2004
Service Manual

Powertrain Control/Emissions Diagnosis

Car/Truck

Focus, Taurus/Sable, Mustang, Lincoln LS, Crown Victoria/Grand Marquis, Thunderbird
Town Car, Escape, Ranger, Freestar, Explorer/Mountaineer, Expedition/Navigator, Blackwood
5.4L/6.8L Excursion, 4.6L/5.4L/6.8L E-Series, 4.6L/5.4L/6.8L F-Series

Bi-Fuel and 6.0L Diesel vehicles (purchased separately) can be placed under separate tab in back of manual.

NOTE: The descriptions and specifications contained in this manual were in effect at the time this manual was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring any obligation.

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TECHNICAL
SUPPORT OPERATIONS
Ford Customer Service Division

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Introduction

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Important Safety Notice

Appropriate service methods and procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This manual provides general directions for performing service with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

Notes, Cautions, and Warnings

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause you personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Make sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific operation. If you have a manual transmission, it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific operation. Place wood blocks (4" x 4" or larger) against the front and rear surfaces of the tires to help prevent the vehicle from moving.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide poisoning.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the drive belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, three-way catalytic converter, and muffler.
- Do not smoke while working on a vehicle.

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- To avoid injury,always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle.
- When it is necessary to work under the hood, keep hands and other objects clear of the radiator fan blades!

Preface

This manual provides a step-by-step approach for diagnosing driveability, emission and powertrain control system symptoms. Before beginning diagnosis, it may be helpful to reference any Technical Service Bulletins (TSBs) or On-line Automotive Service Information System (OASIS) information when this is available.

Note: For 6.0L diesel and Bi-Fuel, go to the 6.0L DIESEL or BI-FUEL tab in this manual.

This manual is used in conjunction with the Body, Chassis, Electrical, Powertrain Workshop Manuals, and the Wiring Diagram Manuals. The Workshop Manuals are used to provide additional diagnostics when directed by this manual. The Workshop Manuals are also used for component removal and replacement information. Refer to the Wiring Diagram Manuals for vehicle specific wiring information and component, connector and splice location.

The following is a description of the information contained in each section of this manual.

Section 1: Description And Operation

This section contains description and operation information on powertrain control systems and components. This section is designed to give the technician a general knowledge of the powertrain control system. It should be used when general information about the powertrain control system is desired, and is rarely referenced from other sections of the manual.

Section 2: Diagnostic Methods

The Diagnostic Methods section contains information on specific diagnostic tasks that are used during diagnosis. Descriptions of specific diagnostic methods are included, as well as detailed instructions on how to access or perform the tasks. This section provides the technician with step-by-step instructions for performing routine diagnostic tasks.

Section 3: Symptom Charts

All diagnosis begins in Section 3 with Step 1: PCM Quick Test. If the PCM Quick Test is completed and no DTCs are received, the technician may be directed to Step 2: No DTCs Present Symptom Chart Index (refer to Section 3 for details). The No DTCs Present Symptom Chart Index contains the list of symptoms addressed in this manual, and will send the technician to the appropriate Step 3: No DTCs Present Symptom Chart. If no PCM DTCs are present and the vehicle symptom is not listed in the Step 2: No DTCs Present Symptom Chart Index, the technician should go the appropriate Workshop Manual to continue diagnosis.

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Section 4: Powertrain DTC Charts and Description

Section 4 contains the Powertrain Diagnostic Trouble Code (DTC) “Go To” Charts. These charts will be referenced if a DTC is received in Section 3. Also included in this section are the Powertrain DTC descriptions and list of possible causes.

Section 5: Pinpoint Tests

All pinpoint tests are included in Section 5. Never enter a Pinpoint Test unless directed there. When directed to a Pinpoint Test, always read the information and look at the schematic included at the beginning of the Pinpoint Test.

Section 6: Reference Values

Section 6 contains the “Typical Diagnostic Reference Values” charts. The technician will be directed to these charts from Pinpoint Test Z in Section 5.

How To Use The Diagnostic Procedures

- Use the information about the vehicle driveability or emission concern to attempt to verify/re-create the symptom. Look for any vehicle modifications or aftermarket items that may contribute to the symptom. A check of any applicable TSBs or OASIS messages may be useful, if this information is available.
- Go to Section 3, Step 1: PCM Quick Test. Perform the PCM Quick Test step(s). Follow any notes as directed.
- If PCM Quick Test is completed, no DTCs were received and no special notes applied, go to Step 2: No DTCs Present Symptom Chart Index.
- Select the symptom that best describes the vehicle symptom (for multiple symptoms select the one that is most noticeable). Go to the Step 3: No DTCs Present Symptom Chart that is indicated. If no PCM DTCs are present and the vehicle’s symptom is not listed in the No DTCs Present Symptom Chart Index, go to the appropriate Workshop Manual to continue diagnosis.

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- The No DTCs Present Symptom Chart contains areas to be tested for diagnosis of the vehicle's symptom. The chart is arranged to place the higher probability, or easiest to test items toward the top of the chart. The technician, however, is not required to follow this order due to reasons such as variations in vehicle type, vehicle repair history or technician experience.
  - — The System/Component column indicates the areas that will be tested. This column may also contain a quick system/component test.
  - — The Reference column indicates where to go for the System/Component testing. All references are to pinpoint test steps in Section 5 of this manual unless noted otherwise. If referenced to a Pinpoint Test Step in this manual or a Workshop Manual section, go to the procedures. Follow the directions given in those procedures, including directions to other tests or sections. If a damaged part is found, repair/replace as directed. If no fault is found, and diagnosis in that area is complete, return to the No DTCs Present Symptom chart and continue to the next item.
  - — If a quick system/component test is in the System/Component column, the reference column will indicate where to go if the test failed.
- During diagnosis, if directed to test a system/component that is not contained on that vehicle, proceed to the next step.
- If the No DTCs Present Symptom Chart for the vehicle symptom is completed and no fault is found, return to Step 2: No DTCs Present Symptom Chart Index to address the next most prominent symptom. If all diagnosis is complete and no fault is found, it may be helpful to go to Section 5, Pinpoint Test Step Z1, for further diagnosis.
- After service, restore vehicle by reconnecting any components, removing test equipment, etc. Verify that the vehicle is operating properly and the original complaint is eliminated. If a DTC was present, rerun Quick Test to verify repair and complete a PCM Reset to clear any Continuous Memory DTCs.

Note: If a symptom is determined to be intermittent, careful visual and physical underhood inspection of connectors, wiring harnesses, vacuum lines, components, etc. is required. The Customer Information Worksheet may contain more detailed symptom information. Before an in-depth diagnosis begins, start the engine and wiggle wires, tap on components, etc., while listening for an indication of a concern (such as rpm change or relay clicking).

Information about engine conditions is stored when a Diagnostic Trouble Code (DTC) that lights the Malfunction Indicator Lamp (MIL) is set. This information is called Freeze Frame Data and may be helpful in diagnosing intermittents. (Refer to Section 2, Freeze Frame Data, for more information.)

What's New In This Manual

The following is a list of changes to this manual for 2004:

Introduction

New Authoring Software Used For Sections 4 (Powertrain DTC Charts and Description) and 5 (Pinpoint Tests):

For 2004, some style changes may be noticed in sections 4 and 5. These impovements are due to new authoring software that was used for the development of those sections. Some changes that may be noticed include the style used for measurement test steps and connector views.

New Vehicles:

- F-150, including the new 5.4L 3V engine. The 5.4L 3v and 4.6L engines on the new F-150 will have Electronic Throttle Control (ETC), and use CAN communication protocol.
- Freestar and Monterey with 4.2L and new 3.9L

Deleted Vehicles:

- Escort
- Blackwood
- Explorer Sport
- Windstar

Other Changes:

- Harley Davidson truck deletes 5.4L SC, adds 6.8L
- Existing F-150 renamed F-150 Heritage
- Mustang 3.8L deleted mid year, replaced with 3.9L
- 4.2L in E-Series deleted
- Taurus/Sable use new PCM with CAN communication protocol
- Explorer/Mountaineer will have Electronic Throttle Control (ETC), and new PCM with CAN communication protocol

Acronyms and Definitions

Note: This Acronyms and Definitions listing contains technical terms applicable to Ford Motor Company products. It is not intended to be an all—inclusive dictionary of components and their functions. If a detailed description of a particular system or component is desired, refer to the applicable section within this PC/ED Service Manual or consult the Workshop Manual for the specific vehicle being serviced.

2V: Two Valves per engine cylinder.

3V: Three Valves per engine cylinder.

4V: Four Valves per engine cylinder.

4WDIWE: Four Wheel Drive Integrated Wheel Ends.

4WDL_IL: Four Wheel Drive Low Indicator Lamp.

4WDMCS: Four Wheel Drive Mode Command Switch.

4WD_POS1/2/3/4: Four Wheel Drive Motor Position (1-4).

4WDSWRTN: Four Wheel Drive Mode Command Switch Return.

4WDT_IL: Four Wheel Drive Tow Indicator Lamp.

4X4L:4 Wheel Drive Low Switch.

ABS: Anti—lock Brake System.

A/C: Air Conditioning. A vehicle accessory system that modifies the passenger compartment air by cooling and dehydrating the air.

ACC: Air Conditioning Clutch. Indicates status of the A/C clutch.

ACCR:A/C Clutch Control Relay / WOT AC Cutoff (WAC).

ACCS: Air Conditioning Cycling Switch. Indicates status of the A/C cycling switch.

ACD: Air Conditioning Demand. A signal input to the PCM from the Air Conditioning control panel.

ACDS: Air Conditioning Diagnostic Switch (Refrigerent Containment Switch).

ACET: Air Conditioning Evaporator Temperature (may also be referred to as Evaporator Air Discharge Temperature).

ACP: Air Conditioning Head Pressure or A/C cycling switch input state.

ACPSW: Air Conditioning Pressure Switch.

ACPT: Air Conditioning Head Pressure Transducer Sensor.

ACP V: Air Conditioning Head Pressure Volts. A voltage input to the PCM from the ACP switch or sensor.

ACR: Air Conditioning Relay. Commanded output controlled by the PCM and acts as an A/C cutout control during heavy acceleration.

Acronyms and Definitions

A/D: Analog—to—Digital. Analog—to—Digital signal conversion.

ADC: See ATDC.

AFCM: Alternative Fuel Control Module.

AIR: Secondary Air Injection.

AIRB: Secondary Air Injection Bypass.

Air Diverter: Air Diverter Valve. Part of the EAIR system. Diverts fresh air to the exhaust system when the electric air pump is commanded on.

AIR EVAL: Air System Evaluated. Displays a YES or NO status indicating whether the Air System has been evaluated for OBD (On—Board Diagnostic) II purposes.

Air/Fuel Ratio: Air to fuel mixture ratio. An air/fuel mixture that is 14.7:1 is also called stoichiometry.

AIRM: Secondary AIR pump monitor.

ALTCOM: Alternator Command.

ALTMON: Alternator Monitor.

Ambient Air Temperature: Temperature of the air surrounding an object.

Analog (Electrical/Electronic): An electrical signal that can obtain any value within the voltage limits of the signal.

APP: Accelerator Pedal Position

ARB: Air Resource Board.

ARPMIDES: Ancillary RPM Desired. RPM required to maintain the vehicle speed commanded by Speed Control Command Switch (SCCS) inputs.

ASCII: American Standard Code for Information Interchange.

ATDC: After Top Dead Center. The location of the piston after it has reached the top of its stroke. Measured in degrees of crankshaft rotation.

AVOM: Analog Volt—Ohm Multimeter. Readings are indicated by a sweep hand on a printed scale, rather than a digital display.

AWD: All—Wheel Drive.

BARO: Barometric Pressure.

Base Idle: Idle rpm determined by the throttle lever hardset on the throttle body with the IAC solenoid disconnected.

Base Timing: Spark advance in degrees before top dead center of the base engine without any control from the PCM or ICM.

Battery Positive Voltage (B+): The positive (+) voltage from the battery or any circuit connected directly to the battery. Compare "Vehicle Power (VPWR)."

Acronyms and Definitions

BATTEMP: Battery Temperature.

BJB: Battery Junction Box.

BOB: Breakout Box. A test device which connects in series to the PCM and PCM harness.

BPA: Brake Pedal Applied switch. Typically located on the braking system master cylinder. Can be hydraulic or electric.

BPP: Brake Pedal Position. Indicates the position of the brake pedal, based on input from the Brake Pedal Position (BPP) switch.

BPS: Brake Pedal Switch\Speed Control Deactivation.

BRAKE _LMP or BRKL: Brake Warning Lamp Status. Activates the Brake Warning Lamp by applying voltage to the control line.

BTDC: Before Top Dead Center. The location of the piston before it has reached the top of its stroke. Measured in degrees of crankshaft rotation.

Bus + or Bus — : Multiplex circuits that carry SCP data from module to module and to the DLC.

BVREF: Buffer Voltage Reference. A dedicated circuit that provides approximately a 5.0 volt signal used as a reference by certain sensors.

CAC: Charge Air Cooler. Formerly known as Intercooler. A device which lowers the temperature of pressurized intake air.

CAFE: Corporate Average Fuel Economy. A set of federal requirements and regulations which govern fuel economy standards.

CANVNT: Canister Vent Solenoid.

Catalyst: Catalytic converter. An in—line exhaust system device used to reduce the level of engine exhaust emissions.

CAT EVAL: Catalyst System Evaluated. This item indicates YES when the Catalyst Efficiency Monitor has successfully completed.

CCM: Comprehensive Component Monitor.

CCRM: Constant Control Relay Module. A relay module that provides ON—OFF control of various EEC components.

CD A through J: Coil Driver 1 through 10.

Centralized Testing Facility: State government operation. Provides Inspection/Maintenance (IM) and safety inspections.

CGND or CSE GND: Case Ground. Provides a ground source for the PCM or ECU case.

CHT: Cylinder Head Temperature. Units are displayed in either degrees Fahrenheit or Centigrade.

CHTIL: Cylinder Head Temperature Indicator Lamp.

CHTV: Cylinder Head Temperature Voltage. The actual voltage drop across the CHT sensor thermistor.

Acronyms and Definitions

CID: Cylinder Identification. PCM input signal from Camshaft Position Sensor.

CKP: Crankshaft Position. Senses the position of the crankshaft.

CKP+, CKP—:CKP+ is the Crankshaft Position (CKP) sensor signal wire. CKP— is the signal return.

CL: Closed Loop. An operating condition or mode which enables operation based on sensor feedback.

CMCVM: Charge Motion Control Valve.

CMP, CMP1, CMP2: Camshaft Position. Indicates camshaft position.

CMPFM: Camshaft Position Failure Mode. Indicates when the PCM identifies a CID/CMP fault.

CMS: Catalyst Monitor Sensor. Downstream HO2S.

CMVSS: Canadian Motor Vehicle Safety Standards.

CNG: Compressed Natural Gas.

CO: Carbon Monoxide. A colorless, odorless and toxic gas that is a component of auto exhaust emissions.

CO_2: Carbon Dioxide. A colorless, odorless gas that is a normal by—product of the combustion of fuel.

Coil:A device consisting of windings around an iron core. In a spark ignition system, designed to increase voltage.

Cold Soak: Time given to a vehicle to sit at a low temperature (typically below 68° F / 20° C) until the temperature of external and internal components stabilize.

CONT: Continuous Memory. The portion of KAM (keep alive memory) used to store DTCs generated during Continuous Memory Self—Test.

Continuous Memory Self—Test:A continuous test of the EEC system conducted by the PCM whenever the vehicle is operating.

COP: Coil On Plug. Igniton coil on plug assembly.

CPP: Clutch Pedal Position. Indicates clutch pedal position.

CPP Switch: Clutch Pedal Position Switch. Located on the clutch pedal and detects when the clutch pedal is depressed.

CQIS: Common Quality Indicator System.

CSE GND: Case Ground.

CT: Closed Throttle Mode. A mode when the PCM varies the pulse width of the fuel injectors to obtain the air/fuel mixture appropriate for closed throttle operation.

CTO: Clean Tach Output. Signal used to drive the instrument panel tachometer.

Acronyms and Definitions

Data Communications Link:A communication path between various in—vehicle electronic modules. Accessed by scan tools through the Data Link Connector (DLC).

DC:1. Direct Current. Electric current flowing in one direction. 2. Duty Cycle. The voltage measurement of ON time versus the full cycle period, expressed in percent.

DCL: Data Communication Link.

DI: Distributor Ignition. A system in which the ignition coil secondary circuit is sequenced by a distributor.

Digital: Controls process information by switching the current or voltage ON and OFF.

DIS: Distributorless Ignition System. A system in which the ignition coil secondary circuit is sequenced without a distributor.

DLC: Data Link Connector. J1962 connector providing access to vehicle diagnostic information.

DOHC: Dual Overhead Cam. An engine configuration that uses two camshafts positioned above the valves.

DOL: Data Output Line. A circuit that sends certain information from the PCM to the instrument cluster.

DPFEGR: Differential Pressure Feedback Exhaust Gas Recirculation. System that uses a pressure transducer to control the operation of the EGR Vacuum Regulator Valve.

DRI: Deposit Resistant Injector. A fuel injector designed to prevent build—up of carbon and other unwanted deposits.

DRL: Daytime Running Lamps. A system that keeps the vehicle running lamps on at all times while the vehicle is operating.

DTM: Diagnostic Test Mode. A level of capability in an On—Board Diagnostic (OBD) system.

DTC: Diagnostic Trouble Code. An alpha/numeric identifier for a fault condition identified by the On—Board Diagnostic System.

DVOM: Digital Volt—Ohm Meter.

E—85: Fuel containing 85% ethanol alcohol.

EAIR: Electric Secondary Air Injection. A pump—driven system for providing secondary air using an electric air pump.

EAIRM: Electric Secondary Air Pump circuit Monitor.

ECT: Engine Coolant Temperature. Displayed in either Fahrenheit or Centigrade.

ECTV: Engine Coolant Temperature Voltage. The actual voltage drop across the ECT sensor thermistor.

ECU: Electronic Control Unit. A module that handles the control strategy and monitors system inputs or outputs.

EEC: Electronic Engine Control system.

Acronyms and Definitions

EEC—V: Fifth generation EEC system.

EFT: Engine Fuel Temperature.

EFTA: Bank 1 input. EFTA is displayed in either Fahrenheit or Centigrade.

EFTAV: Voltage drop across the EFTA (Bank 1) sensor thermistor.

EFTB: Bank 2 input. EFTB is displayed in either Fahrenheit or Centigrade.

EFTBV: Voltage drop across the EFTB (Bank 2) sensor thermistor.

EGR: Exhaust Gas Recirculation. A process in which a small amount of exhaust gas is routed into the combustion chamber.

EGR EVAL: Exhaust Gas Recirculation System Evaluated. EGR EVAL will display YES when the monitor is complete.

EGRMC (1-4): Electric Exhaust Gas Recirculation Motor Control Valve. Four EGRMC outputs control four coils in the stepper motor and the corresponding movement in the EGR valve. The PCM energizes two coils for a full step and one coil for a half step, controling both the amount and the direction of rotation (open or close).

EGRMDSD: Electric Exhaust Gas Recirculation Motor Desired position. The PID name used to operate the EEGR valve with scan tool's output state control.

EGRS:EGR Shutoff. A normally closed solenoid that applies vacuum to the EGR valve when energized by the PCM.

EGRT: Exhaust Gas Recirculation Valve Temperature Sensor. A temperature sensor that is threaded into the bottom of the intake plenum.

EGR Vacuum Regulator: Controls vacuum to the EGR valve by a duty cycle signal from the PCM.

EGRVR: Exhaust Gas Recirculation Vacuum Regulator. Solenoid which varies the vacuum to the EGR valve by varying the duty cycle to the regulator.

EGRVRA: Exhaust Gas Recirculation Vacuum Regulator Actual (volt). The actual state of the commanded output.

EGRVRF: Exhaust Gas Recirculation Vacuum Regulator Fault. Represents whether a fault exists in the EGRV circuit.

EI: Integrated Electronic Ignition. An Electronic Ignition system that has the Ignition Control Module (ICM) integrated into the PCM.

EI—HDR: Electronic Ignition, High Data Rate. Formerly known as Electronic Distributorless Ignition System.

EI—LDR: Electronic Ignition, Low Data Rate. Formerly known as Distributorless Ignition System.

EMI: Electromagnetic Interference. Usually caused by ignition voltage spikes, solenoids, relay operation or noisy generator contacts.

EOL: End Of Line. A system designed specifically for use at assembly plants to make sure all new vehicles perform to design specifications.

Acronyms and Definitions

EOT: Engine Oil Temperature Sensor.

EPA: Environmental Protection Agency (U.S. Government).

EPROM: Erasable Programmable Read—Only Memory. An electronic component in the PCM that requires the electronic storage of information.

ESM:EGR System Module.

ESOF: Electronic Shift—on—the—Fly.

ETC: Electronic Throttle Control .

ETCVREFVoltage Reference (5V) for ETC (APP BVREF, TP BVREF).

EVAP: Evaporative Emissions. A system to prevent fuel vapor from escaping into the atmosphere.

EVAPCP: Evaporative Canister Purge Solenoid. Controls a solenoid which allows venting of the evaporative purge canister.

EVAPCPF: Evaporative Canister Purge Solenoid Fault. Identifies whether an electrical fault exists for the current commanded state.

EVAPCV: Evaporative Canister Vent Solenoid. Controls a solenoid which seals the EVAP system canister from atmospheric pressure during the EVAP OBD II Monitor test.

Evaporative Emissions Canister: An evaporative emission canister, containing activated charcoal which absorbs and holds fuel vapors.

EVAPPDC: Evaporative Canister Purge Duty Cycle. The duty cycle commanded to the Evap Canister Purge Solenoid by the PCM.

EVO: Electronic Variable Orifice.

EVMV: Electric Vapor Management Valve also known as the EVAP Canister Purge Valve.

EWP: Electric Water Pump.

Exciter Ring:A toothed or notched iron or steel disk, which is the moveable part of a wheel speed sensor.

FAN: Fan Speed. Used in conjunction with vehicles having multiple fan speed control. Displays OFF, LOW, or HIGH status.

FANSS: Fan Speed Sensor.

FC, FC1, FC2, FC3: Fan Control.

FCS: Fuel Control Solenoid.

FCIL: Fuel Cap Off Indicator Lamp. Indicates that the fuel filler cap was not properly installed.

FCV: Fan Control — Variable.

FEAD: Front End Accessory Drive.

Acronyms and Definitions

FEPS: Flash EEPROM Programming Signal. 18 volt DC signal sent by the scan tool to initiate PCM reprogramming.

FFV: Flexible Fuel Vehicle.

FIFO: First In First Out.

FILO: First In Last Out.

FIM: Fuel Indicator Module.

FLI: Fuel Level Input. Used by the Evap monitor to calculate fuel tank vapor volume. Displayed as a percentage.

FLI V: Fuel Level Input Voltage.

FMEM: Failure Mode Effects Management. Operating strategy that maintains limited vehicle function in the event of a PCM or EEC component failure.

FP:1. Fuel Pump. Indicates whether the pump has been commanded ON or OFF by the PCM. 2. Fuel Pump (Modulated). Fuel pump duty cycle percentage.

FPC: Fuel Pump Control. See FP.

FPDM: Fuel Pump Driver Module. A module that controls the electric fuel pump.

FPF: Fuel Pump Fault. Identifies whether a fault exists in the FP circuit.

FPM: Fuel Pump Monitor. Monitors the Fuel Pump / circuits for faults.

Freeze Frame:A block of memory containing the vehicle operating conditions at a specific time.

FRP: Fuel Rail Pressure. Based on FRP V.

FRP V: Fuel Rail Pressure Voltage. A voltage input to the PCM from the Fuel Rail Pressure Sensor.

FRT: Fuel Rail Temperture Sensor.

FSC: Fail—Safe Cooling.

FSV: Fuel Shut—Off Valve. A component of Natural Gas Vehicles. This valve either allows or prevents Natural Gas flow to the fuel rail.

FSVF: Fuel Shut—Off Valve Fault. Indicates if there is a fault in the FSV circuit. Displayed as YES or NO.

FSVM: Fuel Shut—Off Valve Monitor. Monitors operation of the Fuel Shut—Off Valve / circuit.

FTP: Fuel Tank Pressure. Displayed as inches of water, kPa, or volts.

FTP V: Fuel Tank Pressure Voltage. From the FTP transducer.

FUEL PR: Fuel Pressure. Measurement of the force of the fuel delivered via the fuel pump.

FUELPW: Fuel Pulse Width. Displays the commanded pulse width at time of last data update.

Acronyms and Definitions

FUELPW1: Fuel Injector Pulse Width #1. Corresponds to injectors normally affected by O2S1 (HEGO1).

FUELPW2: Fuel Injector Pulse Width #2. Corresponds to injectors normally affected by O2S2 (HEGO2).

FUELSYS: Fuel System Status (OPEN/CLOSED Loop). Formerly known as LOOP.

Fuel Tank Vapor Valve:A valve mounted in the top of the fuel tank that vents excess vapor and pressure from the fuel tank into the Evaporative Emission Control System.

FWD: Front Wheel Drive.

GEM: Generic Electronic Module.

GEN: Generator.

GENF: Generator output fault.

GENFDC: Generator field control output.

GFS: Generator field signal monitor.

GND: Ground.

GPM: Grams Per Mile. Also known as Gallons Per Minute.

GPS: Global Positioning Satellite.

Green State Vehicle: Formally known as California Emissions. A vehicle that is equipped with California on—board diagnostics.

GSS: Gear Select Solenoid.

GVW: Gross Vehicle Weight.

Hall Effect:A process where current is passed through a small slice of semi—conductor material and a magnetic field to produce a small voltage in the semi—conductor.

Hard Fault:A fault currently present in the system.

HC:1. Hydrocarbon. A by—product of combustion and a component of auto exhaust emissions. 2. High Compression.

HFC: High Fan Control.

HFCF: High Fan Control Fault. Identifies if there is a fault in the HFC circuit.

HFP: High Fuel Pump.

HLOS: Hardware Limited Operating Strategy. A mode of operation where the PCM replaces output commands with fixed values in response to internal PCM malfunctions.

HO: High Output.

HO2S: Heated Oxygen Sensor. Formerly known as Heated Exhaust Gas Oxygen (HEGO) Sensor. Provides information on rich or lean exhaust conditions to the PCM.

Acronyms and Definitions

Hot Soak: Period of time after an engine operates where localized combustion heat dissipates throughout the engine.

HTR, HTR11, HTR12, HTR21, HTR22, HTRX1, HTRX2:HO2S Heater. Heater element for the HO2S sensor.

Hydrogen: Chemical symbol H. Highly flammable gas.

Hz: Hertz. Cycles per second.

IAC: Idle Air Control. Electrical control of throttle bypass air.

IAT: Intake Air Temperature.

IATV: Intake Air Temperature Voltage. Actual voltage drop across the IAT sensor.

IAT2: Intake Air Temperature 2. Displayed in either Fahrenheit or Centigrade. Used on supercharged vehicles.

IAT2V: Intake Air Temperature 2 Voltage. Actual voltage drop across the IATV2 sensor.

IC: Integrated Circuit. A small semi—conductor device capable of doing many separate circuit functions.

ICM: Ignition Control Module. The module that controls the ignition system.

IFDM: Integrated Fuel Delivery Module.

IFS: Inertia Fuel Shutoff.

IGN GND: Ignition Ground.

Ignition: System used to provide high voltage spark for internal combustion engines.

IGN_KEY (IGKY): Ignition Key status.

IGN_SW (IGSW): Ignition Switch Position.

IMRC: Intake Manifold Runner Control. Controls airflow through the high—speed runners in the intake manifold.

IMRCM: Intake Manifold Runner Control Monitor. Monitors the IMRC / circuits for faults.

IMTV, IMTV1, IMTV2: Intake Manifold Tuning Valve. Controls airflow through runners in a split intake manifold.

INJ1, INJ2, INJ3, INJ4, INJ5, INJ6, INJ7, INJ8, INJ9, INJ10: Injector number or its signal output from the PCM.

Injector:A device for delivering metered pressurized fuel to the intake system or the cylinders.

Intake Air: Air drawn through a filter and distributed to each cylinder for use in combustion.

Intercooler: See CAC.

IPATS: Integrated Passive Anti—Theft System.

ISO: International Standards Organization.

Acronyms and Definitions

KAM: Keep Alive Memory. A portion of the memory within the PCM that must have power even when the vehicle is not operating.

KAPWR: Keep Alive Power. Dedicated, unswitched power circuit that maintains KAM.

Key On Engine Off Self—Test:A test of the EEC system conducted by the PCM with power applied and the engine at rest.

Key On Engine Running Self—Test:A test of the EEC system conducted by the PCM with the engine running and the vehicle at rest.

KEYPWR: Key Power. Battery voltage supplied when the ignition key is in the ON position.

Knock: The sharp metallic sound produced when two combustion pressure fronts collide in the combustion chamber of an engine.

KOEC: Key On Engine Continuous.

KOEO: Key On Engine Off.

KOER: Key On Engine Running.

KPA: Kilopascal. Unit of pressure. 3.386 kPa = 1 inch of mercury (Hg.).

KPH: Kilometers Per Hour.

KS: Knock Sensor. Detects engine knock.

L:Liters. The unit of volume in the metric measuring system. One liter equals 1.06 quarts.

LEV: Low Emissions Vehicle.

LFC: Low Fan Control.

LFP: Low Fuel Pump. Reduced operating speed for multi—speed fuel pumps.

LIFO: Last In First Out.

LILO: Last In Last Out.

LONGFT1, LONGFT2: Long—Term Fuel Trim. Fuel flow adjustment determined by the PCM.

LOOP: Indicates OPEN or CLOSED loop status.

LPG: Liquefied Petroleum Gas.

LPLR: Low Pressure Low Resistance fuel injector.

M—85: Fuel containing 85% methanol alcohol.

MAF: Mass Air Flow. Used to measure the mass (weight) of the air entering the engine.

MAF RTN: Mass Air Flow Return. A return circuit for the MAF sensor.

MAP: Manifold Absolute Pressure. The internal pressure of the intake manifold.

MFC: Medium Fan Control.

Acronyms and Definitions

MFI: Multiport Fuel Injection. A fuel—delivery system in which each cylinder is individually fueled.

MFP: Modulated Fuel Pump.

Microprocessor:A digital processor on a chip which performs arithmetic and control logic.

MIL: Malfunction Indicator Lamp. An indicator lamp alerting the driver of an emission related malfunction. May also read "CHECK ENGINE" or "SERVICE ENGINE SOON."

MISF: Misfire. Any event in the cylinder that causes a sudden change in acceleration of the crankshaft.

MON: Motor Octane Number.

Monolithic Substrate: The ceramic honeycomb structure used in the catalytic converter.

MSOF: Manual Shift—on—the—Fly.

MY: Model Year.

NA: Naturally Aspirated. Engine that is not supercharged or turbocharged.

NAAO: North American Automotive Operations.

NC: Normally Closed.

NG: Natural Gas. A system capable of using natural gas for vehicle operation.

NGS: New Generation STAR (Self—Test Automatic Readout) tester.

NGVM: Natural Gas Vehicle Module.

NO: Normally Open.

NO_X: Oxides of Nitrogen. Formed at high combustion temperatures.

NVH: Noise, Vibration, Harshness. A classification of vehicle concerns.

O2S, O2S11, O2S12, O2S13, O2S21, O2S22, O2S23: Oxygen Sensor. Provides information on rich or lean exhaust conditions to the PCM.

OASIS: On—line Automotive Service Information System.

OBD, OBD—II: On—Board Diagnostics, On—Board Diagnostics Second Generation. A system that monitors PCM input and output control signals.

On—Demand Test: Technician initiated "KOEO" and "KOER" tests performed by the PCM.

OC: Oxidation Catalytic converter. A catalytic converter system that reduces levels of HC and CO.

OCT ADJ: Octane Adjust. Compensating strategy that adjusts for changes in fuel octane.

OEM: Original Equipment Manufacturer.

OHC: OverHead Cam. An engine configuration that uses a single camshaft positioned above the valves.

Acronyms and Definitions

OWL: Overheat Warning Lamp or its signal output from the PCM. Turns the TEMP warning lamp ON when engine oil temperature exceeds safe limits.

Open Circuit:A circuit which does not provide a complete path for flow of current.

OL: Open Loop. An operating condition based on instructions not modified by PCM feedback.

OSC: Output State Control.

OSS: Output Shaft Speed.

Ozone:A blue gaseous form of oxygen (O_3) formed naturally by electric discharge or exposure to ultraviolet radiation.

Particulate: Small solid matter found in exhaust gases, especially prevalent in diesel engines.

PATS: Passive Anti—Theft System.

PATSIL: Passive Anti—Theft System Indicator Light.

PATSIN: Passive Anti—Theft System Receive Signal.

PATSOUT: Passive Anti—Theft System Transmit Signal.

PATSTRT: Passive Anti—Theft System Starter Relay Control

PCM: Powertrain Control Module. Formerly known as the EEC (Electronic Engine Control) Processor.

PCV: Positive Crankcase Ventilation. A system which allows the controlled flow of crankcase vapors into the combustion chamber.

PF: Purge Flow. Amount of fuel vapor burned in the engine.

Photochemical: Term describing the action of light on air pollutants which results in creating smog.

PID: Parameter Identifier. Identifies an address in PCM memory which contains operating information.

Powertrain: Engine and transmission/transaxle components.

Pressure — Absolute:A pressure referenced to a perfect vacuum.

Pressure — Atmospheric: The pressure of the surrounding air at any given temperature and altitude. Sometimes called Barometric Pressure.

Pressure — Barometric: Pertaining to atmospheric pressure or the results obtained by a barometer.

Pressure — Differential: The pressure difference between two regions, such as between the intake manifold and atmospheric pressure.

Pressure — Gage: The amount by which absolute pressure exceeds the ambient atmospheric pressure.

PIP: Profile Ignition Pickup. Provides crankshaft position information for ignition synchronization.

Acronyms and Definitions

Potentiometer: An adjustable resistance component commonly used as a sensor (Example: TP Sensor).

PPM: Parts Per Million. A measure used in emission analysis.

PROM: Programmable Read—Only Memory. Similar to ROM except without program instructions.

Protocol:A set of rules for the exchange of information on a network.

PSOM: Programmable Speedometer/Odometer Module. A module that processes vehicle speed information.

PSP: Power Steering Pressure. Indicates the pressure in the power steering system.

PSP V: Power Steering Pressure Input Voltage.

PSPT: Power Steering Pressure Transducer

PTEC: PowerTrain Electronic Controller.

PTO: Power Take—Off.

PW: Pulse Width. The length of time an actuator, such as a fuel injector, remains energized.

PWM: Pulse Width Modulation. Controls the intensity of an output by varying the signal duty cycle.

PWR GND: Power Ground. The main ground circuit in the EEC system.

Quick Test:A series of diagnostic tests of the EEC system consisting of KOEO, KOER and Continuous Memory Self—Tests. Results are displayed as a series of DTCs.

RABS: Rear Antilock Brake System.

RAM: Random Access Memory. Memory into which information can be written as well as read.

REDOX: Reduction Oxidation Catalytic converter. A catalytic converter system designed to operate at high temperatures.

Regulator: Controls the alternator/generator field current to maintain proper battery charge. Contained within the PCM in smart charging applications.

Relay: An electromechanical device in which connections in one circuit are opened or closed by changes in another circuit.

REM: Rear Electronic Module.

Repetitive Spark: Multiple firings of individual spark plugs at engine speeds below 1000 RPM to improve idle quality and improve emissions.

RF: Radio Frequency.

RFI: Radio Frequency Interference.

RFS: Returnless Fuel System.

RM: Relay Module. A module containing two or more relays.

ROM: Read—Only Memory. Computer memory that can be accessed and utilized, but not altered.

Acronyms and Definitions

RON: Research Octane Number.

Routine:A group of related tasks, such as a series of diagnostic tests.

RPM: Revolutions Per Minute.

RS: Reverse Switch.

RTN: Return. A dedicated sensor ground circuit.

RWD: Rear Wheel Drive.

SAE: Society of Automotive Engineers.

SAIR: Secondary Air.

SBS: Supercharger Bypass Solenoid or its signal output from the PCM.

SC: Supercharged or Supercharger.

SBC: Supercharger Bypass Control. A system that allows manifold vacuum to be bled away from the supercharger wastegate actuator to allow for maximum boost.

SBCF: Supercharger Bypass Control Fault. Identifies whether a fault exists in the Supercharger Bypass circuit.

SCCS: Speed Control Command Switch

SCICP: Supercharger Intercooler Pump Control.

SCICPF: Supercharger Intercooler Pump Control Fault.

SCIPC: The PID to monitor the operation of the Supercharger and Charge Air Cooler pump.

SCP: Standard Corporate Protocol.

Self—Test: See Quick Test.

Sensor:A device that detects the value or change in a physical quantity, such as temperature, pressure or flow rate, and converts the data into an electrical signal.

SFI: Sequential Multiport Fuel Injection. A multiport fuel delivery system where each injector is individually energized and timed relative to its cylinder intake event.

Shield:A conducting sleeve that surrounds wires to be electronically isolated from electromagnetic interference (EMI).

Short Circuit: An undesirable condition in a circuit where it is terminated at a point other than that intended.

SHRT FT: Short—Term Fuel Trim. Fuel flow adjustment in response to the HO2S sensor(s) input during closed—loop operation.

SIG RTN: Signal Return. A dedicated sensor ground circuit that is common to two or more sensors.

SIL: Shift Indicator Lamp.

Acronyms and Definitions

Smart Driver:A PCM or ECU output driver that can detect faults (open or shorts) on its output circuit.

SME: Society of Manufacturing Engineers.

SOF: Shift—On—the—Fly.

SOHC: Single Overhead Cam.

Solenoid:A device consisting of an electrical coil which produces a magnetic field in a plunger and pulled to a central position.

ST: Scan Tool. A device that interfaces with and communicates information on a data link.

Stoichiometry: An air/fuel mixture that is neither too rich nor too lean. Stoichiometric ratio is 14.7 parts of air for every 1 part of fuel.

Switch:A device for making, breaking, or changing the connections in an electrical circuit.

TA: Traction Assist.

TACH: Tachometer.

TACM, TACMP, TACMN, TACP (+/-) Throttle Actuator Control Motor +/- used in the electronic throttle control system.

TB: Throttle Body. A device that controls airflow through the engine via a butterfly valve, and has an air bypass channel around the throttle plate.

TC:1. Traction Control. Combines anti—lock braking and axle torque reduction to control wheel slippage. 2. Turbocharger.

TDC: Top Dead Center.

Tear Tag: The two—piece adhesive label attached to the PCM to identify its calibration.

Thermistor:A temperature dependent resistor, like that used in CHT and ECT sensors.

Timing: Relationship between spark plug firing and piston position expressed in crankshaft degrees before (BTDC) or after (ATDC) top dead center of the compression stroke.

TMAP: Thermal Manifold Absolute Pressure Sensor. A MAP Sensor that includes a thermistor to measure intake air temperature.

TP: Throttle Position (sensor). A potentiometer that provides throttle angle and rate information for the PCM.

TP V: Throttle Position Sensor Voltage.

Transducer:A device that receives energy from one medium and transfers it to another. For example, thermal energy is converted to an electrical signal through a temperature probe.

Transmissions/Transaxles:

Note: **All related items are grouped under the general heading "TRANSMISSIONS" located at the end of this section.**

Acronyms and Definitions

TSB: Technical Service Bulletin. Notifies service personnel of any known vehicle concerns, procedures, or general service information.

Underspeed Mode:A control mode that prevents the engine from stalling in the event it stumbles while running. Also used during engine crank.

Vacuum: Manifold pressure that is reduced below the ambient atmospheric pressure.

Variable Reluctance:A process of passing a varying magnetic field through wire windings and inducing a voltage.

VCT, VCT1, VCT2: Variable Camshaft Timing.

VDF: Visctronic Drive Fan.

VECI: Vehicle Emission Control Information label.

VIN: Vehicle Identification Number. A unique identification number given to every vehicle produced. Includes information about the year, model, engine, and plant origin of the vehicle.

VMV: Vapor Management Valve. Controls the flow of fuel vapors out of the carbon canister.

VOM: Volt—Ohm Meter. Readings are indicated by sweep hand on a printed scale rather than a digital (DVOM) display.

VBPWR: Vehicle Buffered Power. A PCM supplied power source that supplies regulated voltage.

VPWR: Vehicle Power. A switched circuit that provides power to the EEC system. Compare "Battery Voltage (B+)."

VREF: Reference Voltage. A dedicated circuit that provides approximately a 5.0 volt signal used as a reference by certain sensors.

WAC: Wide Open Throttle A/C Cut—Off. Turns A/C system off during wide open throttle or certain other operating conditions.

Wastegate Control:A device that opens the wastegate in case of overboost from a turbocharger.

WOT: Wide Open Throttle. A condition of maximum airflow through the throttle body.

Zip Tube: Another name for "fresh air duct" or "air inlet duct".

TRANSMISSIONS:

Acronyms and Definitions

Note: **The transmission naming convention is as follows:**

- The first character, a number, is the number of forward gears.
- The second character, either the letter "F" or "R," represents front (transaxle) or rear (transmission) wheel drive.
- The next set of characters, a grouping of numbers, represents the design torque capacity of the transmission/transaxle (for example, "27" represents 270ft./lbs. in the 4F27E transaxle).
- The last character, if used, is one of the following:
  - "E" for electronic shift
  - "N" for non—synchronous shift
  - "S" for synchronous shift
  - "W" for wide ratio
- **4F27E:**Also known as the FN Focus automatic transmission.
- **4F44E:**Formerly known as the CD4E.
- **4F46S:**Formerly known as the AX4S and regular—duty AXOD—E.
- **4F50N:**Formerly known as the AX4N and heavy—duty AXOD—E.
- **4R44E:**Formerly known as A4LD for 3.0L applications.
- **4R55E:**Formerly known as A4LD for 4.0L applications.
- **4R70W:**Formerly known as AOD—E.
- **4R100:**Formerly known as E4OD.
- **5R44E:**Formerly known as A5LD for 3.0L applications.
- **5R55E:**Formerly known as A5LD for 4.0L applications.
- **5R55N:**Lincoln LS automatic transmission.
- **5R55W:**Wide—ratio truck transmission.
- **4x4L:**4x4 Low.
- **A/T:**Automatic Transmission.
- **CCS:**Coast Clutch Solenoid.
- **CCSF:**Coast Clutch Solenoid Fault. Displays a YES if fault exists.
- **EPC, EPC1, EPC2:**Electronic Pressure Control.
- **EPCV:**Electronic Pressure Control Volts.
- **ESS:**Electronic Shift Scheduling.

Acronyms and Definitions

- **HCDSS:**High Clutch Drum Speed Sensor. PCM input from the 4R44E and 4R55E.
- **ISS:**Intermediate/Input Shaft Speed Sensor.
- **M5OD:**Manual 5—Speed transmission with overdrive (RWD).
- **M/T:**Manual Transmission/Transaxle.
- **NPS:**Neutral Pressure Switch or its signal input to the PCM.
- **OCS:**Overdrive Cancel Switch.
- **OSS:**Output Shaft Speed. Indicates rotational speed of the transmission output shaft.
- **PNP:**Park/Neutral Position switch. Also known as Neutral Drive Switch (NDS), Neutral Gear Switch (NGS), and Transmission Switch Neutral (TSN).
- **REVERSE or REV:**Transmission Reverse Switch Input.
- **SIL:**Shift Indicator Lamp. A lamp that indicates the preferred shift points on select manual transmission/transaxle vehicles.
- **SS1/SS2/SS3:**Shift solenoids. Devices that control the shifting in an automatic transmission.
- **TCC/TCCH:**Torque Converter Clutch. When energized, causes a mechanical engagement and disengagement of the Torque Converter Clutch.
- **TCIL:**Transmission Control Indicator Lamp. Indicates that the TCS has been activated.
- **TCS:**Transmission Control Switch. Modifies the operation of electronically controlled transmissions.
- **Torque converter:**A device which by its design multiplies the torque in a fluid coupling between an engine and transmission/transaxle.
- **TFT:**Transmission Fluid Temperature. Indicates temperature of transmission fluid.
- **Transaxle:**A device consisting of a transmission and axle drive gears assembled in the same case. Front—wheel drive applications.
- **Transmission:**A device which selectively increases or decreases the ratio of relative rotation between its input and output shafts. Rear—wheel drive applications.
- **TR, TR1, TR2, TR3, TR4:**Transmission Range. The range in which the transmission is operating.
- **TR Sensor:**Formerly known as Manual Lever Position Sensor (MLPS). Provides information to the PCM on the transmission range selector position.
- **TR V:**Transmission Range Voltage.
- **TSS:**Turbine Shaft Speed. Indicates rotational speed of the transmission turbine shaft.
- **VSS:**Vehicle Speed Sensor. A magnetic pickup device that generates an AC signal that is proportional to vehicle speed.

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Vehicle Emission Control Information (VECI)

VECI Decal

Each vehicle has a VECI decal (Figure 1) containing emission control information that applies specifically to the vehicle and engine. The specifications on the decal are critical to servicing emissions systems.

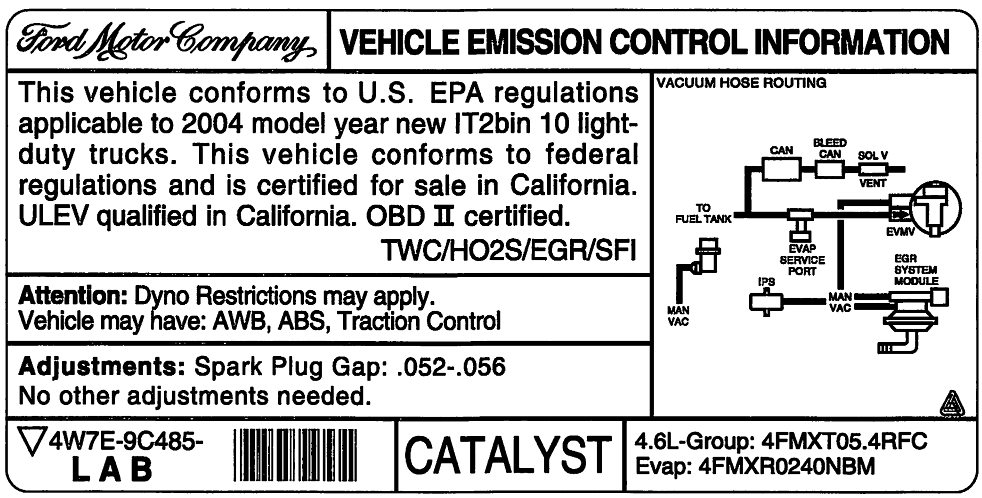

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Figure 1: Typical Vehicle Emission Control Information (VECI) Decal.

VECI Decal Location

Typical location of the decal will be on the underside of the hood or the radiator support sight shield.

Engine/Evaporative Emission System Information

Manufacturers must use a standardized system for identifying their individual engine families. The system described below was developed by the Environmental Protection Agency (EPA) in 1991 to meet new regulatory requirements for 1994 and later model years.

The ENGINE FAMILY GROUP and EVAPORATIVE FAMILY name consists of 12 characters each.

Both the engine family group and the evaporative family name are listed in the box on the emission decal as indicated in Figure 2, in the area marked as engine evaporative family information. The first line contains engine size and the 12-character engine family group. The second line contains the 12-character evaporative family name information. Both the engine family group and the evaporative family name are specific to the vehicle. Please refer to the Engine Family Group and the Evaporative Family Name work sheet for decoding information.

Vehicle Emission Control Information (VECI)

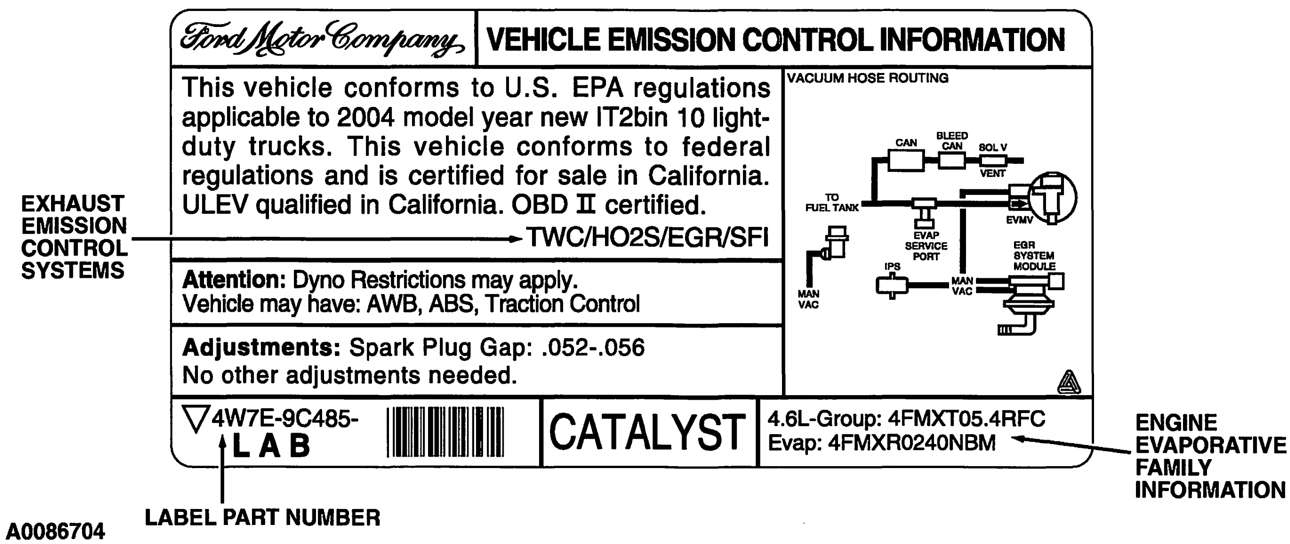

Figure 2: Typical VECI Decal Used As An Example.

Vehicle Emission Control Information (VECI)

ENGINE FAMILY GROUP WORK SHEET

	My Year		Manufacturer			Type		Displacement				Wild Card		
	1					5								
Char	Code	Year	2	3	4	Code	Description	6	7	8	9	10	11	12
	1	2001	F	M	X	N	Nonstandard Family	0	1 to 9	0	0 to 9	Alpha/Numeric		
	2	2002				V	Light Duty Vehicle							
	3	2003				T	Light Duty Truck							
	4	2004				C	Motorcycle							
	5	2005				A	Calif Medium Duty Truck							
	6	2006				H	Heavy Duty Engine							
	7	2007				S	Small Nonroad							
	8	2008				L	Large Nonroad							
	9	2009				M	Marine							
Family Name			F	M	X			0	1 to 9	•	0 to 9			

A0086705

Vehicle Emission Control Information (VECI)

Evaporative Family Name Work Sheet

Char	Year		Manufacturer			Type		Canister Working Capacity				Wild Card		
	1		2	3	4	5		6	7	8	9	10	11	12
	Code	Year				Code	Description							
	1	2001	F	M	X	E	Evaporative (Use for Existing/ Enhanced)	a	a	a	a	alpha/numeric		
	2	2002												
	3	2003				R	Evaporative/ Refueling (Use for ORVR)							
	4	2004												
	5	2005												
	6	2006												
	7	2007												
	8	2008												
	9	2009												
Family Name			F	M	X									

a Total Grams in all canisters (Use 0 for each character not used for capacity starting with character 6)

A0029217

Vehicle Certification Label

Base Engine Calibration Information

Base Engine Calibration Information also sometimes refer to as the Powertrain Calibration is located in the lower right corner of the Vehicle Certification (VC) Label. Engine calibration information is limited to a maximum of five characters per line (two lines maximum). Calibration information more than five characters long will wrap to the second line of this field. Only the Base Calibration will appear on this label, see (Figure 3) for Car and (Figure 4) for Truck. The Revision Level is no longer printed on the label; however, it can be found in On-Line Automotive Service Information System (OASIS). For more information on Vehicle Certification Label or Engine Calibration, refer to the Workshop Manual Section 100.

Engine Calibration Location (Car)

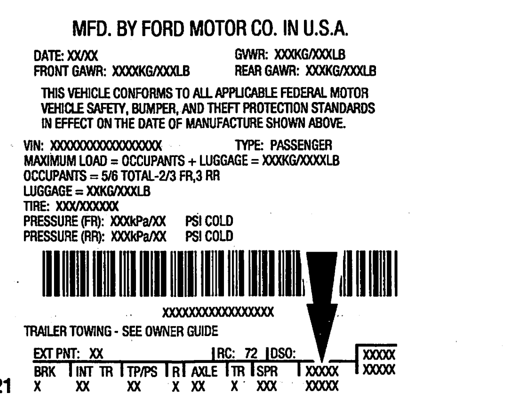

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Figure 3: Typical Car Vehicle Certification Label

Vehicle Certification Label

Engine Calibration Information (Truck)

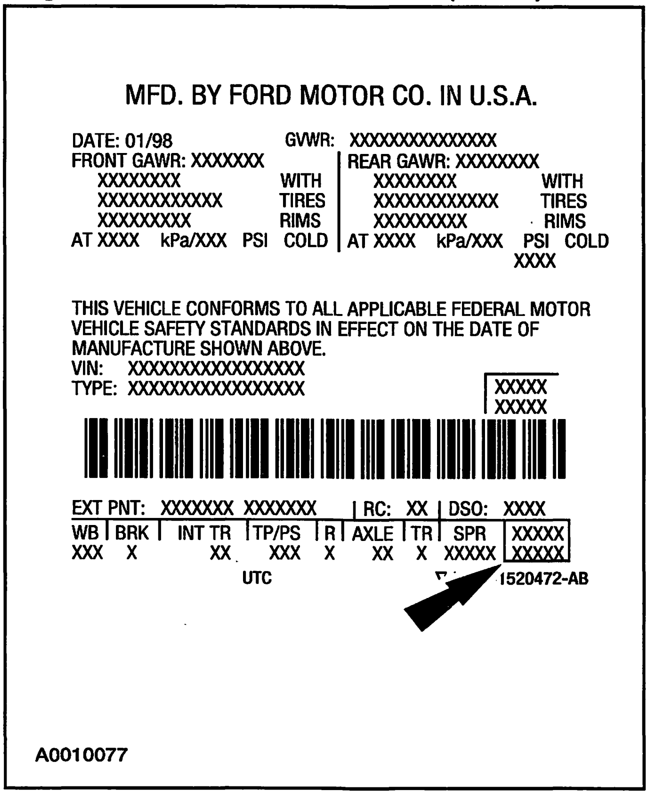


Figure 4: Typical Truck Vehicle Certification Label

Decal Location

Typical location of Vehicle Certification label is on LH door or door post pillar.

Engine Calibration Code

2004 Model Year Example

Engine Calibration Code: 4 B7 1 6E 4 5 00	
4	MODEL YEAR — Model year in which calibration was first introduced. Example: “4” = 2004
B7	VEHICLE CODE — Vehicle line description. Example: “B7” = Expedition
1	TRANSMISSION CODE — Transmission description. Example: “1” = automatic, “2” = manual
6E	UNIQUE CALIBRATION — Identifications are assigned to cover similar vehicle to differentiate between tires, drive configurations, final drive ratios and other calibration-significant factors.
4	FLEET CODE — Describes fleet to which vehicle belongs to “4” = Not assigned.

(Continued)

Vehicle Certification Label

2004 Model Year Example

Engine Calibration Code: 4 B7 1 6E 4 5 00	
5	CERTIFICATION REGION — Lead region code where multiple regions are included in one Calibration. Example “5” = U.S. fifty states
00	REVISION LEVEL — Revision level of the calibration. “00” = Job 1 production or initial calibration. (Not printed on VC label)

VECI Acronym Definitions

ALVW—Adjusted Loaded Vehicle Weight, (Curb Weight + GVWR) /2.

Averaging Bank/Trade—Used for Nox Credits on Heavy Duty Trucks Only.

BBL—Barrel.

CALIFORNIA ARB—California Air Resource Board.

CARB—California Air Resource Board.

CARB LEV—Low Emission Vehicle.

CARB TLEV—Transitional Low Emission Vehicle.

CARB ULEV—Ultra Low Emission Vehicle.

CARB ZEV—Zero Emission Vehicle.

CPI—Central Port Injection.

CI—Cylinder Injection.

CNG—Compressed Natural Gas.

EPA—Environmental.

EVAP—Evaporative Emissions.

GVW—Gross Vehicle Weight.

GVWR—Gross Vehicle Weight Rating, Curb weight plus payload.

HHDE—Heavy Heavy Duty Engine.

HHDDE—Heavy Heavy Duty Diesel Engine.

MHDE—Medium Heavy Duty Diesel Engine.

MPI—Multi Port Injection.

LDDT—Light Duty Diesel Truck categories.

LDT—Light Duty Truck (gasoline) categories based on weight as defined in the table.

LDV—Light Duty Vehicle, generally passenger cars and light trucks under 6000 pounds GVWR.

LHDE—Light Heavy Duty Engine (several weight categories).

LVW—Loaded Vehicle Weight, curb weight plus 300 pounds.

MDT—Medium Duty Truck categories based on weight as defined in the table.

MDV—Medium Duty Vehicle.

MHDE—Medium Heavy Duty Engine.

MY—Model Year.

VECI Acronym Definitions

NCP—Non Compliance Penalty.

OBD—On-Board Diagnostic.

ORVR—On-Board Refueling Vapor Recovery.

PC—Passenger Car.

SI—Sequential Injection.

SULEV—Super Ultra Low Emission Vehicle.

Tier 0—California and Federal regulations effective prior to Tier 1 phase in dates.

Tier 1—California regulations beginning in 1993 model year and Federal regulations beginning in 1994 model year.

TBI—Throttle Body Injection.

LEV—Low Emission Vehicle.

ZEV—Zero Emission Vehicle.

ULEV—Ultra Low Emission Vehicle.

ILEV—Inherently Low Emission Vehicle.

On Board Diagnostics Monitors

OBD-I and OBD-II Overview

The California Air Resources Board (CARB) began regulating On Board Diagnostic (OBD) systems for vehicles sold in California beginning with the 1988 model year. The initial requirements, known as OBD-I, required identifying the likely area of malfunction with regard to the fuel metering system, Exhaust Gas Recirculation (EGR) system, emission-related components and the Powertrain Control Module (PCM). A malfunction indicator lamp (MIL) labeled CHECK ENGINE or SERVICE ENGINE SOON was required to illuminate and alert the driver of the malfunction and the need to service the emission control system. A fault code or Diagnostic Trouble Code (DTC) was required to assist in identifying the system or component associated with the fault.

Starting with the 1994 model year, both CARB and Environmental Protection Agency (EPA) mandated enhanced OBD systems, commonly known as OBD-II. The objectives of the OBD-II system are to improve air quality by reducing high in-use emissions caused by emission-related malfunctions, reducing the time between the occurrence of a malfunction and its detection and repair, and assisting in the diagnosis and repair of emission-related problems.

North American OBD-II/Federal OBD requirements apply to:

- **Gasoline engines:**All California (CA), Massachusetts (MA), and New York (NY) Federal passenger cars, California, MA, and NY Medium Duty Passenger Vehicles (MDPVs) and trucks up to 14,000 lbs. GVWR (Gross Vehicle Weight Rating). Federal trucks from 8,500 lbs. to 14,000 GVWR will begin phasing in OBD-II starting in the 2004 model year. Federal heavy-duty trucks up to 10,000 lbs. GVWR choosing to certify using Light Duty Truck provisions must comply with OBD-II requirements. Federal heavy-duty trucks over 8,500 lbs. GVWR that do not comply with OBD-II regulations must comply with OBD-I in order to meet minimum Ford serviceability requirements. Passenger cars and trucks sold in Canada and Mexico have Federal calibrations, unless unique calibrations are certified for Mexico at high altitude.
- **Diesel Engines:**All passenger cars and California trucks up to 14,000 lb. GVWR. Federal trucks from 8,500 lbs. to 14,000 lbs.GVWR will begin phase in of OBD II starting in the 2004MY.
- **Alternative fuel vehicles (AFV):**Ethanol/methanol AFVs must meet full OBD-II requirements during operation on all fuels. Bi-fuel NGVs/LPGs are required to meet full OBD-II requirements while operating on gasoline. Dedicated NGVs and bi-fuel NGVs/LPGs are required to partially meet OBD-II requirements while operating on gaseous fuels.

"Green States" are states that choose to adopt California emission regulations. National Low Emission Vehicle (NLEV) is a vehicle required to compliance with California OBD-II, including the 0.020" evaporative system monitoring requirements. Both the NLEV and "Green States" receive California vehicles for all passenger cars and trucks < 6,000 lbs. GVWR. "Green States" are: MA, NY, VT and ME. NLEV states are: VA, CT, RI, MD, NJ, PA, DE and Washington DC.

On Board Diagnostics Monitors

The OBD-II system monitors virtually all emission control systems and components that can affect tailpipe or evaporative emissions. In most cases, malfunctions must be detected before emissions exceed 1.5 times the applicable 100K, 120K or 150K passenger cars or 120K trucks - mile emission standards. Partial Zero Emission Vehicle (PZEV), Super Ultra Low Emission Vehicle (SULEV-II) and Federal Tier 2 (Bin 3 and 4) vehicles can use malfunction criteria of 2.5 in lieu of 1.5 standard whenever required. If a system or component exceeds emission thresholds or fails to operate within a manufacturer's specifications, a DTC will be stored and the MIL will be illuminated within two driving cycles.

The OBD-II system monitors for malfunctions either continuously, regardless of driving mode, or non-continuously, once per drive cycle during specific drive modes. A pending DTC is stored in the PCM Keep Alive Memory (KAM) when a malfunction is initially detected. This pending DTC may be erased on the third vehicle restart after two consecutive drives cycles with no malfunction. However if the malfunction is still present after two consecutive drive cycles, the MIL is illuminated. Once the MIL is illuminated, three consecutive drive cycles without a malfunction detected are required to extinguish the MIL. The DTC is erased after 40 engine warm-up cycles once the MIL is extinguished.

In addition to specifying and standardizing much of the diagnostics and MIL operation, OBD-II requires the use of a standard Diagnostic Link Connector (DLC), standard communication links and messages, standardized DTCs and terminology. Examples of standard diagnostic information are freeze frame data and Inspection Maintenance (IM) Readiness Indicators.

Freeze frame data describes data stored in KAM at the point the malfunction is initially detected. Freeze frame data consists of parameters such as engine rpm and load, state of fuel control, spark, and warm-up status. Freeze frame data is stored at the time the first malfunction is detected, however, previously stored conditions will be replaced if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

OBD Inspection Maintenance (IM) Readiness indicators show whether all of the OBD monitors have been completed since the last time KAM or the PCM DTC(s) have been cleared. Ford also stores a P1000 DTC to indicate that some monitors have not completed. In some states, it may be necessary to perform an OBD check in order to renew a vehicle registration. The IM Readiness indicators must show that all monitors have been completed prior to the OBD check.

Vehicles not required to comply with OBD-II requirements will utilizes an OBD-I system. OBD-I systems are used on all Federal truck calibrations over 8,500 lbs. GVWR. OBD-I vehicles use the same data communication link, data link connector (DLC) and PCM software as the corresponding OBD-II vehicle. Differences between OBD-I and OBD-II vehicles may be removal of the rear oxygen sensor(s), fuel tank pressure sensor, canister vent solenoid and PCM calibration. The table below lists what monitors and functions have been altered for the OBD-I calibration.

Monitor/Feature	Calibration
Catalyst Monitor	Not required, monitor calibration out, rear O2 sensors may be deleted.
Misfire Monitor	Calibrated in for service, all DTC are non-MIL. Catalyst damage misfire criteria calibrated out, emission threshold criteria set to 4%, enabled between 150°F (66°C) and 220°F (104°C), 254 second start-up delay.

(Continued)

On Board Diagnostics Monitors

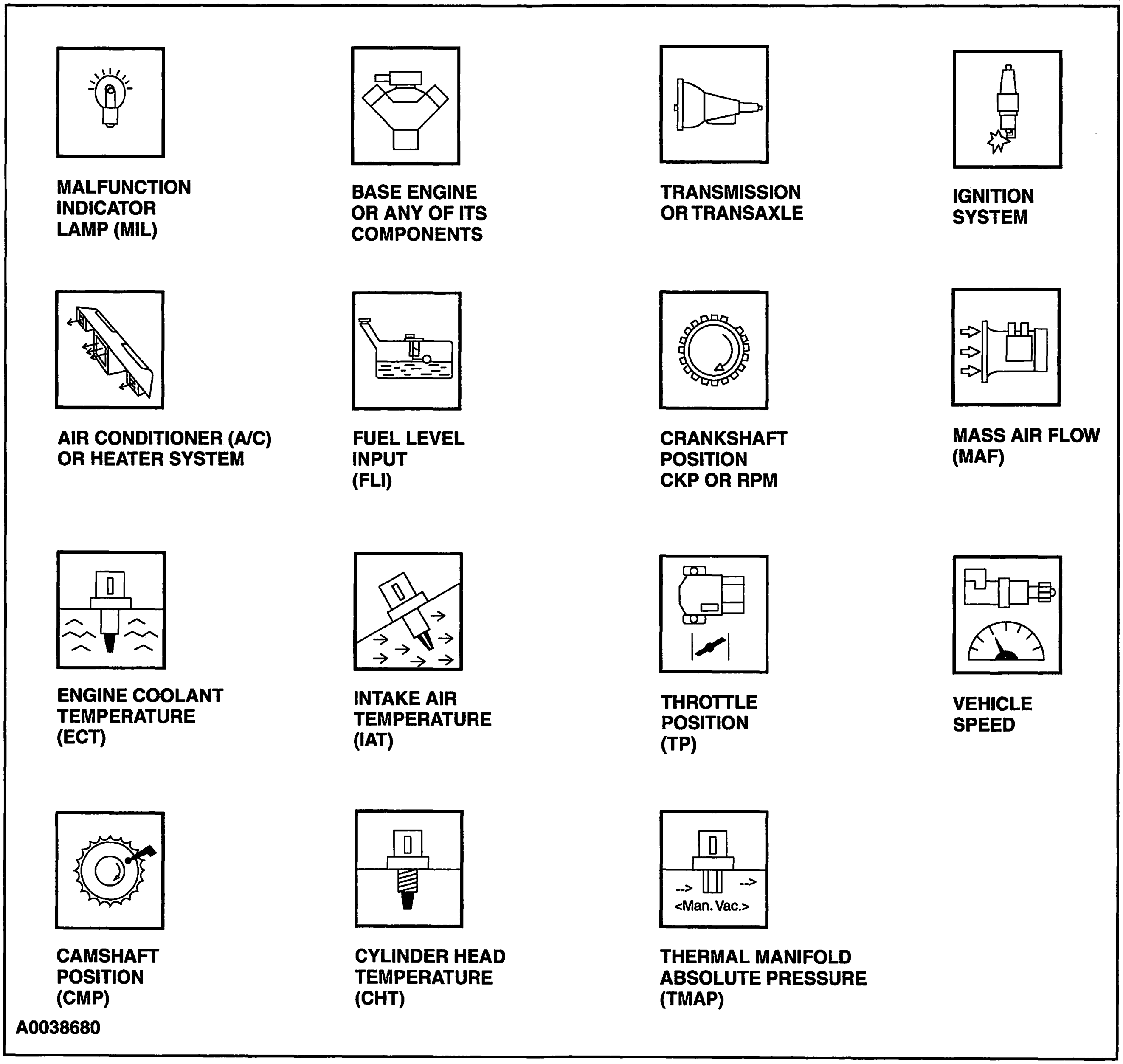
Monitor/Feature	Calibration
Oxygen Sensor Monitor	Rear O2 sensor test calibrated out, rear O2 sensor may be deleted, front O2 sensor response test calibrated out.
EGR Monitor	Same as OBD-II calibration except that P0402 test uses a higher threshold.
Fuel System Monitor	Same as OBD-II calibration.
Secondary Air Monitor	Functional (low flow) test calibrated out, circuit codes are same as OBD-II calibration.
Evap System Monitor	EVAP system leak check calibrated out, fuel level input circuit checks retained as non-MIL. Fuel tank pressure sensor and canister vent solenoid may be deleted.
PCV Monitor	Same hardware as OBD-II
Thermostat Monitor	Thermostat monitor calibrated out.
Comprehensive Component Monitor	All circuit checks same as OBD-II. Some rationality and functional test calibrated out.
Communication Protocol and DLC	Same as OBD-II, all generic and enhances scan tool modes work the same as OBD-II but reflect the OBD-I calibration that contains fewer supported monitors.
MIL Control	Same as OBD-II, it takes 2 driving cycles to illuminate the MIL.

The following section provides a general description of each On Board Diagnostic monitor. In these descriptions, the monitor strategy, hardware, testing requirements and methods are presented to provide an overall understanding of monitor operation. An illustration of each monitor is also provided. These illustrations should be used as typical examples and are not intended to represent all possible vehicle configurations.

Each illustration depicts the PCM as the main focus with primary inputs and outputs for each monitor. The icons to the left of the PCM represent the inputs used by each of the monitor strategies to enable or activate the monitor. The components and subsystems to the right of the PCM represent the hardware and signals used while performing the tests and the systems being tested. The Comprehensive Component Monitor (CCM) illustration has numerous components and signals involved and are shown generically. When referring to the illustrations, match the numbers to the corresponding numbers in the monitor descriptions for a better comprehension of the monitor and associated DTC's.

On Board Diagnostics Monitors

These icons are used in the illustrations of the On Board Diagnostic monitors and throughout this section.



Catalyst Efficiency Monitor

The Catalyst Efficiency Monitor uses an oxygen sensor before and after the catalyst to infer the hydrocarbon (HC) efficiency based on oxygen storage capacity of the catalyst. Under normal, close-loop fuel conditions, high efficiency catalysts have significant oxygen storage. This makes the switching frequency of the rear heated oxygen sensor (HO2S) very slow and reduces the amplitude of those switches as compared to the switching frequency and amplitude of the front HO2S. As the catalyst efficiency deteriorates due to thermal and/or chemical deterioration, its ability to store oxygen declines. The post-catalyst or downstream HO2S signal begins to switch more rapidly with increasing amplitude, approaching the switching frequency and amplitude of the pre-catalyst or upstream HO2S.

Note: The predominant failure mode for high mileage catalysts is chemical deterioration (phosphorus deposition on the front brick of the catalyst), not thermal deterioration.

All vehicles utilize an FTP-based (Federal Test Procedure) catalyst monitor. This simply means that the catalyst monitor must run during a standard FTP emission test. This differs from the 20-second steady state catalyst monitor used in 1994 through some 1996 vehicles. Currently, two slightly different versions of the catalyst monitor are utilized - the Switch Ratio method and the Index Ratio method. Beginning with the 2001 model year and beyond, both versions will continue to be used in subsequent model years.

Switch Ratio Method

1. In order to assess catalyst oxygen storage, the monitor counts front and rear HO2S switches during part-throttle, close-loop fuel condition after the engine is warmed-up and inferred catalyst temperature is within limits. Front switches are accumulated in up to nine different air mass regions or cells although three air mass regions is typical. Rear switches are counted in a single cell for all air mass regions. When the required number of front switches has accumulated in each cell, the total number of rear switches is divided by the total number of front switches to compute a switch ratio. A switch ratio near 0.0 indicates high oxygen storage capacity; hence high HC efficiency. A switch ratio near 1.0 indicates low oxygen storage capacity; hence low HC efficiency. If the actual switch ratio exceeds a calibrated threshold switch ratio, the catalyst is considered failed.

   Inputs from ECT or CHT (warm engine), IAT (not extreme ambient temperatures), MAF (greater than minimum engine load), VSS (within vehicle speed window) and TP (at part-throttle) are required to enable the Catalyst Efficiency Monitor.

Typical Switch Ratio Monitor Entry Conditions:

- Part throttle with no rapid throttle transients
- Minimum 330 seconds since start-up at 70° F (21°C)
- Engine coolant temperature is between 170° F (76.6°C) and 230°F (110°C)
- Intake air temperature is between 20°F (-6°C) and 180°F (82°C)
- Engine load greater than 10%
- Time since entering close loop is 30 seconds

Catalyst Efficiency Monitor

- Vehicle speed is between 5 and 70 mph (8 and 112 km/h)
- Inferred Catalyst Mid-bed Temperature of 900° F (482° C)
- Mass air flow is between 1 and 5 lbs/min
- Fuel level greater than 15%
- EGR is between 1 and 12%

2. The DTCs associated with this test are DTC P0420 (Bank 1 or Y-pipe system) and P0430 (Bank 2). Because an Exponentially Weighted Moving Average algorithm is used for malfunction determination, up to six driving cycles may be required to illuminate the MIL during normal customer driving. If KAM is reset or the battery is disconnected, a malfunction will illuminate the MIL in 2 drive cycles.

Index Ratio Method

1. In order to assess catalyst oxygen storage, the catalyst monitor counts front HO2S switches during part-throttle, closed-loop fuel conditions after the engine is warmed-up and inferred catalyst temperature is within limits. Front switches are accumulated in up to three different air mass regions or cells. While catalyst monitoring entry conditions are being met, the front and rear HO2S signal lengths are continually being calculated. When the required number of front switches has accumulated in each cell, the total signal length of the rear HO2S is divided by the total signal length of the front HO2S to compute a catalyst index ratio. An index ratio near 0.0 indicates high oxygen storage capacity; hence high HC efficiency. A switch ratio near 1.0 indicates low oxygen storage capacity; hence low HC efficiency. If the actual index ratio exceeds the threshold index ratio, the catalyst is considered failed.

   Inputs from ECT or CHT (warm engine), IAT (not extreme ambient temperatures), MAF (greater than minimum engine load), VSS (within vehicle speed window) and TP (at part-throttle) are required to enable the Catalyst Efficiency Monitor.

Typical Index Ratio Monitor Entry Conditions:

- Minimum 330 seconds since start-up at 70° F (21°C)
- Engine coolant temperature is between 170° F (76.6°C) and 230°F (110°C)
- Intake air temperature is between 20°F (-6°C) and 180°F (82°C)
- Time since entering close loop is 30 seconds
- Inferred Rear HO2S sensor temperature of 900° F (482° C)
- EGR is between 1 and 12%
- Part throttle, maximum rate of change 0.2 volts/0.050 sec
- Vehicle speed is between 5 and 70 mph (8 and 112 km/h)
- Fuel level greater than 15%

Catalyst Efficiency Monitor

- First Air Flow Cell
  - Engine RPM 1,000 to 1,300 rpm.
  - Engine load 15 to 35%.
  - Inferred catalyst temp. 850° F (454° C) to 1,200° F (649° C).
  - Number of front O2 switches: 50.
- Second Air Flow Cell
  - Engine RPM 1,200 to 1,500 rpm.
  - Engine load 20 to 35%.
  - Inferred catalyst temp. 900° F (482° C) to 1,250° F (677° C).
  - Number of front O2 switches: 70.
- Third Air Flow Cell
  - Engine RPM 1,300 to 1,600 rpm.
  - Engine load 20 to 40%.
  - Inferred catalyst temp. 950° F (510° C) to 1,300° F (704° C).
  - Number of front O2 switches: 30.

2. The DTCs associated with this test are DTC P0420 (Bank 1or Y-pipe system) and P0430 (Bank 2). Because an Exponentially Weighted Moving Average algorithm is used for malfunction determination, up to six driving cycles may be required to illuminate the MIL during normal customer driving. If KAM is reset or the battery is disconnected, a malfunction will illuminate the MIL in 2 drive cycles.

General Catalyst Monitor Operation

Monitor execution is once per drive cycle. Typical monitor duration is 700 seconds. In order for the catalyst monitor to run, the HO2S monitor must be complete and Secondary AIR and EVAP system functional with no stored DTCs. If the catalyst monitor does not complete during a particular driving cycle, the already accumulated switch/signal data is retained in Keep Alive Memory and is used during the next driving cycle to allow the catalyst monitor a better opportunity to complete.

Catalyst Efficiency Monitor

Rear HOS2 sensors can be located in various configurations to monitor different kinds of exhaust systems. In-line engines and many V-engines are monitored by their individual bank. A rear HO2S sensor is used along with the front, fuel control HO2S sensor for each bank. Two sensors are used on an in-line engine; four sensors are used on a V-engine. Some V-engines have exhaust banks that combine into a single underbody catalyst. These systems are referred to as Y-pipe systems. They use only one rear HO2S sensor along with the two front, fuel-control HO2S sensors. Y-pipe system uses three sensors in all. For Y-piped systems, the two front HO2S sensor signals are combined by the PCM software to infer what the HO2S signal would have been in front of the monitored catalyst. The inferred front HO2S signal and the actual single, rear HO2S signal is then used to calculate the switch ratio.

Most vehicles that are part of the Low Emission Vehicle (LEV) catalyst monitor phase-in will monitor less than 100% of the catalyst volume. Often this is the first catalyst brick of the catalyst system. Partial volume monitoring is done on LEV and Ultra Low Emission Vehicle (ULEV) vehicles in order to meet the 1.75 emission standard.

Many applications that utilize partial-volume monitoring place the rear HO2S sensor after the first light-off catalyst can or, after the second catalyst can in a three-can per bank system. (A few application placed the HO2S in the middle of the catalyst can, between the first and second bricks).

Some Partial Zero Emission Vehicles (PZEV) will utilize three sets of HO2S sensors per engine bank. The front sensors or stream 1 (HO2S11/HO2S21) are the primary fuel control sensors. The next sensors downstream or stream 2 in the exhaust are utilized to monitor the light-off catalyst (HO2S12/HO2S22). The last sensors downstream or stream 3 in the exhaust (HO2S13/HO2S23) are utilized for very long term fuel trim in order to optimize catalyst efficiency (For Aft Oxygen Sensor Control). For addition heated oxygen sensor information, refer to the Heated Oxygen Sensor (HO2S) Monitorlater in this section.

Index ratios for ethanol (Flex fuel) vehicle vary based on the changing concentration of alcohol in the fuel. The malfunction threshold typically increases as the percent of alcohol increases. For example, a malfunction threshold of 0.5 may be used at E10 (10% ethanol) and 0.9 may be used at E85 (85% ethanol). The malfunction thresholds are therefore adjusted based on the percentage of alcohol in the fuel.

Catalyst Efficiency Monitor

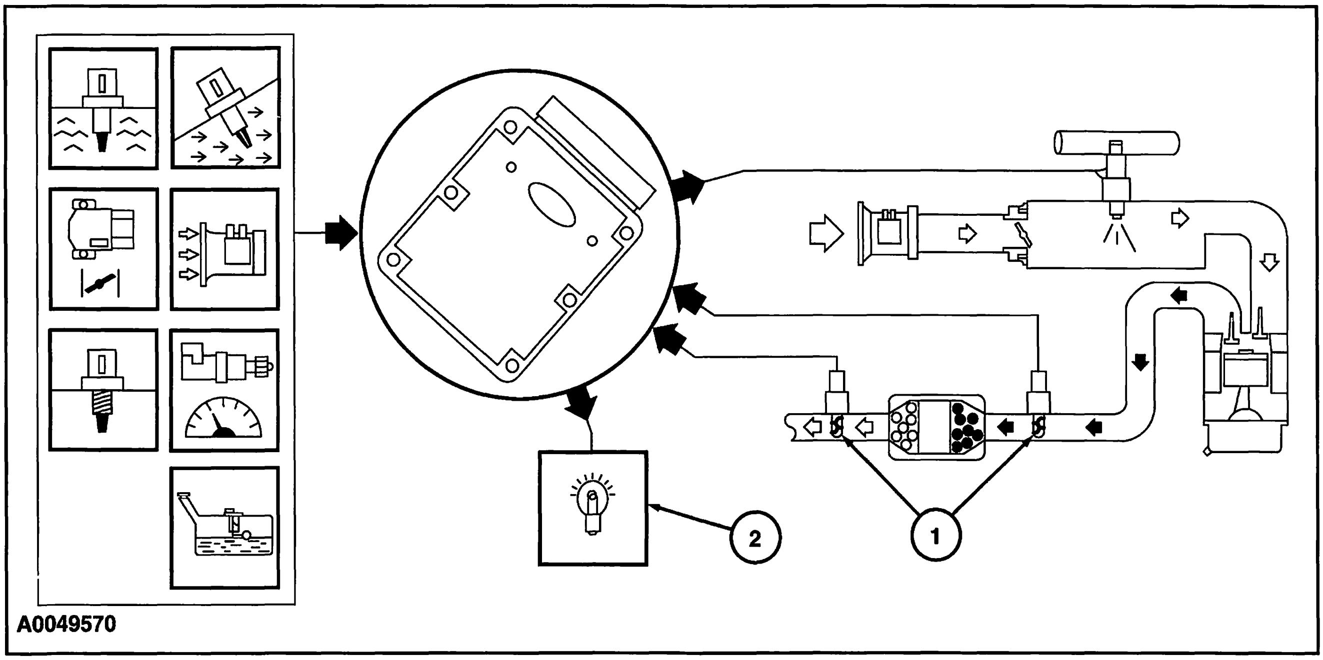


Figure 5: Catalyst Efficiency Monitor

Comprehensive Component Monitor

The Comprehensive Component Monitor (CCM) monitors for malfunctions in any powertrain electronic component or circuit that provides input or output signals to the PCM that can affect emissions and is not monitored by another OBD II monitor. Inputs and outputs are, at a minimum, monitored for circuit continuity or proper range of values. Where feasible, inputs are also checked for rationality, outputs are also checked for proper functionality.

CCM covers many components and circuits and tests them in various ways depending on the hardware, function, and type of signal. For example, analog inputs such as Throttle Position or Engine Coolant Temperature are typically checked for opens, shorts and out-of-range values. This type of monitoring is performed continuously. Some digital inputs like Vehicle Speed or Crankshaft Position rely on rationality checks - checking to see if the input value makes sense at the current engine operating conditions. These types of tests may require monitoring several components and can only be performed under appropriate test conditions.

Outputs such as the Idle Air Control solenoid are checked for opens and shorts by monitoring a feedback circuit or “smart driver” associated with the output. Other outputs, such as relays, require additional feedback circuits to monitor the secondary side of the relay. Some outputs are also monitored for proper function by observing the reaction of the control system to a given change in the output command. An Idle Air Control solenoid can be functionally tested by monitoring idle rpm relative to the target idle rpm. Some tests can only be performed under appropriate test conditions; for example, transmission shift solenoids can only be tested when the PCM commands a shift.

The following is an example of some of the input and output components monitored by the CCM. The components monitor may belong to the engine, ignition, transmissions, air conditioning, or any other PCM supported subsystem.

1. Inputs:

   mass air flow (MAF) sensor, intake air temperature (IAT) sensor, engine coolant temperature (ECT) sensor, throttle position (TP) sensor, camshaft position (CMP) sensor, air conditioning pressure sensor (ACPS), fuel tank pressure (FTP) sensor.

2. Outputs:

   fuel pump (FP), wide open throttle A/C cutout (WAC), idle air control (IAC), shift solenoid (SS), torque converter clutch (TCC) solenoid, intake manifold runner control (IMRC), EVAP canister purge valve, canister vent (CV) solenoid.

3. CCM is enabled after the engine starts and is running. A Diagnostic Trouble Code (DTC) is stored in Keep Alive Memory and the MIL is illuminated after two driving cycles when a malfunction is detected. Many of the CCM tests are also performed during on demand self-test.

Comprehensive Component Monitor

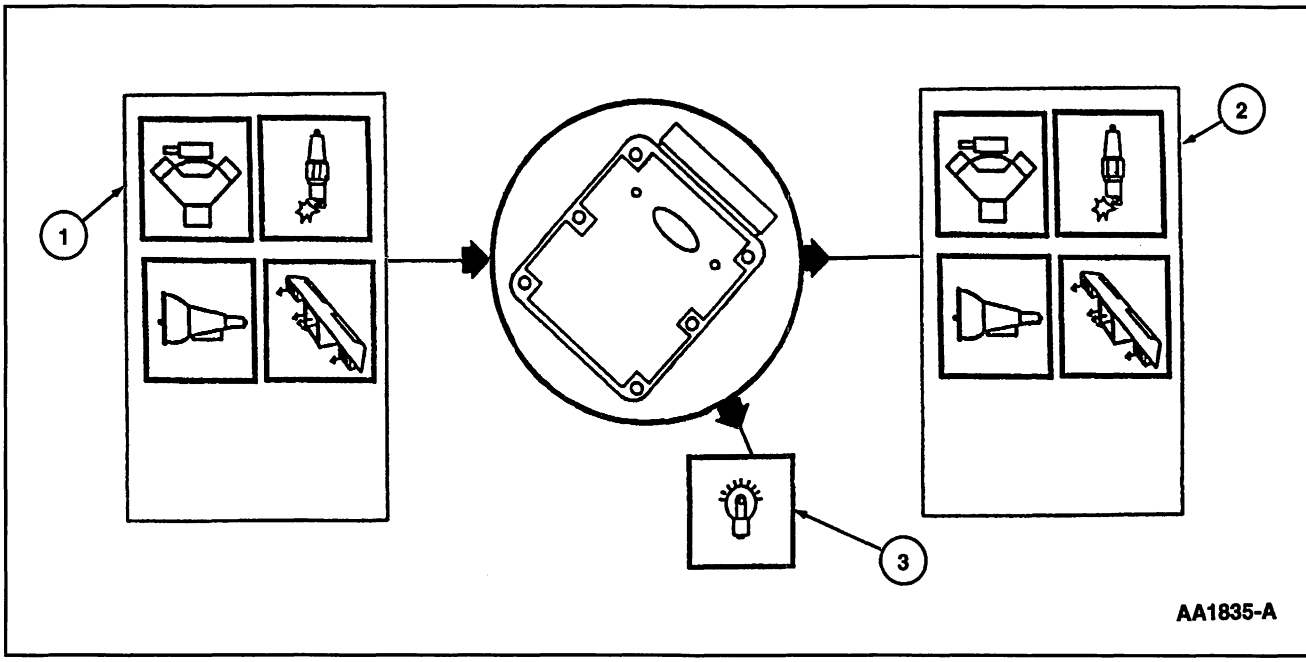


Figure 6: Comprehensive Component Monitor

Evaporative Emission (EVAP) Leak Check Monitor

The Evaporative Emission (EVAP) Leak Check Monitor is an on-board strategy designed to detect a leak from a hole (opening) equal to or greater than 0.508 mm (0.020 inch) in the Enhanced EVAP system. The proper function of the individual components of the Enhanced EVAP system as well as its ability to flow fuel vapor to the engine is also examined. The EVAP Leak Check Monitor relies on the individual components of the Enhanced EVAP system to apply vacuum to the fuel tank and then seal the entire Enhanced EVAP system from atmosphere. The fuel tank pressure is then monitored to determine the total vacuum lost (bleed-up) for a calibrated period of time. Inputs from the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor, intake air temperature (IAT) sensor, mass air flow (MAF) sensor, vehicle speed, fuel level input (FLI) and fuel tank pressure (FTP) sensor are required to enable the EVAP Leak Check Monitor.

Note: During the EVAP Leak Check Monitor Repair Verification Drive Cycle a PCM reset will bypass the minimum soak time required to complete the monitor. The EVAP Leak Check Monitor will not run if the key is turned off after a PCM reset. The EVAP Leak Check Monitor will not run if a MAF sensor failure is indicated. The EVAP Leak Check Monitor will not initiate until the Heated Oxygen Sensor (HO2S) Monitor has completed.

The EVAP Leak Check Monitor is executed by the individual components of the Enhanced EVAP system as follows:

1. The EVAP canister purge valve is used to control the flow of vacuum from the engine and create a target vacuum on the fuel tank.
2. The Canister Vent (CV) solenoid is used to seal the EVAP system from attmosphere. It is closed by the PCM (100% duty cycle) which then allows the EVAP canister purge valve to obtain the target vacuum on the fuel tank.
3. The fuel tank pressure (FTP) sensor will be used by the EVAP Leak Check Monitor to determine if the target vacuum on the fuel tank is being reached to perform the leak check. Some vehicle applications with the EVAP Leak Check Monitor use a remote in-line FTP sensor. Once the target vacuum on the fuel tank is achieved, the change in fuel tank vacuum for a calibrated period of time will determine if a leak exists.

Evaporative Emission (EVAP) Leak Check Monitor

4. If the initial target vacuum cannot be reached, DTC P0455 (gross leak detected) will be set. The EVAP Leak Check Monitor will abort and not continue with the leak check portion of the test.

   For some vehicle applications: If the initial target vacuum cannot be reached after a refueling event and the purge vapor flow is excessive, DTC P0457 (fuel cap off) is set. If the initial target vacuum cannot be reached and the purge flow is too small, DTC P1443 (no purge flow condition) is set.

   If the initial target vacuum is exceeded, a system flow fault exists and DTC P1450 (unable to bleed-up fuel tank vacuum) is set. The EVAP Leak Check Monitor will abort and not continue with the leak check portion of the test.

   If the target vacuum is obtained on the fuel tank, the change in the fuel tank vacuum (bleed-up) will be calculated for a calibrated period of time. The calculated change in fuel tank vacuum will be compared to a calibrated threshold for a leak from a hole (opening) of 1.016 mm (0.040 inch) in the Enhanced EVAP system. If the calculated bleed-up is less than the calibrated threshold, the Enhanced EVAP system passes. If the calibrated bleed-up exceeds the calibrated threshold, the test will abort and rerun the test up to three times.

   If the bleed-up threshold is still being exceeded after three tests, a vapor generation check must be performed before DTC P0442 (small leak detected) will be set. This is accomplished by returning the Enhanced EVAP system to atmospheric pressure by closing the EVAP canister purge valve and opening the CV solenoid. Once the FTP sensor observes the fuel tank is at atmospheric pressure, the CV solenoid closes and seals the Enhanced EVAP system.

   The fuel tank pressure build-up for a calibrated period of time will be compared to a calibrated threshold for pressure build-up due to vapor generation.

   If the fuel tank pressure build-up exceeds the threshold, the leak test results are invalid due to vapor generation. The EVAP Leak Check Monitor will attempt to retest again.

   If the fuel tank pressure build-up does not exceed the threshold, the leak test results are valid and DTC P0442 will be set.

5. If the 1.016 mm (0.40 inch) test passes, the test time is extended to allow the 0.508 mm (0.020 inch) test to run.

   The calculated change in fuel vacuum over the extended time is compared to a calibrated threshold for a leak from a 0.508 mm (0.020 inch) hole (opening).

   If the calculated bleed-up exceeds the calibrated threshold, vapor generation is run. If vapor generation passes (no vapor generation), an internal flag is set in the PCM to run a 0.508 mm (0.020 inch) test at idle (vehicle stopped).

   On the next start following a long engine off period, the Enhanced EVAP system will be sealed and evacuated for the first 10 minutes of operation.

   If the appropriate conditions are met, a 0.508 mm (0.020 inch) leak check is conducted at idle.

   If the test at idles fails, a DTC P0456 will be set. There is no vapor generation test with the idle test.

Note: If the vapor generation is high on some vehicle Enhanced EVAP Systems, where the monitor does not pass, the result is treated as a no test. Thereby, the test is complete for the day.

Evaporative Emission (EVAP) Leak Check Monitor

6. The malfunction indicator lamp (MIL) is activated for DTCs P0442, P0455, P0456, P0457, P1443 and P1450 (or P446) after two occurrences of the same fault. The MIL can also be activated for any Enhanced EVAP system component DTCs in the same manner. The Enhanced EVAP system component DTCs P0443, P0452, P0453 and P1451 are tested as part of the Comprehensive Component Monitor (CCM).

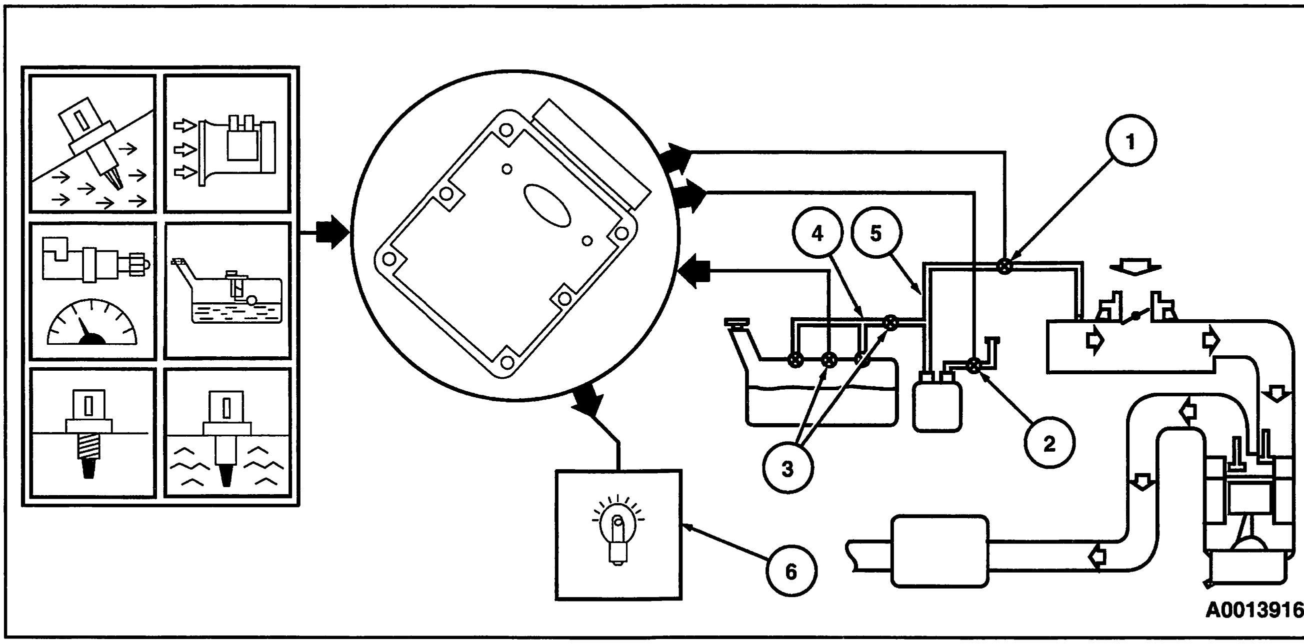


Figure 7: Evaporative Emission (EVAP) Leak Check Monitor

Exhaust Gas Recirculation (EGR) System Monitor — Delta Pressure Feedback (DPFE) EGR and EGR System Module (ESM) EGR

The EGR System Monitor is an on-board strategy designed to test the integrity and flow characteristics of the EGR system. The monitor is activated during EGR system operation and after certain base engine conditions are satisfied. Input from the ECT, CHT, IAT, TP and CKP sensors is required to activate the monitor. Once activated, the EGR System Monitor will perform each of the tests described below during the engine modes and conditions indicated. Some of the EGR System Monitor tests are also performed during on demand self-test.

Note: The Delta Pressure Feedback EGR (DPFE) sensor, EGR Vacuum Regulator (EVR) solenoid, Manifold Absolute Pressure (MAP) sensor and the EGR valve itself are integrated into one unit in the ESM EGR assembly. The ESM is not serviceable. If any one component fails within the ESM, the entire ESM assembly must be replaced.

1. The Delta Pressure Feedback EGR sensor and circuit are continuously tested for opens and shorts. The monitor looks for the DPFE circuit voltage to exceed the maximum or minimum allowable limits.

   The DTCs associated with this test are DTCs P0405 or P1400 and P0406 or P1401.

2. The EVR solenoid is continuously tested for opens and shorts. The monitor looks for an EVR circuit voltage that is inconsistent with the EVR circuit commanded output state.

   The DTC associated with this test is DTC P0403 or P1409.

3. The test for a stuck open EGR valve or EGR flow at idle is continuously performed whenever at idle (TP sensor indicating closed throttle). The monitor compares the DPFE circuit voltage at idle to the DPFE circuit voltage stored during key on engine off to determine if EGR flow is present at idle.

   The DTC associated with this test is DTC P0402.

4. The DPFE sensor hoses are tested once per drive cycle for disconnect and plugging. The test is performed with EGR valve closed and during a period of acceleration. The PCM will momentarily command the EGR valve closed. The monitor looks for the DPFE sensor voltage to be inconsistent for a no flow voltage. A voltage increase or decrease during acceleration while the EGR valve is closed may indicate a fault with a signal hose during this test.

   The DTCs associated with this test are DTC P1405 and P1406.

5. The EGR flow rate test is performed during a steady state when engine speed and load are moderate and EVR duty cycle is high. The monitor compares the actual DPFE circuit voltage to a desired EGR flow voltage for that state to determine if EGR flow rate is acceptable or insufficient. This is a system test and may trigger a DTC for any fault causing the EGR system to fail.

   The DTC associated with this test is DTC P0401. DTC P1408 is similar to P0401 but performed during KOER Self-Test conditions.

6. The MIL is activated after one of the above tests fails on two consecutive drive cycles.

Exhaust Gas Recirculation (EGR) System Monitor — Delta Pressure Feedback (DPFE) EGR and EGR System Module (ESM) EGR

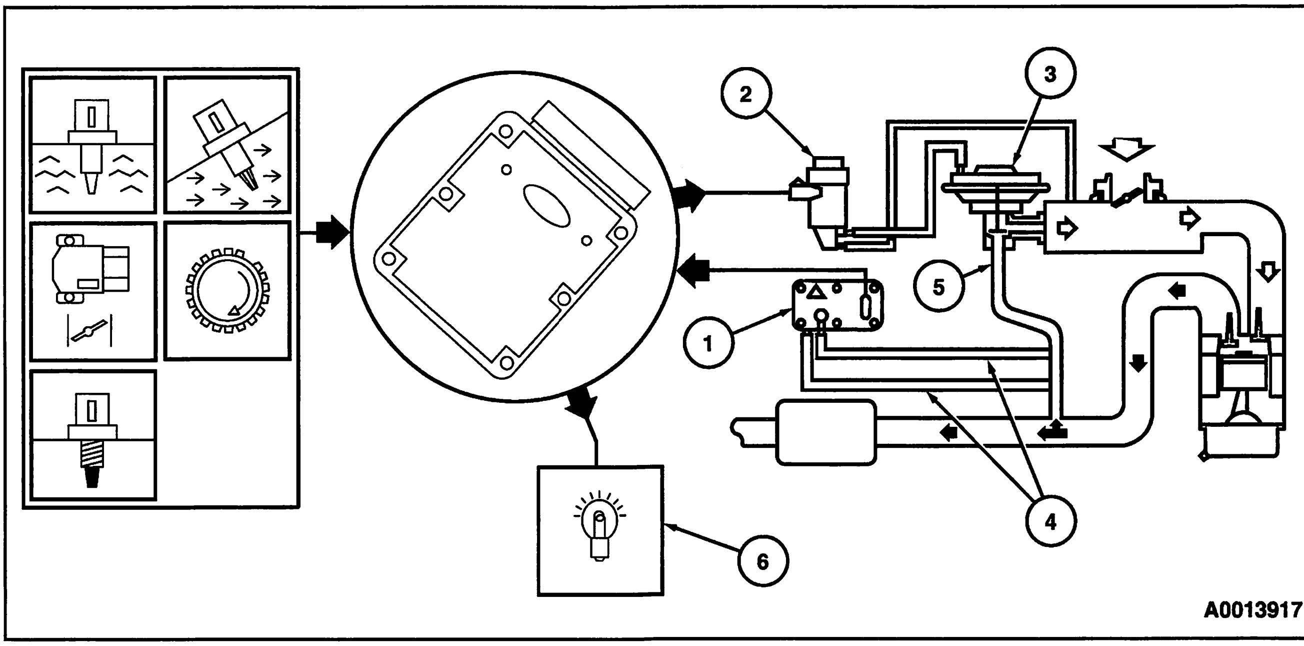


Figure 8: EGR System Monitor - Delta Pressure Feedback EGR

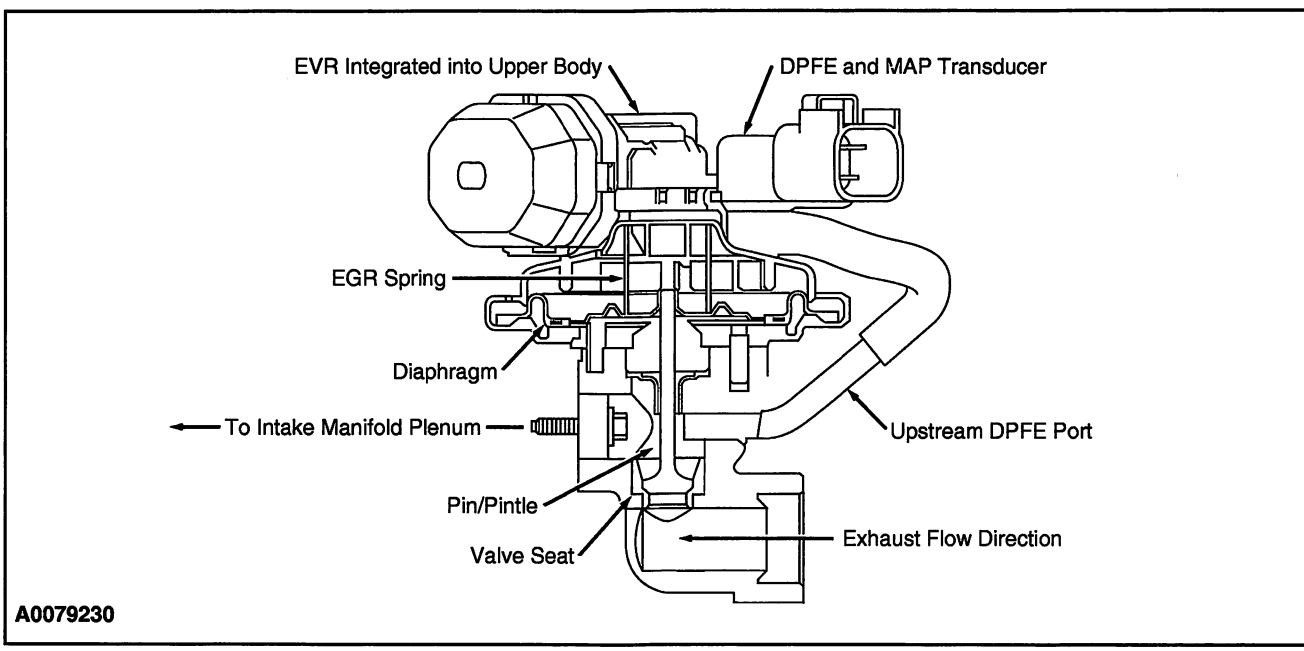


Figure 9: EGR System Monitor - EGR System Module EGR

Electric Exhaust Gas Recirculation (EEGR) System Monitor

The Electric or “Stepper” Motor EGR System Monitor is an on-board strategy designed to test the integrity and flow characteristics of the EGR system. The monitor is activated during EGR system operation and after certain base engine conditions are satisfied. Input from the ECT or CHT, IAT, TP, CKP, MAF, and MAP sensors is required to activate the EGR System Monitor. Once activated, the EGR System Monitor will perform each of the tests described below during the engine modes and conditions indicated. Some of the EGR System Monitor tests are also performed during on demand self-test

The Electric EGR Monitor consists of an electrical and functional test that checks the stepper motor and the EEGR system for proper flow. The PCM controls the EEGR valve by commanding from 0 to 52 discreet increments or “steps” to get the valve from fully closed to fully open. The stepper motor electrical test is a continuous check of the four electric stepper motor coils and circuits to the PCM. A malfunction is indicated if an open circuit, short to power or short to ground has occurred in one or more of the stepper motor coils or circuits for a calibrated period of time. If a malfunction has been detected, the EEGR system will be disabled, setting the KOER, and Continuous P0403 DTC. Additional monitoring will be suspended for the remainder of the drive cycle, or until the next engine startup.

After the vehicle has warmed up and normal EEGR flow rates are being commanded by the PCM, the EEGR flow check is performed. The flow test is performed once per drive cycle when a minimum amount of exhaust gas is requested and the remaining entry conditions required to initiate the test are satisfied. If a malfunction is detected, the EEGR system as well as the EEGR monitor is disabled until the next engine startup.

The EEGR flow test is done by observing the behavior of two different values: MAP - the analog MAP sensor reading, and inferred MAP - calculated from the Mass Air Flow Sensor, throttle position, rpm, etc. During normal, steady-state operating conditions, EEGR is intrusively commanded ON to a specified percentage. Then, EEGR is commanded OFF. If the EEGR system is working properly, there is a significant difference in both the observed and the calculated values of MAP, between the EGR-ON and the EGR-OFF states.

When flow test entry conditions have been satisfied, EEGR is commanded to flow at a calibrated test rate (about 10%). At this time, the value of MAP is recorded (EGR-ON MAP). The value of inferred MAP EGR-ON IMAP is also recorded. Next the EEGR is commanded off (0%). Again, the value of MAP is recorded (EGR-OFF MAP). The value of EGR-OFF IMAP is also recorded. Typically, seven such ON/OFF samples are taken. After all the samples have been taken, the average EGR-ON MAP, EGR-ON IMAP, EGR-OFF MAP and EGR-OFF IMAP values are stored.

Next, the difference between the EGR-ON and EGR-OFF value is calculated:

- MAP-delta = EGR-ON MAP — EGR-OFF MAP (analog MAP)
- IMAP-delta = EGR-ON IMAP — EGR-OFF IMAP (inferred MAP)

If the sum of MAP-delta and IMAP-delta exceeds a maximum threshold or falls below a minimum threshold, a P0400 (high or low flow malfunction) is registered.

Electric Exhaust Gas Recirculation (EEGR) System Monitor

As an additional check, if the EGR-ON MAP exceeds a maximum threshold (BARO, a calibrated value), DTC P0400 (low flow) is set. This check is performed to detect reduced EGR flow on systems where the MAP pickup point is not located in the intake manifold, but is located just upstream of the EEGR valve in the EEGR delivery tube.

Note: BARO is inferred at engine startup using the KOEO MAP sensor reading. It is updated during high, part-throttle or high rpm engine operation.

If the inferred ambient temperature is less than -7° C (20° F), greater than 54° C (130° F), or the altitude is greater than 8,000 feet (BARO <22.5 " Hg), the EEGR flow test cannot be reliably done. In these conditions, the EEGR flow test is suspended and a timer starts to accumulate the time in these conditions. When the vehicle leaves these extreme conditions, the timer starts decrementing, and if conditions permit, will attempt to complete the EGR flow monitor. If the timer reaches 500 seconds, the EEGR flow test is disabled for the remainder of the current driving cycle and the EGR Monitor will be set to a "ready" condition.

A DTC of P1408, like the P0400, will indicate a EGR flow failure (outside the minimum or maximum limits) but is only set during the KOER self test. The P0400 and P0403 are MIL codes. P1408 is a non-MIL code.

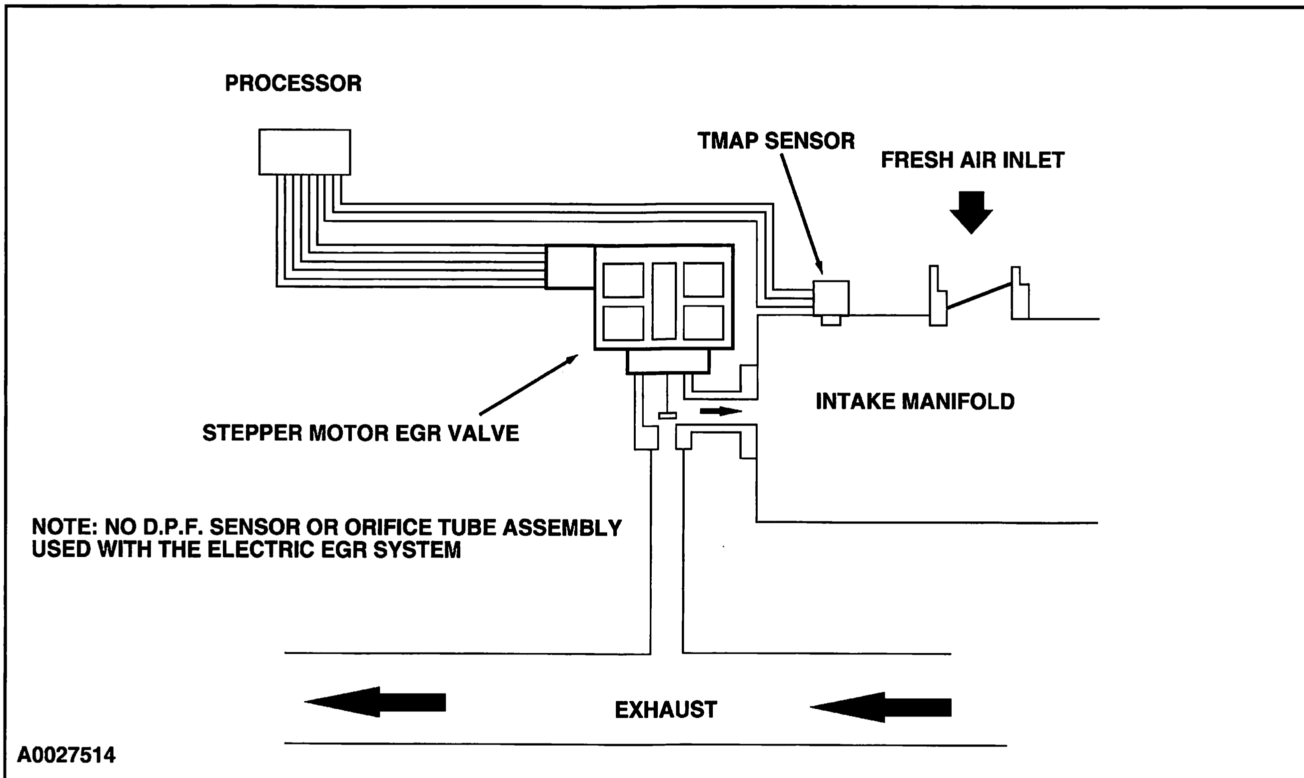


Figure 10: EEGR System Monitor - Electric EGR System

Fuel System Monitor

The Fuel System Monitor is an on-board strategy designed to monitor the fuel trim system. The fuel control system uses fuel trim tables stored in the PCM's Keep Alive Memory (KAM) to compensate for variability in fuel system components due to normal wear and aging. Fuel trim tables are based on engine rpm and engine load. During closed-loop fuel control, the fuel trim strategy learns the corrections needed to correct a "biased" rich or lean fuel system. The correction is stored in the fuel trim tables. The fuel trim has two means of adapting; Long Term Fuel Trim and a Short Term Fuel Trim. Both are described in greater detail in this section under Powertrain Control Software, Fuel Trim. Long Term relies on the fuel trim tables and Short Term refers to the desired air/fuel ratio parameter called "LAMBSE". LAMBSE is calculated by the PCM from HO2S inputs and helps maintain a 14.7:1 air/fuel ratio during closed-loop operation. Short Term Fuel Trim and Long Term Fuel Trim work together. If the HO2S indicates the engine is running rich, the PCM will correct the rich condition by moving Short Term Fuel Trim in the negative range (less fuel to correct for a rich combustion). If after a certain amount of time the Short Term Fuel Trim is still compensating for a rich condition, the PCM "learns" this and moves the Long Term Fuel Trim into the negative range to compensate and allows Short Term Fuel Trim to return to a value near 0%. Input from the ECT or CHT, IAT, and MAF sensors is required to activate the fuel trim system, which in turn activates the Fuel System Monitor. Once activated, the Fuel System Monitor looks for the fuel trim tables to reach the adaptive clip (adaptive limit) and LAMBSE to exceed a calibrated limit. The Fuel System Monitor will store the appropriate DTC when a fault is detected as described below.

1. The heated oxygen sensor (HO2S) detects the presence of oxygen in the exhaust and provides the PCM with feedback indicating air/fuel ratio.
2. A correction factor is added to the fuel injector pulsewidth calculation and/or mass air flow calculation, according to the Long and Short Term Fuel Trims as needed to compensate for variations in the fuel system.
3. When deviation in the parameter LAMBSE increases, air/fuel control suffers and emissions increase. When LAMBSE exceeds a calibrated limit and the fuel trim table has clipped, the Fuel System Monitor sets a Diagnostic Trouble Code (DTC) as follows:

   The DTCs associated with the monitor detecting a lean shift in fuel system operation are DTCs P0171 (Bank 1) and P0174 (Bank 2).

   The DTCs associated with the monitor detecting a rich shift in fuel system operation are DTCs P0172 (Bank 1) and P0175 (Bank 2).
4. The MIL is activated after a fault is detected on two consecutive drive cycles.

Typical Fuel System Monitor Entry Conditions:

- RPM range between at Idle.
- Air Mass Range greater than 0.75 lb/min.
- Purge duty cycle of 0%.

Fuel System Monitor

Typical Fuel Monitor Malfunction Thresholds:

- Lean Malfunction: LONGFT > 25%, SHRTFT > 5%.
- Rich Malfunction: LONGFT < 25%, SHRTFT < 10%

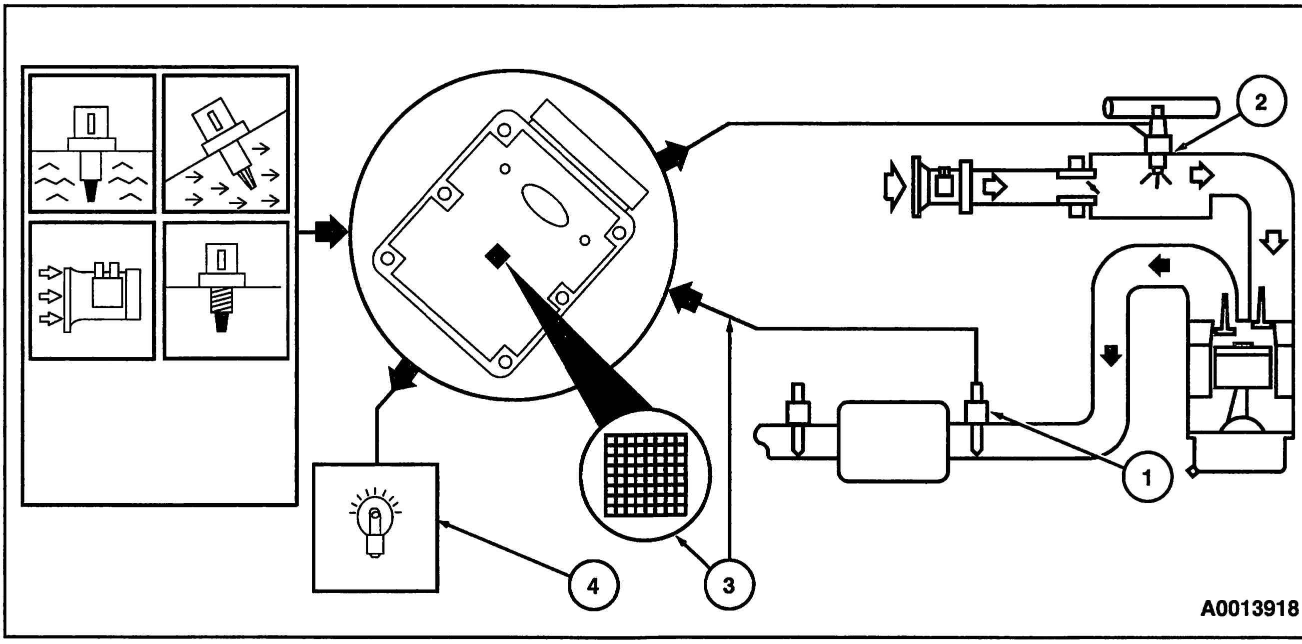


Figure 11: Fuel System Monitor

Heated Oxygen Sensor (HO2S) Monitor

The HO2S Monitor is an on-board strategy designed to monitor the HO2S sensors for a malfunction or deterioration which can affect emissions. The fuel control or Stream 1 HO2S sensors are checked for proper output voltage and response rate (the time it takes to switch from lean to rich or rich to lean). Stream 2 HO2S sensors used for Catalyst Monitoring, and Stream 3 HO2S sensors used for FAOS (Fore-Aft Oxygen Sensor) control are also monitored for proper output voltage. Input is required from the ECT or CHT, IAT, MAF and CKP sensors to activate the HO2S Monitor. The Fuel System Monitor and Misfire Detection Monitor must also have completed successfully before the HO2S Monitor is enabled.

1. The HO2S sensor senses the oxygen content in the exhaust flow and outputs a voltage between zero and 1.0 volt. Lean of stoichiometric (air/fuel ratio of approximately 14.7:1), the HO2S will generate a voltage between zero and 0.45 volt. Rich of stoichiometric, the HO2S will generate a voltage between 0.45 and 1.0 volt. The HO2S Monitor evaluates the Stream 1 (Fuel Control) and Stream 2 (Catalyst Monitor) and the Stream 3 (FAOS Control) HO2Ss for proper function.
2. The time between HO2S switches is monitored after vehicle startup and during closed loop fuel conditions. Excessive time between switches or no switches since startup indicates a malfunction. Since lack of switching malfunctions can be caused by HO2S sensor malfunctions or by shifts in the fuel system, DTCs are stored that provide additional information for the lack of switching malfunction. Different DTCs indicate whether the sensor was always indicates lean/disconnected (P1131 or P2195, P1151 or P2197), or always indicates rich (P1132 or P2196, P1152 or P2198). 2004 MY vehicles will monitor the HO2S signal for high voltage, in excess of 1.1 volts and store a unique DTC. (P0132, P0152). An over voltage condition is caused by a HO2S heater or battery power short to the HO2S signal line.

   A functional test of the rear HO2S sensors is done during normal vehicle operation. The peak rich and lean voltages are continuously monitored. Voltages that exceed the calibratable rich and lean thresholds indicate a functional sensor. If the voltages have not exceeded the thresholds after a long period of vehicle operation, the air/fuel ratio may be forced rich or lean in an attempt to get the rear sensor to switch. This situation normally occurs only with a green catalyst (< 500 miles). If the sensor does not exceed the rich and lean peak thresholds, a malfunction is indicated. 2004 MY vehicles will monitor the rear HO2S signal for high voltage, in excess of 1.1 volts and store a unique DTC. (P0138, P0158). An over voltage condition is caused by a HO2S heater or battery power short to the HO2S signal line.
3. The MIL is activated after a fault is detected on two consecutive drive cycles.

Heated Oxygen Sensor (HO2S) Monitor

4. Some 2004 Partial Zero Emission Vehicles (PZEV Focus) will utilize three sets of HO2S sensors. The front sensors (HO2S11/HO2S21) are the primary fuel control sensors. The next sensors downstream in the exhaust are utilized to monitor the light-off catalyst (HO2S12/HO2S22). The last sensors downstream in the exhaust (HO2S13/HO2S23) are utilized for very long term fuel trim in order to optimize catalyst efficiency (Fore Aft Oxygen Sensor Control). Ford's first PZEV vehicle uses a 4-cylinder engine so only the Bank 1 DTCs are utilized.

The HO2S Monitor DTCs can be catagorized as follows:

- HO2S signal circuit malfunction - P0131, P0136, P0151, P0156.
- HO2S slow response rate - P0133, P0153.
- HO2S circuit high voltage - P0132, P0138, P0144, P0152, P0158, P0164.
- HO2S heater circuit malfunction - P0135, P0141, P0155, P0161, P0147, P0167.
- HO2S heater current malfunction - P0053, P0054, P0055, P0059, P0060, P0061.
- Donwstream HO2S not running in on-demand self test - P1127.
- Swapped HO2S connectors - P0040, P0041, P1128, P1129, P2278.
- HO2S lack of switching - P1131, P1132, P1151, P1152, P2195, P2196, P2197, P2198.
- HO2S lack of switching (Sensor indicates lean) - P1137, P1157, P2270, P2272, P2274, P2276.
- HO2S lack of switching (Sensor indicates rich) - P1138, P1158, P2271, P2273, P2275, P2277.

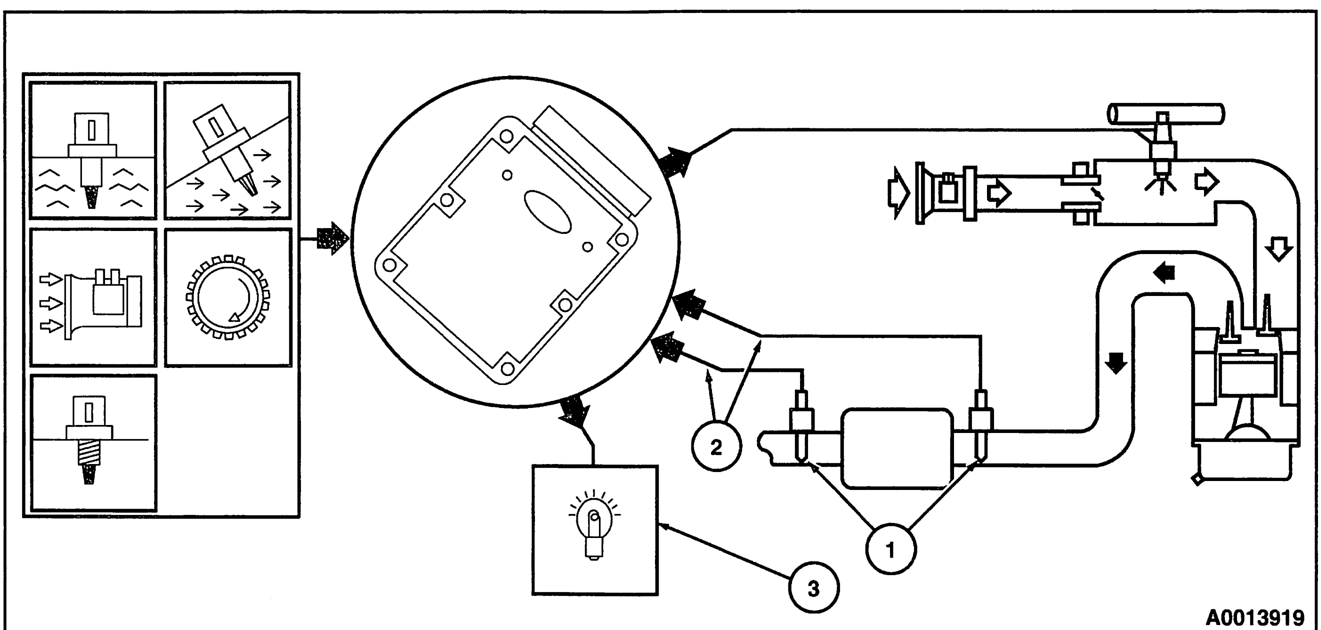


Figure 12: Heated Oxygen Sensor Monitor

Heated Oxygen Sensor (HO2S) Monitor

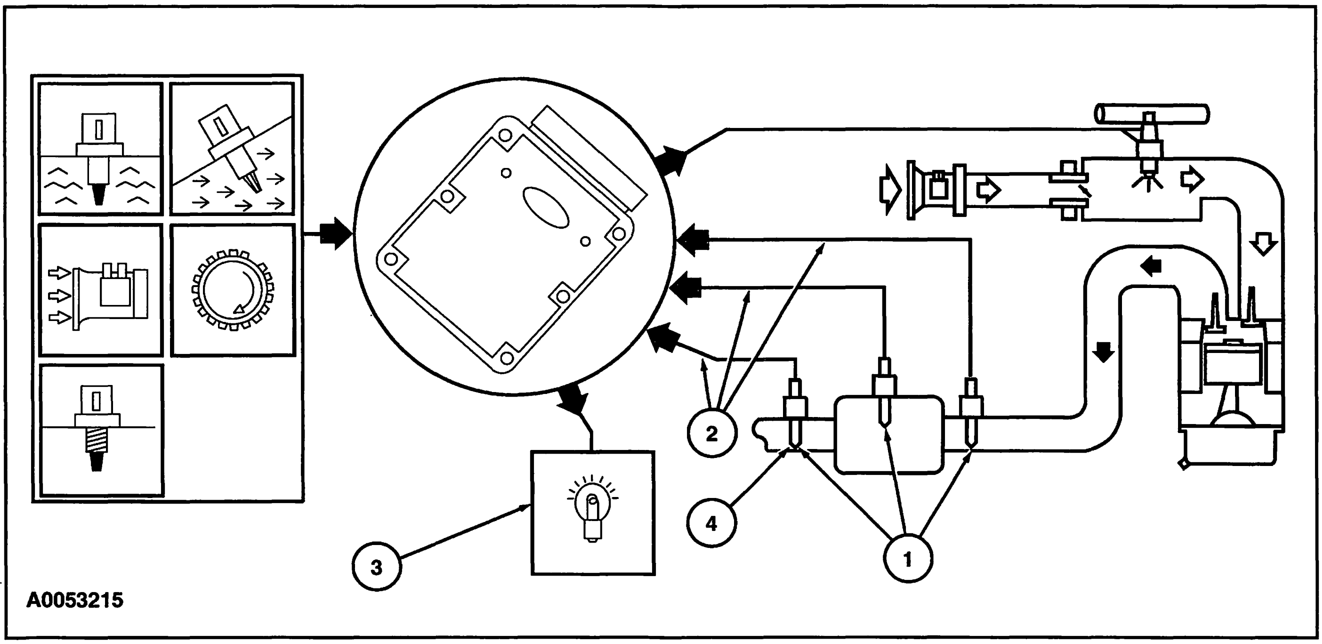


Figure 13: Heated Oxygen Sensor Monitor - PZEV (Partial Zero Emission Vehicle) Focus Only

Misfire Detection Monitor

The Misfire Detection Monitor is an on-board strategy designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. The Misfire Detection Monitor will be enabled only when certain base engine conditions are first satisfied. Input from the ECT or CHT, MAF and CKP sensors is required to enable the monitor. The Misfire Detection Monitor is also performed during on demand self-test.

1. The PCM synchronized ignition spark is based on information received from the CKP sensor. The CKP signal generated is also the main input used in determining cylinder misfire.
2. The input signal generated by the CKP sensor is derived by sensing the passage of teeth from the crankshaft position wheel mounted on the end of the crankshaft.
3. The input signal to the PCM is then used to calculate the time between CKP edges and also crankshaft rotational velocity and acceleration. By comparing the accelerations of each cylinder event, the power loss of each cylinder is determined. When the power loss of a particular cylinder is sufficiently less than a calibrated value and other criteria is met, then the suspect cylinder is determined to have misfired.

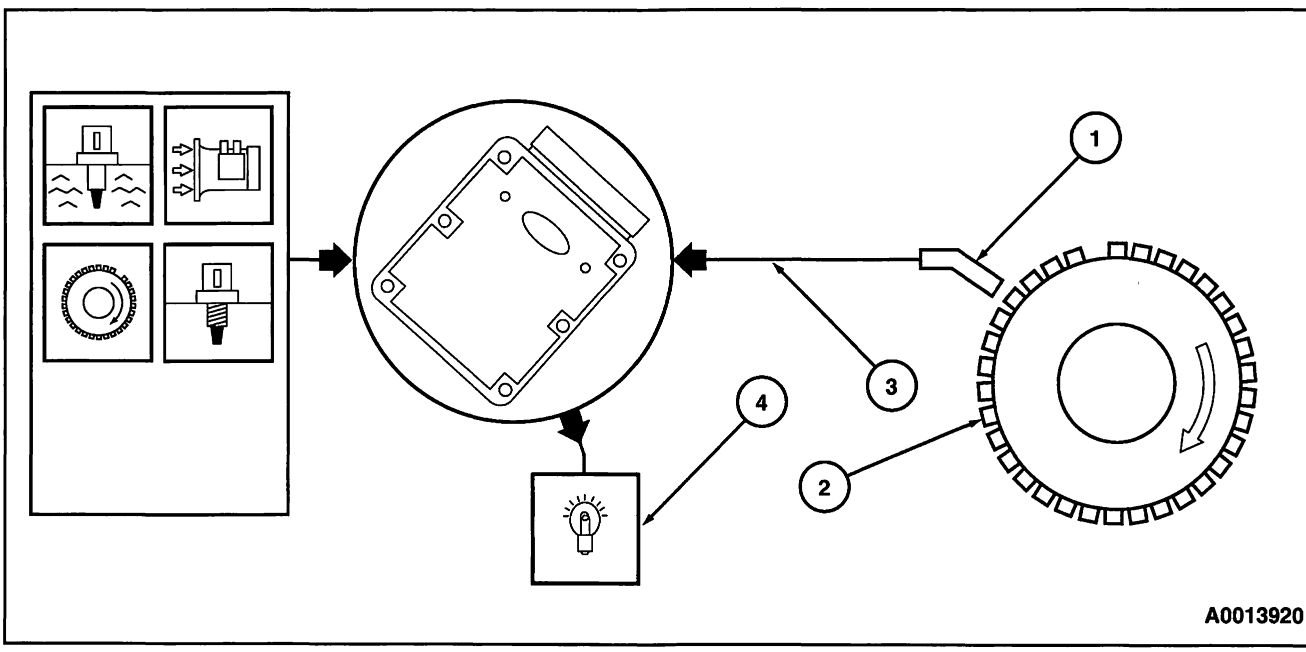


Figure 14: Misfire Detection Monitor

Misfire Detection Monitor

Misfire Monitor Operation

There are two different misfire monitoring technologies used in the 2004 MY. They are Low Data Rate (LDR) and High Data Rate (HDR). The LDR system is capable of meeting the FTP monitoring requirements on most engines and is capable of meeting full-range misfire monitoring requirements on 4-cylinder engines. The HDR system is capable of meeting full-range misfire monitoring requirements on 6 and 8 cylinder engines. HDR is being phased in on these engines to meet the full-range misfire phase-in requirements specified in the OBD-II regulations. All all engines except the 6.8L V-10 are full-range capable. All 2004 MY software allows for detection of any misfires that occur 6 engine revolutions after initially cranking the engine. This meets the new OBD-II requirement to identify misfires within 2 engine revolutions after exceeding the warm drive, idle rpm.

Low Data Rate System

The LDR Misfire Monitor uses a low-data-rate crankshaft position signal, (i.e. one position reference signal at 10 deg BTDC for each cylinder event). The PCM calculates crankshaft rotational velocity for each cylinder from this crankshaft position signal. The acceleration for each cylinder can then be calculated using successive velocity values. The changes in overall engine rpm are removed by subtracting the median engine acceleration over a complete engine cycle. The resulting deviant cylinder acceleration values are used in evaluating misfire in the General Misfire Processing“ section below.

Misfire Detection Monitor

High Data Rate System

The HDR Misfire Monitor uses a high data rate crankshaft position signal, (i.e. 18 position references per crankshaft revolution). This high-resolution signal is processed using two different algorithms. The first algorithm, called pattern cancellation, is optimized to detect low rates of misfire. The algorithm learns the normal pattern of cylinder accelerations from the mostly good firing events and is then able to accurately detect deviations from that pattern. The second algorithm is optimized to detect hard misfires, i.e. one or more continuously misfiring cylinders. This algorithm filters the high-resolution crankshaft velocity signal to remove some of the crankshaft torsional vibrations that degrade signal to noise. This significantly improves detection capability for continuous misfires. Both algorithms produce a deviant cylinder acceleration value, which is used in evaluating misfire in the General Misfire Algorithm Processing section below. Due to the high data processing requirements, the HDR algorithms could not be implemented in the PCM microprocessor. They are implemented in a separate chip in the PCM called an AICE chip. The PCM microprocessor communicates with the AICE chip using a dedicated serial communication link. The output of the AICE chip (the cylinder acceleration values) is sent to the PCM microprocessor for additional processing as described below. Lack of serial communication between the AICE chip and the PCM microprocessor, or an inability to synchronize the crank or cam sensors inputs sets a P1309 DTC. For 2004 MY software, the P1309 DTC is being split into two separate DTCs. A P0606 will be set if there is a lack of serial communication between the AICE chip and the PCM microprocessor. A P1336 will be set if there is an inability to synchronize the crank or cam sensors inputs. This change was made to improve serviceability. A P0606 generally results in PCM replacement while a P1336 points to a cam sensor that is out of synchronization with the crank. Profile correction software is used to learn and correct for mechanical inaccuracies in crankshaft tooth spacing under de-fueled engine conditions (requires three 60 to 40 mph no-braking decels after Keep Alive Memory has been reset). If KAM has been reset, the PCM microprocessor initiates a special routine which computes correction factors for each of the 18 (or 20) position references and sends these correction factors back to the AICE chip to be used for subsequent misfire signal processing. These learned corrections improve the high rpm capability of the monitor. The misfire monitor is not active until a profile has been learned.

Misfire Detection Monitor

Generic Misfire Processing

The acceleration that a piston undergoes during a normal firing event is directly related to the amount of torque that cylinder produces. The calculated piston/cylinder acceleration value(s) are compared to a misfire threshold that is continuously adjusted based on inferred engine torque. Deviant accelerations exceeding the threshold are conditionally labeled as misfires. The calculated deviant acceleration value(s) are also evaluated for noise. Normally, misfire results in a nonsymmetrical loss of cylinder acceleration. Mechanical noise, such as rough roads or high rpm/light load conditions, will produce symmetrical acceleration variations. Cylinder events that indicate excessive deviant accelerations of this type are considered noise. Noise-free deviant acceleration exceeding a given threshold is labeled a misfire. The number of misfires are counted over a continuous 200 revolution and 1000 revolution period. (The revolution counters are not reset if the misfire monitor is temporarily disabled such as for negative torque mode, etc.) At the end of the evaluation period, the total misfire rate and the misfire rate for each individual cylinder is computed. The misfire rate evaluated every 200 revolution period (Type A) and compared to a threshold value obtained from an engine speed/load table. This misfire threshold is designed to prevent damage to the catalyst due to sustained excessive temperature (1600°F for Pt/Pd/Rh conventional washcoat, 1650°F for Pt/Pd/Rh advanced washcoat and 1800°F for Pd-only high tech washcoat). If the misfire threshold is exceeded and the catalyst temperature model calculates a catalyst mid-bed temperature that exceeds the catalyst damage threshold, the MIL blinks at a 1 Hz rate while the misfire is present. If the threshold is again exceeded on a subsequent driving cycle, the MIL is illuminated. If a single cylinder is indicated to be consistently misfiring in excess of the catalyst damage criteria, the fuel injector to that cylinder may be shut off for a period of time to prevent catalyst damage. Up to two cylinders may be disabled at the same time. This fuel shut-off feature is used on many 8-cylinder engine and some 6- cylinder engines. It is never used on a 4-cylinder engine. Next, the misfire rate is evaluated every 1000 rev period and compared to a single (Type B) threshold value to indicate an emission-threshold malfunction, which can be either a single 1000 rev exceedence from startup or four subsequent 1000 rev exceedences on a drive cycle after start-up. Many 2004 MY vehicles will set a P0316 DTC if the Type B malfunction threshold is exceeded during the first 1,000 revs after engine startup. This DTC is stored in addition to the normal P03xx DTC that indicates the misfiring cylinder(s).

Misfire Detection Monitor

Profile Correction

"Profile correction" software is used to "learn" and correct for mechanical inaccuracies in the crankshaft position wheel tooth spacing. Since the sum of all the angles between crankshaft teeth must equal 360o, a correction factor can be calculated for each misfire sample interval that makes all the angles between individual teeth equal. To prevent any fueling or combustion differences from affecting the correction factors, learning is done during decelfuel cutout. The correction factors are learned during closed-throttle, non-braking, de-fueled decelerations in the 60 to 40 mph range after exceeding 60 mph (likely to correspond to a freeway exit condition). In order to minimize the learning time for the correction factors, a more aggressive decel-fuel cutout strategy may be employed when the conditions for learning are present. The corrections are typically learned in a single deceleration, but can be learned during up to 3 such decelerations. The "mature" correction factors are the average of a selected number of samples. A low data rate misfire system will typically learn 4 such corrections in this interval, while a high data rate system will learn 36 or 40 in the same interval (data is actually processed in the AICE chip). In order to assure the accuracy of these corrections, a tolerance is placed on the incoming values such that an individual correction factor must be repeatable within the tolerance during learning This is to reduce the possibility of learning corrections on rough road conditions which could limit misfire detection capability. Since inaccuracies in the wheel tooth spacing can produce a false indication of misfire, the misfire monitor is not active until the corrections are learned. In the event of battery disconnection or loss of Keep Alive Memory the correction factors are lost and must be relearned. If the software is unable to learn a profile after three 60 to 40 mph decels, a P0315 DTC is set.

Misfire Monitor Specifications

Misfire Monitor Operation: DTCs P0300 to P0310 (general and specific cylinder misfire), P1309 (no cam/crank synchronization, AICE chip malfunction), P1336 (no cam/crank synchronization), P0606 (AICE chip malfunction), P0315 (unable to learn profile), P0316 (misfire during first 1,000 revs after start-up). The Monitor execution is Continuous, misfire rate calculated every 200 or 1000 revs. The Monitor does not have a specific sequence. The Sensors CKP and CMP have to be OK to run the monitor. The Monitoring Duration is the Entire driving cycle (see disablement conditions below)

Typical misfire monitor entry conditions: Entry condition Minimum Maximum Time since engine start-up is 0 seconds, Engine Coolant Temperature is 20 to 250 degrees F, RPM Range is (Full-Range Misfire certified, with 2 rev delay) 2 revs after exceeding 150 rpm below drive idle rpm to redline on tach or fuel cutoff, Profile correction factors learned in KAM are "Yes", and Fuel tank level 15%.

Typical misfire temporary disablement conditions: Temporary disablement conditions: Closed throttle decel (negative torque, engine being driven), Fuel shut-off due to vehicle-speed limiting or engine-rpm limiting mode, and a High rate of change of torque (heavy throttle tip-in or tip out)

Misfire Detection Monitor

The Profile Learning operation includes: DTCs: P0315 - unable to learn profile in three 60 to 40 mph decels P1309 AICE chip communication failure, Monitor Execution is once per KAM reset, The Monitor Sequence: Profile must be learned before misfire monitor is active, Sensors required to be OK: CKP, CMP, no AICE communication errors, CKP/CMP in synch, The Monitoring Duration; 10 cumulative seconds in conditions (a maximum of three 60-40 mph defueled decels)

Typical profile learning entry conditions: Entry conditions from Minimum to Maximum: Engine in decel-fuel cutout mode for 4 engine cycle,s the Brakes are not applied, the Engine RPM is 1300 to 3700 rpm, the Change in is less than RPM 600, the Vehicle Speed is 30 to 75 mph, and the Learning tolerance is 1%.

PCV System Monitor

The PCV Monitor consists of a modified PCV system design. The PCV valve is installed into the rocker cover using a quarter-turn cam-lock design to prevent accidental disconnection. High retention force molded plastic lines are used from the PCV valve to the intake manifold. The diameter of the lines and the intake manifold entry fitting are increased so that inadvertent disconnection of the lines after a vehicle is serviced will cause either an immediate engine stall or will not allow the engine to be restarted. In the event that the vehicle does not stall if the line between the intake manifold and PCV valve is inadvertently disconnected, the vehicle will have a large vacuum leak that will cause the vehicle to run lean at idle. This will illuminate the MIL after two consecutive driving cycles and will store one or more of the following DTCs: Lack of O2 sensor switches, Bank 1 (P1131 or P2195), Lack of O2 sensor switches Bank 2 (P1151 or P2197), Fuel system Lean, Bank 1 (P0171) or Fuel System Lean, Bank 2 (P0174).

For additional PCV information refer to Positive Crankcase Ventilation System later in this section.

Secondary Air Injection (AIR) System Monitor—Electric Secondary Air Injection Pump System

The Secondary Air Injection (AIR) System Monitor is an on-board strategy designed to monitor the proper function of the secondary air injection system. The AIR Monitor for the Electric Secondary Air Injection Pump system consists of two monitor circuits: an AIR circuit to diagnose concerns with the primary circuit side of the AIR relay, and an AIR Monitor circuit to diagnose concerns with the secondary circuit side of the AIR relay. A functional check is also performed that tests the ability of the AIR system to inject air into the exhaust. The functional check relies upon HO2S sensor feedback to determine the presence of air flow. The monitor is enabled during AIR system operation and only after certain base engine conditions are first satisfied. Input is required from the CHT, IAT, and CKP sensors and the HO2S Monitor test must also have passed without a fault detection to enable the AIR Monitor. The AIR Monitor is also activated during on demand self-test.

1. On the primary side of the AIR relay, open and short circuit faults are detected during normal operation by the PCM output driver.

   The DTC associated with this test is DTC P0412.

2. On the secondary side of the AIR relay, the AIR Monitor circuit is held low by the resistance path through the AIR pump when the pump is off. If the AIR Monitor circuit is high there is either an open circuit to the PCM from the pump or there is power supplied to the AIR Pump. If the AIR Monitor is low when the pump is commanded on, there is either an open circuit from the AIR relay or the AIR relay has failed to supply power to the pump.

   The DTCs associated with this test are DTCs P2257 and P2258.

3. The functional check may be done in two parts: at startup when the AIR pump is normally commanded on, or during a hot idle if the startup test was not able to be performed. The flow test relies upon the HO2S to detect the presence of additional air in the exhaust when introduced by the Secondary Air Injection system.

   The DTC associated with this test is DTC P0411.

4. The MIL is activated after one of the above tests fail on two consecutive drive cycles.

Secondary Air Injection (AIR) System Monitor—Electric Secondary Air Injection Pump System

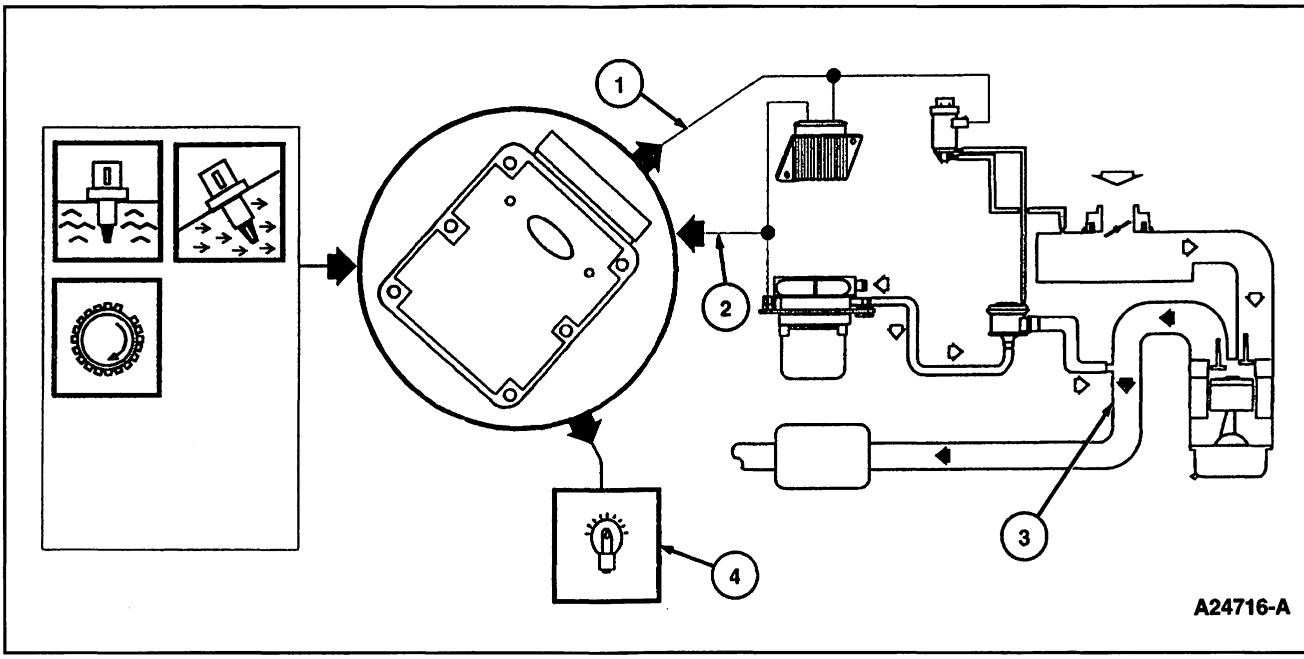


Figure 15: AIR System Monitor

Thermostat Monitor

The Thermostat Monitor is designed to verify proper thermostat operation. This monitor will be executed once per drive cycle and has a monitor run duration of 300-800 seconds. If a malfunction occurs, a diagnostic trouble code P0125 or P0128 will be set and the malfunction indicator lamp will be illuminated.

The monitor checks the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor to warm up in a predictable manner when the engine is generating sufficient heat. A timer is incremented while the engine is at moderate load and the vehicle speed is above a calibrated limit. The target timer value is based on ambient air temperature at start-up. If the timer exceeds the target time and ECT/CHT has not warmed up to the target temperature, a malfunction is indicated. The test runs if the start-up intake air temperature from the IAT sensor is at, or below the target temperature. A two-hour engine off soak time is also required to enable the monitor and to prevent erasing of any pending DTC during a hot soak. This soak time feature will also prevents false-passes of the monitor when the engine coolant temperature rises after the engine is turned off during a short engine off soak period.

The target temperature will be calibrated to the thermostat regulating temperature minus 20°F (11°C). For a typical 195°F (90°C) thermostat, the warm-up temperature would be calibrated to 175°F (79°C). For the 2004 model year, some vehicle calibrations may lower the target temperature below 50 °F (10 °C) for vehicles that do not warm-up to thermostat regulating temperatures in the 20°F (-7 °C) to 50 °F (10 °C) ambient temperature range.

1. Inputs: ECT or CHT, IAT, engine LOAD (from MAF sensor) and vehicle speed input.

Typical Monitor entry conditions:

- Vehicle speed greater than 15 mph (24 km/h)
- Intake Air temperature at start-up is between 20 °F (-7 °C) and target thermostat temperature
- Engine load greater than 30%
- Engine off (soak) time greater than a 2 hours

2. Output: MIL.

Thermostat Monitor

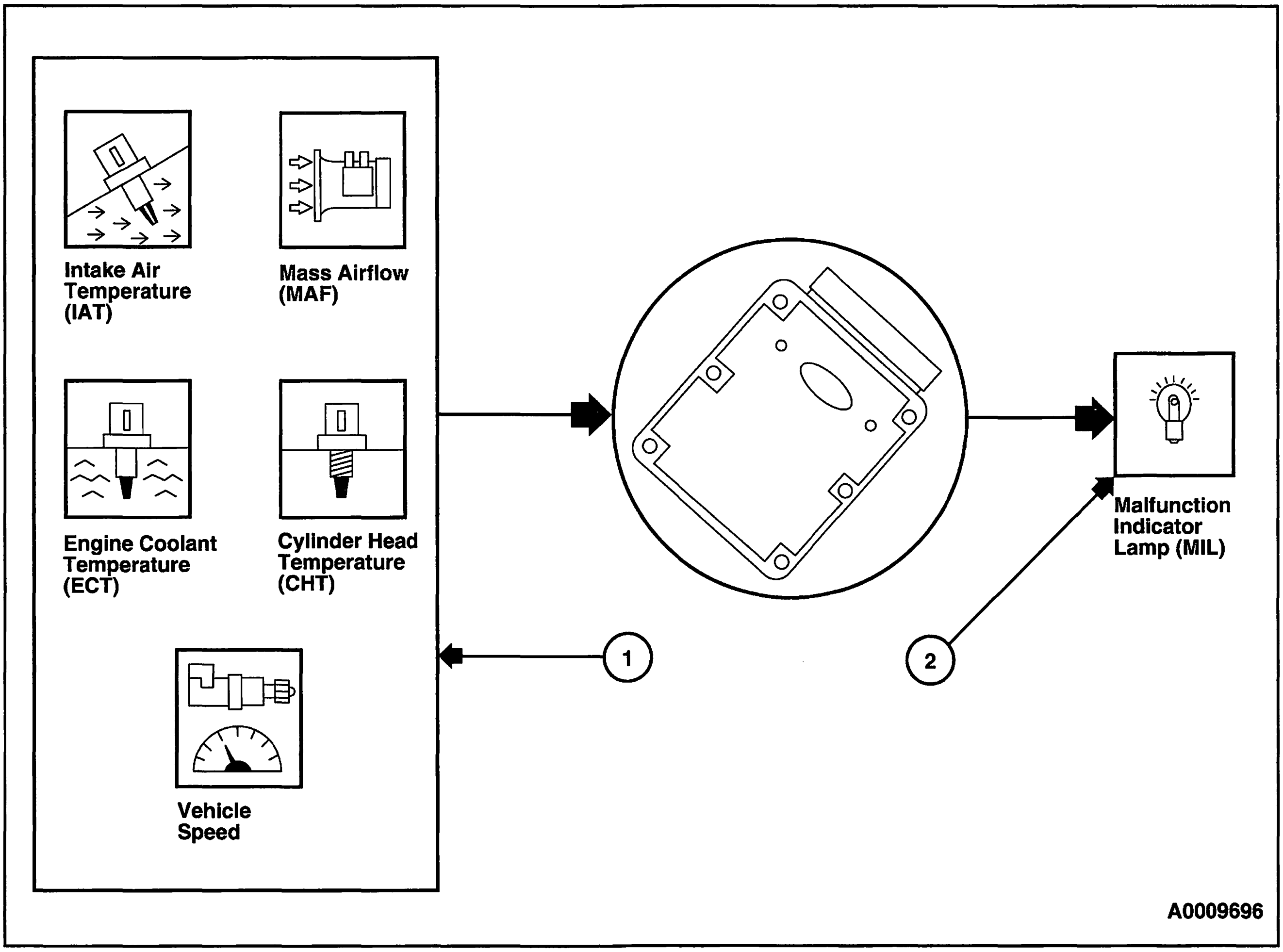


Figure 16: Thermostat Monitor

Malfunction Indicator Lamp (MIL)

The malfunction indicator lamp (MIL) (Figure 17) alerts the driver that the powertrain control module (PCM) has detected an OBD II emission-related component or system fault. When this occurs, an OBD II Diagnostic Trouble Code (DTC) will be set.

- The MIL is located on the instrument cluster and is labeled CHECK ENGINE, SERVICE ENGINE SOON or ISO standard engine symbol (Figure 18).
- Power is supplied to the MIL whenever the ignition switch is in the RUN or START position.
- The MIL will remain on in the RUN/START mode as a bulb check during the instrument cluster proveout for approximately 4 seconds.
- If the MIL remains on after the bulb check:
  - — The PCM illuminates the MIL for an emission related concern and a DTC will be present.
  - — The instrument cluster will illuminate the MIL if the PCM does not send a control message to the instrument cluster.
  - — The PCM is operating in the Hardware Limited Operation Strategy (HLOS).
  - — The MIL circuit is shorted to ground.
- If the MIL remains off (during the bulb check):
  - — Bulb is damaged.
  - — MIL circuit is open.
- To turn off the MIL after a repair, a reset command from the Scan Tool must be sent, or three consecutive drive cycles must be completed without a fault.
- For any MIL concern, go to Section 3, Symptom Charts.
- If the MIL blinks at a steady rate, a severe misfire condition could possibly exist.
- If the MIL blinks erratically, an intermittent open B+ to the bulb or an intermittent short to ground in the MIL circuit exist. Also, the PCM can reset while cranking if battery voltage is low.

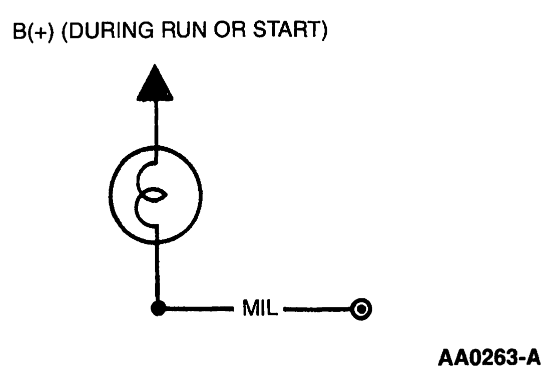


Figure 17: Malfunction Indicator Lamp (MIL)

Malfunction Indicator Lamp (MIL)

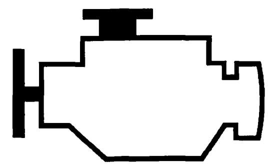


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Figure 18: CHECK ENGINE, SERVICE ENGINE SOON or ISO Standard Engine Symbol

Electronic Engine Control (EC) System

Overview

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

The Electronic EC system has two major divisions: hardware and software. The hardware includes the powertrain control module (PCM), natural gas vehicle (NGV) module, constant control relay module (CCRM), sensors, switches, actuators, solenoids, and interconnecting terminals. The software in the PCM provides the strategy control for outputs (engine hardware) based on the values of the inputs to the PCM. Electronic EC hardware and software are discussed in this section.

This section contains detailed descriptions of the operation of Electronic EC system input sensors and switches, output actuators, solenoids, relays and connector pins (including other power-ground signals).

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 malfunction indicator lamp (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. Anti-theft systems, cellular telephones and CB radios must be carefully installed. **Do not install these devices by tapping into or running wires close to powertrain control system wires or components.**

Powertrain Control Software

Multiplexing

The increased number of modules on the vehicle necessitates a more efficient method of communication. Multiplexing is a method of sending two or more signals simultaneously over a single circuit. In an automotive application, multiplexing is used to allow two or more electronic modules to communicate simultaneously over a single media. Typically this media is a twisted pair of wires. The information or messages that can be communicated on these wires consists of commands, status or data. The advantage of using multiplexing is to reduce the weight of the vehicle by reducing the number of redundant components and electrical wiring.

Multiplexing Implementation

Currently Ford Motor Company uses two different types of communication language protocols to communicate with the powertrain control module (PCM). These protocols are Standard Corporate Protocol (SCP) and Controller Area Network (CAN). For the 2004 model year the following vehicles will utilize the High Speed -CAN (HS-CAN) protocol for PCM communication:

- 2.3L Focus PZEV (partial zero emission vehicle)
- LS6
- LS8
- Taurus/Sable
- Thunderbird
- Explorer/Mountaineer
- 4.6L 2V and 5.4L 3V F150 (Non-Heritage)

The LS and Thunderbird will use HS-CAN between the DCL (Data Communication Link) connector and the PCM for scan tool to PCM diagnostics only. Inter communication (PCM to other network modules) for the LS and Thunderbird will continue to use SCP. The other CAN vehicles will use HS-CAN for PCM to network module communication and for scan tool diagnostics.

All other vehicles for model year 2004 will continue to use SCP as its communication media for the PCM. For more information about the entire communication network refer to Section 418 in the Workshop manual.

Standard Corporate Protocol (SCP)

SCP is a communication language protocol based on SAE J1850 and is used by Ford Motor Company for exchanging bi-directional message (signals) between electronic modules. Two or more signals can be sent over one SCP network circuit. Fords SCP network operates at 41.6kB/sec (kilobytes per second).

Powertrain Control Software

Included in these messages is diagnostic data that is outputted over the BUS (+) and BUS (-) lines to the data link connector (DLC). PCM connection to the DLC is typically done with a two wire, twisted pair cable used for network interconnection. The diagnostic data such as Self-test or PIDs can be accessed with a scan tool. Information on scan tool equipment is described in Section 2, Diagnostic Methods.

High Speed - Controller Area Network (HS-CAN)

HS-CAN is based on SAE J2284, ISO-11898 and is a serial communication language protocol used to transfer messages (signals) between electronic modules or nodes. Two or more signals can be sent over one CAN network circuit allowing two or more electronic modules or nodes to communicate with each other. This communication or multiplexing network operates at 500kB/sec (kilobytes per second) and allows the electronic modules to share their information messages.

Included in these messages is diagnostic data that is outputted over the CAN High (+) and CAN Low (-) lines to the data link connector (DLC). PCM connection to the DLC is typically done with a two wire, twisted pair cable used for the network interconnection. The diagnostic data such as Self-test or PIDs can be accessed with a scan tool. Information on scan tool equipment is described in Section 2, Diagnostic Methods.

Flash Electrically Erasable Programmable Read Only Memory

The Flash Electrically Erasable Programmable Read Only Memory (EEPROM) is an Integrated Circuit (IC) within the PCM. This IC contains the software code required by the PCM to control the powertrain. One feature of the EEPROM is that it can be electrically erased and then reprogrammed without removing the PCM from the vehicle. If a software change is required to the PCM, the module no longer needs to be replaced, but can be reprogrammed at the dealership through the DLC.

Idle Air Trim

Idle Air Trim is designed to adjust the Idle Air Control (IAC) calibration to correct for wear and aging of components. When engine conditions meet the learning requirement, the strategy monitors the engine and determines the values required for ideal idle calibration. The Idle Air Trim values are stored in a table for reference. This table is used by the PCM as a correction factor when controlling idle speed. The table is stored in Keep Alive Random Access Memory (RAM) and retains the learned values even after the engine is shut off. A Diagnostic Trouble Code (DTC) is output if the Idle Air Trim has reached its learning limits.

Whenever an IAC component is replaced or cleaned or a service affecting idle is performed, it is recommended that Keep Alive RAM be cleared. This is necessary so the idle strategy does not use the previously learned Idle Air Trim values.

To clear Keep Alive RAM, refer to PCM Reset in Section 2. It is important to note that erasing DTCs with a scan tool does not reset the Idle Air Trim table.

Once Keep Alive RAM has been reset, the engine must idle for 15 minutes (actual time varies between strategies) to learn new idle air trim values. Idle quality will improve as the strategy adapts. Adaptation occurs in four separate modes. The modes are shown in the following table.

Powertrain Control Software

IDLE AIR TRIM LEARNING MODES

Transmission Range	Air Conditioning Mode
NEUTRAL	A/C ON
NEUTRAL	A/C OFF
DRIVE	A/C ON
DRIVE	A/C OFF

Fuel Trim

Short Term Fuel Trim

If the oxygen sensors are warmed up and the PCM determines that the engine can operate near stoichiometric air/fuel ratio (14.7 to 1 for gasoline), the PCM goes into closed loop fuel control mode. Since an oxygen sensor can only indicate rich or lean, the fuel control strategy must constantly adjust the desired air/fuel ratio rich and lean to get the oxygen sensor to "switch"around the stoichiometric point. If the time between switches are the same, then the system is actually operating at stoichiometry. The desired air/fuel control parameter is called short term fuel trim (SHRTFT1 and 2) where stoichiometry is represented by 0%. Richer (more fuel) is represented by a positive number and leaner (less fuel) is represented by a negative number. Normal operating range for short term fuel trim is +/- 25%. Some calibrations will have time between switches and short term fuel trim excursions that are not equal. These unequal excursions are used to run the system slightly lean or rich of stoichiometry. This practice is referred to as using "bias". For example, the fuel system can be biased slightly rich during closed loop fuel to help reduce NOx.

Values for SHRTFT1 and 2 may change a great deal on a scan tool when the engine is operated at different rpm and load points. This is because SHRTFT1 and 2 will react to fuel delivery variability that can change as a function of engine rpm and load. Short term fuel trim values are not retained after the engine is turned off.

Long Term Fuel Trim

While the engine is operating in closed loop fuel, the short term fuel trim corrections can be "learned" by the PCM as long term fuel trim (LONGFT1 and 2) corrections. These corrections are stored in Keep Alive Memory (KAM) in tables that are referenced by engine speed and load (and by bank for engines with two HO2S sensors forward of the catalyst). Learning the corrections in KAM improves both open loop and closed loop air/fuel ratio control. Advantages include:

- Short term fuel trim does not have to generate new corrections each time the engine goes into closed loop.
- Long term fuel trim corrections can be used both while in open loop and closed loop modes.

Long term fuel trim is represented as a percentage, just like short term fuel trim, however it is not a single parameter. There is a separate long term fuel trim value that is used for each rpm/load point of engine operation. Long term fuel trim corrections may change depending on the operating conditions of the engine (rpm and load), ambient air temperature and fuel quality (% alcohol, oxygenates, etc.). When viewing the LONGFT1/2 PID(s), the values may change a great deal as the engine is operated at different rpm and load points. The LONGFT1/2 PID(s) will display the long term fuel trim correction that is currently being used at that rpm/load point.

Powertrain Control Software

Idle Speed Control Closed Throttle Determination (applications without Electronic Throttle Control)

One of the fundamental criteria for entering rpm control is an indication of closed throttle. Throttle mode is always calculated to the lowest learned throttle position (TP) voltage seen since engine start. This lowest learned value is called "ratch," since the software acts like a one-way ratch. The ratch value (voltage) is displayed as the TPREL PID. The ratch value is relearned after every engine start. Ratch will learn the lowest, steady TP voltage seen after the engine starts. In some cases, ratch can learn higher values of TP. The time to learn the higher values is significantly longer than the time to learn the lower values. The brakes must also be applied to learn the higher values.

All PCM functions are done using this ratch voltage, including idle speed control. The PCM goes into closed throttle mode when the TP voltage is at the ratch (TPREL PID) value. Increase in TP voltage, normally less than 0.05 volts, will put the PCM in part throttle mode. Throttle mode can be viewed by looking at the TP MODE PID. With the throttle closed, the PID must read C/T (closed throttle). Slightly corrupt values of ratch can prevent the PCM from entering closed throttle mode. An incorrect part throttle indication at idle will prevent entry into closed throttle rpm control, and could result in a high idle. Ratch can be corrupted by a throttle position sensor or circuit that "drops out" or is noisy, or by loose/worn throttle plates that close tight during a decel and spring back at a normal engine vacuum.

Fail-Safe Cooling Strategy

The fail-safe cooling strategy is activated by the PCM only in the event that an overheating condition has been identified. This strategy provides engine temperature control when the cylinder head temperature exceeds certain limits. The cylinder head temperature is measured by the Cylinder Head Temperature (CHT) sensor. For additional information about the CHT sensor, refer to PCM Inputs for a description of the CHT sensor. Note: Not all vehicles equiped with a CHT sensor will have the fail-safe cooling strategy.

A cooling system failure such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Along with a CHT sensor, the fail-safe cooling strategy is used to prevent damage by allowing air cooling of the engine. This strategy allows the vehicle to be driven safely for a short time with some loss of performance when a overheat condition exist.

Engine temperature is controlled by varying and alternating the number of disabled fuel injectors. This allows all cylinders to cool. When the fuel injectors are disabled, their respective cylinders work as air pumps, and this air is used to cool the cylinders. The more fuel injectors that are disabled, the cooler the engine runs, but the engine has less power.

Note: A wide open throttle (WOT) delay is incorporated if the CHT temperature is exceeded during WOT operation. At WOT, the injectors will function for a limited amount of time allowing the customer to complete a passing maneuver.

Powertrain Control Software

Before injectors are disabled, the fail-safe cooling strategy alerts the customer to a cooling system problem by moving the instrument cluster temperature gauge to the hot zone and a PCM DTC P1285 is set. Depending on the vehicle, other indicators, such as an audible chime or warning lamp, can be used to alert the customer of fail-safe cooling. If overheating continues, the strategy begins to disable the fuel injectors, a DTC P1299 is stored in the PCM memory, and a malfunction indicator light (MIL) (either CHECK ENGINE or SERVICE ENGINE SOON), comes on. If the overheating condition continues and a critical temperature is reached, all fuel injectors are turned off and the engine is disabled.

Failure Mode Effects Management

Failure Mode Effects Management (FMEM) is an alternate system strategy in the PCM designed to maintain engine operation if one or more sensor inputs fail.

When a sensor input is perceived to be out-of-limits by the PCM, an alternative strategy is initiated. The PCM substitutes a fixed value and continues to monitor the incorrect sensor input. If the suspect sensor operates within limits, the PCM returns to the normal engine operational strategy.

All FMEM sensors display a sequence error message on the scan tool. The message may or may not be followed by Key On Engine Off or Continuous Memory DTCs when attempting Key On Engine Running Self-Test Mode.

Engine RPM/Vehicle Speed Limiter

The powertrain control module (PCM) will disable some or all of the fuel injectors whenever an engine rpm or vehicle overspeed condition is detected. The purpose of the engine rpm or vehicle speed limiter is to prevent damage to the powertrain. The vehicle will exhibit a rough running engine condition, and the PCM will store one of the following Continuous Memory DTCs: P0219, P0297 or P1270. Once the driver reduces the excessive speed, the engine will return to the normal operating mode. No repair is required. However, the technician should clear the PCM and inform the customer of the reason for the DTC.

Excessive wheel slippage may be caused by sand, gravel, rain, mud, snow, ice, etc. or excessive and sudden increase in rpm while in NEUTRAL or while driving.

Powertrain Control Hardware

Powertrain Control Module

The center of the Electronic EC system is a microprocessor called the powertrain control module (PCM). The PCM receives input from sensors and other electronic components (switches, relays). Based on information received and programmed into its memory, the PCM generates output signals to control various relays, solenoids and actuators. There are several different types of PCM's in use for this model year. Refer to the vehicle PCM application table below for PCM type and their applications.

VEHICLE PCM APPLICATION TABLE

PCM Type	Applications
104-Pin (Figure 19)	Focus, Taurus/Sable, Mustang, Crown Victoria/Grand Marquis, Town Car, Escape, Ranger, Freestar/Monterey, Explorer Sport Trac, E-Series, F-Series Heritage, F-Series Super Duty, Lightning, Excursion
122-Pin (Figure 20)	Expedition, Navigator
150-Pin (Figure 21)	Lincoln LS, Thunderbird, Aviator
150-Pin (Figure 22)	2.3L Focus, Explorer/Mountaineer
190-Pin (Figure 23)	F150 (Non-Heritage)

PCM Locations

Note: For PCM Removal and Installation procedures refer to Workshop manual Section 303.

- Focus - passenger side behind kick panel.
- Taurus/Sable, Freestar/Monterey - behind glove compartment (access from engine compartment dash panel) on passenger side.
- Mustang - behind kick panel cover on passenger side, near instrument panel.
- Crown Victoria/Grand Marquis, Marauder, Town Car - behind instrument panel (cowl), driver side near brake pedal.
- LS6/LS8, Thunderbird, Explorer/Mountaineer, Aviator- passenger side, near side cowl, behind glove compartment.
- Escape, Explorer Sport Trac, Ranger - behind instrument panel (cowl), center to both driver and passenger sides (Access from engine compartment).
- Expedition/Navigator, F150 (Non-Heritage) - passenger side of engine compartment, mounted to the cowl.
- F-Series Heritage - lower dash panel on passenger side.
- Excursion, F-Series Super Duty - lower dash panel on driver side.
- E-Series - lower dash panel (cowl) on driver side (Access from engine compartment).

Powertrain Control Hardware

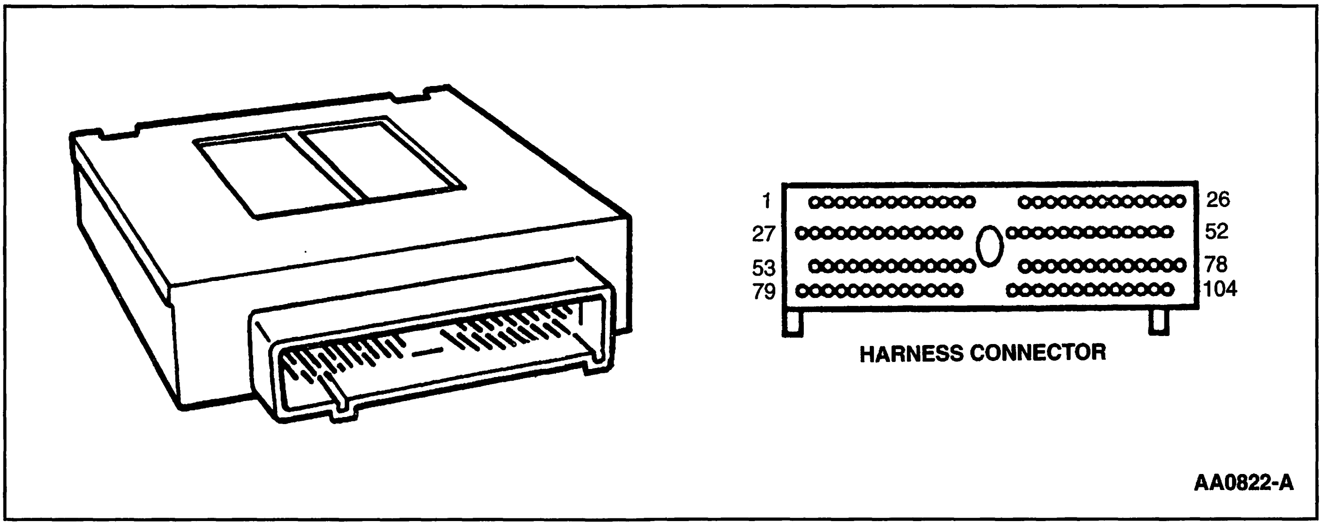


Figure 19: 104-Pin PCM

TABLE 1—104-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	71,97
PWRGND	Power ground	3,24,51,76,77,103
CSEGND	Case ground	25
SIGRTN	Signal return	91
VREF	5V reference	90
KAPWR	Keep alive power	55

Powertrain Control Hardware

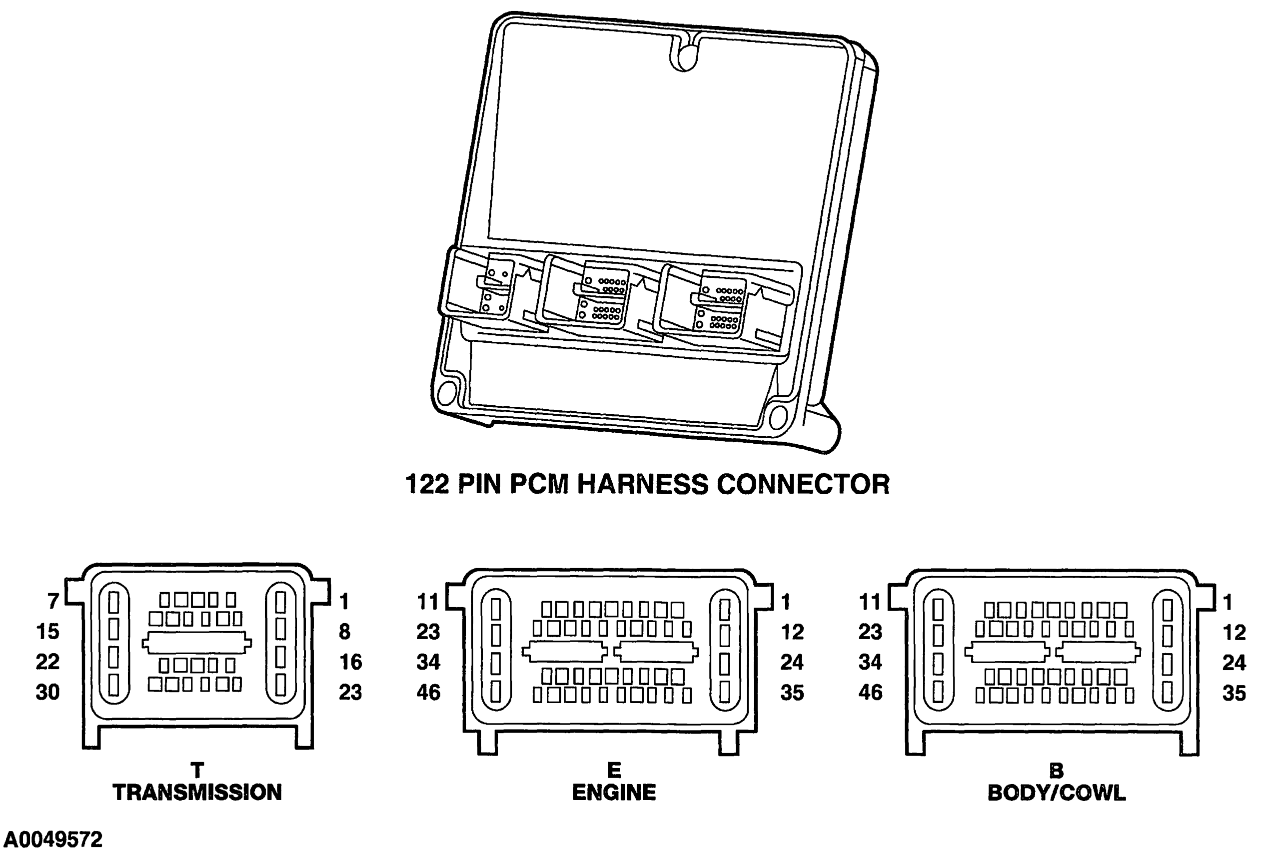


Figure 20: 122-Pin PCM

TABLE 1—122-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B34
VPWR	Voltage input to module	B46
PWRGND	Power ground	B1
PWRGND	Power ground	B11
PWRGND	Power ground	B23
CSEGND	Case ground	B10
SIGRTN	Connector B signal return	B33
SIGRTN	Connector E signal return	E25
SIGRTN	Connector T signal return	T27
VREF	Connector B Buffered 5V reference	B45
VREF	Connector E Buffered 5V reference	E36
KAPWR	Keep alive power	B40

Powertrain Control Hardware

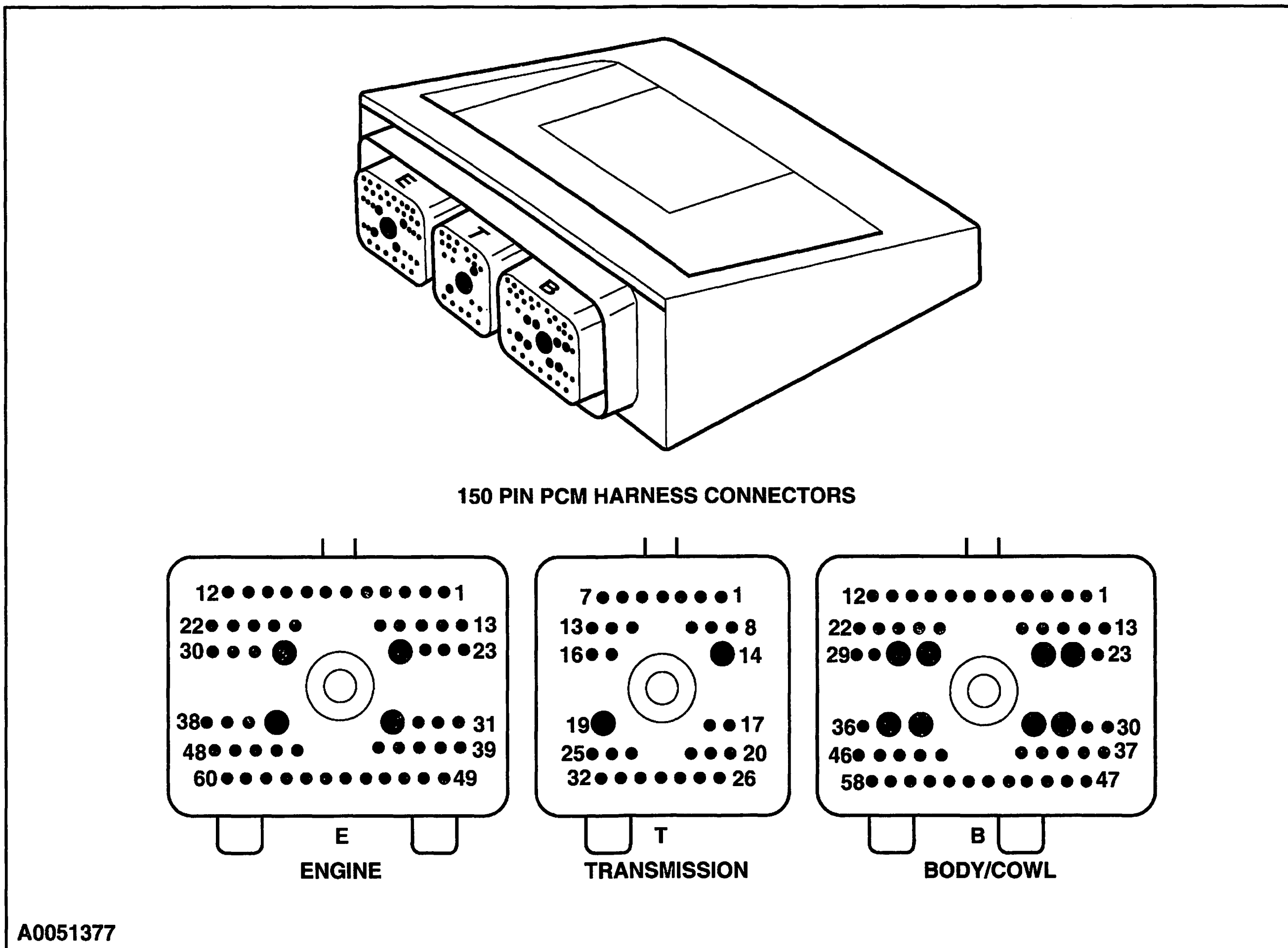


Figure 21: 150-Pin PCM

TABLE 1—150-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B32
VPWR	Voltage input to module	B33
PWRGND	Power ground	B24
PWRGND	Power ground	B25
PWRGND	Power ground	B26
PWRGND	Power ground	B27
CSEGND	Case ground	B43
SIGRTN	Connector B signal return	B17 (B5 for LS6/LS8/ Thunderbird)
SIGRTN	Connector T signal return	T17 (T14 for LS6/LS8/ Thunderbird)
SIGRTN	Connector E signal return	E17

(Continued)

Powertrain Control Hardware

TABLE 1—150-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VREF	Connector B Buffered 5V reference	B20 (B55 for LS6/LS8/ Thunderbird)
VREF	Connector E Buffered 5V reference	E20 (E14 for LS6/LS8/ Thunderbird)
KAPWR	Keep alive power	B44

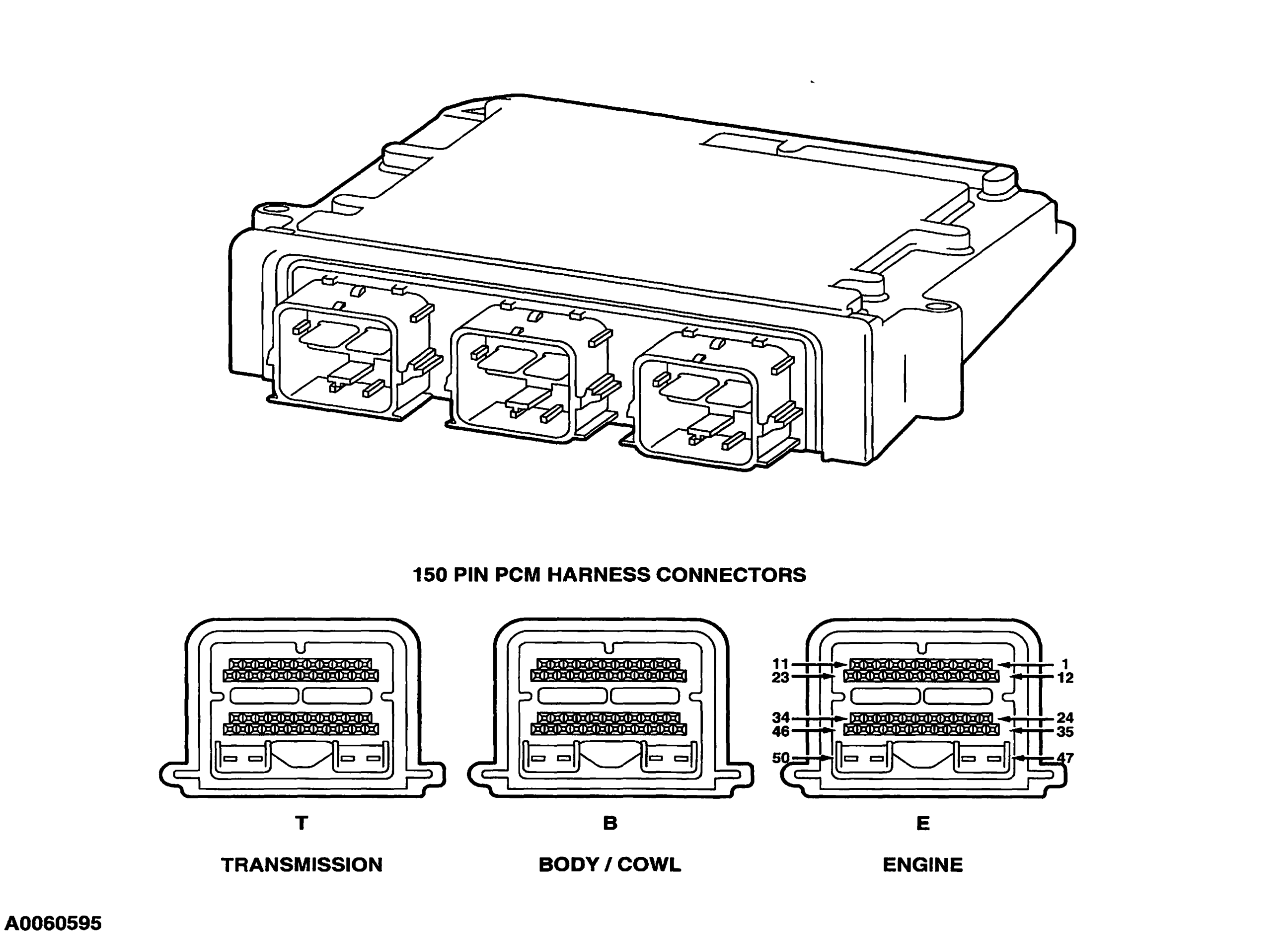


Figure 22: 150-Pin PCM

TABLE 1—150-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B35
VPWR	Voltage input to module	B36
PWRGND	Power ground	B47
PWRGND	Power ground	B48
PWRGND	Power ground	B49

(Continued)

Powertrain Control Hardware

TABLE 1—150-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
CSEGND	Case ground	B10
SIGRTN	Connector B signal return	B41
SIGRTN	Connector T signal return	T41
SIGRTN	Connector E signal return	E41
VREF	Connector B Buffered 5V reference	B40
VREF	Connector E Buffered 5V reference	E40
KAPWR	Keep alive power	B45

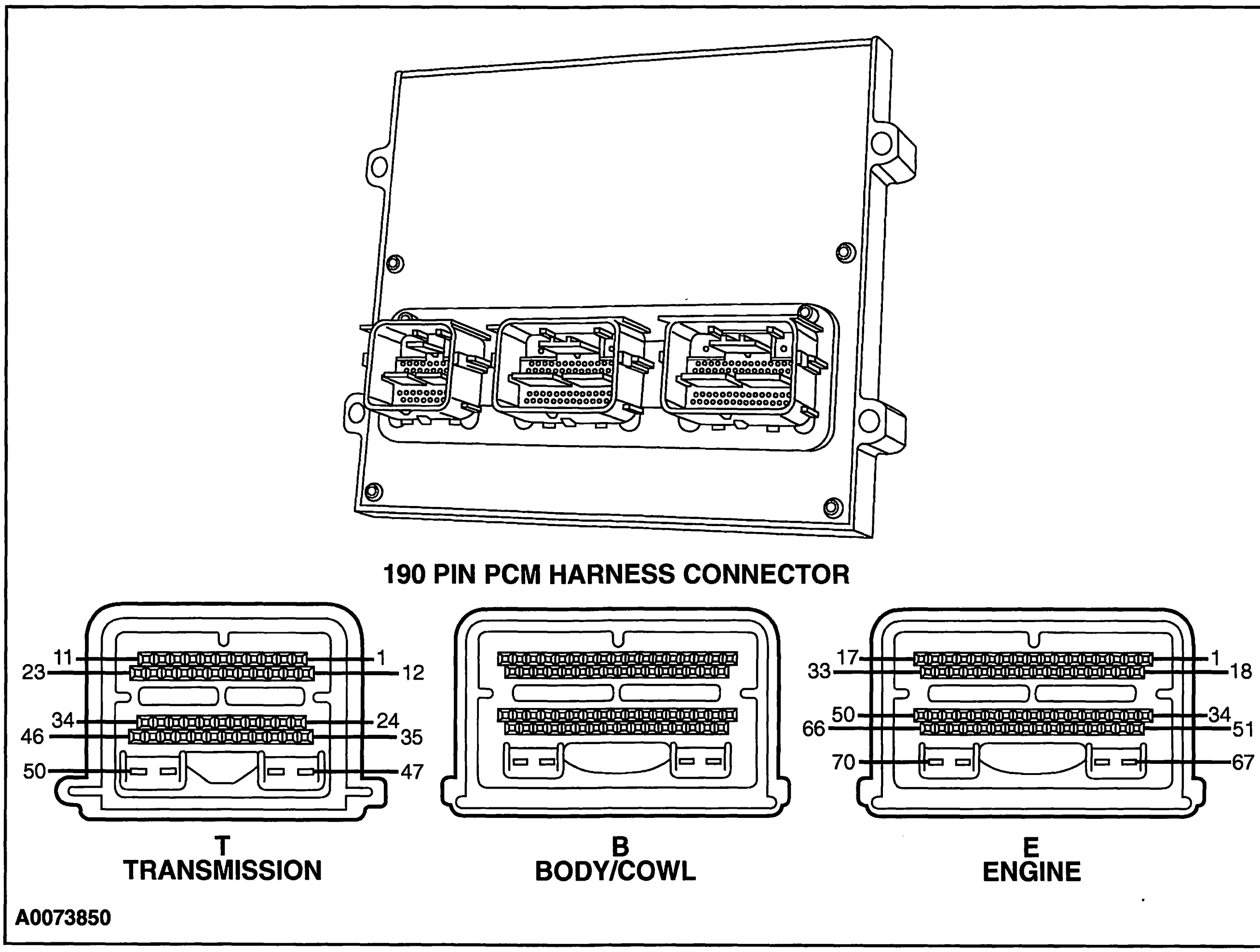


Figure 23: 190-Pin PCM

Powertrain Control Hardware

TABLE 1—190-PIN PCM POWER AND GROUNDS

Function	Description	Connector/Pin
VPWR	Voltage input to module	B51
VPWR	Voltage input to module	B52
VPWR	Voltage input to module	B53
PWRGND	Power ground	B67
PWRGND	Power ground	B68
PWRGND	Power ground	B69
PWRGND	Power ground	B70
CSEGND	Case ground	B66
SIGRTN	Connector B signal return	B58
SIGRTN	Connector T signal return	T43
SIGRTN	Connector E signal return	E58
VREF	Connector B Buffered 5V reference	B29
VREF	Connector E Buffered 5V reference	E57
KAPWR	Keep alive power	B54

Natural Gas (NG) Vehicle Module

The natural gas (NG) vehicle module (Figure 24) provides two functions. The first function operates the fuel injectors and is referred to as the injector driver module (IDM). The second function sends a fuel level indicator signal to drive the fuel gauge and is called the fuel indicator module (FIM). IDM NG vehicle fuel indicator driver signals are based on powertrain control module (PCM) fuel injector driver signals and are controlled directly by the corresponding injector drivers in the PCM. The IDM must be used to provide the NG fuel injectors with the required high current necessary for proper operation. The greater demand of NG fuel injector current warrants an increased size of the injector driver and increased heat dissipation. Given these conditions, the PCM would not be suitable for placement of these drivers. The IDM closely resembles the Electronic Engine Control 60 Pin PCM module in appearance. This style of module is used on the NG F-Series and Crown Victoria, while a 90 pin Alternative Fuel Control Module (AFCM) (Figure 25) is used on the E-Series.

The IDM injector drivers are capable of controlling the amount of current flow to each NG fuel injector. Once the fuel injector is open, the IDM NG fuel injector driver will reduce current flow sufficient to continue to hold the fuel injector open. This is done by the IDM in an effort to reduce heat. If the IDM driver does not detect the required peak current to initially open the NG fuel injector within a specified amount of time, the IDM driver will drop current to fuel injector hold open current.

The fuel indicator module (FIM) is not part of the powertrain control subsystem and will not be discussed here.

Powertrain Control Hardware

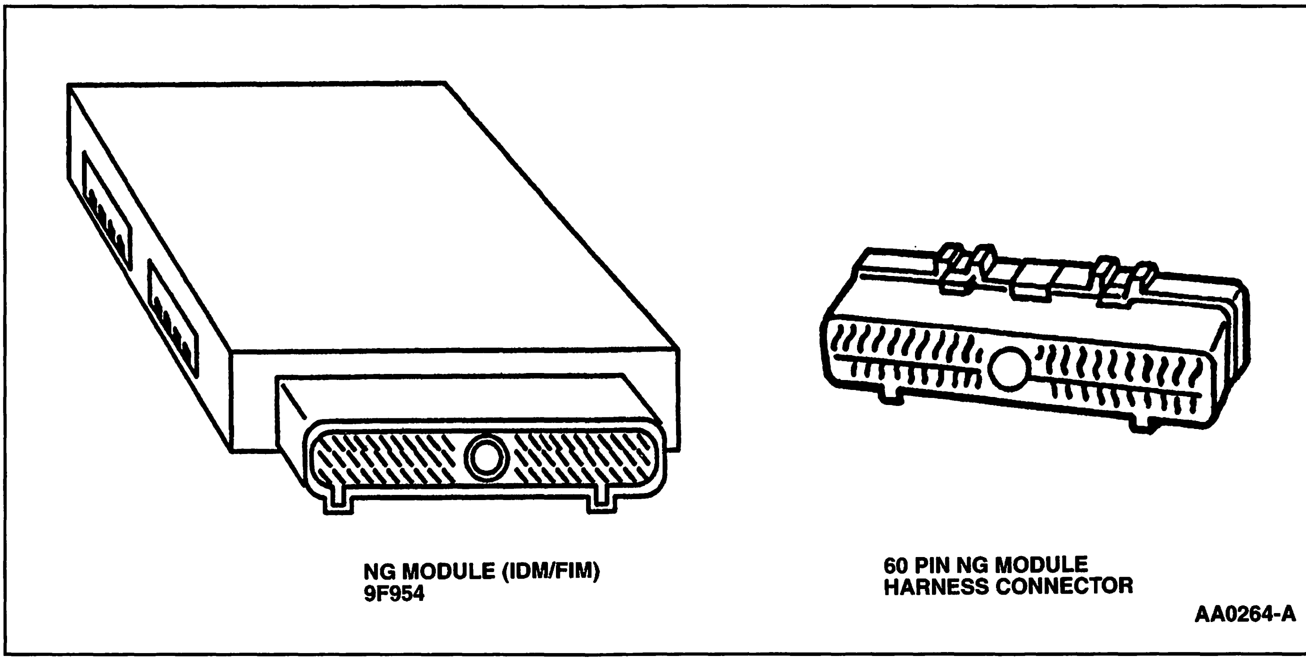


Figure 24: 60 Pin Natural Gas (NG) Vehicle Module

Powertrain Control Hardware

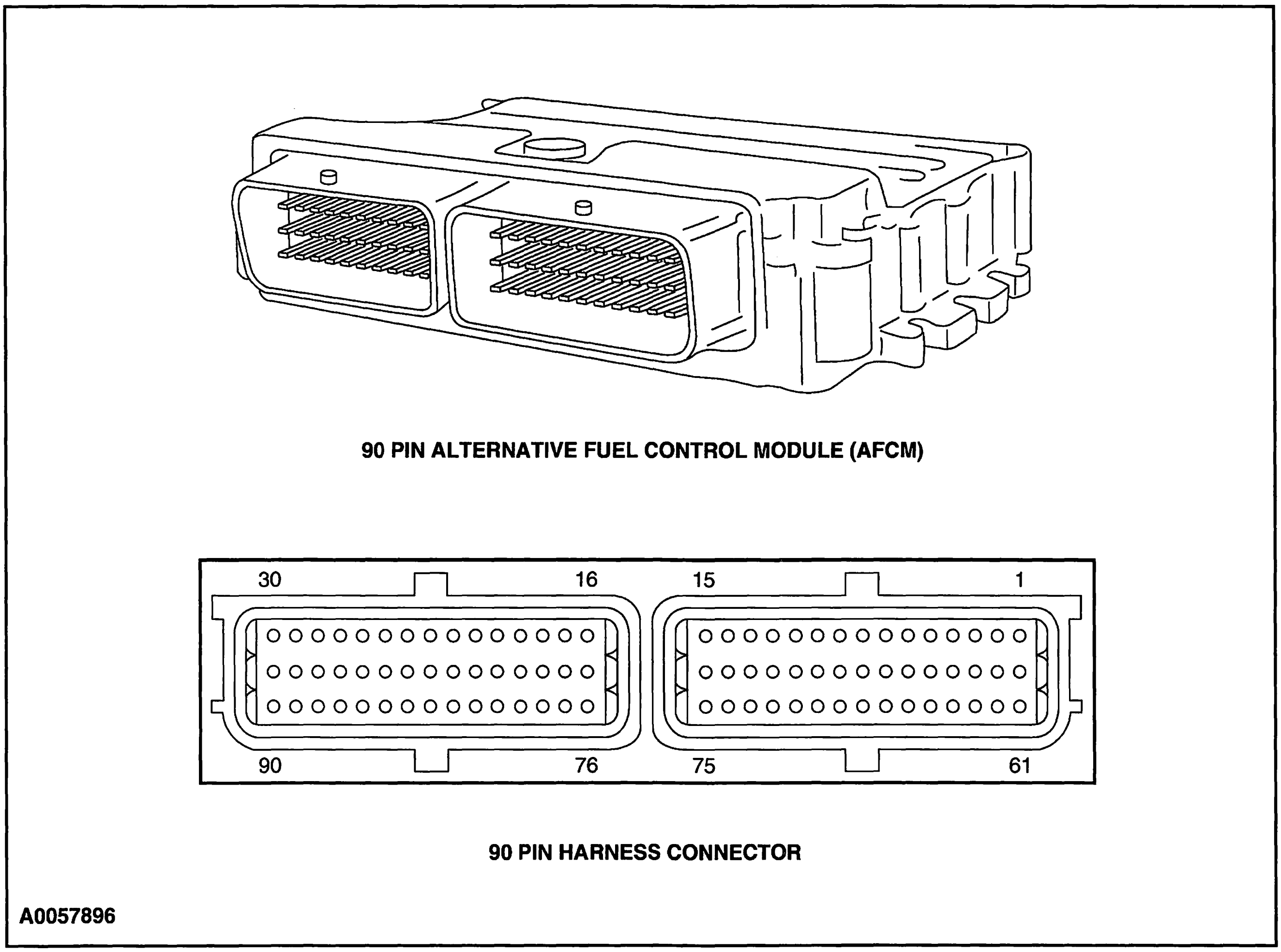


Figure 25: 90 Pin Natural Gas (NG) Alternative Fuel Control Module

Constant Control Relay Module

The constant control relay module (CCRM) interfaces with the Electronic EC system to provide vehicle power (VPWR) to the powertrain control module (PCM) and the Electronic EC system, and for the control of the cooling fan and A/C clutch. The CCRM also contains the fuel pump driver module (FPDM) power supply relay, which supplies power to the FPDM. If any of the internal components of the CCRM fail, the entire unit must be replaced. The descriptions of the specific CCRM functions, as well as the Dual Function A/C high pressure switch are found under the individual hardware - PCM inputs and outputs in this section.

Fuel Pump Driver Module

Note: For the Thunderbird and LS6/LS8, the FPDM functions are incorporated in the Rear Electronic Module (REM). Fuel pump operation is the same as applications using the stand-alone FPDM. The REM will, however, communicate diagnostic information through the communication link instead of using a fuel pump monitor (FPM) circuit.

Powertrain Control Hardware

The fuel pump driver module (FPDM) receives a duty cycle signal from the PCM and controls the fuel pump operation in relation to this duty cycle. This results in variable speed fuel pump operation. The FPDM sends diagnostic information to the PCM on the fuel pump monitor circuit. For additional information, refer to PCM Outputs, Fuel Pump and PCM Inputs, Fuel Pump Monitor in this section.

Generic Electronic Module

For information on the generic electronic module, refer to the description of the Transfer Case 4x4 System in the vehicle drivetrain workshop manual.

Keep Alive Random Access Memory (RAM)

The PCM stores information in Keep Alive RAM (a memory integrated circuit chip) about vehicle operating conditions, and then uses this information to compensate for component variability. Keep Alive RAM remains powered when the ignition switch is off so that this information is not lost.

Hardware Limited Operation Strategy (HLOS)

This system of special circuitry provides minimal engine operation should the PCM (mainly the central processing unit (CPU) or EEPROM) stop functioning correctly. All modes of Self-Test are not functional at this time. Electronic hardware is in control of the system while in HLOS.

HLOS Allowable Output Functions:

- Spark output controlled directly by the CKP signal.
- Fixed fuel pulse width synchronized with the CKP signal.
- Fuel pump relay energized.
- Idle speed control output signal functional.

HLOS Disabled Outputs To Default State:

- EGR solenoids.
- No torque converter clutch lock-up.

Integrated Electronic Ignition System

The Integrated Electronic Ignition (EI) System consists of a crankshaft position (CKP) sensor, coil pack(s), connecting wiring, and PCM. The Coil On Plug (COP) Integrated EI System uses a separate coil for each spark plug and each coil is mounted directly onto the plug. The COP Integrated EI System eliminates the need for spark plug wires but does require input from the camshaft position (CMP) sensor.

Powertrain Control Hardware

Power and Ground Signals

Vehicle Buffered Power (VBPWR)

Vehicle Buffered Power (VBPWR) is a PCM supplied power source that supplies regulated voltage (10 to 14 volts) to vehicle sensors that run off 12 volts but cannot withstand VPWR voltage variations. It is regulated to VPWR minus 1.5 volts and is voltage limited to protect the sensors.

Vehicle Power (VPWR)

When the ignition switch is turned to the START or RUN position, battery positive voltage (B+) is applied to the coil of the Electronic EC power relay. Since the other end of the coil is wired to ground, this energizes the coil and closes the contacts of the Electronic EC power relay. Vehicle power (VPWR) is now sent to the PCM and the Electronic EC System as VPWR.

Vehicle Reference Voltage (VREF)

The vehicle reference voltage (VREF) is a positive voltage (about 5.0 volts) that is output by the PCM. This is a consistent voltage that is used typically by the 3-wire sensors and some digital input signals.

Mass Air Flow Return

The mass air flow return (MAF RTN) is a dedicated analog signal return from the mass air flow (MAF) sensor. It serves as a ground offset for the analog voltage differential input by the MAF sensor to the PCM.

Signal Return

The signal return (SIG RTN) is a dedicated ground circuit used by most Electronic EC sensors and some other inputs.

Power Ground

Power ground (PWR GND) is an electric current path return for VPWR voltage circuit. The purpose of the PWR GND is to maintain sufficient voltage at the PCM.

Gold Plated Pins

Note: Damaged gold terminals should only be replaced with new gold terminals.

Some engine control hardware has gold plated pins on the connectors and mating harness connectors to improve electrical stability for low current draw circuits and to enhance corrosion resistance. The electronic EC components equipped with gold terminals will vary by vehicle application.

PCM Inputs

Note: Transmission input, which are not described in this section are discussed in the respective transmission Workshop Manual.

Air Conditioning Cycling Switch

The air conditioning (A/C) cycling switch may be wired to either the ACCS or ACPSW PCM input. When the A/C cycling switch opens, the PCM will turn off the A/C clutch. For information on the specific function of the A/C cycling switch, refer to the Climate Control Group in the Workshop Manual.

The A/C cycling switch (ACCS) circuit to the PCM provides a voltage signal which indicates when the A/C is requested. When the A/C demand switch is turned on, and both the A/C cycling switch and the high pressure contacts of the A/C high pressure switch (if equipped and in circuit) are closed, voltage is supplied to the ACCS circuit at the PCM. Refer to the applicable Wiring Diagram Manual for vehicle specific wiring.

If the ACCS signal is not received by the PCM, the PCM circuit will not allow the A/C to operate. For additional information, refer to PCM outputs, wide open throttle air conditioning cutoff.

Note: Some applications do not have a dedicated (separate) input to the PCM indicating that A/C is requested. This information is received by the PCM through the communication link.

Air Conditioning Evaporator Temperature Sensor

The air conditioning evaporative temperature (ACET) sensor senses evaporator air discharge temperature. The ACET sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and increases as the temperature decreases. The PCM sources a low current 5 volts on the ACET circuit. With SIG RTN also connected to the ACET sensor, the varying resistance affects the voltage drop across the sensor terminals. As A/C evaporator air temperature changes, the varying resistance of the ACET sensor changes the voltage the PCM detects.

The ACET sensor is used to more accurately control A/C clutch cycling, improving defrost/demist performance, reduce A/C clutch cycling, etc.

A/C EVAPORATOR TEMPERATURE (ACET) SENSOR VOLTAGE AND RESISTANCE

°C	°F	Volts	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25

(Continued)

PCM Inputs

A/C EVAPORATOR TEMPERATURE (ACET) SENSOR VOLTAGE AND RESISTANCE

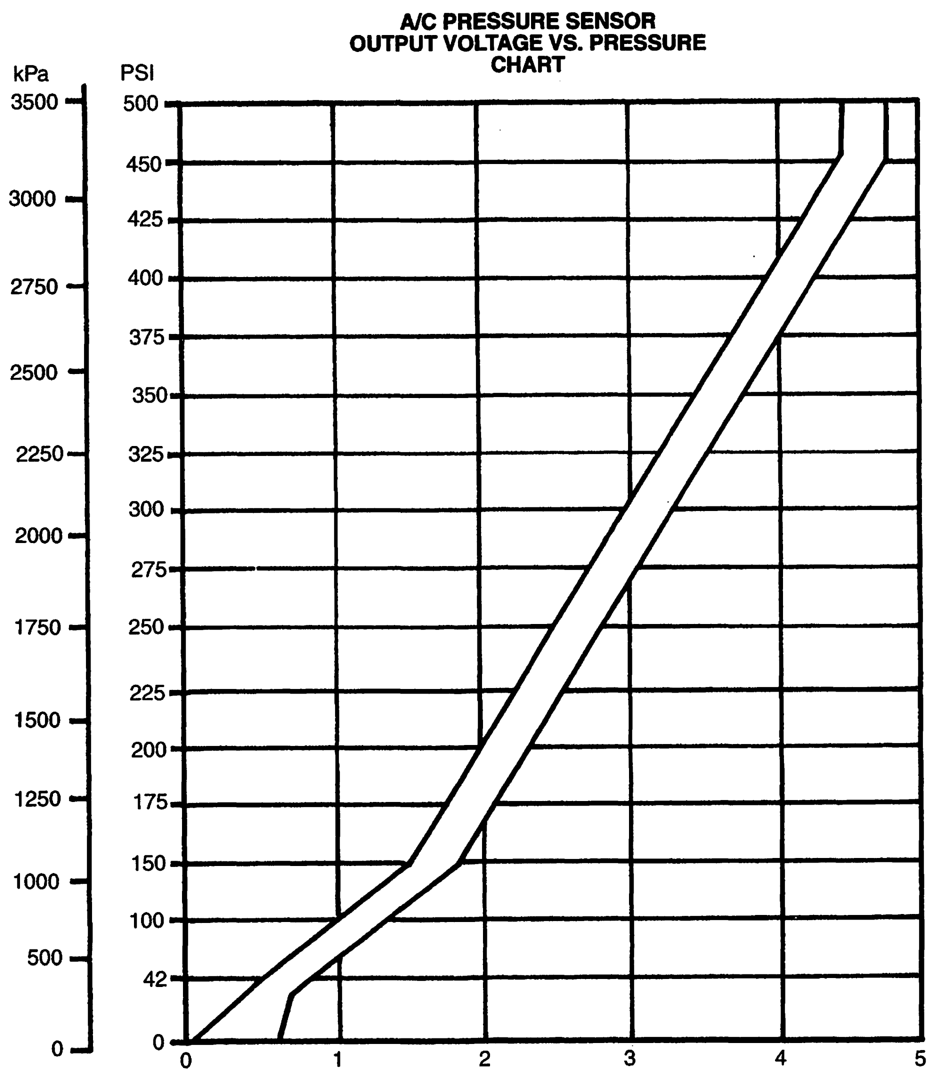
°C	°F	Volts	Resistance (K ohms)
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

Note: These values can vary 15 percent due to sensor and VREF variations. Voltage values were calculated for VREF = 5.0 volts.

PCM Inputs

Air Conditioning Pressure Sensor

The air conditioning pressure (A/C pressure) sensor (Figure 26)is located in the high pressure (discharge) side of the air conditioning A/C system. The A/C pressure sensor provides a voltage signal to the powertrain control module (PCM) that is proportional to the A/C pressure. The PCM uses this information for A/C clutch control, fan control and idle speed control.



A/C PRESSURE SENSOR OUTPUT VOLTAGE*

*VOLTAGE MAY VARY ± 10 PERCENT DUE TO SENSOR, VREF AND DIGITAL MULTIMETER VARIATIONS.

AA0460-B

PCM Inputs

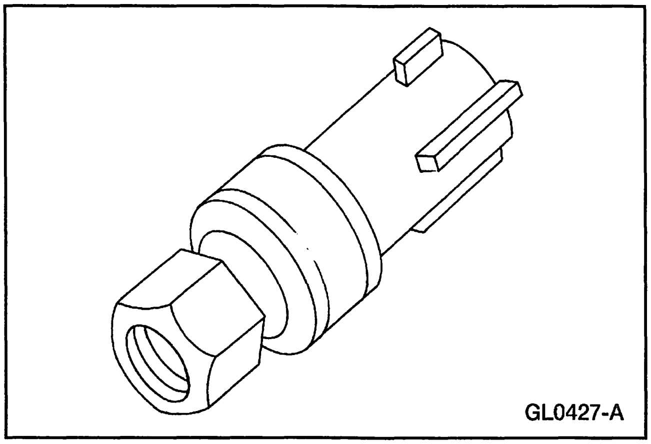


Figure 26: Typical Air Conditioning Pressure Sensor

Air Conditioning High Pressure Switch

The A/C high pressure switch is used for additional A/C system pressure control. The A/C high pressure switch is either dual function for two-speed electric fan applications or single function for all others.

For refrigerant containment control, the normally closed high pressure contacts open at a predetermined A/C pressure. This will result in the A/C turning off, preventing the A/C pressure from rising to a level that would open the A/C high pressure relief valve.

For fan control, the normally open medium pressure contacts close at a predetermined A/C pressure. This grounds the ACPSW circuit input to the PCM. The PCM will then turn on the high speed fan to help reduce the pressure.

For additional information, refer to the Climate Control Group in the Workshop Manual or the Wiring Diagram Manual.

Brake Pedal Position Switch

The brake pedal position (BPP) switch (Figure 27) is used by the PCM to disengage the transmission torque converter clutch and on some applications as an input to the idle speed control for idle quality and for vehicle speed control deactivation. Depending on the vehicle application the BPP switch can be connected to the PCM in the following manner:

- BPP switch is hard wired to the PCM supplying battery positive voltage (B+) when the vehicle brake is applied.
- BPP switch is hard wired to a module (ABS, LCM or REM), BPP signal is than broadcasted over the data link to be received by the PCM.

PCM Inputs

- BPP switch is hard wired to the anti-lock brake (ABS)- traction control / stability assist module. The stability module will interpret the BPP switch input along with other ABS inputs and generate an output called the Driver Brake Application (DBA) signal. The DBA signal is than sent to the PCM and to other BPP signal users.

Note on applications where the BPP switch is hard wired to the PCM and stoplamp circuit, if all stoplamp bulbs are burned out (open), high voltage is present at the PCM due to a pull-up resistor in the PCM. This provides fail-safe operation in the event the circuit to the stoplamp bulbs has failed.

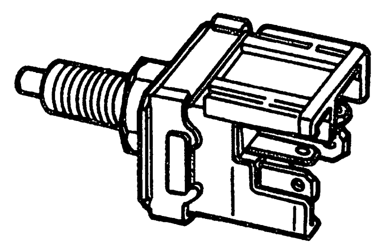


Figure 27: Typical Brake Pedal Position Switch

Brake Pressure Applied/Brake Deactivator Switch

The brake pressure applied (BPA) switch also sometimes called the brake deactivator switch for vehicle speed control deactivation. Is a normally closed switch, witch supplies battery positive voltage (B+) to the PCM when the brake pedal is NOT applied. When the brake pedal is depressed, the normally closed switch will open and power is removed from the PCM.

On some applications the normally closed BPA switch along with the normally open brake pedal position (BPP) switch are used for a brake rationality test within the PCM. The PCM misfire monitor profile learn function can be disable if a brake switch failure occurs. If one or both brake pedal inputs to the PCM did not change states when they were expected to a diagnostic trouble code P1572 can be set by the PCM strategy.

Camshaft Position Sensor

The camshaft position (CMP) sensor detects the position of the camshaft. The CMP sensor identifies when piston No. 1 is on its compression stroke. A signal is then sent to the powertrain control module (PCM) and used for synchronizing the sequential firing of the fuel injectors. The Coil On Plug (COP) ignition applications also use the CMP signal to select the proper ignition coil to fire. The input circuit to the PCM is referred to as the CMP input or circuit. DTC P0340 is associated with this sensor.

Vehicles with two CMP sensors are equipped with variable camshaft timing (VCT). They use the second sensor to identify the position of the camshaft on bank 2 as an input to the PCM. DTC P0345 is associated with this sensor and it is referred to as CMP2.

PCM Inputs

There are two types of CMP sensors: the three pin connector Hall-effect type sensor (Figure 28) found on F-Series 4.2L applications, and the two pin connector variable reluctance sensor found on all other vehicles(Figure 29).

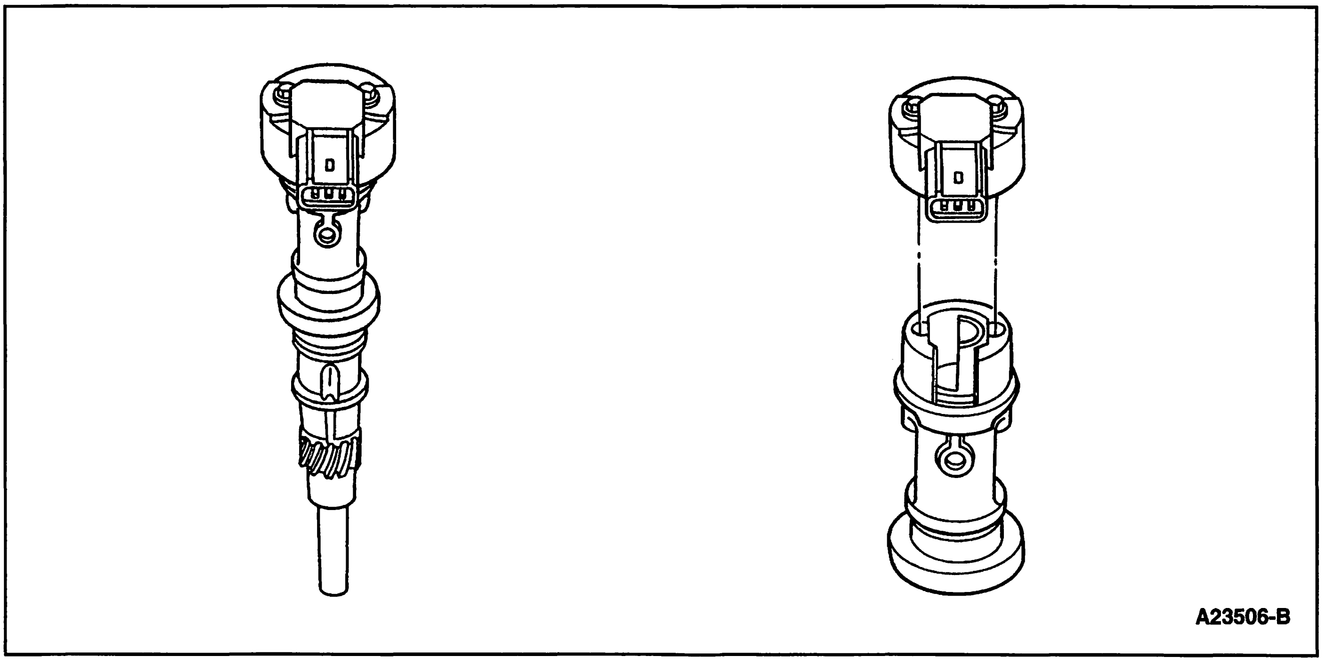


Figure 28: Typical Hall-Effect Sensor

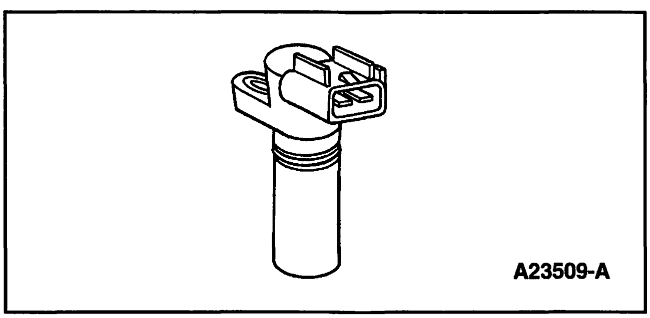


Figure 29: Typical Variable Reluctance Sensor

PCM Inputs

Clutch Pedal Position Switch

The clutch pedal position (CPP) switch (Figure 30) is an input to the PCM indicating the clutch pedal position. The PCM provides a 5-volt reference (VREF) signal to the CPP switch. If the CPP switch is closed, indicating the clutch pedal is engaged, the output voltage (5 volts) from the PCM is grounded through the signal return line to the PCM, and there is 1 volt or less. One volt or less indicates there is a reduced load on the engine. If the CPP switch is open, meaning the clutch pedal is disengaged, the input on the CPP signal to the PCM will be approximately 5 volts. Then, the 5-volt signal input at the PCM will indicate a load on the engine. The PCM uses the load information in mass air flow and fuel calculations.

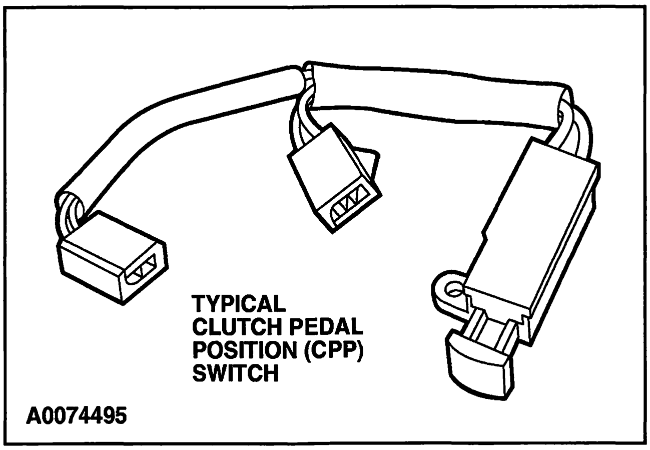


Figure 30: Clutch Pedal Position (CPP) Switch

Crankshaft Position Sensor (Integrated Ignition Systems)

The crankshaft position (CKP) sensor is a magnetic transducer mounted on the engine block or timing cover and is adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the powertrain control module (PCM). The trigger wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L ten cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the trigger wheel, the CKP indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to fixed reference (Figure 31).

PCM Inputs

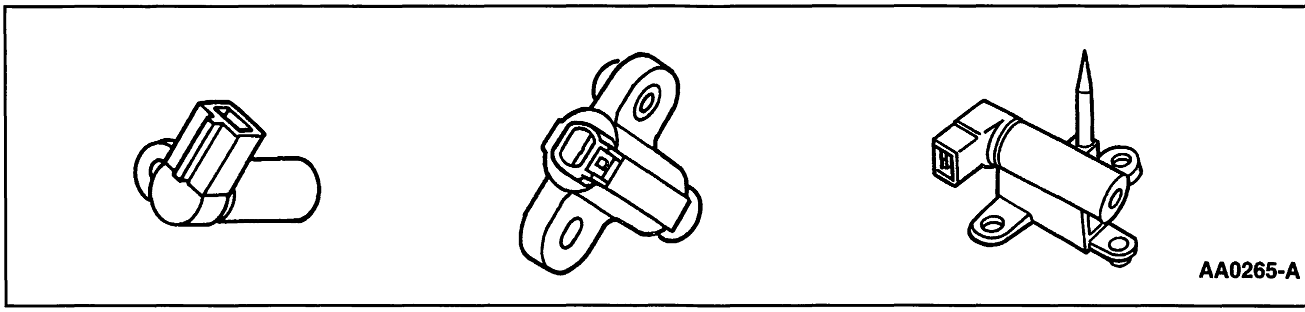


Figure 31: Three Different Types of Crankshaft Position (CKP) Sensors

Cylinder Head Temperature Sensor

The cylinder head temperature (CHT) sensor (Figure 32) is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as temperature increases, and increases as temperature decreases. The varying resistance affects the voltage drop across the sensor terminals 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 cylinder head temperature (CHT) sensor is installed in the aluminum cylinder head and measures the metal temperature. The CHT sensor can provide complete engine temperature information and can be used to infer coolant temperature. If the CHT sensor conveys an overheating condition to the PCM, the PCM would then initiate a fail-safe cooling strategy based on information from the CHT sensor. A cooling system failure such as low coolant or coolant loss could cause an overheating condition. As a result, damage to major engine components could occur. Using both the CHT sensor and fail-safe cooling strategy, the PCM prevents damage by allowing air cooling of the engine and limp home capability. For additional information, refer to Powertrain Control Software for Fail-Safe Cooling Strategy details.

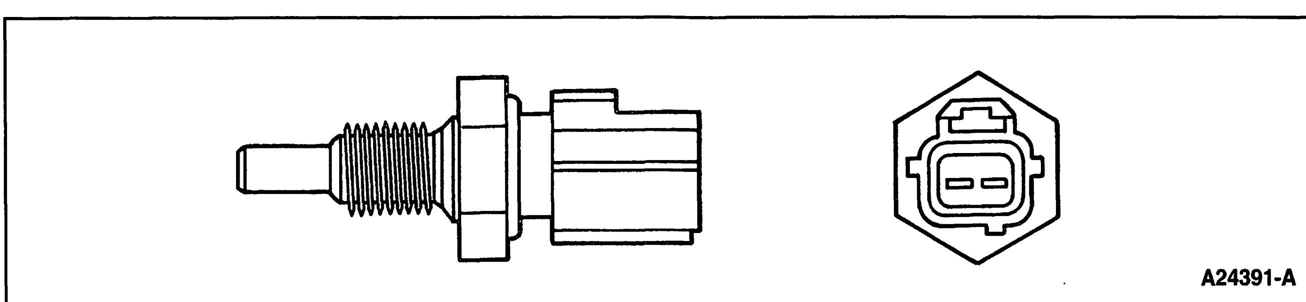


Figure 32: Typical Cylinder Head Temperature (CHT) Sensor

PCM Inputs

Differential Pressure Feedback EGR Sensor

For information on the differential pressure feedback EGR sensor, refer to the description of the Exhaust Gas Recirculation Systems.

Engine Coolant Temperature Sensor

The engine coolant temperature (ECT) sensor (Figure 33) is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals 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 a 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 ECT measures the temperature of the engine coolant. The sensor is threaded into an engine coolant passage. The ECT sensor is similar in construction to the IAT sensor.

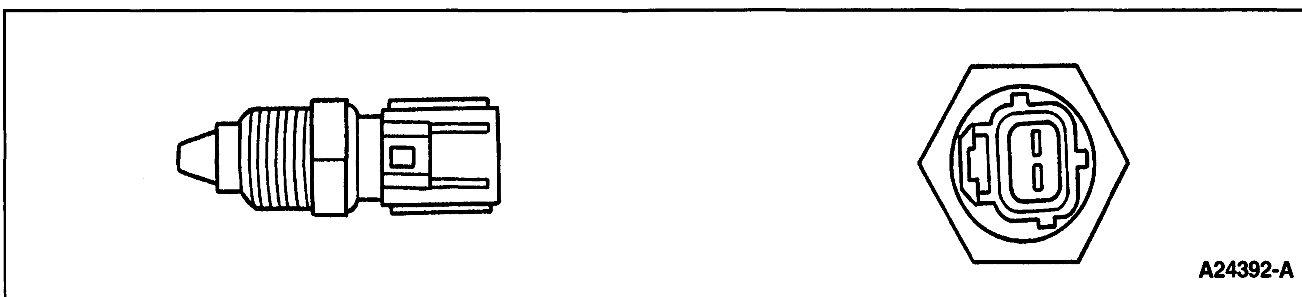


Figure 33: Typical Engine Coolant Temperature (ECT) Sensor

Engine Fuel Temperature Sensor

The engine fuel temperature (EFT) sensor (Figure 34) is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as temperature increases, and increases as temperature decreases. The varying resistance affects the voltage drop across the sensor terminals 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.

PCM Inputs

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 EFT sensor measures the temperature of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulse width and meter fuel to each engine combustion cylinder.

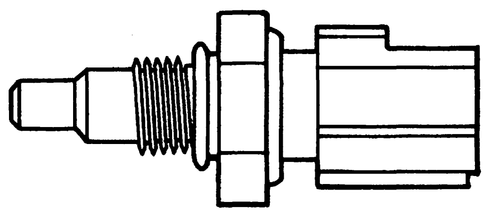


Figure 34: Engine Fuel Temperature (EFT) Sensor used on the 4.6L NG Crown Victoria

Engine Oil Temperature Sensor

The engine oil temperature (EOT) sensor (Figure 35) is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases and increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals 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 a 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 EOT sensor measures the temperature of the engine oil. The sensor is typically threaded into the engine oil lubrication system near the oil filter or screwed into the oil pan. The PCM can use the EOT sensor input to determine the following:

- On Variable Cam Timing (VCT) applications the EOT input is used to adjust the VCT control gains and logic for camshaft timing.
- The PCM can use EOT sensor input in conjunction with other PCM inputs to determine oil degradation.

PCM Inputs

- The PCM can use EOT sensor input to initiate a soft engine shutdown. To prevent engine damage from occurring as a result of high oil temperatures, the PCM has the ability to initiate a soft engine shutdown. Whenever engine RPM exceeds a calibrated level for a certain period of time, the PCM will begin reducing power by disabling engine cylinders.

Figure 35: Typical Engine Oil Temperature (EOT) Sensor

Fuel Level Input

The fuel level input (FLI) is a hard wire signal input to the PCM from the fuel pump (FP) module. Refer to the description of the FLI in the On-Board Diagnostics II Monitors.

Fuel Pump Monitor

Applications Using a Fuel Pump Relay for Fuel Pump On/Off Control

The Fuel Pump Monitor (FPM) circuit is spliced into the fuel pump power (FP PWR) circuit and is used by the PCM for diagnostic purposes. The PCM sources a low current voltage down the FPM circuit. With the fuel pump off, this voltage is pulled low by the path to ground through the fuel pump. With the fuel pump off and the FPM circuit low, the PCM can verify that the FPM circuit and the FP PWR circuit are complete from the FPM splice through the fuel pump to ground. This also confirms that the FP PWR or FPM circuits are not shorted to power. With the fuel pump on, voltage is now being supplied from the fuel pump relay to the FP PWR and FPM circuits. With the fuel pump on and the FPM circuit high, the PCM can verify that the FP PWR circuit from the fuel pump relay to the FPM splice is complete. It can also verify that the fuel pump relay contacts are closed and there is a B+ supply to the fuel pump relay.

Fuel Pump Driver Module Applications

The fuel pump driver module (FPDM) communicates diagnostic information to the powertrain control module (PCM) through the Fuel Pump Monitor (FPM) circuit. This information is sent by the FPDM as a duty cycle signal. The three duty cycle signals that may be sent are listed in the following table.

PCM Inputs

FUEL PUMP DRIVER MODULE DUTY CYCLE SIGNALS

Duty Cycle [a]	On Time (mSec)	Comments	FP_M PID[b]
50%	500	"All OK" output from FPDM. With this input, the PCM can verify that the FPDM is powered and able to communicate on the FPM circuit.	80-125%
25%	250	FPDM did not receive a Fuel Pump (FP) duty cycle command from the PCM, or the duty cycle that was received was invalid (refer to PCM Outputs, Fuel Pump).	15-60%
75%	750	The FPDM has detected a fault in the circuits between the fuel pump and FPDM.	250-400%

a If a duty cycle meter and breakout box is used, be aware that these values may be reversed depending on the trigger setting of the specific meter (for example, 25% from FPDM may read as 75% on duty cycle meter depending on trigger setting).

b Some scan tools will display the FP_M PID as the duty cycle in column 1. Other scan tools will display the FP_M PID as a value shown in the FP_M PID column. This value will fluctuate randomly. It is ok for the value to briefly go outside this range, then return.

Fuel Tank Pressure Sensor

For information on the fuel tank pressure (FTP) sensor, refer to the description of the Evaporative Emission Systems.

Fuel Rail Pressure Sensor

The fuel rail pressure (FRP) sensor (Figure 36) is a diaphragm strain gauge device in which resistance changes with pressure. The electrical resistance of a strain gauge increases as pressure increases, and decreases as pressure decreases. The varying resistance affects the voltage drop across the sensor terminals and provides electrical signals to the PCM corresponding to pressure.

PCM Inputs

Strain gauge 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 FRP sensor measures the pressure of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulse width and meter fuel to each engine combustion cylinder.

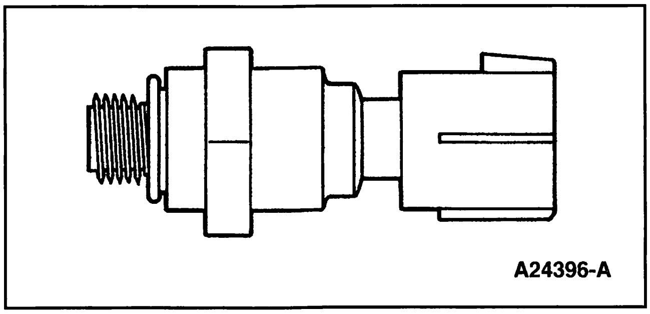


Figure 36: Fuel Rail Pressure (FRP) Sensor on the 4.6L NG Crown Victoria

The fuel rail pressure (FRP) sensor (Figure 37) senses the pressure difference between the fuel rail and the intake manifold. The return fuel line to the fuel tank has been deleted in this type of fuel system. The differential fuel/intake manifold pressure together with measured fuel temperature provides an indication of the fuel vapors in the fuel rail. Both differential pressure and temperature feedback signals are used to control the speed of the fuel pump. The speed of the fuel pump sustains fuel rail pressure which preserve fuel in its liquid state. The dynamic range of the fuel injectors increase because of the higher rail pressure, which allows the injector pulse width to decrease.

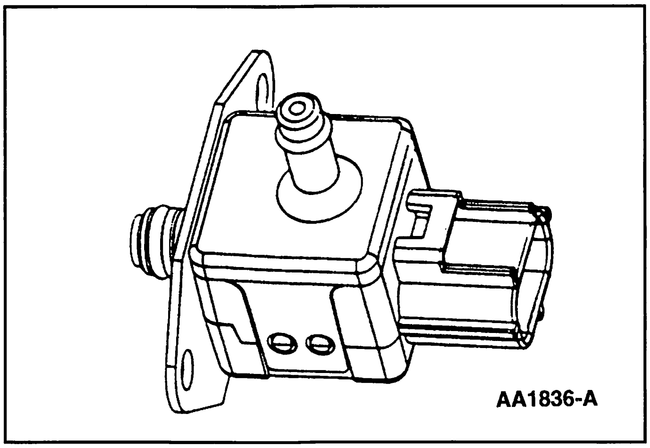


Figure 37: Fuel Rail Pressure (FRP) Sensor

PCM Inputs

Generator Monitor (Gen Mon)

For information on the generator monitor, refer to the description of the PCM/Controlled Charging System.

Heated Oxygen Sensor

The heated oxygen sensor (HO2S) (Figure 38) detects the presence of oxygen in the exhaust and produces a variable voltage according to the amount of oxygen detected. A high concentration of oxygen (lean air/fuel ratio) in the exhaust produces a voltage signal less than 0.4 volt. A low concentration of oxygen (rich air/fuel ratio) produces a voltage signal greater than 0.6 volt. The HO2S provides feedback to the PCM indicating air/fuel ratio in order to achieve a near stoichiometric air/fuel ratio of 14.7:1 during closed loop engine operation. The HO2S generates a voltage between 0.0 and 1.1 volts.

Embedded with the sensing element is the HO2S heater. The heating element heats the sensor to temperatures of 800°C (1400°F). At approximately 300°C (600 °F) the engine can enter closed loop operation. The VPWR circuit supplies voltage to the heater and the PCM will turn on the heater by providing the ground when the proper conditions occur. Since model year 1998 a high power HO2S heater and heater control system have been installed on the Stream 1 HO2S sensors of most vehicles. The high power heater reaches closed loop fuel control temperatures faster, wich allows closed lop engine operation sooner. The use of this heater requires that the HO2S heater control be duty cycled, to prevent damage to the heater. The 6 ohm design is **not** interchangeable with new style 3.3 ohm heater. Use the appropriate service part number.

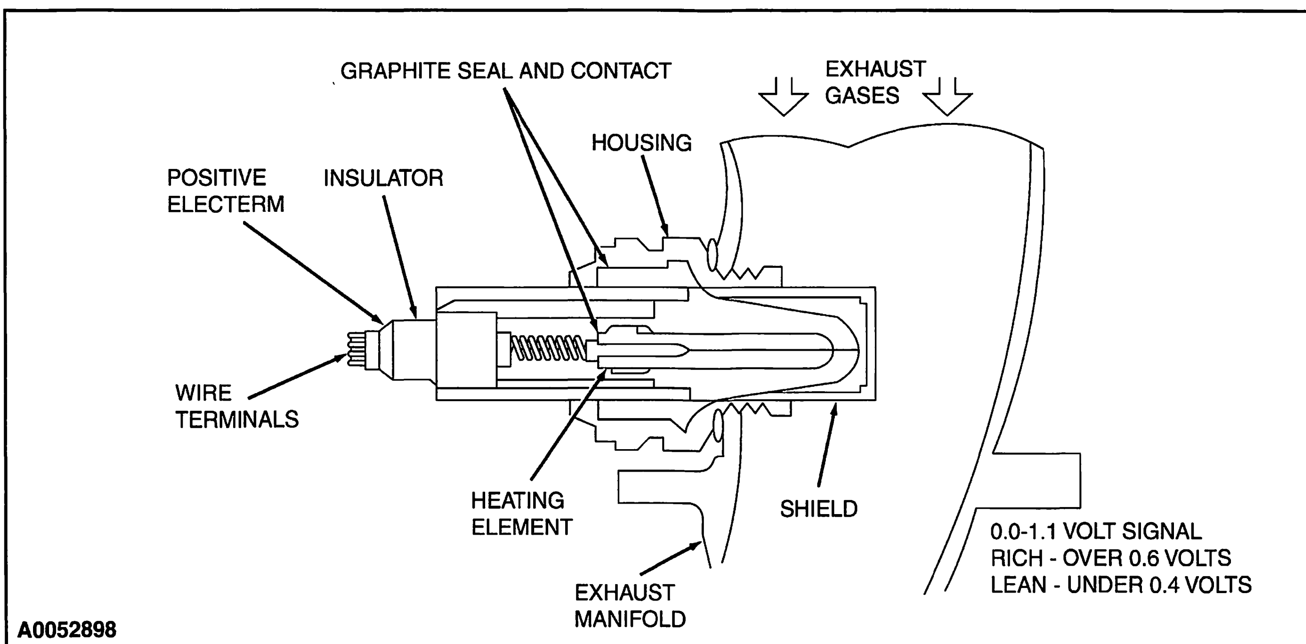


Figure 38: Heated Oxygen Sensor (HO2S)

PCM Inputs

Intake Air Temperature Sensor

The intake air temperature (IAT) sensor is a thermistor device in which resistance changes with temperature. The electrical resistance of a thermistor decreases as the temperature increases, and increases as the temperature decreases. The varying resistance affects the voltage drop across the sensor terminals 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 a 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 IAT provides air temperature information to the PCM. The PCM uses the air temperature information as a correction factor in the calculation of fuel, spark and air flow.

The IAT sensor provides a quicker temperature change response time than the ECT or CHT sensor.

Currently there are two design types of IAT sensors used, a stand alone\non-integrated type (Figure 39) and a integrated (Figure 40) type. Both types function the same, however the integrated type is incorporated into the Mass Air Flow (MAF) sensor instead of being a stand alone sensor.

Supercharged vehicles use (2) IAT sensors. Both sensors are thermistor type devices and operate as described above. However, one is located before the supercharger at the air cleaner for standard OBD II/cold weather input, while a second sensor (IAT2) is located after the supercharger in the intake manifold. The IAT2 sensor located after the supercharger provides air temperature information to the PCM to control border-line spark and to help determine intercooler efficiency.

Currently two types of IAT2 sensors are used. A non-integrated screw in type (Figure 39) and an integrated type, which is part of the Thermal Manifold Absolute Pressure (TMAP) sensor (Figure 48). The TMAP sensor consists of a IAT thermistor and a manifold absolute pressure (MAP) sensor. The thermistor portion of the TMAP is used for IAT2 function and operates in the same manner as a non-integrated IAT2. For additional information on the MAP portion of the TMAP, refer to the Thermal Manifold Absolute Pressure Sensor description and operation found later in this Section.

PCM Inputs

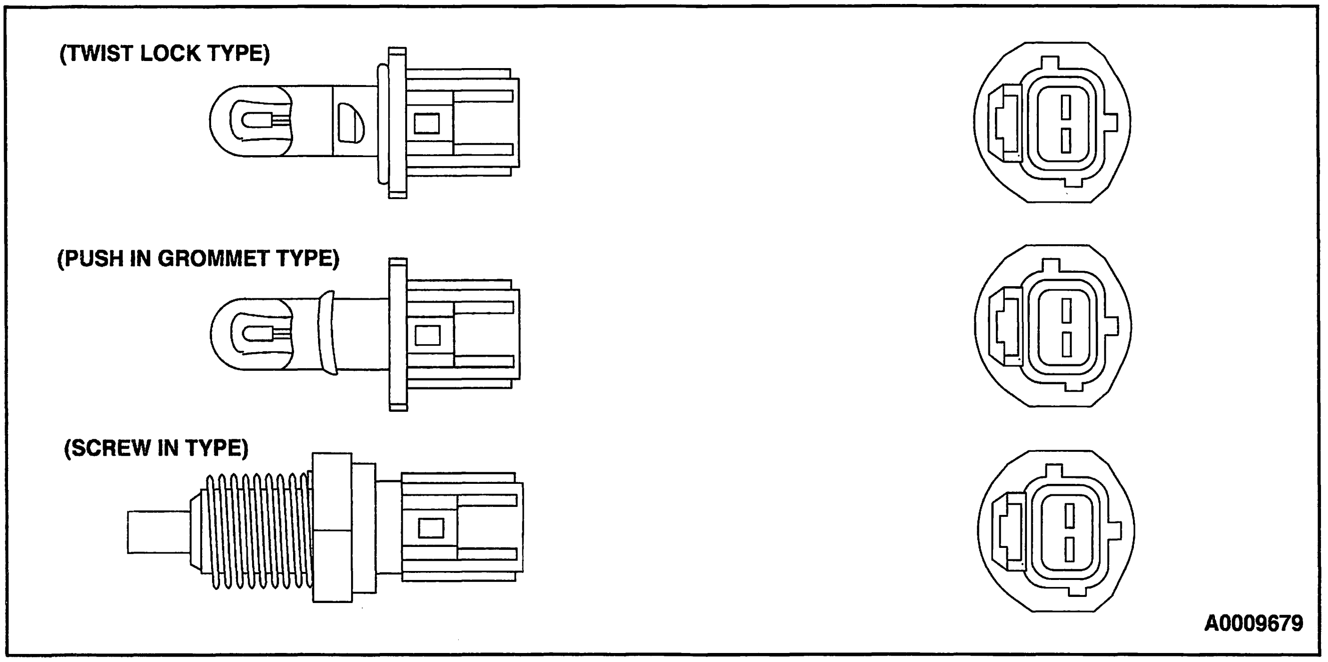


Figure 39: Typical Stane Alone\Non-integrated Intake Air Temperature (IAT) Sensors

PCM Inputs

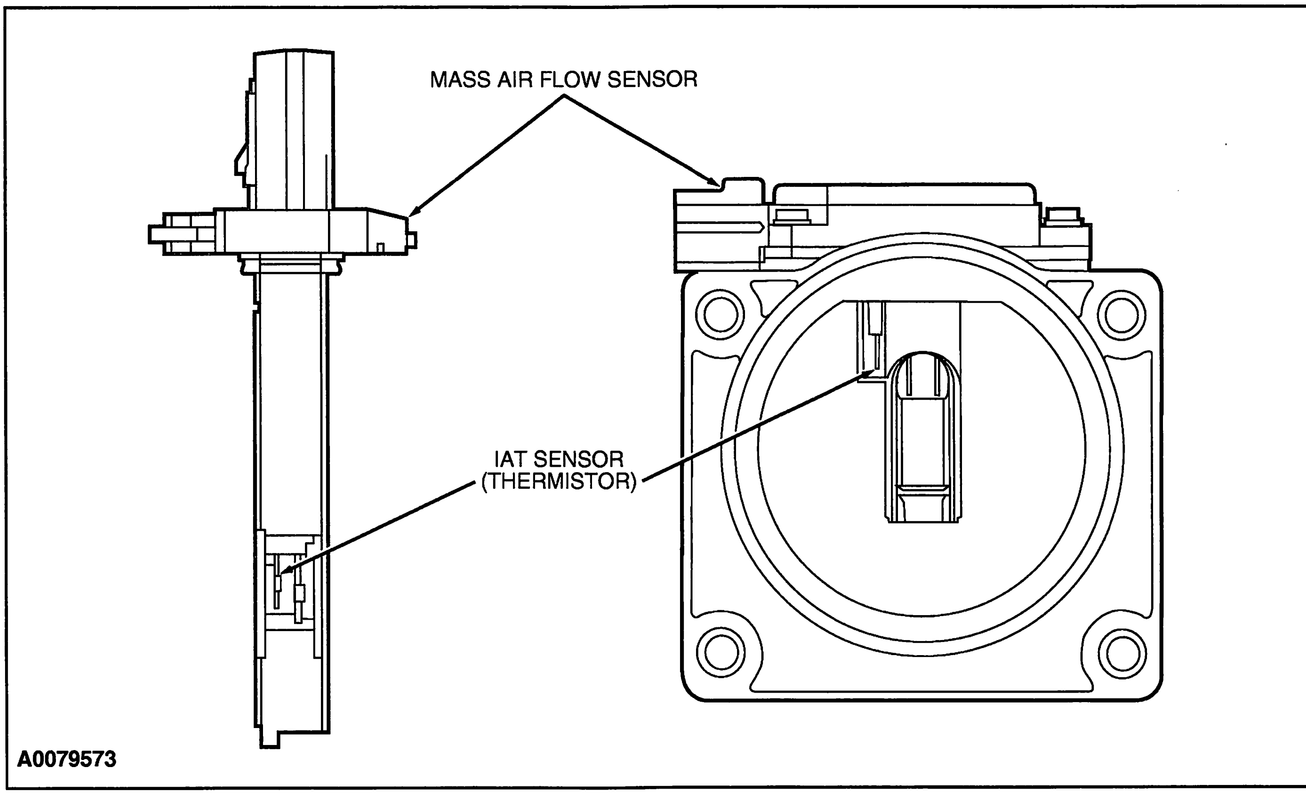


Figure 40: Typical Integrated Intake Air Temperature (IAT) Sensor incorporated into a Drop-in or Flange type MAF sensor

Intake Manifold Runner Control

For information on the intake manifold runner control (IMRC), refer to the description of the Intake Air Systems.

Intake Manifold Swirl Control

For information on the intake manifold swirl control (IMSC), refer to the description of the Intake Air Systems.

Intake Manifold Tuning Valve

For information on the intake manifold tuning valve(IMTV), refer to the description of the Intake Air Systems.

Knock Sensor

The knock sensor (KS) (Figure 41) is a tuned accelerometer on the engine which converts engine vibration to an electrical signal. The PCM uses this signal to determine the presence of engine knock and to retard spark timing.

PCM Inputs

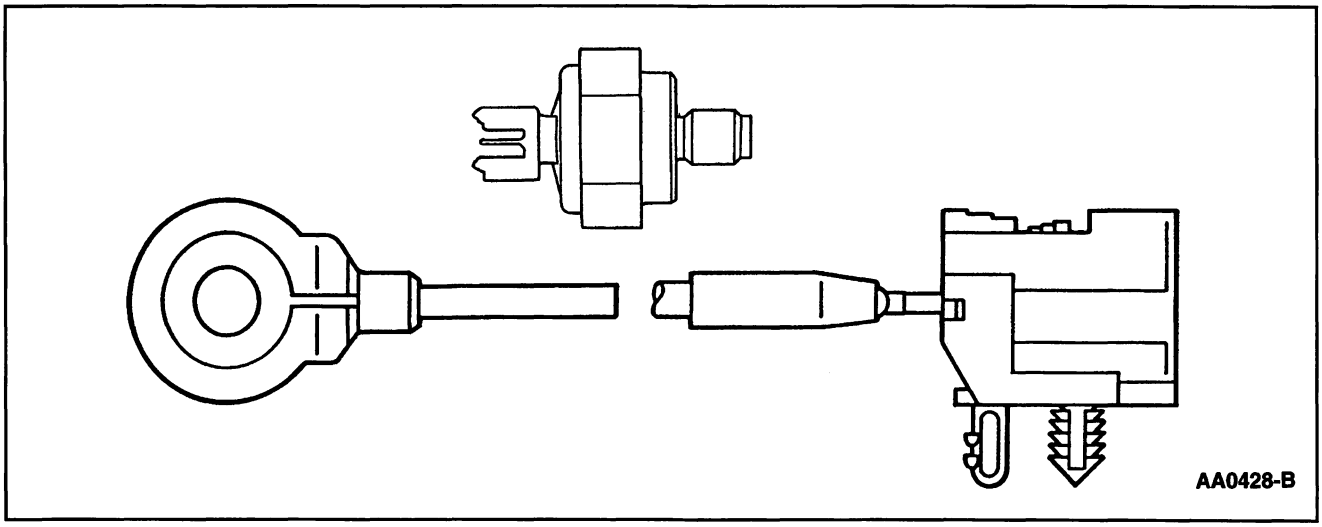


Figure 41: Two Types of Knock Sensor (KS)

Mass Air Flow Sensor

The mass air flow (MAF) sensor uses a hot wire sensing element to measure the amount of air entering the engine. Air passing over the hot wire causes it to cool. This hot wire is maintained at 200°C (392°F) above ambient temperature as measured by a constant cold wire (Figure 42). If the hot wire electronic sensing element must be replaced, then the entire assembly must be replaced. Replacing only the element may change the air flow calibration.

PCM Inputs

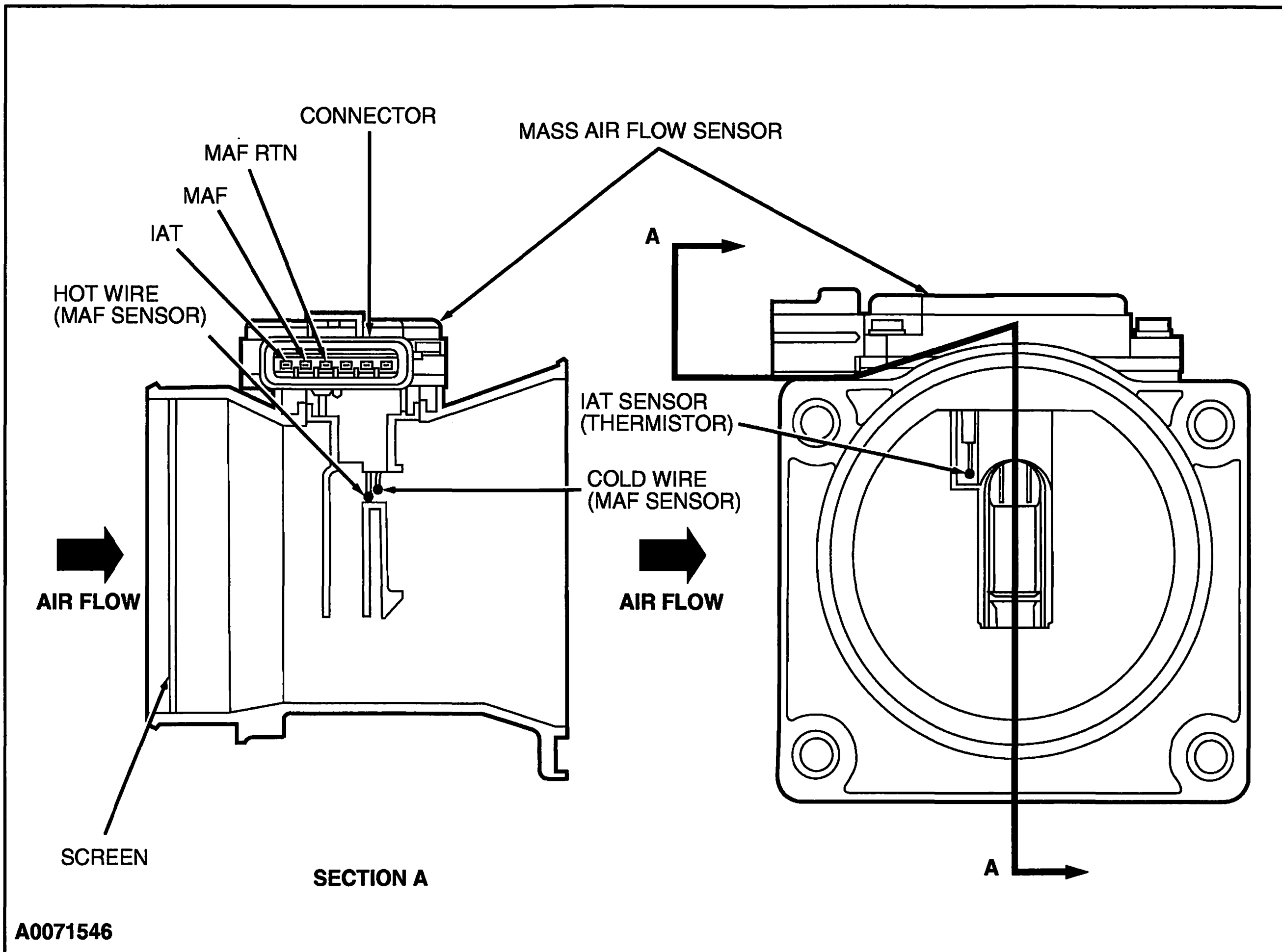


Figure 42: Diagram of Air Flow through Throttle Body contacting MAF sensor hot and cold wire (and IAT sensor wire where applicable) terminals.

The current required to maintain the temperature of the hot wire is proportional to the air mass flow. The MAF sensor then outputs an analog voltage signal to the PCM proportional to the intake air mass. The PCM calculates the required fuel injector pulse width in order to provide the desired air/fuel ratio. This input is also used in determining transmission electronic pressure control (EPC), shift and torque converter clutch scheduling.

Most MAF sensors have integrated bypass technology (IBT) with an integrated intake air temperature (IAT) sensor.

The MAF sensor is located between the air cleaner and the throttle body or inside the air cleaner assembly.

PCM Inputs

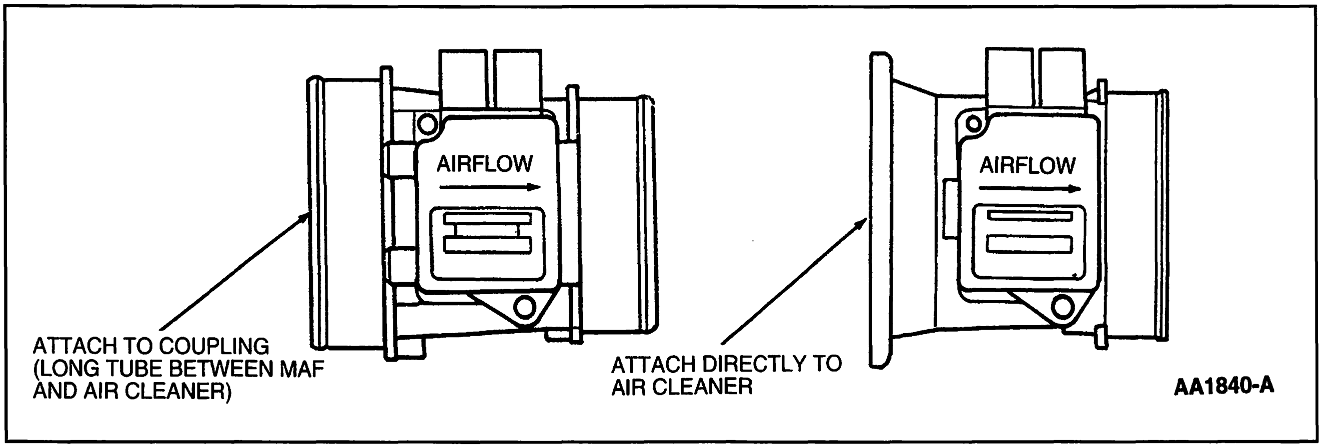


Figure 43: Typical Mass Air Flow (MAF) Sensor

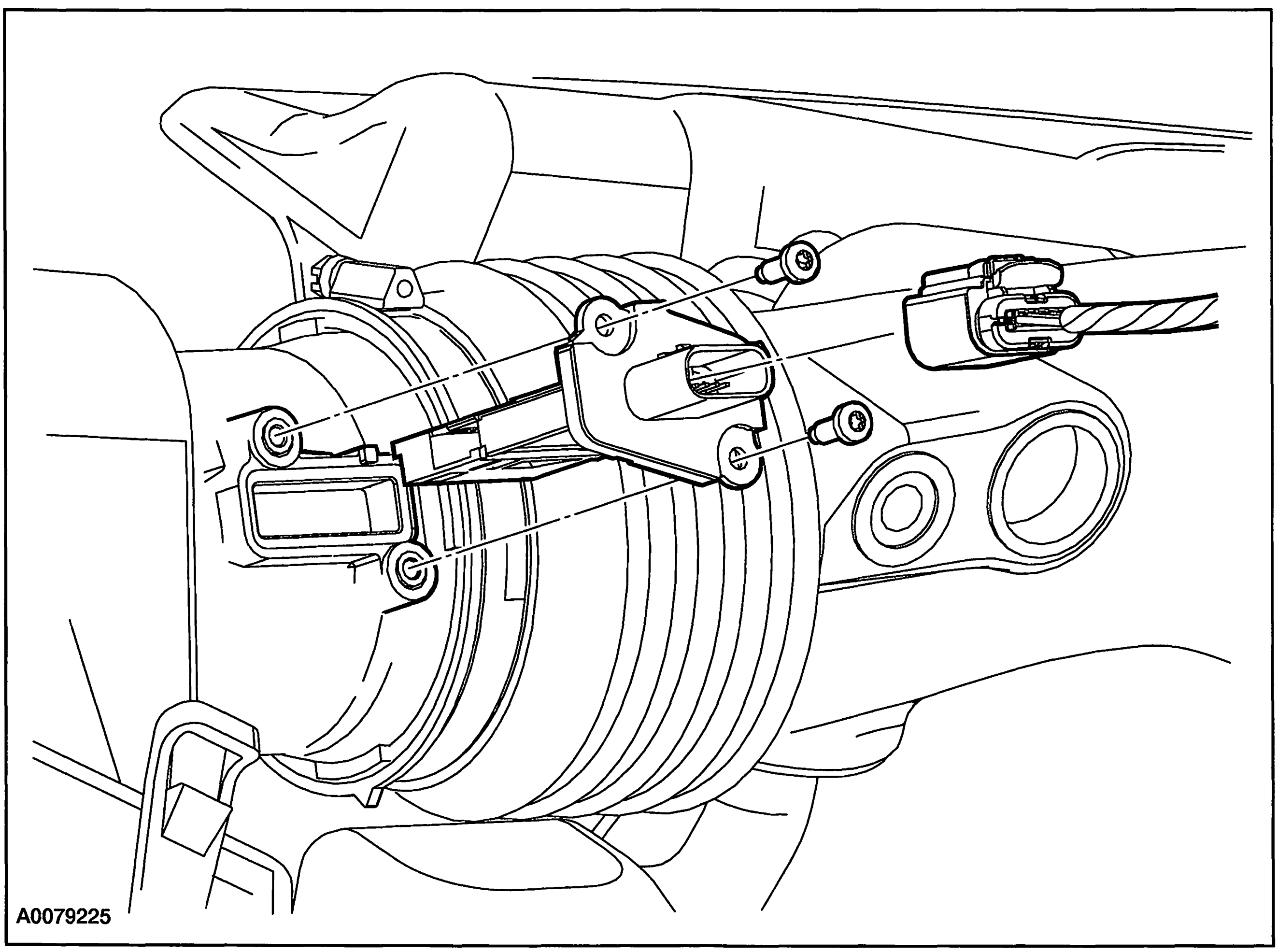


Figure 44: Typical "Drop-in" Mass Air Flow (MAF) Sensor

PCM Inputs

Output Shaft Speed Sensor

The Output Shaft Speed Sensor (OSS), provides the Powertrain Control Module (PCM) with information about the rotational speed of an output shaft.The (PCM) uses the information to control and diagnose powertrain behavior. In some applications, the sensor is also used as the source of vehicle speed. The sensor may be physically located in different places on the vehicle, depending upon the specific application. The design of each speed sensor is unique and depends on which powertrain control feature uses the infomation generated.

Power Steering Pressure Switch

The power steering pressure (PSP) switch (Figure 45) monitors the hydraulic pressure within the power steering system. The PSP switch is a normally closed switch that opens as the hydraulic pressure increases. The PCM uses the input signal from the PSP switch to compensate for additional loads on the engine by adjusting the idle rpm and preventing engine stall during parking maneuvers. Also, the PSP switch signals the PCM to adjust transmission electronic pressure control (EPC) pressure during the increased engine load, for example during parking maneuvers.

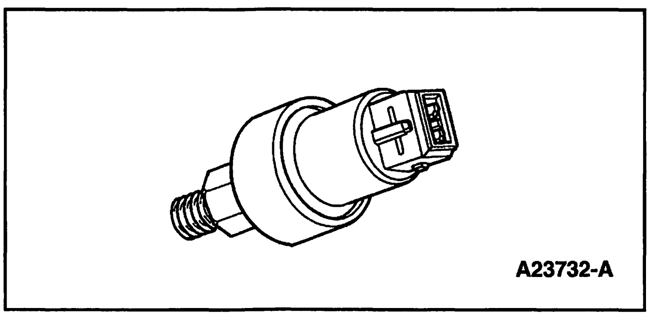


Figure 45: Power Steering Pressure (PSP) Switch

Power Steering Pressure Sensor

The power steering pressure (PSP) sensor (Figure 46) monitors the hydraulic pressure within the power steering system. The PSP sensor voltage input to the PCM will change as the hydraulic pressure changes. The PCM uses the input signal from the PSP sensor to compensate for additional loads on the engine by adjusting the idle rpm and preventing engine stall during parking maneuvers. Also, the PSP sensor signals the PCM to adjust transmission electronic pressure control (EPC) pressure during the increased engine load, for example during parking maneuvers.

PCM Inputs

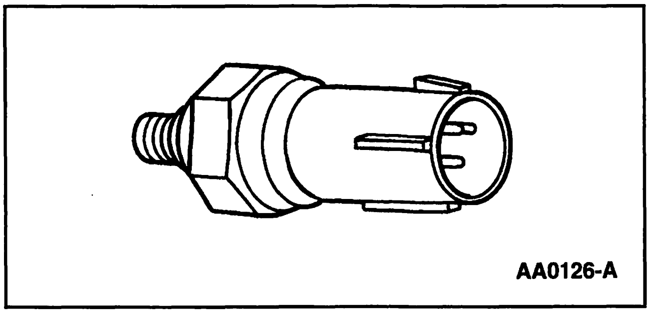


Figure 46: Power Steering Pressure (PSP) Sensor

Power Take-Off Switch and Circuit

The Power Take-Off (PTO) circuit (Figure 47) is used by the PCM to disable some of the OBD II Monitors during PTO operation. The PTO switch is normally open. When the PTO unit is activated the PTO switch is closed and battery voltage is supplied to the PTO input circuit. This indicates to the PCM that an additional load is being applied to the engine.

When the PTO unit is activated, the PCM disables some OBD-II monitors, which may not function reliably during PTO operation. Without the PTO circuit information to the PCM, false Diagnostic Trouble Codes (DTCs) may be set during PTO operation. Prior to an Inspection/Maintenance test, the vehicle will have to be operated with the PTO disengaged long enough to successfully complete the OBD-II Monitors.

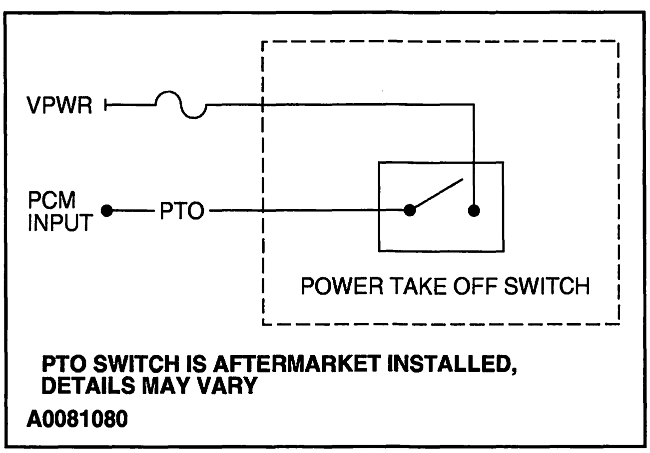


Figure 47: Power Take-Off (PTO) Switch and Circuit to PCM

PCM Inputs

Thermal Manifold Absolute Pressure Sensor

The Thermal Manifold Absolute Pressure Sensor (TMAP) (Figure 48)consists of a manifold absolute pressure (MAP) sensor and an integrated thermistor. The MAP portion of the sensor uses a piezo-resistive silicon sensing element to provide a voltage proportional to the absolute pressure in the intake manifold. The thermistor portion of the sensor operates in the same manner as an intake air temperature (IAT) sensor. For additional information on how the IAT sensor operates, refer to the Intake Air Temperature Sensor description and operation located in this section.

For the 2.3L Ranger and 2.3L PZEV Focus, the TMAP sensor is part of the Exhaust Gas Recirculation (EGR) system. The PCM uses information from the MAP portion of the TMAP sensor, throttle position (TP) sensor, mass air flow (MAF) sensor, engine coolant temperature (ECT) sensor or cylinder head temperature (CHT) sensor and crankshaft position (CKP) sensor to determine how much exhaust gas is introduced into the intake manifold. The thermistor portion of the TMAP sensor is currently not being used on this application.

For the 4.6L SC Mustang, the PCM uses manifold absolute pressure information from the MAP portion of the TMAP sensor along with other sensor inputs to determine the proper amount of fuel needed for combustion under varying engine load conditions. The thermistor portion of the TMAP sensor is used as a second IAT sensor. This second IAT sensor, located after the supercharger, provides manifold air temperature information to the PCM.

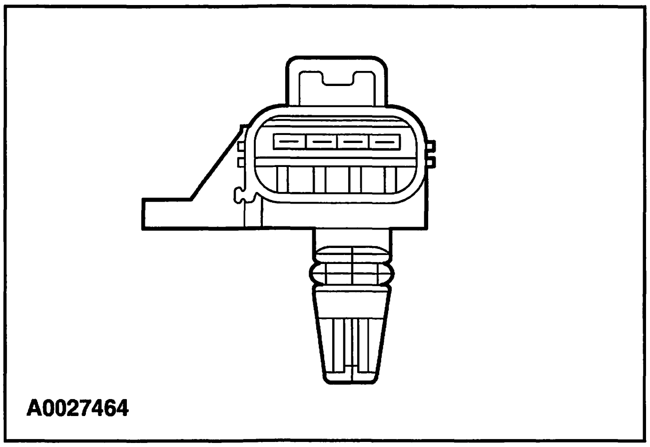


Figure 48: Thermal Manifold Absolute Pressure (TMAP) Sensor

Throttle Position Sensor

The throttle position (TP) sensor (Figure 49) is a rotary potentiometer sensor that provides a signal to the PCM that is linearly proportional to the throttle plate/shaft position. The sensor housing has a three-blade electrical connector that may be gold plated. The gold plating increases corrosion resistance on terminals and increases connector durability. The TP sensor is mounted on the throttle body. As the TP sensor is rotated by the throttle shaft, four operating conditions are determined by the PCM from the TP. Those conditions are closed throttle (includes idle or deceleration), part throttle (includes cruise or moderate acceleration), wide open throttle (includes maximum acceleration or de-choke on crank), and throttle angle rate.

PCM Inputs

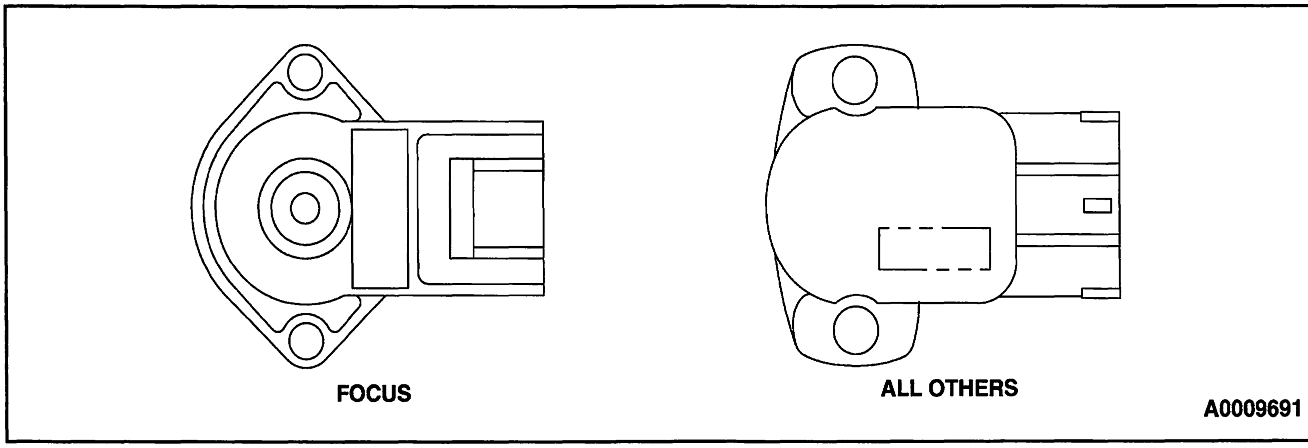


Figure 49: Typical Throttle Position (TP) Sensor

Transmission Control Switch

The transmission control switch (TCS) (Figure 50) and (Figure 51) signals the PCM with keypower whenever the TCS is pressed. On vehicles with this feature, the transmission control indicator lamp (TCIL) lights when the TCS is cycled to disengage overdrive. The operator of the vehicle controls the position of the TCS.

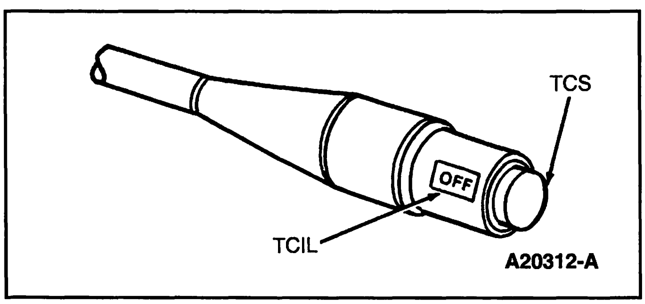


Figure 50: Transmission Control Switch (TCS)

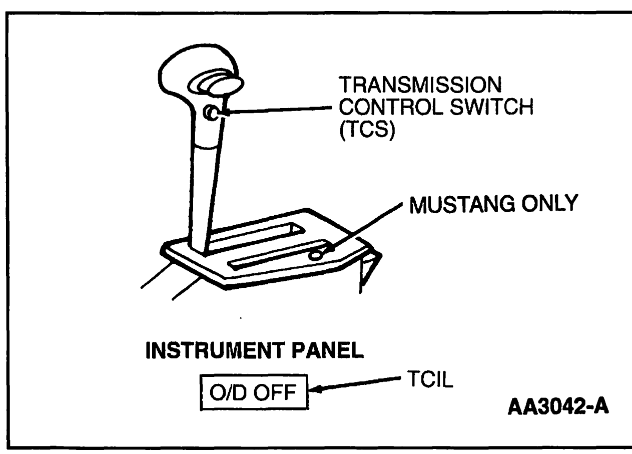


Figure 51: Transmission Control Switch (TCS)

PCM Inputs

Vehicle Speed Sensor

The vehicle speed sensor (VSS) (Figure 52) is a variable reluctance or Hall-effect sensor that generates a waveform with a frequency that is proportional to the speed of the vehicle. If the vehicle is moving at a relatively low velocity, the sensor produces a signal with a low frequency. As the vehicle velocity increases, the sensor generates a signal with a higher frequency. The PCM uses the frequency signal generated by the VSS (and other inputs) to control such parameters as fuel injection, ignition control, transmission/transaxle shift scheduling and torque converter clutch scheduling.

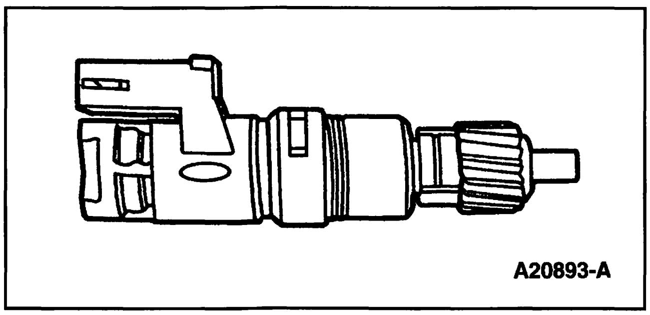


Figure 52: Typical Vehicle Speed Sensor (VSS)

4x4 Mode Switch

The generic electronic module (GEM) or the 4x4 module (4x4M) provides the PCM with an indication of 4x4L. This input is used to adjust the shift schedule. A 5.0 volt module pull-up indicates 4x4H or 2WD (Figure 53).

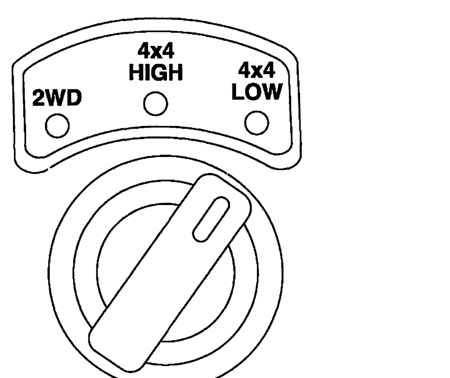


Figure 53: Typical 4x4 Switch

PCM Outputs

Note: Transmission outputs which are not described in this section are discussed in the Transmission/Powertrain Group, transmission section in the Workshop Manual.

Canister Vent Solenoid

For information on the canister vent solenoid, refer to the description of the Evaporative Emission System.

Coil Pack

A coil in a coil pack (Figure 54) is turned on (for example is coil charging) by the PCM, and is turned off when firing two spark plugs at once. The spark plugs are paired so that as one spark plug fires on the compression stroke, the other spark plug fires on the exhaust stroke. The next time the coil is fired the order is reversed. The next pair of spark plugs fire according to the engine firing order.

Coil On Plug

The coil on plug (COP) (Figure 55) ignition operates similar to standard coil pack ignition except each plug has one coil per plug. COP has three different modes of operation: engine crank, engine running, and CMP Failure Mode Effects Management (FMEM).

Engine Crank/Engine Running

During engine crank the PCM will fire two spark plugs simultaneously. Of the two plugs simultaneously fired one will be under compression the other will be on the exhaust stroke. Both plugs will fire until camshaft position is identified by a successful camshaft position sensor signal. Once camshaft position is identified, only the cylinder under compression will be fired.

CMP FMEM

During CMP FMEM the COP ignition works the same as during engine crank. This allows the engine to operate without the PCM knowing if cylinder one is under compression or exhaust.

