Fuel System (G4ED/G4EE - GSL 1.6/1.4)

GENERAL

SPECIFICATIONS EECCDE06

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: Magnetic field sensitive 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)	Ouput Voltage (V)
-5g	0.26 ~ 1.74V
-3g	1.16 ~ 1.44V
-1g	2.05 ~ 2.15V
0g	2.5V
2g	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)	14.6 ~ 16.2Ω (20℃)
Opening Coil Resistance (Ω)	11.1 ~ 12.7Ω (20℃)

Duty (%)	Air Flow Rate (㎥/h)
15%	0.7 ~ 1.7 ㎥/h
35%	6.0 ~ 11.2 ㎥/h
70%	30.0 ~ 42.0 ㎥/h
96%	45.0 ~ 55.0 ㎥/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 EC9CC710

Ignition Timing (After warm up, at idle)		BTDC 0° ~ 5°
Basic Idle rpm(After warm up)	Neutral,N,P-range	700 ± 100 rpm
	D-range	700 ± 100 rpm

TIGHTENING TORQUES E18F147D

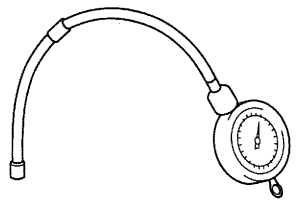
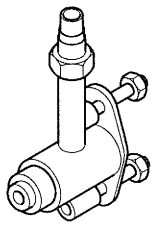
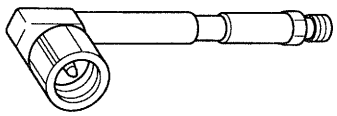
ENGINE CONTROL SYSTEM

Items	N·m	kgf·m	lbf·ft
ECM bracket installation bolts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
ECM installation bolts (or bracket)	3.9 ~ 6.9	0.4 ~ 0.7	2.9 ~ 5.1
Heated oxygen sensor (Bank 1 / Sensor 1) installation	49.1 ~ 58.9	5.0 ~ 6.0	36.2 ~ 43.4
Heated oxygen sensor (Bank 1 / Sensor 2) installation	49.1 ~ 58.9	5.0 ~ 6.0	36.2 ~ 43.4
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	4.9	0.5	3.6
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	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
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
Chassis Acceleration Sensor installation bolts	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7

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	14.7 ~ 19.6	1.5 ~ 2.0	10.9 ~ 14.5
Fuel pump installation bolts	2.0 ~ 2.9	0.2 ~ 0.3	1.4 ~ 2.2

SPECIAL SERVICE TOOLS E4D536D6

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 E4C6457A

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

LW8F1001

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.

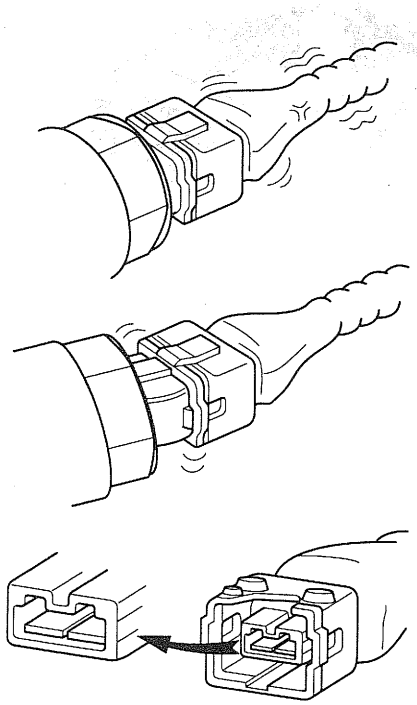
NOTE

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/PCM directly.**

● SIMULATING WATER SPRINKLING

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

WARNING

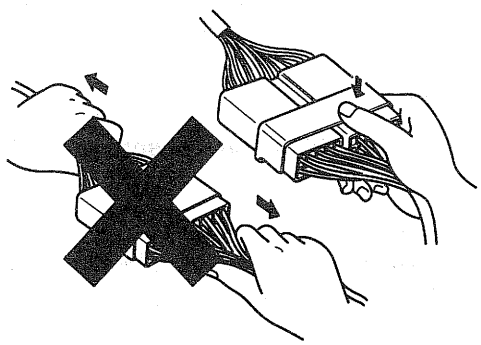
DO NOT sprinkle water directly into the engine compartment or electronic components.

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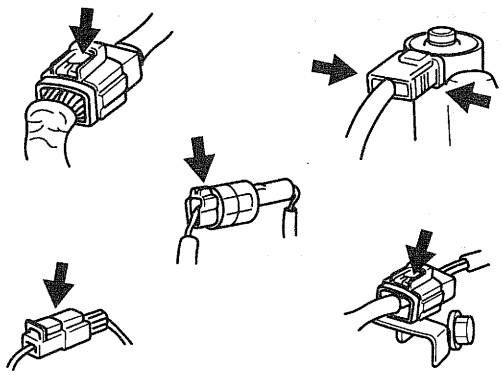
   b. When removing the connector with a lock, press or pull locking lever.



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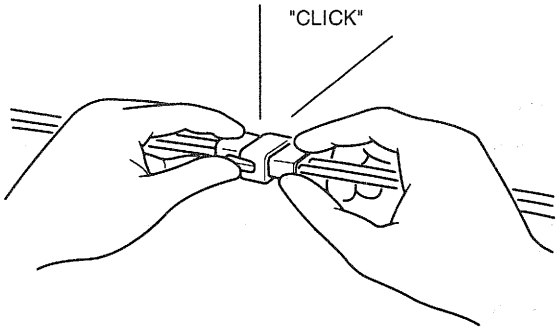
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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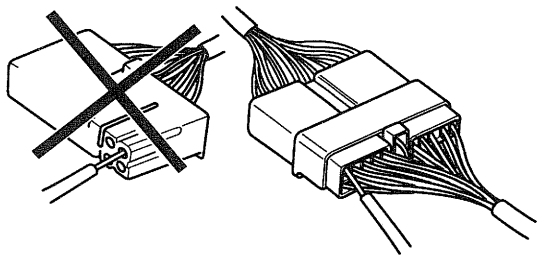
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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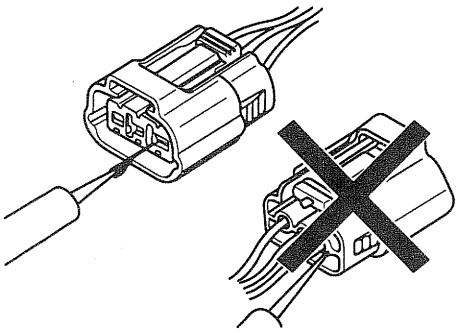
e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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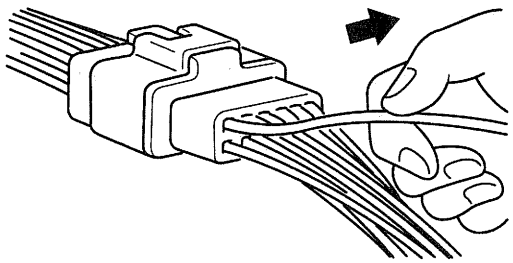
NOTE

- *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.

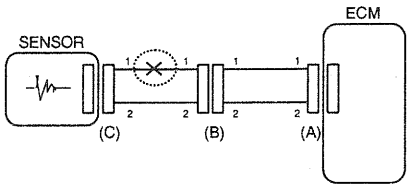
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● 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

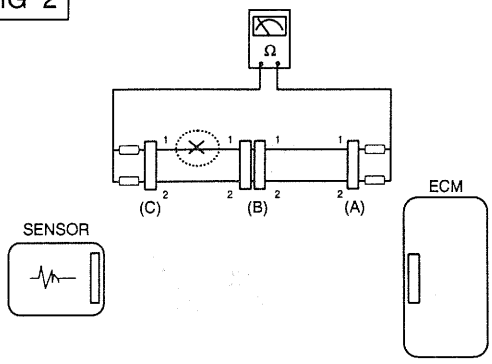
   When measuring for resistance, lightly shake the wire harness above and below or from side to side.

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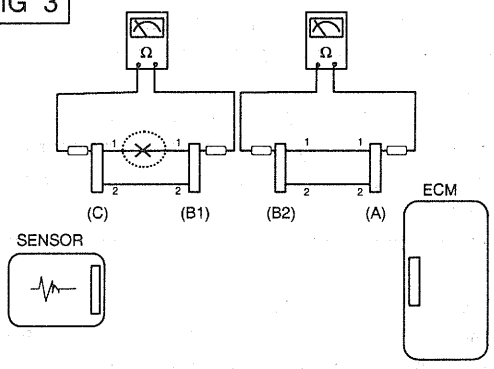
   b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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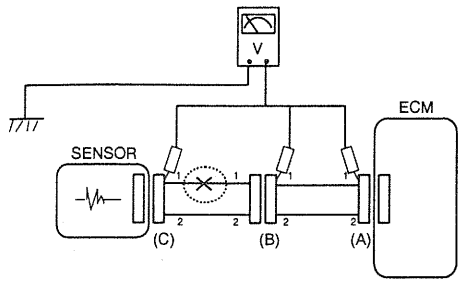
3. Voltage Check Method
   a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

      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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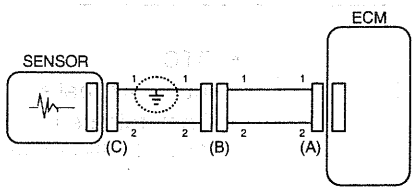
● CHECK SHORT CIRCUIT

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

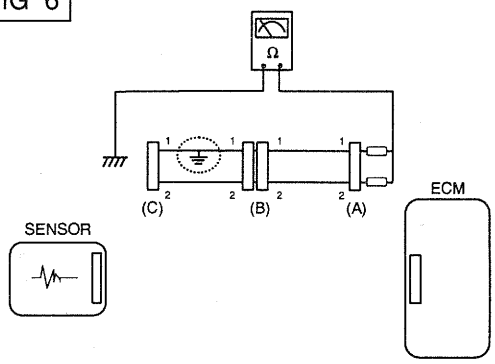
   Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

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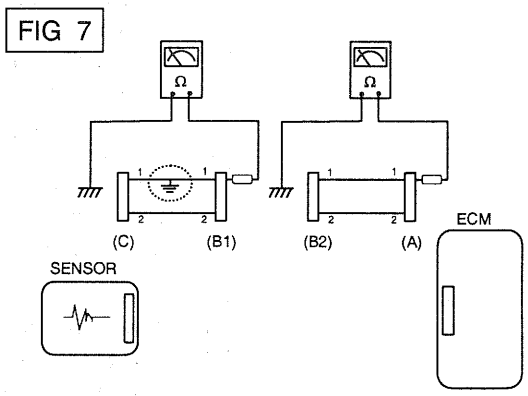
b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

   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.

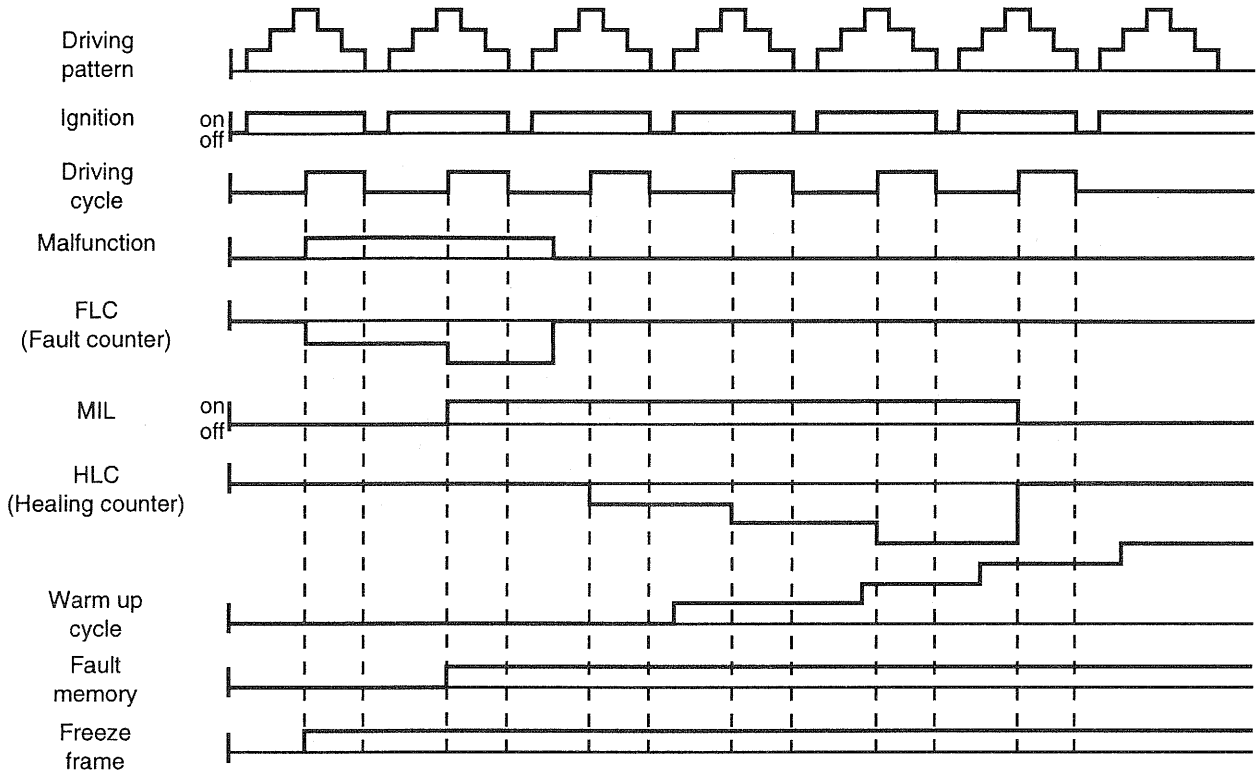
SELF-DIAGNOSIS

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



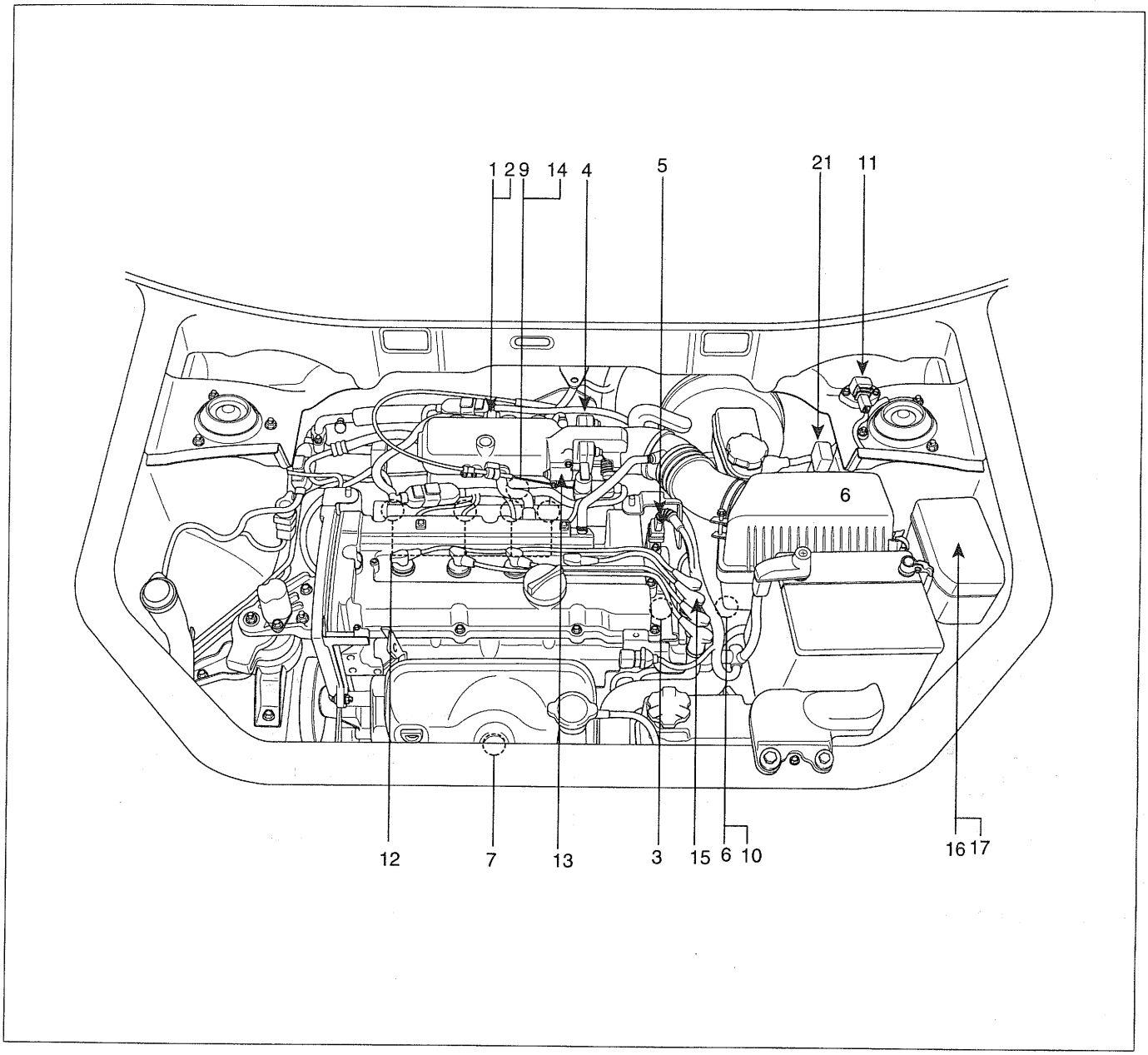
LGIF601Q

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.*

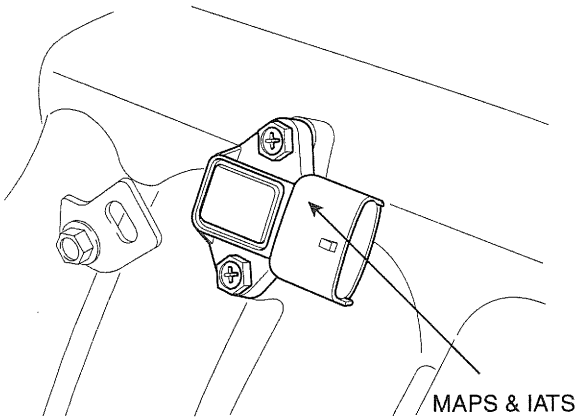
COMPONENTS E702E94B



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)

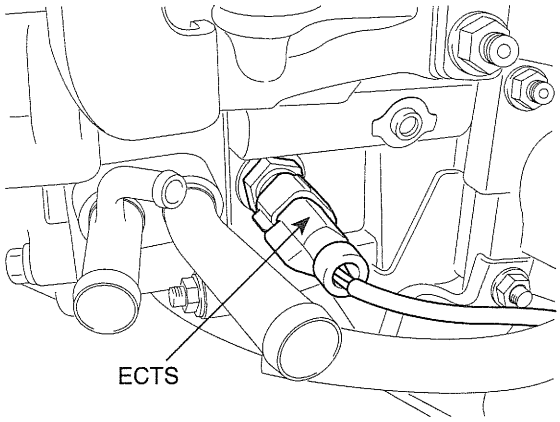
EFPF701S

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



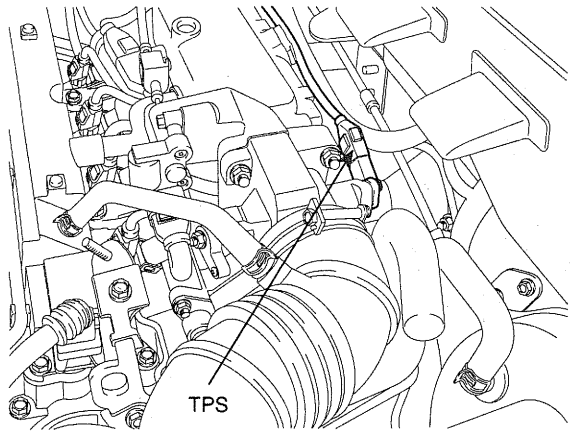
AFJF374A

3. Engine Coolant Temperature Sensor (ECTS)



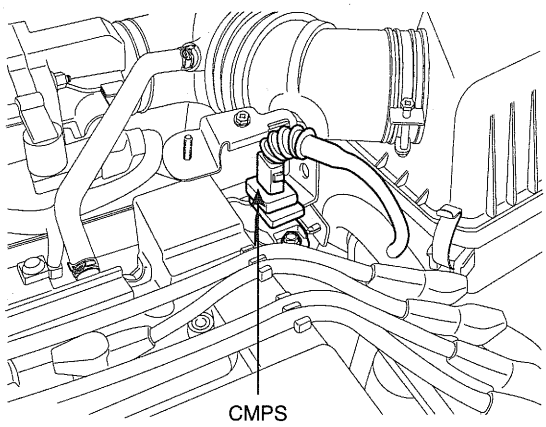
AFJF381A

4. Throttle Position Sensor (TPS)



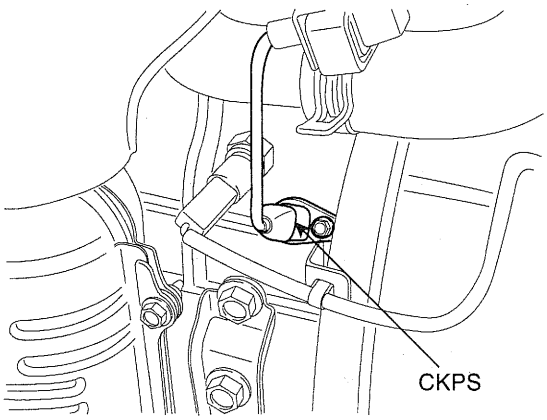
KFPF201A

5. Camshaft Position Sensor (CMPS)



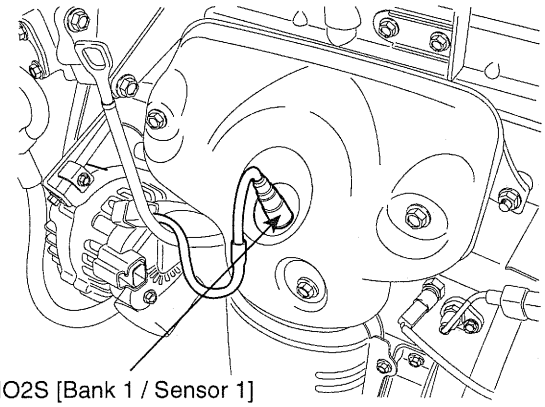
KFPF202A

6. Crankshaft Position Sensor (CKPS)



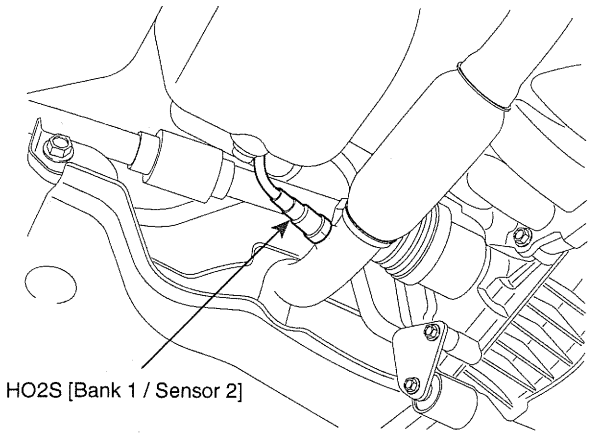
AFJF378A

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



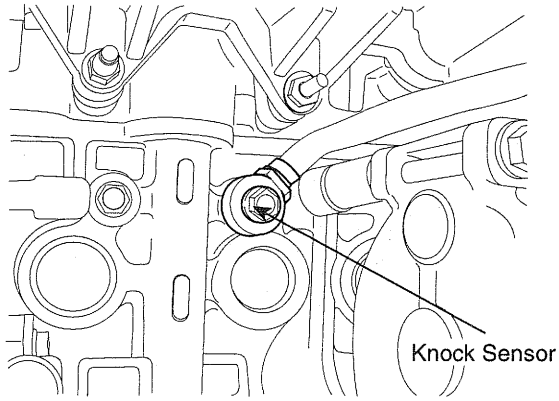
EFPF701T

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



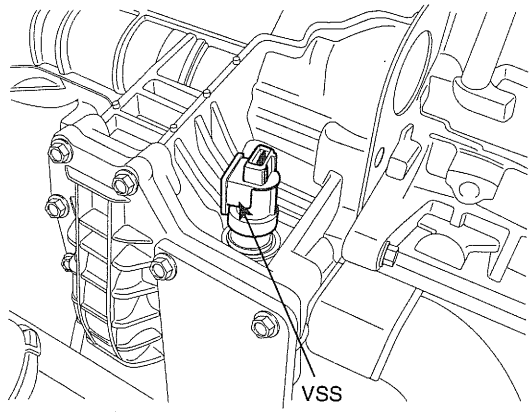
EFPF701U

9. Knock Sensor (KS)



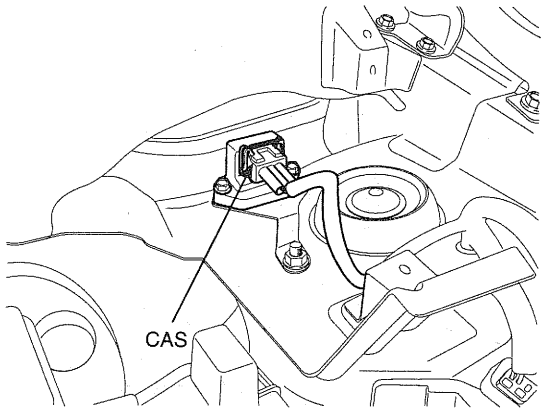
EFPF701V

10. Vehicle Speed Sensor (VSS)



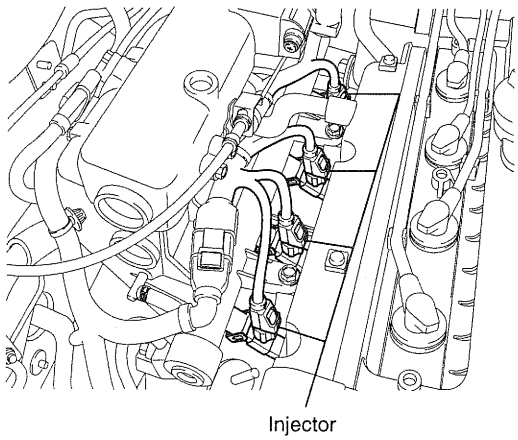
KFPF204A

11. Chassis Acceleration Sensor (CAS)



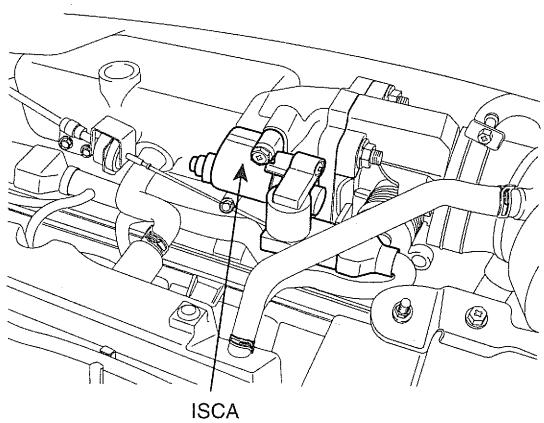
KFPF205A

12. Injector



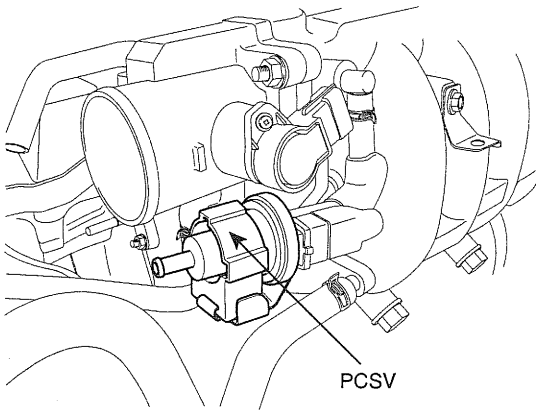
EFPF600A

13. Idle Speed Control Actuator (ISCA)



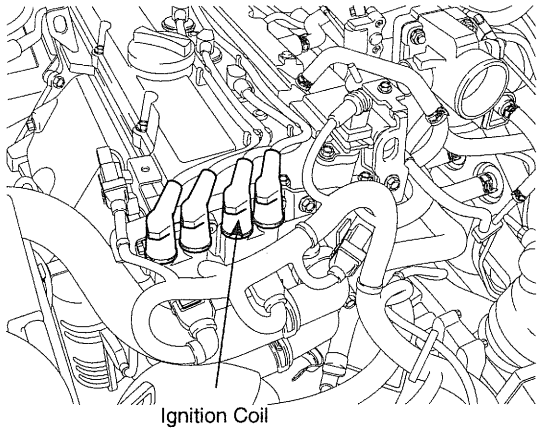
KFPF207A

14. Purge Control Solenoid Valve (PCSV)



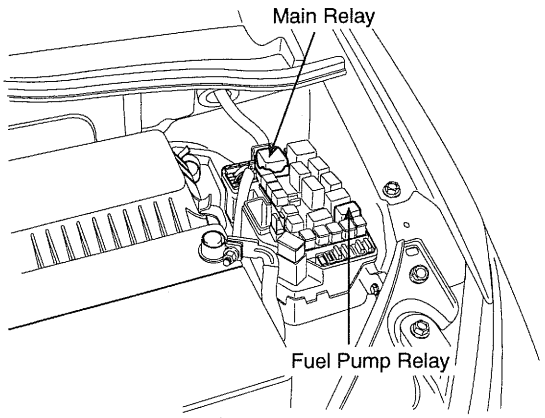
KFPF208A

15. Ignition Coil



EFPF701W

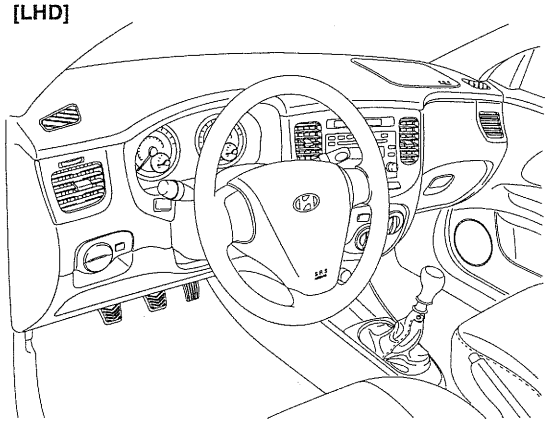
16. Main Relay
17. Fuel Pump Relay



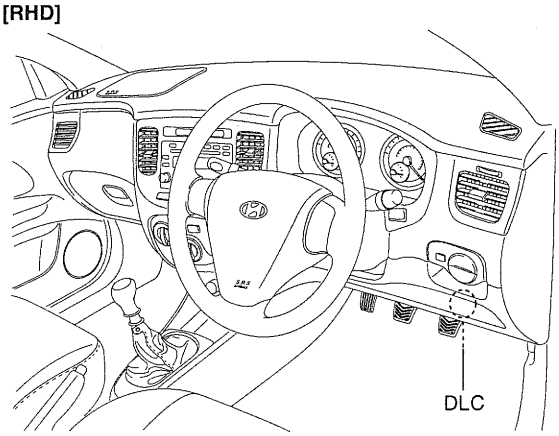
EFPF701X

18. Data Link Connector (DLC)

[LHD]



[RHD]

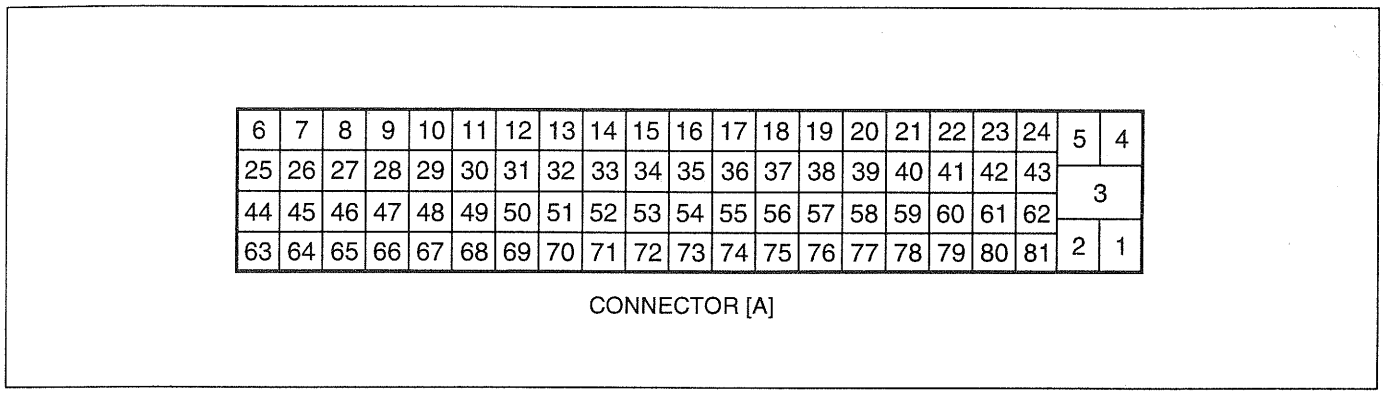


EFPF701Y

ENGINE CONTROL MODULE (ECM)

ECM (ENGINE CONTROL MODULE) E3233EE0

1. ECM HARNESS CONNECTOR



CONNECTOR [A]

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	-		
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) [A] 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	Crankshaft Position Sensor (CKPS) [B] signal input	Crankshaft Position Sensor (CKPS)	
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 (M/T)	A/C Pressure Transducer (APT)	M/T Only
41	A/C Pressure Transducer (APT) signal input (A/T)	A/C Pressure Transducer (APT)	A/T Only
42	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)	
43	-		
44	Batter voltage supply after main relay	Main Relay	
45	-		

Pin	Description	Connected to	Remark
46	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)	
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	CAN [High]	Other Control Module	
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	-		
77	Electrical Load signal input (Power Steering)	EPS Control Module	M/T Only
78	-		
79	Camshaft Position Sensor (CMPS) signal input	Camshaft Position Sensor (CMPS)	

Pin	Description	Connected to	Remark
80	Ground	Chassis Ground	
81	CAN [Low]	Other Control Module	

ECM PROBLEM INSPECTION PROCEDURE E3BABA64

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) ECC30ACC

DTC	Description	MIL				Page
		EURO-III/IV	EURO-II	LEADED	INDIA	
P0031	HO2S Heater Circuit Low (Bank 1 / Sensor 1)	●	▲		▲	FLA-31
P0032	HO2S Heater Circuit High (Bank 1 / Sensor 1)	●	▲		▲	FLA-37
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	●			▲	FLA-40
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	●			▲	FLA-46
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	●			▲	FLA-49
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	●				FLA-52
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	●	●	▲	FLA-57
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	●	●	▲	FLA-61
P0112	Intake Air Temperature Sensor1 Circuit Low Input	●	▲	▲	▲	FLA-65
P0113	Intake Air Temperature Sensor1 Circuit High Input	●	▲	▲	▲	FLA-71
P0116	Engine Coolant Temperature Circuit Range/Performance	●				FLA-75
P0117	Engine Coolant Temperature Circuit Low Input	●	●	●	▲	FLA-81
P0118	Engine Coolant Temperature Circuit High Input	●	●	●	▲	FLA-84
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	▲				FLA-88
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	●	●	▲	FLA-93
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	●	●	▲	FLA-97
P0124	Throttle/Pedal Position Sensor/Switch "A" Circuit Intermittant	▲				FLA-102
P0130	HO2S Circuit (Bank 1/ Sensor 1)	●	▲		▲	FLA-106
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	▲		▲	FLA-113
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	▲		▲	FLA-117
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	●	▲		▲	FLA-121

DTC	Description	MIL				Page
		EURO-III/IV	EURO-II	LEADED	INDIA	
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	▲		▲	FLA-126
P0135	HO2S Heater Circuit (Bank 1 / Sensor 1)	●	▲		▲	FLA-130
P0136	HO2S Circuit (Bank 1/ Sensor 2)	●			▲	FLA-134
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●			▲	FLA-140
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●			▲	FLA-143
P0139	HO2S Circuit Slow Response (Bank 1 / Sensor 2)	●			▲	FLA-146
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●			▲	FLA-151
P0141	HO2S Heater Circuit (Bank 1 / Sensor 2)	●			▲	FLA-154
P0171	System Too Lean (Bank 1)	●	▲		▲	FLA-158
P0172	System Too Rich (Bank 1)	●	▲		▲	FLA-163
P0230	Fuel Pump Primary Circuit	▲	▲	▲	▲	FLA-167
P0261	Cylinder 1-Injector Circuit Low	●	●	●	●	FLA-172
P0262	Cylinder 1-Injector Circuit High	●	●	●	●	FLA-177
P0264	Cylinder 2-Injector Circuit Low	●	●	●	●	FLA-172
P0265	Cylinder 2-Injector Circuit High	●	●	●	●	FLA-177
P0267	Cylinder 3-Injector Circuit Low	●	●	●	●	FLA-172
P0268	Cylinder 3-Injector Circuit High	●	●	●	●	FLA-177
P0270	Cylinder 4-Injector Circuit Low	●	●	●	●	FLA-172
P0271	Cylinder 4-Injector Circuit High	●	●	●	●	FLA-177
P0300	Random/Multiple Cylinder Misfire Detected	●				FLA-180
P0301	Cylinder 1-Misfire detected	●				FLA-189
P0302	Cylinder 2-Misfire detected	●				FLA-189
P0303	Cylinder 3-Misfire detected	●				FLA-189
P0304	Cylinder 4-Misfire detected	●				FLA-189
P0325	Knock Sensor 1 Circuit	▲	▲	▲	▲	FLA-195
P0335	Crankshaft Position Sensor A Circuit	●	▲	▲	▲	FLA-200
P0336	Crankshaft Position Sensor A Circuit Range/Performance	●	▲	▲	▲	FLA-206
P0340	Camshaft Position Sensor A Circuit Malfunction (Bank 1 or Single Sensor)	●	▲	▲	▲	FLA-209
P0420	Catalyst System Efficiency below Threshold (Bank 1)	●				FLA-215

