CARQUEST ENGINE CONTROLS FALL 2005

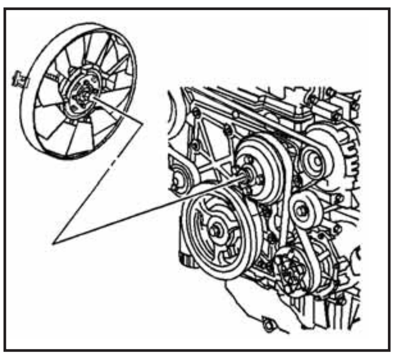
TechPro Bulletin

SPECIAL EDITION

GM'S EV FAN SYSTEM
GM VEHICLES - 2000 & LATER

Since 2002, GM's Trailblazer and Envoy mid-sized trucks have used a unique cooling fan system. Called the EV or Electro-Viscous, it combines the reliability of a mechanical fan with the flexibility of electronic control. It is bolted to a belt driven pulley with an electrical connector running into the fan shroud.

The PCM looks at coolant, intake air, transmission temperatures, A/C pressure, and MPH to calculate desired fan speed. Unlike many computer- controlled outputs, the PCM pulses 12v to the fan relay to



energize it. By varying the on time of the pulses, the PCM can control fan speed. The relay contacts send power to the fan clutch. A solenoid in the clutch allows fluid past spring loaded valves to "lock up" the clutch when energized, causing fan speed to increase. By varying the on time fan speed is controlled. The PCM monitors fan speed by a three wire Hall effect sensor, which pulses a voltage back on the signal line. Both the command and the feedback can be seen on a scan tool to see if the system is in control.

Desired Fan Speed- shows what speed the PCM calculated based on sensor inputs.

Actual Fan Speed- feedback sent by the fan speed sensor in the clutch. While not always exactly the same as desired, it should be close.
The PCM can detect malfunctions in the system and set codes. Here are some examples:

P0495- Fan speed too high -PCM has seen fan speed too high after 0% command for about 2 minutes.
P1481- Cooling fan sensor circuit. PCM lost signal from the cooling fan speed sensor for about 10 seconds.
P1482- Cooling fan speed output circuit. PCM detects an incorrect voltage from the fan relay circuit for about 6 seconds.
P1484- Cooling fan system performance. PCM detects fan as being locked up or a speed error of 1000+ RPM for 100 seconds.

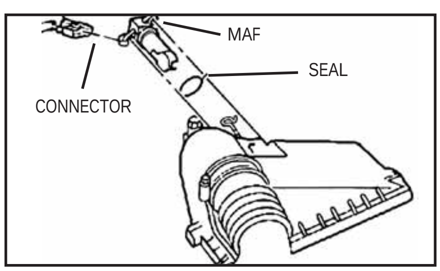
A scan tool with bi-directional control can allow you to see if the fan responds to commands from the PCM.

From the calls we've seen so far, the most common issues seem to be P0495 or P1484. The callbacks with fixes mostly were bad fan clutches. Some of the earlier vehicles had updated flash calibrations to make the P1484 less likely to set. When diagnosing one of these that seem to operate ok, don't forget to check for updates!

Joe Dantuono - *Top Gun Technician*

CODE P0171-1998-2002 CHEVY PRISM

Chevy's '98-'02 Prizm, with it's Toyota systems, has been a very trouble free vehicle. Recently though we've been getting calls with a MIL on and a P0171 in memory. The owner may also mention a slight hesitation or not as much power lately. Both concerns we've mentioned could stem from a lean condition where fuel pressure and O2 sensor testing show those



systems ok. It may be time to look at the MAF sensor. These cars use a 5-wire unit located in the air filter housing. The sensor uses the hot wire method to sense airflow and integrates the intake air temperature sensor.

The MAF's job is to be the primary sensor for engine load so the PCM can calculate fuel and timing requirements. You can watch the sensor input on a scan tool as grams/sec. This value changes with RPM and engine load. If the sensor is skewed low, it won't "tell" the PCM about all of the air passing through it and the PCM won't calculate a long enough on time for the injectors. For example, when the throttle is first opened on acceleration, a shifted sensor may "miss" the extra rush of air coming into the engine and cause a lean stumble. Another possibility would be if the sensor didn't report all the air entering at high speed cruise resulting in a slightly short on time and the fuel trims going up to try and compensate from that end.

Joe Dantuono - *Top Gun Technician*

ASIAN QUICK TIPS

1996 and up Honda Civic models engine designation is easily identified by the white sticker on the timing belt cover. These vehicles all utilize a 1.6L motor and correct motor designation is crucial for diagnostic information or parts ordering. The motor designation will start with a D. For instance, D16Y8 is a very common motor designation. Sometimes there may be as many as 5 different 1.6L motors on a particular year vehicle. A quick look at the timing belt cover will go a long way.

Toyota vacuum operated EGR systems all utilize a pressure transducer. This pressure transducer uses an atmospheric vent that is routed to the throttle body ahead of the throttle plate. This vent or bleed is essential for proper EGR operation. Problems occur when a throttle body is coked up and restricts or plugs this vent up. EGR operation becomes harsh and driveability complaints will follow. A good practice to follow when doing a throttle body service is to make sure these ports are free and clear.

