

2006 ENGINE**Engine Controls - 2.4L - Introduction (1 Of 2) - HHR****DIAGNOSTIC STARTING POINT - ENGINE CONTROLS**

Begin the system diagnosis with **Diagnostic System Check - Vehicle** in Vehicle DTC Information. The Diagnostic System Check-Vehicle will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and the codes' statuses

The use of the Diagnostic System Check-Vehicle will identify the correct procedure for diagnosing the system and where the procedure is located.

SCAN TOOL DATA LIST

The Engine Scan Tool Data List contains all engine related parameters that are available on the scan tool. The list is arranged in alphabetical order. A given parameter may appear in any one of the data lists, and in some cases may appear more than once, or in more than one data list in order to group certain related parameters together.

Use the Engine Scan Tool Data List only after the following is determined:

- The **Diagnostic System Check - Vehicle** is completed.
- No DTCs
- On-board diagnostics are functioning properly.

Scan tool values from a properly running engine may be used for comparison with the engine you are diagnosing. The Engine Scan Tool Data List represents values that would be seen on a normal running engine.

IMPORTANT: A scan tool that displays faulty data should not be used. The scan tool problem should be reported to the manufacturer. Use of a faulty scan tool can result in misdiagnosis and unnecessary parts replacement.

Only the parameters listed below are referenced in this service manual for use in diagnosis. If all values are within the typical range described below, refer to **Symptoms - Engine Controls** for diagnosis.

The column labeled Data List indicates where a parameter can be located on the scan tool. Refer to the scan tool operating manual for the exact locations of the data lists. The

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following is a description of each term listed:

All

The Parameter is in all of the data lists indicated below.

CMP

CMP Actuator Data

ED

Engine Data

EVAP

EVAP Data

FT

Fuel Trim Data List

IND

Induction Data

MF

Misfire Data List

TAC

Throttle Actuated Control Data List

HO2S

HO2S Data

ID

Ignition Data

Scan Tool Data List

Scan Tool Parameter	Data List	Parameter Range/Units	Typical Data Values
Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed			

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Loop/Accessories Off			
5-Volt Reference 1	EVAP, ID, IND, TAC	Volts	4.5 Volts
5-Volt Reference 1 Circuit Status	EVAP, ID, IND, TAC	OK/Incomplete/Short B+/ Short Ground/ Short Open	OK
5-Volt Reference 2	EVAP, ID, IND, TAC	Volts	4.5 Volts
5-Volt Reference 2 Circuit Status	EVAP, ID, IND, TAC	OK/Incomplete/Short B+/ Short Ground/ Short Open	OK
A/C Relay Command	ED, MF, IND, TAC	On/Off	Off
Air Flow Calculated	ED, EVAP, FT, IND, MF, TAC	g/s	3 g/s
Ambient Air Temp	ED, EVAP	Degrees	7°F (14°C)
APP Indicated Angle	ALL	0-96%	0%
APP Sensor 1	TAC	%/Volts	0%/1.02 Volts
APP Sensor 1	TAC	%	17%
APP Sensor 1 Indicated Angle	TAC	%	0%
APP Sensor 2	TAC	%/Volts	0%/4.04 Volts
APP Sensor 2	TAC	%	89%
APP Sensor 2 Indicated Angle	TAC	%	4%
APP Sensor 1 and 2	TAC	Agree/Disagree	Agree
BARO	ED, EVAP, FT, HO2S, ID, IND	kPa	65-104 kPa/ Varies w/Altitude
BPP Circuit Signal	ED, TAC	Applied/Released/ Invalid	Released
BPP Signal	ED, TAC	Applied/Released/ Invalid	Invalid
Calc. TWC Temp	FT	Degrees	800-1,000°F
Catalytic Converter Protection Active	FT, HO2S	Yes/No	No
CKP Active Counter	ID	Counts	Varies
CKP Resync Counter	ID	Counts	0
CKP Sensor	ED, ID	RPM	Varies
CMP Active	CMP, ID	1-250	9-250

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Counter			
CMP Sensor	CMP, ID, MF	RPM	Varies
Cold Start-Up	ED, EVAP	Yes/No	Varies
Cruise Control Active	ED, TAC	Yes/No	No
Cycles of Misfire Data	MF	0-100 Counts	Varies
Cyl. 1 IC Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Cyl. 2 IC Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Cyl. 3 IC Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Cyl. 4 IC Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Cyl. 1 Inj. Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Cyl. 2 Inj. Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Cyl. 3 Inj. Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Cyl. 4 Inj. Circuit Status	MF	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
Decel Fuel Cutoff	ED, FT, HO2S	Active/Inactive	Inactive
Desired Exh. CMP	CMP	Degrees	-
Desired Idle Speed	CMP, ED, EVAP, ID, TAC	RPM	PCM Controlled
Desired Int. CMP	CMP	Degrees	0°
EC Ignition Relay Circuit Status	ED, TAC	OK/Incomplete/ Short B+/ Short Ground/ Short Open	Incomplete
EC Ignition Relay Command	ED, TAC	ON/OFF	ON