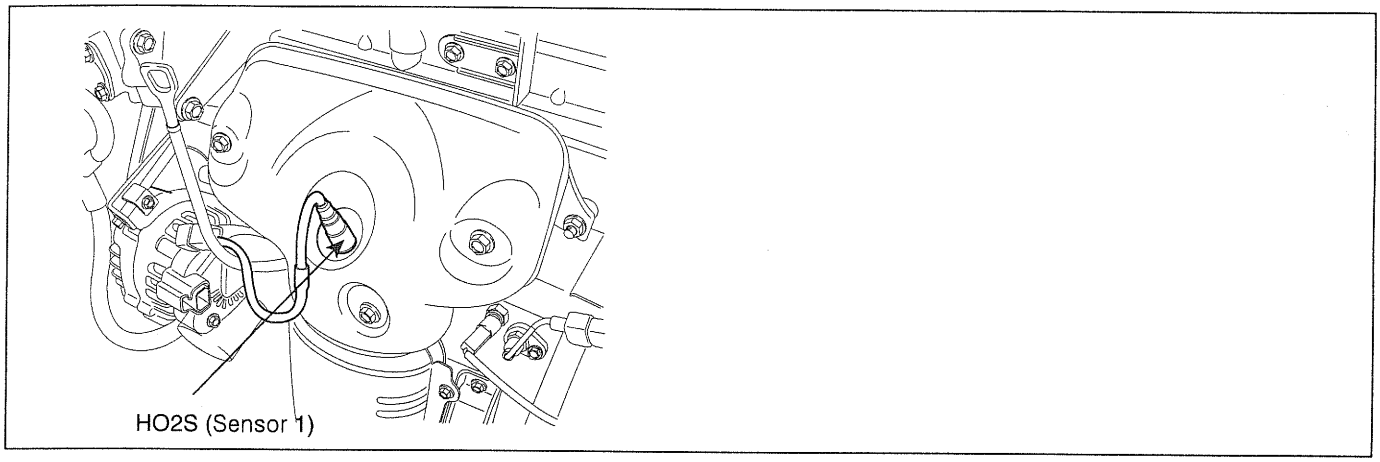
DTC	Description	MIL				Page
		EURO-III/IV	EURO-II	LEADED	INDIA	
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●				FLA-218
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●				FLA-223
P0501	Vehicle Speed Sensor A Range/Performance	●	▲	▲	▲	FLA-226
P0506	Idle Air Control System-RPM lower than expected	●	▲	▲	▲	FLA-232
P0507	Idle Air Control System-RPM higher than expected	●	▲	▲	▲	FLA-237
P0562	System Voltage Low	●	▲	▲	▲	FLA-241
P0563	System Voltage High	●	▲	▲	▲	FLA-247
P0605	Internal Control Module Read Only Memory(ROM) Error	●	▲	▲	▲	FLA-251
P1307	Acceleration Sensor Range/Performance	●				FLA-253
P1308	Acceleration Sensor Circuit Low Input	●				FLA-257
P1309	Acceleration Sensor Circuit High Input	●				FLA-259
P1505	Idle Charge Actuator Signal Low of Coil #1	●	●	●	▲	FLA-262
P1506	Idle Charge Actuator Signal High of Coil #1	●	●	●	▲	FLA-268
P1507	Idle Charge Actuator Signal Low of Coil #2	●	●	●	▲	FLA-271
P1508	Idle Charge Actuator Signal High of Coil #2	●	●	●	▲	FLA-275
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	●				FLA-278
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	●				FLA-284
P2232	HO2S Signal Circuit Shorted to Heater Circuit (Bank 1 / Sensor 2)	●			▲	FLA-288
U0001	CAN Communication Malfunction	▲	▲	▲	▲	FLA-293
U0101	Serial Communication Problem with TCU (Timeout)	▲	▲	▲	▲	FLA-298

NOTE

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

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

COMPONENT LOCATION E44298E0



LFJF800A

GENERAL DESCRIPTION EFDE018A

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 E35B35A1

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

DTC DETECTING CONDITION E49FE243

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	

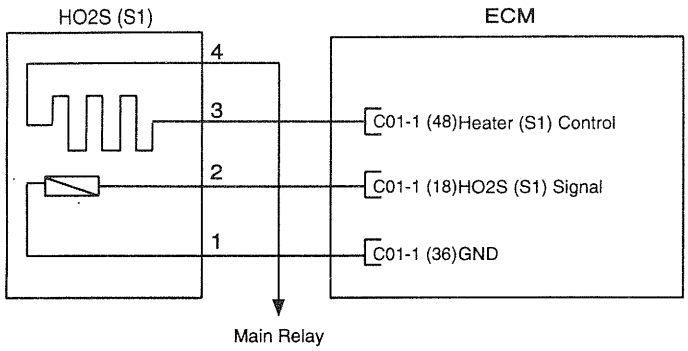
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E168019D

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

SCHEMATIC DIAGRAM E0813081

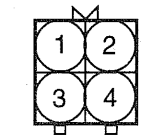
[CIRCUIT DIAGRAM]



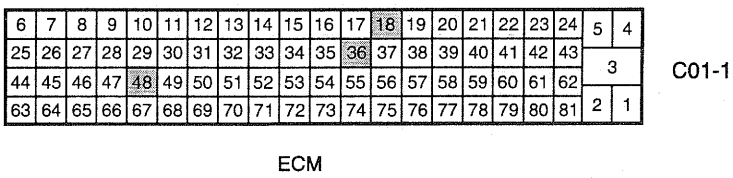
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (36)	Sensor Ground
2	ECM C01-1 (18)	HO2S (S1) Signal
3	ECM C01-1 (48)	Heater (S1) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



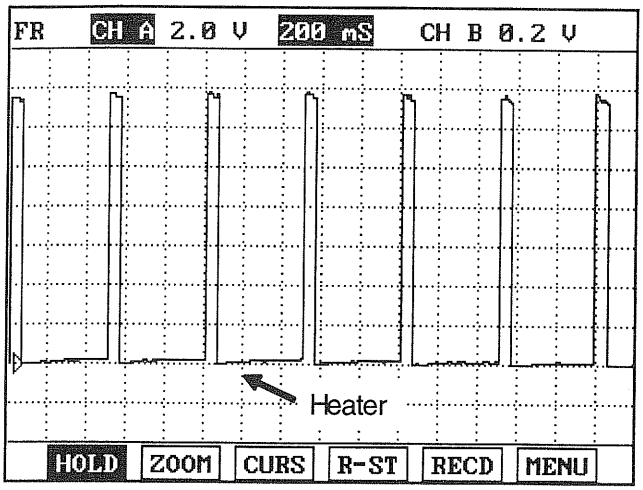
HO2S [S1] (C17)

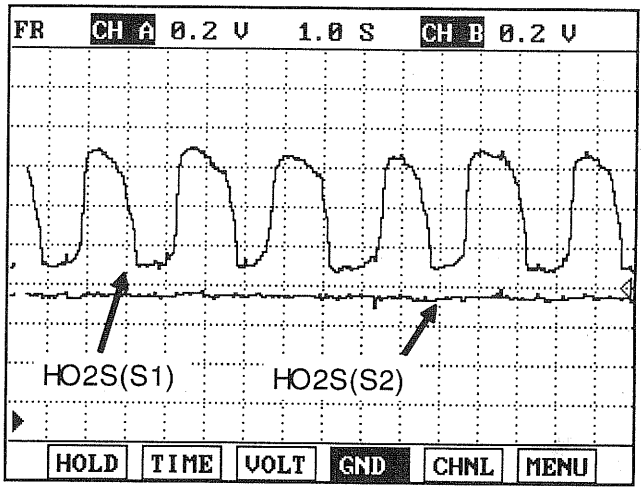


ECM

EFPF001A

SIGNAL WAVEFORM & DATA E936CC4F



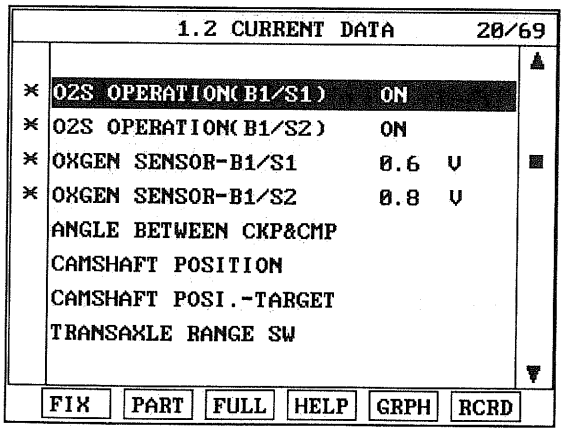


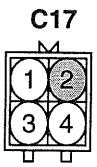
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed 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 E0FED856

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





1. Sensor Ground
2. Sensor(B1S1) Signal
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

EFPF601A

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 EC9197AF

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 E6D35C31

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 : 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 E279AB04

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 : 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 E1FED242

1. Check resistance.

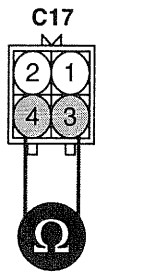
   1) IG "OFF".

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

EFPF300C

   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 EDA0512C

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 EB025506

Refer to DTC P0031.

GENERAL DESCRIPTION EDD6289F

Refer to DTC P0031.

DTC DESCRIPTION EF2B9A12

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

DTC DETECTING CONDITION E6E6C43E

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	

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

SPECIFICATION E0604EA5

Refer to DTC P0031.

SCHEMATIC DIAGRAM E0808FDB

Refer to DTC P0031.

SIGNAL WAVEFORM & DATA E44CDCFA

Refer to DTC P0031.

MONITOR SCANTOOL DATA ECA77FCA

Refer to DTC P0031.

TERMINAL AND CONNECTOR INSPECTION EF0D1FF7

Refer to DTC P0031.

POWER CIRCUIT INSPECTION E86A829F

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 : 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 E73979C9

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 : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

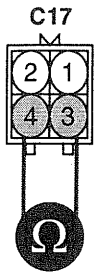
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E0A8DEFA

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

EFPF300C

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

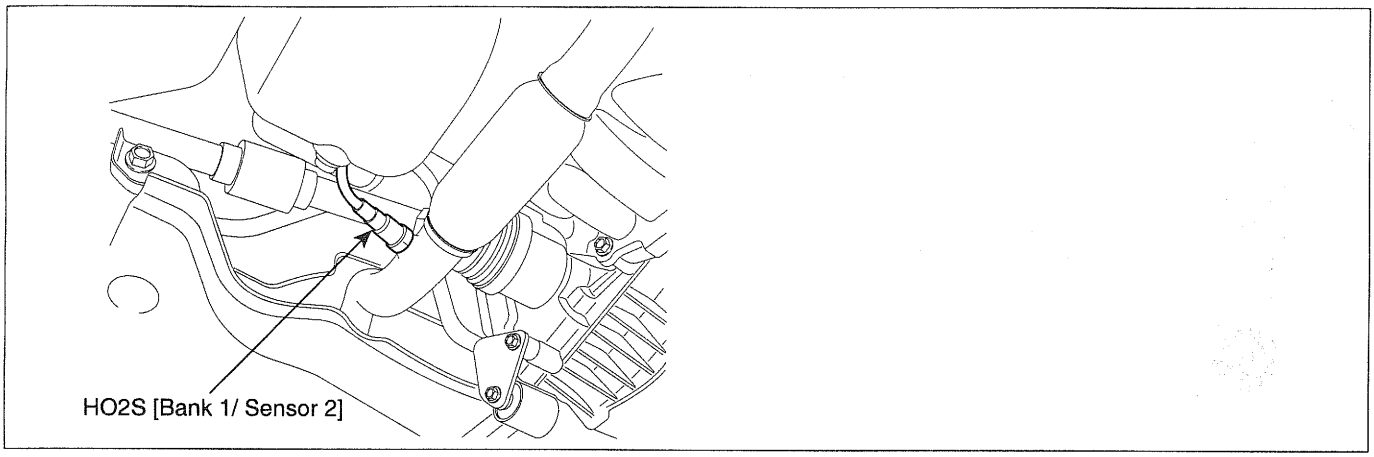
- ▶ Substitute with a known - good HO2S(S1) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E2A3C3E9

Refer to DTC P0031.

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

COMPONENT LOCATION EBBA5506



EFPF701G

GENERAL DESCRIPTION E946C027

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 E79C834E

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

DTC DETECTING CONDITION E414E81B

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	

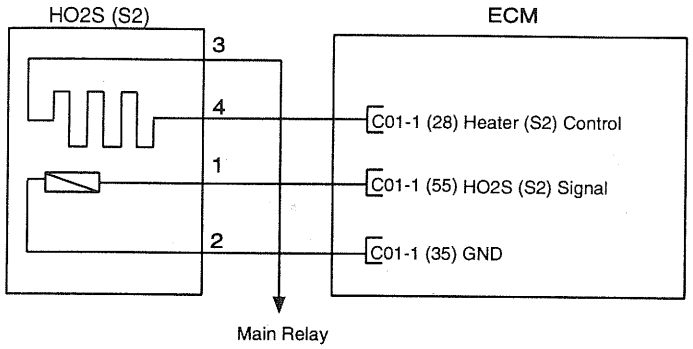
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E236B411

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

SCHEMATIC DIAGRAM E4D875A0

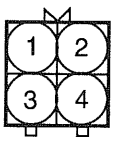
[CIRCUIT DIAGRAM]



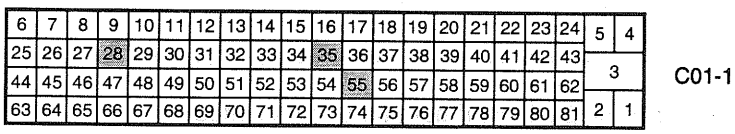
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (55)	HO2S (S2) Signal
2	ECM C01-1 (35)	Sensor Ground
3	Main Relay	Battery Voltage (B+)
4	ECM C01-1 (28)	Heater (S2) Control

[HARNESS CONNECTOR]



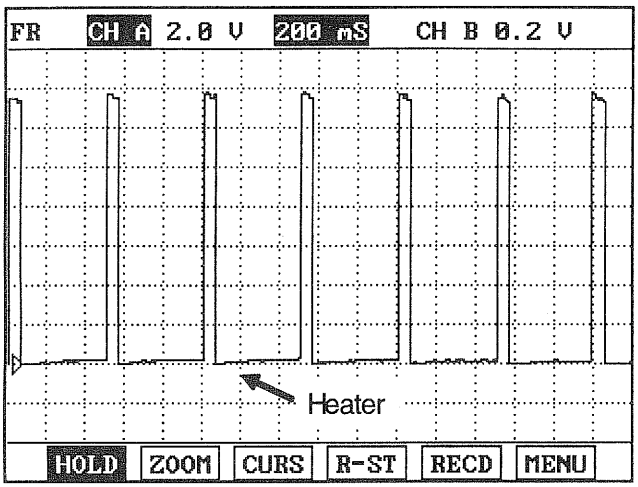
HO2S [S2] (C16)

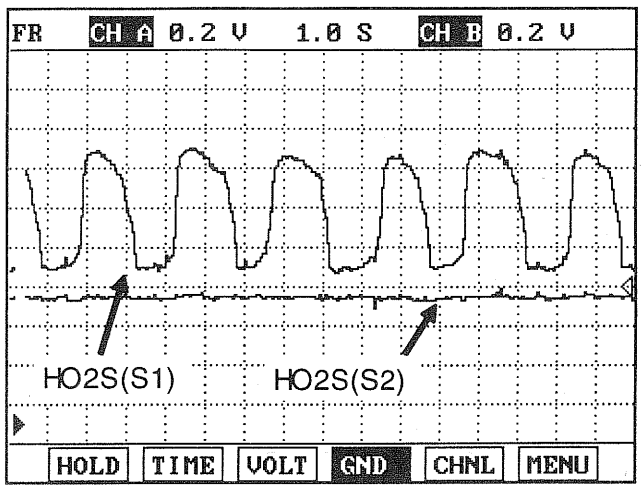


ECM

EFPF003A

SIGNAL WAVEFORM & DATA E5DE414D



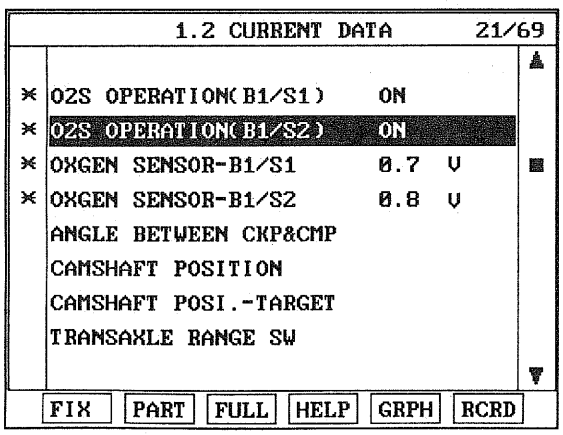


The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed 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 E4609B55

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



EFPF602A

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 E20612E7

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 E13A32EA

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 E71975A6

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 E363413E

1. Check resistance.

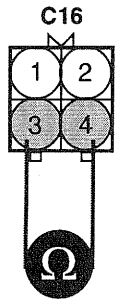
   1) IG "OFF".

   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

EFPF300F

   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 E1E25245

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 E33D9DE9

Refer to DTC P0036.

GENERAL DESCRIPTION E570BB8B

Refer to DTC P0036.

DTC DESCRIPTION E2D8ABCE

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

DTC DETECTING CONDITION E6808FFF

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	

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

SPECIFICATION ED348781

Refer to DTC P0036.

SCHEMATIC DIAGRAM E2A77DDA

Refer to DTC P0036.

SIGNAL WAVEFORM & DATA EC80D9D5

Refer to DTC P0036.

MONITOR SCANTOOL DATA E08E2043

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION ED709253

Refer to DTC P0036.

POWER CIRCUIT INSPECTION E9A892B6

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 E38A419F

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

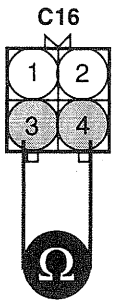
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION EDDFCA28

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

EFPF300F

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 EC5ADA6B

Refer to DTC P0036.

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

COMPONENT LOCATION E3D7CCF8

Refer to DTC P0036.

GENERAL DESCRIPTION EA119B92

Refer to DTC P0036.

DTC DESCRIPTION E5D73395

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

DTC DETECTING CONDITION EE68D1E7

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	

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

SPECIFICATION EBC5059E

Refer to DTC P0036.

SCHEMATIC DIAGRAM EBF519D4

Refer to DTC P0036.

SIGNAL WAVEFORM & DATA EB784268

Refer to DTC P0036.

MONITOR SCANTOOL DATA E17B7BC5

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION ECA6D4D1

Refer to DTC P0036.

POWER CIRCUIT INSPECTION EE60FCDF

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 E42FF389

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

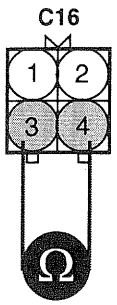
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION E2F38E46

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

EFPF300F

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

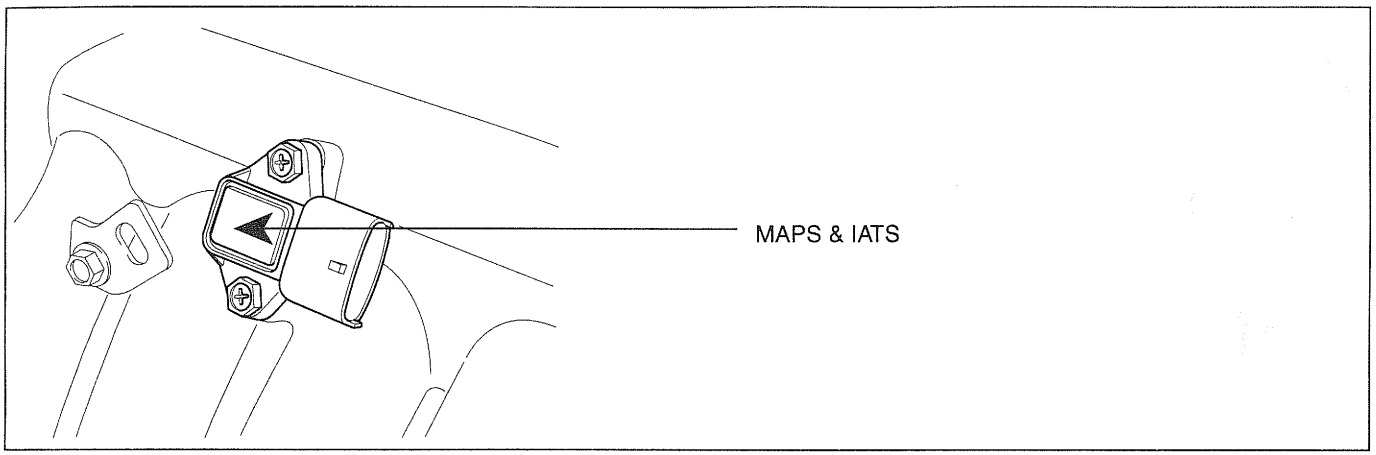
- ▶ Substitute with a known - good HO2S(S2) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(S2) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E032AF65

Refer to DTC P0036.

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

COMPONENT LOCATION E2DFFF50



AFJF374B

GENERAL DESCRIPTION EF47C997

The amount of intake air flow must be inputted to PCM 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, PCM 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 EA645D54

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 E63DD7CD

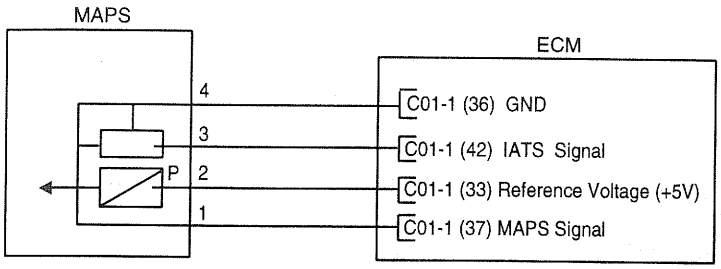
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • MAPS • ECM
Enable Conditions	• No TPS error detected	
Threshold Value	• Intake manifold pressure 〉 max. Threshold f(Eng. Speed, TPS) • Intake manifold pressure 〈 min. Threshold f(Eng. Speed, TPS)	
Diagnostic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

SPECIFICATION EF228B47

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

SCHEMATIC DIAGRAM EAF6BAF3

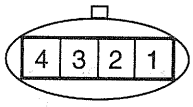
[CIRCUIT DIAGRAM]



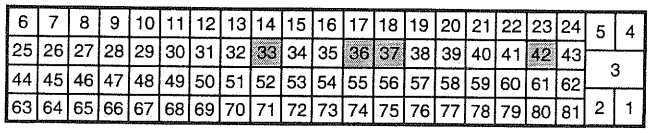
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (37)	MAPS Signal
2	ECM C01-1 (33)	Reference Voltage (+5V)
3	ECM C01-1 (42)	IATS Signal
4	ECM C01-1 (36)	Sensor Ground

[HARNESS CONNECTORS]



MAPS & IATS (C15)

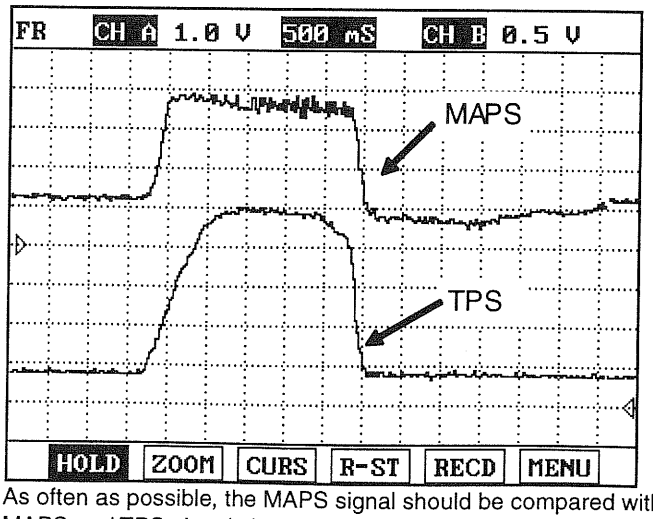


C01-1

ECM

EFPF005A

SIGNAL WAVEFORM & DATA E5EE0BDB

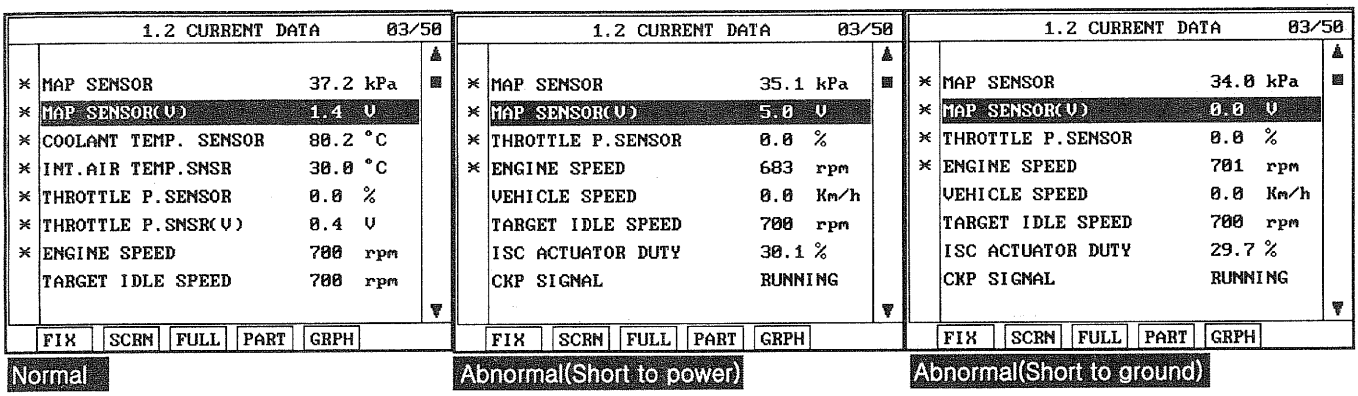


As often as possible, the MAPS signal should be compared with the TPS signal. Check whether the MAPS and TPS signals increase at the same time when accelerating. During acceleration, the MAPS output voltage increases; during deceleration, the MAPS output voltage decreases.

LFJF360A

MONITOR SCANTOOL DATA EBCEBE9D

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



EFPF018A

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 E0065669

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 EF01B228

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 E92CA3CD

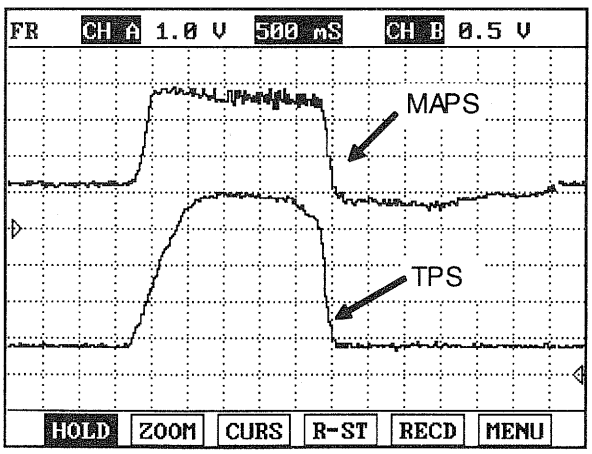
1. Check MAPS performance.

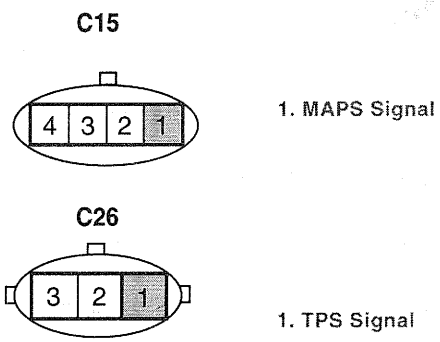
   1) IG "OFF".

   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.





EFPF019A

   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.

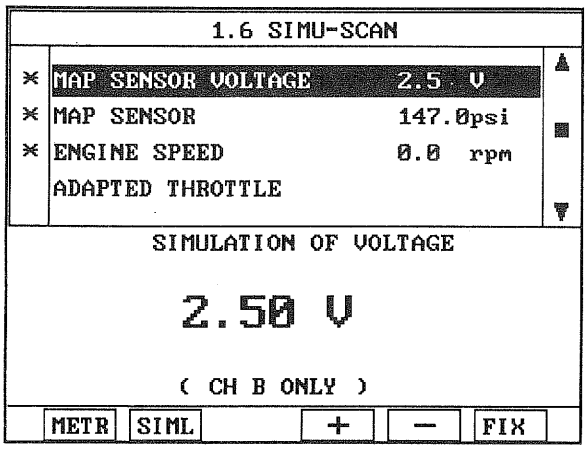
2. Check ECM.

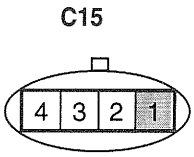
   1) IG "OFF" and disconnect MAPS connector.

   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

EFPF020A

   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 E42B4835

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 EBF2F481

Refer to DTC P0106.

GENERAL DESCRIPTION E8842300

Refer to DTC P0106.

DTC DESCRIPTION E7307C17

If sensor signal input is lower than 0.25V during 5 sec, ECM sets DTC P0107.

DTC DETECTING CONDITION EA1CD088

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 〈 0.25 V	
Diagnostic Time	• 5 sec	
MIL	• ON	

SPECIFICATION EF801A9D

Refer to DTC P0106.

SCHEMATIC DIAGRAM ECBBDF19

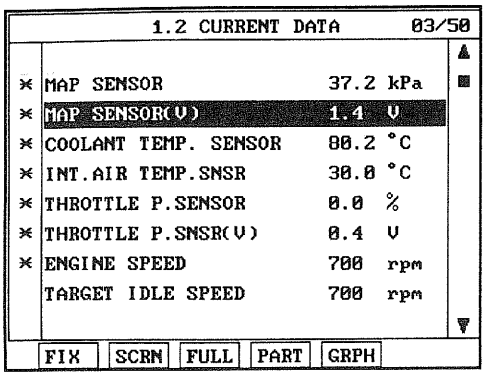
Refer to DTC P0106.

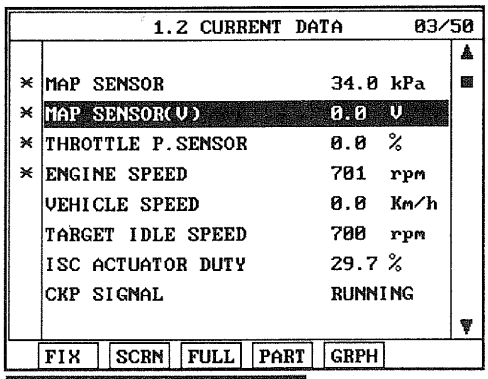
SIGNAL WAVEFORM & DATA E693261D

Refer to DTC P0106.

MONITOR SCANTOOL DATA E5926B38

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





EFPF021A

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 E6E24D88

Refer to DTC P0106.

POWER SUPPLY CIRCUIT INSPECTION ED65AE09

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 E843382A

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

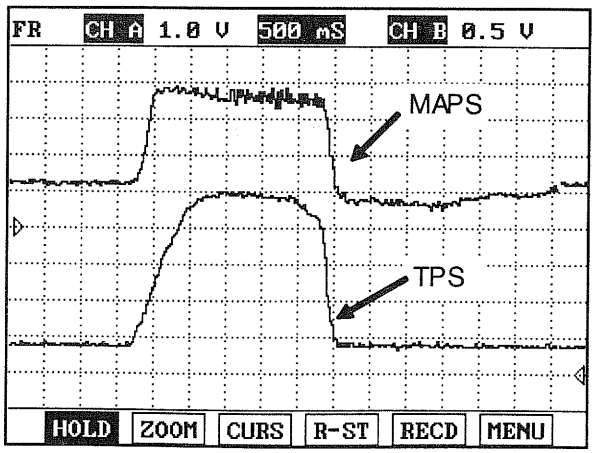
▶ Go to "Component Inspection" procedure.

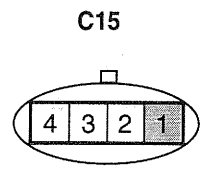
NO

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

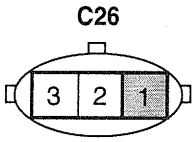
COMPONENT INSPECTION E2E1A8DB

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.





1. MAPS Signal



1. TPS Signal

EFPF019A

   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..

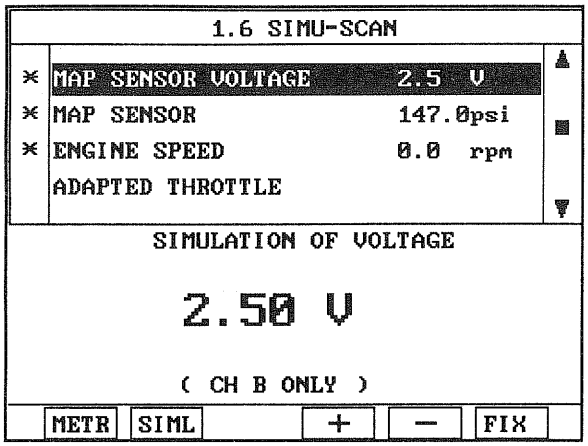
2. Check ECM.

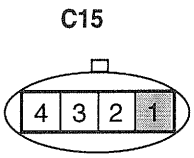
1) IG "OFF" and disconnect MAPS connector.

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

EFPF020A

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 EB246145

Refer to DTC P0106.

DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E52029EA

Refer to DTC P0106.

GENERAL DESCRIPTION E37596B4

Refer to DTC P0106.

DTC DESCRIPTION E6BD3A9D

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

DTC DETECTING CONDITION E5F3498F

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	• ON	

SPECIFICATION EDCE04B8

Refer to DTC P0106.

SCHEMATIC DIAGRAM EBCB0483

Refer to DTC P0106.

SIGNAL WAVEFORM & DATA E8300B63

Refer to DTC P0106.

MONITOR SCANTOOL DATA EA699906

Refer to DTC P0107.

TERMINAL AND CONNECTOR INSPECTION E7DEB924

Refer to DTC P0106.

SIGNAL CIRCUIT INSPECTION E06C347B

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 EDF86DA3

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 E3C9A57D

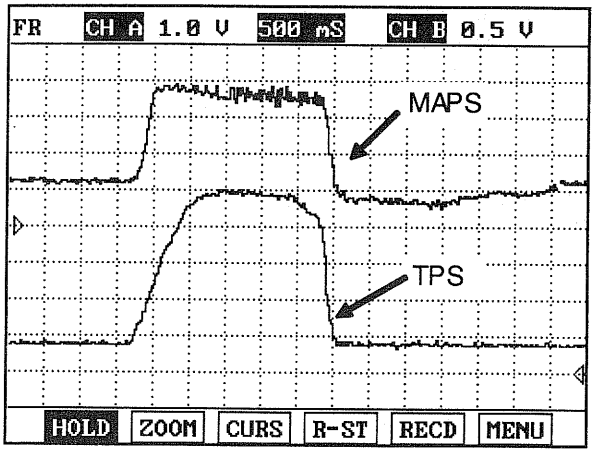
1. Check MAPS performance.

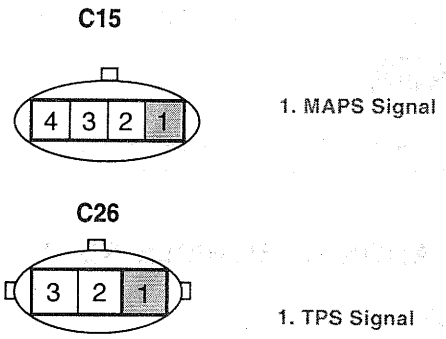
   1) IG "OFF".

   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.





EFPF019A

   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.

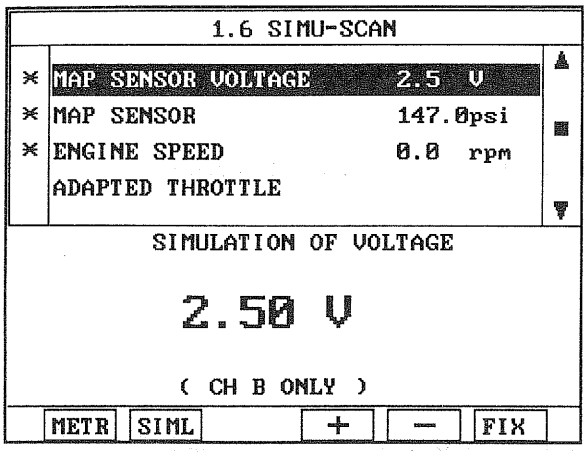
2. Check ECM.

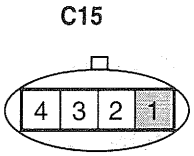
   1) IG "OFF" and disconnect MAPS connector.

