



"Understanding Engine Management"

Presented by Motor Age & TST

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What To Expect From This Webinar

- **A 60 to 90+ Minute Webinar**
- **A solid understanding of vehicle engine management helps you identify and resolve many of the drivability issues you encounter.**
- **A quick overview of PCM functions, covering inputs, outputs, and how sensors and actuators regulate engine performance.**
- **This webinar will discuss sensors, actuators, fuel trim, ignition systems, and O2/Air Fuel sensors essential for efficient engine operation.**
- **Explain the primary functions of the Powertrain Control Module (PCM), including how inputs, outputs, sensors, and actuators interact to control engine performance.**

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What To Expect From This Webinar

- **Identify key engine management components - fuel systems, ignition systems, and describe their role in efficient engine operation.**
- **Apply a foundational understanding of PCM logic to interpret sensor and actuator behavior during real-world diagnostic and performance scenarios.**
- **The Recording Will Be Available at Motor Age Training Account & TSTseminars.org**

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First Things First

- 1. Listen to the vehicle owner complaint**
- 2. Verify the complaint - this in many cases will require a test drive**
- 3. Perform a good visual**
- 4. Connect a scan tool and check for DTCs & look at Generic OBD II data**
- 5. Perform a complete vehicle scan**
- 6. Use AllData to check for DTC information, TSBs and system understanding**

Autel Ultra S2



ALLDATA - TSBs

Courtesy of AllData

ALLDATA - TSBs

Courtesy of AllData

ALLDATA - TSBs

ALLDATA Repair

2010 Ford Truck Explorer 4WD V6-4.6L

CAN System - Testing Information

Vehicle > Technical Information > Technical Service Bulletins > CAN System - Testing Information

CAN SYSTEM - TESTING INFORMATION

General Service Bulletin (GSB) - Line Network Monitor Test.

GSB Description: The Line Network Monitor Test allows you to test the vehicles Module Communication Network circuitry both statically and during a test driving.

Application: Ford Lincoln Motor Company vehicles that use CAN communication network.

What is a CAN Network Monitor?

What is a CAN Network Monitor? A CAN Network Monitor module monitors the vehicle's CAN communication network to ensure that the modules are communicating correctly. If the module is not communicating correctly, the CAN Network Monitor module will alert the driver to the problem.

How do I use the CAN Network Monitor?

How do I use the CAN Network Monitor? To use the CAN Network Monitor, you will need to connect a PC to the vehicle's CAN bus. Once the PC is connected, you can use a diagnostic software to read the CAN bus data and identify any errors or problems.

Where can I find additional information on the Module Communication Network?

Where can I find additional information on the Module Communication Network? You can find additional information on the Module Communication Network in the Ford Technical Service Bulletin (TSB) for the CAN System - Testing Information.

Line Network Monitor Test GSB

NOTE: The Line Network Monitor module is located in the Linking Module for F-150 and F-150 Heritage. GSB higher to other test coverage 23.

Access via the PTU "Vehicle" tab with one OBD or CAN connection to the PC and vehicle. Select "Vehicle" and "Line Network Monitor Test".

Open in New Tab Zoom/Print

Courtesy of AllData

ALLDATA - TSBs

ALLDATA Repair

2010 Ford Truck Explorer 4WD V6-4.6L

Fuel System - Easy Fuel(R) Capless Difficult Nozzle Operation

Vehicle > Technical Information > Technical Service Bulletins > Fuel System - Easy Fuel(R) Capless Difficult Nozzle Operation

FUEL SYSTEM - EASY FUEL(R) CAPLESS DIFFICULT NOZZLE OPERATION

TSB 14/13

01/2014

EASY FUEL CAPLESS - CONCERNING WITH FUEL NOZZLE INSERTION OR REMOVAL.

FORD

2009-2014 F-150, SuperCrew 8/100 Plus
2012-2014 F-150, Midsize, Taurus Connect
2013-2014 F-150, SuperCrew
2013-2014 F-150, SuperCrew
2009-2014 Explorer
2012-2015 Taurus

LINCOLN

2009-2014 F-150, Navigator
2012-2014 MKC
2012-2014 MKX

MERCURY

2009-2011 Mariner
2009-2011 Milan
2012-2013 Milan

ISSUE

Some vehicles equipped with the Easy Fuel Capless Fuel System may exhibit a condition where a fuel nozzle cannot be inserted and/or removed. This condition may be caused by a problem with the fuel nozzle itself. The sleeve on the tip of the nozzle may be causing the nozzle to stick and/or seize.

ACTION

Follow the service provider steps to correct the condition.

