Fuel System (G4HD - GSL 1.1)

FUEL DELIVERY SYSTEM

GENERAL

SPECIFICATIONS EF8E4DAC

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	45 lit. (11.9 U.S.gal., 9.9 Imp.gal.)
Fuel Filter (built in Fuel Pump Assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump Assembly)	Regulated Fuel Pressure	343 kpa (3.5 kgf/cm2, 49.8 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor
Fuel Retrun System	Type	Returnless

INPUT SENSORS

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)

▷ Type : Piezo-resistive pressure sensor type
▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0kPa	0.79V
35.0kPa	1.38V
60.0kPa	2.37V
95.0kPa	3.75V
107.0kPa	4.22V

INTAKE AIR TEMPERATURE SENSOR (IATS)

▷ Type : Thermister type
▷ Specification

Temperature (℃)	Resistance (kΩ)
-40℃	40.93 ~ 48.35kΩ
-20℃	13.89 ~ 16.03kΩ
0℃	5.38 ~ 6.09kΩ
20℃	2.31 ~ 2.57kΩ
40℃	1.08 ~ 1.20kΩ
60℃	0.54 ~ 0.62kΩ
80℃	0.29 ~ 0.34kΩ

ENGINE COOLANT TEMPERATURE SERNSOR (ECTS)

▷ Type: Thermister type
▷ Specification

Temperature (℃)	Resistance (kΩ)
-40℃	48.14kΩ
-20℃	14.13 ~ 16.83kΩ
0℃	5.79kΩ
20℃	2.31 ~ 2.59kΩ
40℃	1.15kΩ
60℃	0.59kΩ
80℃	0.32kΩ

THROTTLE POSITION SENSOR (TPS)

▷ Type: Variable resistor type
▷ Specification

Throttle Angle	Output Voltage (V)
C.T	0.2 ~ 0.9V
W.O.T	Min. 4.0V

Items	Specification
Sensor Resistance (kΩ)	1.6 ~ 2.4 kΩ

HEATED OXYGEN SENSOR (HO2S)

▷ Type: Zirconia (ZrO2) Type
▷ Specification

A/F Ratio	Output Voltage (V)
Rich	0.6 ~ 1.0V
Lean	0 ~ 0.4V

Items	Specification
Heater Resistance (Ω)	Approximately 9.0Ω (20℃)

CAMSHAFT POSITION SENSOR (CMPS)

▷ Type: Hall effect type

CRANKSHAFT POSITION SENSOR (CKPS)

▷ Type: Hall effect type

KNOCK SENSOR (KS)

▷ Type: Piezo-electricity type
▷ Specification

Items	Specification
Capacitance (pF)	800 ~ 1,600pF

CHASSIS ACCERATION SENSOR (CAS)

▷ Type: Piezo-electricity type
▷ Specification

Acceleration (g)	Output Voltage (V)
-5g	0.26 ~ 1.74V
-3g	1.16 ~ 1.44V
-1g	2.05 ~ 2.15V
0g	2.5V
1g	2.85 ~ 2.95V
3g	3.56 ~ 3.84V
5g	4.26 ~ 4.74V

OUTPUT ACTUATORS

INJECTOR

▷ Number: 4
▷ Specification

Items	Specification
Coil Resistance (Ω)	13.8 ~ 15.2Ω (20℃)

IDLE SPEED CONTROL ACTUATOR (ISCA)

▷ Type: Double coil type
▷ Specification

Items	Specification
Closing Coil Resistance (Ω)	16.6 ~ 18.6Ω (20℃)
Opening Coil Resistance (Ω)	14.5 ~ 16.5Ω (20℃)

Duty (%)	Air Flow Rate (㎥/h)
5 ~ 21%	0.8 ~ 1.7 ㎥/h
30%	0.8 ~ 4.0 ㎥/h
40%	3.5 ~ 7.4 ㎥/h
60%	16.3 ~ 21.3 ㎥/h
90%	29.0 ~ 34.0 ㎥/h

PURGE CONTROL SOLENOID VALVE (PCSV)

▷ Specification

Items	Specification
Coil Resistance (Ω)	26.0Ω (20℃)

IGNITION COIL

▷ Type: Double ended type
▷ Specification

Items	Resistance
Primary Coil	0.87Ω±10% (20℃)
Secondary Coil	13.0kΩ±15% (20℃)

SERVICE STANDARD EDA8FCCD

Ignition Timing (After warm up, at idle)			About BTDC 3°
Basic Idle rpm(After warm up)	A/C ON	Neutral,N,P-range	900 ± 100 rpm
	A/C OFF	Neutral,N,P-range	850 ± 100 rpm

TIGHTENING TORQUES E5BBDBEB

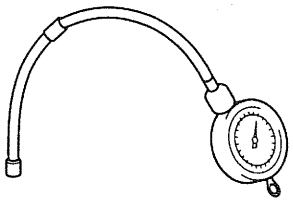
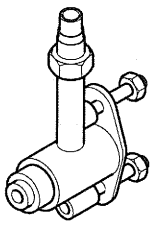
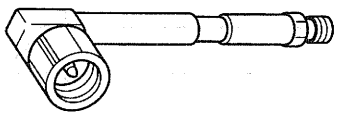
ENGINE CONTROL SYSTEM

Items	N·m	kgf·m	lbf·ft
ECM installation bolts (or bracket)	3.9 ~ 6.9	0.4 ~ 0.7	2.9 ~ 5.1
ECM bracket installation bolts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Heated oxygen sensor (Bank 1 / Sensor 1) installation	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / Sensor 2) installation	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Engine Coolant Temperature Sensor installation	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Throttle Position Sensor installation bolts	1.5 ~ 2.5	0.15 ~ 0.25	1.1 ~ 1.8
Manifold Absolute Pressure Sensor installation bolts	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Camshaft Position Sensor installation bolt	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Crankshaft Position Sensor target wheel installation screw	4.9 ~ 5.9	0.5 ~ 0.6	3.6 ~ 4.3
Crankshaft Position Sensor installation bolt	8.8 ~ 9.8	0.9 ~ 1.0	6.5 ~ 7.2
Knock sensor installation	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Throttle body installation bolts/nuts	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Oil pressure switch installation	14.7 ~ 21.6	1.5 ~ 2.2	10.9 ~ 15.9
Purge Control Solenoid Valve bracket installation bolt	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4

FUEL DELIVERY SYSTEM

Item	N·m	kgf·m	lbf·ft
Fuel tank installation bolts/nuts	39.2 ~ 54.0	4.0 ~ 5.5	28.9 ~ 39.8
Delivery pipe installation bolts	18.6 ~ 23.5	1.9 ~ 2.4	13.7 ~ 17.4
Fuel pump installation bolts	2.0 ~ 2.9	0.2 ~ 0.3	1.4 ~ 2.2

SPECIAL SERVICE TOOLS EF2CFCF6

Tool (Number and name)	Illustration	Application
09353-24100 Fuel Pressure Gauge	 EFDA003A	Measuring the fuel line pressure
09353-38000 Fuel Pressure Gauge Adapter	 BF1A025D	Connection between the delivery pipe and fuel feed line
09353-24000 Fuel Pressure Gauge Connector	 EFDA003C	Connection between Fuel Pressure Gauge (09353-24100) and Fuel Pressure Gauge Adapter (09353-38000)

BASIC TROUBLESHOOTING ECC4FDBB

BASIC TROUBLESHOOTING GUIDE

1	Bring Vehicle to Workshop

2	Analyze Customer's Problem
• Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).	

3	Verify Symptom, and then Check DTC and Freeze Frame Data
• Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC). • Record the DTC and freeze frame data. *NOTE* *To erase DTC and freeze frame data, refer to Step 5.*	

4	Confirm the Inspection Procedure for the System or Part
• Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.	

5	Erase the DTC and Freeze Frame Data
WARNING **NEVER erase DTC and freeze frame data before completing Step 2 MIL/DTC in "CUSTOMER PROBLEM ANALYSIS SHEET".**	

6	Inspect Vehicle Visually
• Go to Step 11, if you recognize the problem.	

7	Recreate (Simulate) Symptoms of the DTC
• Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer. • If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.	

8	Confirm Symptoms of Problem
• If DTC(s) is/are not displayed, go to Step 9. • If DTC(s) is/are displayed, go to Step 11.	

9	Recreate (Simulate) Symptom
• Try to recreate or simulate the condition of the malfunction as described by the customer.	

10	Check the DTC
• If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE. • If DTC(s) occur(s), go to Step 11.	

11	Perform troubleshooting procedure for DTC

12	Adjust or repair the vehicle

13	Confirmation test

14	END

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CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLE INFORMATION

(I) VIN:
(II) Production Date:
(III) Odometer Reading: (miles)

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other_____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High: _____ rpm, Low: _____rpm) ☐ Other _____
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other _____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other _____

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other _____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other _____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other _____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (____ min) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other _____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)	☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

BASIC INSPECTION PROCEDURE

MEASURING CONDITION OF ELECTRONIC PARTS' RESISTANCE

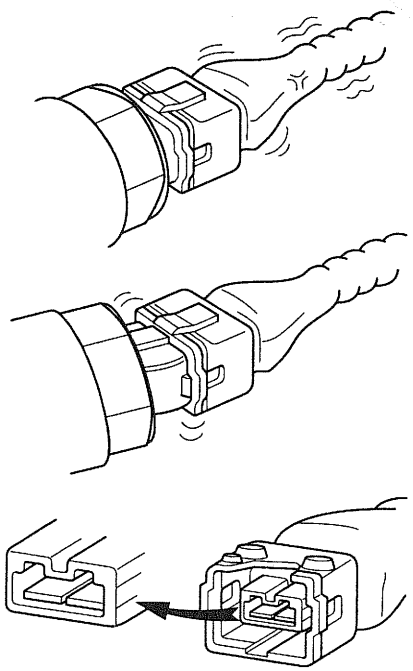
The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20℃, 68°F), unless there is any notice.

> *NOTE*
>
> *The measured resistance in except for ambient temperature (20℃, 68°F) is reference value.*

INTERMITTENT PROBLEM INSPECTION PROCEDURE

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "CUSTOMER PROBLEM ANALYSIS SHEET" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



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3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● SIMULATING VIBRATION

a. Sensors and Actuators
: Slightly vibrate sensors, actuators or relays with finger.

> **WARNING**
>
> **Strong vibration may break sensors, actuators or relays**

b. Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

● SIMULATING HEAT

a. Heat components suspected of causing the malfunction with a hair dryer or other heat sourre.

> **WARNING**
>
> - **DO NOT heat components to the point where they may be damaged.**
> - **DO NOT heat the ECM/ECM directly.**

● SIMULATING WATER SPRINKLING

a. Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

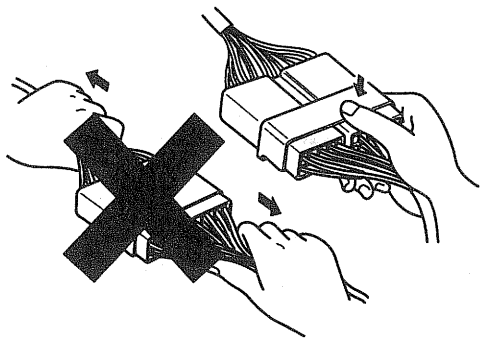
> **WARNING**
>
> **DO NOT sprinkle water directly into the engine compartment or electronic components.**

● SIMULATING ELECTRICAL LOAD

a. Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, etc.).

CONNECTOR INSPECTION PROCEDURE

1. Handling of Connector
   a. Never pull on the wiring harness when disconnecting connectors.



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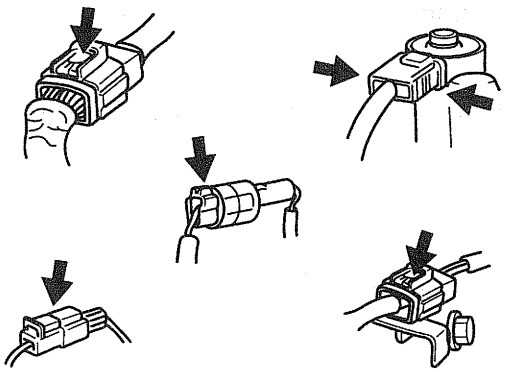
   b. When removing the connector with a lock, press or pull locking lever.



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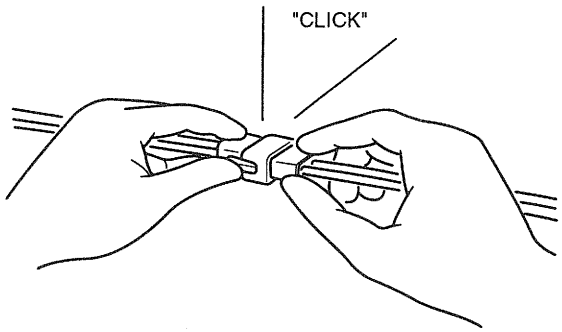
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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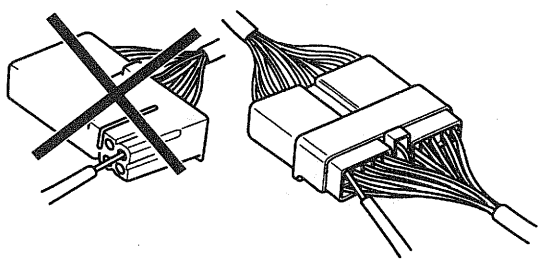
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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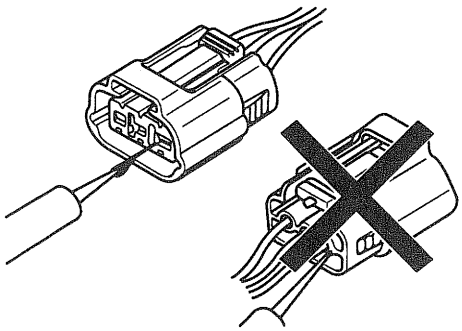
e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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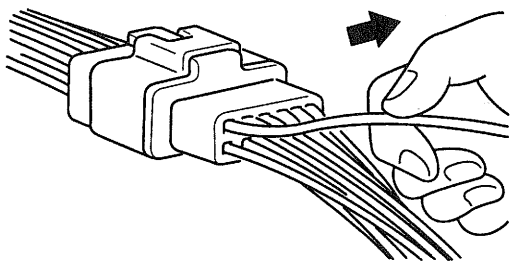
NOTE

- *Use a fine wire to prevent damage to the terminal.*
- *Do not damage the terminal when inserting the tester lead.*

2. Checking Point for Connector
   a. While the connector is connected:
      Hold the connector, check connecting condition and locking efficiency.
   b. When the connector is disconnected:
      Check for missing terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
      Visually check for rust, contamination, deformation and bend.
   c. Check terminal tightening condition:
      Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.
   d. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



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3. Repair Method of Connector Terminal
   a. Clean the contact points using air gun and/or shop rag.

NOTE

Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

   b. In case of abnormal contact pressure, replace the female terminal.

WIRE HARNESS INSPECTION PROCEDURE

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

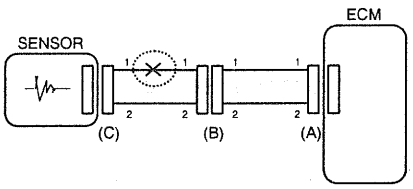
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● CHECK OPEN CIRCUIT

1. Procedures for Open Circuit
   - Continuity Check
   - Voltage Check

   If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



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2. Continuity Check Method

   NOTE

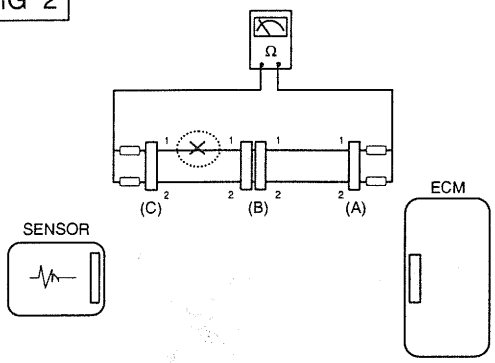
   When measuring for resistance, lightly shake the wire harness above and below or from side to side.

Specification (Resistance)
1Ω or less → Normal Circuit
1MΩ or Higher → Open Circuit

   a. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

      In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1MΩ and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2



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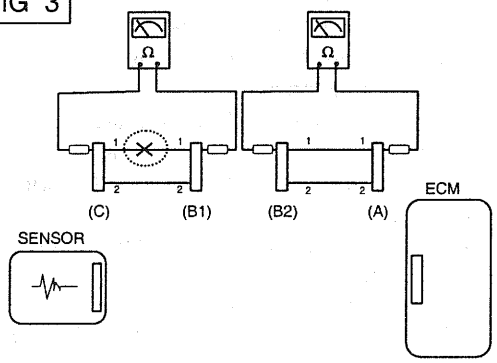
   b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

      In this case the measured resistance between connector (C) and (B1) is higher than 1MΩ and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 3



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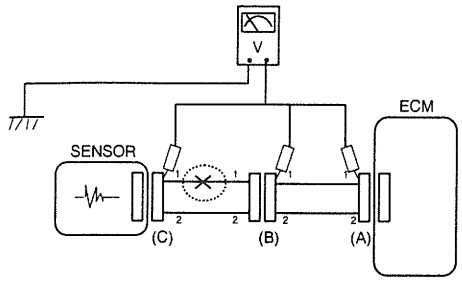
3. Voltage Check Method
   a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

      The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

FIG 4



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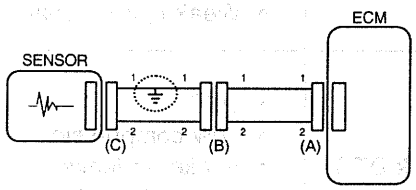
● CHECK SHORT CIRCUIT

1. Test Method for Short to Ground Circuit
   - Continuity Check with Chassis Ground

   If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing below Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



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2. Continuity Check Method (with Chassis Ground)

   NOTE

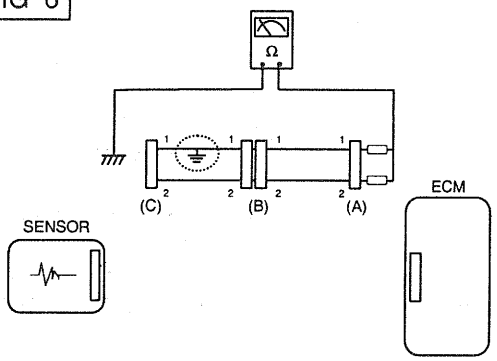
   Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

   a. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].

      The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.

FIG 6



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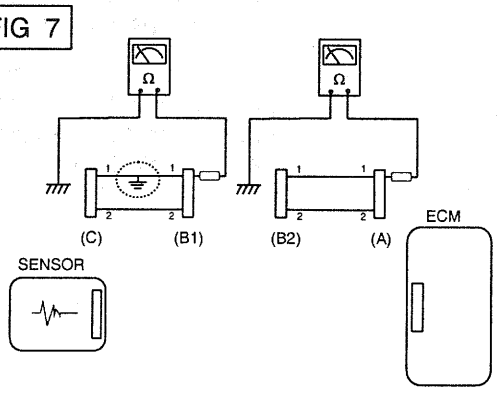
   b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

      The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FIG 7



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SYMPTOM TROUBLESHOOTING GUIDE CHART

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp ON)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Poor fuel economy	1. Check customer's driving habits • Is A/C on full time or the defroster mode on? • Are tires at correct pressure? • Is excessively heavy load being carried? • Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECT sensor and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe • Pinched, kinked or blocked? • Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

GASOLINE ENGINE CONTROL SYSTEM

DESCRIPTION EEF2C701

If the Gasoline Engine Control system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for various engine operating conditions will result. The following situations may be encountered.

1. Engine is hard to start or does not start at all.
2. Unstable idle.
3. Poor driveability

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.). Then, inspect the Gasoline Engine Control system components with the HI-SCAN (Pro).

NOTE

- *Before removing or installing any part, read the diagnostic trouble codes and then disconnect the battery negative (-) terminal.*
- *Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operation or while the ignition switch is ON could cause damage to the ECM.*
- *The control harnesses between the ECM and heated oxygen sensor are shielded with the shielded ground wires to the body in order to prevent the influence of ignition noises and radio interference. When the shielded wire is faulty, the control harness must be replaced.*
- *When checking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.*
- *When charging the battery with the external charger, disconnect the vehicle side battery terminals to prevent damage to the ECM.*

MALFUNCTION INDICATOR LAMP (MIL)

[EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL.

- Catalyst
- Fuel system
- Mass Air Flow Sensor (MAFS)
- Intake Air Temperature Sensor (IATS)
- Engine Coolant Temperature Sensor (ECTS)
- Throttle Position Sensor (TPS)
- Upstream Oxygen Sensor
- Upstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Injector
- Misfire
- Crankshaft Position Sensor (CKPS)
- Camshaft Position Sensor (CMPS)
- Evaporative Emission Control System
- Vehicle Speed Sensor (VSS)
- Idle Speed Control Actuator (ISCA)
- Power Supply
- ECM
- MT/AT Encoding
- Acceleration Sensor
- MIL-on Request Signal
- Power Stage

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

[NON-EOBD]

A malfunction indicator lamp illuminates to notify the driver that there is a problem with the vehicle. However, the MIL will go off automatically after 3 subsequent sequential driving cycles without the same malfunction. Immediately after the ignition switch is turned on (ON position - do not start), the MIL will illuminate continuously to indicate that the MIL operates normally.

Faults with the following items will illuminate the MIL

- Heated oxygen sensor (HO2S)
- Mass Air Flow sensor (MAFS)
- Throttle position sensor (TPS)
- Engine coolant temperature sensor (ECTS)
- Idle speed control actuator (ISCA)
- Injectors
- ECM

NOTE

Refer to "INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC)" for more information.

[INSPECTION]

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.

2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

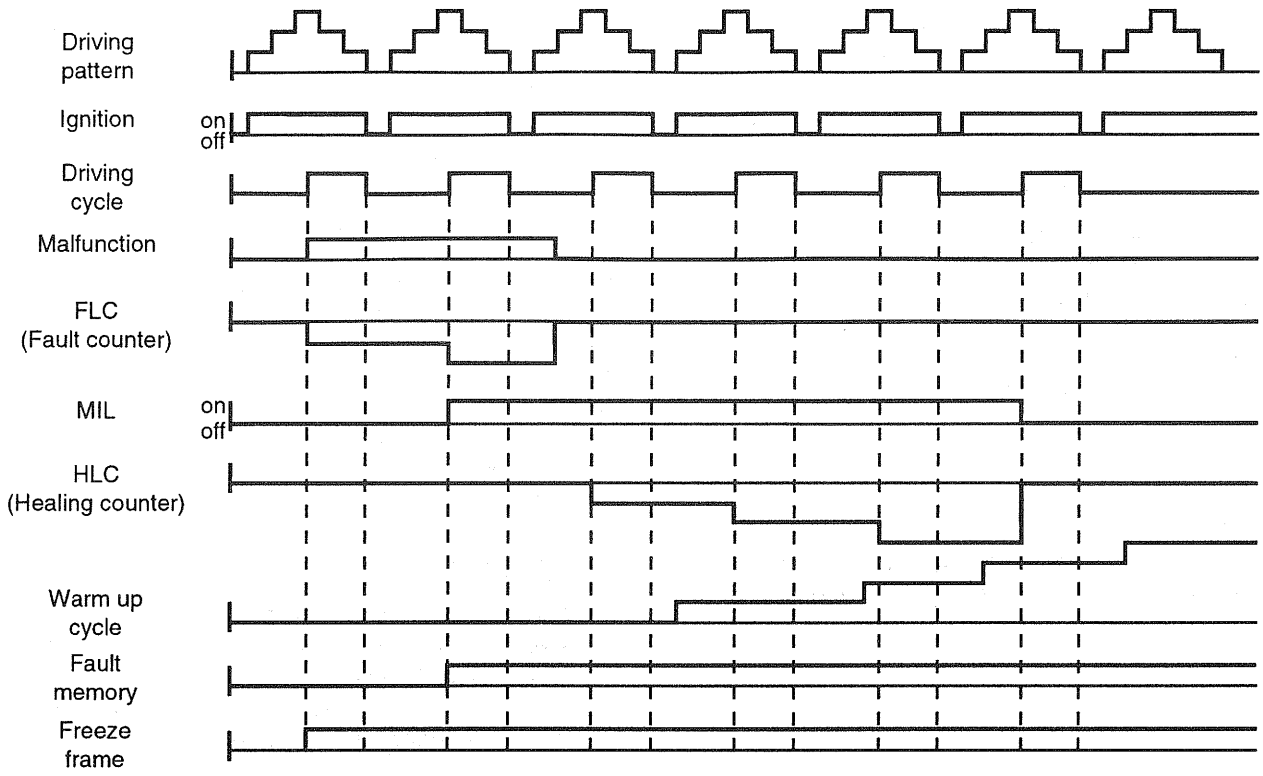
SELF-DIAGNOSIS

The ECM monitors the input/output signals (some signals at all times and the others under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or HI-SCAN (Pro). Diagnostic Trouble Codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or ECM connector is disconnected, or by the HI-SCAN (Pro).

NOTE

If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

THE RELATION BETWEEN DTC AND DRIVING PATTERN IN EOBD SYSTEM



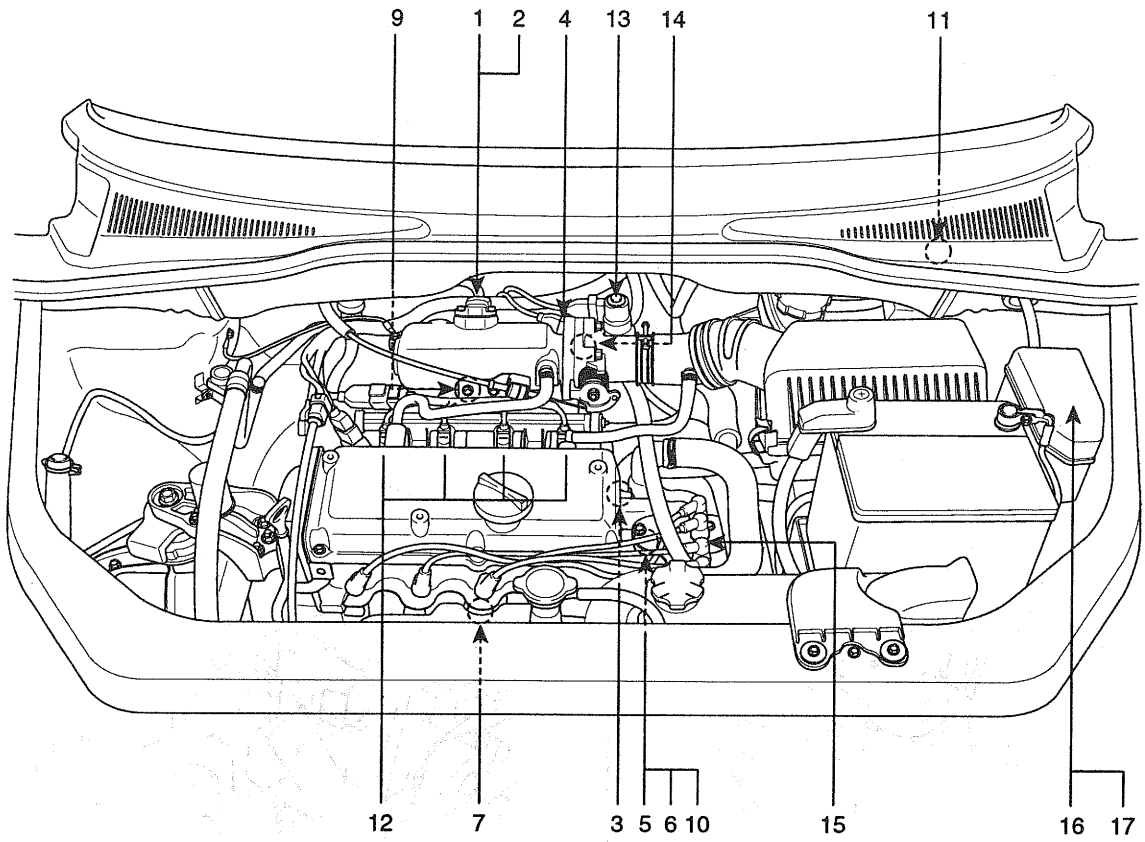
LGIF601Q

1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
   If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.
4. A Diagnostic Trouble Code(DTC) will automatically erase from ECM memory if the same malfunction is not detected for 40 driving cycles.

NOTE

- *A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degress Fahrenheit.*
- *A "driving cycle" consists of engine startup, vehicle operation beyond the beginning of closed loop operation.*

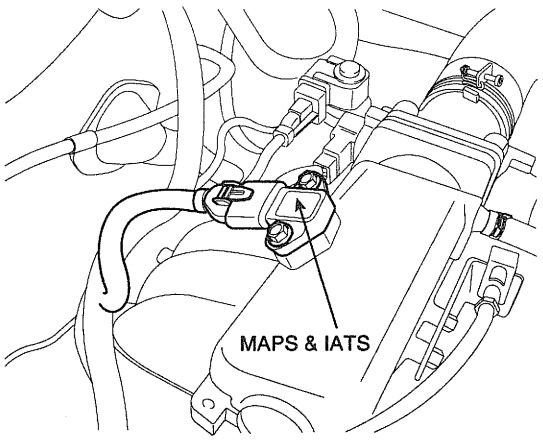
COMPONENTS E529D590



1. Manofild Absolute Pressure Sensor (MAPS)
2. Intake Air Temperature Sensor (IATS)
3. Engine Coolant Temperature Sensor (ECTS)
4. Throttle Position Sensor (TPS)
5. Camshaft Position Sensor (CMPS)
6. Crankshaft Position Sensor (CKPS)
7. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
8. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
9. Knock Sensor (KS)
10. Vehicle Speed Sensor (VSS)
11. Chassis Acceleration Sensor (CAS)
12. Injector
13. Idle Speed Control Actuator (ISCA)
14. Purge Control Solenoid Valve (PCSV)
15. Ignition Coil
16. Main Relay
17. Fuel Pump Relay
18. Data Link Connector (DLC)

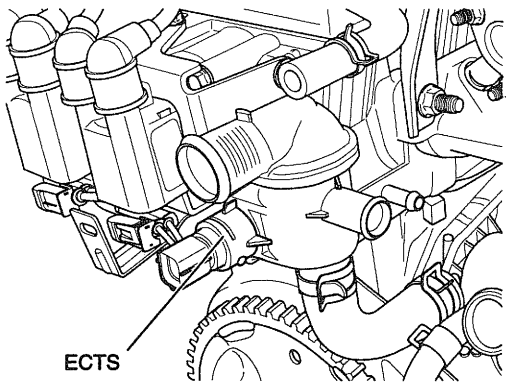
EGPF400A

1. Manifold Absolute Pressure Sensor (MAPS)
2. Intake Air Temperature Sensor (IATS)



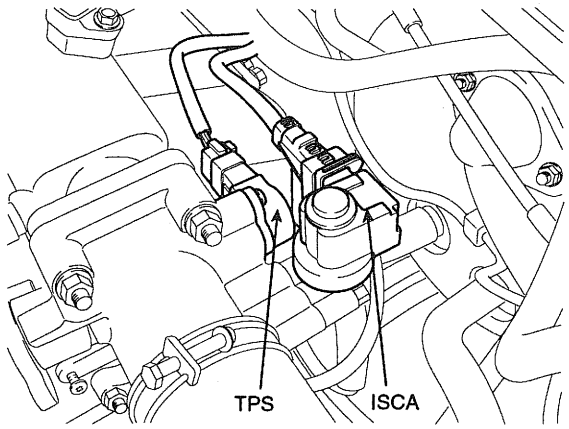
EGPF401A

3. Engine Coolant Temperature Sensor (ECTS)



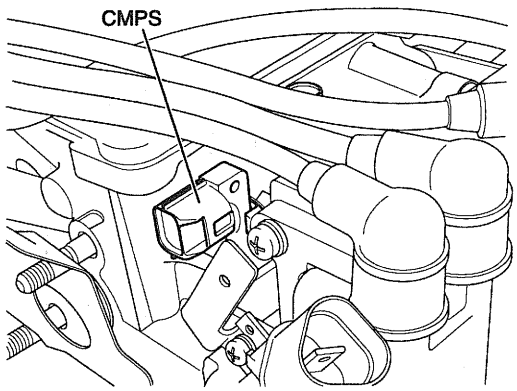
LFHE101B

4. Throttle Position Sensor (TPS)
13. Idle Speed Control Actuator (ISCA)



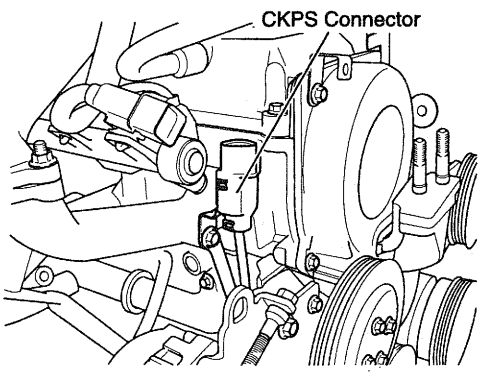
EGPF402A

5. Camshaft Position Sensor (CMPS)



LFHE101D

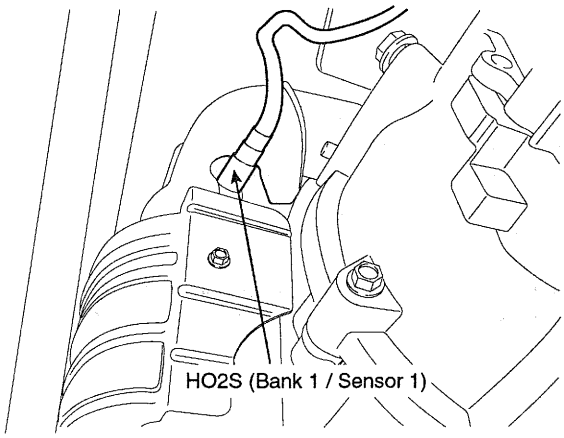
6. Crankshaft Position Sensor (CKPS)



* CKPS is on transaxle housing

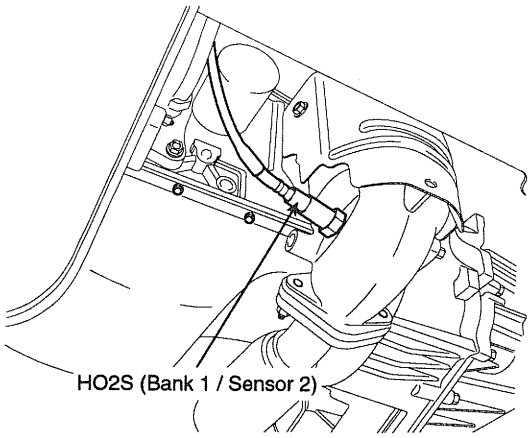
LFHE101E

7. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]



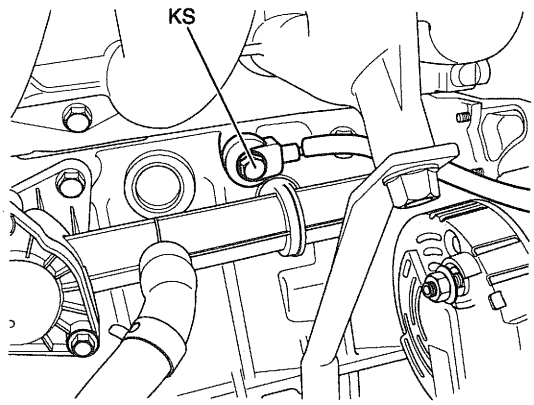
EGPF403A

8. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]



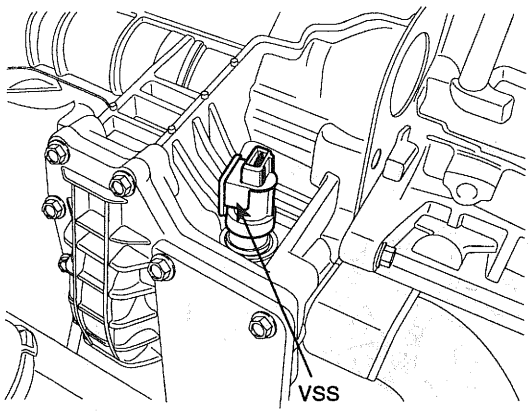
EGPF404A

9. Knock Sensor (KS)



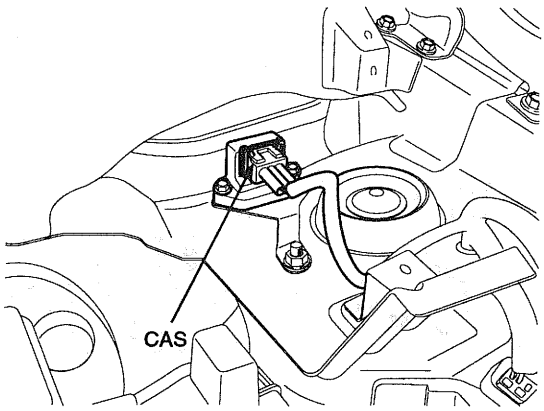
LFHE101J

10. Vehicle Speed Sensor (VSS)



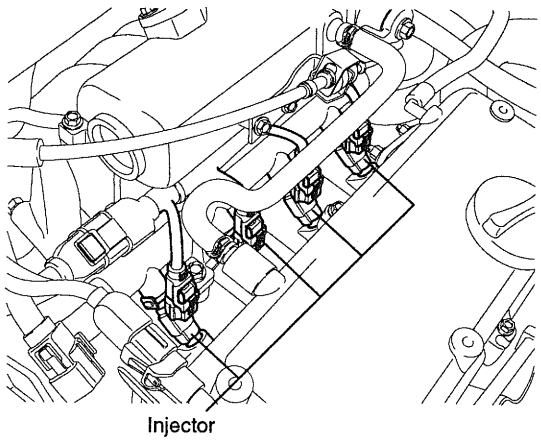
KFPF204A

11. Chassis Acceleration Sensor (CAS)



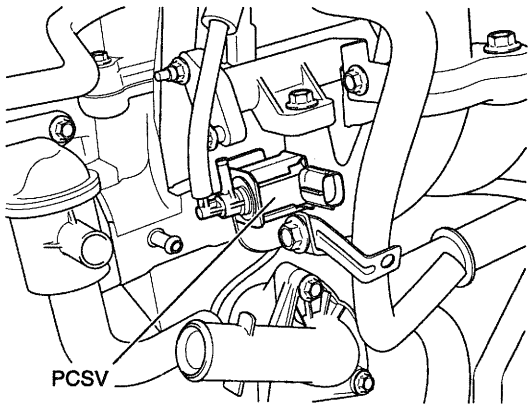
KFPF205A

12. Injector



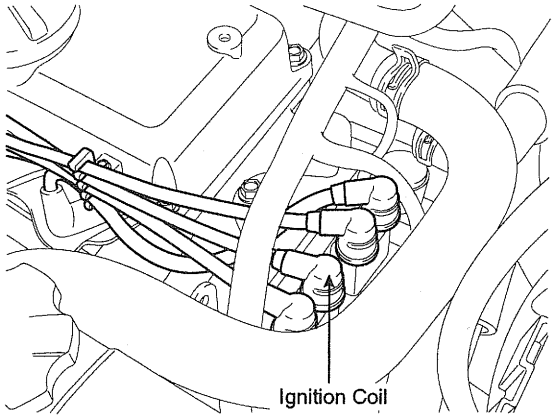
EGPF405A

14. Purge Control Solenoid Valve (PCSV)



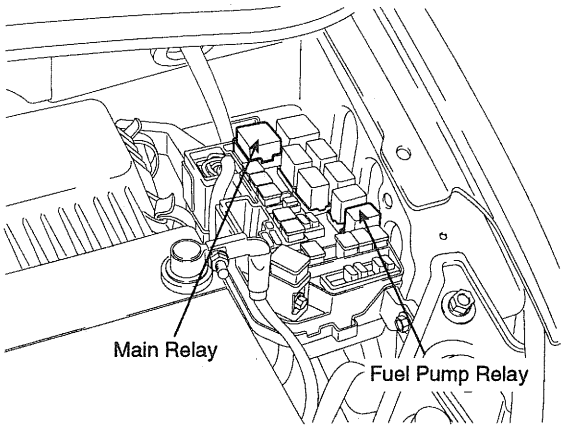
LFHE101L

15. Ignition Coil



EGPF406A

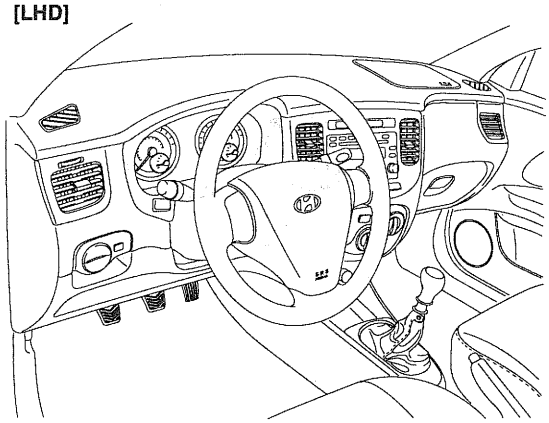
16. Main Relay
17. Fuel Pump Realy



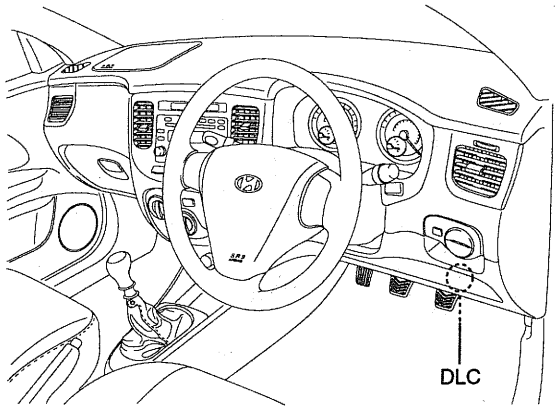
EGPF407A

18. Data Link Connector (DLC : 16 pin)

[LHD]



[RHD]

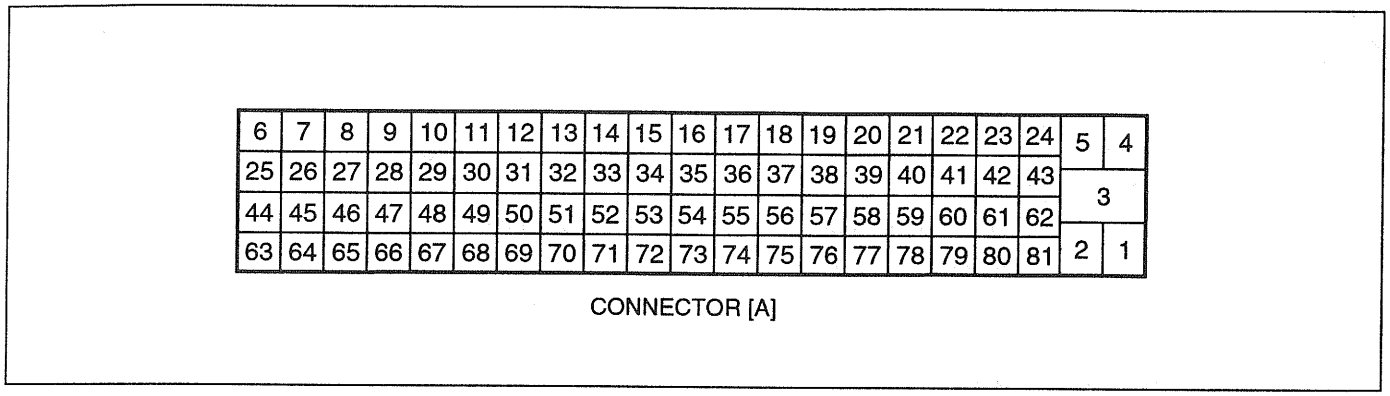


EFPF701Y

ENGINE CONTROL MODULE (ECM)

ECM (ENGINE CONTROL MODULE) E764C622

1. ECM HARNESS CONNECTOR



EFPF210A

2. ECM TERMINAL FUNCTION

CONNECTOR [A]

Pin	Description	Connected to	Remark
1	-		
2	Ignition Coil (Cylinder #2,3) control output	Ignition Coil (Cylinder #2,3)	
3	Ground	Chassis Ground	
4	-		
5	Ignition Coil (Cylinder #1,4) control output	Ignition Coil (Cylinder #1,4)	
6	Injector (Cylinder #2) control output	Injector (Cylinder #2)	
7	Injector (Cylinder #3) control output	Injector (Cylinder #3)	
8	Engine speed signal output	Tachometer (Cluster)	
9	Throttle Position Senosr (TPS) PWM signal output	Transaxle Control Module (TCM)	
10	-		
11	Fuel consumption signal output	Trip computer	
12	Battery power	Battery	
13	Ignition switch signal input	Ignition switch	
14	Main Relay control output	Main Relay	
15	Crankshaft Position Sensor (CKPS) signal input	Crankshaft Position Sensor (CKPS)	
16	Throttle Position Senosr (TPS) signal input	Throttle Position Senosr (TPS)	
17	Sensor ground	TPS, CAS,APT	EURO-III/IV
		TPS, APT	Except for EURO-III/IV
18	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	Except for LEADED

Pin	Description	Connected to	Remark
19	Knock Sensor signal input	Knock Sensor	
20	Sensor ground	Knock Sensor	
21	-		
22	-		
23	-		
24	-		
25	-		
26	Idle Speed Control Actuator (ISCA) [CLOSE] control output	Idle Speed Control Actuator (ISCA)	
27	Injector (Cylinder #1) control output	Injector (Cylinder #1)	
28	HO2S [Bank 1 / Sensor 2] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	EURO-III/IV
29	Idle Speed Control Actuator (ISCA) [OPEN] control output	Idle Speed Control Actuator (ISCA)	
30	-		
31	Malfunction Indicator Lamp (MIL) control output	Malfunction Indicator Lamp (Cluster)	
32	Reference supply (+5V)	TPS, CAS,APT	EURO-III/IV
		TPS, APT	Except for EURO-III/IV
33	Reference supply (+5V)	MAPS & IATS	
34	-		
35	Sensor ground	ECTS, HO2S [B1/S2]	EURO-III/IV
		ECTS	Except for EURO-III/IV
36	Sensor ground	MAPS & IATS, HO2S [B1/S1]	Except for LEADED
		MAPS & IATS	LEADED
37	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)	
38	-		
39	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)	
40	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)	
41	-		
42	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)	
43	Electrical Load signal input (Head Lamp)	Heated Lamp	Active: Low
44	Batter voltage supply after main relay	Main Relay	
45	Batter voltage supply after main relay	Main Relay	
46	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)	

Pin	Description	Connected to	Remark
47	Injector (Cylinder #4) control output	Injector (Cylinder #4)	
48	HO2S [Bank 1 / Sensor 1] heater control output	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]	Except for LEADED
49	Immobilizer Lamp control output	Immobilizer Lamp (Cluster)	
50	Cooling Fan [High] control output	Condensor Fan Relay	
51	Ground	Chassis Ground	
52	Immobilizer Communication Line	Immobilizer Control Module	
53	Ground	Chassis Ground	
54	-		
55	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]	EURO-III/IV
56	-		
57	A/C Pressure Switch signal input	A/C Control Module	
58	-		
59	Vehicle speed signal input	Vehicle Speed Sensor (VSS)	
60	Chassis Acceleration Sensor (CAS) signal input	Chassis Acceleration Sensor (CAS)	
61	Ground	Immobilizer Control Module	
62	-		
63	Batter voltage supply after main relay	Main Relay	
64	-		
65	-		
66	-		
67	-		
68	Cooling Fan [Low] control output	Radiator Fan Relay	
69	A/C Compressor Relay control output	A/C Compressor Relay	
70	Fuel Pump Relay control output	Fuel Pump Relay	
71	Diagnostic Data Line (K-Line)	Data Link Connector (DLC), Multi-purpose Check Connector	
72	-		
73	-		
74	-		
75	A/C switch signal input	A/C Control Module	
76	Electrical Load signal input (Defogger)	Defogger	Active: High
77	Electrical Load signal input (Power Steering)	Power Steering Switch, EPS Control Module	Active: Low
78	-		
79	Camshaft Position Sensor (CMPS) signal input	Camshaft Position Sensor (CMPS)	
80	Ground	Chassis Ground	
81	-		

ECM PROBLEM INSPECTION PROCEDURE EADADAF8

1. TEST ECM GROUND CIRCUIT: Measure resistance between ECM and chassis ground using the backside of ECM harness connector as ECM side check point. If the problem is found, repair it.

