SECTION : 1F

ENGINE CONTROLS

CAUTION : Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

TABLE OF CONTENTS

SPECIFICATIONS

ENGINE DATA DISPLAY TABLES

Engine Data Display 01 Selected by 2: Data Display 1: Engine Data 2.2L Manual Transmission

Parameter	Scaling	Value
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
Desired Idle	rpm=N*12.5	ECM Idle Command
Engine Coolant Temperature	Celsius=n–40	85˚– 115˚F (185˚– 239˚C)
Intake Air Temperature	Celsius=n–40	10˚– 80˚F (50˚– 176˚C)
Throttle Position	%=n/2.56	0% (up to 100% at wide open throttle)
Throttle Position	Volts=n/51	0.200–0.900v (up to 5.0 at wide open throttle)
MAP	kPa=N	12–103 kPa
BARO	kPa=(n+28)/2.71	65–100 kPa (varies with altitude and with the BARO pressure)
EGR Actual Position	%=n/2.56	0%
EGR Desired Position	%=n/2.56	
EGR Feedback	Volt=5n/255	0–5 volts
IAC Position	Counts=N	5–60
Cam Speed Activity	Counts=N	0–255
Ignition Voltage	Volts=n/10	12.0–15.0
Engine Run Time	Seconds=N	00:00:00–18:12:15 (hours:minutes: seconds)
BPW Bank 1	ms=N/65.535	0–999.9 ms
Air Fuel Ratio	x:1=n/10	0:1–25.5:1
Spark	Degrees=(n/2)–64	64 to –64
Knock Retard	Degrees=N/(256/22.5)	0–90
Knock Active Counter	Counts=N	0–255
Knock Present	1=Yes/0=No	–
Calculated Load	%=N/2.56	0–100
Vehicle Speed	mph=n/1.61	0–255 mph

Parameter	Scaling	Value
Air Condition Pressure	Volt=5n/255	0–5 volts
O2 Sensor Bank 1 Sensor 1	mV=N/0.2304	0–1132 mV
O2 Sensor Bank 1 Sensor 2	mV=N/0.2304	0–1132 mV
Decel Fuel Mode	1=Yes/0=No	–
Power Enrichment Mode	1=Yes/0=No	–
Closed Loop	1=Yes/0=No	–
Loop Status	See Table 3	
Hot Loop Open	1=Yes/0=No	–
Rich/Lean Bank 1	1=Rich/0=Lean	–
Short Term Fuel Trim	%=(N–128)/1.28	–100 to 100%
Long Term Fuel Trim	%=(N–128)/1.28	–100 to 100%
EVAP Purge Solenoid	%=N/2.56	0–100%
EVAP Vent Solenoid	1=On/0=Off	–
IAC Base Position	Counts=N	0–255
Fuel Trim Cell	Cell=N	
Calculated Air Flow	g/sec=N/128	0–512 g/sec
Weak Cylinder	See Table 01	–
Rough Road Sensor	Volt=5n/255	
5 Volt Reference	Volt=5n/255	
Throttle at Idle	1=Yes/0=No	–
Power Steering Cramp	1=Yes/0=No	–
Air Conditioning Request	1=On/0=Off	–
Air Conditioning Clutch	1=On/0=Off	–
Fuel Pump	1=On/0=Off	–
Malfunction Indicator Lamp	1=On/0=Off	–
Upshift Lamp	1=On/0=Off	–
Low Fuel Lamp	1=On/0=Off	–
Hot Open Loop Lamp	1=On/0=Off	–
Variable Gate Intake	1=Long/0=Short	–
Fuel Trim Learned	1=On/0=Off	–
Fan 1	1=On/0=Off	–
Fan 2	1=On/0=Off	–

Engine Data Display 04 Selected by 2: Data Display 1: Engine Data 2.2L Automatic Transmission