PCM Outputs

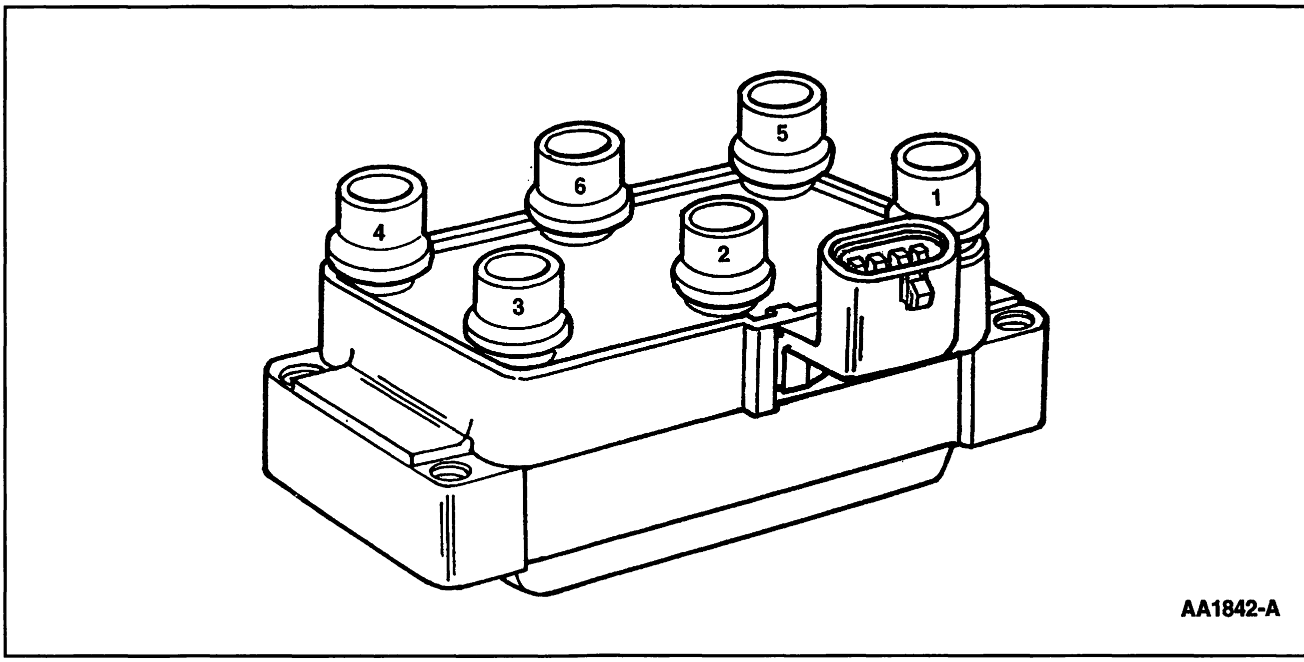


Figure 54: Six-Tower Coil Pack

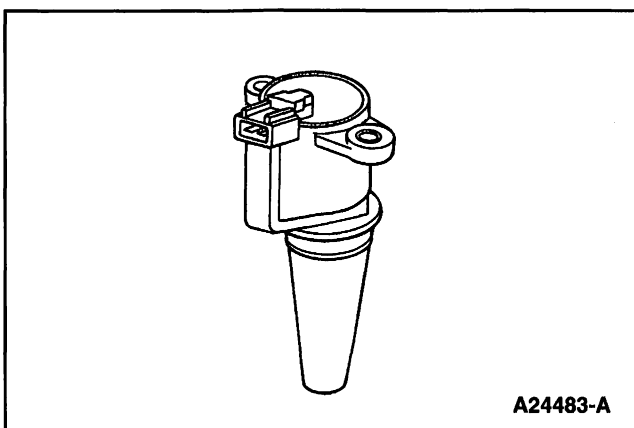


Figure 55: Coil On Plug

Electric Motor EGR System (EEGR)

For information on the EEGR system, refer to the description and operation section. Electric Exhaust Gas Recirculation (EEGR) System Monitor

EGR System Module (ESM)

For information on the ESM system, refer to the description and operation section. Electric Exhaust Gas Recirculation (EEGR) System Monitor

PCM Outputs

EGR Vacuum Regulator Solenoid

For information on the EGR vacuum regulator (EVR) solenoid, refer to the description of the Exhaust Gas Recirculation Systems.

Electric Secondary Air Injection Pump

For information on the electric secondary air injection pump, refer to the description of the Secondary Air Injection Systems.

Evaporative Emission Canister Purge Valve

For information on the Evaporative Emission (EVAP) canister purge valve, refer to the description of the Evaporative Emission Systems.

Fan Control

The PCM monitors certain parameters (such as engine coolant temperature, vehicle speed, A/C on/off status, A/C pressure, etc) to determine engine cooling fan needs.

For Variable Speed Electric Fan(s):

The PCM controls the fan speed and operation using a duty cycle output on the Fan Control - Variable (FCV) circuit. The fan controller (located at or integral to the engine cooling fan assembly) receives the FCV command and operates the cooling fan at the speed requested (by varying the power applied to the fan motor).

CROWN VICTORIA/GRAND MARQUIS, TOWN CAR: FCV DUTY CYCLE OUTPUT FROM PCM (negative duty cycle)

FCV Duty Cycle Command (NEGATIVE (-) duty cycle)	Cooling Fan Response/Speed
0-<5%	Fan off, controller inactive
5-<10%	Fan off, controller is in active/ready state
10-90%	Linear speed increase from 20% to 100%
>90-<95%	100%
95-100%	Fan off

PCM Outputs

LS6/LS8, THUNDERBIRD: FCV DUTY CYCLE OUTPUT FROM PCM

FCV Duty Cycle Command (positive (+) duty cycle)	Cooling Fan Response/Speed
0-4%	100% (default maximum)
4-6%	100% if duty cycle is increasing 0% (off) if duty cycle is decreasing
6-12%	0% (off)
12-16%	20% if duty cycle is increasing 0% if duty cycle is decreasing
16-90%	Linear speed increase from 20% to 100%
90-100%	100% (default maximum)

For Relay Controlled Fans:

The PCM controls the fan operation through the Fan Control (FC) (single speed fan applications), Low Fan Control (LFC), Medium Fan Control (MFC) and/or High Fan Control (HFC) outputs.

For three speed fans, although the PCM output circuits are called low, medium and high fan control (FC), cooling fan speed is controlled by a combination of these outputs. Refer to the table below.

2.0L FOCUS (with A/C) and TAURUS/SABLE: PCM FC OUTPUT STATE FOR COOLING FAN SPEEDS

PCM OUTPUT	LOW SPEED	MEDIUM SPEED	HIGH SPEED	FAN OFF
LFC (FC1)	ON	ON	ON	OFF
MFC (FC2)	ON	OFF	ON	OFF
HFC (FC3)	ON	OFF	OFF	OFF

2.0L ESCAPE: PCM FC OUTPUT STATE FOR COOLING FAN SPEEDS

PCM OUTPUT	LOW SPEED	MEDIUM SPEED	HIGH SPEED	FAN OFF
LFC (FC1)	ON	ON	ON	OFF
MFC (FC2)	OFF	ON	OFF (or ON)	OFF
HFC (FC3)	OFF	OFF	ON	OFF

FREESTAR, MONTEREY: PCM FC OUTPUT STATE FOR COOLING FAN SPEEDS

PCM OUTPUT	LOW SPEED	MEDIUM SPEED	HIGH SPEED	FAN OFF
LFC (FC1)	OFF	ON	ON	OFF
MFC (FC2)	ON	OFF	ON	OFF
HFC (FC3)	ON	ON	ON	OFF

PCM Outputs

Fuel Cap Off Indicator Lamp

The Fuel Cap Off Indicator Lamp (FCIL) is an output signal that is controlled by the PCM and will illuminate when the strategy determines that there is a failure in the vapor management system due to the fuel filler cap not being sealed properly. This would be detected by the inability to pull vacuum in the fuel tank, after a fueling event.

Note: The Escape, Freestar/Monterey, Mustang, Thunderbird, Town Car, Lincoln LS6/LS8, Expedition and Navigator do not have a dedicated (separate) output wire from the PCM to the instrument cluster. The PCM commands the FCIL on and off through the BUS +/- circuits (SCP).

Fuel Pump

Applications Using a Fuel Pump Relay for Fuel Pump On/Off Control

The Fuel Pump (FP) is a PCM output signal that is used to control the electric fuel pump. With the electronic EC power relay contacts closed, vehicle power (VPWR) is sent to the coil of the fuel pump relay. For electric fuel pump operation, the PCM grounds the FP circuit, which is connected to the coil of the fuel pump relay. This energizes the coil and closes the contacts of the relay, sending B+ through the FP PWR circuit to the electric fuel pump. When the ignition key is turned on, the electric fuel pump runs for about one second, but is then turned off by the PCM if engine rotation is not detected.

For applications with two speed fuel pumps, a normally closed low speed fuel pump relay (Figure 56) is wired into the fuel pump ground circuit. With the low speed fuel pump relay contacts in the normally closed position, there is no extra resistance in the ground circuit for high speed operation. For low speed fuel pump operation, the PCM will ground the Low Fuel Pump (LFP) circuit, which opens the relay contacts. With the relay contacts open, the fuel pump ground circuit now passes through a resistor that is wired into the circuit.

PCM Outputs

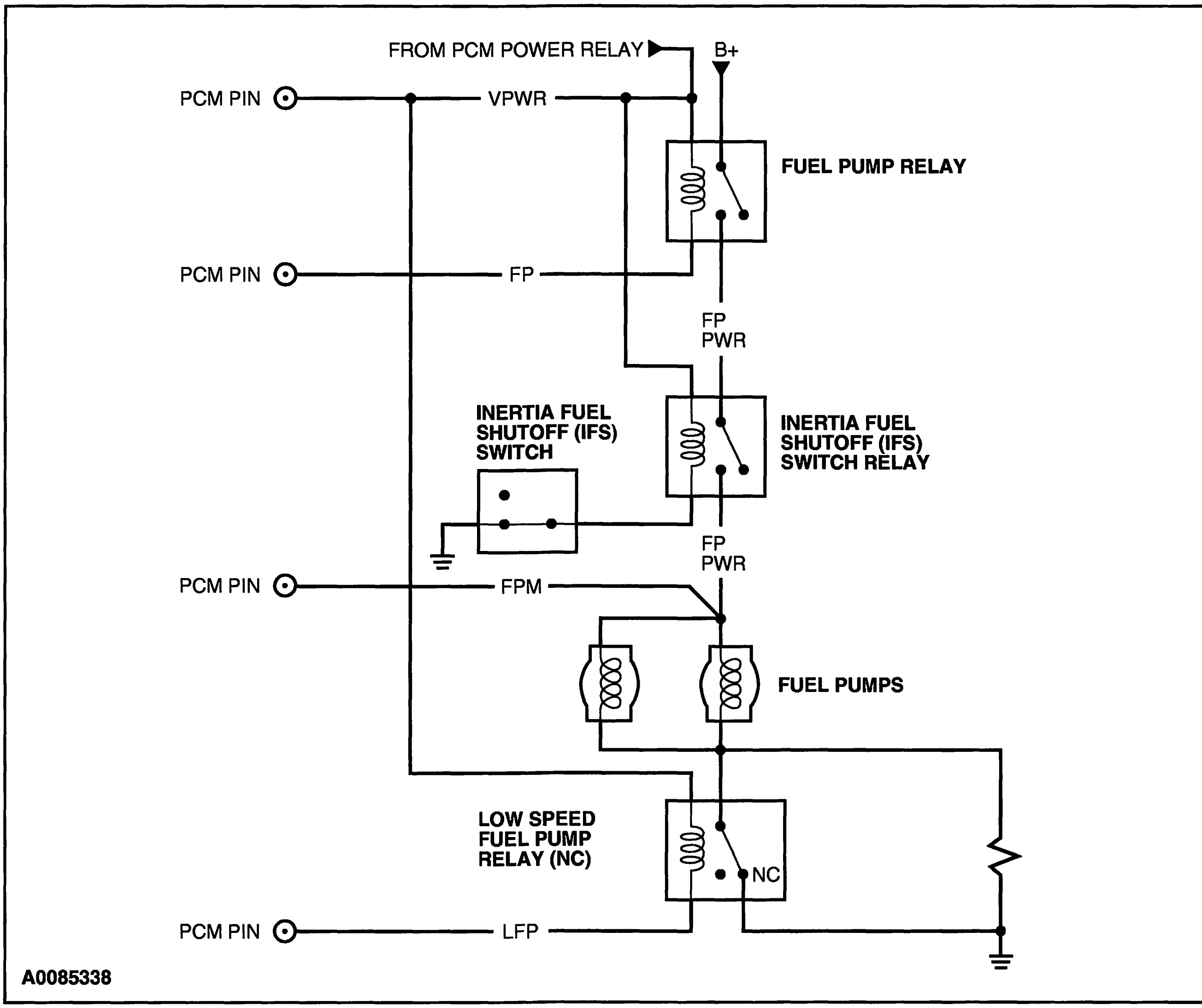


Figure 56: Low Speed Fuel Pump Relay Wiring

Fuel Pump Driver Module Applications (and Applications with Fuel Pump Functions Incorporated in Rear Electronic Module)

Note: For the Thunderbird and LS6/LS8, the FPDM functions are incorporated in the Rear Electronic Module (REM). Fuel pump operation is the same as applications using the stand-alone FPDM. The REM will, however, communicate diagnostic information through the BUS +/- circuits (SCP) instead of using a fuel pump monitor (FPM) circuit.

The Fuel Pump (FP) signal is a duty cycle command sent from the powertrain control module (PCM) to the fuel pump driver module (FPDM) (Table 2). The FPDM uses the FP command to operate the fuel pump at the speed requested by the PCM or to turn the pump off.

PCM Outputs

TABLE 2—FUEL PUMP DUTY CYCLE OUTPUT FROM PCM

FP Duty Cycle Command	PCM Status	FPDM Actions
0-5%	PCM will not output this duty cycle.	Invalid FP duty cycle. FPDM will send 25% duty cycle signal on the fuel pump monitor (FPM) circuit. The fuel pump will be off.
5-51%	Normal operation.	FPDM will operate the fuel pump at the speed requested. "FP duty cycle" x 2 = pump speed % of full on. (for example FP duty cycle = 42%. 42x2=84. Pump is run at 84% of full on). FPDM will send 50% duty cycle signal on FPM circuit.
51-67.5%	PCM will not output this duty cycle.	Invalid FP duty cycle. FPDM will send 25% duty cycle signal on the fuel pump monitor (FPM) circuit. The fuel pump will be off.
67.5-82.5%	To request the fuel pump off, the PCM will output a 75% duty cycle.	Valid fuel pump off command from PCM. FPDM will not operate the fuel pump. FPDM will send a 50% duty cycle signal on the FPM circuit.
82.5-100%	PCM will not output this duty cycle.	Invalid FP duty cycle. FPDM will send 25% duty cycle signal on the FPM circuit. The fuel pump will be off.

Note: Also refer to PCM Inputs, Fuel Pump Monitor and Powertrain Control Hardware, Fuel Pump Driver Module.

Fuel Injectors

For information on the fuel injectors, refer to the description of the Fuel Systems.

Fuel Pressure Regulator Control Solenoid

For information on the fuel pressure regulator control (FPRC) solenoid, refer to the description of the Fuel Systems.

Generator Communication (Gen Com)

For information on the generator (Gen Com), refer to the description of PCM/Controlled Charging System.

High Fan Control

For information on high fan control, refer to Fan Control.

Idle Air Control Solenoid

For information on the idle air control solenoid, refer to the description of the Intake Air Systems.

PCM Outputs

Intake Manifold Runner Control

For information on the intake manifold runner control, refer to the description of the Intake Air Systems.

Intake Manifold Swirl Control

For information on the intake manifold swirl control, refer to the description of the Intake Air Systems.

Intake Manifold Tuning Valve

For information on the intake manifold tuning valve, refer to the description of the Intake Air Systems.

Low Fan Control

For information on low fan control, refer to Fan Control.

Medium Fan Control

For information on medium fan control, refer to Fan Control.

Secondary Air Injection Bypass Solenoid

For information on the secondary air injection bypass solenoid, refer to the description of the Secondary Air Injection Systems.

Transmission Control Indicator Lamp

The transmission control indicator lamp (TCIL) is an output signal from the PCM that controls the lamp on/off function depending on the engagement or disengagement of overdrive. Refer to Transmission Control Switch in Hardware PCM Inputs.

Wide Open Throttle A/C Cut-Off (WAC)

The wide open throttle A/C cutoff relay (may be referred to as the A/C clutch relay) is wired normally open (normally closed for Aviator). There is no direct electrical connection between the A/C switch or EATC Module and the A/C clutch. The PCM will receive a signal indicating that A/C is requested (for some applications, this message is sent through the BUS + and BUS - circuits). When A/C is requested, the PCM will check other A/C related inputs that are available (such as ACP (SW), ACCS). If these inputs indicate A/C operation is OK, and the engine conditions are OK (such as coolant temperature, engine rpm, throttle position), the PCM will ground the WAC output (unground for Aviator), closing the relay contacts and sending voltage to the A/C clutch.

PCM Outputs

Vapor Management Valve (VMV)

For information on the vapor management valve (EVAP canister purge valve), refer to the description of the Evaporative Emission Systems.

Powertrain Control Module - Vehicle Speed Output (VSO)

The PCM-VSO (Powertrain Control Module - Vehicle Speed Output) speed signal subsystem generates vehicle speed information for distribution to the vehicle's electrical/electronic modules and subsystems that require vehicle speed data. This subsystem senses the transmission output shaft speed with a sensor. The data is processed by the PCM, and distributed as a hard-wired signal or as a message on the vehicle communication network (SCP or HS-CAN).

The key features of the PCM-VSO system are to:

- Infer vehicle movement from the output shaft sensor signal
- Convert transmission output shaft rotational information to vehicle speed information
- Compensate for tire size and axle ratio with a programmed calibration variable
- Utilize a transfer case sensor for four wheel drive applications
- Distribute vehicle speed information as a multiplexed message and/or an analog signal

The signal from a non-contact shaft sensor (Output Shaft Sensor--OSS or Transfer Case Shaft Sensor--TCSS) mounted on the transmission (automatics, manuals, or 4X4 transfer cases) is sensed directly by the PCM. The PCM converts the OSS or TCSS information to 8000 pulses per mile, based on a tire and axle ratio conversion factor. This conversion factor is programmed into the PCM at the time the vehicle is assembled and can be reprogrammed in the field for servicing changes in the tire size and axle ratio. The PCM transmits the computed vehicle speed and distance traveled information to all the vehicle speed signal users on the vehicle. VSO information can be transmitted by a hard-wired interface between the vehicle speed signal user and the PCM, or by Speed and Odometer data message via the vehicle communication network data link.

The VSO hard -wired signal wave form is a DC square wave with a voltage level of 0 to VBAT. Typical output operating range is 2.22 Hz per MPH (1.3808 Hz pr 1 Km/h).

Ignition Systems

Overview

The Ignition System is designed to ignite the compressed air/fuel mixture in an internal combustion engine by a high voltage spark from an ignition coil. The ignition system also provides engine timing information to the powertrain control module (PCM) for proper vehicle operation and misfire detection.

Integrated Electronic Ignition System

The Integrated Electronic Ignition (EI) system consists of a crankshaft position (CKP) sensor, coil pack(s), connecting wiring, and PCM. The Coil On Plug (COP) Integrated EI System uses a separate coil per spark plug and each coil is mounted directly onto the plug. The COP Integrated EI System eliminates the need for spark plug wires but does require input from the camshaft position (CMP) sensor. Operation of the components are as follows (Figure 57):

1. Note: Electronic Ignition engine timing is entirely controlled by the PCM. Electronic Ignition engine timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

   The CKP sensor is used to indicate crankshaft position and speed by sensing a missing tooth on a pulse wheel mounted to the crankshaft. The CMP sensor is used by the COP Integrated EI System to identify top dead center of compression of cylinder 1 to synchronize the firing of the individual coils.

2. The PCM uses the CKP signal to calculate a spark target and then fires the coil pack(s) to that target shown (Figure 58). The PCM uses the CMP sensor not shown in Figure 58 on COP Integrated EI Systems to identify top dead center of compression of cylinder 1 to synchronize the firing of the individual coils.

3. The coils and coil packs receive their signal from the PCM to fire at a calculated spark target. Each coil within the pack fires two spark plugs at the same time. The plugs are paired so that as one fires during the compression stroke the other fires during the exhaust stroke. The next time the coil is fired the situation is reversed. The COP system fires only one spark plug per coil and only on the compression stroke.

   The PCM acts as an electronic switch to ground in the coil primary circuit. When the switch is closed, battery positive voltage (B+) applied to the coil primary circuit builds a magnetic field around the primary coil. When the switch opens, the power is interrupted and the primary field collapses inducing the high voltage in the secondary coil windings and the spark plug is fired. A kickback voltage spike occurs when the primary field collapses. The PCM uses this voltage spike to generate an Ignition Diagnostic Monitor (IDM) signal. IDM communicates information by pulsewidth modulation in the PCM.

4. The PCM processes the CKP signal and uses it to drive the tachometer as the Clean Tach Out (CTO) signal.

Ignition Systems

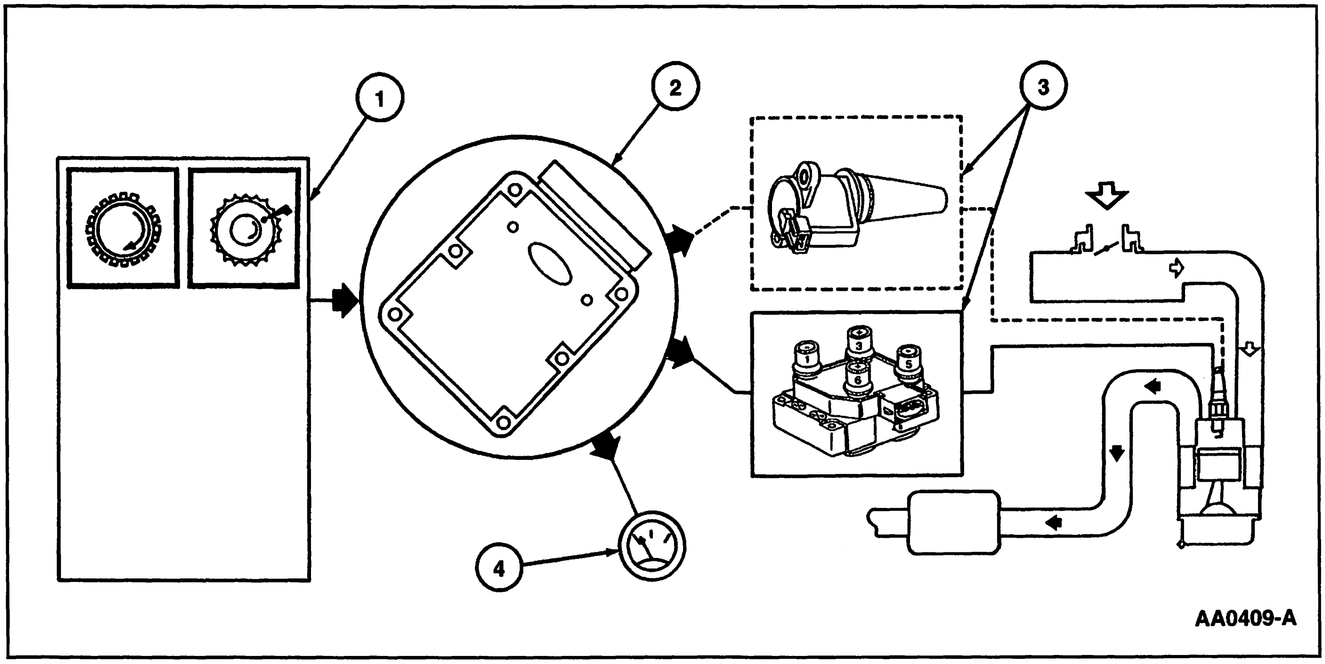


Figure 57: Ignition Systems—Integrated Electronic Ignition (Refer to the On Board Diagnostics Monitor System Overview for icon definitions.)

Ignition Systems

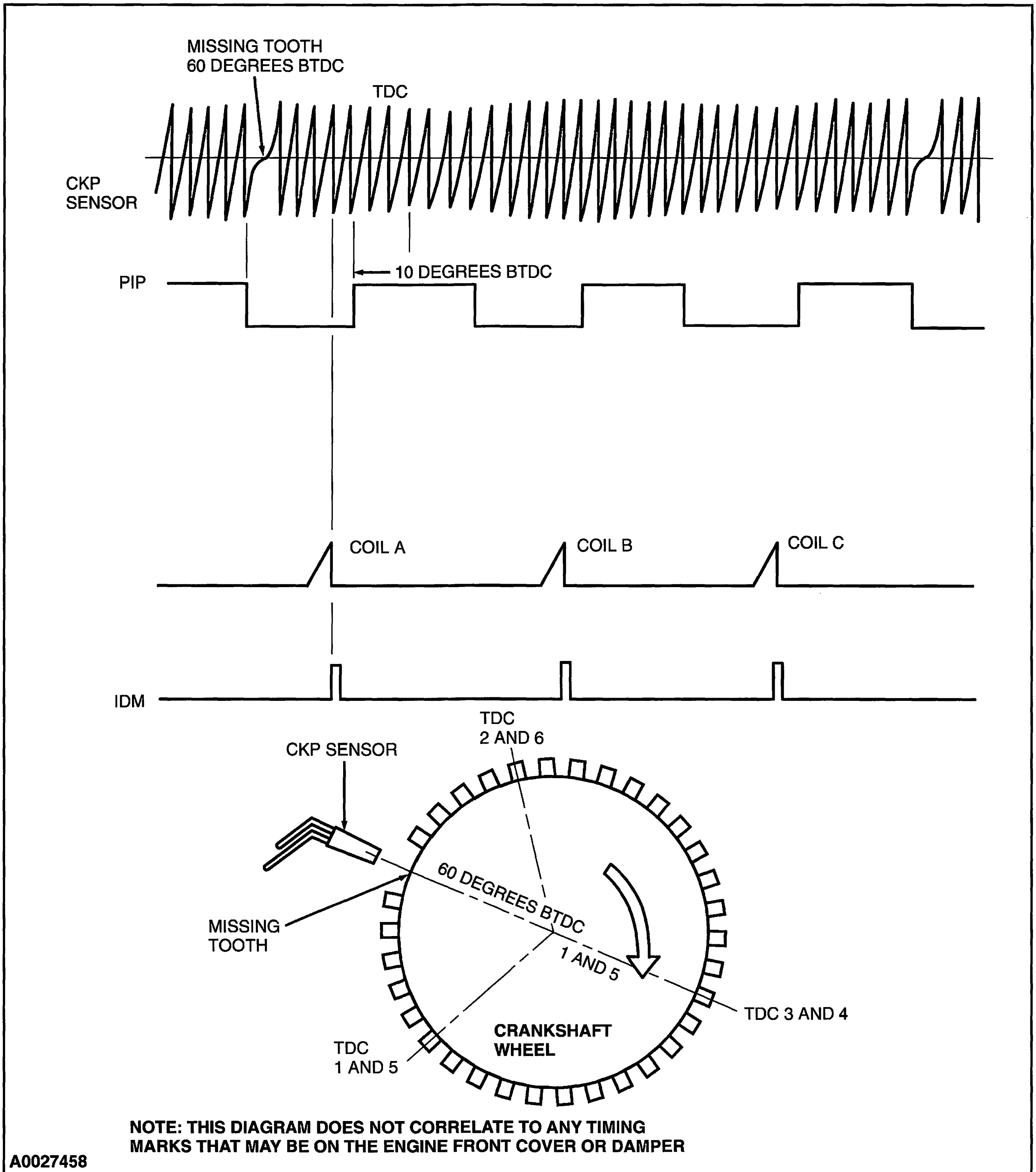


Figure 58: Six Cylinder Integrated Electronic (EI) Ignition Waveforms. Four, eight, and ten cylinder are similar.

Ignition Systems

Hardware

Crankshaft Position Sensor

The crankshaft position (CKP) sensor (Figure 59) is a magnetic transducer mounted on the engine block adjacent to a pulse wheel located on the crankshaft. By monitoring the crankshaft mounted pulse wheel, the CKP is the primary sensor for ignition information to the PCM. The pulse wheel has a total of 35 teeth spaced 10 degrees apart with one empty space for a missing tooth. The 6.8L ten cylinder pulse wheel has 39 teeth spaced 9 degrees apart and one 9 degree empty space for a missing tooth. By monitoring the pulse wheel, the CKP sensor signal indicates crankshaft position and speed information to the PCM. By monitoring the missing tooth, the CKP sensor is also able to identify piston travel in order to synchronize the ignition system and provide a way of tracking the angular position of the crankshaft relative to a fixed reference (Figure 57) for the CKP sensor configuration. The PCM also uses the CKP signal to determine if a misfire has occurred by measuring rapid decelerations between teeth.

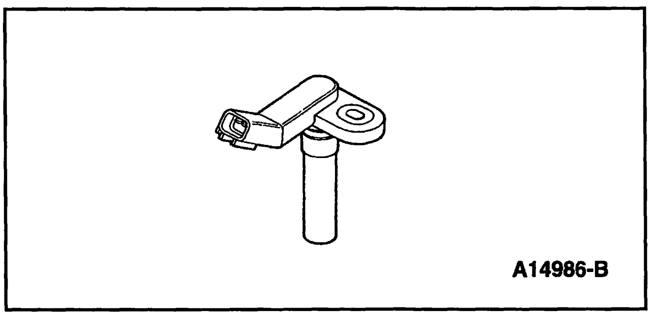


Figure 59: Typical Crankshaft Position (CKP) Sensor Actual Sensor May Vary

Camshaft Position Sensor

The camshaft position sensor (Figure 60) used by COP Integrated EI system is a magnetic transducer mounted on the engine front cover adjacent to the camshaft. By monitoring a target on the camshaft sprocket, the CMP sensor identifies cylinder one to the PCM. The COP Integrated EI system uses this information to synchronize the firing of the individual coils.

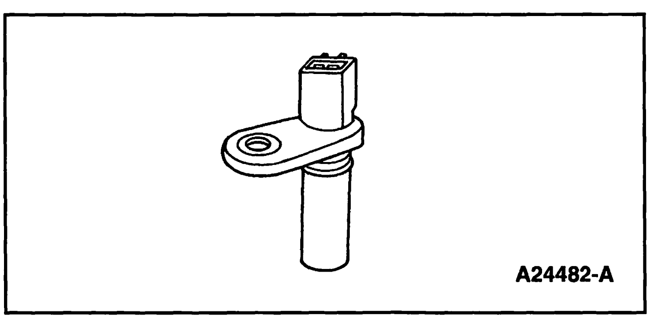


Figure 60: Camshaft Position (CMP) Sensor

Ignition Systems

Coil Pack

Coil packs come in four tower, Series 5 four tower, six-tower horizontal connector and Series 5 Six tower models. Two adjacent coil towers share a common coil and are called a matched pair. For six-tower coil pack (six cylinder) applications the matched pairs are 1 and 5, 2 and 6, and 3 and 4 (Figure 61) and (Figure 62). For four-tower coil pack (four cylinder) applications the matched pairs are 1 and 4, and 2 and 3 (Figure 63) and (Figure 64).

When the coil is fired by the PCM, spark is delivered through the matched pair towers to their respective spark plugs. The spark plugs are fired simultaneously and are paired so that as one fires on the compression stroke, the other spark plug fires on the exhaust stroke. The next time the coil is fired the situation is reversed. The next pair of spark plugs fire according to the engine firing order.

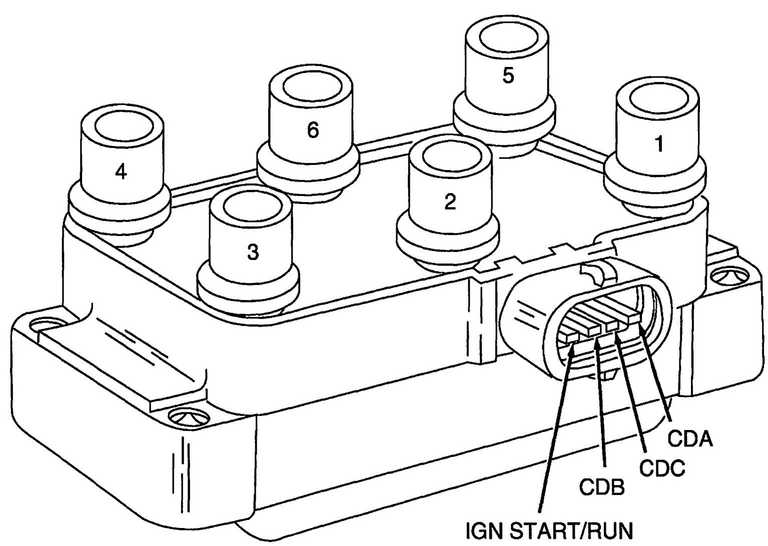


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Figure 61: Horizontal Connector Six Tower Coil Pack for 4.0L Ranger, 4.0L Explorer Sport Trac and 4.0L Explorer/Mountaineer

Ignition Systems

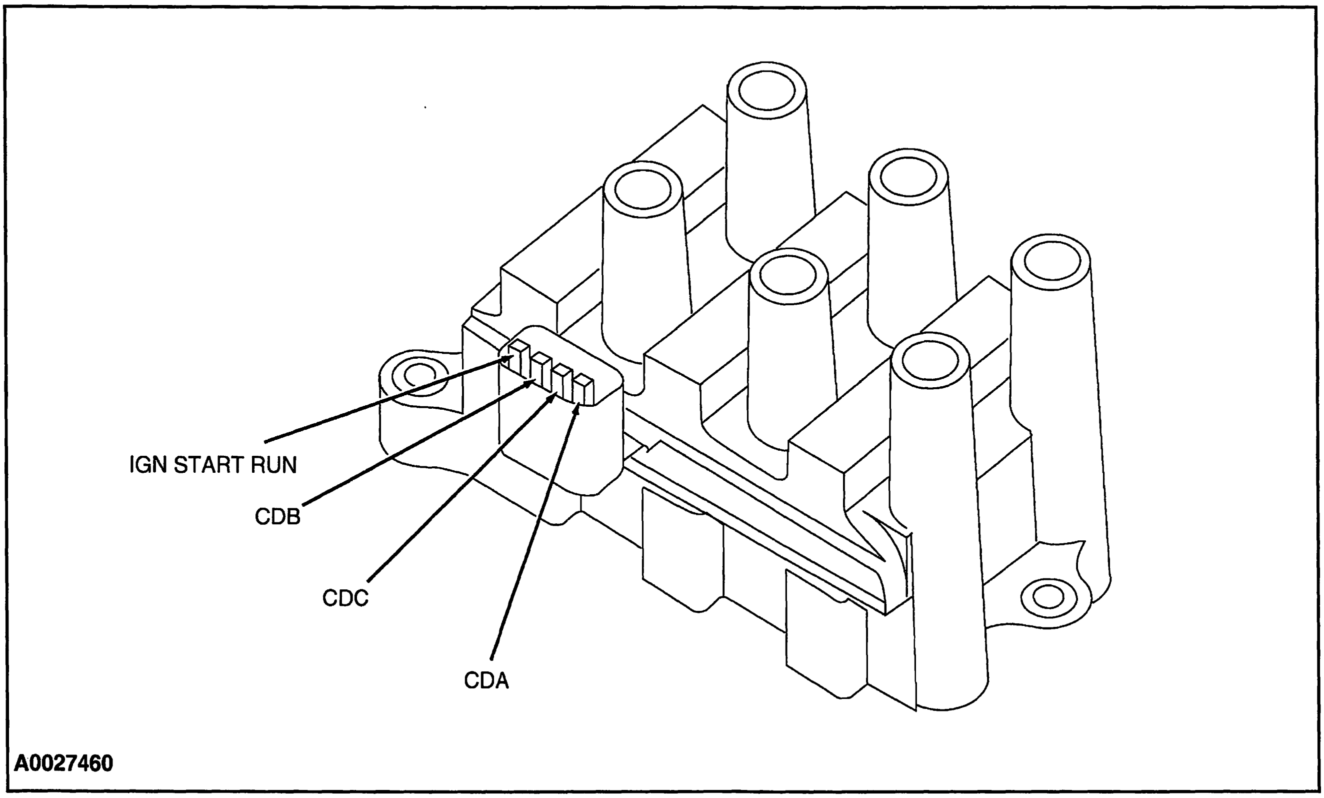


Figure 62: Series 5 Six Tower Coil Pack for 3.0L 2V Taurus/Sable, 3.8L/3.9L Mustang, 3.0L Ranger, Freestar/Monterey, 4.2L F Series

Ignition Systems

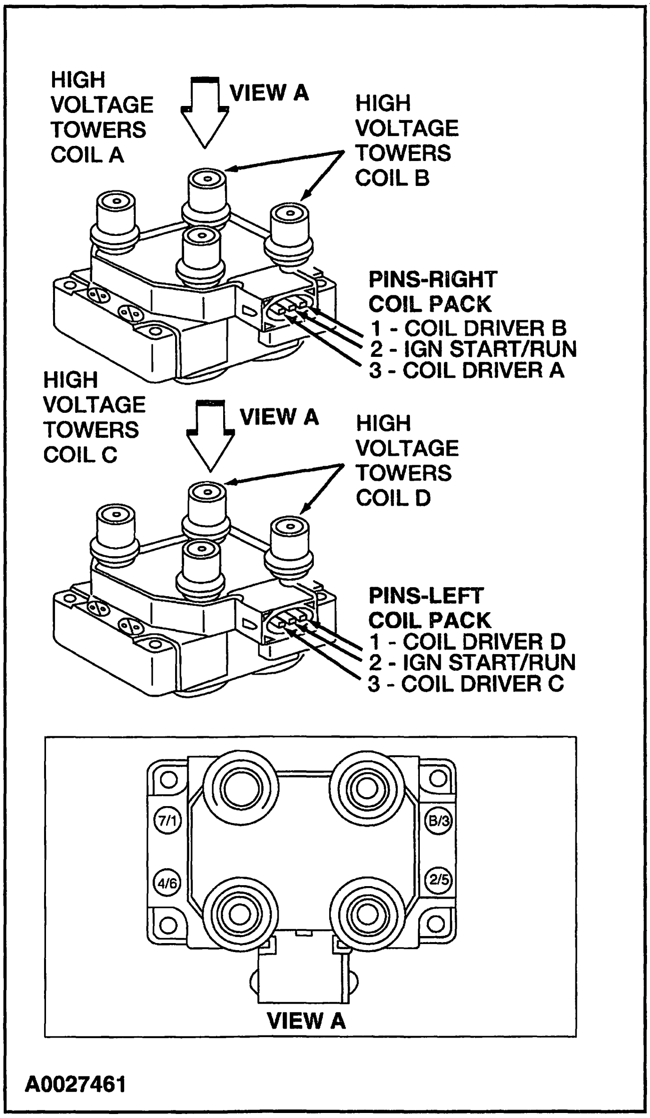


Figure 63: Four-Tower Coil Packs for Focus and 2.3L Ranger

Ignition Systems

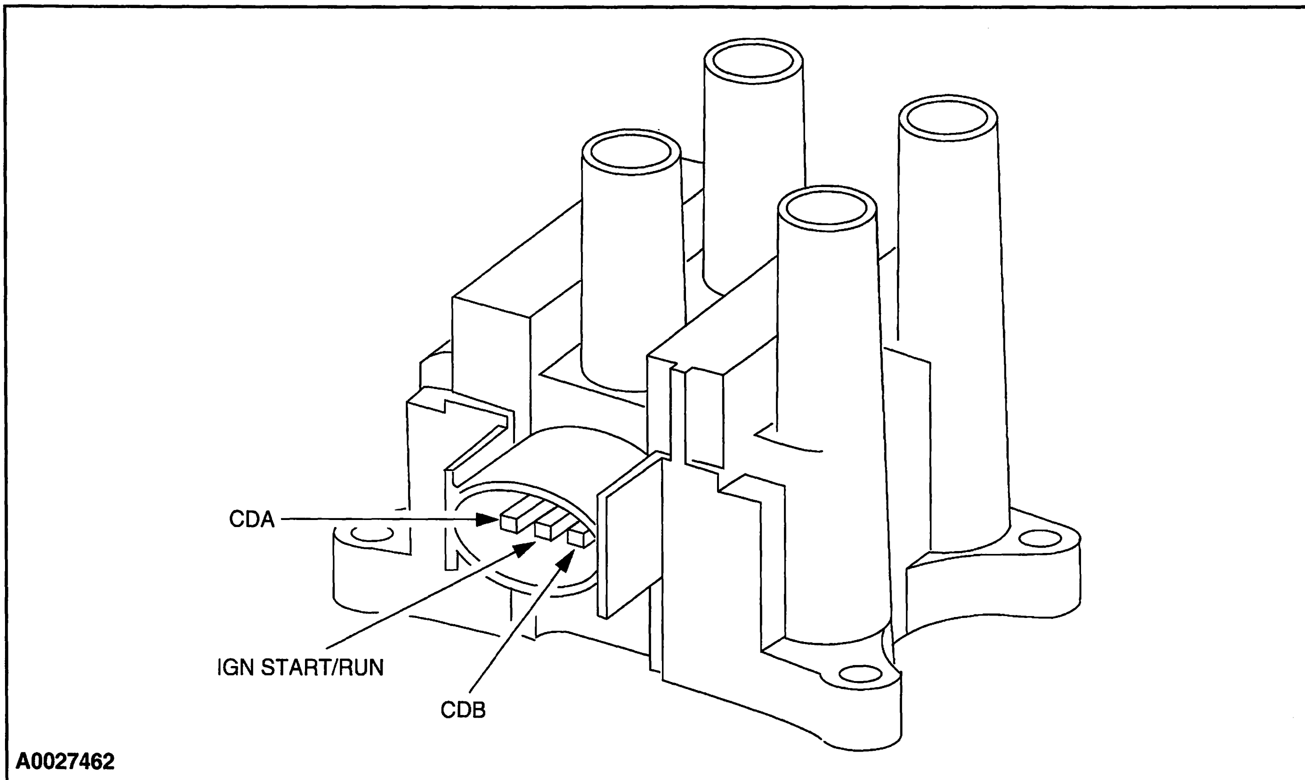


Figure 64: Series 5 Four Tower Coil Pack for 2.0L Escape

Coil On Plug

The coil on plug (COP) (Figure 65) ignition operates similar to standard coil pack ignition except each plug has one coil per plug. COP has three different modes of operation: engine crank, engine running, and CMP Failure Mode Effects Management (FMEM).

Engine Crank/Engine Running

During engine crank the PCM will fire two spark plugs simultaneously. Of the two plugs simultaneously fired one will be under compression the other will be on the exhaust stroke. Both plugs will fire until camshaft position is identified by a successful camshaft position sensor signal. Once camshaft position is identified only the cylinder under compression will be fired.

CMP FMEM

During CMP FMEM the COP ignition works the same as during engine crank. This allows the engine to operate without the PCM knowing if cylinder one is under compression or exhaust.

Ignition Systems

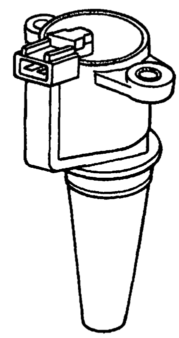


Figure 65: Coil On Plug for 3.0L Escape, 3.0L 4V Taurus, Thunderbird, LS6/LS8 , 4.6L Mustang, Crown Victoria/Grand Marquis, Town Car, 4.6L Explorer/Mountaineer, 4.6L/5.4L/6.8L E/F Series, Aviator, Expedition, Navigator, Excursion

Fuel Systems

Overview

The fuel system supplies the Sequential Multiport Fuel Injection (SFI) fuel injectors with clean fuel at controlled pressure. The powertrain control module (PCM) controls the fuel pump and monitors the fuel pump circuit. The PCM also controls the duration of the on/off cycle providing correct timing of the fuel injectors. If the injectors have been replaced, it is necessary to clear learned values contained in the Keep Alive Random Access Memory (RAM) in the PCM. This can be done by disconnecting the battery or the PCM for five minutes. (Refer to Section 2, Powertrain Control Module (PCM) Reset, for more information.)

The three types of fuel systems used are:

- Returnable Fuel
- Mechanical Returnless Fuel
- Electronic Returnless Fuel

Returnable Fuel System

The fuel system consists of a fuel tank with a reservoir, fuel pump module, fuel supply lines, fuel filter(s), schrader/pressure test point, fuel rail, fuel injectors, and fuel pressure regulator. Operation of the system is as follows (refer to (Figure 66) for all others):

1. The fuel delivery system uses the crankshaft position (CKP) sensor to signal the PCM that the engine is either cranking or running.
2. The fuel pump logic is defined in the Fuel System control strategy and is executed in the PCM. The PCM will ground the fuel pump relay for one second during key on and engine off. During crank the fuel pump relay is grounded as long as the PCM receives a CKP signal.
3. The fuel pump relay has a primary and a secondary circuit. The primary side is controlled by the PCM and the secondary side provides B+ to the fuel pump circuit when the relay is energized.
4. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery secondary circuit in the event of a collision. The IFS Switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).
5. The fuel injector is a solenoid-operated valve that meters fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by length of time the fuel injector is held open. The injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.
6. A pressure test point valve (schrader valve) is located on the fuel rail. This is used to measure fuel injector supply pressure for service and diagnostic procedures. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.

Fuel Systems

7. The fuel pressure regulator is attached to the fuel rail downstream of the fuel injectors. It regulates fuel pressure supplied to the fuel injectors. The fuel pressure regulator is a diaphragm-operated relief valve. One side of the diaphragm senses fuel pressure and the other side is connected to the intake manifold vacuum. Fuel pressure is established by a spring preload applied to the diaphragm. Balancing one side of the diaphragm with manifold vacuum maintains a constant fuel pressure drop across the fuel injectors. Fuel pressure is high when engine vacuum is low. Excess fuel is bypassed through the fuel pressure regulator and returned through the fuel return line to the fuel tank.

8. There are four filtering or screening devices in the fuel delivery system. The fuel intake sock or screen is a fine, nylon mesh mounted on the intake side of the fuel pump. There is a fuel filter screen located at the fuel rail side of the fuel injector. A fuel filter/screen is located in the inlet side of the fuel pressure regulator. The fuel filter assembly is located between the fuel pump and the pressure test point/schrader valve.

9. The fuel pump (FP) module is a device that contains both fuel pump and fuel sender assembly. The fuel pump is located inside the reservoir and supplies fuel through the fuel pump module manifold to the engine and the fuel pump module jet pump.

Note: Some vehicles have the relay located in the Power Distribution Box.

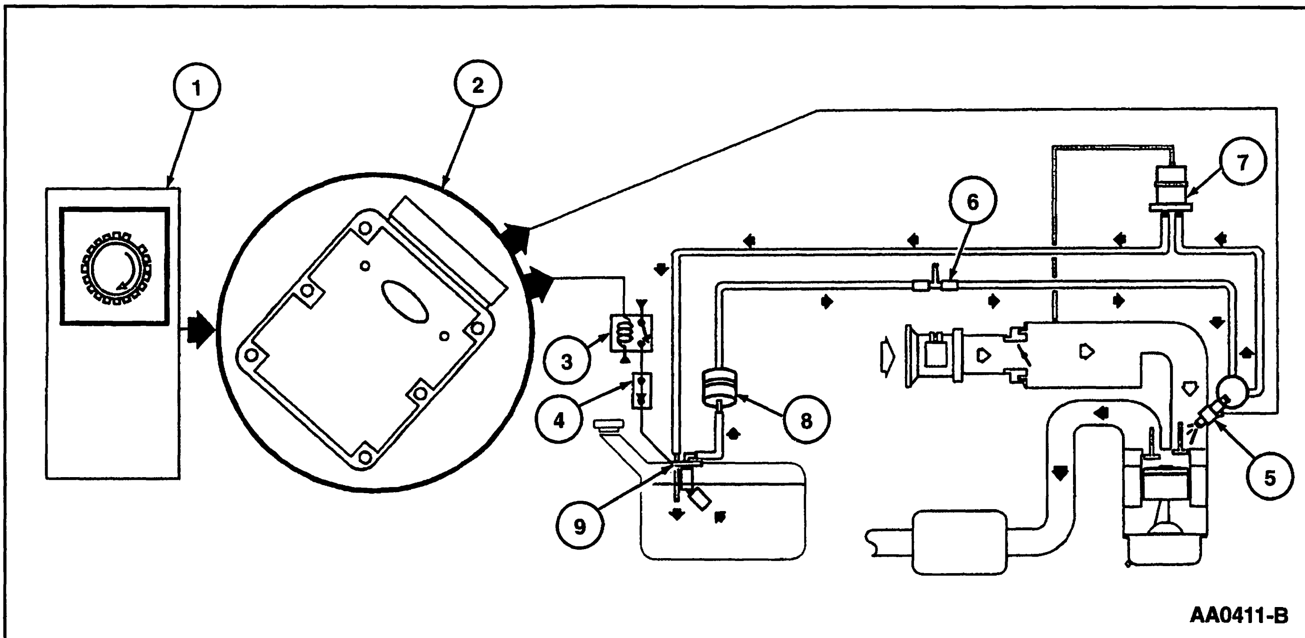


Figure 66: Fuel System - All others

Mechanical Returnless Fuel System

The fuel system consists of a fuel tank with reservoir, fuel pump, fuel pressure regulator, fuel filter, fuel supply line, fuel rail, fuel rail pulse damper, fuel injectors, and schrader/pressure test point. Operation of the system is as follows (Figure 67):

Fuel Systems

1. The fuel delivery system is enabled during crank or running mode once the PCM receives a crankshaft position (CKP) sensor signal.
2. The fuel pump logic is defined in the fuel system control strategy and is executed by the PCM.
3. The PCM grounds the fuel pump relay, which provides VPWR to the fuel pump.
4. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery secondary circuit in the event of collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).
5. A pressure test point valve (schrader valve) is located on the fuel rail. This is used to measure fuel injector supply pressure for diagnostic procedures and repairs. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.
6. Located on the fuel rail is a pulse damper. The pulse damper reduces fuel system noise caused by the pulsing of the fuel injectors. The vacuum port located on the damper is connected to manifold vacuum to avoid fuel spillage in the event the pulse damper diaphragm were to rupture (the pulse damper should not be confused with a fuel pressure regulator).
7. The fuel injector is a solenoid-operated valve that meters the fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open. The injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.
8. There are three filtering or screening devices in the fuel delivery system. The intake sock is a fine, nylon mesh screen mounted on the intake side of the fuel pump. There is a fuel filter screen located at the fuel rail side of the fuel injector. The fuel filter assembly is located between the fuel pump and the pressure test point/schrader valve.
9. The fuel pump (FP) module contains the fuel pump, fuel pressure regulator and the fuel sender assembly. The fuel pressure regulator is attached to the fuel pump in the fuel pump module located in the fuel tank. It regulates fuel pressure supplied to the fuel injectors. The fuel pressure regulator is a diaphragm-operated relief valve. Fuel pressure is established by a spring preload applied to the diaphragm. Excess fuel is bypassed through the regulator and returned to the fuel tank.

Fuel Systems

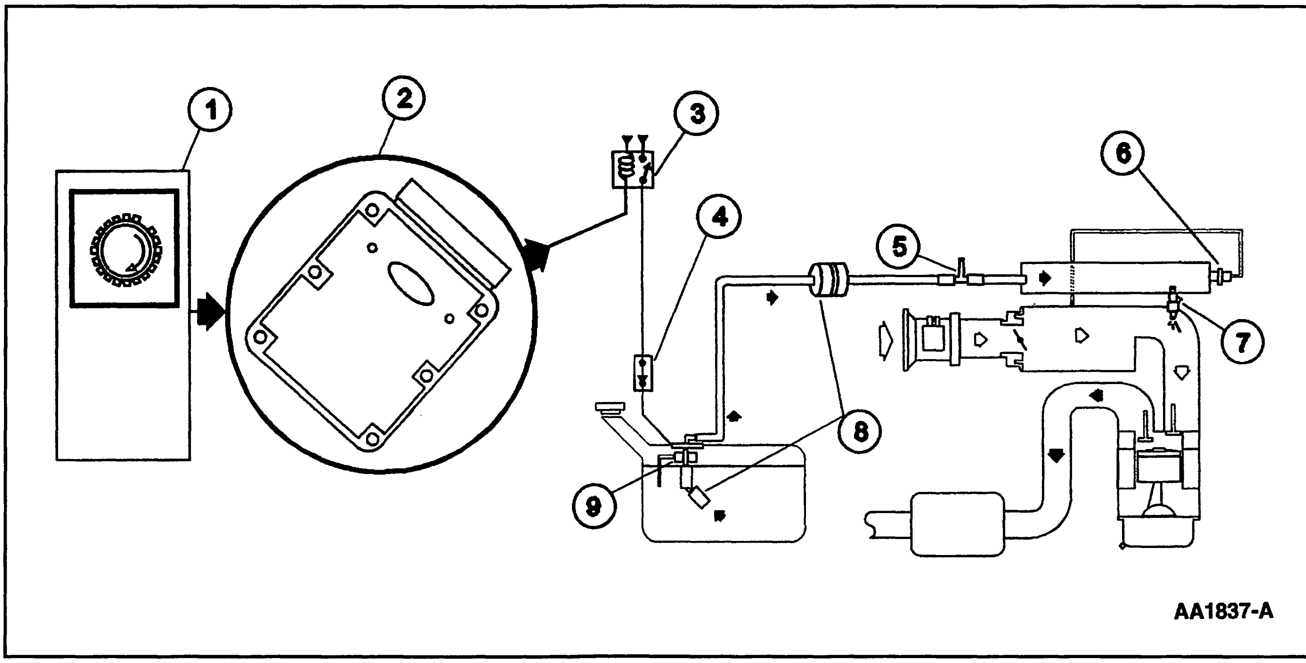


Figure 67: Fuel System—Mechanical Returnless

Electronic Returnless Fuel System

The fuel system consists of a fuel tank with reservoir, fuel pump, fuel rail pressure sensor, fuel filter, fuel supply line, engine fuel temperature sensor, fuel rail, fuel injectors, and schrader/pressure test point. Operation of the system is as follows (Figure 68) and (Figure 69):

1. The fuel delivery system is enabled during crank or running mode once the PCM receives a crankshaft position (CKP) sensor signal.
2. The fuel pump logic is defined in the fuel system control strategy and is executed by the PCM.
3. The PCM commands a duty cycle to the fuel pump driver module (FPDM).
4. The fuel pump driver module modulates the voltage to the fuel pump (FP) to achieve the proper fuel pressure. Voltage for the fuel pump is supplied by the power relay or FPDM power supply relay. (For additional information on FPDM operation, refer to PCM Outputs—Fuel Pump and PCM Inputs—FPM.)
5. The fuel rail pressure (FRP) sensor provides the PCM with the current fuel rail pressure. The PCM uses this information to vary the duty cycle output to the FPDM to compensate for varying loads.
6. The engine fuel temperature (EFT) sensor measures current fuel temperatures in the fuel rail. This information is used to vary the fuel pressure and avoid fuel system vaporization.

Fuel Systems

7. The fuel injector is a solenoid-operated valve that meters the fuel flow to each combustion cylinder. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open. The injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.
8. A pressure test point valve (schrader valve) is located on the fuel rail. This is used to measure fuel injector supply pressure for diagnostic procedures and repairs. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.
9. There are three filtering or screening devices in the fuel delivery system. The intake sock is a fine, nylon mesh screen mounted on the intake side of the fuel pump. There is a fuel filter screen located at the fuel rail side of the fuel injector. The fuel filter assembly is located between the fuel pump and the pressure test point/schrader valve.
10. The fuel pump (FP) module is a device that contains the fuel pump and the fuel sender assembly. The fuel pump is located inside the reservoir and supplies fuel through the fuel pump module manifold to the engine and the fuel pump module jet pump.
11. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery secondary circuit in the event of a collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).

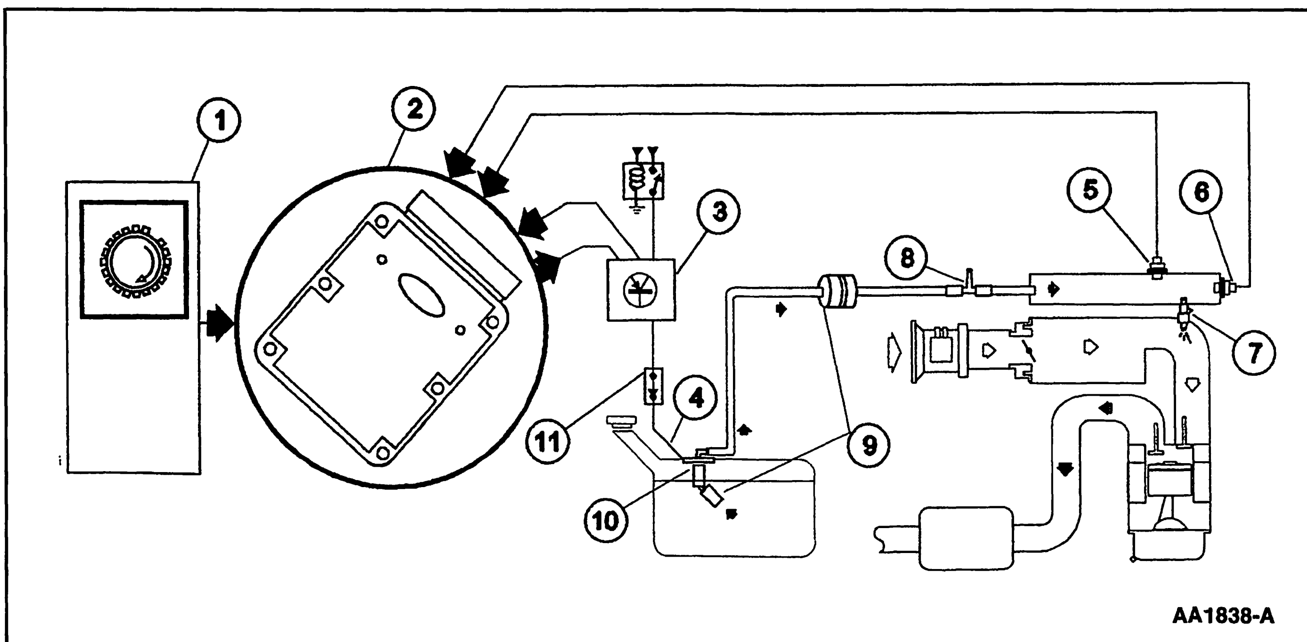


Figure 68: Fuel System—Electronic Returnless

Fuel Systems

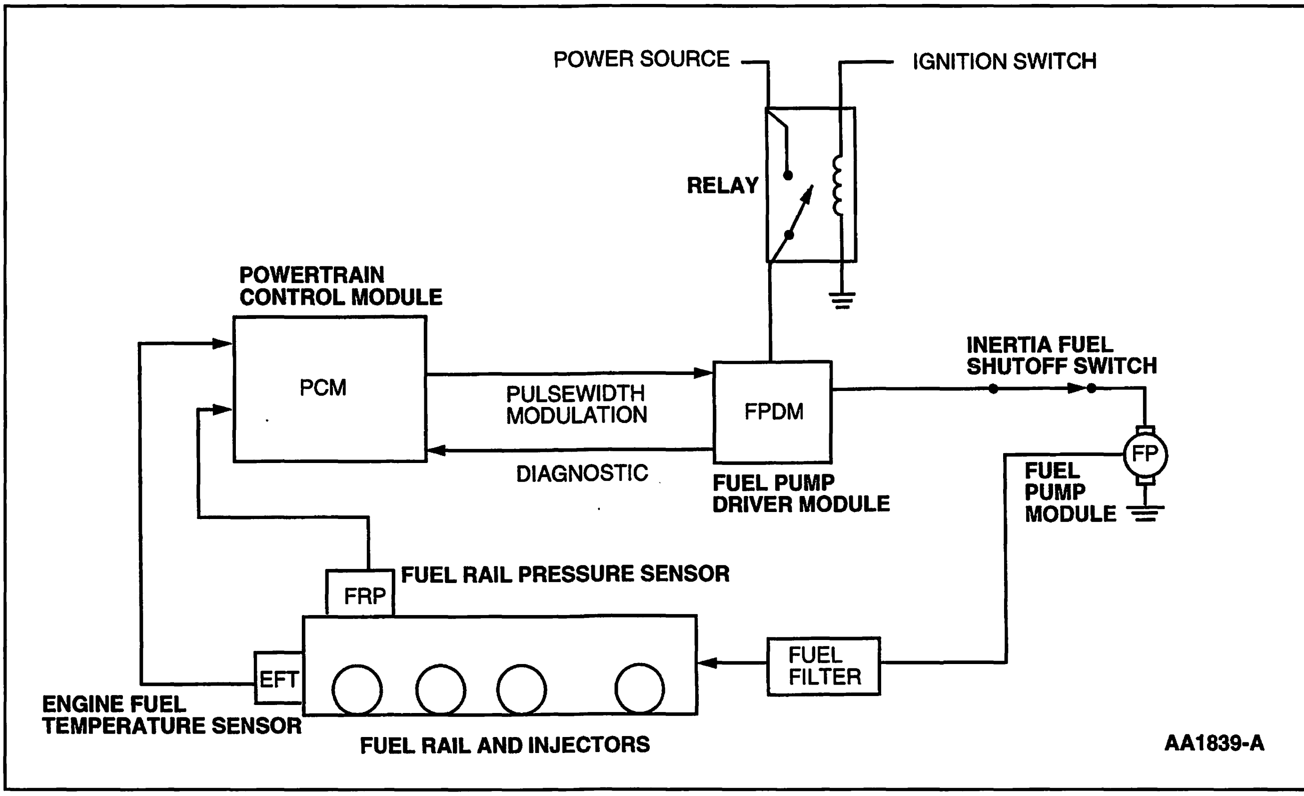


Figure 69: Typical Electronic Returnless Fuel System Schematic (NOTE: See wiring diagram for proper power source and relay usage.)

Fuel Pump and Reservoir

The fuel pump module (Figure 70) is mounted inside the fuel tank in a reservoir. The pump has a discharge check valve that maintains system pressure after the ignition key has been turned off to minimize starting concerns. The reservoir prevents fuel flow interruptions during extreme vehicle maneuvers with low tank fill levels.

Fuel Systems

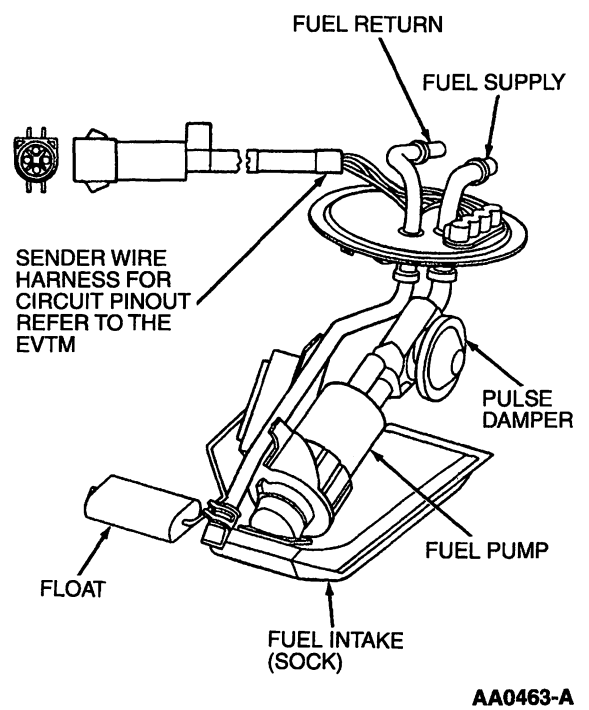


Figure 70: Fuel Pump Module

Fuel Pump Module

The fuel pump (FP) module (Figure 71),(Figure 72) and(Figure 73) is a device that contains the fuel pump and sender assembly. The fuel pump is located inside the FP module reservoir and supplies fuel through the FP module manifold to the engine and FP module jet pump. The jet pump continuously refills the reservoir with fuel, and a check valve located in the manifold outlet maintains system pressure when the fuel pump is not energized. A flapper valve located in the bottom of the reservoir allows fuel to enter the reservoir and prime the fuel pump during the initial fill.

Fuel Systems

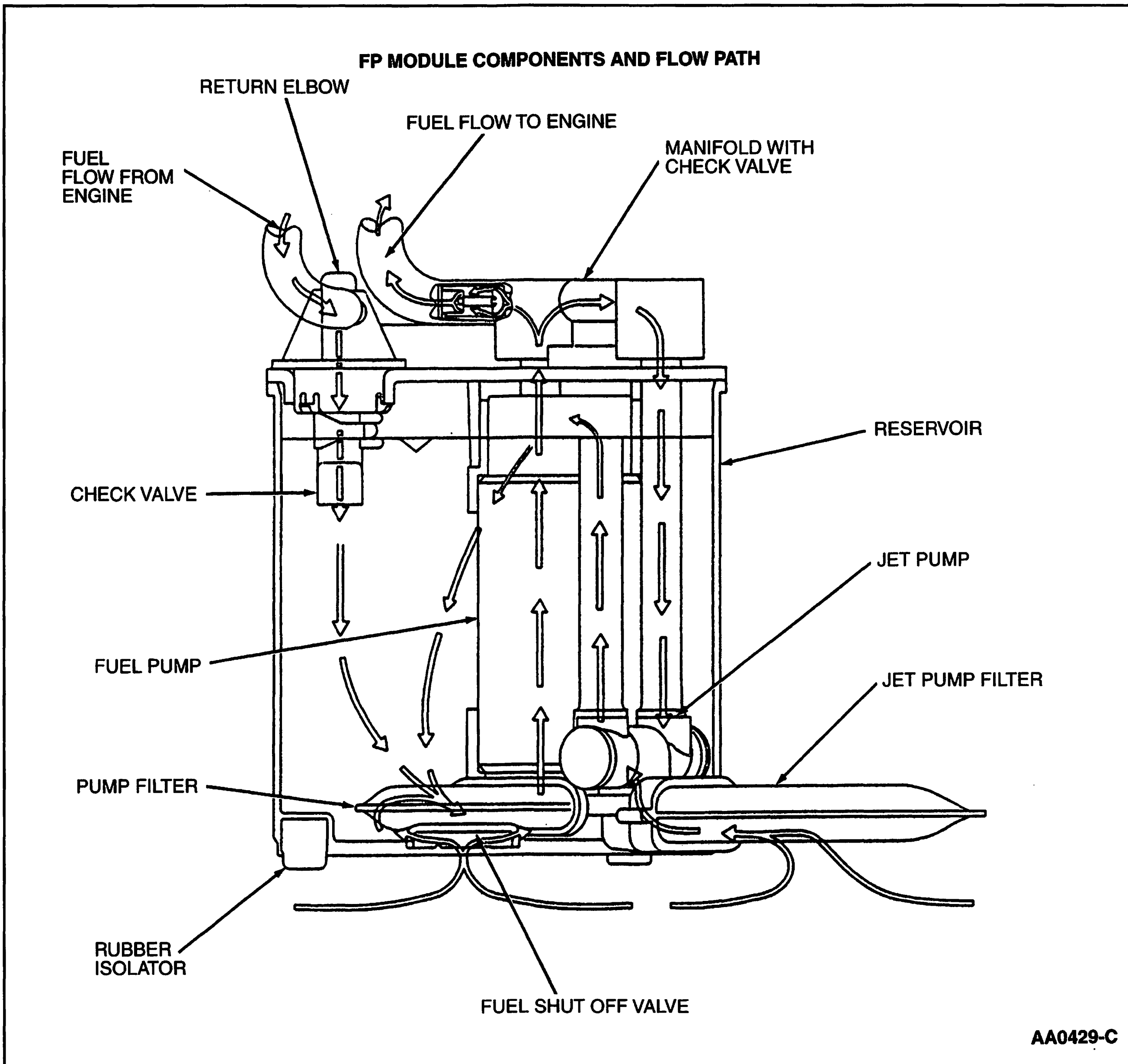


Figure 71: Fuel Pump Module (For Returnable Fuel Systems)

Fuel Systems

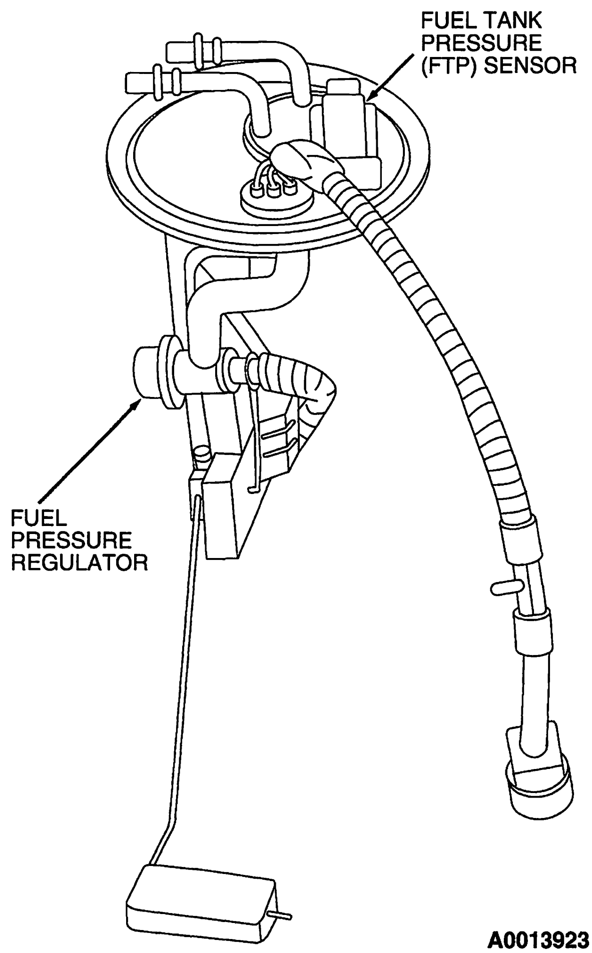


Figure 72: Mechanical Returnless Fuel Pump Module (FPM)

Fuel Systems

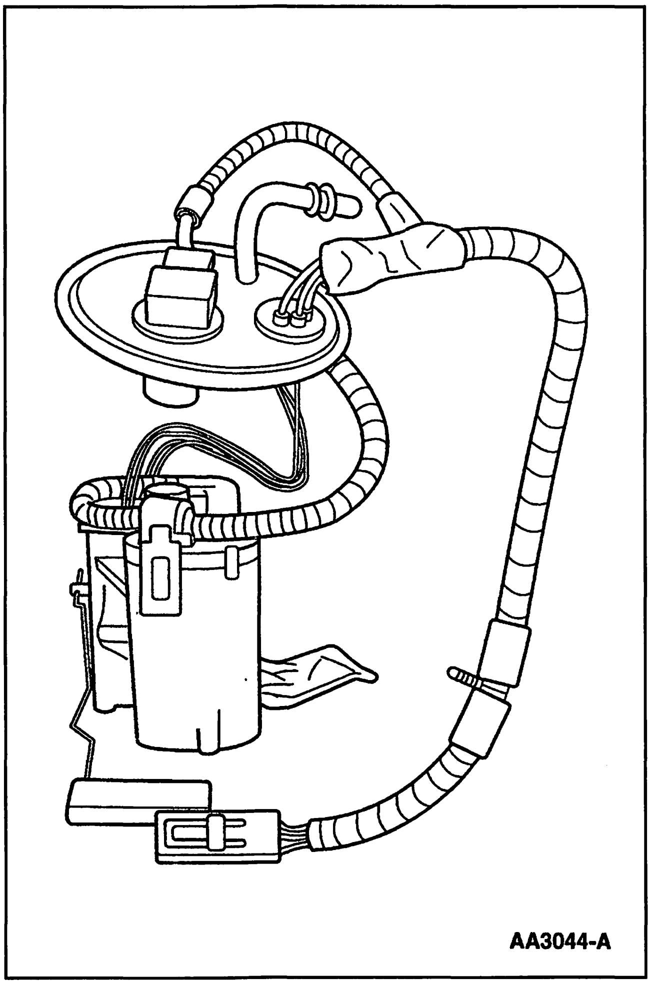


Figure 73: Electronic Returnless Fuel Pump Module (FPM)

Fuel Filters

The system contains four filtering or screening devices. Refer to the individual component pictorial for location.

1. The fuel intake sock or screen is a fine nylon mesh sock mounted on the intake side of the fuel pump. It is part of the assembly and cannot be serviced separately.
2. The filter/screen at the fuel rail port of the Injectors is part of the fuel injector assembly and cannot be serviced separately.
3. The filter/screen at fuel inlet side of the fuel pressure regulator is part of the regulator assembly and cannot be serviced separately.

Fuel Systems

4. The fuel filter assembly is located between the fuel pump (tank) and the pressure test point (schrader valve) or Injectors. This filter may be serviced.

Pressure Test Point

There is a pressure test point with a schrader fitting in the fuel rail that relieves fuel pressure and measures the fuel injector supply pressure for service and diagnostic procedures. Before servicing or testing the fuel system, read any CAUTION, WARNING, and HANDLING information. ON VEHICLES NOT EQUIPPED WITH A SCHRADER VALVE, USE ROTUNDA FUEL PRESSURE TEST KIT #134—R0087 OR EQUIVALENT.

Fuel Injector

The fuel injector (Figure 74) is a solenoid-operated valve that meters fuel flow to the engine. The fuel injector is opened and closed a constant number of times per crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open.

The fuel injector is normally closed and is operated by 12 volt VPWR from the electronic engine control power relay. The ground signal is controlled by the PCM.

CAUTION

Do not apply battery positive voltage (B+) directly to the fuel injector electrical connector terminals. The solenoids may be damaged internally in a matter of seconds.

The injector is the deposit resistant injection (DRI) type and does not have to be cleaned. However, it can be flow checked and, if found outside of specification, the fuel injector should be replaced.

Fuel Systems

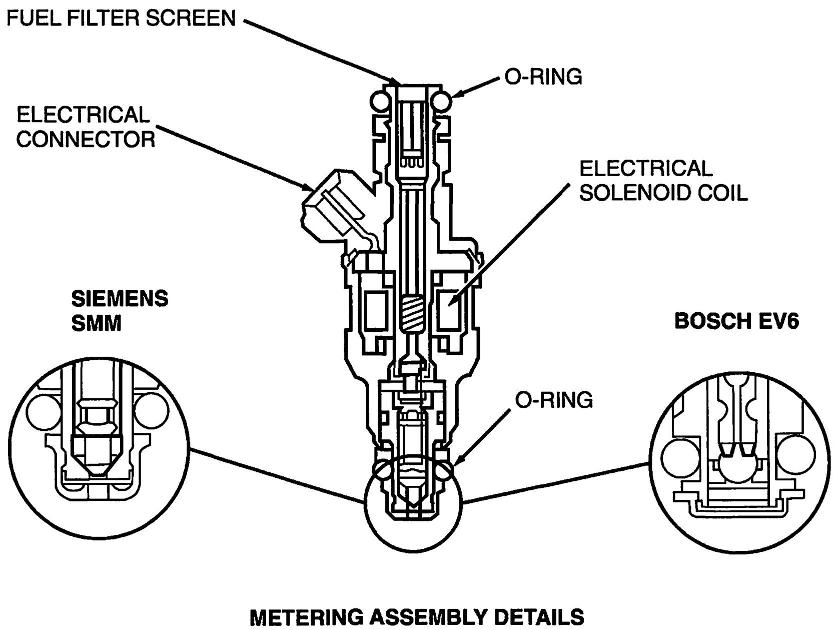


Figure 74: Fuel Injectors

Fuel Pressure Regulator

The fuel pressure regulator (Figure 75) is attached to the fuel rail downstream of the fuel injectors. It regulates fuel pressure supplied to the fuel injectors. The regulator is a diaphragm-operated relief valve. One side of the diaphragm senses fuel pressure and the other side is connected to the intake manifold vacuum. Fuel pressure is established by a spring preload applied to the diaphragm. Balancing one side of the diaphragm with manifold vacuum maintains a constant fuel pressure drop across the fuel injectors. Fuel pressure is high when engine vacuum is low. Excess fuel is bypassed through the fuel pressure regulator and returned through the fuel return line to the fuel tank.

Fuel Systems

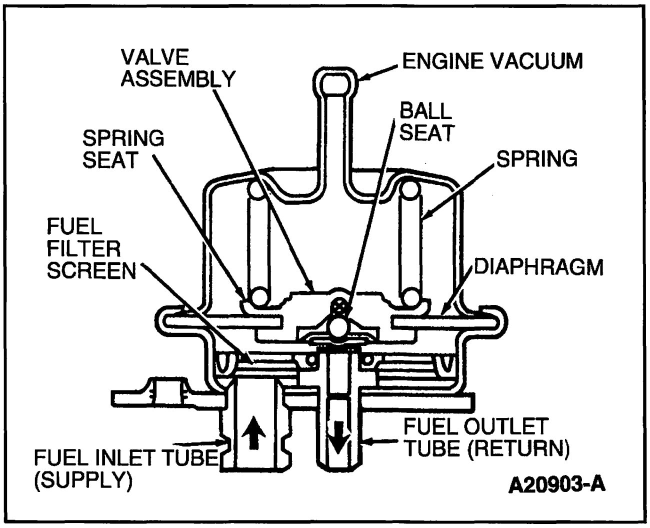


Figure 75: Fuel Pressure Regulator

Fuel Rail Pulse Damper

The fuel rail pulse damper located on the fuel rail reduces fuel system noise caused by the pulsing of the fuel injectors. The vacuum port located on the damper is connected to manifold vacuum to avoid fuel spillage in the event the pulse damper diaphragm were to rupture. **(The pulse damper should not be confused with a fuel pressure regulator, it does not regulate fuel rail pressure.)**

Inertia Fuel Shutoff (IFS) Switch

Inertia Fuel Shutoff (IFS) Switch

The inertia fuel shutoff (IFS) switch (Figure 76) is used in conjunction with the electric fuel pump. The purpose of the IFS switch is to shut off the fuel pump if a collision occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and shuts off the electric fuel pump. **Once the switch is open, it must be manually reset before restarting the vehicle**. Refer to the Owner Guide for the location of the IFS.

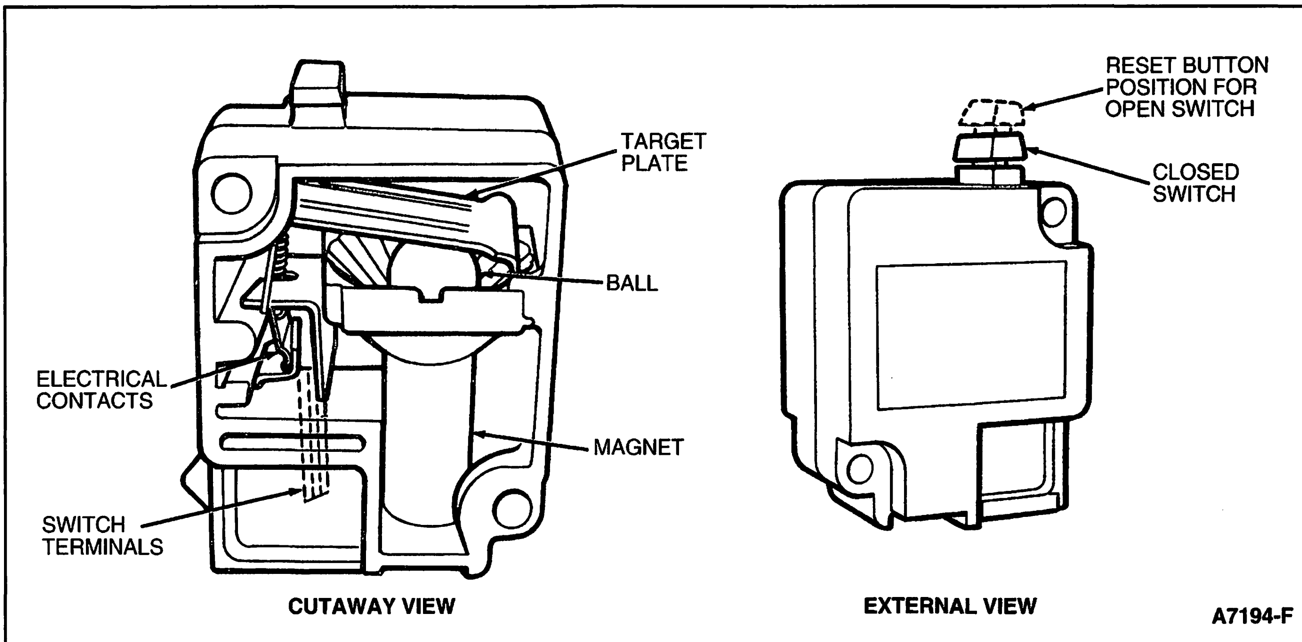


Figure 76: Inertia Fuel Shutoff (IFS) Switch

Natural Gas Fuel System

Overview

The Fuel System provides a means of transporting clean fuel from the fuel tank to the fuel injectors under a controlled pressure.

Natural Gas Fuel System

The fuel system consists of a fuel tank, fuel shut-off valve assemblies, fuel supply lines, fuel filter, schrader/service valve, manual fuel shut-off valve, fuel rail, and fuel pressure regulator. Operation of the system is as follows (Figure 77),(Figure 78) and (Figure 79):

1. The fuel delivery system uses the crankshaft position (CKP) sensor to signal the PCM that the engine is either cranking or running.
2. The fuel shut-off valve logic is defined in the Fuel System control strategy and is executed in the PCM. The PCM will ground the fuel pump relay for one second during key on and engine off. During crank the fuel pump relay is grounded as long as the PCM receives a signal from the CKP.
3. The fuel pump relay has a primary and a secondary circuit. The primary side is controlled by the PCM and the secondary side provides B+ to the fuel shut-off valve circuit when the relay is energized.
4. The inertia fuel shut-off (IFS) switch is used to de-energize the fuel delivery circuit in the event of a collision. The IFS switch is a safety device that should only be reset after a thorough inspection of the vehicle (following a collision).
5. The fuel injector is used to meter natural gas to each combustion cylinder. Although the NG fuel injector appears very similar to some gasoline fuel injectors, it is unique. Flow capacity of this fuel injector is 6 to 12 times as large as various gasoline fuel injectors.
6. The fuel tank shut-off solenoid valve is located in the fuel tank. The solenoid valves are on the same circuit as the fuel pump and utilize the same inertia fuel shut-off (IFS) switch as gasoline.
7. The high pressure fuel filter is used to protect the engine fuel system components. A natural gas coalescing and particulate filter is positioned on the high pressure side of the fuel system just prior to the fuel pressure regulator.
8. The fuel pressure regulator used on the NG vehicle is a single-staged pressure reducing regulator which expands natural gas from storage pressures of 1,379 to 20,685 kPa (200 to 3,000 psig) to engine fuel pressures of 724 to 862 kPa (105 to 125 psig).
9. The fuel rail shut-off valve is a normally closed solenoid actuated valve that opens when grounded by the PCM. The valve isolates the fuel injectors from fuel line pressure when the engine is not operating. The fuel rail shut-off valve is wired in parallel with the fuel tank shut-off solenoid valves.

Natural Gas Fuel System

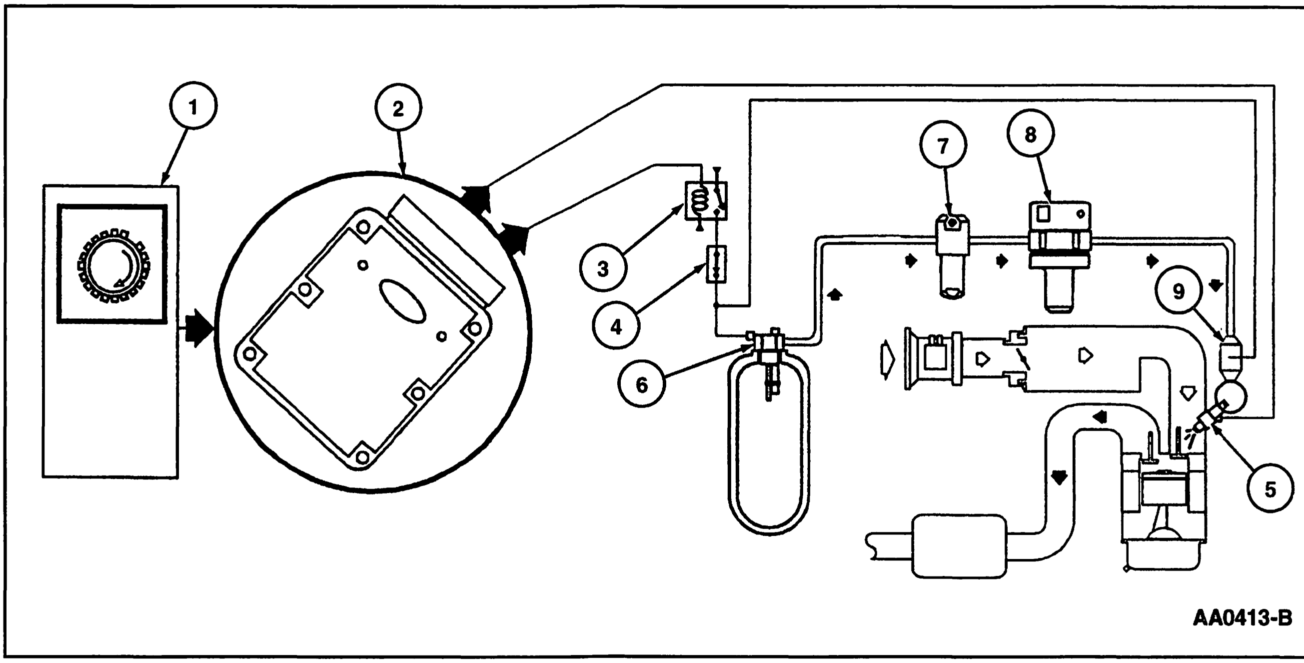


Figure 77: Natural Gas Fuel System

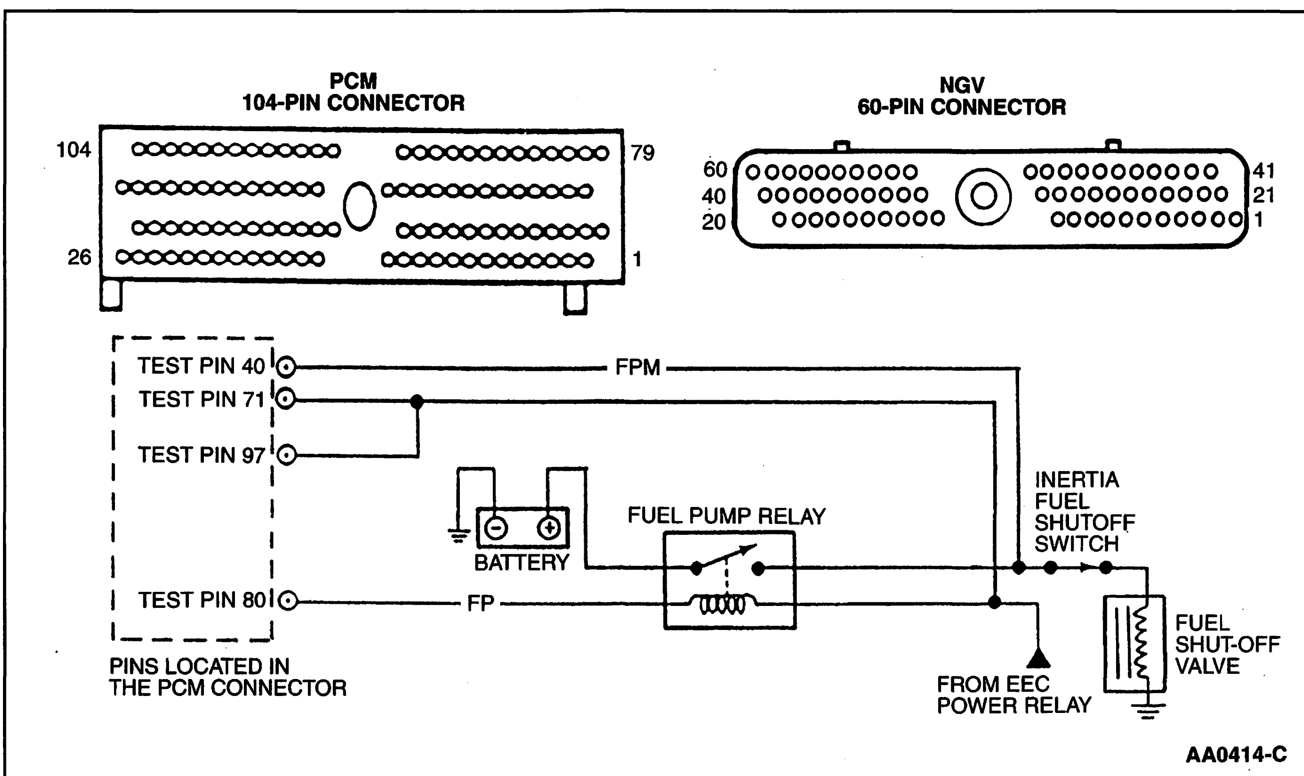


Figure 78: Natural Gas Fuel System Electrical Schematic—Typical

Natural Gas Fuel System

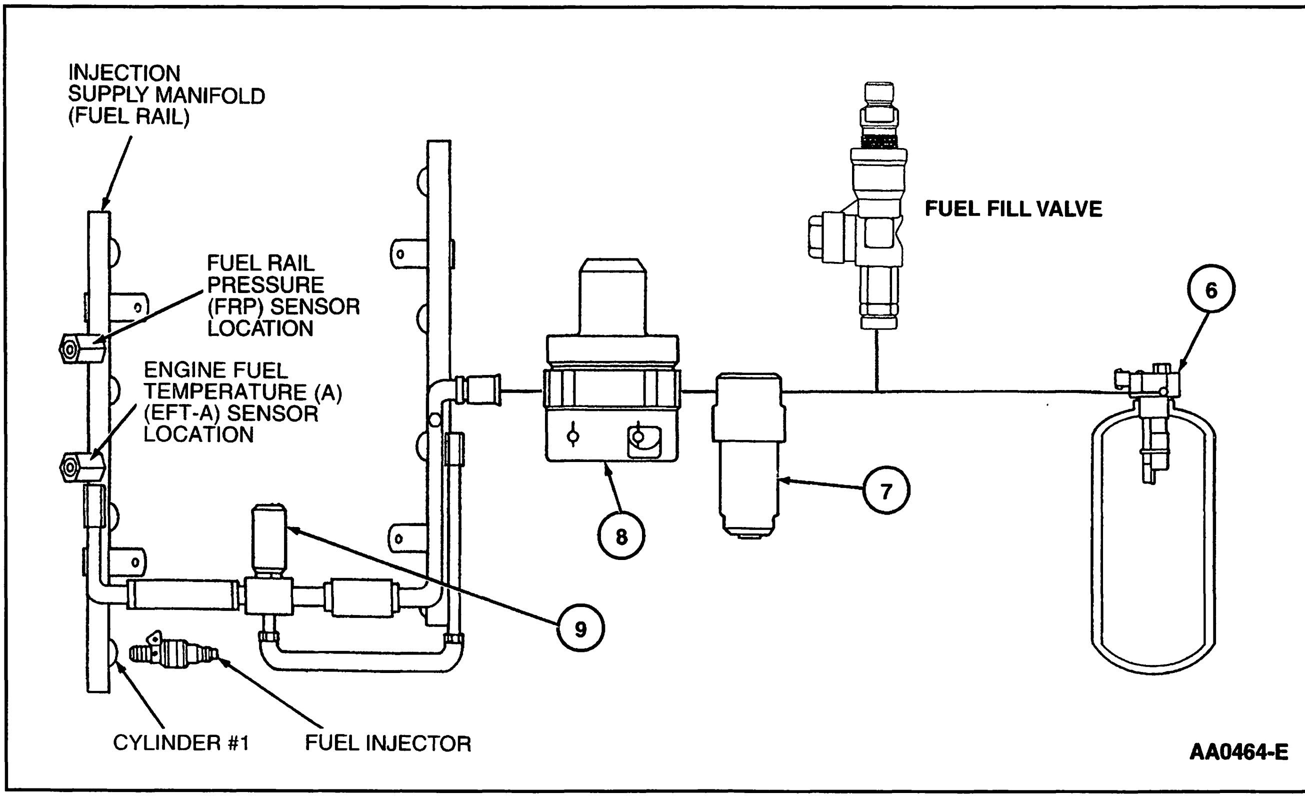


Figure 79: Natural Gas Fuel System

Hardware

Fuel Rail

The fuel rail (Figure 80) distributes low pressure fuel from the chassis supply line to each fuel injector. Fuel pressure at the top of each fuel injector is maintained within 1% of the other fuel injectors at all times; this is done with nearly symmetric flow paths. The fuel rail is also designed to have minimal flow restriction by increasing the cross-sectional flow area and reducing the flow path length. The fuel rail contains several other parts in assembly (PIA) components that perform crucial functions. These include:

— **Injection pressure sensor** which measures the pressure of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulsewidth and meter fuel to each engine combustion cylinder.

— **Engine fuel temperature sensor** which measures the pressure of the fuel near the fuel injectors. This signal is used by the PCM to adjust the fuel injector pulsewidth and meter fuel to each engine combustion cylinder.

Natural Gas Fuel System

— **Low pressure solenoid shut-off valve** which isolates the fuel rail from the upstream fuel system when the engine is OFF. This minimizes the amount of fuel available to flow through the fuel injectors when the engine is off or leak from a damaged fuel rail during and after a crash. The valve is controlled by the PCM fuel shut-off valve circuit and contains an inertia switch. The valve is only on for one second after a key-on or whenever CKP signals are being received by the PCM.

— **schrader/service valve** (if equipped) provides a service port to the low pressure fuel system. This valve is needed to relieve the pressure in the system before and during service. This valve could also be used to monitor the pressure near the injectors during diagnostic procedures.

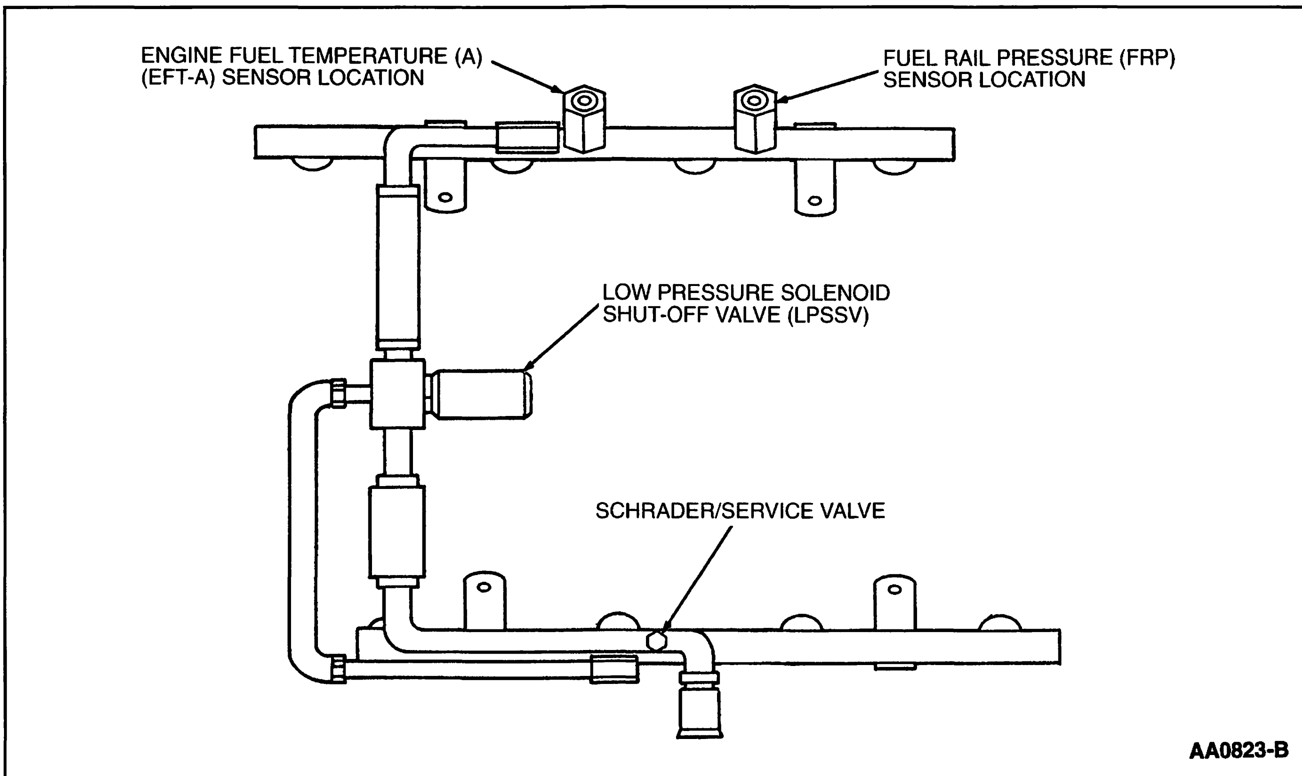


Figure 80: Fuel Rail Components

Fuel Injector(s)

The fuel injector (Figure 81) is a solenoid-operated valve that meters fuel flow to the engine. The fuel injector is opened and closed every other crankshaft revolution. The amount of fuel is controlled by the length of time the fuel injector is held open.

The fuel injector is normally closed and is operated by 12 volt VPWR from the power relay. The ground signal is controlled by the PCM.

Natural Gas Fuel System

The fuel injectors are used to meter natural gas to each combustion cylinder. Although the natural gas fuel injectors appear very similar to some gasoline fuel injectors, they are unique. Flow capacity of these fuel injectors is 6 to 12 times as large as various gasoline fuel injectors. Electrical resistance is much lower than typical gasoline fuel injectors (4.6 ohms as opposed to 14.5 ohms). To accommodate this lower resistance, a fuel injector driver module is used to convert the PCM fuel injector driver signal to the signal required by the fuel injector.

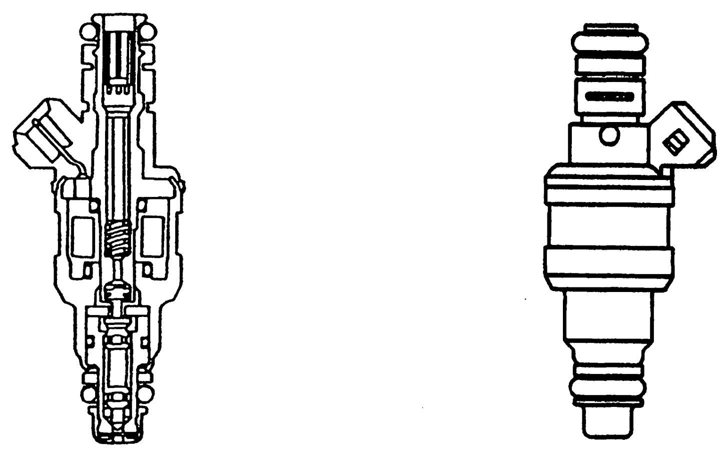


Figure 81: Fuel Injector

Fuel Pressure Regulator

The fuel pressure regulator (Figure 82) used in the Natural Gas fuel system is a single-stage pressure reducing regulator which expands natural gas from storage pressures of 1,379 to 20,685 kPa (200 to 3,000 psig) to engine fuel injector pressures of 724 to 862 kPa (105 to 125 psig).

The regulator contains a pressure relief device, a 1,896 kPa (275 psig) check valve, which protects the low pressure fuel system. The low pressure fuel system no longer must fulfill the design requirements of the high pressure fuel system, therefore reducing cost, weight and complexity.

When gas expands, the fuel temperature drops significantly causing extreme cold temperatures (-177°C or -160°F) that may damage synthetic fuel system components as well as cause water vapor within the fuel to condense, freeze and plug the lines, valve and injectors. To prevent this, engine coolant is routed through the fuel pressure regulator to warm the fuel before it expands.

The regulator has an internal thermostat in its coolant bowl to control the flow of engine coolant. This prevents overheating and subsequent thinning of the fuel which may cause lean combustion. Outlet coolant flow is restricted by the thermostat when it rises above approximately 82°C (100°F). If service of the coolant bowl and/or thermostat is required, the coolant bowl and thermostat are serviced separately (9G735)

Natural Gas Fuel System

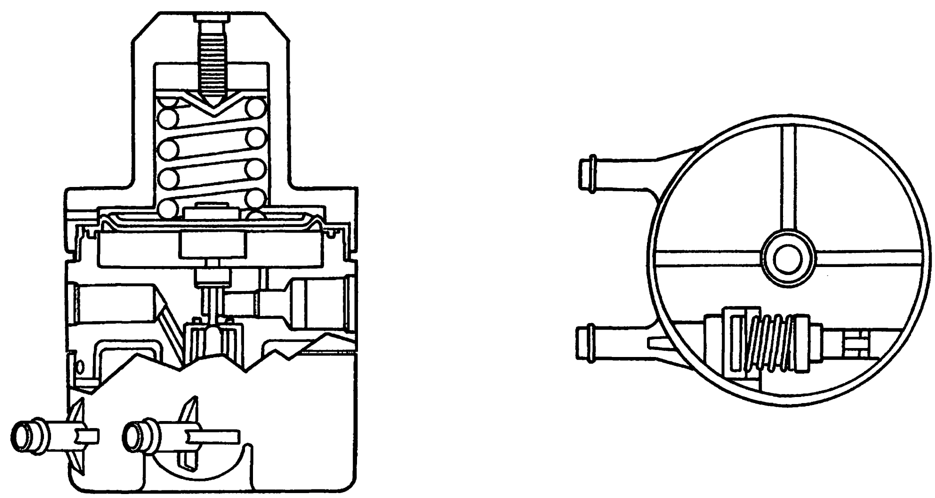


Figure 82: Fuel Pressure Regulator

High Pressure Fuel Filter

The high pressure fuel filter (Figure 83) is used to protect the engine fuel system components. A natural gas coalescing and particulate filter is positioned on the high pressure side of the fuel system just prior to the pressure regulator. The filter is part of the regulator assembly. The filter can be disassembled to service the element. The drain plug on the bottom of the housing can be removed to drain any water that accumulates.

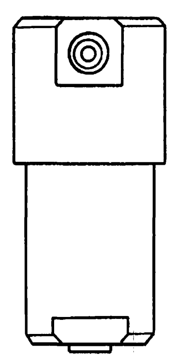


Figure 83: Fuel Filter

Natural Gas Fuel System

Fuel Lines and Fittings

A fuel line assembly (Figure 84) consists of flexible hose and/or stainless steel seamless tubing, end fittings and tube nuts. The hose is a conductive polytetrafluoroethylene (PTFE) liner reinforced with a stainless steel wire braided covering. The fittings are inserted into the hose ends and crimped into place. The stainless steel tubing contains end fittings which are brazed to the tube. There are high pressure fuel lines that are identified by either 1/4-inch or 3/8-inch outer diameter and a low pressure fuel line identified by a 1/2-inch outer diameter. The low pressure fuel line has a quick-connect at one end for connection to the fuel rail. The other fittings used on the natural gas vehicle to connect fuel components are SAE O-ring face seal tube fittings. There are two end types: an O-ring face seal end and a straight thread end. On tee and elbow fittings, a washer and a positionable nut are provided to aid in orientation of the fitting.

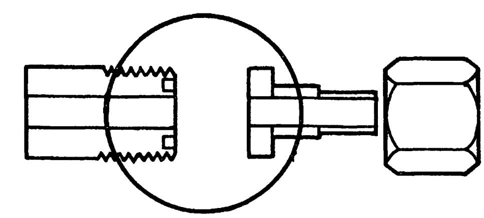


Figure 84: Fuel Line Assembly

Fueling Connector

Flange Assembly—Fuel Tank Fill

The flange assembly (Figure 85) is designed for 20,685 kPa (3,000 psi) service pressure and is the refueling connection to fill the vehicle. The assembly is mounted behind the fuel filler door and attached to the fuel filler housing, similar to a gasoline vehicle. This assembly consists of an NGVP1 type receptacle with a 150 micron filter (which can be serviced), a spring loaded check valve to allow filling of the vehicle and a manually opened bypass to provide safe venting of the fuel system. The vehicle is refueled by attaching the fuel station fill nozzle to the receptacle and locking into place.

Natural Gas Fuel System

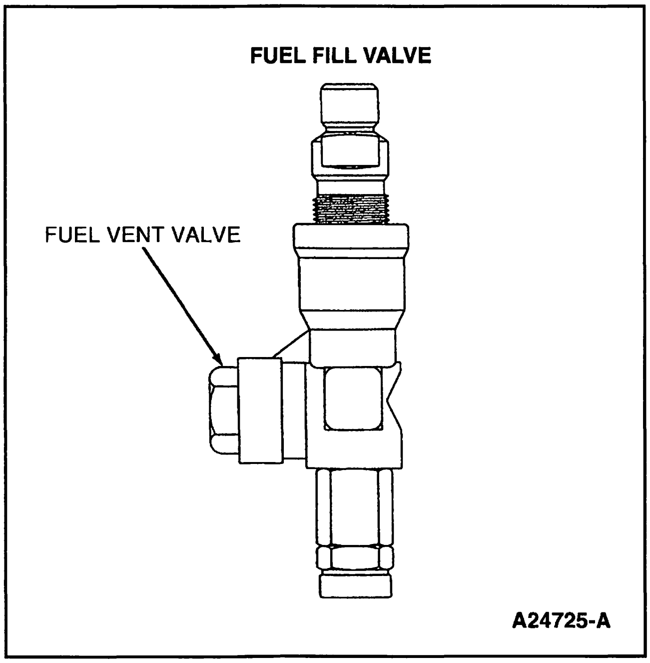


Figure 85: Flange Assembly

Fuel Tank Shutoff Valve

The fuel tank shutoff solenoid valve (Figure 86) is located in the fuel tank. The solenoid valves are on the same circuit as the gasoline fuel pump and utilize the same Inertia fuel shutoff (IFS) switch as gasoline. When the key is in the off position, the shutoff valves are closed and fuel in the tanks is isolated. During refueling, the shutoff valve acts as a check valve and allows flow due to pressure differential between the fuel being added from the fill station and the fuel in the tank.

The internal solenoid valves also have the capability of being “manually locked down.” If, while servicing the vehicle, it becomes necessary to remove the fuel tank, the lock down feature provides an added measure of safety. In addition, the valve has an internal Canadian Gas Association (CGA) type 9 fusible link pressure relief device (PRD) that senses the internal fuel tank gas temperature. The contents in the tank are vented when the internal fuel tank gas temperature reaches 199°C (217°F) and melts the fusible link. The escaping gas is vented through a vent line to the atmosphere.

Natural Gas Fuel System

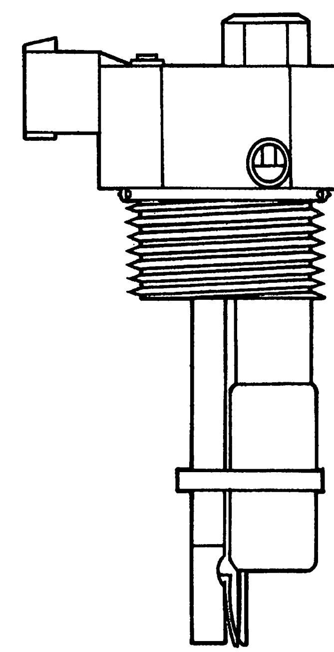


Figure 86: Fuel Tank Shutoff Valve

Inertia Fuel Shutoff (IFS) Switch

The inertia fuel shutoff (IFS) switch (Figure 87) is used in conjunction with electric fuel close valves. The purpose of the IFS switch is to close the fuel shut-off valves if a crash occurs. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and closes the electric fuel shut-off valve. **Once the switch is open, it must be manually reset before restarting the vehicle.** On some vehicles a fuel reset light illuminates. Refer to the Owner Guide for the location of the IFS.

Natural Gas Fuel System

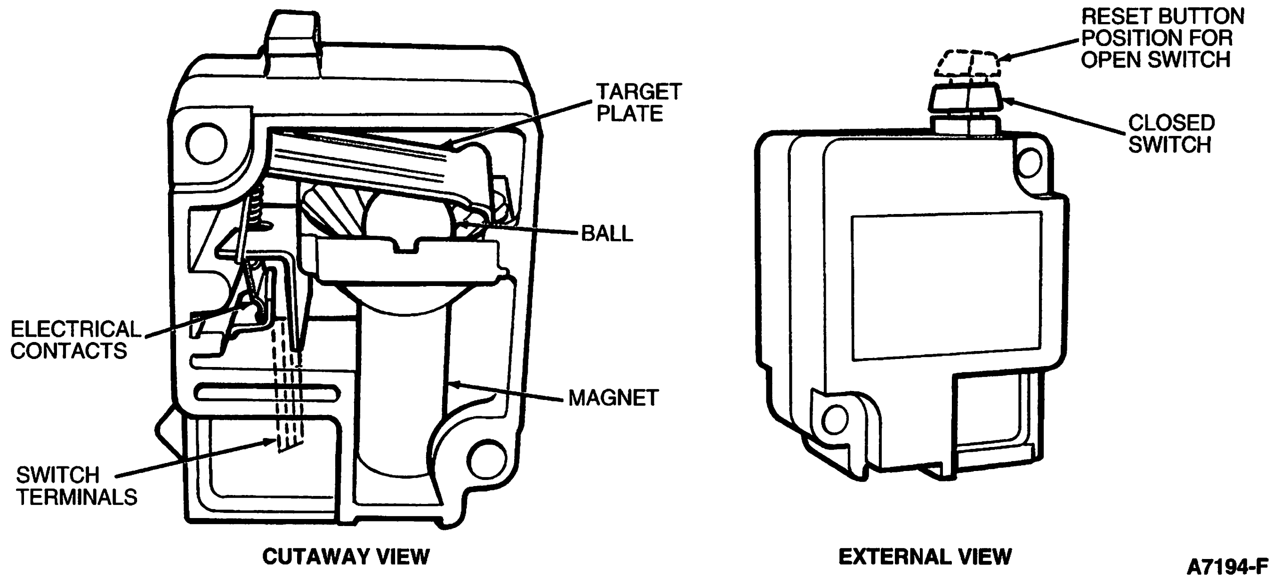


Figure 87: Inertia Fuel Shutoff (IFS) Switch

Reset Instructions

1. Turn key off.
2. Check for natural gas leaks in the engine compartment.
3. Note: In the closed position, the button can be depressed an additional 1.57 cm (1/16 inch) against a spring.

   If no natural gas leak is apparent, reset the IFS by pushing the reset button on the top of the switch (refer to Owner Guide).
4. Turn key to on or start position for a few seconds, then off again.
5. **WARNING:**

   IF YOU SMELL NATURAL GAS AT ANY TIME OTHER THAN DURING FUELING, DO NOT RESET THE IFS SWITCH.

   Again, check for leaking natural gas.

Natural Gas Fuel System

Fuel Rail Shut-Off Valve

The fuel rail shut-off valve (Figure 88) is a normally closed solenoid actuated valve that opens when (along with all of the tank valves) Pin 80 is grounded by the PCM. The valve isolates the fuel injectors from fuel line pressure when the engine is off. Nominal resistance of the coil is 11 ohms. The fuel rail shut-off valve is wired in parallel with the four tank valves.

Fuel Rail Valve Circuit Operation

When the key is turned to the ON position, the power relay is turned on. The power relay provides power to the PCM and the control side of the fuel shut off valve relay. The relay provides voltage to the fuel rail valve. If the ignition switch is not turned to the START position, the PCM will shut off the fuel rail valve after one second. The PCM will open the valve (along with the four tank valves) to provide fuel while cranking. The valve will remain open when the engine is running unless the inertia fuel shut-off switch is "tripped."

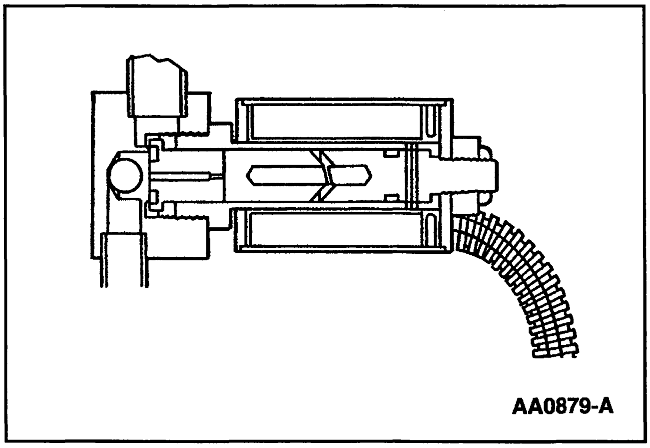


Figure 88: Fuel Rail Shut-Off Valve

Exhaust Gas Recirculation Systems

Overview

The Exhaust Gas Recirculation (EGR) system controls the oxides of nitrogen (NOx) emissions. Small amounts of exhaust gases are recirculated back into the combustion chamber to mix with the air/fuel charge. The combustion chamber temperature is reduced, lowering NOx emissions.

Differential Pressure Feedback EGR System

The Differential Pressure Feedback EGR system consists of a differential pressure feedback EGR sensor, EGR vacuum regulator solenoid, EGR valve, orifice tube assembly, powertrain control module (PCM) and connecting wires and vacuum hoses. Operation of the system is as follows (Figure 89):

1. The Differential Pressure Feedback EGR system receives signals from the engine coolant temperature (ECT) sensor or cylinder head temperature (CHT) sensor, intake air temperature (IAT) sensor, throttle position (TP) sensor, mass air flow (MAF) sensor and crankshaft position (CKP) sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable and running at a moderate load and rpm before the EGR system is activated. The PCM deactivates EGR during idle, extended wide open throttle or whenever a failure is detected in an EGR component or EGR required input.

2. The PCM calculates the desired amount of EGR flow for a given engine condition. It then determines the desired pressure drop across the metering orifice required to achieve that flow and outputs the corresponding signal to the EGR vacuum regulator solenoid.

3. The EGR vacuum regulator solenoid receives a variable duty cycle signal (0 to 100%). The higher the duty cycle the more vacuum the solenoid diverts to the EGR valve.

4. The increase in vacuum acting on the EGR valve diaphragm overcomes the valve spring and begins to lift the EGR valve pintle off its seat, causing exhaust gas to flow into the intake manifold.

5. Exhaust gas flowing through the EGR valve must first pass through the EGR metering orifice. With one side of the orifice exposed to exhaust backpressure and the other to the intake manifold, a pressure drop is created across the orifice whenever there is EGR flow. When the EGR valve closes, there is no longer flow across the metering orifice and pressure on both sides of the orifice is the same. The PCM constantly targets a desired pressure drop across the metering orifice to achieve the desired EGR flow.

6. The differential pressure feedback EGR sensor measures the actual pressure drop across the metering orifice and relays a proportional voltage signal (0 to 5 volts) to the PCM. The PCM uses this feedback signal to correct for any errors in achieving the desired EGR flow.

Exhaust Gas Recirculation Systems

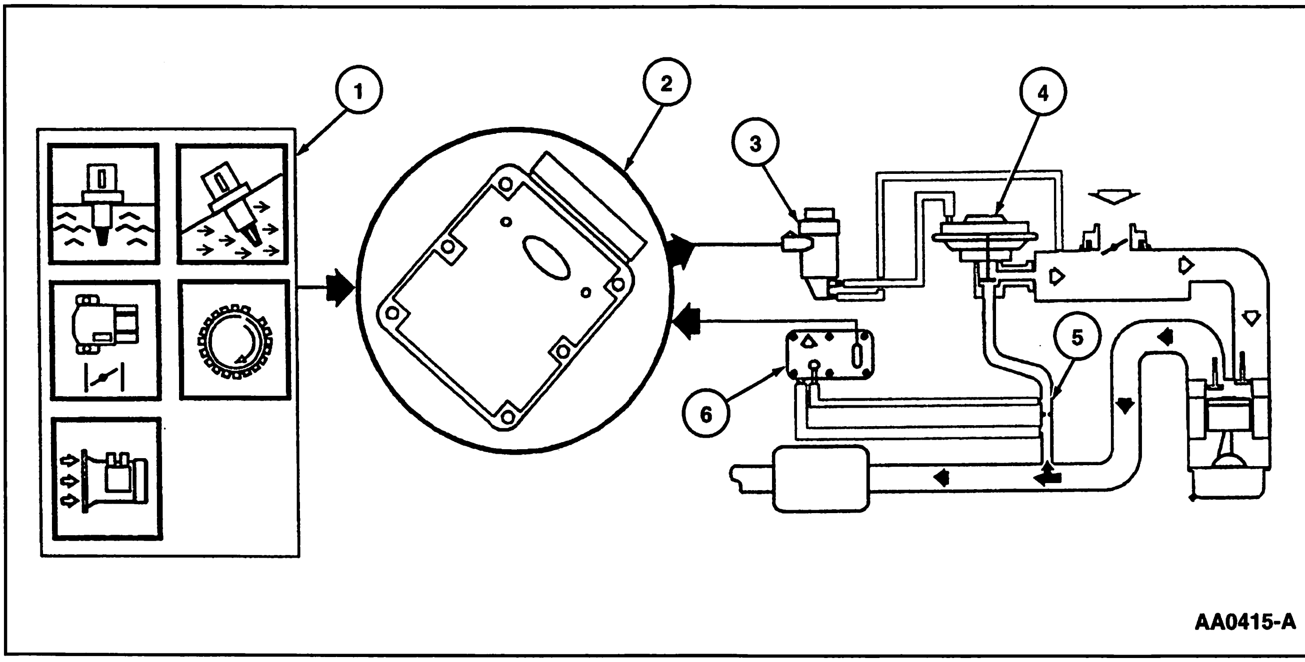


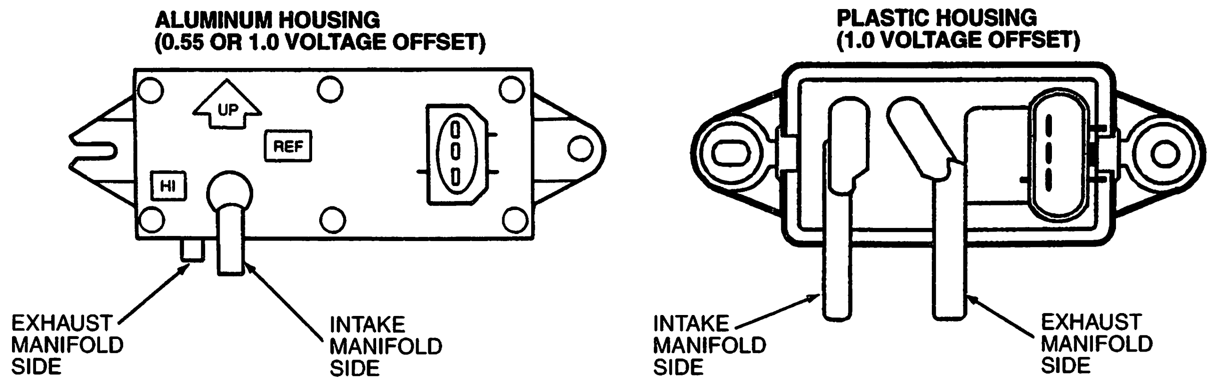
Figure 89: Differential Pressure Feedback EGR System Operation (Refer to the On Board Diagnostics Monitor System Overview for icon definitions.)

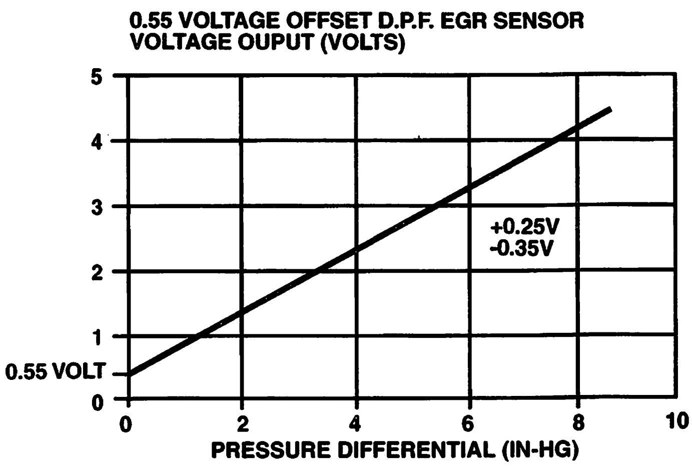
Hardware

Differential Pressure Feedback EGR Sensor

The differential pressure feedback EGR sensor (Figure 90) is a ceramic, capacitive-type pressure transducer that monitors the differential pressure across a metering orifice located in the orifice tube assembly. The differential pressure feedback sensor receives this signal through two hoses referred to as the downstream pressure hose (REF SIGNAL) and upstream pressure hose (HI SIGNAL). The HI and REF hose connections are marked on the differential pressure feedback EGR sensor housing for identification (note that the HI signal uses a larger diameter hose). The differential pressure feedback EGR sensor outputs a voltage proportional to the pressure drop across the metering orifice and supplies it to the PCM as EGR flow rate feedback.

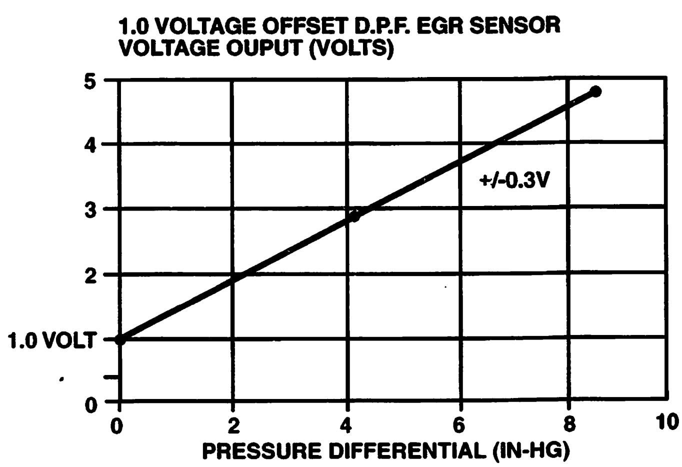
Exhaust Gas Recirculation Systems





0.55 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			Volts
IN-H2O	In-Hg	kPa	
120	8.83	29.81	4.66
90	6.62	22.36	3.64
60	4.41	14.90	2.61
30	2.21	7.46	1.58
0	0	0	0.55



1.0 VOLTAGE OFFSET D.P.F. EGR SENSOR DATA

Differential Pressure			Volts
IN-H2O	In-Hg	kPa	
116	8.56	28.9	4.95
58	4.3	14.4	2.97
0	0	0	1.0

AA0438-E

Figure 90: Differential Pressure Feedback EGR Sensor

Exhaustive Gas Recirculation Systems

Tube Mounted Differential Pressure Feedback EGR Sensor

The tube mounted differential pressure feedback EGR sensor (Figure 91) is identical in operation as the larger metal or plastic DPFE sensors and uses a 1.0 volt offset. The HI and REF hose connections are marked on the underside of the sensor.

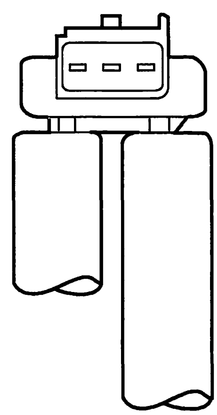


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Figure 91: Tube Mounted Differential Pressure Feedback EGR Sensor

EGR Vacuum Regulator Solenoid

The EGR vacuum regulator solenoid (EVR), (Figure 92) is an electromagnetic device which is used to regulate the vacuum supply to the EGR valve. The solenoid contains a coil which magnetically controls the position of a disc to regulate the vacuum. As the duty cycle to the coil increases, the vacuum signal passed through the solenoid to the EGR valve also increases. Vacuum not directed to the EGR valve is vented through the solenoid vent to atmosphere. Note that at 0% duty cycle (no electrical signal applied), the EGR vacuum regulator solenoid allows some vacuum to pass, but not enough to open the EGR valve.

Exhaust Gas Recirculation Systems

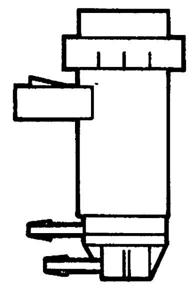
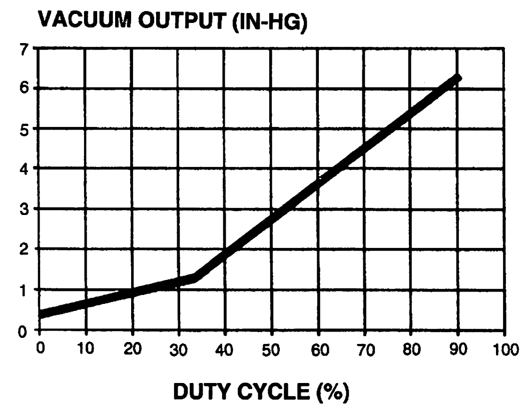


Figure 92: EVR Solenoid



EGR VACUUM REGULATOR SOLENOID DATA

Duty Cycle (%)	Vacuum Output					
	Minimum		Nominal		Maximum	
	In-Hg	kPa	In-Hg	kPa	In-Hg	kPa
0	0	0	.38	1.28	.75	2.53
33	.55	1.86	1.3	4.39	2.05	6.9
90	5.69	19.2	6.32	21.3	6.95	23.47
EVR resistance: 26-40 Ohms						

Exhaust Gas Recirculation Valve

The EGR valve (Figure 93) in the Differential Pressure Feedback EGR system is a conventional, vacuum-actuated EGR valve. The valve increases or decreases the flow of exhaust gas recirculation. As vacuum applied to the EGR valve diaphragm overcomes the spring force, the valve begins to open. As the vacuum signal weakens, at 5.4 kPa (1.6 in-Hg) or less, the spring force closes the valve. The EGR valve is fully open at about 15 kPa (4.5 in-Hg).

Since EGR flow requirement varies greatly, providing service specifications on flow rate is impractical. The on-board diagnostic system monitors the EGR valve function and triggers a Diagnostic Trouble Code if the test criteria is not met. The EGR valve flow rate is not measured directly as part of the field diagnostic procedures.

Exhaust Gas Recirculation Systems

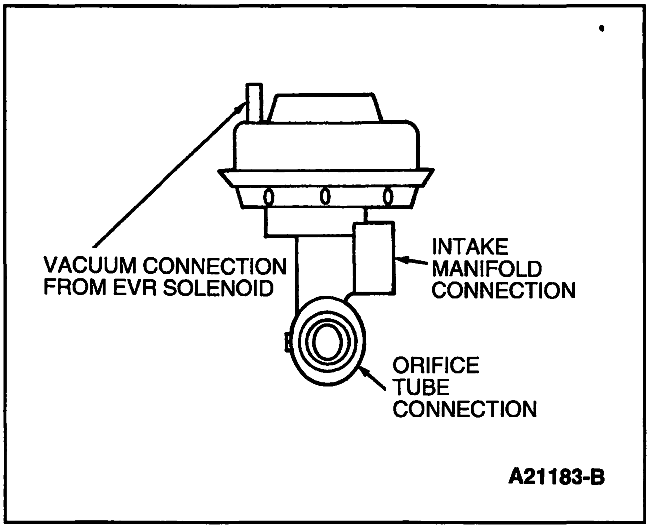
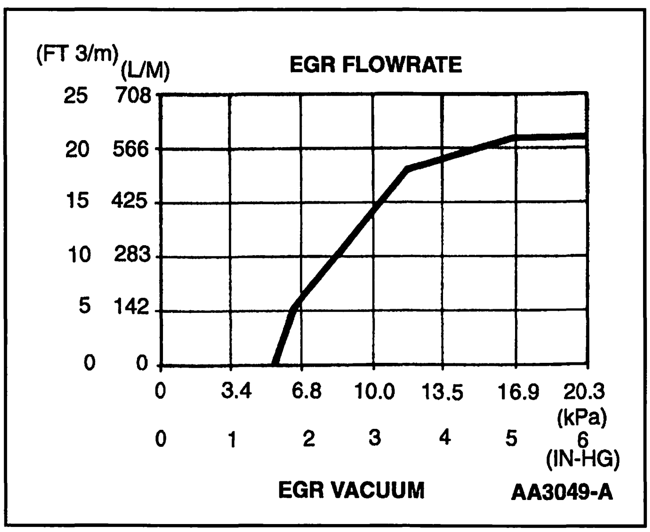


Figure 93: EGR Valve



Orifice Tube Assembly

The orifice tube assembly (Figure 94) is a section of tubing connecting the exhaust system to the intake manifold. The assembly provides the flow path for the EGR to the intake manifold and also contains the metering orifice and two pressure pick-up tubes. The internal metering orifice creates a measurable pressure drop across it as the EGR valve opens and closes. This pressure differential across the orifice is picked up by the differential pressure feedback EGR sensor which provides feedback to the PCM.

Exhaust Gas Recirculation Systems

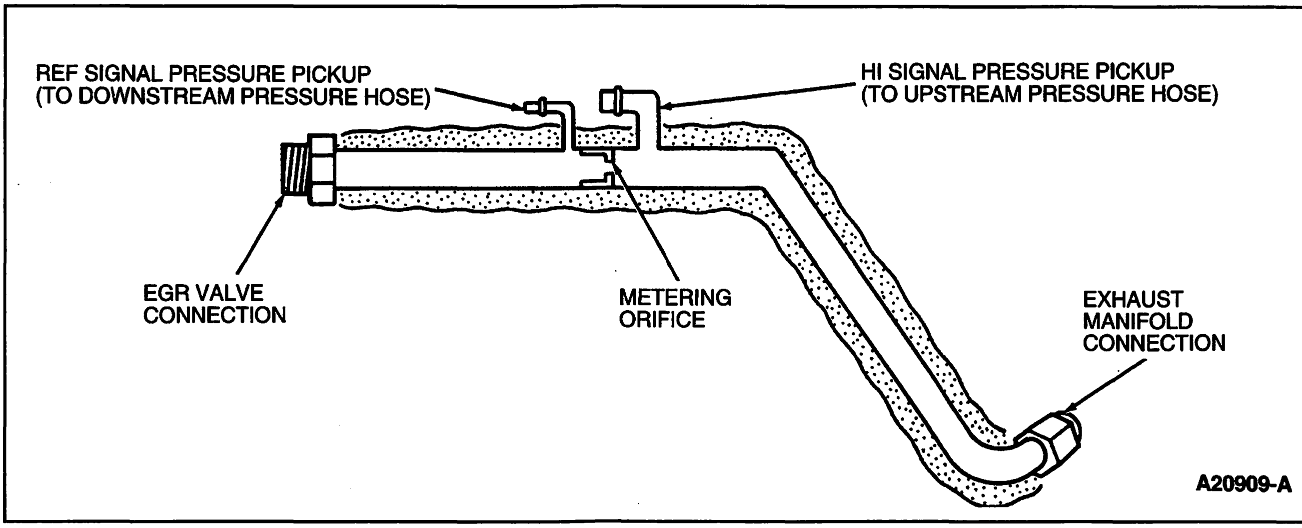


Figure 94: Orifice Tube Assembly

Electric EGR System (EEGR)

Highlights of the Electric System

- EEGR valve is activated by an electric stepper motor and does not use vacuum to control the physical movement of the valve.
- No vacuum diaphragm is used.
- No DPFE sensor is used.
- No Orifice Tube/Assembly is used.
- No EGR EVR solenoid is used.
- A new MAP sensor called a TMAP is used, where the temperature function is used as a second IAT in certain applications.
- Engine coolant is routed through the assembly extending durability of the electric motor.

Overview

The EEGR system uses exhaust gas recirculation to control the oxides of nitrogen (NOx) emissions just like vacuum operated systems. The only difference is the way in which the exhaust gas is controlled.

The EEGR system consists of an electric motor/EGR valve integrated assembly, a PCM, and connecting wiring. Additionally a MAP sensor is also required. Operation of the system is as follows (Figure 95):

Exhaust Gas Recirculation Systems

1. The EEGR system receives signals from the engine coolant temperature (ECT) or cylinder head temperature (CHT) sensor, throttle position (TP) sensor, mass air flow (MAF) sensor, crankshaft position (CKP) sensor and the manifold absolute pressure (MAP) sensor to provide information on engine operating conditions to the PCM. The engine must be warm, stable and running at a moderate load and rpm before the EEGR system is activated. The PCM will deactivate EEGR during idle, extended wide open throttle or whenever a failure is detected in an EEGR component or EGR required input.
2. The PCM calculates the desired amount of EGR for a given set of engine operating conditions.
3. The PCM in turn will output signals to the EEGR motor to move (advance or retract) a calibrated number of discrete steps. The electric stepper motor will directly actuate the EEGR valve, independent of engine vacuum. The EEGR valve is commanded from 0 to 52 discrete steps to get the EGR valve from a fully closed to fully open position. The position of the EGR valve determines the EGR flow.
4. A TMAP sensor is used to measure variations in manifold pressure as exhaust gas recirculation is introduced into the intake manifold. Variations in EGR being used will correlate to the TMAP signal (increasing EGR will increase manifold pressure values).

Exhaust Gas Recirculation Systems

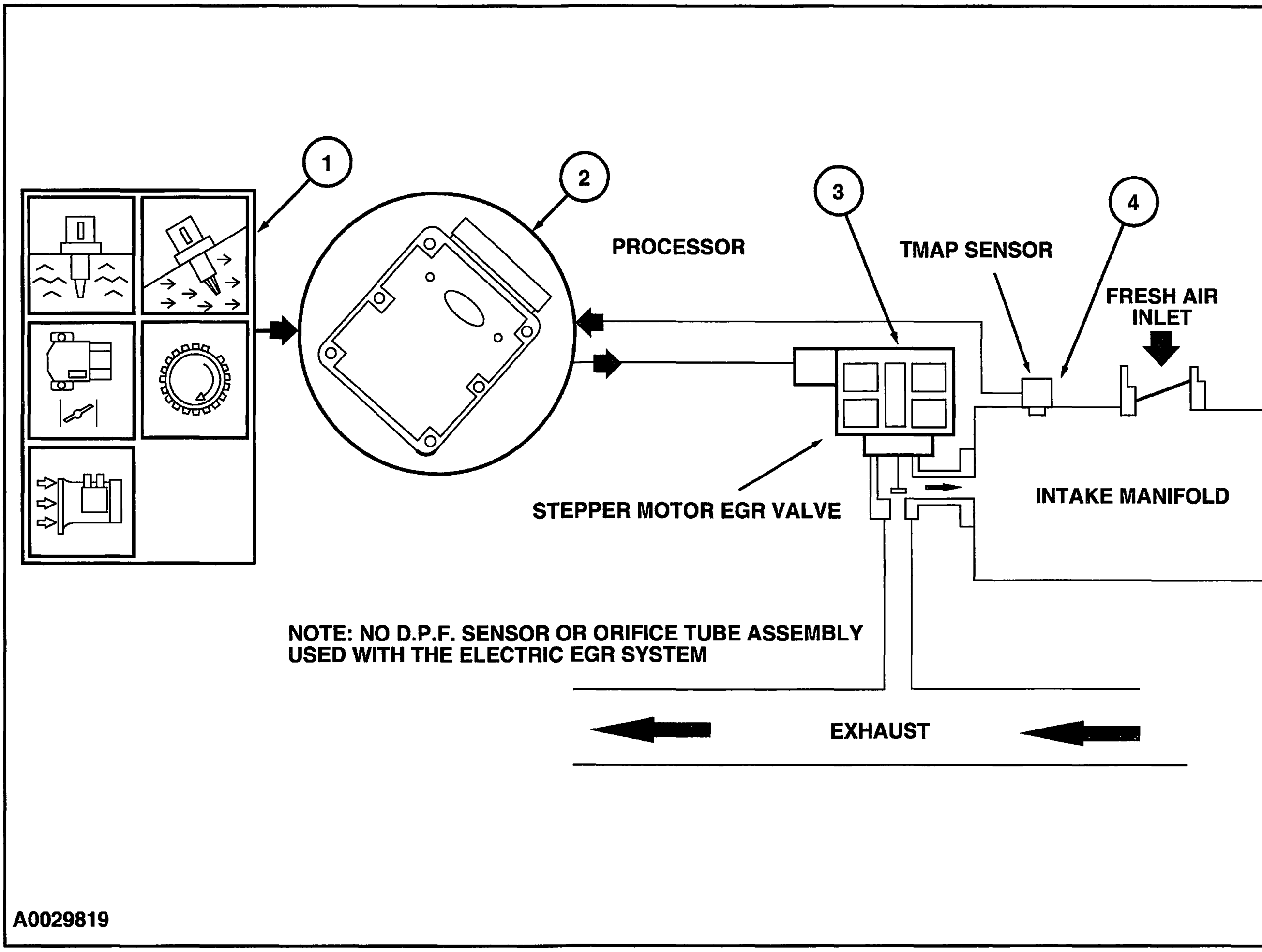


Figure 95: Electric EGR System

Hardware

The EEGR valve (Figure 96) and (Figure 97) is a water cooled motor/valve assembly. The motor is commanded to move in 52 discrete steps as it acts directly on the the EEGR valve. The position of the valve determines the rate of EGR. The built in spring works to close the valve (against the motor opening force).

Exhaustive Gas Recirculation Systems

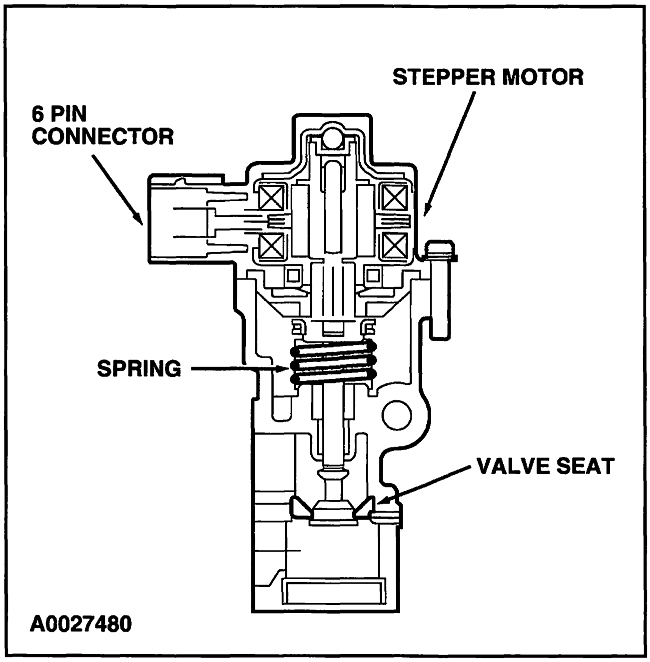


Figure 96: Electric EGR Motor/Valve Assembly

Exhaust Gas Recirculation Systems

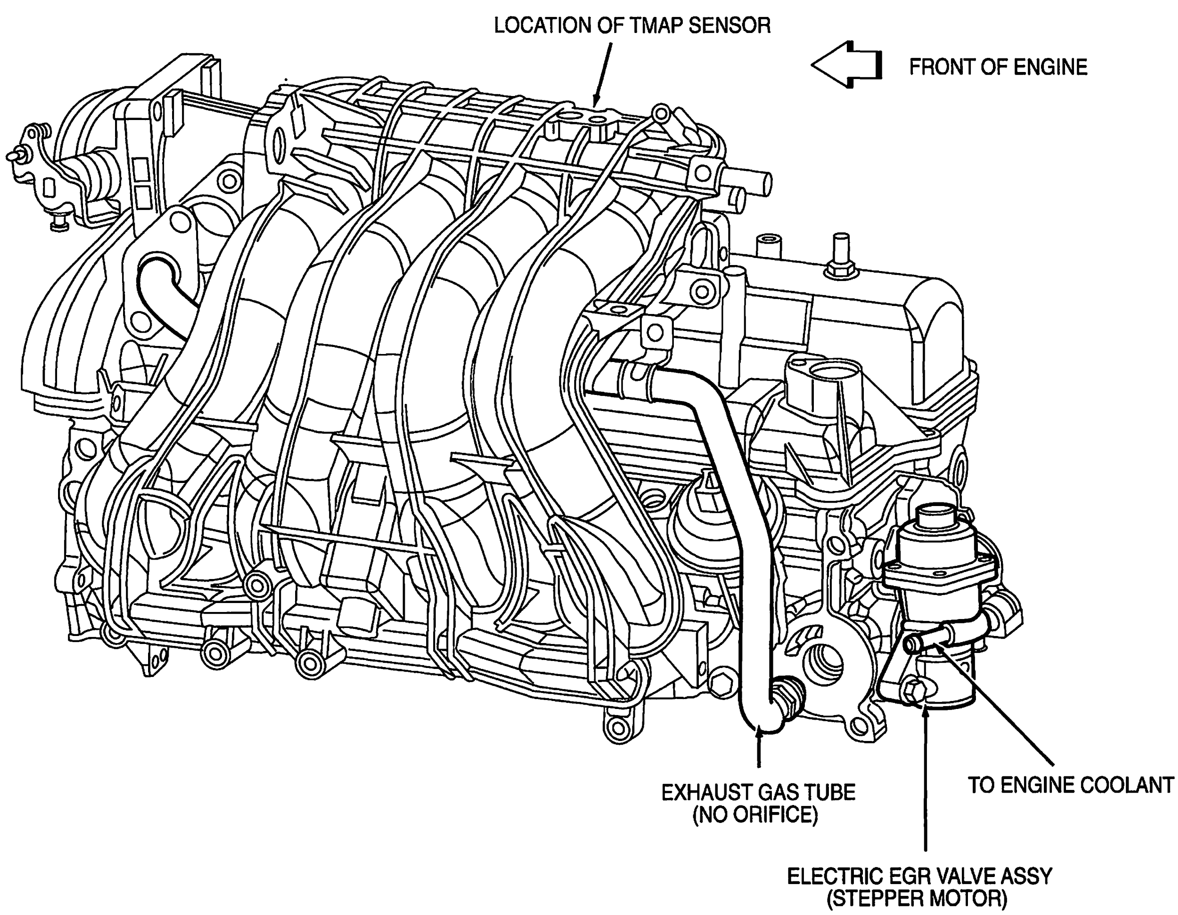


Figure 97: 2.3L Ranger Electric EGR

EGR System Module EGR System (ESM)

Overview

The ESM EGR system is an updated DPFE EGR system. It functions in the same manner as the conventional DPFE system, however the various system components have been integrated into a single component called the EGR System Module (ESM) (Figure 98). The flange of the valve portion of the ESM bolts directly to the intake manifold with a metal gasket that forms the measuring orifice. This arrangement increases system reliability, response time and system precision. By relocating the EGR orifice from the exhaust to the intake side of the EGR valve, the downstream pressure signal measures Manifold Absolute Pressure (MAP). The system provides the PCM with a differential DPFE signal, identical to a traditional DPFE system.

Exhaust Gas Recirculation Systems

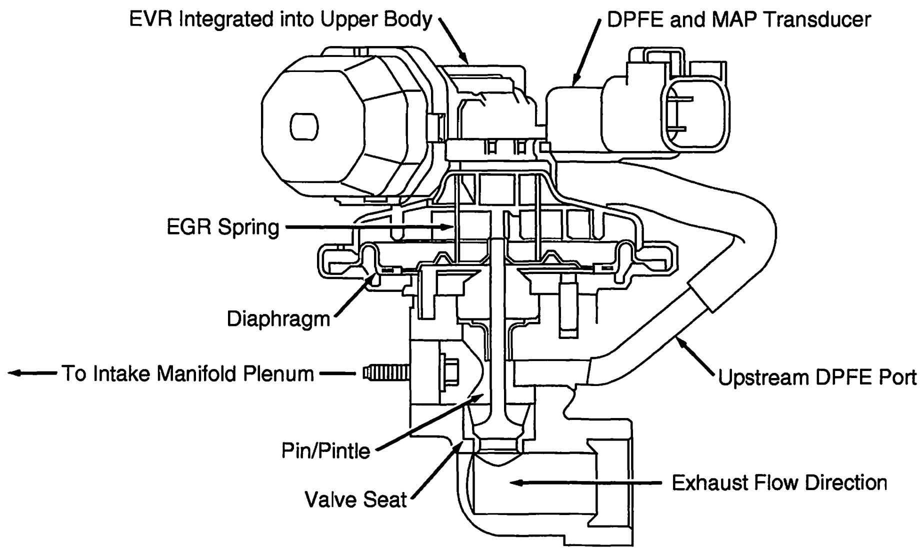


Figure 98: ESM System

The Delta Pressure Feedback EGR Monitor is comprised of a series of electrical tests and functional tests that monitor various aspects of EGR system operation.

First, the Delta Pressure Feedback EGR (DPFE) sensor input circuit is checked for out of range values (P1400/P0405 P1401/P0406). The Electronic Vacuum Regulator (EVR) output circuit is checked for opens and shorts (P1409/P0403).

Note: EGR normally has large amounts of water vapor that are the result of the engine combustion process. During cold ambient temperatures, under some circumstances, water vapor can freeze in the DPFE sensor, hoses, as well as other components in the EGR system. In order to prevent MIL illumination for temporary freezing, the following logic is used:

If an EGR system malfunction is detected below 32°F, only the EGR system is disabled for the current driving cycle. A DTC is not stored and the I/M readiness status for the EGR monitor will not change. The EGR monitor will, however, continue to operate. If the EGR monitor determines that the malfunction is no longer present (i.e., the ice melts), the EGR system will be enabled and normal system operation will be restored.

If an EGR system malfunction is detected above 32°F, the EGR system and the EGR monitor is disabled for the current driving cycle. A DTC is stored and the MIL is illuminated if the malfunction has been detected on two consecutive driving cycles.

After the vehicle is started, during initial vehicle acceleration, the differential pressure indicated by the DPFE sensor at zero EGR flow is checked to ensure that both hoses to the DPFE sensor are connected. Under this condition, the differential pressure should be zero. If the differential pressure indicated by the DPFE sensor exceeds a maximum threshold or falls below a minimum threshold, an upstream or downstream DPFE hose malfunction is indicated (P1405 P1406).

Exhaust Gas Recirculation Systems

After the vehicle has warmed up and normal EGR rates are being commanded by the PCM, the low flow check is performed. Since the EGR system is a closed loop system, the EGR system will deliver the requested EGR flow as long as it has the capability to do so. If the EVR duty cycle is very high (greater than 80% duty cycle), the differential pressure indicated by the DPFE sensor is evaluated to determine the amount of EGR system restriction. If the differential pressure is below a calibratable threshold, a low flow malfunction in indicated (P0401/P0406).

Finally, the differential pressure indicated by the DPFE sensor is also checked at idle with zero requested EGR flow to perform the high flow check. If the differential pressure exceeds a calibratable limit, it indicates a stuck open EGR valve or debris temporarily lodged under the EGR valve seat (P0402).

If the inferred ambient temperature is less than 32°F, or greater than 140°F, or the altitude is greater than 8,000 feet (BARO < 22.5 "Hg), the EGR monitor cannot be run reliably. In these conditions, a timer starts to accumulate the time in these conditions. If the vehicle leaves these extreme conditions, the timer starts decrementing, and, if conditions permit, will attempt to complete the EGR flow monitor. If the timer reaches 500 seconds, the EGR monitor is disabled for the remainder of the current driving cycle and the EGR Monitor I/M Readiness bit will be set to a "ready" condition after one such driving cycle. Vehicles will require two such driving cycles for the EGR Monitor to be set to a "ready" condition.

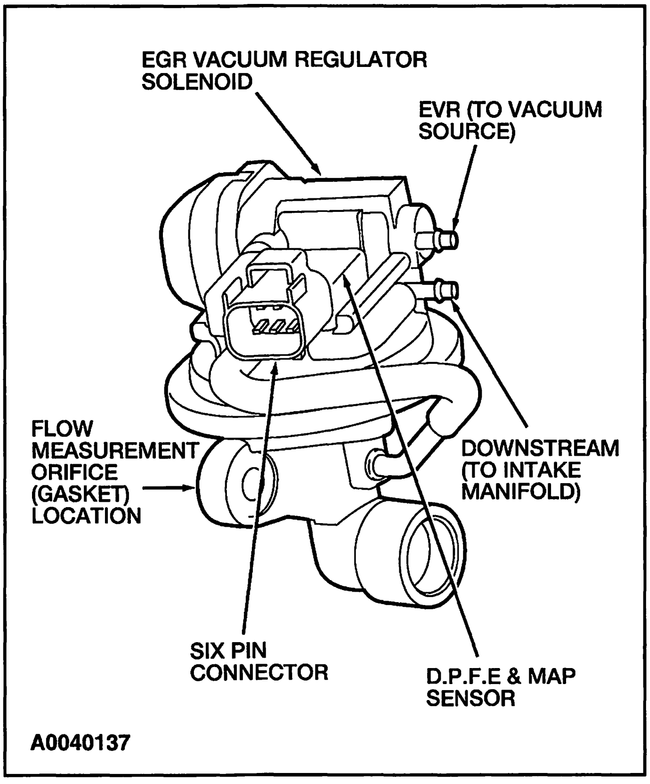


Figure 99: ESM Module

Evaporative Emission Systems

Overview

The Evaporative Emission (EVAP) system prevents fuel vapor build-up in the sealed fuel tank. Fuel vapors trapped in the sealed tank are vented through the vapor valve assembly on top of the tank. The vapors leave the valve assembly through a single vapor line and continue to the EVAP canister for storage until the vapors are purged to the engine for burning.

All applications required to meet OBD-II regulations, utilize the Enhanced Evaporative Emission (EVAP) System. Some applications also incorporate an On Board Refueling Vapor Recovery (ORVR) System. Refer to Section 303-13 in the Workshop Manual for vehicle specific information.

Enhanced Evaporative Emission (EVAP) System

The Enhanced EVAP system (Figure 100) consists of a fuel tank, fuel filler cap, fuel tank mounted or in-line fuel vapor control valve, fuel vapor vent valve, EVAP canister, fuel tank mounted or fuel pump mounted or in-line fuel tank pressure (FTP) sensor, EVAP canister purge valve, intake manifold hose assembly, canister vent (CV) solenoid, powertrain control module (PCM) and connecting wires and fuel vapor hoses.

1. The Enhanced EVAP system uses inputs from the engine coolant temperature (ECT) sensor or cylinder head temperature (CHT) sensor, the intake air temperature (IAT) sensor, the mass air flow (MAF) sensor, the vehicle speed sensor (VSS) and the fuel tank pressure (FTP) sensor to provide information about engine operating conditions to the PCM. The fuel level input (FLI) and FTP sensor signals to the PCM are used by the PCM to determine activation of the EVAP leak check Monitor based on presence of vapor generation or fuel sloshing.

2. The PCM determines the desired amount of purge vapor flow to the intake manifold for a given engine condition. The PCM can then output the required signal to the EVAP canister purge valve. The PCM uses the Enhanced EVAP system inputs to evacuate the system using the EVAP canister purge valve, seals the Enhanced EVAP system from atmosphere using the CV solenoid, and uses the FTP sensor to observe total vacuum lost for a period of time.

3. The canister vent (CV) solenoid seals the Enhanced EVAP system to atmosphere during the EVAP leak check Monitor.

4. The PCM outputs a variable duty cycle signal (between 0% and 100%) to the solenoid on the EVAP canister purge valve. On applications with Electronic EVAP Canister Purge Valve, the PCM outputs a variable current (between 0 mA and 1000 mA).

5. The fuel tank pressure (FTP) sensor monitors the fuel tank pressure during engine operation and continuously transmits an input signal to the PCM. During the EVAP monitor testing, the FTP sensor monitors the fuel tank pressure or vacuum bleed-up.

6. The fuel tank mounted fuel vapor vent valve assembly, fuel tank mounted fuel vapor control valve (or remote fuel vapor control valve) are used in the Enhanced EVAP system to control the flow of fuel vapor entering the engine. All of these valves also prevent fuel tank overfilling during refueling operation and prevent liquid fuel from entering the EVAP canister and the EVAP canister purge valve under any vehicle altitude, handling or rollover condition.

Evaporative Emission Systems

7. The Enhanced EVAP system, including all the fuel vapor hoses, can be checked when a leak is detected by the PCM. Refer to the Workshop Manual for information on leak detection tools and procedures.

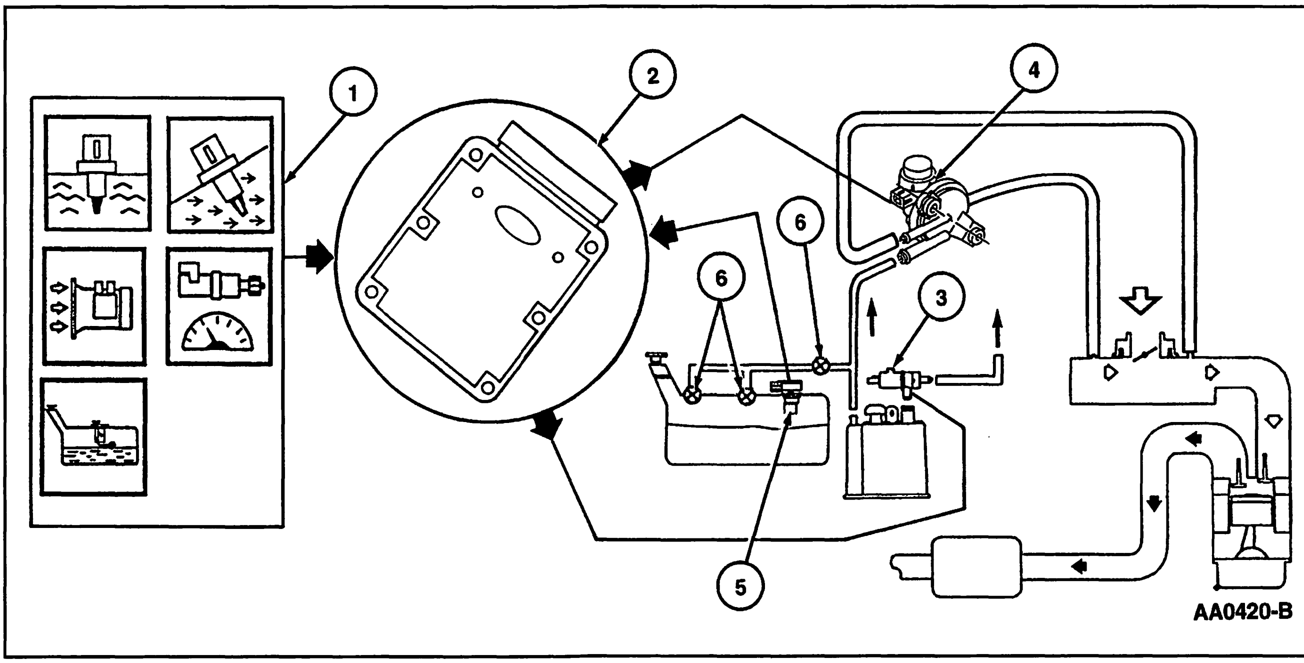


Figure 100: Enhanced Evaporative Emission System (Refer to the On Board Diagnostics Monitor System Overview for icon definitions.)

Hardware

EVAP Canister Purge Valve

The EVAP canister purge valve (Figure 101) is part of the Enhanced EVAP system that is controlled by the PCM. This valve controls the flow of vapors (purging) from the EVAP canister to the intake manifold during various engine operating modes. The EVAP canister purge valve is normally closed valve. The electronic EVAP canister purge valve (Figure 102) controls the flow of vapors electronically by way of a solenoid thereby, eliminating the need for an electronic vacuum regulator and vacuum diaphgram. The PCM outputs a signal between 0% and 100% duty cycle to control the EVAP canister purge valve. On applications with Electronic EVAP canister purge valve, the PCM outputs a signal between 0 mA and 1000 mA to control the solenoid.

Evaporative Emission Systems

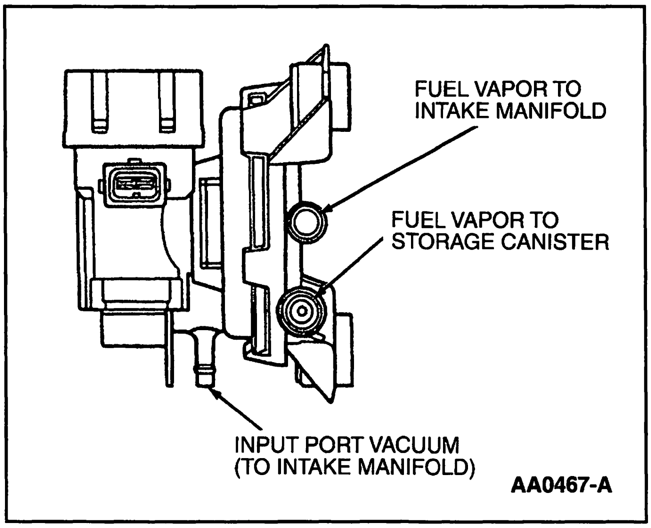


Figure 101: EVAP Canister Purge Valve

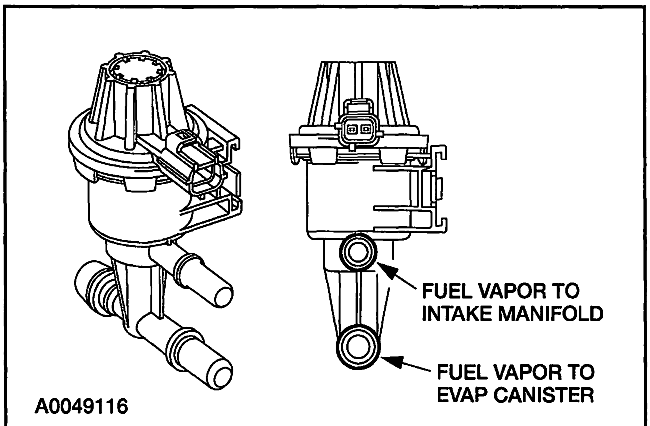


Figure 102: Electronic EVAP Canister Purge Valve

Fuel Tank Pressure Sensor

The fuel tank pressure (FTP) sensor (Figure 103) or inline fuel tank pressure (FTP) sensor (Figure 104) is used to measure the fuel tank pressure during the EVAP Leak Check Monitor.

Evaporative Emission Systems

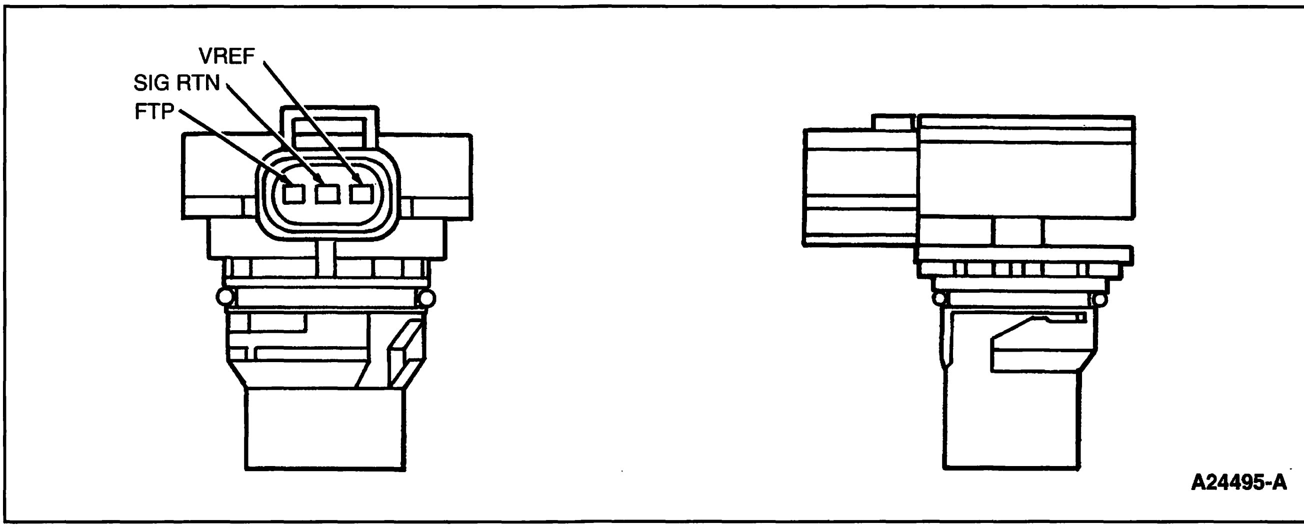


Figure 103: Fuel Tank Pressure (FTP) Sensor

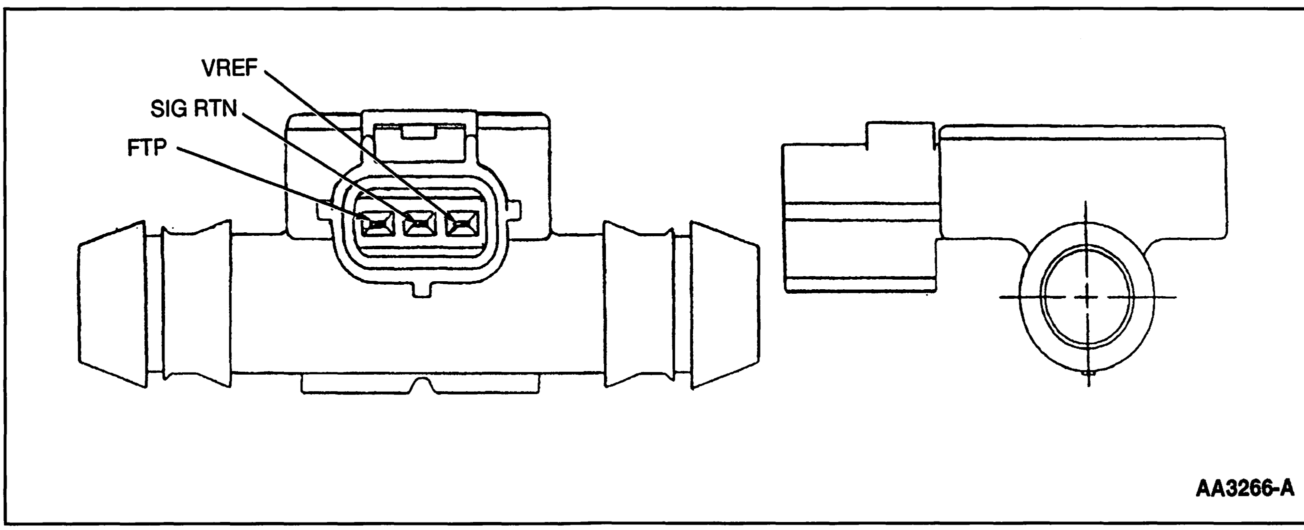


Figure 104: In-Line Fuel Tank Pressure (FTP) Sensor

Canister Vent Solenoid

During the EVAP Leak Check Monitor, the canister vent (CV) solenoid (Figure 105) seals the EVAP canister from atmospheric pressure. This allows the EVAP canister purge valve to obtain the target vacuum in the fuel tank during the EVAP Leak Check Monitor.

Evaporative Emission Systems

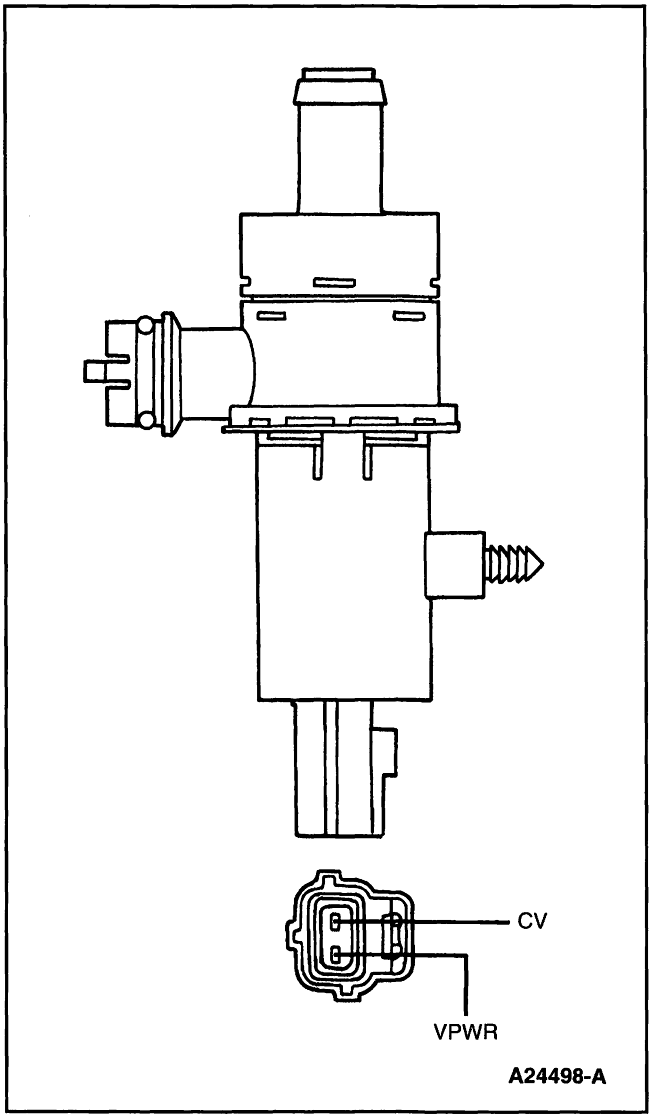


Figure 105: Typical Canister Vent (CV) Solenoid

Intake Air Systems

Overview

The Intake Air system (Figure 106) provides clean air to the engine, optimizes air flow and reduces unwanted induction noise. The Intake Air System consists of an air cleaner assembly, resonator assemblies and hoses. The main component of the intake air system is the air cleaner assembly. The air cleaner assembly houses the air cleaner element that removes potential engine contaminants, particularly abrasive types. The mass air flow (MAF) sensor is attached internally or externally to the air cleaner assembly and measures the quantity of air delivered to the engine combustion chamber. The MAF sensor can be serviced or replaced as an individual component. The intake air system also contains a sensor that measures the intake air temperature which may also be integrated with the MAF sensor. (Refer to Electronic EC Hardware - PCM Inputs for additional information on the MAF and IAT sensors.) Air induction resonators can be separate components or part of the intake air housing (i.e., conical air cleaner). The function of a resonator is to reduce induction noise. The air induction components are connected to each other and to the throttle body assembly with hoses.

Intake Air Systems

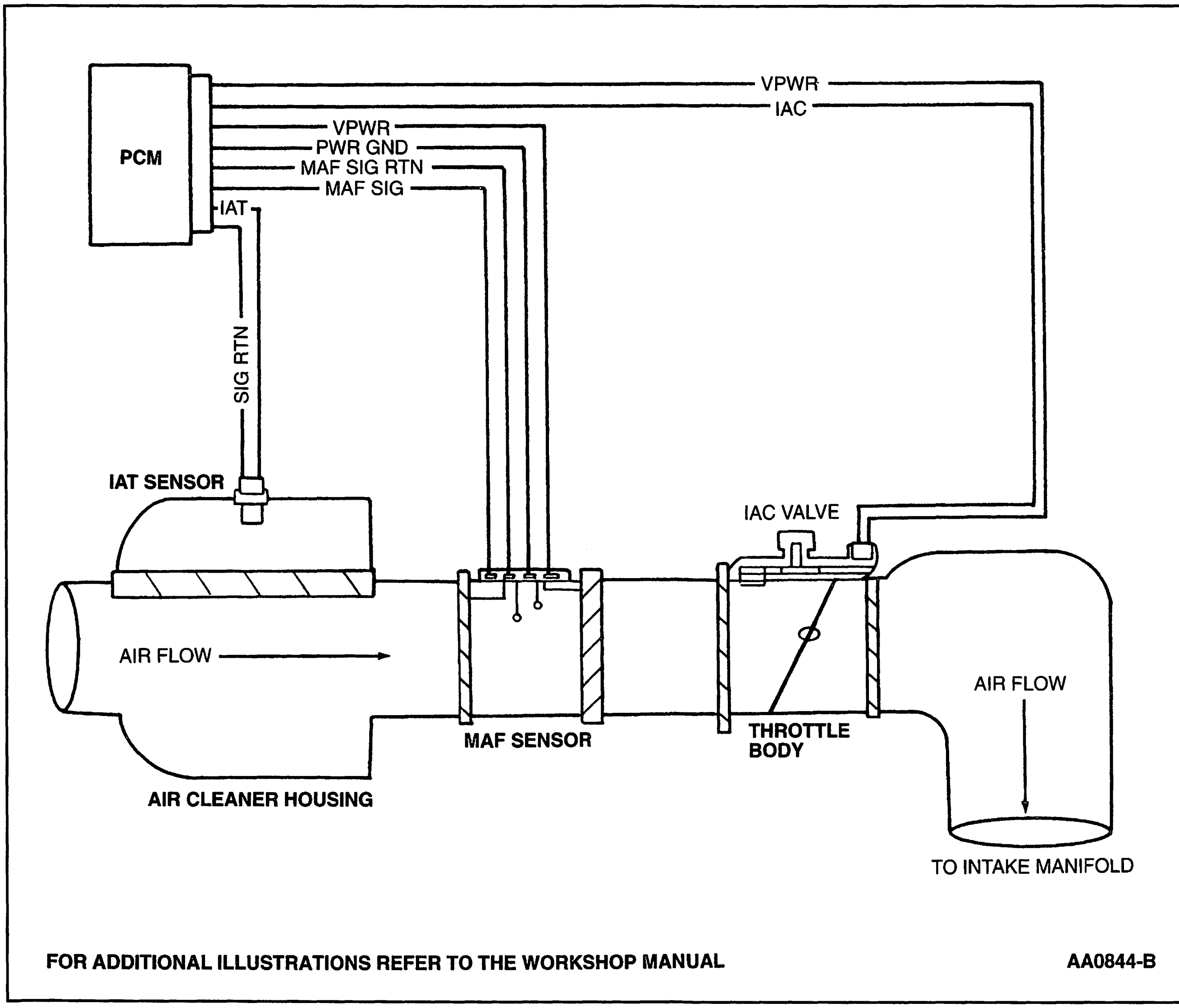


Figure 106: Intake Air System

Note: For additional illustrations, refer to the Workshop Manual.

There are three basic types of intake air sub-systems:

- Intake Manifold Runner Control (IMRC) electric actuated system
- Intake Manifold Swirl Control (IMSC) vacuum actuated system
- Intake Manifold Tuning Valve (IMTV)

These subsystems are used to provide increased intake airflow to improve torque, emissions and performance. The overall quantity of air metered to the engine is controlled by the throttle body.

Intake Air Systems

Intake Manifold Runner Control (IMRC) Electric Actuated System

The Intake Manifold Runner Control (IMRC) Electric Actuated system (Figure 107) consists of a remote mounted motorized actuator with an attaching cable for each housing on each bank. Some applications will use one cable for both banks. The cable or linkage attaches to the housing butterfly plate levers. The 2.0L (2V) Focus IMRC uses a motorized actuator mounted directly to a single housing without the use of a cable. Each IMRC housing is an aluminum casting with two intake air passages for each cylinder. One passage is always open and the other is opened and closed with a butterfly valve plate. The housing uses a return spring to hold the butterfly valve plates closed. The motorized actuator houses an internal switch or switches, depending on the application, to provide feedback to the PCM indicating cable and butterfly valve plate position.

Below approximately 3000 rpm, the motorized actuator will not be energized. This will allow the cable to fully extend and the butterfly valve plates to remain closed. Above approximately 3000 rpm, the motorized actuator will be energized. The attaching cable will pull the butterfly valve plates into the open position. Some vehicles will activate the IMRC near 1500 rpm.

WARNING:

SUBSTANTIAL OPENING AND CLOSING TORQUE IS APPLIED BY THIS SYSTEM. TO PREVENT INJURY, BE CAREFUL TO KEEP FINGERS AWAY FROM LEVER MECHANISMS WHEN ACTUATED.

1. The PCM uses the TP sensor and CKP signals to determine activation of the IMRC system. There must be a positive change in voltage from the TP sensor along with the increase in rpm to open the valve plates.
2. The PCM uses the information from the input signals to control the IMRC motorized actuator based upon rpm and changes in throttle position.
3. The PCM energizes the actuator to pull the butterfly plates open with the cable(s) or linkage.
4. The IMRC housing contains butterfly plates to allow increased air flow.

Intake Air Systems

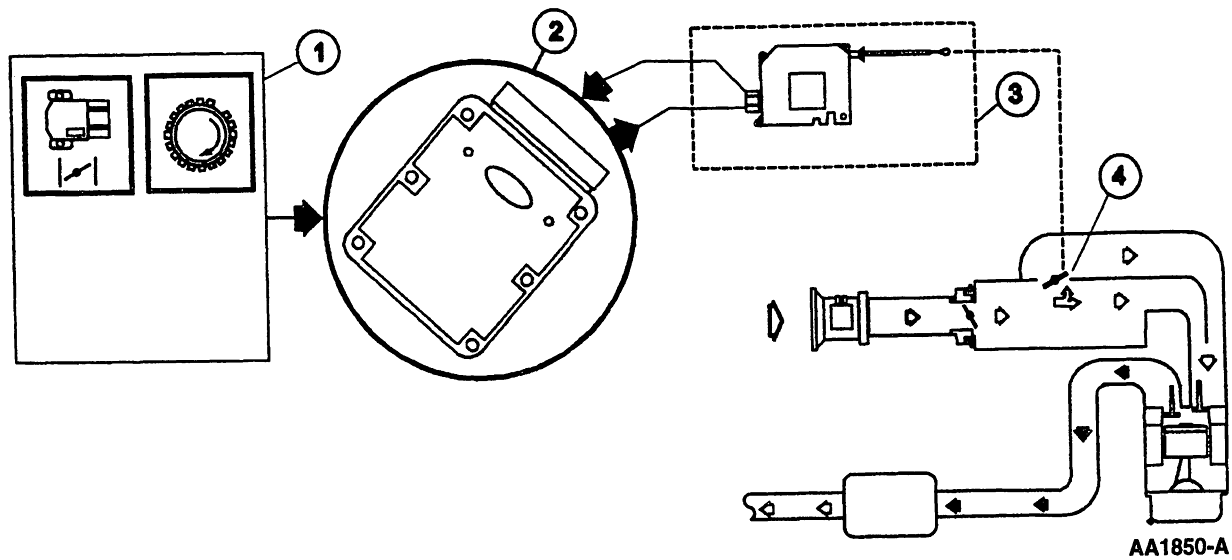


Figure 107: Intake Manifold Runner Control (IMRC) - Electric Actuated (Refer to the On Board Diagnostics Monitor System Overview for Icon Definitions.

Intake Manifold Swirl Control (IMSC) Vacuum Actuated System

The Intake Manifold Swirl Control (IMSC) Vacuum Actuated system (Figure 108) consists of a manifold mounted vacuum actuator and a PCM controlled electric solenoid. The linkage from the actuator attaches to the manifold butterfly plate lever. The IMSC actuator and manifold are composite/plastic with a single intake air passage for each cylinder. The passage has a butterfly valve plate that blocks 60% of the opening when actuated, leaving the top of the passage open to generate turbulence. The housing uses a return spring to hold the butterfly valve plates open. The vacuum actuator houses an internal monitor circuit to provide feedback to the PCM indicating butterfly valve plate position.

Below approximately 3000 rpm, the vacuum solenoid will be energized. This will allow manifold vacuum to be applied and the butterfly valve plates to remain closed. Above approximately 3000 rpm, the vacuum solenoid will be de-energized. This will allow vacuum to vent from the actuator and the butterfly valve plates to open.

WARNING:

SUBSTANTIAL OPENING AND CLOSING TORQUE IS APPLIED BY THIS SYSTEM. TO PREVENT INJURY, BE CAREFUL TO KEEP FINGERS AWAY FROM LEVER MECHANISMS WHEN ACTUATED.

Intake Air Systems

1. The PCM monitors the TP sensor, CHT and CKP signals to determine activation of the IMSC system. There must be a positive change in voltage from the TP sensor along with the increase in rpm at the proper engine temperature to open the valve plates.
2. The PCM uses the information from the input signals to control the IMSC electric solenoid based upon changes in throttle position, engine temperature and rpm.
3. The PCM energizes the solenoid with the key on engine running, vacuum is then applied to the actuator to pull the butterfly plates closed.

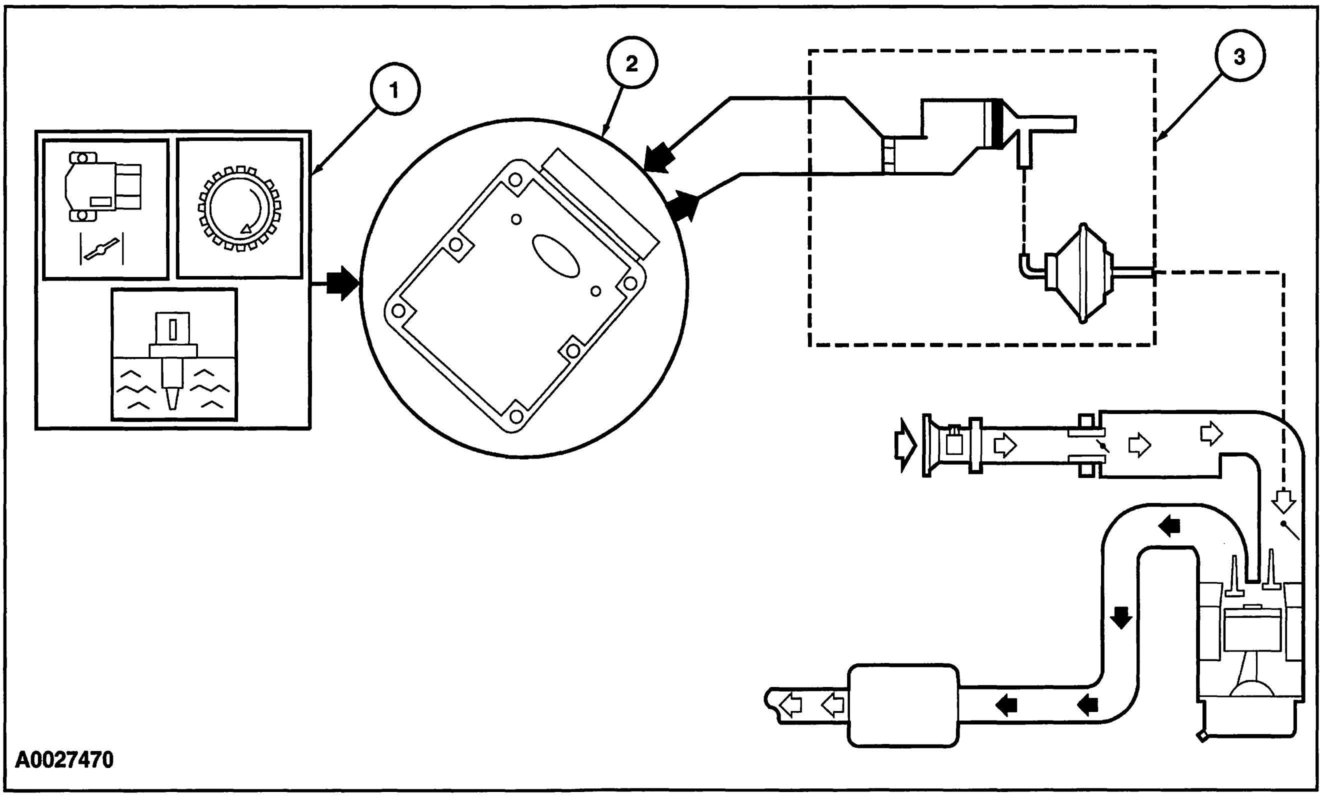


Figure 108: Intake Manifold Swirl Control (IMSC) -Vacuum Actuated (Refer to the On Board Diagnostics Monitor System Overview for Icon Definitions.

Intake Manifold Tuning Valve (IMTV)

The intake manifold tuning valve (IMTV) (Figure 109) is a motorized actuated unit mounted directly to the intake manifold. The IMTV actuator controls a shutter device attached to the actuator shaft. There is no monitor input to the PCM with this system to indicate shutter position.

Intake Air Systems

The motorized IMTV unit will not be energized below approximately 2600 rpm or higher on some vehicles. The shutter will be in the closed position not allowing airflow blend to occur in the intake manifold. Above approximately 2600 rpm or higher, the motorized unit will be energized. The motorized unit will be commanded on by the PCM initially at a 100 percent duty cycle to move the shutter to the open position and then falling to approximately 50 percent to continue to hold the shutter open.

1. The PCM uses the TP sensor and CKP signals to determine activation of the IMTV system. There must be a positive change in voltage from the TP sensor along with the increase in rpm to open the shutter.
2. The PCM uses the information from the input signals to control the IMTV.
3. When commanded on by the PCM, the motorized actuator shutter opens up the end of the vertical separating wall at high engine speeds to allow both sides of the manifold to blend together.

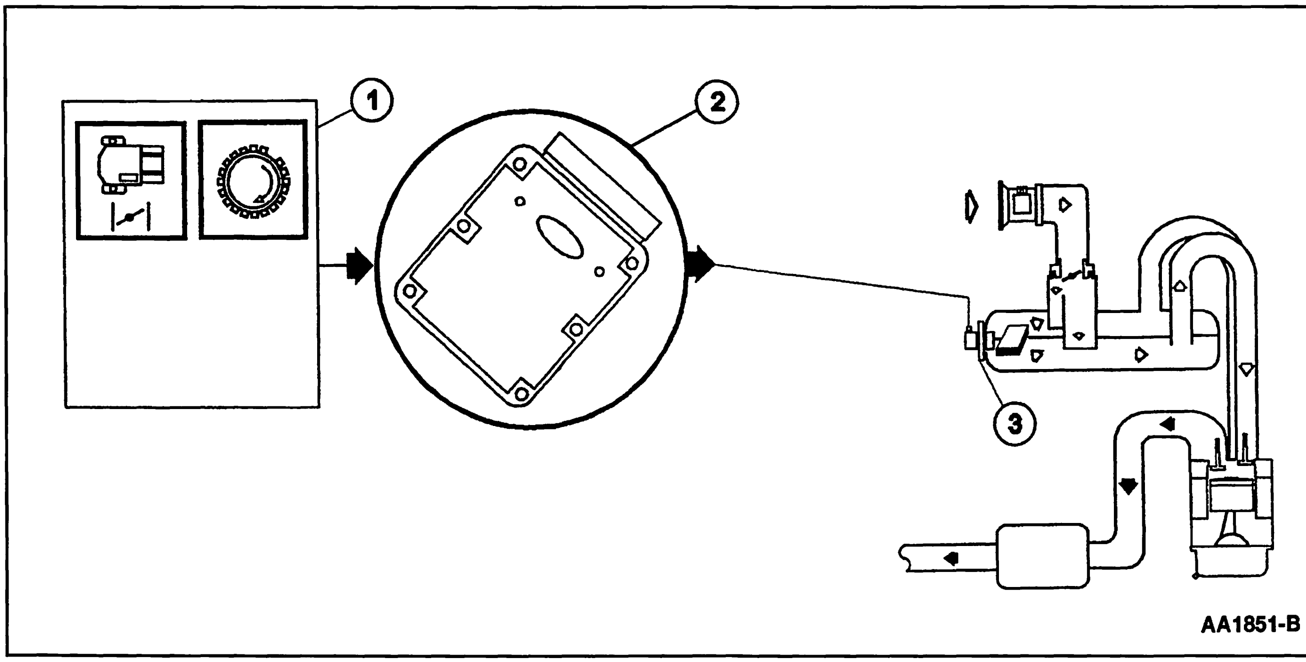


Figure 109: Intake Manifold Tuning Valve (IMTV) (Refer to the On Board Diagnostics Monitor System Overview for icon definitions.)

Throttle Body System Overview

Note: This overview is for applications without Electronic Throttle Control (ETC). For ETC applications, refer to Torque Based Electronic Throttle Control (ETC) in this section.

Intake Air Systems

The throttle body system meters air to the engine during idle, part throttle, and wide open throttle (WOT) conditions. The throttle body system consists of an Idle air control (IAC) valve assembly, idle air orifice, single or dual bores with butterfly valve throttle plates and a Throttle Position (TP) sensor. One other source of idle air flow is the Positive Crankcase Ventilation (PCV) system. The combined idle air flow (from idle air orifice IAC flow and PCV flow) is measured by the MAF sensor on all applications.

During idle, the throttle body assembly provides a set amount of air flow to the engine through the idle air passage and PCV valve. The IAC valve assembly provides additional air when commanded by the powertrain control module (PCM) to maintain the proper engine idle speed under varying conditions. The IAC valve assembly mounts directly to the throttle body assembly in most applications, but is remote-mounted to the intake manifold in some applications. Idle speed is controlled by the PCM and cannot be adjusted.

Note: The traditional idle air adjust procedure as well as throttle return screw are no longer used on OBD applications.

Throttle rotation is controlled by a cam/cable linkage to slow the initial opening rate of the throttle plate. The TP sensor monitors throttle position and provides an electrical signal to the PCM. Some throttle body applications provide an air supply channel upstream of the throttle plate to provide fresh air to the Positive Crankcase Ventilation (PCV) or IAC systems. Other throttle body applications provide individual vacuum taps downstream of the throttle plate for PCV return, Exhaust Gas Recirculation (EGR), Evaporative Emission (EVAP), and miscellaneous control signals.

Throttle Body System Hardware

The major components of the throttle body assembly include the TP sensor, IAC valve assembly, and throttle body housing assembly.

Throttle Position Sensor

The TP sensor monitors throttle position and provides an electrical signal to the PCM. It is monitored by the OBD system for component integrity, system functionality, and faults that can cause emissions levels to exceed standards set in government regulations. For additional information on the TP sensor, refer to Electronic EC System Hardware-PCM Inputs.

Idle Air Control Valve

The idle air control (IAC) valve assembly controls engine idle speed and provides a dashpot function. The IAC valve assembly meters intake air around the throttle plate through a bypass within the IAC valve assembly and throttle body. The PCM determines the desired idle speed or bypass air and signals the IAC valve assembly through a specified duty cycle. The IAC valve responds by positioning the IAC valve to control the amount of bypassed air. The PCM monitors engine rpm and increases or decreases the IAC duty cycle in order to achieve the desired rpm.

Note: The IAC Valve Assembly is NOT ADJUSTABLE and CANNOT BE CLEANED.

Intake Air Systems

The IAC valve (part of throttle body assembly) has an internal diode on some applications. If the internal diode is measured in crossed terminal position with a digital multimeter, there will be an incorrect or negative reading. It is important that the mating component and harness connectors are correctly oriented. Diagnostic procedures emphasize this importance.

The PCM uses the IAC valve assembly to control:

- No touch start
- Cold engine fast idle for rapid warm-up
- Idle (corrects for engine load)
- Stumble or stalling on deceleration (provides a dashpot function)
- Over-temperature idle boost.

Throttle Body Housing

The throttle body housing assembly is a single piece of aluminum casting with an air passage and a butterfly throttle plate with linkage mechanisms. When the throttle plate is in the idle (or closed) position, the throttle lever arm should be in contact with the Throttle Return Stop. The throttle return stop prevents the throttle plate from contacting the bore and sticking closed. The setting also establishes the amount of air flow between the throttle plate and bore. To minimize the closed plate air flow, a special coating is applied to the throttle plate and bore to help seal this area. This sealant/coating also makes the throttle body resistant to engine intake sludge accumulation.

Features of the Throttle Body Assembly include:

1. Idle air control (IAC) valve assembly mounted directly to the throttle body assembly (some vehicles).
2. A pre-set stop to locate the WOT position.
3. An air supply channel upstream of the throttle plate to provide fresh air to the PCV system (some vehicles only).
4. Individual vacuum taps for PCV, EGR, EVAP and miscellaneous control signals (some vehicles only).
5. PCV air return (if applicable).
6. A throttle body-mounted throttle position (TP) sensor.
7. A sealant/coating on the throttle bore and throttle plate makes the throttle body air flow tolerant to engine intake sludge accumulation. These throttle body assemblies **MUST NOT BE CLEANED** and have a white/black attention decal (Figure 110) advising not to clean.

Intake Air Systems

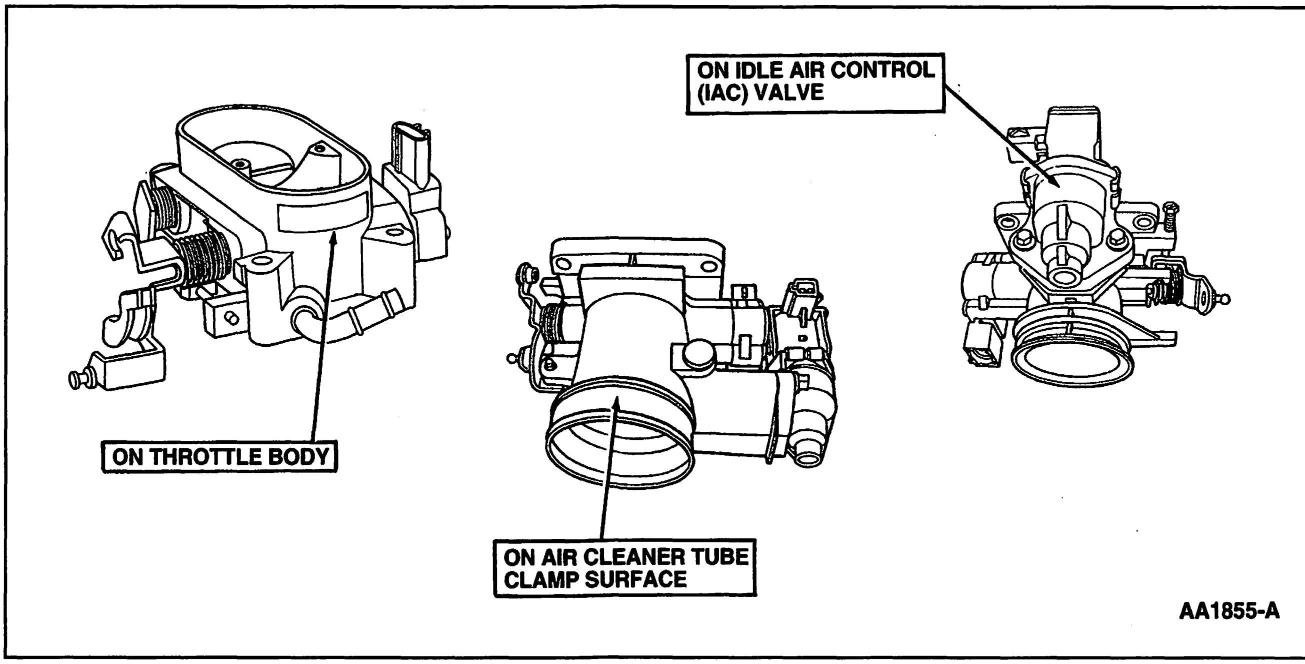


Figure 110: Typical Attention Decal Locations

Secondary Air Injection (AIR) Systems

Overview

The Secondary Air Injection (AIR) system controls emissions during the first few seconds of engine operation by forcing air downstream into the exhaust manifolds to oxidize the hydrocarbons and carbon monoxide created by running rich at start up.

Electric Secondary Air Injection System

The Electric Secondary Air Injection (AIR) system consists of an Electric AIR pump (EAP), single or dual combination check air injection diverter (AIR diverter) valve(s), an AIR bypass solenoid, a AIR relay, powertrain control module (PCM) and connecting wires and vacuum hoses (Figure 111).

1. The PCM requires CHT, IAT and CKP inputs to initiate Secondary Air Injection function.
2. When the engine is started, the strategy will determine when to enable the electric AIR pump. The PCM signals the AIR relay and the AIR bypass solenoid, after a (5 to 15) second delay, to begin system operation. Once the catalyst is lit-off, the PCM then signals the AIR relay to stop AIR pump operation and to close the AIR bypass solenoid from supplying vacuum to the AIR diverter valve(s).
3. The AIR relay provides the start-up signal and will switch the high current required to operate the AIR pump.
4. The AIR bypass solenoid applies a vacuum to the AIR diverter valve(s) causing it to open and to allow air to flow into the exhaust manifolds.
5. The function of the water shield if equipped is to provide the AIR pump with a source of dry air.
6. The electric AIR pump delivers the required amount of air to control emissions during engine operation. Air is forced into the exhaust manifolds to oxidize the hydrocarbons and carbon monoxide created by running rich at start up.

Secondary Air Injection (AIR) Systems

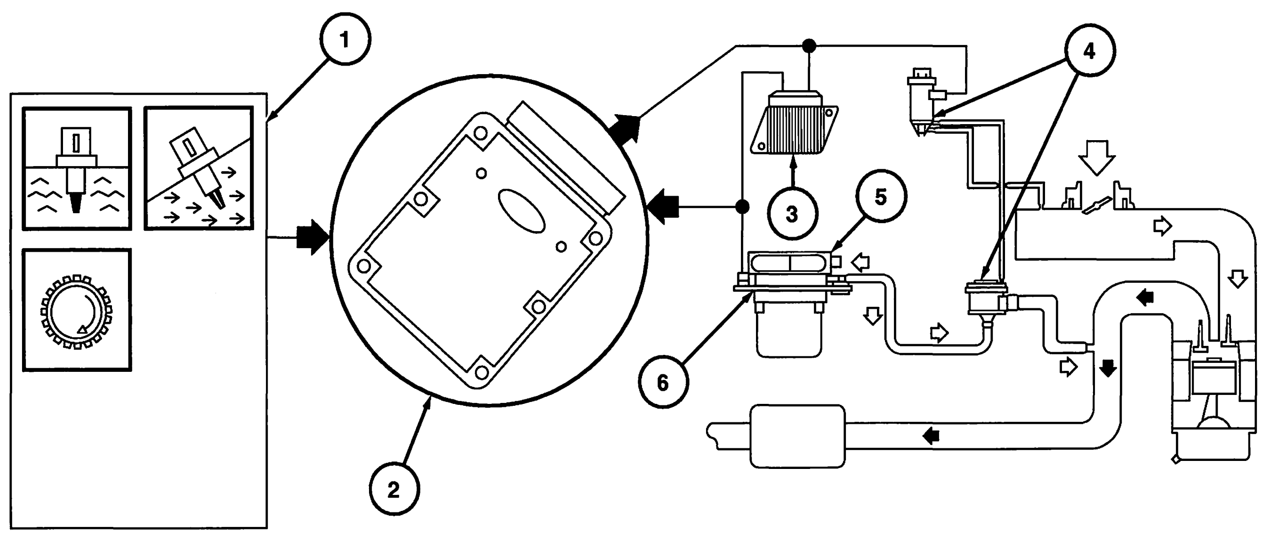


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Figure 111: Dual or Single AIRD Valve Electric Secondary Air Injection (AIR) (Refer to the On Board Diagnostics Monitor System Overview for icon definitions.)

Hardware

Electric AIR Pump

The electric AIR pump (Figure 112) provides pressurized air to the Secondary Air Injection system. The electric AIR pump functions independently of rpm and is controlled by the PCM. The electric AIR pump is only used for short periods of time. Delivery of air is dependent on the amount of system backpressure and system voltage. The inlet system of the AIR pump incorporates a splash cap which helps to guard against dirt and water.

Secondary Air Injection (AIR) Systems

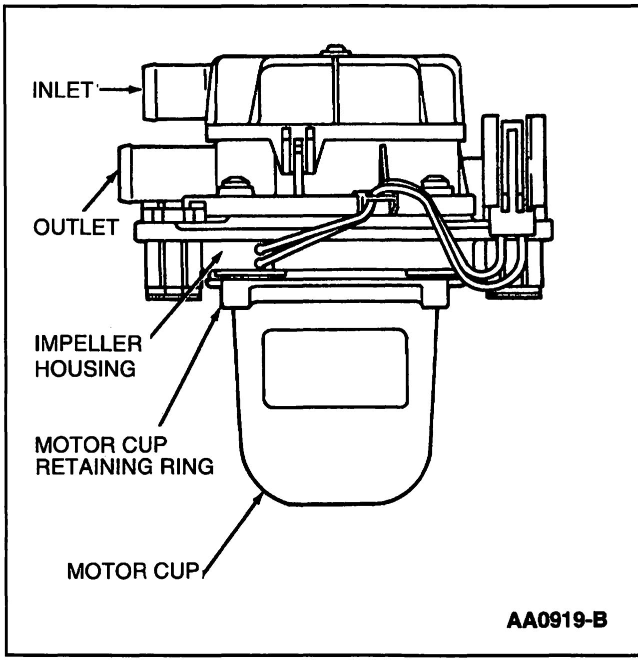

Figure 112: Electric Air Pump

AIR Bypass Solenoid

The secondary air injection bypass (AIR bypass) solenoid (Figure 113) is used by the PCM to control vacuum to the secondary air injection diverter (AIR diverter) valve. The AIR bypass solenoid is a normally closed solenoid. The AIR bypass solenoid also has a filtered vent feature to permit vacuum release.

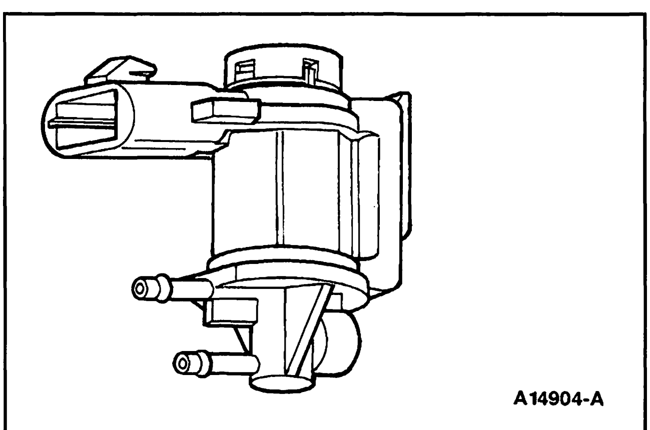

Figure 113: Secondary Air Injection Bypass Solenoid

Secondary Air Injection (AIR) Systems

AIR Diverter Valve

The secondary air injection diverter (AIR diverter) valve (Figure 114) is used with the electric AIR pump to provide on/off control of air to the exhaust manifold and catalytic converter. When the electric AIR pump is on and vacuum is supplied to the AIR diverter valve, air passes the integral check valve disk. When the electric AIR pump is off, and vacuum is removed from the AIR diverter valve, the integral check valve disk is held on the seat and stops air from being drawn into the exhaust system and prevents the back flow of the exhaust into the Secondary Air Injection System.

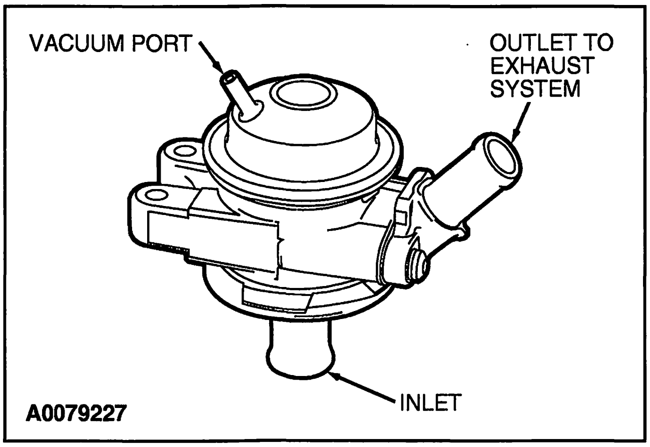

Figure 114: Air Injection Diverter (AIR Diverter) Valve

Variable Cam Timing System

Overview

Variable Cam Timing (VCT) enables rotation of the camshaft(s) relative to the crankshaft (phase-shafting) as a function of engine operating conditions. There are four types of VCT systems.

- Exhaust Phase Shifting (EPS) system - the exhaust cam is the active cam being retarded.
- Intake Phase Shifting (IPS) system - the intake cam is the active cam being advanced.
- Dual Equal Phase Shifting (DEPS) system - both intake and exhaust cams are phase shifted and equally advanced or retarded.
- Dual Independent Phase Shifting (DIPS) system - where both the intake and exhaust cams are shifted independently.

All systems have four operational modes; idle, part throttle, wide open throttle and default mode. At idle and low engine speeds with closed throttle, the phase angle are controlled by air flow, engine oil temperature and engine coolant temperature. At part and wide open throttle the PCM controls cam timing based on engine RPM, load and throttle position. VCT systems provide reduced emissions and enhanced engine power, fuel economy and idle quality. IPS systems also have the added benefit of improve torque. In addition, on some applications a VCT system can eliminated the need for an external Exhaust Gas Recirculation (EGR) system. The elimination of the EGR system is accomplished by controlling the overlap in valve opening between the intake valve opening and exhaust valve closing.

Currently for the 2004 model year, Ford Motor Company uses the IPS and DEPS systems. The IPS system is on Lincoln LS, Thunderbird and Focus SVT and the DEPS system is on the F150 5.4L 3V.

Variable Cam Timing

The VCT (variable cam timing) system consists of an electric hydraulic positioning control solenoid, a CMP (camshaft position sensor) and trigger wheel. The CMP trigger wheel has a number of equally spaced teeth equal to the number (n) of cylinders on a bank plus one extra tooth (n+1). Four cylinder and V8 engines use a CMP 4+1 tooth trigger wheel. V6 engines use a CMP 3+1 tooth trigger wheel. The extra tooth placed between the equally spaced teeth represents the CMP signal for that bank. A CKP (crankshaft position sensor) provides the PCM with crankshaft positioning information in 10 degree increments (Figure 115).

1. The PCM receives input signals from the IAT (intake air temperature), ECT (engine coolant temperature), EOT (engine oil temperature), CMP, TP (throttle position), MAF (mass air flow) and CKP to determine the operating conditions of the engine. At idle (low engine speeds and closed throttle) the PCM controls camshaft position based on air and coolant temperatures. During part and wide open throttle, camshaft position is determined by engine RPM, load and throttle position. The VCT system will not operate until the engine is at normal operating temperature.
2. The VCT system is enabled by the PCM when the proper conditions are met.

Variable Cam Timing System

3. The CKP signal is used as a reference for CMP positioning.

4. The VCT solenoid valve is an integral part of the VCT system. The solenoid valve controls the flow of engine oil in the VCT actuator assembly. As the PCM controls the duty cycle of the solenoid valve, oil pressure/flow advances or retards the cam timing. Duty cycles near 0% or 100% represent rapid movement of the camshaft. Retaining a fixed camshaft position is acomplished by dithering (oscillating) the solenoid valve duty cycle.

   The PCM calculates and determines the desired camshaft position. It will continually update the VCT solenoid duty cycle until desired positioning is achieved. A difference between the desired and actual camshaft position represents a position error in the PCM's VCT control loop. The PCM will disable the VCT and place the camshaft in a default position if a fault is detected. A related DTC will also be set when this fault is detected.

5. When the VCT solenoid is energized, engine oil is allowed to flow to the VCT actuator assembly which advances or retards the cam timing. One half of the VCT actuator is coupled to the camshaft and the other half is connected to the timing chain. Oil chambers between the two halves couple the camshaft to the timing chain. When the flow of oil is shifted from one side of the chamber to the other, the differential change in oil pressure forces the camshaft to rotate in either a advance or retard position depending on the oil flow.

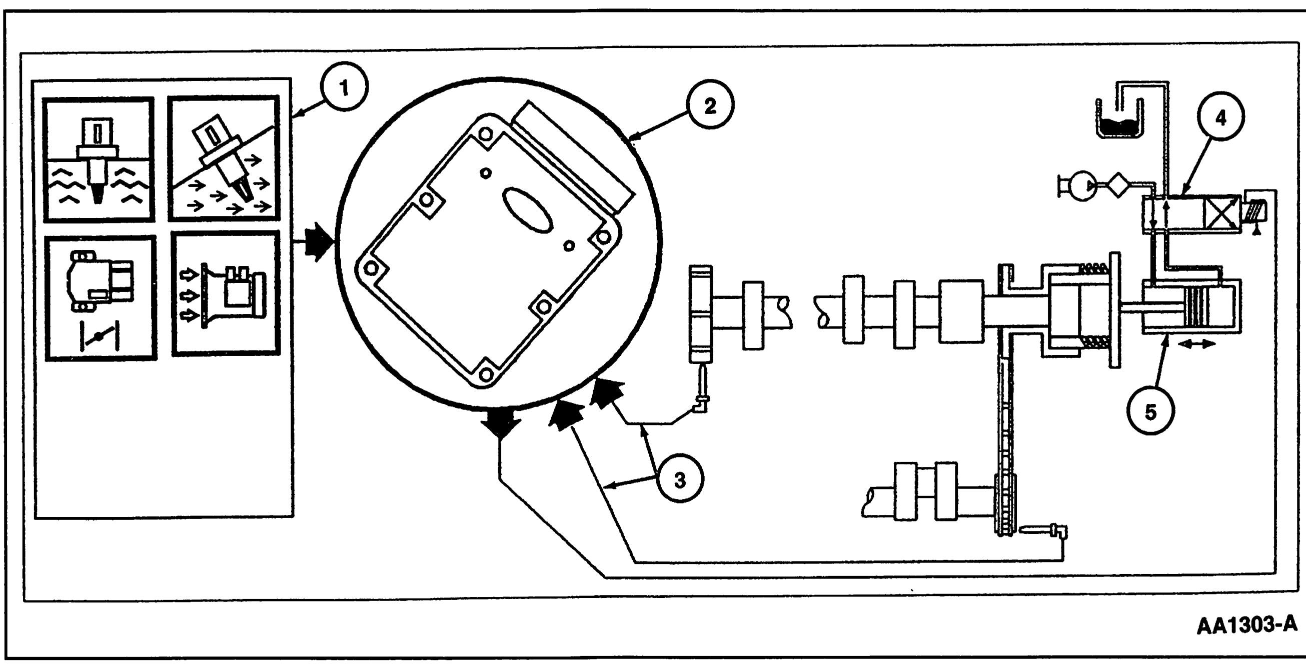

Figure 115: Variable Cam Timing System (Refer to the On Board Diagnostics System Overview for icon definitions.)

Positive Crankcase Ventilation System

Overview

The Positive Crankcase Ventilation (PCV) System (Figure 116) cycles crankcase gases back through the induction system into the engine where they are burned. The PCV valve regulates the amount of ventilated air and blow-by gases to the intake manifold and prevents backfire from traveling into the crankcase.

Currently, Ford uses heated and non-heated PCV valves. The purpose of the PCV heater is to prevent the PCV valve from freezing in cold ambient temperatures. Heated PCV valves are heated either by water or electric. Water heated systems use engine coolant to heat the valve to prevent freezing. Electrically heated systems use a heating element enclosed in the PCV valve to prevent the valve from freezing. Ford currently uses two types of electrically heated PCV valve systems:

- Thermal harness controlled — On vehicle application that are equipped with a thermal harness to the PCV valve. The thermal harness only provides electrical continuity to the heating element when temperature are less than 40°F (5°C +/-7°F (+/-4°C). Typically this harness is located close to the PCV valve.
- PCM heater controlled — On these applications the PCV heater is turned on by the PCM. When the intake air temperature is less than 32°F (0°C) the PCM grounds the Positive Crankcase Ventilation Valve Heater Control (PCVHC) circuit and turns the heater ON. When the intake air temperature exceeds 48°F (9°C) the heater is turned OFF. The PCV heater is also OFF when the engine is not running to prevent unnecessary battery drain. The heater is also OFF if the vehicle charging system is above 16 volts. This minimizes heater element overload.

Refer to the following figures for examples of these types of PCV valves.

Note: PCV systems that comply with OBD PCV monitoring requirements will use a quarter-turn cam-lock thread design at one end to prevent accidental disconnection from the rocker cover. For more information about the PCV monitor refer to PCV System Monitor in beginning of this Section.

CAUTION

Do not remove the PCV system from the engine. Removal of the PCV system will adversely affect the fuel economy and engine ventilation and result in shorter engine life.

Positive Crankcase Ventilation System

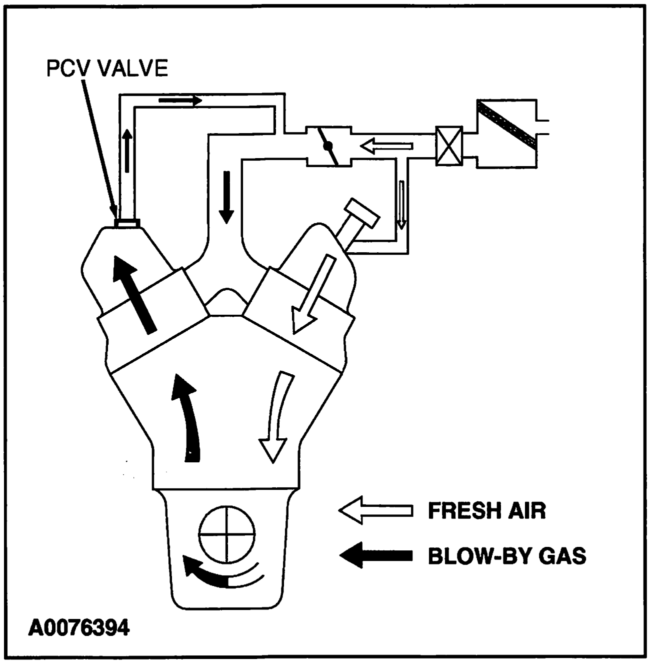

Figure 116: PCV System

Hardware

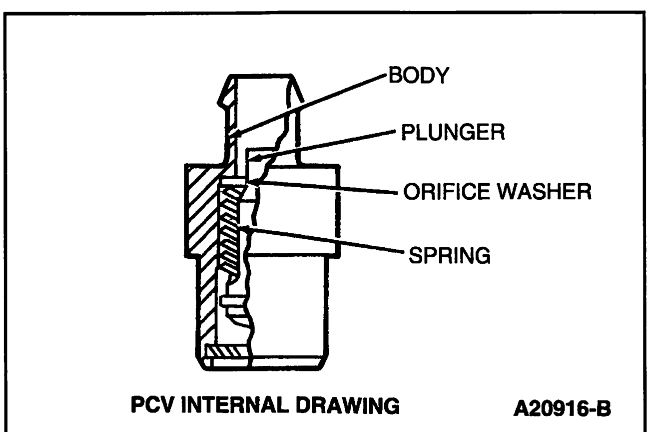

Figure 117: PCV Internal Drawing

Positive Crankcase Ventilation System

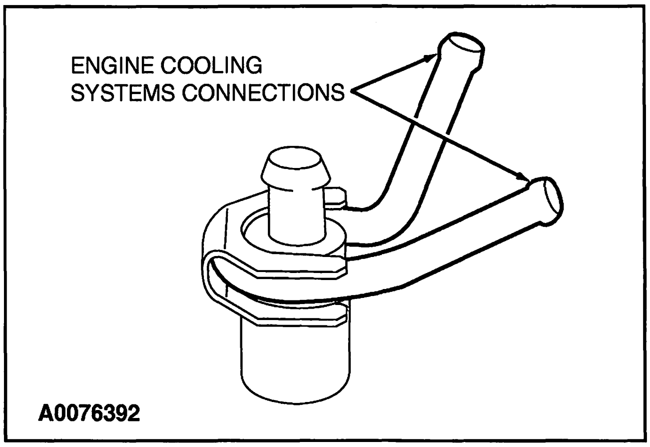

Figure 118: Water Heated PCV

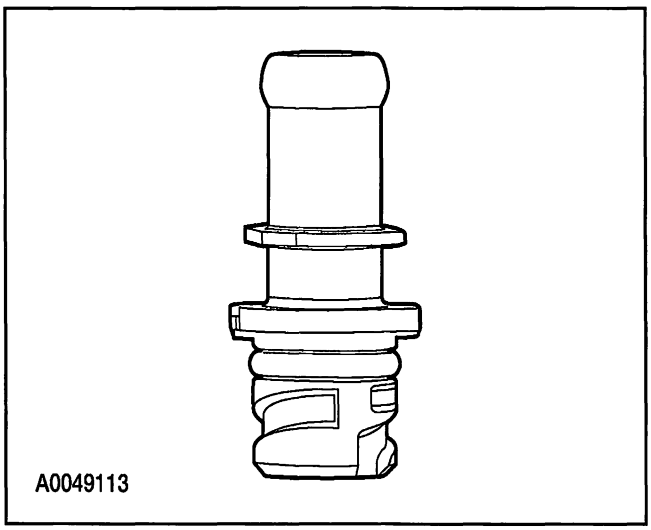

Figure 119: Quarter-Turn Cam-Lock Design PCV

Positive Crankcase Ventilation System

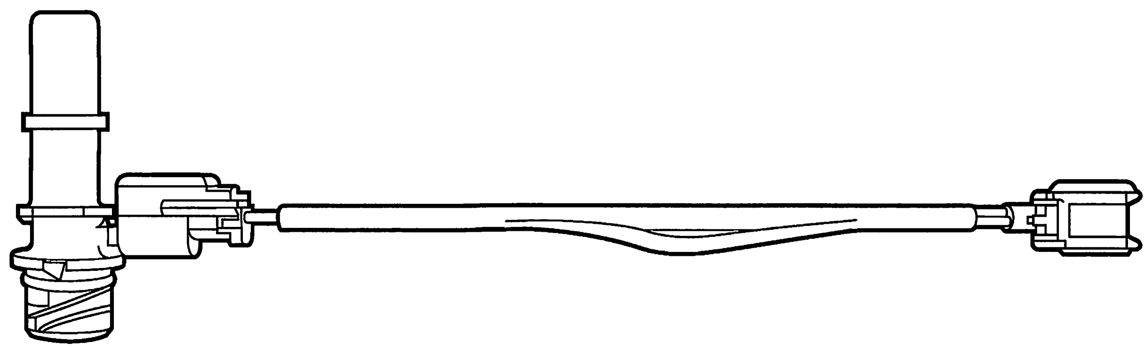
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Figure 120: Electrically Heated PCV (with thermal harness)

Note: On vehicle applications that are equipped with a thermal harness to the PCV valve . The thermal harness only provides electrical continuity when temperatures is less than 40° F (5° C) +/- 7° F (+/- 4°C).

Catalyst and Exhaust Systems

Overview

The Catalytic Converter and Exhaust systems work together to control the release of harmful engine exhaust emissions into the atmosphere. The engine exhaust gas consists mainly of nitrogen (N), carbon dioxide (CO_2) and water vapor (H_2O). However, it also contains carbon monoxide (CO), oxides of nitrogen (NO_x), hydrogen (H), and various unburned hydrocarbons (HCs). CO, NO_x, and HCs are major air pollutants, and their emission into the atmosphere must be controlled.

The exhaust system generally consists of an exhaust manifold, front exhaust pipe, front heated oxygen sensor (HO2S), rear exhaust pipe, catalyst HO2S, a muffler and an exhaust tailpipe. The catalytic converter is typically installed between the front and rear exhaust pipes. On some vehicle applications, more than one catalyst will be used between the front and rear exhaust pipes. Catalytic converter efficiency is monitored by the On Board Diagnostic (OBD) system strategy in the PCM. Refer to the Catalyst Efficiency Monitor-Federal Test Procedure at the beginning of Section 1 for specific OBD catalyst monitor information.

The number of HO2S(s) used in the exhaust stream and the location of these sensors depend on the vehicle emission certification level (i.e. LEV, ULEV, PZEV). Refer to (Figure 121) and (Figure 122) for typical HO2S stream locations and naming convention. On most vehicles only two HO2S are used in an exhaust stream. The front sensors (HO2S11/HO2S21) before the catalyst will be used for primary fuel control while the ones after the catalyst (HO2S12/HO2S22) will be utilized to monitor catalyst efficiency. However, some Partial Zero Emission Vehicles (PZEV) will utilize three HO2S sensors for each engine bank. The stream 1 sensors (HO2S11/HO2S21) before the catalyst will be used for primary fuel control, the next group of sensors or stream 2 (HO2S12/HO2S22) is utilized to monitor the light-off catalyst and the last group of sensors or stream 3 (HO2S13/HO2S23) is utilized for long term fuel trim control to optimize catalyst efficiency (Fore Aft Oxygen Sensor Control). Currently Ford's PZEV vehicles use only a 4-cylinder engine, so only the Bank 1 HO2S(s) will be utilized.

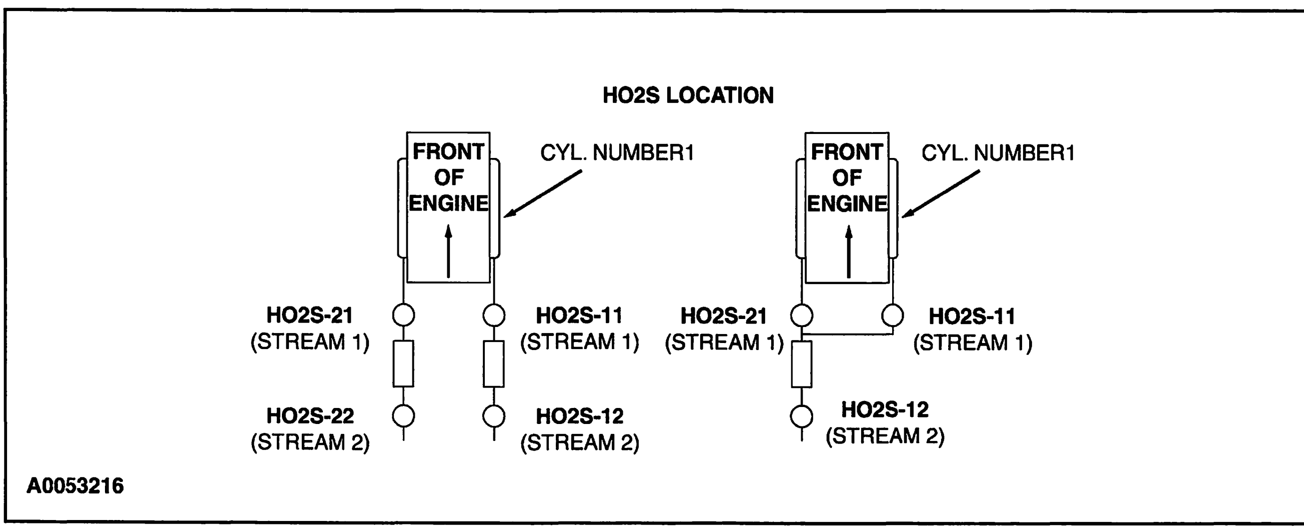

Figure 121: V- Engines

Catalyst and Exhaust Systems

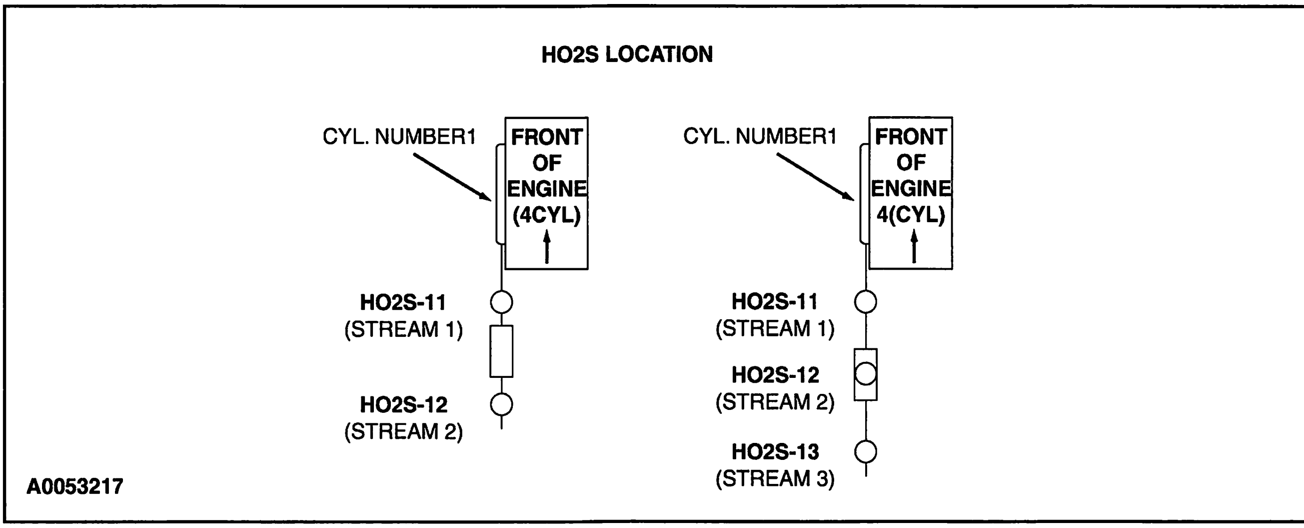

Figure 122: In-Line Engines

Catalytic Converter

A catalyst is a material that remains unchanged when it initiates and increases the speed of a chemical reaction. A catalyst will also enable a chemical reaction to occur at a lower temperature. The concentration of exhaust gas products released to the atmosphere must be controlled. The catalytic converter assists in this task. It contains a catalyst in the form of a specially treated ceramic honeycomb structure saturated with catalytically active precious metals. As the exhaust gases come in contact with the catalyst, they are changed into mostly harmless products. The catalyst initiates and speeds up heat producing chemical reactions of the exhaust gas components so they are used up as much as possible.

Light Off Catalyst

As the catalyst heats up, converter efficiency rises rapidly. The point at which conversion efficiency exceeds 50% is called catalyst light off. For most catalysts this point occurs at 475 to 575°F (246 to 301°C). A fast light catalyst is a three way catalyst (TWC) that is located as close to the exhaust manifold as possible. Because the light off catalyst is located close too the exhaust manifold it will light off faster and reduce emissions quicker than the catalyst located under the body. Once the catalyst lights off, the catalyst will quickly reach the maximum conversion efficiency for that catalyst.

Three-Way Catalyst (TWC) Conversion Efficiency

A TWC requires a stoichiometric fuel ratio, 14.7 pounds of air to 1 pound of fuel (14.7:1), for high conversion efficiency. In order to achieve these high efficiencies, the air/fuel ratio must be tightly controlled with a narrow window of stoichiometry. Deviations outside of this window will greatly decrease the conversion efficiency (Figure 123). For example a rich mixture will decrease the HC and CO conversion efficiency while a lean mixture will decreases the NO_x conversion efficiency.

Catalyst and Exhaust Systems

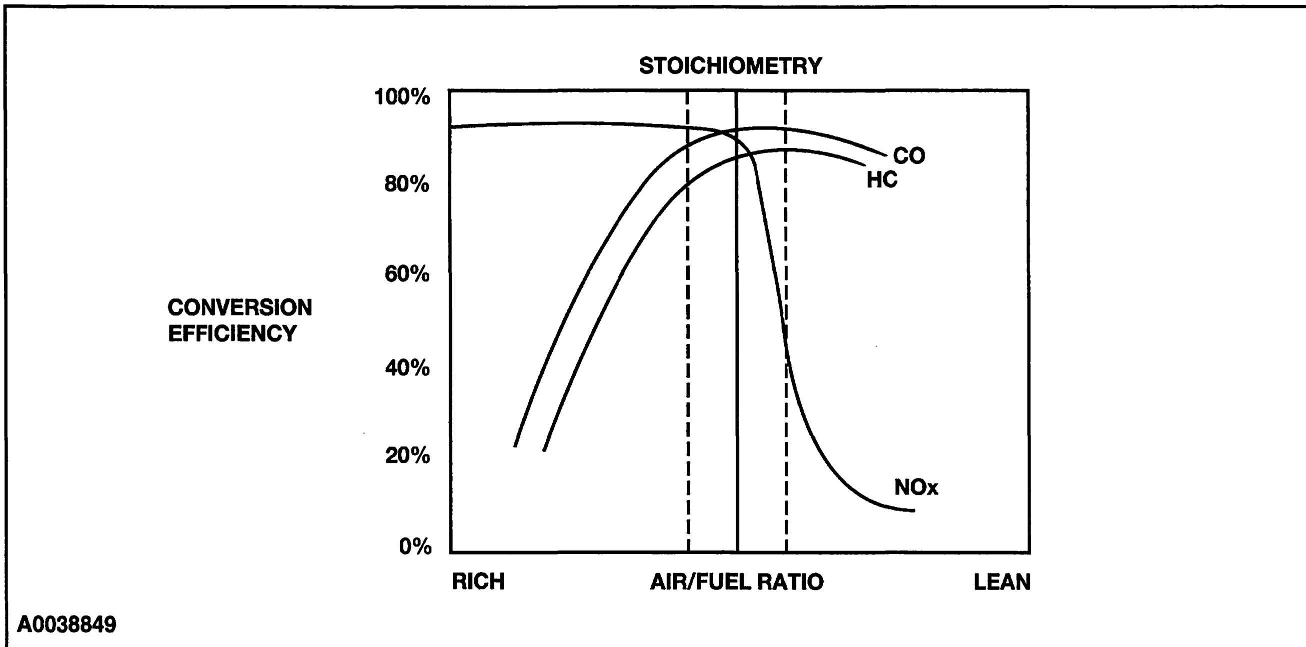

Figure 123: TWC Conversion Efficiency Chart

Exhaust System

The purpose of the exhaust system is to convey engine emissions from the exhaust manifold to the atmosphere. Engine exhaust emissions are directed from the engine exhaust manifold to the catalytic converter through the front exhaust pipe. An HO2S is mounted on the front exhaust pipe before the catalyst. The catalytic converter reduces the concentration of carbon monoxide (CO), unburned hydrocarbons (HCs) and oxides of nitrogen (NO_x) in the exhaust emissions to an acceptable level. The reduced exhaust emissions are directed from the catalytic converter through another HO2S mounted in the rear exhaust pipe (Figure 124) and then on into the muffler. Lastly, the exhaust emissions are directed to the atmosphere through an exhaust tailpipe.

Note on some Partial Zero Emission Vehicles (PZEV), there will be a total of 3 HO2S in the exhaust stream. One near the exhaust manifold (stream 1), one in the middle of the light-off catalyst (stream 2) and the third (stream 3) is mounted after the light-off catalyst (Figure 125).

Catalyst and Exhaust Systems

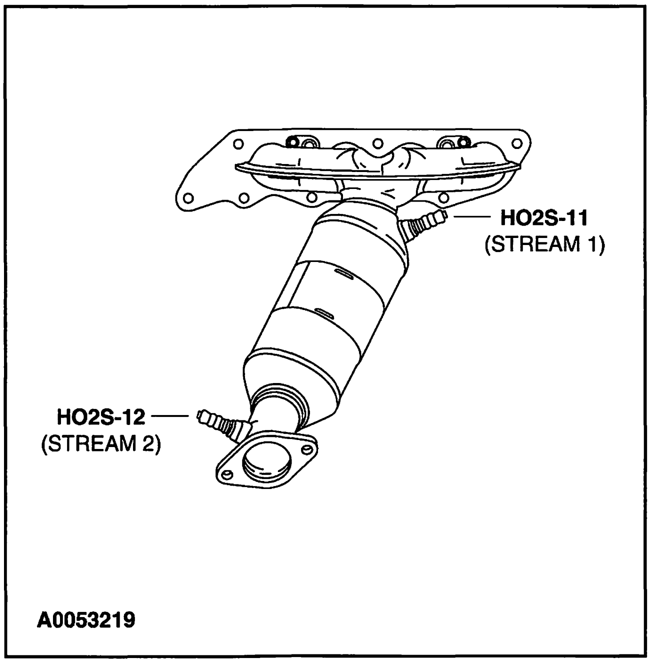

Figure 124: Typical Bank 1 Catalyst Two HO2S Configuration

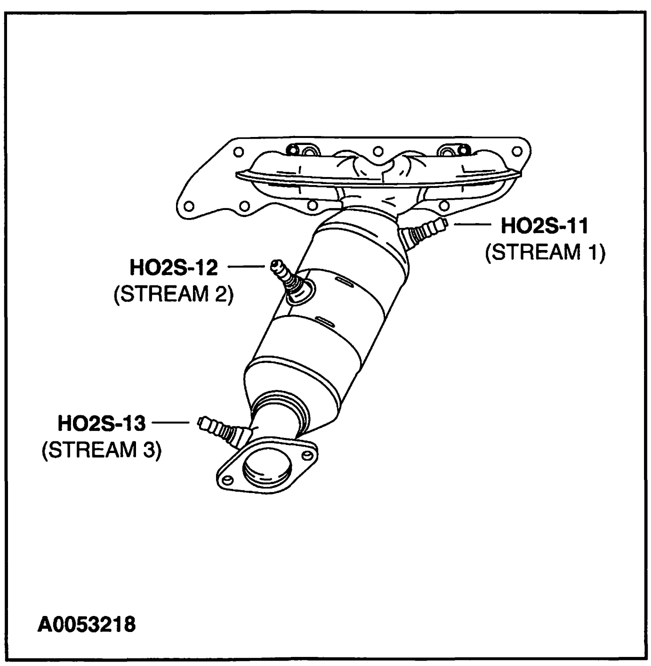

Figure 125: Typical Bank 1 Catalyst Three HO2S Configuration

Catalyst and Exhaust Systems

Underbody Catalyst

The underbody catalyst is located after the light off catalyst. The underbody catalyst may be in-line with the light off catalyst, or the underbody catalyst may be common to two light off catalysts, forming a "Y" pipe configuration. For an exact configuration of the catalyst and exhaust system for a specific vehicle, refer to the Exhaust System Section 309 in the Workshop Manual for that vehicle.

Three-Way Catalytic Converter

The three-way catalytic (TWC) converter contains either platinum (Pt) and rhodium (Rh) or palladium (Pd) and rhodium (Rh). The TWC converter catalyzes the oxidation reactions of unburned HCs and CO and the reduction reaction of NO_x. The three-way conversion can be best accomplished by always operating the engine air fuel/ratio at or close to stoichiometry.

Exhaust Manifold/Runners

The exhaust manifold runners collect exhaust gases from engine cylinders. The number of exhaust manifolds and exhaust manifold runners depends on the engine configuration and number of cylinders.

Exhaust Pipes

Exhaust pipes are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The pipes serve as guides for the flow of exhaust gases from the engine exhaust manifold through the catalytic converter and the muffler.

Heated Oxygen Sensors (HO2S)

The HO2S provide the powertrain control module (PCM) with voltage and frequency information related to the oxygen content of the exhaust gas. (Refer to the PCM Inputs for a description of how the HO2S operates.)

Muffler

Mufflers are usually treated during manufacturing with an anti-corrosive coating agent to increase the life of the product. The muffler reduces the level of noise produced by the engine, and it also reduces the noise produced by exhaust gases as they travel from the catalytic converter to the atmosphere.

Supercharger and Intercooler Systems

Supercharger Bypass System

The Supercharger Bypass (SCB) System allows the high pressure air at the outlet of the supercharger to vent back in the inlet of the supercharger, equalizing the pressure. This eliminates the boost (increased pressure that a supercharger produces) for times when supercharger function is undesirable. The components in this system are the vacuum bypass actuator (Figure 127)(which controls the bypass valve inside the supercharger), a supercharger (boost) bypass (SCB) solenoid (Figure 128) and a vacuum reservoir (Figure 129). The system normally operates with engine vacuum applied to the upper port of the vacuum bypass actuator, while the lower port references the air pressure in the clean air tube to cancel out any pressure difference in the intake air system. The actuator is set to open (bypassing the supercharger) during high vacuum engine conditions. As the throttle is opened, and engine vacuum decreases, the actuator closes to allow the supercharger to pressurize the air in the manifold. If an undesirable condition occurs in the engine, such as overheating or a critical Electric Engine Control (Electronic EC) sensor failure, the powertrain control module (PCM) also has the ability to control the SCB solenoid and direct the vacuum bypass actuator to bypass the supercharger. Once the engine condition has been corrected, the PCM allows the engine vacuum to control the vacuum bypass actuator.

Supercharger Assembly

The supercharger assembly (Figure 126) is a positive displacement pump. Its purpose is to supply an excess volume of intake air to the engine by increasing air pressure and density in the intake manifold. The supercharger assembly incorporates the bypass system to reduce air handling losses when boost is not required, resulting in better fuel economy. When integrated on the engine, the supercharger will increase torque across the entire engine operating range from 25 to 50 percent without compromising driveability or emissions. The supercharger is matched to the engine by its displacement and belt ratio, and can provide excess airflow at any engine speed. It contains two three-lobed rotors. The helical shape and specialized porting provide a smooth discharge flow and low level of noise during operation. The rotors are supported by ball bearings in front and needle bearings at the rear. The drive gears are pressed into place, therefore the supercharger is replaced as a unit, and is not serviceable.

Supercharger (Boost) Bypass Solenoid/(Thermactor Air Control Solenoid/Vacuum Valve Assembly)

The supercharger (boost) (SCB) solenoid is used to control intake manifold vacuum to the vacuum bypass actuator. This part is replaced in field service diagnostics under the part name of a thermactor air control solenoid/vacuum valve assembly (part number 9H465). The PCM transmits an output signal to the SCB solenoid, thereby activating the solenoid to apply stored vacuum from the reservoir to the actuator, when an undesirable condition occurs in the engine. Once the engine condition has been corrected, the solenoid will be de-activated by the PCM, allowing engine intake manifold vacuum to control the actuator. The SCB solenoid is normally de-energized.

Vacuum Reservoir Assembly

The vacuum reservoir assembly stores vacuum that is applied to the vacuum actuator when a condition such as overheating or a critical sensor failure is generated. This allows the vacuum actuator to bypass the supercharger.

Supercharger and Intercooler Systems

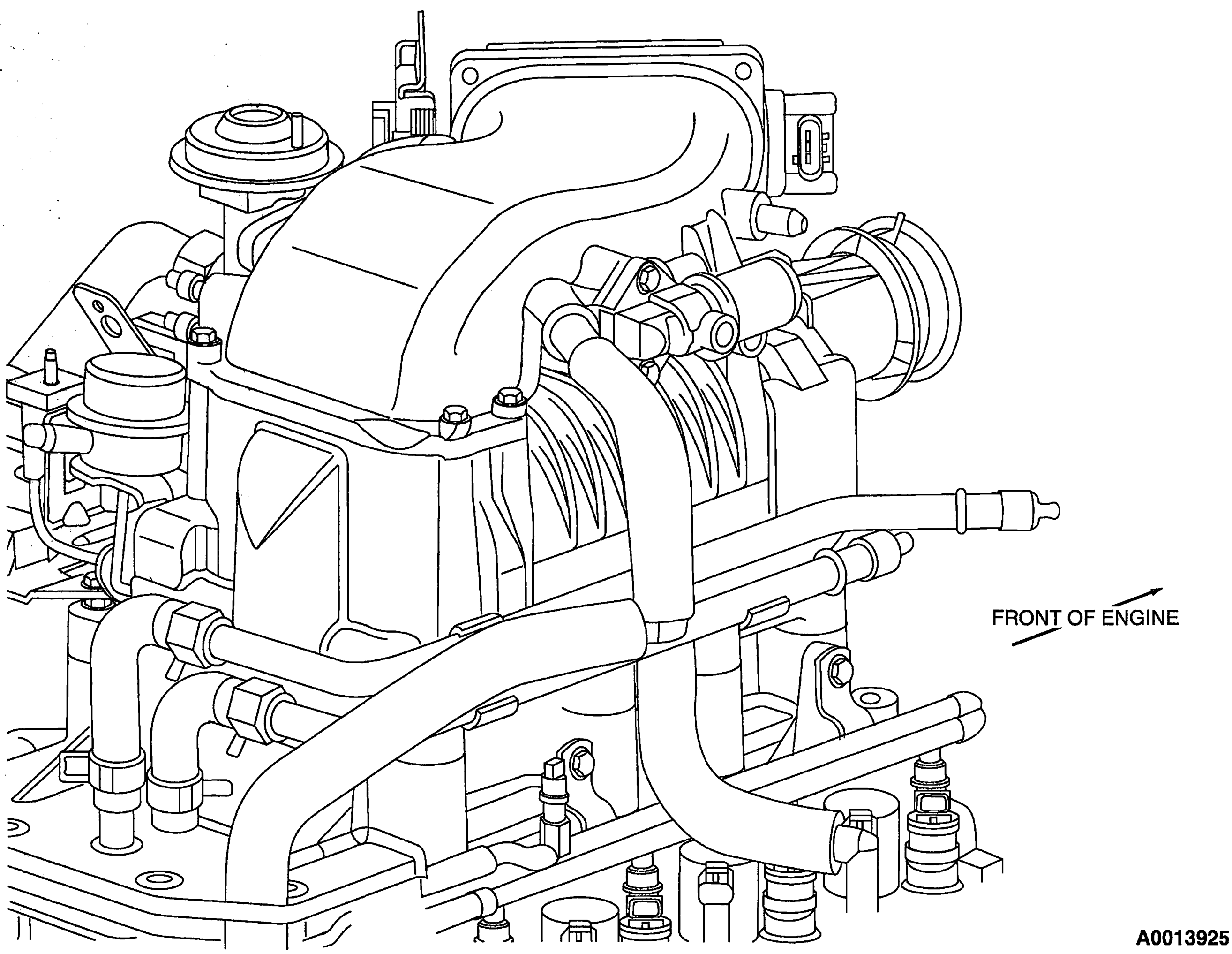

Figure 126: 5.4L Supercharger Assembly

Supercharger and Intercooler Systems

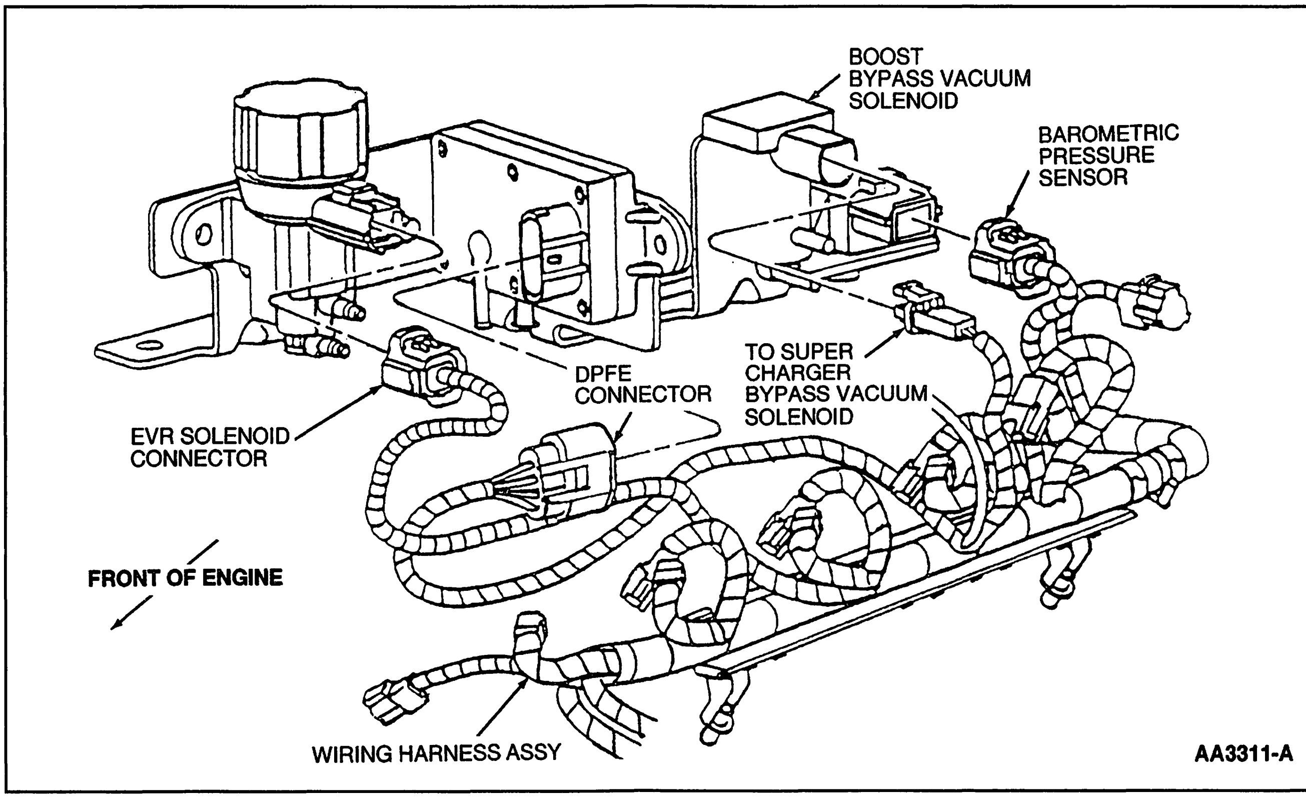

Figure 127: 5.4L Supercharger Controls—Wiring Harness Assembly

Supercharger and Intercooler Systems

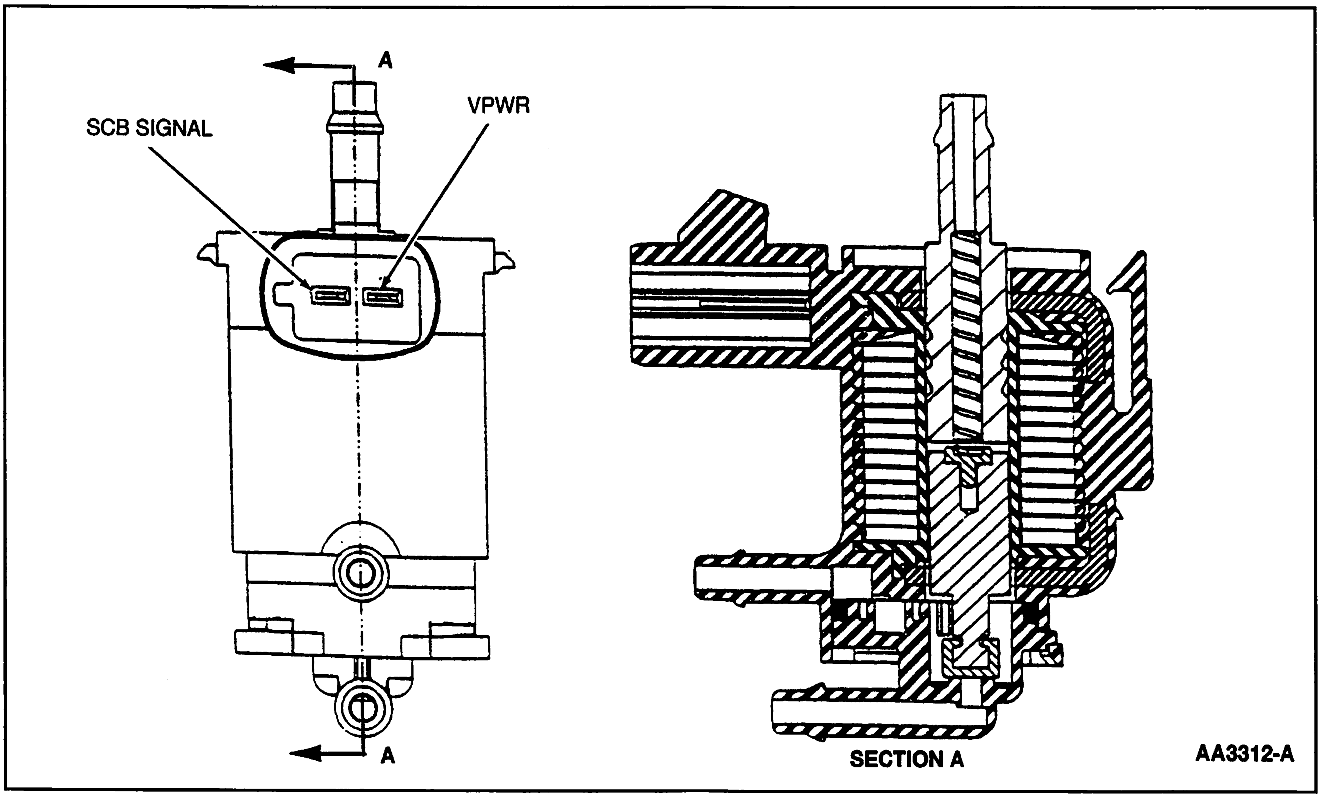

Figure 128: Supercharger (Boost) Bypass Solenoid (Thermactor Air Control Solenoid/Valve Assembly)

Supercharger and Intercooler Systems

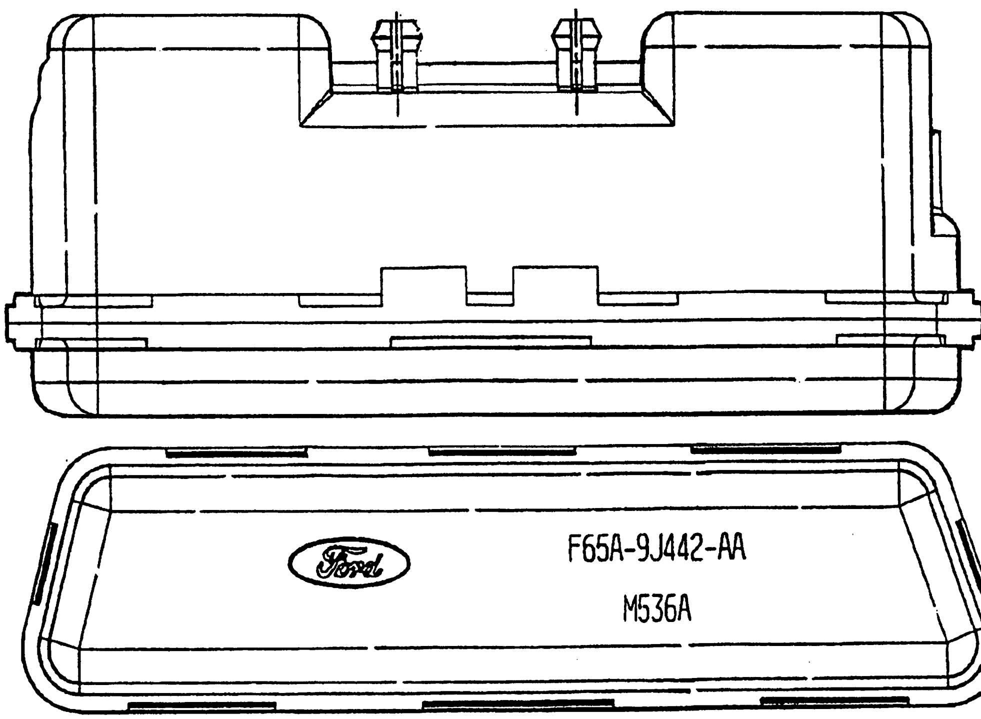

Figure 129: Vacuum Reservoir Assembly

Intercooler System

The Intercooler System (Figure 130) and (Figure 131) is designed to cool the induction air, which has been heated by the supercharger. The removal of heat from the pressurized air going into the intercooler increases the air density, which improves combustion efficiency, engine horsepower and torque. The system consists of an additional radiator in the grille, a reservoir (independent from engine cooling system), an electric water pump, a heat exchanger (intercooler) located in the lower intake manifold and tubing to interconnect these components. The intercooler is positioned after the supercharger, directly in the flow of the intake air. As the heated air flows through the intercooler, heat is transferred to the coolant which is circulated back to the intercooler radiator to be cooled by the airflow through the grille. The intercooler pump is controlled by the powertrain control module (PCM) to maintain a desirable intake air temperature by a second intake air temperature (IAT2) sensor in the lower intake manifold.

Supercharger and Intercooler Systems

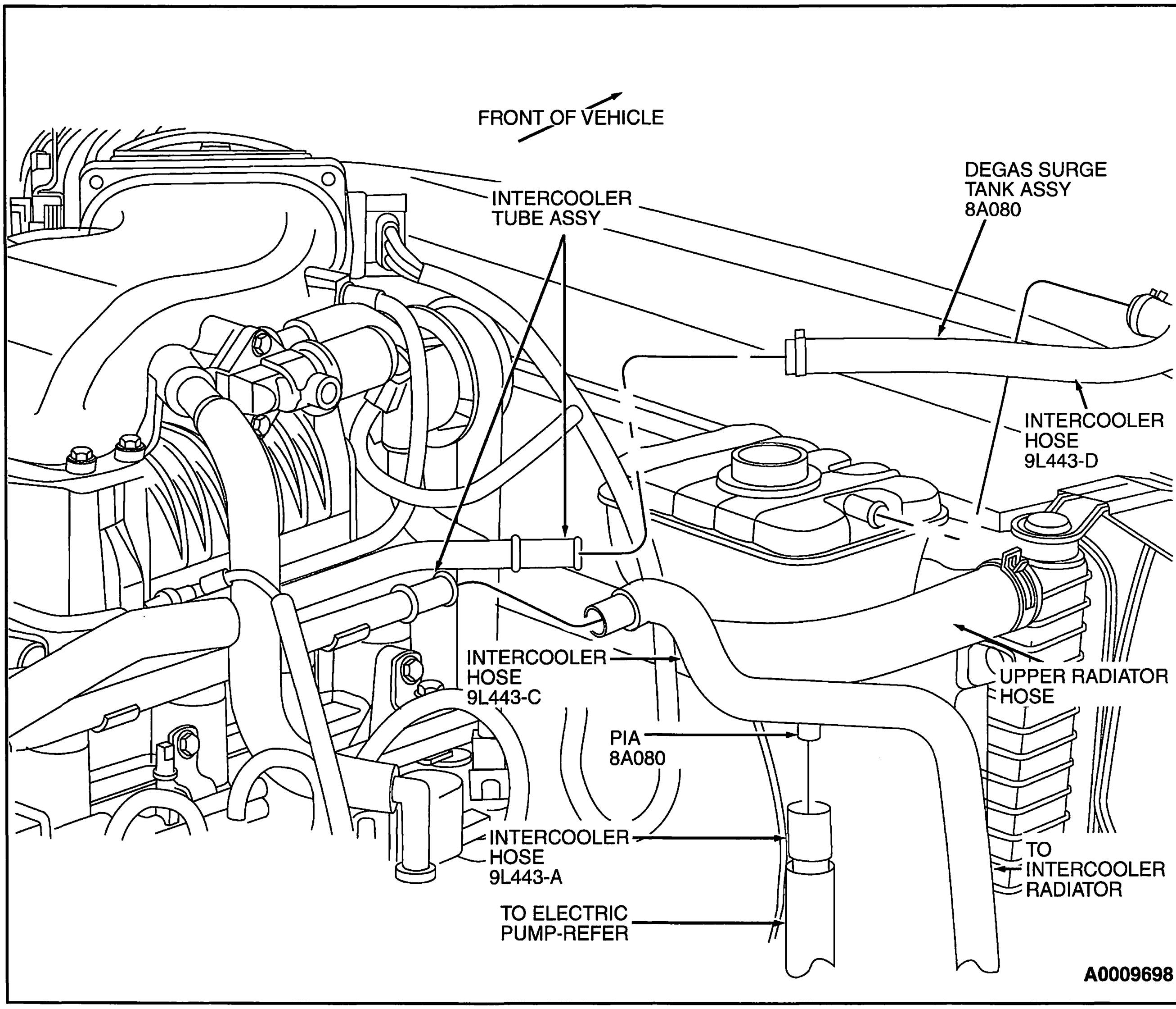

Figure 130: Intercooler Hoses

Supercharger and Intercooler Systems

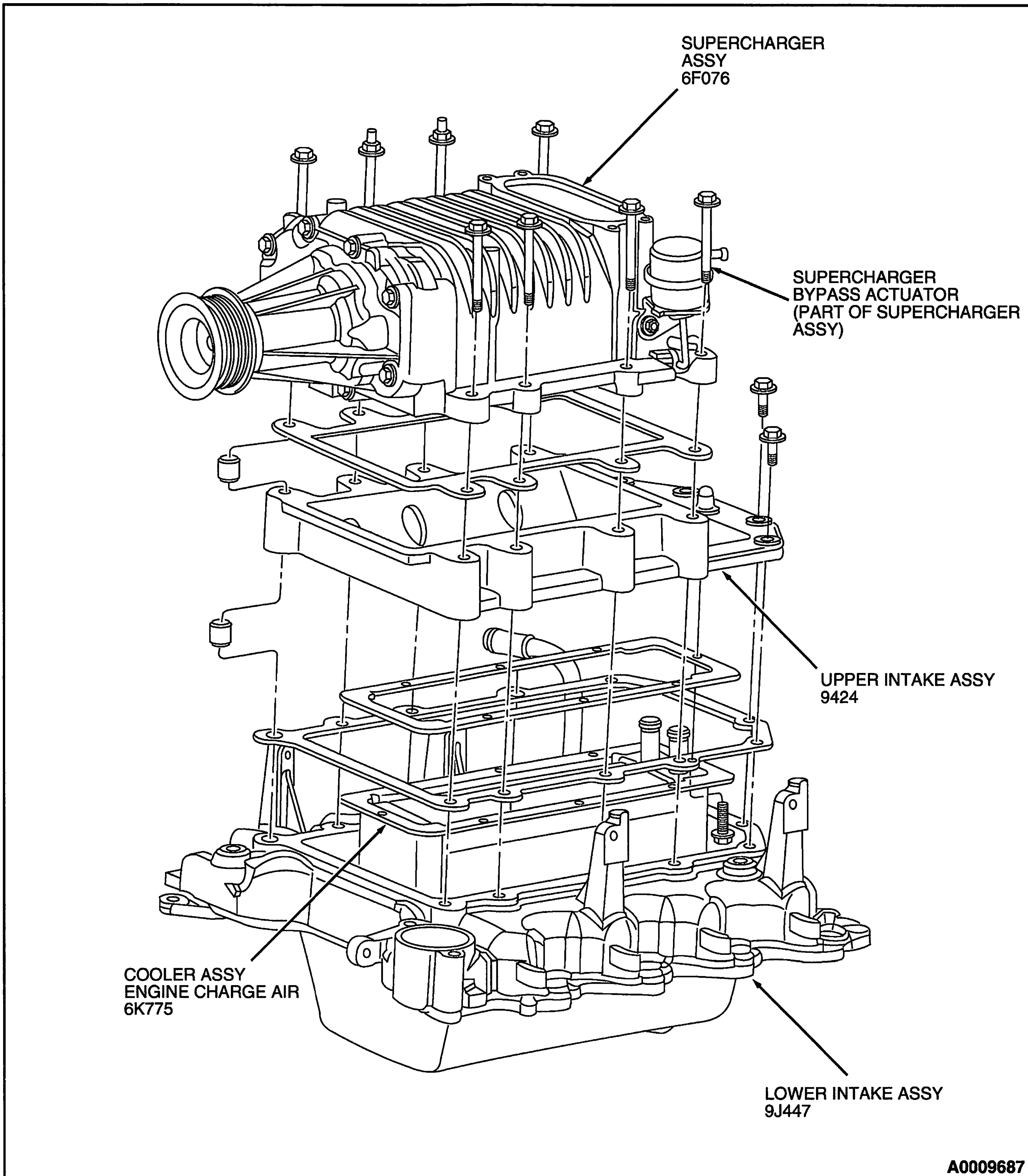

Figure 131: Unassembled Intercooler Hardware

PCM—Controlled Charging System

Overview

The PCM-Controlled charging system (Figure 132) provides many additional benefits over the current Integral Generator Regulator system. The first benefit is improved battery life. In an integral generator regulator system, the regulator set point is established by a temperature sensor in the regulator which estimates battery temperature. Field data has shown this approach lacks accuracy. With a PCM-controlled generator, the regulator voltage set point is determined by the PCM and communicated to the regulator via the generator communication line. The PCM will use a calibratable algorithm to estimate battery temperature. Improving battery temperature estimates will reduce battery damage caused by over- and undercharging.

The second benefit is improved engine performance. Whenever the PCM senses a wide-open throttle (WOT) condition, the PCM will momentarily lower the regulator voltage set point. This reduces the torque load of the generator on the engine and improves acceleration. The PCM has a calibratable time limit on this reduced voltage feature. This is to prevent the generator output from being cut back for an extended WOT period, which could cause battery discharge.

The third benefit is improved idle stability. In response to the PCM's generator communication signal, the regulator uses a generator monitor signal to provide feedback to the PCM. The generator monitor signal provides the PCM with charging system information. Specifically, it lets the PCM know when the charging system receives a transient electrical load which would normally affect idle stability. Because the PCM can anticipate additional loads, actions can be taken to minimize idle sag. The PCM can choose to either reduce the regulator set point or increase engine idle speed, both of which are calibratable features. In order to establish whether the regulator is accurately maintaining the desired voltage set point, the regulator uses a charging system voltage line to sense battery voltage at the rear power distribution box.

The fourth benefit is reduced cranking efforts. The PCM can reduce the mechanical load on the starter by initially commanding a low voltage set point. This may improve start times.

If the PCM detects a charging system error, it will broadcast a low voltage telltale (ON) command which tells the cluster to light the charge indicator. The charge indicator will be illuminated if the PCM fails to see a signal on the generator monitor line for a time period greater than 500 milliseconds. This telltale command will also be used to indicate over-voltage conditions detected by the PCM controlled generator.

Each time the ignition switch is cycled to the run position, the cluster will initiate a bulb check by illuminating the charge indicator. It is the PCM's responsibility to issue a low voltage telltale (OFF) command if the charging system is functioning properly. This message should be sent during Network Initialization in the voluntary phase (250 milliseconds to 450 milliseconds after the ignition switch is cycled to the run position). If a low voltage telltale (OFF) command is not received by the cluster, the cluster will continue to light the charge light indefinitely.

PCM—Controlled Charging System

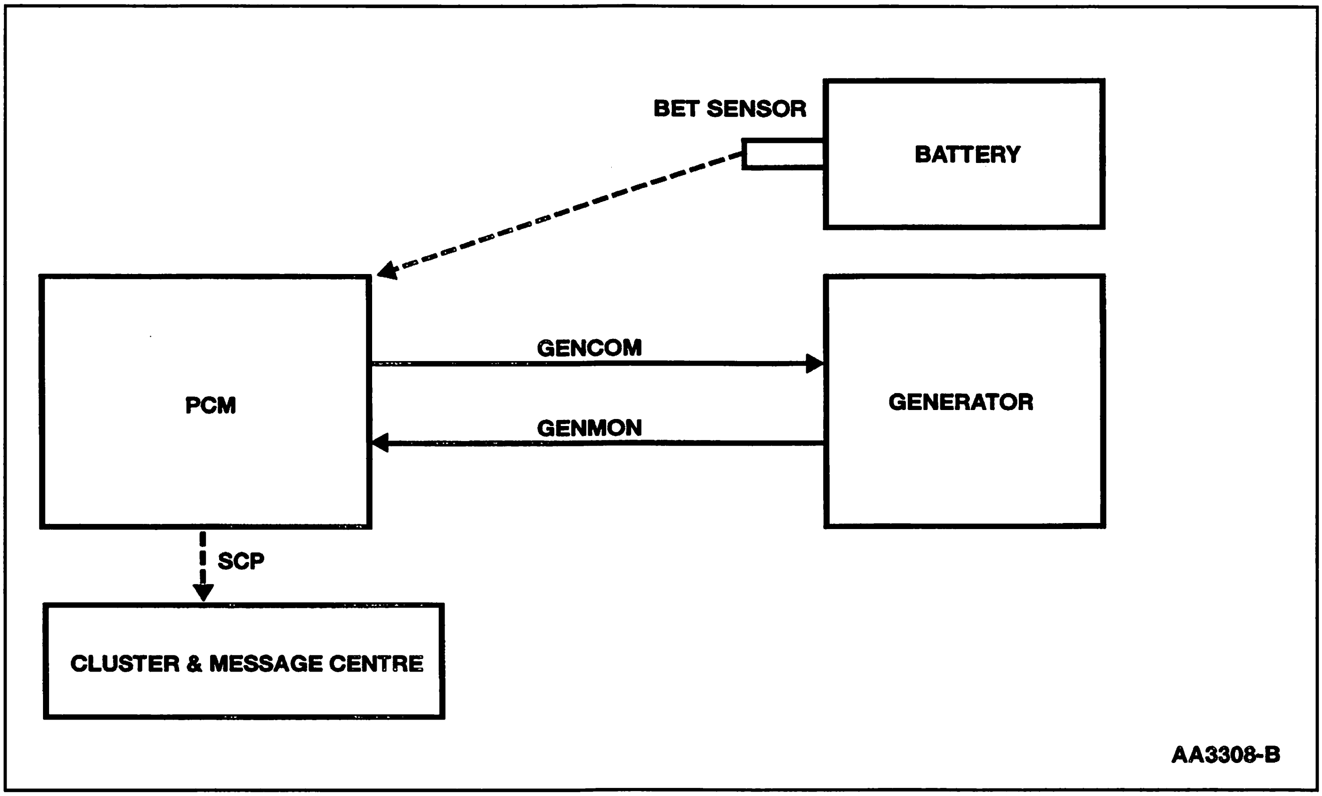

Figure 132: PCM Charging System Interfaces

Torque Based Electronic Throttle Control (ETC)

Overview

The Generation II (Gen II) Torque Based Electronic Throttle Control (ETC) is a hardware and software strategy that delivers a transmission output shaft torque (via throttle angle) based on driver demand (pedal position). It utilizes an electronic throttle body, the PCM and a accelerator pedal assembly to control throttle opening and engine torque. The ETC system basically replaces the standard cable operated accelerator pedal, idle air control (IAC) motor, 3-wire throttle position sensor (TPS) and mechanical throttle body .

Background "Why Torque Based ETC"

Torque based ETC enables aggressive automatic transmission shift schedules (earlier upshifts and later downshifts). This is possible by adjusting the throttle angle to achieve the same wheel torque during shifts, and by calculating this desired torque, the system prevents engine lugging (low RPM and low manifold vacuum) while still delivering the performance and torque requested by the driver.

It also enables many fuel economy/emission improvement technologies such as:

- VCT (deliver same torque during transitions)
- Hybrid Electric Vehicle (HEV)

Torque based ETC also results is a less intrusive vehicle and engine speed limiting, along with smoother traction control.

Other generic benefits of ETC are:

- Eliminate cruise control actuators
- Eliminate Idle Air Control (IAC) Bypass actuator
- Better airflow range
- Packaging (no cable)
- More responsive powertrain at altitude and improved shift quality

It should be noted that the ETC system includes a wrench light on the instrument cluster that illuminates when a fault is detected. Faults are also accompanied by DTCS and the "Check Engine Soon" light.

Electronic Throttle Body (ETB)

The Gen II electronic throttle body (Figure 133) has the following characteristics

1. The DC motor is driven by the PCM (requires two wires). The gear ratio from the motor to the throttle plate shaft is 17:1.

Torque Based Electronic Throttle Control (ETC)

2. There are two designs; parallel and in-series. The parallel design has the motor under the bore parallel to the plate shaft. The motor housing is integrated into the main housing (in general this is more difficult to package). The in-series design has a separate motor housing that protrudes out and offers more packaging flexibility.
3. Two springs are used: one is used to close the throttle (main spring) and the other is in a plunger assembly that results in a default angle with no power applied. This is for limp home reasons (force of plunger spring is 2 times stronger than the main spring). Default angle is usually set to result in a top vehicle speed of 30 MPH (48Km). Typically this throttle angle is 7 to 8 degrees from the hard-stop angle.
4. The closed throttle plate hard stop is used to avoid the throttle from binding in the bore (~0.75 degree). This hard stop setting is non-adjustable and is set to result in less airflow than the minimum engine airflow required at idle.
5. Unlike cable type throttle bodies, the intent for the ETB is not to have a hole in the throttle plate or to use plate sealant. The hole is not required in the ETB because the required idle airflow is provided by the plate angle in the throttle body assembly. This plate angle controls idle and idle quality and eliminates the need for IAC bypass actuator.
6. The system has two throttle position sensors. Redundant throttle position signals are required for monitor reasons. TP1 has a negative slope (increasing angle, decreasing voltage) and TP2 has a positive slope (increasing angle, increasing voltage). During normal operation the negative sloped TP sensor (TP1) is used by the control strategy as the indication of throttle position. The TP sensor assembly requires four wires.
   - 5 V Reference Voltage
   - Signal Return (ground)
   - TP1 voltage with negative voltage slope (5-0)
   - TP2 voltage with positive voltage slope (0-5)

Accelerator Pedal Position Sensors (APPS)

The ETC strategy uses pedal position sensors as an input to determine the driver demand.

1. There are three pedal position sensors required for system monitoring. APP1 has a negative slope (increasing angle, decreasing voltage) and APP2 & APP3 both have a positive slope (increasing angle, increasing voltage). During normal operation APP1 is used as the indication of pedal position by the strategy.
2. There are two VREF wires, two signal return wires and three signal wires (total of seven wires and pins) between the PCM and APPS assembly.
   - 2- 5 V Reference Voltage
   - 2- Signal Return (ground)

Torque Based Electronic Throttle Control (ETC)

- APP1 voltage with negative voltage slope (5-0)
- APP2 voltage with positive voltage slope (0-5)
- APP3 voltage with positive voltage slope (0-5)

3. The pedal position signal is converted to pedal travel degrees (rotary angle) by the PCM. The software then converts these degrees to counts, which is the input to the torque based strategy.
4. The three pedal position signals ensure a correct input to the PCM, if any one signal has a fault. The PCM knows if a signal is wrong by calculating where it should be, inferred by the other signals. A value will be substituted for a faulty signal if two out of the three signals are bad.

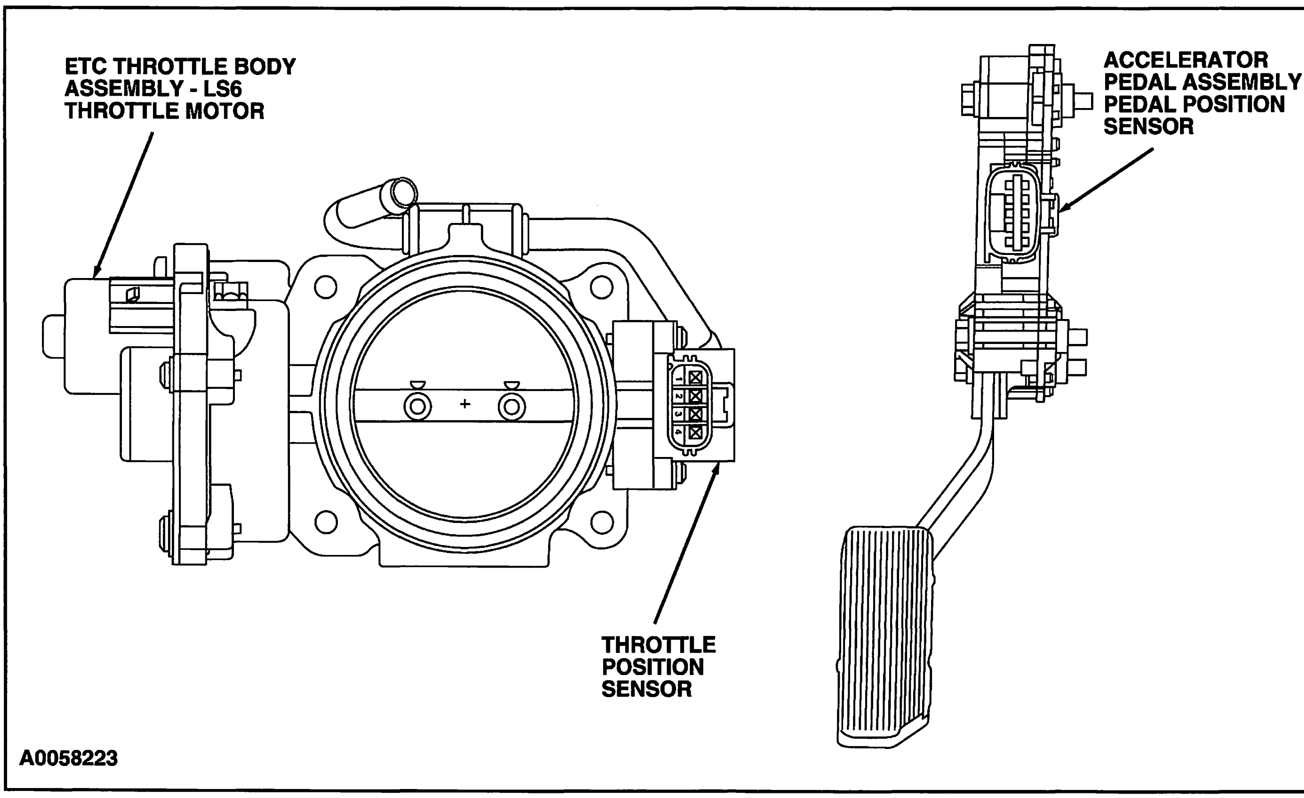

Figure 133: Electronic Throttle Body and Accelerator Pedal Assembly

Electronic Throttle Control System Strategy

As stated earlier the torque based ETC strategy was developed mainly to improve fuel economy and to accommodate Variable Cam Timing. This is possible by not coupling the throttle angle to the drivers pedal position. By uncoupling the throttle angle (produce engine torque) from pedal position (driver demand). This allows the powertrain control strategy to optimize fuel control and transmission shift schedules while delivering the requested wheel torque. ETC is used on the 2004 MY Lincoln LS and Ford Thunderbird, Explorer/Mountaineer, and the new light-duty F-series.