Specification (Resistance): 1Ω or less

2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminal on ECM side and harness side for bent pins or poor contact pressure, If the problem is found, repair it.

3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle agaon. If the vehicle operates normally then the problem was likely with the ECM.

4. RE-TEST THE ORIGINAL ECM: Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem dose not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

DTC TROUBLESHOOTING PROCEDURES

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC) E80D266D

DTC	Description	MIL			Page
		EURO -III/IV	EURO -II	LEADED	
P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	●	▲		FL - 30
P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	●	▲		FL - 36
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	●			FL - 39
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	●			FL - 45
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	●			FL - 48
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	●			FL - 51
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	●	●	FL - 56
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	●	●	FL - 60
P0112	Intake Air Temperature Sensor1 Circuit Low Input	●	▲	▲	FL - 64
P0113	Intake Air Temperature Sensor1 Circuit High Input	●	▲	▲	FL - 69
P0116	Engine Coolant Temperature Circuit Range/Performance	●			FL - 73
P0117	Engine Coolant Temperature Circuit Low Input	●	●	●	FL - 78
P0118	Engine Coolant Temperature Circuit High Input	●	●	●	FL - 81
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	▲			FL - 85
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	●	●	FL - 90
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	●	●	FL - 94
P0124	Throttle/Pedal Position Sensor/Switch "A" Circuit Intermittant	▲			FL - 99
P0130	HO2S Circuit (Bank 1/ Sensor 1)	●	▲		FL - 103
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	▲		FL - 110
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	▲		FL - 114
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●	▲		FL - 118
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	▲		FL - 123
P0135	HO2S Heater Circuit (Bank 1 / Sensor 1)	●	▲		FL - 127
P0136	HO2S Circuit (Bank 1/ Sensor 2)	●			FL - 131
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●			FL - 137

DTC	Description	MIL			Page
		EURO -III/IV	EURO -II	LEADED	
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●			FL - 140
P0139	HO2S Circuit Slow Response (Bank 1 / Sensor 2)	●			FL - 143
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●			FL - 148
P0141	HO2S Heater Circuit (Bank 1 / Sensor 2)	●			FL - 151
P0171	System Too Lean (Bank 1)	●	▲		FL - 155
P0172	System Too Rich (Bank 1)	●	▲		FL - 160
P0230	Fuel Pump Primary Circuit	▲	▲	▲	FL - 164
P0261	Cylinder 1-Injector Circuit Low	●	●	●	FL - 169
P0262	Cylinder 1-Injector Circuit High	●	●	●	FL - 174
P0264	Cylinder 2-Injector Circuit Low	●	●	●	FL - 169
P0265	Cylinder 2-Injector Circuit High	●	●	●	FL - 174
P0267	Cylinder 3-Injector Circuit Low	●	●	●	FL - 169
P0268	Cylinder 3-Injector Circuit High	●	●	●	FL - 174
P0270	Cylinder 4-Injector Circuit Low	●	●	●	FL - 169
P0271	Cylinder 4-Injector Circuit High	●	●	●	FL - 174
P0300	Random/Multiple Cylinder Misfire Detected	●			FL - 177
P0301	Cylinder 1-Misfire detected	●			FL - 177
P0302	Cylinder 2-Misfire detected	●			FL - 177
P0303	Cylinder 3-Misfire detected	●			FL - 177
P0304	Cylinder 4-Misfire detected	●			FL - 177
P0325	Knock Sensor 1 Circuit	▲	▲	▲	FL - 187
P0335	Crankshaft Position Sensor A Circuit	●	▲	▲	FL - 192
P0336	Crankshaft Position Sensor A Circuit Range/Performance	●	▲	▲	FL - 198
P0340	Camshaft Position Sensor A Circuit Malfunction (Bank 1 or Single Sensor)	●	▲	▲	FL - 201
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●			FL - 207
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●			FL - 210
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●			FL - 215
P0501	Vehicle Speed Sensor A Range/Performance	●	▲	▲	FL - 218
P0506	Idle Air Control System-RPM lower than expected	●	▲	▲	FL - 224
P0507	Idle Air Control System-RPM higher than expected	●	▲	▲	FL - 229
P0562	System Voltage Low	●	▲	▲	FL - 233
P0563	System Voltage High	●	▲	▲	FL - 239

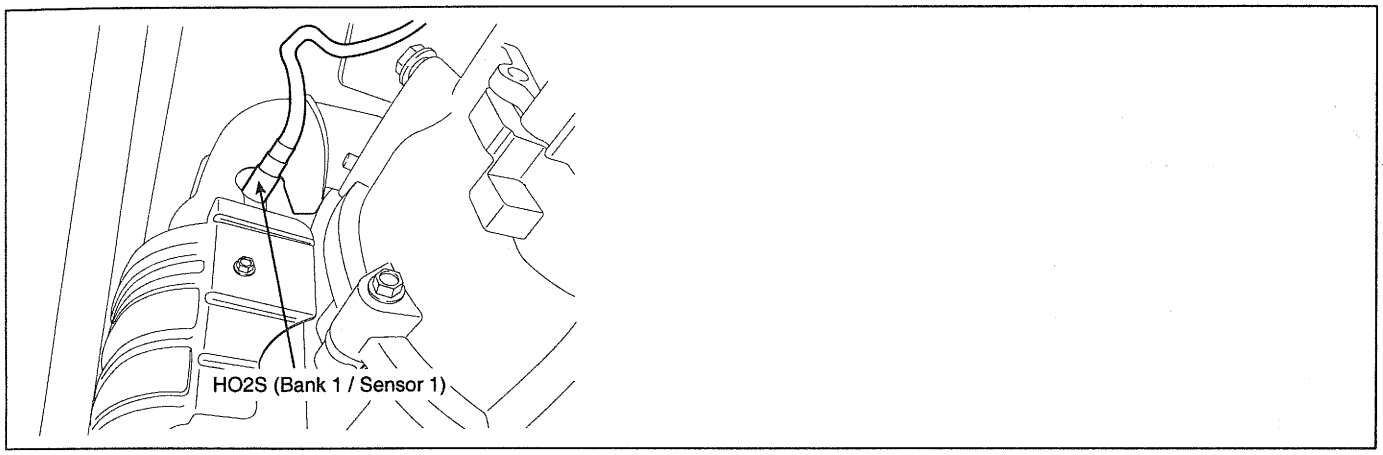
DTC	Description	MIL			Page
		EURO -III/IV	EURO -II	LEADED	
P0605	Internal Control Module Read Only Memory(ROM) Error	●	▲	▲	FL - 243
P1307	Acceleration Sensor Range/Performance	●			FL - 245
P1308	Acceleration Sensor Circuit Low Input	●			FL - 249
P1309	Acceleration Sensor Circuit High Input	●			FL - 251
P1505	Idle Charge Actuator Signal Low of Coil #1	●	●	●	FL - 254
P1506	Idle Charge Actuator Signal High of Coil #1	●	●	●	FL - 260
P1507	Idle Charge Actuator Signal Low of Coil #2	●	●	●	FL - 263
P1508	Idle Charge Actuator Signal High of Coil #2	●	●	●	FL - 267
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	●			FL - 270
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	●			FL - 276
P2232	HO2S Signal Circuit Shorted to Heater Circuit (Bank 1 / Sensor 2)	●			FL - 280

NOTE

● : *MIL ON & MEMORY*
▲ : *MIL OFF & MEMORY*

DTC P0031 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 1)

COMPONENT LOCATION E648A7AE



EFPG800A

GENERAL DESCRIPTION EE30DE16

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DESCRIPTION E6CA5D75

When ECM detects open or short to ground in the heater control circuit(B1S1), ECM sets DTC P0031.

DTC DETECTING CONDITION E8DDEB53

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check voltage	• Poor connection • Open or short to ground in power circuit • Open or short to ground in control circuit • B1S1 • ECM
Enable Conditions		
Threshold Value	• Open or short to ground	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

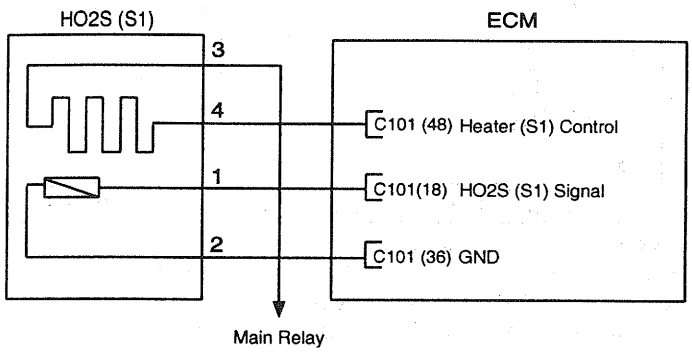
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E96B295D

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

SCHEMATIC DIAGRAM E2D40118

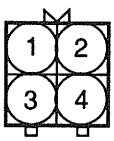
[CIRCUIT DIAGRAM]



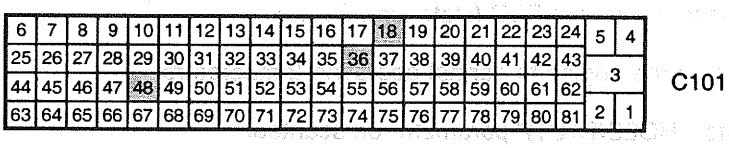
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (18)	HO2S (S1) Signal
2	ECM C101 (36)	Sensor Ground
3	Main Relay	Battery Voltage (B+)
4	ECM C101 (48)	Heater (S1) Control

[HARNESS CONNECTOR]



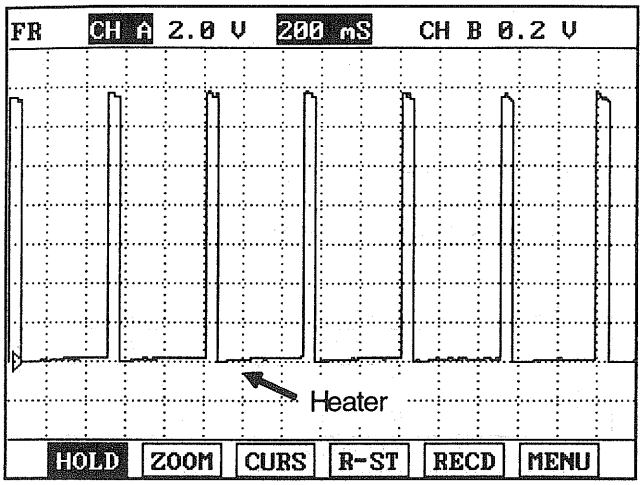
HO2S [S1] (C117)

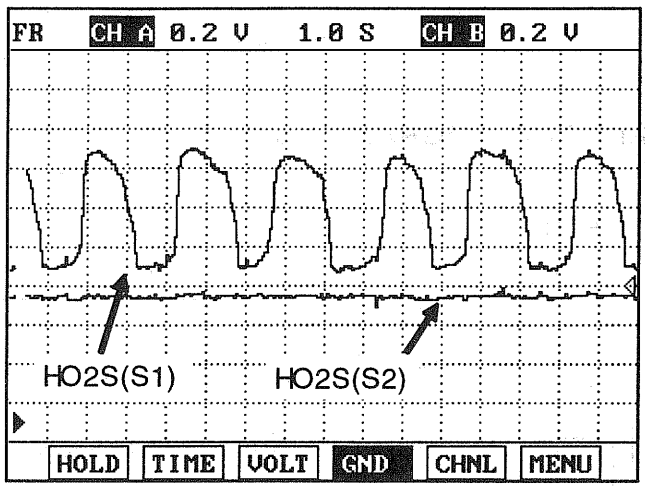


ECM

EFPG500A

SIGNAL WAVEFORM & DATA E9781070



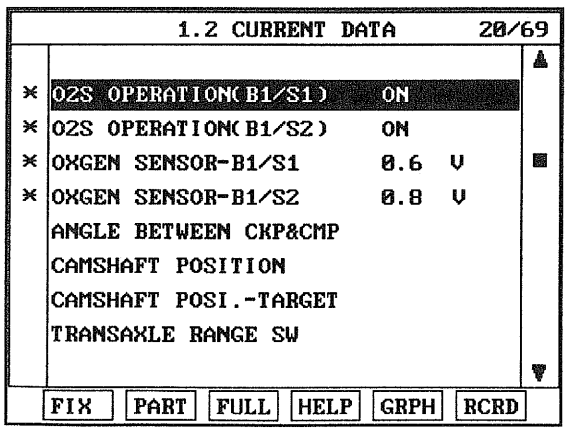


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

LFJF318A

MONITOR SCANTOOL DATA E74E8CF1

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool.



EGPF500B

4. Is the "HO2S(B1S1)" parameter operating correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E65D81B7

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E4B751D2

1. IG "OFF".
2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S1) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E40D0FA8

1. IG "OFF".
2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S1) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E21E3D44

1. Check resistance.

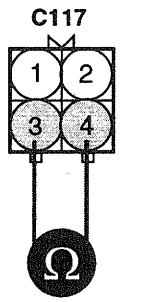
   1) IG "OFF".

   2) Disconnect HO2S(S1) connector.

   3) Measure resistance between terminal 3 and 4 of HO2S(S1)(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)



1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF001C

   4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good HO2S(S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECB43E70

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0032 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 1)

COMPONENT LOCATION E9303D56

Refer to DTC P0031.

GENERAL DESCRIPTION E17AF184

Refer to DTC P0031.

DTC DESCRIPTION E585D703

When ECM detects short to power in the heater control circuit(B1S1), ECM sets DTC P0032.

DTC DETECTING CONDITION E8012D8E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check voltage	• Poor connection • Short to battery in control circuit • B1S1 • ECM
Enable Conditions		
Threshold Value	• Short to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E0A55EEA

Refer to DTC P0031.

SCHEMATIC DIAGRAM E4CFE273

Refer to DTC P0031.

SIGNAL WAVEFORM & DATA E5855477

Refer to DTC P0031.

MONITOR SCANTOOL DATA ED3D938F

Refer to DTC P0031.

TERMINAL AND CONNECTOR INSPECTION EFF5727A

Refer to DTC P0031.

POWER CIRCUIT INSPECTION E477C9C4

1. IG "OFF".
2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S1) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION EA2B1928

1. IG "OFF".
2. Disconnect HO2S(S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S1) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

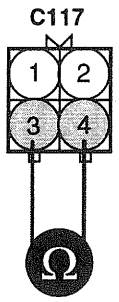
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E3190EA9

1. Check resistance.
   1) IG "OFF".
   2) Disconnect HO2S(S1) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S1)(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)



1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF001C

4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

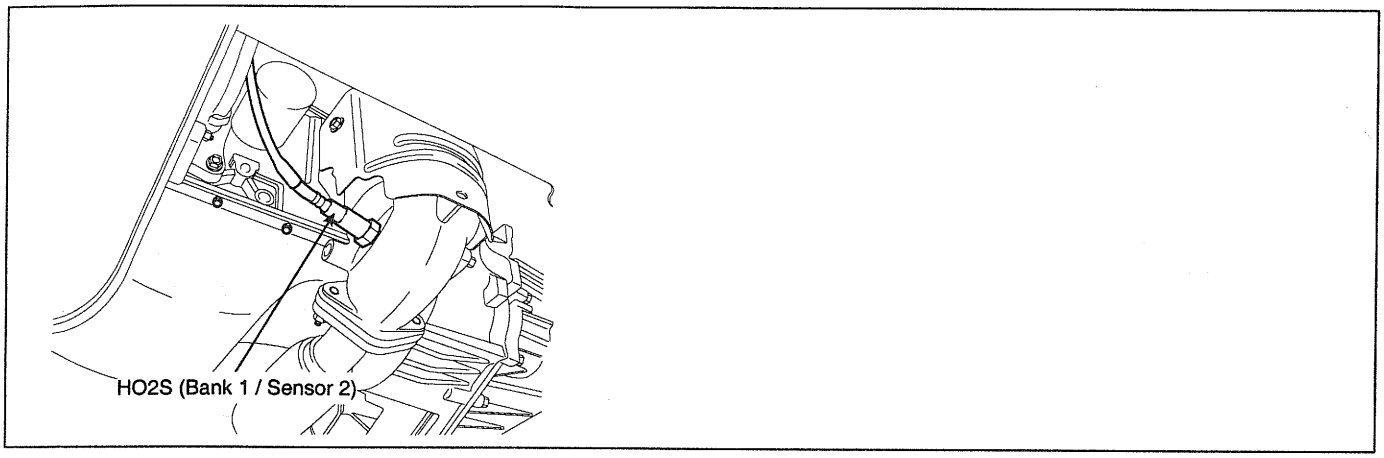
- ▶ Substitute with a known - good HO2S(S1) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECCE8E27

Refer to DTC P0031.

DTC P0036 HO2S HEATER CONTROL CIRCUIT (BANK 1 / SENSOR 2)

COMPONENT LOCATION E4C01BF9



EFPG800B

GENERAL DESCRIPTION EC495C79

In order to control emissions of the CO, HC and NOx components of the exhaust gas, heated oxygen sensor (HO2S), mounted on the front side and rear side of catalytic converter, detects the oxygen content in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation.
The HO2S requires a minimum temperature to operate properly and provide a closed loop fuel control system. The HO2S contains the heater element to reduce its warming-up time and ensure its performance during all driving conditions.The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

DTC DESCRIPTION E15319E1

When ECM detects the open in the heater control circuit(B1S2), ECM sets DTC P0036.

DTC DETECTING CONDITION E2C0429C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check voltage	• Poor connection • Open in control circuit • B1S2 • ECM
Enable Conditions		
Threshold Value	• Open in control circuit	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

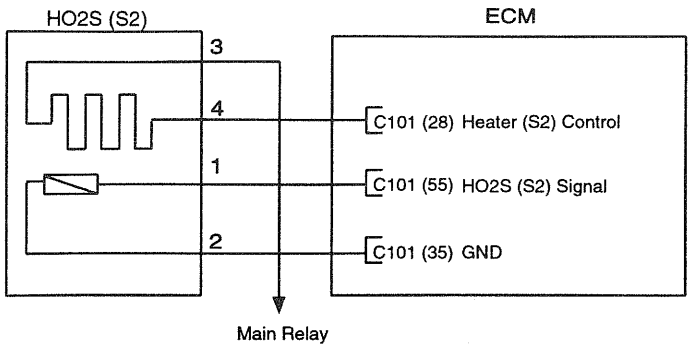
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E24D4675

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)

SCHEMATIC DIAGRAM ED7215C4

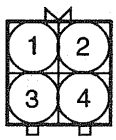
[CIRCUIT DIAGRAM]



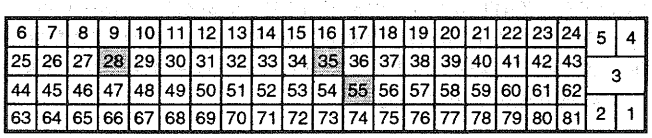
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (55)	HO2S (S2) Signal
2	ECM C101 (35)	Sensor Ground
3	Main Relay	Battery Voltage (B+)
4	ECM C101 (28)	Heater (S2) Control

[HARNESS CONNECTOR]



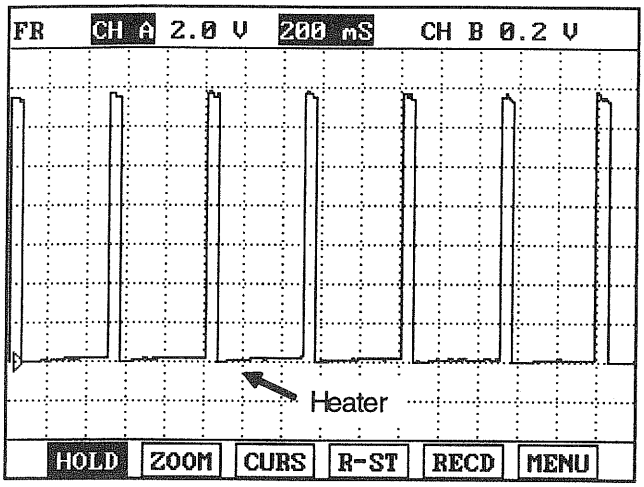
HO2S [S2] (C116)

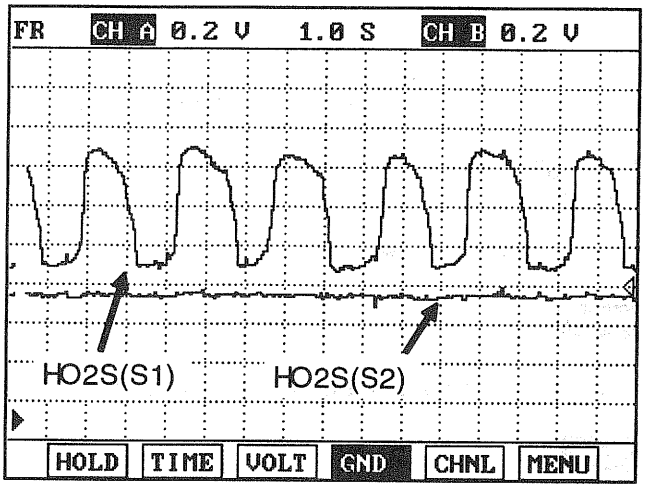


ECM

EGPF500C

SIGNAL WAVEFORM & DATA E36D0E92



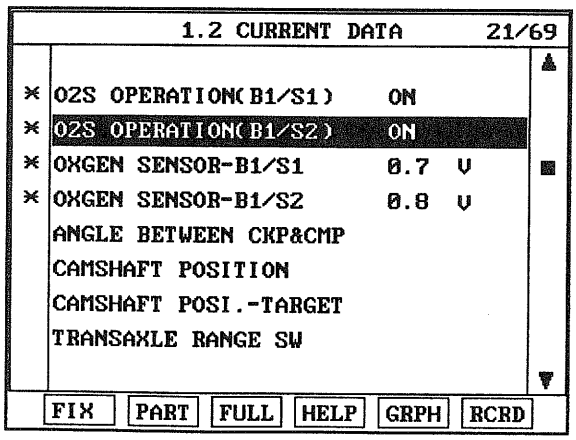


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

LFJF318A

MONITOR SCANTOOL DATA E635098A

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool.



EGPF500D

4. Is the "HO2S Heater(B1/S2)" data displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E9C10B2F

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EAB726B9

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E71D3E6A

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION EE4F0A1A

1. Check resistance.

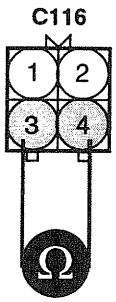
   1) IG "OFF".

   2) Disconnect HO2S(S2) connector.

   3) Measure resistance between terminal 3 and 4 of HO2S(S2) (Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)



1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF001F

   4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good HO2S(S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBA40EE9

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.

2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0037 HO2S HEATER CIRCUIT LOW (BANK 1 / SENSOR 2)

COMPONENT LOCATION E38EF0AB

Refer to DTC P0036.

GENERAL DESCRIPTION E25FB3CD

Refer to DTC P0036.

DTC DESCRIPTION E4153308

When ECM detects short to ground in the heater control circuit(B1S2), ECM sets DTC P0037.

DTC DETECTING CONDITION E4385FA4

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check voltage	• Poor connection • Open or short to ground in power circuit • Short to ground in control circuit • B1S2 • ECM
Enable Conditions		
Threshold Value	• Short to ground	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EFE408A7

Refer to DTC P0036.

SCHEMATIC DIAGRAM E52AF195

Refer to DTC P0036.

SIGNAL WAVEFORM & DATA E96E09D6

Refer to DTC P0036.

MONITOR SCANTOOL DATA E90C17F3

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E419FD5A

Refer to DTC P0036.

POWER CIRCUIT INSPECTION E0BF56FD

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION E9FEFE0E

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

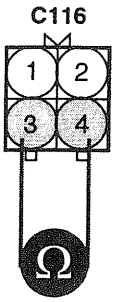
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION EA064144

1. Check resistance (S2).
   1) IG "OFF".
   2) Disconnect HO2S(S2) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S2) (Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)



1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF001F

4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good HO2S(S2) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE8BA139

Refer to DTC P0036.

DTC P0038 HO2S HEATER CIRCUIT HIGH (BANK 1 / SENSOR 2)

COMPONENT LOCATION EA97379E

Refer to DTC P0036.

GENERAL DESCRIPTION ED5AA61D

Refer to DTC P0036.

DTC DESCRIPTION E90A0832

When ECM detects short to power in the heater control circuit, ECM sets DTC P0038.

DTC DETECTING CONDITION E7548F6F

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check voltage	• Poor connection • Short to power in control circuit • B1S2 • ECM
Enable Conditions		
Threshold Value	• Short to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E37B3B47

Refer to DTC P0036.

SCHEMATIC DIAGRAM EFF9BE1B

Refer to DTC P0036.

SIGNAL WAVEFORM & DATA EDB3AAD5

Refer to DTC P0036.

MONITOR SCANTOOL DATA E7D49CBF

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E7A520D6

1. Refer to DTC P0036.

POWER CIRCUIT INSPECTION ED083B86

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of HO2S(S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedue.

CONTROL CIRCUIT INSPECTION EC1D9DE0

1. IG "OFF".
2. Disconnect HO2S(S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

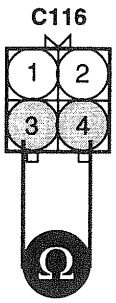
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E5B1BAB0

1. Check resistance (S2).
   1) IG "OFF".
   2) Disconnect HO2S(S2) connector.
   3) Measure resistance between terminal 3 and 4 of HO2S(S2) (Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance(Ω)	Approx. 9.0Ω (20℃)



1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF001F

4) Is the measured resistance within specification?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

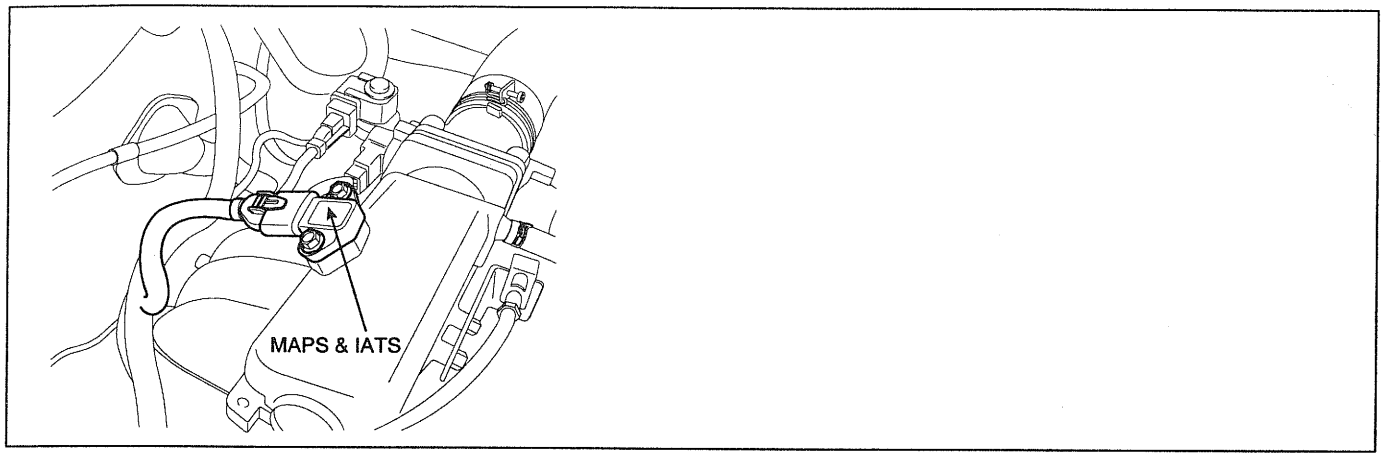
- ▶ Substitute with a known - good HO2S(S2) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EDE03445

Refer to DTC P0036.

DTC P0106 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EF2C1725



EFPG374B

GENERAL DESCRIPTION E04F5E4B

The amount of intake air flow must be inputted to ECM in order to determine the fuel injection quantity. MAPS(Manifold Absolute Pressure) calculates the amount of air indirectly as measuring the pressure inside of intake manifold. This mechanism is alsl called Speed-Density Type.
MAPS transfers analog output signal which is proportional to the change of intake manifold pressure, then, with this signal and RPM, ECM calculates the amount of intake air flow.
MAPS is mounted on surge tank to measure the pressure inside of intake manifold, and it consists of a piezo electric element and hybrid IC which amplifies output signal from the element. A piezo electric element is a sort of a diaphragm using piezo electric effect. One side of the diaphragm is surrounded with vacuum chamber while intake pressure is applied to the other side. Thus, signals are output by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION E64DBCA0

If intake manifold pressure is lower than the minimum threshold value or higher than the maximum threshold value according to RPM and TPS under normal TPS signal input condition, ECM sets DTC P0106.

DTC DETECTING CONDITION E67DE91D

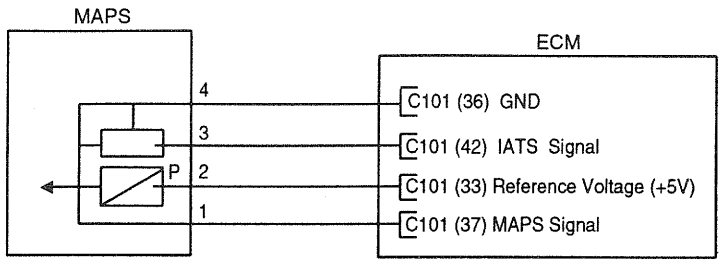
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • MAPS • ECM
Enable Conditions	• No TPS error detected	
Threshold Value	• Intake manifold pressure 〈 max. Threshold f(Eng. Speed, TPS) • Intake manifold pressure 〈 min. Threshold f(Eng. Speed, TPS)	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E7148450

Pressure [Pa]	20	35	60	95	107
Voltag [V]	0.79	1.38	2.37	3.75	4.22

SCHEMATIC DIAGRAM E62A1A66

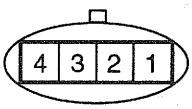
[CIRCUIT DIAGRAM]



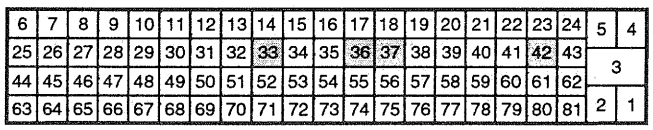
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (37)	MAPS Signal
2	ECM C101 (33)	Reference Voltage (+5V)
3	ECM C101 (42)	IATS Signal
4	ECM C101 (36)	Sensor Ground

[HARNESS CONNECTORS]



MAPS & IATS (C115)

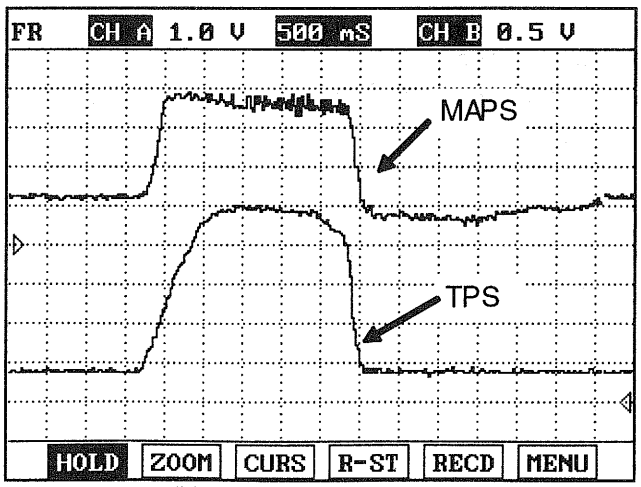


C101

ECM

EGPF500F

SIGNAL WAVEFORM & DATA EBCCB4B8

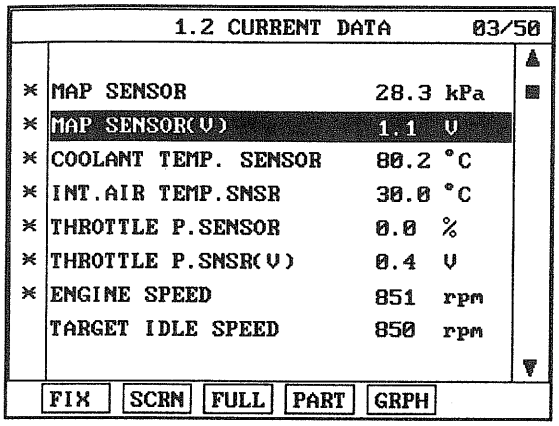


As often as possible, the MAPS signal should be compared with the TPS signal. Check whether the MAPS and TPS signals increase at the same time when accelerating. During acceleration, the MAPS output voltage increases; during deceleration, the MAPS output voltage decreases.

LFJF360A

MONITOR SCANTOOL DATA E2525C72

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "MAPS" parameter on scantool.



EGPF500G

4. Is the "MAPS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EFE698A2

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to " Voltage Inspection " procedure.

VOLTAGE INSPECTION E522758A

1. IG "OFF".

2. Disconnect MAPS connector.

3. IG "ON" & ENG "OFF".

4. Measure voltage between terminal 1, 2,4 of MAPS harness connector and chassis ground.

Specification :
Terminal 1 : Approx. 5V
Terminal 2 : Approx. 5V
Terminal 4 : Below 0V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection " procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7CF4672

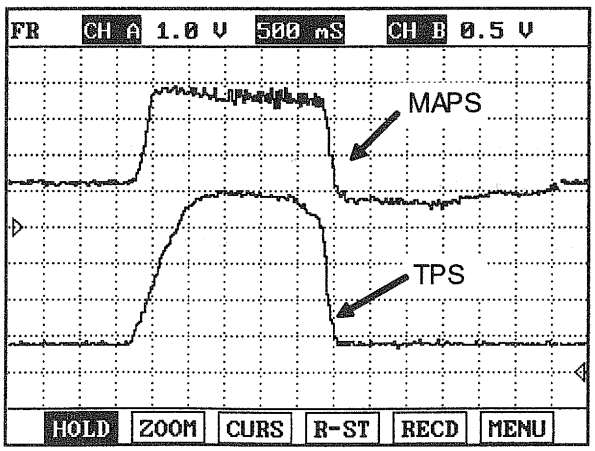
1. Check MAPS performance.

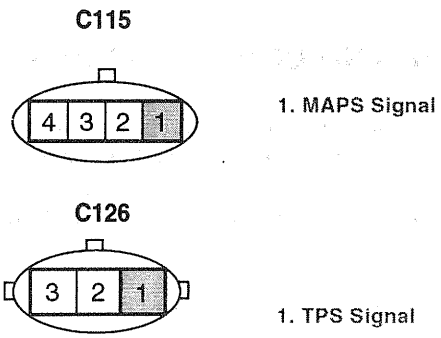
   1) IG "OFF".

   2) Connnect CH A probe to terminal 1 of MAPS and CH B probe to terminal 1 of TPS connector.

   3) Warm up the engine to normal operating temperature.

   4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator padel.





EGPF003U

   5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAPS and check for proper operation.
▶ If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

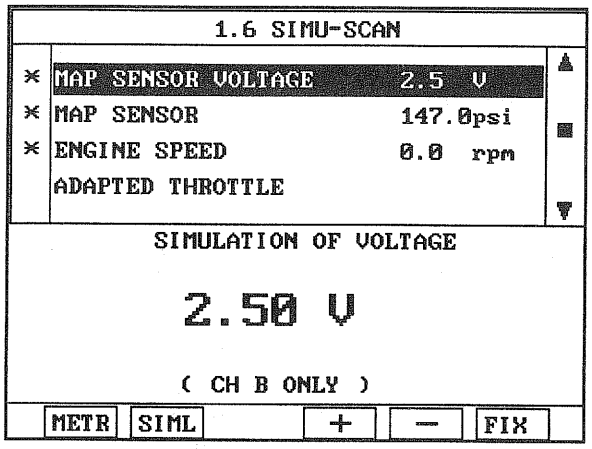
2. Check ECM.

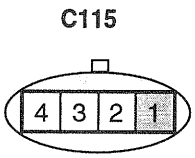
1) IG "OFF" and disconnect MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of MAPS signal connector.





1. MAPS Signal
2. MAPS Power
3. IATS Signal
4. Sensor Ground

EGPF003V

5) Does the signal value of MAPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E41F3D42

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

COMPONENT LOCATION E3AEF66C

Refer to DTC P0106.

GENERAL DESCRIPTION E3AA76EA

Refer to DTC P0106.

DTC DESCRIPTION E5782058

If sensor signal input is lower than 0.23V during 5 sec, ECM sets DTC P0107.

DTC DETECTING CONDITION E6C1E4FF

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Open or short to ground in power circuit • Short to ground in signal circuit • MAPS • ECM
Enable Conditions		
Threshold Value	• Sensor voltage 〈 0.23 V	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E3C8A1CE

Refer to DTC P0106.

SCHEMATIC DIAGRAM EE7159CD

Refer to DTC P0106.

SIGNAL WAVEFORM & DATA EB8BFFAD

Refer to DTC P0106.

MONITOR SCANTOOL DATA ED29D76D

Refer to DTC P0106.

TERMINAL AND CONNECTOR INSPECTION E08EC57C

Refer to DTC P0106.

POWER SUPPLY CIRCUIT INSPECTION EA6F2018

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 2 of MAPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E6EA7997

1. IG "OFF".
2. Disconnect MAPS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage terminal 1 of MAPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

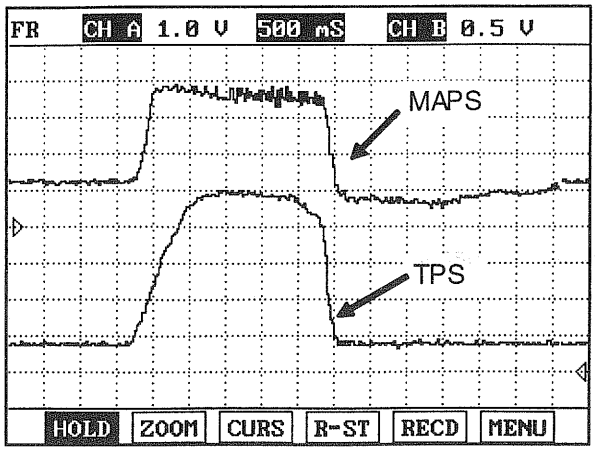
▶ Go to "Component Inspection" procedure.

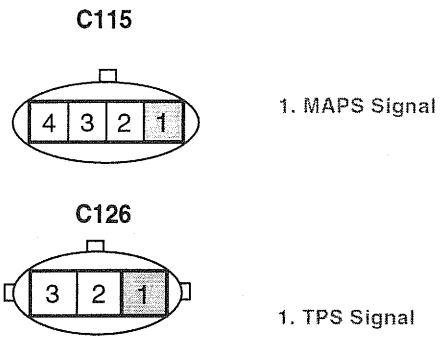
NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2B0F175

1. Check MAPS performance.
   1) IG "OFF".
   2) Connnect CH A probe to terminal 1 of MAPS and CH B probe to terminal 1 of TPS connector.
   3) Warm up the engine to normal operating temperature.
   4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator padel.





EGPF003U

5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K?

YES

▶ Go to "Check ECM" as follows

NO

▶ Substitute with a known - good MAPS and check for proper operation.
▶ If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure..

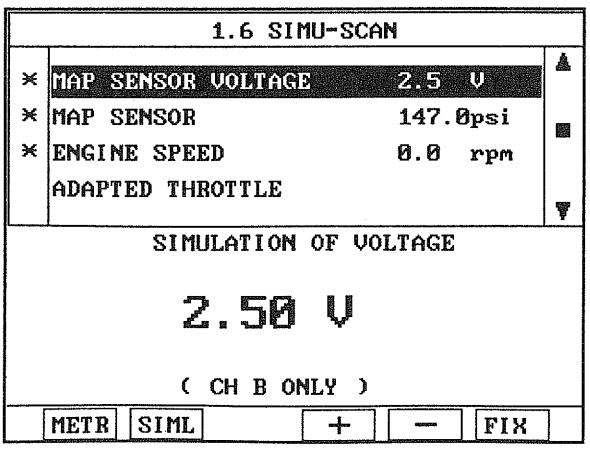
2. Check ECM.

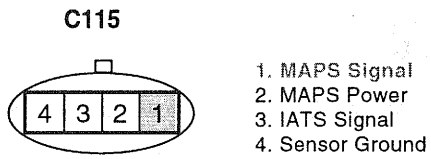
1) IG "OFF" and disconnect MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of MAPS signal connector.





EGPF003V

5) Does the signal value of MAPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4454230

Refer to DTC P0106.

DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E8616607

Refer to DTC P0106.

GENERAL DESCRIPTION EA3C93A9

Refer to DTC P0106.

DTC DESCRIPTION E8B5E5D0

If sensor signal input is higher than 4.88V during 5 sec, ECM sets DTC P0108.

DTC DETECTING CONDITION E7963D75

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • MAPS • ECM
Enable Conditions	• RPM < 30 • 5sec after engine start	
Threshold Value	• Sensor voltage 〉 4.88V	
Diagnostic Time	• 5 sec	
MIL ONCondition	• 3 driving cycle	

SPECIFICATION E69DB4EB

Refer to DTC P0106.

SCHEMATIC DIAGRAM ECB08A4A

Refer to DTC P0106.

SIGNAL WAVEFORM & DATA E782035C

Refer to DTC P0106.

MONITOR SCANTOOL DATA E51BCF80

Refer to DTC P0106.

TERMINAL AND CONNECTOR INSPECTION E776A4C2

Refer to DTC P0106.

SIGNAL CIRCUIT INSPECTION E490390D

1. Check open in harness.
   1) IG "OFF".
   2) Disconnect MAPS connector.
   3) IG "ON" & ENG "OFF"
   4) Measure voltage between terminal 1 of MAPS harness connector and chassis ground.

Specification : Approx. 5V

   5) Is the measured voltage within specification?

YES

▶ Go to "Check short to battery in harness" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check short to battery in harness.
   1) IG "OFF".
   2) Disconnect MAPS and ECM connector.
   3) Measure resistance between terminal 1 and 2 MAPS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0370950

1. IG "OFF".
2. Disconnect MAPS connector.
3. Measure resistance between terminal 4 of MAPS harness connector and chassis ground.

Specification : Below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7A19DE4

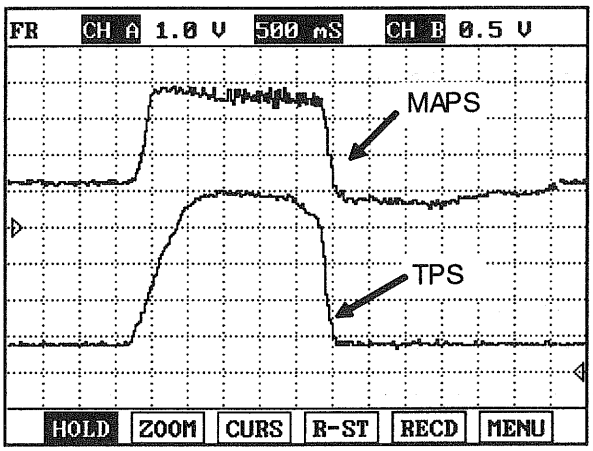
1. Check MAPS performance.

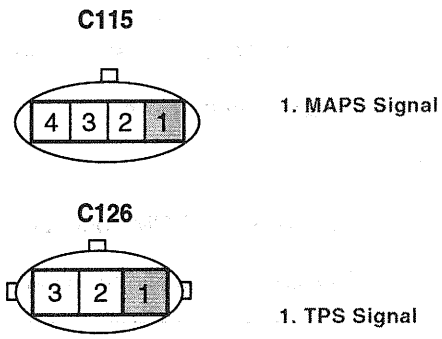
   1) IG "OFF".

   2) Connnect CH A probe to terminal 1 of MAPS and CH B probe to terminal 1 of TPS connector.

   3) Warm up the engine to normal operating temperature.

   4) Measure signal waveform of MAPS and TPS together by stepping on and off the accellerator padel.





EGPF003U

   5) Is the measured signal waveform(Comparison response of TPS with MAPS) O.K?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good MAPS and check for proper operation.
▶ If the problem is corrected, replace MAPS and go to "Verification of Vehicle Repair" procedure.

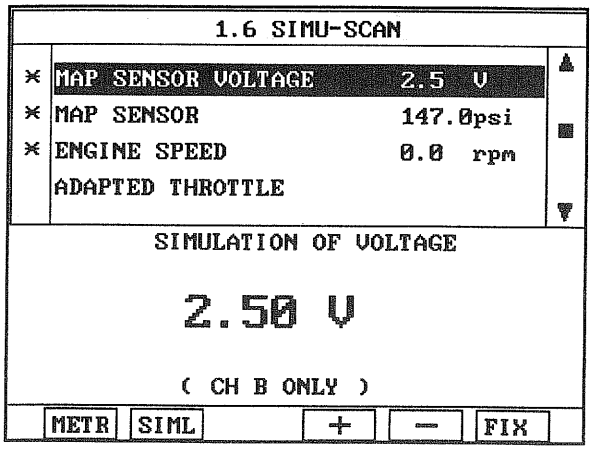
2. Check ECM.

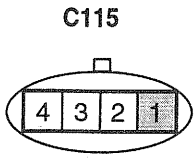
   1) IG "OFF" and disconnect MAPS connector.

   2) Connect scantool and Key "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 1 of MAPS signal connector.