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EC Ignition Relay Feedback Signal	ED, TAC	Volts	14 Volts
ECT Sensor	ED, EVAP, FT, HO2S, ID, IND, MF, TAC	-40 to -40°C (+151 to +303°F)	88-105°C (190-221°F) Depends on ambient temperature
Engine Load	ALL	0-100%	23-24% @ Idle 7-42% @ 2500 RPM
Engine Oil Life Remaining	CMP	%	Varies
Engine Oil Pressure Switch	CMP, ED, MF	OK/Low	OK
Engine Oil Temp Calculated	CMP	Degrees	Varies
Engine Run Time	ALL	Hrs, Min, Sec	Varies
Engine Speed	ALL	0-10,000 RPM	500-700 RPM
Engine Time Off	EVAP	HH:MM:SS	Varies
EVAP Fault History	EVAP	No Fault/ Excess Vacuum/ Purge Valve Leak/ Small Leak/ Weak Vacuum/ No Test Result	No Fault
EVAP Purge Solenoid Command	ED, EVAP, FT, HO2S	0-100%	10-30%
EVAP Purge Solenoid Status	EVAP	OK/Incomplete/ Short B+/ Short Ground/ Short Open	OK
EVAP Vent Solenoid Command	ED, EVAP	Not Venting/Venting	Venting
EVAP Vent Solenoid Status	EVAP	OK/Incomplete/ Short B+/ Short Ground/ Short Open	Incomplete
Exh. CMP Active Counter	CMP, ID	Counts	0-250
Exh. CMP Angle	CMP	Degrees	0°
Exh. CMP Command	CMP	%	0%
Exh. CMP Solenoid Circuit Status	CMP	OK/ Incomplete/ Short B+/ Short Ground/ Short Open	Incomplete
Exh. CMP Variance	CMP	Degrees	0°

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Ext, Travel BPP Signal	TAC	Applied/ Released/ Invalid	Invalid
Fuel Level Sensor	EVAP	Volts	1-2 Volts
Fuel Pump Relay Circuit Status	ED	OK/ Incomplete/ Short B+/ Short Ground/ Short Open	Incomplete
Fuel Tank Level Remaining	ED, EVAP, FT, MF	0%	Varies
Fuel Tank Pressure Sensor	ED, EVAP	mm/Hg / In H2O	Varies
Fuel Tank Pressure Sensor	EVAP	mm/Hg / In H2O/Volts	Varies
Fuel Tank Rated Cap.	EVAP	Liters	Varies
Fuel Trim Cell	ED, FT	Counts	16, 17, 21
Fuel Trim Learn	ED, FT	Able/Disable	Disabled
Fuel Trim System	FT	Disabled/ Enabled/ Run purge test	-
Fuel Pump Relay Command	ED	On/Off	On
Fuel Volatility	EVAP, FT	Low/ Med/ High	Low
HO2S Heater Command	HO2S	%	-
HO2S 1	ED, EVAP, FT, HO2S, IND	mV	10-1,000 mV and Varying
HO2S 1 Heater Circuit Status	HO2S	OK/ Incomplete/ Short B+/ Short Ground/ Short Open	OK
HO2S 1 Heater Command	HO2S	ON/ OFF	ON
HO2S 1 Heater Current	HO2S	Amps	Varies
HO2S 2	ED, FT, HO2S	mV	10-1,000 mV and Varying
HO2S 2 Heater Circuit Status	HO2S	OK/ Incomplete/ Short B+/ Short Ground/ Short Open	OK
HO2S 2 Heater Command	HO2S	ON/ OFF	ON
HO2S 2 Heater Current	HO2S	Amps	Varies

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Hot Open Loop	FT, HO2S	Active/Inactive	Inactive
IAT Sensor	ALL	-40 to +151°C (-40 to +303°F)	Depends on ambient temperature
Ignition Accessory Signal	ED, TAC	On/Off	Off
Ignition 1 Signal	ALL	0-25 volts	11.5-14.5 Volts
Ignition OFF Time	ED, EVAP	HH:MM:SS	Varies
Injector 1 Disabled Due to Misfire	MF	Yes/ No	No
Injector 2 Disabled Due to Misfire	MF	Yes/ No	No
Injector 3 Disabled Due to Misfire	MF	Yes/ No	No
Injector 4 Disabled Due to Misfire	MF	Yes/ No	No
Int. CMP Active Counter	CMP, ID	Counts	0-250
Int. CMP Angle	CMP	Degrees	0%
Int. CMP Command	CMP	%	0%
Int. CMP Solenoid Circuit Status	CMP	OK/ Incomplete/ Short B+/ Short Ground/ Short Open	Incomplete
Int. CMP Variance	CMP	Degrees	0%
Intake Manifold Pressure	ED, EVAP, ID	kPa	55-65 kPa
Injector PWM	ED, FT, HO2S, MF	Milliseconds	2-6 ms
Knock Detected Cyl. 1	ID	Yes/No	No
Knock Detected Cyl. 2	ID	Yes/No	No
Knock Detected Cyl. 3	ID	Yes/No	No
Knock Detected Cyl. 4	ID	Yes/No	No
Knock Retard	ID	Degrees	0%
KS Circuit Status	ID	Pass/Fail	Pass
KS Module Status	ID	OK/ Incomplete/ Short B+/ Short Ground/ Short Open	Incomplete

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Long Term FT	ED, EVAP, FT, HO2S	%	Near 0%
Long Term Fuel Trim Test Avg.	FT	Counts	0.95-1
Long Term Fuel Trim Test Avg. w/o Purge	FT	Counts	0.95-1
Loop Status	ED, EVAP, FT, HO2S	Open/Closed	Closed
MAF Performance Test	FT, IND, TAC	Ok/ Fault	OK
MAF Sensor	ED, EVAP, FT, MF, HO2S, IND	Hz	3 g/s
MAF Sensor	ALL	g/s	3 g/s
MAP Performance Test 2	FT, IND, TAC	Ok/ Fault	OK
MAP Sensor	ED	Volts	28-35
MAP Sensor	ALL	kPa	20-48 kPa
MIL Circuit Status	ED	OK/ Incomplete/ Short B+/ Short Ground/ Short Open	Incomplete
MIL Command	ED, EVAP, ID	Off/On	Off
MIL Requested By DTC	ALL	Yes/No	No
Misfire Current Cyl #1	MF	Counts	0
Misfire Current Cyl #2	MF	Counts	0
Misfire Current Cyl #3	MF	Counts	0
Misfire Current Cyl #4	MF	Counts	0
Misfire History Cyl #1	MF	Counts	0
Misfire History Cyl #2	MF	Counts	0
Misfire History Cyl #3	MF	Counts	0
Misfire History Cyl #4	MF	Counts	0
PNP Switch	ED	Park/ Net/ In Gear	-