   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

EFPF020A

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

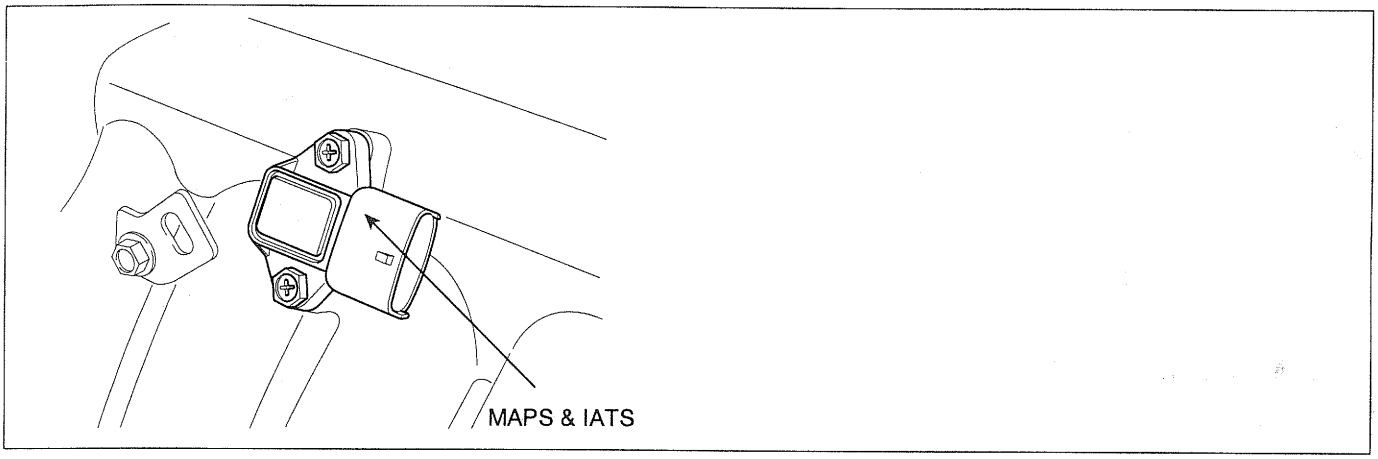
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E13D813E

Refer to DTC P0106.

DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

COMPONENT LOCATION EFCD20B2



EFPF701A

GENERAL DESCRIPTION EA03EA33

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 PCM applies 5V to the IAT sensor. The PCM 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 PCM will receive a high voltage input, and when the air temperature is warm the PCM 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 E5E76D16

If measured temperature is higher than the maximum threshold value during 2sec, ECM sets DTC P0112.
(In this case, the input signal voltage is the minimum threshold vaue.)

DTC DETECTING CONDITION E4D5D40D

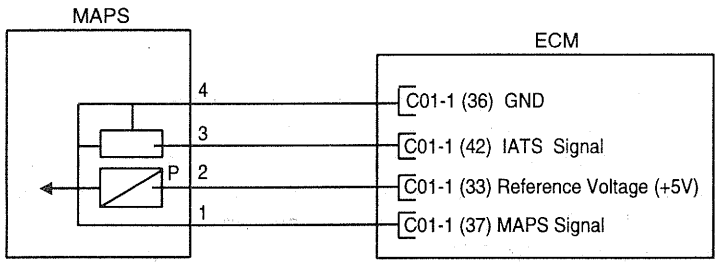
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check, low	• Poor connection • Short to ground in signal circuit • IATS • ECM
Enable Conditions		
Threshold Value	• Measured temperature 〉 126 ℃	
Diagnostic Time	• 2 sec	
MIL	• ON	

SPECIFICATION E4E8F531

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 EB727C5C

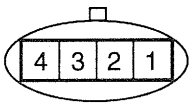
[CIRCUIT DIAGRAM]



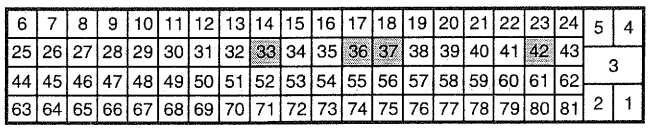
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (37)	MAPS Signal
2	ECM C01-1 (33)	Reference Voltage (+5V)
3	ECM C01-1 (42)	IATS Signal
4	ECM C01-1 (36)	Sensor Ground

[HARNESS CONNECTORS]



MAPS & IATS (C15)



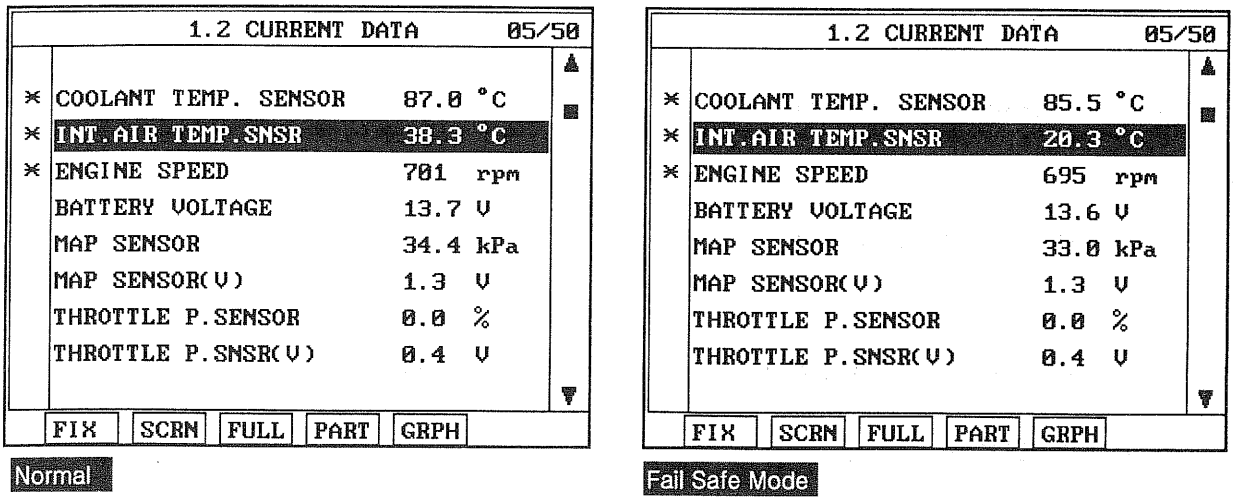
C01-1

ECM

EFPF005A

MONITOR SCANTOOL DATA E4FBA4CD

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



EFPF022A

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 E9D4B34B

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 E7651A35

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 E8C67EB0

1. Check IATS resistance.

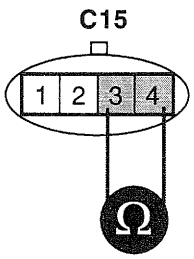
   1) IG "OFF".

   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

EFPF300M

   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.

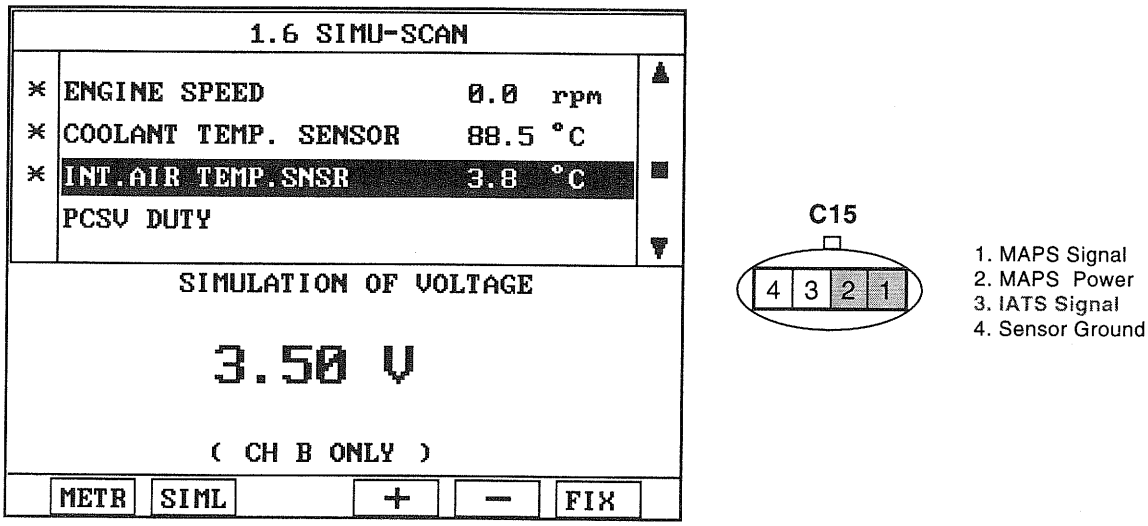
2. Check ECM.

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.



EFPF023A

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 E5753B69

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 ED980792

Refer to DTC P0112.

GENERAL DESCRIPTION E08EDC74

Refer to DTC P0112.

DTC DESCRIPTION EA965EEA

If measured temperature is higher than the maximum threshold value during 2sec, ECM sets DTC P0112.
(In this case, the input signal voltage is the minimum threshold vaue.)

DTC DETECTING CONDITION ED21A23D

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 • Time after engine start 〉 18s • Integrated air mass 〉 0.27kg • Increase of measured temp. after start 〈 1.5℃	
Threshold Value	• Measured temperature 〈 -43.5℃	
Diagnostic Time	• 2 sec	
MIL	• ON	

SPECIFICATION EDDA1102

Refer to DTC P0112.

SCHEMATIC DIAGRAM E54C2424

Refer to DTC P0112.

MONITOR SCANTOOL DATA EA419421

Refer to DTC P0112.

TERMINAL AND CONNECTOR INSPECTION E1F66649

Refer to DTC P0112.

SIGNAL CIRCUIT INSPECTION E734D2E9

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 EB671586

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 E35654F7

1. Check IATS resistance.

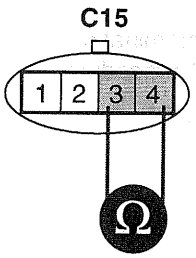
   1) IG "OFF".

   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

EFPF300M

   4) Is the measured resistance within specification ?

YES

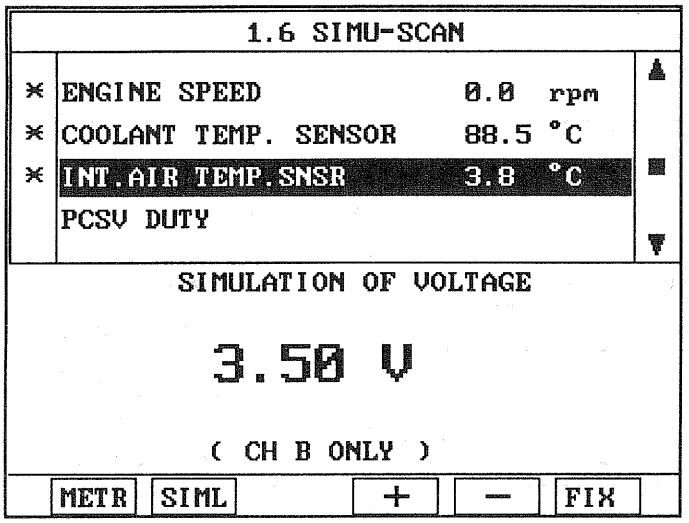
▶ Go to "Check ECM" as follows.

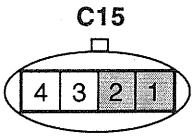
NO

▶ 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

EFPF023A

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

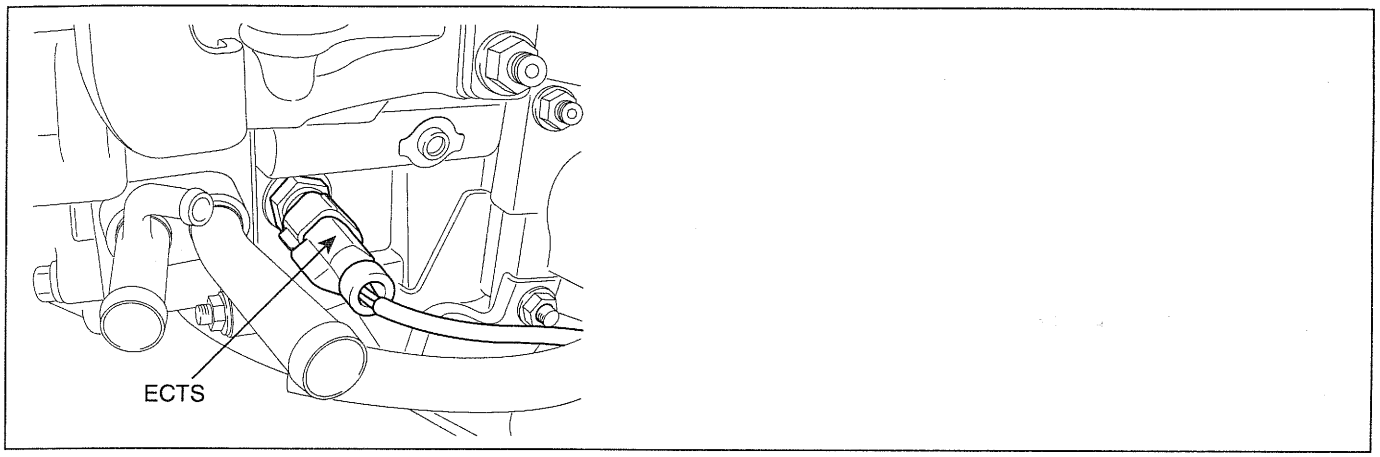
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E50C06E9

Refer to DTC P0112.

DTC P0116 ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E52E5E01



AFJF381B

GENERAL DESCRIPTION E9FB51C3

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 EB2B193E

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 ED3EE41C

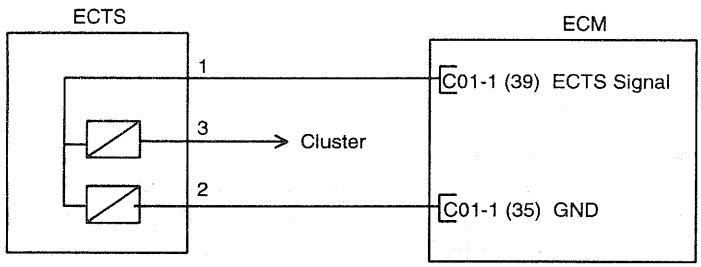
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • ECTS • ECM
Enable Conditions	• Low heat power mode driving counter ≥ 2 • High heat power mode driving counter ≥ 2	
Threshold Value	• Max temp. - Min temp. 〈 0.8~3.0 ℃	
Diagnostic Time		
MIL	• ON	

SPECIFICATION EA5A0332

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 ED05DC79

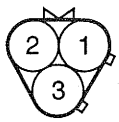
[CIRCUIT DIAGRAM]



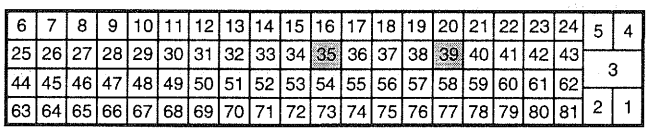
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (39)	ECTS Signal
2	ECM C01-1 (35)	Sensor Ground
3	Cluster	

[HARNESS CONNECTORS]



ECTS (C27)

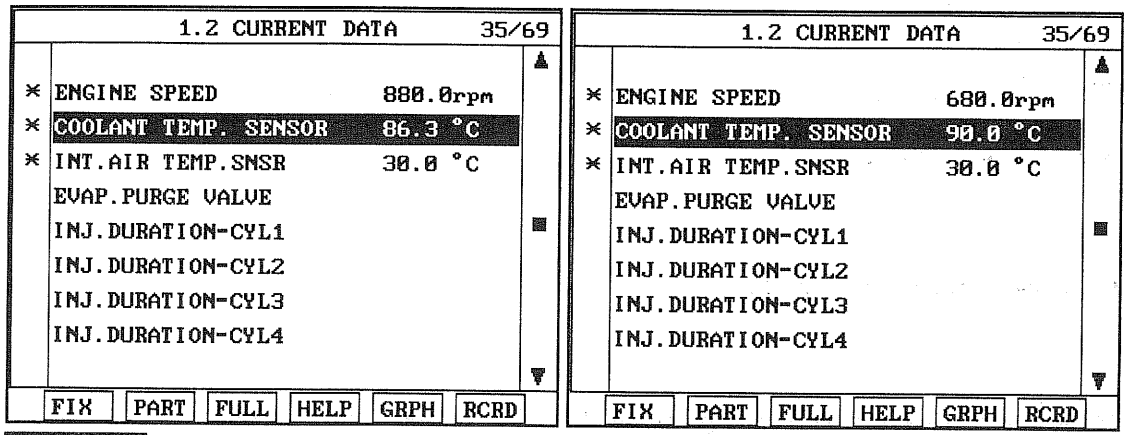


ECM

EFPF006A

MONITOR SCANTOOL DATA E7DA32D5

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



LFJF387A

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 ED68F6C5

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 ECB5D9DE

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

Specification :
Terminal 1 Approx. 5V
Terminal 2 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 E6D77C50

1. Check ECTS resistance.

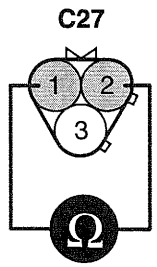
   1) IG "OFF".

   2) Disconnect ECTS connector.

   3) Measure resistance between terminal 1 and 2 of ECTS harness connector.(Component Side)

SPECIFICATION :

Temperature [℃]	Temperature [℉]	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. ECTS Signal
2. Sensor Ground
3. Cluster Signal

EFPF300Q

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.

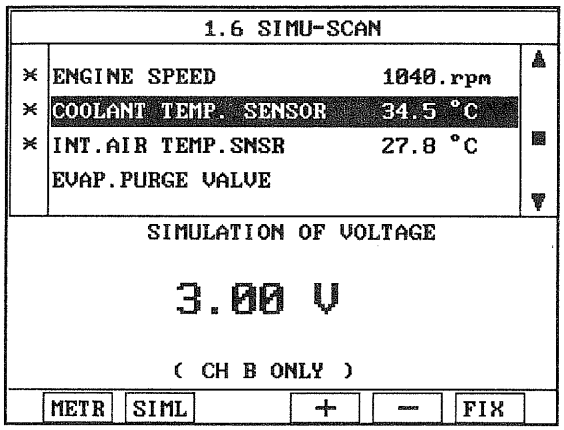
2. Check ECM.

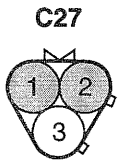
1) IG "OFF" and disconnect ECTS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

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





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

EFPF024A

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 E9EB7378

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 EAB8D688

Refer to DTC P0116.

GENERAL DESCRIPTION EADCB172

Refer to DTC P0116.

DTC DESCRIPTION EB84EA08

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 E8B4EA07

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	

SPECIFICATION E8D1F1D6

Refer to DTC P0116.

SCHEMATIC DIAGRAM ED615736

Refer to DTC P0116.

MONITOR SCANTOOL DATA EBDA3F38

Refer to DTC P0116.

TERMINAL AND CONNECTOR INSPECTION E5D3BB3F

Refer to DTC P0116.

SIGNAL CIRCUIT INSPECTION E8EEB530

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

4. Measure voltage between terminal 1 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 ED7AE86A

1. Check ECTS resistance.

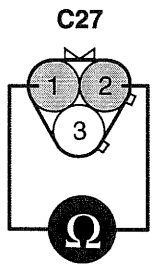
   1) IG "OFF".

   2) Disconnect ECTS connector.

   3) Measure resistance between terminal 1 and 2 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



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

EFPF300Q

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.

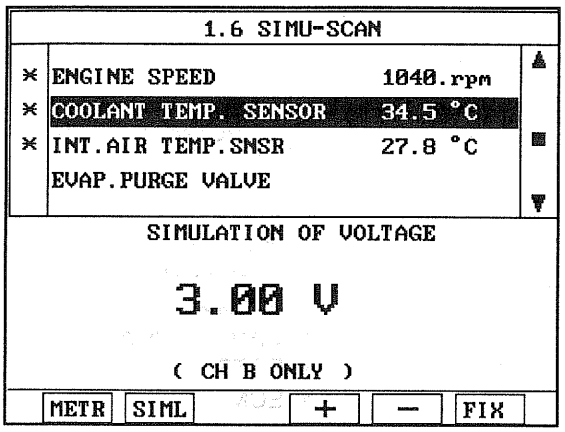
2. Check ECM.

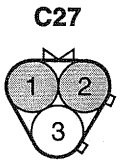
1) IG "OFF" and disconnect ECTS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

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





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

EFPF024A

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 E249C2FB

Refer to DTC P0116.

DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E4001CBD

Refer to DTC P0116.

GENERAL DESCRIPTION E3F3CF04

Refer to DTC P0116.

DTC DESCRIPTION EAE78F43

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 EEF51BA0

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	

SPECIFICATION E534015C

Refer to DTC P0116.

SCHEMATIC DIAGRAM E16E99B7

Refer to DTC P0116.

MONITOR SCANTOOL DATA E4E82D5A

Refer to DTC P0116.

TERMINAL AND CONNECTOR INSPECTION EE748C9F

Refer to DTC P0116.

SIGNAL CIRCUIT INSPECTION EFC03047

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

4. Measure voltage between terminal 1 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 E68D1C51

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

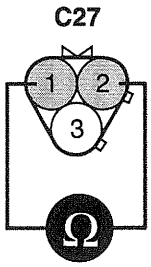
COMPONENT INSPECTION E036A7E1

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



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

EFPF300Q

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.

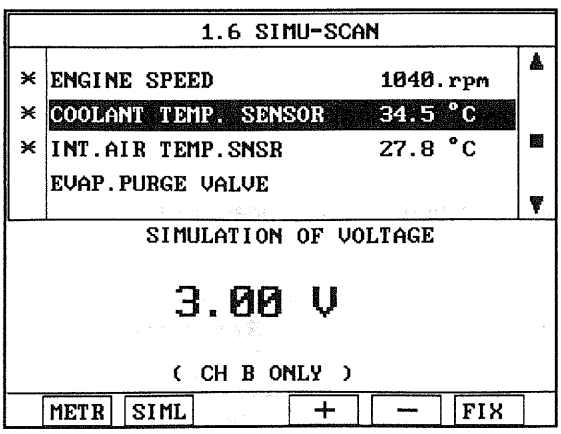
2. Check ECM.

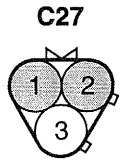
1) IG "OFF" and disconnect ECTS connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

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





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

EFPF024A

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

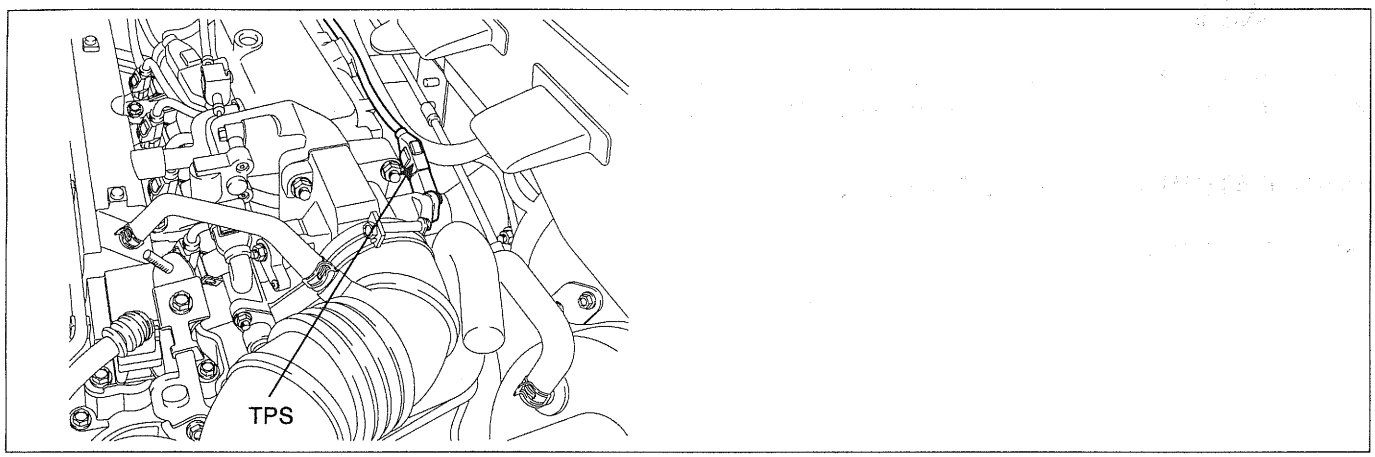
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9A68780

Refer to DTC P0116.

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

COMPONENT LOCATION E203D4F7



EFPF701C

GENERAL DESCRIPTION E87CCBD6

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 E57B796F

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

DTC DETECTING CONDITION E910C0A6

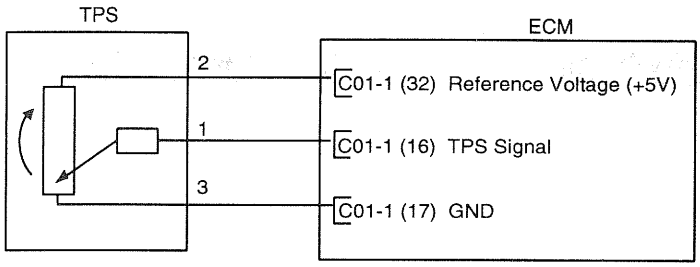
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check (Jittering)	• Poor connection • TPS • ECM
Enable Conditions	• Engine speed 〉 600 rpm	
Threshold Value	• Counter of | △ throttle angle 〉 30% | ≥ 3 times	
Diagnostic Time		
MIL	• OFF	

SPECIFICATION E75545FA

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

SCHEMATIC DIAGRAM EA049A80

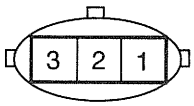
[CIRCUIT DIAGRAM]



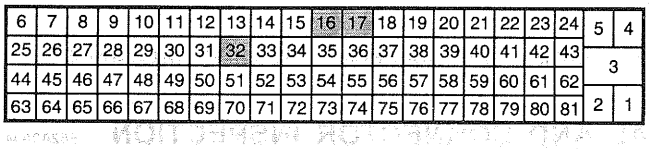
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (16)	TPS Signal
2	ECM C01-1 (32)	Reference Voltage (+5V)
3	ECM C01-1 (17)	Sensor Ground

[HARNESS CONNECTORS]



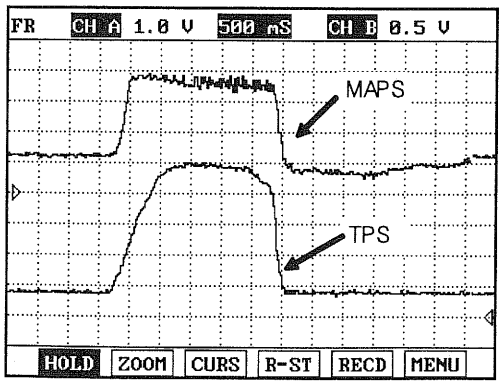
TPS (C26)



ECM

EFPF007A

SIGNAL WAVEFORM & DATA EEA633BE

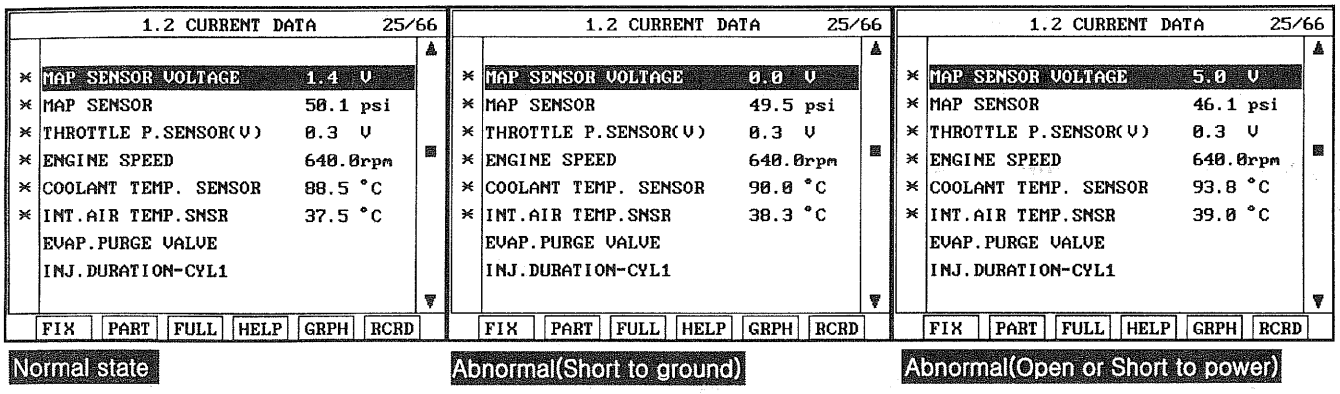


EFPF025A

MONITOR SCANTOOL DATA ED3AD278

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.



EFPF026A

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 E52A9A44

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 E64EDA0A

1. Check TPS resistance.

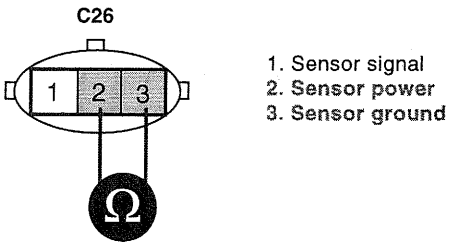
   1) Key "OFF".

   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

EFPF300U

   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.

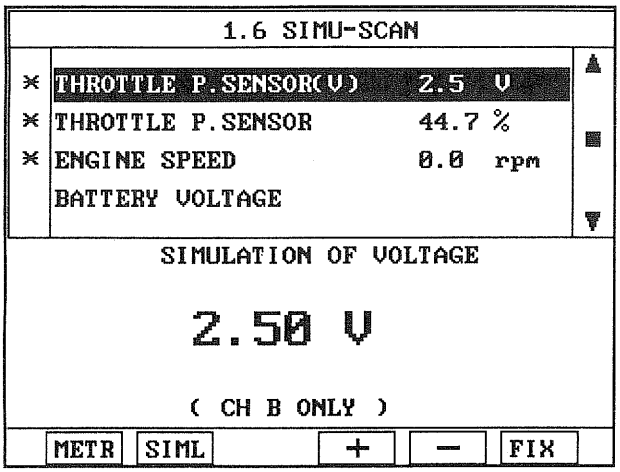
2. Check ECM.

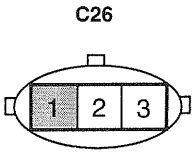
   1) Key "OFF".

   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

EFPF027A

   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 EABBFB98

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 EDF832ED

Refer to DTC P0121.

GENERAL DESCRIPTION EF1D0872

Refer to DTC P0121.

DTC DESCRIPTION EECAF3EF

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 E18ED8BB

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 〉 480 rpm	
Threshold Value	• Calculated signal from sensor voltage 〈 3.1%	
Diagnostic Time	• 0.5 sec	
MIL	• ON	

SPECIFICATION EEF60D5E

Refer to DTC P0121.

SCHEMATIC DIAGRAM E0912895

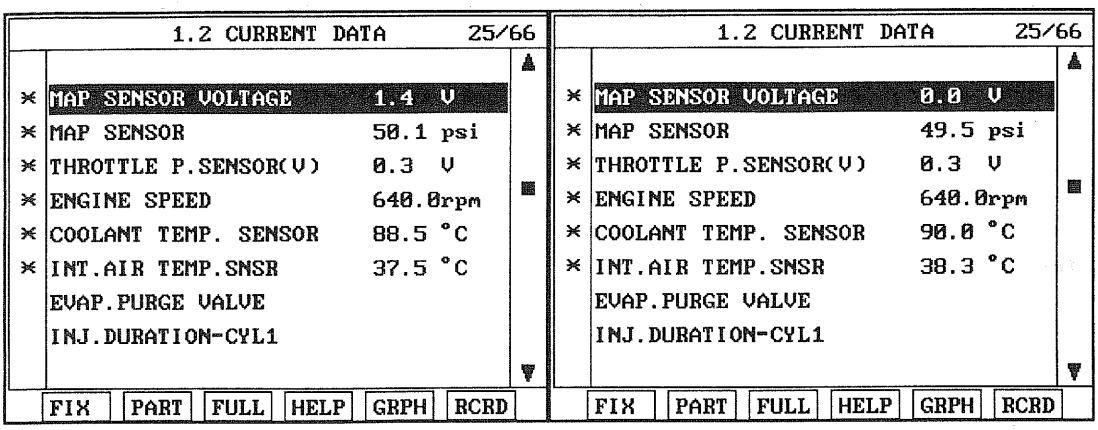
Refer to DTC P0121.

SIGNAL WAVEFORM & DATA E5951BB0

Refer to DTC P0121.

MONITOR SCANTOOL DATA E00FEB67

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.



EFPF028A

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 E70F089B

Refer to DTC P0121.

POWER CIRCUIT INSPECTION E0ED0E6F

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 EADD5860

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

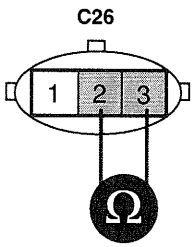
▶ Repair Short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0A45F67

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

EFPF300U

   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.

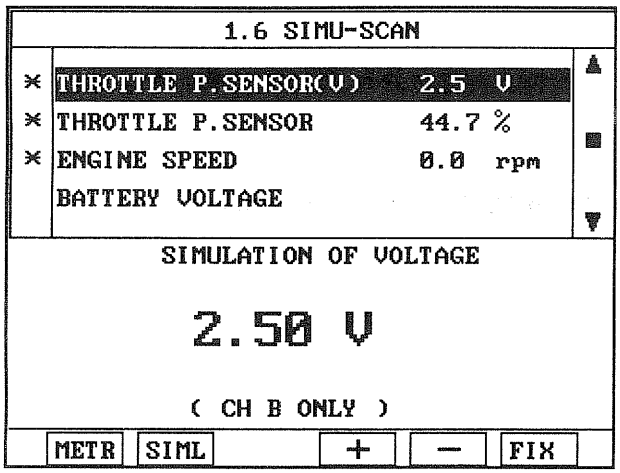
2. Check ECM.

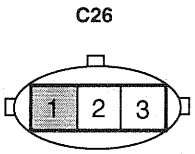
1) Key "OFF".

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

EFPF027A

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 EA4B6CE0

Refer to DTC P0121.

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

COMPONENT LOCATION EDEEB390

Refer to DTC P0121.

GENERAL DESCRIPTION EBB687FA

Refer to DTC P0121.

DTC DESCRIPTION E1499934

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

DTC DETECTING CONDITION E3542856

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 〉 480rpm	
Threshold Value	• Calculated signal from sensor voltage 〉 95.7%	
Diagnostic Time	• 0.5 sec	
MIL	• ON	

SPECIFICATION EA45ED8B

Refer to DTC P0121.

SCHEMATIC DIAGRAM E9590AA5

Refer to DTC P0121.

SIGNAL WAVEFORM & DATA EC231625

Refer to DTC P0121.

MONITOR SCANTOOL DATA E4626A98

Refer to DTC P0122.

TERMINAL AND CONNECTOR INSPECTION E3B27877

Refer to DTC P0121.

POWER CIRCUIT INSPECTION E6A09D48

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 to ground in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EC782F82

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 E0709712

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 EB4DDDC7

1. Check TPS resistance.

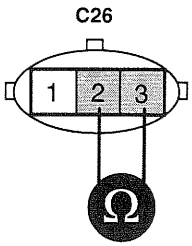
1) Key "OFF".

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

EFPF300U

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.

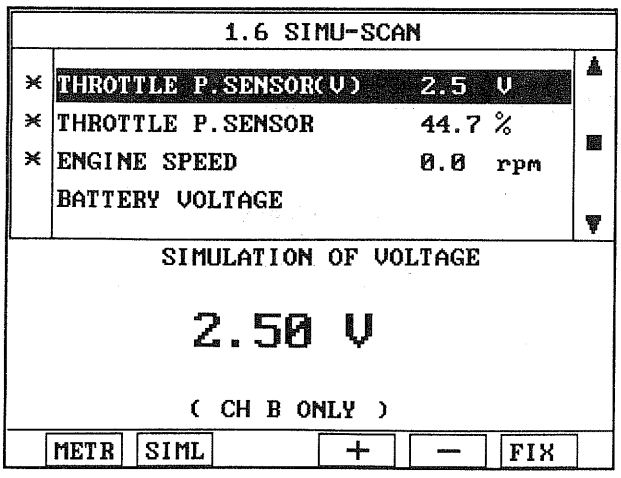
2. Check ECM.

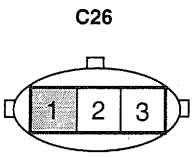
1) Key "OFF".

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

EFPF027A

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 EEF18D7A

Refer to DTC P0121.

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

COMPONENT LOCATION E342CB94

Refer to DTC P0121.

GENERAL DESCRIPTION EEC3F700

Refer to DTC P0121.

DTC DESCRIPTION E52A2B10

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 E4FBBF1D

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	• OFF	

SPECIFICATION E505604C

Refer to DTC P0121.

SCHEMATIC DIAGRAM EC1FB70A

Refer to DTC P0121.

SIGNAL WAVEFORM & DATA EFF3312F

Refer to DTC P0121.

MONITOR SCANTOOL DATA E3A715EE

Refer to DTC P0121.

TERMINAL AND CONNECTOR INSPECTION E3DB92DF

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

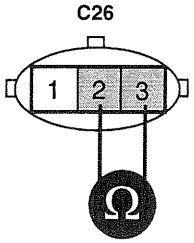
▶ Check for Open or Short in TPS circuit. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E247D7B0

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

EFPF300U

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.

