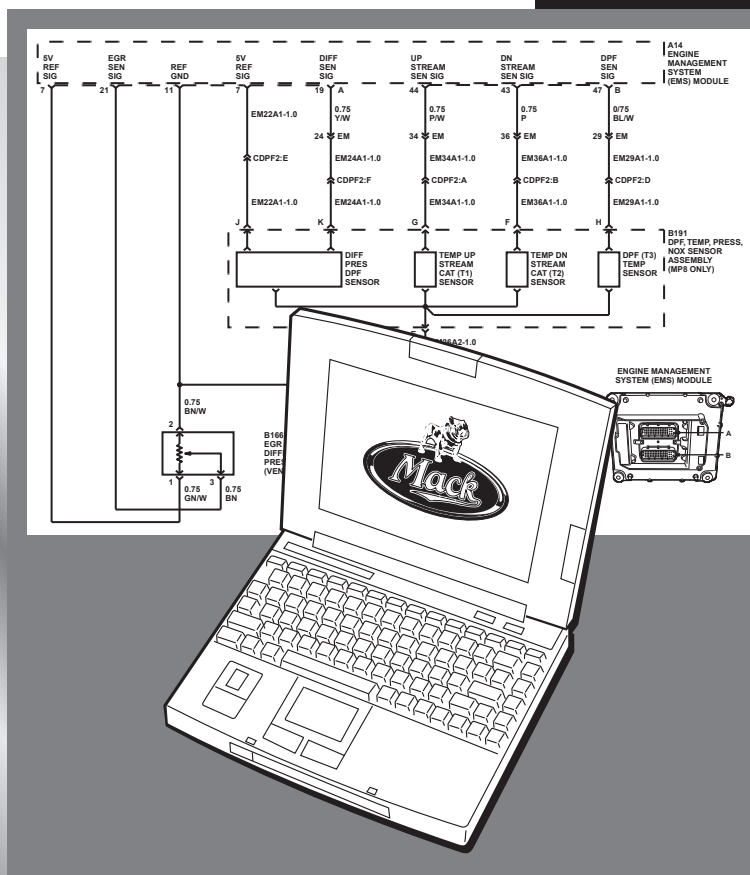




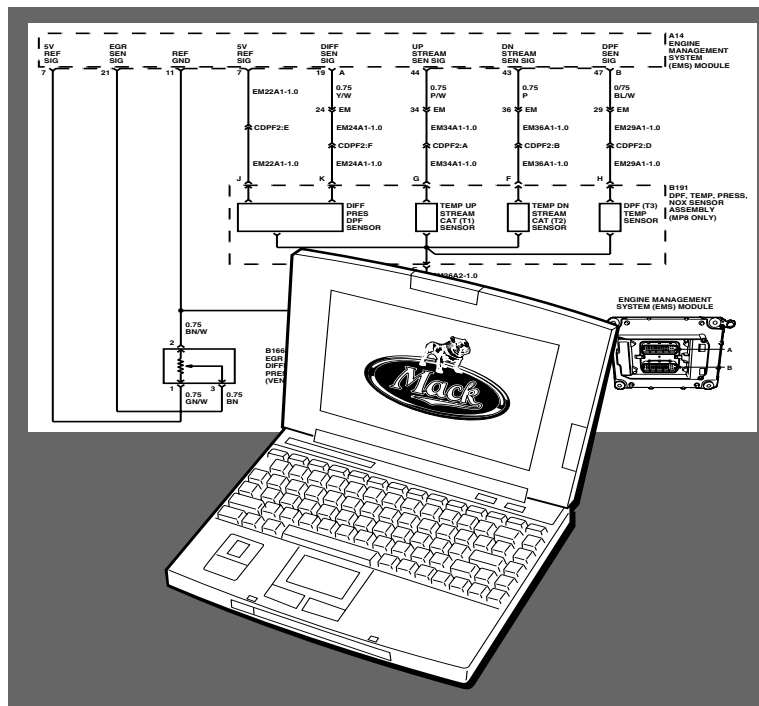
2007 EMISSIONS STANDARD FAULT CODE MANUAL



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2007 EMISSIONS STANDARDS FAULT CODE MANUAL



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V-MAC IV Diagnostic Equipment



ATTENTION

The information in this manual is not all inclusive and cannot take into account all unique situations. Note that some illustrations are typical and may not reflect the exact arrangement of every component installed on a specific chassis.

The information, specifications, and illustrations in this publication are based on information that was current at the time of publication.

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NOTES



INTRODUCTION

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INTRODUCTION

SAFETY INFORMATION

Advisory Labels

Cautionary *signal words* (Danger-Warning-Caution) may appear in various locations throughout this manual. Information accented by one of these signal words must be observed to minimize the risk of personal injury to service personnel, or the possibility of improper service methods which may damage the vehicle or cause it to be unsafe. Additional Notes and Service Hints are used to emphasize areas of procedural importance and provide suggestions for ease of repair. The following definitions indicate the use of these advisory labels as they appear throughout the manual:

DANGER

Activities associated with Danger indicate that death or serious personal injury may result from failing to heed the advisory. Serious personal injury may be equated to career-ending injury.

WARNING

Activities associated with Warning indicate that personal injury may result from failing to heed the advisory. In this case, personal injury is not equated to career-ending injury, but results in possible change in quality of life.

CAUTION

Activities associated with Caution indicate that product damage may result from failing to heed the advisory. Caution is not used for personal injury.

NOTE

A procedure, practice, or condition that is essential to emphasize.

SERVICE HINT

A helpful suggestion that will make it quicker and/or easier to perform a procedure, while possibly reducing service cost.



INTRODUCTION

ABOUT THIS MANUAL

This Manual is intended to provide the technician with the information necessary to diagnose the V-MAC IV (Vehicle Management and Control) System. Although every effort has been made to ensure that all the information is as accurate as possible, due to our product upgrades, some information may not be applicable to all vehicles. Not all vehicles are equally equipped, and care should be taken to determine exactly what equipment is installed on the vehicle.

Please pay particular attention to the Notes, Cautions and Warnings which are placed throughout the manual. These are intended to call attention to specific procedures which must be followed.

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Please take the time to familiarize yourself with the contents of this manual before attempting to work on a vehicle. Make sure you completely understand the instructions for performing a test before beginning the test procedure. Do not attempt to save time by skipping steps or using procedures other than those listed in this manual.



NOTES



DESCRIPTION AND OPERATION

DESCRIPTION AND OPERATION



DESCRIPTION AND OPERATION

V-MAC IV SYSTEM OVERVIEW

The V-MAC IV System uses three electronic control modules; the Engine Management System (EMS) Module, Instrument Cluster Module (ICM) and the Vehicle Electronic Control Unit (VECU). Together, these modules operate and communicate through the J1939 high speed serial data line to control a variety of engine and vehicle cab functions. The Engine Management System (EMS) Module controls fuel timing and delivery, fan operation, engine protection functions, engine brake operation, the EGR valve, and the turbocharger nozzle. The Vehicle Electronic Control Unit (VECU) controls engine speed, cruise control functions, accessory relay controls and idle shutdown functions. The Vehicle Electronic Control Unit also performs the trip recorder functions. The Instrument Cluster Module (ICM) primarily displays operational parameters and communicates these to the other ECU's. All have the capability to communicate over the J1587 low speed data lines primarily for programming, diagnostics and data reporting.

In addition to their control functions, the modules have on-board diagnostic capabilities. The on-board diagnostics are designed to detect faults or abnormal conditions that are not within normal operating parameters. When the system detects a fault or abnormal condition, the fault will be logged in one or both of the modules' memory, and the vehicle operator will be advised that a fault has occurred by illumination of the Electronic Malfunction Lamp (EML). The module will also initiate the engine shutdown procedure if the system determines that the fault will severely damage the engine.

In some situations when a fault is detected, the system will enter the "limp home" mode. The limp home mode allows continued vehicle operation but the system may substitute a sensor or signal value that may result in poor performance. In some instances, the system will continue to function but engine power may be limited to protect the engine and vehicle. Fault codes logged in the system memory can later be read, to aid in diagnosing the faults, with a diagnostic computer or through the instrument cluster. When diagnosing an intermittent code or condition, it is necessary to use a diagnostic computer connected to the Serial Communication Port.

Additional data and diagnostic tests are available when a diagnostic computer is connected to the Serial Communication Port.

The Vehicle Electronic Control Unit (VECU) is mounted on a panel below the top dash access panel in the center of the dash on conventional models. The VECU is a microprocessor based controller programmed to perform several functions, these include:

- Driver Controls
- Vehicle and engine speed controls
- Starter control
- Cap Power
- Idle controls
- Broadcasting data on the serial data lines
- Trip data logging
- Diagnostic fault logging and password processing

The VECU performs these functions by monitoring the signals from sensors and switches, and data received over the serial data lines from the other ECU's. The VECU directly monitors the Throttle Position (TP) Sensor Vehicle Speed (MPH) Sensor (VSS).

The VECU also monitors the position or state of a number of switches to perform its control and diagnostic functions. They are:

- A/C Pressure Switch
- Air Suspension Height Control Switch
- Clutch Switch
- Differential Lock Switch
- DRL Override Switch
- Engine Brake Switches
- Fan Override Switch
- Ignition Key Switch
- PTO Switches (if equipped)
- Service and Park Brake Switches
- Shutdown Override Switch
- Speed Control Switches (Set/Decel, Resume/Accel)
- 5th Wheel Slide Switch



DESCRIPTION AND OPERATION

The Engine Management System (EMS) Module is bolted to a fuel cooled mounting plate which is on the left side of the engine on the air intake manifold. The EMS is a microprocessor based controller programmed to perform fuel injection quantity and timing control, diagnostic fault logging, and to broadcast data to other modules. The fuel quantity and injection timing to each cylinder is precisely controlled to obtain optimal fuel economy and reduced exhaust emissions in all driving situations.

The EMS controls the operation of the Electronic Unit Injectors (EUIs), engine brake solenoid, EGR valve, turbocharger nozzle position, and cooling fan clutch based on input information it receives over the serial data lines and from the following sensors:

- Ambient Air Temperature Sensor
- Ambient (Barometric) Pressure Sensor
- Boost Air Pressure (BAP) Sensor
- Camshaft Position (Engine Position) Sensor
- Cooling Fan Speed (CFS) Sensor
- Crankshaft Position (Engine Speed) Sensor
- Differential Pressure DPF Sensor
- EGR Differential Pressure Sensor
- EGR Temperature Sensor
- Engine Coolant Level (ECL) Sensor
- Engine Coolant Temperature (ECT) Sensor
- Engine Oil Pressure (EOP) Sensor
- Engine Oil Level (EOL) Sensor
- Engine Oil Temperature (EOT) Sensor
- Exhaust Temperature Sensor (DPF Sensors)
- Fuel Pressure Sensor
- Intake Air Temperature And Humidity (IATH) Sensor
- Intake Manifold (Boost) Temperature Sensor
- Throttle Position (TP) Sensor
- Turbo Speed Sensor
- Variable Turbine Geometry (VTG) Position Sensor

The Vehicle Electronic Control Unit (VECU) and Engine Management System (EMS) Module are dependent on each other to perform their specific control functions. In addition to switch and sensor data the broadcast of data between modules also includes various calculations and conclusions each module has developed, based on the input information it has received.

Sensors

AMBIENT AIR TEMPERATURE SENSOR

The Ambient Air Temperature Sensor is used to detect the outside air temperature. The sensor modifies a voltage signal from the ECM. The modified signal returns to the ECM as the ambient air temperature. The sensor uses a thermistor that is sensitive to the change in temperature. The electrical resistance of the thermistor decreases as temperature increases.

The Ambient Air Temperature Sensor is located in the left front of the vehicle.

AMBIENT (BAROMETRIC) PRESSURE SENSOR

The Ambient (Barometric) Pressure Sensor contains a pressure sensitive diaphragm and an electrical amplifier. Mechanical pressure applied to the diaphragm causes the diaphragm to deflect and the amplifier to produce an electrical signal proportional to the deflection.

The Ambient (Barometric) Pressure Sensor is built into the Engine Management System (EMS) Module.

