Fuel System

GENERAL

GASOLINE ENGINE CONTROL SYSTEM

- ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM
- MASS AIR FLOW SENSOR (MAFS)
- INTAKE AIR TEMPERATURE SENSOR (IATS)
- MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)
- ENGINE COOLANT TEMPERATURE SENSOR (ECTS)
- CAMSHAFT POSITION SENSOR (CMPS)
- CRANKSHAFT POSITION SENSOR (CKPS)
- HEATED OXYGEN SENSOR (HO2S)
- KNOCK SENSOR (KS)
- INJECTOR
- CVVT OIL CONTROL VALVE (OCV)
- CVVT OIL TEMPERATURE SENSOR(OTS)
- PURGE CONTROL SOLENOID VALVE (PCSV)
- VARIABLE INTAKE SOLENOID (VIS) VALVE
- ACCELERATOR POSITION SENSOR (APS)
- POWERTRAIN CONTROL MODULE (PCM)

DTC TROUBLESHOOTING PROCEDURES

FUEL DELIVERY SYSTEM

- FUEL PUMP
- SUB FUEL SENDER
- FUEL TANK
- FILLER-NECK ASSEMBLY
- ACCELERATOR PEDAL

GENERAL

SPECIFICATIONS E347D44B

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	75 lit. (16.5 Imp.gal., 19.8 U.S.gal.)
Fuel Filter (built in Fuel Pump assembly)	Type	High pressure type
Fuel Pressure Regulator (built in Fuel Pump assembly)	Regulated Fuel Pressure	375 ~ 385 kPa(3.82 ~ 3.92 kgf/㎠, 54.3 ~ 55.8 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor

SENSORS

MASS AIR FLOW SENSOR (MAFS)

▷ Type: Hot-film type
▷ Specification

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

INTAKE AIR TEMPERATURE SENSOR (IATS)

▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
℃	°F	
-40	-40	100.87
-20	-4	28.58
0	32	9.40
10	50	5.66
20	68	3.51
40	104	1.47
60	140	0.67
80	176	0.33

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)

▷ Type: Piezo-resistive pressure type
▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0kPa	0.79
46.66kPa	1.84
101.32kPa	4.0

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
℃	˚F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

THROTTLE POSITION SENSOR (TPS)

▷ Type: Variable resistor type
▷ Specification (When reference voltage = 5.0V)

Throttle Angle (˚)	Output Voltage(V)	
	TPS1	TPS2
0	0	5.0
10	0.5	4.5
20	0.9	4.1
30	1.4	3.6
40	1.8	3.2
50	2.3	2.7
60	2.7	2.3
70	3.2	1.8
80	3.6	1.4
90	4.1	0.9
100	4.5	0.5
110	5.0	0.0

Item	Sensor Resistance (kΩ)
TPS1	4.0 ~ 6.0 [20℃ (68˚F)]
TPS2	2.7 ~ 4.1 [20℃ (68˚F)]

ACCELERATOR POSITION SENSOR (APS)

▷ Type: Variable resistor type
▷ Specification (When reference voltage = 5.0V)

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.70 ~ 0.80	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

Item	Sensor Resistance (kΩ)
APS1	0.7 ~ 1.3 [20℃ (68˚F)]
APS2	1.4 ~ 2.6 [20℃ (68˚F)]

HEATED OXYGEN SENSOR (HO2S)

▷ Type: Zirconia (ZrO2) type
▷ Specification

A/F Ratio	Output Voltage (V)
RICH	0.80 ~ 0.92
LEAN	0.1

Item	Resistance (Ω)
Sensor Heater	3.0 ~ 4.0 [21℃ (69.8˚F)]

CAMSHAFT POSITION SENSOR (CMPS)

▷ Type: Hall effect type
▷ Specification

Item	Specification
Output Voltage (V)	High: 4.75 ~ 5.25
	Low: 0 ~ 0.7
Air Gap (mm)	0.5 ~ 1.5

CRANKSHAFT POSITION SENSOR (CKPS)

▷ Type: Magnetic field sensitive type
▷ Specification

Item	Specification
Coil Resistance (Ω)	630 ~ 770 [20℃ (68˚F)]
Air Gap (mm)	0.5 ~ 1.5

KNOCK SENSOR (KS)

▷ Type: Piezo-electricity type
▷ Specification

Item	Specification
Capacitance (pF)	950 ~ 1,350pF

CVVT OIL TEMPERATURE SENSOR (OTS)

▷ Type: Thermistor type
▷ Specification

Temperature		Resistance (kΩ)
℃	˚F	
-40	-40	52.0
-20	-4	16.5
0	32	6.0
20	68	2.45
40	104	1.10
60	140	0.544
80	176	0.290
100	212	0.164
120	248	0.099

ACTUATORS

INJECTOR

▷ Number: 6
▷ Specification

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20℃ (68˚F)]

PURGE CONTROL SOLENOID VALVE (PCSV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0 [20℃ (68˚F)]

VARIABLE INTAKE SOLENOID (VIS) VALVE #1 (SURGE TANK SIDE)

▷ Specification

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 [22℃ (71.6˚F)]

VARIABLE INTAKE SOLENOID (VIS) VALVE #2 (INTAKE MANIFOLD SIDE)

▷ Specification

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 [20℃ (68˚F)]

CVVT OIL CONTROL VALVE (OCV) [BANK 1]

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7 [20℃ (68˚F)]

CVVT OIL CONTROL VALVE (OCV) [BANK 2]

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7 [20℃ (68˚F)]

ETC MOTOR

▷ Specification

Item	Specification
Coil Resistance (Ω)	1.275 ~ 1.725 [20℃ (68˚F)]

IGNITION COIL

▷ Type: Stick type
▷ Specification

Item	Specification
1st Coil Resistance (Ω)	0.62Ω±10% [20℃ (68˚F)]
2nd Coil Resistance (kΩ)	7.0kΩ±15% [20℃ (68˚F)]

SERVICE STANDARD E85141FD

Ignition Timing	BTDC 7˚ ± 10˚		
Idle Speed	A/CON OFF	Neutral,N,P-range	680 ± 100 rpm
		D-range	630 ± 100 rpm
	A/CON ON	Neutral,N,P-range	680 ± 100 rpm
		D-range	630 ± 100 rpm

TIGHTENING TORQUES EAEFEBE8

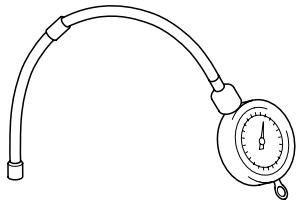
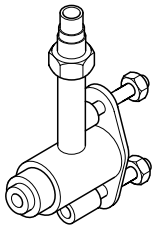
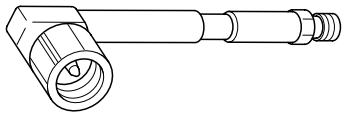
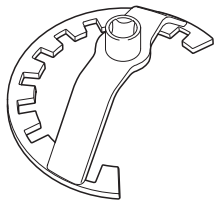
ENGINE CONTROL SYSTEM

