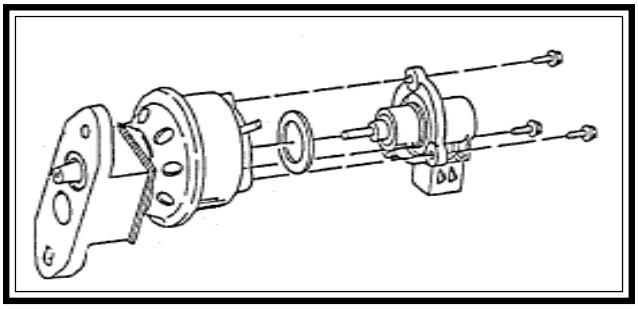
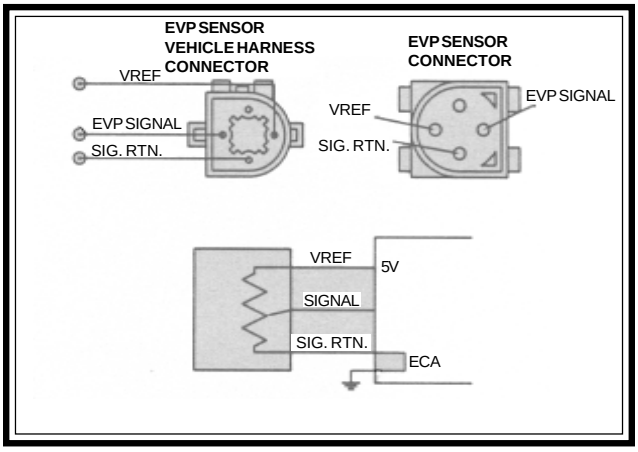
TomcoTechtips
TM
ISSUE 19

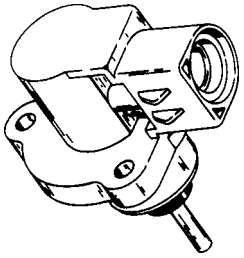
EGR VALVE POSITION SENSORS

The EVP (Exhaust gas recirculation Valve Position) sensor fits on top of the Ford Sonic EGR valve. It is held on to the EGR valve by three nuts or machine screws. (Fig. 1) In between the EVP sensor and EGR valve is a rubber gasket or o-ring that seals the vacuum chamber of the EGR valve. The EVP sensor provides the electronic control assembly (ECA) with a signal indicating the position of the EGR valve pintle.



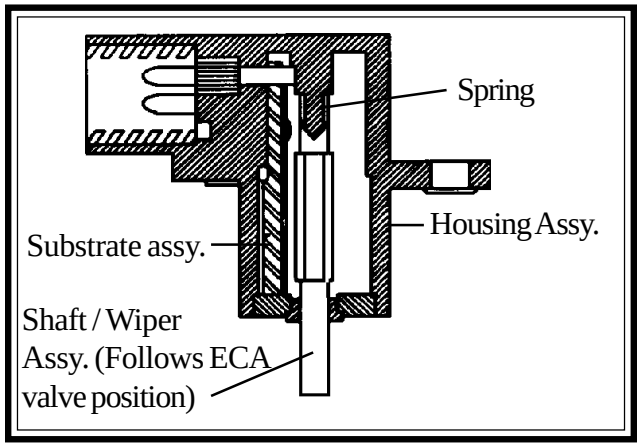
The EVP sensor is a linear potentiometer. A potentiometer is a mechanical device that measures movement. It converts this mechanical movement into a voltage value.



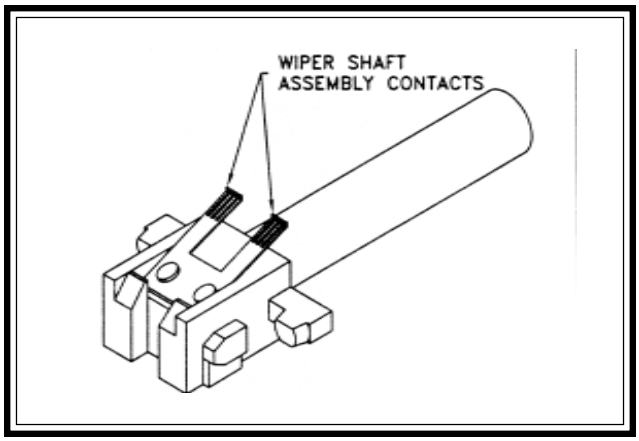


The EVP sensor has a three terminal connector. (Fig. 2) One terminal carries a 5.0 volt reference signal from the ECA. Another terminal, which Ford calls the signal return, provides a ground for the sensor. The last terminal is the EVP signal sent back to the computer.