BOOST AIR PRESSURE (BAP) SENSOR

The Boost Air Pressure Sensor contains a pressure sensitive diaphragm and an electrical amplifier. Mechanical pressure applied to the diaphragm causes the diaphragm to deflect and the amplifier to produce an electrical signal proportional to the deflection.

The Boost Air Pressure Sensor is threaded into the top and to the rear of the intake manifold on the left side of the engine.



DESCRIPTION AND OPERATION

CAMSHAFT POSITION (ENGINE POSITION) SENSOR

The Camshaft Position (Engine Position) Sensor is located in the rear face of the timing gear cover at the rear of the engine, near the bottom of the valve cover. It uses magnetic induction to generate a pulsed electrical signal. It senses the passage of seven (7) timing bumps on the edge of the camshaft dampener. Six of the holes correspond to the phasing of the electronic unit injectors, while the seventh hole indicates the top dead center position.

COOLING FAN SPEED (CFS) SENSOR

On engines with an electronically controlled viscous fan drive, the electronic fan drive contains a Hall effect speed sensor. When the engine is running, a series of vanes in the fan drive housing rotates past a magnet in the fan drive solenoid generating a pulsed voltage signal. The Engine Management System (EMS) Module monitors the status of the air conditioning system and signals from the Engine Coolant Temperature (ECT) Sensor, the Engine Oil Temperature (EOT) Sensor, and the Engine Speed/Timing (RPM/TDC) Sensor and calculates the optimal cooling fan speed.

The Cooling Fan Speed Sensor is located in the fan drive on the front of the engine.

CRANKSHAFT POSITION (ENGINE SPEED) SENSOR

The Crankshaft Position (Engine Speed) Sensor uses magnetic induction to generate a pulsed electrical signal. Notches are machined into the edge of the flywheel. When one of the notches passes close to the sensor, electric pulses result.

The Crankshaft Position (Engine Speed) Sensor also indicates when the crankshaft is at the top dead center position. The sensor recognizes the end of one of the group of 18 notches and aligns that to the top dead center mark on the Engine Position (EP) Sensor.

DIFFERENTIAL PRESSURE DPF SENSOR

The differential pressure sensor is used for flow measurement of the Diesel Particulate Filter (DPF). This sensor has two pressure ports and senses the difference in pressure between the

two ports. Measurement of the pressure before and after the DPF is used to calculate diesel filter regeneration.

The Differential Pressure DPF Sensor is located on the side of the Diesel Particulate Filter (DPF).

EGR DIFFERENTIAL PRESSURE SENSOR

The EGR differential pressure sensor is used for flow measurement of the Exhaust Gas Recirculation (EGR) valve. This sensor has two pressure ports and senses the difference in pressure between the two ports. Measurement of the pressure before and after the EGR valve is used to calculate EGR flow.

The EGR Differential Pressure Sensor is located on the left side of the engine.

EGR TEMPERATURE SENSOR

The EGR temperature sensor detects exhaust gas temperature for EGR system. The sensor modifies a voltage signal from the control unit. The modified signal returns to the control unit as the exhaust temperature of the EGR system to confirm EGR operation. The sensor uses a thermistor that is sensitive to the change in temperature.

The EGR Temperature Sensor is located near the EGR valve.

ENGINE COOLANT LEVEL (ECL) SENSOR

The Engine Coolant Level (ECL) Sensor is a switch. If engine coolant level falls below a calibrated point the contacts open and the driver will be notified of the low coolant level.

The Engine Coolant Level (ECL) Sensor is located in the upper radiator tank or in the cooling system overflow tank.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

The Engine Coolant Temperature Sensor is located in the thermostat body at the front of the engine. The sensor will indicate a high coolant temperature caused by problems like radiator blockage, thermostat failure, heavy load, or high ambient temperatures. This sensor is also used for cold start enhancement and for fan clutch engagement.



DESCRIPTION AND OPERATION

ENGINE OIL PRESSURE (EOP) SENSOR

The Engine Oil Pressure Sensor contains a pressure sensitive diaphragm and a electrical amplifier. Mechanical pressure applied to the diaphragm causes the diaphragm to deflect and the amplifier to produce an electrical signal proportional to the deflection.

The Engine Oil Pressure Sensor is located on top of the oil filter assembly. The sensor monitors engine oil pressure to warn of lubrication system failure.

ENGINE OIL LEVEL (EOL) SENSOR

The Engine Oil Level Sensor is located in the oil pan. As the level varies the current required to maintain a heat dissipation rate varies.

ENGINE OIL TEMPERATURE (EOT) SENSOR

The Engine Oil Temperature Sensor is a thermistor whose resistance varies inversely to temperature. The sensor has a negative temperature coefficient, which means the sensor resistance will decrease as the engine oil temperature increases.

The Engine Oil Temperature Sensor is located in the oil pan.

EXHAUST TEMPERATURE SENSOR (DPF SENSORS)

The exhaust gas temperature sensor detects exhaust gas temperature for DPF protection as well as DPF regeneration control. The sensor modifies a voltage signal from the control unit. The modified signal returns to the control unit as the exhaust temperature at that specific location of the exhaust. The sensor uses a thermistor that is sensitive to the change in temperature.

The Exhaust Temperature Sensor is located in the exhaust pipe, just downstream from the turbocharger.

FUEL PRESSURE SENSOR

The fuel pressure sensor contains a diaphragm that senses fuel pressure. A pressure change causes the diaphragm to flex, inducing a stress or strain in the diaphragm. The resistor values in the sensor change in proportion to the stress applied to the diaphragm and produces an electrical output.

The Fuel Pressure Sensor is located on top of the fuel filter adapter.

INTAKE AIR TEMPERATURE AND HUMIDITY (IATH) SENSOR

The Intake Air Temperature and Humidity (IATH) Sensor contains a thermistor and a capacitive sensor. The resistance of the thermistor varies inversely to temperature. The output of the capacitive sensor increases as the humidity of the surrounding air increases. By monitoring the signals from both portions of the sensor, the Engine Management System (EMS) Module calculates the temperature and humidity of the air passing through the air filter housing.

The Intake Air Temperature and Humidity (IATH) Sensor is located in the air intake tube just downstream from the air filter canister.

INTAKE MANIFOLD (BOOST) TEMPERATURE SENSOR

The Intake Manifold (Boost) Temperature Sensor is a thermistor whose resistance varies inversely to temperature. The sensor has a negative temperature coefficient, which means the sensor resistance will decrease as the inlet air temperature increases.

The Intake Manifold (Boost) Temperature Sensor is located on the intake manifold. The sensor signal is used to control engine timing to prevent the formation of white smoke during engine warm-up. Intake air temperature information is also used to prevent misfire under light load conditions.



DESCRIPTION AND OPERATION

THROTTLE POSITION (TP) SENSOR

The Throttle Position Sensor is a potentiometer that is mechanically linked to the accelerator pedal. A potentiometer is a variable resistor whose resistance will change as the pedal is pressed. As the resistance changes, the signal voltage of the sensor changes indicating the accelerator pedal position.

The Throttle Position Sensor replaces the mechanical linkage for fuel control. The sensor is located under the accelerator pedal. The “drive by wire” pedal is designed to provide a system that “feels” similar to the standard type of accelerator pedal and mechanical linkage. The sensor is designed to improve the driver's control by reducing sensitivity to chassis motion. This sensor provides the driver's fuel request input to the VECU.

TURBO SPEED SENSOR

The Turbo Speed Sensor uses magnetic induction to generate a pulsed voltage signal. When the turbocharger vanes pass close to the sensor, a pulsed voltage signal is generated. The Engine Management System (EMS) Module uses this signal in conjunction with the VTG position sensor signal to control the speed of the turbocharger and therefore optimize the intake manifold pressure.

The Turbo Speed Sensor is mounted in the center of the turbocharger.

VARIABLE GEOMETRY TURBOCHARGER SMART REMOTE ACTUATOR (VGT SRA)

The Variable Geometry Turbocharger Smart Remote Actuator (VGT SRA) takes the position commands from the EMS, moves the nozzle of the turbocharger to the desired position, and performs all of the diagnostics and self checks on the actuator.



DESCRIPTION AND OPERATION

SYSTEM CONNECTORS

The V-MAC IV system utilizes many different connector styles and sizes. The Engine Management System (EMS) Module and the Vehicle Electronic Control Unit (VECU) are some of the largest connectors in the system. These connectors and control units are where the majority of the V-MAC IV system testing is performed. This section illustrates the EMS Module and Vehicle Electronic Control Unit (VECU) connectors and includes charts with connector terminal identification and functions. The charts should not be used as a replacement for the detailed tests that appear in this manual. The charts are intended as an identification reference for use when repairing a connector or terminal.

Engine Management System (EMS) Module

The Engine Management System (EMS) Module has two 62 pin connectors. To disconnect a connector from the EMS Module, pull back on the connector lock and gently pull the connector back on its heel and away from the EMS Module. For easy reference, the following illustration shows each pin number as it appears on the connector. Be sure that the connector is aligned as shown below to avoid confusion when checking pin numbers. The connector numbers and EMS Module orientation are shown as a reference for reconnecting the EMS Module to the engine harness.

The programming of the Engine Management System (EMS) Module should be performed using Vcads Pro.

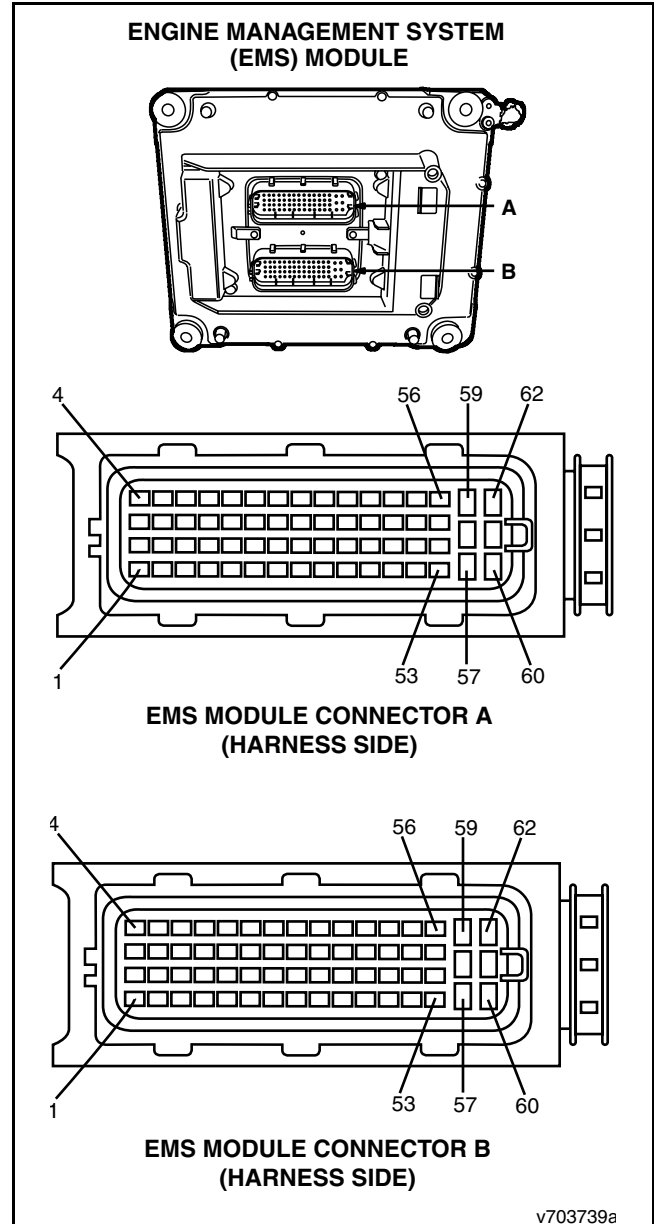


Figure 1 — EMS Connectors



DESCRIPTION AND OPERATION

Vehicle Electronic Control Unit (VECU) Connectors

The Vehicle Electronic Control Unit (VECU) has two 30 pin connectors and one 5 pin connector. Each pin is marked on the inside of the connector. To disconnect a connector from the VECU, press down on the tang of the harness connector and gently pull the connector from the VECU. Be sure that the connector is aligned as shown below to avoid confusion when checking pin numbers. The connector number and color are shown as a reference for reconnecting the VECU harness.