1. MAPS Signal
2. MAPS Power
3. IATS Signal
4. Sensor Ground

EGPF003V

5) Does the signal value of MAPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

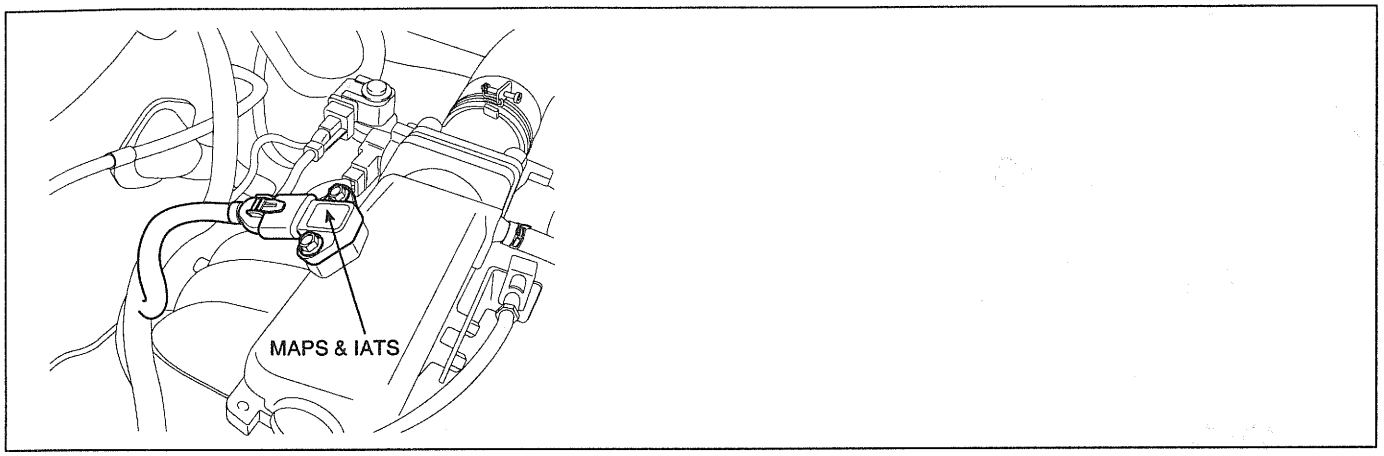
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E087DFA6

Refer to DTC P0106.

DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

COMPONENT LOCATION E0985323



EFPG374B

GENERAL DESCRIPTION EC2EDB41

The Intake Air Temperature (IAT) sensor measures the temperature of engine intake air. The Intake Air Temperature (IAT) sensor is a thermistor (a variable resistor that changes along with outside air temperature) in series with a fixed resistor in the PCM. The ECM applies 5V to the IAT sensor. The ECM monitors the voltage across the IAT sensor and converts it into a temperature reading. When the outside air temperature is cold the IAT sensor resistance is high, and when the outside air temperature is warm the IAT sensor resistance is low. Therefore, when the air temperature is cold the ECM will receive a high voltage input, and when the air temperature is warm the ECM will receive a low voltage input. The signal from IAT sensor is used for injection duration correction, ignition timing correction and idle speed correction(Air-density correction).

DTC DESCRIPTION E5EA5BB5

If measured temperature is higher than the maximum threshold value during 0.2sec, ECM sets DTC P0112.
(In this case, the input signal voltage is the minimum threshold vaue.)

DTC DETECTING CONDITION EDCDE444

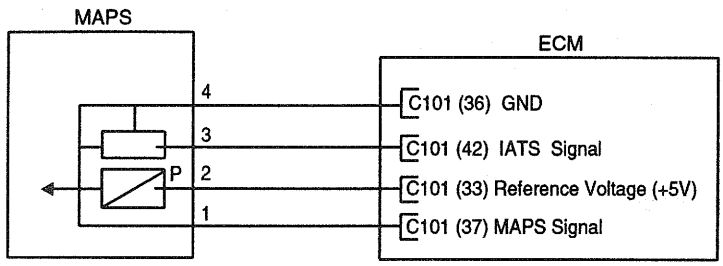
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in signal circuit • IATS • ECM
Enable Conditions		
Threshold Value	• Measured temperature 〉 128 ℃	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E8C4159E

Temperature [℃]	Temperature [°F]	Resistance [Ω]
-40.0	-40.0	40.93 ~ 48.35
-20.0	-4.0	13.89 ~ 16.03
0.0	32.0	5.38 ~ 6.09
20.0	68.0	2.31 ~ 2.57
40.0	104.0	1.08 ~ 1.20
60.0	140.0	0.54 ~ 0.62
80.0	176.0	0.29 ~ 0.34

SCHEMATIC DIAGRAM E5088A75

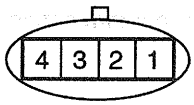
[CIRCUIT DIAGRAM]



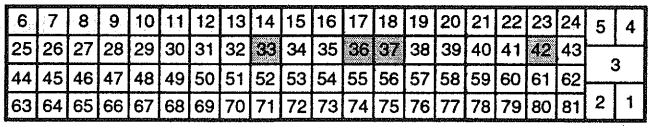
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (37)	MAPS Signal
2	ECM C101 (33)	Reference Voltage (+5V)
3	ECM C101 (42)	IATS Signal
4	ECM C101 (36)	Sensor Ground

[HARNESS CONNECTORS]



MAPS & IATS (C115)



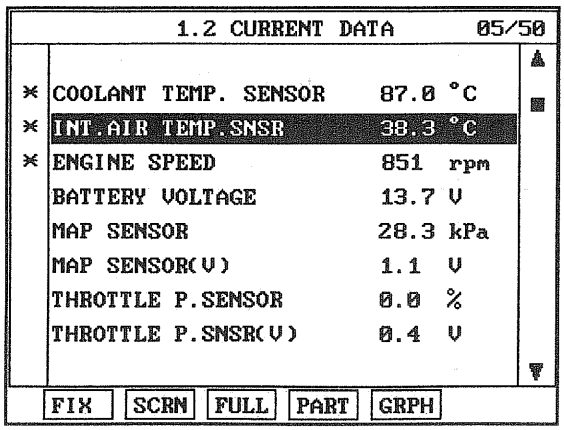
C101

ECM

EGPF500F

MONITOR SCANTOOL DATA EEDB95E4

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "IATS" parameter on scantool.



EGPF500H

4. Is the "IATS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E26023B1

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION ED862587

1. IG "OFF".
2. Disconnect IATS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 3 of IATS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBF76AC4

1. Check IATS resistance.

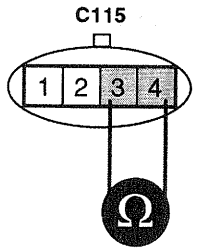
   1) IG "OFF".

   2) Disconnect IATS connector.

   3) Measure resistance between terminal 3 and 4 of IATS connector(Component Side)

Specification :

Temperature [℃]	Temperature [°F]	Resistance [Ω]
-40.0	-40.0	40.93 ~ 48.35
-20.0	-4.0	13.89 ~ 16.03
0.0	32.0	5.38 ~ 6.09
20.0	68.0	2.31 ~ 2.57
40.0	104.0	1.08 ~ 1.20
60.0	140.0	0.54 ~ 0.62
80.0	176.0	0.29 ~ 0.34



1. MAPS Signal
2. MAPS Power
3. IATS Signal
4. Sensor Ground

EGPF001M

4) Is the measured resistance within specification ?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good IATS and check for proper operation.
▶ If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

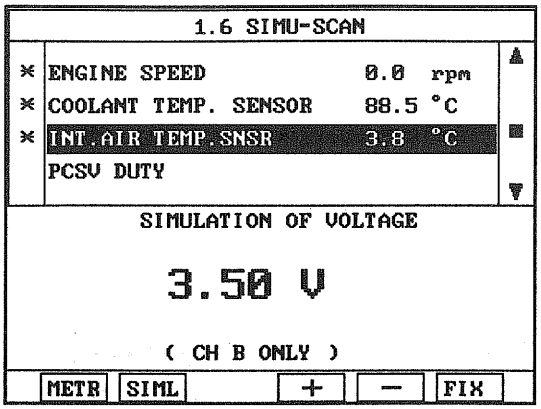
2. Check ECM.

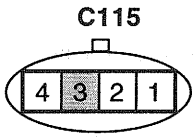
1) IG "OFF" and disconnect MAFS/MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 3 of IATS signal connector.





1. MAPS Signal
2. MAPS Power
3. IATS Signal
4. Sensor Ground

EGPF003W

5) Does the signal value of IATS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2650746

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0113 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT HIGH INPUT

COMPONENT LOCATION E62B7AC8

Refer to DTC P0112.

GENERAL DESCRIPTION E57FC4C8

Refer to DTC P0112.

DTC DESCRIPTION E42FED67

If measured temperature is lower than the minimum threshold value during 0.2sec, ECM sets DTC P0113.
(In this case, the input signal voltage is the maximum threshold vaue.)

DTC DETECTING CONDITION E8955F61

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • IATS • ECM
Enable Conditions	• Idle and no fuel cut-off • No fault on ECTS and VSS • Integrated air mass > 24kg	
Threshold Value	• Measured temperature < -38℃	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E1D8613F

Refer to DTC P0112.

SCHEMATIC DIAGRAM EEB12017

Refer to DTC P0112.

MONITOR SCANTOOL DATA EE43A220

Refer to DTC P0112.

TERMINAL AND CONNECTOR INSPECTION E8E6C65A

Refer to DTC P0112.

SIGNAL CIRCUIT INSPECTION EFC26AEF

1. Check open in harness.
   1) IG "OFF".

2) Disconnect IATS connector.

3) IG "ON" & ENG "OFF"

4) Measure voltage between terminal 3 of IATS harness connector and chassis ground.

Specification : Approx. 5V

5) Is the measured voltage within specification?

YES

▶ Go to "Check short to ground in harness" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness.

1) IG "OFF".

2) Disconnect IATS and ECM connector.

3) Measure resistance between terminal 3 and 4 of IATS harness connector.

Specification : Infinite

4) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E78F85F3

1. IG "OFF".
2. Disconnect IATS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 3 of IATS harness connector and chassis ground(A)
5. Measure voltage between terminal 3 and 4 of IATS harness connector. (B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6381ADF

1. Check IATS resistance.

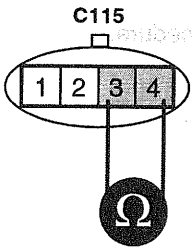
   1) IG "OFF".

   2) Disconnect IATS connector.

   3) Measure resistance between terminal 3 and 4 of IATS connector(Component Side)

Specification :

Temperature [℃]	Temperature [°F]	Resistance [Ω]
-40.0	-40.0	40.93 ~ 48.35
-20.0	-4.0	13.89 ~ 16.03
0.0	32.0	5.38 ~ 6.09
20.0	68.0	2.31 ~ 2.57
40.0	104.0	1.08 ~ 1.20
60.0	140.0	0.54 ~ 0.62
80.0	176.0	0.29 ~ 0.34



1. MAPS Signal
2. MAPS Power
3. **IATS Signal**
4. **Sensor Ground**

EGPF001M

   4) Is the measured resistance within specification ?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good IATS and check for proper operation.
▶ If the problem is corrected, replace IATS and go to "Verification of Vehicle Repair" procedure.

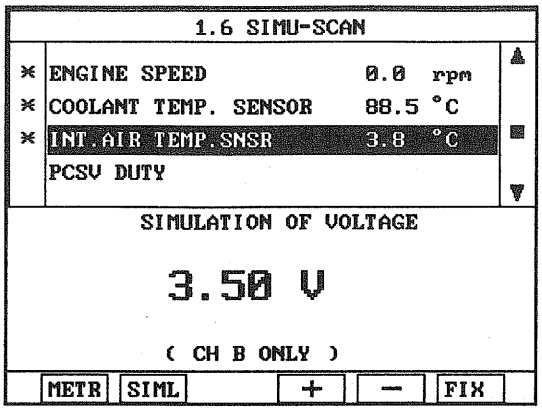
2. Check ECM.

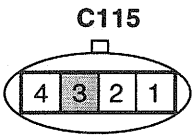
1) IG "OFF" and disconnect MAFS/MAPS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 3 of IATS signal connector.





1. MAPS Signal
2. MAPS Power
3. IATS Signal
4. Sensor Ground

EGPF003W

5) Does the signal value of IATS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

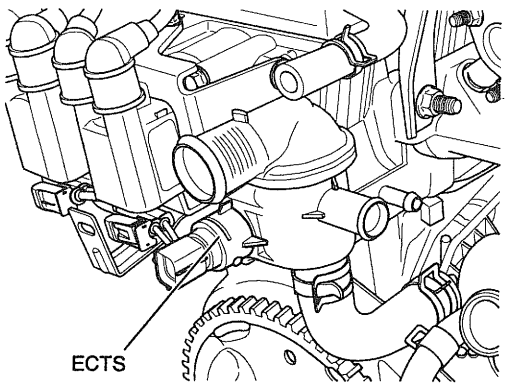
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED846A43

Refer to DTC P0112.

DTC P0116 ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E1D00F83



EFPG381B

GENERAL DESCRIPTION E961C0EA

The Engine Coolant Temperature(ECT) Sensor measures the temperature of engine coolant. The Engine Coolant Temperature (ECT) Sensor is located near the thermostat housing of the cylinder head. ECT Sensor is a thermistor (A Variable Resistor that Changes Along with ECT) in series with a fixed resistor in the Engine Control Module (ECM). The ECM applies 5 volts to the ECT sensor. The ECM monitors the voltage across the ECT sensor and converts it into a temperature reading. When the engine is cold the ECT sensor resistance is high, and when the engine is warm the ECT sensor resistance is low. Therefore, when the engine is cold the ECM will receive a high voltage input, and when the engine is warm the ECM will receive a low voltage input. The signal from ECT sensor is used for Injection control, ignition timing, idle speed and cooling fan control.

DTC DESCRIPTION E64D797E

ECM compares measured value to model value, then the deviation between 2 values is over the threshold value, ECM sets DTC P0116.

DTC DETECTING CONDITION E7AEEF52

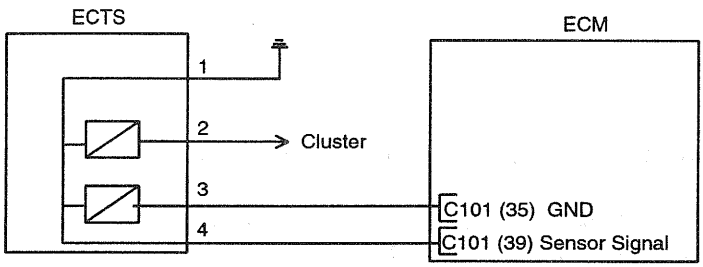
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • ECTS • ECM
Enable Conditions	• Low heat power mode driving counter ≥ 2 • High heat power mode driving counter ≥ 2	
Threshold Value	• Max temp. - Min temp. < 0.8~3.0 ℃ (1.44~5.4 °F)	
Diagnostic Time	• -	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E6E7ED74

Temperature [℃]	Temperature [°F]	Resistance [Ω]
-40.0	-40.0	48.14
-20.0	-4.0	14.13 ~ 16.83
0.0	32.0	5.79
20.0	68.0	2.31 ~ 2.59
40.0	104.0	1.15
60.0	140.0	0.59
80.0	176.0	0.32

SCHEMATIC DIAGRAM E170A986

[CIRCUIT DIAGRAM]

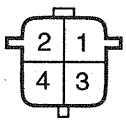


[CONNECTION INFORMATION]

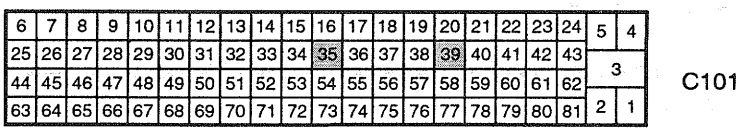
Cluster

Terminal	Connected to	Function
1	Chassis ground	
2	Cluster	
3	ECM C101 (35)	Sensor Ground
4	ECM C101 (39)	Sensor Signal

[HARNESS CONNECTORS]



ECTS (C127)



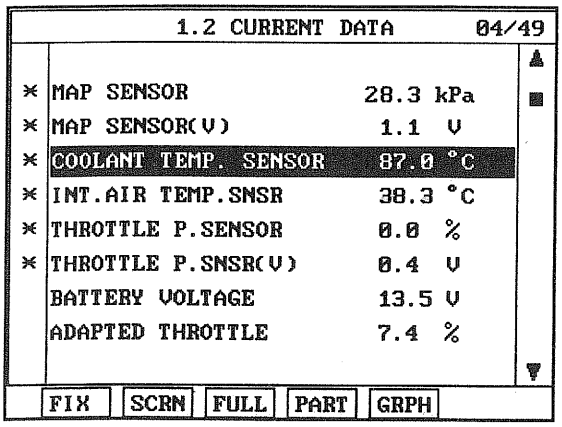
C101

ECM

EGPF500I

MONITOR SCANTOOL DATA E531A483

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "ECTS" parameter on scantool.



EGPF500J

4. Is the "ECTS" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EC6D383E

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to " Voltage check " procedure.

VOLTAGE INSPECTION E3C94F45

1. IG "OFF".
2. Disconnect ECTS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of ECTS harness connector and chassis ground.
5. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.

Specification :
Terminal 4 Approx. 5V
Terminal 3 Approx. 0V

6. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3A67E44

1. Check ECTS resistance.

   1) IG "OFF".

   2) Disconnect ECTS connector.

   3) Measure resistance between terminal 3 and 4 of ECTS harness connector.(Component Side)

SPECIFICATION :

Temperature [℃]	Temperature [°F]	Resistance [Ω]
-40.0	-40.0	48.14
-20.0	-4.0	14.13 ~ 16.83
0.0	32.0	5.79
20.0	68.0	2.31 ~ 2.59
40.0	104.0	1.15
60.0	140.0	0.59
80.0	176.0	0.32

   4) Is the measured resistance within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good ECTS and check for proper operation.
▶ If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.

   1) IG "OFF" and disconnect ECTS connector.

   2) Connect scantool and Key "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 4 of ECTS signal connector.

5) Does the signal value of ECTS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E517CF97

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

COMPONENT LOCATION E1F850F5

Refer to DTC P0116.

GENERAL DESCRIPTION E7C27A28

Refer to DTC P0116.

DTC DESCRIPTION E1FFD21F

If measured temperature is higher than the maximum threshold value, ECM sets DTC P0117.
(In this case, the input signal voltage is the minimum threshold vaue.)

DTC DETECTING CONDITION E125962B

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in signal circuit • ECTS • ECM
Enable Conditions		
Threshold Value	• Measured temperature 〉 138.8 ℃	
Diagnostic Time		
MIL ON Condition	• 3 driving cycle	

SPECIFICATION EC52465D

Refer to DTC P0116.

SCHEMATIC DIAGRAM E8692688

Refer to DTC P0116.

MONITOR SCANTOOL DATA E62A6AE5

Refer to DTC P0116.

TERMINAL AND CONNECTOR INSPECTION E862879C

Refer to DTC P0116.

SIGNAL CIRCUIT INSPECTION EFDEC720

1. IG "OFF".
2. Disconnect ECTS connector.
3. IG "ON" & ENG "OFF"

4. Measure voltage between terminal 4 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E018EF02

1. Check ECTS resistance.

   1) IG "OFF".

   2) Disconnect ECTS connector.

   3) Measure resistance between terminal 3 and 4 of ECTS harness connector.(Component Side)

SPECIFICATION :

Temperature [℃]	Temperature [°F]	Resistance [Ω]
-40.0	-40.0	48.14
-20.0	-4.0	14.13 ~ 16.83
0.0	32.0	5.79
20.0	68.0	2.31 ~ 2.59
40.0	104.0	1.15
60.0	140.0	0.59
80.0	176.0	0.32

   4) Is the measured resistance within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good ECTS and check for proper operation.
▶ If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.

   1) IG "OFF" and disconnect ECTS connector.

   2) Connect scantool and Key "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 4 of ECTS signal connector.

5) Does the signal value of ECTS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED6764C4

Refer to DTC P0116.

DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION EBD7C8F0

Refer to DTC P0116.

GENERAL DESCRIPTION ED7A5B6C

Refer to DTC P0116.

DTC DESCRIPTION EEAE7F34

If measured temperature is lower than the minimum threshold value, ECM sets DTC P0118.
(In this case, the input signal voltage is the maximum threshold vaue.)

DTC DETECTING CONDITION E128E3E5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • ECTS • ECM
Enable Conditions	• Time (after Integrated air mass 〉 0.18kg) 〉 0s • Increase of measured temp. after start 〈 2.3℃	
Threshold Value	• Measured temperature 〈 -38.3 ℃	
Diagnostic Time		
MIL ON Condition	• 3 driving cycle	

SPECIFICATION ECA74F75

Refer to DTC P0116.

SCHEMATIC DIAGRAM EDA7AE4E

Refer to DTC P0116.

MONITOR SCANTOOL DATA EAD16454

Refer to DTC P0116.

TERMINAL AND CONNECTOR INSPECTION E64AC790

Refer to DTC P0116.

SIGNAL CIRCUIT INSPECTION EAC15C80

1. IG "OFF".
2. Disconnect ECTS connector.

3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of ECTS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0886D19

1. IG "OFF".
2. Disconnect ECTS connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of ECTS harness connector and chassis ground.(A)
5. Measure voltage between terminal 4 and 3 of ECTS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Component Insepction" procedure.

NO

▶ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

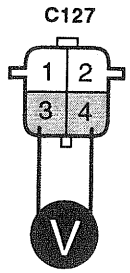
COMPONENT INSPECTION E9C63F27

1. Check ECTS resistance.
   1) IG "OFF".
   2) Disconnect ECTS connector.
   3) Measure resistance between terminal 3 and 4 of ECTS connector.(Component Side)

SPECIFICATION :

Temperature [℃]	Temperature [°F]	Resistance [Ω]
-40.0	-40.0	48.14
-20.0	-4.0	14.13 ~ 16.83
0.0	32.0	5.79

20.0	68.0	2.31 ~ 2.59
40.0	104.0	1.15
60.0	140.0	0.59
80.0	176.0	0.32



1. Ground
2. Cluster Signal
3. Sensor Ground
4. ECTS Signal

EGPF001Q

4) Is the measured resistance within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good ECTS and check for proper operation.
▶ If the problem is corrected, replace ECTS and go to "Verification of Vehicle Repair" procedure.

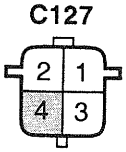
2. Check ECM.

1) IG "OFF" and disconnect ECTS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 4 of ECTS signal connector.



1. Ground
2. Cluster Signal
3. Sensor Ground
4. ECTS Signal

EFPG003X

5) Does the signal value of ECTS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

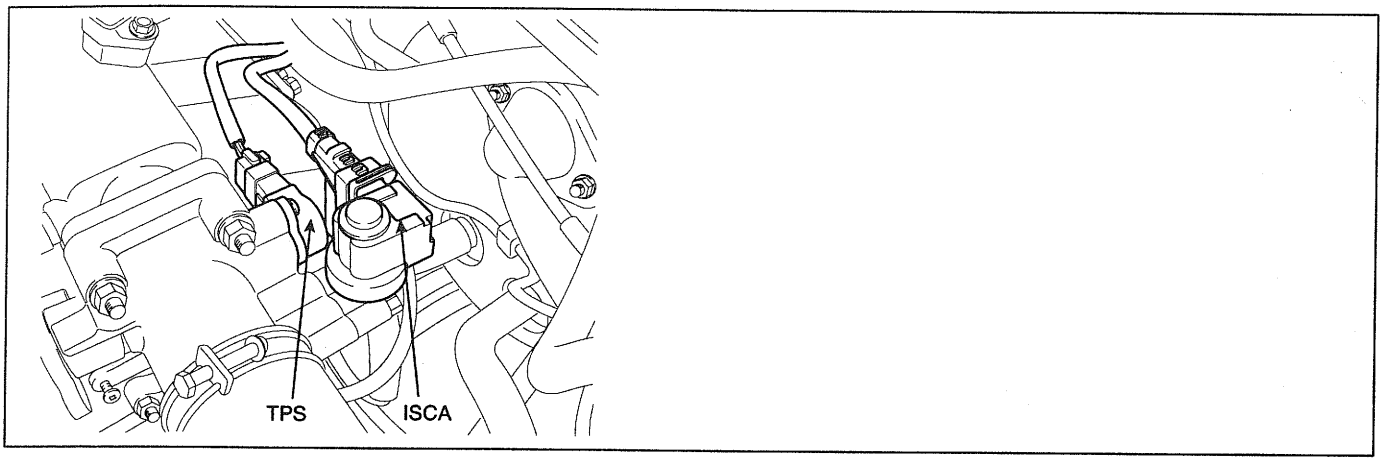
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4B8C530

Refer to DTC P0116.

DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EC161352



EFPG375B

GENERAL DESCRIPTION EDFC3C28

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate.The TPS has a variable resistor (potentiometer) whose characteristic is the resistance changing according to the throttle angle. During acceleration, the TPS resistance between the reference 5V and the signal terminal decreases and output voltage increases; during deceleration, the TPS resistance increases and TPS output voltage decreases.The ECM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The TPS output voltage will vary from 0.2~0.8V at closed throttle to 4.3~4.8V at wide-open throttle.The ECM determines operating conditions such as idle (closed throttle), part load, acceleration/deceleration, and wide-open throttle from the TPS. Also The ECM uses the Mass Air Flow Sensor (MAFS) or Manifold Absolute Pressure Sensor (MAPS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.

DTC DESCRIPTION EDBDD7A4

If the number that throttle angle input signal chages rapidly (above 30%) is 3 times or more, ECM sets DTC P0121.

DTC DETECTING CONDITION E4C69AC6

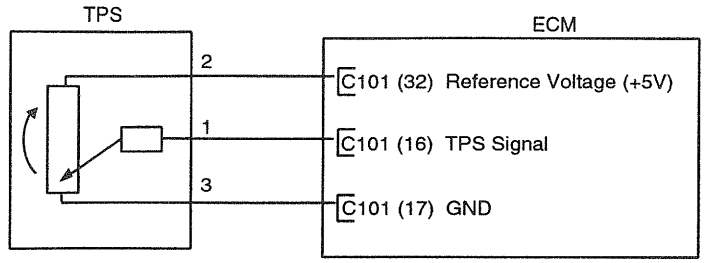
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check (Jittering)	• Poor connection • TPS • ECM
Enable Conditions	• Engine speed 〉 600 rpm	
Threshold Value	• Counter of ∣ △ throttle angle 〉 30% ∣ ≥ 3 times	
Diagnostic Time		
MIL ON Condition	• 3 driving cycle	

SPECIFICATION ED396EB7

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)

SCHEMATIC DIAGRAM EA9FEE2E

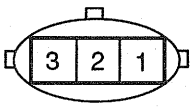
[CIRCUIT DIAGRAM]



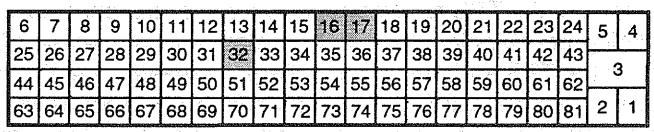
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (16)	TPS Signal
2	ECM C101 (32)	Reference Voltage (+5V)
3	ECM C101 (17)	Sensor Ground

[HARNESS CONNECTORS]



TPS (C126)

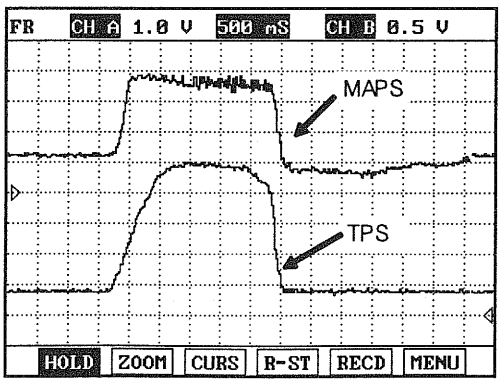


C101

ECM

EGPF500K

SIGNAL WAVEFORM & DATA E9A9C8CA

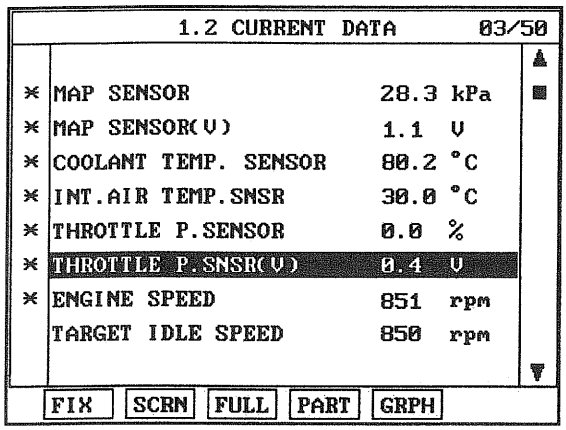


EFPF025A

MONITOR SCANTOOL DATA EB88DE89

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.

3. Monitor the "TPS" parameters on the scantool.



EGPF500L

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E0C6B7D3

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "TPS circuit inspection" procedure.

TPS CIRCUIT INSPECTION

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 1, 2, 3 of TPS harness connector and chassis ground.

Specification :
Terminal 1 : Approx. 5V
Terminal 2 : Approx. 5V
Terminal 3 : Approx. 0V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for Open or Short in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC8F542D

1. Check TPS resistance.

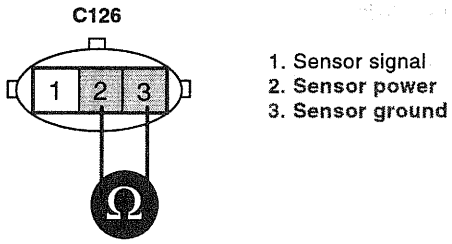
   1) Key "OFF".

   2) Disconnect TPS connector.

   3) Measure the resistance between terminal 2 and 3 of TPS component side.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)



1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF001U

   4) Is the measured resistance within specifications?

YES

▶ Go to "Check ECM" procedure.

NO

▶ Substitute with a known-good TPS and check for proper operation. If the problem iscorrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

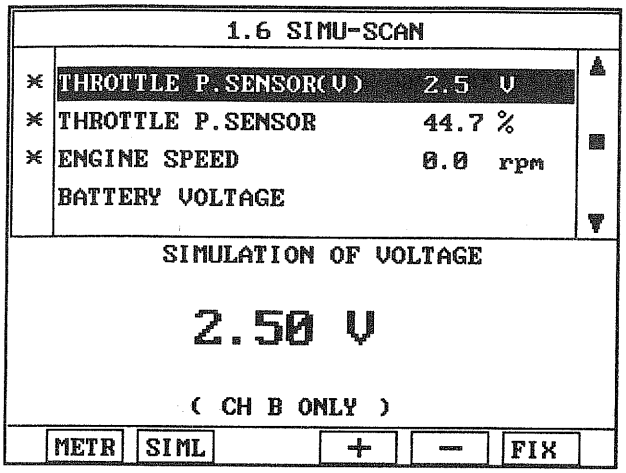
2. Check ECM.

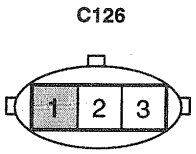
   1) Key "OFF".

   2) Connect the scantool and select "Simulation SCAN" in the menu.

   3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON" & ENG "OFf".

   4) Simulate voltage at signal line.





1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF003Y

   5) Does the signal output of TPS change according to simulation voltage?

   YES

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Substitute with a known - good ECM and check for proper operation.
   ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EA62B6E9

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

   YES

   ▶ Go to the applicable troubleshooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT

COMPONENT LOCATION E1D32352

Refer to DTC P0121.

GENERAL DESCRIPTION E961572F

Refer to DTC P0121.

DTC DESCRIPTION EEDC8B25

If the sensor input voltage is lower than the minimum threshold value during 0.5 sec under normal driving condition, ECM sets DTC P0122.

DTC DETECTING CONDITION EAAE67DE

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Open or short to ground in power circuit • Short to ground in signal circuit • TPS • ECM
Enable Conditions	• Engine speed 〉 600 rpm	
Threshold Value	• Calculated signal from sensor voltage 〈 3.1%	
Diagnostic Time	• 0.1 sec	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E801D995

Refer to DTC P0121.

SCHEMATIC DIAGRAM EB111D47

Refer to DTC P0121.

SIGNAL WAVEFORM & DATA E78DE816

Refer to DTC P0121.

MONITOR SCANTOOL DATA E619A5AC

Refer to DTC P0121.

TERMINAL AND CONNECTOR INSPECTION E40CB2D4

Refer to DTC P0121.

POWER CIRCUIT INSPECTION E12BE554

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 2 of TPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Check for Open or Short to ground in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E3439837

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 1 of TPS harness connecto and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

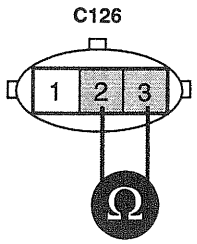
▶ Repair Short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E001DABF

1. Check TPS resistance.
   1) Key "OFF".
   2) Disconnect TPS connector.
   3) Measure the resistance between terminal 2 and 3 of TPS component side.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)



1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF001U

4) Is the measured resistance within specifications?

YES

▶ Go to "Check ECM" procedure.

NO

▶ Substitute with a known-good TPS and check for proper operation. If the problem iscorrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

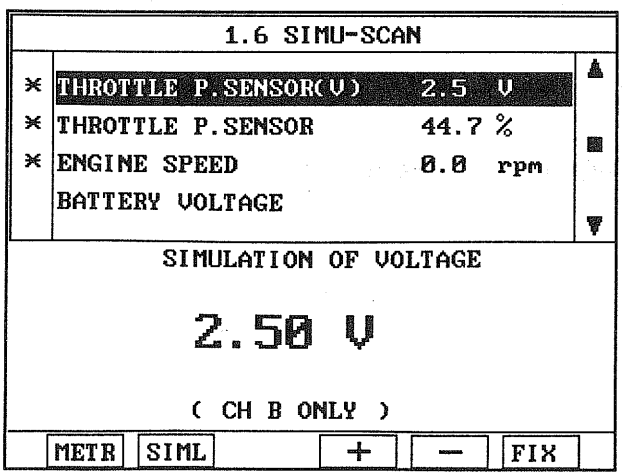
2. Check ECM.

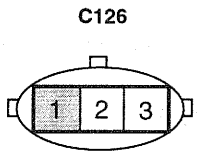
1) Key "OFF".

2) Connect the scantool and select "Simulation SCAN" in the menu.

3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON".

4) Simulate voltage at signal line.





1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF003Y

5) Does the signal output of TPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6209299

Refer to DTC P0121.

DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT

COMPONENT LOCATION EB4D3CFF

Refer to DTC P0121.

GENERAL DESCRIPTION E6EFA20E

Refer to DTC P0121.

DTC DESCRIPTION E9747563

If the sensor input voltage is higher than the maximum threshold value during 0.5 sec under normal driving condition, ECM sets DTC P0123.

DTC DETECTING CONDITION E328307C

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Open or short to power in signal circuit • Open in ground circuit • TPS • ECM
Enable Conditions	• Engine speed 〉 600 rpm	
Threshold Value	• Calculated signal from sensor voltage 〉 95.7%	
Diagnostic Time	• 0.1 sec	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E4D0A477

Refer to DTC P0121.

SCHEMATIC DIAGRAM E0FB5C05

Refer to DTC P0121.

SIGNAL WAVEFORM & DATA E5B280EC

Refer to DTC P0121.

MONITOR SCANTOOL DATA E6DB2AAC

Refer to DTC P0121.

TERMINAL AND CONNECTOR INSPECTION E6F863EF

Refer to DTC P0121.

POWER CIRCUIT INSPECTION ED320F80

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 2 of TPS harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Check for Open or Short in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EB6187AB

1. Key "OFF".
2. Disconnect TPS connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 2 of TPS harness connector and chassis ground.(A)
5. Measure the voltage between terminal 2 and 3 of TPS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Check for Open in ground circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E640FC01

1. Check for open in signal circuit.
   1) Key "OFF".
   2) Disconnect TPS connector.
   3) Key "ON" & ENG "OFF".
   4) Measure the voltage between terminal 1 of TPS harness connector and chassis ground.

Specification : Approx. 5V

5) Is the measured voltage within specification?

YES

▶ Go to "Check for Short in signal circuit" procedure.

NO

▶ Repair Open or Short to power in signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check for short in signal circuit.

1) Key "OFF".

2) Disconnect TPS connector and ECM connector.

3) Measure the resistance between terminal 1 and 2 of TPS harness connector.

Specification : Infinite

4) Is the measured resistance within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E233F8CE

1. Check TPS resistance.

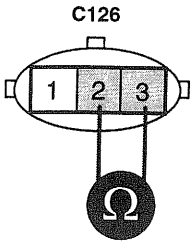
1) Key "OFF".

2) Disconnect TPS harness connector.

3) Measure the resistance between terminal 2 and 3 of TPS component side connector.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)



1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF001U

4) Is the measured resistance within specifications?

YES

▶ Go to "Check ECM" procedure.

NO

▶ Substitute with a known-good TPS and check for proper operation. If the problem iscorrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

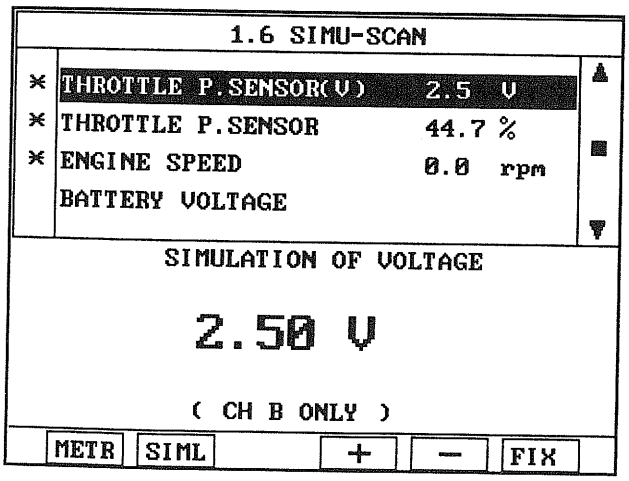
2. Check ECM.

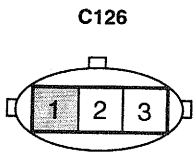
1) Key "OFF".

2) Connect the scantool and select "Simulation SCAN" in the menu.

3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON".

4) Simulate voltage at signal line.





1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF003Y

5) Does the signal output of TPS change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2E38786

Refer to DTC P0121.

DTC P0124 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT INTERMITTANT

COMPONENT LOCATION E7185974

Refer to DTC P0121.

GENERAL DESCRIPTION E0A4A648

Refer to DTC P0121.

DTC DESCRIPTION EADC0CFE

If the difference between modeled relative load and measured relative load is over the threshold value according to throttle position under enable conditions, ECM sets DTC P0124.

DTC DETECTING CONDITION EBA6992E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • TPS • ECM
Enable Conditions	• Rate of change of throttle angle 〈 0.1221% • Engine speed 〉 600rpm • Coolant temperature 〉 75℃ • Rate of change of predicted eng. load 〈 15% • Altitude 〉 0m • Time in idling 〉 30s	
Threshold Value	• Difference between modeled relative load and measured relative load 〉 threshold f(throttle position)	
Diagnostic Time	• 2.5sec	
MIL ON Condition	• DTC only	

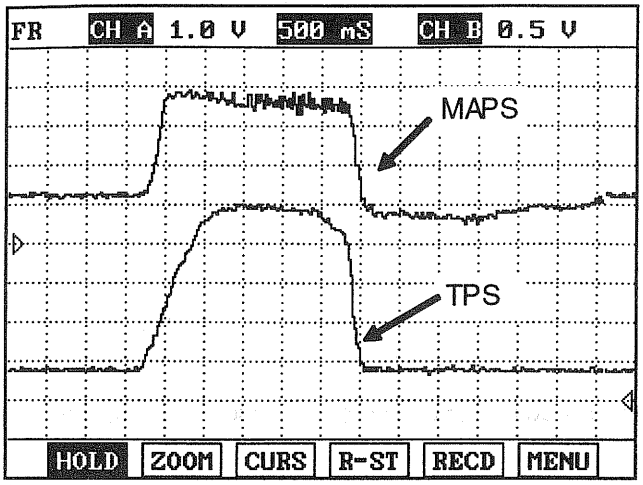
SPECIFICATION EA86BF80

Refer to DTC P0121.

SCHEMATIC DIAGRAM E0DFE9D7

Refer to DTC P0121.

SIGNAL WAVEFORM & DATA ED016E55



As often as possible, the MAPS signal should be compared with the TPS signal. Check whether the MAPS and TPS signals increase at the same time when accelerating. During acceleration, the MAPS output voltage increases; during deceleration, the MAPS output voltage decreases.

LFJF360A

MONITOR SCANTOOL DATA EB13E944

Refer to DTC P0121.

TERMINAL AND CONNECTOR INSPECTION EC542149

Refer to DTC P0121.

TPS CIRCUIT INSPECTION

1. Ignition "OFF"
2. Disconnect TPS connector.
3. Ignition "ON"
4. Measure voltage between terminal "1","2" and "3" of sensor harness connector and chassis ground

Specification : Terminal 1 : Approx. 5V Terminal 2 : Approx. 5V Terminal 3 : Approx. 0V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for Open or Short in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EAD8E1BE

1. Check TPS.

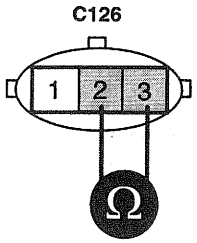
   1) Ignition "OFF"

   2) Disconnect TPS connector

   3) Measure resistance terminal 2 and 3 of TPS Component side connector.

SPECIFICATION :

ITEM	Specification
TPS Resistance (kΩ)	2kΩ ± 20% (20℃)



1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF001U

   4) Is the measured resistance within specifications?

   YES

   ▶ Go to "Check ECM" procedure.

   NO

   ▶ Check TPS for contamination, deterioration, or damage. Substitute with a known-good TPS andcheck for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

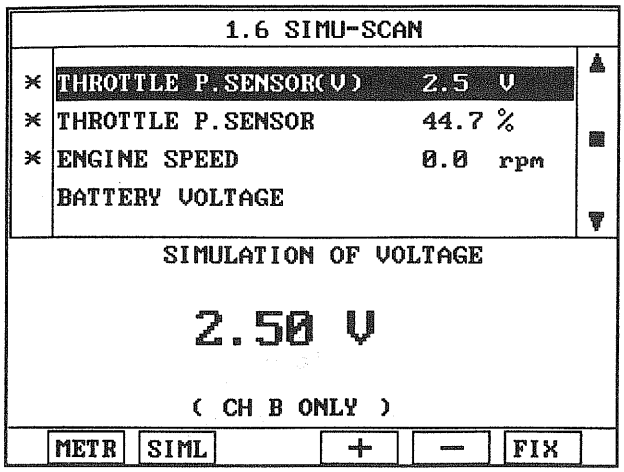
2. Check ECM.

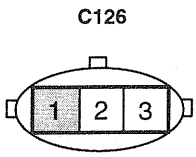
   1) Ignition "OFF"

   2) Connect the scantool and select "Simulation SCAN" in the menu.

   3) Connect channel A of scantool with terminal 1 of TPS harness connector, and key "ON".

   4) Simulate voltage at signal line.





1. Sensor signal
2. Sensor power
3. Sensor ground

EGPF003Y

5) Is TPS signal value changed according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination,deterioration, or damage. Repair or replace as necessary and then go to "Verification of VehicleRepair" procedure..

NO

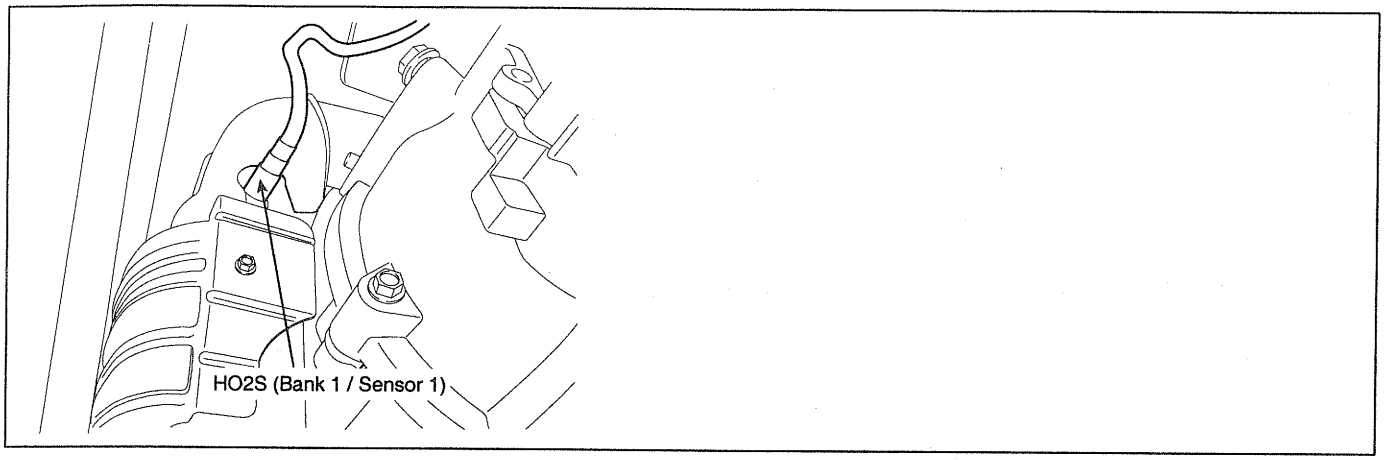
▶ Substitute with a known-good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBEF5440

Refer to DTC P0121.

DTC P0130 HO2S CIRCUIT (BANK 1/ SENSOR 1)

COMPONENT LOCATION EE9B2C22



EFPG800A

GENERAL DESCRIPTION EDA074B8

The heated oxygen sensors are mounted on the front side and the rear sied of Catalytic Converter (warm-up catalytic converter), which detects the oxygen concentration in the exhaust gas. The front HO2S signal is used to control air/fuel ratio (closed loop fuel control) and the rear HO2S signal is used to monitor front HO2S and catalyst for proper operation. The heated oxygen snesor (HO2S) produces a voltage that varies between 0V and 1V. When the air/fuel ratio is lean, the oxygen concentration in the exhaust gas increases and the front HO2S outputs a low voltage (approximately 0 ~ 0.1 V). When the air/fuel ratio is rich, the oxygen concentration in the exhaust gas decreases and the front HO2S output a high voltage (approximately 0.8 ~ 1 V). The ECM constantly monitors the HO2S and increases or decreases the fuel injection duration by using the HO2S signal, which is called closed-loop fuel control operation.

