TomcoTechtips

TM

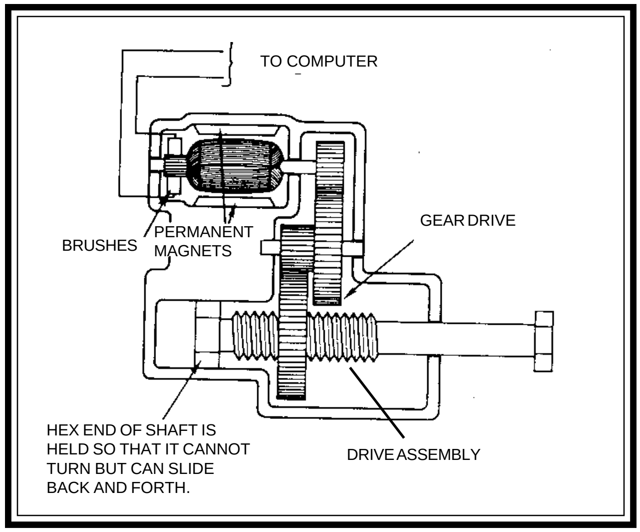
ISSUE 21

Idle Speed Control Motors

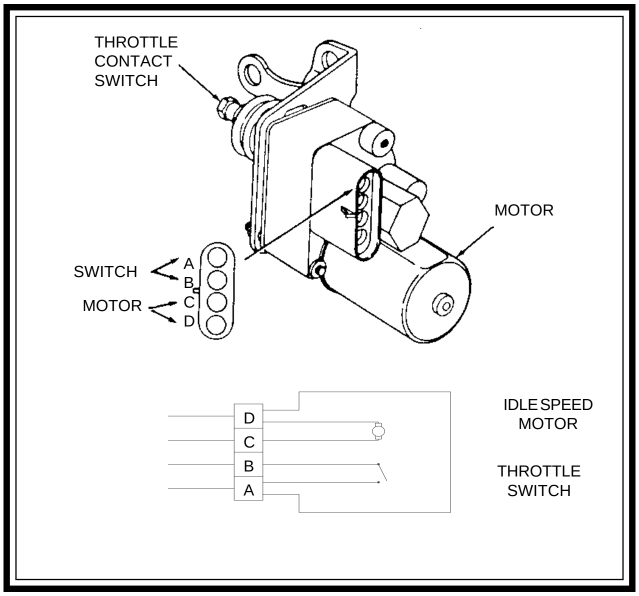
In previous issues of Tech Tips, our discussion of engine computer controls has concentrated on *input* sensors. These sensors are responsible for feeding the computer the information it needs to adjust the air/fuel ratio to 14.7:1 (stoichiometric value) and control ignition timing. This information is processed by the Central Processing Unit of the computer. The computer then decides on a course of action to take. This course of action is in the form of commands to *output* devices. We will use the next several issues to discuss these output devices, starting with one of the earlier output devices, the Idle Speed Control Motor (ISC).

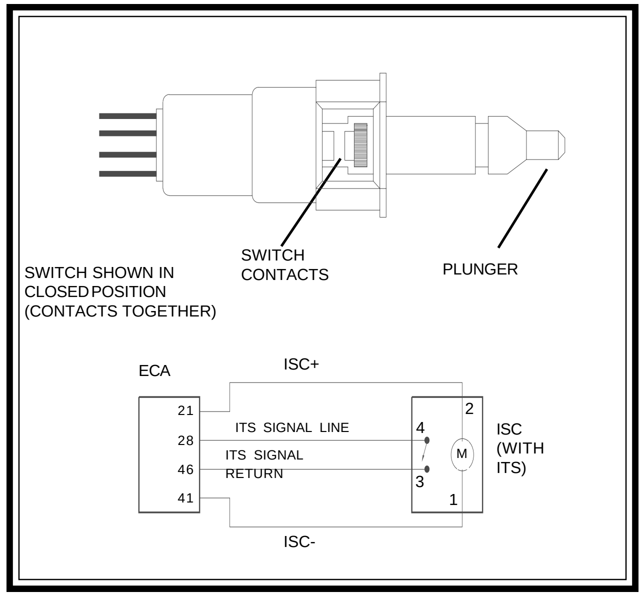
The ISC is located on the side of the carburetor or throttle body. Its function is to control and maintain idle speed under various operating conditions. Controlling the idle speed electronically by the computer helps maintain the best average idle speed. This will keep the idle speed from being so low it stalls or so high it wastes fuel and causes a lurch when the vehicle is put in gear.

The ISC keeps the idle at a desired value when various loads such as the air conditioning are placed upon the engine. This prevents the idle from going up and down causing a noticeable change in the idle speed to the driver. The ISC is also used to adjust idle speed to compensate for low charging system voltage, low engine temperature, or engine overheating.



The ISC is a permanent magnet, reversible field, electric motor. In most cases this consists of a DC motor that has a wire wound armature and a permanent magnet. (Fig. 1) The armature is attached to a small gear that drives a larger gear or gears. These gears are attached to a drive assembly. This drive assembly contains a plunger that extends or retracts as the motor turns. The direction the motor turns depends on the polarity of the voltage applied to the motor. This allows the plunger to extend or retract when the computer senses an increase or decrease in engine load, so it can maintain the desired idle.





This desired idle is maintained except in certain situations where a higher idle is required. Some of these conditions are:

1. When system voltage falls below a set value. The idle speed is then increased to increase alternator output.

2. When an engine overheating condition is sensed, idle speed is increased to lower coolant temperatures.

3. On cold engine start-up, the computer increases idle speed until a desired engine coolant temperature is met.

The wiring diagram for a typical GM vehicle is shown in Figure 2. This shows that terminals C and D are connected to and control the DC motor. Terminals A and B are connected to what is known as a “nose switch”. This switch is normally in the open position. When the throttle linkage is resting on the plunger assembly it closes the nose switch. When this switch is in the closed position it signals the computer to control the idle. When the throttle is away from the plunger the switch is in the open position and the computer does not control the idle.