Parameter	Scaling	Value
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
Desired Idle	rpm=N*12.5	ECM Idle Command
Engine Coolant Temperature	Celsius=n–40	85˚– 115˚C (185˚– 239˚F)
Intake Air Temperature	Celsius=n–40	10˚– 80˚C (50˚– 176˚F)
Throttle Position	%=n/2.56	0% (up to 100% at wide open throttle)

Parameter	Scaling	Value
Throttle Position	Volts=n/51	0.200–0.900v (up to 5.0 at wide open throttle)
MAP	kPa=N	23–35 kPa
BARO	kPa=(n+28)/2.71	65–100 kPa (varies with altitude and with the BARO pressure)
EGR Actual Position	%=n/2.56	0%
EGR Desired Position	%=n/2.56	0–100%
EGR Feedback	Volt=5n/255	
IAC Position	Counts=N	5–60
Cam Speed Activity	Counts=N	0–255
Ignition Voltage	Volts=n/10	12.0–15.0
Engine Run Time	Seconds=N	00:00:00–18:12:15 (hours:minutes: seconds)
BPW Bank 1	ms=N/65.535	0–999.9
Air Fuel Ratio	x:1=n/10	0:1–25.5:1
Spark	Degrees=(n/2)–64	64 to –64
Knock Retard	Degrees=N/(256/22.5)	0–90
Knock Active Counter	Counts=N	0–255
Knock Present	1=Yes/0=No	0–90
Calculated Load	%=N/2.56	0–100
Vehicle Speed	mph=n/1.61	0–255 mph
Air Condition Pressure	Volt=5n/255	0–5 volts
Oxygen Bank 1 Sensor 1	mv=N/0.2304	0–1132 mV
Oxygen Bank 1 Sensor 2	mV=N/0.2304	0–1132 mV
Decel Fuel Mode	1=On/0=Off	–
Power Enrichment Mode	1=Yes/0=No	–
Closed Loop	1=Yes/0=No	–
Loop Status	See Table 3	–
Hot Loop Open	1=Yes/0=No	–
Rich/Lean Bank 1	1=Rich/0=Lean	–
Short Term Fuel Trim	%=(N–128)/1.28	–100 to 100%
Long Term Fuel Trim	%=(N–128)/1.28	–100 to 100%
EVAP Purge Solenoid	%=N/2.56	0–100%
EVAP Vent Solenoid	1=On/0=Off	–
IAC Base Position	Counts=N	0–255
Fuel Trim Cell	Cell=N	
Calculated Air Flow	g/sec=N/128	0–512 g/sec
Weak Cylinder	Misfire Detected/Misfire Not DT	–
Rough Road Sensor	Volt=5n/255	0–5 volts
5 Volt Reference	Volt=5n/255	0–5 volts
Throttle at Idle	1=Yes/0=No	–
Power Steering Cramp	1=Yes/0=No	–
Air Conditioning Request	1=On/0=Off	–

Parameter	Scaling	Value
Air Conditioning Clutch	1=On/0=Off	–
Fuel Pump	1=On/0=Off	–
Malfunction Indicator Lamp	1=On/0=Off	–
Upshift Lamp	1=On/0=Off	–
Low Fuel Lamp	1=On/0=Off	–
Hot Open Loop Lamp	1=On/0=Off	–
Variable Gate Intake	1=Long/0=Short	–
Fuel Trim Learned	1=Yes/0=No	–
Fan 1	1=On/0=Off	–
Fan 2	1=On/0=Off	–
Park/Neutral	1=Yes/0=No	–

EVAP Data Display 01 Selected by 2: Data Display 2: Specific Data 1: EVAP
Manual Transmission