Torque Based Electronic Throttle Control (ETC)

The ETC monitor system is distributed across two processors within the PCM: the main powertrain control processor unit (CPU) and a monitoring processor called an Enhanced-Quizzer (E-Quizzer) processor. The primary monitoring function is performed by the Independent Plausibility Check (IPC) software, which resides on the main processor. It is responsible for determining the driver-demanded torque and comparing it to an estimate of the actual torque delivered. If the generated torque exceeds driver demand by specified amount, the IPC takes appropriate mitigating action.

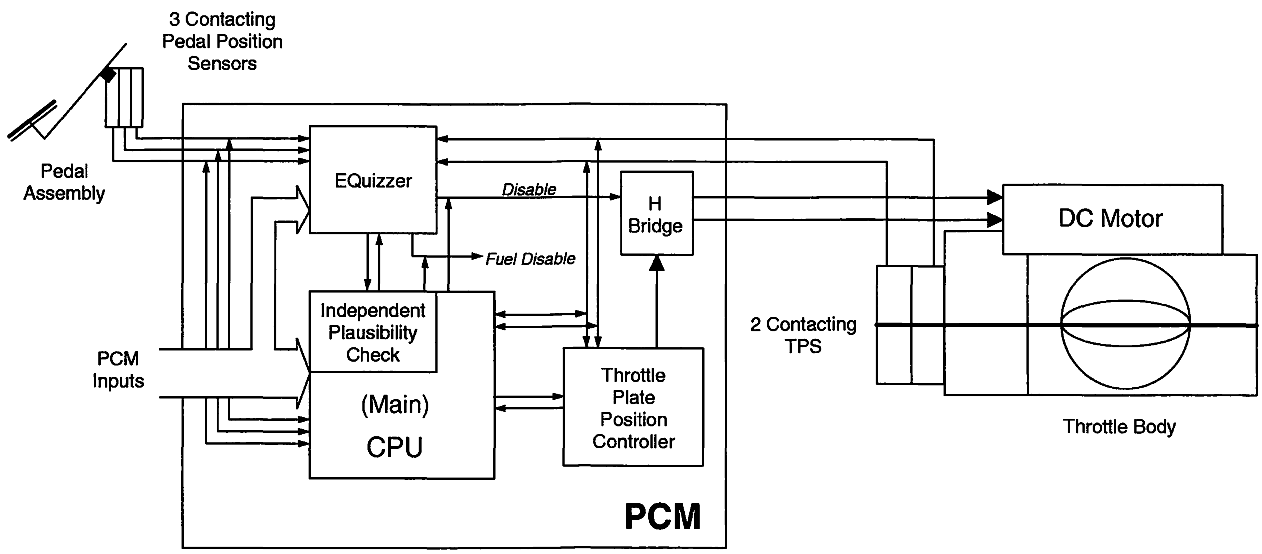

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Figure 134: GEN II ETC System

Since the IPC and main controller share the same processor, they are subject to a number of potential, common failure modes. Therefore, the E-Quizzer processor was added to redundantly monitor selected PCM inputs and to act as an intelligent watchdog and monitor the performance of the IPC and the main processor. If it determines that the IPC function is impaired in any way, it takes appropriate Failure Mode and Effects Management (FMEM) actions.

ETC System Failure Mode and Effects Management:

Effect	Failure Mode [a]
No Effect on Driveability	A loss of redundancy or loss of a non-critical input could result in a fault that does not affect driveability. The ETC light will turn on, but the throttle control and torque control systems will function normally.
Disable Speed Control	If certain failures are detected, speed control will be disabled. Throttle control and torque control will continue to function normally.

(Continued)

Torque Based Electronic Throttle Control (ETC)

ETC System Failure Mode and Effects Management:

Effect	Failure Mode [a]
RPM Guard w/Pedal Follower	In this mode, torque control is disabled due to the loss of a critical sensor or PCM fault. The throttle is controlled in pedal-follower mode as a function of the pedal position sensor input only. A maximum allowed RPM is determined based on pedal position (RPM Guard.) If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The ETC light and the MIL are turned on in this mode and a P2106 is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard w/ Default Throttle	In this mode, the throttle plate control is disabled due to the loss of Throttle Position, the Throttle Plate Position Controller, or other major Electronic Throttle Body fault. A default command is sent to the TPPC, or the H-bridge is disabled. Depending on the fault detected, the throttle plate is controlled or springs to the default (limp home) position. A maximum allowed RPM is determined based on pedal position (RPM Guard.) If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The ETC light and the MIL are turned on in this mode and a P2110 is set. EGR, VCT, and IMRC outputs are set to default values.
RPM Guard w/ High Forced Idle	This mode is caused by the loss of 2 or 3 pedal position sensor inputs due to sensor, wiring, or PCM faults. The system is unable to determine driver demand, and the throttle is controlled to a fixed high idle airflow. There is no response to the driver input. The maximum allowed RPM is a fixed value (RPM Guard). If the actual RPM exceeds this limit, spark and fuel are used to bring the RPM below the limit. The ETC light and the MIL are turned on in this mode and a P2104 is set. EGR, VCT, and IMRC outputs are set to default values. Shutdown If a significant processor fault is detected, the monitor will force vehicle shutdown by disabling all fuel injectors. The ETC light and the MIL are turned on in this mode and a P2105 is set.
Shutdown	If a significant processor fault is detected, the monitor will force vehicle shutdown by disabling all fuel injectors. The ETC light and the MIL are turned on in this mode and a P2105 is set.

a ETC illuminates or displays a message on the message center immediately, MIL illuminates after 2 driving cycles

Electronic Throttle Monitor Operation:

DTCs [a]	
P0606	PCM processor failure (MIL, ETC light)
P2106	ETC FMEM forced limited power; sensor fault: MAF, one TP, CKP, TSS, OSS, stuck throttle, throttle actuator circuit fault (MIL, ETC light)
P2110	ETC FMEM forced limited rpm; two TPs failed; TPPC detected fault (MIL, ETC light)

(Continued)

Torque Based Electronic Throttle Control (ETC)

Electronic Throttle Monitor Operation:

DTCs [a]	
P2104	ETC FMEM forced idle, two or three pedal sensors failed (MIL, ETC light)
P2105	ETC FMEM forced engine shutdown; EQuizzer detected fault (MIL, ETC light)
U0300	ETC software version mismatch, IPC, EQuizzer or TPPC (non-MIL, ETC light)

a Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a malfunction.

Accelerator and Throttle Position Sensor Inputs

Accelerator Pedal Position Sensor Check:

DTCs[a]	
P2122, P2123, P2127, P2128, P2132, P2133	APP sensor circuit continuity test (ETC light, non-MIL).
P2121, P2126, P2131	APP range/performance (ETC light, non-MIL).
P2138, P2140, P2139	APP to APP sensor correlation (ETC light, non-MIL).

a Correlation and range/performance - sensor disagreement between processors (PCM and EQuizzer). Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a malfunction. Refer to Section 4 for addition DTC information.

Throttle Position Sensor Check:

DTCs [a]	
P0122, P0123, P0222, P0223	TP circuit continuity test (MIL, ETC light).
P0121, P0221	TP range/performance (non-MIL).
P2135	TP to TP sensor correlation test (ETC light, non-MIL).

a Correlation and range/performance - sensor disagreement between processors (PCM and EQuizzer), TP inconsistent with TPPC throttle plate position. Monitor execution is continuous. Monitor false detection duration is less than 1 second to register a malfunction. Refer to Section 4 for addition DTC information.

Throttle Plate Position Controller (TPPC) Outputs

The purpose of the TPPC is to control the throttle position to the desired throttle angle. It is a separate chip embedded in the PCM. The desired angle is communicated from the main CPU via a 312.5 Hz duty cycle signal. The TPPC interprets the duty cycle signal as follows:

- 0% <= DC < 5% - Out of range, limp home default position.
- 5% <= DC < 6% - Commanded default position, closed.
- 6% <= DC < 7% - Commanded default position. Used for key-on, engine off.
- 7% <= DC < 10% - Closed against hard-stop. Used to learn zero throttle angle position (hard-stop) after key-up.

Torque Based Electronic Throttle Control (ETC)

- 10% <= DC <=92% - Normal operation, between 0 degrees (hard-stop) and 82%, 10% duty cycle = 0 degrees throttle angle, 92% duty cycle = 82 degrees throttle angle.
- 92% < DC <= 96% - Wide Open Throttle, 82 to 86 degrees throttle angle.
- 96% < DC <= 100% - Out of Range, limp home default position.

The desired angle is relative to the hard-stop angle. The hard-stop angle is learned during each key-up process before the main CPU requests the throttle plate to be closed against the hard-stop. The output of the TPPC is a voltage request to the H-driver (also in PCM). The "H" driver is capable of positive or negative voltage to the Electronic Throttle Body Motor.

Throttle Plate Controller Check Operation:

DTCs [a]	
P2107	Processor test (MIL).
P2111	Throttle actuator system stuck open (MIL).
P2112	Throttle actuator system stuck closed (MIL).
P2100	Throttle actuator circuit open, short to power, short to ground (MIL).
P2101	Throttle actuator range/performance test (MIL).
P2072	Throttle body ice blockage (non-MIL).

a Note: For all DTCs, in addition to the MIL, the ETC light will be on for the fault that caused the FMEM action. Monitor execution is continuous. Monitor false detection duration is less than 5 second to register a malfunction.

SECTION 2

Diagnostic Methods

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SECTION 2

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Diagnostic Methods

Overview

The Diagnostic Methods Section provides information on routine diagnostic tasks.

When following powertrain diagnostics on OBD II vehicles, the system may be checked by an off-board tester referred to as a scan tool. This section contains information for performing diagnostics with a scan tool. A scan tool has certain generic capabilities that are standard across the automotive industry in the United States. All functions are selected from a menu. Refer to the instruction manual provided by the tool manufacturer.

Diagnostic Tools

Below is an equipment list with corresponding part numbers:

REQUIRED EQUIPMENT:

- Rotunda Worldwide Diagnostic System (WDS) 418-F224 or scan tool with functionality described under Scan Tool Set-up and Functionality.
- Rotunda Evaporative Emission System Tester 310-F007 (134-00056) or equivalent.

RECOMMENDED EQUIPMENT:

- Rotunda EEC-IV type 60-Pin Breakout Box 418-005 (014-00322) or equivalent.
- Rotunda EEC-V 104-Pin Breakout Box 418-049 (014-00950) or equivalent.
- Rotunda Vacuum/Pressure Tester 164-R0253 or equivalent. Range 0-101.3 kPa (0-30 in-Hg.) Resolution 3.4 kPa (1 in-Hg.)
- Rotunda Vacuum Tester 014-R1054 or equivalent. Range 0-101.3 kPa (0-30 in-Hg.)
- Rotunda Engine EAR Amplifier 107-R2100 or equivalent.
- Rotunda 73 III Automotive Meter 105-R0057 or equivalent. Input impedance 10 Megaohm minimum.
- Rotunda Electronic Ignition (EI) System Tester (Distributor/less Ignition System Tester) 418-F024 (007-00075) or equivalent.
- Dist Integrated EDIS Cable Option 418-F039 (007-00110) or equivalent.
- Series 100 Engine/Ignition Analyzer 010-01060 or equivalent.
- Spark Tester D81P-6666-A or equivalent.
- Non-powered Test Lamp.

OPTIONAL EQUIPMENT:

- Rotunda Auxiliary Adapter 418-F007 (007-00023) or equivalent.
- Rotunda Pressure/Vacuum Adapter 418-F006 (007-00022) or equivalent.
- Rotunda Fuel (Gasoline) pressure test kit 134-R0087 or equivalent (Use tool manufacturer's instructions. For specific applications, refer to Workshop Manual Group 3).
- Rotunda Fuel Composition Test Kit 014-00770.
- Fuel Injector Tester/Cleaner 164-R3759 or equivalent.
- Rotunda NG Tool Kit 134-00114 or equivalent.

Scan Tool Set-up and Functionality

The scan tool must be connected to the data link connector (DLC) for communication with the vehicle.

The DLC is located in the passenger compartment. It is attached to the instrument panel and accessible from the driver's seat.

The DLC is rectangular in design and capable of accommodating up to 16 terminals. The connector has keying features to allow easy connection. The vehicle connector and the test equipment connector have latching features that ensure the test equipment connector will remain mated when properly connected.

The required scan tool functions are described below:

— Monitor, record and playback of PIDs

— Freeze frame PID data

— Diagnostic test modes (self test)/clear diagnostic DTCs (PCM reset)

— Output Test Mode

— Reset Keep Alive Memory

— Digital measurement system (multimeter functionality)

— Diagnostic monitoring test results (for OBD II on-board monitors)

— On board system readiness (OBD II monitor completion status)

Some of these functions are described in this section. Refer to the scan tool manufacturer's manual for specific information on scan tool set-up and operation.

Vehicle Check/Preparation

Before using the scan tool to perform any test, refer to the important Safety Notice located at the beginning of this manual and the necessary visual checks listed below.

Visual Checks

- Inspect the air cleaner and inlet duct.
- Check all engine vacuum hoses for damage, leaks, cracks, kinks and proper routing.
- Check Electronic EC system wiring harness for proper connections, bent or broken pins, corrosion, loose wires and proper routing.
- Check the powertrain control module (PCM), sensors, and actuators for physical damage.
- Check the engine coolant for proper level and mixture.
- Check the transmission fluid level and quality.
- Make all necessary repairs before continuing with Quick Test.

Vehicle Preparation

- Perform ALL safety steps required to start and run vehicle tests. Apply parking brake, place shift lever firmly into PARK position (NEUTRAL on manual transmission) and block drive wheels.
- Turn off ALL electrical loads: radios, lamps, A/C, blower, and fans.
- Start engine and bring up to normal operating temperature before running Quick Test.

Quick Test

Quick Test

Quick Test is divided into three specialized tests:

(1) Key On Engine Off (KOEO)On-Demand Self-Test

(2) Key On Engine Running (KOER) On-Demand Self-Test

(3) Continuous Memory Self-Test

Quick Test checks the integrity and function of the Electronic EC System and outputs the test results when requested by a scan tool. Quick Test also provides a quick end check of the powertrain control system and is usually performed at the start of each diagnostic procedure with all accessories off. Quick Test is also performed at the end of most pinpoint tests for verification of repair and to make sure no other faults were incurred while repairing a previous fault. A system pass will be displayed when no DTCs are output and a scan tool communication error does not exist. System pass means that hardware monitored by the PCM is functioning within normal operating limits. Only a system pass, DTC or an incomplete OBDII drive cycle (P1000) will be displayed.

Key On Engine Off (KOEO) On-Demand Self-Test

Key On Engine Off (KOEO) On-Demand Self-Test is a functional test of the powertrain control module performed on demand with the key on and the engine off. This test will perform checks on certain sensor and actuator circuits. A fault must be present at the time of testing for the KOEO Self-Test to detect the fault. When a fault is detected, a Diagnostic Trouble Code (DTC) will be output on the data link at the end of the test when requested by a scan tool.

Key On Engine Running (KOER) On-Demand Self-Test

Key On Engine Running (KOER) On-Demand Self-Test is a functional test of the powertrain control module performed on demand with the key on engine running and vehicle stopped. A check of certain inputs and outputs is made during operating conditions and at normal temperature. The brake pedal position, transmission control and power steering switch tests are part of KOER On-Demand Self-Test and MUST be performed during this operation if applicable. These are described below. A fault must be present at the time of testing KOER On-Demand Self-Test to detect the fault. When a fault is detected, a Diagnostic Trouble Code (DTC) will be output on the data link at the end of the test when requested by a scan tool.

Brake Pedal Position Test

This tests the ability of the Electronic EC system to detect a change of state in the stoplight switch. Brake pedal MUST briefly be applied and released on all vehicles equipped with Brake Pedal Position input. This is done during KOER On-Demand Self-Test.

Quick Test

Transmission Control Switch Test

This tests the ability of the Electronic EC system to detect a change of state in the transmission control switch (TCS). Switch MUST briefly be cycled on all vehicles equipped with TCS input. This is done during KOER On-Demand Self-Test.

Power Steering Pressure Test

This tests the ability of the Electronic EC system to detect a change in power steering system fluid pressure. The steering wheel MUST briefly be turned at least 1/4 of a revolution on vehicles equipped with a power steering pressure (PSP) switch or sensor. This is done during KOER On-Demand Self-Test.

Continuous Memory Self-Test

Testing for Continuous Memory DTC's is a functional test of the powertrain control module performed under any condition (engine running or off) with the key on. Unlike the KOEO and KOER self tests, which can only be activated on demand, the Continuous Self Test is always active. A fault does not need to be present at the time of testing for Continuous DTC's and is therefore, especially valuable when diagnosing intermittent faults. This test will detect failures contributing to driveability or emission concerns. The vehicle may need to be driven or the OBDII Drive Cycle completed to allow the PCM to detect a fault. Refer to Drive Cycles for more information. When a fault is stored in memory, a Diagnostic Trouble Code (DTC) will be output on the data link at the end of the test when requested by a scan tool.

There are two types of Continuous DTC's. The first type is an emission related malfunction indicator lamp (MIL) code which will illuminate the CHECK ENGINE or SERVICE ENGINE SOON indicator in the instrument cluster. The second is a non emission related non-MIL code which will never illuminate the cluster indicator.

For emission related MIL codes, the PCM will store the DTC in continuous memory when a fault is detected for the first time. At this point the DTC will not illuminate the MIL and is now considered a pending code. The purpose of pending codes is to assist in repair verification by reporting a pending DTC after one drive cycle. If the same fault is detected after the next ignition start-run cycle, the emission related MIL code will illuminate the MIL. The MIL will remain on even if the fault is intermittent. The MIL will be extinguished if the fault is not present through three consecutive drive cycles or a PCM reset is performed. Also, an emission related pending MIL and non emission related (non-MIL) code will be erased after approximately 40 vehicle warm up cycles or a PCM reset.

Any scan tool that meets OBDII requirements can access Continuous Memory to retrieve emission related MIL DTC's. However, not all scan tools access pending and non emission related (non-MIL) DTC's in the same way.

During most diagnostic procedures in this manual, it is required that all DTC's be retrieved and cleared. Consult the instruction manual from the tool manufacturer for specific instructions.

Parameter Identification (PID)

Description

The Parameter Identification (PID) mode allows access to powertrain control module (PCM) information. This includes analog and digital signal inputs and outputs along with calculated values and system status. There are two types of PID lists available and both are used throughout this manual. The first is the Generic (J1979) OBDII PID list. This is a standard set of PIDs for all manufacturers all scan tools must be able to access. The second is a Ford specific (J2190) list which can be accessed by an adequate scan tool. When accessing any of these PIDs, the values will be continuously updated. The Generic or Ford PID list provides definitions and values in appropriate units. For more information, refer to the Society of Automotive Engineers (SAE) J2205 document.

Generic OBD II PID List

"X" in the "Freeze Frame" column denotes both a mode 1 and mode 2 PID (real time and freeze frame).

Freeze Frame	Acronym	Description	Measurement Units
	AIR	Secondary Air Status	ON/OFF
	CCNT	Continuous DTC Counter	Unitless
X	ECT	Engine Coolant Temperature	DEGREES
X	FUEL SYS1	Fuel System Feedback Control Status-Bank 1	OL/CL/OL DRIVE[a]/ OL FAULT/ CL FAULT
X	FUEL SYS2	Fuel System Feedback Control Status-Bank 2	OL/CL/OL DRIVE[a]/OL FAULT/ CL FAULT
	IAT	Intake Air Temp	DEGREES
X	LOAD[b]	Calculated Engine Load	Percent
X	LONG FT1	Current BANK 1 fuel trim adjustment (kamref1) from stoichiometry which is considered LONG TERM.	Percent
X	LONG FT2	Current BANK 2 fuel trim adjustment (kamref2) from stoichiometry which is considered LONG TERM.	Percent
	MAF	Mass Air Flow Rate	GM/SEC-LB/ MIN
	O2S11	Bank 1 Upstream Oxygen Sensor (11)	VOLTS
	O2S12	Bank 1 Downstream Oxygen Sensor (12)	VOLTS
	O2S21	Bank 2 Upstream Oxygen Sensor (21)	VOLTS
	O2S22	Bank 2 Downstream Oxygen Sensor (22)	VOLTS
	OBD SUP	On-Board Diagnostic System	Cal. OBD II 50 States OBD II OBD I and OBD II OBD I None

(Continued)

Parameter Identification (PID)

Freeze Frame	Acronym	Description	Measurement Units
	PTO	Power Take-Off Status	ON/OFF
X	RPM	Revolutions Per Minute	RPM
X	SHRT FT1	Current BANK fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
	SHRT FT11[1]	Current BANK fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
	SHRT FT12[2]	Current BANK 1 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
X	SHRT FT2	Current BANK 2 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
X	SHRT FT21[3]	Current BANK 2 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
X	SHRT FT22[4]	Current BANK 2 fuel trim adjustment (lambse1) from stoichiometry which is considered SHORT TERM.	Percent
	SPARKADV	Spark Advance Cylinder No. 1	DEGREES
	TP	Throttle Position	Percent
X	VSS	Vehicle Speed Sensor	MPH-KM/H

a OL = Open loop, have not satisfied conditions for closed loop.
b Percent engine load adjusted for atmospheric pressure.

CL = Closed loop using O2S(s) as feedback for fuel control.

OL DRIVE = Open loop due to driving conditions (heavy accel).

OL FAULT = Open loop due to fault with all upstream O2S sensors.

CL FAULT = Closed loop fuel control, but fault with one upstream O2S sensor on dual bank vehicles.

Ford PID List

Acronym	PID #	Description	Ford Units
4X4L	1101 b2	Requested 4 Wheel Drive Input	ON/OFF
ACCS	1101 b0	Air Conditioning Cycling Switch Input	ON/OFF
ACP	1102 b0	A/C Head Pressure Switch Input	OPEN/CLOSED
ACP V	1638	A/C Head Pressure Switch Input	VOLTS
ACP T	1686	A/C Head Pressure Transducer Sensor	PSI
AIR	1104 b4	Secondary AIR Pump Control	ON/OFF
AIRF	162F b3	Secondary AIR Fault Indicator	YES/NO
AIRM	110C b1	Secondary AIR Pump Monitor	ON/OFF
ALTLAMP	0968	Generator Indicator Fault	YES/NO
ALT SEN	9935 b13	Alternator Sensor Line	ON/OFF
ALT V	16E9	Generator Output Voltage	VOLTS

(Continued)

1, 2, 3, 4 Individual oxygen sensor fuel trim adjustment is not supported.

Parameter Identification (PID)

Acronym	PID #	Description	Ford Units
AP	1340	Accelerator Pedal Position	VOLTS
APPS1	0914	Accelerator Pedal Position 1	VOLTS
APPS2	0915	Accelerator Pedal Position 2	VOLTS
APPS3	0916	Accelerator Pedal Position 3	VOLTS
ATCS	1101 b4	Automatic Transmission Control Switch (TCS)	ON/OFF
BARO	1127	Barometric Pressure (may be software determined)	Hz
BARO V	16B3	Barometric Pressure Signal Voltage	VOLTS
BPA	A211 b1	Brake Pressure Applied	ON/OFF
BPP/BOO	1101 b1	Brake Pedal Position/Brake On-Off Switch Input	ON/OFF
CAMDCR	16CF	Commanded Duty Cycle for VCT Solenoid	%
CAMERRR	16CE	VCT Error in Crankshaft Degrees	DEGREES
CAS GND	16CO	PCM Case Ground	VOLTS
CCS	1105 b7	Coast Clutch Solenoid Control	ON/OFF
CHT	1624	Cylinder Head Temperature Input	DEGREES
CHT V	1685	Cylinder Head Temperature Input	VOLTS
CMPFM	1107 b0	Camshaft Position Sensor Fault Mode	YES/NO
CMPFM2	0959 b1	Camshaft Position Sensor 2 Failure Mode	YES/NO
CPP	1101 b3	Clutch Pedal Position Switch Input	ON/OFF
CPP/PNP	1101 b3	Clutch Pedal/Park Neutral Position Switch Input	ON/OFF
DPFEGR	114E	Differential Pressure Feedback EGR Input	VOLTS
ECT	1139	Engine Coolant Temperature Input	DEGREES
ECT V	114D	Engine Coolant Temperature Input	VOLTS
EFTA	168E	Engine Fuel Temperature - Bank 1 Input	DEGREES
EFTA V	168D	Engine Fuel Temperature - Bank 1 Input	VOLTS
EFTB	169O	Engine Fuel Temperature - Bank 2 Input	DEGREES
EFTB V	168F	Engine Fuel Temperature - Bank 2 Input	VOLTS
EGRBARO	1680	Enable Baro Read (instead of EGR pressure)	YES/NO
EGRMC1	16D2 b0	EGR Motor Control Output Command	ON/OFF
EGRMC2	16D2 b1	EGR Motor Control Output Command	ON/OFF
EGRMC3	16D2 b2	EGR Motor Control Output Command	ON/OFF
EGRMC4	16D2 b3	EGR Motor Control Output Command	ON/OFF
EGRMDSD	098E	Electric EGR Motor Commanded In Steps	Steps
EGRVR	113C	EGR Valve Vacuum Control	%
EOT	1310	Engine Oil Temperature Sensor Input	DEGREES
EOT V	16AF	Engine Oil Temperature Sensor Input	VOLTS
EOTF	16A9	Engine Oil Temperature Fault Detection	YES/NO
EPC	11C0	Transmission Line Pressure Control	PSI
EPC V	11B2	Transmission Line Pressure Control	VOLTS
EVAPCPF	162F b2	Evaporative Emissions Canister Purge Fault	YES/NO
EVAPCV	1167	Evaporative Emissions Canister Purge Vent Control	%
EVAPCVF	1630 b3	Evaporative Emissions Canister Purge Vent Fault	YES/NO
EVAPPDC	1166	Evaporative Emissions Canister Purge Control	%
EVAPPF	1627	Evaporative Purge Flow Input	VOLTS
EVAPVMA	1636	Evaporative Vapor Management Valve Internal Circuit Monitor	VOLTS
EVMV	099D	Electronic Vapor Management Valve Commanded Current	CURRENT (mA)

(Continued)

Parameter Identification (PID)

Acronym	PID #	Description	Ford Units
FANDC	091F	Variable Speed Fan Duty Cycle	%
FANVARF	1630 b5	Variable Speed Fan Output Fault	YES/NO
FANSS	099F	Variable Speed Fan RPM	RPM
FANSSM	099C b17	Variable Speed Fan Hall Sensor Input	HIGH/LOW
FF	16AB	Flex Fuel Sensor Input	%
FLI	16C1	Fuel Level Indicator Input	%
FLI V	16BF	Fuel Level Indicator Input	VOLTS
FP	1672	Fuel Pump Duty Cycle	%
FP M	1673	Fuel Pump Secondary Monitor	%
FPF	162E b6	Fuel Pump Output Fault	YES/NO
FPM	110C b0	Fuel Pump Secondary Monitor	ON/OFF
FRP	168C	Engine Injector Pressure Input	PSI
FRP V	168B	Engine Injector Pressure Input	VOLTS
FRT \ EFTA_TEMP	168E	Fuel Rail Temperature	DEGREES
FRT V\ EFTA	168D	Fuel Rail Temperature Votlage	VOLTS
FSVF	1691 b1	Engine Fuel Solenoid Valve Fault	YES/NO
FSVM	1691 b2	Engine Fuel Solenoid Valve Secondary Monitor	ON/OFF
FTP	1687	Fuel Tank Pressure Input	in.H2O
FTP V	1639	Fuel Tank Pressure Input	VOLTS
FUELPW1	1141	Injector Pulse Width Bank 1	MILLISECONDS
FUELPW2	1142	Injector Pulse Width Bank 2	MILLISECONDS
GEAR	11B3	Transmission Gear Status	GEAR
GENF	0927 b2	Generator Output Fault Detection	YES/NO
GENFDC	16E8	Generator Field Control Output	%
GENVDSD	097C	Generator Desired Voltage	VOLTS
GFS	0939	Generator Field Signal Monitor	%
GENB F	099C b15	Generator 2 Fault	YES/NO
HFC	1103 b3	High Speed Fan Control	ON/OFF
HFCF	162F b1	High Speed Fan Control Fault	YES/NO
HTR11	1631 b0	Bank 1 Sensor 1 O2S Heater Control	ON/OFF
HTR11F	1631 b4	Bank 1 Sensor 1 O2S Heater Circuit Fault	YES/NO
HTR12	1631 b1	Bank 1 Sensor 2 O2S Heater Control	ON/OFF
HTR12F	1631 b5	Bank 1 Sensor 2 O2S Heater Circuit Fault	YES/NO
HTR21	1631 b2	Bank 2 Sensor 1 O2S Heater Control	ON/OFF
HTR21F	1631 b6	Bank 1 Sensor 1O2S Heater Circuit Fault	YES/NO
HTR22	1631 b3	Bank 2 Sensor 2 O2S Heater Control	ON/OFF
HTR22F	1631 b7	Bank 1 Sensor 2 O2S Heater Circuit Fault	YES/NO
HTRX1	1102 b1/6	O2S Sensor 1 (Upstream) Heater Control	ON/OFF
HTRX2	1102 b2/7	O2S Sensor 2 (Downstream) Heater Control	ON/OFF
IAC	1153	Idle Air Control	%
IAT	1123	Intake Air Temperature Input	DEGREES
IAT V	114A	Intake Air Temperature Input	VOLTS
IAT2	16A8	Intake Air Temperature Sensor 2 Input	DEGREES
IAT2 V	16A7	Intake Air Temperature Sensor 2 Input	VOLTS
IMRC	1103 b4	Intake Manifold Runner Control	ON/OFF
IMRC F	162F b5	Intake Manifold Runner Control Fault	YES/NO

(Continued)

Parameter Identification (PID)

Acronym	PID #	Description	Ford Units
IMRCM	1634	Intake Manifold Runner Control Monitor Input Bank 1	VOLTS
IMRCM2	1635	Intake Manifold Runner Control Monitor Input Bank 2	VOLTS
IMSC	1103 b4	Intake Manifold Swirl Control	ON/OFF
IMSC F	162F b6	Intake Manifold Swirl Control Fault	YES/NO
IMTV	1684	Intake Manifold Tuning Valve Control	%
IMTVF	162F b5	Intake Manifold Tuning Valve Fault	YES/NO
INJ1F-8F	162D b0-7	Fuel Injector Primary Fault (Cylinders 1 thru 8)	YES/NO
INJ9F-10F	16EA b0-1	Fuel Injector Primary Fault (Cylinders 9 and 10)	YES/NO
KS1 V	16E6	Knock Sensor Input Bank 1	VOLTS
KS2 V	16E7	Knock Sensor Input Bank 2	VOLTS
LFC	1103 b2	Low Speed Fan Control	ON/OFF
LFCF	162F b0	Low Speed Fan Control Fault	YES/NO
LOAD	115A	Calculated Engine Load	%
LONGFT1	1156	Long Term Fuel Trim Bank 1	%
LONGFT2	1157	Long Term Fuel Trim Bank 2	%
MAF	1671	Mass Airflow Rate Input	GM/S
MAF V	1177	Mass Airflow Rate Input	VOLTS
MAF V	1633	Mass Airflow Rate Input (Before FMEM substitutions)	VOLTS
MAP	1452	Intake Manifold Absolute Pressure	Hz
MAP V	0900	Intake Manifold Absolute Pressure (Analog)	VOLTS
MFC	0967 b10	Medium Speed Fan Control	ON/OFF
MFCF	0967 b11	Medium Speed Fan Control Fault	YES/NO
MIL	1103 b5	Malfunction Indicator Lamp Control	ON/OFF
MFF RPM	16D3	Engine RPM at the time of misfire	RPM
MFF LOAD	16D4	Engine load at the time of misfire	%
MFF VS	16D5	Vehicle speed at the time of misfire	MPH/KPH
MFF IAT	16D6	Intake air temperature at the time of misfire	DEGREES
MFF SOAK	16D7	Engine-off soak time at the time of misfire	MINUTES
MFF RNTM	16D8	Engine running time at the time of misfire	MINUTES
MFF EGR	16D9	EGR DPFE sensor at the time of misfire	VOLTAGE
MFF TP	16DA	Throttle Position at time of misfire	VOLTAGE
MFF T CNT	16DC	Number of driving cycles at the time of misfire (at least one 1,000 rev block)	# TRIPS
MFF PNP	16DD b1	1= in drive during the time of misfire	MODE
MP LRN	16DD b0	1= Misfire wheel profile learned in KAM	MODE
OCTADJ	1102 b3	Octane Adjust Status	OPEN/CLOSED
OCTADJS	16EF b0	Octane Adjust Software Status	RETARD/NO RETARD
O2S11	1173	Bank 1 Sensor 1 O2S Input	VOLTS
O2S12	1174	Bank 1 Sensor 2 O2S Input	VOLTS
O2S13	09A8	Bank 1 Sensor 3 O2S Input	VOLTS
O2S21	1175	Bank 2 Sensor 1 O2S Input	VOLTS
O2S22	1176	Bank 2 Sensor 2 O2S Input	VOLTS
O2HTR13	09AC b8	Bank 1 Sensor 3 O2S Hearter Control	ON/OFF
OSS	11B5	Output Shaft Speed	RPM
PIP	1102 b4	Profile Ignition Pickup Input	ON/OFF
PSP	1101 b7	Power Steering Pressure Switch Input	HIGH/LOW

(Continued)

Parameter Identification (PID)

Acronym	PID #	Description	Ford Units
PSP V	1626	Power Steering Pressure Input	VOLTS
PSP V	1625	Power Steering Pressure Input	VOLTS
PTO	160D b5	Power Take Off Status Input	ON/OFF
RCAM	16CD	VCT Solenoid Commanded in Crank Shaft Degrees	DEGREES
REM-PWM_DC1	REM PID D128	Rear Electronic Module - Pulse Width Modulated Duty Cycle	%
REV	1697 b0	Transmission Reverse Switch Input	ON/OFF
RPM	1165	Engine Speed Based Upon CKP Input	RPM
SCB	0964 b0	Supercharger Bypass Control	ON/OFF
SCBF	0964 b1	Supercharger Bypass Control Fault	YES/NO
SCCS	A216	Speed Control Input Switch	VOLTS
SCICP	0964 b2	Supercharger Intercooler Pump Control	ON/OFF
SCICPF	0964 b3	Supercharger Intercooler Pump Control Fault	YES/NO
SHRTFT1	1158	Short Term Fuel Trim	%
SHRTFT2	1159	Short Term Fuel Trim	%
SIL	160D b6	Shift Indicator Light	ON/OFF
SPARKADV	116B	Spark Advance Desired	DEGREES
SS1	1105 b4	Shift Solenoid 1 Control	ON/OFF
SS2	1105 b5	Shift Solenoid 2 Control	ON/OFF
SS3	1105 b6	Shift Solenoid 3 Control	ON/OFF
TANKPR	1171	Fuel Tank Pressure Transducer	PRESSURE
TCC	11B0	Torque Converter Clutch Control	%
TCCA	110E b7	Torque Converter Clutch Control Internal Circuit Monitor	ON/OFF
TCIL	1104 b2	Transmission Control Indicator Lamp Clutch Control Status	ON/OFF
TCS	1101 b4	Transmission Clutch Convertor Control Switch Input	ON/OFF
TFT	1674	Transmission Fluid Temperature Input	DEGREES
TFT V	11BD	Transmission Fluid Temperature Input	VOLTS
TIREREV	16F0	Active Tire Size	REVS/MILE
THTRC	0965	Thermostat Heater Control	%
TMAP	0945	Thermal Manifold Absolute Pressure	kPa
TP	17B6	Throttle Position	%
TP MODE	1125	Throttle Position Mode	C/T, P/T, WOT
TP V	1154	Throttle Position Input	VOLTS
TP1	0917	Throttle Position 1 Voltage	VOLTS
TP2	0918	Throttle Position 2Voltage	VOLTS
TPB	1629	Secondary Throttle Position Input	VOLTS
TPREL	1169	Lowest Steady TP Voltage Since Engine Start (RATCH)	VOLTS
TR	11B6	Transmission Selector Position Input Status	POSITION
TR V	1151	Transmission Selector Position Input Status	VOLTS
TR D	16B5	Transmission Selector Position Input Status (Digital)	BINARY
TSS/ISS	11B4	Turbine Shaft Speed/Input Shaft Speed	RPM
VCTA	16B1 b6	VCT Control Circuit Monitor	ON/OFF
VCTENA	16B1 b5	Conditions Correct to Enable VCT	YES/NO
VOLTDSD	097C	Desired Voltage	VOLTS

(Continued)

Parameter Identification (PID)

Acronym	PID #	Description	Ford Units
VFCDC	091F	Variable Speed Fan Duty Cycle	%
VFCF	1630 b5	Variable Speed Fan Output Fault	YES/NO
VPWR	1172	Vehicle Power Voltage	VOLTS
VREF	1155	Vehicle Reference Voltage	VOLTS
VSS	11C1	Vehicle Speed	MPH
WAC	1104 b0	A/C Clutch Command	ON/OFF
WACF	162E b5	WOT A/C Primary Circuit Fault	YES/NO

On-Board System Readiness

Description

All OBD II scan tools display the On-Board System Readiness (OSR) Test. The OSR will display the supported monitors on the vehicle and the status of all monitors (complete or not complete) at that time. Fuel, misfire and comprehensive component monitors run continuously and will always display "YES" status. Only a PCM reset or a keep alive RAM reset will cause the non-continuous monitors to reinitialize to "NO" status.

Freeze Frame Data

Description

Freeze Frame Data allows access to emission-related values from specific generic PIDs. These values are stored when an emission-related DTC is stored in Continuous Memory. This provides a snapshot of the conditions that were present when the DTC was stored. Once one set of freeze frame data is stored, this data will remain in memory even if another emission-related DTC is stored, with the exception of Misfire or Fuel System DTCs. Once freeze frame data for Misfire or Fuel System DTC is stored, it will overwrite any previous data, and freeze frame will not be further overwritten. When a DTC associated with the freeze frame is erased or a PCM memory reset is performed, new freeze frame data can be stored again. In the event of multiple emission-related DTCs in memory, always note the DTC for the freeze frame data.

FREEZE FRAME DATA TABLE

Acronym	Description	Measurement Units
ECT	Engine Coolant	DEGREES
FUELSYS1	Open/Closed Loop1	OL/CL/OL DRIVE/OL FAULT/CL FAULT
FUELSYS2	Open/Closed Loop2	OL/CL/OL DRIVE/OL FAULT/CL FAULT
LONGFT1	Long Term Fuel Bank1	PERCENT
LONGFT2	Long Term Fuel Bank2	PERCENT
LOAD	Calculated Load Value	PERCENT
RPM	Engine RPM	R/MIN
SHRTFT1	Short Term Fuel Bank1	PERCENT
SHRTFT2	Short Term Fuel Bank2	PERCENT
VSS	Vehicle Speed	MPH-KMH

Some unique parameters (PIDs) are stored in the Keep Alive Memory of the PCM to help in diagnosing the root cause of misfires. These PIDs are collectively called misfire freeze-frame (MFF) data. These parameters are separate from the generic freeze-frame data that is stored for every MIL code. They are used for misfire diagnosis only. The MFF data is more useful for misfire diagnosis than the normal diagnosis only. It is captured at the time of the highest misfire rate and not when the DTC is stored at the end of a 1000 or 200 revolution block. (Generic freeze-frame data for misfire can be stored minutes after the misfire actually occurred.)

Note: MFF PIDs are supported on all vehicles but may not be available on all scan tools because enhanced PID access may vary by scan tool manufacturer.

MISFIRE FREEZE-FRAME PIDs

PID Name	Description	PID #	Measurement Units
MFF RPM	Engine RPM at the time of misfire	16D3	RPM
MFF LOAD	Engine load at the time of misfire	16D4	PERCENT
MFF VS	Vehicle speed at the time of misfire	16D5	MPH/KPH
MFF IAT	Intake air temperature at the time of misfire	16D6	DEGREES

(Continued)

Freeze Frame Data

MISFIRE FREEZE-FRAME PIDs

PID Name	Description	PID #	Measurement Units
MFF SOAK	Engine-off soak time at the time of misfire	16D7	MINUTES
MFF RNTM	Engine running time at the time of misfire	16D8	SECONDS
MFF EGR	EGR DPFE sensor at the time of misfire	16D9	VOLTAGE
MFF TP	Throttle Position at time of misfire	16DA	VOLTAGE
MFF T CNT	Number of driving cycles at the time of misfire (at least one 1,000 rev block)	16DC	# TRIPS
MFF PNP	1= in drive during the time of misfire	16DD b1	MODE
MP LRN	1= Misfire wheel profile learned in KAM	16DD b0	NONE

Output Test Mode

Description

The Output Test Mode (OTM) aids in servicing output actuators associated with the PCM. This mode allows the technician to energize and de-energize most of the system output actuators on command. When entering OTM, the outputs can be turned off and on without activating the fan control. The low and high speed fan control(s) may be turned on separately without energizing the other outputs. This function is supported by each vehicle strategy and may not be available on all scan tools.

As a safety precaution, Output Test Mode will default to the off state after 10 minutes and fuel pump off after approximately 7-10 seconds. OTM will also turn off after the vehicle is started or after cycling the key off then on.

WARNING:

SAFETY MUST BE OBSERVED WHEN USING OUTPUT TEST MODE:

- **WHEN ALL OUTPUTS ARE ON, THE ELECTRIC FUEL PUMP IS BRIEFLY ENERGIZED, SO MAKE SURE FUEL SYSTEM IS INTACT AND IS NOT BEING SERVICED AT THIS TIME.**
- **WHEN LOW SPEED OR HIGH SPEED FAN CONTROL(S) ARE TURNED ON, MAKE SURE FAN BLADES ARE CLEAR OF ANY OBSTRUCTION.**

Powertrain Control Module (PCM) Reset

Description

All OBDII scan tools support the powertrain control module (PCM) reset.

The PCM Reset allows the scan tool to command the PCM to clear all emission-related diagnostic information. When resetting the PCM, a DTC P1000 will be stored in the PCM until all the OBD II system monitors or components have been tested to satisfy a drive cycle, without any other faults occurring. For more information about a drive cycle, refer to Drive Cycles.

The following events occur when a PCM reset is performed:

- Clears the number of Diagnostic Trouble Codes (DTCs).
- Clears the DTCs.
- Clears the freeze frame data.
- Clears diagnostic monitoring test results.
- Resets status of the OBD II system monitors.
- Sets DTC P1000.

Resetting Keep Alive Memory (KAM)

Resetting Keep Alive Memory will return PCM memory to its default setting. Adaptive learning contents such as idle speed, refueling event, and fuel trim are included. A PCM Reset (described above) is also part of a KAM Reset. Both can be useful in post repair retest.

After Keep Alive Memory has been reset, the vehicle may exhibit certain driveability concerns. It will be necessary to drive the vehicle to allow the PCM to relearn values for optimum driveability and performance.

This function may not be supported by all scan tools. Refer to scan tool manufacturer's instruction manual.

If an error message is received or the scan tool does not support this function, disconnecting the battery ground cable for a minimum of 5 minutes may be used as an alternative procedure.

Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM

Description

Flash Electrically Eraseable Programmable Read Only Memory (EEPROM) is contained in an Integrated Circuit (IC) internal to the PCM. The EEPROM contains the vehicle strategy including calibration information specific to the vehicle and is capable of being reprogrammed or reflashed repeatedly.

As part of the calibration there is an area referred to as the Vehicle Identification (VID) block. The VID block must be programmed when replacing the PCM as described under Programming the VID Block for a Replacement PCM. Failure to perform this procedure may generate fault codes: P1635, P1639, VID Block not programmed or is corrupt. The VID block in an existing PCM can also be tailored to accommodate various hardware/parameter changes made to the vehicle since production. Failure to perform this procedure properly may generate fault code: P1635, Tire/Axle Ratio out of Acceptable Range is one of the main causes for code: P1639. This is described under Making Changes to the VID Block and also under Making Changes to the PCM Calibration. The VID block contains many items used by the strategy for a variety of functions. Some of these items include the VIN number, octane adjust, fuel octane, fuel type, vehicle speed limit, tire size, axle ratio, the presence of speed control and four wheel drive electronic shift on the fly versus manual shift on the fly. Only items applicable to vehicle hardware and supported by the VID block will be displayed on the scan tool.

When changing items in the VID block, the strategy will place range limits on certain items such as tire and axle ratio. The VID block is also limited to the number of times to be reconfigured. When this limit is reached, the scan tool will display a message indicating the need to flash the PCM again to reset the VID block.

Each of the procedures described below use the Worldwide Diagnostic System (WDS). Reprogramming can be performed by a local Ford dealer for any non Ford facility. There are other Enhanced Scan Tools that may have reprogramming capabilities available. Refer to the manufacturers users manual for details.

Programming the VID Block for a Replacement PCM

A new PCM will contain the latest strategy and calibration level for a particular vehicle. However, the VID block will be blank and will need programming. There are two procedures available. The first is an automatic data transfer from the old PCM to the new PCM and the second is manual data entry into the new PCM.

Automatic data transfer will be performed if the old PCM is capable of communicating. This is done by the use of a scan tool to retrieve data from the old PCM before removing it from the vehicle. The stored data can now be downloaded to the new PCM after it has been replaced.

Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM

Manual data entry must be performed if the old module is damaged and/or incapable of communicating. Remove and replace the old PCM. Using a compatible Scan Tool select and execute Module/Parameter reprogramming referring to the manufacturers users manual. Important, make certain that all parameters are included. Failure to properly program Tire Size in revolutions per mile, (rev/mile = 63,360 divided by the tire circumference in inches) Axle Ratio, 4x4/4x2, and/or Manual/Electronic shift on the fly (MSOF/ESOF) may result in codes: P1635, P1639. You may be instructed to contact the "AS BUILT" data center for the information needed to manually update the VID block with the scan tool. Contact the center ONLY if the old PCM cannot be used or the data is corrupt. For Ford L-M technician's, contact your National Hotline or the Professional Technician Society (PTS) web sight for "AS Built" data. Non Ford technicians, use the Fed World website at "fedworld.gov". Select Auto Service Information and search for "Calibrations" or "Vehicle Calibrations" then specify vehicle manufacturer, model name and model year as required.

For Ford L-M technician's, check out the "Programmable Module Installation" link on the Professional Technician Society (PTS) web sight for quick Programmable Module data information by vehicle when using WDS or NGS.

Making Changes to the VID Block

A PCM which is programmed may require changes to be made to certain VID information to accommodate vehicle hardware. Refer to PCM/Module Reprogramming on the Scan Tool.

Making Changes to the PCM Calibration

At certain times, the entire EEPROM will need to be completely reprogrammed. This is due to changes made to the strategy or calibration after production or the need to reset the VID block because it has reached its limit. Refer to PCM/Module Reprogramming on the Scan Tool.

Diagnostic Monitoring Test Results

The purpose of this test mode is to allow access to the results of OBD II monitor diagnostic test results. The test values that are stored at the time of the particular monitor completion are displayed when the particular test identification is requested. Refer to the following table for test information.

DIAGNOSTIC MONITORING TEST RESULTS TABLE

Module ID h[a]	Test ID h[a]	Component ID h[a]	Test Description
			Oxygen Sensor Monitor (01-0F)
10	01	11	Sensor Voltage Amplitude - Bank 1, Sensor 1
10	01	21	Sensor Voltage Amplitude - Bank 2, Sensor 1
10	02	11	Upstream Static Shift, Lean Shift on EGO11
10	02	11	Upstream Static Shift, Rich Shift on EGO11
10	02	21	Upstream Static Shift, Lean Shift on EGO21
10	02	21	Upstream Static Shift, Rich Shift on EGO21
10	03	01	Upstream Switchpoint
10	03	02	Downstream Switchpoint
			Catalyst Monitor (10-1F)
10	10	11	Rear to Front Switch Ratio Test - Bank 1 test
10	10	21	Rear to Front Switch Ratio Test - Bank 2 test
			Evaporative Monitor (21-2F)
10	21[b]	00	Fuel Tank Pressure test - Low
10	21[b]	00	Fuel Tank Pressure test - High
10	22[b]	00	Evap-Phase 2 change in pressure test
10	23[b]	00	Evap-Phase 4 change in pressure too large
10	24[b]	00	Evap-Phase 4 change in pressure too small
10	25[b]	00	Evap-Phase 4 pressure build test-upper limit
10	26	00	Phase 0 initial tank vacuum and minimum limit
10	26	00	Phase 0 initial tank vacuum and maximum limit
10	27	00	Phase 2 0.040“ cruise leak check vacuum bleed-up and max 0.04” leak threshold
10	28	00	Phase 2 0.020“ cruise leak check vacuum bleed-up and max leak threshold
10	29	00	EVAP-Phase 4 change in pressure too small
10	2A	00	Phase 4 vapor generation maximum change in pressure and maximum threshold
10	2B	00	Phase 4 vapor generation maximum absolute pressure rise and maximum threshold
10	2C	00	Phase 2 0.020” idle leak check vac bleed-up and max leak threshold
10	2D	00	Phase 2 0.020“ idle leak check vacuum bleed-up and max no-leak threshold
			Secondary Air Monitor (30-3F)
10	30	11	O2S11 rich during flow test
10	30	21	O2S21 rich during flow test
10	30	12	O2S12 rich during flow test
10	31	00	O2Ss lean timer test
10	31	01	O2Ss lean timer test

(Continued)

Diagnostic Monitoring Test Results

DIAGNOSTIC MONITORING TEST RESULTS TABLE

Module ID h[a]	Test ID h[a]	Component ID h[a]	Test Description
			EGR System Monitor (41-4F)
10	41[b]	11	Upstream hose disconnected test
10	41[b]	12	Downstream hose disconnected test
10	45	20	Stuck Open Valve Test
10	49	30	EGR Flow Test
10	4B	30	Flow test
			Misfire Monitor (51-5F)
10	50	00	Total Misfires that exceeded threshold
10	53	01	Misfire rate per 200 revs for Cylinder 1/Type A
10	53	02	Misfire rate per 200 revs for Cylinder 2/Type A
10	53	03	Misfire rate per 200 revs for Cylinder 3/Type A
10	53	04	Misfire rate per 200 revs for Cylinder 4/Type A
10	53	05	Misfire rate per 200 revs for Cylinder 5/Type A
10	53	06	Misfire rate per 200 revs for Cylinder 6/Type A
10	53	07	Misfire rate per 200 revs for Cylinder 7/Type A
10	53	08	Misfire rate per 200 revs for Cylinder 8/Type A
10	53	09	Misfire rate per 200 revs for Cylinder 9/Type A
10	53	0A	Misfire rate per 200 revs for Cylinder 10/Type A
10	54	00	Highest misfire rate in 200 rev test/Type A
10	55	00	Highest misfire rate in 1000 rev test/Type B
10	56	00	Misfire monitor trip complete test

a = hexadecimal

b = These test IDs are signed values. Scan tool may display them as unsigned.

The conversion is done as follows:

If the value is > 32767 then complement (change 0's to 1's and 1's to 0's), add 1 and a negative sign.

Example:

50000 = Complement of 50000 =	1100001101010000 0011110010101111 +1
	0011110010110000
Signed Value =	-15536

Drive Cycles

Description of OBD II Drive Cycle

The following procedure is designed to execute and complete the OBDII monitors and to clear the Ford P1000, I/M readiness code. To complete a specific monitor for repair verification, follow steps 1 through 4, then continue with the step described by the appropriate monitor found under the "OBDII Monitor Exercised" column. When the ambient air temperature is outside 4.4 to 37.8°C (40 to 100 °F), or the altitude is above 2438 meters (8000 feet), the EVAP monitor will not run. If the P1000 code must be cleared in these conditions, the PCM must detect them once (twice on some applications) before the EVAP monitor can be "bypassed" and the P1000 cleared. The EVAP "bypassing" procedure is described in the following drive cycle.

The OBDII Drive Cycle will be performed using a scan tool. Consult the instruction manual for each described function.

Note: A detailed description of a Powertrain Control Module (PCM) Resetis found in this section, refer to the table of contents.

Drive Cycle Recommendations

1. Most OBDII monitors will complete more readily using a "steady foot" driving style during cruise or acceleration modes. Operating the throttle in a "smooth" fashion will minimize the time required for monitor completion.
2. Fuel tank level should be between 1/2 and 3/4 fill with 3/4 fill being the most desirable.
3. The Evaporative Monitor can only operate during the first 30 minutes of engine operation. When executing the procedure for this monitor, stay in part throttle mode and drive in a smooth fashion to minimize "fuel slosh".

WARNING:

STRICT OBSERVANCE OF POSTED SPEED LIMITS AND ATTENTION TO DRIVING CONDITIONS ARE MANDATORY WHEN PROCEEDING THROUGH THE FOLLOWING DRIVE CYCLES.

For best result, follow each of the following steps as accurately as possible:

OBDII Monitor Exercised	Drive Cycle Procedure	Purpose of Drive Cycle Procedure
Drive Cycle Preparation	1. Install scan tool. Turn key on with the engine off. Cycle key off, then on. Select appropriate Vehicle & Engine qualifier. Clear all DTC's/Perform a PCM reset. 2. Begin to monitor the following PIDs: ECT, EVAPDC, FLI (if available) and TP MODE. Start vehicle WITHOUT returning to Key Off.	Bypass engine soak timer. Resets OBDII Monitor status.

(Continued)

Drive Cycles

OBDII Monitor Exercised	Drive Cycle Procedure	Purpose of Drive Cycle Procedure
Prep for Monitor Entry	3. Idle vehicle for 15 seconds. Drive at 64 Km/h (40 MPH) until ECT is at least 76.7°C (170°F). 4. Is IAT within 4.4 to 37.8°C (40 to 100°F)? **If not, complete the following steps, but note that step 14 will be required to "bypass" the EVAP monitor and clear the P1000.**	Engine warm-up and provide IAT input to the PCM.
HEGO	5. Cruise at 64 Km/h (40 MPH) for at least 5 minutes.	Executes the HEGO monitor.
EVAP	6. Cruise at 64 to 128 Km/h (45 to 65 MPH) for 10 minutes (avoid sharp turns and hills). NOTE: To initiate the monitor TP MODE should = PT, EVAPDC must be > 75%, and FLI must be between 15 and 85%.	Executes the EVAP monitor (If IAT is within 4.4 to 40°C (40 to 120°F).
Catalyst	7. Drive in stop-and-go traffic conditions. Include five different constant cruise speeds, ranging from 32 to 112 Km/h (20 to 70 MPH) over a 10 minute period.	Executes the Catalyst Monitor.
EGR	8. From a stop, accelerate to 72 Km/h (45 MPH) at 1/2 to 3/4 throttle. Repeat 3 times.	Executes the EGR Monitor.
SEC AIR/CCM (Engine)	9. Bring the vehicle to a stop. Idle with transmission in drive (neutral for M/T) for 2 minutes.	Executes the ISC portion of the CCM.
CCM (Trans)	10. For M/T, accelerate from 0 to 80 Km/h (0 to 50 MPH), continue to step 11. For A/T, from a stop and in overdrive, moderately accelerate to 80 Km/h (50 MPH) and cruise for at least 15 seconds. Stop vehicle and repeat without overdrive to 64 Km/h (40 MPH) cruising for at least 30 seconds. While at 64 Km/h (40 MPH), activate overdrive and accelerate to 80 Km/h (50 MPH) and cruise for at least 15 seconds. Stop for at least 20 seconds and repeat step 10 five times.	Executes the transmission portion of the CCM.
Misfire & Fuel Monitors	11. From a stop, accelerate to 104 Km/h (65 MPH). Decelerate at closed throttle until 64 Km/h (40 MPH) (no brakes). Repeat this 3 times.	Allows learning for the misfire monitor.
Readiness Check	12. Access the On-Board System Readiness (OBDII monitor status) function on the scan tool. Determine whether all non-continuous monitors have completed. If not, go to step 13.	Determines if any monitor has not completed.

(Continued)

Drive Cycles

OBDII Monitor Exercised	Drive Cycle Procedure	Purpose of Drive Cycle Procedure
Pending Code Check and EVAP Monitor "Bypass" Check	13. With the scan tool, check for pending codes. Conduct normal repair procedures for any pending code concern. Otherwise, rerun any incomplete monitor. If the EVAP monitor is not complete AND IAT was out of the 4.4 to 37.8 °C (40 to 100 °F) temperature range in step #4, or the altitude is over 2438 m. (8000 ft.), the EVAP "bypass" procedure must be followed. Proceed to Step 14.	Determines if a pending code is preventing the clearing of P1000.
EVAP Monitor "Bypass"	14. Park vehicle for a minimum of 8 hours. Repeat steps 2 through 12. DO NOT REPEAT STEP 1.	Allow the "bypass" counter to increment to two.

Intermittent Diagnostic Techniques

Intermittent diagnostic techniques help find and isolate the root cause of intermittent faults associated with the Electronic Engine Control System. The information is organized to help find the fault and perform the repair. The process of finding and isolating an intermittent starts with recreating a fault symptom, accumulating PCM data and comparing that data to typical values, then analyzing the results. Refer to the scan tool users manual for functions described below.

Before proceeding, be sure that:

- Customary mechanical system tests and inspections do not reveal a concern. (Remember, mechanical component conditions can make a PCM system react abnormally.)
- Technical Service Bulletins (TSBs) and OASIS messages, if available, are reviewed.
- Quick Test and associated Diagnostic Subroutines have been completed without finding a fault, and the symptom is still present.

Recreating the Fault

Recreating the fault is the first step in isolating the cause of the intermittent symptom. A thorough investigation should start with the customer information worksheet located in the Introduction. If Freeze Frame Data is available, it may help in recreating the conditions at the time of a Malfunction Indicator Lamp Diagnostic Trouble Code (MIL DTC). Listed below are some of the conditions for recreating the fault:

CONDITIONS TO RECREATE FAULT

Engine Type Conditions	Non-Engine Type Conditions
Engine Temperature	Ambient Temperature
Engine rpm	Moisture Conditions
Engine Load	Road Conditions (smooth-bumpy)
Engine idle/accel/decel	

Accumulating PCM Data

PCM data can be accumulated in a number of ways. This includes circuit measurements with a DVOM or scan tool PID data. Acquisition of PCM PID data using a scan tool is one of the easiest ways to gather information. Gather as much data as possible when the fault is occurring to prevent improper diagnosis. Data should be accumulated during different operating conditions and based on the customer description of the intermittent fault. Compare this data with the known good data values located in Section 6 in the Typical Diagnostic Reference Values. This will require recording data in four conditions for comparison: 1) KOEO, 2) HOT IDLE, 3) 48 km/h (30 mph), and 4) 89 km/h (55 mph).

Intermittent Diagnostic Techniques

Analyzing Data From Playback of Stored PIDs

Look for abnormal events or values that are clearly incorrect. Inspect the signals for abrupt or unexpected changes. For example, during a steady cruise most of the sensor values should be relatively stable. Sensors such as TP, MAF and RPM that change abruptly when the vehicle is traveling at a constant speed are clues to a possible fault area.

Look for agreement in related signals. For example, if TP is changed during acceleration, a corresponding change should occur in IAC, RPM and SPARK ADV PID.

Make sure the signals act in proper sequence. An increase in rpm after the TP is increased is expected. However, if rpm increases without a TP change, then a fault may exist.

Table Format (Figure 1): Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the values. (Refer to the following TP example). Notice the major jump in the TP voltage while scrolling through the information. This example would require a smooth and progressive accelerator pedal travel during a key on and engine off mode.

Graph Format (Figure 2): Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the linear lines showing the transformation of values to the line graph. This example would require smooth progressive accelerator pedal pressure with the key on and the engine off.

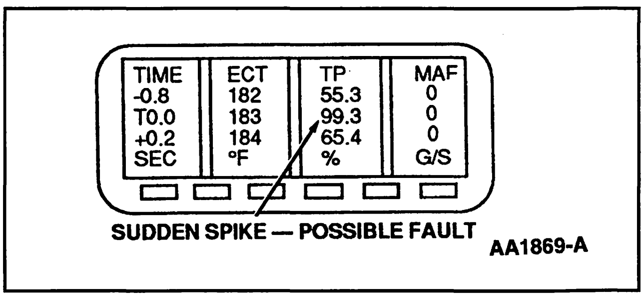

Figure 1: Table Format

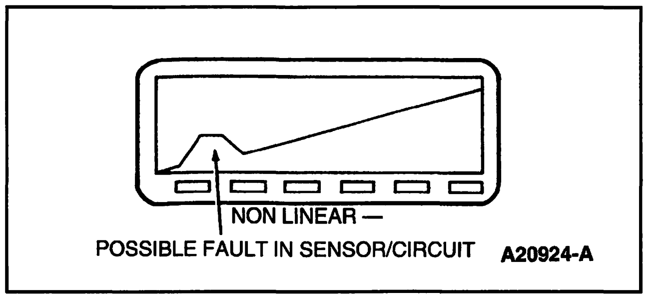

Figure 2: Graph Format

Peripheral Inputs

Some signals may require certain peripherals or auxiliary tools for diagnosis. These tools include the Auxiliary Adapter and Pressure/Vacuum Adapter. In some cases, these devices can be inserted into the measurement jacks of the scan tool or multimeter. For example, connecting an electronic fuel pressure gauge to monitor and record the fuel pressure voltage reading and capturing the data would help find the fault.

Comparing PCM Data

After the PCM values have been acquired, it is necessary to determine the fault area. Typically, it will require the comparison of the actual values from the vehicle to the typical values from the Typical Diagnostic Reference Valuesin Section 6. The charts apply to different vehicle applications (i.e., model, engine, transmission, etc.).

Adaptive Fuel DTCs Diagnostic Techniques

Adaptive Fuel DTCs Diagnostic Techniques help isolate the root cause of the adaptive fuel concern. Before proceeding, attempt to verify if any driveability concerns are present. These diagnostic aids are meant as a supplement to the pinpoint test steps in Section 5. For a description of fuel trim, refer to Section 1, Powertrain Control Software, Fuel Trim.

Obtain Freeze Frame Data

Freeze Frame Data can be helpful in duplicating and diagnosing adaptive fuel concerns. This data (a snapshot of certain PID values, recorded at the time the DTC was stored in Continuous Memory) is helpful to determine how the vehicle was being driven when the fault occurred, and can be especially useful on intermittent concerns. Freeze Frame Data, in many cases, can help to isolate possible areas of concern as well as rule out others. Refer to Freeze Frame Data in this section for a more detailed description of this data.

Using the LONGFT1 and LONGFT2 (dual bank engines) PIDs

The LONGFT1/2 PIDs can be useful for diagnosing fuel trim concerns. A negative PID value indicates that fuel is being reduced to compensate for a rich condition, while a positive PID value indicates that fuel is being increased to compensate for a lean condition. It is important to know that there is a separate LONGFT value that is used for each rpm/load point of engine operation. When viewing the LONGFT1/2 PIDs, the values may change a great deal as the engine is operated at different rpm and load points. This is because the fuel system may have learned corrections for fuel delivery concerns that can change as a function of engine rpm and load. The LONGFT1/2 PIDs will display the fuel trim currently being used at that rpm and load point. Observing these changes in LONGFT1/2 can help when diagnosing fuel system concerns. For example:

- A contaminated MAF sensor would result in matching LONGFT1/2 correction values that are negative at idle (reducing fuel), but positive (adding fuel) at higher rpm and loads.
- LONGFT1 values that differ greatly from LONGFT2 values would rule out concerns that are common for both banks (for example, fuel pressure concerns, MAF sensor, etc. could be ruled out).
- Vacuum leaks would result in large rich corrections (positive LONGFT1/2 value) at idle, but little or no correction at higher rpm and loads.
- A plugged fuel filter will result in no correction at idle, but large rich corrections (positive LONGFT1/2 value) at high rpm and load.

Resetting Long Term Fuel Trims

Long term fuel trim corrections can be reset by resetting the PCM Keep Alive Memory (KAM). Refer to Resetting Keep Alive Memory in this section to reset KAM. After making a fuel system repair, KAM must be reset. For example, if dirty/plugged injectors cause the engine to run lean and generate rich long term corrections, replacing the injectors and not resetting KAM will now make the engine run very rich. The rich correction will eventually be "learned out" during closed loop operation, but the vehicle may have poor driveability and have high CO emissions while it is learning.

Adaptive Fuel DTCs Diagnostic Techniques

P0171/P0174 System Too Lean Diagnostic Aids

Note: If the system is lean at certain conditions, then the LONGFT PID would be a positive value at those conditions, indicating that increased fuel is needed.

The ability to identify the type of lean condition causing the concern can be crucial to a correct diagnosis.

Air Measurement System:

With this condition, the engine may actually run rich or lean of stoichiometry (14.7:1 air/fuel ratio) if the Powertrain Control Module (PCM) is not able to compensate enough to correct for the condition. One possibility is that the mass of air entering the engine is actually greater than what the MAF sensor is indicating to the PCM. For example, with a contaminated MAF sensor, the engine would run lean at higher rpm because the PCM would deliver fuel for less air than is actually entering the engine.

Examples: MAF sensor measurement inaccurate (corroded connector, contamination/dirty (a contaminated MAF sensor will typically result in a rich system at low airflows (PCM will reduce fuel) and a lean system at high airflows (PCM will increase fuel), etc).

Vacuum Leaks/Unmetered Air:

With this condition, the engine may actually run lean of stoichiometry (14.7:1 air/fuel ratio) if the Powertrain Control Module (PCM) is not able to compensate enough to correct for the condition. This condition can be caused by unmetered air entering the engine, or due to a MAF malfunction. In this situation, the volume of air entering the engine is actually greater than what the MAF sensor is indicating to the PCM. Vacuum leaks will normally be most apparent when high manifold vacuum is present (for example, during idle or light throttle). If freeze frame data indicates that the fault occurred at idle, a check for vacuum leaks/unmetered air might be the best starting point.

Examples: Loose, leaking or disconnected vacuum lines, intake manifold gaskets or o-rings, throttle body gaskets, brake booster, air inlet tube, stuck/frozen/aftermarket PCV valve, unseated engine oil dipstick, etc.

Insufficient Fueling:

With this condition, the engine may actually run lean of stoichiometry (14.7:1 air/fuel ratio) if the PCM is not able to compensate enough to correct for the condition. This condition can be caused by a fuel delivery system concern that restricts or limits the amount of fuel being delivered to the engine. This condition will normally be most apparent when the engine is under a heavy load and at high rpm, when a higher volume of fuel is required. If freeze frame data indicates that the fault occurred under a heavy load and at higher rpm, a check of the fuel delivery system (checking fuel pressure with engine under a load) might be the best starting point.

Examples: low fuel pressure (fuel pump, fuel filter, fuel leaks, restricted fuel supply lines), fuel injector concerns, etc.

Exhaust System Leaks:

Adaptive Fuel DTCs Diagnostic Techniques

In this type of condition, the engine may actually be running rich of stoichiometry (14.7:1 air / fuel ratio) because the fuel control system is adding fuel to compensate for a perceived (not actual) lean condition. This condition is caused by oxygen (air) entering the exhaust system from an external source. The HO2S will react to this exhaust leak by increasing fuel delivery. This condition will cause the exhaust gas mixture from the cylinder to be rich.

Examples: Exhaust system leaks upstream or near HO2S, poorly welded/leaking HO2S boss, malfunctioning Secondary Air Injection system, etc.

P0172/P0175 System Too Rich Diagnostic Aids

Note: If the system is rich at certain conditions, then the LONGFT PID would be a negative value at that airflow, indicating that decreased fuel is needed.

System rich concerns are usually caused by fuel system concerns, although the MAF sensor, and base engine (for example, engine oil contaminated with fuel) should also be checked.

Air Measurement System:

With this condition, the engine may actually run rich or lean of stoichiometry (14.7:1 air/fuel ratio) if the Powertrain Control Module (PCM) is not able to compensate enough to correct for the condition. One possibility is that the mass of air entering the engine is actually less than what the MAF sensor is indicating to the PCM. For example, with a contaminated MAF sensor, the engine would run rich at idle because the PCM would deliver fuel for more air than is actually entering the engine.

Examples: MAF sensor measurement inaccurate (corroded connector, contamination/dirty (a contaminated MAF sensor will typically result in a rich system at low airflows (PCM will reduce fuel) and a lean system at high airflows (PCM will increase fuel), etc.).

Fuel System:

With this condition, the engine may actually run rich of stoichiometry (14.7:1 air/fuel ratio) if the Powertrain Control Module (PCM) is not able to compensate enough to correct for the condition. This situation can be caused by a fuel delivery system that is delivering excessive fuel to the engine.

Examples:

- Fuel pressure regulator causes excessive fuel pressure (system rich at all airflows)(fuel pressure can be intermittent, going to pump deadhead pressure, then returning to normal after engine is turned off then restarted).
- Fuel pressure regulator vacuum hose off (causes excessive fuel pressure at idle, system rich at idle airflows).
- Fuel pressure regulator diaphragm ruptured (fuel leaking into intake manifold, system rich at lower airflows).
- Fuel return line crimped/damaged (fuel pressure high, system rich at lower airflows).

Adaptive Fuel DTCs Diagnostic Techniques

- Fuel injector leaks (injector delivers extra fuel).
- EVAP canister purge valve leak (if canister is full of vapors, introduces extra fuel).
- Fuel rail pressure sensor (electronic returnless fuel systems) concern causes sensor to indicate lower pressure than actual. PCM commands higher pressure to the fuel pump driver module (FPDM), causing high fuel pressure (system rich at all airflows).

Base Engine

Engine oil contaminated with fuel can contribute to a rich running engine.

Basic Circuit Checks

Description

Basic circuit checks help to minimize pinpoint test steps by providing a procedure to diagnose harness faults associated with the Electronic Engine Control (EC) System. The following techniques provide helpful reminders for diagnosing open circuits (continuity), shorts to ground and shorts to power.

NOTE:

- The suspect circuit must be isolated before testing.
- When disconnecting any harness connector, always inspect for damaged or pushed out pins, corrosion and loose wires. Repair as necessary.
- The digital multimeter must be set to the correct scale.
- The techniques do not apply in all situations, therefore, it is necessary to follow each pinpoint test step accurately and completely.
- General resistance and voltage values are specified below. Always use the pinpoint test values if they differ.
- Always turn the key to the OFF position unless directed otherwise by the pinpoint test.

Each of the following procedures will require the powertrain control module (PCM) and component to be disconnected to isolate the harness.

Open Circuit (Continuity)

Disconnect PCM. Measure the harness resistance between the suspect circuit at the harness connector and the appropriate PCM harness connector pin or PCM breakout box (if available). The resistance must be less than 5.0 ohms.

Shorts to Ground

Measure the harness resistance between the suspect circuit at the harness connector and a reliable ground (B-, chassis gnd or PWR GND at the PCM breakout box, if available). The resistance must be greater than 10,000 ohms.

Shorts to Power

Key ON to power up circuit. Measure voltage between the suspect circuit at the harness connector and a reliable ground. The voltage must be less than 1.0 volt.

SECTION 3

Symptom Charts

Contents

QT: Step 1: PCM Quick Test 3-1

Step 2: No DTC(s) Present Symptom Chart Index 3-3

Step 3: No DTC(s) Present Symptom Charts 3-6

Step 1: PCM Quick Test — QT

Test Steps		Results →	Action to Take
QT1	PERFORM PCM QUICK TEST		
	Note: If the vehicle was brought in with an emission compliance failure symptom, GO directly to Section 5; GO to **EM1**. • Complete preliminary checks looking for obvious concerns that may relate to the symptom. Check items such as those listed: — Related electrical connectors or fuses — Vacuum lines (leaks, routing) — Air intake system (leaks, restrictions) — Fuel quality (octane, contamination, winter/summer blend) — Cooling system (engine operating at proper temperature) • Access any related OASIS or TSB information (if available). • Complete PCM Quick Test to access any DTCs. Note any Key On Engine Off, Key On Engine Running (if engine runs) and Continuous Memory (MIL and non-MIL) DTCs. Note: If unable to access DTCs, or any scan tool communication concern exists, GO to **QA1** in Section 5. For additional information on retrieving MIL and non-MIL DTCs, refer to Section 2, Diagnostic Methods (Continuous Memory Self-Test). • **Were any DTCs present?**	Yes →	**If engine runs rough at idle and Key On Engine Running or Continuous Memory DTC(s) are present:** GO to Quick Test **QT2** to check injector fault PIDS. **All Others:** GO to Section 4 (Diagnostic Trouble Code (DTC) Charts) for direction to service DTC(s) after noting the following: Service DTCs in the following order (begin diagnosis with the first DTC output in that mode). (1) Any KOEO DTC(s) (2) Any KOER DTC(s) (3) Any Continuous Memory DTC(s) (retrieve any available Freeze Frame Data)(disregard any identical/related Continuous DTC(s) of DTC(s) already serviced).
		No →	GO to Step 2: NO DTC(s) PRESENT SYMPTOM CHART INDEX for direction to proper STEP 3 Chart. Note: If symptom is not listed, REFER to applicable Workshop Manual or GO to **Z1** in Section 5 (for intermittent PCM system diagnostics).

Step 1: PCM Quick Test	QT

Test Steps		Results →	Action to Take
QT2	ENGINE RUNS ROUGH AT IDLE WITH KEY ON ENGINE RUNNING OR CONTINUOUS MEMORY DTC(s): CHECK INJECTOR FAULT (INJxF) PID(s)		
	Note: An injector circuit fault could result in unrelated DTC(s) being received from the PCM. • Key on, engine off. • Access the INJxF PIDs (the “x” indicates the injector number). There will be one INJxF PID for each engine cylinder. • **Do any of the INJxF PIDs indicate a fault (or Yes)?**	Yes →	An injector circuit fault exists. KEY OFF. Disregard DTC(s). **Natural Gas applications:** GO to **HA30** . **All Others:** GO to **H41**.
		No →	No fault detected by injector fault PIDs. KEY OFF. GO to Quick Test **QT1** and follow the YES Action To Take for all others.

Step 2: No DTC(s) Present Symptom Chart Index

System / Symptom		OASIS Number	Chart Number	Page Number
Driveability				
Starting Concerns	Hard Start/Long Crank/Erratic Start/Erratic Crank	602300	Chart Number: 2	9
	Stall After Start	—	Chart Number: 1	6
	No Crank	601300	Chart Number: 23	24
	No Start (engine cranks)	603300	Chart Number: 3	10
Unique Idle Concerns	Slow Return to Idle	617400	Chart Number: 4	11
	Rolling Idle	618400	Chart Number: 1	6
	Fast Idle	619400	Chart Number: 5	11
	Low/Slow Idle	—	Chart Number: 6	12
Driveability - Performance While Driving Concerns				
Stalls/Quits	Idle, Acceleration, Cruise	607x00	Chart Number: 1	6
	Deceleration	607700	Chart Number: 6	12
Runs Rough		608x00	Chart Number: 1	6
Misses		609x00	Chart Number: 1	6
Buck/Jerk		610x00	Chart Number: 1	6
Hesitation/Stumble		611x00	Chart Number: 1	6
Surge		612x00	Chart Number: 1	6
Backfires		613x00	Chart Number: 7	13
Lack/Loss of Power		614x00	Chart Number: 8	13
Spark Knock		615x00	Chart Number: 9	15

Note: OASIS identifiers (the "x" means any number (1-9) can be used) xxx4xx=during idle, xxx5xx=during acceleration, xxx6xx=during cruise, xxx7xx=during deceleration.

(Continued)

Step 2: No DTC(s) Present Symptom Chart Index

System / Symptom		OASIS Number	Chart Number	Page Number
Additional Driveability Concerns				
Diesels/Runs On		621000	Chart Number: 5	11
Poor Fuel Economy		622000	Chart Number: 10	16
Emissions Compliance		623000	Chart Number: 11	17
Malfunction Indicator Lamp (MIL) Concern		698298	Chart Number: 12	18
Electrical				
Warning Indicators	Malfunction Indicator Lamp (MIL)	698298	Chart Number: 12	18
	Transmission Control Indicator Lamp (TCIL)	698298	Chart Number: 12	18
	Temperature Warning Indicator Lamp or Gauge (applications with CHT sensor only)	—	Chart Number: 12	18
	Check Fuel Cap Indicator Lamp	—	Chart Number: 12	18
Climate Control	Lack of A/C cooling, A/C not functioning	208200	Chart Number: 21	23
	A/C always on and/or A/C compressor runs continuously	—	Chart Number: 21	23
	A/C does not cut off under WOT conditions (Mustang only)	—	Chart Number: 21	23
Instrumentation	Tachometer Inoperative	—	Chart Number: 14	19
	Speedometer/odometer Inoperative	—	Chart Number: 14	19
	Boost gauge indicates higher than normal boost (supercharger applications)	—	Chart Number: 14	19
	Fuel Gauge Inoperative	—	Chart Number: 14	19
Engine				
Oil System Concerns	High Oil Consumption	—	Chart Number: 15	20
	Leaks	—	Chart Number: 15	20

(Continued)

Step 2: No DTC(s) Present Symptom Chart Index

System / Symptom		OASIS Number	Chart Number	Page Number
Engine (Continued)				
Cooling System Concerns	Electric cooling fan(s) does not operate (low, medium, high and/or variable speed)	—	Chart Number: 16	21
	Electric cooling fan always runs	—	Chart Number: 17	21
Exhaust System Concerns	Visible smoke	—	Chart Number: 18	22
	Odor (sulfur or "rotten egg" smell)	—	Chart Number: 22	23
Fuel System Concerns	Odor, engine compartment	—	Chart Number: 19	22
Engine Noise (under hood)		497000	Chart Number: 20	22
Driveline				
Automatic Transmission Shift Concerns	A/T upshift concern	501000	Chart Number: 13	19
	A/T downshift concern	502000	Chart Number: 13	19
	Engagement concern	503000	Chart Number: 13	19

Step 3: No DTC(s) Present Symptom Charts

Chart 1

— Starting Concerns: Stalls After Start

— Stalls/Quits: Idle, Acceleration, Cruise

— Runs Rough

— Misses

— Buck/Jerk

— Hesitation/Stumble

— Surge

— Unique Idle concerns: Rolling Idle

Note: For stalls on passenger car applications, engine may stall if left running while refueling. Advise customer to turn engine off while refueling to avoid contamination or damage to the EVAP system.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Check The Following PIDs: — DPFEGR (if equipped) (hot idle value within 0.15V of KOEO value) — LONGFT1 / LONGFT2 (value between -20 and +20) — VPWR (value between 10.5 and 17.0 volts, and within 0.5 volts of battery voltage)	**DPFEGR PID value not within 0.15V of KOEO value:** • **For vehicles equipped with ESM EGR:** GO to **HH31** • **All others:** GO to **HE57** **LONGFT1 / LONGFT2 value low (-):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich. **LONGFT1 / LONGFT2 value high (+):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean. **VPWR not between 10.5 and 17.0 volts:** Go to the Workshop Manual, Charging System Section 414. **VPWR between 10.5 and 17.0 volts, but not within 0.5 of battery voltage:** CHECK B(+) supply to PCM power relay (or CCRM). CHECK VPWR circuit between PCM and PCM power relay or CCRM. CHECK PWR GND circuits.
For vehicles that run rough at idle: With the key on, engine off, check the INJxF PIDs (the "x" indicates the injector number, there will be one INJxF PID for each engine cylinder). All INJxF PIDs must indicate no fault (or NO).	**INJxF PID(s) indicate a fault (an injector circuit fault is indicated):** **Natural Gas applications:** GO to **HA30** **All others:** GO to **H41**

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Mass Air Flow (MAF) Sensor	GO to **DC25**
Secondary Ignition System	GO to **JB1**
Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All Others:** GO to **HC1**
Exhaust System	GO to **HF5**
PCV System	GO to **HG1**
Natural Gas applications with rough idle: Injector circuits between NG module and injectors.	GO to **HA27**
EVAP System	GO to **HX14**
Automatic Transmission	Automatic Transaxle/Transmission - Section 307 of the Workshop Manual
Base Engine	Engine System - Section 303 of the Workshop Manual
Intake Air System	GO to **HU1**
Applications with A/C Pressure Sensor (3 wire sensor): A/C pressure (ACP) sensor input to PCM	GO to **DS19**
Additional Testing	GO to **Z1**

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Additional Checks: Note: Some applications have a PID that will indicate whether the PCM is reducing torque (TQ_CNTL)(#095E b0), and if so, why the torque is being reduced (#095Eb1-13) (0 = No torque reduction requested; 1 = Torque Truncation. Cuts fuel to protect when line pressure fails to minimum limit; 2 = Traction Control Event. Cuts fuel and/or spark for traction control; 3 = Vehicle Speed Limit - Cuts fuel). — Correct PCM vehicle identification (VID) block information (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM) — Be aware of engine RPM/speed limiting functions of the PCM (look for incorrect high vehicle speed signal from ABS, VSS or OSS) — Verify fuel cap is properly tightened, and not physically damaged. — Drivelines	Applicable section in Workshop Manual

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
— Manual transmission/clutch — Charging System — Traction control system (if equipped) — A/C system (for surge with A/C on) — Speed control system (for surge with speed control on) — A/C compressor diode, if equipped (for rolling idle)	

Chart 2

Starting Concerns:

— Hard Start/Long Crank

— Erratic Start/Erratic Crank

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Battery Condition and Current Draw	Visual, Charging System - Section 414 of the Workshop Manual
Secondary Ignition System	GO to **JB1**
Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All Others:** GO to **HC1**
Exhaust System	GO to **HF5**
PCV System	GO to **HG1**
EVAP System	GO to **HX14**
Intake Air System	GO to **HU1**
Starting System	Starting System, Section 303 of the Workshop Manual
Mass Air Flow (MAF) Sensor	GO to **DC25**
5.4L SC F-Series only: Check high speed fuel pump secondary circuits.	GO to **KA52**
Additional Testing	GO to **Z1**

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Additional Checks: — For applications with two Camshaft Position (CMP) sensors, verify CMP1 and CMP2 circuits are not shorted together.	Visual

Chart 3

Starting Concerns:

— No Start (engine cranks)

Note: Extended cranking because of a no start can load the exhaust system with raw fuel, damaging the catalytic converter after the engine starts. For applications with Secondary Air Injection (AIR) Systems, perform the following after the no start has been repaired: Disconnect the electric secondary air injection (AIR) solid state relay, run the engine until the surplus fuel is used up, and reconnect the relay (disconnecting the relay may set a Continuous Memory PCM DTC that will need to be cleared).

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Add-on Anti-Theft Devices	Visual, check with customer.
Fuel/Ignition	**Thunderbird and LS6/LS8:** GO to **KB64** . **All others:** GO to **A1**.
If engine will not start now: If engine will not start at closed throttle, but will start and run normally at part throttle, check Idle Air Control (IAC) System.	**Engine will now start and run normally at part throttle:** GO to **KE2**
Exhaust System (restrictions)	GO to **HF5**
Base Engine	Engine System - Section 303 of the Workshop Manual
Additional Testing	GO to **Z1**

Step 3: No DTC(s) Present Symptom Charts

Chart 4

Unique Idle Concerns:

— Slow Return To Idle

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Vacuum Leaks, Throttle Body	Visual
PCV System	GO to **HG1**
Intake Air System (air leaks)	GO to **HU1**

Chart 5

Unique Idle Concerns:

— Fast Idle

Additional Driveability Concerns:

— Diesels/Runs On

Note: If vehicle runs normally after the ignition key is turned OFF, check for damaged ignition switch, IGN RUN circuit short to power, VPWR circuit short to power, etc. Refer to applicable Wiring Diagram and/or Workshop Manual

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Base engine air leaks, including proper sealing of intake manifold and components/vacuum lines attached to intake air (such as the PCV, EGR or IAC valve/vacuum lines).	Visual, Engine System - Section 303 of the Workshop Manual
Verify engine operates at normal temperature.	Visual (refer to Symptom Index, or Engine Cooling Section 303 of Workshop Manual, to diagnose any cooling system concerns that are present).

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Fast idle concerns: Key on, engine off, monitor TP MODE PID while wiggling TP sensor circuits. TP MODE PID can also be monitored during vehicle drive. With throttle closed, TP MODE PID must be C/T (closed throttle).	**TP Mode PID is not C/T with throttle closed:** Note: At vehicle start, the TPREL will begin at about 1.25 volts, and count down to the lowest TP V value seen since engine start. If the TP V value goes below the "normal" range, then increases again, TPREL will set to the lower voltage. If TP V is about 0.04 volts greater than the TPREL value at closed throttle, the PCM will go into part throttle mode. Monitor TP V and TPREL PIDs for sudden changes while checking for intermittent TP circuit/connector concerns. Also check for loose/worn throttle plates. If no concern is found, GO to **Z1** in Section 5.
Intake Air System (air leaks)	GO to **HU1**
Additional Testing	GO to **Z1**

Chart 6

Unique Idle Concerns:

— Low/Slow Idle

Stalls/Quits

— Deceleration

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify fuel filler cap is properly tightened	Visual
For A/T with Stalls/Quits on deceleration: Transmission	Automatic Transaxle/Transmission, Section 307 of the Workshop Manual (Diagnosis By Symptom: Torque Converter Concerns)
For Low idle with A/C on (4.6/5.4L/6.8L E-Series): Check ACCS PID with A/C on and engine running (PID should indicate ON when A/C clutch is engaged). (On applications where the PCM cannot control the A/C clutch on and off, the PCM uses the ACCS circuit to determine additional load on the engine.)	**ACCS PID does not indicate ON with A/C clutch engaged:** GO to **KM7**

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All Others:** GO to **HC1**
Intake Air System	GO to **HU1**
Base Engine	Engine System - Section 303-00 of the Workshop Manual
Additional Checks: — Check if the operation of certain systems are causing the low idle.	Visual
Additional Testing	GO to **Z1**

Chart 7

Backfires

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Secondary Ignition	GO to **JB1**
Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All Others:** GO to **HC1**
Base Engine	Engine System - Section 303 of the Workshop Manual
Exhaust System	GO to **HF5**
Additional Testing	GO to **Z1**

Chart 8

Lack/Loss of Power

Note: Verify symptom is reported under normal driving conditions without excessive engine/vehicle load. Also, be aware of the engine rpm/speed limiting functions of the PCM.

Note: For applications with knock sensor, a lack of power may result when the vehicle is operated with a breakout box installed at the PCM. The KS circuits are not shielded in the breakout box, and KS signal noise may be noticed by the PCM. If this happens, spark timing will be retarded and a lack of power may result.

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
— Automatic Transmission Fluid — Throttle Linkage — Air cleaner element	Visual
Check the Following PIDS: — DPFEGR (if equipped) (hot idle value within 0.15V of KOEO value) — LONGFT1 / LONGFT2 (value between -20 and +20) — **For 4.6L E/F Series:** IMTVF with both Key On Engine Off, and with transmission in PARK/NEUTRAL and engine rpm greater than 3000 rpm (PID should indicate no fault (or NO) in both situations).	**DPFEGR PID value not within 0.15V of KOEO value:** • **For vehicles equipped with ESM EGR:** GO to **HH31** • **All others:** GO to **HE57** **LONGFT1 / LONGFT2 value low (-):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich. **LONGFT1 / LONGFT2 value high (+):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean. **IMTVF PID indicates a fault:** GO to **HU42**
Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All others:** GO to **HC1**
Secondary Ignition	GO to **JB1**
Mass Air Flow (MAF) Sensor	GO to **DC25**
Exhaust System	GO to **HF5**
Base Engine	Engine System - Section 303 of the Workshop Manual
Automatic Transmission	Automatic Transaxle/Transmission, Section 307 of the Workshop Manual (Diagnosis by Symptom - Poor Performance)
Brake System (brake drag or binding)	Brake System Section 206 of the Workshop Manual
Mustang only: Check for lack of A/C cutoff under wide open throttle conditions.	Audible (listen for A/C clutch to disengage during a brief wide open throttle, then re-engage a few seconds after returning to idle). Follow Symptom Chart 21 if A/C does not cutoff.
Supercharged applications: Supercharger bypass system	GO to **KJ13**
5.4L SC F-Series: Check high speed fuel pump secondary circuits	GO to **KA52**
Additional Testing	GO to **Z1**

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Additional Checks: Note: Some applications have a PID that will indicate whether the PCM is reducing torque (095E b0), and if so, why the torque is being reduced (095E b1-13). — Customer driving habits — Correct PCM vehicle identification (VID) block information (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM) — IMRC linkage (if equipped) — Clutch (M/T) — Charging System — Engine RPM/speed limiting functions of the PCM (look for incorrect high vehicle speed signal from ABS, VSS or OSS)	Visual. Appropriate Group of the Workshop Manual

Chart 9

Spark Knock

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify engine operates at normal temperature	Visual (refer to Symptom Index, or Engine Cooling Section 303 of the Workshop Manual, to diagnose any cooling system concerns that are present).
Verify correct coolant level and coolant concentration	Refer to Engine Cooling Section 303-03 for proper fill concentrations and fill procedures.
Mass Air Flow (MAF) Sensor	GO to **DC25**
Base Engine	Engine System - Section 303 of the Workshop Manual

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All Others:** GO to **HC1**
Secondary Ignition System	GO to **JB1**
PCV System	GO to **HG1**
Engine Oil Quality	Visual
Additional Testing	GO to **Z1**

Chart 10

Poor Fuel Economy

Note: Since driving styles can have a significant influence on fuel economy, verify the concern before starting an in-depth diagnosis. Also, the following external factors could contribute to “poor fuel economy” conditions:

- Stop/go driving
- Improper tire pressure/size
- Vehicle loads (such as trailer towing)
- Extended winter warm-up conditions
- High speed driving
- Improper axle ratio
- Road/weather conditions
- Aftermarket add-ons
- Short run operations
- Customer expectations

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Transmission Fluid Level	Visual
Check The Following PIDs: — DPFEGR (if equipped) (hot idle value within 0.15V of KOEO value) — LONGFT1 / LONGFT2 (value between -20 and +20) — VPWR (value between 10.5 and 17.0 volts, and within 0.5 volts of battery voltage)	**DPFEGR PID value not within 0.15V of KOEO value:** • **For vehicles equipped with ESM EGR:** GO to **HH31** • **All others:** GO to **HE57** **LONGFT1 / LONGFT2 value low (-):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run rich. **LONGFT1 / LONGFT2 value high (+):** Continue diagnosis. Concentrate checks in areas that would cause the engine to run lean. **VPWR not between 10.5 and 17.0 volts:** Go to the Charging System - Section 414 of the Workshop Manual **VPWR between 10.5 and 17.0 volts, but not within 0.5 of battery voltage:** CHECK B(+) supply to PCM power relay (or CCRM). CHECK VPWR circuit between PCM and PCM power relay or CCRM. CHECK PWR GND circuits.
Verify engine operates at normal temperature	Visual (refer to Symptom Index, or Engine Cooling Section 303 of the Workshop Manual, to diagnose any cooling system concerns that are present).

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Secondary Ignition System	GO to **JB1**
Fuel System	**Natural Gas Applications:** GO to **HB1** **All Others:** GO to **HC1**
Exhaust System	GO to **HF5**
Automatic Transmission	Automatic Transaxle/Transmission Section 307 of the Workshop Manual (Diagnosis by Symptom - Poor Performance)
PCV System	GO to **HG1**
Additional Checks: — Correct PCM vehicle identification (VID) block information (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM) — Brake drag — Base engine concerns — Incorrect PCV valve — Contaminated MAF sensor — Intake air system	Appropriate section in Workshop Manual
Additional Testing	GO to **Z1**

Chart 11

Emissions Compliance

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Emissions Related Systems	GO to **EM1**

Step 3: No DTC(s) Present Symptom Charts

Chart 12

Warning Indicators:

— MIL

— TCIL

— Temperature Warning Indicator Lamp or Gauge (applications with CHT sensor)

— Check Fuel Cap Indicator Lamp

Note:

— If the symptom is both "MIL on" AND "exhaust emission test failure", GO directly to Chart 11.

— If engine is a no start, GO directly to Chart 3.

— If engine runs rough at idle, GO directly to Chart 1.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Verify fuel filler cap is properly tightened	Visual
Trucks with Power Takeoff (PTO) and MIL concern: PTO input to PCM	GO to **FB1**
MIL always on when engine is running (no DTCs): MIL circuits	**Crown Victoria, Grand Marquis, Marauder, Explorer Sport Trac, Ranger:** GO to **NB1** **All Others:** Instrument Cluster, Section 413 of the Workshop Manual
TCIL always on when engine is running (no DTCs): TCIL circuits	**Focus, Mustang, Town Car, Thunderbird, LS6/LS8, Freestar/Monterey , Expedition, Aviator and Navigator:** Instrument Cluster, Section 413 of the Workshop Manual **All Others:** GO to **TB7**
MIL never on (including the bulb check when the engine is first started): MIL circuits	**Crown Victoria, Grand Marquis, Marauder, Explorer Sport Trac, Ranger:** GO to **NB3** **All others:** Instrument Cluster, Section 413 of the Workshop Manual
TCIL never on: TCIL circuits	**Focus, Mustang, Town Car, Thunderbird, LS6/LS8, Freestar/Monterey, Expedition, Aviator and Navigator:** Instrument Cluster, Section 413 of the Workshop Manual **All others:** GO to **TB9**
Temperature Warning Indicator Lamp or Gauge concerns (applications with CHT sensor only): Engine cooling system or lamp circuits	**If engine is overheating:** Engine Cooling, Section 303 of the Workshop Manual. Be aware that since a PCM DTC was not received, the PCM has not attempted to turn the lamp on. **If engine operates at normal temperature:** GO to **DL35**

(Continued)

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Check Fuel Cap Indicator Lamp Always on or off: Check fuel indicator lamp circuits	**Focus (2.0L), Crown Victoria/Grand Marquis/Marauder, Ranger, Explorer Sport Trac, E-Series, and F-150 (4.2L and 4.6L):** Indicator Lamp Always On: GO to **HX47** Indicator Lamp Always Off: GO to **HX48** **All others:** Instrument Cluster, Section 413 of the Workshop Manual
Additional Testing	GO to **Z1**

Chart 13

Automatic Transmission Concerns:

— Upshift

— Downshift

— Engagement

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Transmission	Automatic Transaxle/Transmission Section 307 of the Workshop Manual
Additional Tests	GO to **Z1**

Chart 14

Instrumentation:

— Tachometer Inoperative

— Speedometer Inoperative

— Boost Gauge indicates higher than normal boost (supercharger applications)

— Fuel Gauge Inoperative

Step 3: No DTC(s) Present Symptom Charts

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Tachometer Inoperative Applications with CTO circuit from PCM pin 48: CTO circuit from PCM	GO to **JH1**
Speedometer/odometer Inoperative	**Applications with Manual Shift On The Fly (MSOF) transfer case using a Transfer Case Speed Sensor (TCSS):** GO to **DP9** **Applications with manual transmissions using a Vehicle Speed Sensor (VSS):** GO to **DP1** **Applications with manual transmissions using an Output Shaft Speed (OSS) Sensor:** GO to **TJ1**
Boost Gauge indicates higher than normal boost Supercharger bypass control Intercooler system	**Supercharger bypass control:** GO to **KJ1** **Intercooler system:** GO to **KP8**
Fuel Gauge Inoperative Fuel Gauge always indicates full or empty	**For vehicles with hardwire circuit input to PCM (E-Series, Explorer Sport Trac, Ranger, Crown Victoria, Grand Marquis, Marauder):** GO to **HX40** **All others:** REFER to Section 413, fuel level indicator or Rear Electronic Module diagnosis of the Workshop Manual
Instrumentation	Instrument Cluster, Section 413 of the Workshop Manual

Chart 15

Oil System Concerns:

— High Oil Consumption

— Leaks

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
PCV System	GO to **HG1**
Base Engine	Engine System - Section 303 of the Workshop Manual
Additional Checks — External leaks — Proper dipstick — Proper oil viscosity	Visual

Step 3: No DTC(s) Present Symptom Charts

Chart 16

Cooling System Concerns:

— Electric Cooling Fan(s) Does Not Operate (Low, Medium, High or Variable speed))

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Electric Cooling Fan Components	**Mustang:** GO to **X21** **Crown Victoria/Grand Marquis, LS6/LS8, Thunderbird and Town Car:** GO to **KN9** **All Others:** GO to **KF56**
Cooling System	Engine Cooling, Section 303 of the Workshop Manual

Chart 17

Cooling System Concerns:

— Electric Cooling Fan(s) Always Runs

Note: This chart is intended to only diagnose an electric cooling fan that always runs with a "cool" engine and the A/C and defroster off.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Cooling fan circuits and ACPSW or ACP circuits	**Crown Victoria/Grand Marquis, Thunderbird, LS6/LS8 and Town Car:** VERIFY results of Quick Test. Visually inspect cooling fan for concerns. **Freestar/Monterey, Aviator:** Go to Cooling System check below (also check for overpressurized A/C system) **3.8/3.9L Mustang:** GO to **X39** **4.6L Mustang:** GO to **X37** **All others:** GO to **KF55**
Cooling System	Engine Cooling, Section 303 of the Workshop Manual

Step 3: No DTC(s) Present Symptom Charts

Chart 18

Exhaust System Concerns:

— Smoke

Note: Black smoke indicates a rich fuel mixture, blue smoke indicates burning oil, and white smoke indicates water in the combustion chamber.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Base Engine	Engine System - Section 303 of the Workshop Manual
Black Smoke: Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All Others:** GO to **HC1**
Black Smoke: Ignition System	GO to **JB1**
Blue Smoke: PCV System	REFER to Engine System (Oil Consumption Test), Section 303 of the Workshop Manual

Chart 19

Fuel System Concerns:

— Odor, Engine Compartment

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Natural Gas Applications: Fuel Delivery System	GO to **HB27**
EVAP System	GO to **HX14**
Fuel System	Visual (refer to Fuel Tank and Lines, Section 310 of the Workshop Manual for system description)

Chart 20

Engine Noise (under hood)

Step 3: No DTC(s) Present Symptom Charts

Note: Attempt to identify source of noise. If noise is from source other than those listed below, refer to Symptom Index (for noise such as spark knock) or applicable Workshop Manual section.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Snap noise that may be due to secondary ignition arcing: Secondary Ignition System	**Coil On Plug Ignition Systems:** Check condition of spark plug boots. **All Others:** GO to **JB1**

Chart 21

Climate Control:

— Lack of Cooling (A/C)/ A/C Not Functioning

— A/C Always On

— A/C Compressor Runs Continuously

— A/C Does Not CUT-OFF Under WOT Conditions (Mustang only)

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Mustang only: A/C electrical circuits	**For lack of A/C cooling or A/C not functioning:** GO to **X42** (Mustang) **For A/C always on:** GO to **X69** (Mustang) **For A/C does not CUT-OFF under WOT conditions:** GO to **X67** (Mustang)
A/C System	**If sent here from Workshop Manual with WACF PID indicating a fault (or YES):** GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts and follow direction for KOEO DTC P0645. **All others:** Climate Control System, Section 412 of the Workshop Manual

Chart 22

Exhaust System Concerns

— Odor (Sulfur, Rotten Egg Smell)

Step 3: No DTC(s) Present Symptom Charts

Note: A slight sulfur smell may be normal. Catalysts with less than 8,000-16,000 kilometers (5,000-10,000 miles)(new vehicle or replaced catalyst) are likely to have a sulfur smell due to the highly active state of new catalysts. Replacing the catalyst can actually make the symptom worse.

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Check for any driveability or exhaust smoke symptoms	Refer to STEP 2: NO DTC(s) PRESENT SYMPTOM Chart INDEX for direction to repair other symptoms.
Fuel Delivery System	**Natural Gas Applications:** GO to **HB1** **All others:** GO to **HC1**
EVAP System	GO to **HX14**
Fuel Source	Talk with customer. Since sulfur content can vary in different fuels, suggest trying a different fuel source.

Chart 23

Starting Concerns:

— No Crank

SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Add-on Anti-Theft Devices	Visual, check with customer.
Anti-Theft	Anti-Theft - Section 419 of the Workshop Manual
Base Engine (Starting System)	Engine System - Section 303 of the Workshop Manual

SECTION 4

Powertrain DTC Charts and Descriptions

Contents

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Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
Bxxxx	All	See Note 1	See Note 1	See Note 1
C172X	All	See Note 2	See Note 2	See Note 2
C197X	All	See Note 3	See Note 3	See Note 3
C198X	All	See Note 4	See Note 4	See Note 4
Cxxxx	All	See Note 5	See Note 5	See Note 5
P0010	All	GO to **HK1**	GO to **HK1**	GO to **HK1**
P0011	All	—	GO to **HK11**	GO to **HK11**
P0012	All	—	GO to **HK11**	GO to **HK11**
P0013	All	GO to **HK1**	GO to **HK1**	GO to **HK1**
P0020	All	GO to **HK2**	GO to **HK2**	GO to **HK2**
P0021	All	—	GO to **HK11**	GO to **HK11**
P0022	All	—	GO to **HK11**	GO to **HK11**
P0040	Dedicated NGV All Others	GO to **HA52** —	GO to **HA52** GO to **H64**	GO to **HA52** —
P0041	Dedicated NGV All Others	GO to **HA52** —	GO to **HA52** GO to **H64**	GO to **HA52** —
P0053	All	GO to **H12**	GO to **H12**	GO to **H12**
P0054	All	GO to **H12**	GO to **H12**	GO to **H12**
P0055	All	GO to **H12**	GO to **H12**	GO to **H12**
P0059	All	GO to **H12**	GO to **H12**	GO to **H12**
P0060	All	GO to **H12**	GO to **H12**	GO to **H12**
P0061	All	GO to **H12**	GO to **H12**	GO to **H12**
P0068	Vehicles with ETC All Others:	— —	GO to **DV15** GO to **DH16**	GO to **DV15** GO to **DH16**
P0102	All	GO to **DC4**	GO to **DC4**	GO to **DC4**
P0103	All	GO to **DC19**	GO to **DC19**	GO to **DC19**
P0104	All	—	GO to **DC4**	GO to **DC1**
P0106	Vehicles with ESM (EGR System Module) Vehicles with MAP or TMAP sensor Vehicles with Barometric Pressure (BARO) Sensor	GO to **DM15** GO to **DM22** GO to **DQ1**	GO to **DM15** GO to **DM22** GO to **DQ1**	GO to **DM15** GO to **DM22** GO to **DQ1**
P0107	Vehicles with ESM (EGR System Module) Vehicles with MAP or TMAP sensor Vehicles with Barometric Pressure (BARO) Sensor	GO to **DM2** GO to **DM17** GO to **DQ1**	GO to **DM2** GO to **DM17** GO to **DQ1**	GO to **DM14** GO to **DM21** GO to **DQ1**
P0108	Vehicles with ESM (EGR System Module)	GO to **DM2**	GO to **DM2**	GO to **DM14**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
	Vehicles with MAP or TMAP sensor	GO to **DM17**	GO to **DM17**	GO to **DM21**
	Vehicles with Barometric Pressure (BARO) Sensor	GO to **DQ1**	GO to **DQ1**	GO to **DQ1**
P0109	Vehicles with ESM (EGR System Module)	GO to **DM14**	—	—
	Vehicles with MAP or TMAP sensor	GO to **DM21**	—	—
	Vehicles with Barometric Pressure (BARO) Sensor	GO to **DQ1**	—	—
P0112	All	GO to **DA5**	GO to **DA5**	GO to **DA7**
P0113	All	GO to **DA1**	GO to **DA1**	GO to **DA7**
P0114	All	GO to **DA7**	GO to **DA7**	GO to **DA7**
P0116	Vehicles with CHT sensor only	—	—	GO to **DL24**
	Vehicles with ECT sensor only	—	—	GO to **DX13**
	Vehicles with both CHT and ECT sensor	—	—	GO to **DX13**
P0117	Vehicles with CHT sensor only	GO to **DL7**	GO to **DL7**	GO to **DL15**
	Vehicles with ECT sensor only	GO to **DX11**	GO to **DX11**	GO to **DX15**
	Vehicles with both CHT and ECT sensor	GO to **DX11**	GO to **DX11**	GO to **DX15**
P0118	Vehicles with CHT sensor only	GO to **DL7**	GO to **DL7**	GO to **DL15**
	Vehicles with ECT sensor only	GO to **DX7**	GO to **DX7**	GO to **DX15**
	Vehicles with both CHT and ECT sensor	GO to **DX7**	GO to **DX7**	GO to **DX15**
P0119	Vehicles with CHT sensor only	—	—	GO to **DL15**
	Vehicles with ECT sensor only	—	—	GO to **DX15**
	Vehicles with both CHT and ECT sensor	—	—	GO to **DX15**
P0121	Vehicles with ETC	GO to **DV1**	GO to **DV1**	GO to **DV1**
	All Others:	GO to **DH23**	GO to **DH23**	GO to **DH23**
P0122	Vehicles with ETC	GO to **DV2**	GO to **DV2**	GO to **DV2**
	All Others:	GO to **DH11**	GO to **DH11**	GO to **DH11**
P0123	Vehicles with ETC	GO to **DV6**	GO to **DV6**	GO to **DV6**
	All Others:	GO to **DH8**	GO to **DH8**	GO to **DH8**
P0125	Vehicles with CHT sensor only	—	—	GO to **DL22**
	Vehicles with ECT sensor only	—	—	GO to **DX18**
	Vehicles with both CHT and ECT sensor	—	—	GO to **DX18**
P0127	All	GO to **DU7**	GO to **DU7**	GO to **DU7**
P0128	Vehicles with CHT sensor only	—	—	GO to **DL22**
	Vehicles with ECT sensor only	—	—	GO to **DX18**
	Vehicles with both CHT and ECT sensor	—	—	GO to **DX18**
P0131	All	—	GO to **H7**	GO to **H7**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P0132	All	GO to **H55**	GO to **H55**	GO to **H55**
P0133	All	—	—	GO to **H2**
P0135	Gasoline Dedicated NGV	GO to **H10** GO to **HA1**	GO to **H10** GO to **HA1**	GO to **H10** GO to **HA1**
P0138	All	GO to **H55**	GO to **H55**	GO to **H55**
P0141	Dedicated NGV All Others	GO to **HA1** GO to **H10**	GO to **HA1** GO to **H10**	GO to **HA1** GO to **H10**
P0144	All	GO to **H55**	GO to **H55**	GO to **H55**
P0147	All	GO to **H10**	GO to **H10**	GO to **H10**
P0148	All	—	—	GO to **HC1**
P0151	All	—	—	GO to **H7**
P0152	All	—	GO to **H65**	GO to **H65**
P0153	All	—	—	GO to **H2**
P0155	Dedicated NGV All Others	GO to **HA1** GO to **H10**	GO to **HA1** GO to **H10**	GO to **HA1** GO to **H10**
P0158	All	—	GO to **H65**	GO to **H65**
P0161	Dedicated NGV All Others	GO to **HA1** GO to **H10**	GO to **HA1** GO to **H10**	GO to **HA1** GO to **H10**
P0167	All	GO to **H10**	GO to **H10**	GO to **H10**
P0171	Dedicated NGV All Others	GO to **HA10** —	GO to **HA10** —	GO to **HA10** GO to **H17**
P0172	Dedicated NGV All Others	GO to **HA10** —	GO to **HA10** —	GO to **HA10** GO to **H17**
P0174	Dedicated NGV All Others	GO to **HA10** —	GO to **HA10** —	GO to **HA10** GO to **H17**
P0175	Dedicated NGV All Others	GO to **HA10** —	GO to **HA10** —	GO to **HA10** GO to **H17**
P0180	Fuel Rail Pressure Temperature (FRPT) Sensor Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD68** GO to **DD43**	GO to **DD68** GO to **DD43**	GO to **DD68** GO to **DD43**
P0181	Fuel Rail Pressure Temperature (FRPT) Sensor Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD69** GO to **DD35**	GO to **DD69** GO to **DD35**	— —
P0182	Fuel Rail Pressure Temperature (FRPT) Sensor Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD61** GO to **DD35**	GO to **DD61** GO to **DD35**	GO to **DD61** GO to **DD35**
P0183	Fuel Rail Pressure Temperature (FRPT) Sensor Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD61** GO to **DD35**	GO to **DD61** GO to **DD35**	GO to **DD61** GO to **DD35**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P0190	Fuel Rail Pressure Temperature (FRPT) Sensor	—	—	GO to **DD60**
	Fuel Rail Pressure (FRP) Sensor ONLY	GO to **DD11**	GO to **DD11**	GO to **DD11**
	Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD11**	GO to **DD11**	GO to **DD11**
P0191	Fuel Rail Pressure Temperature (FRPT) Sensor	GO to **DD60**	GO to **DD60**	GO to **DD60**
	Fuel Rail Pressure (FRP) Sensor ONLY	GO to **DD11**	GO to **DD11**	GO to **DD11**
	Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD11**	GO to **DD11**	GO to **DD11**
P0192	Fuel Rail Pressure Temperature (FRPT) Sensor	GO to **DD46**	GO to **DD46**	GO to **DD46**
	Fuel Rail Pressure (FRP) Sensor ONLY	GO to **DD1**	GO to **DD1**	GO to **DD1**
	Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD1**	GO to **DD1**	GO to **DD1**
P0193	Fuel Rail Pressure Temperature (FRPT) Sensor	GO to **DD51**	GO to **DD51**	GO to **DD51**
	Fuel Rail Pressure (FRP) Sensor ONLY	GO to **DD8**	GO to **DD8**	GO to **DD8**
	Fuel Rail Pressure AND Fuel Rail Temperature (FRT) Sensors	GO to **DD8**	GO to **DD8**	GO to **DD8**
P0196	All	GO to **DY1**	GO to **DY1**	GO to **DY1**
P0197	All	GO to **DY2**	GO to **DY2**	GO to **DY2**
P0198	All	GO to **DY2**	GO to **DY2**	GO to **DY2**
P0201	All	GO to **H36**	GO to **H36**	GO to **H36**
P0202	All	GO to **H36**	GO to **H36**	GO to **H36**
P0203	All	GO to **H36**	GO to **H36**	GO to **H36**
P0204	All	GO to **H36**	GO to **H36**	GO to **H36**
P0205	All	GO to **H36**	GO to **H36**	GO to **H36**
P0206	All	GO to **H36**	GO to **H36**	GO to **H36**
P0207	All	GO to **H36**	GO to **H36**	GO to **H36**
P0208	All	GO to **H36**	GO to **H36**	GO to **H36**
P0209	All	GO to **H36**	GO to **H36**	GO to **H36**
P0210	All	GO to **H36**	GO to **H36**	GO to **H36**
P0211	All	GO to **H36**	GO to **H36**	GO to **H36**
P0212	All	GO to **H36**	GO to **H36**	GO to **H36**
P0217	Mustang 4.6L Cobra F-150 Heritage 5.4L SC	GO to **DX20** GO to **DL21**	GO to **DX20** GO to **DL21**	GO to **DX20** GO to **DL21**
P0218	All	See Note 6	See Note 6	See Note 6
P0219	All	—	—	GO to **ND1**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P0221	LS, Thunderbird, F-150, Explorer, Mountaineer	GO to **DV1**	GO to **DV1**	GO to **DV1**
P0222	LS, Thunderbird, F-150, Explorer, Mountaineer	GO to **DV6**	GO to **DV6**	GO to **DV6**
P0223	LS, Thunderbird, F-150, Explorer, Mountaineer	GO to **DV6**	GO to **DV6**	GO to **DV6**
P0230	Dedicated NGV	GO to **KC1**	GO to **KC1**	GO to **KC26**
	F-Series Super Duty, Excursion, Expedition, Navigator	GO to **KA55**	GO to **KA55**	GO to **KA84**
	All Others	GO to **KA1**	GO to **KA1**	GO to **KA40**
P0231	Dedicated NGV	GO to **KC18**	GO to **KC18**	GO to **KC24**
	F-Series Super Duty, Excursion, Expedition, Navigator	GO to **KA80**	GO to **KA80**	GO to **KA85**
	All Others	GO to **KA23**	GO to **KA23**	GO to **KA39**
P0232	Dedicated NGV	GO to **KC10**	GO to **KC10**	GO to **KC22**
	F-Series Super Duty, Excursion, Expedition, Navigator	GO to **KA64**	GO to **KA64**	GO to **KA86**
	All Others	GO to **KA10**	GO to **KA10**	GO to **KA37**
P0234	All	GO to **KJ1**	GO to **KJ1**	GO to **KJ1**
P0243	All	GO to **KJ5**	GO to **KJ5**	GO to **KJ5**
P0297	All	—	—	GO to **ND1**
P0298	All	—	—	GO to **DY13**
P0300	All	—	—	GO to **HD1**
P030X	All	—	—	GO to **HD1**
P0310	All	—	—	GO to **HD1**
P0315	All	—	—	GO to **HD1**
P0316	All	—	—	GO to **HD1**
P0320	All	—	—	GO to **NC1**
P0325	All	GO to **DG1**	GO to **DG1**	GO to **DG1**
P0326	All	GO to **DG1**	GO to **DG1**	GO to **DG1**
P0330	All	GO to **DG1**	GO to **DG1**	GO to **DG1**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P0331	All	GO to **DG1**	GO to **DG1**	GO to **DG1**
P0340	All	GO to **DR1**	GO to **DR1**	GO to **DR1**
P0345	All	GO to **DR1**	GO to **DR1**	GO to **DR1**
P0350	All	—	GO to **JB1**	GO to **JB1**
P0351	Coil On Plug ignition testing: Coil Pack ignition testing:	— —	GO to **JF1** GO to **JE1**	GO to **JF1** GO to **JE1**
P0352	Coil On Plug ignition testing: Coil Pack ignition testing:	— —	GO to **JF1** GO to **JE1**	GO to **JF1** GO to **JE1**
P0353	Coil On Plug ignition testing: Coil Pack ignition testing:	— —	GO to **JF1** GO to **JE1**	GO to **JF1** GO to **JE1**
P0354	Coil On Plug ignition testing: Coil Pack ignition testing:	— —	GO to **JF1** GO to **JE1**	GO to **JF1** GO to **JE1**
P0355	All	—	GO to **JF1**	GO to **JF1**
P0356	All	—	GO to **JF1**	GO to **JF1**
P0357	All	—	GO to **JF1**	GO to **JF1**
P0358	All	—	GO to **JF1**	GO to **JF1**
P0359	All	—	GO to **JF1**	GO to **JF1**
P0360	All	—	GO to **JF1**	GO to **JF1**
P0400	All	GO to **KD9**	GO to **KD9**	GO to **KD9**
P0401	Vehicles with ESM (EGR System Module) All Others	— —	— —	GO to **HH25** GO to **HE36**
P0402	Vehicles with ESM (EGR System Module) All Others	— —	GO to **HH13** GO to **HE12**	GO to **HH13** GO to **HE12**
P0403	Vehicles with EEGR (Electric EGR) Vehicles with ESM (EGR System Module) All Others	GO to **KD1** GO to **HH29** GO to **HE59**	GO to **KD1** GO to **HH29** GO to **HE59**	GO to **KD1** GO to **HH38** GO to **HE59**
P0405	Vehicles with ESM (EGR System Module) All Others	GO to **HH1** GO to **HE1**	GO to **HH1** GO to **HE1**	GO to **HH1** GO to **HE1**
P0406	Vehicles with ESM (EGR System Module) All Others	GO to **HH5** GO to **HE5**	GO to **HH5** GO to **HE5**	GO to **HH5** GO to **HE5**
P0411	All	—	GO to **HM17**	GO to **HM17**
P0412	All	GO to **HM1**	GO to **HM1**	GO to **HM9**
P0420	All	—	—	GO to **HF1**
P0430	All	—	—	GO to **HF1**
P0442	All	—	—	GO to **HX55**
P0443	All	GO to **HX1**	GO to **HX1**	GO to **HX1**
P0446	All	GO to **HX34**	GO to **HX34**	GO to **HX34**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P0451	All	GO to **HX49**	GO to **HX49**	GO to **HX49**
P0452	All	GO to **HX19**	GO to **HX19**	GO to **HX19**
P0453	All	GO to **HX24**	GO to **HX24**	GO to **HX24**
P0454	All	—	—	GO to **Z1**
P0455	All	—	—	GO to **HX50**
P0456	All	—	—	GO to **HX55**
P0457	All	—	—	GO to **HX50**
P0460	E-Series, Explorer SportTrac, Ranger, Crown Victoria, Grand Marquis, Marauder	GO to **HX40**	GO to **HX40**	GO to **HX40**
	All Others	See Note 7	See Note 7	See Note 7
P0461	All	GO to **HX40**	GO to **HX40**	GO to **HX40**
P0462	E-Series, Explorer SportTrac, Ranger, Crown Victoria, Grand Marquis, Marauder	GO to **HX40**	GO to **HX40**	GO to **HX40**
	All Others	See Note 7	See Note 7	See Note 7
P0463	E-Series, Explorer SportTrac, Ranger, Crown Victoria, Grand Marquis, Marauder	GO to **HX40**	GO to **HX40**	GO to **HX40**
	All Others	See Note 7	See Note 7	See Note 7
P0480	Crown Victoria, Grand Marquis, Town Car	GO to **KN1**	GO to **KN1**	GO to **KN7**
	LS, Thunderbird	GO to **KN12**	GO to **KN12**	GO to **KN19**
	Mustang	GO to **X11**	GO to **X11**	GO to **X17**
	Freestar / Monterey	GO to **KF16**	GO to **KF16**	GO to **KF49**
	All Others	GO to **KF1**	GO to **KF1**	GO to **KF43**
P0481	Taurus, Sable, Focus 2.0L, Escape 3.0L	GO to **KF34**	GO to **KF34**	GO to **KF53**
	Mustang	GO to **X4**	GO to **X4**	GO to **X19**
	All Others	GO to **KF11**	GO to **KF11**	GO to **KF45**
P0482	Freestar / Monterey	GO to **KF25**	GO to **KF25**	GO to **KF51**
	All Others	GO to **KF6**	GO to **KF6**	GO to **KF47**
P0500	Escape Manual	GO to **DP1**	GO to **DP1**	GO to **DP1**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
	Excursion, F-Series Super Duty	GO to **DF1**	GO to **DF1**	GO to **DF1**
	LS, Thunderbird, Freestar / Monterey, Town Car	See Note 8	See Note 8	See Note 8
	F-150 U/8500 4x4 MSOF, F-150 Heritage U/8500 4x4 MSOF	GO to **DP9**	GO to **DP9**	GO to **DP9**
	All Others	See Note 6	See Note 6	See Note 6
P0501	LS, Freestar / Monterey, Town Car, Thunderbird	See Note 8	See Note 8	See Note 8
	Excursion, F-Series Super Duty	GO to **DF1**	GO to **DF1**	GO to **DF1**
	Escape Manual	GO to **DP1**	GO to **DP1**	GO to **DP1**
	F-150 U/8500 4x4 MSOF, F-150 Heritage U/8500 4x4 MSOF	GO to **DP9**	GO to **DP9**	GO to **DP9**
	All Others	See Note 6	See Note 6	See Note 6
P0503	Excursion, F-Series Super Duty	—	—	GO to **DF1**
	Escape Manual	GO to **DP6**	GO to **DP6**	GO to **DP6**
	F-150 U/8500 4x4 MSOF, F-150 Heritage U/8500 4x4 MSOF	GO to **DP9**	GO to **DP9**	GO to **DP9**
	All Others	See Note 6	See Note 6	See Note 6
P0505	All	GO to **KE2**	GO to **KE2**	GO to **KE2**
P0506	All	GO to **KE2**	GO to **KE2**	GO to **KE2**
P0507	All	GO to **KE13**	GO to **KE13**	GO to **KE13**
P0511	All	GO to **KE2**	GO to **KE2**	GO to **KE2**
P0532	All	GO to **DS1**	GO to **DS1**	GO to **DS1**
P0533	All	GO to **DS8**	GO to **DS8**	GO to **DS8**
P0534	All	—	—	GO to **X57**
P0537	All	GO to **DJ5**	GO to **DJ5**	GO to **DJ8**
P0538	All	GO to **DJ1**	GO to **DJ1**	GO to **DJ8**
P0552	All	GO to **DT2**	GO to **DT2**	GO to **DT7**
P0553	All	GO to **DT2**	GO to **DT2**	GO to **DT7**
P0579	All	See Note 9	See Note 9	See Note 9
P0581	All	See Note 9	See Note 9	See Note 9
P0602	All	See Note 10	See Note 10	See Note 10
P0603	All	GO to **QB1**	—	—
P0605	All	See Note 11	See Note 11	See Note 11
P0606	Vehicles with ETC	See Note 12	See Note 12	See Note 12
	All Others:	See Note 11	See Note 11	See Note 11
P0620	All	GO to **HY1**	GO to **HY1**	GO to **HY1**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P0622	All	GO to **HY1**	GO to **HY1**	GO to **HY1**
P0645	Mustang All Others	GO to **X49** GO to **KM1**	GO to **X49** GO to **KM1**	GO to **X59** GO to **KM14**
P0660	All	GO to **HU42**	GO to **HU42**	GO to **HU42**
P0663	All	GO to **HU58**	GO to **HU58**	GO to **HU58**
P0703	Town Car Freestar / Monterey Expedition, Navigator All Others	See Note 13 See Note 14 See Note 15 GO to **FD2**	See Note 13 See Note 14 See Note 15 GO to **FD1**	See Note 13 See Note 14 See Note 15 GO to **FD3**
P0704	All	GO to **TA1**	—	GO to **TA1**
P0705	All	See Note 6	See Note 6	See Note 6
P0707	All	See Note 6	See Note 6	See Note 6
P0708	All	See Note 6	See Note 6	See Note 6
P071x	All	See Note 6	See Note 6	See Note 6
P0720	Manual All Others	— —	— —	GO to **TJ1** See Note 16
P0721	Manual All Others	— —	— —	GO to **TJ1** See Note 6
P0722	All	—	—	GO to **TJ1**
P0723	Manual All Others	— —	— —	GO to **TJ1** See Note 6
P072x	All	See Note 6	See Note 6	See Note 6
P073x	All	See Note 6	See Note 6	See Note 6
P074x	All	See Note 6	See Note 6	See Note 6
P075x	All	See Note 6	See Note 6	See Note 6
P076x	All	See Note 6	See Note 6	See Note 6
P077x	All	See Note 6	See Note 6	See Note 6
P078x	All	See Note 6	See Note 6	See Note 6
P079x	All	See Note 6	See Note 6	See Note 6
P0815	All	See Note 6	See Note 6	See Note 6
P0840	All	See Note 6	See Note 6	See Note 6
P09XX	All	See Note 6	See Note 6	See Note 6
P1000	All	See Note 17	See Note 17	GO to **QC1**
P1001	All	—	GO to **QA12**	—
P1100	All	GO to **DC17**	GO to **DC17**	GO to **DC17**
P1101	All	GO to **DC6**	GO to **DC1**	—
P1112	All	—	—	GO to **DA7**
P1114	All	GO to **DU5**	GO to **DU5**	GO to **DU5**
P1115	All	GO to **DU1**	GO to **DU1**	GO to **DU1**
P1116	Vehicles with CHT sensor only	GO to **DL1**	GO to **DL1**	—

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
	Vehicles with ECT sensor only Vehicles with both CHT and ECT sensor	GO to **DX1** GO to **DX1**	GO to **DX1** GO to **DX1**	— —
P1117	Vehicles with CHT sensor only Vehicles with ECT sensor only Vehicles with both CHT and ECT sensor	— — —	— — —	GO to **DL15** GO to **DX15** GO to **DX15**
P1120	All	GO to **DH3**	GO to **DH3**	GO to **DH3**
P1121	All	—	GO to **DH16**	GO to **DH16**
P1124	All	GO to **DH1**	GO to **DH1**	—
P1125	All	—	—	GO to **DH21**
P1127	Dedicated NGV All Others	— —	GO to **HA49** GO to **H63**	— —
P1128	Dedicated NGV All Others	— —	GO to **HA50** GO to **H64**	— —
P1129	Gasoline Dedicated NGV	— GO to **HA52**	GO to **H64** GO to **HA52**	— GO to **HA52**
P1130	Dedicated NGV All Others	— —	— —	GO to **HA9** GO to **H17**
P1131	Dedicated NGV All Others	GO to **HA9** —	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**
P1132	Dedicated NGV All Others	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**
P1137	All	—	GO to **H53**	—
P1138	All	—	GO to **H53**	—
P1150	Dedicated NGV All Others	GO to **HA9** —	GO to **HA9** —	GO to **HA9** GO to **H17**
P1151	Gasoline Dedicated NGV	— —	GO to **H17** GO to **HA9**	GO to **H17** GO to **HA9**
P1152	Dedicated NGV All Others	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**
P1157	All	—	GO to **H53**	—
P1158	All	—	GO to **H53**	—
P1168	Dedicated NGV	—	—	GO to **HB12**
P1169	Dedicated NGV	—	—	GO to **HB12**
P1180	Crown Victoria Dedicated NGV, F-150 Heritage Dedicated NGV, E-Series Dedicated NGV	—	—	GO to **HB28**
P1181	Crown Victoria Dedicated NGV, F-150 Heritage Dedicated NGV, E-Series Dedicated NGV	—	—	GO to **HB28**
P1184	All	GO to **DY1**	GO to **DY1**	GO to **DY1**
P1229	All	GO to **KP1**	GO to **KP1**	GO to **KP1**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P1232	All	GO to **KA41**	GO to **KA41**	GO to **KA47**
P1233	LS, Thunderbird All Others	See Note 18 GO to **KB1**	See Note 18 GO to **KB1**	See Note 18 GO to **KB1**
P1235	All	GO to **KB23**	GO to **KB23**	GO to **KB23**
P1237	All	GO to **KB34**	GO to **KB34**	GO to **KB34**
P1244	All	GO to **HY1**	GO to **HY1**	GO to **HY1**
P1245	All	GO to **HY1**	GO to **HY1**	GO to **HY1**
P1246	All	GO to **HY1**	GO to **HY1**	GO to **HY1**
P1260	All	—	—	GO to **QD1**
P1270	All	—	—	GO to **ND1**
P1285	All	GO to **DL18**	GO to **DL18**	GO to **DL18**
P1288	All	GO to **DL1**	GO to **DL1**	GO to **DL1**
P1289	All	GO to **DL7**	GO to **DL7**	GO to **DL15**
P1290	All	GO to **DL7**	GO to **DL7**	GO to **DL15**
P1299	All	GO to **DL21**	GO to **DL21**	GO to **DL21**
P1309	All	—	—	GO to **HD23**
P1336	Hall Effect VRS	— —	— —	GO to **HD23** GO to **DR4**
P1380	All	GO to **HK1**	GO to **HK1**	GO to **HK1**
P1381	All	—	GO to **HK11**	GO to **HK11**
P1383	All	—	GO to **HK11**	GO to **HK11**
P1385	All	GO to **HK2**	GO to **HK2**	GO to **HK2**
P1386	All	—	GO to **HK11**	GO to **HK11**
P1388	All	—	GO to **HK11**	GO to **HK11**
P1400	Vehicles with ESM (EGR System Module) All Others	GO to **HH1** GO to **HE1**	GO to **HH1** GO to **HE1**	GO to **HH1** GO to **HE1**
P1401	Vehicles with ESM (EGR System Module) All Others	GO to **HH5** GO to **HE5**	GO to **HH5** GO to **HE5**	GO to **HH5** GO to **HE5**
P1405	Vehicles with ESM (EGR System Module) All Others	— —	GO to **HH13** GO to **HE27**	GO to **HH40** GO to **HE27**
P1406	Vehicles with ESM (EGR System Module) All Others	GO to **HH42** GO to **HE31**	GO to **HH42** GO to **HE31**	GO to **HH42** GO to **HE31**
P1408	Vehicles with EEGR (Electric EGR) Vehicles with ESM (EGR System Module) All Others	— — —	GO to **KD9** GO to **HH26** GO to **HE36**	— — —
P1409	Vehicles with ESM (EGR System Module)	GO to **HH29**	GO to **HH29**	GO to **HH39**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
	All Others	GO to **HE59**	GO to **HE59**	GO to **HE59**
P1436	All	GO to **DJ5**	GO to **DJ5**	GO to **DJ8**
P1437	All	GO to **DJ1**	GO to **DJ1**	GO to **DJ8**
P1443	All	—	—	GO to **HX52**
P1450	All	—	—	GO to **HX9**
P1451	All	GO to **HX34**	GO to **HX34**	GO to **HX34**
P1460	Mustang All Others	GO to **X49** GO to **KM1**	GO to **X49** GO to **KM1**	GO to **X59** GO to **KM14**
P1461	All	GO to **DS1**	GO to **DS1**	GO to **DS1**
P1462	All	GO to **DS8**	GO to **DS8**	GO to **DS8**
P1463	All	—	—	GO to **DS17**
P1464	Mustang All Others	GO to **X60** GO to **KM9**	GO to **X60** GO to **KM9**	— —
P1469	All	—	—	GO to **X57**
P1474	Mustang Freestar / Monterey All Others	GO to **X11** GO to **KF16** GO to **KF1**	GO to **X11** GO to **KF16** GO to **KF1**	GO to **X17** GO to **KF49** GO to **KF43**
P1477	Freestar / Monterey All Others	GO to **KF25** GO to **KF6**	GO to **KF25** GO to **KF6**	GO to **KF51** GO to **KF47**
P1479	Mustang Taurus, Sable, Focus 2.0L, Escape 3.0L All Others	GO to **X4** GO to **KF34** GO to **KF11**	GO to **X4** GO to **KF34** GO to **KF11**	GO to **X19** GO to **KF53** GO to **KF45**
P1489	All	GO to **HG8**	GO to **HG8**	GO to **HG8**
P1500	Escape All Others	GO to **DP6** See Note 6	GO to **DP6** See Note 6	GO to **DP6** See Note 6
P1501	Escape Excursion, F-Series Super Duty All Others	GO to **DP5** GO to **DF1** See Note 6	GO to **DP5** GO to **DF1** See Note 6	GO to **DP5** GO to **DF1** See Note 6
P1502	F-150 U/8500 4x4 MSOF, F-150 Heritage U/8500 4x4 MSOF F-Series Super Duty, Excursion Escape Manual Town Car, Freestar / Monterey, LS, Thunderbird All Others	GO to **DP9** GO to **DF1** GO to **DP1** See Note 8 See Note 16	GO to **DP9** GO to **DF1** GO to **DP1** See Note 8 See Note 16	GO to **DP9** GO to **DF1** GO to **DP1** See Note 8 See Note 16
P1504	All	GO to **KE2**	GO to **KE2**	GO to **KE2**
P1506	All	GO to **KE2**	GO to **KE2**	GO to **KE2**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P1507	All	GO to **KE2**	GO to **KE2**	GO to **KE2**
P1512	All	—	—	GO to **HU15**
P1513	All	—	—	GO to **HU15**
P1516	All	GO to **HU15**	—	GO to **HU15**
P1517	All	GO to **HU15**	—	GO to **HU15**
P1518	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P1519	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P1520	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P1537	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P1538	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P1549	All	GO to **HU42**	—	GO to **HU42**
P1550	All	GO to **DT2**	GO to **DT1**	—
P1565	All	See Note 9	See Note 9	See Note 9
P1566	All	See Note 9	See Note 9	See Note 9
P1567	All	See Note 9	See Note 9	See Note 9
P1568	All	See Note 9	See Note 9	See Note 9
P1572	All	—	—	GO to **FD3**
P1582	All	See Note 19	See Note 19	See Note 19
P1633	All	GO to **QB1**	GO to **QB1**	GO to **QB1**
P1635	All	—	—	See Note 19
P1636	All	See Note 20	See Note 20	See Note 20
P1639	All	See Note 10	See Note 10	See Note 10
P1640	All	—	—	See Note 21
P1641	LS, Thunderbird	GO to **KB23**	GO to **KB23**	GO to **KB23**
	Dedicated NGV	GO to **KC1**	GO to **KC1**	GO to **KC26**
	F-Series Super Duty, Excursion, Expedition, Navigator	GO to **KA55**	GO to **KA55**	GO to **KA84**
	All Others	GO to **KA1**	GO to **KA1**	GO to **KA40**
P1650	All	GO to **FF2**	GO to **FF1**	—
P1651	All	—	—	GO to **FF6**
P1703	Town Car	See Note 13	See Note 13	See Note 13
	Freestar / Monterey	See Note 14	See Note 14	See Note 14
	Expedition, Navigator	See Note 15	See Note 15	See Note 15
	All Others	GO to **FD2**	GO to **FD1**	GO to **FD3**
P1705	All	See Note 6	See Note 6	See Note 6
P1709	All	See Note 6	See Note 6	—

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P1729	F-150 Heritage 4.2L, F-150 Heritage 4.6L, F-150 Heritage 5.4L F-150	— —	— —	GO to **TG1** See Note 22
P1780	All	GO to **TB1**	GO to **TB1**	GO to **TB1**
P1781	Aviator, Expedition, Navigator, F-Series Super Duty, Excursion All Others	See Note 22 GO to **TG1**	— —	— —
P17XX	All	See Note 6	See Note 6	See Note 6
P18XX	All	See Note 22	See Note 22	See Note 22
P1900	Manual All Others	GO to **TJ1** See Note 6	GO to **TJ1** See Note 6	GO to **TJ1** See Note 6
P1901	All	See Note 6	See Note 6	See Note 6
P2004	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P2005	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P2006	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P2007	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P2008	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P2014	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P2019	All	GO to **HU15**	GO to **HU15**	GO to **HU15**
P2065	All	See Note 7	See Note 7	See Note 7
P2066	All	See Note 7	See Note 7	See Note 7
P2067	All	See Note 7	See Note 7	See Note 7
P2068	All	See Note 7	See Note 7	See Note 7
P2070	All	—	GO to **HU42**	GO to **HU42**
P2071	All	—	GO to **HU42**	GO to **HU42**
P2072	All	—	—	See Note 23
P2100	All	GO to **DV18**	GO to **DV18**	GO to **DV18**
P2101	All	GO to **DV24**	GO to **DV24**	GO to **DV24**
P2104	All	GO to **DV1**	GO to **DV1**	GO to **DV1**
P2105	All	GO to **DV1**	GO to **DV1**	GO to **DV1**
P2106	All	GO to **DV1**	GO to **DV1**	GO to **DV1**
P2107	All	GO to **DV18**	GO to **DV18**	GO to **DV18**
P2110	All	GO to **DV19**	GO to **DV19**	GO to **DV19**
P2111	All	GO to **DV1**	GO to **DV1**	GO to **DV1**
P2112	All	GO to **DV1**	GO to **DV1**	GO to **DV1**
P2121	All	GO to **DK7**	GO to **DK7**	GO to **DK7**
P2122	All	GO to **DK7**	GO to **DK7**	GO to **DK7**
P2123	All	GO to **DK7**	GO to **DK7**	GO to **DK7**

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
P2126	All	GO to **DK7**	GO to **DK7**	GO to **DK7**
P2127	All	GO to **DK7**	GO to **DK7**	GO to **DK7**
P2128	All	GO to **DK7**	GO to **DK7**	GO to **DK7**
P2131	All	GO to **DK1**	GO to **DK1**	GO to **DK1**
P2132	All	GO to **DK1**	GO to **DK1**	GO to **DK1**
P2133	All	GO to **DK1**	GO to **DK1**	GO to **DK1**
P2135	All	GO to **DV6**	GO to **DV6**	GO to **DV6**
P2195	Gasoline Dedicated NGV	— —	GO to **H17** GO to **HA9**	GO to **H17** GO to **HA9**
P2196	Dedicated NGV All Others	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**
P2197	Dedicated NGV All Others	GO to **HA9** —	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**
P2198	Dedicated NGV All Others	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**	GO to **HA9** GO to **H17**
P2257	All	GO to **HM37**	GO to **HM37**	GO to **HM37**
P2258	All	GO to **HM49**	GO to **HM49**	GO to **HM49**
P2270	All	—	GO to **H53**	GO to **H53**
P2271	All	—	GO to **H53**	GO to **H53**
P2272	All	—	GO to **H53**	GO to **H53**
P2273	All	—	GO to **H53**	GO to **H53**
P2274	All	—	GO to **H53**	GO to **H53**
P2275	All	—	GO to **H53**	GO to **H53**
P2278	Dedicated NGV All Others	GO to **HA52** —	GO to **HA52** GO to **H64**	GO to **HA52** —
Pxxxx	All	See Note 24	See Note 24	See Note 24
U0300	All	See Note 25	See Note 25	See Note 25
U1021	All	See Note 26	See Note 26	See Note 26
U1039	All	See Note 27	See Note 27	See Note 27
U1051	All	See Note 28	See Note 28	See Note 28
U1131	All	See Note 29	See Note 29	See Note 29
U1147	All	See Note 30	See Note 30	See Note 30

(Continued)

Diagnostic Trouble Code (DTC) Charts

Diagnostic Trouble Code	Application	Key On Engine Off	Key On Engine Running	Continuous Memory
U1262	All	See Note 31	See Note 31	See Note 31
U1451	All	See Note 30	See Note 30	See Note 30
Uxxxx	All	See Note 32	See Note 32	See Note 32

Note: "x" = any number 0 thru 9

Note 1: Go to the applicable Section of the Workshop Manual to diagnose the Body DTC.

Note 2: Go to the Wheel Drive Systems, Section 308 of the Workshop Manual for transfer case transition shift concerns to 4x2H, 4x4H and 4x4L (C1728, C1729).

Note 3: Go to the Wheel Drive Systems, Section 308 of the Workshop Manual for 4x4L system circuits such as the 4x4 Low Mode Switch circuit (C1970, C1971) and the Integrated Wheel End Solenoid circuit (C1979).

Note 4: Go to the Wheel Drive Systems, Section 308 of the Workshop Manual for 4x4L system circuit such as the Integrated Wheel End Solenoid circuit (C1980).

Note 5: Go to the applicable Section of the Workshop Manual to diagnose the chassis DTC.

Note 6: Go to the Workshop Manual Powertrain Group, Transmission Section 307.

Note 7: REFER to Section 413, fuel level indicator or Rear Electronic Module diagnosis in the Workshop Manual.

Note 8: Vehicle speed information is provided by the anti-lock brake system. Go to Workshop Manual Section 206, Anti-Lock Control to perform complete diagnosis.

Note 9: Go to the Vehicle Speed Control Section 310 of the Workshop Manual.

Note 10: The Vehicle ID (VID) Block must reprogrammed. For instructions refer to Flash VID Block Procedure.

Note 11: Be sure to check for aftermarket performance products before replacing PCM. If replacement is necessary refer to Section 2.

Note 12: DTC is an indication of a failure mode in the Electronic Throttle Control System, that includes the APPS, ETB, and PCM. It is accompanied by other DTCS which provide repair direction. Proceed to Section 4 to repair those DTCS, and the P0606 will not be reset.

Note 13: REFER to Exterior Lighting, Section 417 in the Workshop Manual for further diagnosis of the lighting control module LCM system. Make sure break pedal was applied and released for KOER self teat and break pedal was applied for KOEO self test.

Note 14: REFER to Exterior Lighting, Section 417 in the Workshop manual for further diagnosis of the Smart Junction Box (SJB). Make sure break pedal was applied and released for KOER self teat and break pedal was applied for KOEO self test.

Note 15: REFER to Anti-Lock Brake System ABS, Section 206 in the Workshop Manual for further diagnosis of cause of incorrect brake pedal status from ABS to PCM. Make sure break pedal was applied and

Diagnostic Trouble Code (DTC) Charts

released for KOER self teat and break pedal was applied for KOEO self test.

Note 16: All Automatic Transmissions go to Transmission Section 307 of the Workshop Manual.

Note 17: DTC P1000 is ignored in KOEO AND KOER Self-Test. Disregard DTC P1000 and continue as directed.

Note 18: Go to Section 418 of the Workshop Manual for REM (Rear Electronics Module) self-test diagnostics.

Note 19: See DTC description and causes.

Note 20: DTC P1636 indicates the PCM has lost communication with the Inductive Signature Chip. Replace PCM.

Note 21: See BI-Fuel PCED Manual for instructions on how to retrieve DTCs from secondary module. See P1640 Diagnostic Trouble Code (DTC) Descriptions for additional information.

Note 22: Go to the Wheel Drive Systems, Section 308 of the Workshop Manual.

Note 23: See Diagnostic Aids for DTC P2072.

Note 24: For P DTCs not listed in this chart, refer to the customer's symptom to determine the applicable Workshop Manual section for diagnosis.

Note 25: Go to the Module Reprogramming feature on your scan tool and reprogram the PCM to the latest level.

Note 26: Go to Workshop Manual Section 412 Climate Control

Note 27: Go to Workshop Manual Section 206 Anti-Lock Control

Note 28: Go to Workshop Manual Section 417 Exterior Lighting

Note 29: Go to Workshop Manual Section 413 Instrument Cluster

Note 30: Go to Workshop Manual Section 419, Electrical Anti-theft.

Note 31: Go to Workshop Manual Section 418, Module Communications Network

Note 32: U DTC(s) received during Self-test from another module other than the PCM. GO to PC/ED Section 3, QT1 PCM Quick Test.

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0010 - Intake Camshaft Position Actuator Circuit Open/ (Bank 1)	The comprehensive component monitor(CCM) monitors the VCT circuit to the PCM for high and low voltage. If during testing voltage was to fall below a calibrated limit a calibrated amount of time the test will fail.	• Open or short VCT circuit • Open VPWR circuit • Damaged PCM • Open or short VCT solenoid valve	DTC P1380 is a VCT circuit check. Testing should include wires, solenoid coil and PCM.
P0011 - Intake Camshaft Position Timing - Over-Advanced (Bank 1)	The comprehensive component monitor (CCM) monitors the VCT position for an over-advanced camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.	• Cam timing improperly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)	DTC P1383 is a check of the VCT unit. Testing should not include electrical checks. Engine will idle rough, hard starting and may stall. Diagnostics and repair for the VCT unit are located in the Workshop Manual.
P0012 - Variable Cam Timing Over-retarded (Bank 1)	The comprehensive component monitor (CCM) monitors the VCT position for over-retarded camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an retarded position.	• Cam timing improperly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)	DTC P1383 is a check of the VCT unit. Testing should not include electrical checks. Engine will idle rough, hard starting and may stall. Diagnostics and repair for the VCT unit are located in the Workshop Manual.
P0013 - Exhaust Camshaft Position Actuator Circuit / Open (Bank 1)	The comprehensive component monitor(CCM) monitors the VCT circuit to the PCM for high and low voltage. If during testing voltage was to fall below a calibrated limit a calibrated amount of time the test will fail.	• Open or short VCT circuit • Open VPWR circuit • Damaged PCM • Open or short VCT solenoid valve	DTC P1380 is a VCT circuit check. Testing should include wires, solenoid coil and PCM.
P0020 - Intake Camshaft Position Actuator Circuit Open/ (Bank 2)	Camshaft Position Actuator Circuit/Open (Bank 2)	solenoid open circuit Open in wiring from the circuit driver to solenoid. Defective circuit driver No VPWR at the solenoid.	
P0021 - Intake Camshaft Position Timing - Over-Advanced (Bank 2)	The comprehensive component monitor (CCM) monitors the VCT position for an over-advanced camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.		

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0022 - Intake Camshaft Position Timing - Over-Retarded (Bank 2)	The comprehensive component monitor (CCM) monitors the VCT position for over-retarded camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an retarded position.		
P0040 - Upstream Oxygen Sensors Swapped from Bank to Bank (HO2S-11-21)	The HEGO monitor checks and determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when a response from the HO2S(s) being tested is not indicated.	• Crossed HO2S harness connectors (upstream). • Crossed HO2S wiring at the harness connectors (upstream). • Crossed HO2S wiring at the 104-pin harness connectors (upstream).	
P0041 - Downstream Oxygen Sensors Swapped from Bank to Bank (HO2S-12-22)	The HEGO monitor checks and determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when a response from the HO2S(s) being tested is not indicated.	• Crossed HO2S harness connectors (downstream). • Crossed HO2S wiring at the harness connectors (downstream). • Crossed HO2S wiring at the 104-pin harness connectors (downstream).	
P0053 - HO2S Heater Resistance (Bank1, Sensor 1)	Heater current requirements too low or high in HO2S Heater Control Circuit (Bank 1, Sensor 1)		
P0054 - HO2S Heater Resistance (Bank 1, Sensor 2)	Heater current requirements too low or high in HO2S Heater Control Circuit (Bank 1, Sensor 2)		
P0055 - HO2S Heater Resistance (Bank 1, Sensor 3)	Heater current requirements too low or high in HO2S Heater Control Circuit (Bank 1, Sensor 3)		
P0059 - HO2S Heater Resistance (Bank 2, Sensor 1)	Heater current requirements too low or high in HO2S Heater Control Circuit (Bank 2, Sensor 1)		
P0060 - HO2S Heater Resistance (Bank 2, Sensor 2)	Heater current requirements too low or high in HO2S Heater Control Circuit (Bank 2 Sensor 2)		

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0061 - HO2S Heater Resistance (Bank 2, Sensor 3)	Heater current requirements too low or high in HO2S Heater Control Circuit (Bank 2 Sensor 3)		
P0068 - Throttle Position (TP) Sensor Inconsistent with MAF Sensor All Others:	The PCM monitors a vehicle operation rationality check by comparing sensed throttle position to mass air flow readings. If during key ON engine running self-test the comparison of the TP sensor and MAF sensor readings are not consistent with calibrated load values, the test fails and a diagnostic trouble code is stored in continuous memory.	• Air leak between MAF sensor and throttle body • TP sensor not seated properly • Damaged TP sensor • Damaged MAF sensor	Drive vehicle and exercise throttle and TP sensor in all gears. A TP PID (TP V PID) less than 4.82 percent (0.24 volt) with a LOAD PID greater than 55 percent or a TP PID (TP V PID) greater than 49.05 percent (2.44 volts) with a LOAD PID less than 30 percent indicates a hard fault.
P0102 - Mass Air Flow (MAF) Circuit Low Input	The MAF sensor circuit is monitored by the PCM for low air flow (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine running the air flow (or voltage) changes below a minimum calibrated limit, the test fails.	• MAF sensor disconnected • MAF circuit open to PCM • VPWR open to MAF sensor • PWR GND open to MAF sensor • MAF RTN circuit open to PCM • MAF circuit shorted to GND • Intake air leak (near MAF sensor) • A closed throttle indication • Damaged MAF sensor • Damaged PCM	A MAF V PID (MAF PID) reading less than 0.23 volts in continuous memory or key ON and engine running indicates a hard fault.
P0103 - Mass Air Flow (MAF) Circuit High Input	The MAF sensor circuit is monitored by the PCM for high air flow (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the air flow (or voltage) changes above a maximum calibrated limit, the test fails.	• MAF sensor screen is blocked • MAF circuit shorted to VPWR • Damaged MAF sensor • Damaged PCM	A MAF V PID (MAF PID) reading less than 4.6 volts in continuous memory or key ON and engine running indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0104 - Mass or Volume Air Flow A Circuit intermittent/erratic	A fault exists in the Mass Air Flow A circuit, or Air tube containing the Sensor, causing incorrect Air Flow reading.	Intermittent circuit A open or short, air leaks in the tube from the MAF to the throttle body.	Verify the integrity of the Mass Air Flow Sensor circuit A, for intermittent fault. CHECK the Mass Air Flow Sensor tube for air leaks.
P0106 - Barometric (BARO) Pressure Sensor Circuit Performance	Baro sensor input to the PCM is monitored and is not within the calibrated value.	• Slow responding BARO sensor • Electrical circuit failure • Damaged BARO sensor • Damaged PCM	• VREF voltage should be between 4.0 and 6.0 volts • PID reading is in frequency
P0107 - BARO/MAP Sensor Low Voltage Detected	Sensor operating voltage is less than 0.25 volts (VREF), as a result it failed below the minimum allowable calibrated parameter.	• Open in the circuit, or short to ground • VREF circuit open, or short to ground • Damaged BARO/MAP sensor • Damaged PCM	• VREF should be greater than 4.0 volts • PID reading is in frequency/volts
P0108 - BARO/MAP Sensor High Voltage Detected	Sensor operating voltage is greater than 5.0 volts (VREF), as a result it failed above maximum allowable calibrated parameter.	• VREF shorted to VWPR • BARO/MAP signal shorted to VPWR • VREF should be less than 6.0 volts. PID reading is in frequency/Volts • Damaged PCM	• VREF should be greater than 4.0 volts • PID reading is in frequency/volts
P0109 - BARO Sensor Circuit Intermittent	The sensor signal to the PCM is failing intermittently.	• Loose electrical connection • Damaged BARO sensor	Check harness and connection.
P0112 - Intake Air Temperature (IAT) Sensor 1 Circuit Low Input	Indicates the sensor signal is less than Self-Test minimum. The IAT sensor minimum is 0.2 volts or 121°C (250°F).	• Grounded circuit in harness • Damaged sensor • Improper harness connection • Damaged PCM	IAT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.
P0113 - Intake Air Temperature (IAT) Sensor 1 Circuit High Input	Indicates the sensor signal is greater than Self-Test maximum. The IAT sensor maximum is 4.6 volts or -50°C (-58°F).	• Open circuit in harness • Sensor signal short to power • Damaged sensor • Improper harness connection • Damaged PCM	IAT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.
P0114 - Intake Air Temperature (IAT) Sensor 1 Intermittent/Erratic	Indicates IAT sensor signal was intermittent during the comprehensive component monitor.	• Damaged harness • Damaged sensor • Damaged harness connector • Damaged PCM	Monitor IAT on scan tool, look for sudden changes in reading when harness is wiggled or sensor is tapped.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0116 - Engine Coolant Temperature Sensor 1 Circuit Range/Performance Failure	Indicates the engine coolant temperature rationality test has failed. The PCM logic that sets this DTC indicates that engine coolant temperature sensor (ECT or CHT) drifted higher than the nominal sensor calibration curve and could prevent one or more OBD monitors from executing. The PCM runs this logic after an engine off\calibrated soak period (typically 6 hours). This soak period allows the Intake Air Temperature (IAT) and engine coolant temperature (CHT or ECT) to stabilize and not differ by more than a calibrated value. DTC P0116 is set when all of the following conditions are met: • Engine coolant temperature at engine start exceeds IAT at engine start by more than a calibrated value typically 30°F (-1°C). • Engine coolant temperature exceeds a calibrated value, typically 225°F (107°C). • The Fuel System, Heated Oxygen and Misfire Monitors have not completed. • Calibrated timer to set DTC P0116 has expired.	• Engine Coolant Temperature (ECT) or Cylinder Head Temperature (CHT) sensor • Coolant System Concern	Ensure IAT and engine coolant temperature are similar when engine is cold. Also ensure engine coolant temperature sensor (ECT or CHT) and actual engine operating temperature are the same.
P0117 - Engine Coolant Temperature (ECT) Sensor 1 Circuit Low Input	Indicates the sensor signal is less than Self-Test minimum. The ECT sensor minimum is 0.2 volts or 121°C (250°F). Note on some vehicles that are not equipped with an ECT sensor, CHT can be used and can set this DTC.	• Grounded circuit in harness • Damaged sensor • Improper harness connection • Damaged PCM	ECT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0118 - Engine Coolant Temperature (ECT) Sensor 1 Circuit High Input	Indicates the sensor signal is greater than Self-Test maximum. The ECT sensor maximum is 4.6 volts or -50°C (-58°F). Note on some vehicles that are not equipped with an ECT sensor, CHT can be used and can set this DTC.	• Open circuit in harness • Sensor signal short to power • Damaged PCM • Improper harness connection • Damaged sensor	ECT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.
P0119 - Engine Coolant Temperature (ECT) Sensor 1 Circuit Intermittent/Erratic	Indicates ECT circuit became intermittently open or shorted while engine was running. Note on some vehicles that are not equipped with an ECT sensor, CHT can be used and can set this DTC.	• Damaged harness • Damaged sensor • Damaged PCM • Damaged harness connector • Low engine coolant	Monitor ECT or CHT on scan tool, look for sudden changes in reading when harness is wiggled or sensor is tapped.
P0121 - ETC Throttle Position (TP1) sensor Circuit Range/Performance Vehicles with ETC	The ETC TP1 was flagged as fault status by the PCM indicating the an out of range in either the closed or wide open throttle modes.	• Obstruction in the throttle plate movement. • Damaged throttle body • TP circuit open to PCM • Damaged TP sensor • SIG RTN circuit open to TP sensor • Operator placing	Fault exhibits a symptom of limited power. A TP1 PID (TP V PID) reading less than 13% (.65 volt), or greater than 93% (4.65volts) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0121 - Throttle Position (TP) Circuit Performance Problem All Others:	The TP sensor circuit is monitored by the PCM for a non closed throttle position at idle. If key ON engine running self-test terminates upon placing the transmission range selector in gear (DRIVE or REVERSE) or when closing the throttle (idle) after opening it (in PARK or NEUTRAL) the TP closed throttle position is not attained, the test fails.	• Binding throttle linkage • Damaged throttle body • TP circuit open to PCM • Damaged TP sensor • SIG RTN circuit open to TP sensor	Drive vehicle, bring to a stop, turn key OFF. Start vehicle, run key ON engine running self-test at idle. Access KOER diagnostic trouble codes on scan tool.
P0122 - ETC Throttle Position (TP1) sensor Circuit Low Input Vehicles with ETC	The ETC TP1 sensor was flagged as fault status by the PCM indicating a low voltage, or open circuit.	• Open ETC TP sensor harness • Short to ground in ETC TP sensor harness • Damaged TP sensor • SIG RTN circuit open to TP sensor	Fault exhibits a symptom of limited power. A TP1 PID (TP V PID) reading less than 3.42% (0.17 volt) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0122 - Throttle Position (TP) sensor Circuit Low Input All Others:	The TP sensor circuit is monitored by the PCM for a low TP rotation angle (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) changes below a minimum calibrated limit, the test fails.	• TP sensor not seated properly • TP circuit open to PCM • VREF open to TP sensor • TP circuit short to GND • Damaged TP sensor • Damaged PCM	Fault exhibits a symptom of limited power. A TP PID (TP V PID) reading less than 3.42 percent (0.17 volt) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0123 - ETC Throttle Position (TP1) sensor Circuit High Input Vehicles with ETC	The ETC TP sensor 1 was flagged as fault status by the PCM indicating high voltage.	• ETC TP sensor harness shorted to VREF • ETC TP sensor harness shorted to PWR • Damaged TP sensor • VREF circuit shorted to TP sensor	Drive vehicle, bring to a stop, turn key OFF. Start vehicle, run key ON engine running self-test at idle. Access KOER diagnostic trouble codes on scan tool. The TP1 signal is normally at a high voltage at closed throttle, and a lower voltage at wide open throttle. (opposite of TP2)
P0123 - Throttle Position (TP) Circuit High Input All Others:	The TP sensor circuit is monitored by the PCM for a high TP rotation angle (or voltage) input through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) changes above maximum calibrated limit, the test fails.	• TP sensor not seated properly • TP circuit short to PWR • TP circuit short to VREF • SIG RTN circuit open to TP sensor • Damaged TP sensor • Damaged PCM	A TP PID (TP V PID) reading greater than 93 percent (4.65 volts) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0125 - Insufficient Coolant Temperature For Closed Loop Fuel Control	Indicates the ECT or CHT sensor has not achieved the required temperature level to enter closed loop operating conditions within a specified amount of time after starting the engine.	• Insufficient warm up time • Low engine coolant level • Leaking or stuck open thermostat • Malfunctioning ECT sensor • Malfunctioning CHT sensor	Compare thermostat specification to actual engine coolant temperature using the engine temperature PID (ECT or CHT). Temperature reading should be similar when engine is at normal operating temperature.
P0127 - Intake Air Temperature Too High	Indicates that IAT2 sensor has detected a potential abnormality in the intercooler system. This condition will cause the boost from the supercharger to be bypassed to avoid potential engine damage.	• Blockage of heat exchangers • Low fluid level • Fluid leakage • Intercooler pump or relay failure • Crossed intercooler coolant lines	Monitor IAT2 PID. Typical IAT2 temperature should be greater than IAT1. REFER to Section 6: Reference Values for ranges.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0128 - Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature)	Indicates that the Thermostat Monitor has not achieved the required engine operating temperature level within a specified amount of time after starting the engine.	• Insufficient warm up time • Low engine coolant level • Leaking or stuck open thermostat • Malfunctioning ECT sensor • Malfunctioning CHT sensor	Refer to Thermostat Monitor in Section 1, Description and Operation, for system information.
P0131 - HO2S Sensor Circuit Out of Range Low Voltage (HO2S-11)	The HO2S sensor is monitored for a negative voltage known as characteristic shift downward (CSD). If the sensor is thought to be switching from 0 volts to -1 volts during testing, the PCM will use this input and remain in fuel control.	• Contaminated HO2S (water, fuel, etc) • Crossed HO2S signal/signal return wiring	
P0132 - HO2S Sensor Circuit High Voltage (HO2S-11)	The HO2S Sensor Signals are monitored for an over voltage fault. The code is set when HO2S signal voltage is 1.5 volts or greater.	• HO2S Signal Circuit shorted to Heater Power inside of HO2S sensor. • HO2S Signal Circuit shorted to VPWR or VREF in harness. • PCM failure.	An HO2S PID switching across 0.45 volt from 0.2 to 0.9 volts indicates a normal switching HO2S. HO2S PID voltage of 1.5 volts or greater indicates a short to power.
P0133 - HO2S Sensor Circuit Slow Response (HO2S-11)	The HEGO Monitor checks the HO2S Sensor frequency and amplitude. If during testing the frequency and amplitude were to fall below a calibrated limit, the test will fail.	• Contaminated HO2S sensor. • Exhaust leaks. • Shorted /open wiring. • Improper fueling. • MAF sensor. • Deteriorating HO2S sensor. • Inlet air leaks.	Access HO2S test results from the Generic OBD-II menu to verify DTC.
P0135 - HO2S Sensor Circuit Malfunction (HO2S-11)	During testing the HO2S Heaters are checked for opens/shorts and excessive current draw. The test fails when current draw exceeds a calibrated limit and/or an open or short is detected.	• Vacuum hose disconnected on ESM (EGR System Module) applications. • Short to VPWR in harness or HO2S. • Water in harness connector. • Open VPWR circuit. • Open GND circuit. • Low battery voltage. • Corrosion or poor mating terminals and wiring • Damaged HO2S heater. • Damaged PCM.	• Wiring. • Damaged HO2S heater. • Damaged PCM.
P0138 - HO2S Sensor Circuit High Voltage (HO2S-12)	See description for DTC P0132	See possible causes for DTC P0132	See diagnostic aids for DTC P0132

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0141 - HO2S Sensor Circuit Malfunction (HO2S-12)	See description for DTC P0135	See possible causes for DTC P0135	See diagnostic aids for DTC P0135
P0144 - HO2S Sensor Circuit High Voltage (HO2S-13)	See description for DTC P0132	See possible causes for DTC P0132	See diagnostic aids for DTC P0132
P0147 - HO2S Sensor Circuit Malfunction (HO2S-13)	See description for DTC P0135	See possible causes for DTC P0135	See diagnostic aids for DTC P0135
P0148 - Fuel Delivery Error	At least one bank lean at wide open throttle.	• Severely restricted fuel filter. • Severely restricted fuel supply line.	
P0151 - HO2S Sensor Circuit Out of Range Low Voltage (HO2S-21)	See description for DTC P0131	See possible causes for DTC P0131	
P0152 - HO2S Sensor Circuit High Voltage (HO2S-21)	See description for DTC P0132	See possible causes for DTC P0132	See diagnostic aids for DTC P0132
P0153 - HO2S Sensor Circuit Slow Response (HO2S-21)	See description for DTC P0133	See possible causes for DTC P0133	See diagnostic aids for DTC P0133
P0155 - HO2S Sensor Circuit Malfunction (HO2S-21)	See description for DTC P0135	See possible causes for DTC P0135	See diagnostic aids for DTC P0135
P0158 - HO2S Sensor Circuit High Voltage (HO2S-22)	See description for DTC P0132	See possible causes for DTC P0132	See diagnostic aids for DTC P0132
P0161 - HO2S Sensor Circuit Malfunction (HO2S-22)	See description for DTC P0135	See possible causes for DTC P0135	See diagnostic aids for DTC P0135
P0167 - HO2S Sensor Circuit Malfunction (HO2S-23)	See description for DTC P0135	See possible causes for DTC P0135	See diagnostic aids for DTC P0135

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0171 - System to Lean (Bank 1)	The Adaptive Fuel Strategy continuously monitors the fuel delivery hardware. The test fails when the adaptive fuel tables reach a rich calibrated limit. Refer to Section 1, Powertrain Control Software, Fuel Trim for more information.	Air Measurement System • MAF sensor (contaminated, damaged, malfunctioning, etc.) Fuel System • Fuel pressure regulator (leaking, malfunctioning, etc.). • Fuel filter plugged, dirty. • Fuel pump (weak, check valve leaking, etc.). • Leaking/contaminated fuel injectors. • Low fuel pressure or running out of fuel. • EVAP canister purge valve leaking (when canister is "clean"). • Fuel supply line restricted. • Fuel rail pressure sensor (incorrect reading). Air Induction System • Air leaks after the MAF. • Vacuum Leaks. • PCV system (leak, valve stuck open, etc.) • Improperly seated engine oil dipstick. Exhaust System • Exhaust leaks before or near the HO2Ss (exhaust manifold gasket, mating gaskets, etc.).. EGR system • Vacuum hose disconnected on ESM (EGR System Module) applications. • EGR valve tube/gasket leak • EVR solenoid vacuum leak Secondary air injection • Damaged/malfunctioning secondary air injection system (mechanically stuck valve).	View Freeze Frame Data to determine operating conditions when DTC was set. Observe LONGFT1 and 2 PID(s). Refer to Section 2, Adaptive Fuel DTCs Diagnostic Techniques for more information.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0172 - System to Rich (Bank 1)	The Adaptive Fuel Strategy continuously monitors the fuel delivery hardware. The test fails when the adaptive fuel tables reach a lean calibrated limit. Refer to Section 1, Powertrain Control Software, Fuel Trim for more information.	Air Measurement System • MAF sensor (contaminated, damaged, corroded connector, etc.). Fuel System • Fuel pressure regulator (vacuum hose off, diaphram leak, malfunctioning, etc.). • Leaking fuel injectors. • Fuel return line restricted. • Fuel rail pressure sensor (incorrect reading). • EVAP canister purge valve leak (when canister is full). Base engine • Engine oil contamination.	View Freeze Frame Data to determine operating conditions when DTC was set. Observe LONGFT1 and 2 PID(s). Refer to Section 2, Adaptive Fuel DTCs Diagnostic Techniques for more information.
P0174 - System to Lean (Bank 2)	See description for DTC P0171	See possible causes for DTC P0171	See diagnostic aids for DTC P0171
P0175 - System to Rich (Bank 2)	See description for DTC P0172	See possible causes for DTC P0172	See diagnostic aids for DTC P0172
P0180 - Engine Fuel Temperature Sensor A Circuit Low Input (EFT)	The comprehensive component monitor (CCM) monitors the EFT sensor circuit to the PCM for low and high voltage. If voltage were to fall below or exceed a calibrated limit and amount of time during testing, the test will fail.	• Open or short in harness. • Low ambient temperature operation. • Improper harness connection. • Damaged EFT sensor. • Damaged PCM.	Verify EFT-PID value to determine open or short.
P0181 - Engine Fuel Temperature Sensor A Circuit Range/ Performance (EFT)	The comprehensive component monitor (CCM) monitors the EFT Temperature for acceptable operating temperature. If during testing voltage were to fall below or exceed a calibrated limit, a calibrated amount of time the test will fail.	• Open or short in harness. • Low ambient temperature operation. • Improper harness connection. • Damaged EFT sensor. • Damaged PCM.	Verify EFT-PID value to determine open or short.
P0182 - Engine Fuel Temperature Sensor A Circuit Low Input (EFT)	The comprehensive component monitor (CCM) monitors the EFT sensor circuit to the PCM for low voltage. If voltage were to fall below a calibrated limit and amount of time during testing, the test will fail.	• Short in harness. • VREF open or shorted. • Low ambient temperature operation. • Improper harness connection. • Damaged EFT sensor. • Damaged PCM.	Verify EFT-PID and VREF values to determine open or short.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0183 - Engine Fuel Temperature Sensor A Circuit High Input (EFT)	The comprehensive component monitor (CCM) monitors the EFT sensor circuit to the PCM for high voltage. If voltage were to exceed a calibrated limit and a calibrated amount of time during testing, the test will fail.	• Open or short to PWR in harness. • Damaged EFT sensor. • Improper harness connection. • Damaged PCM.	Verify EFT-PID value to determine open or short.
P0186 - Engine Fuel Temperature Sensor B Circuit Range/Performance (EFT)	See description for DTC P0181	See possible causes for DTC P0181	See diagnostic aids for DTC P0181
P0187 - Engine Fuel Temperature Sensor B Circuit Low Input (EFT).	See description for DTC P0182	See possible causes for DTC P0182	See diagnostic aids for DTC P0182
P0188 - Engine Fuel Temperature Sensor B Circuit High Input (EFT)	See description for DTC P0183	See possible causes for DTC P0183	See diagnostic aids for DTC P0183
P0190 - Fuel Rail Pressure Sensor Circuit Malfunction (FRP)	The comprehensive component monitor (CCM) monitors the FRP sensor to the PCM for VREF voltage. The test fails when the VREF voltage from the PCM drops to a voltage less than a minimum calibrated value.	• VREF open in harness. • VREF open in sensor. • VREF open in PCM.	Verify VREF voltage between 4.0 and 6.0V.
P0191 - Fuel Rail Pressure Sensor Circuit Performance (FRP)	The comprehensive component monitor (CCM) monitors the FRP pressure for acceptable fuel pressure. The test fails when the fuel pressure falls below or exceeds a minimum/maximum calibrated value for a calibrated period of time.	• High fuel pressure. • Low fuel pressure. • Damaged FRP sensor. • Excessive resistance in circuit. • Low or no fuel.	A FRP PID value during KOER of 138 kpa (20 psi) and 413 kpa (60 psi) for gasoline or 586 kpa (85 psi) and 725 kpa (105 psi) for natural gas vehicles (NG) is acceptable.
P0192 - Fuel Rail Pressure Sensor Circuit Low Input (FRP)	The comprehensive component monitor (CCM) monitors the FRP sensor circuit to the PCM for low voltage. If voltage were to fall below a calibrated limit and amount of time during testing, the test will fail.	• FRP signal shorted to SIG RTN or PWR GND. • FRP signal open (NG only) • Low fuel pressure (NG only) • Damaged FRP sensor. • Damaged PCM.	A FRP PID value during KOER or KOEO less than 0.3 volts for gasoline or 0.5 volts for natural gas vehicles (NG) would indicate a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0193 - Fuel Rail Pressure Sensor Circuit High Input (FRP)	The comprehensive component monitor (CCM) monitors the FRP sensor circuit to the PCM for high voltage. If voltage were to fall below a calibrated limit and a calibrated amount of time during testing, the test will fail.	• FRP signal shorted to VREF or VPWR. • FRP signal open (gasoline only) • Low fuel pressure (NG only) • Damaged FRP sensor. • Damaged PCM. • High fuel pressure (caused by damaged fuel pressure regulator) NG.	FRP signal high condition can be caused by any number of conditions; a short on FRP signal to VREF or a more positive voltage level or an open FRP signal or signal return. Note the FRP signal line is pulled up by the PCM and VREF at the sensor and downward by the sensor through SIGRTN.
P0196 - Engine Oil Temperature (EOT) Sensor Circuit Range/Performance	Indicates that the sensed EOT value from the EOT sensor is not within the PCM predicted engine oil temperature range, based on other PCM inputs.	• Engine not at operating temperature • Cooling system problem of stuck thermostat • EOT circuit failure • Damaged PCM	EOT rationality test looks for the engine oil temperature sensor to be within a calibrated delta of the PCM predicted engine oil temperature. Ensure EOT sensor reading is similar to engine temperature. If EOT reading greatly differs from engine temperature. Check EOT circuitry for correct operation.
P0197 - Engine Oil Temperature (EOT) Sensor Circuit Low Input	Indicates EOT signal voltage is low (high temperature)	• Damaged harness • Damaged sensor • Damaged harness connector • Damaged PCM	EOT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault short to ground.
P0198 - Engine Oil Temperature (EOT) Sensor Circuit High Input	Indicates EOT signal voltage is high (low temperature)	• Damaged harness • Damaged sensor • Damaged harness connector • Damaged PCM	EOT V PID reading greater than 4.5 volts with key ON and engine OFF or during any engine operating mode indicates an open circuit hard fault.
P0201 - Cylinder #1 Injector Circuits	The comprehensive component monitor (CCM) monitors the operation of the fuel injector drivers in the PCM. The test fails when the fuel injector does not operate electrically even though the harness assembly and fuel injectors test satisfactorily.	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ1F fault flags = YES.
P0202 - Cylinder #2 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ2F fault flags = YES.
P0203 - Cylinder #3 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ3F fault flags = YES.
P0204 - Cylinder #4 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ4F fault flags = YES.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0205 - Cylinder #5 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ5F fault flags = YES.
P0206 - Cylinder #6 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ6F fault flags = YES.
P0207 - Cylinder #7 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ7F fault flags = YES.
P0208 - Cylinder #8 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ8F fault flags = YES.
P0209 - Cylinder #9 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ9F fault flags = YES.
P0210 - Cylinder #10 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ10F fault flags = YES.
P0211 - Cylinder #11 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ11F fault flags = YES.
P0212 - Cylinder #12 Injector Circuits	See description for DTC P0201	• Faulty fuel injector driver within the PCM.	PID Data Monitor INJ12F fault flags = YES.
P0217 - Engine Coolant Over-Temperature Condition	Indicates an engine overheat condition was detected by the engine temperature sensor (CHT or ECT depending how vehicle is equipped). This condition will cause the boost from the supercharger to be bypassed to avoid potential engine damage.	• Engine cooling system concerns. • Low engine coolant level. • Base engine concerns.	Monitor engine temperature PID (CHT or ECT) for overheat condition. Typical engine temperature should be close to cooling system thermostat specification.
P0218 - Transmission Fluid TFT Over Temperature Condition	Indicates a transmission overheat condition was sensed by the Transmission Fluid Temperature TFT sensor.	Low transmission fluid level Transmission cooling system concerns	Monitor transmission temperature PID TFT for overheat condition.
P0219 - Engine Over Speed Condition	Indicates the vehicle has been operated in a manner, which caused the engine speed to exceed a calibration limit. The engine rpm is continuously monitored and evaluated by the PCM. The DTC is set when the rpm exceeds the calibrated limit set within the PCM. For additional information on the engine rpm limiter, refer to Section 1, Electronic Engine Control (EC) System, Powertrain Control Software.	• Wheel slippage (water, ice, mud and snow) • Excessive engine rpm in NEUTRAL or operated in the wrong transmission gear	The DTC indicates the vehicle has been operated in a manner, which caused the engine speed to exceed a calibrated limit.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0221 - Throttle Position (TP2) sensor Circuit Range/Performance	The ETC TP sensor 2 was flagged as fault status the PCM indicating an out of range in either the closed or wide open throttle modes.	• Binding throttle linkage • Damaged throttle body • TP circuit open to PCM • Damaged TP sensor • SIG RTN circuit open to TP sensor • Self test operator error (foot resting on the accelerator pedal during test)	Fault exhibits a symptom of limited power. A TP2 PID (TP V PID) reading greater than 96.42% (4.65 volts) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0222 - Throttle Position (TP2) sensor Circuit Low Input	The ETC TP2 sensor was flagged as fault status by the PCM indicating a low voltage, or open circuit.	• Open ETC TP sensor harness • Short to ground in ETC TP sensor harness • Damaged TP sensor • SIG RTN circuit open to TP sensor	Fault exhibits a symptom of limited power. A TP2 PID (TP V PID) reading less than 3.42% (.17 volts) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0223 - Throttle Position (TP2) sensor Circuit High Input	The ETC TP2 sensor was flagged as fault status by the PCM indicating a high voltage.	• ETC TP sensor harness shorted to VREF • Damaged TP sensor • ETC TP2 circuit open • VREF circuit shorted to TP sensor	Fault exhibits a symptom of limited power. A TP2 PID (TP V PID) reading greater than 93% (4.65 volts) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P0230 - Fuel pump primary circuit malfunction	NOTE: For natural gas applications, the following description applies to the fuel shutoff valve (FSV) circuit. The PCM monitors the fuel pump (FP) circuit output from the PCM. The test fails if: With the FP output commanded ON (grounded), excessive current draw is detected on the FP circuit; or with the FP output commanded OFF, voltage is not detected on the FP circuit (the PCM expects to detect VPWR voltage coming through the fuel pump relay coil to the FP circuit).	• Open or shorted fuel pump (FP) circuit • Open VPWR circuit to fuel pump relay • Damaged fuel pump relay • Damaged PCM	• When the LFCF PID reads YES, a fault is currently present FPF • An open circuit or short to ground can only be detected with the fuel pump commanded OFF. • A short to power can only be detected with the fuel pump commanded ON. • During KOEO and KOER self-test, the fuel pump output command will be cycled ON and OFF.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0231 - Fuel pump secondary circuit Low	NOTE: For natural gas applications, the following description applies to the fuel shutoff valve monitor (FSVM) and the fuel shutoff valve power (FSV PWR) circuits. The PCM monitors the fuel pump monitor (FPM) circuit. The test fails if the PCM commands the fuel pump ON and B+ voltage is not detected on the FPM circuit.	• Open B+ circuit to the fuel pump relay • Open FP PWR circuit between the fuel pump relay and its connection to the FPM circuit • Damaged fuel pump relay • Damaged PCM (engine will start) • For 5.4L SC Lightning, damaged IFS switch, IFS switch relay, or concern with related circuits.	During KOEO self-test, the PCM will command the fuel pump ON so this test can be performed.
P0232 - Fuel pump secondary circuit High	NOTE: For natural gas applications, the following description applies to the fuel shutoff valve monitor (FSVM) and the fuel shutoff valve power (FSV PWR) circuits. The PCM monitors the fuel pump monitor (FPM) circuit. This test fails when the PCM detects voltage on the FPM circuit while the fuel pump is commanded OFF. The FPM circuit is wired to a pull-up voltage inside the PCM. The FPM circuit will go high if, with the key ON and the fuel pump commanded OFF, the FPM/FP PWR circuit loses its path to ground through the fuel pump. The FPM circuit will also go high if the FPM/FP PWR circuit is shorted to power.	• Inertia fuel shutoff (IFS) switch not reset or electrically open • Open circuit between the fuel pump and the FPM connection to the FP PWR circuit • Poor fuel pump ground • Fuel pump electrically open • Fuel pump secondary circuits short to power • Fuel pump relay contacts always closed • Open FPM circuit between PCM and connection to FP PWR circuit • Damaged low speed fuel pump relay or concern with related circuits (if equipped). • Damaged PCM	Continuous memory P0232 can be set if the IFS switch was tripped, then reset, or if the fuel pump circuit is activated when the PCM expected the circuit to be off (i.e. fuel system test or prime procedure).
P0234 - Supercharger Overboost Condition	The PCM disables (bypasses) the supercharger boost and sets a diagnostic trouble code (DTC) to keep from damaging the powertrain (engine or transmission) during potential harmful operating conditions.	• Brake torque (brake on and throttle at wide open) • Transmission oil temperature (TOT) exceeds calibrated threshold • Engine over temperature • Ignition misfire exceeds calibrated threshold • Knock sensor (KS) failure or knock detected • Low speed fuel pump relay not switching	Check for other diagnostic trouble codes accompanying the P0234 or check appropriate and available PIDs related to above possible causes.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0243 - Supercharger (Boost) Bypass Solenoid Circuit Malfunction	The PCM monitors the supercharger (boost) bypass (SCB) solenoid circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified SCB solenoid duty cycle (100% or 0%) by PCM command.	• VPWR circuit open to SCB solenoid • SCB solenoid circuit shorted to PWR GND or CHASSIS GND • Damaged SCB solenoid • SCB solenoid circuit open • SCB solenoid circuit shorted to VPWR • Damaged PCM	Disconnect SCB solenoid. Connect test lamp to SCB solenoid harness connector. Cycle SCB driver in PCM by Output Test Mode. Test lamp cycle on and off - SCB solenoid is suspect. Test lamp always on - SCB signal short in harness or PCM. Test always off - SCB signal or VPWR open in harness or PCM.
P0297 - Vehicle Over Speed Condition	Indicates the vehicle has been operated in a manner, which caused the vehicle speed to exceed a calibration limit. The vehicle speed is continuously monitored and evaluated by the PCM. The DTC is set when the vehicle speed exceed the calibrated limit set within the PCM. For additional information on the vehicle speed limiter, refer to Section 1, Electronic Engine Control (EC) System, Powertrain Control Software.	• Vehicle driven at a high rate of speed	The DTC indicates the vehicle has been operated in a manner, which caused the engine speed to exceed a calibrated limit.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0298 - Engine Oil Over Temperature Condition	Indicates the Engine Oil Temperature Protection strategy in the PCM has been activated. This will temporarily prohibit high engine speed operation by disabling injectors, therefore reducing the risk of engine damage from high engine oil temperature. Note: On engines which are equipped with an oil temperature sensor, the PCM reads oil temperature to determine if it is excessive. When an oil temperature sensor is not present, the PCM uses an oil algorithm to infer actual temperature. Engine shutdown strategy function is the same on vehicles with and without oil temperature sensors.	• Very high engine rpm for extended period of time. • Over-heating condition. • Malfunction EOT sensor or circuit (vehicles w/EOT sensor). • Base engine concerns.	Engine operating in high rpm range, due to improper gear selection. May cause Lack/Loss of Power or Surge customer concern.
P0300 - Random Misfire	The random misfire DTC indicates multiple cylinders are misfiring or the PCM cannot identify which cylinder is misfiring.	• Camshaft position sensor (CMP) • Low fuel: less than 1/8 tank • Stuck open EGR valve • Blocked EGR passages	One or more EGR passages may be blocked or partially blocked. If this is the case the Misfire Detection Monitor will indicate the EGR port to check for possible blockage.
P030X - Misfire Detection Monitor	The misfire detection monitor is designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause.	• Ignition System • Fuel Injectors • Running out of fuel • EVAP canister purge valve • Fuel Pressure • Evaporative emission system • Base engine	The MIL will blink once per second when a misfire is detected severe enough to cause catalyst damage. If the MIL is on steady state, due to a misfire, this will indicate the threshold for emissions was exceeded and cause the vehicle to fail an inspection and maintenance tailpipe test.
P0310 - Misfire Detection Monitor	The misfire detection monitor is designed to monitor engine misfire and identify the specific cylinder in which the misfire has occurred. Misfire is defined as lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause.	• Ignition System • Fuel Injectors • Running out of fuel • EVAP canister purge valve • Fuel Pressure • Evaporative emission system • Base engine	The MIL will blink once per second when a misfire is detected severe enough to cause catalyst damage. If the MIL is on steady state, due to a misfire, this will indicate the threshold for emissions was exceeded and cause the vehicle to fail an inspection and maintenance tailpipe test.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0315 - PCM is unable to learn Crankshaft Pulse Wheel tooth spacing (exceeded the allowable correction tolerances).	PCM is unable to learn and correct for mechanical inaccuracies in Crankshaft Pulse Wheel tooth spacing. This DTC will disable the Misfire Monitor.	• Damaged Crankshaft Pulse Wheel teeth. • Damaged CKP sensor	Visual inspection of the CKP sensor and Crankshaft Pulse Wheel teeth for damage.
P0316 - Misfire Occurred in the First 1000 Engine Revolutions	P0316 code will be set in addition to any type B misfire DTC which occurs in the first 1000 revolution test interval, following engine start.	• Damaged CKP sensor • Ignition System • Fuel Injectors • Running out of fuel • Fuel Quality • Base engine • Damaged PCM	Freeze Frame Data and the P03XX DTC will also be stored, indicating in which cylinder the misfire occurred.
P0320 - Ignition Engine Speed Input Circuit Malfunction	The ignition engine speed sensor input signal to PCM is continuously monitored. The test fails when the signal indicates that two successive erratic profile ignition pickup (PIP) pulses have occurred.	• Loose wires/connectors. • Arcing secondary ignition components (coil, wires and plugs) • On board transmitter (2-way radio)	The DTC indicates that two successive erratic PIP pulses occurred.
P0325 - Knock Sensor 1 Circuit Malfunction (Bank 1)	The knock sensor detects vibrations upon increase and decrease in engine rpm. The knock sensor generates a voltage based on this vibration. Should this voltage go outside a calibrated level a DTC will set.	• Knock sensor circuit short to GND • Knock sensor circuit short to PWR • Knock sensor circuit open • Damaged knock sensor • Damaged PCM	A knock sensor voltage greater than 0.5V with the key ON and engine OFF indicates a hard fault.
P0326 - Knock Sensor 1 Circuit Range/ Performance (Bank 1)	The knock sensor detects vibrations upon increase and decrease in engine rpm. The knock sensor generates a voltage based on this vibration. Should this voltage go outside a calibrated level a DTC will set.	• Knock sensor circuit short to GND • Knock sensor circuit short to PWR • Knock sensor circuit open • Damaged knock sensor • Damaged PCM	A knock sensor voltage greater than 0.5V with the key ON and engine OFF indicates a hard fault.
P0330 - Knock Sensor 2 Circuit Malfunction (Bank 2)	The knock sensor detects vibration upon increase and decrease in engine rpm. The knock sensor generates a voltage based on this vibration. Should this voltage go outside a calibrated level a DTC will set.	• Knock sensor circuit short to GND • Knock sensor circuit short to PWR • Damaged knock sensor • Damaged PCM • Knock sensor circuit open	A knock sensor voltage greater than 0.5V with the key ON and engine OFF indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0331 - Knock Sensor 2 Circuit Range/Performance (Bank 2)	The knock sensor detects vibration upon increase and decrease in engine rpm. The knock sensor generates a voltage based on this vibration. Should this voltage go outside a calibrated level a DTC will set.	• Knock sensor circuit short to GND • Knock sensor circuit short to PWR • Damaged knock sensor • Damaged PCM • Knock sensor circuit open	A knock sensor voltage greater than 0.5V with the key ON and engine OFF indicates a hard fault.
P0340 - Camshaft Position (CMP) Sensor Circuit Malfunction (Bank 1)	The test fails when the PCM can no longer detect the signal from the CMP sensor on Bank 1.	• CMP circuit open • CMP circuit short to GND • CMP circuit short to PWR • SIG RTN open (VR sensor) • CMP GND open (Hall effect sensor) • CMP misinstalled (Hall effect sensor) • Damaged CMP sensor shielding • Damaged CMP sensor • Damaged PCM	Harness routing, harness alterations, improper shielding, or electrical interference from other improperly functioning systems may have intermittent impact on the CMP signal.
P0345 - Camshaft Position (CMP) Sensor Circuit Malfunction (Bank 2)	The test fails when the PCM can no longer detect the signal from the CMP sensor on Bank 2.	See possible causes for DTC P0340	See possible causes for DTC P0340
P0350 - Ignition Coil (Undetermined) Primary/ Secondary Circuit Malfunction	Each ignition primary circuit is continuously monitored. The test fails when the PCM does not receive a valid IDM pulse signal from the ignition module (integrated in PCM).	• Open or short in Ignition START/RUN circuit • Open coil driver circuit • Coil driver circuit shorted to ground • Damaged coil • Damaged PCM • Coil driver circuit shorted to VPWR	
P0351 - Ignition Coil A Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0352 - Ignition Coil B Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0353 - Ignition Coil C Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0354 - Ignition Coil D Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0355 - Ignition Coil E Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0356 - Ignition Coil F Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0357 - Ignition Coil G Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0358 - Ignition Coil H Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0359 - Ignition Coil I Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0360 - Ignition Coil J Primary/Secondary Circuit Malfunction	See description for DTC P0350	See possible causes for DTC P0350	
P0400 - EGR Flow Failure (outside the minimum or maximum limits)	The EEGR system is monitored once per drive cycle during steady state conditions above 48 mph . The test will fail when a malfunction is detected by PCM calculations indicating the EGR flow is less or greater than expected.	• EEGR valve stuck open or closed • Connector to EEGR not seated • EEGR motor windings shorted or open circuited • No power to EEGR • Harness open or shorted to power or ground • Vacuum signal to MAP restricted or leaking • MAF sensor signal erroneous • Damaged PCM • Carbon build up in EEGR valve seat area • One or more sensor not responding or out of range	All of the following sensors input data to the PCM for proper operation of the EEGR system: ECT, CPS, IAT, MAF, TP, MAP. Any DTC relating to these sensors must be resolved prior to addressing P0400 code.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0401 - EGR Flow Insufficient Detected	The EGR system is monitored during steady state driving conditions while the EGR is commanded on. The test fails when the signal from the DPF EGR sensor indicates that EGR flow is less than the desired minimum.	• Vacuum supply • EGR valve stuck closed • EGR valve leaks vacuum • EGR flow path restricted • EGRVR circuit shorted to PWR • VREF open to DPFEGR sensor • DPFEGR sensor downstream hose off or plugged • EGRVR circuit open to PCM • VPWR open to EGRVR solenoid • DPFEGR sensor hoses both off • DPFEGR sensor hoses reversed • Damaged EGR orifice tube • Damaged EGRVR solenoid • Damaged PCM	Perform KOER self-test and look for DTC P1408 as an indication of a hard fault. If P1408 is not present, look for contamination, restrictions, leaks, and intermittents.
P0402 - EGR Flow Excessive Detected	The EGR system is monitored for undesired EGR flow during idle. The EGR monitor looks at the DPF EGR signal at idle and compares it to the stored signal measured during key ON and engine OFF. The test fails when the signal at idle is greater than at key ON engine OFF by a calibrated amount.	• EGR valve stuck open • Plugged EGR vacuum regulator solenoid vent • Plugged EGR tube • Slow responding DPFEGR sensor • Damaged DPF EGR sensor • Improper vacuum hose connection • Plugged vacuum hoses • EGRVR circuit shorted to ground • Damaged EGR vacuum regulator solenoid • Damaged PCM	A DPFEGR PID reading that is greater at idle than during key ON and engine OFF by 0.5 volt or a rough engine idle, may indicate a hard fault.
P0403 - EGR Vacuum Regulator Solenoid Circuit Malfunction (Vehicles with out Electric EGR)	This test checks the electrical function of the EGRVR solenoid. The test fails when the EGRVR circuit voltage is either too high or too low when compared to the expected voltage range. The EGR system must be enabled for the test to be completed.	• EGRVR circuit open • VPWR open to EGRVR solenoid • EGRVR circuit short to VPWR or GND • Damaged EGRVR solenoid • Damaged PCM	The EGR vacuum regulator solenoid resistance is from 26 to 40 ohms.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0405 - DPF EGR Sensor Circuit Low Voltage Detected	The EGR monitor checks the DPF EGR sensor signal to the PCM for low voltage. The test fails when the average voltage to the PCM drops to a voltage less than the minimum calibrated value.	• DPFEGR circuit short to GND • Damaged DPF EGR sensor • VREF short to GND • Damaged PCM	A DPF EGR PID reading less than 0.2 volt with the key ON and engine OFF or running, indicates a hard fault.
P0406 - DPF EGR Sensor Circuit High Voltage Detected	The EGR monitor checks the DPF EGR sensor signal to the PCM for high voltage. The test fails when the average voltage to the PCM goes to a voltage greater than the maximum calibrated value.	• DPF EGR circuit open • VREF short to PWR • Damaged DPF EGR sensor • DPFEGR circuit short to PWR • SIG RTN circuit open • Damaged PCM	A DPF EGR PID reading greater than 4.5 volts with the key ON and engine OFF or running, indicates a hard fault.
P0411 - Secondary Air Injection (AIR) system upstream flow	The secondary air injection system does not detect the presence of air in the exhaust when introduced by the secondary air injection system	• AIR bypass solenoid - circuit open • AIR bypass solenoid - leaking/blocked or stuck open/closed • Electric AIR Pump - no/low air flow • AIR diverter valve - leaking/blocked or stuck open/closed • AIR air hoses - restricted or leaking • AIR vacuum hoses - restricted or leaking	In order to test the AIR pump, it must be capable of driving the HO2S lean. A single electrical circuit open such as an AIR bypass solenoid in this multi-component circuit will not be detected by a PCM output driver circuit yet it will create DTC P0411.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0412 - Secondary Air Injection System (AIR) circuit malfunction	On the primary side of the AIR relay, the AIR command circuit, open and short circuit faults are detected during normal operation by the PCM output driver.	• Short to power or ground in AIR command circuit • Open in AIR command circuit • AIR bypass solenoid fault • AIR relay fault • Damaged PCM	A single open AIR component, solenoid or relay on this multi-component circuit will not be detected by a PCM output driver circuit yet it will generate DTC a solenoid open - P0411 or relay open - P2257 respectively. For intermittent faults consider using AIR PCM output driver fault PID AIRF with a harness wiggle test with the AIR PCM output driver in OFF and ON states. The AIR PCM output driver fault PID AIRF will instantly detect open circuits and short-to-grounds with the PCM output driver OFF. The AIR PCM output driver fault PID AIRF will instantly detect short-to-power or low resistance load with the PCM output driver ON. Use OTM or OSC to toggle the PCM output driver from OFF to ON. (REFER to Section 2, OTM)

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0420 - Catalyst System Efficiency Below Threshold (Bank 1)	Indicates Bank 1 catalyst system efficiency is below the acceptable threshold	• Use of leaded fuel • Damaged HO2S • Malfunctioning engine coolant temperature sensor • High Fuel Pressure • Damaged exhaust manifold • Damaged catalytic converter • Oil contamination • Cylinder misfiring • Downstream HO2S wires improperly connected • Damaged exhaust system pipe • Damaged muffler/tailpipe assembly • Retarded spark timing	Compare HO2S upstream HO2S11 and downstream HO2S12 switch rate and amplitude. Under normal closed loop fuel conditions, high efficiency catalysts have oxygen storage which makes the switching frequency of the downstream HO2S very slow and reduces the amplitude of those switches as compared to the upstream HO2S. As catalyst efficiency deteriorates, its ability to store oxygen declines and the downstream HO2S signal begins to switch more rapidly with increase amplitude, approaching the switching rate and amplitude of the upstream HO2S. Once beyond an acceptable limit the DTC is set.
P0430 - Catalyst System Efficiency Below Threshold (Bank 2)	Indicates Bank 2 catalyst system efficiency is below the acceptable threshold.	See possible causes for DTC P0420	Compare HO2S upstream (HO2S21) and downstream (HO2S22) switch rate and amplitude. Under normal closed loop fuel conditions, high efficiency catalysts have oxygen storage which makes the switching frequency of the downstream HO2S very slow and reduces the amplitude of those switches as compared to the upstream HO2S. As catalyst efficiency deteriorates, its ability to store oxygen declines and the downstream HO2S signal begins to switch more rapidly with increase amplitude, approaching the switching rate and amplitude of the upstream HO2S. Once beyond an acceptable limit the DTC is set.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0442 - EVAP Control System Leak Detected (Small Leak)	The PCM monitors the complete EVAP control system for presence of a small fuel vapor leak. The system failure occurs when a fuel vapor leak from an opening as small as 1.016 mm (0.04 inch) is detected by the EVAP running loss monitor test.	• After-market EVAP hardware (such as fuel filler cap) non-conforming to required specifications • Small holes or cuts in fuel vapor hoses/tubes • Canister vent solenoid stays partially open on closed command • Damaged, missing or loosely installed fuel filler cap • Loose fuel vapor hose/tube connections to EVAP system components • EVAP system component seals leaking (EVAP canister purge valve, fuel tank pressure sensor, canister vent solenoid, fuel vapor control valve tube assembly or fuel vapor vent valve assembly)	
P0443 - EVAP Control System Canister Purge Valve Circuit Malfunction	The PCM monitors the state of the EVAP canister purge valve circuit output driver. The test fails when the signal moves outside the minimum or maximum limit for the commanded state.	• VPWR circuit open • EVAP canister purge valve circuit shorted to GND • Damaged EVAP canister purge valve • EVAP canister purge valve circuit open • EVAP canister purge valve circuit shorted to VPWR • Damaged PCM	To verify normal function, monitor the EVAP canister purge valve signal PID EVAPPDC (or EVMV for electronic valve) and the signal voltage (PCM control side). With the valve closed, EVAPPDC will indicate 0 percent duty cycle (0 mA for EVMV) and the voltage approximately equal to battery voltage. When the valve is commanded fully open, EVAPPDC will indicate 100 percent duty cycle (1000mA for EVMV) and a voltage drop of 3 volts minimum is normal. Output test mode may be used to switch output ON/OFF to verify function.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0446 - EVAP Control System Canister Vent Solenoid Circuit Malfunction	Monitors the canister vent (CV) solenoid circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified canister vent duty cycle by PCM command.	• VPWR circuit open • CV solenoid circuit shorted to PWR GND or CHASSIS GND • Damaged CV solenoid • CV solenoid circuit open • CV solenoid circuit shorted to VPWR • Damaged PCM	To verify normal function, monitor the EVAP canister vent solenoid signal PID EVAPCV and the signal voltage (PCM control side). With the valve open, EVAPCV will indicate 0 percent duty cycle and the voltage approximately equal to battery voltage. When the valve is commanded fully closed, EVAPCV will indicate 100% duty cycle and a voltage drop of 4 volts minimum is normal. Output test mode may be used to switch output ON/OFF to verify function.
P0451 - EVAP System FTP Sensor Range/Performance/Intermittent	Note: Starting on some 2004 applications, DTC P0451 will be set for FTP sensor range (offset) fault. DTC P0454 will replace the original P0451 for intermittent (noisy) sensor faults. Until the phase in process is complete, noisy or offset FTP sensor faults may set a P0451. • The fuel tank pressure changes greater than 14 inches of water in 0.10 seconds. • FTP sensor output is offset by + /- 1.7 inches H2O	• Intermittent open or short in the FTP sensor or the FTP sensor signal. • Contaminated or damaged sensor. • PCM damaged	• Monitor FTP PID and does it change from above 15 inches of water to below a minus (-) 15 inches of water often in 1.0 minute. • With the FTP sensor at atmospheric pressure, the FTP PID will normally indicate 0 inches of H2O. Look for a minimum reading of plus or minus 1.7 inches of water as an indication of an offset condition.
P0452 - FTP Sensor Circuit Low Voltage Detected	The PCM monitors the EVAP control system FTP sensor input signal to the PCM. The test fails when the signal average drops below a minimum allowable calibrated parameter.	• Contamination internal to FTP sensor connector • Damaged PCM • FTP circuit shorted to GND or SIG RTN • Damaged FTP sensor	FTP V PID reading less than 0.22 volt with key ON and engine OFF or during any engine operating mode indicates a hard fault.
P0453 - FTP Sensor Circuit High Voltage Detected	The PCM monitors the EVAP control system FTP sensor input signal to the PCM. The test fails when the signal average jumps above a minimum allowable calibrated parameter.	• FTP circuit open • VREF shorted to VPWR • Damaged PCM • FTP circuit shorted to VREF or VPWR • SIG RTN circuit open • Damaged FTP sensor	FTP V PID reading greater than 4.50 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0454 - FTP Sensor Circuit Noisy	The fuel tank pressure changes greater than 14 inches of water in 0.10 seconds.	• Intermittent open or short in the FTP sensor or the FTP sensor signal. • Contaminated or damaged sensor.	Monitor FTP PID and does it change from above 15 inches of water to below a minus (-) 15 inches of water often in 1.0 minute.
P0455 - EVAP Control System Leak Detected (No Purge Flow or Large Leak)	The PCM monitors the complete EVAP control system for no purge flow, the presence of a large fuel vapor leak or multiple small fuel vapor leaks. The system failure occurs when no purge flow (attributed to fuel vapor blockages or restrictions), a large fuel vapor leak or multiple fuel vapor leaks are detected by the EVAP running loss monitor test with the engine running (but not at idle).	• After-market EVAP hardware (such as fuel filler cap) non-conforming to required specifications • Disconnected or cracked fuel EVAP canister tube, EVAP canister purge outlet tube or EVAP return tube • EVAP canister purge valve stuck closed • Damaged EVAP canister • Damaged or missing fuel filler cap • Insufficient fuel filler cap installation • Loose fuel vapor hose/tube connections to EVAP system components • Blockages or restrictions in fuel vapor hoses/tubes (items also listed under disconnections or cracks) • Fuel vapor control valve tube assembly or fuel vapor vent valve assembly blocked • Canister vent (CV) solenoid stuck open • Mechanically inoperative fuel tank pressure (FTP) sensor	Check for audible vacuum noise or significant fuel odor in the engine compartment or near the EVAP canister and fuel tank.
P0456 - EVAP Control System Leak Detected (Very Small Leak)	The PCM monitors the complete EVAP control system for the presence of a very small fuel vapor leak. The system failure occurs when a fuel vapor leak from an opening as small as 0.508 mm (0.020 inch) is detected by the EVAP running loss monitor test.	• Very small holes or cuts in fuel vapor hoses/tubes. • Loose fuel vapor hose/tube connections to EVAP system components. • EVAP system component seals leaking (refer to Possible Causes under DTC P0442).	

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0457 - EVAP Control System Leak Detected (Fuel Filler Cap Loose/Off)	A fuel tank pressure change less than a minus (-) 7 inches of water in 30 seconds has occurred after refueling; or there is excessive purge (fuel vapor) flow greater than 0.06 pounds per minute.	• Fuel filler cap not installed on refueling (storing continuous memory DTC) and "Check Fuel Cap" light may also be illuminated. • Damaged, missing or loosely installed fuel filler cap	Check for missing fuel filler cap or integrity of the cap. If OK, clear continuous memory DTCs and re-initiate EVAP Emission Running Loss Monitor Drive Cycle.
P0460 - Fuel Level Sensor Circuit Malfunction	The PCM monitors the fuel level input (FLI) circuit for electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified fuel fill percentage in the fuel tank.	• Empty fuel tank • Fuel pump (FP) module concern • Incorrectly installed fuel gauge • Damaged instrument cluster • CASE GND circuit open • FLI shorted to VPWR • Overfilled fuel tank • Damaged fuel gauge • FLI circuit open • FLI circuit shorted to CASE GND or PWR GND • CSE GND shorted to VPWR • Damaged PCM	Monitor FLI PID and FLI V PID in key ON engine RUNNING. FLI PID at 25% fill (with non matching fuel gauge) and FLI V PID less than 0.90 volts r FLI PID at 75% fill (with non matching fuel gauge) and FLI V PID greater than 2.45 volts] indicates a hard fault.
P0461 - Fuel Level Sensor Circuit Range/Performance	Excessive electrical noise	Fuel level sensor circuit intermittent FLI signal line open circuit	
P0462 - Fuel level sensor circuit low input	The PCM monitors the fuel level input (FLI) circuit for electrical failure. The test fails when the signal moves below the minimum allowable calibrated parameter for a specified fuel fill percentage in the fuel tank.	• Empty fuel tank • Fuel pump (FP) module concern • Incorrectly installed fuel gauge • Damaged instrument cluster • Damaged fuel gauge • FLI circuit open • FLI circuit shorted to CASE GND or PWR GND • Damaged PCM	Monitor FLI PID and FLI V PID in key ON engine RUNNING. FLI PID at 25% fill (with non matching fuel gauge) and FLI V PID less than 0.90 volts r FLI PID at 75% fill (with non matching fuel gauge) and FLI V PID greater than 2.45 volts] indicates a hard fault.
P0463 - Fuel level sensor circuit high input	The PCM monitors the fuel level input (FLI) circuit for electrical failure. The test fails when the signal moves above the maximum allowable calibrated parameter for a specified fuel fill percentage in the fuel tank.	• Fuel pump (FP) module concern • Incorrectly installed fuel gauge • Damaged instrument cluster • FLI shorted to VPWR • CASE GND circuit open • Overfilled fuel tank • Damaged fuel gauge • Damaged PCM	Monitor FLI PID and FLI V PID in key ON engine RUNNING. FLI PID at 25% fill (with non matching fuel gauge) and FLI V PID less than 0.90 volts r FLI PID at 75% fill (with non matching fuel gauge) and FLI V PID greater than 2.45 volts] indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0480 - Low Fan Control (LFC)/Fan Control 1 (FC1) Primary Circuit Malfunction Relay controlled electric cooling fan	Monitors the low fan control (LFC) (fan control for one speed fan application) primary circuit output from the PCM. The test fails if: When the PCM grounds the LFC/FC circuit, excessive current draw is detected on the LFC/FC circuit; or with the LFC/FC circuit not grounded by the PCM, voltage is not detected on the LFC/FC circuit (the PCM expects to detect VPWR voltage coming through the low speed FC relay coil to the LFC/FC circuit).	• Open or shorted LFC/FC circuit • Open VPWR circuit to low speed FC relay • Damaged low speed FC relay (or CCRM) • PCM damaged	• When the LFCF PID reads YES, a fault is currently present • During KOEO and KOER Self-Test, the LFC/FC circuit will be cycled on and off • A short to power can only be detected when the PCM is grounding the LFC/FC circuit. • During KOEO and KOER Self-Test, the LFC/FC circuit will be cycled on and off
P0480 - Cooling Fan Electrical Malfunction Variable Speed Electric Cooling Fan	This test checks the Fan Control - Variable (FCV) output circuit. The DTC sets if the PCM detects that the voltage on the FCV circuit is not within the expected range.	• FCV circuit open or shorted. • B+ or ground circuit fault to cooling fan. • VPWR open to cooling fan (if applicable). • Damaged cooling fan module. • PCM damaged	During KOEO Self-Test, the cooling fan will be cycled on and off.
P0481 - High Fan Control (HFC)/Fan Control 3 (FC3) Primary Circuit Malfunction	Monitors the high fan control (HFC) primary circuit output from the PCM. The test fails if: With the HFC output commanded on (grounded), excessive current draw is detected on the HFC circuit; or with the HFC circuit commanded off, voltage is not detected on the HFC circuit (the PCM expects to detect VPWR voltage coming through the high speed FC relay coil to the HFC circuit).	• Open or shorted HFC circuit • Open VPWR circuit to high speed FC relay • Damaged high speed FC relay (or CCRM) • Damaged PCM	• When the HFCF PID reads YES, a fault is currently present • An open circuit or short to ground can only be detected when the PCM is not grounding the HFC circuit • A short to power can only be detected when the PCM is grounding the HFC circuit. • During KOEO and KOER Self-Test, the HFC circuit will be cycled on and off

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0482 - Medium Fan Control (MFC) Primary Circuit Failure	Monitors the medium fan control (MFC) primary circuit output from the PCM. The test fails if: With the MFC output commanded on (grounded), excessive current draw is detected on the MFC circuit; or with the MFC circuit commanded off, voltage is not detected on the MFC circuit (the PCM expects to detect IGN START/RUN voltage coming through the medium speed FC relay coil to the MFC circuit).	• Open or shorted MFC circuit • Open IGN START/RUN circuit to medium speed FC relay • Damaged medium speed FC relay • Damaged PCM	• When the MFCF PID reads YES, a fault is currently present • An open circuit or short to ground can only be detected when the PCM is not grounding the MFC circuit • A short to power can only be detected when the PCM is grounding the MFC circuit. • During KOEO and KOER Self-Test, the MFC circuit will be cycled on and off • Using Output Test Mode on scan tool, when commanding the low speed fan on, the PCM will also activate the medium speed fan output.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0500 - Vehicle Speed Sensor (VSS) Malfunction	Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. Vehicle speed data is received from either the vehicle speed sensor (VSS), transfer case speed sensor (TCSS) or anti-lock brake system (ABS) control module. If the engine rpm is above the torque converter stall speed (automatic transmission) and engine load is high, it can be inferred that the vehicle must be moving. If there is insufficient vehicle speed data input, a malfunction is indicated and a DTC is set. On most vehicle applications the malfunction indicator lamp (MIL) will be triggered when this DTC is set.	• Open in VSS+/VSS- harness circuit. • Open in TCSS signal or TCSS signal return harness circuit. • Short to GND in VSS harness circuit. • Short to GND in TCSS harness circuit. • Short to PWR in VSS harness circuit. • Short to PWR in TCSS harness circuit. • Damage drive mechanism for VSS or TCSS. • Damaged VSS or TCSS. • Damaged wheel speed sensors. • Damaged wheel speed sensor harness circuits. • Damage in module(s) connected to VSC/VSS circuit. • Open or short in vehicle speed circuit VSS signal between ABS VSS signal output and VSS signal inputs to PCM and other models - Excursion and F Series Super Duty only.	Monitor VSS PID while driving vehicle. This DTC is set when the PCM detects a sudden loss of vehicle speed signal over a period of time. If vehicle speed data is lost, check the source of where the vehicle speed input originates from: VSS, TCSS or ABS. Note: On some MSOF applications, VSS and TCSS PID can be monitor. However if no TCSS PID is available and VSS PID is zero, TCSS circuitry frequency must be checked for loss of sensor signal. If another vehicle electronic module has generated the P0500 and the vehicle does not receive its vehicle speed input from one of the above mention sources (VSS, TCSS or ABS). Check the PCM for Output Shaft Speed Sensor (OSS) DTCs. On OSS applications the PCM uses the OSS to calculated the vehicle speed. If no OSS DTCs are found check for correct PCM configuration. Check PCM configuration for correct tire size and axle ratio.
P0501 - Vehicle Speed Sensor (VSS) Range/ Performance	Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. This DTC is set the same way as P0500, however the malfunction indicator lamp (MIL) is not triggered.	• Refer to possible causes for P0500.	Refer to diagnostic aids for P0500.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0503 - Vehicle Speed Sensor (VSS) Intermittent	Indicates poor or noisy VSS performance. Vehicle speed data is received from either the vehicle speed sensor (VSS), transfer case speed sensor (TCSS) or anti-lock brake system (ABS) control module.	• Noisy VSS/TCSS input signal from Radio Frequency Interference/ Electro-Magnetic Interference (RFI/EMI) external sources such as ignition components or charging circuit. • Damaged VSS or driven gears. • Damaged TCSS. • Damaged wiring harness or connectors. • Malfunction in module(s) or circuit connected to VSS/TCSS circuit. • After market add-on.	Monitor VSS PID while driving vehicle, check for intermittent vehicle speed indication. Verify ignition and charging system are functioning correctly.
P0505 - Idle Air Control System Malfunction	The PCM attempts to control engine speed during KOER self-test. The test fails when the desired rpm could not be reached or controlled during the self-test.	• IAC circuit open • VPWR to IAC solenoid open • IAC circuit shorted to PWR • Air inlet is plugged • Damaged IAC valve • Damaged PCM	The IAC solenoid resistance is from 6 to 13 ohms. Monitor IAC PID duty cycle and/or voltage.
P0506 - Idle Air Control System RPM lower than expected	The PCM attempts to control engine speed during KOER self-test. The test fails when the desired rpm could not be reached or controlled during the self-test.	• IAC circuit shorted to PWR • VPWR to IAC solenoid open • IAC circuit open • Damaged IAC valve • Damaged PCM • Air inlet is plugged	The IAC solenoid resistance is from 6 to 13 ohms. Monitor IAC PID duty cycle and/or voltage.
P0507 - Idle Air Control System RPM higher than expected	The PCM attempts to control engine speed during KOER self-test. The test fails when the desired rpm could not be reached or controlled during the self-test.	• IAC circuit shorted to ground • Damaged IAC valve • Damaged PCM • Air intake leak after throttle body	The IAC solenoid resistance is from 6 to 13 ohms. Monitor IAC PID duty cycle and/or voltage.
P0511 - Idle Air Control Circuit Malfunction	The PCM attempts to control engine speed during KOER self-test. The test fails when the desired rpm could not be reached or controlled during the self-test.	• IAC circuit open • VPWR to IAC solenoid open • IAC circuit shorted to PWR • Damaged IAC valve • Damaged PCM	The IAC solenoid resistance is from 6 to 13 ohms. Monitor IAC PID duty cycle and/or voltage.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0532 - Air Conditioning Pressure Sensor (ACP) Sensor High Voltage Detected	ACP inputs a voltage to the PCM. If the voltage is above a calibrated level the DTC will set.	• ACP sensor circuit short to PWR • ACP circuit open • Damaged PCM • ACP circuit short to VREF • ACP circuit short to SIGRTN • Damaged ACP sensor	Verify VREF voltage between 4.0 and 6.0V.
P0533 - Air Conditioning Pressure Sensor (ACP) Sensor Low Voltage Detected	ACP inputs a voltage to the PCM. If the voltage is below the calibrated level the DTC will set.	• ACP circuit short to GND or SIGRTN • VREF circuit open • Damaged PCM • Open ACP circuit • Damaged ACP sensor	Verify VREF voltage between 4.0 and 6.0V.
P0534 - Low A/C cycling period	Indicates frequent A/C compressor clutch cycling.	• Mechanical A/C system concern (such as low refrigerant charge, damaged A/C cycling switch) • Intermittent open between the cycling pressure switch and the PCM • Intermittent open in IGN RUN circuit to cycling pressure switch (if applicable)	• An intermittent open circuit, although possible, is unlikely • This test was designed to protect the transmission. In some strategies, the PCM will unlock the torque converter during A/C clutch engagement. If a concern is present that results in frequent A/C clutch cycling, damage could occur if the torque converter was cycled at these intervals. This test will detect this condition, set the DTC and prevent the torque converter from excessive cycling.
P0537 - A/C Evaporator Temperature (ACET) Circuit Low Input	Indicates the ACET signal input was less than Self-Test minimum. Self-Test minimum is 0.13 volts.	• ACET circuit short to ground or SIG RTN • Damaged ACET sensor • Damaged PCM	The PCM sources a low current 5 volts on the ACET circuit (this voltage can be measured with the sensor disconnected). As A/C evaporator air temperature changes, the ACET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the ACET signal is detected below the Self-Test minimum, check for shorts to SIG RTN or ground, which would pull the voltage low.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0538 - A/C Evaporator Temperature (ACET) Circuit High Input	Indicates the ACET signal input was greater than Self-Test minimum. Self-Test maximum is 4.5 volts.	• ACET circuit open • SIG RTN circuit open to ACET sensor • ACET circuit short to power (VREF) • Damaged ACET sensor • Damaged PCM	The PCM sources a low current 5 volts on the ACET circuit (this voltage can be measured with the sensor disconnected). As A/C evaporator air temperature changes, the ACET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the ACET signal is detected above the Self-Test maximum, check for open cirucits (ACET or SIG RTN), which would cause the voltage to remain high. Although not as probable, also check for a short to power (VREF).
P0552 - Power Steering Pressure (PSP) Sensor Circuit Low Input	Indicates the PSP sensor input signal was less than Self-Test minimum.	• PSP sensor damaged • SIG RTN circuit open or shorted • VREF circuit open or shorted • PSP sensor signal circuit open or shorted • Damaged PCM	View PSP PID to monitor the PSP input.
P0553 - Power Steering Pressure (PSP) Sensor Circuit High Input	Indicates the PSP sensor input signal was greater than Self-Test maximum.	• PSP sensor damaged • SIG RTN circuit shorted to power • VREF circuit shorted to power • PSP sensor signal circuit shorted to power • Damaged PCM	View PSP PID to monitor the PSP input.
P0602 - Control Module Programming Error	This Diagnostic Trouble Code (DTC) indicates programming error within Vehicle ID block (VID).	• VID data corrupted by the scan tool during VID reprogramming	Using the scan tool, reprogram the VID block. If PCM does not allow reprogramming of the VID block, reflashing PCM will be required.
P0603 - Powertrain Control Module Keep Alive Memory (KAM) Error	Indicates the PCM has experienced an internal memory fault. However there are external items that can cause this DTC.	• Reprogramming • Battery terminal corrosion • KAPWR to PCM interrupt/open • Loose battery connection • Damaged PCM	If KAPWR is interrupted to the PCM because of a battery or PCM disconnect, DTC can be generated on the first power-up.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0605 - PCM read only memory (ROM) error	The PCM ROM has been corrupted.	• An attempt was made to change the calibration • Module programming error • Physically damaged PCM	• Reprogram or update calibration • Reprogram VID block (use as built data) • Check for other DTC's or drive symptoms for further action
P0606 - Powertrain Control Module Internal Communication error	P0606 indicates register readback (PCM internal Communications) error.	• PCM damaged or defective	Internal PCM failure replace PCM For Electronic Throttle Control applications, can indicate an Internal PCM failure, or an ETC system FMEM condition exists. Repairing the other DTCS can fix the P0606.
P0620 - Generator Control Circuit Failure	The PCM reads the I-Line (or the ALF) and sends a DTC through the network when the I-Line (or ALF) indicates a fault.	• ILC circuit short to GND • ILC circuit short to B+ • ILC circuit open • ALF circuit short to GND • ALF circuit short to B+ • B+ circuit open • Generator drive mechanism • Damaged generator/regulator assembly • Damaged PCM	Verify battery voltage is 14.5V. Verify generator/regulator has the correct part number.
P0622 - Generator Field Terminal Circuit Failure	The PCM monitors generator load from the generator/regulator in the form of frequency. The frequency range is determined by the temperature of the voltage regulator, where 97 percent indicates full load, below 6 percent indicates no load.	• GEN-MON circuit short to GND • GEN-MON circuit short to B+ • GEN-MON circuit open • GEN-COM circuit short to GND • GEN-COM circuit short to B+ • GEN-COM circuit open • ILC circuit short to GND • ILC circuit short to B+ • ILC circuit open • ALI circuit short to GND • ALI circuit short to B+ • ALI circuit open • Battery-sense circuit open • Generator drive mechanism • Damaged generator/regulator assembly • Damaged PCM	Verify battery voltage is 14.5V. Verify generator/regulator has the correct part number.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0645	Monitors the wide open throttle A/C cutoff (WAC) circuit output from the PCM. The test fails if: When the PCM grounds the WAC circuit, excessive current draw is detected on the WAC circuit; or with the WAC circuit not grounded by the PCM, voltage is not detected on the WAC circuit (the PCM expects to detect VPWR voltage coming through the WAC relay coil to the WAC circuit).	• Open or shorted WAC circuit • Damaged WAC relay (or CCRM) • Open VPWR circuit to WAC relay • Damaged PCM	• The A/CCR control circuit can be monitored using the WACF & WAC PID • When the WACF PID reads YES, a fault is currently present • An open circuit or short to ground can only be detected when the PCM is not grounding the circuit • A short to power can only be detected when the PCM is grounding the circuit • During KOEO and KOER self-test, the WAC circuit will be cycled ON and OFF • Verify A/C and defrost were OFF during KOEO and KOER self-test (Check ACCS PID to verify) • If vehicle is not equipped with A/C, DTC P1460 can be ignored
P0660 - Intake Manifold Tuning Valve Control Circuit / Open - Bank 1	The IMTV system is monitored for failure during continuous, key ON engine OFF or key ON engine running self-test. The test fails when the signal on the monitor pin is more or less than an the expected calibrated range.	• IMTV signal circuit open, shorted to PWR GND or SIG RTN • Damaged IMTV actuator • Damaged PCM	An IMTVM PID reading may indicate a fault if available
P0663 - Intake Manifold Tuning Valve Control Circuit / Open - Bank 2	The IMTV system is monitored for failure during continuous, key ON engine OFF or key ON engine running self-test. The test fails when the signal on the monitor pin is more or less than an the expected calibrated range.	• IMTV signal circuit open, shorted to PWR GND or SIG RTN • Damaged IMTV actuator • Damaged PCM	An IMTVM PID reading may indicate a fault if available

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P0703 - Brake Switch Circuit Input Malfunction	Indicates PCM did not receive a brake pedal position (BPP) input.	• Open or short in BPP circuit • Open or short in stoplamp circuits • Damaged PCM • Malfunction in module(s) connected to BPP circuit. (Rear Electronic Module Freestar/Monterey, LS6/LS8 and Thunderbird or Lighting Control Module (LCM) for Town Car) • Damaged brake switch • Misadjusted brake switch	Check for proper function of stoplamps. Using the scan tool, check BPP PID. Stoplamps and PID should toggle on and off with brake pedal activation.
P0704 - Clutch Pedal Position Switch Malfunction	When the clutch pedal is depressed the voltage goes to low. If the PCM does not see this change from high to low the DTC is set.	• CPP circuit short to PWR • Damaged CPP switch • CPP circuit open in the SIGRTN • Damaged PCM	When depressing the CPP switch the voltage should cycle from 5.0V down.
P0720 - Insufficient input from Output Shaft Speed sensor	The output shaft speed sensor inputs a signal to the PCM, based on the speed of the output shaft of the transmission. The PCM compares this signal with the signal of the VSS or TCSS and determines correct tire size and axle gear ratio.	• OSS sensor circuit short to GND • OSS sensor circuit short to PWR • OSS sensor circuit open • Damaged OSS sensor • Damaged PCM	Verify sensor signal output varies with vehicle speed.
P0721 - Noise interference on Output Shaft Speed sensor signal	The output shaft speed sensor signal is very sensitive to noise. This noise distorts the input to the PCM.	• Wiring misrouted • After market add-on • Wiring damaged • Wiring insulation wear	• Check routing of harness. • Check wiring and connector for damage.
P0722 - No signal from Output Shaft Speed sensor	The output shaft speed sensor failed to provide a signal to the PCM upon initial movement of vehicle.	• Damaged OSS connector • Damaged OSS sensor, or not installed properly • Harness intermittently shorted or open	
P0723 - Output Shaft Speed sensor circuit intermittent failure	The output shaft speed sensor signal to the PCM is irregular or interrupted.	• Harness connector not properly seated • Harness intermittently shorted, or open • Harness connector damaged • OSS sensor damaged, or not installed properly	• Verify harness and connector integrity • Verify OSS sensor proper installation

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1000 - OBD (On Board Diagnostic) System Readiness Test Not Complete	The OBD monitors are performed during the OBD Drive Cycle. The P1000 will be stored in continuous memory if any of the OBD monitors do not complete their full diagnostic check.	• Vehicle is new from the factory • Battery or PCM had recently been disconnected • An OBD monitor failure had occurred before completion of an OBD drive cycle • PCM DTCs have recently been cleared with a scan tool • PTO circuit is shorted to VPWR or B+ or PTO is on during testing	The Ford P1000, inspection/maintenance (I/M) readiness function is part of the PCM strategy. A battery disconnection or clearing codes using a scan tool results in the various I/M readiness bits being set to a "not-ready" condition. As each non-continuous OBD monitor completes a full diagnostic check, the I/M readiness bit associated with that monitor is set to a "ready" condition. This may take 1 or 2 drive cycles based on whether malfunctions are detected or not. The readiness bits for comprehensive component monitoring, misfire and fuel system monitoring are considered complete once all the non-continuous monitors have been evaluated. Because the EVAP system monitor requires certain ambient conditions to run, special logic can "bypass" the monitor for purpose of clearing the EVAP system I/M readiness bit due to continued presence of these extreme conditions. Note: The P1000 does not need to be cleared from the PCM except to pass an I/M test.
P1001 - KOER Not Able To Complete, KOER Aborted	This Non-MIL (Malfunction Indicator Lamp) code will be set when Key On Engine Running (KOER) Self-Test does not complete in the time intended.	• Incorrect Self-Test Procedure. • Unexpected response from Self-Test monitors. • RPM out of specification.	Rerun Self-Test following QT1 in Section 3, Symptom Charts, STEP 1: PCM Quick Test.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1100 - Mass Air Flow (MAF) Sensor Intermittent	The MAF sensor circuit is monitored by the PCM for sudden voltage (or air flow) input change through the comprehensive component monitor (CCM). If during the last 40 warm-up cycles in key ON engine running the PCM detects a voltage (or air flow) change beyond the minimum or maximum calibrated limit, a continuous memory diagnostic trouble code (DTC) is stored.	• Poor continuity through the MAF sensor connectors • Poor continuity through the MAF sensor harness • Intermittent open or short inside the MAF sensor.	While accessing the MAF V PID on the scan tool, lightly tap on the MAF sensor or wiggle the MAF sensor connector and harness. If the MAF V PID suddenly changes below 0.23 volt or above 4.60 volts, an intermittent fault is indicated.
P1101 - Mass Air Flow (MAF) Sensor Out of Self-Test Range	The MAF sensor circuit is monitored by the PCM for an out of range air flow (or voltage) input. If during key ON engine OFF the air flow voltage signal is greater than 0.27 volts the test fails. Likewise, if during key ON engine running, an air flow voltage signal is not within 0.46 volt to 2.44 volts, the test fails.	• Low battery charge • MAF sensor partially connected • MAF sensor contamination • PWR GND open to MAF sensor • MAF RTN circuit open to PCM • Damaged MAF sensor • Damaged PCM	A MAF V PID reading greater than 0.27 volts (KOEO) or a MAF V PID reading outside the 0.46 volt to 2.44 volts range (KOER) indicates a hard fault.
P1112 - Intake Air Temperature Circuit Intermittent	Indicates IAT sensor signal was intermittent during the comprehensive component monitor.	• Damaged harness • Damaged sensor • Damaged harness connector • Damaged PCM	Monitor IAT on scan tool, look for sudden changes in reading when harness is wiggled or sensor is tapped.
P1114 - Intake Air Temperature 2 (IAT2) Circuit Low Input	Indicates the sensor signal is less than Self-Test minimum. The IAT2 sensor minimum is 0.2 volts.	• Grounded circuit in harness • Improper harness connection • Damaged sensor • Damaged PCM	Monitor IAT2 PID. Typical IAT2 temperature should be greater than IAT1. REFER to Section 6: Reference Values for ranges.
P1115 - Intake Air Temperature 2 (IAT2) Circuit High Input	Indicates the sensor signal is greater than Self-Test maximum. The IAT2 sensor maximum is 4.6 volts.	• Open circuit in harness • Sensor signal short to power • Improper harness connection • Damaged sensor • Damaged PCM	Monitor IAT2 PID. Typical IAT2 temperature should be greater than IAT1. REFER to Section 6: Reference Valves for ranges.
P1116 - Engine Coolant Temperature (ECT) Sensor Out of Self-Test Range	Indicates the ECT sensor is out of Self-Test range. Correct range is 0.3 to 3.7 volts.	• Overheating condition • Malfunctioning thermostat • Damaged ECT sensor • Low engine coolant • Damaged harness connector • Damaged PCM	Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 82°C (180°F) to pass the KOER Self-Test.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1117 - Engine Coolant Temperature (ECT) Sensor Intermittent	Indicates ECT circuit became intermittently open or shorted while engine was running. Note on some vehicles that are not equipped with an ECT sensor, CHT can be used and can set this DTC.	• Damaged harness • Damaged sensor • Damaged PCM • Damaged harness connector • Low engine coolant	Monitor ECT or CHT on scan tool, look for sudden changes in reading when harness is wiggled or sensor is tapped.
P1120 - Throttle Position (TP) Sensor Out of Range Low (RATCH too Low)	The TP sensor circuit is monitored by the PCM for a low TP rotation angle (or voltage) input below the closed throttle position through the comprehensive component monitor (CCM). If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) remains within the calibrated self-test range but falls between 3.42 and 9.85 percent (0.17 and 0.49 volt), the test fails.	• TP circuit with frayed wires • Corrosion on TP circuit connectors • VREF open to TP sensor • VREF short to SIG RTN • TP sensor loose pins	A TP PID (TP V PID) between 3.42 and 9.85 percent (0.17 and 0.49 volt) in key ON engine OFF, continuous memory or key ON engine running indicates a hard fault.
P1121 - Throttle Position (TP) Sensor Inconsistent with MAF Sensor	The PCM monitors a vehicle operation rationality check by comparing sensed throttle position to mass air flow readings. If during key ON engine running self-test the comparison of the TP sensor and MAF sensor readings are not consistent with calibrated load values, the test fails and a diagnostic trouble code is stored in continuous memory.	• Air leak between MAF sensor and throttle body • TP sensor not seated properly • Damaged TP sensor • Damaged MAF sensor	Drive vehicle and exercise throttle and TP sensor in all gears. A TP PID (TP V PID) less than 4.82 percent (0.24 volt) with a LOAD PID greater than 55 percent or a TP PID (TP V PID) greater than 49.05 percent (2.44 volts) with a LOAD PID less than 30 percent indicates a hard fault.
P1124 - Throttle Position (TP) Sensor Out of Self-Test Range	The TP sensor circuit is monitored by the PCM for an out of range TP rotation angle (or voltage) input. If during key ON engine OFF or key ON engine running the TP rotation angle (or voltage) reading is less than 13.27 percent (0.66 volt) or greater than 23.52 percent (1.17 volts), the test fails.	• Binding or bent throttle linkage • TP sensor not seated properly • Throttle plate below closed throttle position • Throttle plate/screw misadjusted • Damaged TP sensor • Damaged PCM	The TP PID (TP V PID) reading not between 13.27 and 23.52 percent (0.66 and 1.17 volts) in key ON engine OFF or key ON engine running indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1125 - Throttle Position (TP) Sensor Intermittent	The TP sensor circuit is monitored by the PCM for sudden TP rotation angle (or voltage) input change through the comprehensive component monitor (CCM). If during the last 80 warm-up cycles in key ON engine running the PCM detects a TP rotation angle (or voltage) changes beyond the minimum or maximum calibrated limit, a continuous diagnostic trouble code (DTC) is stored.	• Poor continuity through the TP sensor connectors • Poor continuity through the TP harness • Intermittent open or short inside the TP sensor	While accessing the TP V PID on the scan tool, lightly tap on the TP sensor or wiggle the TP sensor connector and harness. If the TP V PID suddenly changes below 0.49 volt or above 4.65 volts, an intermittent fault is indicated.
P1127 - Exhaust Not Warm Enough, Downstream Sensor Not Tested	The HEGO monitor uses an exhaust temperature model to determine when the HO2S heaters are cycled ON. The test fails when the inferred exhaust temperature is below a minimum calibrated value.	• Engine not operating long enough prior to performing KOER self-test. • Exhaust system too cool.	Monitor HO2S Heater PIDs to determine their ON/OFF state. DTC P1127 will be present if the exhaust is not hot.
P1128 - Upstream Oxygen Sensors Swapped from Bank to Bank (HO2S-11-21)	The HEGO monitor checks and determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when a response from the HO2S(s) being tested is not indicated.	• Crossed HO2S harness connectors (upstream). • Crossed HO2S wiring at the harness connectors (upstream). • Crossed HO2S wiring at the 104-pin harness connectors (upstream).	
P1129 - Downstream Oxygen Sensors Swapped from Bank to Bank (HO2S-12-22)	The HEGO monitor checks and determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when a response from the HO2S(s) being tested is not indicated.	• Crossed HO2S harness connectors (downstream). • Crossed HO2S wiring at the harness connectors (downstream). • Crossed HO2S wiring at the 104-pin harness connectors (downstream).	

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1130 - Lack of HO2S-11 Switch, Fuel Trim at Limit	The HEGO Sensor is monitored for switching. The test fails when the HO2S fails to switch due to circuit or fuel at or exceeding a calibrated limit.	• Electrical: • Short to VPWR in harness or HO2S • Water in harness connector • Open/Shorted HO2S circuit • Corrosion or poor mating terminals and wiring • Damaged HO2S • Damaged PCM • Fuel System: • Excessive fuel pressure • Leaking/contaminated fuel injectors • Leaking fuel pressure regulator • Low fuel pressure or running out of fuel • Vapor recovery system • Induction System: • Air leaks after the MAF • Vacuum Leaks • PCV system • Improperly seated engine oil dipstick • EGR System: • Leaking gasket • Stuck EGR valve • Leaking diaphragm or EVR • Base Engine: • Oil overfill • Cam Timing • Cylinder compression • Exhaust leaks before or near the HO2S(s)	A fuel control HO2S PID switching across 0.45 volt from 0.2 to 0.9 volt indicates a normal switching HO2S.
P1131 - Lack of HO2S-11 Switch, Sensor Indicates Lean	A HEGO sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	See possible causes for DTC P1130	
P1132 - Lack of HO2S-11 Switch, Sensor Indicates Rich	A HEGO sensor indicating rich at the end of a test is trying to correct for an over-lean condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	See possible causes for DTC P1130	

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1137 - Lack of HO2S-12 Switch, Sensor Indicates Lean	The downstream HO2S sensors are forced rich and lean and monitored by the PCM. The test fails if the PCM does not detect the output of the HO2S in a calibrated amount of time.	• Pinched, shorted, and corroded wiring and pins • Crossed sensor wires • Exhaust leaks • Contaminated or damaged sensor	
P1138 - Lack of HO2S-12 Switch, Sensor Indicates Rich	The downstream HO2S sensors are forced rich and lean and monitored by the PCM. The test fails if the PCM does not detect the output of the HO2S in a calibrated amount of time.	• Pinched, shorted, and corroded wiring and pins • Crossed sensor wires • Exhaust leaks • Contaminated or damaged sensor	
P1150 - Lack of HO2S-21 Switch, Fuel Trim at Limit	See description for DTC P1130	See possible causes for DTC P1130	See diagnostic aids for DTC P1130
P1151 - Lack of HO2S-21 Switch, Sensor Indicates Lean	A HEGO sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when fuel control system no longer detects switching for a calibrated amount of time.	See possible causes for DTC P1130	
P1152 - Lack of HO2S-21 Switch, Sensor Indicates Rich	A HEGO sensor indicating rich at the end of a test is trying to correct for an over-lean condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	See possible causes for DTC P1130	
P1157 - Lack of HO2S-22 Switch, Sensor Indicates Lean	The downstream HO2S sensors are forced rich and lean and monitored by the PCM. The test fails if the PCM does not detect the output of the HO2S in a calibrated amount of time.	• Pinched, shorted, and corroded wiring and pins • Crossed sensor wires • Exhaust leaks • Contaminated or damaged sensor	
P1158 - Lack of HO2S-22 Switch, Sensor Indicates Rich	The downstream HO2S sensors are forced rich and lean and monitored by the PCM. The test fails if the PCM does not detect the output of the HO2S in a calibrated amount of time.	• Pinched, shorted, and corroded wiring and pins • Crossed sensor wires • Exhaust leaks • Contaminated or damaged sensor	
P1168 - Fuel Rail Pressure Sensor in Range But Low	The comprehensive component monitor (CCM) monitors the FRP pressure for acceptable fuel pressure. The test fails when the fuel pressure falls below a calibrated value.	• Low fuel pressure • Damaged FRP sensor • Excessive resistance in circuit • Low or no fuel	• A FRP PID value below 551 kpa (80 psi) indicates a failure • Low or no fuel • A FRP PID value greater than 896 kpa (130 psi) indicates a failure

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1169 - Fuel Rail Pressure (FRP) Sensor in Range But High	The comprehensive component monitor (CCM) monitors the FRP pressure for acceptable fuel pressure. The test fails when the fuel pressure falls below or exceeds a minimum/maximum calibrated value for a calibrated period of time.	• High Fuel Pressure • Low fuel pressure • Damaged FRP sensor • Excessive resistance in circuit	
P1180 - Fuel Delivery System - Low	The PCM receives fuel tank pressure (FTP) information from the natural gas module (NG), which uses the information to infer fuel rail pressure (FRP). The test fails when the inferred pressure is less than a minimum calibrated value.	• Restriction in the fuel line • Plugged fuel filter	
P1181 - Fuel Delivery System - High	The PCM receives fuel tank pressure (FTP) information from the natural gas module (NG), which uses the information to infer fuel rail pressure (FRP). The test fails when the inferred pressure is higher than a maximum calibrated value.	• Fuel pressure regulator	
P1184 - Engine Oil Temperature (EOT) Sensor Out of Self-Test Range	Indicates EOT signal was out of Self-Test range.	• Damaged harness • Damaged sensor • Damaged harness connector • Damaged PCM	Engine should be at operating temperature before running self-test.
P1229 - Supercharger Intercooler Pump (ICP) Pump Not Operating	The ICP DTC will be set when the PCM is calling for the pump to be operating but no current is being detected.	• Pump motor open circuited • Pump relay coil open • Open circuit between relay and pump • Damaged PCM • Pump motor shorted • Open circuit between PCM and relay • Poor pump ground connection	Check for voltage at relay, check fuse in power feed, check ground connection of pump motor, PID reading is on/off.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1232 - Low Speed Fuel Pump Primary Circuit Malfunction	The PCM monitors the low speed fuel pump (LFP) primary circuit output from the PCM. The test fails if: When the LFP circuit is commanded on (grounded), excessive current draw is detected on the LFP circuit; or when the LFP circuit is commanded off, voltage is not detected on the LFP circuit (the PCM expects to detect VPWR voltage coming through the low speed fuel pump relay coil to the LFP circuit).	• Open or shorted low fuel pump (LFP) circuit • Open VPWR to low speed fuel pump relay • Damaged low speed fuel pump relay • Damaged PCM	• An open circuit or short to ground can only be detected with the low speed fuel pump. • A short to power can only be detected with the low speed fuel pump commanded on. • During KOEO and KOER Self-Test, the low speed fuel pump output command will be cycled on and off.
P1233 - Fuel System Disabled or Offline	LS6/LS8 and Thunderbird: • For LS6/LS8 and Thunderbird, DTC indicates the PCM is not receiving the fuel level information on the communication link from the rear electronics module (REM). REFER to Workshop Manual Section 418 for REM (REAR ELECTRONICS MODULE) self-test/diagnostics. All Others: • The PCM monitors the fuel pump monitor (FPM) circuit from the fuel pump driver module (FPDM). With the key on, the FPDM continuously sends a duty cycle signal to the PCM through the FPM circuit. The test fails if the PCM stops receiving the duty cycle signal.	• Inertia fuel shutoff (IFS) switch needs to be reset • Open FPDM ground circuit • Open circuit to FPDM PWR RLY • Open FPDM PWR circuit • Open or shorted FPM circuit (engine should start) • Damaged IFS switch • Damaged FPDM PWR RLY • Damaged FPDM • Damaged PCM • Also for Mustang: • Open B+ circuit to constant control relay module (CCRM) pin 11 • Open ground to CCRM pin 18 • Damaged CCRM	The PCM expects to see one of the following duty cycle signals from the FPDM on the FPM circuit: 1) 50% (500 msec on, 500 msec off), all OK. 2) 25% (250 msec on, 750 msec off), FPDM did not receive a fuel pump (FP) duty cycle command from the PCM, or the duty cycle that was received was invalid. 3) 75% (750 msec ON, 250 OFF), the FPDM has detected a fault in the circuits between the FPDM and the fuel pump.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1235 - Fuel pump control out of range	DTC indicates that the FPDM has detected an invalid or missing FP circuit signal from the PCM. The FPDM will send a message to the PCM through the FPM circuit, indicating that this failure has been detected. The PCM will set the DTC when the message is received. • Note: For LS6/LS8 and Thunderbird, the FPDM functions are incorporated in the Rear Electronics Module (REM). Also, the REM does not use a FPM circuit. Diagnostic information will be sent on the communication link.	• FP circuit open or shorted • ETC system concern (check for ETC DTCs) • Damaged FPDM. • Damaged PCM	• The FPDM sends a 25% duty cycle (250 msec ON, 750 msec OFF) through the FPM circuit to the PCM while the fault is being detected by the FPDM. If the fault is no longer detected, the PDM will return to sending an "all OK" (50% duty cycle) message to the PCM. • For ETC applications, check if ETC DTC P2105 is present. An ETC system concern could cause a P1235, and should be diagnosed first.
P1237 - Fuel Pump Secondary Circuit Malfunction	DTC indicates that the FPDM has detected a fuel pump secondary circuit fault. The FPDM will send a message to the PCM through the FPM circuit, indicating that this failure has been detected. The PCM will set the DTC when the message is received. • Note: For LS6/LS8 and Thunderbird, the FPDM functions are incorporated in the Rear Electronics Module (REM). Also, the REM does not use a FPM circuit. Diagnostic information will be sent on the communication link.	• Open or shorted FP PWR circuit • Open FP RTN circuit to FPDM • Open or shorted circuit in the fuel pump • Locked fuel pump rotor • Damaged FPDM • For LS6/LS8 and Thunderbird, circuits associated with the Fuel Pump relay	• The FPDM sends a 75% duty cycle (750 msec ON, 250 msec OFF) through the FPM circuit to the PCM while the fault is being detected by the FPDM. If the fault is no longer detected, the PCM will return to sending an "all OK" (50% duty cycle) message to the PCM. • The FPDM controls pump speed by supplying a "variable" ground on the RTN circuit.
P1244 - Generator Load Input High	The PCM monitors generator load from the generator/regulator in the form of frequency. The fault indicates the input is lower than the load should be in normal operation. The load input could be high when a battery short to ground exists.	• GEN-MON circuit short to B+ • GEN-COM circuit short to B+ • B+ open prior to start-up • Open GEN-COM prior to start-up • Open I-line prior to start-up • Damaged PCM	• Verify battery voltage is 14.5V. • Verify generator/regulator has the correct part number.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1245 - Generator Load Input Low	The PCM monitors generator load from the generator/regulator in the form of frequency. The fault indicates the input is lower than the load should be in normal operation. The load input could be low when no generator output exists.	• GEN-COM circuit short to GND • GEN-MON circuit short to GND • Open B+ wire during operation • Low system voltage • Broken generator belt • Damaged generator/regulator assembly • Damaged PCM	• Verify battery voltage is 14.5V. • Verify generator/regulator has the correct part number.
P1246 - Generator Load Input Failed	The PCM monitors generator load from the generator/regulator in the form of frequency. The frequency range is determined by the temperature of the voltage regulator, where 97 percent indicates full load, below 6 percent indicates no load.	• GEN-MON circuit short to GND • GEN-MON circuit short to B+ • GEN-MON circuit open • GEN-COM circuit short to GND • GEN-COM circuit short to B+ • GEN-COM circuit open • ILC circuit short to GND • ILC circuit short to B+ • ILC circuit open • Battery-sense circuit open • Generator drive mechanism • Damaged generator/regulator assembly • Damaged PCM	• Verify battery voltage is 14.5V. • Verify generator/regulator has the correct part number.
P1260 - Theft Detected - Vehicle Immobilized	Indicates that the passive anti-theft system (PATS) has determined a theft condition existed and the engine is disabled. This DTC is a good indicator to check the PATS for DTCs.	• Previous theft condition • Anti-Theft System failure	Theft indicator flashing rapidly or on solid when ignition switch is in the ON position. Check anti-theft system for DTCs. Typical vehicle symptoms are: Start/Stall or Crank/No Start. NOTE: No crank symptom only on vehicles equipped with PATS starter disable feature.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1270 - Engine RPM/Vehicle Speed Limiter	Indicates the vehicle has been operated in a manner, which caused the engine or vehicle to exceed a calibration limit. The engine rpm and vehicle speed are continuously monitored and evaluated by the PCM. The DTC is set when the rpm or vehicle speed falls out of a calibrated range. For additional information on the engine rpm/vehicle speed limiter, refer to Section 1, Electronic Engine Control (EC) System, Powertrain Control Software.	• Wheel slippage (water, ice, mud and snow) • Excessive engine rpm in NEUTRAL or operated in the wrong transmission gear • Vehicle driven at a high rate of speed	The DTC indicates the vehicle has been operated in a manner, which caused the engine or vehicle speed to exceed a calibrated limit.
P1285 - Cylinder Head Over Temperature	Indicates an engine overheat condition was sensed by the cylinder head temperature sensor.	• Low engine coolant level • Base engine concerns • Engine cooling system concerns • CHT sensor concern	On some applications when this fault occurs the Engine Temperature warning indicator will illuminate and/or force the temperature gauge to full H (Hot) zone. The warning indicator can be trigger by either grounding the engine temperature warning circuit when wired to the PCM. Or by sending a PCM network message to the instrument cluster.
P1288 - Cylinder Head Temperature (CHT) Sensor Circuit Out of Self-Test Range	Indicates the CHT sensor is out of Self-Test range. Engine is not at normal operating temperature.	• Cold engine • Engine overheating • Damaged harness connector • Damaged PCM • Low engine coolant level • Damaged CHT sensor	Bring engine to operating temperature. If cold, re-run self-test. If engine over-heats check cooling system.
P1289 - Cylinder Head Temperature (CHT) Sensor Circuit High Input	Indicates a CHT sensor circuit malfunction (open).	• Open CHT sensor circuit. • CHT sensor circuit short to PWR • Damaged CHT sensor • Improper harness connection • Damaged PCM	CHT V PID reading greater than 4.6 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault. Note: DTC P0118 may also be reported when this DTC is set, either of these DTC's will activate the MIL light.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1290 - Cylinder Head Temperature (CHT) Sensor Circuit Low Input	Indicates a CHT sensor circuit malfunction (shorted).	• Grounded circuit in CHT harness • Damaged CHT sensor • Improper harness connection • Damaged PCM	CHT V PID reading less than 0.2 volts with key ON and engine OFF or during any engine operating mode indicates a hard fault. Note: DTC P0117 may also be reported when this DTC is set, either of these DTC's will activate the MIL light.
P1299 - Cylinder Head Over Temperature Protection Active	Indicates an engine overheat condition was detected by the cylinder head temperature (CHT) sensor. An FMEM Strategy called Fail-safe Cooling was activated to cool the engine.	• Engine cooling system concerns • Low engine coolant level • Base engine concerns	REFER to Section 1, Powertrain Control Software, for more information on Fail-safe Cooling Strategy and cylinder head temperature sensor.
P1309 - Misfire Monitor Disabled	When the misfire monitor is disabled, usually due to the input signal generated by the camshaft position (CMP) sensor, by sensing the passage of teeth from the CMP wheel.	• Camshaft Position Sensor • Powertrain Control Module • ECT, MAF, and CKP sensors	Verify the CMP is installed correctly and not out of synchronization.
P1336 - CKP and or CMP Input Signal to PCM Concerns	Input Signal to PCM from CKP Sensor and or CMP Sensor erratic.	• Damaged PCM • Damaged CKP sensor • Damaged CMP sensor • Base engine concerns • Harness Concerns	Harness routing, alterations, improper shielding, or electrical interference from other improperly functioning systems.
P1380 - Variable Cam Timing Solenoid A Circuit Malfunction (Bank 1)	The comprehensive component monitor(CCM) monitors the VCT circuit to the PCM for high and low voltage. If during testing voltage was to fall below a calibrated limit a calibrated amount of time the test will fail.	• Open or short VCT circuit • Open VPWR circuit • Damaged PCM • Open or short VCT solenoid valve	DTC P1380 is a VCT circuit check. Testing should include wires, solenoid coil and PCM.
P1381 - Variable Cam Timing Over-advanced (Bank 1)	The comprehensive component monitor (CCM) monitors the VCT position for an over-advanced camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.	• Cam timing improperly set • No oil flow to the VCT piston chamber • Low oil pressure • VCT solenoid valve stuck closed • Camshaft advance mechanism binding (VCT unit)	P1381 DTC is a check of the VCT unit. Testing should not include electrical checks. Diagnostics and repair for the VCT unit are located in the Workshop Manual.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1383 - Variable Cam Timing Over-retarded (Bank 1)	The comprehensive component monitor (CCM) monitors the VCT position for over-retarded camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an retarded position.	• Cam timing improperly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)	DTC P1383 is a check of the VCT unit. Testing should not include electrical checks. Engine will idle rough, hard starting and may stall. Diagnostics and repair for the VCT unit are located in the Workshop Manual.
P1385 - Variable Cam Timing Solenoid A Circuit Malfunction (Bank 2)	The comprehensive component monitor(CCM) monitors the VCT circuit to the PCM for high and low voltage. If during testing voltage was to fall below a calibrated limit a calibrated amount of time the test will fail.	• Open or short VCT circuit • Open VPWR circuit • Damaged PCM • Open or short VCT solenoid valve	DTC P1380 is a VCT circuit check. Testing should include wires, solenoid coil and PCM.
P1386 - Variable Cam Timing Over-advanced (Bank 2)	The comprehensive component monitor (CCM) monitors the VCT position for an over-advanced camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an advanced position.	• Cam timing improperly set • No oil flow to the VCT piston chamber • Low oil pressure • VCT solenoid valve stuck closed • Camshaft advance mechanism binding (VCT unit)	P1381 DTC is a check of the VCT unit. Testing should not include electrical checks. Diagnostics and repair for the VCT unit are located in the Workshop Manual.
P1388 - Variable Cam Timing Over-retarded (Bank 2)	The comprehensive component monitor (CCM) monitors the VCT position for over-retarded camshaft timing. The test fails when the camshaft timing exceeds a maximum calibrated value or remains in an retarded position.	• Cam timing improperly set • Continuous oil flow to the VCT piston chamber • VCT solenoid valve stuck open • Camshaft advance mechanism binding (VCT unit)	DTC P1383 is a check of the VCT unit. Testing should not include electrical checks. Engine will idle rough, hard starting and may stall. Diagnostics and repair for the VCT unit are located in the Workshop Manual.
P1400 - DPF EGR Sensor Circuit Low Voltage Detected	The EGR monitor checks the DPF EGR sensor signal to the PCM for low voltage. The test fails when the average voltage to the PCM drops to a voltage less than the minimum calibrated value.	• DPFEGR circuit short to GND • Damaged DPF EGR sensor • VREF short to GND • Damaged PCM	A DPF EGR PID reading less than 0.2 volt with the key ON and engine OFF or running, indicates a hard fault.
P1401 - DPF EGR Sensor Circuit High Voltage Detected	The EGR monitor checks the DPF EGR sensor signal to the PCM for high voltage. The test fails when the average voltage to the PCM goes to a voltage greater than the maximum calibrated value.	• DPF EGR circuit open • VREF short to PWR • Damaged DPF EGR sensor • DPFEGR circuit short to PWR • SIG RTN circuit open • Damaged PCM	A DPF EGR PID reading greater than 4.5 volts with the key ON and engine OFF or running, indicates a hard fault.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1405 - DPF EGR Sensor Upstream Hose Off or Plugged	While driving, the EGR monitor commands the EGR valve closed and checks the differential pressure across the EGR orifice. The test fails when the signal from the DPF EGR sensor indicates EGR flow is in the negative direction.	• Upstream hose is disconnected • Upstream hose is plugged (ice) • Plugged or damaged EGR tube	• Look for signs of water or icing in hose • Verify hose connection and routing (no excessive dips) • Verify DPF EGR sensor proper mounting and function (view DPF EGR PID while applying and releasing vacuum directly to sensor with a hand pump)
P1406 - DPF EGR Sensor Downstream Hose Off or Plugged	While driving, the EGR monitor commands the EGR valve closed and checks the differential pressure across the EGR orifice. The test fails when the signal from the DPF EGR sensor continues to indicate EGR flow even after the EGR valve is commanded closed.	• Downstream hose is disconnected • Downstream hose is plugged (ice) • Plugged or damaged EGR tube	• Look for signs of water or icing in hose • Verify connection and routing (no excessive dips) • Verify DPF EGR sensor proper mounting and function (view DPFEGR PID while applying and releasing vacuum directly to sensor with a hand pump)
P1408 - EGR Flow Out of Self-Test Range (Non MIL)	This test is performed during the KOER on demand self-test only. The EGR system is commanded ON at a fixed engine speed. The test fails and the DTC is output when the measured EGR flow falls above or below the required calibration .	For vacuum activated systems, see Possible Causes for DTC P0401. For electric motor system, see Possible Causes DTC P0400.	For Electric EGR, use the output state control function of the scan tool and monitor the MAP PID (MAP) and the EEGR PID (EGRMDSD) while commanding the EEGR on. If EGR is introduced into the engine at idle, the rpm will drop or stall out. For vacuum systems see Diagnostic Aids for P0401.
P1409 - EGR Vacuum Regulator Solenoid Circuit Malfunction	This test checks the electrical function of the EGRVR solenoid. The test fails when the EGRVR circuit voltage is either too high or too low when compared to the expected voltage range. The EGR system must be enabled for the test to be completed.	• EGRVR circuit open • VPWR open to EGRVR solenoid • EGRVR circuit short to VPWR or GND • Damaged EGRVR solenoid • Damaged PCM	The EGR vacuum regulator solenoid resistance is from 26 to 40 ohms.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1436 - A/C Evaporator Temperature (ACET) Circuit Low Input	Indicates the ACET signal input was less than Self-Test minimum. Self-Test minimum is 0.13 volts.	• ACET circuit short to ground or SIG RTN • Damaged ACET sensor • Damaged PCM	The PCM sources a low current 5 volts on the ACET circuit (this voltage can be measured with the sensor disconnected). As A/C evaporator air temperature changes, the ACET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the ACET signal is detected below the Self-Test minimum, check for shorts to SIG RTN or ground, which would pull the voltage low.
P1437 - A/C Evaporator Temperature (ACET) Circuit High Input	Indicates the ACET signal input was greater than Self-Test minimum. Self-Test maximum is 4.5 volts.	• ACET circuit open • SIG RTN circuit open to ACET sensor • ACET circuit short to power (VREF) • Damaged ACET sensor • Damaged PCM	The PCM sources a low current 5 volts on the ACET circuit (this voltage can be measured with the sensor disconnected). As A/C evaporator air temperature changes, the ACET circuit resistance to SIG RTN (ground) changes (which changes the voltage the PCM detects). When the ACET signal is detected above the Self-Test maximum, check for open cirucits (ACET or SIG RTN), which would cause the voltage to remain high. Although not as probable, also check for a short to power (VREF).
P1443 - Very Small Or No Purge Flow Condition	A fuel tank pressure change greater than a minus (-) 7 inches of water in 30 seconds has occurred with purge (fuel vapor) flow less than 0.02 pounds per minute.	• Blocked fuel vapor hose between EVAP canister purge valve and FTP sensor. • Blocked fuel vapor hose between EVAP canister purge valve and engine intake manifold. • Blocked vacuum hose between EVAP canister purge valve-solenoid and engine intake manifold. • EVAP canister purge valve stuck closed (mechanically).	Check for blockages between the fuel tank, EVAP canister purge valve and engine intake manifold. Check obstructions in the EVAP canister purge valve diaphragm and ports.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1450 - Unable to Bleed Up Fuel Tank Vacuum	Monitors the fuel vapor vacuum and pressure in the fuel tank. The system failure occurs when the EVAP running loss monitor detects excessive fuel tank vacuum with the engine running (but not at idle).	• Blockages or kinks in EVAP canister tube or EVAP canister purge outlet tube (between fuel tank, EVAP canister purge valve and EVAP canister) • Fuel filler cap stuck closed (no vacuum relief) • Contaminated fuel vapor elbow on EVAP canister • Restricted EVAP canister • CV solenoid stuck open (partially or fully) • Plugged CV solenoid filter • EVAP canister purge valve stuck open • VREF circuit open (harness near FTP sensor, FTP sensor or PCM) • Damaged FTP sensor	
P1451 - EVAP Control System Canister Vent Solenoid Circuit Malfunction	Monitors the canister vent (CV) solenoid circuit for an electrical failure. The test fails when the signal moves outside the minimum or maximum allowable calibrated parameters for a specified canister vent duty cycle by PCM command.	• VPWR circuit open • CV solenoid circuit shorted to PWR GND or CHASSIS GND • Damaged CV solenoid • CV solenoid circuit open • CV solenoid circuit shorted to VPWR • Damaged PCM	To verify normal function, monitor the EVAP canister vent solenoid signal PID EVAPCV and the signal voltage (PCM control side). With the valve open, EVAPCV will indicate 0 percent duty cycle and the voltage approximately equal to battery voltage. When the valve is commanded fully closed, EVAPCV will indicate 100% duty cycle and a voltage drop of 4 volts minimum is normal. Output test mode may be used to switch output ON/OFF to verify function.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1460 - A/C Clutch Relay (A/CCR) Primary Circuit Malfunction (also referred to as WAC circuit)	Monitors the wide open throttle A/C cutoff (WAC) circuit output from the PCM. The test fails if: When the PCM grounds the WAC circuit, excessive current draw is detected on the WAC circuit; or with the WAC circuit not grounded by the PCM, voltage is not detected on the WAC circuit (the PCM expects to detect VPWR voltage coming through the WAC relay coil to the WAC circuit).	• Open or shorted WAC circuit • Damaged WAC relay (or CCRM) • Open VPWR circuit to WAC relay • Damaged PCM	• The A/CCR control circuit can be monitored using the WACF & WAC PID • When the WACF PID reads YES, a fault is currently present • An open circuit or short to ground can only be detected when the PCM is not grounding the circuit • A short to power can only be detected when the PCM is grounding the circuit • During KOEO and KOER self-test, the WAC circuit will be cycled ON and OFF • Verify A/C and defrost were OFF during KOEO and KOER self-test (Check ACCS PID to verify) • If vehicle is not equipped with A/C, DTC P1460 can be ignored
P1461 - Air Conditioning Pressure Sensor (ACP) Sensor High Voltage Detected	ACP inputs a voltage to the PCM. If the voltage is above a calibrated level the DTC will set.	• ACP sensor circuit short to PWR • ACP circuit open • Damaged PCM • ACP circuit short to VREF • ACP circuit short to SIGRTN • Damaged ACP sensor	Verify VREF voltage between 4.0 and 6.0V.
P1462 - Air Conditioning Pressure Sensor (ACP) Sensor Low Voltage Detected	ACP inputs a voltage to the PCM. If the voltage is below the calibrated level the DTC will set.	• ACP circuit short to GND or SIGRTN • VREF circuit open • Damaged PCM • Open ACP circuit • Damaged ACP sensor	Verify VREF voltage between 4.0 and 6.0V.
P1463 - Air Conditioning Pressure Sensor (ACP) Insufficient Pressure Change	Each time the A/C clutch engages, the PCM is looking for a pressure change in the refrigerant. If the change in pressure is outside of the calibration the DTC will set.	• A/C system mechanical failure • Open ACP or VREF circuit • A/C sensor damaged • A/C system electrical failure • A/C clutch always engaged	Verify A/C system function, including refrigerant charge.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1464 - A/C Demand Out Of Self-Test Range	DTC is set if PCM receives request for A/C during Self-Test.	• A/C or defrost on during self-test • A/C Clutch PWR circuit short to power (applications with N/C WAC relay contacts) • ACCS circuit short to power • Damaged A/C demand switch • Damaged WAC relay (or CCRM) • Damaged PCM	• If A/C or defrost were on during self-test, turn off and rerun test. • A/C request to PCM may come through communication link or be on dedicated hardwire circuit from driver's A/C switch.
P1469 - Low A/C cycling period	Indicates frequent A/C compressor clutch cycling.	• Mechanical A/C system concern (such as low refrigerant charge, damaged A/C cycling switch) • Intermittent open between the cycling pressure switch and the PCM • Intermittent open in IGN RUN circuit to cycling pressure switch (if applicable)	• An intermittent open circuit, although possible, is unlikely • This test was designed to protect the transmission. In some strategies, the PCM will unlock the torque converter during A/C clutch engagement. If a concern is present that results in frequent A/C clutch cycling, damage could occur if the torque converter was cycled at these intervals. This test will detect this condition, set the DTC and prevent the torque converter from excessive cycling.
P1474 - Cooling Fan Electrical Malfunction LS, Thunderbird, Crown Victoria, Grand Marquis, Town Car	This test checks the Fan Control - Variable (FCV) output circuit. The DTC sets if the PCM detects that the voltage on the FCV circuit is not within the expected range.	• FCV circuit open or shorted. • B+ or ground circuit fault to cooling fan. • VPWR open to cooling fan (if applicable). • Damaged cooling fan module. • PCM damaged	During KOEO Self-Test, the cooling fan will be cycled on and off.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1474 - Low Fan Control (LFC)/Fan Control 1 (FC1) Primary Circuit Malfunction All Others	Monitors the low fan control (LFC) (fan control for one speed fan application) primary circuit output from the PCM. The test fails if: When the PCM grounds the LFC/FC circuit, excessive current draw is detected on the LFC/FC circuit; or with the LFC/FC circuit not grounded by the PCM, voltage is not detected on the LFC/FC circuit (the PCM expects to detect VPWR voltage coming through the low speed FC relay coil to the LFC/FC circuit).	• Open or shorted LFC/FC circuit • Open VPWR circuit to low speed FC relay • Damaged low speed FC relay (or CCRM) • PCM damaged	• When the LFCF PID reads YES, a fault is currently present • An open circuit or short to ground can only be detected when the PCM is not grounding the LFC/FC circuit • A short to power can only be detected when the PCM is grounding the LFC/FC circuit. • During KOEO and KOER Self-Test, the LFC/FC circuit will be cycled on and off
P1477 - Medium Fan Control (MFC) Primary Circuit Failure	Monitors the medium fan control (MFC) primary circuit output from the PCM. The test fails if: With the MFC output commanded on (grounded), excessive current draw is detected on the MFC circuit; or with the MFC circuit commanded off, voltage is not detected on the MFC circuit (the PCM expects to detect IGN START/RUN voltage coming through the medium speed FC relay coil to the MFC circuit).	• Open or shorted MFC circuit • Open IGN START/RUN circuit to medium speed FC relay • Damaged medium speed FC relay • Damaged PCM	• When the MFCF PID reads YES, a fault is currently present • An open circuit or short to ground can only be detected when the PCM is not grounding the MFC circuit • A short to power can only be detected when the PCM is grounding the MFC circuit. • During KOEO and KOER Self-Test, the MFC circuit will be cycled on and off • Using Output Test Mode on scan tool, when commanding the low speed fan on, the PCM will also activate the medium speed fan output.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1479 - High Fan Control (HFC)/Fan Control 3 (FC3) Primary Circuit Malfunction	Monitors the high fan control (HFC) primary circuit output from the PCM. The test fails if: With the HFC output commanded on (grounded), excessive current draw is detected on the HFC circuit; or with the HFC circuit commanded off, voltage is not detected on the HFC circuit (the PCM expects to detect VPWR voltage coming through the high speed FC relay coil to the HFC circuit).	• Open or shorted HFC circuit • Open VPWR circuit to high speed FC relay • Damaged high speed FC relay (or CCRM) • Damaged PCM	• When the HFCF PID reads YES, a fault is currently present • An open circuit or short to ground can only be detected when the PCM is not grounding the HFC circuit • A short to power can only be detected when the PCM is grounding the HFC circuit. • During KOEO and KOER Self-Test, the HFC circuit will be cycled on and off
P1489 - PCV Heater Control Circuit	DTC sets when the PCM detects a PCV heater circuit failure.	• Open or shorted PCV circuit • Damaged PCV heater assembly • Damaged PCM	Ensure PCV valve is correct for the engine application and that PCV heater circuit is properly connected.
P1500 - Vehicle Speed Sensor (VSS) Intermittent	Indicates the VSS input signal was intermittent. This DTC is set when a VSS fault interferes with other OBDII tests, such as Catalyst efficiency monitor, EVAP monitor, HO2S monitor, etc.	• Intermittent VSS connections • Intermittent open in VSS harness circuit(s) • Intermittent short in VSS harness circuit(s) • Damaged VSS • Damaged PCM	
P1501 - Vehicle Speed Sensor (VSS) Out of Self Test Range	Indicates the VSS input signal is out of Self Test range. If the PCM detects a VSS input signal any time during Self Test, a DTC P1501 will be set and the test will abort.	• Noisy VSS input signal from Radio Frequency Interference/ Electro-Magnetic Interference (RFI/EMI) external sources such as ignition wires, charging circuit or after market equipment.	Check for VSS input to be 0 mph when vehicle transmission is in Park.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1502 - Vehicle Speed Sensor (VSS) Intermittent	Indicates the powertrain control module (PCM) detected an error in the vehicle speed information. Vehicle speed data is received from either the vehicle speed sensor (VSS), transfer case speed sensor (TCSS) or anti-lock brake system (ABS) control module. This DTC is set the same way as P0500. However, it is intended to flash the transmission control indicator lamp (TCIL) for first time VSS circuit error/malfunctions.	• Refer to possible causes for P0500.	Refer to diagnostic aids for P0500.
P1504 - Idle Air Control (IAC) Circuit Malfunction	This DTC is set when the PCM detects an electrical load failure on the IAC output circuit.	• IAC circuit open • VPWR to IAC solenoid open • IAC circuit short to PWR • IAC circuit short to GND • Damaged IAC valve • Damaged PCM	• The IAC solenoid resistance is from 6 to 13 ohms.
P1506 - Idle Air Control (IAC) Overspeed Error	This DTC is set when the PCM detects engine idle speed that is greater than the desired rpm.	• IAC circuit short to GND • Damaged IAC valve • IAC valve stuck open • Vacuum Leaks • Failed EVAP system • Damaged PCM	Disconnect IAC valve and look for little or no change in engine rpm as an indication of a stuck or damaged valve.
P1507 - Idle Air Control (IAC) Underspeed Error	This DTC is set when the PCM detects engine idle speed that is less than the desired rpm.	• IAC circuit open • IAC circuit short to PWR • VPWR to IAC solenoid open • Air inlet is plugged • Damaged IAC solenoid • Damaged PCM	• The IAC solenoid resistance is from 6 to 13 ohms • Disconnect IAC valve and look for no change in engine rpm as an indication of a stuck or damaged valve
P1512 - Intake Manifold Runner Control Stuck Closed (Bank 1)	This DTC is set when the vacuum actuated IMRC is commanded open, but the IMRCM indicates closed	• IMRC monitor circuit open • Suspect IMRC solenoid • Mechanical concern - bind, seize, damage or obstruction of IMRC hardware • Damaged PCM	
P1513 - Intake Manifold Runner Control Stuck Closed (Bank 2)	This DTC is set when the vacuum actuated IMRC is commanded open, but the IMRCM indicates closed	• IMRC monitor circuit open • Suspect IMRC solenoid • Mechanical concern - bind, seize, damage or obstruction of IMRC hardware • Damaged PCM	

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1516 - Intake Manifold Runner Control Input Error (Bank 1)	The IMRC system is monitored for failure during continuous or key ON engine OFF self-test. Each DTC will distinguish the corresponding failed bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal on the monitor pin is outside an expected calibrated range.	• Mechanical concern - bind, seize, damage or obstruction of IMRC hardware	An IMRCM PID reading at closed throttle that is less than VREF may indicate a fault An IMRCM PID reading near 1 volt or greater with engine rpm of at least 3000 may indicate a fault
P1517 - Intake Manifold Runner Control Input Error (Bank 2)	The IMRC system is monitored for failure during continuous or key ON engine OFF self-test. Each DTC will distinguish the corresponding failed bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal on the monitor pin is outside an expected calibrated range.	• Mechanical concern - bind, seize, damage or obstruction of IMRC hardware	An IMRCM PID reading at closed throttle that is less than VREF may indicate a fault An IMRCM PID reading near 1 volt or greater with engine rpm of at least 3000 may indicate a fault
P1518 - Intake Manifold Runner Control Malfunction (Stuck Open)	This DTC is set when the electrically actuated IMRC is commanded closed, but the IMRCM indicates open	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator • Damaged PCM	An IMRCM PID reading approximately near 1 volt at closed throttle may indicate a fault
P1519 - Inlet Manifold Runner Control Malfunction (Stuck Closed)	This DTC is set when the electrically actuated IMRC is commanded open, but the IMRCM indicates closed	• IMRC monitor circuit open • IMRC control circuit open • IMRC monitor circuit short to VREF • IMRC monitor return circuit open • Damaged IMRC actuator • IMRC VPWR circuit open • Damaged PCM	An IMRCM PID reading at VREF with engine rpm of at least 3000 may indicate a fault.
P1520 - Intake Manifold Runner Control Circuit	This DTC indicates a failure in the IMRC primary control circuit	• IMRC control circuit open	An IMRCM PID reading near 1 volt or greater with engine rpm of at least 3000 may indicate a fault
P1537 - Intake Manifold Runner Control Stuck Open (Bank 1)	This DTC is set when the vacuum actuated IMRC is commanded closed, but the IMRCM indicates open	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC solenoid • Blocked vacuum hoses • Damaged PCM	

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1538 - Intake Manifold Runner Control Stuck Open (Bank 2)	This DTC is set when the vacuum actuated IMRC is commanded closed, but the IMRCM indicates open	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC solenoid • Blocked vacuum hoses • Damaged PCM	
P1549 - Intake Manifold Communication Control Circuit Malfunction	The IMCC or intake manifold tuning (IMT) valve system is monitored for failure during continuous or key ON engine OFF self-test. The test fails when the PCM detects a concern with IMT valve output circuit.	• Open IMT valve circuit • Open VPWR circuit • Shorted IMT valve circuit • Damaged IMT valve • Damaged PCM	• An IMT valve fault PID (IMTVF) displaying YES status may indicate a fault
P1550 - Power Steering Pressure (PSP) Sensor Malfunction	The PSP sensor input signal to PCM is continuously monitored. The test fails when the signal falls out of a maximum or minimum calibrated range.	• PSP sensor damaged • Damaged PCM	• The DTC indicates the PSP sensor is out of Self-Test range.
P1572 - Brake Pedal Switch Circuit	Indicates that the brake input rationality test for brake pedal position (BPP) and brake pressure applied (BPA) switches has failed. One or both inputs to the PCM did not change state when it was expected to. Note: On vehicles with stability assist. BPP is connected to the ABS module and the ABS generates a Driver Brake Application (DBA) signal, which is than sent to the PCM.	• Misadjusted brake switches, BPP or BPA • Blown fuse • Damaged BPP switch • Damaged BPA switch • Open or short in BPP circuit • Open or short in DBA circuit • Open or short in BPA circuit • Damaged PCM	DTC P1572 is set when the PCM does not see the proper sequence of the brake pedal input signal from both the BPP and BPA when the brake pedal is pressed and released.
P1582 - Electronic Throttle Monitor Data Available	Indicates actuation of restraint deployment, and Electronic Throttle Monitor data is available.	• The DTC only indicates the actuation of the restraint deployment system, do not replace the PCM because there is no fault indicated.	
P1633 - Keep Alive Power Voltage Too Low	Indicates that the Keep Alive Power (KAPWR) circuit has experienced a power interrupt.	• Open KAPWR circuit • Intermittent KAPWR • Damaged PCM	Loss of KAPWR to the PCM will result in a immediate MIL illumination and a DTC P1633.
P1635 - Tire/Axle Ratio Out Of Acceptable Range	This Diagnostic Trouble Code (DTC) indicates the tire and axle information contained in Vehicle ID block (VID) does not match vehicle hardware.	• Incorrect tire size • Incorrect axle ratio • Incorrect VID configuration parameters	Using the scan tool, view the tire and axle parameters within the VID. They must match vehicle hardware.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1636 - Inductive Signature Chip Communication Error	Indicates the PCM has lost communication with the Inductive Signature Chip.	• PCM damaged	
P1639 - Vehicle ID Block Not Programed Or Is Corrupt	This diagnostic trouble code (DTC) indicates that the vehicle ID (VID) block is not programed or the information within is corrupt.	• New PCM • Incorrect PCM • Incorrect VID configuration	Using an enhanced scan tool, reprogram the PCM to the most recent calibration available.
P1640 - Powertrain DTC's Available in Another Module	Vehicles using a secondary Engine Control Module can request that the Powertrain Control Module illuminate the Check Engine Light when a failure occurs which affect emission.	• DTCs stored in a secondary module, which requested the MIL to be turned on.	Call-up PID address 0946 to determine secondary module requesting MIL illumination. Once secondary module is determined request DTCs from module.
P1641 - Fuel pump primary circuit malfunction.			DTC is equivalent to P1235/P1236.
P1641 - Fuel pump primary circuit malfunction. All Others			DTC is equivalent to P0230.
P1650 - Power Steering Pressure (PSP) Switch Malfunction	In Key On, Engine Off Self-Test, this DTC indicates the PSP input to the PCM is high. In Key On, Engine Running Self-Test, this DTC indicates that the PSP input did not change state.	• Steering wheel must be turned during Key On, Engine Running Self-Test • PSP switch/shorting bar damaged • SIG RTN circuit open • PSP circuit open or shorted to SIGRTN • PCM damaged	
P1651 - Power Steering Pressure (PSP) Switch Signal Malfunction	The PCM counts the number of times vehicle speed transitions from 0 to a calibratable speed. After a calibratable number of speed transitions the PCM expects that the PSP input should have changed. This DTC is set if the transition is not detected.	• Vehicle towed with engine running • Power steering hydraulic concern was repaired but DTC was not erased • PSP switch/shorting bar damaged • SIG RTN circuit open • PSP circuit open or shorted to SIGRTN • PCM damaged	• Check, if possible, if vehicle was towed or power steering service was performed. • Observe PSP V PID while checking wires for intermittents.