The programming of the Vehicle Electronic Control Unit (VECU) should be performed using Vcads Pro.

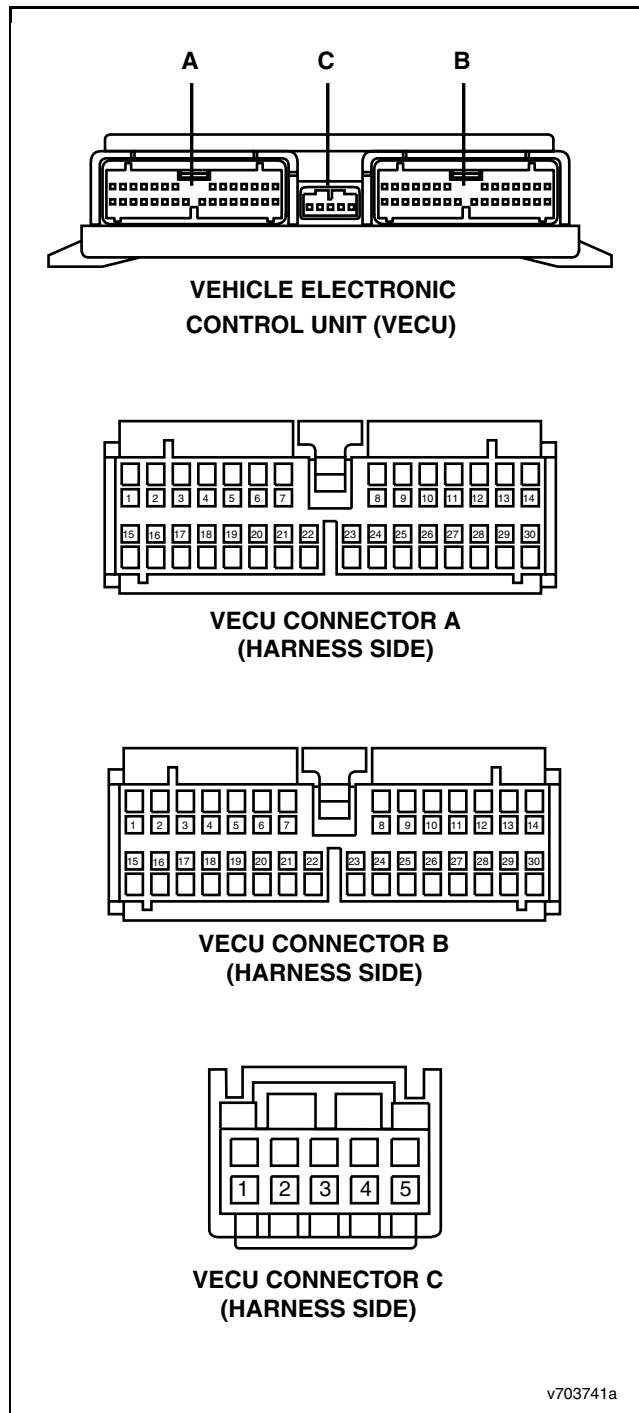


Figure 2 — VECU Connectors



DESCRIPTION AND OPERATION

TROUBLESHOOTING

MACK FAULT CODE IDENTIFICATION TABLE

Definitions

MID (Message Identification Description):
Identification of ECU

- The MID identifies which ECU is broadcasting the code.
- Example: MID 128 indicates that the code is being broadcasted by the Engine Management System (EMS) Module.

SID (Subsystem Identification Description):
Identification of component

- The SID describes the fault code.
- Example: SID 1 represents a failure with the Fuel Injector Unit #1.

FMI (Failure Mode Identifier): Identification of parameter value

- The FMI specifically defines the fault.
- Example: FMI 7 indicates that the mechanical system is not responding or may be out of adjustment.

PPID (Proprietary Parameter Identification Description): Volvo unique identification of parameter value

PSID (Proprietary Subsystem Identification Description): Volvo unique identification of component

NOTE

The above fault code structure allows the technician to determine the exact cause of the fault. Always use the entire fault code (all 3 components) when fault tracing.

Emissions Fault Code	Component/Function	"FMI Codes"
MID 128 PID 81	Particulate Trap Differential Pressure	0, 2, 3, 5, 12
MID 128 PID 94	Fuel Pressure	1, 3, 5, 7
MID 128 PID 102	Boost Pressure	0, 2, 3, 5, 11
MID 128 PID 103	Turbo Speed	0, 1, 9
MID 128 PID 105	Boost Temperature	2, 4, 5, 10
MID 128 PID 108	Ambient Pressure	2, 3, 4
MID 128 PID 110	Coolant Temperature	0, 2, 4, 5, 10
MID 128 PID 153	Crankcase Pressure	0, 1, 2, 3, 5
MID 128 PID 171	Ambient Air Temperature	9
MID 128 PID 173	Exhaust Gas Temperature Sensor #1	0, 2, 4, 5, 10
MID 128 PID 354	Relative Air Humidity	3, 5
MID 128 PID 404	Compressor Discharge Temperature	0
MID 128 PID 411	EGR Differential Pressure	2, 3, 5
MID 128 PID 412	EGR Temperature After Cooler	0, 4, 5, 10
MID 128 PPID 35	EGR Mass Flow	0, 1
MID 128 PPID 89	VGT SRA Temperature	0
MID 128 PPID 122	Vehicle Compression Brake (VCB)	1, 3, 4, 5
MID 128 PPID 272	Air Temperature For Humidity Compensation	4, 5
MID 128 PPID 326	Soot Level	0, 11, 14
MID 128 PPID 328	After Treatment Injection Shut-off Valve	3, 4, 5, 7, 14
MID 128 PPID 329	After Treatment Fuel Injector	3, 4, 5, 7, 14
MID 128 PPID 387	Exhaust Gas Temperature Sensor #2	2, 4, 5, 10
MID 128 PPID 436	Exhaust Gas Temperature Sensor #3	0, 2, 4, 5, 10



DESCRIPTION AND OPERATION

Emissions Fault Code	Component/Function	"FMI Codes"
MID 128 PPID 437	After Treatment Injector Fuel Pressure	3, 4, 5, 7, 14
MID 128 PSID 98	Boost Air System	0, 1
MID 128 PSID 109	Coolant Temperature	7, 12
MID 128 SID 1	Injector #1	3, 5, 7, 12, 14
MID 128 SID 2	Injector #2	3, 5, 7, 12, 14
MID 128 SID 3	Injector #3	3, 5, 7, 12, 14
MID 128 SID 4	Injector #4	3, 5, 7, 12, 14
MID 128 SID 5	Injector #5	3, 5, 7, 12, 14
MID 128 SID 6	Injector #6	3, 5, 7, 12, 14
MID 128 SID 21	Camshaft Speed Sensor	2, 3, 8
MID 128 SID 22	Crankshaft Speed Sensor	2, 3, 8
MID 128 SID 27	Variable Geometry Turbocharger Actuator #1	2, 4, 7, 9, 13
MID 128 SID 33	Cooling Fan Control	3, 4, 5
MID 128 SID 146	EGR Valve 1	3, 5, 7, 12
MID 128 SID 211	5V Supply 2	3, 4
MID 128 SID 230	Buffered IVS	3, 5
MID 128 SID 232	5V Supply 1	3, 4
MID 144 PID 72	Output Supply #1	3, 4
MID 144 PID 73	Output Supply #2	3, 4
MID 144 PID 84 (with Tachometer)	Road Speed	2
MID 144 PID 84	Road Speed	2
MID 144 PID 91	Percent Accelerator Pedal Position	3, 4, 5, 6, 14
MID 144 PPID 61	Engine Retarder Switch	7
MID 144 PPID 69	Buffered Idle Validation Switch #1 output	3, 4
MID 144 PPID 70	Output Supply #3	4
MID 144 PPID 71	Output Supply #4	4
MID 144 PPID 265	Vehicle Speed Sensor supply	3, 4
MID 144 PSID 2	Idle Validation Switch #2	7
MID 144 SID 230	Idle Validation Switch #1	7



MID 128-PID 81

MID 128 PID 81 — PARTICULATE TRAP DIFFERENTIAL PRESSURE SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range - Most Severe Level), 2 (Data Erratic, Intermittent or Incorrect), 3 (Voltage Above Normal, or Shorted To High Source), 5 (Current Below Normal or Open Circuit), 12 (Intelligent Device or Component)

Parameter Identification (PPID): P81

Message Identification (MID): 128

FMI 0

Data Valid But Above Normal Operational Range - Most Severe Level

Conditions for fault code:

- Moderately high pressure

Possible causes:

- Particulate Trap Pressure (PTP) Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss
- Engine derate

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Sensor is not rational

Possible causes:

- Particulate Trap Pressure (PTP) Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Short to battery on the metering side of the circuit
- Open circuit in the ground line

Possible causes:

- Particulate Trap Pressure (PTP) Sensor failure
- Faulty Particulate Trap Pressure (PTP) Sensor connector
- Faulty harness

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Open circuit in 5 volt supply line
- Short to ground in metering line
- Open circuit in the metering line

Possible causes:

- Particulate Trap Pressure (PTP) Sensor failure
- Faulty harness

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated
- Default value substituted



MID 128-PID 81

FMI 12

Bad Intelligent Device or Component

Conditions for fault code:

- Particulate Trap Pressure (PTP) Sensor signal high or low but still within range

Possible causes:

- Diesel Particulate Filter (DPF) is damaged, filled with soot or missing

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Reduced power



MID 128-PID 94

MID 128 PID 94 — FUEL PRESSURE (FP) SENSOR

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 1 (Pressure Critically Low), 3 (Voltage High/Open), 5 (Current Low/Open), 7 (Mechanical System Not Responding)

Parameter Identification (PID): P94

Message Identification (MID): 128

Circuit Description: The Fuel Pressure (FP) Sensor is used to detect low fuel pressure system failures. The sensor consists of a pressure sensitive diaphragm and amplifier. Fuel pressure causes the sensor's diaphragm to deflect and produce an electrical signal proportional to the pressure. The diaphragm deflection signal is amplified in the sensor. The sensor's signal is monitored by the Engine Management System (EMS) Module. The EMS Module will set a fault code if the sensor signal is not within predetermined limits.

Location: The Fuel Pressure (FP) Sensor is located on the right side of the engine near the fuel filters.

FMI 1:

- Pressure Critically Low

Conditions for fault code:

- The EMS module detects a low fuel pressure reading from the Fuel Pressure (FP) Sensor.

Possible causes:

- A clogged fuel filter.
- Fuel leaking from a fuel line or fitting.
- Poor fuel pump pressure.

Reaction from EMS module:

- Illuminate MIL if fault is present for 2 or more drive cycles

Noticeable external symptoms:

- Rough idle
- Uneven running
- Poor engine power and acceleration

FMI 3:

- Voltage High/Open

Conditions for fault code:

- The Malfunction Indicator Lamp (MIL) will illuminate when the Fuel Pressure (FP) Sensor signal line voltage is low.

Possible causes:

- Poor connector contacts in harness
- Faulty Fuel Pressure (FP) Sensor
- Short to battery

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Loss of power
- Uneven running
- MIL lamp illuminated

FMI 5:

- Current Low/Open

Conditions for fault code:

- The Malfunction Indicator Lamp (MIL) will illuminate when the Fuel Pressure (FP) Sensor signal line voltage is low.

Possible causes:

- Poor connector contacts in harness
- Faulty Fuel Pressure (FP) Sensor

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Loss of power
- Uneven running
- MIL lamp illuminated



MID 128-PID 94

FMI 7:

- Current Low/Open

Conditions for fault code:

- FMI 7 will set if the fuel pressure drops.

Possible causes:

- A clogged fuel filter.
- Fuel leaking from a fuel line or fitting.
- Poor fuel pump pressure.

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Loss of power
- Uneven running
- MIL lamp illuminated



MID 128-PID 97

MID 128 PID 97 — WATER IN FUEL SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage High/Open), 4 (Voltage Low)

Parameter Identification (PID): P97

Message Identification (MID): 128

Circuit Description: Voltage from the Engine Management System (EMS) Module is applied to the Water In Fuel (WIF) Sensor when the ignition switch is in the ON position. If water is detected, the WIF sensor will notify the driver to drain the water from the bowl by illuminating a lamp on the dash of the vehicle.