Parameter	Scaling	Value
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
Ignition Voltage	Volts=n/10	12.0–15.0
Engine Coolant Temperature	Celsius=n–40	85˚– 115˚C (39˚– 93˚F)
Start Up Coolant Temperature	Celsius=n–40	4˚– 34˚C (39˚– 93˚F)
Intake Air Temperature	Celsius=n–40	10˚ – 80
Start Up Intake Air Temperature	Celsius=n–40	12˚ – 42˚C (54˚ – 108˚F)
Engine Run Time	Seconds=N	00:00:00–18:12:15 (hours:minutes: seconds)
Fuel Level Sensor	Volt=5n/255	0.4–4.5 volts
Fuel Gauge	1=On/0=Off	–
EVAP Purge Solenoid	%=N/2.56	0–100%
EVAP Vent Solenoid	1=On/0=Off	–
EVAP Tank Vacuum	in H2O=n(25/65535)–7.5	
Throttle Position	%=n/2.56	0% (up to 100% at wide open throttle)
Throttle Position	Volts=n/51	0.200–0.900v (up to 5.0 at wide open throttle)
IAC Position	Counts=N	5–60
BPW Bank 1	ms=N/65.535	0–999.9
Air Fuel Ratio	x:1=n/10	0:1–25.5:1
Spark	Degrees=(n/2)–64	64 to –64
MAP	kPa=N	25–35 kPa
BARO	kPa=(n+28)/2.71	65–100 kPa (varies with altitude and with the BARO pressure)
Calculated Load	%=N/2.56	0–100
Vehicle Speed	mph=n/1.61	0–255
Oxygen Sensor Bank 1 Sensor 1	mV=N/0.2304	0–1132
Oxygen Sensor Bank 1 Sensor 2	mV=N/0.2304	0–1132

EVAP Data Display 02 Selected by 2: Data Display 2: Specific Data 1: EVAP
Automatic Transmission

Parameter	Scaling	Value
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
Ignition Voltage	Volts=n/10	12.0–15.0
Engine Coolant Temperature	Celsius=n–40	4˚– 34˚C (–39˚– 93˚F)
Start Up Coolant Temperature	Celsius=n–40	10˚ – 80
Intake Air Temperature	Celsius=n–40	12˚– 42˚C (54˚– 108˚F)
Start Up Intake Air Temperature	Celsius=n–40	–34.6˚– 275˚F (–37˚– 135˚C)
Engine Run Time	Seconds=N	Varies (since start up)
Fuel Level Sensor	Volt=5n/255	0.4–4.5 volts
Fuel Gauge	1=On/0=Off	–
Park/Neutral	1=Yes/0=No	–
EVAP Purge Solenoid	%=N/2.56	0–100%
EVAP Vent Solenoid	1=On/0=Off	–
EVAP Tank Vacuum	in H2O=n(25/65535)–7.5	
Fuel Tank Vacuum Sensor	Volt=5n/255	0.0–5.0
Throttle Position	%=n/2.56	0% (up to 100% at wide open throttle)
Throttle Position	Volts=n/51	0.200–0.900v (up to 5.0 at wide open throttle)
IAC Position	Counts=N	5–60
BPW Bank 1	ms=N/65.535	0–999.9
Air Fuel Ratio	x:1=n/10	0:1–25.5:1
Spark	Degrees=(n/2)–64	64 to –64
MAP	kPa=N	12–103 kPa
BARO	kPa=(n+28)/2.71	65–100 kPa (varies with altitude and with the BARO pressure)
Calculated Load	%=N/2.56	0–100
Vehicle Speed	mph=n/1.61	0–255
Oxygen Sensor Bank 1 Sensor 1	mV=N/0.2304	0–1132
Oxygen Sensor Bank 1 Sensor 2	mV=N/0.2304	0–1132

EVAP Service Bay Test F5: Functional Tests–F5: Outputs–F5: EVAP Service Bay Test All