Item	kgf·m	N·m	lbf·ft
PCM installation bolts (on upper bracket)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
PCM upper bracket installation bolts (on air cleaner assembly)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor [Bank 1] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Camshaft position sensor [Bank 2] installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
Crankshaft position sensor installation bolt	0.7 ~ 1.0	6.9 ~ 9.8	5.1 ~ 7.2
CVVT Oil control valve [Bank 1] installation bolt	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2
CVVT Oil control valve [Bank 2] installation bolt	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2
CVVT Oil temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
ETC module installation bolt	0.9 ~ 1.1	8.8 ~ 10.8	6.5 ~ 8.0
Heated oxygen sensor (Bank 1 / Sensor 1) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 1 / Sensor 2) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 2 / Sensor 1) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Heated oxygen sensor (Bank 2 / Sensor 2) installation	3.5 ~ 4.5	34.3 ~ 44.1	25.3 ~ 32.6
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Knock sensor [Bank 1] installation	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Knock sensor [Bank 2] installation	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Manifold absolute pressure sensor installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7

FUEL DELIVERY SYSTEM

Item	kgf·m	N·m	lbf·ft
Fuel tank band mounting nuts	4.0 ~ 5.5	39.2 ~ 54.0	28.9 ~ 39.8
Fuel pump plate cover tightening	6.0 ~ 7.0	58.9 ~ 68.7	43.4 ~ 50.6
Sub fuel sender plate cover tightening	6.0 ~ 7.0	58.9 ~ 68.7	43.4 ~ 50.6
Delivery pipe installation bolts	0.9 ~ 1.4	8.8 ~ 13.7	6.5 ~ 10.1
Accelerator pedal module installation bolts	1.7 ~ 2.6	16.7 ~ 25.5	12.3 ~ 18.8

SPECIAL SERVICE TOOLS E5DDDCC6

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)
09310-2B100 Fuel Pump Plate Cover Wrench	 SCMFL6666D	Removal of installation of fuel pump plate cover

REFERENCE SERVICE TOOLS (I) - WIRE HARNESS REPAIR KIT II

Tool Number	Tool Name
TRK00A	Wiring Repair Kit

*For more information of the Wiring Repair Kit, please refer to BE group - "REFERENCE SERVICE TOOLS"

BASIC TROUBLESHOOTING E726FCB8

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**

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLEINFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile		

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 check (Pre-check)	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data
	Check mode	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

SCMFL6150L

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 stated otherwise.

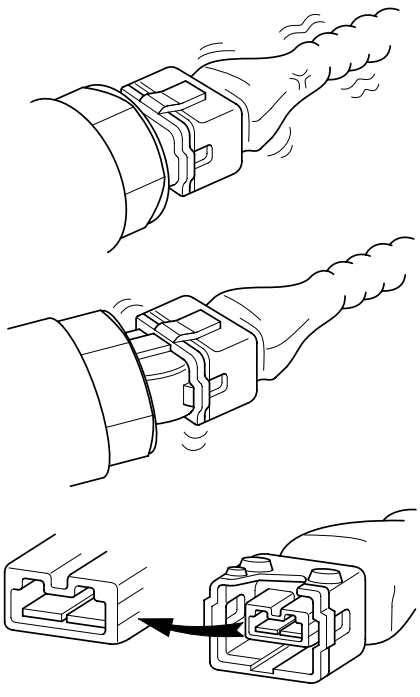
NOTE

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.



BFGE321A

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 source.

WARNING

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

● SIMULATING WATER SPRINKLING

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

WARNING

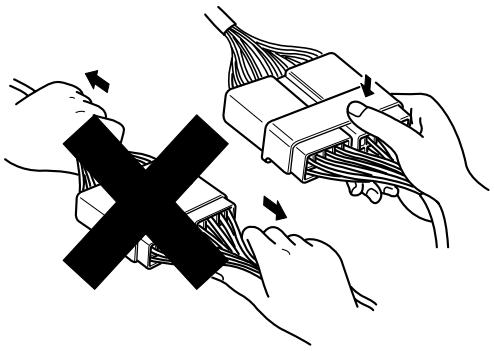
DO NOT sprinkle water directly into the engine compartment or electronic components.

● SIMULATING ELECTRICAL LOAD

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

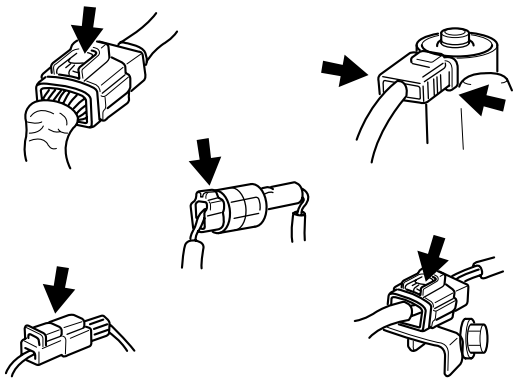
CONNECTOR INSPECTION PROCEDURE

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



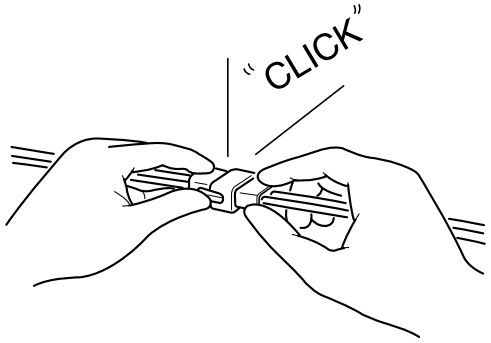
BFGE015F

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



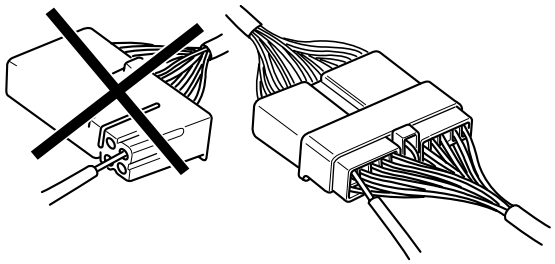
BFGE015G

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



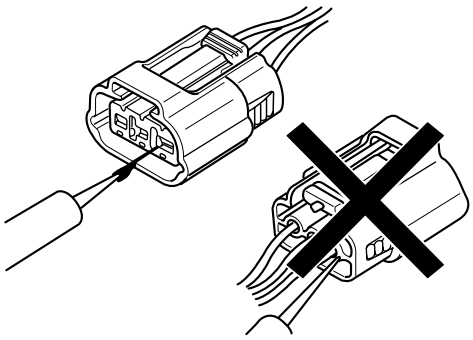
BFGE015H

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



BFGE015I

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



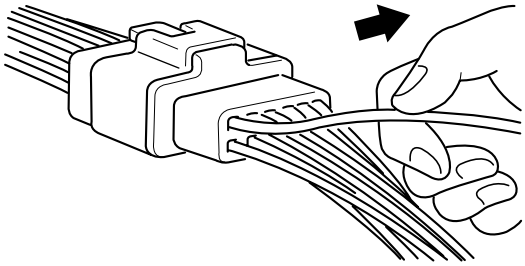
BFGE015J

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 missed 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.



BFGE015K

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.