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1703 - Brake Switch Out of Self-Test Range	Indicates that during Key On Engine Off (KOEO) Self-Test, BPP signal was high. Or during Key On Engine Running (KOER) Self -Test, the BPP signal did not cycle high and low.	• Open or short in (BPP) circuit • Open or short in stoplamp circuits • Damaged PCM • Malfunction in module(s) connected to BPP circuit (Rear Electronic Module Freestar/Monerey, LS6/LS8 and Thunderbird or Lighting Control Module (LCM) for Town Car) • Damaged brake switch • Misadjusted brake switch	Check for proper function of stoplamps. Using scan tool, check BPP PID. Stoplamps and PID should toggle on and off with brake pedal activation.
P1705 - Transmission Range Sensor Out of Self-Test Range	Transmission Range circuit not indicating Park/Neutral during self-test.	• Gear selector not in Park/Neutral	Verify gear selector is in Park/Neutral.
P1709 - Park/Neutral Position Switch Out of Self-Test Range	The DTCs indicate that the voltage is high when it should be low.	• PNP/CPP circuit short to PWR • Damaged PNP or CPP switch • PNP/CPP circuit open in the SIGRTN • Damaged PCM	When exercising either the PNP or CPP switch the voltage should cycle from 5.0V to low
P1729 - 4x4L switch circuit malfunction F-150 Heritage 4.2L, F-150 Heritage 4.6L, F-150 Heritage 5.4L, F-150	The 4x4L switch is an ON/OFF. If the PCM does not see appropriate voltage when the switch is cycled on and off a DTC will set for mechanical shift on the fly systems.	• 4x4L harness between PCM and 4x4L switch open or shorted • Damaged 4x4L switch • Damaged PCM	Verify the 4x4L switch cycles ON/OFF
P1780 - Transmission Control Switch Out of Self-Test Range	During KOER self-test the TCS has to be cycled, if not cycled a DTC is set.	• TCS circuit short or open • Damaged TCS switch • Damaged PCM	Verify the TCS switch cycles ON/OFF
P1781 - 4x4L Switch Out of Self-Test Range	The 4x4L switch is an ON/OFF. If the PCM does not see low voltage when the switch is on a DTC will set.	• 4x4L harness open or shorted • Damaged electronic shift module • Damaged PCM	Verify the 4x4L switch cycles ON/OFF
P1900 - Output Shaft Speed sensor circuit intermittent failure	The output shaft speed sensor signal to the PCM is irregular or interrupted.	• Harness connector not properly seated • Harness intermittently shorted, or open • Harness connector damaged • OSS sensor damaged, or not installed properly	• Verify harness and connector integrity • Verify OSS sensor proper installation

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Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P1901 - Turbine Shaft Speed sensor circuit intermittent	The TSS sensor signal to the PCM is irregular or interrupted.	Harness connector not properly seated Harness intermittently shorted or open Harness connector damaged TSS sensor damaged or not installed properly	Verify harness and connector integrity Verify TSS sensor proper installation.
P2004 - Intake Manifold Runner Control Stuck Open (Bank 1)	This DTC is set when the IMRC is commanded closed, but the IMRCM indicates open This DTC replaces P1518 and P1537	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator or solenoid • Damaged PCM • Blocked vacuum hoses	An IMRCM PID reading approximately near 1 volt at closed throttle may indicate a fault
P2005 - Intake Manifold Runner Control Stuck Open (Bank 2)	This DTC is set when the IMRC is commanded closed, but the IMRCM indicates open This DTC replaces P1538	• IMRC monitor signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator or solenoid • Damaged PCM • Blocked vacuum hoses	An IMRCM PID reading approximately near 1 volt at closed throttle may indicate a fault
P2006 - Intake Manifold Runner Control Stuck Closed (Bank 1)	This DTC is set when the IMRC is commanded open, but the IMRCM indicates closed This DTC replaces P1512 and P1519	• IMRC monitor circuit open • IMRC control circuit open • IMRC monitor circuit short to VREF • Damaged IMRC actuator or solenoid • Damaged PCM	An IMRCM PID reading at VREF with engine rpm of at least 3000 may indicate a fault.
P2007 - Intake Manifold Runner Control Stuck Closed (Bank 2)	This DTC is set when the IMRC is commanded open, but the IMRCM indicates closed This DTC replaces P1513	• IMRC monitor circuit open • IMRC control circuit open • IMRC monitor circuit short to VREF • Damaged IMRC actuator or solenoid • Damaged PCM	An IMRCM PID reading at VREF with engine rpm of at least 3000 may indicate a fault.
P2008 - Intake Manifold Runner Control Circuit / Open (Bank 1)	This DTC indicates a failure in the IMRC primary control circuit This DTC replaces P1520	• IMRC control circuit open	An IMRCM PID reading near 1 volt or greater with engine rpm of at least 3000 may indicate a fault

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2014 - Intake Manifold Runner Position Sensor/Switch Circuit (Bank 1)	The IMRC system is monitored for failure during continuous or key ON engine OFF self-test. Each DTC will distinguish the corresponding failed bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal on the monitor pin is outside an expected calibrated range. This DTC replaces P1516	• IMRC monitor circuit open • Mechanical concern - bind, seize, damage or obstruction of IMRC hardware	
P2019 - Intake Manifold Runner Position Sensor/Switch Circuit (Bank 2)	The IMRC system is monitored for failure during continuous or key ON engine OFF self-test. Each DTC will distinguish the corresponding failed bank for IMRC actuator assemblies with dual monitor switches. The test fails when the signal on the monitor pin is outside an expected calibrated range. This DTC replaces P1517	• IMRC monitor circuit open • Mechanical concern - bind, seize, damage or obstruction of IMRC hardware	
P2065 - Fuel Level Sensor B circuit concern	Fuel Level Sensor B circuit concern This information is sent to PCM on communication link.		
P2066 - Fuel Level Sensor B circuit concern	Fuel Level Sensor B circuit concern This information is sent to PCM on communication link.		
P2067 - Fuel Level Sensor B circuit concern	Fuel Level Sensor B circuit concern This information is sent to PCM on communication link.		
P2068 - Fuel Level Sensor B circuit concern	Fuel Level Sensor B circuit concern This information is sent to PCM on communication link.		

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2070 - Intake Manifold Tuning Valve Stuck Open	The IMTV system is monitored for failure during continuous, key ON engine OFF or key ON engine running self-test. The test fails when the signal on the monitor pin is more or less than an the expected calibrated range.	• IMTV signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator • Damaged PCM	An IMTVM PID reading may indicate a fault if available.
P2071 - Intake Manifold Tuning Valve Stuck Closed	The IMTV system is monitored for failure during continuous, key ON engine OFF or key ON engine running self-test. The test fails when the signal on the monitor pin is more or less than an the expected calibrated range.	• IMTV signal circuit shorted to PWR GND or SIG RTN • Damaged IMRC actuator • Damaged PCM • IMTV circuit open.	An IMTVM PID reading may indicate a fault if available.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2072 - PCM is indicating that the throttle mode has been activated. F-150 4.6L	This DTC identifies only that the strategy has performed several open and closed cycles to remove potential ice build up. The DTC does not imply any system fault, only that the mode has occurred, and that mode may be causing a long start time.	Ice or oil in the induction system, could be a fault in the PCV system.	CHECK the PCV System for evidence of water or ice: • Disconnect the Air Induction Fresh Air Plenum from the throttle body check for water or oily residue at the PCV Fresh Air port. • Disconnect the tube at the Cam cover and check the tube for ice obstruction/ice. • Start engine, to check the PCV system, place a piece of card board on the crankcase vent in the rocker cover. • If the card board is held on the crank case vent and fumes are not exiting, reconnect the tube to cam cover and Air Induction port. (If the test passes, no further investigation of the PCV System is required.) • If the cardboard is not held in place, turn off engine and check the PCV valve side of the system for ice or obstruction and repair as needed. • If no obstruction is found there, isolate and repair any obstruction in the intake manifold connection. • If no obstruction is found there, make sure PCV coolant heater is functional and repair as needed. • If no fault is detected, ensure the PCV valve is allowing the proper vacuum flow and repair as needed.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2072 - PCM is indicating that the throttle mode has been activated. F-150 5.4L 3V	This DTC identifies only that the strategy has performed several open and closed cycles to remove potential ice build up. The DTC does not imply any system fault, only that the mode has occurred, and that mode may be causing a long start time.	Ice or oil in the induction system, could be a fault in the PCV system.	CHECK the PCV System for evidence of water or ice: • Disconnect the Air Induction Fresh Air Plenum from the Air Fuel Module IAFM and remove oil or water near the fresh air port as needed. • Disconnect the tube at the Cam cover and check the tube for ice obstruction, repairing as needed. • Start engine, to check the PCV system, place a piece of card board on the crankcase vent in the rocker cover. • If the card board is held on the crank case vent and fumes are not exiting, reconnect the tube to cam cover and Air Induction port. (If the test passes, no further investigation of the PCV System is required.) • If the cardboard is not held in place, turn off engine and check the PCV valve side of the system for ice or obstruction and repair as needed.
P2100 - Throttle Actuator Control Motor Circuit/Open.	PCM fault flag is set indicating the motor circuit is open. May require cycling the key.	• TACM has an open winding • TACM is damaged • TACM harness is open • TACM harness is shorted to pwr • TACM harness circuits are shorted together • TACM harness connector is unplugged	An (TACM) circuit PID reading may indicate a fault if available.
P2101 - Throttle Actuator Control Motor Range/Performance.	PCM fault flag is set indicating the motor circuit is open. May require cycling the key.	• TACM circuits are crosswired	An (TACM) circuit PID reading may indicate a fault if available

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2104 - Throttle Actuator Control System - Forced Idle.	Throttle actuator control system is in FMEM mode of forced idle.	• PCM damaged • Multiple ETC system faults • Bad APP sensor	DTC indicates FMEM condition, and can be set in combination with DTCS P2121, P2126, or P2131 and P2111 or P2112. When P2104 is set in combination with P2121, P2126, or P2131 repair Accelerator Pedal Position Sensor faults first (pinpoint test DK), when the P2104 is set in combination with P2111 or P2112 repair the Electronic Throttle Body faults first (pinpoint test DV).
P2105 - Throttle Actuator Control System - Forced Engine Shutdown.	Throttle actuator control system is in FMEM mode of forced engine shutdown.	• Total system failure • PCM damaged • Incorrect Equizzer or Power PC software	Indicates FMEM present, when set in combination with U300, it indicates The Power PC and Equizzer chips have incompatible software. (See section 4, page 16, DTC U0300 diagnosis.
P2106 - Throttle Actuator Control System - Forced Limited Power.	Throttle actuator control system is in FMEM mode of forced limited power.	• Unplugged motor, circuits shorted to power • TACM motor open, unplugged motor, circuits shorted to power • TACM motor stuck open or closed • PCM damaged • MAF fault • TPS fault • OSS fault • TSS fault • Brake Module fault	DTC is an indication of FMEM condition, and can be set in combination with a number of other DTCS causing the FMEM. The other DTCS include: P0102, P0103, P0122, P0123, P0222, P0223, P2135, P0320, P0715, P0720, P0731, P0732, P0733, P0734, P0735, P0500, and should be repaired prior to entering Dk or DV pinpoint tests.(previous DTCS effect Electronic Throttle Control system operation)
P2107 - Throttle Actuator Control Motor Processor.	The ETC control area of the PCM failed self test. Fault could be the result of an incorrect TP command, or the TACM wires shorted together.	• TACM wire shorted together • TACM circuit wires shorted to pwr • PCM damaged • ETB damaged	An (TACM) circuit PID reading may indicate a fault if available
P2110 - Throttle Actuator Control System - Forced Limited RPM.	Throttle actuator control system is in FMEM mode of forced limited RPM.	• PCM damaged • Cross wired TACM motor	DTC indicates only that FMEM condition exists, and can be set incombination with DTCS P2100, P2101, or P2107, meaning the ETB faults should be repaired first.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2111 - Throttle Actuator Control System - Stuck Open.	PCM fault status indicates throttle plate is at a greater angle than commanded.	• Binding throttle body, stuck open • TACM circuits crosswired • TACM circuits shorted together • PCM damaged	An (TACM) circuit PID reading may indicate a fault if available
P2112 - Throttle Actuator Control System - Stuck Closed.	PCM fault status indicates throttle plate is at a lower angle than commanded.	• Binding throttle body, stuck closed • PCM damaged	An (TACM) circuit PID reading may indicate a fault if available
P2121 - Accelerator Pedal Position Sensor Circuit 1 Range/Performance.	Accelerator Pedal Position sensor fault flag is set for sensor 1 by the PCM, indicating that signal is out of the normal self test operating range.	• APP sensor defective • APP sensor 1 is open, or shorted to ground or power • APP sensor signal circuits shorted together • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2122 - Accelerator Pedal Position Sensor Circuit 1 Low Input.	Acelerator Pedal Position sensor 1 is out of self test range low	• APP sensor defective • PP sensor harness open • PP sensor harness shorted to ground • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2123 - Accelerator Pedal Position Sensor Circuit 1 High Input	Acelerator Pedal Position sensor 1 is out of self test range high	• APP sensor defective • APP sensor harness shorted to VREF • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2126 - Accelerator Pedal Position Sensor Circuit 2 Range/Performance.	Acelerator Pedal Position sensor 2 has flagged a fault by the PCM, indicating the signal is not within the normal self test operating range.	• APP sensor is defective • APP sensor assembly is binding • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2127 - Accelerator Pedal Position Sensor Circuit 2 Low Input.	Acelerator Pedal Position sensor 2 is out of range low, open circuit.	• APP sensor is defective • APP sensor circuit is shorted to ground • APP sensor circuit is open • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2128 - Accelerator Pedal Position Sensor Circuit 2 High Input.	Acelerator Pedal Position sensor 2 is out of range high input	• APP sensor is defective • APP sensor assembly is binding • APP sensor harness is shorted to power • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2131 - Accelerator Pedal Position Sensor Circuit 3 Range Performance	Acelerator Pedal Position sensor 3 has flagged a fault by the PCM, indicating the signal is not within the normal self test operating range.	• APP sensor is defective • APP sensor assembly is binding • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2132 - Accelerator Pedal Position Sensor Circuit 3 Low Input.	Acelerator Pedal Position sensor 3 is out of range low, open circuit	• APP sensor is defective • APP sensor assembly is binding • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2133 - Accelerator Pedal Position Sensor Circuit 3 High Input.	Accelerator Pedal Position sensor 3 is out of range high input.	• APP sensor is defective • APP sensor assembly is binding • APP sensor harness is shorted to power • Damaged PCM	An (APP) sensor PID reading may indicate a fault if available
P2135 - ETC Throttle Position (TP) Sensor A/B Voltage Correlation.	The PCM flagged a fault indicating that TP1 and TP2 disagree, or that TP1 should not be in it's present position given the position of TP2 unless a problem is present.	• ETC TP is defective • TP sensor shorted internally to VREF • TP sensor harness is shorted to power • TP sensor signal wire are shorted together • Damaged PCM	
P2195 - Lack of HO2S-11 Switch, Sensor Indicates Lean	A HEGO sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	• Electrical: • Short to VPWR in harness or HO2S • Water in harness connector • Open/Shorted HO2S circuit • Corrosion or poor mating terminals and wiring • Damaged HO2S • Damaged PCM • Fuel System: • Excessive fuel pressure • Leaking/contaminated fuel injectors • Leaking fuel pressure regulator • Low fuel pressure or running out of fuel • Vapor recovery system • Induction System: • Air leaks after the MAF • Vacuum Leaks • PCV system • Improperly seated engine oil dipstick • EGR System: • Leaking gasket • Stuck EGR valve • Leaking diaphragm or EVR • Base Engine: • Oil overfill • Cam Timing • Cylinder compression • Exhaust leaks before or near the HO2S(s)	

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2196 - Lack of HO2S-11 Switch, Sensor Indicates Rich	A HEGO sensor indicating rich at the end of a test is trying to correct for an over-lean condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	See possible causes for DTC P2195	
P2197 - Lack of HO2S-21 Switch, Sensor Indicates Lean	A HEGO sensor indicating lean at the end of a test is trying to correct for an over-rich condition. The test fails when fuel control system no longer detects switching for a calibrated amount of time.	See possible causes for DTC P2195	
P2198 - Lack of HO2S-21 Switch, Sensor Indicates Rich	A HEGO sensor indicating rich at the end of a test is trying to correct for an over-lean condition. The test fails when the fuel control system no longer detects switching for a calibrated amount of time.	See possible causes for DTC P2195	
P2257 - Secondary Air Injection System Monitor Circuit Low	The secondary air injection system monitor circuit is low, indicating the electrical AIR pump is off although the electrical AIR pump was commanded on by the PCM.	• Open B+ circuit • Open VPWR circuit • Open power circuit between AIR relay and AIR pump. • Faulted AIR relay • Damaged PCM	The AIR monitor circuit PCM input contains a pull up voltage through a resistance internal to the PCM. This voltage is normally held low by the resistance path through the AIR pump when the pump is off. A single electrical open circuit component such as an AIR relay coil in this multi-component circuit will not be detected by the PCM output driver yet it will create DTC P2257.
P2258 - Secondary Air Injection System Monitor Circuit High	The secondary air injection system monitor circuit is high, indicating the electrical AIR pump is on although the electrical AIR pump was commanded off by the PCM.	• AIR relay fault - stuck closed • AIR pump fault - circuit open in motor. • Open ground to AIR pump. • Open AIR monitor circuit between AIR pump and PCM. • Short to Power in AIR relay to AIR pump power circuit. • Damaged PCM	The AIR monitor circuit PCM input contains a pull up voltage through a resistance internal to the PCM. This voltage is normally held low by the resistance path through the AIR pump when the pump is off.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
P2270 - Lack of HO2S-12 Switch, Sensor Indicates Lean	The downstream HO2S sensors are forced rich and lean and monitored by the PCM. The test fails if the PCM does not detect the output of the HO2S in a calibrated amount of time.	• Pinched, shorted, and corroded wiring and pins • Crossed sensor wires • Exhaust leaks • Contaminated or damaged sensor	
P2271 - Lack of HO2S-12 Switch, Sensor Indicates Rich	See description for DTC P2270	See possible causes for DTC P2270	
P2272 - Lack of HO2S-22 Switch, Sensor Indicates Lean	See description for DTC P2270	See possible causes for DTC P2270	
P2273 - Lack of HO2S-22 Switch, Sensor Indicates Rich	See description for DTC P2270	See possible causes for DTC P2270	
P2274 - O2 Sensor Signal Stuck Lean - Bank 1, Sensor 3	See description for DTC P2270	See possible causes for DTC P2270	
P2275 - O2 Sensor Signal Stuck Rich - Bank 1, Sensor 3	See description for DTC P2270	See possible causes for DTC P2270	
P2278 - HO2S sensor signals swapped bank to bank (HO2S-13-23)	The HEGO monitor checks and determines if the HO2S signal response for a fuel shift corresponds to the correct engine bank. The test fails when a response from the HO2S(s) being tested is not indicated.		
U0300 - Internal Control Module Software Incompatibility	This DTC indicates that there are incompatible software levels within the PCM that control the Electronic Throttle Control (ETC) system. The ETC system utilizes three different chips (Power PC, TPPC and Equizzer) within the PCM each having their own software level and function. The three chips must have the proper level of software in order to communicate and function together.		DTC U0300 can be set in combination with P2105. Check and confirm that the correct latest version of software is present on the PCM, reflash PCM if required.

(Continued)

Diagnositic Trouble Code (DTC) Description

Diagnostic Trouble Code	Descriptions	Possible Causes	Diagnostic Aides
U1021 - SCP Invalid or Missing Data for Air Conditioning Clutch		Network DTC(s) occur during module to module communication failures. Network faults can be categorized in to two types: • Invalid data network faults - Data transferred within normal inter-module message but contains known invalid data. Transmitting module shall log a DTC related to the invalid data fault. • Missing message network faults - Missing message fault logged by an module upon failure to receive a message from another module within a defined retry period.	PERFORM On-Board Diagnostics for the associated network module. For additional information concerning description and operation of the vehicle communication network, refer to Section 418-00 in the Workshop Manual.
U1039 - SCP Invalid or Missing Data for Vehicle Speed		See possible causes for DTC P1021	See diagnostic aids for DTC P1021
U1051 - SCP Invalid or Missing Data for Brakes		See possible causes for DTC P1021	See diagnostic aids for DTC P1021
U1131 - SCP Invalid or Missing Data for Fuel System		See possible causes for DTC P1021	See diagnostic aids for DTC P1021
U1147 - SCP Invalid or Missing Data for Vehicle Security		See possible causes for DTC P1021	See diagnostic aids for DTC P1021
U1262 - SCP Communication Bus Fault - Perform Network Communication Test		See possible causes for DTC P1021	Go to Workshop Manual Section 418, Module Communications Network for further diagnosis.
U1451 - SCP Invalid or Missing Data for Anti-Theft module		See possible causes for DTC P1021	See diagnostic aids for DTC P1021

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Pinpoint Tests

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No Start	A

Note

This pinpoint test is intended to diagnose the following:

- Spark (As related to Electronic Engine Control).
- Powertrain Control Module (PCM) (12a650).

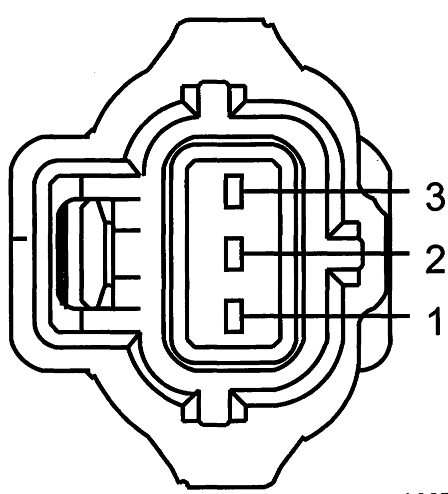
Warning

STOP THIS TEST AT THE FIRST SIGN OF A FUEL LEAK AND SERVICE AS REQUIRED.

No open flame - No smoking during fuel delivery checks.

Throttle position (TP) Sensor Connector

A



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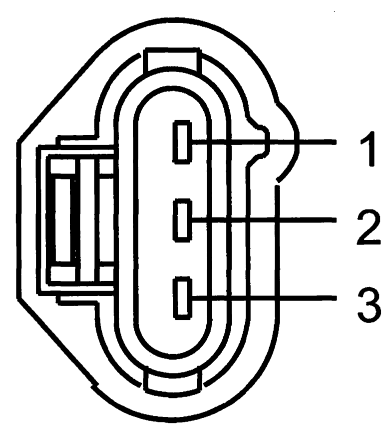
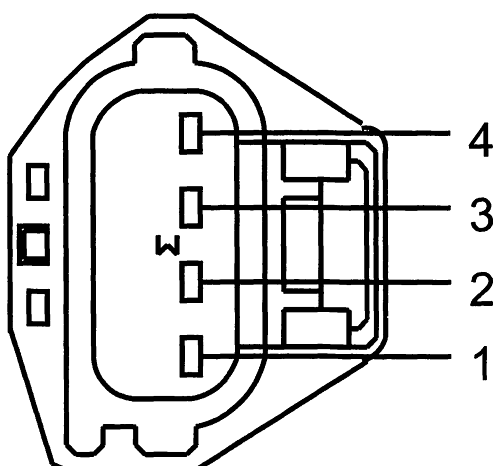


A0077555

No Start	A

Vehicle	Connector	Circuit	Pin
Focus, Ranger 2.3L	A	SIGRTN VREF	1 3
All other vehicles	B	SIGRTN VREF	3 1

Electronic Throttle Body TPS (ETBTPS) Sensor Connector



A0077519

Circuit	Pin
ETCRTN (Electronic Throttle Control Return)	3
ETCREF (ETCREF (Electronic Throttle Control Reference Voltage to TP))	2

Test Steps		Results →	Action to Take
A1	CHECK PASSIVE ANTI-THEFT SYSTEM (SECURE LOCK)		
	• Verify anti-theft system status. • **Is the system activated?**	Yes →	REFER to Workshop Manual, Section 419, Electrical Anti-theft.
		No →	GO to **A2**.

No Start

A

Test Steps		Results →	Action to Take
A2	ATTEMPT TO CRANK ENGINE		
	Note: Verify inertia fuel shutoff (IFS) switch is set (button pushed in). REFER to Owner Guide for location. • **Does the engine crank?**	Yes → No →	KEY OFF. GO to **A3**. KEY OFF. REFER to Workshop Manual, Section 303, Starting Systems.
A3	IDENTIFY TYPE OF NO START		
	Note: The purpose of this test step is to identify intermittent No Starts in order to determine the proper repair procedure. • **Does the vehicle start?**	Yes → No →	KEY OFF. Vehicle is an intermittent No Start. GO to **Z2**. KEY OFF. GO to **A4**.
A4	DETERMINE THROTTLE TYPE		
	• **Is vehicle equipped with Electronic Throttle Control?**	Yes → No →	GO to **A6**. GO to **A5**.
A5	CHECK VREF VOLTAGE TO TP SENSOR		
	• TP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)TP Sensor Connector, Harness Side**: VREF **(-)TP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 5.5 V?**	Yes → No →	KEY OFF. RECONNECT TP sensor. GO to **A7**. KEY OFF. GO to **C1**.
A6	CHECK VREF VOLTAGE TO ETC SENSOR		
	• ETBTPS Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)ETBTPS Sensor Connector, Harness Side**: ETCREF - Pin 2 **(-)ETBTPS Sensor Connector, Harness Side**: ETCRTN - Pin 3 • **Is the Voltage between 4 V - 5.5 V?**	Yes → No →	KEY OFF. Reconnect ETC. GO to **A7**. KEY OFF. GO to **C1**.

No Start	A

Test Steps		Results →	Action to Take
A7	CHECK FLASH EPROM POWER SUPPLY (FEPS) CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: (+)DLC Connector, Harness Side: FEPS — (-)Vehicle battery: Negative post • **Is the Voltage above 9 V?**	Yes → No →	KEY OFF. REPAIR short circuit to PWR. **For Coil On Plug ignition testing:** GO to **A16**. KEY OFF. GO to **A8**.
A8	CHECK PCM DRIVER TO COILS		
	• Connect test lamp between B+ and each coil driver circuit at the harness connector. • Crank the engine. Note: Test lamp bulb filament wattages vary widely. Intensity and duration of blinking will depend upon test lamp being used. • **Does the test lamp blink consistently (one blink per engine revolution)?**	Yes → No →	KEY OFF. GO to **A9**. KEY OFF. GO to **JD1**.
A9	CHECK RPM IN THE PCM		
	Note: The scan tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged. • Access the PCM-RPM PID using a scan tool. • Crank engine while viewing RPM PID. • **Is the RPM between 150 RPM - 350 RPM?**	Yes → No →	KEY OFF. **For Coil On Plug ignition testing:** GO to **JB1**. **For Coil Pack ignition testing:** GO to **JC1**. **For Dedicated NGV vehicles that do not require ignition testing:** GO to **A12**. **For All Other vehicles that do not require ignition testing:** GO to **A10**. KEY OFF. GO to **JD2**.

(+)DLC Connector, Harness Side	(-)Vehicle battery
FEPS	Negative post

No Start	A

	Test Steps	Results →	Action to Take
A10	CHECK FUEL PRESSURE		
	WARNING: THE FUEL SYSTEM WILL REMAIN PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. **FOR ADDITIONAL INFORMATION, REFER TO THE WARNING TEXT FOUND AT THE BEGINNING OF PINPOINT TEST HC.** • Relieve fuel pressure. • Connect fuel pressure gauge to the Schrader valve using the appropriate fuel pressure test hose and adaptor. • Scan Tool Connected. • Key ON Engine OFF. • Enter Output Test Mode (refer to section 2). • Activate the fuel pump to obtain maximum fuel pressure. • **Is the fuel pressure within specification (use fuel pressure chart in Pinpoint Test HC)?**	Yes → No →	KEY OFF. GO to **A11**. KEY OFF. GO to **HC1**.
A11	CHECK FUEL PRESSURE LEAKDOWN		
	• Scan Tool Connected. • Key ON Engine OFF. • Enter Output Test Mode (refer to section 2). • Activate the fuel pump to obtain maximum fuel pressure. • Exit Output Test Mode. • Verify Fuel pressure remains within 34 kPa (5 PSI) of the maximum pressure for 1 minute after turning pump off. • **Does fuel pressure remain within 34 kPa (5 PSI)?**	Yes → No →	KEY OFF. GO to **A12**. KEY OFF. GO to **HC1**.
A12	CHECK FUEL INJECTORS FOR VPWR		
	• CHECK at least 2 fuel injectors, one on each bank on V type engines. A no start condition can exist only if greater than half of the fuel injectors are without VPWR. • Disconnect two fuel injectors. • Key ON Engine OFF. • Measure VPWR voltage at the each fuel injector harness connector. • **Is the voltage greater than 10.5 volts?**	Yes → No →	KEY OFF. **For Dedicated NGV** GO to **A14**. **For Gasoline** GO to **A13**. KEY OFF. REPAIR VPWR circuit.

No Start

A

Test Steps		Results →	Action to Take
A13	CHECK FUEL INJECTORS ABILITY TO DELIVER FUEL		
	• Cycle key several times to charge fuel system. • Locate and activate the fuel inertia switch to disable fuel pump. • Monitor fuel pressure gauge while cranking the engine for at least 5 seconds. • **Is there a pressure drop greater than 34 kPa (5 PSI) while cranking the engine?**	Yes →	KEY OFF. The Electronic Engine Control system is not the cause of the no start. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No →	KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
A14	CHECK FUEL PRESSURE		
	WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN PINPOINT TEST HB WARNING, CAUTION, AND HANDLING. • Key ON Engine OFF. • Access the PCM-FRP PID using a scan tool. • Record fuel pressure. • **Is the fuel pressure within specification (use fuel pressure chart in Pinpoint Test HC)?**	Yes → No →	GO to **A15**. GO to **HB1**.
A15	CHECK INJECTOR SIGNAL FROM NATURAL GAS MODULE		
	Note: This test requires a standard 12V test lamp. A properly operating system will show a dim glow. • Connect a non-powered test lamp between the injector signal circuit and VPWR circuit pin at the injector harness. • Crank the engine. • **Does the test lamp have a dim glow while cranking?**	Yes → No →	GO to **HB1**. GO to **HA16**.
A16	CHECK PCM DRIVER TO COILS		
	• Connect test lamp between B+ and each coil driver circuit at the harness connector. • Crank the engine. • **Does the test lamp blink consistently (one blink per engine revolution)?**	Yes → No →	GO to **A9**. GO to **JD1**.

Powertrain Control Module PCM Power Relay	B

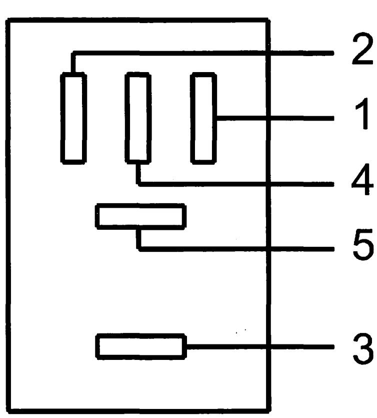
Note

This Pinpoint Test is intended to diagnose the following:

- Harness Circuit(s):
- Vehicle Power.
- Ignition Start/Run.
- PCM Power Relay Ground.
- Battery positive voltage.
- PCM Power Relay (12A646).

PCM Power (PCMPWR) Relay Connector

A



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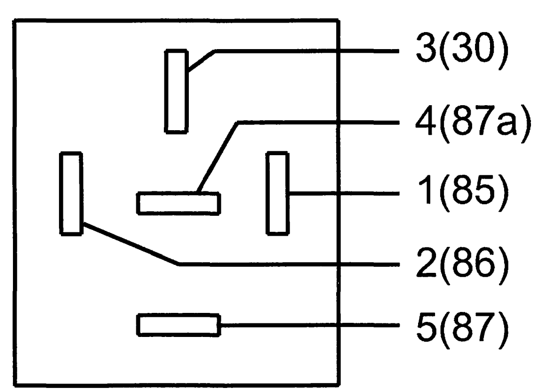

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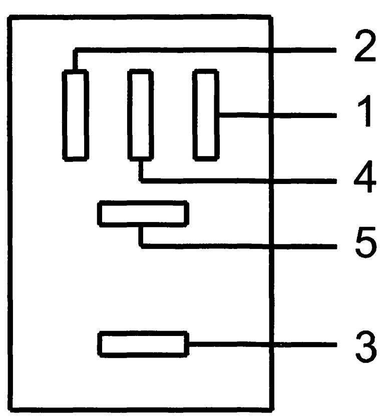
Powertrain Control Module PCM Power Relay

B

Vehicle	Connector	Circuit	Pin
Escape, Focus, Sable	A	VPWR GND IGN START/RUN B+	5 2 1 3
All other vehicles	B	VPWR GND IGN START/RUN B+	87 85 86 30

NOTE: The IGN START/RUN and GROUND circuits, and/or the B+ and VPWR circuits may be reversed in the harness connector. REFER to the Wiring Diagram Manual for more information.

Powertrain Control Module Power - 2 (PCMPWR-2) Relay Connector



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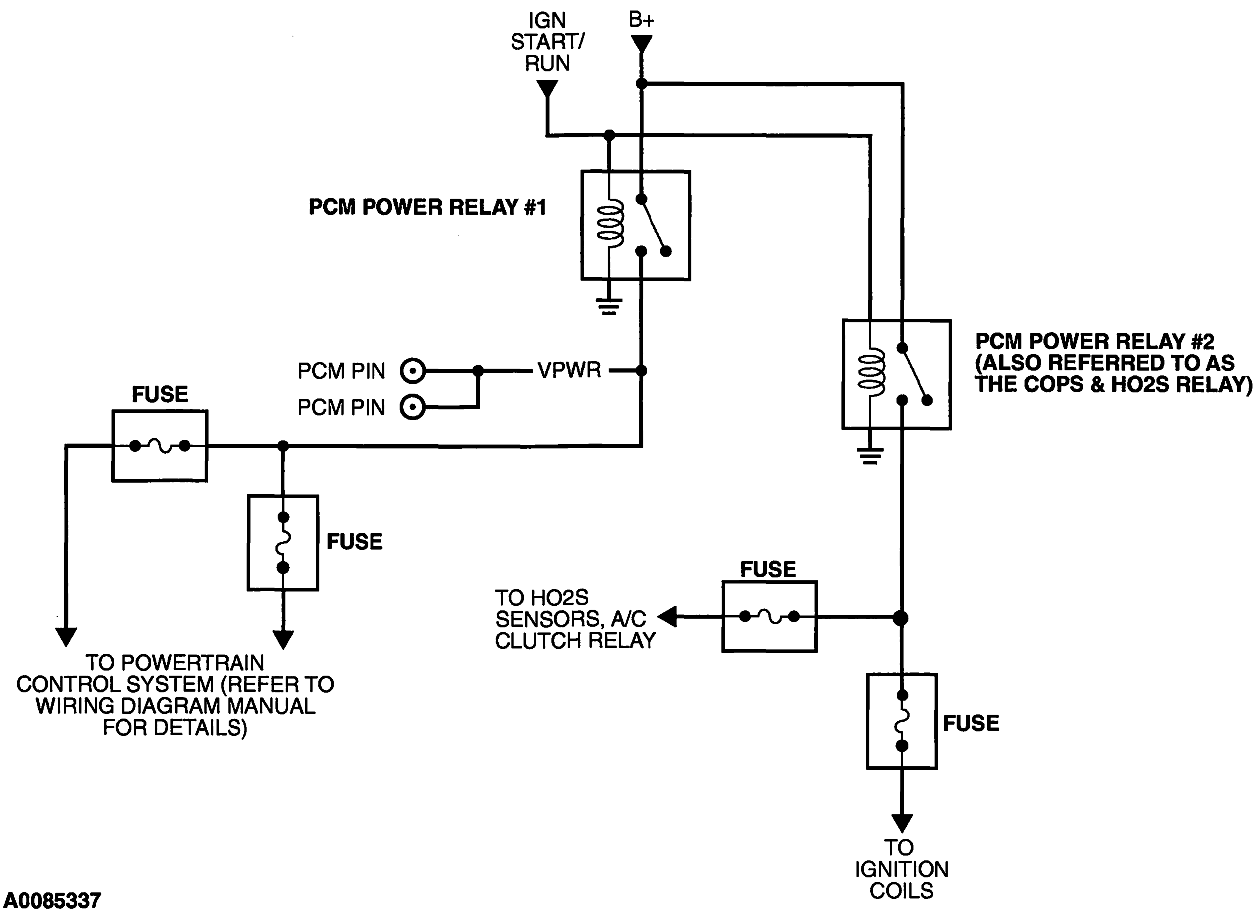
Circuit	Pin
GND (Ground)	1
IGN START/RUN	2
B+ (Battery positive voltage)	3
VPWR (Power supply)	5

Powertrain Control Module PCM Power Relay

B

NOTE: The IGN START/RUN and GROUND circuits, and/or the B+ and VPWR circuits may be reversed in the harness connector. REFER to the Wiring Diagram Manual for more information.



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<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>B1</td><td>CHECK B+ AND IGN START/RUN VOLTAGE TO PCM POWER RELAY</td><td></td><td></td></tr>
<tr><td colspan="2">

PCMPWR Relay connector disconnected.
Key ON Engine OFF.
Measure the Voltage between:

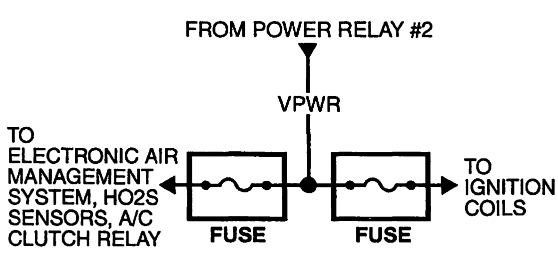
<table>
<tr><th>(+)PCMPWR Relay Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>B+</td><td>Ground</td></tr>
<tr><td>IGN START/RUN</td><td>Ground</td></tr>
</table>

Are the voltages above 10.5 V?

</td>
<td>Yes →
No →</td>
<td>GO to B2.
KEY OFF. REPAIR open circuit.
B+ or IGN START/RUN circuit fault. CHECK condition of related fuse(s)/diode. If OK, REPAIR open circuit. If fuse is damaged, check IGN START/RUN or B+ and VPWR circuits for short to ground before replacing.</td></tr>
</table>

Powertrain Control Module PCM Power Relay

B

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>B2</td><td>CHECK GROUND CIRCUIT TO PCM POWER RELAY</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to B3.
KEY OFF. REPAIR open circuit.</td></tr>
<tr><td colspan="2">
• Measure the Voltage between:
<table>
<tr><th>(+)PCMPWR Relay Connector, Harness Side</th><th>(-)PCMPWR Relay Connector, Harness Side</th></tr>
<tr><td>B+</td><td>GND</td></tr>
</table>
• Is the Voltage above 10.5 V?
</td></tr>
<tr><td>B3</td><td>CHECK FOR OPEN VPWR CIRCUIT BETWEEN PCM AND POWER RELAY</td><td rowspan="2">Yes →
No →</td><td rowspan="2">INSTALL a new PCMPWR relay.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">
• PCM connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)PCMPWR Relay Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>VPWR</td><td>VPWR</td></tr>
</table>
• Is the Resistance below 5 Ohm?
</td></tr>
<tr><td>B4</td><td>CHECK FOR VEHICLES THAT HAVE 2 PCM POWER RELAYS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to B5.
INSTALL a new Component: Fuse.
CHECK VPWR for shorts to ground</td></tr>
<tr><td colspan="2">
Note: The PCM power relay #2 (also referred to as the COPS and HO2S relay) supplies VPWR to two separately fused circuits. REFER to the applicable Wiring Diagrams to determine fuse locations.
•


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• Inspect VPWR circuit fuse that goes to component where VPWR check failed.
• Is the fuse OK?
</td></tr>
</table>

Powertrain Control Module PCM Power Relay	B

Test Steps		Results →	Action to Take
B5	CHECK FOR VPWR TO BOTH FUSES CONNECTED TO PCMPWR-2 RELAY		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)Component: Fuse Connector, Harness Side** / **(-)** VPWR / Ground • Remove and inspect other VPWR circuit fuse that goes to the components supplied by the PCMPR #2. Service as necessary. • Measure the Voltage between: **(+)Component: Fuse Connector, Harness Side** / **(-)** VPWR / Ground • **Is voltage to both fuses greater than 10.5 volts?**	Yes → No →	REPAIR open circuit. (open circuit is between fuse and component where VPWR check failed) KEY OFF. If only one voltage was less than 10.5 volts, repair open circuit between fuse and splice. Otherwise, GO to **B6**.
B6	CHECK VPWR CIRCUIT CONTINUITY BETWEEN FUSE AND PCM POWER RELAY #2		
	• PCMPWR-2 Relay connector disconnected. • Measure the Resistance between: **(+)PCMPWR-2 Relay Connector, Harness Side** / **(-)Component: Fuse Connector, Harness Side** VPWR - Pin 5 / FUSE • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **B7**. REPAIR open circuit. (open is between splice and PCMPWR-2 relay)
B7	CHECK B+ AND IGN START/RUN VOLTAGE TO PCMPWR-2		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)PCMPWR-2 Relay Connector, Harness Side** / **(-)** B+ - Pin 3 / Ground IGN START/RUN - Pin 2 / Ground • **Are the voltages above 10.5 V?**	Yes → No →	GO to **B8**. KEY OFF. REPAIR open circuit. B+ or IGN START/RUN circuit fault. CHECK condition of related fuse(s)/diode. If OK, REPAIR open circuit. If fuse is damaged, check IGN START/RUN or B+ and VPWR circuits for short to ground before replacing.

Powertrain Control Module PCM Power Relay

B

Test Steps		Results →	Action to Take
B8	CHECK PCMPWR-2 GND CIRCUIT FOR OPEN IN HARNESS		
• Measure the Voltage between:		Yes →	INSTALL a new PCMPWR-2 relay.
		No →	KEY OFF. REPAIR open circuit.

(+)PCMPWR-2 Relay Connector, Harness Side	(-)PCMPWR-2 Relay Connector, Harness Side
B+ - Pin 3	GND - Pin 1

• **Is the Voltage above 10.5 V?**

Reference Voltage | C

Note

This Pinpoint Test is intended to diagnose the following: TP, ETCTP, TMAP, ACP, APPS, TR, ACPT, PSPS, and FRP sensors, harness, and PCM.

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	VREF SIGRTN PWRGND VPWR	B20, E20 B17, E17, T17 B24, B25, B26, B27 B32, B33
E-Series 4.6L, E-Series 5.4L, Excursion 5.4L	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 24, 3, 51, 76, 77 71, 97
E-Series 6.8L, Escape 2.0L, Excursion 6.8L, F-150 Heritage 5.4L Dedicated NGV, F-150 Heritage 5.4L Bi-Fuel, F-Series Super Duty	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 23, 24, 3, 51, 76, 77 71, 97
Expedition, Navigator	122 Pin	VREF SIGRTN PWRGND VPWR	B45, E36 B33, E25, T27 B1, B11, B23 B34, B46
Explorer SportTrac, F-150 Heritage 4.2L, Ranger, Sable, Taurus	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 24, 51, 76, 77 71, 97
Explorer, Mountaineer	150 (50-50-50) Pin	ETCREF2 ETCREF1 ETCREF VREF ETCRTN2 ETCRTN1 ETCRTN SIGRTN PWRGND VPWR	B40 B4 E18 B40, E40 B41 B6 E7 B41, E41, T41 B47, B48, B49 B35, B36

(Continued)

Reference Voltage

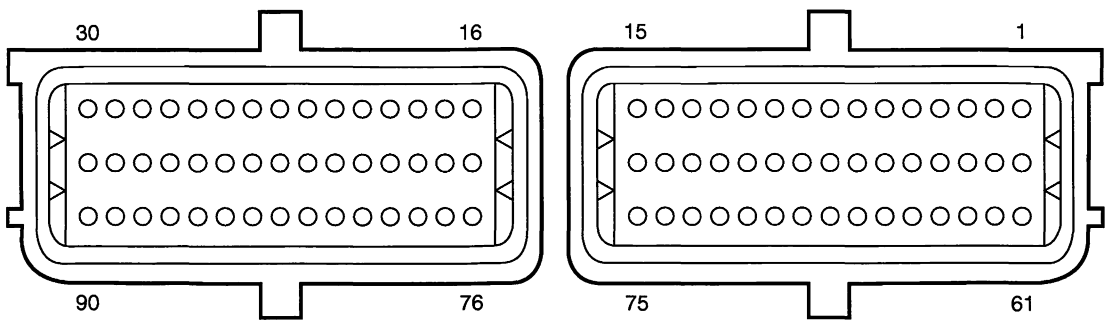
C

Vehicle	Connector	Circuit	Pin
F-150	190 Pin	VREF SIGRTN PWRGND VPWR	B29, E57 B58, E58, T43 B67, B68, B69, B70 B51, B52, B53
F-150 Heritage SC 5.4L	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 24, 3, 51, 77 71, 97
Focus 2.0L 2V, Focus 2.0L 4V	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 24, 51, 77 71, 97
Focus 2.0L SVT	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 23, 24, 51, 77 71, 97
Focus 2.3L	150 (50-50-50) Pin	VREF SIGRTN PWRGND VPWR	B40, E40, T40 B41, E41, T41 B47, B48, B49 B35, B36
Freestar / Monterey	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 24, 51, 76 71, 97
LS, Thunderbird	150 (60-32-58) Pin	ETCREF2 ETCREF1 ETCREF VREF ETCRTN1 ETCRTN SIGRTN PWRGND VPWR	B23 B20 E24 B55, E14 B17 E15 B5, E17, T14 B24, B25, B26, B27 B32, B33
Mustang 3.8L, Mustang 3.9L, Mustang 4.6L Cobra, Mustang 4.6L Mach 1	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 3, 51, 76 71, 97
Mustang 4.6L 2V	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 51, 76, 77 71, 97
All other vehicles	104 Pin	VREF SIGRTN PWRGND VPWR	90 91 103, 24, 3, 51, 76 71, 97

Reference Voltage	C

Natural Gas (NG) Module Connector

A



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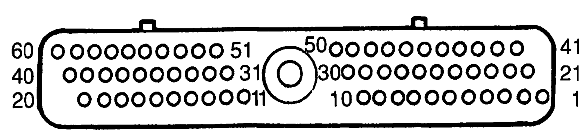

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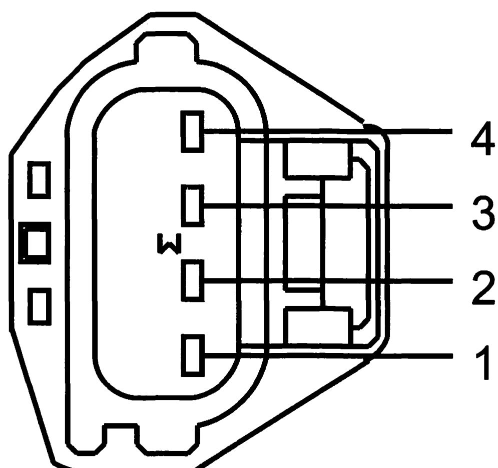
Vehicle	Connector	Circuit	Pin
E-Series	A	CASE GND SRtn SRef PWRGND VPWR	75 89 74 89 60
All other vehicles	B	CASE GND SRtn SRef PWRGND VPWR	25 46 26 40 37

Reference Voltage	C

Electronic Throttle Body TPS (ETBTPS) Sensor Connector



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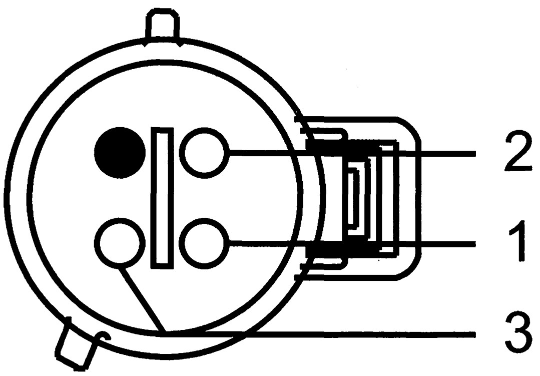
Circuit	Pin
ETCREF (ETCREF (Electronic Throttle Control Reference Voltage to TP))	2
ETCRTN (Electronic Throttle Control Return)	3

Reference Voltage | C

Fuel Rail Pressure (FRP) Sensor Connector

A



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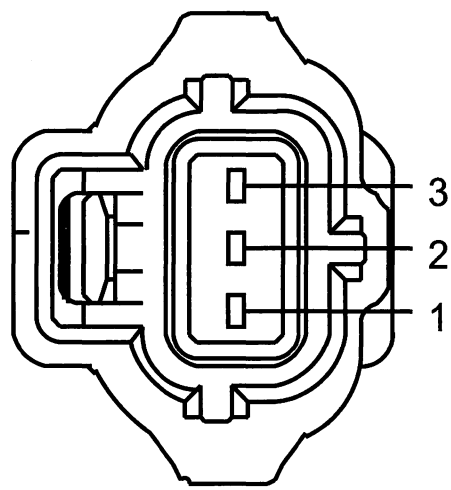

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Vehicle	Connector	Circuit	Pin
Crown Victoria Dedicated NGV, F-150 Heritage 5.4L Dedicated NGV	A	SIGRTN VREF	1 2
E-Series 5.4L Dedicated NGV, F-150 Heritage 5.4L Bi-Fuel	A	SRtn SRef	1 2
All other vehicles	B	SIGRTN VREF	2 1

SENSORS CONNECTED TO VREFS

Applications	TP or ETC TP	DPFEGR or ESM or SMC	FTPT	ACPT	PSPSN	FRP	BARO	TMAP
2.0L 4V Focus	TP	DPFEGR	X		X	X		
Aviator	TP	ESM	X					
2.0L Escape	TP	SMC	X			X		X
Marauder	TP	ESM	X	X	X	X		
3.0L Escape	TP	DPFEGR	X					
2.3L Ranger	TP	SMC	X		X			X
Town Car	TP	ESM	X	X	X	X		
3.0L Ranger, 4.0L Ranger, Mustang	TP	DPFEGR	X			X		
Freestar/Monterey	TP	DPFEGR	X	X				

(Continued)

Reference Voltage | C

SENSORS CONNECTED TO VREFS

Applications	TP or ETC TP	DPFEGR or ESM or SMC	FTPT	ACPT	PSPSN	FRP	BARO	TMAP
Taurus, Sable	TP	DPFEGR	X		X			
E/F Series 5.4L non NGV	TP	DPFEGR	X		X			
LS6, LS8, Thunderbird	ETC TP	ESM	X		X	X		
Expedition/Navigator	TP	DPFEGR	X					
Explorer, Mountaineer(4.6L)	ETC TP	DPFEGR	X					
Excursion/Blackwood	TP	DPFEGR	X					
Explorer, Mountaineer (4.0L)	TP	DPFEGR	X					
5.4L SC F-Series	TP	DPFEGR	X			X	X	
Crown Victoria, Grand Marquis (non NGV)	TP	DPFEGR	X					
5.4L E/F Series w/NGV	TP	DPFEGR	X			X		
Crown Victoria NGV	TP	DPFEGR	X			X		
4.2/4.6L non NGV	TP	ESM	X		X			

Test Steps		Results →	Action to Take
C1	CHECK FOR VREF GREATER THAN 6.0 VOLTS		
	• **Was VREF greater than 6.0 volts when measured in the last test step?**	Yes → No →	KEY OFF. GO to **C14**. GO to **C2**.
C2	CHECK VBAT VOLTAGE		
	• Measure the Voltage between: **(+)12V vehicle battery** — **(-)Vehicle battery** Positive post — Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **C3**. KEY OFF. REPAIR the charging system. REFER to Section 414-00.
C3	CHECK VPWR VOLTAGE AT PCM HARNESS CONNECTOR		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)PCM Connector, Harness Side** — **(-)PCM Connector, Harness Side** VPWR — PWRGND • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **C4**. KEY OFF. VPWR circuit open **For Mustang** GO to **X1**. **For All Others** GO to **B1**.

Reference Voltage

C

	Test Steps	Results →	Action to Take
C4	CHECK VPWR VOLTAGE COMPARED TO VBATT		
	• PCM connector connected. • Key ON Engine OFF. • Use measurement taken in the previous step. • **Is the measured reading within 1.0 V of the VBAT.**	Yes → No →	GO to **C5**. REFER to Charging System, Section 414 in the Workshop Manual.
C5	CHECK VOLTAGE BETWEEN VBAT AND THE SIGRTNS, ETCRTN, ETCRTN1, ETCRTN2		
	• Disconnect sensor where VREF failed. (DTC indicates the failure location). Note: The following measurement is to be performed using the SIGRTN at the sensor where failure is indicated. • Measure voltage between SIGRTNs, ETCRTN, ETCRTN1, ETCRTN2 where VREF failed and battery power. • **Is the voltage above 10.5V?**	Yes → No →	GO to **C6**. KEY OFF. REPAIR open SIGRTN circuit. If DTCS reappear or vehicle will not re-self test : GO to **C7**.
C6	VERIFY THAT VEHICLE WILL SELF TEST		
	• Perform Self-Test. • **Does the vehicle self test?**	Yes → No →	GO to **C7**. KEY OFF. If DTCS reappear or vehicle will not re-self test : GO to **C8**.
C7	CHECK VREF WITH ALL SENSORS DISCONNECTED		
	Note: The following measurement is to be performed using the SIGRTN at the sensor where failure is indicated. Also, for NGV applications, the NGV Module should be disconnected for the measurements. • Remove harness connectors from all the sensors connected to VREF. • Measure voltage between VREF and SIGRTN circuits at the sensor harness connector. • **Is the voltage reading between 4.0 and 6.0 volts?**	Yes → No →	GO to **C15**. KEY OFF. GO to **C8**.

Reference Voltage — C

Test Steps		Results →	Action to Take
C8	CHECK FOR OPEN SIGRTN AND VREF CIRCUITS IN THE PCM		

- PCM connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Component Side	(-)PCM Connector, Component Side
SIGRTN	PWRGND
PWRGND	ETCRTN

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
PWRGND	ETCRTN1
PWRGND	ETCRTN2

- Measure the Resistance between:

(+)PCM Connector, Component Side	(-)PCM Connector, Component Side
VREF	ETCREF
VREF	ETCREF1
VREF	ETCREF1
VREF	ETCREF2

- Measure resistance between SIGRTN and the sensor where fault is indicated.
- **Are the resistances above 5 Ohms.**

Results	Action to Take
Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
No →	VREF short to GND GO to **C9**.

Reference Voltage

C

Test Steps		Results →	Action to Take
C9	CHECK VREF CIRCUIT FOR SHORT TO GND IN PCM		
	Note: Measure circuits the following circuits that apply to the vehicle. • Measure the Resistance between:	Yes → No →	GO to **C10**. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

(+)PCM Connector, Component Side	(-)PCM Connector, Component Side
SIGRTN	VREF
SIGRTN	ETCREF

• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
SIGRTN	ETCREF1
SIGRTN	ETCREF2

• Measure the Resistance between:

(+)PCM Connector, Component Side	(-)PCM Connector, Component Side
ETCRTN	VREF
ETCRTN	ETCREF
ETCRTN	ETCREF1
ETCRTN	ETCREF2
ETCRTN1	VREF
ETCRTN1	ETCREF
ETCRTN1	ETCREF1
ETCRTN1	ETCREF2
ETCRTN2	VREF
ETCRTN2	ETCREF
ETCRTN2	ETCREF1
ETCRTN2	ETCREF2

• **Are the resistances above 10 K Ohms.**

Reference Voltage

C

Test Steps		Results →	Action to Take
C10	CHECK FOR OPEN CIRCUITS BETWEEN PCM AND SIGRTN COMPONENTS		
	• Measure resistance between SIGRTNs at the PCM connector and SIGRTNs at the sensors. • Measure the Resistance between:	Yes → No →	REPAIR open circuit. VREF short to GND GO to **C11**.

(+)PCM Connector, Harness Side	(-)ETBTPS Sensor Connector, Harness Side
ETCRTN	ETCRTN - Pin 3

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)APPS Connector, Harness Side
ETCRTN1	ETCRTN1
ETCRTN2	ETCRTN2

- Measure resistance between SIGRTN and the sensor where fault is indicated.
- **Are the resistances above 5 Ohmns.**

Test Steps		Results →	Action to Take
C11	CHECK VREF CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **C12**. REPAIR short circuit to GND. VREF short to GND

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VREF	SIGRTN
VREF	PWRGND
ETCREF	ETCRTN
ETCREF1	ETCRTN1
ETCREF2	ETCRTN2

- **Are the resistances above 1 KOhm?**

Reference Voltage

C

Test Steps		Results →	Action to Take
C12	CHECK THE VREF CIRCUIT FOR OPEN IN HARNESS		
	• Sensor where the VREF check failed disconnected. • PCM connector disconnected. • Measure the resistance of VREF circuit between PCM Connector, Harness Side, and appropriate sensor connector harness side, VREF pin. • **Is resistance less than 5 ohms?**	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	KEY OFF. REPAIR open circuit. CLEAR the DTCs and REPEAT Self-Test. If DTCS reappear or vehicle will not re-self test : GO to **C13**.
C13	CHECK THE PWRGND CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Sensor where the VREF check failed connected. • Measure the Resistance between:	Yes →	GO to **C14**.
		No →	REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)12V vehicle battery
PWRGND	Negative post

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
C14	CHECK VREF CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	KEY OFF. CLEAR the DTCs and REPEAT Self-Test. If any DTCS are present proceed to the step where the fault is indicated. GO to **C15**.
		No →	KEY OFF. REPAIR short circuit to PWR.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VREF	VPWR
ETCREF	VPWR
ETCREF1	VPWR
ETCREF2	VPWR

• **Are the resistances above 10 KOhm?**

Reference Voltage

C

Test Steps		Results →	Action to Take
C15	CHECK VOLTAGE ON THE TP CIRCUIT		
	Note: Proceed to next step if vehicle does not have the sensor. • PCM connector connected. • TP Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **C16**.
		No →	KEY OFF. INSTALL a new TP sensor.

(+)TP Sensor Connector, Harness Side	**(-)TP Sensor Connector, Harness Side**
VREF	SIGRTN

• **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
C16	CHECK VOLTAGE ON THE ETC TP CIRCUIT		
	• ETBTPS Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **C17**.
		No →	KEY OFF. INSTALL a new ETCTP.

(+)ETBTPS Sensor Connector, Harness Side	**(-)ETBTPS Sensor Connector, Harness Side**
ETCREF - Pin 2	ETCRTN - Pin 3

• **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
C17	CHECK VOLTAGE ON THE DPFEGR CIRCUIT		
	Note: Proceed to next step if vehicle does not have the sensor. • DPFEGR Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **C18**.
		No →	INSTALL a new DPFEGR sensor.

(+)DPFEGR Sensor Connector, Harness Side	**(-)DPFEGR Sensor Connector, Harness Side**
VREF	SIGRTN

• **Is the Voltage between 4 V - 6 V?**

Reference Voltage — C

Test Steps		Results	Action to Take
C18	CHECK VOLTAGE ON THE ESM CIRCUIT		
	Note: Proceed to next step if vehicle does not have the sensor. • ESM connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between: **(+)ESM Connector, Harness Side**: VREF — **(-)ESM Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	KEY OFF. GO to **C19**. KEY OFF. INSTALL a new ESM.
C19	CHECK VOLTAGE ON THE TMAP CIRCUIT		
	Note: Proceed to next step if vehicle does not have the sensor. • MAP/TMAP Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between: **(+)MAP/TMAP Sensor Connector, Harness Side**: VREF — **(-)MAP/TMAP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	KEY OFF. GO to **C20**. KEY OFF. INSTALL a new MAP/TMAP sensor.
C20	CHECK VREF CIRCUIT FOR SHORT TO SIGRTN IN FRP		
	Note: Proceed to next step if vehicle does not have the sensor. • FRP Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between: **(+)FRP Sensor Connector, Harness Side**: VREF — **(-)FRP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	KEY OFF. GO to **C21**. KEY OFF. INSTALL a new FRP sensor.

Reference Voltage

C

Test Steps		Results →	Action to Take
C21	CHECK VREF CIRCUIT FOR SHORT TO SIGRTN IN APPS		
	Note: Proceed to next step if vehicle does not have the sensor. • APPS connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **C22**.
		No →	KEY OFF. INSTALL a new APPS.

(+)APPS Connector, Harness Side	**(-)APPS Connector, Harness Side**
ETCREF1	ETCRTN1

- **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
C22	CHECK VREF CIRCUIT FOR SHORT TO SIGRTN IN FTPT		
	Note: If vehicle is not equipped with proceed to the next step. • FTPT Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **C23**.
		No →	KEY OFF. INSTALL a new FTPT sensor.

(+)FTPT Sensor Connector, Harness Side	**(-)FTPT Sensor Connector, Harness Side**
VREF	SIGRTN

- **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
C23	CHECK VREF CIRCUIT FOR SHORT TO SIGRTN IN ACPT		
	• Proceed to next step if vehicle does not have the sensor. • ACPT Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **C24**.
		No →	KEY OFF. INSTALL a new ACPT sensor.

(+)ACPT Sensor Connector, Harness Side	**(-)ACPT Sensor Connector, Harness Side**
VREF	SIGRTN

- **Is the Voltage between 4 V - 6 V?**

Reference Voltage — C

Test Steps		Results →	Action to Take
C24	CHECK VREF CIRCUIT FOR SHORT TO SIGRTN IN PSPSN		
	• Proceed to next step if vehicle does not have the sensor. • PSP Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **C25**.
		No →	KEY OFF. INSTALL a new PSPSN.

(+)PSP Sensor Connector, Harness Side	(-)PSP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
C25	CHECK VREF CIRCUIT FOR SHORT TO SIGRTN IN BARO		
	• BARO connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	INSTALL a new BARO.

(+)BARO Connector, Harness Side	(-)BARO Connector, Harness Side
VREF	SIGRTN

- **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
C26	CHECK FOR SREF GREATER THAN 6.0 VOLTS		
	• **Was SREF greater than 6.0 volts when measured in the last step?**	Yes →	KEY OFF. GO to **C30**.
		No →	GO to **C27**.
C27	CHECK VBAT VOLTAGE		
	• Measure the Voltage between:	Yes →	GO to **C28**.
		No →	KEY OFF. REPAIR the charging system. REFER to Section 414-00.

(+)12V vehicle battery	(-)Vehicle battery
Positive post	Negative post

- **Is the Voltage above 10.5 V?**

Reference Voltage

C

Test Steps	Results →	Action to Take
C28 CHECK VPWR VOLTAGE AT NG HARNESS CONNECTOR		
• NG Module connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)NG Module Connector, Harness Side**: VPWR / **(-)NG Module Connector, Harness Side**: PWRGND • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **C29**. KEY OFF. REPAIR open circuit.
C29 CHECK VPWR VOLTAGE COMPARED TO VBATT		
• NG Module connector connected. • Key ON Engine OFF. • Use measurement taken in the previous step. • **Is the measured reading within 1.0 V of the VBAT.**	Yes → No →	GO to **C31**. REFER to Charging System, Section 414 in the Workshop Manual.
C30 CHECK SREF CIRCUIT FOR SHORT TO VPWR IN HARNESS		
• NG Module connector disconnected. • Measure the Resistance between: **(+)NG Module Connector, Harness Side**: SRef / **(-)NG Module Connector, Harness Side**: VPWR • Measure the Resistance between: **(+)NG Module Connector, Harness Side**: SRef / **(-)Vehicle battery**: Positive post • **Are the resistances greater than 10 K Ohms?**	Yes → No →	KEY OFF. CLEAR the DTCs and REPEAT Self-Test. If any DTCS are present proceed to the step where the fault is indicated. KEY OFF. REPAIR short circuit to PWR.
C31 CHECK FOR OPEN SRTN CIRCUIT IN THE NG MODULE		
• NG Module connector disconnected. • Measure the Resistance between: **(+)NG Module Connector, Component Side**: SRtn / **(-)NG Module Connector, Component Side**: PWRGND **(+)NG Module Connector, Component Side**: SRtn / **(-)NG Module Connector, Component Side**: CASE GND • **Are the resistances above 5 Ohm?**	Yes → No →	INSTALL a new NG module. GO to **C32**.

Reference Voltage — C

Test Steps		Results →	Action to Take
C32	CHECK SREF CIRCUIT FOR SHORT TO GND IN NG MODULE		
	• NG Module connector disconnected. • Measure the Resistance between:	Yes →	GO to **C33**.
		No →	INSTALL a new NG module.

(+)NG Module Connector, Component Side	**(-)NG Module Connector, Component Side**
SRef	SRtn
SRef	PWRGND

• Measure the Resistance between:

(+)NG Module Connector, Harness Side	**(-)NG Module Connector, Harness Side**
SRef	CASE GND

• **Are the resistances above 10 K Ohms.**

Test Steps		Results →	Action to Take
C33	CHECK FOR OPENS IN HARNESS BETWEEN THE NG MODULE AND SREF SENSORS		
	• NG Module connector disconnected. • FRP Sensor connector disconnected. • Measure the Resistance between:	Yes →	GO to **C34**.
		No →	REPAIR open circuit.

(+)NG Module Connector, Harness Side	**(-)FRP Sensor Connector, Harness Side**
SRef	SRef
SRtn	SRtn

• **Are all resistances below 5 Ohm?**

Test Steps		Results →	Action to Take
C34	CHECK SREF CIRCUIT(S) FOR SHORT TO SRTN OR GND IN HARNESS		
	• FRP Sensor connector disconnected. • NG Module connector disconnected. • Measure the Resistance between:	Yes →	GO to **C35**.
		No →	REPAIR short circuit to GND.

(+)NG Module Connector, Harness Side	**(-)NG Module Connector, Harness Side**
SRef	SRtn
SRef	PWRGND
SRef	CASE GND

• **Are all resistances greater than 10K ohms?**

Reference Voltage

C

Test Steps		Results →	Action to Take
C35	CHECK THE PWRGND CIRCUIT FOR OPEN IN HARNESS		
	• FRP Sensor connector disconnected. • NG Module connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **C36**. REPAIR open circuit.

(+)NG Module Connector, Harness Side	(-)12V vehicle battery
PWRGND	Negative post

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
C36	CHECK SREF VOLTAGE AT THE FRP HARNESS CONNECTOR		
	• FRP Sensor connector disconnected. • NG Module connector connected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **C37**. KEY OFF. INSTALL a new NG module.

(+)FRP Sensor Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
SRef	SRtn

• **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
C37	CHECK SREF VOLTAGE WITH THE FRP CONNECTED		
	• FRP Sensor connector connected. • Key ON Engine OFF. • The following measurement is made at the back of the harness connector with the connector connected. • Measure the Voltage between:	Yes → No →	KEY OFF. Concern is intermittent: GO to **Z1**. KEY OFF. INSTALL a new FRP sensor.

(+)FRP Sensor Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
SRef	SRtn

• **Is the Voltage between 4 V - 6 V?**

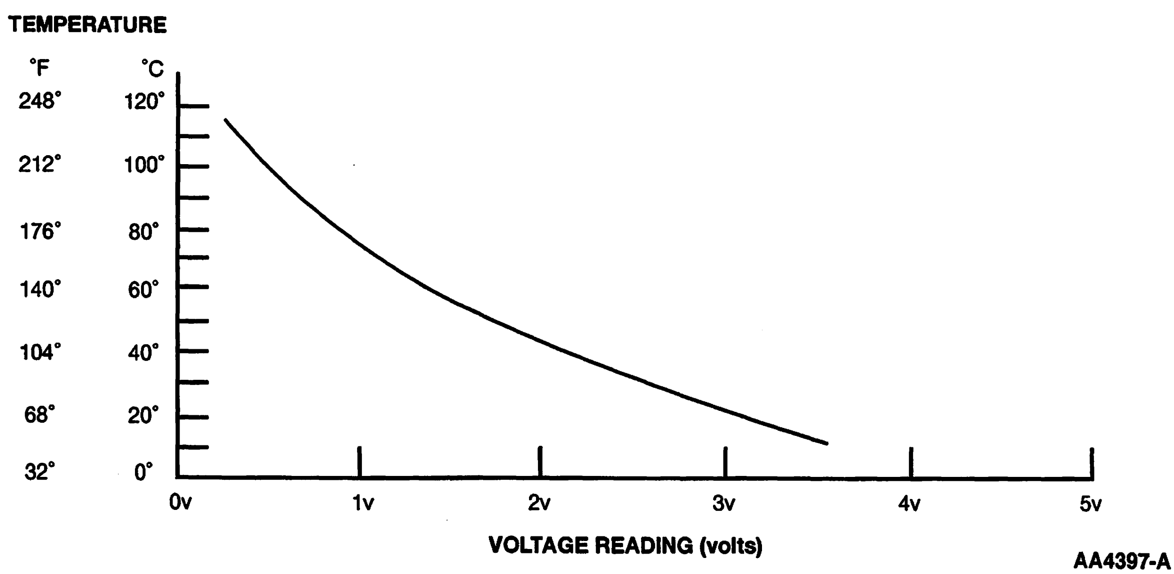
Intake Air Temperature (IAT) Sensor | DA

Note

This Pinpoint Test is intended to diagnose the following:

- Intake Air Temperature (IAT) Sensor (12A697).
- Integrated MAF/intake air temperature (IAT) sensor (12B579).
- Harness circuits: IAT, VREF and SIGRTN.
- Powertrain control module (PCM) (12A650).

Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.



TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84

(Continued)

Intake Air Temperature (IAT) Sensor | DA

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

Intake Air Temperature (IAT) Connector

On some applications the IAT signal is integrated into the MAF sensor.

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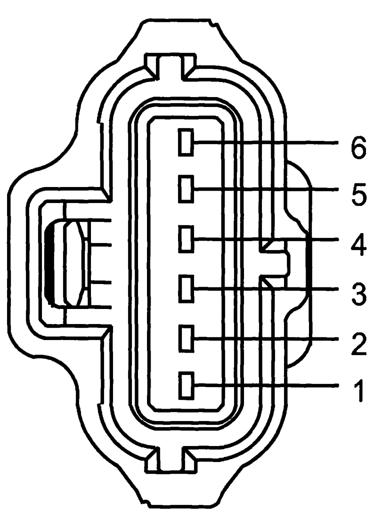

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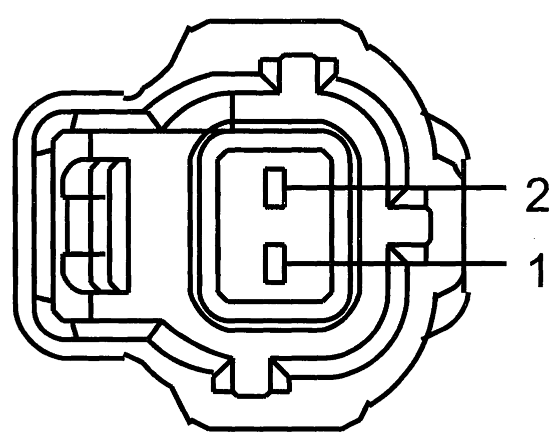

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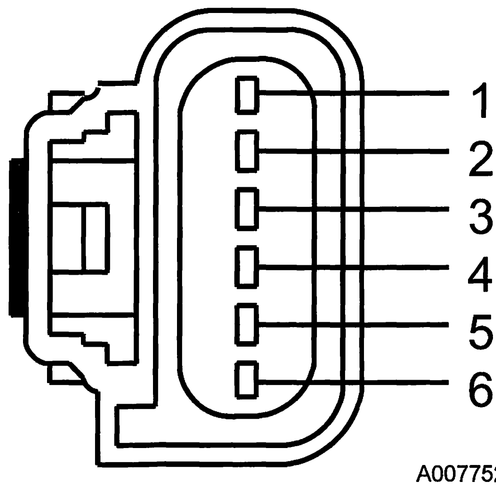
Intake Air Temperature (IAT) Sensor	DA

C



Vehicle	Connector	Circuit	Pin
Aviator, Crown Victoria Non-Police, Grand Marquis, Marauder, Mustang 3.8L, Mustang 3.9L, Mustang 4.6L 2V, Mustang 4.6L Mach 1, Town Car, Escape, Excursion, Explorer SportTrac, F-150 4.6L, F-Series Super Duty	A	SIGRTN IAT	1 6
Mustang 4.6L Cobra, F-150 Heritage, Expedition, F-150 Heritage, Navigator	B	SIGRTN IAT	2 1
Focus 2.0L	A	SIGRTN IAT	6 1
All other vehicles	C	SIGRTN IAT	2 1

Powertrain Control Module (PCM) Connector

Intake Air Temperature (IAT) Sensor | DA

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	VREF SIGRTN IAT	B20 B17 B51
Expedition, Navigator	122 Pin	VREF SIGRTN IAT	B45 E25 B19
Explorer, Mountaineer	150 (50-50-50) Pin	VREF SIGRTN IAT	B40 B41 B16
F-150	190 Pin	VREF SIGRTN IAT	B29 E58 B43
Focus 2.3L	150 (50-50-50) Pin	VREF SIGRTN IAT	B40 E41 B20
LS, Thunderbird	150 (60-32-58) Pin	VREF SIGRTN IAT	B55 B5 B51
All other vehicles	104 Pin	VREF SIGRTN IAT	90 91 39

Test Steps		Results →	Action to Take
DA1	DTC P0113: SIMULATE OPPOSITE SIGNAL TO PCM		
	• DTC indicates the sensor signal is greater than the Self-Test maximum. • Possible causes: — Open in harness. — Incorrect harness connections. — Faulty Sensor. — Faulty or damaged PCM. • IAT connector disconnected. Note: On some applications the IAT signal is integrated into the MAF sensor. • Key ON Engine OFF. • Add jumper wire between the points described below: (see table below) • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. REMOVE jumper. GO to **DA4**. GO to **DA2**.

Point A IAT Connector, Harness Side	Point B IAT Connector, Harness Side
IAT	SIGRTN

Intake Air Temperature (IAT) Sensor | DA

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DA2</td><td>CHECK FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">INSTALL a new IAT.
KEY OFF.
REMOVE jumper.
GO to DA3.</td></tr>
<tr><td colspan="2">• Jumper installed.
• Access the PCM-IAT V PID using a scan tool.
• Is the Voltage below 0.2 V?</td></tr>
<tr><td>DA3</td><td>CHECK SIGNAL AND SIGRTN CIRCUITS FOR OPEN IN HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM.
REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM
REPAIR open circuit.</td></tr>
<tr><td colspan="2">• PCM connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)IAT Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>IAT</td><td>IAT</td></tr><tr><td>SIGRTN</td><td>SIGRTN</td></tr></table>• Are the resistances below 5 Ohm?</td></tr>
<tr><td>DA4</td><td>CHECK SENSOR SIGNAL FOR SHORT TO VREF</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM.
REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM
REPAIR short circuit to VREF.</td></tr>
<tr><td colspan="2">• Key OFF.
• PCM connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>IAT</td><td>VREF</td></tr></table>• Is the Resistance above 10 KOhm?</td></tr>
<tr><td>DA5</td><td>DTC P0112: SIMULATE OPPOSITE SIGNAL TO PCM</td><td rowspan="2">Yes →
No →</td><td rowspan="2">KEY OFF. INSTALL a new IAT.
KEY OFF.
GO to DA6.</td></tr>
<tr><td colspan="2">• DTC indicates the sensor signal is less than the Self-Test minimum.
• Possible causes:
— Grounded circuit in harness.
— Incorrect harness connections.
— Faulty Sensor.
— Faulty or damaged PCM.
• IAT connector disconnected.
Note: On some applications the IAT signal is integrated into the MAF sensor.
• Key ON Engine OFF.
• Access the PCM-IAT V PID using a scan tool.
• Is the Voltage above 4.2 V?</td></tr>
</table>

Intake Air Temperature (IAT) Sensor | DA

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DA6</td><td>CHECK SENSOR SIGNAL FOR SHORT TO GROUND</td><td></td><td></td></tr>
<tr><td colspan="2">
• PCM connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>IAT</td><td>SIGRTN</td></tr>
</table>
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)12V vehicle battery</th></tr>
<tr><td>IAT</td><td>Negative post</td></tr>
</table>
• Is the Resistance above 10 KOhm?
</td><td>Yes →

No →</td><td>INSTALL a new PCM.
REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM

REPAIR short circuit.</td></tr>
<tr><td>DA7</td><td>SELF-TEST DTCS P0112, P0113, P0114 OR P1112: INTERMITTENT CHECK</td><td></td><td></td></tr>
<tr><td colspan="2">
• Key ON Engine OFF.
• Access the PCM-IAT V PID using a scan tool.
• While observing the PID, complete the following:
— Tap on sensor to simulate road shock.
— Wiggle the sensor connector.
• Is there a large change in the voltage reading?
</td><td>Yes →

No →</td><td>DISCONNECT and INSPECT connector.
If OK,
REPLACE Component.

GO to DA8.</td></tr>
<tr><td>DA8</td><td>CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
• Access the PCM-IAT V PID using a scan tool.
• While observing the PID, complete the following:
— Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM.
• Is there a large change in the voltage reading?
</td><td>Yes →

No →</td><td>ISOLATE fault
Repair as necessary.

KEY OFF.
GO to DA9.</td></tr>
<tr><td>DA9</td><td>CHECK PCM AND VEHICLE HARNESS CONNECTORS</td><td></td><td></td></tr>
<tr><td colspan="2">
• PCM connector disconnected.
• IAT connector disconnected.
Note: On some applications the IAT signal is integrated into the MAF sensor.
• Are connectors and terminals OK?
</td><td>Yes →

No →</td><td>Fault is not present at this time
Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.

Repair as necessary.</td></tr>
</table>

Mass Air Flow Sensor	DC

Note

This Pinpoint Test is intended to diagnose the following:

- Mass Air Flow (MAF) Sensor (12B579).
- Harness Circuits: MAF SIG, MAF RTN, Vehicle Power (VPWR), and PowerGround (PWRGND).
- Powertrain Control Module (PCM) (12A650).

Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor Connector

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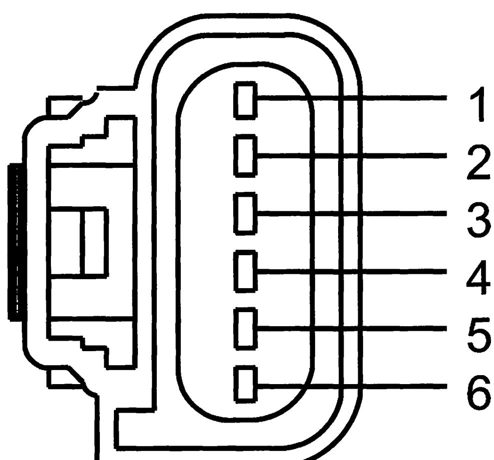

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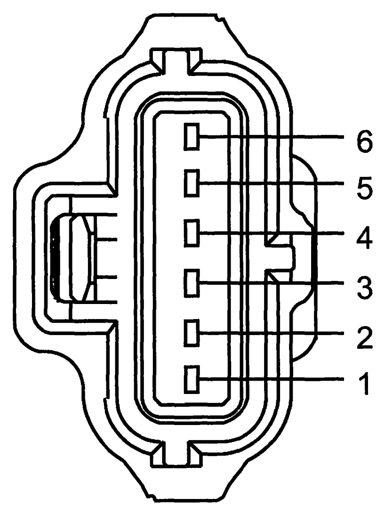

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Mass Air Flow Sensor

DC

Vehicle	Connector	Circuit	Pin
F-150 5.4L, LS, Freestar / Monterey, Ranger	A	MARTN MAF PWRGND VPWR	4 3 5 6
Focus 2.3L	A	MARTN MAF PWRGND VPWR	3 4 2 1
All other vehicles	B	MARTN MAF PWRGND VPWR	4 5 3 2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	MARTN MAF	B38 B31
Expedition, Navigator	122 Pin	MARTN MAF	B30 B31
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	MARTN MAF	B43 B32
F-150	190 Pin	MARTN MAF	B42 B41
All other vehicles	104 Pin	MARTN MAF	36 88

BAROMETRIC PRESSURE REFERENCE CHART

Barometric Pressure (in. Hg.)	Barometric Pressure (kPa)	BARO/MAP PID (Hz)	Altitude Above Sea Level (ft)
3.5	11.8	89.3	
5	16.9	92.8	
10	33.8	104.6	
15	50.7	117.0	14,000
20	67.5	129.6	10,000
21	70.9	132.5	9,000
22	74.3	135.4	8,000
23	77.7	138.3	7,000
24	81.1	141.1	6,000

(Continued)

Mass Air Flow Sensor | DC

BAROMETRIC PRESSURE REFERENCE CHART

Barometric Pressure (in. Hg.)	Barometric Pressure (kPa)	BARO/MAP PID (Hz)	Altitude Above Sea Level (ft)
25	84.4	144.0	5,000
26	87.8	146.9	4,000
27	91.2	149.8	3,000
28	94.6	152.8	2,000
29	97.9	155.8	1,000
30	101.3	158.9	0 (sea level)
31	104.7	162.0	
31.875	107.7	164.7	

Test Steps		Results →	Action to Take
DC1	DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCS		
	• Retrieve CMDTCs. • **Is a Continuous Memory MAF DTC present with the KOER DTC P1101?**	Yes → No →	GO to **DC2**. KEY OFF. GO to **DC4**.
DC2	VERIFY CONTINUOUS MEMORY DTC P0102		
	• **Is Continuous Memory DTC P0102 present with the KOER DTC P1101?**	Yes → No →	GO to **DC4**. GO to **DC3**.
DC3	VERIFY CONTINUOUS MEMORY DTC P0103		
	• **Is Continuous Memory DTC P0103 present with the KOER DTC P1101?**	Yes → No →	GO to **DC19**. All other Continuous Memory DTCs: Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
DC4	KOER AND CONTINUOUS MEMORY DTCS P0102, P0104 OR P1101: CHECK INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE		
	• CHECK air inlet system (air cleaner, housing, ductwork, etc.) for obstructions or blockage. • CHECK for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in air outlet tube, worn gaskets between MAF sensor and air cleaner assembly. Verify MAF sensor is connected. Repair as necessary. • **Were there any concerns found during the visual inspection?**	Yes → No →	KEY OFF. Repair as necessary. GO to **DC5**.

Mass Air Flow Sensor | DC

Test Steps		Results →	Action to Take
DC5	CHECK MAF PID		
	• Run engine up to 1500 rpm for 5 seconds, then bring it back to idle. • Access the MAF V PID using a scan tool. • **Is the Voltage below 0.23 V?**	Yes → No →	KEY OFF. GO to **DC8**. KEY OFF. GO to **DC6**.
DC6	CHECK MAF SIGNAL SENT TO PCM		
	Note: DTC P1101 can be generated by a low charged vehicle battery or the garage exhaust ventilation system. Repair battery as necessary. Then remove ventilation system and properly vent to outside atmosphere. Check air inlet system (air cleaner, housing, ductwork, etc.) for obstructions or blockage. Rerun KOEO Self Test. • MAF/IAT Sensor connector connected. • Key ON Engine OFF. • Access the MAF V PID using a scan tool. • **Is the Voltage below 0.2 V?**	Yes → No →	GO to **DC7**. KEY OFF. GO to **DC8**.
DC7	CHECK MAF SIGNAL SENT TO PCM		
	• Key ON Engine RUN. • Access the MAF V PID using a scan tool. • **Is the Voltage between 0.46 V - 2.44 V?**	Yes → No →	Unable to identify fault at this time. GO to **Z1**. KEY OFF. GO to **DC8**.
DC8	CHECK VPWR TO MAF SENSOR		
	• MAF/IAT Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)MAF/IAT Sensor Connector, Harness Side: VPWR — (-)Vehicle battery: Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **DC9**. KEY OFF. REPAIR open circuit.
DC9	CHECK PWRGND CIRCUIT TO MAF SENSOR		
	• Measure the Voltage between: (+)Vehicle battery: Positive post — (-)MAF/IAT Sensor Connector, Harness Side: PWRGND • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **DC10**. KEY OFF. REPAIR open circuit.

DC8 measurement:

(+)MAF/IAT Sensor Connector, Harness Side	(-)Vehicle battery
VPWR	Negative post

DC9 measurement:

(+)Vehicle battery	(-)MAF/IAT Sensor Connector, Harness Side
Positive post	PWRGND

Mass Air Flow Sensor DC

Test Steps		Results →		Action to Take
DC10	CHECK MAF CIRCUIT SHORT TO PWRGND OR MAF RTN IN THE HARNESS			
	• MAF/IAT Sensor connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes	→	GO to **DC11**.
		No	→	REPAIR short circuit.

(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side
MAF	PWRGND
MAF	MARTN

• **Are the resistances above 10 KOhm?**

Test Steps		Results →		Action to Take
DC11	CHECK MAF RTN CIRCUIT FOR SHORT TO PWRGND IN HARNESS			
	• Measure the Resistance between:	Yes	→	GO to **DC12**.
		No	→	REPAIR short circuit to GND.

(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side
MARTN	PWRGND

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →		Action to Take
DC12	CHECK MAF CIRCUIT SHORT TO PWRGND IN THE PCM			
	• PCM connector connected. • Measure the Resistance between:	Yes	→	GO to **DC13**.
		No	→	INSTALL a new PCM.

(+)MAF/IAT Sensor Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side
MAF	PWRGND

• **Is the Resistance above 10 KOhm?**

Mass Air Flow Sensor	DC

Test Steps	Results →	Action to Take
DC13 CHECK MAF CIRCUIT VOLTAGE CYCLING INTEGRITY		

- Scan tool connector connected.
- Key ON Engine OFF.
- Access MAF V PID.
- Record the MAF V PID reading.
- Add jumper wire between the points described below:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MARTN	PWRGND
MAF	VPWR

- **Does the MAF V PID change from less than .23 volts (closer to zero volts) to greater than 4.50 volts?**

Results	Action to Take
Yes →	KEY OFF. INSTALL a new MAF sensor. REMOVE jumper wire(s) RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).
No →	KEY OFF. REMOVE jumper wire(s) GO to **DC14**.

DC14 CHECK MAF CIRCUIT FOR OPEN IN HARNESS

- PCM connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side
MAF	MAF

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	GO to **DC15**.
No →	REPAIR open circuit.

DC15 CHECK PWRGND CIRCUIT FOR OPEN IN HARNESS

- PCM connector disconnected.
- Measure the Resistance between:

(+)MAF/IAT Sensor Connector, Harness Side	(-)Vehicle battery
PWRGND	Negative post

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	GO to **DC16**.
No →	REPAIR open circuit.

DC16 CHECK MAF RTN CIRCUIT FOR OPEN IN HARNESS

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)MAF/IAT Sensor Connector, Harness Side
MARTN	MARTN

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	INSTALL a new PCM.
No →	REPAIR open circuit.

Mass Air Flow Sensor — DC

Test Steps		Results →	Action to Take
DC17	DTC P1100: CHECK MAF CIRCUIT FOR INTERMITTENT VOLTAGE TO PCM		
	• CHECK for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in air outlet tube, worn gaskets between MAF sensor and air cleaner assembly. Verify MAF sensor is connected. • Key ON Engine RUN. • Access the PCM-MAF V PID using a scan tool. • If idle is not stable, GO to Section 3, Symptom Charts. • Run engine up to 1500 rpm for 5 seconds, then bring it back to idle. • Access the MAF V PID using a scan tool. • Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock. • **Does the MAF PID go below 0.23V or above 4.6V?**	Yes → No →	KEY OFF. INSPECT MAF sensor connector. If OK, REPLACE MAF sensor. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset). GO to **DC18**.
DC18	CHECK MAF CIRCUIT FOR INTERMITTENT OPEN OR SHORTS		
	• Key ON Engine RUN. • Access the MAF V PID using a scan tool. • Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • **Does the MAF PID go below 0.23V or above 4.6V?**	Yes → No →	KEY OFF. REPAIR as necessary. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset). KEY OFF. Unable to duplicate or identify fault at this time.
DC19	DTC P0103: CHECK MAF SENSOR SCREEN FOR CONTAMINATION		
	Note: DTC P0103 can be generated by foreign material blocking the MAF sensor screen causing an air flow restriction. • CHECK the MAF sensor screen for contamination or blockage. • CHECK air cleaner element and air tubes for proper installation and sealing. • **Were any problems found?**	Yes → No →	Repair as necessary. Rerun Self Test GO to **DC20**.
DC20	DTC P0103: CHECK MAF SENSOR SIGNAL HIGH INPUT TO PCM		
	• Key ON Engine OFF. • Access the PCM-MAF V PID using a scan tool. • **Is the Voltage above 2.44 V?**	Yes → No →	KEY OFF. GO to **DC21**. GO to **DC23**.

Mass Air Flow Sensor

DC

Test Steps		Results →	Action to Take
DC21	CHECK MAF SENSOR SIGNAL SENT TO PCM		
	• MAF/IAT Sensor connector disconnected. • Add jumper wire between the points described below: **Point A MAF/IAT Sensor Connector, Harness Side**: MARTN **Point B MAF/IAT Sensor Connector, Harness Side**: PWRGND • Key ON Engine OFF. • Access the PCM-MAF V PID using a scan tool. • **Is the Voltage below 0.1 V?**	Yes → No →	KEY OFF. REMOVE jumper wire(s) CHECK MAF sensor electrical connector for damage, corrosion, and water ingress. If ok, replace MAF sensor. Reset KAM KEY OFF. GO to **DC22**.
DC22	CHECK THE MAF CIRCUIT FOR SHORT TO POWER		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)PCM Connector, Harness Side**: MAF **(-)**: Ground • **Is the Voltage below 1 V?**	Yes → No →	GO to **DC24**. KEY OFF. REPAIR short circuit to PWR.
DC23	CHECK MAF SENSOR SIGNAL SENT TO PCM		
	• Key ON Engine RUN. • Monitor the MAF signal voltage while increasing the engine RPM from idle to approximately 2500 RPM, and then back to idle. • Access the PCM-MAF V PID using a scan tool. • **Is the Voltage between 0.23 V - 4.6 V?**	Yes → No →	KEY OFF. Intermittent concern. GO to **Z1**. KEY OFF. GO to **DC21**.
DC24	VERIFY IDLE CONCERN		
	• **Is there an idle concern present?**	Yes → No →	Disregard DTC P0103 at this time RETURN to Section 3, Symptom Charts. INSTALL a new PCM.

Mass Air Flow Sensor

DC

Test Steps		Results →	Action to Take
DC25	DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130, P1150, P2195, P2196, P2197, P2198: (OR LEAN DRIVEABILITY CONCERNS) CHECK CONDITIONS RELATED TO MAF SENSOR		
	• CHECK air inlet system (air cleaner, housing, ductwork, etc.) for obstructions or blockage. • CHECK for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in air outlet tube, worn gaskets between MAF sensor and air cleaner assembly. Verify MAF sensor is connected. • **Were any problems found?**	Yes → No →	Repair as required and reset KAM. GO to **DC26**.

Mass Air Flow Sensor

DC

Test Steps		Results →	Action to Take
DC26	DTC P0171, P0172, P0174, P0175, P1131, P1132, P1151, P1152, P1130, P1150, P2195, P2196, P2197, P2198: (OR LEAN DRIVEABILITY CONCERNS) CHECK CONDITIONS RELATED TO MAF SENSOR		
	Note: Most weather service reports are a local barometric pressure that has been corrected to sea level. However, the BARO PID reports the actual barometric pressure for the altitude the vehicle is being diagnosed in. Local weather conditions (high or low pressure areas) will change the local barometric pressure by several inches of mercury. • Key ON Engine RUN. • Access the PCM-LONGFT1, PCM-LONGFT2, PCM-MAF V and PCM-BARO PIDs using a scan tool. • CHECK that the BARO PID is approximately the same as the barometric pressure reading for the location, day and altitude the vehicle is being diagnosed at. — BARO PID values in Keep Alive Memory require updating at high throttle openings. If vehicle is driven down from higher altitudes for diagnosing, complete three or four heavy accelerations at greater than half-throttle to allow BARO PID to update. — BARO PID must be within +/- 6 Hz. (+/- 2 in Hg.) of the altitude value in Barometric Pressure Reference Chart (at the beginning of this pinpoint test). — Make BARO PID comparisons to Barometric Pressure Reference Chart or daily airport barometric pressure reports, if available. • CHECK that the LONGFT1 and LONGFT2 PIDs for all injector banks at idle are not more negative than -12%. • CHECK that the MAF V PID at idle and neutral is not greater than 30% of the normal MAF V listed in Section 6, Reference Values (or not greater than 1.1 volts). • **Are two of the three checks OK?**	Yes → No →	GO to **DC28**. KEY OFF. GO to **DC27**.

Mass Air Flow Sensor

DC

Test Steps		Results →	Action to Take
DC27	CHECK TO ISOLATE MAF SENSOR FROM LEAN DRIVEABILITY OCCURRENCE		
	• Due to increasingly stringent emission/OBD2 requirements, a fuel system DTC on some vehicles will be generated without a noticeable driveability concern with or without the MAF sensor disconnected. Under these conditions, if the BARO_V, LONGFT1, LONGFT2 and MAF PIDs indicate a MAF sensor concern, install a new MAF sensor. • MAF/IAT Sensor connector disconnected. • Key ON Engine RUN. • Drive the vehicle on the road. • **Is the lean driveability symptom (lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration) gone?**	Yes → No →	INSTALL a new MAF/IAT sensor. Reset KAM GO to **DC28**.
DC28	VERIFY DTC		
	• **Are any of the following DTCs present: P0171, P0172, P0174, P0175, P1130, P1131, P1132, P1150, P1151, P1152, P2195, P2196, P2197 or P2198.**	Yes → No →	GO to **DC29**. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
DC29	VERIFY TYPE OF VEHICLE		
	• **Is this a natural gas vehicle?**	Yes → No →	**For P1131, P1151, P2195 and P2197** GO to **HA36**. **For P1132, P1152, P2196 and P2198** GO to **HA41**. GO to **H18**.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Note

This Pinpoint Test is intended to diagnose the following:

- Fuel Rail Pressure (FRP) Sensor.
- Fuel Rail Temperature (FRT) Sensor.
- Fuel Rail Pressure Temperature (FRPT) Sensor.
- Related FRP, FRT and FRPT harness circuits.
- Powertrain Control Module (PCM) (12A650).
- Natural Gas Module (NG) (9F954).

Tables and Graphs

FRP SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Voltage	Pressure (kPa)	Pressure (PSI)
4.5	482	70
3.9	413	60
3.4	344	50
2.8	275	40
2.2	207	30
1.6	138	20
1.1	69	10
0.5	0	0

FRT SENSOR TEMPERATURE, VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Sensor	
°C	°F	Volts	K Ohms
100	212	0.47	2.073
95	203	0.54	2.405
90	194	0.61	2.800
85	185	0.70	3.273
80	176	0.80	3.840

(Continued)

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

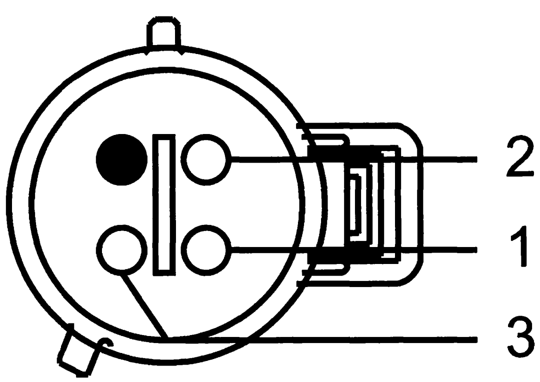
DD

FRT SENSOR TEMPERATURE, VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Sensor	
°C	°F	Volts	K Ohms
75	167	0.92	4.524
70	158	1.06	5.351
65	149	1.21	6.356
60	140	1.38	7.584
55	131	1.56	9.091
50	122	1.77	10.949
45	113	1.99	13.252
40	104	2.23	16.123
35	95	2.48	19.720
30	86	2.74	24.253
25	77	3.00	30.000
20	68	3.26	37.332
15	59	3.50	46.745
10	50	3.73	58.911
5	41	3.95	74.745
0	32	4.13	95.501

Fuel Rail Pressure (FRP) Sensor Connector

A



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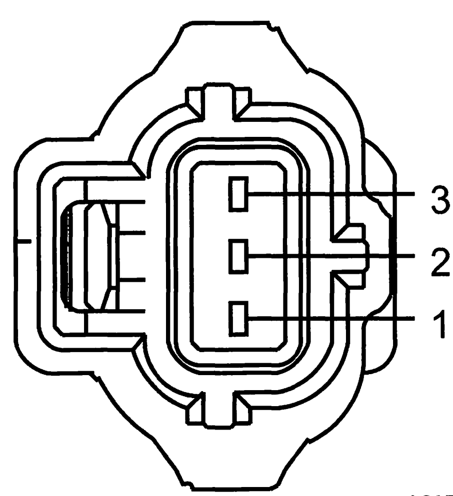

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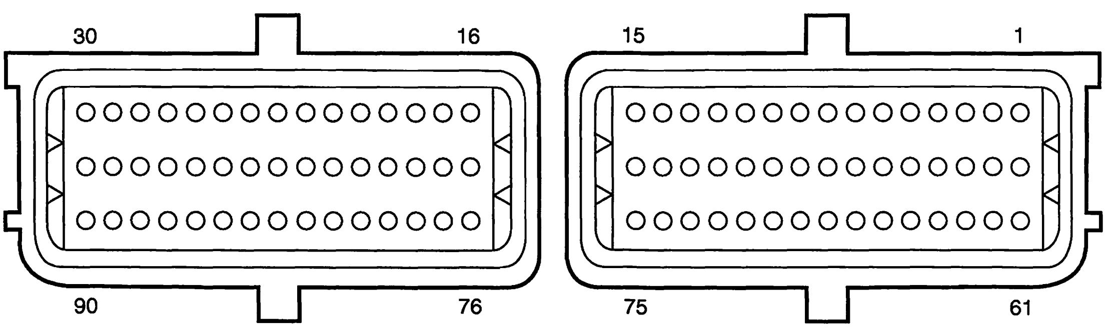
Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Vehicle	Connector	Circuit	Pin
Crown Victoria Dedicated NGV, F-150 Heritage 5.4L Dedicated NGV	A	SIGRTN VREF FRP	1 2 3
E-Series 5.4L Dedicated NGV, F-150 Heritage 5.4L Bi-Fuel	A	SRef SRtn FRP	2 1 3
All other vehicles	B	SIGRTN VREF FRP	2 1 3

Natural Gas (NG) Module Connector



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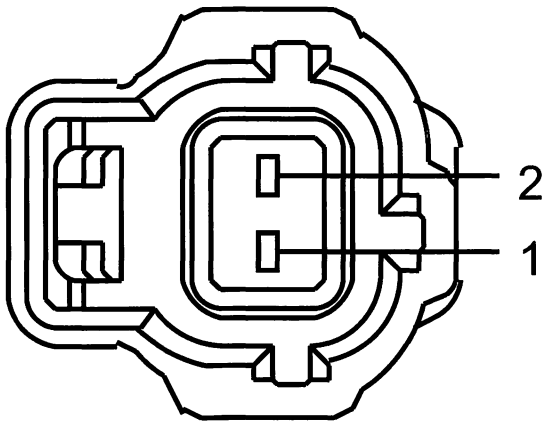
Circuit	Pin
SRef (Signal Reference Voltage)	74
SRtn (Signal Return)	89
FRT (Fuel Rail Temperature)	31
FRP (Fuel Rail Pressure)	38

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Fuel Rail Temperature (FRT) Sensor Connector



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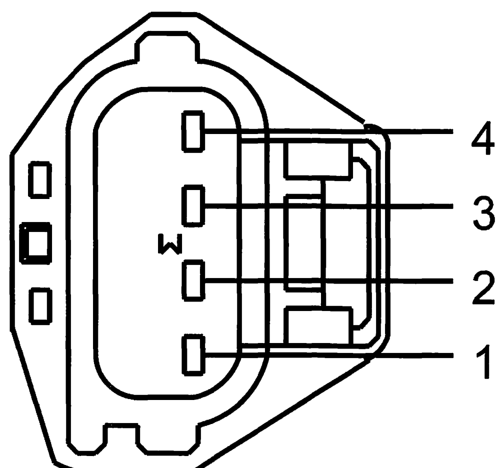
Vehicle	Connector	Circuit	Pin
E-Series 5.4L Dedicated NGV, F-150 Heritage 5.4L Bi-Fuel	A	SRtn FRT	2 1
All other vehicles	A	SIGRTN FRT	2 1

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors	DD

Fuel Rail Pressure/Temperature (FRPT) Sensor Connector



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Circuit	Pin
FRT (Fuel Rail Temperature)	3
FRP (Fuel Rail Pressure)	1
SIGRTN (Signal return)	4
VREF (Reference Voltage)	2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	VPWR SIGRTN VREF FRP	B32 E17 E20 E49
Explorer SportTrac	104 Pin	VPWR FRT SIGRTN VREF FRP	71 66 91 90 8
Explorer 4.0L, Mountaineer 4.0L	150 (50-50-50) Pin	VPWR FRT SIGRTN VREF FRP	B35 E36 E41 E40 E37
Explorer 4.6L, Focus 2.3L, Mountaineer 4.6L	150 (50-50-50) Pin	VPWR SIGRTN VREF FRP	B35 E41 E40 E37
F-150	190 Pin	VPWR SIGRTN VREF FRP	B51 E58 E57 E32
Focus 2.0L SVT	104 Pin	VPWR SIGRTN VREF FRP	71 91 90 37
Freestar / Monterey, Sable 3.0L 4V, Taurus 3.0L 4V	104 Pin	VPWR FRT SIGRTN VREF FRP	71 10 91 90 63
LS, Thunderbird	150 (60-32-58) Pin	VPWR FRT SIGRTN VREF FRP	B32 E4 E17 E14 E49
All other vehicles	104 Pin	VPWR SIGRTN VREF FRP	71 91 90 63

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Warning

VEHICLE FUEL SYSTEMS ARE PRESSURIZED EVEN WHEN THE ENGINE IS NOT RUNNING. TO AVOID FIRE OR PERSONAL INJURY, DISABLE THE FUEL DELIVERY SYSTEM AND RELIEVE FUEL SYSTEM PRESSURE BEFORE REMOVING ANY FUEL SYSTEM COMPONENT. REFER TO FUEL SYSTEM INFORMATION AT THE BEGINNING OF SECTION HC.

Note

To compare a mechanical gauge reading to FRP reading of a running engine, measure the vacuum level at the FRP sensor then multiply (in Hg) of intake manifold vacuum times 0.4912. Add this value to the mechanical gauge PSI reading and make note of the value. Reconnect vacuum to FRP sensor then compare noted value to current FRP PID value of running engine.

Test Steps		Results →	Action to Take
DD1	DTC P0192: DETERMINE PRESENT FRP V PID VOLTAGE		
	Note: Service P0230, P0231 or P0232 fuel pump DTC(s) prior to this test. • Key ON Engine OFF. • Access the PCM-FRP V PID using a scan tool. • **Is the Voltage below 0.25 V?**	Yes →	KEY OFF. **For F-150 Heritage 5.4L Dedicated NGV, and Crown Victoria Dedicated NGV** GO to **DD3**. **For E-Series Dedicated NGV, and** **F-150 Heritage Bi-Fuel** GO to **DD31**. **For All Others** GO to **DD2**.
		No →	KEY OFF. GO to **DD29**.
DD2	CHECK FRP SENSOR FOR LEAKS		
	• Key ON Engine RUN. • Idle the engine for 2 minutes. • Key OFF. • REMOVE the FRP Sensor vacuum hose. • INSPECT the FRP Sensor and vacuum hose for traces of fuel. • **Is fuel present?**	Yes →	KEY OFF. INSTALL a new FRP sensor. REFER to fuel system service WARNING information. CLEAR the PCM DTCs and REPEAT Self-Test.
		No →	GO to **DD3**.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

DD3 CHECK FRP CIRCUIT(S) FOR OPEN IN HARNESS

- PCM connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
FRP	FRP

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	GO to **DD4**.
No →	REPAIR open circuit.

DD4 CHECK VREF AND SIGRTN CIRCUITS FOR OPEN IN HARNESS

- PCM connector connected.
- FRP Sensor connector disconnected.
- Measure the Voltage between:

(+)FRP Sensor Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the Voltage between 4 V - 5.5 V?**

Results	Action to Take
Yes →	KEY OFF. GO to **DD5**.
No →	GO to **C1**.

DD5 VERIFY SCAN TOOL COMMUNICATION

- PCM connector connected.
- Add jumper wire between the points described below:

Point A FRP Sensor Connector, Harness Side	Point B FRP Sensor Connector, Harness Side
FRP	SIGRTN

- Access the PCM-FRP PID using a scan tool.
- **Does a scan tool communication concern exist?**

Results	Action to Take
Yes →	KEY OFF. GO to **DD6**.
No →	KEY OFF. GO to **DD7**.

DD6 CHECK FRP V CIRCUIT FOR SHORT TO VREF

- REMOVE jumper wire(s)
- PCM connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VREF	FRP

- **Is the Resistance above 10 KOhm?**

Results	Action to Take
Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
No →	REPAIR short circuit.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD7	CHECK FRP CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS		
	• Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: FRP — (-)PCM Connector, Harness Side: SIGRTN • Measure the Resistance between: (+)PCM Connector, Harness Side: FRP — (-)Vehicle battery: Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
DD8	DTC P0193: DETERMINE PRESENT FRP V PID VOLTAGE		
	Note: Service P0230, P0231 or P0232 fuel pump DTC(s) prior to this test. • Key ON Engine OFF. • Access the PCM-FRP V PID using a scan tool. • **Is the Voltage above 4 V?**	Yes → No →	GO to **DD9**. GO to **DD29**.
DD9	CHECK FRP SENSOR FOR LEAKS		
	• Key ON Engine RUN. • Idle the engine for 2 minutes. • Key OFF. • REMOVE the FRP Sensor vacuum hose. • INSPECT the FRP Sensor and vacuum hose for traces of fuel. • **Is fuel present?**	Yes → No →	KEY OFF. INSTALL a new FRP sensor. REFER to fuel system service WARNING information. CLEAR the PCM DTCs and REPEAT Self-Test. GO to **DD10**.
DD10	CHECK FUEL PRESSURE		
	• Key ON Engine RUN. • Access the PCM-FRP PID using a scan tool. • **Is the Pressure above 827 KPa (119.9 psi)?**	Yes → No →	**For E-Series Dedicated NGV, and** **F-150 Heritage Bi-Fuel** GO to **DD19**. **For All Others** GO to **DD13**. KEY OFF. GO to **HB1**.

Sub-tables in DD7:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
FRP	SIGRTN

(+)PCM Connector, Harness Side	(-)Vehicle battery
FRP	Negative post

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD11	DTCS P0190 AND P0191: CHECK FOR FUEL PUMP DTCS		
	• **Are DTCs P0230, P0231 or P0232 present?**	Yes →	Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	GO to **DD12**.
DD12	IS DTC P0191 PRESENT IN KOEO OR KOER SELF TEST?		
	• **Is DTC P0191 present in KOEO or KOER Self Test?**	Yes →	**For E-Series Dedicated NGV, and F-150 Heritage Bi-Fuel** GO to **DD24**. **For All Others** GO to **DD13**.
		No →	GO to **DD86**.
DD13	CHECK VREF & SIGRTN CIRCUIT(S)		
	• FRP Sensor connector disconnected. • Measure the Voltage between: **(+)FRP Sensor Connector, Harness Side**: VREF — **(-)FRP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 5.5 V?**	Yes →	KEY OFF. GO to **DD14**.
		No →	GO to **C1**.
DD14	CHECK FRP CIRCUIT(S) FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: FRP — **(-)FRP Sensor Connector, Harness Side**: FRP • **Is the Resistance below 5 Ohm?**	Yes →	GO to **DD15**.
		No →	REPAIR open circuit.

DD13 measurement table:

(+)FRP Sensor Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
VREF	SIGRTN

DD14 measurement table:

(+)PCM Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
FRP	FRP

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps	Results →	Action to Take
DD15 VERIFY SCAN TOOL COMMUNICATION		
• PCM connector connected. • Add jumper wire between the points described below: **Point A FRP Sensor Connector, Harness Side**: FRP — **Point B FRP Sensor Connector, Harness Side**: SIGRTN • Access the PCM-FRP PID using a scan tool. • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. GO to **DD16**. KEY OFF. GO to **DD17**.
DD16 CHECK FRP CIRCUIT FOR SHORT TO VREF		
• REMOVE jumper wire(s) • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: VREF — **(-)PCM Connector, Harness Side**: FRP • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
DD17 CHECK FRP CIRCUIT FOR SHORT TO POWER		
• PCM connector disconnected. • FRP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)FRP Sensor Connector, Harness Side**: FRP — **(-)Vehicle battery**: Negative post • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **DD18**. KEY OFF. REPAIR short circuit.
DD18 CHECK FRP VOLTAGE PID DURING FUEL RAIL PRESSURE RELIEF		
• PCM connector connected. • FRP Sensor connector connected. Note: Before servicing or replacing any components in the fuel system, reduce the possibility of injury or fire by following directions in pinpoint test HB warning, caution, and handling. • Relieve fuel pressure. • Crank the engine. • Access the PCM-FRP V PID using a scan tool. • **Is the Voltage between 0.4 V - 0.6 V?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). For Dedicated NGV: Go to HB1 All Others: REPLACE FRP sensor

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD19	CHECK FRP CIRCUIT(S) FOR OPEN IN HARNESS		
	• FRP Sensor connector disconnected. • NG Module connector disconnected. • Measure the Resistance between: (+)NG Module Connector, Harness Side: FRP - Pin 38 / (-)FRP Sensor Connector, Harness Side: FRP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DD20**. REPAIR open circuit.
DD20	VERIFY SCAN TOOL COMMUNICATION		
	• NG Module connector connected. • Add jumper wire between the points described below: Point A FRP Sensor Connector, Harness Side: FRP / Point B FRP Sensor Connector, Harness Side: SRtn • Access the PCM-FRP PID using a scan tool. • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. GO to **DD21**. KEY OFF. GO to **DD22**.
DD21	CHECK FRP CIRCUIT FOR SHORT TO SREF		
	• REMOVE jumper wire(s) • NG Module connector disconnected. • Measure the Resistance between: (+)FRP Sensor Connector, Harness Side: FRP / (-)FRP Sensor Connector, Harness Side: SRef • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new NG module. REPAIR short circuit.
DD22	CHECK FRP CIRCUIT FOR SHORT TO POWER		
	• NG Module connector disconnected. • FRP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)FRP Sensor Connector, Harness Side: FRP / (-)Vehicle battery: Negative post • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **DD23**. KEY OFF. REPAIR short circuit.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD23	CHECK FRP VOLTAGE PID DURING FUEL RAIL PRESSURE RELIEF		
	• NG Module connector connected. • FRP Sensor connector connected. Note: Before servicing or replacing any components in the fuel system, reduce the possibility of injury or fire by following directions in pinpoint test HB warning, caution, and handling. • Relieve fuel pressure. • Crank the engine. • Access the PCM-FRP V PID using a scan tool. • **Is the Voltage between 0.4 V - 0.6 V?**	Yes → No →	INSTALL a new NG module. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). GO to **HB1**.
DD24	CHECK SREF & SRTN CIRCUIT(S)		
	• FRP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)FRP Sensor Connector, Harness Side: SRef (-)FRP Sensor Connector, Harness Side: SRtn • **Is the Voltage between 4 V - 5.5 V?**	Yes → No →	KEY OFF. GO to **DD25**. KEY OFF. GO to **C26**.
DD25	CHECK FRP CIRCUIT(S) FOR OPEN IN HARNESS		
	• NG Module connector disconnected. • Measure the Resistance between: (+)NG Module Connector, Harness Side: FRP - Pin 38 (-)FRP Sensor Connector, Harness Side: FRP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DD26**. REPAIR open circuit.
DD26	CHECK FRP CIRCUIT FOR SHORT TO VREF		
	• Measure the Resistance between: (+)FRP Sensor Connector, Harness Side: FRP (-)FRP Sensor Connector, Harness Side: SRef • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DD27**. REPAIR short circuit.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DD27</td><td>CHECK FRP CIRCUIT FOR SHORT TO POWER</td><td></td><td></td></tr>
<tr><td colspan="2">
Key ON Engine OFF.
Measure the Voltage between:
<table>
<tr><th>(+)FRP Sensor Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>FRP</td><td>Ground</td></tr>
</table>
Is the Voltage below 1 V?
</td><td>Yes →
No →</td><td>KEY OFF.
GO to DD28.
KEY OFF. REPAIR short circuit.</td></tr>
<tr><td>DD28</td><td>CHECK FRP VOLTAGE PID DURING FUEL RAIL PRESSURE RELIEF</td><td></td><td></td></tr>
<tr><td colspan="2">
NG Module connector connected.
FRP Sensor connector connected.
Note: Before servicing or replacing any components in the fuel system, reduce the possibility of injury or fire by following directions in pinpoint test HB warning, caution, and handling.
Relieve fuel pressure.
Crank the engine.
Access the PCM-FRP V PID using a scan tool.
Is the Voltage between 0.4 V - 0.6 V?
</td><td>Yes →
No →</td><td>INSTALL a new NG module.
GO to HB1.</td></tr>
<tr><td>DD29</td><td>CHECK FRP VOLTAGE PID DURING FUEL RAIL PRESSURE RELIEF</td><td></td><td></td></tr>
<tr><td colspan="2">
Disable inertia switch.
Key ON Engine OFF.
Access the PCM-FRP V PID using a scan tool.
Monitor FRP voltage while cranking the engine.
FRP voltage will decrease as the fuel rail pressure drops and will stabilize when the fuel rail pressure reaches atmospheric pressure.
<table>
<tr><th>Vehicle</th><th>Low Limit</th><th>High Limit</th></tr>
<tr><td>F-150</td><td>1.0V</td><td>1.5V</td></tr>
<tr><td>All Others</td><td>0.2V</td><td>0.7V</td></tr>
</table>
Is the voltage value within specification?
</td><td>Yes →
No →</td><td>GO to DD30.
KEY OFF. INSTALL a new FRP sensor.
REFER to fuel system service WARNING information.</td></tr>
<tr><td>DD30</td><td>PERFORM A THOROUGH WIGGLE TEST ON THE FRP HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Key ON Engine OFF.
Access the FRP_V PID using a scan tool.
Perform a thorough wiggle test on the FRP Sensor harness.
Is the FRP signal stable?
</td><td>Yes →
No →</td><td>GO to Z1.
KEY OFF.
Repair as necessary.</td></tr>
</table>

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD31	CHECK SREF AND SRTN CIRCUITS FOR OPEN IN HARNESS		
	• FRP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)FRP Sensor Connector, Harness Side**: SRef — **(-)FRP Sensor Connector, Harness Side**: SRtn • **Is the Voltage between 4 V - 5.5 V?**	Yes →	KEY OFF. GO to **DD32**.
		No →	GO to **C26**.
DD32	CHECK FRP CIRCUIT(S) FOR OPEN IN HARNESS		
	• NG Module connector disconnected. • Measure the Resistance between: **(+)NG Module Connector, Harness Side**: FRP - Pin 38 — **(-)FRP Sensor Connector, Harness Side**: FRP • **Is the Resistance below 5 Ohm?**	Yes →	GO to **DD33**.
		No →	REPAIR open circuit.
DD33	CHECK FRP CIRCUIT(S) FOR SHORT TO SRTN OR GND IN HARNESS		
	• Scan tool connector disconnected. • NG Module connector disconnected. • FRP Sensor connector disconnected. • Measure the Resistance between: **(+)FRP Sensor Connector, Harness Side**: FRP — **(-)FRP Sensor Connector, Harness Side**: SRtn • Measure the Resistance between: **(+)FRP Sensor Connector, Harness Side**: FRP — **(-)Vehicle battery**: Negative post • **Is the Resistance above 10 KOhm?**	Yes →	GO to **DD34**.
		No →	REPAIR short circuit.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD34	INDUCE OPPOSITE FRP SENSOR VOLTAGE		
	• NG Module connector connected. • Scan tool connector connected. • Add jumper wire between the points described below:	Yes →	KEY OFF. INSTALL a new FRP sensor. REFER to fuel system service WARNING information. CLEAR the PCM DTCs and REPEAT Self-Test.
	Point A FRP Sensor Connector, Harness Side: FRP — **Point B FRP Sensor Connector, Harness Side**: SRef		
	• Key ON Engine OFF. • Access the PCM-FRP V PID using a scan tool. • (If PID cannot be accessed, follow the NO action to take). • **Is the Voltage above 4.75 V?**	No →	KEY OFF. INSTALL a new NG module. CLEAR the PCM DTCs and REPEAT Self-Test.
DD35	DTCS P0181, P0182 OR P0183: ARE DTCS P0181, P0182 OR P0183 PRESENT IN KOEO OR KOER SELF-TEST?		
	• **Are DTCs P0181, P0182 or P0183 present in KOEO or KOER Self-Test?**	Yes →	**For E-Series Dedicated NGV, and** **F-150 Heritage Bi-Fuel** GO to **DD71**. **For All Others** GO to **DD36**.
		No →	**For E-Series Dedicated NGV, and** **F-150 Heritage Bi-Fuel** GO to **DD82**. **For All Others** GO to **DD84**.
DD36	DETERMINE PRESENT FRT PID VOLTAGE		
	• Allow vehicle temperatures to stabilize prior to temperature sensor tests. • Key ON Engine OFF. • Normal test range 100 Deg C (212 Deg F) to 0 Deg C (32 Deg F). • Access the FRT_V PID using a scan tool. • **Is the Voltage above 0.4 V?**	Yes → No →	GO to **DD37**. GO to **DD38**.

Jumper table for DD34:

Point A FRP Sensor Connector, Harness Side	Point B FRP Sensor Connector, Harness Side
FRP	SRef

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DD37</td><td>FRT SENSOR RESISTANCE TEST
• FRT Sensor connector disconnected.
• Sensor resistance measurements can be compared to table above when the sensor temperature is known.
• Measure the Resistance between:
<table>
<tr><th>(+)FRT Sensor Connector, Component Side</th><th>(-)FRT Sensor Connector, Component Side</th></tr>
<tr><td>FRT</td><td>SIGRTN</td></tr>
</table>
• Is the Resistance between 2 KOhm - 96 KOhm?</td>
<td>Yes →
No →</td>
<td>GO to DD38.
KEY OFF. INSTALL a new FRT sensor.
REFER to fuel system service WARNING information.
CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
<tr><td>DD38</td><td>CHECK FRT AND SIG RTN CIRCUIT(S) FOR OPEN IN HARNESS
• PCM connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)FRT Sensor Connector, Harness Side</th></tr>
<tr><td>FRT</td><td>FRT</td></tr>
<tr><td>SIGRTN</td><td>SIGRTN</td></tr>
</table>
• Are the resistances above 5 Ohm?</td>
<td>Yes →
No →</td>
<td>REPAIR open circuit.
GO to DD39.</td></tr>
<tr><td>DD39</td><td>CHECK FRT CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS
• Scan tool connector disconnected.
• FRT Sensor connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>FRT</td><td>SIGRTN</td></tr>
</table>
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>FRT</td><td>Negative post</td></tr>
</table>
• Is the Resistance above 10 KOhm?</td>
<td>Yes →
No →</td>
<td>GO to DD40.
REPAIR short circuit.</td></tr>
</table>

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD40	VERIFY SCAN TOOL COMMUNICATION		
	• PCM connector connected. • Add jumper wire between the points described below: **Point A FRT Sensor Connector, Harness Side** / **Point B FRT Sensor Connector, Harness Side** FRT / SIGRTN • Access the PCM-FRT V PID using a scan tool. • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. GO to **DD42**. KEY OFF. REMOVE jumper(s). GO to **DD41**.
DD41	CHECK SENSOR SIGNAL CIRCUIT FOR SHORT TO SIGRTN		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: **(+)FRT Sensor Connector, Harness Side** / **(-)FRT Sensor Connector, Harness Side** FRT / SIGRTN • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DD42**. REPAIR short circuit. CLEAR the DTCs and REPEAT Self-Test.
DD42	CHECK SENSOR SIGNAL FOR SHORT TO VREF		
	• Key OFF. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side** FRT / VREF • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit to VREF.
DD43	DTC P0180: PERFORM A THOROUGH WIGGLE TEST ON THE FRT SENSOR HARNESS		
	• PCM connector connected. • Access the FRT_V PID using a scan tool. • Perform a through wiggle test on the FRT Sensor harness. • **Is the FRT signal stable?**	Yes → No →	GO to **DD45**. KEY OFF. Repair as necessary.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DD44</td><td>KOEO AND KOER DTC P0181: CHECK FRT_V PID</td><td></td><td></td></tr>
<tr><td colspan="2">

Allow vehicle temperatures to stabilize prior to temperature sensor tests.
Key ON Engine OFF.
Normal test range 100 Deg C (212 Deg F) to 0 Deg C (32 Deg F).
Access the PCM-FRT V PID using a scan tool.

<table>
<tr><th>Vehicle</th><th>Low Limit</th><th>High Limit</th></tr>
<tr><td>Vehicles with 60 pin NG module</td><td>0.4V</td><td>5.0V</td></tr>
<tr><td>All Others</td><td>0.4V</td><td>4.5V</td></tr>
</table>

Is the voltage value within specification?

</td><td>Yes →
No →</td><td>GO to DD35.
Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.</td></tr>
<tr><td>DD45</td><td>COMPARE PIDS AFTER STABILIZING VEHICLE TEMPERATURE</td><td></td><td></td></tr>
<tr><td colspan="2">

Access the FRT, CHT and PCM-ECT PIDs using a scan tool.
Are the Temperature PIDs nearly equal value?

</td><td>Yes →
No →</td><td>Fault is not present at this time
CLEAR the DTCs and REPEAT Self-Test.
GO to Z1.</td></tr>
<tr><td>DD46</td><td>DTC P0192: DETERMINE PRESENT FRP V PID VOLTAGE</td><td></td><td></td></tr>
<tr><td colspan="2">
Note: Service P0230, P0231 or P0232 fuel pump DTC(s) prior to this test.

Key ON Engine OFF.
Access the PCM-FRP V PID using a scan tool.
Is the Voltage below 0.25 V?

</td><td>Yes →
No →</td><td>For F-150 Heritage 5.4L Dedicated NGV, and Crown Victoria Dedicated NGV
GO to DD48.
For All Others
GO to DD47.
GO to DD59.</td></tr>
<tr><td>DD47</td><td>CHECK FRPT SENSOR FOR LEAKS</td><td></td><td></td></tr>
<tr><td colspan="2">

Key ON Engine RUN.
Idle the engine for 2 minutes.
Key OFF.
REMOVE the FRPT vacuum hose.
INSPECT the FRPT and vacuum hose for traces of fuel.
Is fuel present?

</td><td>Yes →
No →</td><td>KEY OFF. INSTALL a new FRPT sensor.
REFER to fuel system service WARNING information.
CLEAR the PCM DTCs and REPEAT Self-Test.
GO to DD48.</td></tr>
</table>

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DD48</td><td>CHECK VREF AND SIGRTN CIRCUITS FOR OPEN IN HARNESS
Measure the Voltage between:
<table>
<tr><th>(+)FRPT Sensor Connector, Harness Side</th><th>(-)FRPT Sensor Connector, Harness Side</th></tr>
<tr><td>VREF - Pin 2</td><td>SIGRTN - Pin 4</td></tr>
</table>
Is the Voltage between 4 V - 5.5 V?</td>
<td>Yes →

No →</td>
<td>KEY OFF.
GO to DD49.
GO to C1.</td></tr>
<tr><td>DD49</td><td>INDUCE OPPOSITE FRPT SENSOR VOLTAGE
Scan tool connector connected.
Key ON Engine OFF.
Access the PCM-FRP V PID using a scan tool.
Is the Voltage above 4.75 V?</td>
<td>Yes →

No →</td>
<td>KEY OFF. INSTALL a new FRPT sensor.
REFER to fuel system service WARNING information.
CLEAR the PCM DTCs and REPEAT Self-Test.
GO to DD50.</td></tr>
<tr><td>DD50</td><td>CHECK FRPT CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS
Scan tool connector disconnected.
PCM connector disconnected.
FRPT Sensor connector disconnected.
Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>FRP</td><td>SIGRTN</td></tr>
</table>
Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>FRP</td><td>Negative post</td></tr>
</table>
Is the Resistance above 10 KOhm?</td>
<td>Yes →

No →</td>
<td>INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
REPAIR short circuit.</td></tr>
<tr><td>DD51</td><td>DTC P0193: DETERMINE PRESENT FRP V PID VOLTAGE
Note: Service P0230, P0231 or P0232 fuel pump DTC(s) prior to this test.
PCM connector connected.
Key ON Engine OFF.
Access the PCM-FRP V PID using a scan tool.
Is the Voltage above 4 V?</td>
<td>Yes →

No →</td>
<td>For F-150 Heritage 5.4L Dedicated NGV, and Crown Victoria Dedicated NGV
GO to DD53.
For All Others
GO to DD52.
GO to DD59.</td></tr>
</table>

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD52	CHECK FRPT SENSOR FOR LEAKS		
	• Key ON Engine RUN. • Idle the engine for 2 minutes. • Key OFF. • REMOVE the FRPT Sensor vacuum hose. • INSPECT the FRPT Sensor and vacuum hose for traces of fuel. • **Is fuel present?**	Yes → No →	KEY OFF. INSTALL a new FRPT sensor. REFER to fuel system service WARNING information. CLEAR the PCM DTCs and REPEAT Self-Test. GO to **DD53**.
DD53	CHECK VREF AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
	• Measure the Voltage between: **(+)FRPT Sensor Connector, Harness Side**: VREF - Pin 2 **(-)FRPT Sensor Connector, Harness Side**: SIGRTN - Pin 4 • **Is the Voltage between 4 V - 5.5 V?**	Yes → No →	KEY OFF. GO to **DD54**. GO to **C1**.
DD54	CHECK FRP V CIRCUIT FOR SHORT TO POWER		
	• FRPT Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)FRPT Sensor Connector, Harness Side**: FRP - Pin 1 **(-)Vehicle battery**: Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. REPAIR short circuit. GO to **DD55**.
DD55	VERIFY SCAN TOOL COMMUNICATION		
	• Add jumper wire between the points described below: **Point A FRPT Sensor Connector, Harness Side**: FRP - Pin 1 **Point B FRPT Sensor Connector, Harness Side**: SIGRTN - Pin 4 • Access the PCM-FRP PID using a scan tool. • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. GO to **DD56**. KEY OFF. REMOVE jumper(s). GO to **DD57**.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DD56</td><td>CHECK FRP V CIRCUIT FOR SHORT TO VREF</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DD58.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>VREF</td><td>FRP</td></tr></table>
Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>DD57</td><td>INDUCE OPPOSITE FRP V SENSOR VOLTAGE</td><td rowspan="2">Yes →
No →</td><td rowspan="2">KEY OFF. INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
KEY OFF.
GO to DD58.</td></tr>
<tr><td colspan="2">
PCM connector connected.
Scan tool connector connected.
Add jumper wire between the points described below:
<table><tr><th>Point A FRPT Sensor Connector, Harness Side</th><th>Point B FRPT Sensor Connector, Harness Side</th></tr><tr><td>FRP - Pin 1</td><td>SIGRTN - Pin 4</td></tr></table>
Key ON Engine OFF.
Access the PCM-FRP V PID using a scan tool.
Is the Voltage below 0.05 V?
</td></tr>
<tr><td>DD58</td><td>CHECK FRP AND SIG RTN CIRCUIT(S) FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">REPAIR open circuit.
INSTALL a new FRPT sensor.
REFER to fuel system service WARNING information.
CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
<tr><td colspan="2">
FRPT Sensor connector disconnected.
PCM connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)FRPT Sensor Connector, Harness Side</th></tr><tr><td>FRP</td><td>FRP - Pin 1</td></tr><tr><td>SIGRTN</td><td>SIGRTN - Pin 4</td></tr></table>
Are the resistances above 5 Ohm?
</td></tr>
<tr><td>DD59</td><td>PERFORM A THOROUGH WIGGLE TEST ON THE FRPT HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to Z1.
KEY OFF.
Repair as necessary.</td></tr>
<tr><td colspan="2">
PCM connector connected.
Key ON Engine OFF.
Access the FRP_V PID using a scan tool.
Perform a thorough wiggle test on the FRPT Sensor harness.
Is the FRP signal stable?
</td></tr>
</table>

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD60	DTCS P0190 AND P0191: CHECK FRP VOLTAGE PID DURING FUEL RAIL PRESSURE RELIEF		
	• Disable inertia switch. • Key ON Engine OFF. • Access the PCM-FRP V PID using a scan tool. • Monitor FRP voltage while cranking the engine. FRP voltage will decrease as the fuel rail pressure drops and will stabilize when the fuel rail pressure reaches atmospheric pressure. (see table below) • **Is the voltage value within specification?**	Yes → No →	Fault is not present at this time CLEAR the DTCs and REPEAT Self-Test. KEY OFF. INSTALL a new FRPT sensor. REFER to fuel system service WARNING information. CLEAR the PCM DTCs and REPEAT Self-Test.
DD61	DTCS P0182 OR P0183: DETERMINE PRESENT FRT PID VOLTAGE		
	• Allow vehicle temperatures to stabilize prior to temperature sensor tests. • Key ON Engine OFF. • Access the PCM-FRT V PID using a scan tool. • **Is the Voltage below 0.4 V?**	Yes → No →	GO to **DD62**. GO to **DD65**.
DD62	FRT SENSOR RESISTANCE TEST		
	• FRPT Sensor connector disconnected. • Sensor resistance measurements can be compared to table above when the sensor temperature is known. • Measure the Resistance between: (see table below) • **Is the Resistance between 2 KOhm - 96 KOhm?**	Yes → No →	GO to **DD63**. KEY OFF. INSTALL a new FRPT sensor. REFER to fuel system service WARNING information. CLEAR the PCM DTCs and REPEAT Self-Test.

DD60 specification table:

Vehicle	Low Limit	High Limit
F-150	1.0V	1.5V
All Others	0.2V	0.7V

DD62 measurement table:

(+)FRPT Sensor Connector, Component Side	(-)FRPT Sensor Connector, Component Side
FRT - Pin 3	SIGRTN - Pin 4

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD63	CHECK FRT AND SIG RTN CIRCUIT(S) FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side / (-)FRPT Sensor Connector, Harness Side: FRT — FRT - Pin 3 SIGRTN — SIGRTN - Pin 4 • **Are the resistances above 5 Ohm?**	Yes → No →	REPAIR open circuit. GO to **DD64**.
DD64	CHECK FRT CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS		
	• Scan tool connector disconnected. • FRPT Sensor connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side / (-)PCM Connector, Harness Side: FRT — SIGRTN • Measure the Resistance between: (+)PCM Connector, Harness Side / (-)Vehicle battery: FRT — Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DD65**. REPAIR short circuit.
DD65	CHECK FOR OPEN IN HARNESS		
	• PCM connector connected. • Add jumper wire between the points described below: Point A FRPT Sensor Connector, Harness Side / Point B FRPT Sensor Connector, Harness Side: FRT - Pin 3 — SIGRTN - Pin 4 • Access the PCM-FRT V PID using a scan tool. • **Is the Voltage below 0.2 V?**	Yes → No →	INSTALL a new FRPT sensor. REFER to fuel system service WARNING information. CLEAR the PCM DTCs and REPEAT Self-Test. KEY OFF. REMOVE jumper wire(s) GO to **DD66**.

DD63 measurement:

(+)PCM Connector, Harness Side	(-)FRPT Sensor Connector, Harness Side
FRT	FRT - Pin 3
SIGRTN	SIGRTN - Pin 4

DD64 measurements:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
FRT	SIGRTN

(+)PCM Connector, Harness Side	(-)Vehicle battery
FRT	Negative post

DD65 jumper points:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRT - Pin 3	SIGRTN - Pin 4

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD66	CHECK SIGNAL AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)FRPT Sensor Connector, Harness Side** / **(-)PCM Connector, Harness Side**: FRT - Pin 3 / FRT SIGRTN - Pin 4 / SIGRTN • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **DD67**. REPAIR open circuit.
DD67	CHECK SENSOR SIGNAL FOR SHORT TO VREF		
	• Key OFF. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side**: FRT / VREF • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit to VREF.
DD68	DTC P0180: PERFORM A THOROUGH WIGGLE TEST ON THE FRPT SENSOR HARNESS		
	• Access the FRT_V PID using a scan tool. • Perform a through wiggle test on the FRPT Sensor harness. • **Is the FRT signal stable?**	Yes → No →	GO to **Z1**. KEY OFF. Repair as necessary.
DD69	KOEO AND KOER DTC P0181: CHECK FRT_V PID		
	• Allow vehicle temperatures to stabilize prior to temperature sensor tests. • Key ON Engine OFF. • Access the PCM-FRT V PID using a scan tool. • **Is the Voltage between 0.4 V - 4.5 V?**	Yes → No →	GO to **DD70**. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
DD70	COMPARE PIDS AFTER STABILIZING VEHICLE TEMPERATURE		
	• Access the FRT, CHT and PCM-ECT PIDs using a scan tool. • **Are the Temperature PIDs nearly equal value?**	Yes → No →	Fault is not present at this time CLEAR the DTCs and REPEAT Self-Test. GO to **Z1**.
DD71	ARE DTCS P0182 OR P0183 PRESENT IN KOEO OR KOER SELF-TEST?		
	• **Are DTCs P0182 or P0183 present in KOEO or KOER Self-Test?**	Yes → No →	GO to **DD75**. GO to **DD72**.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

	Test Steps	Results →	Action to Take
DD72	KOEO AND KOER DTC P0181: CHECK COOLING SYSTEM		
	• Verify cooling system is operating normally. **WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.** • Check the vehicle coolant level. • **Is cooling system OK?**	Yes → No →	GO to **DD73.** REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Repair as necessary.
DD73	CHECK RESISTANCE OF FRP SENSOR WITH ENGINE OFF		
	• Key OFF. • FRT Sensor connector disconnected. • Measure the Resistance between: (see table below) Note: REFER to the chart at the beginning of this test for resistance specifications. • **Is resistance within specification?**	Yes → No →	GO to **DD74.** INSTALL a new FRT sensor.
DD74	CHECK RESISTANCE OF CHT SENSOR WITH ENGINE RUNNING		
	CAUTION: While conducting checks with a running engine ensure adequate safety precautions are observed to prevent contact with moving engine parts. For example; ensure ties or loose clothing do not come into contact with the cooling fan or drive belts. • Vehicle must be at normal operating temperature. • Measure the Resistance between: (see table below) Note: REFER to the chart at the beginning of this test for resistance specifications. • **Is resistance within specification?**	Yes → No →	KEY OFF. Check FRT & NG connector for damage, corrosion, etc. Check FRT % SRtn circuit(s) between sensor and NG module. Service as necessary KEY OFF. INSTALL a new FRT sensor.

DD73 measurement:

(+)FRT Sensor Connector, Component Side	(-)FRT Sensor Connector, Component Side
FRT	SRtn

DD74 measurement:

(+)FRT Sensor Connector, Component Side	(-)FRT Sensor Connector, Component Side
FRT	SRtn

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DD75</td><td>KOEO AND KOER DTCS P0182 OR P0183: ACCESS FRT PID AND CHECK VOLTAGE</td><td></td><td></td></tr>
<tr><td></td><td>Note: The PID referred to below may read as EFT on some scan tools.
• Key ON Engine OFF.
• Access the PCM-FRT V PID using a scan tool.
• Is the Voltage below 0.2 V?</td><td>Yes →

No →</td><td>KEY OFF.
GO to DD76.
KEY OFF.
GO to DD78.</td></tr>
<tr><td>DD76</td><td>CHECK FOR GROUNDED CIRCUIT</td><td></td><td></td></tr>
<tr><td></td><td>• FRT Sensor connector disconnected.
• Key ON Engine OFF.
• Access the PCM-FRT V PID using a scan tool.
• Is the Voltage above 4.6 V?</td><td>Yes →
No →</td><td>INSTALL a new FRT sensor.
KEY OFF.
GO to DD77.</td></tr>
<tr><td>DD77</td><td>CHECK SENSOR SIGNAL FOR SHORT TO GROUND</td><td></td><td></td></tr>
<tr><td></td><td>• NG Module connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)FRT Sensor Connector, Harness Side</th><th>(-)FRT Sensor Connector, Harness Side</th></tr><tr><td>FRT</td><td>SRtn</td></tr></table>• Measure the Resistance between:
<table><tr><th>(+)FRT Sensor Connector, Harness Side</th><th>(-)</th></tr><tr><td>FRT</td><td>Ground</td></tr></table>• Is the Resistance above 10 KOhm?</td><td>Yes →

No →</td><td>INSTALL a new NG module. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
REPAIR short circuit.</td></tr>
<tr><td>DD78</td><td>CHECK RESISTANCE OF FRT SENSOR WITH ENGINE OFF</td><td></td><td></td></tr>
<tr><td></td><td>• FRT Sensor connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)FRT Sensor Connector, Component Side</th><th>(-)FRT Sensor Connector, Component Side</th></tr><tr><td>FRT</td><td>SRtn</td></tr></table>Note: REFER to the chart at the beginning of this test for resistance specifications.
• Is resistance within specification?</td><td>Yes →
No →</td><td>GO to DD79.
INSTALL a new FRT sensor.</td></tr>
</table>

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DD79</td><td>CHECK FRT CIRCUIT FOR SHORT TO POWER</td><td></td><td></td></tr>
<tr><td colspan="2">
NG Module connector disconnected.
Key ON Engine OFF.
Measure the Voltage between:
<table>
<tr><th>(+)FRT Sensor Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>FRT</td><td>Ground</td></tr>
</table>
Is the Voltage below 1 V?
</td><td>Yes →
No →</td><td>KEY OFF.
GO to DD80.
KEY OFF. REPAIR short circuit to PWR.</td></tr>
<tr><td>DD80</td><td>CHECK FRT & SRTN CIRCUIT(S) FOR OPEN</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table>
<tr><th>(+)FRT Sensor Connector, Harness Side</th><th>(-)NG Module Connector, Harness Side</th></tr>
<tr><td>FRT</td><td>FRT - Pin 31</td></tr>
<tr><td>SRtn</td><td>SRtn - Pin 89</td></tr>
</table>
Are the resistances below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to DD81.
REPAIR open circuit.</td></tr>
<tr><td>DD81</td><td>CHECK SENSOR SIGNAL FOR SHORT TO SREF</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table>
<tr><th>(+)NG Module Connector, Harness Side</th><th>(-)NG Module Connector, Harness Side</th></tr>
<tr><td>FRT - Pin 31</td><td>SRef - Pin 74</td></tr>
</table>
Is the Resistance above 10 KOhm?
</td><td>Yes →
No →</td><td>INSTALL a new NG module.
REPAIR short circuit.</td></tr>
<tr><td>DD82</td><td>CONTINUOUS MEMORY DTCS P0182 OR P0183: INTERMITTENT CHECK</td><td></td><td></td></tr>
<tr><td colspan="2">
Key ON Engine OFF.
Note: The PID referred to below may read as EFT on some scan tools.
Access the PCM-FRT V PID using a scan tool.
While observing the PID, complete the following:
— Tap on sensor to simulate road shock.
— Wiggle the sensor connector.
— Shake, wiggle, bend the FRT & SRtn circuit(s). Check FRT & SRtn circuit(s) between sensor and NG module.
Is there a large change in the voltage reading?
</td><td>Yes →
No →</td><td>ISOLATE fault and REPAIR as necessary.
GO to DD83.</td></tr>
</table>

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD83	CHECK FRT & NG CONNECTOR FOR DAMAGE, CORROSION, ETC		
	• NG Module connector disconnected. • FRT Sensor connector disconnected. • **Are connectors and terminals OK?**	Yes →	Fault is not present at this time Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	Repair as necessary.
DD84	CONTINUOUS MEMORY DTCS P0182 OR P0183: INTERMITTENT CHECK		
	• Key ON Engine OFF. Note: The PID referred to below may read as EFT on some scan tools. • Access the PCM-FRT V PID using a scan tool. • While observing the PID, complete the following: — Tap on sensor to simulate road shock. — Wiggle the sensor connector. — Wiggle, shake and bend small sections of the wiring harness while working from the FRT Sensor to the PCM. • **Is there a large change in the voltage reading?**	Yes →	ISOLATE fault and REPAIR as necessary.
		No →	GO to **DD85**.
DD85	CHECK FRT & PCM CONNECTOR FOR DAMAGE, CORROSION, ETC		
	• PCM connector disconnected. • FRT Sensor connector disconnected. • **Are connectors and terminals OK?**	Yes →	Fault is not present at this time Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	Repair as necessary.

Fuel Rail Pressure (FRP), Fuel Rail Temperature (FRT) and Fuel Rail Pressure Temperature (FRPT) Sensors

DD

Test Steps		Results →	Action to Take
DD86	CONTINUOUS MEMORY DTCS P0190 AND P0191: CHECK FRP VOLTAGE PID DURING FUEL RAIL PRESSURE RELIEF		
	Note: Before servicing or replacing any components in the fuel system, reduce the possibility of injury or fire by following directions in pinpoint test HB warning, caution, and handling. • Relieve fuel pressure. • Crank the engine. • Access the PCM-FRP V PID using a scan tool. • **Is the Voltage between 0.4 V - 0.6 V?**	Yes → No →	GO to **DD87**. For Dedicated NGV: Go to HB1 All Others: CHECK fuel delivery system for concerns If OK, REPLACE FRP sensor
DD87	CHECK FUEL SYSTEM AND FRP SENSOR CIRCUITS		
	• CHECK fuel delivery system for concerns. • Key ON Engine OFF. • Access the PCM-FRP V PID using a scan tool. • While observing the PID, complete the following: — Tap on sensor to simulate road shock. — Wiggle the sensor connector. — Wiggle, shake and bend small sections of the wiring harness while working from the FRP Sensor to the PCM. • Check FRP connector for damage, corrosion, etc. • **Is a fault indicated?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **Z1**.

Vehicle Speed Circuit Check | DF

Note

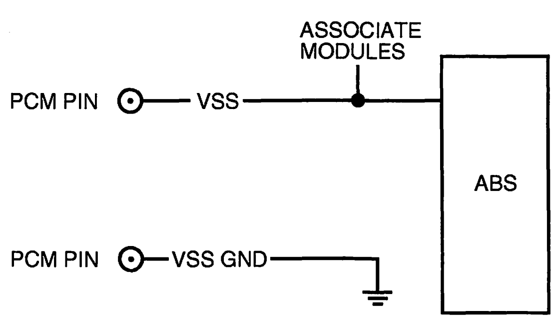
This Pinpoint Test is intended to diagnose the following:

Powertrain Control Module PCM (12A650).

Harness circuits: VSS, VSS-GND.

Typical Circuit Schematic

Typical wiring diagram with VSS output signal from an ABS module and VSS input signals to PCM and related user modules.



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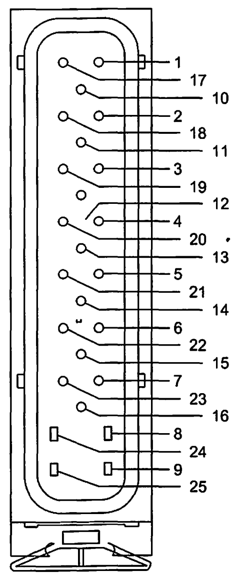
Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
104 Pin	VSS-GND VSS	33 58

Vehicle Speed Circuit Check	DF

Antilock braking system (ABS) Module Connector



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Circuit	Pin
VSS (Vehicle speed sensor)	11

Warning

STRICT OBSERVANCE OF POSTED SPEED LIMITS AND DRIVING CONDITIONS IS MANDATORY WHEN PROCEEDING THROUGH THE FOLLOWING DRIVE CYCLES.

Vehicle Speed Circuit Check | DF

Test Steps		Results →	Action to Take
DF1	DTCS P0500, P0503, P1501 AND P1502: CHECK VEHICLE SPEED CIRCUIT FOR INTERMITTENT CONCERNS		
	Note: PCM detected an error in the vehicle speed information received from the ABS control module. This test step checks for recurrence of this vehicle speed error. • Key ON Engine OFF. • Scan tool connector connected. • CLEAR the DTCs. • Take the vehicle to a suitable location and gradually increase the vehicle speed to 80 km/h (50 mph). • Coast down to an idle and stop the vehicle. • Key OFF. • Key ON Engine OFF. • CHECK Continuous Memory DTCs: • **Are DTCs P0500, P0503, P1501 or P1502 present?**	Yes → No →	KEY OFF. The vehicle speed input was not as expected GO to **DF2**. KEY OFF. The vehicle speed input was as expected. The fault that produced the original DTC may be intermittent. GO to **DF6**.
DF2	CHECK VSS AND VSS-GND FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • ABS Module connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (table below) • **Are the voltages below 1 V?**	Yes → No →	GO to **DF3**. KEY OFF. GO to **DF7**.
DF3	CHECK FOR OPEN VSS BETWEEN PCM AND ABS CONTROL MODULE		
	• Measure the Resistance between: (table below) • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DF4**. REPAIR open circuit. COMPLETE VSS Circuit Repair Verification Drive Cycle GO to **DF8**.
DF4	CHECK VSS-GND CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (table below) • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DF5**. REPAIR open circuit. COMPLETE VSS Circuit Repair Verification Drive Cycle GO to **DF8**.

DF2 measurement:

(+)PCM Connector, Harness Side	**(-)**
VSS - Pin 58	Ground
VSS-GND - Pin 33	Ground

DF3 measurement:

(+)PCM Connector, Harness Side	**(-)ABS Module Connector, Harness Side**
VSS - Pin 58	VSS - Pin 11

DF4 measurement:

(+)PCM Connector, Harness Side	**(-)**
VSS-GND - Pin 33	Ground

Vehicle Speed Circuit Check — DF

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DF5</td><td>CHECK VSS CIRCUIT(S) FOR SHORT TO GROUND IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">

• Scan tool connector disconnected.
• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)
VSS - Pin 58	Ground

• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VSS - Pin 58	VSS-GND - Pin 33

• **Are all resistances greater than 10K ohms?**

</td><td>Yes →

No →</td><td>RESTORE vehicle.
REFER to Anti-Lock Control, Section 206 in the Workshop Manual, for further diagnosis of the ABS control module, its speed sensors and its wheel speed sensor harness circuits.
If those components are working properly, INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
GO to **DF8**.

GO to **DF7**.</td></tr>
<tr><td>DF6</td><td>VISUAL INSPECTION</td><td></td><td></td></tr>
<tr><td colspan="2">• Visually inspect the VSS circuit harness and connectors at PCM, ABS and other VSS User Modules for damage, loose connections, loose grounds or incorrect routing.
Note: REFER to Wiring Diagrams Manual for harness, module and connector locations.
• **Did the visual inspection reveal a potential failure?**</td><td>Yes →

No →</td><td>Repair the fault as necessary.
GO to **DF8**.

Unable to duplicate or identify fault at this time.
REFER to Anti-Lock Control, Section 206 in the Workshop Manual, for diagnosis of intermittent control module and wheel speed sensor concern.</td></tr>
<tr><td>DF7</td><td>VERIFY IF VSS IS SHORTED IN HARNESS OR ANOTHER MODULE</td><td></td><td></td></tr>
<tr><td colspan="2">• Determine which, if any, modules are connected to the VSS circuit (REFER to Wiring Diagrams Manual). If no other modules are connected to the VSS circuit, GO to the “YES” Action To Take.
• One at a time, disconnect the modules associated with the VSS. After disconnecting each module, again test for short circuit (REFER to test step that sent you here). Repeat until each associated module has been disconnected or the short circuit has been eliminated.
• **Did the short circuit remain after all associated modules were disconnected?**</td><td>Yes →

No →</td><td>REPAIR short circuit.
GO to **DF8**.

REFER to the Workshop Manual for further diagnosis of appropriate module.
After repair, RESTORE vehicle.
GO to **DF8**.</td></tr>
</table>

Vehicle Speed Circuit Check — DF

Test Steps		Results →	Action to Take
DF8	VSS CIRCUIT REPAIR VERIFICATION DRIVE CYCLE		
	Note: Warm the engine to normal operating temperature before continuing. Note: Complete the VSS circuit Drive Cycle at least three times as described below. • Automatic Transmission Drive Cycle: — Place transmission range selector lever in DRIVE range. — Accelerate heavily to 56 km/h (35 mph). — Coast down to an idle and stop the vehicle. — Cycle Key OFF and ON. • Manual Transmission Drive Cycle: — Shift from first to second gear. — Accelerate moderately to 64 km/h (40 mph). — Coast down to an idle and stop the vehicle. — Cycle Key OFF and ON. • Key OFF. • Key ON Engine OFF. • CHECK Continuous Memory DTCs: • **Are DTCs P0500, P0503, P1501 or P1502 present?**	Yes → No →	Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts. The repair has been verified.

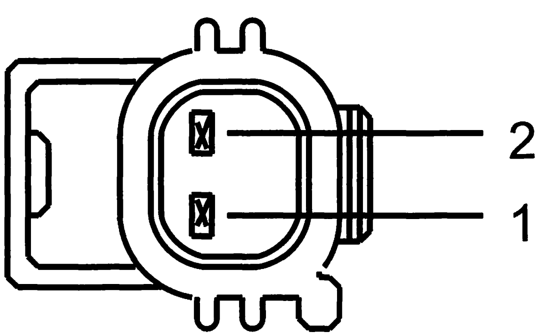
Knock sensor	DG

Note

This Pinpoint Test is intended to diagnose the Knock Sensor (12A699), PCM (12A650), and harness.

Knock sensor (KS) Connector

A



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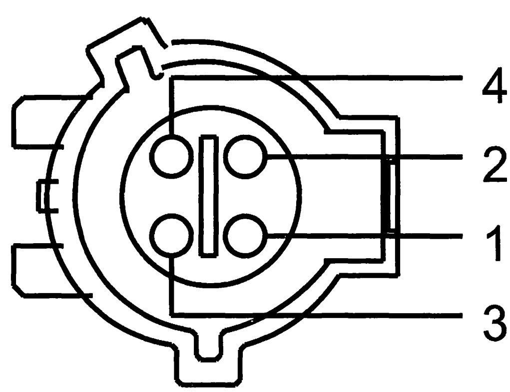

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Vehicle	Connector	Circuit	Pin
LS	A	KS2+ KS2- KS1+ KS1-	1 2 1 2
Escape, Mustang	A	KS1+ KS1-	1 2
Expedition 4.6L	B	KS2+ KS2- KS1+ KS1-	2 1 3 4

(Continued)

Knock sensor	DG

Vehicle	Connector	Circuit	Pin
Explorer 4.6L, Marauder	B	KS2+ KS2- KS1+ KS1-	1 2 3 4
Thunderbird	A	KS2+ KS2- KS1+ KS1-	1 2 2 1
All other vehicles	A	KS1+ KS1-	2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	VREF VPWR KS2- KS1- KS2+ KS1+	E20 B32 E43 E42 E52 E51
Escape 2.0L, Focus 2.0L 2V, Focus 2.0L 4V	104 Pin	VREF VPWR KS1- KS1+	90 71 87 57
Expedition 4.6L	122 Pin	VREF VPWR KS2- KS1- KS2+ KS1+	E36 B34 E39 E40 E28 E29
Expedition 5.4L, Navigator	122 Pin	VREF VPWR KS1- KS1+	E36 B34 E40 E29
Explorer 4.0L, Focus 2.3L, Mountaineer 4.0L	150 (50-50-50) Pin	VREF VPWR KS1- KS1+	E40 B35 E20 E32
Explorer 4.6L, Mountaineer 4.6L	150 (50-50-50) Pin	VREF VPWR KS2- KS1- KS2+ KS1+	E40 B35 E22 E20 E21 E32

(Continued)

Knock sensor

DG

Vehicle	Connector	Circuit	Pin
F-150 4.6L	190 Pin	VREF VPWR KS1- KS1+	E57 B51 E48 E49
F-150 5.4L	190 Pin	VREF VPWR KS2- KS1- KS2+ KS1+	E57 B51 E30 E48 E31 E49
LS 3.0L	150 (60-32-58) Pin	VREF VPWR KS1- KS1+	E14 B32 E42 E51
LS 3.9L, Thunderbird	150 (60-32-58) Pin	VREF VPWR KS2- KS1- KS2+ KS1+	E14 B32 E43 E42 E52 E51
All other vehicles	104 Pin	VREF VPWR KS1- KS1+	90 71 32 57

Test Steps	Results →	Action to Take
DG1 KOER AND CONTINUOUS MEMORY DTCS P0325 AND P0326: CHECK RESISTANCE OF KS1		
• Verify that the KS is connected and properly installed. • KS connector disconnected. • Measure the Resistance between:	Yes →	KEY OFF. GO to **DG3**.
	No →	INSTALL a new KS.

(+)KS Connector, Component Side	(-)KS Connector, Component Side
KS1-	KS1+

- **Is the Resistance between 4.39 MOhm - 5.35 MOhm?**

Knock sensor

DG

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DG2</td><td>KOER AND CONTINUOUS MEMORY DTCS P0330 AND P0331: CHECK RESISTANCE OF KS2</td><td></td><td></td></tr>
<tr><td colspan="2">
Verify that the KS is connected and properly installed.
KS connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)KS2 Sensor Connector, Component Side</th><th>(-)KS2 Sensor Connector, Component Side</th></tr><tr><td>KS2-</td><td>KS2+</td></tr></table>
Is the Resistance between 4.39 MOhm - 5.35 MOhm?
</td><td>Yes →
No →</td><td>KEY OFF.
GO to DG4.
INSTALL a new KS2 sensor.</td></tr>
<tr><td>DG3</td><td>CHECK KS1+ CIRCUIT FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
PCM connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)KS Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>KS1+</td><td>KS1+</td></tr></table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to DG5.
REPAIR open circuit.</td></tr>
<tr><td>DG4</td><td>CHECK KS2+ CIRCUIT FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table><tr><th>(+)KS2 Sensor Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>KS2+</td><td>KS2+</td></tr></table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to DG6.
REPAIR open circuit.</td></tr>
<tr><td>DG5</td><td>CHECK KS1- CIRCUIT FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table><tr><th>(+)KS Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>KS1-</td><td>KS1-</td></tr></table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to DG7.
REPAIR open circuit.</td></tr>
<tr><td>DG6</td><td>CHECK KS2- CIRCUIT FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table><tr><th>(+)KS2 Sensor Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>KS2-</td><td>KS2-</td></tr></table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to DG8.
REPAIR open circuit.</td></tr>
</table>

Knock sensor — DG

Test Steps		Results →	Action to Take
DG7	CHECK KS1+ CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG9**.
		No →	REPAIR short circuit to GND.

(+)KS Connector, Component Side	(-)Vehicle battery
KS1+	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DG8	CHECK KS2+ CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG10**.
		No →	REPAIR short circuit to GND.

(+)KS2 Sensor Connector, Component Side	(-)Vehicle battery
KS2+	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DG9	CHECK KS1- CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG11**.
		No →	REPAIR short circuit to GND.

(+)KS Connector, Harness Side	(-)Vehicle battery
KS1-	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DG10	CHECK KS2- CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG12**.
		No →	REPAIR short circuit to GND.

(+)KS2 Sensor Connector, Harness Side	(-)Vehicle battery
KS2-	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DG11	CHECK KS1+ CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG13**.
		No →	REPAIR short circuit to PWR.

(+)KS Connector, Harness Side	(-)PCM Connector, Harness Side
KS1+	VPWR
KS1+	VREF

• **Are the resistances above 10 KOhm?**

Knock sensor — DG

Test Steps		Results →	Action to Take
DG12	CHECK KS2+ CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG14**.
		No →	REPAIR short circuit to PWR.

(+)KS2 Sensor Connector, Harness Side	(-)PCM Connector, Harness Side
KS2+	VREF
KS2+	VPWR

• **Are the resistances above 10 KOhm?**

Test Steps		Results →	Action to Take
DG13	CHECK KS1- CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG15**.
		No →	REPAIR short circuit to PWR.

(+)KS Connector, Harness Side	(-)PCM Connector, Harness Side
KS1-	VREF
KS1-	VPWR

• **Are the resistances above 10 KOhm?**

Test Steps		Results →	Action to Take
DG14	CHECK KS2- CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **DG16**.
		No →	REPAIR short circuit to PWR.

(+)KS2 Sensor Connector, Harness Side	(-)PCM Connector, Harness Side
KS2-	VREF
KS2-	VPWR

• **Are the resistances above 10 KOhm?**

Test Steps		Results →	Action to Take
DG15	CHECK KS1- CIRCUIT FOR INTERMITTENT FAULTS		
	Note: Carefully wiggle all accessible wiring and connectors associated with the KS circuit.	Yes →	GO to **DG17**.
	• Measure the Resistance between:	No →	REPAIR open circuit.

(+)KS Connector, Harness Side	(-)PCM Connector, Harness Side
KS1-	KS1-

• **Is the Resistance below 5 Ohm?**

Knock sensor

DG

Test Steps		Results →	Action to Take
DG16	CHECK KS2- CIRCUIT FOR INTERMITTENT FAULTS		
	Note: Carefully wiggle all accessible wiring and connectors associated with the KS circuit. • Measure the Resistance between: (+)KS2 Sensor Connector, Harness Side: KS2- / (-)PCM Connector, Harness Side: KS2- • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DG18**. REPAIR open circuit.
DG17	CHECK KS1+ CIRCUIT FOR INTERMITTENT FAULTS		
	Note: Carefully wiggle all accessible wiring and connectors associated with the KS circuit. • Measure the Resistance between: (+)KS Connector, Harness Side: KS1+ / (-)PCM Connector, Harness Side: KS1+ • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DG19**. REPAIR open circuit.
DG18	CHECK KS2+ CIRCUIT FOR INTERMITTENT FAULTS		
	Note: Carefully wiggle all accessible wiring and connectors associated with the KS circuit. • Measure the Resistance between: (+)KS2 Sensor Connector, Harness Side: KS2+ / (-)PCM Connector, Harness Side: KS2+ • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DG20**. REPAIR open circuit.
DG19	CHECK PCM INTERNAL RESISTANCE OF CIRCUIT FOR KS1		
	Note: The following measurement is intended to check the PCM internal resistance. • Measure the Resistance between: (+)KS Connector, Component Side: KS1+ / (-)KS Connector, Component Side: KS1- • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new KS. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Knock sensor

DG

Test Steps		Results →	Action to Take
DG20	CHECK PCM INTERNAL RESISTANCE OF CIRCUIT FOR KS2		
	Note: The following measurement is intended to check the PCM internal resistance. • Measure the Resistance between: (+)KS2 Sensor Connector, Component Side: KS2+ — (-)KS2 Sensor Connector, Component Side: KS2- • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new KS2 sensor. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

(+)KS2 Sensor Connector, Component Side	**(-)KS2 Sensor Connector, Component Side**
KS2+	KS2-

Throttle Position (TP) Sensor	DH

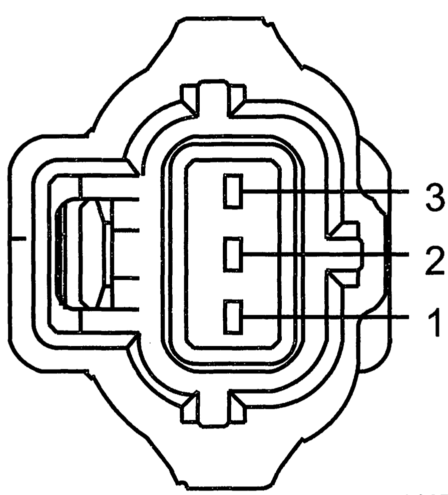
Note

This Pinpoint Test is intended to diagnose the following:

- TP Sensor (9B989).
- Binding or sticking throttle linkage.
- Harness circuits: TP, SIGRTN, VREF, VPWR and PWRGND.
- Powertrain control module (PCM) (12A650).

Throttle position (TP) Sensor Connector

A



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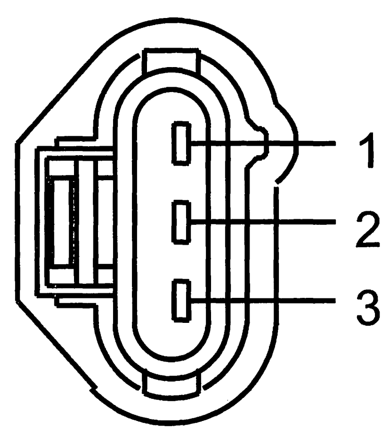

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Throttle Position (TP) Sensor

DH

Vehicle	Connector	Circuit	Pin
Focus, Ranger 2.3L	A	TP SIGRTN VREF	2 1 3
All other vehicles	B	TP SIGRTN VREF	2 3 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	SIGRTN PWRGND VREF VPWR TP	E17 B24 E20 B32 E57
Expedition, Navigator	122 Pin	SIGRTN PWRGND VREF VPWR TP	E25 B1 E36 B34 E44
Focus 2.3L	150 (50-50-50) Pin	SIGRTN PWRGND VREF VPWR TP	E41 B47 E40 B35 E19
All other vehicles	104 Pin	SIGRTN PWRGND VREF VPWR TP	91 103 90 71 89

Test Steps		Results →	Action to Take
DH1	KOEO AND KOER DTC P1124: CHECK FOR ANY OTHER DTCS		
	• CHECK for DTC P1400 or P0405 in KOEO or KOER Self-Test. • CHECK KOEO and KOER DTCs: • **Are DTCs P1400 or P0405 present?**	Yes →	Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	KEY OFF. GO to **DH2**.

Throttle Position (TP) Sensor — DH

Test Steps		Results →	Action to Take
DH2	CHECK FOR STUCK THROTTLE PLATE OR LINKAGE		
	• Visually inspect the throttle linkage and throttle plate for binding or sticking. • Verify the throttle plate and linkage is at closed throttle position. • **Does the throttle move freely and return to closed throttle position?**	Yes → No →	Throttle plate and linkage are OK. GO to **DH8**. REPAIR as necessary.
DH3	DTC P1120: CHECK TP CIRCUIT FOR FRAYED WIRES OR CORROSION ON CONNECTORS		
	• Key OFF. • Complete a visual inspection of pins on harness connector at the TP sensor for corrosion. • Complete a visual inspection of the harness wires between the TP sensor and the PCM for insulation fraying and corrosion. • **Is a fault present?**	Yes → No →	REPAIR as necessary. GO to **DH4**.
DH4	CHECK FOR STUCK TP SENSOR		
	• Key ON Engine OFF. • Slowly move throttle from closed throttle position to wide open throttle position and observe the TP V PID. • Access the PCM-TP V PID using a scan tool. • **Is the Voltage below 0.49 V?**	Yes → No →	KEY OFF. GO to **DH5**. GO to **DH21**.
DH5	CHECK VOLTAGE BETWEEN VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR		
	• TP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)TP Sensor Connector, Harness Side: VREF — (-)TP Sensor Connector, Harness Side: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	KEY OFF. GO to **DH6**. GO to **C1**.

Measurement table for DH5:

(+)TP Sensor Connector, Harness Side	**(-)TP Sensor Connector, Harness Side**
VREF	SIGRTN

Throttle Position (TP) Sensor — DH

Test Steps		Results →	Action to Take
DH6	CHECK TP CIRCUIT FOR OPEN IN HARNESS		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: TP — **(-)TP Sensor Connector, Harness Side**: TP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DH7**. REPAIR open TP circuit.
DH7	CHECK TP SENSOR VOLTAGE TO PCM		
	• PCM connector connected. • TP Sensor connector connected. • Start engine and idle for 2 minutes. • Slowly move throttle from closed throttle position to wide open throttle position and observe the TP V PID. • Access the PCM-TP V PID using a scan tool. • Observe reading at any time within the limits. • **Is the Voltage between 0.17 V - 0.49 V?**	Yes → No →	REPLACE TP sensor. If DTC P1120 is still present, GO to **DH21**.
DH8	DTC P0123 OR DTC P1124: INDUCE OPPOSITE TP SENSOR VOLTAGE		
	• TP Sensor connector disconnected. • Key ON Engine OFF. • Access the PCM-TP V PID using a scan tool. • **Is the Voltage below 0.17 V?**	Yes → No →	GO to **DH9**. KEY OFF. GO to **DH10**.
DH9	CHECK VOLTAGE BETWEEN VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)TP Sensor Connector, Harness Side**: VREF — **(-)TP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	REPLACE TP sensor. GO to **C1**.

DH6 measurement:

(+)PCM Connector, Harness Side	(-)TP Sensor Connector, Harness Side
TP	TP

DH9 measurement:

(+)TP Sensor Connector, Harness Side	(-)TP Sensor Connector, Harness Side
VREF	SIGRTN

Throttle Position (TP) Sensor — DH

Test Steps		Results →	Action to Take
DH10	CHECK CIRCUIT FOR SHORT TO VREF AND VPWR IN HARNESS		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • PCM connector disconnected. Note: For 150 pin PCM and 122 pin PCM, measure to both VREF pins. • Measure the Resistance between: (+)PCM Connector, Harness Side / (-)PCM Connector, Harness Side: VPWR — TP VREF — TP • **Are the resistances above 10 KOhm?**	Yes → No →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
DH11	DTC P0122: VERIFY SCAN TOOL COMMUNICATION		
	Note: An intermittent fault can cause a Continuous Memory DTC P0122. If a Continuous Memory DTC P0122 is still present after DH11 through DH15, GO to Z1. • TP Sensor connector disconnected. • Add jumper wire between the points described below: Point A TP Sensor Connector, Harness Side / Point B TP Sensor Connector, Harness Side: VREF — TP • Key ON Engine OFF. • Access the PCM-TP V PID using a scan tool. • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. GO to **DH15**. KEY OFF. GO to **DH12**.
DH12	INDUCE OPPOSITE TP SENSOR VOLTAGE		
	• Jumper still connected. • Key ON Engine OFF. • Access the PCM-TP V PID using a scan tool. • **Is the Voltage above 4.65 V?**	Yes → No →	REPLACE TP sensor. REMOVE jumper. GO to **DH13**.

Throttle Position (TP) Sensor — DH

Test Steps	Results →	Action to Take

DH13 CHECK VOLTAGE BETWEEN VREF AND SIGRTN CIRCUITS AT THE TP SENSOR VEHICLE HARNESS CONNECTOR

- Key ON Engine OFF.
- Measure the Voltage between:

(+)TP Sensor Connector, Harness Side	(-)TP Sensor Connector, Harness Side
VREF	SIGRTN

- **Is the Voltage between 4 V - 6 V?**

Results	Action to Take
Yes →	KEY OFF. GO to **DH14**.
No →	GO to **C1**.

DH14 CHECK TP CIRCUIT FOR OPEN IN HARNESS

Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test.

- PCM connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)TP Sensor Connector, Harness Side
TP	TP

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	GO to **DH15**.
No →	REPAIR open circuit.

DH15 CHECK TP CIRCUIT FOR SHORT TO PWRGND OR SIGRTN IN HARNESS

- REMOVE jumper wire.
- PCM connector disconnected.
- Scan tool connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
TP	PWRGND
TP	SIGRTN

- **Are the resistances above 10 KOhm?**

Results	Action to Take
Yes →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
No →	REPAIR short circuit.

DH16 DTC P1121 OR P0068: CHECK RATIONALITY OPERATION BETWEEN TP AND MAF SENSORS

- Attempt to start engine.
- **Does the engine start?**

Results	Action to Take
Yes →	GO to **DH17**.
No →	CHECK for major leaks, cracks and openings between MAF sensor and throttle body. If OK, GO to **A1**.

Throttle Position (TP) Sensor

DH

Test Steps		Results →	Action to Take
DH17	CHECK TP SENSOR FOR MECHANICAL OPERATION		
	• Key ON Engine OFF. • Slowly move throttle from closed throttle position to wide open throttle position and observe the TP V PID. • Access the PCM-TP V PID using a scan tool. • **Is the Voltage between 0.49 V - 4.65 V?**	Yes → No →	GO to **DH18**. REPLACE TP sensor.
DH18	CHECK TP SENSOR SIGNAL HIGH VERSUS THE ENGINE LOAD WHILE DRIVING VEHICLE		
	• Key ON Engine RUN. • Drive vehicle, exercising the throttle and TP sensor while accessing PIDs. • Access the PCM-TP V and PCM-LOAD PIDs using a scan tool. • **Is the TP V PID greater than 2.44 volts and the LOAD PID less than 30%?**	Yes → No →	Listen for air noise around MAF sensor and throttle body while engine is running. If OK, REPLACE the TP sensor. GO to **HU1**. GO to **DH20**.
DH19	REVARIFICATION THAT NO START OCCURS		
	• CHECK that engine runs so that a stall and no start occurs. • **Does the engine start?**	Yes → No →	GO to **DH20**. GO to **A1**.
DH20	CHECK TP SENSOR SIGNAL LOW VERSUS THE ENGINE LOAD WHILE DRIVING VEHICLE		
	• Key ON Engine RUN. • Drive vehicle exercising the throttle and TP sensor near higher gears (preferably overdrive) while accessing PIDs. • Access the PCM-TP V and PCM-LOAD PIDs using a scan tool. • **Is the TP V PID less than 0.24 volts and the LOAD PID greater than 55%?**	Yes → No →	If Continuous Memory P1121 or P0068 is present, REPLACE MAF sensor. Unable to identify fault at this time.
DH21	CMDTCS P1120 OR P1125: CHECK FOR TP CIRCUIT INTERMITTENT SIGNAL		
	• Start engine and allow to idle. • Run throttle up to 1500 RPM for 5 seconds. • While lightly tapping on the TP sensor and wiggling the harness connector to simulate road shock, do the following. • Access the PCM-TP V PID using a scan tool. • **Is the Voltage between 0.49 V - 4.65 V?**	Yes → No →	KEY OFF. GO to **DH22**. INSPECT the TP sensor connector. If OK, REPLACE the TP sensor.

Throttle Position (TP) Sensor — DH

Test Steps		Results →	Action to Take
DH22	CHECK TP SENSOR HARNESS FOR INTERMITTENT OPENS OR SHORTS		
	• Key ON Engine OFF. • While doing the next three steps, access the named PID below. • Grasp the vehicle harness closest to the TP sensor connector. • Shake and bend a small section of the harness all the way to the dashpanel. • Wiggle, shake and bend the harness from the dash panel to the PCM. • Access the PCM-TP V PID using a scan tool. • **Is the Voltage between 0.49 V - 4.65 V?**	Yes → No →	KEY OFF. Unable to identify fault at this time. GO to **Z1**. ISOLATE fault and REPAIR as necessary.
DH23	DTC P0121: CHECK FOR OBSTRUCTION OR STICKING CONCERNS		
	• Disconnect accelerator cable and speed control cable from Throttle Body linkage. **CAUTION: Do not attempt to clean the throttle bore and plate area. Cleaning will damage the throttle body assembly.** Note: Conditions of sticking or obstruction can either be within cables or throttle body assembly. • Rotate throttle body linkage. • **Does the throttle body rotate freely without a sticking, binding or grabbing condition?**	Yes → No →	INSPECT cable(s). REPAIR as necessary. RERUN Quick Test. If the DTC P0121 is still present, GO to **DH24**. REPLACE the throttle body assembly.
DH24	CHECK FUNCTIONALITY OF THE THROTTLE POSITION SENSOR		
	• Key ON Engine OFF. • While slowly pressing the accelerator from closed throttle position to wide open throttle position, observe the TP V PID. • **Did the TP V PID display a smooth reading during accelerator movement?**	Yes → No →	VERIFY a symptom no longer exists. KEY OFF. REPLACE TP sensor.

Air Conditioner Evaporator Temperature sensor

DJ

Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuit(s): ACET & SIGRTN.
- Air Conditioner Evaporator Temperature Sensor (19C734).
- Powertrain Control Module (PCM) (12A650).

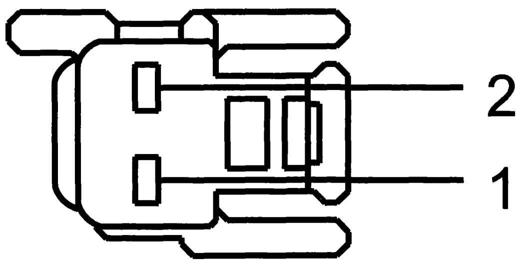
Air Conditioner Evaporator Temperature sensor

°C	°F	Voltage	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.8
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

Note: These values can vary 15 percent due to sensor and VREF variations. Voltage values were calculated for VREF = 5.0 volts.

Air Conditioner Evaporator Temperature sensor	DJ

Air Conditioner Evaporator Temperature Sensor (ACET) Sensor Connector



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Circuit	Pin
SIGRTN (Signal return)	2
ACET (Air Conditioner Evaporator Temperature Sensor)	1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Sable, Taurus	104 Pin	VREF SIGRTN ACET	90 91 66
All other vehicles	104 Pin	VREF SIGRTN ACET	90 91 38

Air Conditioner Evaporator Temperature sensor

DJ

Test Steps		Results →	Action to Take
DJ1	DTCS P0538 OR P1437: SIMULATE OPPOSITE SIGNAL TO PCM		
	• ACET Sensor connector disconnected. • Add jumper wire between the points described below: **Point A ACET Sensor Connector, Harness Side** / **Point B ACET Sensor Connector, Harness Side** ACET - Pin 1 / SIGRTN - Pin 2 • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. REMOVE jumper wire(s) GO to **DJ4**. GO to **DJ2**.
DJ2	SIMULATE OPPOSITE SIGNAL TO PCM		
	• CHECK Self-Test DTCs: • **Are DTCs P0537 or P1436 present?**	Yes → No →	INSTALL a new ACET sensor. KEY OFF. GO to **DJ3**.
DJ3	CHECK ACET & SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• REMOVE jumper wire(s) • PCM connector disconnected. • Measure the Resistance between: **(+)ACET Sensor Connector, Harness Side** / **(-)PCM Connector, Harness Side** ACET - Pin 1 / ACET SIGRTN - Pin 2 / SIGRTN • **Are the resistances below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.
DJ4	CHECK ACET CIRCUIT FOR SHORT TO VREF IN HARNESS		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side** ACET / VREF • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit to VREF.
DJ5	DTCS P0537 OR P1436: SIMULATE OPPOSITE SIGNAL TO PCM		
	• ACET Sensor connector disconnected. • CHECK KOEO DTCs: • **Are DTCs P1437 or P0538 present?**	Yes → No →	INSTALL a new ACET sensor. GO to **DJ6**.

Air Conditioner Evaporator Temperature sensor

DJ

Test Steps		Results →	Action to Take
DJ6	CHECK ACET CIRCUIT(S) FOR SHORT TO SIGRTN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)ACET Sensor Connector, Harness Side**: ACET - Pin 1; **(-)ACET Sensor Connector, Harness Side**: SIGRTN - Pin 2 • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DJ7**. REPAIR short circuit.
DJ7	CHECK ACET CIRCUIT(S) FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: **(+)ACET Sensor Connector, Harness Side**: ACET - Pin 1; **(-)**: Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
DJ8	CONTINUOUS MEMORY DTCS P0537 OR P0538: CHECK THE ACET & SIGRTN CIRCUIT FOR INTERMITTENT CONCERN		
	• ACET Sensor connector disconnected. • Measure the Voltage between: **(+)ACET Sensor Connector, Harness Side**: ACET - Pin 1; **(-)ACET Sensor Connector, Harness Side**: SIGRTN - Pin 2 • Key ON Engine OFF. • While monitoring the voltage reading on the DVOM, perform the following (The voltage should be between 4.5 and 5.5 volts. The voltage reading will change suddenly when a fault is detected. For P1436/P0537, a sudden change could indicate a short to ground. For P1437/P0538, a sudden change could indicate an open ACET or SIGRTN circuit.): • Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • Key OFF. • Inspect connectors for signs of damage, water ingress, corrosion, etc. • **Is there any change in the voltage reading, or is a concern found?**	Yes → No →	ISOLATE fault Repair as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.

Accelerator Pedal Position Sensor	DK

Note

This pinpoint test is intended to diagnose the following:

Accelerator Pedal Position (APP) Sensor (9F836).

Harness circuits: ETCRTN, SIGRTN, ETCREF, APPS1, APPS2, APPS3.

Powertrain Control Module PCM (12A650).

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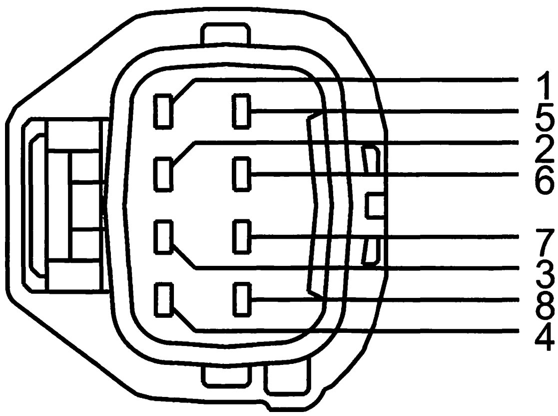
The nature of the Electronic Throttle Control system requires the following items:

The following DTCS should be repaired through Section 4 and the Workshop Manual respectively before entering pinpoint tests DK or DV: (P0715, P0720, P0731, P0732, P0733, P0734, P0735, P0102, P0103, P0104, P0321) and (C1165, U1027).

Accelerator Pedal Position Sensor	DK

Accelerator Pedal Position Sensor (APPS) Connector



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Circuit	Pin
ETCRTN2 (Electronic Throttle Control Return 2)	1
ETCREF2 (Electronic Throttle Control Reference Voltage2)	6
APPS3 (Accelerator pedal position sensor 3)	8
APPS2 (Accelerator pedal position sensor 2)	5
APPS1 (Accelerator pedal position sensor 1)	2
ETCRTN1 (Electronic Throttle Control Return 1)	3
ETCREF1 (Electronic Throttle Control Reference Voltage1)	7

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Accelerator Pedal Position Sensor — DK

Vehicle	Connector	Circuit	Pin
F-150	190 Pin	APPS3 APPS2 APPS1	B27 B26 B25
LS, Thunderbird	150 (60-32-58) Pin	ETCRTN1 ETCREF2 ETCREF1 APPS3 APPS2 APPS1	B17 B23 B20 B16 B1 B15
All other vehicles	150 (50-50-50) Pin	ETCRTN2 ETCRTN1 ETCREF2 ETCREF1 APPS3 APPS2 APPS1	B41 B6 B40 B4 B28 B17 B5

Test Steps		Results →	Action to Take
DK1	DTCS P2104, P2106, P2121, P2122, P2123, P2126, P2127, P2128, P2131, P2132 AND P2133: CHECK APPS FOR OBSTRUCTION		
	Note: On certain applications with ETC (Electronic Throttle Control), erroneous ignition and ETC related DTCs may be set due to salt water intrusion into the CKP harness connector. These DTCs are: P0320, P0351, P0356 and P2106. Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, REPLACE the CKP sensor. • Key ON Engine OFF. • Push accelerator pedal to the floor and release. • **Does the pedal move freely to the floor and back?**	Yes → No →	KEY OFF. **For P2111, P2112,** GO to **DV1**. **For For All others:** GO to **DK2**. KEY OFF. Isolate and repair obstruction.

Accelerator Pedal Position Sensor — DK

Test Steps		Results →	Action to Take
DK2	CHECK APPS SIGNAL VOLTAGE RANGES AT CLOSED AND OPEN PEDAL POSITION		
	• Key ON Engine OFF. • Access the PCM-APPS1, PCM-APPS2 and PCM-APPS3 PIDs using a scan tool. • Push the throttle plate to wide open position and release. **Accelerator pedal position: sensor signal voltages** (see table below) • **Are all three APPS signals out of range?**	Yes →	KEY OFF. GO to **DK3**.
		No →	KEY OFF. **For (P2121, P2122) alone, (P2126, P2127) alone, (P2131, P2132) alone** GO to **DK7**. **For combinations of above DTCS** GO to **DK3**. **For Continuous codes together P2104, P2121, P2126, P2131, and or P2104** GO to **DK24**.
DK3	CHECK VREF VOLTAGE TO APPS		
	• APPS connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (see table below) • **Is the Voltage between 4 V - 6 V?**	Yes →	GO to **DK4**.
		No →	GO to **C1**.
DK4	CHECK FUNCTIONALITY OF APPS1 CIRCUIT		
	Note: Use voltage measurements from DK. • **Was APPS1 out of range?**	Yes →	GO to **DK7**.
		No →	GO to **DK5**.
DK5	CHECK THE FUNCTIONALITY OF APPS2		
	Note: Use voltage measurements from DK. • **Was APPS2 out of range?**	Yes →	GO to **DK7**.
		No →	GO to **DK6**.
DK6	CHECK FUNCTIONALITY OF APPS3		
	Note: Use voltage measurements from DK. • **Was APPS3 out of range?**	Yes →	GO to **DK7**.
		No →	GO to **DK24**.

Accelerator pedal position: sensor signal voltages

Accelerator Pedal Position	APPS1	APPS2	APPS3
Pedal High	3.9-4.2	1.4-1.6	.8-1.1
Pedal Low	.7-1.2	3.6-4.1	3.1-3.5

(+)APPS Connector, Harness Side	(-)APPS Connector, Harness Side
ETCREF1 - Pin 7	ETCRTN1 - Pin 3

Accelerator Pedal Position Sensor | DK

Test Steps		Results →	Action to Take
DK7	CHECK FUNCTIONALITY OF APPS		
	• APPS connector disconnected. • Measure resistance through sensor. APPS1 to ETCRTN1 = 1.3 - 2.3 KOhms. APPS1 to ETCREF1 = .80 - 1.4 KOhms. APPS1 to ETCRTN2 = 1.2 - 2.1 KOhms. APPS1 to ETCREF2 = .85 - 2.5 KOhms. APPS1 to APPS2 = 3.0 - 3.8 KOhms. APPS1 to APPS3 = 2.9 - 3.6 KOhms. APPS2 to ETCRTN1 = 2.0 - 2.8 KOhms. APPS2 to ETCREF1 = 2.5 - 3.1 KOhms. APPS2 to ETCRTN2 = 2.0 - 3.1 KOhms. APPS2 to ETCREF2 = 2.6 - 3.3 KOhms. APPS2 to APPS3 = 2.6 - 4.6 KOhms. APPS3 to ETCRTN1 = 1.8 - 2.3 KOhms. APPS3 to ETCREF1 = 2.3 - 3.1 KOhms. APPS3 to ETCRTN2 = 1.7 - 2.5 KOhms. APPS3 to ETCREF2 = 2.3 - 3.1 KOhms. • **Are all resistances within specifications?**	Yes →	**For KOER DTCS P2121 and P2123** GO to **DK9.** **For KOER DTCS P2126 and P2127** GO to **DK14.** **For KOER DTCS P2131 and P2132 or P2133** GO to **DK19.** **For All Others** GO to **DK24.**
		No →	KEY OFF. INSTALL a new APPS. KOEO, Clear DTCS, depress accelerator pedal several times and self test again. If DTCS are output proceed to: GO to **DK8.**
DK8	CHECK APPS CIRCUIT INTEGRITY		
	• APPS connector disconnected. • Measure the Resistance between: (see table below) • **Is the Resistance between 700 Ohm - 1.6 KOhm?**	Yes →	**For the following Continuous codes alone or together: (P2121, P2122), (P2121, P2123), (P2104, P2121, P2126, P2131).** GO to **DK9.** **For the following Continuous codes alone or together: (P2126, P2127), (P2126, P2128), (P2104, P2121, P2126, P2131).** GO to **DK14.** **For the following Continuous codes alone or together: (P2121, P2122) , (P2131, P2133), (P2104).** GO to **DK19.**
		No →	INSTALL a new APPS. KOEO, Clear DTCS, depress accelerator pedal several times and self test again. If DTCS are output proceed to: GO to **DK9.**

(+)APPS Connector, Component Side	(-)APPS Connector, Component Side
ETCREF1 - Pin 7	ETCRTN1 - Pin 3

Accelerator Pedal Position Sensor — DK

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DK9</td><td>CHECK THE APPS1 CIRCUIT FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DK10.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)APPS Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>APPS1 - Pin 2</td><td>APPS1</td></tr></table>
Is the Resistance below 5 Ohm?
</td></tr>
<tr><td>DK10</td><td>CHECK THE APPS1 CIRCUIT FOR SHORT TO GROUND IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DK11.
REPAIR short circuit to GND.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)APPS Connector, Harness Side</th><th>(-)12V vehicle battery</th></tr><tr><td>APPS1 - Pin 2</td><td>Negative post</td></tr></table>
Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>DK11</td><td>CHECK THE APPS1 CIRCUIT FOR SHORT TO SIGRTN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DK12.
REPAIR short circuit to GND.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)APPS Connector, Harness Side</th><th>(-)APPS Connector, Harness Side</th></tr><tr><td>APPS1 - Pin 2</td><td>ETCRTN1 - Pin 3</td></tr></table>
Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>DK12</td><td>CHECK THE APPS1 CIRCUIT FOR SHORT TO VREF IN HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to DK13.
KEY OFF. REPAIR short circuit to PWR.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Key ON Engine OFF.
Measure the Resistance between:
<table><tr><th>(+)APPS Connector, Harness Side</th><th>(-)APPS Connector, Harness Side</th></tr><tr><td>APPS1 - Pin 2</td><td>ETCREF1 - Pin 7</td></tr></table>
Is the Resistance above 10 KOhm?
</td></tr>
</table>

Accelerator Pedal Position Sensor	DK

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DK13</td><td>CHECK THE APPS1 CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">KEY OFF. GO to DK24.
KEY OFF. REPAIR short circuit to PWR.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Key ON Engine OFF.
Measure the Resistance between:
<table><tr><th>(+)APPS Connector, Harness Side</th><th>(-)12V vehicle battery</th></tr><tr><td>APPS1 - Pin 2</td><td>Positive post</td></tr></table>
Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>DK14</td><td>CHECK THE APPS2 CIRCUIT FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DK15.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)APPS Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>APPS2 - Pin 5</td><td>APPS2</td></tr></table>
Is the Resistance below 5 Ohm?
</td></tr>
<tr><td>DK15</td><td>CHECK THE APPS2 CIRCUIT FOR SHORT TO GROUND IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DK16.
REPAIR short circuit to GND.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)12V vehicle battery</th></tr><tr><td>APPS2</td><td>Negative post</td></tr></table>
Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>DK16</td><td>CHECK THE APPS2 CIRCUIT FOR SHORT TO SIGRTN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DK17.
REPAIR short circuit to GND.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
APPS connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)APPS Connector, Harness Side</th><th>(-)APPS Connector, Harness Side</th></tr><tr><td>APPS2 - Pin 5</td><td>ETCRTN1 - Pin 3</td></tr></table>
Is the Resistance above 10 KOhm?
</td></tr>
</table>

Accelerator Pedal Position Sensor — DK

Test Steps		Results →	Action to Take
DK17	CHECK THE APPS2 CIRCUIT FOR SHORT TO VREF IN HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Key ON Engine OFF. • Measure the Resistance between:	Yes →	KEY OFF. GO to **DK18**.
		No →	KEY OFF. REPAIR short circuit to PWR.

(+)APPS Connector, Harness Side	(-)APPS Connector, Harness Side
APPS2 - Pin 5	ETCREF1 - Pin 7

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DK18	CHECK THE APPS2 CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Key ON Engine OFF. • Measure the Resistance between:	Yes →	KEY OFF. GO to **DK25**.
		No →	KEY OFF. REPAIR short circuit to PWR.

(+)PCM Connector, Harness Side	(-)12V vehicle battery
APPS2	Positive post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DK19	CHECK THE APPS3 CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Measure the Resistance between:	Yes →	GO to **DK20**.
		No →	REPAIR open circuit.

(+)APPS Connector, Harness Side	(-)PCM Connector, Harness Side
APPS3 - Pin 8	APPS3

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
DK20	CHECK THE APPS3 CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Measure the Resistance between:	Yes →	KEY OFF. GO to **DK21**.
		No →	REPAIR short circuit to GND.

(+)PCM Connector, Harness Side	(-)12V vehicle battery
APPS3	Negative post

• **Is the Resistance above 10 KOhm?**

Accelerator Pedal Position Sensor — DK

Test Steps		Results →	Action to Take
DK21	CHECK THE APPS3 CIRCUIT FOR SHORT TO SIGRTN IN HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Measure the Resistance between: **(+)APPS Connector, Harness Side** / **(-)APPS Connector, Harness Side** APPS3 - Pin 8 / ETCRTN1 - Pin 3 • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DK22**. REPAIR short circuit to GND.
DK22	CHECK THE APPS3 CIRCUIT FOR SHORT TO VREF IN HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Key ON Engine OFF. • Measure the Resistance between: **(+)APPS Connector, Harness Side** / **(-)APPS Connector, Harness Side** APPS3 - Pin 8 / ETCREF1 - Pin 7 • **Is the Resistance above 10 KOhm?**	Yes → No →	KEY OFF. GO to **DK23**. KEY OFF. REPAIR short circuit to PWR.
DK23	CHECK THE APPS3 CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Key ON Engine OFF. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)12V vehicle battery** APPS3 / Positive post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DK26**. KEY OFF. REPAIR short circuit to PWR.
DK24	CHECK THE APPS1 CIRCUIT FOR SHORT TOGETHER		
	• PCM connector disconnected. • APPS connector disconnected. • Measure the Resistance between: **(+)APPS Connector, Harness Side** / **(-)APPS Connector, Harness Side** APPS1 - Pin 2 / APPS2 - Pin 5 APPS1 - Pin 2 / APPS3 - Pin 8 APPS1 - Pin 2 / ETCREF2 - Pin 6 APPS1 - Pin 2 / ETCREF1 - Pin 7 APPS1 - Pin 2 / ETCRTN2 - Pin 1 • **Are the resistances above 10 KOhm?**	Yes → No →	GO to **DK25**. REPAIR short circuit.

Accelerator Pedal Position Sensor | DK

Test Steps		Results →	Action to Take
DK25	CHECK FOR APPS2 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DK26**. REPAIR short circuit.

(+)APPS Connector, Harness Side	**(-)APPS Connector, Harness Side**
APPS2 - Pin 5	APPS1 - Pin 2
APPS2 - Pin 5	APPS3 - Pin 8
APPS2 - Pin 5	ETCREF1 - Pin 7
APPS2 - Pin 5	ETCREF2 - Pin 6
APPS2 - Pin 5	ETCRTN1 - Pin 3
APPS2 - Pin 5	ETCRTN2 - Pin 1

- **Are the resistances above 10 KOhm?**

Test Steps		Results →	Action to Take
DK26	CHECK FOR APPS3 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS		
	• PCM connector disconnected. • APPS connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DK27**. REPAIR short circuit.

(+)APPS Connector, Harness Side	**(-)APPS Connector, Harness Side**
APPS3 - Pin 8	APPS1 - Pin 2
APPS3 - Pin 8	APPS2 - Pin 5
APPS3 - Pin 8	ETCREF1 - Pin 7
APPS3 - Pin 8	ETCREF2 - Pin 6
APPS3 - Pin 8	ETCRTN1 - Pin 3
APPS3 - Pin 8	ETCRTN2 - Pin 1

- Is each resistance greater than 10,000 ohms?
- **Are the resistances above 10 KOhm?**

Accelerator Pedal Position Sensor	DK

Test Steps		Results →	Action to Take
DK27	CHECK THE APPS CIRCUIT FOR INTERMITTENT CONCERN		
	• APPS connector disconnected. • PCM connector disconnected. • Key OFF. • Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • Measure the Resistance between:	Yes →	KEY OFF. INSTALL a new PCM. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
		No →	KEY OFF. ISOLATE fault and REPAIR as necessary.

(+)APPS Connector, Harness Side	(-)PCM Connector, Harness Side
APPS1 - Pin 2	APPS1
APPS2 - Pin 5	APPS2
APPS3 - Pin 8	APPS3

• **Are the resistances below 5 Ohm?**

Cylinder Head Temperature (CHT) Sensor	DL

Note

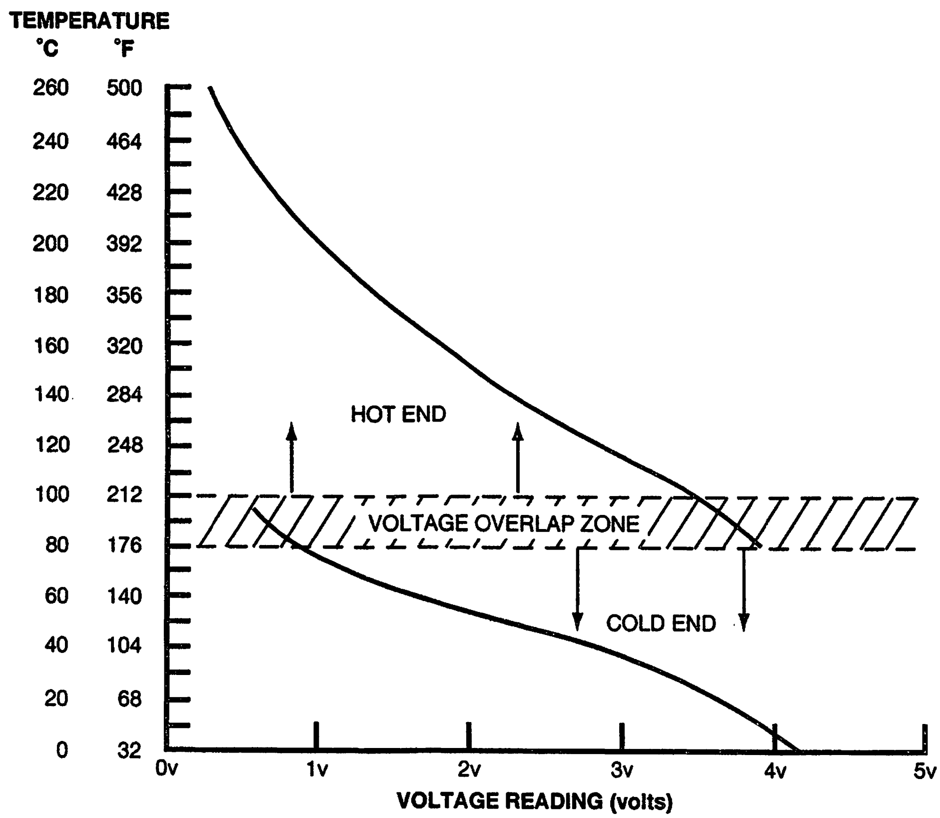
This Pinpoint Test is intended to diagnose the following:

- Cylinder Head Temperature (CHT) Sensor (6G004).
- Engine coolant temperature (ECT) sensor (12A648) Marauder Only.
- Harness Circuits: CHT, VREF & SIGRTN.
- Powertrain control module (PCM) (12A650).

On applications that do not use a ECT sensor, the CHT sensor is used to determine the engine coolant temperature in place of the ECT sensor. To cover the entire temperature range of both the CHT and ECT sensors, the PCM has a dual switching resistor circuit on the CHT input. A graph showing the temperature switching from the COLD END line to the HOT END line with increasing temperature and back with decreasing temperature is included. Note the temperature to voltage overlap zone. Within this zone it is possible to have either a COLD END or HOT END voltage at the same temperature. For example, at 90 °C (194 °F) the voltage could read either 0.60 volts or 3.71 volts. REFER to the table for the temperature to voltage expected values.

Cylinder Head Temperature (CHT) Sensor

DL



AA0885-B

Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.

CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

Temperature		CHT Sensor Values		
°C	°F	COLD END (volts)	HOT END (volts)	Resistance (K ohms)
-40	-40	4.89	-	965.808
-30	-22	4.81	-	513.019
-20	-4	4.67	-	283.664
-10	14	4.45	-	162.584
0	32	4.14	-	96.255
10	50	3.73	-	59.175
20	68	3.26	-	37.387
30	86	2.74	-	24.215
40	104	2.23	-	16.043
50	122	1.76	-	10.85

(Continued)

Cylinder Head Temperature (CHT) Sensor

DL

CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

Temperature		CHT Sensor Values		
°C	°F	COLD END (volts)	HOT END (volts)	Resistance (K ohms)
60	140	1.36	-	7.487
70	158	1.04	-	5.268
80	176	0.79	3.99	3.775
85	185	0.69	3.86	3.215
90	194	0.60	3.71	2.75
95	203	0.53	3.56	2.361
100	212	0.46	3.41	2.034
110	230	-	3.07	1.523
120	248	-	2.74	1.155
130	266	-	2.41	0.8866
140	284	-	2.10	0.6891
150	302	-	1.81	0.5417
160	320	-	1.55	0.4301
170	338	-	1.33	0.3449
180	356	-	1.13	0.2791
190	374	-	0.96	0.2278
200	392	-	0.82	0.1875
210	410	-	0.70	0.155
220	428	-	0.60	0.130
230	446	-	0.51	0.109
240	464	-	0.44	0.092
250	482		0.35	0.078
260	500		0.33	0.067

Marauder Only

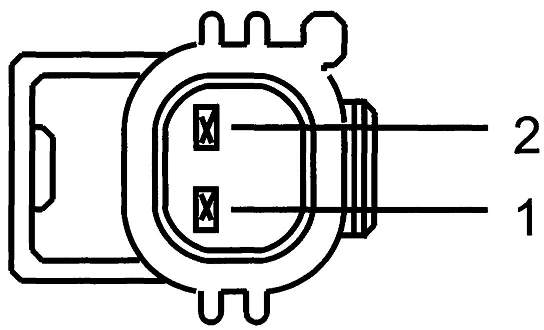
Note

IMPORTANT Marauder Only - An ECT (Engine Coolant Temperature) sensor is used in place of the CHT sensor. However, internal PCM logic for DTCs and PIDs still references the ECT sensor as a CHT sensor. The ECT is located in the water crossover near the passenger side cylinder head. During this pinpoint reference the ECT sensor when asked to disconnect, measure or service the CHT sensor or circuit.

Cylinder Head Temperature (CHT) Sensor	DL

Cylinder Head Temperature (CHT) Sensor Connector

A



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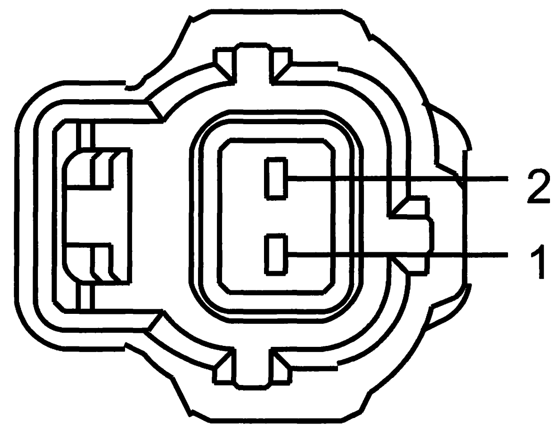
B



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Vehicle	Connector	Circuit	Pin
LS, Thunderbird, Focus 4V	A	SIGRTN CHT	2 1
All other vehicles	B	SIGRTN CHT	2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	VREF SIGRTN CHT	E20 E17 E40
Escape, Focus 2.0L	104 Pin	VREF SIGRTN CHT	90 91 38

(Continued)

Cylinder Head Temperature (CHT) Sensor

DL

Vehicle	Connector	Circuit	Pin
Expedition, Navigator	122 Pin	VREF SIGRTN CHT	E36 E25 E45
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	VREF SIGRTN CHT	E40 E41 E33
F-150	190 Pin	VREF SIGRTN CHT	E57 E58 E41
LS, Thunderbird	150 (60-32-58) Pin	VREF SIGRTN CHT	E14 E17 E40
All other vehicles	104 Pin	VREF SIGRTN CHT	90 91 66

Test Steps		Results →	Action to Take
DL1	SELF-TEST DTCS P1288 OR P1116: CHECK COOLING SYSTEM		
	• DTC indicates that the temperature sensor is out of Self-Test range. Engine is not at normal operating temperature. • Possible causes: — Cold engine. — Low engine coolant. — Engine overheat. — Damaged harness. — CHT sensor. — Faulty or damaged PCM. • Check the vehicle coolant level. **WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.** • **Is cooling system OK?**	Yes → No →	GO to **DL2**. REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Repair as necessary.
DL2	CHECK IF VEHICLE ENGINE STARTS		
	• Attempt to start the engine. • **Does engine start and run normally?**	Yes → No →	GO to **DL5**. GO to **DL3**.

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps		Results →	Action to Take
DL3	CHECK RESISTANCE OF CHT SENSOR WITH ENGINE OFF		
	Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • Key OFF. • CHT Sensor connector disconnected. • Measure the Resistance between: (+)CHT Sensor Connector, Component Side: CHT; (-)CHT Sensor Connector, Component Side: SIGRTN Note: REFER to the chart at the beginning of this test for resistance specifications. • **Is resistance within specification?**	Yes → No →	GO to **DL4**. INSTALL a new CHT sensor.
DL4	CHECK CIRCUIT FROM MODULE TO COMPONENT		
	• CHT Sensor connector connected. • Key ON Engine OFF. • Access the PCM-CHT V PID using a scan tool. • Using the data collected from the previous step. Compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM. Note: REFER to the chart at the beginning of this test for resistance specifications. • **Does the measured value at the sensor agree with measured PID value at the PCM?**	Yes → No →	No Start or Stalls Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. CHECK Harness GO to **DL12**.
DL5	CHECK CHT SENSOR OPERATION		
	• Run engine until engine temperature stabilizes. • Verify the upper radiator hose is hot and the cooling system is pressurized. • Rerun KOER Self-Test. • CHECK Self-Test DTCs: • **Are DTCs P1288 or P1116 present?**	Yes → No →	GO to **DL6**. Engine temperature was not stabilized. REPAIR any other DTCs as necessary.

Measurement table for DL3:

(+)CHT Sensor Connector, Component Side	(-)CHT Sensor Connector, Component Side
CHT	SIGRTN

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps		Results →	Action to Take
DL6	CHECK RESISTANCE OF CHT SENSOR WITH ENGINE RUNNING		
	CAUTION: While conducting checks with a running engine ensure adequate safety precautions are observed to prevent contact with moving engine parts. For example; ensure ties or loose clothing do not come into contact with the cooling fan or drive belts. • Vehicle must be at normal operating temperature. Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • CHT Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). INSTALL a new CHT sensor.

(+)CHT Sensor Connector, Component Side	(-)CHT Sensor Connector, Component Side
CHT	SIGRTN

Note: REFER to the chart at the beginning of this test for resistance specifications.
- **Is resistance within specification?**

Test Steps		Results →	Action to Take
DL7	DTCS P0117, P0118, P1289 OR P1290: ACCESS CHT PID AND CHECK VOLTAGE		
	Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • Key ON Engine OFF. • Access the PCM-CHT V PID using a scan tool. • **Is the Voltage below 0.2 V?**	Yes → No →	KEY OFF. GO to **DL8**. KEY OFF. GO to **DL9**.
DL8	CHECK FOR GROUNDED CIRCUIT		
	• CHT Sensor connector disconnected. • Key ON Engine OFF. • Access the PCM-CHT V PID using a scan tool. • **Is the Voltage above 4.6 V?**	Yes → No →	INSTALL a new CHT sensor. GO to **DL14**.

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps	Results →	Action to Take
DL9 CHECK FOR VREF SHORT		
• CHT Sensor connector disconnected. • Key ON Engine OFF. • Access the PCM-CHT V PID using a scan tool. • Add jumper wire between the points described below:	Yes →	REMOVE jumper. GO to **DL13**.
	No →	REMOVE jumper. GO to **DL10**.

Point A CHT Sensor Connector, Harness Side	Point B CHT Sensor Connector, Harness Side
CHT	SIGRTN

• **Does a scan tool communication concern exist?**

Test Steps	Results →	Action to Take
DL10 CHECK CHT CIRCUIT FOR SHORT TO POWER		
Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • CHT Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. REPAIR short circuit to PWR. CHECK Sensor for damage GO to **DL11**.
	No →	KEY OFF. GO to **DL11**.

(+)CHT Sensor Connector, Harness Side	(-)
CHT	Ground

• **Is the Voltage above 5.5 V?**

Test Steps	Results →	Action to Take
DL11 CHECK RESISTANCE OF CHT SENSOR WITH ENGINE OFF		
Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • CHT Sensor connector disconnected. • Measure the Resistance between:	Yes →	GO to **DL12**.
	No →	INSTALL a new CHT sensor.

(+)CHT Sensor Connector, Component Side	(-)CHT Sensor Connector, Component Side
CHT	SIGRTN

Note: REFER to the chart at the beginning of this test for resistance specifications.

• **Is resistance within specification?**

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps	Results →	Action to Take
DL12 CHECK SIGNAL AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
• PCM connector disconnected. • Measure the Resistance between: **(+)CHT Sensor Connector, Harness Side** / **(-)PCM Connector, Harness Side**: CHT / CHT; SIGRTN / SIGRTN • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **DL13**. REPAIR open circuit.
DL13 CHECK SENSOR SIGNAL FOR SHORT TO VREF		
• Key OFF. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side**: CHT / VREF • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit to VREF.
DL14 CHECK SENSOR SIGNAL FOR SHORT TO GROUND		
• Key OFF. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side**: CHT / SIGRTN • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)12V vehicle battery**: CHT / Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.

Sub-tables within test steps:

(+)CHT Sensor Connector, Harness Side	(-)PCM Connector, Harness Side
CHT	CHT
SIGRTN	SIGRTN

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
CHT	VREF

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
CHT	SIGRTN

(+)PCM Connector, Harness Side	(-)12V vehicle battery
CHT	Negative post

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps		Results →	Action to Take
DL15	DTCS P0117, P0118, P0119, P1117, P1289 OR P1290: INTERMITTENT CHECK		
	Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • Key ON Engine OFF. • Access the PCM-CHT V PID using a scan tool. • While observing the PID, complete the following: — Tap on sensor to simulate road shock. — Wiggle the sensor connector. • **Is there a large change in the voltage reading?**	Yes →	DISCONNECT and INSPECT connector. If OK, REPLACE Component.
		No →	GO to **DL16**.
DL16	CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS		
	• Access the PCM-CHT V PID using a scan tool. • While observing the PID, complete the following: — Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • **Is there a large change in the voltage reading?**	Yes →	ISOLATE fault Repair as necessary.
		No →	GO to **DL17**.
DL17	CHECK PCM AND VEHICLE HARNESS CONNECTORS		
	• PCM connector disconnected. • CHT Sensor connector disconnected. • **Are connectors and terminals OK?**	Yes →	Fault is not present at this time Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	Repair as necessary.

Cylinder Head Temperature (CHT) Sensor

DL

	Test Steps	Results →	Action to Take
DL18	SELF-TEST DTC P1285: EARLY WARNING OF ENGINE OVERHEAT CONDITION		
	Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • An engine overheat condition was sensed by the CHT sensor. • CHECK cooling system for: — Correct coolant level. — Internal or external coolant leaks. — Blockage of radiator. — Cooling fan operation. **WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.** Note: If electric cooling fan does not operate, return to Section 3 for electric cooling fan DTC or symptom diagnosis. • **Is cooling system OK?**	Yes → No →	Check: CHT sensor GO to **DL19**. REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Repair as necessary.
DL19	CHECK OPERATION OF CYLINDER HEAD TEMPERATURE SENSOR		
	• Run engine until engine temperature stabilizes. • Verify the upper radiator hose is hot and the cooling system is pressurized. • Rerun KOER Self-Test. • CHECK Self-Test DTCs: • **Is DTC P1285 present?**	Yes → No →	GO to **DL20**. Engine overheat temperature was not detected. REPAIR any other DTCs as necessary.

Cylinder Head Temperature (CHT) Sensor

DL

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DL20</td><td>CHECK RESISTANCE OF CHT SENSOR WITH ENGINE RUNNING</td><td></td><td></td></tr>
<tr><td></td><td>CAUTION: While conducting checks with a running engine ensure adequate safety precautions are observed to prevent contact with moving engine parts. For example; ensure ties or loose clothing do not come into contact with the cooling fan or drive belts.
• Vehicle must be at normal operating temperature.
• CHT Sensor connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)CHT Sensor Connector, Component Side</th><th>(-)CHT Sensor Connector, Component Side</th></tr><tr><td>CHT</td><td>SIGRTN</td></tr></table>• REFER to the chart at the beginning of this test for resistance specifications.
• Is resistance within specification?</td><td>Yes →

No →</td><td>INSTALL a new PCM.
REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM

INSTALL a new CHT sensor.</td></tr>
<tr><td>DL21</td><td>SELF-TEST DTCS P0217 OR P1299: INDICATES AN ENGINE OVERHEAT CONDITION</td><td></td><td></td></tr>
<tr><td></td><td>Note: REFER to Section 4, Diagnostic Trouble Code (DTC) Description for possible causes and additional DTC description information.
WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.
• CHECK engine coolant level.
• Is the engine coolant fill level correct?</td><td>Yes →

No →</td><td>REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics.
Select Symptom
Engine overheat

REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics.
Select Symptom
Loss of Engine Coolant</td></tr>
</table>

Cylinder Head Temperature (CHT) Sensor	DL

	Test Steps	Results →	Action to Take
DL22	SELF-TEST DTCS P0125 OR P0128: CHECK ENGINE COOLANT LEVEL		
	Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information. • Diagnostic Trouble Code (DTC) indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time. • Possible causes: — Insufficient warm up time. — Leaking or stuck-open thermostat. — Low engine coolant. **WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.** • CHECK engine coolant level. • **Is the engine coolant fill level correct?**	Yes → No →	GO to **DL23**. REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Select Symptom Loss of Engine Coolant
DL23	CHECK SENSOR OPERATION		
	• Run engine until engine temperature stabilizes. • Verify the upper radiator hose is hot and the cooling system is pressurized. • Access the PCM-CHT PID using a scan tool. • **Is the Temperature above 77 C (170.6 F)?**	Yes → No →	Test Complete REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Select Symptom Engine does not reach operating temperature

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps		Results →	Action to Take

DL24 DTC P0116: CHECK RESISTANCE OF CHT SENSOR WITH ENGINE OFF

Note: Verify that engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. REFER to Diagnostic Trouble Code DTC Descriptions, in Section 4 for information concerning P0116.

Note: IMPORTANT Marauder Only - See pinpoint introduction for important ECT\CHT sensor information.

- Key OFF.
- CHT Sensor connector disconnected.
- Measure the Resistance between:

(+)CHT Sensor Connector, Component Side	(-)CHT Sensor Connector, Component Side
CHT	SIGRTN

- REFER to the chart at the beginning of this test for resistance specifications.
- **Is resistance within specification?**

Results	Action to Take
Yes →	Reconnect CHT. GO to **DL25**.
No →	INSTALL a new CHT sensor.

DL25 DTC P0116: CHECK RESISTANCE OF CHT SENSOR WITH ENGINE RUNNING

CAUTION: While conducting checks with a running engine ensure adequate safety precautions are observed to prevent contact with moving engine parts. For example; ensure ties or loose clothing do not come into contact with the cooling fan or drive belts.

- Run engine until engine temperature stabilizes.

  Note: Verify that engine is at operating temperature before taking CHT reading.
- CHT Sensor connector disconnected.
- Measure the Resistance between:

(+)CHT Sensor Connector, Component Side	(-)CHT Sensor Connector, Component Side
CHT	SIGRTN

- REFER to the chart at the beginning of this test for resistance specifications.
- **Is resistance within specification?**

Results	Action to Take
Yes →	Fault is not present at this time COMPLETE OBD Drive Cycle to determine if Fuel, HO2S, Catalyst and Misfire monitors can be executed. REFER to Section 2, Drive Cycles Retest if necessary.
No →	INSTALL a new CHT sensor.

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps		Results →	Action to Take
DL26	DTC P0298: ENGINE OIL OVERTEMPERATURE CONDITION		
	• Engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating. REFER to Section 4, Diagnostic Trouble Code (DTC) Description for possible causes and additional DTC description information. — CHECK for overheating condition and base engine concerns. • **Is there any overheating or base engine concerns?**	Yes → No →	ISOLATE fault. REPAIR as necessary. GO to **DL27**.
DL27	CHECK FOR CHT DTCS		
	• CHECK Self-Test DTCs: • **Are DTCs P1285, P1288, P1289 or P1299 present?**	Yes → No →	RETURN to Diagnostic Subroutines, Section 4, for direction in addressing the other DTCs. GO to **DL28**.
DL28	ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVERTEMPERATURE		
	• Access Freeze Frame Data (if available) and record DTC malfunction conditions. • Access the PCM-CHT V PID using a scan tool. • Test drive the vehicle and allow engine to reach normal operating temperature. • Observe CHT PID. • **Does the engine overheat?**	Yes → No →	REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. REPAIR as necessary. Unable to duplicate or identify fault at this time.
DL29	SELF-TEST DTC P0118: SIMULATE OPPOSITE SIGNAL TO PCM		
	• CHT Sensor connector disconnected. • Key ON Engine OFF. • Access the PCM-CHT V PID using a scan tool. • Add jumper wire between the points described below: (see table below) • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. REMOVE jumper wire(s) GO to **DL32**. GO to **DL30**.

Point A CHT Sensor Connector, Harness Side	Point B CHT Sensor Connector, Harness Side
CHT	SIGRTN

Cylinder Head Temperature (CHT) Sensor

DL

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DL30</td><td>CHECK FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
• Jumper installed.
• Access the PCM-CHT V PID using a scan tool.
• Is the Voltage below 0.2 V?
</td><td>Yes →

No →</td><td>INSTALL a new CHT sensor.
REMOVE jumper wire(s)
KEY OFF.
REMOVE jumper wire(s)
GO to DL31.</td></tr>
<tr><td>DL31</td><td>CHECK SIGNAL AND SIGRTN CIRCUITS FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
• PCM connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)CHT Sensor Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>CHT</td><td>CHT</td></tr>
<tr><td>SIGRTN</td><td>SIGRTN</td></tr>
</table>
• Are the resistances below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to DL32.
REPAIR open circuit.</td></tr>
<tr><td>DL32</td><td>CHECK SENSOR SIGNAL FOR SHORT TO VREF</td><td></td><td></td></tr>
<tr><td colspan="2">
• Key OFF.
• PCM connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>CHT</td><td>VREF</td></tr>
</table>
• Is the Resistance above 10 KOhm?
</td><td>Yes →

No →</td><td>INSTALL a new PCM.
REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM
REPAIR short circuit to VREF.</td></tr>
<tr><td>DL33</td><td>SELF-TEST DTC P0117: CHECK FOR GROUNDED CIRCUIT</td><td></td><td></td></tr>
<tr><td colspan="2">
• CHT Sensor connector disconnected.
• Key ON Engine OFF.
• Access the PCM-CHT V PID using a scan tool.
• Is the Voltage above 4.6 V?
</td><td>Yes →
No →</td><td>INSTALL a new CHT sensor.
GO to DL34.</td></tr>
</table>

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps		Results →	Action to Take
DL34	CHECK SENSOR SIGNAL FOR SHORT TO GROUND		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side**: CHT / SIGRTN • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)12V vehicle battery**: CHT / Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR short circuit.
DL35	ENGINE TEMPERATURE WARNING INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, BUT ENGINE IS NOT OVERHEATING		
	Note: PCM Self Test must be performed prior to entering this Pinpoint Test. • **Was PCM Self Test performed prior to entering this Pinpoint Test?**	Yes → No →	No DTCs present GO to **DL36**. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Resistance measurement tables for DL34:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
CHT	SIGRTN

(+)PCM Connector, Harness Side	(-)12V vehicle battery
CHT	Negative post

Cylinder Head Temperature (CHT) Sensor

DL

Test Steps		Results →	Action to Take
DL36	ENGINE TEMPERATURE INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT, WITH NO DTCS		
	Note: The Engine Temperature Warning Indicator (gauge or lamp) is a warning system that gives the driver information during an engine overheating condition. The PCM monitors the CHT sensor and determines if fail-safe cooling mode is needed. If fail-safe cooling mode is needed, the PCM can signal the drive in two ways: • Temperature Warning Indicator information received through the vehicle Communication Link (SCP or CAN): The PCM sends a SCP or CAN message to the instrument cluster to signal an overheating condition. This causes the instrument cluster indicator to illuminate and/or forces the temperature gauge to H (hot) zone. A P1285 will also be stored in the PCM. • Temperature Warning Indicator hard wired to PCM: The PCM ground the engine temperature warning circuit when the engine is overheating. This causes the instrument cluster indicator to illuminate and/or forces the temperature gauge to H (hot) zone. A P1285 will also be stored in the PCM. • This pinpoint test ONLY diagnoses the PCM hardwire systems with no PCM DTCs. Currently only the Crown Victoria, Grand Marquis, Marauder and 2.3L Ranger use the hardwire system. • For any other type of Engine Temperature Warning Indicator system problems, refer to Workshop manual. • Possible causes: — Damaged engine coolant temperature sensor. — Instrument cluster concern. — Wiring harness fault between PCM and Instrument cluster. — Damaged PCM. • PCM connector disconnected. • Key ON Engine OFF. • **Does the engine temperature warning indicator lamp turn OFF (prove out) and\or the temperature gauge return to the normal zone with the PCM disconnected?**	Yes → No →	KEY OFF. INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM PCM has not attempted to set the Warning Indicators. REFER to Workshop Manual, Section 413.

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor	DM

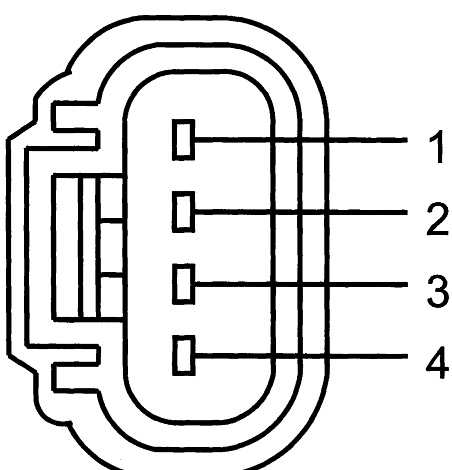
Note

This Pinpoint Test is intended to diagnose the following:

- Thermal Manifold Absolute Pressure (TMAP) Sensor.
- Harness Circuits: MAP, SIGRTN, VREF.

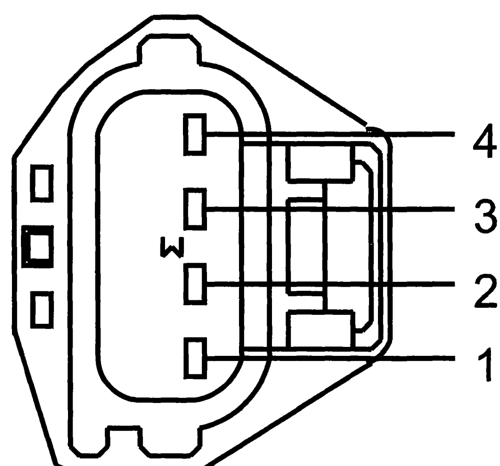
Manifold Absolute Pressure/Thermal Manifold Absolute Pressure (MAP/TMAP) Sensor Connector

A



A0077580

B



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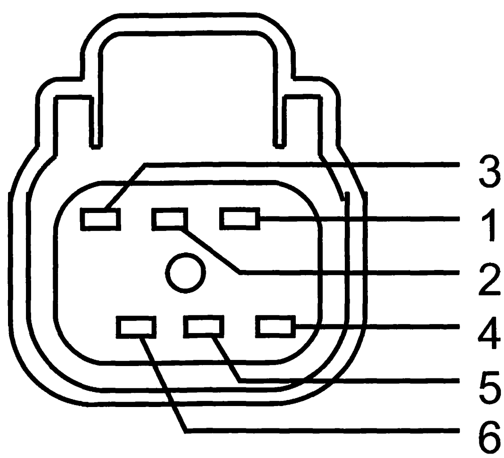
Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

Vehicle	Connector	Circuit	Pin
Mustang	A	MAP SIGRTN VREF	1 4 2
All other vehicles	B	MAP SIGRTN VREF	4 1 3

EGR System Module (ESM) Connector



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Circuit	Pin
VPWR (Power supply)	4
MAP (Manifold absolute pressure sensor)	3
SIGRTN (Signal return)	6
VREF (Reference Voltage)	2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	SIGRTN MAP	E17 E59
Explorer, Focus, Mountaineer	150 (50-50-50) Pin	SIGRTN MAP	E41 E23
LS, Thunderbird	150 (60-32-58) Pin	SIGRTN MAP	E17 E23
Ranger	104 Pin	SIGRTN MAP	91 63
All other vehicles	104 Pin	SIGRTN MAP	91 10

Test Steps		Results →	Action to Take
DM1	DETERMINE COMPONENT TYPE		
	• **Is the vehicle equipped with ESM (EGR System Module) type EGR?**	Yes → No →	GO to **DM2**. GO to **DM17**.
DM2	MONITOR MAP_V PID		
	• Key ON Engine RUN. • Perform KOER Self-Test. • Access the PCM-MAP_V PID using a scan tool. • **Is the Voltage between 0.05 V - 4.95 V?**	Yes →	Verify PCM is at the latest at the latest calibration level. REPROGRAM if necessary. Otherwise, fault is not present at this time.
		No →	KEY OFF. GO to **DM3**.
DM3	VERIFY HARNESS AND CONNECTOR INTEGRITY		
	• ESM connector disconnected. • Perform a thorough visual inspection of the connector, pins and wires attaching to the pins. • ESM connector connected. • **Are there any concerns with the wiring or the ESM connection?**	Yes → No →	REPAIR as necessary. GO to **DM4**.
DM4	MONITOR MAP_V PID		
	• Key ON Engine OFF. • Perform KOEO Self-Test. • Access the PCM-MAP_V PID using a scan tool. • **Is the Voltage between 0.05 V - 4.95 V?**	Yes → No →	Fault is not present at this time GO to **DM5**.
DM5	DETERMINE PRESENT MAP_V PID VOLTAGE		
	• Access the PCM-MAP_V PID using a scan tool. • **Is the Voltage below 0.05 V?**	Yes → No →	GO to **DM6**. GO to **DM9**.

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

Test Steps		Results	Action to Take
DM6	KOEO AND KOER DTC P0107: CHECK VOLTAGE BETWEEN VREF AND SIGRTN AT ESM SENSOR		
	• ESM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **DM7**.
		No →	KEY OFF. GO to **C1**.

(+)ESM Connector, Harness Side	(-)ESM Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 6

• **Is the Voltage between 4 V - 5.5 V?**

Test Steps		Results	Action to Take
DM7	CHECK MAP CIRCUIT FOR SHORT TO SIGRTN AND GND IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **DM8**.
		No →	REPAIR short circuit.

(+)ESM Connector, Harness Side	(-)
MAP - Pin 3	Ground

• Measure the Resistance between:

(+)ESM Connector, Harness Side	(-)ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

• **Is the Resistance above 10 KOhm?**

Test Steps		Results	Action to Take
DM8	INDUCE OPPOSITE MAP SENSOR VOLTAGE		
	• PCM connector connected. • Add jumper wire between the points described below:	Yes →	KEY OFF. INSTALL a new ESM. CLEAR the PCM DTCs and REPEAT Self-Test.
		No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
MAP - Pin 3	VREF - Pin 2

• Key ON Engine OFF.
• Access the PCM-MAP_V PID using a scan tool.
• **Is the Voltage above 4.6 V?**

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

Test Steps		Results →	Action to Take
DM9	KOEO AND KOER DTC P0108: CHECK VOLTAGE BETWEEN VREF AND SIGRTN AT ESM SENSOR		
	• ESM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)ESM Connector, Harness Side** / **(-)ESM Connector, Harness Side** VREF - Pin 2 / SIGRTN - Pin 6 • **Is the Voltage between 4 V - 5.5 V?**	Yes → No →	KEY OFF. GO to **DM10**. KEY OFF. GO to **C1**.
DM10	CHECK MAP AND SIGRTN CIRCUIT(S) FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)ESM Connector, Harness Side** MAP / MAP - Pin 3 SIGRTN / SIGRTN - Pin 6 • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **DM11**. REPAIR open circuit.
DM11	CHECK MAP CIRCUIT FOR SHORT TO VREF IN HARNESS		
	• Measure the Resistance between: **(+)ESM Connector, Harness Side** / **(-)ESM Connector, Harness Side** MAP - Pin 3 / VREF - Pin 2 • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DM12**. REPAIR short circuit.
DM12	CHECK MAP CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• Measure the Resistance between: **(+)ESM Connector, Harness Side** / **(-)ESM Connector, Harness Side** MAP - Pin 3 / VPWR - Pin 4 • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DM13**. REPAIR short circuit.

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

Test Steps		Results →	Action to Take
DM13	INDUCE OPPOSITE MAP SENSOR VOLTAGE		
	• PCM connector connected. • Add jumper wire between the points described below: **Point A ESM Connector, Harness Side**: MAP - Pin 3; **Point B ESM Connector, Harness Side**: SIGRTN - Pin 6 • Key ON Engine OFF. • Access the PCM-MAP_V PID using a scan tool. • **Is the Voltage below 0.23 V?**	Yes →	KEY OFF. INSTALL a new ESM. CLEAR the PCM DTCs and REPEAT Self-Test.
		No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
DM14	DTCS P0107, P0108 AND P0109: CHECK MAP CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Key ON Engine OFF. • Access the PCM-MAP_V PID using a scan tool. • Perform a thorough wiggle test on the ESM harness. Lightly tap on the ESM (to simulate road shock). • **Did a sudden change in voltage occur while monitoring the PID?**	Yes →	ISOLATE fault. REPAIR as necessary.
		No →	KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Jumper wire points for DM13:

Point A ESM Connector, Harness Side	Point B ESM Connector, Harness Side
MAP - Pin 3	SIGRTN - Pin 6

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DM15</td><td>DTC P0106: MAP RANGE/PERFORMANCE</td><td></td><td></td></tr>
<tr><td></td><td>
Note: If MAP DTC(s) P0107, P0108 or P0109 are present, diagnose those DTC(s) first.
If any Mass Air Flow (MAF) sensor related DTCs are present, diagnose those DTCs prior to diagnosing MAP DTC P0106.
Disregard any DTC(s) generated as a result of this test.
• Key OFF.
• ESM connector disconnected.
• Add jumper wire between the points described below:
<table>
<tr><th>Point A ESM Connector, Harness Side</th><th>Point B ESM Connector, Component Side</th></tr>
<tr><td>VREF - Pin 2</td><td>VREF - Pin 2</td></tr>
<tr><td>SIGRTN - Pin 6</td><td>SIGRTN - Pin 6</td></tr>
</table>
• Key ON Engine RUN.
• Measure the Voltage between:
<table>
<tr><th>(+)ESM Connector, Component Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>MAP - Pin 3</td><td>Negative post</td></tr>
</table>
• Is the Voltage between 1 V - 2 V?
</td><td>Yes →

No →</td><td>Note actual MAP voltage values at KOEO, idle, 1000 and 2000 RPM. You will use the values for comparison in the following test step.
GO to DM16.

KEY OFF.
CHECK MAP circuit in ESM harness for open and short circuits</td></tr>
<tr><td>DM16</td><td>COMPARE ACTUAL MAP VOLTAGE TO MAP_V PID VOLTAGE</td><td></td><td></td></tr>
<tr><td></td><td>
• Key ON Engine OFF.
• Access the PCM-MAP_V PID using a scan tool.
• Note MAP_V PID voltage.
• Key ON Engine RUN.
• Note MAP_V PID voltage.
• Increase engine speed to 1000 RPM.
Note MAP_V PID voltage.
• Increase engine speed to 2000 RPM.
Note MAP_V PID voltage.
• Does the MAP_V PID voltage stay within .5V of the actual MAP voltage?
</td><td>Yes →

No →</td><td>Fault is not present at this time
CLEAR the DTCs and REPEAT Self-Test.

INSTALL a new ESM.
CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
</table>

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

Test Steps		Results →	Action to Take
DM17	KOEO AND KOER DTCS P0107 AND P0108: CHECK VOLTAGE BETWEEN VREF AND SIGRTN AT MAP/TMAP SENSOR		
	• MAP/TMAP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)MAP/TMAP Sensor Connector, Harness Side**: VREF — **(-)MAP/TMAP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 5.5 V?**	Yes → No →	KEY OFF. GO to **DM18**. KEY OFF. GO to **C1**.
DM18	CHECK MAP/TMAP SENSOR OPERATION		
	• Add jumper wire between the points described below: **Point A MAP/TMAP Sensor Connector, Component Side** / **Point B MAP/TMAP Sensor Connector, Harness Side**: VREF / VREF; SIGRTN / SIGRTN • Key ON Engine RUN. • Measure the Voltage between: **(+)MAP/TMAP Sensor Connector, Harness Side**: MAP — **(-)Vehicle battery**: Negative post • Briefly increase engine RPM to 3000 then return to idle. Monitor TMAP voltage. • **Did the voltage reading rapidly increase to greater than 2.0V then rapidly decrease to less than 1.0V?**	Yes → No →	KEY OFF. GO to **DM19**. KEY OFF. INSTALL a new MAP/TMAP sensor. CLEAR the PCM DTCs and REPEAT Self-Test.
DM19	CHECK MAP/TMAP CIRCUIT FOR SHORT TO VREF AND SIGRTN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)MAP/TMAP Sensor Connector, Harness Side** / **(-)MAP/TMAP Sensor Connector, Harness Side**: MAP / VREF; MAP / SIGRTN • **Are the resistances above 10 KOhm?**	Yes → No →	GO to **DM20**. REPAIR short circuit.

Inner tables:

DM17:

(+)MAP/TMAP Sensor Connector, Harness Side	(-)MAP/TMAP Sensor Connector, Harness Side
VREF	SIGRTN

DM18:

Point A MAP/TMAP Sensor Connector, Component Side	Point B MAP/TMAP Sensor Connector, Harness Side
VREF	VREF
SIGRTN	SIGRTN

(+)MAP/TMAP Sensor Connector, Harness Side	(-)Vehicle battery
MAP	Negative post

DM19:

(+)MAP/TMAP Sensor Connector, Harness Side	(-)MAP/TMAP Sensor Connector, Harness Side
MAP	VREF
MAP	SIGRTN

Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor

DM

Test Steps		Results →	Action to Take
DM20	CHECK MAP/TMAP CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)MAP/TMAP Sensor Connector, Harness Side** MAP / MAP • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.
DM21	DTCS P0107, P0108 AND P0109: CHECK MAP/TMAP CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Key ON Engine OFF. • Access the PCM-MAP_V PID using a scan tool. • Perform a thorough wiggle test on the MAP/TMAP harness. Lightly tap on the MAP/TMAP (to simulate road shock). • **Did a sudden change in voltage occur while monitoring the PID?**	Yes → No →	ISOLATE fault. REPAIR as necessary. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.
DM22	DTC P0106: MAP/TMAP RANGE/PERFORMANCE		
	Note: If MAP DTC(s) P0107, P0108 or P0109 are present, diagnose those DTC(s) first. If any Mass Air Flow (MAF) sensor related DTCs are present, diagnose those DTCs prior to diagnosing MAP DTC P0106. Disregard any DTC(s) generated as a result of this test. • Key OFF. • MAP/TMAP Sensor connector disconnected. • Add jumper wire between the points described below: **Point A MAP/TMAP Sensor Connector, Harness Side** / **Point B MAP/TMAP Sensor Connector, Component Side** VREF / VREF SIGRTN / SIGRTN • Key ON Engine RUN. • Measure the Voltage between: **(+)MAP/TMAP Sensor Connector, Component Side** / **(-)Vehicle battery** MAP / Negative post • **Is the Voltage between 1 V - 2 V?**	Yes → No →	Record actual MAP/TMAP voltage values at idle, 1000 and 2000 RPM. You will use the values for comparison in the following test step. GO to **DM23**. KEY OFF. CHECK MAP/TMAP harness for open and short circuits

# Manifold Absolute Pressure (MAP) and Thermal Manifold Absolute Pressure (TMAP) Sensor	DM

Test Steps		Results →	Action to Take
DM23	COMPARE ACTUAL MAP VOLTAGE TO MAP_V PID VOLTAGE		
	• Key ON Engine OFF. • Access the PCM-MAP_V PID using a scan tool. • Note MAP_V PID voltage. • Key ON Engine RUN. • Note MAP_V PID voltage. • Increase engine speed to 1000 RPM. Note MAP_V PID voltage. • Increase engine speed to 2000 RPM. Note MAP_V PID voltage. • **Does the MAP_V PID voltage stay within .5V of the actual MAP voltage?**	Yes → No →	Fault is not present at this time CLEAR the DTCs and REPEAT Self-Test. INSTALL a new MAP/TMAP sensor. CLEAR the PCM DTCs and REPEAT Self-Test.

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS)	DP

Note

This Pinpoint Test is intended to diagnose the following:

VSS.

TCSS.

PCM.

Harness Circuit(s):

VSS positive.

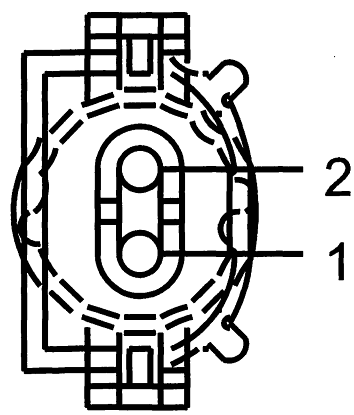
VSS negative.

TCSS.

SIGRTN.

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS)	DP

Transfer case speed sensor (TCSS) Connector



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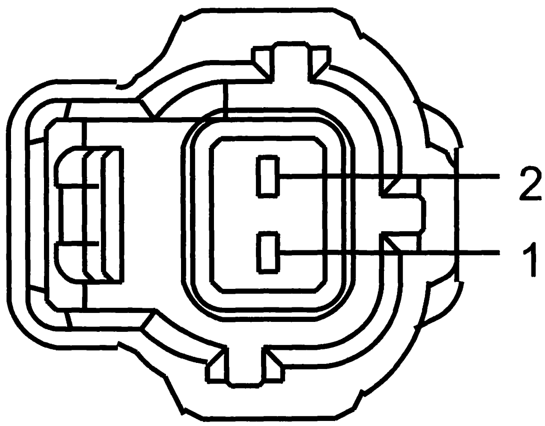
Circuit	Pin
TCSS (Transfer case speed sensor)	2
SIGRTN (Signal return)	1

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS)	DP

Vehicle speed sensor (VSS) Connector



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Circuit	Pin
VSS-GND (Vehicle Speed Signal - Ground)	1
VSS (Vehicle speed sensor)	2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Excursion, F-Series Super Duty	104 Pin	VPWR SIGRTN VSS-GND VSS	71 91 33 58
F-150	190 Pin	TCSS VPWR SIGRTN	T16 B51 T43
F-150 Heritage 4.2L	104 Pin	TCSS VPWR SIGRTN	59 71 91

(Continued)

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS) — DP

Vehicle	Connector	Circuit	Pin
F-150 Heritage 4.6L, F-150 Heritage 5.4L	104 Pin	TCSS VPWR SIGRTN	4 71 91
Focus 2.3L	150 (50-50-50) Pin	VPWR SIGRTN VSS	B35 T41 T3
All other vehicles	104 Pin	VPWR SIGRTN VSS	71 91 58

Test Steps	Results →	Action to Take
DP1 DTCS P0500, P0501 AND P1502: CHECK VSS CIRCUIT(S) FOR OPEN IN HARNESS		
Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • PCM connector disconnected. • VSS connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)VSS Connector, Harness Side**: VSS — VSS - Pin 2; VSS-GND — VSS-GND - Pin 1 • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **DP2**. REPAIR open circuit. COMPLETE an OBD Drive Cycle (REFER to Section 2, Drive Cycles.)
DP2 CHECK VSS CIRCUIT(S) FOR SHORT TO GROUND AND POWER IN HARNESS		
• Measure the Resistance between: **(+)VSS Connector, Harness Side** / **(-)VSS Connector, Harness Side**: VSS-GND - Pin 1 — VSS - Pin 2 • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)VSS Connector, Harness Side**: SIGRTN — VSS - Pin 2; VPWR — VSS - Pin 2 • **Are the resistances above 5 Ohm?**	Yes → No →	GO to **DP3**. GO to **DP4**.

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS)

DP

Test Steps		Results →	Action to Take
DP3	CHECK VSS RESISTANCE		
	• Measure the Resistance between: **(+)VSS Connector, Component Side**: VSS-GND - Pin 1 **(-)VSS Connector, Component Side**: VSS - Pin 2 • **Is the Resistance between 170 Ohm - 270 Ohm?**	Yes →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). COMPLETE an OBD Drive Cycle (REFER to Section 2, Drive Cycles.)
		No →	REPLACE VSS sensor. COMPLETE an OBD Drive Cycle (REFER to Section 2, Drive Cycles.)
DP4	VERIFY IF VSS CIRCUIT IS SHORTED IN HARNESS OR OTHER MODULE(S)		
	• Determine which, if any, modules are connected to the VSS circuit (REFER to Wiring Diagrams Manual). If no other modules are connected to the VSS circuit, Go to the "YES" Action to Take. • One at a time, disconnect the modules associated with the VSS circuit. After disconnecting each module, again test for short circuit (REFER to test step that sent you here). Repeat until each associated module has been disconnected or the short circuit has been eliminated. • **Does the short circuit remain after all associated modules were disconnected?**	Yes →	REPAIR short circuit. COMPLETE an OBD Drive Cycle (REFER to Section 2, Drive Cycles.)
		No →	REFER to the Workshop Manual for further diagnosis of appropriate module.
DP5	KOER DTC P1501: CHECK VSS PID FOR INPUT SIGNAL		
	• Key ON Engine RUN. • Access the PCM-VSS PID using a scan tool. • Observe VSS input to the PCM. • Increase the engine speed, not greater than 2000 RPM, several times while observing the VSS PID. • **Is the reading on the PID less than 5 KM/H (3 MPH)?**	Yes →	Unable to duplicate or identify fault at this time. REFER to Section 4, DTCs description for a list of possible causes. If DTC P1501 still exists GO to **Z1**.
		No →	GO to **DP8**.

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS) — DP

Test Steps		Results →	Action to Take
DP6	DTC P0503: INSPECT VSS AND CIRCUIT FOR AN INTERMITTENT		
	• Visually inspect the VSS and harness circuits for any potential failures. • Use the following check list for reference: Loose wires/connectors. Pushed out connector pins. Damaged wiring harness insulation. Incorrect harness routing. Incorrect VSS mounting. • **Did the visual inspection reveal a potential failure?**	Yes → No →	Repair the fault as necessary. COMPLETE an OBD Drive Cycle (REFER to Section 2, Drive Cycles.) GO to **DP7**.
DP7	CHECK PCM VSS PID FOR INPUT SIGNAL		
	• Access the PCM-VSS PID using a scan tool. • Drive the vehicle at several steady state speeds above and below 50KM/H (30 MPH). • Note: For Scan Tools which have Data Record feature, record data for playback to help identify variations. During each steady state speed observe the VSS PID for variations of (+) or (-) 8 KM/H (5 MPH) for greater than 10 seconds. • **Is there any indicators of a noisy or intermittent signal with the VSS PID?**	Yes → No →	GO to **DP8**. Unable to duplicate or identify fault at this time. REPAIR any other DTCs.
DP8	CHECK VSS HARNESS ROUTING		
	• CHECK VSS harness routing. Verify that the harness is not routed adjacent to high current wires such as ignition wires or generator wiring. Verify VSS harness is shielded and grounded, if applicable. Measure resistance of the VSS harness. REFER to Pinpoint Test Schematic and Connectors at beginning of pinpoint test. • **Are any concerns evident?**	Yes → No →	REPAIR as necessary. COMPLETE an OBD Drive Cycle (REFER to Section 2, Drive Cycles.) Unable to duplicate or identify fault at this time. REFER to Section 4, DTCs description for a list of possible causes. GO to **Z1**.

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS)

DP

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DP9</td><td>DTCS P0500 AND P1502: VISUAL INSPECTION OF TCSS</td><td></td><td></td></tr>
<tr><td colspan="2">Note: The transfer case speed sensor TCSS provides rotational speed of output shaft of the transfer case.
The PCM uses this information to control powertrain behavior and on some application is used as the source of vehicle speed information.
TCSS connector disconnected.
INSPECT TCSS vehicle harness connector for damage and proper seating.
Have any problems been found?</td><td>Yes →
No →</td><td>REPAIR as necessary.
GO to DP10.</td></tr>
<tr><td>DP10</td><td>CHECK RESISTANCE OF TCSS SENSOR</td><td></td><td></td></tr>
<tr><td colspan="2">Measure the Resistance between:
<table><tr><th>(+)TCSS Connector, Component Side</th><th>(-)TCSS Connector, Component Side</th></tr><tr><td>SIGRTN - Pin 1</td><td>TCSS - Pin 2</td></tr></table>
Is the Resistance between 1 KOhm - 1.25 KOhm?</td><td>Yes →
No →</td><td>GO to DP11.
REPLACE TCSS sensor.</td></tr>
<tr><td>DP11</td><td>CHECK TCSS SENSOR OUTPUT</td><td></td><td></td></tr>
<tr><td colspan="2">Raise the vehicle on a wheel free two post lift. Put the vehicle in neutral with the Parking Brake off. Take safety precautions as necessary.
Measure the Frequency between:
<table><tr><th>(+)TCSS Connector, Component Side</th><th>(-)TCSS Connector, Component Side</th></tr><tr><td>SIGRTN - Pin 1</td><td>TCSS - Pin 2</td></tr></table>
Monitor the TCSS signal while rotating the driven wheel as fast as possible.
Note: The opposite wheel must be held stationary.
REFER to Section 6, Reference Values for frequency ranges.
Does frequency reading increase and decrease with wheel speed?</td><td>Yes →
No →</td><td>GO to DP12.
REMOVE the TCSS and inspect target wheel.
REPAIR as necessary.
If OK, REPLACE TCSS sensor.</td></tr>
</table>

Vehicle Speed Sensor (VSS) / Transfer Case Speed Sensor (TCSS) — DP

Test Steps		Results →	Action to Take
DP12	CHECK TCSS CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • TCSS connector disconnected. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **DP13**. KEY OFF. REPAIR short circuit.

(+)TCSS Connector, Harness Side	**(-)**
TCSS - Pin 2	Ground

• **Is the Voltage below 1 V?**

Test Steps		Results →	Action to Take
DP13	CHECK CIRCUIT(S) FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DP14**. REPAIR open circuit.

(+)PCM Connector, Harness Side	**(-)TCSS Connector, Harness Side**
TCSS	TCSS - Pin 2
SIGRTN	SIGRTN - Pin 1

• **Are the resistances below 5 Ohm?**

Test Steps		Results →	Action to Take
DP14	CHECK TCSS CIRCUIT(S) FOR SHORT TO GROUND AND POWER IN HARNESS		
	• Measure the Resistance between:	Yes → No →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.

(+)TCSS Connector, Harness Side	**(-)TCSS Connector, Harness Side**
SIGRTN - Pin 1	TCSS - Pin 2

• Measure the Resistance between:

(+)TCSS Connector, Harness Side	**(-)**
TCSS - Pin 2	Ground

• **Are all resistances greater than 10K ohms?**

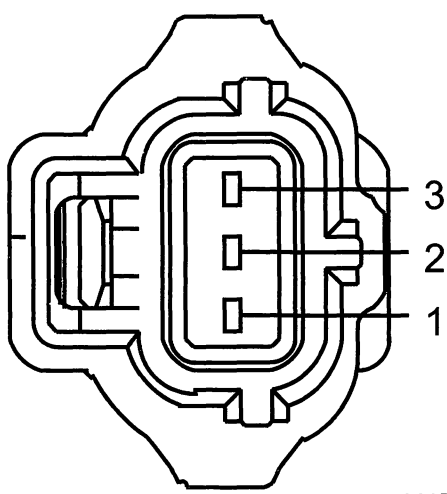
Barometric Pressure (BARO) Sensor — DQ

Note

This Pinpoint Test is intended to diagnose the following:

- BARO sensor (9F479).
- Harness circuits: BARO, SIGRTN and VREF.
- Powertrain control module (PCM) (12A650).

Barometric pressure (BARO) Connector



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Circuit	Pin
BARO (Barometric pressure)	3
SIGRTN (Signal return)	1
VREF (Reference Voltage)	2

Barometric Pressure (BARO) Sensor — DQ

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
F-150 Heritage	104 Pin	VPWR BARO PWRGND SIGRTN VREF	71 63 103 91 90
Focus	104 Pin	VPWR BARO PWRGND SIGRTN VREF	71 9 103 91 90

BAROMETRIC PRESSURE REFERENCE CHART

Barometric Pressure (In-Hg)	Barometric Pressure (kPa)	BARO/MAP PID (Hz)	Altitude Above Sea Level (ft.)
3.5	11.8	89.3	
5	16.9	92.8	
10	33.8	104.6	
15	50.7	117.0	14,000
20	67.5	129.6	10,000
21	70.9	132.5	9,000
22	74.3	135.4	8,000
23	77.7	138.3	7,000
24	81.1	141.1	6,000
25	84.4	144.0	5,000
26	87.8	146.9	4,000
27	91.2	149.8	3,000
28	94.6	152.8	2,000
29	97.9	155.8	1,000
30	127.7	158.9	0 (sea level)
31	104.7	162.0	+500
31.875	107.7	164.7	-500

Barometric Pressure (BARO) Sensor — DQ

Test Steps		Results →	Action to Take
DQ1	DTC P0106, P0107, P0108 AND P0109: CHECK BARO PID		
	Note: . Most weather service reports are a local barometric pressure that has been corrected to sea level. However, the BARO PID reports the actual barometric pressure for the altitude the vehicle is being diagnosed in. Local weather conditions (high or low pressure areas) will change the local barometric pressure by several inches of mercury. • Verify the BARO sensor is connected. If not, repair as necessary. • Key ON Engine OFF. • Access the BARO PID using a scan tool. • CHECK that the BARO PID is approximately the same as the barometric pressure reading for the location, day and altitude the vehicle is being diagnosed at. • Compare PID readings with chart. • BARO PID values in Keep Alive Memory require updating at high throttle openings. If vehicle is driven down from higher altitudes for diagnosing, complete three or four heavy accelerations at greater than half-throttle to allow BARO PID to update. • BARO PID must be within +/- .9 Volt (+/- 2 in. Hg.) of the altitude value in Barometric Pressure Reference Chart (at the beginning of this pinpoint test). • Make BARO PID comparisons to Barometric Pressure Reference Chart or daily airport barometric pressure reports, if available. • **Does PID reading compare with that of chart?**	Yes → No →	Unable to identify fault at this time. GO to **Z1**. GO to **DQ3**.
DQ2	CHECK FOR INITIAL DTCS PRESENT		
	• Review the original DTCs that brought you to the above pinpoint test step. • **Is DTC P0108 present?**	Yes → No →	GO to **DQ8**. GO to **DQ3**.
DQ3	CHECK VREF VOLTAGE TO BARO SENSOR		
	• Disconnect the BARO sensor harness connector. • Measure the Voltage between: (see table below) • **Is the Voltage between 4 V - 6 V?**	Yes → No →	KEY OFF. GO to **DQ6**. KEY OFF. GO to **DQ4**.

(+)BARO Connector, Harness Side	**(-)BARO Connector, Harness Side**
VREF - Pin 2	SIGRTN - Pin 1

Barometric Pressure (BARO) Sensor — DQ

Test Steps	Results →	Action to Take
DQ4 CHECK VREF CIRCUIT FOR OPEN		
• Disconnect PCM. • Measure the Resistance between: **(+)PCM Connector, Harness Side** — **(-)BARO Connector, Harness Side** VREF — VREF - Pin 2 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DQ5**. REPAIR open circuit.
DQ5 CHECK FOR VREF CIRCUIT SHORT TO GROUND		
• Measure the Resistance between: **(+)PCM Connector, Harness Side** — **(-)PCM Connector, Harness Side** VREF — SIGRTN VREF — PWRGND • **Are both resistances greater than 10 KOhm?**	Yes → No →	GO to **DQ6**. REPAIR short circuit.
DQ6 CHECK BARO SIGNAL AND SIGRTN CIRCUIT FOR OPEN		
• PCM disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** — **(-)BARO Connector, Harness Side** BARO — BARO - Pin 3 SIGRTN — SIGRTN - Pin 1 • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **DQ7**. REPAIR open circuit.
DQ7 CHECK BARO CIRCUIT FOR SHORT TO GROUND		
• Measure the Resistance between: **(+)PCM Connector, Harness Side** — **(-)PCM Connector, Harness Side** BARO — SIGRTN BARO — PWRGND • **Are all resistances greater than 10 KOhm?**	Yes → No →	REPLACE BARO. If concern is still present, REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
DQ8 DTC P0108: INDUCE OPPOSITE CODE		
• Disconnect the BARO sensor harness connector. • Key ON Engine OFF. • CHECK for DTCs. • **Is DTC P0107 present?**	Yes → No →	KEY OFF. REPLACE BARO sensor. KEY OFF. GO to **DQ9**.

Barometric Pressure (BARO) Sensor — DQ

Test Steps		Results →	Action to Take
DQ9	CHECK BARO SIGNAL FOR SHORT TO POWER		
	• Disconnect PCM. • Measure the Resistance between:	Yes →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VPWR	BARO

- **Is the Resistance above 10 KOhm?**

Camshaft Position (CMP) Sensor	DR

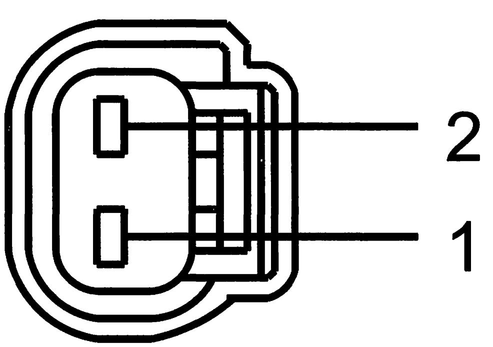
Note

This Pinpoint Test is intended to diagnose the following:

- Camshaft Position (CMP) Sensor.
- CMP and SIGRTN circuits.
- Powertrain Control Module (PCM) (12A650).

Camshaft position (CMP) Sensor Connector

A



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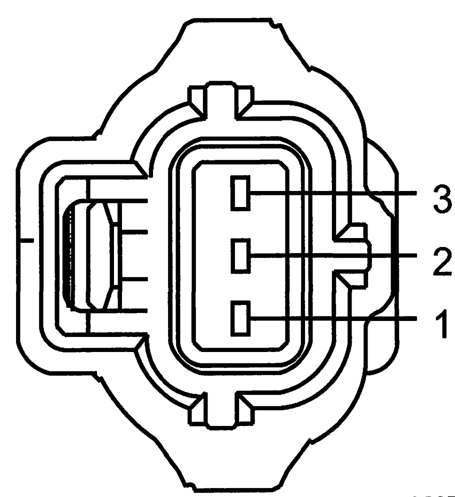

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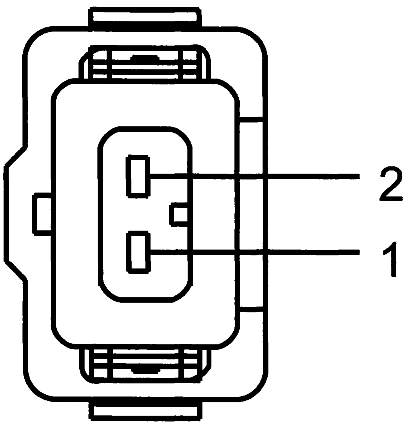
Camshaft Position (CMP) Sensor	DR

C



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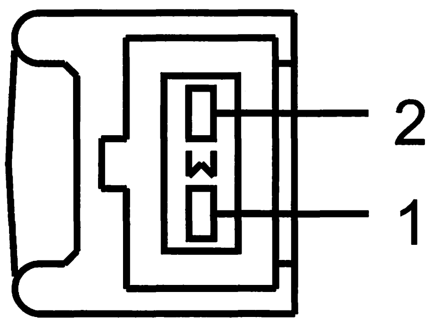

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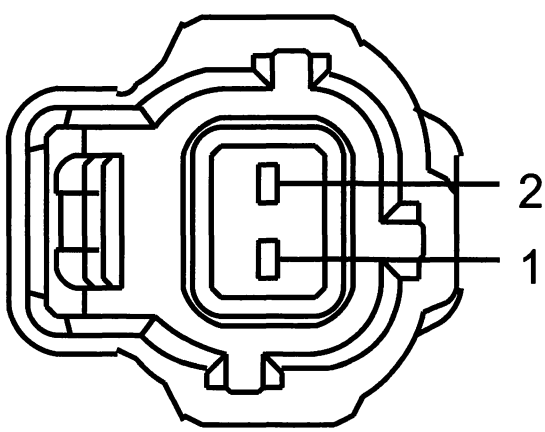
E



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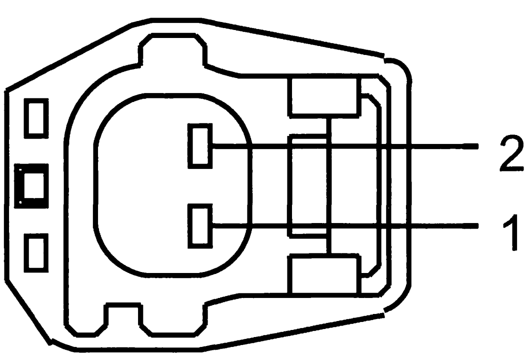
Camshaft Position (CMP) Sensor | DR

Vehicle	Connector	Circuit	Pin
Expedition, LS, Navigator, Thunderbird	A	SIGRTN CMP	1 2
F-150 Heritage 4.2L, E-Series 4.2L	B	PWRGND VPWR CMP	1 3 2
Explorer 4.0L	C	SIGRTN CMP	2 1
Focus 2.0L	D	SIGRTN CMP	2 1
All other vehicles	E	SIGRTN CMP	1 2

Camshaft Position Sensor 2 (CMP2) Connector

A



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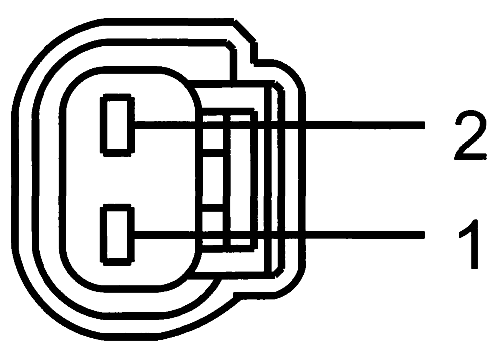
B



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Vehicle	Connector	Circuit	Pin
LS, Thunderbird	A	SIGRTN CMP2	2 1
All other vehicles	B	SIGRTN CMP2	1 2

Camshaft Position (CMP) Sensor — DR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	PWRGND CMP2 SIGRTN CMP	B24 E54 E17 E53
Expedition, Navigator	122 Pin	PWRGND SIGRTN CMP	B1 E25 E31
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	PWRGND SIGRTN CMP	B47 E41 E25
F-150	190 Pin	PWRGND CMP2 SIGRTN CMP	B67 E44 E58 E45
All other vehicles	104 Pin	PWRGND SIGRTN CMP	103 91 85

Test Steps		Results →	Action to Take
DR1	CONTINUOUS MEMORY DTCS P0340 AND P0345: CHECK IF ENGINE WILL START		
	• Attempt to start engine. • **Will the engine start?**	Yes → No →	GO to **DR2**. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
DR2	CHECK CMP SIGNAL SENT TO PCM		
	• Key ON Engine RUN. • Connect scan tool. • Access the PCM-CMPFM and PCM-CMPFM2 PIDs using a scan tool. Note: Not all vehicles may have PCM-CMPFM and PCM-CMPFM2 PIDs. On vehicles without those PIDs, clear DTCs and perform KOER Self-Test. GO to step DR3 and answer the question WITHOUT performing the steps in DR3. • **Is a CMP sensor fault present?**	Yes → No →	GO to **DR3**. GO to **Z1**.

Camshaft Position (CMP) Sensor — DR

Test Steps		Results →	Action to Take
DR3	CONTINUOUS MEMORY DTCS P0340 AND P0345: CLEAR AND ATTEMPT TO RE-GENERATE DTC		
	• Complete PCM Reset to clear DTCs. • Increase engine speed to greater than 1500 RPM for 10 seconds. • Repeat this three times. • CHECK Self-Test DTCs: • **Is DTC P0345 present?**	Yes → No →	KEY OFF. GO to **DR13**. KEY OFF. GO to **DR4**.
DR4	DETERMINE CMP SENSOR PHYSICAL TYPE		
	• **Is the CMP sensor a synchronizer (gear driven) type?**	Yes → No →	GO to **DR5**. GO to **DR6**.
DR5	VERIFY CORRECT INSTALLATION OF CMP SENSOR		
	• A CMP sensor identifies the cylinder 1 power stroke. A sensor that is improperly installed/indexed can identify the wrong cylinder as 1, produce a tip-in hesitation and generate DTC P0340. Note: If the vehicle has a miss with DTC P0340, ignition, alternator noise, RFI and CKP concerns should be considered. • **Is the CMP sensor installed correctly?**	Yes → No →	GO to **DR6**. REPOSITION CMP sensor.
DR6	DETERMINE CMP SENSOR ELECTRONIC TYPE		
	Note: VR (Variable Reluctance) sensors have 2-wire connectors, Hall Effect sensors have 3-wire connectors. • **Is the CMP sensor a VR type?**	Yes → No →	KEY OFF. GO to **DR7**. CMP sensor is Hall Effect type. GO to **DR20**.
DR7	CONTINUOUS MEMORY DTC P0340: CHECK CMP SENSOR RESISTANCE		
	• CMP Sensor connector disconnected. • Measure the Resistance between: (see tables below) • **Is the resistance value(s) within specifications?**	Yes → No →	GO to **DR8**. INSTALL a new CMP sensor. CLEAR the PCM DTCs and REPEAT Self-Test.

(+)CMP Sensor Connector, Component Side	(-)CMP Sensor Connector, Component Side
CMP	SIGRTN

Vehicle	Low Limit	High Limit
LS, Thunderbird 3.9L	1850 Ohms	2850 Ohms
F-150	300 Ohms	425 Ohms
All Others	250 Ohms	1000 Ohms

Camshaft Position (CMP) Sensor — DR

Test Steps		Results	→	Action to Take

DR8 CHECK CMP CIRCUIT FOR SHORT TO POWER IN HARNESS

- PCM connector disconnected.
- Key ON Engine OFF.
- Measure the Voltage between:

(+)CMP Sensor Connector, Harness Side	(-)Vehicle battery
CMP	Negative post

- **Is the Voltage below 1 V?**

Results	Action to Take
Yes →	KEY OFF. GO to **DR9**.
No →	REPAIR short circuit.

DR9 CHECK THE CMP CIRCUIT FOR OPEN IN HARNESS

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)CMP Sensor Connector, Harness Side
CMP	CMP
SIGRTN	SIGRTN

- **Are the resistances below 5 Ohm?**

Results	Action to Take
Yes →	GO to **DR10**.
No →	REPAIR open circuit.

DR10 CHECK FOR A SHORT IN HARNESS BETWEEN PCM AND CMP SENSOR

- Measure the Resistance between:

(+)CMP Sensor Connector, Harness Side	(-)CMP Sensor Connector, Harness Side
CMP	SIGRTN

- Measure the Resistance between:

(+)CMP Sensor Connector, Harness Side	(-)Vehicle battery
CMP	Negative post
SIGRTN	Negative post

- Measurement can be performed at either PCM or CMP harness connector.
- **Are the resistances above 10 KOhm?**

Results	Action to Take
Yes →	GO to **DR11**.
No →	REPAIR short circuit.

DR11 CHECK FOR SHORTS IN PCM

- PCM connector connected.
- Measure the Resistance between:

(+)CMP Sensor Connector, Harness Side	(-)CMP Sensor Connector, Harness Side
CMP	SIGRTN

- **Is the Resistance above 500 Ohm?**

Results	Action to Take
Yes →	GO to **DR12**.
No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Camshaft Position (CMP) Sensor

DR

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DR12</td><td>CHECK CMP SENSOR OUTPUT</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

INSTALL a new CMP sensor. CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
<tr><td colspan="2">
CMP Sensor connector connected.
Digital multimeter on low voltage AC scale.
Measure the Voltage between:
<table><tr><th>(+)CMP Sensor Connector, Harness Side</th><th>(-)CMP Sensor Connector, Harness Side</th></tr><tr><td>CMP</td><td>SIGRTN</td></tr></table>
Run engine at approximately 2500 RPM.
Is the Voltage above 0.25 V?
</td></tr>
<tr><td>DR13</td><td>CONTINUOUS MEMORY DTC P0345: CHECK CMP2 SENSOR RESISTANCE</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DR14.
INSTALL a new CMP2. CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
<tr><td colspan="2">
CMP2 connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)CMP2 Connector, Component Side</th><th>(-)CMP2 Connector, Component Side</th></tr><tr><td>CMP2</td><td>SIGRTN</td></tr></table>
<table><tr><th>Vehicle</th><th>Low Limit</th><th>High Limit</th></tr><tr><td>LS, Thunderbird 3.9L</td><td>1850 Ohms</td><td>2850 Ohms</td></tr><tr><td>F-150</td><td>300 Ohms</td><td>425 Ohms</td></tr><tr><td>All Others</td><td>250 Ohms</td><td>1000 Ohms</td></tr></table>
Is the resistance value(s) within specifications?
</td></tr>
<tr><td>DR14</td><td>CHECK CMP2 CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to DR15.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
Key ON Engine OFF.
Measure the Voltage between:
<table><tr><th>(+)CMP2 Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>CMP2</td><td>Negative post</td></tr></table>
Is the Voltage below 1 V?
</td></tr>
<tr><td>DR15</td><td>CHECK THE CMP2 CIRCUIT FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DR16.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)CMP2 Connector, Harness Side</th></tr><tr><td>CMP2</td><td>CMP2</td></tr><tr><td>SIGRTN</td><td>SIGRTN</td></tr></table>
Are the resistances below 5 Ohm?
</td></tr>
</table>

Camshaft Position (CMP) Sensor — DR

Test Steps	Results →	Action to Take

DR16 CHECK FOR A SHORT IN HARNESS BETWEEN PCM AND CMP2 SENSOR

- Measure the Resistance between:

(+)CMP2 Connector, Harness Side	(-)CMP2 Connector, Harness Side
CMP2	SIGRTN

- Measure the Resistance between:

(+)CMP2 Connector, Harness Side	(-)Vehicle battery
CMP2	Negative post
SIGRTN	Negative post

- Measurement can be performed at either PCM or CMP2 harness connector.
- **Are the resistances above 10 KOhm?**

Results	Action to Take
Yes →	GO to **DR17**.
No →	REPAIR short circuit.

DR17 CHECK FOR SHORT BETWEEN CMP & CMP2 CIRCUITS

- CMP Sensor connector disconnected.
- CMP2 connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
CMP	CMP2

- **Is the Resistance above 10 KOhm?**

Results	Action to Take
Yes →	GO to **DR18**.
No →	REPAIR short circuit.

DR18 CHECK FOR SHORTS IN PCM

- CMP Sensor connector connected.
- PCM connector connected.
- Measure the Resistance between:

(+)CMP2 Connector, Harness Side	(-)CMP2 Connector, Harness Side
CMP2	SIGRTN

- **Is the Resistance above 500 Ohm?**

Results	Action to Take
Yes →	GO to **DR19**.
No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

DR19 CHECK CMP2 SENSOR OUTPUT

- CMP2 connector connected.
- Digital multimeter on low voltage AC scale.
- Measure the Voltage between:

(+)CMP2 Connector, Harness Side	(-)CMP2 Connector, Harness Side
CMP2	SIGRTN

- Run engine at approximately 2500 RPM.
- **Is the Voltage above 0.25 V?**

Results	Action to Take
Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
No →	INSTALL a new CMP2. CLEAR the PCM DTCs and REPEAT Self-Test.

Camshaft Position (CMP) Sensor | DR

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DR20</td><td>CONTINUOUS MEMORY DTC P0340: CHECK VPWR VOLTAGE TO CMP SENSOR</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to DR21.
KEY OFF. REPAIR open circuit.</td></tr>
<tr><td colspan="2">• CMP Sensor connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)CMP Sensor Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>VPWR</td><td>Negative post</td></tr></table>• Is the Voltage above 10.5 V?</td></tr>
<tr><td>DR21</td><td>CHECK PWRGND VOLTAGE TO CMP SENSOR</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DR22.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">• Measure the Voltage between:
<table><tr><th>(+)CMP Sensor Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>PWRGND</td><td>Positive post</td></tr></table>• Is the Voltage above 10.5 V?</td></tr>
<tr><td>DR22</td><td>CHECK CMP CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to DR23.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">• PCM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)CMP Sensor Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>CMP</td><td>Negative post</td></tr></table>• Is the Voltage below 1 V?</td></tr>
<tr><td>DR23</td><td>CHECK FOR OPEN CIRCUIT BETWEEN PCM AND CMP SENSOR</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to DR24.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">• CMP Sensor connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)CMP Sensor Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>CMP</td><td>CMP</td></tr></table>• Is the Resistance below 5 Ohm?</td></tr>
</table>

Camshaft Position (CMP) Sensor — DR

Test Steps		Results →	Action to Take
DR24	CHECK CMP SENSOR CIRCUIT FOR SHORT TO GND IN HARNESS		
	Note: Measurement may be taken at PCM or CMP connector, whichever is easier to access. • Measure the Resistance between: (+)CMP Sensor Connector, Harness Side: CMP — (-)CMP Sensor Connector, Harness Side: PWRGND • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DR25**. REPAIR short circuit.
DR25	CHECK FOR SHORTS IN PCM		
	• Measure the Resistance between: (+)CMP Sensor Connector, Harness Side: CMP — (-)CMP Sensor Connector, Harness Side: VPWR (+)CMP Sensor Connector, Harness Side: CMP — (-)CMP Sensor Connector, Harness Side: PWRGND • **Are the resistances above 500 Ohm?**	Yes → No →	GO to **DR26**. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
DR26	CHECK CMP SENSOR OUTPUT DURING CRANK MODE		
	• CMP Sensor connector connected. • Digital multimeter on low voltage DC scale. • Measure the Voltage between: (+)PCM Connector, Harness Side: CMP — (-)PCM Connector, Harness Side: PWRGND • Crank the engine for at least 10 revolutions. • **Does the voltage switch between LOW (less than 2.0V DC) and HIGH (greater than 8.0V DC)?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). INSTALL a new CMP. CLEAR the PCM DTCs and REPEAT Self-Test.

