DESCRIPTION

NOTE: This article contains information pertaining to the basic operation of the Ford Motor Co. EEC IV engine control system only. For testing with codes and diagnostic information see the following appropriate articles:

For 1.9L CFI, see: 1.9L CFI EEC IV TESTING
For 1.9L EFI, see: 1.9L EFI EEC IV TESTING
For 2.3L EFI/EFI Turbo, see: 2.3L EFI/EFI TURBO TESTS
For 2.3L HSC/EFI, see: 2.3L HSC/CFI TESTING
For 2.5L HSC/CFI, see: 2.5L HSC/CFI TESTING
For 3.0L EFI, see: 3.0L EFI EEC IV TESTING
For 3.8L CFI, see: 3.8L CFI EEC IV TESTING
For 5.0L SEFI, see: 5.0L SEFI EEC IV TESTING

The center of the EEC-IV system is the Electronic Control Assembly (ECA). The ECA receives information from various sensors and switches. Based on information received and the operation program in the ECA’s memory, the ECA generates output signals to control engine operation.

The calibration module for EEC-IV system is mounted inside the ECA. The ECA is located in one of the following locations: under dash behind right kick panel, under dash on left side of steering column, or on left rear corner of engine compartment (below windshield wiper motor).

The EEC-IV system controls 3 major areas of engine operation: air/fuel mixture, ignition, and emission control. Additionally, the system can control A/C compressor clutch operation and idle speed. The system provides self-diagnostic capabilities.

The air/fuel mixture control is accomplished by an airflow controlled, multi-point fuel injection system on 1.9L EFI, 2.3L EFI, and 2.3L EFI/EFI Turbo models. Escort, EXP, and Lynx models equipped with the 1.9L CFI engine use a central fuel injection system. Sable and Taurus models equipped with the 2.5L HSC/CFI engine use a central fuel injection system, as well as a 3.0L EFI (multi-point fuel injection) engine. Tempo and Topaz models with the 2.3L HSC/CFI engine use central fuel injection, as do all models with a 3.8L CFI engine. All 5.0L SEFI engines use sequential electronic fuel injection.

The EEC-IV ignition system is controlled by the ECA through a Thick Film Integrated (TFI-IV) ignition module. Ignition timing (advance or retard) and dwell are controlled with this system to improve ignition system performance. The ignition coil is an "E-core" version and replaces the earlier oil filled coil.

Emission control components controlled by this system include EGR and canister purge. These systems are normally off, but are turned on when the engine is ready to operate with the mixture change caused by EGR and canister purge operation.
OPERATION

The engine control system consists of the ECA, sensors, switches, and actuators. In order for the ECA to perform properly, it must be kept constantly informed of engine operating conditions.

It is the task of the engine sensors to supply the ECA, via electrical signals, with specific information required to determine engine operating conditions. The ECA will then send out electrical signals to control air/fuel ratio, emission controls, idle speed and ignition timing. Individual component operation is as follows:

INPUTS

A/C Compressor Clutch Signal
Whenever battery voltage is applied to A/C compressor clutch, a signal is sent to ECA. ECA uses signal to increase engine idle speed to compensate for added load created by A/C compressor. Idle speed is increased by using throttle air by-pass valve on 1.9L EFI, 2.3L EFI/Turbo, 3.0L EFI, and all 5.0L SEFI engines. An idle speed control motor is used on all other engines.

Air Charge Temperature (ACT) Sensor (All Exc. 1.9L EFI)
The ACT sensor is threaded into cylinder runner of intake manifold or attached to air cleaner. It provides ECA with air/fuel mixture temperature information. The ECA uses this information for correcting fuel flow and to control fuel flow during cold enrichment (cold starts).

Barometric Pressure (BP) Sensor (1.9 EFI & 2.3L EFI/Turbo)
Sensor is mounted on right inner fender and measures barometric pressure of atmospheric air. Variations in atmospheric pressure are converted to electrical signals and sent to ECA. ECA uses this signal to calculate correct fuel flow for altitude compensation.

Brake On/Off (BOO) Switch (2.3L HSC/CFI, 2.5L HSC/CFI, 2.3L EFI, 2.3L EFI/Turbo & 3.0L EFI)
The brake on/off switch signals the ECA whenever brakes are applied and/or released.

Detonation (Knock) Sensor (2.3L EFI, 2.3L EFI/Turbo, & 3.0L EFI)
The knock sensor is a piezoelectric device designed to resonate at approximately the same frequency as engine knock. This unit senses and amplifies engine detonation (knock) and signals ECA to retard timing.

EEC Power Relay (1.9L CFI, 2.3L HSC/CFI, 3.8L CFI, 1.9L EFI, 2.3L EFI & 5.0L SEFI)
This relay is activated by ignition switch. Relay supplies battery voltage to ECA when ignition switch is on. Some relays incorporate a time delay of 5-10 seconds. A time delay EEC power relay is used on 1.9L CFI, 2.3L HSC/CFI, and 3.8L CFI engines. All other models use a power relay without time delay feature.