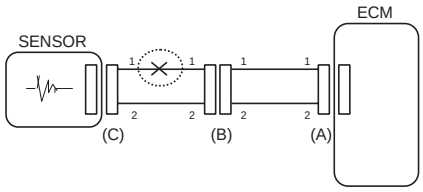
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

● **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



BFGE501A

2. Continuity Check Method

   NOTE

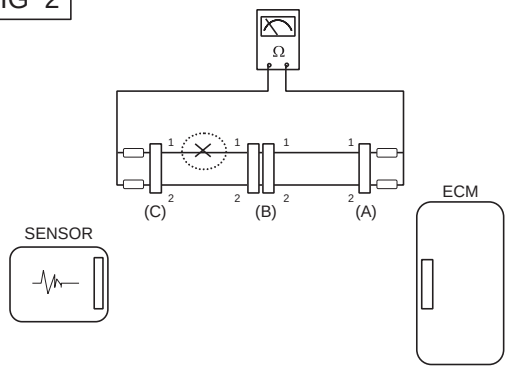
   When measuring for resistance, lightly shake the wire harness above and below or from side to side.

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

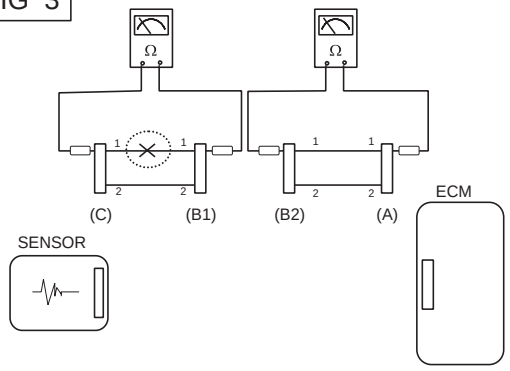


BFGE501B

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

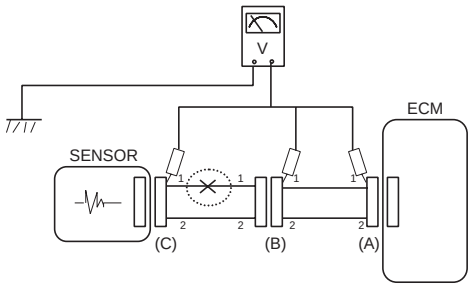


BFGE501C

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



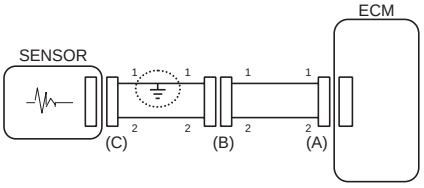
BFGE501D

● 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 Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



BFGE501E

2. Continuity Check Method (with Chassis Ground)

NOTE

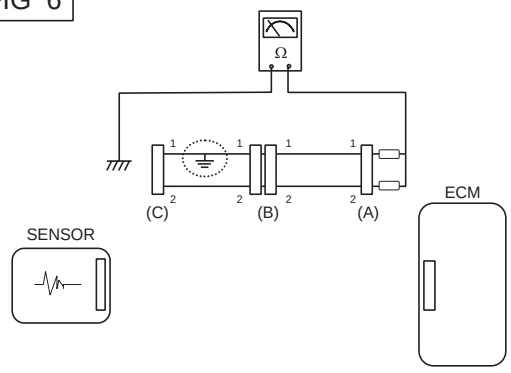
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

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

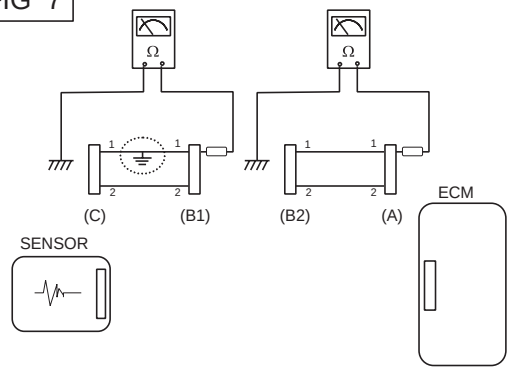


BFGE501F

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



BFGE501G

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 flashing)	• 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 E722E9A3

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/ PCM
- 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.

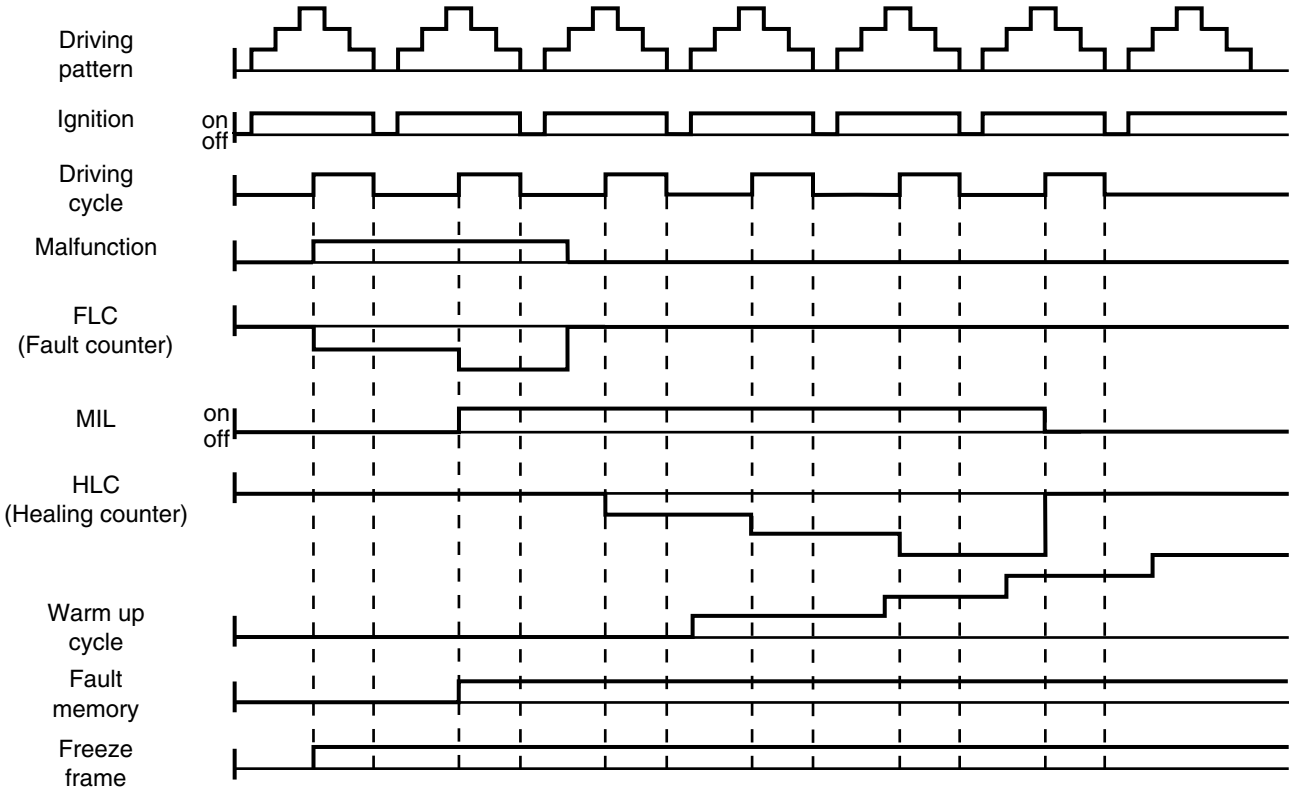
SELF-DIAGNOSIS

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.