SERVICE PROCEDURE

- Provide the customer with the customer information sheet. (Input 2).
- Identify the customer concern.
- For fuel nozzle insertion concerns, proceed to Step 3.
- For fuel nozzle removal concerns, proceed to Step 5.

For fuel nozzle insertion concerns, an attempt to insert the fuel is to be made with the vehicle on the fuel tank filler neck.

Courtesy of AllData

ALLDATA - TSBs

2010 Ford Truck Explorer 4WD V6-4.0L.

Engine, A/T Controls - Harsh Downshift When Stopping

Vehicle > Powertrain Management > Technical Service Bulletins > Engine, A/T Controls - Harsh Downshift When Stopping

TSB11-65

06/16/11

4.0L (2010) ALU/BLA/THM/SGT/WD/VE/STOPING

FORD

2009-10 Explorer Sport Trac, Explorer

MERCURY

2010-11 Mountaineer

NOTE

Some 2009 and 2010 Explorer, Explorer Sport Trac and Mountaineer vehicles equipped with a 4.0L engine and 5R55 transmission may exhibit a harsh downshift while moving to a stop.

ACTION

Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

Change in the powertrain control module (PCM) in the latest calibration (C2, revision 72-08 and higher) or TSB 11-65. This class of condition is not included in the PCM 2011-12 software. This may also be referred to as the service.

NOTE

PLEASE ADVISE THE CUSTOMER THAT THIS VEHICLE IS SHIPPED WITH AN ADAPTIVE TRANSMISSION. SHIFT STRATEGY WHICH ALLOWS THE VEHICLE COMPUTER TO LEARN THE TRANSMISSION'S UNIQUE PARAMETERS AND IMPROVE SHIFT QUALITY. WHEN THE ADAPTER IS STARTED TO REACT, THE COMPUTER WILL BEGIN A RE-LEARNING PROCESS. THIS RE-LEARNING PROCESS MAY RESULT IN FASTER THAN NORMAL UPshiftS AND DOWNshiftS FOR SEVERAL DAYS.

WARRANTY STATUS: Eligible Under Provision of New Vehicle Limited Warranty Coverage

IMPORTANT: Warranty coverage limits are not affected by a TSB. Warranty coverage limits are determined by the identified cause/part.

OPERATION DESCRIPTION: TIME: 11/05/04-20/09/10 Explorer, 3.5 L Mountaineer, And Explorer Sport Trac 5R55 Transmission. Diagnosis: The PCM (Do not use with any other Powertrain).

DEALER CODE:

CONDITION CODE: RAMP NO. 2202 RSL-14

NOTE: The service procedure is intended to correct a vehicle that exhibits a harsh downshift when moving to a stop. If the vehicle exhibits a harsh downshift when moving to a stop, but does not exhibit the symptoms described in this service procedure, refer to the appropriate service procedure for that symptom.

DISCLAIMER

Courtesy of AllData

ALLDATA - TSBs

2010 Ford Truck Explorer 4WD V6-4.0L.

Engine - Rattle Noise/MIL/ON/DTC P0340/Misfire DTC's

Vehicle > Powertrain Management > Technical Service Bulletins > Engine - Rattle Noise/MIL/ON/DTC P0340/Misfire DTC's

TSB1516-11

09/27/10

4.0L (2010) Explorer, Explorer Sport Trac, Explorer

MERCURY

2010 Mountaineer

The article supersedes TSB 10-54 to update the

Part List, Service Procedure and Service Labor

Time Standards

DISCLAIMER

Some 2010 Explorer, Mountaineer, Explorer Sport Trac vehicles equipped with a 4.0L engine and 2010 Mustang vehicles equipped with a 4.0L engine and manual transmission(s) may exhibit some or all of the following symptoms: Engine rattle noise, misfire and/or misfire (long/MIL) and/or diagnosis trouble code P0340, misfire codes, lacks power, runs rough or no start condition. This affects vehicles with engine build dates from 9/28/2009 to 6/30/2010.

ACTION

Follow the Service Procedure steps to correct the condition.

SERVICE PROCEDURE

1. Check the engine build date. Refer to Workshop Manual (WOM), Section 300-014, for how to read engine build date. Date is in 02MMYY format.

a. If the engine build date is not within the date range 9/28/2009 to 6/30/2010, proceed to use of the following procedures based on symptoms:

b. If the engine build date is within the date range 9/28/2009 to 6/30/2010, refer to OEM Diagnostic.

Symptom A

Vehicle exhibits engine rattle noise in idle between idle and 1100 RPM. No DTC stored in powertrain control module (PCM).