NOTE: The 2.5L HSC/CFI, 2.3L EFI/Turbo, and 3.0L EFI engines use an Integrated Relay Controller Module (IRCM). The IRCM incorporates the EEC power relay. See OUTPUTS in this article.

EGR Valve Position (EVP) Sensor (2.3L HSC/CFI, 2.5L HSC/CFI, 3.8L CFI, 2.3L EFI & 5.0L SEFI)
This sensor is located on top of EGR valve. It tells the ECA the position of the EGR valve.

**Engine Coolant Temperature (ECT) Sensor**
This sensor, threaded into heater outlet fitting or engine cooling passage, monitors engine coolant temperature. The ECA is sent a signal throughout the entire range of operating temperatures. In turn, the ECA modifies air/fuel mixture, ignition timing, and EGR operation. On models equipped with electronic instrument cluster, ECT output is also used to control the coolant temperature indicator.

**Idle Tracking Switch (ITS) (1.9L CFI, 2.3L HSC/CFI, 2.5L HSC/CFI & 3.8L CFI)**
The ITS is a mechanically operated switch held open by throttle linkage when throttle is closed. When throttle stop lever is against switch, ITS is open. The input will inform ECA that ISC motor plunger is touching throttle. The ITS is an integral part of the ISC motor.

**Manifold Absolute Pressure (MAP) Sensor (1.9L CFI, 2.3L HSC/CFI, 2.5L HSC/CFI, 2.3L EFI, 3.0L EFI, 3.8L CFI & 5.0L SEFI)**
MAP sensor measures absolute pressure of mixture in intake manifold and sends a signal to ECA that is proportional to absolute pressure. It is mounted on right inner fender for 5.0L engine and left inner fender for all others.

**Neutral Drive Switch (NDS) & Neutral Gear Switch (NGS)**
The NDS switch is used on auto. trans. equipped vehicles to adjust idle speed due to the increased loading of an engaged transaxle/transmission. Vehicles equipped with manual transaxle/transmission use a NGS switch to notify the ECA when transaxle/transmission is in or out of gear.

**Heated Oxygen (HEGO) Sensor**
This sensor constantly monitors oxygen content of exhaust gases. A voltage signal is produced which varies according to difference in oxygen content between exhaust gases and surrounding atmosphere.

This signal is sent to the ECA which translates exhaust gas oxygen content to air/fuel ratio. It then alters air/fuel ratio to hold the ideal ratio for current engine operating conditions. The 3.8L CFI and 5.0L SEFI engines use 2 oxygen sensors, one in each exhaust manifold.

**Profile Ignition Pick-Up (PIP)**
The PIP informs the ECA of crankshaft position and speed. PIP assembly is integral with distributor on all models. PIP has an armature with 4 windows and 4 metal tabs that rotate past a stator assembly (Hall effect switch). Ignition distributor does not have any mechanical or vacuum advance.

**Power Steering Pressure Switch (PSPS) (2.3L HSC/CFI, 2.5 CFI, 2.3L EFI & 3.0L EFI Engines)**
The power steering pressure switch signals the ECA when power steering pressure exceeds 400-600 psi. On Sable and Taurus, switch is located on power steering rack.

**Pressure Feedback Electronic (PFE)**
EGR Valve (1.9L CFI & 3.0L EFI Engine)
The PFE exhaust gas recirculation valve is a conventional ported EGR valve with a backpressure sensing element attached to it. The valve is used in conjunction with the backpressure transducer to
inform ECA of EGR valve position.

The PFE transducer converts varying exhaust pressure signals into a proportional analog voltage which is digitized by the ECA. The ECA uses the signals received from the transducer to complete optimum EGR flow.

Self-Test Input (SRI)
Self-Test Input (STI) trigger is a wire (pigtail) near SELF-TEST connector. It is used to activate SELF-TEST. SELF-TEST procedures are built into EEC-IV control module so system can display service codes for diagnosis of intermittent problems.

Throttle Position Sensor (TPS)
The TPS is mounted on side of carburetor and/or throttle body and connected directly to throttle shaft. The TPS senses throttle movement and position and then transmits an electrical signal to ECA. These signals keep ECA informed of wide open throttle, closed throttle, or normal cruise conditions.

Vane Airflow (VAF) Meter (1.9L CFI, 1.9L EFI & 2.3L EFI/Turbo)
The airflow meter housing incorporates 2 sensors and is mounted between the air cleaner and the throttle body assembly. The Vane Airflow (VAF) meter measures the volume of air drawn into engine and relays this information to the ECA by means of a potentiometer attached to the vane assembly. Inside the vane airflow meter is an air temperature sensor that continually measures intake air temperature and sends this information to the ECA.

OUTPUTS

A/C/Cooling Fan Controller & Wide Open Throttle A/C (WAC) Cut-Off
The A/C/Cooling Fan Controller is operated by ECA, coolant temperature switch and brake/stop light switch. Controller provides an output signal which controls operation of A/C compressor clutch and engine cooling fan.

The WAC circuit is energized by ECA when wide open throttle condition is detected. During wide open throttle, power to the A/C compressor clutch is interrupted. The A/C remains off for about 3 seconds after returning to part throttle.