Parameter	Scaling	Value
EVAP Service Bay Test State	see PID table 4	–
EVAP Service Bay Test Min. TPS	%=N/2.56	0–100
Throttle Position	%=n/2.56	0–100
EVAP Service Bay Test Max. TPS	%=n/2.56	0–100
EVAP Service Bay Test Abort Reason	see PID table 5	–
EVAP Service Bay Test Results	see PID table 6	–
EVAP Purge Solenoid	%=N/2.56	0–100
EVAP Vent Solenoid	1=On/0=Off	–
EVAP Tank Vacuum	in H2O=n(25/65535)–7.5	
Fuel Tank Vacuum Sensor	Volt=5n/255	0.0–5.0
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
Ignition Voltage	Volts=n/10	12.0–15.0
Engine Coolant Temperature	Celsius=n–40	85˚ – 115
Start Up Coolant Temperature	Celsius=n–40	4˚ – 34˚C (39˚ – 93˚F)
Intake Air Temperature	Celsius=n–40	10˚ – 80˚C (50˚ – 176˚F)
Start Up Intake Air Temperature	Celsius=n–40	12˚ – 42˚C (54˚ – 108˚F)
Engine Run Time	Seconds=N	00:00:00–18:12:15 (hours:minutes:seconds)
Fuel Level Sensor	Volt=5n/255	0.4–4.5
Fuel Gauge	1=On/0=Off	–

EGR Data Display Selected by 2: Data Display 2: Specific Data 2: EGR All Displays EGR01

Parameter	Scaling	Value
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
Ignition Voltage	Volts=n/10	12.0–15.0
IAC Position	Counts=N	0–255
Engine Coolant Temperature	Celsius=n–40	85˚– 115˚C (185˚– 239˚F)
Throttle Position	%=n/2.56	0% (up to 100% at wide open throttle)
Throttle Position	Volts=n/51	0.200–0.900v (up to 5.0 at wide open throttle)
EGR Actual Position	%=n/2.56	0%
EGR Desired Position	%=n/2.56	0–100%
EGR Feedback	Volt=5n/255	
EGR Closed Pintle Position	Counts=N	
EGR Trip Sample Count	Tests=N	
EGR EWMA Threshold	n=Counts(signed)	
EGR EWMA	Counts=n(signed)	
EGR Pintle Position Error	Counts=n(signed)	
Engine Run Time	Seconds=N	00:00:00–18:12:15 (hours:minutes: seconds)
BPW Bank 1	ms=N/65.535	0–999.9
Air Fuel Ratio	x:1=n/10	0:1–25.2:1
Spark	Degrees=(n/2)–64	64 to –64
MAP	kPa=N	25–35 kPa
BARO	kPa=(n+28)/2.71	65–100 kPa (varies with altitude and with the BARO pressure)
Calculated Load	%=N/2.56	0–100
Vehicle Speed	mph=n/1.61	0–255

Oxygen Sensor Data Display Selected by F2: Data Display F2: Specific Data F4: Oxygen Sensors All Displays O2SO1

Parameter	Scaling	Value
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
Engine Run Time	N=seconds	00:00:00–18:12:15 (hours:minutes: seconds)
Loop Status	0=Open/1=Closed	–
O2S 1 Bank 1 Sensor 1	mV=N/0.2304	0–1132 mV
O2S 1 Bank 1 Sensor 1	0=Not Ready, 1=Ready	–
Rich/Lean Bank 1	0=Lean, 1=Rich	–
Injector Pulse Bank 1	msec=N/65.535	
Start Up Coolant Temperature	Celsius=n–40	4˚– 34˚C (39˚– 93˚F)
Engine Coolant Temperature	Celsius=n–40	85˚– 115˚C (185˚– 239˚F)
Start Up Intake Air Temperature	Celsius=n–40	12˚– 42˚C (54˚– 108˚F)
Intake Air Temperature	Celsius=n–40	10˚– 80˚C (50˚– 176˚F)
O2S 1 Time to Activity Bank 1 Sensor 1	Seconds=N	
Short Term FT Bank 1	%=(N–128)1.28	–100 to 100%
Long Term FT Bank 1	%=(N–128)1.28	–100 to 100%
TP Angle	%=N/2.56	0–100%
Calculated Air Flow	g/sec=n/128	0–512 g/sec
MAP	kPa=n	25–35 kPa
EVAP Purge PWM	%=N/2.56	0–100%
Ignition 1	Volts=N/10	12.0–15.0
Air Fuel Ratio	x:1=N/10	0:1–25.5:1
Decel Fuel Mode	0=Inactive, 1=Active	–
Power Enrichment	0=Inactive, 1=Active	–
HO2S 2 Warm Up Time Bank 1 Senor 1	Seconds=N	
HO2S 2 Bank 1 Sensor 2	mV=N/0.2304	0–1132