Symptom B

Vehicle has DTC P0340 stored in the PCM with any of the following symptoms: misfire codes stored in the PCM, lack power, and/or runs rough.

Symptom C

Vehicle exhibits engine rattle noise in idle between idle and 1100 RPM. No DTC stored in powertrain control module (PCM).

Repair suggestions are down further but not shown here

Courtesy of AllData

ALLDATA - TSBs

Courtesy of AllData

ALLDATA - TSBs

Part 1

Courtesy of AllData

ALLDATA - TSBs

2. Check the clearance between the heater inlet hose and the throttle position sensor (TPS) connector and wiring. (Figure 1)

a. If the clearance is more than 3/8" (10 mm), follow normal diagnostics.

b. If the hose is touching the wiring or the clearance is 3/8" (10 mm) or less, proceed to Step 3.

3. Relieve cooling system pressure. Refer to Work Shop Manual (WSM), Section 3024.

4. Remove the spring clamp at the heater core outlet tube connection and rotate hose clockwise until the hose is oriented as shown in the picture and install the spring clamp. There should be about 15/16"-1 9/16" (23-30 mm) clearance between the hose and the TPS connector and wiring harness. In addition, the hose must have clearance to all clamps on the other heater hose.

5. Inspect the wires at the TPS connector where the hose was contacting. If the wires are worn, repair as needed.

6. Turn off engine coolant as needed.

7. Close OTS.

WARRANTY STATUS: Eligible Under Provisions Of New Vehicle Limited Warranty Coverage
IMPORTANT: Warranty coverage limits/policies are not altered by a TSB. Warranty coverage limits are determined by the identified causal part.

OPERATION DESCRIPTION: TIME 062244-2009-2010 Explore, 0.4L; Mountaineer 4.0L, Rotate The Heater Hose Following The Service Procedure (Do Not Use With Any Other Labor Operations) 062248-2009-2010 Explore, 0.5L; Mountaineer 4.0L, Rotate The Heater Hose, Repair Wires At The TPS Connector Following The Service Procedure (Do Not Use With Any Other Labor Operations)

DEALER CODING

CONDITION BASIC PART NO. CODE 19472.12



Part 2

Figure 1

Courtesy of AllData

ALLDATA - DTC Diagnosis

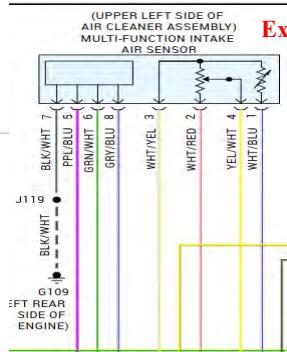
Courtesy of AllData

ALLDATA - System Description & Operation

Circuit/System Description from AllData

Component	Description
B74 Manifold Absolute Pressure Sensor	<p>The sensor is a capacitive pressure transducer. Electronics in the sensor convert pressure into an analog voltage signal.</p> <p>The sensor measures the pressure in the intake manifold between the throttle valve and the intake valves.</p> <p>When the engine is idling or decelerating, the sensor pressure should be low. When the engine is off or under wide-open throttle conditions the pressure should be the same or close to the barometric pressure.</p>
B75C Multifunction Intake Air Sensor	<p>The assembly has several functions:</p> <ul style="list-style-type: none"> The mass air flow sensor is a hot film type sensor that measures the mass of air (not the volume) entering the engine. The signal varies with engine load and is displayed by the scan tool in Hertz (Hz) and grams per second (g/s). The component houses the following sensors: <ul style="list-style-type: none"> BARO Sensor 1 BARO Sensor 2 IAT Sensor 1 IAT Sensor 2 Intake Air Humidity Sensor

