Know the system and you can fix it.

By: Scott Shotton

If you know how something works... you can fix it. No matter what system you deal with on a car or truck, it can be fixed if you have the right knowledge and information. Some technicians do not have the luxury of factory service manuals for every vehicle that rolls into the shop. A computer system with technical information like AllData or Mitchell on Demand may not be available either. In these cases it is even more important for the technician to understand the effected system. In other cases, if a trouble tree is available, it might not explain what is being checked in each step and may confuse the technician even further. Besides, could technical information ever contain typographical errors?

My point is simple: knowledge is a valuable tool. Understanding whatever system you are trying to diagnose makes all of the difference in the world. Some printed technical materials you cannot live without, while others seem to make no sense at all. As a result we need to step back and use all of our tools, including available literature and our minds, to solve problems. The few moments it takes to review our options can save valuable time and effort. These same few moments also present multiple plans of attack. These plans are fabricated from literature, knowledge, and experience.

To illustrate my point I have chosen a Ford Exhaust Gas Recirculation system. Fords usually set PFE (Pressure Feedback Egr), DPFE (Delta Pressure Feedback Egr), or EVP (Egr Valve Position) sensor codes when a problem is detected in the EGR system. Although these sensors are common failures on these vehicles, you cannot afford to jump to conclusions. The incorrect sensor value could be a result of a malfunctioning mechanical component. Swapping a sensor and sending the car down the road could come back to bite you. So what route should we take to solve these problems?

To answer this question we will be attacking a P0401 on a 2000 Ford Explorer. The first step is to break the system down into it's three base parts. These three parts remain the same from the early 1980's to the present. They are as follows: the mechanical system, the control system, and the feedback system. down Because Ford EGR systems have been very similar for more than two decades this procedure works on almost all Ford products.

Lets take a 1991 Lincoln Town Car with a 4.6 for our example. Its operation is really quite simple but, as you may have seen, it has its problems. Our patient's code will be 332 - DPFE signal does not change. Checking the factory service manuals would lead you to Pinpoint Test DL. This Pinpoint Test consists of 23 pages and 102 tests. I don't know about you, but to me that seems like an awful lot of information for such a simple system. Don't pitch those charts in the trash, but let's think about this for a minute. What is another option?

Lets take a look at how this system works. The engine supplies vacuum to the EVR (Egr Vacuum Regulator). The EVR has power when the ignition is on and the ECM supplies the ground to the EVR (opening and closing it). The vacuum is allowed to pass through the EVR to the EGR valve. When the EGR valve opens the pressure in the exhaust tube just prior to the EGR valve changes. The DPFE sensor reads the pressure change and relays that information back to the ECM. That's it. If it is that simple, how can we break down this system to test it?

We can separate the system into three distinct parts: 1. The EGR valve and passages (exhaust and intake), 2. The control circuit (vacuum and electrical), and 3. The monitoring circuit (or the DPFE). Verifying these parts independently allows us to quickly narrow a fault down to a much smaller area.

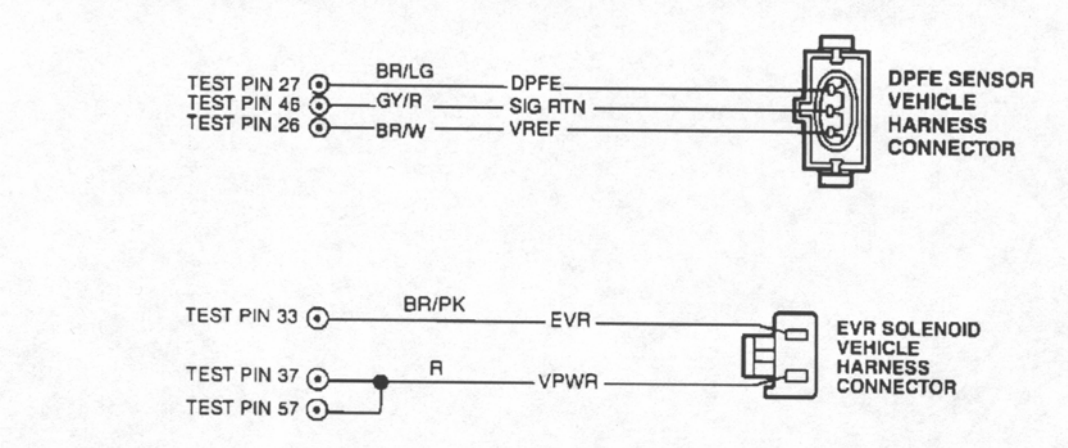

FIG 1. The entire wiring schematic for this EGR system is really quite simple.