1995 and up Subaru Legacy and Impreza vehicles with a misfire on #1 cylinder. First confirm that the misfire is caused by no injector pulse. Then check for idle speed codes and also for proper idle speed. These vehicles utilize a strategy that if idle speed is too high it will disable #1 injector in an effort to rectify idle speed. Fix the idle issue and #1 injector will come back from the dead. Something to remember the next time. On a different misfire note. A common complaint is hard start/no start and poor driveability in the morning on these cars. A quick check for spark quality is in order. Check with an open gap style tester calibrated for 30kv. It should jump this open gap easily and consistently at the plug wire end. If it doesn't, check the coil positive voltage at the center terminal with a DVOM. It should read battery voltage. Water logged or high resistance ignition relays are commonplace causing low or erratic coil positive voltage. If voltage is good, a coil pack/ignition wire replacement is the next step. Don't forget to look at those spark plugs as well.

***John Rogers** - Asian Specialist*

FORD QUICK TIPS

If scanning a EEC-4 vehicle nets you a code 15 (ram error) first check to see if there is an aftermarket performance module attached to the processor itself. Attaching one of these "chips" will result in an on demand code 15.

Have problems getting the high speed fan to shut off on a Ford product. A look at scan data reveals the temperature is in working order and the ac is off. Look for a three wire ac pressure sensor on the high side ac line. This three wire sensor will have a 5vref, sensor ground, and a signal. A quick check at the signal wire will tell you your problems. Basically for every 100psi ac pressure you will see 1.0v. For instance, if we have 240psi high side pressure you should see 2.4v on signal wire. This parameter is easily overlooked on the scanner and some scanners don't have this PID labeled ACP.

Intermittent stalling on deceleration with EGR equipped vehicles. Disconnect the EGR vacuum line and car is fine. Before replacing that EGR valve take a look at the EVR solenoid. This is the solenoid that controls vacuum to the EGR. It has a plastic cap on top of it and under that cap is a foam filter. This filter can clog and cause poor bleed off of vacuum from the egr circuit. A quick removal and cleaning with shop air is all that is needed usually.

***John Rogers** - Ford Specialist*

OXYGEN SENSOR DIAGNOSTICS

A vehicle exhibits driveability issues such as: bucking, surging, and MIL illumination. The codes retrieved may be adaptive fuel codes or straight up oxygen sensor codes. A quick visual shows oxygen sensors are hooked up electrically. But, the question is are the hooked up properly?

When I receive this call, the first thing I have the tech do is to disconnect all the o2 sensor connectors, both upstream and downstream sensors. Now, road test the vehicle. Is the problem gone?
If it is it is, time to break out the wiring diagram and match the right oxygen sensor to the correct harness connector. I typically see this on SUV vehicles that have had recent transmission, engine, or exhaust work. Connecting the wrong o2 sensor to the wrong harness causes the computer to check trims that are on the wrong bank or checking fuel trim after the catalytic converter. Either way, it is a recipe for driveability issues.

One instance that can really drive a tech nuts is on a late 80's EFI Honda vehicles incorporating dual oxygen sensors. This system uses an O2 "A" circuit which monitors exhaust on cylinders one and four. O2 "B" circuits monitors cylinders two and three. Switching these will cause major driveability issues until the mil is illuminated and an oxygen sensor circuit problem/open loop failsafe is set. Incidentally Honda utilizes a .5v bias on O2 signal wires much like GM.

***John Rogers** - Asian Specialist*

In the early days of electronic fuel delivery there was no oxygen sensor and life was simple. Controllers were analog devices in those days, not digital like modern computers, so a change in a sensor signal directly caused a change in the controller's output(s) for fuel and/or spark control. Then along came the EPA, the Clean Air Act and Bosch with their Oxygen Sensor and the lives of mechanics and technicians changed forever.

In early EFI systems the O2 signal had real authority over fuel delivery. Ford's EEC III system for example could add fuel –based on a lean, low voltage O2 signal-until there were black clouds coming out of the tailpipe. It could also lean out the system to the point of a stall. Since the sensor wasn't really needed to run the engine, it's authority- or the degree to which it can alter fuel delivery-was greatly reduced in later systems. These are the systems we've all been fixing for the last 20 years and whether it's a Ford, a Toyota or a Saab the O2 could alter fuel delivery by about +/- 10 % before the computer would set a code.

OBD2 systems can easily change fuel delivery by more than +/- 30% and this can cause problems when this much of a change isn't really needed. Some systems have been seen going beyond 40%! In most of the OBD2 systems when the O2 heater power supply shorted to the signal we just get a code indicating that the signal was stuck rich. In a few we see misfire codes but no sensor faults; this is because a misfire is deemed a more serious –or potentially pollution causing- problem.

In several newer GM vans we have seen the O2 signal cause rapid fuel trim changes that caused both misfire codes and a stall. These vehicles have a lot of wiring harness problems in general. Most scanners can't show the actual voltage on the O2 signal circuit. Instead they display a little over 1,000 mV [typically 1,070] even when the 12v heater supply is shorted to the signal. One van was setting misfire codes but only for the cylinders on one bank. That sensor indicated 1,070mV key on engine off when cold and the short term fuel trim for that bank was -32%. Within a minute of starting cold these four cylinders started missing badly. Once the upstream sensor for that bank was disconnected they all started working again. Swapping the O2 harness connectors to see if this was a wiring or sensor problem created a start/stall with both banks indicating -32% STFT. Disconnecting both of the sensors proved they were faulty as the scanned data then showed only the 0.450V bias voltage. Measured voltage on the two banks was between 8V and 9V. Disconnecting the upstream O2 sensors on an OBD2 system does NOT make the system "go full rich" any more than it did on earlier systems. All this does is prevent feedback, or closed loop, operation.

This happened in a G/Express/Savannah van, but the fuel system is the same as what's in many pickups, so you can expect the problem to show up in those vehicles as well. Manufacturers have indirectly given the O2 sensor more control over fuel delivery. Now you'll have more of an understanding of the O2 sensor's role in these systems.

***Jeff Auerbach** - Top Gun Technician*