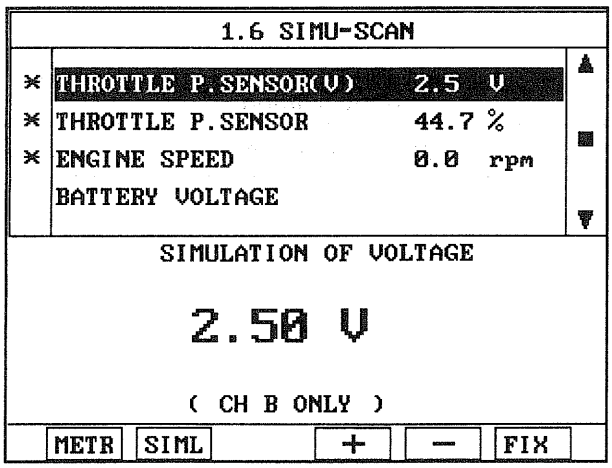
2. Check ECM.

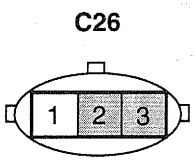
1) Ignition "OFF"

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

EFPF031A

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

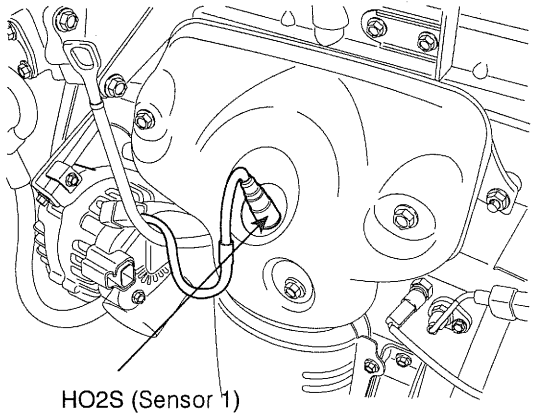
▶ Substitute with a known-good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E63B71C6

Refer to DTC P0121.

DTC P0130 HO2S CIRCUIT (BANK 1/ SENSOR 1)

COMPONENT LOCATION E97F4F66



LFJF800A

GENERAL DESCRIPTION E29D4BA6

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 E8C5139F

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 E6FC3A79

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 ~ 1.08V	
	Diagnostic Time	• 25 sec	
Case3	Enable Conditions	• Time after dew point end detected 〉 10s	
	Threshold Value	• Counter of I △usvk 〉 2V during 0.04 secafter heater on→off I 〉 5 times	
MIL		• ON	

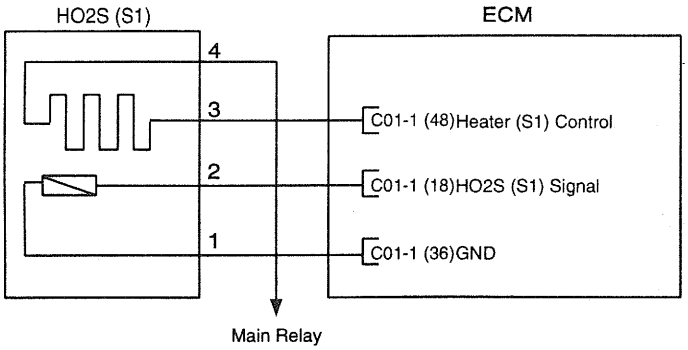
※△usvk : Sum of the signal voltage change value (B1S1)
※ B1S1 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E2CACB75

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

SCHEMATIC DIAGRAM EC35B133

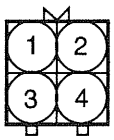
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (36)	Sensor Ground
2	ECM C01-1 (18)	HO2S (S1) Signal
3	ECM C01-1 (48)	Heater (S1) Control
4	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTOR]



HO2S [S1] (C17)

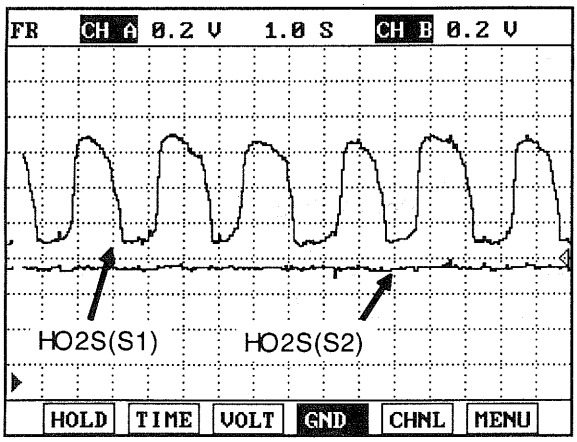
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C01-1

ECM

EFPF001A

SIGNAL WAVEFORM & DATA E50AF374



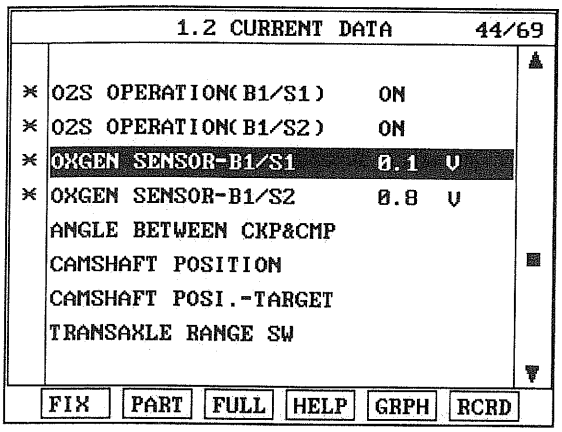
If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O2 sensor service data in the Hi-Scan (Pro) will display values 200mV or lower.
When you suddenly press on the accelerator pedal down, the voltage will reach 0.6 ~ 1.0 V.
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 E5F261F7

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

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



EFPF603A

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 E0C97986

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 EAA2DFD9

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

3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 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 EA0C0A50

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. Measure resistance between terminal 1 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 E766ED97

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.

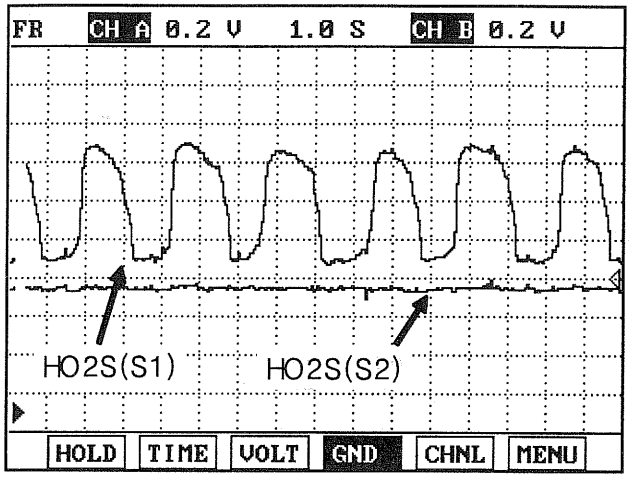
2. Check HO2S(B1/S1) performance.

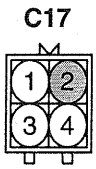
   1) IG "OFF".

   2) Connect probe to terminal 2 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. Sensor Ground
2. Sensor(B1S1) Signal
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

EFPF032A

   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.

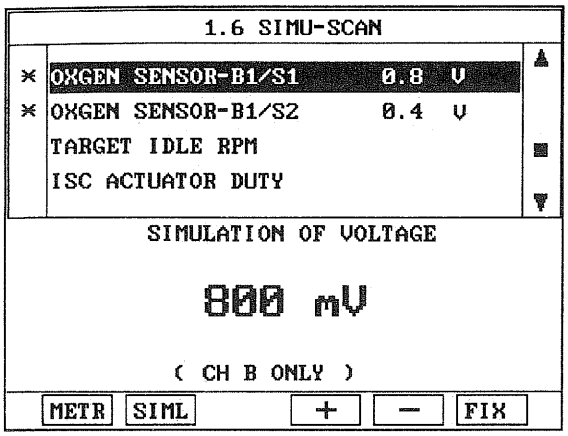
3. Check ECM.

   1) IG "OFF" and disconnect B1S1 connector.

   2) Connect scantool and Key "ON".

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.



EFPF604A

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 E66D5CCC

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 E26D2C30

Refer to DTC P0130.

GENERAL DESCRIPTION E82EC724

Refer to DTC P0130.

DTC DESCRIPTION E876D6D2

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 E8BACACB

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 〈 0.06V	
MIL		• ON	

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

SPECIFICATION EBCDC2B1

Refer to DTC P0130.

SCHEMATIC DIAGRAM EAE8BD84

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA EA89BCC8

Refer to DTC P0130.

MONITOR SCANTOOL DATA EB516355

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION E06314BE

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION E49399FB

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 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 EAFB7277

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?

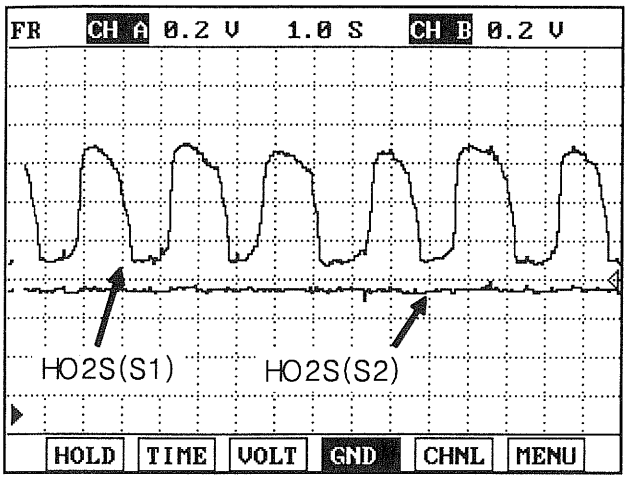
      YES

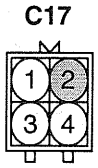
      ▶ Go to "Check HO2S(B1/S1) performance" as follows.

      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 2 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. Sensor Ground
2. Sensor(B1S1) Signal
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

EFPF032A

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.

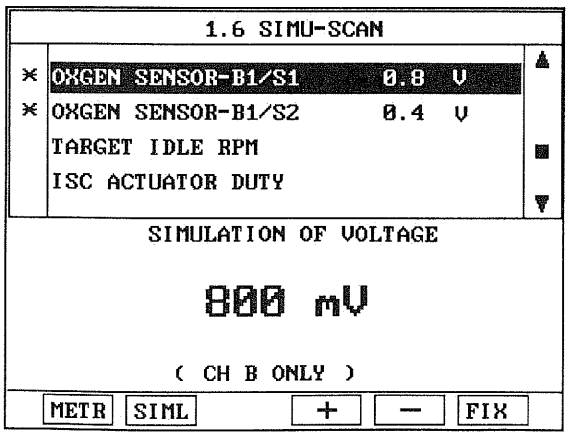
3. Check ECM.

1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.



EFPF604A

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 EFD2CA59

Refer to DTC P0130.

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

COMPONENT LOCATION E661332F

Refer to DTC P0130.

GENERAL DESCRIPTION ED0B169B

Refer to DTC P0130.

DTC DESCRIPTION EF077139

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 EE8D5F24

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 〉 1.08V	
Diagnostic Time	• 5 sec	
MIL	• ON	

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

SPECIFICATION E4801B1D

Refer to DTC P0130.

SCHEMATIC DIAGRAM EA5CBFA1

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E7941802

Refer to DTC P0130.

MONITOR SCANTOOL DATA EBF49C83

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION E869ECE0

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION E8A08CDD

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 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 EE305DA9

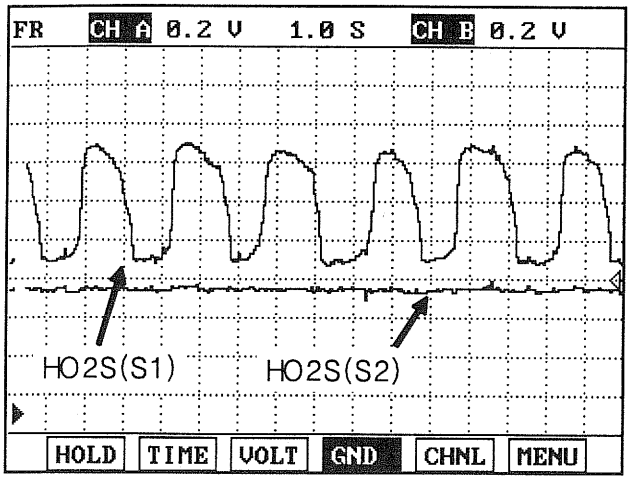
1. Visual Inspection.
   1) IG "OFF"
   2) Disconnect HO2S(B1/S1) connector.
   3) Check that HO2S(B1S1) is contaminated or damaged by foreign materials.
   4) Has a problem been found?

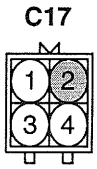
   YES

   ▶ 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 2 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. Sensor Ground
2. Sensor(B1S1) Signal
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

EFPF032A

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.

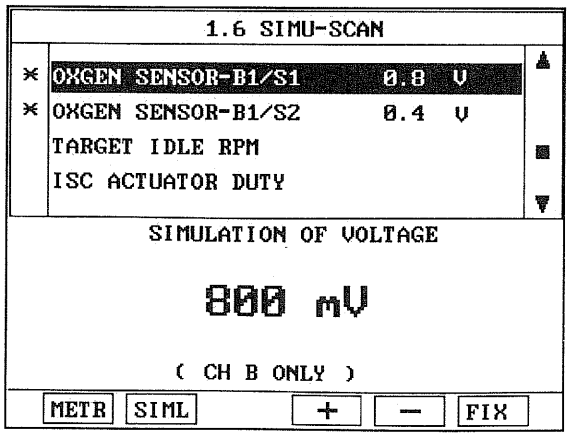
3. Check ECM.

1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.



EFPF604A

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 E0271C70

Refer to DTC P0130.

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

COMPONENT LOCATION EA86763A

Refer to DTC P0130.

GENERAL DESCRIPTION E99206D3

Refer to DTC P0130.

DTC DESCRIPTION E1635CC9

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 E6D21582

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 1800~2800rpm • Engine load 30~65% • Exhaust gas temperature (model) 〉 450℃	
Threshold Value	• Cycle period of B1S1 signal 〉 3 sec	
Diagnostic Time	• 12 cycle	
MIL	• ON	

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

SPECIFICATION E9164810

Refer to DTC P0130.

SCHEMATIC DIAGRAM EDAA640B

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA EA46DFE1

Refer to DTC P0130.

MONITOR SCANTOOL DATA E355E0B4

Refer to DTC P0130.

SYSTEM INSPECTION EC0D0FCB

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 EECE811E

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"

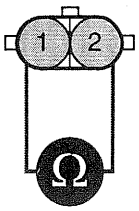
   2) Remove Injector.

   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

EFPF301B

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.

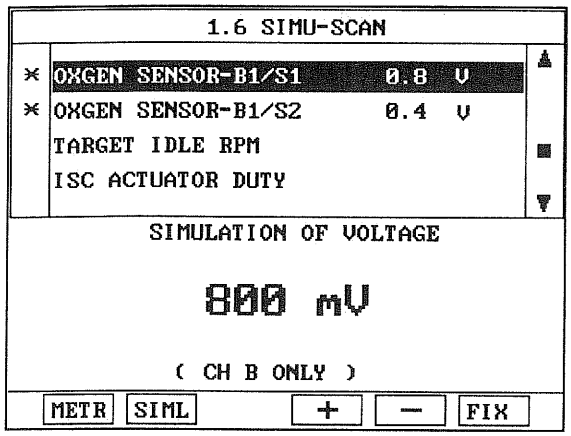
5. Check ECM.

1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1S1) sensor signal connector.



EFPF604A

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 E59291F2

Refer to DTC P0130.

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

COMPONENT LOCATION E8208129

Refer to DTC P0130.

GENERAL DESCRIPTION E74E993E

Refer to DTC P0130.

DTC DESCRIPTION E264C63D

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 E60E2CFC

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) 〉 450℃	
	Threshold Value	• Internal resistance 〉 20 kΩ	
MIL		• ON	

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

SPECIFICATION E26E436C

Refer to DTC P0130.

DTC TROUBLESHOOTING PROCEDURES

SCHEMATIC DIAGRAM EFCE72C2

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E39CF0D3

Refer to DTC P0130.

MONITOR SCANTOOL DATA E90BEC9C

Refer to DTC P0130.

TERMINAL AND CONNECTOR INSPECTION E431B408

Refer to DTC P0130.

SIGNAL CIRCUIT INSPECTION EBB8710D

1. IG "OFF".
2. Disconnect HO2S(B1/S1) connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 2 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 EE7A20F4

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

aplace as necessary and then, go to "Verification of Vehicle Repair" procedure.

4T INSPECTION E7B5A274

spection.

OFF"

connect HO2S(B1/S1) connector.

eck that HO2S(B1S1) is contaminated or damaged by foreign materials.

s 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.

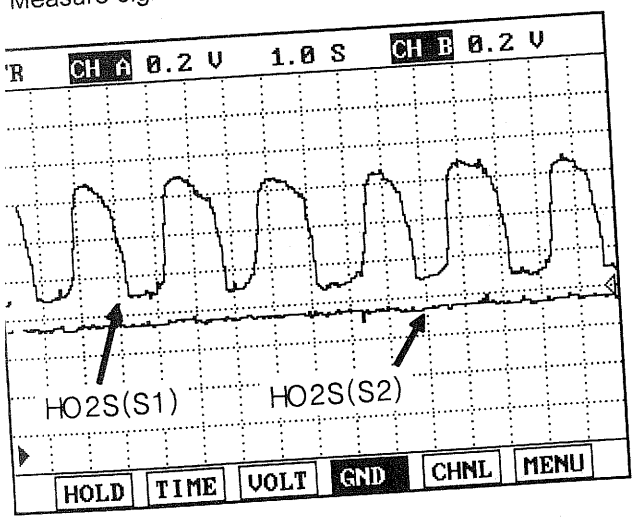
k HO2S(B1/S1) performance.

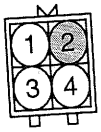
G "OFF".

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

Warm up the engine to normal operating temperature.

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





1. Sensor Ground
2. Sensor(B1S1) Signal
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

EFPF032A

) 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.

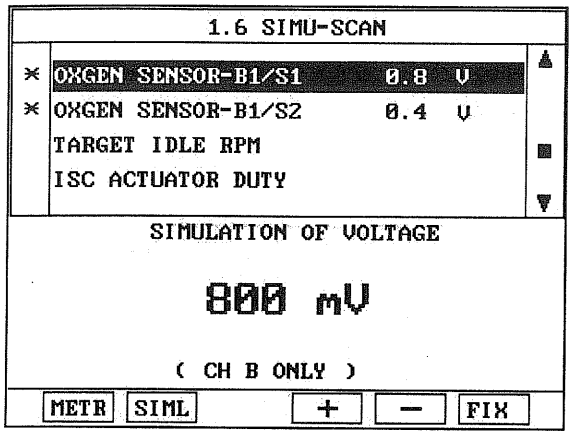
3. Check ECM.

1) IG "OFF" and disconnect B1S1 connector.

2) Connect scantool and Key "ON".

3) Select simulation function on scantool.

4) Simulate voltage at terminal 2 of HO2S(B1/S1) signal connector.



EFPF604A

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 EF399C3E

Refer to DTC P0130.

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

COMPONENT LOCATION EF022C6B

Refer to DTC P0130.

GENERAL DESCRIPTION E1CB3789

Refer to DTC P0130.

DTC DESCRIPTION EFF6FF18

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

DTC DETECTING CONDITION E8C2B267

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) 200~575 ℃ • Intake air temperature 〉 -7.5 ℃ • Battery voltage 10.7~16.1 V	
Threshold Value	• Internal resistance 〉 threshold f(exh. temp., heater power)	
Diagnostic Time	• Above 15 sec	
MIL	• ON	

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

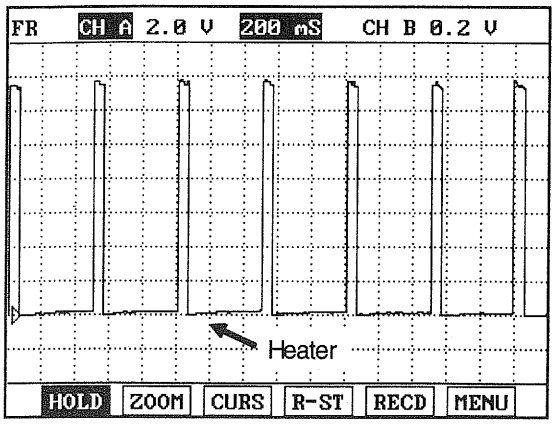
SPECIFICATION EDF951BE

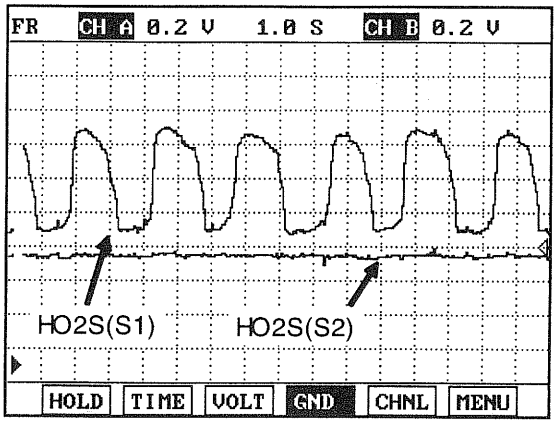
ITEM	Specification
Heater Resistance	Approx. 9.0Ω (20℃)

SCHEMATIC DIAGRAM ECDE1B68

Refer to DTC P0130.

SIGNAL WAVEFORM & DATA E1679A8A



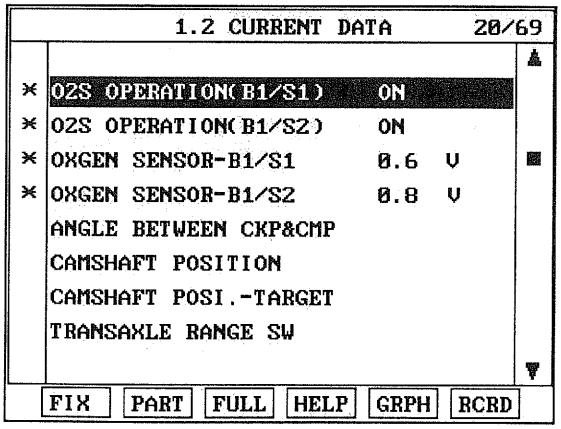


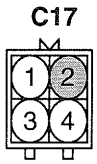
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater is controlled ON after engine start except for Cold condition and high speed 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 E2C0C9FA

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





1. Sensor Ground
2. Sensor(B1S1) Signal
3. Sensor(B1S1) Heater Control
4. Sensor(S1) Heater Power

EFPF601A

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 E6944999

Refer to DTC P0130.

POWER CIRCUIT INSPECTION EC1C424C

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 : 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 ECC4D328

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 : Approx. 3.5V

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

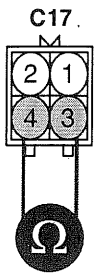
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDD8C0F8

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

EFPF300C

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

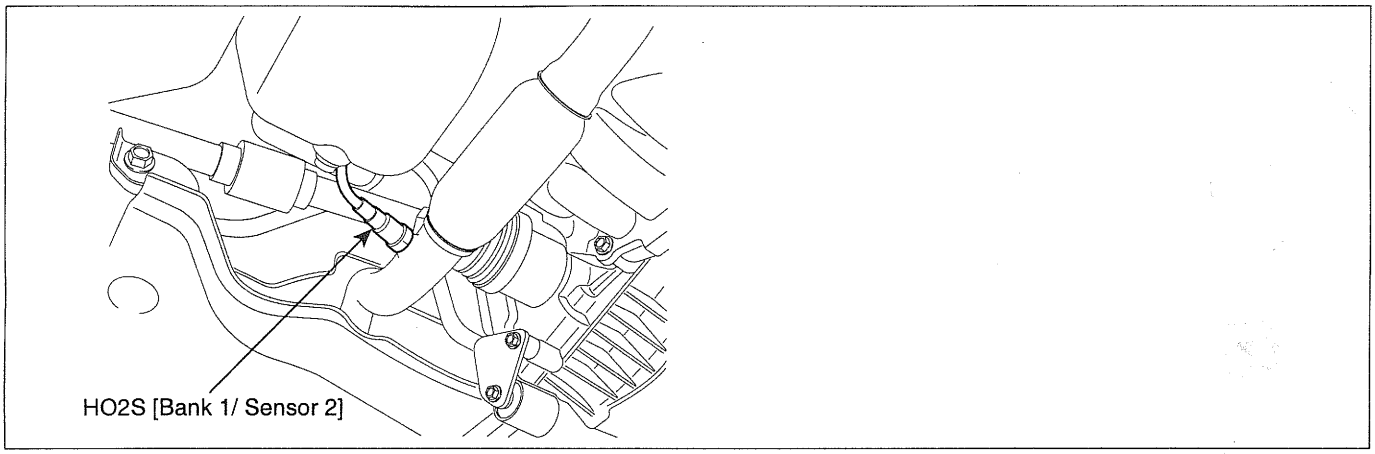
- ▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
- ▶ If the problem is corrected, replace HO2S(B1/S1) and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E67567D9

Refer to DTC P0130.

DTC P0136 HO2S CIRCUIT (BANK 1/ SENSOR 2)

COMPONENT LOCATION EE347132



EFPF701G

GENERAL DESCRIPTION E49EBA12

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 E2512EC7

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 E95AF21F

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) 〉 450 ℃	
	Threshold Value	• Internal resistance 〉 40 kΩ	
MIL		• ON	

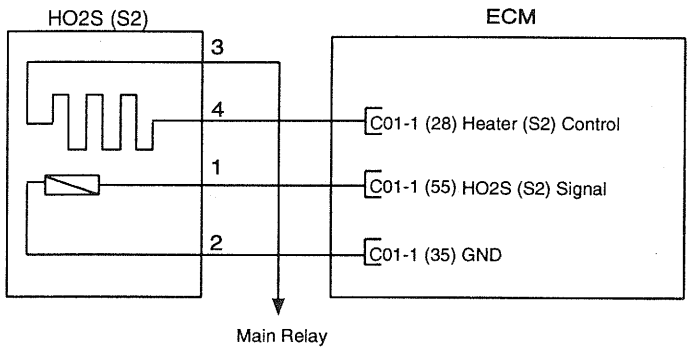
※ B1S2 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E1A67CE1

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

SCHEMATIC DIAGRAM E062ABCD

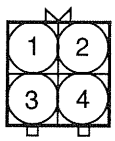
[CIRCUIT DIAGRAM]



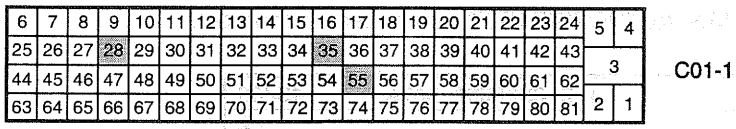
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (55)	HO2S (S2) Signal
2	ECM C01-1 (35)	Sensor Ground
3	Main Relay	Battery Voltage (B+)
4	ECM C01-1 (28)	Heater (S2) Control

[HARNESS CONNECTOR]



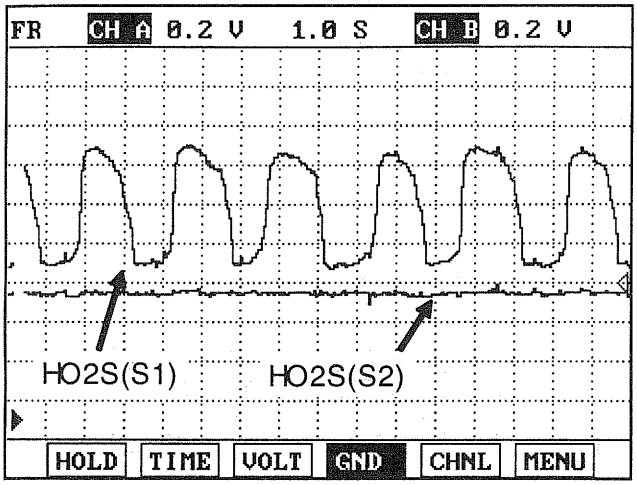
HO2S [S2] (C16)



ECM

EFPF003A

SIGNAL WAVEFORM & DATA EA512A91

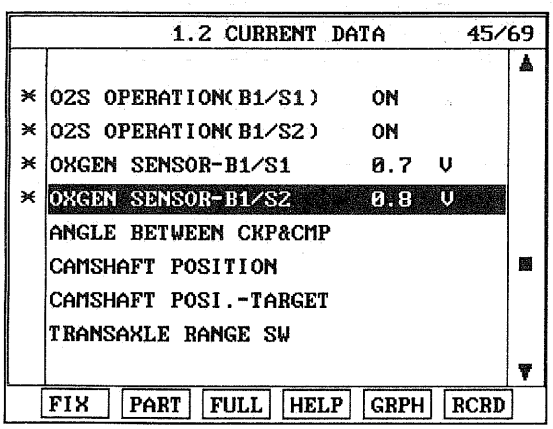


The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter.
This is the normal signal waveform of the rear HO2S at idle.

LFJF451A

MONITOR SCANTOOL DATA EBED35DE

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



EFPF605A

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 E9648F30

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 EDCA7082

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 EFE026D8

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 E45A61C8

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.

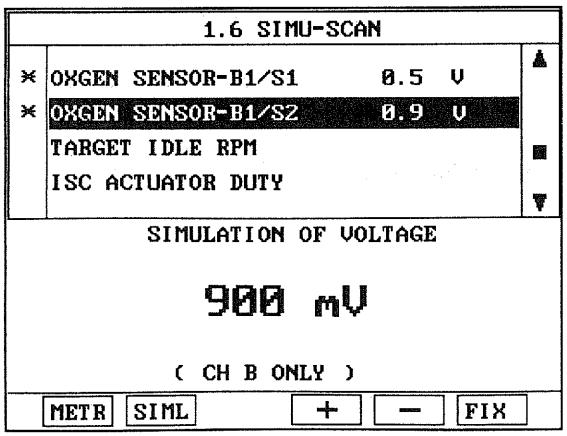
2. Check ECM.

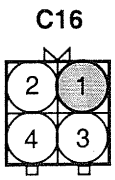
   1) IG "OFF" and disconnect B1S2 connector.

   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. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

EFPF606A

   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 E44E0F91

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 E21881F1

Refer to DTC P0136.

GENERAL DESCRIPTION E234DF9F

Refer to DTC P0136.

DTC DESCRIPTION EAE73F75

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 E764E1D5

Item		Detecting Condition	Possible Cause
DTC Strategy		• Signal check, low	• Poor connection • Short to ground in signal circuit • B1S2 • ECM
General Enable Conditions		• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃	
Case1	Enable Conditions	• Engine speed : 1000 ~ 3520 rpm • Engine load : 20~56%	
	Threshold Value	• B1S2 sensor voltage 〈 0.06 V	
	Diagnostic Time	• 25 sec	
Case2	Enable Conditions	• Sensor in cold condition	
	Threshold Value	• B1S2 sensor voltage 〈 0.06 V	
	Diagnostic Time	• 0.1 sec	
MIL		• ON	

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

SPECIFICATION EA14FC28

Refer to DTC P0136.

SCHEMATIC DIAGRAM E99A7A64

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA EB6D1B9C

Refer to DTC P0136.

MONITOR SCANTOOL DATA E894818A

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION EB52D067

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E5740717

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 EFF1A66A

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?

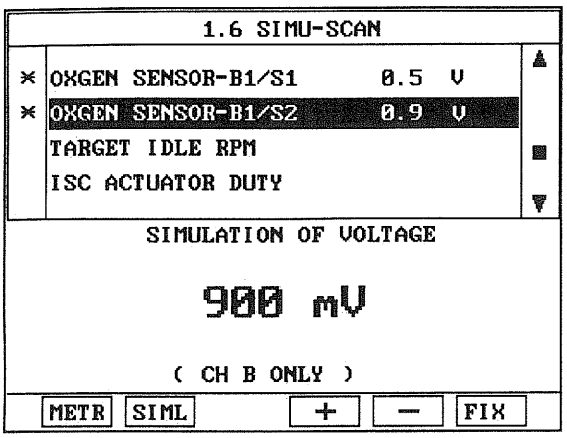
   YES

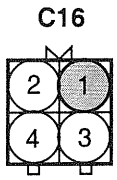
   ▶ Go to "Check ECM" as follows.

   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. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

EFPF606A

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 E46BBC38

Refer to DTC P0136.

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

COMPONENT LOCATION EF91540D

Refer to DTC P0136.

GENERAL DESCRIPTION E4857EDF

Refer to DTC P0136.

DTC DESCRIPTION E12B350B

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 EB930BA4

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 〉 1.08 V	
Diagnostic Time	• 5 sec	
MIL	• ON	

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

SPECIFICATION EA0A4254

Refer to DTC P0136.

SCHEMATIC DIAGRAM EF8FC95E

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA EF4421FD

Refer to DTC P0136.

MONITOR SCANTOOL DATA E88EEF69

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION E46C121A

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E1ECB137

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 E59A18AC

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?

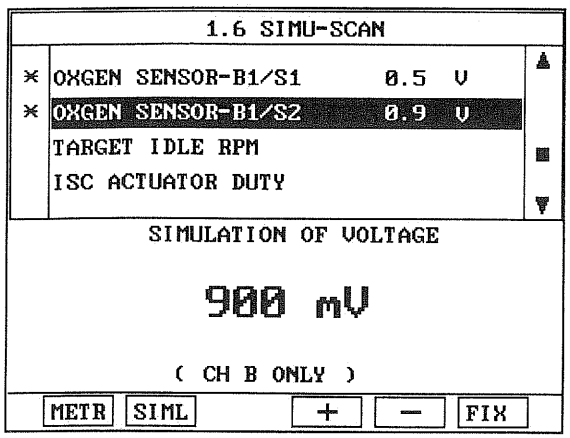
YES

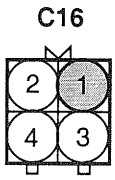
▶ Go to "Check ECM" as follows.

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. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

EFPF606A

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 EF12F9C3

Refer to DTC P0136.

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

COMPONENT LOCATION E4514E83

Refer to DTC P0136.

GENERAL DESCRIPTION EEA4323A

Refer to DTC P0136.

DTC DESCRIPTION E4001EA3

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 E53F7378

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 E5D5F2EE

Refer to DTC P0136.

SCHEMATIC DIAGRAM E0876543

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA E024CA1F

Refer to DTC P0136.

MONITOR SCANTOOL DATA E204DDB1

Refer to DTC P0136.

SYSTEM INSPECTION E9B53580

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 E4C1995C

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"

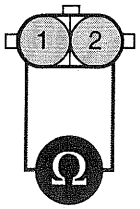
   2) Remove Injector.

   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

EFPF301B

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.

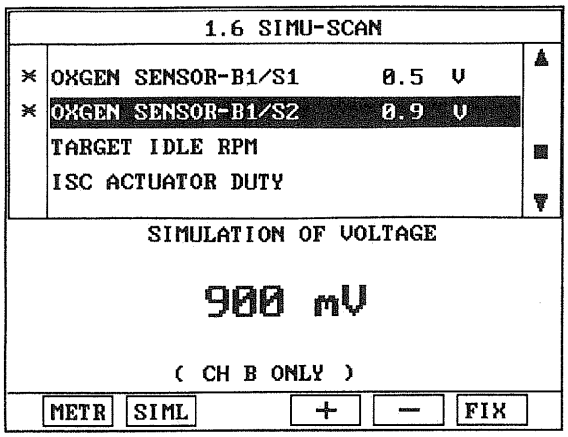
5. Check ECM.

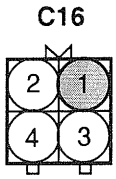
1) IG "OFF" and disconnect B1S2 connector.

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. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

EFPF606A

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 EF5F0488

Refer to DTC P0136.

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

COMPONENT LOCATION EEEB84D4

Refer to DTC P0136.

GENERAL DESCRIPTION E13447EA

Refer to DTC P0136.

DTC DESCRIPTION E239F431

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 EE671460

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 detected 〉 10s	
Threshold Value	• Signal voltage changes higher than 2V after HO2S heater operation stops 〉 4times	
MIL	• ON	

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

SPECIFICATION E2E2ED91

Refer to DTC P0136.

SCHEMATIC DIAGRAM EFAAFB04

Refer to DTC P0136.

SIGNAL WAVEFORM & DATA E9D6F51B

Refer to DTC P0136.

MONITOR SCANTOOL DATA ED613111

Refer to DTC P0136.

TERMINAL AND CONNECTOR INSPECTION E2C88192

Refer to DTC P0136.

SIGNAL CIRCUIT INSPECTION E3ACD3A6

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 E9A74989

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?

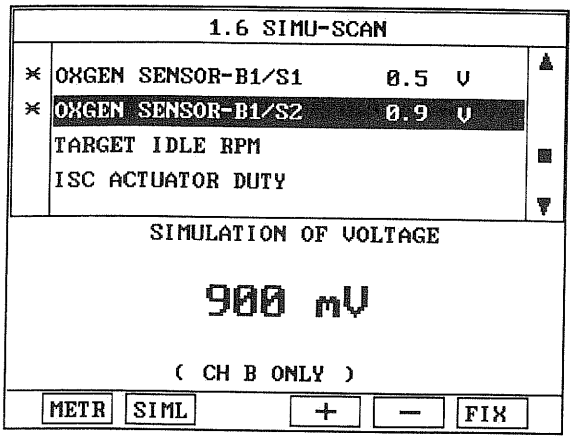
YES

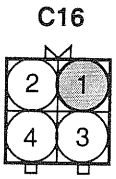
▶ Go to "Check ECM" as follows.

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. Sensor Ground
2. Sensor(B1S2) Signal
3. Sensor(B1S2) Heater Control
4. Sensor(B1S2) Heater Power

EFPF606A

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 E441327F

Refer to DTC P0136.