Location: The Water In Fuel (WIF) Sensor is located in the transparent plastic bowl under the fuel filter. The fuel filter is located on the left side of the engine.

FMI 3:

- Voltage High/Open

Possible causes:

- Harness is shorted to battery
- Open circuit in the harness

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Possible undetected water in the fuel supply. This can cause the engine to stop.
- Uneven running
- MIL lamp illuminated

FMI 4:

- Voltage Low

Possible causes:

- Harness is shorted to ground
- Open circuit in the harness

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Possible undetected water in the fuel supply. This can cause the engine to stop.
- Uneven running
- MIL lamp illuminated



MID 128-PID 102

MID 128 PID 102 — BOOST AIR PRESSURE SENSOR

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range), 3 (Voltage High/Open), 5 (Current Low/Open)

Parameter Identification (PID): P102

Message Identification (MID): 128

Circuit Description: The Boost Air Pressure Sensor is used to monitor the pressure of the air in the intake system downstream from the turbocharger. The sensor consists of a pressure sensitive diaphragm/amplifier. Air pressure causes the sensor's diaphragm to deflect and produce an electrical signal proportional to the pressure. The diaphragm deflection signal is amplified in the sensor. The sensor's signal is monitored by the EMS Module. The EMS Module will set a fault code if the sensor signal is not within predetermined limits, or the signal is not rational.

Location: The Boost Pressure Sensor is located in the air intake manifold.

FMI 0:

- Data Valid But Above Normal Operational Range

Conditions for fault code:

- This fault will become active when the EMS Module detects that the Boost Air Pressure Sensor output is high.
- The Boost Air Pressure Sensor is indicating an unphysical value.

Possible causes:

- Variable Geometry Turbo (VGT) actuator stuck.
- Wastegate stuck
- Faulty Boost Air Pressure Sensor harness
- Inlet air leakage
- Boost Air Pressure Sensor failure

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Intermittent powerloss
- MIL lamp illuminated

FMI 1:

- Data Valid But Below Normal Operational Range

Conditions for fault code:

- The Boost Air Pressure Sensor is indicating an unphysical value.

Possible causes:

- Intermittent fault in the Boost Air Pressure Sensor harness
- Faulty Boost Air Pressure Sensor connector
- Boost Air Pressure Sensor failure

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated



MID 128-PID 102

FMI 2:

- Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- The Boost Air Pressure Sensor output is too high or too low.

Possible causes:

- Intermittent fault in the Boost Air Pressure Sensor harness failure.
- Faulty Boost Air Pressure Sensor connector
- Boost Air Pressure Sensor failure

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated

FMI 3:

- Voltage Above Normal, or Shorted to High Source

Conditions for fault code:

- A short to battery in the metering circuit
- An open in the ground circuit of the Boost Air Pressure Sensor

Possible causes:

- Intermittent fault in the Boost Air Pressure Sensor harness
- Faulty Boost Air Pressure Sensor connector
- Boost Air Pressure Sensor failure

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated

FMI 5:

- Current Below Normal or Open Circuit

Conditions for fault code:

- A short to ground
- An open in the 5 volt supply circuit
- An open in the metering circuit

Possible causes:

- Intermittent fault in the Boost Air Pressure Sensor harness
- Faulty Boost Air Pressure Sensor connector
- Boost Air Pressure Sensor failure

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated

FMI 11:

- Root Cause Not Known (Data Incorrect)

Conditions for fault code:

- The Boost Air Pressure Sensor output is too high or too low.

Possible causes:

- Faulty Boost Air Pressure Sensor harness
- Inlet air leakage
- Boost Air Pressure Sensor failure

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated



MID 128-PID 103

MID 128 PID 103 — TURBO SPEED SENSOR

Failure Mode Identifier (FMI): 0 (Data Valid but Above Normal Operational Range), 1 (Data Valid but Below Normal Operational Range), 9 (Abnormal Update Rate)

Parameter Identification (PID): P103

Message Identification (MID): 128

Circuit Description: The Turbo Speed Sensor is an inductive sensor. When the engine is running, the turbocharger shaft rotates past the Turbo Speed Sensor tip and a pulsed voltage signal is generated. The Engine Management System (EMS) Module monitors the frequency of the signal generated by the Turbo Speed Sensor to calculate the turbo speed.

Location: The Turbo Speed Sensor is located on the right side of the engine and mounted in the turbocharger.

FMI 0:

- Data Valid But Above Normal Operational Range

Conditions for fault code:

- A fault is logged if the measured turbocharger speed is at least 25% greater than the target wheel speed for the measured boost.

Possible causes:

- Miss detection
- Faulty Turbo Speed Sensor harness
- Faulty Turbo Speed Sensor connector
- Turbo Speed Sensor failure

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Intermittent powerloss
- MIL lamp illuminated

FMI 1:

- Data Valid But Below Normal Operational Range

Conditions for fault code:

- A fault is logged if the measured turbocharger speed is at least 25% less than the target wheel speed for the measured boost.

Possible causes:

- Miss detection
- Faulty Turbo Speed Sensor harness
- Turbo Speed Sensor failure
- Faulty Turbo Speed Sensor connector

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Intermittent powerloss
- MIL lamp illuminated

FMI 9:

- Abnormal Update Rate (Missing Sensor Signal)

Conditions for fault code:

- A fault is logged if the Turbo Speed Sensor signal is lost.

Possible causes:

- Short to battery in the measuring line of the Turbo Speed Sensor circuit
- Short to ground in the metering line of the Turbo Speed Sensor circuit
- An open in the metering line of the Turbo Speed Sensor circuit

Reaction from EMS module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Intermittent powerloss
- MIL lamp illuminated



MID 128-PID 105

MID 128 PID 105 — BOOST TEMPERATURE SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range), 1 (Data Valid But Below Normal Operational Range), 2 (Data Erratic, Intermittent or Incorrect), 4 (Voltage Below Normal, or Shorted Low), 5 (Current Below Normal or Open Circuit), 10 (Abnormal Rate of Change)

Parameter Identification (PID): P105

Message Identification (MID): 128

Circuit Description: The Boost Temperature Sensor is used to monitor the temperature of the air in the intake system downstream from the turbocharger. The sensor's signal is monitored by the EMS Module. The EMS Module will set a fault code if the sensor signal is not within predetermined limits, or the signal is not rational.

Location: The Boost Temperature Sensor is located in the air intake manifold.

FMI 0:

- Data Valid But Above Normal Operational Range

Conditions for fault code:

- The Boost Temperature Sensor is indicating an unphysical value.

Possible causes:

- Faulty Boost Temperature Sensor or Engine Management System (EMS) Module connector.
- Break in the Boost Temperature Sensor harness
- Malfunctioning Boost Temperature Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated

FMI 1:

- Data Valid But Below Normal Operational Range

Conditions for fault code:

- The Boost Temperature Sensor is indicating an unphysical value.

Possible causes:

- Faulty Boost Temperature Sensor or Engine Management System (EMS) Module connector.
- Break in the Boost Temperature Sensor harness
- Malfunctioning Boost Temperature Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Minor power loss
- MIL lamp illuminated

FMI 2:

- Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- The Boost Temperature Sensor output is too high or too low.

Possible causes:

- Faulty Boost Temperature Sensor or Engine Management System (EMS) Module connector.
- Break in the Boost Temperature Sensor harness
- Malfunctioning Boost Temperature Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate



MID 128-PID 105

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated

FMI 4:

- Voltage Below Normal, or Shorted Low

Possible causes:

- A short to ground
- Intermittent fault in the Boost Temperature Sensor harness
- Faulty Boost Temperature Sensor connector
- Boost Temperature Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Difficult to start in cold climates
- Power loss
- MIL lamp illuminated

FMI 5:

- Current Below Normal or Open Circuit

Conditions for fault code:

- A short to battery
- An open in the 5 volt supply circuit

Possible causes:

- A short to ground in the metering circuit
- Intermittent fault in the Boost Temperature Sensor harness
- Faulty Boost Temperature Sensor connector
- Boost Temperature Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Difficult to start in cold climates
- Power loss
- MIL lamp illuminated

FMI 10:

- Abnormal Rate of Change

Conditions for fault code:

- The Boost Temperature Sensor output is showing a constant value.

Possible causes:

- Faulty Boost Temperature Sensor harness
- Boost Temperature Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Power loss
- MIL lamp illuminated



MID 128-PID 108

MID 128 PID 108 — AMBIENT PRESSURE SENSOR

Failure Mode Identifier (FMI): 2 (Data Erratic), 3 (Voltage Above Normal, or Shorted to High Source), 4 (Voltage Below Normal, or Shorted to Low Source)

Parameter Identification (PID): P108

Message Identification (MID): 128

Location: The Ambient Pressure Sensor is located inside the Engine Management System (EMS) Module.

NOTE

The Ambient Pressure Sensor is shorted to another circuit. If the code is active, attempt to clear the code from memory and check if the code resets. If PID 108 resets, replace the Engine Management System (EMS) Module and retest the system.

FMI 2

Data Erratic

Conditions for fault code:

- Ambient air pressure is showing too high or too low a value (abnormal value)

Possible causes:

- Faulty Ambient Pressure sensor
- Faulty Engine Management System (EMS) Module

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss (minor)

FMI 3

Voltage Above Normal, or Shorted to High Source

Conditions for fault code:

- Short to battery on the metering side

Possible causes:

- Internal fault in Engine Management System (EMS) Module
- Faulty Ambient Pressure sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated
- Pressure is set to default value

FMI 4

Voltage Below Normal, or Shorted to Low Source

Conditions for fault code:

- Short to ground on the metering side

Possible causes:

- Internal fault in Engine Management System (EMS) Module
- Faulty Ambient Pressure sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated
- Pressure is set to default value



MID 128-PID 110

MID 128 PID 110 — ENGINE COOLANT TEMPERATURE (ECT) SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range), 2 (Data Erratic, Intermittent or Incorrect), 4 (Voltage Below Normal, or Shorted Low), 5 (Current Below Normal or Open Circuit), 10 (Abnormal Rate of Change)

Parameter Identification (PID): P110

Message Identification (MID): 128

Circuit Description: The Engine Coolant Temperature (ECT) Sensor is a thermistor. The resistance of the ECT Sensor changes inversely to the temperature of the engine coolant. When the coolant is cold, the sensor resistance is high. As the temperature of the coolant increases, the sensor resistance decreases. The Engine Management System (EMS) Module monitors the voltage drop across the ECT Sensor. The coolant temperature signal is used to calculate fuel injection and to evaluate operating conditions of the engine coolant temperature. Examples of conditions that may cause high coolant temperature are: thermostat failure, fan failure, heavy load, high ambient temperatures and radiator blockage.

Location: The Engine Coolant Temperature (ECT) Sensor is located on the right front side of the engine.

FMI 0:

- Data Valid But Above Normal Operational Range

Conditions for fault code:

- The Boost Temperature Sensor is indicating an unphysical value.

Possible causes:

- Extreme driving conditions
- Faulty coolant thermostat
- Malfunctioning fan
- Blocked radiator

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate
- Illuminate red lamp when coolant temperature is critically high
- Illuminate yellow lamp when coolant temperature is moderately high

Noticeable external symptoms:

- MIL lamp illuminated

FMI 2:

- Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- The Engine Coolant Temperature (ECT) Sensor output is too high or too low.