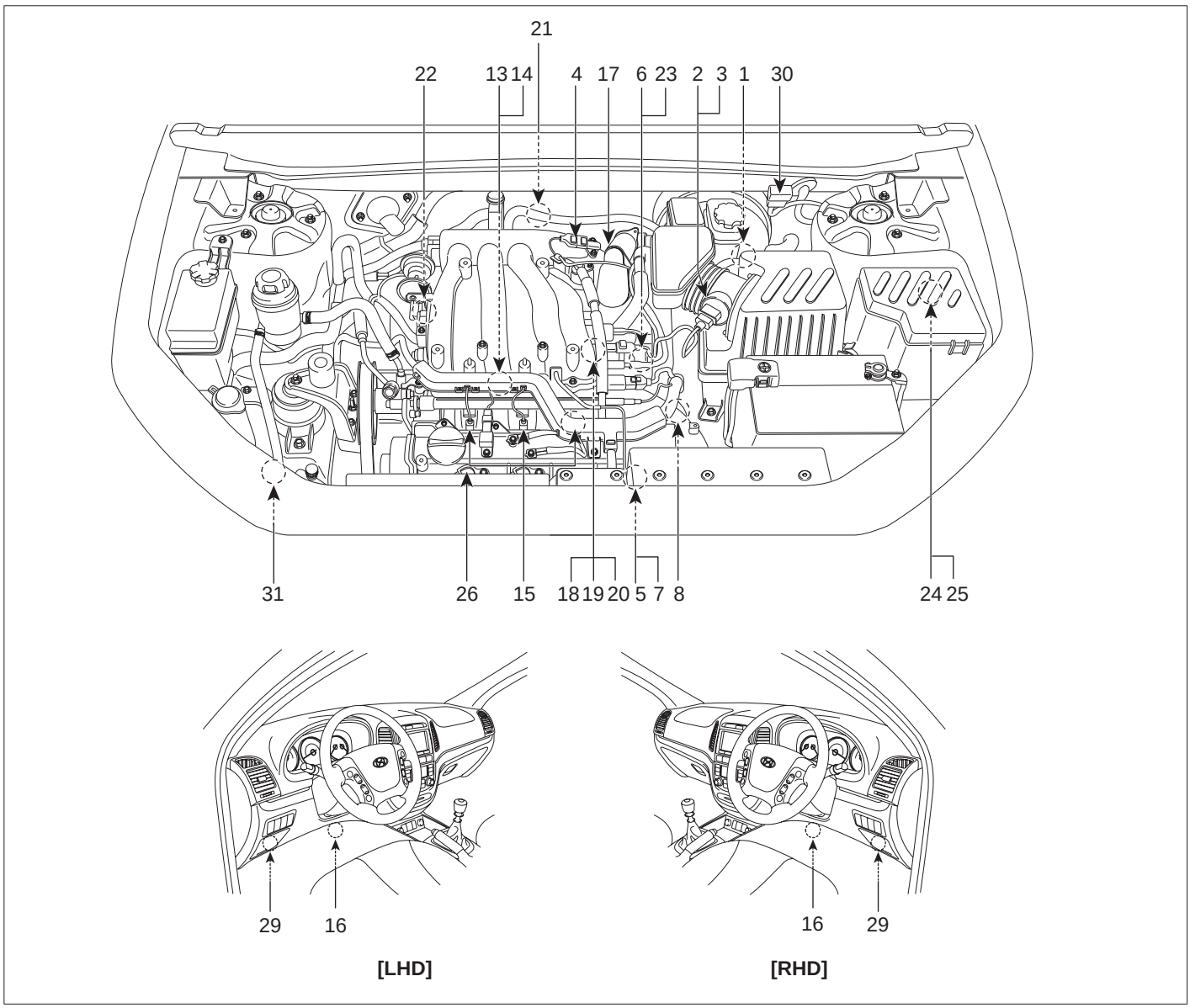
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.
   If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately 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.*

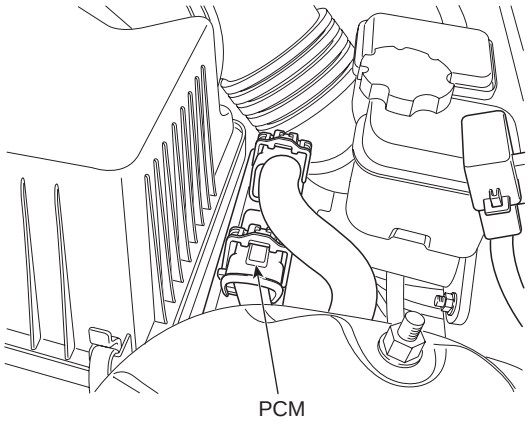
COMPONENT LOCATION E478BABD



1. PCM (Powertrain Control Module)
2. Mass Air Flow Sensor (MAFS)
3. Intake Air Temperature Sensor (IATS)
4. Manifold Absolute Pressure Sensor (MAPS)
5. Engine Coolant Temperature Sensor (ECTS)
6. Camshaft Position Sensor (CMPS) [Bank 1]
7. Camshaft Position Sensor (CMPS) [Bank 2]
8. Crankshaft Position Sensor (CKPS)
9. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
11. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 1]
12. Heated Oxygen Sensor (HO2S) [Bank 2 / Sensor 2]
13. Knock Sensor (KS) [Bank 1]
14. Knock Sensor (KS) [Bank 2]
15. Injector
16. Accelerator Position Sensor (APS)
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]
18. CVVT Oil Control Valve (OCV) [Bank 1]
19. CVVT Oil Control Valve (OCV) [Bank 2]
20. CVVT Oil Temperature Sensor (OTS)
21. Purge Control Solenoid Valve (PCSV)
22. Variable Intake Solenoid (VIS) Valve #1 (Surge Tank Side)
23. Variable Intake Solenoid (VIS) Valve #2 (Intake Manifold Side)
24. Fuel Pump Relay
25. Main Relay
26. Ignition Coil
27. Wheel Speed Sensor (WSS) [Without ABS/ESP (Euro-Ⅲ/Ⅳ)]
28. Vehicle Speed Sensor (VSS) [Except for Euro-Ⅲ/Ⅳ]
29. Data Link Connector (DLC)
30. Multi-Purpose Connector
31. A/C Pressure Transducer (APT)

