diagnostic link connector.
- Set it for Global OBD-II (figure 1).
- Check for any codes in memory; record any codes you find.
- *Don't* clear the codes yet.
- Start the engine and let it run until the engine reaches normal operating temperature.
- Check and record the Long Term Fuel Trim at:
  1. Idle (figure 2)
  2. 1500 RPM in park (figure 3)
  3. Normal cruising speed while driving (figure 4)

Don't bother checking it at wide-open throttle; under those conditions the system will drop out of closed loop and your readings will be meaningless.

Examine your readings: Under each condition they should be around 0 to +7. If they're outside of those readings, it can affect transmission operation without setting any codes or affecting emissions. So consider looking more closely for a problem in the computer system, or at *minimal,* documenting your readings.

If there were any codes in memory, check them first, before going anywhere else. If there were no codes, start by checking powers and grounds to the computer system, including the battery terminal ends.

Then move on to the sensor circuits. In most cases, the problem you'll be looking for will involve a load sensor, speed sensor, or temperature sensor. These are the sensors that have the greatest effect on transmission operation. (Of course, other sensors will affect the Long Term Fuel Trim.)

One thing to look for is whether there are differences between the banks on V-type engines. For example, if the left bank's Long Term Fuel Trim is within specs but the right bank's is pulled negative, you know the problem is related only to the right bank, such as a fuel injector or primary oxygen sensor. There's no reason to waste time checking things like the fuel pressure or sensors such as the MAF, TPS, MAP, IAT, or other systems that will always affect both banks.

Figure 4: The Fuel Trim reading look normal. The low reading at an idle is worth noting. You may not have any problems now but it's good to note this in case the customer has problems later.

When it comes to oxygen sensors, remember that the only oxygen sensors that affect engine performance and fuel delivery are those in front of the catalytic converters. The ones behind the catalytic converters are only there to measure converter performance. They have no effect on fuel delivery.

When it comes to checking Long Term Fuel Trim, Robert offered this suggestion: "I'd recommend checking the Long Term Fuel Trim on every car that comes into your shop, whether it has a transmission problem or not. And record the results on the repair order. This gives you a chance to become familiar with how Long Term Fuel Trim should look on a wide variety of vehicles. And that record could be useful if the customer comes back later with a new problem that 'wasn't there before you touched it.'"

Long Term Fuel Trim won't point you directly toward any one problem, but it's a terrific way to help answer one of the most important questions when it comes to transmission diagnosis: Inside or outside? It's not a pinpoint diagnostic tool, but there's no question that Long Term Fuel Trim is a nod in the right direction.