Example of a GM MAF Sensor



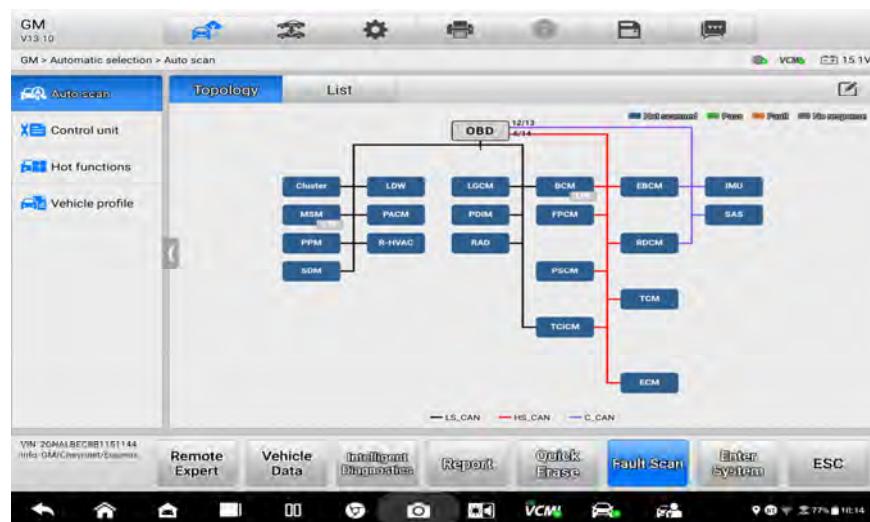
Courtesy of AllData

On To The Vehicle

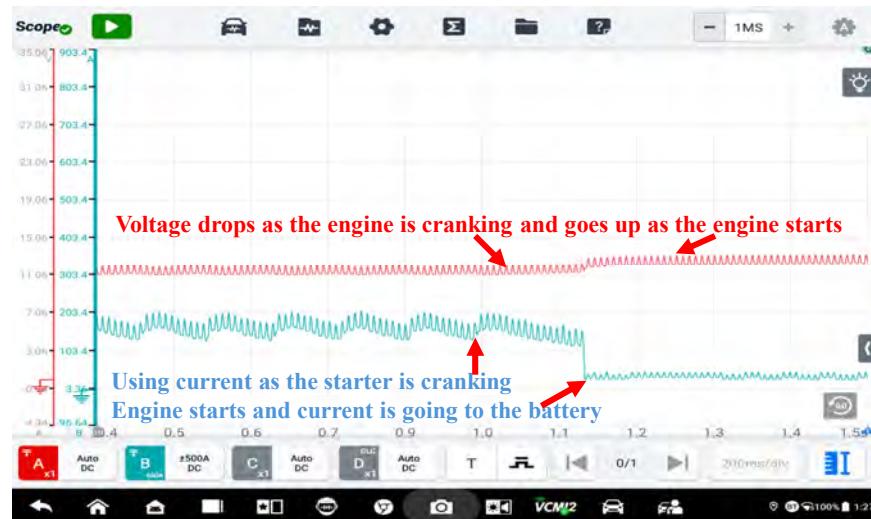
Check Generic Scan Data & Complete Vehicle Scan



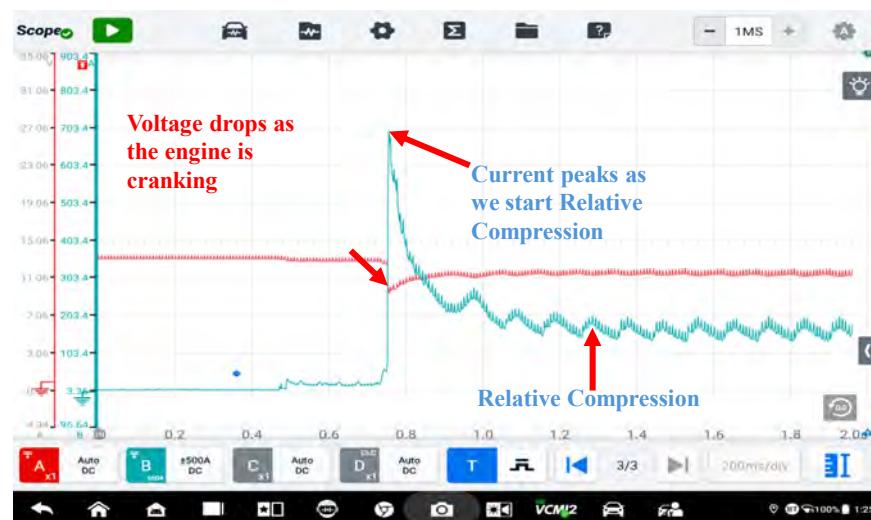
Check Topology - Complete Vehicle Scan



Check The Battery - Starter - Alternator / Generator

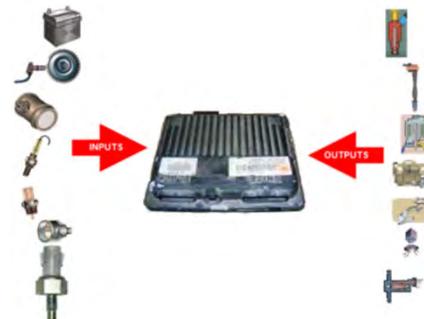


Check The Engine Health - Relative Compression



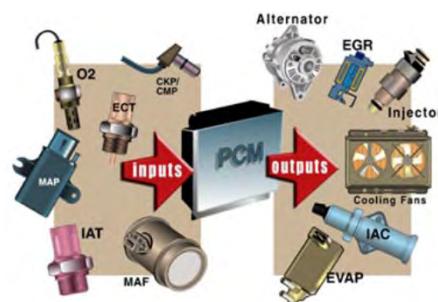
How Vehicle Computer Work

The PCM is the brain of the vehicle comparing engine data to what it would like things to be. Sensors in a vehicle are the eyes, ears, nose, and hands that God gave you to know what's going on. The PCM knowing what is going on might want to do something, like firing the fuel injectors for a certain period of time, uses actuators to get this done.