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Power Enrichment	ED, FT, HO2S, MF	Active/Inactive	Inactive
Reduced Engine Power	TAC	Active/Inactive	Inactive
Short Term Fuel Trim Test Avg.	FT	Counts	0.95-1
Short Term FT	ED, EVAP, FT, HO2S	%	Near 0%
Spark	ED, FT, HO2S, ID, IND, MF	Degrees	11-20°
Start Up ECT	EVAP, FT, HO2S	°C/°F	Varies
Start Up IAT	EVAP, FT, HO2S	°C/°F	Varies
TAC Forced Engine Shutdown	TAC	Yes/No	No
TAC Motor	TAC	Enabled/Disabled	Enabled
TAC Motor Command	TAC	%	179%
TCS Torque Delivered Signal	TAC	%	0%
TCS Torque Required Signal	TAC	%	55-60%
Torque	ID	Degrees	0%
Total Knock Retard	ID	Degrees	0%
Total Misfire Count	MF	Count	0
TP Desired Angle	TAC	%	4%
TP Indicated Angle	ALL	%	4.2%
TP Performance Test	FT, IND, TAC	Active/Inactive	Inactive
TP Sensor 1	TAC	0-100%	4%
TP Sensor 1	TAC	0-5 Volts	4.24 Volts
TP Sensor 1 Indicated Position	TAC	%	4%
TP Sensor 1 Learned Minimum	TAC	Volts	0.55 Volts
TP Sensors 1 and 2	TAC	Agree/Disagree	Agree
TP Sensor 2	TAC	0-100%	4%
TP Sensor 2	TAC	0-5 Volts	0.43 Volts
TP Sensor 2 Indicated Position	TAC	%	4%
TP Sensor 2 Learned Minimum	TAC	Volts	0.57 Volts

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Vehicle Speed Sensor	ALL	km/h (mph)	0
Warm-ups Without Emission Faults	ED	Counts	Varies
Warm-ups Without Non-Emission Faults	ED	Counts	Varies
Wide Open Throttle	TAC	Yes/No	No

SCAN TOOL DATA DEFINITIONS

The Engine Scan Tool Data Definitions contains a brief description of all engine related parameters available on the scan tool. The list is arranged in alphabetical order. A given parameter may appear in any one of the data lists. In some cases, the parameter may appear more than once or in more than one data list in order to group certain related parameters together.

5-Volt Reference 1

This parameter displays the voltage sensed on the 5-volt reference 1 circuit at the control module. The scan tool will display a higher value at higher voltage. The scan tool will display a lower value at lower voltage.

5-Volt Reference 2

This parameter displays the voltage sensed on the 5-volt reference 2 circuit at the control module. The scan tool will display a higher value at higher voltage. The scan tool will display a lower value at lower voltage.

A/C Relay Command

This parameter displays the commanded state of the A/C clutch relay control circuit. The scan tool will display ON or OFF. ON indicates the A/C clutch relay control circuit is being grounded by the control module, allowing voltage to the A/C compressor clutch. OFF indicates the A/C clutch relay is not being commanded on by the control module.

Air Flow Calculated

This parameter displays the air flow of the engine as calculated by the control module using information from the manifold absolute pressure (MAP) sensor. The scan tool will display a range of values indicating a high air flow when MAP pressure is high and a low air flow when MAP pressure is low. This value is listed in grams per second (g/s).

Air Fuel Ratio

This parameter displays the ratio of air to fuel as calculated by the control module based on various sensor inputs. The scan tool will display a lower air fuel ratio when a richer air to fuel mixture is commanded. The scan tool will display a higher air fuel ratio when a leaner air to fuel mixture is commanded. In closed loop operation the air fuel ratio should normally be around 14.2-14.7 to 1.

APP Indicated Angle

This parameter displays the angle of the accelerator pedal as calculated by the control module using the signals from the accelerator pedal position sensors. The APP indicated angle is a range of values indicating a low percentage when the accelerator pedal is not depressed to a high percentage when the accelerator pedal is fully depressed.

APP Sensor 1

This parameter displays the voltage signal sent to the control module from accelerator pedal (APP) sensor 1 of the APP sensor assembly. APP sensor 1 is a range of values indicating a low voltage when the accelerator pedal is not depressed to a high voltage when the accelerator pedal is fully depressed.

APP Sensor 1

This parameter displays the angle of the APP sensor 1 as calculated by the control module using the signal from the APP sensor 1. APP sensor 1 is a range of values indicating a low percentage when the accelerator pedal is not depressed to a high percentage when the accelerator pedal is fully depressed.

APP Sensors 1 and 2

This parameter displays the results of a control module test that compares the signals from the APP sensors 1 and 2. The scan tool will display Agree or Disagree. Agree indicates that APP sensor 1 and APP sensor 2 voltages correspond to the same accelerator pedal position. Disagree indicates that APP sensor 1 and APP sensor 2 voltages correspond to different accelerator pedal positions.

APP Sensor 2

This parameter displays the voltage signal sent to the control module from APP sensor 2 of the APP sensor assembly. APP sensor 2 is a range of values indicating a low voltage when the accelerator pedal is not depressed to a high voltage when the accelerator pedal is fully depressed.