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

COMPONENT LOCATION EC2B95F7

Refer to DTC P0136.

GENERAL DESCRIPTION E42917EE

Refer to DTC P0136.

DTC DESCRIPTION E3E10951

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

DTC DETECTING CONDITION E46D4AA0

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) 200~550℃ • Intake air temperature 〉 -7℃ • Battery voltage 10.7~16.1V	
Threshold Value	• Internal resistance 〉 threshold f (cat. temp., heater power)	
Diagnostic Time	• Above 6 sec	
MIL	• ON	

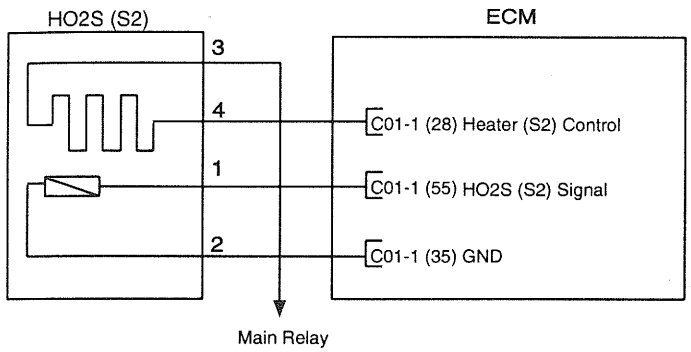
※ B1S2 : upstream oxygen sensor / B1S2 : downstream oxygen sensor

SPECIFICATION E1F47B96

ITEM	Specification
Heater Resistance	Approx. 9.0 (20℃)

SCHEMATIC DIAGRAM E9BBAD5A

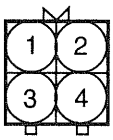
[CIRCUIT DIAGRAM]



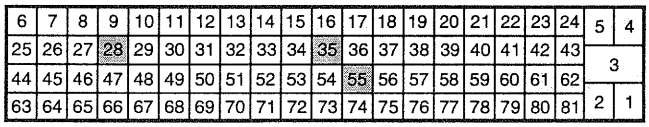
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (55)	HO2S (S2) Signal
2	ECM C01-1 (35)	Sensor Ground
3	Main Relay	Battery Voltage (B+)
4	ECM C01-1 (28)	Heater (S2) Control

[HARNESS CONNECTOR]



HO2S [S2] (C16)



ECM

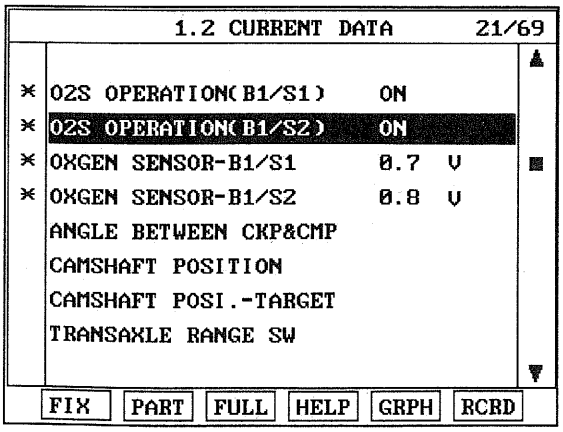
EFPF003A

SIGNAL WAVEFORM & DATA E882ED0F

Refer to DTC P0136.

MONITOR SCANTOOL DATA E9A80EDD

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



EFPF602A

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 E48A1107

Refer to DTC P0136.

POWER CIRCUIT INSPECTION EE3E029E

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 E6EE3056

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 E61AEB17

1. Check Heater resistance.

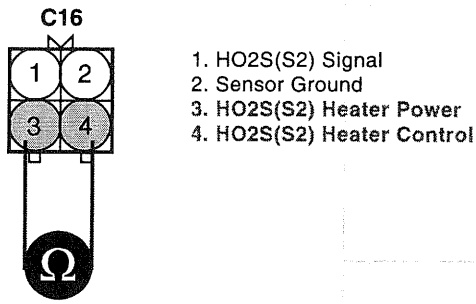
   1) IG "OFF".

   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

EFPF300F

   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 EEB12250

Refer to DTC P0136.

DTC P0171 SYSTEM TOO LEAN (BANK 1)

GENERAL DESCRIPTION E27022BA

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 E5309CCC

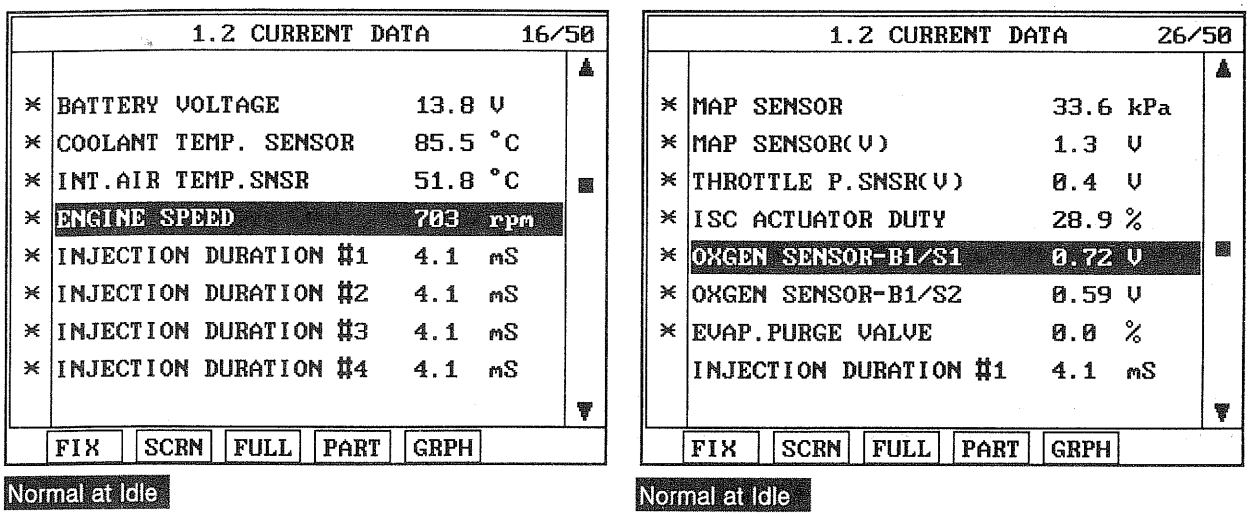
If the correction value of air-fuel ratio is higher than the threshold value, PCM sets DTC P0171.

DTC DETECTING CONDITION EB08E1C0

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 〉 70℃ • Intake air temperature 〈 80℃ • Throttle angle 〈 60% • Closed loop control enabled • No transient control phase • No canister purge phase	
Case1	Enable Conditions	• Engine load : 30~75 % • Air mass : 40~200 kg/h	
	Threshold Value	• Multiplicative 〉 1.23	
	Diagnostic Time	• 30 sec	
Case2	Enable Conditions	• Engine speed ≤ 920 rpm • Air mass ≤ 24 kg/h	
	Threshold Value	• Additive value > 8.5 %	
	Diagnostic Time	• 20 sec	
MIL		• ON	

MONITOR SCANTOOL DATA E886E932

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.



EFPF035A

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 E2B3653A

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 ED01547F

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 EA7F2BE4

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".

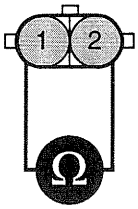
2) Disconnect injectors.

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

EFPF301B

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 E0D518CC

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 EEF6D547

Refer to DTC P0171.

DTC DESCRIPTION E6DB54AB

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

DTC DETECTING CONDITION EC788ED8

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 〉 70℃ • Intake air temperature 〈 80℃ • Throttle angle 〈 60% • Closed loop control enabled • No transient control phase • No canister purge phase	
Case1	Enable Conditions	• Engine load : 30~75 % • Air mass : 40~200 kg/h	
	Threshold Value	• multiplicative value 〈 0.77	
	Diagnostic Time	• 30 sec	
Case2	Enable Conditions	• Engine speed ≤ 920 rpm • Air mass ≤ 24 kg/h	
	Threshold Value	• additive value 〈 -8.5%	
	Diagnostic Time	• 20 sec	
MIL		• ON	

MONITOR SCANTOOL DATA E1993A19

Refer to DTC P0171.

TERMINAL AND CONNECTOR INSPECTION EE36FCAA

Refer to DTC P0171.

SYSTEM INSPECTION E065C13C

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 EC714325

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".

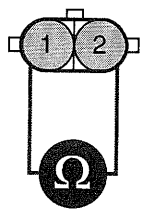
   2) Disconnect injectors.

   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

EFPF301B

   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 EFA9FC34

Refer to DTC P0171.

DTC P0230 FUEL PUMP PRIMARY CIRCUIT

COMPONENT LOCATION E0BDF0FE

EFPF701O

GENERAL DESCRIPTION EFD65AA3

The PCM 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 PCM monitors the control circuit between the fuel pump relay and the ECM. When the ignition switch is turned ON, the PCM energizes the fuel pump relay, which sends power to the fuel pump.

DTC DESCRIPTION EFA2338D

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

DTC DETECTING CONDITION E6FD1E4A

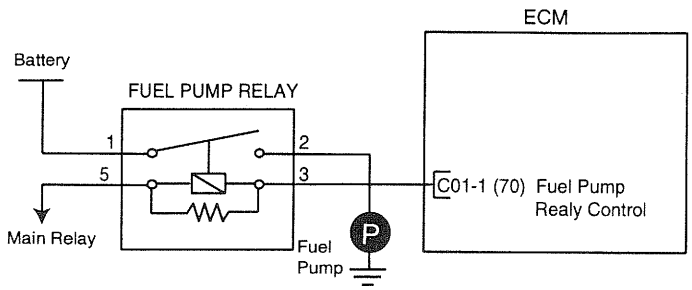
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, open	• Poor connection • Open or short to ground in power circuit • Open in control circuit • Fuel pump relay • PCM
Enable Conditions		
Threshold Value		
Diagnostic Time	• Continuous	
MIL	• OFF	

SPECIFICATION E2947818

Coil
70Ω ~ 120Ω

SCHEMATIC DIAGRAM E982292B

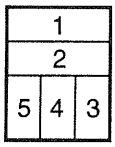
[CIRCUIT DIAGRAM]



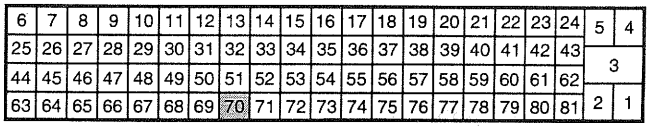
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery Voltage (B+)
2	Fuel Pump	Fuel Pump Power supply
3	ECM C01-1 (70)	Fuel Pump Relay Control
4	-	-
5	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



FUEL PUMP RELAY (E45)

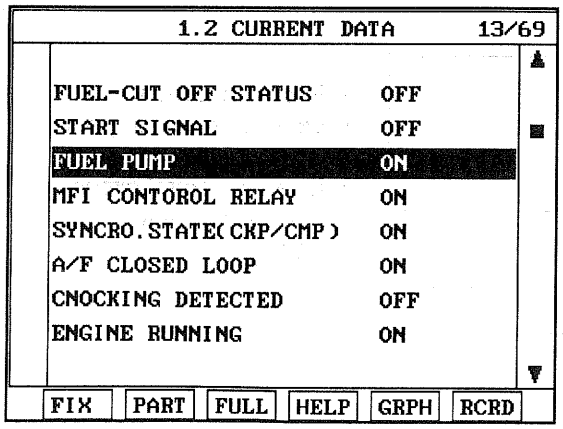


ECM

EFPF008A

MONITOR SCANTOOL DATA E532829A

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 EE3D13BD

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 E58391F4

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 EE34FB70

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

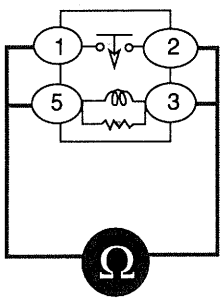
▶ Repair Open in control circuit, and go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION EC89FD7D

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 E12815B0

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

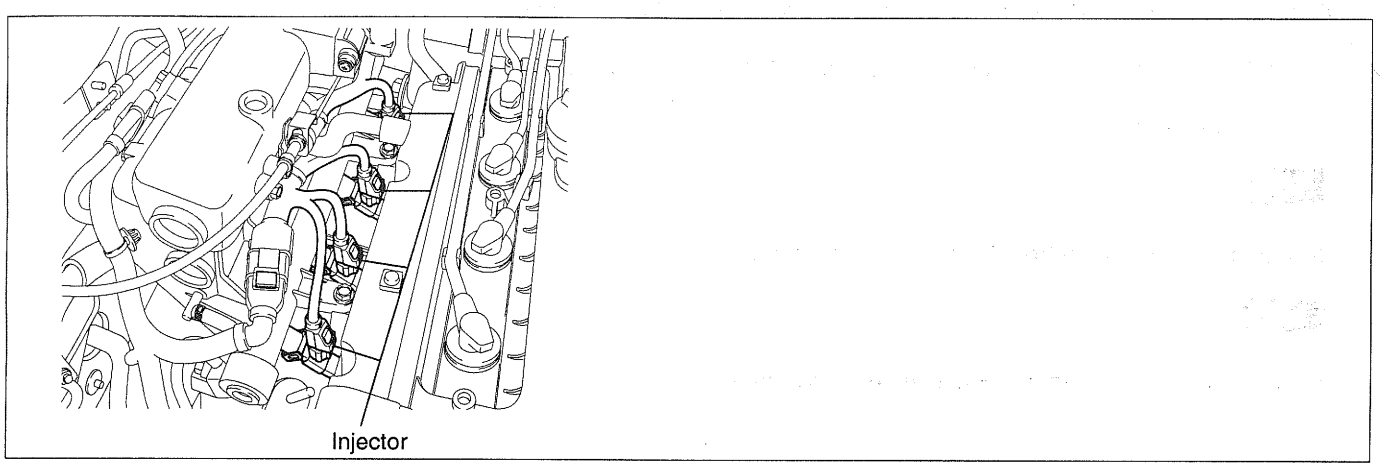
- ▶ Go to the applicable troubleshooting procedure.

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 EF322272



EFPF701K

GENERAL DESCRIPTION E0CAC4C9

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 E0DFDF9C

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

DTC DETECTING CONDITION E78BD3D5

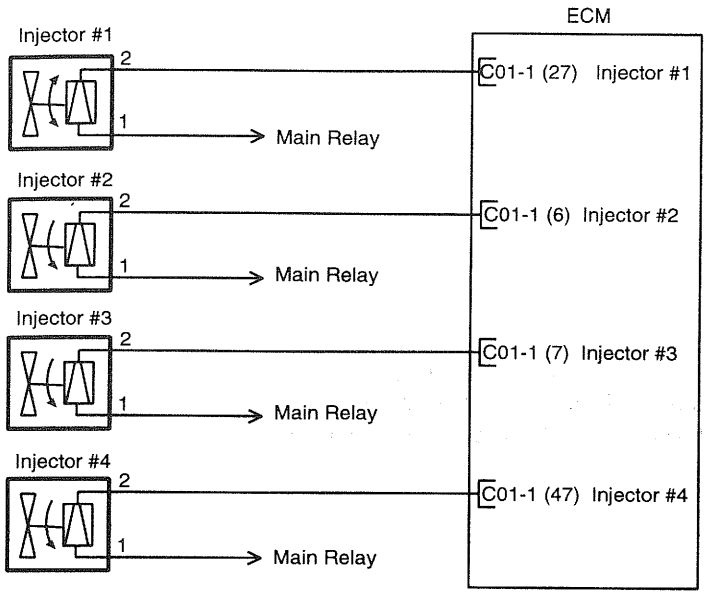
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low	• Poor connection • Short to ground in control circuit • Injector • ECM
Enable Conditions		
Threshold Value	• Short to ground	
Diagnostic Time	• Continuous	
MIL	• ON	

SPECIFICATION E7812523

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

SCHEMATIC DIAGRAM EDB16A30

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (27)	Injector #1 Control

Injector #2

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (6)	Injector #2 Control

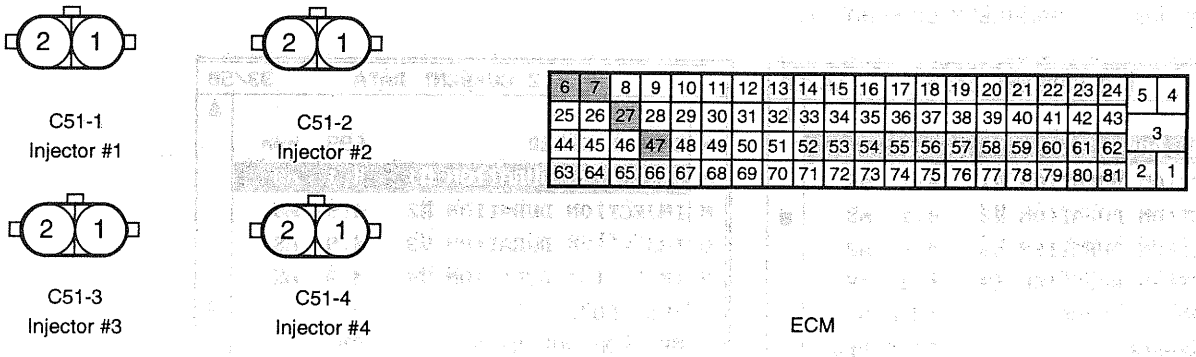
Injector #3

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (7)	Injector #3 Control

Injector #4

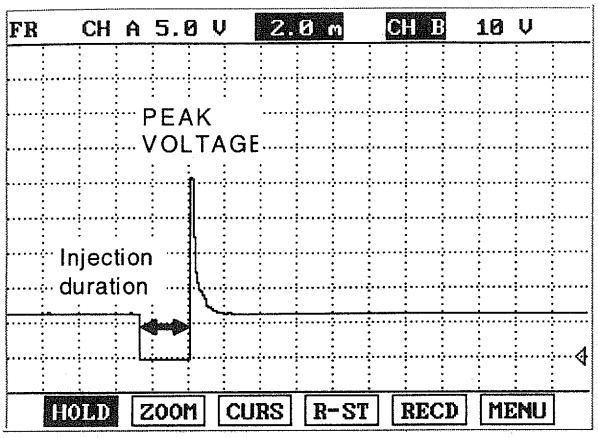
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (47)	Injector #4 Control

[HARNESS CONNECTORS]



EFPF009A

SIGNAL WAVEFORM & DATA E25E8DA4

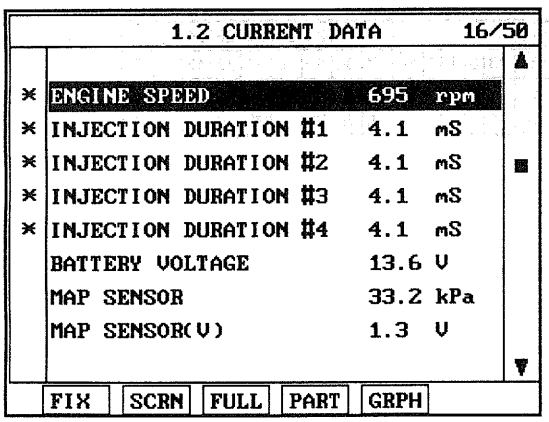


When the ECM energizes the injector by grounding the control circuit, the circuit voltage should below (theoretically 0V) and the fuel is iniected. When the ECM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak for a moment.

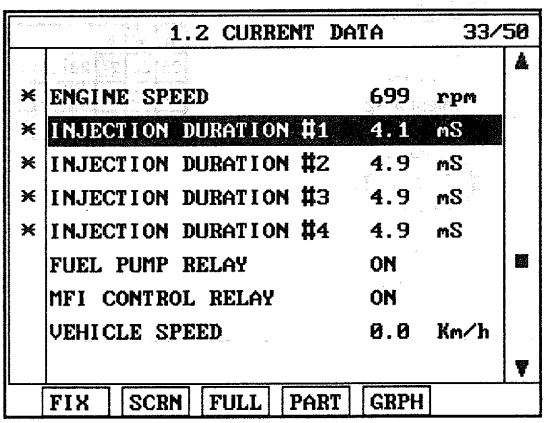
LFJF479A

MONITOR SCANTOOL DATA EC97F5BA

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



Abnormal State

EFPF039A

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 E965DD1A

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 " Control Circuit Inspection " procedure.

CONTROL CIRCUIT INSPECTION E0E5DC8D

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

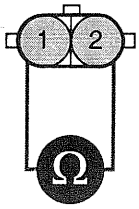
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E35CEA38

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

EFPF301H

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 E33B6722

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 EE0F6774

Refer to DTC P0261.

GENERAL DESCRIPTION EE4B3EC2

Refer to DTC P0261.

DTC DESCRIPTION E48CEDEE

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

DTC DETECTING CONDITION E1786033

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	• Short to battery	
Diagnostic Time	• Continuouss	
MIL	• ON	

SPECIFICATION E988D9A4

Refer to DTC P0261.

SCHEMATIC DIAGRAM E1388588

Refer to DTC P0261.

SIGNAL WAVEFORM & DATA E51AF6B6

Refer to DTC P0261.

MONITOR SCANTOOL DATA E3139CA2

Refer to DTC P0261.

TERMINAL AND CONNECTOR INSPECTION E8E9292F

Refer to DTC P0261.

CONTROL CIRCUIT INSPECTION E3FD7BA2

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

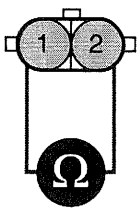
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5F994C1

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

EFPF301H

   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

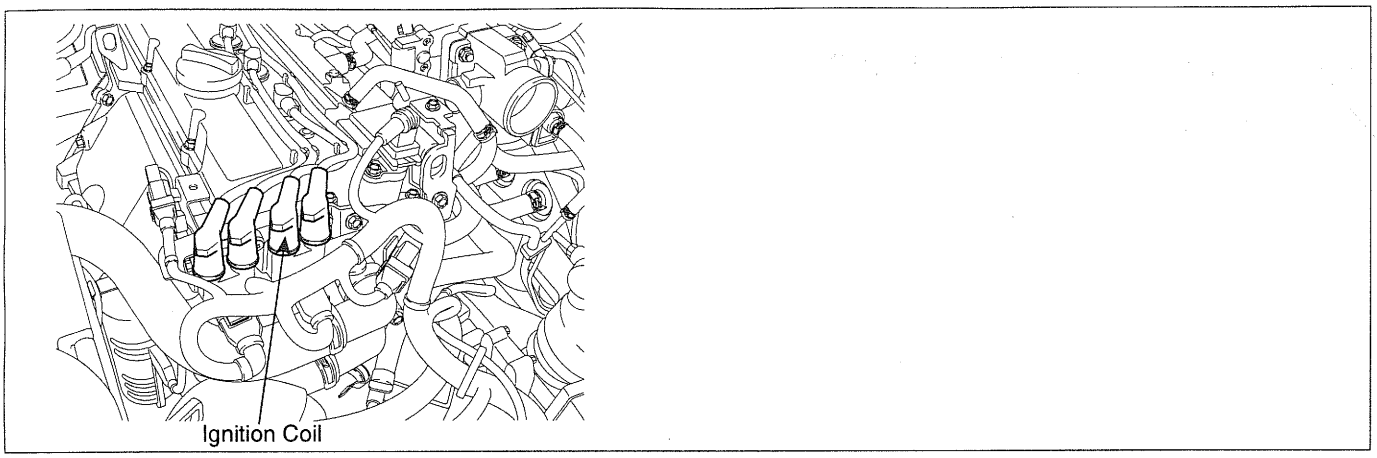
- Substitute with a known - good injector and check for proper operation.
- If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EF1B0D70

Refer to DTC P0261.

DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

COMPONENT LOCATION E0885725



EFPF701N

GENERAL DESCRIPTION E2641CED

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 PCM monitors the crankshaft speed variation to determine if any misfiring generated. The PCM 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 ED159131

If there happen misfires over the threshold value at 2 cylinders or more, PCM sets DTC P0300.

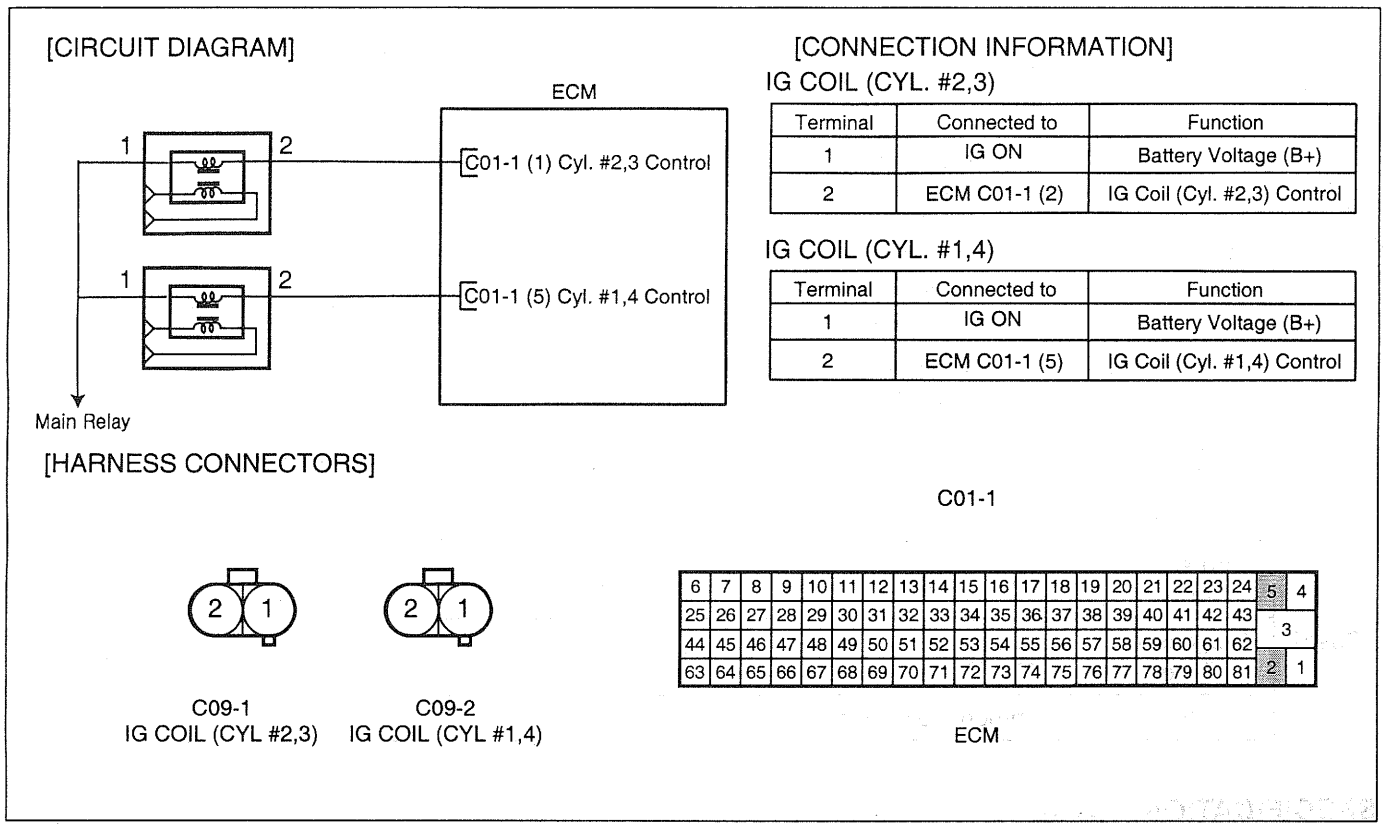
DTC DETECTING CONDITION E19ACA19

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 400~6000rpm • Engine load 〉 Zero torq. • Eng. load change 〈 Max. • Eng. speed change 〈 Max. • Time after engine start 〉 25 sec • Intake air temperature 〉 -7.5℃	
Case1	Threshold Value	• Misfire rate for FTP(Federal Test Procedure) emission thresh 〉 5%	
	Diagnostic Time	• 1000 revs	
	MIL	• ON	
Case2	Threshold Value	• 4% 〈 Misfire rate for catalyst damage 〈 22%	
	Diagnostic Time	• 200 revs	
	MIL	• Immediately (Blink)	

SPECIFICATION E9BD080B

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

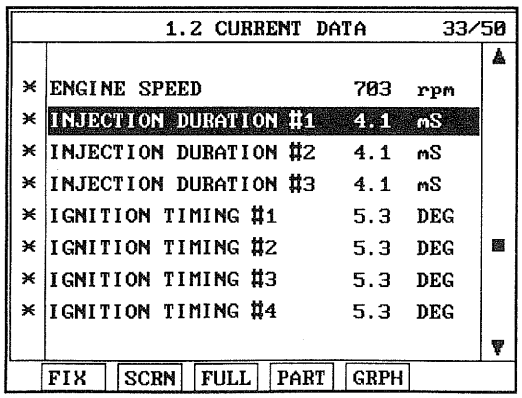
SCHEMATIC DIAGRAM EA8F8A6F



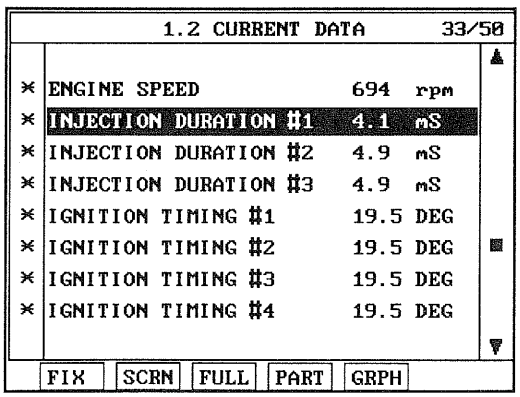
EFPF010A

MONITOR SCANTOOL DATA E731059C

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



Abnormal State

EFPF040A

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 E5FDA26E

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 EC9A631C

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".

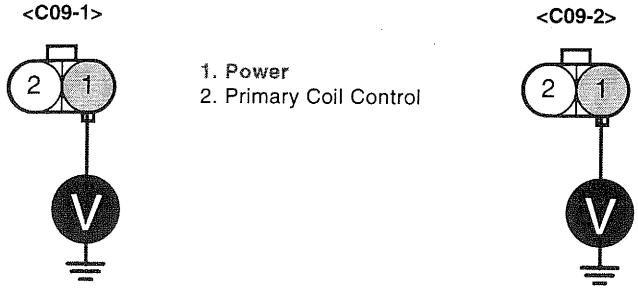
2) Disconnect Ignition coil connector.

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

4) Key "ON".

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

Specification : Approx. B+



EFPF301U

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.

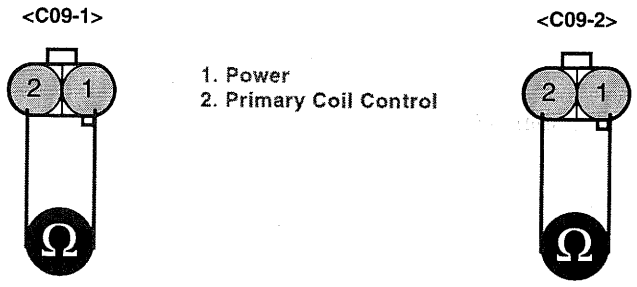
5. Ignition coil check

1) Measure the resistance between terminal 1 and 2 of ingnition coil connector #1, #2.
(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)



EFPF301V

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.

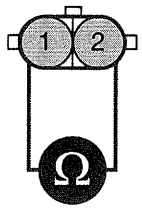
3) Check leakage or clog on injectors.

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

SPECIFICATION :

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

<C51-1,2,3,4>



1. Power
2. Primary Coil Control

EFPF301W

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 E5D5565D

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 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 E3CB35C2

Refer to DTC P0300.

GENERAL DESCRIPTION E3F28BB1

Refer to DTC P0300.

DTC DESCRIPTION ED410150

If there happen misfires over the threshold value at #1/2/3/4 cylinder, PCM sets DTC P0301/P0302/P0303/P0304.

DTC DETECTING CONDITION E2C8ACD8

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 400~6000rpm • Engine load > Zero torq. • Eng. load change < Max. • Eng. speed change < Max. • Time after engine start > 25 sec • Intake air temperature > -7.5℃	
Case1	Threshold Value	• Misfire rate for FTP(Federal Test Procedure) emission thresh 〉 5%	
	Diagnostic Time	• 1000 revs	
	MIL	• ON	
Case2	Threshold Value	• 4% 〈 Misfire rate for catalyst damage 〈 22%	
	Diagnostic Time	• 200 revs	
	MIL	• Immediately (Blink)	

SPECIFICATION E73A17F5

Refer to DTC P0300.

SCHEMATIC DIAGRAM EE98B542

Refer to DTC P0300.

MONITOR SCANTOOL DATA EC323082

Refer to DTC P0300.

TERMINAL AND CONNECTOR INSPECTION E1AD9878

Refer to DTC P0300.

SYSTEM INSPECTION E17FFB3C

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" & ENG "OFF".

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

Specification : Approx. B+

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 1 and 2 of ingnition coil connector.
(Component side / Primary coil)

2) Measure the resistance between terminal for cylinder.
(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)

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.

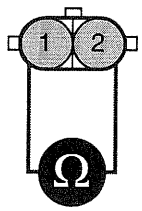
   3) Check leakage or clog on injectors.

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

SPECIFICATION :

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

<C51-1,2,3,4>



1. Power
2. Primary Coil Control

EFPF301W

   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.)

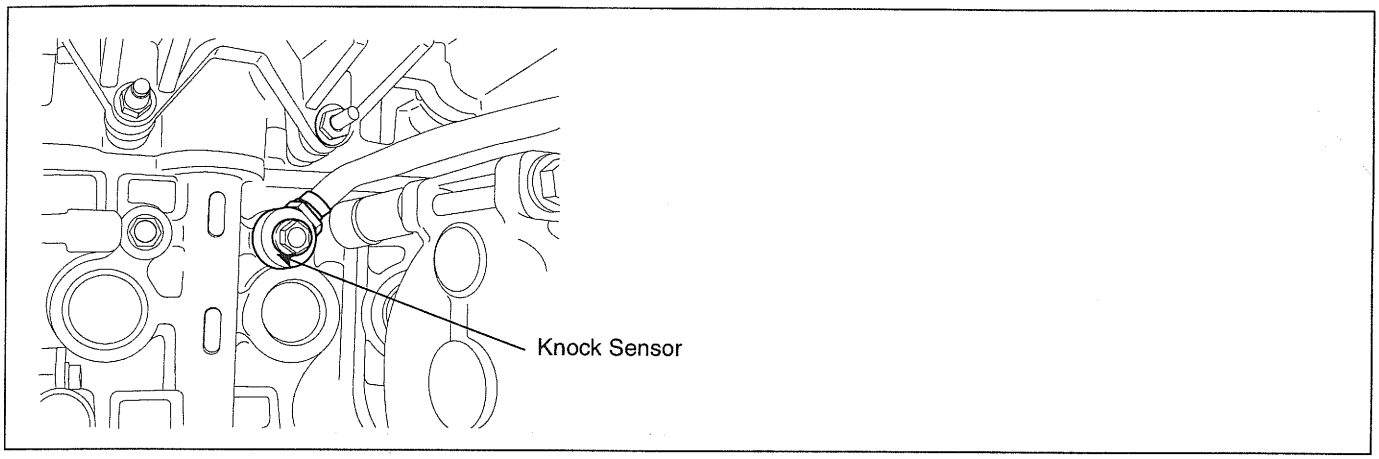
- Check the fuel supply and return line.
- Repair as necessary and go to "Verification of vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECDB5A8A

Refer to DTC P0300.

DTC P0325 KNOCK SENSOR 1 CIRCUIT

COMPONENT LOCATION EF1DF6EC



LFJF800F

GENERAL DESCRIPTION E1456A46

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 PCM 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 EE6388A6

If the signal of knock sensor is less than threshold under enable conditions, PCM sets P0325.

DTC DETECTING CONDITION E847AD0D

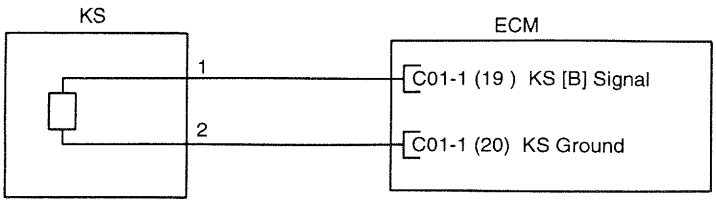
Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor signal check	• Poor connection • Open or short in signal circuit • Knock sensor • PCM
Enable Conditions	• Engine coolant temperature 〉 40℃ • Engine speed 〉 2600 rpm	
Threshold Value	• Sensor signal < threshold(which is the function of engine speed.)	
Diagnostic Time	• Continuous	
MIL	• OFF	

SPECIFICATION E53BBBEC

Item	Specification
Capacitance	950 ~ 1,350pF

SCHEMATIC DIAGRAM EDE61BFD

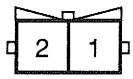
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (19)	KS [A] Signal
2	ECM C01-1 (20)	KS [B] Signal

[HARNESS CONNECTORS]



KS (C13)

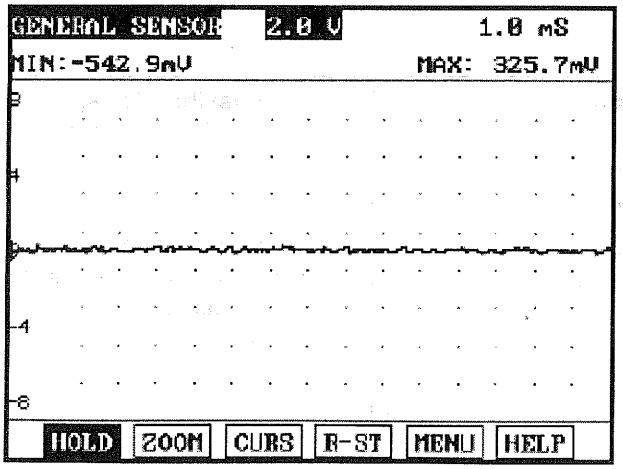
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C01-1

ECM

EFPF011A

SIGNAL WAVEFORM & DATA E5B98F0A



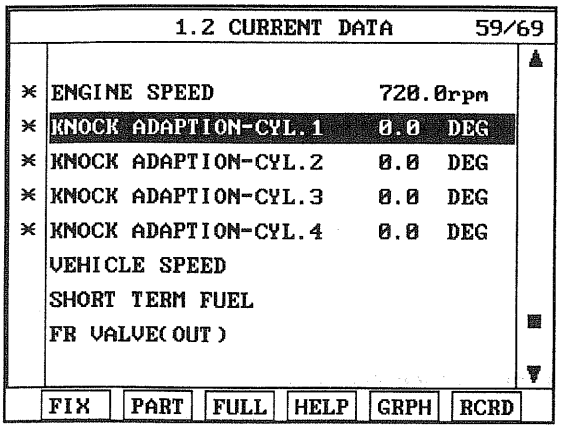
This is a normal signal waveform of knock sensor. Generally, there would be much more noise on knock sensor signal than the others.