Measurement tables:

DR24:

(+)CMP Sensor Connector, Harness Side	(-)CMP Sensor Connector, Harness Side
CMP	PWRGND

DR25:

(+)CMP Sensor Connector, Harness Side	(-)CMP Sensor Connector, Harness Side
CMP	VPWR
CMP	PWRGND

DR26:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
CMP	PWRGND

Air Conditioning Pressure Transducer	DS

Note

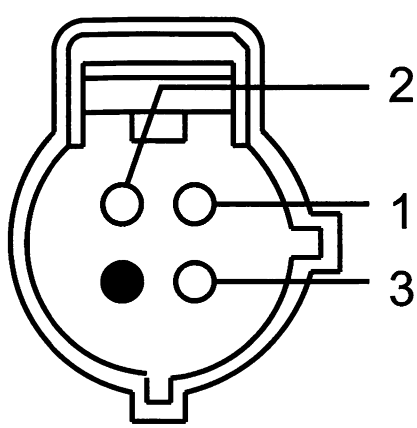
This pinpoint test is intended to diagnose the following:

Air Conditioning Pressure Transducer.

Harness Circuits: ACPT, VREF, SIGRTN.

Powertrain Control Module (PCM) (12a650).

Air Conditioning Pressure Transducer (ACPT) Sensor Connector



A0077539

Circuit	Pin
ACPT (Air Conditioning Pressure Transducer)	3
SIGRTN (Signal return)	2
VREF (Reference Voltage)	1

Air Conditioning Pressure Transducer — DS

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
104 Pin	PWRGND ACPT VPWR	103 86 71

Test Steps		Results →	Action to Take
DS1	DTC P0532, P1461: CHECK ACPT PID		
	• Connect scan tool. • Key ON Engine OFF. • Access the PCM-ACP V PID using a scan tool. • **Is the Voltage below 4.9 V?**	Yes →	KEY OFF. ACP voltage is now below maximum. GO to **DS16**.
		No →	KEY OFF. A hard fault is present. GO to **DS2**.
DS2	CHECK VOLTAGE BETWEEN VREF AND SIGRTN CIRCUITS AT THE ACP SENSOR VEHICLE HARNESS CONNECTOR		
	• Key ON Engine OFF. • ACPT Sensor connector disconnected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **DS3**.
		No →	KEY OFF. GO to **C1**.

(+)ACPT Sensor Connector, Harness Side	(-)ACPT Sensor Connector, Harness Side
VREF - Pin 1	SIGRTN - Pin 2

• **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
DS3	CHECK RESISTANCE OF ACP SENSOR		
	• Key OFF. • ACPT Sensor connector disconnected. • Remove ACP sensor. • Measure the Resistance between:	Yes →	KEY OFF. REINSTALL ACP sensor. GO to **DS4**.
		No →	KEY OFF. INSTALL a new ACPT sensor. Go to Climate Control System, Section 412, in the workshop manual and charge system if required, then if resistance check fails.

(+)ACPT Sensor Connector, Component Side	(-)ACPT Sensor Connector, Harness Side
ACPT - Pin 3	SIGRTN - Pin 2

• **Is the Resistance above 9 MOhm?**

Air Conditioning Pressure Transducer | DS

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DS4</td><td>CHECK ACP CIRCUIT FOR SHORT TO VREF</td><td></td><td></td></tr>
<tr><td colspan="2">

Scan tool connector disconnected.
ACPT Sensor connector disconnected.
PCM connector disconnected.
Measure the Resistance between:

<table>
<tr><th>(+)ACPT Sensor Connector, Harness Side</th><th>(-)ACPT Sensor Connector, Harness Side</th></tr>
<tr><td>ACPT - Pin 3</td><td>VREF - Pin 1</td></tr>
</table>
Is the Resistance above 10 KOhm?
</td><td>Yes →
No →</td><td>GO to DS5.
REPAIR short circuit to VREF.
START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.</td></tr>
<tr><td>DS5</td><td>CHECK ACP CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">

Key OFF.
Measure the Resistance between:

<table>
<tr><th>(+)ACPT Sensor Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>ACPT - Pin 3</td><td>VPWR - Pin 71</td></tr>
</table>
Is the Resistance above 10 KOhm?
</td><td>Yes →
No →</td><td>KEY OFF.
GO to DS6.
REPAIR short circuit to PWR.
START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.</td></tr>
<tr><td>DS6</td><td>CHECK FOR OPEN ACP CIRCUIT IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Note: REFER to the PCM connector pin numbers at the beginning of the pinpoint test.
Measure the Resistance between:
<table>
<tr><th>(+)ACPT Sensor Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>ACPT - Pin 3</td><td>ACPT - Pin 86</td></tr>
</table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>KEY OFF.
GO to DS7.
REPAIR open circuit.
START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.</td></tr>
<tr><td>DS7</td><td>CHECK PCM OUTPUT</td><td></td><td></td></tr>
<tr><td colspan="2">

PCM connector connected.
Add jumper wire between the points described below:

<table>
<tr><th>Point A ACPT Sensor Connector, Harness Side</th><th>Point B ACPT Sensor Connector, Harness Side</th></tr>
<tr><td>ACPT - Pin 3</td><td>SIGRTN - Pin 2</td></tr>
</table>

Key ON Engine OFF.
Access the PCM-ACP V PID using a scan tool.
Is the Voltage below 4.9 V?
Note: If a scan tool communication concern exists follow the NO answer.

</td><td>Yes →
No →</td><td>KEY OFF. INSTALL a new ACPT sensor.
REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.
INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.</td></tr>
</table>

Air Conditioning Pressure Transducer — DS

Test Steps		Results →	Action to Take
DS8	DTC P0533, P1462: CHECK ACP V PID		
	• Scan tool connector disconnected. • Key ON Engine OFF. • Access the PCM-ACP V PID using a scan tool. • **Is the Voltage above 0.15 V?**	Yes →	To determine if an intermittent condition exists. GO to **DS16**.
		No →	KEY OFF. A hard fault exists, GO to **DS9**.
DS9	CHECK VOLTAGE BETWEEN VREF AND SIGRTN CIRCUITS AT THE ACP SENSOR VEHICLE HARNESS CONNECTOR		
	• ACPT Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **DS10**.
		No →	KEY OFF. VREF is out of range, GO to **C1**.

(+)ACPT Sensor Connector, Harness Side	**(-)ACPT Sensor Connector, Harness Side**
VREF - Pin 1	SIGRTN - Pin 2

• **Is the Voltage between 4 V - 6 V?**

Test Steps		Results →	Action to Take
DS10	CHECK RESISTANCE OF ACP SENSOR		
	• Key OFF. • ACPT Sensor connector disconnected. • Remove ACP sensor. • Measure the Resistance between:	Yes →	KEY OFF. REINSTALL ACP sensor. GO to **DS11**.
		No →	KEY OFF. INSTALL a new ACPT sensor.

(+)ACPT Sensor Connector, Component Side	**(-)ACPT Sensor Connector, Component Side**
ACPT - Pin 3	SIGRTN - Pin 2

• **Is the Resistance above 9 MOhm?**

Test Steps		Results →	Action to Take
DS11	CHECK ACP CIRCUIT FOR SHORT TO GND		
	• Key OFF. • Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **DS12**.
		No →	REPAIR short circuit. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.

(+)ACPT Sensor Connector, Harness Side	**(-)PCM Connector, Harness Side**
ACPT - Pin 3	PWRGND - Pin 103

• **Is the Resistance above 10 KOhm?**

Air Conditioning Pressure Transducer	DS

Test Steps		Results →	Action to Take
DS12	CHECK ACP CIRCUIT FOR SHORT TO SIGRTN		
	• Key OFF. • Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between: **(+)ACPT Sensor Connector, Harness Side** / **(-)Vehicle battery** ACPT - Pin 3 / Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **DS13**. REPAIR short circuit. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.
DS13	CHECK THE ACP CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)ACPT Sensor Connector, Harness Side** / **(-)PCM Connector, Harness Side** ACPT - Pin 3 / ACPT - Pin 86 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DS14**. KEY OFF. REPAIR open circuit. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.
DS14	CHECK FOR THE A/CC TO ENGAGE		
	• PCM connector connected. • ACPT Sensor connector connected. • Key ON Engine OFF. • While listening for the A/C clutch to engage, turn the A/C on. Repeat if necessary. • **Did the A/C engage when the A/C was turned on?**	Yes → No →	KEY OFF. INSTALL a new PCM. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test. GO to **DS15**.

Air Conditioning Pressure Transducer — DS

Test Steps		Results →	Action to Take
DS15	VERIFY A/C SYSTEM FUNCTION, INCLUDING REFRIGERANT CHARGE		
	• RESTORE vehicle. • Verify A/C system function, including refrigerant charge. Go to Climate Control System, Section 412, in the workshop manual . • **Does the A/C have a refrigerant charge?**	Yes →	KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.
		No →	KEY OFF. REFER to the Climate Control System, Section 412 in the Workshop Manual to check A/C system pressure, to test ACCS cycle times, and to check causes of fast ACCS cycling. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.
DS16	CHECK ACP CIRCUIT FOR INTERMITTENT CONCERN		
	• Key ON Engine OFF. • Access the ACP PID. • Observe ACP V PID for indication of fault while completing the following (a fault will be indicated by a sudden change in ACP V PID voltage): • Shake, wiggle, bend the ACP, SIGRTN, and VREF wires between the ACP and PCM. circuit(s). • Lightly tap on the ACP (to simulate road shock). • **Is a fault indicated?**	Yes →	REPAIR open circuit. PERFORM PCM reset to clear DTCs. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.
		No →	GO to **Z1**.
DS17	DTC P1463: VERIFY A/C CLUTCH CAN DISENGAGE		
	• A/C and Defroster off. • Key ON Engine RUN. • Verify A/C clutch can disengage. • **Is the A/C clutch disengaged?**	Yes →	KEY OFF. GO to **DS18**.
		No →	See symptom chart 24 (A/C Compressor Runs Continuously, (A/C always on) to diagnose then always engaged issue. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Air Conditioning Pressure Transducer — DS

Test Steps		Results →	Action to Take
DS18	CHECK FOR VOLTAGE AND GROUND TO A/C CLUTCH (USING NON POWERED TEST LAMP)		
	• A/CCS Switch connector disconnected. • ACCS Assembly connector disconnected. • Connect a non powered test lamp between the power pin and ground pin at the A/C clutch harness connector. • Connect a jumper wire in the A/C low pressure cycling switch harness connector to complete the circuit. • Key ON Engine RUN. • Turn On A/C, wait 15 seconds. • Monitor test lamp. • Reconnect A/C clutch and A/C cycling switch when done testing. • **Does the lamp light (or can A/C clutch be heard clicking on)?**	Yes → No →	GO to **DS19**. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
DS19	CHECK A/C FOR A SUFFICIENT PRESSURE CHANGE AT ACP PID		
	• Key ON Engine RUN. • A/C and Defroster off. • Access ACP V PID. • Monitor ACP V PID voltage, turn A/C on. Five seconds after A/C clutch engagement, note the voltage (if clutch does not engage, follow the NO answer instructions). • **Did the A/C V PID voltage change more than .3 within 5 seconds of clutch engagement?**	Yes → No →	KEY OFF. For symptom without DTC P1463, RETURN to Section 3. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test. GO to **DS20**.
DS20	CHECK A/C SYSTEM PRESSURE AND PRESSURE CHANGE		
	• INSTALL an A/C System manifold Gauge Set and check the A/C system high pressure reading. • Key ON Engine RUN. • A/C and defrost off. • Note the A/C high pressure reading. • While monitoring the A/C system high pressure reading, turn the A/C on. Five seconds after clutch engagement, note the pressure (the pressure should increase). • A/C and defrost off. • **Did the A/C high pressure reading change more than 207 kPa (30 psi) within five seconds of clutch engagement?**	Yes → No →	GO to **DS21**. KEY OFF. REPAIR short circuit to PWR. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.

Air Conditioning Pressure Transducer | DS

Test Steps		Results →	Action to Take
DS21	CHECK VOLTAGE BETWEEN VREF AND SIGRTN CIRCUITS AT THE ACP SENSOR VEHICLE HARNESS CONNECTOR		
	• ACPT Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)ACPT Sensor Connector, Harness Side**: VREF - Pin 1 **(-)ACPT Sensor Connector, Harness Side**: SIGRTN - Pin 2 • **Is the Voltage between 4 V - 6 V?**	Yes → No →	GO to **DS22**. GO to **C1**.
DS22	CHECK ACP CIRCUIT FOR OPEN IN SENSOR		
	• ACPT Sensor connector disconnected. • Remove ACP sensor. • Measure the Resistance between: **(+)ACPT Sensor Connector, Component Side**: ACPT - Pin 3 **(-)ACPT Sensor Connector, Component Side**: SIGRTN - Pin 2 • **Is the Resistance above 9 MOhm?**	Yes → No →	INSTALL a new ACPT sensor. REPAIR open circuit. START engine. TURN A/C on, WAIT 15 seconds then turn A/C off. RERUN Quick Test.

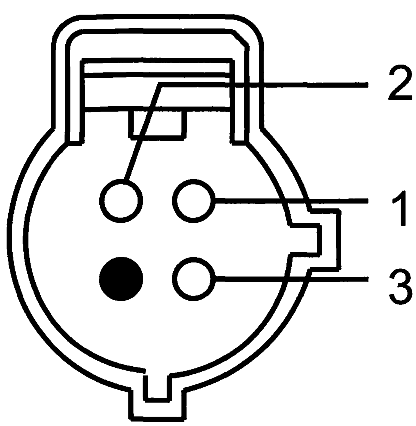
Power Steering Pressure Sensor	DT

Note

This Pinpoint Test is intended to diagnose the following:

- Power Steering Pressure Sensor (3K215).
- Harness circuit(s): PSP, SIGRTN & VREF.
- Powertrain Control Module (PCM) (12A650).

Power steering pressure (PSP) Sensor Connector



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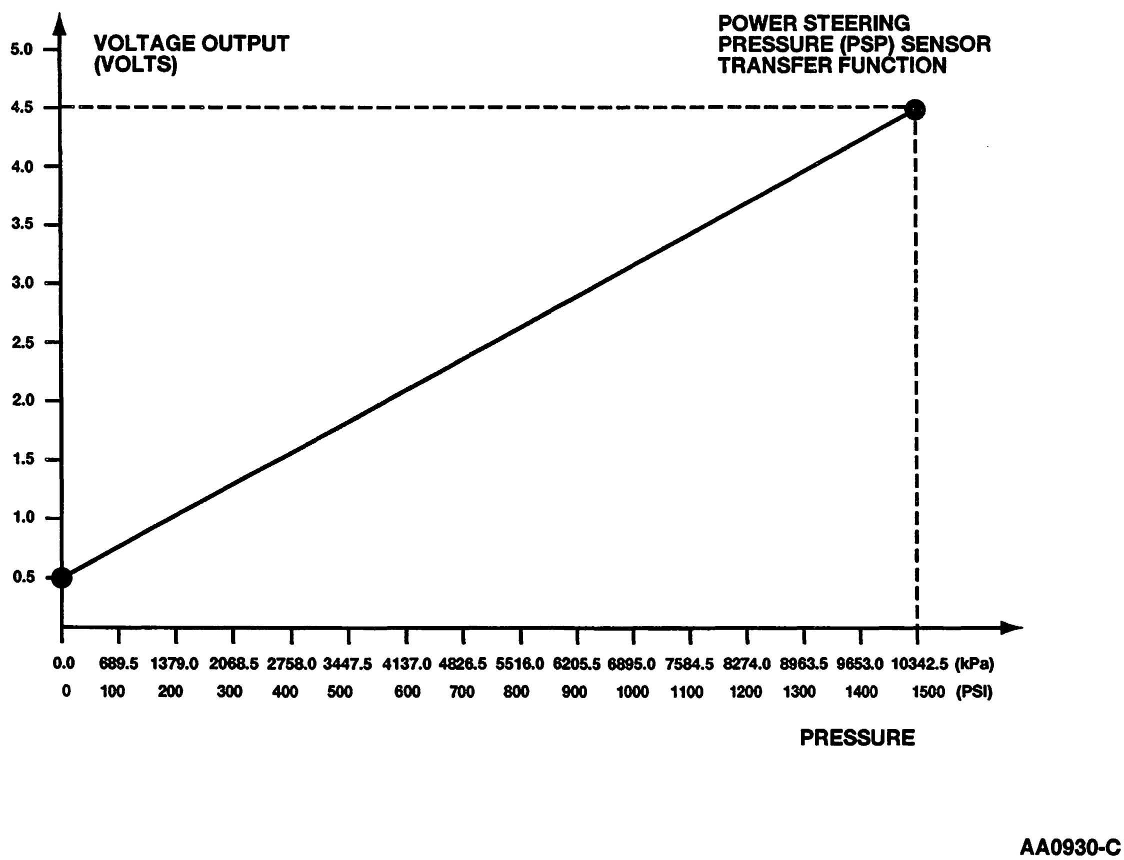
Circuit	Pin
PSP (Power steering pressure)	3
SIGRTN (Signal return)	1
VREF (Reference Voltage)	2

Power Steering Pressure Sensor | DT

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	PSP	B37
Expedition	122 Pin	PSP	B18
F-150	190 Pin	PSP	E24
Focus 2.3L	150 (50-50-50) Pin	PSP	B15
LS, Thunderbird	150 (60-32-58) Pin	PSP	E5
All other vehicles	104 Pin	PSP	31



Power Steering Pressure Sensor — DT

Test Steps		Results →	Action to Take
DT1	DTC P1550: ENSURE THE FOLLOWING ACTION HAS BEEN TAKEN		
	• **Did you turn the steering wheel at least one half turn within 20 seconds of starting KOER self-test?**	Yes →	If there are any symptoms with the power steering system (for example, lack of power assist), refer to Steering Systems, Section 211 in the workshop manual. If no symptoms are present with the power steering system, GO to **DT2**.
		No →	Rerun KOER Self-Test.
DT2	KOEO AND KOER DTCS P0552 OR P0553: CHECK VOLTAGE BETWEEN VREF & SIGRTN AT PSP SENSOR		
	• PSP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)PSP Sensor Connector, Harness Side: VREF - Pin 2; (-)PSP Sensor Connector, Harness Side: SIGRTN - Pin 1 • **Is the Voltage between 4 V - 6 V?**	Yes →	KEY OFF. GO to **DT3**.
		No →	KEY OFF. GO to **C1**.
DT3	CHECK SENSOR OPERATION		
	• Add jumper wire between the points described below (see table A). • Start engine and allow to idle. • Measure the Voltage between (see table B). • Observe voltage while turning the steering wheel at least one half turn right and left. • **Is voltage reading between 0.3 and 4.7 volts and does the voltage change when the steering wheel is turned?**	Yes →	KEY OFF. GO to **DT4**.
		No →	INSTALL a new PSP sensor.

DT2 measurement:

(+)PSP Sensor Connector, Harness Side	(-)PSP Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 1

DT3 table A:

Point A PSP Sensor Connector, Harness Side	Point B PSP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 1	SIGRTN - Pin 1
PSP - Pin 3	PSP - Pin 3

DT3 table B:

(+)PSP Sensor Connector, Component Side	(-)
PSP - Pin 3	Ground

Power Steering Pressure Sensor

DT

Test Steps		Results →	Action to Take
DT4	CHECK PSP CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PSP Sensor Connector, Harness Side** / **(-)PCM Connector, Harness Side** PSP - Pin 3 / PSP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **DT5**. REPAIR open circuit.
DT5	CHECK PSP CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)PSP Sensor Connector, Harness Side** / **(-)** PSP - Pin 3 / Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **DT6**. REPAIR short circuit.
DT6	CHECK PSP CIRCUIT FOR SHORT TO VREF, SIGRTN AND GND IN HARNESS		
	• Measure the Resistance between: **(+)PSP Sensor Connector, Harness Side** / **(-)PSP Sensor Connector, Harness Side** PSP - Pin 3 / VREF - Pin 2 PSP - Pin 3 / SIGRTN - Pin 1 • Measure the Resistance between: **(+)PSP Sensor Connector, Harness Side** / **(-)** PSP - Pin 3 / Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.

Power Steering Pressure Sensor | DT

Test Steps		Results →	Action to Take
DT7	CONTINUOUS MEMORY DTC P0552, P0553: CHECK POWER STEERING PRESSURE SENSOR CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Key ON Engine OFF. • Access the PSP V PID using a scan tool. • Observe the PSP V PID for an indication of a fault while completing the following: (a fault will be indicated by a sudden change in the voltage). — Shake, wiggle, bend the PSP, VREF, SIGRTN circuit(s). — Lightly tap on the Power Steering Pressure Sensor (to simulate road shock). • **Is a fault indicated?**	Yes → No →	ISOLATE fault Repair as necessary. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

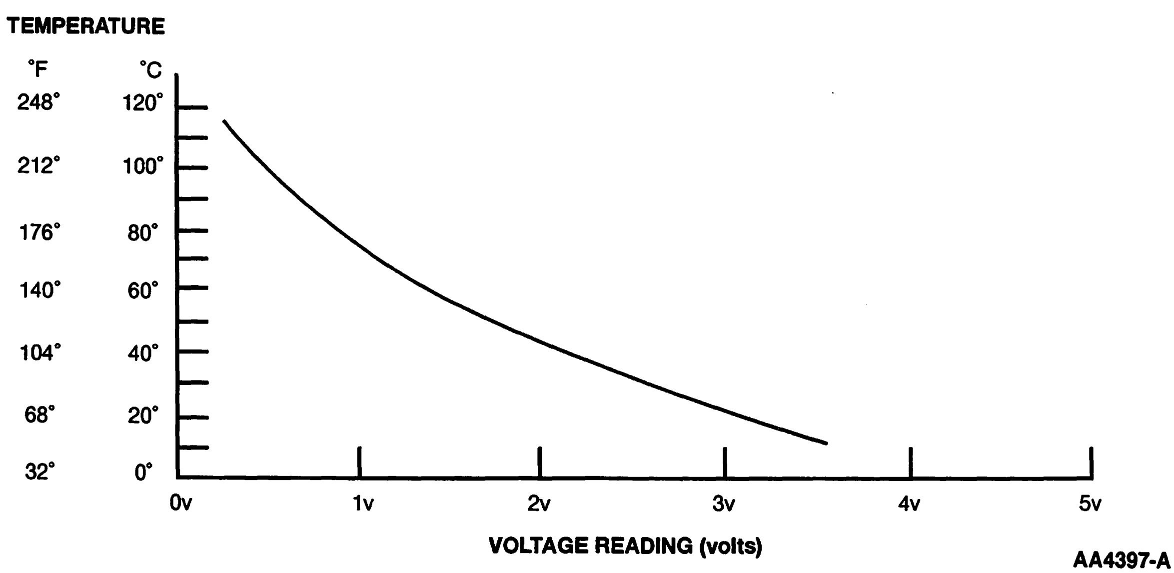
Intake Air Temperature 2 Sensor | DU

Note

This Pinpoint Test is intended to diagnose the following:

- Intake Air Temperature 2 (IAT2) sensor (12A697).
- Integrated Intake Air Temperature 2 (IAT2) sensor portion of the Thermal Manifold Absolute Pressure (TMAP) sensor (9F479).
- Harness circuits: IAT2 & SIGRTN.
- Powertrain Control Module (PCM) (12A650).

Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.



TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80

(Continued)

Intake Air Temperature 2 Sensor | DU

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

Intake Air Temperature 2 (IAT2) Connector

On some applications the IAT2 signal is integrated into the TMAP sensor.

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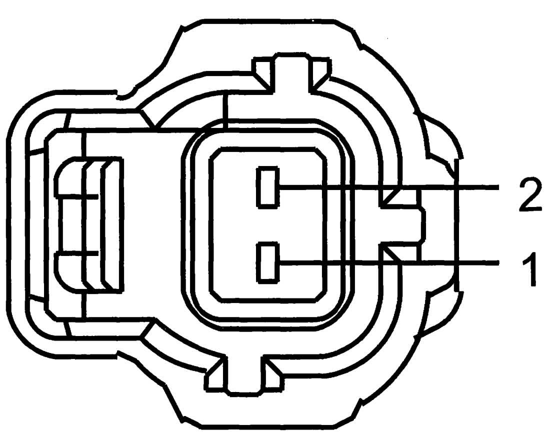

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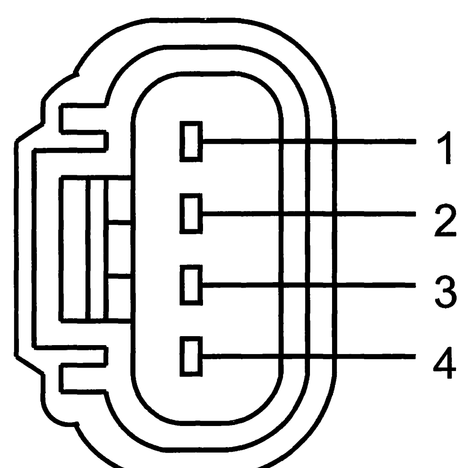
B



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Vehicle	Connector	Circuit	Pin
F-150 Heritage	A	SIGRTN IAT2	2 1
Mustang	B	SIGRTN IAT2	4 3

Intake Air Temperature 2 Sensor — DU

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
F-150 Heritage	104 Pin	VREF SIGRTN IAT2	90 91 38
Mustang	104 Pin	VREF SIGRTN IAT2	90 91 37

Test Steps		Results →	Action to Take
DU1	DTC P1115: SIMULATE OPPOSITE SIGNAL TO PCM		
	• DTC indicates the sensor signal is greater than the Self-Test maximum. • Possible causes: — Open in harness. — Incorrect harness connections. — Faulty Sensor. — Faulty or damaged PCM. • IAT2 connector disconnected. Note: On some applications the IAT2 signal is integrated into the TMAP sensor. • Key ON Engine OFF. • Add jumper wire between the points described below: **Point A IAT2 Connector, Harness Side**: IAT2 — **Point B IAT2 Connector, Harness Side**: SIGRTN • **Does a scan tool communication concern exist?**	Yes → No →	KEY OFF. REMOVE jumper. GO to **DU4**. GO to **DU2**.
DU2	CHECK FOR OPEN IN HARNESS		
	• Jumper installed. • Access the PCM-IAT2 V PID using a scan tool. • **Is the Voltage below 0.2 V?**	Yes → No →	INSTALL a new IAT2. KEY OFF. REMOVE jumper. GO to **DU3**.

Point A IAT2 Connector, Harness Side	Point B IAT2 Connector, Harness Side
IAT2	SIGRTN

Intake Air Temperature 2 Sensor — DU

Test Steps		Results →	Action to Take
DU3	CHECK SIGNAL AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)IAT2 Connector, Harness Side** / **(-)PCM Connector, Harness Side** IAT2 / IAT2 SIGRTN / SIGRTN • **Are the resistances below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR open circuit.
DU4	CHECK SENSOR SIGNAL FOR SHORT TO VREF		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side** IAT2 / VREF • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR short circuit to VREF.
DU5	DTC P1114: SIMULATE OPPOSITE SIGNAL TO PCM		
	• DTC indicates the sensor signal is less than the Self-Test minimum. • Possible causes: — Grounded circuit in harness. — Incorrect harness connections. — Faulty Sensor. — Faulty or damaged PCM. • IAT2 connector disconnected. Note: On some applications the IAT2 signal is integrated into the TMAP sensor. • Key ON Engine OFF. • Access the PCM-IAT2 V PID using a scan tool. • **Is the Voltage above 4.2 V?**	Yes → No →	KEY OFF. INSTALL a new IAT2. KEY OFF. GO to **DU6**.

Intake Air Temperature 2 Sensor

DU

Test Steps		Results →	Action to Take
DU6	CHECK SENSOR SIGNAL FOR SHORT TO GROUND		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: IAT2 — **(-)PCM Connector, Harness Side**: SIGRTN • Measure the Resistance between: **(+)PCM Connector, Harness Side**: IAT2 — **(-)12V vehicle battery**: Negative post • **Is the Resistance above 10 KOhm?**	Yes →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM
		No →	REPAIR short circuit.
DU7	DTC P0127: IAT2 TOO HIGH. CHECK SUPERCHARGER INTERCOOLER PUMP OPERATION		
	• Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • **Does supercharger intercooler pump run?**	Yes →	GO to **DU8**.
		No →	KEY OFF. Charge air cooler (CAC) pump GO to **KP8**.
DU8	CHECK INTERCOOLER SYSTEM		
	• Check intercooler system for low fluid level, cracked, blocked or misrouted coolant lines, cracked or blocked heat exchanger. • **Does the intercooler system check OK?**	Yes →	KEY OFF. GO to **DU9**.
		No →	REPAIR as necessary.
DU9	SIMULATE HIGH IAT2 SIGNAL TO PCM		
	• Key ON Engine OFF. • Access the PCM-IAT2 V PID using a scan tool. • Observe PID while disconnecting IAT2 sensor. • **Is the Voltage above 4.2 V?**	Yes →	KEY OFF. GO to **DU10**.
		No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM

Intake Air Temperature 2 Sensor — DU

Test Steps		Results →	Action to Take
DU10	SIMULATE LOW IAT2 SIGNAL TO PCM		
	• IAT2 connector disconnected. Note: On some applications the IAT2 signal is integrated into the TMAP sensor. • Add jumper wire between the points described below:	Yes →	RECONNECT sensor and GO to Section 6, Reference Values. COMPARE IAT2 PID to reference values under different road test conditions. If sensor is not in range replace sensor.
	Point A IAT2 Connector, Harness Side: IAT2 — **Point B IAT2 Connector, Harness Side**: SIGRTN		
	• Key ON Engine OFF. • Access the PCM-IAT2 V PID using a scan tool. • **Is the Voltage below 0.2 V?**	No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM

Point A IAT2 Connector, Harness Side	Point B IAT2 Connector, Harness Side
IAT2	SIGRTN

Throttle Body Assembly ETC	DV

Note

This pinpoint test is intended to diagnose the following:

Electronic Throttle Body 9N825.

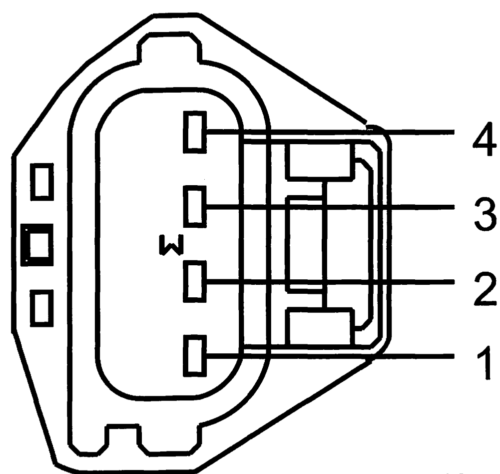
Harness circuits: ETCRTN, ETCREF, TP1, TP2, TACM+, TACM-.

Powertrain Control Module (PCM) (12a650).

- DTC U0300 is set in combination with P2105 and indicates an incompatible software between the Power PC and Equizzer chip. REFLASH the PCM if required. (See Section 2).
- If DTC P2106 is present, perform self test on the 4X4 Control Module, Anti Lock Brake module/Interactive Vehicle Dynamics Module, Electronic Air Temperature Control Module, Instrument Cluster Module, and the Tire pressure Module. Repair any powertrain DTCs output through PCED Section 4, and the appropriate workshop manual for non powertrain DTCs. Clear DTC P2106 and road test vehicle to verify the repair.

Throttle Body Assembly ETC	DV

Electronic Throttle Body TPS (ETBTPS) Sensor Connector



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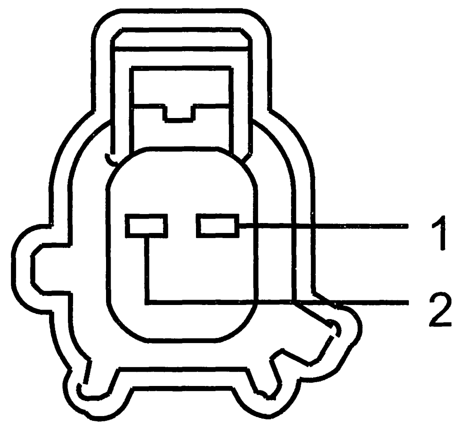
Circuit	Pin
TP2 (Throttle Position Sensor 2)	1
TP1 (Throttle Position Sensor 1)	4
ETCRTN (Electronic Throttle Control Return)	3
ETCREF (ETCREF (Electronic Throttle Control Reference Voltage to TP))	2

Throttle Body Assembly ETC	DV

Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Solenoid Connector



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Circuit	Pin
TACM- (TACM-)	2
TACM+ (TACM+)	1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
F-150	190 Pin	VPWR PWRGND TP2 TP1	B51 B67 E60 E61
LS, Thunderbird	150 (60-32-58) Pin	ETCREF ETCRTN VPWR PWRGND TP2 TP1	E24 E15 B32 B24 E57 E32

(Continued)

Throttle Body Assembly ETC

DV

Vehicle	Connector	Circuit	Pin
All other vehicles	150 (50-50-50) Pin	ETCREF ETCRTN VPWR PWRGND TP2 TP1	E18 E7 B35 B47 E29 E19

Test Steps		Results →	Action to Take
DV1	CHECK FOR OBSTRUCTION OF THE THROTTLE BODY		
	Note: The nature of the Electronic Throttle Control system dictates that the following Continuous DTCS should be repaired first by proceeding to DK1. P2121, P2122, P2123, P2126, P2127, P2128, P2131, P2132, P2133, P2104. On certain applications with ETC (Electronic Throttle Control), erroneous ignition and ETC related DTCs may be set due to salt water intrusion into the CKP harness connector. These DTCs are: P0320, P0351, P0356 and P2106. Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, REPLACE the CKP sensor. • Key ON Engine OFF. • REMOVE inlet tube from throttle body. • Visually inspect for throttle plate obstruction. • Slowly, push throttle plate to wide open and release. • **Does the throttle plate move freely to wide open and back?**	Yes → No →	KEY OFF. GO to **DV2**. KEY OFF. Isolate and repair obstruction.

Throttle Body Assembly ETC — DV

Test Steps	Results →	Action to Take

DV2 CHECK TP OPEN AND CLOSED VOLTAGES

- Key ON Engine OFF.
- Access and monitor TP1 and TP2 PIDS.
- Push accelerator pedal to the floor and release.

Electronic Throttle Control Throttle Position sensor signal voltages

VEHICLE	Throttle Plate	TP1	TP2
LS6/LS8 and Thunderbird:	Closed throttle	3.7-4.7	.3-1.9
	Wide-open throttle	.7-1.6	4.1-4.7
2004 MY, F-150	Closed throttle	3.7-4.7	.3-1.9
	Wide-open throttle	.7-2.9	4.1-4.7
2004 MY, Explorer	Closed throttle	3.7-4.7	.3-1.9
	Wide-open throttle	.7-2.9	4.1-4.7

- **Are both PIDS within the chart ranges?**

Results	Action to Take
Yes →	KEY OFF. GO to **DV10**.
No →	KEY OFF. **For the following Continuous codes alone or together: DTCS P0121, P0122, P0221, P0222, P2106,** GO to **DV3**. **For Continuous codes together DTCS P2100, P2101, P2107, P2112** GO to **DV18**. **For All Others:** GO to **DV6**.

DV3 CHECK VREF VOLTAGE TO TP

- ETBTPS Sensor connector disconnected.
- Measure the Voltage between:

(+)ETBTPS Sensor Connector, Harness Side	(-)ETBTPS Sensor Connector, Harness Side
ETCREF - Pin 2	ETCRTN - Pin 3

- **Is the Voltage between 4 V - 6 V?**

Results	Action to Take
Yes →	GO to **DV4**.
No →	GO to **C1**.

DV4 CHECK FUNCTIONALITY OF TP1 CIRCUIT

Note: Use voltage measurements from DV2.

- **Was TP1 out of range?**

Results	Action to Take
Yes →	GO to **DV6**.
No →	GO to **DV5**.

DV5 CHECK THE FUNCTIONALITY OF TP2

Note: Use voltage measurements from DV2.

- **Was TP2 out of range?**

Results	Action to Take
Yes →	GO to **DV6**.
No →	GO to **DV10**.

Throttle Body Assembly ETC | DV

Test Steps		Results →	Action to Take
DV6	CHECK FUNCTIONALITY OF TP		
	• ETBTPS Sensor connector disconnected. • Measure resistance between the following circuits through the sensor : TP1 to TP2 = 4.0 - 5.3 KOhms. TP1 to ETCREF = 1.7 - 2.3 KOhms. TP1 to ETCRTN = 3.3 - 3.9 KOhms. TP2 to ETCREF = 2.9 - 4.6 KOhms. TP2 to ETCRTN = 1.5 - 2.6 KOhms. ETCREF to ETCRTN = 2.9 - 4.4 KOhms. • **Are all resistances within specifications?**	Yes → No →	GO to **DV7**. INSTALL a new ETCTP.
DV7	CHECK THE TP1 CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • ETBTPS Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DV8**. REPAIR open circuit.

(+)ETBTPS Sensor Connector, Harness Side	(-)PCM Connector, Harness Side
TP1 - Pin 4	TP1

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
DV8	CHECK THE TP1 CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • ETBTPS Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DV9**. REPAIR short circuit to GND.

(+)ETBTPS Sensor Connector, Harness Side	(-)12V vehicle battery
TP1 - Pin 4	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DV9	CHECK THE TP1 CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • ETBTPS Sensor connector disconnected. • Key ON Engine OFF. • Measure the Resistance between:	Yes → No →	KEY OFF. GO to **DV10**. KEY OFF. REPAIR short circuit to PWR.

(+)ETBTPS Sensor Connector, Harness Side	(-)12V vehicle battery
TP1 - Pin 4	Positive post

• **Is the Resistance above 10 KOhm?**

Throttle Body Assembly ETC | DV

Test Steps		Results →	Action to Take
DV10	CHECK THE TPS CIRCUIT FOR SHORT TOGETHER		
	• PCM connector disconnected. • ETBTPS Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DV11**. REPAIR short circuit.

(+)ETBTPS Sensor Connector, Harness Side	(-)ETBTPS Sensor Connector, Harness Side
TP1 - Pin 4	TP2 - Pin 1
TP1 - Pin 4	ETCREF - Pin 2
TP1 - Pin 4	ETCRTN - Pin 3
TP2 - Pin 1	ETCREF - Pin 2
TP2 - Pin 1	ETCRTN - Pin 3

• **Are the resistances above 10 KOhm?**

Test Steps		Results →	Action to Take
DV11	CHECK THE TP2 CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • ETBTPS Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DV12**. REPAIR open circuit.

(+)ETBTPS Sensor Connector, Harness Side	(-)PCM Connector, Harness Side
TP2 - Pin 1	TP2

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
DV12	CHECK THE TP2 CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • ETBTPS Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DV13**. REPAIR short circuit to GND.

(+)PCM Connector, Harness Side	(-)12V vehicle battery
TP2	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
DV13	CHECK THE TP2 CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • ETBTPS Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	KEY OFF. GO to **DV14**. KEY OFF. REPAIR short circuit to PWR.

(+)PCM Connector, Harness Side	(-)12V vehicle battery
TP2	Positive post

• **Is the Resistance above 10 KOhm?**

Throttle Body Assembly ETC | DV

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DV14</td><td>CHECK FOR CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
PCM connector disconnected.
ETBTPS Sensor connector disconnected.
Measure the Resistance between:
<table>
<tr><th>(+)ETBTPS Sensor Connector, Harness Side</th><th>(-)ETBTPS Sensor Connector, Harness Side</th></tr>
<tr><td>TP2 - Pin 1</td><td>TP1 - Pin 4</td></tr>
<tr><td>TP2 - Pin 1</td><td>ETCREF - Pin 2</td></tr>
<tr><td>TP2 - Pin 1</td><td>ETCRTN - Pin 3</td></tr>
</table>
Are the resistances above 10 KOhm?
</td><td>Yes →
No →</td><td>GO to DV15.
REPAIR short circuit.</td></tr>
<tr><td>DV15</td><td>CHECK FOR TP2 SIGNAL HIGH VERSUS LOAD WHILE DRIVING VEHICLE</td><td></td><td></td></tr>
<tr><td colspan="2">HEVETB Sensor connector connected.
PCM connector connected.
Key ON Engine RUN.
Access and monitor LOAD and TP2 PIDS.
Drive vehicle, while exercising the throttle and ETCTP sensor and accessing the PIDS.
Is the TP2 greater than 2.44 volts and the Load less than 30 percent?</td><td>Yes →
No →</td><td>LISTEN for air noise around MAF sensor and throttle body while engine is running and repair as necessary, otherwise: and return to DV16 if no fault is found.
GO to HU1.
GO to DV16.</td></tr>
<tr><td>DV16</td><td>CHECK FOR TP2 SIGNAL LOW VERSUS LOAD WHILE DRIVING VEHICLE</td><td></td><td></td></tr>
<tr><td colspan="2">Key ON Engine RUN.
Drive vehicle, while exercising the throttle and ETCTP sensor and accessing the PIDS.
Is the TP2 PID less than .24 volts and the LOAD PID greater than 55 percent?</td><td>Yes →
No →</td><td>If after clearing Continuous DTCs, and driving vehicle while exercising the throttle, Continuous DTCs P0124 or P0124 are set:
GO to DV17.</td></tr>
<tr><td>DV17</td><td>CHECK THE TPS CIRCUIT FOR INTERMITTENT CONCERN</td><td></td><td></td></tr>
<tr><td colspan="2">Key ON Engine OFF.
Access and monitor TP1 and TP2 PIDS.
Wiggle, shake, and bend the harness from the TP to the PCM.
Is the TP2 PID less than .49 volts or above 4.65 volts?</td><td>Yes →
No →</td><td>KEY OFF.
REPAIR any faults found, If DTC P2100 and or P2101 are present:
GO to DV18.
KEY OFF. INSTALL a new PCM.</td></tr>
</table>

Throttle Body Assembly ETC | DV

Test Steps		Results →	Action to Take
DV18	CHECK TACM MOTOR VISUALLY		
	Note: Ensure that TACM harness connector is properly connected. • Key OFF. • INSPECT TACM for damaged housing, harness connector, and harness. • **Are there any faults with the TACM hardware?**	Yes → No →	INSTALL a new ETB. GO to **DV19**.
DV19	CHECK TACM FOR SHORT OR OPEN		
	• ETBTACM Solenoid connector disconnected. • PCM connector disconnected. • Measure the Resistance between: **(+)ETBTACM Solenoid Connector, Component Side** / **(-)ETB Connector, Component Side** TACM+ - Pin 1 / TACM- • **Is the Resistance between 800 mOhm - 1 KOhm?**	Yes →	KEY OFF. **For DTCs P2100, P2106, P2112 or P2100, P2106, P2111** GO to **DV20**. **For DTCs P2100, P2106, P2107** GO to **DV21**. **For DTCs P2100, P2106, P2107, P2111, P2112** GO to **DV23**. **For DTCs P2101, P2106, P2110, P2111, P2112** GO to **DV20**.
		No →	KEY OFF. INSTALL a new ETB.
DV20	CHECK TACM HARNESS FOR OPEN		
	• PCM connector disconnected. • Measure the Resistance between: **(+)ETBTACM Solenoid Connector, Harness Side** / **(-)PCM Connector, Harness Side** TACM+ - Pin 1 / TACM+ TACM- - Pin 2 / TACM- • **Are the resistances below 5 Ohm?**	Yes → No →	KEY OFF. GO to **DV21**. REPAIR open circuit.

Throttle Body Assembly ETC — DV

Test Steps	Results →	Action to Take

DV21 CHECK HARNESS FOR SHORT TO GND, PWR, ETCREF, AND ETCRTN

- Measure the Resistance between:

(+)ETBTACM Solenoid Connector, Harness Side	(-)PCM Connector, Harness Side
TACM+ - Pin 1	PWRGND
TACM+ - Pin 1	VPWR
TACM+ - Pin 1	ETCRTN
TACM+ - Pin 1	ETCREF
TACM- - Pin 2	PWRGND
TACM- - Pin 2	ETCRTN
TACM- - Pin 2	VPWR
TACM- - Pin 2	ETCREF

- **Are the resistances above 10 KOhm?**

Results	Action to Take
Yes →	GO to **DV22**.
No →	REPAIR short circuit.

DV22 CHECK FOR SELF TEST CODES

- Rerun KOEO and KOER Self-Test and retrieve Continuous Memory DTCs.
- **Is there a P2101 present?**

Results	Action to Take
Yes →	GO to **DV23**.
No →	GO to **DV24**.

DV23 CHECK FOR TACM HARNESS CIRCUITS SHORTED TOGETHER

- This test step takes the measurement through the harness connector.
- Measure the Resistance between:

(+)ETBTACM Solenoid Connector, Harness Side	(-)ETBTACM Solenoid Connector, Harness Side
TACM+ - Pin 1	TACM- - Pin 2

- **Is the Resistance above 10 KOhm?**

Results	Action to Take
Yes →	GO to **DV24**.
No →	REPAIR short circuit.

DV24 CHECK FOR PROPER TACM+ WIRING IN THE HARNESS CONNECTOR

- Measure the Resistance between:

(+)ETBTACM Solenoid Connector, Harness Side	(-)PCM Connector, Harness Side
TACM+ - Pin 1	TACM+

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	GO to **DV25**.
No →	REPAIR open circuit. Properly wire the TACM harness connector per TACM and PCM connector diagrams.

Throttle Body Assembly ETC	DV

Test Steps		Results →	Action to Take
DV25	CHECK FOR PROPER TACM- WIRING IN THE HARNESS CONNECTOR		
	• Measure the Resistance between: **(+)ETBTACM Solenoid Connector, Harness Side** / **(-)PCM Connector, Harness Side** TACM- - Pin 2 / TACM- • Self test noting any DTCS. • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. GO to **DV26**.
DV26	CHECK REPAIR THROUGH PROCEDURE		
	• Key ON Engine OFF. • Record and clear DTCs. • Cycle accelerator pedal to the floor and back several times. • Self test noting any DTCS. • **Were there any ETC system related DTCs?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). GO to **Z1**.

Engine Coolant Temperature (ECT) Sensor

DX

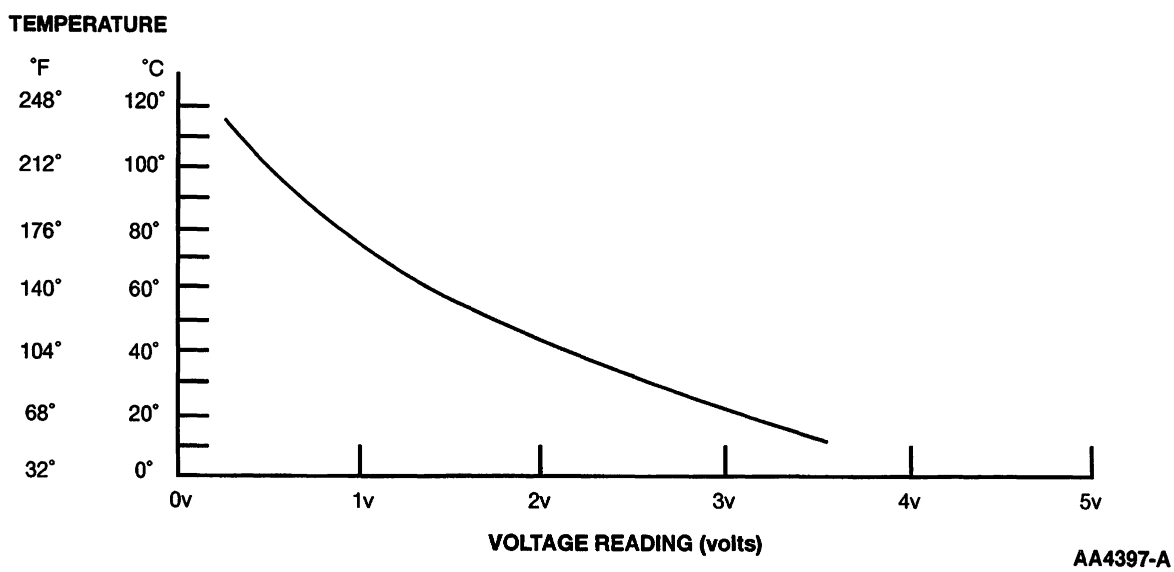
Note

This Pinpoint Test is intended to diagnose the following:

- Engine coolant temperature (ECT) sensor (12A648).
- Harness circuits: ECT & SIGRTN.
- Powertrain control module (PCM) (12A650).

Engine coolant temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 82°C (180°F) to pass the KOER Self-Test. To accomplish this, the engine must be at normal operating temperature.

Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.



TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07

(Continued)

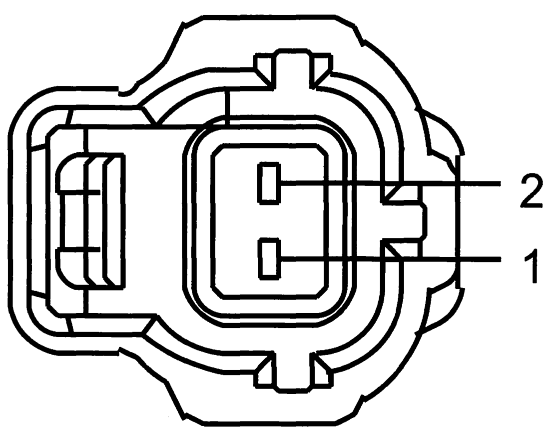
Engine Coolant Temperature (ECT) Sensor

DX

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

Engine coolant temperature (ECT) Sensor Connector



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Circuit	Pin
SIGRTN (Signal return)	2
ECT (Engine coolant temperature)	1

Engine Coolant Temperature (ECT) Sensor

DX

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	VREF SIGRTN ECT	E20 E17 E46
Explorer, Mountaineer	150 (50-50-50) Pin	VREF SIGRTN ECT	E40 E41 E21
Marauder	104 Pin	VREF SIGRTN ECT	90 91 66
Navigator	122 Pin	VREF SIGRTN ECT	E36 E25 E32
All other vehicles	104 Pin	VREF SIGRTN ECT	90 91 38

Test Steps		Results →	Action to Take
DX1	DTC P1116: CHECK COOLING SYSTEM		
	• DTC indicates that the temperature sensor is out of Self-Test range. Engine is not at normal operating temperature. • Possible causes: — Cold engine. — Low engine coolant. — Engine overheat. — Damaged harness. — ECT sensor. — Faulty or damaged PCM. • Check the vehicle coolant level. **WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.** • **Is cooling system OK?**	Yes → No →	GO to **DX2**. REFER to Engine Cooling, Section 303 in the Workshop Manual for cooling system diagnosis. Repair as necessary.
DX2	CHECK IF VEHICLE ENGINE STARTS		
	• Attempt to start the engine. • **Does engine start and run normally?**	Yes → No →	GO to **DX5**. GO to **DX3**.

Engine Coolant Temperature (ECT) Sensor

DX

Test Steps		Results →	Action to Take
DX3	CHECK RESISTANCE OF ECT SENSOR WITH ENGINE OFF		
	• Key OFF. • ECT Sensor connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **DX4**. INSTALL a new ECT sensor.

(+)ECT Sensor Connector, Component Side	(-)ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

	Note: REFER to the chart at the beginning of this test for resistance specifications. • **Is resistance within specification?**		
DX4	CHECK CIRCUIT FROM MODULE TO COMPONENT		
	• ECT Sensor connector connected. • Key ON Engine OFF. • Access the PCM-ECT V PID using a scan tool. • Using the data collected from the previous step. Compare temperature resistance measured at the sensor to the PID temperature voltage measured at the PCM. Note: REFER to the chart at the beginning of this test for resistance specifications. • **Does the measured value at the sensor agree with measured PID value at the PCM?**	Yes → No →	No Start or Stalls Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. CHECK Harness GO to **DX9**.
DX5	CHECK ECT SENSOR OPERATION		
	• Run engine until engine temperature stabilizes. • Verify the upper radiator hose is hot and the cooling system is pressurized. • Rerun KOER Self-Test. • CHECK Self-Test DTCs: • **Is DTC P1116 present?**	Yes → No →	GO to **DX6**. Engine temperature was not stabilized. REPAIR any other DTCs as necessary.

Engine Coolant Temperature (ECT) Sensor

DX

Test Steps		Results →	Action to Take
DX6	CHECK RESISTANCE OF ECT SENSOR WITH ENGINE RUNNING		

CAUTION: While conducting checks with a running engine ensure adequate safety precautions are observed to prevent contact with moving engine parts. For example; ensure ties or loose clothing do not come into contact with the cooling fan or drive belts.

- Vehicle must be at normal operating temperature.
- ECT Sensor connector disconnected.
- Measure the Resistance between:

(+)ECT Sensor Connector, Component Side	(-)ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

Note: REFER to the chart at the beginning of this test for resistance specifications.

- **Is resistance within specification?**

Results	Action to Take
Yes →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM
No →	INSTALL a new ECT sensor.

DX7	DTC P0118: SIMULATE OPPOSITE SIGNAL TO PCM

- DTC indicates the sensor signal is greater than the Self-Test maximum.
- Possible causes:
  - — Open in harness.
  - — Incorrect harness connections.
  - — Faulty Sensor.
  - — Faulty or damaged PCM.
- ECT Sensor connector disconnected.
- Key ON Engine OFF.
- Add jumper wire between the points described below:

Point A ECT Sensor Connector, Harness Side	Point B ECT Sensor Connector, Harness Side
ECT - Pin 1	SIGRTN - Pin 2

- **Does a scan tool communication concern exist?**

Results	Action to Take
Yes →	KEY OFF. REMOVE jumper. GO to **DX10**.
No →	GO to **DX8**.

DX8	CHECK FOR OPEN IN HARNESS

- Jumper installed.
- Access the PCM-ECT V PID using a scan tool.
- **Is the Voltage below 0.2 V?**

Results	Action to Take
Yes →	INSTALL a new ECT sensor.
No →	KEY OFF. REMOVE jumper. GO to **DX9**.

Engine Coolant Temperature (ECT) Sensor

DX

Test Steps		Results	Action to Take
DX9	CHECK SIGNAL AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: <table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)ECT Sensor Connector, Harness Side</th></tr><tr><td>ECT</td><td>ECT - Pin 1</td></tr><tr><td>SIGRTN</td><td>SIGRTN - Pin 2</td></tr></table>• **Are the resistances below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR open circuit.
DX10	CHECK SENSOR SIGNAL FOR SHORT TO VREF		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: <table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>ECT</td><td>VREF</td></tr></table>• **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR short circuit to VREF.
DX11	DTC P0117: SIMULATE OPPOSITE SIGNAL TO PCM		
	• DTC indicates the sensor signal is less than the Self-Test minimum. • Possible causes: — Grounded circuit in harness. — Incorrect harness connections. — Faulty Sensor. — Faulty or damaged PCM. • ECT Sensor connector disconnected. • Key ON Engine OFF. • Access the PCM-ECT V PID using a scan tool. • **Is the Voltage above 4.2 V?**	Yes → No →	KEY OFF. INSTALL a new ECT sensor. KEY OFF. GO to **DX12**.

Engine Coolant Temperature (ECT) Sensor

DX

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>DX12</td><td>CHECK SENSOR SIGNAL FOR SHORT TO GROUND</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM

REPAIR short circuit.</td></tr>
<tr><td colspan="2">

• PCM connector disconnected.
• Measure the Resistance between:

<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>ECT</td><td>SIGRTN</td></tr>
</table>

• Measure the Resistance between:

<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)12V vehicle battery</th></tr>
<tr><td>ECT</td><td>Negative post</td></tr>
</table>

• Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>DX13</td><td>DTC P0116: CHECK RESISTANCE OF ECT SENSOR WITH ENGINE OFF</td><td rowspan="2">Yes →

No →</td><td rowspan="2">Reconnect ECT.
GO to DX14.

INSTALL a new ECT sensor.</td></tr>
<tr><td colspan="2">

Note: Verify that engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. REFER to Diagnostic Trouble Code DTC Descriptions, in Section 4 for information concerning P0116.
• Key OFF.
• ECT Sensor connector disconnected.
• Measure the Resistance between:

<table>
<tr><th>(+)ECT Sensor Connector, Component Side</th><th>(-)ECT Sensor Connector, Component Side</th></tr>
<tr><td>ECT - Pin 1</td><td>SIGRTN - Pin 2</td></tr>
</table>

• REFER to the chart at the beginning of this test for resistance specifications.
• Is resistance within specification?
</td></tr>
</table>

Engine Coolant Temperature (ECT) Sensor

DX

Test Steps		Results →	Action to Take
DX14	DTC P0116: CHECK RESISTANCE OF ECT SENSOR WITH ENGINE RUNNING		
	CAUTION: While conducting checks with a running engine ensure adequate safety precautions are observed to prevent contact with moving engine parts. For example; ensure ties or loose clothing do not come into contact with the cooling fan or drive belts. • Run engine until engine temperature stabilizes. Note: Verify that engine is at operating temperature before taking ECT reading. • ECT Sensor connector disconnected. • Measure the Resistance between: **(+)ECT Sensor Connector, Component Side**: ECT - Pin 1; **(-)ECT Sensor Connector, Component Side**: SIGRTN - Pin 2 • REFER to the chart at the beginning of this test for resistance specifications. • **Is resistance within specification?**	Yes → No →	Fault is not present at this time COMPLETE OBD Drive Cycle to determine if Fuel, HO2S, Catalyst and Misfire monitors can be executed. REFER to Section 2, Drive Cycles INSTALL a new ECT sensor.
DX15	DTCS P0117, P0118, P0119 OR P1117: INTERMITTENT CHECK		
	• Key ON Engine OFF. • Access the PCM-ECT V PID using a scan tool. • While observing the PID, complete the following: — Tap on sensor to simulate road shock. — Wiggle the sensor connector. • **Is there a large change in the voltage reading?**	Yes → No →	DISCONNECT and INSPECT connector. If OK, REPLACE Component. GO to **DX16**.
DX16	CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS		
	• Access the PCM-ECT V PID using a scan tool. • While observing the PID, complete the following: — Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • **Is there a large change in the voltage reading?**	Yes → No →	ISOLATE fault REPAIR as necessary. KEY OFF. GO to **DX17**.

(+)ECT Sensor Connector, Component Side	(-)ECT Sensor Connector, Component Side
ECT - Pin 1	SIGRTN - Pin 2

Engine Coolant Temperature (ECT) Sensor

DX

Test Steps		Results →	Action to Take
DX17	CHECK PCM AND VEHICLE HARNESS CONNECTORS		
	• PCM connector disconnected. • ECT Sensor connector disconnected. • **Are connectors and terminals OK?**	Yes →	Fault is not present at this time Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	Repair as necessary.
DX18	DTCS P0125 OR P0128: CHECK ENGINE COOLANT LEVEL		
	• Diagnostic Trouble Code (DTC) indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time. • Possible causes: — Insufficient warm up time. — Leaking or stuck-open thermostat. — Low engine coolant. **WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.** • CHECK engine coolant level. • **Is the engine coolant fill level correct?**	Yes →	GO to **DX19**.
		No →	REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Select Symptom Loss of Engine Coolant
DX19	CHECK SENSOR OPERATION		
	• Run engine until engine temperature stabilizes. • Verify the upper radiator hose is hot and the cooling system is pressurized. • Access the PCM-ECT PID using a scan tool. • **Is the Temperature above 77 C (170.6 F)?**	Yes →	Test Complete Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Select Symptom Engine does not reach operating temperature

Engine Coolant Temperature (ECT) Sensor

DX

	Test Steps	Results	→	Action to Take
DX20	DTC P0217: INDICATES AN ENGINE OVERHEAT CONDITION			
	Note: REFER to Section 4, Diagnostic Trouble Code (DTC) Description for possible causes and additional DTC description information. **WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE; STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.** • CHECK engine coolant level. • **Is the engine coolant fill level correct?**	Yes No	→ →	REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Select Symptom Engine overheat REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. Select Symptom Loss of Engine Coolant
DX21	DTC P0298: ENGINE OIL OVERTEMPERATURE CONDITION			
	• Engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating. REFER to Section 4, Diagnostic Trouble Code (DTC) Description for possible causes and additional DTC description information. — CHECK for overheating condition and base engine concerns. • **Is there any overheating or base engine concerns?**	Yes No	→ →	ISOLATE fault. REPAIR as necessary. GO to **DX22**.
DX22	CHECK FOR ECT DTCS			
	• CHECK Self-Test DTCs: • **Are DTCs P0117, P0118, P1116 or P1117 present?**	Yes No	→ →	RETURN to Diagnostic Subroutines, Section 4, for direction in addressing the other DTCs. GO to **DX23**.
DX23	ROAD TEST THE VEHICLE AND MONITOR FOR ENGINE OVERTEMPERATURE			
	• Access Freeze Frame Data (if available) and record DTC malfunction conditions. • Access the PCM-ECT PID using a scan tool. • Test drive the vehicle and allow engine to reach normal operating temperature. • Observe ECT PID. • **Does the engine overheat?**	Yes No	→ →	REFER to Workshop Manual, Section 303 Engine Cooling for cooling system diagnostics. REPAIR as necessary. Unable to duplicate or identify fault at this time.

Engine Oil Temperature (EOT) Sensor	DY

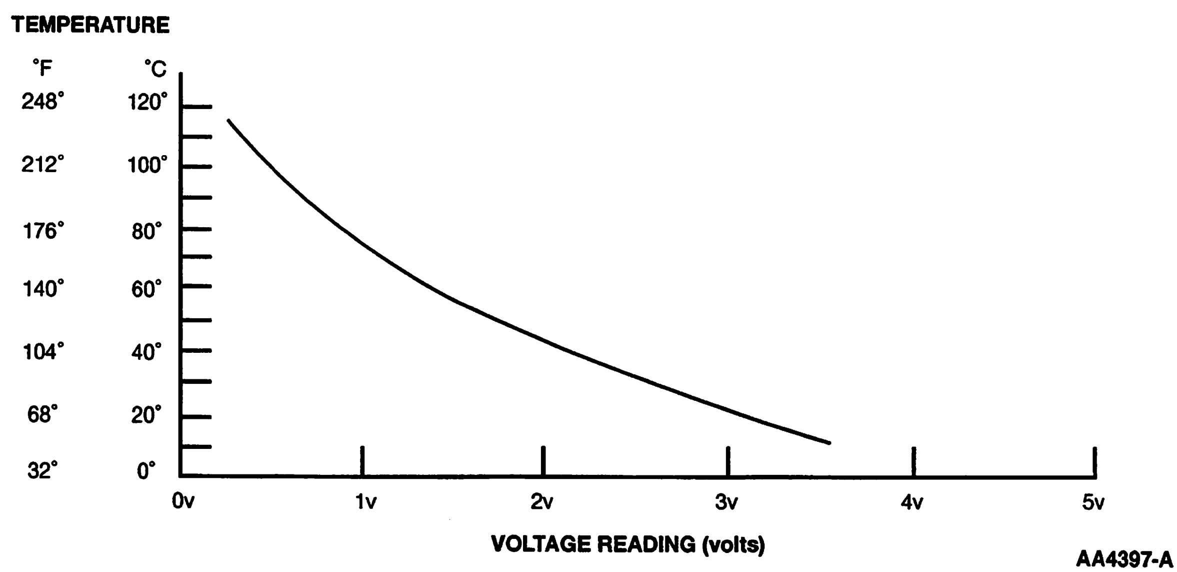
Note

This Pinpoint Test is intended to diagnose the following:

- Engine oil temperature (EOT) sensor (12A648).
- Harness circuits: EOT & SIGRTN.
- Powertrain control module (PCM) (12A650).

Engine oil temperature must be greater than 10°C (50°F) to pass the KOEO Self-Test and greater than 66°C (150°F) to pass the KOER Self-Test.

Voltage values were calculated for VREF = 5.0 volts. These values can vary 15 percent due to sensor and VREF variations.



TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80

(Continued)

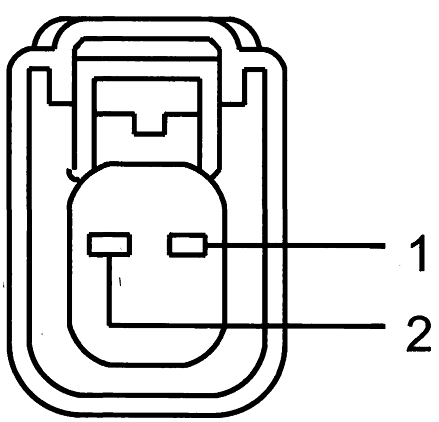
Engine Oil Temperature (EOT) Sensor	DY

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

Engine Oil Temperature (EOT) Sensor Connector

A



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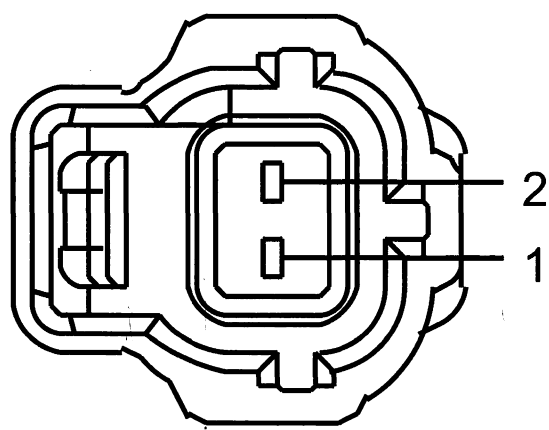

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Vehicle	Connector	Circuit	Pin
F-150 5.4L 3V	A	SIGRTN EOT	2 1
All other vehicles	B	SIGRTN EOT	2 1

Engine Oil Temperature (EOT) Sensor — DY

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
F-150	190 Pin	SIGRTN VPWR VREF EOT	E58 B51 E57 E27
All other vehicles	150 (60-32-58) Pin	SIGRTN VPWR VREF EOT	E17 B32 E14 E39

Test Steps		Results →	Action to Take
DY1	DTCS P0196 OR P1184: CHECK EOT SENSOR OPERATION		
	Note: Before continuing with this pinpoint, verify engine oil condition and level are within specification. • Run engine until engine temperature stabilizes. • Verify the upper radiator hose is hot and the cooling system is pressurized. • Run Self-Test • **Are DTCs P0196 or P1184 present?**	Yes → No →	GO to **DY2**. Engine temperature was not stabilized. REPAIR any other DTCs as necessary.
DY2	DTCS P0196, P0197, P0198, P1184 OR P0298: CHECK TEMPERATURE SENSOR SIGNAL		
	• Key ON Engine OFF. • Access the PCM-EOT_V PID using a scan tool. • **Is the Voltage below 0.3 V?**	Yes → No →	GO to **DY3**. GO to **DY5**.
DY3	SIMULATE OPPOSITE SIGNAL TO PCM		
	• Key ON Engine OFF. • EOT Sensor connector disconnected. • Access the PCM-EOT_V PID using a scan tool. • **Is the Voltage above 4.2 V?**	Yes → No →	INSTALL a new EOT sensor. GO to **DY4**.

Engine Oil Temperature (EOT) Sensor — DY

Test Steps	Results →	Action to Take
DY4 CHECK SENSOR SIGNAL FOR SHORT TO GROUND		
• PCM connector disconnected. • Measure the Resistance between: **(+)EOT Sensor Connector, Harness Side**: EOT — **(-)EOT Sensor Connector, Harness Side**: SIGRTN • Measure the Resistance between: **(+)EOT Sensor Connector, Harness Side**: EOT — **(-)Vehicle battery**: Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR short circuit.
DY5 CHECK FOR HIGH EOT SENSOR VOLTAGE		
• Access the PCM-EOT_V PID using a scan tool. • **Is the Voltage above 4.2 V?**	Yes → No →	GO to **DY6**. GO to **DY10**.
DY6 CHECK EOT CIRCUIT VOLTAGE		
• EOT Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)EOT Sensor Connector, Harness Side**: EOT — **(-)EOT Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage above 4.2 V?**	Yes → No →	KEY OFF. GO to **DY7**. KEY OFF. GO to **DY9**.
DY7 CHECK RESISTANCE OF EOT SENSOR WITH ENGINE OFF		
• EOT Sensor connector disconnected. • Measure the Resistance between: **(+)EOT Sensor Connector, Component Side**: EOT — **(-)EOT Sensor Connector, Component Side**: SIGRTN • REFER to the chart at the beginning of this test for resistance specifications. • **Is resistance within specification?**	Yes → No →	GO to **DY8**. INSTALL a new EOT sensor.

Engine Oil Temperature (EOT) Sensor — DY

Test Steps		Results →	Action to Take
DY8	CHECK SENSOR SIGNAL CIRCUIT FOR SHORTS TO PWR		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side / (-)PCM Connector, Harness Side: EOT — VREF EOT — VPWR • **Are the resistances above 10 KOhm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR short circuit.
DY9	CHECK SIGNAL AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side / (-)EOT Sensor Connector, Harness Side: EOT — EOT SIGRTN — SIGRTN • **Are the resistances below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM REPAIR open circuit.
DY10	INTERMITTENT CHECK		
	• Key ON Engine OFF. • Access the PCM-EOT_V PID using a scan tool. • While observing the PID, complete the following: — Tap on sensor to simulate road shock. — Wiggle the sensor connector. • **Is there a large change in the voltage reading?**	Yes → No →	KEY OFF. DISCONNECT and INSPECT connector. If OK, REPLACE Component. GO to **DY11**.
DY11	CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS		
	• Access the PCM-EOT_V PID using a scan tool. • While observing the PID, complete the following: — Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • **Is there a large change in the voltage reading?**	Yes → No →	ISOLATE fault REPAIR as necessary. GO to **DY12**.

Sub-tables:

DY8

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
EOT	VREF
EOT	VPWR

DY9

(+)PCM Connector, Harness Side	(-)EOT Sensor Connector, Harness Side
EOT	EOT
SIGRTN	SIGRTN

Engine Oil Temperature (EOT) Sensor — DY

Test Steps		Results →	Action to Take
DY12	CHECK RESISTANCE OF EOT SENSOR WITH ENGINE RUNNING		
	• Run engine until engine temperature stabilizes. • Verify the upper radiator hose is hot and the cooling system is pressurized. • Measure the Resistance between: (+)EOT Sensor Connector, Component Side: EOT — (-)EOT Sensor Connector, Component Side: SIGRTN • REFER to the chart at the beginning of this test for resistance specifications. • **Is resistance within specification for the given engine temperature?**	Yes → No →	Fault is not present at this time GO to **Z1**. INSTALL a new EOT sensor.
DY13	DTC P0298: ENGINE OIL OVER TEMPERATURE CONDITION		
	• Engine oil temperature protection strategy in the PCM has been activated. — CHECK for overheating condition and base engine concerns. • **Is there any overheating or base engine concerns?**	Yes → No →	ISOLATE fault. REPAIR as necessary. REFER to Workshop Manual, Section 303. GO to **DY14**.
DY14	CHECK FOR EOT SENSOR HARDWARE		
	• Engine oil temperature protection strategy in the PCM can be activated with or without an EOT sensor. • **Does the vehicle have a EOT sensor?**	Yes → No →	GO to **DY2**. GO to **DY15**.
DY15	IDENTIFY CUSTOMER DRIVING HABITS		
	• Identify customer driving habits. • Access Freeze Frame Data (if available) and record DTC malfunction conditions. • **Does the vehicle appear to have been driven in a improper transmission gear or at high rpm for extend period?**	Yes → No →	Advise customer improper transmission gear selection and high rpm for extend period will initialize the engine protection strategy. GO to **DY16**.
DY16	TYPE OF ENGINE COOLANT SENSOR		
	Note: When an oil temperature sensor is not present, the PCM uses an oil algorithm to infer actual temperature based on input from the engine temperature sensor. • **Is the vehicle equipped with CHT?**	Yes → No →	GO to **DL26**. GO to **DX21**.

Emission Compliance | EM

Note

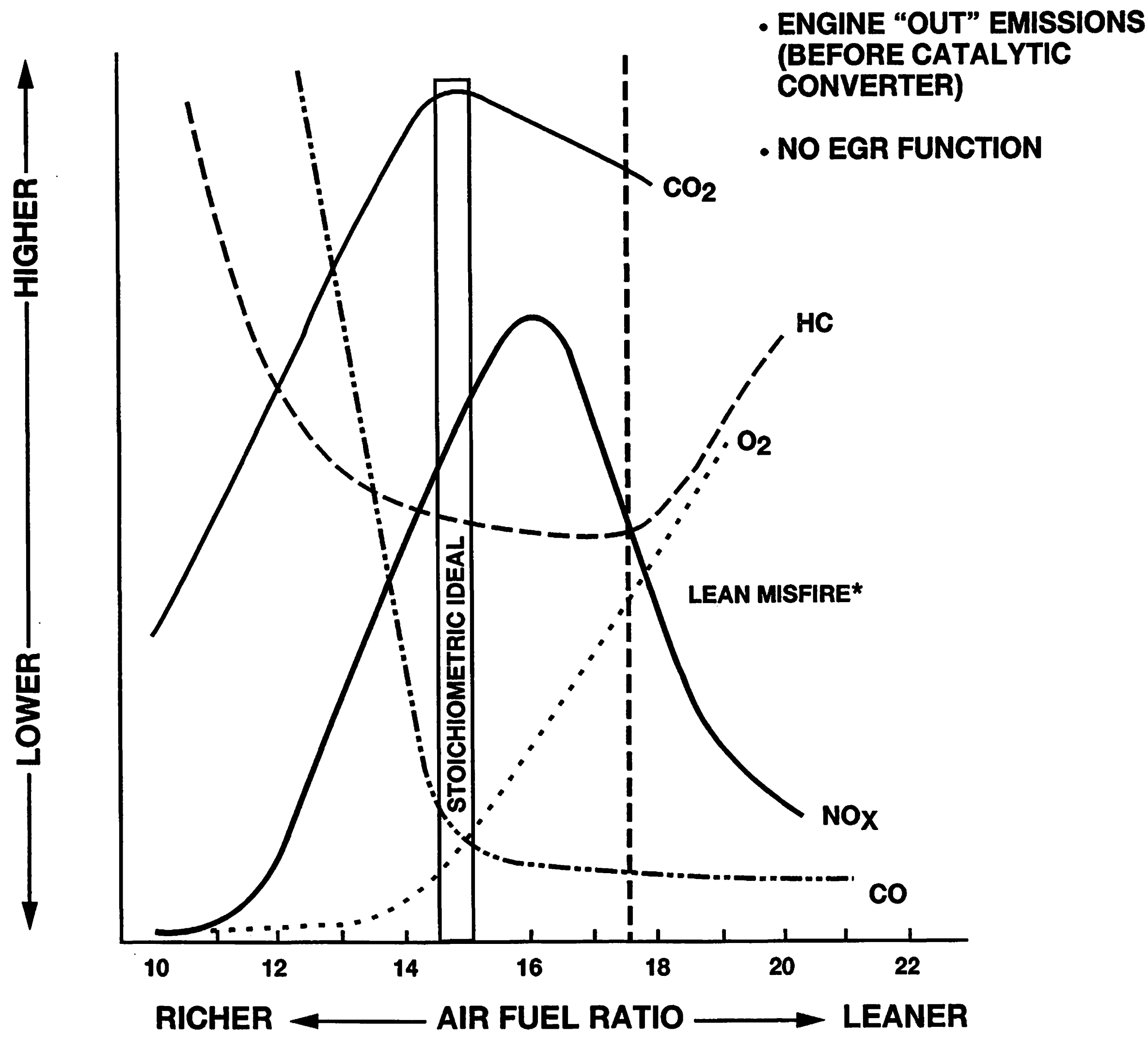
Canada and some states or metropolitan areas in the United States require periodic Emission, or I/M Tests. All Ford products have been designed to pass these tests. If a Ford product fails an I/M Test, it's probably that 1) the engine or catalyst temperature was not warm and stabilized before the test, or 2) the vehicle had idled excessively before the test.

If any emission components are replaced, perform the following before repeating the I/M Test procedure:

- RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).
- To relearn some basic Adaptive Learning (trim) values, run the engine at 2500 rpm for one minute and idle engine for two minutes.

Emission Compliance	**EM**

Exhaust Gas Analysis Chart



* EXACT AIR FUEL RATIO VARIES DEPENDING ON ENGINE

AA0215-A

Verifying an Excessive Grams Per Mile (GPM) Indication Using a Parts Per Million (PPM) Reading.

For the vehicle's gas reading(s) that is excessive, compare the actual GPM reading to the gas cutpoint level needed to pass testing. This will give an indication of how much the PPM reading will have to be reduced (if the actual reading is twice the cutpoint, the baseline reading will have to be cut in half or more).

Emission Compliance — EM

Example:

- The actual HC produced by a vehicle was 1.6 GPM. The cutpoint for HC in this example is 0.8 GPM. The actual reading is twice the cutpoint.
- The HC reading obtained for the same vehicle during the baseline drive averages 440 PPM. In order for this vehicle to pass the I/M test, the HC reading from the verification trip must be at least half of the baseline reading, or an average of 220 PPM or less.
- This method only gives a general idea of how much the PPM reading needs to be reduced in order for the vehicle to pass an I/M test that calculates GPM. This test is not exact. Experience will still have to be used to determine if the emission readings have been reduced enough for the vehicle to pass the I/M test.

Test Steps		Results →	Action to Take
EM1	ANALYZE I/M TEST REPORT		
	• Analyze I/M test report for data entry errors. — MODEL. — Model Year. — Correct calibration, if included on report. — Correct test weight, if included on report (this number will be less than the vehicle's GVW). Analyze I/M test report results. — Identify high and low gas readings. — For reports that include a drive trace, identify during which mode the gas(es) failed. Be aware that if all gases were high early then decreased, the catalyst may have been cool when testing began. • **Has the I/M test report been analyzed.**	Yes → No →	GO to **EM2**. Repeat test
EM2	EVAP SYSTEM LEAK OR PURGE FLOW TEST (IF THESE TESTS WERE PERFORMED)		
	• **Did the vehicle fail only an EVAP system leak or Purge Flow test (if these tests were performed).**	Yes → No →	EVAP concern only GO to **EM22**. GO to **EM3**.

Emission Compliance — EM

	Test Steps	Results →	Action to Take
EM3	BASELINE VEHICLES		
	Note: Baselining the vehicle's exhaust gas readings is important so the baseline readings can be used for comparison after any repair is made. • Baseline vehicle using an exhaust gas analyzer. If the vehicle must be driven, be certain any baseline drive used is repeatable. The same drive cycle will be used to verify any repair. • During the baseline, check for any related symptoms that may be present (such as drivability, transmission shifting or exhaust smoke concerns). • **Has the vehicle been baselined?**	Yes → No →	GO to **EM4**. Repeat test
EM4	SYMPTOM CHECKS		
	• **Are any of the following symptoms present?** — **Transmission Concerns.** — **Idle Concerns.** — **Driveability Concerns.** — **Exhaust smoke.** — **Cooling System Concerns.**	Yes → No →	Go to section 3 (begin at step 1: PCM Quick Test) for direction to repair the additional symptom. Also refer to the Exhaust Gas Analysis Chart at the beginning of this pinpoint test. After any repair, GO to **EM26**. GO to **EM5**.
EM5	PRELIMINARY CHECKS		
	• Perform these checks. — Vacuum lines (leak/blockage). — Electrical connections. — proper scheduled maintenance. — Ford authorized emission controls and components installed on vehicle. — Intake air tube and air cleaner concerns (such as obstructions, leaks or dirty air cleaner element). • **Are all Test checks ok?**	Yes → No →	GO to **EM6**. REPAIR as necessary. After any repair, GO to **EM26**.
EM6	PERFORM PCM QUICK TEST		
	• Complete PCM Quick Test to access any PCM DTCs (REFER to section 3, Step 1: PCM Quick Test (for Test Step procedure only)). • **Is a fault indicated?**	Yes → No →	Follow section 3 Quick Test direction. After any repair, GO to **EM26**. GO to **EM7**.

Emission Compliance — EM

Test Steps		Results →	Action to Take
EM7	EXCESSIVE CARBON MONOXIDE (CO) LEVELS?		
	• **Did the vehicle have excessive Carbon Monoxide (CO) levels?**	Yes →	Excessive CO levels indicate Engine Running Rich GO to **EM10**.
		No →	GO to **EM8**.
EM8	EXCESSIVE HYDROCARBON HC LEVELS?		
	• **Did the vehicle have excessive Hydrocarbon HC levels?**	Yes →	Excessive HC with low to normal CO levels indicate Engine Running Lean GO to **EM16**.
		No →	GO to **EM9**.
EM9	EXCESSIVE OXIDES OF NITROGEN NOX LEVELS?		
	• **Did the vehicle have excessive Oxides of Nitrogen NOx levels?**	Yes →	GO to **EM20**.
		No →	Verify test step results
EM10	HIGH CO LEVELS: CHECK HC LEVELS		
	• **Did the vehicle have excessive Hydrocarbon HC levels?**	Yes →	CHECK for issues with Engine Running Rich & Incomplete Combustion GO to **EM11**.
		No →	GO to **EM12**.
EM11	CHECK SECONDARY IGNITION SYSTEM		
	• FOLLOW Pinpoint Test direction in test step JB1. • **Is a fault indicated?**	Yes →	Follow Pinpoint Test direction. After any repair, GO to **EM26**.
		No →	GO to **EM12**.
EM12	CHECK FUEL DELIVERY SYSTEM FOR CONCERNS (SUCH AS HIGH FUEL PRESSURE AND ABILITY TO HOLD PRESSURE)		
	• For natural gas applications: — FOLLOW Pinpoint Test direction in test step HB1. • All Others: — FOLLOW Pinpoint Test direction in test step HC1. • **Is a fault indicated?**	Yes →	Follow Pinpoint Test direction. After any repair, GO to **EM26**.
		No →	GO to **EM13**.

Emission Compliance | EM

Test Steps		Results →	Action to Take
EM13	CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)		
	• FOLLOW Pinpoint Test direction in test step HG1. • **Is a fault indicated?**	Yes →	Follow Pinpoint Test direction. After any repair, GO to **EM26**.
		No →	GO to **EM14**.
EM14	CHECK EXHAUST SYSTEM		
	• FOLLOW Pinpoint Test direction in test step HF1. • **Is a fault indicated?**	Yes →	Follow Pinpoint Test direction. After any repair, GO to **EM26**.
		No →	GO to **EM15**.
EM15	CHECK BASE ENGINE		
	• Go to Engine System Section 303 in the Workshop Manual to check for proper compression, valvetrain, camshaft, etc. • **Is a fault indicated?**	Yes →	Refer to the appropriate workshop manual. Repair as required. After any repair, GO to **EM26**.
		No →	GO to **EM27**.
EM16	HIGH HC WITH NORMAL TO LOW CO LEVEL		
	• CHECK fuel delivery system for concerns : — For natural gas applications: FOLLOW Pinpoint Test direction in test step HB1. — All Others: FOLLOW Pinpoint Test direction in test step HC1. • **Is a fault indicated?**	Yes →	Follow Pinpoint Test direction. After any repair, GO to **EM26**.
		No →	GO to **EM17**.
EM17	CHECK SECONDARY IGNITION		
	• FOLLOW Pinpoint Test direction in test step JB1. • **Is a fault indicated?**	Yes →	Follow Pinpoint Test direction. After any repair, GO to **EM26**.
		No →	GO to **EM18**.
EM18	CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)		
	• FOLLOW Pinpoint Test direction in test step HG1. • **Is a fault indicated?**	Yes →	Follow Pinpoint Test direction. After any repair, GO to **EM26**.
		No →	GO to **EM19**.

Emission Compliance | EM

Test Steps		Results →	Action to Take
EM19	CHECK BASE ENGINE		
	• Go to Engine System Section 303 in the Workshop Manual to check base engine for concerns such as intake manifold leaks, improper compression, valvetrain or camshaft damage. • **Is a fault indicated?**	Yes →	Refer to the appropriate workshop manual. Repair as required. After any repair, GO to **EM26**.
		No →	GO to **EM27**.
EM20	HIGH NOX WITH NORMAL TO LOW HC AND CO LEVELS: CHECK BASE ENGINE		
	• Go to the Engine System Section 303 in the Workshop Manual to check for base engine concerns such as excessive carbon build up in the combustion chamber. • **Is a fault indicated?**	Yes →	Refer to the appropriate workshop manual. Repair as necessary. After any repair, GO to **EM26**.
		No →	GO to **EM21**.
EM21	ADDITIONAL CHECKS		
	• Additional Checks. — transmission torque converter clutch operation. — Cooling System Concerns (such as aftermarket front fascia covering intake air, intake air system modifications). — Engine Running Lean (concerns such as vacuum leaks, low fuel pressure). • **Are all checks ok?**	Yes →	GO to **EM27**.
		No →	Repair as necessary. After any repair, GO to **EM26**.
EM22	EVAP SYSTEM CONCERN: PRELIMINARY CHECKS		
	• Analyze I/M test report to determine when concern is present. Attempt to verify concern. • Preliminary Checks. — Fuel filler cap. — EVAP system lines/hoses (check for proper connections, damage or blockage). — Fuel vapor storage canister damage. • **Are all checks ok?**	Yes →	GO to **EM23**.
		No →	Repair as necessary. After any repair, GO to **EM25**.
EM23	PERFORM PCM QUICK TEST		
	• Complete PCM Quick Test to access any PCM DTCs (REFER to section 3, Step 1: PCM Quick Test (for Test Step procedure only)). • **Is a fault indicated?**	Yes →	Follow section 3 Quick Test direction. After any repair, GO to **EM25**.
		No →	GO to **EM24**.

Emission Compliance

EM

Test Steps		Results →	Action to Take
EM24	EVAP SYSTEM CHECK		
	• Go to EVAP Section 303 in the Workshop Manual to check for system leaks. • **Is a fault indicated?**	Yes →	Refer to the appropriate workshop manual. REPAIR as necessary. After any repair, GO to **EM25**.
		No →	Verify test step results If all test steps are OK, GO to Z1. Otherwise, return to Section 3 to repair any additional symptoms. After any repair, GO to **EM25**.
EM25	EVAP SYSTEM REPAIR VERIFICATION		
	• Vehicle repair performed. • RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset). Be aware that this will set DTC P1000 (and reset the On-Board System Readiness Test). • To relearn some basic Adaptive Learning (trim) values, run the engine at 2500 rpm for one minute and idle engine for two minutes. • Complete PCM Quick Test to access any PCM DTCs (REFER to section 3, Step 1: PCM Quick Test (for Test Step procedure only)). • Perform the EVAP system leak test and flow check. • **Does the vehicle pass the EVAP system leak test and flow check?**	Yes →	Save any repair documentation that may be required by local/federal laws. Return the vehicle to the customer
		No →	Original concern not repaired, or another concern exists. GO to **EM1**.

Emission Compliance | EM

Test Steps		Results →	Action to Take
EM26	REPAIR AND VERIFICATION		
	• Vehicle repair performed. • RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset). Be aware that this will set DTC P1000 (and reset the On-Board System Readiness Test). • To relearn some basic Adaptive Learning (trim) values, run the engine at 2500 rpm for one minute and idle engine for two minutes. • Complete PCM Quick Test to access any PCM DTCs (REFER to section 3, Step 1: PCM Quick Test (for Test Step procedure only)). — REPAIR any other DTCs as necessary. • Perform the baseline test using the exhaust gas analyzer. Note: If vehicle needs to be driven for the baseline, it may be necessary to drive the vehicle first up to 8 Km(5 miles) to relearn some Additional Adaptive Learning (trim) values. Also, during the baseline be certain to use the same drive mode that was used for the original baseline test. • For I/M 240 Emission testing areas: — REFER to the beginning of this pinpoint test for information on verifying an excessive Grams Per Mile indication using a Parts Per Million (PPM) reading. • All Others (original gas concentrations reported in Parts Per Million): — Verify gas levels are within acceptable range. • **Are all gases within the acceptable range?**	Yes → No →	Save any repair documentation that may be required by local/federal laws. Return the vehicle to the customer Gas level is still high, or another gas level is above the acceptable range. GO to **EM1**.

Emission Compliance | EM

Test Steps	Results →	Action to Take
EM27 CATALYST DELTA TEMPERATURE TEST		
• All previous testing as indicated completed. • Disable the AIR system, if equipped. • Run the engine for 2 minutes at 2500 rpm to heat the exhaust system. • Key OFF. • Disconnect and ground one spark plug wire from each cylinder bank (for Coil On Plug applications, disconnect coil connector). • Run engine at approximately 1000 RPM. • Disconnect the IAC valve (maintain (1000 rpm)). • Measure the surface temperature of both the inlet and outlet of each under-body catalytic converter using an infrared temperature probe. • Compare the difference in temperature between the inlet and outlet readings of each under-body catalytic converter. • **Does each catalytic converter have a difference of more than 28°C (50°F) between its inlet and outlet reading?**	Yes →	The catalytic converter(s) is operating correctly. Reconnect the spark plug wire(s), the IAC, and the AIR system (if equipped). Complete PCM Reset to clear DTCs. Verify test step results If all test steps are OK, GO to Z1. Otherwise, return to Section 3 to repair any additional symptoms. After any repair, GO to **EM26**.
	No →	For the catalytic converter(s) that has less than 28 °C(50 °F) difference, testing indicates the catalytic converter(s) is not working. REPEAT test to verify results. If the temperature difference is still less than required, REPLACE the catalytic converter. RESTORE vehicle After any repair, GO to **EM26**.

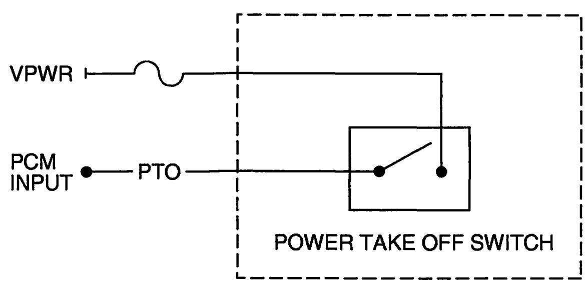
Power Take Off	FB

Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuit(s): PTO.
- PTO Switch.
- Powertrain control module (PCM) (12A650).

Typical PTO wiring diagram.



PTO SWITCH IS AFTERMARKET INSTALLED, DETAILS MAY VARY
A0081080

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
104 Pin	PTO	4

Power Take Off

FB

Test Steps		Results →	Action to Take
FB1	MIL ON: CHECK PTO PID		
	• Key ON Engine OFF. • Access the PCM-PTO PID using a scan tool. • **Is the PTO PID available and displaying on or off?**	Yes → No →	GO to **FB2**. GO to **FB8**.
FB2	CHECK PTO CIRCUIT WITH SCAN TOOL		
	Note: This step requires operating the PTO component. REFER to aftermarket manufacturer for PTO operating instructions. Follow all safety precautions. • Key ON Engine RUN. • Access the PCM-PTO PID using a scan tool. • Cycle PTO switch/actuator while viewing PTO PID. • **Did the PTO PID cycle on and off?**	Yes → No →	KEY OFF. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. KEY OFF. GO to **FB3**.
FB3	PTO PID DOES NOT CYCLE: CHECK FOR DEFECTIVE PTO SWITCH		
	• PTO connector disconnected. • Measure the resistance across PTO switch while in the ON and then OFF position. • **Is resistance less than 5 ohms with the PTO switch in the ON position and greater than 10,000 ohms with the PTO switch in the OFF position?**	Yes → No →	GO to **FB4**. REPAIR or REPLACE PTO switch. REFER to aftermarket component manufacturer for service information.
FB4	CHECK PTO CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)PCM Connector, Harness Side** — **(-)Vehicle battery** PTO - Pin 4 — Negative post • **Is the Voltage below 1 V?**	Yes → No →	GO to **FB5**. KEY OFF. REPAIR short circuit and retest vehicle.
FB5	CHECK PTO CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • Scan tool connector disconnected. • PTO connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** — **(-)** PTO - Pin 4 — Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **FB6**. REPAIR short circuit and retest vehicle.

Power Take Off FB

FB6 CHECK PTO CIRCUIT FROM SWITCH TO PCM

- PCM connector connected.
- Add jumper wire between the points described below:

Point A Vehicle battery	Point B PTO Connector, Harness Side
Positive post	PTO

- Key ON Engine OFF.
- Access the PCM-PTO PID using a scan tool.
- **Does PTO PID indicate ON with jumper inserted and OFF with jumper removed?**

Results →	Action to Take
Yes →	KEY OFF. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
No →	KEY OFF. GO to **FB7**.

FB7 CHECK PTO CIRCUIT RESISTANCE

- PCM connector disconnected.
- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PTO Connector, Harness Side
PTO - Pin 4	PTO

- **Is the Resistance below 5 Ohm?**

Results →	Action to Take
Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
No →	REPAIR open circuit and retest vehicle.

FB8 PERFORM PCM QUICK TEST

Note: The following steps are used for PTO diagnostics when the vehicle does not support the PTO circuit or PID.

- Complete PCM Quick Test to access any PCM DTCs (REFER to section 3, Step 1: PCM Quick Test (for Test Step procedure only)).
- **Are any KOEO or KOER DTCs present?**

Results →	Action to Take
Yes →	KEY OFF. Follow section 3 Quick Test direction.
No →	GO to **FB9**.

FB9 COMPLETE AN OBD DRIVE CYCLE WITH PTO DISENGAGED

Note: This step will determine if the PTO operation resulted in any Continuous Memory DTCs stored due to extra load of the PTO component on the engine.

- Complete PCM Reset.

  Note: Make sure the PTO is disengaged.
- Complete an OBD Drive Cycle. (REFER to Section 2, Drive Cycles.).
- Retrieve Continuous Memory DTCs. (REFER to Section 2, Quick Test - Continuous Memory Self-Test.).
- **Are any Continuous Memory DTCs stored?**

Results →	Action to Take
Yes →	KEY OFF. Go to section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, to address the first Continuous Memory DTC.
No →	KEY OFF. MIL can be caused by engaging the PTO, creating a load on the engine, while the OBD monitors were running. If symptom is intermittent, GO to Z1.

Brake Pedal Inputs | FD

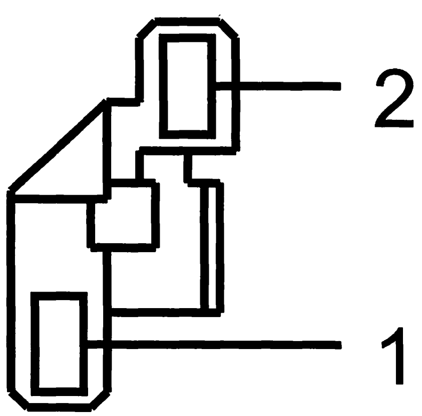
Note

This Pinpoint Test is intended to diagnose the following:

- Brake pedal position (BPP) switch.
- Brake pedal applied (BPA).
- Harness circuits: B+, BPP, BPA.
- Powertrain control module (PCM) (12A650).

Brake Pedal Position (BPP) Switch Connector

A



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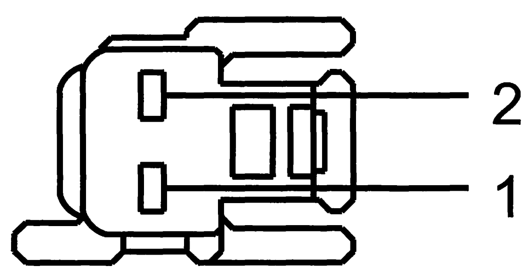

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Brake Pedal Inputs	FD

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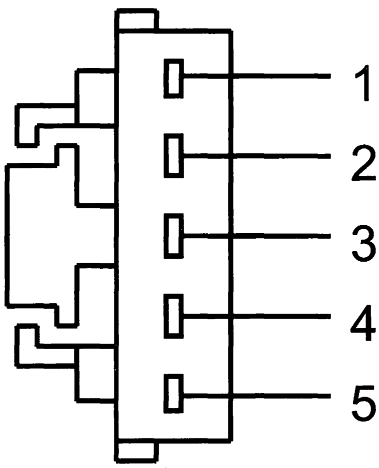

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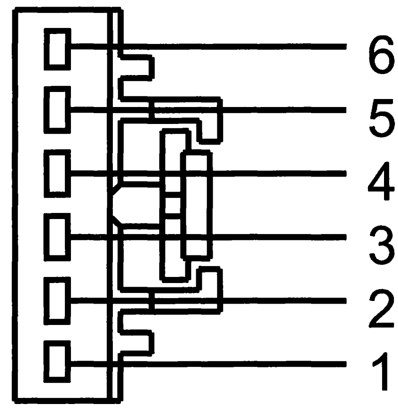

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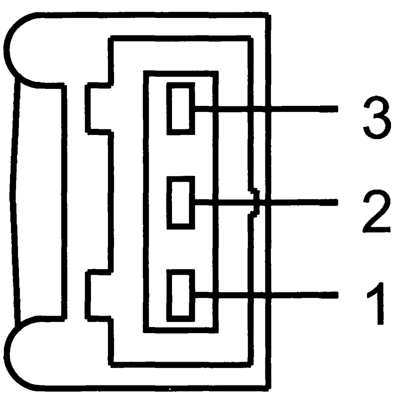

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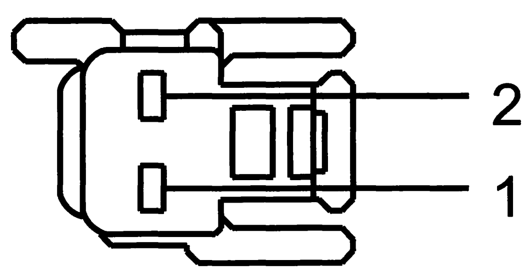

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Brake Pedal Inputs

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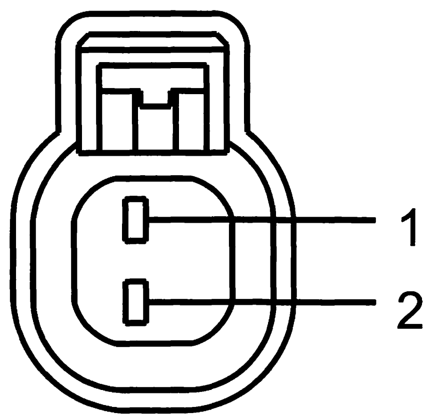

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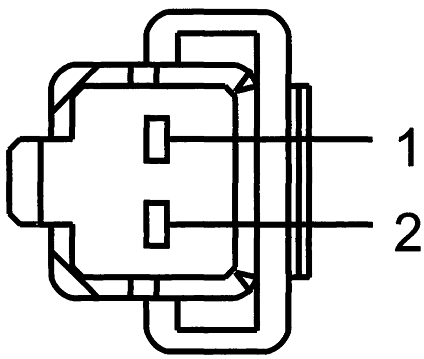
Vehicle	Connector	Circuit	Pin
Crown Victoria, Grand Marquis, Marauder, Mustang	A	BPP B+	1 2
E-Series	A	BPP B+	2 1
Escape	B	BPP B+	1 2
Excursion, Explorer SportTrac, F-Series Super Duty, Ranger	C	BPP GND B+	4 5 3
F-150	D	BPP B+	6 5
F-150 Heritage	C	BPP B+	2 1
Focus	E	BPP B+	1 3
LS, Thunderbird	F	BPP B+	2 1
All other vehicles	G	BPP B+	1 2

Brake Pedal Inputs | FD

Brake Pressure Applied (BPA) Switch Connector

A



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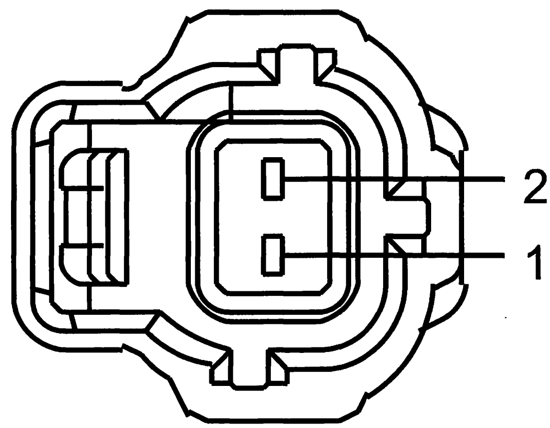

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Vehicle	Connector	Circuit	Pin
F-150	A	B+ BPA	2 1
All other vehicles	B	B+ BPA	2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	BPP	B40
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	BPP	B8
F-150	190 Pin	BPA BPP	B47 B46
All other vehicles	104 Pin	BPP	92

Brake Pedal Inputs — FD

Test Steps		Results →	Action to Take
FD1	KOER DTCS P0703 AND P1703: VERIFY BRAKE PEDAL WAS APPLIED		
	• **Was the brake pedal applied and released during KOER Self-Test?**	Yes →	GO to **FD3**.
		No →	Rerun KOER Self-Test. Apply and release the brake pedal during the KOER test.
FD2	KOEO DTC P0703, P1703: VERIFY BRAKE PEDAL WAS NOT APPLIED		
	• **Was the brake pedal applied during KOEO Self-Test?**	Yes →	Rerun KOEO Self-Test. Avoid applying the brake pedal during the KOEO test.
		No →	GO to **FD3**.
FD3	DTCS P0703, P1572 AND P1703: CHECK OPERATION OF STOPLAMPS		
	Note: CHECK the condition of the stoplamp bulbs before starting this test. • Key ON Engine OFF. • Apply and release the brake pedal several times and observe stoplamp operation. • **Do the stoplamps operate normally?**	Yes →	GO to **FD6**.
		No →	GO to **FD4**.
FD4	CHECK IF APPLICATION USES STABILITY ASSIST		
	• For the following vehicles with Stability Assist: — Focus. — Lincoln LS6 and LS8. — Thunderbird. — Aviator and Explorer/Mountaineer. • **Is vehicle equipped with stability assist and listed above?**	Yes →	REFER to Exterior Lighting, Section 417 in the Workshop Manual for further stoplamp diagnosis.
		No →	GO to **FD5**.
FD5	CHECK FOR STOPLAMPS ALWAYS ON OR ALWAYS OFF		
	• Apply and release the brake pedal several times and observe stoplamp operation. Note: This step addresses always on or always off operation. For intermittent operation. GO to **Z1**. • **Are the stoplamps always ON?**	Yes →	GO to **FD14**.
		No →	GO to **FD9**.
FD6	CHECK FOR BPP PID AVAILABILITY		
	• Scan tool connector connected. • Access the PCM-BPP/BOO PID using a scan tool. • **Is BPP PID available?**	Yes →	GO to **FD7**.
		No →	GO to **FD23**.

Brake Pedal Inputs — FD

Test Steps		Results →	Action to Take
FD7	CHECK FOR PCM BPP PID CYCLING		
	• Apply and release the brake pedal several times while viewing the BPP PID. • **Does the BPP PID cycle ON and OFF?**	Yes → No →	GO to **FD8**. GO to **FD9**.
FD8	DTC P1572 PRESENT		
	• **Is DTC P1572 present?**	Yes → No →	GO to **FD23**. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.
FD9	CHECK B+ VOLTAGE TO BPP SWITCH		
	• BPP Switch connector disconnected. • Measure the Voltage between: **(+)BPP Switch Connector, Harness Side**: B+ — **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **FD10**. VERIFY integrity of fuse for B+ to BPP switch. If OK, REPAIR open in B+ circuit. If fuse is damaged, check B+ circuit, BPP circuit, stoplamp PWR circuit and any other associated circuits (REFER to Wiring Diagrams) for short to ground. REPAIR as necessary.
FD10	CHECK APPLICATION FOR GROUND TO THE BPP SWITCH		
	• The following vehicles have a ground to the BPP switch. — F-Series Super Duty. — Excursion. • **Is vehicle listed above?**	Yes → No →	GO to **FD11**. GO to **FD13**.
FD11	CHECK GROUND TO BPP SWITCH		
	• Measure the Resistance between: **(+)BPP Switch Connector, Harness Side**: GND — **(-)**: Ground • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **FD12**. REPAIR open circuit.
FD12	VERIFY INTEGRITY OF BPP SWITCH - NORMALLY CLOSED SWITCH CONTACTS		
	• Do not apply break pedal while observing resistance measurement. • Measure the Resistance between: **(+)BPP Switch Connector, Harness Side**: GND — **(-)BPP Switch Connector, Harness Side**: BPP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **FD13**. INSTALL a new BPP switch.

Brake Pedal Inputs	FD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>FD13</td><td>VERIFY INTEGRITY OF BPP SWITCH - NORMALLY OPEN SWITCH CONTACTS</td><td></td><td></td></tr>
<tr><td></td><td>
Apply the brake pedal and observe resistance measurement.
Measure the Resistance between:
<table><tr><th>(+)BPP Switch Connector, Component Side</th><th>(-)BPP Switch Connector, Component Side</th></tr><tr><td>B+</td><td>BPP</td></tr></table>
Is the Resistance below 5 Ohm?
</td><td>Yes →

No →</td><td>REPAIR open circuit.
Between BPP switch and stoplamp ground.

INSTALL a new BPP switch.</td></tr>
<tr><td>FD14</td><td>VERIFY BPP SWITCH IS NOT ALWAYS CLOSED</td><td></td><td></td></tr>
<tr><td></td><td>BPP Switch connector disconnected.
Key ON Engine OFF.
Are stoplamps still on?</td><td>Yes →

No →</td><td>KEY OFF.
GO to FD15.

Verify proper installation of BPP switch.
If OK, install a new BPP switch.</td></tr>
<tr><td>FD15</td><td>CHECK FOR SHORT TO POWER IN PCM</td><td></td><td></td></tr>
<tr><td></td><td>PCM connector disconnected.
Key ON Engine OFF.
Are stoplamps still on?</td><td>Yes →
No →</td><td>GO to FD16.
KEY OFF. INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).</td></tr>
<tr><td>FD16</td><td>CHECK STOPLAMP CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td></td><td></td></tr>
<tr><td></td><td>One at a time, disconnect all modules associated with the stoplamp circuit (REFER to Wiring Diagram Manual). After disconnecting each module, turn key on and observe stoplamps. Turn key OFF. Repeat until each associated module has been disconnected or stoplamps turn off.
Did stoplamps turn off when any of the modules were disconnected?</td><td>Yes →

No →</td><td>REFER to the Workshop Manual for further diagnosis of appropriate module.

REPAIR short circuit to PWR.</td></tr>
<tr><td>FD17</td><td>CHECK IF APPLICATION USES STABILITY ASSIST</td><td></td><td></td></tr>
<tr><td></td><td>For the following vehicles with Stability Assist:
— Focus.
— Lincoln LS6 and LS8.
— Thunderbird.
— Aviator and Explorer/Mountaineer.
Is vehicle equipped with stability assist and listed above?</td><td>Yes →
No →</td><td>GO to FD18.
GO to FD19.</td></tr>
</table>

Brake Pedal Inputs — FD

Test Steps	Results →	Action to Take
FD18 CHECK FOR BPP CIRCUIT CYCLING		
• PCM connector disconnected. • Apply and release the brake pedal and observe voltage measurement. • Measure the Voltage between:	Yes →	GO to **FD20**.
	No →	KEY OFF. REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)
BPP	Ground

• **Does the voltage cycle?**

Test Steps	Results →	Action to Take
FD19 CHECK FOR BPP CIRCUIT CYCLING		
• PCM connector disconnected. • Apply and release the brake pedal and observe voltage measurement. • Measure the Voltage between:	Yes →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
	No →	KEY OFF. REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)
BPP	Ground

• **Does the voltage cycle?**

Test Steps	Results →	Action to Take
FD20 CHECK FOR A BPA CIRCUIT CYCLING		
• PCM connector disconnected. • Apply and release the brake pedal and observe voltage measurement. • Measure the Voltage between:	Yes →	GO to **FD25**.
	No →	GO to **FD21**.

(+)PCM Connector, Harness Side	(-)
BPA	Ground

• **Does the voltage cycle?**

Test Steps	Results →	Action to Take
FD21 CHECK BPA CIRCUIT FOR OPEN IN HARNESS		
• Disconnect BPA deactivator switch. • Measure the Resistance between:	Yes →	GO to **FD22**.
	No →	REPAIR open circuit.

(+)BPA Switch Connector, Harness Side	(-)PCM Connector, Harness Side
BPA	BPA

• **Is the Resistance below 5 Ohm?**

Test Steps	Results →	Action to Take
FD22 CHECK BPA CIRCUIT FOR POWER		
• Measure the Voltage between:	Yes →	KEY OFF. INSTALL a new BPA switch.
	No →	KEY OFF. REPAIR open circuit.

(+)BPA Switch Connector, Harness Side	(-)
B+	Ground

• **Is the Voltage above 10.5 V?**

Brake Pedal Inputs | FD

Test Steps		Results	Action to Take
FD23	CHECK FOR BPA PID AVAILABILITY		
	• Scan tool connector connected. • Access the PCM-BPA PID using a scan tool. • **Is BPA PID available?**	Yes → No →	GO to **FD24**. GO to **FD17**.
FD24	CHECK FOR PCM BPA SWITCH PID CYCLING		
	• Key ON Engine RUN. • Access the PCM-BPA PID using a scan tool. • Apply and release the brake pedal several times while viewing the BPA PID. • **Does the BPA PID cycle ON and OFF?**	Yes → No →	KEY OFF. GO to **FD19**. GO to **FD20**.
FD25	BPP AND BPA RATIONALITY CHECK		
	• Reconnect all disconnected components. • CLEAR the DTCs. • Key ON Engine RUN. • Apply and release break pedal several times. • Retrieve Continuous Memory DTCs • **Is DTC P1572 present?**	Yes → No →	CHECK for misadjusted brake switch (BPP or BPA). Service as necessary. GO to **FD26**.
FD26	CHECK PCM FOR REOCCURRING BRAKE PEDAL DTCS		
	• Rerun KOER Self-Test. • CHECK Self-Test DTCs: • **Are DTCs P0703 or P1703 present?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). KEY OFF. Test Complete

Power steering pressure switch	FF

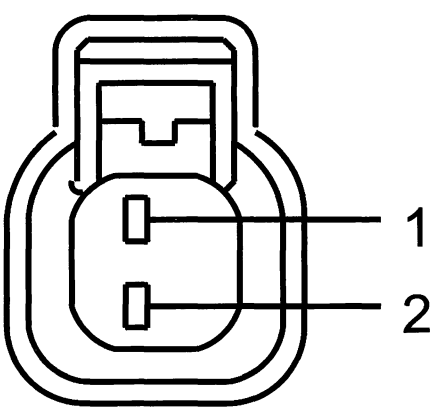
Note

This pinpoint test is intended to diagnose the following:

- Power steering pressure switch (3N824).
- Harness circuits: PSP and SIGRTN.
- Powertrain control module (PCM) (12A650).

Power steering pressure (PSP) Switch Connector

A



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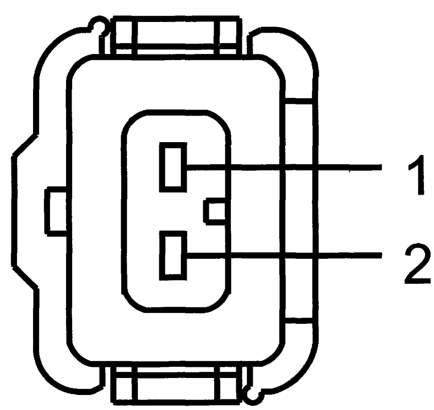
B



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Vehicle	Connector	Circuit	Pin
Focus	A	SIGRTN PSP	2 1
All other vehicles	B	SIGRTN PSP	1 2

The PSP & SIGRTN circuits may be reversed in the harness connector. REFER to the wiring diagram manual for more information.

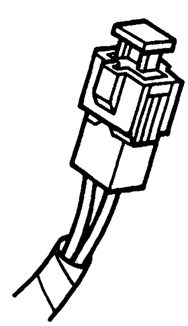
Power steering pressure switch	FF

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	SIGRTN PSP	B17 B37
Expedition	122 Pin	SIGRTN PSP	E25 B18
F-150	190 Pin	SIGRTN PSP	E58 E24
Focus 2.3L	150 (50-50-50) Pin	SIGRTN PSP	B41 B15
LS, Thunderbird	150 (60-32-58) Pin	SIGRTN PSP	E17 E5
All other vehicles	104 Pin	SIGRTN PSP	91 31

Shorting Bar for Harness Circuit without PSP Switch (typical)



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	Test Steps	Results →	Action to Take
FF1	KOER DTC P1650: DID YOU TURN THE STEERING WHEEL AT LEAST ONE HALF TURN WITHIN 20 SECONDS OF STARTING KOER SELF-TEST?		
	• **Did you turn the steering wheel at least one half turn within 20 seconds of starting KOER self-test?**	Yes → No →	GO to **FF2**. Rerun KOEO Self Test

Power steering pressure switch — FF

Test Steps		Results →	Action to Take
FF2	DTC P1650: CHECK PSP PID		
	• Key ON Engine RUN. • Access the PSP PID using a scan tool. • Turn steering wheel back and forth. • **Does the PID state change?**	Yes → No →	GO to **FF6**. KEY OFF. GO to **FF3**.
FF3	CHECK PSP CIRCUITS TO PSP SWITCH FOR CYCLING		
	• PSP Switch connector disconnected. • Key ON Engine OFF. • Access the PCM-PSP PID using a scan tool. • Add jumper wire between the points described below: **Point A PSP Switch Connector, Harness Side**: PSP — **Point B PSP Switch Connector, Harness Side**: SIGRTN • REMOVE jumper wire(s) • **Does the PID state change?**	Yes → No →	INSTALL a new PSP switch. KEY OFF. GO to **FF4**.
FF4	CHECK THE PSP & SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PSP Switch Connector, Harness Side**: PSP — PSP SIGRTN — SIGRTN • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **FF5**. REPAIR open circuit.
FF5	CHECK PSP CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS		
	• Measure the Resistance between: **(+)PSP Switch Connector, Harness Side** / **(-)**: PSP — Ground • Measure the Resistance between: **(+)PSP Switch Connector, Harness Side** / **(-)PSP Switch Connector, Harness Side**: PSP — SIGRTN • **Is the Resistance below 10 KOhm?**	Yes → No →	REPAIR short circuit. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Power steering pressure switch

FF

Test Steps		Results →	Action to Take
FF6	DTC P1651: CHECK PSP CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	Note: Be aware that P1651 could be set if vehicle is towed with the engine running, or if a power steering hydraulic concern was present. • Key ON Engine OFF. • Access the PCM-PSP PID using a scan tool. • CHECK for open circuits while performing the following (a fault will be indicated by a sudden change in the PSP PID): — Shake, wiggle, bend the PSP & SIGRTN circuit(s). — Lightly tap on the PSP (to simulate road shock). • PSP Switch connector disconnected. • CHECK PSP circuit for short to ground while performing the following: — Shake, wiggle, bend the PSP circuit(s). • **Is a fault indicated?**	Yes → No →	KEY OFF. ISOLATE fault Repair as necessary. KEY OFF. RECONNECT PSPS Unable to duplicate or identify fault at this time. GO to **Z1**.

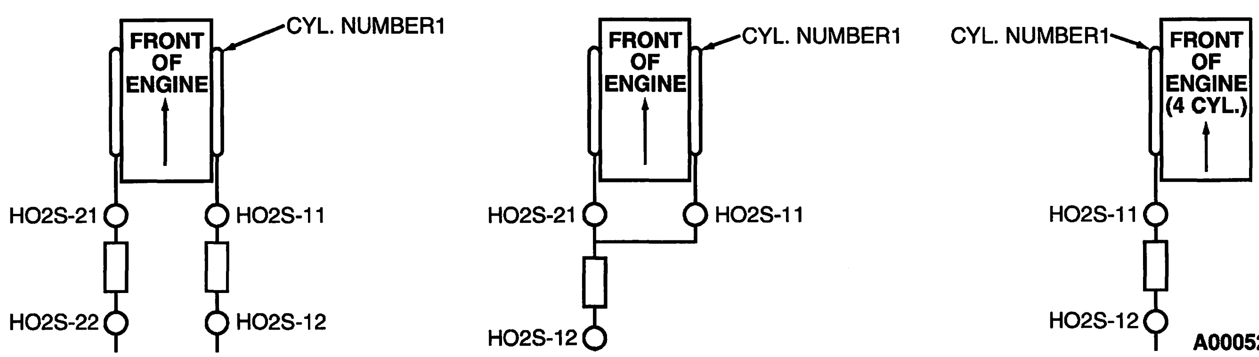
Fuel Control	H

Note

This Pinpoint Test is intended to diagnose the following:

- HO2S/O2S (9F472).
- HO2S/O2S (9G444).
- Fuel Injector(s) (9F593).
- Harness Circuits: HO2S, SIGRTN, VPWR, HO2S Heater & INJ 1 - 10.
- Vacuum Systems.
- Powertrain Control Module (PCM) (12A650).

HO2S LOCATION



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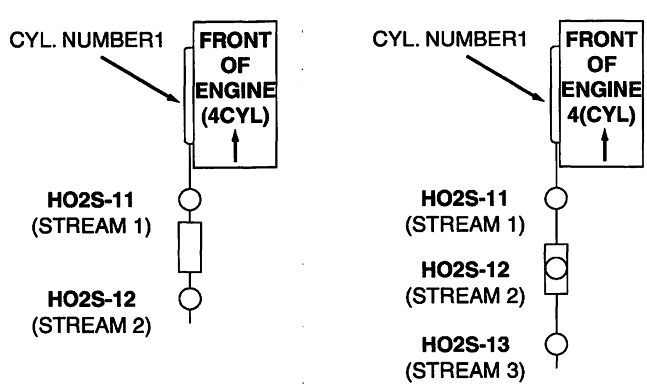
HO2S LOCATION



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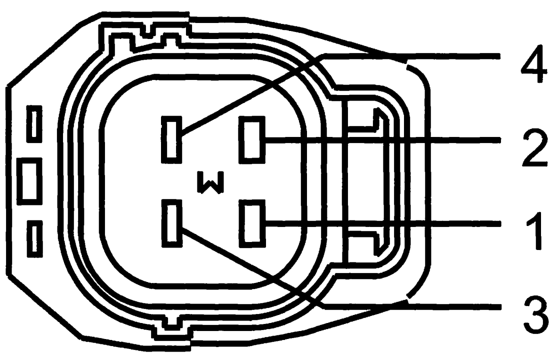
Fuel Control	H

Heated Exhaust Oxygen Sensor (HO2S) Sensor Connector

A



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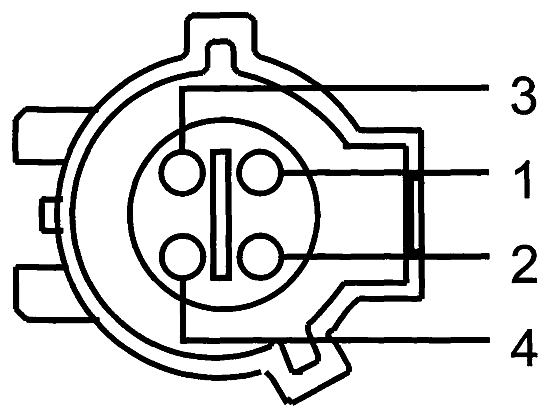
B



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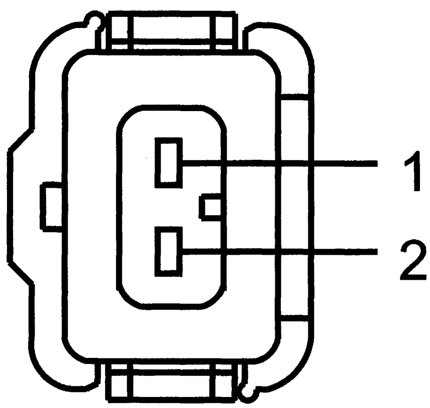
Vehicle	Connector	Circuit	Pin
Focus 2.3L	A	HO2S Heater SIGRTN VPWR HO2S Signal	2 3 1 4
All other vehicles	B	HO2S Heater SIGRTN VPWR HO2S Signal	1 4 2 3

Fuel Control	H

Injector (INJ) Connector

A



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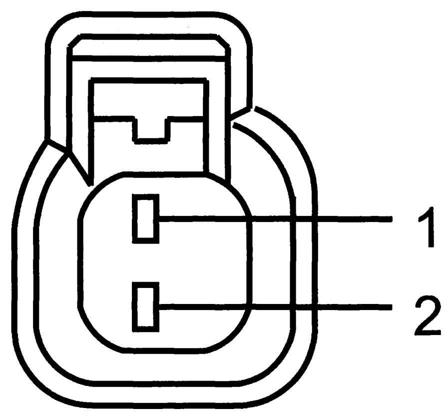
B



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Vehicle	Connector	Circuit	Pin
Injector Type A	A	VPWR INJ	2 1
Injector Type B	B	VPWR INJ	2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Fuel Control

H

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	HTR22	T16
		HTR21	E8
		HTR12	T15
		HTR11	E7
		HO2S22	T29
		HO2S21	E44
		HO2S12	T28
		HO2S11	E45
		INJ8	E37
		INJ7	E29
		INJ6	E21
		INJ5	E11
		INJ4	E32
		INJ3	E24
		INJ2	E14
		INJ1	E2
		VREF	E20
		VPWR	B32
		SIGRTN	E17
E-Series 6.8L	104 Pin	HTR22	96
		HTR21	94
		HTR12	95
		HTR11	93
		HO2S22	61
		HO2S21	87
		HO2S12	35
		HO2S11	60
		INJ10	42
		INJ9	68
		INJ8	98
		INJ7	72
		INJ6	99
		INJ5	73
		INJ4	100
		INJ3	74
		INJ2	101
		INJ1	75
		VREF	90
		VPWR	71
		SIGRTN	91
Escape 2.0L, Focus 2.0L	104 Pin	HTR12	100
		HTR11	93
		HO2S12	35
		HO2S11	60
		INJ4	95
		INJ3	20
		INJ2	96
		INJ1	70
		VREF	90
		VPWR	71
		SIGRTN	91

(Continued)

Fuel Control

H

Vehicle	Connector	Circuit	Pin
Escape 3.0L, F-150 Heritage 4.2L, Freestar / Monterey, Mustang 3.8L, Mustang 3.9L, Ranger 3.0L, Ranger 4.0L, Sable, Taurus	104 Pin	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	96 94 95 93 61 87 35 60 99 73 100 74 101 75 90 71 91
Excursion 5.4L, F-Series Super Duty 5.4L	104 Pin	HTR21 HTR12 HTR11 HO2S21 HO2S12 HO2S11 INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	94 95 93 87 35 60 98 72 99 73 100 74 101 75 90 71 91
Excursion 6.8L, F-Series Super Duty 6.8L	104 Pin	HTR21 HTR12 HTR11 HO2S21 HO2S12 HO2S11 INJ10 INJ9 INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	94 95 93 87 35 60 42 68 98 72 99 73 100 74 101 75 90 71 91

(Continued)

Fuel Control | H

Vehicle	Connector	Circuit	Pin
Expedition, Navigator	122 Pin	HTR22	T29
		HTR21	E20
		HTR12	T21
		HTR11	E21
		HO2S22	T2
		HO2S21	E27
		HO2S12	T3
		HO2S11	E26
		INJ8	E6
		INJ7	E5
		INJ6	E4
		INJ5	E3
		INJ4	E8
		INJ3	E7
		INJ2	E15
		INJ1	E14
		VREF	E36
		VPWR	B34
		SIGRTN	E25
Explorer SportTrac	104 Pin	HTR21	94
		HTR12	95
		HTR11	93
		HO2S21	87
		HO2S12	35
		HO2S11	60
		INJ6	99
		INJ5	73
		INJ4	100
		INJ3	74
		INJ2	101
		INJ1	75
		VREF	90
		VPWR	71
		SIGRTN	91
Explorer 4.0L, Mountaineer 4.0L	150 (50-50-50) Pin	HTR22	T48
		HTR21	E50
		HTR12	T47
		HTR11	E49
		HO2S22	T25
		HO2S21	E31
		HO2S12	T24
		HO2S11	E30
		INJ6	E9
		INJ5	E8
		INJ4	E5
		INJ3	E4
		INJ2	E3
		INJ1	E2
		VREF	E40
		VPWR	B35
		SIGRTN	E41

(Continued)

Fuel Control

H

Vehicle	Connector	Circuit	Pin
Explorer 4.6L, Mountaineer 4.6L	150 (50-50-50) Pin	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	T48 E50 T47 E49 T22 E31 T24 E30 E11 E10 E9 E8 E5 E4 E3 E2 E40 B35 E41
F-150	190 Pin	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	T12 E70 T1 E69 T21 E28 T22 E29 E38 E55 E37 E54 E36 E53 E35 E52 E57 B51 E58
Focus 2.3L	150 (50-50-50) Pin	HTR13 HTR12 HTR11 HO2S13 HO2S12 HO2S11 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	T48 T47 E49 T25 T24 E30 E5 E4 E3 E2 E40 B35 E41

(Continued)

Fuel Control H

Vehicle	Connector	Circuit	Pin
LS 3.0L	150 (60-32-58) Pin	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	T16 E8 T15 E7 T29 E44 T28 E45 E28 E20 E11 E21 E46 E47 E14 B32 E17
LS 3.9L, Thunderbird	150 (60-32-58) Pin	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	T16 E8 T15 E7 T29 E44 T28 E45 E37 E29 E21 E11 E46 E28 E20 E47 E14 B32 E17
Ranger 2.3L	104 Pin	HTR12 HTR11 HO2S12 HO2S11 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	95 93 35 60 100 74 101 75 90 71 91

(Continued)

Fuel Control — H

Vehicle	Connector	Circuit	Pin
All other vehicles	104 Pin	HTR22 HTR21 HTR12 HTR11 HO2S22 HO2S21 HO2S12 HO2S11 INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VREF VPWR SIGRTN	96 94 95 93 61 87 35 60 98 72 99 73 100 74 101 75 90 71 91

	Test Steps	Results →	Action to Take
H1	PERFORM KOER SELF-TEST		
	• Engine at normal operating temperature. • CHECK Self-Test DTCs: • **Are DTCs P0040, P0041, P1127, P1128, P1129 or P2278 present?**	Yes →	KEY OFF. Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	GO to **H2**.
H2	CONTINUOUS MEMORY DTCS P0133 AND P2190: HO2S RESPONSE TEST		
	• Key ON Engine OFF. • Select . • Press . • Select . • Scroll to Test ID: 01. • Key OFF. • **Is the indicated value greater than the minimum threshold?**	Yes →	KEY OFF. Complete PCM Reset to clear DTCs. Complete HO2S Monitor Drive Cycle. GO to **H1**.
		No →	GO to **H3**.

Fuel Control — H

Test Steps		Results →	Action to Take
H3	CHECK FOR UNMETERED AIR LEAKS		
	Note: Fuel calculations can be affected by unmetered air leaks. • Carefully inspect the following areas for potential air leaks: — Hoses connecting to MAF sensor assembly. — Hoses connecting to throttle body. — Intake manifold gasket leaks. — PCV disconnected. — The vacuum lines are disconnected. — Improperly seated engine oil dipstick, tube or oil fill cap. — Exhaust leaks at flanges and gaskets. • **Are any air leaks present?**	Yes → No →	REPAIR source of air leak. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset). GO to **H4**.
H4	CHECK HO2S CIRCUIT CONTINUITY		
	• HO2S Sensor connector disconnected. • Check the connector (both halves) for any water contamination. • Add jumper wire between the points described below: **Point A HO2S Sensor Connector, Harness Side**: HO2S Signal — **Point B HO2S Sensor Connector, Harness Side**: VPWR • Key ON Engine RUN. Note: HO2S displayed as O2S on scan tool. • Access the HO2S PID using a scan tool. • **Is the Voltage above 1 V?**	Yes → No →	KEY OFF. INSTALL a new HO2S sensor. CHANGE engine oil filter. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset). KEY OFF. GO to **H5**.
H5	CHECK HO2S CIRCUIT(S) FOR OPEN IN HARNESS		
	• REMOVE jumper wire(s) Note: A vehicle hoist may be required to access the HO2S harness. • Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion and proper assembly. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)HO2S Sensor Connector, Harness Side**: HO2S Signal — HO2S Signal SIGRTN — SIGRTN • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **H6**. REPAIR open circuit. Complete HO2S Monitor Drive Cycle.

H4 jumper points:

Point A HO2S Sensor Connector, Harness Side	Point B HO2S Sensor Connector, Harness Side
HO2S Signal	VPWR

H5 resistance measurement:

(+)PCM Connector, Harness Side	(-)HO2S Sensor Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

Fuel Control — H

Test Steps		Results →	Action to Take
H6	CHECK HO2S CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **H7**.
		No →	GO to **H9**.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
HO2S Signal	VPWR

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
H7	DTC P0131: CHECK FOR SOURCE OF POTENTIAL HO2S CONTAMINATION		
	• Investigate the following items as potential sources of HO2S contamination: — Use of unapproved silicon sealers. — Fuel contaminated by silicon additives. — Excessive oil burning. (rings, valve seals, oil overfill). — Glycol leaking internally in the engine. — Lead-contaminated fuel. — Short drive cycles in cold weather. — Use of unapproved cleaning agents. • **Were any of the above conditions or concerns found during inspection?**	Yes →	Repair the source of contamination. CHANGE engine oil filter. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).
		No →	GO to **H8**.
H8	DETERMINE DTC BEING DIAGNOSED		
	• **Are you diagnosing DTC P0141 or P0161?**	Yes →	GO to **H10**.
		No →	GO to **H9**.
H9	VERIFY HARNESS PINS ARE IN PROPER LOCATION		
	• Measure the Resistance between:	Yes →	INSTALL a new HO2S sensor.
		No →	REPAIR as necessary.

(+)PCM Connector, Harness Side	(-)HO2S Sensor Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

• **Are the resistances below 5 Ohm?**

Test Steps		Results →	Action to Take
H10	DTCS P0135, P0141, P0147, P0155, P0161 OR P0167: VISUALLY INSPECT HO2S HARNESS		
	• PCM connector connected. • Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion and proper assembly. • **Were any exposed wiring, contamination, corrosion and correct assembly concerns present?**	Yes →	REPAIR as necessary.
		No →	GO to **H11**.

Fuel Control — H

Test Steps		Results →	Action to Take
H11	PERFORM KOEO ON DEMAND SELF TEST		
	• Key ON Engine OFF. • **Are any of the following DTCs present: P0135, P0141, P0147, P0155, P0161 or P0167.**	Yes → No →	KEY OFF. GO to **H12**. KEY OFF. GO to **H13**.
H12	DTCS P0053, P0054, P0055, P0059, P0060 AND P0061: CHECK FOR VPWR IN HARNESS		
	Note: If DTCs are present, test their related circuits individually. • HO2S Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **H13**. REPAIR open circuit. Check fuses.

(+)HO2S Sensor Connector, Harness Side	**(-)HO2S Sensor Connector, Harness Side**
VPWR	SIGRTN

• **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
H13	CHECK HO2S HEATER FOR SHORTS IN HARNESS		
	• HO2S Sensor connector disconnected. • PCM connector disconnected. Note: If DTCs P0053, P0054, P0055, P0059, P0060 or P0061 are present, test their related circuits individually. • Measure the Resistance between:	Yes → No →	GO to **H14**. REPAIR short circuit.

(+)HO2S Sensor Connector, Harness Side	**(-)Vehicle battery**
HO2S Heater	Negative post

• Measure the Resistance between:

(+)HO2S Sensor Connector, Harness Side	**(-)HO2S Sensor Connector, Harness Side**
HO2S Heater	VPWR
HO2S Heater	SIGRTN
HO2S Heater	HO2S Signal

• **Are the resistances above 10 KOhm?**

Fuel Control	H

Test Steps		Results →	Action to Take
H14	CHECK HO2S CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)PCM Connector, Harness Side** | **(-)HO2S Sensor Connector, Harness Side** HO2S Heater | HO2S Heater • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **H15**. REPAIR open circuit.
H15	CHECK INTERNAL RESISTANCE OF HO2SHTR		
	• Measure the Resistance between: **(+)HO2S Sensor Connector, Component Side** | **(-)HO2S Sensor Connector, Component Side** HO2S Heater | VPWR • **Is the Resistance between 3 Ohm - 30 Ohm?**	Yes → No →	GO to **H16**. INSTALL a new HO2S sensor.
H16	CHECK HO2S CASE FOR SHORT TO VPWR, HTR AND SIGRTN		
	• Measure the Resistance between: **(+)HO2S Sensor Connector, Component Side** | **(-)HO2S Sensor Connector, Component Side** HO2S Heater | SIGRTN • Measure the Resistance between: **(+)HO2S Sensor Connector, Component Side** | **(-)Vehicle battery** HO2S Heater | Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. INSTALL a new HO2S sensor.
H17	CONTINUOUS MEMORY DTCS P0171, P0172, P0174, P0175, P1131, P1132, P1152, P2195, P2196, P2197 OR P2198: HO2S PERFORMANCE		
	Note: Address all Continuous Memory Ignition and Misfire DTCs before any KOER HO2S DTCs. • CHECK intake air system for leaks, obstructions and damage. — CHECK air filter element and housing for blockage. — Verify the integrity of the PCV system. — Check for vacuum leaks. • **Were there any concerns found during the visual inspection?**	Yes → No →	REPAIR as necessary. GO to **DC26**.

Fuel Control

H

Test Steps		Results →	Action to Take
H18	PERFORM KOER SELF-TEST		
	• Disconnect the fuel vapor hose from the intake manifold and the plug fitting at the intake manifold. • Start engine and run at 2000 RPM for 5 minutes and return to idle. • Key ON Engine RUN. • Perform KOER Self-Test. • CHECK Self-Test DTCs: • **Are DTCs P0040, P1128, P0041, P1129, P1127 or P0402 present?**	Yes →	KEY OFF. Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	KEY OFF. GO to **H19**.
H19	DETERMINE DTC BEING DIAGNOSED		
	• HO2S11, HO2S21 STUCK LEAN. • CHECK Self-Test DTCs: • **Are DTCs P1131, P2195, P1151 or P2197 present?**	Yes →	KEY OFF. GO to **H21**.
		No →	GO to **H20**.
H20	DETERMINE DTC BEING DIAGNOSED		
	• HO2S11, HO2S21 STUCK RICH. • CHECK Self-Test DTCs: • **Are DTCs P1132, P2196, P1152 or P2198 present?**	Yes →	GO to **H29**.
		No →	Reconnect the fuel vapor line. Unable to identify fault at this time. GO to **Z1**.
H21	HO2S CIRCUIT TEST (WITH LEAN DTCS)		
	• Disconnect HO2S related to current DTC. • Add jumper wire between the points described below: **Point A HO2S Sensor Connector, Harness Side**: HO2S Signal — **Point B HO2S Sensor Connector, Harness Side**: VPWR • Key ON Engine RUN. • Access the PCM-HO2S Signal PID using a scan tool. • **Is the Voltage above 1.3 V?**	Yes →	KEY OFF. GO to **H22**.
		No →	KEY OFF. GO to **H24**.
H22	CHECK SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• Disconnect HO2S related to current DTC. • Measure the Resistance between: **(+)HO2S Sensor Connector, Harness Side**: SIGRTN — **(-)Vehicle battery**: Negative post • **Is the Resistance below 5 Ohm?**	Yes →	KEY OFF. INSTALL a new HO2S sensor.
		No →	GO to **H23**.

H21 jumper points:

Point A HO2S Sensor Connector, Harness Side	Point B HO2S Sensor Connector, Harness Side
HO2S Signal	VPWR

H22 resistance measurement:

(+)HO2S Sensor Connector, Harness Side	(-)Vehicle battery
SIGRTN	Negative post

Fuel Control	H

Test Steps		Results →	Action to Take
H23	CHECK SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)HO2S Sensor Connector, Harness Side**: SIGRTN — **(-)PCM Connector, Harness Side**: SIGRTN • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REPAIR open circuit.
H24	CHECK HO2S CIRCUIT(S) FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)HO2S Sensor Connector, Harness Side**: HO2S Signal — **(-)PCM Connector, Harness Side**: HO2S Signal • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **H25**. REPAIR open circuit.
H25	CHECK HO2S CIRCUIT FOR SHORT TO GND IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: HO2S Signal — **(-)PCM Connector, Harness Side**: SIGRTN • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **H26**. REPAIR short circuit.
H26	CHECK HO2S CIRCUIT FOR SHORT TO GND IN HARNESS		
	• Measure the Resistance between: **(+)PCM Connector, Harness Side**: HO2S Signal — **(-)Vehicle battery**: Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **H27**. REPAIR short circuit.
H27	CHECK HO2S SENSOR CIRCUIT FOR SHORT TO GROUND		
	• HO2S Sensor connector connected. Related DTC • Measure the Resistance between: **(+)PCM Connector, Harness Side**: HO2S Signal — **(-)PCM Connector, Harness Side**: SIGRTN • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **H28**. INSTALL a new HO2S sensor.

Fuel Control | H

Test Steps		Results →	Action to Take
H28	CHECK HO2S SENSOR CIRCUIT FOR SHORT TO GROUND		
	• HO2S Sensor connector connected. Related DTC • Measure the Resistance between:	Yes → No →	INSTALL a new PCM. INSTALL a new HO2S sensor.

(+)PCM Connector, Harness Side	(-)Vehicle battery
HO2S Signal	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
H29	HO2S CIRCUIT TEST (WITH RICH DTCS)		
	• HO2S Sensor connector disconnected. Related DTC • Key ON Engine RUN. • Access the HO2S V PID using a scan tool. • **Is the Voltage below 0.2 V?**	Yes → No →	KEY OFF. INSTALL a new HO2S sensor. KEY OFF. GO to **H30**.
H30	CHECK HO2S CIRCUIT FOR SHORT TO VPWR OR HEATER IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes → No →	INSTALL a new PCM. REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
HO2S Signal	HO2S Heater
HO2S Signal	VPWR

• **Are the resistances above 10 KOhm?**

Test Steps		Results →	Action to Take
H31	CHECK FUEL PRESSURE		
	WARNING: WHEN CHECKING THE FUEL SYSTEM REMEMBER THAT THE FUEL SYSTEM MAY STILL BE PRESSURIZED WHEN THE ENGINE IS SWITCHED OFF. ALWAYS FOLLOW THE INSTRUCTIONS RELATED TO FUEL SYSTEM PRESSURE RELIEF. ALL FUEL HANDLING SAFETY PRECAUTIONS MUST BE OBSERVED. • Connect the battery charger to the vehicle. • Mechanical fuel pressure gauge connected. • Key ON Engine OFF. • Scan Tool Connected • Control using Output State Control. • Run fuel pump to obtain maximum fuel pressure. • **Is the fuel pressure within range for the vehicle being diagnosed?**	Yes → No →	KEY OFF. GO to **H32**. GO to **HC1**.

Fuel Control | H

Test Steps		Results →	Action to Take
H32	CHECK FUEL SYSTEM FOR PRESSURE STABILITY - FAST LEAKDOWN		
	• Key ON Engine OFF. • Cycle key several times to charge fuel system. • **Does the fuel pressure remain within 34 kPa (5 PSI) of the highest reading after 10 seconds?**	Yes → No →	GO to **H34**. GO to **H33**.
H33	VERIFY EXTERNAL FUEL LEAK		
	• **Is an external fuel leak present?**	Yes → No →	GO to **HC1**. GO to **H36**.
H34	CHECK FUEL SYSTEM FOR PRESSURE STABILITY - SLOW LEAKDOWN		
	• Key ON Engine OFF. • Cycle key several times to charge fuel system. • **Does the fuel pressure remain within 34 kPa (5 PSI) of the highest reading after one minute?**	Yes → No →	GO to **H35**. GO to **HC5**.
H35	DETERMINE DTC BEING DIAGNOSED		
	• **Are any misfire DTCs displayed with the HO2S DTCs?**	Yes → No →	GO to **H38**. GO to **H43**.
H36	CHECK INJECTOR FAULT PIDS AND ASSOCIATED DTCS		
	Note: Access all INJF PIDs using a scan tool. • **Is DTC P0201 through P0210 or an associated injector fault flag PID present?**	Yes → No →	GO to **H38**. GO to **H37**.
H37	DETERMINE DTC BEING DIAGNOSED		
	• **Are any misfire DTCs present?**	Yes → No →	GO to **HD12**. GO to **H43**.
H38	CHECK FUEL INJECTOR(S) AND HARNESS RESISTANCE		
	Note: Continuous Memory DTCs will be erased during this test. Note: Test all Fuel Injectors identified by DTC or PID interpretation. • PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: VPWR — (-)PCM Connector, Harness Side: Suspect INJ • **Is the Resistance between 11 Ohm - 18 Ohm?**	Yes → No →	GO to **H39**. GO to **H40**.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VPWR	Suspect INJ

Fuel Control H

	Test Steps	Results →	Action to Take
H39	PERFORM A THOROUGH WIGGLE TEST ON THE INJECTOR HARNESS		
	• Fuel Injector connector connected. • Key ON Engine RUN. • Engine at normal operating temperature. • Access the PCM-INJ PID using a scan tool. • Wiggle, shake and bend small sections of the wiring harness while working from the Injector to the PCM. • **Are any injector values fluctuating in and out of range?**	Yes → No →	KEY OFF. REPAIR open circuit. KEY OFF. GO to **H40**.
H40	DETERMINE DTC BEING DIAGNOSED		
	• **Is DTC P0201 through P0210 or an associated injector fault flag PID present?**	Yes → No →	INSTALL a new PCM. GO to **Z1**.
H41	CHECK FUEL INJECTOR HARNESS RESISTANCE		
	Note: Disconnect suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed. • Measure the Resistance between:	Yes → No →	GO to **H42**. REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)INJ Connector, Harness Side
Suspect INJ	INJ
VPWR	VPWR

• **Are the resistances below 5 Ohm?**

	Test Steps	Results →	Action to Take
H42	CHECK FOR SHORTS BETWEEN CIRCUITS IN FUEL INJECTOR HARNESS		
	• PCM connector disconnected. • Suspect fuel injector disconnected. • Measure the Resistance between:	Yes → No →	GO to **H43**. REPAIR short circuit.

(+)INJ Connector, Harness Side	(-)Vehicle battery
INJ	Negative post

• Measure the Resistance between:

(+)INJ Connector, Harness Side	(-)Vehicle battery
INJ	Positive post

• **Is the Resistance above 10 KOhm?**

Fuel Control	H

Test Steps		Results →	Action to Take
H43	FLOW TEST		
	• Flow test the injector using the Fuel Injector Tester/Cleaner. • **Is the flow rate for each injector within specification?**	Yes →	**For P0172, P0175** GO to **Z1**. **For P1132, P1152, P2196, P2198** GO to **H49**. **For Other DTCs** GO to **H44**.
		No →	INSTALL a new Fuel Injector.
H44	DETERMINE VEHICLE EQUIPMENT		
	• **Is a Secondary Air Pump equipped to this vehicle?**	Yes →	GO to **H45**.
		No →	GO to **H46**.
H45	CHECK FOR SECONDARY AIR LEAKS		
	Note: A HO2S always lean condition can be caused by: — Leaks in hoses from secondary air injection pump to engine. — Secondary air diverted upstream of HO2S. • Disconnect the secondary air injection hose(s) from the engine and the plug side of the secondary air injection system. • Key ON Engine RUN. • Perform KOER Self-Test. • **Are DTCs P1131, P2195, P1151 or P2197 present?**	Yes →	GO to **H46**.
		No →	GO to **HM17**.
H46	INSPECT INDUCTION SYSTEM FOR LEAKS		
	• Carefully inspect the following areas for potential air leaks: — Inlet tube(s) from air cleaner to throttle body. — Gaskets sealing the upper to lower intake manifold. — Vacuum hoses and lines for cracks, breaks and proper connections. • **Are any of these conditions present?**	Yes →	REPAIR as necessary.
		No →	**For P0171** GO to **Z1**. **For P0174** GO to **Z1**. **For Misfire DTCs** GO to **HD11**. **For Other DTCs** GO to **H47**.

Fuel Control — H

Test Steps	Results →	Action to Take
H47 CYLINDER COMPRESSION CHECK		
Note: Use the Misfire DTC(s) displayed or prior retrieval to determine which cylinder's compression to check. • Perform cylinder compression checks. Refer to the workshop manual. • **Is the suspect cylinder's compression within specification?**	Yes →	**For P1132, P1151, P2195, P2197** GO to **H48**. **For P1132, P1152, P2196, P2198** GO to **H49**. **For Misfire DTCs** GO to **HD11**.
	No →	REPAIR as necessary.
H48 CHECK HO2S OUTPUT VOLTAGE		
Note: Fuel calculations can be affected by unmetered air leaks. DTC P2195 may result. • Check the following: — Water contamination in connector. — Leaking vacuum actuators. — Engine sealing (intake manifold and IAC). — EGR system. — PCV system. — Unmetered air leaks between the throttle body and mass air flow (MAF) sensor assembly. • Visually inspect the HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. Repair as necessary. • HO2S Sensor connector disconnected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **H51**.
	No →	KEY OFF. INSTALL a new HO2S sensor.

(+)HO2S Sensor Connector, Component Side	**(-)HO2S Sensor Connector, Component Side**
HO2S Signal	SIGRTN

• Run engine at approximately 2000 RPM.
Maintain engine speed for three minutes.
Rerun KOER Self-Test.
Monitor HO2S voltage.
• **Is the Voltage above 0.4 V?**

Fuel Control

H

Test Steps		Results →	Action to Take
H49	ATTEMPT TO GENERATE DTC P1131 OR P2195 OR P1151 OR P2197		
	• HO2S Sensor connector disconnected. • Add jumper wire between the points described below: **Point A HO2S Sensor Connector, Harness Side** / **Point B Vehicle battery**: HO2S Signal / Negative post • Perform KOER Self-Test. • **Did DTC P1131 or P2195 or P1151 or P2197 appear?**	Yes → No →	KEY OFF. REMOVE jumper wire(s) GO to **H50**. KEY OFF. INSTALL a new PCM. REMOVE jumper wire(s)
H50	HO2S SENSOR VOLTAGE CHECK		
	• HO2S Sensor connector disconnected. • Disconnect vacuum line to vacuum tree . • Run engine at approximately 2000 RPM. • Run engine for approximately 30 seconds. • Measure the Voltage between: **(+)HO2S Sensor Connector, Component Side** / **(-)HO2S Sensor Connector, Component Side**: HO2S Signal / SIGRTN • **Is the Voltage below 0.4 V?**	Yes → No →	KEY OFF. Reconnect all hoses. GO to **H51**. KEY OFF. INSTALL a new HO2S sensor and retest vehicle.
H51	PERFORM A THOROUGH WIGGLE TEST ON THE HO2S HARNESS		
	• HO2S Sensor connector connected. • Key ON Engine RUN. • Engine at normal operating temperature. • Access the HO2S PID using a scan tool. • Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • **While monitoring the HO2S PID, did the HO2S stop switching?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **H52**.
H52	TEST DRIVE WHILE MONITORING HO2S PID SWITCHING		
	CAUTION: This test requires an observer to monitor the HO2S PID. • Access the HO2S and LOOP PIDs using a scan tool. • Start engine and let idle until vehicle goes into the closed loop fuel condition. • While observer monitors PIDs, test drive vehicle in a manner consistent with the Freeze Frame data in an attempt to simulate the original fault. • **Does the HO2S PID switch?**	Yes → No →	KEY OFF. Unable to duplicate or identify fault at this time. KEY OFF. INSTALL a new HO2S sensor.

Fuel Control — H

Test Steps		Results →	Action to Take
H53	KOER DTCS P1137, P2270, P1157, P2272, P1138, P2271, P1158, P2273, P2274 OR P2275: H02S LACK OF SWITCHES STUCK LEAN OR RICH		
	Note: Address all Continuous Memory Ignition and Misfire DTCs before any KOER HO2S DTCs. • Visually inspect for: — Pinched, shorted, and corroded wiring and pins. — Oil or water contamination. — Crossed sensor wires. — Contaminated or damaged sensor. • **Were any of the above conditions or concerns found during inspection?**	Yes → No →	REPAIR as necessary. GO to **H54**.
H54	KOER DTCS P1137, P2270, P1157, P2272, P1138, P2271, P1158, P2273, P2274 OR P2275: CHECK FOR KOER DTCS		
	• Key ON Engine RUN. • Run engine at approximately 2000 RPM. Maintain engine speed for three minutes. • Perform KOER Self-Test. • **Are any of the above listed DTCs present?**	Yes → No →	KEY OFF. GO to **H55**. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Fuel Control — H

Test Steps		Results →	Action to Take
H55	DTCS P0132, P0138 AND P0144: CHECK H02S SIGNAL LEVEL TOO HIGH		
	Note: Fuel calculations can be affected by unmetered air leaks. • Carefully inspect the following areas for potential air leaks: — Hoses connecting to MAF sensor assembly. — Hoses connecting to throttle body. — Intake manifold gasket leaks. — PCV disconnected. — The vacuum lines are disconnected. — Improperly seated engine oil dipstick, tube or oil fill cap. — Exhaust leaks at flanges and gaskets. Note: Any exhaust leaks between the engine and the output of the catalyst can cause DTCs P0136 or P0156. • Raise the vehicle on a hoist and make sure the vehicle is level. • Visually inspect for: — Exhaust leaks at flanges and gaskets. — HO2S not torqued to specification. — Physical exhaust system concerns. — Aftermarket exhaust. — Punctures or cracks in the catalyst. • **Were any of the above conditions or concerns found during inspection?**	Yes → No →	REPAIR as necessary. GO to **H56**.
H56	CHECK HO2S CIRCUIT FOR SHORT TO GND IN HARNESS		
	• PCM connector disconnected. • Disconnect the HO2S harness connector. • Measure the Resistance between:	Yes → No →	GO to **H57**. REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)Vehicle battery
HO2S Signal	Negative post

• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
HO2S Signal	SIGRTN
HO2S Signal	VPWR
HO2S Signal	HO2S Heater

• **Are the resistances above 10 KOhm?**

Fuel Control — H

Test Steps		Results →	Action to Take
H57	CHECK HO2S CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **H58**.
		No →	REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)HO2S Sensor Connector, Harness Side
HO2S Heater	HO2S Heater
VPWR	VPWR
HO2S Signal	HO2S Signal
SIGRTN	SIGRTN

• **Are the resistances below 5 Ohm?**

Test Steps		Results →	Action to Take
H58	CHECK HO2S CIRCUIT VOLTAGE		
	• PCM connector connected. • HO2S Sensor connector connected. • Key ON Engine RUN. • Access the HO2S PID using a scan tool. • **Is the voltage greater than 1.5 volts?**	Yes →	KEY OFF. **For PZEV** GO to **H61**. **For All Others:** GO to **H60**.
		No →	KEY OFF. GO to **H59**.
H59	CHECK HO2S CIRCUIT VOLTAGE		
	• PCM connector connected. • HO2S Sensor connector disconnected. • Add jumper wire between the points described below:	Yes →	INSTALL a new HO2S sensor.
		No →	INSTALL a new PCM.

Point A HO2S Sensor Connector, Harness Side	Point B HO2S Sensor Connector, Harness Side
HO2S Signal	VPWR

• Key ON Engine RUN.
• Access the HO2S PID using a scan tool.
• **Is the Voltage above 1.5 V?**

Test Steps		Results →	Action to Take
H60	CHECK FOR OVER VOLTAGE IN THE PCM		
	• Key ON Engine RUN. • HO2S Sensor connector disconnected. • Measure the Voltage between:	Yes →	INSTALL a new PCM.
		No →	INSTALL a new HO2S sensor.

(+)HO2S Sensor Connector, Harness Side	(-)Vehicle battery
SIGRTN	Negative post
HO2S Signal	Negative post

• **Are the voltages below 1.5 V?**

Fuel Control

H

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>H61</td><td>CHECK HO2S CIRCUIT FOR SHORT TO VREF AND VPWR IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to H62.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">
• PCM connector disconnected.
• HO2S Sensor connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)HO2S Sensor Connector, Harness Side</th></tr>
<tr><td>HO2S Signal</td><td>VPWR</td></tr>
</table>
• Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>H62</td><td>CHECK HO2S CIRCUIT VOLTAGE</td><td rowspan="2">Yes →
No →</td><td rowspan="2">INSTALL a new HO2S sensor and retest vehicle.
INSTALL a new PCM.</td></tr>
<tr><td colspan="2">
• PCM connector connected.
• HO2S Sensor connector disconnected.
• Add jumper wire between the points described below:
<table>
<tr><th>Point A HO2S Sensor Connector, Harness Side</th><th>Point B HO2S Sensor Connector, Harness Side</th></tr>
<tr><td>HO2S Signal</td><td>VPWR</td></tr>
</table>
• Key ON Engine RUN.
• Access the HO2S PID using a scan tool.
• Is the Voltage above 1.5 V?
</td></tr>
<tr><td>H63</td><td>KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE</td><td rowspan="2">Yes →
No →</td><td rowspan="2">Perform KOER Self-Test.
Run engine until PID indicates ON.
Perform KOER Self-Test.</td></tr>
<tr><td colspan="2">
Note: Address all other DTCs before proceeding.
Engine at normal operating temperature.
• Key ON Engine RUN.
• Access the HO2S HTR PID using a scan tool.
• Is the PID state ON?
</td></tr>
<tr><td>H64</td><td>KOER DTCS P0040, P0041, P1128, P1129 AND P2278: CROSSED SENSOR WIRES</td><td rowspan="2">Yes →
No →</td><td rowspan="2">Swap connectors on H02S sensors
CLEAR the DTCs and REPEAT Self-Test.
KEY OFF.
Unable to duplicate or identify fault at this time.
GO to Z1.</td></tr>
<tr><td colspan="2">
• Key OFF.
Note: Sensor wiring swapped bank to bank.
• Warning: Use caution near hot components.
• Confirm wiring is connected to opposite bank.
• Are there any crossed connections or wires?
</td></tr>
</table>

Fuel Control — H

Test Steps		Results →	Action to Take
H65	KOER DTCS P0132, P0138, P0152 AND P0158: CHECK HO2S CIRCUIT FOR HIGH AND INTERMITTENT FAULTS		
	• HO2S Sensor connector disconnected. • Visually inspect HO2S harness. Check the connector (both halves) for any water contamination. A vehicle hoist may be required to access the HO2S harness. Be sure connectors are fully seated. • HO2S Sensor connector connected. • Key ON Engine RUN. Note: If DTCs are present, test their related circuits individually. • Access the PCM-O2S11, PCM-O2S12 and PCM-O2S13 PIDs using a scan tool. • **Is the suspect PID voltage above 1.5 volts?**	Yes → No →	GO to **H67**. GO to **H66**.
H66	PERFORM A THOROUGH WIGGLE TEST ON THE HO2S HARNESS		
	• Perform a thorough wiggle test on the HO2S harness. • **Did the voltage change while performing the wiggle test?**	Yes → No →	REPAIR as necessary. GO to **Z1**.
H67	CHECK SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• Key OFF. • HO2S Sensor connector disconnected. Related DTC • Measure the Resistance between:	Yes → No →	GO to **H69**. GO to **H68**.

(+)HO2S Sensor Connector, Harness Side	(-)Vehicle battery
SIGRTN	Negative post

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
H68	CHECK SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes → No →	INSTALL a new PCM. REPAIR open circuit.

(+)HO2S Sensor Connector, Harness Side	(-)PCM Connector, Harness Side
SIGRTN	SIGRTN

• **Is the Resistance below 5 Ohm?**

Fuel Control H

Test Steps		Results →	Action to Take
H69	CHECK HO2S SIGNAL FOR SHORT TO POWER INSIDE SENSOR		
	• HO2S Sensor connector disconnected. • Key ON Engine RUN. • Access the PCM-HO2S Signal PID using a scan tool. • **Is the Voltage above 0.4 V?**	Yes → No →	GO to **H70**. INSTALL a new HO2S sensor.
H70	CHECK HO2S CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key OFF. • HO2S Sensor connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes → No →	INSTALL a new PCM. REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
HO2S Signal	VPWR
HO2S Signal	VREF

• **Are the resistances above 10 KOhm?**

Natural Gas Fuel Control | HA

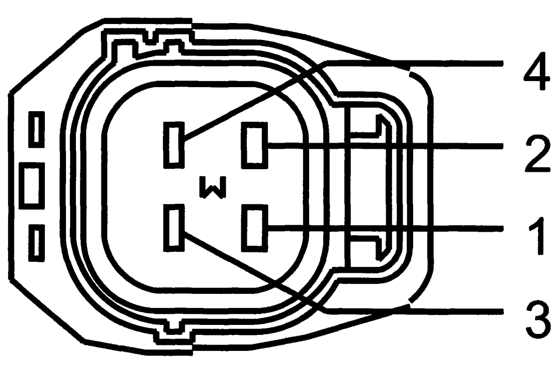
Note

This Pinpoint Test is intended to diagnose the following:

- HO2S/HTR (Heater) (9F472).
- HO2S Connections.
- Vacuum Systems.
- Fuel Injectors.
- Harness Circuits: HO2S GND, HO2S, INJ-1-8, VPWR and SIG RTN.
- Powertrain control module (PCM) (12A650).
- Natural Gas Module (NG) (9F954).

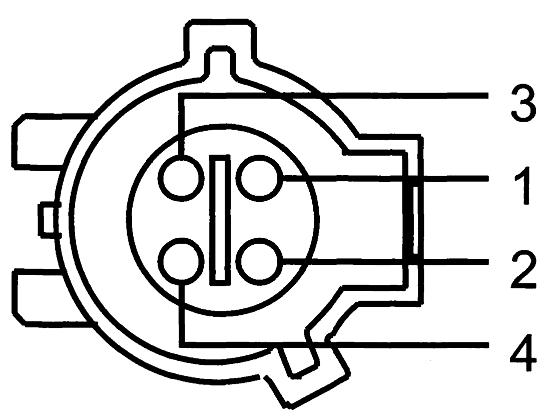
Heated Exhaust Oxygen Sensor (HO2S) Sensor Connector

A



A0077521

B



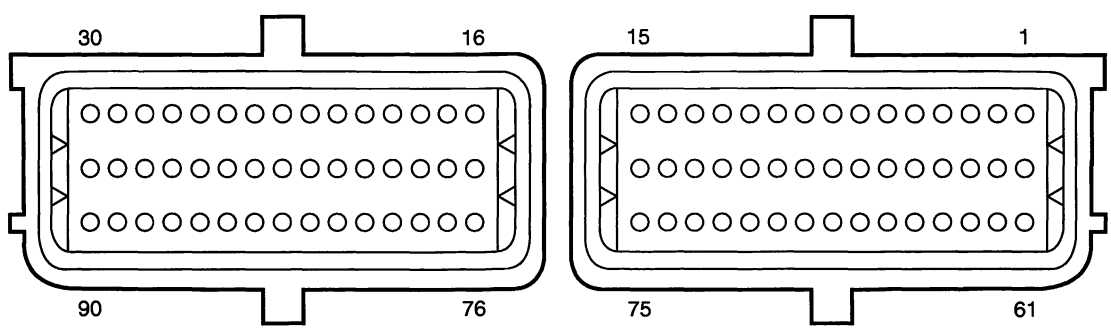
A0077561

Natural Gas Fuel Control	HA

Vehicle	Connector	Circuit	Pin
Focus 2.3L	A	HO2S Signal HO2S Heater SIGRTN VPWR	4 2 3 1
All other vehicles	B	HO2S Signal HO2S Heater SIGRTN VPWR	3 1 4 2

Natural Gas (NG) Module Connector

A



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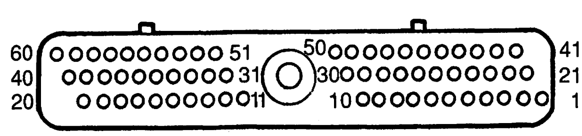
B



A16075-A

Natural Gas Fuel Control | HA

Vehicle	Connector	Circuit	Pin
E-Series	A	INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 INJ8 Out INJ7 Out INJ6 Out INJ5 Out INJ4 Out INJ3 Out INJ2 Out INJ1 Out CASE GND VPWR PWRGND SRtn SRef	68 67 66 65 64 63 62 61 53 52 51 50 49 48 47 46 75 60 89 89 74
All other vehicles	B	INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 INJ8 Out INJ7 Out INJ6 Out INJ5 Out INJ4 Out INJ3 Out INJ2 Out INJ1 Out CASE GND VPWR PWRGND SRtn SRef	44 43 25 24 23 5 4 3 54 53 42 33 35 39 59 58 25 37 40 46 26

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Natural Gas Fuel Control | HA

Connector	Circuit	Pin
104 Pin	HTR22 HTR12 HTR21 HTR11 HO2S22 HO2S12 HO2S21 HO2S11 PWRGND SIGRTN INJ8 INJ7 INJ6 INJ5 INJ4 INJ3 INJ2 INJ1 VPWR	96 95 94 93 61 35 87 60 103 91 98 72 99 73 100 74 101 75 71

Test Steps		Results →	Action to Take
HA1	DTCS P0135, P0141, P0155 AND P0161: HO2S HTR CIRCUIT FAULT		
	• DTC/HO2S Reference List. — DTC P0135 = HO2S HTR-11. — DTC P0141 = HO2S HTR-12. — DTC P0155 = HO2S HTR-21. — DTC P0161 = HO2S HTR-22. Note: On some applications, a vehicle hoist is required to access the HO2S harness. • Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion and proper assembly. • **Were any of the above conditions or concerns found during inspection?**	Yes → No →	Repair any concerns found. GO to **HA2**.
HA2	PERFORM KOEO SELF-TEST		
	• Key ON Engine RUN. • Engine at 2000 RPM for 1 minute. • Key ON Engine OFF. • Run PCM KOEO Self-Test. • **Are DTCs P0135, P0141, P0155 or P0161 present?**	Yes → No →	KEY OFF. GO to **HA3**. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Natural Gas Fuel Control

HA

Test Steps		Results →	Action to Take
HA3	CHECK VPWR VOLTAGE TO HO2S HARNESS CONNECTOR		
	Note: If DTCs P0135 and P0155 or P0141 and P0161 are displayed, both heater circuits will require testing. DTCs displayed separately are tested individually. • HO2S Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)HO2S Sensor Connector, Harness Side**: VPWR; **(-)HO2S Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **HA5**. KEY OFF. GO to **HA4**.
HA4	CHECK VPWR CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: VPWR - Pin 71; **(-)HO2S Sensor Connector, Harness Side**: VPWR • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HA5**. REPAIR open circuit. CHECK fuse.
HA5	CHECK HO2S HEATER RESISTANCE		
	• HO2S Sensor connector disconnected. • Measure the Resistance between: **(+)HO2S Sensor Connector, Component Side**: HO2S Heater; **(-)HO2S Sensor Connector, Component Side**: VPWR • **Is the Resistance between 3 Ohm - 30 Ohm?**	Yes → No →	GO to **HA6**. INSTALL a new HO2S sensor.
HA6	CHECK HO2S CASE FOR SHORT TO VPWR AND SIGRTN		
	• Measure the Resistance between: **(+)HO2S Sensor Connector, Component Side** / **(-)HO2S Sensor Connector, Component Side**: SIGRTN / HO2S Case; VPWR / HO2S Case • **Are the resistances above 10 KOhm?**	Yes → No →	GO to **HA7**. INSTALL a new HO2S sensor.

Natural Gas Fuel Control	HA

Test Steps	Results →	Action to Take

HA7 CHECK HO2S HEATER CIRCUIT FOR SHORTS TO VPWR AND GROUND

- PCM connector disconnected.
- Measure the Resistance between:

(+)HO2S Sensor Connector, Harness Side	(-)HO2S Sensor Connector, Harness Side
HO2S Heater	HO2S Signal
HO2S Heater	VPWR
HO2S Heater	SIGRTN

- Measure the Resistance between:

(+)HO2S Sensor Connector, Harness Side	(-)Vehicle battery
HO2S Heater	Negative post

- **Is the Resistance above 10 KOhm?**

Results	Action to Take
Yes →	GO to **HA8**.
No →	REPAIR short circuit.

HA8 CHECK HO2S HTR GROUND FOR OPEN IN IN HARNESS

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)HO2S Sensor Connector, Component Side
HO2S Heater	HO2S Heater

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
No →	REPAIR open circuit.

HA9 DTCS P1130, P1131, P1132, P1150, P1151, P1152, P2195, P2196, P2197 AND P2198: UPSTREAM HO2S (S) NOT SWITCHING

- DTC/HO2S Reference List.
  - HO2S-11 = DTCs P1131, P1132, P1130, P2195 and P2196.
  - HO2S-21 = DTCs P1151, P1152, P1150, P2197 and P2198.

  CHECK intake air system for leaks, obstructions and damage.

  Verify the integrity of the PCV system.

  CHECK for disconnected spark plug wires.

  Check for vacuum leaks.
- **Are any of the above concerns present?**

Results	Action to Take
Yes →	Repair as necessary.
No →	GO to **DC25**.

Natural Gas Fuel Control

HA

Test Steps		Results	Action to Take
HA10	DTCS P0171, P0172, P0174 AND P0175: FUEL SYSTEM AT THE CORRECTED FUEL TRIM		
	• Fuel System DTC Reference list: — Bank 1 = DTCs P0171 (lean) and P0172 (rich). — Bank 2 = DTCs P0174 (lean) and P0175 (rich). • CHECK intake air system for leaks, obstructions and damage. • Check the air cleaner for blockage. • Verify customer did not run out of fuel. • Verify clean sufficient fuel. • Verify the integrity of the PCV system. • CHECK for disconnected spark plug wires. • Check for vacuum leaks. • **Are any of the above concerns present?**	Yes → No →	REPAIR as necessary. GO to **DC25**.
HA11	RETRIEVE CONTINUOUS MEMORY DTCS		
	• Retrieve Continuous Memory DTCs • **Are DTCs P1130, P1150, P0171, P0174, P0172 or P0175 present?**	Yes → No →	KEY OFF. GO to **HA12**. GO to Z1. GO to **Z1**.
HA12	PERFORM KOER SELF-TEST		
	• Run KOER Self-Test. • **Are DTCs P1131, P1132, P1151, P1152, P2195, P2196, P2197 or P2198 present?**	Yes → No →	KEY OFF. GO to **HA13**. GO to **Z1**.
HA13	CHECK FUEL PRESSURE		
	Note: THE FUEL SYSTEM IS PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. BECOME FAMILIAR WITH THE WARNING, CAUTION AND NOTE IN PINPOINT TEST HB BEFORE SERVICING. • Key ON Engine OFF. • Access the PCM-FRP PID using a scan tool. • Record fuel pressure. Increase engine speed to 2500 rpm and maintain for one minute. Record pressure reading. • **Is the Pressure between 552 KPa (80.1 psi) - 827 KPa (119.9 psi)?**	Yes → No →	KEY OFF. GO to **HA14**. GO to **HB1**.

Natural Gas Fuel Control

HA

Test Steps		Results →	Action to Take
HA14	CHECK FUEL SYSTEM FOR PRESSURE STABILITY		
	• Cycle key ON and OFF twice. • Key ON Engine OFF. • Access the PCM-FRP PID using a scan tool. • Monitor fuel pressure for two minutes. INSPECT fuel system for external leaks. • **Does the fuel pressure remain within 69 kPa (10 psi) of the highest reading after two minutes?**	Yes →	**For No Start symptom** GO to **HA15**. **For For DTCs P1130, P1150, P0171, P0172, P0174 and P0175:** GO to **HA15**. **For All other symptoms** GO to **HA32**.
		No →	GO to **HB1**.
HA15	CHECK FUEL SYSTEM FOR PRESSURE STABILITY WITH KEY ON		
	• Key ON Engine OFF. • Access FRP PID and monitor the fuel pressure. • **Does the fuel pressure remain within 69 kPa (10 psi) of the highest reading after 10 seconds?**	Yes →	**For No Start symptom** GO to **HA16**. **For DTCs P1130, P1150, P0171 and P0174:** GO to **HA25**.
		No →	REPAIR pressure concern. GO to **HA26**.
HA16	CHECK FUEL INJECTORS ABILITY TO DELIVER FUEL		
	• Access the PCM-FRP PID using a scan tool. • Access FRP PID and monitor the fuel pressure. • Cycle key ON and OFF twice. • IFS connector disconnected. • Crank the engine for ten seconds and monitor the fuel pressure reading. • **Was there a pressure drop greater than 34 kPa (10 psi)?**	Yes →	Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No →	GO to **HA17**.
HA17	CHECK VREF VOLTAGE AT NATURAL GAS (NG) VEHICLE MODULE		
	• IFS connector connected. • INSTALL NG Module Breakout Box. • Key ON Engine OFF. • Measure the Voltage between: (+)NG Module: SRef — (-)NG Module: SRtn • **Is the Voltage between 4 V - 6 V?**	Yes →	KEY OFF. **For No Start symptom** GO to **HA18**. **For All other symptoms** GO to **HA27**.
		No →	KEY OFF. GO to **HA20**.

(+)NG Module	(-)NG Module
SRef	SRtn

Natural Gas Fuel Control

HA

Test Steps	Results →	Action to Take
HA18 CHECK FOR OPEN IN POWER GROUND		
• NG Module connector disconnected. • Measure the Resistance between: **(+)NG Module Connector, Harness Side**: PWRGND — **(-)Vehicle battery**: Negative post • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HA19**. REPAIR open circuit.
HA19 CHECK FOR OPEN IN POWER GROUND CIRCUIT IN NG MODULE		
• NG Module connector disconnected. • Measure the Resistance between: **(+)NG Module Connector, Harness Side**: PWRGND — **(-)NG Module Connector, Harness Side**: SRtn • **Is the Resistance below 5 Ohm?**	Yes → No →	**For No Start symptom** GO to **HA27**. **For All other symptoms** GO to **A9**. INSTALL a new NG module.
HA20 CHECK VREF VOLTAGE		
• **Is the VREF reading greater than 6.0 volts?**	Yes → No →	GO to **HA25**. GO to **HA21**.
HA21 CHECK BATTERY VOLTAGE		
• Measure the battery voltage across terminals. • **Is the voltage reading greater than 10.5 volts?**	Yes → No →	GO to **HA22**. REFER to section 414 in the Workshop Manual.
HA22 CHECK VPWR AT THE NG MODULE		
• Key ON Engine OFF. • Measure the Voltage between: **(+)NG Module Connector, Harness Side**: VPWR — **(-)NG Module Connector, Harness Side**: PWRGND • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **HA24**. GO to **HA23**.
HA23 CHECK VOLTAGE BETWEEN VPWR AT THE NG MODULE AND BATTERY GROUND		
• Measure the Voltage between: **(+)NG Module Connector, Harness Side**: VPWR — **(-)Vehicle battery**: Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	REPAIR open circuit. (Ground) REPAIR open circuit. (Power)

Natural Gas Fuel Control | HA

Test Steps		Results →	Action to Take
HA24	CHECK VREF VOLTAGE TO THE FUEL TANK PRESSURE SENSOR		
	• FTP Sensor connector disconnected. (On the Crown Vic., the fuel tank pressure sensor is located under the vent box cover of the upper tank assembly.) • Key ON Engine OFF. • Measure the Voltage between: **(+)FTP Sensor Connector, Harness Side**: VREF; **(-)FTP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	KEY OFF. INSTALL a new FTP sensor. REFER to Fuel System General Information, Section 310 in the Workshop Manual. KEY OFF. GO to **HA26**.
HA25	CHECK VREF CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• FTP Sensor connector disconnected. • NG Module connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)NG Module Connector, Harness Side**: SRef; **(-)NG Module Connector, Harness Side**: PWRGND • **Is the Voltage below 1 V?**	Yes → No →	INSTALL a new NG module. REPAIR short circuit to PWR.
HA26	CHECK VREF CIRCUIT FOR SHORT TO PWR GND		
	• NG Module connector disconnected. • Measure the Resistance between: **(+)NG Module Connector, Harness Side** / **(-)NG Module Connector, Harness Side**: SRef / SRtn; SRef / PWRGND; SRef / CASE GND • **Are the resistances above 10 KOhm?**	Yes → No →	INSTALL a new NG module. REPAIR short circuit to GND.

(+)FTP Sensor Connector, Harness Side	(-)FTP Sensor Connector, Harness Side
VREF	SIGRTN

(+)NG Module Connector, Harness Side	(-)NG Module Connector, Harness Side
SRef	PWRGND

(+)NG Module Connector, Harness Side	(-)NG Module Connector, Harness Side
SRef	SRtn
SRef	PWRGND
SRef	CASE GND

Natural Gas Fuel Control — HA

Test Steps		Results →	Action to Take
HA27	CHECK FUEL INJECTOR(S) AND HARNESS RESISTANCE FROM THE NATURAL GAS (NG) MODULE TO THE FUEL INJECTOR(S)		
	• NG Module connector disconnected. • Measure the Resistance between: (see table below) • **Are the resistances between 3 Ohm - 7 Ohm?**	Yes → No →	GO to **HA30**. GO to **HA28**.

(+)NG Module Connector, Harness Side	(-)NG Module Connector, Harness Side
VPWR	INJ1 Out
VPWR	INJ2 Out
VPWR	INJ3 Out
VPWR	INJ4 Out
VPWR	INJ5 Out
VPWR	INJ6 Out
VPWR	INJ7 Out
VPWR	INJ8 Out

Test Steps		Results →	Action to Take
HA28	CHECK FUEL INJECTOR(S) HARNESS RESISTANCE BETWEEN NG MODULE AND FUEL INJECTOR		
	• INJ connector disconnected. • Measure the Resistance of injector circuits between the NG module harness connector pins and the fuel injector(s) harness connector. • Measure the Resistance between: (see table below) • **Are the resistances below 5 Ohm?**	Yes → No →	GO to **HA29**. REPAIR open circuit.

(+)NG Module Connector, Harness Side	(-)INJ Connector, Harness Side
INJ1 Out	INJ
INJ2 Out	INJ
INJ3 Out	INJ
INJ4 Out	INJ
INJ5 Out	INJ
INJ6 Out	INJ
INJ7 Out	INJ
INJ8 Out	INJ
VPWR	VPWR

Natural Gas Fuel Control — HA

	Test Steps	Results →	Action to Take
HA29	CHECK FUEL INJECTOR HARNESS CIRCUIT FOR SHORTS TO POWER AND GROUND BETWEEN THE NG MODULE AND INJECTORS		
	• Measure the Resistance between: (see table below) • **Are the resistances above 10 KOhm?**	Yes →	For other than P0172 and P0175, REPLACE only the damaged fuel injector(s), otherwise: GO to **HA31**.
		No →	REPAIR short circuit.

(+)NG Module Connector, Harness Side	(-)NG Module Connector, Harness Side
INJ1 Out	VPWR
INJ2 Out	VPWR
INJ3 Out	VPWR
INJ4 Out	VPWR
INJ5 Out	VPWR
INJ6 Out	VPWR
INJ7 Out	VPWR
INJ8 Out	VPWR
INJ1 Out	PWRGND
INJ2 Out	PWRGND
INJ3 Out	PWRGND
INJ4 Out	PWRGND
INJ5 Out	PWRGND
INJ6 Out	PWRGND
INJ7 Out	PWRGND
INJ8 Out	PWRGND

	Test Steps	Results →	Action to Take
HA30	CHECK FUEL INJECTOR DRIVER SIGNAL		
	• NG Module connector connected. • This test step requires a standard 12 volt test lamp. Note: A properly operating system will show a dim glow at idle on the test lamp. • Connect non-powered test lamp between: (see table below) • Crank or start the engine. • **Does the test lamp have a dim glow while cranking or running the engine?**	Yes →	For Runs Rough condition, RETURN to Section 3, Symtom Charts. **For No Start symptom** GO to **A5**. **For All other symptoms** GO to **HA34**.
		No →	No light/ bright continuous light , GO to **HA31**.

(+)Fuel Injector Connector, Harness Side	(-)Fuel Injector Connector, Harness Side
INJ	VPWR

Natural Gas Fuel Control — HA

Test Steps		Results →	Action to Take
HA31	CHECK PCM FUEL INJECTOR HARNESS CIRCUIT RESISTANCE		
	• PCM connector disconnected. • NG Module connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **HA32**. REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)NG Module Connector, Harness Side
VPWR - Pin 71	VPWR
INJ1 - Pin 75	INJ1
INJ2 - Pin 101	INJ2
INJ3 - Pin 74	INJ3
INJ4 - Pin 100	INJ4
INJ5 - Pin 73	INJ5
INJ6 - Pin 99	INJ6
INJ7 - Pin 72	INJ7
INJ8 - Pin 98	INJ8

• **Are the resistances below 5 Ohm?**

Test Steps		Results →	Action to Take
HA32	CHECK PCM FUEL INJECTOR CIRCUIT FOR SHORT TO POWER AND GROUND IN HARNESS		
	• Measure the Resistance between:	Yes → No →	For other than P0172 and P0175, REPLACE only the damaged fuel injector(s), otherwise: GO to **HA34**. REPAIR short circuit.

(+)NG Module Connector, Harness Side	(-)NG Module Connector, Harness Side
INJ1	VPWR
INJ2	VPWR
INJ3	VPWR
INJ4	VPWR
INJ5	VPWR
INJ6	VPWR
INJ7	VPWR
INJ8	VPWR
INJ1	PWRGND
INJ2	PWRGND
INJ3	PWRGND
INJ4	PWRGND
INJ5	PWRGND
INJ6	PWRGND
INJ7	PWRGND
INJ8	PWRGND

• **Are the resistances above 10 KOhm?**

Natural Gas Fuel Control — HA

Test Steps		Results →	Action to Take
HA33	CHECK FUEL INJECTOR DRIVER SIGNAL FROM PCM		
	• This test requires a standard 12 volt test lamp. • PCM connector disconnected. • NG Module connector disconnected. Note: A properly operating system will show a dim glow or flicker at idle on the test lamp. • Connect a test lamp between the VPWR circuit and each PCM Fuel Injector Signal circuit at the NG module harness connector. • **Does the test lamp have a dim glow or flicker while cranking or starting the engine?**	Yes →	For no starts: REPLACE NG module. For runs rough: Return to Symptom Chart. For DTCs: GO to **HA34**.
		No →	INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)
HA34	FLOW TEST FUEL INJECTORS		
	• Use Rotunda Natural Gas (NG) Injector Tester found in the special NG Tool Kit (113-00114) or equivalent to flow test NG fuel injectors. Follow the Rotunda Natural Gas (NG) Injector Tester test steps indicated below, or follow the specific instructions included with the injector tester you are using. • Observe WARNING, CAUTION and NOTE. • Key OFF. • Key ON Engine OFF. • Access the PCM-FPM PID using a scan tool. • Note initial FRP sensor pressure using the scan tool. • Electronic fuel injector tester installed to suspect fuel injector. • Select pulse width of 200 m sec. • Activate the fuel injector tester. • Note the final FRP sensor pressure using scan tool. • Subtract final pressure from initial pressure to find pressure drop. • REPEAT above test procedure for all remaining fuel injectors. • **Is the leakage and flow within specifications?**	Yes →	**For P0171, P0172, P0174, P0175:** GO to **Z1**. **For P1130 and P1150:** GO to **HA37**. **For All other symptoms** GO to **HA36**.
		No →	INSTALL a new Fuel Injector.
HA35	CYLINDER COMPRESSION CHECK		
	• REFER to Powertrain/Engine Group Base Engine/Engine-Service Section of the Workshop Manual. • **Are cylinder compression readings within specification?**	Yes →	**For DTCs P1132, P1152, P2196 and P2198:** GO to **HA41**. **For All other symptoms** GO to **HA36**.
		No →	REPAIR as necessary.

Natural Gas Fuel Control | HA

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HA36</td><td>CHECK HO2S INTEGRITY</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HA37.
Unable to duplicate or identify fault.
GO to Z1.</td></tr>
<tr><td colspan="2">• CHECK HO2S harness for chafing, or damage and service as required.
• Visually inspect the HO2S and connector for indication of submersion in water, oil and coolant.
REPAIR as necessary.
• Run engine at 2000 rpm for two minutes.
• Perform KOER Self-Test.
• Key OFF.
• Are DTCs P1131, P1151, P2195 and/or P2197 present?</td></tr>
<tr><td>HA37</td><td>CHECK HO2S'S ABILITY TO GENERATE A VOLTAGE GREATER THAN 0.5 VOLT</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HA38.
INSTALL a new HO2S sensor.</td></tr>
<tr><td colspan="2">• Any vacuum or air leaks can cause DTCs P1131, P1151,P1130,P1150,P2195 and P2197.
• HO2S Sensor connector disconnected.
• Connect digital multimeter to the HO2S Signal circuit and HO2S SIG RTN circuit or HO2S GND circuit at the HO2S sensor connector.
• Run engine at 2000 rpm for two minutes.
• Rerun KOER Self-Test and monitor HO2S voltage.
• Does voltage reading indicate greater than 0.5 volt during or at the end of Self-Test?</td></tr>
<tr><td>HA38</td><td>CHECK HO2S SIGNAL AND HO2S GROUND CIRCUITS FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HA39.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">• PCM connector disconnected.
• HO2S Sensor connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)HO2S Sensor Connector, Harness Side</th></tr>
<tr><td>HO2S Signal</td><td>HO2S Signal</td></tr>
<tr><td>SIGRTN - Pin 91</td><td>SIGRTN</td></tr>
</table>
• Are the resistances below 5 Ohm?</td></tr>
<tr><td>HA39</td><td>CHECK HO2S CIRCUIT FOR SHORT TO GROUND IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HA40.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>HO2S Signal</td><td>Negative post</td></tr>
</table>
• Is the Resistance above 10 KOhm?</td></tr>
</table>

Natural Gas Fuel Control — HA

	Test Steps	Results →	Action to Take
HA40	CHECK HO2S CIRCUIT FOR SHORT TO GROUND		
	• Measure the Resistance between: **(+)HO2S Sensor Connector, Harness Side** / **(-)PCM Connector, Harness Side** HO2S Signal / PWRGND - Pin 103 HO2S Signal / SIGRTN - Pin 91 • **Are the resistances above 10 KOhm?**	Yes → No →	For other than P1130 and P1150 INSTALL a new PCM, otherwise: GO to **HA41**. REPAIR short circuit.
HA41	CHECK FOR DTCS P1132, P1152, P2196 AND P2198 WITH P1130 AND P1150		
	• Perform KOER Self-Test. • **Are DTCs P1132, P1152, P2196 or P2198 present?**	Yes → No →	GO to **HA42**. Unable to duplicate or identify fault at this time. GO to **Z1**.
HA42	CHECK HO2S SIGNAL FOR SHORT TO VPWR AND VREF		
	• DTCs P1130, P1132, P2196=HO2S-11. DTCs P1150, P1152, P2198=HO2S-21. • Key ON Engine OFF. • Access the HO2S PID for the DTC generated. • **Is the voltage greater than 1.0 volt and less than 4.0 volts?**	Yes → No →	GO to **HA43**. GO to **HA45**.
HA43	CHECK HO2S CIRCUIT FOR SHORT TO VPWR		
	• HO2S Sensor connector disconnected. • PCM connector disconnected. • Measure the Resistance between: **(+)HO2S Sensor Connector, Harness Side** / **(-)HO2S Sensor Connector, Harness Side** HO2S Signal / VPWR • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **HA44**. REPAIR short circuit to PWR.
HA44	CHECK HO2S SIGNAL FOR SHORT TO HO2S HTR CIRCUIT IN THE SENSOR		
	• HO2S Sensor connector disconnected. • Key ON Engine OFF. • Access the PCM-HO2S Signal PID using a scan tool. • **Is the HO2S voltage less than 0.2 volt?**	Yes → No →	INSTALL a new HO2S sensor. INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)

Natural Gas Fuel Control — HA

Test Steps		Results →	Action to Take
HA45	ATTEMPT TO GENERATE DTCS P1131, P1151, P2195 AND P2197		
	• HO2S Sensor connector disconnected. • Add jumper wire between the points described below: **Point A HO2S Sensor Connector, Harness Side** / **Point B Vehicle battery**: HO2S Signal / Negative post • Activate KOER Self-Test. • **Is DTC P1131, P1151, P2195 OR P2197 present?**	Yes → No →	GO to **HA46**. Disconnect PCM and inspect connector for damage. If OK REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
HA46	HO2S SENSOR VOLTAGE CHECK		
	• HO2S Sensor connector disconnected. • Connect digital Multimeter to HO2S SIG circuit and HO2S SIG RTN circuit at the HO2S sensor connector. • Disconnect Vacuum hose from vacuum tree. • Start engine and run at 2000 rpm. • **Does the voltage reading indicate less than 0.4 volt within 30 seconds?**	Yes → No →	GO to **HA47**. INSTALL a new HO2S sensor.
HA47	MONITOR HO2S PID FOR PROPER SWITCHING		
	• Key ON Engine RUN. • Engine at operating temperature. • Access the PCM-HO2S Signal PID using a scan tool. • Perform a wiggle-Test on the harness connected to the HO2S sensor. • **Did the HO2S voltage stay high (greater than 0.45 volt) or low (less than 0.45 volt?**	Yes → No →	Isolate cause of lack of HO2S switching and repair. GO to **HA48**.
HA48	TEST DRIVE WHILE MONITORING HO2S PID FOR PROPER SWITCHING		
	Note: This test step requires an observer to monitor PID for proper operation. • Access the PCM-HO2S Signal PID using a scan tool. • While observer views HO2S PID, test drive vehicle under different road conditions in an attempt to simulate the original fault. • **Does HO2S appear to switch properly?**	Yes → No →	Unable to duplicate or identify fault at this time. INSTALL a new HO2S sensor.

Natural Gas Fuel Control | HA

Test Steps		Results →	Action to Take
HA49	DTC P1127 KOER		
	• Possible causes: — Engine not operating long enough prior to performing KOER self-test. — Exhaust system too cool. • Key ON Engine RUN. • Access the PCM-HTR11 and PCM-HTR21 PIDs using a scan tool. • Access HTR11, 21 PIDS. • **Do all PIDS indicate on?**	Yes → No →	With engine still running, complete a KOER Self-Test to verify P1127 is no longer present. Operate engine until all PIDS indicate ON. Complete a KOER Self-Test.
HA50	DTC P1128 KOER		
	• P1128 refers to the upstream HO2S. Possible causes: — Crossed HO2S harness connectors. — Crossed wiring at PCM 104-pin harness connector. • Key OFF. • Visually inspect HO2S connector(s) for any crossed or streched wire or wire harnesses not mounted properly. • **Are there any indications of crossed connectors or wires?**	Yes → No →	Repair as necessary. GO to **HA51**.
HA51	VERIFY PROPER HO2S SIGNAL PIN LOCATION		
	• PCM connector disconnected. • Disconnect both of the suspect HO2S sensors at the HO2S harness connector. • P1128 = HO2S 11/21 Upstream. — HO2S-11 = Test Pin 60. — HO2S-21 = Test Pin 87. • Measure the Resistance between: **(+)HO2S Sensor Connector, Harness Side**: HO2S Signal — **(-)PCM Connector, Harness Side**: HO2S Signal • **Is the Resistance below 5 Ohm?**	Yes → No →	HO2S SIG circuit is OK. Unable to duplicate or identify fault at this time. Connect HO2S connector to proper HO2S or RELOCATE HO2S signal pins in the PCM harness connector or HO2S harness connector.
HA52	KOER DTCS P0040, P0041, P1129 AND P2278: CROSSED SENSOR WIRES		
	• Key OFF. Note: Sensor wiring swapped bank to bank. • Warning: Use caution near hot components. • Confirm wiring is connected to opposite bank. • **Are there any crossed connections or wires?**	Yes → No →	Swap connectors on H02S sensors CLEAR the DTCs and REPEAT Self-Test. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

HA51 resistance measurement table:

(+)HO2S Sensor Connector, Harness Side	(-)PCM Connector, Harness Side
HO2S Signal	HO2S Signal

Natural Gas Fuel Delivery System	HB

Note

This Pinpoint Test is intended to diagnose the following:

- Fuel Pressure.
- Fuel Supply Lines.
- Fuel Filter.
- Fuel Injectors.
- Fuel Pressure Regulator.
- Fuel Injection Supply Manifold.
- FSV (Fuel Solenoid Valve).

Fuel Delivery System Special Tool Kit

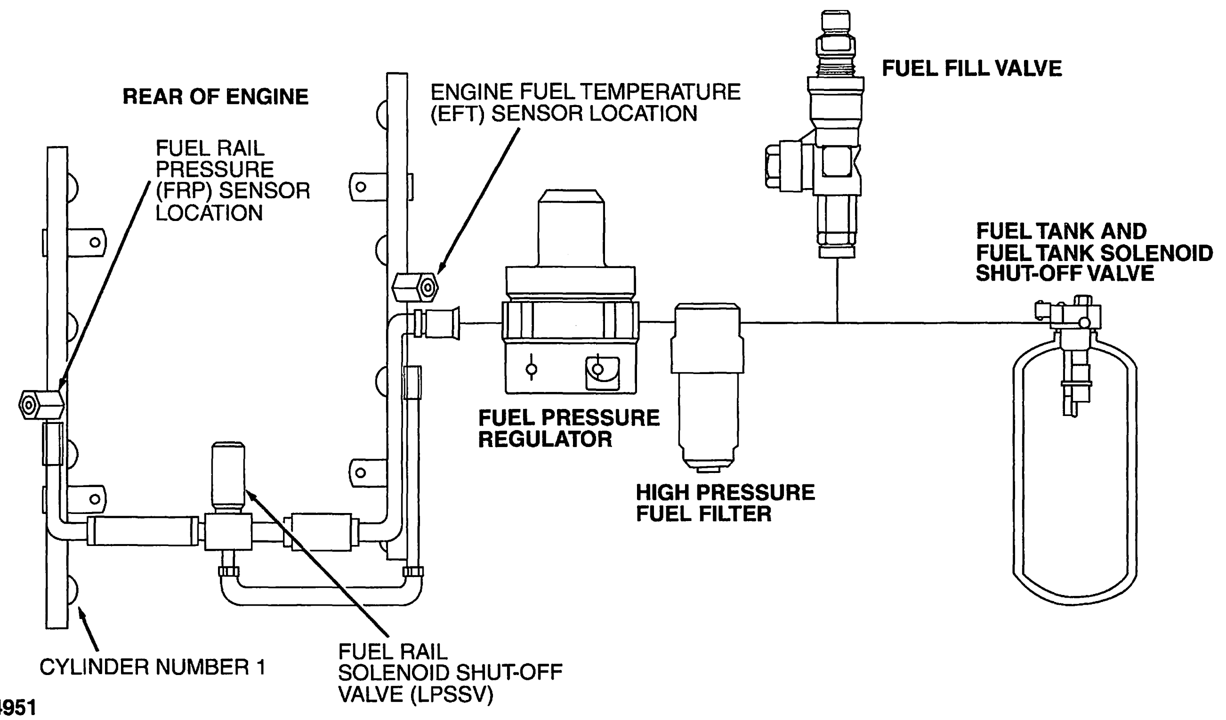
Tool Kit 134-00254 Contains:
Filler Connector Venting Tool
Fuel Injector Flow Tester

Note: For specific fuel delivery system specifications, REFER to the Fuel Delivery System Test Information Chart located at the beginning of pinpoint test HC.

Natural Gas Fuel Delivery System	HB

Typical NGV Fuel System

4.6L Crown Victoria NGV



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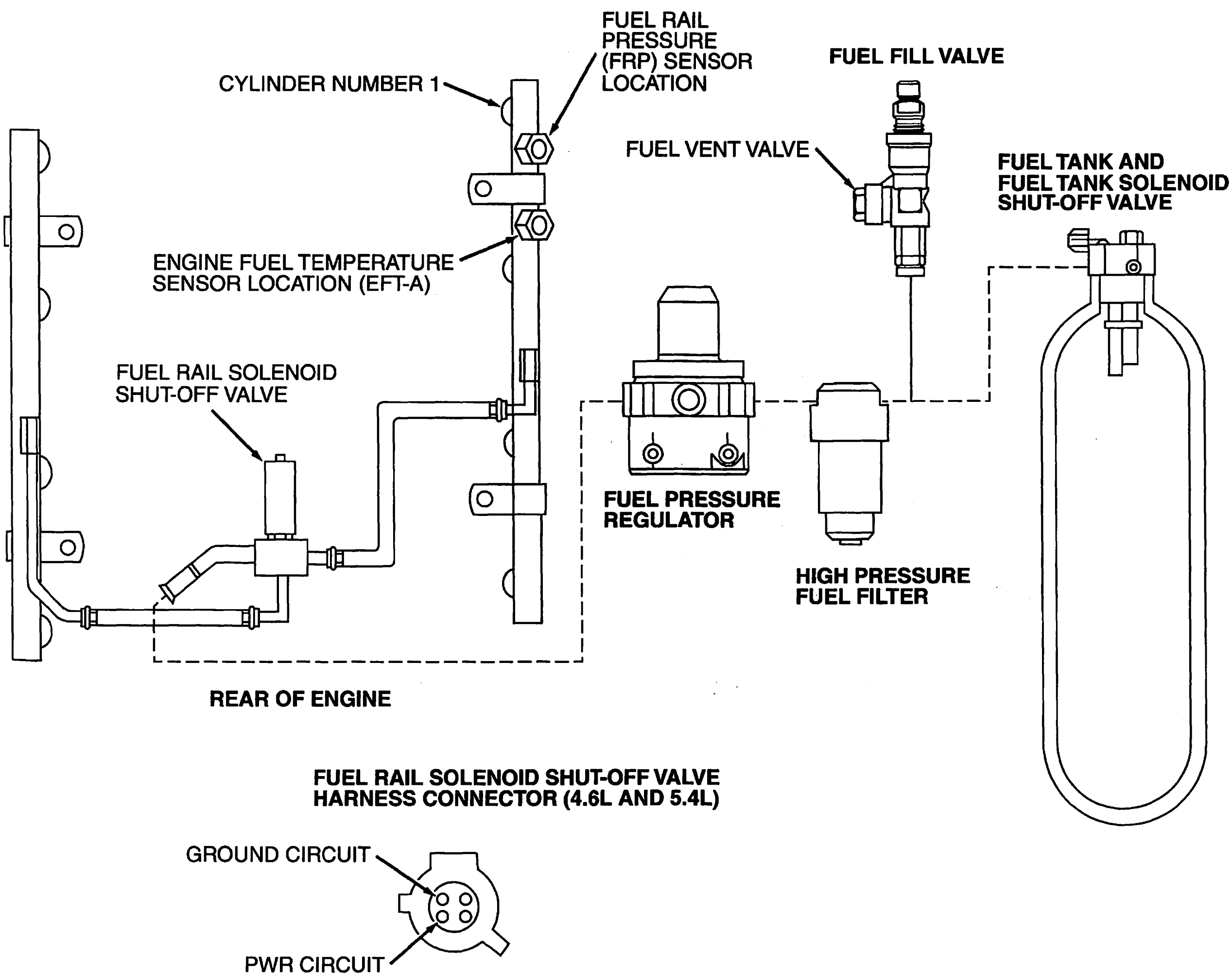
Natural Gas Fuel Delivery System | HB

5.4L E/F-Series NGV



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Warning

FUEL LINE VENTING IS REQUIRED PRIOR TO FUEL SYSTEM COMPONENT SERVICE.

Natural Gas Fuel Delivery System	HB

EYE AND EAR PROTECTION ARE REQUIRED TO BE WORN DURING VENTING OR REMOVAL AND INSTALLATION OF FUEL SYSTEM COMPONENTS.

NATURAL GAS IN THE FUEL SYSTEM IS AT HIGH PRESSURE AT ALL TIMES. TO AVOID INJURY OR FIRE, RELEASE THE FUEL PRESSURE FROM THE FUEL SYSTEM BEFORE DISASSEMBLING ANY FUEL SYSTEM COMPONENT. TO RELEASE THE PRESSURE FROM THE SYSTEM, FOLLOW THE PRESSURE RELIEF PROCEDURES OUTLINED BELOW. BECOME FAMILIAR WITH THESE PROCEDURES BEFORE PROCEEDING.

Note

For vehicles with a No-Start condition, the Alternate Fuel System Pressure Relief Procedure will need to be followed if fuel system service is required.

Fuel Line Pressure Relief Procedure:

- (1)Turn key OFF. Close the manual lockdown valve jackscrew on each FSV (Fuel Solenoid Valve). REFER to Section 310 of the appropriate Workshop Manual to determine the location of each of the fuel tanks and jackscrews. Become familiar with the procedures in the Workshop Manual before proceeding.
- (2)Turn key ON. Using a scan tool, access the FRP (Fuel Rail Pressure) sensor PID. At this point, the FRP PID should indicate 80 to 120 PSI, the normal system operating pressure.

Note: If the vehicle is being diagnosed for an FRP sensor DTC, be aware that the FRP PID reading may not indicate the actual pressure in the fuel rail.

- (3)Turn key OFF. Disconnect the FRP sensor electrical connector at the FRP sensor. Start the engine and let idle until the engine stalls. Once the engine stalls, crank the engine for an additional 15 seconds. This will relieve most of the residual system pressure. Reconnect the FRP sensor connector.

Note: If the engine does not stall within 3 minutes, start this procedure again from the beginning. Running the engine with the FRP sensor disconnected will generate a DTC that will need to be cleared.

WARNING:

STEP (4) IN THIS PROCEDURE WILL VENT A VERY SLIGHT AMOUNT OF RESIDUAL PRESSURE TO THE ATMOSPHERE. USE CARE TO PREVENT THE COMBUSTION OF ESCAPING FUEL. NO SMOKING, OPEN FLAMES OR ANY KIND OF ARCING.

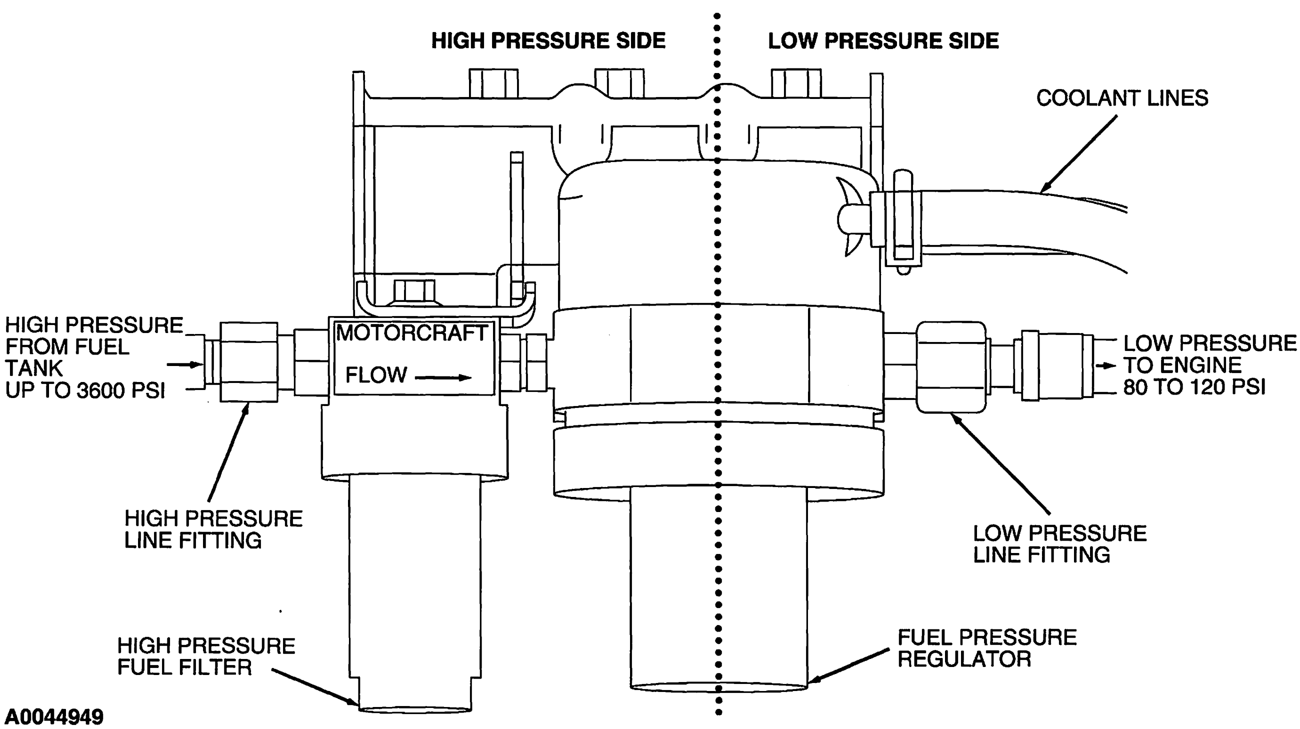
- (4)Turn key OFF. Access the fuel pressure regulator. Using the proper size wrench, slightly loosen the low pressure fuel line fitting at the fuel pressure regulator. This will release the residual pressure from the fuel system. REFER to the Fuel Pressure Regulator illustration below.

Natural Gas Fuel Delivery System	HB

Note: The fuel line O-ring(s) must be replaced at any fuel line fitting or connection that has been loosened or disconnected. REFER to the appropriate Workshop Manual for O-ring replacement.

- (5)Re-secure the low pressure fuel line fitting. Turn key ON. Using a scan tool, access the FRP (Fuel Rail Pressure) sensor PID. The FRP PID should indicate less than 5 PSI. If so, the fuel system may now be carefully opened and serviced.

Fuel Pressure Regulator



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Alternate Fuel System Pressure Relief Procedure:

Note: This procedure should only be used if the vehicle has a No-Start condition.

- (1)Turn key OFF. Close the manual lockdown valve jackscrew on each FSV (Fuel Solenoid Valve). REFER to Section 310 of the appropriate Workshop Manual to determine the location of each of the fuel tanks and jackscrews. Become familiar with the procedures in the Workshop Manual before proceeding.
- (2)Access the fuel pressure regulator. REFER to Fuel System General Information, Section 310 in the Workshop Manual for the location of the fuel pressure regulator.

WARNING:

Natural Gas Fuel Delivery System	HB

STEP 3 AND STEP (4) IN THIS PROCEDURE WILL VENT A VERY SLIGHT AMOUNT OF RESIDUAL PRESSURE TO THE ATMOSPHERE. USE CARE TO PREVENT THE COMBUSTION OF ESCAPING FUEL. NO SMOKING, OPEN FLAMES OR ANY KIND OF ARCING.

- (3)Using the proper size wrench, slightly loosen the low pressure fuel line fitting at the fuel pressure regulator. The line should only be loosened far enough to generate a small leak, and a hissing noise will be heard. Allow the pressure to vent to atmosphere. REFER to the Fuel Pressure Regulator illustration above.
- (4)Disconnect the FRP sensor electrical connector at the FRP sensor. Using the proper size wrench, slightly loosen the low pressure fuel line fitting at the FRP sensor. The line should only be loosened far enough to generate a small leak, and a hissing noise will be heard. Allow the pressure to vent to atmosphere.

Note: The fuel line O-ring(s) must be replaced at any fuel line fitting or connection that has been loosened or disconnected. REFER to the appropriate Workshop Manual for O-ring replacement.

- (5)Re-secure the FRP sensor. Reconnect the FRP sensor connector.

Warning

USE CARE TO PREVENT THE COMBUSTION OF ESCAPING FUEL. NO SMOKING, OPEN FLAMES OR ANY KIND OF ARCING.

SAFE FUEL HANDLING PRACTICES: NATURAL GAS - FIRE.

- REPORT ALL FIRES TO THE APPROPRIATE AUTHORITIES.
- FLAMES FROM NATURAL GAS HAVE A YELLOW AND/OR BLUE COLOR.
- KNOW THE LOCATIONS OF PORTABLE FIRE EXTINGUISHER, FIRE BLANKETS AND FIRE ALARM. LEARN HOW TO USE THEM.
- USE AN ABC RATED/CERTIFIED FIRE EXTINGUISHER OR FIRE BLANKET TO FIGHT FLAMMABLE GAS FIRES.

FIRST AID.

- WHEN OVERCOME BY VAPORS, IF SAFE, MOVE VICTIM TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION OR CPR (CARDIOPULMONARY RESUSCITATION) AS APPROPRIATE. SEEK MEDICAL ATTENTION IMMEDIATELY!
- FOR IRRITATED EYES, FLUSH WITH LARGE AMOUNTS OF WATER FOR 15 MINUTES. REMOVE CONTACT LENSES, IF WORN. SEEK MEDICAL ATTENTION IMMEDIATELY!

Natural Gas Fuel Delivery System	HB

HEALTH.

- NATURAL GAS (AND ALL OTHER FUEL VAPORS) CAN BE HARMFUL BY INHALATION.
- ALL FUELS ARE IRRITATING TO THE EYES AND RESPIRATORY SYSTEM.
- ALL FUELS CAN BE HARMFUL IF ABSORBED THROUGH THE SKIN.
- ALL FUELS CAN BE HARMFUL OR FATAL IF SWALLOWED.
- FUELS AND PRODUCTS CONTAINING METHANOL (WINDSHIELD WASHER FLUID) CAN CAUSE BLINDNESS IF SWALLOWED.

HANDLING.

- BE AWARE OF THE MERCUROUS MERCAPTAN "ROTTEN EGG" SMELL OF NATURAL GAS.
- USE FLAMMABLE GAS HANDLING PRECAUTIONS.
- KEEP FLAMMABLE GASES IN APPROVED, LABELED CONTAINERS.
- USE IN WELL-VENTILATED AREAS AND CONTROL VAPORS. BE AWARE THAT VAPORS ARE NOT VISIBLE, ARE LIGHTER THAN AIR, CAN TRAVEL ALONG THE CEILING AND WILL COLLECT IN HIGH HOLLOW AREAS.
- WHEN TRANSFERRING FLAMMABLE GASES, CONNECT THE VENT STACK TO THE SOURCE AND GROUND THE SOURCE TO EARTH.
- DO NOT SMOKE OR USE HEAT/SPARK PRODUCING EQUIPMENT NEAR VAPORS.
- DO NOT EAT, SMOKE OR DRINK WHERE THESE FUELS ARE HANDLED, PROCESSED OR STORED.
- WASH HANDS THOROUGHLY AFTER HANDLING ANY FUEL.

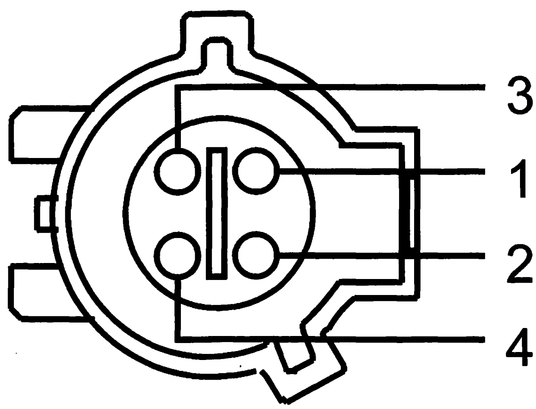
LEAKAGE.

- NOTIFY THE PROPER AUTHORITIES IN THE EVENT OF ANY LEAKAGE YOU HAVE NOT BEEN TRAINED TO ADDRESS.
- STOP AND ALLOW FUEL TO VENTILATE TO OUTSIDE ATMOSPHERE AFTER ANY FUEL ESCAPE.

Fuel Shutoff Valve (FSV) Solenoid Connector

Natural Gas Fuel Delivery System	HB

Identical FSV connectors are used at the fuel rail and fuel tank.



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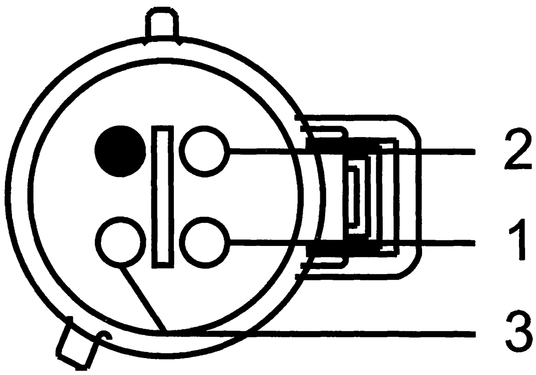
Circuit	Pin
GND (Ground)	3
FSVPWR (Fuel Shutoff Valves Power)	1

Natural Gas Fuel Delivery System	HB

Fuel Rail Pressure (FRP) Sensor Connector

A



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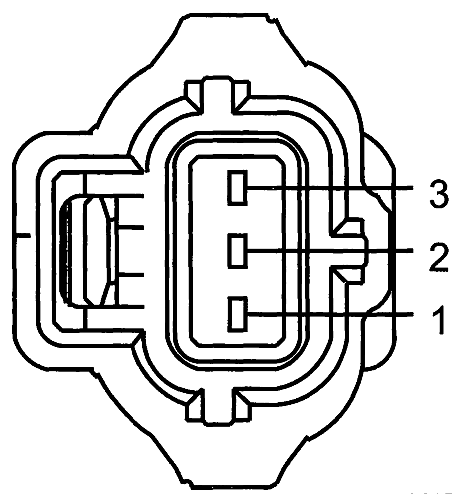
B



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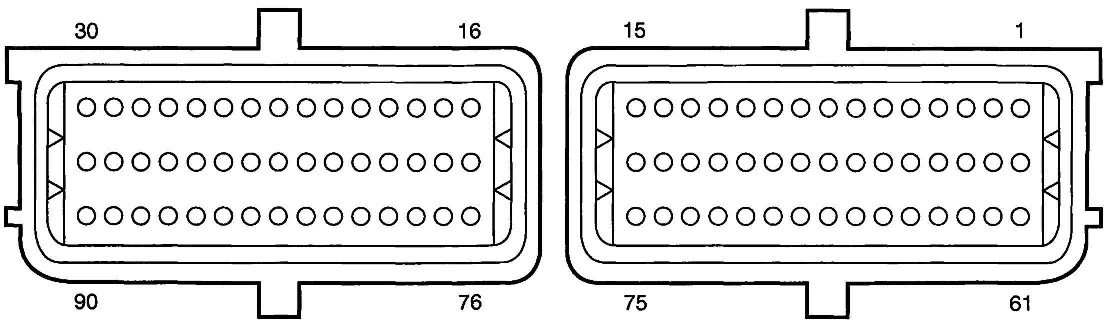
Vehicle	Connector	Circuit	Pin
Crown Victoria Dedicated NGV, F-150 Heritage 5.4L Dedicated NGV	A	SIGRTN VREF FRP	1 2 3
E-Series 5.4L Dedicated NGV, F-150 Heritage 5.4L Bi-Fuel	A	SRtn SRef FRP	1 2 3
All other vehicles	B	SIGRTN VREF FRP	2 1 3

Natural Gas Fuel Delivery System	HB

Natural Gas (NG) Module Connector



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Circuit	Pin
SRtn (Signal Return)	89
FRP (Fuel Rail Pressure)	38

Powertrain Control Module (PCM) Connector

Connector	Circuit	Pin
104 Pin	SIGRTN FRP	91 63

Natural Gas Fuel Delivery System — HB

Test Steps		Results →	Action to Take
HB1	CHECK SYSTEM INTEGRITY		
	WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST. • Key ON Engine OFF. • Wait 5 seconds. • Key OFF. • Visually inspect the complete fuel delivery system including fuel lines, connections, fuel rail, pressure regulator and fuel injector areas for leaks (hissing noise), looseness, cracks, kinks, pinching or abrasion caused by a collision or mishandling. • Visually inspect the electrical harness and connectors for loose pins, corrosion, abrasion or other damage from collision or mishandling. • INSPECT vehicle maintenance schedule and fuel filter. • Verify inertia fuel shutoff (IFS) switch is set (button pushed in). REFER to Owner Guide for location. • Verify battery is fully charged. • Verify fuse integrity. • **Are any of the above concerns present?**	Yes → No →	REPAIR as necessary. VERIFY symptom no longer exists. For poor fuel range symptom GO to NG fuel tank venting procedures located in Section 310 in the Workshop Manual. **For Fuel smell symptom** GO to **HB27**. **For All other symptoms** GO to **HB2**.
HB2	CHECK FUEL TANK PRESSURE		
	• Verify there is a minimum of 1/8 tank of fuel. • Install fuel tank venting tool (supplied in Tool Kit 134-00254) to vehicle fuel line at the outlet of the fuel fill valve. • Open bypass on fill valve (REFER to Powertrain/Fuel Systems Group in the Workshop Manual for this procedure). • Key ON Engine OFF. • Record fuel tank pressure reading and fuel gauge reading. • **Is the fuel pressure reading greater than 3,448 kPa (500 PSI)?**	Yes → No →	KEY OFF. CLOSE bypass on fill valve and REMOVE fuel tank venting tool. **For No Start symptom** GO to **HB12**. **For All other symptoms** GO to **HB5**. GO to **HB3**.

Natural Gas Fuel Delivery System | HB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HB3</td><td>CHECK PWR AND GND CIRCUITS TO THE FUEL TANK FSV (FUEL SOLENOID VALVE)</td><td></td><td></td></tr>
<tr><td colspan="2">
• Key ON Engine OFF.
• Command outputs ON
Note: Measurement must be made within 7 seconds of activating test mode.
• Measure the Voltage between:
<table>
<tr><th>(+)FSV Solenoid Connector, Harness Side</th><th>(-)FSV Solenoid Connector, Harness Side</th></tr>
<tr><td>FSVPWR - Pin 1</td><td>GND - Pin 3</td></tr>
</table>
• Is the Voltage above 10.5 V?
</td><td>Yes →

No →</td><td>GO to NG fuel tank venting procedures located in Section 310 in the Workshop Manual.
Follow fuel tank solenoid shut-off valve diagnostic procedures.

GO to HB4.</td></tr>
<tr><td>HB4</td><td>CHECK FOR OPEN GND CIRCUIT TO FUEL TANK FSV</td><td></td><td></td></tr>
<tr><td colspan="2">
• Key OFF.
• Measure the Resistance between:
<table>
<tr><th>(+)FSV Solenoid Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>GND - Pin 3</td><td>Negative post</td></tr>
</table>
• Is the Resistance below 5 Ohm?
</td><td>Yes →

No →</td><td>REPAIR open circuit and retest vehicle.
FSVPWR circuit concern.

REPAIR open circuit and retest vehicle.
GND circuit concern.</td></tr>
<tr><td>HB5</td><td>CHECK FUEL PRESSURE</td><td></td><td></td></tr>
<tr><td colspan="2">
WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST.
• Key ON Engine OFF.
• Access the PCM-FRP PID using a scan tool.
• Is the Pressure between 552 KPa (80.1 psi) - 827 KPa (119.9 psi)?
</td><td>Yes →

No →</td><td>Verify voltage was steady.
If voltage was not steady verify that no injector is stuck open.
If an injector is stuck open, verify NGV module circuit is not the cause.
If OK,
For E-Series Dedicated NGV, and
F-150 Heritage Bi-Fuel
GO to HB6.
For All Others
GO to HB11.

GO to HB16.</td></tr>
</table>

Natural Gas Fuel Delivery System — HB

Test Steps		Results →	Action to Take
HB6	GENERATE OPPOSITE SIGNAL		
	• FRP Sensor connector disconnected. • Key ON Engine OFF. • Access the PCM-FRP V PID using a scan tool. • Add jumper wire between the points described below:	Yes →	KEY OFF. REMOVE jumper. GO to **HB10**.
		No →	GO to **HB7**.

Point A FRP Sensor Connector, Harness Side	Point B FRP Sensor Connector, Harness Side
FRP	VREF

• **Does a scan tool communication concern exist?**

Test Steps		Results →	Action to Take
HB7	CHECK FRP V PID		
	• Access the PCM-FRP V PID using a scan tool. • **Is the Voltage above 4.75 V?**	Yes →	KEY OFF. REMOVE jumper. For other than No Start symptoms, INSTALL a new FRP, otherwise: GO to **HB9**.
		No →	REMOVE jumper. GO to **HB8**.
HB8	CHECK VREF VOLTAGE TO FRP SENSOR		
	• Measure the Voltage between:	Yes →	KEY OFF. GO to **HB9**.
		No →	KEY OFF. GO to **C26**.

(+)FRP Sensor Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
SRef	SRtn

• **Is the Voltage between 4 V - 5.5 V?**

Test Steps		Results →	Action to Take
HB9	CHECK FRP CIRCUIT(S) FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **HB10**.
		No →	REPAIR open circuit.

(+)NG Module Connector, Harness Side	(-)FRP Sensor Connector, Harness Side
FRP - Pin 38	FRP

• **Is the Resistance below 5 Ohm?**

Natural Gas Fuel Delivery System | HB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HB10</td><td>CHECK FRP CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">For other than No Start symptoms, INSTALL a new NG Module, otherwise: GO to HB19.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">
• Scan tool connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)NG Module Connector, Harness Side</th><th>(-)NG Module Connector, Harness Side</th></tr>
<tr><td>FRP - Pin 38</td><td>SRtn - Pin 89</td></tr>
</table>
• Measure the Resistance between:
<table>
<tr><th>(+)NG Module Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>FRP - Pin 38</td><td>Negative post</td></tr>
</table>
• Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>HB11</td><td>GENERATE OPPOSITE SIGNAL</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
REMOVE jumper.
GO to HB15.
GO to HB12.</td></tr>
<tr><td colspan="2">
• FRP Sensor connector disconnected.
• Key ON Engine OFF.
• Access the PCM-FRP V PID using a scan tool.
• Add jumper wire between the points described below:
<table>
<tr><th>Point A FRP Sensor Connector, Harness Side</th><th>Point B FRP Sensor Connector, Harness Side</th></tr>
<tr><td>FRP</td><td>VREF</td></tr>
</table>
• Does a scan tool communication concern exist?
</td></tr>
<tr><td>HB12</td><td>CHECK FRP V PID</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
REMOVE jumper.
For other than No Start symptoms, INSTALL a new FRP, otherwise:
GO to HB14.
REMOVE jumper.
GO to HB13.</td></tr>
<tr><td colspan="2">
• Access the PCM-FRP V PID using a scan tool.
• Is the Voltage above 4.75 V?
</td></tr>
<tr><td>HB13</td><td>CHECK VREF VOLTAGE TO FRP SENSOR</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to HB14.
KEY OFF.
GO to C1.</td></tr>
<tr><td colspan="2">
• Measure the Voltage between:
<table>
<tr><th>(+)FRP Sensor Connector, Harness Side</th><th>(-)FRP Sensor Connector, Harness Side</th></tr>
<tr><td>VREF</td><td>SIGRTN</td></tr>
</table>
• Is the Voltage between 4 V - 5.5 V?
</td></tr>
</table>

Natural Gas Fuel Delivery System — HB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HB14</td><td>CHECK FRP CIRCUIT(S) FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HB15.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)FRP Sensor Connector, Harness Side</th></tr>
<tr><td>FRP - Pin 63</td><td>FRP</td></tr>
</table>
Is the Resistance below 5 Ohm?
</td></tr>
<tr><td>HB15</td><td>CHECK FRP CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">For other than No Start symptoms, INSTALL a new PCM, otherwise:
GO to HB19.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">
Scan tool connector disconnected.
Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>FRP - Pin 63</td><td>SIGRTN - Pin 91</td></tr>
</table>
Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>FRP - Pin 63</td><td>Negative post</td></tr>
</table>
Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>HB16</td><td>VERIFY FUEL RAIL FSV OPENS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">For E-Series Dedicated NGV, and
F-150 Heritage Bi-Fuel
GO to HB6.
For All Others
GO to HB11.
GO to HB17.</td></tr>
<tr><td colspan="2">
WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST.
Key ON Engine OFF.
Command outputs ON
START and STOP several times by toggling the START and STOP button on the scan tool and listening or feeling for a click at the FSV.
Key OFF.
Was a click of the FSV felt or heard?
</td></tr>
</table>

Natural Gas Fuel Delivery System | HB

Test Steps		Results →	Action to Take
HB17	CHECK PWR AND GND CIRCUITS TO THE FUEL RAIL FSV (FUEL SOLENOID VALVE)		
	• Key ON Engine OFF. • Command outputs ON • Key ON Engine RUN. • Measure the Voltage between: **(+)FSV Solenoid Connector, Harness Side**: FSVPWR - Pin 1 **(-)FSV Solenoid Connector, Harness Side**: GND - Pin 3 • **Is the Voltage above 10.5 V?** Note: Measurement must be made within 7 seconds of activating test mode.	Yes → No →	INSTALL a new FSV solenoid and retest vehicle. GO to **HB18**.
HB18	CHECK FOR OPEN GND CIRCUIT TO FUEL RAIL FSV		
	• Measure the Resistance between: **(+)FSV Solenoid Connector, Harness Side**: GND - Pin 3 **(-)Vehicle battery**: Negative post • **Is the Resistance below 5 Ohm?**	Yes → No →	REPAIR open circuit and retest vehicle. FSVPWR circuit concern. REPAIR open circuit and retest vehicle. GND circuit concern.
HB19	VERIFY FSV SEALS		
	WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST. • Relieve fuel pressure. Follow the Fuel Line Pressure Relief procedure in the beginning of this pinpoint test. • FSV Solenoid connector disconnected. (Located at the fuel injection supply manifold.) • Re-open the manual lockdown valve jackscrews that were closed while performing the fuel line pressure relief procedure. • Wait 2 minutes. • Key ON Engine OFF. • Access the PCM-FRP PID using a scan tool. • **Is the Pressure below 70 KPa (10.2 psi)?**	Yes → No →	GO to **HB20**. INSTALL a new FSV solenoid and retest vehicle.

Natural Gas Fuel Delivery System — HB

Test Steps		Results →	Action to Take
HB20	VERIFY FSV PARTIALLY OPENS		
	Note: Observe WARNING, CAUTION and NOTE. • Key OFF. • FSV Solenoid connector connected. (Located at the fuel injection supply manifold.) • Key ON Engine OFF. • Access the PCM-FRP PID using a scan tool. • **Is the Pressure between 552 KPa (80.1 psi) - 827 KPa (119.9 psi)?**	Yes → No →	KEY OFF. GO to **HB21**. INSTALL a new FSV plunger and housing assembly and retest vehicle.
HB21	VERIFY FSV FULLY OPENS		
	Note: Observe WARNING, CAUTION and NOTE. • Relieve fuel pressure. Follow the Fuel Line Pressure Relief procedure in the beginning of this pinpoint test. • Re-open the manual lockdown valve jackscrews that were closed while performing the fuel line pressure relief procedure. • Key OFF then SNAP START (Key quickly turned from OFF to START without pausing at the RUN position.). • Immediately increase engine speed to 2500 RPM. • Access the PCM-FRP PID using a scan tool. • **Is the Pressure between 552 KPa (80.1 psi) - 827 KPa (119.9 psi)?**	Yes → No →	KEY OFF. GO to **HB22**. INSTALL a new FSV plunger and housing assembly and retest vehicle.
HB22	VISUALLY CHECK FSV PLUNGER AND HOUSING		
	Note: Observe WARNING, CAUTION and NOTE. • Visually check FSV plunger and housing. The FSV plunger may be sticking in the FSV plunger housing due to fuel contamination. Verify FSV plunger and housing is clean. • **Are all checks ok?**	Yes → No →	GO to **HB23**. Service as necessary (plunger and housing assembly are serviced separately)

Natural Gas Fuel Delivery System — HB

Test Steps		Results →	Action to Take
HB23	CHECK FUEL PRESSURE		
	Note: Observe WARNING, CAUTION and NOTE. • Key ON Engine RUN. • Access the PCM-FRP PID using a scan tool. • Note FRP PID pressure at idle and at 2500 RPM. • **Is the Pressure between 552 KPa (80.1 psi) - 827 KPa (119.9 psi)?** Note: Pressure must be greater than 552 kPa (80.1 PSI) at 2500 RPM.	Yes → No →	KEY OFF. GO to **HB24**. INSTALL a new Fuel Pressure Regulator and retest vehicle. Verify a blockage does not exist in fuel lines.
HB24	VERIFY FPR THERMOSTAT OPERATION		
	Note: Observe WARNING, CAUTION and NOTE. • Key ON Engine RUN. • Bring engine to normal operating temperature. • Measure the temperature of the fuel pressure regulator coolant bowl or coolant outlet with a thermometer or temperature probe. • **Is the Temperature between 15 C (59 F) - 60 C (140 F)?**	Yes → No →	KEY OFF. GO to **HB25**. INSTALL a new Fuel Pressure Regulator and retest vehicle. CHECK coolant lines and coolant system for proper operation.
HB25	VERIFY FUEL INJECTOR FLOW		
	• Key OFF. • Key ON Engine OFF. • Access the PCM-FRP PID using a scan tool. • Electronic fuel injector tester connected to suspect injector. • Select pulse width of 200 msec. • Activate fuel injector tester. • Subtract final pressure from initial pressure to determine pressure drop. • Repeat test on all remaining fuel injectors. • **Is the pressure drop within 241 KPa (35 PSI) to 345 KPa (50 PSI)?**	Yes → No →	Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. GO to **HB26**.

Natural Gas Fuel Delivery System — HB

	Test Steps	Results →	Action to Take
HB26	DETERMINE FUEL INJECTOR FLOW CONSISTENCY		
	• **Do all fuel injectors flow within 20 KPa (3 PSI) of each other?**	Yes →	Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No →	INSTALL a new Fuel Injector and retest vehicle. Note: More than one fuel injector may require replacement.
HB27	CHECK FOR LEAKING FUEL		
	• Possible causes: — Loose fitting connections. — Damaged or worn seals or fittings. — Damaged fuel lines or fuel system components. Note: After the vehicle has not run for several hours, a slight natural gas smell may emanate from within the intake manifold and intake air system. This is normal as the fuel injectors leak down over several hours. If a fuel leak is present, it may be necessary to cycle the key to maintain adequate pressure when checking for leaks when using the natural gas sniffer. • Key OFF. • Access the PCM-FRP PID using a scan tool. • Key ON Engine OFF. • CHECK for leaks with the natural gas sniffer provided in Rotunda tool kit (134-00254) or a soapy water based solution such as Snoop. Cover the complete joint with this solution. Examine the components or joints for 60 seconds for signs of bubbles. • **Are any fuel leaks present?**	Yes → No →	VERIFY proper torque of suspect fuel system component(s). REPAIR as necessary. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
HB28	CONTINUOUS MEMORY DTCS P1180 AND P1181: CHECK FUEL PRESSURE		
	• Visually inspect the complete fuel delivery system including fuel lines, connections, fuel rail, pressure regulator and fuel injector areas for leaks (hissing noise), looseness, cracks, kinks, pinching or abrasion caused by a collision or mishandling. • **Are any Fuel System concerns present?**	Yes →	REPAIR as necessary.
		No →	GO to **HB29**.

Natural Gas Fuel Delivery System | HB

Test Steps		Results →	Action to Take
HB29	CHECK FUEL TANK PRESSURE		
	• Key ON Engine RUN. • Access the PCM-FRP and PCM-TANKPR PIDs using a scan tool. • Record PID values. • Locate the approximate fuel tank pressure value on the chart below. Using this value, determine the approximate PCM inferred pressure.	Yes →	Diagnose other Continuous Memory DTCs. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No →	For other than P1180, REPLACE fuel pressure regulator, otherwise: GO to **HB30**.

Fuel Tank Pressure (kPa)	PCM inferred pressure (PSI)
30000	94
28000	95.5
26000	96
24000	96
23000	96.31
22000	97.25
21000	97.5
20000	98.5
19000	99
18000	99.31
17000	99.75
16000	100.75
14000	101.75
13000	102.25
12000	102.5
11000	103
10000	103.38
9000	104.5
8000	105
7000	105.56
6000	106
5000	106.5
4000	106.88
3000	108.44
2000	109
0	0

- **Is the PCM inferred pressure +/- 152 KPa (+/- 22 PSI) of the FRP value?**

Natural Gas Fuel Delivery System

HB

Test Steps		Results →	Action to Take
HB30	CHECK FUEL FILTER FOR WATER OR OTHER CONTAMINATION		
	WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST. • Disassemble fuel filter and check for water and other contamination. • **Is there any evidence of contamination ?**	Yes → No →	INSTALL a new Fuel Filter assembly and retest vehicle. CLEAN contamination from filter housing. GO to **HB31**.
HB31	CHECK FUEL SUPPLY LINE FOR RESTRICTION		
	• Visually inspect the complete fuel delivery system for damage. • **Are any fuel delivery concerns present?**	Yes → No →	REPAIR as necessary. GO to **HB32**.
HB32	ENGINE NO START		
	WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST. • FRP Sensor connector disconnected. • Attempt to start engine. • **Will the engine start?**	Yes → No →	INSTALL a new FRP sensor and retest vehicle. INSTALL a new Fuel Pressure Regulator and retest vehicle.

Fuel Delivery System | HC

Note

This Pinpoint Test is intended to diagnose the following:

- Chassis Components.
- Engine Vacuum.
- Fuel Pressure.
- Fuel Supply Line.
- Fuel Supply.
- Fuel Injector. (9F593).

Fuel System Specification Chart

Application	Engine	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (PSI)	External Pressure Gauge (kPa)	External Pressure Gauge (PSI)
CARS:						
Focus	2.0L 2V SPI	ERFS (3)	240-448	35-65	-	-
Focus	2.0L 4V ZETEC	ERFS (3)			-	-
Focus	2.0L 4V HO SVT	ERFS (3)			-	-
Focus	2.3L PZEV	ERFS (3)			-	-
Taurus	3.0L 2V FFV	ERFS (3)	210-450	30-65	-	-
Taurus/Sable	3.0L 2V	ERFS (3)	270-450	39-65	-	-
Taurus/Sable	3.0L 4V	ERFS (3)	270-380	39-55	-	-
Lincoln LS	3.0L	ERFS (3)	270-380	39-55	-	-
Mustang	3.9L	ERFS (3)	240-380	35-55	-	-
Freestar	3.9L	ERFS (3)			-	-
Freestar/Monterey	4.2L	ERFS (3)			-	-

(Continued)

Fuel Delivery System

HC

Fuel System Specification Chart

Application	Engine	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (PSI)	External Pressure Gauge (kPa)	External Pressure Gauge (PSI)
Lincoln LS/T-Bird	3.9L	ERFS (3)	270-450	39-65	-	-
Crown Vic/Grand Marq/Town Car	4.6L	ERFS (3)	275-485	40-70	-	-
Crown Vic	4.6L NGV	NGV (4)	550-825	80-120	-	-
Mustang GT	4.6L 2V	ERFS (3)	275-485	40-70	-	-
Mustang Mach 1/Cobra	4.6L 4V	ERFS (3)	205-380	30-55	-	-
Marauder	4.6L 4V	ERFS (3)	275-485	40-70	-	-
TRUCKS:						
Escape	2.0L 4V	MRFS (2)	-	-	345-450	50-65
Escape HEV	2.3L	ERFS (3)	275-485	40-70	-	-
Ranger	2.3L	MRFS (2)	-	-	345-450	50-65
Escape	3.0L 4V	MRFS (2)	-	-	345-450	50-65
Explorer Sport	4.0L SOHC	ERFS (3)			-	-
Ranger	3.0L	MRFS (2)	-	-	345-450	50-65
Ranger	3.0L FFV	MRFS (2)	-	-	275-380	40-55
Ranger	4.0L SOHC	MRFS (2)	-	-	345-450	50-65
E/F Series	4.2L	RFS (1)	-	-	205-310	30-45
Aviator	4.6L 4V	ERFS (3)	275-485	40-70	-	-
Explorer/Mountaineer	4.0L SOHC	ERFS (3)	345-485	50-70	-	-
Explorer/Mountaineer	4.6L	ERFS (3)	345-485	50-70	-	-
E/F Series	4.6L	ERFS (3)	275-485	40-70	-	-
F Series	5.4L 3V	ERFS (3)	275-485	40-70	-	-
E Series	5.4L 2V	ERFS (3)	240-485	35-70	-	-

(Continued)

Fuel Delivery System

HC

Fuel System Specification Chart

Application	Engine	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (PSI)	External Pressure Gauge (kPa)	External Pressure Gauge (PSI)
E/F Heritage Series	4.6L	RFS (1)	-	-	205-310	30-45
Expedition	4.6L	MRFS (2)	-	-	240-450	35-65
E/F Series/Excursion	5.4L 2V	MRFS (2)	-	-		
Expedition	5.4L 2V	MRFS (2)	-	-	240-450	35-65
E/F Series	5.4L NGV	NGV (4)	550-825	80-120	-	-
F Series Bi Fuel CNG	5.4L 2V CNG	ERFS (3)			-	-
F Series Lightning	5.4L SC	RFS (1)	-	-	205-310	30-45
Navigator	5.4L 4V	MRFS (2)	-	-	240-450	35-65
E/F Series/Excursion	6.8L	ERFS (3)			-	-

Fuel System Type Definitions:

(1) Return Fuel System:

This type of fuel delivery system returns excess fuel to the fuel tank by means of a fuel return line from the fuel rail. Fuel pressure is controlled by a mechanical pressure regulator located on the fuel rail. Vehicles equipped with RFS do not utilize a fuel rail pressure (FRP) sensor.

(2) Mechanical Returnless Fuel System (MRFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. Fuel pressure is controlled by a mechanical pressure regulator located on the fuel pump module in the fuel tank. Vehicles equipped with MRFS do not utilize a fuel rail pressure (FRP) sensor.

(3) Electronic Returnless Fuel System (ERFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. This system does not incorporate a mechanical pressure regulator. Pressure is controlled by continuously varying the fuel pump speed through the fuel pump driver module (FPDM). All vehicles equipped with ERFS utilize a fuel rail pressure sensor (FRP).

(4) Natural Gas Fuel System (NGV):

Fuel Delivery System | HC

This type of fuel system does not return fuel to the fuel tanks. Pressure in the fuel tanks acts as the "fuel pump". Line pressure is controlled by a mechanical pressure regulator located upstream of the fuel tanks. All NGVs utilize a fuel rail pressure (FRP) sensor. The FRP sensor is also commonly referred to as an Injection Pressure Sensor (IPS).

Note: Service replacement fuel injectors may not be the same color as the injectors in the vehicle. Verify replacement injector is correct for the application by part number.

Warning

WARNING : THE FUEL SYSTEM REMAINS UNDER PRESSURE AFTER THE ENGINE IS OFF. RELIEVE PRESSURE BEFORE SERVICING. HIGHLY FLAMMABLE MIXTURES PRESENT. TO RELEASE PRESSURE FROM THE FUEL SYSTEM PERFORM THE FOLLOWING:

- CONNECT ROTUNDA FUEL PRESSURE GAUGE 134R0087 OR EQUIVALENT.
- GRADUALLY OPEN THE TESTING KIT VALVE TO RELIEVE FUEL PRESSURE IN THE VEHICLE FUEL SYSTEM AND DRAIN THE FUEL INTO A SUITABLE CONTAINER OR RETURN IT TO THE FUEL TANK.
- TO AVOID UNNECESSARY FUEL SPILLAGE AND FIRE HAZARD, ANY TIME FUEL LINES ARE DISCONNECTED, THE IGNITION SWITCH MUST BE IN THE OFF POSITION UNLESS FUEL PUMP OPERATION IS REQUIRED FOR TEST PURPOSES.

Caution

Use care to prevent combustion from fuel spillage. No smoking, open flames or any kind of arcing.

SAFE FUEL HANDLING PRACTICES.

Gasoline, Methanol and Methanol Blends.

FIRE.

- Report all fires to the appropriate authorities.
- Flames from methanol or methanol-gasoline blends can be invisible.
- Know the locations of portable fire extinguishers, fire blankets, fire alarms and eye/wash shower facilities. Know how to use them.
- Use a B or AFFF (light water) type fire extinguisher to fight flammable liquid fires.

Fuel Delivery System	HC

FIRST AID.

- If swallowed:
- If gasoline has been swallowed, do not induce vomiting. Seek medical attention immediately!
- If methanol or methanol/gasoline blend has been swallowed, induce vomiting under the direction of a physician or a Poison Control Center. Seek medical attention immediately!
- When overcome by vapors, if safe, move victim to fresh air. If not breathing, give artificial respiration or CPR (Cardiopulmonary Resuscitation) as appropriate. Seek medical attention immediately!
- If splashed in eyes, flush with large amounts of water for 15 minutes. REMOVE contact lenses, if worn. Seek medical attention immediately!
- If splashed on skin, remove contaminated clothing. Wash skin thoroughly with soap and water.

HEALTH.

- All fuels can be harmful or fatal if swallowed.
- Be aware, if fuel is swallowed, onset of serious health effects can be delayed 12 to 24 hours.
- Fuels and products containing methanol (windshield washer fluid) can cause blindness if swallowed.
- All fuel vapors can be harmful if inhaled.
- All fuels can be harmful if absorbed through the skin.
- All fuels are irritating to the eyes and respiratory system.
- Some fuels made with gasoline contain benzene which is a cancer-causing agent.

HANDLING.

- Use flammable liquid handling precautions.
- Wear chemical goggles and nitrile gloves (additional protective clothing and equipment may be necessary in some instances).
- Keep flammable liquids in approved, labeled, closed containers.
- Use in well-ventilated areas and control vapors. Be aware that vapors are not visible, are heavier than air, can travel along the floor and will settle in lower areas.
- When transferring flammable liquids, bond the receiving container to the source and ground the source to the earth.
- Do not smoke or use heat/spark producing equipment near vapors.
- Do not eat, smoke or drink where these products are handled, processed or stored.
- Never siphon by mouth.
- Wash hands thoroughly after handling any fuel.

Fuel Delivery System	HC

SPILLS.

- Notify the proper authorities in the event of any spill you have not been trained to clean up.
- Stop, contain and clean up small spills with an absorbent material.

Inertia Fuel Shutoff (IFS) Switch - Reset Instructions

Warning

IF YOU SEE OR SMELL GASOLINE AT ANY TIME OTHER THAN DURING FUELING, DO NOT RESET THE INERTIA FUEL SHUTOFF (IFS) SWITCH.

- Turn key OFF.
- CHECK for fuel leaks in the engine compartment.
- If no leak is present, RESET the IFS switch by pushing the reset button on the top of the switch (refer to Owner Guide for IFS switch location).
- In the closed position, the button can be depressed an additional 1.57 mm (1/16 inch) against a spring.
- Turn key ON. Turn key OFF. REPEAT twice.
- CHECK for leaking fuel.

Fuel Delivery System — HC

Test Steps		Results →	Action to Take
HC1	CHECK SYSTEM INTEGRITY		
	• Visually inspect the complete fuel delivery system for damage. Check the following: — Fuel lines and connections. — Relays. — Fuel tank. — Fuel pump. — Fuel pressure regulator. — Fuel pulse damper. — Fuel Rail at injectors. — Damaged connector pins. — Electrical connectors not fully engaged. • Verify vehicle has followed maintenance schedule. (ex. fuel filter replaced within last 48,280 km/30,000 miles, etc.). • Verify inertia fuel shutoff (IFS) switch is set (button pushed in). REFER to Owner Guide for location. • Verify fuse integrity. • Verify battery is fully charged. • Verify clean sufficient fuel. • **Are any of the above concerns present?**	Yes → No →	REPAIR as necessary. GO to **HC2**.
HC2	CHECK FUEL PRESSURE		
	WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN PINPOINT TEST HC WARNING, CAUTION, AND HANDLING. • Key OFF. • Relieve fuel pressure. • Mechanical fuel pressure gauge connected. • Key ON Engine OFF. • Scan Tool Connected • Control using Output State Control. Note: During Output Test Mode, the fuel pump will stay commanded on for only about 5 seconds. • Compare recorded fuel pressure reading to the Fuel System Specification Chart. • **Is the fuel pressure within range?**	Yes → No →	GO to **HC5**. GO to **HC3**.

Fuel Delivery System | HC

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HC3</td><td>CHECK VOLTAGE AT FUEL PUMP HARNESS CONNECTOR</td><td></td><td></td></tr>
<tr><td colspan="2">
• FP connector disconnected.
Note: REFER to the Wiring Diagram Manual for correct pin location.
• Measure the Voltage between:
<table><tr><th>(+)Vehicle battery</th><th>(-)FP Connector, Harness Side</th></tr><tr><td>Positive post</td><td>FPGND</td></tr></table>
• Is the Voltage above 10 V?
</td><td>Yes →
No →</td><td>GO to HC4.
KEY OFF. REPAIR open circuit.</td></tr>
<tr><td>HC4</td><td>CHECK VOLTAGE AT FUEL PUMP HARNESS CONNECTOR</td><td></td><td></td></tr>
<tr><td colspan="2">
• Verify inertia fuel shutoff (IFS) switch is set (button pushed in). REFER to Owner Guide for location.
• FP connector disconnected.
• Key ON Engine OFF.
• Scan Tool Connected
• Control using Output State Control.
• Be aware that Output Test Mode will turn off the FP after a calibrated time. If this happens, again command the outputs on to continue testing.
• Measure the Voltage between:
<table><tr><th>(+)FP Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>FPPWR</td><td>Negative post</td></tr></table>
• Is the Voltage above 10 V?
</td><td>Yes →
No →</td><td>KEY OFF.
EXIT Output State Control.
GO to HC9.
KEY OFF. REPAIR open circuit.</td></tr>
</table>

Fuel Delivery System | HC

Test Steps		Results →	Action to Take
HC5	CHECK ALL SYSTEM RELATED DEVICES (SENSOR, DAMPER OR REGULATOR) FOR LEAKAGE		
	• Fuel pressure tester installed. • Key ON Engine RUN. • CHECK for manifold vacuum at each system related component with a vacuum line. • Key OFF. • Wait 10 seconds. • Key ON Engine RUN. • Run engine for approximately 10 seconds. • Key OFF. • REMOVE vacuum hose on each system device connected to fuel rail. • INSPECT for presence of fuel in vacuum line of each device connected to the fuel rail. • **Are all vacuum lines for system related devices indicating no fuel present?**	Yes → No →	GO to **HC6**. REPLACE any component with vacuum line indicating fuel leakage.
HC6	CHECK FUEL PRESSURE LEAKDOWN		
	• Mechanical fuel pressure gauge connected. • Key ON Engine OFF. • Scan Tool Connected • Control using Output State Control. • Run fuel pump to obtain maximum fuel pressure. • Verify Fuel pressure remains within 34 kPa (5 PSI) of the maximum pressure for 1 minute after turning pump off. • **Does the fuel pressure remain within 34 kPa (5 PSI) of the highest reading after one minute?**	Yes → No →	GO to **HC7**. Fuel rail pressure leakdown GO to **HC13**.
HC7	DETERMINE FUEL SYSTEM TYPE		
	Note: All vehicles equipped with Return Fuel Systems RFS: utilize a pressure regulator with fuel return at the fuel rail. • **Is the vehicle equipped with Return Fuel Systems RFS:?**	Yes → No →	GO to **HC8**. GO to **HC13**.
HC8	CHECK FOR VACUUM SOURCE		
	• Key ON Engine RUN. • **Is the vacuum level at the Fuel Pressure Regulator equal to manifold vacuum?**	Yes → No →	GO to **HC9**. Repair as required.

Fuel Delivery System — HC

	Test Steps	Results →	Action to Take
HC9	CHECK FUEL PRESSURE REGULATOR RESPONSE		
	• Fuel pressure tester installed. • Disconnect the vacuum hose at the pressure regulator. Plug hose. • Drive vehicle with heavy accelerations while observing fuel pressure gauge reading. • **Does fuel pressure reading hold steady within 21 kPa (3 psi) during test?**	Yes → No →	GO to **HC10**. GO to **HC14**.
HC10	CHECK FUEL PRESSURE REGULATOR RESPONSE TO DECREASE IN MANIFOLD VACUUM		
	• Fuel pressure tester installed. • Key ON Engine RUN. • Rapidly accelerate the engine speed to 2500 RPM then return to idle. • **Does the fuel pressure increase during rapid acceleration?**	Yes → No →	GO to **HC11**. INSTALL a new FPR1 assembly.
HC11	CHECK FOR RESTRICTED FUEL RETURN LINE		
	• Fuel pressure tester installed. • REMOVE fuel return line at fuel rail. • Connect short hose from fuel rail to clean container of at least 1.1L(1.0 quart) capacity. • Key ON Engine OFF. • Scan Tool Connected • Control PCM-FP using Output State Control. • Run fuel pump to obtain maximum fuel flow. • Record fuel pressure. • Observe if fuel is being returned to container. • **Is the fuel pressure within range?**	Yes → No →	KEY OFF. GO to **HC12**. KEY OFF. INSTALL a new FPR1 assembly.
HC12	CHECK FUEL RETURN SYSTEM		
	Note: Observe Warning, Caution and Notes. • Disconnect fuel return line at the fuel rail. • Disconnect fuel return line at the fuel pump. • CHECK for restricted fuel return line. • Apply 21 to 34 kPa (3 to 5 psi) regulated shop air to the return line pressure. • **Does air flow freely through the line?**	Yes → No →	GO to **HC13**. REPAIR the fuel return line

Fuel Delivery System

HC

Test Steps		Results →	Action to Take
HC13	CHECK FUEL INJECTOR FLOW AND LEAKAGE		
	Note: Observe Warning, Caution and Notes. • CHECK fuel injectors for leakage and flow rate using Injector Flow Tester. • **Are test results satisfactory?**	Yes → No →	Test passed. RETURN to Section 3, Symptom Charts. REPLACE or clean inoperative fuel injector(s) as required.
HC14	CHECK FUEL SUPPLY LINE FOR RESTRICTION		
	Note: Observe Warning, Caution and Notes. • Disconnect fuel supply line at the fuel rail. • Disconnect fuel supply line at the fuel pump. • CHECK fuel supply line for restriction. • Apply 21 to 34 kPa (3 to 5 PSI) air pressure to the fuel supply line. • **Does air flow freely through the line?**	Yes → No →	INSTALL a new FPDM. REPAIR cause of restriction

Misfire Detection Monitor

HD

Note

This Pinpoint Test is intended to diagnose the following:

- Misfire Detection Monitor.

Powertrain Control Module (PCM) Connector

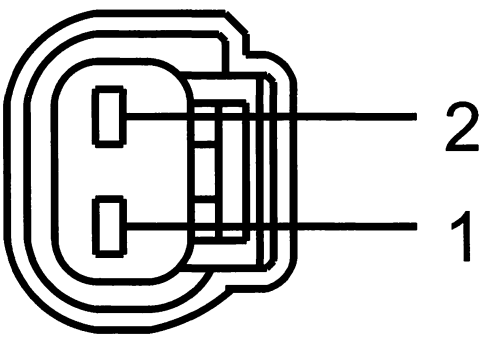
For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	CMP	E53
Expedition, Navigator	122 Pin	CMP	E31
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	CMP	E25
F-150	190 Pin	CMP	E45
All other vehicles	104 Pin	CMP	85

Misfire Detection Monitor	HD

Camshaft position (CMP) Sensor Connector

A



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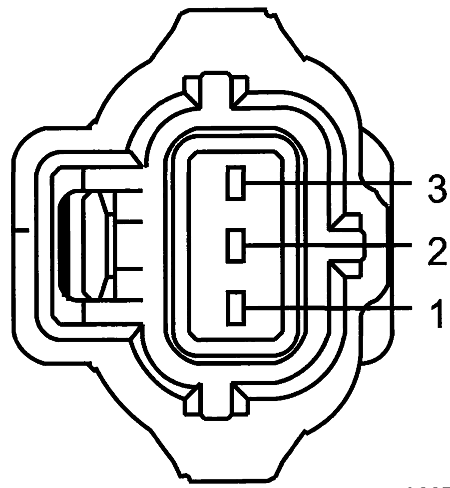

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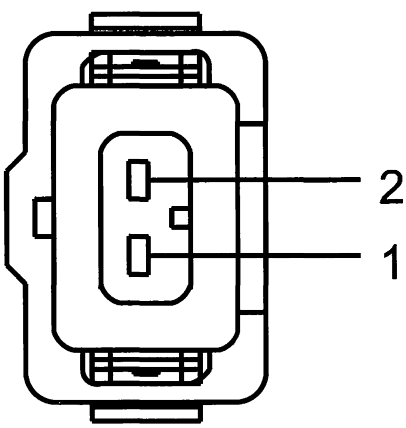

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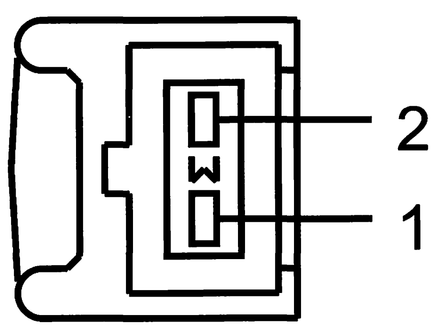
D



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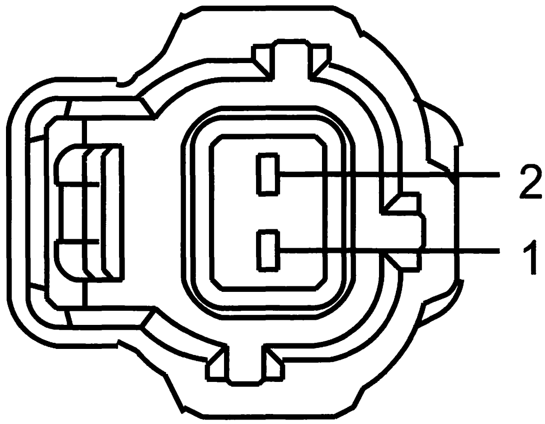
Misfire Detection Monitor — HD

E



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Vehicle	Connector	Circuit	Pin
Expedition, LS, Navigator, Thunderbird	A	CMP	2
F-150 Heritage 4.2L, E-Series 4.2L	B	CMP	2
Explorer 4.0L	C	CMP	1
Focus 2.0L	D	CMP	1
All other vehicles	E	CMP	2

Test Steps		Results →	Action to Take
HD1	CHECK FOR ADAPTIVE FUEL MONITOR AND HEGO MONITOR DTCS (CONTINUOUS MEMORY)		
	• CHECK PCM Self-Test DTCs: • **Are DTCs P0136, P0156, P0171, P0172 or P0175 present?**	Yes → No →	GO to **HD3**. GO to **HD2**.
HD2	CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS		
	• **Are there other non-misfire DTC in Continuous Memory. present?**	Yes →	Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	GO to **HD3**.

Misfire Detection Monitor | HD

Test Steps		Results →	Action to Take
HD3	CHECK FOR ANY OTHER KOEO SELF TEST DTCS		
	• **Are any other KOEO DTCs present?**	Yes →	(If Misfire or Coil DTCS are present, and WDS or equivalent tool is available, utilize the scope function to verify the suspect coil.) Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	KEY OFF. **For spark plug wires that are OK:** GO to **HD4**. **For spark plug wires that need evaluation:** GO to **JB1**.
HD4	CHECK FOR ANY OTHER CODES THAT MAY CAUSE A MISFIRE		
	• CHECK Self-Test DTCs: • **Are DTCs P1131, P1132, P1137, P1138, P1151, P1152, P1157 or P1158 present?**	Yes → No →	GO to **HD6**. GO to **HD5**.
HD5	CHECK FOR ANY OTHER KOER DTCS		
	• **Are any other KOER DTCs present?**	Yes →	KEY OFF. Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	GO to **HD6**.
HD6	CHECK INJECTOR DRIVER PIDS INJ1F THROUGH INJ10F		
	• Key ON Engine OFF. • Access appropriate INJxF PIDS for the suspect injector. • **Are the PIDS status YES?**	Yes → No →	GO to **HD7**. KEY OFF. GO to **HD8**.
HD7	CHECK FUEL INJECTORS AND HARNESS FOR OPEN		
	• PCM connector disconnected. Note: Go to Pinpoint Test HC Fuel Delivery System Test Information Chart at the beginning of the pinpoint test for injector resistance values.	Yes →	INSTALL a new PCM. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
	• **Are the resistance values between 11 and 18 ohms?**	No →	GO to **H41**.

Misfire Detection Monitor — HD

Test Steps		Results →	Action to Take
HD8	CHECK FUEL PRESSURE		
	WARNING: THE FUEL SYSTEM WILL REMAIN PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. • Key ON Engine RUN. • Start and run engine at idle, Check and record the FUELP. • Fuel pressure gauge connected. • Increase the engine speed to a minimum of 2000 RPM and maintain for two minutes. • Note and compare fuel pressure. • **Is the fuel pressure at specified pressure (use fuel pressure chart in Pinpoint Test HC)?**	Yes → No →	KEY OFF. GO to **HD9**. REFER to Fuel System General Information, Section 310 in the Workshop Manual.
HD9	VERIFY FUEL SYSTEM WILL HOLD PRESSURE		
	• Start and run engine at idle, CHECK fuel pressure. • Increase the engine speed to a minimum of 2000 RPM and maintain for two minutes. • CHECK for fuel leaking at the fuel injector o-ring, fuel pressure regulator, and the fuel lines to the fuel charging assembly. • **Did fuel pressure remain within 34 kPa (5 psi) for 60 seconds?**	Yes → No →	KEY OFF. GO to **HD10**. REFER to Fuel System General Information, Section 310 in the Workshop Manual. Manual to determine which area within the fuel Delivery system is at fault.
HD10	CHECK FUEL INJECTORS ABILITY TO DELIVER FUEL		
	Note: Fuel delivery system is not likely to have caused the misfire DTC if the flow test is within specification. • Go to Pinpoint Test HC for reference to the Warning, Caution, and Handling to prevent accident. • Verify that the flow rate for each injector is within specification. Use the injector flow tester. • **Is the flow rate for each injector within specification?**	Yes → No →	GO to **HD11**. REPLACE or clean inoperative fuel injector(s) as required. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
HD11	CHECK VACUUM SYSTEM		
	Note: Some vacuum leaks can be heard. • Visually inspect the vacuum hoses for signs of damage or deterioration. A collapsed vacuum hose may cause a blockage to one of the various actuators or sensors. If a blockage is found remove the blockage or install new parts as necessary. • **Is the vehicle vacuum system OK?**	Yes → No →	GO to **HD12**. REPAIR the vacuum system. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).

Misfire Detection Monitor — HD

Test Steps		Results	Action to Take
HD12	CHECK DAMPER AND PULLEY ASSEMBLY		
	Note: This step is for engines that have damper mounted pulse rings. Remove the front cover if necessary to observe the crank pulley. • Observe the crank pulley for wobble. • Examine the EI pulse ring fastened to the harmonic dampener. • **Does the crank pulley wobble or is the pulse ring loose or damaged?**	Yes →	Disconnect the battery for 5 minutes to allow the PCM to learn the new profile. REPLACE the pulley or damper assembly. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
		No →	GO to **HD13**.
HD13	CHECK THE EVAPORATIVE EMISSION SYSTEM		
	• The misfire monitor can be influenced by the Evaporative Emission System. The next five Pinpoint Test steps will diagnose the Evaporative Emission System. • CHECK the EVAP canister for fuel saturation. • **Is there an excess amount of liquid fuel present in the canister?**	Yes →	REPLACE the EVAP canister. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
		No →	GO to **HD14**.
HD14	PRESSURE TEST EVAPORATIVE EMISSION SYSTEM		
	• INSTALL rotunda Evaporative Emission System Tester 134-00056 or equivalent first at the EVAP service port. If equipped, then at the fuel filler cap. • Follow the test instructions from the Tester kit. • **Is the evaporative emission system holding pressure?**	Yes →	GO to **HD15**.
		No →	Repair the fault as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
HD15	CHECK VACUUM IN EVAPORATIVE EMISSION SYSTEM		
	• CHECK vacuum system between engine vacuum port and the EVAP canister. • CHECK EVAP system lines/hoses (check for proper connections, damage or blockage). • CHECK for blockage in the fuel tank vent system. • **Is there a fault indicated?**	Yes →	REPLACE the damaged vacuum hoses, or remove blockage/restrictions. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
		No →	GO to **HD16**.

Misfire Detection Monitor | HD

	Test Steps	Results →		Action to Take
HD16	CHECK EVAP CANISTER PURGE VALVE HOUSING LEAKS			
	• EVAP canister purge valve is electrically connected. • INSTALL a hand vacuum pump to the fuel vapor port from the EVAP canister on the EVAP canister purge vacuum valve at line. • Apply 53 kPa (16 in-Hg) of vacuum with the vacuum pump. • **Does the EVAP canister purge valve hold vacuum at room temperature?**	Yes	→	GO to **HD17**.
		No	→	REMOVE vacuum pump. REPLACE damaged EVAP canister purge valve. Complete PCM Reset to clear DTCs.
HD17	CHECK FOR FILTER CONTAMINATION ON EVAP CANISTER PURGE VALVE			
	• Vacuum line from input vacuum port to intake manifold on the EVAP canister purge valve (control vacuum solenoid part of valve) is removed. • INSTALL a hand vacuum to the open vacuum port on the EVAP canister purge valve. • Apply 48-52 kPa (10-15 in-Hg) of vacuum to the canister purge valve. • **Does the EVAP canister purge valve hold vacuum, or is the valve very slow to release vacuum to atmosphere?**	Yes	→	REPAIR EVAP canister purge valve filter. If unable to clean filter or remove blockage to filter, replace EVAP canister purge valve. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
		No	→	GO to **HD18**.
HD18	CHECK FOR BASE ENGINE CONCERNS			
	• This step will determine if there are any base engine concerns that any have caused the Misfire DTC or drive concern. Note: Engine temperature may affect results. • Perform the following tests in order to evaluate base engine integrity: • Perform engine compression and leakdown tests. • Perform valve train analysis. • CHECK Positive Crankcase Ventilation System. • CHECK possible leakage points. REFER to the Engine System general Information, Section 303-11 in the Workshop manual for all of the above. • **Is any service required?**	Yes	→	REPAIR fault. REFER to the Engine System general Information, Section 303-11 in the Workshop manual for all of the above.
		No	→	GO to **Z1**.
HD19	CHECK Z1 TO IDENTIFY FAULT			
	• **Did Pinpoint Test Z find a fault?**	Yes	→	COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
		No	→	GO to **HD20**.

Misfire Detection Monitor

HD

Test Steps		Results →	Action to Take
HD20	CHECK FOR ADDITIONAL MISFIRE DTCS		
	• Diagnostic trouble code P0300 indicate multiple cylinders are misfiring or the PCM cannot identify which cylinder is misfiring. • **Are any other misfire DTCs present?**	Yes → No →	GO to **HD1**. GO to **HD21**.
HD21	CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS		
	• **Are other continuous memory DTCs present?**	Yes →	GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, for Pinpoint Test direction and REPAIR other DTCs first.
		No →	GO to **HD22**.
HD22	CHECK THE CRANKSHAFT POSITION SENSOR TYPE		
	• Identify the which type of crankshaft position sensor the vehicle uses. • **Does the vehicle use a Hall Effects sensor?**	Yes → No →	GO to **HD23**. GO to **HD24**.
HD23	CHECK CMP SENSOR LOW RANGE OUTPUT WITH PCM DISCONNECTED		
	• Diagnostic trouble code P1309 indicates Misfire detection Monitor is not enabled. • PCM connector disconnected. • Connect digital multimeter. • Bump engine with a short burst from the starter, without starting engine for at least 10 engine revolutions. • Measure the Voltage between:	Yes →	A Hall type CMP that is installed out of synchronization will produce a DTC. To verify the correct installation, refer to Section 303 Electronic Engine Controls of the Workshop Manual. I f the CMP is installed properly, replace the PCM (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
	• **Is the Voltage below 2 V?**	No →	REPLACE CMP sensor. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).

(+)CMP Sensor Connector, Harness Side	(-)12V vehicle battery
CMP	Negative post

Misfire Detection Monitor | HD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HD24</td><td>CHECK CMP SENSOR HIGH RANGE OUTPUT VOLTAGE</td><td></td><td></td></tr>
<tr><td></td><td>
• PCM Disconnected.
• Diagnostic trouble code P1309 indicates Misfire detection Monitor is not enabled.
• Connect digital multimeter.
• Measure the Voltage between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)12V vehicle battery</th></tr>
<tr><td>CMP</td><td>Negative post</td></tr>
</table>
• Is the Voltage above 8 V?
</td><td>Yes →

No →</td><td>A Hall type CMP that is installed out of synchronization will produce a DTC. To verify the correct installation, refer to Section 303 Electronic Engine Controls of the Workshop Manual. I f the CMP is installed properly, replace the PCM (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

INSTALL a new CMP sensor.</td></tr>
<tr><td>HD25</td><td>CHECK THE PHYSICAL CONDITION OF THE CRANKSHAFT PULSE WHEEL</td><td></td><td></td></tr>
<tr><td></td><td>
Note: DTC P0315 is set when the PCM is unable to learn and correct for the mechanical variations in the crankshaft Pulse Wheel tooth spacing (the allowable correction tolerances have been exceeded).
• INSPECT crankshaft pulse wheel for damaged teeth.
• INSPECT Crankshaft Pulsewheel for wobble.
• CHECK for a loose Crankshaft Pulse Wheel.
• CHECK CKP sensor form damage.
• Are the CKP sensor and Crankshaft Pulse wheel OK?
</td><td>Yes →

No →</td><td>INSPECT the Crankshaft Pulse Wheel. refer to Electronic Engine Controls Section 303 of the Workshop Manual, if the CMP is installed properly,

REPAIR as necessary. Disconnect battery for 5 minutes to allow PCM to learn new data.
GO to Z1.</td></tr>
</table>

Exhaust Gas Recirculation (EGR) Systems

HE

Note

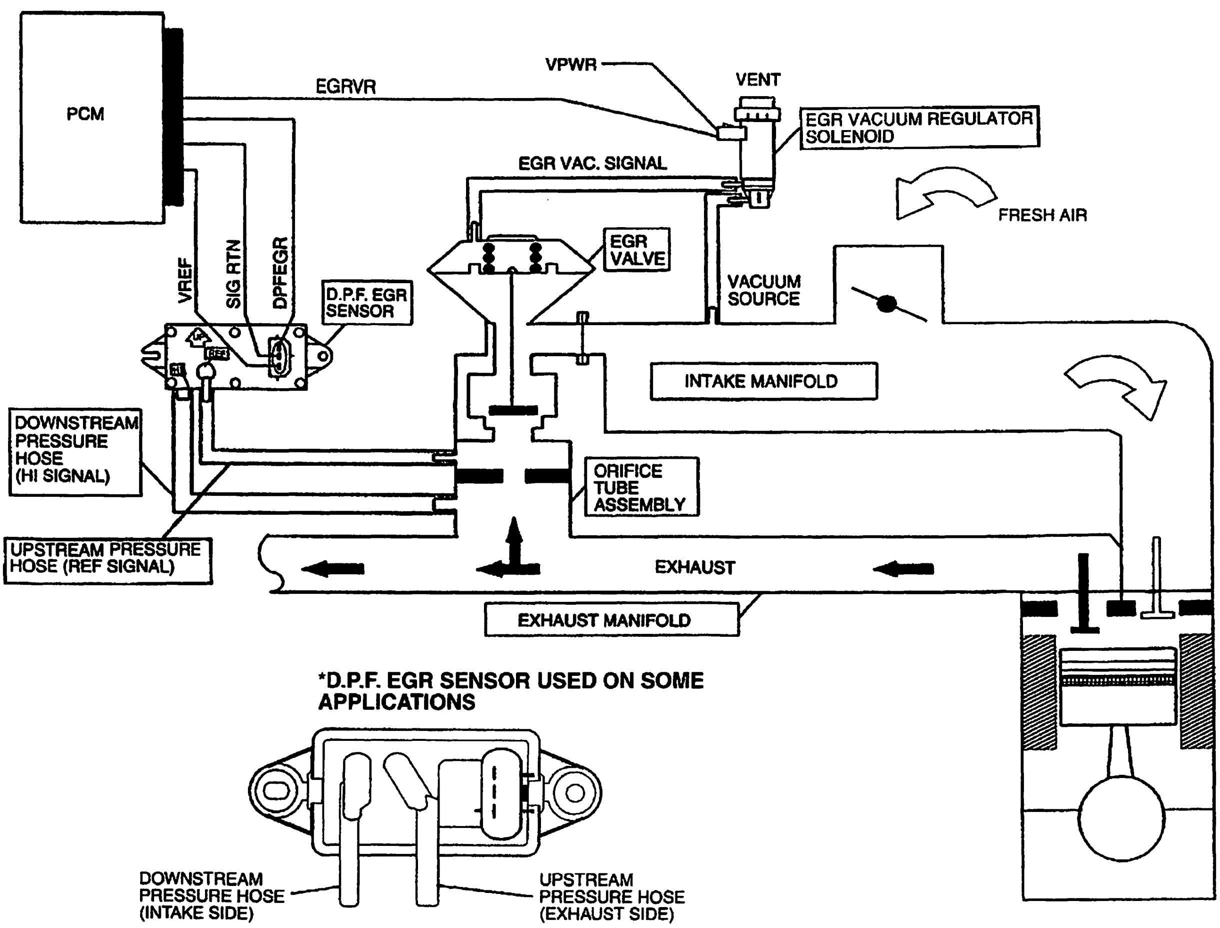
This Pinpoint Test is intended to diagnose the following:

- Differential Pressure Feedback EGR. sensor. (9J460).
- Exhaust gas recirculation (EGR) valve (9D460) (9D475).
- EGR vacuum regulator (VR) solenoid (9J459).
- Orifice tube assembly (9D477).
- Differential Pressure Feedback EGR (DPFE) sensor pressure hoses.
- Vacuum lines.
- Harness circuits: VREF, DPFE, SIGRTN, EVR, VPWR.
- Powertrain Control Module (PCM) (12A650).

Exhaust Gas Recirculation (EGR) Systems

HE

Typical DPFE EGR System



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Exhaust Gas Recirculation (EGR) Systems

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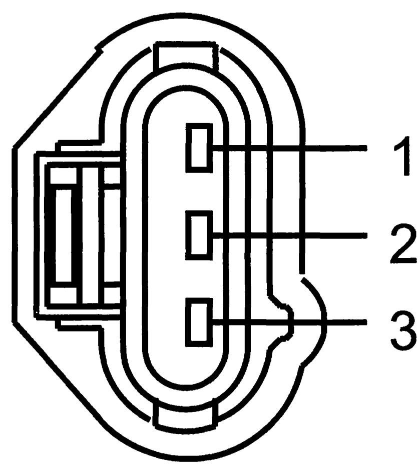
Delta Pressure Feedback EGR (DPFEGR) Sensor Connector



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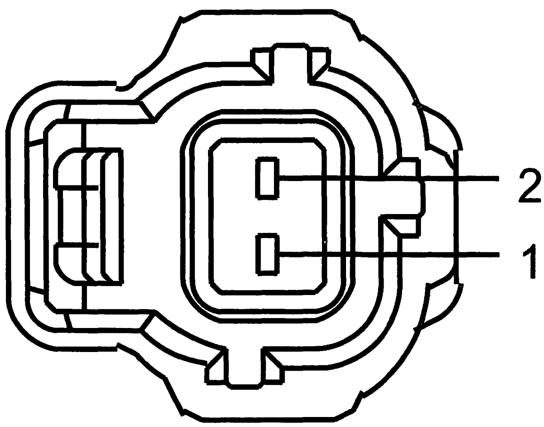
Circuit	Pin
DPFEGR (Delta Pressure Feedback EGR)	1
SIGRTN (Signal return)	2
VREF (Reference Voltage)	3

Exhaust Gas Recirculation (EGR) Systems	HE

Electronic vacuum regulator (EVR) Solenoid Connector



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Circuit	Pin
EGRVR (EGR Vacuum Regulator)	2
VPWR (Power supply)	1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	PWRGND VREF SIGRTN DPFEGR	B24 E20 E17 E41
Crown Victoria, E-Series 6.8L, Grand Marquis, Mustang 3.8L, Mustang 3.9L, Mustang 4.6L 2V	104 Pin	PWRGND VREF SIGRTN DPFEGR	103 90 91 65

(Continued)

Exhaust Gas Recirculation (EGR) Systems

HE

Vehicle	Connector	Circuit	Pin
Escape 2.0L	104 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	103 79 90 91 65
Expedition	122 Pin	PWRGND VREF SIGRTN DPFEGR	B1 E36 E25 E33
Explorer, Mountaineer	150 (50-50-50) Pin	PWRGND VREF SIGRTN DPFEGR	B47 E40 E41 E44
F-150	190 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	B67 E63 E57 E58 E21
LS, Thunderbird	150 (60-32-58) Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	B24 E16 E14 E17 E41
Navigator	122 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	B1 E22 E36 E25 E33
All other vehicles	104 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	103 47 90 91 65

Test Steps		Results →	Action to Take
HE1	DTCS P0405 AND P1400: DETERMINE PRESENT DPFEGR PID VOLTAGE		
	Note: Depending on the application, verify a prior repair has not resulted in the DPFE sensor being installed backwards or the vacuum hoses being installed on the opposite ports. • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • **Is the Voltage below 0.2 V?**	Yes → No →	KEY OFF. Fault is present GO to **HE2**. An intermittent fault is suspected in the EGR system GO to **HE11**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE2	CHECK VREF AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
	• DPFEGR Sensor connector disconnected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **HE3**.
		No →	GO to **C1**.