APP Sensor 2

This parameter displays the angle of the APP sensor 2 as calculated by the control module using the signal from the APP sensor 2. APP sensor 2 is a range of values indicating a low percentage when the accelerator pedal is not depressed to a high percentage when the accelerator pedal is fully depressed.

BARO

This parameter displays the barometric pressure as calculated by the control module using the signal from the manifold absolute pressure (MAP) sensor measured when the ignition is turned on with the engine not running. The control module will update the barometric pressure during wide-open throttle (WOT) conditions.

Catalytic Converter Protection Active

This parameter displays the state of the Catalytic Converter Protection mode.

CKP Active Counter

This parameter displays an incrementing counter when the control module receives a signal from the crankshaft position sensor (CKP).

CKP Sensor

This parameter displays the mode the control module is using for crankshaft position sensing.

CMP Active Counter

This parameter displays an incrementing counter when the control module receives a signal from the camshaft position (CMP) sensor.

CMP Sensor

This parameter displays the speed of the engine as calculated by the signal from the camshaft position (CMP) sensor.

CMP Sensor Signal Present

This parameter displays when the CMP signal is received by the control module. The scan tool will display Yes when the control module is receiving a signal from the CMP sensor. The scan tool will display No when the control module has not received a signal from the CMP sensor after receiving signals from the crankshaft position sensor.

Cold Startup

This parameter displays whether the engine meets the conditions for a cold startup during the present ignition cycle. The scan tool displays Yes when the conditions for a cold startup are met during this ignition cycle. The scan tool displays No when the conditions for a cold startup are not met during the present ignition cycle. Conditions for a cold startup require the coolant temperature and the intake air temperature to be below a predetermined temperature and within a certain range of each other. These conditions must occur after the engine was warmed up to a specific temperature during the previous ignition cycle.

Cruise Control Active

This parameter displays the status of the cruise control system as determined by the control module. The scan tool will display Yes when the cruise control system is in control of vehicle speed. The scan tool will display No when the cruise control system is not operating.

Cycles Of Misfire Data

This parameter displays the number of cylinder firing events that were recorded as misfires as determined by the control module.

Cylinder 1 IC Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Cylinder 2 IC Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Cylinder 3 IC Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Cylinder 4 IC Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector

control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Cylinder 1 Injector Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Cylinder 2 Injector Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Cylinder 3 Injector Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Cylinder 4 Injector Circuit Status

This parameter displays the current diagnostic state of the output driver for the injector control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

Decel. Fuel Cutoff

This parameter displays the status of the operating mode used to turn off the fuel injectors during certain deceleration conditions. When the scan tool displays Active, the control module has turned off the fuel injectors. When the scan tool displays Inactive, the fuel system is operating normally.

Desired Exhaust CMP

This parameter displays the desired exhaust camshaft position, as determined by the control module. The scan tool will display a higher value for more advanced exhaust valve timing, such as at high load or speed conditions. The scan tool will display a lower value for a less advanced exhaust valve timing, such as at idle.

Desired Idle Speed

This parameter displays the engine idle speed in RPM commanded by the control module. The control module compensates for various engine loads in order to maintain the desired engine RPM at idle. This parameter is not valid unless the engine is running.

Desired Intake CMP

This parameter displays the desired exhaust camshaft position, as determined by the control module. The scan tool will display a higher value for more advanced intake valve timing, such as at high load or speed conditions. The scan tool will display a lower value for a less advanced intake valve timing, such as at idle.

EC Ignition Relay Circuit Status

This parameter displays the status of the output driver for the EC Ignition Relay control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground or a short to voltage on the circuit.

EC Ignition Relay Circuit History

This parameter displays the diagnostic state history of the output driver for the EGR Solenoid circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Low/Open if there is an open or short to ground on the injector circuit. The scan tool will display High if there is a short to voltage on the injector circuit.

EC Ignition Relay Command

This parameter displays the commanded state of the EC ignition relay control circuit. The scan tool will display ON or OFF. ON indicates the EC ignition relay control circuit is being grounded by the control module, allowing voltage to the ignition system. OFF indicates the EC ignition relay is not being commanded on by the control module.

EC Ignition Relay Feedback Signal

This parameter displays the voltage signal sent to the control module from the engine control ignition relay. The scan tool will display battery voltage when the engine is running. The scan tool will display no voltage when the relay is OFF.

ECT Sensor

This parameter displays the temperature of the engine coolant based on the input from

the engine coolant temperature sensor. When the coolant temperature is low, the scan tool will display a low temperature. When the coolant temperature is high, the scan tool will display a high temperature.

Engine Load

This parameter displays the engine load in percent based on inputs to the control module from various engine sensors. The scan tool will display a low percentage when the engine is at idle with little or no load. The scan tool will display a high percentage when the engine is running at a high RPM under a heavy load.

Engine Off Time

This parameter displays the time elapsed since the engine was shut off.

Engine Oil Life Remaining

This parameter displays the amount engine oil life remaining before requiring an oil change based on calculations by the control module. The scan tool will display lower values as the engine oil life approaches 0 miles.

Engine Oil Pressure Switch

This parameter displays the state of the engine oil pressure as determined by the control module. The control module monitors the engine oil pressure switch to determine if the engine oil pressure is sufficient. The scan tool will display low when the engine oil pressure is below a predetermined value.

The scan tool displays OK or Low. This parameter displays whether or not sufficient engine oil pressure is present.

Engine Oil Temperature

This parameter displays the temperature of the engine oil as calculated by the control module using a signal from the engine oil temperature sensor. The engine oil temperature sensor has a range of values indicating a low value when the oil temperature is low to a high value when the oil temperature is high.