The EVP sensor is made up of a plastic housing (Fig. 3), substrate assembly, two springs, and a wiper shaft assembly.



The tip of the wiper shaft assembly rests on the EGR valve's diaphragm pintle assembly. As the diaphragm pintle assembly opens and closes it moves the wiper shaft assembly an amount equal to the position of the valve.



The wiper shaft assembly has two contacts (Fig. 4) located on one side. These contacts run over the substrate assembly in a linear motion.

The substrate is made of ceramic material. The ceramic material has three electrical circuit paths on one side. (Fig. 5). Each circuit path connects to a specific terminal of the sensor. The left one connects to the 5.0 volt reference terminal, the center one connects to the signal return (ground) terminal, and the right one connects to the EVP voltage return line.

The one on the right has a high resistive value while the other two have a very low resistive value.

As mentioned earlier, the contacts on the wiper shaft assembly run over the substrate. The two contacts move over the two outer electrical current paths as the EGR valve opens and closes.

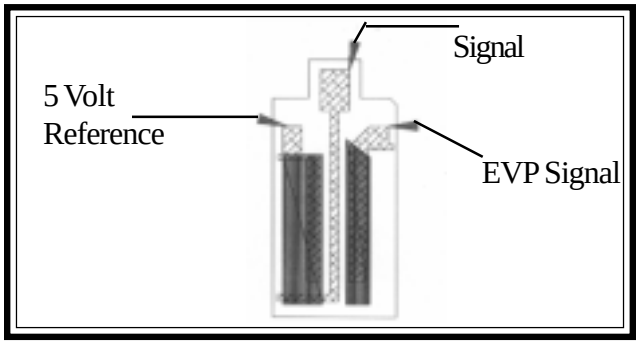
When the EGR valve is closed the wiper shaft assembly is located at the position shown in Fig. 6. The 5.0 volt reference signal is traveling across a large portion of the resistive circuit path. This results in most of the voltage being dropped across the resistive circuit path. Therefore, the voltage signal sent to the computer will be a small voltage. This is typically between 0.4 to 0.8 volts.

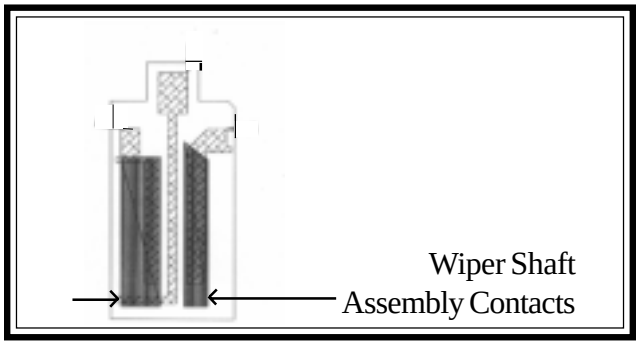
As the EGR valve opens the wiper shaft moves upward along the resistive circuit path. This will result in less of the 5.0 volt reference being dropped across the resistive circuit path, and a greater voltage value being sent back to the ECA. In Fig. 7 the wiper shaft assembly is about halfway up on the resistive circuit path. The 5.0 volt reference signal is traveling over a smaller portion of the resistive circuit path. The ECA would see about 2.5 volts at this position.