Misfire Data Display Selected by F2: Data Display F2: Specific Data F5: Misfire
All 2.2L Displays MISF01

Parameter	Scaling	Value
Misfire Current #1	Count=n	0–255
Misfire History #1	Count=n	0–255
Misfire Current #2	Count=n	0–255
Misfire History #2	Count=n	0–255
Misfire Current #3	Count=n	0–255
Misfire History #3	Count=n	0–255
Misfire Current #4	Count=n	0–255
Misfire History #4	Count=n	0–255
Misfire Failures Since First Fail	N=decimal	
Misfire Passes Since First Fail	N=decimal	
Total Misfire Current Count	Count=n	0–255
Weak Cylinder	See Table 01	–
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
TP Angle	%=N/2.56	0–100
Calculated Load	%=N/2.56	0–100
Engine Coolant Temperature	Celsius=n–40	85˚– 115˚C (185˚– 239˚F)
Intake Air Temperature	Celsius=n–40	10˚– 80˚C (50˚– 176˚F)
Cam Active Counter	Counts=N	0–255
Spark	Degrees=(n/2)–64	64 to –64
G Sensor	Volts=n/51	
EGR Desired Position	%=n/2.56	0–100%
EGR Actual Position	%=n/2.56	0%
MAP	kPa=N	25–35 kPa
Vehicle Speed	mph=n/1.61	0–255 mph
Air Conditioning Request	1=On/0=Off	–
Air Conditioning Clutch	1=On/0=Off	–
Knock Active Counter	Counts=N	0–255
Knock Retard	Degrees=N/(256/22.5)	0–90˚
Decel Fuel Mode	1=Yes/0=No	–
Power Enrichment Mode	1=Yes/0=No	–
Injector Pulse Bank 1	msec=N/65.535	
O2S 1 Bank 1 Sensor 1	mv=N/0.2304	0–1132
HO2S 2 Bank 2 Sensor 1	mv=N/0.2304	0–1132
Short Term FT Bank 1	%=(N–128)1.28	–100 to 100
Long Term FT Bank 1	%=(N–128)1.28	–100 to 100

TEC Display Table Selected by 5: Engine Outputs 5: Engine Outputs TEC01

Parameter	Scaling	Value
Engine Speed	rpm=N/4	±100 rpm from the Desired rpm
TP Angle	%=N/2.56	0–100%
Engine Coolant Temperature	Celsius=n–40	85˚– 115˚C (185˚– 239˚F)
Intake Air Temperature	Celsius=n–40	10˚– 80˚C (50˚– 176˚F)
Cam Activity Counter	N=decimal	0–255
Spark	Degrees=(n/2)–64	64 to –64
MAP	kPa=N	12–103 kPa
Vehicle Speed	mph=n/1.61	0–255 mph
Decel Fuel Mode	1=Yes/0=No	–
Power Enrichment Mode	1=Yes/0=No	–
Injector Pulse Bank 1	msec=N/65.535	
Crank Error Latched	1=Yes/0=No	–
Sum Out Of Range	1=Yes/0=No	–
Opposing Factor Out Of Range	1=Yes/0=No	–
Factor Out Of Range	1=Yes/0=No	–
Enable Criteria Not Met	1=Yes/0=No	–
Cat Damaging Misfire	1=Yes/0=No	–
Test is Running	1=Yes/0=No	–
Learned This Key Cycle	1=Yes/0=No	–
Attempts to Learn	Counts=N	

ENGINE DATA DISPLAY TABLE DEFINITIONS

ECM Data Description

The following information will assist in diagnosing emission or driveability problems. A first technician can view the displays while the vehicle is being driven by second technician. Refer to Powertrain On–Board Diagnostic (OBD II) System Check for additional information.