Possible causes:

- Faulty Engine Coolant Temperature (ECT) Sensor or Engine Management System (EMS) Module connector.
- Break in the Engine Coolant Temperature (ECT) Sensor harness
- Malfunctioning Engine Coolant Temperature (ECT) Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- May affect vehicle driveability in some extreme cases
- MIL lamp illuminated



MID 128-PID 110

FMI 4:

- Voltage Below Normal, or Shorted Low

Possible causes:

- Intermittent fault in the Engine Coolant Temperature (ECT) Sensor harness
- Faulty Engine Coolant Temperature (ECT) Sensor connector
- Engine Coolant Temperature (ECT) Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Difficult to start in cold climates
- Idle run regulation is deteriorated
- MIL lamp illuminated

FMI 5:

- Current Below Normal or Open Circuit

Possible causes:

- An open in the Engine Coolant Temperature (ECT) Sensor circuit
- An open in the Engine Coolant Temperature (ECT) Sensor
- Intermittent fault in the Engine Coolant Temperature (ECT) Sensor harness
- Faulty Engine Coolant Temperature (ECT) Sensor connector
- Engine Coolant Temperature (ECT) Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Difficult to start in cold climates
- Idle run regulation is deteriorated
- MIL lamp illuminated

FMI 10:

- Abnormal Rate of Change

Conditions for fault code:

- The Engine Coolant Temperature (ECT) Sensor output is showing a constant value.

Possible causes:

- Faulty Engine Coolant Temperature (ECT) Sensor harness
- Engine Coolant Temperature (ECT) Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- May affect vehicle driveability



MID 128-PID 171

MID 128 PID 171 — AMBIENT AIR TEMPERATURE STATUS

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 9 (Abnormal Update Rate)

Parameter Identification (PID): P171

Message Identification (MID): 128

Circuit Description: The V-MAC IV system uses the J1939 data lines is used to control functions and communicates between the Vehicle Electronic Control Unit (VECU), Engine Management System (EMS) Module, Instrument Cluster Module (ICM) and accessory systems, depending on vehicle model and option content. The J1939 data lines consist of an expandable data bus allowing the addition of accessory control modules. The J1939 data lines are the primary data bus. Data is prioritized and then transmitted across the J1939 data lines to the appropriate control module. The V-MAC IV system is designed to allow limp home engine operation with the loss of the J1939 data signal as long as the J1587 data lines are still operational. The ambient air temperature signal is sent to the Instrument Cluster Module (ICM). The ICM then transmits the ambient air temperature data to the EMS Module via the J1939 data lines.

Location: The Instrument Cluster Module (ICM) is located near left side of the dash. The EMS module is located on the left side of the engine block.

Normal Engine Coolant Temperature Sensor

Parameters: The Ambient Air Temperature Status code will set when a fault is detected in the Ambient Air Temperature Sensor, the J1507/J1708 Data Lines or the Instrument Cluster Module (ICM).

FMI 9

Abnormal Update Rate

Conditions for fault code:

- This fault will become active when the Engine Management System (EMS) Module detects that the Ambient Air Temperature message from the Instrument Cluster Module does not exist.

Possible causes:

- Faulty Ambient Air Temperature Sensor harness
- Problem in the Instrument Cluster Module

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- MIL lamp illuminated



MID 128-PID 173

MID 128 PID 173 — EXHAUST GAS TEMPERATURE

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range - Most Severe Level), 2 (Data Erratic, Intermittent or Incorrect), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit), 10 (Abnormal Rate of Change)

Parameter Identification (PPID): P173

Message Identification (MID): 128

FMI 0

Data Valid But Above Normal Operational Range - Most Severe Level

Conditions for fault code:

- Exhaust Gas Temperature is too high

Possible causes:

- Faulty Exhaust Gas Temperature (EGT) system
- Faulty harness or connector

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss
- Poor driveability

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Sensor is not rational

Possible causes:

- Harness connected to incorrect sensor
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Short to ground on the metering side of the circuit

Possible causes:

- Faulty harness
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Short to battery on the metering side of the circuit
- Open in the metering side of the circuit
- Open in the ground side of the circuit

Possible causes:

- Faulty harness
- Sensor failure



MID 128-PID 173

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 10

Abnormal Rate of Change

Conditions for fault code:

- Sensor is stuck

Possible causes:

- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability



MID 128-PID 354

MID 128 PID 354 — INTAKE AIR TEMPERATURE AND HUMIDITY SENSOR

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted to High Source), 5 (Current Below Normal or Open Circuit)

Parameter Identification (PID): P354

Message Identification (MID): 128

Circuit Description: The Intake Air Temperature and Humidity (IATH) Sensor contains two thermistors, and the resistance of each thermistor varies inversely to temperature. By monitoring the current flow through each thermistor, the Engine Management System (EMS) Module calculates the temperature and humidity of the air entering the turbocharger.

Location: The Intake Air Temperature and Humidity (IATH) Sensor is located in the air intake tube.

FMI 3

Voltage Above Normal, or Shorted to High Source

Conditions for fault code:

- Short to battery in the metering circuit of the Intake Air Temperature and Humidity (IATH) Sensor
- Open in the ground circuit of the Intake Air Temperature and Humidity (IATH) Sensor

Possible causes:

- Faulty connector
- Faulty Intake Air Temperature and Humidity (IATH) Sensor harness
- Faulty Intake Air Temperature and Humidity (IATH) Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate
- Humidity value is set to 100 percent

Noticeable external symptoms:

- MIL lamp illuminated
- Turbocharger noise

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Open in the metering circuit of the Intake Air Temperature and Humidity (IATH) Sensor
- Open in the 5 volt supply circuit of the Intake Air Temperature and Humidity (IATH) Sensor
- Short to ground in the metering circuit of the Intake Air Temperature and Humidity (IATH) Sensor

Possible causes:

- Faulty connector
- Faulty Intake Air Temperature and Humidity (IATH) Sensor harness
- Faulty Intake Air Temperature and Humidity (IATH) Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate
- Humidity value is set to 100 percent

Noticeable external symptoms:

- MIL lamp illuminated
- Turbocharger noise



MID 128-PID 411

MID 128 PID 411 — EGR DIFFERENTIAL PRESSURE

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 2 (Data Erratic, Intermittent or Incorrect), 3 (Voltage Above Normal, or Shorted To High Source), 5 (Current Below Normal or Open Circuit)

Parameter Identification (PID): P411

Message Identification (MID): 128

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- EGR differential pressure sensor output is too high or too low

Possible causes:

- Faulty EGR Differential Pressure Sensor connector
- Faulty EGR Differential Pressure Sensor harness
- Faulty EGR Differential Pressure Sensor
- EGR leakage
- Clogged EGR cooler
- Clogged EGR venturi

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Uneven running
- Engine derate

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Short to battery in metering line
- Open in the ground circuit

Possible causes:

- Faulty EGR Differential Pressure Sensor connector
- Faulty EGR Differential Pressure Sensor harness
- Faulty EGR Differential Pressure Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated
- EGR Valve is closed

Noticeable external symptoms:

- Engine responds poorly
- Engine derate

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Open in the 5 volt supply line
- Short to ground in metering line
- Open in the metering line

Possible causes:

- Faulty EGR Differential Pressure Sensor connector
- Faulty EGR Differential Pressure Sensor harness
- Faulty EGR Differential Pressure Sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated
- EGR Valve is closed

Noticeable external symptoms:

- Engine responds poorly
- Engine derate



MID 128-PID 412

MID 128 PID 412 — EGR TEMPERATURE AFTER COOLER

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range - Most Severe Level), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit), 10 (Abnormal Rate of Change)

Parameter Identification (PID): P412

Message Identification (MID): 128

Location: The EGR temperature probe and heater probe are located in the EGR tube between the EGR cooler and the intake manifold. The EGR Sensor assembly is supplied from the manufacturer as a single calibrated unit. The components of the sensor are not to be replaced individually.

FMI 0

Data Valid But Above Normal Operational Range - Most Severe Level

Possible causes:

- Extreme driving conditions
- EGR cooler failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate
- Engine power will be derated according to the error torque map

Noticeable external symptoms:

- MIL lamp illuminated

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Short to ground on the metering side of the EGR Sensor circuit

Possible causes:

- Faulty connector
- Faulty harness
- Faulty sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate
- Engine power will be derated according to the error torque map

Noticeable external symptoms:

- MIL lamp illuminated
- Engine unresponsive

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Short to battery in the metering side of the EGR Sensor circuit
- Open in the metering side of the EGR Sensor circuit
- Open circuit in the ground line of the EGR Sensor circuit

Possible causes:

- Faulty connector
- Faulty harness
- Faulty sensor

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- MIL lamp illuminated
- Engine unresponsive



MID 128-PID 412

FMI 10

Abnormal Rate of Change

Conditions for fault code:

- EGR Sensor is shows a constant value that will not change.

Possible causes:

- Faulty sensor
- Faulty harness
- EGR system leakage

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- MIL lamp illuminated



MID 128-PPID 35

MID 128 PPID 35 — EGR MASS FLOW

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range - Most Severe Level), 1 (Data Valid But Below Normal Operational Range - Most Severe Level)

Parameter Identification (PPID): P35

Message Identification (MID): 128

Circuit Description:

FMI 0

Data Valid But Above Normal Operational Range - Most Severe Level

Conditions for fault code:

- EGR flow is too high

Possible causes:

- Faulty EGR system
- Faulty harness or connector

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 1

Data Valid But Below Normal Operational Range - Most Severe Level

Conditions for fault code:

- EGR flow is too low

Possible causes:

- Faulty EGR system
- Clogged EGR cooler
- Faulty harness or connector

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability



MID 128-PPID 89

MID 128 PPID 89 — VARIABLE GEOMETRY TURBOCHARGER SMART REMOTE ACTUATOR TEMPERATURE

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range - Most Severe Level)

Parameter Identification (PPID): P89

Message Identification (MID): 128

Circuit Description: The Variable Geometry Turbocharger Smart Remote Actuator (VGT SRA) is a self-contained component with motors, sensors and a control unit. The VGT SRA uses a movable nozzle to adjust the intake manifold pressure for various operating conditions. Nozzle movement is controlled by an actuator mounted on the turbocharger. Information to and from the VGT SRA is communicated over the J1939 serial data lines. These data lines communicate with the Engine Management System (EMS) Module.

Location: The Variable Geometry Turbocharger Smart Remote Actuator (VGT SRA) is located on the right side of the engine at the turbocharger.

FMI 0

Data Valid But Above Normal Operational Range - Most Severe Level

Conditions for fault code:

- VGT SRA temperature is moderately too high

Possible causes:

- Coolant systems malfunctions
- Extreme driving conditions
- Overheated VGT actuator

Reaction from Engine Management System (EMS):

- MIL lamp illuminated

Noticeable external symptoms:

- Engine derate (major)



MID 128-PPID 326

MID 128 PPID 326 — SOOT LEVEL

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range - Most Severe Level), 11 (Root Cause Not Known), 14 (Special Instructions)

Parameter Identification (PPID): P326

Message Identification (MID): 128

FMI 0

Data Valid But Above Normal Operational Range - Most Severe Level

Conditions for fault code:

- Moderately high soot load

Possible causes:

- Diesel Particulate Filter (DPF) clogged
- Injector AFI clogged

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated
- Manual regeneration required

Noticeable external symptoms:

- Engine derate, powerloss

FMI 11

Critically high soot load

Conditions for fault code:

- High soot level in Diesel Particulate Filter (DPF)

Possible causes:

- Diesel Particulate Filter (DPF) clogged
- Injector AFI clogged

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated
- Replace or clean Diesel Particulate Filter (DPF)

Noticeable external symptoms:

- Powerloss

FMI 14

Special Instructions

Conditions for fault code:

- Ash level too high

Possible causes:

- Diesel Particulate Filter (DPF) needs service

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss
- Manual regeneration needed



MID 128-PPID 328

MID 128 PPID 328 — AFTER TREATMENT INJECTION SHUT OFF VALVE

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit), 7 (Mechanical System Not Responding or Out Of Adjustment)

Parameter Identification (PPID): P328

Message Identification (MID): 128

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Circuit shorted to battery

Possible causes:

- Faulty harness
- Actuator failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Circuit shorted to ground

Possible causes:

- Faulty harness
- Actuator failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Open circuit

Possible causes:

- Faulty harness
- Actuator failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 7

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- After Treatment Fuel Injector stuck closed

Possible causes:

- Shut off valve stuck closed

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 14

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- After Treatment Fuel Injector leaking

Possible causes:

- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated



MID 128-PPID 329

MID 128 PPID 329 — AFTER TREATMENT FUEL INJECTOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit), 7 (Mechanical System Not Responding or Out Of Adjustment), 14 (Mechanical System Not Responding or Out Of Adjustment)

