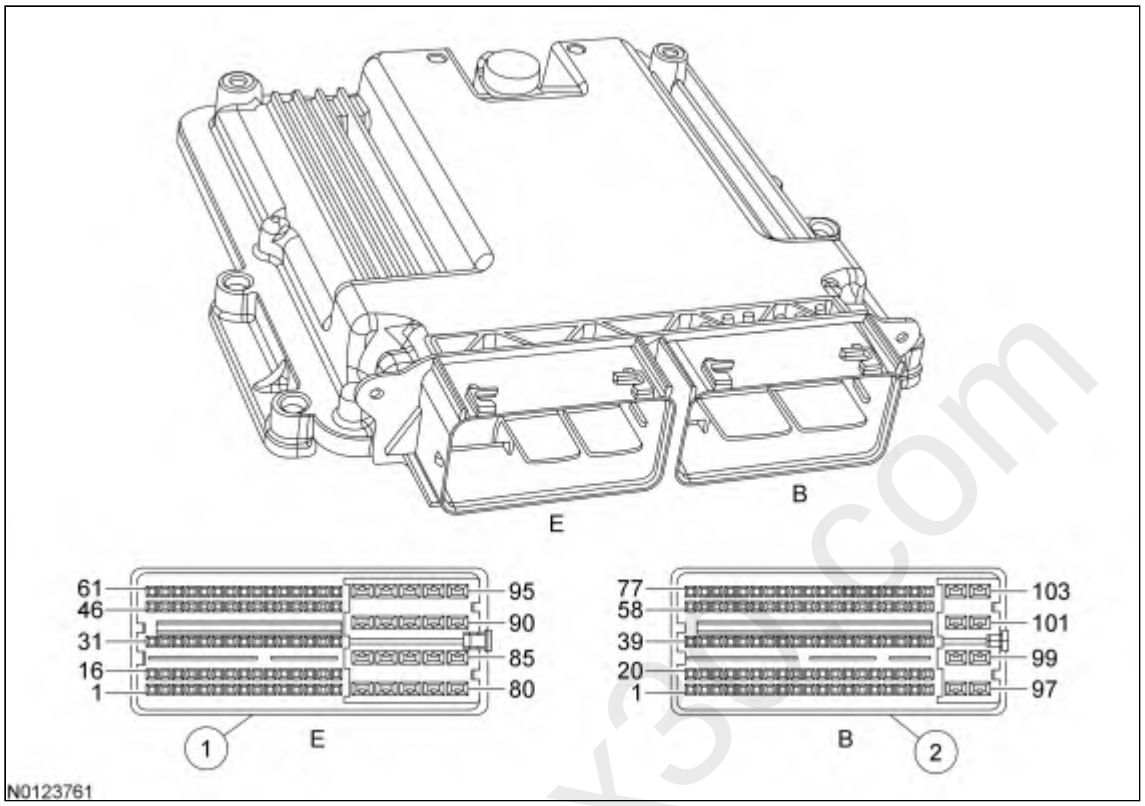
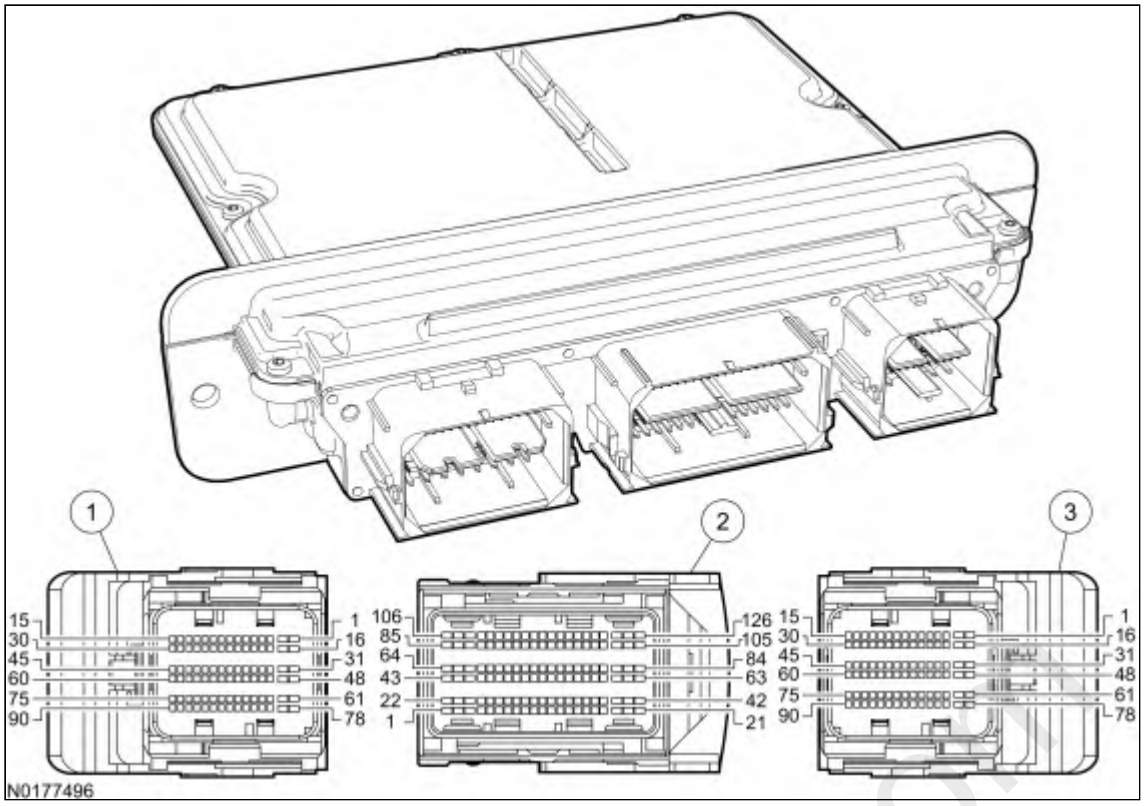
1	—	E Connector
2	—	B Connector
3	—	T Connector