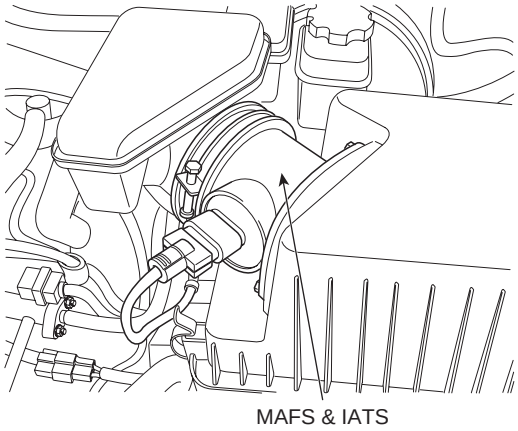
SCMF16001L

1. PCM (Powertrain Control Module)



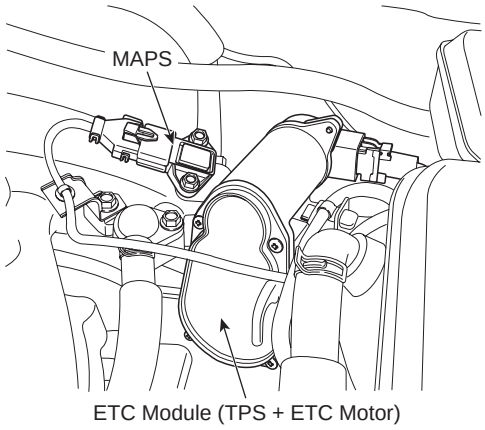
SCMF16003L

2. Mass Air Flow Sensor (MAFS)
3. Intake Air Temperature Sensor (IATS)



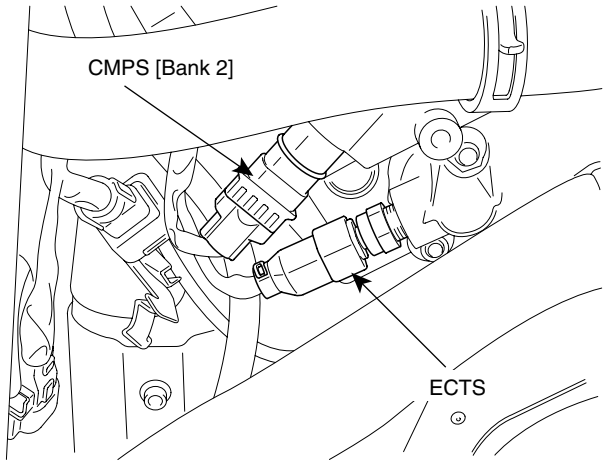
SCMF16002L

4. Manifold Absolute Pressure Sensor (MAPS)
17. ETC Module [Throttle Position Sensor (TPS) + ETC Motor]



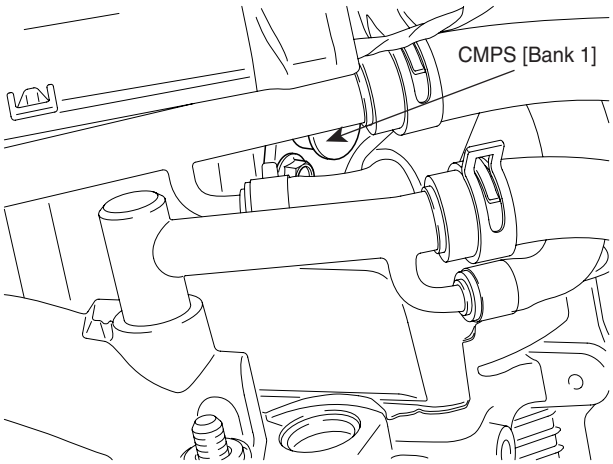
SCMF16005L

5. Engine Coolant Temperature Sensor (ECTS)
7. Camshaft Position Sensor (CMPS) [Bank2]



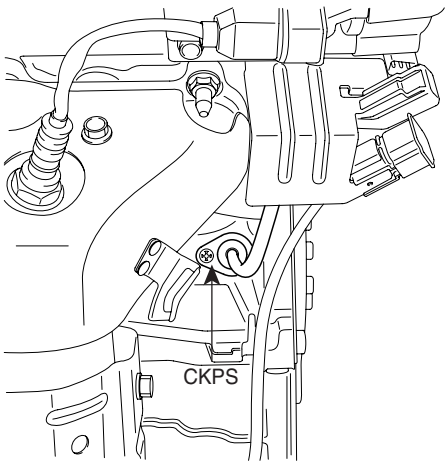
LGLG001R

6. Camshaft Position Sensor (CMPS) [Bank 1]



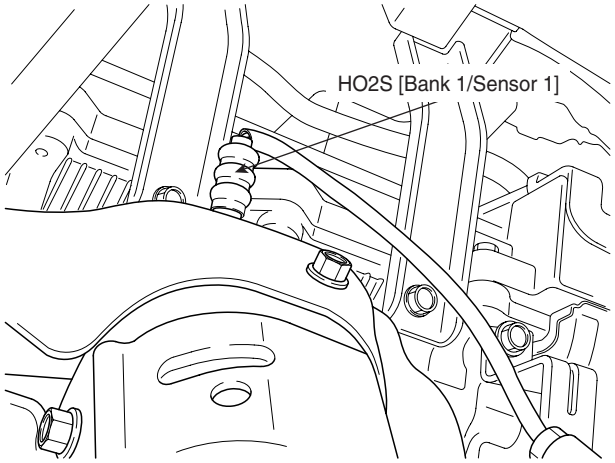
LGLG001S

8. Crankshaft Position Sensor (CKPS)



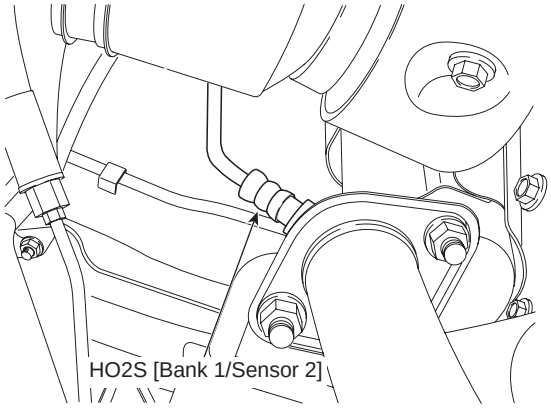
LGLG001T

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