The wiring diagram for a typical Ford vehicle is shown in Figure 3. This shows that two of the wires (isc+/ isc-) control the DC motor. The other two wires are for the nose switch. Ford calls this an idle tracking switch (ITS). This switch is normally in the closed position. When the throttle is resting on the plunger assembly the switch is open. When the switch is open the computer commands the ISC to control the idle. When the throttle is away from the plunger assembly, the switch is closed and the computer does not control the idle.

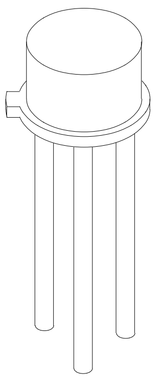
In some applications the ISC is commanded to fully retract when the ignition switch is turned off. This fully retracted ISC allows the throttle to close completely, lowering the idle speed which will prevent the engine from dieseling.

Some applications use the ISC as a dashpot. When the throttle linkage is off of the plunger assembly, as it is under acceleration, the computer fully extends the plunger. On deceleration the throttle linkage contacts the plunger, which signals the computer to control the idle. The plunger retracts to the desired idle setting. This results in a slower closing of the throttle plates which allows more air into the intake manifold. The extra air is used to mix with the fuel that evaporates from the manifold walls and floors during deceleration. This allows a more complete burn and lower emissions.

Although on some models the ISC is adjustable, it should not be used for setting the idle speed. The proper way to set the idle is to follow the service manual procedures for adjusting the minimum and maximum authority adjustments. Idle speed control motors should be checked for proper operation during each engine tune-up.

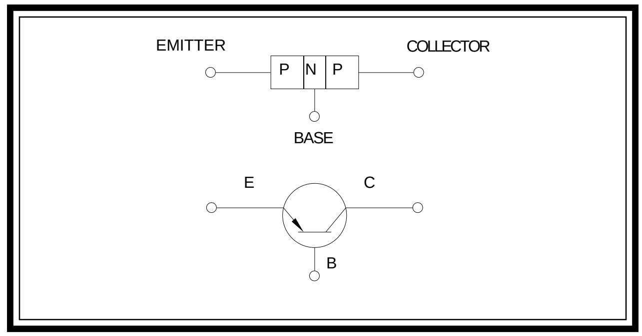
TRANSISTORS

A transistor is a semiconductive device that has three leads. There are many different types of transistors: bipolar junction, unijunction, field effect to name a few.



We will be looking at a type of bipolar junction switching transistor. It is the second most common device found in the output signal processing side of the computer in automotive applications.

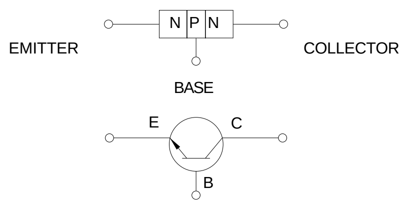
A switching transistor is very similar to an old style single coil relay. Just as in a relay, the switching transistor can use a very small current or voltage to control a much larger current or voltage. The main advantage of using a switching transistor over a relay is speed. When current begins to flow in a typical relay, it takes time for the magnetic field to build, to pull the contacts closed. Although this seems to be instantaneous, it is actually quite slow compared to a switching transistor. In fact a conventional relay is about a hundred times slower than a switching transistor. This difference in time becomes very significant in today's vehicles where components need to be turned on and off accurately at rapid speeds.



The bipolar junction transistor (BJT) is closely related to the PN junction diode we have just studied. The BJT is also made from the semiconductor materials of germanium and silicon. But instead of just two semiconductive materials joined together, the BJT has three semiconductive materials joined. This means there is a possibility of two different types of semiconductor arrangements, a PNP or a NPN arrangement.

The PNP transistor has a N type material sandwiched between two P type materials. The N material or region in this case is called the base. The two outer P regions are called the emitter and collector. The base region is normally much thinner than the emitter and collector. The base region is also not as heavily doped as the emitter and collector. An example of a PNP transistor arrangement and its symbol is shown in Figure 4.

The NPN transistor has a P type



material sandwiched between two N type materials. The P material or region in this case is called the base. The two outer N regions are called the emitter and collector. As in the PNP transistor the base region is thinner and is lightly doped relative to the emitter and collector. An example of a NPN transistor arrangement and its symbol is shown in Figure 5. As you will note in both of the figures the arrow is always located on the emitter lead and it always points to the N type material.

Since these transistors have three semiconductor regions, they have two junctions. There is a PN junction between the base and the emitter and a PN junction between the base and the collector. This means that these style transistors have three layers and two junctions.

Discussion of transistors will continue in the next issue of Tech Tips.

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Tech Tip

Some 1991 XJ and MJ Jeep Cherokee and Comanchee vehicles equipped with the 4.0L engine may exhibit an intermittent engine miss and/or erratic coolant temperature gauge reading. Scan tool diagnosis may also show fault messages concerning any of the following components: Throttle Position Sensor, Crank Position Sensor, Automatic Idle Speed Motor, Oxygen Sensor, Injectors, Charge Temperature Sensor, or Coolant Temperature Sensor.

If any or all of the above symptom / conditions are present, inspect the engine wiring harness at the rear of the engine valve cover, along the injector trough, and at the flange along the bulkhead. Repair if there is evidence of any harness chafing (wiring is exposed and there is a possibility of a short-to-ground).

Source: ALLDATA