A/C Clutch

The A/C Relay represents the commanded state of the A/C clutch control relay. The A/C clutch should be engaged when the scan tool displays ON.

A/C Pressure

The A/C High Side displays the pressure value of the A/C refrigerant pressure sensor. The A/C High Side helps to diagnose the diagnostic trouble code (DTC) P0533.

A/C Request

The A/C Request represents whether the air conditioning is being requested from the HVAC selector. The input is received by the instrument panel cluster and then sent over Universal Asynchronous Receiver Transmitter (UART) serial data to the ECM and finally to the scan tool over class 2 serial data.

Air Fuel Ratio

The Air Fuel Ratio indicates the air to fuel ratio based on the Oxygen Sensor (O2S 1) inputs. The ECM uses the fuel trims to adjust fueling in order to attempt to maintain an air fuel ratio of 14.7:1.

BARO

The Barometric Pressure (BARO) sensor measures the change in the intake manifold pressure which results from altitude changes. This value is updated at ignition ON and also at Wide Open Throttle (WOT).

BPW Bank 1

Indicates the base Pulse Width Modulation (PWM) or ON time of the indicated cylinder injector in milliseconds. When the engine load is increased, the injector pulse width will increase.

Calculated Air Flow

The calculated air flow is a calculation based on manifold absolute pressure. The calculation is used in several diagnostics to determine when to run the diagnostics.

Camshaft Activity Counter

The Camshaft Position (CMP) activity counter displays the activity sent to the ECM from the CMP sensor. The counter will continually increment while the engine is running. The CMP activity counter is helpful in diagnosing DTC P0342.

Desired Idle

The ECM commands the idle speed. The ECM compensates for various engine loads in order to maintain the desired idle speed. The actual engine speed should remain close to the desired idle under the various engine loads with the engine idling.

Engine Coolant Temperature

The Engine Coolant Temperature (ECT) sensor sends engine temperature information to the ECM. The ECM supplies 5 volts to the engine coolant temperature sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the ECM monitors a high voltage which it interprets as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal will decrease and the ECM will interpret the lower voltage as a warm engine.

EGR Desired Position

The desired Exhaust Gas Recirculation (EGR) position is the commanded EGR position. The ECM calculates the desired EGR position. The higher the percentage, the longer the ECM is commanding the EGR valve ON.

Engine Run Time

The engine run time is a measure of how long the engine has been running. When the engine stops running, the timer resets to zero.

Engine Speed

Engine Speed is computed by the ECM from the fuel control reference input. It should remain close to desired idle under the various engine loads with the engine idling.

EVAP Purge

The Evaporative Emission (EVAP) purge valve solenoid is a proportional signal used in order to control the EVAP canister purge function. At 0% the valve is commanded fully closed. 100% implies that the valve is fully open.

EVAP Purge Solenoid

When energized, the EVAP Solenoid allows the fuel vapor to flow from the EVAP canister to the engine. The EVAP Solenoid is normally closed. The EVAP Solenoid is pulse width modulated by the ECM. The EVAP Solenoid reads 0% when closed and 100% when fully opened.

EVAP Vent Solenoid

The EVAP Vent Solenoid allows fresh outside air to the EVAP canister during purge mode. The EVAP Vent Solenoid allows the diagnostic to pull a vacuum on the fuel tank by closing the vent solenoid.

Fan

The Fan Control (FC) Relay is commanded by the ECM. The FC Relay displays the command as ON or OFF.

Fuel Level Sensor

The Fuel Level Sensor monitors the fuel level in the tank. The Fuel Level Sensor monitors the rate of change of the air pressure in the EVAP system. Several of the Enhanced EVAP System diagnostics are dependent upon the correct fuel level.

Fuel Tank Pressure Sensor

The fuel tank pressure sensor measures the difference between the pressure or the vacuum in the fuel tank and the outside air pressure. When the air pressure in the fuel tank equals the outside air pressure, the output voltage of the sensor is 1.3 to 1.7 volts.