Parameter Identification (PPID): P329

Message Identification (MID): 128

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Circuit shorted to battery

Possible causes:

- Faulty harness
- Injector failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Circuit shorted to ground

Possible causes:

- Faulty harness
- Injector failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Open circuit

Possible causes:

- Faulty harness
- Injector failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 7

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- After Treatment Fuel Injector clogged

Possible causes:

- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 14

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- After Treatment Fuel Injector leaking

Possible causes:

- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated



MID 128-PPID 387

MID 128 PPID 387 — EXHAUST GAS TEMPERATURE SENSOR #2

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 2 (Data Erratic, Intermittent or Incorrect), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit), 10 (Abnormal Rate of Change)

Parameter Identification (PPID): P387

Message Identification (MID): 128

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Sensor is not rational

Possible causes:

- Harness connected to incorrect sensor
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Short to ground on the metering side of the circuit

Possible causes:

- Faulty harness
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Short to battery on the metering side of the circuit
- Open in the metering side of the circuit
- Open in the ground side of the circuit

Possible causes:

- Faulty harness
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 10

Abnormal Rate of Change

Conditions for fault code:

- Sensor is stuck

Possible causes:

- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability



MID 128-PPID 436

MID 128 PPID 436 — EXHAUST GAS TEMPERATURE SENSOR #3

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 2 (Data Erratic, Intermittent or Incorrect), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit), 10 (Abnormal Rate of Change)

Parameter Identification (PPID): P436

Message Identification (MID): 128

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Sensor is not rational

Possible causes:

- Harness connected to incorrect sensor
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Short to ground on the metering side of the circuit

Possible causes:

- Faulty harness
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Short to battery on the metering side of the circuit
- Open in the metering side of the circuit
- Open in the ground side of the circuit

Possible causes:

- Faulty harness
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability

FMI 10

Abnormal Rate of Change

Conditions for fault code:

- Sensor is stuck

Possible causes:

- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Poor driveability



MID 128-PPID 437

MID 128 PPID 437 — AFTER TREATMENT INJECTOR FUEL PRESSURE SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 2 (Data Erratic, Intermittent or Incorrect), 3 (Voltage Above Normal, or Shorted To High Source), 5 (Current Below Normal or Open Circuit), 10 (Abnormal Rate of Change)

Parameter Identification (PPID): P437

Message Identification (MID): 128

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Sensor is not rational

Possible causes:

- Faulty shut off valve
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Short circuit to battery on the metering side
- Open circuit in the ground line

Possible causes:

- Faulty harness
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Open circuit in the 5 volt supply
- Short circuit to ground in the metering line
- Open circuit in the metering line

Possible causes:

- Faulty harness
- Sensor failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

FMI 10

Abnormal Rate of Change

Conditions for fault code:

- After Treatment Injector Fuel Pressure Sensor stuck

Possible causes:

- Sensor failure
- Faulty shut off valve
- Injector failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated



MID 128-PSID 98

MID 128 PSID 98 — BOOST AIR SYSTEM

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 0 (Data Valid But Above Normal Operational Range - Most Severe Level), 1 (Data Valid But Below Normal Operational Range - Most Severe Level)

Parameter Identification (PSID): P98

Message Identification (MID): 128

FMI 0

Data Valid But Above Normal Operational Range - Most Severe Level

Conditions for fault code:

- Boost pressure is too high

Possible causes:

- EGR system failure
- Faulty turbocharger actuator

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Turbocharger surge

FMI 1

Data Valid But Below Normal Operational Range - Most Severe Level

Conditions for fault code:

- Boost pressure is too low

Possible causes:

- Faulty Boost Air System hoses, pipes, brackets, cooler, EGR system components and turbo components

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss
- Engine slow to respond



MID 128-PSID 109

MID 128 PSID 109 — ENGINE COOLANT TEMPERATURE (ECT) SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 7 (Thermostat Blocked Closed), 12 (Thermostat Blocked Open)

Parameter Identification (PSID): P109

Message Identification (MID): 128

Circuit Description: The Engine Coolant Temperature (ECT) Sensor is a thermistor. The resistance of the ECT Sensor changes inversely to the temperature of the engine coolant. When the coolant is cold, the sensor resistance is high. As the temperature of the coolant increases, the sensor resistance decreases. The Engine Management System (EMS) Module monitors the voltage drop across the ECT Sensor. The coolant temperature signal is used to calculate fuel injection and to evaluate operating conditions of the engine coolant temperature. Examples of conditions that may cause high coolant temperature are: thermostat failure, fan failure, heavy load, high ambient temperatures and radiator blockage.

Location: The Engine Coolant Temperature (ECT) Sensor is located on the right front side of the engine.

FMI 7:

- Thermostat Blocked Closed

Conditions for fault code:

- This fault will become active when the Engine Management System (EMS) Module detects that the Engine Coolant Temperature (ECT) Sensor output is high but still within the acceptable range for the sensor.
- The Coolant Temperature Sensor is indicating a high coolant temperature.

Possible causes:

- Thermostat Blocked Closed
- Faulty radiator fan
- Clogged radiator

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- MIL lamp illuminated

FMI 12:

- Thermostat Blocked Open

Conditions for fault code:

- This fault will become active when the Engine Management System (EMS) Module detects that the Engine Coolant Temperature (ECT) Sensor output is low but still within the acceptable range for the sensor.

Possible causes:

- Thermostat Blocked Open

Reaction from Engine Management System (EMS) Module:

- MIL lamp will illuminate

Noticeable external symptoms:

- Poor heat in cab
- MIL lamp illuminated



MID 128-SID 1-6

MID 128 SID 1-6 — FUEL INJECTOR UNIT #1-6

Failure Mode Identifier (FMI): 3 (Voltage High/Open), 5 (Current Low/Open), 7 (Out of Calibration), 12 (Failed Device), 14 (Special Instruction)

Parameter Identification (SID): S1, S2, S3, S4, S5 & S6

Message Identification (MID): 128

Circuit Description: Fuel Injector Unit #'s 1-6 operation is controlled by the Engine Management System (EMS) Module. This module provides supply voltage and output transistor drivers to control the ground circuits. There are two solenoid circuits within the injector; a Needle Control Valve (NCV) and a Spill Valve (SV).

Location: The Fuel Injector Units are located under the valve cover.

Code Setting Conditions: If the Engine Management System (EMS) Module detects a fault in the electrical circuit while attempting to operate the Fuel Injector Unit, the Malfunction Indicator Lamp (MIL) will turn ON and code SID 1 will set.

Additional Symptoms: Poor performance, low power or no start.

FMI 3:

- Voltage High/Open

Conditions for fault code:

- EMS module detects a short circuit to battery on the low side of the Spill Valve (SV)/Needle Control Valve (NCV).

Possible causes:

- Harness shorted to battery

Reaction from EMS module:

- Injector #1 is shut off
- Enter limp home mode

Noticeable external symptoms:

- Loss of power
- Uneven running
- Running on 3 to 5 cylinders
- MIL lamp illuminated

FMI 5:

- Current Low/Open

Conditions for fault code:

- EMS detects a short circuit to battery positive, a short circuit to ground, or an open circuit on the high side of the SV/Needle Control Valve (NCV) or a Short Circuit to ground on the low side of the SV/NCV.

Possible causes:

- Harness shorted or open
- Faulty fuel injector solenoid

Reaction from EMS module:

- Injector #1 is shut off
- Enter limp home mode

Noticeable external symptoms:

- Loss of power
- Uneven running
- Running on 3 to 5 cylinders
- MIL lamp illuminated

FMI 7:

- Out of calibration

Conditions for fault code:

- Cylinder balancing data is above the limit

Possible causes:

- Clogged fuel injector(s)
- Low fuel pressure
- Poor Compression

Reaction from EMS module:

- Software compensation is stopped
- EMS module will store freeze frame data



MID 128-SID 1-6

Noticeable external symptoms:

- Erratic engine idle speed

FMI 12:

- Failed Device (Low injector hold current)

Conditions for fault code:

- Injector or harness resistance too high

Possible causes:

- Injector solenoid resistance out of specification
- Harness resistance too high

Reaction from EMS module:

- Turbocharger boost reduction

Noticeable external symptoms:

- Loss of power
- Uneven running
- MIL lamp illuminated

FMI 14:

- Special Instruction

Conditions for fault code:

- Fuel injector flow is too low or high. Cylinder compression is low.

Possible causes:

- Low injector flow
- High injector flow
- Poor compression

Reaction from EMS module:

- Uneven cylinder balancing

Noticeable external symptoms:

- Loss of power
- Uneven running
- Running on 3 to 5 cylinders
- MIL lamp illuminated



MID 128-SID 21

MID 128 SID 21 — CAM SPEED SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 2 (Data Erratic, Intermittent or Incorrect), 3 (Voltage Above Normal, or Shorted To High Source), or 8 (Abnormal Frequency or Pulse Width or Period)

Parameter Identification (PID): S21

Message Identification (MID): 128

Circuit Description: The CAM Speed Sensor is an inductive device. As the camshaft turns, the tip of the CAM Speed Sensor senses the holes in the camshaft drive gear and sends a series of voltage pulses to the Engine Management System (EMS) Module. The frequency of the pulses is translated into engine speed and position by the EMS Module. The EMS Module uses this information along with the information from Crank Speed Sensor to synchronize fuel injection.

Location: The CAM Speed Sensor is located on top right rear of engine.

NOTE

Electrical problems can cause this fault to be generated, and electrical diagnostics are provided in this section. Mechanical problems can also cause temporary or permanent speed signal errors. After all electrical possibilities have been ruled out, check mechanical conditions that could cause vibration or signal errors. Such conditions include but are not limited to:

- Faulty Engine Vibration Damper
- Contaminated sensor tips
- Contaminated Cam Gear face
- Excessive Camshaft end play
- Improperly adjusted sensor
- Improperly balanced engine components
- Faulty engine timing cover.

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Phase Error - Incorrect correlation between CAM and Crank Sensor

Possible causes:

- Faulty connector
- Faulty CAM Sensor harness
- Faulty CAM Sensor

Reaction from Engine Management System (EMS) Module:

- Engine will be started using Crank Speed (Flywheel) signal

Noticeable external symptoms:

- Increased fuel consumption

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Missing Signal from CAM Sensor
- Open in the CAM Sensor Circuit
- Short to battery in the CAM Sensor Circuit
- Short to ground in the CAM Sensor Circuit

Possible causes:

- Faulty CAM Sensor harness

Reaction from Engine Management System (EMS) Module:

- Engine will be started using Crank Speed (Flywheel) signal

Noticeable external symptoms:

- Increased engine start time
- Loss of engine power



MID 128-SID 21

FMI 8

Abnormal Frequency or Pulse Width or Period

Conditions for fault code:

- Noisy Signal from CAM Sensor
- Open in the CAM Sensor Circuit

Possible causes:

- Faulty CAM Sensor harness
- Faulty CAM Sensor mounting

Reaction from Engine Management System (EMS) Module:

- Engine will be started using Crank Speed (Flywheel) signal

Noticeable external symptoms:

- Increased engine start time
- Loss of engine power



MID 128-SID 22

MID 128 SID 22 — CRANK SPEED SENSOR

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 2 (Data Erratic, Intermittent or Incorrect), 3 (Voltage Above Normal, or Shorted To High Source), or 8 (Abnormal Frequency or Pulse Width or Period)

Parameter Identification (PID): S22

Message Identification (MID): 128

Circuit Description: The Crank Speed Sensor is an inductive sensor that will generate a variable voltage signal when the sensor's magnetic field is excited. The Crank Speed Sensor is installed near the flywheel. When the engine is running the flywheel's teeth rotate past the sensor's tip and voltage pulses are generated. The Engine Management System (EMS Module) monitors the frequency of the signal generated by the Crank Speed Sensor and calculates the engine RPM. The air gap between the sensor tip and the flywheel teeth can influence the sensor's output signal and should be checked if SID 22 is set or is setting intermittently.

Location: The Crank Speed Sensor is located on the left side of the engine on the flywheel housing.