Engine Run Time

This parameter displays the time elapsed since the engine was started. The scan tool will display the time in hours, minutes and seconds. The engine run time will reset to zero when the engine stops running.

Engine Speed

This parameter displays the speed of the crankshaft as determined by the control module using an input from the crankshaft position (CKP) sensor. The scan tool will display a high value at high engine speeds and a low value at low engine speeds.

EVAP Fault History

This parameter displays the result of the evaporative emission (EVAP) system diagnostic.

Scan tool displays NO FAULT, EXCESS VACUUM, PURGE VALVE LEAK, SMALL LEAK, or WEAK VACUUM. The EVAP Fault History indicates the status of EVAP system diagnostics performed by the PCM.

EVAP Purge Solenoid Circuit Status

This parameter displays the status of the output driver for the evaporative emission purge solenoid control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground or a short to voltage on the circuit.

EVAP Purge Solenoid Command

This parameter displays the on-time or duty cycle of the EVAP purge solenoid commanded by the control module expressed as a percent. The scan tool will display a high percentage when the control module is commanding the EVAP purge solenoid to be open a large amount. The scan tool will display a low percentage when the control module is commanding the EVAP purge solenoid to be open a small amount. The scan tool will display 0 when the control module is commanding the EVAP purge solenoid closed.

EVAP Vent Solenoid Circuit Status

This parameter displays the status of the output driver for the evaporative emission vent solenoid control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground or a short to voltage on the circuit.

EVAP Vent Solenoid Command

This parameter displays the state of the EVAP vent solenoid commanded by the control module expressed as a Venting or Not Venting. The scan tool will display a venting when the control module is commanding the EVAP vent solenoid to be open. The scan tool will display a not venting when the control module is commanding the EVAP vent solenoid to be closed.

Exhaust CMP Angle

This parameter displays the degrees of advanced exhaust camshaft angle related to crankshaft position as determined by the control module based on input from the exhaust CMP sensors. The scan tool will display a higher value for a more advanced exhaust camshaft position. The scan tool will display a lower value when the exhaust camshaft is not being advanced, such as at idle.

Fuel Level Sensor

This parameter displays the approximate fuel level in the fuel tank as a voltage. The control module calculates this level using the signal from the sensor used to monitor the fuel level in the fuel tank. The scan tool will display a low reading when the fuel level in the tank is low or near empty. The scan tool will display a high reading when the fuel level in the tank is high or near full.

Fuel Pump Relay Circuit Status

This parameter displays the status of the output driver for the fuel pump relay control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground or a short to voltage on the circuit.

Fuel Pump Relay Command

This parameter displays the commanded state of the fuel pump relay control circuit. The fuel pump relay should be on when the scan tool indicates the Fuel Pump Relay Command is On. The fuel pump relay should be off when the scan tool indicates the Fuel Pump Relay Command is Off.

Fuel Tank Level Remaining

This parameter displays the amount of fuel remaining in the fuel tank as a percentage. The control module calculates this level using the signal from the sensor used to monitor the fuel level in the fuel tank. The scan tool will display a low reading when the fuel level in the tank is low or near empty. The scan tool will display a high reading when the fuel level in the tank is high or near full.

Fuel Tank Pressure Sensor

This parameter displays the fuel tank pressure as calculated based on a signal sent to the control module from the fuel tank pressure (FTP) sensor. The scan tool will display a low value when the pressure in the fuel tank is low or a vacuum. The scan tool will display a high value when the pressure in the fuel tank is high.

Fuel Tank Rated Capacity

This parameter displays the rated maximum quantity of fuel the fuel tank will hold.

This is calibrated in the control module to match the vehicle.

Fuel Trim Cell

This parameter displays the fuel trim cell number as calculated by the control module based on engine speed and load inputs. The scan tool will display a lower number as conditions are nearer to idle, and a higher value as conditions approach maximum engine speed and maximum load.

Fuel Trim Learn

This parameter indicates if the control module is adjusting long term fuel trim in response to the short term fuel trim. The scan tool displays Enabled or Disabled. When conditions are appropriate for enabling long term fuel trim corrections, the scan tool displays Enabled.

Fuel Volatility

This parameter indicates the rate the fuel can be vaporized in the cylinder as calculated by the control module. The scan tool will display HIGH when the fuel volatility is high. The scan tool will display LOW when the fuel volatility is low.

HO2S 1

The scan tool displays a range of 0-1,106 mV.

HO2S 1 Heater

This parameter displays the current through the control module when the HO2S 1 heater is commanded ON by the control module. HO2S 1 Heater Current is a range of values indicating a low current when the heater circuit resistance is high to a high current when the heater circuit resistance is low.

HO2S 1 Heater Circuit Status

This parameter displays the diagnostic state of the output driver for the heater control circuit of oxygen sensor 1. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground, or a short to voltage on the circuit.

HO2S 1 Heater Command

This parameter displays the commanded state of the heater control circuit for oxygen sensor 1. The oxygen sensor 1 heater should be on when the scan tool indicates the HO2S1 Heater Command is On. The oxygen sensor 1 heater should be off when the

scan tool indicates the HO2S 1 Heater Command is Off. The scan tool displays 1=On /0=Off.

HO2S 2

The scan tool displays a range of 0-1,106 mV.

HO2S 2 Heater

This parameter displays the current through the control module when the HO2S 2 heater is commanded ON by the control module. HO2S 2 Heater Current is a range of values indicating a low current when the heater circuit resistance is high to a high current when the heater circuit resistance is low.