DTC DESCRIPTION E57E1E03

If ECM detects that the output signal satisfies the threshold values under enable conditions, ECM sets DTC P0130.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E7D7D9D9

Item		Detecting Condition	Possible Cause
DTC Strategy		• Rationality check	• Poor connection • Open or short power/ground in signal circuit • B1S1 • ECM
General Enable Conditions		• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Case1	Enable Conditions	• B1S2 sensor voltage 〉 0.5V	
	Threshold Value	• B1S1 sensor voltage : 0.06 ~ 0.4V	
	Diagnostic Time	• 25 sec	
Case2	Enable Conditions	• B1S2 sensor voltage 〈 0.1V	
	Threshold Value	• B1S1 sensor voltage : 0.6 ~ 1.5V	
	Diagnostic Time	• 25 sec	
Case3	Enable Conditions	• Time after dew point end detected 〉 10s	
	Threshold Value	• Counter of I △usvk 〉 2V during 0.04 sec after heater on→off I 〉 5 times	
MIL ON Condition		• 2 driving cycle	

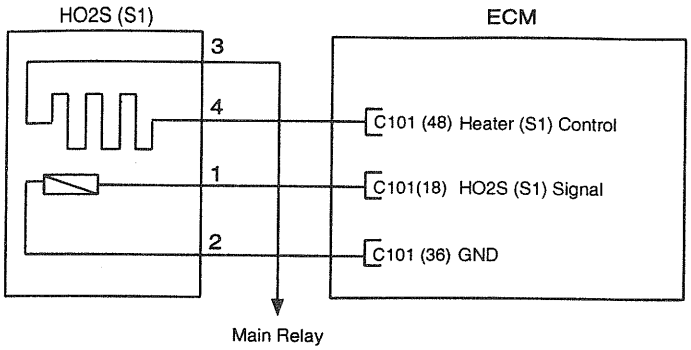
※ △usvk : Sum of the signal voltage change value (B1S1)
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E53467B8

A/F Ratio	Output Voltage (V)
Rich	0.6 ~ 1.0V
Lean	0 ~ 0.4V

SCHEMATIC DIAGRAM ED4F68B3

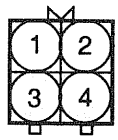
[CIRCUIT DIAGRAM]



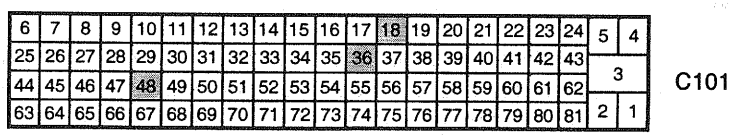
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (18)	HO2S (S1) Signal
2	ECM C101 (36)	Sensor Ground
3	Main Relay	Battery Voltage (B+)
4	ECM C101 (48)	Heater (S1) Control

[HARNESS CONNECTOR]



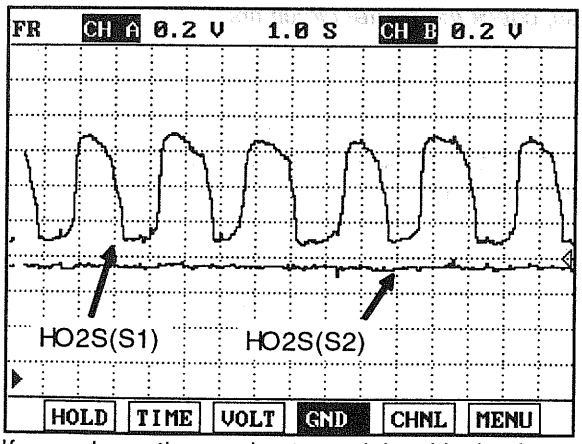
HO2S [S1] (C117)



ECM

EGPF500A

SIGNAL WAVEFORM & DATA E645A02C



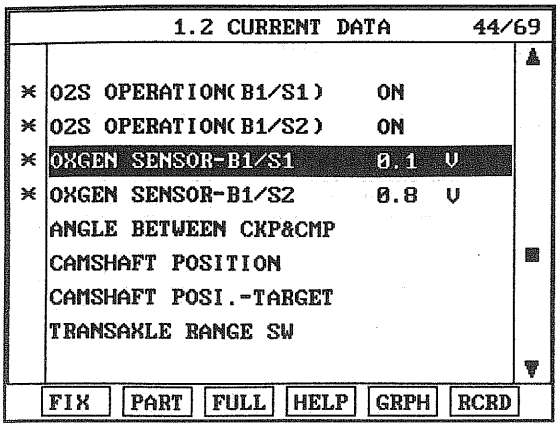
If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O2 sensor service data in the Hi-Scan (Pro) will display values 200mV or lower.
When you suddenly press on the accelerator pedal down, the voltage will reach 0.6 ~ 1.0 V.
When you let the engine idle again, the voltage will fluctuate between 200 mV or lower and 0.6 ~ 1.0 V.
In this case, the O2sensor can be determined as good.

LFJF421A

MONITOR SCANTOOL DATA E9E1D37F

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.

3. Monitor "HO2S(B1S1)" parameter on scantool.



EGPF500M

4. Is the "HO2S(B1S1)" parameter operating correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

NOTE

This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.

TERMINAL AND CONNECTOR INSPECTION EAB2057F

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION EA620E02

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.

3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Groud Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION E8298FB3

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. Measure resistance between terminal 2 of HO2S(B1/S1) and chassis ground.

Specification : Approx. below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3F6A665

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

YES

▶ Go to "Check HO2S(B1/S1) performance" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

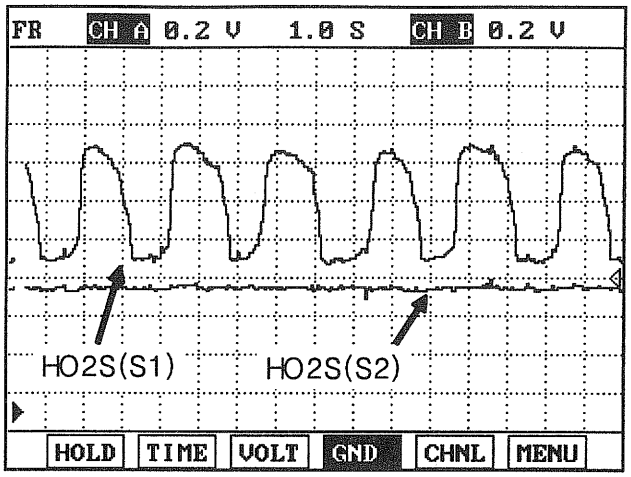
2. Check HO2S(B1/S1) performance.

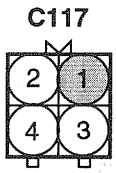
   1) IG "OFF".

   2) Connect probe to terminal 1 of HO2S(B1/S1) connector and select oscilloscope function with scantool.

   3) Warm up the engine to normal operating temperature.

   4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF003Z

   5) Is the measured signal waveform within specification?

   YES

   ▶ Go to "Check ECM" as follows.

   NO

   ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
   ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

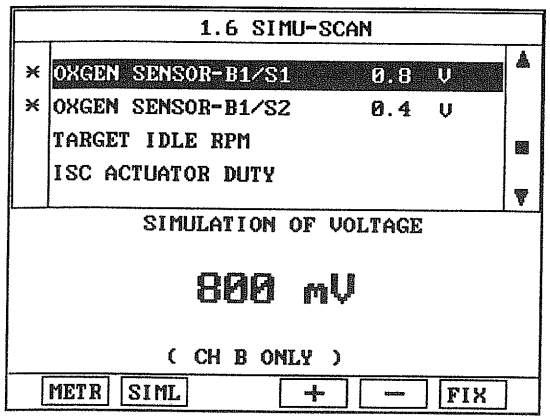
3. Check ECM.

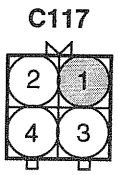
   1) IG "OFF" and disconnect B1S1 connector.

   2) Connect scantool and Key "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 1 of HO2S(B1/S1) signal connector.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF004A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0E8D26B

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0131 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E7AA482B

Refer to DTC P0130.

GENERAL DESCRIPTION E7940512

Refer to DTC P0130.

DTC DESCRIPTION EA9CE990

If the sensor output is below 0.06 V under enable conditions, ECM sets DTC P0131.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E4FB0F46

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, low	• Poor connection • Short to ground in signal circuit • B1S1 • ECM
General Enable Conditions		• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Case1	Enable Conditions	• B1S2 sensor voltage 〉 0.5V	
	Diagnostic Time	• 25 sec	
Case2	Enable Conditions	• Sensor in cold condition	
	Diagnostic Time	• 0.1 sec	
Case3	Threshold Value	• Sensor voltage 〈 0.04V	
MIL ON Condition		• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E3588038

Refer to DTC P0130.

SCHEMATIC DIAGRAM EA668DBC

Refer to DTC P0031.

SIGNAL WAVEFORM & DATA E553A524

Refer to DTC P0130.

MONITOR SCANTOOL DATA E8E1E118

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION E7C53F0C

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION E7145B69

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION ED468B62

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

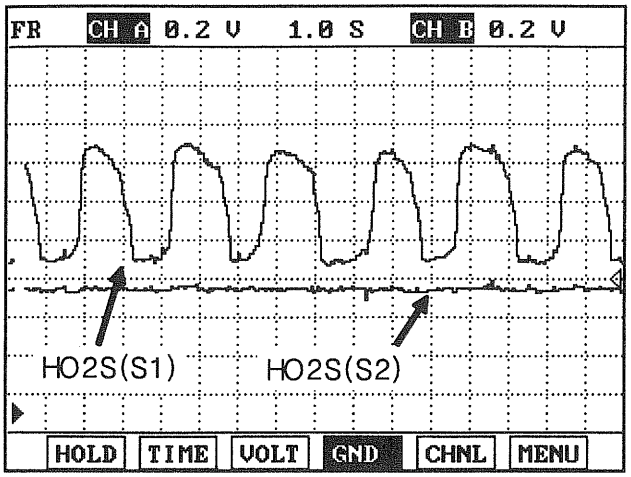
   YES

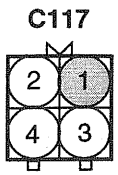
   ▶ Go to "Check HO2S(B1/S1) performance" as follows.

   NO

   ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
   ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.
2. Check HO2S(B1/S1) performance.
   1) IG "OFF".
   2) Connect probe to terminal 1 of HO2S(B1/S1) connector and select oscilloscope function with scantool.
   3) Warm up the engine to normal operating temperature.

4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF003Z

5) Is the measured signal waveform within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

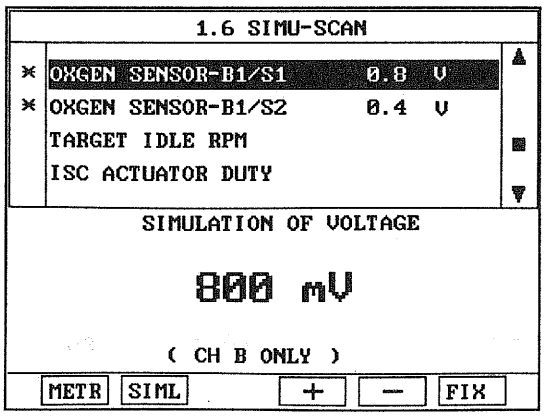
3. Check ECM.

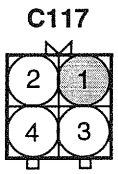
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of HO2S(B1/S1) signal connector.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF004A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4336BB5

Refer to DTC P0130.

DTC P0132 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E3A55999

Refer to DTC P0130.

GENERAL DESCRIPTION E6F31562

Refer to DTC P0130.

DTC DESCRIPTION E0C6A521

If the sensor output is over 1.08 V under enable conditions, ECM sets P0132.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION EE4C709A

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Short to battery in signal circuit • B1S1 • ECM
Enable Conditions	• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Threshold Value	• B1S1 sensor voltage > 1.5V	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 2 dirving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E198950B

Refer to DTC P0130.

SCHEMATIC DIAGRAM E0A626E9

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA EF1C5AFF

Refer to DTC P0130.

MONITOR SCANTOOL DATA E44DD055

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION EDE838C4

1. Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION E62F9E57

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E0BA59FD

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

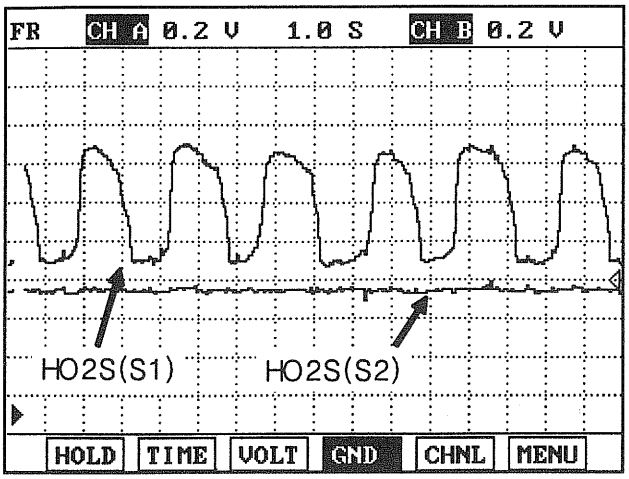
YES

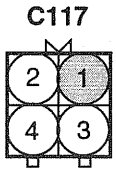
▶ Go to "Check HO2S(B1/S1) performance" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

2. Check HO2S(B1/S1) performance.
   1) IG "OFF".
   2) Connect probe to terminal 1 of HO2S(B1/S1) connector and select oscilloscope function with scantool.
   3) Warm up the engine to normal operating temperature.
   4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF003Z

5) Is the measured signal waveform within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

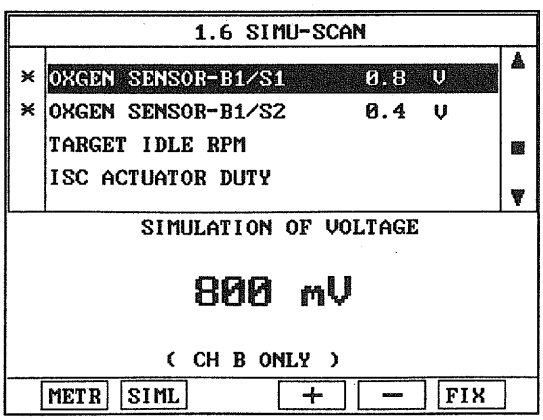
3. Check ECM.

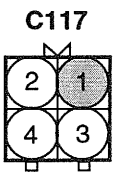
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of HO2S(B1/S1) signal connector.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF004A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9162877

Refer to DTC P0130.

DTC P0133 HO2S CIRCUIT SLOW RESPONSE (BANK 1 / SENSOR 1)

COMPONENT LOCATION E2185770

Refer to DTC P0130.

GENERAL DESCRIPTION E6BF00F0

Refer to DTC P0130.

DTC DESCRIPTION EB494316

If there is abnormal response rate of HO2S under enable conditions, ECM sets DTC P0133.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E6FA4315

Item	Detecting Condition	Possible Cause
DTC Strategy	• Response rate	• Poor connection • leak or clog in intake air system • Injector • Fuel pressure • B1S1 • ECM
Enable Conditions	• Engine speed 1800~3000rpm • Engine load 20~50% • Exhaust gas temperature (model) 〉 450℃	
Threshold Value	• Cycle period of B1S1 signal 〉 2.9 sec	
Diagnostic Time	• 12 cycle	
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EC9CB506

Refer to DTC P0130.

SCHEMATIC DIAGRAM EA38206A

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E73D87FA

Refer to DTC P0130.

MONITOR SCANTOOL DATA E8278670

Refer to DTC P0130.

SYSTEM INSPECTION E9291774

1. Check leakage or clog of air.

1) Check contamination, clog and installation of gasket
   - ▶ Any damage or installation of throttle body gasket.
   - ▶ Any damage or installation of gasket between intake manifold and surge tank.
   - ▶ Clog or contamination of intake manifold and injector by foreign materials
   - ▶ Contamination and open stuck between surge tank and PCSV by foreign materials
   - ▶ Any damage or contamination of HO2S(B1/S1) by foreign materials.

2) Has a problem been found?

YES

▶ Go to " Check Fuel Line" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check Fuel Line.

1) Check Clog, contamination and installation of Fuel Line as follows.
   - ▶ Connection for each connectors in Fuel Line.
   - ▶ Damage, interference and installation of vaccum hose connected to Fuel Line.
   - ▶ Bend, Leakage and squeeze of pipe in Fuel Line.

2) Has a problem been found?

YES

▶ Go to "Check Fuel Pressure" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

3. Check Fuel Pressure.

1) IG "OFF".

2) Disconnect fuel pump relay from junction box in passenger compartment.

3) Start engine and await until engine is off and then, IG "OFF".

4) Connect fuel pump relay again.

5) Connect fuel pressure gauge on the fuel filter with fuel pressure gauge adaptor.

6) Start engine again and measure fuel pressure.

Specification : Approx. 3.5 kg/cm²

7) Is the fuel pressue normal?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check any damage of fuel return hose or pipe.

▶ Check any stuck of the valve in the fuel pressure regulator.
▶ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EAEB5098

1. Check PCV.

   1) IG "OFF"

   2) Disconnect PCV.

   3) Check that PCV is properly operating.

   4) Is the PCV O.K?

   YES

   ▶ Go to "Check PCSV" as follows.

   NO

   ▶ Substitute with a known - good PCV and check for proper operation.
   ▶ If the problem is corrected, replace PCV and go to "Verification of Vehicle Repair" procedure.

2. Check the PCSV.

   1) Ignition "OFF".

   2) Disconnect PCSV and Vacuum Hose.

   3) Apply vacuum on PCSV with Hand Vacuum Gauge.

   4) Is the PCSV keeping the Vacuum?

   YES

   ▶ Go to "Check Injector" as below.

   NO

   ▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check Injector.

   1) Ignition "OFF"

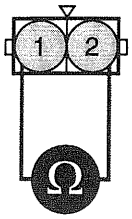
   2) Remove Injector.

   3) Check Leakage and clog on Injector.

   4) Measure resistance terminal 1 and 2 of Injector connector(Component side).

SPECIFICATION :

ITEM	Resistance [Ω]
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)



1. Injector Power
2. Injector control

EGPF002B

5) Is the measured resistance within specifications?

YES

▶ Go to "Check sensors related to Fuel Trim " as below.

NO

▶ Substitute with a known-good Injector and check for proper operation. If the problem is corrected, replace Injector and then go to "Verification of Vehicle Repair" procedure.

4. Check Sensors related to Fuel Trim.

1) Check the Input Voltage of Sensors related to Fuel Trim(MAPS, TPS, ECTS, PCSV, Injector, and etc) - Refer to Trouble Shooting Guide -

2) Are the sensors related to Fuel Trim O.K?

YES

▶ Go to "Check ECM" as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

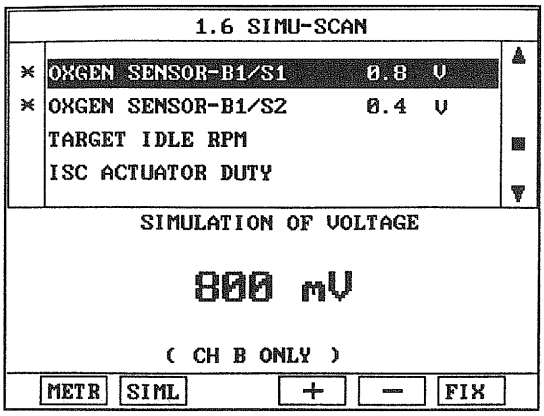
5. Check ECM.

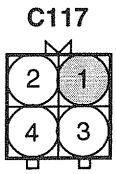
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of HO2S(B1S1) sensor signal connector.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF004A

5) Is the HO2S(B1/S1) signal value changed according to simulation voltage ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination,deterioration, or damage. Repair or replace as necessary and then go to "Verification of VehicleRepair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EF3BF86C

Refer to DTC P0130.

DTC P0134 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 1)

COMPONENT LOCATION E9073559

Refer to DTC P0130.

GENERAL DESCRIPTION E905520E

Refer to DTC P0130.

DTC DESCRIPTION E055E9CD

If the signal output satisfies the threshold value under enable conditions, ECM sets DTC P0134.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E0A85728

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, wiring interruption	• Poor connection • Open or short in signal circuit • B1S1 • ECM
General Enable Conditions		• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled	
Case1	Enable Conditions	• Time after fuel cut-off 〉 3.0s • B1S2 sensor voltage 〉 0.2V	
	Diagnostic Time	• 0.1 sec	
	Threshold Value	• Sensor Voltage > 0.2V	
Case2	Threshold Value	• Sensor voltage : 0.4~0.6V	
	Diagnostic Time	• 6 sec	
Case3	Enable Conditions	• Exhaust gas temperature (model) 〉 600℃	
	Threshold Value	• Internal resistance 〉 20 kΩ	
MIL ON Condition		• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E25683EA

Refer to DTC P0130.

SCHEMATIC DIAGRAM EBB3A401

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E59C4CC1

Refer to DTC P0130.

MONITOR SCANTOOL DATA E2E082E9

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION E9D0FAC5

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION E86CCDC2

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S1) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Groud Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION E488EE52

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. Measure resistance between terminal 2 of HO2S(B1/S1) and chassis ground.

Specification : Approx. below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE52CFA7

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

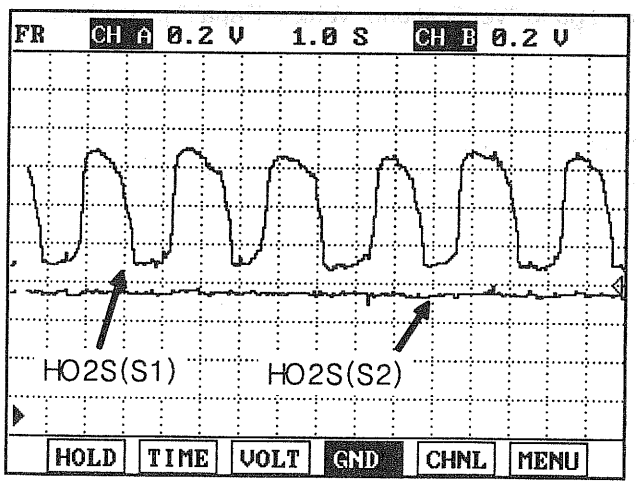
YES

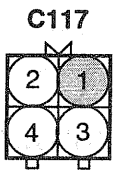
▶ Go to "Check HO2S(B1/S1) performance" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

2. Check HO2S(B1/S1) performance.
   1) IG "OFF".
   2) Connect probe to terminal 1 of HO2S(B1/S1) connector and select oscilloscope function with scantool.
   3) Warm up the engine to normal operating temperature.
   4) Measure signal waveform of HO2S(B1/S1) with scantool.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF003Z

   5) Is the measured signal waveform within specification?

YES

▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.

▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

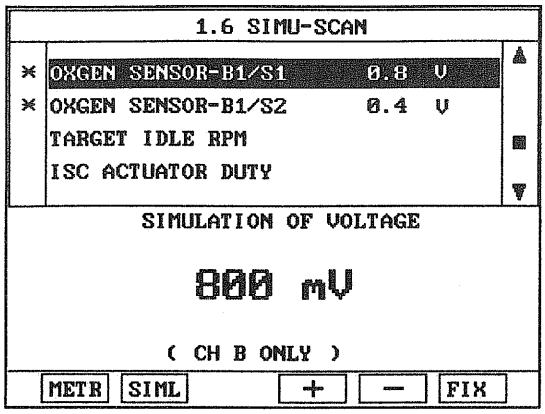
3. Check ECM.

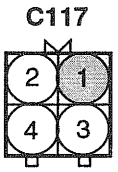
1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of HO2S(B1/S1) signal connector.





1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF004A

5) Does the signal value of HO2S(B1/S1) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E32FC1CD

Refer to DTC P0130.

DTC P0135 HO2S HEATER CIRCUIT (BANK 1 / SENSOR 1)

COMPONENT LOCATION E75B729B

Refer to DTC P0130.

GENERAL DESCRIPTION E3134BE8

Refer to DTC P0130.

DTC DESCRIPTION E5404A1F

If ECM detects that the internal resistance of heater is out of threshold value, ECM sets DTC P0135.

DTC DETECTING CONDITION E20614DB

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check heating condition	• Poor connection • Open or short to ground in control circuit • B1S1 • ECM
Enable Conditions	• Exhaust gas temperature (model) 450~530 ℃ • Battery voltage 10.7~15.6 V	
Threshold Value	• Internal resistance 〉 threshold f(exh. temp., heater power)	
Diagnostic Time		
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

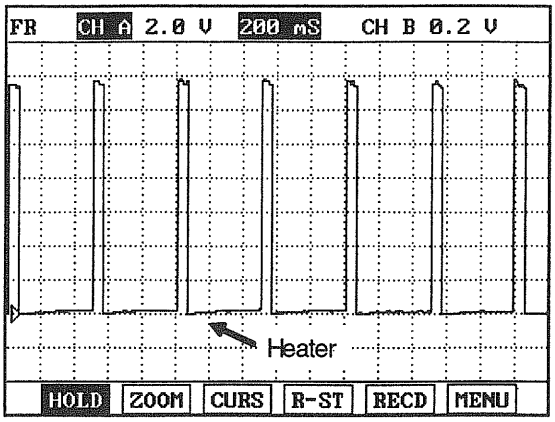
SPECIFICATION ED83D8AE

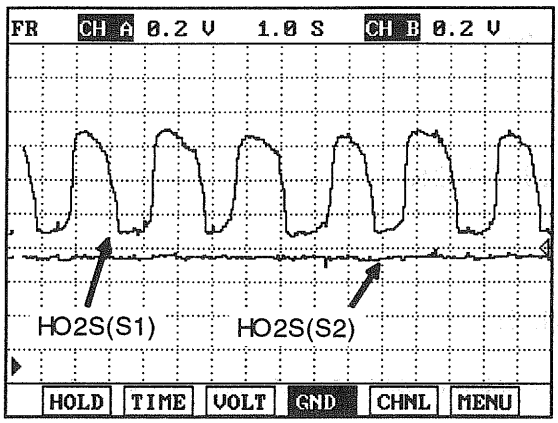
ITEM	Specification
Heater Resistance	Approx. 9.0Ω (20℃)

SCHEMATIC DIAGRAM E2D35198

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA EFB180B3



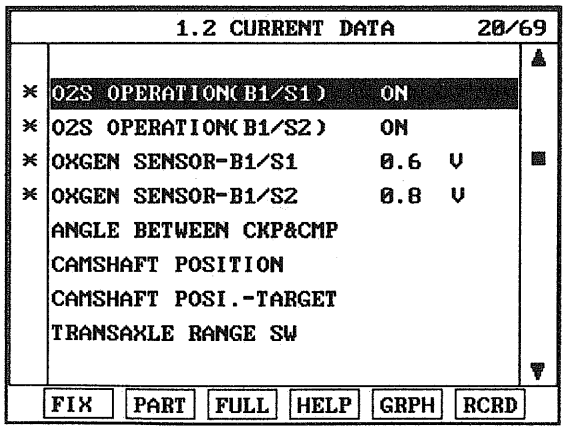


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed accelleration. The ECM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the ECM provides a ground circuit for activating the heater.

LFJF445A

MONITOR SCANTOOL DATA E4632E1E

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S1)" parameter on scantool.



EGPF500B

4. Is the "HO2S(B1S1)" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, ending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E81B5BE5

1. Refer to DTC P0130.

POWER CIRCUIT INSPECTION E7027EAB

1. IG "OFF".
2. Disconnect HO2S(B1S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 3 of HO2S (B1S1) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EE8F9801

1. IG "OFF".
2. Disconnect HO2S(B1S1) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(B1S1) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

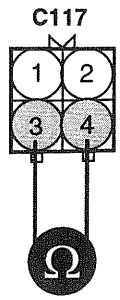
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC6F1BAB

1. Check Heater resistance.
   1) IG "OFF".
   2) Disconnect HO2S(B1S1) connector.
   3) Measure resistance bwteen terminal 3 and 4 of HO2S(B1S1) connector.(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance	Approx. 9.0Ω (20℃)



1. HO2S(S1) Signal
2. Sensor Ground
3. HO2S(S1) Heater Power
4. HO2S(S1) Heater Control

EGPF001C

4) Is the measured resistance within specification ?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

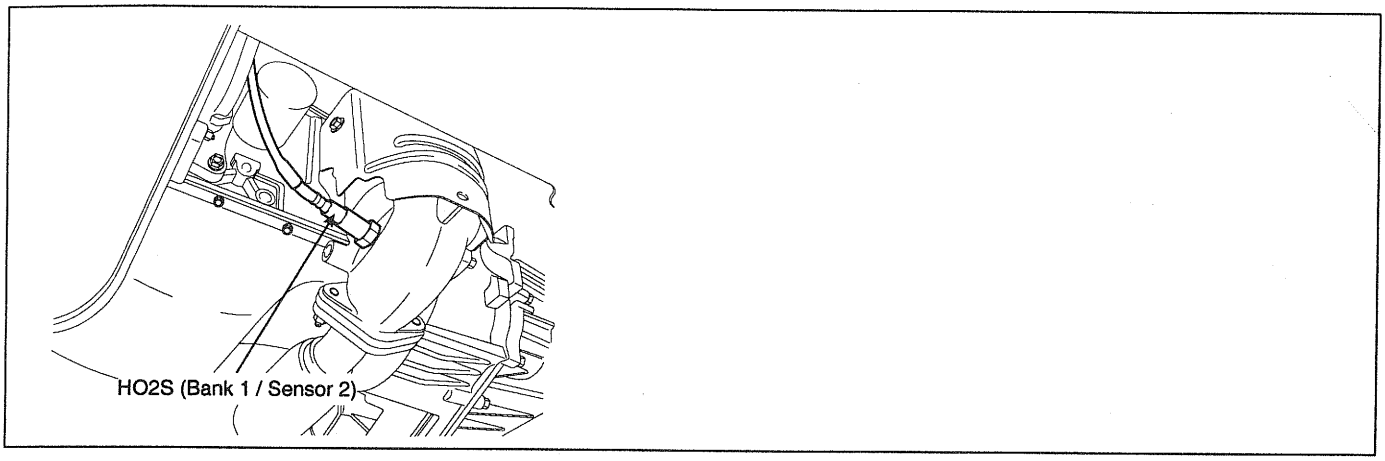
- ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E87B9BDC

Refer to DTC P0130.

DTC P0136 HO2S CIRCUIT (BANK 1/ SENSOR 2)

COMPONENT LOCATION EB257E45



EFPG800B

GENERAL DESCRIPTION E7286B96

HO2S(B1/S2) is in the rear side of Catalytic Converter to check the proper operation of catalyst. Oxygen density after the catalytic converter has to be within specific range (around 0.5V when there is no acceclation and deceleration.)If the oxygen density changes in accordance with HO2S(B1/S1), it means the poor performance of catalytic converter.

DTC DESCRIPTION EA647409

In case the sensor output is 0.4~0.52 V during 600sec or the internal resistance is over 40 kΩ under enable conditions, ECM sets DTC P0136.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION EA692912

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, wiring interruption	• Poor connection • Open or short in signal circuit • B1S2 • ECM
General Enable Conditions		• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃	
Case1	Threshold Value	• Sensor voltage : 0.4~0.52 V	
	Diagnostic Time	• 600 sec	
Case2	Enable Conditions	• Catalyst temperature (model) 〉 600 ℃	
	Threshold Value	• Internal resistance 〉 40 kΩ	
MIL ON Condition		• 3 driving cycle	

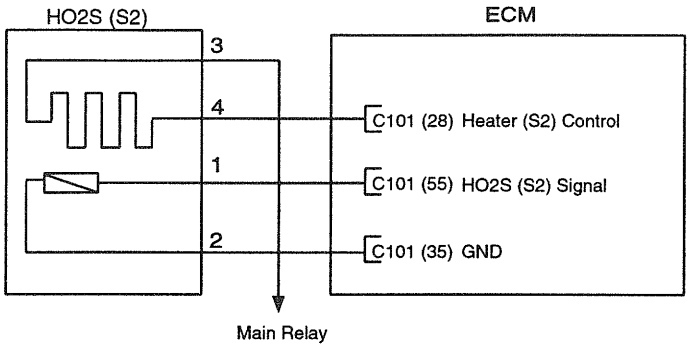
※ B1S2 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E004A76D

A/F Ratio	Output Voltage (V)
Rich	0.6 ~ 1.0V
Lean	0 ~ 0.4V

SCHEMATIC DIAGRAM E03D2D1A

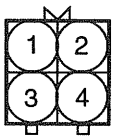
[CIRCUIT DIAGRAM]



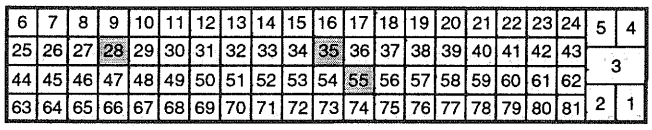
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (55)	HO2S (S2) Signal
2	ECM C101 (35)	Sensor Ground
3	Main Relay	Battery Voltage (B+)
4	ECM C101 (28)	Heater (S2) Control

[HARNESS CONNECTOR]



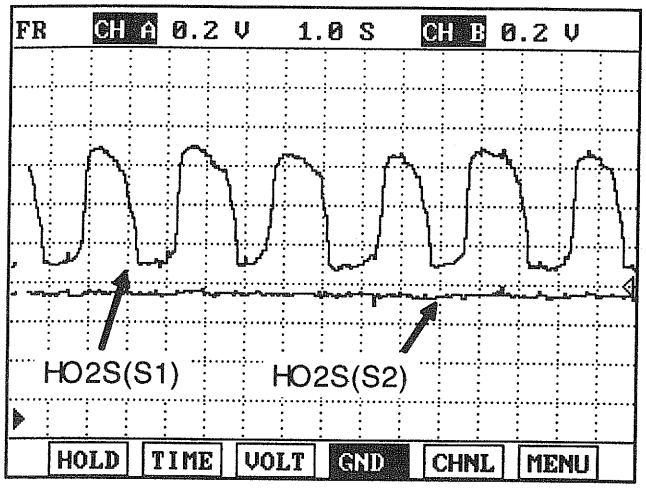
HO2S [S2] (C116)



ECM

EGPF500C

SIGNAL WAVEFORM & DATA EF5C7DD9

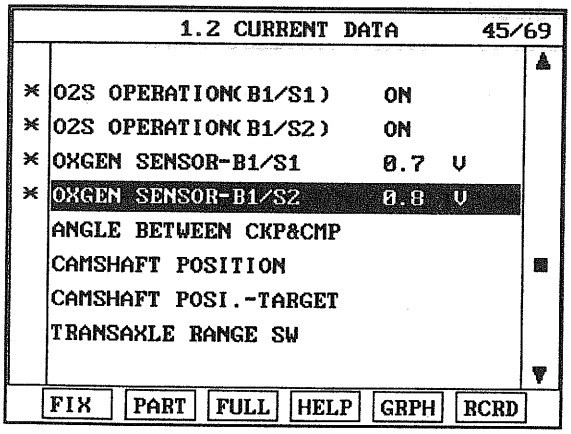


The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter.
This is the normal signal waveform of the rear HO2S at idle.

LFJF451A

MONITOR SCANTOOL DATA EAC91760

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool.



EGPF500N

4. Is the "HO2S(B1S2)" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

NOTE

This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.

TERMINAL AND CONNECTOR INSPECTION ED5FBD90

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to " Signal Circuit Inspection " procedure.

SIGNAL CIRCUIT INSPECTION E3776806

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Groud Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

GROUND CIRCUIT INSPECTION E1AAD200

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. Measure resistance between terminal 2 of HO2S(B1/S2) and chassis ground.

Specification : Approx. below 1Ω

4. Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E831F6BF

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

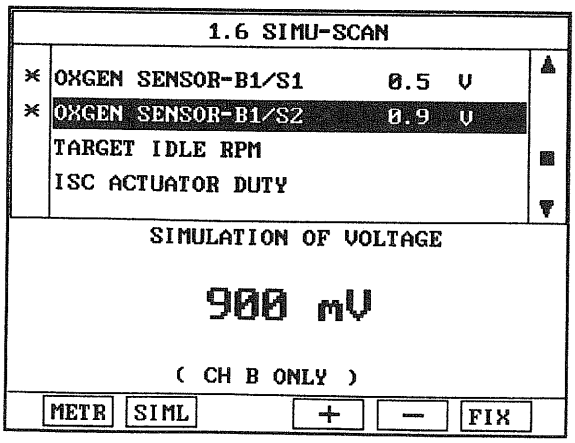
      YES

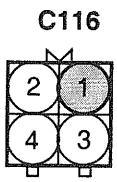
      ▶ Go to "Check ECM" as follows.

      NO

      ▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
      ▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect B1S2 connector.
   2) Connect scantool and Key "ON".
   3) Select simulation function on scantool.
   4) Simulate voltage at terminal 1 of HO2S(B1/S2) signal connector.





1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF500O

   5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

      YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4F5A961

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0137 HO2S CIRCUIT LOW VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION ECADBE66

Refer to DTC P0136.

GENERAL DESCRIPTION EFBD95A2

Refer to DTC P0136.

DTC DESCRIPTION EA9CE605

If the sensor output is below 0.06V under enable conditions, ECM sets DTC P0137.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION ED0337A0

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in signal circuit • B1S2 • ECM
Enable Conditions	• After enough heated • Battery voltage > 10.7 • Catalyst temperature (model) < 800℃	
Threshold Value	• B1S2 sensor voltage < 0.04V	
Diagnostic Time		
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EA2A38F8

Refer to DTC P0136.

SCHEMATIC DIAGRAM E4F8CCB0

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA E0EDE3C2

Refer to DTC P0136.

MONITOR SCANTOOL DATA EC5FCEE3

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION E7CFA1F7

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E463F780

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E63292C0

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

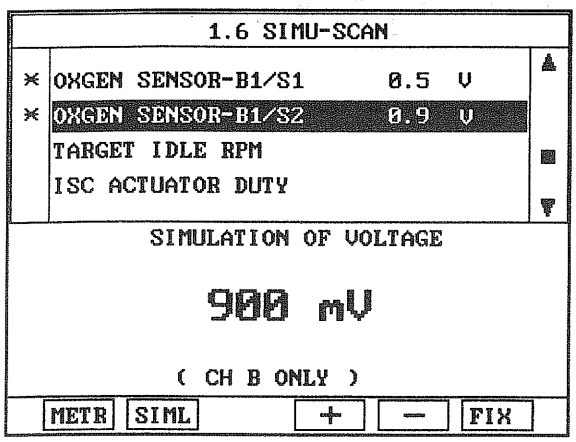
YES

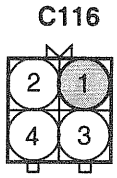
▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect B1S2 connector.
   2) Connect scantool and Key "ON".
   3) Select simulation function on scantool.
   4) Simulate voltage at terminal 1 of HO2S(B1/S2) signal connector.





1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF500O

5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9284634

Refer to DTC P0136.

DTC P0138 HO2S CIRCUIT HIGH VOLTAGE (BANK 1 / SENSOR 2)

COMPONENT LOCATION E3E1356E

Refer to DTC P0136.

GENERAL DESCRIPTION EE984028

Refer to DTC P0136.

DTC DESCRIPTION ED1B9468

If the sensor output is over 1.08V under enable conditions, ECM sets DTC P0138.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION ECDACD84

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Short to power in signal circuit • B1S2 • ECM
Enable Conditions	• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃	
Threshold Value	• B1S2 sensor voltage 〉 1.5 V	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E16730D8

Refer to DTC P0136.

SCHEMATIC DIAGRAM E2855999

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA EAF4432E

Refer to DTC P0136.

MONITOR SCANTOOL DATA E3FB5AE0

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION EF098DD7

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION EFA864B7

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION EE4DC9C4

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

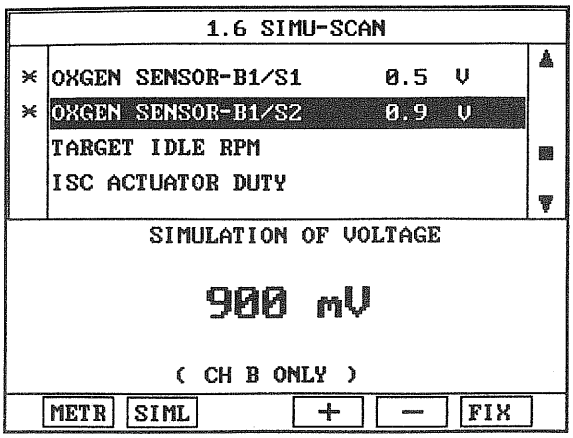
YES

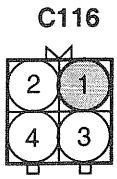
▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect B1S2 connector.
   2) Connect scantool and Key "ON".
   3) Select simulation function on scantool.
   4) Simulate voltage at terminal 1 of HO2S(B1/S2) signal connector.





1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF500O

5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3EC89B7

Refer to DTC P0136.

DTC P0139 HO2S CIRCUIT SLOW RESPONSE (BANK 1 / SENSOR 2)

COMPONENT LOCATION E2700E1C

Refer to DTC P0136.

GENERAL DESCRIPTION E5A641FF

Refer to DTC P0136.

DTC DESCRIPTION EFFDBFEC

If the sensor output is over 0.15 V under enable conditions, ECM sets DTC P0139.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E6D31DC9

Item	Detecting Condition	Possible Cause
DTC Strategy	• Response rate	• Poor connection • leak or clog in intake air system • Injector • Fuel pressure • B1S2 • ECM
Enable Conditions	• Time after fuel cut-off 〉 5 s • Integrated air mass after fuel cut-off 〉 15 g • Time after dew point end detected 〉 30 s	
Threshold Value	• B1S2 sensor voltage 〉 0.15 V	
Diagnostic Time	• 0.2 sec	
MIL	• ON	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION EFFF51D2

Refer to DTC P0136.

SCHEMATIC DIAGRAM ECB90A6D

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA EE420E98

Refer to DTC P0136.

MONITOR SCANTOOL DATA EA668C23

Refer to DTC P0136.

SYSTEM INSPECTION E6DBEA5C

1. Check leakage or clog of air.

1) Check contamination, clog and installation of gasket
   - ▶ Any damage or installation of throttle body gasket.
   - ▶ Any damage or installation of gasket between intake manifold and surge tank.
   - ▶ Clog or contamination of intake manifold and injector by foreign materials
   - ▶ Contamination and open stuck between surge tank and PCSV by foreign materials
   - ▶ Any damage or contamination of HO2S(B1/S2) by foreign materials.

2) Has a problem been found?

YES

▶ Go to " Check Fuel Line" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

2. Check Fuel Line.

1) Check Clog, contamination and installation of Fuel Line as follows.
   - ▶ Connection for each connectors in Fuel Line.
   - ▶ Damage, interference and installation of vaccum hose connected to Fuel Line.
   - ▶ Bend, Leakage and squeeze of pipe in Fuel Line.

2) Has a problem been found?

YES

▶ Go to "Check Fuel Pressure" as follows.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

3. Check Fuel Pressure.

1) IG "OFF".

2) Disconnect fuel pump relay from junction box in passenger compartment.

3) Start engine and await until engine is off and then, IG "OFF".

4) Connect fuel pump relay again.

5) Connect fuel pressure gauge on the fuel filter with fuel pressure gauge adaptor.

6) Start engine again and measure fuel pressure.

Specification : Approx. 3.5 kg/cm²

7) Is the fuel pressue normal?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check any damage of fuel return hose or pipe.

▶ Check any stuck of the valve in the fuel pressure regulator.
▶ Repair or replace as necessary and then, go to 'Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E32E5F00

1. Check PCV.

   1) IG "OFF"

   2) Disconnect PCV.

   3) Check that PCV is properly operating.

   4) Is the PCV O.K?

   YES

   ▶ Go to "Check PCSV" as follows.

   NO

   ▶ Substitute with a known - good PCV and check for proper operation.
   ▶ If the problem is corrected, replace PCV and go to "Verification of Vehicle Repair" procedure.

2. Check the PCSV.

   1) Ignition "OFF".

   2) Disconnect PCSV and Vacuum Hose.

   3) Apply vacuum on PCSV with Hand Vacuum Gauge.

   4) Is the PCSV keeping the Vacuum?

   YES

   ▶ Go to "Check Injector" as below.

   NO

   ▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure.

3. Check Injector.

   1) Ignition "OFF"

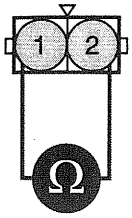
   2) Remove Injector.

   3) Check Leakage and clog on Injector.

   4) Measure resistance terminal 1 and 2 of Injector connector(Component side).

SPECIFICATION :

ITEM	Specification
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)



1. Injector Power
2. Injector control

EGPF002B

5) Is the measured resistance within specifications?

YES

▶ Go to "Check sensors related to Fuel Trim " as below.

NO

▶ Substitute with a known-good Injector and check for proper operation. If the problem is corrected, replace Injector and then go to "Verification of Vehicle Repair" procedure.

4. Check Sensors related to Fuel Trim.

1) Check the Input Voltage of Sensors related to Fuel Trim(MAPS, TPS, ECTS, PCSV, Injector, and etc) - Refer to Trouble Shooting Guide -

2) Are the sensors related to Fuel Trim O.K?

YES

▶ Go to "Check ECM" as below.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

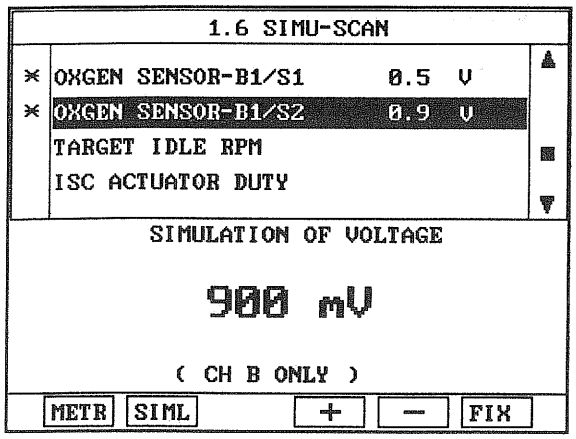
5. Check ECM.

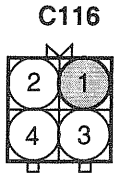
1) IG "OFF" and disconnect B1S2 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 1 of HO2S(B1S2) sensor signal connector.





1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF500O

5) Is the HO2S(B1/S2) signal value changed according to simulation voltage ?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination,deterioration, or damage. Repair or replace as necessary and then go to "Verification of VehicleRepair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFDF10DC

Refer to DTC P0136.

DTC P0140 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 1 / SENSOR 2)

COMPONENT LOCATION ED06E614

Refer to DTC P0136.

GENERAL DESCRIPTION E655A299

Refer to DTC P0136.

DTC DESCRIPTION E5D9A7B6

If there is not any signal activity, ECM sets DTC P0140.
(This DTC might be caused by the malfunction of Heater circuit, so, check the heater circuit first.)

DTC DETECTING CONDITION E999A7C6

Item	Detecting Condition	Possible Cause
DTC Strategy	• No signal activity	• Poor connection • Open or short in signal circuit • B1S2 • ECM
Enable Conditions	• Time after dew point is reached > 10 sec	
Threshold Value	• Signal voltage changes more than 2V after HO2S heater operation stops > 4 times	
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E6EB6494

Refer to DTC P0136.

SCHEMATIC DIAGRAM EE2EF4ED

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA E21D2572

Refer to DTC P0136.

MONITOR SCANTOOL DATA E6207306

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION EC72125E

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E8053293

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E95E17D0

1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S2) connector.
   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

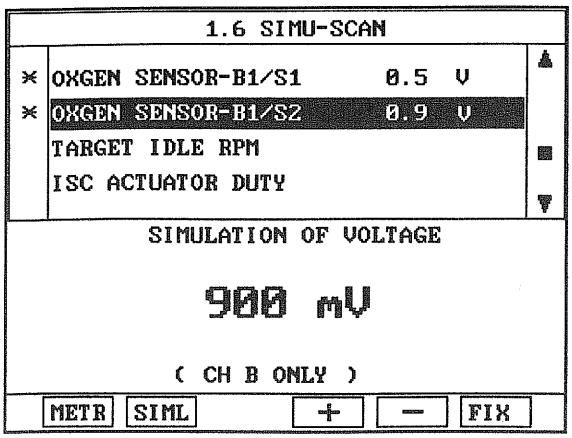
YES

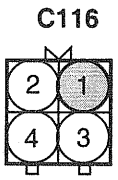
▶ Go to "Check ECM" as follows.