198 Pin PCM



Item	Number	Description
1	—	E Connector
2	—	B Connector

306 Pin PCM



Item	Number	Description
1	—	B Connector
2	—	E Connector
3	—	T Connector

PCM Locations

For PCM location, removal and installation procedures, refer to the Workshop Manual Section 303-14, Electronic Engine Controls.

Fuel Pump Control Module

Note: *The Continental 3.0L, Ford GT, MKZ 3.0L, and Mustang 5.2L engines use two fuel pump control modules to control fuel for the fuel delivery system. The PCM outputs only one fuel pump duty cycle on the FPC circuit. Both fuel pump control modules use this circuit. The PCM individually monitors the fuel pump control modules through the FPM and FPM2 circuits. The fuel pump control module located on the driver side of the luggage compartment is referred to as Fuel Pump Control Module 1 and the fuel pump control module located on the passenger side of the luggage compartment is referred to as Fuel Pump Control Module 2.*

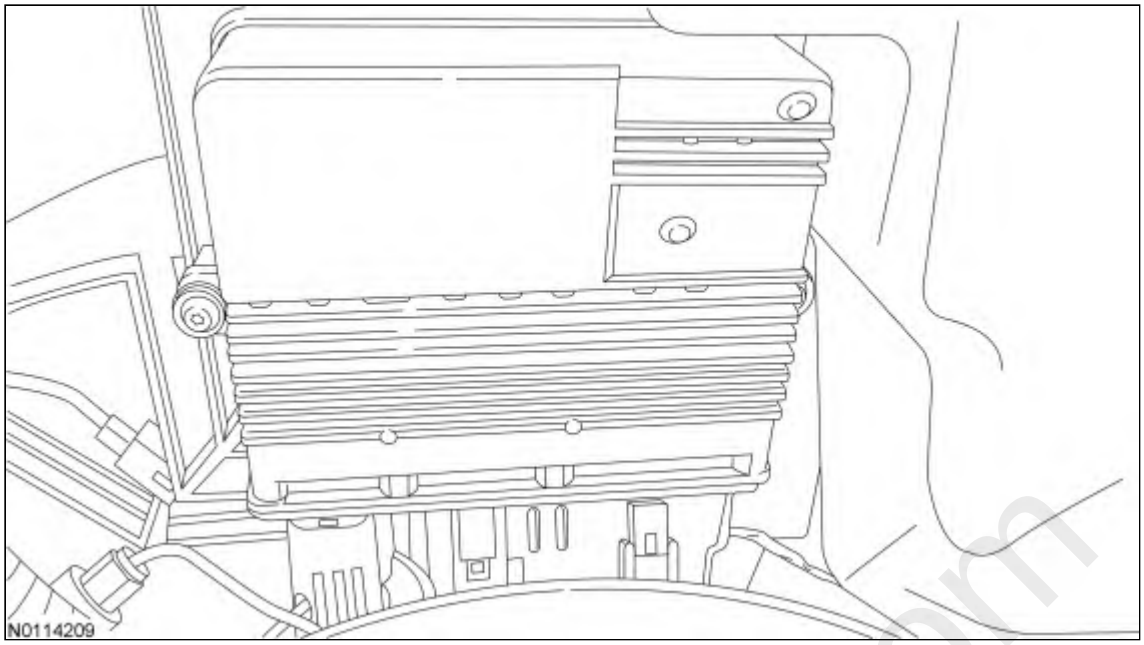
The fuel pump control module receives a duty cycle signal from the PCM and controls the fuel pump operation in relation to this duty cycle. The PCM requests low or high speed fuel pump operation depending on engine fuel demand. The fuel pump control module controls the fuel pump by switching the fuel pump power circuit ON and OFF at the required duty cycle. The fuel pump control module sends diagnostic information to the PCM on the FPM circuit. For additional information on the fuel pump control and the fuel pump monitor, refer to Fuel Systems in this section.

On vehicles with gasoline direct fuel injection, the high pressure fuel system may be under vacuum after several hours of cold soak. Fuel vapor may collect at the fuel injection pump, causing a long start condition. To prevent this, the fuel pump relay is energized for 1 or 2 seconds, depending on application, as soon as the dome light is commanded ON. This causes the fuel pump control module and the fuel pump to cycle for 1 or 2 seconds and purge any trapped air or fuel vapor from the high pressure fuel system.

Fuel Injector Heater Control Module

The fuel injector heater control module supplies direct battery voltage to the individual fuel injector heaters. The fuel injector heater ON time varies depending on ambient and engine coolant temperatures. The PCM may activate the fuel injector heaters any time the engine is running during cold ambient temperatures. The PCM monitors the fuel injector

heater functionality and control. If a concern is present, a DTC will set. For additional information, refer to Cold Start System in this section.



Fuel Injector Heater Control Module

Keep Alive Memory (KAM)

The PCM stores information about vehicle operating conditions in the KAM (a memory integrated circuit chip) and then uses this information to compensate for component variability. The KAM remains powered when the ignition is in the OFF position so the information is not lost.

Power and Ground Signals

Accelerator Pedal Position Reference Voltage (APPVREF)

The APPVREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) circuit.

Accelerator Pedal Position Return (APPRTN)

The APPRTN is a return path for APPVREF circuit.

Electronic Throttle Control Reference Voltage (ETCREF)

The ETCREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) circuit.

Electronic Throttle Control Return (ETCRTN)

The ETCRTN is a return path for ETCREF circuit.

Gold Plated Pins

Some engine control hardware has gold plated pins within the connectors and mating harness connectors to improve electrical stability for low current draw circuits and to enhance corrosion resistance. The engine control (EC) components equipped with gold plated pins vary by vehicle application. Only replace gold plated pins with new gold plated pins.

Keep Alive Power (KAPWR)

The KAPWR provides a constant voltage input independent of ignition switch state to the PCM. This voltage is used by the PCM to maintain the KAM.

Mass Airflow Return (MAFRTN)

The MAFRTN is a signal return circuit from the mass airflow (MAF) sensor.