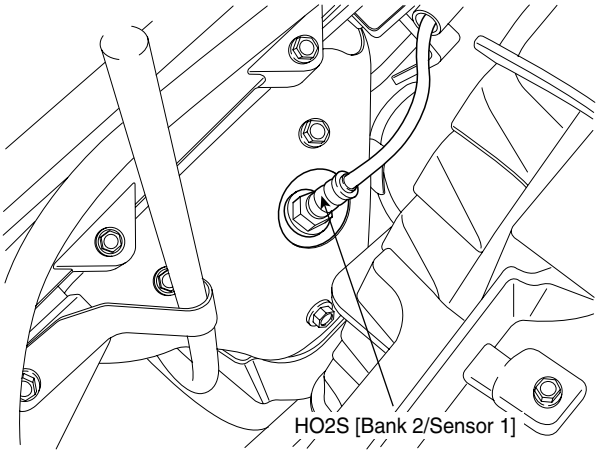
LGLG001U

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



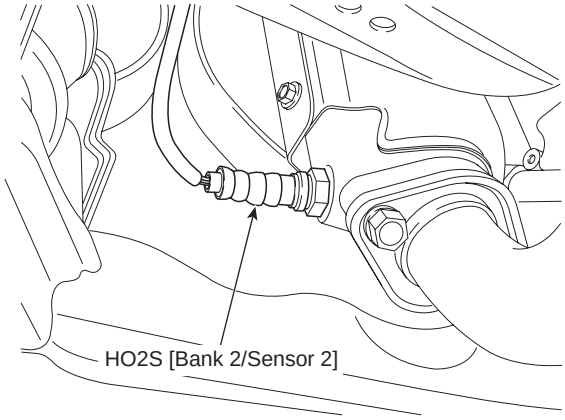
SCMF16006L

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



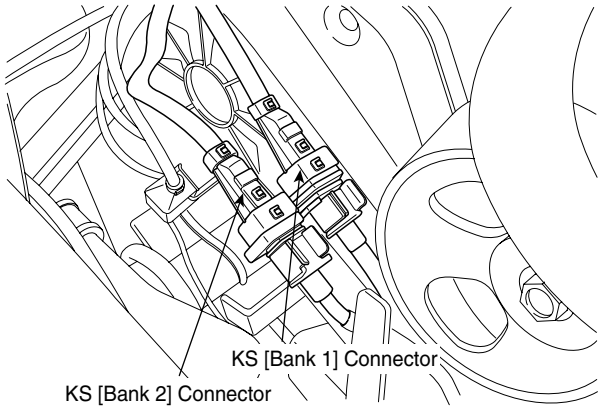
LGLG001G

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



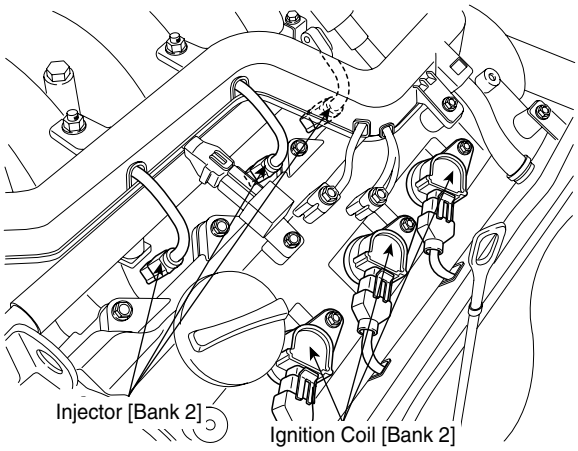
SCMF16007L

13. Knock Sensor (KS) [Bank 1]
14. Knock Sensor (KS) [Bank 2]



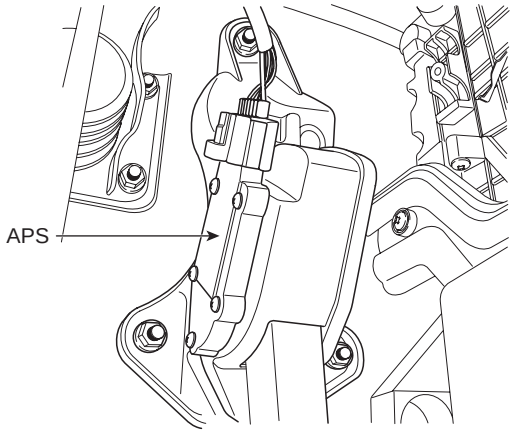
LGLG001J

15. Injector
26. Ignition Coil



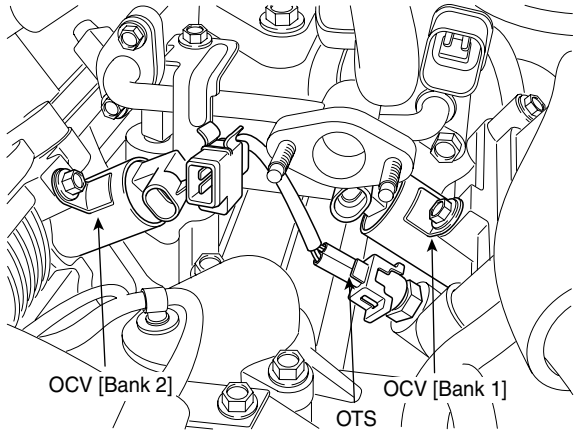
LGLG001I

16. Accelerator Position Sensor (APS)



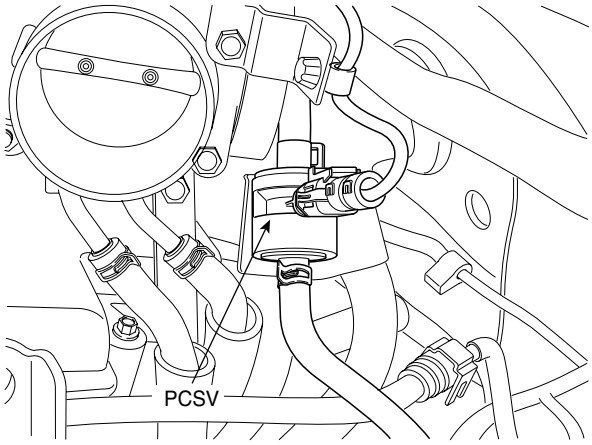
SCMFL6005D

18. CVVT Oil Control Valve (OCV) [Bank 1]
19. CVVT Oil Control Valve (OCV) [Bank 2]
20. CVVT Oil Temperature Sensor (OTS)