NO

▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

2. Check ECM.
   1) IG "OFF" and disconnect B1S2 connector.
   2) Connect scantool and Key "ON".
   3) Select simulation function on scantool.
   4) Simulate voltage at terminal 1 of HO2S(B1/S2) signal connector.





1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF500O

5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE45F8AA

Refer to DTC P0136.

DTC P0141 HO2S HEATER CIRCUIT (BANK 1 / SENSOR 2)

COMPONENT LOCATION EB2BFFD3

Refer to DTC P0136.

GENERAL DESCRIPTION EDC7C05D

Refer to DTC P0136.

DTC DESCRIPTION E095B39E

If the internal resistance of heater is over the threshold value under enable conditins, ECM sets DTC P0141.

DTC DETECTING CONDITION E864AE39

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check heating condition	• Poor connection • Open or short to ground in signal circuit • B1S2 • ECM
Enable Conditions	• Catalyst temperature (model) 450~680℃ • Battery voltage 10.7~15.6V	
Threshold Value	• Internal resistance 〉 threshold f (cat. temp., heater power)	
Diagnostic Time		
MIL ON Condition	• 3 driving cycle	

※ B1S2 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E2C1CFC5

ITEM	Specification
Heater Resistance	Approx. 9.0 (20℃)

SCHEMATIC DIAGRAM E7B3DFEB

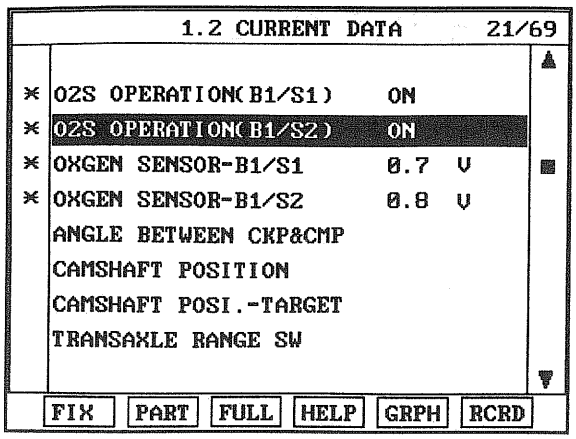
Refer to DTC P0136.

SIGNAL WAVEFORM & DATA EC486315

Refer to DTC P0136.

MONITOR SCANTOOL DATA E7FB3ACB

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "HO2S(B1S2)" parameter on scantool.



EGPF500D

4. Is the "HO2S(B1S2)" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION ECB3D0B1

Refer to DTC P0136.

POWER CIRCUIT INSPECTION EE1CA0A0

1. IG "OFF".
2. Disconnect HO2S(B1S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 3 of HO2S (B1S2) harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION ED07E1AD

1. IG "OFF".
2. Disconnect HO2S(B1S2) connector.
3. IG "ON" & ENG "OFF"
4. Measure voltage between terminal 4 of HO2S(B1S2) harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

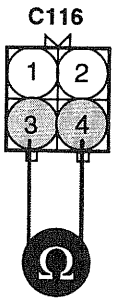
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ECA6F6A6

1. Check Heater resistance.
   1) IG "OFF".
   2) Disconnect HO2S(B1S2) connector.
   3) Measure resistance bwteen terminal 3 and 4 of HO2S(B1S2) connector.(Component Side)

SPECIFICATION :

ITEM	Specification
Heater Resistance	Approx. 9.0 (20℃)



1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF002H

   4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.

▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good HO2S and check for proper operation.
▶ If the problem is corrected, replace HO2S and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3113F2E

Refer to DTC P0136.

DTC P0171 SYSTEM TOO LEAN (BANK 1)

GENERAL DESCRIPTION EE502814

The catalyst' s efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor' s signal trace begins to match the front oxygen sensor' s signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2 O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION E1EF8406

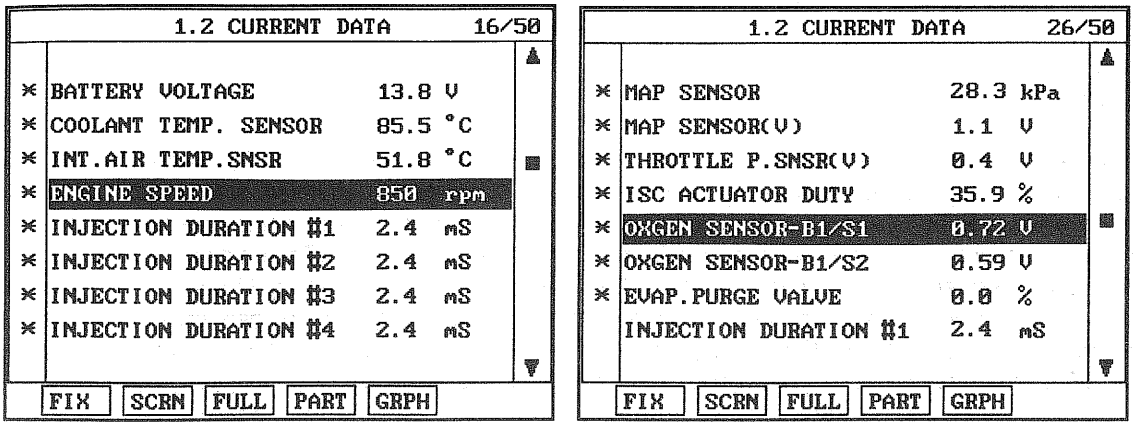
If the correction value of air-fuel ratio is higher than the threshold value, ECM sets DTC P0171.

DTC DETECTING CONDITION E5F16C40

Item		Detecting Condition	Possible Cause
DTC Strategy		• Long-term fuel trim limit	• Poor connection • Related sensor • Intake air system • Fuel pressure • ECM
General Enable Conditions		• Coolant temperature 〉 60℃ • Throttle angle 〈 70℃ • Closed loop control enabled • No transient control phase • No canister purge phase	
Case1	Enable Conditions	• Engine load : 30~70% • Air mass : 32~900 kg/h	
	Threshold Value	• Multiplicative value (The correction during driving) 〉 1.23	
	Diagnostic Time	• 25 sec	
Case2	Enable Conditions	• Engine speed ≤ 1040 rpm • Air mass ≤ 16 kg/h	
	Threshold Value	• Additive value (The correction during idling) > 7.5 %	
	Diagnostic Time	• 20 sec	
MIL ON Condition		• 3 driving cycle	

MONITOR SCANTOOL DATA EAB6AC9D

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Parameters related to air/fuel ratio(HO2S, MAF, MAP, TPS, ECTS, PCSV, Injector, etc)" on the scantool.



EGPF500P

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION EC6ADA0B

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "System inspection" procedure.

SYSTEM INSPECTION E8D67799

1. Air leakage check.
   1) Check "Air intake system"
      ▶ Check looseness, deterioration or contamination on throttle body and gasket.
      ▶ Check contamination, damage or crack on intake manifold, ISCA and injectors.
   2) Is there any leakage?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure

NO

▶ Go to "Fuel line check" procedure.

2. Fuel line check.

1) Check "Fuel line system"
▶ Check looseness of connectors on fuel line.
▶ Check looseness, damage, or interference of vacuum hose on fuel line.
▶ Check damage, leakage or bending on fuel line pipe.

2) Is fuel line normal?

YES

▶ Go to "Fuel line pressure check" procedure.

NO

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

3. Fuel line pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

Specification : Approx. 3.5kg/cm²

7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check clogging on the fuel filter.
▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EB74EBAB

1. PCV(Positive Crankcase Ventilation) valve check.

1) Key "OFF".

2) Disconnect PCV valve.

3) Check the movement of plunger by putting in and out a thin stick.

4) Is the movement of plunger normal?

YES

▶ Go to "PCSV check" procedure.

NO

▶ Substitute with a known - good PCV valve and check for proper operation.
▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. PCSV check.

1) Key "OFF".

2) Disconnect PCSV and vacuum hose.

3) Apply a vacuum by a hand vacuum gauge on PCSV.

4) Does PCSV keep the vacuum condition normally?

YES

▶ Go to "Injector check" procedure.

NO

▶ Substitute with a known - good PCSV and check for proper operation.
▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

3. Injector check.

1) Key "OFF".

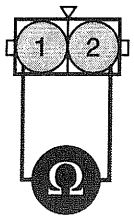
2) Disconnect injectors.

3) Check clog on injectors.

4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

ITEM	Specification
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)



1. Injector Power
2. Injector control

EGPF002B

5) Is the measured resistance within specifications?

YES

▶ Go to "Sensors related to air/fuel ratio check" procedure.

NO

▶ Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

4. Sensors related to air/fuel ratio check.

1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

2) Are those sensors normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECCAFED4

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0172 SYSTEM TOO RICH (BANK 1)

GENERAL DESCRIPTION EACC0B79

Refer to DTC P0171.

DTC DESCRIPTION E96FF732

If the correction value of air-fuel ratio is lower than the threshold value, ECM sets DTC P0172.

DTC DETECTING CONDITION E64B8529

Item		Detecting Condition	Possible Cause
DTC Strategy		• Long-term fuel trim limit	• Poor connection • Related sensor • Intake air system • Fuel pressure • ECM
General Enable Conditions		• Coolant temperature 〉 60℃ • Throttle angle 〈 70% • Closed loop control enabled • No transient control phase • No canister purge phase	
Case1	Enable Conditions	• Engine load : 37~70 % • Air mass : 32~900 kg/h	
	Threshold Value	• multiplicative value (The correction during driving) 〈 0.77	
	Diagnostic Time	• 25 sec	
Case2	Enable Conditions	• Engine speed ≤ 1040 rpm • Air mass ≤ 16 kg/h	
	Threshold Value	• additive value (The correction during idling) 〈 -7.5%	
	Diagnostic Time	• 20 sec	
MIL ON Condition		• 3 driving cycle	

MONITOR SCANTOOL DATA E56FA50D

Refer to DTC P0171.

TERMINAL AND CONNECTOR INSPECTION E7D5E224

Refer to DTC P0171.

SYSTEM INSPECTION EF4CED5B

1. Air clog check

   1) Check "Air intake system"
      ▶ Check clog of air-cleaner.
      ▶ Check deterioration or contamination on throttle body and gasket.
      ▶ Check contamination, damage, stuck or clog on intake manifold, PCSV, ISCA and injectors.

2) Is there any problem?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure

NO

▶ Go to "Fuel pressure check" procedure

2. Fuel pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

Specification : Approx. 3.5kg/cm²

7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EAE53945

1. PCV(Positive Crankcase Ventilation) valve check.

1) Key "OFF".

2) Disconnect PCV valve.

3) Check the movement of plunger by putting in and out a thin stick.

4) Is the movement of plunger normal?

YES

▶ Go to "PCSV check" procedure.

NO

▶ Substitute with a known - good PCV valve and check for proper operation.
▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. PCSV check.

   1) Key "OFF".

   2) Disconnect PCSV and vacuum hose.

   3) Apply a vacuum by a hand vacuum gauge on PCSV.

   4) Does PCSV keep the vacuum condition normally?

   YES

   ▶ Go to "Injector check" procedure.

   NO

   ▶ Substitute with a known - good PCSV and check for proper operation.
   ▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

3. Injector check.

   1) Key "OFF".

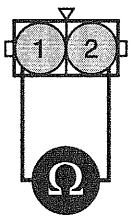
   2) Disconnect injectors.

   3) Check clog on injectors.

   4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

ITEM	Specification
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)



1. Injector Power
2. Injector control

EGPF002B

   5) Is the measured resistance within specifications?

   YES

   ▶ Go to "Sensors related to air/fuel ratio check" procedure.

   NO

   ▶ Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

4. Sensors related to air/fuel ratio check.

1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

2) Are those sensors normal?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

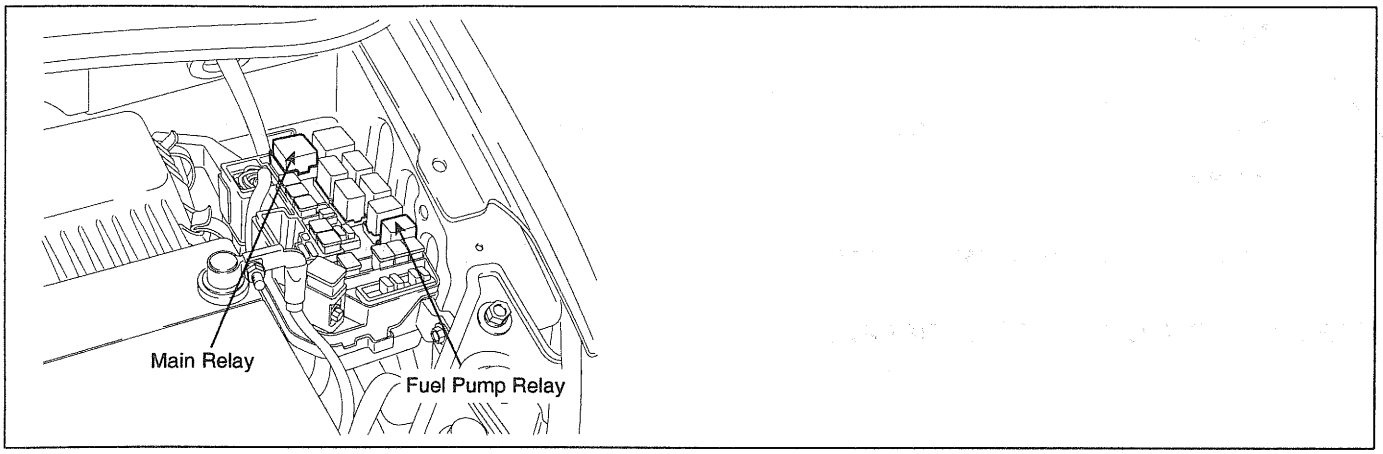
Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E595AE92

Refer to DTC P0171.

DTC P0230 FUEL PUMP PRIMARY CIRCUIT

COMPONENT LOCATION EAC3A670



EFPG800C

GENERAL DESCRIPTION ED58D9EA

The ECM provides ground to one side of the coil in the fuel pump relay to control the fuel pump relay. The other side of the fuel pump relay coil is connected to fuel pump relay, which activates when the ignition switch is ON. The ECM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the ECM energizes the fuel pump relay, which sends power to the fuel pump.

DTC DESCRIPTION EE143728

If there is Open in fuel pump circuit, ECM sets DTC P0230.

DTC DETECTING CONDITION ECBBDF29

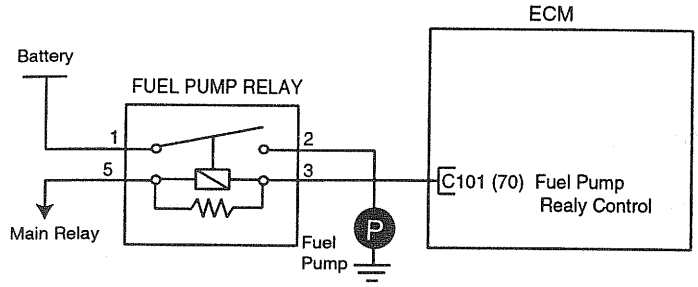
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, open	• Poor connection • Open or short to ground in power circuit • Open in control circuit • Fuel pump relay • PCM
Enable Conditions		
Threshold Value	• Open	
Diagnostic Time	• Continuous	
MIL ON Condition	• DTC only	

SPECIFICATION E5C2848C

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM E9DFEA97

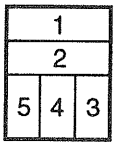
[CIRCUIT DIAGRAM]



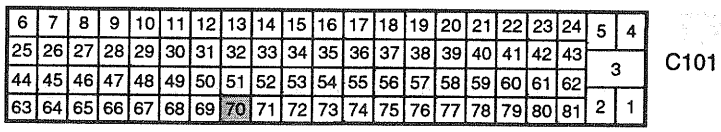
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery Voltage (B+)
2	Fuel Pump	Fuel Pump Power supply
3	ECM C101 (70)	Fuel Pump Relay Control
4	-	-
5	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



FUEL PUMP RELAY (E45)

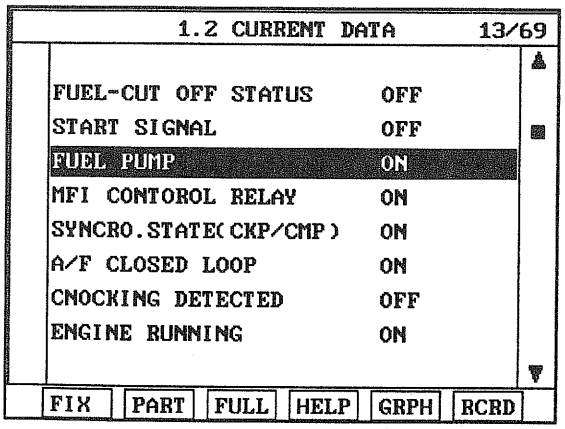


ECM

EGPF500Q

MONITOR SCANTOOL DATA EB628B0F

1. Connect scantool to Data Link Connector(DLC).
2. Engine start.
3. Monitor the "Fuel pump relay" parameters on the scantool.



LFJF499A

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E5B1C1F1

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Fuel pump relay circuit inspection" procedure.

POWER CIRCUIT INSPECTION EE061C3A

1. Key "OFF".
2. Disconnect fuel pump relay.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 1 and 5 of fuel pump relay harness connector.

Specification : B+

5. Is the measured voltage within specifications?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Check "SNSR 10A" fuse between fuel pump relay and main relay.
▶ Check "ECU A 30A" or F/PUMP 15A fuse between fuel pump relay and battery.
▶ Repair Open or Short in power circuit, and go to "Verification of vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E13E4E67

1. Key "OFF".
2. Disconnect fuel pump relay.
3. Key "ON" & ENG "OFF".

4. Measure the voltage between terminal 3 of fuel pump relay harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

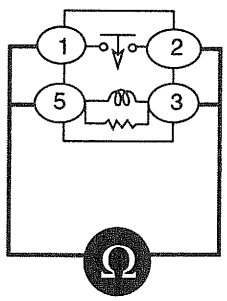
▶ Repair Open in control circuit, and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E59CECA7

1. Fuel pump relay check.
   1) Key "OFF".
   2) Disconnect fuel pump relay.
   3) Measure the resistance between terminal 1 and 2 of fuel pump relay component side.
   4) Measure the resistance between terminal 3 and 5 of fuel pump relay component side.

SPECIFICATION :

Terminal	Power Approval
1 ~ 2	NO
3 ~ 5	YES (70Ω ~ 120Ω)



EFPF038A

   5) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good Fuel pump relay and check for proper operation.
- ▶ If the problem is corrected, replace Fuel pump relay and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4AE8505

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

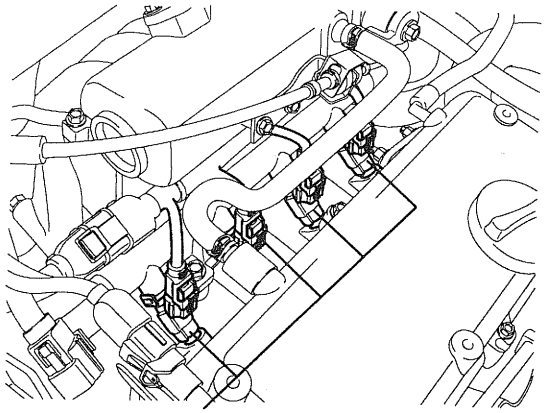
- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0261 CYLINDER 1-INJECTOR CIRCUIT LOW
DTC P0264 CYLINDER 2-INJECTOR CIRCUIT LOW
DTC P0267 CYLINDER 3-INJECTOR CIRCUIT LOW
DTC P0270 CYLINDER 4-INJECTOR CIRCUIT LOW

COMPONENT LOCATION E9AB8E1D



EFPG800D

GENERAL DESCRIPTION EF94F656

Electronically controlled fuel injector is a solenoid valve which supplies exactly calculated amount of fuel to engine for optimum conbustion under various engine load and speed. To meet air-fuel ratio required in system, ECM regulates fuel injection quantity as controlling injector solenoid operating duration referring air flow to cylinders and output signals from HO2S. For this precise control, quick response of solenoid is required and for perfect combustion, injection characteristic is important.

DTC DESCRIPTION EE4DD6A9

If there is Short to ground in injector #1/2/3/4 circuit, ECM sets DTC P0261/P0264/P0267/P0270.

DTC DETECTING CONDITION E2450D50

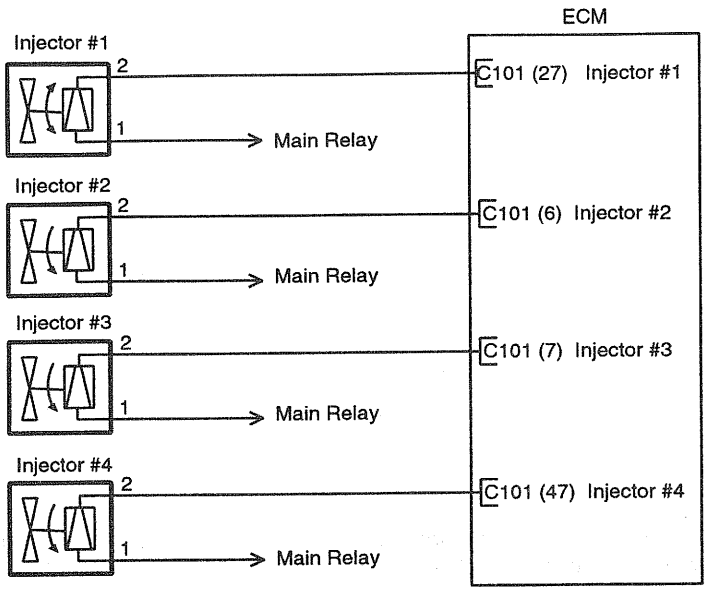
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low	• Poor connection • Short to ground in control circuit • Open in power circuit • Injector • ECM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Continuous	
MIL ON Condition	• 5 sec	

SPECIFICATION E2A2B15E

Item	Specification
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)

SCHEMATIC DIAGRAM EB8D9BAF

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C101 (27)	Injector #1 Control

Injector #2

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C101 (6)	Injector #2 Control

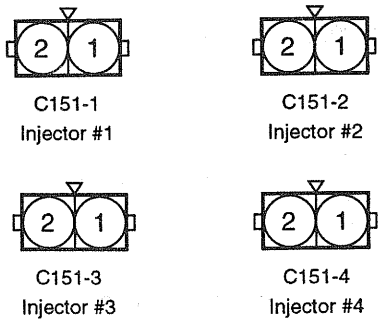
Injector #3

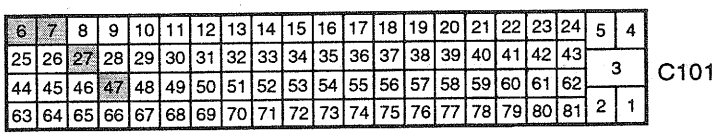
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C101 (7)	Injector #3 Control

Injector #4

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C101 (47)	Injector #4 Control

[HARNESS CONNECTORS]

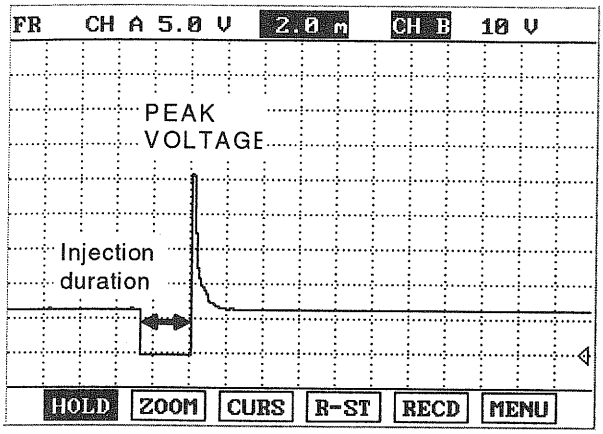




ECM

EGPF500R

SIGNAL WAVEFORM & DATA E51A9629

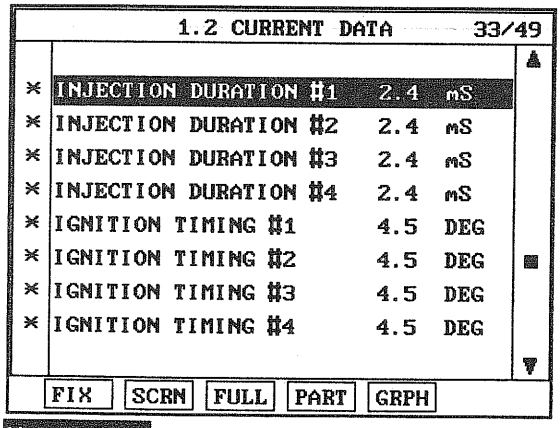


When the ECM energizes the injector by grounding the control circuit, the circuit voltage should below (theoretically 0V) and the fuel is iniected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

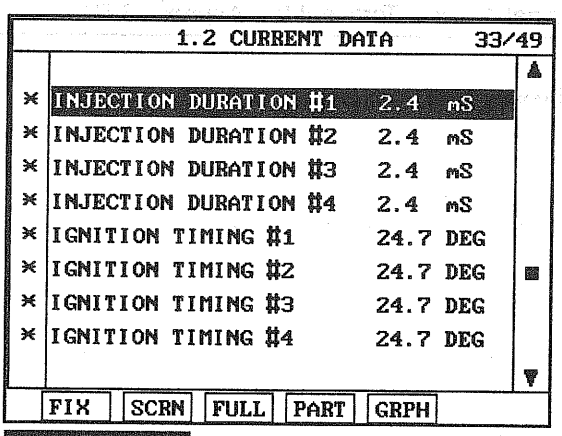
LFJF479A

MONITOR SCANTOOL DATA E0507A5A

1. Connect scantool to DLC (Data Link Cable).
2. Warm up the engine to normal operating temperature.
3. Monitor "injector" parameter on scantool.



Normal State



#I disconnected

EGPF500S

4. Is the "Injector" parameter displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, ending, corrosion, contamination, deterioration, or damage. Repair or replace asnecessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E67694D6

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Circuit Inspection " procedure.

CIRCUIT INSPECTION E6FB205A

1. IG "OFF".
2. Disconnect injector connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of injector harness connector and chassis ground.
   Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Terminal 1 : B+, Terminal 2 : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

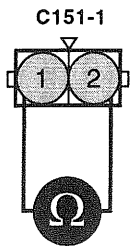
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED71B2FC

1. Check injecotor resistance.
   1) IG "OFF".
   2) Disconnect injector connector.
   3) Measure resistance between terminal 1 and 2 of injector connector.(Component Side)

SPECIFICATION :

Item	Specification
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)



1. Injector Power
2. Injector control

EGPF002J

4) Is the measured resistance within specification?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good injector and check for proper operation.
- If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE553178

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

- Go to the applicable troubleshooting procedure.

NO

- System is performing to specification at this time.

DTC P0262 CYLINDER 1-INJECTOR CIRCUIT HIGH
DTC P0265 CYLINDER 2-INJECTOR CIRCUIT HIGH
DTC P0268 CYLINDER 3-INJECTOR CIRCUIT HIGH
DTC P0271 CYLINDER 4-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION EB5E1546

Refer to DTC P0261.

GENERAL DESCRIPTION EBB5891E

Refer to DTC P0261.

DTC DESCRIPTION E8365B72

If there is Short to battery in injector #1/2/3/4 circuit, ECM sets DTC P0262/P0265/P0268/P0271.

DTC DETECTING CONDITION E8E50B95

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high	• Poor connection • Short to power in control circuit • Injector • ECM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Continuouss	
MIL ON Condition	• 5 sec	

SPECIFICATION E6AD214E

Refer to DTC P0261.

SCHEMATIC DIAGRAM E29E48F6

Refer to DTC P0261.

SIGNAL WAVEFORM & DATA E2743E31

Refer to DTC P0261.

MONITOR SCANTOOL DATA E40B7E55

Refer to DTC P0261.

TERMINAL AND CONNECTOR INSPECTION E0F7E78E

Refer to DTC P0261.

CONTROL CIRCUIT INSPECTION E10A3059

1. IG "OFF".
2. Disconnect injector connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

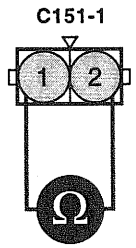
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E40BF849

1. Check injecotor resistance.
   1) IG "OFF".
   2) Disconnect injector connector.
   3) Measure resistance between terminal 1 and 2 of injector connector.(Component Side)

SPECIFICATION :

Item	Specification
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)



1. Injector Power
2. Injector control

EGPF002J

   4) Is the measured resistance within specification?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

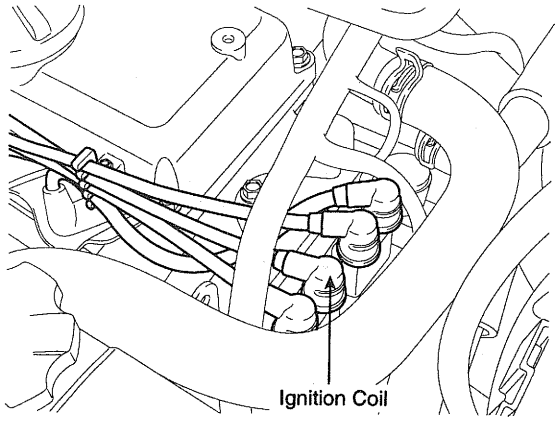
- Substitute with a known - good injector and check for proper operation.
- If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8E42609

Refer to DTC P0261.

DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED
DTC P0301 CYLINDER 1-MISFIRE DETECTED
DTC P0302 CYLINDER 2-MISFIRE DETECTED
DTC P0303 CYLINDER 3-MISFIRE DETECTED
DTC P0304 CYLINDER 4-MISFIRE DETECTED

COMPONENT LOCATION EEF736F3



EFPG800G

GENERAL DESCRIPTION E735A87F

Misfires can be caused by lack of combustion in a cylinder due to absence of spark, poor fuel metering, poor compression, or many other causes. Even a small number of misfires may result in excessive exhaust emissions due to the unburned mixture. Increased misfire rates cause damage to the catalytic converter. The ECM monitors the crankshaft speed variation to determine if any misfiring generated. The ECM identifies the specific cylinder in which the misfire has occurred and counts individual misfire events by monitoring changes in the crankshaft rotation for each cylinder. A random misfire indicates two or more cylinders are misfiring.

DTC DESCRIPTION E8F87E7F

If there happen misfires over the threshold value at 1 cylinder or more, ECM sets DTC P0300.
If there happen misfires over the threshold value at #1 cylinder or more, ECM sets DTC P0301.
If there happen misfires over the threshold value at #2 cylinder or more, ECM sets DTC P0302.
If there happen misfires over the threshold value at #3 cylinder or more, ECM sets DTC P0303.
If there happen misfires over the threshold value at #4 cylinder or more, ECM sets DTC P0304.

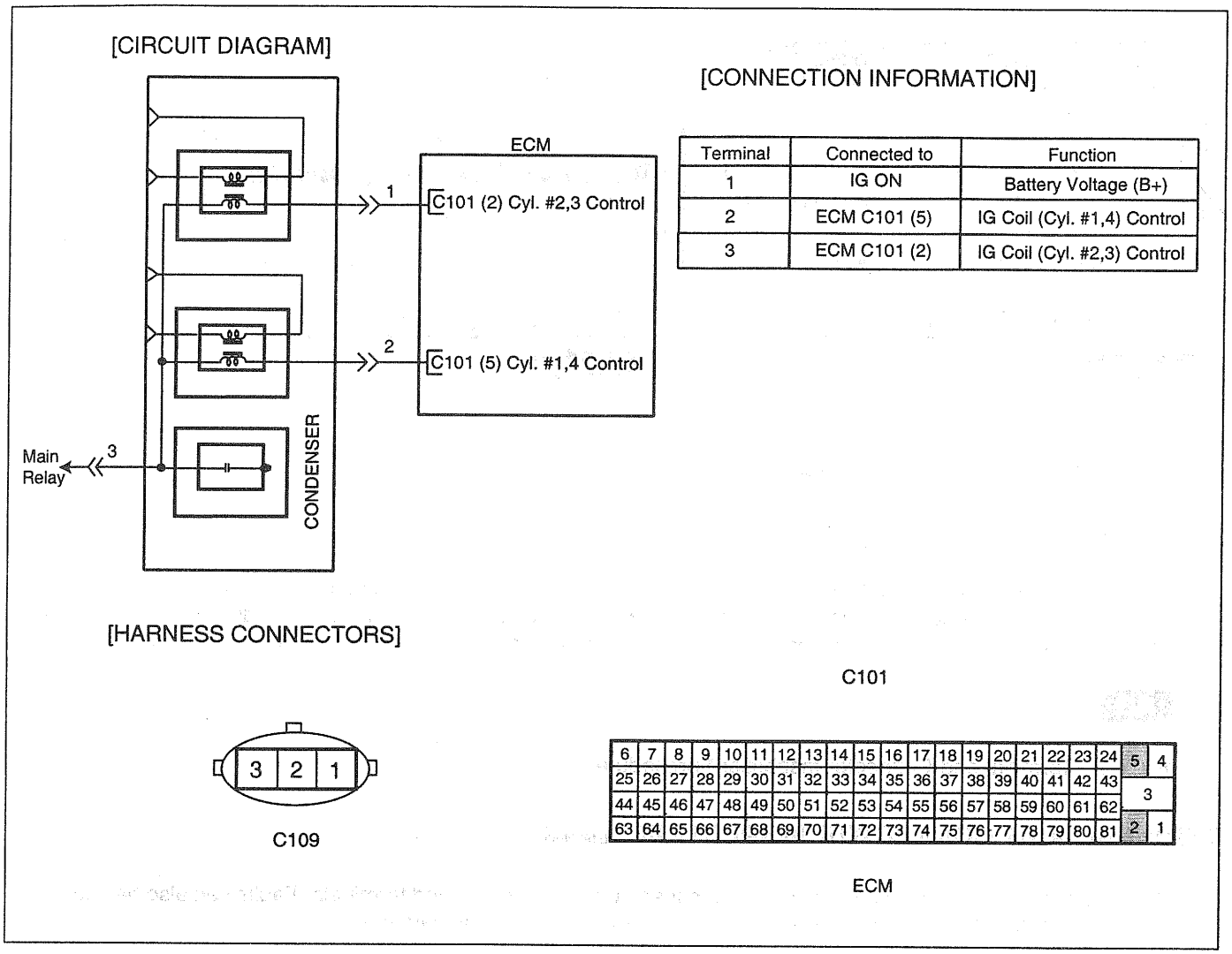
DTC DETECTING CONDITION EED61D03

Item		Detecting Condition	Possible Cause
DTC Strategy		• Engine roughness through crankshaft speed fluctuation	• Poor connection • Ignition system • Fuel system • Intake/exhaust air system • Ignition timing • Injector • ECM
Enable Conditions		• Engine speed 520~4520rpm • Engine load 〉 Zero torq. • Eng. load change 〈 Max. • Eng. speed change 〈 Max. • Time after engine start 〉 4.5 sec • Intake air temperature 〉 -9.8℃	
Case1	Threshold Value	• Misfire rate for emission thresh 〉 4%	
	Diagnostic Time	• 1000 revs	
	MIL ON Condition	• 3 driving cycle	
Case2	Threshold Value	• 3% 〈 Misfire rate for catalyst damage 〈 15%	
	Diagnostic Time	• 200 revs	
	MIL ON Condition	• Immediately (Blink)	

SPECIFICATION E92111AC

Items	Resistance
Primary coil	Secondary coil
0.87 ± 10% at 20℃ (68°F)	13.0 ± 10% at 20℃ (68°F)

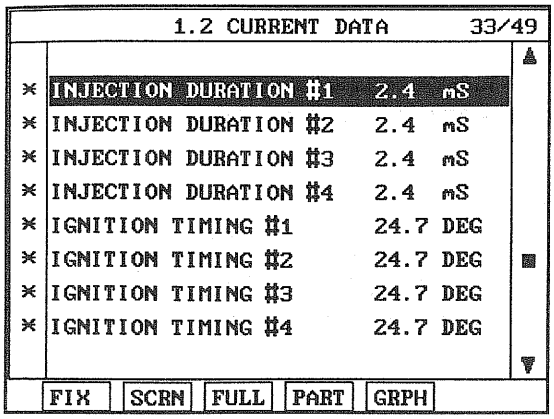
SCHEMATIC DIAGRAM E8A33824



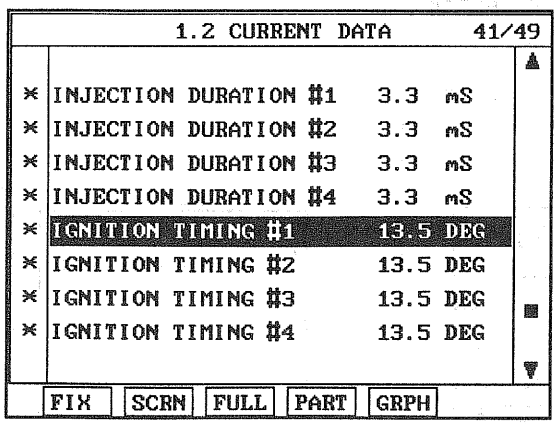
EFPG500X

MONITOR SCANTOOL DATA E2F22A9E

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Parameters related to Ignition and Misfire" on the scantool.



Normal State



#I disconnected

EGPF500Y

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION E19398A8

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "System inspection" procedure.

SYSTEM INSPECTION E0642209

1. Spark cable check
   1) Do visual inspect
      ▶ Check contamination or damage on spark cable.
   2) Measure the resistance of spark cable.

Specification : 5.6kΩ m ± 20%

3) Is the measured resistance within specifications?

YES

▶ Go to "Check Spark Plug" as below.

NO

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Spark plug check.

1) Remove cylinder' s spark plugs.

2) Visually/physically inspect the following items:
- Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks
- Check for plug gap : 1.0 - 1.1 mm (0.039 - 0.043 in.)
- Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.

3) Has a problem been found in any of the above areas?

YES

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "Compression pressure check" procedure.

3. Compression pressure check.

1) Warm up the engine to normal operating temperature.

2) Disconnect the spark plug cables. And remove the spark plugs and fuel pump relay.

3) Crank the engine to remove any foreign material in the cylinders.

4) Put compression pressure gauge into spark pulg hole.

5) Check compression pressure at each cylinder.

Specification : Approx. 15 kg/cm²

6) Is compression pressure for each cylinder displayed within specifications?

YES

▶ Go to "Ignition system check" procedure.

NO

▶ Add a small amount of oil through the spark plug hole, and repeat above steps.
▶ If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▶ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure is leaking from the gasket.

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

4. Ignition system check

1) Key "OFF".

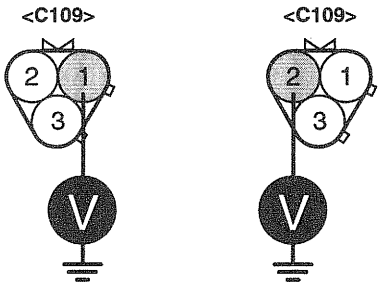
2) Disconnect Ignition coil connector.

3) Do visual inspection.
▶ Check contamination or damege on ignition coil.

4) Key "ON".

5) Measure the voltage between terminal 1(2) of ignition coil harness connector and chassis ground.

Specification : Approx. B+



1. Primary Coil Control(CYL2,3)
2. Primary Coil Control(CYL1,4)
3. Power

EGPF002Q

6) Is the measured voltage within specifications?

YES

▶ Go to "Ignition coil check" procedure.

NO

▶ Repair Open or Short to ground in power circuit, and go to "Verification of Vehicle Repair" procedure.

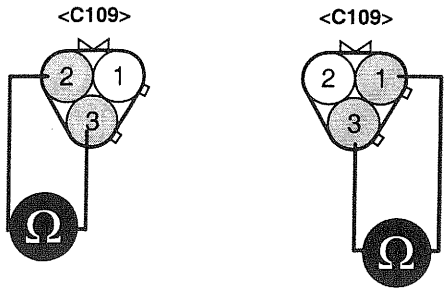
5. Ignition coil check

1) Measure the resistance between terminal 3 and 1(2) of ingnition coil connector.
(Component side / Primary coil)

2) Measure the resistance between terminal for cylinder #1 and terminal for cylinder #4.
(Component side / Secondary coil)
Measure the resistance between terminal for cylinder #2 and terminal for cylinder #3.
(Component side / Secondary coil)

SPECIFICATION

Items	Resistance
Primary coil	Secondary coil
0.87 ± 10% at 20℃ (68°F)	13.0 ± 10% at 20℃ (68°F)



1. Primary Coil Control(CYL2,3)
2. Primary Coil Control(CYL1,4)
3. Power

EFPG500Z

3) Is the measured resistance within specifications?

YES

▶ Go to "Timing mark check" procedure.

NO

▶ Substitute with a known - good ignition coil and check for proper operation.
▶ If the problem is corrected, replace ignition coil and go to "Verification of Vehicle Repair" procedure.

6. Timing mark check.

1) Key "OFF".

2) Check the timing mark.

3) Is the timing mark normal?

YES

▶ Go to "Air leakage check" procedure.

NO

▶ Repair and go to "Verification of Vehicle Repair" procedure.

7. Air leakage check.

1) Visually/physically inspect the air leakage in intake/exhaust system as following items,
- Vacuum hoses for splits, kinks and improper connections.
- Throttle body gasket
- Gasket between intake manifold and cylinder head
- Seals between intake manifold and fuel injectors
- Exhaust system between HO2S and Three way catalyst for air leakage.

2) Has a problem been found in any of the above areas?

YES

▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "PCV(Positive Crankcase Ventilation) valve check" procedure.

8. PCV(Positive Crankcase Ventilation) valve check.

1) Key "OFF".

2) Disconnect PCV valve.

3) Check the movement of plunger by putting in and out a thin stick.

4) Is the movement of plunger normal?

YES

▶ Go to "Injector check" procedure.

NO

▶ Substitute with a known - good PCV valve and check for proper operation.
▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

9. Injector check.

1) Key "OFF".

2) Remove injectors.

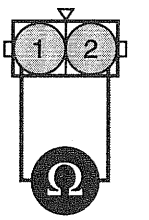
3) Check leakage or clog on injectors.

4) Measure the resistance between terminal 1 and 2. (Component side)

SPECIFICATION :

ITEM	Specification
Coil Resistance	13.8 ~ 15.2Ω at 20℃ (68°F)

<C151-1,2,3,4>



1. Power
2. Injector control

EGPF002S

5) Is the measured resistance within specification?

YES

▶ Go to "Fuel line check" procedure.

NO

▶ Substitute with a known - good injector and check for proper operation.
▶ If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

10. Fuel line check.

1) Check clog, contamination and damage on fuel line.

- Splits, kinks and improper connections of fuel line pipe.
- Interference, damage and improper connections of vacuum hose on fuel line.
- Improper connection of connectors on fuel line.

2) Is the fuel line normal?

YES

▶ Go to "Fuel pressure check" procedure.

NO

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

11. Fuel pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

Specification : Approx. 3.5 kg/cm²

7) Is the fuel pressure normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Check clogging on the fuel filter.
▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the fuel supply and return line.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E37D7809

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

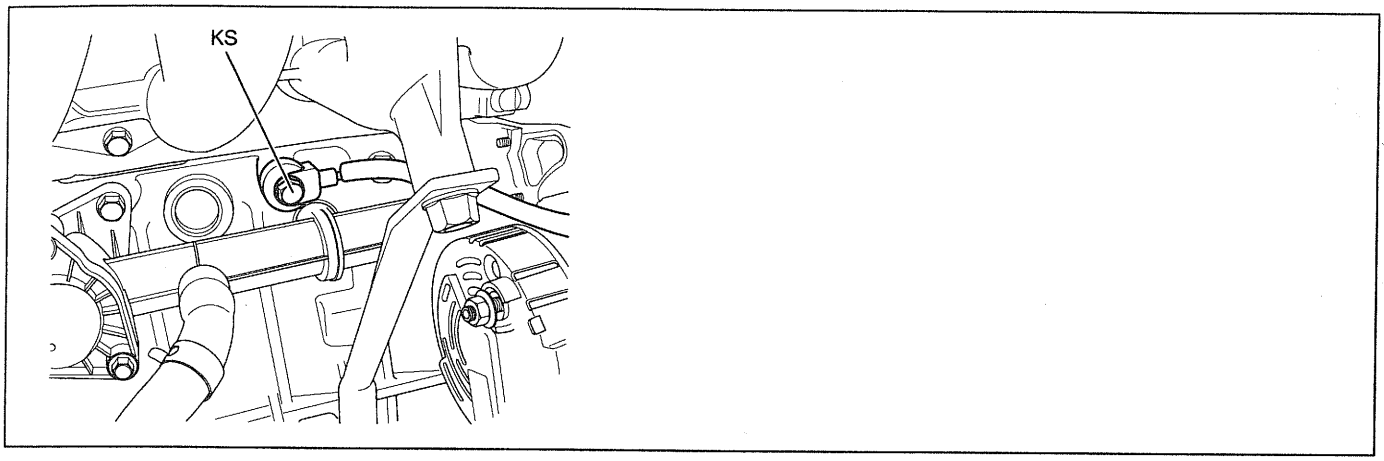
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0325 KNOCK SENSOR 1 CIRCUIT

COMPONENT LOCATION EA357CC6



EFPG800F

GENERAL DESCRIPTION E3DC78FD

Knocking is a phenomenon characterized by undesirable vibration and noise that can cause engine damage. A knock sensor (KS) is mounted on the cylinder block and senses engine knocking. A knocking vibration from the cylinder block is applied as pressure to the piezoelectric element. A knock sensor (KS) detects vibration when RPM rises or drops and generates voltages based on this vibration. The ECM controls the ignition timing based on the amplitude and frequency of the knock sensor signal. For example, if engine knocking occurs, the ignition timing is retarded to prevent it.

DTC DESCRIPTION EDBE4082

If the signal of knock sensor is less than threshold under enable conditions, ECM sets P0325.