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Power Ground (PWRGND)

The PWRGND circuits provides a return path for the PCM vehicle power (VPWR) circuits.

Signal Return (SIGRTN)

The SIGRTN is a dedicated return path for VREF applied components.

Starter Motor Request (SMR) Circuit

The SMR circuit provides the PCM with a signal from the ignition switch to the PCM. The input is pulled high when the ignition is in the START position and the transmission range (TR) sensor ignition lockout circuit allows the starter to engage.

Variable Reluctance Sensor Return (VRSRTN)

The VRSRTN circuit is a dedicated return path for variable reluctance (VR) type sensors.

Vehicle Buffered Power (VBPWR)

The VBPWR is a regulated voltage supplied by the PCM to vehicle sensors. These sensors require a constant 12 volts for operation and cannot withstand VPWR voltage variations. VBPWR is regulated to VPWR minus 1.5 volts and is also current limited to protect the sensors.

Vehicle Power (VPWR)

The VPWR is the primary source of PCM power. VPWR is switched through the PCM power relay.

Vehicle Reference Voltage (VREF)

The VREF is a consistent positive voltage (5 volts plus or minus 0.5 volt) provided by the PCM. VREF is typically used by 3 wire sensors and some digital input signals.

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Powertrain Control Software

Adaptive Airflow

Some vehicles equipped with electronic throttle control (ETC) have an adaptive airflow strategy that allows the PCM to correct for changes in the airflow. During idle, the PCM monitors the throttle angle and airflow. If the airflow is determined to be less than expected, the PCM adjusts the throttle angle to compensate.

The PCM only learns the adaptive airflow when the vehicle is at idle and normal operating temperature and the airflow is less than a calibrated limit. Whenever the battery is disconnected or the keep alive memory (KAM) is reset, it is necessary for the PCM to learn the new value and not use the default value. For additional information on a KAM reset, refer to Section 2, Resetting The Keep Alive Memory (KAM).

Auto Start Stop

The auto start stop system helps reduce fuel consumption and decrease emissions by automatically shutting down the engine when the vehicle stops and the engine is idling, usually within 1500 ms (1.5 seconds). To initiate the auto start stop operation, the vehicle gear selector must be in DRIVE when the vehicle comes to a stop and the brake pedal must be fully applied. The engine automatically restarts when the brake pedal is released, usually within 200 ms (0.5 seconds), or when a vehicle system requires a restart, for example to recharge the battery or to maintain interior comfort settings.

The auto start stop system is defaulted to an ON state when the engine is started. To switch the auto start stop system OFF, press the auto start stop switch located on the center console. To turn the auto start stop system ON, press the auto start stop switch again. The auto start stop system can only be deactivated during the current ignition cycle.

The instrument panel cluster (IPC) auto start stop indicator illuminates when an auto start stop system inhibit or disable condition is present.

During normal operation the auto start stop system may not stop the engine under the following conditions:

- The A/C, heat or defrost settings are ON
- The rear defroster is ON
- The battery has a low state of charge or is below 5°C (41°F) or above 60°C (140°F)
- The maximum engine off time is exceeded
- The engine operating temperature is less than 60°C (140°F)
- The gear selector is in the PARK, REVERSE, NEUTRAL or SECOND GEAR position
- The steering wheel is turned rapidly or is at a sharp angle
- Initial vehicle speed of greater than 4 km/h (2.5 MPH) and less than 2 seconds has elapsed
- The vehicle is on a steep road grade
- Elevation is above 10,000 feet (3,048 meters) approximately
- The clutch pedal position (CPP) sensor indicates the clutch pedal is fully released

Any of the following conditions may result in an automatic restart of the engine:

- The blower fan speed is increased or the climate control temperature is changed
- An electrical accessory is turned ON or plugged in
- Incorrect brake vacuum
- The auto start stop switch is pressed to disable the system while the engine is stopped

Automatic Engine Idle Shutdown

Vehicles equipped with automatic engine idle shutdown have an instrument panel cluster message and an audible alert that notifies the driver 30 seconds prior to engine shutdown. When the shutdown occurs, the PCM broadcasts a shutdown message and vehicle power is disabled. For additional information on the automatic engine idle shutdown, refer to the Owners Literature.