NOTE

Electrical problems can cause this fault to be generated, and electrical diagnostics are provided in this section. Mechanical problems can also cause temporary or permanent speed signal errors. After all electrical possibilities have been ruled out, check mechanical conditions that could cause vibration or signal errors. Such conditions include but are not limited to:

- Faulty Engine Vibration Damper
- Contaminated sensor tips
- Missing or chipped gear teeth
- Improperly installed Flywheel Ring Gear
- Incorrect Flywheel
- Contaminated Flywheel Ring Gear
- Improperly adjusted sensor
- Excessive driveshaft backlash
- Improperly balanced engine components.

NOTE

FMI 3 will only be seen as active with the engine OFF. In all cases the SID 22 FMI will change to 2 when the engine is started.

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Intermittent or weak signal

Possible causes:

- Faulty connector
- Faulty Crank Sensor harness
- Faulty Crank Sensor

Reaction from Engine Management System (EMS) Module:

- Engine will be started using Crank Speed signal



MID 128-SID 22

Noticeable external symptoms:

- Increased fuel consumption
- Imprecise engine timing
- High fuel consumption
- Uneven cylinder balancing
- Power loss
- Smoke

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Missing Signal from Crank Sensor
- Open in the Crank Sensor Circuit
- Short to battery in the Crank Sensor Circuit
- Short to ground in the Crank Sensor Circuit

Possible causes:

- Faulty Crank Sensor harness
- Faulty Crank Sensor mounting

Reaction from Engine Management System (EMS) Module:

- Engine will be started using CAM Speed signal

Noticeable external symptoms:

- Increased engine start time
- Vehicle may be in limp home mode
- Loss of engine power

FMI 8

Abnormal Frequency or Pulse Width or Period

Conditions for fault code:

- Erratic or intermittent signal from Crank Sensor
- Open in the Crank Sensor Circuit

Possible causes:

- Faulty Crank Sensor harness
- Faulty Crank Sensor mounting

Reaction from Engine Management System (EMS) Module:

- Engine will be started using Crank Speed (Flywheel) signal

Noticeable external symptoms:

- Increased fuel consumption
- Imprecise engine timing
- High fuel consumption
- Uneven cylinder balancing
- Power loss
- Smoke



MID 128-SID 27

MID 128 SID 27 — VARIABLE GEOMETRY TURBOCHARGER ACTUATOR #1

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 2 (Data Erratic, Intermittent or Incorrect), 4 (Voltage Below Normal, or Shorted To Low Source), 7 (Mechanical System Not Responding or Out Of Adjustment), 9 (Abnormal Update Rate), 13 (Out of Calibration)

Parameter Identification (SID): S27

Message Identification (MID): 128

Circuit Description: The Variable Geometry Turbocharger Smart Remote Actuator (VGT SRA) is a self-contained component with motors, sensors and a control unit. The VGT SRA uses a movable nozzle to adjust the intake manifold pressure for various operating conditions. Nozzle movement is controlled by an actuator mounted on the turbocharger. Battery voltage is supplied to the VGT SRA and the unit is grounded by means of the engine block. Information to and from the VGT SRA is communicated over the J1939 serial data lines.

Location: The Variable Geometry Turbocharger Smart Remote Actuator (VGT SRA) is located on the right side of the engine at the turbocharger.

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Smart remote actuator has not seen a valid command on CAN2
- Incorrect data

Possible causes:

- Disturbance on CAN2 data lines

Reaction from Engine Management System (EMS):

- MIL lamp illuminated

Noticeable external symptoms:

- Low boost
- Low power
- Nozzle opens
- Smoke from engine

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Short to ground

Possible causes:

- Faulty SRA VGT connector
- Faulty SRA VGT harness
- Low battery voltage

Reaction from Engine Management System (EMS):

- MIL lamp illuminated

Noticeable external symptoms:

- Nozzle will open resulting in low power and low boost
- SRA will continue to attempt and maintain target nozzle position

FMI 7

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- Mechanical problem with the VGT SRA

Possible causes:

- Actuator motor effort is temporarily limited to prevent overheating
- Restrictions detected when running learn sequence
- SRA is slow to follow commands
- SRA position is not tracking command



MID 128-SID 27

Reaction from Engine Management System (EMS):

- MIL lamp illuminated

Noticeable external symptoms:

- Low boost and smoke
- Possible engine derate
- Power loss in some cases when actuator motor has been disabled

FMI 9

Abnormal Update Rate

Conditions for fault code:

- Data from the SRA has been missing for 2-seconds

Possible causes:

- Data line harness
- No supply to VGT actuator
- VGT actuator
- VGT SRA connector

Reaction from Engine Management System (EMS):

- MIL lamp illuminated

Noticeable external symptoms:

- Engine derated (major)
- EGR valve closed

FMI 13

Out of Calibration

Conditions for fault code:

- Failed self-calibration

Possible causes:

- Smart remote actuator

Reaction from Engine Management System (EMS):

- MIL lamp illuminated



MID 128-SID 33

MID 128 SID 33 — COOLING FAN CONTROL

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit)

Parameter Identification (PID): S33

Message Identification (MID): 128

Circuit Description (On/Off Fan): The Fan Clutch Solenoid controls the operation of the cooling fan by using a solenoid. The Fan Clutch Solenoid is supplied battery voltage and is grounded by the Engine Management System (EMS) Module. When the EMS System Module determines fan operation is needed, based on coolant temperature, intake air temperature or A/C load, the EMS Module will de-energize the Fan Clutch Solenoid allowing the fan clutch to engage.

Circuit Description (Electronic Viscous Fan): The Electronic Fan Drive contains a solenoid that controls the flow of fluid between reservoirs in the fan drive housing and cover. The EMS Module provides power to the solenoid and controls solenoid operation to optimize fan speed, based on coolant temperature, intake air temperature and A/C load.

Location: The On/Off Fan Clutch Solenoid is located on the lower left side of the radiator shroud. The Electronic Fan Drive is bolted to the drive pulley on the front of the engine.

Code Setting Conditions: When the Engine Management System (EMS) Module detects there is a short to voltage in the cooling fan control circuit, FMI 3 will set and the fan will operate continuously. When there is a short to ground, FMI 4 will set and the fan will not operate. If there is an open circuit, FMI 5 will be set and the fan will operate continuously.

NOTE

If code SID 33 sets with FMI 4, there may be additional active codes. If this is the case, follow the diagnostic procedures for the other codes first, then check to make sure code SID 33 is no longer active.

Additional Symptoms: Higher than normal coolant temperatures, poor air conditioning performance or lower than normal coolant temperatures may be experienced.

NOTE

If a customer complains that the fan clutch does not disengage and code SID 33 has not been logged in the EMS Module, the problem may be due to a mechanical failure in the chassis air system.

DANGER

The fan can engage without warning. Hands, arms and personal items can easily be entangled in the belts or fan blades. Keep arms, hair, clothing, jewelry, etc. clear from the fan and belts when the engine is running.

FMI 3:

- Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Short to positive in the Cooling Fan control circuit

Possible causes:

- Broken Cooling Fan Actuator
- Faulty Cooling Fan Actuator harness or connector
- Engine Management System (EMS) Module driver output failure

Reaction from Engine Management System (EMS) Module:

- Fan runs at full speed
- Increased fuel consumption



MID 128-SID 33

Noticeable external symptoms:

- MIL lamp illuminated

FMI 4:

- Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Short to ground in the Cooling Fan control circuit
- Output voltage is 1/3 the supply voltage

Possible causes:

- Broken Cooling Fan Actuator
- Faulty Cooling Fan Actuator harness or connector
- Engine Management System (EMS) Module driver output failure

Reaction from Engine Management System (EMS) Module:

- Fan always deactivated
- Engine may be overheated

Noticeable external symptoms:

- MIL lamp illuminated

FMI 5:

- Current Below Normal or Open Circuit

Conditions for fault code:

- Open in the Cooling Fan control circuit

Possible causes:

- Broken Cooling Fan Actuator
- Faulty Cooling Fan Actuator harness or connector
- Engine Management System (EMS) Module driver output failure

Reaction from Engine Management System (EMS) Module:

- Fan runs at full speed
- Increased fuel consumption

Noticeable external symptoms:

- MIL lamp illuminated



MID 128-SID 146

MID 128 SID 146 — EGR CONTROL VALVE

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 5 (Current Below Normal or Open Circuit), 7 (Mechanical System Not Responding or Out Of Adjustment), 12 (Bad Intelligent Device or Component)

Parameter Identification (PID): S146

Message Identification (MID): 128

Circuit Description: The EGR Valve operation is controlled by the Engine Management System (EMS) Module using output transistor drivers that provide the power and ground circuits.

Location: The EGR Control Valve is located on the right rear side of the engine.

NOTE

If the Engine Management System (EMS) Module detects a short circuit to ground in the EGR Control Valve high side drive circuit, the EMS Module will turn OFF the high side driver and the driver will remain OFF until the key is cycled.

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Stuck EGR Control Valve
- EGR Control Valve circuit shorted to positive
- EGR Control Valve circuit shorted to ground

Possible causes:

- Faulty EGR Control Valve actuator
- EGR Control Valve harness
- Engine Management System (EMS) Module driver output failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Open EGR Control Valve Circuit

Possible causes:

- Faulty EGR Control Valve actuator
- EGR Control Valve harness
- Engine Management System (EMS) Module driver output failure

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss

FMI 7

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- EGR Valve stuck closed

Possible causes:

- Faulty EGR Valve

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss

FMI 12

Bad Intelligent Device or Component

Conditions for fault code:

- EGR Valve stuck open



MID 128-SID 146

Possible causes:

- Faulty EGR Valve

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Powerloss



MID 128-SID 211

MID 128 SID 211 — SENSOR SUPPLY VOLTAGE #2

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PID): S211

Message Identification (MID): 128

Circuit Description: This fault code is used to detect a short circuit in the 5 volt supply to the Fuel Pressure Sensor, Crankcase Pressure Sensor and the Oil Pressure Sensor.

Location: Internal to the Engine Management System (EMS) Module.

FMI 3

Voltage Above Normal, or Shorted To High Source

Possible causes:

- 5 volt reference circuit shorted to positive
- Faulty harness or connector
- Faulty sensor power supply
- MID 128 PID's 27, 94, 100, 153 and 362 may also be set

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Strange information displayed on cluster
- Poor driveability

FMI 4

Voltage Below Normal, or Shorted To Low Source

Possible causes:

- 5 volt reference circuit shorted to ground
- Faulty harness or connector
- Faulty sensor power supply
- MID 128 PID's 27, 94, 100, 153 and 362 may also be set

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Strange information displayed on cluster
- Poor driveability



MID 128-SID 230

MID 128 SID 230 — BUFFERED IDLE VALIDATION SWITCH SIGNAL

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 5 (Current Below Normal or Open Circuit)

Parameter Identification (SID): S230

Message Identification (MID): 128

Circuit Description: The Idle Validation Switch (IVS) updates the Vehicle Electronic Control Unit (VECU) with the idle status. At idle, the Idle Validation Switch (IVS) is open and no voltage is applied to the Idle Validation Switch (IVS) signal input. At approximately 5% - 100% pedal position the Idle Validation Switch (IVS) closes.

Location: The Engine Management System (EMS) Module is located on the left side of the engine block and the Vehicle Electronic Control Unit (VECU) is located behind the center of the dash.

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- IVS buffered signal shorted to voltage

Possible causes:

- Faulty connector
- Faulty VECU
- Short to voltage in signal circuit harness

Reaction from Vehicle Electronic Control Unit (VECU):

- MIL lamp illuminated

Noticeable external symptoms:

- No IVS limp home function for pedal position

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- IVS buffered signal shorted to ground or open

Possible causes:

- Faulty connector
- Faulty VECU
- Short to ground or open in signal circuit harness

Reaction from Vehicle Electronic Control Unit (VECU):

- MIL lamp illuminated

Noticeable external symptoms:

- No IVS limp home function for pedal position



MID 128-SID 232

MID 128 SID 232 — SENSOR SUPPLY VOLTAGE #1

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PID): S232

Message Identification (MID): 128

Circuit Description: This fault code is used to detect a short circuit in the 5 volt supply to the Electronic Fan Controller, Boost Pressure Sensor and Intake Air Temperature and Humidity Sensor.