DTC DETECTING CONDITION E9EC87A2

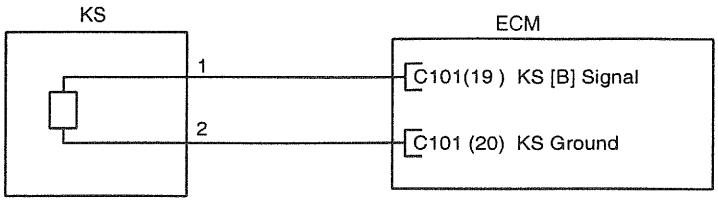
Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor signal check	• Poor connection • Open or short in signal circuit • Knock sensor • PCM
Enable Conditions	• Engine coolant temperature 〉 40℃ • Engine speed 〉 2600 rpm	
Threshold Value	• Sensor signal < threshold(which is the function of engine speed.)	
Diagnostic Time	• Continuous	
MIL ON Condition	• DTC only	

SPECIFICATION E91CDBDF

Item	Specification
Capacitance	950 ~ 1,350pF

SCHEMATIC DIAGRAM E42C2447

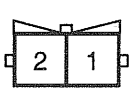
[CIRCUIT DIAGRAM]



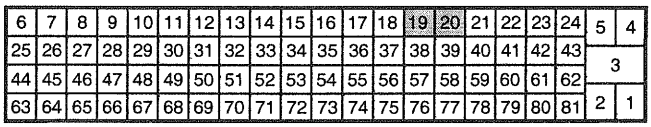
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (19)	KS Signal
2	ECM C01-1 (20)	KS ground

[HARNESS CONNECTORS]



KS (C113)

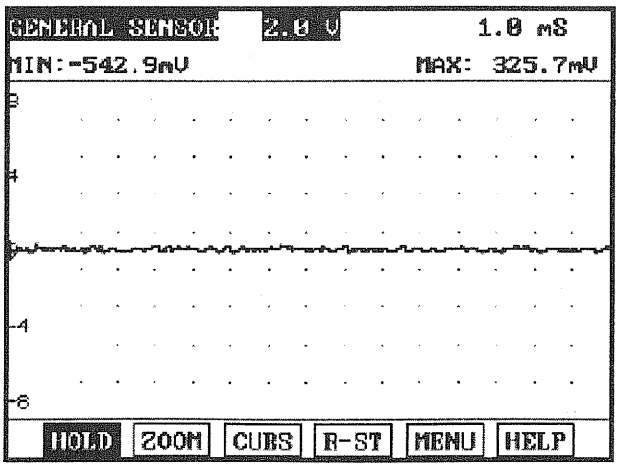


C101

ECM

EFPG501A

SIGNAL WAVEFORM & DATA ECA2B740



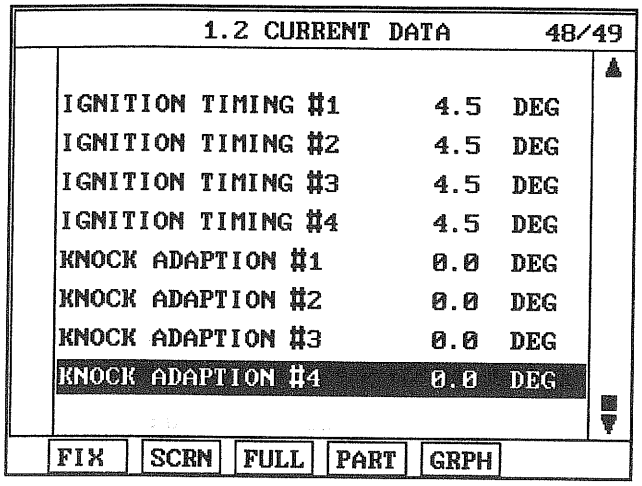
This is a normal signal waveform of knock sensor. Generally, there would be much more noise on knock sensor signal than the others.

LFJF564A

MONITOR SCANTOOL DATA E8E2E575

1. Connect scantool to DLC(Data Link Cable).
2. Warm up the engine to normal operating temperature.

3. Monitor the "Knock sensor" parameters on the scantool.



EGPF501B

4. Are the parameters displayed correctly ?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection"procedure.

TERMINAL AND CONNECTOR INSPECTION E8875329

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Knock sensor circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION E10E4B03

1. Check Short to Voltage in signal circuit.
   1) Key "OFF".
   2) Disconnect Knock sensor connector.

3) Key "ON" & ENG "OFF".

4) Measure the voltage between terminal 1 of knock sensor harness connector and chassis ground.

Specification : Approx 0V

5) Is the measured voltage within specification?

YES

▶ Go to "Check Short to ground in signal circuit" procedure.

NO

▶ Repair Short to Power in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Shrot to ground in signal circuit.

1) Key "OFF".

2) Disconnect Knock sensor connector and ECM connector.

3) Measure the resistance between terminal 1 and 2 of knock sensor harness connector.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Check Open in signal circuit" procedure.

NO

▶ Repair Short to ground in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

3. Check Open in signal circuit

1) Key "OFF".

2) Disconnect Knock sensor connector and ECM connector.

3) Measure the resistance between terminal 1 of knock sensor harness connector and terminal 19of ECM harness connector.

Specification : Below 1Ω

4) Is the measured resistance within specifications?

YES

▶ Go to "Check Open in ground circuit" procedure.

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E1E255EB

1. Check Open in ground circuit.
   1) Key "OFF".
   2) Disconnect Knock sensor connector and ECM connector.
   3) Measure the resistance between terminal 2 of knock sensor harness connector and ground.

Specification : Below 1Ω

   4) Is the measured resistance within specifications ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in ground circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7D32F33

1. Check Knock sensor.
   1) Substitute with a known - good Knock sensor and check for proper operation.
   2) Is the signal normal?

YES

▶ Replace Knock sensor and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE7C35DD

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

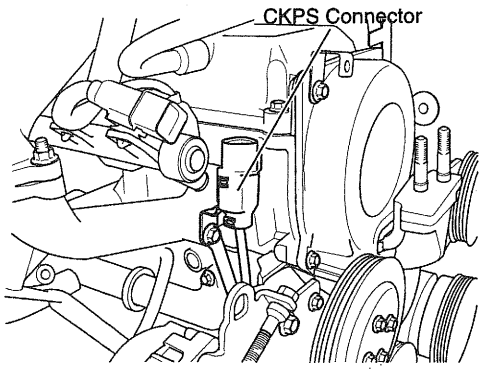
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION E4DD5CAE



* CKPS is on transaxle housing

EFPG378B

GENERAL DESCRIPTION E96B4884

The Crankshaft Position Sensor (CKPS) is a hall effect type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 28 slots in the target wheel where one is longer than the others. When the slot in the wheel aligns with the sensor, the sensor voltage outputs low. When the metal (tooth) in the wheel aligns with the sensor, the sensor voltage outputs high. During one crankshaft rotation there are 28 rectangular signals and one longer signal. The ECM calculates engine RPM by using the sensor' s signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the ECM identifies which cylinder is at top dead center.

DTC DESCRIPTION E1FC989C

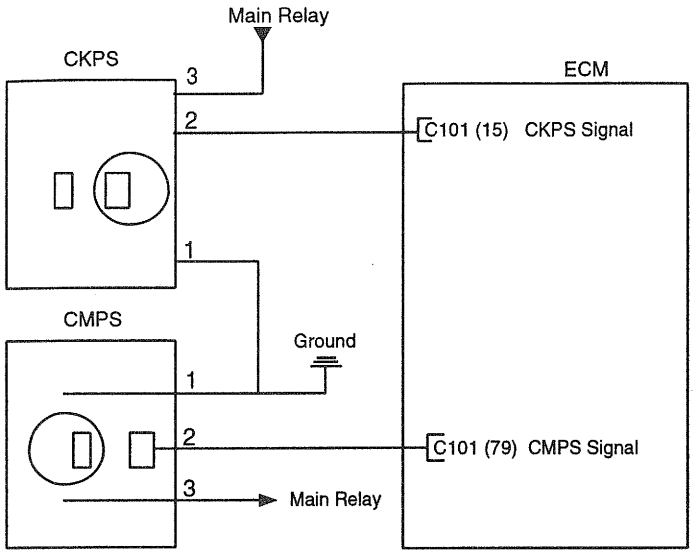
If CKPS cannot find reference mark during 8 times or more, ECM sets DTC P0335.

DTC DETECTING CONDITION ED9CE7E0

Item	Detecting Condition	Possible Cause
DTC Strategy	• Reference mark check	• Poor connection • Open or short in signal circuit • CKPS • PCM
Enable Conditions		
Threshold Value	• No reference mark 〉 8 times	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

SCHEMATIC DIAGRAM E7244F19

[CIRCUIT DIAGRAM]

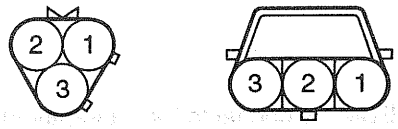


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Chasses ground	Sensor ground
2	ECM C101 (15)	CKPS Signal
3	Main Relay	Battery Voltage (B+)

Terminal	Connected to	Function
3	Main Relay	Battery Voltage (B+)
2	ECM C101 (79)	CMPS Signal
1	Chassis Ground	Sensor Ground

[HARNESS CONNECTOR]



CKPS (C107) CMPS (C133)

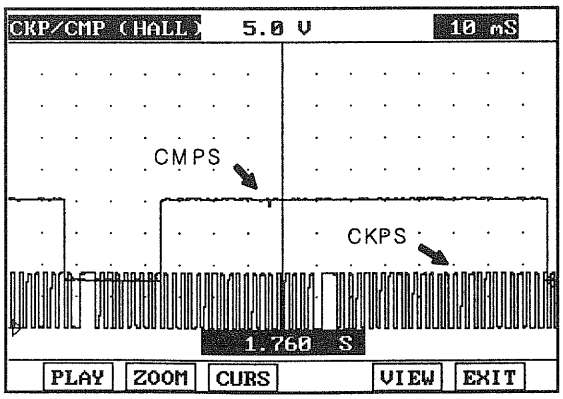
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

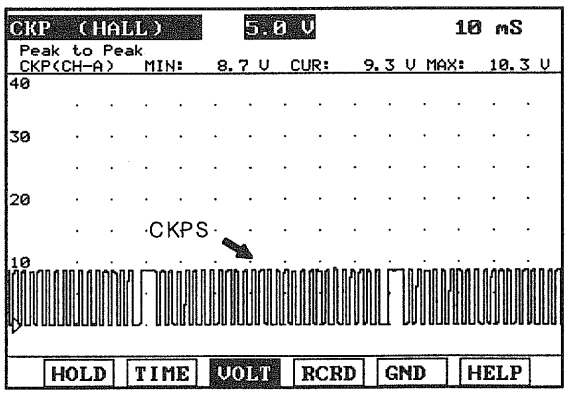
C101

ECM

EGPF501C

SIGNAL WAVEFORM & DATA E7F8CA8A



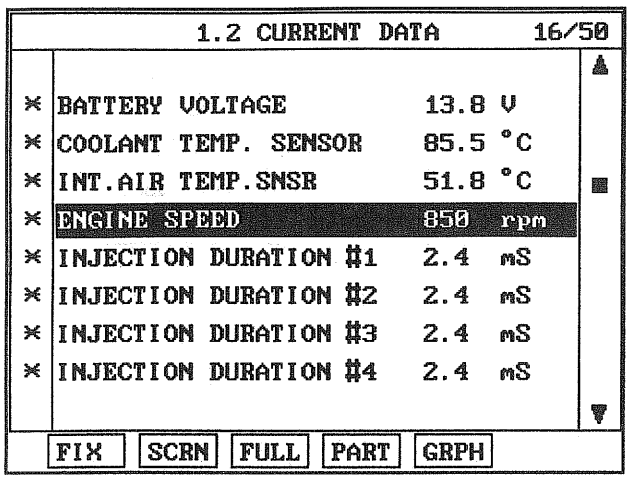


This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

EGPF501D

MONITOR SCANTOOL DATA E2E7FC52

1. Connect scantool to DLC(Data Link Cable).
2. Engine start.
3. Monitor the "CKP" parameters on the scantool.



EGPF501E

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E5D1FF88

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "CKPS circuit inspection" procedure.

POWER CIRCUIT INSPECTION E8A1C9FD

1. Key "OFF".
2. Disconnect CKPS connector.
3. Key "ON".
4. Measure the voltage between terminal 3 of CKPS harness connector and chassis ground.

Specification : Approx 12V

5. Is the measured voltage within specification ?

YES

▶ Go to "Check signal circuit" procedure.

NO

▶ Repair Short to ground or Open in Power circuit, and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E9DF1427

1. Key "OFF".
2. Disconnect CKPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx 8V

5. Is the measured voltage within specification ?

YES

▶ Go to "Check Ground circuit" procedure.

NO

▶ Repair Short or Open in Signal circuit, and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EED12CA6

1. Key "OFF".
2. Disconnect CKPS connector.
3. Measure the resistance between 3 of CKPS harness connector and chassis ground.
   Measure the resistance between 1 and 3 of CKPS harness connector.

Specification : "A" - "B" = Below 200mV

4. Is the measured voltage within specifications ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in ground circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC6CE857

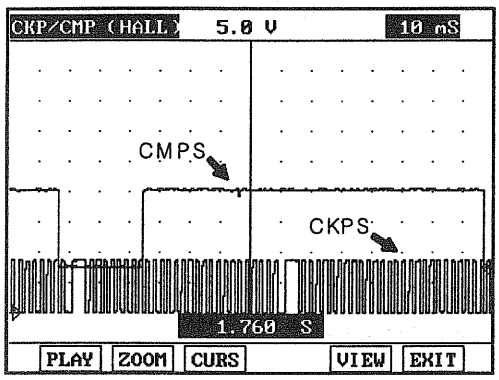
1. Check CKPS.

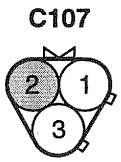
   1) Key "ON". (Don't disconnect sensors.)

   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of CKPS harness connector.

   3) Engine start. And check the signal waveforms.

SPECIFICATION :





1. CKPS Ground
2. CKPS signal
3. CKPS Power

EGPF004C

   4) Is the measured signal waveform O.K?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good CKPS and check for proper operation.
▶ If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E74FDABE

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0336 CRANKSHAFT POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EE412808

Refer to DTC P0335.

GENERAL DESCRIPTION E3F755A4

Refer to DTC P0335.

DTC DESCRIPTION EAE20FE2

If there is no signal from CKPS while there are 8 or more edge signals of CMPS, ECM sets DTC P0336.

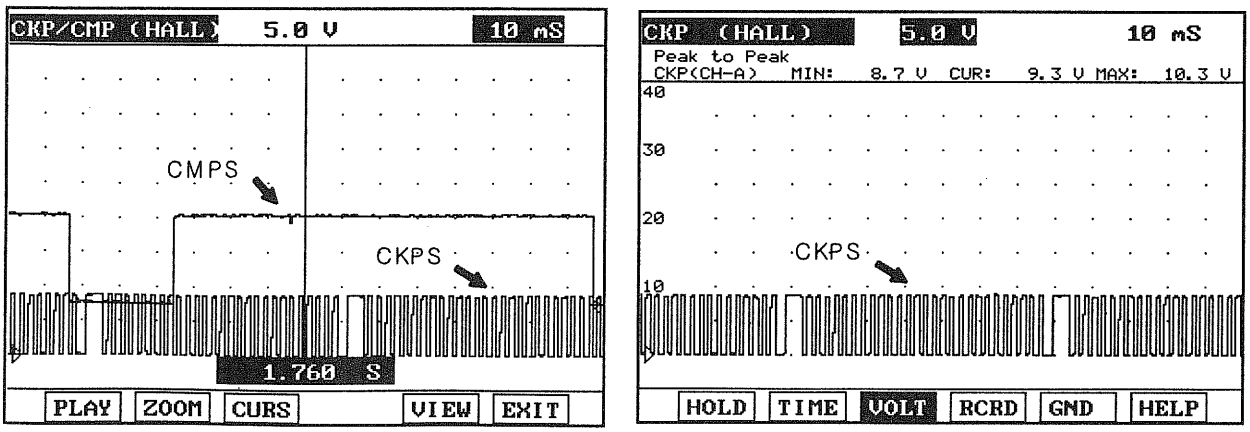
DTC DETECTING CONDITION E008BE26

Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor signal check	• Poor connection • Open in power circuit • Open or short in signal circuit • CKPS • PCM
Enable Conditions	• Edge counter of camshaft position sensor > 8	
Threshold Value	• No signal	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

SCHEMATIC DIAGRAM E5DC4B16

Refer to DTC P0335.

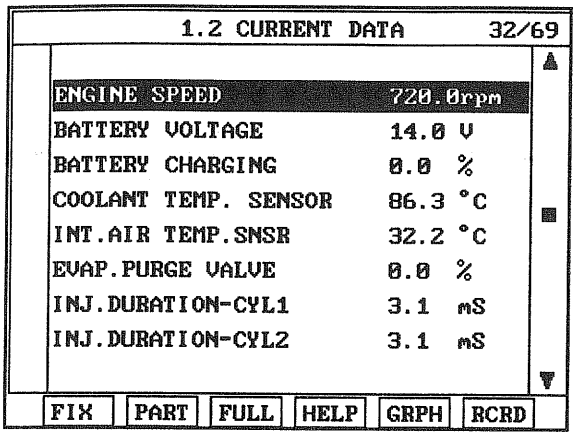
SIGNAL WAVEFORM & DATA E73E80FB



EGPF501F

MONITOR SCANTOOL DATA E76073A6

1. Connect scantool to DLC(Data Link Cable).
2. Engine Start.
3. Monitor the "CKP" parameters on the scantool.



LFJF577A

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E3A7FEEE

Refer to DTC P0335.

CKPS CIUCUIT INSPECTION E8E93C99

1. Key "OFF".
2. Disconnect CKPS connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 1 of CKPS harness connector and chassis ground.
   Measure the voltage between terminal 2 of CKPS harness connector and chassis ground.
   Measure the voltage between terminal 3 of CKPS harness connector and chassis ground.

Specification : Terminal 1 0 V , Terminal 2 Approx. 8V, Terminal 3 B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open or Short in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E8E714BD

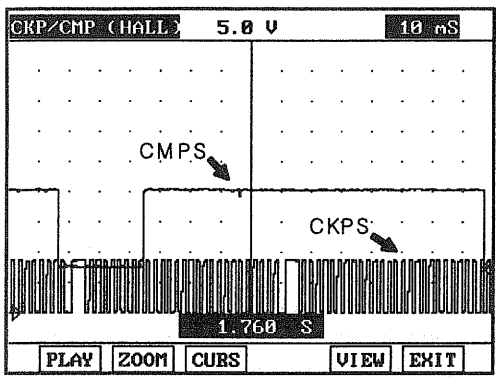
1. Check CKPS.

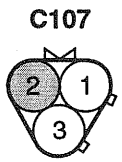
   1) Key "ON". (Don't disconnect sensors.)

   2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 1 of CKPS harness connector.

   3) Engine start. And check the signal waveforms.

SPECIFICATION :





1. CKPS Ground
2. CKPS signal
3. CKPS Power

EGPF004C

   4) Is the measured signal waveform O.K?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

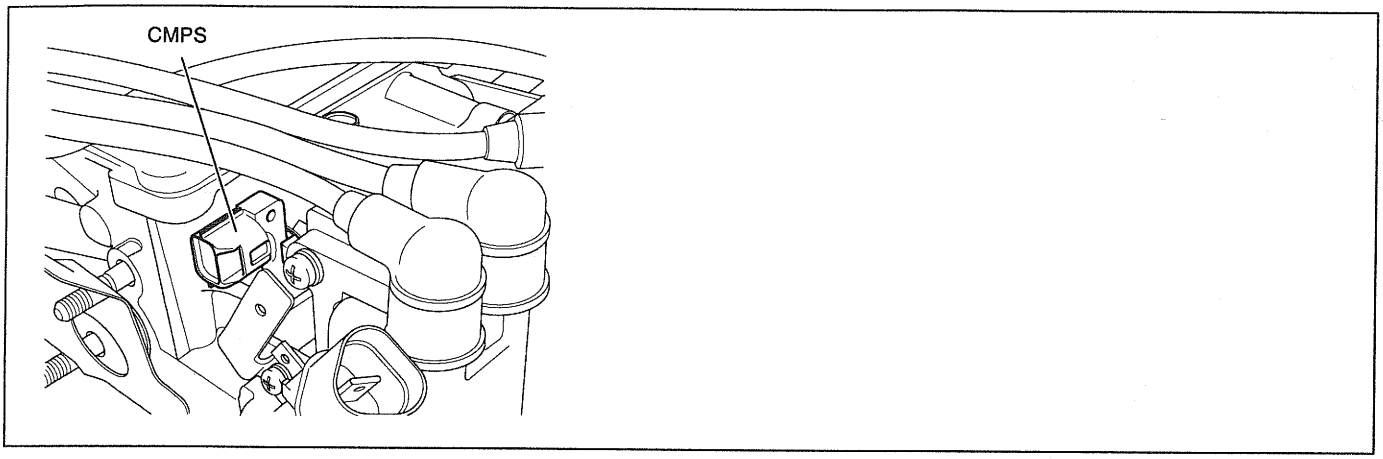
▶ Substitute with a known - good CKPS and check for proper operation.
▶ If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED618FE7

Refer to DTC P0335.

DTC P0340 CAMSHAFT POSITION SENSOR A CIRCUIT MALFUNCTION (BANK 1 OR SINGLE SENSOR)

COMPONENT LOCATION E8E504A3



EFPG378C

GENERAL DESCRIPTION EC884E44

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can' t detect. The CMPS are installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. When teeth on the target wheel trigger the sensor, output voltage is 12V. If not, it is 0V. These CMPS signal is sent to the ECM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

DTC DESCRIPTION E1FA1B0C

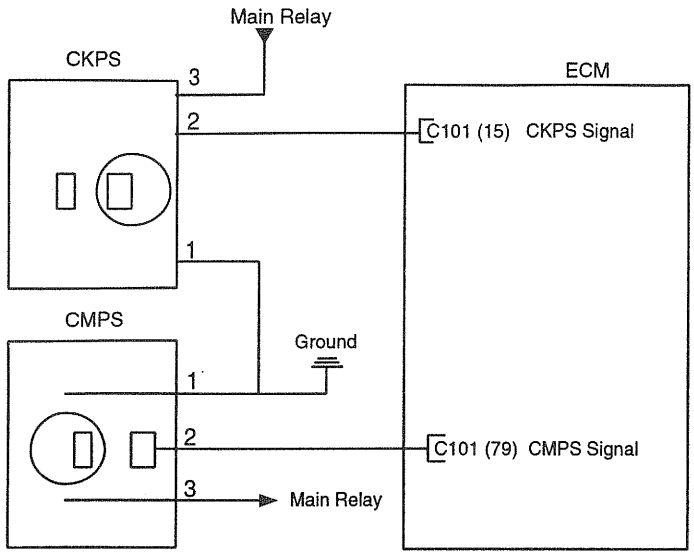
If signal input phase is abnormal over 12 times by faulty assembling, ECM sets DTC P0340.

DTC DETECTING CONDITION E4484891

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check (check the assembling state)	• Poor connection • Open or Short in signal circuit • Open or Short in power circuit • Open in ground circuit • abnormal assembling state • CMPS • PCM
Enable Conditions	• Sensor signal requested	
Threshold Value	• Abnormal phase edges > 12 times • High signal voltage and no change of phase edges > 12 times • Low signal voltage and no change of phase edges > 12 times	
Diagnostic Time		
MIL ON Condition	• 3 driving cycle	

SCHEMATIC DIAGRAM E900C53F

[CIRCUIT DIAGRAM]

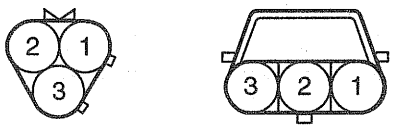


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Chasses ground	Sensor ground
2	ECM C101 (15)	CKPS Signal
3	Main Relay	Battery Voltage (B+)

Terminal	Connected to	Function
3	Main Relay	Battery Voltage (B+)
2	ECM C101 (79)	CMPS Signal
1	Chassis Ground	Sensor Ground

[HARNESS CONNECTOR]



CKPS (C107) CMPS (C133)

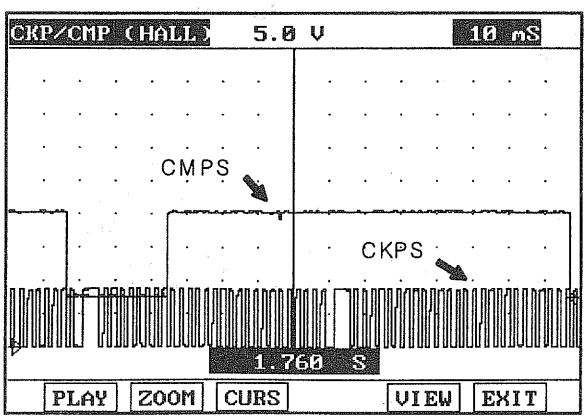
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

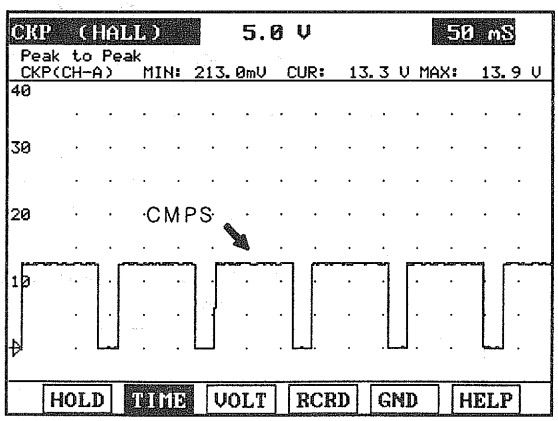
C101

ECM

EGPF501C

SIGNAL WAVEFORM & DATA E888FA7F





EGPF501G

MONITOR SCANTOOL DATA E265B1A9

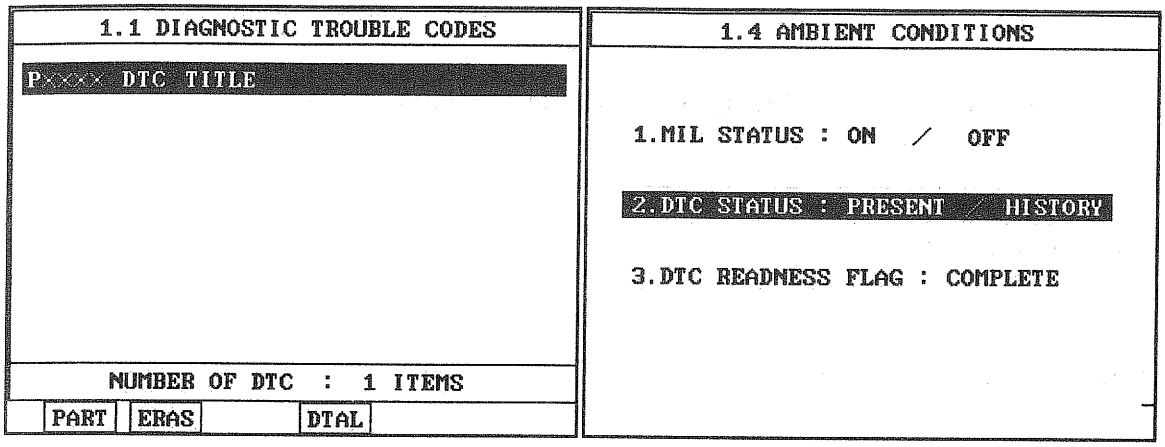
1. Connect scantool to Data Link Connector(DLC).

2. IG "ON".

3. Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu.

4. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions noted in the DTC detecting condition.

5. Read "DTC Status" parameter.



EFPF045A

6. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness,poor connection, bending, corrosion, contamination, deterioration, or damage.Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure

TERMINAL AND CONNECTOR INSPECTION E7F41D48

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "CMPS Power circuit inspection" procedure.

POWER CIRCUIT INSPECTION E3213A25

1. Key "OFF".
2. Disconnect CMPS connector.
3. key "ON" .
4. Measure the voltage between terminal 3 of CMPS harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair Open or Short circuit and then, go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EA02BDF4

1. Check Oepn in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector.
   3) Key "ON" & ENG "OFF".
   4) Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.

Specification : Approx 12V

   5) Is the measured voltage within specification?

YES

▶ Go to "Short to power circuit inspection" procedure

NO

▶ Repair Open or short to ground in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short to power in signal circuit.
   1) Key "OFF".
   2) Disconnect CMPS connector and ECM connector.
   3) Measure the resistance between terminal 2 and 3 of CMPS harness connector.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Repair Short to power in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E2FD4BE9

1. Key "OFF".
2. Disconnect CMPS connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of CMPS harness connector and chassis ground.(A)
5. Measure the voltage between terminal 1 and 2 of CMPS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE9B96F5

1. CMPS visual check.
   1) Key "OFF".
   2) Check damage and assembling state of CMPS.
   3) Check the projection of cam-shaft visually after remove the CMPS.
   4) Is everything O.K?

YES

▶ Go to "CMPS check" procedure.

NO

▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

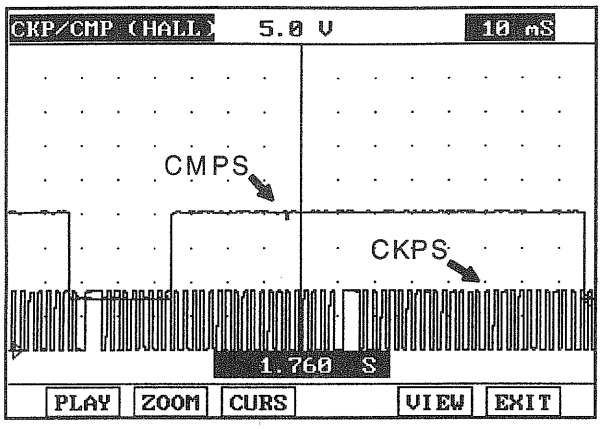
2. CMPS check.

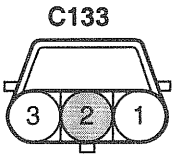
1) Key "ON". (Don't disconnect sensors.)

2) Select "vehicle scopemeter" in the menu, and connect channel A of scantool with terminal 2 of CMPS harness connector.

3) Engine start. And check the signal waveforms.

SPECIFICATION :





1. Sensor power
2. CMPS signal
3. Sensor ground

EGPF004E

4) Is the signal waveform within specifications?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good CMPS and check for proper operation. If the problem is corrected, replace CMPS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E342E985

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

GENERAL DESCRIPTION E3951E79

The catalyst' s efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor' s signal trace begins to match the front oxygen sensor' s signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2 O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION ECCEB561

If amplitude of B1S2 is over 0.65 voltage during 30 sec under enable conditions, ECM sets DTC P0420.

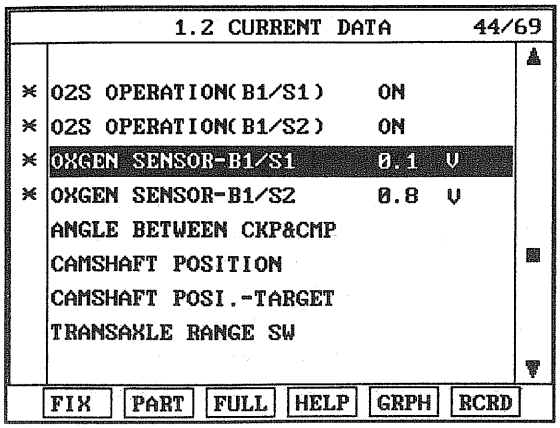
DTC DETECTING CONDITION EA7DC163

Item	Detecting Condition	Possible Cause
DTC Strategy	• Oxygen storage capacity	• Exhaust system • B1S2 • Catalyst converter • ECM
Enable Conditions	• Engine speed 1800~2920rpm • Engine load 20~45% • Catalyst temp.(model) 540~800℃ • Purge factor (high load canister) < 12 • Closed loop control	
Threshold Value	• Amplitude of downstream O2 sensor signal 〉 0.648	
Diagnostic Time	• 30 sec	
MIL ON Condition	• 3 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

MONITOR SCANTOOL DATA E0D08BF1

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "B1S1 and B1S2" parameters on the scantool.



EGPF500M

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "System Inspection" procedure.

SYSTEM INSPECTION ECCB886D

1. Exhaust gas system check.

   1) Visual check.
      - Check air leakage at junction of HO2S or Catalyst converter.
      - Check looseness, poor connection, or damage.

   2) Is there something wrong?

      YES

      ▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

      NO

      ▶ Go to "Component inspection" procedure.

COMPONENT INSPECTION E4CB3128

1. Rear HO2S(B1S2) check.

   1) B1S2 visual check
      - Check assembling state of B1S2. (Check the interference between sensor wiring and exhaust pipe.)
      - Check corrosion, contamination, or damage on sensor terminal and connector.

   2) Is there something wrong?

      YES

▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Catalyst converter check" procedure.

2. Catalyst converter check.

   1) Catalyst converter visual check.
      - Check discoloration by over-heating.
      - Check deflection or crack(hole).
      - Check noise.

   2) Check whether the catalyst converter is genuine.

   3) Is there something wrong?

      YES

      ▶ Substitute with a known-good Catalyst Converter and check for proper operation. If the problem iscorrected, replace Catalyst Converter and then go to "Verification of Vehicle Repair" procedure.

      NO

      ▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E25D686D

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

   YES

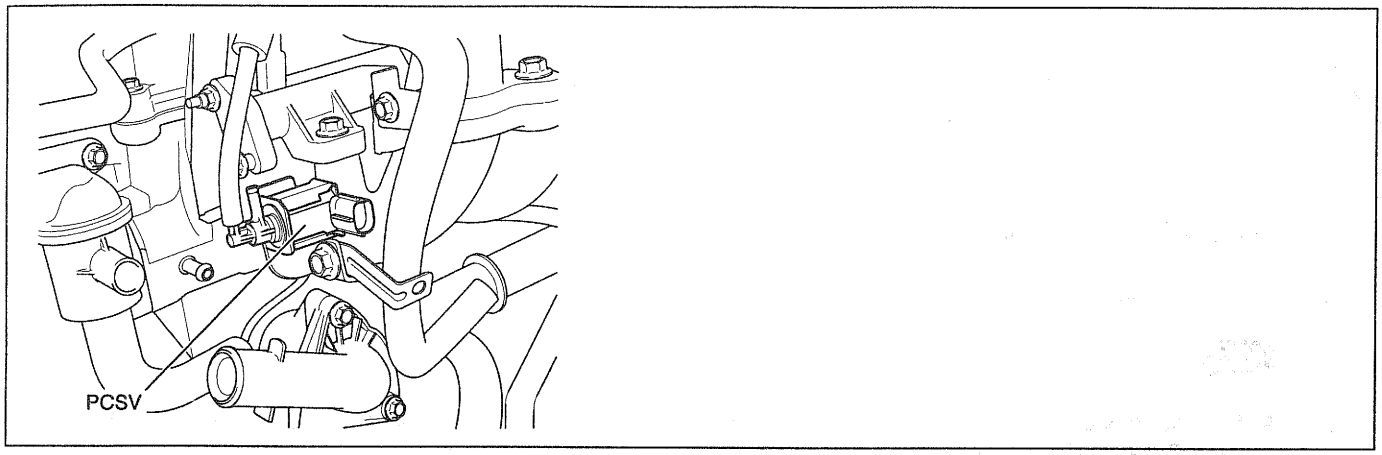
   ▶ Go to the applicable troubleshooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P0444 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT OPEN

COMPONENT LOCATION E82254F3



EFPG390B

GENERAL DESCRIPTION E61B3D9B

The purge solenoid is a pneumatic device that meters the air and fuel (purge) vapor flow to the purge port. In a sense, the purge solenoid is comparable to a fuel injector, because the metered purge flow follows the same slope and offset characteristics. However, the purge solenoid normally runs with a duty cycle at a fixed frequency because the opening response is significantly slower than a fuel injector. It would not practical to run the solenoid synchronously with engine events except perhaps at very low RPM. The normal frequencies for the purge solenoid are between 8 and 20 Hz.

DTC DESCRIPTION EFC7BDE0

If there is Open in PCSV circuit, ECM sets DTC P0444.

DTC DETECTING CONDITION E903A851

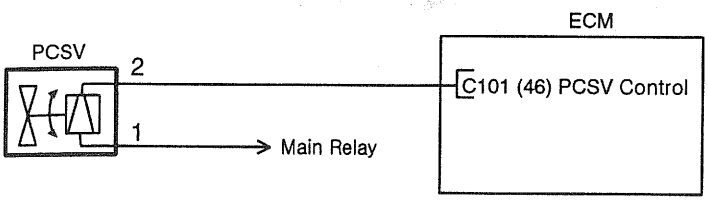
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Poor connection • Open in power circuit • Open or short to ground in control circuit • PCSV • PCM
Enable Conditions		
Threshold Value	• Open or short to ground	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E00359D4

ITEM	Specification
PCSV Coil Resistance (Ω)	26Ω at 20℃ (68°F)

SCHEMATIC DIAGRAM E7C047A3

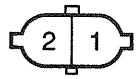
[CIRCUIT DIAGRAM]



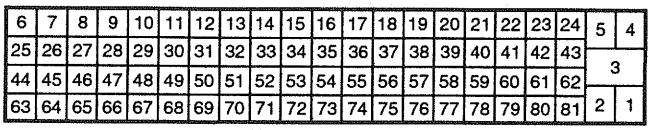
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C101 (46)	PCSV Control

[HARNESS CONNECTORS]



PCSV (C131)

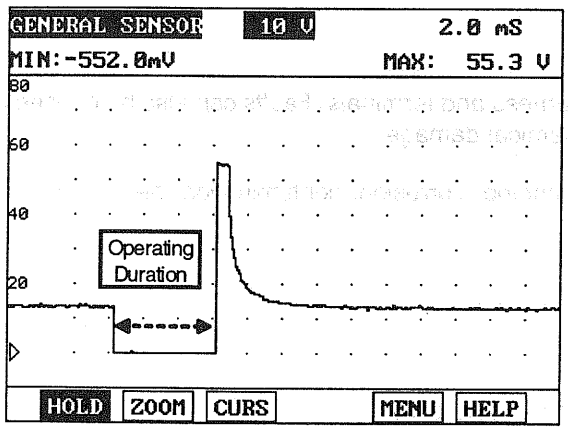


C101

ECM

EGPF501I

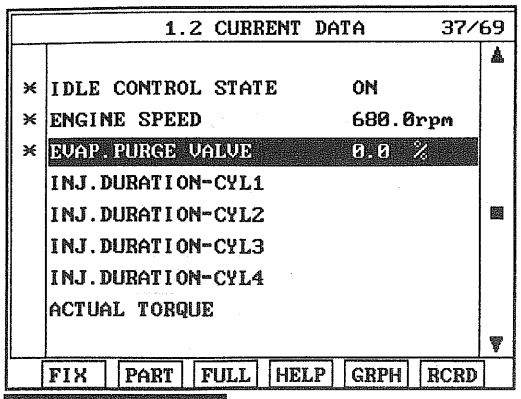
SIGNAL WAVEFORM & DATA E4C3E3FC



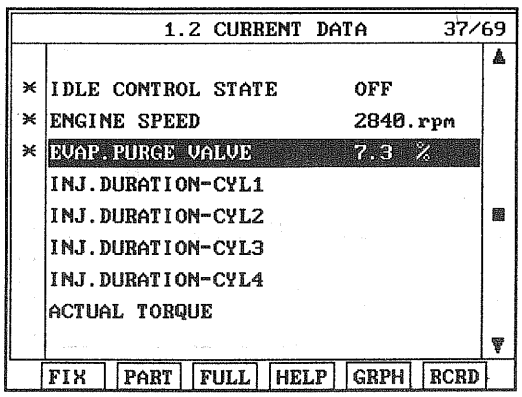
LFJF600A

MONITOR SCANTOOL DATA EC07F067

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "PCSV" parameters on the scantool.



Normal state at idle



Normal state at accelerating

LFJF601A

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E96BF54A

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "PCSV circuit inspection" procedure.

POWER CIRCUIT INSPECTION E8C292AE

1. Key "OFF".
2. Disconnect PCSV connector.
3. key "ON" & ENG "OFF".
4. Measure the voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E8E6A1B2

1. Key "OFF".
2. Disconnect PCSV connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx 3.5V

5. Is the measured voltage within specification?
6. ▶ Go to "Component inspection" procedure.

NO

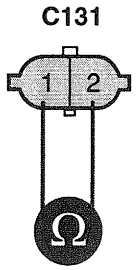
▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED8A6BF2

1. PCSV check.
   1) Key "OFF".
   2) Disconnect PCSV harness connector.
   3) Measure the resistance between terminal 1 and 2 of PCSV harness connector.(Component side)

SPECIFICATION :

ITEM	Specification
PCSV Coil Resistance (Ω)	26Ω at 20℃ (68°F)



1. PCSV power
2. PCSV control

EGPF003L

4) Is the measured resistance within specification?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E5EABAE7

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0445 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT SHORTED

COMPONENT LOCATION EC406F63

Refer to DTC P0444.

GENERAL DESCRIPTION E3825983

Refer to DTC P0444.

DTC DESCRIPTION E6F12FB0

If there is Short in PCSV circuit, ECM sets DTC P0445.

DTC DETECTING CONDITION ECBA8845

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check	• Poor connection • Short to battery in control circuit • PCSV • PCM
Enable Conditions		
Threshold Value	• Short to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION EB444787

Refer to DTC P0444.

SCHEMATIC DIAGRAM E2613B4A

Refer to DTC P0444.

SIGNAL WAVEFORM & DATA EC55AC11

Refer to DTC P0444.

MONITOR SCANTOOL DATA EAB3CCE4

Refer to DTC P0444.

TERMINAL AND CONNECTOR INSPECTION E5E58A19

Refer to DTC P0444.

POWER CIRCUIT INSPECTION E56347E2

1. Key "OFF".
2. Disconnect PCSV connector.
3. key "ON" & ENG "OFF".
4. Measure the voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION ECF9AD10

1. Key "OFF".
2. Disconnect PCSV connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx 3.5V

5. Is the measured voltage within specification?
6. ▶ Go to "Component inspection" procedure.

NO

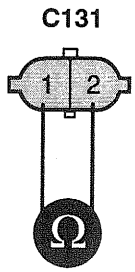
▶ Repair Short to power circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5415017

1. PCSV check.
   1) Key "OFF".
   2) Disconnect PCSV harness connector.
   3) Measure the resistance between terminal 1 and 2 of PCSV harness connector.(Component side)

SPECIFICATION :

ITEM	Specification
PCSV Coil Resistance (Ω)	26Ω at 20℃ (68°F)



1. PCSV power
2. PCSV control

EGPF003L

4) Is the measured resistance within specification?

YES

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO

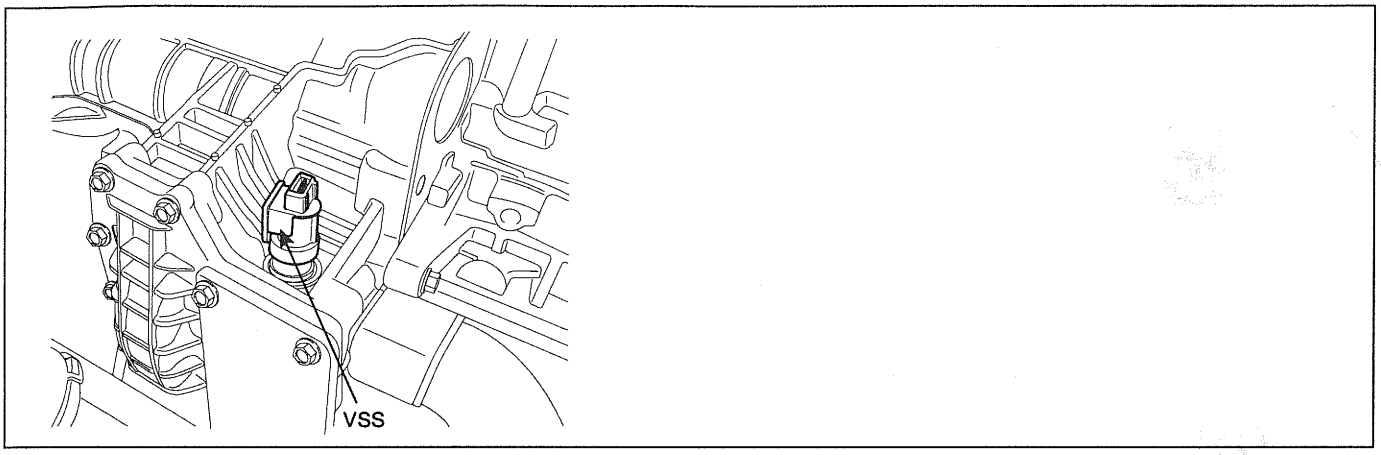
▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E4A59E27

Refer to DTC P0444.

DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

COMPONENT LOCATION E3653379



EFPG376B

GENERAL DESCRIPTION E067ECB1

The Wheel Speed Sensor (WSS) generates a waveform with a frequency according to the speed of the vehicle. The signal generated by the WSS informs the ECM not only if the vehicle speed is low or high but also is stopped the vehicle or not. The ECM uses this signal to control the fuel injection, ignition timing, transmission/transaxle shift scheduling and torque converter clutch scheduling. Also the WSS signal is used to detect rough road driving condition.

DTC DESCRIPTION E84BB1F1

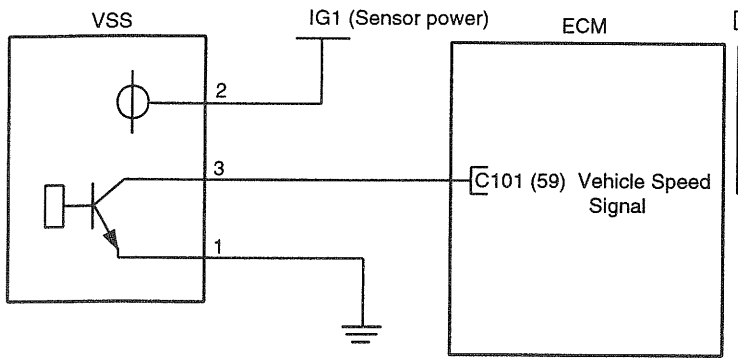
If the vehicle speed signal is below 1.0 Km/h during 2 sec under enable conditions, ECM sets P0501.

DTC DETECTING CONDITION E52175B8

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check	• Poor connection • Open or short to ground in power circuit • Short to ground in signal circuit • VSS • PCM
Enable Conditions	• (M/T or A/T) Engine speed during fuel cut-off 1520~4000rpm • (only A/T at D or R position) Engine speed > 3000rpm, Engine load > 49.5% • Coolant temperature > 65℃	
Threshold Value	• Vehicle speed signal 〈 5.0 Km/h	
Diagnostic Time	• 5 sec	
MIL ON Condition	• 3 driving cycle	

SCHEMATIC DIAGRAM E2C3EED3

[CIRCUIT DIAGRAM]

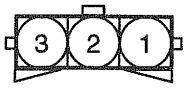


[CONNECTION INFORMATION]

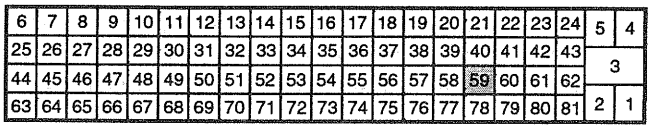
[VSS]

Terminal	Connected to	Function
1	Chassis Ground	Sensor Ground
2	IG 1	Battery Voltage (B+)
3	ECM C101 (59)	VSS Signal

[HARNESS CONNECTORS]



VSS (C122)

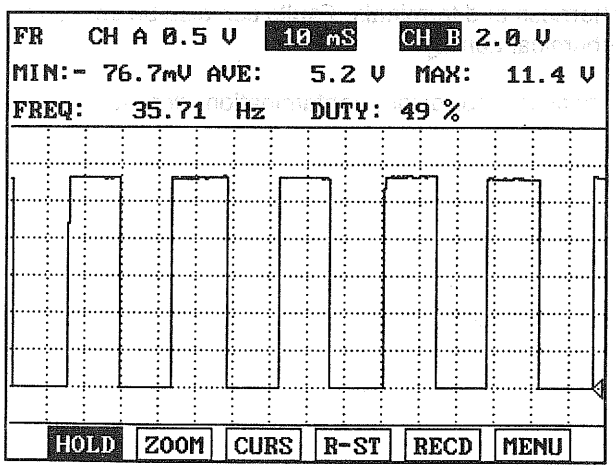


C101

ECM

EGPF501J

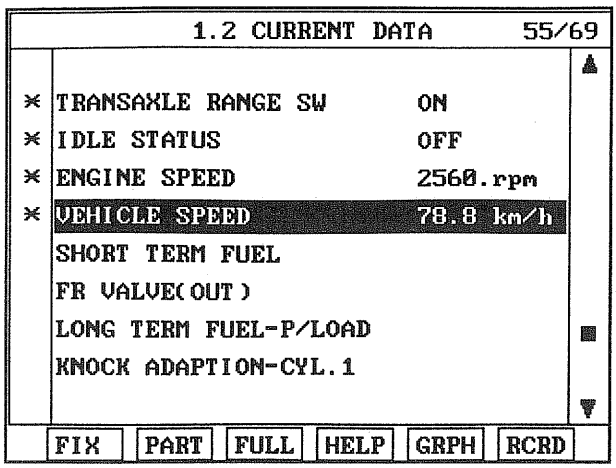
SIGNAL WAVEFORM & DATA E8C9BBC3



EFPF047A

MONITOR SCANTOOL DATA E48EA9F9

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "VSS" parameters on the scantool.