Shutdown occurs under the following conditions:

- The vehicle is stationary
- The gear selector is in the PARK or NEUTRAL position or the clutch pedal is released
- The accelerator pedal is released

- The brake pedal is released
- Scan tool is not connected

Brake Over Accelerator

Note: *On some vehicles, for off road use the brake over accelerator feature can be disabled along with the electronic stability control system by pressing and holding the traction control OFF button for 5 seconds.*

The brake over accelerator feature may not be active during low speed operating conditions. This enables unique drive maneuvers, such as trailer tow, boat launch and retrieval, or operation in hilly environments, where the operator may require the application of both the accelerator pedal and the brake pedal during low speed maneuvering. The brake over accelerator feature will be active at speeds greater than 16 km/h (10 MPH).

In the event the accelerator pedal becomes entrapped, such as by an object lodging the pedal, the brake over accelerator feature will reduce engine power when the brake pedal is applied.

Operators that rest a foot on the brake pedal when also applying the accelerator pedal may activate the brake over accelerator feature. The brake activation is detected by the PCM from the electrical brake switch. In addition to brake over accelerator comments, the customer may bring the vehicle in for repair to address concerns such as a hesitation/stumble or a lack/loss of power. In the event of a hesitation/stumble or a lack/loss of power concern, carry out normal vehicle diagnostics for the appropriate symptom code. If the brake over accelerator feature is suspect, the BRKOVR_ACTION, BRKOVRD_POSS and DIST_BRKOVRD PIDs will display a brake over accelerator event occurred.

In the event the brake over accelerator feature is suspected as the cause of the customer concern, explain to the customer the details of the override system as described above. Additionally, make sure the customer is aware that resting a foot on the brake pedal while driving may cause the activation of this feature. This also results in activation of the brake lights on the vehicle while driving. For additional information, refer to the Owners Literature.

Check Fuel Cap

The check fuel cap is a communications network message sent by the PCM. The PCM sends the message to illuminate the lamp when the strategy determines there is a concern in the EVAP system due to the fuel filler cap or capless fuel tank filler pipe not being sealed correctly. This is detected by the inability to pull vacuum in the fuel tank after a fueling event.

Computer Controlled Shutdown

The PCM controls the PCM power relay when the ignition is turned to the ON or START position, by grounding the PCMRC circuit. After the ignition is turned to the OFF, ACC or LOCK position, the PCM stays powered up until the correct engine shutdown occurs.

The ISP-R and the INJPWRM circuits provide the ignition state input to the PCM. Based on the ISP-R and INJPWRM signals the PCM determines when to power down the PCM power relay.

Deceleration Fuel Shut Off (DFSO)

During a DFSO event the PCM disables the fuel injectors. A DFSO event occurs during closed throttle, deceleration; similar to exiting a freeway. This strategy improves fuel economy, allows for increased rear heated oxygen sensor (HO2S) concern detection, and allows for misfire profile correction learning. One some vehicles with direct fuel injection, the PCM may also disable the ignition coils. This strategy extends spark plug life during the fuel shutoff events.

Engine Fluid Temperature Management

The engine fluid temperature management can be activated when high temperature or high load conditions take place. When the engine fluid temperature management is activated, the PCM sends a controller area network (CAN) message to the instrument panel cluster (IPC). The IPC then displays a power reduced to lower temp message. The engine coolant temperature gauge needle moves toward the H (hot) zone. In order to manage the engine's fluid temperatures, the PCM starts to reduce engine power and vehicle speed. The air conditioning may cycle ON and OFF to protect overheating of the engine.

Engine RPM Limiter

The PCM disables some or all of the fuel injectors whenever an engine RPM over speed condition is detected. The purpose of the engine RPM limiter is to prevent damage to the powertrain. Once the driver reduces the excessive engine speed, the engine returns to the normal operating mode. No repair is required. However, the technician should clear the DTCs and inform the customer of the reason for the DTC.

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