Canister Purge Solenoid (CANP) (All Except 2.3L EFI, 2.3L EFI/Turbo, 2.3L CFI & 3.8L CFI)
This solenoid switches manifold vacuum to operate canister purge valve when a signal is received from ECA. Vacuum opens purge valve when solenoid is energized by ECA.

EGR Control (EGRC) Solenoid (2.3L EFI & 3.8L CFI)
Solenoid switches manifold vacuum to operate EGR valve on command from ECA. Vacuum opens the EGR valve when the solenoid is energized.

EGR Shut-Off (EGRSO) Solenoid (1.9L CFI, 1.9L EFI & 2.3L EFI/Turbo)
The EGR shut-off solenoid is an electrically-operated vacuum valve located between manifold vacuum source and EGR valve. A controlled vacuum bleed is located between solenoid and EGR valve. This vacuum bleed is a backpressure variable transducer. These 2 devices operate EGR valve for optimum performance. Solenoid switched vacuum is also supplied to canister purge valve.

EGR Vent (EGRV) Solenoid (2.3L EFI & 3.8L CFI)
Solenoid vents EGR control solenoid vacuum line. When vent solenoid is energized, control solenoid can open EGR valve.

Exhaust Heat Control (EHC) Valve (3.8L CFI)
This valve diverts hot exhaust manifold gases to intake manifold heat riser to heat incoming air/fuel mixture during cold engine operation. The ECA monitors coolant temperature and engine load to control operation of this valve.

Fuel Injectors
On the 1.9L EFI, 2.3L EFI/Turbo, 3.0L EFI, and 5.0L SEFI engine, each cylinder has a solenoid-operated injector which sprays fuel toward back of each inlet valve. Each injector is energized through ignition circuit and grounded through ECA to complete circuit. Injectors deliver 1/2 the amount of fuel required for an operating cycle each time they open (twice per cycle).
On the 1.9L CFI, 2.3L HSC/CFI and 2.5L HSC/CFI engines, one solenoid-operated injector is used in the throttle body. On the 3.8L CFI engine, 2 solenoid-operated injectors are used inside the throttle body. On all fuel injected models, ECA controls length of time each injector is open. The "open" time of injector governs amount of fuel delivered.

Fuel Pump Relay
Fuel pump relay is activated by ECA with ignition in on or crank positions. When ignition switch is turned on, relay is activated to supply initial line pressure to system. The 2.5L HSC/CFI, 2.3L EFI/Turbo, and 3.0L EFI engines use an Integrated Relay Controller Module (IRCM). The IRCM incorporates the fuel pump relay.

Idle Speed Control (ISC) Motor
(1.9L CFI, 2.3L HSC/CFI, 2.5 HSC/CFI & 3.8L CFI)
This is a DC motor used to provide idle speed control according to signals from ECA. Idler speed motor also controls high cam RPM, anti-diesel shut-off, dashpot, and pre-positioning for next vehicle start up. The ISC includes an integral Idle Tracking Switch (ITS).

Integrated Relay Controller Module (IRCM)
(2.5L HSC/CFI, 2.3L EFI/Turbo & 3.0L EFI)
The integral relay control module interacts with the ECA to provide control of the cooling fan, A/C compressor clutch, and fuel pump. The module incorporates the EEC power and fuel pump relays. On Sable and Taurus, control module is located above radiator, on radiator support.

Self-Test Output (STO)
The STO is a circuit in the ECA which transmits service codes, in the form of timed pulses, to either a VOM or diagnostic tester hooked-up at SELF-TEST connector. These pulses are read as diagnostic codes.

Shift Indicator Light (SIL) (1.9L CFI, 2.3L HSC/CFI, 2.5L HSC/CFI, 2.3L EFI/Turbo, & 5.0L SEFI Engines)
Shift indicator light indicates to driver when to shift gears for optimum fuel economy. ECA signals lamp to light according to information received on engine speed and manifold vacuum levels.

Spark Output (SPOUT)
The TFI ignition module is located on side of distributor. The ECA receives engine timing information from the distributor through the TFI ignition module. The ECA uses this information to control ignition timing and advance. The ECA triggers TFI by using a
Spark Output (SOUT) signal.

Thermactor Air By-Pass (TAB) Solenoid (3.8L CFI & 5.0L SEFI)
Solenoid provides a vacuum signal to by-pass valve in response to ECA signals. The TAB valve then by-passes thermactor pump air to atmosphere.

Thermactor Air Diverter (TAD) Solenoid (3.8L CFI & 5.0L SEFI)
Solenoid provides a vacuum signal to diverter valve in response to ECA signals. The TAD valve then diverts thermactor pump air to either exhaust manifold or catalytic converter.

Throttle Air By-Pass Valve (1.9L EFI, 2.3L EFI, 2.3L EFI/Turbo, 3.0L EFI & 5.0L SEFI)
The throttle air by-pass valve is a solenoid-operated valve controlled by ECA. The valve allows air to by-pass around throttle plates to control cold engine fast idle, no touch start, dashpot, overtemperature idle boost, and engine load idle correction.