Engine Control (EC) System

Overview

The EC system provides optimum control of the engine and transmission through the enhanced capability of the powertrain control module (PCM). The EC system also has an on board diagnostics (OBD) monitoring system with features and functions to meet federal regulations on exhaust emissions.

Some vehicle applications use a stand alone transmission control module (TCM). Even though it is still part of the EC system, the stand alone TCM communicates with the PCM, the antilock brake system (ABS) module, the instrument panel cluster (IPC), and the four wheel drive (4WD) control modules using the high speed controller area network (CAN) communications network. The stand alone TCM incorporates a stand alone OBD II system. The stand alone TCM independently processes and stores DTCs, freeze frame data, support parameter identifiers (PIDs) as well as J1979 Mode 09 CALID and calibration verification number. The stand alone TCM does not directly illuminate the malfunction indicator lamp (MIL), but requests the PCM to do so. The stand alone TCM is located inside the transmission assembly. It is not repairable, with the exception of reprogramming.

For additional information on TCM diagnostics, refer to the Workshop Manual Section 307-01, Automatic Transmission.

The EC system has hardware and software. The hardware includes the PCM, sensors, switches, actuators, solenoids, and interconnecting pins. The software in the PCM provides the strategy control for outputs (engine hardware) based on the values of the inputs to the PCM. The EC hardware and software are discussed in this section.

This section contains detailed descriptions of the operation of the EC system input sensors and switches, output actuators, solenoids, relays and connector pins (including other power ground signals). For additional information on the input sensors and output actuators, refer to Engine Control Components in this section.

The PCM receives information from a variety of sensor and switch inputs. Based on the strategy and calibration stored within the memory chip, the PCM generates the appropriate output. The system is designed to minimize emissions and optimize fuel economy and driveability. The software strategy controls the basic operation of the engine and transmission, provides the OBD strategy, controls the MIL, communicates to the scan tool via the data link connector (DLC), allows for flash electrically erasable programmable read only memory (EEPROM), provides idle air and fuel trim, and controls failure mode effects management (FMEM).

Modifications To OBD Vehicles

Modifications or additions to the vehicle may cause incorrect operation of the OBD system. Install anti-theft systems, remote starters, cellular telephones and aftermarket radios carefully. Do not install these devices by tapping into or running wires close to the powertrain control system wires or components.

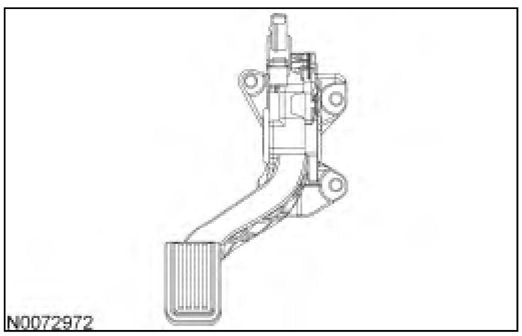
Engine Control Components

Note: *Transmission inputs which are not described in this section are discussed in the applicable Workshop Manual transmission section.*

Accelerator Pedal Position (APP) Sensor

The APP sensor is an input to the PCM and determines the amount of torque requested by the operator.

There are 2 pedal position signals in the sensor. Both signals, APP1 and APP2, have a positive slope (increasing angle, increasing voltage), but are offset and increase at different rates. The 2 pedal position signals make sure the PCM receives a correct input even if one of the signals has a concern. The PCM determines if a signal is incorrect by calculating where it should be, inferred from the other signals. If a concern is present with one of the circuits the other input is used. There are 2 reference voltage circuits, 2 signal return circuits, and 2 signal circuits (a total of 6 circuits and pins) between the PCM and the APP sensor assembly. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software converts these degrees to counts, which is the input to the torque based strategy. For additional information, refer to Torque Based Electronic Throttle Control (ETC) in this section.



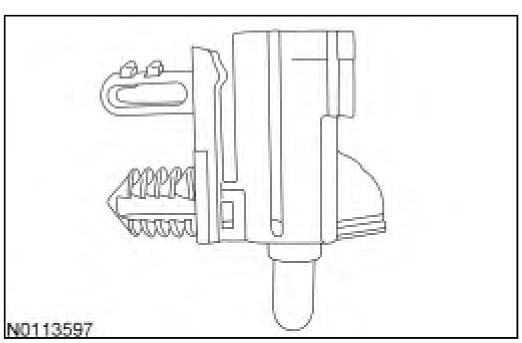
Typical APP Sensor

Ambient Air Temperature (AAT) Sensor

The AAT sensor is a thermistor device in which resistance changes with temperature. The resistance of a thermistor decreases as the temperature increases, and the resistance increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor pins and provides electrical signals to the PCM corresponding to temperature.

Thermistor type sensors are considered passive sensors. A passive sensor is connected to a voltage divider network so that varying the resistance of the passive sensor causes a variation in total current flow. Voltage that is dropped across a fixed resistor in series with the sensor resistor determines the voltage signal at the PCM. This voltage signal is equal to the reference voltage minus the voltage drop across the fixed resistor.

The AAT sensor provides ambient air temperature information to the PCM for the temperature sensor correlation tests. The PCM also communicates the AAT sensor information to all other modules on the controller area network (CAN).



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