IAC Position

The scan tool displays the ECM command for the Idle Air Control (IAC) pintle position in counts. The higher the number of counts, the greater the commanded idle speed reads. The Idle Air Control responds to changes in the engine load in order to maintain the desired idle rpm.

Intake Air Temperature

The ECM 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 temperature is used by the ECM to adjust fuel delivery and spark timing according to incoming air density.

Ignition 1 (Voltage)

The ignition volts represent the system voltage measured by the ECM at the ignition feed circuit.

Knock Retard

The Knock Sensor (KS) Retard indicates the amount of spark advance the ECM is decreasing in response to the KS signal.

Knock Present

The KS Noise Channel indicates when the ECM detects the KS signal. The ECM should display NO at idle.

Calculated Load

Indicates engine load based on manifold absolute pressure. The higher the percentage, the more load the engine is under.

Long Term FT

The Long Term Fuel Trim (FT) is derived from the short term fuel trim value. The Long Term FT is used for the long term correction of the fuel delivery. A value of 128 counts

(0%) indicates that the fuel delivery requires no compensation in order to maintain a 14.7:1 air to fuel ratio. A value below 128 counts means that the fuel system is too rich and the fuel delivery is being reduced. The ECM is decreasing the injector pulse width. A value above 128 counts indicates that a lean condition exists for which the ECM is compensating.

Long Term FT Average

Long Term FT Average is derived from the long term fuel trim from all of the cells. The ECM then takes all of the values and then creates one average value.

Loop Status

The Closed Loop is displayed indicating that the ECM is controlling the fuel delivery according to the Oxygen Sensor (O2S 1) voltage as close to an air/fuel ratio of 14.7 to 1 as possible.

MAP

The Manifold Absolute Pressure (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 the additional fuel is required.

Misfire Current #1–4

Indicates the number of current misfires that are present in the indicated cylinder. Increments only when misfire is current.

Misfire History #1–4

Indicates the number of misfires that have occurred after 195 current misfires have been counted. The current misfire counter will add its misfires to the history misfire counter after 195 total misfires have taken place. If 1 cylinder is misfiring, the misfiring current counter will have 195 misfires counted before adding to its history counter. If 2 cylinders are misfiring, the misfiring current counter will add to their history counters after 97 misfires. The counter increments only after a misfire diagnostic trouble code (DTC) has been set.

Oxygen Sensor Bank 1 Sensor 1

The pre–converter Oxygen Sensor (O2S 1) reading represents the exhaust oxygen sensor output voltage. This voltage will fluctuate constantly between 100 mv (lean exhaust) and 900 mv (rich exhaust) when the system is operating in a Closed Loop.

Oxygen Sensor Bank 1 Sensor 2

The post–converter Heated Oxygen Sensor (HO2S 2) represents the exhaust oxygen output voltage past the catalytic converter. This voltage remains inactive, or the voltage will appear lazy within a range of 100 mv (lean exhaust) and 900 mv (rich exhaust) when operating in a Closed Loop.

Short Term FT

The Short Term FT represents a short term correction to fuel delivery by the ECM in response to the amount of time the oxygen sensor voltage spends above or below the 450 mv threshold. If the oxygen sensor has mainly been below 450 mv, indicating a lean air/fuel mixture, short term fuel trim will increase to tell the ECM to add fuel. If the oxygen sensor voltage stays mainly above the threshold, the ECM will reduce fuel delivery to compensate for the indicated rich condition.

Short Term FT Average

The Short Term FT Average is derived from the short term fuel trim from all of the cells. The ECM takes all of the values and then creates one average value.

Spark

This is a display of the spark advance Ignition Coil calculation which the ECM is programming in the ignition system. It computes the desired spark advance using data such as engine temperature, rpm, engine load, vehicle speed and operating mode.

TCC Brake Switch

When the brake pedal is applied, the Torque Converter Clutch (TCC) brake switch sends a signal to the PCM/ECM to disengage the TCC and disable the cruise control.