How Vehicle Computer Work

Sensors tell the PCM what is going on by transferring voltage signals that reflect what is going on in the engine such as load, throttle position, temperature, and more. So, to summarize, what vehicle computers do is Sense, Compare and Adjust.



On To Component Testing

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Testing Vehicle Sensors - Off Vehicle



Testing Vehicle Actuators - Off Vehicle



Testing Vehicle Actuators - Off Vehicle

Use **CAUTION** when replacing PCMs, they just don't happen to burn out. The sensitive circuits inside the PCM are easily damaged by actuators that have shorted out due to low electrical resistance or high mechanical resistance.

Use proper diagnostic procedures to test all solenoids before replacing a PCM.

Damage to PCMs are commonly caused by shorted solenoids.

Low Resistance = High Amperage



Generic OBD II

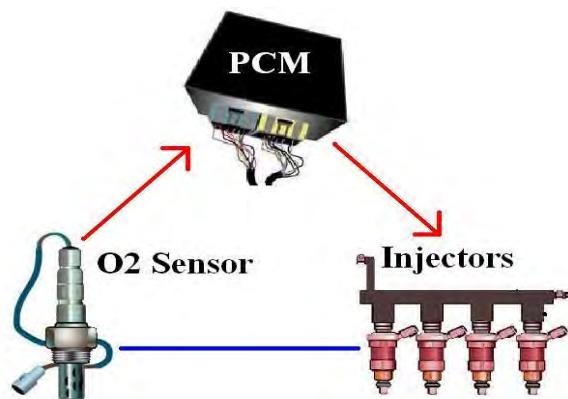
MODES	GENERIC TITLE
Mode 1	Powertrain Diagnostic Data
Mode 2	Powertrain Freeze Frame Data
Mode 3	Emission Related Powertrain DTCs
Mode 4	Clear/Reset Emission Related Diagnostic Information
Mode 5	Oxygen Sensor Monitoring Test Results
Mode 6	Test Results for Non-Continuously Monitoring Systems
Mode 7	Test Results for Continuously Monitored Systems
Mode 8	Request Control of On-Board System Test or Component
Mode 9	Request Vehicle Information
Mode 0A/10	Permanent Diagnostic Trouble Codes (DTCs) (Cleared DTCs)

The 10 Modes of OBD II are something you have been using for years. When you connect your scan tool collecting information for DTCs, hey that's Mode 3. When you look at scan data PIDS your using Mode 1. So, see you know some of the 10 Modes of OBD II. Mode 0A/ 10 is Permanent DTCs that started in 2010.

How Vehicle Computer Work

Think of a vehicle computer (PCM) system as the human body. A sensor (a sensor such as the HO2S) is like your fingertips touching something hot, sending the signal to your brain (the PCM) then sending the signal to your arm muscles (an actuator like injectors) to pull away.

Sense, Compare & Adjust



On To The Vehicle

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Ignition Test Using Labscope



Fuel Injector Test Using Labscope



Review -Helpful Sensor Information On The Most Common Sensors

- **CTS about 1.5 volts on a normal operating engine.**
- **HO2S (Oxygen Sensor) the voltage should switch from 150 mV or less to 850 mV or higher, at 2000 RPMs, within 100 milliseconds or less.**
- **IAT about 1 volts or so on a normal operating engine at idle.**
- **MAP should be about 1 volt on an engine that has 18 to 20 inches of vacuum at idle.**
- **MAF at least 1 gram per liter of the engine, tested at idle.**
- **TP (Throttle Position) voltage should be tested with a meter on Min/Max or better yet with a labscope. At closed throttle, the voltage typically is 300 mV to 1200 mV (1 volt, 200 mV) and approximately 5 volts at wide open throttle.**

TIP: When a new or good running vehicle enters your shop, check for DTCs and Pending DTCs. If there are **NONE** present, make a printout or write down the scan data at idle and 2500 RPM. This becomes very helpful information that you can use to compare a known good against what you are working on. **The information will assist you in finding a PID that is out of specification. Make sure it's the same engine with similar conditions, cold, hot, and 2500 RPM.**

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