EFPF048A

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection " procedure.

TERMINAL AND CONNECTOR INSPECTION EF529391

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION E2AFCAFF

1. Key "ON" & ENG "OFF".
2. Measure voltage between terminal 2 of the Vehicle speed sensor harness connector and chassis ground. (Connect wheel speed sensor connector)

Specification : Approx. B+

3. Is the measured voltage within specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EB35AD0C

1. Check short to ground in harness.
   1) Key "OFF".
   2) Disconnect ECM connector.
   3) Disconnect wheel speed sensor connector.
   4) Measure resistance between terminal 3 of the vehicle speed sensor harness connector and chassis ground.

Specification : Infinite

   5) Is the measured resistance within specification?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check for open in harness.
   1) Key "OFF".
   2) Disconnect ECM connector.
   3) Disconnect wheel speed sensor connector.
   4) Measure resistance between terminal 59 of PCM/ECM harness connector and terminal 3 harness cnnector.

Specification : Approx. below 1Ω

   5) Is the measured resistance within specifications?

YES

▶ Go to "Ground inspection" procedure.

NO

▶ Repair Open circuit and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EE424207

1. Key "OFF".

2. Disconnect VSS connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 3 of VSS harness connector and chassis ground.(A)
5. Measure the voltage between terminal 3 and 1 of VSS harness connector.(B)

Specification : "A" - "B" = Below 200mV

6. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

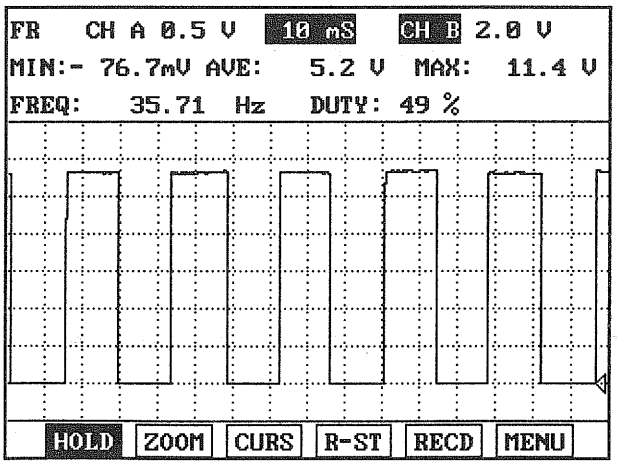
NO

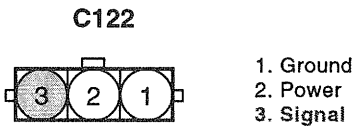
▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3102F1C

1. ENG "ON".
2. Measure signal waveform of wheel speed sensor while driving.

SPECIFICATION :





1. Ground
2. Power
3. Signal

EGPF004F

3. Is the signal waveform normal?

YES

▶ Substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good VSS and check for proper operation. If the problem is corrected, replace VSS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E06CB77A

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

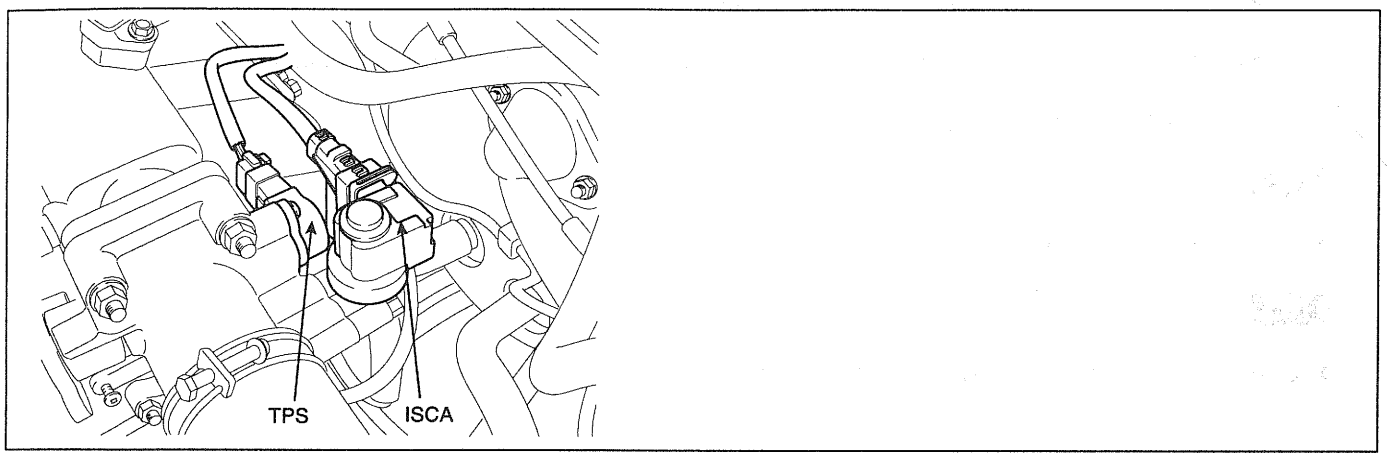
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

COMPONENT LOCATION E2440F07



EFPG375B

GENERAL DESCRIPTION E2311620

The ISCA (Idle Speed Control Actuator) is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION E3A369BC

If the real engine speed is lower than the desired engine speed over 100 rpm under enable conditions, ECM sets P0506.

DTC DETECTING CONDITION EF779F8C

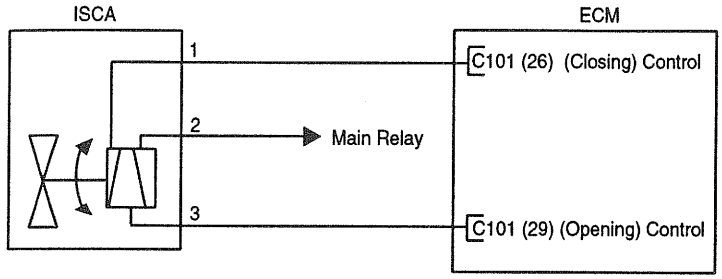
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check, low	• Poor connection • Clog in intake air system • Carbon pile • ISCA • ECM
Enable Conditions	• Vehicle speed = 0 • Coolant temperature 〉 70℃ • Intake air temperature 〉 -7.5℃ • Altitude 〈 3000m • Idle status • Idle controller I part = 15.0% • Engine load 〈 35%	
Threshold Value	• Desired engine speed - Engine speed 〉 100rpm	
Diagnostic Time	• 8 sec	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E79420C4

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35℃ (68~95°F)	15.4±0.8	11.9±0.8

SCHEMATIC DIAGRAM EDF4942A

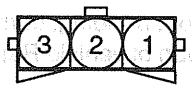
[CIRCUIT DIAGRAM]



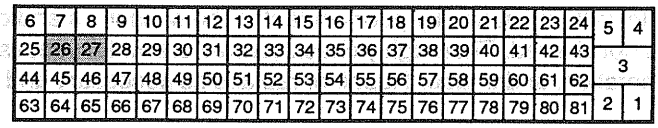
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (26)	Closing Control
2	Main Relay	Battery Voltage (B+)
3	ECM C101 (27)	Opening Control

[HARNESS CONNECTORS]



ISCA (C132)

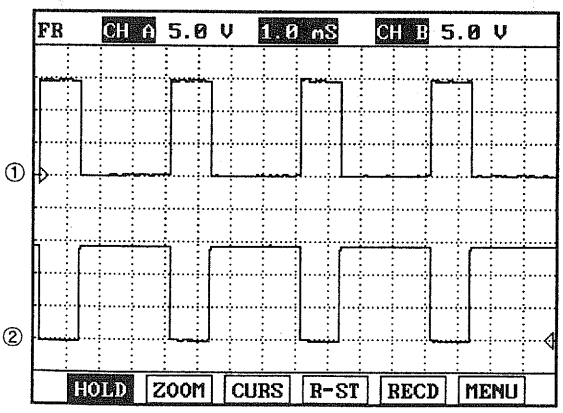


C101

ECM

EGPF501K

SIGNAL WAVEFORM & DATA EE41A05B

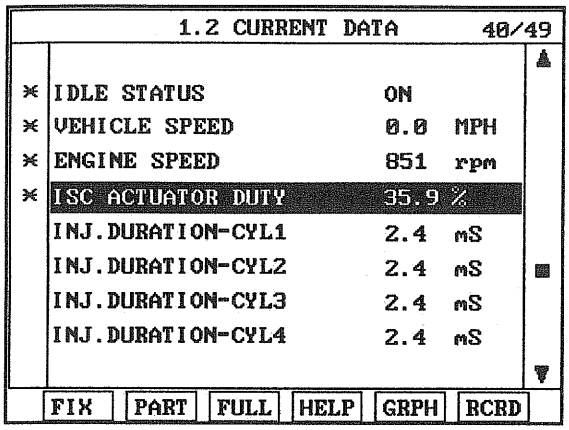


① Closing control duty signal at idle
② Opening control duty signal at idle

LFJF616A

MONITOR SCANTOOL DATA EDDB3173

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "ISCA" parameters on the scantool.



EGPF501L

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E39B2880

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "System inspection" procedure.

SYSTEM INSPECTION E2539A9F

1. Visual Inspection.

1) Check "Air intake/exhaust system."
   ▶ Check looseness, deterioration or contamination on air cleaner, throttle body and gasket.
   ▶ Check contamination, damage or clog on exhaust gas system.

2) Is the air intake/exhaust system O.K?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EB2167D7

1. ISCA visual check.

   1) Key "OFF".

   2) Disassemble ISCA.

   3) Check contamination, damage or stuck on ISCA.

   4) Check the operating sound when key turns "OFF" to "ON".

   5) Is ISCA O.K?

   YES

   ▶ Go to "ISCA check" procedure.

   NO

   ▶ Substitute with a known - good ISCA and check for proper operation.
   ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.

   1) Key "OFF".

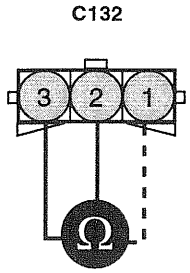
   2) Disassemble ISCA.

   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)

   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35℃ (68~95°F)	15.4±0.8	11.9±0.8



1. ISCA closing control
2. Sensor power
3. ISCA opening control

EGPF003Q

5) Is the measured resistance within specifications?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good ISCA and check for proper operation.
- ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E866CA02

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0507 IDLE AIR CONTROL SYSTEM-RPM HIGHER THAN EXPECTED

COMPONENT LOCATION E6FB7F6D

Refer to DTC P0506.

GENERAL DESCRIPTION E8F6E207

Refer to DTC P0506.

DTC DESCRIPTION E257BCF1

If the real engine speed is higher than the desired engine speed over 200 rpm under enable conditions, ECM sets P0507.

DTC DETECTING CONDITION EFF8DFB6

Item		Detecting Condition	Possible Cause
DTC Strategy		• Rationality check, high	• Poor connection • Leak in intake air system • Carbon pile • ISCA • ECM
General Enable Conditions		• Vehicle speed = 0 • Coolant temperature 〉 70℃ • Intake air temperature 〉 -7.5℃ • Altitude 〈 3000m • Idle status	
Case 1	Enable Conditions	• Idle controller I part = -15%	
	Threshold Value	• Desired engine speed - Engine speed 〈 -200rpm	
Case 2	Threshold Value	• Fuel cut-off ≥ 3times	
Diagnostic Time		• 15 sec	
MIL ON Condition		• 3 driving cycle	

SPECIFICATION EBE93CE1

Refer to DTC P0506.

SCHEMATIC DIAGRAM E3513E67

Refer to DTC P0506.

SIGNAL WAVEFORM & DATA E8024676

Refer to DTC P0506.

MONITOR SCANTOOL DATA E0DB050B

Refer to DTC P0506.

TERMINAL AND CONNECTOR INSPECTION E07D5973

Refer to DTC P0506.

POWER CIRCUIT INSPECTION E0918BC1

1. Key "OFF".
2. Disconnect ISCA connector.
3. Key "ON".
4. Measure the voltage between terminal 2 of ISCA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short in power circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E2EFD73B

1. Key "OFF".
2. Disconnect ISCA connector and Key "ON".
3. Measure the voltage between terminal 1 of ISCA harness connector and chassis ground.
4. Measure the voltage between terminal 3 of ISCA harness connector and chassis ground.

Specification : Approx 1.7V (at terminal 1), Approx 2V (at terminal 3)

5. Is the measured voltage within specification?

YES

▶ Go to "System inspection" procedure.

NO

▶ Repair Open or Short in control circuit and then, go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EE5A06B3

1. Visual inspection.
   1) Key "OFF".
   2) Check intake air system
      ▶ Check assembling state and damage on throttle body gasket.
      ▶ Check assembling/sealing state and damage on MAFS and PCV valve.

3) Is everything O.K?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC64B962

1. ISCA visual check.

   1) Key "OFF".

   2) Disassemble ISCA.

   3) Check contamination, damage or stuck on ISCA.

   4) Check the operating sound when key turns "OFF" to "ON".

   5) Is ISCA O.K?

   YES

   ▶ Go to "ISCA check" procedure.

   NO

   ▶ Substitute with a known - good ISCA and check for proper operation.
   ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.

   1) Key "OFF".

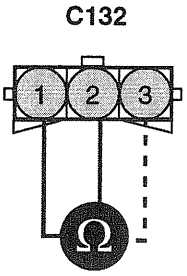
   2) Disassemble ISCA.

   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)

   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35℃ (68~95°F)	15.4±0.8	11.9±0.8



1. ISCA closing control
2. Sensor power
3. ISCA opening control

EGPF003T

5) Is the measured resistance within specifications?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

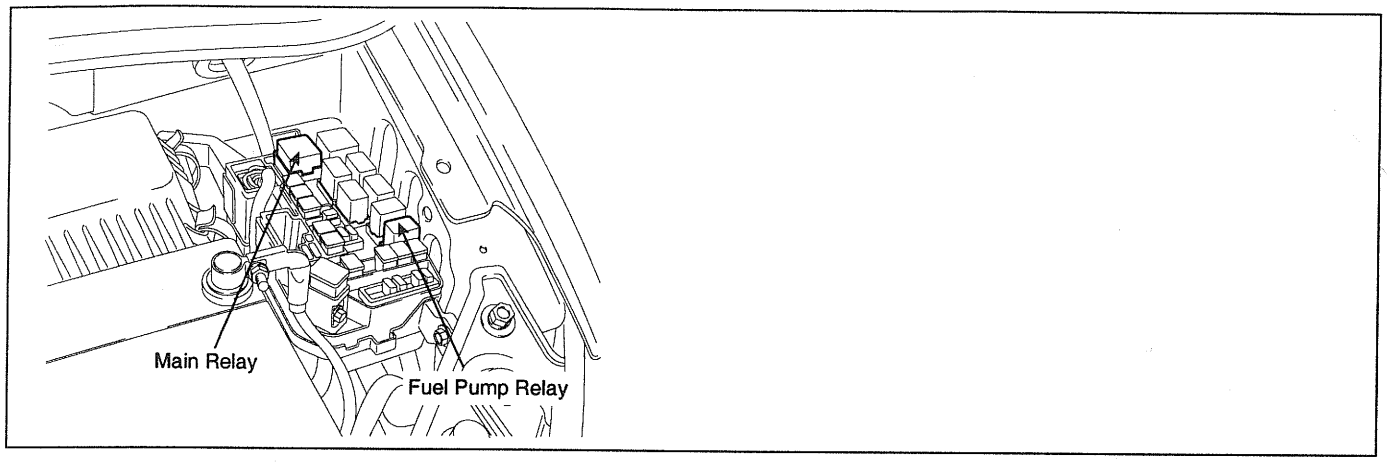
- ▶ Substitute with a known - good ISCA and check for proper operation.
- ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E699A2B4

Refer to DTC P0506.

DTC P0562 SYSTEM VOLTAGE LOW

COMPONENT LOCATION E6FD6236



EFPG800C

GENERAL DESCRIPTION E27919BA

The purpose of the System Voltage is to detect an excessively low or high system voltage that may be caused by a malfunctioning charging system.
System Voltage is the ignition voltage potential at the Powertrain Control Module (PCM)ECM measures and compares voltage from ignition key and each relay. With this mechanism, ECM knows if the main relay switch turns on after IG on or if turns OFF after IG off.

DTC DESCRIPTION EB602C64

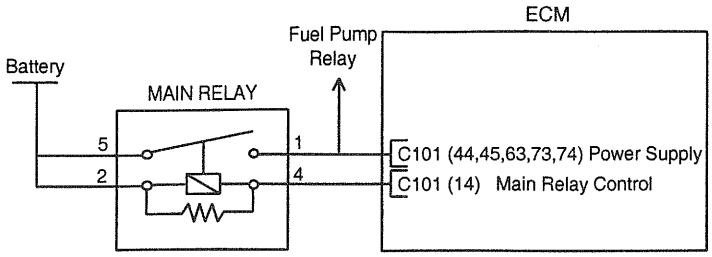
If the system voltage is 2.54~10 V during 0.2 sec, ECM sets DTC P0562.

DTC DETECTING CONDITION E3FCD827

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in control circuit • Charging system • Main relay • ECM
Enable Conditions	• Time after engine start 〉 120 sec	
Threshold Value	• Voltage : 2.54 ~ 10 V	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 3 driving cycle	

SCHEMATIC DIAGRAM EC6A31ED

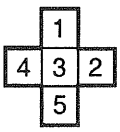
[CIRCUIT DIAGRAM]



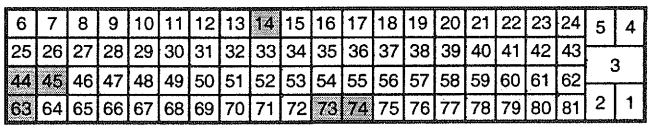
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (44,45,63,73,74)	Power Supply
2	Battery	Battery Voltage (B+)
3	-	-
4	ECM C101 (14)	Main Relay Control
5	Battery	Battery Voltage (B+)

[HARNESS CONNECTORS]



Main Relay (E46)



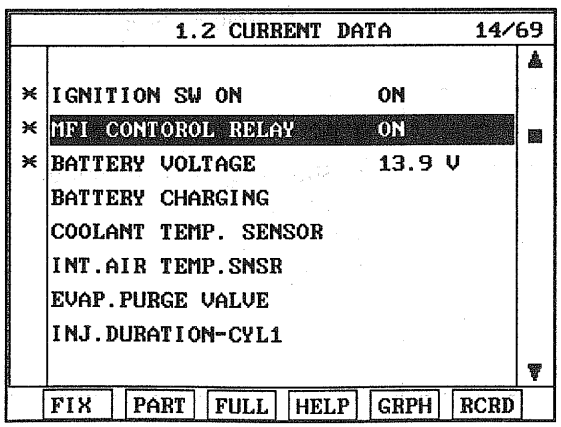
C101

ECM

EFPG501M

MONITOR SCANTOOL DATA EF521F8C

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Main relay" parameters on the scantool.



LFJF634A

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E3B5D00F

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Main relay circuit inspection" procedure.

POWER CIRCUIT INSPECTION EE70201A

1. Key "OFF".
2. Disconnect Main relay and Key "ON".
3. Measure the voltage between terminal 2 of main relay harness connector and chassis ground.
4. Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "System inspection" procedure.

NO

▶ Check the fuse(ECU A 30A) between battery and main relay.
▶ Repair Open or short to ground in power circuit and then go to "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION E0242A10

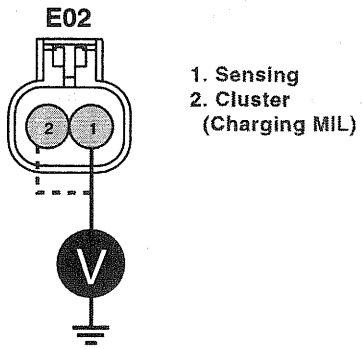
1. Alternator circuit check.
   1) Key "OFF".
   2) Disconnect alternator connector.

3) Key "ON".

4) Measure the voltage between terminal 1 of alternator harness connector and chassis ground.

5) Measure the voltage between terminal 2 of alternator harness connector and chassis ground.

Specification : B+



LFJF633A

6) Is the measured voltage within specification?

YES

7) ▶ Go to "Component inspection" procedure.

NO

▶ In case there is no voltage detected at terminal 1, check Open circuit, Battery and Fuse(MAIN 120 A) between battery and alternator. And then go to "Verification of vehicle Repair" procedure.
▶ In case there is no voltage detected at terminal 2, check Open circuit, MIL circuit and MIL resistor. And then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EF71768D

1. Main relay check.

1) Key "OFF".

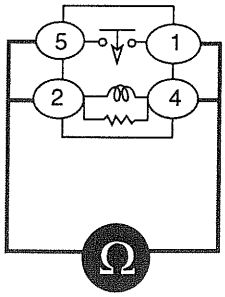
2) Disconnect Main relay.

3) Measure the resistance between terminal 1 and 5 of main relay. (Component side)

4) Measure the resistance between terminal 2 and 4 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
1~5	NO
2~4	YES (Approx. 70Ω ~ 120Ω)



EGPF501N

5) Is the measured resistance within specifications?

YES

▶ Go to "Alternator check" procedure.

NO

▶ Substitute with a known - good Main relay and check for proper operation.
▶ If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Alternator check.

1) Key "OFF".

2) Check the tension of alternator belt.

3) Check corrosion, damage or looseness of Battery terminal and Alternator terminal.

4) Engine start.

5) Operate electrical parts(Head lamp, Defoger, etc).

6) Measure the voltage at 2000rpm.

Specification : Approx 12.5V ~ 14.5V

7) Is the measured voltage within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good Alternator and check for proper operation.
▶ If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE948A60

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0563 SYSTEM VOLTAGE HIGH

COMPONENT LOCATION ED44C1D4

Refer to DTC P0506.

GENERAL DESCRIPTION EB6363E2

Refer to DTC P0506.

DTC DESCRIPTION EBBE3C74

If the system voltage is over 17 V during 0.2 sec, ECM sets DTC P0563.

DTC DETECTING CONDITION E728D7C5

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, high	• Poor connection • Charging system • Main relay • ECM
Enable Conditions	• Time after engine start 〉 120 sec • Vehicle speed 〉 25 kph	
Threshold Value	• Voltage 〉 17 V	
Diagnostic Time	• 0.2 sec	
MIL ON Condition	• 3 driving cycle	

SCHEMATIC DIAGRAM E7E3C730

Refer to DTC P0506.

MONITOR SCANTOOL DATA E1612BB6

Refer to DTC P0506.

TERMINAL AND CONNECTOR INSPECTION EA21FC30

Refer to DTC P0506.

POWER CIRCUIT INSPECTION E5D12D94

1. Key "OFF".
2. Disconnect Main relay and Key "ON".
3. Measure the voltage between terminal 2 of main relay harness connector and chassis ground.
4. Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "System inspection" procedure.

NO

▶ Check the fuse(ECU A 30A) between battery and main relay.
▶ Repair short in power circuit and then go to "Verification of vehicle Repair" procedure.

SYSTEM INSPECTION E9D40732

1. Alternator circuit check.

1) Key "OFF".

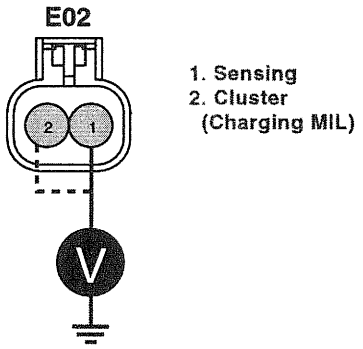
2) Disconnect alternator connector.

3) Key "ON" & ENG "OFF".

4) Measure the voltage between terminal 1 of alternator harness connector and chassis ground.

5) Measure the voltage between terminal 2 of alternator harness connector and chassis ground.

Specification : B+



LFJF633A

6) Is the measured voltage within specification?

YES

7) ▶ Go to "Component inspection" procedure.

NO

▶ In case there is no voltage detected at terminal 1, check Open circuit, Battery and Fuse(MAIN 120 A)between battery and alternator. And then go to "Verification of vehicle Repair" procedure.
▶ In case there is no voltage detected at terminal 2, check Open circuit, MIL circuit and MIL resistor. And then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E872A3C2

1. Main relay check.

   1) Key "OFF".

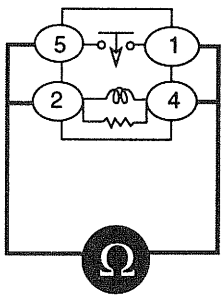
   2) Disconnect Main relay.

   3) Measure the resistance between terminal 1 and 5 of main relay. (Component side)

   4) Measure the resistance between terminal 2 and 4 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
1~5	NO
2~4	YES (Approx. 70Ω ~ 120Ω)



EGPF501N

   5) Is the measured resistance within specifications?

   YES

   ▶ Go to "Alternator check" procedure.

   NO

   ▶ Substitute with a known - good Main relay and check for proper operation.
   ▶ If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

2. Alternator check.

   1) Key "OFF".

   2) Check the tension of alternator belt.

   3) Check corrosion, damage or looseness of Battery terminal and Alternator terminal.

   4) Engine start.

   5) Operate electrical parts(Head lamp, Defoger, etc).

   6) Measure the voltage at 2000rpm.

Specification : Approx 12.5V ~ 14.5V

7) Is the measured voltage within specifications?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good Alternator and check for proper operation.
- If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2DBC4A3

Refer to DTC P0506.

DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY(ROM) ERROR

GENERAL DESCRIPTION E4A57DD9

ECM monitors errors through checksum. Every information consists of the combination of 0 and 1, checksum means summing up all values in a row. Thus, errors are recognized comparing checksum value and the memory value at PCM.

DTC DESCRIPTION E5D16590

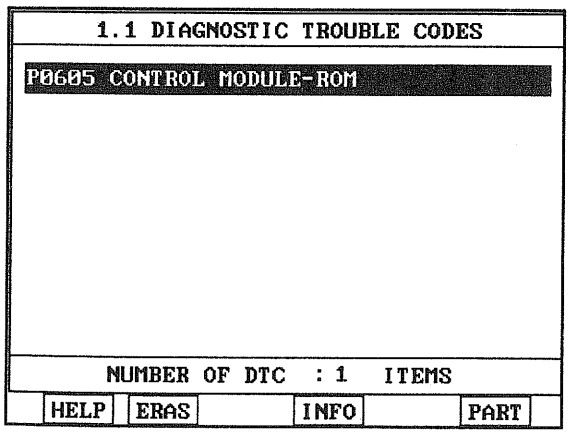
ECM detects the signal exchages between micro-processor and sensor/actuator. By the way, if there is error, ECM sets DTC P0605.

DTC DETECTING CONDITION ED2221FE

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check internal ROM	1. Poor connection 2. ECM
Enable Conditions		
Threshold Value	• Each check sum of several blocks (Actual check sum ≠ check sum data)	
Diagnostic Time		
MIL ON Condition	• Immediately ON	

MONITOR SCANTOOL DATA EB240CF6

1. Connect scantool to Data Link Connector(DLC).
2. Key "ON" & ENG "OFF".
3. Monitor DTC(Diagnostics Trouble Code) on the scantool.



EGPF501O

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E7FADD3D

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E27160B1

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

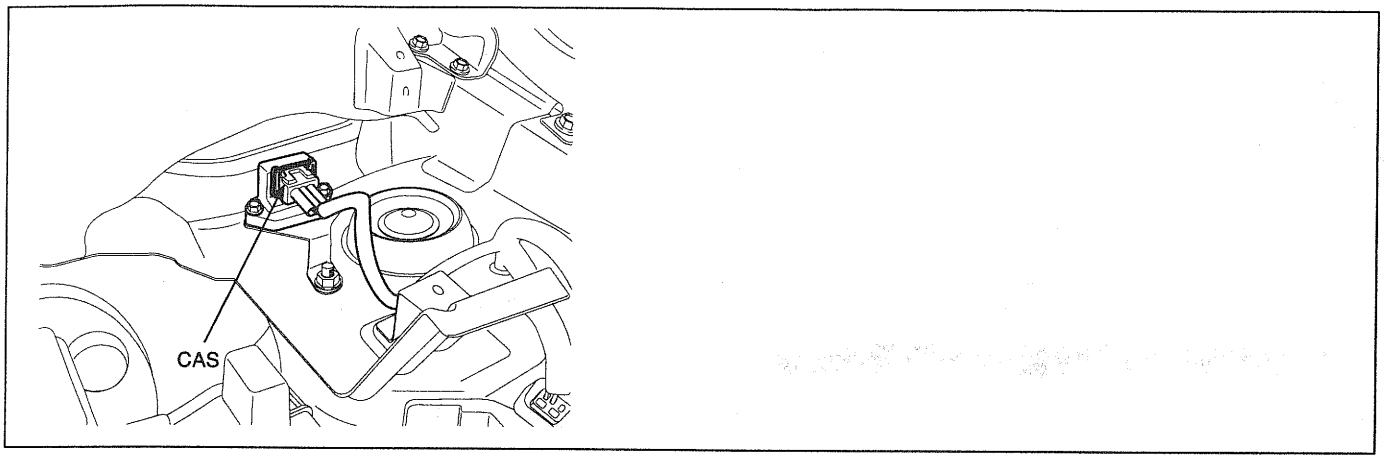
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1307 ACCELERATION SENSOR RANGE/PERFORMANCE

COMPONENT LOCATION E03F1781



EFPG307A

GENERAL DESCRIPTION EB8735EC

The Chassis Acceleration Sensor (CAS) consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

DTC DESCRIPTION E0FE5829

If the value exceeds threshold value, the ECM judges this as a fault and DTC P1307 is set.

DTC DETECTING CONDITION E5141F4E

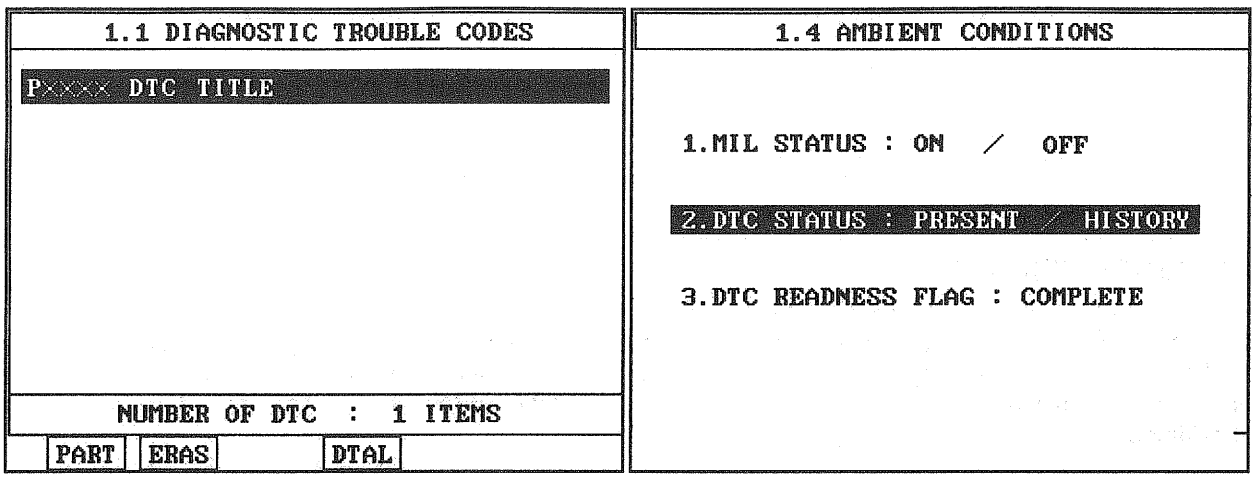
Item	Detecting Condition	Possible Cause
DTC Strategy	• Input signal check	• Contact resistance in connectors • Open or short in signal circuit • Open in ground circuit • Open or short in power circuit • Faulty CAS • Faulty ECM
Enable Conditions	• No vehicle movement > 3sec	
Threshold Value	• Measured Voltage - Modeled Voltage > 0.2V	
Diagnostic Time	• 15 sec	
MIL ON Condition	• 3 Driving Cycle	

SPECIFICATION EA93139E

Accelera-tion (G)	-5	-3	-1	0	1	3	5
Output Voltage (V) (Approx.)	0.26~1.74	1.16~1.44	2.05~2.15	2.5	2.85~2.95	3.56~3.84	4.26~4.74

MONITOR DTC STATUS E9DBDFDF

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & ENG "OFF".
3. Select "Diagnostic Trouble Codes(DTCs)" mode, and then Press F4(DTAL) to check DTC's information from the DTCs menu.
4. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions noted in the DTC detecting condition.
5. Read "DTC Status" parameter.



EFPF050A

6. Is parameter displayed "History(Not Present) fault"?

NOTE

- *History fault : DTC occurred but has been cleared.*
- *Present fault : DTC is occurring at present time.*

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness,poor connection, bending, corrosion, contamination, deterioration, or damage.Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
NO

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E6404423

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults canalso be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination,deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure

NO

▶ Go to "Power Circuit inspection" procedure.

POWER CIRCUIT INSPECTION EFFBB4D4

1. Ignition "OFF".
2. Disconnect CA sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "1" of sensor harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Check for open or short in power harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E01AD231

1. Ignition "OFF".
2. Disconnect CAsensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "3" of sensor harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Check for open or short in signal harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E18C05F3

1. Ignition "OFF".
2. Disconnect CA sensor connector.
3. Measure resistance between terminal 1 of harness connector and chassis ground.
   Measure resistance between terminal 1 and 2 of harness connector.

Specification : "A" - "B" = Below 200mV

4. Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for open in ground harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E12C8EEA

1. Check CAS.
   1) Substitute with a known - good CAS and check for proper operation.
   2) Is the signal normal?

YES

▶ Replace CAS and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE468392

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1308 ACCELERATION SENSOR CIRCUIT LOW INPUT

COMPONENT LOCATION E4CDC201

Refer to DTC P1307.

GENERAL DESCRIPTION EFF58618

Refer to DTC P1307.

DTC DESCRIPTION E5601CF5

ECM sets DTC P1308 if the ECM detects signal voltage lower than the possible range of a properly operation CAS.

DTC DETECTING CONDITION E2A8CFE2

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, Low	• Contact resistance in connectors • Open or short to ground in power circuit • Short to ground in signal circuit • Faulty CAS • Faulty ECM
Enable Conditions		
Threshold Value	• Filtered acceleration sensor signal < 1.5 V	
Diagnostic Time		
MIL ON Condition	• 3 Driving Cycles	

SPECIFICATION E4ACB19E

Refer to DTC P1307.

MONITOR DTC STATUS EBD287FD

Refer to DTC P1307.

TERMINAL AND CONNECTOR INSPECTION EABC35A5

Refer to DTC P1307.

POWER CIRCUIT INSPECTION E0C9088F

1. Ignition "OFF".
2. Disconnect CA sensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "1" of sensor harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Check for open or short in power harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E3553550

1. Ignition "OFF".
2. Disconnect CAsensor connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "3" of sensor harness connector and chassis ground.

Specification : Approx. 5V

5. Is the measured voltage within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for short in signal harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EAA3FE38

1. Check CAS.
   1) Substitute with a known - good CAS and check for proper operation.
   2) Is the signal normal?

YES

▶ Replace CAS and go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E35CD6E5

Refer to DTC P1307.

DTC P1309 ACCELERATION SENSOR CIRCUIT HIGH INPUT

COMPONENT LOCATION E1A75052

Refer to DTC P1307.

GENERAL DESCRIPTION EFE61AA0

Refer to DTC P1307.

DTC DESCRIPTION E6F5CBC6

ECM sets DTC P1309 if the ECM detects signal voltage higher than the possible range of a properly operating CAS.

DTC DETECTING CONDITION E62BF5E8

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check,High	• Contact resistance in connectors • Open or short to battery in signal circuit • Open in ground circuit • Faulty CAS • Faulty ECM
Enable Conditions		
Threshold Value	• CAS signal > 3.5 V	
Diagnostic Time		
MIL ON Condition	• 3 Driving Cycles	

SPECIFICATION E886CB8B

Refer to DTC P1307.

MONITOR DTC STATUS EBAC4A96

Refer to DTC P1307.

TERMINAL AND CONNECTOR INSPECTION E27FEDCE

Refer to DTC P1307.

SIGNAL CIRCUIT INSPECTION E492E26D

1. Signal circuit voltage check

1) Ignition "OFF".

2) Disconnect CAsensor connector.

3) Ignition "ON" & Engine "OFF".

4) Measure voltage between terminal "3" of sensor harness connector and chassis ground.

Specification : Approx. 5V

5) Is the measured voltage within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Check for open or short in signal harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

2. Check for short in harness.

1) Ignition "OFF".

2) Disconnect CS sensor connector and ECM connector.

3) Measure resistance between terminal "1" and "3"of the sensor harness connector .

Specification : infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Check for short to power in signal harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E1BFF079

1. Ignition "OFF".
2. Disconnect CA sensor connector.
3. Measure voltage between terminal 1 of harness connector and chassis ground.
   Measure voltage between terminal 1 and 2 of harness connector.

Specification : "A" - "B" = Below 200mV

4. Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check for open in ground harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EEDAB64D

1. Check CAS.

   1) Substitute with a known - good CAS and check for proper operation.

   2) Is the signal normal?

   YES

   ▶ Replace CAS and go to "Verification of Vehicle Repair" procedure.

   NO

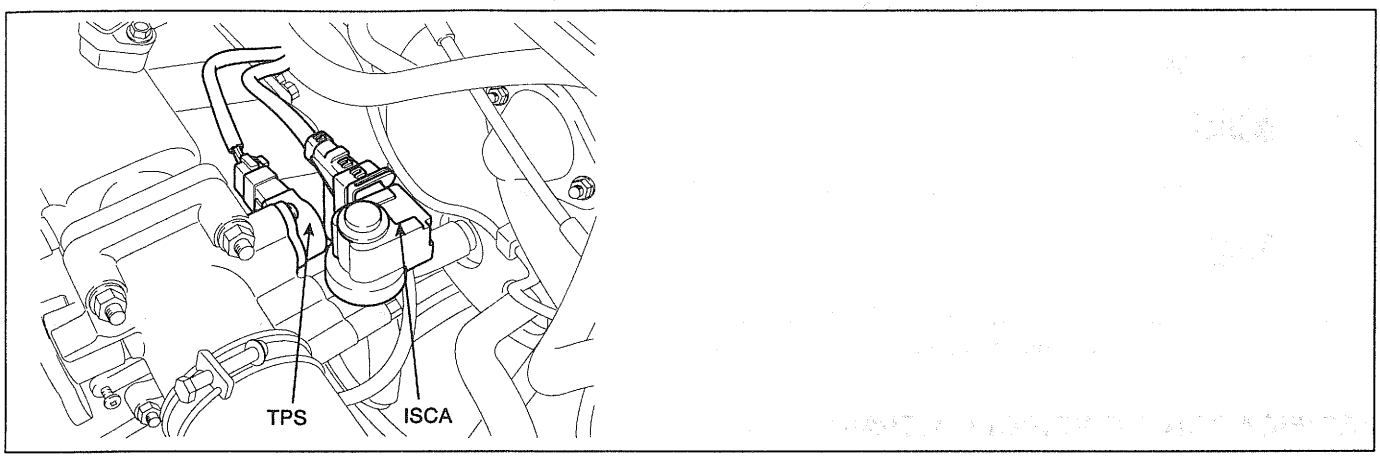
   ▶ Substitute with a known - good ECM and check for proper operation.If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E5CE24D5

Refer to DTC P1307.

DTC P1505 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #1

COMPONENT LOCATION EC4DCCD9



EFPG375B

GENERAL DESCRIPTION EE928B2B

The ISCA (Idle Speed Control Actuator) is designed to maintain a steady desired idle speed. Idle airflow is adjustedthrough the idle air actuator in order to maintain the desired idle speed under various load conditions. Load conditions vary due to numerous factors, such as engine temperature, air conditioning, electrical load and power steering load.

DTC DESCRIPTION E8FCB67C

If there is Open or Short to ground in ISCA(opening coil) circuit, ECM sets DTC P1505.

DTC DETECTING CONDITION E2A206D8

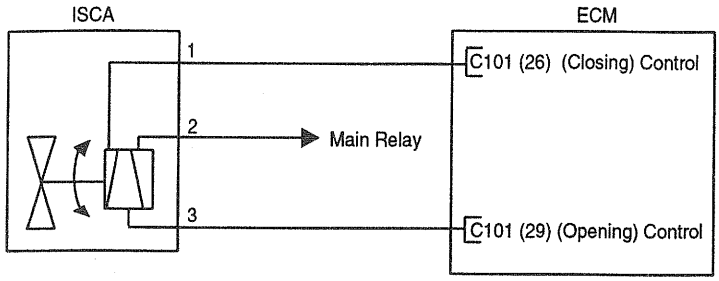
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low (opening coil)	• Poor connection • Open or short to ground in control circuit • ISCA • ECM
Enable Conditions		
Threshold Value	• Shorted to ground or disconnected	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E6D2757B

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35 (68~95°F)	15.4±0.8	11.9±0.8

SCHEMATIC DIAGRAM E012BF11

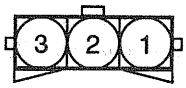
[CIRCUIT DIAGRAM]



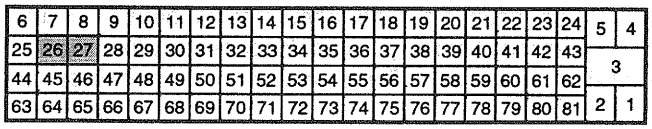
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C101 (26)	Closing Control
2	Main Relay	Battery Voltage (B+)
3	ECM C101 (27)	Opening Control

[HARNESS CONNECTORS]



ISCA (C132)

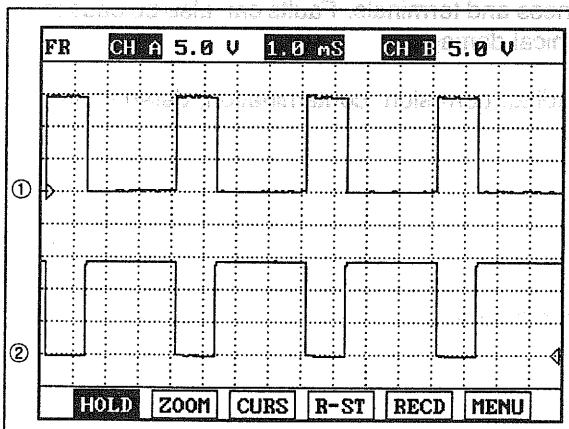


C101

ECM

EGPF501K

SIGNAL WAVEFORM & DATA E9FFD0E4

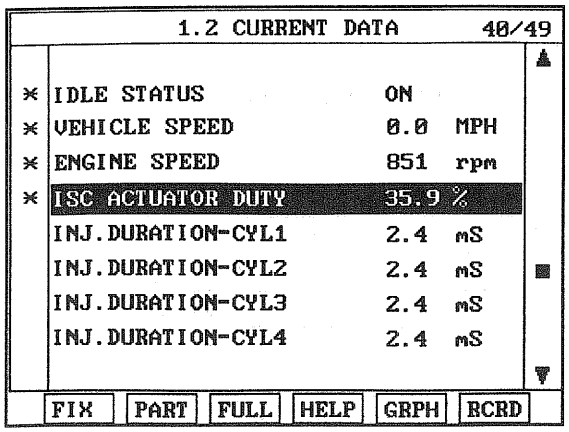


① Closing control duty signal at idle
② Opening control duty signal at idle

LFJF616A

MONITOR SCANTOOL DATA EFA35EDB

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "ISCA" parameters on the scantool.



EGPF501L

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E5B89273

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Power circuit inspection" procedure.

POWER CIRCUIT INSPECTION EB080DBA

1. Key "OFF".
2. Disconnect ISCA connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 2 of ISCA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short in power circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EC64BD2D

1. Check Open in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 3 of ISCA harness connector and terminal 29/C101 of ECM harness connector.

Specification : Approx 1Ω below

   4) Is the measured resistance within specification?

YES

▶ Go to "Check Short in Control circuit" procedure.

NO

▶ Repair Open in control circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 3 of ISCA harness connector and chassis ground.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to ground in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3C2DED2

1. ISCA visual check.

1) Key "OFF".

2) Disassemble ISCA.

3) Check contamination, damage or stuck on ISCA.

4) Check the operating sound when key turns "OFF" to "ON".

5) Is ISCA O.K?

YES

▶ Go to "ISCA check" procedure.

NO

▶ Substitute with a known - good ISCA and check for proper operation.
▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.

1) Key "OFF".

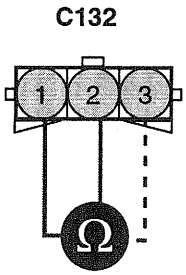
2) Disassemble ISCA.

3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)

4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35 (68~95°F)	15.4±0.8	11.9±0.8



1. ISCA closing control
2. Sensor power
3. ISCA closing control

EGPF204A

5) Is the measured resistance within specifications?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Substitute with a known - good ISCA and check for proper operation.
- ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3F955E7

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P1506 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #1

COMPONENT LOCATION E06F3803

Refer to DTC P1505.

GENERAL DESCRIPTION E1E9D5AC

Refer to DTC P1505.

DTC DESCRIPTION EAA6313F

If there is Short to power in ISCA(opening coil) circuit, ECM sets DTC P1506.

DTC DETECTING CONDITION E795B8C7

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high (opening coil)	• Poor connection • Short to power in control circuit • ISCA • ECM
Enable Conditions		
Threshold Value	• Shorted to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycle	

SPECIFICATION E38702CD

Refer to DTC P1505.

SCHEMATIC DIAGRAM E05AB674

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA E7B4EB3D

Refer to DTC P1505.

MONITOR SCANTOOL DATA EC422E72

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION E48B63D3

Refer to DTC P1505.