(+)DPFEGR Sensor Connector, Harness Side	(-)DPFEGR Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 2

- **Is the Voltage between 4 V - 5.5 V?**

Test Steps		Results →	Action to Take
HE3	CHECK DPFEGR CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS		
	• Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **HE4**.
		No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
DPFEGR	SIGRTN

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)Vehicle battery
DPFEGR	Negative post

- **Is the Resistance above 10 KOhm?**

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE4	INDUCE OPPOSITE DPFEGR SENSOR VOLTAGE		
	• PCM connector connected. • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • **Is the Voltage between 4 V - 5.5 V?**	Yes →	KEY OFF. INSTALL a new DPFEGR sensor. Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
		No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). CLEAR the PCM DTCs and REPEAT Self-Test.
HE5	DTCS P0406 AND P1401: DETERMINE PRESENT DPFEGR PID VOLTAGE		
	• Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • **Is the Voltage above 4 V?**	Yes →	KEY OFF. Fault is present GO to **HE6**.
		No →	An intermittent fault is suspected in the EGR system GO to **HE11**.
HE6	CHECK VREF VOLTAGE TO DPFE SENSOR		
	• DPFEGR Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	GO to **HE7**.
		No →	GO to **C1**.

(+)DPFEGR Sensor Connector, Harness Side	(-)DPFEGR Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 2

• **Is the Voltage between 4 V - 5.5 V?**

Exhaust Gas Recirculation (EGR) Systems

HE

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HE7</td><td>CHECK DPFEGR AND SIGRTN CIRCUIT(S) FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)DPFEGR Sensor Connector, Harness Side
DPFEGR	DPFEGR - Pin 1
SIGRTN	SIGRTN - Pin 2

- **Are the resistances above 5 Ohm?**

</td><td>Yes →
No →</td><td>REPAIR open circuit.
GO to **HE8**.</td></tr>
<tr><td>HE8</td><td>VERIFY SCAN TOOL COMMUNICATION</td><td></td><td></td></tr>
<tr><td colspan="2">

- PCM connector connected.
- Add jumper wire between the points described below:

Point A DPFEGR Sensor Connector, Harness Side	Point B DPFEGR Sensor Connector, Harness Side
DPFEGR - Pin 1	SIGRTN - Pin 2

- Access the PCM-DPFEGR PID using a scan tool.
- **Does a scan tool communication concern exist?**

</td><td>Yes →
No →</td><td>KEY OFF.
GO to **HE9**.
KEY OFF.
REMOVE jumper(s).
GO to **HE10**.</td></tr>
<tr><td>HE9</td><td>CHECK DPFEGR CIRCUIT FOR SHORT TO VREF</td><td></td><td></td></tr>
<tr><td colspan="2">

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VREF	DPFEGR

- **Is the Resistance above 10 KOhm?**

</td><td>Yes →
No →</td><td>INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
REPAIR short circuit.</td></tr>
<tr><td>HE10</td><td>CHECK DPFEGR CIRCUIT FOR SHORT TO POWER</td><td></td><td></td></tr>
<tr><td colspan="2">

- PCM connector disconnected.
- DPFEGR Sensor connector disconnected.
- Key ON Engine OFF.
- Measure the Voltage between:

(+)DPFEGR Sensor Connector, Harness Side	(-)Vehicle battery
DPFEGR - Pin 1	Negative post

- **Is the Voltage above 10.5 V?**

</td><td>Yes →
No →</td><td>KEY OFF. REPAIR short circuit.
INSTALL a new DPFEGR sensor.
Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402.</td></tr>
</table>

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE11	PERFORM A THOROUGH WIGGLE TEST ON THE ESM HARNESS		
	• Access the PCM-DPFEGR PID using a scan tool. • Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • **Is there any change in the voltage reading, or is a concern found?**	Yes →	REPAIR as necessary.
		No →	Unable to duplicate or identify fault at this time. GO to **Z1**.
HE12	DTCS P0402 AND P1405: CHECK FOR SIMULTANEOUS PRESENCE		
	• **Is DTC P0402 present with DTC P1405?**	Yes →	GO to **HE28**.
		No →	GO to **HE13**.
HE13	DTC P0402: CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM HOSE DISCONNECTED		
	• Disconnect and plug the vacuum hose connected to the EGR valve. • Perform KOER Self-Test. • **Did KOER DTC P0402 appear or are you unable to run KOER self-test due to an engine stall or no start?**	Yes →	KEY OFF. INSPECT pressure hoses for pinching, icing or other blockage. If OK, REMOVE and INSPECT EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. GO to **HE14**.
		No →	Reconnect the vacuum hose to the exhaust gas recirculation valve. GO to **HE15**.
HE14	PERFORM KOER SELF-TEST		
	• CLEAR the KOER DTCs and REPEAT Self-Test. • **Did DTC P0402 reappear?**	Yes →	GO to **HE18**.
		No →	Test is complete and no faults were found. CLEAR the DTCs and REPEAT Self-Test.
HE15	CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM HOSE DISCONNECTED		
	• Disconnect the vacuum hose from the EGR valve. • Perform KOER Self-Test. • **Did KOER DTC P0402 appear or are you unable to run KOER self-test due to an engine stall or no start?**	Yes →	GO to **HE16**.
		No →	INSPECT pressure hoses for pinching, icing or other blockage. REPAIR as necessary. GO to **HE23**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE16	CHECK EGR SYSTEM HOSES FOR INTEGRITY AND CONNECTION		
	Note: A pinched or plugged EGR vacuum hose can trap vacuum between the EVR solenoid and EGR valve, not allowing the EGR valve to close. • Trace each vacuum hose from the EVR solenoid and verify each hose connected correctly. • Verify the EGR vacuum hose is not pinched or plugged and is routed properly. • **Are ALL vacuum hoses OK?**	Yes → No →	RECONNECT vacuum hose(s). GO to **HE17**. REPAIR as necessary.
HE17	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at DPFEGR sensor. • Connect vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes → No →	INSTALL a new DPFEGR sensor. Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402. Reconnect DPFEGR. GO to **HE18**.

Exhaust Gas Recirculation (EGR) Systems

HE

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HE18</td><td>CHECK EGR FLOW AT IDLE WITH EVR HARNESS CONNECTOR OFF</td><td></td><td></td></tr>
<tr><td colspan="2">

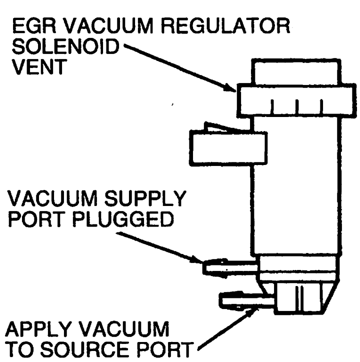
- Disconnect vacuum hose at EGR valve and connect hose to vacuum gauge.
- Start engine.
- EVR Solenoid connector disconnected.
- Observe vacuum gauge.
  - — The EGR valve requires vacuum greater than 5.4 kPa (1.6 in Hg) to begin to open.
  - — If the vacuum reading remains greater than 5.4 kPa (1.6 in Hg) after the EVR solenoid is disconnected, a fault may be present in the EVR solenoid.
- **Does the EGR vacuum remain greater than 5.4 kPa (1.6 in Hg) at idle after the EVR is disconnected?**

</td><td>Yes →

No →</td><td>KEY OFF.
GO to **HE19**.
KEY OFF.
GO to **HE20**.</td></tr>
<tr><td>HE19</td><td>INSPECT EVR SOLENOID VENT FOR BLOCKAGE</td><td></td><td></td></tr>
<tr><td colspan="2">

Note: A plugged EVR (electronic vacuum regulator) solenoid vent will not allow EGR vacuum to vent to the atmosphere.

- EVR vacuum hoses disconnected.
- REMOVE EVR solenoid vent cap (if removable).
- REMOVE filter and inspect for blockage, or in some cases, icing.
- Plug the EGR vacuum supply port.
- Connect a hand vacuum pump to EVR Source port.
- Apply 34 to 51 kPa (10 to 15 in Hg) vacuum.



AA0897-A

- **Is the EVR solenoid vent or filter plugged or restricted?**

</td><td>Yes →

No →</td><td>REPAIR or if not serviceable REPLACE EVR solenoid.
INSTALL a new EVR solenoid.
CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
</table>

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE20	CHECK EVR SOLENOID COIL RESISTANCE		
	• Measure the Resistance between:	Yes →	GO to **HE21**.
		No →	INSTALL a new EVR solenoid. CLEAR the PCM DTCs and REPEAT Self-Test.

(+)EVR Solenoid Connector, Harness Side	(-)EVR Solenoid Connector, Harness Side
VPWR - Pin 1	EGRVR - Pin 2

• **Is the Resistance between 26 Ohm - 40 Ohm?**

Test Steps		Results →	Action to Take
HE21	CHECK EGRVR CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **HE22**.
		No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)Vehicle battery
EGRVR	Negative post

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
HE22	CHECK EGRVR CIRCUIT FOR SHORT TO VREF		
	• Measure the Resistance between:	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
EGRVR	VREF

• **Is the Resistance above 10 KOhm?**

Exhaust Gas Recirculation (EGR) Systems	HE

Test Steps		Results →	Action to Take
HE23	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at DPFEGR sensor. • Connect vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes → No →	INSTALL a new DPFEGR sensor. Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402. Reconnect DPFEGR. GO to **HE24**.

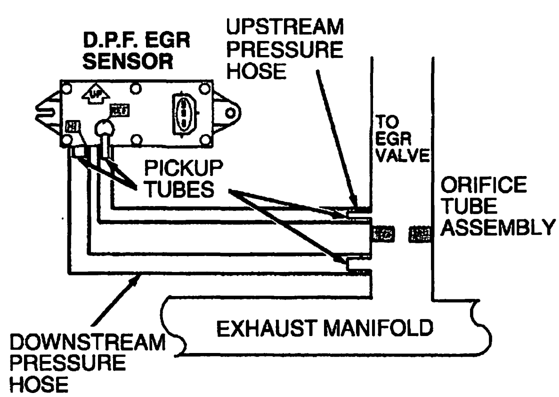
Exhaust Gas Recirculation (EGR) Systems

HE

	Test Steps	Results	Action to Take
HE24	CHECK DPFEGR SENSOR VOLTAGE WHILE EXERCISING EGR VALVE		
	• Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. Note: Typical sensor voltage with no EGR flow is between 0.2V and 1.3V. • Disconnect vacuum hose at EGR valve and plug hose. • Connect vacuum pump to EGR valve. • Start engine. • Observe DPFEGR PID at idle and compare to KOEO voltage. Note: A higher voltage at idle may be due to a non-seating or heavily carboned EGR Valve pintle. • Apply just enough vacuum to EGR valve to open it without stalling engine. • Quickly release vacuum. • Repeat this three times. • Observe DPFEGR PID. Note: DPFEGR PID voltage must increase as valve opens and decrease as valve closes. A slow return voltage is an indication of a binding or slow closing EGR valve. • **Does the DPFEGR PID voltage indicate an open, binding or slow-closing EGR valve?**	Yes → No →	REMOVE and INSPECT EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. KEY OFF. GO to **HE25**.
HE25	PERFORM A THOROUGH WIGGLE TEST ON THE EGRVR HARNESS		
	Note: An intermittent short to GND in the EGRVR circuit will cause the vacuum applied to the EGR valve to be higher than normal when the short is present. The vacuum available at the EGR valve at idle is normally below 3.4 kPa (1.6 in Hg) for the valve to begin to open. • REMOVE hand vacuum pump. • Connect vacuum gauge to EGR valve vacuum hose. • Connect vacuum gauge to EGR valve vacuum hose using a "Tee" fitting. • Key ON Engine RUN. • Observe vacuum gauge. — Lightly tap on the EVR solenoid. — Perform a thorough wiggle test on the EGRVR harness. Note: A fault is indicated by a sudden jump in vacuum reading. • **Was an intermittent concern located?**	Yes → No →	ISOLATE fault and REPAIR as necessary. RECONNECT vacuum hose(s). GO to **HE26**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE26	INSPECT EVR SOLENOID AND VACUUM HOSES FOR PLUGGING		
	• REMOVE EVR solenoid vent cap (if removable). • REMOVE filter and inspect for blockage, or in some cases, icing. • INSPECT pressure hoses for pinching, icing or other blockage. • **Is the EVR solenoid vent or filter plugged or restricted?**	Yes → No →	REPAIR or if not serviceable REPLACE EVR solenoid. CLEAR the PCM DTCs and REPEAT Self-Test. GO to **Z1**.
HE27	DTC P1405: INSPECT UPSTREAM PRESSURE HOSE CONNECTIONS		
	• INSPECT upstream hose at DPFEGR sensor and orifice tube assembly for disconnect or poor connection.  A0057201 • **Is vacuum hose OFF or poorly connected?**	Yes → No →	REPAIR as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). GO to **HE28**.
HE28	INSPECT UPSTREAM PRESSURE HOSE FOR PLUGGING		
	Note: It is essential that ONLY the correct Ford service pressure hose be used. • Visually inspect upstream pressure hose routing. Hose must not be pinched or have dips in it where water could settle or freeze. • REMOVE upstream pressure hose and carefully inspect for plugging, water or leaks. • **Is a fault present?**	Yes → No →	REPAIR or REPLACE pressure hose as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). GO to **HE29**.

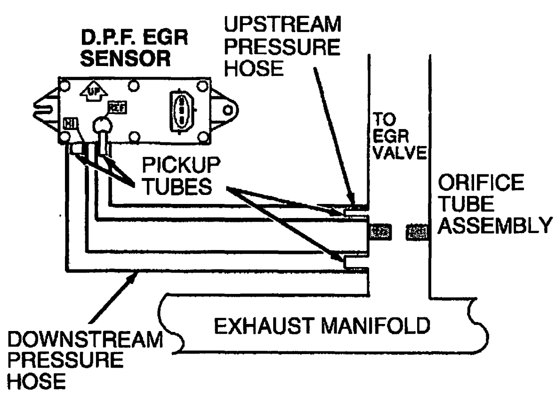
Exhaust Gas Recirculation (EGR) Systems

HE

	Test Steps	Results →	Action to Take
HE29	CHECK ORIFICE TUBE ASSEMBLY AND DPFEGR SENSOR		
	• INSPECT the upstream connection on the DPFEGR sensor for damage or plugging at the sensor. • INSPECT the exhaust manifold side pressure tube at the orifice tube assembly for plugging or damage. • **Is the DPFEGR sensor or orifice tube assembly plugged or damaged?**	Yes →	REPAIR or REPLACE DPFEGR sensor or orifice tube assembly as necessary. Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402.
		No →	GO to **HE30**.
HE30	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at DPFEGR sensor. • Connect vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes →	INSTALL a new DPFEGR sensor. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402.
		No →	GO to **Z1**.

Exhaust Gas Recirculation (EGR) Systems | HE

	Test Steps	Results →	Action to Take
HE31	DTC P1406: INSPECT DOWNSTREAM PRESSURE HOSE CONNECTIONS		
	Note: If the fault is currently present, DTC P1408 will appear when running KOER Self-Test. • Verify EGR valve is securely attached and that exhaust gases are not leaking from the sealing surface. • INSPECT downstream hose at DPFEGR sensor and orifice tube assembly for disconnect or poor connection.	Yes →	REPAIR as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
		No →	GO to **HE32**.



A0057201

	Test Steps	Results →	Action to Take
	• **Is vacuum hose OFF or poorly connected?**		
HE32	INSPECT DOWNSTREAM PRESSURE HOSE FOR PLUGGING		
	Note: It is essential that ONLY the correct Ford service pressure hose be used. • Visually inspect downstream pressure hose routing. • REMOVE downstream pressure hose and carefully inspect for plugging, water or leaks. • **Is a fault present?**	Yes →	REPAIR or REPLACE pressure hose as necessary.
		No →	GO to **HE33**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE33	CHECK ORIFICE TUBE ASSEMBLY AND DPFEGR SENSOR		
	• INSPECT connections at the DPFEGR sensor for plugging or damage. • INSPECT the intake manifold side pressure tube at the orifice tube assembly for plugging or damage. • **Is the DPFEGR sensor or orifice tube assembly plugged or damaged?**	Yes →	REPAIR or REPLACE DPFEGR sensor or orifice tube assembly as necessary. Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402.
		No →	GO to **HE34**.
HE34	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at DPFEGR sensor. • Connect vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes → No →	GO to **HE35**. GO to **Z1**.

Exhaustive Gas Recirculation (EGR) Systems — HE

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HE35</td><td>CHECK DPFEGR CIRCUIT(S) FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">REPAIR open circuit.
INSTALL a new DPFEGR sensor.
COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402.</td></tr>
<tr><td></td><td>• PCM connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)DPFEGR Sensor Connector, Harness Side</th></tr><tr><td>DPFEGR</td><td>DPFEGR - Pin 1</td></tr><tr><td>SIGRTN</td><td>SIGRTN - Pin 2</td></tr><tr><td>VREF</td><td>VREF - Pin 3</td></tr></table>• Are the resistances above 5 Ohm?</td></tr>
<tr><td>HE36</td><td>DTC P0401: PERFORM KOER SELF-TEST</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HE37.
GO to HE53.</td></tr>
<tr><td></td><td>• Perform KOER Self-Test.
• Did DTC P1408 appear?</td></tr>
<tr><td>HE37</td><td>KOER AND CONTINUOUS MEMORY DTC P1408: RETRIEVE CONTINUOUS MEMORY DTC</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HE31.
GO to HE38.</td></tr>
<tr><td></td><td>Note: If any DTC other than P1406 appears, note the DTC and refer to Section 4 after completing this pinpoint test.
• Retrieve all Continuous Memory DTCs.
• Is DTC P1406 present?</td></tr>
<tr><td>HE38</td><td>CHECK VREF VOLTAGE TO DPFE SENSOR</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HE39.
GO to C1.</td></tr>
<tr><td></td><td>• DPFEGR Sensor connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)DPFEGR Sensor Connector, Harness Side</th><th>(-)DPFEGR Sensor Connector, Harness Side</th></tr><tr><td>VREF - Pin 3</td><td>SIGRTN - Pin 2</td></tr></table>• Is the Voltage between 4 V - 5.5 V?</td></tr>
</table>

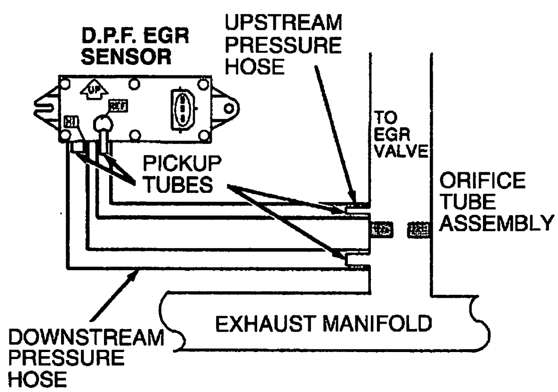
Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE39	CHECK DPFEGR CIRCUIT FOR SHORT TO VREF		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side** VREF / DPFEGR • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **HE40**. REPAIR short circuit.
HE40	PERFORM KOER SELF-TEST WHILE MONITORING EGR VACUUM		
	• PCM connector connected. • DPFEGR Sensor connector connected. • Disconnect vacuum hose at EGR valve and connect hose to vacuum gauge. Note: Since the EGR vacuum hose is disconnected, ignore DTCs during this KOER Self-Test. • Perform KOER Self-Test. Observe vacuum gauge. Approximately 30 seconds into the test, EGR flow will be requested for a few seconds. Vacuum at this time should increase above 5.4 kPa (1.6 in Hg) to open the valve. • **Does the vacuum increase to 10 kPa (3.0 in Hg) or greater at any time during KOER Self-Test?**	Yes → No →	KEY OFF. GO to **HE41**. KEY OFF. GO to **HE44**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE41	INSPECT DPFEGR PRESSURE HOSES		
	• INSPECT pressure hoses for reverse connection at DPFEGR sensor or at orifice tube assembly. • INSPECT hoses for improper routing. • INSPECT both hoses for leaks and blockage. • INSPECT DPFEGR sensor and orifice tube assembly for blockage or damage at the pickup tubes.  A0057201 • **Is a fault present?**	Yes → No →	REPAIR or REPLACE pressure hose as necessary. GO to **HE42**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE42	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at DPFEGR sensor. • Connect vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes →	INSTALL a new DPFEGR sensor. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402.
		No →	Reconnect all hoses. GO to **HE43**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results	Action to Take
HE43	CHECK EGR VALVE FUNCTION BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect vacuum hose at EGR valve and plug hose. • Connect vacuum pump to EGR valve. • Key ON Engine RUN. • Access the PCM-DPFEGR and PCM-RPM PIDs using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. If engine wants to stall, increase engine speed to approximately 1000RPM and hold steady. • Look for the following: — The EGR valve starts opening at about 5.4 kPa (1.6 in Hg) vacuum, indicated by an increasing DPFEGR PID voltage. — The DPFE PID voltage increases until valve is fully open. The DPFEGR PID voltage must read at least 2.5V with full vacuum applied. — The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**	Yes → No →	COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). GO to **HE47**. GO to **HE44**.
HE44	PHYSICALLY INSPECT ALL VACUUM LINES BETWEEN EGR VALVE, EVR AND VACUUM SOURCE		
	• INSPECT all vacuum lines for leaks, kinks, pinches, disconnects, blockage, misrouting or physical damage of any type. • INSPECT EVR for cracks or other physical damage. • **Are any concerns evident?**	Yes → No →	REPAIR as necessary. If EVR is damaged, REPLACE EVR. CLEAR the PCM DTCs and REPEAT Self-Test. KEY OFF. GO to **HE45**.
HE45	PHYSICALLY INSPECT EGR VALVE		
	• REMOVE and INSPECT EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. • **Are any EGR valve assembly concerns present?**	Yes → No →	REPAIR as necessary. If repair is not possible, REPLACE EGR valve. CLEAR the PCM DTCs and REPEAT Self-Test. GO to **HE46**.

Exhaust Gas Recirculation (EGR) Systems

HE

<table>
<tr><th>Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HE46 CHECK ENGINE VACUUM
• EVR vacuum hoses disconnected.
• Connect a hand held vacuum gauge to the vacuum source.
• Key ON Engine RUN.
• Engine warm and at idle.
• Observe vacuum gauge.
• Is vacuum gauge steadily reading at least 51 kPa (15 in Hg)?</td>
<td>Yes →

No →</td>
<td>KEY OFF.
GO to HE47.
ISOLATE base engine concern and REPAIR as necessary.</td></tr>
<tr><td>HE47 CHECK VPWR VOLTAGE TO EVR SOLENOID
• EVR Solenoid connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table>
<tr><th>(+)EVR Solenoid Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>VPWR - Pin 1</td><td>Negative post</td></tr>
</table>
• Is the Voltage above 10.5 V?</td>
<td>Yes →

No →</td>
<td>KEY OFF.
GO to HE48.
REPAIR open circuit.</td></tr>
<tr><td>HE48 CHECK EVR SOLENOID COIL RESISTANCE
• Measure the Resistance between:
<table>
<tr><th>(+)EVR Solenoid Connector, Component Side</th><th>(-)EVR Solenoid Connector, Component Side</th></tr>
<tr><td>VPWR - Pin 1</td><td>EGRVR - Pin 2</td></tr>
</table>
• Is the Resistance between 26 Ohm - 40 Ohm?</td>
<td>Yes →
No →</td>
<td>GO to HE49.
INSTALL a new EVR solenoid.
CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
<tr><td>HE49 CHECK EGRVR CIRCUIT FOR SHORT TO POWER IN HARNESS
• PCM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>EGRVR</td><td>Negative post</td></tr>
</table>
• Is the Voltage above 1 V?</td>
<td>Yes →
No →</td>
<td>REPAIR short circuit.
KEY OFF.
GO to HE50.</td></tr>
<tr><td>HE50 CHECK EGRVR CIRCUIT FOR OPEN IN HARNESS
• Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)EVR Solenoid Connector, Harness Side</th></tr>
<tr><td>EGRVR</td><td>EGRVR - Pin 2</td></tr>
</table>
• Is the Resistance below 5 Ohm?</td>
<td>Yes →

No →</td>
<td>RECONNECT PCM and EGRVR.
GO to HE51.
REPAIR open circuit.</td></tr>
</table>

Exhaustive Gas Recirculation (EGR) Systems | HE

Test Steps		Results →	Action to Take
HE51	INSPECT EGR SYSTEM FOR LEAKS, RESTRICTIONS AND POOR CONNECTIONS		
	• Visually inspect the EGR system for signs of intermittent failure. • **Were there any concerns found during the visual inspection?**	Yes → No →	REPAIR as necessary. GO to **HE52**.
HE52	CHECK EGRVR SOLENOID VACUUM THROUGHPUT BY GROUNDING EGRVR CIRCUIT		
	• PCM connector connected. • Disconnect vacuum hose at EGR valve and connect hose to vacuum gauge. • Key ON Engine RUN. • Engine warm and at idle. • Add jumper wire between the points described below:	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). INSTALL a new EVR solenoid. CLEAR the PCM DTCs and REPEAT Self-Test.

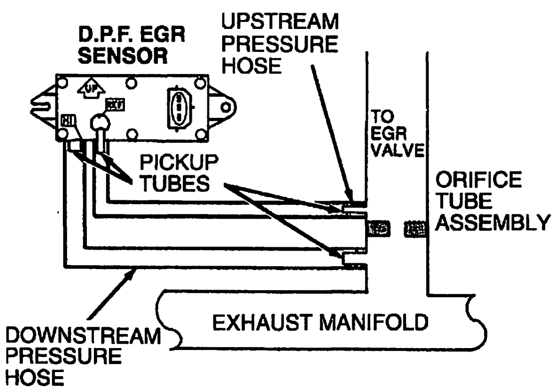
Point A EVR Solenoid Connector, Harness Side	Point B Vehicle battery
EGRVR - Pin 2	Negative post

Note: If the EGRVR does not react within 2 seconds, an EGRVR fault may be present.

- **Does the vacuum gauge indicate 13.5 kPa (4.0 in Hg) or greater within2 seconds?**

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE53	INSPECT DPFEGR PRESSURE HOSES		
	• Visually inspect upstream pressure hose routing. Visually inspect downstream pressure hose routing. INSPECT for reversed connection at DPFEGR sensor or orifice tube assembly. • Hose must not be pinched or have dips in it where water could settle or freeze. • INSPECT both hoses for leaks and blockage. • INSPECT DPFEGR sensor and orifice tube assembly for blockage or damage at the pickup tubes.  A0057201 • **Were there any concerns found during the visual inspection?**	Yes → No →	REPAIR as necessary. GO to **HE54**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE54	CHECK EGR VALVE FUNCTION BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at DPFEGR sensor. • Connect vacuum pump to the downstream connection at sensor (intake manifold side of sensor or the smaller diameter pickup tube). • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes → No →	INSTALL a new DPFEGR sensor. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). Note: After replacing the DPFEGR sensor, it is important to turn the key to the RUN position for approximately 5 seconds before starting. This will allow the PCM to calibrate itself to the new DPFEGR sensor. Failure to do this may result in a false DTC P0402. Reconnect all hoses. GO to **HE55**.

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE55	CHECK EGR VALVE FUNCTION BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect vacuum hose at EGR valve and plug hose. • Connect vacuum pump to EGR valve. • Key ON Engine RUN. • Access the PCM-DPFEGR and PCM-RPM PIDs using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. If engine wants to stall, increase engine speed to approximately 1000RPM and hold steady. • Look for the following: — The EGR valve starts opening at about 5.4 kPa (1.6 in Hg) vacuum, indicated by an increasing DPFEGR PID voltage. — The DPFE PID voltage increases until valve is fully open. The DPFEGR PID voltage must read at least 2.5V with full vacuum applied. — The DPFEGR PID voltage remains steady with steady vacuum. If voltage drops within a few seconds, the EGR valve or vacuum source may be leaking. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate the EGR valve is operating as described in the test step?**	Yes → No →	COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). GO to **HE56**. REMOVE and INSPECT EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. If OK, REMOVE and INSPECT EGR valve and tube for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary.

Exhaust Gas Recirculation (EGR) Systems

HE

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HE56</td><td>INSPECT EGR VACUUM SIGNAL SUPPLY FOR INTERMITTENT FAILURE</td><td></td><td></td></tr>
<tr><td colspan="2">
• Remove the vacuum hose from the exhaust gas recirculation valve and connect to a vacuum gauge.
• Key ON Engine RUN.
• Add jumper wire between the points described below:
<table>
<tr><th>Point A EVR Solenoid Connector, Harness Side</th><th>Point B Vehicle battery</th></tr>
<tr><td>EGRVR - Pin 2</td><td>Negative post</td></tr>
</table>
• Solenoid will be Full ON.
• Vacuum gauge should read above 13.5 kPa (4.0 in Hg).
• Observe vacuum gauge.
• Look for a fault while performing the following checks:
— Lightly tap on the EVR solenoid.
— Perform a thorough wiggle test on the EVR harness.
— INSPECT EGR vacuum signal supply for intermittent failure.
— INSPECT EVR solenoid and vacuum hoses for plugging.
— A fault is indicated by a sudden drop in vacuum reading.
• Is a fault indicated?
</td><td>Yes →

No →</td><td>ISOLATE fault and REPAIR as necessary.

Unable to duplicate or identify fault at this time.
Note: In cold climates, the EGR valve may temporarily freeze shut and thaw when the engine warms.
GO to Z1.</td></tr>
</table>

Exhaustive Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE57	EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH EGR VACUUM HOSE DISCONNECTED AND PLUGGED		
	Note: Perform KOER Self-Test. REPAIR any other DTCs. • Possible causes for EGR flow at idle with no related DTCs: — EGR valve not fully seating. — EVR solenoid vent restricted. — Damaged EVR solenoid. • Disconnect and plug the vacuum hose connected to the EGR valve. • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Note voltage. • Key ON Engine RUN. • With engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage. • An increase in voltage at idle indicates the DPFEGR sensor is sensing EGR flow. • **Is the DPFEGR PID voltage greater at idle by 0.15V than with the engine OFF?**	Yes → No →	REMOVE and INSPECT EGR valve for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. INSPECT EVR solenoid and vacuum hoses for plugging INSPECT EVR solenoid vent for blockage GO to **HE58**.
HE58	DETERMINE EGR VALVE VACUUM SUPPLY		
	• **Is a fault present in the EGR valve vacuum supply?**	Yes → No →	REPAIR as necessary. INSTALL a new EVR solenoid. CLEAR the PCM DTCs and REPEAT Self-Test.
HE59	DTCS P0403 AND P1409: CHECK EVR SOLENOID COIL RESISTANCE		
	• EVR Solenoid connector disconnected. • Measure the Resistance between: (see table below) • **Is the Resistance between 26 Ohm - 40 Ohm?**	Yes → No →	GO to **HE60**. INSTALL a new EVR solenoid. CLEAR the PCM DTCs and REPEAT Self-Test.

(+)EVR Solenoid Connector, Component Side	(-)EVR Solenoid Connector, Component Side
VPWR - Pin 1	EGRVR - Pin 2

Exhaust Gas Recirculation (EGR) Systems

HE

Test Steps		Results	Action to Take
HE60	CHECK VPWR VOLTAGE TO EVR SOLENOID		
	• Key ON Engine OFF. • Measure the Voltage between: (+)EVR Solenoid Connector, Harness Side: VPWR - Pin 1; (-)Vehicle battery: Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **HE61**. REPAIR open circuit.
HE61	CHECK EGRVR CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: EGRVR; (-)EVR Solenoid Connector, Harness Side: EGRVR - Pin 2 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HE62**. REPAIR open circuit.
HE62	CHECK EGRVR CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: (+)PCM Connector, Harness Side: EGRVR; (-)Vehicle battery: Negative post • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **HE63**. KEY OFF. REPAIR short circuit.
HE63	CHECK EGRVR CIRCUIT FOR SHORT TO GND IN HARNESS		
	• Measure the Resistance between: (+)PCM Connector, Harness Side: EGRVR; (-)PCM Connector, Harness Side: PWRGND • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
HE64	CHECK FOR THE PRESENCE OF KOER DTCS P0403 OR P1409		
	• PCM connector connected. • Perform KOER Self-Test. • **Did DTCs P0403 or P1409 appear?**	Yes → No →	GO to **HE59**. GO to **HE65**.

Exhaustive Gas Recirculation (EGR) Systems

HE

Test Steps		Results →	Action to Take
HE65	PERFORM A THOROUGH WIGGLE TEST ON THE EGRVR HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **Z1**.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
EGRVR	PWRGND

- Lightly tap on the EVR solenoid.
  Wiggle EVR solenoid connector.
  Perform a thorough wiggle test on the EGRVR harness.
  A fault is indicated by a voltage drop while performing the wiggle test.
- **Is the Voltage above 10.5 V?**

Catalyst Efficiency Monitor and Exhaust Systems

HF

Note

This Pinpoint Test is intended to diagnose the following:

- Catalytic Converter.
- Exhaust System.

Catalyst Efficiency Monitor Overview

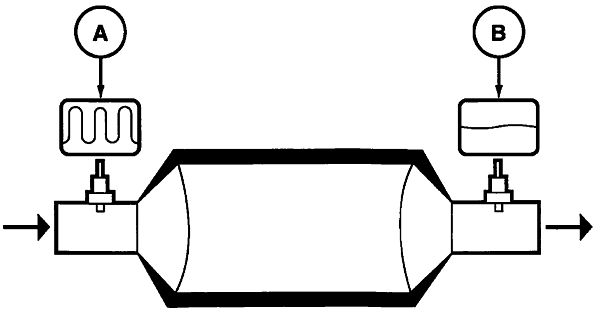
The Catalyst Efficiency Monitor uses pre and post-catalyst heated oxygen sensors (HO2S) to infer the hydrocarbon (HC) efficiency based on Oxygen storage capacity of the catalyst. Under normal, closed-loop fuel conditions, high efficiency catalysts have significant oxygen storage. This makes the switching frequency of the post-catalyst HO2S (B) very slow and reduces the amplitude of those switches as compared to the switching frequency and amplitude of the pre-catalyst HO2S (A). As catalyst efficiency deteriorates due to thermal and/or chemical deterioration, its ability to store oxygen declines. The post-catalyst HO2S (B) signal begins to switch more rapidly with increasing amplitude, approaching the switching frequency and amplitude of the pre-catalyst HO2S (A).

- Note HO2S (A) and (B) locations may vary depending on exhaust system configuration. For additional information on Catalyst Efficiency Monitor and Exhaust Systems, refer to Section 1.

Catalyst Efficiency Monitor and Exhaust Systems

HF

High Catalyst Efficiency



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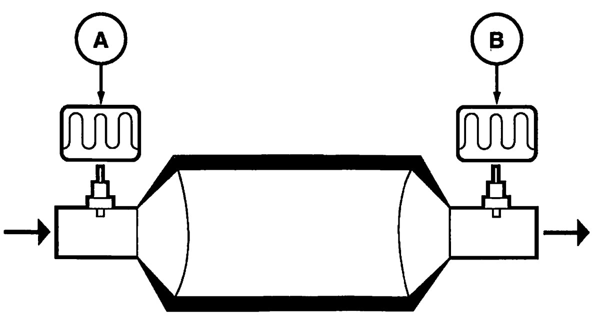
Low Catalyst Efficiency



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Catalyst Efficiency Monitor and Exhaust Systems

HF

Test Steps		Results →	Action to Take
HF1	DTCS P0420 OR P0430: CHECK FOR MISFIRE DETECTION MONITOR DTCS		
	Note: Be sure customer has not: — Refueled vehicle with leaded gasoline. — Noticed high vehicle oil consumption. (Engine that consume oil at a high rate will deposit high levels of phosphorus on the catalyst and reduce the catalyst efficiency). Note: Internal deterioration of a catalytic converter is usually caused by abnormal engine operation upstream of the catalyst. Events that can produce higher than normal temperatures in the catalyst are particularly suspect. For example misfiring can cause higher than normal catalyst operating temperatures. • CHECK Continuous Memory DTCs: • **Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, P0315, P0316 or P1309 present?**	Yes → No →	GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, for Pinpoint Test direction and REPAIR misfire DTCs. GO to **HF2**.
HF2	CHECK FOR HO2S DTCS		
	Note: Incorrect HO2S signal input can cause an abnormal temperature in the catalyst. • REFER to Section 1, Heated Oxygen Sensor (HO2S) monitor for possible HO2S DTCs. • **Are there any HO2S DTCs?**	Yes → No →	GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, for Pinpoint Test direction and REPAIR HO2S DTCs. GO to **HF3**.
HF3	CHECK FOR CHT OR ECT SENSOR DTCS		
	Note: Temperature sensors DTCs can indicate that the thermostat is not operating correctly or that the engine coolant level is not filled to specification, producing above normal operation temperatures. • CHECK Self-Test DTCs: • **Are DTCs P0117, P0118, P0125, P0128, P1117, P1285, P1288, P1289, P1290 or P1299 present?**	Yes → No →	GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, for Pinpoint Test direction and REPAIR CHT or ECT DTCs. GO to **HF4**.
HF4	CHECK FOR ANY OTHER DTCS		
	• **Were there any other DTCs recorded in HF1 (not including the initial P0420 or P0430)?**	Yes → No →	GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, for Pinpoint Test direction and REPAIR other DTCs first. GO to **HF7**.

Catalyst Efficiency Monitor and Exhaust Systems

HF

Test Steps		Results →	Action to Take
HF5	CHECK ELECTRONIC ENGINE CONTROL (EC) WIRING HARNESS \PCM		
	Note: Check the HO2S sensor electrical connectors to ensure the correct HO2S sensor is connected to the correct electrical connector. The electrical connectors are color coded to ensure the correct connection is made. If the electrical connection of the rear HO2S are interchanged/crossed, the Catalyst Efficiency Monitor Test will fail. • Visually inspect the vehicle's HO2S harness connectors for any indication of crossed wiring. • Visually inspect the harness for exposed wiring, corrosion and correct routing. • Disconnect the PCM, inspect for damaged, or pushed out pins, corrosion and loose wires. • **Are there any concerns with the wiring or the PCM connection?**	Yes → No →	REPAIR/REPLACE as necessary. Carry out the catalyst monitor drive cycle to verify the repairs. GO to **HF6**.

Catalyst Efficiency Monitor and Exhaust Systems

HF

Test Steps		Results →	Action to Take
HF6	CHECK FUEL PRESSURE		
	WARNING: THE FUEL SYSTEM WILL REMAIN PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM. **WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING DIRECTIONS IN PINPOINT TEST HC WARNING, CAUTION, AND HANDLING.** Note: Fuel pressure above specification can produce an abnormally rich air/fuel mixture. This rich air/fuel mixture can cause higher than normal catalyst operating temperatures. • Return Fuel Systems RFS: — INSPECT the vacuum hose going to the fuel pressure regulator for proper installation and cracks. Repair as necessary. — Verify vacuum source to fuel pressure regulator. • Mechanical Returnless Fuel Systems MRFS: — If applicable, inspect the vacuum hose going to the fuel rail pulse damper for proper installation and cracks. Repair as necessary. • Connect Rotunda fuel pressure gauge or equivalent. Note: On Electronic Returnless Fuel System (ERFS), the fuel pressure can be monitored by the scan tool using the Fuel Rail Pressure (FRP) sensor PID. • Start engine. Record fuel pressure. • GO to Pinpoint Test HC. Compare recorded fuel pressure reading to the Fuel System Specification Chart found at the beginning of pinpoint HC. • Key OFF. • **Is the fuel pressure within specifications.**	Yes → No →	Fuel pressure is OK. If applicable, remove the fuel pressure gauge. GO to **HF7**. Fuel pressure is out of specification. GO to **HC2**.

Catalyst Efficiency Monitor and Exhaust Systems

HF

Test Steps		Results →	Action to Take
HF7	CHECK FOR LEAKS IN THE EXHAUST SYSTEM		
	Note: If a catalyst is in series with a leaking exhaust system, it can fail the Catalyst Efficiency Monitor test. • INSPECT exhaust system for: leaks, cracks, loose connections, punctures or non-factory modifications. • **Were any problems found?**	Yes → No →	Repair as necessary. Carry out the catalyst monitor drive cycle to verify the repairs. GO to **HF8**.
HF8	CHECK FOR RESTRICTIONS IN THE EXHAUST SYSTEM		
	Note: A slight pressure in the exhaust system is normal, but excessive exhaust back pressure seriously affects engine operation. • INSPECT the following for damage or restrictions: — Front and rear exhaust pipes. — Catalytic Converter. — Muffler and tailpipe assembly. • **Were any problems found?**	Yes → No →	Repair as necessary. CLEAR Continuous Memory DTCs. Carry out the catalyst monitor drive cycle to verify the repairs. GO to **HF9**.
HF9	CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE		
	• The internal condition of exhaust system's ability to flow can be checked with an Exhaust Back Pressure tool. • **Is an Exhaust Back Pressure tester available?**	Yes → No →	GO to **HF10**. GO to **HF11**.

Positive Crankcase Ventilation (PCV) System

HG

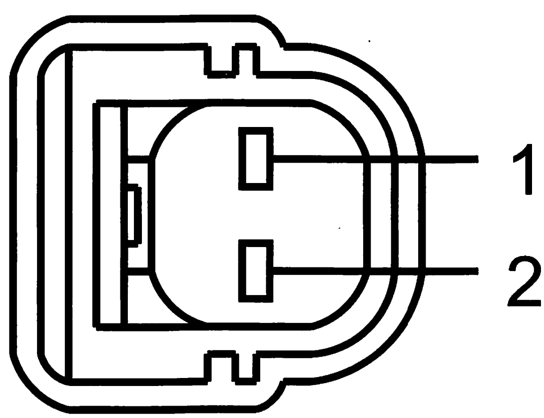
Note

This Pinpoint Test is intended to diagnose the following:

- Positive Crankcase Ventilation (PCV) valve (6A666) and related vacuum lines.
- Electrically Heated PCV valve (6A666) and heater circuit. Both PCM and non-PCM controlled.

Positive Crankcase Ventilation (PCV) Connector

Electrically Heated PCV valve



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Circuit	Pin
PCVHC (Positive Crankcase Ventilation Valve Heater Control)	2
GND (Ground)	2
IGN START/RUN (IGN START/RUN)	1

Positive Crankcase Ventilation (PCV) System — HG

Powertrain Control Module (PCM) Connector

Table only for vehicles equipped with PCM controlled PCV heater

Connector	Circuit	Pin
104 Pin	PCVHC	11

Test Steps		Results →	Action to Take
HG1	VISUAL INSPECTION OF PCV VALVE		
	Note: If PCV valve is electrically heated, verify electrical connection. Note: If PCV valve is water heated, verify coolant hose and clip connections. • CHECK the PCV valve, hoses and connections for leaks or restrictions. • Verify PCV valve maintenance schedule has been followed. • Verify proper PCV valve part number. • Verify PCV valve is clean. • Verify that the fresh air tube and related hoses are clean and routed correctly. • **Were there any concerns found during the visual inspection?**	Yes → No →	REPAIR as necessary. VERIFY symptom no longer exists. GO to **HG2**.
HG2	STUCK PCV VALVE CHECK		
	• Disconnect PCV valve from engine\rocker cover. • Shake the PCV valve. • **Does PCV valve rattle when shaken?**	Yes → No →	REINSTALL PCV valve. GO to **HG3**. PCV valve is sticking. REPLACE PCV valve. VERIFY symptom no longer exists.
HG3	CHECK FOR ELECTRICALLY HEATED PCV VALVE		
	• **Is PCV valve electrically heated?**	Yes → No →	GO to **HG4**. GO to **HG14**.
HG4	CHECK FOR ELECTRICALLY HEATED PCV VALVE DTC P1489		
	Note: The purpose of this test step is to determine if the PCV heater is controlled by the PCM. • Disconnect the electrical connector from the heated PCV valve. • Run Self-Test • **Is DTC P1489 present?**	Yes → No →	PCM Controlled GO to **HG8**. Non-PCM Controlled GO to **HG5**.

Positive Crankcase Ventilation (PCV) System

HG

Test Steps		Results →	Action to Take
HG5	CHECK POWER AND GROUND CIRCUITS TO THE ELECTRICALLY HEATED PCV VALVE		
	Note: On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when temperatures is less than 40 °F (5 °C) +/- 7 °F (+/- 4 °C). Typically this harness is located close to the PCV valve. When making voltage measurements, check for this harness and its operation. REFER to Section 1, Positive Crankcase Ventilation System. • PCV connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)PCV Connector, Harness Side**: IGN START/RUN - Pin 1; **(-)PCV Connector, Harness Side**: GND - Pin 2 • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **HG6**. GO to **HG7**.
HG6	CHECK RESISTANCE OF ELECTRICALLY HEATED PCV VALVE		
	• Measure the Resistance between: **(+)PCV Connector, Component Side**: IGN START/RUN - Pin 1; **(-)PCV Connector, Component Side**: GND - Pin 2 • **Is the Resistance between 20 Ohm - 35 Ohm?**	Yes → No →	GO to **HG14**. INSTALL a new PCV.
HG7	CHECK VPWR VOLTAGE TO ELECTRICALLY HEATED PCV VALVE		
	Note: On some applications the vehicle may be equipped with a thermal harness that only provides electrical continuity when temperatures is less than 40 °F (5 °C) +/- 7 °F (+/- 4 °C). Typically this harness is located close to the PCV valve. When making voltage measurements, check for this harness and its operation. REFER to Section 1, Positive Crankcase Ventilation System. • Measure the Voltage between: **(+)PCV Connector, Harness Side**: IGN START/RUN - Pin 1; **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. REPAIR open ground circuit to Electrically Heated PCV valve. KEY OFF. IGN START/RUN circuit fault. CHECK condition of related fuse(s). If OK, REPAIR open circuit. If fuse is damaged, check IGN START/RUN circuit for short to ground before replacing.

Positive Crankcase Ventilation (PCV) System

HG

	Test Steps	Results →	Action to Take
HG8	SELF-TEST DTC P1489: CHECK VPWR VOLTAGE TO ELECTRICALLY HEATED PCV VALVE		
	• PCV connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: <table><tr><th>(+)PCV Connector, Harness Side</th><th>(-)</th></tr><tr><td>IGN START/RUN - Pin 1</td><td>Ground</td></tr></table>• **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **HG9**. KEY OFF. IGN START/RUN circuit fault. CHECK condition of related fuse(s). If OK, REPAIR open circuit. If fuse is damaged, check IGN START/RUN circuit for short to ground before replacing.
HG9	CHECK PCVHC CIRCUIT FOR OPEN IN HARNESS		
	• PCV connector disconnected. • PCM connector disconnected. • Measure the Resistance between: <table><tr><th>(+)PCV Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>PCVHC - Pin 2</td><td>PCVHC - Pin 11</td></tr></table>• **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HG10**. REPAIR open circuit.
HG10	CHECK PCVHC CIRCUIT FOR SHORT TO GND IN HARNESS		
	• PCV connector disconnected. • PCM connector disconnected. • Measure the Voltage between: <table><tr><th>(+)Vehicle battery</th><th>(-)PCV Connector, Harness Side</th></tr><tr><td>Positive post</td><td>PCVHC - Pin 2</td></tr></table>• **Is the Voltage below 1 V?**	Yes → No →	GO to **HG11**. REPAIR short circuit to GND.
HG11	CHECK PCVHC CIRCUIT FOR SHORT TO PWR IN HARNESS		
	• Measure the Voltage between: <table><tr><th>(+)Vehicle battery</th><th>(-)PCV Connector, Harness Side</th></tr><tr><td>Negative post</td><td>PCVHC - Pin 2</td></tr></table>• **Is the Voltage below 1 V?**	Yes → No →	GO to **HG12**. REPAIR short circuit to PWR.

Positive Crankcase Ventilation (PCV) System

HG

Test Steps		Results →	Action to Take
HG12	CHECK RESISTANCE OF ELECTRICALLY HEATED PCV VALVE		
	• Measure the Resistance between: **(+)PCV Connector, Component Side**: IGN START/RUN - Pin 1 **(-)PCV Connector, Component Side**: PCVHC - Pin 2 • **Is the Resistance between 20 Ohm - 35 Ohm?**	Yes → No →	GO to **HG13**. INSTALL a new PCV.
HG13	CHECK PCM OUTPUT TO PCV HEATER CONTROL CIRCUIT		
	• PCM connector connected. • PCV connector connected. • Run Self-Test • **Is DTC P1489 present?**	Yes → No →	INSTALL a new PCM. GO to **HG14**.
HG14	PCV SYSTEM CHECK		
	• Start engine and warm it until engine temperature is stable. • Disconnect closure (fresh air) hose from remote air cleaner or air outlet tube (tube connecting mass air flow sensor and throttle body). • Place a stiff piece of paper over the hose end. Wait one minute. • **Does vacuum hold the paper in place?**	Yes → No →	PCV System is OK. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. System is leaking/plugged or Evaporative Emission System is leaking. GO to **HG15**.
HG15	EVAPORATIVE EMISSION SYSTEM CHECK		
	Note: If the evaporative emission hose is not connected to the PCV hose, follow the No Action to Take (refer to VECI decal). • Disconnect evaporative emission hose at connection to PCV hose (if equipped). Cap the connector. • Again place a stiff piece of paper over the closure (fresh air) hose end. Wait one minute. • **Does vacuum hold the paper in place?**	Yes → No →	PCV System is OK. REFER to Workshop Manual, Section 303, Evaporative Emissions. CHECK for vacuum leaks/obstruction in the PCV system (such as oil cap, PCV valve, hoses, cut grommets, valve cover bolt torque/gasket leak). REPAIR as necessary.

Exhaust Gas Recirculation System Module (ESM)

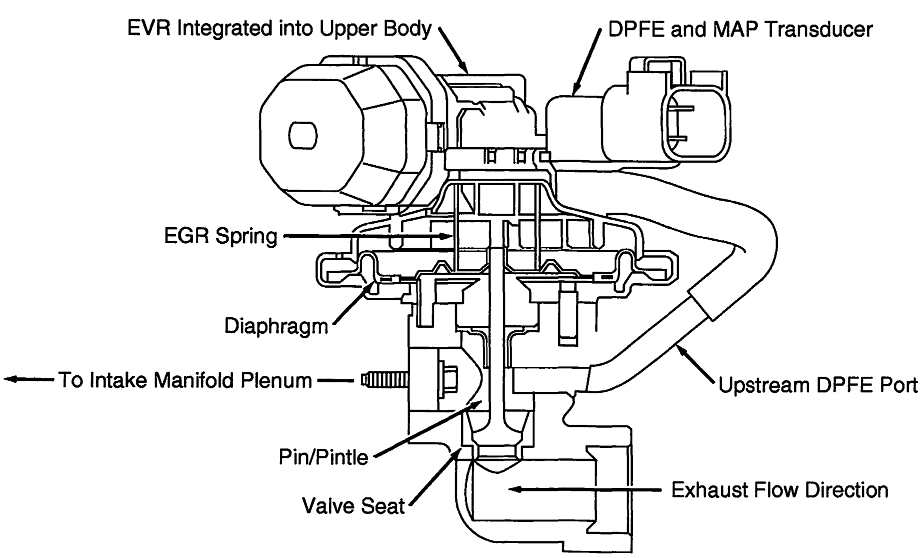
HH

Note

This Pinpoint Test is intended to diagnose the following:

- Differential Pressure Feedback EGR. sensor. (9J460).
- Exhaust gas recirculation (EGR) valve (9D460) (9D475).
- EGR vacuum regulator (VR) solenoid (9J459).
- Orifice tube assembly (9D477).
- Differential Pressure Feedback EGR (DPFE) sensor pressure hoses.
- Vacuum lines.
- Harness circuits: VREF, DPFE, SIGRTN, EVR, VPWR.
- Powertrain Control Module (PCM) (12A650).

ESM EGR Assembly



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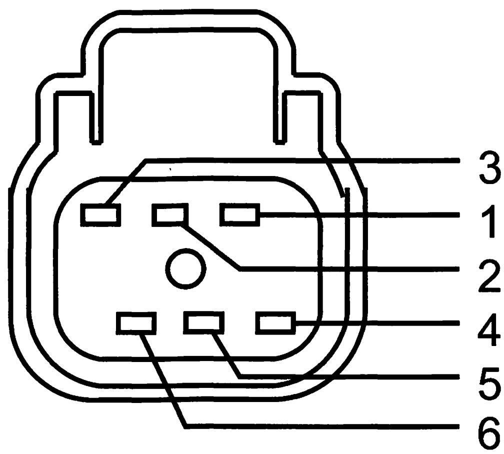
Exhaust Gas Recirculation System Module (ESM)

HH

EGR System Module (ESM) Connector



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Circuit	Pin
EGRVR (EGR Vacuum Regulator)	1
VPWR (Power supply)	4
DPFEGR (Delta Pressure Feedback EGR)	5
SIGRTN (Signal return)	6
VREF (Reference Voltage)	2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Exhaust Gas Recirculation System Module (ESM)

HH

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	PWRGND VREF SIGRTN DPFEGR	B24 E20 E17 E41
Crown Victoria, E-Series 6.8L, Grand Marquis, Mustang 3.8L, Mustang 3.9L, Mustang 4.6L 2V	104 Pin	PWRGND VREF SIGRTN DPFEGR	103 90 91 65
Escape 2.0L	104 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	103 79 90 91 65
Expedition	122 Pin	PWRGND VREF SIGRTN DPFEGR	B1 E36 E25 E33
Explorer, Mountaineer	150 (50-50-50) Pin	PWRGND VREF SIGRTN DPFEGR	B47 E40 E41 E44
F-150	190 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	B67 E63 E57 E58 E21
LS, Thunderbird	150 (60-32-58) Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	B24 E16 E14 E17 E41
Navigator	122 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	B1 E22 E36 E25 E33
All other vehicles	104 Pin	PWRGND EGRVR VREF SIGRTN DPFEGR	103 47 90 91 65

Exhaust Gas Recirculation System Module (ESM) — HH

Test Steps		Results →	Action to Take
HH1	DTCS P0405 AND P1400: DETERMINE PRESENT DPFEGR PID VOLTAGE		
	• Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • **Is the Voltage below 0.2 V?**	Yes → No →	KEY OFF. Fault is present GO to **HH2**. An intermittent fault is suspected in the EGR system GO to **HH12**.
HH2	CHECK VREF AND SIGRTN CIRCUITS FOR OPEN IN HARNESS		
	• Measure the Voltage between: (+)ESM Connector, Harness Side: VREF - Pin 2 / (-)ESM Connector, Harness Side: SIGRTN - Pin 6 • **Is the Voltage between 4 V - 5.5 V?**	Yes → No →	KEY OFF. GO to **HH3**. GO to **C1**.
HH3	CHECK DPFEGR CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS		
	• Scan tool connector disconnected. • PCM connector disconnected. • ESM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: DPFEGR / (-)PCM Connector, Harness Side: SIGRTN • Measure the Resistance between: (+)PCM Connector, Harness Side: DPFEGR / (-)Vehicle battery: Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **HH4**. REPAIR short circuit.

HH2 measurement:

(+)ESM Connector, Harness Side	**(-)ESM Connector, Harness Side**
VREF - Pin 2	SIGRTN - Pin 6

HH3 measurements:

(+)PCM Connector, Harness Side	**(-)PCM Connector, Harness Side**
DPFEGR	SIGRTN

(+)PCM Connector, Harness Side	**(-)Vehicle battery**
DPFEGR	Negative post

Exhaustive Gas Recirculation System Module (ESM)

HH

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HH4</td><td>INDUCE OPPOSITE DPFEGR SENSOR VOLTAGE</td><td></td><td></td></tr>
<tr><td colspan="2">• PCM connector connected.
• Key ON Engine OFF.
• Access the PCM-DPFEGR PID using a scan tool.
• Is the Voltage between 4 V - 6 V?</td><td>Yes →

No →</td><td>KEY OFF. INSTALL a new ESM.
COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
CLEAR the PCM DTCs and REPEAT Self-Test.
INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).</td></tr>
<tr><td>HH5</td><td>DTCS P0406 AND P1401: DETERMINE PRESENT DPFEGR PID VOLTAGE</td><td></td><td></td></tr>
<tr><td colspan="2">• Key ON Engine OFF.
• Access the PCM-DPFEGR PID using a scan tool.
• Is the Voltage above 4 V?</td><td>Yes →

No →</td><td>KEY OFF.
Fault is present
GO to HH6.
An intermittent fault is suspected in the EGR system
GO to HH12.</td></tr>
<tr><td>HH6</td><td>CHECK VREF VOLTAGE TO ESM</td><td></td><td></td></tr>
<tr><td colspan="2">• ESM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)ESM Connector, Harness Side</th><th>(-)ESM Connector, Harness Side</th></tr><tr><td>VREF - Pin 2</td><td>SIGRTN - Pin 6</td></tr></table>• Is the Voltage between 4 V - 5.5 V?</td><td>Yes →
No →</td><td>GO to HH7.
GO to C1.</td></tr>
<tr><td>HH7</td><td>CHECK DPFEGR CIRCUIT FOR SHORT TO POWER</td><td></td><td></td></tr>
<tr><td colspan="2">• ESM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)ESM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>DPFEGR - Pin 5</td><td>Negative post</td></tr></table>• Is the Voltage above 10.5 V?</td><td>Yes →

No →</td><td>KEY OFF. REPAIR short circuit.
GO to HH8.</td></tr>
</table>

Exhaust Gas Recirculation System Module (ESM) — HH

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HH8</td><td>VERIFY SCAN TOOL COMMUNICATION</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to HH9.

KEY OFF.
REMOVE jumper(s).
GO to HH10.</td></tr>
<tr><td colspan="2">
Add jumper wire between the points described below:
<table>
<tr><th>Point A ESM Connector, Harness Side</th><th>Point B ESM Connector, Harness Side</th></tr>
<tr><td>DPFEGR - Pin 5</td><td>SIGRTN - Pin 6</td></tr>
</table>
Access the PCM-DPFEGR PID using a scan tool.
Does a scan tool communication concern exist?
</td></tr>
<tr><td>HH9</td><td>CHECK DPFEGR CIRCUIT FOR SHORT TO VREF</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HH10.
REPAIR short circuit.</td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>VREF</td><td>DPFEGR</td></tr>
</table>
Is the Resistance above 10 KOhm?
</td></tr>
<tr><td>HH10</td><td>CHECK DPFEGR AND SIGRTN CIRCUIT(S) FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">REPAIR open circuit.
GO to HH11.</td></tr>
<tr><td colspan="2">
PCM connector disconnected.
Measure the Resistance between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)ESM Connector, Harness Side</th></tr>
<tr><td>DPFEGR</td><td>DPFEGR - Pin 5</td></tr>
<tr><td>SIGRTN</td><td>SIGRTN - Pin 6</td></tr>
</table>
Are the resistances above 5 Ohm?
</td></tr>
<tr><td>HH11</td><td>INDUCE OPPOSITE DPFEGR SENSOR VOLTAGE</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF. INSTALL a new ESM.
COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
CLEAR the PCM DTCs and REPEAT Self-Test.

KEY OFF. INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).</td></tr>
<tr><td colspan="2">
PCM connector connected.
Add jumper wire between the points described below:
<table>
<tr><th>Point A ESM Connector, Harness Side</th><th>Point B ESM Connector, Harness Side</th></tr>
<tr><td>DPFEGR - Pin 5</td><td>SIGRTN - Pin 6</td></tr>
</table>
Key ON Engine OFF.
Access the PCM-DPFEGR PID using a scan tool.
Is the Voltage below 0.05 V?
</td></tr>
</table>

Exhaust Gas Recirculation System Module (ESM) — HH

	Test Steps	Results →	Action to Take
HH12	PERFORM A THOROUGH WIGGLE TEST ON THE ESM HARNESS		
	• Access the PCM-DPFEGR PID using a scan tool. • Wiggle, shake and bend small sections of the wiring harness while working from the sensor to the PCM. • **Is there any change in the voltage reading, or is a concern found?**	Yes → No →	REPAIR as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.
HH13	DTCS P0402 AND P1405: CHECK FOR SIMULTANEOUS PRESENCE		
	• **Is DTC P0402 present with DTC P1405?**	Yes → No →	GO to **HH40**. GO to **HH14**.
HH14	DTC P0402: CHECK FOR EGR FLOW AT IDLE WITH EGR VACUUM HOSE DISCONNECTED		
	• Disconnect and plug the vacuum hoses connected to the ESM. • Perform KOER Self-Test. • **Did KOER DTC P0402 appear or are you unable to run KOER self-test due to an engine stall or no start?**	Yes → No →	KEY OFF. GO to **HH15**. Reconnect vacuum hoses to the ESM. GO to **HH17**.
HH15	INSPECT UPSTREAM DPFE HOSE (LARGE NON-MOLDED HIGH-SILICONE HOSE) FOR COLLAPSE AND BLOCKAGE		
	• **Are any faults or blockage found in the hose?**	Yes → No →	REPLACE upstream DPFE pressure hose. GO to **HH16**.

Exhaust Gas Recirculation System Module (ESM) — HH

Test Steps		Results →	Action to Take
HH16	CHECK FOR PRESENCE OF CARBON BUILDUP IN EGR PASSAGE BEHIND THROTTLE BODY		
	Note: In certain vehicle applications, carbon buildup may occur downstream of the ESM. An inspection is required to make sure the passage in the upper intake manifold plenum chamber behind the ESM is open to allow exhaust gas flow. • REMOVE the ESM. REFER to the appropriate workshop manual for the removal and replacement procedure. • Disconnect the air inlet tube from the throttle body. Refer to the appropriate workshop manual for further details. • Prop open the throttle body using a screwdriver or similar tool. • Using compressed air, lightly blow through the EGR port at the location where the ESM attaches to the upper intake manifold. • CHECK for air flow. • **Does compressed air freely pass through the EGR port?**	Yes → No →	COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). GO to **HH17**. Clean EGR port and reinstall ESM.
HH17	CHECK FOR EGR FLOW AT IDLE WITH ESM VACUUM HOSES CONNECTED		
	• ESM vacuum hoses connected. • Perform KOER Self-Test. • **Did KOER DTC P0402 appear or are you unable to run KOER self-test due to an engine stall or no start?**	Yes → No →	GO to **HH18**. GO to **HH19**.

Exhaust Gas Recirculation System Module (ESM)

HH

Test Steps		Results →	Action to Take
HH18	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect DPFE (lower) pressure hose. • Verify pressure hose(s) are clear and free of obstructions. • Connect a hand vacuum pump to the downstream DPFE port connection. • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes → No →	INSTALL a new ESM. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). CLEAR the PCM DTCs and REPEAT Self-Test. Reconnect ESM. GO to **HH19**.
HH19	CHECK EGR FLOW AT IDLE WITH ESM HARNESS CONNECTOR OFF		
	• Start engine. • ESM connector disconnected. • Disconnect and reconnect upstream (lower) vacuum hose at ESM several times. • **Does the engine RPM decrease or idle become rough when the upstream pressure hose is connected, then return to normal when disconnected?**	Yes → No →	KEY OFF. GO to **HH20**. KEY OFF. GO to **HH21**.

Exhaust Gas Recirculation System Module (ESM) — HH

Test Steps		Results →	Action to Take
HH20	INSPECT EVR SOLENOID VENT FOR BLOCKAGE		
	Note: A plugged EVR (electronic vacuum regulator) solenoid vent will not allow EGR vacuum to vent to the atmosphere. • EVR vacuum hoses disconnected. • REMOVE EVR solenoid vent cap (if removable). • REMOVE filter and inspect for blockage, or in some cases, icing. • Plug the EGR vacuum supply port. • Connect a hand vacuum pump to EVR Source port. • Apply 34 to 51 kPa (10 to 15 in Hg) vacuum. • **Is the EVR solenoid vent or filter plugged or restricted?**	Yes →	REPAIR vent or if not serviceable REPLACE ESM assembly. CLEAR the PCM DTCs and REPEAT Self-Test.
		No →	INSTALL a new ESM. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). CLEAR the PCM DTCs and REPEAT Self-Test.
HH21	CHECK EVR SOLENOID COIL RESISTANCE		
	• Measure the Resistance between: (+)ESM Connector, Harness Side: VPWR - Pin 4 (-)ESM Connector, Harness Side: EGRVR - Pin 1 • **Is the Resistance between 26 Ohm - 40 Ohm?**	Yes →	GO to **HH22**.
		No →	INSTALL a new ESM. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). CLEAR the PCM DTCs and REPEAT Self-Test.
HH22	CHECK EGRVR SOLENOID VACUUM THROUGHPUT BY GROUNDING EGRVR CIRCUIT		
	• PCM connector connected. • Access the PCM-RPM PID using a scan tool. • Key ON Engine RUN. • Engine warm and at idle. • Add jumper wire between the points described below: Point A ESM Connector, Harness Side: EGRVR - Pin 1 Point B: Ground • **Does the engine reduce speed or stall with the jumper connected?**	Yes →	GO to **HH23**.
		No →	INSTALL a new ESM. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). CLEAR the PCM DTCs and REPEAT Self-Test.

HH21 measurement points:

(+)ESM Connector, Harness Side	(-)ESM Connector, Harness Side
VPWR - Pin 4	EGRVR - Pin 1

HH22 jumper points:

Point A ESM Connector, Harness Side	Point B
EGRVR - Pin 1	Ground

Exhaust Gas Recirculation System Module (ESM) — HH

Test Steps		Results →	Action to Take
HH23	CHECK EVR CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)Vehicle battery**: EGRVR / Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **HH24**. REPAIR short circuit.
HH24	CHECK EVR CIRCUIT FOR SHORT TO VREF		
	• Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side**: EGRVR / VREF • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
HH25	DTC P0401: PERFORM KOER SELF-TEST		
	• Perform KOER Self-Test. • **Did DTC P0408 appear?**	Yes → No →	GO to **HH26**. GO to **HH31**.
HH26	KOER DTC P1408: RETRIEVE CONTINUOUS MEMORY DTC		
	Note: If any DTC other than P1406 appears, note the DTC and refer to Section 4 after completing this pinpoint test. Note: Do NOT replace the ESM if DTCs P0106 and P0400 are in Continuous Memory. Check the vacuum hose to the MAP sensor and verify proper MAP sensor operation. • Retrieve all Continuous Memory DTCs. • **Is DTC P1406 present?**	Yes → No →	GO to **HH42**. GO to **HH27**.

Exhaustive Gas Recirculation System Module (ESM)

HH

Test Steps		Results →	Action to Take
HH27	PERFORM KOER SELF-TEST WHILE MONITORING EGR VACUUM		
	Note: Disregard DTC P0106 if it appears during KOER Self-Test. • Disconnect vacuum hose at EVR and "T" in a vacuum gauge. • Perform KOER Self-Test. Approximately 30 seconds into the test, EGR flow will be requested for a few seconds. The vacuum at this time should show a brief deflection to near zero from a steady value of approximately 15 in.-Hg indicating the command for the valve to open. Observe vacuum gauge. • **Does the vacuum decrease briefly to near zero from a steady value during KOER Self-Test?**	Yes →	KEY OFF. Fault is unlikely in the EGR valve vacuum control system. GO to **HH28**.
		No →	KEY OFF. Insufficient vacuum. GO to **HH29**.
HH28	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect pressure hoses at DPFEGR sensor. • Connect a hand vacuum pump to the downstream connection of sensor (intake manifold side). • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFEGR sensor and hold for 10 seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes →	INSTALL a new ESM. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). CLEAR the PCM DTCs and REPEAT Self-Test.
		No →	Reconnect all hoses. GO to **HH29**.

Exhaust Gas Recirculation System Module (ESM) — HH

Test Steps		Results →	Action to Take
HH29	KOEO AND KOER DTCS P0403 AND P1409: CHECK VPWR VOLTAGE TO EVR SOLENOID		
	• ESM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)ESM Connector, Harness Side: VPWR - Pin 4 / (-)Vehicle battery: Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **HH30**. KEY OFF. REPAIR open circuit.
HH30	CHECK EVR SOLENOID COIL RESISTANCE		
	• Measure the Resistance between: (+)ESM Connector, Harness Side: VPWR - Pin 4 / (-)ESM Connector, Harness Side: EGRVR - Pin 1 • **Is the Resistance between 26 Ohm - 40 Ohm?**	Yes → No →	GO to **HH31**. INSTALL a new ESM. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). CLEAR the PCM DTCs and REPEAT Self-Test.
HH31	EGR DIAGNOSIS BY SYMPTOM: CHECK FOR EGR FLOW WITH EGR VACUUM HOSE DISCONNECTED AND PLUGGED		
	Note: Perform KOER Self-Test. REPAIR any other DTCs. • Possible causes for EGR flow at idle with no related DTCs: — EGR valve not fully seating. — EVR solenoid vent restricted. — Damaged EVR solenoid. • Disconnect and plug the vacuum hose connected to the EGR valve. • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Note voltage. • Key ON Engine RUN. • With engine at idle, observe the DPFEGR PID voltage. Compare to engine OFF voltage. • An increase in voltage at idle indicates the DPFEGR sensor is sensing EGR flow. • **Is the DPFEGR PID voltage greater at idle by 0.15V than with the engine OFF?**	Yes → No →	REMOVE and INSPECT ESM for signs of contamination, unusual wear, carbon deposits, binding or other damage. REPAIR as necessary. If no concerns are present, install a new ESM. CLEAR the PCM DTCs and REPEAT Self-Test. INSPECT EVR solenoid vent for blockage GO to **HH32**.

Exhaustive Gas Recirculation System Module (ESM) — HH

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HH32</td><td>CHECK EGRVR CIRCUIT FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
PCM connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)ESM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>EGRVR - Pin 1</td><td>EGRVR</td></tr></table>
Is the Resistance below 5 Ohm?</td>
<td>Yes →
No →</td><td>GO to HH33.
REPAIR open circuit.</td></tr>
<tr><td>HH33</td><td>CHECK EGRVR CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Key ON Engine OFF.
Measure the Voltage between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>EGRVR</td><td>Negative post</td></tr></table>
Is the Voltage below 1 V?</td>
<td>Yes →
No →</td><td>GO to HH34.
KEY OFF. REPAIR short circuit.</td></tr>
<tr><td>HH34</td><td>CHECK EGRVR CIRCUIT FOR SHORT TO GND IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>EGRVR</td><td>PWRGND</td></tr></table>
Is the Resistance above 10 KOhm?</td>
<td>Yes →
No →</td><td>GO to HH35.
REPAIR short circuit.</td></tr>
<tr><td>HH35</td><td>CHECK EGRVR CIRCUIT FOR SHORT TO GND IN PCM</td><td></td><td></td></tr>
<tr><td colspan="2">
PCM connector connected.
Measure the Resistance between:
<table><tr><th>(+)ESM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>EGRVR - Pin 1</td><td>Negative post</td></tr></table>
Is the Resistance above 2 Ohm?</td>
<td>Yes →
No →</td><td>GO to HH36.
INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).</td></tr>
<tr><td>HH36</td><td>VACUUM SUPPLY LEAKAGE / RESTRICTION</td><td></td><td></td></tr>
<tr><td colspan="2">
Inspect vacuum supply line(s) to the ESM for leakage and restriction.
Is a fault present in the ESM vacuum supply?</td>
<td>Yes →
No →</td><td>REPAIR as necessary.
GO to HH37.</td></tr>
</table>

Exhaust Gas Recirculation System Module (ESM) — HH

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HH37</td><td>CHECK EGRVR SOLENOID VACUUM THROUGHPUT BY GROUNDING EGRVR CIRCUIT</td><td></td><td></td></tr>
<tr><td colspan="2">
• Access the PCM-RPM PID using a scan tool.
• Key ON Engine RUN.
• Engine warm and at idle.
• Add jumper wire between the points described below:
<table>
<tr><th>Point A ESM Connector, Harness Side</th><th>Point B</th></tr>
<tr><td>EGRVR - Pin 1</td><td>Ground</td></tr>
</table>
• Does the engine reduce speed or stall with the jumper connected?
</td><td>Yes →

No →</td><td>INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
INSTALL a new ESM.
COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
CLEAR the PCM DTCs and REPEAT Self-Test.</td></tr>
<tr><td>HH38</td><td>CONTINUOUS MEMORY DTC P0403: CHECK FOR THE PRESENCE OF DTC P1409</td><td></td><td></td></tr>
<tr><td colspan="2">
• PCM connector connected.
• Perform KOER Self-Test.
• Did DTC P1409 appear?
</td><td>Yes →
No →</td><td>GO to HH29.
GO to HH39.</td></tr>
<tr><td>HH39</td><td>CONTINUOUS MEMORY DTC P0403: PERFORM A THOROUGH WIGGLE TEST ON THE EGRVR HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
• PCM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>EGRVR</td><td>PWRGND</td></tr>
</table>
• Lightly tap on the EVR solenoid.
Wiggle EVR solenoid connector.
Perform a thorough wiggle test on the EGRVR harness.
A fault is indicated by a voltage drop while performing the wiggle test.
• Is the Voltage above 10.5 V?
</td><td>Yes →

No →</td><td>ISOLATE fault and REPAIR as necessary.
GO to Z1.</td></tr>
</table>

Exhaust Gas Recirculation System Module (ESM) — HH

Test Steps		Results →	Action to Take
HH40	DTC P1405: INSPECT UPSTREAM PRESSURE HOSE CONNECTION AND ESM ATTACHMENT		
	• Verify EGR valve is securely attached and that exhaust gases are not leaking from the sealing surface. • Inspect upstream hose (lower hose) at the EVR sensor on the ESM for disconnect or poor connection. • **Are pressure hoses and the ESM securely attached?**	Yes → No →	GO to **HH41**. REPAIR as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
HH41	INSPECT UPSTREAM PRESSURE HOSE FOR PLUGGING		
	Note: It is essential that ONLY the correct Ford service pressure hose be used. The length of hose must also remain the same for proper system operation. • Visually inspect upstream pressure hose routing. Hose must not be pinched or have dips in it where water could settle or freeze. • REMOVE upstream pressure hose and carefully inspect for plugging, water or leaks. • **Is a fault present?**	Yes → No →	REPAIR or REPLACE pressure hose as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). GO to **HH44**.
HH42	DTC P1406: INSPECT DOWNSTREAM PRESSURE HOSE CONNECTION AND ESM ATTACHMENT		
	• Verify EGR valve is securely attached and that exhaust gases are not leaking from the sealing surface. • Inspect downstream hose (upper hose) at the DPFE sensor connection on the ESM for disconnect or poor connection. • **Are pressure hoses and the ESM securely attached?**	Yes → No →	GO to **HH43**. REPAIR as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
HH43	INSPECT DOWNSTREAM PRESSURE HOSE FOR PLUGGING		
	Note: It is essential that ONLY the correct Ford service pressure hose be used. The length of hose must also remain the same for proper system operation. • Visually inspect downstream pressure hose routing. • REMOVE downstream pressure hose and carefully inspect for plugging, water or leaks. • **Is a fault present?**	Yes → No →	REPAIR or REPLACE pressure hose as necessary. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). GO to **HH44**.

Exhaust Gas Recirculation System Module (ESM)

HH

Test Steps		Results →	Action to Take
HH44	CHECK DPFE SENSOR OUTPUT BY APPLYING VACUUM WITH HAND PUMP		
	• Disconnect downstream (lower) vacuum source hose on ESM. • Connect vacuum pump to the downstream connection at DPFE sensor on ESM. • Key ON Engine OFF. • Access the PCM-DPFEGR PID using a scan tool. • Apply 27-30 kPa (8-9 in Hg) vacuum to the DPFE sensor and hold for 10seconds. • Quickly release vacuum. — The DPFEGR PID voltage must be between 0.2V and 1.3V with the key ON and no vacuum applied. — The DPFEGR PID voltage must increase to greater than 4.0V with vacuum applied. — The DPFEGR PID must drop to less than 1.5V in less than 3 seconds when vacuum is released. • **Does the DPFEGR PID voltage indicate a fault in the DPFE sensor?**	Yes → No →	INSTALL a new ESM. COMPLETE EGR Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles). CLEAR the PCM DTCs and REPEAT Self-Test. GO to **Z1**.

Variable Cam Timing (VCT)	HK

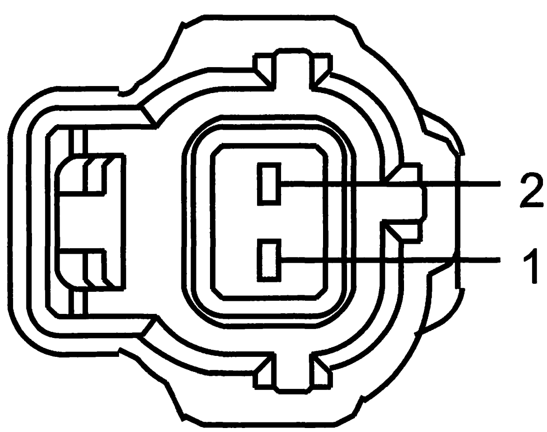
Note

This Pinpoint Test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650).
- Harness circuits: VPWR and VCT.
- VCT Solenoid (6L713) or (6B297).
- Spider Assembly (6C260) Right Bank, or (6C261) Left Bank.

Variable Cam Timing (VCT) Actuator Connector

A



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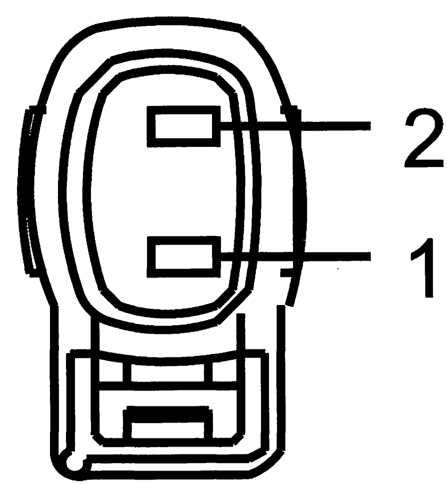
B



A0077517

Variable Cam Timing (VCT) — HK

Vehicle	Connector	Circuit	Pin
F-150	A	VCT2 VCT1 VPWR	2 2 1
Focus	A	VCT1 VPWR	2 1
All other vehicles	B	VCT2 VCT1 VPWR	2 2 1

Test Steps		Results →	Action to Take
HK1	KOER DTCS P0010, P0013 OR P1380: VARIABLE CAM TIMING ACTUATOR CIRCUIT OPEN BANK 1		
	• CLEAR the DTCs. • Engine should be at operating temperature before running self-test. • Run PCM KOER Self-Test. • **Are DTCs P0010 or P1380 present?**	Yes → No →	GO to **HK4**. GO to **HK2**.
HK2	KOER DTCS P0020 OR P1385: VARIABLE CAM TIMING ACTUATOR CIRCUIT OPEN BANK 2		
	Note: VCT systems on V engines require a solenoid for each bank. • CHECK KOER DTCs: • **Are DTCs P0020 or P1385 present?**	Yes → No →	GO to **HK4**. GO to **HK3**.
HK3	PERFORM A THOROUGH WIGGLE TEST ON THE VARIABLE CAM TIMING (VCT) HARNESS		
	• Perform a through wiggle test on all Variable Cam Timing (VCT) harnesses. • Run KOER Self-Test. • **Are DTCs P0010, P1380, P0020 or P1385 present?**	Yes → No →	GO to **HK4**. KEY OFF. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
HK4	CHECK VCT SOLENOID RESISTANCE		
	• Key OFF. • VCT Actuator connector disconnected. • Measure the Resistance between: **(+)VCT Actuator Connector, Component Side**: VCT **(-)VCT Actuator Connector, Component Side**: VPWR • **Is the Resistance between 5 Ohm - 14 Ohm?**	Yes → No →	GO to **HK5**. INSTALL a new VCT actuator and retest vehicle.

(+)VCT Actuator Connector, Component Side	(-)VCT Actuator Connector, Component Side
VCT	VPWR

Variable Cam Timing (VCT) | HK

Test Steps		Results →	Action to Take
HK5	CHECK VCT SOLENOID FOR INTERNAL SHORTS		
	• Measure the Resistance between: (+)VCT Actuator Connector, Component Side: VCT — (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **HK6**. INSTALL a new VCT actuator and retest vehicle.
HK6	CHECK VCT VPWR CIRCUIT FOR OPEN OR SHORT IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: (+)VCT Actuator Connector, Harness Side: VPWR — (-)Vehicle battery: Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **HK9**. KEY OFF. GO to **HK7**.
HK7	CHECK VCT VPWR CIRCUIT FOR OPEN IN HARNESS		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: (+)VCT Actuator Connector, Harness Side: VPWR — (-)PCM Connector, Harness Side: VPWR • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HK8**. KEY OFF. REPAIR open circuit.
HK8	CHECK VCT CIRCUIT FOR SHORT TO GND IN HARNESS		
	• Measure the Resistance between: (+)VCT Actuator Connector, Harness Side: VPWR — (-)Vehicle battery: Negative post • **Is the Resistance above 5 Ohm?**	Yes → No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). KEY OFF. REPAIR short circuit to GND.

Variable Cam Timing (VCT) — HK

Test Steps		Results →	Action to Take
HK9	CHECK VARIABLE CAM TIMING (VCT) CIRCUIT FOR OPEN IN HARNESS		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: **(+)VCT Actuator Connector, Harness Side**: VCT — **(-)PCM Connector, Harness Side**: VCT • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HK10**. KEY OFF. REPAIR open circuit.
HK10	CHECK VCT CIRCUIT FOR SHORT TO GND IN HARNESS		
	• Measure the Resistance between: **(+)VCT Actuator Connector, Harness Side**: VCT — **(-)Vehicle battery**: Negative post • **Is the Resistance above 5 Ohm?**	Yes → No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). KEY OFF. REPAIR short circuit to GND.
HK11	KOER DTCS P0011, P1381, P0012, P1383, P0021, P1386, P0022 AND P1388:		
	Note: Oil contamination in VCT systems can cause positioning errors. Note: VCT systems require Oil Filter specific to the application. Note: CHECK the operation of the VCT solenoid and check for a stuck or sticking solenoid valve caused by contamination. If valve is stuck, check spider bracket for contamination prior to solenoid replacement. • CHECK vehicle oil filter identification to insure proper type. • Engine at normal operating temperature. • Clear fault codes. • KOER Self Test. • CHECK KOER DTCs: • **Are DTCs P0011, P1381, P0012, P1383, P0021, P1386, P0022 or P1388 present?**	Yes → No →	KEY OFF. INSTALL a new VCT actuator and retest vehicle. REFER to Engine Section 303 in the Workshop Manual Unable to duplicate or identify fault at this time. GO to **Z1**.

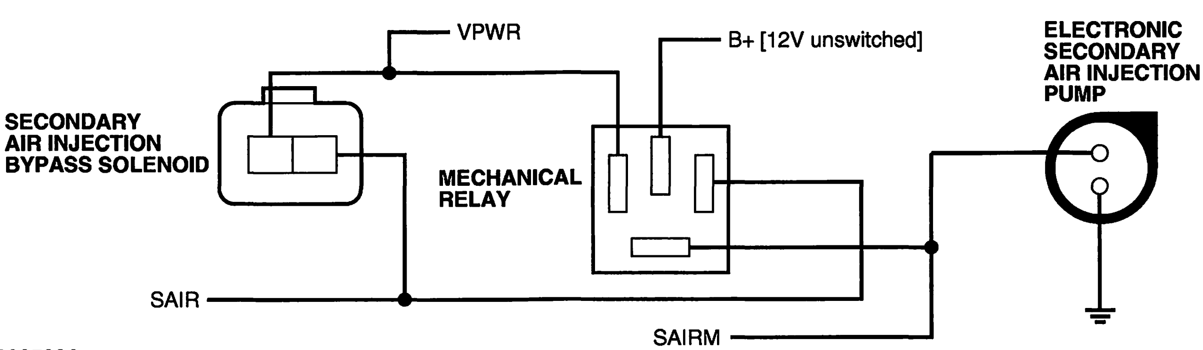
Secondary Air Injection (AIR) System | HM

Note

This Pinpoint Test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650).
- Harness circuits: B+, VPWR, SAIR, SAIRM, Ground.
- Secondary Air Injection System Relay (14B192).
- Electric Air injection Pump (9A486).
- Secondary Air Injection Bypass Solenoid (9H465).
- Secondary Air Injection Diverter Valve (9F491).
- Vacuum supply.
- Air Water Shield /Silencer (9C463).
- Hoses.
- Partial restricted exhaust.

Typical AIR wiring diagram.



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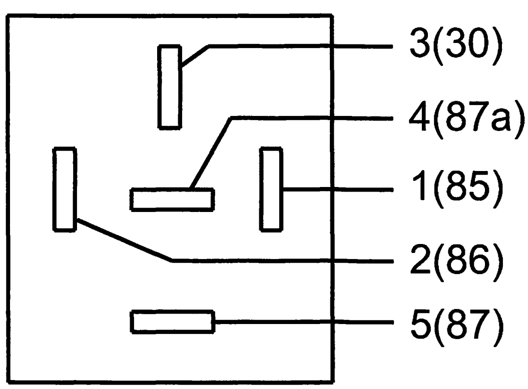
Secondary Air Injection (AIR) System	HM

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
150 (50-50-50) Pin	SAIRM VREF SIGRTN CASE GND PWRGND VPWR SAIR	B19 B40 B41 B10 B47 B35 B17

Secondary air injection (AIR) Relay Connector



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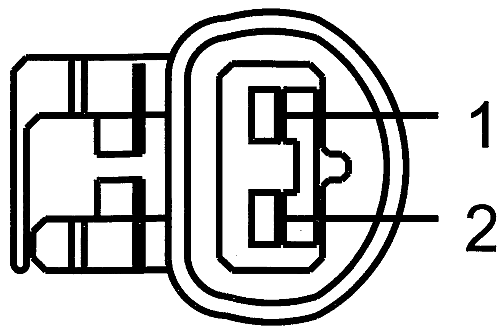
Circuit	Pin
AIR_PWR (AIR Pump Power)	87
B+ (Battery positive voltage)	30
VPWR (Power supply)	86
SAIR (Secondary Air)	85

Secondary Air Injection (AIR) System	HM

Secondary air injection (AIR) Solenoid Connector



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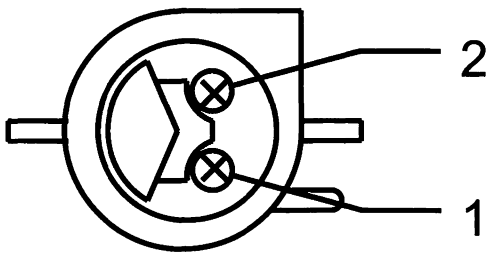
Circuit	Pin
VPWR (Power supply)	2
SAIR (Secondary Air)	1

Secondary Air Injection (AIR) System — HM

Secondary air injection (AIR) Motor Connector



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Circuit	Pin
AIR_PWR (AIR Pump Power)	2
AIR_GND (AIR Pump Ground)	1

Test Steps		Results →	Action to Take
HM1	KOEO AND KOER DTC P0412: ISOLATE COMMAND SIGNAL CIRCUIT TO ONE COMPONENT AND RERUN SELF TEST		
	Note: Only start at this step if you followed section 3 PCM Quick Test direction and a KOEO or KOER DTC is present. • Key OFF. • Scan tool connector connected. • AIR Solenoid connector disconnected. • Key ON Engine OFF. • CLEAR the DTCs. • Run KOEO Self-Test. • **Is DTC P0412 present?**	Yes → No →	GO to **HM2**. KEY OFF. INSTALL a new AIR solenoid.

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM2	CHECK RESISTANCE OF AIR SOLENOID		
	• Measure the Resistance between: **(+)AIR Solenoid Connector, Component Side**: SAIR - Pin 1 **(-)AIR Solenoid Connector, Component Side**: VPWR - Pin 2 • **Is the Resistance between 50 Ohm - 95 Ohm?**	Yes → No →	GO to **HM3**. KEY OFF. INSTALL a new AIR solenoid.
HM3	CHECK VPWR VOLTAGE TO AIR SOLENOID		
	• Measure the Voltage between: **(+)AIR Solenoid Connector, Harness Side**: VPWR - Pin 2 **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **HM4**. KEY OFF. REPAIR open circuit.
HM4	ISOLATE COMMAND SIGNAL CIRCUIT TO ONE COMPONENT AND RERUN SELF TEST		
	• Key OFF. • AIR Solenoid connector connected. • AIR Relay connector disconnected. • Key ON Engine OFF. • CLEAR the DTCs. • Run KOEO Self-Test. • **Is DTC P0412 present?**	Yes → No →	GO to **HM5**. KEY OFF. INSTALL a new AIR relay.
HM5	CHECK RESISTANCE OF AIR RELAY		
	• Measure the Resistance between: **(+)AIR Relay Connector, Component Side**: SAIR - Pin 85 **(-)AIR Relay Connector, Component Side**: VPWR - Pin 86 • **Is the Resistance between 40 Ohm - 80 Ohm?**	Yes → No →	GO to **HM6**. KEY OFF. INSTALL a new AIR relay.
HM6	CHECK VPWR VOLTAGE TO AIR RELAY		
	• Measure the Voltage between: **(+)AIR Relay Connector, Harness Side**: VPWR - Pin 86 **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **HM7**. KEY OFF. REPAIR open circuit.

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM7	CHECK SAIR CIRCUIT(S) FOR OPEN IN HARNESS		
	• Key OFF. • AIR Solenoid connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **HM8**. REPAIR open circuit.

(+)PCM Connector, Harness Side	**(-)AIR Solenoid Connector, Harness Side**
SAIR - Pin B17	SAIR - Pin 1

• Measure the Resistance between:

(+)PCM Connector, Harness Side	**(-)AIR Relay Connector, Harness Side**
SAIR - Pin B17	SAIR - Pin 85

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
HM8	CHECK SAIR FOR SHORTS TO POWER(S) AND GROUND(S) IN HARNESS - DIRECT AND INDIRECT		
	• Measure the Resistance between:	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.

(+)PCM Connector, Harness Side	**(-)PCM Connector, Harness Side**
SAIR - Pin B17	VPWR - Pin B35
SAIR - Pin B17	PWRGND - Pin B47
SAIR - Pin B17	CASE GND - Pin B10
SAIR - Pin B17	SIGRTN - Pin B41
SAIR - Pin B17	VREF - Pin B40

• Measure the Resistance between:

(+)PCM Connector, Harness Side	**(-)**
SAIR - Pin B17	Ground

• **Is the Resistance above 10 KOhm?**

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM9	CONTINUOUS MEMORY DTC P0412: WIGGLE TEST ON THE AIR HARNESS SAIR CIRCUIT LOOKING FOR OPEN CIRCUIT OR SHORT TO GROUND - PCM OUTPUT OFF		
	Note: Only start at this step if you followed section 3 PCM Quick Test direction and no KOEO or KOER DTC is present. Note: Open circuit and short-to-ground conditions will be detected when the PCM output driver is OFF. The AIRF PID will instantly shows a SAIR PCM output circuit open or short-to-ground fault - PCM output OFF. • Key ON Engine OFF. • Scan tool connector connected. • Access the PCM-AIR, PCM-AIRM and PCM-AIRF PIDs using a scan tool. • Observe the PCM output driver fault PID AIRF. Wiggle the SAIR harness and connectors, lightly tap components while observing AIRF PID. • **Was a fault found?**	Yes → No →	KEY OFF. REPAIR / REPLACE as necessary GO to **HM10**.
HM10	WIGGLE TEST ON THE AIR HARNESS SAIR CIRCUIT LOOKING FOR SHORT TO POWER OR LOW RESISTANCE LOAD TO POWER - PCM OUTPUT ON		
	CAUTION: Running the AIR Pump with OTM longer than two minutes may overheat and damage AIR Pump. (REFER to Section 2, OTM). Note: The SAIR PCM output driver will detect a short-to-power VPWR,VBAT, etc. condition, when the driver is on. The AIRF PID will instantly shows a SAIR PCM output circuit short-to-power or low resistance short-to-power fault - PCM output ON. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe the PCM output driver fault PID AIRF. While commanding outputs on with OTM wiggle the SAIR line harness and connectors, lightly tap components while observing AIRF PID. • Command outputs OFF • Exit Output Test Mode • **Was a fault found?**	Yes → No →	KEY OFF. REPAIR / REPLACE as necessary KEY OFF. GO to **HM11**.

Secondary Air Injection (AIR) System — HM

Test Steps	Results →	Action to Take
HM11 CHECK RESISTANCE OF AIR SOLENOID		
• AIR Solenoid connector disconnected. • Measure the Resistance between: (+)AIR Solenoid Connector, Component Side: SAIR - Pin 1; (-)AIR Solenoid Connector, Component Side: VPWR - Pin 2 • **Is the Resistance between 50 Ohm - 95 Ohm?**	Yes → No →	GO to **HM12**. INSTALL a new AIR solenoid.
HM12 CHECK VPWR VOLTAGE TO AIR SOLENOID		
• Key ON Engine OFF. • Measure the Voltage between: (+)AIR Solenoid Connector, Harness Side: VPWR - Pin 2; (-): Ground • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **HM13**. KEY OFF. REPAIR open circuit.
HM13 CHECK RESISTANCE OF AIR RELAY		
• AIR Relay connector disconnected. • Measure the Resistance between: (+)AIR Relay Connector, Component Side: SAIR - Pin 85; (-)AIR Relay Connector, Component Side: VPWR - Pin 86 • **Is the Resistance between 40 Ohm - 80 Ohm?**	Yes → No →	GO to **HM14**. INSTALL a new AIR relay.
HM14 CHECK VPWR VOLTAGE TO AIR RELAY		
• Key ON Engine OFF. • Measure the Voltage between: (+)AIR Relay Connector, Harness Side: VPWR - Pin 86; (-): Ground • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **HM15**. KEY OFF. REPAIR open circuit.

Secondary Air Injection (AIR) System — HM

	Test Steps	Results →	Action to Take
HM15	CHECK SAIR CIRCUIT(S) FOR OPEN IN HARNESS		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **HM16**. REPAIR open circuit.

(+)PCM Connector, Harness Side	**(-)AIR Solenoid Connector, Harness Side**
SAIR - Pin B17	SAIR - Pin 1

• Measure the Resistance between:

(+)PCM Connector, Harness Side	**(-)AIR Relay Connector, Harness Side**
SAIR - Pin B17	SAIR - Pin 85

• **Is the Resistance below 5 Ohm?**

	Test Steps	Results →	Action to Take
HM16	CHECK SAIR FOR SHORTS TO POWER(S) AND GROUND(S) IN HARNESS - DIRECT AND INDIRECT		
	• Measure the Resistance between:	Yes → No →	Unable to duplicate or identify fault at this time. GO to **Z1**. REPAIR short circuit.

(+)PCM Connector, Harness Side	**(-)PCM Connector, Harness Side**
SAIR - Pin B17	VPWR - Pin B35
SAIR - Pin B17	PWRGND - Pin B47
SAIR - Pin B17	CASE GND - Pin B10
SAIR - Pin B17	SIGRTN - Pin B41
SAIR - Pin B17	VREF - Pin B40

• Measure the Resistance between:

(+)PCM Connector, Harness Side	**(-)**
SAIR - Pin B17	Ground

• **Is the Resistance above 10 KOhm?**

	Test Steps	Results →	Action to Take
HM17	DTC P0411: VISUALLY INSPECT AIR SYSTEM COMPONENTS AND HOSES		
	• Visually inspect AIR system components and hoses for damage, obstruction, binding, including exhaust damage, cracking, blocked water shield on AIR pump inlet hose, water, or ice. • **Are AIR system components and hoses OK?**	Yes → No →	GO to **HM18**. KEY OFF. REPAIR / REPLACE as necessary CLEAR the DTCs and REPEAT Self-Test.

Secondary Air Injection (AIR) System	HM

	Test Steps	Results →	Action to Take
HM18	CHECK THE AIR PUMP / MOTOR OPERATION		
	CAUTION: Running the AIR Pump with OTM longer than two minutes may overheat and damage AIR Pump. (REFER to Section 2, OTM). • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Listen for the AIR Pump operation while toggling to OTM states from ON to OFF. • Command outputs ON • Command outputs OFF • Exit Output Test Mode • **Does the AIR pump operation correspond with the OTM ON and OFF commands?**	Yes → No →	GO to **HM19**. GO to **HM33**.
HM19	MEASURE VACUUM AT AIR DIVERTER VALVE		
	• Connect a vacuum gauge to the control vacuum hose at the AIR diverter valve(s). • Apply 54 kPa (16 in-Hg) of vacuum at the manifold side of the AIR bypass solenoid vacuum supply hose(s). • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe vacuum gauge reading at AIR diverter valve(s). • Command outputs OFF • **Is applied vacuum present at the AIR diverter valve(s)?**	Yes → No →	GO to **HM22**. Exit Output Test Mode GO to **HM20**.
HM20	MEASURE VACUUM AT AIR SOLENOID VALVE		
	• Connect a vacuum gauge to the control vacuum outlet at the AIR solenoid valve(s). • Apply 54 kPa (16 in-Hg) of vacuum at the manifold side of the AIR bypass solenoid vacuum supply hose(s). • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe vacuum gauge reading at AIR solenoid valve. • Command outputs OFF • Exit Output Test Mode • **Is applied vacuum present at the AIR diverter valve(s)?**	Yes → No →	KEY OFF. REPAIR / REPLACE as necessary restricted vacuum duct, tubing or hoses between AIR solenoid and AIR diverter valve GO to **HM21**.

Secondary Air Injection (AIR) System | HM

Test Steps		Results →	Action to Take
HM21	MEASURE MANIFOLD VACUUM AT AIR SOLENOID VALVE		
	• Connect a vacuum gauge to the manifold vacuum hose at the AIR solenoid valve(s). • Key ON Engine RUN. • **Is manifold vacuum greater than 47 kPa (14 in-Hg)?**	Yes → No →	KEY OFF. GO to **HM30**. KEY OFF. REPAIR cause of restriction
HM22	MEASURE VACUUM AT AIR DIVERTER VALVE - VACUUM RELEASE		
	• Command outputs OFF • Exit Output Test Mode • Observe vacuum gauge reading at AIR solenoid valve. • **Was vacuum released - 0 kPa (0 in-Hg)?**	Yes → No →	GO to **HM23**. KEY OFF. INSTALL a new AIR solenoid.
HM23	CHECK AIR FLOW AT AIR DIVERTER VALVE(S) OUTLET		
	• Disconnect air hose from AIR diverter valve(s) outlet side. • Apply 54 kPa (16 in-Hg) of vacuum at the AIR diverter valve(s). • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe air flow at AIR diverter valve(s) outlet. • Command outputs OFF • Exit Output Test Mode • **Is air flow present at AIR diverter valve(s) outlet?**	Yes → No →	GO to **HM24**. KEY OFF. GO to **HM25**.
HM24	CHECK AIR FLOW AT AIR DIVERTER VALVE(S) OUTLET. - CONTINUED		
	• Disconnect control vacuum hose from AIR diverter valve(s). • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe air flow at AIR diverter valve(s) outlet. • Command outputs OFF • Exit Output Test Mode • **Is air flow present at AIR diverter valve(s) outlet?**	Yes → No →	KEY OFF. REPLACE the appropriate AIR diverter valve(s). KEY OFF. GO to **HM28**.

Secondary Air Injection (AIR) System | HM

	Test Steps	Results →	Action to Take
HM25	CHECK AIR FLOW AT AIR DIVERTER VALVE(S) INLET		
	• Disconnect air hose from AIR diverter valve(s) inlet side. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe air flow at AIR diverter(s) inlet hose. • Command outputs OFF • Exit Output Test Mode • **Is air flow present at AIR diverter valve(s) inlet hose?**	Yes → No →	KEY OFF. REPLACE the appropriate AIR diverter valve(s). KEY OFF. GO to **HM26**.
HM26	CHECK AIR FLOW AT AIR PUMP		
	• Disconnect air hose from AIR pump outlet side. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe air flow at AIR pump outlet. • Command outputs OFF • Exit Output Test Mode • **Was air flow present at AIR pump outlet?**	Yes → No →	REPAIR / REPLACE as necessary restricted air flow duct, tubing or hoses between AIR pump and AIR diverter valve KEY OFF. GO to **HM27**.
HM27	CHECK AIR FLOW AT AIR PUMP - CONTINUED		
	• Disconnect air hose from AIR pump inlet side. • INSPECT air hose and water shield from AIR pump inlet side for restrictions or damage. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe air flow at AIR pump outlet. • Command outputs OFF • Exit Output Test Mode • **Was air flow present at AIR pump outlet?**	Yes → No →	REPAIR / REPLACE as necessary restricted air flow duct, tubing or hoses between AIR pump inlet and pump AIR water shield / silencer and / or silencer. KEY OFF. INSTALL a new AIR motor.
HM28	CHECK AIR DISTRIBUTION MANIFOLD INTEGRITY AT EXHAUST MANIFOLD		
	• CHECK AIR distribution manifold at exhaust manifold for restrictions, blockage or damage. • **Is AIR distribution manifold at exhaust manifold restriction free?**	Yes → No →	GO to **HM29**. REPAIR / REPLACE as necessary

Secondary Air Injection (AIR) System | HM

	Test Steps	Results →	Action to Take
HM29	CHECK FOR RESTRICTIONS IN THE EXHAUST SYSTEM		
	• CHECK for restrictions in the exhaust system. • **Is the exhaust system restriction free?**	Yes → No →	GO to **Z1**. REPAIR / REPLACE as necessary
HM30	CHECK RESISTANCE OF AIR SOLENOID		
	• AIR Solenoid connector disconnected. • Measure the Resistance between: **(+)AIR Solenoid Connector, Component Side**: SAIR - Pin 1; **(-)AIR Solenoid Connector, Component Side**: VPWR - Pin 2 • **Is the Resistance between 50 Ohm - 95 Ohm?**	Yes → No →	GO to **HM31**. INSTALL a new AIR solenoid.
HM31	CHECK ELECTRICAL CONNECTOR INTEGRITY		
	• Observe AIR Solenoid harness connector and component connector. • CHECK electrical connector for damage, corrosion, and water ingress. • **Is the connector in good working order?**	Yes → No →	GO to **HM32**. REPAIR / REPLACE as necessary
HM32	CHECK VPWR VOLTAGE TO AIR SOLENOID		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)AIR Solenoid Connector, Harness Side**: VPWR - Pin 2; **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	INSTALL a new AIR solenoid. REPAIR open circuit.
HM33	CHECK AIR PUMP / MOTOR ELECTRICAL CONNECTOR INTEGRITY		
	• CHECK AIR pump / motor electrical connector for damage, corrosion, and water ingress. • AIR Motor connector disconnected. • **Is the connector in good working order?**	Yes → No →	GO to **HM34**. REPAIR / REPLACE as necessary
HM34	CHECK AIR PUMP / MOTOR GROUND CIRCUIT FOR OPEN IN HARNESS		
	• AIR Motor connector disconnected. • Measure the Resistance between: **(+)AIR Motor Connector, Harness Side**: AIR_GND - Pin 1; **(-)**: Ground • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HM35**. REPAIR open circuit.

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM35	CHECK B+ VOLTAGE FROM AIR RELAY AT AIR PUMP / MOTOR		
	• Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Measure the Voltage between: **(+)AIR Motor Connector, Harness Side** / **(-)**: AIR_PWR - Pin 2 / Ground • Command outputs OFF • Exit Output Test Mode • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. INSTALL a new AIR motor. KEY OFF. GO to **HM36**.
HM36	CHECK AIR PUMP / MOTOR FOR WATER OR ICE CONTAMINATION		
	Note: Water ingested in the AIR pump will reduce the life of the pump. • Disconnect air hose from AIR pump inlet side. • Disconnect air hose from AIR pump outlet side. • AIR Motor connector disconnected. Note: AIR pump temperature must be above freezing 0 C (-32 F) degrees. • Tilt AIR pump assembly to a range of positions to see if any water is present. • **Is water or evidence of ice present in AIR pump?**	Yes → No →	INSTALL a new AIR motor. Carefully inspect AIR pump hoses for proper routing and installation of inlet water shield / silencer. REPAIR / REPLACE as necessary INSTALL a new AIR motor.

(+)AIR Motor Connector, Harness Side	(-)
AIR_PWR - Pin 2	Ground

Secondary Air Injection (AIR) System — HM

	Test Steps	Results	Action to Take
HM37	DTC P2257: CHECK AIR PID OPERATION WITH OTM		
	CAUTION: Running the AIR Pump with OTM longer than two minutes may overheat and damage AIR Pump. (REFER to Section 2, OTM). • Key ON Engine OFF. • Access the PCM-AIR PID using a scan tool. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Observe the AIR PID while toggling to OTM state from ON to OFF. Note: When OTM outputs are commanded on the PCM output signal AIR PID should turn on. • Command outputs ON • Command outputs OFF • Exit Output Test Mode • **Does the AIR PID correspond with the OTM ON and OFF commands?**	Yes → No →	GO to **HM38**. GO to **HM47**.
HM38	CHECK AIRM PID OPERATION WITH OTM		
	• Key ON Engine OFF. • Access the PCM-AIR and PCM-AIRM PIDs using a scan tool. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Observe the AIRM PID while toggling to OTM state from ON to OFF. Note: When OTM outputs are commanded on the PCM output signal AIR PID should turn on followed by the PCM input signal AIRM PID. The AIRM PID indicates voltage at the AIR pump / motor. • Command outputs ON • Command outputs OFF • Exit Output Test Mode • **Does the AIRM PID correspond with the OTM ON and OFF commands?**	Yes → No →	Unable to duplicate or identify fault at this time. GO to **HM39**. GO to **HM40**.

Secondary Air Injection (AIR) System | HM

Test Steps		Results →	Action to Take
HM39	PERFORM A THOROUGH WIGGLE TEST ON THE AIR HARNESS - SAIRM LINE		
	• Access the PCM-AIR and PCM-AIRM PIDs using a scan tool. Note: When OTM outputs are commanded on the PCM output signal AIR PID should turn on followed by the PCM input signal AIRM PID. The AIRM PID indicates voltage at the AIR pump / motor. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • While commanding outputs on with OTM wiggling the SAIRM line harness and connectors, lightly tap components while observing AIRM PID. Note: Changing AIRM PID states indicate a fault location in the secondary side of the AIR relay circuit. The AIRM PID indicates voltage at the AIR pump / motor. • Command outputs OFF • Exit Output Test Mode • **Was a fault found?**	Yes → No →	KEY OFF. REPAIR / REPLACE as necessary KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.
HM40	CHECK B+ AND VPWR VOLTAGE TO AIR RELAY		
	• Key OFF. • AIR Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	GO to **HM43**. KEY OFF. REPAIR open circuit. GO to **HM41**.

(+)AIR Relay Connector, Harness Side	**(-)**
B+ - Pin 30	Ground
VPWR - Pin 86	Ground

• **Are the voltages above 10.5 V?**

Test Steps		Results →	Action to Take
HM41	CHECK FOR AN ISOLATED B+ AIR FUSE FAULT IN LAST STEP		
	Note: An isolated B+ AIR fuse fault could be the result of frozen water in AIR pump. • **Was a B+ AIR fuse fault the only fault in the last step?**	Yes → No →	KEY OFF. GO to **HM42**. KEY OFF. Stop Repair is complete

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM42	CHECK AIR PUMP / MOTOR FOR WATER OR ICE CONTAMINATION		
	Note: Water ingested in the AIR pump will reduce the life of the pump. • Disconnect air hose from AIR pump inlet side. • Disconnect air hose from AIR pump outlet side. • AIR Motor connector disconnected. Note: AIR pump temperature must be above freezing 0 C (-32 F) degrees. • Tilt AIR pump assembly to a range of positions to see if any water is present. • **Is water or evidence of ice present in AIR pump?**	Yes → No →	INSTALL a new AIR motor. Carefully inspect AIR pump hoses for proper routing and installation of inlet water shield / silencer. Stop Repair is complete
HM43	CHECK POWER CIRCUIT FROM AIR RELAY TO AIR PUMP / MOTOR FOR OPEN CIRCUIT		
	• Key OFF. • AIR Motor connector disconnected. • Measure the Resistance between: **(+)AIR Relay Connector, Harness Side**: AIR_PWR - Pin 87 **(-)AIR Motor Connector, Harness Side**: AIR_PWR - Pin 2 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HM44**. REPAIR open circuit.
HM44	CHECK AIRM PID OPERATION WITH JUMPER		
	CAUTION: Running the AIR Pump with JUMPER wire longer than two minutes may overheat and damage AIR Pump. • Key ON Engine OFF. • Access the PCM-AIRM and PCM-AIR PIDs using a scan tool. Note: The AIRM PID indicates voltage at the AIR pump / motor. • Add jumper wire between the points described below: **Point A AIR Relay Connector, Harness Side**: B+ - Pin 30 **Point B AIR Relay Connector, Harness Side**: AIR_PWR - Pin 87 • REMOVE jumper wire(s) • **Did the AIRM PID turn on with the jumper applied?**	Yes → No →	KEY OFF. INSTALL a new AIR relay. GO to **HM45**.

(+)AIR Relay Connector, Harness Side	(-)AIR Motor Connector, Harness Side
AIR_PWR - Pin 87	AIR_PWR - Pin 2

Point A AIR Relay Connector, Harness Side	Point B AIR Relay Connector, Harness Side
B+ - Pin 30	AIR_PWR - Pin 87

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM45	CHECK SAIRM CIRCUIT AND AIR PUMP / MOTOR POWER CIRCUIT FOR SHORT(S)		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: SAIRM - Pin B19; (-): Ground • Measure the Resistance between: (+)AIR Relay Connector, Harness Side: AIR_PWR - Pin 87; (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **HM46**. REPAIR open circuit.
HM46	CHECK SAIRM CIRCUIT AND AIR PUMP / MOTOR POWER CIRCUIT FOR OPEN(S) IN HARNESS		
	• Measure the Resistance between: (+)PCM Connector, Harness Side: SAIRM - Pin B19; (-)AIR Relay Connector, Harness Side: AIR_PWR - Pin 87 • Measure the Resistance between: (+)PCM Connector, Harness Side: SAIRM - Pin B19; (-)AIR Motor Connector, Harness Side: AIR_PWR - Pin 2 • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.
HM47	CHECK SAIR CIRCUIT(S) FOR OPEN IN HARNESS		
	• Key OFF. • AIR Relay connector disconnected. • AIR Solenoid connector disconnected. • PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: SAIR - Pin B17; (-)AIR Solenoid Connector, Harness Side: SAIR - Pin 1 • Measure the Resistance between: (+)PCM Connector, Harness Side: SAIR - Pin B17; (-)AIR Relay Connector, Harness Side: SAIR - Pin 85 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HM48**. REPAIR open circuit.

Secondary Air Injection (AIR) System | HM

Test Steps		Results →	Action to Take
HM48	CHECK SAIR FOR SHORTS TO POWER(S) AND GROUND(S) IN HARNESS - DIRECT AND INDIRECT		
	• Measure the Resistance between:	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
SAIR - Pin B17	VPWR - Pin B35
SAIR - Pin B17	PWRGND - Pin B47
SAIR - Pin B17	SIGRTN - Pin B41
SAIR - Pin B17	VREF - Pin B40
SAIR - Pin B17	CASE GND - Pin B10

- Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)
SAIR - Pin B17	Ground

- **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
HM49	DTC P2258: CHECK AIR PID OPERATION WITH OTM		
	See below	Yes →	GO to **HM50**.
		No →	GO to **HM61**.

CAUTION: Running the AIR Pump with OTM longer than two minutes may overheat and damage AIR Pump. (REFER to Section 2, OTM).

- Key ON Engine OFF.
- Access the PCM-AIR PID using a scan tool.
- Observe the AIR PID(s) while toggling the OTM states from ON to OFF.

  Note: When OTM outputs are commanded on the PCM output signal AIR PID should turn on.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command outputs ON
- Command outputs OFF
- Exit Output Test Mode
- **Does the AIR PID correspond with the OTM ON and OFF commands?**

Secondary Air Injection (AIR) System | HM

Test Steps		Results →	Action to Take
HM50	CHECK AIRM PID OPERATION WITH OTM		
	• Scan tool connector connected. • Key ON Engine OFF. • Access the PCM-AIR and PCM-AIRM PIDs using a scan tool. • Observe the AIRM PID while toggling to OTM state from ON to OFF. Note: When OTM outputs are commanded on the PCM output signal AIR PID should turn on followed by the PCM input signal AIRM PID. The AIRM PID indicates voltage at the AIR pump / motor. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Command outputs OFF • Exit Output Test Mode • **Does the AIRM PID correspond with the OTM ON and OFF commands?**	Yes → No →	GO to **HM51**. GO to **HM52**.
HM51	PERFORM A THOROUGH WIGGLE TEST ON THE AIR HARNESS		
	• Access the PCM-AIR and PCM-AIRM PIDs using a scan tool. Note: When OTM outputs are commanded on the PCM output signal AIR PID should turn on followed by the PCM input signal AIRM PID. The AIRM PID indicates voltage at the AIR pump / motor. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • While commanding outputs on with OTM wiggling the harness and connectors, lightly tap components while observing AIRM PID. Note: Changing AIRM PID states indicate a fault location in the secondary side of the AIR relay circuit. The AIRM PID indicates voltage at the AIR pump / motor. • Command outputs OFF • Exit Output Test Mode • **Was a fault found?**	Yes → No →	KEY OFF. REPAIR / REPLACE as necessary KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM52	REMOVE AIR RELAY OBSERVE AIR MONITOR PID		
	• Key OFF. • AIR Relay connector disconnected. • Key ON Engine OFF. Note: AIRM PID corresponds to PCM input SAIRM line voltage indicating voltage to the AIR pump / motor and should be in the OFF state. • Access the PCM-AIR and PCM-AIRM PIDs using a scan tool. • **Is the AIRM PID in the OFF state?**	Yes → No →	GO to **HM53**. GO to **HM56**.
HM53	CONFIRM SAIR SIGNAL WITH TEST LAMP		
	• Key ON Engine OFF. • Connect non-powered test lamp between: (see table below) • **Is the test lamp OFF?**	Yes → No →	KEY OFF. INSTALL a new AIR relay. GO to **HM54**.
HM54	CHECK SAIR CIRCUIT FOR OPEN IN HARNESS		
	• Key OFF. • AIR Solenoid connector disconnected. • PCM connector disconnected. • Measure the Resistance between: (see tables below) • Measure the Resistance between: • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HM55**. REPAIR open circuit.

HM53:

(+)AIR Relay Connector, Harness Side	(-)Vehicle battery
SAIR - Pin 85	Positive post

HM54:

(+)PCM Connector, Harness Side	(-)AIR Solenoid Connector, Harness Side
SAIR - Pin B17	SAIR - Pin 1

(+)PCM Connector, Harness Side	(-)AIR Relay Connector, Harness Side
SAIR - Pin B17	SAIR - Pin 85

Secondary Air Injection (AIR) System — HM

Test Steps	Results →	Action to Take
HM55 CHECK SAIR LINE FOR SHORTS TO GROUND(S) IN HARNESS - DIRECT AND INDIRECT		
• Measure the Resistance between: (+)PCM Connector, Harness Side / (-)PCM Connector, Harness Side: SAIR - Pin B17 / PWRGND - Pin B47 SAIR - Pin B17 / VREF - Pin B40 SAIR - Pin B17 / CASE GND - Pin B10 • Measure the Resistance between: (+)PCM Connector, Harness Side / (-): SAIR - Pin B17 / Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.
HM56 CHECK FOR VOLTAGE AT AIR RELAY TO AIR PUMP \ MOTOR POWER CIRCUIT		
• Key ON Engine OFF. • Measure the Voltage between: (+)AIR Relay Connector, Harness Side / (-)Vehicle battery: AIR_PWR - Pin 87 / Negative post • **Is the Voltage below 0.1 V?**	Yes → No →	KEY OFF. GO to **HM60**. KEY OFF. GO to **HM57**.
HM57 CHECK AIR PUMP / MOTOR ELECTRICAL CONNECTOR INTEGRITY		
• CHECK AIR pump / motor electrical connector for damage, corrosion, and water ingress. • AIR Motor connector disconnected. • **Is the connector in good working order?**	Yes → No →	GO to **HM58**. REPAIR / REPLACE as necessary
HM58 CHECK AIR PUMP / MOTOR GROUND CIRCUIT FOR OPEN IN HARNESS		
• Measure the Resistance between: (+)AIR Motor Connector, Harness Side / (-): AIR_GND - Pin 1 / Ground • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HM59**. REPAIR open circuit.

Secondary Air Injection (AIR) System — HM

Test Steps	Results	Action to Take
HM59 CHECK AIR PUMP / MOTOR FOR OPEN		
• Measure the Resistance between:	Yes →	GO to **HM60**.
	No →	INSTALL a new AIR motor.

(+)AIR Motor Connector, Component Side	**(-)AIR Motor Connector, Component Side**
AIR_GND - Pin 1	AIR_PWR - Pin 2

• **Is the Resistance below 10 Ohm?**

Test Steps	Results	Action to Take
HM60 CHECK SAIR LINE FOR SHORTS TO GROUND(S) IN HARNESS		
• Measure the Resistance between:	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
	No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	**(-)PCM Connector, Harness Side**
SAIR - Pin B17	PWRGND - Pin B47
SAIR - Pin B17	VREF - Pin B40
SAIR - Pin B17	CASE GND - Pin B10

• Measure the Resistance between:

(+)AIR Solenoid Connector, Harness Side	**(-)**
SAIR - Pin 1	Ground

• Measure the Resistance between:

(+)AIR Relay Connector, Harness Side	**(-)**
SAIR - Pin 85	Ground

• **Is the Resistance above 10 KOhm?**

Test Steps	Results	Action to Take
HM61 CHECK SAIR CIRCUIT(S) FOR OPEN IN HARNESS		
• Key OFF.	Yes →	GO to **HM62**.
• AIR Relay connector disconnected.	No →	REPAIR open circuit.
• AIR Solenoid connector disconnected.		
• PCM connector disconnected.		
• Measure the Resistance between:		

(+)PCM Connector, Harness Side	**(-)AIR Solenoid Connector, Harness Side**
SAIR - Pin B17	SAIR - Pin 1

• Measure the Resistance between:

(+)PCM Connector, Harness Side	**(-)AIR Relay Connector, Harness Side**
SAIR - Pin B17	SAIR - Pin 85

• **Is the Resistance below 5 Ohm?**

Secondary Air Injection (AIR) System — HM

Test Steps		Results →	Action to Take
HM62	CHECK SAIR FOR SHORTS TO POWER(S) AND GROUND(S) IN HARNESS - DIRECT AND INDIRECT		
	• Measure the Resistance between:	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
SAIR - Pin B17	VPWR - Pin B35
SAIR - Pin B17	PWRGND - Pin B47
SAIR - Pin B17	SIGRTN - Pin B41
SAIR - Pin B17	VREF - Pin B40
SAIR - Pin B17	CASE GND - Pin B10

• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)
SAIR - Pin B17	Ground

• **Is the Resistance above 10 KOhm?**

Intake Air Systems	HU

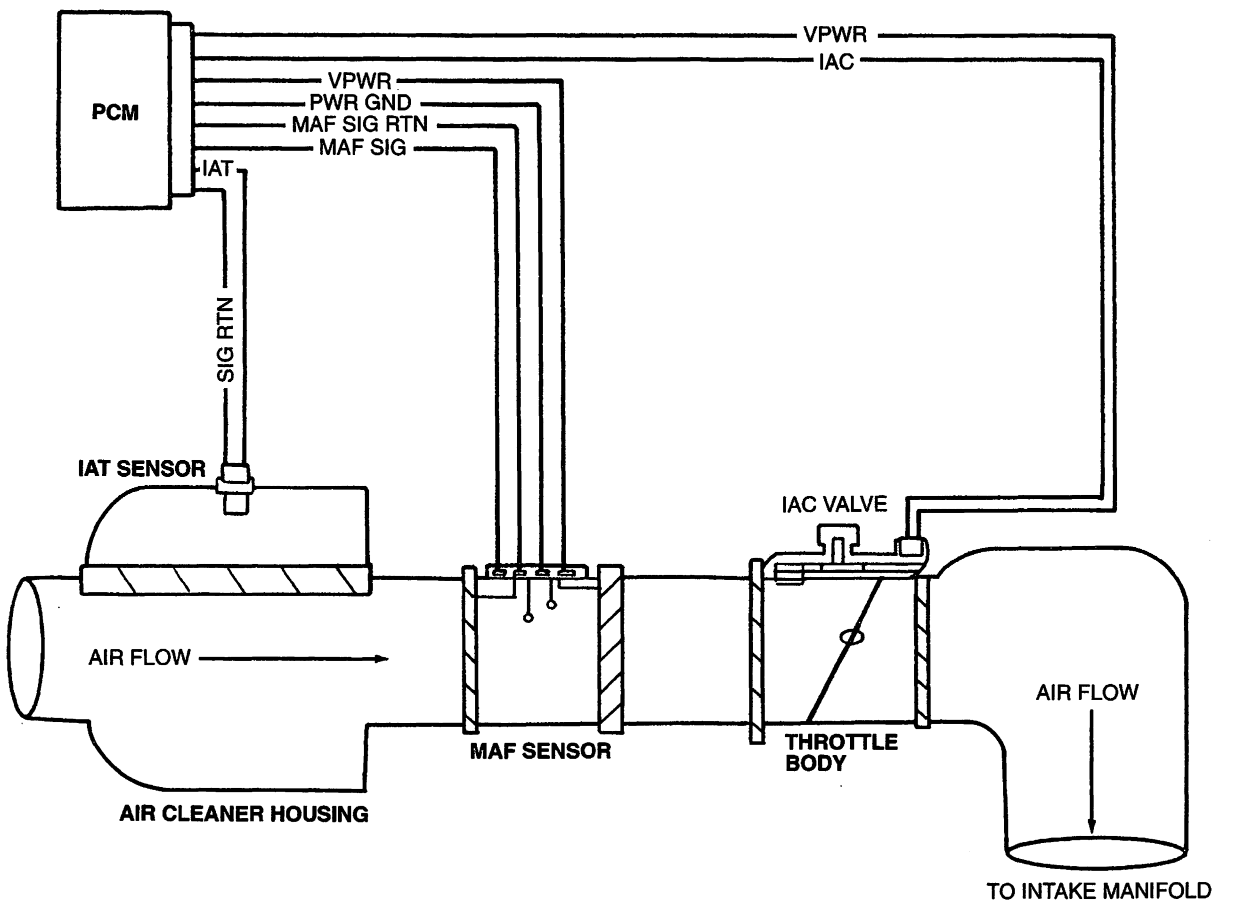
Note

This Pinpoint Test is intended to diagnose the following:

- Throttle body assembly (9E926).
- Speed control cable (9A825).
- Accelerator cable linkage to throttle body (9C799).
- Air cleaner assembly (including air cleaner element).
- Air inlet tube.
- Clean air tube hose and resonator (9R504) and (9F593).
- Intake manifold runner control housing assembly (IMRC) (9U531), (9U524) and (9J447).
- IMRC actuator assembly (9J559).
- IMRC also includes Charge Motion Control Valve (CMCV) (9G730).
- Harness circuits: IMRC, MONITOR, SIGNAL, SIGRTN, PWRGND, VREF and VPWR.
- Intake manifold tuning valve (IMTV) also includes Long Short Runner Control (LSRC).
- IMTV electric actuator assembly (9L490).
- Harness circuits: IMTV SIGNAL and VPWR.
- Powertrain control module (PCM) (12A650).

Intake Air Systems | HU

Intake Air System



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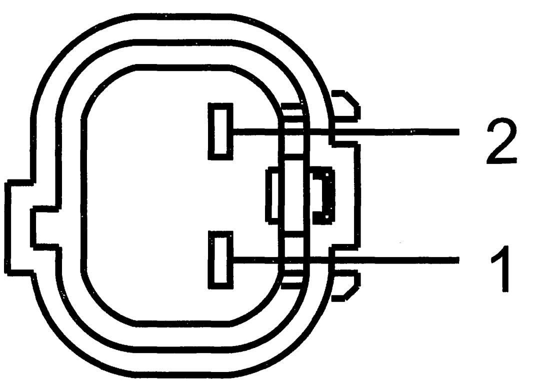
IMRCM voltage values

VEHICLE	IMRC OFF	IMRC ON
BASE	2.5	0
Focus, 2.0L	5	0
Focus, 2.3L	0	5
F-150, 5.4L	5	0

Intake Air Systems | HU

Intake Manifold Runner Control (IMRC) Actuator Connector

A



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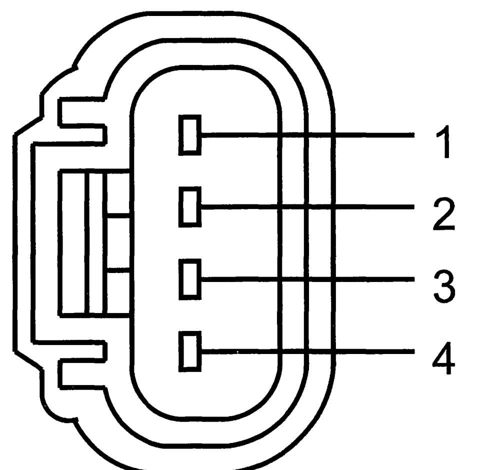

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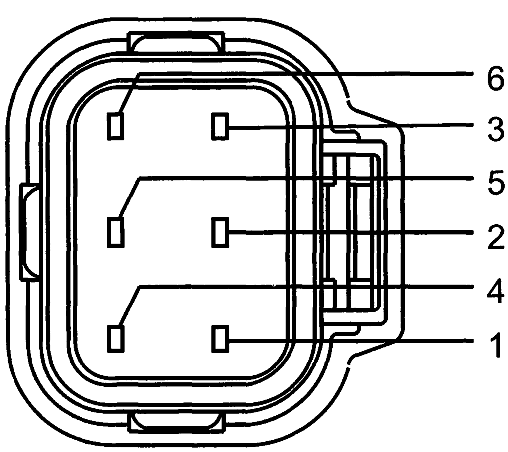

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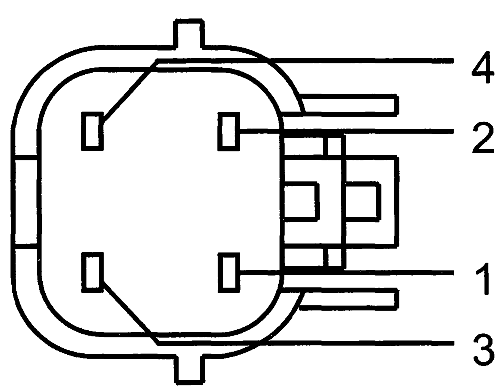

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Intake Air Systems

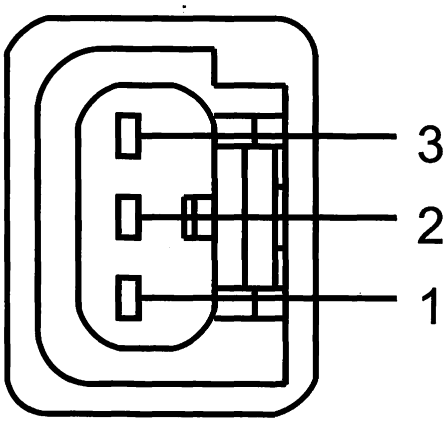
HU

Vehicle	Connector	Circuit	Pin
Focus 2.3L	A	IMRC VPWR	1 2
F-150 5.4L 3V	B	IMRCM IMRC PWRGND VPWR	4 3 2 1
Focus 2.0L SVT	C	IMRCM IMRC PWRGND VPWR	5 1 3, 6 2
All other vehicles	D	IMRCM IMRC PWRGND VPWR	4 1 2 3

Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector

For most vehicles the IMRCM is integrated into the IMRC connector

A



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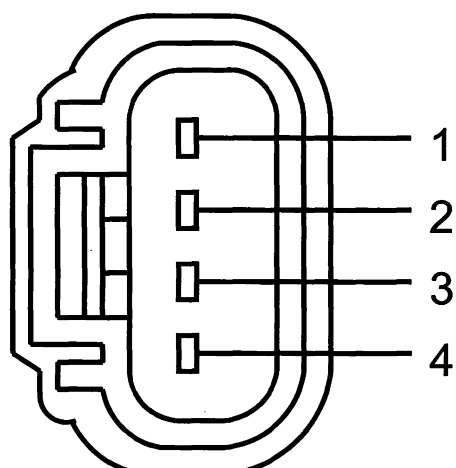

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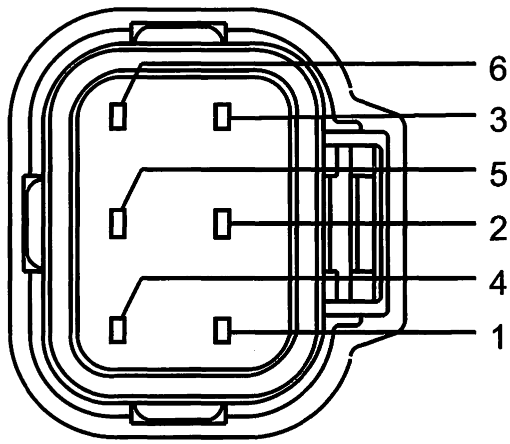
Intake Air Systems	HU

C



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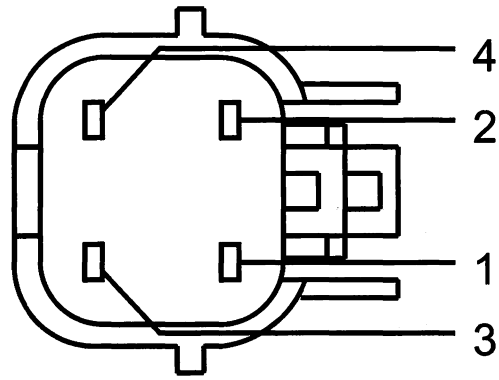

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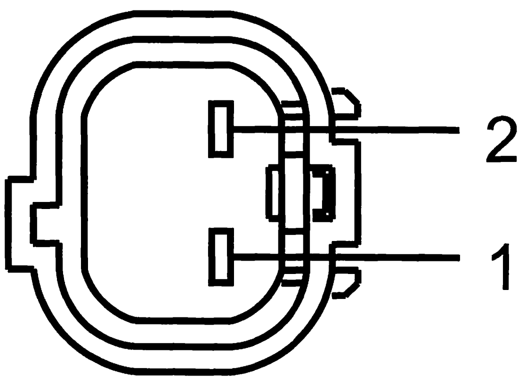
Vehicle	Connector	Circuit	Pin
Focus 2.3L	A	PWRGND VPWR IMRCM	2 3 1
F-150 5.4L 3V	B	PWRGND VPWR IMRCM	2 1 4
Focus 2.0L SVT	C	PWRGND VPWR IMRCM	3, 6 2 5
All other vehicles	D	PWRGND VPWR IMRCM	2 3 4

Intake Air Systems	HU

Intake Manifold Tuning Valve (IMTV) Actuator Connector

A



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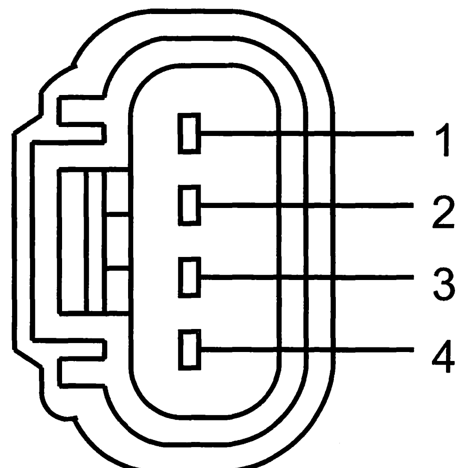

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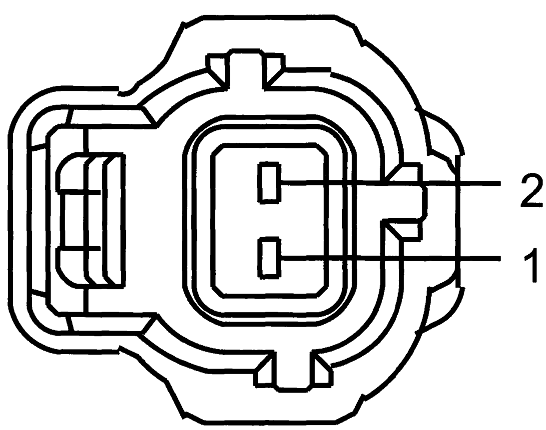

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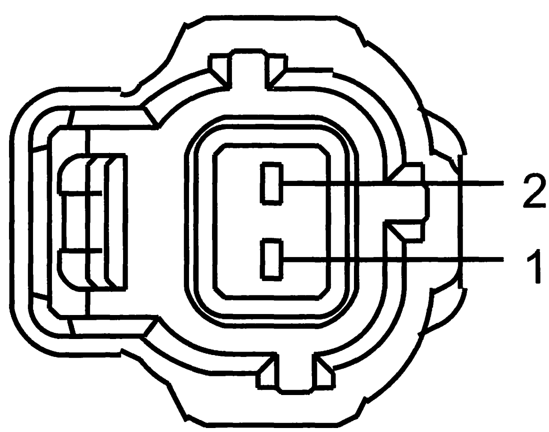
Intake Air Systems	HU

Vehicle	Connector	Circuit	Pin
Focus 2.3L	A	IMTV VPWR	1 2
Aviator	B	PWRGND IMTVM IMTV VPWR	2 4 3 1
All other vehicles	C	IMTV VPWR	2 1

Intake Manifold Tuning Valve (Bank 2) (IMTV2) Actuator Connector



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Circuit	Pin
IMTV2 (Intake Manifold Tuning Valve (Bank 2))	2
VPWR (Power supply)	1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Intake Air Systems

HU

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	IMTVM IMTV PWRGND SIGRTN	E58 E3 B24 E17
E-Series, F-150 Heritage 4.6L	104 Pin	IMTV PWRGND SIGRTN	46 103 91
F-150 4.6L	190 Pin	IMTV PWRGND SIGRTN	E64 B67 E58
F-150 5.4L	190 Pin	IMRCM PWRGND SIGRTN IMRC	E43 B67 E58 E50
F-150 Heritage 4.2L, Freestar / Monterey, Mustang	104 Pin	IMRCM PWRGND SIGRTN IMRC	8 103 91 42
Focus 2.0L 2V	104 Pin	IMRCM PWRGND SIGRTN IMRC	3 103 91 80
Focus 2.0L SVT	104 Pin	IMRCM PWRGND SIGRTN IMRC	3 103 91 12
Focus 2.3L	150 (50-50-50) Pin	IMTV IMRCM PWRGND SIGRTN IMRC	E6 E17 B47 E41 E14
LS	150 (60-32-58) Pin	IMTV2 IMTV PWRGND SIGRTN	E37 E29 B24 E17
All other vehicles	104 Pin	IMTV PWRGND SIGRTN	29 103 91

Intake Air Systems — HU

Test Steps		Results →	Action to Take
HU1	PART THROTTLE SYMPTOM		
	• **Are any Part Throttle concerns present?**	Yes → No →	GO to **HU6**. GO to **HU2**.
HU2	CHECK THE BASE IDLE SPEED		
	Note: Vehicle must be at operating temperature and at idle for a minimum of one minute. • Key ON Engine RUN. • Determine if idle speed is incorrect. REFER to the Typical Reference Value Charts in Section 6, if necessary. • Access the PCM-RPM PID using a scan tool. • If equipped, read the vehicle tachometer. • **Is vehicle idle speed incorrect?**	Yes → No →	GO to **HU3**. KEY OFF. GO to **HU4**.
HU3	CHECK THE BASE IDLE SPEED		
	• CHECK that the throttle arm contacts the return stop.. • **Is the idle speed high?**	Yes → No →	GO to **HU8**. GO to **HU10**.
HU4	CHECK FOR BINDING OR STICKING OF THE THROTTLE SYSTEM		
	• Gently cycle throttle from fully closed to fully open and back to fully closed. CHECK for sticking or binding during rotation. • **Is a stick or bind condition present?**	Yes → No →	GO to **HU5**. GO to **HU6**.
HU5	ISOLATE BINDING AND/OR STICKING CONCERN		
	• Disconnect accelerator cable and speed control cable from Throttle Body linkage. **CAUTION: Do not attempt to clean the throttle bore and plate area. Cleaning will damage the throttle body assembly.** Note: Sticking or binding condition can either be within cables or throttle body assembly. • Rotate throttle body linkage. • **Does the throttle body rotate freely without a sticking, binding or grabbing condition?**	Yes → No →	REPAIR cable(s) causing the concern. INSTALL a new Throttle body assembly.
HU6	CHECK FUNCTIONALITY OF THROTTLE POSITION SENSOR		
	• Key ON Engine OFF. • Access the PCM-TP V PID using a scan tool. • Gently cycle throttle from fully closed to fully open and back to fully closed. • **Did the TP PID display a smooth reading?**	Yes → No →	KEY OFF. GO to **HU7**. KEY OFF. INSTALL a new TP sensor.

Intake Air Systems | HU

Test Steps		Results →	Action to Take
HU7	CHECK INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE		
	• REMOVE the air cleaner element. Check the air cleaner for blockage. • CHECK for restrictions between the air inlet and the throttle body. • **Are any restriction concerns present?**	Yes → No →	INSTALL a new air cleaner element. Remove the restriction. Reinstall the air cleaner element. GO to **HU8**.
HU8	CHECK POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM		
	Note: A high idle may indicate incorrect PCV valve size or vacuum leak. • Check that no leaks are present. • REMOVE the PCV valve. — Verify clean PCV valve. — Verify proper PCV valve part number. • **Are any PCV System concerns present?**	Yes → No →	INSTALL a new PCV valve. Repair as necessary. GO to **HU9**.
HU9	CHECK PCV SYSTEM		
	• **Is the idle speed high?**	Yes → No →	GO to **HU13**. Reconnect PCV valve. GO to **HU10**.
HU10	CHECK IAC VALVE RESPONSE		
	• Key ON Engine RUN. • Vehicle must be at operating temperature and at idle for a minimum of one minute. • IAC Actuator connector disconnected. • **Did the RPM drop or the engine stall?**	Yes → No →	GO to **HU12**. GO to **HU11**.
HU11	CHECK IAC VALVE RESPONSE		
	• **Is the idle speed high?**	Yes → No →	GO to **HU13**. KEY OFF. INSTALL a new IAC actuator.
HU12	INSPECT THROTTLE BODY PLATE HOLE FOR PLUGGING		
	Note: Only some applications have a throttle plate hole. If not equipped GO to Section 3, Symptom Charts. • Key OFF. • REMOVE the resonator from throttle body assembly. • INSPECT throttle plate hole for any restrictions. • **Are any restriction concerns present?**	Yes → No →	Clear throttle plate hole Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Intake Air Systems — HU

Test Steps		Results →	Action to Take
HU13	CHECK FOR VACUUM LEAKS		
	• Listen for vacuum leaks. • INSPECT entire air intake system from the mass air flow (MAF) sensor to the intake manifold for leaks such as: — cracked or punctured inlet air tube. — loose connections on the inlet air tube at the air cleaner housing or throttle body. — IAC valve assembly or gasket. — EGR valve gasket leak to intake manifold. — intake manifold assembly or gasket. — EGR valve diaphragm or control solenoid. — vacuum supply connectors and hose. • **Are any leaks present?**	Yes → No →	KEY OFF. Repair as necessary. KEY OFF. GO to **HU14**.
HU14	CHECK THROTTLE BODY FOR EXCESSIVE WEAR		
	• REMOVE the throttle body assembly. REFER to Workshop Manual, Section 303-04, Fuel Charging and Controls. • Check the following: — excessive wear or grooving in throttle bore. — misaligned or worn throttle plate. — excessive gap between throttle bore and plate. • **Are any concerns present?**	Yes → No →	INSTALL a new throttle body assembly. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Intake Air Systems | HU

Test Steps		Results →	Action to Take
HU15	DTCS P1512, P1513, P1516, P1517, P1518, P1519, P1520, P1537, P1538, P2004, P2005, P2006, P2007, P2008, P2014 OR P2019: VISUAL INSPECTION		
	Note: If unable to fully perform the following inspections, answer NO to the question in this step. • Visually inspect linkage for possible causes of binding or obstructions. Check lever/linkage for movement. There may be some tension in one direction but there should be full travel. Note: The IMRC return spring is strong, make sure they operate properly and the plates open and close fully. On vacuum operated systems the engine must run for 20 seconds to restore vacuum then return to KOEO for testing. • Manually open and close IMRC plates at intake manifold and check for sticking or binding. • **Is a mechanical concern detected?**	Yes → No →	GO to **HU16**. GO to **HU17**.
HU16	CHECK IMRC FOR MECHANICAL OPERATION		
	• Disconnect IMRC linkage or remove actuator assembly from manifold. Note: IMRC return spring is strong approximately .34 to .45 Nm (3 to4 in-lb). • Rotate IMRC plate lever fully open to fully closed contacting both limits. • CHECK for sticking or binding during rotation. • **Is a mechanical concern detected?**	Yes → No →	Clean or repair IMRC manifold REFER to Workshop Manual, Section 303-01, Engine INSTALL a new IMRC actuator and retest vehicle.

Intake Air Systems | HU

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HU17</td><td>CHECK FUNCTIONALITY OF IMRC</td><td></td><td></td></tr>
<tr><td></td><td>WARNING: KEEP FINGERS CLEAR OF MECHANISM.
• Key ON Engine RUN.
Note: Vehicle must be at operating temperature and at idle for a minimum of one minute.
• Key ON Engine OFF.
• Scan Tool Connected
• Control PCM-IMRC using Output State Control.
• Access the PCM-IMRCM PID using a scan tool.
• Command IMRC ON then OFF.
Note: If the vehicle is equipped with a vacuum type IMRC return to Key ON Engine RUN to conduct the IMRC check. Momentarily increase the engine speed above 3000 RPM and observe the PIDs.

IMRCM voltage values
<table><tr><th>VEHICLE</th><th>IMRC OFF</th><th>IMRC ON</th></tr><tr><td>BASE</td><td>2.5</td><td>0</td></tr><tr><td>Focus, 2.0L</td><td>5</td><td>0</td></tr><tr><td>Focus, 2.3L</td><td>0</td><td>5</td></tr><tr><td>F-150, 5.4L</td><td>5</td><td>0</td></tr></table>
• Using the table for reference, did the IMRCM voltage values correctly change while the IMRC was cycled?</td><td>Yes →
No →</td><td>GO to Z1.
GO to HU18.</td></tr>
</table>

Intake Air Systems | HU

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HU18</td><td>CHECK FUNCTIONALITY OF IMRC</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to HU28.
KEY OFF.
GO to HU19.</td></tr>
<tr><td colspan="2">WARNING: KEEP FINGERS CLEAR OF MECHANISM.
• Key ON Engine RUN.
Note: Vehicle must be at operating temperature and at idle for a minimum of one minute.
• Key ON Engine OFF.
• Physically monitor the IMRC actuator.
• Scan Tool Connected
• Control PCM-IMRC using Output State Control.
• Command outputs ON.
Note: If the vehicle is equipped with a vacuum type IMRC return to Key ON Engine RUN to conduct the IMRC check. Momentarily increase the engine speed above 3000 RPM and observe the PIDs.
• Did the IMRC levers cycle from fully closed and remain fully open while outputs were on?</td></tr>
<tr><td>HU19</td><td>CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HU20.
REPAIR open circuit and retest vehicle.</td></tr>
<tr><td colspan="2">• IMRC Actuator connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)IMRC Actuator Connector, Harness Side</th><th>(-)</th></tr><tr><td>VPWR</td><td>Ground</td></tr></table>• Is the Voltage above 10.5 V?</td></tr>
<tr><td>HU20</td><td>CHECK GROUND CIRCUIT FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HU21.
REPAIR open circuit and retest vehicle.</td></tr>
<tr><td colspan="2">• Measure the Voltage between:
<table><tr><th>(+)IMRC Actuator Connector, Harness Side</th><th>(-)IMRC Actuator Connector, Harness Side</th></tr><tr><td>VPWR</td><td>PWRGND</td></tr></table>• Is the Voltage above 10.5 V?</td></tr>
<tr><td>HU21</td><td>VERIFY DRIVER CIRCUIT FUNCTION</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
For Focus 2.3L
GO to HU26.
For All Others
GO to HU27.
GO to HU22.</td></tr>
<tr><td colspan="2">• Connect non-powered test lamp between:
<table><tr><th>(+)IMRC Actuator Connector, Harness Side</th><th>(-)IMRC Actuator Connector, Harness Side</th></tr><tr><td>VPWR</td><td>IMRC</td></tr></table>• Is the test lamp ON?</td></tr>
</table>

Intake Air Systems | HU

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HU22</td><td>VERIFY DRIVER CIRCUIT FUNCTION</td><td rowspan="2">Yes →

No →</td><td rowspan="2">For Focus 2.3L
GO to HU26.
For All Others
GO to HU25.
KEY OFF.
GO to HU23.</td></tr>
<tr><td colspan="2">• Scan Tool Connected
• Control PCM-IMRC using Output State Control.
• Connect non-powered test lamp between:
<table><tr><th>(+)IMRC Actuator Connector, Harness Side</th><th>(-)IMRC Actuator Connector, Harness Side</th></tr><tr><td>VPWR</td><td>IMRC</td></tr></table>• Command outputs ON.
Note: If the vehicle is equipped with a vacuum type IMRC return to Key ON Engine RUN to conduct the IMRC check. Momentarily increase the engine speed above 3000 RPM and observe the PIDs.
• Is the test lamp ON?</td></tr>
<tr><td>HU23</td><td>CHECK IMRC CIRCUIT FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HU24.
REPAIR open circuit and retest vehicle.</td></tr>
<tr><td colspan="2">• PCM connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)IMRC Actuator Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>IMRC</td><td>IMRC</td></tr></table>• Is the Resistance below 5 Ohm?</td></tr>
<tr><td>HU24</td><td>CHECK IMRC CIRCUIT FOR SHORT TO VPWR IN HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF. INSTALL a new PCM and retest vehicle.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
KEY OFF. REPAIR short circuit to PWR and retest vehicle.</td></tr>
<tr><td colspan="2">• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)IMRC Actuator Connector, Harness Side</th><th>(-)</th></tr><tr><td>IMRC</td><td>Ground</td></tr></table>• Is the Voltage below 10.5 V?</td></tr>
<tr><td>HU25</td><td>CHECK FOR SHORTS BETWEEN CIRCUITS IN IMRC HARNESS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new IMRC actuator and retest vehicle.
GO to HU27.</td></tr>
<tr><td colspan="2">• Key OFF.
• PCM connector connected.
• Measure the Resistance between:
<table><tr><th>(+)IMRC Actuator Connector, Harness Side</th><th>(-)IMRC Actuator Connector, Harness Side</th></tr><tr><td>IMRC</td><td>IMRCM</td></tr><tr><td>IMRC</td><td>PWRGND</td></tr></table>• Are the resistances above 10 KOhm?</td></tr>
</table>

Intake Air Systems | HU

Test Steps		Results →	Action to Take
HU26	CHECK SHORT BETWEEN IMRC AND SIGRTN CIRCUITS IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side** IMRC / SIGRTN IMRC / PWRGND • **Are the resistances above 10 KOhm?**	Yes →	INSTALL a new PCM and retest vehicle. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit and retest vehicle. GO to **HU41**.
HU27	CHECK FOR SHORTS BETWEEN CIRCUITS IN IMRC HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)IMRC Actuator Connector, Harness Side** / **(-)IMRC Actuator Connector, Harness Side** IMRC / IMRCM IMRC / PWRGND • **Are the resistances above 10 KOhm?**	Yes →	INSTALL a new PCM and retest vehicle. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit and retest vehicle. GO to **HU41**.
HU28	CHECK IMRCM PID		
	• Key ON Engine OFF. • Access the PCM-IMRCM PID using a scan tool. • **Is the IMRCM PID displaying either VREF or approximately 2.5 volts?**	Yes →	**For Focus 2.3L** GO to **HU35**. **For All Others** GO to **HU29**.
		No →	**For Focus 2.3L** GO to **HU29**. **For All Others** GO to **HU33**.

HU26 resistance measurement:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
IMRC	SIGRTN
IMRC	PWRGND

HU27 resistance measurement:

(+)IMRC Actuator Connector, Harness Side	(-)IMRC Actuator Connector, Harness Side
IMRC	IMRCM
IMRC	PWRGND

Intake Air Systems | HU

Test Steps		Results →	Action to Take
HU29	CHECK IMRCM CIRCUIT FOR SHORT TO VPWR		
	• Key ON Engine RUN. Note: Vehicle must be at operating temperature and at idle for a minimum of one minute. • Key ON Engine OFF. • Scan Tool Connected • Control PCM-IMRC using Output State Control. • Command outputs ON. Note: If the vehicle is equipped with a vacuum type IMRC return to Key ON Engine RUN to conduct the IMRC check. Momentarily increase the engine speed above 3000 RPM and observe the PIDs. • Access the PCM-IMRCM PID using a scan tool. • **Is the Voltage below 1 V?**	Yes → No →	**For Focus 2.3L** GO to **HU33**. **For All Others** GO to **HU30**. **For Focus 2.3L** GO to **HU30**. **For All Others** GO to **HU35**.
HU30	CHECK IMRCM CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• Key ON Engine OFF. • IMRCM Sensor connector disconnected. • Measure the Voltage between:	Yes → No →	GO to **HU31**. GO to **HU32**.

(+)IMRCM Sensor Connector, Harness Side	**(-)**
IMRCM	Ground

• **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
HU31	CHECK IMRCM CIRCUIT FOR SHORT TO POWER IN CONTROL MODULE		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. REPAIR short circuit to PWR and retest vehicle. KEY OFF. INSTALL a new PCM and retest vehicle. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

(+)IMRCM Sensor Connector, Harness Side	**(-)**
IMRCM	Ground

• **Is the Voltage above 10.5 V?**

Intake Air Systems — HU

Test Steps		Results →	Action to Take
HU32	CHECK IMRCM CIRCUIT FOR SHORT TO VPWR		
	• Key OFF. • Measure the Resistance between: **(+)IMRCM Sensor Connector, Component Side**: IMRCM; **(-)IMRCM Sensor Connector, Component Side**: VPWR • **Is the Resistance above 10 KOhm?**	Yes →	CHECK for intermittent concern GO to **Z1**.
		No →	INSTALL a new IMRCM sensor and retest vehicle. GO to **HU41**.
HU33	CHECK IMRCM CIRCUIT FOR SHORT TO GROUND		
	• Key ON Engine OFF. • Access the PCM-IMRCM PID using a scan tool. • IMRCM Sensor connector disconnected. • **Did voltage change from less than 1 volt to VREF when disconnecting the IMRCM harness connector?**	Yes →	KEY OFF. INSTALL a new IMRCM sensor and retest vehicle. GO to **HU41**.
		No →	GO to **HU34**.
HU34	CHECK IMRCM CIRCUIT(S) FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)IMRCM Sensor Connector, Harness Side**: IMRCM; **(-)IMRCM Sensor Connector, Harness Side**: PWRGND • **Is the Resistance above 10 KOhm?**	Yes →	KEY OFF. INSTALL a new PCM and retest vehicle. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). GO to **HU41**.
		No →	KEY OFF. REPAIR short circuit to GND and retest vehicle. GO to **HU41**.
HU35	CHECK MONITOR CIRCUIT RESPONSE		
	• IMRCM Sensor connector disconnected. • Access the PCM-IMRCM PID using a scan tool. • Add jumper wire between the points described below: **Point A IMRCM Sensor Connector, Harness Side**: IMRCM; **Point B**: Ground • **Did the IMRCM PID voltage change from VREF to less than 1 volt when connecting the jumper?**	Yes →	KEY OFF. GO to **HU36**.
		No →	KEY OFF. GO to **HU39**.

HU32 resistance measurement:

(+)IMRCM Sensor Connector, Component Side	(-)IMRCM Sensor Connector, Component Side
IMRCM	VPWR

HU34 resistance measurement:

(+)IMRCM Sensor Connector, Harness Side	(-)IMRCM Sensor Connector, Harness Side
IMRCM	PWRGND

HU35 jumper points:

Point A IMRCM Sensor Connector, Harness Side	Point B
IMRCM	Ground

Intake Air Systems | HU

Test Steps		Results →	Action to Take
HU36	CHECK SIGRTN OR CHASSIS GROUND CIRCUIT CONTINUITY		
	• REMOVE jumper wire(s) • PCM connector connected. • Measure the Resistance between:	Yes → No →	GO to **HU37**. GO to **HU38**.

(+)IMRCM Sensor Connector, Harness Side	**(-)Vehicle battery**
IMRCM	Negative post

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
HU37	CHECK MONITOR CIRCUIT FOR INTERMITTENT OPEN		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	REPAIR open circuit and retest vehicle. GO to **HU41**.
		No →	INSTALL a new IMRCM sensor and retest vehicle. GO to **HU41**.

(+)IMRCM Sensor Connector, Harness Side	**(-)PCM Connector, Harness Side**
IMRCM	IMRCM

• Wiggle, shake and bend small sections of the wiring harness while working from the component to the module.
• **Is the resistance fluctuating while checking the harness?**

Test Steps		Results →	Action to Take
HU38	CHECK SIGRTN OR CHASSIS GROUND CIRCUIT CONTINUITY		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	CHECK for intermittent concern GO to **Z1**.
		No →	REPAIR open circuit and retest vehicle. GO to **HU41**.

(+)IMRCM Sensor Connector, Harness Side	**(-)PCM Connector, Harness Side**
PWRGND	PWRGND

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
HU39	CHECK IMRCM CIRCUIT FOR OPEN IN HARNESS		
	• REMOVE jumper wire(s) • PCM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **HU40**. REPAIR open circuit and retest vehicle. GO to **HU41**.

(+)IMRCM Sensor Connector, Harness Side	**(-)PCM Connector, Harness Side**
IMRCM	IMRCM

• **Is the Resistance below 5 Ohm?**

Intake Air Systems | HU

Test Steps		Results →	Action to Take
HU40	CHECK MONITOR CIRCUIT FOR INTERMITTENT OPEN		
	• Measure the Resistance between: **(+)IMRCM Sensor Connector, Harness Side** / **(-)PCM Connector, Harness Side**: IMRCM / IMRCM • Wiggle, shake and bend small sections of the wiring harness while working from the component to the module. • **Is the resistance fluctuating while checking the harness?**	Yes →	REPAIR open circuit and retest vehicle. GO to **HU41**.
		No →	INSTALL a new PCM and retest vehicle. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). GO to **HU41**.
HU41	VERIFY REPAIR		
	• Key ON Engine OFF. • CLEAR the PCM DTCs. • Access the PCM-IMRCM, PCM-IMRCF and PCM-IMRC PIDs using a scan tool. • Key ON Engine RUN. • Drive vehicle, obeying all traffic and safety laws. • Safely perform three acceleration runs from a stop or roll to between 3000 and 4000 rpm. • Watch for any PID change. • Perform Quick test or On Demand self test. • **Are any DTCs received?**	Yes →	KEY OFF. Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	Test completed successfully
HU42	DTCS P0660, P1549, P2070 OR P2071: VISUAL INSPECTION OF INTAKE MANIFOLD TUNING VALVE		
	• INSPECT the component for signs of damage. • CHECK harness and connection. • **Are any concerns present?**	Yes →	Repair as necessary. CLEAR the DTCs and REPEAT Self-Test.
		No →	GO to **HU43**.
HU43	CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS		
	• IMTV Actuator connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)IMTV Actuator Connector, Harness Side** / **(-)Vehicle battery**: VPWR / Negative post • **Is the Voltage above 10.5 V?**	Yes →	GO to **HU44**.
		No →	REPAIR open circuit and retest vehicle.

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<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HU44</td><td>CHECK IMTV CIRCUIT FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Key OFF.
IMTV Actuator connector disconnected.
PCM connector disconnected.
Measure the Resistance between:
<table><tr><th>(+)IMTV Actuator Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>IMTV</td><td>IMTV</td></tr></table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to HU45.
REPAIR open circuit and retest vehicle.</td></tr>
<tr><td>HU45</td><td>CHECK IMTV CIRCUIT FOR SHORT TO GROUND IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)</th></tr><tr><td>IMTV</td><td>Ground</td></tr></table>
Is the Resistance above 10 KOhm?
</td><td>Yes →
No →</td><td>GO to HU46.
REPAIR short circuit to GND and retest vehicle.</td></tr>
<tr><td>HU46</td><td>CHECK IMTV CIRCUIT FOR SHORT TO VPWR IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Voltage between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)</th></tr><tr><td>IMTV</td><td>Ground</td></tr></table>
Is the Voltage below 1 V?
</td><td>Yes →
No →</td><td>GO to HU47.
REPAIR short circuit to PWR and retest vehicle.</td></tr>
<tr><td>HU47</td><td>DTCS P2070 AND P2071: CHECK FOR IMTVM DTCS</td><td></td><td></td></tr>
<tr><td colspan="2">
Are any of the above listed DTCs present?
</td><td>Yes →
No →</td><td>GO to HU48.
GO to HU54.</td></tr>
<tr><td>HU48</td><td>CHECK IMTVM CIRCUIT FOR OPEN IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table><tr><th>(+)IMTV Actuator Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>IMTVM</td><td>IMTVM</td></tr></table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>GO to HU49.
REPAIR open circuit and retest vehicle.</td></tr>
</table>

Intake Air Systems | HU

Test Steps		Results →	Action to Take
HU49	CHECK PWRGND CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)IMTV Actuator Connector, Harness Side** / **(-)**: PWRGND / Ground • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HU50**. REPAIR open circuit and retest vehicle.
HU50	CHECK FOR SHORTS BETWEEN CIRCUITS IN IMTV HARNESS		
	• Measure the Resistance between: **(+)IMTV Actuator Connector, Harness Side** / **(-)IMTV Actuator Connector, Harness Side**: IMTVM / IMTV; IMTVM / PWRGND • **Are the resistances above 10 KOhm?**	Yes → No →	GO to **HU51**. REPAIR short circuit and retest vehicle.
HU51	CHECK IMTVM CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• Measure the Voltage between: **(+)IMTV Actuator Connector, Harness Side** / **(-)Vehicle battery**: IMTVM / Negative post • **Is the Voltage below 1 V?**	Yes → No →	GO to **HU52**. REPAIR short circuit to PWR and retest vehicle.
HU52	CHECK IMTVM CIRCUIT FOR SHORT TO POWER IN CONTROL MODULE		
	• PCM connector connected. • Measure the Voltage between: **(+)IMTV Actuator Connector, Harness Side** / **(-)Vehicle battery**: IMTVM / Negative post • **Is the Voltage below 10.5 V?**	Yes → No →	GO to **HU53**. INSTALL a new PCM and retest vehicle. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
HU53	CHECK FOR SHORTS IN PCM		
	• Measure the Resistance between: **(+)IMTV Actuator Connector, Harness Side** / **(-)IMTV Actuator Connector, Harness Side**: IMTVM / IMTV; IMTVM / PWRGND • **Are the resistances above 10 KOhm?**	Yes → No →	GO to **HU54**. INSTALL a new PCM and retest vehicle. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Intake Air Systems | HU

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HU54</td><td>CHECK IMTV FOR INTERMITTENT CONCERN</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM and retest vehicle.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

GO to HU55.</td></tr>
<tr><td colspan="2">
• IMTV Actuator connector disconnected.
• PCM connector connected.
• Key ON Engine OFF.
• Connect non-powered test lamp between:
<table>
<tr><th>(+)IMTV Actuator Connector, Harness Side</th><th>(-)IMTV Actuator Connector, Harness Side</th></tr>
<tr><td>VPWR</td><td>IMTV</td></tr>
</table>
• Is the test lamp ON?</td></tr>
<tr><td>HU55</td><td>CHECK IMTV FOR INTERMITTENT CONCERN</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HU56.
KEY OFF. INSTALL a new PCM and retest vehicle.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).</td></tr>
<tr><td colspan="2">
• Scan Tool Connected
• Enter Output Test Mode (refer to section 2)
• Connect non-powered test lamp between:
<table>
<tr><th>(+)IMTV Actuator Connector, Harness Side</th><th>(-)IMTV Actuator Connector, Harness Side</th></tr>
<tr><td>VPWR</td><td>IMTV</td></tr>
</table>
• Command outputs ON.
• Is the test lamp ON?</td></tr>
<tr><td>HU56</td><td>CHECK IMTV FOR DAMAGE</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new IMTV actuator and retest vehicle.
GO to HU57.</td></tr>
<tr><td colspan="2">
• Key OFF.
• REMOVE the IMTV. REFER to Workshop Manual, Section 303-14, Electronic Engine Controls.
• Visually inspect shutter for damage.
• Manually rotate shutter.
• Are any concerns present?</td></tr>
<tr><td>HU57</td><td>CHECK FOR INTERMITTENT CONCERN</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
Intermittent concern.
GO to Z1.
KEY OFF. INSTALL a new IMTV actuator and retest vehicle.</td></tr>
<tr><td colspan="2">
• IMTV Actuator connector connected.
• Key ON Engine OFF.
• Scan Tool Connected
• Enter Output Test Mode (refer to section 2)
• Command outputs ON
• Did IMTV shutter rotate?</td></tr>
<tr><td>HU58</td><td>DTCS P0663 OR P1532: VISUAL INSPECTION OF INTAKE MANIFOLD TUNING VALVE (BANK 2)</td><td rowspan="2">Yes →

No →</td><td rowspan="2">Repair as necessary.
CLEAR the DTCs and REPEAT Self-Test.
GO to HU59.</td></tr>
<tr><td colspan="2">
• INSPECT the component for signs of damage.
• CHECK harness and connection.
• Are any concerns present?</td></tr>
</table>

Intake Air Systems — HU

Test Steps		Results →	Action to Take
HU59	CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS		
	• IMTV2 Actuator connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	GO to **HU60**.
		No →	REPAIR open circuit and retest vehicle.

(+)IMTV2 Actuator Connector, Harness Side	(-)Vehicle battery
VPWR - Pin 1	Negative post

• **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
HU60	CHECK IMTV2 CIRCUIT FOR OPEN IN HARNESS		
	• Key OFF. • IMTV2 Actuator connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **HU61**.
		No →	REPAIR open circuit and retest vehicle.

(+)IMTV2 Actuator Connector, Harness Side	(-)PCM Connector, Harness Side
IMTV2 - Pin 2	IMTV2

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
HU61	CHECK IMTV2 CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **HU62**.
		No →	REPAIR short circuit to GND and retest vehicle.

(+)PCM Connector, Harness Side	(-)
IMTV2	Ground

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
HU62	CHECK IMTV2 CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• Measure the Voltage between:	Yes →	GO to **HU63**.
		No →	REPAIR short circuit to PWR and retest vehicle.

(+)PCM Connector, Harness Side	(-)
IMTV2	Ground

• **Is the Voltage below 1 V?**

Intake Air Systems

HU

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HU63</td><td>CHECK IMTV2 FOR INTERMITTENT CONCERN</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM and retest vehicle.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

GO to HU64.</td></tr>
<tr><td colspan="2">
• IMTV2 Actuator connector disconnected.
• PCM connector connected.
• Key ON Engine OFF.
• Connect non-powered test lamp between:
<table>
<tr><th>(+)IMTV2 Actuator Connector, Harness Side</th><th>(-)IMTV2 Actuator Connector, Harness Side</th></tr>
<tr><td>VPWR - Pin 1</td><td>IMTV2 - Pin 2</td></tr>
</table>
• Is the test lamp ON?</td></tr>
<tr><td>HU64</td><td>CHECK IMTV2 FOR INTERMITTENT CONCERN</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to HU65.
KEY OFF. INSTALL a new PCM and retest vehicle.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).</td></tr>
<tr><td colspan="2">
• Scan Tool Connected
• Enter Output Test Mode (refer to section 2)
• Connect non-powered test lamp between:
<table>
<tr><th>(+)IMTV2 Actuator Connector, Harness Side</th><th>(-)IMTV2 Actuator Connector, Harness Side</th></tr>
<tr><td>VPWR - Pin 1</td><td>IMTV2 - Pin 2</td></tr>
</table>
• Command outputs ON.
• Is the test lamp ON?</td></tr>
<tr><td>HU65</td><td>CHECK IMTV2 FOR DAMAGE</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new IMTV2 actuator and retest vehicle.
GO to HU66.</td></tr>
<tr><td colspan="2">
• Key OFF.
• REMOVE the IMTV2. REFER to Workshop Manual, Section 303-14, Electronic Engine Controls.
• Visually inspect shutter for damage.
• Manually rotate shutter.
• Are any concerns present?</td></tr>
<tr><td>HU66</td><td>CHECK FOR INTERMITTENT CONCERN</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
Intermittent concern.
GO to Z1.
KEY OFF. INSTALL a new IMTV2 actuator and retest vehicle.</td></tr>
<tr><td colspan="2">
• IMTV2 Actuator connector connected.
• Key ON Engine OFF.
• Scan Tool Connected
• Enter Output Test Mode (refer to section 2)
• Command outputs ON
• Did IMTV2 shutter rotate?</td></tr>
</table>

Evaporative Emission (EVAP) Monitor and System

HX

Note

Enter this Pinpoint Test only when directed here.

The use of a soap solution, such as SNOOP, around the fuel filler cap or the use of the hydrocarbon emission analyzer to determine an evaporative emission system leak is not recommended. The mandatory Rotunda Evaporative Emission System Leak Tester for OBD II (including the ultra-sonic tester) and the Rotunda Vacutec 522 Leak Detector Smoke Machine are the only devices to be used at this time for evaporative emission system leak detection.

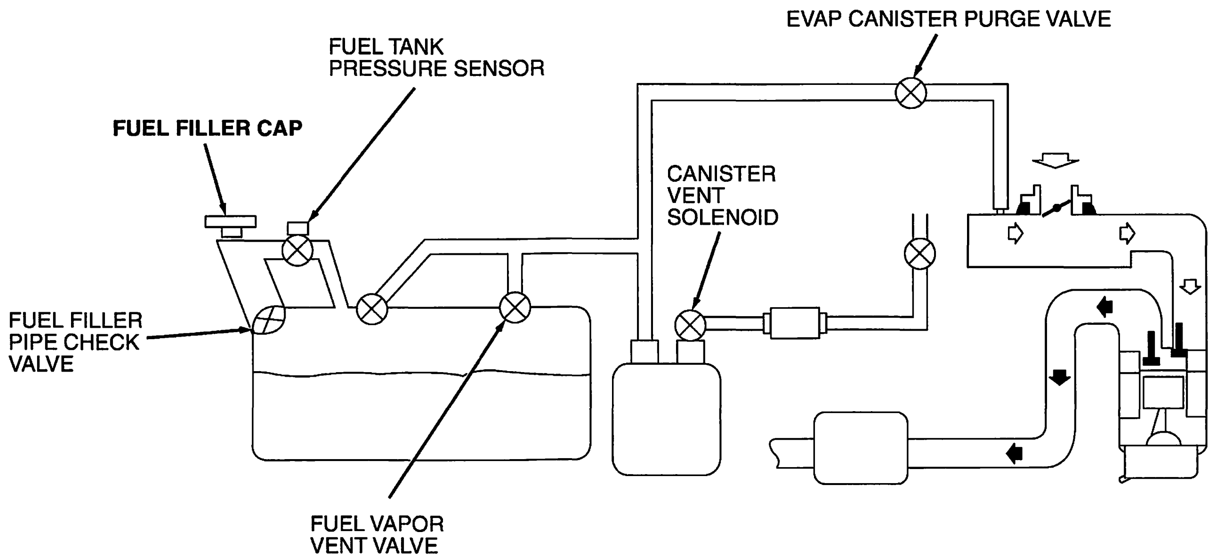
This Pinpoint Test is intended to diagnose the following:

- Canister vent (CV) solenoid (9F945).
- Fuel filler cap (9030).
- Fuel tank pressure (FTP) sensor (9C052).
- EVAP canister purge (EVAPCP) valve (9C915). Also known as Vapor Management Valve VMV .
- EVAP system leaks using the Rotunda Vacutec Leak Detector Smoke Machine.
- Powertrain control module (PCM) (12A650).
- Harness circuits: CV, EVAPCP, FCIL, FLI, FTP, SIGRTN, VPWR, VREF and CASE GND.

Typical EVAP System

The image shown here is a generic EVAP system illustration. Refer to the vehicle Workshop Manual for further system details.

Evaporative Emission (EVAP) Monitor and System	HX



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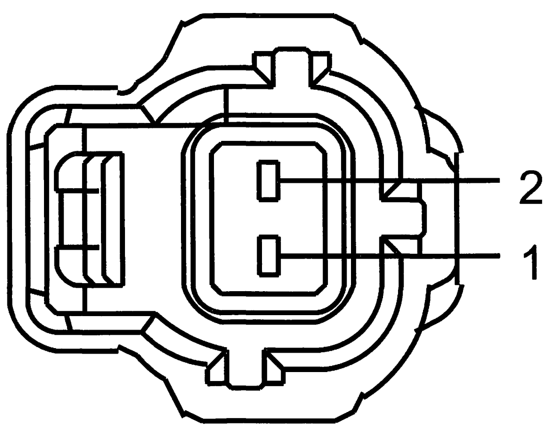
Canister Vent Solenoid (CANV) Connector



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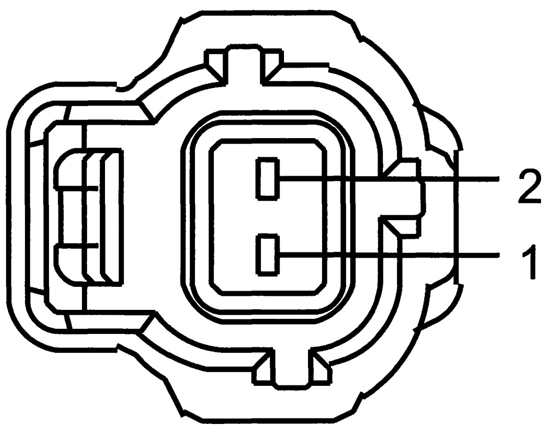
Evaporative Emission (EVAP) Monitor and System

HX

Circuit	Pin
CANV (Canister Vent Solenoid)	2
VPWR (Power supply)	1

EVAP Canister Purge Valve (EVAPCP) Connector



A0077550

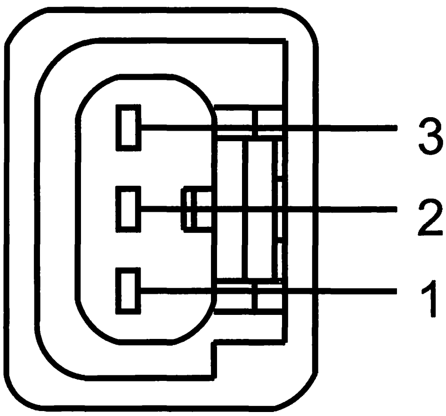
Circuit	Pin
VPWR (Power supply)	1
EVAPCP (EVAP Canister Purge Valve)	2

Evaporative Emission (EVAP) Monitor and System

HX

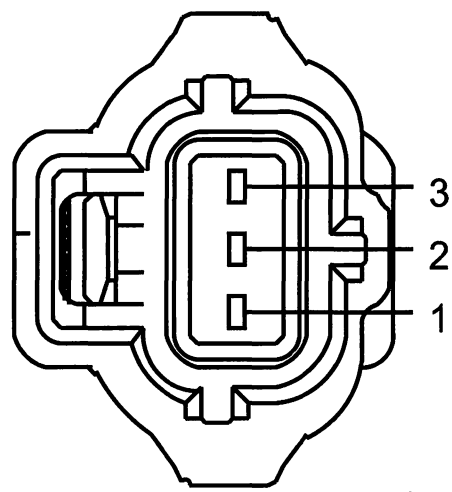
Fuel Tank Pressure (kPa) (FTP) Sensor Connector

A



A0077573

B



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Vehicle	Connector	Circuit	Pin
E-Series, Expedition, F-150, Focus 2.3L, Freestar / Monterey, LS 3.0L, LS 3.9L, Navigator, Sable, Taurus, Thunderbird	A	FTP SIGRTN VREF	3 2 1
All other vehicles	B	FTP SIGRTN VREF	3 2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Evaporative Emission (EVAP) Monitor and System

HX

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	CANV	B6
		FTP	B52
		SIGRTN	B17
		VREF	B20
		EVAPCP	B12
Crown Victoria, Grand Marquis, Marauder	104 Pin	FCIL	20
		CASE GND	25
		FLI	9
		CANV	67
		FTP	62
		SIGRTN	91
		VREF	90
		EVAPCP	56
E-Series	104 Pin	FCIL	70
		CASE GND	25
		FLI	9
		CANV	67
		FTP	62
		SIGRTN	91
		VREF	90
		EVAPCP	56
Expedition, Navigator	122 Pin	CASE GND	B10
		CANV	B36
		FTP	B8
		SIGRTN	B33
		VREF	B45
		EVAPCP	B38
Explorer SportTrac, Ranger	104 Pin	FCIL	82
		CASE GND	25
		FLI	12
		CANV	67
		FTP	62
		SIGRTN	91
		VREF	90
		EVAPCP	56
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	CASE GND	B10
		CANV	B13
		FTP	B9
		SIGRTN	B41
		VREF	B40
		EVAPCP	B34
F-150	190 Pin	CASE GND	B66
		CANV	B61
		FTP	B44
		SIGRTN	B58
		VREF	B29
		EVAPCP	E65

(Continued)

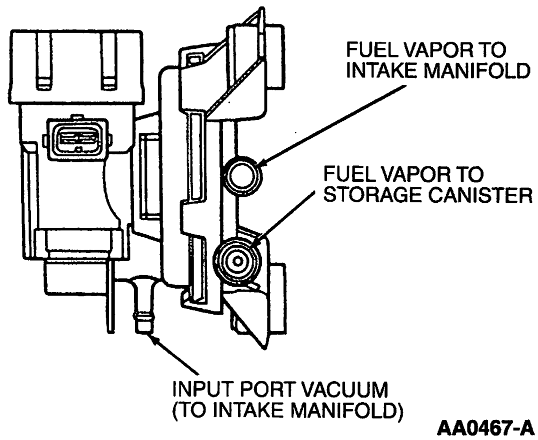
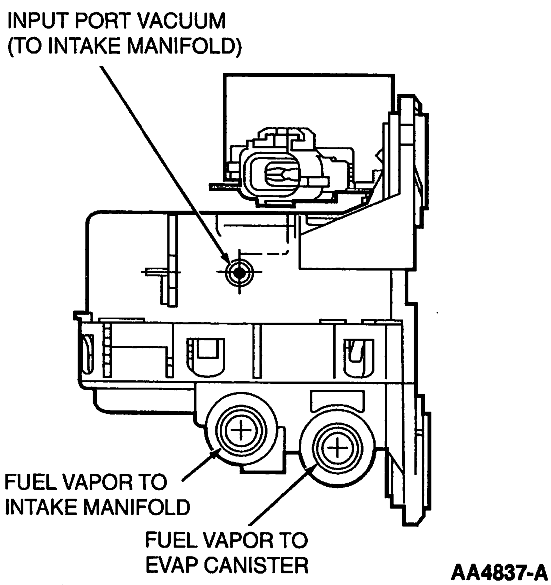
Evaporative Emission (EVAP) Monitor and System

HX

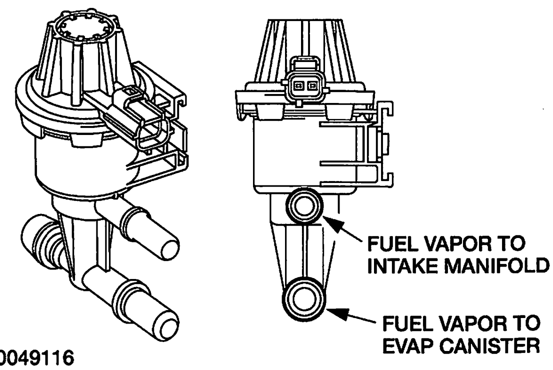
Vehicle	Connector	Circuit	Pin
F-150 Heritage 4.2L, F-150 Heritage 4.6L	104 Pin	FCIL CASE GND CANV FTP SIGRTN VREF EVAPCP	70 25 67 62 91 90 56
Focus 2.0L	104 Pin	FCIL CASE GND CANV FTP SIGRTN VREF EVAPCP	46 25 67 62 91 90 56
LS, Thunderbird	150 (60-32-58) Pin	CASE GND CANV FTP SIGRTN VREF EVAPCP	B43 B30 B52 B5 B55 B12
All other vehicles	104 Pin	CASE GND CANV FTP SIGRTN VREF EVAPCP	25 67 62 91 90 56

Test Steps		Results →	Action to Take
HX1	DTC P0443: CHECK PCM OUTPUT TO EVAP CANISTER PURGE VALVE		
	• Key OFF. • EVAPCP connector disconnected. • Connect a non-powered test lamp between EVAPCP and VPWR circuits at the EVAP canister purge valve harness connector. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Command outputs OFF • Exit Output Test Mode • **Does the test lamp turn on and off when the output(s) are commanded on and off?**	Yes → No →	KEY OFF. GO to **HX2**. GO to **HX5**.

Evaporative Emission (EVAP) Monitor and System	HX

Test Steps		Results →	Action to Take
HX2	TYPE OF EVAP CANISTER PURGE VALVE		
	• Typical EVAP Canister Purge Valve (with vacuum diaphragm).   • Typical Electronic EVAP Canister Purge Valve.	Yes → No →	KEY OFF. GO to **HX3**. KEY OFF. GO to **HX4**.

Evaporative Emission (EVAP) Monitor and System — HX

<table>
<tr><th>Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>


A0049116
• **Are you testing an electronic EVAP canister purge valve?**
</td><td></td><td></td></tr>
<tr><td>
HX3 CHECK EVAP CANISTER PURGE VALVE SOLENOID RESISTANCE
Note: EVAP canister purge valve resistance reading must be taken with engine cooled down.
• EVAPCP connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)EVAPCP Connector, Component Side</th><th>(-)EVAPCP Connector, Component Side</th></tr>
<tr><td>EVAPCP - Pin 2</td><td>VPWR - Pin 1</td></tr>
</table>
• Is the Resistance between 2.5 Ohm - 6 Ohm?
</td><td>Yes →

No →</td><td>Unable to identify fault at this time.
GO to Z1.
INSTALL a new EVAPCP.</td></tr>
<tr><td>
HX4 CHECK EVAP CANISTER PURGE VALVE SOLENOID RESISTANCE
Note: EVAP canister purge valve resistance reading must be taken with engine cooled down.
• EVAPCP connector disconnected.
• Measure the Resistance between:
<table>
<tr><th>(+)EVAPCP Connector, Component Side</th><th>(-)EVAPCP Connector, Component Side</th></tr>
<tr><td>EVAPCP - Pin 2</td><td>VPWR - Pin 1</td></tr>
</table>
• Is the Resistance between 30 Ohm - 38 Ohm?
</td><td>Yes →

No →</td><td>Unable to identify fault at this time.
GO to Z1.
INSTALL a new EVAPCP.</td></tr>
</table>

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX5	CHECK VPWR VOLTAGE TO EVAP CANISTER PURGE VALVE		
	• Measure the Voltage between:	Yes →	KEY OFF. GO to **HX6**.
		No →	REPAIR open circuit.
	(+)EVAPCP Connector, Harness Side / **(-)Vehicle battery**: VPWR - Pin 1 / Negative post		
	• **Is the Voltage above 10.5 V?**		
HX6	CHECK EVAP CANISTER PURGE VALVE CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **HX7**.
		No →	REPAIR open circuit.
	(+)PCM Connector, Harness Side / **(-)EVAPCP Connector, Harness Side**: EVAPCP / EVAPCP - Pin 2		
	• **Is the Resistance below 5 Ohm?**		
HX7	CHECK EVAP CANISTER PURGE VALVE CIRCUIT FOR SHORT TO PWRGND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between:	Yes →	GO to **HX8**.
		No →	REPAIR short circuit to GND.
	(+)PCM Connector, Harness Side / **(-)**: EVAPCP / Ground		
	• **Is the Resistance above 10 KOhm?**		
HX8	CHECK EVAP CANISTER PURGE VALVE CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between:	Yes →	INSTALL a new PCM.
		No →	REPAIR short circuit to PWR.
	(+)EVAPCP Connector, Harness Side / **(-)**: EVAPCP - Pin 2 / Ground		
	• **Is the Voltage below 1 V?**		

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX9	DTC P1450: CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM		
	Note: If the EVAP canister-CV solenoid and fuel tank assemblies are not accessible during this pinpoint step, GO to Evaporative Emissions, Section 303 in the Workshop Manual for removal instructions. • CHECK for kinks or bends in the fuel vapor hoses/tubes (EVAP canister purge outlet tube and EVAP canister tube). • Visually inspect EVAP canister inlet port, CV solenoid filter and canister vent hose assembly for contamination or debris. • CHECK CV solenoid filter for blockage or contamination. • **Is a fault indicated?**	Yes →	REMOVE any contamination or debris around fuel vapor hose/tubes and EVAP canister- CV solenoid assembly. REMOVE kinks or bends in EVAP canister purge outlet tube, EVAP canister tube and canister vent hose assembly. Complete PCM Reset. For Repair Verification: PERFORM WDS EVAP test. OR COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
		No →	GO to **HX10**.
HX10	CHECK FUEL TANK PRESSURE SENSOR VOLTAGE WITH FUEL FILLER CAP REMOVED		
	• REMOVE the fuel filler cap. • Key ON Engine OFF. • Access the PCM-FTP V PID using a scan tool. • **Is the Voltage between 2.4 V - 2.8 V?**	Yes →	GO to **HX14**.
		No →	KEY OFF. GO to **HX11**.
HX11	CHECK FOR ANY OTHER DTCS		
	• CHECK for other three wire sensor DTCs (KOEO, KOER or Continuous Memory) present with the DTC P1450. • **Are any other DTCs present?**	Yes →	Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	KEY OFF. GO to **HX12**.

Evaporative Emission (EVAP) Monitor and System — HX

Test Steps		Results →	Action to Take
HX12	CHECK VREF VOLTAGE TO FUEL TANK PRESSURE SENSOR		
	• FTP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+) FTP Sensor Connector, Harness Side: VREF — (-) FTP Sensor Connector, Harness Side: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes →	KEY OFF. INSTALL a new FTP sensor. Complete PCM Reset. For Repair Verification: PERFORM WDS EVAP test. OR COMPLETE an Evaporative Emission Leak Check Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
		No →	KEY OFF. GO to **HX13**.
HX13	CHECK VREF AND SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: (+) PCM Connector, Harness Side: VREF — (-) FTP Sensor Connector, Harness Side: VREF (+) PCM Connector, Harness Side: SIGRTN — (-) FTP Sensor Connector, Harness Side: SIGRTN • **Are the resistances below 5 Ohm?**	Yes →	INSTALL a new PCM.
		No →	REPAIR open circuit.
HX14	CHECK IF ENGINE WILL IDLE		
	• Key ON Engine RUN. • **Does the engine stall or cannot maintain idle?**	Yes →	KEY OFF. GO to **HX15**.
		No →	GO to **HX16**.
HX15	CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE		
	• Disconnect the larger of two manifold lines at the EVAPCP and cap it at the EVAPCP. • Key ON Engine RUN. • **Does the engine stall or cannot maintain idle?**	Yes →	KEY OFF. The EVAP system is not the cause of the symptom. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No →	KEY OFF. INSTALL a new EVAP Canister Purge Valve.

HX12 measurement:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	SIGRTN

HX13 measurement:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF	VREF
SIGRTN	SIGRTN

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX16	CHECK FOR BLOCKAGE IN THE FUEL TANK VENT SYSTEM		
	• Key ON Engine RUN. • Access the PCM-EVAPPDC, PCM-EVMV, PCM-FTP V and PCM-EVAPCV PIDs using a scan tool. • While monitoring the FTP PID, open the EVAPCP by commanding the EVAPPDC PID to a 100% duty cycle (or EVMV PID to a 1000mA). Ramp the EVAP canister purge valve open in increments. Note: The EVAPCV is normally open and venting to atmosphere. • **Does the FTP sensor voltage drop below 2.0 volts when the EVAP canister purge valve is commanded fully open?**	Yes →	CHECK for blockage in the vapor line to the EVAPCV solenoid. CHECK CV solenoid filter for blockage or contamination. CHECK carbon canister for blockage. If OK, REPLACE EVAPCV.
		No →	GO to **HX17**.
HX17	CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE		
	• Key ON Engine RUN. • Close the EVAPCP by commanding the EVAPPDC pid to 0 % duty cycle or EVMV pid to 0 mA. • Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle). • **Does the FTPV PID decrease, engine RPM change, or engine stalls, as an indication that the EVAPCP is stuck open?**	Yes →	KEY OFF. INSTALL a new EVAP Canister Purge Valve.
		No →	GO to **HX18**.
HX18	EVAP CANISTER PURGE VALVE TEST		
	• Key ON Engine RUN. • Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle). • While monitoring the FTP PID, open the EVAPCP by commanding the EVAPPDC PID to a 100% duty cycle (or EVMV PID to a 1000mA). • **Does the FTPV PID decrease, engine RPM change, or engine stalls, as an indication that the EVAPCP is opening?**	Yes →	KEY OFF. For DTC P1450: No Fault Found. Problem may be intermittent. All others, check EVAP system for leaks: GO to **HX50**.
		No →	KEY OFF. Check for blockages between the fuel tank, EVAP canister purge valve and engine intake manifold. Check obstructions in the EVAP canister purge valve diaphragm and ports. If ok, replace EVAP canister purge valve.

Evaporative Emission (EVAP) Monitor and System

HX

	Test Steps	Results →	Action to Take
HX19	DTC P0452: CHECK FOR FUEL TANK PRESSURE SENSOR CONNECTOR CONTAMINATION		
	• Key OFF. • Visually check for liquid fuel contamination of the FTP sensor electrical connector. • CHECK for completely submerged FTP sensor (tank mounted type only) in liquid fuel (can affect correct FTP voltage reading). • **Does the FTP sensor and its connector show any signs of fuel contamination?**	Yes → No →	Repair connector as necessary. ADJUST fuel tank overfill. GO to **HX20**.
HX20	CHECK FOR LOW FTP SENSOR VOLTAGE		
	Note: FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts. • Key ON Engine OFF. • Access the PCM-FTP V PID using a scan tool. • **Is the Voltage below 0.22 V?**	Yes → No →	KEY OFF. GO to **HX21**. The fault that produced the DTC P0452 is intermittent. GO to **Z1**.
HX21	CHECK OPPOSITE INDUCED HIGH FTP SENSOR SIGNAL		
	• FTP Sensor connector disconnected. • Add jumper wire between the points described below: **Point A FTP Sensor Connector, Harness Side**: VREF — **Point B FTP Sensor Connector, Harness Side**: FTP • Key ON Engine OFF. **CAUTION: If a scan tool communication concern exists immediately remove jumper and follow the "NO" path in RESULT/ACTION column.** • Access the PCM-FTP V PID using a scan tool. • **Is the Voltage between 4 V - 6 V?**	Yes → No →	INSTALL a new FTP sensor. REMOVE jumper. GO to **HX22**.
HX22	CHECK VREF VOLTAGE TO FTP SENSOR		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)FTP Sensor Connector, Harness Side**: VREF — **(-)FTP Sensor Connector, Harness Side**: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	KEY OFF. GO to **HX23**. GO to **C1**.

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX23	CHECK FTP CIRCUIT(S) FOR SHORT TO SIGRTN OR GND IN HARNESS		
	• PCM connector disconnected. • Scan tool connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side**: FTP / SIGRTN • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)Vehicle battery**: FTP / Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. REPAIR short circuit.
HX24	DTC P0453: CHECK FOR HIGH FTP SENSOR VOLTAGE		
	Note: FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts. • Key ON Engine OFF. • Access the PCM-FTP V PID using a scan tool. • **Is the Voltage above 4.5 V?**	Yes → No →	KEY OFF. GO to **HX25**. The fault that produced the DTC P0453 is intermittent. GO to **Z1**.
HX25	CHECK FTP CIRCUIT FOR SHORT TO POWER		
	• FTP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)FTP Sensor Connector, Harness Side** / **(-)Vehicle battery**: FTP / Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **HX26**. KEY OFF. GO to **HX27**.
HX26	CHECK FTP CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)PCM Connector, Harness Side** / **(-)Vehicle battery**: FTP / Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	REPAIR short circuit to PWR. INSTALL a new PCM.

Evaporative Emission (EVAP) Monitor and System

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Test Steps	Results →	Action to Take
HX27 INSTALL JUMPER BETWEEN FTP AND SIGRTN CIRCUITS		
• Scan tool connector connected. • Add jumper wire between the points described below:	Yes →	REMOVE jumper. GO to **HX33**.
	No →	GO to **HX28**.

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
FTP	SIGRTN

• Key ON Engine OFF.

CAUTION: If a scan tool communication concern exists REMOVE jumper.

• **Does a scan tool communication concern exist?**

Test Steps	Results →	Action to Take
HX28 CHECK OPPOSITE INDUCED LOW FTP SIGNAL		
• Access the PCM-FTP V PID using a scan tool. • **Is the Voltage below 0.1 V?**	Yes →	REMOVE jumper. GO to **HX29**.
	No →	KEY OFF. REMOVE jumper. GO to **HX31**.
HX29 CHECK VOLTAGE BETWEEN VREF AND SIGRTN CIRCUITS AT THE FTP SENSOR VEHICLE HARNESS CONNECTOR		
• Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **HX30**.
	No →	GO to **C1**.

(+)FTP Sensor Connector, Harness Side	(-)FTP Sensor Connector, Harness Side
VREF	SIGRTN

• **Is the Voltage between 4 V - 6 V?**

Test Steps	Results →	Action to Take
HX30 CHECK FTP CIRCUIT FOR SHORT TO VREF		
• PCM connector disconnected. • Measure the Resistance between:	Yes →	INSTALL a new FTP sensor.
	No →	REPAIR short circuit to VREF.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
VREF	FTP

• **Is the Resistance above 10 KOhm?**

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX31	CHECK FTP CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)FTP Sensor Connector, Harness Side**: FTP / FTP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HX32**. REPAIR open circuit.
HX32	CHECK SIGRTN CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)FTP Sensor Connector, Harness Side**: SIGRTN / SIGRTN • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **HX33**. REPAIR open circuit.
HX33	CHECK FTP CIRCUIT FOR SHORT TO VREF IN PCM		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side**: FTP / VREF • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. REPAIR short circuit to VREF.
HX34	DTCS P1451 OR P0446: CHECK PCM OUTPUT TO EVAP CANISTER VENT SOLENOID		
	• Key OFF. • CANV connector disconnected. • Connect a non-powered test lamp between CANV and VPWR circuits at the CANV solenoid harness connector. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Command outputs OFF • Exit Output Test Mode • **Does the test lamp turn on and off when the output(s) are commanded on and off?**	Yes → No →	KEY OFF. GO to **HX35**. GO to **HX36**.

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX35	CHECK CANV SOLENOID RESISTANCE		
	• Measure the Resistance between:	Yes →	Unable to identify fault at this time. GO to **Z1**.
		No →	INSTALL a new EVAPCV.

(+)CANV Connector, Component Side	(-)CANV Connector, Component Side
VPWR - Pin 1	CANV - Pin 2

- **Is the Resistance between 48 Ohm - 65 Ohm?**

Test Steps		Results →	Action to Take
HX36	CHECK VPWR VOLTAGE TO CANV SOLENOID		
	• Measure the Voltage between:	Yes →	KEY OFF. GO to **HX37**.
		No →	REPAIR open circuit.

(+)CANV Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
HX37	CHECK CANV CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **HX38**.
		No →	REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)CANV Connector, Harness Side
CANV	CANV - Pin 2

- **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
HX38	CHECK CANV CIRCUIT FOR SHORT TO PWRGND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between:	Yes →	GO to **HX39**.
		No →	REPAIR short circuit to GND.

(+)CANV Connector, Harness Side	(-)Vehicle battery
CANV - Pin 2	Negative post

- **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
HX39	CHECK CANV CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between:	Yes →	INSTALL a new PCM.
		No →	REPAIR short circuit to PWR.

(+)CANV Connector, Harness Side	(-)
CANV - Pin 2	Ground

- **Is the Voltage below 1 V?**

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX40	DTCS P0460, P0461, P0462 OR P0463: CHECK FLI CIRCUIT VOLTAGE		
	• Key ON Engine RUN. • Access the PCM-FLI V PID using a scan tool. • **Is the Voltage between 0.25 V - 4.5 V?**	Yes → No →	GO to **HX41**. GO to **HX42**.
HX41	CHECK FOR FUEL TANK FLOAT LEVEL RESPONSE		
	• Key ON Engine OFF. • Access the PCM-FLI V PID using a scan tool. • If fuel level is under one quarter (25 percent on FLI), add approximately one quarter tank of fuel. • If fuel level is greater than three quarters (75 percent on FLI), drain approximately one quarter tank of fuel. • **Did the FLI PID indicate a movement upward or downward as fuel is either added or drained?**	Yes → No →	No Fault Found. Problem may be intermittent. GO to **Z1**. KEY OFF. REFER to Instrument Cluster Section 413 in the Workshop Manual for inoperative fuel level sender.
HX42	CHECK FLI CIRCUIT AT FP MODULE		
	• IC connector disconnected. (REFER to Instrument Cluster Section 413 in the Workshop Manual or Wiring Diagram Manual for cluster connector configuration). • Gain access to the fuel pump connector or intermediate fuel pump connector. • FP connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: [(+)FP Connector, Harness Side: FLI — (-)Vehicle battery: Negative post] • **Is the Voltage above 5 V?**	Yes → No →	KEY OFF. GO to **HX43**. KEY OFF. GO to **HX44**.
HX43	CHECK FLI CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: [(+)FP Connector, Harness Side: FLI — (-)Vehicle battery: Negative post] • **Is the Voltage above 10.5 V?**	Yes → No →	REPAIR short circuit to PWR. INSTALL a new PCM.

HX42 measurement table:

(+)FP Connector, Harness Side	(-)Vehicle battery
FLI	Negative post

HX43 measurement table:

(+)FP Connector, Harness Side	(-)Vehicle battery
FLI	Negative post

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX44	CHECK FLI CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **HX45**.
		No →	REPAIR short circuit to GND.

(+)PCM Connector, Harness Side	(-)Vehicle battery
FLI	Negative post

• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
FLI	CASE GND

• **Is the Resistance above 10 KOhm?**

Test Steps		Results →	Action to Take
HX45	CHECK FLI CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **HX46**.
		No →	REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)IC Connector, Harness Side
FLI	FLI

• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)FP Connector, Harness Side
FLI	FLI

• **Is the Resistance below 10 Ohm?**

Test Steps		Results →	Action to Take
HX46	CHECK CASE GROUND CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between:	Yes →	Refer to the workshop manual for instrument cluster diagnostics. If OK REPLACE PCM.
		No →	REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)FP Connector, Harness Side
CASE GND	CASE GND

• Measure the Resistance between:

(+)PCM Connector, Harness Side	(-)IC Connector, Harness Side
CASE GND	GND

• **Is the Resistance below 10 Ohm?**

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX47	FUEL CAP INDICATOR LAMP ALWAYS ON WITHOUT DTCS		
	• PCM connector disconnected. • Key ON Engine OFF. • **Is the fuel cap indicator lamp OFF with the PCM disconnected?**	Yes →	KEY OFF. INSTALL a new PCM.
		No →	The PCM has not caused the fuel cap indicator lamp to turn ON. Refer to the workshop manual for instrument cluster diagnostics.
HX48	FUEL CAP INDICATOR LAMP ALWAYS OFF WITHOUT DTCS		
	• Key OFF. • IC connector disconnected. (REFER to Instrument Cluster Section 413 in the Workshop Manual or Wiring Diagram Manual for cluster connector configuration). • PCM connector disconnected. • Measure the Resistance between:	Yes →	Refer to the workshop manual for instrument cluster diagnostics. If the FCIL bulb is ok, install a new PCM.
		No →	REPAIR open circuit. VERIFY repair by turning the key to the ON position. (lamp will turn OFF in 3 seconds).

(+)PCM Connector, Harness Side	(-)IC Connector, Harness Side
FCIL	FCIL

	• **Is the Resistance below 5 Ohm?**		
HX49	DTC P0451: CLEAR AND ATTEMPT TO RE-GENERATE DTC		
	• Key ON Engine OFF. • CLEAR Continuous Memory DTCs. • Key ON Engine RUN. • Run engine for approximately 10 seconds. • Retrieve Continuous Memory DTCs. • **Is DTC P0451 present in Continuous Memory?**	Yes →	KEY OFF. CHECK PCM and FTP sensor connector for any signs of damage, rust, or pushed out pins. Make sure both connectors are securely connected. If ok, replace FTP sensor. CLEAR Continuous Memory DTCs. Retest If DTC P0451 is still present, Install a new PCM.
		No →	The fault that produced the DTC P0451 is intermittent. GO to **Z1**.

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX50	DTCS P0455 OR P0457: CHECK FUEL FILLER CAP		
	Note: Many EVAP leaks are caused by a loose or faulty cap. If the fuel cap is suspect during visual inspection, do not disturb the fuel cap until the repair verification method is complete. If the repair verification method fails, the cap can be repositioned or replaced and the test repeated. This action will isolate the cap from the rest of the EVAP system as a potential concern. • Visually inspect fuel filler cap without initially disturbing it. • CHECK for missing or loose fuel filler cap. • CHECK Fuel filler cap for damage. • **Is a concern present with the proper installation of the Fuel filler cap?**	Yes → No →	For Repair Verification: PERFORM WDS EVAP test. OR Perform Smoke Machine PHASE 1 - Leak Verification Pressure Test REPLACE or RECONNECT fuel filler cap. GO to **HX55**. GO to **HX51**.
HX51	CHECK OPERATION OF THE FUEL GAUGE		
	• Check operation of the fuel gauge. NOTE: A fuel gauge that always indicates fuel level below a half tank or always a full tank, may be caused by a FLI fault. • **Is the fuel gauge functioning properly?**	Yes → No →	KEY OFF. GO to **HX52**. KEY OFF. CHECK functionality of FLI circuit. Return to Section 3 to continue diagnosis.
HX52	DTC P1443: EVAPORATIVE EMISSION SYSTEM VISUAL INSPECTION		
	• Visually inspect for: — EVAP system lines/hoses (check for proper connections, damage or blockage). — Loose fuel vapor hose/tube connections to EVAP system components. — Vacuum line from input vacuum port to intake manifold on the EVAP canister purge valve (control vacuum solenoid part of valve) is removed. — Blocked vacuum hose between EVAP canister purge valve-solenoid and engine intake manifold. — Damaged fuel tank or fuel filler pipe. • **Were there any concerns found during the visual inspection?**	Yes → No →	REPAIR as necessary. For Repair Verification: PERFORM WDS EVAP test. OR Perform Smoke Machine PHASE 1 - Leak Verification Pressure Test GO to **HX55**. GO to **HX53**.

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX53	CHECK FUEL TANK PRESSURE SENSOR VOLTAGE WITH FUEL FILLER CAP REMOVED		
	• REMOVE the fuel filler cap. • Key ON Engine OFF. • Access the PCM-FTP V PID using a scan tool. • **Is the Voltage between 2.4 V - 2.8 V?**	Yes →	Reconnect Fuel filler cap. GO to **HX54**.
		No →	KEY OFF. INSTALL a new FTP sensor. Repeat test, if necessary, to verify results. For Repair Verification: Perform Smoke Machine PHASE 1 - Leak Verification Pressure Test GO to **HX55**.
HX54	EVAP CANISTER PURGE VALVE TEST		
	• Key ON Engine RUN. • Access the PCM-EVAPCV, PCM-EVAPPDC, PCM-EVMV and PCM-FTP V PIDs using a scan tool. • Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle). • While monitoring the FTP PID, open the EVAPCP by commanding the EVAPPDC PID to a 100% duty cycle (or EVMV PID to a 1000mA). • **Does the FTPV PID decrease, engine RPM change, or engine stalls, as an indication that the EVAPCP is opening?**	Yes →	KEY OFF. GO to **HX55**.
		No →	KEY OFF. INSTALL a new EVAPCP. Repeat test, if necessary, to verify results. For Repair Verification: Perform Smoke Machine PHASE 1 - Leak Verification Pressure Test GO to **HX55**.

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX55	DTCS P0442 OR P0456: HOOK UP SMOKE MACHINE (ROTUNDA VACUTEC)		
	• Disconnect the larger of two manifold lines at the EVAPCP and cap it at the EVAPCP. • Connect the Smoke Machine power cables to vehicle battery. CHECK to see that the Smoke Machine power indicator lamp is on, indicating good battery contact. • Locate the EVAP service test port and remove the green cap. It is located on or close to the EVAPCP. • For vehicles equipped with the vacuum diaphragm type EVAPCP, remove the schrader valve from the EVAP service test port by turning it in a clockwise rotation. Do not remove the schrader valve from vehicles equipped with electronic type EVAPCP. REFER to the illustration in step HX2 for EVAPCP type identification. **CAUTION: Removing the schrader valve from the test port on vehicles equipped with Electronic EVAPCP will permanently damage the valve.** • Install the EVAP Service Port Adapter (provided with Vacutec Smoke Machine) to the test port. • Scan Tool Connected. • **Is Smoke Machine hook up complete?**	Yes → No →	**For Repair Verification:** GO to **HX57**. **For All Others:** GO to **HX56**. KEY OFF. REFER to the Smoke Machine operator manual for additional instructions and for helpful tips.

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX56	PERFORM SMOKE MACHINE PHASE 2 - LEAK DETECTION SMOKE TEST		
	• Position the control lever located on the Smoke Machine to "SMOKE". • REMOVE the fuel filler cap. • Connect the smoke supply hose (black hose) nozzle tip into the EVAP Service Port Adapter. • Key ON Engine OFF. • Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle). Note: The EVAPCV will reopen after 9 minutes of continuous operation. • Depress the remote starter button on the Smoke Machine. Smoke will be introduced into the EVAP system. — Secure the fuel cap once smoke is observed exiting the fuel tank's neck area. Note: If smoke does not exit the fuel filler neck after system is pressurized, command the EVAPCV open to allow air to purge out the canister vent solenoid. Once smoke is seen at the canister vent solenoid, close the EVAPCV. — Continue to introduce smoke into the system for 60 seconds to obtain pressure. — Press and release the remote starter button in intervals of approximately 15 seconds on and 15 seconds off while checking for exiting smoke. — Use the halogen spotlight provided with the Smoke Machine to follow the EVAP system's path and look for the smoke exiting at the source of the leak(s). Note: If the leak is not detected from the top, check the EVAP system for leaks from under the vehicle. CHECK EVAP hoses, EVAPCP, EVAPCV, carbon canister, fuel tank, components around fuel tank area and at fuel filler cap. Wiggle components and connections to simulate road bumps while looking for signs of leaking smoke. If leak is in fuel filler neck between check valve and cap, smoke under pressure may not reach the leak. If leaking smoke is not found, a thorough visual inspection of the fuel filler neck and fuel cap should be performed. • **Was the source of EVAP leak(s) located?**	Yes → No →	KEY OFF. REPAIR as necessary. Reconnect all disconnected components. For Repair Verification: Perform Smoke Machine PHASE 1 - Leak Verification Pressure Test GO to **HX57**. KEY OFF. Test passed. Reconnect all disconnected components. Perform Smoke Machine PHASE 1 - Leak Verification Pressure Test GO to **HX57**.

Evaporative Emission (EVAP) Monitor and System

HX

Test Steps		Results →	Action to Take
HX57	PERFORM SMOKE MACHINE PHASE 1 - LEAK VERIFICATION PRESSURE TEST		
	• Position the control lever located on the Smoke Machine to "METER". • Calibrate the Smoke Machine flow meter using the the .020 standard as follows: — Insert air supply hose (transparent hose) nozzle tip into the .020 EVAP System Standard located on the front of the Smoke Machine. — Depress the remote starter button on the Smoke Machine. Observe the position of the flow meter indicator ball. — Position the flow meter red pointer flag so that it alligns with the measurement of the indicator ball. — Release the button and remove the air supply hose nozzle tip from the EVAP System Standard. • Connect the air supply hose (transparent hose) nozzle tip into the EVAP Service Port Adapter. • Key ON Engine OFF. • Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle). • Depress the remote starter button on the Smoke Machine. Notice that the ball in the flowmeter is all the way at the top. This indicates that the system is is being pressurized. • Continue to depress the remote starter button untill the ball stops descending. Once the ball stops descending, observe if it is above or below the red pointer flag. If the measurement is below the indicator flag, the system has passed the pressure test. If the measurement is above the indicator flag, the EVAP system has an unacceptable leak. • **Does the EVAP system pass the Smoke Machine Leak Verification Pressure Test?**	Yes → No →	KEY OFF. Test passed, no faults found. GO to **HX56**.

Generator/Regulator System	HY

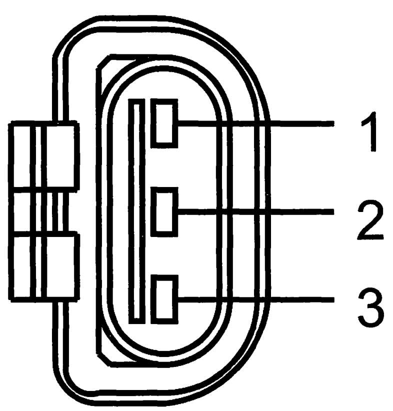
Note

This Pinpoint Test is intended to diagnose the following:

- Generator/Regulator (10346).
- Generator/Regulator harness circuits: GEN-MON, GEN-COM, BATT-SENSE, ILC, ALI, ALF.
- Powertrain control module (PCM) (12A650).

Generator/Regulator (GEN-REG) Connector

A



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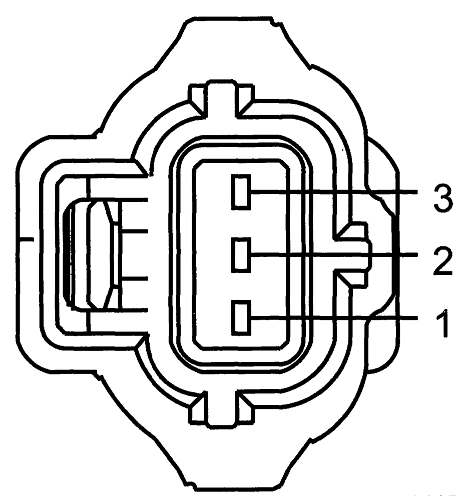

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Generator/Regulator System | HY

Vehicle	Connector	Circuit	Pin
Aviator, Explorer, Mountaineer	A	ILC	1
Escape, F-150, Focus, Freestar / Monterey, Sable 2V, Taurus 2V	B	GEN-COM GEN-MON	2 1
Expedition, Navigator	B	ALF ILC	1 2
LS, Thunderbird	B	ALI ILC	1 2
All other vehicles	A	GEN-COM GEN-MON	2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	ILC	B8
Escape, Focus 2.0L	104 Pin	GEN-COM GEN-MON	72 59
Expedition, Navigator	122 Pin	ALF ILC	B7 B14
Explorer, Mountaineer	150 (50-50-50) Pin	ILC	B24
F-150	190 Pin	GEN-COM GEN-MON	B22 B23
Focus 2.3L	150 (50-50-50) Pin	GEN-COM GEN-MON	E7 E16
Freestar / Monterey, Sable, Taurus	104 Pin	GEN-COM GEN-MON	45 20
LS, Thunderbird	150 (60-32-58) Pin	ALI ILC	E50 E19
All other vehicles	104 Pin	GEN-COM GEN-MON	45 7

Generator/Regulator System

HY

	Test Steps	Results →	Action to Take
HY1	DTC P0620, P0622, P1244, P1245, P1246: VERIFY GENERATOR DRIVE FUNCTION		
	• CHECK that the output cable is clean at the generator/regulator assembly. • CHECK that the output cable nut and battery sense line is tightened at the generator/regulator assembly. • CHECK generator drive belt condition. • CHECK generator drive belt tension. • Start the engine, verify generator is turning. • **Does the generator turn?**	Yes → No →	SERVICE the output cable and nut as necessary. GO to **HY2**. KEY OFF. REFER to Charging System, Section 414 in the Workshop Manual.
HY2	CHECK GENERATOR CHARGING VOLTAGE		
	• All accessories OFF (no load on engine). • Key ON Engine RUN. • Ensure that the engine is idling. • Connect a voltmeter across the battery terminals. • Accelerate the engine speed to 2000 RPM and observe voltage reading across battery terminals. • **Is the battery voltage between 13.0 and 16.0 volts?**	Yes → No →	GO to **HY4**. GO to **HY3**.
HY3	CHECK GENERATOR OUTPUT TO THE BATTERY		
	• Ensure that the engine is idling. • Measure the voltage between the generator output cable and the generator outer shell (for ground) at the generator/regulator assembly. • **Is the voltage reading between 12.5 and 15.0 volts?**	Yes → No →	KEY OFF. REPAIR open circuit. CLEAR the DTCs and REPEAT Self-Test. KEY OFF. GO to **HY4**.

Generator/Regulator System | HY

Test Steps		Results →	Action to Take
HY4	CHECK BATTERY-SENSE VOLTAGE AT BATTERY		
	• Battery output cable at generator/regulator assembly connected. • Battery terminals are connected. • Disconnect the generator/regulator harness connector. • Key ON Engine OFF. • Measure battery sense voltage from the B+ pin at the generator harness connector and GND. • **Is the battery sense voltage within plus or minus 0.5 volt of the battery voltage?**	Yes →	KEY OFF. **For LS, and Thunderbird** GO to **HY8**. **For Focus, Escape 2.0L, Taurus, Sable, Town Car, F-150, Crown Victoria, Grand Marquis, Freestar / Monterey, and Marauder** GO to **HY7**. **For Aviator, Explorer, and Mountaineer** GO to **HY5**. **For Expedition, and Navigator** GO to **HY6**.
		No →	KEY OFF. REPAIR open battery sense (B+) circuit.
HY5	CHECK THE ILC CIRCUIT THROUGH THE PCM		
	• PCM connected. • Measure the Resistance between: **(+)GEN-REG Connector, Harness Side**: ILC — **(-)**: Ground • **Is the Resistance between 100 Ohm - 150 Ohm?**	Yes →	KEY OFF. REFER to Charging System, Section 414 in the Workshop Manual.
		No →	KEY OFF. GO to **HY8**.

Generator/Regulator System — HY

Test Steps		Results →	Action to Take
HY6	CHECK THE ILC CIRCUIT THROUGH THE PCM		
	• PCM connected. • Measure the Resistance between: **(+)12V vehicle battery** / **(-)GEN-REG Connector, Harness Side** Positive post / ILC • **Is the Resistance between 1.55 KOhm - 1.65 KOhm?**	Yes → No →	KEY OFF. REFER to Charging System, Section 414 in the Workshop Manual. KEY OFF. GO to **HY8**.
HY7	CHECK THE GENERATOR/REGULATOR VOLTAGE OUTPUT		
	• Reconnect the generator/regulator harness connector. • Key ON Engine RUN. • Accelerate the engine speed to 2000 rpm and then back to idle. • Access the VOLTDSD PID using a scan tool. • Record the PID voltage. • Measure the voltage between the generator output cable and the generator outer shell (for ground) at the generator/regulator assembly. • **Is the voltage reading taken at the generator/regulator output cable within plus or minus 0.5 volt of the VOLTDSD PID reading?**	Yes → No →	KEY OFF. Generator/regulator function is OK. Go To Pinpoint Test Z intermittent circuit failure diagnosis. KEY OFF. GO to **HY9**.
HY8	CHECK ILC, ALI AND ALF CIRCUITS FOR SHORT TO PWR		
	Note: The voltage measurements in this test step are to be taken between the PCM signal harness pin and chassis ground. LS and Thunderbird have ALI and ILC circuits. Expedition/Navigator have ALF and ILC circuits. Aviator, Explorer/Mountaineer only has an ILC circuit. • Disconnect the generator/regulator harness connector. • Disconnect PCM. • Key ON Engine OFF. • Measure the Voltage between: **(+)GEN-REG Connector, Harness Side** / **(-)** ILC / Ground ALI / Ground ALF / Ground • **Are the voltages below 0.5 V?**	Yes → No →	KEY OFF. GO to **HY10**. KEY OFF. REPAIR short circuit to PWR.

Generator/Regulator System — HY

Test Steps		Results →	Action to Take
HY9	CHECK GEN-MON AND GEN-COM CIRCUITS FOR SHORT TO PWR		
	Note: The voltage measurements in this test step are to be taken between the PCM signal harness pin and chassis ground. • Disconnect the generator/regulator harness connector. • Disconnect PCM. • Key ON Engine OFF. • Measure the Voltage between: (+)GEN-REG Connector, Harness Side / (-): GEN-MON / Ground; GEN-COM / Ground • **Are the voltages below 0.5 V?**	Yes → No →	KEY OFF. GO to **HY11**. KEY OFF. REPAIR short circuit to PWR.
HY10	CHECK ILC, ALI AND ALF CIRCUITS FOR SHORT TO GND		
	Note: The resistance measurements in this test step are to be taken between the PCM signal harness pin and chassis ground. LS and Thunderbird have ALI and ILC circuits. Expedition/Navigator have ALF and ILC circuits. Aviator, Explorer/Mountaineer only has an ILC circuit. • Measure the Resistance between: (+)GEN-REG Connector, Harness Side / (-): ILC / Ground; ALI / Ground; ALF / Ground • **Are the resistances above 10 KOhm?**	Yes → No →	**For LS, and Thunderbird** GO to **HY16**. **For Aviator, Explorer, and Mountaineer** GO to **HY14**. **For Expedition, and Navigator** GO to **HY14**. REPAIR short circuit to GND.
HY11	CHECK GEN-MON AND GEN-COM CIRCUITS FOR SHORT TO GND		
	Note: The resistance measurements in this test step are to be taken between the PCM signal harness pin and chassis ground. • Measure the Resistance between: (+)GEN-REG Connector, Harness Side / (-): GEN-MON / Ground; GEN-COM / Ground • **Are the resistances above 10 KOhm?**	Yes → No →	GO to **HY12**. REPAIR short circuit to GND.

HY9 measurement table:

(+)GEN-REG Connector, Harness Side	(-)
GEN-MON	Ground
GEN-COM	Ground

HY10 measurement table:

(+)GEN-REG Connector, Harness Side	(-)
ILC	Ground
ALI	Ground
ALF	Ground

HY11 measurement table:

(+)GEN-REG Connector, Harness Side	(-)
GEN-MON	Ground
GEN-COM	Ground

Generator/Regulator System — HY

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>HY12</td><td>CHECK GEN-MON CIRCUIT SHORT TO GEN-COM CIRCUIT IN THE HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">• Measure the Resistance between:
<table><tr><th>(+)GEN-REG Connector, Harness Side</th><th>(-)GEN-REG Connector, Harness Side</th></tr><tr><td>GEN-MON</td><td>GEN-COM</td></tr></table>• Is the Resistance above 10 KOhm?</td><td>Yes →
No →</td><td>GO to HY13.
REPAIR short circuit.</td></tr>
<tr><td>HY13</td><td>CHECK GEN-MON AND GEN-COM CIRCUITS FOR OPEN</td><td></td><td></td></tr>
<tr><td colspan="2">• Measure the Resistance between:
<table><tr><th>(+)GEN-REG Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr><tr><td>GEN-MON</td><td>GEN-MON</td></tr><tr><td>GEN-COM</td><td>GEN-COM</td></tr></table>• Are the resistances below 5 Ohm?</td><td>Yes →
No →</td><td>GO to HY15.
REPAIR open circuit.</td></tr>
<tr><td>HY14</td><td>CHECK ALF AND ILC CIRCUITS FOR OPEN</td><td></td><td></td></tr>
<tr><td colspan="2">Note: Expedition/Navigator have ALF and ILC circuits. Aviator, Explorer/Mountaineer only has an ILC circuit.
• Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)GEN-REG Connector, Harness Side</th></tr><tr><td>ILC</td><td>ILC</td></tr><tr><td>ALF</td><td>ALF</td></tr></table>• Are the resistances below 5 Ohm?</td><td>Yes →
No →</td><td>REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
REPAIR open circuit.</td></tr>
<tr><td>HY15</td><td>CHECK GENERATOR MONITOR SIGNAL</td><td></td><td></td></tr>
<tr><td colspan="2">• Reconnect the PCM.
• Reconnect the generator/regulator harness connector.
• Key ON Engine RUN.
• Ensure that the engine is idling.
• Access the PCM-GFS PID using a scan tool.
• Is the Duty Cycle between 5% - 97%?</td><td>Yes →
No →</td><td>KEY OFF.
REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
KEY OFF.
REPLACE generator/regulator assembly</td></tr>
</table>

Generator/Regulator System — HY

Test Steps	Results →	Action to Take
HY16 CHECK ALI AND ILC CIRCUITS FOR OPEN		
Note: LS and Thunderbird have ALI and ILC circuits. • Measure the Resistance between: (see table below) • **Are the resistances below 5 Ohm?**	Yes →	REFER to Charging System, Section 414 in the Workshop Manual.
	No →	REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)GEN-REG Connector, Harness Side
ALI	ALI
ILC	ILC

Secondary Ignition (COP) | JB

Note

This Pinpoint Test is intended to diagnose the following:

- Spark plugs (12405).

Secondary side of coil.

Caution

A malfunctioning ignition system may cause high catalyst temperatures. Check components next to the catalyst and muffler for heat damage.

Vehicle	Firing Order for Coil On Plug Applications
BASE, 4 cylinder applications	1 3 4 2
LS, 3.0L	1 4 2 5 3 6
LS8, Thunderbird	1 5 4 2 6 3 7 8
BASE, 8 cylinder applications	1 3 7 2 6 5 4 8
BASE, 10 cylinder applications	1 6 5 10 2 7 3 8 4 9

Secondary Ignition (COP) — JB

Test Steps		Results →	Action to Take
JB1	VISUAL INSPECTION OF IGNITION SYSTEM		
	Note: On certain applications with ETC (Electronic Throttle Control), erroneous ignition and ETC related DTCs may be set due to salt water intrusion into the CKP harness connector. These DTCs are: P0320, P0351, P0356 and P2106. Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, REPLACE the CKP sensor. • Visually inspect the engine compartment to make sure all coils are properly and securely connected. • Examine all wiring harnesses and connectors for damaged, burned or overheated insulation and loose or broken conditions. • Ensure vehicle battery is in good condition and all accessories are turned off. • **Is a problem indicated?**	Yes → No →	Repair as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles). GO to **JB2**.
JB2	DTC P0301 THROUGH P0310: MISFIRE ON CYLINDERS 1 THROUGH 10		
	• **Are any of the above listed DTCs present?**	Yes → No →	GO to **JB3**. GO to **JB4**.
JB3	CHECK FOR SPARK AT CYLINDER(S) INDICATED BY DTC(S)		
	• Locate and activate the fuel inertia switch to disable fuel pump. • Disconnect ignition coil(s) from spark plug(s). • Connect an air gap spark tester 303-D037 (D81P-6666-A) or equivalent to a coil. • If a WDS or equivalent tester is available utilize the scope function to verify that the coil is the problem. • Observe spark tester while cranking engine. • **Is a bluish-white spark present?**	Yes → No →	KEY OFF. GO to **JB5**. KEY OFF. INSPECT coil boot(s) for missing cylinder(s). REPLACE if necessary. INSPECT spark plug(s) for missing cylinder(s). MEASURE resistance of spark plug(s). REPLACE if lower than 2 kOhms or higher than 20 kOhms. GO to **JB4**.

Secondary Ignition (COP) — JB

Test Steps		Results →	Action to Take
JB4	CHECK FOR SPARK AT ALL CYLINDERS		
	• Locate and activate the fuel inertia switch to disable fuel pump. • Disconnect ignition coil(s) from spark plug(s). • Connect an air gap spark tester 303-D037 (D81P-6666-A) or equivalent to a coil. • Observe spark tester at each cylinder while cranking engine. • **Is a bluish-white spark consistent between all cylinders?**	Yes →	KEY OFF. GO to **JB5**.
		No →	KEY OFF. INSPECT coil boot(s) for missing cylinder(s). REPLACE if necessary. INSPECT spark plug(s) for missing cylinder(s). MEASURE resistance of spark plug(s). REPLACE if lower than 2 kOhms or higher than 20 kOhms. Record cylinder(s) with inconsistent spark. GO to **JB7**.
JB5	CHECK SPARK PLUGS		
	• Remove and inspect plugs for damage, wear, carbon deposits and proper plug gap. • **Are plugs OK?**	Yes →	GO to **JB6**.
		No →	REPAIR plug(s). ADJUST gap or REPLACE as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
JB6	CHECK SPARK PLUG RESISTANCE		
	• Measure spark plug resistance. • **Is resistance between 2000 and 20000 ohms?**	Yes →	GO to **JB7**.
		No →	INSTALL a new Spark Plug. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
JB7	TEST DIRECTION		
	• **Were you directed to this Pinpoint Test from Section 3?**	Yes →	Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No →	GO to **JB8**.
JB8	TEST DIRECTION		
	• **Were you directed to this Pinpoint Test from Pinpoint Test Step HD3?**	Yes →	GO to **HD4**.
		No →	GO to **JB9**.
JB9	TEST DIRECTION		
	• **Were you directed to this Pinpoint Test from A9?**	Yes →	GO to **A10**.
		No →	Intermittent: GO to **Z1**.

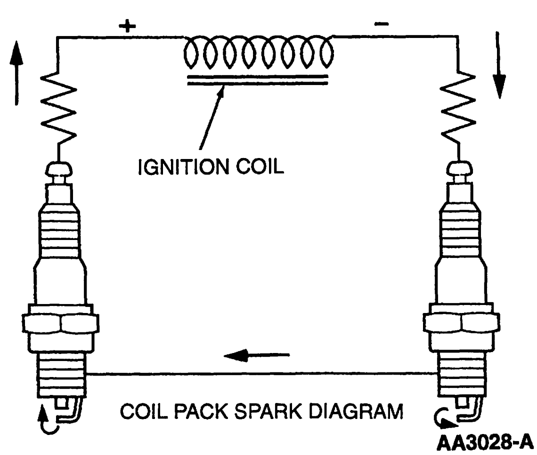
Secondary Ignition (Coil Pack)	JC

Note

This Pinpoint Test is intended to diagnose the following:

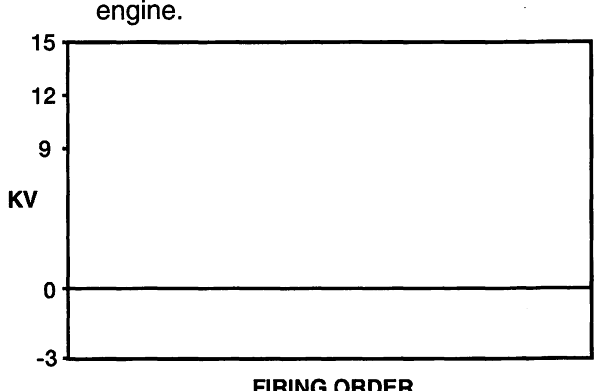
Spark plugs (12405).

Spark plug wires (12280, 12281).

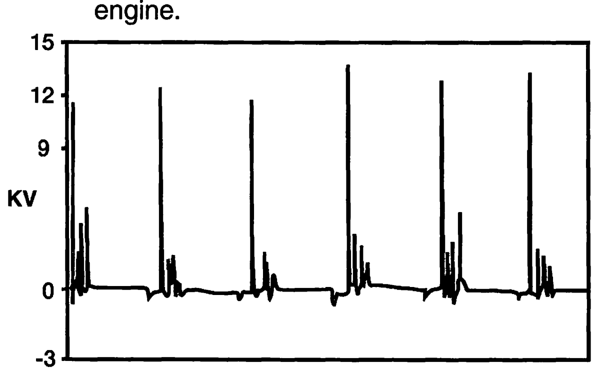


Focus, 2.0L Escape, Taurus/Sable, 3.8L Mustang, Ranger, Monterey/Freestar, 40L Explorer/Mountaineer, 4.2L E/F Series.

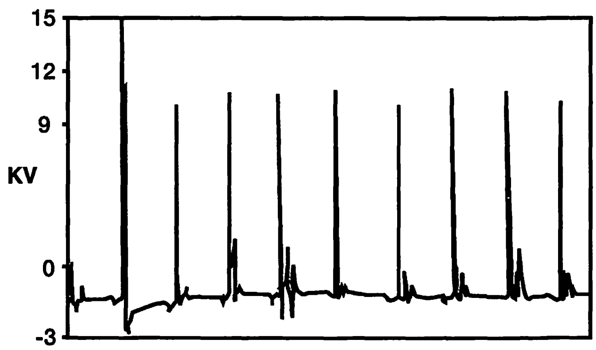
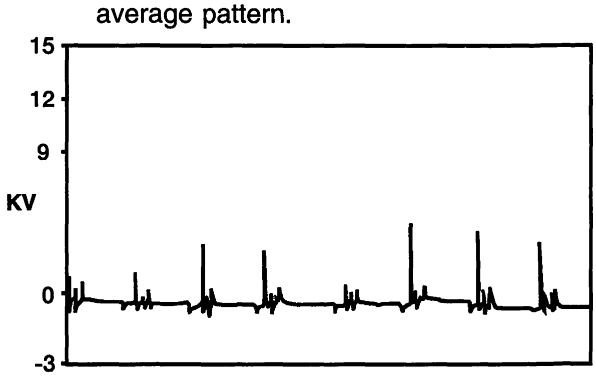
Secondary Ignition (Coil Pack) — JC

Test Steps		Results →	Action to Take
JC1	VISUAL INSPECTION OF IGNITION SYSTEM		
	Note: On certain applications with ETC (Electronic Throttle Control), erroneous ignition and ETC related DTCs may be set due to salt water intrusion into the CKP harness connector. These DTCs are: P0320, P0351, P0356 and P2106. Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, REPLACE the CKP sensor. • Visually inspect the engine compartment to make sure all coils and spark plug wires are properly and securely connected. • Examine all wiring harnesses and connectors for damaged, burned or overheated insulation and loose or broken conditions. • Ensure vehicle battery is in good condition and all accessories are turned off. • **Is a problem indicated?**	Yes →	Repair as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
		No →	**For Coil pack using engine analyzer.** GO to **JC2**. **For Coil pack not using engine analyzer.** GO to **JC11**.
JC2	CONNECT ENGINE ANALYZER		
	• Obtain an Engine Analyzer to diagnose concerns in the secondary side of the ignition system. • **Is the engine analyzer connected?**	Yes →	GO to **JC3**.
		No →	Repeat step JC2
JC3	CHECK FOR IGNITION PATTERN		
	• Observe pattern on scope while cranking engine.  A0027507 • **Is the pattern flat which indicates no spark on all cylinders?**	Yes →	IGN/START/RUN circuit concern. IGN START/RUN circuit fault. KEY OFF. Check condition of related fuses/fuse links. If OK REPAIR open circuit. If fuse/fuse link is damaged Check IGN START/RUN circuit for short to ground. REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycle).
		No →	GO to **JC4**.

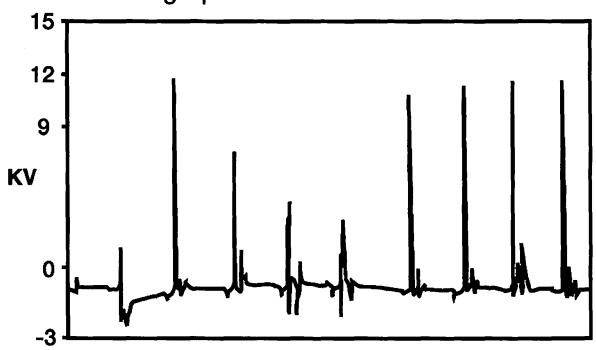
Secondary Ignition (Coil Pack) — JC

Test Steps	Results →	Action to Take
JC4 CHECK FOR NORMAL IGNITION PATTERN		
Note: Spark plugs may be fired more than once per combustion event. Multi-strike operating mode is RPM dependent. • Key on, start engine / if no start crank engine.  FIRING ORDER A0027508 • **Are the patterns even and is the average value of spark plug firing voltage between 9 kV and 15 kV (higher during engine crank / no start)?**	Yes → No →	GO to **Z1**. GO to **JC5**.
JC5 IGNITION PATTERN EVALUATION		
• **Is the ignition pattern normal?**	Yes → No →	GO to **JC6**. GO to **JC7**.
JC6 TEST DIRECTION		
• **Were you directed to this Pinpoint Test from A9?**	Yes → No →	GO to **A10**. GO to **JC7**.
JC7 CHECK FOR MISSING SPARK PATTERNS		
•  FIRING ORDER A0027509 • **Is the spark pattern inconsistent?**	Yes → No →	INSPECT spark plug wires for missing cylinders. MEASURE resistance of spark plug wires. REPLACE if greater than 7000 ohms per 30.5 cm (1 foot). GO to **JE1**. GO to **JC8**.

Secondary Ignition (Coil Pack) — JC

Test Steps	Results	→	Action to Take
JC8 CHECK FOR HIGH SPARK PLUG FIRING VOLTAGE			
•  FIRING ORDER A0027511 • **Is the average value of spark plug firing voltage greater than 15KV?**	Yes	→	INSPECT spark plug wires for missing cylinders. MEASURE resistance of spark plug wires. REPLACE if greater than 7000 ohms per 30.5 cm (1 foot).
	No	→	GO to **JC9**.
JC9 CHECK FOR LOW SPARK PLUG FIRING VOLTAGE			
• CHECK the spark plug firing voltage average pattern.  FIRING ORDER A0027512 • **Is there consistently low spark plug firing voltage or sloping sparkline on one or more cylinders?**	Yes	→	INSPECT spark plug wires and plugs. MEASURE resistance of spark plug wires. REPLACE if greater than 7000 ohms per 30.5 cm (1foot). MEASURE resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
	No	→	GO to **JC10**.

Secondary Ignition (Coil Pack) — JC

Test Steps		Results →	Action to Take
JC10	CHECK FOR EVENESS BETWEEN CYLINDERS		
	• CHECK the spark plug firing voltage average pattern.  FIRING ORDER A0027513 • **Is the evenness of spark plug firing voltage greater than 6 kV?**	Yes →	INSPECT spark plug wires and plugs. MEASURE resistance of spark plug wires. REPLACE if greater than 7000 ohms per 30.5 cm (1foot). CHECK for damaged spark plugs or narrow spark plug gaps. MEASURE resistance of spark plugs. REPLACE if lower than 2000 or higher than 20000 ohms. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
		No →	GO to **Z1**.
JC11	DTC P0301 THROUGH P0306: MISFIRE ON CYLINDERS 1 THROUGH 6		
	• **Are any of the above listed DTCs present?**	Yes →	GO to **JC12**.
		No →	GO to **JC13**.
JC12	CHECK FOR SPARK AT CYLINDER(S) INDICATED BY DTC(S)		
	• Disable inertia switch. • Disconnect spark plug wire(s) from spark plug(s). • Connect a Spark Tester 303-D037 (D81P-6666-A) or equivalent to a spark plug wire. • CHECK for spark while cranking engine. • **Is the bluish-white spark present?**	Yes →	KEY OFF. GO to **JC14**.
		No →	KEY OFF. INSPECT spark plug wires for missing cylinders. MEASURE resistance of spark plug wires. REPLACE if greater than 7000 ohms per 30.5 cm (1 foot). COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles). If spark plug wires are OK, GO to **JE1**.

Secondary Ignition (Coil Pack) — JC

Test Steps		Results →	Action to Take
JC13	CHECK FOR SPARK AT ALL CYLINDERS		
	• Disable inertia switch. • Disconnect spark plug wire(s) from spark plug(s). • Connect a Spark Tester 303-D037 (D81P-6666-A) or equivalent to a spark plug wire. • CHECK for spark while cranking engine. • **Is the bluish-white spark present?**	Yes →	KEY OFF. GO to **JC14**.
		No →	KEY OFF. INSPECT spark plug wires for missing cylinders. MEASURE resistance of spark plug wires. REPLACE if greater than 7000 ohms per 30.5 cm (1 foot). COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles). If spark plug wires are OK, GO to **JE1**.
JC14	CHECK SPARK PLUGS		
	• CHECK for damaged spark plugs or narrow spark plug gaps. • **Are plugs OK?**	Yes →	GO to **JC15**.
		No →	Repair plugs. ADJUST gap or REPLACE as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
JC15	CHECK SPARK PLUG RESISTANCE		
	• Measure spark plug resistance. • **Is resistance between 2000 and 20000 ohms?**	Yes →	GO to **Z1**.
		No →	REPLACE spark plugs. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).

Crankshaft Position (CKP) Sensor	JD

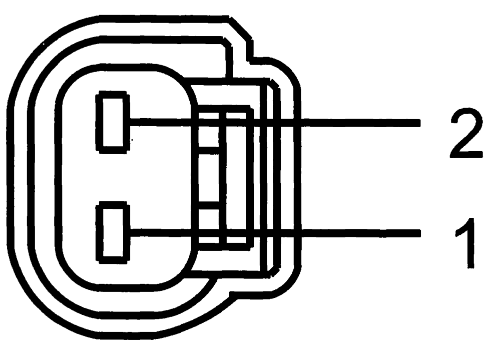
Note

This Pinpoint Test is intended to diagnose the following:

- Crankshaft Position (CKP) Sensor. (6C135).
- Harness Circuits: CKP(+) and (CKP(-).
- Powertrain Control Module (PCM) (12A650).

Crankshaft position sensor (CKP) Connector

A



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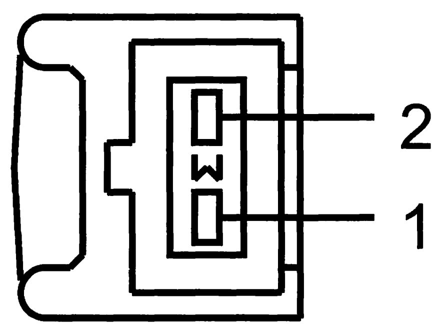

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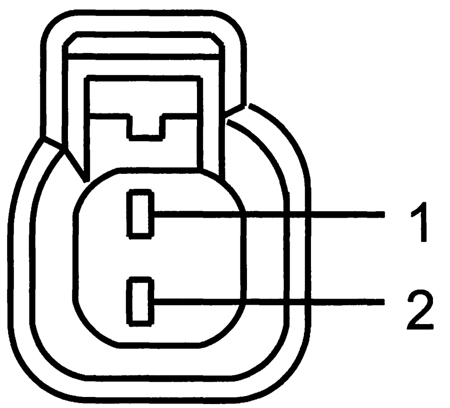
Crankshaft Position (CKP) Sensor | JD

C



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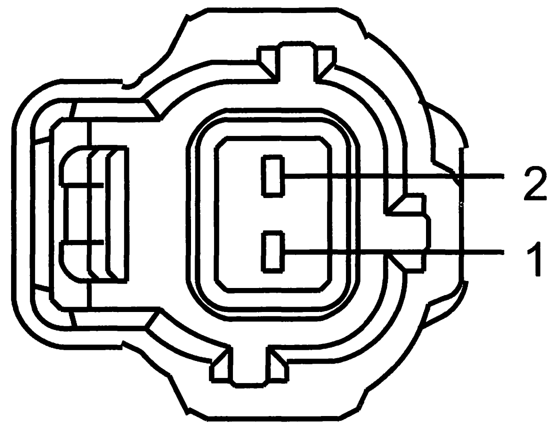

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Vehicle	Connector	Circuit	Pin
Aviator, Expedition, Explorer 4.6L, Focus 2.0L, LS 3.0L, Mountaineer, Navigator, Ranger 3.0L	A	CKP- CKP+	1 2
Explorer 4.0L	B	CKP- CKP+	2 1
LS 3.9L, Thunderbird	C	CKP- CKP+	1 2
All other vehicles	D	CKP- CKP+	2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Crankshaft Position (CKP) Sensor — JD

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	CKP+ CKP-	E55 E56
Expedition, Navigator	122 Pin	CKP+ CKP-	E30 E41
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	CKP+ CKP-	E34 E45
F-150	190 Pin	CKP+ CKP-	E47 E46
All other vehicles	104 Pin	CKP+ CKP-	21 22

Test Steps		Results →	Action to Take
JD1	CHECK CRANKSHAFT POSITION (CKP) SENSOR SIGNAL SENT TO PCM		
	Note: On certain applications with ETC (Electronic Throttle Control), erroneous ignition and ETC related DTCs may be set due to salt water intrusion into the CKP harness connector. These DTCs are: P0320, P0351, P0356 and P2106. Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, REPLACE the CKP sensor. • Battery fully charged and starting system performing properly. • Scan tool connector connected. • Key ON Engine OFF. • Access the RPM PID using a scan tool. • Disable inertia switch. Crank the engine. • **Is the RPM above 150 RPM?**	Yes → No →	CKP, PCM and harness working properly. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. GO to **JD2**.
JD2	CHECK TIMING COVER, CKP SENSOR AND EXTERNAL TRIGGER WHEEL (OUTSIDE TIMING COVER) FOR OBVIOUS PHYSICAL DAMAGE		
	• Key OFF. • Visually CHECK timing cover, CKP sensor and external trigger wheel (outside timing cover) for obvious physical damage. • **Do any parts appear physically damaged?**	Yes → No →	REPAIR or REPLACE damaged parts. GO to **JD3**.

Crankshaft Position (CKP) Sensor — JD

Test Steps		Results →	Action to Take
JD3	CHECK FOR PROPER CKP BIAS VOLTAGES IN PCM		
	• CKP connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	GO to **JD4**. GO to **JD6**.

(+)CKP Connector, Harness Side	(-)Vehicle battery
CKP+	Negative post
CKP-	Negative post

- **Are the voltages between 1 V - 3 V?**

Test Steps		Results →	Action to Take
JD4	CHECK CKP SENSOR RESISTANCE		
	• Key OFF. • Measure the Resistance between:	Yes → No →	GO to **JD5**. INSTALL a new CKP.

(+)CKP Connector, Component Side	(-)CKP Connector, Component Side
CKP+	CKP-

- Note: CKP sensor resistance values change significantly with temperature rise.
- **Is the Resistance between 250 Ohm - 1 KOhm?**

Test Steps		Results →	Action to Take
JD5	CHECK CKP HARNESS SHIELD GROUND		
	Note: The harness shield protects the CKP signal from electrical noise and is grounded at one end, typically near the PCM. • Measure the Resistance between:	Yes → No →	GO to **JD6**. REPAIR open circuit. CHECK for poor ground connection.

(+)CKP_SHLD Assembly Connector, Harness Side	(-)Vehicle battery
CKP_SHLD	Negative post

- **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
JD6	CHECK FOR SHORT BETWEEN CKP(+) AND CKP(-) IN HARNESS		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between:	Yes → No →	REPAIR short circuit. GO to **JD7**.

(+)CKP Connector, Harness Side	(-)CKP Connector, Harness Side
CKP+	CKP-

- **Is the Resistance below 10 KOhm?**

Crankshaft Position (CKP) Sensor — JD

Test Steps	Results →	Action to Take
JD7 CHECK CKP CIRCUIT(S) FOR OPEN IN HARNESS		
• Measure the Resistance between:	Yes →	REPAIR open circuit.
	No →	GO to **JD8**.

(+)CKP Connector, Harness Side	(-)PCM Connector, Harness Side
CKP-	CKP-
CKP+	CKP+

• **Are the resistances above 5 Ohm?**

Test Steps	Results →	Action to Take
JD8 CHECK CKP CIRCUIT(S) FOR SHORT TO GROUND IN HARNESS		
• Measure the Resistance between:	Yes →	REPAIR short circuit.
	No →	GO to **JD9**.

(+)CKP Connector, Harness Side	(-)Vehicle battery
CKP+	Negative post
CKP-	Negative post

• **Are the resistances below 10 KOhm?**

Test Steps	Results →	Action to Take
JD9 CHECK CKP CIRCUIT FOR SHORT TO POWER IN HARNESS		
• Key ON Engine OFF. • Measure the Voltage between:	Yes →	REPAIR short circuit.
	No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

(+)PCM Connector, Harness Side	(-)Vehicle battery
CKP+	Negative post
CKP-	Negative post

• **Are the voltages above 3 V?**

Integrated Ignition Coil Pack A, B or C failure	JE

Note

This Pinpoint Test is intended to diagnose the following:

Ignition coil packs (12029).

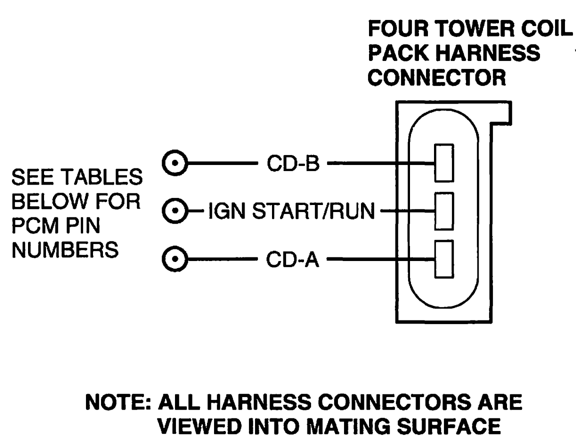
Ignition coil harness.

ign start/run circuit to coil packs.

Powertrain Control Module (PCM) (12A650).

Pinpoint Test Schematics and Connectors

For PCM connector views, refer to Section 1, Powertrain Control Hardware.



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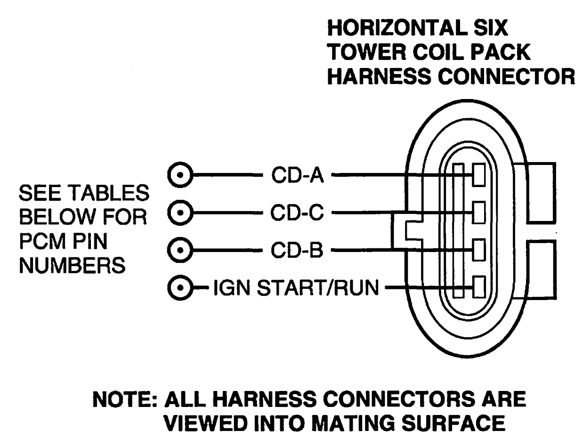

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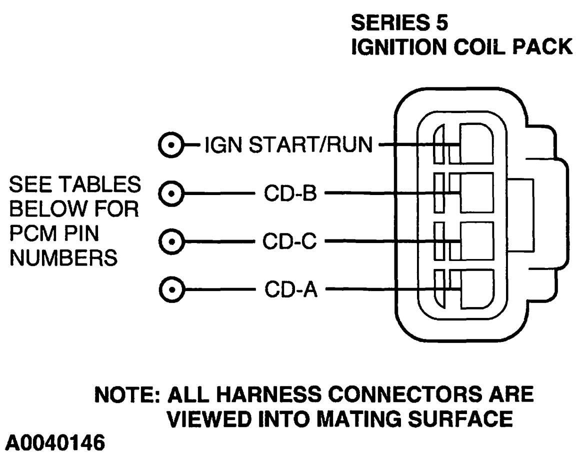
Integrated Ignition Coil Pack A, B or C failure

JE



IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
4 cylinders	P0351	1	A	A	26
	P0352	2	B	B	52
	P0353	3	B	B	52
	P0354	4	A	A	26
6 cylinders	P0351	1	A	A	26
	P0352	4	B	B	52
	P0353	2	C	C	78
	P0351	5	A	A	26
	P0352	3	B	B	52
	P0353	6	C	C	78
4.0L/ EXPLR/MNTR	P0351	1	A	A	E31
	P0352	4	B	B	E23
	P0353	2	C	C	E13
	P0351	5	A	A	E31
	P0352	3	B	B	E23
	P0353	6	C	C	E13
	P0351	5	A	A	26

Integrated Ignition Coil Pack A, B or C failure

JE

Test Steps		Results →	Action to Take
JE1	DETERMINE WHICH COIL IS NOT FIRING PROPERLY		
	Note: Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings. • Record suspect cylinder, coil and PCM pin number from the table. • Determine which coil is not firing properly using information from Pinpoint Test JB or DTC and the table at the beginning of this pinpoint test. • Record suspect cylinder, coil and PCM pin number from the table. • **Have the suspect cylinder number, coil driver and PCM pin number been recorded?**	Yes → No →	GO to **JE2**. To obtain required information, repeat step JE1
JE2	DTC P0351, P0352, P0353: CHECK IGN. START/RUN VOLTAGE TO COIL PACK		
	Note: On certain applications with ETC (Electronic Throttle Control), erroneous ignition and ETC related DTCs may be set due to salt water intrusion into the CKP harness connector. These DTCs are: P0320, P0351, P0356 and P2106. Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, REPLACE the CKP sensor. • Disconnect suspect coil (determine from the table). • Key ON Engine OFF. • Measure voltage between IGN START/RUN circuit at coil pack harness connector and ground. • **Is the voltage greater than 10.0 volts?**	Yes → No →	KEY OFF. GO to **JE3**. IGN START/RUN circuit fault. KEY OFF. Check condition of related fuses/fuse links. If OK REPAIR open circuit. If fuse/fuse link is damaged Check IGN START/RUN circuit for short to ground. REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycle).
JE3	CHECK FUNCTIONALITY OF SUSPECT COIL DRIVER (CD) CIRCUIT		
	• Connect incandescent test lamp between IGN START/Run and suspect CD circuit. (determine from the table) at the coil pack harness connector. • Locate and activate the fuel inertia switch to disable fuel pump. • Observe incandescent test lamp while cranking engine. • **Did test lamp blink consistently?**	Yes → No →	KEY OFF. GO to **JE7**. KEY OFF. GO to **JE4**.

Integrated Ignition Coil Pack A, B or C failure

JE

	Test Steps	Results →	Action to Take
JE4	CHECK SUSPECT CD CIRCUIT FOR OPEN IN HARNESS		
	• Disconnect PCM. • Measure resistance of suspect CD circuit between PCM harness connector pin (determine from the table) and coil pack connector. • **Is resistance less than 5 ohms?**	Yes → No →	GO to **JE5**. REPAIR open circuit. Complete Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
JE5	CHECK SUSPECT CD CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• Key ON Engine OFF. • Measure voltage between suspect CD circuit at the PCM harness connector (determined from the table) and ground. • **Is voltage less than 1.0 volt?**	Yes → No →	KEY OFF. GO to **JE6**. KEY OFF. REPAIR short circuit. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
JE6	CHECK SUSPECT CD CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Disconnect the Scan tool. • Measure resistance between suspect CD circuit at the PCM harness connector (determined from the table) and ground. • **Is resistance greater than 10,000 ohms?**	Yes → No →	REPLACE PCM (REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). If symptom or DTC is still present GO to **JE7**. REPAIR short circuit. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).
JE7	CHECK SUSPECT COIL FOR DAMAGE		
	• REMOVE spark plug wire from suspect coil tower (determine from table). • Connect an air gap spark tester 303-DO37 (D81P-6666-A) or equivalent in series between suspect coil tower and spark plug wire. • Disable inertia switch. • Observe spark tester while cranking engine. • **Is the bluish-white spark present?**	Yes → No →	KEY OFF. GO to **Z1**. REPLACE coil pack. Complete Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).

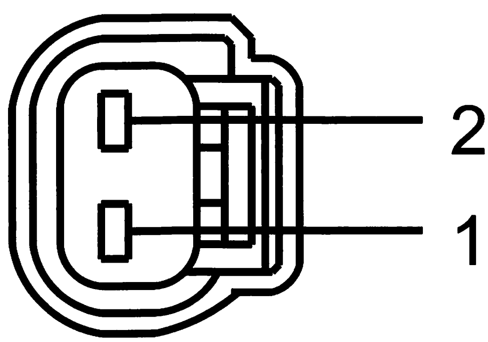
Integrated Ignition Coil On Plug Coil A Through D Failure	JF

Note

This Pinpoint Test is intended to diagnose the following:

- Ignition coils (12A366).
- Ignition coil harness.
- Powertrain Control Module PCM.

Coil On Plug (COP) Connector



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Integrated Ignition Coil On Plug Coil A Through D Failure

JF

Vehicle	Connector	Circuit	Pin
E-Series 6.8L, Escape 3.0L, Excursion 6.8L, F-Series Super Duty 6.8L, LS, Mustang 4.6L, Navigator, Thunderbird	A	COP	1
All other vehicles	A	COP	2

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
4 Cylinder Applications	P0351	1	A	A	E1
	P0352	2	B	D	E35
	P0353	3	C	B	E12
	P0354	4	D	C	E24
LS, 3.0L	P0351	1	A	A	E58
	P0352	2	B	C	E48
	P0353	3	C	E	E60
	P0354	4	D	B	E12
	P0355	5	E	D	E22
	P0356	6	F	F	E30
Escape 3.0L	P0351	1	A	A	26
	P0352	2	B	B	52
	P0353	3	C	C	78
	P0354	4	D	D	1
	P0355	5	E	E	27
	P0356	6	F	F	53
LS, TBIRD, 3.9L	P0351	1	A	A	E58
	P0352	2	B	D	E59
	P0353	3	C	F	E60
	P0354	4	D	C	E48
	P0355	5	E	D	E12
	P0356	6	F	E	E22
	P0357	7	G	G	E30
	P0358	8	H	H	E38
Aviator	P0351	1	A	A	E31
	P0352	2	B	D	E1
	P0353	3	C	B	E23
	P0354	4	D	G	E30
	P0355	5	E	F	E22

(Continued)

Integrated Ignition Coil On Plug Coil A Through D Failure

JF

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
	P0356	6	F	E	E12
	P0357	7	G	C	E13
	P0358	8	H	H	E38
Explr./Mntr 4.6L	P0351	1	A	A	E1
	P0352	2	B	D	E12
	P0353	3	C	B	E24
	P0354	4	D	G	E35
	P0355	5	E	F	E38
	P0356	6	F	E	E39
	P0357	7	G	C	E42
	P0358	8	H	H	E43
F150	P0351	1	A	A	E17
	P0352	2	B	D	E11
	P0353	3	C	B	E12
	P0354	4	D	G	E14
	P0355	5	E	F	E10
	P0356	6	F	E	E15
	P0357	7	G	C	E16
	P0358	8	H	H	E9
Exped./Nav.	P0351	1	A	A	E35
	P0352	2	B	D	E1
	P0353	3	C	B	E24
	P0354	4	D	G	E23
	P0355	5	E	F	E34
	P0356	6	F	E	E46
	P0357	7	G	C	E12
	P0358	8	H	H	E11
All other 8 Cylinder Applications	P0351	1	A	A	26
	P0352	2	B	D	104
	P0353	3	C	B	52
	P0354	4	D	G	53
	P0355	5	E	F	27
	P0356	6	F	E	1
	P0357	7	G	C	78
	P0358	8	H	H	79
10 Cylinder Applications	P0351	1	A	A	E26

(Continued)

Integrated Ignition Coil On Plug Coil A Through D Failure

JF

IGNITION COIL TO CYLINDER CORRELATION

Vehicle	Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
	P0352	2	B	E	E78
	P0353	3	C	G	E104
	P0354	4	D	I	E102
	P0355	5	E	C	E52
	P0356	6	F	B	E1
	P0357	7	G	F	E53
	P0358	8	H	H	E79
	P0359	9	I	J	E82
	P0360	10	J	D	E27

Test Steps		Results →	Action to Take
JF1	DETERMINE WHICH COIL IS NOT FIRING PROPERLY		
	Note: Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings. • Determine which coil is not firing properly using information from Pinpoint Test JB or DTC and the table at the beginning of this pinpoint test. • Record suspect cylinder, coil and PCM pin number from the table. • **Have the suspect cylinder number, coil driver and PCM pin number been recorded?**	Yes → No →	GO to **JF2**. REPEAT test step to obtain required information.
JF2	CHECK FUNCTIONALITY OF SUSPECT COIL DRIVER (CD) CIRCUIT		
	Note: On certain applications with ETC (Electronic Throttle Control), erroneous ignition and ETC related DTCs may be set due to salt water intrusion into the CKP harness connector. These DTCs are: P0320, P0351, P0356 and P2106. Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, REPLACE the CKP sensor. • Suspect Coil connector disconnected. • Connect incandescent test lamp between IGN START/RUN and Coil Driver (CD) A circuit at the coil on plug harness connector. • Disable fuel pump by disconnecting inertia fuel shutoff switch. • Observe incandescent test lamp while cranking engine. • **Is the test lamp blinking consistently?**	Yes → No →	KEY OFF. GO to **JF3**. KEY OFF. GO to **JF4**.

Integrated Ignition Coil On Plug Coil A Through D Failure

JF

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>JF3</td><td>CHECK FUNCTIONALITY OF SUSPECT COIL</td><td></td><td></td></tr>
<tr><td></td><td>• Carry out a visual inspection. Closely inspect coil case and boot for carbon tracking, cracks and torn or improperly installed boots.
• Remove suspect coil (determined from the table) from spark plug.
• Connect an air gap spark tester 303-D037 (D81P-6666-A) or equivalent to the suspect coil.
• If WDS or equivalent tester is available utilize the scope function to verify problem.
• Suspect Coil connector connected.
• Observe spark tester while cranking engine.
• Is a bluish-white spark present?</td><td>Yes →

No →</td><td>KEY OFF.
INSPECT spark plug, replace if necessary.
GO to Z1.
KEY OFF. INSTALL a new Suspect Coil.
INSPECT spark plug, REPLACE if necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).</td></tr>
<tr><td>JF4</td><td>CHECK IGN START/RUN VOLTAGE TO SUSPECT COIL</td><td></td><td></td></tr>
<tr><td></td><td>• Key ON Engine OFF.
• Suspect Coil connector disconnected.
• Measure the Voltage between:
<table><tr><th>(+)COP Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>COP</td><td>Negative post</td></tr></table>• Is the Voltage above 10 V?</td><td>Yes →

No →</td><td>KEY OFF.
GO to JF6.
KEY OFF.
GO to JF5.</td></tr>
<tr><td>JF5</td><td>DETERMINE VEHICLE BEING DIAGNOSED</td><td></td><td></td></tr>
<tr><td></td><td>• Are you servicing a LS6, LS8 or Thunderbird?</td><td>Yes →
No →</td><td>GO to B5.
IGN START/RUN circuit fault. CHECK condition of related fuses/fuse links. If OK, REPAIR open circuit. If fused/fuse link is damaged, CHECK IGN START/RUN circuit for short to ground. REPAIR as necessary. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section 2, Drive Cycles).</td></tr>
</table>

Integrated Ignition Coil On Plug Coil A Through D Failure

JF

Test Steps		Results →	Action to Take
JF6	CHECK SUSPECT COIL DRIVER (CD) CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Suspect Coil connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)COP Connector, Harness Side** Suspect coil driver. / COP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **JF7**. REPAIR open circuit. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
JF7	CHECK SUSPECT COIL DRIVER (CD) CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)PCM Connector, Harness Side** / **(-)Vehicle battery** Suspect coil driver. / Negative post • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **JF8**. KEY OFF. REPAIR short circuit to PWR. COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).
JF8	CHECK SUSPECT COIL DRIVER (CD) CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Disconnect scan tool. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)Vehicle battery** Suspect coil driver. / Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). If symptom or DTC is still present, GO to JF8 to check for damaged coil, otherwise COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles). REPAIR short circuit to GND. If symptom or DTC is still present, GO to JF8 to check for damaged coil, otherwise COMPLETE Misfire Monitor Repair Verification Drive Cycle (REFER to Section2, Drive Cycles).

Integrated Ignition Coil On Plug Coil A Through D Failure

JF

Test Steps		Results →	Action to Take
JF9	CHECK SUSPECT COIL FOR DAMAGE		
	• Remove suspect coil (determined from the table) from spark plug. • Connect an air gap spark tester 303-D037 (D81P-6666-A) or equivalent to the suspect coil. • Locate and activate the fuel inertia switch to disable fuel pump. • Observe spark tester while cranking engine. • **Is a bluish-white spark present?**	Yes →	KEY OFF. INSPECT spark plug, REPLACE if necessary. GO to **Z1**.
		No →	KEY OFF. INSTALL a new COP.

Tachometer Signal Output CTO | JH

Note

This pinpoint test is intended to diagnose the following: PCM (12A650), and harness.

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
104 Pin	SIGRTN PWRGND VREF VPWR CTO	91 103 90 71 48

Test Steps		Results →	Action to Take
JH1	CHECK THE CTO SIGNAL FROM THE PCM		
	• Disconnect the instrument cluster harness connector. • PCM connector connected. • Key ON Engine RUN. • Measure voltage between the CTO Pin 48 at the instrument cluster and battery negative post. • **Is the voltage between 3.0 and 9.0 volts?**	Yes → No →	REFER to Workshop Manual, Section 413 for diagnosis and testing. KEY OFF. GO to **JH2**.
JH2	CHECK CTO FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: (see table below) • **Are the resistances above 10 KOhm?**	Yes → No →	KEY OFF. GO to **JH3**. KEY OFF. REPAIR short circuit to PWR.

(+)PCM Connector, Harness Side	**(-)PCM Connector, Harness Side**
CTO - Pin 48	VPWR - Pin 71
CTO - Pin 48	VREF - Pin 90

Tachometer Signal Output CTO

JH

Test Steps		Results →	Action to Take
JH3	CHECK CTO CIRCUIT FOR SHORT TO GROUND		
	• Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)PCM Connector, Harness Side** CTO - Pin 48 / PWRGND - Pin 103 CTO - Pin 48 / SIGRTN - Pin 91 • **Are the resistances above 10 KOhm?**	Yes → No →	GO to **JH4**. REPAIR short circuit to GND.
JH4	CHECK CTO CIRCUIT FOR OPEN IN HARNESS		
	• CHECK CTO circuit resistance. • **Is the resistance less than 5 ohms?**	Yes → No →	GO to **JH5**. REPAIR open circuit.
JH5	CHECK CTO CIRCUIT FOR INTERMITTENT FAULTS		
	• Lightly tap on the CTO and wiggle the harness connector to simulate road shock. • Measure the CTO resistance between the PCM and the instrument cluster. • **Is resistance less than 5 ohms?**	Yes → No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). KEY OFF. REPAIR open circuit.

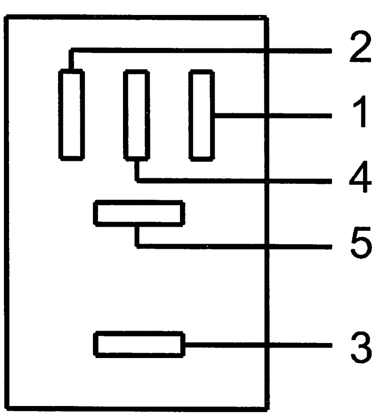
Fuel Pump Relay	KA

Note

- This pinpoint test is intended to diagnose the following:
- Fuel Pump Relay (9345).
- Inertia Fuel Shutoff (9341).
- Harness Circuit(s): B+, VPWR, FP, LFP, GND, FPM & FP PWR.
- Powertrain Control Module (PCM) (12A650).

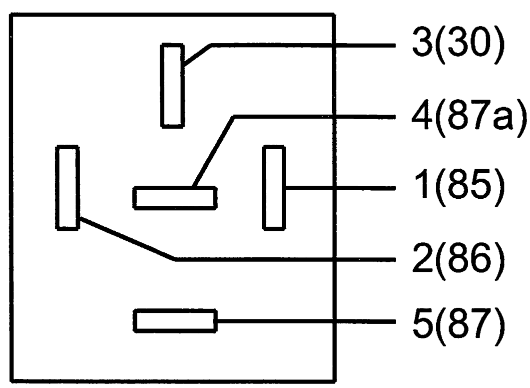
Fuel pump (FP) Relay Connector

A



A0077584

B



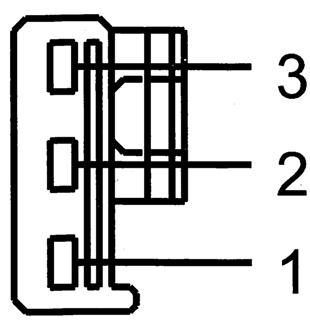
A0077582

Fuel Pump Relay	KA

Vehicle	Connector	Circuit	Pin
Ranger	A	B+ FPPWR FP VPWR	3 5 1 2
All other vehicles	B	B+ FPPWR FP VPWR	3 5 1 2

The VPWR & FP circuits may be reversed in the harness connector. REFER to the wiring diagram manual for more information.