Here is how I test a Ford EGR system:

1. Disconnect the vacuum line at the EGR valve. Connect a vacuum pump to the valve and a vacuum gage to the line. The vacuum pump allows us to operate the EGR valve. The vacuum gage allows us to monitor the entire control circuit (vacuum and electrical) while the ECM requests EGR flow.
2. Connect a scan tool to the DLC and get ready to run the Key On Engine Running test. (During this test the ECM cycles the EGR system)
3. Run the Key On Engine Running test and observe the vacuum gage. At some point during the KOER the vacuum gage should slowly climb to about 7 inches of mercury then drop back to zero. If the desired 7 inches of mercury is achieved then we know the entire control circuit is good.
4. Apply vacuum to the EGR valve and see if the engine runs rough or stalls. If there is a noticeable PRM change then we know that the EGR valve and passages are functioning.

With these 4 steps we can gather enough information to solve most any problem, or at least narrow the problem down to a very small area, in the EGR system. If the vacuum gage showed the desired reading then we know that the entire control circuit is functioning properly. All of the vacuum lines, EVR solenoid, wiring for the EVR and ECM are good. If the engine runs rough when vacuum is applied to the EGR we know that it is functioning properly. All that leaves us is the DPFE. Checking the DPFE hoses and the scan tool readings against specifications is about all there is left.

Lets say that we run this test on our Lincoln. Step 3 works fine but step 4 does not produce any RPM change. The next step would be to shut the engine off, apply vacuum to the EGR valve, and release it quickly while listening for the EGR valve to snap shut. If an audible noise is heard then the valve is opening and closing and the passages are probably plugged. In this case, that is exactly what we have. Plugged passages are very common on this vehicle and Ford has issued a TSB because of it (TSB 96-23-4). The throttle body can be removed and the EGR passages can be cleaned. The only part required to perform this repair is gasket part # F1AZ-9H486-A.

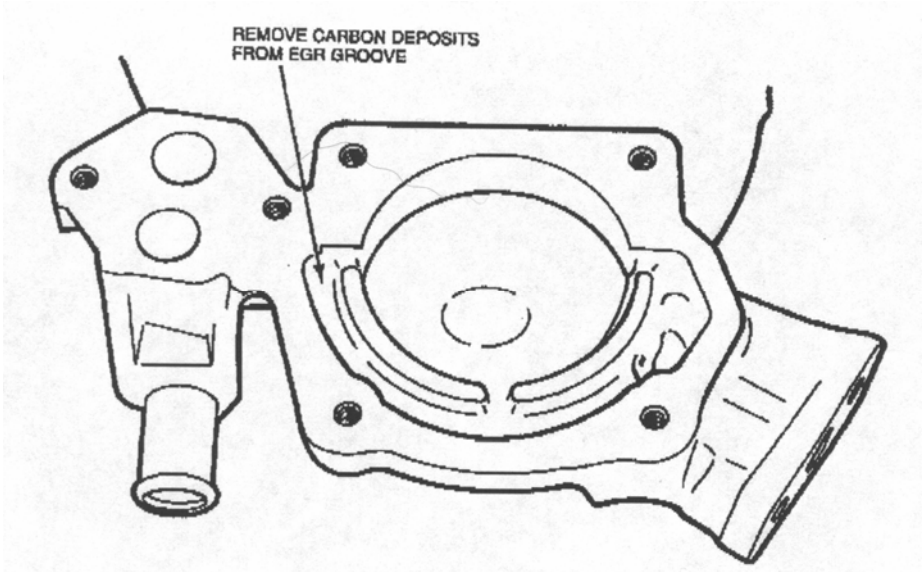

FIG 2. TSB 96-23-4 shows exactly where the carbon builds up in the EGR passages.

If another deviation from the expected test results is obtained, all we have to do is trace backwards. Backtrack just like checking spark at the plug, cap, coil wire, and then the coil. The vacuum circuit works the same way, and so does the EVR control circuit. If the EVR doesn't work: does it have power? Is the ECM grounding it? It's all common sense when you know how it works.

So now we have two options: follow the trouble chart or use our knowledge to tackle the problem. The road you choose to take is up to you.

Now, just to make sure no one read this wrong, I didn't say throw the Pinpoint Tests in the garbage. You may end up needing them if you should happen to have a very odd problem. However, doing this test first will allow you to go through a good portion of the chart and know the answers without performing the requested check (because you know how it works). Basically, we are streamlining the process and making the diagnosis quicker and more profitable.

Knowing how the system works, and spending a little time thinking about it, can save lots of time and lead to the correct diagnosis the first time. It doesn't matter what system it is. Stop, think, and figure what is supposed to happen. Is it happening? What isn't happening? What is making you a better technician? Exactly, the more you know… the more you can fix. Always a desirable thing.