LFJF564A

MONITOR SCANTOOL DATA EE36A0F1

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.



LFJF565A

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 EE18955E

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 E9326E96

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 E7C322DA

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 E1CB31B6

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 E25F6972

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

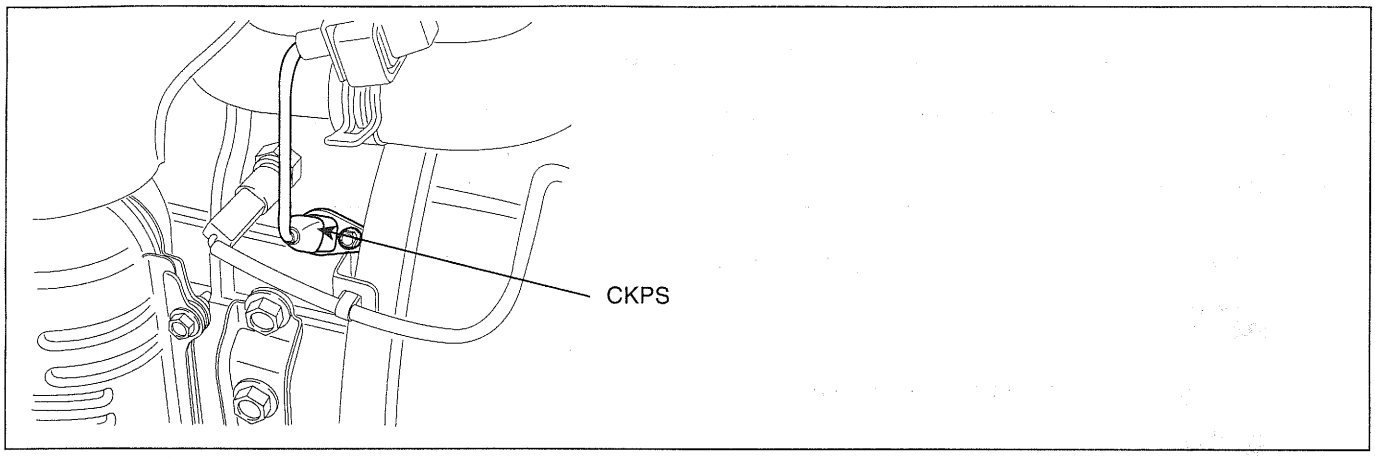
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION E8349A8F



AFJF378B

GENERAL DESCRIPTION E4A1200E

A Crankshaft Position Sensor (CKPS) is a magnetic type sensor that generates voltage using a sensor and a target wheel mounted on the crankshaft; there are 58 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 58 rectangular signals and one longer signal. The PCM 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 PCM identifies which cylinder is at top dead center.

DTC DESCRIPTION E44C7446

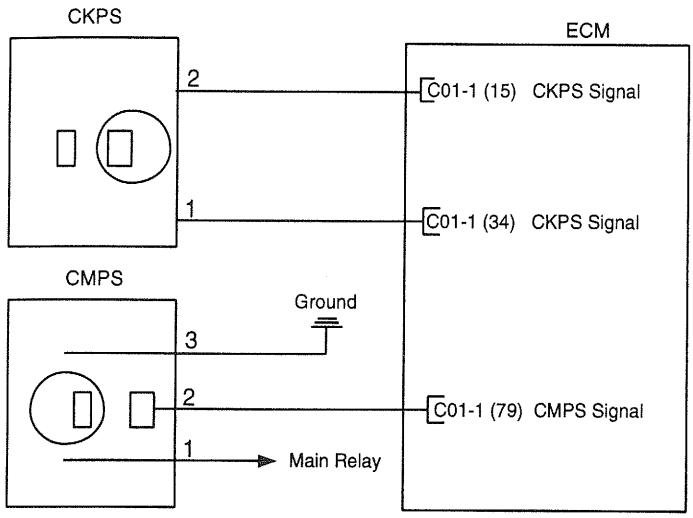
If CKPS cannot find reference mark during 6 times or more, PCM sets DTC P0335.

DTC DETECTING CONDITION E507F8C2

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 〉 6 times	
Diagnostic Time	• Continuous	
MIL ON Condition	• ON	

SCHEMATIC DIAGRAM E9D23334

[CIRCUIT DIAGRAM]

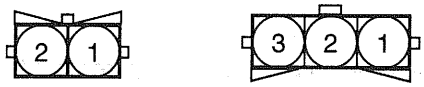


[CONNECTION INFORMATION]

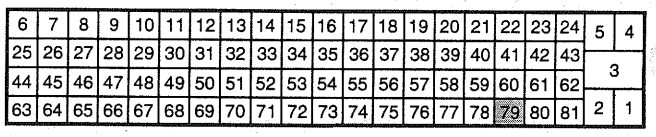
Terminal	Connected to	Function
1	ECM C01-1 (34)	CKPS Signal
2	ECM C01-1 (15)	CKPS Signal

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (79)	CMPS Signal
3	Chassis Ground	Sensor Ground

[HARNESS CONNECTOR]



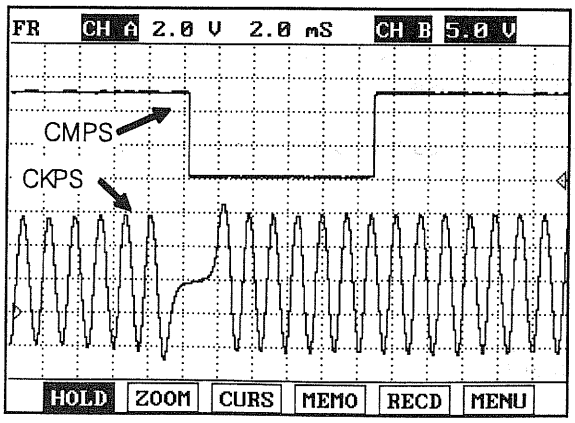
CKPS (C07) CMPS (C24)

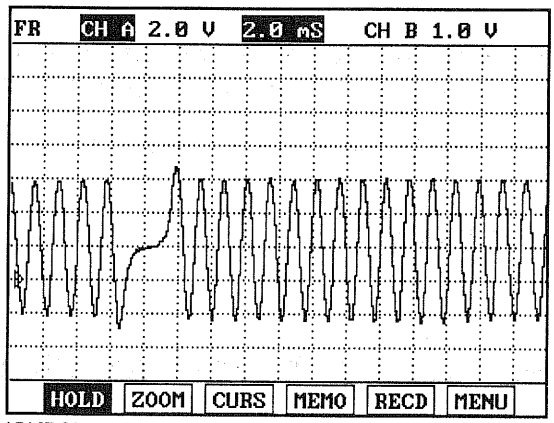


ECM

EFPF012A

SIGNAL WAVEFORM & DATA E2140842



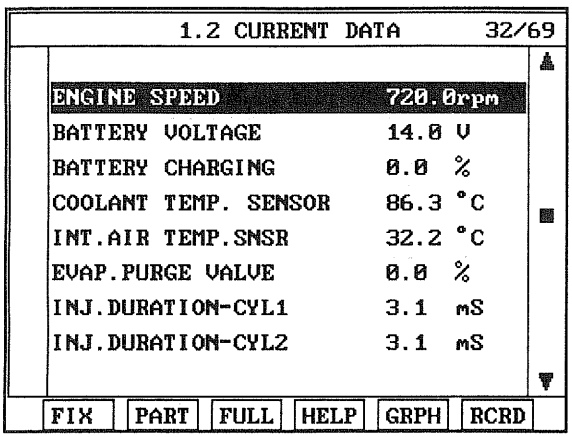


This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

EFPF041A

MONITOR SCANTOOL DATA E3AFEE7A

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 EC75FFAF

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.

SIGNAL CIRCUIT INSPECTION E5CC303B

1. Check Oepn in signal circuit.

1) Key "OFF".

2) Disconnect CKPS connector.

3) Key "ON" & ENG "OFF".

4) Measure the voltage between terminal 1 / 2 of CKPS harness connector and chassis ground.

Specification : Approx 2.5V

5) Is the measured voltage within specification?

YES

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

NO

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

2. Check Short to ground in signal circuit.

1) Key "OFF".

2) Disconnect CKPS connector and ECM connector.

3) Measure the resistance between 1 / 2 of CKPS harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

NO

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

3. Check Short in signal circuit.

1) Key "OFF".

2) Disconnect CKPS connector and ECM connector.

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

Specification : Infinite

4) Is the measured resistance within specifications?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E7518279

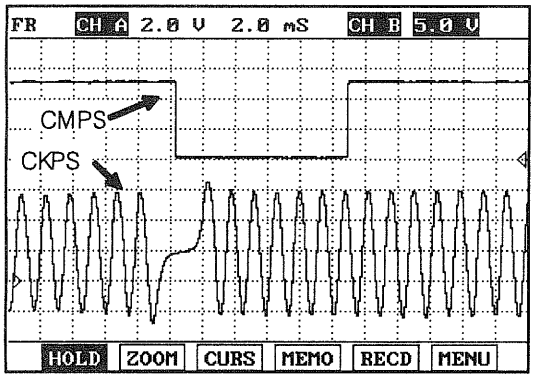
1. Check CKPS.

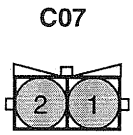
   1) Key "ON". (Don't disconnect sensors.)

   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 signal B
2. CKPS signal A

EFPF042A

   4) Is the measured signal waveform O.K?

YES

▶ Go to "Check ECM" as follows.

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.

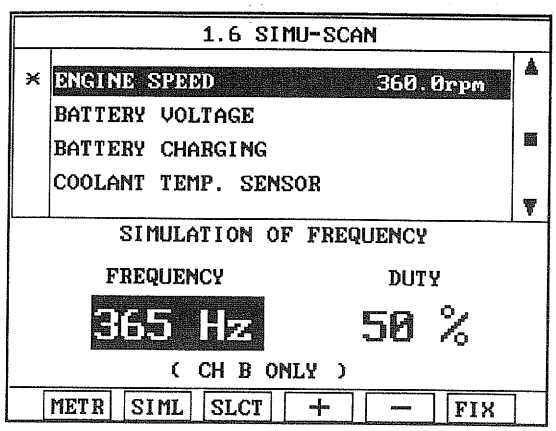
2. Check ECM.

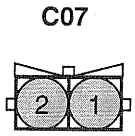
   1) IG "OFF".

   2) Connect scantool and Engine "ON".

   3) Select simulation function on scantool.

   4) Simulate frequency(Hz) at terminal 1 of CKPS signal connector.





1. CKPS signal B
2. CKPS signal A

EFPF043A

5) Does the signal value of CKPS change according to simulation frequency?

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 EB2663AF

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 E6A84138

Refer to DTC P0335.

GENERAL DESCRIPTION E1C7F20F

Refer to DTC P0335.

DTC DESCRIPTION ECF65AF4

If frequency counter of the lost reference gap is over 2000, PCM sets DTC P0336.

DTC DETECTING CONDITION E16E10AB

Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor Signal Check	• Poor connection • Open or short in signal circuit • CKPS • PCM
Enable Conditions	• Counter of CMPS signal 〉 8	
Threshold Value	• No sensor signal	
Diagnostic Time	• Continuous	
MIL ON Condition	• ON	

SCHEMATIC DIAGRAM E1E3DAAF

Refer to DTC P0335.

SIGNAL WAVEFORM & DATA E8AC1719

Refer to DTC P0335.

MONITOR SCANTOOL DATA EBE48A80

Refer to DTC P0335.

TERMINAL AND CONNECTOR INSPECTION E493D7E0

Refer to DTC P0335.

SIGNAL CIRCUIT INSPECTION EF989F22

1. Key "OFF".
2. Disconnect CKPS connector.
3. Key "ON" & ENG "OFF".

4. Measure the voltage between terminal 1 / 2 of CKPS harness connector and chassis ground.

Specification : Approx 2.5V

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 EC679CD2

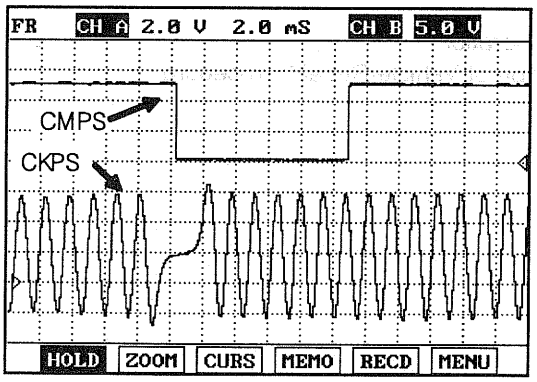
1. Check CKPS.

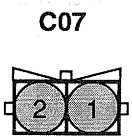
   1) Key "ON". (Don't disconnect sensors.)

   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 signal B
2. CKPS signal A

EFPF042A

   4) Is the measured signal waveform O.K?

YES

▶ Go to "Check ECM" as follows.

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.

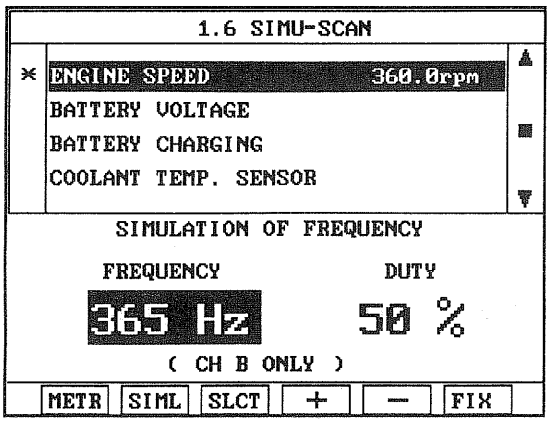
2. Check ECM.

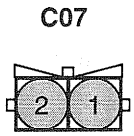
   1) IG "OFF".

   2) Connect scantool and Engine "ON".

3) Select simulation function on scantool.

4) Simulate frequency(Hz) at terminal 1 of CKPS signal connector.





1. CKPS signal B
2. CKPS signal A

EFPF043A

5) Does the signal value of CKPS change according to simulation frequency?

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

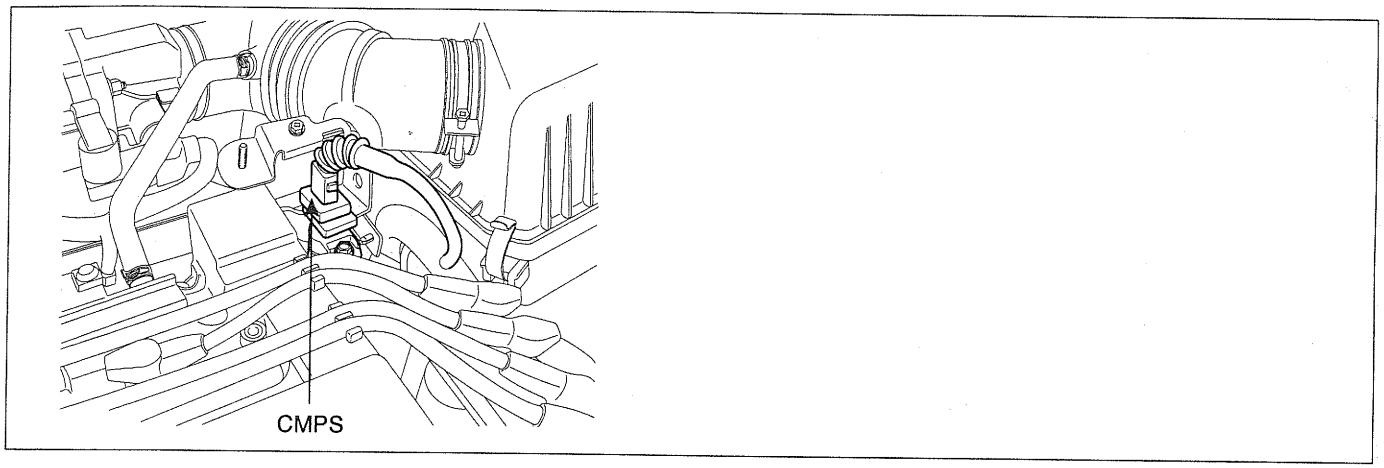
▶ Substitute with a known - good ECM and check for proper operation.
▶ If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EC1ED44B

Refer to DTC P0335.

DTC P0340 CAMSHAFT POSITION SENSOR A CIRCUIT MALFUNCTION (BANK 1 OR SINGLE SENSOR)

COMPONENT LOCATION E3F48553



EFPF701D

GENERAL DESCRIPTION E7479461

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 PCM and it uses CMPS signals for determining the ignition timing with CKPS signals. CMPS makes Sequential Injection possible.

DTC DESCRIPTION E8CEB809

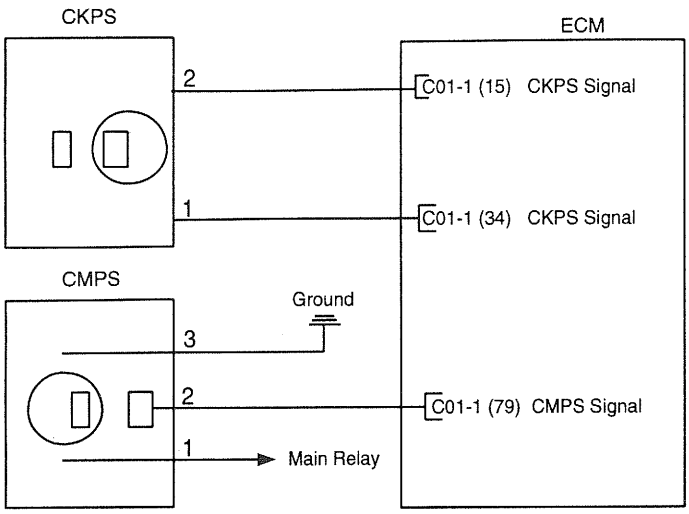
If signal input phase is abnormal over 12 times by faulty assembling, PCM sets DTC P0340.

DTC DETECTING CONDITION E2013C17

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal check (check the assembling state)	• Poor connection • abnormal assembling state • CMPS • PCM
Enable Conditions	• Sensor signal requested	
Threshold Value	• Abnormal phase edges 〉 12 times	
Diagnostic Time		
MIL	• ON	

SCHEMATIC DIAGRAM E81F5131

[CIRCUIT DIAGRAM]

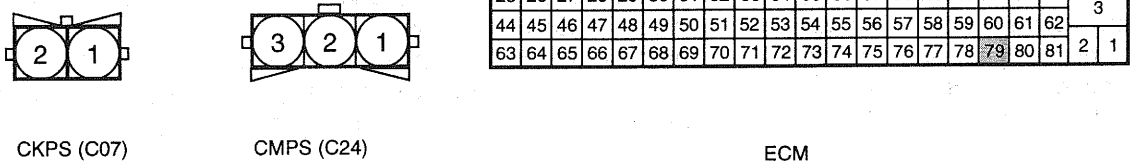


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (34)	CKPS Signal
2	ECM C01-1 (15)	CKPS Signal

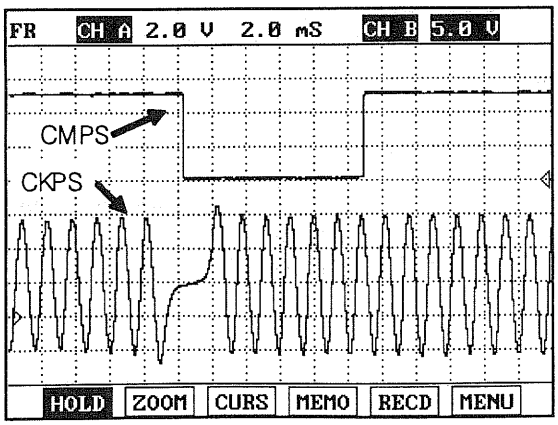
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (79)	CMPS Signal
3	Chassis Ground	Sensor Ground

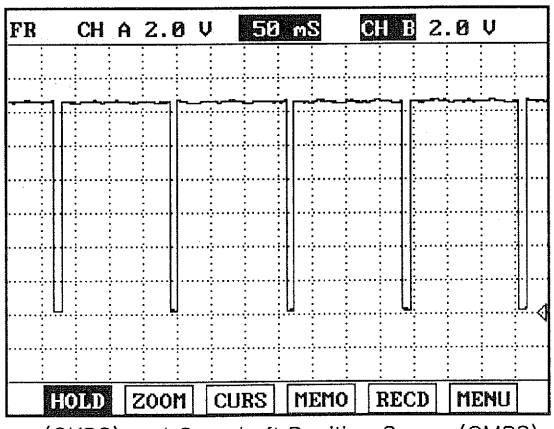
[HARNESS CONNECTOR]



EFPF012A

SIGNAL WAVEFORM & DATA E013EF2C



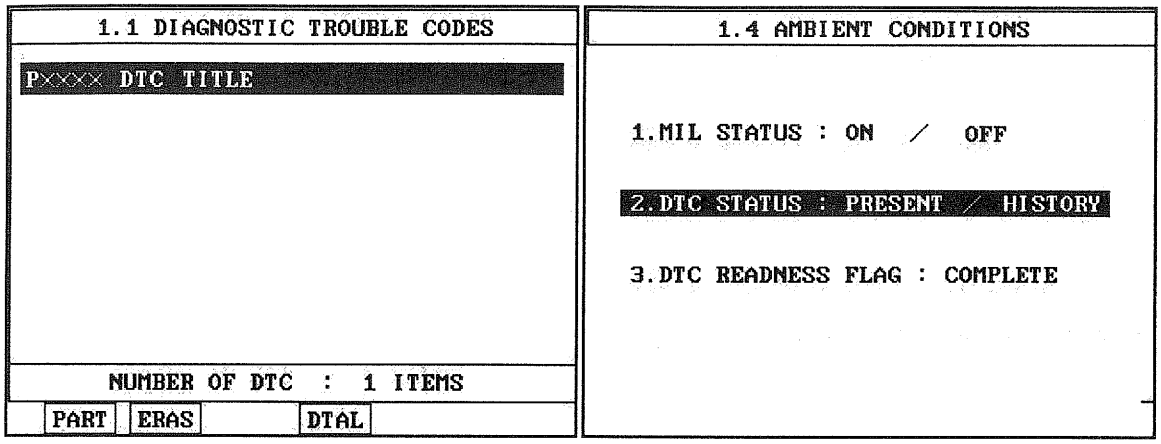


This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. The PCM controls the injection and ignition timing by using these signals. Generally CKPS signal is used to detect the piston's position and CMPS signal is used to detect the Top Dead Center of each cylinder.

EFPF044A

MONITOR SCANTOOL DATA E24DF30C

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 E2CCBFC3

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 E77B2130

1. Key "OFF".
2. Disconnect CMPS connector.
3. key "ON".
4. Measure the voltage between terminal 1 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 EAE0BEC3

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 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 PCM connector.

3) Measure the resistance between terminal 1 and 2 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 EDE4FC16

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 2 and 3 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 E5436880

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.

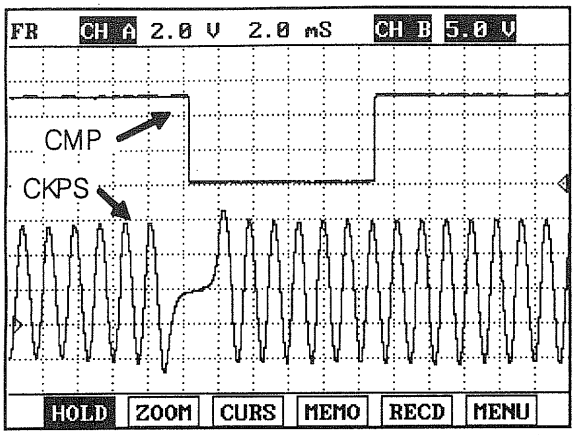
2. CMPS check.

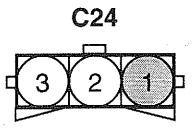
   1) Key "ON". (Don't disconnect sensors.)

   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

EFPF046A

   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 E574A4A8

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 E068A6FB

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 E2D33A89

If amplitude of B1S2 is over 0.65 voltage during 50 sec under enable conditions, PCM sets DTC P0420.

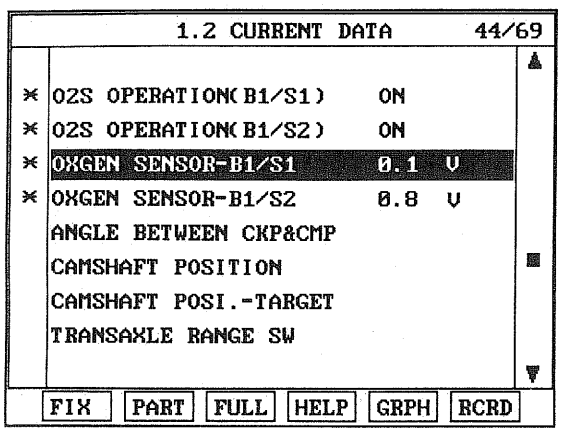
DTC DETECTING CONDITION E052EE71

Item	Detecting Condition	Possible Cause
DTC Strategy	• Oxygen storage capacity	• Exhaust system • B1S2 • Catalyst converter • ECM
Enable Conditions	• Engine speed 1600 ~ 3200rpm • Engine load 15~50% • Catalyst temp.(model) 450~720℃ • Purge factor (high load canister) 〈 12 • Closed loop control	
Threshold Value	• Amplitude of downstream O2 sensor signal 〉 0.648	
Diagnostic Time	• 50 sec	
MIL	• ON	

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

MONITOR SCANTOOL DATA E2C0E4C7

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.



EFPF603A

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 ED51788E

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 EAA302B1

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 E6914691

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

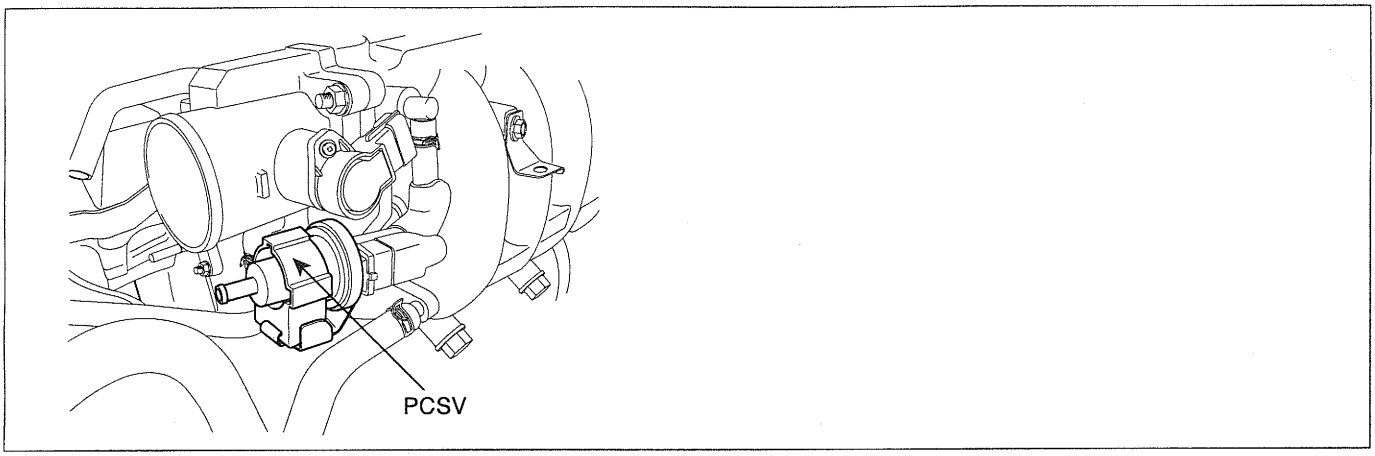
   ▶ Go to the applicable troubleshooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P0444 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT OPEN

COMPONENT LOCATION E5369F38



EFPF701M

GENERAL DESCRIPTION EAECA60B

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 EFC5C9AA

If there is Open in PCSV circuit, PCM sets DTC P0444.

DTC DETECTING CONDITION EAD55655

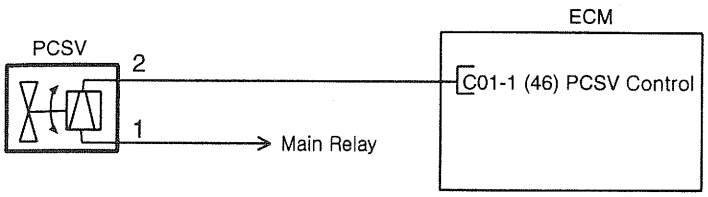
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check.	• Poor connection • Open in power circuit • Open or short to ground in control circuit • PCSV • PCM
Enable Conditions		
Threshold Value	• Open or short to ground.	
Diagnostic Time	• Continuous	
MIL	• ON	

SPECIFICATION E4B6691A

ITEM	Specification
PCSV Coil Resistance (Ω)	26Ω at 20℃ (68°F)

SCHEMATIC DIAGRAM ED9F7B12

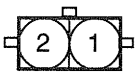
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C01-1 (46)	PCSV Control

[HARNESS CONNECTORS]



PCSV (C53)

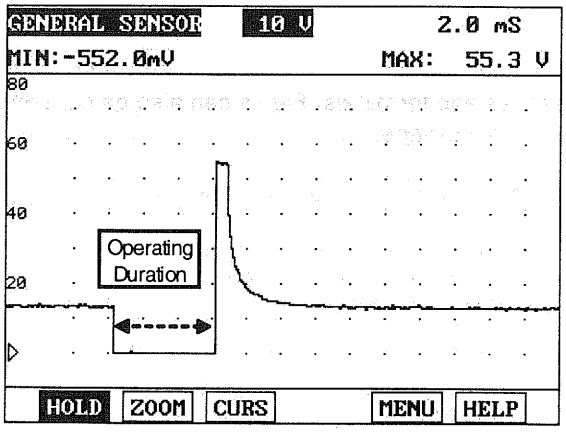
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

ECM

C01-1

EFPF013A

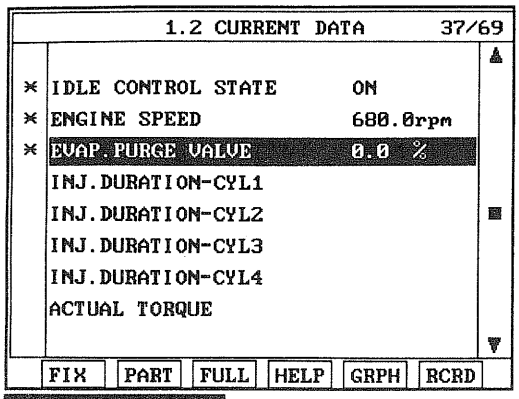
SIGNAL WAVEFORM & DATA EE7FFFBA



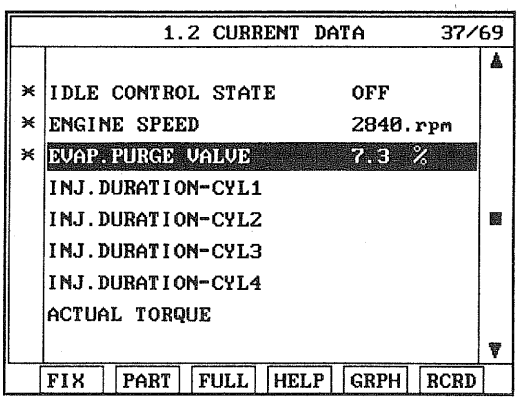
LFJF600A

MONITOR SCANTOOL DATA E0254A30

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 E92EF83E

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 E4E920B4

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 EA667EA5

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

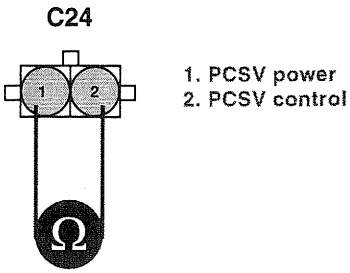
▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E23D2B38

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)



EFPF518A

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 E85AD444

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 E8AC0EB5

Refer to DTC P0444.

GENERAL DESCRIPTION EEEDC856

Refer to DTC P0444.

DTC DESCRIPTION E33A5DF7

If there is Short in PCSV circuit, PCM sets DTC P0445.

DTC DETECTING CONDITION EA43AD36

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	

SPECIFICATION ED009714

Refer to DTC P0444.

SCHEMATIC DIAGRAM E629DD7A

Refer to DTC P0444.

SIGNAL WAVEFORM & DATA E321D6C7

Refer to DTC P0444.

MONITOR SCANTOOL DATA E4762DB8

Refer to DTC P0444.

TERMINAL AND CONNECTOR INSPECTION E816CAA2

Refer to DTC P0444.

POWER CIRCUIT INSPECTION EE4D3D57

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 E65C63AC

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

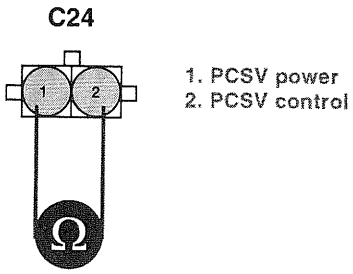
▶ Repair Open or Short to ground circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0329388

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)



EFPF518A

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

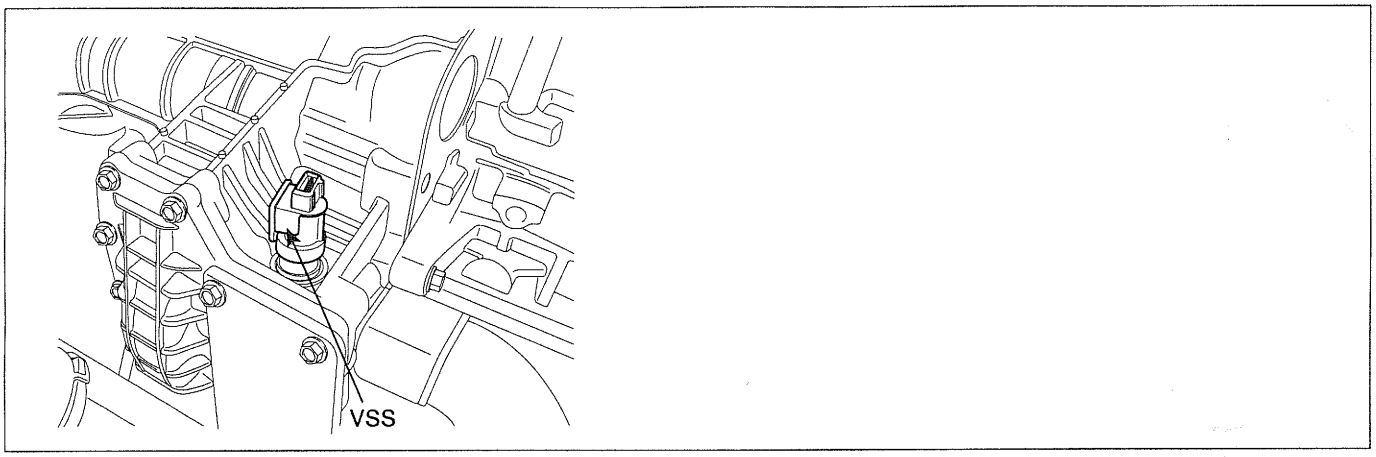
▶ Substitute with a known-good PCSV and check for proper operation. If the problem is corrected, replace PCSV and then go to "Verification of Vehicle Repair" procedure

VERIFICATION OF VEHICLE REPAIR E00E812A

Refer to DTC P0444.

DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

COMPONENT LOCATION EB21FE41



EFPF701I

GENERAL DESCRIPTION E5888BE5

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 EA4F0FEF

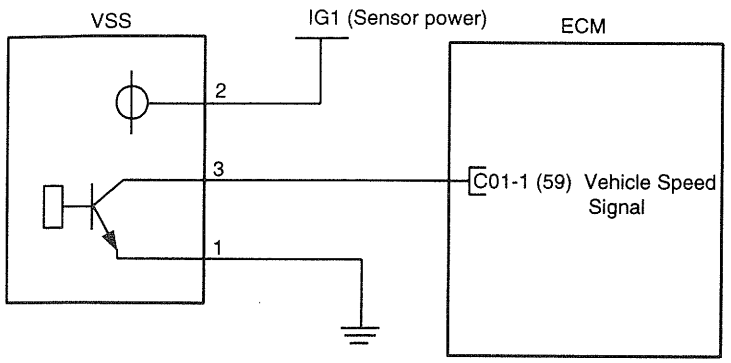
If the vehicle speed signal is below 1.0 Km/h during 2 sec under enable conditions, PCM sets P0501.