Hot Open Loop

This parameter indicates the status of the fuel delivery system. The scan tool will display Active if the fuel system is running in open loop due to a temperature concern. The scan tool will display Inactive if the fuel system is operating normally.

IAT Sensor

The scan tool displays °C. The PCM converts the resistance of the intake air temperature (IAT) sensor to degrees in the same manner as the engine coolant temperature (ECT) sensor. Intake air temp is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

The scan tool displays a range of -39 to +140°C (-38 to +284°F). The PCM converts the resistance of the intake air temperature sensor to degrees. The PCM uses the IAT in order to adjust fuel delivery and spark timing according to incoming air density.

Ignition 1 Signal

This parameter displays the voltage measured at the ignition 1 circuit of the control module. Voltage is applied to the control module when the ignition switch is in the ignition 1 position.

Ignition Off Time

The Scan tool displays time in minutes.

This parameter is used by the control module to identify the amount of time that has passed. This parameter is used for various components and systems including throttle actuator control (TAC) system and the EVAP system.

Injector PWM

The scan tool displays mS.

Indicates the base PWM or ON time of the fuel injectors in milliseconds. When the engine load is increased, the injector pulse width will increase.

Indicates the amount of time the PCM is commanding each injector ON during each engine cycle. A longer injector pulse width will cause more fuel to be delivered.

Injector pulse width should increase with increased engine load.

Knock Retard

The scan tool displays °.

Indicates the amount of spark the PCM is removing from ignition control (IC) spark advance in response to the signal from the knock sensors. The traction control system desired torque signal from the electronic brake and traction control module (EBTCM) may cause knock retard to display a value more than 0.0 degrees if traction control is active.

Long Term FT

The scan tool displays percentage. The powertrain control module (PCM) derives the long term fuel trim from the short term fuel trim value. The long term fuel trim represents a long term correction of fuel delivery. A value of 0 percent indicates that fuel delivery requires no compensation in order to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0 percent indicates that the fuel system is rich and the PCM is reducing the fuel delivery. A positive value significantly more than 0 percent indicates that a lean condition exists and the PCM compensates by adding fuel. Fuel trim values at maximum authority indicates an excessively rich or lean system.

Long Term FT Avg.

This parameter is the average long term fuel trim for this bank as calculated by the control module. The scan tool will display a value more than 0 percent indicating that time is being added to the injector pulse width, increasing the amount of fuel to this bank of the engine. The scan tool will display a value of less than 0, indicating time is being subtracted from the injector pulse width, reducing the amount of fuel to this bank of the engine. A value of 0 percent indicates no compensation is required to operate the engine at the desired air/fuel ratio.

Loop Status

Closed loop indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In open loop, the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on throttle position (TP) sensor, ECT, and MAF sensor inputs only.

MAF Sensor

The scan tool displays g/s

The scan tool displays a range of 0.0-655 g/s. The mass air flow (MAF) is the MAF input frequency converted to grams of air per second. This indicates the amount of air entering the engine.

MAF Sensor

The scan tool displays a range of 0-31,999 Hz. The MAF sensor is a hot wire type air flow sensor. The PCM converts current draw needed by the MAF to keep the hot wires at a constant into a frequency signal. The scan tool displays this frequency in a hertz signal.

MAP Sensor

The scan tool displays kPa

The MAP sensor measures the change in the intake manifold pressure which results from engine load and speed changes. As the intake manifold pressure increases, the air density in the intake also increases and additional fuel is required.

The scan tool displays a range of 10-105 kPa. The MAP sensor measures the absolute pressure in the intake manifold.

MAP Sensor

The scan tool displays Volts

The MAP sensor measures the change in the intake manifold pressure which results from engine load and speed changes. As the intake manifold pressure increases, the air density in the intake also increases and additional fuel is required.

The scan tool displays a range of 10-105 kPa. The MAP sensor measures the absolute pressure in the intake manifold.

MIL Circuit Status

This parameter displays the status of the output driver for the malfunction indicator lamp control circuit. The scan tool will display OK if the circuit is operating correctly. The scan tool will display Fault if there is an open, short to ground or a short to voltage on the circuit.

MIL Command

This parameter displays the commanded state of the MIL control circuit. The malfunction indicator lamp should be on when the scan tool indicates the MIL Command is On. The malfunction indicator lamp should be off when the scan tool indicates the MIL Command is Off. The control module will command the MIL On

when the ignition is ON with the engine OFF in order to perform a bulb check.

MIL Requested by DTC

This parameter indicates the reason the control module illuminated the MIL. The scan tool will display YES when the MIL is requested as a result of an A or B type DTC. The scan tool will display NO if the MIL is illuminated for another reason, such as transmission DTCs.

Misfire Current Cyl. 1-4

The scan tool displays 0-255 counts. The display shows the number of misfires that have been detected during the last 200 cylinder firing events. The counters may normally display some activity, but the activity should be nearly equal for all of the cylinders, and in low numbers.

Misfire History Cyl. 1-4

The scan tool range is 0-255 counts. This parameter indicates the total level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire or DTC P0300 has become active. The misfire history counter will update every 200 cylinder firing events.

Power Enrichment

Scan tool displays ACTIVE or INACTIVE. ACTIVE displayed indicates that the PCM has detected conditions appropriate to operate in Power Enrichment mode. The PCM will command Power Enrichment mode when a large increase in throttle position and load is detected. While in Power Enrichment, the PCM will increase the amount of fuel delivered by entering Open Loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

Reduced Engine Power

The scan tool displays Active or Inactive. The scan tool displays Active when the PCM receives a signal from the TAC module that a throttle actuator control system fault is occurring. The PCM limits the engine power.