Total Misfire Current Counter

Indicates the total number of misfires that have been detected in all the cylinders after 100 engine cycles. One cycle equals one complete 4 stroke cycle. The total misfire only increments during the steady state cruise conditions.

TP Angle

From the Throttle Position (TP) Sensor voltage input, the ECM computes the TP. The TP Angle will auto zero to 0% at idle (TP voltage below 0.90 volt). The TP Angle will read 100% at WOT.

TP Sensor

The ECM uses the TP Sensor in order to determine the amount of the throttle demanded by the vehicle's operator. The TP Sensor reads between 0.36–0.96 volts at idle to above 4 volts at WOT.

Vehicle Speed

The vehicle speed sensor signal is converted into mph or km/h for display. The vehicle speed output from the ECM is 4000 pulses per mile. The scan tool uses the class 2 serial data from the ECM to obtain vehicle speed, while the Instrument Panel Cluster (IPC), cruise control module and the chime alarm module use the 4000 ppm output.

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb–Ft	Lb–In
Accessory Mounting Bracket Bolts	35	26	–
Camshaft Postion Bolts	12	–	106
Crankshaft Position Sensor Retaining Bolt	10	–	89
Electronic Ignition System Ignition Coil Retaining Bolts	10	–	89
Engine Coolant Temperature Sensor	25	18	–
Evaporative Emission Canister Flange Bolt	20	15	–
Evaporative Emission Canister Protective Cover	8	–	71
Evaporative Emission Canister Purge Solenoid Bracket Bolts	5	–	44
Exhaust Gas Recirculation Valve Retaining Bolts	20	15	–
Fuel Cutoff Switch Bolts	3	–	27
Fuel Pressure Regulator Retaining Clamp	12	–	106
Fuel Rail Retaining Bolts	25	18	–
Fuel Tank Strap Retaining Nuts	13	–	115
Heated Oxygen Sensor	41	30	–
Idle Air Control Valve Retaining Bolts	3	–	27
Knock Sensor Bolt	20	15	–
Manifold Absolute Pressure Sensor Retaining Bolt	10	–	89
Oxygen Sensor	41	30	–
Rear A/C Compressor Mounting Bracket Bolts	35	26	–
Throttle Body Retaining Nuts	9	–	80
Throttle Cable Bracket Bolts	10	–	89
Throttle Position Sensor Retaining Bolts	2	–	18

FUEL SYSTEM SPECIFICATIONS

Gasoline

All engines are designed to use unleaded fuel only. Unleaded fuel must be used for proper emission control system operation. Its use will also minimize spark plug fouling and extend engine oil life. Using leaded fuel can damage the emission warranty coverage. The fuel should meet specification ASTM D4814 for the U.S. or CGSB 3.5 M93 for Canada. All engines are designed to use unleaded fuel with a minimum U(R+M)/2e (pump) octane number of 87, where R=research octane number, and M=motor octane number.

Ethanol

You may use fuel containing ethanol (ethyl alcohol) or grain alcohol providing that there is no more than 10 percent ethyl alcohol by volume.

Methanol

Do not use fuels containing methanol. Methanol can corrode metal parts and cause damage to plastic and rubber parts in the fuel system.

Methyl Tertiary–Butyl Ether (MTBE)

You may use fuel containing Methyl Tertiary–Butyl Ether (MTBE) providing there is no more than 15 percent MTBE by volume.

TEMPERATURE VS RESISTANCE

˚C	˚F	OHMS
Temperature vs Resistance Values (Approximate)		
100	212	177
90	194	241
80	176	332
70	158	467
60	140	667
50	122	973
45	113	1188
40	104	1459
35	95	1802
30	86	2238
25	77	2796
20	68	3520
15	59	4450
10	50	5670
5	41	7280
0	32	9420
–5	23	12300
–10	14	16180
–15	5	21450
–20	–4	28680
–30	–22	52700
–40	–40	100700