CONTROL CIRCUIT INSPECTION E02C4761

1. Key "OFF".

2. Disconnect ISCA connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 3 of ISCA harness connector and chassis ground.

Specification : Approx 2V

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E146FE37

1. ISCA visual check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Check contamination, damage or stuck on ISCA.
   4) Check the operating sound when key turns "OFF" to "ON".
   5) Is ISCA O.K?

   YES

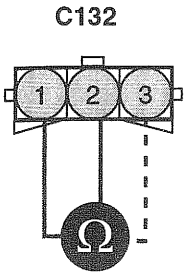
   ▶ Go to "ISCA check" procedure.

   NO

   ▶ Substitute with a known - good ISCA and check for proper operation.
   ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.
2. ISCA check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)
   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35 (68~95°F)	15.4±0.8	11.9±0.8



1. ISCA closing control
2. Sensor power
3. ISCA closing control

EGPF204A

5) Is the measured resistance within specifications?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good ISCA and check for proper operation.
- If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EAFBF34E

Refer to DTC P1505.

DTC P1507 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #2

COMPONENT LOCATION E26D489A

Refer to DTC P1505.

GENERAL DESCRIPTION E996B66B

Refer to DTC P1505.

DTC DESCRIPTION E6BCB7E5

If there is Open or Short to ground in ISCA(closing coil) circuit, ECM sets DTC P1507.

DTC DETECTING CONDITION EC543C46

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low (Closing coil)	• Poor connection • Open or short to ground in control circuit • ISCA • PCM
Enable Conditions		
Threshold Value	• Shorted to ground or disconnected	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycles	

SPECIFICATION EE2AA688

Refer to DTC P1505.

SCHEMATIC DIAGRAM EA89EC0B

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA ECE04027

Refer to DTC P1505.

MONITOR SCANTOOL DATA EC5A1FBC

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION E7A9E49B

Refer to DTC P1505.

POWER CIRCUIT INSPECTION EAB03962

1. Key "OFF".

2. Disconnect ISCA connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 2 of ISCA harness connector and chassis ground.

Specification : B+

5. Is the measured voltage within specification?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair Open or Short in power circuit and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E75742F3

1. Check Open in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 1 of ISCA harness connector andterminal 26/C101 of ECM harness connector.

Specification : Approx 1Ω below

   4) Is the measured resistance within specification?

YES

▶ Go to "Check Short in Control circuit" procedure.

NO

▶ Repair Open in control circuit and then, go to "Verification of Vehicle Repair" procedure.

2. Check Short in control circuit.
   1) Key "OFF".
   2) Disconnect ISCA connector and ECM connector.
   3) Measure the resistance between terminal 1 of ISCA harness connector and chassis ground.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to ground in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE13C8A6

1. ISCA visual check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Check contamination, damage or stuck on ISCA.
   4) Check the operating sound when key turns "OFF" to "ON".
   5) Is ISCA O.K?

   YES

   ▶ Go to "ISCA check" procedure.

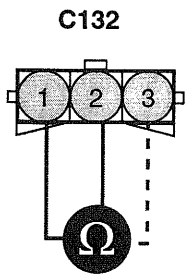
   NO

   ▶ Substitute with a known - good ISCA and check for proper operation.
   ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

2. ISCA check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)
   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35 (68~95°F)	15.4±0.8	11.9±0.8



1. ISCA closing control
2. Sensor power
3. ISCA closing control

EGPF204A

5) Is the measured resistance within specifications?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

- Substitute with a known - good ISCA and check for proper operation.
- If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E05F1237

Refer to DTC P1505.

DTC P1508 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #2

COMPONENT LOCATION E888F45A

Refer to DTC P1505.

GENERAL DESCRIPTION E8AB52FB

Refer to DTC P1505.

DTC DESCRIPTION ECB7C551

If there is Short to power in ISCA(closing coil) circuit, ECM sets DTC P1508.

DTC DETECTING CONDITION ECCD6241

Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, high (closing coil)	• Poor connection • Short to power in control circuit • ISCA • PCM
Enable Conditions		
Threshold Value	• Shorted to battery	
Diagnostic Time	• Continuous	
MIL ON Condition	• 3 driving cycles	

SPECIFICATION E86B25CD

Refer to DTC P1505.

SCHEMATIC DIAGRAM E555555A

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA E0387337

Refer to DTC P1505.

MONITOR SCANTOOL DATA E66BB30A

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION EF2BC07A

Refer to DTC P1505.

CONTROL CIRCUIT INSPECTION E4EDE13B

1. Key "OFF".

2. Disconnect ISCA connector.
3. Key "ON" & ENG "OFF".
4. Measure the voltage between terminal 1 of ISCA harness connector and chassis ground.

Specification : Approx 1.7V

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short to power in control circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E1629278

1. ISCA visual check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Check contamination, damage or stuck on ISCA.
   4) Check the operating sound when key turns "OFF" to "ON".
   5) Is ISCA O.K?

   YES

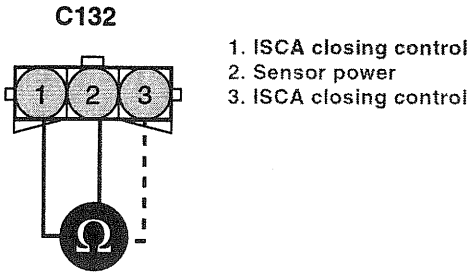
   ▶ Go to "ISCA check" procedure.

   NO

   ▶ Substitute with a known - good ISCA and check for proper operation.
   ▶ If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.
2. ISCA check.
   1) Key "OFF".
   2) Disassemble ISCA.
   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)
   4) Measure the resistance between terminal 2 and 3 of ISCA harness connector. (Component side)

SPECIFICATION :

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35 (68~95°F)	15.4±0.8	11.9±0.8



EGPF204A

5) Is the measured resistance within specifications?

YES

- Substitute with a known - good ECM and check for proper operation.
- If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

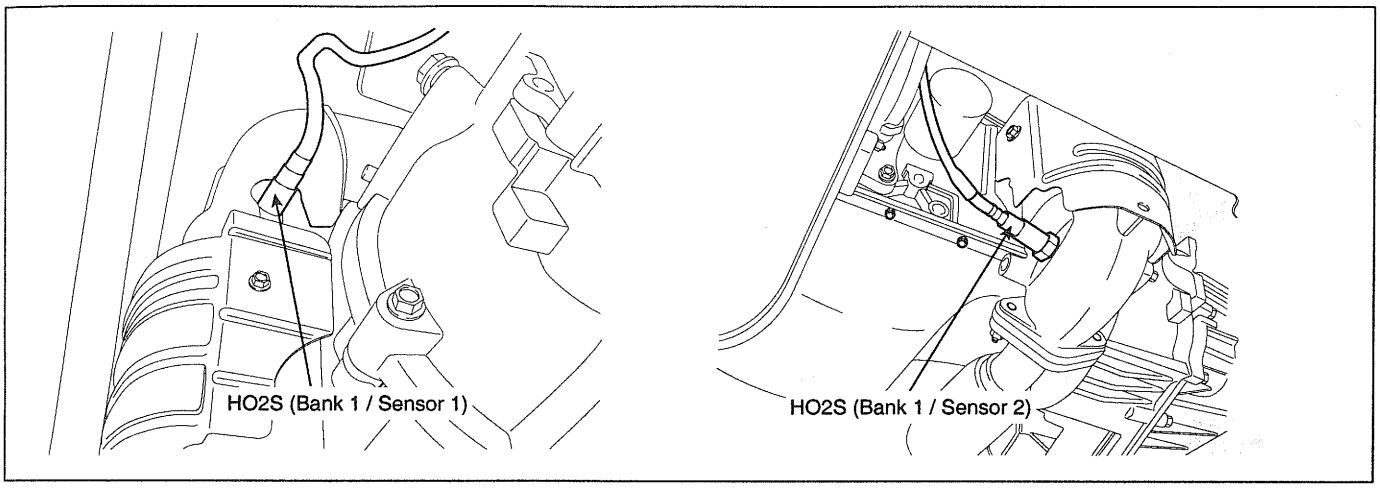
- Substitute with a known - good ISCA and check for proper operation.
- If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E45F57D9

Refer to DTC P1505.

DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

COMPONENT LOCATION E76087B1



EFPG800H

GENERAL DESCRIPTION ED44C909

The catalyst' s efficiency is demonstrated by its ability to oxidize CO and hydrocarbon emissions. The Powertrain Control Module (PCM) compares the output signals of the front and rear oxygen sensors to determine whether the output of the rear sensor is beginning to match the output of the front oxygen sensor. Air/fuel mixture compensation keeps the frequency of the front oxygen sensor high due to the changes from rich-to-lean combusition. The catalyst causes the rear oxygen sensor to have a lower frequency. As the catalyst wears, the rear oxygen sensor' s signal trace begins to match the front oxygen sensor' s signal trace. That is because the catalyst becomes saturated with oxygen and cannot use the oxygen to convert hydrocarbon and CO into H_2 O and CO_2 with the same efficiency as when it was new. A completely worn catalyst shows a 100% match between the frequency of the front and rear sensors.

DTC DESCRIPTION E4499D46

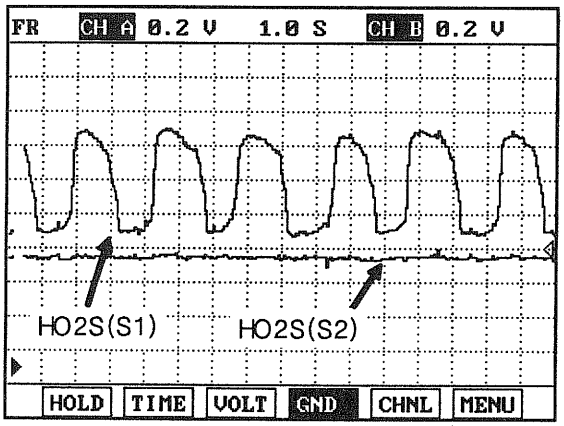
ECM controls Air/Fuel ratio by B1S1 monitoring and B1S2 monitoring. By the way, if there is the advanced B1S1 signal line shift compared with the value of B1S2 controller, ECM sets DTC P2096.

DTC DETECTING CONDITION EFC242B6

Item	Detecting Condition	Possible Cause
DTC Strategy	• O2 sensor characteristic line shift	• Catalyst converter • B1S1 • ECM
Enable Conditions	• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled • 1200rpm 〈 Engine speed 〈 3520rpm • Engine load : 15 ~ 78 %	
Threshold Value	• The second controller by B1S2 〉 1sec	
Diagnostic Time	• 15 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

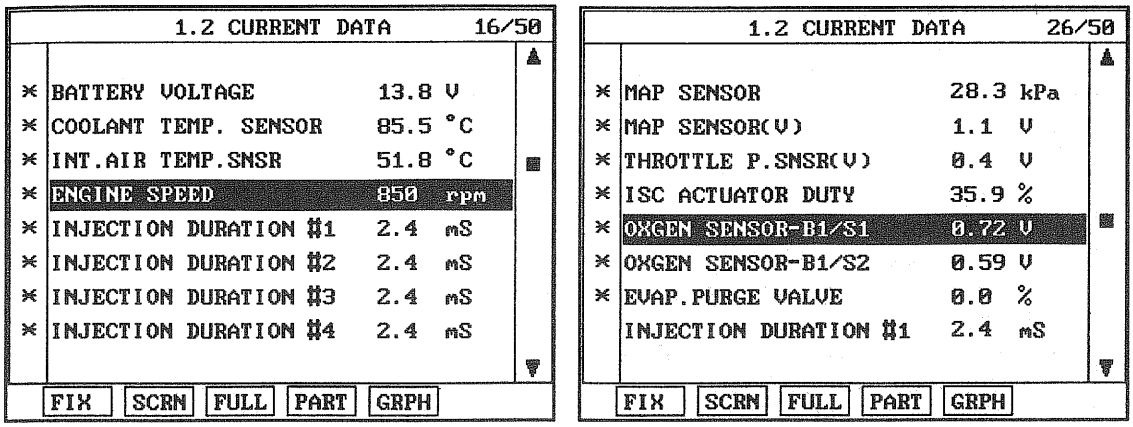
SIGNAL WAVEFORM & DATA E8813F1F



LFJF669A

MONITOR SCANTOOL DATA E4ED3C3B

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "Parameters related to air/fuel ratio(HO2S, MAF, MAP, TPS, ECTS, PCSV, Injector, etc)" on the scantool.



EGPF500P

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "System Inspection" procedure

SYSTEM INSPECTION EEF0F460

1. Check clog on Exhaust gas system

   1) Key "OFF".

   2) Check clog on muffler or catalyst converter.

   3) Is Exhaust gas system O.K?

      YES

      ▶ Go to "Intake air system check" procedure.

      NO

      ▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

2. Intake air system check.

   1) Check leakage on Intake air system
      ▶ Check looseness, deterioration or contamination on throttle body and gasket.
      ▶ Check contamination, damage or crack on intake manifold, ISCA and injectors.
      ▶ Check contamination or stuck on ISCA and EGR valve.

   2) Is there any leakage?

      YES

      ▶ Repair as necessary and go to "Verification of vehicle Repair" procedure

NO

▶ Go to "Fuel line check" procedure.

3. Fuel line check.

1) Check "Fuel line system"
▶ Check looseness of connectors on fuel line.
▶ Check looseness, damage, or interference of vacuum hose on fuel line.
▶ Check damage, leakage or bending on fuel line pipe.

2) Is fuel line normal?

YES

▶ Go to "Fuel line pressure check" procedure.

NO

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

4. Fuel line pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

Specification : Approx. 3.5 kg/cm²

7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check clogging on the fuel filter.
▶ Check the valve in a fuel pressure regulator.
(If it has a problem, fuel happen to be leaked to a return line.)
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E12C6FEE

1. PCV(Positive Crankcase Ventilation) valve check.

1) Key "OFF".

2) Disconnect PCV valve.

3) Check the movement of plunger by putting in and out a thin stick.

4) Is the movement of plunger normal?

YES

▶ Go to "injectors check" procedure.

NO

▶ Substitute with a known - good PCV valve and check for proper operation.
▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. Injector check

1) Key "OFF".

2) Disconnect injectors.

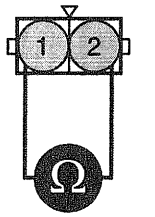
3) Check clog on injectors.

4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

ITEM	Specification
Coil Resistance	13.8 ~15.2Ω at 20℃ (68°F)

<C151-1,2,3,4>



1. Injector Power
2. Injector control

EGPF207A

5) Is the measured resistance within specifications ?

YES

▶ Go to "Sensors related to air/fuel ratio check" procedure.

NO

▶ Substitute with a known - good Injector and check for proper operation.
▶ If the problem is corrected, replace Injector and go to "Verification of Vehicle Repair" procedure.

3. Sensors related to air/fuel ratio check.

1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

2) Are those sensors normal?

YES

- ▶ Substitute with a known - good ECM and check for proper operation.
- ▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E80DF258

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

- ▶ Go to the applicable troubleshooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

COMPONENT LOCATION EDE99072

Refer to DTC P2096.

GENERAL DESCRIPTION E0FFE41B

Refer to DTC P2096.

DTC DESCRIPTION E5D09F14

ECM controls Air/Fuel ratio by B1S1 monitoring and B1S2 monitoring. By the way, if there is the retarded B1S1 signal line shift compared with the value of B1S2 controller, ECM sets DTC P2097.

DTC DETECTING CONDITION EF3FBC2E

Item	Detecting Condition	Possible Cause
DTC Strategy	• O2 sensor characteristic line shift	• Catalyst converter • B1S1 • ECM
Enable Conditions	• Dew point end detected • Required lambda = 1 • Battery voltage 〉 10.7V • Exhaust gas temperature (model) 〈 800℃ • Heater control enabled • 1200rpm 〈 Engine speed 〈 3520rpm • Engine load : 15 ~ 78 %	
Threshold Value	• The second controller by B1S2 〉 -1sec	
Diagnostic Time	• 15 sec	
MIL ON Condition	• 2 driving cycle	

※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SIGNAL WAVEFORM & DATA E495C302

Refer to DTC P2096.

MONITOR SCANTOOL DATA EA17605B

Refer to DTC P2096.

SYSTEM INSPECTION EF7D6A32

1. Check clog on Exhaust gas system
   1) Key "OFF".
   2) Check clog on muffler or catalyst converter.

3) Is Exhaust gas system O.K?

YES

▶ Go to "Intake air system check" procedure.

NO

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

2. Intake air system check.

1) Check clog on Intake air system"
▶ Check clog of air-cleaner.
▶ Check deterioration or contamination on throttle body and gasket.
▶ Check contamination, damage, stuck or clog on intake manifold, hoses, PCSV, ISCA and injectors.

2) Is there any problem?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure

NO

▶ Go to "Fuel line check" procedure.

3. Fuel line pressure check.

1) Key "OFF".

2) Disconnect a fuel pump relay.

3) Engine start and wait until engine stop. and then key "OFF".

4) Connect a fuel pump relay.

5) Connect a fuel pressure guage to a fuel filter by a fuel pressure guage adaptor.

6) Engine start and measure a fuel pressure.

Specification : Approx. 3.5 kg/cm²

7) Is the fuel pressure normal?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Check clog or stuck of the valve in a fuel pressure regulator.
▶ Check the supply pressure of fuel pump.
▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION ED43FF45

1. PCV(Positive Crankcase Ventilation) valve check.

1) Key "OFF".

2) Disconnect PCV valve.

3) Check the movement of plunger by putting in and out a thin stick.

4) Is the movement of plunger normal?

YES

▶ Go to "PCSV check" procedure.

NO

▶ Substitute with a known - good PCV valve and check for proper operation.
▶ If the problem is corrected, replace PCV valve and go to "Verification of Vehicle Repair" procedure.

2. PCSV check.

1) Key "OFF".

2) Disconnect PCSV and vacuum hose.

3) Apply a vacuum by a hand vacuum gauge on PCSV.

4) Does PCSV keep the vacuum condition normally?

YES

▶ Go to "Injector check" procedure.

NO

▶ Substitute with a known - good PCSV and check for proper operation.
▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

3. Injector check

1) Key "OFF".

2) Disconnect injectors.

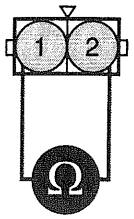
3) Check clog on injectors.

4) Measure the resistance between terminal 1 and 2 of injectors(Component side).

SPECIFICATION :

ITEM	Specification
Coil Resistance	13.8 ~15.2Ω at 20℃ (68°F)

<C151-1,2,3,4>



1. Injector Power
2. Injector control

EGPF207A

5) Is the measured resistance within specifications ?

YES

▶ Go to "Sensors related to air/fuel ratio check" procedure.

NO

▶ Substitute with a known - good Injector and check for proper operation.
▶ If the problem is corrected, replace Injector and go to "Verification of Vehicle Repair" procedure.

4. Sensors related to air/fuel ratio check.

1) Check the output data of sensors related to air/fuel ratio (HO2S, MAPS, TPS, ECTS, PCSV, Injectors, etc) on scantool. (Refer to each DTC guide procedure.)

2) Are those sensors normal?

YES

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

NO

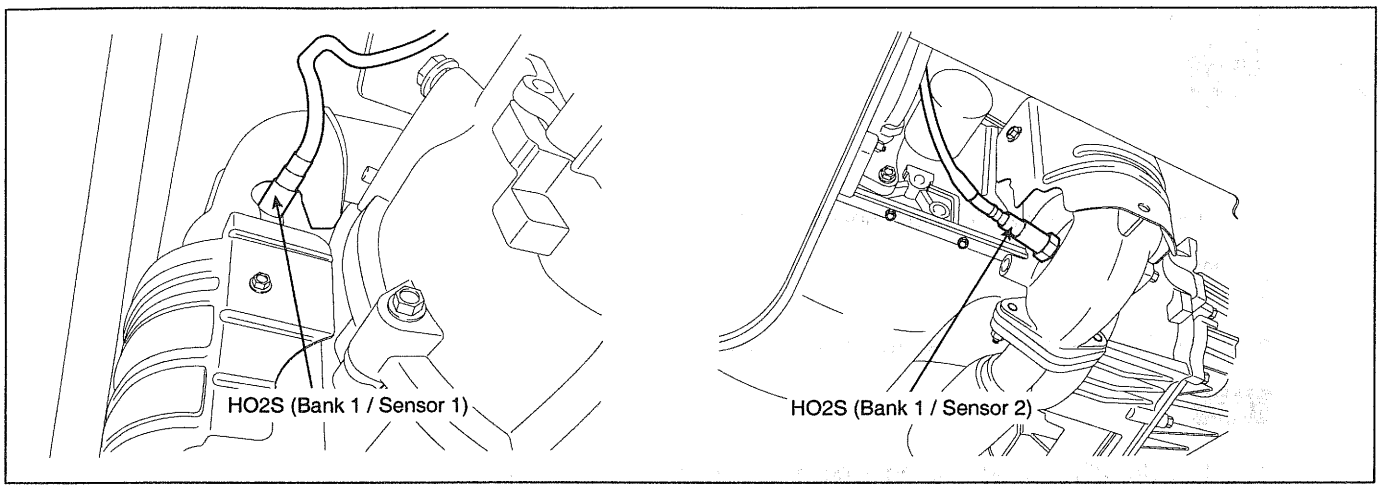
Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2C8922C

Refer to DTC P2096.

DTC P2232 O2 SENSOR SIGNAL CIRCUIT SHORTED TO HEATER CIRCUIT (SENSOR 2)

COMPONENT LOCATION E56876B3



EFPG800H

GENERAL DESCRIPTION E8244CCD

HO2S(B1/S2) is in the rear side of Catalytic Converter to check the proper operation of catalyst. Oxygen density after the catalytic converter has to be within specific range (around 0.5V when there is no acceclation and deceleration.)If the oxygen density changes in accordance with HO2S(B1/S1), it means the poor performance of catalytic converter.

DTC DESCRIPTION EC5E8F56

If the counter that the signal voltage changes rapidly is over 5 times, ECM sets DTC P2232.

DTC DETECTING CONDITION E6685B73

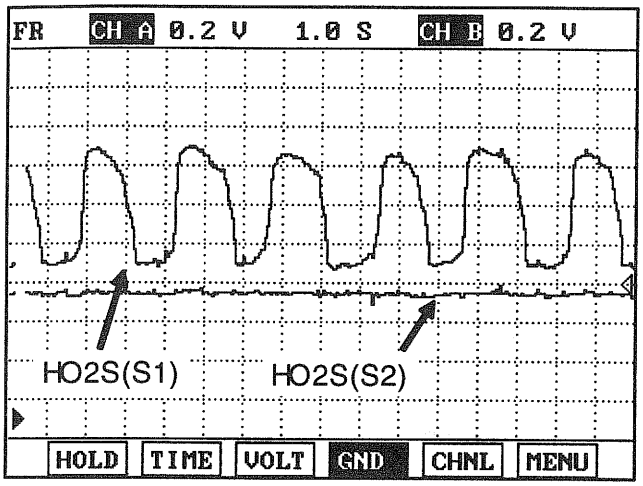
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Short to power in signal circuit • B1S2 • ECM
Enable Conditions	• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃ • Time after dew point end detected 〉 10 sec	
Threshold Value	• Counter of [△ushk > 2V after heater on→off] > 5 times	
Diagnostic Time		
Diagnostic Time	• 2 driving cycle	

△ushk : Sum of the signal voltage change value (B1S2)
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E96C33C4

Specification	0.1 ~ 0.9V

SIGNAL WAVEFORM & DATA E169A35D

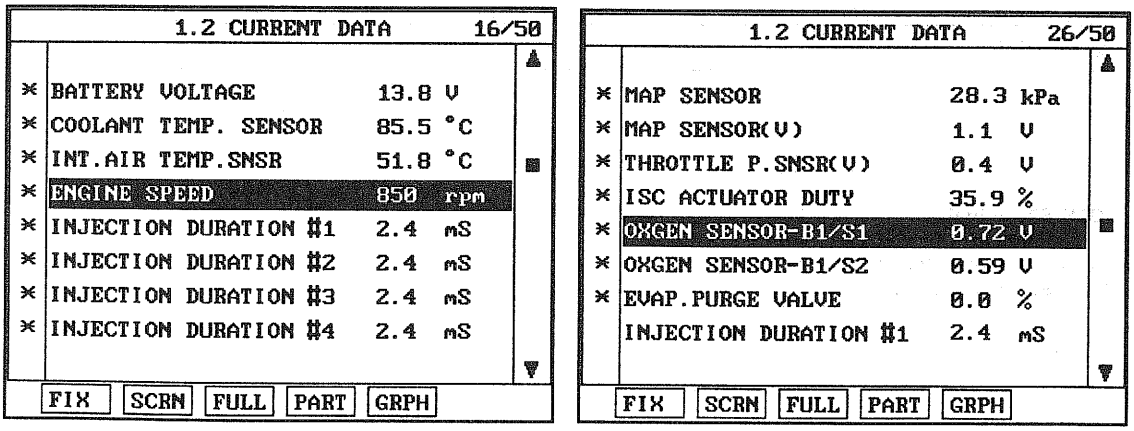


The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter.
This is the normal signal waveform of the rear HO2S at idle.

LFJF451A

MONITOR SCANTOOL DATA E7797ACB

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "B1S2" parameters on the scantool.



EGPF500P

4. Are the parameters displayed correctly?

YES

▶ Fault is intermittent caused by poor contact in the sensor' s and/or ECM' s connector or wasrepaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poorconnection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure.

NO

▶ Go to "Terminal and connector inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION EA218A98

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

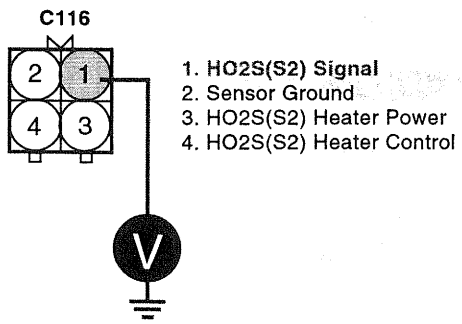
NO

▶ Go to "B1S2 circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION E7134449

1. IG "OFF".
2. Disconnect HO2S(B1/S2) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 1 of HO2S(B1/S2) and chassis ground.

Specification : Approx. 0.45V



EGPF208A

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to power in signal circuit and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION ED0D12E3

1. Visual Inspection.

   1) IG "OFF"

   2) Disconnect HO2S(B1/S2) connector.

   3) Check that HO2S(B1S2) is contaminated or damaged by foreign materials.

   4) Has a problem been found?

   YES

   ▶ Go to "Check ECM" as follows.

   NO

   ▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
   ▶ If the problem is corrected, replace HO2S(B1/S2) and go to "Verification of Vehicle Repair" procedure.

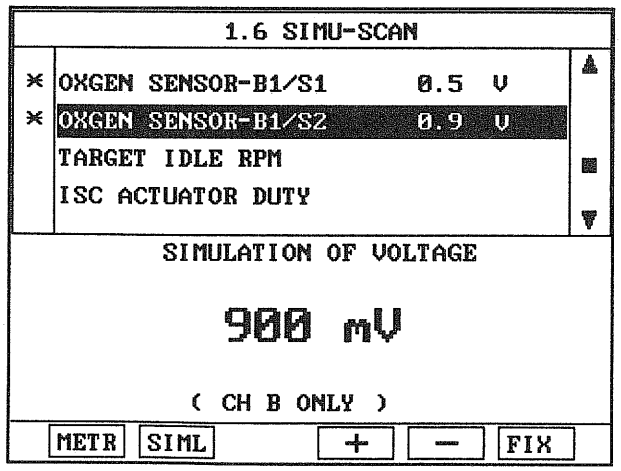
2. Check ECM.

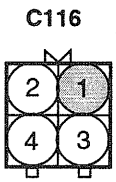
   1) IG "OFF".

   2) Connect scantool and Engine "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 1 of HO2S(B1/S2) signal connector.





1. HO2S(S2) Signal
2. Sensor Ground
3. HO2S(S2) Heater Power
4. HO2S(S2) Heater Control

EGPF209A

   5) Does the signal value of HO2S(B1/S2) change according to simulation voltage?

   YES

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion,contamination, deterioration, or damage. Repair or replace as necessary and go to "Verificationof Vehicle Repair" procedure.

NO

▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE692F75

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Are any DTCs present ?

YES

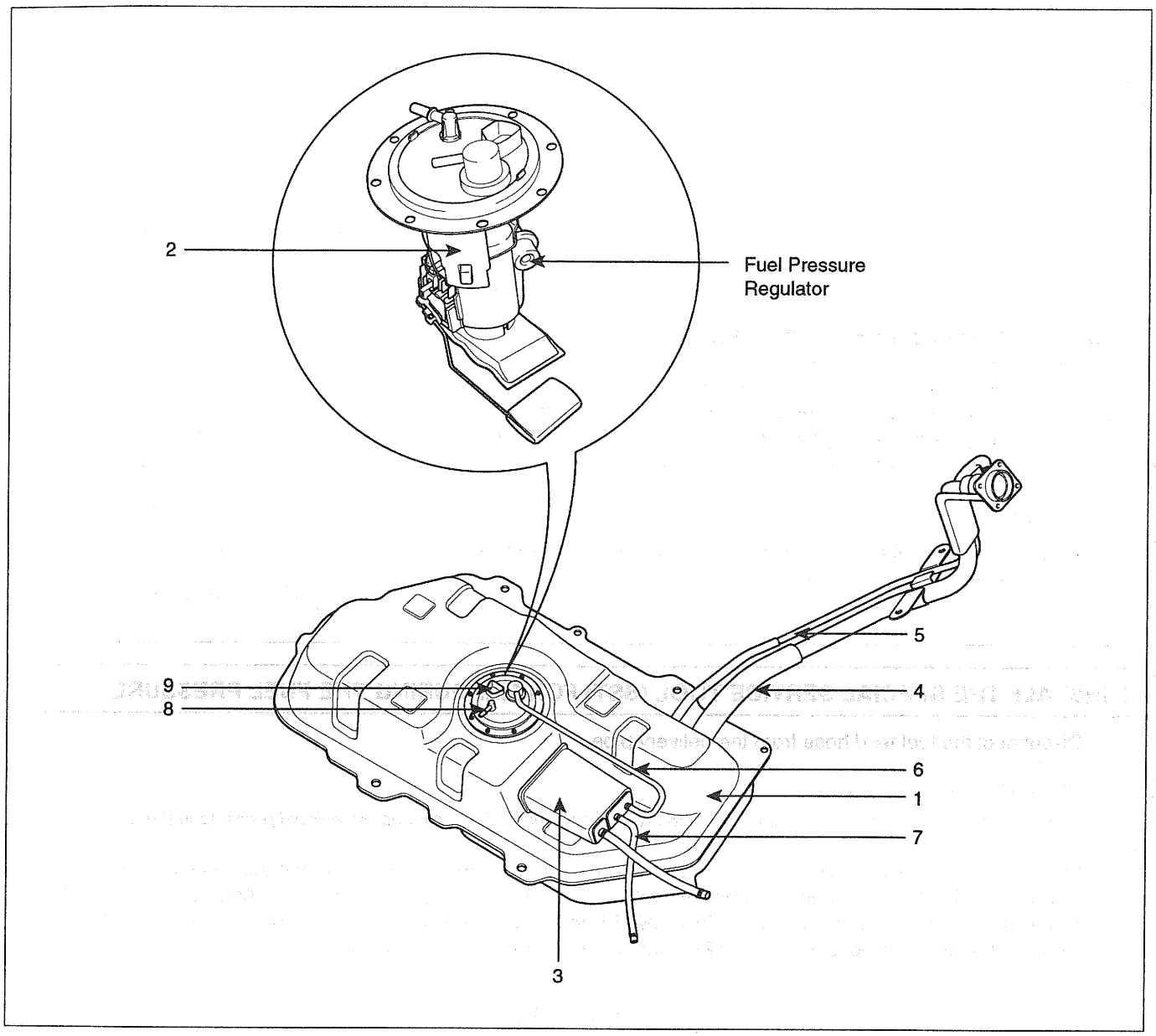
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

FUEL DELIVERY SYSTEM

COMPONENTS E743A7EA



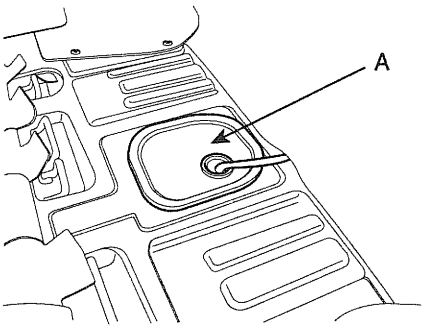
1. Fuel Tank
2. Fuel Pump Assembly (including Fuel Filter & Fuel Pressure Regulator)
3. Canister
4. Fuel Filler Pipe
5. Leveling Pipe
6. Hose (Canister ↔ Fuel Tank)
7. Hose (Canister ↔ Intake Manifold)
8. Nipple-Fuel Feed Line
9. Fuel Pump Connector

EFPF201A

FUEL PRESSURE TEST E55D8D39

1. PREPARING

1. Fold the rear seat (Refer to "BD" group in this WORKSHOP MANUAL).
2. Open the service cover (A).

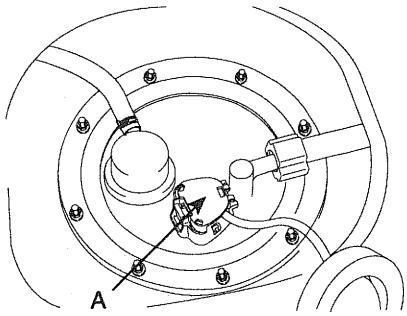


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



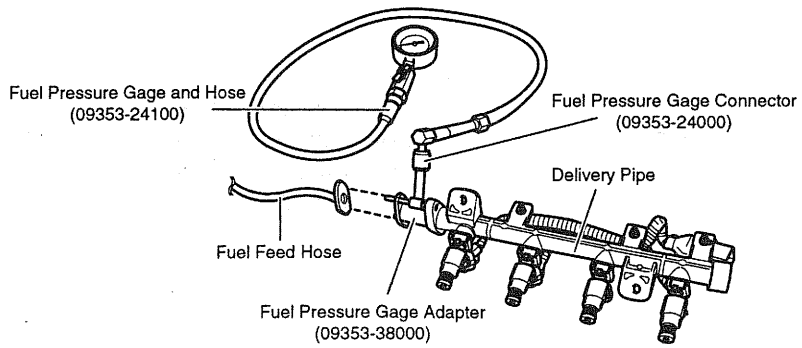
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gage Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gage Connector (09353-24000) to the Fuel Pressure Gage Adapter (09353-38000).
4. Connect the Fuel Pressure Gage and Hose (09353-24100) to Fuel Pressure Gage Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gage Adapter (09353-38000).



EFPF202A

4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESURE TEST

1. Diconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 343 kpa (3.5 kgf/㎠, 49.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Suspected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gage reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gage reading drops and perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

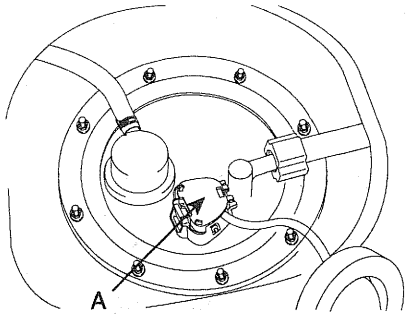
LGIF009J

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector (A).
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

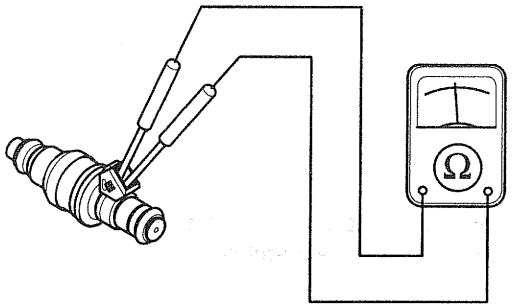
EGPF408A

FUEL INJECTOR

INSPECTION E90A74FF

1. Measure resistance between the terminal 1 and 2 of the injector.

Injector Resistance: 13.8 ~ 15.2 Ω at 20℃ (68°F)



LGIF602P

2. If the resistance is not within specification, replace the injector.

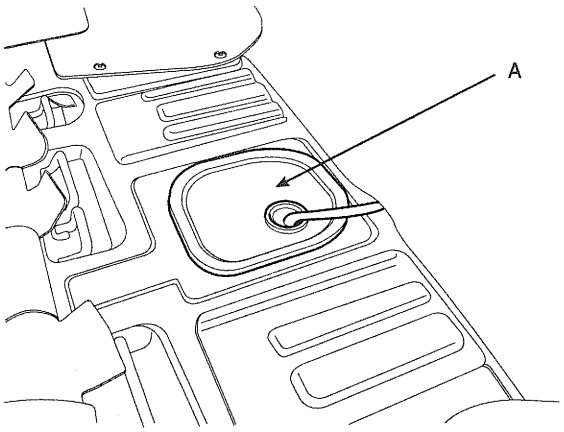
FUEL PUMP (FP)

REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) E2C52FFC

1. Preparation

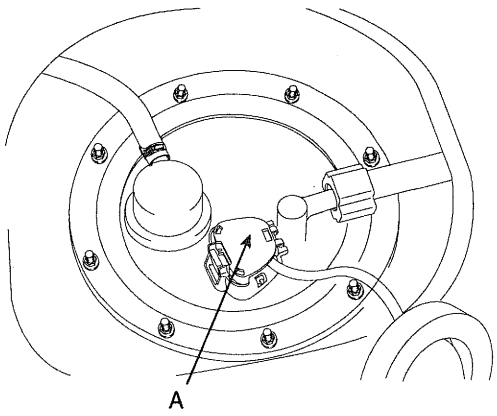
   1) Fold the rear seat (Refer to "BD" group in this WORKSHOP MANUAL)/

   2) Remove the service cover (A).



KFPF217A

   3) Disconnect the fuel pump connector (A).

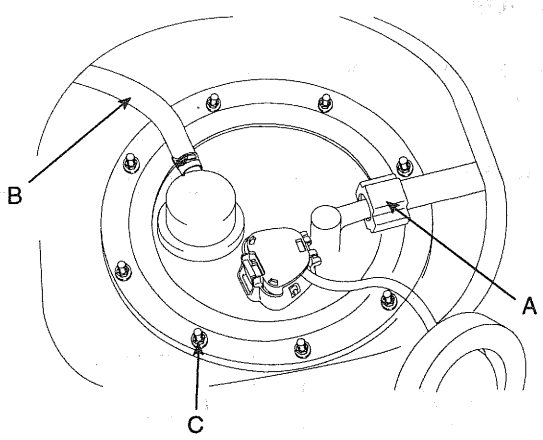


EGPF409A

   4) Start the engine and wait until fuel in fuel line is exhausted.

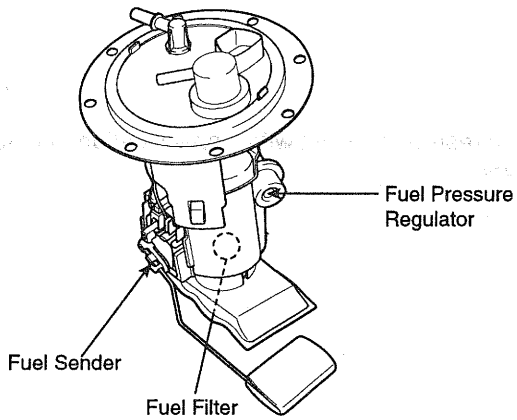
   5) After engine stalls, turn the ignition switch to OFF position.

2. Disconnect the fuel feed hose quick-connector (A) and canister hose (B).



EGPF410A

3. Unscrew the fuel pump mounting bolts (C) and remove the fuel pump assembly.



EGPF411A

INSTALLATION E626BD30

Install the Fuel Pump acording to the reverse order of REMOVAL procedure.

Tightening Torques
Fuel pump installation bolts/nuts: 2.0 ~ 2.9N·m (0.2 ~ 0.3kg·m, 1.4 ~ 2.2lb·ft)

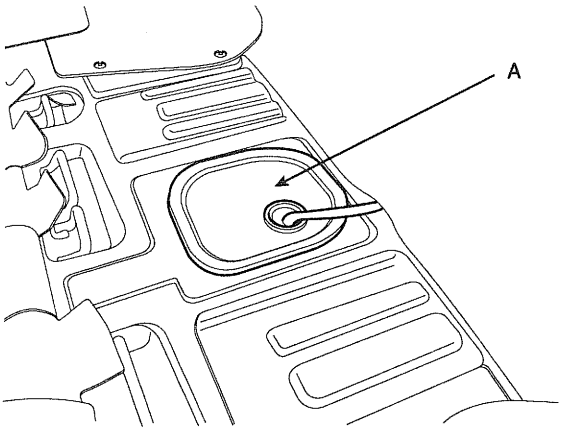
FUEL TANK

REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) E2F9B783

1. Preparation

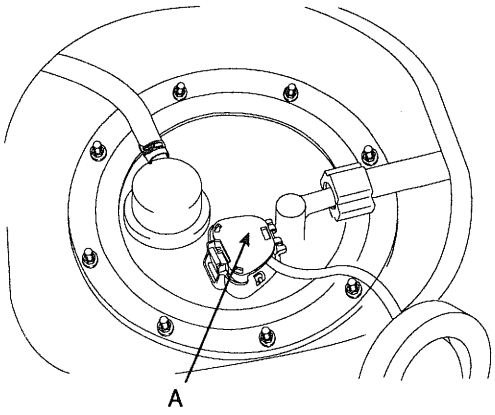
   1) Fold the rear seat (Refer to "BD" group in this WORKSHOP MANUAL)/

   2) Remove the service cover (A).



KFPF217A

   3) Disconnect the fuel pump connector (A).

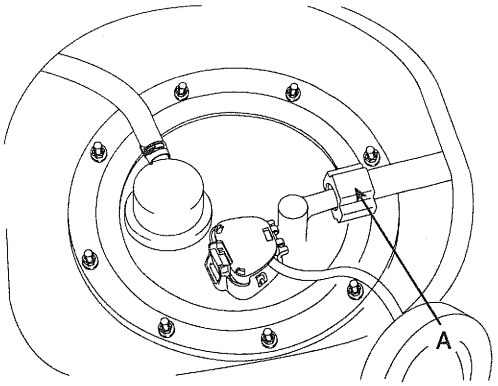


EGPF409A

   4) Start the engine and wait until fuel in fuel line is exhausted.

   5) After engine stalls, turn the ignition switch to OFF position.

2. Disconnect the fuel feed hose quick-connector (A).

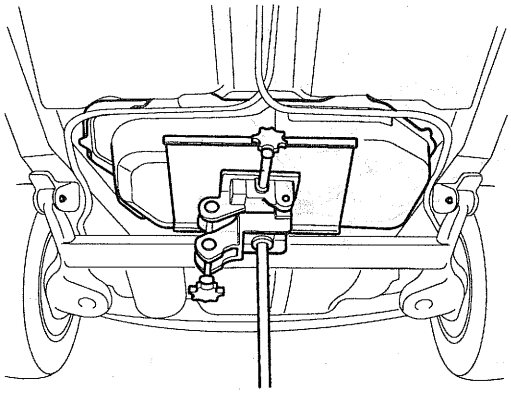


EGPF412A

3. Life the vehicle.

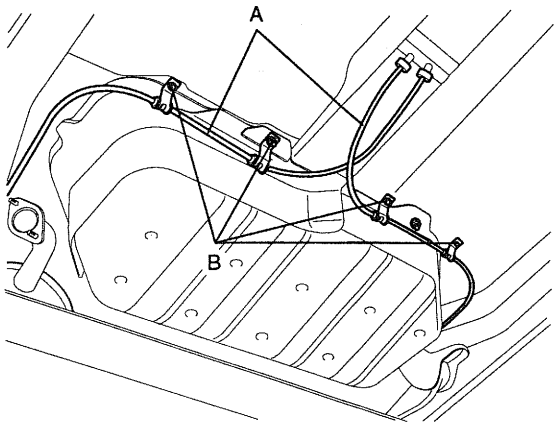
4. Remove the center muffler (Refer to "EM" group in this WORKSHOP MANUAL).

5. Support the fuel tank with a jack.



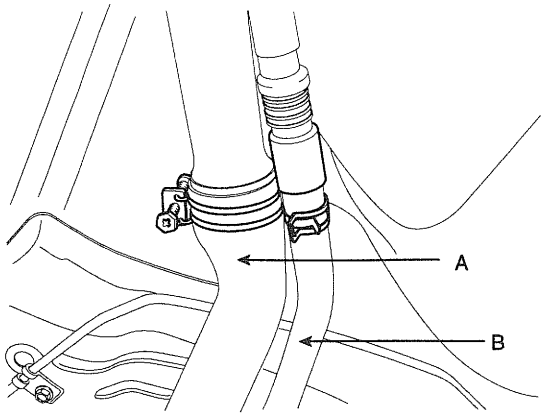
KFPF222A

6. Remove the brake hoses (A) by unscrewing the mounting bolts (B).



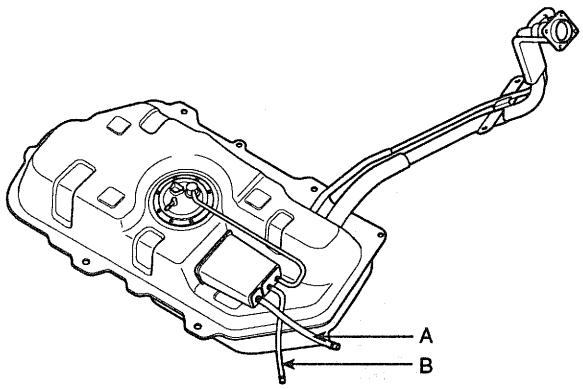
EGPF413A

7. Disconnect the fuel filler pipe (A), and the leveling pipe (B).



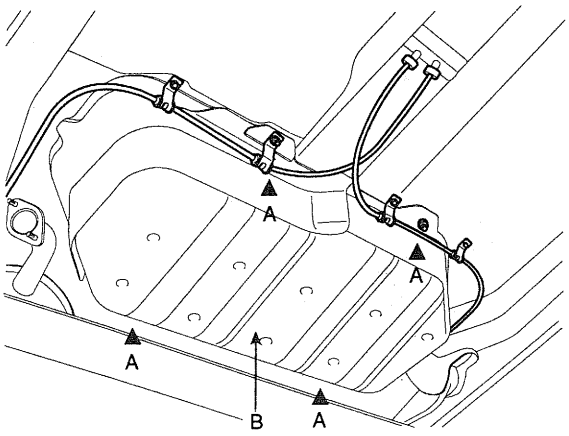
KFPF223A

8. Disconnect the canister hose (A,B)



EGPF414A

9. Unscrew the fuel tnak mounting bolts (A) and nuts (A), and then remove the fuel tnak(B).



KFPF225A

INSTALLATION EF198E9B

Install the Fuel Tank according to the reverse order to REMOVAL procedure.

Tightening Torques
Fuel tank installation bolts: 39.2 ~ 54.0 N·m (4.0 ~ 5.5 kg·m, 28.9 ~ 39.8 lb·ft)