Short Term FT

The scan tool displays percentage. The short term fuel trim represents a short term correction to fuel delivery by the powertrain control module (PCM) in response to the amount of time the fuel control oxygen sensor voltage spends above or below the 450 mV threshold. If the oxygen sensor voltage mainly remains less than 450 mV, indicating a lean air/fuel mixture, short term fuel trim increases into the positive range

above 0 percent. The PCM adds fuel. If the oxygen sensor voltage stays mainly above the threshold, the short term fuel trim decreases below 0 percent into the negative range. The PCM reduces the fuel delivery in order to compensate for the indicated rich condition. Under certain conditions such as an extended idle and a high ambient temperature, the canister purge may cause the short term fuel trim to read in the negative range during normal operation. The fuel trim values at maximum authority may indicate an excessively rich or lean system.

Short Term FT Avg.

The scan tool displays %. This parameter indicates the average short term fuel trim for this bank. The scan tool will display a value more than 0 if the time is being added to the injector pulse width, increasing the amount of fuel to that bank of the engine to compensate for a lean condition sensed by the oxygen sensors on that bank. The scan tool will display a value less than 0 if time is being subtracted from the injector pulse width, reducing the amount of fuel to the engine to compensate for a rich condition sensed by the oxygen sensors on that bank. A value of 0 percent indicates no compensation is required to operate the engine at the desired air/fuel ratio.

Spark

The scan tool displays a range of -64 to +64°. The scan tool displays the amount of degrees the PCM commands. The PCM computes the desired spark advance using the following: (1) ECT, (2) engine speed (RPM), (3) load, (4) vehicle speed. The PCM adjusts the timing.

A negative (-) value indicates degrees before top dead center (BTDC) or spark advance; a positive value indicates degrees after top dead center (ATDC) or spark retard.

Start Up ECT

Indicates the engine coolant temperature at engine start up.

The scan tool displays a range of -39 to +140°C (-38 to +284°F). The scan tool displays the engine ECT at the time the engine was started. The PCM uses start-up ECT for certain DTCs.

Indicates the engine coolant temperature at the time that the vehicle was started. Used to determine if the last startup was a cold start.

Start Up IAT

Indicates the IAT at the time that the vehicle was started. Used to determine if the last startup was a cold start.

The scan tool range is -39 to 140°C (-38 to 284°F). This parameter indicates the ambient air temperature at start-up.

Torque Delivered Signal

Represents the PWM signal which indicates the percent of available torque the engine is delivering to the drive wheels. The EBTCM monitors the traction control torque signal to ensure that the PCM is responding properly to the traction control desired torque signal.

Torque Request Signal

Represents the PWM signal from the electronic brake and traction control module (EBTCM). The EBTCM reduces the traction control desired torque signal pulse width when a drive wheel slippage situation is detected. The PCM monitors the traction control desired torque signal and reduces drive wheel slippage as necessary by retarding spark timing, decreasing boost sol. PWM, or increasing air/fuel ratio. The PCM can also turn OFF up to three fuel injectors if the traction control desired torque signal indicates a large enough amount of drive wheel slippage.

Total Misfire Count

The scan tool range is 0-255 counts. This parameter indicates the total level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire or DTC P0300 has become active. The misfire history counter will update every 200 cylinder firing events.

TP 1 Learned Min

This parameter displays the learned minimum value of TP sensor 1 as recorded by the control module on start-up for the ignition cycle.

TP 2 Learned Min

This parameter displays the learned minimum value of TP sensor 2 as recorded by the control module on start-up for the ignition cycle.

TP Desired Angle

The scan tool displays %. The scan tool displays 0-100 percent. The PCM indicates the desired throttle angle commanded by the vehicle operator. The scan tool indicates the desired throttle angle commanded by the vehicle operator.

TP Indicated Angle

This parameter displays the angle of the throttle position (TP) in percent. This information is calculated by the control module using the signals from the throttle position sensors. The scan tool will display a low percentage when the throttle plate is closed. The scan tool will display a high percentage when the throttle plate is fully open.

TP Sensor 1

This parameter displays the voltage signal sent to the control module from the sensor used to monitor the position of the throttle plates. This parameter is for sensor 1 of the TP sensor assembly. The scan tool will display a low voltage when the throttle plates are at rest. The scan tool will display a high voltage when the throttle plates are fully open.

TP Sensor 1

This parameter displays the angle of the TP sensor 1 in percent. This information is calculated by the control module using the signal from the throttle position sensor 1. The scan tool will display a low percentage when the throttle plates are closed. The scan tool will display a high percentage when the throttle plates are fully open.

TP Sensors 1 and 2

This parameter displays the results of a control module test that compares the signals from the TP sensors 1 and 2. The scan tool will display Agree when the signal from TP sensor 1 corresponds with the signal from TP sensor 2. The scan tool will display Disagree when the signal from TP sensor 1 conflicts with the signal from TP sensor 2.

TP Sensor 2

This parameter displays the voltage signal sent to the control module from the sensor used to monitor the position of the throttle plates. This parameter is for sensor 2 of the TP sensor assembly. The scan tool will display a high voltage when the throttle plates are at rest. The scan tool will display a low voltage when the throttle plates are fully open.

TP Sensor 2

This parameter displays the angle of the TP sensor 2 in percent. This information is calculated by the control module using the signal from the throttle position sensor 2. The scan tool will display a low percentage when the throttle plates are closed. The scan tool will display a high percentage when the throttle plates are fully open.

Traction Control Status

This parameter displays the status of the Traction Control circuit. The scan tool displays active if the PCM receives a signal from the EBTCM requesting torque reduction during a traction control event.