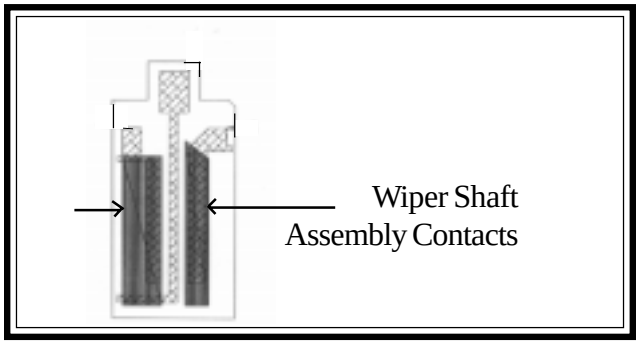
This varying voltage signal sent to the ECA lets the computer know the position of the EGR valve. This signal is used by the ECA to:

- Calculate spark timing
- Calculate air/fuel ratio
- Adjust EGR flow
- Set an EGR service code

An analog ohmmeter can be used to check the EVP sensor. Disconnect the wiring connector from the EVP sensor. Connect one lead of the analog ohmmeter to the EVP signal side of

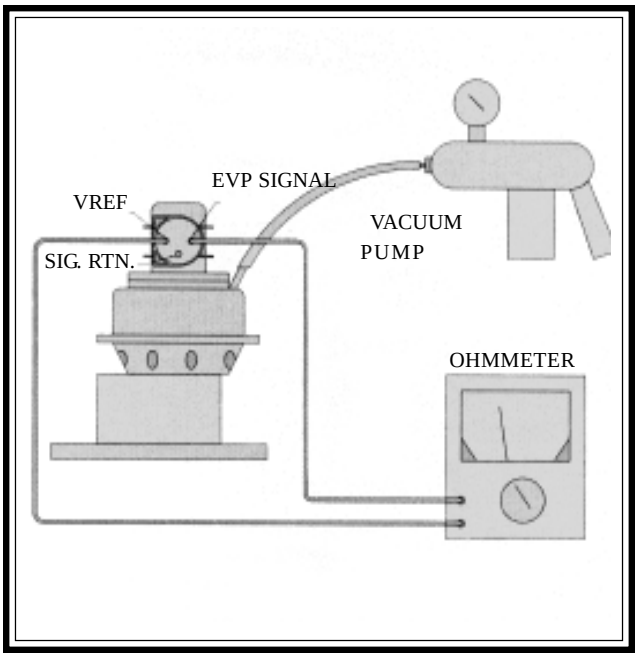






the sensor. (Fig. 8) Connect the other lead to the voltage reference side of the sensor. Place the ohmmeter on the 200 K OHM scale. Connect a vacuum pump to the EGR valve. While watching the ohmmeter, gradually and steadily apply vacuum to the EGR valve (not exceeding 10 PSI). The ohmmeter should show a steady decrease in the OHM reading. If the ohmmeter needle has any sharp movements or shows a slight increase while applying the vacuum, the sensor is bad.

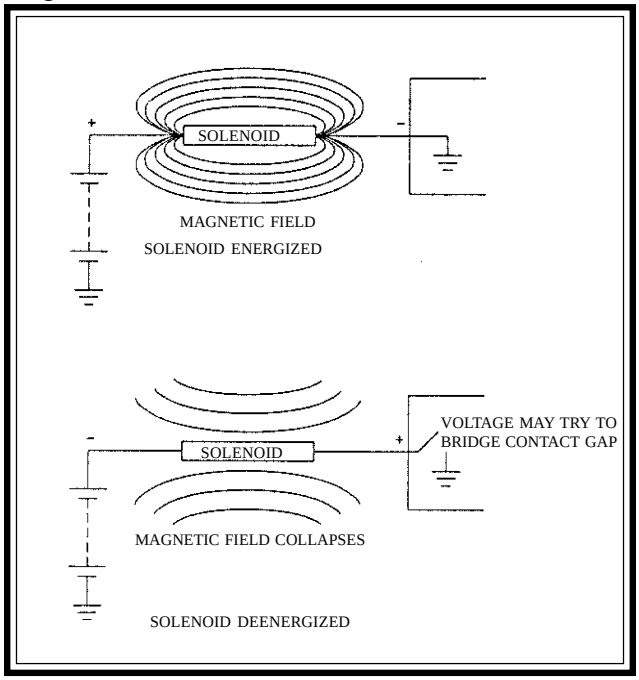
There is also a range that the OHM readings should fall between. In some cases this ranges from no higher than 5,500 OHMs, to no less than 100 OHMs. Check with your service manual for the exact specifications for your vehicle's sensor.