Location: Internal to the Engine Management System (EMS) Module.

FMI 3

Voltage Above Normal, or Shorted To High Source

Possible causes:

- 5 volt reference circuit shorted to positive
- Faulty harness or connector
- Faulty sensor power supply
- MID 128 PID's 26, 102, 132, 164 and 411 may also be set

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Strange information displayed on cluster
- Poor driveability

FMI 4

Voltage Below Normal, or Shorted To Low Source

Possible causes:

- 5 volt reference circuit shorted to ground
- Faulty harness or connector
- Faulty sensor power supply
- MID 128 PID's 26, 102, 132, 164 and 411 may also be set

Reaction from Engine Management System (EMS) Module:

- MIL lamp illuminated

Noticeable external symptoms:

- Strange information displayed on cluster
- Poor driveability



MID 144-PID 84

MID 144 PID 84 — ROAD SPEED

Failure Mode Identifier (FMI): 2 (Data Erratic), 14 (Special Instructions)

Parameter Identification (PID): P84

Message Identification (MID): 144

Circuit Description: The Vehicle Speed Sensor (VSS) is an inductive sensor. When the vehicle is moving, the transmission output shaft speedometer gear teeth rotate past the VSS tip and a pulsed signal voltage is generated. The Vehicle Electronic Control Unit (VECU) monitors the frequency of the signal generated by the VSS, to calculate the road speed. The air gap between the sensor and the toothed gear influences the VSS signal output and should be checked if erratic or inaccurate speedometer readings are reported.

Location: The Vehicle Speed Sensor (VSS) is located in the rear of transmission, near the output shaft.

FMI 2

Data Erratic, Intermittent or Incorrect

Conditions for fault code:

- Intermittent faulty data
- Speed signal from speedometer and ABS differs too much
- Speed signal from tachometer and ABS differs too much

Possible causes:

- ABS Harness
- ABS Sensor
- Tachometer
- Tachometer harness

Reaction from Vehicle Electronic Control Unit (VECU):

- N/A

Noticeable external symptoms:

- N/A

FMI 14

Special Instructions

Conditions for fault code:

- Intermittent faulty data
- Speed signal from tachometer was updated incorrectly

Possible causes:

- Faulty information from tachometer
- J1939 dataline link
- Tachometer harness

Reaction from Vehicle Electronic Control Unit (VECU):

- N/A

Noticeable external symptoms:

- N/A



MID 144-PID 91

MID 144 PID 91 — PERCENT ACCELERATOR PEDAL POSITION

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source), 5 (Current Below Normal or Open Circuit), 6 (Current Above Normal or Grounded Circuit), 14 (Special Instructions)

Parameter Identification (PID): P91

Message Identification (MID): 144

Circuit Description: The Accelerator Pedal Position (APP) Sensor is a potentiometer that is mechanically linked to the accelerator pedal. When the accelerator pedal is depressed during normal operation, the Accelerator Pedal Position (APP) Sensor signal voltage to the Vehicle Electronic Control Unit (VECU) increases. The Vehicle Electronic Control Unit (VECU) monitors the Accelerator Pedal Position (APP) Sensor signal voltage and uses the signal to calculate engine fuel requirements.

Location: The Accelerator Pedal Position (APP) Sensor is part of the Accelerator Pedal Assembly.

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Abnormally high voltage

Possible causes:

- APP harness shorted high
- Faulty APP sensor

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Abnormally low voltage

Possible causes:

- APP harness shorted low
- Faulty APP sensor

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine

FMI 5

Current Below Normal or Open Circuit

Conditions for fault code:

- Abnormally low current
- Input is not correct compared to IVS 1 & IVS 2

Possible causes:

- Faulty APP sensor

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel increase



MID 144-PID 91

FMI 6

Current Above Normal or Grounded Circuit

Conditions for fault code:

- Abnormally high current
- Input is not correct compared to IVS 1 & IVS 2

Possible causes:

- Faulty APP sensor

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel increase

FMI 14

Special Instructions

Conditions for fault code:

- Supply error from PPID 72
- Supply error

Possible causes:

- Faulty APP sensor harness

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel increase



MID 144-PPID 61

MID 144 PPID 61 — ENGINE RETARDER SWITCH

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 7 (Mechanical System Not Responding or Out Of Adjustment)

Parameter Identification (PPID): P61

Message Identification (MID): 144

Circuit Description: The engine retarder switch sends a battery voltage signal to the Vehicle Electronic Control Unit (VECU) depending on the position of the switch. The VECU activates the engine brake system to assist in slowing the vehicle.

Location: The engine brake selector switch is located on the dashboard of the vehicle.

FMI 7

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- SET+ and SET- signal received at the same time

Possible causes:

- Engine retarder switch harness
- Engine retarder switch

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine retarder brake will not activate



MID 144-PPID 69

MID 144 PPID 69 — BUFFERED IDLE VALIDATION SWITCH

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PPID): P69

Message Identification (MID): 144

Circuit Description: The Idle Validation Switch (IVS) updates the Vehicle Electronic Control Unit (VECU) with the idle status. At idle, the Idle Validation Switch (IVS) is open and no voltage is applied. At approximately 5% - 100% pedal position the Idle Validation Switch (IVS) closes.

Location: The Idle Validation Switch is integral to the Accelerator Pedal Position (APP) Sensor. The Accelerator Pedal Position (APP) Sensor is part of the accelerator pedal assembly.

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Abnormally high voltage or short to higher voltage

Possible causes:

- Signal shorted high

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- N/A

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Abnormally low voltage or short to ground

Possible causes:

- Signal shorted low

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- N/A



MID 144-PPID 70

MID 144 PPID 70 — OUTPUT SUPPLY #3

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PPID): P70

Message Identification (MID): 144

Circuit Description: The Idle Validation Switch (IVS) updates the Vehicle Electronic Control Unit (VECU) with the idle status. At idle, the Idle Validation Switch (IVS) is open and no voltage is applied to the Idle Validation Switch (IVS) signal input. At approximately 5% - 100% pedal position the Idle Validation Switch (IVS) closes.

Location: The Idle Validation Switch is integral to the Accelerator Pedal Position (APP) Sensor.

Normal Idle Validation Switch Parameters: The IVS should pass 12 volts through the switch when the throttle is off the idle position.

FMI 4

Voltage Below Normal, or Shorted To Low Source

Possible causes:

- Faulty connector
- Faulty harness
- Supply voltage shorted low

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- N/A



MID 144-PPID 71

MID 144 PPID 71 — OUTPUT SUPPLY #4

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PPID): P71

Message Identification (MID): 144

Circuit Description: The Vehicle Electronic Control Unit (VECU) monitors the switched voltage through the SET/RESUME, SPEED CONTROL and ENGINE BRAKE SELECTOR switch.

Location: The SET/RESUME switch, SPEED CONTROL switch and ENGINE BRAKE SELECTOR switch are located on the dash of the vehicle.

Normal Set/Resume Switch, Speed Control Switch and Engine Brake Selector Switch

Parameters: The switches should pass battery voltage through the switch when the switch is closed.

FMI 4

Voltage Below Normal, or Shorted To Low Source

Possible causes:

- Faulty connector
- Faulty harness
- Supply voltage shorted low

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine won't supply the requested fuel increase



MID 144-PPID 72

MID 144 PPID 72 — OUTPUT SUPPLY #1

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PPID): P72

Message Identification (MID): 144

Circuit Description: The Accelerator Pedal Position (APP) Sensor is a potentiometer that is mechanically linked to the accelerator pedal. When the accelerator pedal is depressed during normal operation, the Accelerator Pedal Position (APP) Sensor signal voltage to the Vehicle Electronic Control Unit (VECU) increases. The Vehicle Electronic Control Unit (VECU) monitors the Accelerator Pedal Position (APP) Sensor signal voltage and uses the signal to calculate engine fuel requirements.

Location: The Accelerator Pedal Position (APP) Sensor is part of the Accelerator Pedal Assembly.

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Abnormally high voltage

Possible causes:

- APP harness shorted high
- Faulty VECU

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine
- Engine brake retarder is disabled

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Abnormally low voltage

Possible causes:

- APP harness shorted low
- Faulty VECU

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine
- Engine brake retarder is disabled



MID 144-PPID 73

MID 144 PPID 73 — OUTPUT SUPPLY #2

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PPID): P73

Message Identification (MID): 144

Circuit Description: N/A

Location: N/A

Normal APP Sensor Parameters: N/A

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Abnormally high voltage

Possible causes:

- APP harness shorted high
- Faulty VECU

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine
- Engine brake retarder is disabled

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Abnormally low voltage

Possible causes:

- APP harness shorted low
- Faulty VECU

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine
- Engine brake retarder is disabled



MID 144-PPID 265

MID 144 PPID 265 — VEHICLE SPEED SENSOR SUPPLY

NOTE

When performing electrical tests, wiggle wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 3 (Voltage Above Normal, or Shorted To High Source), 4 (Voltage Below Normal, or Shorted To Low Source)

Parameter Identification (PPID): P265

Message Identification (MID): 144

Circuit Description: The Vehicle Speed Sensor (VSS) is an inductive sensor. When the vehicle is moving, the transmission output shaft speedometer gear teeth rotate past the VSS tip and a pulsed signal voltage is generated. The Vehicle Electronic Control Unit (VECU) monitors the frequency of the signal generated by the VSS, to calculate the road speed. The air gap between the sensor and the toothed gear influences the VSS signal output and should be checked if erratic or inaccurate speedometer readings are reported.

Location: The Vehicle Speed Sensor (VSS) is located in the rear of transmission, near the output shaft.

FMI 3

Voltage Above Normal, or Shorted To High Source

Conditions for fault code:

- Abnormally high voltage

Possible causes:

- VSS harness shorted high
- Faulty VSS

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- N/A

FMI 4

Voltage Below Normal, or Shorted To Low Source

Conditions for fault code:

- Abnormally low voltage

Possible causes:

- VSS harness shorted low
- Faulty VSS

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- N/A



MID 144-PSID 2

MID 144 PSID 2 — IDLE VALIDATION SWITCH #2

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 7 (Mechanical System Not Responding or Out Of Adjustment)

Parameter Identification (PSID): P2

Message Identification (MID): 144

Circuit Description: The Idle Validation Switch (IVS) updates the Vehicle Electronic Control Unit (VECU) with the idle status. At idle, the Idle Validation Switch (IVS) is open and no voltage is applied to the Idle Validation Switch (IVS) signal. At approximately 5% - 100% pedal position the Idle Validation Switch (IVS) closes.

Location: The Idle Validation Switch is integral to the Accelerator Pedal Position (APP) Sensor. The Accelerator Pedal Position (APP) Sensor is part of the accelerator pedal assembly.

FMI 7

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- Faulty reading from IVS #2

Possible causes:

- Idle Validation Switch (IVS)
- IVS connector
- IVS harness

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine



MID 144-SID 230

MID 144 SID 230 — IDLE VALIDATION SWITCH #1

NOTE

When performing electrical tests, wiggle the wires and connectors to find intermittent problems.

Failure Mode Identifier (FMI): 7 (Mechanical System Not Responding or Out Of Adjustment)

Parameter Identification (SID): S230

Message Identification (MID): 144

Circuit Description: The Idle Validation Switch (IVS) updates the Vehicle Electronic Control Unit (VECU) with the idle status. At idle, the Idle Validation Switch (IVS) is open and no voltage is applied to the Idle Validation Switch (IVS). At approximately 5% - 100% pedal position the Idle Validation Switch (IVS) closes.

Location: The Idle Validation Switch is integral to the Accelerator Pedal Position (APP) Sensor. The Accelerator Pedal Position (APP) Sensor is part of the accelerator pedal assembly.

FMI 7

Mechanical System Not Responding or Out Of Adjustment

Conditions for fault code:

- Faulty reading from IVS #1

Possible causes:

- Idle Validation Switch (IVS)
- IVS connector
- IVS harness

Reaction from Vehicle Electronic Control Unit (VECU):

- Yellow lamp is illuminated

Noticeable external symptoms:

- Engine will not supply requested fuel to engine



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