Inertia Fuel Shutoff (IFS) Connector



A0077528

Circuit	Pin
FPPWR-B (Fuel Pump Power - B)	1
FPPWR-A (Fuel Pump Power - A)	2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

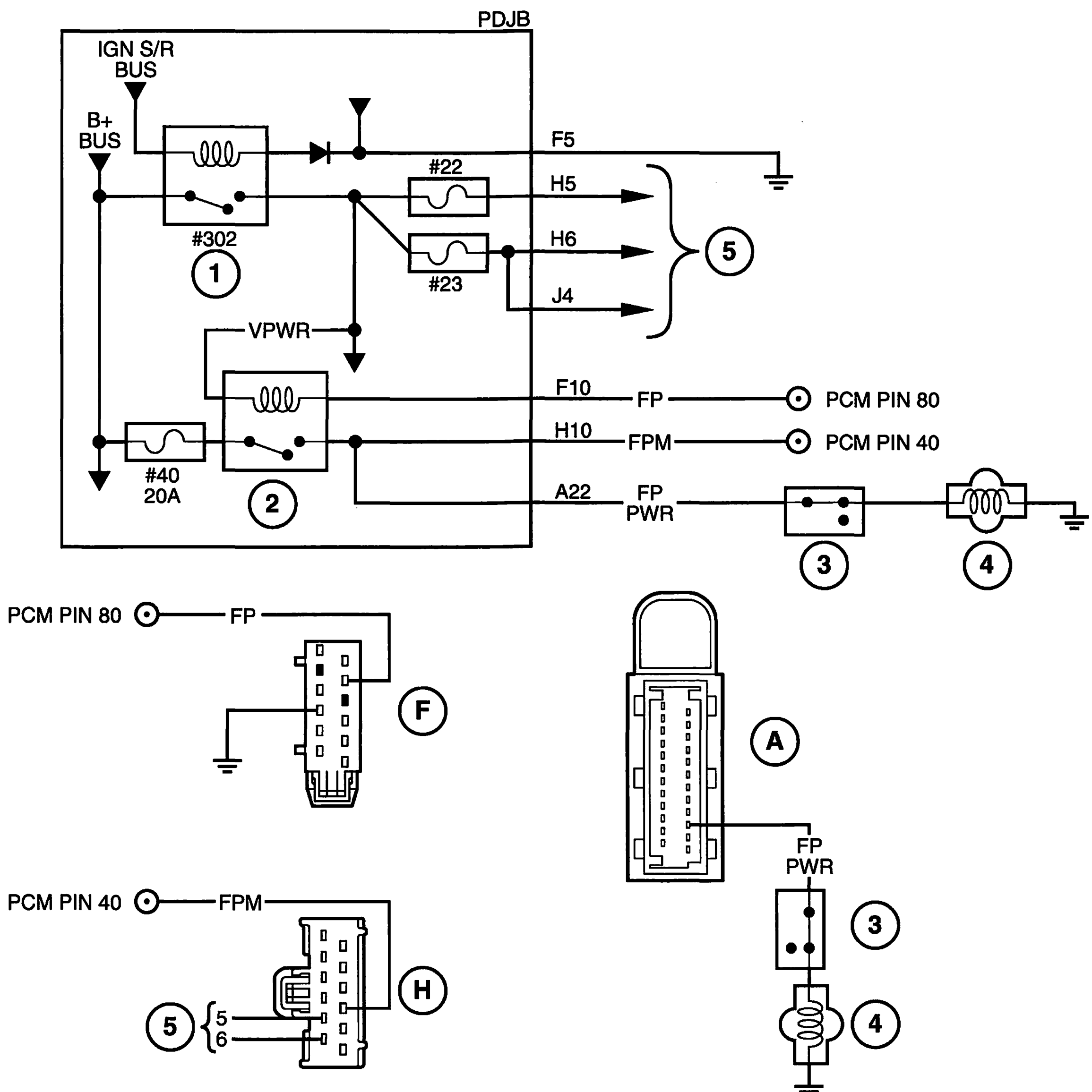
Fuel Pump Relay

KA

Vehicle	Connector	Circuit	Pin
Escape 2.0L	104 Pin	FPM FP	40 54
Expedition, Navigator	122 Pin	FPM FP	B20 B27
F-150 Heritage SC 5.4L	104 Pin	LFP FPM FP	19 40 80
All other vehicles	104 Pin	FPM FP	40 80

Fuel Pump Relay | KA

F-Super Duty 250-550, Excursion



A0059769

Item	Description
1	PCM Power Relay (#302)
2	Fuel Pump Relay (#202, soldered on circuit board)
3	Inertia Fuel Shutoff (IFS) Switch

(Continued)

Fuel Pump Relay

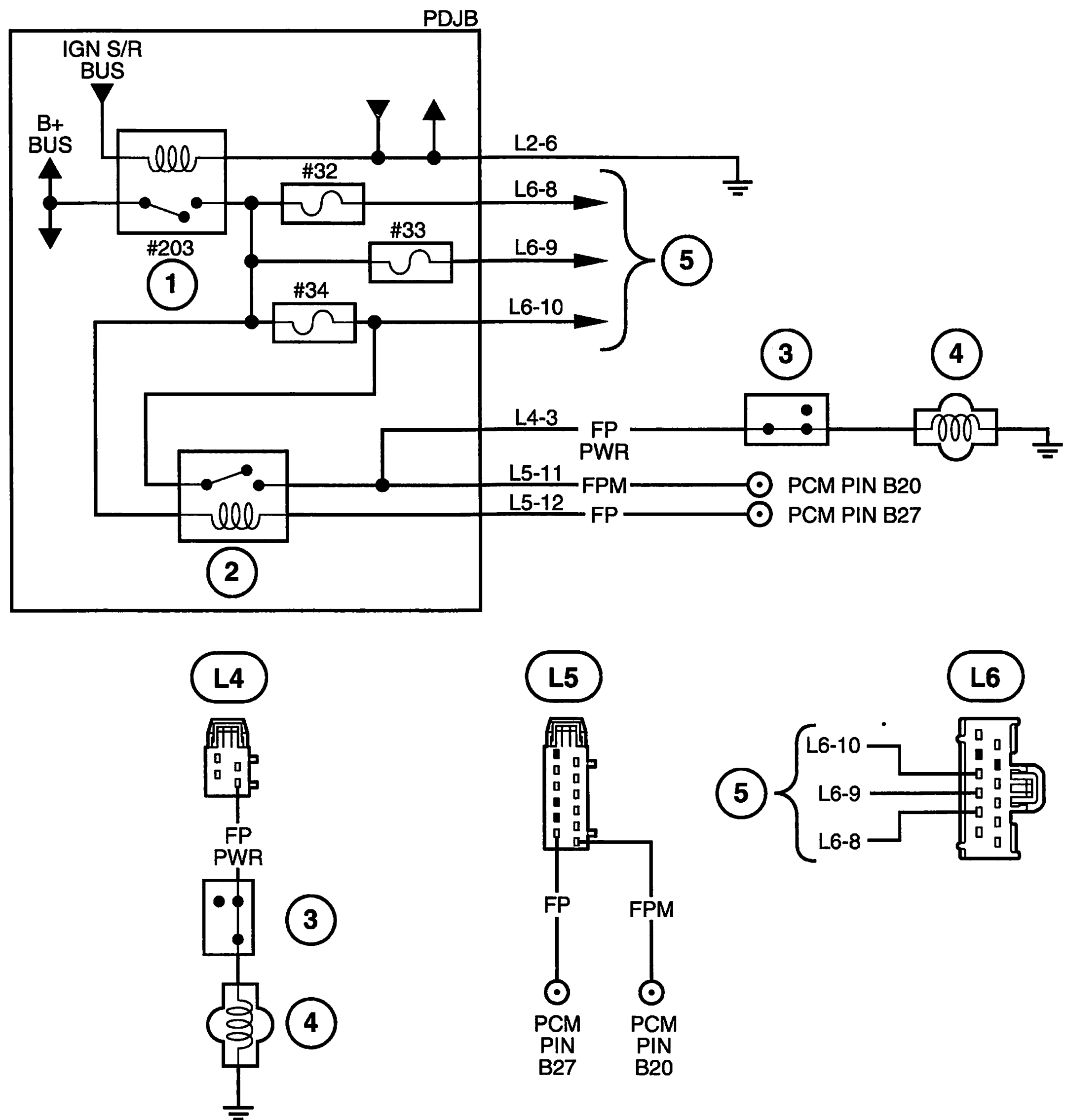
KA

Item	Description
4	Fuel Pump
5	To Powertrain Control System
A	Power Distribution Junction Box (PDJB) harness connector A
F	Power Distribution Junction Box (PDJB) harness connector F
H	Power Distribution Junction Box (PDJB) harness connector H

Fuel Pump Relay

KA

Expedition, Navigator



A0059768

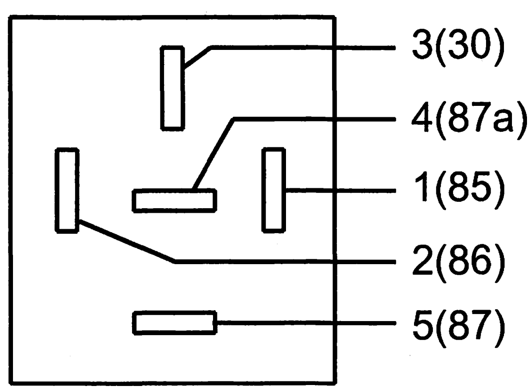
Item	Description
1	PCM Power Relay (#302)
2	Fuel Pump Relay (#202, soldered on circuit board)

(Continued)

Fuel Pump Relay	KA

Item	Description
3	Inertia Fuel Shutoff (IFS) Switch
4	Fuel Pump
5	To Powertrain Control System
L4	Power Distribution Junction Box (PDJB) harness connector L4
L5	Power Distribution Junction Box (PDJB) harness connector L5
L6	Power Distribution Junction Box (PDJB) harness connector L6

Low Speed Fuel Pump (LSFP) Relay Connector



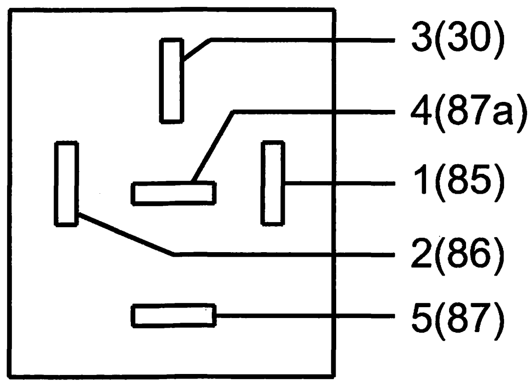
A0077582

Circuit	Pin
From Fuel Pump (GND)	3
GND (Ground)	4
LFP (Low Fuel Pump)	1
VPWR (Power supply)	2

Fuel Pump Relay

KA

Inertia Fuel Shutoff (IFS) Relay Connector



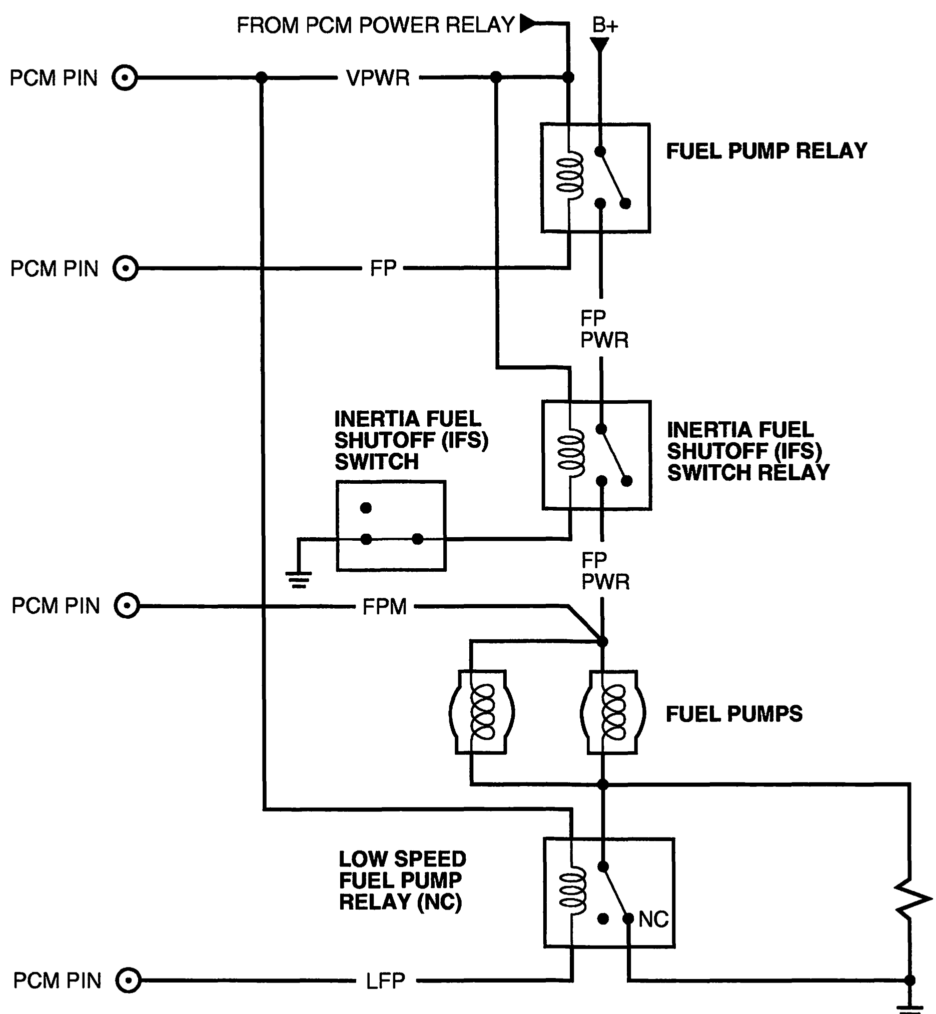
A0077582

Circuit	Pin
FPPWR-B (Fuel Pump Power - B)	5
FPPWR-A (Fuel Pump Power - A)	3
IFS (Inertia Fuel Shutoff)	2
VPWR (Power supply)	1

Fuel Pump Relay

KA

5.4L SC F-150 Heritage



A0085338

	Test Steps	Results →	Action to Take
KA1	KOEO DTC P0230: CHECK VPWR VOLTAGE TO FUEL PUMP RELAY		
	• FP Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **KA2**. REPAIR open circuit.

(+)FP Relay Connector, Harness Side	**(-)**
VPWR	Ground

- **Is the Voltage above 10.5 V?**

Fuel Pump Relay — KA

Test Steps		Results →	Action to Take
KA2	CHECK FUEL PUMP RELAY		
	• REFER to the pin numbers indicated on the FP relay. There will be either a pin 1 or pin 85. • Measure resistance between either pin 1 or pin 85 and all other pins of the relay. One measurement must be between 40 and 120 ohms, with the other measurements being greater than 10,000 ohms. • **Are all Resistance checks ok?**	Yes → No →	GO to **KA3**. INSTALL a new FP relay.
KA3	CHECK THE FP CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)FP Relay Connector, Harness Side: FP — (-): Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KA4**. REPAIR short circuit.
KA4	CHECK FUEL PUMP CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: (+)FP Relay Connector, Harness Side: FP — (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KA5**. REPAIR short circuit.
KA5	CHECK FUEL PUMP CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (+)FP Relay Connector, Harness Side: FP — (-)PCM Connector, Harness Side: FP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA6**. REPAIR open circuit.
KA6	CHECK KOEO DTCS:		
	• CHECK KOEO DTCs: • **Are DTCs P0231 or P0232 present?**	Yes → No →	GO to **KA7**. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Sub-tables:

KA3:

(+)FP Relay Connector, Harness Side	(-)
FP	Ground

KA4:

(+)FP Relay Connector, Harness Side	(-)
FP	Ground

KA5:

(+)FP Relay Connector, Harness Side	(-)PCM Connector, Harness Side
FP	FP

Fuel Pump Relay

KA

Test Steps		Results →	Action to Take
KA7	CHECK THE FP PRIMARY CIRCUIT INSIDE THE PCM		
	• PCM connector connected. • FP Relay connector connected. • Key ON Engine OFF. • Access the FPF PID using a scan tool. • **Is the PID state FAULT?**	Yes → No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). GO to **KA8**.
KA8	CHECK FUEL PUMP PRIMARY CIRCUIT INSIDE PCM WHILE CRANKING ENGINE		
	Note: The scan tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged. • Access the FPF PID using a scan tool. • While observing the PID, complete the following: — Crank the engine. • **Does the PID display indicate a fault during crank?**	Yes → No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). KEY OFF. Fuel pump primary circuit is OK in the harness and PCM GO to **KA9**.
KA9	IS DTC P0231 PRESENT IN KOEO SELF TEST		
	• CHECK KOEO DTCs: • **Is DTC P0231 present?**	Yes → No →	GO to **KA23**. DTC P0232 present GO to **KA10**.
KA10	KOEO DTC P0232: DOES THE ENGINE START?		
	• **Does the engine start?**	Yes → No →	GO to **KA11**. **For F-150 Heritage 5.4L SC** GO to **KA48**. **For All Others** GO to **KA17**.
KA11	VERIFY THAT FUEL PUMP IS OFF		
	• Key ON Engine OFF. • Wait for 5 seconds. • The fuel pump is located above the fuel tank. Listen for the sound of the fuel pump operating which can be heard from outside the vehicle. • **Is Fuel pump OFF with the key on?**	Yes → No →	GO to **KA13**. GO to **KA12**.

Fuel Pump Relay — KA

	Test Steps	Results	→	Action to Take
KA12	CHECK FOR FUEL PUMP RELAY CONTACTS ALWAYS CLOSED			
	• FP Relay connector disconnected. • Key ON Engine OFF. • **Is Fuel pump OFF with the key on?**	Yes	→	INSTALL a new FP relay.
		No	→	REPAIR short circuit to PWR. (FPPWR/FPM ckt)
KA13	CHECK FPM CIRCUIT FOR OPEN IN HARNESS			
	• PCM connector disconnected. • FP Relay connector disconnected. • Measure the Resistance between:	Yes	→	GO to **KA14**.
		No	→	REPAIR open circuit. (fault is between splice and PCM)

(+)FP Relay Connector, Harness Side	(-)PCM Connector, Harness Side
FPPWR	FPM

	Test Steps	Results	→	Action to Take
	• **Is the Resistance below 5 Ohm?**			
KA14	WAS KOEO DTC P0231 PRESENT?			
	• CHECK KOEO DTCs: • **Is DTC P0231 present?**	Yes	→	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No	→	**For F-150 Heritage 5.4L SC** GO to **KA16**. **For All Others** GO to **KA15**.
KA15	CHECK THE FPM PRIMARY CIRCUIT INSIDE THE PCM			
	• PCM connector connected. • FP Relay connector connected. • Key ON Engine OFF. • Access the PCM-FPM PID using a scan tool. • **Is the PID state OFF?**	Yes	→	KEY OFF. Fault is not present at this time The FPM circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No	→	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Fuel Pump Relay — KA

Test Steps		Results →	Action to Take
KA16	CHECK THE FPM PRIMARY CIRCUIT INSIDE THE PCM		
	• PCM connector connected. • FP Relay connector connected. • Key ON Engine OFF. • Access the PCM-FPM PID using a scan tool. • **Is the PID state OFF?**	Yes → No →	KEY OFF. GO to **KA46**. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
KA17	CHECK IF INERTIA FUEL SHUTOFF TRIPPED		
	• **Is IFS tripped?**	Yes → No →	Reset Switch GO to **KA18**.
KA18	CHECK INERTIA FUEL SHUTOFF		
	• IFS connector disconnected. • Measure the Resistance between: **(+)IFS Connector, Component Side**: FPPWR-A - Pin 2 **(-)IFS Connector, Component Side**: FPPWR-B - Pin 1 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA19**. INSTALL a new IFS.
KA19	CHECK FP PWR CIRCUIT FOR OPEN IN HARNESS		
	• FP Relay connector disconnected. • Measure the Resistance between: **(+)IFS Connector, Harness Side**: FPPWR-A - Pin 2 **(-)FP Relay Connector, Harness Side**: FPPWR • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA20**. REPAIR open circuit. CHECK for an open circuit between IFS & FPM splice REFER to wiring diagram.
KA20	CHECK FUEL PUMP GROUND CIRCUIT FOR OPEN IN HARNESS		
	• FP connector disconnected. • Measure the Resistance between: **(+)FP Connector, Harness Side**: FPGND **(-)**: Ground • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA21**. REPAIR open circuit.

Fuel Pump Relay — KA

Test Steps		Results →	Action to Take
KA21	CHECK FP PWR CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (+)FP Connector, Harness Side: FPPWR — (-)IFS Connector, Harness Side: FPPWR-B - Pin 1 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA22**. REPAIR open circuit.
KA22	CHECK INTERNAL RESISTANCE OF FUEL PUMP		
	• Measure the Resistance between: (+)FP Connector, Harness Side: FPPWR — (-)FP Connector, Harness Side: FPGND • **Is the Resistance below 10 Ohm?**	Yes → No →	The Fuel pump circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. Verify test step results Reconnect all disconnected components. Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed INSTALL a new FP.
KA23	KOEO DTC P0231: WAS KOEO DTC P0230 ALSO PRESENT?		
	• CHECK KOEO DTCs: • **Is DTC P0230 present?**	Yes → No →	GO to **KA1**. GO to **KA24**.
KA24	DOES THE ENGINE START?		
	• **Does the engine start?**	Yes → No →	GO to **KA13**. GO to **KA25**.
KA25	CHECK IF IFS TRIPPED		
	• **Is IFS tripped?**	Yes → No →	Reset Switch GO to **KA26**.
KA26	CHECK B+ CIRCUIT VOLTAGE TO FP RELAY		
	• FP Relay connector disconnected. • Measure the Voltage between: (+)FP Relay Connector, Harness Side: B+ — (-): Ground • **Is the Voltage above 10.5 V?**	Yes → No →	**For F-150 Heritage 5.4L SC** GO to **KA28**. **For All Others** GO to **KA27**. B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.

Measurement tables:

KA21:

(+)FP Connector, Harness Side	(-)IFS Connector, Harness Side
FPPWR	FPPWR-B - Pin 1

KA22:

(+)FP Connector, Harness Side	(-)FP Connector, Harness Side
FPPWR	FPGND

KA26:

(+)FP Relay Connector, Harness Side	(-)
B+	Ground

Fuel Pump Relay

KA

Test Steps		Results →	Action to Take
KA27	CHECK FP PWR CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (+)FP Relay Connector, Harness Side | (-) FPPWR | Ground • **Is the Resistance below 10 Ohm?**	Yes → No →	INSTALL a new FP relay. REPAIR open circuit. (open is between splice and FP relay) Note: Some applications may have the IFS in this part of the circuit. First verify that the IFS is set.
KA28	CHECK VPWR & IFS CIRCUIT TO IFS RLY		
	• IFS Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)IFS Relay Connector, Harness Side | (-)IFS Relay Connector, Harness Side VPWR - Pin 1 | IFS - Pin 2 • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **KA34**. GO to **KA29**.
KA29	CHECK VPWR CIRCUIT TO IFS RLY		
	• Measure the Voltage between: (+)IFS Relay Connector, Harness Side | (-) VPWR - Pin 1 | Ground • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **KA30**. REPAIR open circuit.
KA30	CHECK IF INERTIA FUEL SHUTOFF SWITCH TRIPPED		
	• **Is Inertia Fuel Shutoff tripped?**	Yes → No →	Reset Switch GO to **KA31**.
KA31	CHECK GROUND CIRCUIT TO INERTIA FUEL SHUTOFF SWITCH		
	• IFS connector disconnected. • Measure the Resistance between: (+)IFS Connector, Harness Side | (-) GND | Ground • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA32**. REPAIR open circuit.

Fuel Pump Relay — KA

Test Steps	Results →	Action to Take
KA32 CHECK IFS SWITCH		
• Measure the Resistance between: **(+)IFS Connector, Component Side**: IFS; **(-)IFS Connector, Component Side**: GND • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA33**. INSTALL a new IFS.
KA33 CHECK IFS CIRCUIT FOR OPEN IN HARNESS		
• Measure the Resistance between: **(+)IFS Relay Connector, Harness Side**: IFS - Pin 2; **(-)IFS Connector, Harness Side**: IFS • **Is the Resistance below 5 Ohm?**	Yes → No →	Fault is not present at this time Disregard DTC P0232 at this time Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed REPAIR open circuit.
KA34 CHECK FP PWR CIRCUIT CONTINUITY		
• Measure the Resistance between: **(+)FP Relay Connector, Harness Side**: FPPWR; **(-)IFS Relay Connector, Harness Side**: FPPWR-A - Pin 3 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA35**. REPAIR open circuit.
KA35 CHECK FUNCTIONALITY OF IFS RLY		
• Add jumper wire between the points described below: **Point A IFS Relay Connector, Component Side**: VPWR - Pin 1; **Point B Vehicle battery**: Positive post • Add jumper wire between the points described below: **Point A IFS Relay Connector, Component Side**: IFS - Pin 2; **Point B Vehicle battery**: Negative post • Measure the Resistance between: **(+)IFS Relay Connector, Component Side**: FPPWR-A - Pin 3; **(-)IFS Relay Connector, Component Side**: FPPWR-B - Pin 5 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA36**. INSTALL a new IFS relay.

Fuel Pump Relay — KA

Test Steps		Results →	Action to Take
KA36	CHECK FUNCTIONALITY OF FP RLY		
	• Add jumper wire between the points described below:	Yes →	REPAIR open circuit. BETWEEN: FPM splice and IFS RLY
		No →	INSTALL a new FP relay.

Point A FP Relay Connector, Component Side	Point B
FP	Ground

• Add jumper wire between the points described below:

Point A FP Relay Connector, Component Side	Point B Vehicle battery
VPWR	Positive post

• Measure the Resistance between:

(+)FP Relay Connector, Component Side	(-)FP Relay Connector, Component Side
B+	FPPWR

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
KA37	CONTINUOUS MEMORY DTC P0232: IS CONTINUOUS DTC P0230 PRESENT?		
	• CHECK Continuous Memory DTCs:	Yes →	GO to **KA40**.
	• **Is DTC P0230 present?**	No →	GO to **KA38**.

Fuel Pump Relay | KA

Test Steps		Results →	Action to Take
KA38	CHECK FUEL PUMP SECONDARY CIRCUITS FOR FAULT		
	Note: Be aware that P0232 could be set if the inertia fuel shutoff (IFS) switch was tripped then reset, or if power was supplied to the FP PWR circuit when the PCM expected the fuel pump to be off (i.e. fuel pump prime procedure). • Key ON Engine OFF. • Access the PCM-FPM PID using a scan tool. • Observe the FPM PID for an indication of a fault while completing the following: The FPM PID will turn ON when a fault is indicated. — Shake, wiggle, bend the FPPWR circuit between the FP RLY and the FP. — Shake, wiggle, bend the FP GND. — Shake, wiggle, bend the FPM circuit between the PCM and the splice to the FPPWR circuit. — Lightly tap on the FP & IFS & FP RLY (to simulate road shock). — For 5.4L SC F-Series: disconnect low speed fuel pump relay and note FPM PID. • **Is a fault indicated?**	Yes →	KEY OFF. For 5.4L SC F-Series: If the FPM PID is consistently on with the low speed fuel pump relay disconnected; VERIFY condition of fuel pump ground circuit resistor. If OK, REPAIR open circuit between low speed fuel pump relay, through resistor to splice. Otherwise, GO to "All others" Action to Take. All Others ISOLATE fault Repair as necessary.
		No →	KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Fuel Pump Relay

KA

Test Steps		Results	Action to Take
KA39	CONTINUOUS MEMORY DTC P0231: CHECK HARNESS		
	Note: Some applications have the FPM splice to the FP PWR circuit between the IFS switch and the FP. On those applications, be aware that P0231 could be set if the IFS switch was tripped then reset. • PCM connector disconnected. • Add jumper wire between the points described below:	Yes →	ISOLATE fault Repair as necessary.
		No →	Unable to duplicate or identify fault at this time. GO to **Z1**.

Point A PCM Connector, Harness Side	Point B
FP	Ground

- Key ON Engine OFF.
- Measure the Voltage between:

(+)PCM Connector, Harness Side	(-)
FPM	Ground

- The FP will turn on and voltage will be greater than 10 V.
- CHECK for an indication of a fault while completing the following (the voltage will change suddenly when a fault is detected):
  - — Shake, wiggle, bend the B+ supply to FPR.
  - — Shake, wiggle, bend the FP PWR circuit between the FPR and the FPM splice.
  - — Lightly tap on the FPR & IFS (to simulate road shock).

  For 5.4L SC F-Series:
  - — Shake, wiggle, bend the circuits connected to the IFSR.
  - — Lightly tap on the IFS & IFSR (to simulate road shock).
- Key OFF.
- Visually inspect the FPR and its loom connector for damage and corrosion, repair or clean as necessary.
- **Is a fault indicated?**

Fuel Pump Relay | KA

Test Steps		Results →	Action to Take
KA40	CONTINUOUS MEMORY DTC P0230: CHECK FP PRIMARY CIRCUITS		
	• Key ON Engine OFF. • Wait for 5 seconds. • Access the FPF PID using a scan tool. • Observe the FPF PID for an indication of a fault while completing the following: The PID will indicate a fault (or YES), when a fault is detected. Shake, wiggle, bend the FP circuit between the PCM and the FPR. Shake, wiggle, bend the VPWR circuit between the electronic engine control power relay and the FPR. Lightly tap on the FPR (to simulate road shock). • Key OFF. • Visually inspect the PCM connector and wires as far back as the main loom for damage. Repair or clean as appropriate. • Visually inspect the FPR connector and wires as far back as the main loom for damage. Repair or clean as appropriate. • **Is a fault indicated?**	Yes → No →	ISOLATE fault Repair as necessary. Unable to duplicate or identify fault at this time.
KA41	KOEO DTC P1232: CHECK VPWR CIRCUIT FOR OPEN IN HARNESS		
	• LSFP Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)LSFP Relay Connector, Harness Side** / **(-)**: VPWR - Pin 2 / Ground • **Is the Voltage below 10.5 V?**	Yes → No →	KEY OFF. GO to **KA42**. REPAIR open circuit.
KA42	CHECK LOW SPEED FUEL PUMP RELAY		
	• Measure resistance between pin 85 and all other pins of the Low Speed Fuel Pump Relay. One measurement must be between 40 and 100 ohms, with the other measurements being greater than 10,000 ohms. • **Are all Resistance checks ok?**	Yes → No →	GO to **KA43**. INSTALL a new LSFP relay.

Measurement table for KA41:

(+)LSFP Relay Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Fuel Pump Relay

KA

Test Steps		Results →	Action to Take
KA43	CHECK THE LOW FUEL PUMP CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)LSFP Relay Connector, Harness Side** / **(-)**: LFP - Pin 1 / Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KA44**. REPAIR short circuit.
KA44	CHECK LFP CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: **(+)LSFP Relay Connector, Harness Side** / **(-)**: LFP - Pin 1 / Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KA45**. REPAIR short circuit.
KA45	CHECK LFP CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)LSFP Relay Connector, Harness Side** / **(-)PCM Connector, Harness Side**: LFP - Pin 1 / LFP • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.
KA46	CHECK THE FUEL PUMP GROUND RESISTOR CIRCUIT FOR OPEN IN HARNESS		
	• LSFP Relay connector disconnected. • Key ON Engine OFF. • Access the FPM PID using a scan tool. • **Is the PID state OFF?**	Yes → No →	KEY OFF. No fault is present Disregard DTC P0232 at this time Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed REPAIR open circuit.

Fuel Pump Relay	KA

Test Steps		Results →	Action to Take
KA47	CONTINUOUS MEMORY DTC P1232: CHECK LOW SPEED FUEL PUMP PRIMARY CIRCUITS		
	• Key ON Engine OFF. • Wait for 5 seconds. • Access the LFPF PID using a scan tool. • Observe the LFPF PID for an indication of a fault while completing the following: Note: — The LFPF PID will indicate a fault (or YES), when a fault is detected. — Shake, wiggle, bend the VPWR circuit between electronic engine control power relay and the LSFPR. — Shake, wiggle, bend the LFP circuit between the PCM and the LSFPR. — Lightly tap on the LSFPR (to simulate road shock). • Key OFF. • Visually inspect the PCM and its loom connector for damage and corrosion, repair or clean as necessary. • Visually inspect the LSFPR connector and wires as far back as the main loom for damage. Repair or clean as appropriate. • **Is a fault indicated?**	Yes → No →	ISOLATE fault Repair as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.
KA48	CHECK FUEL PUMP GROUND RESISTOR		
	• LSFP Relay connector disconnected. • Measure the Resistance between: [(+)LSFP Relay Connector, Harness Side: FPGND — (-): Ground] • **Is the Resistance below 7 Ohm?**	Yes → No →	GO to **KA49**. REPAIR open circuit.
KA49	CHECK FOR AN OPEN CIRCUIT BETWEEN LSFPR & FP		
	• Repeat test for each Fuel Pump. • FP connector disconnected. • Measure the Resistance between: [(+)LSFP Relay Connector, Harness Side: FPGND — (-)FP Connector, Harness Side: FPGND] • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA50**. REPAIR open circuit.

KA48 measurement:

(+)LSFP Relay Connector, Harness Side	**(-)**
FPGND	Ground

KA49 measurement:

(+)LSFP Relay Connector, Harness Side	**(-)FP Connector, Harness Side**
FPGND	FPGND

Fuel Pump Relay | KA

Test Steps		Results →	Action to Take
KA50	CHECK INTERNAL RESISTANCE OF FP		
	• Repeat test for each Fuel Pump. • Measure the Resistance between: (+)FP Connector, Component Side: FPPWR-B — (-)FP Connector, Component Side: FPGND • **Is the Resistance below 10 Ohm?**	Yes → No →	GO to **KA51**. INSTALL a new FP.
KA51	CHECK FOR AN OPEN CIRCUIT BETWEEN FPM SPLICE AND FUEL PUMPS		
	• Repeat test for each Fuel Pump. • IFS Relay connector disconnected. • Measure the Resistance between: (+)IFS Relay Connector, Harness Side: FPPWR-B - Pin 5 — (-)FP Connector, Harness Side: FPPWR-B • **Is the Resistance below 5 Ohm?**	Yes → No →	No fault is present Disregard DTC P0232 at this time Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed REPAIR open circuit.
KA52	HARD START/LACKS POWER: CHECK GROUND CIRCUIT USED FOR HIGH SPEED FUEL PUMP OPERATION BETWEEN LSFP & GND		
	• LSFP Relay connector disconnected. • Measure the Resistance between: (+)LSFP Relay Connector, Harness Side: GND - Pin 4 — (-): Ground • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA53**. REPAIR open circuit.
KA53	CHECK FOR AN OPEN CIRCUIT BETWEEN LSFPR AND SPLICE TO GROUND CIRCUIT THAT GOES THROUGH RESISTOR		
	• Measure the Resistance between: (+)LSFP Relay Connector, Harness Side: From Fuel Pump (GND) - Pin 3 — (-): Ground • **Is the Resistance below 7 Ohm?**	Yes → No →	GO to **KA54**. REPAIR open circuit.

Fuel Pump Relay — KA

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KA54</td><td>CHECK FOR LOW SPEED FUEL PUMP CONTACTS ALWAYS CLOSED</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table>
<tr><th>(+)LSFP Relay Connector, Harness Side</th><th>(-)LSFP Relay Connector, Harness Side</th></tr>
<tr><td>FPGND</td><td>GND - Pin 4</td></tr>
</table>
Is the Resistance below 5 Ohm?
</td><td>Yes →

No →</td><td>High speed fuel pump circuits OK.
Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed
INSTALL a new LSFP relay.</td></tr>
<tr><td>KA55</td><td>KOEO AND KOER DTC P0230: CHECK FOR FP CIRCUIT CYCLING AT PDJB</td><td></td><td></td></tr>
<tr><td colspan="2">
Note: Related to applications with FP relay soldered on PDJB circuit board.
Disconnect PDJB connector that contains the FP circuit.
Connect non-powered test lamp between:
<table>
<tr><th>(+)PDJB Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>FP</td><td>Negative post</td></tr>
</table>
For F-Series and Excursion: (add following jumper to complete circuit).
Add jumper wire between the points described below:
<table>
<tr><th>Point A PDJB Connector, Harness Side</th><th>Point B</th></tr>
<tr><td>GND</td><td>Ground</td></tr>
</table>
Key ON Engine OFF.
Scan Tool Connected
Enter Output Test Mode (refer to section 2)
Command outputs ON
Command outputs OFF
Does the test lamp turn on and off when the output(s) are commanded on and off?
</td><td>Yes →
No →</td><td>GO to KA56.
KEY OFF.
GO to KA57.</td></tr>
<tr><td>KA56</td><td>CHECK VPWR VOLTAGE THROUGH FP RLY AT PDJB</td><td></td><td></td></tr>
<tr><td colspan="2">
Key ON Engine OFF.
Measure the Voltage between:
<table>
<tr><th>(+)PDJB Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>FP</td><td>Negative post</td></tr>
</table>
Is the Voltage above 10 V?
</td><td>Yes →

No →</td><td>Unable to duplicate or identify fault at this time.
Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed
INSTALL a new PDJB.</td></tr>
</table>

Fuel Pump Relay

KA

Test Steps		Results	→	Action to Take
KA57	CHECK THE FP CIRCUIT FOR SHORT TO POWER IN HARNESS			
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)PDJB Connector, Harness Side: FP — (-): Ground • **Is the Voltage below 1 V?**	Yes	→	KEY OFF. GO to **KA58**.
		No	→	REPAIR short circuit.
KA58	CHECK THE FUEL PUMP CIRCUIT FOR SHORT TO GROUND IN HARNESS			
	• Measure the Resistance between: (+)PDJB Connector, Harness Side: FP — (-): Ground • **Is the Resistance above 10 KOhm?**	Yes	→	GO to **KA59**.
		No	→	REPAIR short circuit.
KA59	CHECK THE FUEL PUMP CIRCUIT FOR OPEN IN HARNESS			
	• Measure the Resistance between: (+)PDJB Connector, Harness Side: FP — (-)PCM Connector, Harness Side: FP • **Is the Resistance below 5 Ohm?**	Yes	→	GO to **KA60**.
		No	→	REPAIR open circuit.
KA60	WAS KOEO DTC P0231, P0232 ALSO PRESENT?			
	• **Was KOEO DTC P0231, P0232 also present?**	Yes	→	GO to **KA61**.
		No	→	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
KA61	CHECK THE FUEL PUMP PRIMARY CIRCUIT INSIDE THE PCM			
	Note: The following step(s) will monitor the FPF PID to indicate if a fault is detected in the FP circuit in the PCM. • PCM connector connected. • PDJB connector connected. • Key ON Engine OFF. • Access the FPF PID using a scan tool. • **Is the PID state FAULT?**	Yes	→	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No	→	GO to **KA62**.

Fuel Pump Relay — KA

Test Steps		Results →	Action to Take
KA62	CHECK FUEL PUMP PRIMARY CIRCUIT INSIDE PCM WHILE CRANKING ENGINE		
	Note: The scan tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged. • Observe the FPF PID for an indication of a fault while completing the following: — Crank the engine. • **Does the PID display indicate a fault during crank?**	Yes → No →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). KEY OFF. GO to **KA63**.
KA63	WAS KOEO DTC P0231 ALSO PRESENT?		
	• **Was KOEO DTC P0231 also present?**	Yes → No →	GO to **KA80**. DTC P0232 present GO to **KA64**.
KA64	KOEO AND KOER DTC P0232: DOES THE ENGINE START?		
	Note: Related to applications with FP relay soldered on PDJB circuit board. • **Does the engine start?**	Yes → No →	GO to **KA65**. GO to **KA73**.
KA65	VERIFY THAT FP IS OFF		
	• Key ON Engine OFF. • Wait for 5 seconds. • The fuel pump is located above the fuel tank. Listen for the sound of the fuel pump operating which can be heard from outside the vehicle. • **Is FP OFF with the key on?**	Yes → No →	KEY OFF. GO to **KA69**. KEY OFF. GO to **KA66**.
KA66	CHECK FPPWR CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PDJB connector disconnected. • Key ON Engine OFF. • **Is FP OFF with the key on?**	Yes → No →	GO to **KA67**. REPAIR short circuit to PWR.
KA67	CHECK FOR FPR CONTACTS ALWAYS CLOSED		
	• PDJB connector connected. • Disconnect PDJB connector that contains the FPPWR circuit. • Key ON Engine OFF. • Wait for 5 seconds. • **Is FP OFF with the key on?**	Yes → No →	GO to **KA68**. INSTALL a new PDJB.

Fuel Pump Relay

KA

Test Steps		Results →	Action to Take
KA68	CHECK FPM CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PDJB connector connected. • PCM connector disconnected. • Key ON Engine OFF. • **Is FP OFF with the key on?**	Yes → No →	INSTALL a new PCM. REPAIR short circuit to PWR.
KA69	CHECK FUEL PUMP SECONDARY CIRCUITS FOR OPEN IN PDJB		
	• Disconnect PDJB connector that contains the FPPWR circuit. • Disconnect PDJB connector that contains the FPM circuit. • Measure the Resistance between: **(+)PDJB Connector, Component Side**: FPM — **(-)PDJB Connector, Component Side**: FPPWR-A • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA70**. REPAIR open circuit. INSTALL a new PDJB.
KA70	CHECK FPM CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: FPM — **(-)PDJB Connector, Harness Side**: FPM • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KA71**. REPAIR open circuit.
KA71	WAS KOEO DTC P0231 PRESENT?		
	• **Was KOEO DTC P0231 present?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). DTC P0232 present GO to **KA72**.

KA69 measurement:

(+)PDJB Connector, Component Side	(-)PDJB Connector, Component Side
FPM	FPPWR-A

KA70 measurement:

(+)PCM Connector, Harness Side	(-)PDJB Connector, Harness Side
FPM	FPM

Fuel Pump Relay

KA

Test Steps		Results →	Action to Take
KA72	CHECK FPM PID		
	• PCM connector connected. • PDJB connector disconnected. • Access the PCM-FPM PID using a scan tool. • **Is the PID state OFF?**	Yes →	KEY OFF. The FPM circuit is OK in the harness and PCM. Disregard DTC P0232 at this time. Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed
		No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
KA73	CHECK IF IFS TRIPPED		
	• **Is IFS tripped?**	Yes →	Reset Switch
		No →	GO to **KA74**.
KA74	CHECK IFS SWITCH		
	• Inertia switch connector disconnected. • Measure the Resistance between: **(+)IFS Connector, Component Side**: FPPWR-A - Pin 2 **(-)IFS Connector, Component Side**: FPPWR-B - Pin 1 • **Is the Resistance below 5 Ohm?**	Yes →	GO to **KA75**.
		No →	INSTALL a new IFS.
KA75	CHECK FUEL PUMP SECONDARY CIRCUITS FOR OPEN IN PDJB		
	• Disconnect PDJB connector that contains the FPPWR circuit. • Disconnect PDJB connector that contains the FPM circuit. • Measure the Resistance between: **(+)PDJB Connector, Component Side**: FPM **(-)PDJB Connector, Component Side**: FPPWR-A • **Is the Resistance below 5 Ohm?**	Yes →	GO to **KA76**.
		No →	REPAIR open circuit. INSTALL a new PDJB.
KA76	CHECK FPPWR CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)IFS Connector, Harness Side**: FPPWR-A - Pin 2 **(-)PDJB Connector, Harness Side**: FPPWR-A • **Is the Resistance below 5 Ohm?**	Yes →	GO to **KA77**.
		No →	REPAIR open circuit.

Fuel Pump Relay	KA

Test Steps		Results	→	Action to Take
KA77	CHECK FUEL PUMP GROUND CIRCUIT FOR OPEN IN HARNESS			
	• FP connector disconnected. • Measure the Resistance between: (+)FP Connector, Harness Side: FPGND; (-): Ground • **Is the Resistance below 5 Ohm?**	Yes	→	GO to **KA78**.
		No	→	REPAIR open circuit.
KA78	CHECK FPPWR CIRCUIT FOR OPEN IN HARNESS			
	• Measure the Resistance between: (+)IFS Connector, Harness Side: FPPWR-A - Pin 2; (-)FP Connector, Harness Side: FPPWR • **Is the Resistance below 5 Ohm?**	Yes	→	GO to **KA79**.
		No	→	REPAIR open circuit.
KA79	CHECK INTERNAL RESISTANCE OF FP			
	• Measure the Resistance between: (+)FP Connector, Harness Side: FPPWR; (-)FP Connector, Harness Side: FPGND • **Is the Resistance below 10 Ohm?**	Yes	→	All FP circuit checks are OK Verify test step results If all test steps are OK, Reconnect all disconnected components. Disregard DTC P0232 at this time Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed
		No	→	INSTALL a new FP.
KA80	KOEO AND KOER DTC P0231: WAS KOEO DTC P0230 ALSO PRESENT?			
	Note: Related to applications with FP relay soldered on PDJB circuit board. • CHECK PCM KOEO DTCs: • **Is DTC P0230 present?**	Yes	→	GO to **KA70**.
		No	→	GO to **KA81**.
KA81	KOEO DTC P0231: DOES THE ENGINE START?			
	• **Does the engine start?**	Yes	→	GO to **KA70**.
		No	→	GO to **KA82**.
KA82	CHECK THE FUEL PUMP FUSE			
	• **CHECK FP fuse. Is it ok?**	Yes	→	GO to **KA83**.
		No	→	Before replacing fuse : Check for damage to wiring. Check for a damaged or seized motor.

Measurement tables within test steps:

KA77:

(+)FP Connector, Harness Side	(-)
FPGND	Ground

KA78:

(+)IFS Connector, Harness Side	(-)FP Connector, Harness Side
FPPWR-A - Pin 2	FPPWR

KA79:

(+)FP Connector, Harness Side	(-)FP Connector, Harness Side
FPPWR	FPGND

Fuel Pump Relay — KA

Test Steps		Results →	Action to Take
KA83	CHECK FUEL PUMP SECONDARY CIRCUITS FOR OPEN IN PDJB		
	• Disconnect PDJB connector that contains the FPPWR circuit. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Measure the Voltage between: (+)PDJB Connector, Harness Side: FPPWR-A; (-): Ground • **Is the Voltage above 10.5 V?**	Yes →	All Fuel pump circuit checks are OK Verify test step results If all test steps are OK, Reconnect all disconnected components. Disregard DTC P0232 at this time Return to section 3, Step 1: Quick Test and CONTINUE diagnosis as directed
		No →	INSTALL a new PDJB.
KA84	CONTINUOUS MEMORY DTC P0230: CHECK FP PRIMARY CIRCUITS		
	Note: Related to applications with FP relay soldered on PDJB circuit board. • Key ON Engine OFF. • Wait for 5 seconds. • Access the FPF PID using a scan tool. • Observe the FPF PID for an indication of a fault while completing the following: The PID will indicate a fault (or YES), when a fault is detected. Shake, wiggle, bend the FP circuit between the PCM and the PDJB. Lightly tap on the PDJB (to simulate road shock). • Key OFF. • Visually inspect the PCM and its loom connector for damage and corrosion, repair or clean as necessary. Visually inspect the PDJB and its loom connector for damage and corrosion, repair or clean as necessary. • **Is a fault indicated?**	Yes →	ISOLATE fault Repair as necessary.
		No →	Unable to duplicate or identify fault at this time. GO to **Z1**.

KA83 measurement table:

(+)PDJB Connector, Harness Side	(-)
FPPWR-A	Ground

Fuel Pump Relay | KA

Test Steps		Results →	Action to Take
KA85	CONTINUOUS MEMORY DTC P0231: CHECK FUEL PUMP SECONDARY CIRCUITS FOR FAULT		
	• Disconnect PDJB connector that contains the FPPWR circuit. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Measure the Voltage between: (+)PDJB Connector, Harness Side / (-): FPPWR-A / Ground • Observe the Voltage for an indication of a fault while completing the following: Voltage will drop suddenly when a fault is detected. Be aware that Output Test Mode will turn off the FP after a calibrated time. If this happens, again command the outputs on to continue testing. — Lightly tap on the FP FUSE (to simulate road shock). — Lightly tap on the PDJB (to simulate road shock). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.
KA86	KOEO DTC P0232: CHECK FUEL PUMP SECONDARY CIRCUITS FOR FAULT		
	• CHECK Self-Test DTCs: • **Is DTC P0230 present?**	Yes → No →	GO to **KA84**. GO to **KA87**.

Voltage measurement table (KA85):

(+)PDJB Connector, Harness Side	(-)
FPPWR-A	Ground

Fuel Pump Relay | KA

Test Steps		Results →	Action to Take
KA87	KOEO DTC P0232: CHECK FUEL PUMP SECONDARY CIRCUITS FOR FAULT		
	Note: Be aware that P0232 could be set if the inertia fuel shutoff (IFS) switch was tripped then reset, or if power was supplied to the FP PWR circuit when the PCM expected the fuel pump to be off (i.e. fuel pump prime procedure). • Key ON Engine OFF. • Access the FPM PID using a scan tool. • Observe the PID for an indication of a fault while completing the following: The FPM PID will turn ON when a fault is indicated. Shake, wiggle, bend the FPPWR circuit between the FPPWR pin at the PDJB and the FP. Shake, wiggle, bend the FP GND. Shake, wiggle, bend the FPM circuit between the PDJB & PCM. Lightly tap on the FP (to simulate road shock). Lightly tap on the IFS (to simulate road shock). Lightly tap on the PDJB (to simulate road shock). • **Is the PID state FAULT?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Fuel Pump Driver Module	KB

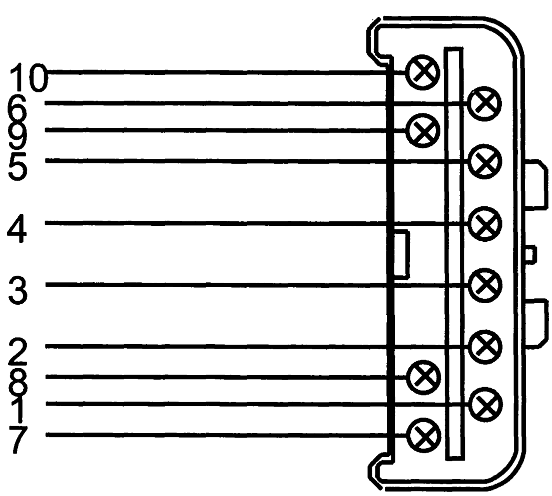
Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuit(s): Batt+, GND, FPDM GND, FPDMR GND, FPM, FP, FP PWR, FP RTN, FPDM PWR.
- Inertia Fuel Shutoff Switch (9341).
- Fuel Pump Driver Module (9D370).
- Fuel Pump Driver Module Power Supply Relay.
- Powertrain Control Module (PCM) (12A650).

Fuel Pump Driver Module (FPDM) Connector

A



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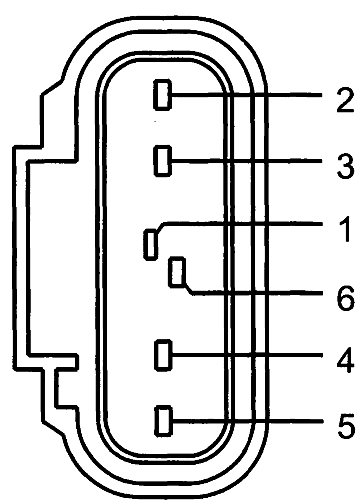
B

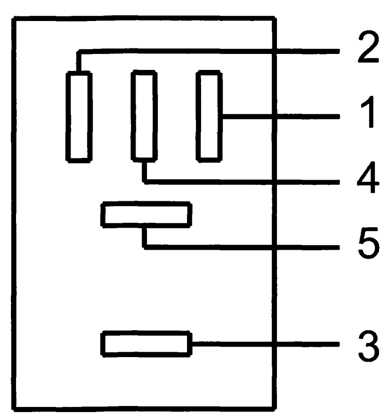


A0077514

# Fuel Pump Driver Module	KB

Vehicle	Connector	Circuit	Pin
Aviator, Crown Victoria, Focus, Grand Marquis, Marauder, Mustang, Sable, Taurus, Town Car	A	FPRTN FPPWR FP FPM GND FPDM PWR	4 7 6 10 5 8
All other vehicles	B	FPRTN FPPWR FP FPM GND FPDM PWR	2 4 6 1 3 5

Fuel Pump Driver Module Power (FPDM PWR) Relay Connector

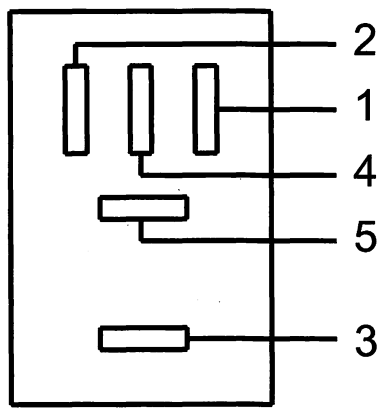


A0077584

Circuit	Pin
FPDM PWR (Fuel Pump Driver Module Power)	5
GND (Ground)	2
VPWR (Power supply)	1
B+ (Battery positive voltage)	3

Fuel Pump Driver Module | KB

Fuel Pump/Rear Electronics Module Power (FP/REM PWR) Relay Connector



A0077584

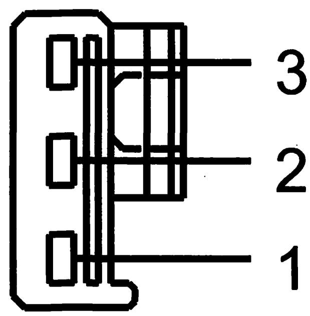
Circuit	Pin
REM/FP PWR (REM/Fuel Pump Power)	5
GND (Ground)	1
IGN START/RUN	2
B+ (Battery positive voltage)	3

Constant Control Relay Module (CCRM) Connector

Circuit	Pin
FPDM PWR (Fuel Pump Driver Module Power)	5
GND (Ground)	15
B+ (C)	11

Fuel Pump Driver Module	KB

Inertia Fuel Shutoff (IFS) Connector



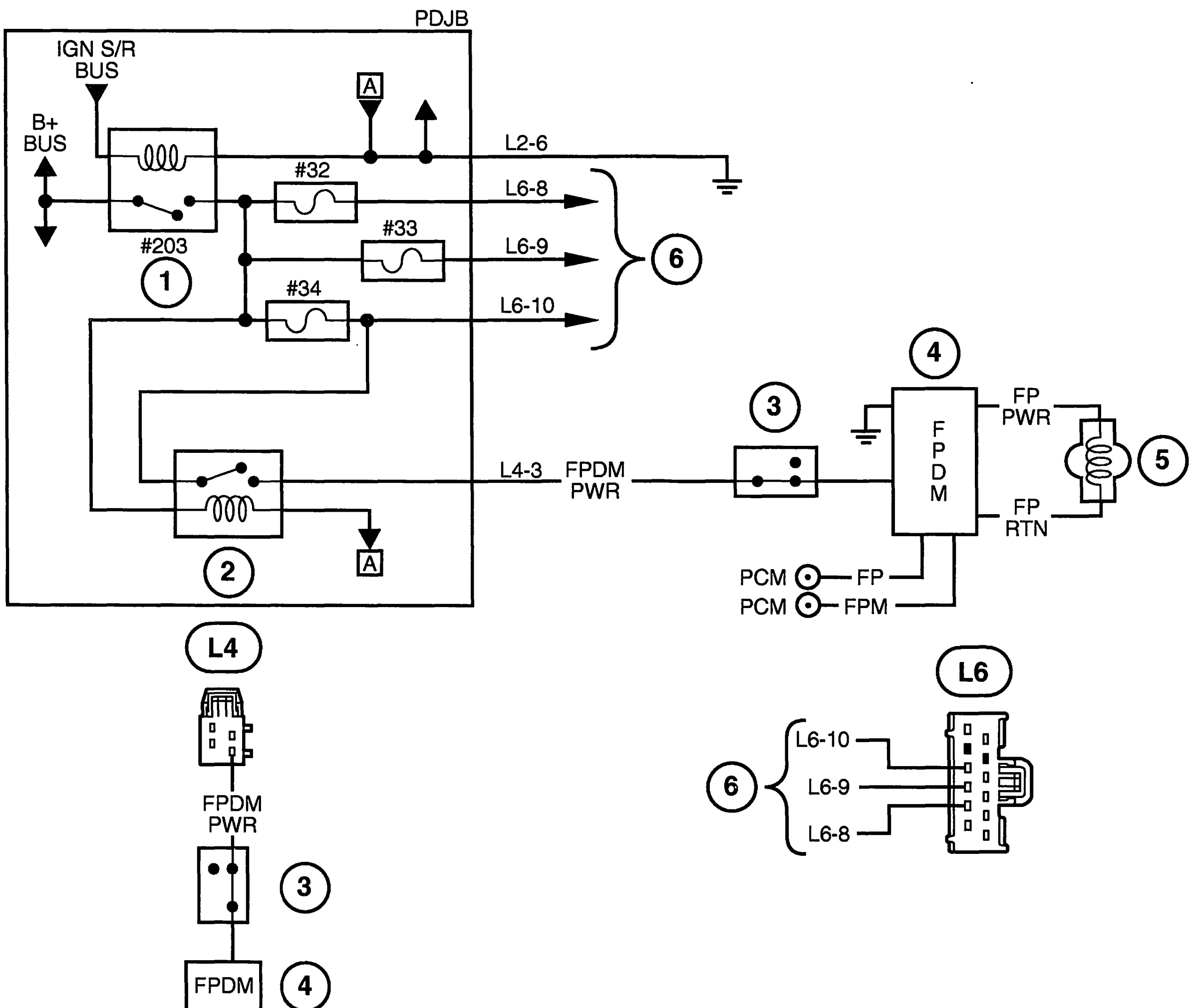
A0077528

Circuit	Pin
FPDMPWR-B (Fuel Pump Driver Module Power - B)	1
FPDMPWR-A (Fuel Pump Driver Module Power - A)	2

Fuel Pump Driver Module

KB

FPDM PWR relay soldered on PDJB (F-150)



A0080788

Item	Description
1	PCM Power Relay (#302)
2	Fuel Pump Relay (#202, soldered on circuit board)
3	Inertia Fuel Shutoff (IFS) Switch
4	Fuel Pump Driver Module (FPDM)
5	Fuel Pump

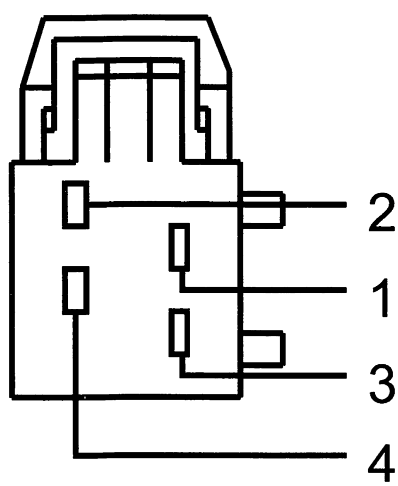
(Continued)

Fuel Pump Driver Module	KB

Item	Description
6	To Powertrain Control System
L4	Power Distribution Junction Box (PDJB) harness connector L4
L6	Power Distribution Junction Box (PDJB) harness connector L6

Power distribution junction box (PDJB) Connector

NOTE: For applications with FPDM PWR relay soldered on PDJB



A0077565

Circuit	Pin
FPDM PWR (Fuel Pump Driver Module Power)	3

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Fuel Pump Driver Module

KB

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	FP FPM	B58 B2
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	FP FPM	B12 B21
F-150	190 Pin	FP FPM	B62 B30
Focus 2.0L 2V	104 Pin	FP FPM	54 54
Focus 2.0L 4V, Focus 2.0L SVT	104 Pin	FP FPM	54 40
LS, Thunderbird	150 (60-32-58) Pin	FP	B49
All other vehicles	104 Pin	FP FPM	80 40

Test Steps		Results →	Action to Take
KB1	DTC P1233: IS DTC P1233 PRESENT IN KEY ON ENGINE OFF SELF-TEST?		
	• CHECK KOEO DTCs: • **Is DTC P1233 present?**	Yes →	A hard fault is present. GO to **KB2**.
		No →	The PCM is now receiving a signal from the FPDM. One possible cause of DTC P1233 is that the IFS switch was tripped, then reset. If engine now is a no start: Disregard DTC at this time. RETURN to Section 3 and continue as directed. After servicing no start, to diagnose intermittent causes of P1233, RETURN to this test step and follow "If engine will start:" path. If engine will start: GO to **KB22**.
KB2	DOES THE ENGINE START?		
	• **Does the engine start?**	Yes →	To check FPM circuit, GO to **KB18**.
		No →	Verify IFS switch is set (button depressed). If OK, GO to **KB3**.

Fuel Pump Driver Module — KB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KB3</td><td>CHECK POWER AND GROUND CIRCUITS TO THE FPDM
• FPDM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)FPDM Connector, Harness Side</th><th>(-)FPDM Connector, Harness Side</th></tr><tr><td>FPDM PWR</td><td>GND</td></tr></table>
• Is the Voltage above 10.5 V?</td>
<td>Yes →
No →</td><td>KEY OFF. INSTALL a new FPDM.
GO to KB4.</td></tr>
<tr><td>KB4</td><td>CHECK POWER TO FPDM
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)FPDM Connector, Harness Side</th><th>(-)</th></tr><tr><td>FPDM PWR</td><td>Ground</td></tr></table>
• Is the Voltage above 10.5 V?</td>
<td>Yes →
No →</td><td>REPAIR open circuit. (Open FPDM ground circuit)
KEY OFF.
No power to FPDM
For Mustang
GO to KB5.
For F-150
GO to KB14.
For All Others
GO to KB9.</td></tr>
<tr><td>KB5</td><td>CHECK B+ VOLTAGE TO CCRM
• CCRM connector disconnected.
• Measure the Voltage between:
<table><tr><th>(+)CCRM Connector, Harness Side</th><th>(-)</th></tr><tr><td>B+ (C) - Pin 11</td><td>Ground</td></tr></table>
• Is the Voltage above 10.5 V?</td>
<td>Yes →
No →</td><td>GO to KB6.
B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.</td></tr>
<tr><td>KB6</td><td>CHECK GROUND CIRCUIT TO CCRM
• Measure the Resistance between:
<table><tr><th>(+)CCRM Connector, Harness Side</th><th>(-)</th></tr><tr><td>GND - Pin 15</td><td>Ground</td></tr></table>
• Is the Resistance below 5 Ohm?</td>
<td>Yes →
No →</td><td>GO to KB7.
REPAIR open circuit.</td></tr>
<tr><td>KB7</td><td>CHECK THE FPDM CIRCUIT FOR OPEN IN HARNESS
• Measure the Resistance between:
<table><tr><th>(+)CCRM Connector, Harness Side</th><th>(-)FPDM Connector, Harness Side</th></tr><tr><td>FPDM PWR - Pin 5</td><td>FPDM PWR</td></tr></table>
• Is the Resistance below 5 Ohm?</td>
<td>Yes →
No →</td><td>INSTALL a new CCRM.
GO to KB8.</td></tr>
</table>

Fuel Pump Driver Module — KB

Test Steps	Results →	Action to Take
KB8 ISOLATE OPEN IN FPDM PWR CIRCUIT		
• IFS connector disconnected. • Measure the Resistance between:	Yes →	INSTALL a new IFS. (Harness is OK.)
	No →	REPAIR open circuit.

(+)CCRM Connector, Harness Side	(-)IFS Connector, Harness Side
FPDM PWR - Pin 5	FPDMPWR-A - Pin 2

• Measure the Resistance between:

(+)FPDM Connector, Harness Side	(-)IFS Connector, Harness Side
FPDM PWR	FPDMPWR-B - Pin 1

• **Is the Resistance below 5 Ohm?**

Test Steps	Results →	Action to Take
KB9 CHECK B+ VOLTAGE TO FPDM POWER SUPPLY RELAY		
• FPDM PWR Relay connector disconnected. • Measure the Voltage between:	Yes →	GO to **KB10**.
	No →	B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.

(+)FPDM PWR Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

• **Is the Voltage above 10.5 V?**

Test Steps	Results →	Action to Take
KB10 CHECK VPWR VOLTAGE TO FPDM POWER SUPPLY RELAY		
• Key ON Engine OFF. • Measure the Voltage between:	Yes →	GO to **KB11**.
	No →	REPAIR open circuit.

(+)FPDM PWR Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

• **Is the Voltage above 10.5 V?**

Test Steps	Results →	Action to Take
KB11 CHECK FOR GROUND TO FPDM POWER SUPPLY RELAY		
• Measure the Resistance between:	Yes →	GO to **KB12**.
	No →	REPAIR open circuit.

(+)FPDM PWR Relay Connector, Harness Side	(-)
GND - Pin 2	Ground

• **Is the Resistance below 5 Ohm?**

Fuel Pump Driver Module | KB

Test Steps		Results →	Action to Take
KB12	CHECK THE FPDM PWR CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between:	Yes →	INSTALL a new FPDM relay.
		No →	GO to **KB13**.

(+)FPDM Connector, Harness Side	(-)FPDM PWR Relay Connector, Harness Side
FPDM PWR	FPDM PWR - Pin 5

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
KB13	ISOLATE OPEN IN FPDM CIRCUIT		
	• IFS connector disconnected. • Measure the Resistance between:	Yes →	INSTALL a new IFS. (Verify that the IFS switch is set (button depressed).)
		No →	REPAIR open circuit.

(+)FPDM Connector, Harness Side	(-)IFS Connector, Harness Side
FPDM PWR	FPDMPWR-B - Pin 1

• Measure the Resistance between:

(+)FPDM PWR Relay Connector, Harness Side	(-)IFS Connector, Harness Side
FPDM PWR - Pin 5	FPDMPWR-A - Pin 2

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
KB14	CHECK FUEL PUMP FUSE		
	Note: These steps are for applications with FPDM PWR relay soldered on PDJB. • CHECK FPDM power supply relay fuse. (located on PDJB). • **Is the fuse OK?**	Yes →	GO to **KB15**.
		No →	INSTALL a new Component: Fuse. (CHECK associated circuits for short to ground before replacing fuse.)
KB15	CHECK POWER TO IFS		
	• IFS connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **KB17**.
		No →	KEY OFF. GO to **KB16**.

(+)IFS Connector, Harness Side	(-)
FPDMPWR-A - Pin 2	Ground

• **Is the Voltage above 10.5 V?**

Fuel Pump Driver Module — KB

Test Steps		Results →	Action to Take
KB16	CHECK FPDM PWR CIRCUIT FOR OPEN BETWEEN IFS AND PDJB		
	• PDJB connector disconnected. (connector with FPDM PWR circuit) • Measure the Resistance between: (+)IFS Connector, Harness Side: FPDMPWR-A - Pin 2 (-)PDJB Connector, Harness Side: FPDM PWR - Pin 3 • **Is the Resistance below 5 Ohm?**	Yes →	Again, Check the fuel pump fuse. If OK, REPLACE FP RLY/PDJB.
		No →	REPAIR open circuit.
KB17	CHECK IFS FOR OPEN		
	• Measure the Resistance between: (+)IFS Connector, Component Side: FPDMPWR-A - Pin 2 (-)IFS Connector, Component Side: FPDMPWR-B - Pin 1 • **Is the Resistance below 5 Ohm?**	Yes →	REPAIR open circuit. (Open FPDM PWR circuit)
		No →	INSTALL a new IFS.
KB18	CHECK THE FPM CIRCUIT FOR OPEN IN HARNESS		
	• FPDM connector disconnected. • PCM connector disconnected. • Measure the Resistance between: (+)FPDM Connector, Harness Side: FPM (-)PCM Connector, Harness Side: FPM • **Is the Resistance below 5 Ohm?**	Yes →	GO to **KB19**.
		No →	REPAIR open circuit.
KB19	CHECK THE FPM CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: (+)FPDM Connector, Harness Side: FPM (-): Ground • **Is the Voltage below 1 V?**	Yes →	KEY OFF. GO to **KB20**.
		No →	REPAIR short circuit.
KB20	CHECK THE FPM CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: (+)FPDM Connector, Harness Side: FPM (-): Ground • **Is the Resistance above 10 KOhm?**	Yes →	GO to **KB21**.
		No →	REPAIR short circuit.

Fuel Pump Driver Module — KB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KB21</td><td>CHECK FOR FPM OUTPUT FROM FPDM
• FPDM connector connected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>FPM</td><td>Ground</td></tr>
</table>
• Is the Voltage between 0.02 V - 1 V?
Note: It is OK for the voltage to cycle below this range and then return within range.</td>
<td>Yes →

No →</td>
<td>INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

INSTALL a new FPDM.</td></tr>
<tr><td>KB22</td><td>CHECK CIRCUITS THAT MAY CAUSE AN INTERMITTENT LOSS OF POWER SUPPLY TO THE FPDM
Note: Be aware that P1233 could be set if the inertia fuel shutoff IFS switch was tripped then reset.
• Key ON Engine OFF.
• Access the PCM-FPM PID using a scan tool.
Note: With no fault detected, the FPDM will send a 50 percent duty cycle (all OK) to the PCM on the FPM circuit. Depending on scan tools, the FPM PID may display 50 percent, or a random value that is fluctuating between 85 and 115 percent.
• Observe the FPM PID for an indication of a fault while completing the following: (look for the FPM PID to change from the 50 percent value, or to stop fluctuating).
• Shake, wiggle, bend the following circuits:
— FPDM GND.
— FPDM PWR circuit to FPDM.
— FPM circuit between the FPDM and the PCM.
— B+ and ground circuits to FPDM power supply relay (for application with CCRM, CCRM pins 11 and 18).
— Lightly tap on the IFS (to simulate road shock).
— Lightly tap on the FPDM (to simulate road shock).
— Lightly tap on the FPDM power supply relay (to simulate road shock).
• Key OFF.
• Is a fault indicated?</td>
<td>Yes →

No →</td>
<td>ISOLATE fault and REPAIR as necessary.

Unable to duplicate or identify fault at this time.
GO to Z1.</td></tr>
</table>

Fuel Pump Driver Module

KB

Test Steps		Results →	Action to Take
KB23	DTC P1235: IS DTC P1235 PRESENT IN KOEO SELF TEST		
	Note: For ETC applications, check if ETC DTC P2105 is present. An ETC system concern could cause a P1235, and should be diagnosed first. • CHECK KOEO DTCs: • **Is DTC P1235 present?**	Yes → No →	GO to **KB24**. **For LS, and Thunderbird** GO to **KB32**. **For All Others** GO to **KB33**.
KB24	CHECK FP CIRCUIT FOR OPEN IN HARNESS		
	Note: For LS6/LS8 and Thunderbird the FPDM functions are incorporated in the Rear Electronics Module REM. In the following steps, if directed to perform an action with the FPDM, complete the action with the REM. • FPDM connector disconnected. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: FP — **(-)FPDM Connector, Harness Side**: FP • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KB25**. REPAIR open circuit.
KB25	CHECK THE FP CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)FPDM Connector, Harness Side**: FP — **(-)**: Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KB26**. REPAIR short circuit.
KB26	CHECK FP CIRCUIT FOR SHORT TO GROUND		
	• Measure the Resistance between: **(+)FPDM Connector, Harness Side**: FP — **(-)**: Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	**For LS, and Thunderbird** GO to **KB28**. **For All Others** GO to **KB27**. REPAIR short circuit.

Fuel Pump Driver Module

KB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KB27</td><td>CHECK FP CIRCUIT IN FPDM</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
INSTALL a new FPDM.</td></tr>
<tr><td colspan="2">• FPDM connector connected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)</th></tr><tr><td>FP</td><td>Ground</td></tr></table>• Is the Voltage between 4.5 V - 5.5 V?</td></tr>
<tr><td>KB28</td><td>CHECK FPF PID</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to KB31.
GO to KB29.</td></tr>
<tr><td colspan="2">• Key ON Engine OFF.
• Access the PCM-FPF PID using a scan tool.
• While viewing the FPF PID, check if PID indicates YES sometime within 20 seconds.
• Does the FPF PID indicate YES sometime within 20 seconds?</td></tr>
<tr><td>KB29</td><td>CHECK FP PID</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to KB30.
KEY OFF. INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).</td></tr>
<tr><td colspan="2">• Access the PCM-FP PID using a scan tool.
• Is the Duty Cycle between 70% - 80%?</td></tr>
<tr><td>KB30</td><td>CHECK PWM_DC1 PID</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
No fault found.
Disregard DTC P1235 at this time
Return to Section 3 to continue diagnosis.
INSTALL a new REM.</td></tr>
<tr><td colspan="2">• Access the REM-PWM_DC1 PID using a scan tool.
• Is the Duty Cycle between 70% - 80%?</td></tr>
<tr><td>KB31</td><td>CHECK REM CIRCUITRY VOLTAGE ON FP CIRCUIT AT PCM</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
INSTALL a new REM.</td></tr>
<tr><td colspan="2">• Key OFF.
• PCM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)</th></tr><tr><td>FP</td><td>Ground</td></tr></table>• Is the Voltage above 8 V?</td></tr>
</table>

Fuel Pump Driver Module — KB

Test Steps		Results →	Action to Take
KB32	CHECK FP CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Key ON Engine OFF. • Access the REM-PWM_DC1 PID using a scan tool. • Observe the PWM_DC1 PID for an indication of a fault while completing the following: (the PID value will change when a fault is detected). — Shake, wiggle, bend the FP circuit between the PCM and REM. — Lightly tap on the FPDM (to simulate road shock). • **Is a fault indicated?**	Yes →	ISOLATE fault and REPAIR as necessary.
		No →	KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.
KB33	CHECK FP CIRCUIT FOR INTERMITTENT OPEN OR SHORTS		
	• Key ON Engine OFF. • Access the PCM-FPM PID using a scan tool. Note: With no fault detected, the FPDM will send a 50 percent duty cycle (all OK) to the PCM on the FPM circuit. Depending on scan tools, the FPM PID may display 50 percent, or a random value that is fluctuating between 85 and 115 percent. • Observe the FPM PID for an indication of a fault while completing the following: (look for the FPM PID to change from the 50 percent value, or to stop fluctuating). — Shake, wiggle, bend the FP circuit between FPDM and the PCM. — Lightly tap on the FPDM (to simulate road shock). • **Is a fault indicated?**	Yes →	ISOLATE fault and REPAIR as necessary.
		No →	KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.
KB34	DTC P1237: IS DTC P1237 PRESENT IN KOEO SELF TEST		
	• CHECK KOEO DTCs: • **Is DTC P1237 present?**	Yes →	A hard fault is present. GO to **KB35**.
		No →	DTC P1237 is possibly intermittent. **For LS, and Thunderbird** GO to **KB52**. **For All Others** GO to **KB41**.

Fuel Pump Driver Module — KB

Test Steps		Results →	Action to Take
KB35	DOES THE ENGINE START?		
	• **Does the engine start?**	Yes →	**For LS, and Thunderbird** GO to **KB62.** **For All Others** GO to **KB44.**
		No →	**For LS, and Thunderbird** GO to **KB46.** **For All Others** GO to **KB36.**
KB36	CHECK FPPWR, FPRTN AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE		
	• FPDM connector disconnected. • Measure the Resistance between: (+)FPDM Connector, Harness Side: FPPWR; (-)FPDM Connector, Harness Side: FPRTN • **Is the Resistance below 10 Ohm?**	Yes →	GO to **KB37.**
		No →	To isolate fault, GO to **KB40.**
KB37	CHECK THE FPRTN CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: (+)FPDM Connector, Harness Side: FPRTN; (-): Ground • **Is the Voltage below 1 V?**	Yes →	GO to **KB38.**
		No →	REPAIR short circuit.
KB38	CHECK THE FPPWR CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• FP connector disconnected. • Measure the Resistance between: (+)FPDM Connector, Harness Side: FPPWR; (-): Ground • **Is the Resistance above 10 KOhm?**	Yes →	GO to **KB39.**
		No →	REPAIR short circuit.

KB36 measurement:

(+)FPDM Connector, Harness Side	**(-)FPDM Connector, Harness Side**
FPPWR	FPRTN

KB37 measurement:

(+)FPDM Connector, Harness Side	**(-)**
FPRTN	Ground

KB38 measurement:

(+)FPDM Connector, Harness Side	**(-)**
FPPWR	Ground

Fuel Pump Driver Module — KB

<table>
<tr><th>Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KB39 CHECK FOR VOLTAGE TO FP</td><td></td><td></td></tr>
<tr><td>

FPDM connector connected.
FP connector disconnected.
Key ON Engine OFF.
Scan Tool Connected
Enter Output Test Mode (refer to section 2)
Command outputs ON
Measure the Voltage between:

<table>
<tr><th>(+)FP Connector, Harness Side</th><th>(-)FP Connector, Harness Side</th></tr>
<tr><td>FPPWR</td><td>FPRTN</td></tr>
</table>

Is the Voltage above 10 V?
Note: During Output Test Mode, the fuel pump will stay commanded on for only about 5 seconds.

</td><td>Yes →

No →</td><td>INSTALL a new FP.

Verify vehicle battery was at proper charge during test.
Verify pump on command did not time-out before voltage check was made.
If OK, REPLACE FPDM.</td></tr>
<tr><td>KB40 ISOLATE OPEN IN FP CIRCUIT</td><td></td><td></td></tr>
<tr><td>

FP connector disconnected.
Measure the Resistance between:

<table>
<tr><th>(+)FP Connector, Harness Side</th><th>(-)FPDM Connector, Harness Side</th></tr>
<tr><td>FPPWR</td><td>FPPWR</td></tr>
<tr><td>FPRTN</td><td>FPRTN</td></tr>
</table>

Measure the Resistance between:

<table>
<tr><th>(+)FP Connector, Component Side</th><th>(-)FP Connector, Component Side</th></tr>
<tr><td>FPPWR</td><td>FPRTN</td></tr>
</table>

Is the Resistance below 10 Ohm?

</td><td>Yes →

No →</td><td>No fault found.
Repeat test, if necessary, to verify results.
If possible, attempt to load test circuits.
(If possible, a headlamp bulb could be used for this test. The added current draw of the headlamp bulb will help test the circuits under load.)

REPAIR open circuit.
If open was internal to pump, REPLACE FP</td></tr>
<tr><td>KB41 VERIFY THAT DTC P1237 IS INTERMITTENT</td><td></td><td></td></tr>
<tr><td>

Key ON Engine OFF.
Access the PCM-FPM PID using a scan tool.
Is the FPM PID 75 percent (or varying between 250 and 400 percent).

</td><td>Yes →

No →</td><td>A hard fault is present.
GO to KB35.

DTC P1237 is possibly intermittent.
GO to KB42.</td></tr>
</table>

Fuel Pump Driver Module — KB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KB42</td><td>CHECK FPPWR & FPRTN CIRCUIT FOR INTERMITTENT OPEN OR SHORTS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">ISOLATE fault and REPAIR as necessary.
KEY OFF.
GO to KB43.</td></tr>
<tr><td colspan="2">
• Key ON Engine OFF.
• Access the PCM-FPM PID using a scan tool.
Note: With no fault detected, the FPDM will send a 50 percent duty cycle (all OK) to the PCM on the FPM circuit. Depending on scan tools, the FPM PID may display 50 percent, or a random value that is fluctuating between 85 and 115 percent.
• Observe the FPM PID for an indication of a fault while completing the following: (look for the FPM PID to change from the 50 percent value, or to stop fluctuating).
— Shake, wiggle, bend the FPPWR & FPRTN circuit between the FPDM and the FP.
— Lightly tap on the FP & FPDM (to simulate road shock).
• Is a fault indicated?</td></tr>
<tr><td>KB43</td><td>CHECK FPPWR CIRCUIT FOR SHORT TO GROUND IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">ISOLATE fault and REPAIR as necessary.
KEY OFF.
Unable to duplicate or identify fault at this time.
GO to Z1.</td></tr>
<tr><td colspan="2">
• FPDM connector disconnected.
• Connect non-powered test lamp between:
<table>
<tr><th>(+)FPDM Connector, Harness Side</th><th>(-)FPDM Connector, Harness Side</th></tr>
<tr><td>FPPWR</td><td>FPDM PWR</td></tr>
</table>
• Key ON Engine OFF.
• Observe test lamp for an indication of a fault while completing the following (the lamp will turn ON when a fault is detected):
— Shake, wiggle, bend the FPPWR circuit between the FPDM and the FP.
• Is a fault indicated?</td></tr>
<tr><td>KB44</td><td>CHECK THE FPPWR CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to KB45.
REPAIR short circuit to PWR.</td></tr>
<tr><td colspan="2">
• FPDM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table>
<tr><th>(+)FPDM Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>FPPWR</td><td>Ground</td></tr>
</table>
• Is the Voltage below 1 V?</td></tr>
</table>

Fuel Pump Driver Module — KB

Test Steps	Results →	Action to Take

KB45 CHECK FPRTN CIRCUIT FOR SHORT TO GROUND IN HARNESS

- FPDM connector disconnected.
- Key ON Engine OFF.
- Measure the Voltage between:

(+)FPDM Connector, Harness Side	(-)FPDM Connector, Harness Side
FPDM PWR	FPRTN

- **Is the Voltage below 1 V?**

Results	Action to Take
Yes →	INSTALL a new FPDM.
No →	REPAIR short circuit to GND.

KB46 CHECK REM/FP PWR AND GROUND CIRCUIT TO REM PINS J1-1, J1-2

Note: Verify IFS is not tripped.

- REM-J1 connector disconnected.
- Key ON Engine OFF.
- Measure the Voltage between:

(+)REM-J1 Connector, Harness Side	(-)REM-J1 Connector, Harness Side
REM/FP PWR	GND

- **Is the Voltage above 10.5 V?**

Results	Action to Take
Yes →	KEY OFF. For these applications, the FPDM functions are incorporated in the Rear Electronics Module REM. In the following steps, if directed to perform an action with the FPDM, complete the action with the REM. GO to **KB36**.
No →	GO to **KB47**.

KB47 CHECK REM/FP PWR CIRCUIT VOLTAGE TO REM USING CHASSIS GROUND AS A REFERENCE

- Key ON Engine OFF.
- Measure the Voltage between:

(+)REM-J1 Connector, Harness Side	(-)
REM/FP PWR	Ground

- **Is the Voltage above 10.5 V?**

Results	Action to Take
Yes →	REPAIR open circuit. (Open FPDM ground circuit)
No →	KEY OFF. GO to **KB48**.

KB48 CHECK B+ VOLTAGE TO FP/REM POWER SUPPLY RELAY

- FP/REM PWR Relay connector disconnected.
- Measure the Voltage between:

(+)FP/REM PWR Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground

- **Is the Voltage above 10.5 V?**

Results	Action to Take
Yes →	GO to **KB49**.
No →	B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.

Fuel Pump Driver Module — KB

Test Steps		Results →	Action to Take
KB49	CHECK FOR IGN START/RUN VOLTAGE (THROUGH IFS SWITCH) TO RELAY HARNESS CONNECTOR		
	• REM-J3 connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **KB50**.
		No →	To isolate fault, GO to **KB54**.

(+)FP/REM PWR Relay Connector, Harness Side	**(-)**
IGN START/RUN - Pin 2	Ground

• **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
KB50	CHECK GROUND CIRCUIT TO FP/REM PWR RLY		
	• Measure the Resistance between:	Yes →	GO to **KB51**.
		No →	REPAIR open circuit.

(+)FP/REM PWR Relay Connector, Harness Side	**(-)**
GND - Pin 1	Ground

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
KB51	CHECK REM/FP PWR CIRCUIT CONTINUITY		
	• Measure the Resistance between:	Yes →	INSTALL a new FP/REM PWR relay.
		No →	REPAIR open circuit.

(+)FP/REM PWR Relay Connector, Harness Side	**(-)REM-J1 Connector, Harness Side**
REM/FP PWR - Pin 5	REM/FP PWR

• **Is the Resistance below 5 Ohm?**

Fuel Pump Driver Module — KB

Test Steps		Results →	Action to Take
KB52	CHECK THE REMJ1 GND & CIRCUITS ASSOCIATED WITH THE FPDM PWR RLY FOR INTERMITTENTS		
	• REMJ1 connector disconnected. • Connect non-powered test lamp between: (+)REM-J1 Connector, Harness Side: REM/FP PWR; (-)REM-J1 Connector, Harness Side: GND • Key ON Engine OFF. • Observe test lamp for an indication of a fault while completing the following (the lamp will turn OFF when a fault is detected): — Shake, wiggle, bend the REM/FP PWR and GND circuits to REM. — Shake, wiggle, bend the circuits going to the FPDM PWR RLY. — Lightly tap on the FPDM PWR RLY & IFS (to simulate road shock). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **KB53**.
KB53	CHECK FPPWR & FPRTN CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Measure the Resistance between: (+)REM-J1 Connector, Harness Side: FPPWR; (-)REM-J1 Connector, Harness Side: FPRTN • Observe DVOM for an indication of a fault while completing the following (Resistance will change suddenly when a fault is detected): — Shake, wiggle, bend the FPPWR and FPRTN circuits between the FP & REM. • Measure the Resistance between: (+)REM-J1 Connector, Harness Side: FPRTN; (-): Ground • Observe DVOM for an indication of a fault while completing the following (Resistance will change suddenly when a fault is detected): — Shake, wiggle, bend the FPPWR and FPRTN circuits between the FP & REM. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. Unable to duplicate or identify fault at this time. RECONNECT REM GO to **Z1**.

KB52 test lamp connection:

(+)REM-J1 Connector, Harness Side	(-)REM-J1 Connector, Harness Side
REM/FP PWR	GND

KB53 resistance measurements:

(+)REM-J1 Connector, Harness Side	(-)REM-J1 Connector, Harness Side
FPPWR	FPRTN

(+)REM-J1 Connector, Harness Side	(-)
FPRTN	Ground

Fuel Pump Driver Module — KB

Test Steps		Results →	Action to Take
KB54	ISOLATE OPEN IN IGN START/RUN CIRCUIT		
	• IFS connector disconnected. • Measure the Resistance between: **(+)IFS Connector, Component Side**: IGN START/RUN-A; **(-)IFS Connector, Component Side**: IGN START/RUN-B • Measure the Resistance between: **(+)FPDM PWR Relay Connector, Harness Side**: IGN START/RUN; **(-)IFS Connector, Harness Side**: IGN START/RUN-B • **Is the Resistance below 5 Ohm?**	Yes → No →	REPAIR open circuit. INSTALL a new IFS.
KB55	SENT HERE FROM PINPOINT TEST HC WITH NO LOW VOLTAGE AT FUEL PUMP AND NO DTC: CHECK BATTERY VOLTAGE WITH OUTPUTS COMMANDED ON		
	Note: For applications with FPDM functions performed by REM, verify REM Self-Test has been previously performed. • FP connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)Vehicle battery**: Positive post; **(-)Vehicle battery**: Negative post • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Note voltage within 5 seconds. • Command outputs OFF • Note voltage within 5 seconds. • **Was battery voltage greater than 11.0 volts?**	Yes → No →	GO to **KB56**. Battery voltage is low. REFER to Section 414 of the Workshop Manual.
KB56	CHECK GROUND CIRCUIT TO FP		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)FP Connector, Harness Side**: FPPWR; **(-)Vehicle battery**: Negative post • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Note voltage within 5 seconds. • **Is the voltage greater than 10.5 volts?**	Yes → No →	GND fault to FP indicated. CHECK all associated wiring and connections for the FP and FPDM ground circuits. REPAIR as necessary. KEY OFF. GO to **KB57**.

Fuel Pump Driver Module

KB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KB57</td><td>CHECK VOLTAGE TO FPDM</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to KB58.

KEY OFF.
Improper voltage is being supplied to FPDM
For Mustang
GO to KB61.
For All Others
GO to KB59.</td></tr>
<tr><td></td><td>Note: For LS6/LS8 and Thunderbird, the FPDM functions are incorporated in the REM.
In the following steps, if directed to complete an action with the FPDM, complete the action with the REM.
• FPDM connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)FPDM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>FPDM PWR</td><td>Negative post</td></tr></table>• Is the Voltage above 10.5 V?</td></tr>
<tr><td>KB58</td><td>CHECK VOLTAGE ON THE FP PWR CIRCUIT</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF. INSTALL a new FPDM.
Before replacing component or connector:
Check for pinched or chaffed wires, signs of corrosion or resistance to ground.
Repeat test, if necessary, to verify results.

KEY OFF.
REMOVE jumper wire(s)
CHECK for causes of high resistance in FP PWR circuit.</td></tr>
<tr><td></td><td>• Add jumper wire between the points described below:
<table><tr><th>Point A FPDM Connector, Harness Side</th><th>Point B FPDM Connector, Harness Side</th></tr><tr><td>FPDM PWR</td><td>FPPWR</td></tr></table>• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)FP Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>FPPWR</td><td>Negative post</td></tr></table>• Is the voltage greater than 10.5 volts? and within 0.5 volts of the reading in KB53?</td></tr>
<tr><td>KB59</td><td>CHECK B+ VOLTAGE TO FPDM POWER SUPPLY RELAY</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to KB60.

Improper voltage is being supplied to FPDMR
Repair as necessary.</td></tr>
<tr><td></td><td>• FPDM PWR Relay connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)FPDM PWR Relay Connector, Component Side</th><th>(-)Vehicle battery</th></tr><tr><td>B+ - Pin 3</td><td>Negative post</td></tr></table>• Is the Voltage above 10.5 V?</td></tr>
</table>

Fuel Pump Driver Module — KB

Test Steps	Results →	Action to Take
KB60 CHECK FPDM PWR CIRCUIT VOLTAGE • Add jumper wire between the points described below: **Point A FPDM PWR Relay Connector, Harness Side**: B+ - Pin 3 **Point B FPDM PWR Relay Connector, Harness Side**: FPDM PWR - Pin 5 • Key ON Engine OFF. • Measure the Voltage between: **(+)FPDM Connector, Harness Side**: FPDM PWR **(-)Vehicle battery**: Negative post • **Is the Voltage above 10.5 V?**	Yes →	INSTALL a new FPDM. Before replacing component or connector: Verify results of previous test steps. Check for pinched or chaffed wires, signs of corrosion or resistance to ground.
	No →	CHECK for causes of high resistance in FPDM PWR circuit. Repair as necessary.
KB61 CHECK B+ VOLTAGE TO CCRM • CCRM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)CCRM Connector, Harness Side**: B+ (C) - Pin 11 **(-)Vehicle battery**: Negative post • **Is the Voltage above 10.5 V?**	Yes →	KEY OFF. GO to **KB62**.
	No →	CHECK for causes of high resistance in B+ circuit. Repair as necessary.
KB62 CHECK FPDM PWR CIRCUIT VOLTAGE • Add jumper wire between the points described below: **Point A CCRM Connector, Harness Side**: B+ (C) - Pin 11 **Point B CCRM Connector, Harness Side**: FPDM PWR - Pin 5 • Key ON Engine OFF. • Measure the Voltage between: **(+)FPDM Connector, Harness Side**: FPDM PWR **(-)Vehicle battery**: Negative post • **Is the Voltage above 10.5 V?**	Yes →	INSTALL a new CCRM. Before replacing component or connector: Repeat test, if necessary, to verify results. Check for pinched or chaffed wires, signs of corrosion or resistance to ground.
	No →	CHECK for causes of high resistance in FPDM PWR circuit. Repair as necessary.

Fuel Pump Driver Module — KB

Test Steps		Results →	Action to Take
KB63	CHECK FPRTN CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• REM-J1 connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)REM-J1 Connector, Harness Side**: REM/FP PWR — **(-)REM Connector, Harness Side**: FPRTN • **Is the Voltage below 1 V?**	Yes → No →	GO to **KB52**. REPAIR short circuit to GND.
KB64	COMPLETE REM SELF TEST TO VERIFY IFS SWITCH INPUT TO REM		
	• Complete Rear Electronic Module Self-Test. REFER to section 419-10, Multifunction Electronic Control modules, in Workshop Manual. • CHECK REM Self-Test DTCs: • **Is DTC B2172 present?**	Yes → No →	GO to **KB65**. GO to **A1**.
KB65	DTC B2172: CHECK IFS SWITCH INPUT CIRCUIT TO REM		
	• REM-J3 connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)REM-J3 Connector, Harness Side**: IFS — **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. If engine is a no start and REM DTC B2172 was received in on-demand self-test mode: REPLACE REM. If engine will start or REM DTC B2172 is a continuous memory DTC: DTC is possibly intermittent. If engine now is a no start: Return to Section 3 to continue diagnosis. If engine will start: GO to **Z1**. KEY OFF. CHECK Inertia Fuel Shutoff Switch for open If OK, REPAIR open circuit.

KB63 measurement:

(+)REM-J1 Connector, Harness Side	(-)REM Connector, Harness Side
REM/FP PWR	FPRTN

KB65 measurement:

(+)REM-J3 Connector, Harness Side	(-)
IFS	Ground

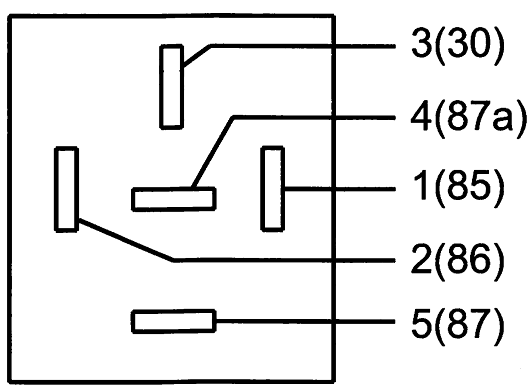
Fuel Shutoff Valve Relay	KC

Note

This pinpoint test is intended to diagnose the following:

- Harness circuit(s): FSV, GND, FSVM, FSVPWR, B+, VPWR.
- Fuel Shutoff Valve Relay.
- Inertia Fuel Shutoff Switch (9341).
- Powertrain Control Module (PCM) (12A650).

Fuel Shutoff Valve (FSV) Relay Connector

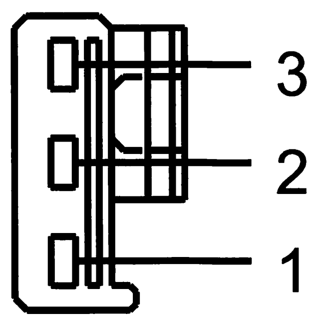


A0077582

Circuit	Pin
B+ (Battery positive voltage)	3
FSVPWR-A (Fuel Shutoff Valves Power - A)	5
FSV (Fuel Shutoff Valve)	1
VPWR (Power supply)	2

Fuel Shutoff Valve Relay | KC

Inertia Fuel Shutoff (IFS) Connector



A0077528

Circuit	Pin
FSVPWR-B (Fuel Shutoff Valves Power - B)	1
FSVPWR-A (Fuel Shutoff Valves Power - A)	2

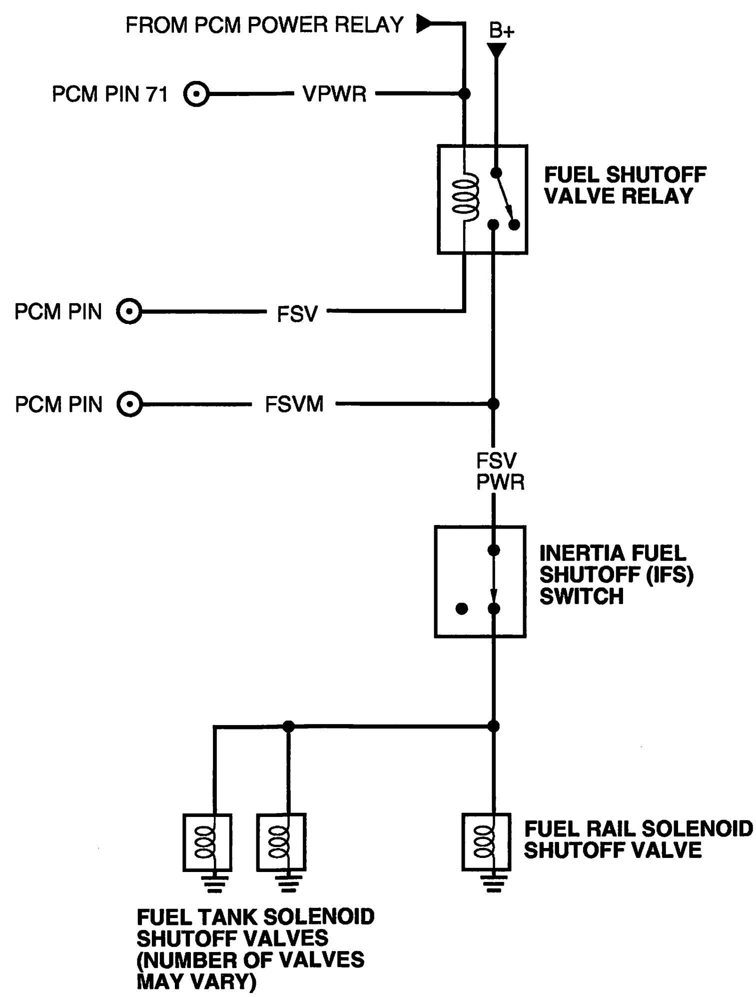
Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
104 Pin	FSVM FSV	40 80

Fuel Shutoff Valve Relay	KC

Typical schematic



A0085335

Test Steps		Results →	Action to Take
KC1	KOEO AND KOER DTC P0230: CHECK VPWR VOLTAGE TO FUEL SHUTOFF VALVE RELAY		
	• FSV Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **KC2**.
		No →	REPAIR open circuit.

(+)FSV Relay Connector, Harness Side	**(-)**
VPWR - Pin 2	Ground

- **Is the Voltage above 10.5 V?**

Fuel Shutoff Valve Relay — KC

Test Steps		Results →	Action to Take
KC2	CHECK FUEL SHUTOFF VALVE RELAY		
	• REFER to the pin numbers indicated on the FSV relay. There will be either a pin 1 or pin 85. • Measure resistance between either pin 1 or pin 85 and all other pins of the relay. One measurement must be between 40 and 120 ohms, with the other measurements being greater than 10,000 ohms. • **Are all Resistance checks ok?**	Yes → No →	GO to **KC3**. INSTALL a new FSV relay.
KC3	CHECK FUEL SHUT OFF VALVE CIRCUIT FOR SHORT TO VPWR IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)FSV Relay Connector, Harness Side**: FSV - Pin 1 / **(-)**: Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KC4**. REPAIR short circuit.
KC4	CHECK FUEL SHUTOFF VALVE CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: **(+)FSV Relay Connector, Harness Side**: FSV - Pin 1 / **(-)Vehicle battery**: Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KC5**. REPAIR short circuit.
KC5	CHECK THE FUEL SHUT OFF VALVE CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)FSV Relay Connector, Harness Side**: FSV - Pin 1 / **(-)PCM Connector, Harness Side**: FSV - Pin 80 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KC6**. REPAIR open circuit.
KC6	WAS KOEO DTC P0231, P0232 ALSO PRESENT?		
	• CHECK KOEO DTCs: • **Are DTCs P0231 or P0232 present?**	Yes → No →	GO to **KC7**. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Fuel Shutoff Valve Relay — KC

Test Steps		Results →	Action to Take
KC7	CHECK THE FUEL SHUTOFF VALVE PRIMARY CIRCUIT INSIDE THE PCM		
	• PCM connector connected. • FSV Relay connector connected. • Key ON Engine OFF. • Access the FSVF PID using a scan tool. • **Is the PID state YES?**	Yes →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	GO to **KC8**.
KC8	CHECK FUEL SHUTOFF VALVE PRIMARY CIRCUIT INSIDE PCM WHILE CRANKING ENGINE		
	Note: The scan tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged. • Key ON Engine OFF. • Access the FSVF PID using a scan tool. • Crank the engine. • **Does the PID display indicate a fault during crank?**	Yes →	KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	KEY OFF. Fuel pump primary circuit is OK in the harness and PCM GO to **KC9**.
KC9	WAS KOEO DTC P0231 PRESENT?		
	• CHECK KOEO DTCs: • **Is DTC P0231 present?**	Yes →	GO to **KC19**.
		No →	DTC P0232 present GO to **KC10**.
KC10	KOEO AND KOER DTC P0232: DOES THE ENGINE START?		
	• **Does the engine start?**	Yes →	GO to **KC11**.
		No →	GO to **KC14**.
KC11	CHECK IF POWER IS ALWAYS BEING SUPPLIED TO FUEL SHUTOFF VALVES POWER CIRCUIT		
	• PCM connector disconnected. • Key ON Engine OFF. • Make sure all the accessories are off. • Measure the Voltage between:	Yes →	GO to **KC13**.
		No →	GO to **KC12**.

(+)PCM Connector, Harness Side	**(-)**
FSVM - Pin 40	Ground

• **Is the Voltage below 1.5 V?**

Fuel Shutoff Valve Relay | KC

Test Steps		Results →	Action to Take
KC12	CHECK FOR FSV RLY CONTACTS ALWAYS CLOSED		
	• FSV Relay connector disconnected. • Key ON Engine OFF. • Make sure all the accessories are off. • Measure the Voltage between: **(+)PCM Connector, Harness Side** / **(-)** FSVM - Pin 40 / Ground • **Is the Voltage below 1.5 V?**	Yes → No →	INSTALL a new FSV relay. REPAIR short circuit to PWR.
KC13	CHECK THE FUEL SHUTOFF VALVE MONITOR CIRCUIT FOR OPEN IN HARNESS		
	• FSV Relay connector disconnected. • Measure the Resistance between: **(+)FSV Relay Connector, Harness Side** / **(-)PCM Connector, Harness Side** FSVPWR-A - Pin 5 / FSVM - Pin 40 • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.
KC14	CHECK IF INERTIA FUEL SHUTOFF TRIPPED		
	• **Is IFS tripped?**	Yes → No →	Reset Switch GO to **KC15**.
KC15	MEASURE RESISTANCE BETWEEN THE C AND NC PINS OF THE IFS		
	• IFS connector disconnected. • Measure the Resistance between: **(+)IFS Connector, Component Side** / **(-)IFS Connector, Component Side** FSVPWR-A - Pin 2 / FSVPWR-B - Pin 1 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KC16**. INSTALL a new IFS.
KC16	CHECK FUEL SHUTOFF VALVES POWER CIRCUIT FOR OPEN IN HARNESS		
	• FSV Relay connector disconnected. • Measure the Resistance between: **(+)FSV Relay Connector, Harness Side** / **(-)IFS Connector, Harness Side** FSVPWR-A - Pin 5 / FSVPWR-A - Pin 2 • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KC17**. REPAIR open circuit.

Fuel Shutoff Valve Relay — KC

Test Steps		Results →	Action to Take
KC17	CHECK FUEL SHUTOFF VALVES POWER CIRCUIT RESISTANCE TO GROUND THROUGH THE FUEL SOLENOID SHUTOFF VALVES		
	• FSV Relay connector connected. • Measure the Resistance between: (+)IFS Connector, Harness Side: FSVPWR-B - Pin 1 / (-)Vehicle battery: Negative post • **Is the Resistance below 10 Ohm?**	Yes →	No Fault Found. Problem may be intermittent. Repeat test If ok, disregard DTC P0232 at this time. Reconnect IFS switch. Return to section 3, Step 1:Quick Test and continue diagnosis as directed.
		No →	REPAIR open circuit. Open is either in the common FSV PWR circuit before any splice to the individual fuel solenoid shutoff valves, or in each of the individual fuel solenoid shutoff valve circuits path to ground
KC18	KOEO AND KOER DTC P0231: WAS KOEO DTC P0230 ALSO PRESENT?		
	• CHECK KOEO DTCs: • **Is DTC P0230 present?**	Yes →	GO to **KC1**.
		No →	GO to **KC19**.
KC19	DOES THE ENGINE START?		
	• **Does the engine start?**	Yes →	Disconnect the PCM. GO to **KC13**.
		No →	GO to **KC20**.
KC20	CHECK B+ VOLTAGE TO FUEL SHUTOFF VALVE RELAY		
	• FSV Relay connector disconnected. • Measure the Voltage between: (+)FSV Relay Connector, Harness Side: B+ - Pin 3 / (-): Ground • **Is the Voltage above 10.5 V?**	Yes →	GO to **KC21**.
		No →	B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.

Fuel Shutoff Valve Relay — KC

Test Steps		Results →	Action to Take
KC21	CHECK BETWEEN RELAY AND FSVM SPLICE CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (+)FSV Relay Connector, Harness Side: FSVPWR-A - Pin 5 / (-): Ground • **Is the Resistance below 10 Ohm?**	Yes → No →	INSTALL a new FSV relay. REPAIR open circuit. between Relay and FSVM Splice
KC22	CONTINUOUS MEMORY DTC P0232: IS CONTINUOUS DTC P0230 PRESENT?		
	• CHECK Continuous Memory DTCs: • **Is DTC P0230 present?**	Yes → No →	GO to **KC26**. GO to **KC23**.
KC23	CHECK FUEL PUMP SECONDARY CIRCUITS FOR FAULT		
	• Key ON Engine OFF. • Access the FSVM PID using a scan tool. • Observe the for an indication of a fault while completing the following: Note: — The FSVM PID will turn ON when a fault is indicated. • Shake, wiggle, bend the FSV PWR circuit between the fuel shutoff valve relay and the fuel solenoid shutoff valves. • Shake, wiggle, bend the Fuel Shutoff Valves ground circuits from each fuel solenoid shutoff valve to ground. • Shake, wiggle, bend the FSVM circuit between the PCM and the splice to the FSV PWR circuit. • Lightly tap on the IFS & FSVR (to simulate road shock). • Key OFF. • **Is a fault indicated?**	Yes → No →	ISOLATE fault Repair as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.
KC24	CONTINUOUS MEMORY DTC P0231: IS CONTINUOUS DTC P0230 PRESENT?		
	• CHECK Continuous Memory DTCs: • **Is DTC P0230 present?**	Yes → No →	GO to **KC26**. GO to **KC25**.

Fuel Shutoff Valve Relay

KC

Test Steps		Results →	Action to Take
KC25	CONTINUOUS MEMORY DTC P0231: CHECK FUEL SHUTOFF VALVES SECONDARY CIRCUITS BETWEEN B+ SUPPLY AND FSVM CONNECTION		
	• IFS connector disconnected. • PCM connector disconnected. • Add jumper wire between the points described below: (see table A below) • Key ON Engine OFF. • Measure the Voltage between: (see table B below) • CHECK for an indication of a fault while completing the following (the voltage will change suddenly when a fault is detected): — Shake, wiggle, bend the B+ supply to Fuel Shutoff Valve Relay. — Lightly tap on the FSV RLY (to simulate road shock). — Shake, wiggle, bend the FSV PWR circuit between the fuel shutoff valve relay and the fuel solenoid shutoff valves. • Key OFF. • Visually inspect the Fuel Shutoff Valve Relay and its loom connector for damage and corrosion, repair or clean as necessary. • **Is a fault indicated?**	Yes → No →	ISOLATE fault Repair as necessary. Unable to duplicate or identify fault at this time. GO to **Z1**.

Point A PCM Connector, Harness Side	Point B PCMPWR Relay Connector, Harness Side
FSV - Pin 80	GND

(+)PCM Connector, Harness Side	(-)
FSVM - Pin 40	Ground

Fuel Shutoff Valve Relay — KC

Test Steps		Results →	Action to Take
KC26	CONTINUOUS MEMORY DTC P0230: CHECK FUEL SHUTOFF VALVE PRIMARY CIRCUITS		
	• Key ON Engine OFF. • Wait for 5 seconds. • Access the FSVF PID using a scan tool. • Observe the PID for an indication of a fault while completing the following: The FSVF PID will turn ON when a fault is indicated. — Shake, wiggle, bend the FSV circuit between PCM and FSV RLY. — Shake, wiggle, bend the VPWR circuit to the FSV relay. — Lightly tap on the FSV RLY (to simulate road shock). • Key OFF. • Visually inspect harness. • **Is a fault indicated?**	Yes → No →	ISOLATE fault Repair as necessary. Unable to duplicate or identify fault at this time.

Electric Exhaust Gas Recirculation (EEGR) System

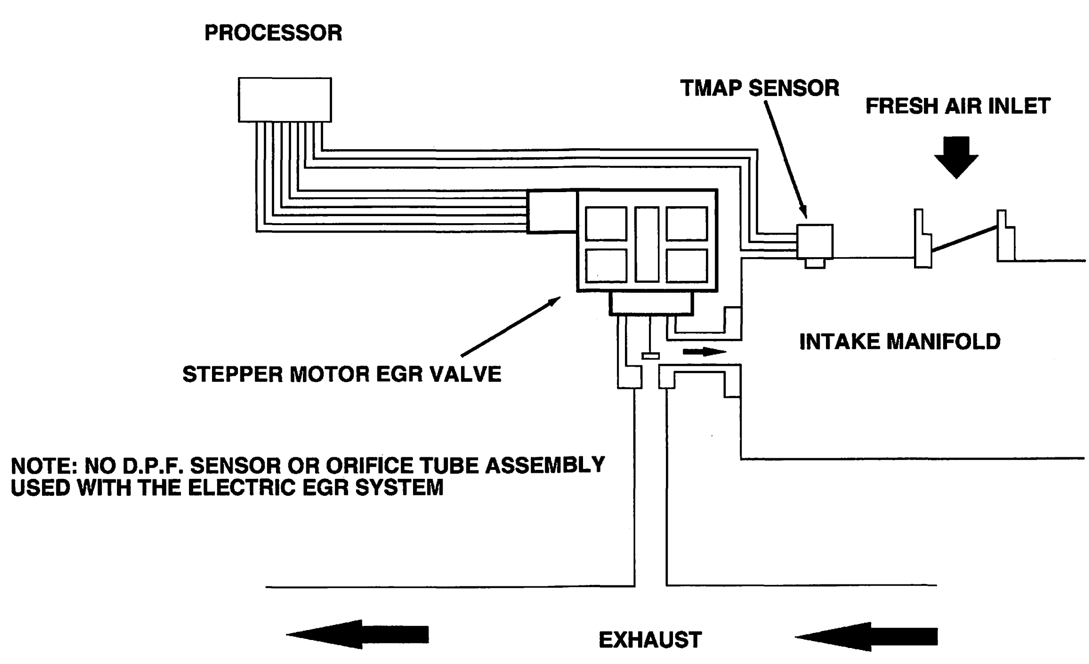
KD

Note

This Pinpoint Test is intended to diagnose the following:

- Electric Exhaust Gas Recirculation (EEGR) System.
- Harness circuit: EEGR.
- Powertrain Control Module (PCM) (12A650).

Electric Exhaust Gas Recirculation (EEGR) System



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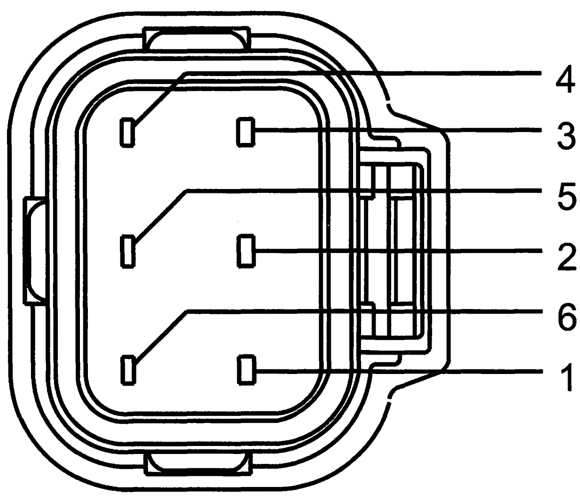
Electric Exhaust Gas Recirculation (EEGR) System	KD

Electric Exhaust Gas Recirculation (EEGR) Assembly Connector



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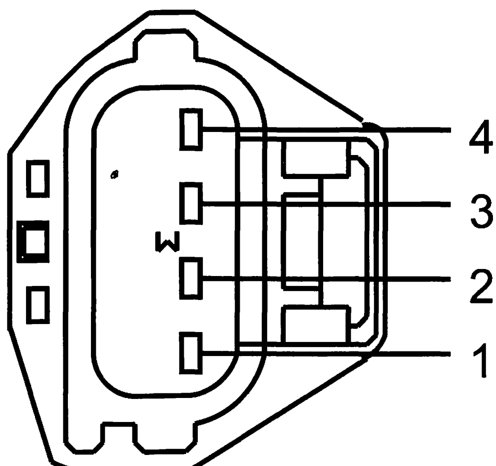
Circuit	Pin
EGRMC4 (EGR Motor Control 4)	6
EGRMC3 (EGR Motor Control 3)	4
EGRMC2 (EGR Motor Control 2)	3
EGRMC1 (EGR Motor Control 1)	1
VPWR (Power supply)	2, 5

Electric Exhaust Gas Recirculation (EEGR) System	KD

Manifold Absolute Pressure/Thermal Manifold Absolute Pressure (MAP/TMAP) Sensor Connector



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Circuit	Pin
MAP (Manifold absolute pressure sensor)	4
SIGRTN (Signal Return)	1
VREF (Reference Voltage)	3

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Electric Exhaust Gas Recirculation (EEGR) System

KD

Vehicle	Connector	Circuit	Pin
Focus	150 (50-50-50) Pin	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1	B35 E11 E10 E9 E8
Ranger	104 Pin	VPWR EGRMC4 EGRMC3 EGRMC2 EGRMC1	71 98 72 99 73

Test Steps		Results →	Action to Take
KD1	DTC P0403: EGR CONTROL CIRCUIT - CHECK CONNECTION OF EEGR HARNESS CONNECTOR TO EEGR		
	Note: If the DTC is intermittent, wiggle the harness and connectors when taking measurements. • - Check connection of EEGR harness connector to EEGR. • **Are the connector contacts clean and properly seated?**	Yes → No →	GO to **KD2**. REPAIR as necessary.
KD2	CHECK FOR VPWR AT THE EEGR HARNESS CONNECTOR		
	• Key ON Engine OFF. • EEGR Assembly connector disconnected. • Measure the Voltage between: (see table below) • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **KD3**. KEY OFF. REPAIR open circuit.
KD3	CHECK EEGR CIRCUIT(S) FOR OPEN IN HARNESS		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between: (see table below) • **Are the resistances above 5 Ohm?**	Yes → No →	REPAIR open circuit. GO to **KD4**.

KD2 measurement:

(+)EEGR Assembly Connector, Harness Side	(-)Vehicle battery
VPWR - Pin 2, 5	Negative post

KD3 measurement:

(+)EEGR Assembly Connector, Harness Side	(-)PCM Connector, Harness Side
EGRMC1 - Pin 1	EGRMC1
EGRMC2 - Pin 3	EGRMC2
EGRMC3 - Pin 4	EGRMC3
EGRMC4 - Pin 6	EGRMC4
VPWR - Pin 2, 5	VPWR

Electric Exhaust Gas Recirculation (EEGR) System

KD

Test Steps		Results →	Action to Take
KD4	CHECK EEGR CIRCUIT(S) FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	REPAIR short circuit.
		No →	GO to **KD5**.

(+)EEGR Assembly Connector, Harness Side	(-)Vehicle battery
EGRMC1 - Pin 1	Negative post
EGRMC2 - Pin 3	Negative post
EGRMC3 - Pin 4	Negative post
EGRMC4 - Pin 6	Negative post
VPWR - Pin 2, 5	Negative post

- **Are the resistances below 1 KOhm?**

Test Steps		Results →	Action to Take
KD5	CHECK FOR SHORTS BETWEEN CIRCUITS IN EEGR HARNESS		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • Measure the Resistance between:	Yes →	REPAIR short circuit.
		No →	GO to **KD6**.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
EGRMC3	EGRMC1
EGRMC3	EGRMC2
EGRMC3	EGRMC4
EGRMC1	EGRMC2
EGRMC1	EGRMC4

- **Are the resistances below 1 KOhm?**

Test Steps		Results →	Action to Take
KD6	CHECK EEGR CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector connected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. REPAIR short circuit.
		No →	GO to **KD7**.

(+)EEGR Assembly Connector, Harness Side	(-)Vehicle battery
EGRMC1 - Pin 1	Negative post
EGRMC2 - Pin 3	Negative post
EGRMC3 - Pin 4	Negative post
EGRMC4 - Pin 6	Negative post

- **Are the voltages above 0.1 V?**

Electric Exhaust Gas Recirculation (EEGR) System

KD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KD7</td><td>CHECK EEGR FOR OPEN AND SHORT CIRCUITS</td><td></td><td></td></tr>
<tr><td colspan="2">

Key OFF.
PCM connector disconnected.
EEGR Assembly connector connected.
Measure the Resistance between:

<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)PCM Connector, Harness Side</th></tr>
<tr><td>EGRMC1</td><td>VPWR</td></tr>
<tr><td>EGRMC2</td><td>VPWR</td></tr>
<tr><td>EGRMC3</td><td>VPWR</td></tr>
<tr><td>EGRMC4</td><td>VPWR</td></tr>
</table>

Are the resistances between 15 Ohm - 24 Ohm?

</td><td>Yes →
No →</td><td>GO to KD8.
INSTALL a new EEGR assembly and retest vehicle.</td></tr>
<tr><td>KD8</td><td>CHECK THE EEGR FOR SHORTS TO GROUND</td><td></td><td></td></tr>
<tr><td colspan="2">

Measure the Resistance between:

<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>EGRMC1</td><td>Negative post</td></tr>
<tr><td>EGRMC2</td><td>Negative post</td></tr>
<tr><td>EGRMC3</td><td>Negative post</td></tr>
<tr><td>EGRMC4</td><td>Negative post</td></tr>
</table>

Are the resistances above 1 KOhm?

</td><td>Yes →
No →</td><td>INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
INSTALL a new EEGR assembly and retest vehicle.</td></tr>
</table>

Electric Exhaust Gas Recirculation (EEGR) System — KD

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KD9</td><td>DTCS P0400 AND P1408: CHECK FOR STUCK OR STICKY EGR VALVE OPERATION BY COMPARING ACTUAL MAP VOLTAGE TO MAP_V PID VOLTAGE</td><td></td><td></td></tr>
<tr><td></td><td>Note: Service the following DTCs first, if present:
— P0102, P0103, P0107, P0108, P1100, P1101.
• Key OFF.
• MAP/TMAP Sensor connector disconnected.
• Add jumper wire between the points described below:
<table><tr><th>Point A MAP/TMAP Sensor Connector, Harness Side</th><th>Point B MAP/TMAP Sensor Connector, Component Side</th></tr><tr><td>VREF - Pin 3</td><td>VREF - Pin 3</td></tr><tr><td>SIGRTN - Pin 1</td><td>SIGRTN - Pin 1</td></tr></table>• Key ON Engine RUN.
• Measure the Voltage between:
<table><tr><th>(+)MAP/TMAP Sensor Connector, Component Side</th><th>(-)Vehicle battery</th></tr><tr><td>MAP - Pin 4</td><td>Negative post</td></tr></table>• Is the Voltage between 1 V - 2 V?</td><td>Yes →

No →</td><td>Note actual MAP voltage values at KOEO, idle, 1000 and 2000 RPM. You will use the values for comparison in the following test step.
GO to KD10.

KEY OFF.
CHECK MAP/TMAP harness for open and short circuits</td></tr>
<tr><td>KD10</td><td>COMPARE ACTUAL MAP VOLTAGE TO MAP_V PID VOLTAGE EGR</td><td></td><td></td></tr>
<tr><td></td><td>• Key ON Engine OFF.
• Access the PCM-MAP_V PID using a scan tool.
• Note MAP_V PID voltage.
• Key ON Engine RUN.
• Note MAP_V PID voltage.
• Increase engine speed to 1000 RPM.
Note MAP_V PID voltage.
• Increase engine speed to 2000 RPM.
Note MAP_V PID voltage.
• Does the MAP_V PID voltage stay within .5V of the actual MAP voltage?</td><td>Yes →

No →</td><td>Fault is not present at this time
Be sure the MAP is properly seated and the vacuum source is not blocked.

GO to KD11.</td></tr>
<tr><td>KD11</td><td>PERFORM KOER SELF-TEST</td><td></td><td></td></tr>
<tr><td></td><td>• Does DTC P1408 reappear?</td><td>Yes →

No →</td><td>INSTALL a new EEGR assembly.

Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.</td></tr>
</table>

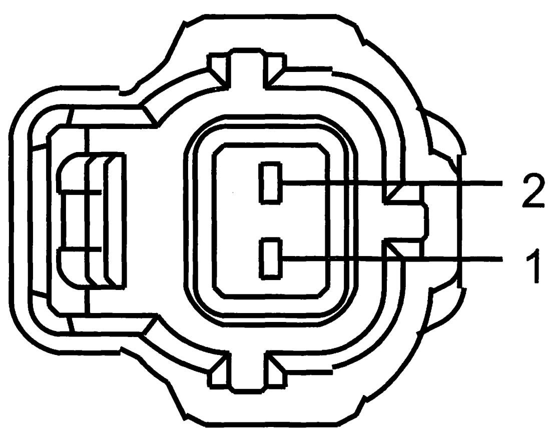
Idle Air Control (IAC) Valve	KE

Note

This Pinpoint Test is intended to diagnose the following:

- Idle Air Control (IAC) Valve (9F715).
- Harness circuits: IAC and VPWR.
- Powertrain Control Module PCM (12A650).

Idle air control (IAC) Actuator Connector



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Circuit	Pin
IAC (Idle air control)	2
VPWR (Power supply)	1

Idle Air Control (IAC) Valve | KE

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator	150 (60-32-58) Pin	IAC	E9
Expedition, Navigator	122 Pin	IAC	E2
Focus 2.3L	150 (50-50-50) Pin	IAC	E39
All other vehicles	104 Pin	IAC	83

Test Steps		Results →	Action to Take
KE1	IDLE CONCERNS OR STALLS: RUN KOER SELF-TEST AND OUTPUT CMDTCS		
	Note: The Symptom Charts have indicated that there was no change in idle quality when the IAC valve was disconnected. • CHECK air inlet for plugging or stuck IAC pintle. — Repair as necessary. • Retrieve all Continuous Memory DTCs. • Run KOER Self-Test. If unable to complete KOER Self-Test, go to the next diagnostic step. • **Are any of the following DTCs present: P0505, P0511 or P0506?**	Yes → No →	KEY OFF. GO to **KE2**. The IAC system is ok, return to Section 3, Symptom Charts.
KE2	DTCS P0505, P0506, P0511, P1504 OR P1507: (OR STARTS ONLY AT PART THROTTLE) CHECK VPWR VOLTAGE TO IAC VALVE		
	Note: If EGR DTC P0402 was output during Self-Test, diagnose it first before continuing with this Pinpoint Test. • IAC Actuator connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **KE3**. KEY OFF. REPAIR open circuit.

(+)IAC Actuator Connector, Harness Side	(-)Vehicle battery
VPWR - Pin 1	Negative post

• **Is the Voltage above 10.5 V?**

Idle Air Control (IAC) Valve

KE

Test Steps		Results →	Action to Take
KE3	CHECK RESISTANCE OF IAC VALVE		
	• IAC Actuator connector disconnected. • Measure the Resistance between: **(+)IAC Actuator Connector, Component Side**: IAC - Pin 2 **(-)IAC Actuator Connector, Component Side**: VPWR - Pin 1 • **Is the Resistance between 6 Ohm - 15 Ohm?**	Yes → No →	GO to **KE4**. INSTALL a new IAC Valve.
KE4	CHECK THE IAC VALVE FOR AN INTERNAL SHORT TO THE IAC CASE		
	• Measure the Resistance between: **(+)IAC Actuator Connector, Component Side**: IAC - Pin 2 **(-)IAC Actuator Connector, Component Side**: IAC Case • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KE5**. INSTALL a new IAC actuator.
KE5	CHECK AIR INLET FOR PLUGGING OR STUCK IAC PINTLE		
	• INSPECT the entire intake air system for debris, blockage or other damage. Remove and inspect the IAC valve and check the pintle movement. Check air tubes (if equipped) for blockage or damage. Remove and inspect the air cleaner element for excessive dirt. • **Is the IAC valve and intake air system ok?**	Yes → No →	Restore the inlet air system. GO to **KE6**. INSTALL a new IAC valve or repair air inlet as necessary.
KE6	CHECK FOR INLET AIR LEAKS		
	• Key ON Engine RUN. • With the engine running at idle, listen for vacuum leaks. • INSPECT entire air intake system from the mass air flow (MAF) sensor to the intake manifold for leaks such as: Damaged or loose IAC air tubes. Cracked or punctured intake air tube. Loose intake air tube at air cleaner housing or throttle body. IAC valve or gasket seal. EGR valve gasket seal. Vacuum supply connector and hose. PCV valve, connectors and hoses. • **Are any leaks detected in the above areas?**	Yes → No →	KEY OFF. Repair as necessary. KEY OFF. GO to **KE7**.

Idle Air Control (IAC) Valve | KE

Test Steps		Results →	Action to Take
KE7	CHECK THE IAC CIRCUIT FOR OPEN IN HARNESS		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • IAC Actuator connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **KE8**. REPAIR open circuit.

(+)IAC Actuator Connector, Harness Side	**(-)PCM Connector, Harness Side**
IAC - Pin 2	IAC

• **Is the Resistance below 5 Ohm?**

KE8	CHECK IAC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **KE9**. KEY OFF. REPAIR short circuit.

(+)PCM Connector, Harness Side	**(-)Vehicle battery**
IAC	Negative post

• **Is the Voltage below 1 V?**

KE9	CHECK IAC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **KE10**. REPAIR short circuit.

(+)PCM Connector, Harness Side	**(-)**
IAC	Ground

• **Is the Resistance above 10 KOhm?**

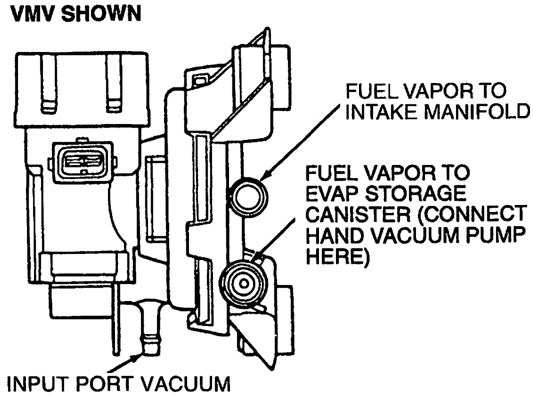
KE10	VERIFY DTC		
	• **Is DTC P0511 or P1504 present in Continuous Memory or from the KOER Self-Test?**	Yes → No →	INSTALL a new PCM. GO to **KE11**.

Idle Air Control (IAC) Valve

KE

Test Steps		Results →	Action to Take
KE11	CHECK THE IAC SIGNAL FROM THE PCM		
	• PCM connector connected. • IAC Actuator connector connected. Note: If stalling occurs, place a shim under the hard stop screw to maintain idle conditions. • Key ON Engine RUN. • Access the PCM-RPM PID using a scan tool. • Access the PCM-IAC PID using a scan tool. • With the engine at normal operating temperature, closed throttle and all accessories OFF, the IAC duty cycle should be between approximately 22 and 65 percent. Slowly increase the engine speed to 3000RPM and return to closed throttle (Note: If closed throttle RPM is significantly higher than normal, ignore this step). • **Is the Duty Cycle between 22% - 65%?**	Yes → No →	GO to **KE12**. KEY OFF. INSTALL a new IAC actuator.
KE12	VERIFY DTC		
	• **Is DTC P0506, P0511, P1504 or P1507 present in Continuous Memory or from Self-Test?**	Yes → No →	GO to **KE18**. KEY OFF. INSPECT throttle body for damage. Repair as necessary. If ok, install a new IAC actuator. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).

Idle Air Control (IAC) Valve | KE

	Test Steps	Results →	Action to Take
KE13	DTCS P0507 OR P1506: CHECK FOR INLET AIR LEAKS		
	• Key ON Engine RUN. • With the engine running at idle, listen for vacuum leaks. • INSPECT entire air intake system from the mass air flow (MAF) sensor to the intake manifold for leaks such as: Damaged or loose IAC air tubes. Cracked or punctured intake air tube. Loose intake air tube at air cleaner housing or throttle body. IAC valve or gasket seal. EGR valve gasket seal. Vacuum supply connector and hose. PCV valve, connectors and hoses. • **Are any leaks detected in the above areas?**	Yes → No →	KEY OFF. Repair as necessary. KEY OFF. GO to **KE14**.
KE14	CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE		
	• Disconnect hoses at the EVAP canister purge valve or the VMV. • Connect a hand vacuum pump at the fuel vapor-to-EVAP canister port on the EVAP canister purge valve (VMV). • Apply 53 kPa (16 in-Hg) of vacuum to the EVAP canister purge valve (VMV). **VMV SHOWN**  • **Does the EVAP canister purge valve (VMV) hold a vacuum for at least 20 seconds?**	Yes → No →	Reconnect all hoses. GO to **KE15**. INSTALL a new EVAPCP.

Idle Air Control (IAC) Valve | KE

Test Steps		Results →	Action to Take
KE15	CHECK THE IAC VALVE FOR CORRECT FUNCTION		
	• Key ON Engine RUN. • Bring engine to normal operating temperature. • Transmission in PARK or NEUTRAL. • Disconnect the IAC Valve. • **Does the RPM drop or the engine stall?**	Yes →	KEY OFF. GO to **KE16**.
		No →	KEY OFF. INSPECT throttle body for damage. Repair as necessary. If ok, install a new IAC actuator. RESET Keep Alive Random Access Memory (RAM) (REFER to Section 2, Powertrain Control Module (PCM) Reset).
KE16	CHECK THE IAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between:	Yes →	GO to **KE17**.
		No →	REPAIR short circuit to GND.

(+)PCM Connector, Harness Side	(-)Vehicle battery
IAC	Negative post

	• **Is the Resistance above 10 KOhm?**		
KE17	VERIFY SYMPTOM		
	• **Is a fast idle symptom currently present?**	Yes →	INSTALL a new PCM.
		No →	GO to **KE18**.

Idle Air Control (IAC) Valve | KE

Test Steps		Results →	Action to Take
KE18	CHECK THE IAC SYSTEM FOR AN INTERMITTENT OPEN OR SHORT		
	• PCM connector connected. • Key ON Engine RUN. • Access the PCM-IAC and PCM-RPM PIDs using a scan tool. • With the engine at normal operating temperature, closed throttle and all accessories OFF, the IAC duty cycle should be between approximately 22 and 65 percent. • Observe the PIDs while completing the following at idle: — Lightly tap on the and wiggle the harness connector to simulate road shock. — Grasp the vehicle harness closest to the IAC valve. Shake and bend a small section of the harness from the IAC to the dash panel and from the dash panel to the PCM. • **Do the IAC or RPM PIDs suddenly change in value indicating a fault?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **KE19**.
KE19	VERIFY SYMPTOM		
	• **Is an idle quality, starting or stalling symptom currently present?**	Yes → No →	INSTALL a new IAC actuator. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Fan Control relays	KF

Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuits: HFC, LFC, MFC, VPWR.
- LFC, MFC, HFC relays.
- PCM (12A650).

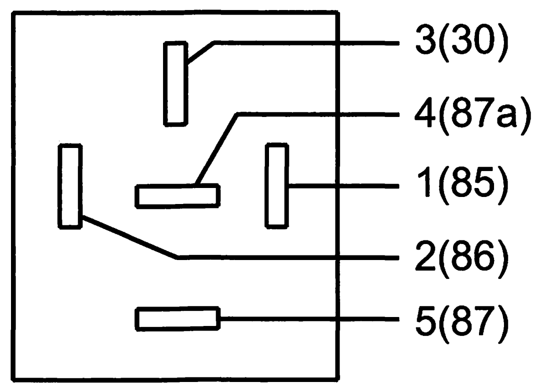
Three Speed Fan Operation

Although the PCM output circuits are called low, medium and high fan control (FC), cooling fan operation is controlled by a combination of these outputs.

REFER to Section 1, PCM Outputs, Fan Control for more information.

Fan Control relays	KF

Low Fan Control (LFC) Relay Connector



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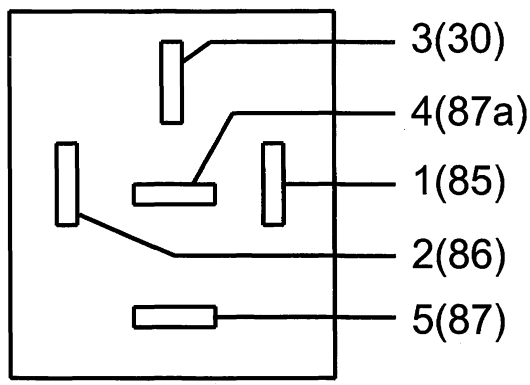
Circuit	Pin
LFC (Low Fan Control)	2
VPWR (Power supply)	1

NOTE: The VPWR & LFC circuits may be reversed in the harness connector. Also, the LFC circuit may be wired to two seperate relays. REFER to the wiring diagram manual for more information.

Fan Control relays	**KF**

Medium Fan Control (MFC) Relay Connector

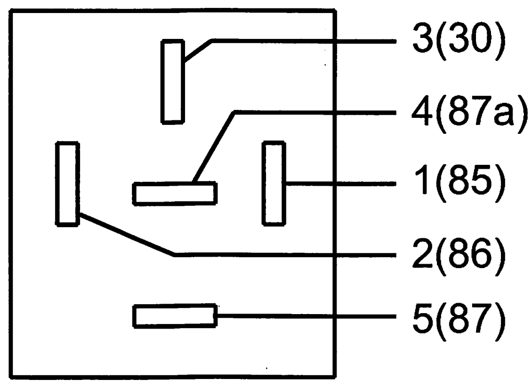


Circuit	Pin
MFC (Medium Fan Control)	2
VPWR (Power supply)	1

NOTE: The VPWR & MFC circuits may be reversed in the harness connector. Also, the MFC circuit may be wired to two seperate relays. REFER to the wiring diagram manual for more information.

Fan Control relays | KF

High Fan Control (HFC) Relay Connector



A0077582

Circuit	Pin
HFC (High Fan Control)	2
VPWR (Power supply)	1

NOTE: The VPWR & HFC circuits may be reversed in the harness connector. Also, the HFC circuit may be wired to two seperate relays. REFER to the wiring diagram manual for more information.

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to Section 6.

Vehicle	Circuit	Pin
Aviator	LFC	B19
Escape 2.0L	HFC MFC LFC	17 43 68
Escape 3.0L	HFC LFC	46 28

(Continued)

Fan Control relays | KF

Vehicle	Circuit	Pin
Focus 2.0L	HFC MFC LFC	17 75 68
Focus 2.3L	HFC LFC	B38 B39
Freestar / Monterey	HFC MFC LFC	46 19 28
Ranger	LFC	45
All other vehicles	HFC MFC LFC	46 42 28

Test Steps		Results →	Action to Take
KF1	KOEO AND KOER DTCS P0480 OR P1474: CHECK VPWR VOLTAGE TO LOW SPEED FC RELAY		
	• LFC Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	GO to **KF2**. REPAIR open circuit.

(+)LFC Relay Connector, Harness Side	**(-)**
VPWR - Pin 1	Ground

- **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
KF2	CHECK FOR LFC CIRCUIT CYCLING		
	• Key ON Engine OFF. • Connect non-powered test lamp between:	Yes → No →	INSTALL a new LFC relay. KEY OFF. REMOVE test lamp. GO to **KF3**.

(+)LFC Relay Connector, Harness Side	**(-)LFC Relay Connector, Harness Side**
VPWR - Pin 1	LFC - Pin 2

- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command low speed fan ON
- Command high speed fan ON
- Command outputs OFF
- **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**

Fan Control relays — KF

Test Steps		Results →	Action to Take
KF3	CHECK LFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)LFC Relay Connector, Harness Side: LFC - Pin 2 — (-): Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KF4**. REPAIR short circuit.
KF4	CHECK LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between: (+)LFC Relay Connector, Harness Side: LFC - Pin 2 — (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KF5**. REPAIR short circuit.
KF5	CHECK LFC CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (+)LFC Relay Connector, Harness Side: LFC - Pin 2 — (-)PCM Connector, Harness Side: LFC • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REPAIR open circuit.
KF6	KOEO AND KOER DTCS P0482 OR P1477: CHECK VPWR VOLTAGE TO MEDIUM SPEED FC RELAY		
	• MFC Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)MFC Relay Connector, Harness Side: VPWR - Pin 1 — (-): Ground • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **KF7**. REPAIR open circuit.

Measurement tables:

KF3:

(+)LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

KF4:

(+)LFC Relay Connector, Harness Side	(-)
LFC - Pin 2	Ground

KF5:

(+)LFC Relay Connector, Harness Side	(-)PCM Connector, Harness Side
LFC - Pin 2	LFC

KF6:

(+)MFC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

Fan Control relays

KF

Test Steps		Results	Action to Take
KF7	CHECK FOR MFC CIRCUIT CYCLING		
	• Key ON Engine OFF. • Connect non-powered test lamp between:	Yes → No →	INSTALL a new MFC relay. KEY OFF. REMOVE test lamp. GO to **KF8**.

(+)MFC Relay Connector, Harness Side	(-)MFC Relay Connector, Harness Side
VPWR - Pin 1	MFC - Pin 2

- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command low speed fan ON
- Command high speed fan ON
- Command outputs OFF
- **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**

Test Steps		Results	Action to Take
KF8	CHECK MFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **KF9**. REPAIR short circuit.

(+)MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the Voltage below 1 V?**

Test Steps		Results	Action to Take
KF9	CHECK MFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **KF10**. REPAIR short circuit.

(+)MFC Relay Connector, Harness Side	(-)
MFC - Pin 2	Ground

- **Is the Resistance above 10 KOhm?**

Test Steps		Results	Action to Take
KF10	CHECK MFC CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between:	Yes → No →	INSTALL a new PCM. REPAIR open circuit.

(+)MFC Relay Connector, Harness Side	(-)PCM Connector, Harness Side
MFC - Pin 2	MFC

- **Is the Resistance below 5 Ohm?**

Fan Control relays

KF

Test Steps		Results →	Action to Take
KF11	KOEO AND KOER DTCS P0481 OR P1479: CHECK VPWR VOLTAGE TO HIGH SPEED FC RELAY		
	• HFC Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)HFC Relay Connector, Harness Side** / **(-)**: VPWR - Pin 1 / Ground • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **KF12**. REPAIR open circuit.
KF12	CHECK FOR HFC CIRCUIT CYCLING		
	• Key ON Engine OFF. • Connect non-powered test lamp between: **(+)HFC Relay Connector, Harness Side** / **(-)HFC Relay Connector, Harness Side**: VPWR - Pin 1 / HFC - Pin 2 • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • Command high speed fan ON • Command outputs OFF • **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**	Yes → No →	INSTALL a new HFC relay. KEY OFF. REMOVE test lamp. GO to **KF8**.
KF13	CHECK HFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)HFC Relay Connector, Harness Side** / **(-)**: HFC - Pin 2 / Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KF14**. REPAIR short circuit.
KF14	CHECK HFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between: **(+)HFC Relay Connector, Harness Side** / **(-)**: HFC - Pin 2 / Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KF15**. REPAIR short circuit.

Fan Control relays — KF

Test Steps	Results →	Action to Take
KF15 CHECK HFC CIRCUIT FOR OPEN IN HARNESS		
• Measure the Resistance between: **(+)HFC Relay Connector, Harness Side**: HFC - Pin 2 — **(-)PCM Connector, Harness Side**: HFC • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REPAIR open circuit.
KF16 KOEO AND KOER DTCS P0480 OR P1474: CHECK VPWR VOLTAGE TO LFC1 RLY		
Note: This application has two relays wired to the LFC circuit. This procedure may call out LFC1 & LFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2. • LFC1 Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)LFC1 Relay Connector, Harness Side**: VPWR — **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **KF17**. REPAIR open circuit.
KF17 CHECK FOR LFC CIRCUIT CYCLING		
• Connect non-powered test lamp between: **(+)LFC1 Relay Connector, Harness Side**: VPWR — **(-)LFC1 Relay Connector, Harness Side**: LFC • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • Command high speed fan ON • Command outputs OFF • **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**	Yes → No →	REPLACE LFC1 RLY at end of diagnostics. Leave RLY disconnected GO to **KF22**. Leave Test Lamp connected GO to **KF18**.

Fan Control relays	KF

Test Steps		Results	Action to Take
KF18	CHECK FOR LFC CIRCUIT CYCLING WITH LFC2 RLY DISCONNECTED		
	• Connect non-powered test lamp between: (+)LFC1 Relay Connector, Harness Side: VPWR; (-)LFC1 Relay Connector, Harness Side: LFC • LFC2 Relay connector disconnected. • Command low speed fan ON • Command high speed fan ON • Command outputs OFF • **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**	Yes → No →	INSTALL a new LFC2 relay. GO to **KF19**.
KF19	CHECK LFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)LFC1 Relay Connector, Harness Side: LFC; (-): Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KF20**. REPAIR short circuit.
KF20	CHECK LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between: (+)LFC1 Relay Connector, Harness Side: LFC; (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KF21**. REPAIR short circuit.
KF21	CHECK LFC CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (+)LFC1 Relay Connector, Harness Side: LFC; (-)PCM Connector, Harness Side: LFC • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REPAIR open circuit.

Fan Control relays

KF

KF22 VERIFY THERE IS NOT AN OPEN IN CIRCUIT SPECIFIC TO LFC2 RELAY

- Access the PCM-LFCF PID using a scan tool.
- Command high speed fan ON
- Command outputs OFF
- Command low speed fan ON
- Command outputs OFF
- **Does the PID indicate a fault (yes) when either the high or low speed Cooling fan output is commanded on and off?**

Results	Action to Take
Yes →	GO to **KF23**.
No →	INSTALL a new LFC1 relay.

KF23 CHECK VPWR VOLTAGE TO LFC2 RLY

- LFC2 Relay connector disconnected.
- Key ON Engine OFF.
- Measure the Voltage between:

(+)LFC2 Relay Connector, Harness Side	**(-)**
VPWR	Ground

- **Is the Voltage above 10.5 V?**

Results	Action to Take
Yes →	KEY OFF. GO to **KF24**.
No →	REPAIR open circuit.

KF24 CHECK LFC CIRCUIT BETWEEN LOW SPEED FC RELAY(S)

- Measure the Resistance between:

(+)LFC1 Relay Connector, Harness Side	**(-)LFC2 Relay Connector, Harness Side**
LFC	LFC

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	INSTALL a new LFC relay. REPLACE both LFC relays
No →	REPAIR open circuit.

KF25 KOEO AND KOER DTCS P0482 OR P1477: CHECK VPWR VOLTAGE TO MFC1 RLY

Note: This application has two relays wired to the MFC circuit. This procedure may call out MFC1 & MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2.

- MFC1 Relay connector disconnected.
- Key ON Engine OFF.
- Measure the Voltage between:

(+)MFC1 Relay Connector, Harness Side	**(-)**
VPWR	Ground

- **Is the Voltage above 10.5 V?**

Results	Action to Take
Yes →	GO to **KF26**.
No →	REPAIR open circuit.

# Fan Control relays	KF

Test Steps		Results →	Action to Take
KF26	CHECK FOR MFC CIRCUIT CYCLING		
	• Connect non-powered test lamp between: **(+)MFC1 Relay Connector, Harness Side**: VPWR — **(-)MFC1 Relay Connector, Harness Side**: MFC • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • Command high speed fan ON • Command outputs OFF • **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**	Yes → No →	REPLACE MFC1 RLY at end of diagnostics. Leave RLY disconnected GO to **KF31**. Leave Test Lamp connected GO to **KF27**.
KF27	CHECK FOR MFC CIRCUIT CYCLING WITH MFC2 RLY DISCONNECTED		
	• Connect non-powered test lamp between: **(+)MFC1 Relay Connector, Harness Side**: VPWR — **(-)MFC1 Relay Connector, Harness Side**: MFC • MFC2 Relay connector disconnected. • Command low speed fan ON • Command high speed fan ON • Command outputs OFF • **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**	Yes → No →	INSTALL a new MFC2 relay. GO to **KF28**.
KF28	CHECK MFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)MFC1 Relay Connector, Harness Side**: MFC — **(-)**: Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KF29**. REPAIR short circuit.
KF29	CHECK MFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between: **(+)MFC1 Relay Connector, Harness Side**: MFC — **(-)**: Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KF30**. REPAIR short circuit.

Fan Control relays

KF

Test Steps		Results	Action to Take
KF30	CHECK MFC CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between:	Yes →	INSTALL a new PCM.
		No →	REPAIR open circuit.

(+)MFC1 Relay Connector, Harness Side	(-)PCM Connector, Harness Side
MFC	MFC

• **Is the Resistance below 5 Ohm?**

Test Steps		Results	Action to Take
KF31	VERIFY THERE IS NOT AN OPEN IN CIRCUIT SPECIFIC TO MFC2 RELAY		
	• Access the PCM-MFCF PID using a scan tool. • Command high speed fan ON • Command outputs OFF • Command low speed fan ON • Command outputs OFF • **Does the PID indicate a fault (yes) when either the high or low speed Cooling fan output is commanded on and off?**	Yes → No →	GO to **KF32**. INSTALL a new MFC relay.
KF32	CHECK VPWR VOLTAGE TO MFC2 RLY		
	• MFC2 Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **KF33**. REPAIR open circuit.

(+)MFC2 Relay Connector, Harness Side	(-)
VPWR	Ground

• **Is the Voltage above 10.5 V?**

Test Steps		Results	Action to Take
KF33	CHECK MFC CIRCUIT BETWEEN MEDIUM SPEED FC RELAY(S)		
	• Measure the Resistance between:	Yes → No →	INSTALL a new HFC relay. (REPLACE both HFC relays) REPAIR open circuit.

(+)MFC1 Relay Connector, Harness Side	(-)MFC2 Relay Connector, Harness Side
MFC	MFC

• **Is the Resistance below 5 Ohm?**

Fan Control relays — KF

Test Steps		Results		Action to Take
KF34	KOEO AND KOER DTCS P0481 OR P1479: CHECK VPWR VOLTAGE TO HFC1 RLY			
	Note: This application has two relays wired to the HFC circuit. This procedure may call out HFC1 & HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2. • HFC1 Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)HFC1 Relay Connector, Harness Side** — VPWR; **(-)** — Ground • **Is the Voltage above 10.5 V?**	Yes No	→ →	GO to **KF35**. REPAIR open circuit.
KF35	CHECK FOR HFC CIRCUIT CYCLING			
	• Connect non-powered test lamp between: **(+)HFC1 Relay Connector, Harness Side** — VPWR; **(-)HFC1 Relay Connector, Harness Side** — HFC • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • Command high speed fan ON • Command outputs OFF • **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**	Yes No	→ →	REPLACE HFC1 RLY at end of diagnostics. Leave RLY disconnected GO to **KF40**. Leave Test Lamp connected GO to **KF36**.
KF36	CHECK FOR HFC CIRCUIT CYCLING WITH HFC2 RLY DISCONNECTED			
	• Connect non-powered test lamp between: **(+)HFC1 Relay Connector, Harness Side** — VPWR; **(-)HFC1 Relay Connector, Harness Side** — HFC • HFC2 Relay connector disconnected. • Command low speed fan ON • Command high speed fan ON • Command outputs OFF • **Does the test lamp turn on and off when either the low or high speed cooling fan output is commanded on and off?**	Yes No	→ →	INSTALL a new HFC2 relay. GO to **KF37**.

Sub-tables within test steps:

KF34:

(+)HFC1 Relay Connector, Harness Side	(-)
VPWR	Ground

KF35:

(+)HFC1 Relay Connector, Harness Side	(-)HFC1 Relay Connector, Harness Side
VPWR	HFC

KF36:

(+)HFC1 Relay Connector, Harness Side	(-)HFC1 Relay Connector, Harness Side
VPWR	HFC

Fan Control relays — KF

Test Steps		Results →	Action to Take
KF37	CHECK HFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **KF38**.
		No →	REPAIR short circuit.
KF38	CHECK HFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • Measure the Resistance between:	Yes →	GO to **KF39**.
		No →	REPAIR short circuit.
KF39	CHECK HFC CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between:	Yes →	INSTALL a new PCM.
		No →	REPAIR open circuit.
KF40	VERIFY THERE IS NOT AN OPEN IN CIRCUIT SPECIFIC TO HFC2 RELAY		
	• Access the PCM-HFCF PID using a scan tool. • Command high speed fan ON • Command outputs OFF • Command low speed fan ON • Command outputs OFF • **Does the PID indicate a fault (yes) when either the high or low speed Cooling fan output is commanded on and off?**	Yes →	GO to **KF41**.
		No →	INSTALL a new HFC1 relay.
KF41	CHECK VPWR VOLTAGE TO HFC2 RLY		
	• HFC2 Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **KF42**.
		No →	REPAIR open circuit.

KF37:

(+)HFC1 Relay Connector, Harness Side	**(-)**
HFC	Ground

- **Is the Voltage below 1 V?**

KF38:

(+)HFC1 Relay Connector, Harness Side	**(-)**
HFC	Ground

- **Is the Resistance above 10 KOhm?**

KF39:

(+)HFC1 Relay Connector, Harness Side	**(-)PCM Connector, Harness Side**
HFC	HFC

- **Is the Resistance below 5 Ohm?**

KF41:

(+)HFC2 Relay Connector, Harness Side	**(-)**
VPWR	Ground

- **Is the Voltage above 10.5 V?**

Fan Control relays

KF

Test Steps		Results →	Action to Take
KF42	CHECK HFC CIRCUIT BETWEEN HIGH SPEED FC RELAY(S)		
	• Measure the Resistance between: **(+)HFC1 Relay Connector, Harness Side**: HFC **(-)HFC2 Relay Connector, Harness Side**: HFC • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new HFC relay. (REPLACE both HFC relays) REPAIR open circuit.
KF43	CONTINUOUS MEMORY DTCS P0480 OR P1474: CHECK LFC CIRCUIT FOR INTERMITTENT OPEN OR SHORT TO POWER		
	• A/C and defrost off. • L Fan Motor connector disconnected. • R Fan Motor connector disconnected. • LFC Relay connector disconnected. • Connect non-powered test lamp between: **(+)LFC Relay Connector, Harness Side**: VPWR - Pin 1 **(-)LFC Relay Connector, Harness Side**: LFC - Pin 2 • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON Note: If test lamp does not turn on, Command high speed fan ON. • Observe test lamp for an indication of a fault while completing the following (the lamp will turn Off when a fault is detected): — Shake, wiggle, bend the LFC circuit(s). — Shake, wiggle, bend the VPWR circuit to the LFC relay. — INSPECT the LFC RLY component for signs of damage. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **KF44**.
KF44	CHECK LFC CIRCUIT FOR INTERMITTENT SHORT TO GROUND		
	• Key ON Engine OFF. • Command outputs OFF • Observe test lamp for an indication of a fault while completing the following (the lamp will turn on when a fault is detected): — Shake, wiggle, bend the LFC circuit(s). — Lightly tap on the LFC RLY (to simulate road shock). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Fan Control relays — KF

Test Steps		Results →	Action to Take
KF45	CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK HFC CIRCUIT FOR INTERMITTENT OPEN OR SHORT TO POWER		
	• A/C and defrost off. • L Fan Motor connector disconnected. • R Fan Motor connector disconnected. • HFC Relay connector disconnected. • Connect non-powered test lamp between:	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **KF44**.

(+)HFC Relay Connector, Harness Side	**(-)HFC Relay Connector, Harness Side**
VPWR - Pin 1	HFC - Pin 2

- Key ON Engine OFF.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command high speed fan ON

  Note: If test lamp does not turn on, Command low speed fan ON.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn Off when a fault is detected):
  - — Shake, wiggle, bend the HFC circuit(s).
  - — Shake, wiggle, bend the VPWR circuit to the HFC relay.
  - — Lightly tap on the HFC RLY (to simulate road shock).
- **Is a fault indicated?**

Test Steps		Results →	Action to Take
KF46	CHECK HFC CIRCUIT FOR INTERMITTENT SHORT TO GROUND		
	• Key ON Engine OFF. • Command outputs OFF • Observe test lamp for an indication of a fault while completing the following (the lamp will turn on when a fault is detected): — Shake, wiggle, bend the HFC circuit(s). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

Fan Control relays — KF

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KF47</td><td>CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK MFC CIRCUIT FOR INTERMITTENT OPEN OR SHORT TO POWER</td><td rowspan="2">Yes →

No →</td><td rowspan="2">ISOLATE fault and REPAIR as necessary.

GO to KF44.</td></tr>
<tr><td colspan="2">

A/C and defrost off.
L Fan Motor connector disconnected.
R Fan Motor connector disconnected.
MFC Relay connector disconnected.
Connect non-powered test lamp between:

<table>
<tr><th>(+)MFC Relay Connector, Harness Side</th><th>(-)MFC Relay Connector, Harness Side</th></tr>
<tr><td>VPWR - Pin 1</td><td>MFC - Pin 2</td></tr>
</table>

Key ON Engine OFF.
Scan Tool Connected
Enter Output Test Mode (refer to section 2)
Command low speed fan ON
Note: If test lamp does not turn on, Command high speed fan ON.
Observe test lamp for an indication of a fault while completing the following (the lamp will turn Off when a fault is detected):
— Shake, wiggle, bend the MFC circuit(s).
— Shake, wiggle, bend the VPWR circuit to the MFC relay.
— INSPECT the MFC RLY component for signs of damage.
Is a fault indicated?

</td></tr>
<tr><td>KF48</td><td>CHECK MFC CIRCUIT FOR INTERMITTENT SHORT TO GROUND</td><td rowspan="2">Yes →

No →</td><td rowspan="2">ISOLATE fault and REPAIR as necessary.

KEY OFF.
Unable to duplicate or identify fault at this time.
GO to Z1.</td></tr>
<tr><td colspan="2">

Key ON Engine OFF.
Command outputs OFF
Observe test lamp for an indication of a fault while completing the following (the lamp will turn Off when a fault is detected):
— Shake, wiggle, bend the MFC circuit(s).
Is a fault indicated?

</td></tr>
</table>

Fan Control relays

KF

Test Steps		Results →	Action to Take
KF49	CONTINUOUS MEMORY DTCS P0480 OR P1474: CHECK LFC CIRCUIT FOR INTERMITTENT OPEN OR SHORT TO POWER		
	Note: This application has two relays wired to the LFC circuit. This procedure may call out LFC1 & LFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2. • AC and defroster OFF. • L Fan Motor connector disconnected. • R Fan Motor connector disconnected. • LFC1 Relay connector disconnected. • Connect non-powered test lamp between:	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **KF50**.

(+)LFC1 Relay Connector, Harness Side	(-)LFC1 Relay Connector, Harness Side
VPWR	LFC

- Key ON Engine OFF.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command low speed fan ON

  Note: If test lamp does not turn on, Command high speed fan ON.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn OFF when a fault is detected):
  - — Shake, wiggle, bend the LFC circuit between the PCM and both Low Speed FC relays.
  - — Shake, wiggle, bend the VPWR circuit to both Low Speed FC relays.
  - — Lightly tap on the Low Speed FC relay that is still connected (to simulate road shock).
- **Is a fault indicated?**

Fan Control relays

KF

	Test Steps	Results →	Action to Take
KF50	CHECK LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Key ON Engine OFF. • Command outputs OFF • Exit Output Test Mode • Observe test lamp for an indication of a fault while completing the following (the lamp will turn ON when a fault is detected): — Shake, wiggle, bend the LFC circuit between the PCM and both Low Speed FC relays. • INSPECT Low Speed FC Relay that is disconnected for intermittent concerns. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **Z1**.

Fan Control relays

KF

Test Steps		Results →	Action to Take
KF51	CONTINUOUS MEMORY DTCS P0482 OR P1477: CHECK MFC CIRCUIT FOR INTERMITTENT OPEN OR SHORT TO POWER		
	Note: This application has two relays wired to the MFC circuit. This procedure may call out MFC1 & MFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2. • AC and defroster OFF. • L Fan Motor connector disconnected. • R Fan Motor connector disconnected. • MFC1 Relay connector disconnected. • Connect non-powered test lamp between: **(+)MFC1 Relay Connector, Harness Side**: VPWR **(-)MFC1 Relay Connector, Harness Side**: MFC • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON Note: If test lamp does not turn on, Command high speed fan ON. • Observe test lamp for an indication of a fault while completing the following (the lamp will turn OFF when a fault is detected): — Shake, wiggle, bend the MFC circuit between the PCM and both Medium Speed FC relays. — Shake, wiggle, bend the VPWR circuit to both Medium Speed FC relays. — Lightly tap on the Medium Speed FC relay that is still connected (to simulate road shock). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **KF52**.

Fan Control relays

KF

Test Steps		Results →	Action to Take
KF52	CHECK MFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Key ON Engine OFF. • Command outputs OFF • Exit Output Test Mode • Observe test lamp for an indication of a fault while completing the following (the lamp will turn ON when a fault is detected): — Shake, wiggle, bend the MFC circuit between the PCM and both Medium Speed FC relays. • INSPECT Medium Speed FC relay that is disconnected for intermittent concerns. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **Z1**.

Fan Control relays

KF

Test Steps		Results		Action to Take
KF53	CONTINUOUS MEMORY DTCS P0481 OR P1479: CHECK HFC CIRCUIT FOR INTERMITTENT OPEN OR SHORT TO POWER			
	Note: This application has two relays wired to the HFC circuit. This procedure may call out HFC1 & HFC2 relays. Either of the relays may be used as the number 1, with the other relay being number 2. • AC and defroster OFF. • L Fan Motor connector disconnected. • R Fan Motor connector disconnected. • HFC1 Relay connector disconnected. • Connect non-powered test lamp between:	Yes	→	ISOLATE fault and REPAIR as necessary.
		No	→	GO to **KF54**.

(+)HFC1 Relay Connector, Harness Side	(-)HFC1 Relay Connector, Harness Side
VPWR	HFC

- Key ON Engine OFF.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command low speed fan ON

  Note: If test lamp does not turn on, Command high speed fan ON.
- Observe test lamp for an indication of a fault while completing the following (the lamp will turn OFF when a fault is detected):
  - Shake, wiggle, bend the HFC circuit between the PCM and both High Speed FC relays.
  - Shake, wiggle, bend the VPWR circuit to both High Speed FC relays.
  - Lightly tap on the High Speed FC relay that is still connected (to simulate road shock).
- **Is a fault indicated?**

Fan Control relays | KF

Test Steps		Results →	Action to Take
KF54	CHECK HFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Key ON Engine OFF. • Command outputs OFF • Exit Output Test Mode • Observe test lamp for an indication of a fault while completing the following (the lamp will turn ON when a fault is detected): — Shake, wiggle, bend the HFC circuit between the PCM and both High Speed FC relays. • INSPECT High Speed FC Relay that is disconnected for intermittent concerns. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **Z1**.
KF55	COOLING FAN ALWAYS RUNS (NO DTCS) : VERIFY FAN IS NOT ON BECAUSE OF A/C HIGH PRESSURE SWITCH INPUT TO PCM		
	• Key ON Engine RUN. • Access the PCM-ACP PID using a scan tool. • **Is the PID state CLOSED?**	Yes → No →	KEY OFF. The PCM will turn the fan on when the medium pressure, normally open contacts of the A/CHPSW are closed. GO to **KF66**. KEY OFF. Input OK GO to **KF56**.
KF56	COOLING FAN CONCERN (NO DTCS): CHECK FAN CONTROL PRIMARY CIRCUITS		
	• Verify that AC is OFF. • Verify engine temperature is below the temperature where the Cooling fan would come on. • Key ON Engine OFF. Note: Chose the PIDs below as appropriate, according to which circuits the vehicle has. • Access the PCM-LFCF, PCM-MFCF and PCM-HFCF PIDs using a scan tool. • **Does either PID indicate a fault?**	Yes → No →	Primary circuit(s) Fault found. GO to **KF57**. For all except Ranger : PCM Primary circuit(s) OK. REFER to Engine Cooling, Section 303-03, of the Workshop Manual to check secondary wiring to cooling fan. For Ranger: GO to **KF59**.

Fan Control relays

KF

Test Steps		Results →	Action to Take
KF57	DID LFCF PID INDICATE A FAULT?		
	• **Did LFCF PID indicate a fault?**	Yes →	Low Fan Control (LFC) Primary Circuit Failure **For Freestar / Monterey** GO to **KF16**. **For All Others** GO to **KF1**.
		No →	GO to **KF58**.
KF58	DID MFCF PID INDICATE A FAULT?		
	• **Did MFCF PID indicate a fault?**	Yes →	Medium Fan Control (MFC) Primary Circuit Failure **For Freestar / Monterey** GO to **KF25**. **For All Others** GO to **KF6**.
		No →	High Fan Control (HFC) Primary Circuit Failure **For Taurus,** **Sable,** **Escape 3.0L, and** **Focus 2.0L** GO to **KF34**. **For All Others** GO to **KF11**.
KF59	IS THE SYMPTOM: COOLING FAN ALWAYS RUNS?		
	• **Is the symptom: cooling fan always runs?**	Yes →	GO to **KF65**.
		No →	GO to **KF60**.
KF60	ELECTRIC COOLING FAN CONCERN (WITH NO DTCS) : ELECTRIC COOLING FAN FUNCTIONAL CHECK		
	• Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • **Does the fan operate?**	Yes →	KEY OFF. All Cooling fan circuit checks are OK RETURN to Section 3, Symptom Charts.
		No →	GO to **KF61**.

Fan Control relays — KF

Test Steps		Results →	Action to Take
KF61	FAN INOPERATIVE: COMMAND LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO CF		

- Key OFF.
- CF Motor connector disconnected.
- Key ON Engine OFF.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command low speed fan ON
- Measure the Voltage between:

(+)CF Motor Connector, Harness Side	(-)
FAN PWR	Ground

- **Is the Voltage above 10.5 V?**

Results	Action to Take
Yes →	KEY OFF. GO to **KF62**.
No →	KEY OFF. GO to **KF63**.

Test Steps		Results →	Action to Take
KF62	CHECK GROUND CIRCUIT TO COOLING FAN		

- Measure the Resistance between:

(+)CF Motor Connector, Harness Side	(-)
GND	Ground

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	INSTALL a new CF motor.
No →	REPAIR open circuit.

Test Steps		Results →	Action to Take
KF63	CHECK B+ VOLTAGE TO FC RLY		

- FC Relay connector disconnected.
- Measure the Voltage between:

(+)FC Relay Connector, Harness Side	(-)
B+	Ground

- **Is the Voltage above 10.5 V?**

Results	Action to Take
Yes →	GO to **KF64**.
No →	REPAIR open circuit. B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.

Test Steps		Results →	Action to Take
KF64	CHECK FAN PWR CIRCUIT FOR OPEN IN HARNESS		

- Measure the Resistance between:

(+)FC Relay Connector, Harness Side	(-)CF Motor Connector, Harness Side
FAN PWR	FAN PWR

- **Is the Resistance below 5 Ohm?**

Results	Action to Take
Yes →	INSTALL a new FC relay.
No →	REPAIR open circuit.

Test Steps		Results →	Action to Take
KF65	CHECK FOR FC RLY CONTACTS ALWAYS CLOSED		

Note: Verify A/C and defrost are off.

- FC Relay connector disconnected.
- Key ON Engine OFF.
- **Does fan run with key on?**

Results	Action to Take
Yes →	REPAIR short circuit to PWR. (FAN PWR ckt)
No →	INSTALL a new FC relay.

Fan Control relays — KF

Test Steps		Results →	Action to Take
KF66	CHECK A/CHPSW (MEDIUM PRESSURE, NORMALLY OPEN CONTACTS)		
	• A/CHPSW connector disconnected. • Key ON Engine OFF. • Access the PCM-ACP PID using a scan tool. • **Is the PID state CLOSED?**	Yes →	KEY OFF. GO to **KF67**.
		No →	KEY OFF. Reconnect A/CHPSW. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom. (Check over-pressurized AC system, etc.) If OK, REPLACE A/CHPSW.
KF67	CHECK A/CPSW CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between:	Yes →	Verify results of previous test steps. Return to Section 3 to continue diagnosis. If OK, REPLACE PCM.
	• **Is the Resistance above 10 KOhm?**	No →	REPAIR short circuit to GND.

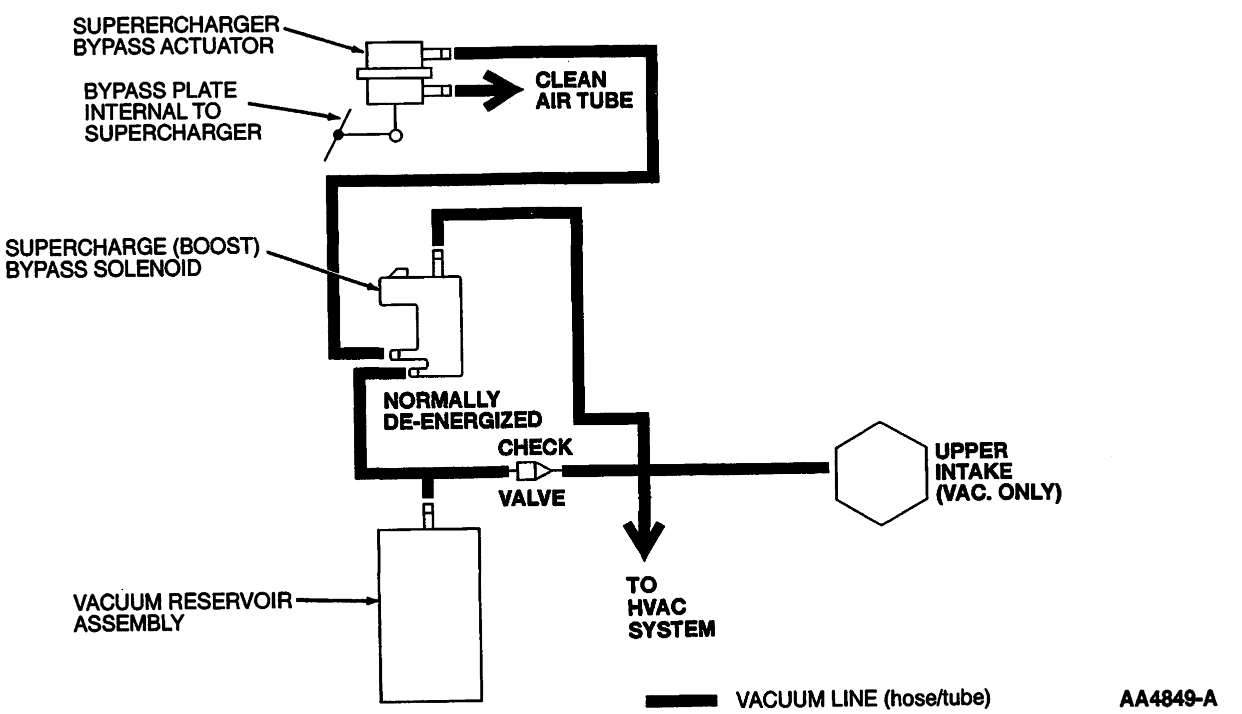
(+)A/CHPSW Connector, Harness Side	(-)
A/CPSW	Ground

Supercharger Bypass Control	KJ

Note

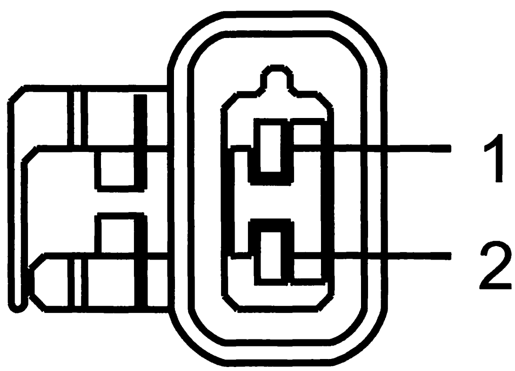
This Pinpoint Test is intended to diagnose the following:

- Supercharger (boost) bypass solenoid (9H465) (service part name is: thermactor air control solenoid/vacuum valve assembly).
- Vacuum reservoir assembly (9J442).
- Vacuum Hoses.
- Harness circuits: SCBC, VPWR and PWRGND.
- Powertrain Control Module PCM (12A650).
- Supercharger assembly (including the supercharger bypass actuator)(6F076).



Supercharger Bypass Control | KJ

Super Charger Bypass Control (SCBC) Solenoid Connector



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Circuit	Pin
SCBC (Super Charger Bypass Control)	1
VPWR (Power supply)	2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
F-150 Heritage	104 Pin	PWRGND SCBC VPWR	103 42 71
Mustang	104 Pin	PWRGND SCBC VPWR	103 45 71

Supercharger Bypass Control — KJ

Test Steps		Results →	Action to Take
KJ1	DTC P0234: CHECK FOR ANY OTHER DTCS		
	Note: The supercharger will be bypassed when the engine is in WOT and the brakes are being applied. This is called a brake torque. • CHECK that the engine has not been subjected to a brake torque. This will cause a P0234 DTC. • Drive the vehicle for 10 to 15 minutes with the engine exceeding 2,000 RPM. Make sure the engine temperature stabilizes. • Return to the repair area and check that the upper radiator hose is hot and pressurized. • **Are any other DTCs present?**	Yes →	KEY OFF. Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.
		No →	GO to **KJ2**.
KJ2	CHECK IAT2 PID		
	• Key ON Engine RUN. • Access the PCM-IAT2 PID using a scan tool. • **Is the Temperature above 110 C (230 F)?**	Yes →	CHECK for low fluid level in the CAC system. Check for cracked intercooler lines. REPAIR as necessary.
		No →	GO to **KJ3**.
KJ3	CHECK TFT PID		
	• Key ON Engine RUN. • Access the PCM-TFT PID using a scan tool. • **Is the Temperature above 135 C (275 F)?**	Yes →	CHECK for low transmission fluid level. REFER to the Automatic Transmission section in the Workshop manual.
		No →	GO to **KJ4**.
KJ4	CHECK FOR THE LOW SPEED FUEL PUMP RELAY NOT SWITCHING		
	• Key ON Engine RUN. • Access the PCM-LFPF PID using a scan tool. • **Is the PID state indicating a fault?**	Yes →	KEY OFF. Go to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts.
		No →	CHECK for indications of engine knock while driving the vehicle. REPAIR as necessary. If ok, indicate to vehicle owner that transmission damage may occur during a brake torque. The diagnostic was unable to determine the cause of the customer complaint.

Supercharger Bypass Control — KJ

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KJ5</td><td>DTC P0243: CHECK THE SUPERCHARGER (BOOST) BYPASS SOLENOID OUTPUT</td><td></td><td></td></tr>
<tr><td colspan="2">

- Key OFF.
- SCBC Solenoid connector disconnected.
- Connect non-powered test lamp between:

<table>
<tr><th>(+)SCBC Solenoid Connector, Harness Side</th><th>(-)SCBC Solenoid Connector, Harness Side</th></tr>
<tr><td>VPWR - Pin 2</td><td>SCBC - Pin 1</td></tr>
</table>

- Key ON Engine OFF.
- Observe the test lamp.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command outputs ON
- Observe the test lamp.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command outputs OFF
- **Does the test lamp turn on and off when the output(s) are commanded on and off?**

</td><td>Yes →

No →</td><td>KEY OFF.
GO to **KJ6**.

GO to **KJ7**.</td></tr>
<tr><td>KJ6</td><td>CHECK THE SCBC SOLENOID RESISTANCE</td><td></td><td></td></tr>
<tr><td colspan="2">

- Measure the Resistance between:

<table>
<tr><th>(+)SCBC Solenoid Connector, Component Side</th><th>(-)SCBC Solenoid Connector, Component Side</th></tr>
<tr><td>SCBC - Pin 1</td><td>VPWR - Pin 2</td></tr>
</table>

- **Is the Resistance between 68 Ohm - 78 Ohm?**

</td><td>Yes →

No →</td><td>CHECK for damaged vacuum hoses between the engine intake manifold and the SCBC solenoid. CHECK for vacuum reservoir assembly leaks. Repair or install new as necessary. If ok, diagnose as an intermittent concern.

INSTALL a new SCBC solenoid.</td></tr>
<tr><td>KJ7</td><td>CONFIRM TEST LAMP STATUS</td><td></td><td></td></tr>
<tr><td colspan="2">

- **Was the test lamp always off?**

</td><td>Yes →

No →</td><td>KEY OFF.
GO to **KJ8**.

KEY OFF.
GO to **KJ11**.</td></tr>
<tr><td>KJ8</td><td>CHECK FOR AN OPEN VPWR CIRCUIT BETWEEN THE SCBC SOLENOID AND THE POWER RELAY</td><td></td><td></td></tr>
<tr><td colspan="2">

- Measure the Voltage between:

<table>
<tr><th>(+)SCBC Solenoid Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>VPWR - Pin 2</td><td>Negative post</td></tr>
</table>

- **Is the Voltage above 10.5 V?**

</td><td>Yes →

No →</td><td>KEY OFF.
GO to **KJ10**.

KEY OFF.
GO to **KJ9**.</td></tr>
</table>

Supercharger Bypass Control — KJ

Test Steps		Results →	Action to Take
KJ9	CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • PCM connector disconnected. • Measure the Resistance between: **(+)SCBC Solenoid Connector, Harness Side**: VPWR - Pin 2 / **(-)PCM Connector, Harness Side**: VPWR • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **KJ10**. REPAIR open circuit.
KJ10	CHECK THE SCBC CIRCUIT FOR AN OPEN IN THE HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)SCBC Solenoid Connector, Harness Side**: SCBC - Pin 1 / **(-)PCM Connector, Harness Side**: SCBC • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. REPAIR open circuit.
KJ11	CHECK THE SCBC CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS		
	• PCM connector disconnected. • Scan tool connector disconnected. • Measure the Resistance between: **(+)SCBC Solenoid Connector, Harness Side**: SCBC - Pin 1 / **(-)PCM Connector, Harness Side**: PWRGND • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KJ12**. REPAIR short circuit.
KJ12	CHECK THE SCBC CIRCUIT FOR A SHORT TO POWER OR TO CHASSIS GROUND IN THE HARNESS		
	• Scan tool connector connected. • Key ON Engine OFF. • Measure the Voltage between: **(+)PCM Connector, Component Side**: SCBC / **(-)**: Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. INSTALL a new PCM. KEY OFF. REPAIR short circuit.

Supercharger Bypass Control | KJ

Test Steps		Results →	Action to Take
KJ13	LACK OF POWER (LOW BOOST) - CHECK THE VACUUM HOSES		
	Note: For vehicle specific vacuum hose routing, refer to the vehicle information decal located in the front of the engine compartment. • CHECK for holes, cracks, bends or kinks in the vacuum line between the supercharger bypass actuator and the supercharger bypass solenoid. • CHECK for holes, cracks, bends or kinks in the vacuum line between the supercharger bypass solenoid and the vacuum reservoir assembly. • CHECK for any disconnected hoses at the supercharger bypass actuator, bypass solenoid or vacuum reservoir assembly. • **Are any vacuum line issues present?**	Yes → No →	REPAIR or install new vacuum lines as required. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Air conditioning clutch relay circuit	KM

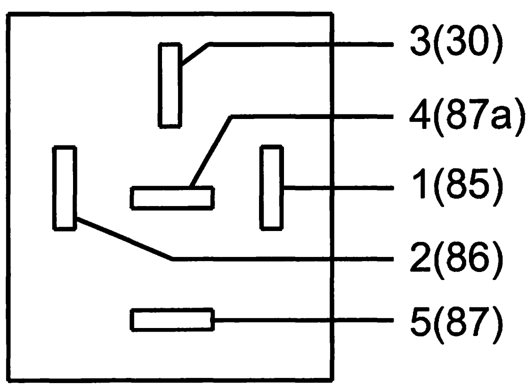
Note

This Pinpoint Test is intended to diagnose the following:

- Harness Circuits: VPWR, A/CC, A/CCS.
- A/CC RELAY.
- PCM (12A650).

Air Conditioning Clutch (A/CC) Relay Connector

A



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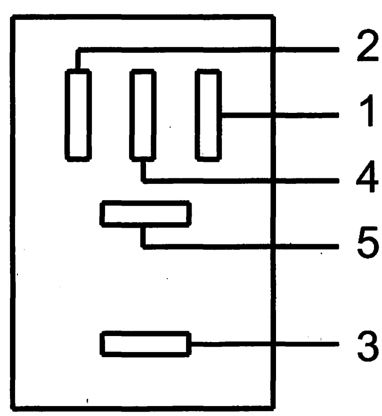
B



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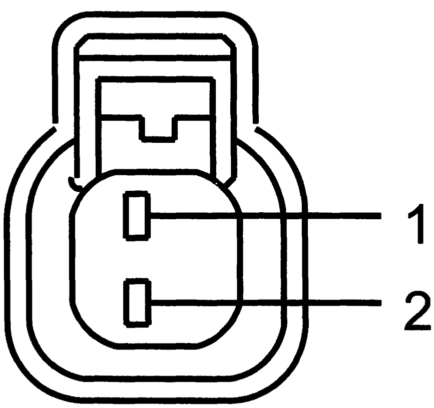
Vehicle	Connector	Circuit	Pin
E-Series 4.2L, Excursion, Expedition, F-150, Navigator	A	A/CCR VPWR	1 2
All other vehicles	B	A/CCR VPWR	1 2

Air conditioning clutch relay circuit	KM

The VPWR & A/CCR circuits may be reversed in the harness connector. REFER to the wiring diagram manual for more information.

Air Conditioning Clutch (A/CC) Assembly Connector

A



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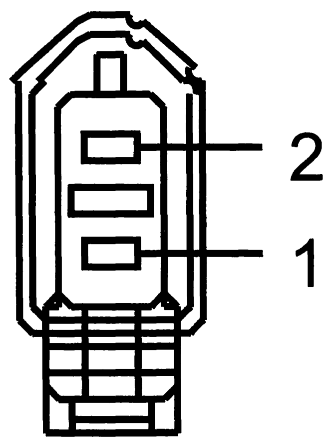
B



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Vehicle	Connector	Circuit	Pin
Explorer, Mountaineer	A	A/CC PWR	2
All other vehicles	B	A/CC PWR	1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Air conditioning clutch relay circuit — KM

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	A/CCR	B9
E-Series	104 Pin	A/CCS	41
Expedition, Navigator	122 Pin	A/CCR	B2
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	A/CCR	B25
F-150	190 Pin	A/CCR	B18
All other vehicles	104 Pin	A/CCR	69

Test Steps		Results →	Action to Take
KM1	KOEO AND KOER DTCS P1460 OR P0645: VERIFY THAT ACCS PID IS OFF		
	Note: Verify AC and defrost were off during KOEO/KOER Self-Tests. If the vehicle is not equipped with AC, the WAC circuit is not used and DTC P1460/P0645 can be ignored. • Key ON Engine RUN. • AC and defroster OFF. • Access the PCM-ACCS PID using a scan tool. • **Is the PID state OFF?**	Yes → No →	KEY OFF. GO to **KM2**. ACCS input to PCM is requesting AC. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
KM2	CHECK VPWR VOLTAGE TO A/CC RELAY		
	• A/CC Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)A/CC Relay Connector, Harness Side**: VPWR — **(-)**: Ground • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **KM3**. REPAIR open circuit. Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test
KM3	CHECK A/CC RELAY		
	• REFER to the pin numbers molded on A/CC RELAY. Measure resistance between either pin 1 or pin 85 and all other pins of the relay. One measurement must be between 40 and 120 ohms, with the other measurements being greater than 10,000 ohms. • **Are all resistance checks ok?**	Yes → No →	GO to **KM4**. INSTALL a new A/CC relay. Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test

Air conditioning clutch relay circuit — KM

Test Steps		Results →	Action to Take
KM4	CHECK A/CCR (WAC) CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)A/CC Relay Connector, Harness Side**: A/CCR; **(-)**: Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KM5**. REPAIR short circuit. Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test
KM5	CHECK A/CC (WAC) CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: **(+)A/CC Relay Connector, Harness Side**: A/CCR; **(-)**: Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KM6**. REPAIR short circuit. Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test
KM6	CHECK A/CC (WAC) CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)A/CC Relay Connector, Harness Side**: A/CCR; **(-)PCM Connector, Harness Side**: A/CCR • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test REPAIR open circuit. Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test

Variable Speed Electric Cooling Fan — KN

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KN11</td><td>CHECK VOLTAGE TO COOLING FAN USING CHASSIS GROUND AS A REFERENCE</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Voltage between:
<table>
<tr><th>(+)CF Motor Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>B+</td><td>Ground</td></tr>
</table>
Is the Voltage above 10.5 V?
</td><td>Yes →
No →</td><td>REPAIR open circuit.
B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.</td></tr>
<tr><td>KN12</td><td>KOEO DTC P0480: CHECK B+ AND GND TO COOLING FAN MOTOR</td><td></td><td></td></tr>
<tr><td colspan="2">
Key OFF.
CF Motor connector disconnected.
Measure the Voltage between:
<table>
<tr><th>(+)CF Motor Connector, Harness Side</th><th>(-)CF Motor Connector, Harness Side</th></tr>
<tr><td>B+</td><td>GND</td></tr>
</table>
Is the Voltage above 10.5 V?
</td><td>Yes →
No →</td><td>GO to KN14.
GO to KN13.</td></tr>
<tr><td>KN13</td><td>CHECK VOLTAGE TO FAN MOTOR USING CHASSIS GROUND AS A REFERENCE</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Voltage between:
<table>
<tr><th>(+)CF Motor Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>B+</td><td>Ground</td></tr>
</table>
Is the Voltage above 10.5 V?
</td><td>Yes →
No →</td><td>REPAIR open circuit. Open GND harness circuit
B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.</td></tr>
<tr><td>KN14</td><td>CHECK VPWR VOLTAGE TO CFC</td><td></td><td></td></tr>
<tr><td colspan="2">
CFC Module connector disconnected.
Key ON Engine OFF.
Measure the Voltage between:
<table>
<tr><th>(+)CFC Module Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>VPWR - Pin 2</td><td>Ground</td></tr>
</table>
Is the Voltage above 10.5 V?
</td><td>Yes →
No →</td><td>KEY OFF. GO to KN15.
REPAIR open circuit.</td></tr>
</table>

Variable Speed Electric Cooling Fan	KN

Test Steps		Results →	Action to Take
KN15	CHECK FCV CIRCUIT(S) TO FAN		
	• Connect 1.6 K ohms resistor between FCV and B+ circuits at the CF harness connector. (this simulates cooling fan circuitry). • Key ON Engine OFF. • Run KOEO Self-Test. • **Is DTC P0480 present?**	Yes → No →	GO to **KN16**. KEY OFF. INSTALL a new CFC module. Replacement of the assembly might be required
KN16	CHECK FCV CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)CFC Module Connector, Harness Side** / **(-)**: FCV - Pin 1 / Ground • **Is the Voltage below 1 V?**	Yes → No →	GO to **KN17**. REPAIR short circuit.
KN17	CHECK FCV CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: **(+)CFC Module Connector, Harness Side** / **(-)**: FCV - Pin 1 / Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KN18**. REPAIR short circuit.
KN18	CHECK THE FCV CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)CFC Module Connector, Harness Side** / **(-)PCM Connector, Harness Side**: FCV - Pin 1 / FCV • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.

Variable Speed Electric Cooling Fan — KN

Test Steps		Results →	Action to Take
KN19	CONTINUOUS MEMORY DTC P0480: CHECK B+ & GND FOR INTERMITTENT CONCERN		
	• Key OFF. • CF Motor connector disconnected. • Connect non-powered test lamp between: **(+)CF Motor Connector, Harness Side** / **(-)CF Motor Connector, Harness Side**: B+ / GND • Observe test lamp for an indication of a fault while completing the following (the lamp will turn Off when a fault is detected): — Shake, wiggle, bend the B+ & GND circuits to the CFM. — Lightly tap on the associated FUSE (to simulate road shock). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **KN20**.
KN20	CHECK VPWR CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Key OFF. • CFC Module connector disconnected. • Connect non-powered test lamp between: **(+)CFC Module Connector, Harness Side** / **(-)**: VPWR - Pin 2 / Ground • Key ON Engine OFF. • Observe test lamp for an indication of a fault while completing the following (the lamp will turn Off when a fault is detected): — Shake, wiggle, bend the VPWR circuit(s). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **KN21**.

Variable Speed Electric Cooling Fan | KN

Test Steps		Results →	Action to Take
KN21	CHECK FCV CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Connect 1.6K ohms resistor between the FCV & VPWR circuits at the CFC harness connector. (this simulates cooling fan circuitry). • Measure the Voltage between:	Yes →	KEY OFF. ISOLATE fault and REPAIR as necessary.
		No →	KEY OFF. GO to **Z1**.

(+)CFC Module Connector, Harness Side	(-)
FCV - Pin 1	Ground

- Key ON Engine OFF.
- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command low speed fan ON
- CHECK DVOM for an indication of a fault while completing the following (the voltage will change suddenly when a fault is detected):
  - — Shake, wiggle, bend the FCV circuit between the CFC and PCM.
- **Is a fault indicated?**

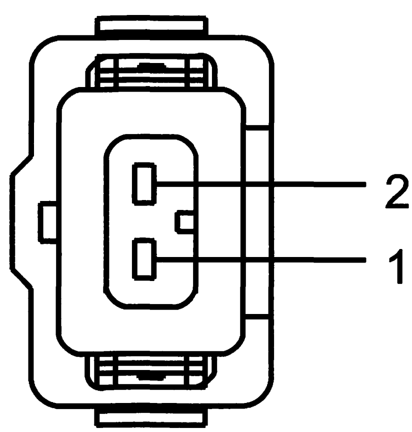
Charge air cooler (CAC) pump	KP

Note

This Pinpoint Test is intended to diagnose the following:

- Charge Air Cooler Pump Relay (14B192).
- Charge Air Cooler Pump Motor (8501).
- Harness circuits: CAC, VPWR and GND.

Charge Air Cooler (CAC) Motor Connector



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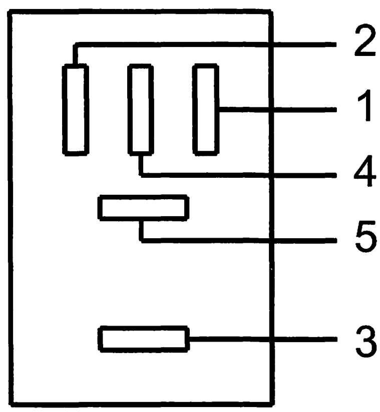
Circuit	Pin
PUMPPWR (Pump Power)	2
GND (Ground)	1

Charge air cooler (CAC) pump	KP

Charge Air Cooler (CAC) Relay Connector



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Circuit	Pin
PUMPPWR (Pump Power)	5
B+ (Battery positive voltage)	3
CAC (Charge Air Cooler)	2
VPWR (Power supply)	1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
F-150 Heritage	104 Pin	CAC	70
Mustang	104 Pin	CAC	82

Charge air cooler (CAC) pump — KP

Test Steps		Results →	Action to Take
KP1	DTC P1229: CHECK THE POWER FEED TO THE CAC PUMP RELAY COIL		
	• Key OFF. • CAC Relay connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	GO to **KP2**. REPAIR open circuit.

(+)CAC Relay Connector, Harness Side	(-)
VPWR - Pin 1	Ground

• **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
KP2	CHECK THE CAC PUMP RELAY		
	• REMOVE the relay from the power distribution box. • Measure the Resistance between:	Yes → No →	GO to **KP4**. INSTALL a new CAC relay.

(+)CAC Relay Connector, Component Side	(-)CAC Relay Connector, Component Side
CAC - Pin 2	VPWR - Pin 1

• **Is the Resistance between 65 Ohm - 100 Ohm?**

Test Steps		Results →	Action to Take
KP3	CHECK THE CAC PUMP RELAY		
	• CHECK the resistance between pin 1 or 2 and all other pins on the CAC relay. • **Are all resistances greater than 10K ohms?**	Yes → No →	GO to **KP4**. INSTALL a new CAC relay.
KP4	CHECK FOR AN OPEN CIRCUIT BETWEEN THE PCM AND THE CAC RELAY		
	• Key OFF. • PCM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **KP5**. REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)CAC Relay Connector, Harness Side
CAC	CAC - Pin 2

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
KP5	CHECK FOR A SHORT TO POWER BETWEEN THE PCM AND THE CAC RELAY		
	• Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	GO to **KP6**. REPAIR short circuit to PWR.

(+)PCM Connector, Harness Side	(-)Vehicle battery
CAC	Negative post

• **Is the Voltage below 0.5 V?**

Charge air cooler (CAC) pump

KP

Test Steps		Results →	Action to Take
KP6	CHECK BETWEEN THE PCM AND THE CAC RELAY FOR A SHORT TO GROUND		
	• Key OFF. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)Vehicle battery**: CAC / Negative post • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KP7**. REPAIR short circuit to GND.
KP7	CHECK SCICP PID		
	• PCM connector connected. • Scan tool connector connected. • Access the PCM-SCICP PID using a scan tool. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • **Is the SCICP PID on?**	Yes → No →	INSTALL a new PCM. If the CAC reservoir is full, there is no air flow blockage at the CAC radiator, the IAT2 and connecting circuits are not high resistance or open circuited, intercooler hoses are not reversed and DTC P1229 is present in KOEO and KOER, then the PCM is bad. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
KP8	CHECK CAC FOR MECHANICAL OPERATION		
	• Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Observe the CAC pump. • Command outputs OFF • **Did the CAC pump run?**	Yes → No →	KEY OFF. CHECK for low fluid level in the intercooler system. Check for cracked or incorrectly routed intercooler lines or airflow blockage at the CAC radiator. Repair as necessary. If symptom still exists, return to Section 3, Symptom Charts. GO to **KP9**.

(+)PCM Connector, Harness Side	(-)Vehicle battery
CAC	Negative post

Charge air cooler (CAC) pump

KP

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KP9</td><td>CHECK THE POWER AND GROUND CIRCUITS AT THE CAC PUMP MOTOR</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF. INSTALL a new CAC motor.

KEY OFF.
GO to KP10.</td></tr>
<tr><td colspan="2">

CAC Motor connector disconnected.
Scan Tool Connected
Enter Output Test Mode (refer to section 2)
Command outputs ON
Measure the Voltage between:

<table>
<tr><th>(+)CAC Motor Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>CAC</td><td>Negative post</td></tr>
</table>
Is the Voltage above 10.5 V?
</td></tr>
<tr><td>KP10</td><td>CHECK THE INTEGRITY OF THE CAC PUMP MOTOR GROUND CONNECTION</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to KP11.
REPAIR open circuit.</td></tr>
<tr><td colspan="2">

CAC Motor connector disconnected.
Measure the Resistance between:

<table>
<tr><th>(+)CAC Motor Connector, Harness Side</th><th>(-)Vehicle battery</th></tr>
<tr><td>GND - Pin 1</td><td>Negative post</td></tr>
</table>
Is the Resistance below 5 Ohm?
</td></tr>
<tr><td>KP11</td><td>CHECK THE VOLTAGE TO THE CAC PUMP RELAY</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to KP12.
KEY OFF. REPAIR open circuit.
Check fuses.</td></tr>
<tr><td colspan="2">

CAC Relay connector disconnected.
Measure the Voltage between:

<table>
<tr><th>(+)CAC Relay Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>B+ - Pin 3</td><td>Ground</td></tr>
</table>
Is the Voltage above 10.5 V?
</td></tr>
<tr><td>KP12</td><td>CHECK FOR OPEN CAC PUMP MOTOR CIRCUIT</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
INSTALL a new CAC pump relay.
KEY OFF. REPAIR open circuit.</td></tr>
<tr><td colspan="2">

Measure the Resistance between:

<table>
<tr><th>(+)CAC Relay Connector, Harness Side</th><th>(-)CAC Motor Connector, Harness Side</th></tr>
<tr><td>PUMPPWR - Pin 5</td><td>PUMPPWR - Pin 2</td></tr>
</table>
Is the Resistance below 5 Ohm?
</td></tr>
</table>

Malfunction Indicator Lamp — NB

Note

This Pinpoint Test is intended to diagnose the following:

- Malfunction Indicator Lamp (MIL) circuit.
- Powertrain Control Module (PCM) (12A650).

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
104 Pin	MIL	2

Test Steps		Results →	Action to Take
NB1	MALFUNCTION INDICATOR LAMP ALWAYS ON (NO DTCS PRESENT)		
	• **Does the vehicle start?**	Yes →	GO to **NB2**.
		No →	Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
NB2	CHECK THE MIL CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)Vehicle battery**: MIL - Pin 2 / Negative post • **Is the Resistance above 10 KOhm?**	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit to GND.
NB3	MALFUNCTION INDICATOR LAMP (MIL) NEVER ON		
	• **Does the vehicle start?**	Yes →	GO to **NB4**.
		No →	Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Malfunction Indicator Lamp

NB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>NB4</td><td>MIL HARNESS CHECK</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF. INSTALL a new PCM.

KEY OFF.
GO to NB5.</td></tr>
<tr><td colspan="2">• PCM connector disconnected.
• Key ON Engine OFF.
• Add jumper wire between the points described below:
<table><tr><th>Point A PCM Connector, Harness Side</th><th>Point B</th></tr><tr><td>MIL - Pin 2</td><td>Ground</td></tr></table>• REMOVE jumper wire(s)
• Did the MIL Illuminate when grounded?</td></tr>
<tr><td>NB5</td><td>CHECK VOLTAGE ON THE B+ CIRCUIT</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to NB6.

KEY OFF. REPAIR open circuit.</td></tr>
<tr><td colspan="2">• PCM disconnected.
• IC connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)IC Connector, Harness Side</th><th>(-)Vehicle battery</th></tr><tr><td>B+</td><td>Negative post</td></tr></table>• Is the Voltage above 10.5 V?</td></tr>
<tr><td>NB6</td><td>CHECK FOR OPEN MIL CIRCUIT BETWEEN PCM AND INSTRUMENT CLUSTER</td><td rowspan="2">Yes →

No →</td><td rowspan="2">Refer to the workshop manual for instrument cluster diagnostics.
If OK REPLACE PCM.
(refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
VERIFY repair by turning the key to the ON position.

REPAIR open circuit.
VERIFY repair by turning the key to the ON position.</td></tr>
<tr><td colspan="2">• PCM disconnected.
• IC connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)IC Connector, Harness Side</th></tr><tr><td>MIL - Pin 2</td><td>MIL</td></tr></table>• Is the Resistance below 5 Ohm?</td></tr>
</table>

Ignition Engine Speed Input Circuit | NC

Note

This pinpoint test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650).

Test Steps		Results →	Action to Take
NC1	CONTINUOUS MEMORY DTC P0320: ERRATIC IGNITION		
	Note: Verify all 2-way radio installations. Carefully follow manufacturer's installation instructions regarding the routing of antenna and power leads. • **Are any faults present?**	Yes → No →	Repair as necessary. KEY OFF. GO to **NC2**.
NC2	NO START CONCERN		
	• **Is the customer complaint No start?**	Yes → No →	GO to **A1**. GO to **NC3**.
NC3	INTERMITTENT FAULTS		
	• **Is this an intermittent condition?**	Yes → No →	GO to **Z1**. GO to **JD1**.

Engine RPM\Vehicle Speed Limiter Reached

ND

Note

Enter this Pinpoint Test only when directed here.

Test Steps		Results →	Action to Take
ND1	DTCS P0219, P0297 OR P1270: EXCESSIVE ENGINE RPM OR VEHICLE SPEED		
	• P0219 (engine over speed), P0297 (vehicle over speed) or P1270 Diagnostic Trouble Codes indicate that the vehicle has been operated in a manner which caused the engine or vehicle speed to exceed a calibrated limit. • — Excessive engine rpm in NEUTRAL or operated in the wrong transmission gear. — Excessive wheel slippage (water, ice, mud or snow). — Vehicle driven at a high rate of speed. • **Was the vehicle operating in any of the above conditions?**	Yes → No →	OBD system is OK. RETURN vehicle to customer with information about DTC GO to Section 3, Symptom Charts if there are other driveability concerns. If there are no other symptoms, RETURN vehicle to customer with information about DTC

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

Note

This Pinpoint Test is intended to diagnose the following:

- Data link connector (DLC) harness circuits: chassis (GND), power ground (PWRGND), 12v battery positive (B+).
- Damaged DLC.
- PCM VREF.
- PCM VPWR.
- PCM GND.
- KOER DTC P1001.

Concerns found that affect the network are referred to the Module Communication Network, Section 418 in the Workshop Manual.

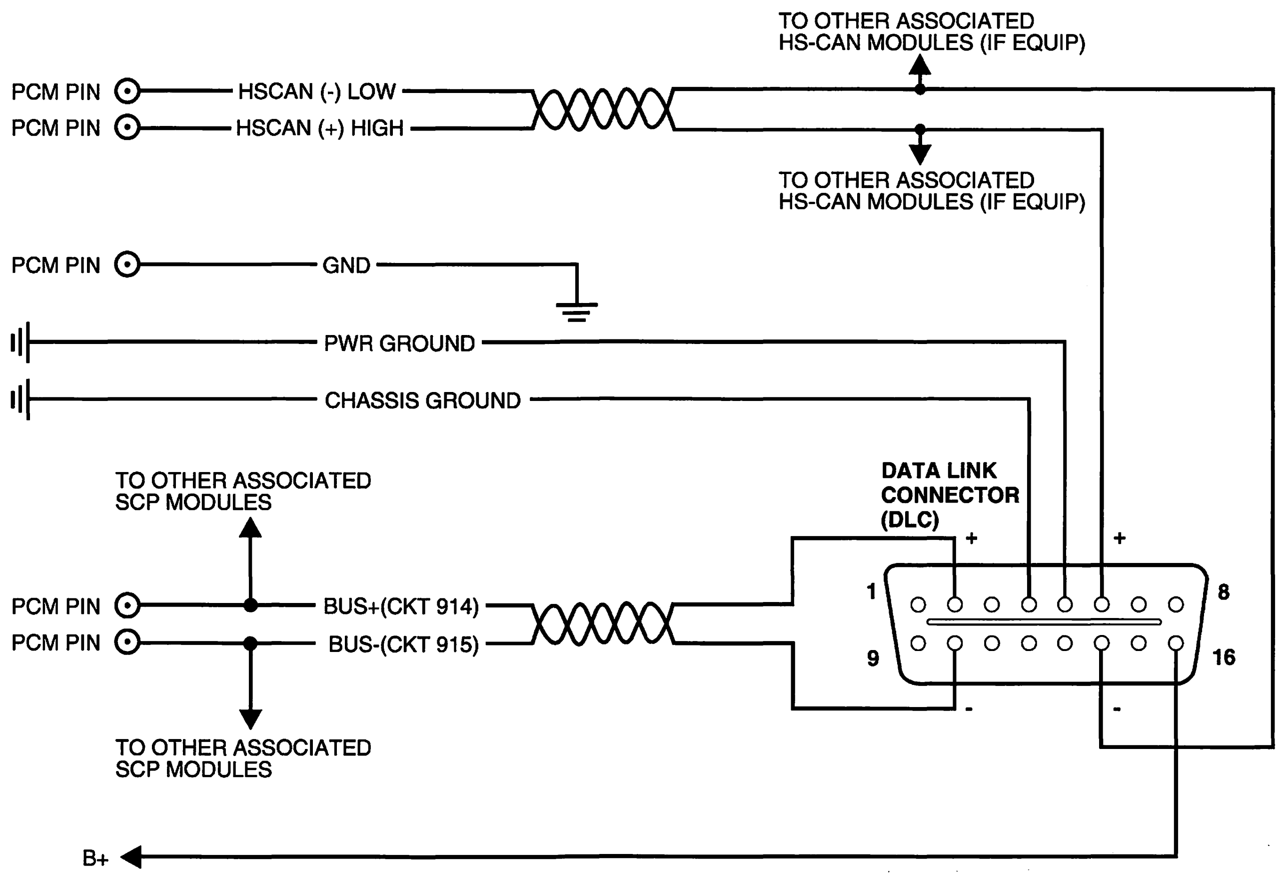
Typical PCM to DLC network connection

IMPORTANT INSTRUCTIONS

SCP or CAN network connection to the PCM depend on vehicle application and configuration. Vehicle may be equipped with both networks SCP and HS-CAN or just have one of them connected to the PCM. REFER to Wiring Diagrams Manual for harness, module and connector locations. For complete description and operation information for the entire vehicle module communications network, refer to the workshop manual Section 418.

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA



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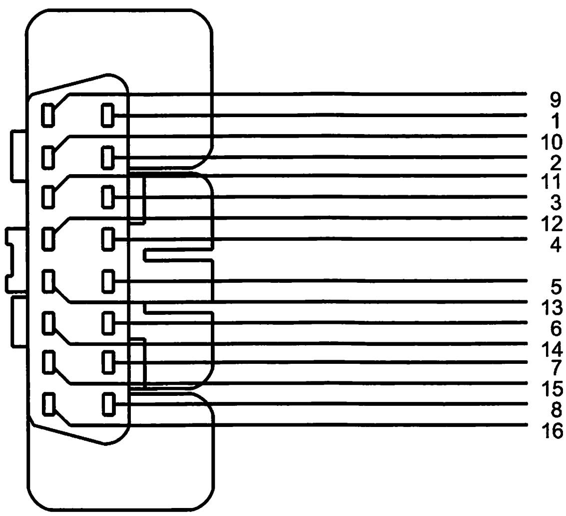
PCM Communication Network and VREF Information Table

Application	Engine	PCM Communication	Measure PCM VREF at:
Focus	2.3L	HS-CAN	TPS
Taurus/Sable	All	HS-CAN	TPS
Lincoln LS, Thunderbird	All	HS-CAN & SCP	FRP
F150 (Non-Heritage)	All	HS-CAN	FRP
Explorer, Mountaineer	4.0L	HS-CAN	FRPT
Explorer, Mountaineer	4.6L	HS-CAN	FRP
All Others	All	SCP	TPS

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

Data Link Connector (DLC) Connector



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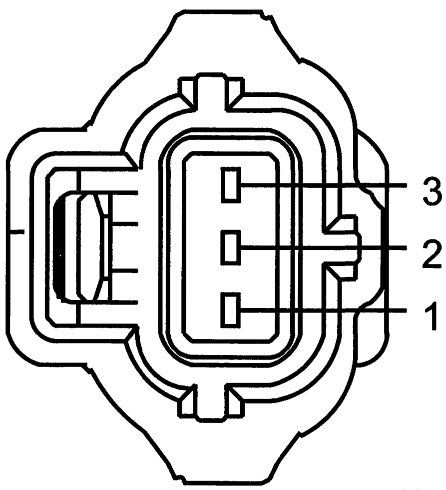
Circuit	Pin
SCP- (Standard Corporate Protocol Negative)	10
SCP+ (Standard Corporate Protocol Positive)	2
CAN- (Controller Area Network)	14
CAN+ (Controller Area Network)	6
PWRGND (Power ground)	5
CHGND (Chassis ground)	4
B+ (Battery positive voltage)	16

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

Throttle position (TP) Sensor Connector

A



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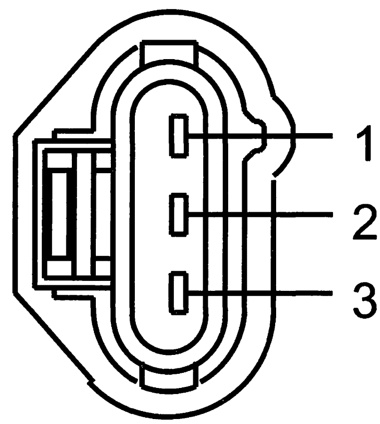
B



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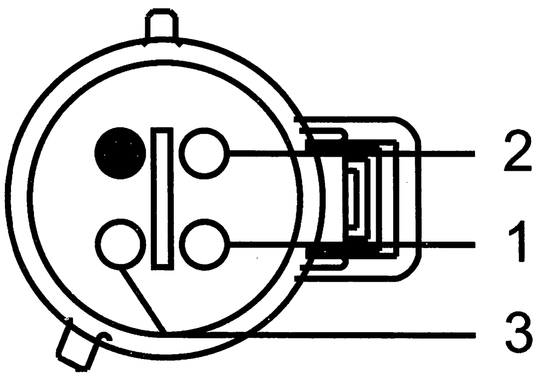
Vehicle	Connector	Circuit	Pin
Focus, Ranger 2.3L	A	SIGRTN VREF	1 3
All other vehicles	B	SIGRTN VREF	3 1

Unable to Activate Self-Test/Network Communication Error/DTC P1001	QA

Fuel Rail Pressure (FRP) Sensor Connector

A



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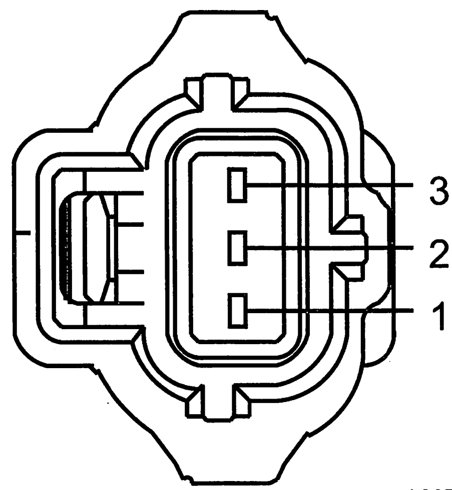
B



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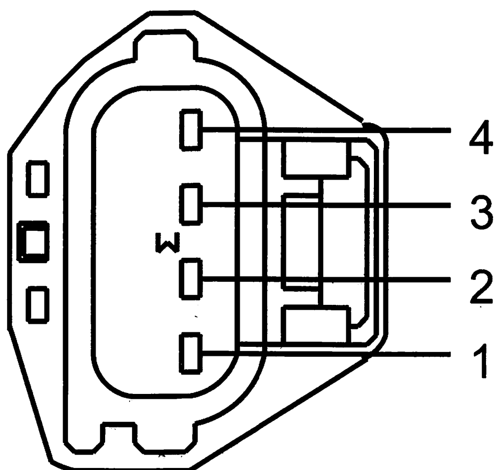
Vehicle	Connector	Circuit	Pin
Crown Victoria Dedicated NGV, F-150 Heritage 5.4L Dedicated NGV	A	SIGRTN VREF	1 2
All other vehicles	B	SIGRTN VREF	2 1

Unable to Activate Self-Test/Network Communication Error/DTC P1001	QA

Fuel Rail Pressure/Temperature (FRPT) Sensor Connector



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Circuit	Pin
SIGRTN (Signal return)	4
VREF (Reference Voltage)	2

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

Test Steps		Results →	Action to Take
QA1	VEHICLE INSPECTION AND VERIFY SELF-TEST PROCEDURE		
	• This pinpoint test addresses the following concerns: — Unable to communicate with PCM. — Unable to activate PCM Self-Test. — Scan tool communication concern. • Possible causes: — Damaged DLC. — Incorrect Self-Test procedure. — Open DLC harness circuit. — Short in DLC harness circuit or associated modules. — Damaged power or ground circuits to PCM. — Damaged PCM. Note: If Self-Test or communication concern only occurred after a failed or aborted module reprogram, the module may be blank. If this is the case, try reprograming the module again before continuing with this pinpoint. • Visually inspect for obvious signs of electrical damage. • Inspect: — Power distribution box fuses. — Smart junction box fuses. — Harness wiring. — Electrical connections. REPAIR/REPLACE as necessary. • Verify that the correct procedure was used to activate Self-Test for the scan tool. REFER to Section 2, Diagnostic Methods. • **Was the correct Self-Test procedure used?**	Yes → No →	KEY OFF. GO to **QA2**. KEY OFF. Correct procedure was not used for activating Self-Test. Return to Section 3, Symptom Charts, Step 1: Quick Test, and COMPLETE Self-Test using the correct procedure.
QA2	INSPECT VEHICLE AND SCAN TOOL DLC FOR DAMAGE		
	• Disconnect scan tool. • INSPECT vehicle and scan tool DLC for damage. Note: CHECK DLC circuit(s) for corrosion, loose wires, etc. • **Are there any concerns with the wiring or the DLC connection?**	Yes → No →	Repair as necessary. GO to **QA3**.

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

Test Steps		Results →	Action to Take
QA3	CHECK B+ VOLTAGE TO DATA LINK CONNECTOR (DLC)		
	• Scan tool disconnected. • Measure the Voltage between: **(+)DLC Connector, Harness Side** / **(-)12V vehicle battery**: B+ - Pin 16 / Negative post • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **QA4**. REPAIR open circuit.
QA4	CHECK DLC CHASSIS GROUND CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Voltage between: **(+)DLC Connector, Harness Side** / **(-)DLC Connector, Harness Side**: B+ - Pin 16 / CHGND - Pin 4 • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **QA5**. REPAIR open circuit.
QA5	CHECK DLC POWER GROUND CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Voltage between: **(+)DLC Connector, Harness Side** / **(-)DLC Connector, Harness Side**: B+ - Pin 16 / PWRGND - Pin 5 • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **QA6**. REPAIR open circuit.

Nested measurement tables:

QA3:

(+)DLC Connector, Harness Side	(-)12V vehicle battery
B+ - Pin 16	Negative post

QA4:

(+)DLC Connector, Harness Side	(-)DLC Connector, Harness Side
B+ - Pin 16	CHGND - Pin 4

QA5:

(+)DLC Connector, Harness Side	(-)DLC Connector, Harness Side
B+ - Pin 16	PWRGND - Pin 5

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

Test Steps		Results →	Action to Take
QA6	RUN DATA LINK DIAGNOSTIC NETWORK TEST		
	Note: The purpose of this test step is to determine if the Scan tool can communicate to the PCM by using the Network Test function on the scan tool. The Network Test pings each module on the network and looks for a reply. If a PCM communication error message is encountered possible causes are: — Loss or intermittent loss of power or ground to the PCM. — PCM VREF circuit concern causing a PCM reset. — PCM to network communication problems (Open or Shorted data link (+) or (-) circuit from PCM to the rest of the network modules or DLC). • Connect scan tool. • Key ON Engine OFF. • Run Data Link Diagnostic Network Test. Note: Typical PCM network error messages: — PCM : No Response/Not Equipped. — PCM: No Response on Bus +. — PCM: No Response on Bus -. — PCM : No Response on HS-CAN(+). — PCM : No Response on HS-CAN(-). • **Are there any PCM network error messages?**	Yes → No →	CHECK to see if the PCM is receiving power and ground. PCM power and ground can be established by measuring VREF voltage at one of the following components. To find the VREF measurement point refer to the PCM Communication Network and VREF Information Table found at the beginning of this pinpoint. Select the applicable Goto for the VREF to be measured. **For Throttle Position (TP) Sensor** GO to **QA7**. **For Fuel Rail Pressure (FRP) Sensor** GO to **QA8**. **For Fuel Rail Pressure Temperature (FRPT) Sensor** GO to **QA9**. PCM network test passed. GO to **QA11**.
QA7	CHECK VREF VOLTAGE TO TP SENSOR		
	Note: This test step determines if the PCM has power and ground. • TP Sensor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)TP Sensor Connector, Harness Side: VREF — (-)TP Sensor Connector, Harness Side: SIGRTN • **Is the Voltage between 4 V - 6 V?**	Yes → No →	PCM has power and ground. GO to **QA10**. GO to **C1**.

(+)TP Sensor Connector, Harness Side	**(-)TP Sensor Connector, Harness Side**
VREF	SIGRTN

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>QA8</td><td>CHECK VREF VOLTAGE TO FRP SENSOR

Note: This test step determines if the PCM has power and ground.
• FRP Sensor connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)FRP Sensor Connector, Harness Side</th><th>(-)FRP Sensor Connector, Harness Side</th></tr><tr><td>VREF</td><td>SIGRTN</td></tr></table>• Is the Voltage between 4 V - 6 V?</td><td>Yes →

No →</td><td>PCM has power and ground. GO to QA10.

GO to C1.</td></tr>
<tr><td>QA9</td><td>CHECK VREF VOLTAGE TO FRPT SENSOR

Note: This test step determines if the PCM has power and ground.
• FRPT Sensor connector disconnected.
• Key ON Engine OFF.
• Measure the Voltage between:
<table><tr><th>(+)FRPT Sensor Connector, Harness Side</th><th>(-)FRPT Sensor Connector, Harness Side</th></tr><tr><td>VREF - Pin 2</td><td>SIGRTN - Pin 4</td></tr></table>• Is the Voltage between 4 V - 6 V?</td><td>Yes →

No →</td><td>PCM has power and ground. GO to QA10.

GO to C1.</td></tr>
<tr><td>QA10</td><td>CHECK LINK COMMUNICATION WITH VREF SENSOR DISCONNECTED

• With the measured VREF sensor from previous step still disconnected.
• Scan Tool Connected.
• Key ON Engine OFF.
• Attempt to access FRP, FRPT, or TP voltage PID.
Note: If PID cannot be access or scan tool communication still exist. GO to the Workshop Section 418, Module Communications Network for further diagnosis.
• Reconnect sensor while monitoring PID.
• Does PCM to scan tool communication error occur only when VREF sensor is reconnected?</td><td>Yes →

No →</td><td>VREF shorted to SIGRTN in the sensor, replace suspect sensor.

PCM has power and ground.
If scan tool communication problems continues:
REFER to Workshop Manual, Section 418, Module Communications Network for further diagnosis.
Otherwise return to the section or pinpoint that sent you here.</td></tr>
</table>

Unable to Activate Self-Test/Network Communication Error/DTC P1001

QA

Test Steps		Results →	Action to Take
QA11	CHECK OTHER ECU(S) FOR NETWORK ERROR MESSAGES		
	• Using previous network test results. • CHECK other ECU(s) for network error messages. Note: Ignore optional equipment modules communication errors unless module is related to symptom being diagnosed. • **Are there any ECU network error messages?**	Yes →	Other ECU network errors encountered. REFER to Workshop Manual, Section 418, Module Communications Network for further diagnosis.
		No →	Test Complete Return to the Symptom Chart or Section for the module in question.
QA12	KOER DTC P1001: KOER NOT ABLE TO COMPLETE, KOER ABORTED		
	• Verify that the correct procedure was used to activate Self-Test for the scan tool. REFER to Section 2, Diagnostic Methods. • **Was the correct Self-Test procedure used?**	Yes →	GO to **QA13**.
		No →	Correct procedure was not used for activating Self-Test. Return to Section 3, Symptom Charts, Step 1: Quick Test, and COMPLETE Self-Test using the correct procedure.
QA13	CHECK FOR ANY OTHER KOER DTCS		
	• **Are there any other KOER DTCs?**	Yes →	GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, for Pinpoint Test direction and REPAIR other DTCs first.
		No →	GO to **QA14**.
QA14	CHECK FOR ANY OTHER PCM DTCS		
	• **Are there any other PCM DTCs?**	Yes →	GO to Section 4, Powertrain Diagnostic Trouble Code (DTC) Charts, for Pinpoint Test direction and REPAIR other DTCs first.
		No →	GO to Section 3, Symptom Charts, Step 2: NO DTC(s) PRESENT SYMPTOM CHART INDEX for direction to proper Step 3 Chart. Note: If symptom is not listed, REFER to applicable Workshop Manual or GO to Z1 in Section 5 (for intermittent system diagnostics)

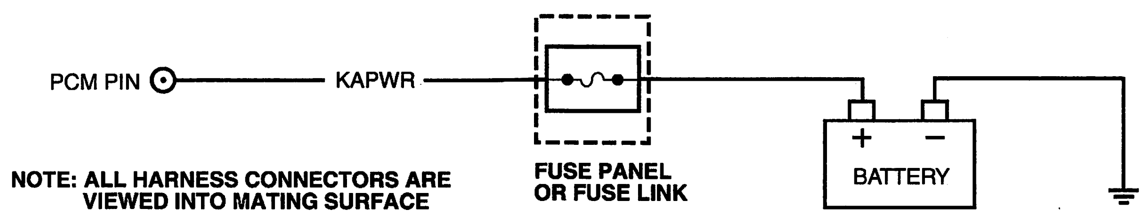
DTCs P0603 or P1633: Keep Alive Power

QB

Note

This Pinpoint Test is intended to diagnose the following:

- Battery terminal condition.
- Keep Alive Power (KAPWR) wire routing.
- Harness circuit: KAPWR.
- Powertrain control module (PCM) (12A650).



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Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	KAPWR	B44
Expedition, Navigator	122 Pin	KAPWR	B40
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	KAPWR	B45
F-150	190 Pin	KAPWR	B54
All other vehicles	104 Pin	KAPWR	55

DTCs P0603 or P1633: Keep Alive Power

QB

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>QB1</td><td>CHECK 12 VOLT BATTERY TERMINALS</td><td rowspan="2">Yes →

No →</td><td rowspan="2">KEY OFF.
GO to QB2.
Repair any concerns found.</td></tr>
<tr><td colspan="2">Note: If KAPWR is interrupted to the PCM when a breakout box is installed or the battery is disconnected, DTC P0603/P1605 can be generated on the first power-up.
• INSPECT the 12 volt battery cables for loose connections and for corrosion.
• Are the 12 volt battery terminal connections in good condition?</td></tr>
<tr><td>QB2</td><td>INSPECT ENGINE COMPARTMENT FOR PROPER WIRE ROUTING</td><td rowspan="2">Yes →
No →</td><td rowspan="2">Repair as necessary.
GO to QB3.</td></tr>
<tr><td colspan="2">• INSPECT Electronic Engine Control (EC) System wiring for proper wire routing.
• Check the wiring routing to establish if any of the electrical connectors are being stressed due to poorly routed wiring. If necessary re-route the wiring and secure.
• Visually inspect wiring and connectors.
• Is there any wiring problems?</td></tr>
<tr><td>QB3</td><td>CHECK KEEP ALIVE POWER (KAPWR) TO PCM</td><td rowspan="2">Yes →

No →</td><td rowspan="2">ISOLATE fault and REPAIR as necessary.
GO to QB4.</td></tr>
<tr><td colspan="2">• PCM connector disconnected.
• Measure the Voltage between:
<table>
<tr><th>(+)PCM Connector, Harness Side</th><th>(-)12V vehicle battery</th></tr>
<tr><td>KAPWR</td><td>Negative post</td></tr>
</table>
• While observing multimeter, grasp the Electronic EC harness and wiggle, shake or bend a small section while working from the battery to the PCM.
• Is the Voltage below 10.5 V?</td></tr>
<tr><td>QB4</td><td>CHECK FOR REPEAT OF DTC</td><td rowspan="2">Yes →

No →</td><td rowspan="2">INSTALL a new PCM.
REFER to Section 2, Flash Electrically Eraseable Programmable Read Only Memory — Flash EEPROM
Unable to duplicate or identify fault at this time.
REFER to Section 4, Diagnostic Trouble Code (DTC) Description for possible causes and additional DTC description information.
GO to Z1.</td></tr>
<tr><td colspan="2">• PCM connector connected.
• Clear all DTCs that may have been caused by PCM disconnect.
• Test drive the vehicle and allow engine to reach normal operating temperature.
• CHECK Self-Test DTCs:
• Are DTCs P0603 or P1633 present?</td></tr>
</table>

DTC P1000: OBD (On Board Diagnostic) Systems Readiness Test Not Complete

QC

Note

Diagnostic Trouble Code (DTC) P1000 indicates that all the On Board Diagnostic monitors have not yet been successfully tested. In some areas, this DTC must be cleared to pass an inspection/maintenance test. The customer should be informed that the law specifies additional city and highway driving must be done to complete the check of the On Board Diagnostic system. This additional driving must occur before the vehicle is tested at the inspection/maintenance station. The amount of driving required varies with individual driving patterns. To complete this requirement in the shortest amount of time, refer to Section 2, Drive Cycles.

It is not necessary to clear DTC P1000 from the PCM by driving the vehicle unless it is requested by the customer to pass an inspection/maintenance test.

The only way a DTC P1000 can be removed from memory is when all the OBD monitors have successfully completed.

DTC P1000 is set by the PCM with any of the following conditions:

- The vehicle is new from the factory and has not yet completed an OBD Drive Cycle.
- The battery or PCM has been disconnected.
- An OBD monitor failure had occurred before completion of an OBD Drive Cycle.
- The PCM DTCs have been cleared with a scan tool as part of a repair process.
- The PCM has been flashed and the vehicle has not yet completed an OBD Drive Cycle.

DTC P1000 cannot be cleared from the PCM when:

- The vehicle has a Power Take OFF (PTO) and the circuit is shorted to VPWR or B+ or the PTO is on during the testing.

Test Steps		Results →	Action to Take
QC1	CONTINUOUS MEMORY DTC P1000: CHECK FOR ANY OTHER DTCS		
	Note: Only perform this pinpoint test if a Diagnostic Trouble Code DTC P1000 was received from Continuous Memory. Ignore any DTC P1000s in KOEO or KOER. • DTC P1000 indicates that all of the OBD monitor have not yet been successfully tested. • **Were any other DTCs received with the P1000?**	Yes → No →	Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts. GO to **QC2**.

DTC P1000: OBD (On Board Diagnostic) Systems Readiness Test Not Complete

QC

Test Steps		Results →	Action to Take
QC2	CHECK FOR PTO		
	• **Is the vehicle equipped with PTO?**	Yes → No →	GO to **QC3**. GO to **QC4**.
QC3	CHECK PTO PID		
	• Key ON Engine RUN. • Access the PCM-PTO PID using a scan tool. • Cycle PTO switch/actuator ON and OFF. (Follow PTO aftermarket instructions). • **Did PTO PID cycle ON, delay, then OFF?**	Yes → No →	GO to **QC4**. GO to **FB1**.
QC4	REQUEST TO CLEAR DTC P1000		
	Note: A complete OBD Drive Cycle has not yet been performed to clear the DTC P1000 from the PCM. • **Has the customer requested the DTC P1000 be cleared from the PCM memory?**	Yes → No →	COMPLETE an OBD Drive Cycle REFER to Section 2, Drive Cycles KEY OFF. INFORM the customer that if the law in your area required additional driving in order to clear the DTC P1000 from the PCM memory, it must be complete before an inspection/maintenance test.

DTC P1260: Passive Anti Theft System — QD

Note

The Passive Anti-Theft System (PATS) system is also known as SecuriLock in North America. The PATS uses radio frequency identification technology to deter a drive away theft. Passive means that it does not require any activity from the user. The PATS uses a specially encoded ignition key. Each encoded ignition key contains a permanently installed electronic device called a transponder. Each transponder contains a unique electronic identification code. Each encoded ignition key must be programmed into the vehicle before it can be used to start the engine. DTC P1260 will be stored any time the PCM disables the vehicle because of the PATS.

Test Steps		Results →	Action to Take
QD1	CHECK FOR PATS DTCS		
	• REPAIR all Passive Anti-Theft PATS DTCs before P1260. REFER to Workshop Manual, Anti-Theft Section 419 for System Description, Operation and Self Test. • **Have all PATS DTCs been diagnosed?**	Yes → No →	GO to **QD2**. REFER to Workshop Manual, Anti-Theft Section 419 for DTC diagnosis
QD2	CHECK FOR ANY OTHER POWERTRAIN DTCS		
	• REPAIR all powertrain DTCs other than P1260. • **Have all other powertrain DTCs been diagnosed?**	Yes → No →	GO to **QD3**. Disregard the current DTC (Diagnostic Trouble Code) at this time. Address the next DTC. Go to Section 4 for DTC charts.

DTC P1260: Passive Anti Theft System | QD

Test Steps		Results →	Action to Take
QD3	ATTEMPT TO START ENGINE		
	• Complete Keep Alive Memory Reset to clear DTC P1260. REFER to Section 2, Powertrain Control Module PCM Reset for instructions. • Attempt to start the engine. • **Will the engine start?**	Yes →	No system faults exist at present time. For intermittent No Start or Start Stalls, CHECK for intermittent PATS faults. (PATS cannot stall the engine after 1 second of operation). For intermittent stalls while driving, VERIFY scan tool-to-PCM communication during concern. If PCM communication error occurs, possible causes are: Loss or PWR or GND to PCM. Faulty PCM PWR relay. Faulty EEC PWR diode. Shorted VREF signal. REPAIR as necessary.
		No →	DTC P1260 is not the cause of the No Start. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.

Clutch Pedal Position CPP Switch	TA

Note

This Pinpoint Test is intended to diagnose the following:

CPP.

PCM.

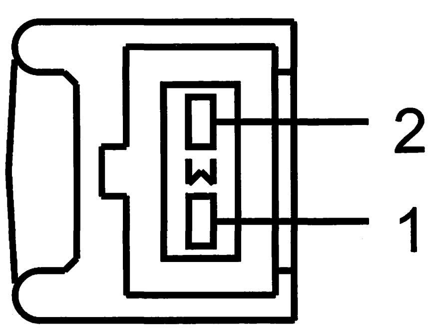
Harness Circuit(s):

CPP.

SIGRTN.

Clutch Pedal Position (CPP) Connector

A



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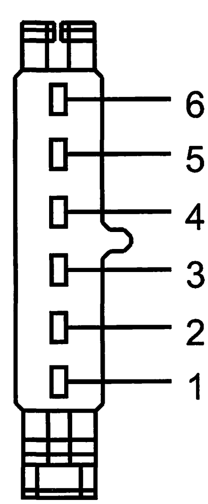

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Clutch Pedal Position CPP Switch

TA

Vehicle	Connector	Circuit	Pin
Focus	A	VPWR CPP	2 1
All other vehicles	B	VPWR CPP	2 1

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Focus 2.3L	150 (50-50-50) Pin	CPP	T16
All other vehicles	104 Pin	CPP	64

Test Steps		Results →	Action to Take
TA1	DTC P0704: CHECK CPP SWITCH		
	CAUTION: Apply vehicle Park Brake. **Ensure that the vehicle is secured with wheel chocks.** • Note: During Self Test, clutch pedal must be down and gearshift lever in NEUTRAL. • Key OFF. • Connect scan tool. • Key ON Engine OFF. • Select the CPP PID and monitor for ON/OFF PID state while performing the following: - Depress and release clutch pedal several times. • **Did reading cycle when the CPP switch was activated?**	Yes → No →	Suspect an intermittent circuit fault. Inspect connectors for signs of damage, water ingress, corrosion, etc. REPAIR as necessary. GO to **TA2**.

Clutch Pedal Position CPP Switch

TA

Test Steps		Results →	Action to Take
TA2	CHECK SWITCH CIRCUIT RESISTANCE		
	• Switch location(s): The CPP switch is located near the clutch pedal. • INSPECT switches and brackets for damage. Repair as necessary. • CPP connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **TA3**. REPLACE the CPP

(+)CPP Connector, Component Side	(-)CPP Connector, Component Side
CPP	CPP

- Measure the CPP switch resistance with the clutch pedal down.
- **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
TA3	CHECK CPP FOR INTERNAL SHORTS		
	• CPP connector disconnected. • Measure the Resistance between:	Yes → No →	REPLACE CPP. GO to **TA5**.

(+)CPP Connector, Component Side	(-)CPP Connector, Component Side
CPP	CPP

- Measure the CPP switch resistance with the clutch pedal UP.
- **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
TA4	CHECK VPWR VOLTAGE TO CPP		
	CAUTION: Apply the parking brake. **Ensure that the vehicle is secured with wheel chocks.** **Ensure the vehicle is in NEUTRAL.** • Measure the Voltage between:	Yes → No →	GO to **TA5**. REPAIR open circuit.

(+)CPP Connector, Harness Side	(-)
VPWR	Ground

- Measure voltage with the ignition in the START position.
- **Is the Voltage above 10.5 V?**

Clutch Pedal Position CPP Switch — TA

Test Steps		Results →	Action to Take
TA5	CHECK CPP CIRCUIT FOR OPEN IN HARNESS		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • PCM connector disconnected. • Measure SIGRTN resistance. • Measure the Resistance between:	Yes → No →	GO to **TA6**. REPAIR open circuit.

(+)CPP Connector, Harness Side	(-)PCM Connector, Harness Side
CPP	CPP

- **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
TA6	CHECK CPP CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit.

(+)PCM Connector, Harness Side	(-)
CPP	Ground

- **Is the Resistance above 10 KOhm?**

Automatic Transmission Control Switch ATCS / Transmission Control Indicator Lamp TCIL

TB

Note

This Pinpoint Test is intended to diagnose the following:

PCM.

Harness Circuits:

TCIL.

ATCS.

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
Aviator, LS, Thunderbird	150 (60-32-58) Pin	ATCS	B41
Escape, Focus 2.0L, Marauder, Mustang, Town Car	104 Pin	ATCS	29
Expedition, Navigator	122 Pin	ATCS	B22
Explorer SportTrac, F-150 Heritage 4.2L, Ranger	104 Pin	TCIL ATCS	79 29
Explorer, Focus 2.3L, Mountaineer	150 (50-50-50) Pin	ATCS	B27
F-150	190 Pin	TCIL ATCS	B33 B45
All other vehicles	104 Pin	TCIL ATCS	12 29

Automatic Transmission Control Switch ATCS / Transmission Control Indicator Lamp TCIL

TB

Test Steps		Results →	Action to Take
TB1	DTC P1780: CHECK ATCS FUNCTION		
	• Key ON Engine OFF. • Access the ATCS PID. • Cycle the ATCS switch button, then hold it depressed for three seconds. Release the button. • **Did ATCS PID reading switch from on to off and did reading indicate on when button was held depressed.**	Yes →	KEY OFF. RERUN KOER Self-Test and cycle ATCS during test.
		No →	For Freestar, refer to Automatic Transaxle/Transmission External Controls section in the Workshop Manual. GO to **TB2**.
TB2	CHECK ATCS VOLTAGE		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: **(+)PCM Connector, Harness Side**: ATCS — **(-)**: Ground • Monitor voltage while cycling the ATCS several times. • **Did the voltage cycle?**	Yes →	KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
		No →	GO to **TB3**.
TB3	CHECK THE ATCS CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• ATCS connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side**: ATCS — **(-)**: Ground • **Is the Resistance above 10 KOhm?**	Yes →	GO to **TB5**.
		No →	REPAIR short circuit.
TB4	CHECK THE ATCS CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Voltage between: **(+)ATCS Connector, Harness Side**: VPWR — **(-)Vehicle battery**: Negative post • **Is the Voltage above 10.5 V?**	Yes →	GO to **TB5**.
		No →	REPAIR open circuit.

Automatic Transmission Control Switch ATCS / Transmission Control Indicator Lamp TCIL

TB

Test Steps		Results →	Action to Take
TB5	CHECK THE ATCS CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)ATCS Connector, Harness Side**: ATCS / ATCS • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **TB6**. REPAIR open circuit.
TB6	CHECK ATCS CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Measure the Voltage between: **(+)ATCS Connector, Harness Side** / **(-)Vehicle battery**: ATCS / Negative post • **Is the Voltage below 1 V?**	Yes → No →	REPLACE ATCS. REPAIR short circuit.
TB7	CHECK TCIL FUNCTION		
	• Key ON Engine OFF. • Cycle the ATCS. • **Did the TCIL change state?**	Yes → No →	Perform intermittent fault testing. GO to **Z1**. GO to **TB8**.
TB8	CHECK TCIL CIRCUIT(S) FOR SHORT TO GROUND IN HARNESS		
	• Key OFF. • PCM connector disconnected. • Key ON Engine OFF. Note: TCIL turns off when PCM is disconnected. • **Did the TCIL change state?**	Yes → No →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). REPAIR short circuit. VERIFY a symptom no longer exists.
TB9	DTC P1780: CHECK FOR DTCS		
	• CHECK PCM KOER DTCs: • **Is DTC P1780 present?**	Yes → No →	REPAIR DTC GO to **TB1**. GO to **TB10**.

Measurement tables:

(+)PCM Connector, Harness Side	(-)ATCS Connector, Harness Side
ATCS	ATCS

(+)ATCS Connector, Harness Side	(-)Vehicle battery
ATCS	Negative post

Automatic Transmission Control Switch ATCS / Transmission Control Indicator Lamp TCIL

TB

Test Steps		Results →	Action to Take
TB10	CHECK FOR VOLTAGE TO TCIL		
	Note: REFER to the PCM connector pin numbers in the beginning of this pinpoint test. • Key OFF. • PCM connector disconnected. • Key ON Engine OFF. • Add jumper wire between the points described below: Point A PCM Connector, Harness Side: TCIL — Point B Vehicle battery: Negative post • **Did the TCIL illuminate?**	Yes →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). CYCLE ATCS to check operation of TCIL.
		No →	CHECK indicator bulb and fuse. If OK, open is in wiring between the ignition switch and TCIL test pin at harness connector. REPAIR as necessary.

Point A PCM Connector, Harness Side	Point B Vehicle battery
TCIL	Negative post

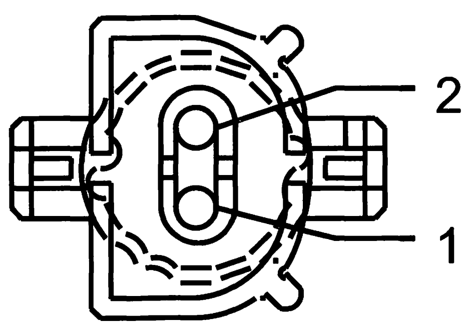
4x4 Low Switch (4X4LSW) And Four Wheel Drive (4WD) Switch	**TG**

Note

This Pinpoint Test is intended to diagnose the following:

- Harness circuits between PCM and Electronic Shift Control Module.
- Harness circuit for mechanical 4x4L.
- Powertrain control module (PCM) (12A650).

4x4 Low Switch (4X4LSW) Connector



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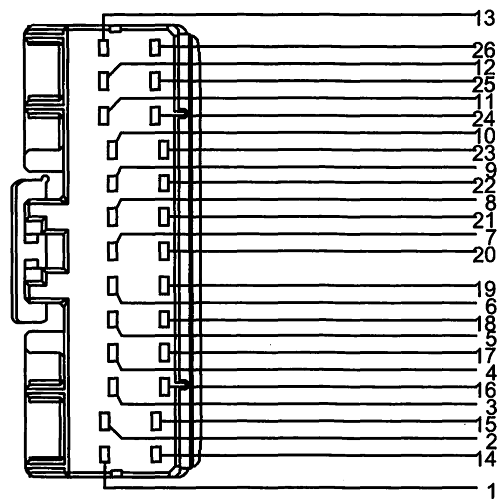
Circuit	Pin
4x4LLMP (4x4 Lamp)	1
4x4L (4x4 Low)	2

4x4 Low Switch (4X4LSW) And Four Wheel Drive (4WD) Switch

TG

Generic electric module (GEM) Connector



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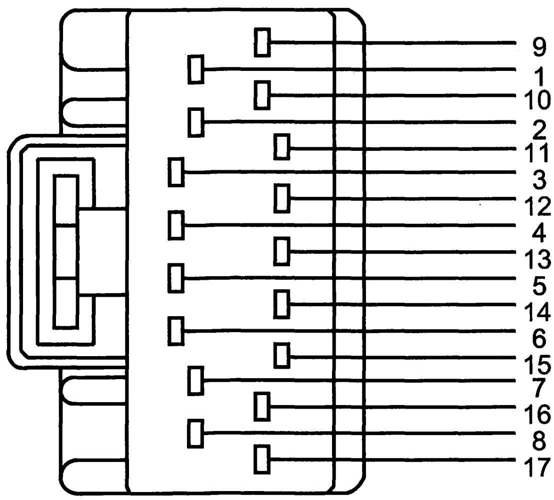
Circuit	Pin
4x4L (4x4 Low)	16

4x4 Low Switch (4X4LSW) And Four Wheel Drive (4WD) Switch	TG

4x4 Control Module (4x4CM) Connector



Circuit	Pin
4x4L (4x4 Low)	9

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
F-150	190 Pin	VPWR PWRGND 4x4L	B51 B67 T8
All other vehicles	104 Pin	VPWR PWRGND 4x4L	71 103 14

4x4 Low Switch (4X4LSW) And Four Wheel Drive (4WD) Switch

TG

	Test Steps	Results →	Action to Take
TG1	DTC P1729, P1781: VERIFY THE 4X4L SWITCH CYCLES ON/OFF		
	Note: The transmission range (TR) sensor must indicate NEUTRAL position before 4x4L shift. • Verify vehicle is equipped with 4x4. • Verify selector is in 4x2 or 4x4H. • **Is the selector in 2WD or 4x4H mode during Quick Test?**	Yes → No →	GO to **TG2**. VERIFY transmission shift lever is in neutral position. SELECT 2WD or 4x4H. Rerun Quick Test.
TG2	CHECK 4X4L CIRCUIT FOR INTERMITTENT FAULT		
	• Connect scan tool. • Key ON Engine OFF. • While doing the next four steps, access the named PID below. • Cycle the 4x4L switch to 2WD. • Grasp the vehicle harness starting at the transfer case vehicle harness connector. Shake and bend a small section of the harness all the way to the PCM. • Tap the vehicle harness connector at the transfer case. • Shake and bend a small section of the harness between the Instrument Cluster Connector and the PCM. • Access the PCM-4X4L PID using a scan tool. • **Did the 4x4L PID reading go ON/OFF during harness and connector movement?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **TG3**.
TG3	CHECK 4X4L SIGNAL VOLTAGE TO PCM		
	• Disconnect PCM. • Key ON Engine OFF. • Observe voltage between 4x4L circuit at PCM harness connector and battery negative post while cycling the switch. • **Did the voltage cycle?**	Yes → No →	KEY OFF. REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)). KEY OFF. GO to **TG4**.

4x4 Low Switch (4X4LSW) And Four Wheel Drive (4WD) Switch

TG

Test Steps		Results →	Action to Take
TG4	CHECK 4X4L CIRCUIT FOR OPEN IN HARNESS		
	• Disconnect the 4x4L switch on mechanical shift on the fly system. • Disconnect the GEM or the 4x4CM on the electronic shift on the fly system. • Measure the Resistance between:	Yes → No →	GO to **TG5**. REPAIR open circuit.

(+)4X4LSW Connector, Harness Side	**(-)PCM Connector, Harness Side**
4x4L - Pin 2	4x4L

• Measure the Resistance between:

(+)GEM Connector, Harness Side	**(-)PCM Connector, Harness Side**
4x4L - Pin 16	4x4L

• Measure the Resistance between:

(+)4x4CM Connector, Harness Side	**(-)PCM Connector, Harness Side**
4x4L - Pin 9	4x4L

• **Are all resistances below 5 Ohm?**

Test Steps		Results →	Action to Take
TG5	CHECK 4X4L CIRCUIT FOR SHORT TO POWER OR GROUND IN HARNESS		
	• Connect the 4x4L switch on mechanical shift on the fly system. • Connect the GEM or the 4x4CM on the electronic shift on the fly system. • Measure the Resistance between:	Yes → No →	REFER to the Workshop Manual, Transfer Case Section 308 for Four Wheel Drive Systems. REPAIR short circuit.

(+)PCM Connector, Harness Side	**(-)PCM Connector, Harness Side**
4x4L	PWRGND
VPWR	4x4L

• **Are both resistances greater than 10 KOhm?**

Output Shaft Speed OSS Sensor	TJ

Note

This Pinpoint Test is intended to diagnose the following:

OSS.

PCM.

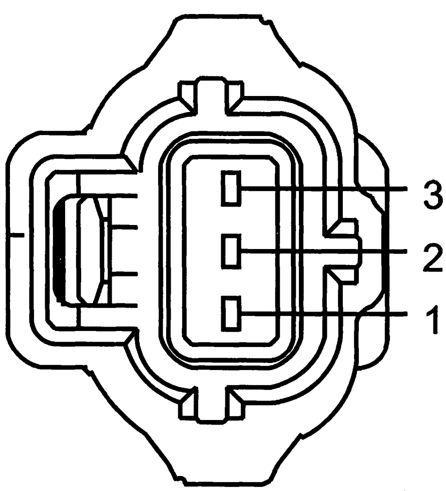
Harness circuits:

OSS.

SIGRTN.

Output Shaft Speed. (OSS) Connector

A



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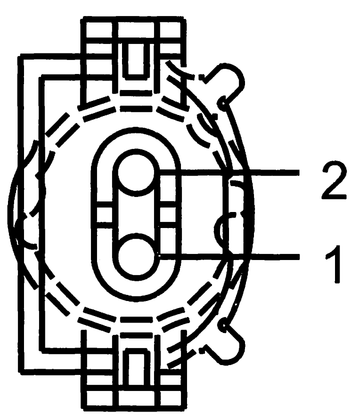

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Output Shaft Speed OSS Sensor — TJ

Vehicle	Connector	Circuit	Pin
Focus	A	OSS PWRGND VPWR	2 1 3
Ranger	B	SIGRTN OSS	2 1
All other vehicles	B	SIGRTN OSS	1 2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Connector	Circuit	Pin
104 Pin	PWRGND SIGRTN OSS	103 91 84

Test Steps		Results →	Action to Take
TJ1	DTCS P0720, P0721, P0722, P0723 AND P1900: VERIFY DRIVE CYCLE		
	• Access the PCM-OSS PID using a scan tool. • Drive vehicle. • Monitor PID in all transmission gear ranges while increasing and decreasing speed. • **Does PID reading increase and decrease with engine and vehicle speed?**	Yes → No →	OSS performed as expected. GO to **TJ2**. KEY OFF. GO to **TJ3**.
TJ2	VISUAL INSPECTION		
	• OSS connector disconnected. • INSPECT OSS harness for damage. INSPECT OSS vehicle harness connector for damage and proper seating. • If possible, complete wiggle test. • **Have any problems been found?**	Yes → No →	REPAIR FAULT GO to **Z1**.
TJ3	VERIFY TYPE OF OSS SENSOR		
	• INSPECT for Hall Effect or VR type of OSS sensor. • **Is this a Hall Effect Type of OSS sensor?**	Yes → No →	GO to **TJ4**. GO to **TJ6**.

Output Shaft Speed OSS Sensor

TJ

Test Steps		Results →	Action to Take
TJ4	CHECK VPWR TO OSS SENSOR		
	• OSS connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **TJ5**.
		No →	KEY OFF. REPAIR open circuit.

(+)OSS Connector, Harness Side	**(-)Vehicle battery**
VPWR	Negative post

• **Is the Voltage above 10.5 V?**

Test Steps		Results →	Action to Take
TJ5	CHECK VPWR GROUND TO OSS SENSOR		
	• Measure the Resistance between:	Yes →	GO to **TJ6**.
		No →	REPAIR open circuit.

(+)OSS Connector, Harness Side	**(-)Vehicle battery**
PWRGND	Negative post

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
TJ6	CHECK OSS CIRCUIT FOR SHORT TO VREF AND VPWR IN HARNESS		
	• Key ON Engine OFF. • OSS connector disconnected. • Measure the Voltage between:	Yes →	KEY OFF. GO to **TJ7**.
		No →	KEY OFF. REPAIR short circuit.

(+)OSS Connector, Harness Side	**(-)Vehicle battery**
OSS	Negative post

• **Is the Voltage below 1 V?**

Test Steps		Results →	Action to Take
TJ7	CHECK OSS CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • OSS connector disconnected. • Measure the Resistance between:	Yes →	GO to **TJ8**.
		No →	REPAIR open circuit.

(+)PCM Connector, Harness Side	**(-)OSS Connector, Harness Side**
OSS - Pin 84	OSS
SIGRTN - Pin 91	SIGRTN

• NOTE: Hall Effect sensors are not equipped with a SIGRTN circuit.
• **Are the resistances below 5 Ohm?**

Output Shaft Speed OSS Sensor

TJ

Test Steps		Results →	Action to Take
TJ8	CHECK OSS CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **TJ9**.
		No →	REPAIR short circuit.

(+)OSS Connector, Harness Side	(-)OSS Connector, Harness Side
OSS	PWRGND
OSS	SIGRTN

• Measure the Resistance between:

(+)OSS Connector, Harness Side	(-)
OSS	Ground

• **Are the resistances above 10 KOhm?**

Test Steps		Results →	Action to Take
TJ9	VERIFY TYPE OF OSS SENSOR		
	• INSPECT for Hall Effect or VR type of OSS sensor. • **Is this a Hall Effect Type of OSS sensor?**	Yes →	GO to **TJ10**.
		No →	GO to **TJ11**.
TJ10	CHECK OSS SIGNAL OUTPUT TO PCM, HALL EFFECT TYPE SENSOR		
	• PCM connector disconnected. • Raise vehicle to allow rotation of the front drive wheels. • Key ON Engine OFF. • Transmission in neutral. • Measure the Voltage between:	Yes →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
		No →	REPLACE OSS sensor.

(+)PCM Connector, Harness Side	(-)PCM Connector, Harness Side
OSS - Pin 84	PWRGND - Pin 103

• Note: The opposite wheel must be held stationary.
• The voltage should rise above 5.0 volts and fall below 1.0 volt in a regular cycle. Observe several cycles.
• **Does the OSS output voltage rise and fall as specified?**

Test Steps		Results →	Action to Take
TJ11	CHECK RESISTANCE OF OSS SENSOR		
	• Measure the Resistance between:	Yes →	REPLACE PCM (refer to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM)).
		No →	REPLACE OSS.

(+)OSS Connector, Component Side	(-)OSS Connector, Component Side
OSS	SIGRTN

• **Is the Resistance between 400 Ohm - 1.25 KOhm?**

Constant Control Relay Module (CCRM)

X

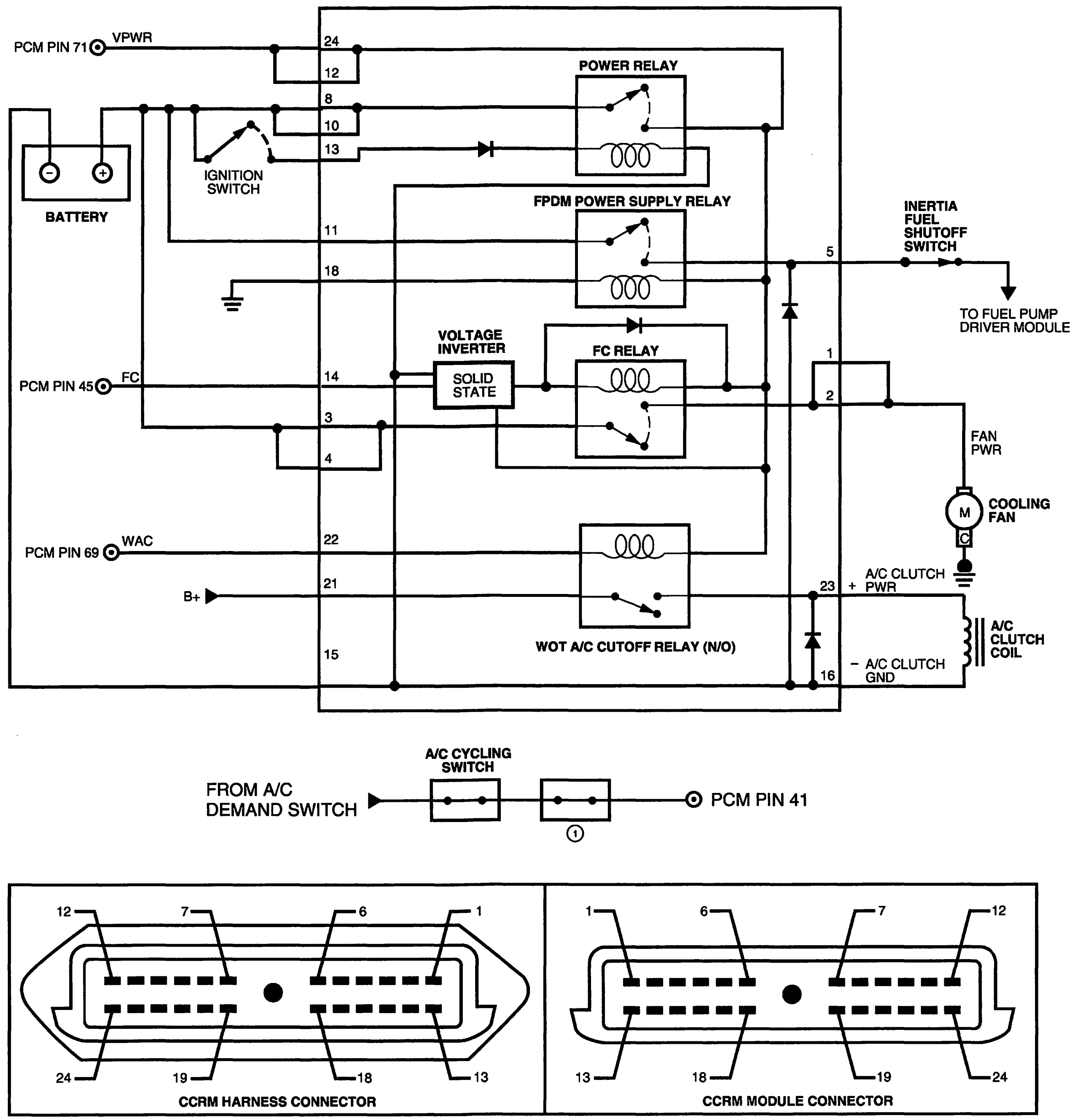
Note

This Pinpoint Test is intended to diagnose the following:

- CCRM (12B581 12B577).
- Harness circuits: B+, FC,LFC, HFC, ACCS, WAC, VPWR, ACC PWR, FAN PWR, GND.
- PCM (12A650).

Constant Control Relay Module (CCRM)	X

3.8L/3.9L Mustang



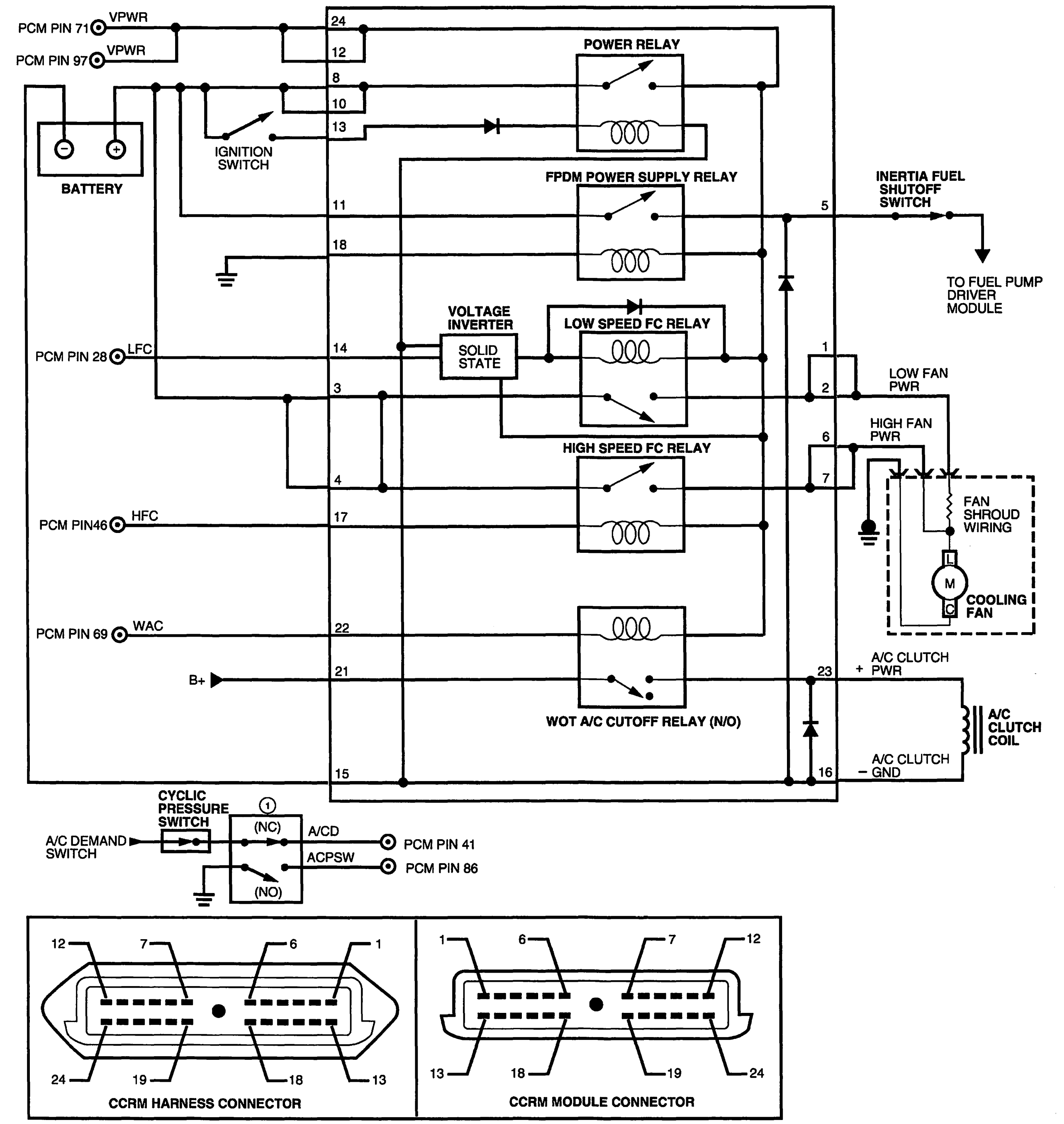
① A/C High Pressure Switch

A0031610

Constant Control Relay Module (CCRM)

X

4.6L Mustang



[1] A/C High Pressure Switch

A0038678

Constant Control Relay Module (CCRM)

X

Constant Control Relay Module (CCRM) Connector

Vehicle	Circuit	Pin
Mustang 4.6L	A/CC PWR A/CCR FAN PWR HFPWR LFC A/CC GND LFPWR FPDM PWR B+ (D) B+ (C) B+ (B) B+ (A) HFC GND IGN START/RUN VPWR	23 22 1, 2 6, 7 14 16 1, 2 5 21 11 10, 8 3, 4 17 15 13 12, 24
All other vehicles	A/CC PWR A/CCR FAN PWR LFC A/CC GND LFPWR FPDM PWR B+ (D) B+ (C) B+ (B) B+ (A) GND IGN START/RUN VPWR	23 22 1, 2 14 16 1, 2 5 21 11 10, 8 3, 4 15 13 12, 24

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Constant Control Relay Module (CCRM) — X

Vehicle	Connector	Circuit	Pin
Mustang 4.6L	104 Pin	A/CCR A/CCS LFC HFC VPWR	69 41 28 46 71
All other vehicles	104 Pin	A/CCR A/CCS LFC VPWR	69 41 45 71

Test Steps	Results →	Action to Take
X1 CHECK FOR OPEN VPWR CIRCUIT IN HARNESS		
• PCM connector disconnected. • CCRM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **X2**. REPAIR open circuit.

(+)PCM Connector, Harness Side	(-)CCRM Connector, Harness Side
VPWR	VPWR

• **Is the Resistance below 5 Ohm?**

Test Steps	Results →	Action to Take
X2 CHECK BATT+ AND IGN START/RUN VOLTAGE TO CCRM		
• Key ON Engine OFF. • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **X3**. REPAIR open circuit. B+ or IGN START/RUN circuit fault. CHECK condition of related fuse(s)/diode. If OK, REPAIR open circuit. If fuse is damaged, check IGN START/RUN or B+ and VPWR circuits for short to ground before replacing.

(+)CCRM Connector, Harness Side	(-)
B+	Ground
IGN START/RUN	Ground

• **Are the voltages above 10.5 V?**

Test Steps	Results →	Action to Take
X3 CHECK GROUND CIRCUIT TO CCRM		
• Measure the Voltage between:	Yes → No →	INSTALL a new CCRM. REPAIR open circuit.

(+)CCRM Connector, Harness Side	(-)CCRM Connector, Harness Side
B+	GND

• **Is the Voltage above 10.5 V?**

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X4	DTCS P1479 OR P0481: CHECK HFC RELAY COIL RESISTANCE IN CCRM		
	Note: For one-speed fan applications, disregard DTC P1479/P0481. • CCRM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **X5**. INSTALL a new CCRM.

(+)CCRM Connector, Component Side	(-)CCRM Connector, Component Side
VPWR	HFC

- **Is the Resistance between 65 Ohm - 110 Ohm?**

Test Steps		Results →	Action to Take
X5	CHECK CCRM FOR INTERNAL SHORTS		
	• Measure the Resistance between:	Yes → No →	GO to **X6**. INSTALL a new CCRM.

(+)CCRM Connector, Component Side	(-)CCRM Connector, Component Side
HFC	IGN START/RUN
HFC	B+ (A)
HFC	B+ (B)
HFC	B+ (C)
HFC	B+ (D)
HFC	FPDM PWR
HFC	LFPWR
HFC	CCRM Case
HFC	FPDM PWR
HFC	A/CC GND
HFC	GND

- **Are the resistances above 1 KOhm?**

Test Steps		Results →	Action to Take
X6	CHECK PCM AND HFC CIRCUIT		
	• Connect non-powered test lamp between:	Yes → No →	INSTALL a new CCRM. KEY OFF. GO to **X7**.

(+)CCRM Connector, Harness Side	(-)
HFC	Ground

- Scan Tool Connected
- Enter Output Test Mode (refer to section 2)
- Command high speed fan ON
- Command outputs OFF
- **Does the test lamp turn on and off when the output(s) are commanded on and off?**

Constant Control Relay Module (CCRM)

X

Test Steps		Results	Action to Take
X7	CHECK HFC CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: HFC — (-)CCRM Connector, Harness Side: HFC • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **X8**. REPAIR open circuit.
X8	CHECK HFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: (+)CCRM Connector, Harness Side: HFC — (-): Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **X9**. REPAIR short circuit.
X9	CHECK HFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: (+)CCRM Connector, Harness Side: HFC — (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **X10**. REPAIR short circuit.
X10	COMMAND HIGH SPEED FAN ON		
	• PCM connector connected. • CCRM connector connected. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command high speed fan ON • Wait 10 seconds. • Command outputs OFF • **Did the High speed cooling fan turn on and off as expected?**	Yes → No →	Disregard DTC P1479/P0481 at this time Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
X11	DTCS P1474 OR P0480: DOES FAN RUN WITH KEY ON?		
	• **Does the cooling fan always run with the key on?**	Yes → No →	KEY OFF. GO to **X14**. KEY OFF. GO to **X12**.

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X12	CHECK FC/LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• PCM connector disconnected. • CCRM connector disconnected. • Measure the Resistance between: **(+)CCRM Connector, Harness Side** / **(-)** LFC / Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **X13**. REPAIR short circuit.
X13	CHECK FAN RUNNING MODE?		
	• CCRM connector connected. • Key ON Engine OFF. • **Is fan running with the key on?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). INSTALL a new CCRM.
X14	CHECK FC/LFC CIRCUIT FOR OPEN IN HARNESS		
	• PCM connector disconnected. • CCRM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** / **(-)CCRM Connector, Harness Side** LFC / LFC • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **X15**. REPAIR open circuit.
X15	CHECK FC/LFC CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• Key ON Engine OFF. • Measure the Voltage between: **(+)CCRM Connector, Harness Side** / **(-)** LFC / Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **X16**. REPAIR short circuit.
X16	FC/LFC CIRCUIT FAULT ISOLATION CHECK		
	• CCRM connector disconnected. • Add jumper wire between the points described below: **Point A PCM Connector, Harness Side** / **Point B** LFC / Ground • Key ON Engine OFF. • **Does fan continue to run?**	Yes → No →	KEY OFF. INSTALL a new CCRM. KEY OFF. INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).

Constant Control Relay Module (CCRM) — X

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>X17</td><td>CONTINUOUS MEMORY DTCS P1474 OR P0480: CHECK FC/LFC FOR OPEN OR SHORT CIRCUIT TO POWER</td><td></td><td></td></tr>
<tr><td colspan="2">• CF Motor connector disconnected.
• Connect non-powered test lamp between:
<table><tr><th>(+)CF Motor Connector, Harness Side</th><th>(-)CF Motor Connector, Harness Side</th></tr><tr><td>FAN PWR</td><td>GND</td></tr></table>• Key ON Engine OFF.
• Observe test lamp for an indication of a fault while completing the following (the lamp will turn ON when a fault is detected):
— Shake, wiggle, bend the FC/LFC circuit between the PCM and CCRM.
— Lightly tap on the CCRM (to simulate road shock).
• Is a fault indicated?</td><td>Yes →

No →</td><td>KEY OFF.
ISOLATE fault and REPAIR as necessary.
GO to X18.</td></tr>
<tr><td>X18</td><td>CHECK FC/LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">• Key ON Engine OFF.
• Scan Tool Connected
• Enter Output Test Mode (refer to section 2)
• Command low speed fan ON
• Observe test lamp for an indication of a fault while completing the following (the lamp will turn OFF when a fault is detected):
Shake, wiggle, bend the FC/LFC circuit between the PCM and CCRM.
Lightly tap on the CCRM (to simulate road shock).
• Is a fault indicated?</td><td>Yes →

No →</td><td>ISOLATE fault and REPAIR as necessary.
KEY OFF.
GO to Z1.</td></tr>
</table>

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X19	DTCS P1479 OR P0481: CHECK HFC FOR OPEN OR SHORT CIRCUIT TO POWER		
	Note: For one-speed fan applications, disregard DTC P1479/P0481. • CF Motor connector disconnected. • Inspect connectors for signs of damage, water ingress, corrosion, etc. • Connect non-powered test lamp between: **(+)CF Motor Connector, Harness Side** / **(-)CF Motor Connector, Harness Side**: HFPWR / GND • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command high speed fan ON • Observe test lamp for an indication of a fault while completing the following (the lamp will turn OFF when a fault is detected): Shake, wiggle, bend the HFC circuit between the PCM and CCRM. Lightly tap on the CCRM (to simulate road shock). • **Is a fault indicated?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. GO to **X20**.
X20	CHECK HFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs OFF • Observe test lamp for an indication of a fault while completing the following (the lamp will turn ON when a fault is detected): — Shake, wiggle, bend the HFC circuit between the PCM and CCRM. — Lightly tap on the CCRM (to simulate road shock). • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. RESTORE vehicle. KEY OFF. GO to **Z1**.

(+)CF Motor Connector, Harness Side	(-)CF Motor Connector, Harness Side
HFPWR	GND

Constant Control Relay Module (CCRM) — X

Test Steps		Results →	Action to Take
X21	ELECTRIC COOLING FAN FUNCTIONAL CHECK		
	Note: For the proper results of these pinpoint tests, no DTCs must have been present during PCM Quick Test. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • For two speed fan applications, check both fan speeds. • Command outputs OFF • **Does the fan(s) operate (at all speeds)?**	Yes → No →	KEY OFF. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. **For 3.8L** GO to **X23**. **For 3.9L** GO to **X23**. **For 4.6L** GO to **X22**.
X22	ELECTRIC COOLING FAN CONCERN: DID THE FAN OPERATE AT ANY SPEED?		
	• **During the operational check of both speeds, did the fan(s) operate at any speed?**	Yes → No →	Only one FAN is operational GO to **X28**. FAN will not operate at any speed GO to **X23**.
X23	COOLING FAN WILL NOT OPERATE AT ANY SPEED: COMMAND FAN ON AND CHECK FOR VOLTAGE AT FAN		
	• Key ON Engine OFF. • CF Motor connector disconnected. • Command low speed fan ON • Measure the Voltage between: (see table below) • **Is the Voltage above 10 V?**	Yes → No →	KEY OFF. GO to **X27**. KEY OFF. GO to **X24**.

(+)CF Motor Connector, Harness Side	**(-)**
FAN PWR	Ground

Constant Control Relay Module (CCRM) — X

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>X24</td><td>CHECK FOR B+ TO FAN CONTROL RELAYS IN CCRM</td><td></td><td></td></tr>
<tr><td colspan="2">
CCRM connector disconnected.
Measure the Voltage between:
<table>
<tr><th>(+)CCRM Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>B+ (A)</td><td>Ground</td></tr>
</table>
Is the Voltage above 10 V?
</td><td>Yes →

No →</td><td>For 3.8L
GO to X26.
For 3.9L
GO to X26.
For 4.6L
GO to X25.
B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.</td></tr>
<tr><td>X25</td><td>CHECK FOR OPEN FAN POWER CIRCUIT BETWEEN CCRM AND COOLING FAN</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table>
<tr><th>(+)CF Motor Connector, Harness Side</th><th>(-)CCRM Connector, Harness Side</th></tr>
<tr><td>HFPWR</td><td>HFPWR</td></tr>
<tr><td>LFPWR</td><td>LFPWR</td></tr>
</table>
Are the resistances below 5 Ohm?
</td><td>Yes →

No →</td><td>INSTALL a new CCRM. Verify applicable FAN PWR circuit is not short to ground
REPAIR open circuit.</td></tr>
<tr><td>X26</td><td>CHECK FOR OPEN FAN POWER CIRCUIT BETWEEN CCRM AND COOLING FAN</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table>
<tr><th>(+)CCRM Connector, Harness Side</th><th>(-)CF Motor Connector, Harness Side</th></tr>
<tr><td>FAN PWR</td><td>FAN PWR</td></tr>
</table>
Is the Resistance below 5 Ohm?
</td><td>Yes →

No →</td><td>INSTALL a new CCRM. Verify applicable FAN PWR circuit is not short to ground
REPAIR open circuit.</td></tr>
<tr><td>X27</td><td>CHECK FOR OPEN CF GROUND CIRCUIT(S)</td><td></td><td></td></tr>
<tr><td colspan="2">
Measure the Resistance between:
<table>
<tr><th>(+)CF Motor Connector, Harness Side</th><th>(-)</th></tr>
<tr><td>GND</td><td>Ground</td></tr>
</table>
Is the Resistance below 5 Ohm?
</td><td>Yes →
No →</td><td>INSTALL a new CF motor.
REPAIR open circuit.</td></tr>
<tr><td>X28</td><td>DETERMINE WHICH FAN SPEED IS OPERATIONAL</td><td></td><td></td></tr>
<tr><td colspan="2">Was the low speed fan operational?</td><td>Yes →
No →</td><td>GO to X32.
GO to X29.</td></tr>
</table>

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X29	LOW SPEED FAN INOPERATIVE: COMMAND LOW SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN		
	• Key ON Engine OFF. • CF Motor connector disconnected. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • Measure the Voltage between:	Yes → No →	KEY OFF. GO to **X31**. KEY OFF. GO to **X30**.

(+)CF Motor Connector, Harness Side	**(-)**
LFPWR	Ground

• **Is the Voltage above 10 V?**

Test Steps		Results →	Action to Take
X30	CHECK THE LFPWR CIRCUIT FOR OPEN IN HARNESS		
	• CCRM connector disconnected. • Measure the Resistance between:	Yes → No →	GO to **X34**. REPAIR open circuit.

(+)CF Motor Connector, Harness Side	**(-)CCRM Connector, Harness Side**
LFPWR	LFPWR

• **Is the Resistance below 5 Ohm?**

Test Steps		Results →	Action to Take
X31	CHECK FOR OPEN DROPPING RESISTOR ON FAN SHROUD ASSEMBLY		
	• Measure the Resistance between:	Yes → No →	INSTALL a new CF motor. Verify condition of dropping resistor, replace as necessary. If OK, replace fan assembly.

(+)CF Motor Connector, Component Side	**(-)CF Motor Connector, Component Side**
HFPWR	LFPWR

• **Is the Resistance below 6 Ohm?**

Test Steps		Results →	Action to Take
X32	HIGH SPEED FAN INOPERATIVE: COMMAND HIGH SPEED FAN ON AND CHECK FOR VOLTAGE TO COOLING FAN		
	• Key ON Engine OFF. • CF Motor connector disconnected. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command high speed fan ON • Measure the Voltage between:	Yes → No →	INSTALL a new CF motor. KEY OFF. GO to **X33**.

(+)CF Motor Connector, Harness Side	**(-)Vehicle battery**
HFPWR	Negative post

• **Is the Voltage above 10.5 V?**

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X33	CHECK HFPWR CIRCUIT FOR OPEN IN HARNESS		
	• CCRM connector disconnected. • Measure the Resistance between: **(+)CF Motor Connector, Harness Side**: HFPWR — **(-)CCRM Connector, Harness Side**: HFPWR • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **X34**. REPAIR open circuit.
X34	IS SCAN TOOL CAPABLE OF VIEWING PIDS WHILE IN OUTPUT TEST MODE?		
	Note: The symptom low speed fan or high speed fan inoperative can be caused by a primary circuit fault, even though a DTC was not set. • **Is scan tool capable of viewing PIDs while in output test mode?**	Yes → No →	GO to **X35**. **For low speed fan inoperative (fan inoperative for single speed fan):** GO to **X36**. **For high speed fan inoperative:** GO to **X4**.

(+)CF Motor Connector, Harness Side	(-)CCRM Connector, Harness Side
HFPWR	HFPWR

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X35	CHECK OPERATION OF LOW SPEED FAN OR HIGH SPEED FAN PRIMARY CIRCUITS		
	• CCRM connector connected. • CF Motor connector connected. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs OFF • Access the PCM-LFC and PCM-LFCF PIDs using a scan tool. • For low speed fan inoperative (fan inoperative for single speed fan applications): With LFC PID off (low speed fan commanded off by PCM), the LFCF PID must indicate no fault (or NO). Command the Low Speed Fan ON. The LFC PID will be ON (the LFCF PID must still indicate no fault (or NO). • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs OFF • Access the PCM-HFC and PCM-HFCF PIDs using a scan tool. • With HFC PID off (high speed fan commanded off by PCM), the HFCF PID must indicate no fault (or NO). Command the High Speed Fan ON. The HFC PID will now be ON (the HFCF PID must still indicate no fault (or NO). • **Does the LFCF/HFCF PID indicate a fault (or YES)?**	Yes → No →	KEY OFF. An HFC or LFC primary circuit fault is detected **For the LFCF PID indicating a fault:** GO to **X11**. **For the HFCF PID indicating a fault:** GO to **X4**. INSTALL a new CCRM. Verify applicable FAN PWR circuit is not short to ground
X36	CHECK FC/LFC CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Scan tool connector disconnected. • PCM connector disconnected. • Measure the Resistance between: (+)CCRM Connector, Harness Side: LFC — (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new CCRM. Verify applicable FAN PWR circuit is not short to ground REPAIR short circuit.

(+)CCRM Connector, Harness Side	(-)
LFC	Ground

Constant Control Relay Module (CCRM) — X

Test Steps		Results →	Action to Take
X37	LOW AND/OR HIGH SPEED COOLING FAN ALWAYS RUNS (NO DTCS): VERIFY FAN IS NOT ON BECAUSE OF AC HIGH PRESSURE SWITCH INPUT TO PCM		
	• Key ON Engine RUN. • Access the PCM-ACP PID using a scan tool. • **Is the PID state CLOSED?**	Yes → No →	GO to **X38**. GO to **X39**.
X38	CHECK ACHP SWITCH FUNCTION		
	• A/CHPSW connector disconnected. • Access the PCM-ACP PID using a scan tool. • **Is the PID state CLOSED?**	Yes →	KEY OFF. GO to **X68**.
		No →	KEY OFF. Reconnect AC High Pressure Switch. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
X39	DISCONNECT CCRM AND CHECK IF FAN STILL RUNS		
	• Turn off all the accessories. • Key ON Engine OFF. • Verify cooling fan always on symptom. • Key OFF. • CCRM connector disconnected. • Key ON Engine OFF. • **Is cooling fan still on?**	Yes →	KEY OFF. For 3.8/3.9L Mustang: REPAIR short to power in FAN PWR circuit For All others: GO to **X40**.
		No →	KEY OFF. GO to **X41**.
X40	CHECK LFPWR & HFPWR CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• CF Motor connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction.
		No →	REPAIR short circuit.

(+)CF Motor Connector, Harness Side	**(-)**
HFPWR	Ground
LFPWR	Ground

• **Are the voltages below 1 V?**

Constant Control Relay Module (CCRM) — X

Test Steps		Results	Action to Take
X41	CHECK OPERATION OF LOW SPEED FAN OR HIGH SPEED FAN PRIMARY CIRCUITS		
	Note: The symptom cooling fan always runs can be caused by a primary circuit fault, even though a DTC was not set. This step will check the primary circuit operation. • CCRM connector connected. • Key ON Engine OFF. • Access the PCM-LFC and PCM-LFCF PIDs using a scan tool. • With LFC PID off (low speed fan commanded off by PCM), the LFCF PID must indicate no fault (or NO). • Access the PCM-HFC and PCM-HFCF PIDs using a scan tool. • For all except 3.8/3.9L Mustang : • — With HFC PID off (high speed fan commanded off by PCM), the HFCF PID must indicate no fault (or NO). • **Does the HFCF/LFCF PID indicate a fault (or YES)?**	Yes → No →	KEY OFF. An HFC or LFC primary circuit fault is detected **For the LFCF PID indicating a fault:** GO to **X11**. **For the HFCF PID indicating a fault:** GO to **X4**. INSTALL a new CCRM.

Constant Control Relay Module (CCRM) — X

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>X42</td><td>LACK OF COOLING / AC NOT FUNCTIONING: CHECK FOR VOLTAGE TO AC CLUTCH</td><td></td><td></td></tr>
<tr><td colspan="2">
• Key OFF.
• A/CCS Switch connector disconnected.
• Add jumper wire between the points described below:
<table><tr><th>Point A A/CCS Switch Connector, Harness Side</th><th>Point B A/CCS Switch Connector, Harness Side</th></tr><tr><td>A/CDSW</td><td>A/CCS</td></tr></table>
• A/CC Assembly connector disconnected.
• Measure the Voltage between:
<table><tr><th>(+)A/CC Assembly Connector, Harness Side</th><th>(-)A/CC Assembly Connector, Harness Side</th></tr><tr><td>A/CC PWR</td><td>GND</td></tr></table>
• Key ON Engine RUN.
• Turn On AC Switch. Wait for 15 seconds.
• Measure the Voltage between:
<table><tr><th>(+)A/CC Assembly Connector, Harness Side</th><th>(-)A/CC Assembly Connector, Harness Side</th></tr><tr><td>A/CC PWR</td><td>GND</td></tr></table>
• Is the Voltage above 10.5 V?
</td><td>Yes →

No →</td><td>KEY OFF.
REMOVE jumper wire(s)
Reconnect A/CCS.
3.8/3.9L and 4.6L not covered below:
REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
For 4.6L with the symptom “poor A/C system performance in hot ambient temperature”:
GO to X71.