Vehicle Speed Sensor

This parameter indicates the vehicle speed as calculated by the control module based on a signal from the vehicle speed sensor (VSS). The scan tool will display a higher value at higher vehicle speeds, and a lower value at lower vehicle speeds.

Warm-ups w/o Emission Faults

The scan tool displays a range of 0-255. This parameter counts the number of warm up cycles without an emission fault present. The counter increments to 255 and rolls back to 0 unless a fault occurs. If a fault occurs, the counter reverts back to 0 until the fault is corrected. Clearing the information with a scan tool or a loss of power to the PCM also resets the counter to 0. The scan tool displays counts. This display indicates the number of warm-up cycles without a emission failure.

Warm-ups w/o Non-Emission Faults

The scan tool displays a range of 0-255. This parameter counts the number of warm up cycles without a non-emission fault present. The counter increments to 255 and rolls back to 0 unless a fault occurs. If a fault occurs, the counter reverts back to 0 until the fault is corrected. Clearing information with a scan tool or a loss of power to the PCM also resets the counter to 0.

SCAN TOOL OUTPUT CONTROLS

Powertrain Control Module Scan Tool Output Control

Scan Tool Output Control	Additional Menu Selection(s)	Description
Engine Controls Ignition Relay	Engine Output Controls	Enables or disables the Engine Controls Ignition Relay. The scan tool will command the engine controller to turn the relay ON or OFF. The normal commanded state is ON.
Engine Speed Control	TAC System	Activates the throttle activation control (TAC) system to change engine RPM. The normal commanded state is None. To enable the RPM control, all instruction on the scan tool must be completed. The system will increase or decrease the RPM within a range of 400-2,200 RPM. The set step value changes the RPM by increments of 25 RPM, 100 RPM, and 500 RPM. The system remains in the commanded state until cancelled by the scan tool.
EVAP Purge Solenoid	Engine Output Controls/EVAP System	Activates the purge solenoid in 10 percent increments from 0 to 100 percent. The device control will be aborted and inhibited if the fuel tank pressure (FTP) sensor exceeds 19 mm Hg

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		(10 in H ₂ O).
EVAP Vent Solenoid	Engine Output Controls/EVAP System	Activates the vent solenoid. The device control will be aborted and inhibited if the FTP sensor exceeds 19 mm Hg (10 in H ₂ O).
EVAP Purge/Seal	Engine Output Controls/EVAP System	Simultaneously activates the purge solenoid in 10 percent increments from 0 to 100 percent and the vent solenoid. The device control will be aborted and inhibited if the FTP sensor exceeds 19 mm Hg (10 in H ₂ O).
Exhaust CMP Actuator	CMP Actuator System	This function controls the exhaust camshaft position (CMP) actuator. The normal commanded state is 0 degrees. The system will INCREASE or DECREASE the exhaust camshaft timing by changing the duty cycle of the actuator in 5-degree increments up to 50 degrees. This also affects Desired Exh. CMP Angle Bank 1 and Bank 2.
Fuel Injector Balance	Fuel System	Enables the fuel injector in order to verify proper fuel injector flow. The PCM will pulse the selected injector when the following conditions are met: • All instruction on the scan tool completed. • Fuel injector selected • Key ON, engine OFF The selected fuel injector can only be flowed/pulsed once per ignition cycle.
Fuel Pump	Engine Output Controls	Activates the fuel pump relay for 2 seconds. Also turns fuel pump ON and OFF while engine is running.
Fuel Trim Enable	Fuel System	Disables the PCMs ability to learn new fuel trim parameters. The commanded states are NONE, ENABLED, DISABLED. The normal commanded state is NONE. The system remains in the commanded state until cancelled by the scan tool.
Fuel Trim Reset	Fuel System	Activates the reset of fuel trim data in all fuel trim cells.
Idle Spark	Engine Output Controls/Spark	Enables or disables idle spark command. When commanded ON, the idle spark will be

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	Control	controlled to 13 degrees before top dead center. The normal commanded state is OFF.
Intake CMP Actuator	CMP Actuator System	This function controls the intake CMP actuator. The normal commanded state is 0 degrees. The system will INCREASE or DECREASE the intake camshaft timing by changing the duty cycle of the actuator in 5 degree increments up to 40 degrees. This also affects Desired Int. CMP Angle Bank 1 and Bank 2.
Loop Status	Engine Output Controls	Controls the system loop status. The commanded states include NONE, OPEN, or CLOSED. The normal commanded state is NONE. When commanded OPEN or CLOSED, the system remains in the commanded state until cancelled by the scan tool.
MIL	Engine Output Controls/Dash Lamps	Activates the malfunction indicator lamp (MIL). The MIL will remain illuminated until cancelled by the scan tool.
-	Misfire Graphic	Graphs the accumulated misfires occurring in each cylinder. The scan tool allows for a reset of the misfire graph.
HO2S Heater Driver	Engine Output Controls	Activates the heated oxygen sensor (HO2S) heater. The commanded states include NONE, ON, and OFF. The normal commanded state is NONE. The system remains in the commanded state until cancelled by the tool.
Spark Retard	Engine Output Controls/Spark Control	Controls the amount of spark retard. The scan tool will command an increase or decrease in the amount of spark retard in 1-degree increments, within a range of 1-10 degrees. The degrees of spark retard will remain in the commanded state until cancelled by the scan tool. The normal commanded states is NONE.
Throttle Position	TAC System	Operates TAC motor in 10 percent increments to open or close the throttle blade. The test operates during key ON, engine OFF.
APP Learn	APP Learn	This procedure allows the TAC system to re-learn the minimum accelerator pedal position in the even of the bracket and rod assembly replacement.