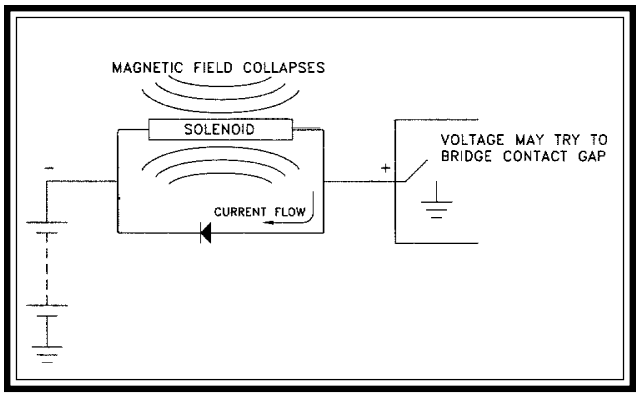


ELECTRONICS 101

CLAMPING DIODE

One type of small signal diode is called a clamping diode. This type of diode is used to prevent and/or safely dissipate a high voltage surge, caused by the abrupt collapse of a magnetic field.





We know that when a voltage is sent through a relay or solenoid a magnetic field is built up. (Fig. 9) When the voltage to the solenoid or relay is abruptly interrupted the magnetic field collapses. This collapse in the magnetic field induces a voltage in the opposite direction.

If the voltage is large enough it could try to bridge the open contact. This voltage spike could cause possible damage to other electrical components. A diode installed in this circuit (Fig. 10) can prevent this from happening.

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When the magnetic field collapses and the polarity is reversed, the diode will become forward biased. The voltage surge is then directed through the diode. This allows the voltage to be dissipated across the coil, preventing the voltage from bridging the open contact. This protects components from any harmful voltage spikes.

A typical use of the clamping diode is the torque convertor clutch solenoid (TCC) used in many of today's automatic transmissions.

SERVICE TIP

A 1986 Ford Tempo 2.3L CFI was experiencing a driveability problem. On cold start-up and initial driving it would hesitate and die. The car would restart right away but would continue to die and hesitate. When the engine was warm, the problem became more intermittent.

Numerous attempts were made by different dealers to repair the vehicle. The throttle position sensor had been replaced several times, the air charge temperature sensor circuit had been repaired, the engine coolant temperature sensor and circuitry had been checked and many other avenues were explored to correct this problem.

Upon receiving this vehicle into our shop, we scanned for codes. No codes had been stored in the computer's memory. We took the vehicle on a long test drive to see if we could duplicate the problem. During our test drive , which consisted of many different driving patterns, we could not duplicate the problem. Returning to the shop, we performed a fuel pressure and volume test. Both of these tests fell right within specifications. We checked all electrical connections and wiring harnesses but found no apparent problems.

Not being able to duplicate the problem, we agreed the owner would take the vehicle and return when the condition was present. Since the owner was a retired technician, he also began to eliminate possibilities as the problem occurred. He kept in close contact with us as he gathered information.

About a week later, when he encountered the problem, he plugged the vacuum line to the EGR valve and that seemed to take away his problem. He brought the vehicle back to us, but there still were no codes recorded. We removed the EGR valve to check for carbon deposits. There was no carbon buildup that could be causing a problem. Next we checked the EGR valve position sensor's (EVP) resistance specs according to the Ford service manual. The EVP sensor fell within specifications.

Every once in a while when we ran the resistance test on the EVP sensor, the analog meter would have a slight hesitation in needle movement. We removed the EVP sensor and carefully cut it apart. Once apart we noticed a section of the resistive material on the ceramic had worn through. This worn section caused the fluctuation in the analog meter. It also tricked the computer into thinking that the EGR valve was not open enough. The computer would compensate by opening the EGR valve even more. Too much EGR valve will cause a hesitation, or a stalling condition. We replaced it with a TOMCO EVP sensor and he has incurred no further problems.

Intermittent problems can be hard to find especially when there are no codes and the sensor involved has an intermittent fault. Thanks to an alert technician and his screening of the symptoms we were able to help him solve this elusive problem.