DTC DETECTING CONDITION EBA24321

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 1520~3520rpm • (only A/T at D or R position) Engine speed > 3000rpm, Engine load > 49.5% • Coolant temperature > -7℃	
Threshold Value	• Vehicle speed signal 〈 1.0 Km/h	
Diagnostic Time	• 2 sec	
MIL	• ON	

SCHEMATIC DIAGRAM EEEDA3DA

[CIRCUIT DIAGRAM]

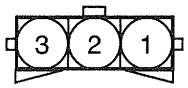


[CONNECTION INFORMATION]

[VSS]

Terminal	Connected to	Function
1	Chassis Ground	Sensor Ground
2	IG 1	Battery Voltage (B+)
3	ECM C01-1 (59)	VSS Signal

[HARNESS CONNECTORS]



VSS (C22)

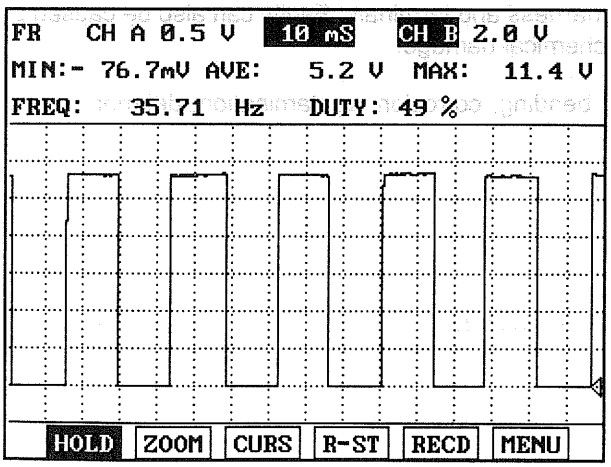
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C01-1

ECM

EFPF014A

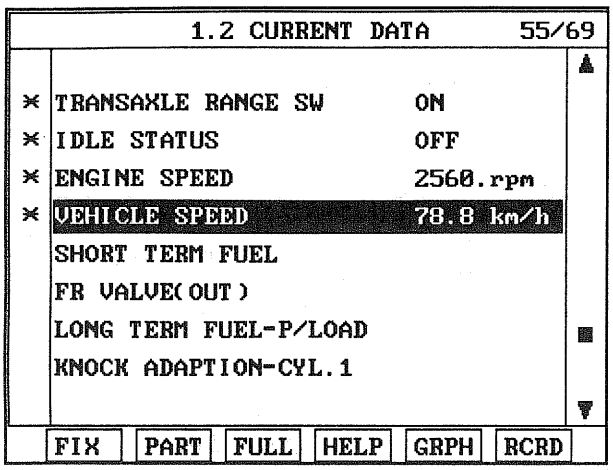
SIGNAL WAVEFORM & DATA ED648959



EFPF047A

MONITOR SCANTOOL DATA EE8DF4F7

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 ED5EA75F

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 E0D83AB8

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 E470324F

1. Check short to ground in harness.
   1) Key "OFF".
   2) Disconnect PCM 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 PCM 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 EDC2D1DC

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.

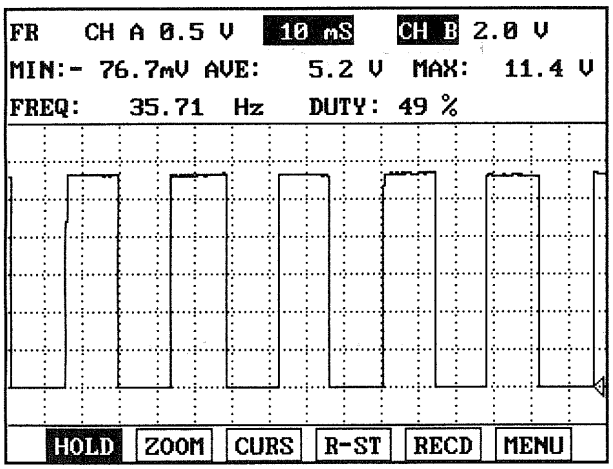
NO

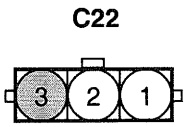
▶ Repair Open in signal circuit and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E55A70D2

1. ENG "ON".
2. Measure signal waveform of wheel speed sensor while driving.

SPECIFICATION :





1. Ground
2. Power
3. Signal

EFPF049A

3. Is the signal waveform normal?

YES

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

NO

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

VERIFICATION OF VEHICLE REPAIR EFA737D8

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

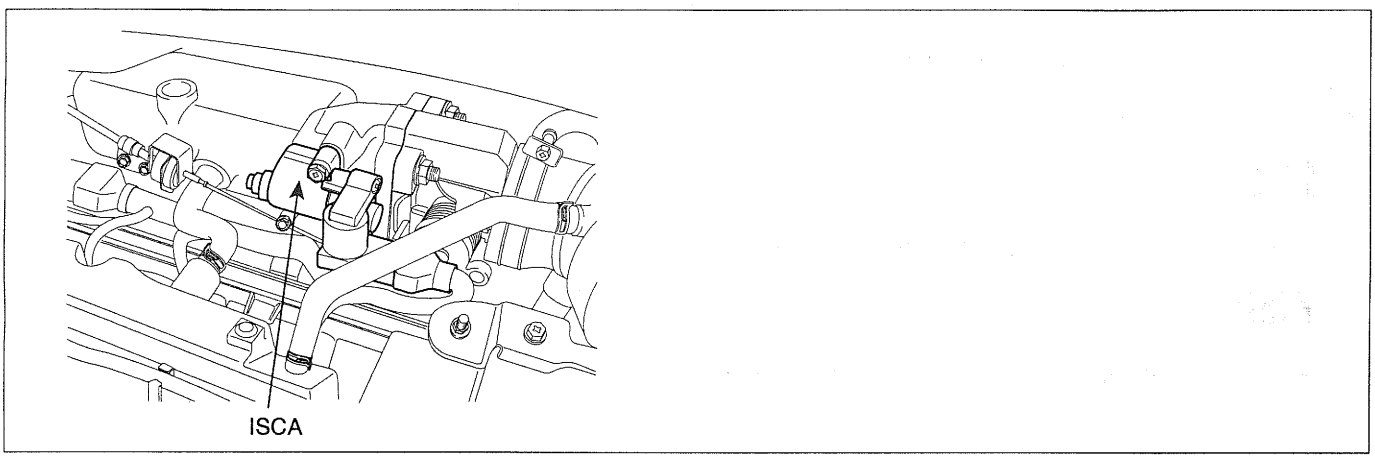
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

COMPONENT LOCATION E89E8D91



EFPF701L

GENERAL DESCRIPTION E4F5B12B

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 E270C52B

If the real engine speed is lower than the desired engine speed over 100 rpm under enable conditions, ECM sets P0506.

DTC DETECTING CONDITION E0753328

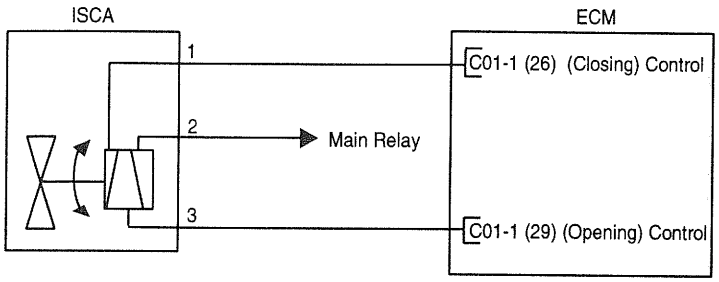
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check, low	• Poor connection • Clog in intake air system • Carbon pile • ISCA • ECM
Enable Conditions	• Vehicle speed = 0 • Coolant temperature 〉 70℃ • Intake air temperature 〉 -7.5℃ • Altitude 〈 3000m • Idle status • Idle controller I part = 15.0% • Engine load 〈 35%	
Threshold Value	• Desired engine speed - Engine speed 〉 100rp (m	
Diagnostic Time	• 8 sec	
MIL	• ON	

SPECIFICATION EDC09BBF

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35℃ (68~95°F)	15.4±0.8	11.9±0.8

SCHEMATIC DIAGRAM E1E65A05

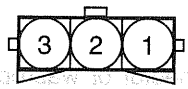
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (26)	Closing Control
2	Main Relay	Battery Voltage (B+)
3	ECM C01-1 (27)	Opening Control

[HARNESS CONNECTORS]



ISCA (C52)

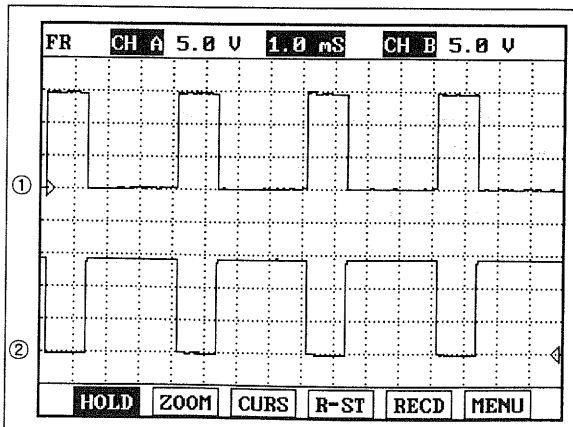
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C01-1

ECM

EFPF015A

SIGNAL WAVEFORM & DATA EEFC122F

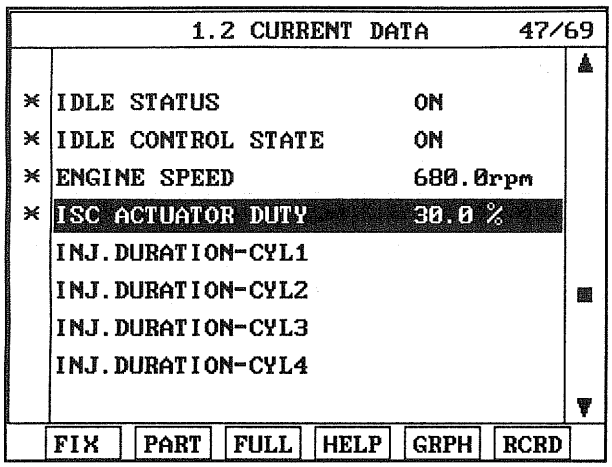


① Closing control duty signal at idle
② Opening control duty signal at idle

LFJF616A

MONITOR SCANTOOL DATA E43010B8

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.



LFJF617A

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 E23567FB

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 E8A8D9DA

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 EAD23CDD

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".

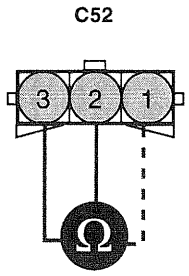
   2) Disassemble ISCA.

   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 opening control
2. Sensor power
3. ISCA closing control

EFPF523A

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 EAEDC879

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 E0C07BC6

Refer to DTC P0506.

GENERAL DESCRIPTION EDEBE834

Refer to DTC P0506.

DTC DESCRIPTION E7A9EDAC

If the real engine speed is higher than the desired engine speed over 200 rpm under enable conditions, PCM sets P0507.

DTC DETECTING CONDITION E96B30AD

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	

SPECIFICATION E378BA13

Refer to DTC P0506.

SCHEMATIC DIAGRAM E8F67D27

Refer to DTC P0506.

SIGNAL WAVEFORM & DATA E3576486

Refer to DTC P0506.

MONITOR SCANTOOL DATA EA1013CC

Refer to DTC P0506.

TERMINAL AND CONNECTOR INSPECTION E2F4DB99

Refer to DTC P0506.

POWER CIRCUIT INSPECTION E59C7206

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 E77DA732

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 E3F7DA07

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 E8D31198

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".

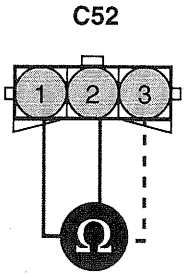
   2) Disassemble ISCA.

   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 opening control
2. Sensor power
3. ISCA closing control

EFPF526A

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 EDA4C3AD

Refer to DTC P0506.

DTC P0562 SYSTEM VOLTAGE LOW

COMPONENT LOCATION E69A1884

EFPF701O

GENERAL DESCRIPTION E220A021

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)PCM measures and compares voltage from ignition key and each relay. With this mechanism, PCM knows if the main relay switch turns on after IG on or if turns OFF after IG off.

DTC DESCRIPTION EF54A428

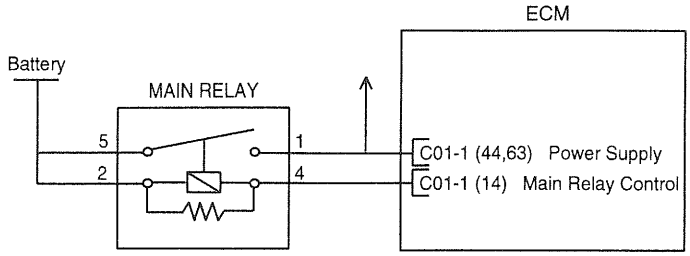
If the system voltage is 2.54~10 V during 0.2 sec, PCM sets DTC P0562.

DTC DETECTING CONDITION EFE4FCA4

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	

SCHEMATIC DIAGRAM E32822E8

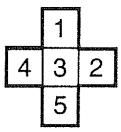
[CIRCUIT DIAGRAM]



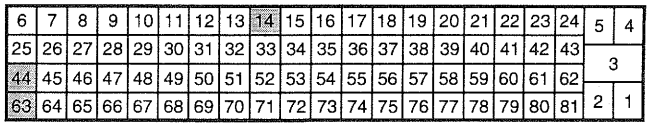
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (44,63)	Power Supply
2	Battery	Battery Voltage (B+)
3	-	-
4	ECM C01-1 (14)_	Main Relay Control
5	Battery	Battery Voltage (B+)

[HARNESS CONNECTORS]



Main Relay (E46)

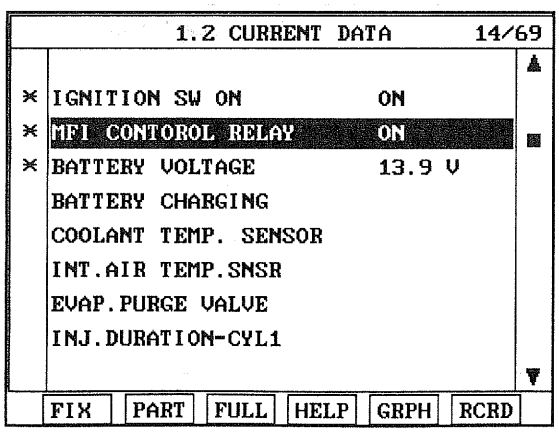


ECM

EFPF016A

MONITOR SCANTOOL DATA E16CEDCB

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 E3B01C7F

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 EDFCA15D

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 EE142FBF

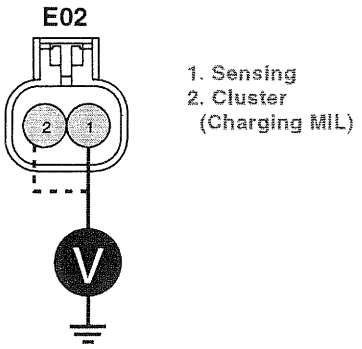
1. Alternator circuit check.
   1) Key "OFF".
   2) Disconnect alternator connector.

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 E98873C6

1. Main relay check.

1) Key "OFF".

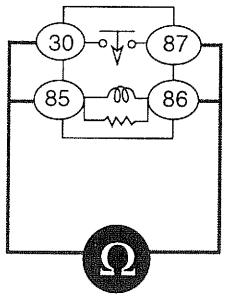
2) Disconnect Main relay.

3) Measure the resistance between terminal 30 and 87 of main relay. (Component side)

4) Measure the resistance between terminal 85 and 86 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)



EFPF540A

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 E6981E0E

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 E1BDE2D2

Refer to DTC P0562.

GENERAL DESCRIPTION E8EAFC3E

Refer to DTC P0562.

DTC DESCRIPTION EFE026C2

If the system voltage is over 17 V during 0.2 sec, PCM sets DTC P0563.

DTC DETECTING CONDITION E4D55355

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 〉 10 kph	
Threshold Value	• Voltage 〉 17 V	
Diagnostic Time	• 0.2 sec	
MIL	• ON	

SCHEMATIC DIAGRAM EA10B241

Refer to DTC P0562.

MONITOR SCANTOOL DATA E867D902

Refer to DTC P0562.

TERMINAL AND CONNECTOR INSPECTION EF55914E

Refer to DTC P0562.

POWER CIRCUIT INSPECTION EE0D876A

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 EF55D10D

1. Alternator circuit check.

   1) Key "OFF".

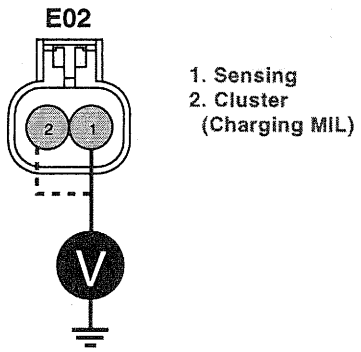
   2) Disconnect alternator connector.

   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 EEB0DEA2

1. Main relay check.

1) Key "OFF".

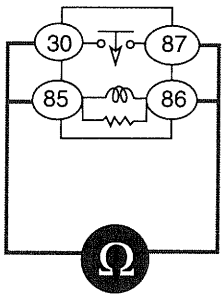
2) Disconnect Main relay.

3) Measure the resistance between terminal 30 and 87 of main relay. (Component side)

4) Measure the resistance between terminal 85 and 86 of main relay. (Component side)

SPECIFICATION :

Terminal	Power Approval
30~87	NO
85~86	YES (Approx. 70Ω ~ 120Ω)



EFPF540A

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 EB8311B0

Refer to DTC P0562.

DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY(ROM) ERROR

GENERAL DESCRIPTION EF949985

PCM 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 E1EA8468

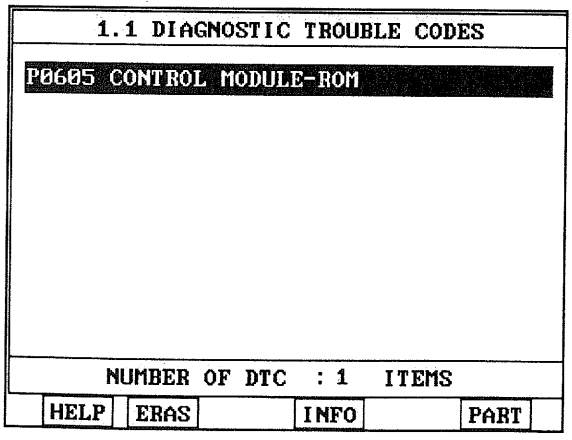
ECM detects the signal exchages between micro-processor and sensor/actuator. By the way, if there is error, ECM sets DTC P0605.

DTC DETECTING CONDITION EB3F6C7D

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	• Immediately ON	

MONITOR SCANTOOL DATA EB345844

1. Connect scantool to Data Link Connector(DLC).
2. Key "ON" & ENG "OFF".
3. Monitor DTC(Diagnostics Trouble Code) on the scantool.



EFPF607A

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 EA5AAEA7

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 E452F2E0

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

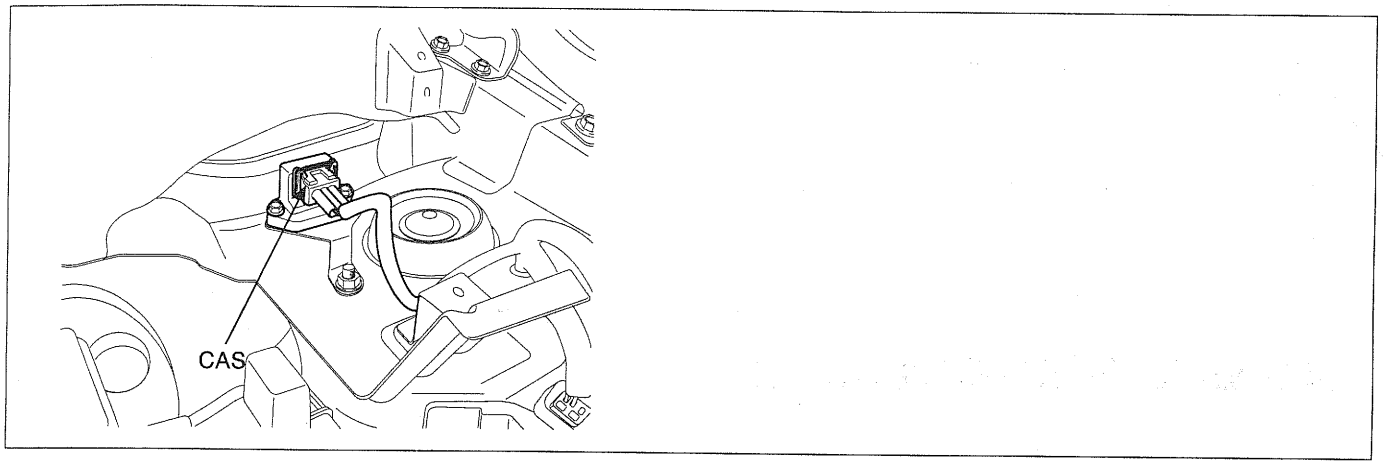
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1307 ACCELERATION SENSOR RANGE/PERFORMANCE

COMPONENT LOCATION E9B9CB15



EFPF701J

GENERAL DESCRIPTION E191F250

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 EE889CB6

If the value exceeds threshold value, the ECM judges this as a fault and DTC P1307 is set.

DTC DETECTING CONDITION EE99E061

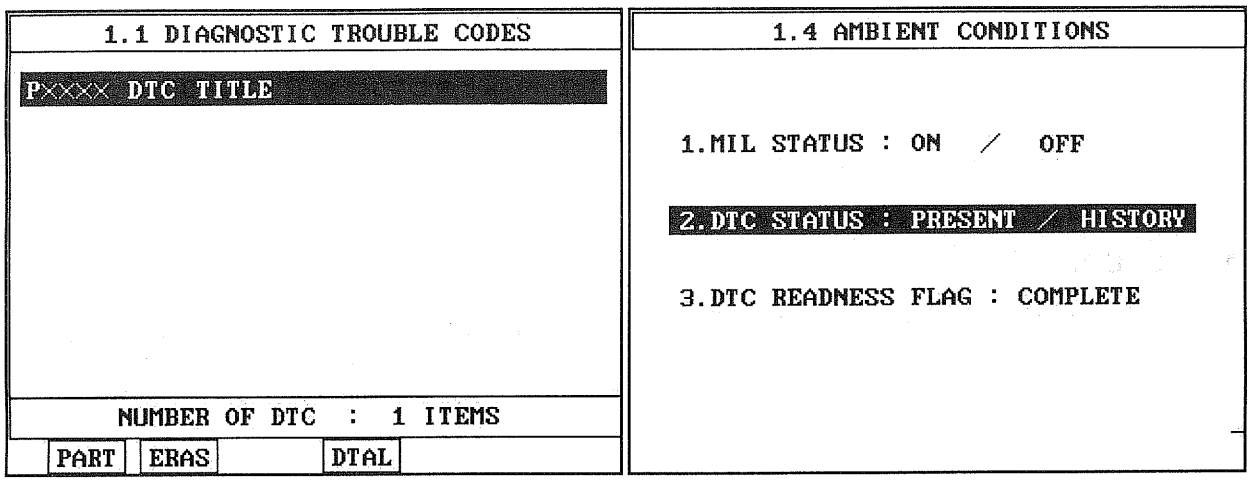
Item	Detecting Condition	Possible Cause
DTC Strategy	• Input Signal check	• Contact resistance in connectors • Open or short in signal circuit • Open in ground circuit • Open or short in power circuit • Faulty CAS • Faulty ECM
Enable Conditions	• No vehicle speed sensor signal > 3sec	
Threshold Value	• Measured Voltage - Modeled Voltage > 0.2V	
Diagnostic Time	• 15 sec	
MIL	• ON	

SPECIFICATION E222D952

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 EBA9AAF3

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'sinformation from the DTCs menu.
4. Confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditionsnoted 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 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

NO

▶ Go to "Terminal and Connector Inspection" procedure.

TERMINAL AND CONNECTOR INSPECTION E8D6661F

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 E41B5893

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 E2DC9733

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 E5FD8F66

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 E9125277

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 EFAF8F54

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 E0C5FB3C

Refer to DTC P1307.

GENERAL DESCRIPTION E4D0B75F

Refer to DTC P1307.

DTC DESCRIPTION E79F6616

ECM sets DTC P1308 if the ECM detects signal voltage lower than the possible range of a properly operation CAS.

DTC DETECTING CONDITION ED3BBFD1

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	

SPECIFICATION EBE7ECE5

Refer to DTC P1307.

MONITOR DTC STATUS EAC3C5CD

Refer to DTC P1307.

TERMINAL AND CONNECTOR INSPECTION E64599AF

Refer to DTC P1307.

POWER CIRCUIT INSPECTION E2297854

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 E56C80E6

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 open or short in signal harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E74637E4

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 E7B9209E

Refer to DTC P1307.

DTC P1309 ACCELERATION SENSOR CIRCUIT HIGH INPUT

COMPONENT LOCATION EBDEEBDB

Refer to DTC P1307.

GENERAL DESCRIPTION E96E9122

Refer to DTC P1307.

DTC DESCRIPTION ED793F3C

ECM sets DTC P1309 if the ECM detects signal voltage higher than the possible range of a properly operating CAS.

DTC DETECTING CONDITION EF6BB997

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	

SPECIFICATION EED1285D

Refer to DTC P1307.

MONITOR DTC STATUS E42053EC

Refer to DTC P1307.

TERMINAL AND CONNECTOR INSPECTION E4D59B1D

Refer to DTC P1307.

SIGNAL CIRCUIT INSPECTION EC511299

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.

6. 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 in signal harness. Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E99A03FC

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 E937E13B

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

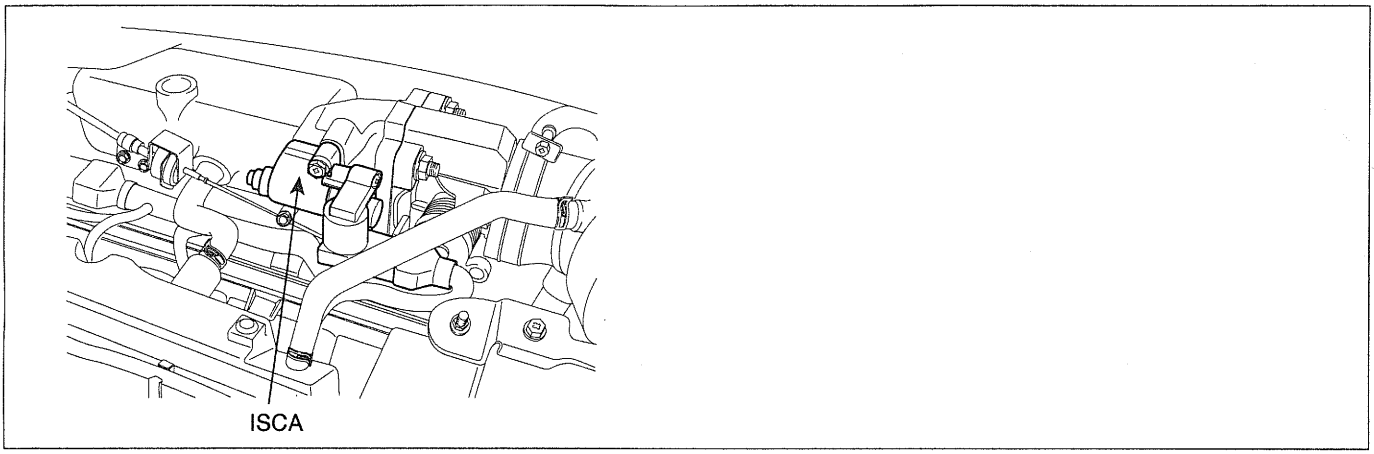
▶ Substitute with a known - good ECM and check for proper operation.If the problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4836650

Refer to DTC P1307.

DTC P1505 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #1

COMPONENT LOCATION E5276810



EFPF701L

GENERAL DESCRIPTION E812A983

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 E8C3747E

If there is Open or Short to ground in ISCA(opening coil) circuit, ECM sets DTC P1505.

DTC DETECTING CONDITION E7A1C6CE

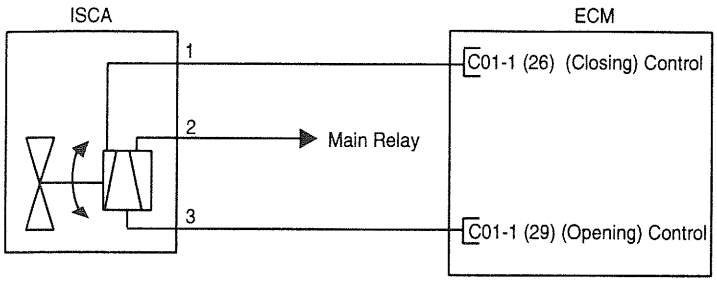
Item	Detecting Condition	Possible Cause
DTC Strategy	• Circuit continuity check, low (opening coil)	• Poor connection • Open or short to ground in control circuit • ISCA • ECM
Enable Conditions		
Threshold Value	• Shorted to ground or disconnected	
Diagnostic Time	• Continuous	
MIL	• ON	

SPECIFICATION ED425B33

Temperature (℃)	Closing Coil Resistance (Ω)	Opening Coil Resistance (Ω)
20~35 (68~95°F)	15.4±0.8	11.9±0.8

SCHEMATIC DIAGRAM E1357024

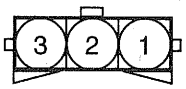
[CIRCUIT DIAGRAM]



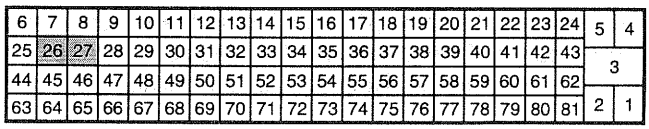
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C01-1 (26)	Closing Control
2	Main Relay	Battery Voltage (B+)
3	ECM C01-1 (27)	Opening Control

[HARNESS CONNECTORS]



ISCA (C52)

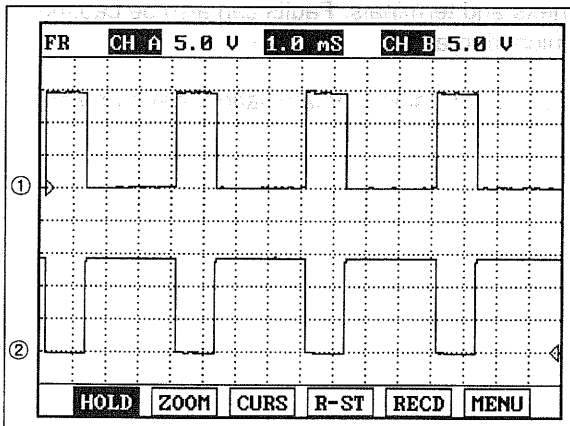


C01-1

ECM

EFPF015A

SIGNAL WAVEFORM & DATA EEF3DF2E

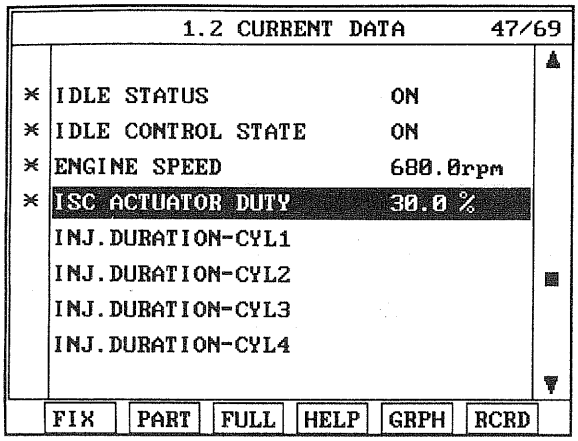


① Closing control duty signal at idle
② Opening control duty signal at idle

LFJF616A

MONITOR SCANTOOL DATA EADDC0EB

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.



LFJF649A

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 EC7A0435

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 EA8D0EE9

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 EE2D83C6

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/C01-1 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 EE1F0EB1

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".

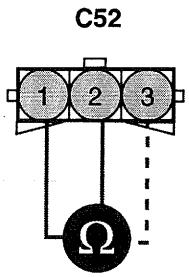
2) Disassemble ISCA.

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

EFPF534A

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 EE1CD66D

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 EFDDB488

Refer to DTC P1505.

GENERAL DESCRIPTION E2EBEF14

Refer to DTC P1505.

DTC DESCRIPTION E246E62D

If there is Short to power in ISCA(opening coil) circuit, PCM sets DTC P1506.

DTC DETECTING CONDITION E807A93C

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 voltage	
Diagnostic Time	• Continuous	
MIL	• ON	

SPECIFICATION E6140BEC

Refer to DTC P1505.

SCHEMATIC DIAGRAM E0D12783

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA EF851896

Refer to DTC P1505.

MONITOR SCANTOOL DATA E26CA9A9

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION EDF55ABB

Refer to DTC P1505.

CONTROL CIRCUIT INSPECTION EB1F76E7

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 E26D210E

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

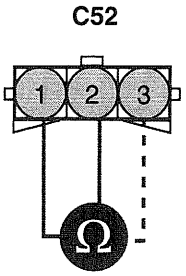
   ▶ Go to "ISCA check" procedure.

   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

EFPF534A

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 EB36F452

Refer to DTC P1505.

DTC P1507 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #2

COMPONENT LOCATION E6E7D229

Refer to DTC P1505.

GENERAL DESCRIPTION EAAA9AC1

Refer to DTC P1505.

DTC DESCRIPTION E4C57E3D

If there is Open or Short to ground in ISCA(closing coil) circuit, PCM sets DTC P1507.

DTC DETECTING CONDITION E4E95B04

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	

SPECIFICATION EB315011

Refer to DTC P1505.

SCHEMATIC DIAGRAM E5327D32

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA EF840935

Refer to DTC P1505.

MONITOR SCANTOOL DATA E32007E0

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION EF2BDC31

Refer to DTC P1505.

POWER CIRCUIT INSPECTION E24E671E

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 E5E7619C

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 and terminal 26/C01-1 ofECM 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 ED7B417C

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.

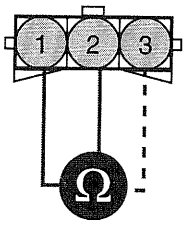
   3) Measure the resistance between terminal 1 and 2 of ISCA harness connector. (Component side)

   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

C52



1. ISCA closing control
2. Sensor power
3. ISCA closing control

EFPF534A

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 E4542F8D

Refer to DTC P1505.

DTC P1508 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #2

COMPONENT LOCATION E9C245CC

Refer to DTC P1505.

GENERAL DESCRIPTION EA1640BB

Refer to DTC P1505.

DTC DESCRIPTION EE6327A7

If there is Short to power in ISCA(closing coil) circuit, PCM sets DTC P1508.

DTC DETECTING CONDITION EFAA8995

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 voltage	
Diagnostic Time	• Continuous	
MIL	• ON	

SPECIFICATION EFDED1C7

Refer to DTC P1505.

SCHEMATIC DIAGRAM E7A40CED

Refer to DTC P1505.

SIGNAL WAVEFORM & DATA E1374A84

Refer to DTC P1505.

MONITOR SCANTOOL DATA E9CC75AF

Refer to DTC P1505.

TERMINAL AND CONNECTOR INSPECTION E3486176

Refer to DTC P1505.

CONTROL CIRCUIT INSPECTION ED1A90D6

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 E1EED6E5

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

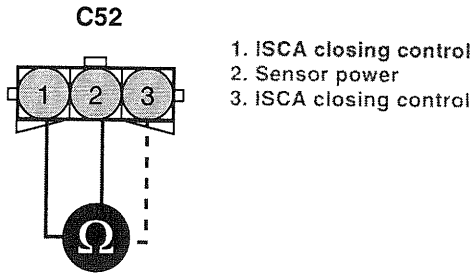
   ▶ Go to "ISCA check" procedure.

   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

EFPF534A

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

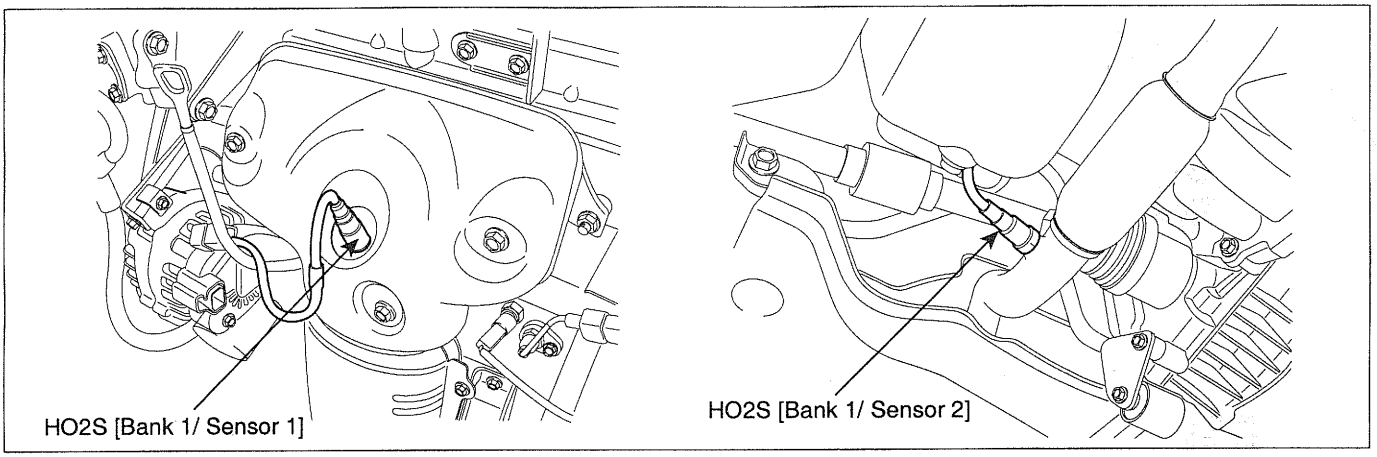
- Substitute with a known - good ISCA and check for proper operation.
- If the problem is corrected, replace ISCA and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EE0B9B33

Refer to DTC P1505.

DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

COMPONENT LOCATION E3CB7405



EFPF702A

GENERAL DESCRIPTION ECD7B7B8

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 E858CC07

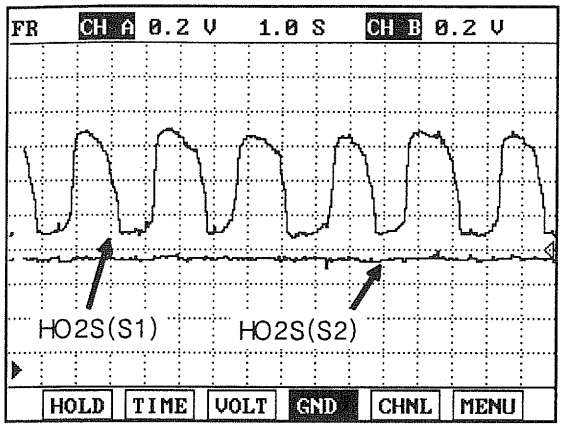
ECM controls Air/Fuel ratio by B1S1 monitoring and B1S2 monitoring. By the way, if there is the advanced B1S1 signal line shift compared with the value of B1S2 controller, PCM sets DTC P2096.

DTC DETECTING CONDITION E3CB087F

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	

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

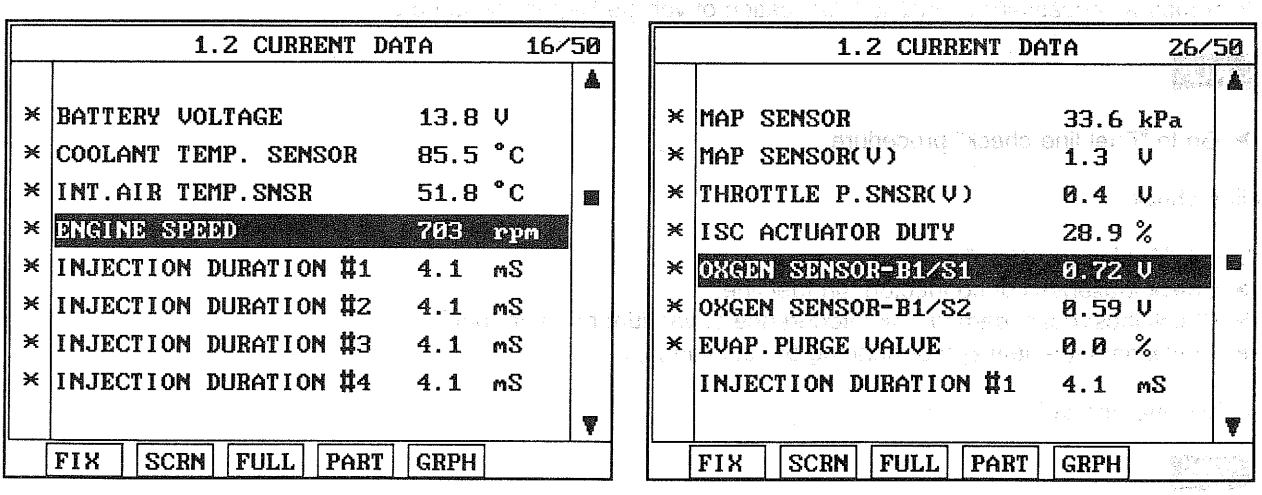
SIGNAL WAVEFORM & DATA E068E671



LFJF669A

MONITOR SCANTOOL DATA EFD3DF3E

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.



EFPF051A

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 ECF5B316

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 E9CF4D4B

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".

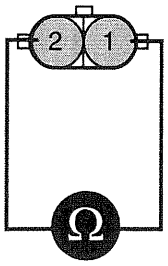
2) Disconnect injectors.

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)



1. Injector Power
2. Injector control

EFPF537A

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 E3377F53

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 E13462BE

Refer to DTC P2096.

GENERAL DESCRIPTION E4F5C954

Refer to DTC P2096.

DTC DESCRIPTION EB3D85CD

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, PCM sets DTC P2097.

DTC DETECTING CONDITION E2903024

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	

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

SIGNAL WAVEFORM & DATA E80F1D07

Refer to DTC P2096.

MONITOR SCANTOOL DATA E72A2383

Refer to DTC P2096.

SYSTEM INSPECTION E77DE238

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 EE01F5A2

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".

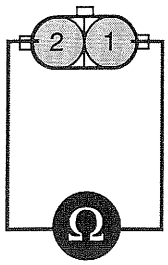
2) Disconnect injectors.

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

EFPF537A

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

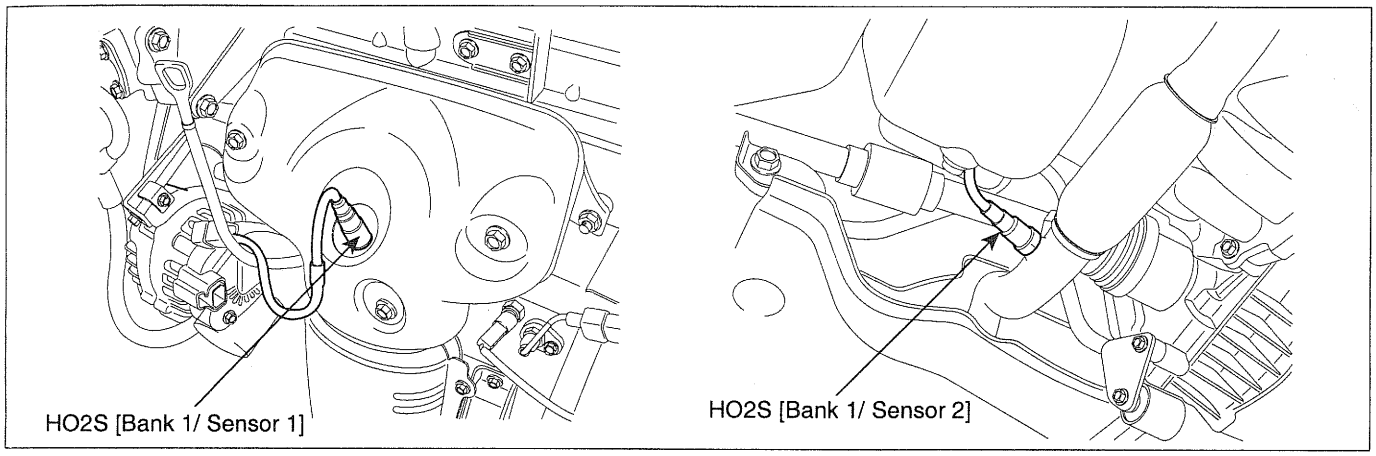
Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFFCFB9F

Refer to DTC P2096.

DTC P2232 O2 SENSOR SIGNAL CIRCUIT SHORTED TO HEATER CIRCUIT (SENSOR 2)

COMPONENT LOCATION E28C62CF



EFPF702A

GENERAL DESCRIPTION E815608A

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 EA2F843B

If the counter that the signal voltage changes rapidly is over 5 times, PCM sets DTC P2232.

DTC DETECTING CONDITION EE08AC84

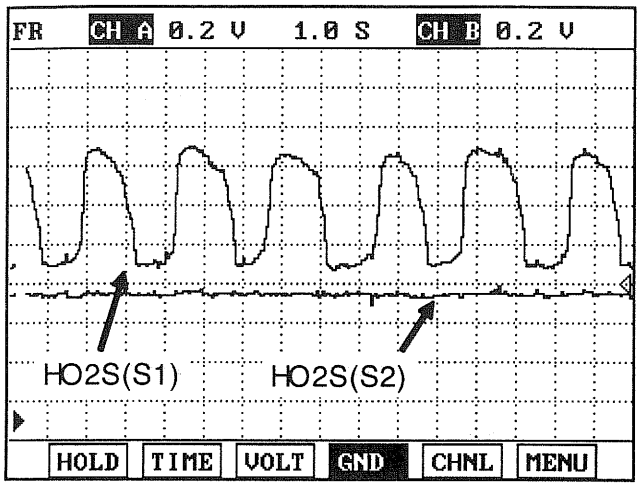
Item	Detecting Condition	Possible Cause
DTC Strategy	• Rationality check	• Poor connection • Short to power in signal circuit • B1S2 • ECM
Enable Conditions	• After enough heated • Battery voltage 〉 10.7V • Catalyst temperature (model) 〈 800℃ • Time after dew point end detected 〉 10 sec	
Threshold Value	• Counter of [△ushk > 2V after heater on→off] > 5 times	
Diagnostic Time		
MIL	• ON	

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

SPECIFICATION E9897DFB

Specification	0.1 ~ 0.9V

SIGNAL WAVEFORM & DATA EC857256

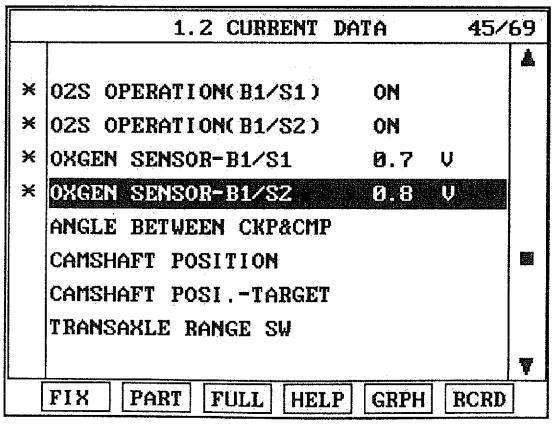


The amplitude of the signal output of the rear HO2S is small compared to the front HO2S because the rear HO2S detects emission gas purified by the catalytic converter.
This is the normal signal waveform of the rear HO2S at idle.

LFJF451A

MONITOR SCANTOOL DATA ECE4988A

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.



EFPF605A

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 ED793FAA

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 EAC2E8AC

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 short to power in signal circuit and then, go to "Verification of Vehicle Repair"procedure.

COMPONENT INSPECTION EEF7F24A

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.

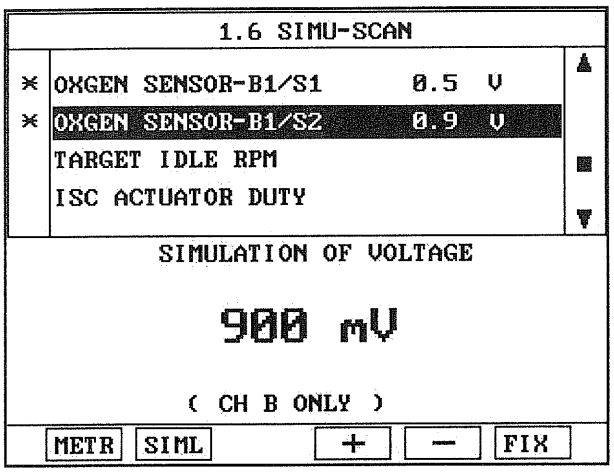
2. Check ECM.

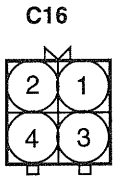
1) IG "OFF".

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

EFPF052A

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 E5545853

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 U0001 CAN COMMUNICATION MALFUNCTION

GENERAL DESCRIPTION E15BE511

As vehicles electronically controlled, various control unit is applied to vehicle and several units are controlled based on the signals from the sensors. Therefore sharing signals of sensors and information is required. To meet this requirement, CAN communication type, which is insensible to external noises and whose communication speed is fast, is applied to power train control.
Sharing signals from RPM, APS, gear shifting, torque reduction in ESP, ABS and various modules, addtive control is performed.

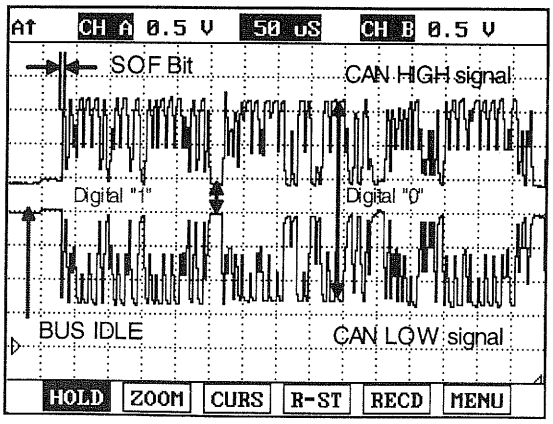
DTC DESCRIPTION E82030A4

If it is impossible to communicate through internal or external CAN line over 500ms, PCM sets DTC P600.

DTC DETECTING CONDITION E2F57D7E

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN communication status check	• Poor connection • PCM
Enable Conditions	• Battery voltage 〉 10.7V • Ignition on, no start phase	
Threshold Value	• Bus-Off time on external CAN 〉 500ms • Bus-Off time on internal CAN 〉 500ms	
Diagnostic Time	• Continuous	
MIL	• OFF	

SIGNAL WAVEFORM & DATA EA6B80F9



Monitoring CAN HIGH and LOW simultaneously is important in monitoring CAN communication waveform.
When CAN HIGH signal rise to 3.5V and LOW signal drops to 1.5V - voltage difference between HIGH and LOW signal is 2V - at BUS IDLE state(DIGITAL "1") whose reference voltage is 2.5V, "0" is recognized. Besides, comparing HIGH and LOW signal if opposite waveform is detected with the reference voltage of 2.5V, Check if current CAM signal is transfers correctly.
Continuous "0"signal above 6BIT means the occurence of error in CAN communication. 1BIT is easily distinguished as calculating the time when "SOF"(START OF FRAME) which notifies the start of frame occurs. Check if "0"signal above 6BIT is detected continuously when monitoring CAN communication waveform.

LFJF636A

MONITOR SCANTOOL DATA E2967055

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "CAN" parameters on the scantool.
   - Check the value of current data displayed normally.
   - Check "Transaxle Range Switch" and "Torque Reqired from TCU" parameters among ECU's current data. (AT vehicle only)
   - Check "TPS", "RPM", and "Idle Status" parameters among TCU's current data. (AT vehicle only)
   - Check "RPM" and "TPS" parameters among ABS's current data. (ABS or ESP vehicle only)
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 E0FD3A1D

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

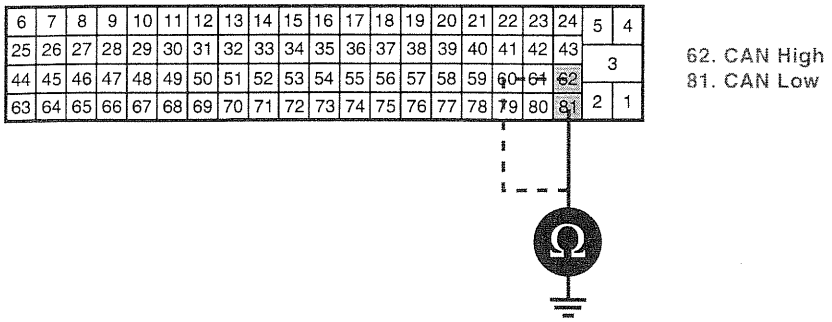
▶ Go to "CAN communication circuit inspection" procedure.

SIGNAL CIRCUIT INSPECTION ED1C533F

1. Check CAN BUS Short to Ground.
   1) Key "OFF".
   2) Disconnect PCM connector.
   3) Measure the resistance between terminal 62 of ECM harness connectorand chassis ground.
   4) Measure the resistance between terminal 81 of ECM harness connectorand chassis ground.

Specification : Infinite

C01-1



EFPF539A

5) Is the measured resistance within specification?

YES

▶ Go to "CAN BUS Terminus Resistance Check(Harness side)" procedure.

NO

▶ Repair Short in signal circuit and then go to "Verification of vehicle Repair" procedure.

2. CAN BUS Terminus Resistance Check(Harness side)

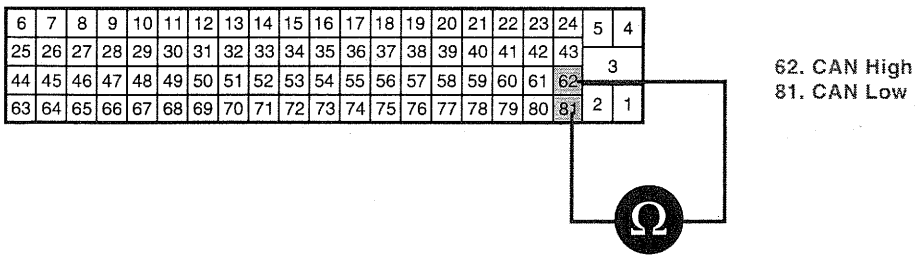
1) Key "OFF".

2) Disconnect PCM connector.

3) Measure the resistance between terminal 62 and 81 of ECM harness connnector.

Specification : 120Ω ± 10Ω

C01-1



EFPF539B

4) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ In case the measured resistance is around 1.0Ω : Repair Short in signal circuit and then go to "Verification of vehicle Repair" procedure.
▶ In case the measured resistance is Infinite : Repair Open in signal circuit and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E83E4AF7

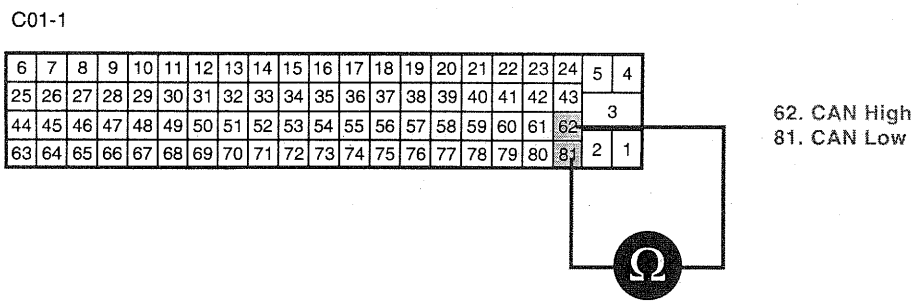
1. CAN BUS Terminus Resistance Check (Component side)

   1) Key "OFF".

   2) Disconnect PCM connector.

   3) Measure the resistance between terminal 62 and 81 of ECM connector. (Component side)

Specification : 120Ω ± 10Ω



EFPF539B

4) Is the measured resistance within specification?

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

▶ 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 E0237268

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 U0101 SERIAL COMMUNICATION PROBLEM WITH TCU (TIMEOUT)

GENERAL DESCRIPTION E18FAAFD

As vehicles electronically controlled, various control unit is applied to vehicle and several units are controlled based on the signals from the sensors. Therefore sharing signals of sensors and information is required. To meet this requirement, CAN communication type, which is insensible to external noises and whose communication speed is fast, is applied to power train control.
Sharing signals from RPM, APS, gear shifting, torque reduction in ESP, ABS and various modules, addtive control is performed.

DTC DESCRIPTION E003B391

If there is no message from TCU to ECM through external CAN line over 500 ms, PCU sets DTC P1602.

DTC DETECTING CONDITION E7250011

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN communication status check	• Poor connection • TCM • ECM
Enable Conditions	• TCU is not coming via internal CAN	
Threshold Value	• No message time from TCU via external CAN 〉 500ms	
Diagnostic Time	• Continuous	
MIL	• OFF	

MONITOR SCANTOOL DATA E2827DFC

1. Connect scantool to Data Link Connector(DLC).
2. Warm up the engine to normal operating temperature.
3. Monitor the "CAN" parameters on the scantool.
   - Check "Transaxle type, Torque control request, etc" at the ECU service data mode.
   - Check "TPS, RPM, IDLE STATE, etc" at the TCU service data mode.
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

▶ 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 E7015CCD

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

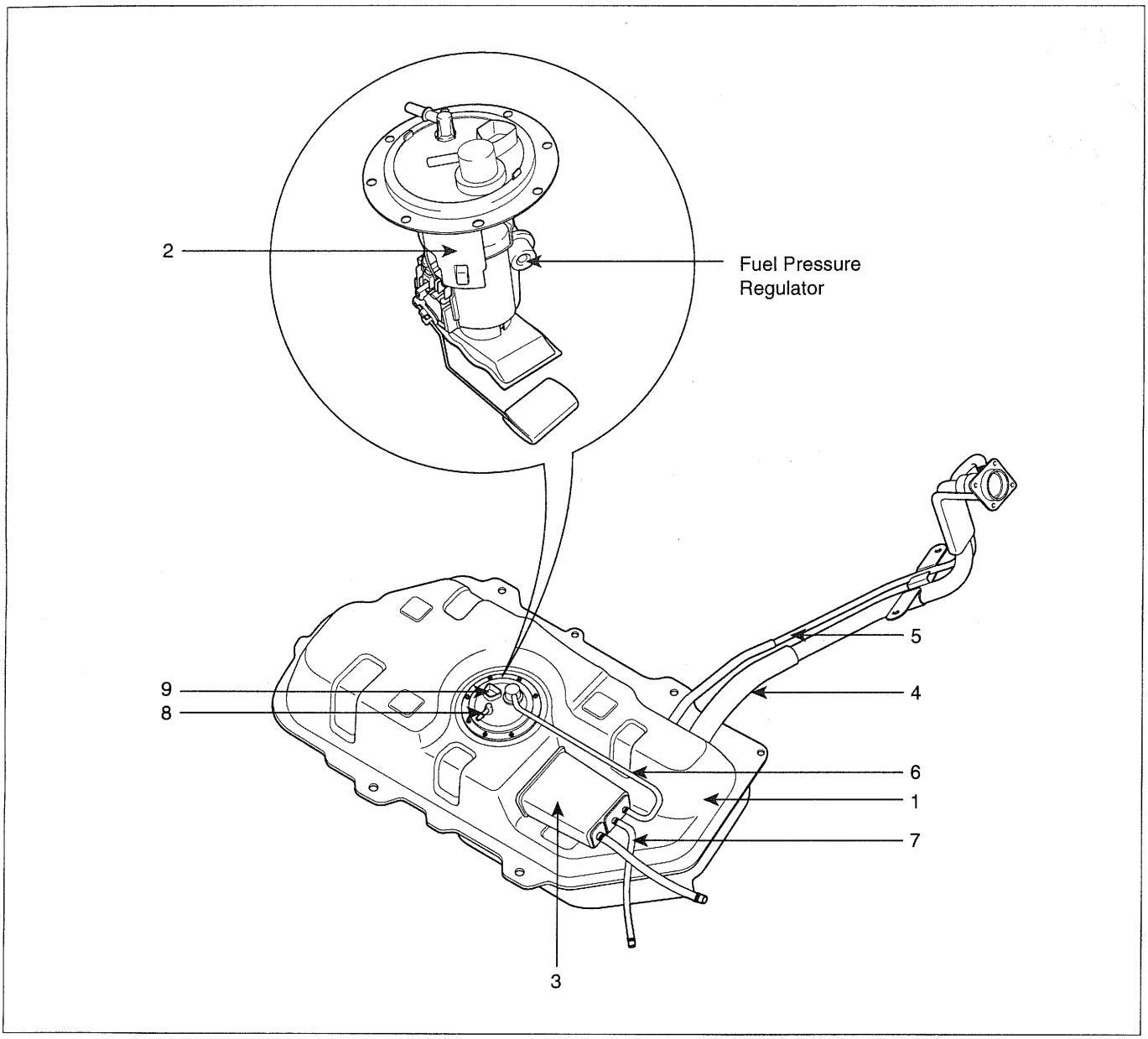
▶ Go to the applicable troubleshooting procedure.

NO

▶ System is performing to specification at this time.

FUEL DELIVERY SYSTEM

COMPONENTS EE512EBF



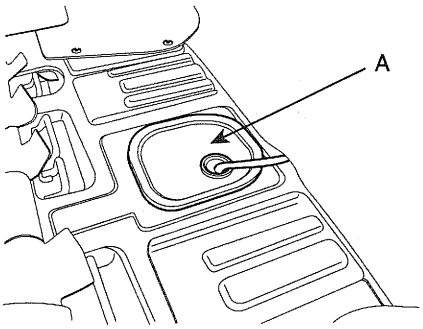
1. Fuel Tank
2. Fuel Pump Assembly (including Fuel Filter & Fuel Pressure Regulator)
3. Canister
4. Fuel Filler Pipe
5. Leveling Pipe
6. Hose (Canister ↔ Fuel Tank)
7. Hose (Canister ↔ Intake Manifold)
8. Nipple-Fuel Feed Line
9. Fuel Pump Connector

EFPF201A

FUEL PRESSURE TEST E25F227A

1. PREPARING

1. Fold the rear seat (Refer to "BD" group in this WORKSHOP MANUAL).
2. Open the service cover (A).

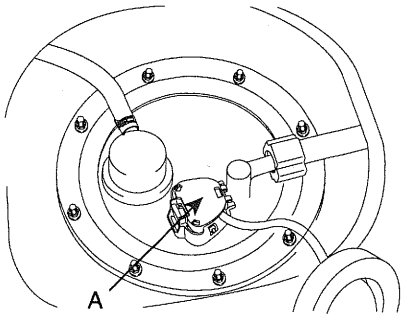


2. RELEASE THE INTERNAL PRESSURE

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.



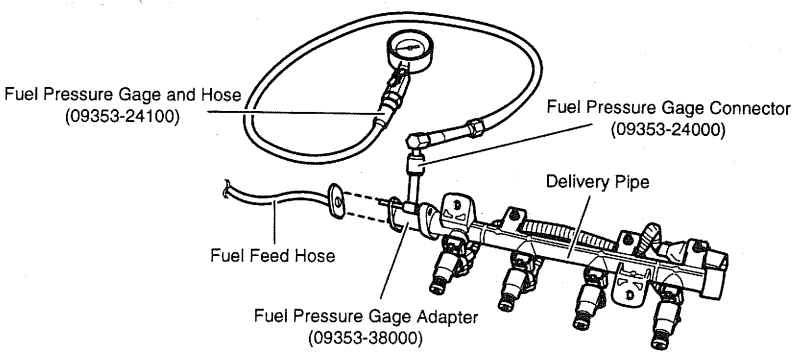
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

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

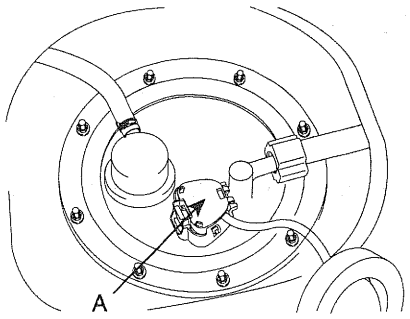
LGIF009J

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.

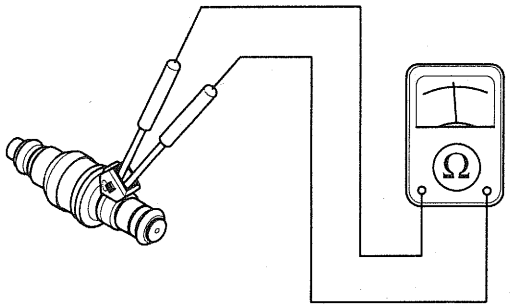
EGPF408A

FUEL INJECTOR

INSPECTION ED6C5AFA

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.

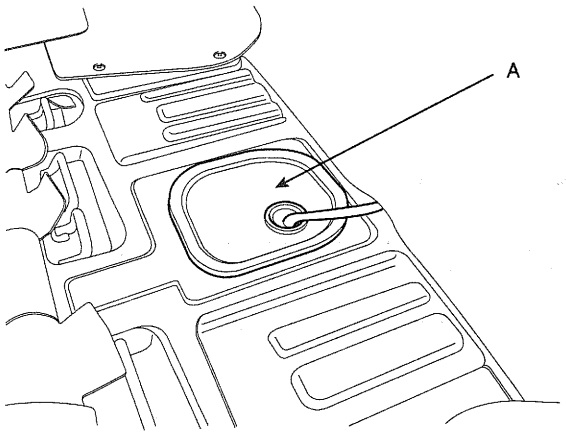
FUEL PUMP (FP)

REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) E0A5BCDA

1. Preparation

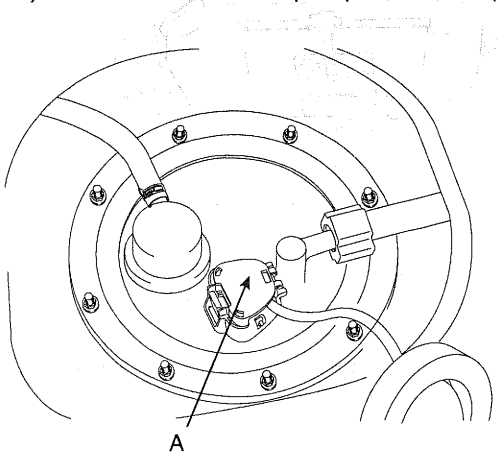
   1) Fold the rear seat (Refer to "BD" group in this WORKSHOP MANUAL)/

   2) Remove the service cover (A).



KFPF217A

   3) Disconnect the fuel pump connector (A).

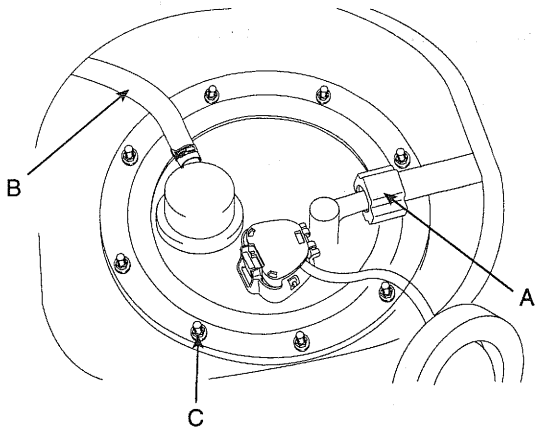


EGPF409A

   4) Start the engine and wait until fuel in fuel line is exhausted.

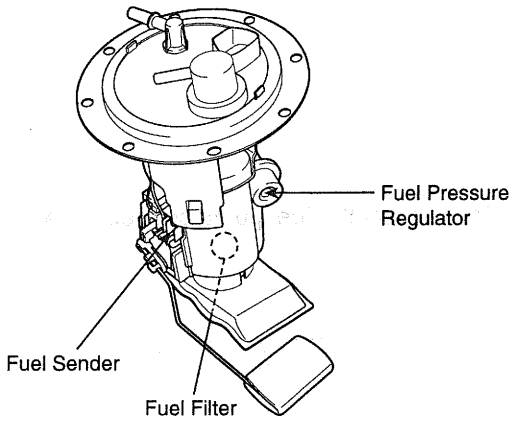
   5) After engine stalls, turn the ignition switch to OFF position.

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 EA1547F5

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)

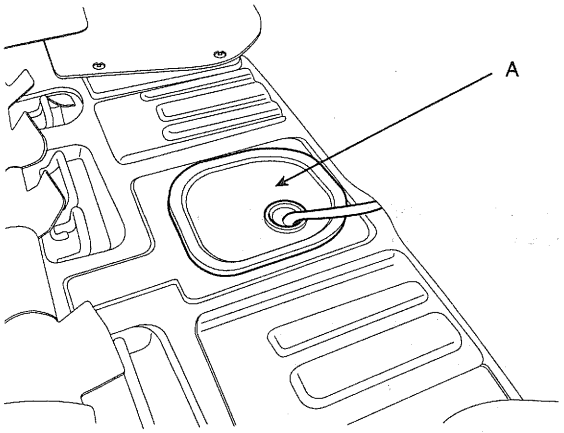
FUEL TANK

REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) EEB8E82F

1. Preparation

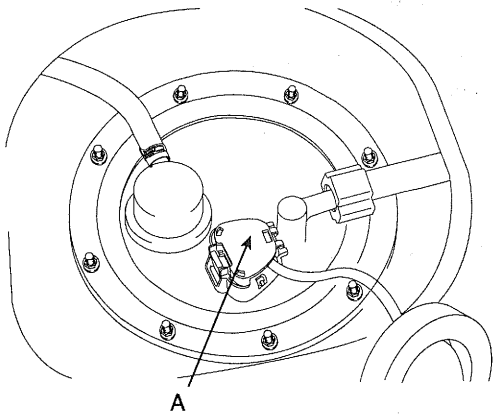
   1) Fold the rear seat (Refer to "BD" group in this WORKSHOP MANUAL)/

   2) Remove the service cover (A).



KFPF217A

   3) Disconnect the fuel pump connector (A).

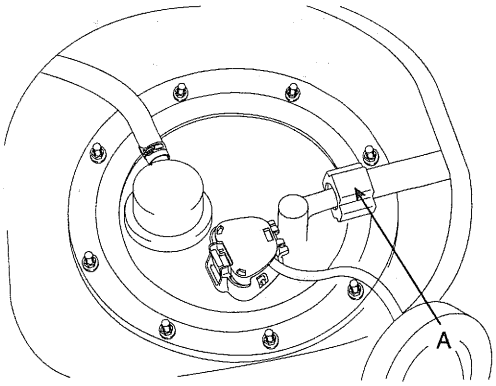


EGPF409A

   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).

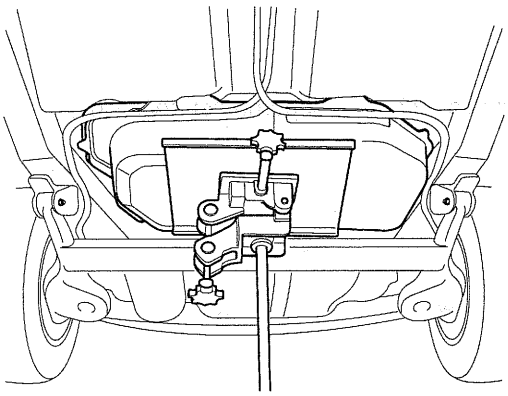


EGPF412A

3. Life the vehicle.

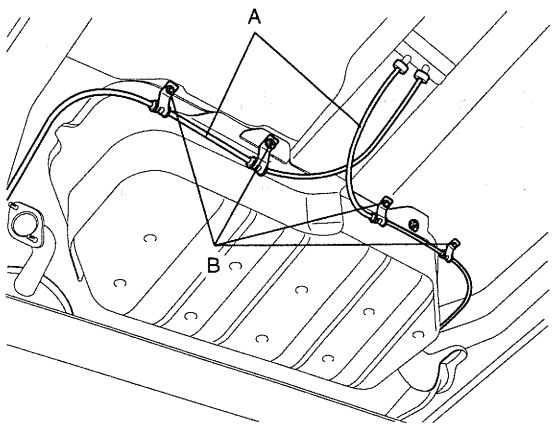
4. Remove the center muffler (Refer to "EM" group in this WORKSHOP MANUAL).

5. Support the fuel tank with a jack.



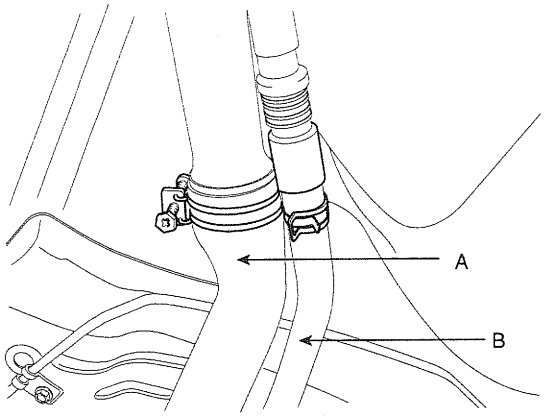
KFPF222A

6. Remove the brake hoses (A) by unscrewing the mounting bolts (B).



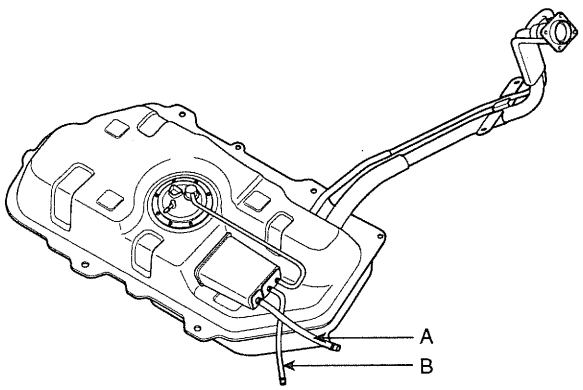
EGPF413A

7. Disconnect the fuel filler pipe (A), and the leveling pipe (B).



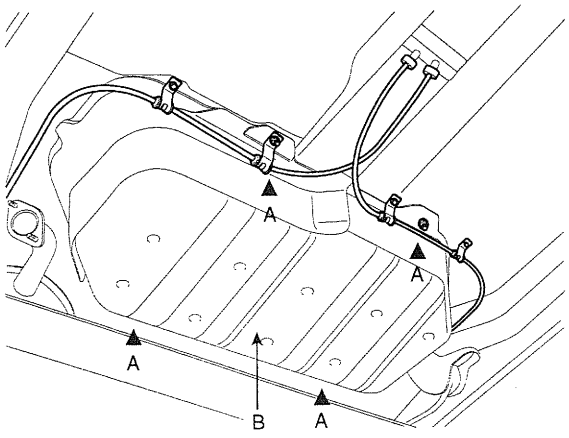
KFPF223A

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 E94A58CD

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)