KEY OFF.
GO to X43.</td></tr>
<tr><td>X43</td><td>CHECK ACCS INPUT TO PCM WITH AC ON</td><td></td><td></td></tr>
<tr><td colspan="2">
• A/CC Assembly connector connected.
• Key ON Engine RUN.
• Turn On AC Switch.
• Access the PCM-ACCS PID using a scan tool.
• After testing, remove jumper, reconnect A/CCS and turn key OFF.
• Is the PID state ON?
</td><td>Yes →

No →</td><td>KEY OFF.
GO to X55.

GO to X44.</td></tr>
</table>

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X44	ACCS PID OFF WITH AC ON: CHECK FOR VOLTAGE TO AC_CYC SWITCH		
	• REMOVE jumper wire(s) • Key ON Engine OFF. • A/CCS Switch connector disconnected. • AC demand switch to AC on. • Measure the Voltage between: **(+)A/CCS Switch Connector, Harness Side** / **(-)** A/CDSW / Ground • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **X45**. KEY OFF. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
X45	CHECK IF AC_CYC CONTACTS ARE CLOSED		
	• Measure the Resistance between: **(+)A/CCS Switch Connector, Component Side** / **(-)A/CCS Switch Connector, Component Side** A/CDSW / A/CCS • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **X46**. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
X46	CHECK FOR VOLTAGE TO DUAL FUNCTION AC_CYC		
	• A/CCS Switch connector connected. • A/CHPSW connector disconnected. • Key ON Engine OFF. • Turn On AC Switch. • Measure the Voltage between: **(+)A/CHPSW Connector, Harness Side** / **(-)** ACCS-A / Ground • **Is the Voltage above 10.5 V?**	Yes → No →	KEY OFF. GO to **X47**. REPAIR open circuit.
X47	CHECK RESISTANCE OF ACHP HIGH PRESSURE CONTACTS		
	• Measure the Resistance between: **(+)A/CHPSW Connector, Component Side** / **(-)A/CHPSW Connector, Harness Side** A/CPSW / GND • **Is the Resistance below 5 Ohm?**	Yes → No →	GO to **X48**. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X48	CHECK FOR VOLTAGE TO PCM ON ACCS CIRCUIT		
	• A/CHPSW connector connected. • PCM connector disconnected. • Key ON Engine OFF. • Turn On AC Switch. • Measure the Voltage between: **(+)PCM Connector, Harness Side** / **(-)** A/CCS / Ground • **Is the Voltage above 10.5 V?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.
X49	KOEO AND KOER DTCS P1460 OR P0645: VERIFY THAT ACCS PID IS OFF		
	Note: Verify AC and Defrost were off during KOEO/KOER Self-Test. If vehicle is not equipped with AC, the WAC circuit is not used and the DTC P1460/P0645 can be ignored. • Key ON Engine RUN. • AC and defroster OFF. • Access the PCM-ACCS PID using a scan tool. • **Is the PID state OFF?**	Yes → No →	KEY OFF. GO to **X50**. KEY OFF. GO to **X61**.
X50	CHECK A/CCR (WAC) CIRCUIT IN CCRM		
	• CCRM connector disconnected. • Measure the Resistance between: **(+)CCRM Connector, Component Side** / **(-)CCRM Connector, Component Side** A/CCR / VPWR • **Is the Resistance between 130 Ohm - 200 Ohm?**	Yes → No →	GO to **X51**. INSTALL a new CCRM. Start Engine Turn On AC Switch Wait 15 seconds. Turn Off AC Switch Rerun Quick Test.

Sub-table for X48:

(+)PCM Connector, Harness Side	(-)
A/CCS	Ground

Sub-table for X50:

(+)CCRM Connector, Component Side	(-)CCRM Connector, Component Side
A/CCR	VPWR

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X51	CHECK CCRM FOR INTERNAL SHORTS		
	• Measure the Resistance between:	Yes →	GO to **X52**.
		No →	INSTALL a new CCRM. Start Engine Turn On AC Switch Wait 15 seconds. Turn Off AC Switch Rerun Quick Test.

(+)CCRM Connector, Harness Side	(-)
HFC	Ground

• Measure the Resistance between:

(+)CCRM Connector, Harness Side	(-)CCRM Connector, Harness Side
HFC	IGN START/RUN
HFC	CCRM Case
HFC	LFPWR
HFC	B+
HFC	FPDM PWR
HFC	HFPWR
HFC	GND

• **Are the resistances above 1 KOhm?**

Test Steps		Results →	Action to Take
X52	CHECK A/CCR (WAC) CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between:	Yes →	KEY OFF. GO to **X53**.
		No →	REPAIR short circuit. Start Engine Turn On AC Switch Wait 15 seconds. Turn Off AC Switch Rerun Quick Test.

(+)CCRM Connector, Harness Side	(-)
A/CCR	Ground

• **Is the Voltage below 1 V?**

Test Steps		Results →	Action to Take
X53	CHECK A/CCR (WAC) CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between:	Yes →	GO to **X54**.
		No →	REPAIR short circuit. Start Engine Turn On AC Switch Wait 15 seconds. Turn Off AC Switch Rerun Quick Test.

(+)CCRM Connector, Harness Side	(-)
A/CCR	Ground

• **Is the Resistance above 10 KOhm?**

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X54	CHECK THE A/CCR (WAC) CIRCUIT FOR OPEN IN HARNESS		
	• Measure the Resistance between: (+)PCM Connector, Harness Side: A/CCR — (-)CCRM Connector, Harness Side: A/CCR • **Is the Resistance below 5 Ohm?**	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). Start Engine Turn On AC Switch Wait 15 seconds. Turn Off AC Switch Rerun Quick Test.
		No →	REPAIR open circuit. Start Engine Turn On AC Switch Wait 15 seconds. Turn Off AC Switch Rerun Quick Test.
X55	NO/LOW VOLTAGE TO ACC: CHECK FOR VOLTAGE TO CCRM		
	• CCRM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)CCRM Connector, Harness Side: B+ — (-): Ground • **Is the Voltage above 10.5 V?**	Yes →	KEY OFF. GO to **X56**.
		No →	B+ or IGN START/RUN circuit fault. CHECK condition of related fuse(s)/diode. If OK, REPAIR open circuit. If fuse is damaged, check IGN START/RUN or B+ and VPWR circuits for short to ground before replacing.
X56	CHECK FOR OPEN A/CC PWR AND A/CC GND CIRCUITS		
	• ACCS Assembly connector disconnected. • Measure the Resistance between: (+)A/CC Assembly Connector, Harness Side: A/CC PWR — (-)CCRM Connector, Harness Side: A/CC PWR (+)A/CC Assembly Connector, Harness Side: GND — (-)CCRM Connector, Harness Side: A/CC GND • **Are the resistances below 5 Ohm?**	Yes →	INSTALL a new CCRM. Verify applicable A/CC PWR circuit is not short to ground
		No →	REPAIR open circuit.

X54 measurement table:

(+)PCM Connector, Harness Side	(-)CCRM Connector, Harness Side
A/CCR	A/CCR

X55 measurement table:

(+)CCRM Connector, Harness Side	(-)
B+	Ground

X56 measurement table:

(+)A/CC Assembly Connector, Harness Side	(-)CCRM Connector, Harness Side
A/CC PWR	A/CC PWR
GND	A/CC GND

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X57	DTCS P1469 OR P0534: CHECK FOR CAUSES OF FAST ACCS CYCLING		
	• REFER to the Climate Control System, Section 412 in the Workshop Manual to check A/C system pressure, to test ACCS cycle times, and to check causes of fast ACCS cycling. • **Is a fault indicated?**	Yes →	REPAIR as required to Workshop Manual direction. Complete PCM Reset to clear DTCs. Start Engine Turn On AC Switch Wait 120 seconds. Turn Off AC Switch Rerun Quick Test.
		No →	GO to **X58**.
X58	CHECK FOR INTERMITTENT OPEN IN ACCS CIRCUIT		
	• Key ON Engine OFF. • Access the PCM-ACCS PID using a scan tool. • Turn On AC Switch. • Observe the ACCS PID for an indication of a fault while completing the following: (the ACCS PID will turn off and on quickly when a fault is detected, indicating an intermittent open). — Shake, wiggle, bend the ACCS circuit between the PCM and the source of the circuit. — Lightly tap on the PS (to simulate road shock). • Disconnect and inspect the AC_CYC connector. • **Is a fault indicated?**	Yes →	KEY OFF. ISOLATE fault and REPAIR as necessary. Complete PCM Reset to clear DTCs. Start Engine Turn On AC Switch Wait 120 seconds. Turn Off AC Switch Rerun Quick Test.
		No →	Unable to duplicate or identify fault at this time. Complete PCM Reset to clear DTCs. Return to Section 3 to continue diagnosis.

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X59	CONTINUOUS MEMORY DTCS P1460 OR P0645: CHECK WAC CIRCUIT FOR INTERMITTENT OPEN OR SHORTS		
	Note: If the vehicle is not equipped with AC, the WAC circuit is not used and the P1460/P0645 can be ignored. • A/CCS Switch connector disconnected. • Add jumper wire between the points described below: **Point A A/CCS Switch Connector, Harness Side** / **Point B A/CCS Switch Connector, Harness Side**: A/CDSW / A/CCS • Key ON Engine OFF. • Turn On ACD Switch. • CHECK A/CCR (WAC) circuit for open or short to power while completing the following: — The A/CC will click on when a fault is detected. — Shake, wiggle, bend the A/CCR (WAC) circuit(s). — Lightly tap on the CCRM (to simulate road shock). • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs OFF • CHECK WAC circuit for short to ground while performing the following: — The WAC will click off when a fault is detected. — Shake, wiggle, bend the WAC circuit(s). — Lightly tap on the CCRM (to simulate road shock). • Key OFF. • Turn Off AC Switch. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. Complete PCM Reset to clear DTCs. Start Engine Turn On AC Switch Wait 15 seconds. Turn Off AC Switch Rerun Quick Test. REMOVE jumper wire(s) GO to **Z1**.
X60	DTC P1464: CHECK ACCS PID		
	Note: Verify AC and defrost were off during Self-Test. If AC or defrost were on, turn off and rerun Self-Test. • Key ON Engine OFF. • AC and defroster OFF. • Access the ACCS PID using a scan tool. • **Is the ACCS PID on?**	Yes → No →	KEY OFF. GO to **X61**. The ACCS PID indicates that the ACCS input to the PCM is low. Verify test step results AC and defroster OFF. Rerun Self-Test where DTC P1464 was received.

Point A A/CCS Switch Connector, Harness Side	Point B A/CCS Switch Connector, Harness Side
A/CDSW	A/CCS

Constant Control Relay Module (CCRM) — X

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>X61</td><td>ACCS PID ON: DISCONNECT A/CCS AND CHECK IF ACCS PID TURNS OFF</td><td></td><td></td></tr>
<tr><td colspan="2">A/CCS Switch connector disconnected.
Key ON Engine OFF.
Access the ACCS PID using a scan tool.
Is the ACCS PID off?</td><td>Yes →

No →</td><td>KEY OFF.
Verify operation of the A/CDSW.
If OK,
REPAIR short to power in A/CCS circuit
KEY OFF.
GO to X62.</td></tr>
<tr><td>X62</td><td>CHECK A/CC PWR CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">CCRM connector disconnected.
Key ON Engine OFF.
Measure the Voltage between:
<table><tr><th>(+)CCRM Connector, Harness Side</th><th>(-)</th></tr><tr><td>A/CC PWR</td><td>Ground</td></tr></table>
Is the Voltage below 1 V?</td><td>Yes →
No →</td><td>GO to X63.
REPAIR short circuit.</td></tr>
<tr><td>X63</td><td>CHECK ACCS CIRCUIT FOR SHORT TO POWER IN HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">Key OFF.
PCM connector disconnected.
Key ON Engine OFF.
Measure the Voltage between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)</th></tr><tr><td>A/CCS</td><td>Ground</td></tr></table>
Is the Voltage below 1 V?</td><td>Yes →

No →</td><td>KEY OFF.
GO to X64.
REPAIR short circuit.</td></tr>
<tr><td>X64</td><td>CHECK ACCS CIRCUIT VOLTAGE TO PCM WITH CCRM CONNECTED</td><td></td><td></td></tr>
<tr><td colspan="2">CCRM connector connected.
Key ON Engine OFF.
Measure the Voltage between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)</th></tr><tr><td>A/CCS</td><td>Ground</td></tr></table>
Is the Voltage below 1 V?</td><td>Yes →

No →</td><td>INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
INSTALL a new CCRM.</td></tr>
<tr><td>X65</td><td>DOES THE AC TURN OFF WHEN THE AC_SW IS TURNED OFF?</td><td></td><td></td></tr>
<tr><td colspan="2">Does the AC turn off when the AC_SW is turned off?</td><td>Yes →
No →</td><td>GO to X66.
GO to X69.</td></tr>
</table>

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X66	CHECK IF AC CUTS OFF DURING WOT		
	• Key ON Engine RUN. • Turn On AC Switch. • Initiate brief WOT and return to idle. Listen for the ACCS to disengage during WOT, then re-engage a few seconds after returning to idle (a "click" sound will be heard when the clutch re-engages). Note: If the clicking sound cannot be heard, disconnect to ACCS. With a test lamp connected between the power pin and ground pin of the ACCS, observe the test lamp while performing the brief WOT. The test lamp must go off during the brief WOT, then come back on a few seconds after returning to idle. • Repeat test, if necessary, to verify results. • **Does ACCS or test lamp operate as indicated?**	Yes → No →	KEY OFF. Reconnect A/CC. GO to **Z1**. GO to **X67**.
X67	NO WOT AC CUTOFF, NO DTCS PRESENT: CHECK CCRM		
	• A/CC Assembly connector connected. • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • Turn On A/CDSW Switch. • While listening to the ACCS, command the outputs off and on a couple of times. • **Does the ACCS engage and disengage when the outputs are cycled on and off?**	Yes → No →	KEY OFF. If symptom is intermittent, GO to Z1. Otherwise, return to Section 3 to repair any additional symptoms. INSTALL a new CCRM.
X68	CHECK ACPSW CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• A/CHPSW connector disconnected. • PCM connector disconnected. • Measure the Resistance between: **(+)PCM Connector, Harness Side** — **(-)** A/CLPCS — Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR short circuit.

Constant Control Relay Module (CCRM)

X

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>X69</td><td>AC ALWAYS ON: CHECK FOR VOLTAGE AT A/C CLUTCH WITH A/C OFF</td><td></td><td></td></tr>
<tr><td colspan="2">• AC and defroster OFF.
• A/CC Assembly connector disconnected.
• Measure the Voltage between:

<table><tr><th>(+)A/CC Assembly Connector, Harness Side</th><th>(-)A/CC Assembly Connector, Harness Side</th></tr><tr><td>A/CC PWR</td><td>GND</td></tr></table>
• Key ON Engine RUN.
• Monitor voltage.
• Measure the Voltage between:

<table><tr><th>(+)A/CC Assembly Connector, Harness Side</th><th>(-)A/CC Assembly Connector, Harness Side</th></tr><tr><td>A/CC PWR</td><td>GND</td></tr></table>
• Is the Voltage below 2 V?</td><td>Yes →

No →</td><td>REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.

GO to X70.</td></tr>
<tr><td>X70</td><td>CHECK ACCS INPUT TO PCM WITH AC OFF</td><td></td><td></td></tr>
<tr><td colspan="2">• Key OFF.
• Connect scan tool to Data Link Connector (DLC).
• Key ON Engine RUN.
• AC and defroster OFF.
• Access the PCM-ACCS PID using a scan tool.
• Is the PID state OFF?</td><td>Yes →

No →</td><td>KEY OFF.
REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.

GO to X61.</td></tr>
</table>

Constant Control Relay Module (CCRM)

X

Test Steps		Results →	Action to Take
X71	CHECK ACHP MEDIUM PRESSURE CIRCUITS		
	Note: An A/CHPSW medium pressure circuit concern can result in the high speed cooling fan not coming on when A/C refrigerant pressure becomes high. In hot ambient conditions, this may result in the refrigerant pressure continuing to increase until the A/C high pressure switch contacts open, shutting off the A/C until the pressure drops to an acceptable range. • Key OFF. • A/CHPSW connector disconnected. • Turn the AC off. • Add jumper wire between the points described below: Point A A/CHPSW Connector, Harness Side: A/CPSW — Point B A/CHPSW Connector, Harness Side: GND • Key ON Engine RUN. • Wait 15 seconds. • **Does the High speed cooling fan come on?**	Yes → No →	KEY OFF. REMOVE jumper wire(s) Reconnect Air Conditioning High Pressure Switch. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom. GO to **X72**.
X72	CHECK FOR OPEN AIR CONDITIONING HIGH PRESSURE SWITCH GROUND CIRCUIT(S)		
	• Key ON Engine RUN. • Add jumper wire between the points described below: Point A A/CHPSW Connector, Harness Side: A/CLPCS — Point B Vehicle battery: Negative post • Wait for 15 seconds. • **Does the High speed cooling fan come on?**	Yes → No →	KEY OFF. REPAIR open circuit. REMOVE jumper wire(s) KEY OFF. REMOVE jumper wire(s) GO to **X73**.
X73	CHECK FOR AN OPEN CIRCUIT BETWEEN PCM & A/CHPSW		
	• PCM connector disconnected. • Measure the Resistance between: (+)PCM Connector, Harness Side: ACPSW — (-)A/CHPSW Connector, Harness Side: A/CPSW • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.

Embedded tables:

Point A A/CHPSW Connector, Harness Side	Point B A/CHPSW Connector, Harness Side
A/CPSW	GND

Point A A/CHPSW Connector, Harness Side	Point B Vehicle battery
A/CLPCS	Negative post

(+)PCM Connector, Harness Side	(-)A/CHPSW Connector, Harness Side
ACPSW	A/CPSW

Intermittent

Z

Note

This pinpoint Test is intended to diagnose and isolate intermittent concerns for the following:

All Electronic EC subsystems.

Coil Pack ignition systems using the Distributorless Ignition System Tester (DIST).

This chart is used to determine which test to run for the suspect circuit. Corresponding PIDs to each circuit are listed. Some circuits do not have an associated PID or the PID may not be available and will have to be measured with a digital multimeter. More specific PIDs can be found in Section 6. if the vehicle has a coil pack system with a no start condition, perform the ignition test with the distributorless ignition system tester. Do not use the DIST for coil on plug applications.

Note

There are two main procedures used to isolate and repair an intermittent concern. one would utilize the Rotunda Distributorless Ignition System Tester (DIST) or similar after market tool, and the other being a scan tool with digital multimeter. This vehicle has Coil On Plug (COP) ignition. It does not have (DIST).

PCM/TCM PIDS/SIGNALS

PCM/TCM PIDS/SIGNALS	Associated Circuit	Test Type
4X4	4X4	input
ACCS	A/CCS	input
ACCR	ACCR	input
ACET	ACET	input
ACFDS	ACFDS	input
ACLPCS	ACLPCS	input
ACP,ACPV	ACPSW	input
ACRDV	ACRDV	output
ACRSW	ACRSW	input
Use Digital Multimeter	AFC	input

(Continued)

Intermittent

Z

PCM/TCM PIDS/SIGNALS

PCM/TCM PIDS/SIGNALS	Associated Circuit	Test Type
AMC	AMC	output
APP1	APPS	input
APP2	APPS	input
APP3	APPS	input
BARO	BARO	input
BPP/BOO	BPP	input
Use Digital Multimeter	BPS	input
CAS GND	case GND	input
CCS	CCS	output
Use Digital Multimeter	CD-A (primary)	output
Use Digital Multimeter	CD-B (primary)	output
Use Digital multimeter	CD-C (primary)	output
Use Digital Multimeter	CD-D (primary)	output
CHT, CHT V	CHT	input
CKP/CPS	CKP	input
CMP/CID	CMP	input
CTO	CTO	output
DCE	DC/DC CONVERT	output
EGRMC1	EGR	output
EGRMC2	EGR	output
EGRMC3	EGR	output
EGRMC4	EGR	output
EFC*	EFC	output
CVV	EVAPCV	output
EVMV	EVAP	output
FC1	FC1/LFC	output
FC2	FC2/MFC	output
FC3	FC3/HFC	output
FP	FPDM	output
FPM	FPDM	input
FRP	FIPT/S	input
FRT	FIPT/S	input
FTIV	FTIV	output
FTPT	FTPT	input

(Continued)

Intermittent

Z

PCM/TCM PIDS/SIGNALS

PCM/TCM PIDS/SIGNALS	Associated Circuit	Test Type
GSDN	GSDN	output
HPCR	HPCR	output
HOS11	HEGO	input
HOS12	HEGO	input
HOS13	HEGO	input
HTR11	HEGO	output
HTR12	HEGO	output
HTR13	HEGO	output
IAT	IAT	input
INJ1	INJECTOR	output
INJ2	INJECTOR	output
INJ3	INJECTOR	output
INJ4	INJECTOR	output
Use Digital Multimeter	KAPWR	input
KS1P	KS	input
MAF	MAF	input
MAP/TMAP	MAP	input
MECP	MECP	output
MECT	MECT	input
MSDN	MSDN	output
PAZV	PAZV	output
PSR	PSR	output
SAIR	Secondary AIR	output
SAIRM	Secondary AIRM	input
SCV	SCV	output
SCVM	SCVM	input
TGAC*	TGAC	output
TMAC*	TMAC	output
TPCMD1	TACM+/ETB	output
TPCMD2	TACM-/ETB	output
TP1	TP	input
TP2	TP	input
TR-A1	TRANS	input
TR-A2	TRANS	input
TR-A3	TRANS	input
TSS/ISS	TSS	input
CAMDCR,RCAM	VCT	output

(Continued)

Air conditioning clutch relay circuit — KM

<table>
<tr><th colspan="2">Test Steps</th><th>Results →</th><th>Action to Take</th></tr>
<tr><td>KM7</td><td>ACCS PID OFF WITH A/C ON: VERIFY A/C CLUTCH IS GETTING POWER</td><td rowspan="2">Yes →
No →</td><td rowspan="2">GO to KM8.
REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.</td></tr>
<tr><td></td><td>• Key ON Engine RUN.
• While listening for A/C clutch to engage, turn A/C on (if clutch cannot be heard, disconnect A/C clutch and connect a non-powered test lamp to A/CC PWR and ground circuit to check for power).
• Does the A/CC engage?</td></tr>
<tr><td>KM8</td><td>CHECK ACCS CIRCUIT FOR OPEN IN HARNESS</td><td rowspan="2">Yes →
No →</td><td rowspan="2">INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
REPAIR open circuit.</td></tr>
<tr><td></td><td>• PCM connector disconnected.
• A/CC Assembly connector disconnected.
• Measure the Resistance between:
<table><tr><th>(+)PCM Connector, Harness Side</th><th>(-)A/CC Assembly Connector, Harness Side</th></tr><tr><td>A/CCS</td><td>A/CC PWR</td></tr></table>• Is the Resistance below 5 Ohm?</td></tr>
<tr><td>KM9</td><td>KOEO AND KOER DTC P1464: VERIFY A/C AND DEFROST WERE OFF DURING SELF-TEST</td><td rowspan="2">Yes →
No →</td><td rowspan="2">For Vehicles with A/CC RLY
GO to KM10.
For All Others
GO to KM11.
The A/CCS PID indicates that an “A/C off” request is being sent to the PCM.
Verify test step results
A/C and defrost off.
Rerun Self-Test where DTC P1464 was received.</td></tr>
<tr><td></td><td>• Verify A/C and defrost were OFF during Self-Test.
• Was A/C and defrost off during Self-Test?</td></tr>
</table>

Air conditioning clutch relay circuit — KM

Test Steps		Results →	Action to Take
KM10	CHECK ACCS PID		
	• Key ON Engine OFF. • AC and defroster OFF. • Access the ACCS PID using a scan tool. • **Is the PID state ON?**	Yes →	KEY OFF. The ACCS PID indicates that the PCM is being requested to turn on A/C. ACCS REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
		No →	The ACCS PID indicates that the ACCS input to the PCM is low. Verify test step results AC and defroster OFF. Rerun Self Test
KM11	CHECK ACCS PID		
	• Key ON Engine OFF. • AC and defroster OFF. • Access the ACCS PID using a scan tool. • **Is the PID state ON?**	Yes →	KEY OFF. GO to **KM12**.
		No →	The ACCS PID indicates that the ACCS input to the PCM is low. Verify test step results AC and defroster OFF. Rerun Self Test
KM12	ACCS PID ON: DISCONNECT A/CCS AND CHECK IF ACCS PID TURNS OFF		
	• A/CCS Switch connector disconnected. • Key ON Engine OFF. • Access the ACCS PID using a scan tool. • **Is the PID state OFF?**	Yes →	Verify operation of the A/CDSW. REFER to the Climate Control System, Section 412 in the Workshop Manual to diagnose symptom.
		No →	KEY OFF. GO to **KM13**.
KM13	CHECK A/CCS CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+) PCM Connector, Harness Side: A/CCS — (-): Ground • **Is the Voltage below 1 V?**	Yes →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)).
		No →	REPAIR short circuit.

Measurement table for KM13:

(+)PCM Connector, Harness Side	(-)
A/CCS	Ground

Air conditioning clutch relay circuit | KM

Test Steps		Results →	Action to Take
KM14	CONTINUOUS MEMORY DTCS P1460 OR P0645: CHECK A/CCR (WAC) CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	Note: If the vehicle is not equipped with AC, the WAC circuit is not used and the P1460/P0645 can be ignored. • Key ON Engine OFF. • CHECK A/CCR (WAC) circuit for short to ground while performing the following: (the A/C clutch will click on when a fault is detected). — Wiggle, shake and bend small sections of the wiring harness while working from the component to the module. — Lightly tap on the A/CC RLY (to simulate road shock). • **Is a fault indicated?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. Complete PCM Reset to clear DTCs. Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test GO to **KM15**.
KM15	CHECK A/CCR (WAC) FOR OPEN OR SHORT CIRCUIT TO POWER		
	• Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command outputs ON • CHECK A/CCR (WAC) circuit for open or short to power while completing the following (the ACCS will click off a fault is detected): — Wiggle, shake and bend small sections of the wiring harness while working from the component to the module. — Lightly tap on the A/CC RLY (to simulate road shock). • **Is a fault indicated?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. Complete PCM Reset to clear DTCs. Start Engine Turn On AC Switch Wait for 15 seconds. Turn Off AC Switch Rerun Self Test KEY OFF. Unable to duplicate or identify fault at this time. GO to **Z1**.

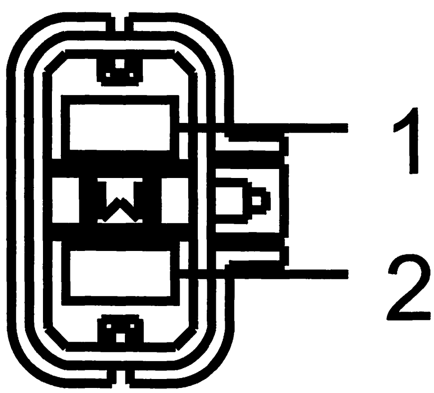
Variable Speed Electric Cooling Fan	KN

This pinpoint test is intended to diagnose the following:

- Variable Speed Electric Cooling Fan (8T00).
- Harness Circuits: FCV , B+, VPWR, GND.
- Powertrain Control Module (PCM) (12A650).

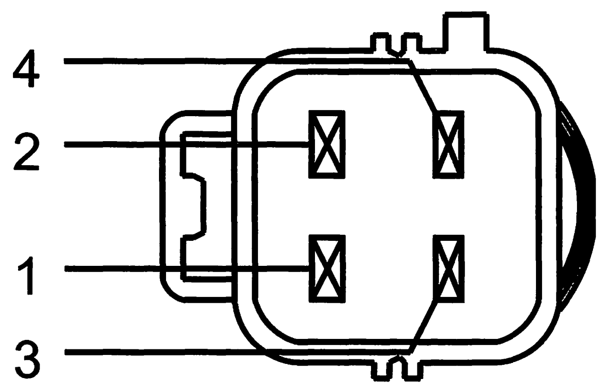
Cooling Fan (CF) Motor Connector

A



A0077506

B

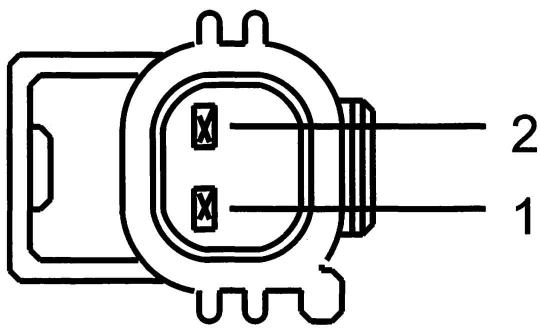


A0077515

Vehicle	Connector	Circuit	Pin
LS, Thunderbird	A	GND B+	2 1
All other vehicles	B	FCV GND B+	3 2 1

Variable Speed Electric Cooling Fan	KN

Cooling Fan Controller (CFC) Module Connector



A0077524

Circuit	Pin
FCV (Fan Control Variable)	1
VPWR (Power supply)	2

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, REFER to Section 6

Vehicle	Connector	Circuit	Pin
LS, Thunderbird	150 (60-32-58) Pin	FCV	B47
All other vehicles	104 Pin	FCV	28

Variable Speed Electric Cooling Fan — KN

Test Steps		Results →	Action to Take
KN1	KOEO DTCS P1474 OR P0480: CHECK B+ & GND CIRCUIT FOR OPEN IN HARNESS		
	• Key OFF. • CF Motor connector disconnected. • Measure the Voltage between: (+)CF Motor Connector, Harness Side: B+ / (-)CF Motor Connector, Harness Side: GND • **Is the Voltage above 10.5 V?**	Yes → No →	GO to **KN3**. GO to **KN2**.
KN2	CHECK VOLTAGE TO FAN MOTOR USING CHASSIS GROUND AS A REFERENCE		
	• Measure the Voltage between: (+)CF Motor Connector, Harness Side: B+ / (-): Ground • **Is the Voltage above 10.5 V?**	Yes → No →	REPAIR open circuit. Open GND harness circuit B+ circuit fault. CHECK condition of related fuse/fuse links. If OK, REPAIR open circuit. If fuse/fuse link is damaged, CHECK circuit for short to ground before replacing.
KN3	CHECK FCV CIRCUIT(S)		
	• Connect 1.6K ohms resistor between FCV and B+ circuits at the CF harness connector. (this simulates cooling fan circuitry). • Key ON Engine OFF. • CHECK KOEO DTCs: • **Are DTCs P0480 or P1474 present?**	Yes → No →	KEY OFF. GO to **KN4**. INSTALL a new CF motor.
KN4	CHECK FCV CIRCUIT FOR SHORT TO POWER IN HARNESS		
	• PCM connector disconnected. • Key ON Engine OFF. • Measure the Voltage between: (+)CF Motor Connector, Harness Side: FCV / (-): Ground • **Is the Voltage below 1 V?**	Yes → No →	KEY OFF. GO to **KN5**. REPAIR short circuit.

KN1 measurement:

(+)CF Motor Connector, Harness Side	(-)CF Motor Connector, Harness Side
B+	GND

KN2 measurement:

(+)CF Motor Connector, Harness Side	(-)
B+	Ground

KN4 measurement:

(+)CF Motor Connector, Harness Side	(-)
FCV	Ground

Variable Speed Electric Cooling Fan — KN

Test Steps		Results →	Action to Take
KN5	CHECK FCV CIRCUIT FOR SHORT TO GROUND IN HARNESS		
	• Measure the Resistance between: (+)CF Motor Connector, Harness Side: FCV — (-): Ground • **Is the Resistance above 10 KOhm?**	Yes → No →	GO to **KN6**. REPAIR short circuit.
KN6	CHECK FOR AN OPEN CIRCUIT BETWEEN PCM & FCV		
	• Measure the Resistance between: (+)PCM Connector, Harness Side: FCV — (-)CF Motor Connector, Harness Side: FCV • **Is the Resistance below 5 Ohm?**	Yes → No →	INSTALL a new PCM. (refer to Section 2, Flash Electrically Eraseable Programmable Read Only Memory (EEPROM)). REPAIR open circuit.
KN7	CONTINUOUS MEMORY DTCS P1474 OR P0480: CHECK THE B+ & GND CIRCUIT FOR INTERMITTENT CONCERN		
	• Key OFF. • CF Motor connector disconnected. • Connect non-powered test lamp between: (+)CF Motor Connector, Harness Side: B+ — (-)CF Motor Connector, Harness Side: GND • Observe test lamp for an indication of a fault while completing the following (the lamp will turn Off when a fault is detected): — Shake, wiggle, bend the B+ & GND circuits to the CF. — Shake, wiggle, bend the associated FUSE. • **Is a fault indicated?**	Yes → No →	ISOLATE fault and REPAIR as necessary. GO to **KN8**.

Variable Speed Electric Cooling Fan | KN

Test Steps		Results →	Action to Take
KN8	CHECK FCV CIRCUIT(S) FOR INTERMITTENT CONCERNS		
	• Connect 1.6 K ohms resistor between FCV and B+ circuits at the CF harness connector. (this simulates cooling fan circuitry). • Measure the Voltage between: **(+)CF Motor Connector, Harness Side**: FCV — **(-)**: Ground • Key ON Engine OFF. • Scan Tool Connected • Enter Output Test Mode (refer to section 2) • Command low speed fan ON • Observe DVOM for an indication of a fault while completing the following (Voltage will change suddenly when a fault is detected): — Shake, wiggle, bend the FCV circuit between the CFC and PCM. • **Is a fault indicated?**	Yes → No →	KEY OFF. ISOLATE fault and REPAIR as necessary. KEY OFF. GO to **Z1**.
KN9	COOLING FAN MOTOR DOES NOT OPERATE (W/ NO DTCS): COMMAND FAN ON TO CHECK OPERATION		
	• Run KOEO Self-Test. — Listen to FAN. • **Does fan run sometime during KOEO self test?**	Yes → No →	KEY OFF. Concern is elsewhere. RETURN to Section 3, Symptom Charts for further direction. KEY OFF. GO to **KN10**.
KN10	CHECK B+ AND GND TO COOLING FAN MOTOR B+ & GND		
	• CF Motor connector disconnected. • Measure the Voltage between: **(+)CF Motor Connector, Harness Side**: B+ — **(-)CF Motor Connector, Harness Side**: GND • **Is the Voltage above 10.5 V?**	Yes → No →	INSTALL a new CF motor. Replacement of the assembly might be required GO to **KN11**.

Intermittent

Z

PCM/TCM PIDS/SIGNALS

PCM/TCM PIDS/SIGNALS	Associated Circuit	Test Type
VPWR	VPWR	input
Use Digital Multimeter	VREF	output
Use Digital Multimeter	VSO	output
VSS	VSS+	input
WAC	WAC	output

Test Steps		Results →	Action to Take
Z1	DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH		
	CAUTION: Proceed with this step only if a PCM Reset was not performed previously. Be sure to record freeze frame data prior to PCM Reset. PCM Reset will clear freeze frame data and eliminate FMEM. This will also insure reproduction of any PCM related symptoms. • Connect scan tool to Data Link Connector (DLC). • Key ON Engine OFF. • Complete PCM Reset. • **Is the PCM Reset complete?**	Yes → No →	GO to **Z2**. Complete PCM Reset. GO to **Z2**.
Z2	SELECT PIDS AND /OR SIGNALS RELATED TO THE SYSTEM		
	• A list of related PIDs and/or Signals are needed for use with the scan tool to monitor the suspect areas. Obtain the customer symptom description. Use the Reference Value Symptom chart and proceed to the Reference Value PID/Signal measurement chart located at the beginning of Section 6, Reference Values. • Highlight each available PID/Signal recommended by the charts under the PID/Signal selection menu on the scan tool. • **Have all available PIDs/Signals related to the symptom been selected?**	Yes → No →	GO to **Z3**. Repeat Z2
Z3	DECISION TO VERIFY SYMPTOM		
	Note: The path to symptom verification is optional, but is recommended for several reasons. For example: the vehicle is in service for a repeat repair, or there is no DTC present. • **Has a fault symptom been detected?**	Yes → No →	GO to **Z10**. GO to **Z4**.

Intermittent — Z

	Test Steps	Results →	Action to Take
Z4	COLLECT ANY SYMPTOM RELATED DATA TO AID IN VERIFICATION		
	Note: Only MIL codes will trigger freeze frame data. REFER to scan tool instruction manual to retrieve freeze frame information. • Prepare freeze frame data for use with information from the Symptom Charts in Section 3. • CHECK Continuous Memory DTCs that should have been recorded from earlier pinpoint test. • Access information from the customer worksheet and the customer if available. Access any other symptom related data available, such as TSBs and CQIS reports. • **Has all available data been recorded?**	Yes → No →	GO to **Z5**. Gather as much data as possible to aid in isolating the intermittent fault area. Repeat Z4
Z5	RECREATE SYMPTOM USING ALL AVAILABLE DATA		
	Note: To recreate original conditions that set the DTC or caused the symptom vehicle may require some driving. • With scan tool, select and monitor the same PIDs as displayed in freeze frame along with previously selected PIDs / Signals from step Z2. Using freeze frame data recorded earlier, recreate the conditions described by each freeze frame PID. Pay special attention to ECT, LOAD, RPM and VSS. Also, use any available data from the customer, TSBs, and alike to aid in producing the correct conditions for recreating the symptom. • When the symptom occurs, press trigger to begin recording. (REFER to the scan tool instruction manual for recorder function). • **Could symptom be recreated?**	Yes → No →	GO to **Z10**. GO to **Z6**.

Intermittent	Z

	Test Steps	Results →	Action to Take
Z6	RECREATE SYMPTOM USING KOEO AND ROAD TEST PROCEDURE		
	• The road test is the last attempt to locate the area of concern before physically disturbing vehicle circuits. Note: PIDs for output in the Reference Value Charts represent command values only. Circuit measurements with digital multimeter indicate actual output status. Therefore, in the case of a fault, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM/TCM circuits with a mismatch in digital multimeter measurement indicate a possible PCM/TCM concern. • The Intermittent Road Test Procedure is a set of instructions for monitoring PIDs/Signals with a scan tool and circuit measurements with a digital multimeter. This is done under four different conditions - KOEO, HOT IDLE, 30 mph and 55 mph (48and 88 kph). Use the typical diagnostic Reference Values from Section 6 to compare with the actual vehicle values. For actual road test at speeds, a planned route or test track and passenger is required. • Locate the correct Reference Value chart in Section 6. • Set vehicle up to measure circuits with a digital multimeter and a scan tool. • Connect scan tool to Data Link Connector (DLC). • Key ON Engine OFF. • With the scan tool, select and monitor PIDs and measure circuits shown in the Reference Value Chart in Section 6. • Compare the scan tool PIDs and digital multimeter values to the Reference Value Charts. • **Are any values out of range?**	Yes → No →	GO to **Z10**. GO to **Z7**.
Z7	RECREATE SYMPTOM USING HOT IDLE ROAD TEST PROCEDURE		
	• Engine temperature should be at least 195 deg F (87 deg C). • Key ON Engine RUN. • Continue to monitor the PIDs and circuits as in the previous step. • **Are any values out of range?**	Yes → No →	GO to **Z10**. GO to **Z8**.

Intermittent — Z

	Test Steps	Results →	Action to Take
Z8	RECREATE SYMPTOM USING 30 MPH (48 KPH) SLOW CRUISE ROAD TEST PROCEDURE		
	• Drive vehicle on preplanned route. • Continue to monitor the PIDs and circuits as in the previous step. • **Are any values out of range?**	Yes → No →	GO to **Z10**. GO to **Z9**.
Z9	RECREATE SYMPTOM USING 55 MPH (88 KPH) HIGH CRUISE ROAD TEST PROCEDURE		
	• Continue to drive vehicle on preplanned route. • Continue to monitor the PIDs and circuits as in the previous step. • **Are any values out of range?**	Yes → No →	GO to **Z10**. It is now necessary to physically disturb selected vehicle circuits in an attempt to recreate the intermittent concern. GO to **Z10**.
Z10	SELECT CIRCUITS FROM THE INTERMITTENT TEST CHART		
	• Remain in the PID/Signal selection menu with the scan tool. • If the intermittent road test was used to verify the symptom, highlight PIDs/Signals that displayed as mismatch to the Reference Values from Section 6. Otherwise highlight only the PIDs/Signals from step Z2. • Proceed to the intermittent Test Chart located at the beginning of this pinpoint. • Match selected PIDs/Signals to the corresponding circuit in the chart. There may be more than one circuit to test. If a PID/Signal recording was made with the scan tool, it may be helpful to replay it at this time (refer to the scan tool instruction manual for recorder function). Note: From the same chart, be sure to select and proceed with the appropriate test type. • Input Test- Used on sensing such as temperature, position or oxygen. • Output Test- Used on output devices such as relays, coils or solenoids. • **Has a test been chosen?**	Yes → No →	**For Input Test** GO to **Z11**. **For Output Test** GO to **Z15**. To diagnose other drivability symptoms, Go to Section 3, Symptom Charts.

Intermittent	Z

Test Steps		Results →	Action to Take
Z11	KOEO INPUT TEST PROCEDURE FOR PCM/TCM SENSORS		
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. • Using circuits chosen from the Intermittent Test Chart, select only the recommended PIDs/Signals to monitor with the scan tool. If a PID is not available for the circuit, use a digital multimeter to check the value. • Proceed to the area of the suspect wiring or component fault. • Key ON Engine OFF. • If the input is a switch type-component, turn on manually. • Monitor the PID or digital multimeter while tapping on component. • Monitor while wiggling sensor harness wire from component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Are there abrupt changes in the PID values that do not compare with Section 6 readings?**	Yes → No →	REPAIR as necessary. VERIFY repair. GO to **Z13**.
Z12	KOER INPUT TEST PROCEDURE PCM/TCM SENSORS		
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. • Key ON Engine RUN. • Continue to monitor the PIDs and circuits as in the previous step. • Proceed to the area of the suspect wiring or component fault. • If the input is a switch type-component, turn on manually. • Monitor the PID or digital multimeter while tapping on component. • Monitor while wiggling sensor harness wire from component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Are any values fluctuating in and out of range?**	Yes → No →	REPAIR as necessary. VERIFY repair. GO to **Z13**.

Intermittent — Z

Test Steps		Results →	Action to Take
Z13	KOEO WATER SOAK TEST PROCEDURE FOR PCM/TCM SENSORS EXCLUDING HIGH VOLTAGE CIRCUITS		
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. • Key ON Engine OFF. • Continue to monitor the PIDs and circuits as in the previous step. • Proceed to the area of the suspect wiring or component fault. • If the input is a switch type-component, turn on manually. • Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM. • Monitor while spraying sensor harness wire from component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Are any values fluctuating in and out of range?**	Yes → No →	REPAIR as necessary. VERIFY repair. GO to **Z14**.
Z14	KOER WATER SOAK TEST PROCEDURE FOR PCM/TCM SENSORS EXCLUDING HIGH VOLTAGE CIRCUITS		
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. • Key ON Engine RUN. • Continue to monitor the PIDs and circuits as in the previous step. • Proceed to the area of the suspect wiring or component fault. • If the input is a switch type-component, turn on manually. • Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM. • Monitor while spraying sensor harness wire from component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Are any values fluctuating in and out of range?**	Yes → No →	REPAIR as necessary. VERIFY repair. GO to **Z15**.

Intermittent — Z

Test Steps		Results →	Action to Take
Z15	KOER WATER SOAK TEST PROCEDURE FOR PCM SENSORS		
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. • Using circuits chosen from the Intermittent Test Chart, select only the recommended PIDs/Signals to monitor with the scan tool. If a PID is not available for the circuit, use a digital multimeter to check the value. Note: Remember that PIDs selected from the Intermittent Test Chart will display commanded values only. A Digital multimeter measurements will be needed to display actual values. Be sure to compare them. Look for fluctuations to occur during any of the following test. Output State Test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators. **CAUTION: Cooling fans or fuel pump may turn on during the next steps.** • Key ON Engine OFF. • With the scan tool, turn on selected outputs using Output State Control (refer to the scan tool instruction manual). • Proceed to the area of the suspect wiring or component fault. • Monitor the PID or digital multimeter while tapping on component. • Monitor while wiggling sensor harness wire from component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts in section 6?**	Yes → No →	REPAIR as necessary. VERIFY repair. GO to **Z16**.

Intermittent

Z

Test Steps		Results →	Action to Take
Z16	KOER OUTPUT TEST PROCEDURE FOR PCM/TCM ACTUATORS		
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. Note: Remember that PIDs selected from the Intermittent Test Chart will display commanded values only. A Digital multimeter measurements will be needed to display actual values. Be sure to compare them. Look for fluctuations to occur during any of the following test. Output State Test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators. • To test these output types, Go to Z18. • Key ON Engine RUN. • Proceed to the area of the suspect wiring or component fault. • Monitor PIDs with the scan tool and note the values. Compare the scan tool values with values from a Digital multimeter with engine at idle. While tapping on the suspect component look for fluctuations in the values. • If a coil for a coil on plug application is suspect, turn off the key. Gain access to the coil and measure continuity from the spark plug terminal to the signal terminal while tapping the coil. A large fluctuation in resistance will indicate an intermittent open or short. • Monitor while wiggling sensor harness wire from component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Is there a scan tool to digital multimeter value mismatch or an idle fluctuation.**	Yes → No →	REPAIR as necessary. VERIFY repair. GO to **Z17**.

Intermittent

Z

Test Steps		Results →	Action to Take
Z17	KOEO WATER SOAK TEST PROCEDURE FOR PCM/TCM ACTUATORS EXCLUDING HIGH VOLTAGE CIRCUITS		
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. **CAUTION: When performing any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.** Note: Remember that PIDs selected from the Intermittent Test Chart will display commanded values only. A Digital multimeter measurements will be needed to display actual values. Be sure to compare them. Look for fluctuations to occur during any of the following test. Output State Test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators. • To test these output types, Go to Z18. • Key ON Engine OFF. • With the scan tool, turn on selected outputs using Output State Control (refer to the scan tool instruction manual). • Proceed to the area of the suspect wiring or component fault. • Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts in section 6?**	Yes → No →	REPAIR as necessary. VERIFY repair. GO to **Z18**.

Intermittent — Z

Test Steps		Results		Action to Take
Z18	KOER WATER SOAK TEST PROCEDURE FOR PCM/TCM ACTUATORS			
	WARNING: WHEN PERFORMING ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. **CAUTION: When performing any test steps, always be aware of hands, clothing or tools near cooling fans, belts or hot surfaces.** • Key ON Engine RUN. • Using circuits chosen from the Intermittent Test Chart, select only the recommended PIDs/Signals to monitor with the scan tool. If a PID is not available for the circuit, use a digital multimeter to check the value. • Proceed to the area of the suspect wiring or component fault. • Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM. • Monitor while spraying sensor harness wire from component to PCM/TCM. • Look for abrupt changes in values. Compare these actual values to the Typical Diagnostic Reference Values in Section 6. • **Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the Reference Value Charts in section 6?**	Yes No	→ →	REPAIR as necessary. VERIFY repair. GO to **Z19**.
Z19	INSPECT FOR INTERMITTENT MECHANICAL CONCERNS			
	Note: It is possible for an intermittent mechanical concern to cause a good PCM/TCM system to react abnormally. • An inspection of DTC related mechanical systems should have been performed in an earlier section. If not, visually inspect at this time. • Look for possible vacuum lines, wires, cables, linkage or hoses that may become kinked, shorted or restricted during normal engine operation. • This may include engine/transmission gear changes, acceleration and deceleration, rough roads and various engine RPM and torque related conditions. • **Is a mechanical concern detected?**	Yes No	→ →	REPAIR as necessary. VERIFY repair. It is necessary to seek additional help. REFER to (PTS) Professional Technician Society web site, the OASIS system or the Technical Hotline. A (VDR) Vehicle Data Recorder or similar flight recorder may also be useful.

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Reference Value Symptom Chart

The Reference Value Symptom Chart is used to provide guidance in selecting the appropriate PID or measured signal related to the fault area. Select a symptom from the symptom chart along with the category number and proceed to the PID/Measured Signal Chart. For multiple symptoms, select the most evident.

Symptom Chart

Symptom occurs during	Symptom	Category Number
STARTUP:	No start/Normal crank	1
	Hard start/Long crank	2
	Stall after start	3
	Diesels/Runs on	4
IDLE:	MIL	5
	Stalls/Quits	6
	Slow	7
	Slow return	8
	Rolling	9
	Fast	10
	Rough	11
	Misses	12
	Backfires	13
ACCELERATION:	Stalls/Quits	6
	Misses	12
	Bucks/Jerks	14
	Backfires	13
	Hesitation	15
	Lack/Loss of power	16
	Surge	17
	Spark knock	18
	Cooling system temperature	19
	Poor fuel economy	20
	Emissions compliance	21
CRUISE:	Stalls/Quits	6
	Misses	12
	Bucks/Jerks	14
	Backfires	13
	Lack/Loss of power	16
	Surge	17
	Spark knock	18
	Cooling system temperature	19
	Poor fuel economy	20
	Emissions compliance	21
DECELERATION:	Stalls/Quits	6
	Backfires	13

(Continued)

Reference Value Symptom Chart

Symptom occurs during	Symptom	Category Number
TRANSMISSION OPERATION: (AUTOMATIC)	Shift/Engagement Concerns	22
	No overdrive	23
TRANSMISSION OPERATION: (MANUAL)	No reverse lights	24

Reference Value PID/Measured Signal Chart

The listing reflects PIDS and/or measured values which may reveal a possible concern within each system shown. Match the category number with the related PID/measured signal and proceed to the Typical Diagnostic Reference Value Charts.

PID/Measured Signal Chart

Category Number	Related PIDS/Measured Signals
5-9-10-17	ACCS
5-10-17	ACP
5-10-17	ACP V
5-21	AIR
5-21	AIRF
5-21	AIRM
1-23	APP1
1-23	APP2
1-23	APP3
23	BPP/BOO
22-23	CCS
18-19	CHT
18-19	CHT V
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CID
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CKP
1-2-3-5-6-7-11-12-13-14-15-16-17-20-21	CMP1/2
10	CPP/PNP
3-5-6-7-9-11-15-16-20-21	DPFEGR
4-18-19-21-22	ECT[a]
4-18-19-21-22	ECT V
2-5-7-10-15-16-18-19-20-21	EFTA
2-5-7-10-15-16-18-19-20-21	EFTA V
2-5-7-10-15-16-18-19-20-21	EFTB
2-5-7-10-15-16-18-19-20-21	EFTB V
3-5-6-7-9-11-15-16-20-21	EGRMC1-4
3-5-6-7-9-11-15-16-20-21	EGRMDSD
3-5-6-7-9-11-15-16-20-21	EGRVR
5-18-19-20-21	EOT
5-18-19-20-21	EOT V
22	EPC
22	EPC V
3-5-6-11-21	EVAPCV
3-5-6-11-21	EVAPPDC
5-21	EVAPPF
3-5-6-11-21	EVMV
20	FLI (H)
20	FLI V
1 thru 21	FP
1 thru 21	FP M
1 thru 21	FPM
1 thru 21	FRP

(Continued)

Reference Value PID/Measured Signal Chart

PID/Measured Signal Chart

Category Number	Related PIDS/Measured Signals
1 thru 21	FRP V
1 thru 21	FRT
1 thru 21	FSV - NGV
1 thru 21	FSVM
5	FTP
5	FTP V
1 thru 21	FUELPW1/2
1 thru 21	FUELSYS1/2[a]
22-23	GEAR
5	GENFDC (ALTCOM)
5	GFS (ALTMON)
19	HFC
1 thru 21	HTR11/12/13/21/22
1 thru 21	IAC
2-3-5-7-8-10-22	IAT[a]
2-3-5-7-8-10-22	IAT2[a]
2-3-5-7-8-10-22	IAT V[a]
2-3-5-7-8-10-22	IAT2 V[a]
5-14-15-16-17-20	IMRC
5-14-15-16-17-20	IMRCM
5-14-15-16-17-20	IMTV
5-14-15-16-17-20	IMTV1
5-14-15-16-17-20	IMTV2
4-5-16-18-19-20-21	KS1[a]
4-5-16-18-19-20-21	KS2[a]
19	LFC
1 thru 21	LONGFT1/2[a]
1 thru 23	MAF[a]
1 thru 23	MAF V
1 thru 23	MAP V
1 thru 22	MISF
1 thru 21	O2S11/12/13/21/22
15-18-20-21	OCTADJ
22	OSS
10	PSP
10	PSPT
10	PSP V
5	PTO
1 thru 23	RPM[a]
5-14-16-17	SCB
5-14-16-17	SCICP
1 thru 21	SHRTFT1/2/11/12/21/22
15-16-18-19-20-21	SPRKADV[a]
22-23	SS1/SS2/SS3/SS4
1-23	TACMN
1-23	TACMP

(Continued)

Reference Value PID/Measured Signal Chart

PID/Measured Signal Chart

Category Number	Related PIDS/Measured Signals
6-14-16-20	TCC
22	TCIL
22-23	TCS
22-23	TFT
22-23	TFT V
1-23	TP
1-23	TP V
22-23	TR
22-23	TR 1-4
22-23	TR V
22-23-24	TR D
22-23	TSS
2-4-5-9-10-11-16-17-18-19-20-21	VCT
2-4-5-9-10-11-16-17-18-19-20-21	VCT1/2
1-2-3-5-6-11-12-13-14	VPWR
22-23	VSS
5-9-10-17	WAC

a Generic PID

Some signals are measured only and will require the use of a breakout box and digital multimeter.

Typical Diagnostic Reference Values

Notes:

The footnotes are referenced throughout the Typical Diagnostic Reference Value Charts. A letter in parentheses next to a value indicates supplemental information is applicable.

An attempt is made to provide as much information as possible; some vehicles may not display all input and output signals.

The Typical Diagnostic Reference Value Charts do not display fault PIDs. These are PIDs which indicate a hard fault with the circuit. They display a value of “YES” or “NO” and are PIDs ending with an “F”.

Reference values may vary +/-20% depending on operating conditions and other factors. RPM values are axle and tire dependent.

For downstream O2S (12, 22) greater activity will result when catalyst monitor is active.

Refer to Introduction Section, Acronyms and Definitions for technical terms applicable to Ford Motor Company products..

Refer to Section 2, Parameter Identification, for PID descriptions.

For detailed Transmission diagnostics refer to Workshop Manual. Transmission signals may be referred to in either alpha/numeric form “example” 1=A, 2=B, 3=C.

gs-green state

fs-federal state

A. A/C on.

B. Cooling fan on (single, low or high speed).

C. O2S(s) should switch from rich to lean at least once every 3 seconds. O2S voltage should toggle above and below 0.450 DCV and never be a negative value. Valid O2S switching only occurs during closed loop fuel control.

D. Downstream O2S(s) will stay close to a constant voltage when the catalyst monitor is off (positive value only). When the catalyst monitor is on, O2S will switch rich to lean above and below 0.450 DCV and never be a negative value.

E. Brake pedal applied.

F. EVMV commanded current will vary from 0mA - 1000mA depending on PCM comand to purge the EVAP system.

G. While pressing transmission control switch (TCS) or switching to manual drive mode.

H. Value is dependent on fuel tank level. Typical operating range is: 15%(Empty) to 90%(Full).

I. Steering wheel turned.

Typical Diagnostic Reference Values

J. Clutch pedal applied.

K. Value is dependent upon ambient air temperature and may fall outside of range.

L. Value is not useful under this condition.

M. If equipped.

N. Transmission in selected range.

O. Values recorded using 100% unleaded gasoline.

P. May change state under this condition.

Q. While pressing switch.

R. Frequency cycles high within a few seconds of turning headlamps on. Frequency cycles back to 0 Hz shortly after cycling high.

S. Canister Vent duty cycles to 100% (close) when EVAP monitor test is running.

T. Refer to Workshop Manual Section 419-01.

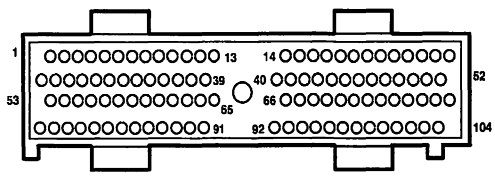
U. ECT hardware with CHT logic. Refer to Section 5 Pinpoint Test DL note,"MARAUDER ONLY".

V. EGR voltage and duty cycle will vary from 0-VBAT or 0-100% depending on EGR demand.

W. RPM dependent. If signal is 0 Hz at idle, check signal at 900 rpm.

2.0L 2V Focus (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCS	29	**.1/OFF**	**VBAT/ON(G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
IMRCM	3	**5/2.5**	**5/2.5**	**5/2.5**	**5/2.5**	DCV
TRR/TR	4	**VBAT/REV (N)**	**VBAT/REV (N)**	**.1/OD**	**.1/OD**	DCV/MODE
TRL/TR	7	**VBAT/MAN1 (N)**	**VBAT/MAN1 (N)**	**.1/OD**	**.1/OD**	DCV MODE
TRD/TR	9	**VBAT/DRIVE (N)**	**VBAT/DRIVE (N)**	**.1/OD**	**.1/OD**	DCV/MODE
TROD/TR	11	**VBAT/OD (N)**	**VBAT/OD (N)**	**VBAT/OD**	**VBAT/OD**	DCV/MODE
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
CKP (+)	21	**0**	**400-425**	**770-900**	**1200-1400**	Hz
PSP V/PSP	31	**.1/LOW**	**VBAT/HI (I)**	**.1/LOW**	**.1/LOW**	DCV/ LOW-HIGH
TSS	34	**0**	**340-380/ 680-720**	**620-680/ 1160-1180**	**1090-1150/ 2150-2220**	Hz/RPM
O2S12	35	**0.1**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
ECT	38	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**3.5/100**	**3.5/100**	**3.5/100**	**3.5/100**	DCV/%
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
EPC SW	44	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
PATSIN	53	**(T)**	**(T)**	**(T)**	**(T)**	(T)
KS	57	**0**	**0**	**0**	**0**	DCV
OSS	58	**0**	**0**	**67/400**	**120/730**	Hz/RPM
GFS (ALTMON)	59	**0**	**130/30**	**130/27**	**130/23**	Hz/%

(Continued)

2.0L 2V Focus (A/T)

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H20
FRP V/FRP	63	**3/93**	**2.8/39**	**2.8/39**	**2.8/39**	DCV/PSI
CPP/PNP	64	**.1/ON**	**.1/ON**	**5/OFF**	**5/OFF**	DCV/OFF-ON
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
CID	85	**0**	**5-7**	**11-15**	**17-21**	Hz
ACP	86	**VBAT/OPEN**	**VBAT/OPEN**	**VBAT/OPEN**	**VBAT/OPEN**	DCV/OPEN-CLOSED
MAF V	88	**0**	**.6-.9**	**1-1.6**	**1.3-2.3**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.3**	**1.1-1.9**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
EFTA	PID	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	DEG
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**10-20**	**20-31**	**25-52**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**730-790**	**1450-1630**	**1750-2100**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
SS2	1	**.1/OFF**	**.1/OFF**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
HFC	17	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ3	20	**0**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
PATSOUT	19	**(T)**	**(T)**	**(T)**	**(T)**	(T)
PATSIL	42	**(T)**	**(T)**	**(T)**	**(T)**	(T)
PATSTRT	27	**(T)**	**(T)**	**(T)**	**(T)**	(T)
VSO	28	**0**	**0**	**65**	**125**	Hz
CDA (CYL 1&4)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**25-38**	**40-48**	**72-85**	Hz
CDB (CYL 2&3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	54	**3.7/75**	**1.5/33**	**1.5/33**	**1.5/33**	DCV/%

(Continued)

2.0L 2V Focus (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
LFC	68	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	73	.1/OFF	.1/OFF	VBAT/ON	VBAT/ON	DCV/OFF-ON
INJ1	70	0	3.3-3.7	4.1-8	4.4-10.1	mS
GENFDC	72	0	0	0	0	Hz/%
MFC	75	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
IMRC	80	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EPC	81	0	2.5/73	2.8/62	1.9/49	DCV/%
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-40	6-7/45-55	DCV/%
DPC 1	82	0	0	3.93	4.10	DCV
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
PC2	99	0	0	0	0	DCV
INJ4	95	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	96	0	3.3-3.7	4.1-8	4.4-10.1	mS
DPC3	102	0	0	0	0	DCV
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	28-35	25-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)-20(+)20	%
LOAD	32-38	16-20	%
MAF	2.4-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%

(Continued)

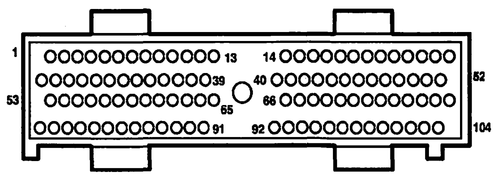
2.0L 2V Focus (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-20	25-33	DEG

2.0L 2V Focus (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IMRCM	3	VBAT/5	VBAT/5	VBAT/5	VBAT/5	DCV
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	750-950	1150-1400	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (1)	.1/LOW	.1/LOW	DCV/ HIGH-LOW
O2S12	35	0.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
KS	57	0	0	0	0	DCV
OSS	58	0	0	67/400	120/730	Hz/RPM
GFS (ALTMON)	59	0	130/30	130/27	130/23	Hz/%
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	3/43	2.8/39	2.8/39	2.8/39	DCV/PSI
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CID	85	0	5-7	11-15	16-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON	.1/OFF	.1/OFF	DCV/OFF-ON

(Continued)

2.0L 2V Focus (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EFTA	PID	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	DEG
FLI (H)	PID	**50**	**50**	**50**	**50**	%
LOAD	PID	**(L)**	**10-20**	**20-31**	**25-52**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**700-800**	**1500-1700**	**1700-2100**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
HFC	17	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSOUT	19	**(T)**	**(T)**	**(T)**	**(T)**	(T)
INJ3	20	**0**	**2.7-3.7**	**4.1-8**	**4.4-10.1**	mS
CDA (CYL 1&4)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
PATSTRT	27	**(T)**	**(T)**	**(T)**	**(T)**	(T)
VSO	28	**0**	**0**	**65**	**125**	Hz
PATSIL	42	**(T)**	**(T)**	**(T)**	**(T)**	(T)
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**25-38**	**37-48**	**72-85**	Hz
CDB (CYL 2&3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV/%
FP	54	**3.7/75**	**1.5/33**	**1.5/33**	**1.5/33**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPC V	67	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	DVC/OFF-ON
LFC	68	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DVC/OFF-ON
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ1	70	**0**	**2.7-3.7**	**4.1-8**	**4.4-10.1**	mS
GENFDC (ALTCOM)	72	**0**	**0**	**0**	**0**	Hz/%
MFC	75	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
IMRC	80	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
IAC	83	**VBAT/0**	**9-10/20-40**	**8-11.1/34-46**	**6-8/45-62**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ4	95	**0**	**2.7-3.7**	**4.1-8**	**4.4-10.1**	mS
INJ2	96	**0**	**2.7-3.7**	**4.1-8**	**4.4-10.1**	mS
HTR12	100	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON

(Continued)

2.0L 2V Focus (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FUELPW1	PID	(L)	2.7-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	28-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

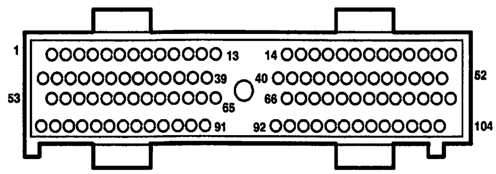
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LOAD	32-38	16-20	%
MAF	2.6-2.7	7.2-8	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-22	25-30	DEG

2.0L 4V Focus (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TRR/TR	4	**VBAT/REV (N)**	**VBAT/REV (N)**	**.1/OD**	**.1/OD**	DCV/MODE
TRL/TR	7	**VBAT/MAN1 (N)**	**VBAT/MAN1 (N)**	**.1/OD**	**.1/OD**	DCV MODE
TRD/TR	8	**VBAT/DRIVE (N)**	**VBAT/DRIVE (N)**	**.1/OD**	**.1/OD**	DCV/MODE
TROD/TR	11	**VBAT/OD (N)**	**VBAT/OD (N)**	**VBAT/OD**	**VBAT/OD**	DCV/MODE
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
CKP (+)	21	**0**	**400-425**	**900-1000**	**1200-1400**	Hz
TCS	29	**.1/OFF**	**VBAT/ON (G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
PSP V/PSP	31	**.1/LOW**	**VBAT/HI (I)**	**.1/LOW**	**.1/LOW**	DCV/ LOW-HIGH
TSS	34	**0**	**340-380/ 680-720**	**620-680/ 1160-1180**	**1090-1150/ 2150-2220**	Hz/RPM
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
CHT V/CHT	38	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**3.5/100**	**3.5/100**	**3.5/100**	**3.5/100**	DCV/%
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
EPCSW	44	VBAT	VBAT	VBAT	VBAT	DCV
PATSIN	53	**(T)**	**(T)**	**(T)**	**(T)**	(T)
KS	57	**0**	**0**	**0**	**0**	DCV
OSS	58	**0**	**0**	**67/400**	**120/730**	Hz/RPM
GFS (ALTMON)	59	**0**	**130/30**	**130/27**	**130/23**	Hz/%

(Continued)

2.0L 4V Focus (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	3/43	2.8/39	2.8/39	2.8/39	DCV/PSI
CPP/PNP	64	VBAT/ON	VBAT/ON	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CID	85	0	5-7	11-15	17-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	730-790	1450-1630	1750-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
INJ3	20	0	3.3-3.7	4.1-8	4.4-10.1	mS
CDA (CYL 1&4)	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	Hz
PATSIL	42	(T)	(T)	(T)	(T)	(T)
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	25-38	40-48	72-85	Hz
CDB (CYL 2&3)	52	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

2.0L 4V Focus (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
FP	54	3.7/75	1.5/33	1.5/33	1.5/33	DCV/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
LFC	68	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	73	.1/OFF	.1/OFF	VBAT/ON	VBAT/ON	DCV/OFF-ON
INJ1	70	0	3.3-3.7	4.1-8	4.4-10.1	mS
GENFDC (ALTCOM)	72	0	0	0	0	Hz/%
MFC	75	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EPC	81	0	9.3/57	9.0/68	9.4/86	DCV/PSI
DPC1	82	0	0	3.93	4.10	DCV
IAC	83	VBAT/0	9-10/20-40	8-11.1/34-40	6-7/45-55	DCV/%
HTR11	93	.1/ON (P)	switching	switching	switching	DCV/OFF-ON
INJ4	95	0	3.3-3.7	4.1-8	4.4-10.1	mS
INJ2	96	0	3.3-3.7	4.1-8	4.4-10.1	mS
HTR12	100	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
DPC3	102	0	0	0	0	DCV
DPC2	99	0	0	0	0	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.3-3.7	4.1-8	4.4-10.1	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SPARKADV	PID	0	15-22	28-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)-20(+)20	%
LOAD	32-38	16-20	%
MAF	2.4-2.7	7.2-8	G/S

(Continued)

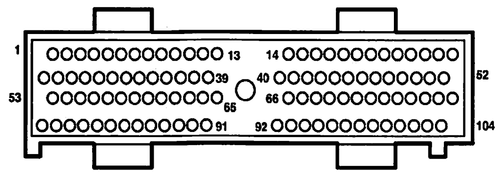
2.0L 4V Focus (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SPARKADV	15-22	25-32	DEG

2.0L 4V Focus (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	900-1000	1150-1400	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
CHT V/CHT	38	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
KS	57	0	0	0	0	DCV
OSS	58	0	0	200-220/ 430-450	360-827	Hz/RPM
GFS (ALTMON)	59	0	130/30	130/27	130/23	Hz/%
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FRPV/FRP	63	3/43	2.8/39	2.8/39	2.8/39	DCV/PSI
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CID	85	0	5-7	11-15	16-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON

(Continued)

2.0L 4V Focus (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ECT	PID	**160-200**	**160-200**	**160-200**	**160-200**	DEG
EFTA	PID	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	DEG
FLI (H)	PID	**50**	**50**	**50**	**50**	%
LOAD	PID	**(L)**	**10-20**	**20-31**	**25-52**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**700-750**	**1630-1820**	**2100-2400**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
HFC	17	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ3	20	**0**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
PATSOUT	19	**(T)**	**(T)**	**(T)**	**(T)**	(T)
CDA (CYL 1&4)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
PATSTRT	27	**(T)**	**(T)**	**(T)**	**(T)**	(T)
VSO	28	**0**	**0**	**65**	**125**	Hz
PATSIL	42	**(T)**	**(T)**	**(T)**	**(T)**	(T)
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**25-38**	**48-59**	**72-85**	Hz
CDB (CYL 2&3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV/%
FP	54	**3.7/75**	**1.3-26**	**1.5/27**	**1.5/30**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPC V	67	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	DVC/OFF-ON
LFC	68	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
GENFDC (ALTCOM)	72	**0**	**0**	**0**	**0**	Hz/%
INJ1	70	**0**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
MFC	75	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
IAC	83	**VBAT/0**	**9-11/20-40**	**8-11.1/34-50**	**6-7.5/45-60**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ2	96	**0**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
INJ4	95	**0**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
HTR12	100	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON

(Continued)

2.0L 4V Focus (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-33**	**28-35**	**25-35**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

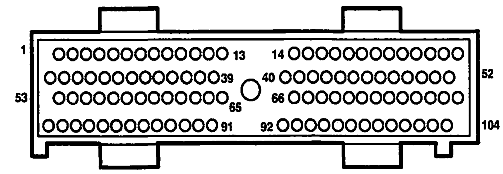
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**38-48**	**16-20**	%
MAF	**1.6-2.6**	**7.2-8**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SPARKADV	**15-33**	**35-38**	DEG

2.0L 4V Focus SVT (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IMRCM	3	5/2.5	5/2.5	5/2.5	5/2.5	DCV
BARO	9	155	155	155	155	Hz
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-425	900-1000	1150-1400	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	(T)	(T)	(T)	(T)	(T)
KS	57	0	0	0	0	DCV
OSS	58	0	0	200-220/ 430-450	360-827	Hz/RPM
GFS (ALTMON)	59	0	130/30	130/27	130/23	Hz/%
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FRPV/FRP	37	3/43	2.8/39	2.8/39	2.8/39	DCV/PSI
FTP V/FTP	66	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CID	85	0	5-7	11-15	16-21	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.6	1.3-2.3	DCV

(Continued)

2.0L 4V Focus SVT (M/T)

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI (H)	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	700-750	1630-1820	2100-2400	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
IMRC	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HFC	17	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ3	20	0	3.3-3.7	4.1-8	4.4-10.1	mS
PATSOUT	19	(T)	(T)	(T)	(T)	(T)
CDA (CYL1&4)	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSTRT	27	(T)	(T)	(T)	(T)	(T)
VSO	28	0	0	65	125	Hz
PATSIL	42	(T)	(T)	(T)	(T)	(T)
VCT	45	VBAT	VBAT	10.5-VBAT	10.5-VBAT	DCV
ALTLOAD	46	0	0-100	0-100	0-100	%
CTO	48	0	25-38	48-59	72-85	Hz
CDB (CYL 2&3)	52	VBAT	VBAT	VBAT	VBAT	DCV/%
FP	54	3.7/75	1.3-26	1.5/27	1.5/30	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPC V	67	0	0-10/0-100	0-10/0-100	0-10/0-100	DVC/OFF-ON
LFC	68	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
GENFDC (ALTCOM)	72	0	0	0	0	Hz/%
INJ1	70	0	3.3-3.7	4.1-8	4.4-10.1	mS
IAC	83	VBAT/0	9-11/20-40	8-11.1/34-50	6-7.5/45-60	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

(Continued)

2.0L 4V Focus SVT (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
INJ2	96	**0**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
INJ4	95	**0**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
HTR12	100	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.3-3.7**	**4.1-8**	**4.4-10.1**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-33**	**28-35**	**25-35**	DEG

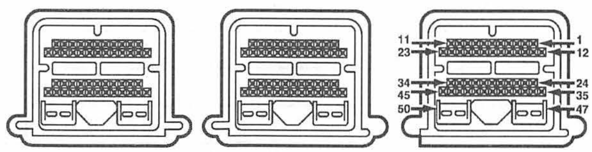
Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**38-48**	**16-20**	%
MAF	**1.6-2.6**	**7.2-8**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SPARKADV	**15-33**	**35-38**	DEG

2.3L 4V Focus PZEV (A/T)



Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACCS	B3	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
BPP	B8	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
FTP V/FTP	B9	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
PSPT	B15	.5	3.75 (I)	.5	.5	DCV
SAIRM (M)	B19	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAT	B20	1.7-3.7/122-50 (K)	1.7-3.7/122-50 (K)	1.7-3.7/122-50 (K)	1.7-3.7/122-50 (K)	DCV/DEG
FPM	B21	.1-VBAT/0-100	.1-VBAT/0-100	.1-VBAT/0-100	.1-VBAT/0-100	DCV/%
ACP	B26	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
TCS	B27	.1/OFF	VBAT/ON(G)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	B42	(T)	(T)	(T)	(T)	(T)
MAF V	B32	0	.6-.9	1-1.6	1.3-2.3	DCV
FEPS	B44	.02	.02	.02	.02	DCV
GFS (ALTMON)	E16	0-200/0-100	0-200/0-100	0-200/0-100	0-200/0-100	Hz/%
IMRCM	E17	.1	.1	VBAT	VBAT	DCV
IMTVM	E18	.1	.1	.1	.1	DCV
TP V	E19	.7-1.2	.7-1.2	1-1.3	1.1-1.9	DCV
DMAP1	E23	4.0	1.0-1.4	1.8-2.1	1.9-2.3	DCV
CID	E25	0	12-15	29-35	36-40	Hz
O2S11	E30	0	switching (C)	switching (C)	switching (C)	DCV
KS	E32	0	0	0	0	DCV

(Continued)

2.3L 4V Focus PZEV (A/T)

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CHT	E33	**4.5-1/240-160**	**4.5-1/240-160**	**4.5-1/240-160**	**4.5-1/240-160**	DCV/DEG
CKP (+)	E34	**0**	**420-455**	**770-900**	**1200-1400**	Hz
FRP V/FRP	E37	**3.2/48**	**3.9/60**	**3.9/60**	**3.9/60**	DCV/PSI
DMAP2	E44	**4.9**	**4.9**	**4.9**	**4.9**	DCV
OSS	T6	**0**	**0**	**67/400**	**120/730**	Hz/RPM
EPC SW	T9	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TSS	T15	**0**	**390-415/780-840**	**620-680/ 1160-1180**	**1090-1170/ 2150-2235**	Hz/RPM
CPP/PNP	T16	**VBAT/ON**	**VBAT/ON**	**5/OFF**	**5/OFF**	DCV/OFF-ON
TS1/TR	T17	**VBAT/MAN 1 (N)**	**VBAT/MAN 1 (N)**	**.1/OD**	**.1/OD**	DCV MODE
TSD/TR	T19	**.1**	**.1**	**VBAT/OD**	**VBAT/OD**	DCV/MODE
O2S12	T24	**0.1**	**(D)**	**(D)**	**(D)**	DCV
O2S13	T25	**0.1**	**(D)**	**(D)**	**(D)**	DCV
TSR/TR	T27	**.1**	**.1**	**.1/OD**	**.1/OD**	DCV/MODE
TS2/TR	T28	**VBAT/MAN 2 (N)**	**VBAT/MAN 2 (N)**	**.1/OD**	**.1/OD**	DCV/MODE
TFT	T29	**.4-2/220-125**	**.4-2/220-125**	**.4-2/220-125**	**.4-2/220-125**	DCV/DEG
EFTA	PID	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	DEG
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**10-20**	**20-31**	**25-52**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**730-790**	**1450-1630**	**1750-2100**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PATSTRT	B2	**(T)**	**(T)**	**(T)**	**(T)**	(T)
FP	B12	**3.6/75**	**1.5/33**	**1.5/33**	**1.5/33**	DCV/%
EVAPCV	B13	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
SAIR	B17	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
WAC	B25	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSOUT	B31	**(T)**	**(T)**	**(T)**	**(T)**	(T)
EVMV	B34	**0**	**0**	**500-900 (F)**	**500-900 (F)**	mA
PATSIL	B37	**(T)**	**(T)**	**(T)**	**(T)**	(T)
HFC	B38	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON

(Continued)

2.3L 4V Focus PZEV (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LFC	B39	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CD1A (CYL1)	E1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ1	E2	**0**	**2.3-3.0**	**4.1-8**	**4.4-10.1**	mS
INJ2	E3	**0**	**2.3-3.0**	**4.1-8**	**4.4-10.1**	mS
INJ3	E4	**0**	**2.3-3.0**	**4.1-8**	**4.4-10.1**	mS
INJ4	E5	**0**	**2.3-3.0**	**4.1-8**	**4.4-10.1**	mS
IMTV	E6	**VBAT/OFF**	**VBAT/OFF**	**VBATOFF**	**VBAT/OFF**	DCV/OFF_ON
GENFDC (ALTCOM)	E7	**0**	**130/45**	**130/45**	**130/45**	Hz/%
EGRMC 1	E8	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	DCV
EGRMC 2	E9	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	DCV
EGRMC 3	E10	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	DCV
EGRMC 4	E11	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	DCV
CD2D (CYL2)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMRC	E14	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CD3B (CYL3)	E24	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CD4C (CYL4)	E35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	E39	**9.3-10/26-34**	**9.8-10.5/32-40**	**8-11.1/24-42**	**6-7/19-23**	DCV/%
HTR11	E49	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
EPC1	T11	**7.5**	**8.5**	**2.8/62**	**1.9/49**	DCV
DPC3	T34	**0**	**.3**	**0**	**0**	DCV
SS1	T42	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
SS2	T43	**.1/OFF**	**.1/OFF**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
DPC 1	T44	**0**	**.3**	**3.93**	**4.10**	DCV
DPC2	T46	**0**	**.3**	**0**	**0**	DCV
HTR12	T47	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR13	T48	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-22**	**28-35**	**25-35**	DEG
TCIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

2.3L 4V Focus PZEV (A/T)

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B45	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
BVREF	B/E40	**5**	**5**	**5**	**5**	DCV

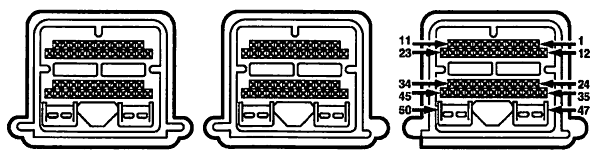
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)-20(+)20**	%
LOAD	**32-38**	**16-20**	%
MAF	**2.4-2.7**	**7.2-8**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SPARKADV	**15-20**	**25-33**	DEG

2.3L 4V Focus PZEV (M/T)

150 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACCS	B3	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
BPP	B8	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
FTP V/FTP	B9	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
PSPT	B15	.5	3.75 (I)	.5	.5	DCV
SAIRM (M)	B19	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAT	B20	1.7-3.7/122-50 (K)	1.7-3.7/122-50 (K)	1.7-3.7/122-50 (K)	1.7-3.7/122-50 (K)	DCV/DEG
FPM	B21	.1-VBAT/0-100	.1-VBAT/0-100	.1-VBAT/0-100	.1-VBAT/0-100	DCV/%
ACP	B26	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
TCS	B27	.1/OFF	VBAT/ON(G)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	B42	(T)	(T)	(T)	(T)	(T)
MAF V	B32	0	.6-.9	1-1.6	1.3-2.3	DCV
FEPS	B44	.09	.09	.09	.09	DCV
GFS (ALTMON)	E16	0-200/0-100	0-200/0-100	0-200/0-100	0-200/0-100	Hz/%
IMRCM	E17	.1	.1	VBAT	VBAT	DCV
IMTVM	E18	.1	.1	.1	.1	DCV
TP V	E19	.7-1.2	.7-1.2	1-1.3	1.1-1.9	DCV
DMAP1	E23	4	1.0-1.4	1.8-2.1	1.9-2.3	DCV
CID	E25	0	12-15	29-35	36-40	Hz
O2S11	E30	0	switching (C)	switching (C)	switching (C)	DCV
KS	E32	0	0	0	0	DCV

(Continued)

2.3L 4V Focus PZEV (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CHT	E33	4.5-1/240-160	4.5-1/240-160	4.5-1/240-160	4.5-1/240-160	DCV/DEG
CKP (+)	E34	0	420-455	770-900	1200-1400	Hz
FRP V/FRP	E37	3.2/48	3.9/60	3.9/60	3.9/60	DCV/PSI
DMAP2	E44	4.9	4.9	4.9	4.9	DCV
OSS	T3	0	0	67/400	120/730	Hz/RPM
PNP/CS	T16	VBAT	VBAT	5/OFF	5/OFF	DCV/OFF-ON
O2S12	T24	0.1	(D)	(D)	(D)	DCV
O2S13	T25	0.1	(D)	(D)	(D)	DCV
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI (H)	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	20-31	25-52	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	730-790	1450-1630	1750-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PATSTRT	B2	(T)	(T)	(T)	(T)	(T)
FP	B12	3.6/75	1.5/33	1.5/33	1.5/33	DCV/%
EVAPCV	B13	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
SAIR	B17	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
WAC	B25	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	B31	(T)	(T)	(T)	(T)	(T)
EVMV	B34	0	0	500-900 (F)	500-900 (F)	mA
PATSIL	B37	(T)	(T)	(T)	(T)	(T)
HFC	B38	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
LFC	B39	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CD1A (CYL1)	E1	VBAT	VBAT	VBAT	VBAT	DCV
INJ1	E2	0	2.3-3.0	4.1-8	4.4-10.1	mS
INJ2	E3	0	2.3-3.0	4.1-8	4.4-10.1	mS
INJ3	E4	0	2.3-3.0	4.1-8	4.4-10.1	mS
INJ4	E5	0	2.3-3.0	4.1-8	4.4-10.1	mS
IMTV	E6	VBAT/OFF	VBAT/OFF	VBATOFF	VBAT/OFF	DCV/OFF_ON
GENFDC (ALTCOM)	E7	0	130/45	130/45	130/45	Hz/%
EGRMC 1	E8	.5-VBAT	.5-VBAT	.5-VBAT	.5-VBAT	DCV

(Continued)

2.3L 4V Focus PZEV (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	**Hot Idle**	**30 MPH**	**55 MPH**	
EGRMC 2	E9	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	DCV
EGRMC 3	E10	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	DCV
EGRMC 4	E11	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	**.5-VBAT**	DCV
CD2D (CYL2)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMRC	E14	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CD3B (CYL3)	E24	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CD4C (CYL4)	E35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	E39	**9.3-10/26-34**	**9.8-10.5/32-40**	**8-11.1/24-42**	**6-7/19-23**	DCV/%
HTR11	E49	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	T47	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR13	T48	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-22**	**28-35**	**25-35**	DEG
TCIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	**Hot Idle**	**30 MPH**	**55 MPH**	
KAPWR	B45	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
BVREF	B/E40	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)-20(+)20**	%
LOAD	**32-38**	**16-20**	%
MAF	**2.4-2.7**	**7.2-8**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SPARKADV	**15-20**	**25-33**	DEG

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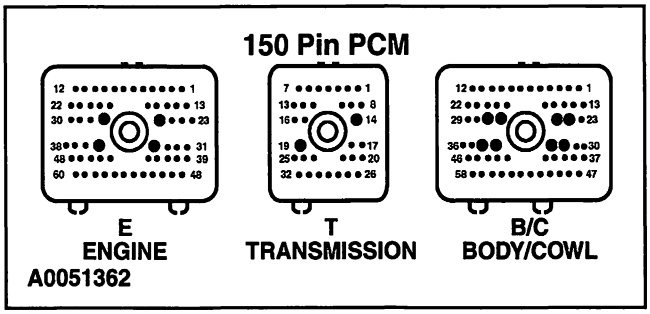


Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
APP2	B1	**1.6**	**1.7**	**1.9**	**2.1**	DCV
FEPS	B13	**.1**	**.1**	**.1**	**.1**	DCV
APP1	B15	**4.1**	**4.2**	**3.9**	**3.7**	DCV
APP3	B16	**1.0**	**1.1**	**1.3**	**1.5**	DCV
BPS	B28	**VBAT/OFF**	**.1/ON(E)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
MAF V	B31	**0**	**.7**	**1.6-1.85**	**2.1-2.3**	DCV
BPP	B40	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
ACP	B42	**1/80**	**1.1/80**	**.8/36**	**.8/30**	DCV/PSI
FCV	B47	**0/100**	**0/100**	**0/100**	**0/100**	%
IAT	B51	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FTP V/FTP	B52	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN. H2O
SCCS	B57	**5**	**.1 (Q)**	**5**	**5**	DCV
TR3	T9	**.1**	**.1**	**1.7**	**1.7**	DCV
TR4	T10	**.1**	**.1**	**VBAT**	**VBAT**	DCV
TR2	T18	**.1**	**.1**	**VBAT**	**VBAT**	DCV
ISS	T21	**0**	**365-380/ 680-720**	**595/1080**	**1070/2060**	Hz/RPM
TR1	T22	**.1**	**.1**	**VBAT**	**VBAT**	DCV
TFT	T23	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
OSS	T26	**0**	**0**	**570-595/ 1400-1500**	**1070-1100/ 2660**	Hz/RPM
TSS	T27	**0**	**365-380/ 680-720**	**595/1080**	**1070/2060**	Hz/RPM
O2S12	T28	**0**	**switching (D)**	**switching (D)**	**switching (D)**	DCV
O2S22	T29	**0**	**switching (D)**	**switching (D)**	**switching (D)**	DCV

(Continued)

3.0L LS6

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FRT	E4	.5-3/210-110	.5-3/210-110	.5-3/210-110	.5-3/210-110	DCV/DEG
PSP V/PSP	E5	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ HIGH-LOW
TP1	E32	4.3	4.6	4.5	4.4	DCV
EOT	E39	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
CHT	E40	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
DPFEGR	E41	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
O2S21	E44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	E45	0	switching (C)	switching (C)	switching (C)	DCV
FRP V/FRP	E49	1.3/14	2.7/39	2.7/39	2.7/39	DCV/PSI
AFS	E50	0	130/30-45	130/20-30	130/15-25	Hz/%
KS1	E51	0	0	0	0	DCV
CMP1	E53	0	30	47	76	Hz
CMP2	E54	0	30	47	76	Hz
CKP	E55	0	435	700-800	1160-1180	Hz
TP2	E57	1.2	.8	1.1	1.3	DCV
EFT A	PID	120-50 (K)	120-50 (K)	120-50 (K)	120-50 (K)	DEG
LOAD	PID	(L)	17-18.6	26-35.7	30-50	%
GEAR	PID	1	1	4	5	GEAR
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	695-755	1422	1950	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACCR	B9	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EVMV	B12	0	0	500-900 (F)	500-900 (F)	mA
EVAPCV	B30	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
FPC	B49	8.6/75	3.8/27	3.8/27	3.8/27	DCV/%
SS1	T1	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	T2	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EPC1	T7	6.1	8.1	10.4	10.5	DCV
SS3	T8	VBAT/OFF	VBAT/OFF	.35/ON	.1/ON	DCV/OFF-ON
EPC3	T12	5.8	8.1	VBAT	VBAT	DCV
EPC2	T13	8.6	10.7	10.4	10.5	DCV
HTR12	T15	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON

(Continued)

3.0L LS6

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HTR22	T16	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS4	T17	.1/ON	.1/ON	.35/ON	.1/ON	DCV/OFF-ON
TCC	T20	VBAT/0	VBAT/0	VBAT/0	.6/100	DCV/%
VCT1	E1	VBAT	VBAT	8.5-VBAT	8.5-VBAT	DCV
HTR11	E7	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	E8	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ4	E11	(L)	2.4-32	4.9	6.7-7.1	mS
CDB (CYL4)	E12	VBAT	VBAT	VBAT	VBAT	DCV
VCT2	E13	VBAT	VBAT	8.5-VBAT	8.5-VBAT	DCV
EGRVR	E16	VBAT/0	VBAT/0	(V)	(V)	DCV/%
GENFDC (ALTCOM)	E19	0	0-130/0-100 (R)	0	0	Hz/%
INJ5	E20	(L)	2.4-3.2	4.9	6.7/7.1	mS
INJ3	E21	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDD (CYL5)	E22	VBAT	VBAT	VBAT	VBAT	DCV
TACMN	E27	VBAT	VBAT	VBAT	VBAT	DCV
INJ6	E28	(L)	2.4-3.2	4.9	6.7-7.1	mS
IMTV1	E29	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
CDF (CYL6)	E30	VBAT	VBAT	VBAT	VBAT	DCV
TACMP	E35	VBAT	VBAT	VBAT	VBAT	DCV
IMTV2	E37	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
INJ2	E46	(L)	2.4-3.2	4.9	6.7-7.1	mS
INJ1	E47	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDC (CYL2)	E48	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL1)	E58	VBAT	VBAT	VBAT	VBAT	DCV
CDE (CYL3)	E60	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
LONGFT1	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%
LONGFT2	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SHRTFT2	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SPARKADV	PID	0	12-17	34	32-40	DEG

3.0L LS6

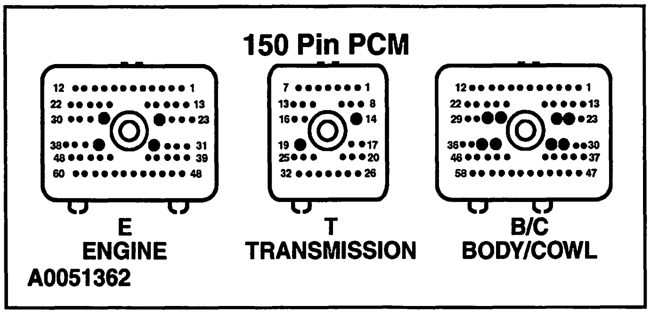
Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B44	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B32/B33	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
BVREF	B55/E14	**5**	**5**	**5**	**5**	DCV
ETCVREF	B20, B23, E24	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**21-27**	**20-25**	%
MAF	**3-4.8**	**12-18**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**12-17**	**35-40**	DEG

3.9L LS8



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
APP2	B1	1.64	1.72	1.90	2.1	DCV
FEPS	B13	.1	.1	.1	.1	DCV
APP1	B15	4.1	4.2	3.9	3.7	DCV
APP3	B16	1.0	1.1	1.3	1.5	DCV
BPS	B28	VBAT/OFF	.1/ON(E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MAF V	B31	0	.7	1.4-1.85	2.1-2.3	DCV
BPP	B40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ACPT	B42	1.3/80	1.4/75	1.3/80	1.3/80	DCV/PSI
IAT	B51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	B52	2.7/0	2.8/0	2.6/0	2.6/0	DCV/IN. H2O
SCCS	B57	5	.1 (Q)	5	5	DCV
TR3	T9	.1	.1	1.8	1.8	DCV
TR4	T10	.1	.1	VBAT	VBAT	DCV
TR2	T18	.1	.1	VBAT	VBAT	DCV
ISS	T21	0	230-380/ 680-720	720/1080	1370/2060	Hz/RPM
TR1	T22	.1	.1	VBAT	VBAT	DCV
TFT	T23	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
OSS	T26	0	0	536-595/ 1400-1500	950-1100/ 2660	Hz/RPM
TSS	T27	0	365-380/ 680-720	535/1080	902/2060	Hz/RPM
O2S12	T28	0	switching (D)	switching (D)	switching (D)	DCV
O2S22	T29	0	switching (D)	switching (D)	switching (D)	DCV
FRT	E4	.5-3/210-110	.5-3/210-110	.5-3/210-110	.5-3/210-110	DCV/DEG

(Continued)

3.9L LS8

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PSP V/PSP	E5	**.1/LOW**	**VBAT/HIGH (I)**	**.1/LOW**	**.1/LOW**	DCV/ HIGH-LOW
TP1	E32	**4.3**	**4.6**	**4.5**	**4.4**	DCV
EOT	E39	**.5-2.5/210-110**	**.5-2.5/210-110**	**.5-2.5/210-110**	**.5-2.5/210-110**	DCV/DEG
CHT V/CHT	E40	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	DCV/DEG
DPFEGR	E41	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
O2S21	E44	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
O2S11	E45	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
FRP V/FRP	E49	**1.3/14**	**3.7/39**	**3.7/39**	**3.7/39**	DCV/PSI
AFS	E50	**0**	**130/30-45**	**130/20-30**	**130/15-25**	Hz/%
KS1	E51	**0**	**0**	**0**	**0**	DCV
CMP1	E53	**0**	**30**	**47**	**76**	Hz
CMP2	E54	**0**	**30**	**47**	**76**	Hz
CKP	E55	**0**	**420**	**660-800**	**1160-1200**	Hz
TP2	E57	**1.2**	**.8**	**1.0**	**1.4**	DCV
EFT A	PID	**120-50 (K)**	**120-50 (K)**	**120-50 (K)**	**120-50 (K)**	DEG
LOAD	PID	**(L)**	**17-18.6**	**26-35.7**	**30-50**	%
GEAR	PID	**1**	**1**	**4**	**5**	GEAR
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**660-700**	**1422**	**1950**	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACCR	B9	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
EVMV	B12	**0**	**0**	**500-900 (F)**	**500-900 (F)**	mA
EVAPCV	B30	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
FCV	B47	**0/100**	**0/100**	**0/100**	**0/100**	%
FPC	B49	**8.3/75**	**3.6/27**	**3.6/27**	**3.8/29**	DCV/%
SS1	T1	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS2	T2	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
EPC1	T7	**6.1**	**8.1**	**10.4**	**10.5**	DCV
SS3	T8	**VBAT/OFF**	**VBAT/OFF**	**.5/ON**	**.4/ON**	DCV/OFF-ON
EPC3	T12	**5.8**	**8.1**	**10.1**	**10.2**	DCV
EPC2	T13	**8.6**	**11.3**	**10.4**	**10.2**	DCV
HTR12	T15	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON

(Continued)

3.9L LS8

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea- sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HTR22	T16	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
SS4	T17	**.1/ON**	**.1/ON**	**.5/ON**	**.4/ON**	DCV/OFF-ON
TCC	T20	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.5/100**	DCV/%
VCT1	E1	**VBAT**	**VBAT**	**8.5-VBAT**	**8.5-VBAT**	DCV
HTR11	E7	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	E8	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ5	E11	**(L)**	**2.4-3.2**	**4.9**	**6.7/7.1**	mS
CDB (CYL5)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VCT2	E13	**VBAT**	**VBAT**	**8.5-VBAT**	**8.5-VBAT**	DCV
EGRVR	E16	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
GENFDC (ALTCOM)	E19	**0**	**0-130/0-100 (R)**	**0**	**0**	Hz/%
INJ2	E20	**(L)**	**2.4-3.2**	**4.9**	**6.7-7.1**	mS
INJ6	E21	**(L)**	**2.4-3.2**	**4.9**	**6.7-7.1**	mS
CDE (CYL6)	E22	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TACMN	E27	**3.7**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ3	E28	**(L)**	**2.4-3.2**	**4.9**	**6.7-7.1**	mS
INJ7	E29	**(L)**	**2.4-32**	**4.9**	**6.7-7.1**	mS
CDG (CYL7)	E30	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TACMP	E35	**3.7**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ8	E37	**(L)**	**2.4-32**	**4.9**	**6.7-7.1**	mS
CDH (CYL8)	E38	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ4	E46	**(L)**	**2.4-32**	**4.9**	**6.7-7.1**	mS
INJ1	E47	**(L)**	**2.4-3.2**	**4.9**	**6.7-7.1**	mS
CDC (CYL4)	E48	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	E58	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDD (CYL2)	E59	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL3)	E60	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
LONGFT1	PID	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	%
LONGFT2	PID	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10 - (+)10**	**(-)10 - (+)10**	**(-)10 - (+)10**	%
SHRTFT2	PID	**(L)**	**(-)10 - (+)10**	**(-)10 - (+)10**	**(-)10 - (+)10**	%
SPARKADV	PID	**0**	**12-17**	**34**	**32-40**	DEG

3.9L LS8

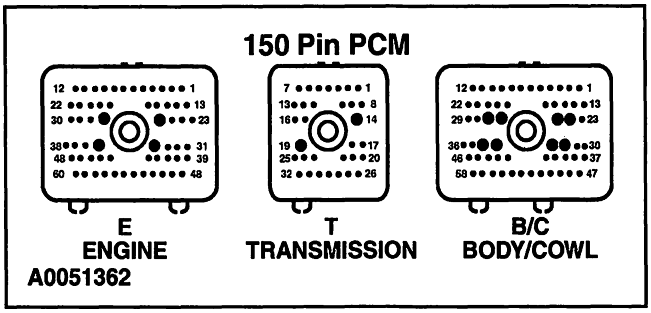
Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B44	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B32/B33	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
BVREF	B55/E14	**5**	**5**	**5**	**5**	DCV
ETCVREF	B20, B23, E24	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**21-27**	**20-25**	%
MAF	**3-4.8**	**12-18**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**12-17**	**35-40**	DEG

3.9L Thunderbird



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
APP2	B1	1.6	1.7	1.9	2.1	DCV
FEPS	B13	.1	.1	.1	.1	DCV
APP1	B15	4.1	4.2	3.9	3.7	DCV
APP3	B16	1.0	1.1	1.3	1.5	DCV
BPS	B28	VBAT/OFF	.1/ON(E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MAF V	B31	0	.7	1.4-1.6	2.1-2.3	DCV
BPP	B40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ACPT	B42	1.1/80	1.1/80	1.1/80	1.1/80	DCV/PSI
IAT	B51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	B52	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN. H2O
SCCS	B57	5	.1 (Q)	5	5	DCV
TR3	T9	.1	.1	1.7	1.7	DCV
TR4	T10	.1	.1	VBAT	VBAT	DCV
TR2	T18	.1	.1	VBAT	VBAT	DCV
ISS	T21	0	235-380/ 680-720	725/1080	1370/2060	Hz/RPM
TR1	T22	.1	.1	VBAT	VBAT	DCV
TFT	T23	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
OSS	T26	0	0	536-595/ 1400-1500	956-1100/ 2660	Hz/RPM
TSS	T27	0	365-380/ 680-720	536/1080	902/2060	Hz/RPM
O2S12	T28	0	switching (D)	switching (D)	switching (D)	DCV
O2S22	T29	0	switching (D)	switching (D)	switching (D)	DCV
FRT	E4	.5-3/210-110	.5-3/210-110	.5-3/210-110	.5-3/210-110	DCV/DEG

(Continued)

3.9L Thunderbird

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PSP V/PSP	E5	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ HIGH-LOW
TP1	E32	4.3	4.6	4.5	4.4	DCV
EOT	E39	.5-3/210-110	.5-3/210-110	.5-3/210-110	.5-3/210-110	DCV/DEG
CHT	E40	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
DPFEGR	E41	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
O2S21	E44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	E45	0	switching (C)	switching (C)	switching (C)	DCV
FRP V/FRP	E49	1.3/14	3.7/44	3.7/44	3.7/44	DCV/PSI
AFS	E50	0	220/30-45	259/20-30	289/15-25	Hz/%
KS1	E51	0	0	0	0	DCV
KS2	E52	0	0	0	0	DCV
CMP1	E53	0	30	47	76	Hz
CMP2	E54	0	30	47	76	Hz
CKP	E55	0	420	665-800	1160-1200	Hz
TP2	E57	1.2	.8	1.0	1.4	DCV
EFT A	PID	120-50 (K)	120-50 (K)	120-50 (K)	120-50 (K)	DEG
LOAD	PID	(L)	17-18.6	26-35.7	30-50	%
GEAR	PID	1	1	4	5	GEAR
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	660-700	1422	1950	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACCR	B9	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EVMV	B12	0	0	500-900 (F)	500-900 (F)	mA
EVAPCV	B30	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
FCV	B47	0-100	0-100	0-100	0-100	%
FP	B49	8.3/72	3.6/25	3.6/25	3.8/27	DCV/%
SS1	T1	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	T2	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EPC1	T7	5	8.1	10.4	10.5	DCV
SS3	T8	VBAT/OFF	VBAT/OFF	.35/ON	.1/ON	DCV/OFF-ON
EPC3	T12	5.8	8.1	10.1	10.2	DCV
EPC2	T13	9.3	11.3	10.4	10.2	DCV

(Continued)

3.9L Thunderbird

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HTR12	T15	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR22	T16	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS4	T17	.1/ON	.1/ON	.35/ON	.1/ON	DCV/OFF-ON
TCC	T20	VBAT/0	VBAT/0	VBAT/0	.6/100	DCV/%
VCT1	E1	VBAT	VBAT	8.6-VBAT	8.6-VBAT	DCV
HTR11	E7	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	E8	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ5	E11	(L)	2.4-3.2	4.9	6.7/7.1	mS
CDB (CYL5)	E12	VBAT	VBAT	VBAT	VBAT	DCV
VCT2	E13	VBAT	VBAT	8.6-VBAT	8.6-VBAT	DCV
EGRVR	E16	VBAT/0	VBAT/0	(V)	(V)	DCV/%
GENFDC (ALTCOM)	E19	0	0-130/0-100 (R)	0	0	Hz/%
INJ2	E20	(L)	2.4-3.2	4.9	6.7-7.1	mS
INJ6	E21	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDE (CYL6)	E22	VBAT	VBAT	VBAT	VBAT	DCV
TACMN	E27	3.7	VBAT	VBAT	VBAT	DCV
INJ3	E28	(L)	2.4-3.2	4.9	6.7-7.1	mS
INJ7	E29	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDG (CYL7)	E30	VBAT	VBAT	VBAT	VBAT	DCV
TACMP	E35	3.7	11.3	12.5	13.9	DCV
INJ8	E37	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDH (CYL8)	E38	VBAT	VBAT	VBAT	VBAT	DCV
INJ4	E46	(L)	2.4-32	4.9	6.7-7.1	mS
INJ1	E47	(L)	2.4-3.2	4.9	6.7-7.1	mS
CDC (CYL4)	E48	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL1)	E58	VBAT	VBAT	VBAT	VBAT	DCV
CDD (CYL2)	E59	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL3)	E60	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
LONGFT1	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%
LONGFT2	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SHRTFT2	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SPARKADV	PID	0	12-17	34	32-40	DEG

3.9L Thunderbird

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B44	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B32/B33	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
BVREF	B55/E14	**5**	**5**	**5**	**5**	DCV
ETCVREF	B20, B23, E24	**5**	**5**	**5**	**5**	DCV

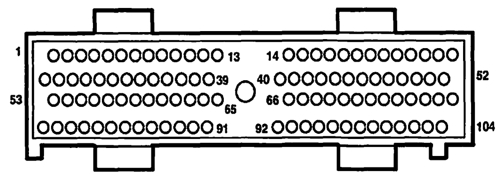
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**21-27**	**20-25**	%
MAF	**3-4.8**	**12-18**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**12-17**	**35-40**	DEG

3.0L Taurus/Sable/Gas & Flex Fuel

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	**0**	**0**	**10.5**	**10.5**	DCV
TSS	6	**0**	**50-65/820-900**	**82-99/ 1400-1500**	**88-120/ 1740-1900**	Hz/RPM
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
PATSIN	17	**(T)**	**(T)**	**(T)**	**(T)**	(T)
CKP (+)	21	**0**	**410-510**	**810-950**	**1050-1820**	Hz
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
ECT	38	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**0-7/85-115**	**0-7/85-115**	**0-7/85-115**	**0-7/85-115**	DCV/%
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
GFS (ALTMON)	45	**0**	**130/30**	**130/27**	**130/23**	Hz/%
TR2	49	**0**	**0**	**10.5**	**10.5**	DCV
TR4	50	**0**	**0**	**10.5**	**10.5**	DCV
KS1	57	**0**	**0**	**0**	**0**	DCV
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
O2S22	61	**0**	**(D)**	**(D)**	**(D)**	DCV
FTP V/FTP	62	**2.6/.51**	**2.6/.48**	**2.6/.49**	**2.6/.44**	DCV/IN-H2O
FRP V/FRP	63	**3.7/55**	**3.6/54**	**2.8/42**	**2.7/40**	DCV/PSI
TR3 V/TR3	64	**0/PARK**	**0/PARK**	**1.7/OD**	**1.7/OD**	DCV/MODE
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
ACET	66	**1.9-4.0**	**1.9-4.0**	**1.9-4.0**	**1.9-4.0**	DCV
OSS	84	**0**	**0**	**300/1750**	**500/2550**	Hz/RPM
CID	85	**0**	**6-8**	**12-14**	**13-16**	Hz

(Continued)

3.0L Taurus/Sable/Gas & Flex Fuel

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	1-1.5	1.1-2.0	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	.8-1.2	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	10-20	16-30	13-50	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	660-800	1440-1625	1830-1970	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Break-out Box Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
PATSOUT	18	(T)	(T)	(T)	(T)	(T)
GENFDC (ALTCOM)	20	0	0	0	0	Hz/%
CDA (CYL1&5)	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
LFC (FC1)	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	30	(T)	(T)	(T)	(T)	(T)
MFC (FC2)	42	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSTRT	44	(T)	(T)	(T)	(T)	(T)
HFC (FC3)	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	35-50	65-78	91-105	Hz
CDB (CYL4&3)	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	11/42	.4/90-100	DCV/%
EVMV	56	0	0	500-900 (F)	500-900 (F)	mA
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz

(Continued)

3.0L Taurus/Sable/Gas & Flex Fuel

Actuators/ Outputs	PCM Break-out Box Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
WAC (ACCR)	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**3.8-4.7**	**3.9-8**	**3-9**	mS
INJ3	74	**0**	**3.8-4.7**	**3.9-8**	**3-9**	mS
INJ1	75	**0**	**3.8-4.7**	**3.9-8**	**3-9**	mS
CDC (CYL2&6)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**3.6/75**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.4/15**	**9/15**	**9.4/17**	**10.7/40**	DCV/PSI
IAC	83	**VBAT/0**	**8.4/40**	**7.5-10/40-60**	**8.8-10.5/40-57**	DCV/%
HTR11	93	**VBAT/OFF**	**SWITCH**	**SWITCH**	**SWITCH**	DCV/OFF-ON
HTR21	94	**VBAT/OFF**	**SWITCH**	**SWITCH**	**SWITCH**	DCV/OFF-ON
HTR12	95	**VBAT/OFF**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**VBAT/OFF**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**3.8-4.7**	**3.9-8**	**3-9**	mS
INJ4	100	**0**	**3.8-4.7**	**3.9-8**	**3-9**	mS
INJ2	101	**0**	**3.8-4.7**	**3.9-8**	**3-9**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**24-30**	**34-42**	**33-46**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71,97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**17-25**	**15-22**	%
MAF	**4-5**	**11-13**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%

(Continued)

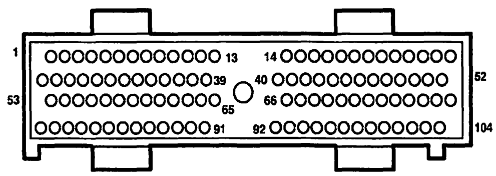
3.0L Taurus/Sable/Gas & Flex Fuel

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	24-30	44	DEG

3.0L 4V Taurus/Sable

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
TSS	6	0	43/700	85-105/ 1480-1570	110-125/ 1690-2000	Hz/RPM
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
PATSIN	17	(T)	(T)	(T)	(T)	(T)
CKP (+)	21	0	390-520	850-1120	1140-1220	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	0-7/85-115	0-7/85-115	0-7/85-115	0-7/85-115	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
GFS (ALTMON)	45	0	130/30	130/27	130/23	Hz/%
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
KS1	57	0	0	0	0	DCV
02S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/.41	2.6/.41	2.6/.41	2.6/.41	DCV/IN-H2O
FRP V/FRP	63	3.15/46	2.74/39	2.88/41	2.86/40	DCV/OFF-ON
TR3 V/TR3	64	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV

(Continued)

3.0L 4V Taurus/Sable

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACET	66	**1.9-4.0**	**1.9-4.0**	**1.9-4.0**	**1.9-4.0**	DCV
OSS	84	**0**	**0**	**300/1650**	**506/2600**	Hz/RPM
CID	85	**0**	**5-7**	**10-13**	**14-17**	Hz
ACP V/ACP	86	**VBAT/OPEN**	**VBAT/OPEN**	**VBAT/OPEN**	**VBAT/OPEN**	DCV/ OPEN-CLOSED
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.5-.7**	**.7-1.5**	**1.3-2**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.1**	**1-1.5**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**15-20**	**20-35**	**15-35**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**674-734**	**1350-1650**	**1800-2060**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	**.1/ON**	**.1/ON**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
CDD (CYL5)	2	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
PATSOUT	18	**(T)**	**(T)**	**(T)**	**(T)**	(T)
GENFDC (ALTCOM)	20	**0**	**0**	**0**	**0**	Hz/%
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	27	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
LFC (FC1)	28	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIL	30	**(T)**	**(T)**	**(T)**	**(T)**	(T)
MFC (FC2)	42	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSTRT	44	**(T)**	**(T)**	**(T)**	**(T)**	(T)
HFC (FC3)	46	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**33-45**	**75-85**	**92-120**	Hz
CDB (CYL4)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS3	53	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCC	54	**VBAT/0**	**VBAT/0**	**.2/100**	**.2/100**	DCV/%
EVMV	56	**0**	**0**	**500-900 (F)**	**500-900 (F)**	mA

(Continued)

3.0L 4V Taurus/Sable

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz/RPM
WAC (ACCR)	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**2.2-2.7**	**2.3-5.5**	**2-7**	mS
INJ3	74	**0**	**2.2-2.7**	**2.3-5.5**	**2-7**	mS
INJ1	75	**0**	**2.2-2.7**	**2.3-5.5**	**2-7**	mS
CDC (CYL2)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDE (CYL3)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**3.6/75**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.5/15**	**9/15**	**8.9-10.1/ 16-25**	**9.2/27**	DCV/%
CDF (CYL6)	82	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	83	**VBAT/0**	**9.8-11.2/24-52**	**7.5-10/24-52**	**7.2-8.0/50-59**	DCV/%
HTR11	93	**VBAT/OFF**	**switching**	**switching**	**switching**	DCV/OFF-ON
HTR21	94	**VBAT/OFF**	**switching**	**switching**	**switching**	DCV/OFF-ON
HTR12	95	**VBAT/OFF**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**VBAT/OFF**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**2.2-2.7**	**2.3-5.5**	**2-7**	mS
INJ4	100	**0**	**2.2-2.7**	**2.3-5.5**	**2-7**	mS
INJ2	101	**0**	**2.2-2.7**	**2.3-5.5**	**2-7**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**12-27**	**25-42**	**20-40**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71,97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**30-34**	**30-40**	%

(Continued)

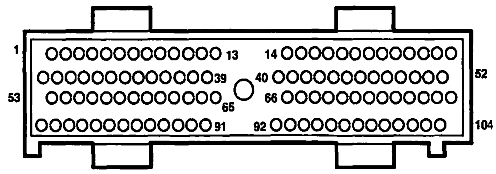
3.0L 4V Taurus/Sable

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
MAF	3.5-4	12-14	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-17	35-40	DEG

3.8L/3.9L Mustang (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR 1	3	0	0	11.5	11.5	DCV
AIRM (gs)	5	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	390-450	650-700	875-1000	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 2	49	0	0	11.5	11.5	DCV
TR 4	50	0	0	11.5	11.5	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PST
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT	66	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
OSS	84	0	0	115-125/ 1150-1300	240/2400	Hz/RPM
CID	85	0	5-7	9-11	10-15	Hz
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.8-1.6	1.1-2.3	DCV

(Continued)

3.8L/3.9L Mustang (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.1**	**.8-1.2**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
EFTA	PID	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	**50-120 (K)**	DEG
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**10-20**	**16-36**	**25-35**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**700-730**	**1000-1200**	**1500-1700**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
SS2	1	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
CDA (CYL1&5)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	27	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
IMRC	42	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
LFC	45	**.1/OFF**	**VBAT/ON (B)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3&4)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**11.1-VBAT/ 0-45**	**.2/95-100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
AIR (gs)	70	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ3	74	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ1	75	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
CDC (CYL2&6)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**3.7/75**	**1.2/26**	**1.2/26**	**1.2/26**	DCV/%
EPC	81	**7/8**	**9/8**	**9-9.8/12-22**	**9-10.7/18-22**	DCV/PSI
IAC	83	**VBAT/0**	**9.1-10.7/34-39**	**8.3-10.1/44-73**	**6.7-10/50-75**	DCV/%

(Continued)

3.8L/3.9L Mustang (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ4	100	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ2	101	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
FUELPW1	PID	**(L)**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
FUELPW2	PID	**(L)**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**17-23**	**30-40**	**31-40**	DEG
TCIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

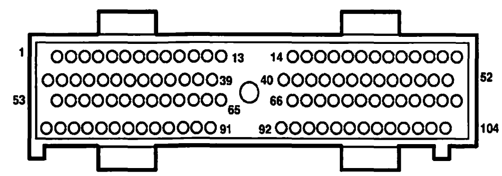
Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**17-22**	**15-20**	%
MAF	**3.4-3.9**	**14.9-15.4**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**17-20**	**28-35**	DEG

3.8L/3.9L Mustang (M/T)



Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
AIRM (gs)	5	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
CKP (+)	21	0	390-450	650-700	875-1000	Hz
02S12	35	.1	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H20
FRP V/FRP	63	3.35/50	2.8/39	2.8/39	2.8/39	DCV/PSI
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT	66	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
OSS	84	0	0	115-125/ 1150-1300	200-250/ 1950-2500	Hz/RPM
CID	85	0	5-7	9-11	10-15	Hz
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.8-1.6	1.1-2.3	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.8-1.2	DCV
EFTA	PID	50-120	50-120	50-120	50-120	DCV/DEG
FLI (H)	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	16-36	25-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON

(Continued)

3.8L/3.9L Mustang (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**700-780**	**1000-1200**	**1500-1700**	RPM
VSS (+)	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDA (CYL1&5)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMRC	42	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
LFC	45	**.1/OFF**	**VBAT/ON (B)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3&4)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
AIR (gs)	70	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ3	74	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ1	75	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
CDC (CYL2&6)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**3.7/75**	**1.8/36**	**1.8/36**	**1.8/36**	DCV/%
IAC	83	**VBAT/0**	**10.7/34**	**8.0-10.1/44-73**	**6.7-10/40-75**	DCV/%
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ4	100	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
INJ2	101	**0**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
FUELPW1	PID	**(L)**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
FUELPW2	PID	**(L)**	**3.8-4.9**	**5.3-10.1**	**6.5-12**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

(Continued)

3.8L/3.9L Mustang (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	17-23	30-40	20-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

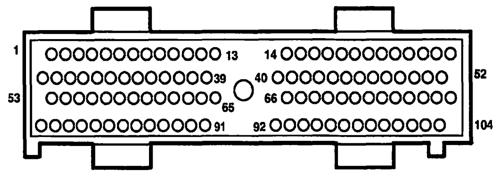
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-22	15-20	%
MAF	3.9-4.8	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-23	35-37	DEG

4.6L 2V Mustang (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	390-450	650-760	980-1020	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 1	34	0	0	11.5	11.5	DCV
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 2	49	0	0	11.5	11.5	DCV
TR 4	50	0	0	11.5	11.5	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/.5-1.4	2.6/.5-1.4	2.6/.5-1.4	2.6/.5-1.4	DCV/IN-H20
FRP V/FRP	63	3.35/50	3/43	2.8/39	2.8/39	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
OSS	84	0	0	135-141/ 1385-1420	240-255/ 2400-2500	Hz/RPM
CID	85	0	5-7	10-12	12-16	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.8-1.2	1.4-1.9	DCV

(Continued)

4.6L 2V Mustang (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
EFTA	PID	120-50 (K)	120-50 (K)	120-50 (K)	120-50 (K)	DEG
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	4	4	GEAR
LOAD	PID	(L)	10-20	16-30	20-30	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	660-700	1200-1300	1700-1740	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
LFC	19	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	27	VBAT	VBAT	VBAT	VBAT	DCV
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL3)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL4)	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.1/100	VBAT/0	VBAT/0	.2/95-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC	69	.1/ON	VBAT/OFF (A)	.1/ON	.1/ON	DCV/OFF-ON
INJ7	72	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ5	73	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ3	74	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ1	75	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDC (CYL7)	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL8)	79	37/75	1.3/28	1.3/28	1.3/28	DCV
FP	80	3.7/75	1.3/28	1.3/28	1.3/28	DCV/%

(Continued)

4.6L 2V Mustang (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EPC	81	7.6/20	9-9.5/15-20	9-9.8/40	9-9.8/40	DCV/PSI
IAC	83	VBAT/0	10/30	9/45	9/41	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ6	99	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ4	100	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ2	101	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS
FUELPW2	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	29-38	34-41	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	15-26	15-24	%
MAF	4.7-6	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%

(Continued)

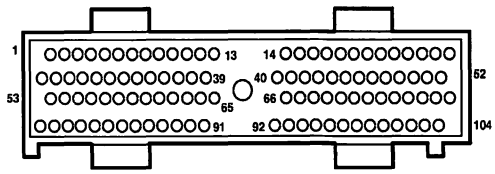
4.6L 2V Mustang (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-20	30	DEG

4.6L 2V Mustang (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	390-450	650-750	970-1030	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	3.5/100	3.5/100	3.5/100	3.5/100	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRPV/FRP	63	3.35/50	3/43	2.8/3.9	2.8/3.9	DCV/PSI
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
OSS	84	0	0	135/1385	240-2500	Hz/RPM
CID	85	0	5-7	10-12	12-16	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.8-1.3	1.2-2	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1.2-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI (H)	PID	50	50	50	50	%
LOAD	PID	(L)	10-20	16-30	20-30	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON

(Continued)

4.6L 2V Mustang (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	660-700	1200/1300	1690-1750	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
CDE (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
LFC	19	.1/OFF	VBAT/ON (B)	.1/OFF	.1/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	27	VBAT	VBAT	VBAT	VBAT	DCV
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL3)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL4)	53	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
INJ7	72	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ5	73	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ3	74	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ1	75	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDC (CYL7)	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL8)	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	3.7/75	1.3/28	1.3/28	1.3/28	DCV/%
IAC	83	VBAT/0	9/38	9/45	9/41	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ6	99	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ4	100	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
INJ2	101	0	3.5-3.7	3.8-5.5	4.9-9.6	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS

(Continued)

4.6L 2V Mustang (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FUELPW2	PID	(L)	3.5-3.7	3.8-5.5	4.9-9.6	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	28-39	35-42	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

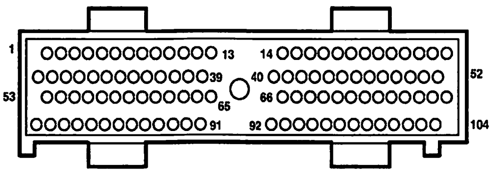
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	15-26	15-24	%
MAF	4.7-6	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	10	27	DEG

4.6L 4V Mustang Mach I

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	360-420	680-800	860-950	Hz
02S12	35	.1	(D)	(D)	(D)	DCV
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	2.5-7.5/87-110	2.5-7.5/87-110	2.5-7.5/87-110	2.5-7.5/87-110	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS1	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP (gs)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.3/40	2.8/39	2.8/39	2.8/39	DCV/PSI
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
OSS	84	0	0	270/1365	470/2440	Hz/RPM
CID	85	0	5-7	9-12	11-14	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.5-.8	.8-1.3	1.2-1.7	DCV
TP V	89	.53-1.27	.53-1.27	.9-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
KS2	102	0	0	0	0	DCV
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI (H)	PID	50	50	50	50	%

(Continued)

4.6L 4V Mustang Mach I

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LOAD	PID	**(L)**	**10-20**	**16-30**	**20-30**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**630-750**	**1180-1360**	**1530-1750**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
LFC	19	**.1/OFF**	**VBAT/ON (B)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
HFC	46	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC	69	**.1/ON**	**VBAT/OFF (A)**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ7	72	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ5	73	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ3	74	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ1	75	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**3.6/75**	**1.2/24**	**1.2/24**	**1.2/24**	DCV/%
IAC	83	**VBAT/0**	**10.3/35**	**8.7-9/34-46**	**8-9/34-54**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ6	99	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ4	100	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ2	101	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS

(Continued)

4.6L 4V Mustang Mach I

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FUELPW1	PID	**(L)**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
FUELPW2	PID	**(L)**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**11-15**	**17-32**	**19-34**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

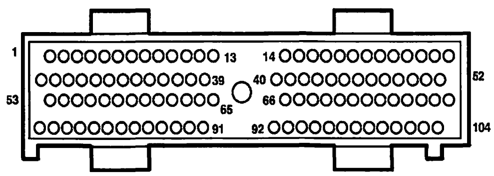
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**23-35**	**17-23**	%
MAF	**4.3-5.3**	**15-18**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**11-15**	**30**	DEG

4.6L 4V Mustang SVT Cobra Supercharged

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	360-420	680-800	860-950	Hz
02S12	35	.1	(D)	(D)	(D)	DCV
IAT2	37	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	2.5-7.5/87-110	2.5-7.5/87-110	2.5-7.5/87-110	2.5-7.5/87-110	DCV/%
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP (gs)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.3/40	2.8/39	2.8/39	2.8/39	DCV/PSI
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
OSS	84	0	0	270/1365	470/2440	Hz/RPM
CID	85	0	5-7	9-12	11-14	Hz
ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/ OPEN-CLOSED
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.5-.8	.8-1.3	1.2-1.7	DCV
TP V	89	.53-1.27	.53-1.27	.9-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
EFTA	PID	50-120 (K)	50-120 (K)	50-120 (K)	50-120 (K)	DEG
FLI (H)	PID	50	50	50	50	%

(Continued)

4.6L 4V Mustang SVT Cobra Supercharged

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
LOAD	PID	**(L)**	**10-20**	**16-30**	**20-30**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**630-750**	**1180-1360**	**1530-1750**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
LFC	28	**.1/OFF**	**VBAT/ON (B)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
HFC	46	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SCB	45	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC	69	**.1/ON**	**VBAT/OFF (A)**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ7	72	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ5	73	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ3	74	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ1	75	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**3.6/75**	**1.2/24**	**1.2/24**	**1.2/24**	DCV/%
SBICP	82	**VBAT/OFF**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
IAC	83	**VBAT/0**	**10.3/35**	**8.7-9/34-46**	**8-9/34-54**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ6	99	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS

(Continued)

4.6L 4V Mustang SVT Cobra Supercharged

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
INJ4	100	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
INJ2	101	**0**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FUELPW1	PID	**(L)**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
FUELPW2	PID	**(L)**	**2.4-2.8**	**1.6-5**	**3.3-6**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**11-15**	**17-32**	**19-34**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

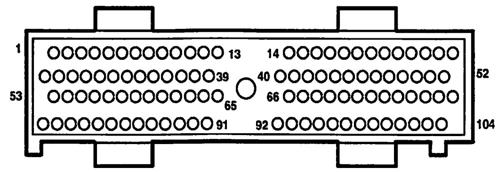
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**23-35**	**17-23**	%
MAF	**4.3-5.3**	**15-18**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**11-15**	**30**	DEG

4.6L Crown Victoria/Grand Marquis

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
GFS (ALTMON)	7	0	130/30	130/27	130/23	Hz/%
FLI V/FLI (H)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	440-490	560-780	900-1100	Hz
TCS	29	.1/0FF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
TR 1	34	0	0	11.5	11.5	DCV
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 2	49	0	0	11.5	11.5	DCV
TR 4	50	0	0	11.5	11.5	DCV
KS1	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.15/46	2.74/39	2.88/41	2.86/40	DCV/OFF-ON
TR3 V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG

(Continued)

4.6L Crown Victoria/Grand Marquis

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OSS	84	0	0	126-136/ 1260-1330	225-243/ 2265-2400	Hz/RPM
CID	85	0	6-7	10-11	13-14	Hz
ACP	86	1.1/102	1.1/102	.6-1.3/80-130	.6-1.3/80-130	DCV/ PSI
02S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.9-1.5	1.4-2.1	DCV
TP V	89	.53-1.27	.53-1.27	1-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	15-19	20-26	23-28	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	790-815	1250-1400	1540-1620	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS1	6	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCIL	12	5/OFF	5/OFF	5/OFF	5/OFF	DCV/OFF-ON
CHTIL	19	4.7/OFF	4.7/OFF	4.7/OFF	4.7/OFF	DCV/OFF-ON
FCIL	20	0/OFF	0/OFF	0/OFF	0/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	27	VBAT	VBAT	VBAT	VBAT	DCV
VFC	28	0/100	0/100	0/100	0/100	%
GENFDC (ALTCOM)	45	0	0	0	0	Hz/%
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL3)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL4)	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	9.9-10.1/42-44	.3/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz

(Continued)

4.6L Crown Victoria/Grand Marquis

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
WAC (ACCR)	69	VBAT/OFF	.1 /ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
ALTLAMP	70	.10	VBAT	VBAT	VBAT	DCV
INJ7	72	0	3.4-3.7	3.7-6	5.5-9	mS
INJ5	73	0	3.4-3.7	3.7-6	5.5-9	mS
INJ3	74	0	3.4-3.7	3.7-6	5.5-9	mS
INJ1	75	0	3.4-3.7	3.7-6	5.5-9	mS
CDC (CYL7)	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL8)	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.9/20	9.5/20	9.3/22	9.5/22	DCV/PSI
IAC	83	VBAT/0	9.2-10.3/32-36	8.3-10.7/30-55	5.7-8/40-70	DCV/%
HTR11	93	.1/ON (P)	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.4-3.7	3.7-6	5.5-9	mS
INJ6	99	0	3.4-3.7	3.7-6	5.5-9	mS
INJ4	100	0	3.4-3.7	3.7-6	5.5-9	mS
INJ2	101	0	3.4-3.7	3.7-6	5.5-9	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.4-3.7	3.7-6	5.5-9	mS
FUELPW2	PID	(L)	3.4-3.7	3.7-6	5.5-9	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	20-35	32-38	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71/97	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

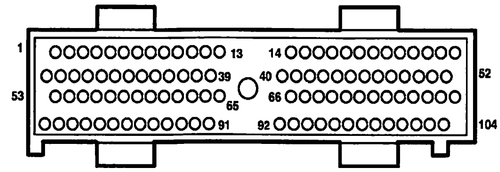
4.6L Crown Victoria/Grand Marquis

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	19-24	19-24	%
MAF	4.7-6	13-16	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	40	DEG

4.6L NG Crown Victoria

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
GFS (ALTMON)	7	0	130/30	130/27	130/23	Hz/%
EFTA V/EFT A	8	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	440-490	580-770	850-1100	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
TR1	34	0	0	11.5	11.5	DCV
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FSVM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FRP V/FRP	63	2.7-3.7/ 105-130	2.7-3.7/ 105-130	2.7-3.7/ 100-130	2.7-3.7/ 105-130	DCV/PSI
TR3 V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	95-110/ 950-1100	175-190/ 1750-1915	Hz/RPM

(Continued)

4.6L NG Crown Victoria

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CID	85	**0**	**6-7**	**8-10**	**11-17.5**	Hz
ACP	86	**1.1/102**	**1.1/102**	**.6-1.3/80-130**	**.6-1.3/80-130**	DCV/ PSI
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.6-.9**	**.9-1.5**	**1.2-2.1**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.1**	**.9-1.3**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**15-19**	**22-30**	**31-46**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
RPM	PID	**0**	**790-825**	**925-1125**	**1320-1395**	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS1	6	**.1/ON**	**.1/ON**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CHTIL	19	**3.5/OFF**	**3.5/OFF**	**3.5/OFF**	**3.5/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VFC	28	**0/100**	**0/100**	**0/100**	**0/100**	%
GENFDC (ALTCOM)	45	**0**	**0**	**0**	**0**	Hz/%
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**9-VBAT/ 0-50**	**.2-10/80-100**	DCV/%
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC (ACCR)	69	**VBAT/OFF**	**.1 /ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
ALTLAMP	70	**.10**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ7	72	**0**	**3.9-5.2**	**4.7-12**	**4.7-12.2**	mS
INJ5	73	**0**	**3.9-5.2**	**4.7-12**	**4.7-12.2**	mS
INJ3	74	**0**	**3.9-5.2**	**4.7-12**	**4.7-12.2**	mS
INJ1	75	**0**	**3.9-5.2**	**4.7-12**	**4.7-12.2**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV

(Continued)

4.6L NG Crown Victoria

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDH (CYL8)	79	VBAT	VBAT	VBAT	VBAT	DCV
FSV	80	VBAT/OFF	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
EPC	81	7.9/20	9.5/20	9/18	9.5/25	DCV/PSI
IAC	83	VBAT/0	8-9.5/32-46	8.3-10.7/30-55	5.7-8/40-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON(P)	.1/ON(P)	.1/ON(P)	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON(P)	.1/ON(P)	.1/ON(P)	DCV/OFF-ON
HTR12	95	.2/ON (P)	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ6	99	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ4	100	0	3.9-5.2	4.7-12	4.7-12.2	mS
INJ2	101	0	3.9-5.2	4.7-12	4.7-12.2	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.5-5.2	4.7-12	4.7-12.2	mS
FUELPW2	PID	(L)	3.5-5.2	4.7-12	4.7-12.2	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SHRTFT2	PID	(L)	(-)15-(+)15	(-)15-(+)15	(-)15-(+)15	%
SPARKADV	PID	0	4-9	20-31	20-28	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71/97	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	27-35	25-30	%
MAF	6.5-7.3	17-19.5	G/S
SHRTFT1	(-)15-(+)15	(-)15-(+)15	%
SHRTFT2	(-)15-(+)15	(-)15-(+)15	%
SHRTFT11	(-)15-(+)15	(-)15-(+)15	%

(Continued)

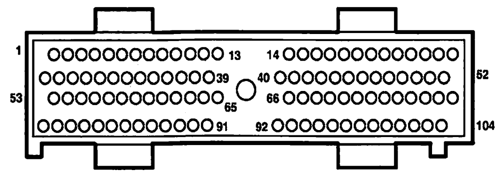
4.6L NG Crown Victoria

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)15-(+)15	(-)15-(+)15	%
SHRTFT22	95-100	95-100	%
SPARKADV	4-9	16-25	DEG

4.6L 4V Marauder

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
GFS (ALTMON)	7	0	130/30	130/27	130/23	Hz/%
FLI V/FLI (H)	9	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	440-490	560-780	900-1100	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
TR 1	34	0	0	11.5	11.5	DCV
02S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR 2	49	0	0	11.5	11.5	DCV
TR 4	50	0	0	11.5	11.5	DCV
KS1	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
02S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.15/46	2.74/39	2.88/41	2.86/40	DCV/OFF-ON
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT V/CHT(U)	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG

(Continued)

4.6L 4V Marauder

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OSS	84	**0**	**0**	**126-136/ 1260-1330**	**225-243/ 2265-2400**	Hz/RPM
CID	85	**0**	**6-7**	**10-11**	**13-14**	Hz
ACP	86	**1.1/102**	**1.1/102**	**.6-1.3/80-130**	**.6-1.3/80-130**	DCV/ PSI
02S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.6-.9**	**.9-1.5**	**1.4-2.1**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.2**	**1-1.3**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**15-19**	**20-26**	**23-28**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**790-815**	**1238-1400**	**1540-1650**	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS1	6	**.1/ON**	**.1/ON**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCIL	12	**5/OFF**	**5/OFF**	**5/OFF**	**5/OFF**	DCV/OFF-ON
CHTIL	19	**4.7/OFF**	**4.7/OFF**	**4.7/OFF**	**4.7/OFF**	DCV/OFF-ON
FCIL	20	**0/OFF**	**0/OFF**	**0/OFF**	**0/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VFC	28	**0/100**	**0/100**	**0/100**	**0/100**	%
GENFDC (ALTCOM)	45	**0**	**0**	**0**	**0**	Hz/%
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**25-38**	**40-48**	**72-85**	Hz
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**9.9-10.1/42-44**	**.3/90-100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %

(Continued)

3.0L Ranger (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
INJ1	75	**0**	**4-4.8**	**6.3-8**	**7-13**	mS
CDC (CYL2&6)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCIL	79	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**8.5/35**	**10.2-10.9/ 35-50**	**10.5-11/23-38**	**10-10.7/ 25-39**	DCV/PSI
CFCIL	82	**.1/OFF**	**.1/OFF**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
IAC	83	**VBAT/0**	**10.7-11.9/ 25-35**	**10-10.7/38-47**	**8.4-10.5/40-57**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**4-4.8**	**6.3-8**	**7-13**	mS
INJ4	100	**0**	**4-4.8**	**6.3-8**	**7-13**	mS
INJ2	101	**0**	**4-4.8**	**6.3-8**	**7-13**	mS
FUELPW1	PID	**(L)**	**4-4.8**	**6.3-8**	**7-13**	mS
FUELPW2	PID	**(L)**	**4-4.8**	**6.3-8**	**7-13**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**16-18**	**26-36**	**25-32**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**17-21**	**27-30**	%
MAF	**3.7-4.8**	**11.5-13**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%

(Continued)

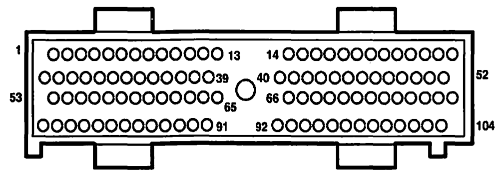
3.0L Ranger (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	16-18	24	DEG

3.0L Ranger (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI (H)	12	**1.7/50**	**1.7/50**	**1.7/50**	**1.7/50**	DCV/%
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
4X4 (M)	14	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIN	17	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CKP (+)	21	**0**	**460-480**	**800-855**	**1180-1230**	Hz
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
ECT	38	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
KS1	57	**0**	**0**	**0**	**0**	DCV
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
OSS	84	**0**	**0**	**290/1435**	**530/2640**	Hz/RPM
CID	85	**0**	**6-8**	**12-15**	**17-19**	Hz
ACP V/ACP	86	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	DCV/OPEN-CLOSED
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.8-1.1**	**1.4-1.7**	**2-2.5**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.2**	**1.2-1.7**	DCV
CPP/PNP	PID	**OFF**	**ON (J)**	**OFF**	**OFF**	%
LOAD	PID	**(L)**	**17-21**	**23-27**	**35-40**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

(Continued)

3.0L Ranger (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	800-830	1435-1475	1900-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	1.1	1.1	1.1	1.1	DCV
CDA (CYL1&5)	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	34-42	70-81	95-120	Hz
CDB (CYL3&4)	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ3	74	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ1	75	0	4-4.8	4.4-5.8	5.8-9.5	mS
CDC (CYL2&6)	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CFCIL	82	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10.7-11.9/ 25-35	10-10.7/ 38-47	8.4-10.5/ 40-57	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ4	100	0	4-4.8	4.4-5.8	5.8-9.5	mS
INJ2	101	0	4-4.8	4.4-5.8	5.8-9.5	mS
FUELPW1	PID	(L)	4-4.8	4.4-5.8	5.8-9.5	mS
FUELPW2	PID	(L)	4-4.8	4.4-5.8	5.8-9.5	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%

(Continued)

3.0L Ranger (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	16-18	26-36	25-32	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

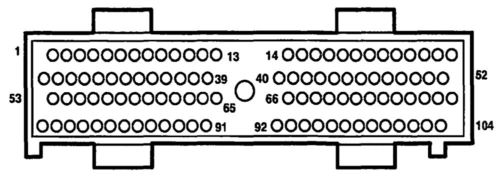
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	17-21	24-27	%
MAF	3.7-4.8	13-17.5	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	16-18	24	DEG

4.0L Ranger (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	**0**	**0**	**10.7**	**10.7**	DCV
TSS	6	**0**	**100-125/ 790-860**	**185-205/ 1400-1475**	**250-280/ 1900-2090**	Hz/RPM
FLI V/FLI (H)	12	**1.7/50**	**1.7/50**	**1.7/50**	**1.7/50**	DCV/%
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
4X4L (M)	14	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIN	17	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CKP (+)	21	**0**	**430-500**	**870-900**	**1230-1300**	Hz
TCS	29	**.1/OFF**	**VBAT/ON (G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
ECT	38	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR2	49	**0**	**0**	**10.7**	**10.7**	DCV
TR4	50	**0**	**0**	**10.7**	**10.7**	DCV
KS1	57	**0**	**0**	**0**	**0**	DCV
ISS	59	**0**	**623**	**1480**	**1980**	Hz
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
O2S22	61	**.1**	**(D)**	**(D)**	**(D)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H20
TRV/TR	64	**0/PARK**	**0/PARK**	**1.7/OD**	**1.7/OD**	DCV/MODE
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
OSS	84	**0**	**0**	**300-1500**	**560-2780**	RPM/Hz
CID	85	**0**	**6-8**	**11-15**	**17-19**	Hz

(Continued)

4.0L Ranger (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
ACP V/ACP	86	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	DCV/OPEN-CLOSED
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.8-1**	**1.4-1.8**	**2-2.7**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.1**	**1.2-1.7**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
GEAR	PID	**1**	**1**	**4**	**5**	GEAR
LOAD	PID	**(L)**	**10-25**	**17-21**	**30-35**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**800-1000**	**1400-1475**	**1525-1880**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
SS2	1	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSOUT	18	**0**	**0**	**0**	**0**	DCV
CDA (CYL1&5)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	27	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS4	28	**VBAT/0**	**VBAT/0**	**VBAT/0**	**VBAT/0**	DCV/%
PATSIL	30	**0**	**0**	**0**	**0**	DCV
PATSTRT	44	**0**	**0**	**0**	**0**	DCV
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**35-49**	**70-82**	**90-120**	Hz
CDB (CYL3&4)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS3	53	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
TCC	54	**VBAT/0**	**VBAT/0**	**3.2/90**	**1.5/80-100**	DCV/%
EVMV	56	**0**	**0**	**500-900 (F)**	**500-900 (F)**	mA
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC (ACCR)	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**3-4.8**	**5.5-8**	**7-17**	mS
INJ3	74	**0**	**3-4.8**	**5.5-8**	**7-17**	mS
INJ1	75	**0**	**3-4.8**	**5.5-8**	**7-17**	mS

(Continued)

4.0L Ranger (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDC (CYL2&6)	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.5/30	10.2/30	10.5-11/23-45	10.1-11.1/ 34-40	DCV/PSI
CFCIL	82	0/OFF	0/OFF	0/OFF	0/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10.3/35	9.6-11/35-41	6-8.4/57-68	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3-4.8	5.5-8	7-17	mS
INJ4	100	0	3-4.8	5.5-8	7-17	mS
INJ2	101	0	3-4.8	5.5-8	7-17	mS
FUELPW1	PID	(L)	3-4.8	5.5-8	7-17	mS
FUELPW2	PID	(L)	3-4.8	5.5-8	7-17	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	13-17	26-35	25-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71\97	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-25	20-24	%
MAF	3.5-5.1	13-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%

(Continued)

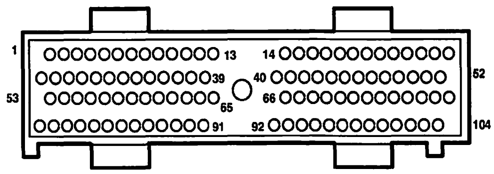
4.0L Ranger (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	13-17	27	DEG

4.0L Ranger (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI (H)	12	**1.7/50**	**1.7/50**	**1.7/50**	**1.7/50**	DCV/%
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
4X4 (L)	14	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIN	17	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CKP (+)	21	**0**	**435-460**	**870-900**	**1225-1300**	Hz
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
ECT	38	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
KS1	57	**0**	**0**	**0**	**0**	DCV
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
O2S22	61	**.1**	**(D)**	**(D)**	**(D)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
OSS	84	**0**	**0**	**300/1500**	**560/2780**	Hz
CID	85	**0**	**6-8**	**11-15**	**16-18**	Hz
ACP V/ACP	86	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	DCV/OPEN-CLOSED
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.6-.9**	**1.1-1.4**	**1.6-2.1**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.2**	**1.2-1.5**	DCV
LOAD	PID	**(L)**	**10-25**	**17-21**	**30-35**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

(Continued)

4.0L Ranger (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	800-1000	1400-1535	1950-2100	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	0	0	0	0	DCV
CDA (CYL1&5)	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSIL	30	0	0	0	0	DCV
PATSTRT	44	0	0	0	0	DCV
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	36-40	73-79	99-115	Hz
CDB (CYL3&4)	52	VBAT	VBAT	VBAT	VBAT	DCV
EVMV	56	0	0	500-900 (F)	500-900 (F)	mA
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC (ACCR)	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	3-4.3	4.4-5.8	6-17	mS
INJ3	74	0	3-4.3	4.4-5.8	6-17	mS
INJ1	75	0	3-4.3	4.4-5.8	6-17	mS
CDC (CYL2&6)	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CFCIL	82	0/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10.9/27	9-10.6/40-45	6-10.2/45-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	3-4.3	4.4-5.8	6-17	mS
INJ4	100	0	3-4.3	4.4-5.8	6-17	mS
INJ2	101	0	3-4.3	4.4-5.8	6-17	mS
FUELPW1	PID	(L)	3-4.3	4.4-5.8	6-17	mS
FUELPW2	PID	(L)	3-4.3	4.4-5.8	6-17	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%

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4.0L Ranger (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**13-17**	**25-35**	**25-40**	DEG

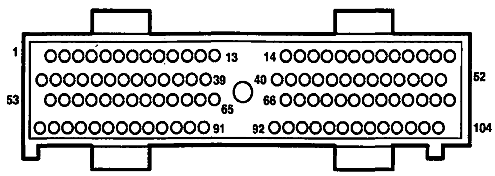
Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71/97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**10-25**	**20-24**	%
MAF	**3.5-5**	**13-17**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	**13-17**	**27**	DEG

3.9L Freestar



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
TR1	3	0	0	10.7	10.7	DCV
TSS	6	0	80-86/ 850-900	80-86/ 850-900	99-113/ 1660-1700	Hz/RPM
IMRCM	8	5.0	5.0	0.0	0.0	DCV
FRT	10	.5-3/210-110	.5-3/210-110	.5-3/210-110	.5-3/210-110	DCV/DEG
FEPS	13	.1	.1	.1	.1	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
GFS (ALTMON)	20	0	130/37	130/25	130/22	Hz/%
CKP (+)	21	0	390-450	740-800	950-1050	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH(I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.0/40	4.0/60	4.0/60	4.0/60	DCV/PSI
TR3 V/TR3	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG

(Continued)

3.9L Freestar

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OSS	84	0	0	260-270/ 1290-1310	475-480/ 2360-2450	Hz/RPM
CID	85	0	5-7	10-11.5	13-15	Hz
ACP V	86	1.2	1	.8	.75	DCV
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.8	.9-1.4	1.3-2	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.3	.8-1.3	DCV
BPP	PID	OFF	ON (E)	OFF	OFF	OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	15-20	19-27	27-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	700-730	1250-1400	1700-1870	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
PATSOUT	18	0.0	0.0	0.0	0.0	DCV
CDA (CYL1&5)	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
LFC (FC1)	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIL	30	VBAT	VBAT	VBAT	VBAT	DCV
IMRC	42	VBAT/OFF	VBAT/OFF	0.0/ON	0.0/ON	DCV/OFF-ON
PATSTRT	44	0	0	0	0	DCV
GENFDC (ALTCOM)	45	0	0-130 (R)	0	0	Hz/%
HFC (FC3)	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL3&4)	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %

(Continued)

3.9L Freestar

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
WAC (ACCR)	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ3	74	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ1	75	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
CDC (CYL2&6)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**9.0**	**3.45**	**3.40**	**3.42**	DCV
EPC	81	**7/15**	**9.2/15**	**8-10.1/16-25**	**9.3/24-28**	DCV/PSI
IAC	83	**VBAT/0**	**9.8-11.2/25-35**	**7.5-10/30-55**	**7.5-8.8/50-59**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ4	100	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ2	101	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
FUELPW1	PID	**(L)**	**3-4**	**4-7**	**6.1-11.7**	mS
FUELPW2	PID	**(L)**	**3-4**	**4-7**	**6.1-11.7**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-20**	**25-35**	**27-36**	DEG
TCIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**20-25**	**20-25**	%

(Continued)

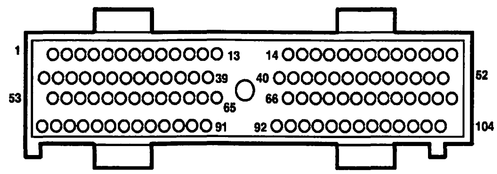
3.9L Freestar

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
MAF	4-5	14-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	28-31	DEG

4.2L Freestar/Monterey

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
TSS	6	0	80-86/ 850-900	80-86/ 850-900	99-113/ 1660-1700	Hz/RPM
IMRCM	8	5.0	5.0	0.0	0.0	DCV
FRT	10	.5-3/210-110	.5-3/210-110	.5-3/210-110	.5-3/210-110	DCV/DEG
FEPS	13	.1	.1	.1	.1	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
GFS (ALTMON)	20	0	130/37	130/25	130/22	Hz/%
CKP (+)	21	0	390-450	740-800	950-1050	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH(I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.7	10.7	DCV
TR4	50	0	0	10.7	10.7	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	0	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
FRP V/FRP	63	3.0/40	4.0/60	4.0/60	4.0/60	DCV/PSI
TR3 V/TR3	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG

(Continued)

4.2L Freestar/Monterey

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OSS	84	**0**	**0**	**260-270/ 1290-1310**	**475-480/ 2360-2450**	Hz/RPM
CID	85	**0**	**5-7**	**10-11.5**	**13-15**	Hz
ACP V	86	**1.2**	**1**	**.8**	**.75**	DCV
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.6-.8**	**.9-1.4**	**1.3-2**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.3**	**.8-1.3**	DCV
BPP	PID	**OFF**	**ON (E)**	**OFF**	**OFF**	OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**15-20**	**19-27**	**27-35**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**700-730**	**1250-1400**	**1700-1870**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	**.1/ON**	**.1/ON**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
PATSOUT	18	**0.0**	**0.0**	**0.0**	**0.0**	DCV
CDA (CYL1&5)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	27	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
LFC (FC1)	28	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIL	30	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMRC	42	**VBAT/OFF**	**VBAT/OFF**	**0.0/ON**	**0.0/ON**	DCV/OFF-ON
PATSTRT	44	**0**	**0**	**0**	**0**	DCV
GENFDC (ALTCOM)	45	**0**	**0-130 (R)**	**0**	**0**	Hz/%
HFC (FC3)	46	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3&4)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS3	53	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCC	54	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.2/100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %

(Continued)

4.2L Freestar/Monterey

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
WAC (ACCR)	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ3	74	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ1	75	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
CDC (CYL2&6)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**9.0**	**3.45**	**3.40**	**3.42**	DCV
EPC	81	**7/15**	**9.2/15**	**8-10.1/16-25**	**9.3/24-28**	DCV/PSI
IAC	83	**VBAT/0**	**9.8-11.2/25-35**	**7.5-10/30-55**	**7.5-8.8/50-59**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ4	100	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
INJ2	101	**0**	**3-4**	**4-7**	**6.1-11.7**	mS
FUELPW1	PID	**(L)**	**3-4**	**4-7**	**6.1-11.7**	mS
FUELPW2	PID	**(L)**	**3-4**	**4-7**	**6.1-11.7**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-20**	**25-35**	**27-36**	DEG
TCIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**20-25**	**20-25**	%

(Continued)

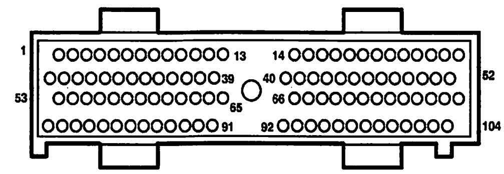
4.2L Freestar/Monterey

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
MAF	4-5	14-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	28-31	DEG

4.0L SOHC Explorer Sport Trac

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.7	10.7	DCV
TSS	6	0	100-125/ 790-860	155-205/ 1100-1475	250-280/ 1900-2090	Hz/RPM
FLI V/FLI (H)	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	430-500	810-885	1100-1230	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.0	11.0	DCV
TR4	50	0	0	11.0	11.0	DCV
KS1	57	0	0	0	0	DCV
ISS	59	0	623	1480	1980	RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR3 V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
OSS	84	0	0	1200-1500	2500-2600	RPM
CID	85	0	6-8	11-15	16-18	Hz

(Continued)

4.0L SOHC Explorer Sport Trac

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACP V/ACP	86	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	DCV/OPEN-CLOSED
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.8-1**	**1.4-1.8**	**2-2.7**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.2**	**1.2-1.7**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
GEAR	PID	**1**	**1**	**4**	**5**	GEAR
LOAD	PID	**(L)**	**13-17**	**20-25**	**30-35**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**800-900**	**1400-1475**	**1525-1880**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSOUT	18	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1&5)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	27	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS4	28	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIL	30	**0**	**0**	**0**	**0**	DCV
PATSTRT	44	**0**	**0**	**0**	**0**	DCV
TPO	45	**1.1/15**	**1.1/15**	**1.4/18**	**1.8/20**	DCV/%
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**36-40**	**73-79**	**99-115**	Hz
CDB (CYL3&4)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS3	53	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
TCC	54	**VBAT/0**	**VBAT/0**	**VBAT/0**	**2.5/80-100**	DCV/%
EVMV	56	**0**	**0**	**500-900 (F)**	**500-900 (F)**	mA
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC (ACCR)	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**2.5-4**	**3-6**	**4-9**	mS
INJ3	74	**0**	**2.5-4**	**3-6**	**4-9**	mS

(Continued)

4.0L SOHC Explorer Sport Trac

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
INJ1	75	0	2.5-4	3-6	4-9	mS
CDC (CYL2&6)	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	8.5/ 30	10.2/ 30	10.5-11/ 23-45	9.6.0-11.0/ 24-30	DCV/PSI
IAC	83	VBAT/0	9.8-10.9/30-40	9.6-11/35-55	7.5-10.2/45-65	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.5-4	3-6	4-9	mS
INJ4	100	0	2.5-4	3-6	4-9	mS
INJ2	101	0	2.5-4	3-6	4-9	mS
FUELPW1	PID	(L)	2.5-4	3-6	4-9	mS
FUELPW2	PID	(L)	2.5-4	3-6	4-9	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	10-25	25-35	19-35	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71/97	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-35	20-24	%
MAF	4-5.1	13-17	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%

(Continued)

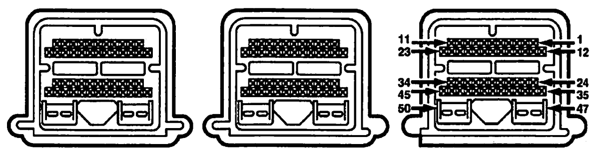
4.0L SOHC Explorer Sport Trac

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	10-18	40	DEG

4.0L SOHC Explorer/Mountaineer

150 Pin PCM



T TRANSMISSION | B/C BODY/COWL | E ENGINE

A0049575

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACDS	B3	.1	.1	.1	.1	DCV
APP1	B5	4.0	4.0	3.4-4.0	2.9-4.0	DCV
BPS	B7	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
BPP	B8	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
FTP V/FTP	B9	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
IAT	B16	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
APP2	B17	1.5	1.5	1.5-1.9	1.5-2.4	DCV
FPM	B21	.1	0 - VBAT	0 - VBAT	0 - VBAT	DCV
4WD MC SW	B22	VBAT	VBAT	VBAT	VBAT	DCV
ILC	B24	.7	9	9	9	DCV
ACP V	B26	VBAT	VBAT	VBAT	VBAT	DCV
TCS	B27	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
APP3	B28	.9	.9	.9-1.3	.9-1.8	DCV
4WDSW RTN	B29	0	0	0	0	DCV
MAF V	B32	0	.7-.9	1.2-1.6	1.6-2.1	DCV
PATSIN	B42	VBAT	VBAT	VBAT	VBAT	DCV
FEPS	B44	.1	.1	.1	.1	DCV
4WD_PWR	B50	VBAT	VBAT	VBAT	VBAT	DCV
OSS	T3	0	0	460-530/ 1250-1290	885-1000/ 2100-2400	Hz/RPM
HCDS	T4	0	0	700	1180	Hz
4WD_POS1	T7	VBAT	VBAT	VBAT	VBAT	DCV
4WD_POS2	T8	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

4.0L SOHC Explorer/Mountaineer

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TSS	T15	0	320-360/ 630-670	500-713/ 1100-1300	845-985/ 1700-1800	Hz/RPM
TR 1	T16	0	0	VBAT	VBAT	DCV
TR 2	T17	0	0	VBAT	VBAT	DCV
4WD_POS3	T19	VBAT	VBAT	VBAT	VBAT	DCV
4WD_POS4	T20	VBAT	VBAT	VBAT	VBAT	DCV
O2S12	T24	.1	(D)	(D)	(D)	DCV
O2S22	T25	.1	(D)	(D)	(D)	DCV
TR3 V/TR3	T27	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR 4	T28	0	0	VBAT	VBAT	DCV
TFT	T29	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
TP1	E19	4.1	4.4	4.1	4.0	DCV
ECT	E21	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
CID	E25	0	5-6	11-12	14-16	Hz
TP2	E29	1.2	.8	1.1	1.4	DCV
O2S11	E30	0	switching (C)	switching (C)	switching (C)	DCV
O2S21	E31	0	switching (C)	switching (C)	switching (C)	DCV
KS1	E32	0	0	0	0	DCV
CKP	E34	0	380-410	800-860	980-1030	Hz
FRT	E36	.5-3/210-110	.5-3/210-110	.5-3/210-110	.5-3/210-110	DCV/DEG
FRP V/FRP	E37	3.4/50	2.8/40	2.8/40	2.8/40	DCV/PSI
DPFEGR	E44	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
ACCS	PID	OFF	ON (A)	OFF	OFF	OFF-ON
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	17-28	19-26	30-40	%
RPM	PID	0	750	1300-1350	1780	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PATSTRT	B2	.1	.5	.5	.5	DCV
FP	B12	8.4	2.5	2.8	2.8	DCV
EVAPCV	B13	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
WAC (ACCR)	B25	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	B31	VBAT	VBAT	VBAT	VBAT	DCV
EVMV	B34	0	0	500-900 (F)	500-900 (F)	mA

(Continued)

4.0L SOHC Explorer/Mountaineer

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PATSIL	B37	**11.0**	**13.0**	**13.0**	**13.0**	DCV
EPC	T11	**6.0**	**8.0**	**10.0**	**10.0**	DCV
EPC2	T23	**8.0**	**10.0**	**10.0**	**10.0**	DCV
EPC3	T34	**6.0**	**8.0**	**VBAT**	**VBAT**	DCV
SS1	T42	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS2	T43	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS3	T44	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
SS4	T45	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCC	T46	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.2/100**	DCV/%
HTR12	T47	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	T48	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
4WD_CLUTCH	T49	**.5**	**.2**	**.2**	**.2**	DCV
CDA (CYL 1&5)	E1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ1	E2	**0**	**2.9-3.3**	**3.1-5.1**	**6-7**	mS
INJ2	E3	**0**	**2.9-3.3**	**3.1-5.1**	**6-7**	mS
INJ3	E4	**0**	**2.9-3.3**	**3.1-5.1**	**6-7**	mS
INJ4	E5	**0**	**2.9-3.3**	**3.1-5.1**	**6-7**	mS
EGRVR	E6	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
INJ5	E8	**0**	**2.9-3.3**	**3.1-5.1**	**6-7**	mS
INJ6	E9	**0**	**2.9-3.3**	**3.1-5.1**	**6-7**	mS
CDB (CYL 3&4)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDC (CYL 2&6)	E24	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TACMP	E47	**3.8**	**VBAT**	**VBAT**	**VBAT**	DCV
TACMN	E48	**3.8**	**VBAT**	**VBAT**	**VBAT**	DCV
HTR11	E49	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	E50	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**0**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**0**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**20-25**	**30-35**	**30-35**	DEG
TCIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

4.0L SOHC Explorer/Mountaineer

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B45	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B35, 36	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	B40, E40	**5**	**5**	**5**	**5**	DCV
ETCVREF	B4, E18	**5**	**5**	**5**	**5**	DCV

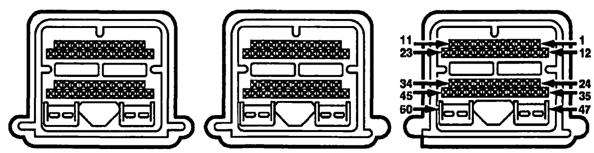
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**17-28**	**17-24**	%
MAF	**4.8-7**	**14-17**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**20-25**	**40**	DEG

4.6L Explorer/Mountaineer

150 Pin PCM



T TRANSMISSION

B/C BODY/COWL

E ENGINE

A0049575

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACDS	B3	.1	.1	.1	.1	DCV
APP1	B5	4.0	4.0	3.4-4.0	2.9-4.0	DCV
BPS	B7	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
BPP	B8	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
FTP V/FTP	B9	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
IAT	B16	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
APP2	B17	1.5	1.5	1.4-1.9	1.4-2.4	DCV
FPM	B21	.1	0 - VBAT	0 - VBAT	0 - VBAT	DCV
4WD MC SW	B22	VBAT	VBAT	VBAT	VBAT	DCV
ILC	B24	.7	9	9	9	DCV
ACP V	B26	VBAT	VBAT	VBAT	VBAT	DCV
TCS	B27	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
APP3	B28	.9	.9	.9-1.3	.9-1.8	DCV
4WDSW RTN	B29	0	0	0	0	DCV
MAF V	B32	0	.7-.9	1.2-1.7	1.5-2.4	DCV
PATSIN	B42	VBAT	VBAT	VBAT	VBAT	DCV
FEPS	B44	.1	.1	.1	.1	DCV
OSS	T3	0	0	460/ 1250	885-1000/ 2100-2400	Hz/RPM
HCDS	T4	0	0	713	1315	Hz
4WD_POS1	T7	VBAT	VBAT	VBAT	VBAT	DCV
4WD_POS2	T8	VBAT	VBAT	VBAT	VBAT	DCV
TSS	T15	0	360/670	713/1300	985/1800	Hz/RPM

(Continued)

4.6L Explorer/Mountaineer

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR 1	T16	0	0	VBAT	VBAT	DCV
TR 2	T17	0	0	VBAT	VBAT	DCV
4WD_POS3	T19	VBAT	VBAT	VBAT	VBAT	DCV
4WD_POS4	T20	VBAT	VBAT	VBAT	VBAT	DCV
O2S22	T22	.1	(D)	(D)	(D)	DCV
O2S12	T24	.1	(D)	(D)	(D)	DCV
TR3 V/TR3	T27	0/PARK	0/PARK	1.6/OD	1.6/OD	DCV/MODE
TR 4	T28	0	0	VBAT	VBAT	DCV
TFT	T29	.5-2.4/210-110	.5-2.4/210-110	.5-2.4/210-110	.5-2.4/210-110	DCV/DEG
TP1	E19	4.1	4.4	4.1	4.0	DCV
KS2	E21	0	0	0	0	DCV
CID	E25	0	6	11-12	16	Hz
TP2	E29	1.2	.8	1.1	1.2	DCV
O2S11	E30	0	switching (C)	switching (C)	switching (C)	DCV
O2S21	E31	0	switching (C)	switching (C)	switching (C)	DCV
KS1	E32	0	0	0	0	DCV
CHT	E33	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
CKP	E34	0	400	800	970-1050	Hz
FRP V/FRP	E37	3.0/40	2.8/40	2.8/40	2.8/40	DCV/PSI
DPFEGR	E44	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	16-23	20	25-37	%
RPM	PID	0	630-750	1465	1726	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VSO	B1	0	0	67	125	Hz
PATSTRT	B2	.1	.5	.5	.5	DCV
FP	B12	8.4	2.5	2.8	2.8	DCV
EVAPCV	B13	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
WAC (ACCR)	B25	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	B31	VBAT	VBAT	VBAT	VBAT	DCV
4WDT_IL	B33	0.1	0.1	0.1	0.1	DCV
4WDL_IL	B46	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

4.6L Explorer/Mountaineer

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVMV	B34	**0**	**0**	**500-900 (F)**	**500-900 (F)**	mA
PATSIL	B37	**11.0**	**13.0**	**13.0**	**13.0**	DCV
EPC	T11	**6.0**	**8.0**	**10.0**	**10.0**	DCV
EPC2	T23	**8.0**	**10.0**	**10.0**	**10.0**	DCV
EPC3	T34	**6.0**	**8.0**	**VBAT**	**VBAT**	DCV
SS1	T42	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS2	T43	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS3	T44	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
SS4	T45	**.1/ON**	**.1/ON**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
TCC	T46	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.2/100**	DCV/%
HTR12	T47	**12.0/OFF (P)**	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	DCV/OFF-ON
HTR22	T48	**12.0/OFF (P)**	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	DCV/OFF-ON
4WD_CLUTCH	T49	**.5**	**.2**	**.2**	**.2**	DCV
CDA (CYL1)	E1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ1	E2	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
INJ2	E3	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
INJ3	E4	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
INJ4	E5	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
EGRVR	E6	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
INJ5	E8	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
INJ6	E9	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
INJ7	E10	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
INJ8	E11	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
CDD (CYL2)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDB (CYL3)	E24	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	E35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	E38	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDE (CYL6)	E39	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDC (CYL7)	E42	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	E43	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TACMP	E47	**3.8**	**VBAT**	**VBAT**	**VBAT**	DCV
TACMN	E48	**3.8**	**VBAT**	**VBAT**	**VBAT**	DCV
HTR11	E49	**12.0/OFF (P)**	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	DCV/OFF-ON
HTR21	E50	**12.0/OFF (P)**	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	DCV/OFF-ON
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
FUELPW2	PID	**0**	**3.3-3.8**	**5.1**	**6-7**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%

(Continued)

4.6L Explorer/Mountaineer

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	12-16	30-35	28-35	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

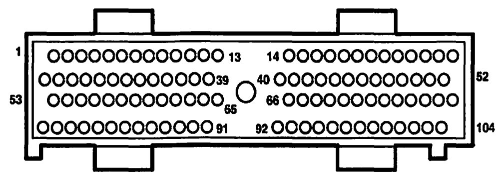
Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B45	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	B35,36	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B40, T40	5	5	5	5	DCV
ETCVREF	B4, E18	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-30	18-20	%
MAF	4.8-7	17-20	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-16	32	DEG

4.2L F-Series Heritage (A/T)



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
TR1	3	0	0	11.5	11.5	DCV
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	430-500	700-900	1000-1200	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
TCSS (M)	59	0	0	265	471	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR3 V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	125-131/ 1250-1310	240-255/ 2400-2550	Hz/RPM
CID	85	0	5-7	10-12	13-17	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED

(Continued)

4.2L F-Series Heritage (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	1.3-1.7	1.2-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI	PID	50 (H)	50 (H)	50 (H)	50 (H)	%
GEAR	PID	1	1	3	4	GEAR
VSS	PID	0	0	30	55	MPH
LOAD	PID	(L)	10-20	20-27	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	750-850	1200-1500	1600-1800	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
SS2	1	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
CDA (CYL1&5)	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	.1/ON	DCV/OFF-ON
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL3&4)	52	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	.2/100	VBAT/0	.2-VBAT/0-100	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	55	125	Hz
WAC (ACCR)	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CFCIL	70	0/OFF	0/OFF	0/OFF	0/OFF	DCV/OFF-ON
INJ5	73	0	2.7-4.5	4.5-8	5.5-11	mS
INJ3	74	0	2.7-4.5	4.5-8	5.5-11	mS
INJ1	75	0	2.7-4.5	4.5-8	5.5-11	mS
CDC (CYL2&6)	78	VBAT	VBAT	VBAT	VBAT	DCV
TCIL	79	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.7/15-20	8.8-10.2/15-20	10.3-10.6/ 35-40	10.6/45	DCV/PSI

(Continued)

4.2L F-Series Heritage (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IAC	83	VBAT/0	10-12/25-40	7.5-10/30-55	7.2-8.1/60-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.7-4.5	4.5-8	5.5-11	mS
INJ4	100	0	2.7-4.5	4.5-8	5.5-11	mS
INJ2	101	0	2.7-4.5	4.5-8	5.5-11	mS
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	2.7-4.5	4.5-8	5.5-11	mS
FUELPW2	PID	(L)	2.7-4.5	4.5-8	5.5-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF/ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	20-30	10-20	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71/97	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

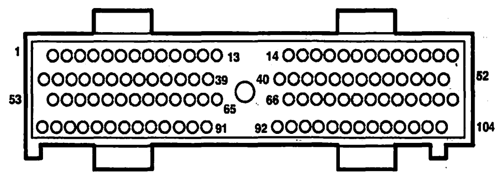
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	10-20	19-25	%
MAF	4-5.1	14-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	40	DEG

4.2L F-Series Heritage (M/T)

104 Pin PCM



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Typical Diagnostic Reference Manual

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IMRCM	8	5/2.5	5/2.5	5/2.5	5/2.5	DCV
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	460-500	660-850	950-1090	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
TCSS (4X4)	59	0	0	265	471	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS (4X2)	84	0	0	218/1170	403/2000	Hz/RPM
CID	85	0	5-7	10-12	13-17	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.7-1.7	1.2-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.2-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
FLI (H)	PID	50	50	50	50	%

(Continued)

4.2L F-Series Heritage (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LOAD	PID	(L)	10-20	20-27	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	750-850	1200-1500	1600-1800	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDA (CYL1&5)	26	VBAT	VBAT	VBAT	VBAT	DCV
IMRC	42	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL3&4)	52	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC (ACCR)	69	VBAT/OFF	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CFCIL	70	0/OFF	0/OFF	0/OFF	0/OFF	DCV/OFF-ON
INJ5	73	0	2.5-4.1	3.8-7	4.6-10	mS
INJ3	74	0	2.5-4.1	3.8-7	4.6-10	mS
INJ1	75	0	2.5-4.1	3.8-7	4.6-10	mS
CDC (CYL2&6)	78	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
IAC	83	VBAT/0	10-12/20-40	10-11/25-45	7-9.5/50-75	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ6	99	0	2.5-4.1	3.8-7	4.6-10	mS
INJ4	100	0	2.5-4.1	3.8-7	4.6-10	mS
INJ2	101	0	2.5-4.1	3.8-7	4.6-10	mS
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	2.5-4.1	3.8-7	4.6-10	mS
FUELPW2	PID	(L)	2.5-4.1	3.8-7	4.6-10	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%

(Continued)

4.2L F-Series Heritage (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-20**	**20-30**	**10-20**	DEG

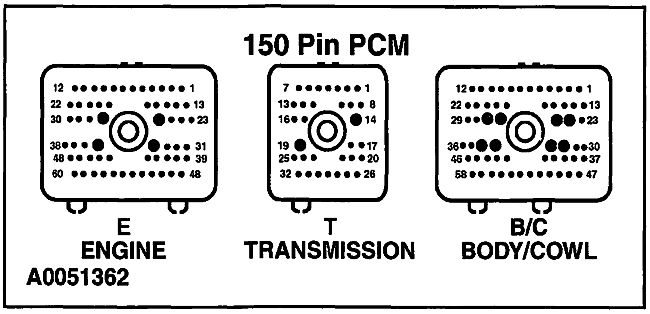
Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71/97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**10-20**	**19-25**	%
MAF	**4-5.1**	**14-18**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	**15-20**	**40**	DEG

4.6L Aviator



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FPM	B2	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ILC	B8	0	9	9	9	DCV
FEPS	B13	.1	.1	.1	.1	DCV
PATSIN	B14	VBAT	VBAT	VBAT	VBAT	DCV
BPS	B28	VBAT/OFF	.1/ON (E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SCMA	B29	VBAT	VBAT	VBAT	VBAT	DCV
ACP V/ACP	B30	.1/OPEN	.1/OPEN	.1/OPEN	.1/OPEN	DCV/ OPEN-CLOSED
MAF V	B31	0	.7-.9	1.2-1.4	1.5-2	DCV
SCMB	B36	VBAT	VBAT	VBAT	VBAT	DCV
PSP V/PSP	B37	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
BPP/DBA	B40	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
TCS	B41	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
SCMC	B46	VBAT	VBAT	VBAT	VBAT	DCV
ACDS	B47	.1	VBAT	VBAT	VBAT	DCV
ACCS	B50	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
IAT	B51	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V/FTP	B52	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
SCCS	B57	5	5	5	5	DCV
TR V/TR	T9	0/PARK	0/PARK	2/OD	2/OD	DCV/MODE
TR 4	T10	0	0	VBAT	VBAT	DCV
TR 2	T18	0	0	VBAT	VBAT	DCV
HCDS	T21	0	200	750	1330	Hz
TR 1	T22	0	0	VBAT	VBAT	DCV
TFT	T23	.5-2.4/210-110	.5-2.4/210-110	.5-2.4/210-110	.5-2.4/210-110	DCV/DEG

(Continued)

4.6L Aviator

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OSS	T26	0	0	460/1250	885-1000/ 2100-2400	Hz/RPM
TSS	T27	0	360/670	630/1260	1000/2000	Hz/RPM
O2S12	T28	.1	(D)	(D)	(D)	DCV
O2S22	T29	.1	(D)	(D)	(D)	DCV
CHT	E40	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
DPFEGR	E41	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
O2S21	E44	0	switching (C)	switching (C)	switching (C)	DCV
O2S11	E45	0	switching (C)	switching (C)	switching (C)	DCV
ECT	E46	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IPS V/IPS	E49	3.15/46	2.74/39	2.88/41	2.86/40	DCV/OFF-ON
KS1	E51	0	0	0	0	DCV
KS2	E52	0	0	0	0	DCV
CID	E53	0	7-8	9-12	16	Hz
CKP	E55	0	540	730	970-1050	Hz
TPV	E57	.53-1.27	.53-1.27	1.3-1.5	1.5-1.8	DCV
LSRCM	E58	5/OFF	5/OFF	5/OFF	.9/ON	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF/ON
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	5	5	GEAR
LOAD	PID	(L)	16-23	25-30	29-34	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	630	1250	1750	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
EVAPCV	B6	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	B7	0	0	70	130	Hz
ACCR	B9	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	B11	11.3	11.8	11.8	11.8	DCV
EVAPPDC	B12	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
LFC	B19	.1	.1	.1	.1	DCV
PATSIL	B22	11.3	12.4	12.8	12.8	DCV
PATSTRT	B39	.1	.1	.1	.1	DCV

(Continued)

4.6L Aviator

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SCC	B45	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	B58	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
SS1	T1	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS2	T2	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS3	T3	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
SS4	T4	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCC	T5	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.2/100**	DCV/%
EPC	T7	**5.8**	**7.6**	**10.3**	**10.6**	DCV
EPC3	T12	**5.9**	**7.7**	**12.3**	**VBAT**	DCV
EPC2	T13	**8.2**	**9.7**	**10.3**	**11**	DCV
HTR12	T15	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	DCV/OFF-ON
HTR22	T16	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	DCV/OFF-ON
CDD (CYL2)	E1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ1	E2	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
LSRC	E3	**5/OFF**	**5/OFF**	**5/OFF**	**.9/ON**	DCV/OFF-ON
HTR11	E7	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	DCV/OFF-ON
HTR21	E8	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	DCV/OFF-ON
IAC	E9	**VBAT/0**	**7.3/70**	**7.3/70**	**5.5/90**	DCV/%
INJ5	E11	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
CDE (CYL6)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDC (CYL7)	E13	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ2	E14	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
EGRVR	E16	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
INJ6	E21	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
CDF (CYL5)	E22	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDB (CYL3)	E23	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ3	E24	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
INJ7	E29	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
CDG (CYL4)	E30	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	E31	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ4	E32	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
INJ8	E37	**0**	**3.3-3.8**	**4.5**	**5-6**	mS
CDH (CYL8)	E38	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**0**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%

(Continued)

4.6L Aviator

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SHRTFT2	PID	0	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	12-16	30	34-39	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B44	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	B32	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B20	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	22-30	18-20	%
MAF	4.8-7	17-20	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-16	32	DEG

4.6L 4V Marauder

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea- sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
VSO	68	0	0	65	125	Hz
WAC (ACCR)	69	VBAT/OFF	.1 /ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
ALTLAMP	70	.10	VBAT	VBAT	VBAT	DCV
INJ7	72	0	3.4-3.7	3.7-6	5.5-9	mS
INJ5	73	0	3.4-3.7	3.7-6	5.5-9	mS
INJ3	74	0	3.4-3.7	3.7-6	5.5-9	mS
INJ1	75	0	3.4-3.7	3.7-6	5.5-9	mS
CDC (CYL7)	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL8)	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.9/20	9.5/20	9.3/22	9.5/22	DCV/PSI
IAC	83	VBAT/0	9.2-10.3/32-36	8.3-10.7/30-55	5.7-8/40-70	DCV/%
HTR11	93	.1/ON (P)	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	SWITCH	SWITCH	SWITCH	DCV/OFF-ON
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.4-3.7	3.7-6	5.5-9	mS
INJ6	99	0	3.4-3.7	3.7-6	5.5-9	mS
INJ4	100	0	3.4-3.7	3.7-6	5.5-9	mS
INJ2	101	0	3.4-3.7	3.7-6	5.5-9	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
FUELPW1	PID	(L)	3.4-3.7	3.7-6	5.5-9	mS
FUELPW2	PID	(L)	3.4-3.7	3.7-6	5.5-9	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-20	20-35	32-38	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea- sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71/97	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

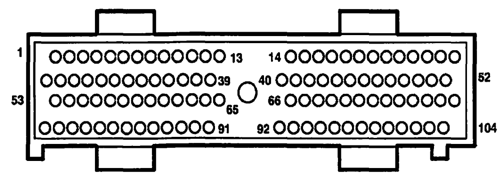
4.6L 4V Marauder

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	19-24	19-24	%
MAF	4.7-6	13-16	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	40	DEG

4.6L Town Car

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	**.1**	**.1**	**.1**	**.1**	DCV
CKP (+)	21	**0**	**440-490**	**680-700**	**870-900**	Hz
TCS	29	**.1/OFF**	**VBAT/ON (G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR1	34	**0**	**0**	**11.5**	**11.5**	DCV
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/ON-OFF
ACCS	41	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
TR2	49	**0**	**0**	**11.5**	**11.5**	DCV
TR4	50	**0**	**0**	**11.5**	**11.5**	DCV
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
O2S22	61	**0**	**(D)**	**(D)**	**(D)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
TR V/TR	64	**0/PARK**	**0/PARK**	**1.7/OD**	**1.7/OD**	DCV/MODE
DPFEGR	65	**.25-1.30**	**.25-1.30**	**.25-4.65**	**.25-4.65**	DCV
CHT V/CHT	66	**.6 or 3.7/194**	**.6 or 3.7/194**	**.6 or 3.7/194**	**.6 or 3.7/194**	DCV/DEG
OSS	84	**0**	**0**	**116/1200**	**216/2130**	Hz/RPM
CID	85	**0**	**6-7**	**9.5-10.5**	**12-14**	Hz
ACP	86	**1.1/102**	**1.1/102**	**.6-1.3/80-130**	**.6-1.3/80-130**	DCV/ PSI
02S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.6-.9**	**.9-1.3**	**1.3-2**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.2**	**1-1.4**	DCV
BPP	PID	**OFF**	**ON (E)**	**OFF**	**OFF**	OFF-ON

(Continued)

4.6L Town Car

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**12-18**	**17-23**	**24-28**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**790-815**	**1150-1250**	**1480-1600**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**VBAT/OFF**	**.1/ON**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VFC	28	**0/100**	**0/100**	**0/100**	**0/100**	%
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**10.1-10.6/ 40-47**	**.2/100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ7	72	**0**	**3.3-3.5**	**3.7-5.5**	**5.6-10**	mS
INJ5	73	**0**	**3.3-3.5**	**3.7-5.5**	**5.6-10**	mS
INJ3	74	**0**	**3.3-3.5**	**3.7-5.5**	**5.6-10**	mS
INJ1	75	**0**	**3.3-3.5**	**3.7-5.5**	**5.6-10**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.9/20**	**9.5/20**	**9.1/18**	**9.5/30**	DCV/PSI
IAC	83	**VBAT/0**	**9.2-10.7/29-36**	**8.5-9/42-47**	**6.6-8.8/52-65**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	**.1/ON (P)**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	**.2/ON (P)**	DCV/OFF-ON

(Continued)

4.6L Town Car

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HTR22	96	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ6	99	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ4	100	0	3.3-3.5	3.7-5.5	5.6-10	mS
INJ2	101	0	3.3-3.5	3.7-5.5	5.6-10	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.3-3.5	3.7-5.5	5.6-10	mS
FUELPW2	PID	(L)	3.3-3.5	3.7-5.5	5.6-10	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	18-24	33-36	32-38	DEG
TCIL	PID	OFF	OFF	OFF	OFF	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

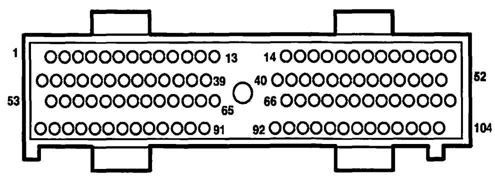
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	19-24	19-24	%
MAF	4.7-6	16-19	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	18-24	38	DEG

2.0L 4V Escape (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-500	985-1100	1450-1550	Hz
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
CHT V/CHT	38	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
PATSIN	53	VBAT	VBAT	VBAT	VBAT	DCV
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
GFS (ALTMON)	59	0	130/30	130/20	130/20	Hz/%
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTPV/FTP	62	2.6/0	2.6/0	2.6.0	2.6/0	DCV/IN-H2O
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CID	85	0	5-7	13-16	20-23	Hz
ACP V/ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
MAF V	88	0	.6-.9	1-1.7	1.2-2.5	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-2	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI (H)	PID	50	50	50	50	%

(Continued)

2.0L 4V Escape (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LOAD	PID	**(L)**	**10-20**	**19-30**	**30-48**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**700-800**	**1750-1800**	**2500-2660**	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HFC	17	**VBAT/OFF**	**.1/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSOUT	19	**10.5**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ3	20	**0**	**1.5-3**	**3.3-5.2**	**4.0-6.5**	mS
CDA (CYL1&4)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
PATSTRT	27	**0**	**0**	**0**	**0**	DCV
VSO	28	**0**	**0**	**65**	**125**	Hz
MFC	43	**VBAT**	**.1 (B)**	**VBAT**	**VBAT**	DCV
CDB (CYL2&3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV/%
FP	54	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
LFC	68	**VBAT/OFF**	**1 51/ON (B)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
WAC (ACCR)	69	**VBAT/OFF**	**1.5/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ1	70	**0**	**1.5-3**	**3.3-5.2**	**4.0-6.5**	mS
GENFDC (ALTCOM)	72	**100/60**	**0**	**0**	**0**	Hz/%
EGRVR	79	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
IAC	83	**VBAT/0**	**10.1/39**	**8.2/60**	**7.6/64**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ4	95	**0**	**1.5-3**	**3.3-5.2**	**4.0-6.5**	mS
INJ2	96	**0**	**1.5-3**	**3.3-5.2**	**4.0-6.5**	mS
HTR12	100	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**1.5-3**	**3.3-5.2**	**4.0-6.5**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**23-35**	**30-45**	**25-48**	DEG

2.0L 4V Escape (M/T)

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71/97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

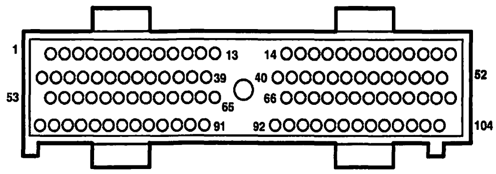
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**10-20**	**10-15**	%
MAF	**2-3**	**6-7**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SPARKADV	**23-35**	**50**	DEG

3.0L 4V Escape (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	400-450	850-1050	1050-1150	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HIGH (I)	.1/LOW	.1/LOW	DCV/ LOW-HIGH
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
ECT	38	.4-1/200-160	.4-1/200-160	.4-1/200-160	.4-1/200-160	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
TSS	59	0	45-50/700-765	90-100/ 1350-1450	110-120/ 1700-1800	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTPV/FTP	62	2.6/0	2.6/0	2.6.0	2.6/0	DCV/IN-H2O
TR V/TR	64	4.4/PARK	4.4/PARK	2.1/OD	2.1/OD	DCV/MODE
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
OSS	84	0	0	400/1450	700-740/ 2550-2700	HZ/RPM
CID	85	0	5-7	12-15	14-16	Hz
ACP V/ACP	86	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	VBAT/OPEN	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV

(Continued)

3.0L 4V Escape (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MAF V	88	0	.6-.9	.7-1.5	1.3-2	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	15-20	25-35	35-50	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	725-775	1550-1700	1800-2000	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDD (CYL4)	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
SS2	11	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	.8	.8	.8	.8	DCV
SS3	20	VBAT/OFF	VBAT/OFF	8.8/OFF	8.8/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDE (CYL5)	27	VBAT	VBAT	VBAT	VBAT	DCV
LFC	28	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MFC (M)	42	VBAT	.1 (B)	VBAT	VBAT	DCV
PATSTRT	44	0	0	0	0	DCV
HFC	46	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL2)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL6)	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
INJ5	73	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
INJ3	74	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
INJ1	75	0	2.6-3.2	2.5-5.5	3.5-8.5	mS
CDC (CYL3)	78	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

3.0L 4V Escape (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea- sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.5/0**	**8.4/0**	**9-10/25-37**	**10.3-11.2/ 42-51**	DCV/PSI
IAC	83	**VBAT/0**	**9.8-10.5/32-40**	**7.5-10/30-55**	**6-8/50-79**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ6	99	**0**	**2.6-3.2**	**2.5-5.5**	**3.5-8.5**	mS
INJ4	100	**0**	**2.6-3.2**	**2.5-5.5**	**3.5-8.5**	mS
INJ2	101	**0**	**2.6-3.2**	**2.5-5.5**	**3.5-8.5**	mS
FUELPW1	PID	**(L)**	**2.6-3.2**	**2.5-5.5**	**3.5-8.5**	mS
FUELPW2	PID	**(L)**	**2.6-3.2**	**2.5-5.5**	**3.5-8.5**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**14-20**	**36-44**	**30-40**	DEG
TCIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

Other	PCM Pin/PID only	Measured/PID Values				Units Mea- sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71/97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**27-35**	**24-29**	%
MAF	**3.5-5.3**	**11-16**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%

(Continued)

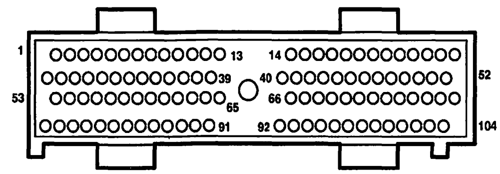
3.0L 4V Escape (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	14-20	41	DEG

2.3L Ranger (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	0	0	10.5	10.5	DCV
TSS	6	0	92/682	211/1600	290/2150	Hz/RPM
FLI V/FLI (H)	12	1.7/50	1.7/50	1.7/50	1.7/50	DCV/%
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
PATSIN	17	VBAT	VBAT	VBAT	VBAT	DCV
CKP (+)	21	0	450-500	850-1000	1220-1500	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
PSP V/PSP	31	.1/LOW	VBAT/HI (I)	.1/LOW	.1/LOW	DCV/LOW-HI
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	10.5	10.5	DCV
TR4	50	0	0	10.5	10.5	DCV
KS1	57	0	0	0	0	DCV
ISS	59	0	0	570	1150	Hz
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
MAP V	63	4.0	1.3-1.7	1-2.0	1-2.5	DCV
TR3 V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	213/1600	385/2860	Hz/RPM
CID	85	0	6-8	12-15	12-18	Hz

(Continued)

2.3L Ranger (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
MAF V	88	0	.6-1	.8-1.6	1.5-2.8	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.9	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	4	5	GEAR
LOAD	PID	(L)	10-20	16-36	35-60	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	800-950	1400-1700	1930-2150	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	12.0	12.0	12.0	12.0	DCV
CDA (CYL1&4)	26	VBAT	VBAT	VBAT	VBAT	DCV
SS1	27	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS4	28	VBAT/0	VBAT/0	VBAT/0	VBAT/0	DCV/%
PATSIL	30	10.0	12.0	12.0	12.0	DCV
PATSTRT	44	0	0	0	0	DCV
LFC	45	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DVC/OFF-ON
CTO	48	0	23-35	50-60	60-74	Hz
CDB (CYL2&3)	52	VBAT	VBAT	VBAT	VBAT	DCV
SS3	53	VBAT/OFF	VBAT/OFF	VBAT/OFF	.1/ON	DCV/OFF-ON
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/95-100	DCV/%
EVMV	56	0	0	500-900 (F)	500-900 (F)	mA
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC (ACCR)	69	VBAT/OFF	.1/ ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRMC 3	72	VBAT	VBAT	VBAT	VBAT	DCV
EGRMC 1	73	VBAT	1.0	VBAT	VBAT	DCV
INJ3	74	0	3-4.5	4-10	7-15	mS
INJ1	75	0	3-4.5	4-10	7-15	mS

(Continued)

2.3L Ranger (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCIL	79	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**9/35**	**10/35**	**10.7/42**	**10.7/42**	DCV/PSI
CFCIL	82	**12.0/OFF**	**12.0/OFF**	**12.0/OFF**	**12.0/OFF**	DCV/OFF-ON
IAC	83	**VBAT/0**	**10/38**	**6-7/50-60**	**5-6/60-70**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
EGRMC 4	98	**VBAT**	**1.0**	**1.0 - VBAT**	**1.0 - VBAT**	DCV
EGRMC 2	99	**VBAT**	**VBAT**	**1.0 - VBAT**	**1.0 - VBAT**	DCV
INJ4	100	**0**	**3-4.5**	**4-10**	**7-15**	mS
INJ2	101	**0**	**3-4.5**	**4-10**	**7-15**	mS
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
EGRMDSD	PID	**60**	**3**	**3-31**	**3-42**	STEPS
FUELPW1	PID	**(L)**	**3-4.5**	**4-10**	**7-15**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**7-10**	**25-35**	**15-30**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71/97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

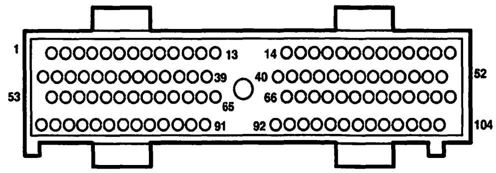
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**30-35**	**15-20**	%
MAF	**2.7-3.5**	**7-9**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SPARKADV	**2-5**	**29-35**	DEG

2.3L Ranger (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI V/FLI (H)	12	**1.7/50**	**1.7/50**	**1.7/50**	**1.7/50**	DCV/%
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
PATSIN	17	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CKP (+)	21	**0**	**450-500**	**850-1000**	**1220-1500**	Hz
PSP V/PSP	31	**.1/LOW**	**VBAT/HI (I)**	**.1/LOW**	**.1/LOW**	DCV/LOW-HI
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
KS1	57	**0**	**0**	**0**	**0**	DCV
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
MAP V	63	**4.0**	**1.3-1.7**	**1-2.0**	**1-2.5**	DCV
CPP/PNP	64	**5/OFF**	**.1/ON (J)**	**5/OFF**	**5/OFF**	DCV/MODE
CHT V/CHT	66	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	DCV/DEG
OSS	84	**0**	**0**	**326/1600**	**550/3000**	Hz/RPM
CID	85	**0**	**6-8**	**12-15**	**12-19**	Hz
ACP	86	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	DCV/OPEN-CLOSED
MAF V	88	**0**	**.6-1**	**.8-1.6**	**1.5-2.8**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.3**	**1.1-1.9**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
ECT	PID	**160-200**	**160-200**	**160-200**	**160-200**	DEG
LOAD	PID	**(L)**	**10-20**	**16-36**	**35-60**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

(Continued)

2.3L Ranger (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	800-950	1400-1700	1930-2150	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	2	.1/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
PATSOUT	18	12.0	12.0	12.0	12.0	DCV
CDA (CYL1&4)	26	VBAT	VBAT	VBAT	VBAT	DCV
PATSIL	30	10.0	12.0	12.0	12.0	DCV
PATSTRT	44	0	0	0	0	DCV
LFC	45	VBAT/OFF	.1/ON (B)	VBAT/OFF	VBAT/OFF	DVC/OFF-ON
CTO	48	0	23-35	50-60	60-74	Hz
CDB (CYL2&3)	52	VBAT	VBAT	VBAT	VBAT	DCV
EVMV	56	0	0	500-900 (F)	500-900 (F)	mA
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC (ACCR)	69	VBAT/OFF	.1/ ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRMC 3	72	VBAT	VBAT	VBAT	VBAT	DCV
EGRMC 1	73	VBAT	1.0	VBAT	VBAT	DCV
INJ3	74	0	3-4.5	4-10	7-15	mS
INJ1	75	0	3-4.5	4-10	7-15	mS
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
CFCIL	82	12.0/OFF	12.0/OFF	12.0/OFF	12.0/OFF	DCV/OFF-ON
IAC	83	VBAT/0	10/38	6-7/50-60	5-6/60-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
EGRMC 4	98	VBAT	1.0	1.0 - VBAT	1.0 - VBAT	DCV
EGRMC 2	99	VBAT	VBAT	1.0 - VBAT	1.0 - VBAT	DCV
INJ4	100	0	3-4.5	4-10	7-15	mS
INJ2	101	0	3-4.5	4-10	7-15	mS
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
EGRMDSD	PID	60	3	3-31	3-42	STEPS
FUELPW1	PID	(L)	3-4.5	4-10	7-15	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	7-10	25-35	15-30	DEG

2.3L Ranger (M/T)

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71/97	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

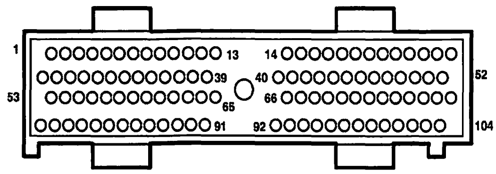
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**30-35**	**15-20**	%
MAF	**2.7-3.5**	**7-9**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SPARKADV	**2-5**	**29-35**	DEG

3.0L Ranger (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TR1	3	**0**	**0**	**11.5**	**11.5**	DCV
TSS	6	**0**	**115-120/ 870-920**	**140-190/ 1000-1400**	**268-275/ 2010-2080**	Hz/MPH
FLI V/FLI (H)	12	**1.7/50**	**1.7/50**	**1.7/50**	**1.7/50**	DCV/%
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
4X4L (M)	14	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIN	17	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CKP (+)	21	**0**	**460-480**	**800-855**	**1180-1230**	Hz
TCS	29	**.1/OFF**	**VBAT/ON (G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
ECT	38	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	**.4-1/200-160**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR2	49	**0**	**0**	**11.5**	**11.5**	DCV
TR4	50	**0**	**0**	**11.5**	**11.5**	DCV
KS1	57	**0**	**0**	**0**	**0**	DCV
ISS	59	**0**	**623**	**1480**	**1980**	Hz
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
TRV/TR	64	**0/PARK**	**0/PARK**	**1.7/OD**	**1.7/OD**	DCV/MODE
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
OSS	84	**0**	**0**	**290/1435**	**530/2640**	Hz/RPM
CID	85	**0**	**6-8**	**13-15**	**17-19**	Hz

(Continued)

3.0L Ranger (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACP V/ACP	86	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	DCV/OPEN-CLOSED
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.8-1.1**	**1.4-1.7**	**2-2.5**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.2**	**1.2-1.7**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**17-21**	**23-27**	**35-40**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**880-920**	**1430-1550**	**1750-2100**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	1	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
MIL	2	**.1/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSOUT	18	**1.1**	**1.1**	**1.1**	**1.1**	DCV
CDA (CYL1&5)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	27	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS4	28	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
PATSIL	30	**0**	**0**	**0**	**0**	DCV
PATSTRT	44	**0**	**0**	**0**	**0**	DCV
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**42-48**	**70-90**	**99-115**	Hz
CDB (CYL3&4)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS3	53	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCC	54	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.2-.3/80-100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ5	73	**0**	**4-4.8**	**6.3-8**	**7-13**	mS
INJ3	74	**0**	**4-4.8**	**6.3-8**	**7-13**	mS

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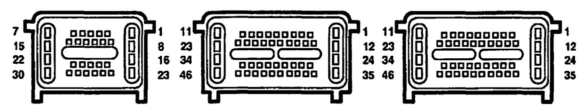
4.6L Expedition



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FTP V/FTP	B8	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
IAT	B19	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	B20	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
TCS	B22	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
MAF V	B31	0	.6-.9	.9-1.5	1.2-2.3	DCV
FEPS	B39	.5-.6	.5-.6	.5-.6	.5-.6	DCV
ACCS	B41	.1/OFF	VBAT/ON	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	E26	0	switching (C)	switching (C)	switching (C)	DCV
O2S21	E27	0	switching (C)	switching (C)	switching (C)	DCV
KS	E29	0	0	0	0	DCV
CKP (+)	E30	0	390-430	600-700	850-1050	Hz
CID	E31	0	5-7	10-12	12-14	Hz
DPFEGR	E33	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
TP V	E44	.53-1.27	.53-1.27	1-1.3	1.1-1.6	DCV
CHT V/CHT	E45	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
O2S22	T2	0	(D)	(D)	(D)	DCV
O2S12	T3	0	(D)	(D)	(D)	DCV
TR V/TR	T17	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR2	T18	0	0	11.1	11.1	DCV
TR4	T19	0	0	11.1	11.1	DCV
TR1	T20	0	0	11.1	11.1	DCV
OSS	T25	0	0	120/1200	215/2150	Hz/RPM
TFT	T28	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG

(Continued)

4.6L Expedition

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**14-16**	**19-25**	**35-43**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**700-760**	**1270-1370**	**1590-1675**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
WAC	B2	**VBAT/OFF**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
VSO	B13	**0**	**0**	**65**	**125**	Hz
FP	B27	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EVAPCV	B36	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
EVAPPDC	B38	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	DCV/%
CDD (CYL2)	E1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	E2	**VBAT/0**	**10/37**	**8-9/50-60**	**5-7.5/65-80**	DCV/%
INJ5	E3	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ6	E4	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ7	E5	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ8	E6	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ3	E7	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ4	E8	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
CDH (CYL8)	E11	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDC (CYL7)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMTV	E13	**VBAT/0**	**VBAT/0**	**VBAT/0**	**VBAT/0**	DCV/%
INJ1	E14	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ2	E15	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
HTR21	E20	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR11	E21	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
EGRVR	E22	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDG (CYL4)	E23	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDB (CYL3)	E24	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	E34	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	E35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDE (CYL6)	E46	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	T11	**.2/90-100**	**VBAT/0**	**VBAT/0**	**.2/90-100**	DCV/%

(Continued)

4.6L Expedition

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS1	T12	.1/ON	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
SS2	T13	VBAT/OFF	VBAT/OFF	.1/ON	.1/ON	DCV/OFF-ON
HTR12	T21	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
EPC	T23	7.7/5	8.7/5	10/40	10/40	DCV/PSI
HTR22	T29	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3-5	4.1-6.9	6.5-12	mS
FUELPW2	PID	(L)	3-5	4.1-6.9	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	15-22	27-35	28-37	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B40	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	B34	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B45	5	5	5	5	DCV

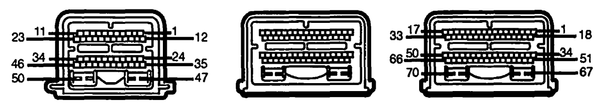
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	27-35	20-27	%
MAF	4.8-6	18.1-22	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-22	38	DEG

4.6L F-150

190 PIN PCM



T TRANSMISSION B BODY/COWL E ENGINE

A0080040

Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACCS	B19	VBAT	VBAT	VBAT	BATT	DCV
APP1	B25	4.0	4.0	3.4-4.0	2.9-4.0	DCV
APP2	B26	1.5	1.5	1.5-1.9	1.5-2.4	DCV
APP3	B27	.9	.9	.9-1.3	.9-1.8	DCV
4WDMCS	B32	8.8 (2HIGH)	9.6 (4LOW)	6.6(4HIGH)	9.5 (2HIGH)	DCV
MAF V	B41	0	.9	1.2-1.5	1.9-2.3	DCV
IAT	B43	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V	B44	2.6	2.6	2.6	2.6	DCV
TCS	B45	.01/OFF	VBAT/ON(G)	.01/OFF	.01/OFF	DCV/OFF-ON
BPP	B46	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
BPS	B47	VBAT/OFF	.1/ON(E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FEPS	B55	.1	.1	.1	.1	DCV
SCCS	B56	4.7	0-4.3 OFF-ON (Q)	4.7	4.7	DCV
OSS	T14	0	0	445-505/ 1400-1500	810-960/ 2660	Hz/RPM
TR1	T17	0	0	VBAT	VBAT	DCV
TR2	T18	0	0	VBAT	VBAT	DCV
TR3	T19	0	0	1.7	1.7	DCV
TFT	T20	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
O2S22	T21	(L)	switching (D)	switching (D)	switching (D)	DCV
O2S12	T22	(L)	switching (D)	switching (D)	switching (D)	DCV
TR4	T32	0	0	VBAT	VBAT	DCV
DPFEGR	E21	.25-1.30	.25-1.30	.25-4.65	.25-4.65 DCV	DCV

(Continued)

4.6L F-150

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
PSPT	E24	.5	3.75 (I)	.5	.5	DCV
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV
FRP V/FRP	E32	3.4/50	2.8/40	2.8/40	2.8/40	DCV/PSI
CHT V/CHT	E41	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
CMP1	E45	0	0-6 (W)	10-12	12-14	Hz
CKP	E47	0	350-370	675	900	Hz
KS1	E49	2.2	2.2	2.3	2.4	DCV
TP2	E60	1.2	.8	1.1	1.2	DCV
TP1	E61	4.1	4.4	4.1	4.0	DCV
4X4L (M)	PID	OFF	ON (4LOW)	OFF	OFF	OFF-ON
ACCS	PID	OFF	OFF	ON (A)	OFF	OFF-ON
LOAD	PID	(L)	15-18	16-25	30-50	%
GEAR	PID	1	1	4	4	GEAR
RPM	PID	0	580-620	1100-1200	1500-1600	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
4WDIWE	B16	0 (2HIGH)	0 (2HIGH)	VBAT (4H OR 4L)	VBAT (4H OR 4L)	DCV
ACCR	B18	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
GENFDC (ALTCOM)	B22	125	0-100/0-100 (R)	0	0	Hz/%
EVAPCV	B61	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
FPC	B62	8.8/75	2.4/27	2.5/27	2.7/29	DCV/%
HTR12	T1	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR22	T12	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
TCCH	T36	VBAT/0	VBAT/0	VBAT/0	.3/100	DCV/%
SS2	T37	VBAT/OFF	VBAT/OFF	.19/ON	VBAT/OFF	DCV/OFF-ON
SS1	T38	.1/ON	.1/ON	.1/ON	VBAT/OFF	DCV/OFF-ON
EPC1	T39	6.8	9.2	9.4	9.25	DCV
CDH (CYL8)	E9	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	E10	VBAT	VBAT	VBAT	VBAT	DCV
CDD (CYL2)	E11	VBAT	VBAT	VBAT	VBAT	DCV
CDB (CYL3)	E12	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

4.6L F-150

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDG (CYL4)	E14	VBAT	VBAT	VBAT	VBAT	DCV
CDE (CYL6)	E15	VBAT	VBAT	VBAT	VBAT	DCV
CDC (CYL7)	E16	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL1)	E17	VBAT	VBAT	VBAT	VBAT	DCV
TACMP	E34	3.8	VBAT	VBAT	VBAT	DCV
INJ2	E35	(L)	2.7	5.2	8.2	mS
INJ4	E36	(L)	2.7	5.2	8.2	mS
INJ6	E37	(L)	2.7	5.2	8.2	mS
INJ8	E38	(L)	2.7	5.2	8.2	mS
TACMN	E51	3.8	VBAT	VBAT	VBAT	DCV
INJ1	E52	(L)	2.7	5.2	8.2	mS
INJ3	E53	(L)	2.7	5.2	8.2	mS
INJ5	E54	(L)	2.7	5.2	8.2	mS
INJ7	E55	(L)	2.7	52	8.2	mS
EGRVR	E63	VBAT\0	VBAT\0	(V)	(V)	DCV/%
IMTV1	E64	VBAT	VBAT	VBAT	VBAT	DCV
EVMV	E65	0	0	500-900 (F)	500-900 (F)	mA
HTR11	E69	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	E70	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
LONGFT1	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%
LONGFT2	PID	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	(-)20 - (+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SHRTFT2	PID	(L)	(-)10 - (+)10	(-)10 - (+)10	(-)10 - (+)10	%
SPARKADV	PID	0	12-17	34	32-40	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B54	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	B51/B52/B53	VBAT	VBAT	VBAT	VBAT	DCV
BVREF	B29/E57	5	5	5	5	DCV
ETCVREF	B21/B28/E66	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

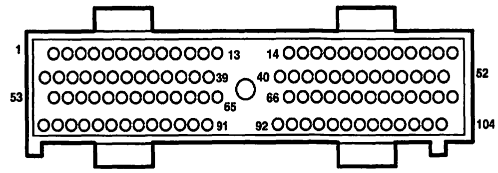
4.6L F-150

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	21-27	20-25	%
MAF	3-4.8	12-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-17	35-40	DEG

4.6L E/F-Series Heritage (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCSS (M)	4	**0**	**0**	**240-265**	**471**	Hz
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
4X4L (M)	14	**7/OFF**	**7.7/OFF**	**7.7/OFF**	**7.7/OFF**	DCV/OFF-ON
CKP (+)	21	**0**	**390-430**	**600-700**	**850-1050**	Hz
TCS	29	**.1/OFF**	**VBAT/ON (G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR1	34	**0**	**0**	**11.1**	**11.1**	DCV
O2S12	35	**.1**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR2	49	**0**	**0**	**11.1**	**11.1**	DCV
TR4	50	**0**	**0**	**11.1**	**11.1**	DCV
KS1	57	**0**	**0**	**0**	**0**	DCV
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
O2S22	61	**.1**	**(D)**	**(D)**	**(D)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
TR V/TR	64	**0/PARK**	**0/PARK**	**1.7/OD**	**1.7/OD**	DCV/MODE
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
CHT V/CHT	66	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	**.67 or 3.7/194**	DCV/DEG
OSS	84	**0**	**0**	**120/1200**	**215/2150**	Hz/RPM
CID	85	**0**	**5-7**	**10-12**	**12-14**	Hz
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.6-.9**	**.9-1.5**	**1.2-2.3**	DCV

(Continued)

4.6L E/F-Series Heritage (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TP V	89	**.53-1.27**	**.53-1.27**	**1-1.3**	**1.1-1.6**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
ECT	PID	**160-200**	**160-200**	**160-200**	**160-200**	DEG
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**15-23**	**20-30**	**40-50**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**680-830**	**1000-1100**	**1500-1600**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMTV	46	**VBAT/0**	**VBAT/0**	**VBAT/0**	**VBAT/0**	DCV/%
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO (E-Series)	48	**0**	**35-49**	**65-90**	**90-120**	Hz
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**VBAT/0**	**.2/90-100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ7	72	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ5	73	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ3	74	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ1	75	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV

(Continued)

4.6L E/F-Series Heritage (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.7/5**	**8.7/5**	**10/40**	**10/40**	DCV/PSI
IAC	83	**VBAT/0**	**10/37**	**8-9/50-60**	**5-7.5/65-80**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ6	99	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ4	100	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ2	101	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
FUELPW2	PID	**(L)**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**14-19**	**15-35**	**20-39**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**23-34**	**15-20**	%
MAF	**4-5.1**	**15-24**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%

(Continued)

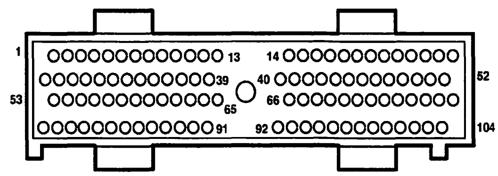
4.6L E/F-Series Heritage (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	19-23	44	DEG

4.6L F-Series Heritage (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCSS (M)	4	0	0	240-265	471	Hz
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
4x4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	390-425	600-700	850-1050	Hz
O2S12	35	.1	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	120-131/ 1200-1310	230-255/ 2300-2550	Hz/RPM
CID	85	0	5-7	10-12	13-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.9	.7-1	1.2-2.3	DCV
TP V	89	.53-1.27	.53-1.27	1-1.3	1.1-1.6	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
FLI (H)	PID	50	50	50	50	%

(Continued)

4.6L F-Series Heritage (M/T)

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
LOAD	PID	**(L)**	**18-23**	**20-30**	**35-45**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**680-830**	**1190-1500**	**1500-1700**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMTV	46	**VBAT/0**	**VBAT/0**	**VBAT/0**	**VBAT/0**	DCV/%
EGRVR	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ7	72	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ5	73	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ3	74	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ1	75	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
IAC	83	**VBAT/0**	**10-11/25-32**	**7.5-10/30-55**	**7-8.2/55-75**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ6	99	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ4	100	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
INJ2	101	**0**	**2.7-4.1**	**4.5-8**	**5.5-11**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON

(Continued)

4.6L F-Series Heritage (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FUELPW1	PID	(L)	2.7-4.1	4.5-8	5.5-11	mS
FUELPW2	PID	(L)	2.7-4.1	4.5-8	5.5-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	19-24	15-35	20-39	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

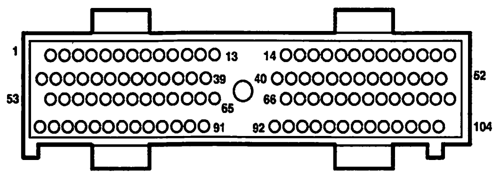
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	23-34	15-20	%
MAF	4-5.1	15-24	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	19-24	44	DEG

5.4L E-Series (4R75W)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO (M)	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	410	600-800	900-1125	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF (G)	.1/OFF (G)	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR (M)	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	120/1200	228/2280	Hz/RPM
CID	85	0	5-8	9-12	13-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON

(Continued)

5.4L E-Series (4R75W)

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
FLI V/FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**0**	**15**	**21-28**	**30-38**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**720**	**1000-1150**	**1580-1680**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Mea-sured/PID
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EGRVR (M)	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO (M)	48	**0**	**46**	**67**	**107**	Hz
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**VBAT/0**	**.3/90-100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
INJ7	72	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ5	73	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ3	74	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ1	75	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7/5**	**8.3/5**	**9.6/45**	**9.6/45**	DCV/PSI
IAC	83	**VBAT/0**	**8.7/43**	**5.5/70**	**2.5-4.5/ 70-90**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON

(Continued)

5.4L E-Series (4R75W)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HTR12 (M)	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ6	99	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ4	100	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ2	101	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
FUELPW2	PID	**(L)**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**16-20**	**29**	**32-36**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

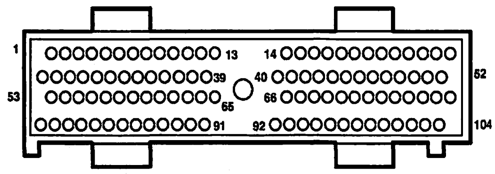
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**22-27**	**20-25**	%
MAF	**4.8-6**	**18.1-21**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**16-20**	**38**	DEG

5.4L E-Series (4R100)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	360-380	700-800	900-1100	Hz
TCS	29	.1/OFF	VBAT/ON(G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
TSS	59	0	325/610	740/925	0/1660	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR (M)	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	130/1320	240/2385	Hz/RPM
CID	85	0	5-8	10-12	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	.9-1.6	DCV

(Continued)

5.4L E-Series (4R100)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
FLI V/FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**0**	**15-20**	**21-30**	**30-45**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**630-700**	**1100-1200**	**1150-1400**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CCS	20	**.1/OFF**	**.1/OFF**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EGRVR (M)	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO (M)	48	**0**	**41-44**	**80-90**	**113**	Hz
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**VBAT/0**	**.2/100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
VSO	68	**0**	**0**	**65**	**125**	Hz
INJ7	72	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ5	73	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ3	74	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ1	75	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**8/0**	**9.5/0**	**10.5/40**	**10.5/40**	DCV/PSI
IAC	83	**VBAT/0**	**11.7/25**	**8.5-10.9/30-55**	**6-8/50-70**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON

(Continued)

5.4L E-Series (4R100)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12 (M)	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ6	99	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ4	100	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ2	101	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.2-4.2**	**4-8**	**8-16**	mS
FUELPW2	PID	**(L)**	**3.2-4.2**	**4-8**	**8-16**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**20-25**	**25-32**	**20-37**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

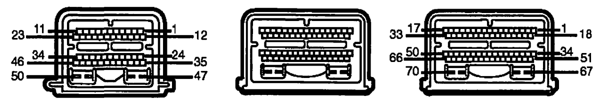
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**15-20**	**20-25**	%
MAF	**4.8-6**	**18.1-21**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	**20-25**	**42**	DEG

5.4L 3V F-150

190 PIN PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
ACCS	B19	VBAT	VBAT	VBAT	BATT	DCV
APP1	B25	4.0	4.0	3.4-4.0	2.9-4.0	DCV
APP2	B26	1.5	1.5	1.5-1.9	1.5-2.4	DCV
APP3	B27	.9	.9	.9-1.3	.9-1.8	DCV
4WDMCS	B32	9.5 (2HIGH)	4.5 (4LOW)	6.6(4HIGH)	9.5 (2HIGH)	DCV
MAF V	B41	0	.7	1.2-1.5	1.9-2.3	DCV
IAT	B43	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FTP V	B44	2.6	2.6	2.6	2.6	DCV
TCS	B45	.01/OFF	VBAT/ON(G)	.01/OFF	.01/OFF	DCV/OFF-ON
BPP	B46	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
BPS	B47	VBAT/OFF	.1/ON(E)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FEPS	B55	.1	.1	.1	.1	DCV
SCCS	B56	4.7	0-4.3 OFF-ON (Q)	4.7	4.7	DCV
OSS	T14	0	0	445-505/ 1400-1500	810-960/ 2660	Hz/RPM
TR1	T17	0	0	VBAT	VBAT	DCV
TR2	T18	0	0	VBAT	VBAT	DCV
TR3	T19	0	0	1.7	1.7	DCV
TFT	T20	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
O2S22	T21	(L)	switching (D)	switching (D)	switching (D)	DCV
O2S12	T22	(L)	switching (D)	switching (D)	switching (D)	DCV
TR4	T32	0	0	VBAT	VBAT	DCV
PSPT	E24	.5	3.75 (I)	.8	.8	DCV
EOT	E27	.5-2.5/210-95	.5-2.5/210-95	.5-2.5/210-95	.5-2.5/210-110	DCV/DEG

(Continued)

5.4L 3V F-150

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
O2S21	E28	(L)	switching (C)	switching (C)	switching (C)	DCV
O2S11	E29	(L)	switching (C)	switching (C)	switching (C)	DCV
KS2	E31	2.2	2.2	2.3	2.4	DCV
FRP V/FRP	E32	3.4/50	2.8/40	2.8/40	2.8/40	DCV/PSI
CHT V/CHT	E41	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
IMTV\CMCVM	E43	11.67	13.0	13.0	13.0	DCV
CMP2	E44	0	24-26	47	63-65	Hz
CMP1	E45	0	24-26	47	63-65	Hz
CKP	E47	0	345-355	675	900	Hz
KS1	E49	2.2	2.2	2.3	2.4	DCV
TP2	E60	1.2	.8	1.1	1.2	DCV
TP1	E61	4.1	4.4	4.1	4.0	DCV
4X4L (M)	PID	OFF	ON (4LOW)	OFF	OFF	OFF-ON
ACCS	PID	OFF	OFF	ON (A)	OFF	OFF-ON
LOAD	PID	(L)	15-17	16-25	30-50	%
GEAR	PID	1	1	4	4	GEAR
RPM	PID	0	580-620	1100-1200	1500-1600	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
4WDIWE	B16	0 (2HIGH)	0 (2HIGH)	VBAT (4H OR 4L)	VBAT (4H OR 4L)	DCV
ACCR	B18	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
GENFDC (ALTCOM)	B22	125	0-100/0-100 (R)	0	0	Hz/%
EVAPCV	B61	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
FPC	B62	8.8/75	2.4/27	2.5/27	2.7/29	DCV/%
HTR12	T1	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR22	T12	VBAT/OFF (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
TCCH	T36	VBAT/0	VBAT/0	VBAT/0	.3/100	DCV/%
SS2	T37	VBAT/OFF	VBAT/OFF	.19/ON	VBAT/OFF	DCV/OFF-ON
SS1	T38	.1/ON	.1/ON	.1/ON	VBAT/OFF	DCV/OFF-ON
EPC1	T39	7.25	8.8	9.4	9.25	DCV
CDH (CYL8)	E9	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	E10	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

5.4L 3V F-150

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDD (CYL2)	E11	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDB (CYL3)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	E14	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDE (CYL6)	E15	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDC (CYL7)	E16	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	E17	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TACMP	E34	**3.8**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ2	E35	**(L)**	**3.6**	**5.2**	**8.2**	mS
INJ4	E36	**(L)**	**3.6**	**5.2**	**8.2**	mS
INJ6	E37	**(L)**	**3.6**	**5.2**	**8.2**	mS
INJ8	E38	**(L)**	**3.6**	**5.2**	**8.2**	mS
IMTV1\CMCV	E50	**0**	**0**	**0**	**VBAT**	DCV
TACMN	E51	**3.8**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ1	E52	**(L)**	**3.6**	**5.2**	**8.2**	mS
INJ3	E53	**(L)**	**3.6**	**5.2**	**8.2**	mS
INJ5	E54	**(L)**	**3.6**	**5.2**	**8.2**	mS
INJ7	E55	**(L)**	**3.6**	**52**	**8.2**	mS
EVMV	E65	**0**	**0**	**500-900 (F)**	**500-900 (F)**	mA
VCT1	E67	**VBAT**	**VBAT**	**7.5-VBAT**	**7.5-VBAT**	DCV
VCT2	E68	**VBAT**	**VBAT**	**7.5-VBAT**	**7.5-VBAT**	DCV
HTR11	E69	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	E70	**VBAT/OFF (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
LONGFT1	PID	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	%
LONGFT2	PID	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	**(-)20 - (+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10 - (+)10**	**(-)10 - (+)10**	**(-)10 - (+)10**	%
SHRTFT2	PID	**(L)**	**(-)10 - (+)10**	**(-)10 - (+)10**	**(-)10 - (+)10**	%
SPARKADV	PID	**0**	**12-17**	**34**	**32-40**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B54	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B51/B52/B53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
BVREF	B29/E57	**5**	**5**	**5**	**5**	DCV
ETCVREF	B21/B28/E66	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

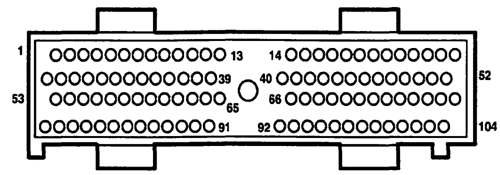
5.4L 3V F-150

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	21-27	20-25	%
MAF	3-4.8	12-18	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	12-17	35-40	DEG

5.4L F-Series Heritage (4R100)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TCSS (M)	4	**0**	**0**	**265**	**471**	Hz
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
4X4L (M)	14	**7/OFF**	**7.7/OFF**	**7.7/OFF**	**7.7/OFF**	DCV/OFF-ON
CKP (+)	21	**0**	**411**	**750-800**	**950-1000**	Hz
TCS	29	**.1/OFF**	**VBAT/ON (G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR1	34	**0**	**0**	**11.5**	**11.5**	DCV
O2S12	35	**0**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR2	49	**0**	**0**	**11.5**	**11.5**	DCV
TR4	50	**0**	**0**	**11.5**	**11.5**	DCV
KS	57	**0**	**0**	**0**	**0**	DCV
ACP V/ACP	58	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	**.1/CLOSED**	DCV/OPEN-CLOSED
TSS	59	**0**	**300/660**	**685/1350**	**0/1672**	Hz/RPM
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
O2S22	61	**0**	**(D)**	**(D)**	**(D)**	DCV
FTP V/FTP	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
TR V/TR	64	**0/PARK**	**0/PARK**	**1.7/OD**	**1.7/OD**	DCV/MODE
DPFEGR	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
CHT V/CHT	66	**.6 or 3.7/194**	**.6 or 3.7/194**	**.6 or 3.7/194**	**.6 or 3.7/194**	DCV/DEG
OSS	84	**0**	**0**	**385/1250**	**685/2300**	Hz/RPM
CID	85	**0**	**6-8**	**10-12**	**13-16**	Hz

(Continued)

5.4L F-Series Heritage (4R100)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1-1.4	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG
FLI (H)	PID	50	50	50	50	%
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	14-16	19-25	35-43	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	700-760	1270-1370	1590-1675	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	27	VBAT	VBAT	VBAT	VBAT	DCV
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CDB (CYL3)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL4)	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.2/90-100	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	69	125	Hz
WAC	69	VBAT/OFF	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CFCIL	70	0/OFF	0/OFF	0/OFF	0/OFF	DCV/OFF-ON
INJ7	72	0	3-5	4.1-6.9	6.5-12	mS
INJ5	73	0	3-5	4.1-6.9	6.5-12	mS
INJ3	74	0	3-5	4.1-6.9	6.5-12	mS
INJ1	75	0	3-5	4.1-6.9	6.5-12	mS

(Continued)

5.4L F-Series Heritage (4R100)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.5/5**	**9.1/5**	**9/5**	**9.1/5-15**	DCV/PSI
IAC	83	**VBAT/0**	**10.2-11/30-34**	**9-10.8/43-55**	**7-9/58-70**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ8	98	**0**	**3-5**	**4.1-6.9**	**6.5-12**	mS
INJ6	99	**0**	**3-5**	**4.1-6.9**	**6.5-12**	mS
INJ4	100	**0**	**3-5**	**4.1-6.9**	**6.5-12**	mS
INJ2	101	**0**	**3-5**	**4.1-6.9**	**6.5-12**	mS
CDD(CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3-5**	**4.1-6.9**	**6.5-12**	mS
FUELPW2	PID	**(L)**	**3-5**	**4.1-6.9**	**6.5-12**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-22**	**27-35**	**28-37**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**27-35**	**20-27**	%
MAF	**4.8-6**	**18.1-22**	G/S

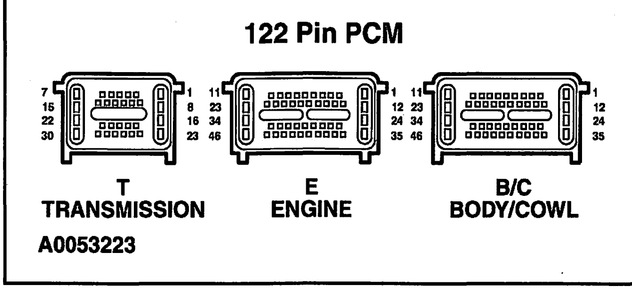
(Continued)

5.4L F-Series Heritage (4R100)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-22	38	DEG

5.4L Expedition (A/T)



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FTP V/FTP	E8	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
IAT	B19	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	B20	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
TCS	B22	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
MAF V	B31	0	.7-.9	1-1.6	1.7-2.4	DCV
FEPS	B39	.5-.6	.5-.6	.5-.6	.5-.6	DCV
ACCS	B41	.1/OFF	VBAT/ON	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	E26	0	switching (C)	switching (C)	switching (C)	DCV
O2S21	E27	0	switching (C)	switching (C)	switching (C)	DCV
KS	E29	0	0	0	0	DCV
CKP (+)	E30	0	350	650-700	875-925	Hz
CID	E31	0	5-7	10-12	12-15	Hz
DPFEGR	E33	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
TP V	E44	.53-1.27	.53-1.27	.8-1.2	1-1.4	DCV
CHT V/CHT	E45	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
O2S22	T2	0	(D)	(D)	(D)	DCV
O2S12	T3	0	(D)	(D)	(D)	DCV
TR V/TR	T17	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
TR2	T18	0	0	11.5	11.5	DCV
TR4	T19	0	0	11.5	11.5	DCV
TR1	T20	0	0	11.5	11.5	DCV
OSS	T25	0	0	385/1250	685/2300	Hz/RPM
TFT	T28	.5-2.5/210-110	.5-2.5/210-110	.5-2.5/210-110	.5-2.5/210-110	DCV/DEG
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
ECT	PID	160-200	160-200	160-200	160-200	DEG

(Continued)

5.4L Expedition (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**14-17**	**29-35**	**35-43**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**600-650**	**950-1100**	**1500-1600**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
WAC	B2	**VBAT/OFF**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
VSO	B13	**0**	**0**	**65**	**117**	Hz
FP	B27	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EVAPCV	B36	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
EVAPPDC	B38	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	DCV/%
CDD (CYL2)	E1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	E2	**VBAT/0**	**10.2-11.5/28-34**	**8-10.8/43-60**	**6-8/60-70**	DCV/%
INJ5	E3	**0**	**3-5**	**4.1-6.9**	**6.5-12**	mS
INJ6	E4	**0**	**3-5**	**5.5-7.8**	**6.5-12**	mS
INJ7	E5	**0**	**3-5**	**5.5-7.8**	**6.5-12**	mS
INJ8	E6	**0**	**3-5**	**5.5-7.8**	**6.5-12**	mS
INJ3	E7	**0**	**3-5**	**5.5-7.8**	**6.5-12**	mS
INJ4	E8	**0**	**3-5**	**5.5-7.8**	**6.5-12**	mS
CDH (CYL8)	E11	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDC (CYL7)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ1	E14	**0**	**3-5**	**5.5-7.8**	**6.5-12**	mS
INJ2	E15	**0**	**3-5**	**5.5-7.8**	**6.5-12**	mS
HTR21	E20	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR11	E21	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
EGRVR	E22	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDG (CYL4)	E23	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDB (CYL3)	E24	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	E34	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	E35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDE (CYL6)	E46	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	T11	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.2/90-100**	DCV/%
SS1	T12	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON

(Continued)

5.4L Expedition (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
SS2	T13	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
CCS	T14	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	T21	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
EPC	T23	**7.5/5**	**9.1/5**	**10.5/5-15**	**10.3/5-15**	DCV/PSI
HTR22	T29	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3-5**	**6-8.9**	**6.5-12.9**	mS
FUELPW2	PID	**(L)**	**3-5**	**6-8.9**	**6.5-12.9**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-22**	**27-35**	**28-37**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B40	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	B34	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	B45	**5**	**5**	**5**	**5**	DCV

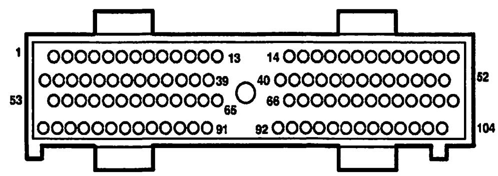
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**27-35**	**20-27**	%
MAF	**4.8-6**	**18.1-22**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**15-22**	**38**	DEG

5.4L F-250/F-350-Series (4R100)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	360-380	700-800	900-1100	Hz
TCS	29	.1/OFF	VBAT/ON(G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
TSS	59	0	325/610	740/925	0/1660	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	130/1320	240/2385	Hz/RPM
CID	85	0	5-8	10-12	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV

(Continued)

5.4L F-250/F-350-Series (4R100)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.2**	**.9-1.6**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
4X4L (M)	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**0**	**15-20**	**21-30**	**30-45**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**630-700**	**1100-1200**	**1150-1400**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**.1/ON**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CCS	20	**.1/OFF**	**.1/OFF**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EGRVR (M)	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO (M)	48	**0**	**41-44**	**80-90**	**113**	Hz
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**.2/100**	**VBAT/0**	**VBAT/0**	**.2/100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV (M)	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
WAC	69	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
INJ7	72	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ5	73	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ3	74	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
INJ1	75	**0**	**3.2-4.2**	**4-8**	**8-16**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**8/0**	**9.5/0**	**10.5/40**	**10.5/40**	DCV/PSI

(Continued)

5.4L F-250/F-350-Series (4R100)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
IAC	83	VBAT/0	11.7/25	8.5-10.9/30-55	6-8/50-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-4.2	4-8	8-16	mS
INJ6	99	0	3.2-4.2	4-8	8-16	mS
INJ4	100	0	3.2-4.2	4-8	8-16	mS
INJ2	101	0	3.2-4.2	4-8	8-16	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.2-4.2	4-8	8-16	mS
FUELPW2	PID	(L)	3.2-4.2	4-8	8-16	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	20-25	25-32	20-37	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

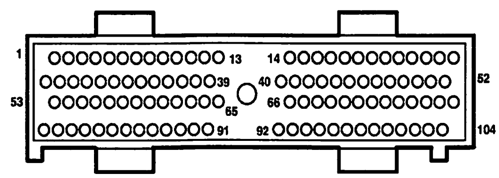
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	15-20	20-25	%
MAF	4.8-6	18.1-21	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	20-25	42	DEG

5.4L F-250/F-350-Series (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	**.1/OFF**	**.1/OFF**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
FEPS	13	**.5-.6**	**.5-.6**	**.5-.6**	**.5-.6**	DCV
CKP (+)	21	**0**	**360-380**	**700-800**	**900-1100**	Hz
O2S12 (M)	35	**0**	**(D)**	**(D)**	**(D)**	DCV
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
KS	57	**0**	**0**	**0**	**0**	DCV
VSS	58	**0**	**0**	**65/30**	**125/55**	Hz/MPH
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
FTP V/FTP (M)	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
CPP/PNP	64	**5/OFF**	**.1/ON**	**5/OFF**	**5/OFF**	DCV/OFF-ON
DPFEGR (M)	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
CHT V/CHT	66	**.6 or 3.7/194**	**.6 or 3.7/194**	**.6 or 3.7/194**	**.6 or 3.7/194**	DCV/DEG
CID	85	**0**	**5-8**	**10-12**	**14-17**	Hz
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.7-.9**	**1-1.6**	**1.7-2.4**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.2**	**.9-1.6**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
4X4L (M)	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FLI (H)	PID	**50**	**50**	**50**	**50**	%
LOAD	PID	**0**	**15-20**	**21-30**	**30-45**	%

(Continued)

5.4L F-250/F-350-Series (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	630-700	1100-1200	1150-1400	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	27	VBAT	VBAT	VBAT	VBAT	DCV
EGRVR (M)	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	41-44	80-90	113	Hz
CDB (CYL3)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL4)	53	VBAT	VBAT	VBAT	VBAT	DCV
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
INJ7	72	0	3.2-4.2	4-8	8-16	mS
INJ5	73	0	3.2-4.2	4-8	8-16	mS
INJ3	74	0	3.2-4.2	4-8	8-16	mS
INJ1	75	0	3.2-4.2	4-8	8-16	mS
CDC (CYL7)	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL8)	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
IAC	83	VBAT/0	11.7/25	8.5-10.9/30-55	6-8/50-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.2-4.2	4-8	8-16	mS
INJ6	99	0	3.2-4.2	4-8	8-16	mS
INJ4	100	0	3.2-4.2	4-8	8-16	mS
INJ2	101	0	3.2-4.2	4-8	8-16	mS
CDD (CYL2)	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.2-4.2	4-8	8-16	mS
FUELPW2	PID	(L)	3.2-4.2	4-8	8-16	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%

(Continued)

5.4L F-250/F-350-Series (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**20-25**	**25-32**	**20-37**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

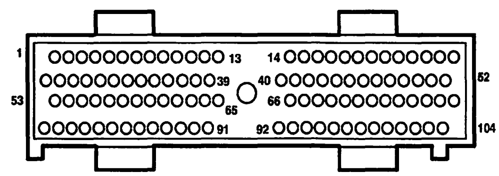
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**15-20**	**20-25**	%
MAF	**4.8-6**	**18.1-21**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	**20-25**	**42**	DEG

5.4L SVT F-Series Heritage Supercharged

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	410	630	1020	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12	35	.1	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT2	38	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
IAT1	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
TSS	59	0	110/200	0/1000	0/1820	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
O2S22	61	.1	(D)	(D)	(D)	DCV
FTP V/FTP	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
BARO	63	155	155	155	155	Hz
TR3 V/TR	64	0/PARK	0/PARK	1.7/0D	1.7/0D	DCV/MODE
DPFEGR	65	.25-1.30	.25-1.30	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	400/1330	730/2430	Hz/RPM
CID	85	0	6-8	9-10	14-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV

(Continued)

5.4L SVT F-Series Heritage Supercharged

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
MAF V	88	0	.7-.9	1-1.6	1.7-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	1-1.3	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
FLI (H)	PID	50	50	50	50	%
LOAD	PID	(L)	18-21	27-32	35-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	575	1100-1150	1675-1770	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
FPL	19	VBAT	.1	.1	.1	DCV
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL5)	27	VBAT	VBAT	VBAT	VBAT	DCV
SCB	42	.1/ON	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
EGRVR	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	45	75	120	Hz
CDB (CYL3)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL4)	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	VBAT/0	.2/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
VSO	68	0	0	65	125	Hz
WAC (ACCR)	69	VBAT/OFF	.1/ON (A)	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SBICP	70	VBAT/OFF	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
INJ7	72	0	2-3.8	3-6	3.5-9	mS
INJ5	73	0	2-3.8	3-6	3.5-9	mS
INJ3	74	0	2-3.8	3-6	3.5-9	mS
INJ1	75	0	2-3.8	3-6	3.5-9	mS
CDC (CYL7)	78	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

5.4L SVT F-Series Heritage Supercharged

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7/5**	**8.8/5**	**8.8/5**	**8.5-9/5-10**	DCV/PSI
IAC	83	**VBAT/0**	**9.4/33**	**9.4/33**	**8-8.5/50-59**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
HTR22	96	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**2-3.8**	**3-6**	**3.5-9**	mS
INJ6	99	**0**	**2-3.8**	**3-6**	**3.5-9**	mS
INJ4	100	**0**	**2-3.8**	**3-6**	**3.5-9**	mS
INJ2	101	**0**	**2-3.8**	**3-6**	**3.5-9**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**2-3.8**	**3-6**	**3.5-9**	mS
FUELPW2	PID	**(L)**	**2-3.8**	**3-6**	**3.5-9**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-20**	**25-35**	**28-38**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**18-21**	**15-20**	%
MAF	**5.3-6.5**	**21-25**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%

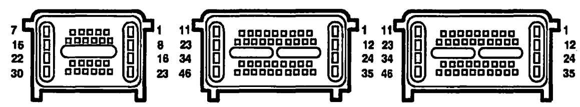
(Continued)

5.4L SVT F-Series Heritage Supercharged

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	15-20	33	DEG

5.4L 4V Navigator (A/T)



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values: KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
FTP V/FTP	B8	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
IAT	B19	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	B20	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
TCS	B22	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
MAF V	B31	0	.7-.9	1-1.6	1.7-2.4	DCV
FEPS	B39	.1	.1	.1	.1	DCV
ACCS	B41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
O2S11	E26	0	switching (C)	switching (C)	switching (C)	DCV
O2S21	E27	0	switching (C)	switching (C)	switching (C)	DCV
KS	E29	0	0	0	0	DCV
CKP (+)	E30	0	410	800-850	900-1125	Hz
CID	E31	0	6-8	10-12	14-17	Hz
ECT	E32	.4-1/210-160	.4-1/210-160	.4-1/210-160	.4-1/210-160	DCV/DEG
DPFEGR	E33	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
TP V	E44	.53-1.27	.53-1.27	.8-1.2	1-1.3	DCV
CHT V/CHT	E45	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
O2S22	T2	0	(D)	(D)	(D)	DCV
O2S12	T3	0	(D)	(D)	(D)	DCV
TR3 V/TR	T17	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV
TR2	T18	0	0	11.5	11.5	DCV
TR4	T19	0	0	11.5	11.5	DCV
TR1	T20	0	0	11.5	11.5	DCV
OSS	T25	0	0	380/1260	707/2350	Hz/RPM
TSS	T26	0	130/241	660/1230	0/1670	Hz/RPM
TFT	T28	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG

(Continued)

5.4L 4V Navigator (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**4**	**4**	GEAR
LOAD	PID	**(L)**	**14-17**	**19-25**	**26-35**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**690-710**	**1270-1390**	**1590-1675**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
WAC (ACCR)	B2	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
TPO (M)	B3	**.9/15**	**.9/15**	**1.4/18**	**1.8/20**	DCV/%
VSO	B13	**0**	**0**	**65**	**125**	Hz
FP	B27	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EVAPCV	B36	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
EVAPPDC	B38	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
CDD (CYL2)	E1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	E2	**VBAT/0**	**10.5/41**	**8.9/55**	**8.5/65**	DCV/%
INJ5	E3	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ6	E4	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ7	E5	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ8	E6	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ3	E7	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
INJ4	E8	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
CDH (CYL8)	E11	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDC (CYL7)	E12	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IMTV	E13	**VBAT/0**	**VBAT/0**	**VBAT/0**	**VBAT/0**	DCV/%
INJ1	E14	**0**	**3.2-3.9**	**4-6.9**	**6.5-12**	mS
INJ2	E15	**0**	**3.2-3.8**	**4-6.9**	**6.5-12**	mS
HTR21	E20	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR11	E21	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
EGRVR	E22	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CDG (CYL4)	E23	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDB (CYL3)	E24	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	E34	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	E35	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV

(Continued)

5.4L 4V Navigator (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	E46	VBAT	VBAT	VBAT	VBAT	DCV
TCC	T11	VBAT/0	VBAT/0	VBAT/0	.2/90-100	DCV/%
SS1	T12	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	T13	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	T14	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
HTR12	T21	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
EPC	T23	8.1/5	9.9/5	9.4/5	9.5/5-15	DCV/PSI
HTR22	T29	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
FUELPW2	PID	(L)	3.2-3.8	4-6.9	6.5-12	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
MIL	PID	OFF	OFF	OFF	OFF	OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	12-18	31-40	28-38	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	B40	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	B34, B46	VBAT	VBAT	VBAT	VBAT	DCV
VREF	B45, E36	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	27-35	25-30	%
MAF	4.8-6.5	21-24	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%

(Continued)

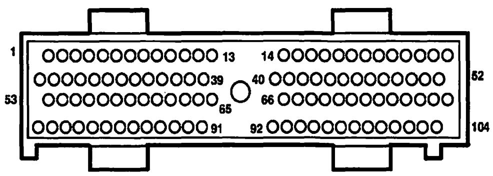
5.4L 4V Navigator (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**12-18**	**36**	DEG

5.4L Excursion (4R100)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	380-411	750-800	975-1000	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
VSS	58	0	0	70/30	125/55	Hz/MPH
TSS	59	0	100/200	680-725/ 1270-1370	0/1635-17700	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR (M)	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	.6 or 3.7/194	DCV/DEG
OSS	84	0	0	400-415/ 1300-1380	700-750/ 2350-2489	Hz/RPM
CID	85	0	6-8	10-12	14-17	Hz

(Continued)

5.4L Excursion (4R100)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
O2S21	87	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
MAF V	88	**0**	**.7-.9**	**1-1.6**	**1.7-2.4**	DCV
TP V	89	**.53-1.27**	**.53-1.27**	**.8-1.2**	**1-1.4**	DCV
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
4X4L	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
ECT	PID	**160-200**	**160-200**	**160-200**	**160-200**	DEG
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**17-25**	**19-25**	**35-50**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**650-760**	**1200-1400**	**1590-1750**	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**VBAT/OFF**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CCS	20	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EGRVR (M)	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**43**	**85**	**110**	Hz
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**VBAT/0**	**VBAT/0**	**.2/90-100**	**.2/90-100**	DCV/%
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV (M)	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ7	72	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
INJ5	73	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
INJ3	74	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
INJ1	75	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV

(Continued)

5.4L Excursion (4R100)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.5/5**	**9.1/5**	**9.1/5**	**9.6/10**	DCV/PSI
IAC	83	**VBAT/0**	**10.2-11/30-34**	**7-10.8/43-60**	**5-9/58-75**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12 (M)	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
INJ6	99	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
INJ4	100	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
INJ2	101	**0**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
FUELPW2	PID	**(L)**	**3.2-4.5**	**4.1-6.9**	**7-14**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**16-20**	**27-35**	**28-37**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**17-25**	**20-27**	%
MAF	**4.8-6**	**18.1-22**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%

(Continued)

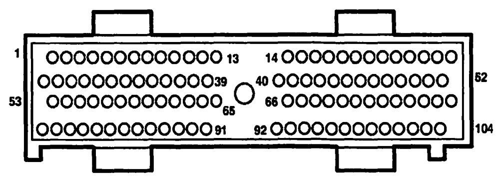
5.4L Excursion (4R100)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	**16-20**	**43**	DEG

5.4L NG Econoline (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-440	810-870	1089-1120	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FSVM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
TSS	59	0	315/170	725-780/ 1360-1460	0/1940-1950	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
EFTA V/EFTA	62	1.7-3.5/50-120 (K)	1.7-3.5/50-120 (K)	1.7-3.5/50-120 (K)	1.7-3.5/50-120 (K)	DCV/DEG
FRP V/FRP	63	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	405-430/ 1360-1460	815/2729	Hz/RPM
CID	85	0	6-8	9-12	15-17.5	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.95	.9-1.7	1.2-2.4	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.2	.9-1.6	DCV

(Continued)

5.4L NG Econoline (A/T)

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
CPP/PNP	PID	**ON**	**ON**	**OFF**	**OFF**	OFF-ON
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**13-19**	**21-30**	**31-38**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
RPM	PID	**0**	**715-850**	**1400-1490**	**1900-1950**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**VBAT/OFF**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CCS	20	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CTO	48	**0**	**45-50**	**90-100**	**120-130**	Hz
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**VBAT/0**	**VBAT/0**	**.2-.3/90-100**	**.2-.3/90-100**	DCV/%
VSO	68	**0**	**0**	**65**	**125**	Hz
INJ7	72	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ5	73	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ3	74	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ1	75	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FSV	80	**VBAT/OFF**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
EPC	81	**7.6/5**	**9.8/5**	**9.2/5**	**9.8/13**	DCV/PSI
IAC	83	**VBAT/0**	**9.2-10.1/32-40**	**8-10.7/30-60**	**5.7-8/40-65**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ8	98	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ6	99	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ4	100	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ2	101	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS

(Continued)

5.4L NG Econoline (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
FUELPW2	PID	**(L)**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)15-(+)15**	**(-)15-(+)15**	**(-)15-(+)15**	%
SHRTFT2	PID	**(L)**	**(-)15-(+)15**	**(-)15-(+)15**	**(-)15-(+)15**	%
SPARKADV	PID	**0**	**8-15**	**20-35**	**20-30**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

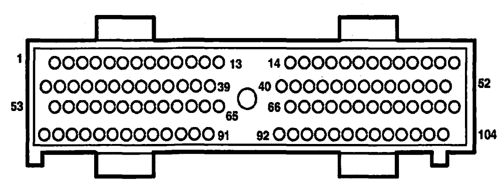
Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**25-28**	**21-30**	%
MAF	**4.8-6.2**	**18.1-22.4**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	**8-15**	**41**	DEG

5.4L NG F-Series Heritage (A/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
FEPS	13	.5-.6	.5-.6	.5-.6	.5-.6	DCV
CKP (+)	21	0	400-440	770-840	985-1030	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FSVM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
TSS	59	0	250	1200-1300	1500-1600	RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
EFTA V/EFTA	62	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FRP V/FRP	63	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	2-3.7/90-100	DCV/PSI
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV
CHT V/CHT	66	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	.67 or 3.7/194	DCV/DEG
OSS	84	0	0	345-405/ 1360-1460	655/2729	Hz/RPM
CID	85	0	6-7	9-12	14-17.5	Hz
ACP V/ACP	86	.1/CLOSED	.1/CLOSED	.1/CLOSED	.1/CLOSED	DCV/OPEN-CLOSED
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.6-.95	.9-1.7	1.2-2.4	DCV
TP V	89	.53-1.27	.53-1.27	8-1.2	9-1.6	DCV

(Continued)

5.4L NG F-Series Heritage (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
BPP	92	**.1/OFF**	**VBAT/ON (E)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
FLI (H)	PID	**50**	**50**	**50**	**50**	%
GEAR	PID	**1**	**1**	**3**	**4**	GEAR
LOAD	PID	**(L)**	**13-19**	**21-30**	**31-39**	%
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
RPM	PID	**0**	**700-825**	**1270-1490**	**1580-1750**	RPM
VSS	PID	**0**	**0**	**30**	**55**	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDE (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
SS1	6	**.1/ON**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
SS2	11	**VBAT/OFF**	**VBAT/OFF**	**.1/ON**	**VBAT/OFF**	DCV/OFF-ON
TCIL	12	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CCS	20	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL5)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDB (CYL3)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL4)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
TCC	54	**VBAT/0**	**VBAT/0**	**VBAT/0**	**.2-.3/90-100**	DCV/%
VSO	68	**0**	**0**	**65**	**120**	Hz
WAC	69	**VBAT/OFF**	**.1/ON**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
INJ7	72	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ5	73	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ3	74	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ1	75	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
CDC (CYL7)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FSV	80	**VBAT/OFF**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
EPC	81	**7.5/5**	**9.3/5**	**9.2/5**	**9.4/13**	DCV/PSI
IAC	83	**VBAT/0**	**9.2-10.1/32-40**	**8-10.7/30-60**	**5.7-8/40-65**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
INJ8	98	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ6	99	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ4	100	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
INJ2	101	**0**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
CDD (CYL2)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV

(Continued)

5.4L NG F-Series Heritage (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
FUELPW2	PID	**(L)**	**3.9-6.5**	**4.7-12**	**4.7-12.2**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)15-(+)15**	**(-)15-(+)15**	**(-)15-(+)15**	%
SHRTFT2	PID	**(L)**	**(-)15-(+)15**	**(-)15-(+)15**	**(-)15-(+)15**	%
SPARKADV	PID	**0**	**8-15**	**20-35**	**20-30**	DEG

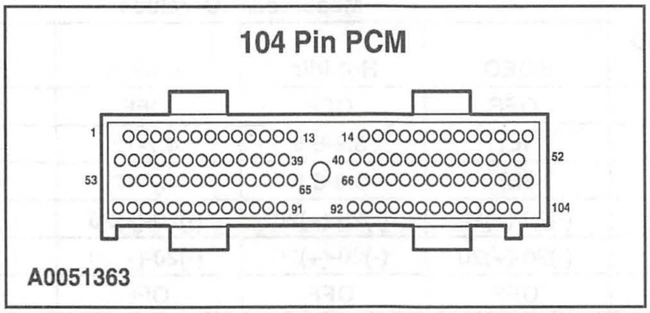
Other	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**28-33**	**25-31**	%
MAF	**4.8-6.2**	**18.1-22.4**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	**17-22**	**39**	DEG

6.8L E/F-Series (A/T)



Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FLI V/FLI (M)	9	1.7/50 (H)	1.7/50 (H)	1.7/50 (H)	1.7/50 (H)	DCV/%
FEPS	13	.1	.1	.1	.1	DCV
4X4L (M)	14	7/OFF	7.7/OFF	7.7/OFF	7.7/OFF	DCV/OFF-ON
CKP (+)	21	0	420-520	800-1050	1100-1300	Hz
TCS	29	.1/OFF	VBAT/ON (G)	.1/OFF	.1/OFF	DCV/OFF-ON
TR1	34	0	0	11.5	11.5	DCV
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
TFT	37	.5-2/210-110	.5-2/210-110	.5-2/210-110	.5-2/210-110	DCV/DEG
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
TR2	49	0	0	11.5	11.5	DCV
TR4	50	0	0	11.5	11.5	DCV
KS	57	0	0	0	0	DCV
VSS (F-Series)	58	0	0	65/30	125/55	Hz/MPH
TSS	59	0	100/200	800/1200	0/1670	Hz/RPM
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
TR V/TR	64	0/PARK	0/PARK	1.7/OD	1.7/OD	DCV/MODE
DPFEGR (M)	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	DCV/DEG
OSS	84	0	0	400/1450	815/2450	Hz/RPM

(Continued)

6.8L E/F-Series (A/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CID	85	0	6.5-10	10-13	13-16	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-1.2	1.2-1.7	1.6-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
4X4L (M)	PID	OFF	OFF	OFF	OFF	OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	14-16	20-25	25-35	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	600-900	1350-1500	1700-1900	RPM
VSS	PID	0	0	30	55	MPH

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDB (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDD (CYL10)	27	VBAT	VBAT	VBAT	VBAT	DCV
INJ10	42	0	3.8-4.6	6-8	11-15	mS
VSO (E-Series)	46	0	0	65	125	Hz
EGRVR (M)	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	55-65	110-130	140-175	Hz
CDC (CYL5)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL7)	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	.1/90-100	.1/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
INJ9	68	0	3.8-4.6	6-8	11-15	mS
WAC (F-Series)	69	VBAT/OFF	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CFCIL	70	0/OFF	0/OFF	0/OFF	0/OFF	DCV/OFF-ON

(Continued)

6.8L E/F-Series (A/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
INJ7	72	0	3.8-4.6	6-8	11-15	mS
INJ5	73	0	3.8-4.6	6-8	11-15	mS
INJ3	74	0	3.8-4.6	6-8	11-15	mS
INJ1	75	0	3.8-4.6	6-8	11-15	mS
CDE (CYL2)	78	VBAT	VBAT	VBAT	VBAT	DCV
CDH (CYL8)	79	VBAT	VBAT	VBAT	VBAT	DCV
FP	80	VBAT/0	.1/100	.1/100	.1/100	DCV/%
EPC	81	7.5/5	9/5	9/5	9.2/11	DCV/PSI
CDJ (CYL9)	82	VBAT	VBAT	VBAT	VBAT	DCV
IAC	83	VBAT/0	9.3-11.5/25-41	7.5-9.5/30-55	4.9-9/50-70	DCV/%
HTR11	93	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR21	94	.1/ON (P)	.1/ON	.1/ON	.1/ON	DCV/OFF-ON
HTR12 (M)	95	.2/ON (P)	.2/ON	.2/ON	.2/ON	DCV/OFF-ON
INJ8	98	0	3.8-4.6	6-8	11-15	mS
INJ6	99	0	3.8-4.6	6-8	11-15	mS
INJ4	100	0	3.8-4.6	6-8	11-15	mS
INJ2	101	0	3.8-4.6	6-8	11-15	mS
CDI (CYL4)	102	VBAT	VBAT	VBAT	VBAT	DCV
CDG (CYL3)	104	VBAT	VBAT	VBAT	VBAT	DCV
CHTIL	PID	OFF	OFF	OFF	OFF	OFF-ON
FUELPW1	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
FUELPW2	PID	(L)	3.8-4.6	5.2-6.5	6.6-11	mS
LONGFT1	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	PID	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	(-)20-(+)20	%
MIL	PID	OFF	OFF	OFF	OFF	DCV/OFF-ON
SHRTFT1	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	PID	(L)	(-)10-(+)10	(-)10-(+)10	(-)10-(+)10	%
SPARKADV	PID	0	17-23	23-34	26-34	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	VBAT	VBAT	VBAT	VBAT	DCV
VPWR	71	VBAT	VBAT	VBAT	VBAT	DCV
VREF	90	5	5	5	5	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

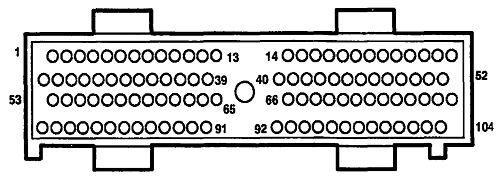
6.8L E/F-Series (A/T)

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	(-)20-(+)20	(-)20-(+)20	%
LONGFT2	(-)20-(+)20	(-)20-(+)20	%
LOAD	14.1	24-28	%
MAF	6-8	20-25	G/S
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-23	38	DEG

6.8L F-Series (M/T)

104 Pin PCM



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Typical Diagnostic Reference Values

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	.1/OFF	.1/OFF	.1/OFF	.1/OFF	DCV/OFF-ON
FEPS	13	.1	.1	.1	.1	DCV
CKP (+)	21	0	400-500	380-800	1100-1300	Hz
O2S12 (M)	35	0	(D)	(D)	(D)	DCV
IAT	39	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	1.7-3.5/120-50 (K)	DCV/DEG
FPM	40	.1/OFF	VBAT/ON	VBAT/ON	VBAT/ON	DCV/OFF-ON
ACCS	41	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
KS	57	0	0	0	0	DCV
VSS	58	0	0	65/30	125/55	Hz/MPH
O2S11	60	0	switching (C)	switching (C)	switching (C)	DCV
FTP V/FTP (M)	62	2.6/0	2.6/0	2.6/0	2.6/0	DCV/IN-H2O
CPP/PNP	64	5/OFF	.1/ON (J)	5/OFF	5/OFF	DCV/OFF-ON
DPFEGR (M)	65	.25-1.3	.25-1.3	.25-4.65	.25-4.65	DCV
CHT V/CHT	66	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	.61 or 3.7/194	DCV/DEG
CID	85	0	5-7	10-13	15-17	Hz
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-1	1.2-1.7	1.6-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
4X4L (M)	PID	OFF	OFF	OFF	OFF	OFF-ON
FLI (H)	PID	50	50	50	50	%
LOAD	PID	(L)	14-16	20-25	24-35	%

(Continued)

6.8L F-Series (M/T)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values: KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
MISF	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
OCTADJS	PID	**NO RETARD**	**NO RETARD**	**NO RETARD**	**NO RETARD**	NO RETARD/ RETARD
RPM	PID	**0**	**600-900**	**1280-1450**	**1600-1800**	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values: KOEO	Hot Idle	30 MPH	55 MPH	Units Measured/PID
CDB (CYL6)	1	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDA (CYL1)	26	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDD (CYL10)	27	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
INJ10	42	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
EGRVR (M)	47	**VBAT/0**	**VBAT/0**	**(V)**	**(V)**	DCV/%
CTO	48	**0**	**50-60**	**110-130**	**140-175**	Hz
CDC (CYL5)	52	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDF (CYL7)	53	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
EVAPPDC	56	**0**	**0-10/0-100**	**0-10/0-100**	**0-10/0-100**	Hz/%
EVAPCV (M)	67	**VBAT/ 0**	**VBAT/ 0**	**VBAT/ 0 (S)**	**VBAT/ 0 (S)**	DCV/ %
INJ9	68	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
WAC	69	**VBAT/OFF**	**.1/ON (A)**	**VBAT/OFF**	**VBAT/OFF**	DCV/OFF-ON
CFCIL	70	**0/OFF**	**0/OFF**	**0/OFF**	**0/OFF**	DCV/OFF-ON
INJ7	72	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ5	73	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ3	74	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ1	75	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
CDE (CYL2)	78	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
CDJ (CYL9)	82	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	83	**VBAT/0**	**9.3-11/25-41**	**8-9/30-55**	**4.9-8/50-70**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12 (M)	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ6	99	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ4	100	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ2	101	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
CDI (CYL4)	102	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL3)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV

(Continued)

6.8L F-Series (M/T)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
FUELPW2	PID	**(L)**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**17-23**	**23-34**	**26-34**	DEG

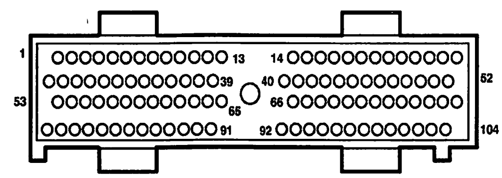
Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**14.1**	**24-28**	%
MAF	**6-8**	**20-25**	G/S
SHRTFT1	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT11	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT12	**95-100**	**95-100**	%
SHRTFT21	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT22	**95-100**	**95-100**	%
SPARKADV	**17-23**	**38**	DEG

6.8L Excursion (4R100)



Typical Diagnostic Reference Values

Sen-sors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Mea-sured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
PTO	4	**.1/OFF**	**.1/OFF**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
FLI V/FLI (M)	9	**1.7/50 (H)**	**1.7/50 (H)**	**1.7/50 (H)**	**1.7/50 (H)**	DCV/%
FEPS	13	**.1**	**.1**	**.1**	**.1**	DCV
CKP (+)	21	**0**	**500-525**	**750-940**	**1000-1195**	Hz
TCS	29	**.1/OFF**	**VBAT/ON (G)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR1	34	**0**	**0**	**11.5**	**11.5**	DCV
O2S12 (M)	35	**0**	**(D)**	**(D)**	**(D)**	DCV
TFT	37	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	**.5-2/210-110**	DCV/DEG
IAT	39	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	**1.7-3.5/120-50 (K)**	DCV/DEG
FPM	40	**.1/OFF**	**VBAT/ON**	**VBAT/ON**	**VBAT/ON**	DCV/OFF-ON
ACCS	41	**.1/OFF**	**VBAT/ON (A)**	**.1/OFF**	**.1/OFF**	DCV/OFF-ON
TR2	49	**0**	**0**	**11.5**	**11.5**	DCV
TR4	50	**0**	**0**	**11.5**	**11.5**	DCV
KS	57	**0**	**0**	**0**	**0**	DCV
VSS	58	**0**	**0**	**65/30**	**125/55**	Hz/MPH
TSS	59	**0**	**410/470**	**690/1300**	**0/1362**	Hz/RPM
O2S11	60	**0**	**switching (C)**	**switching (C)**	**switching (C)**	DCV
FTP V/FTP (M)	62	**2.6/0**	**2.6/0**	**2.6/0**	**2.6/0**	DCV/IN-H2O
TR V	64	**0**	**0**	**1.7**	**1.7**	DCV
DPFEGR (M)	65	**.25-1.3**	**.25-1.3**	**.25-4.65**	**.25-4.65**	DCV
CHT V/CHT	66	**.61 or 3.7/194**	**.61 or 3.7/194**	**.61 or 3.7/194**	**.61 or 3.7/194**	DCV/DEG
OSS	84	0	0	390/1300	690/2290	Hz/RPM
CID	85	**0**	**7-10**	**10-13**	**13-15**	Hz

(Continued)

6.8L Excursion (4R100)

Sensors/Inputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
O2S21	87	0	switching (C)	switching (C)	switching (C)	DCV
MAF V	88	0	.7-1.1	1.2-2	1.6-2.7	DCV
TP V	89	.53-1.27	.53-1.27	.8-1.1	.9-1.5	DCV
BPP	92	.1/OFF	VBAT/ON (E)	.1/OFF	.1/OFF	DCV/OFF-ON
CPP/PNP	PID	ON	ON	OFF	OFF	OFF-ON
GEAR	PID	1	1	3	4	GEAR
LOAD	PID	(L)	14-16	25-30	30-45	%
MISF	PID	OFF	OFF	OFF	OFF	OFF-ON
OCTADJS	PID	NO RETARD	NO RETARD	NO RETARD	NO RETARD	NO RETARD/ RETARD
RPM	PID	0	700-850	1200-1380	1600-1900	RPM

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDB (CYL6)	1	VBAT	VBAT	VBAT	VBAT	DCV
SS1	6	.1/ON	.1/ON	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
SS2	11	VBAT/OFF	VBAT/OFF	.1/ON	VBAT/OFF	DCV/OFF-ON
TCIL	12	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CCS	20	VBAT/OFF	VBAT/OFF	VBAT/OFF	VBAT/OFF	DCV/OFF-ON
CDA (CYL1)	26	VBAT	VBAT	VBAT	VBAT	DCV
CDD (CYL10)	27	VBAT	VBAT	VBAT	VBAT	DCV
INJ10	42	0	3.8-4.6	5.2-6.5	6.6-11	mS
EGRVR (M)	47	VBAT/0	VBAT/0	(V)	(V)	DCV/%
CTO	48	0	60-70	100-120	130-150	Hz
CDC (CYL5)	52	VBAT	VBAT	VBAT	VBAT	DCV
CDF (CYL7)	53	VBAT	VBAT	VBAT	VBAT	DCV
TCC	54	VBAT/0	VBAT/0	VBAT/0	.1/90-100	DCV/%
EVAPPDC	56	0	0-10/0-100	0-10/0-100	0-10/0-100	Hz/%
EVAPCV (M)	67	VBAT/ 0	VBAT/ 0	VBAT/ 0 (S)	VBAT/ 0 (S)	DCV/ %
INJ9	68	0	3.8-4.6	5.2-6.5	6.6-11	mS
WAC	69	.1/OFF	VBAT/ON (A)	.1/OFF	.1/OFF	DCV/OFF-ON
CFCIL	70	0/OFF	0/OFF	0/OFF	0/OFF	DCV/OFF-ON
INJ7	72	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ5	73	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ3	74	0	3.8-4.6	5.2-6.5	6.6-11	mS
INJ1	75	0	3.8-4.6	5.2-6.5	6.6-11	mS
CDE (CYL2)	78	VBAT	VBAT	VBAT	VBAT	DCV

(Continued)

6.8L Excursion (4R100)

Actuators/ Outputs	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
CDH (CYL8)	79	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
FP	80	**VBAT/0**	**.1/100**	**.1/100**	**.1/100**	DCV/%
EPC	81	**7.7/5**	**9.2/5**	**9.2/5**	**9.2/5**	DCV/PSI
CDJ (CYL9)	82	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
IAC	83	**VBAT/0**	**9.3-11/25-41**	**8-9.5/30-55**	**4.9-9/50-70**	DCV/%
HTR11	93	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR21	94	**.1/ON (P)**	**.1/ON**	**.1/ON**	**.1/ON**	DCV/OFF-ON
HTR12 (M)	95	**.2/ON (P)**	**.2/ON**	**.2/ON**	**.2/ON**	DCV/OFF-ON
INJ8	98	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ6	99	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ4	100	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
INJ2	101	**0**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
CDI (CYL4)	102	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CDG (CYL3)	104	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
CHTIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
FUELPW1	PID	**(L)**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
FUELPW2	PID	**(L)**	**3.8-4.6**	**5.2-6.5**	**6.6-11**	mS
LONGFT1	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	PID	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	**(-)20-(+)20**	%
MIL	PID	**OFF**	**OFF**	**OFF**	**OFF**	OFF-ON
SHRTFT1	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SHRTFT2	PID	**(L)**	**(-)10-(+)10**	**(-)10-(+)10**	**(-)10-(+)10**	%
SPARKADV	PID	**0**	**15-20**	**23-34**	**26-34**	DEG

Other	PCM Pin/PID only	Measured/PID Values				Units Measured/PID
		KOEO	Hot Idle	30 MPH	55 MPH	
KAPWR	55	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VPWR	71	**VBAT**	**VBAT**	**VBAT**	**VBAT**	DCV
VREF	90	**5**	**5**	**5**	**5**	DCV

Note: All generic OBD II readings under no load (PARK or NEUTRAL).

GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
LONGFT1	**(-)20-(+)20**	**(-)20-(+)20**	%
LONGFT2	**(-)20-(+)20**	**(-)20-(+)20**	%
LOAD	**47**	**34**	%
MAF	**8-9**	**20-25**	G/S

(Continued)

6.8L Excursion (4R100)

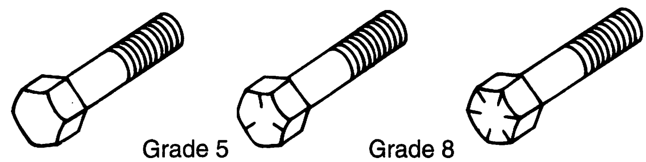
GENERIC OBD II PID VALUES

PID	Hot Idle	2500 RPM	Units
SHRTFT1	(-)10-(+)10	(-)10-(+)10	%
SHRTFT2	(-)10-(+)10	(-)10-(+)10	%
SHRTFT11	(-)10-(+)10	(-)10-(+)10	%
SHRTFT12	95-100	95-100	%
SHRTFT21	(-)10-(+)10	(-)10-(+)10	%
SHRTFT22	95-100	95-100	%
SPARKADV	17-23	38	DEG

METRICS

BOLT STRENGTH IDENTIFICATION

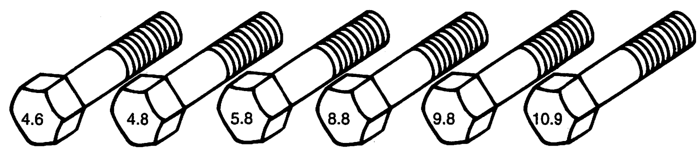
ENGLISH SYSTEM



Grade 1 or 2 Grade 5 Grade 8

English bolts: Identification marks on the bolt head represent Rockwell hardness. Generally, the bolt's grade is equal to the number of marks plus two. The higher the grade, the stronger the bolt.

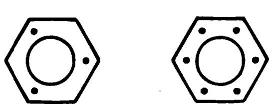
METRIC SYSTEM



Metric bolts: Identification class numbers on bolt heads represent tensile strength. Higher numbers indicate stronger bolts. Common metric fastener bolt strength properties are 9.8 and 10.9.

HEX NUT STRENGTH IDENTIFICATION

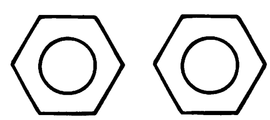
ENGLISH SYSTEM



Grade 5 Grade 8

Identification dots represent Rockwell hardness. The nut's grade is equal to the number of dots plus two. The higher the grade, the stronger the nut.

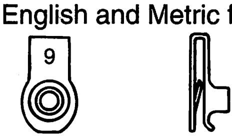
METRIC SYSTEM



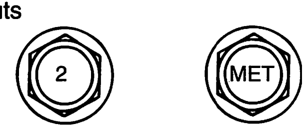
Identification class numbers on nuts represent tensile strength. Higher numbers indicate stronger nuts. Nuts may also have blue finish or paint daub on hex flat.

OTHER TYPES OF PARTS

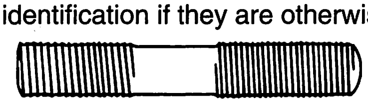
Metric identification schemes vary by type of part, most often a variation of that used for bolts and nuts. Note that many types of English and Metric fasteners carry no special identification if they are otherwise unique.

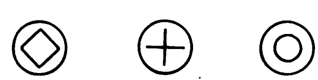


–Stamped U-Nuts



–Tapping, thread forming and certain other case hardened screws.





CLASS 10.9 CLASS 9.8 CLASS 8.8

–Studs, Large studs may carry the property class number. Smaller studs use a geometric code on the end.

METRICS

ENGLISH/METRIC CONVERSION

DESCRIPTION	MULTIPLY	BY	FOR METRIC EQUIVALENT
Acceleration	ft/s^2	0.3048	m/s^2
	in/s^2	0.0254	m/s^2
Torque	lb-in	0.11298	N·m
	lb-ft	1.3558	N·m
Power	horsepower	0.746	kW
Pressure or Stress	inches of water	0.2491	kPa
	psi	6.895	kPa
	psi	0.069	bar
Energy or Work	BTU	1055.0	Joules(J)
	lb-ft	1.3558	Joules(J)
	kiloWatt-hour	3,600,000 or 3.6×10^6	Joules(J)
Light	foot candle	10.764	lumens/square meter (lm/m^2)
Fuel Performance	miles/gal	0.4251	kilometers/liter (km/L)
	gal/mile	2.3527	liters/kilometer (L/km)
Velocity	mph	1.6093	kilometers/hour (km/h)
Length	inch	25.4	mm
	foot	0.3048	m
	yard	0.9144	m
	mile	1.609	km
Area	square inch (in^2)	645.2	mm^2
		6.45	cm^2
	square ft (ft^2)	0.0929	m^2
	square yard	0.8361	m^2
Volume	cubic inch (in^3)	16387.0	mm^3
		16.387	cm^3
		0.0164	liters (L)
	quart	0.9464	liters (L)
	gallon	3.7854	liters(L)
	cubic yard	0.7646	m^3
Mass	pound	0.4536	kg
	ton	907.18	kg
	ton	0.9078	tonne (t)
Force	kilogram	9.807	N
	ounce	0.2780	N
	pound	4.448	N
Temperature	degree Farenheit (˚F)	(˚F-32) 0.556	degree Celsius (˚C)

Customer Information Worksheet

Repair Order No. ________________

CUSTOMER NAME ____ DATE __________________________

PLEASE HELP US by checking all the spaces that describe the drive problem.

When did problem start to occur? ___ Suddenly ___ Gradually: approximate miles ________

Engine Starting Problems	Engine Quits Running Problems	Engine Idle Problems with the Vehicle Not Moving	Engine/Transmission Problems while the Vehicle is Moving
__ Will not start – will not even crank __ Cranks, but will not start __ Tries to start, but won't __ Starts, but takes a long time	Engine Quits: __ Right after starting __ While idling __ When put into gear __ On acceleration __ During steady speed driving __ On deceleration __ Right after the vehicle is brought to a stop __ When parking	__ Engine speed is too slow all the time __ Engine speed is too slow when the A/C is on __ Engine speed is too fast __ Engine speed is rough or uneven	__ Runs rough __ Bucks and jerks __ Hesitates/stumbles on acceleration __ Misfires – cuts out __ Engine knocks or rattles __ Lack of power __ Backfires __ Poor fuel economy __ Transmission shifting concerns

About how often does the problem happen? ___ All the time ___ Most of the time ___ Occasionally

When does the problem usually occur? ___ Morning ___ Later in the day ___ Anytime

How long after starting the engine does the problem happen?
- __ Within 2 minutes of starting the engine.
- __ Between 2 and 10 minutes after the engine starts.
- __ At least 10 minutes or longer after starting the engine.
- __ It could happen any time after starting the engine.

How long does the engine have to be off before the problem will happen again?
- __ 4 hours or more.
- __ More than 30 minutes, but less than 4 hours.
- __ Less than 30 minutes after being turned off.
- __ It does not matter how long the engine was off.

Do weather conditions affect the problem? __ No __ Yes
If yes, which ones? __ Hot __ Cold __ Rain __ Fog __ Snow __ Humid __ Dry
Does outside temperature affect the problem? __ No __ Yes
If yes, what temperature? ____ ˚F/˚C

Please Check any of these driving conditions that cause the problem. __ Accelerating __ Decelerating __ Turning Right/Left __ Steady Speed (approximate vehicle speed ______ MPH / Km/h)

Type of fuel used? __ Regular unleaded __ Midgrade unleaded __ Premium unleaded __ Gasohol __ Other

Was the Check Engine light on? __ Yes __ No __ Flashing
Were other warning lights on? __ Yes __ No __ Flashing Which Ones? ____________________________

Additional Comments:

____

____

____

Additional Customer Information Worksheet in the back of the manual.

S.P.E.C.S.

Service Publications Error Correction System

SPECS Case Submission Form

Attention Ford Motor Company Dealers! You can submit your Service Publication Concern via the web by visiting www.FMCDealer.com. Choose the role: "Technician" and then choose "Service Publications". This will take you to the Professional Technician Society (PTS) web site. Choose Service Publications and then SPECS to view the SPECS web site.

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- Use separate form for each concern
- Do not use this form to order publications
- Mail the completed form to the address on the reverse side **OR**
- FAX the completed form to (313) 565-7022

Date: ____________

Publication:
- ❑ Car/Truck Workshop Manual
- ❑ Wiring Diagram/EVTM
- ❑ PC/ED Manual
- ❑ Rotunda Publication
- ❑ TSB Article
- ❑ OASIS SSMs

Vehicle Line: ____________ **Section and Pages:** ____________ **Model Year:** ____________

Please check the area in which the concern is located in the publication:

- ❑ Schematic(s)
- ❑ Index Error
- ❑ Removal & Installation
- ❑ Specifications
- ❑ Special Service Tools/Equipment
- ❑ Description & Operation
- ❑ Adjustments
- ❑ Pinpoint Test(s)
- ❑ Diagnostic(s)
- ❑ Disassembly & Assembly
- ❑ Other ____________

Explain your concern below: (*Please print*)

____

____

____

____

____

What do you think is the main cause of your concern?

- ❑ Missing Information
- ❑ Inaccurate Information
- ❑ Incomplete Information

Is the concern:

- ❑ Editorial
- ❑ Technical
- ❑ Both

Please tell us who you are: (*Please print*)

Your Name: ____________

Company Name: ____________ P&A Code: ____________ Occupation: ____________

Street: ____________

City: ____________ State: ____________ Zip/ Postal Code: ____________

Phone Number: ____________ Fax Number: ____________

Email Address: ____________

Revision 3, 5/23/2003

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