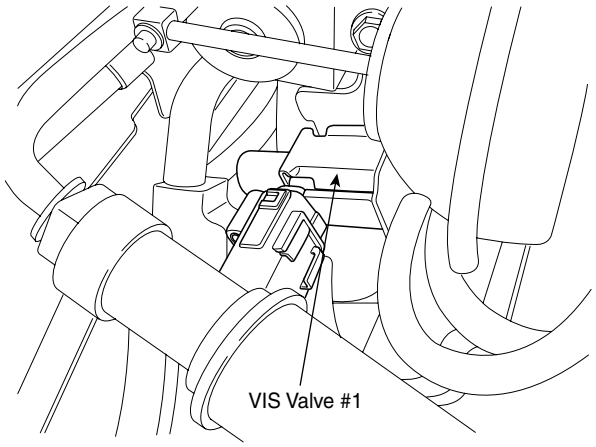
LGLG001K

21. Purge Control Solenoid Valve (PCSV)



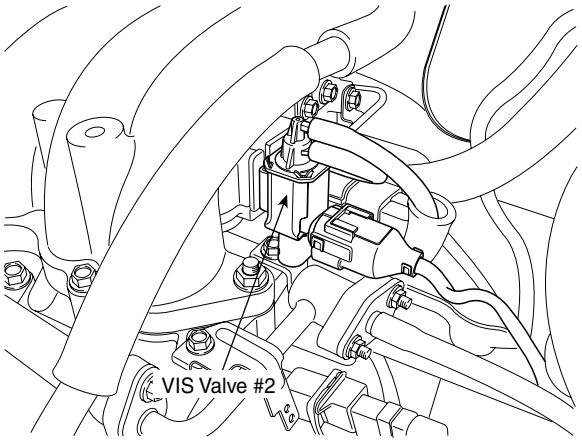
LGLG001L

22. Variable Intake Solenoid (VIS) #1 Valve (Surge Tank Side)



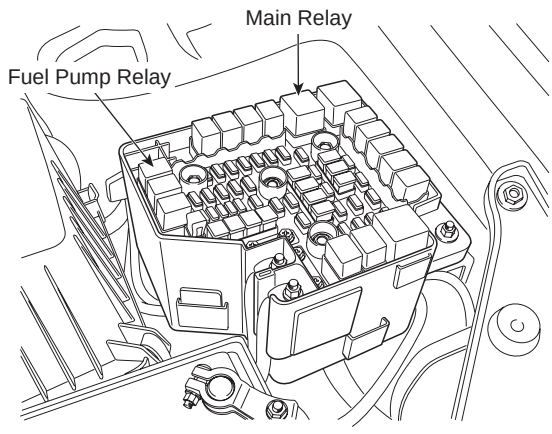
LGLG001N

23. Variable Intake Solenoid (VIS) #2 Valve (Intake Manifold Side)

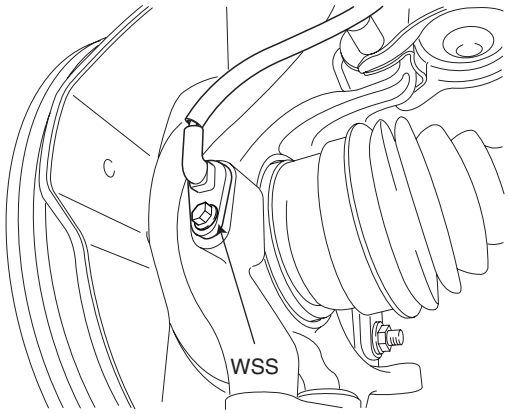
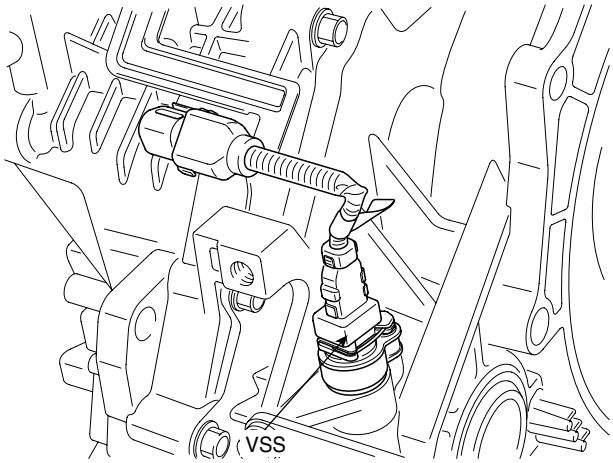
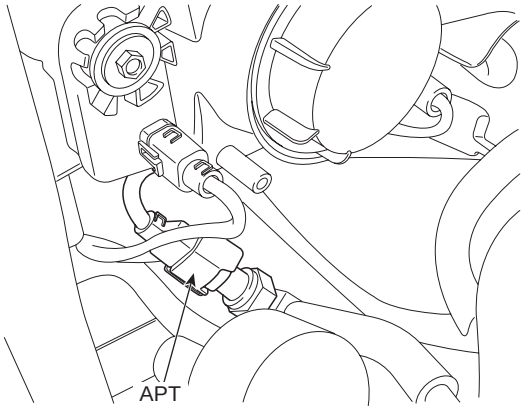


LGLG001O

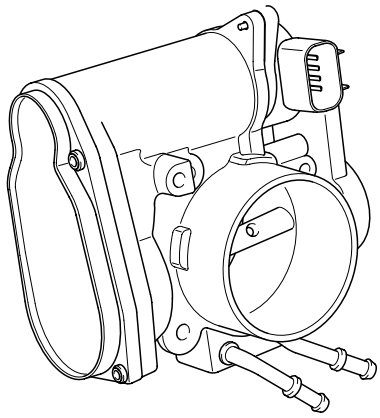
24. Fuel Pump Relay
25. Main Relay



SCMF16014L

27. Wheel Speed Sensor (WSS)	28. Vehicle Speed Sensor (VSS)
 AFLG500C	 LGLG001V
31. A/C Pressure Transducer (APT)	
 SCMF16008L	

ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM

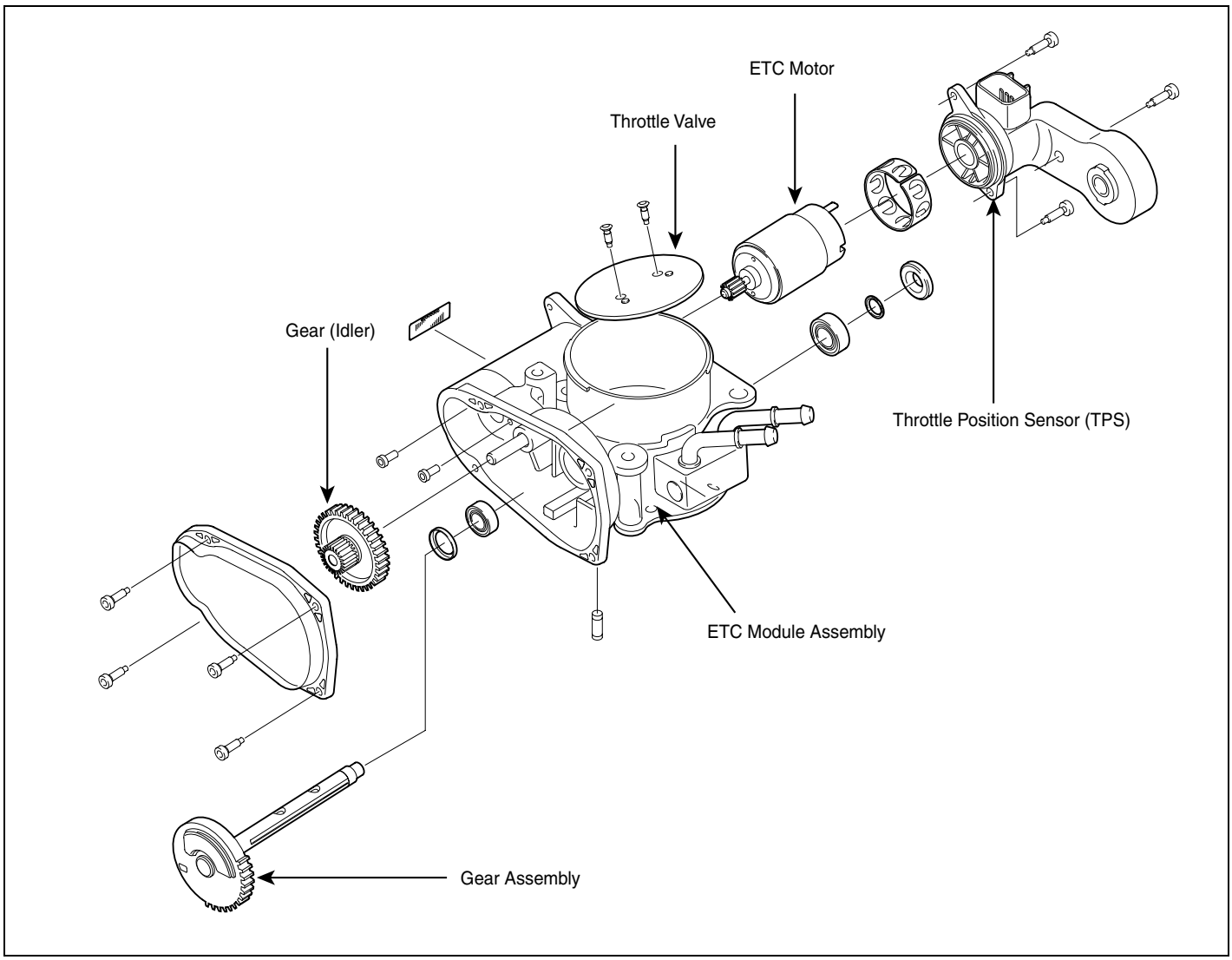


KGBF004U

INSPECTION E4C099A0

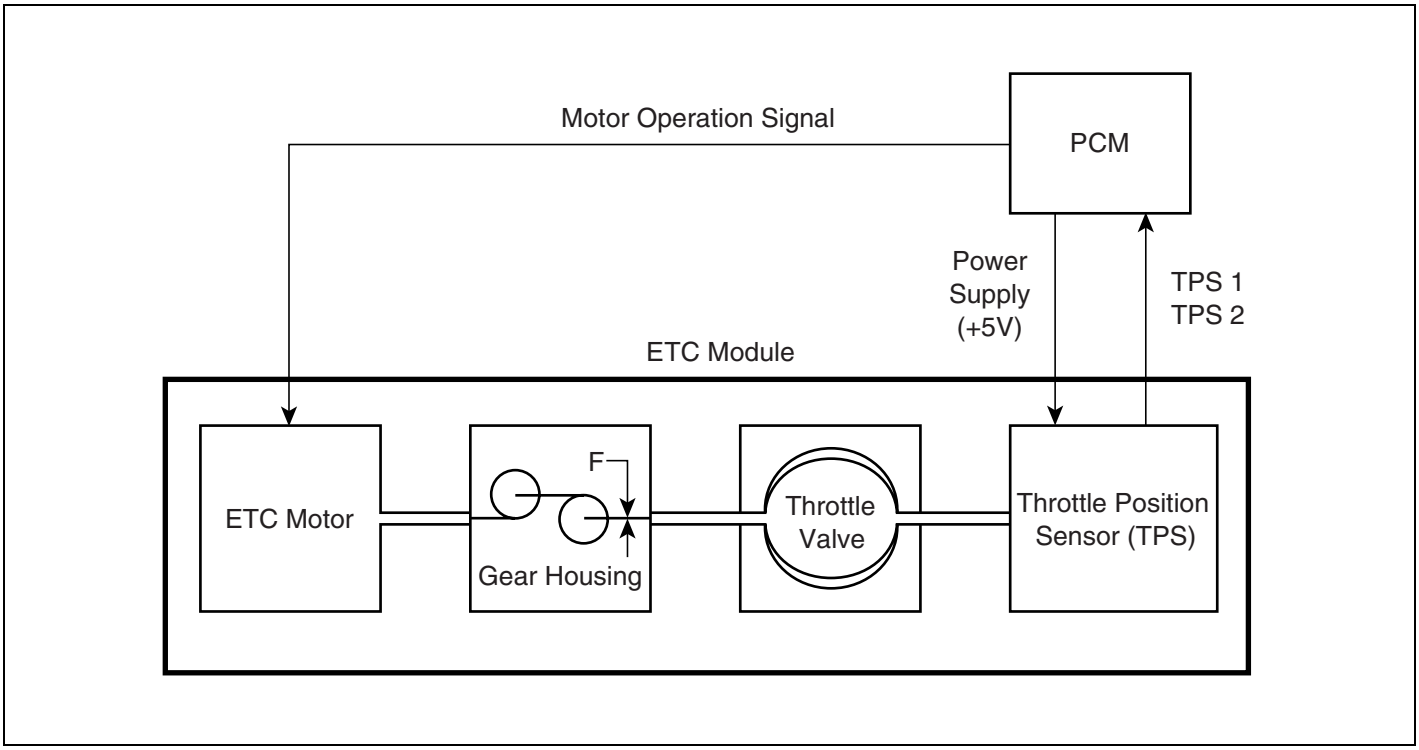
FUNCTION AND OPERATION PRICIPLE

ETC (Electronic Throttle Control) system is electronically controlled throttle device which controls the throttle valve. It consists of ETC motor, throttle body and throttle position sensor (TPS). A mechanical throttle control system receives a driver's intention via a wire cable between the accelerator and the throttle valve, while this ETC system uses the signal from the Accelerator Position Sensor (APS) installed on the accelerator pedal. After the PCM receives the APS signal and calculates the throttle opening angle, it activates the throttle valve by using the ETC motor. Additionally, it can handle cruise control function without any special devices.



LGLG001W

SHEMATIC DIAGRAM



EGRF234A

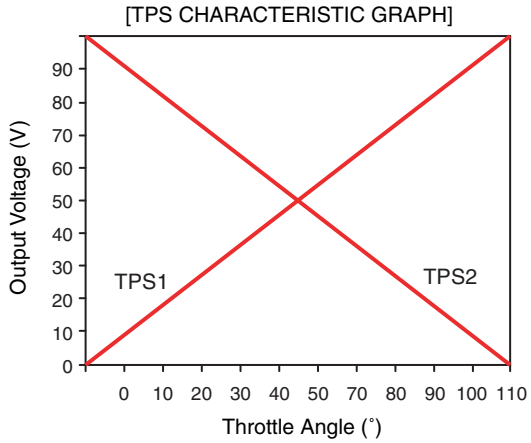
SPECIFICATION

[THROTTLE POSITION SENSOR]

Throttle Angle(˚)	Output Voltage(V) [Vref = 5.0V]	
	TPS1	TPS2
0˚	0V	5.0V
10˚	0.5V	4.5V
20˚	0.9V	4.1V
30˚	1.4V	3.6V
40˚	1.8V	3.2V
50˚	2.3V	2.7V
60˚	2.7V	2.3V
70˚	3.2V	1.8V
80˚	3.6V	1.4V
90˚	4.1V	0.9V
100˚	4.5V	0.5V
110˚	5.0V	0V

Item	Sensor Resistance
TPS1	4.0 ~ 6.0㏀ at 20℃ (68˚F)
TPS2	2.7 ~ 4.1㏀ at 20℃ (68˚F)

[TPS CHARACTERISTIC GRAPH]



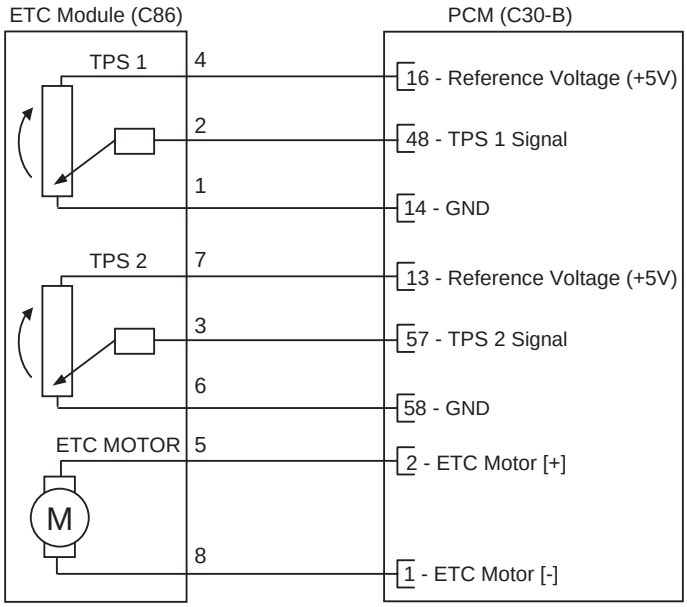
EGRF235A

[ETC MOTOR]

Item	Sensor Resistance
Coil Resistance (Ω)	1.275 ~ 1.725Ω at 20℃ (68˚F)

CIRCUIT DIAGRAM

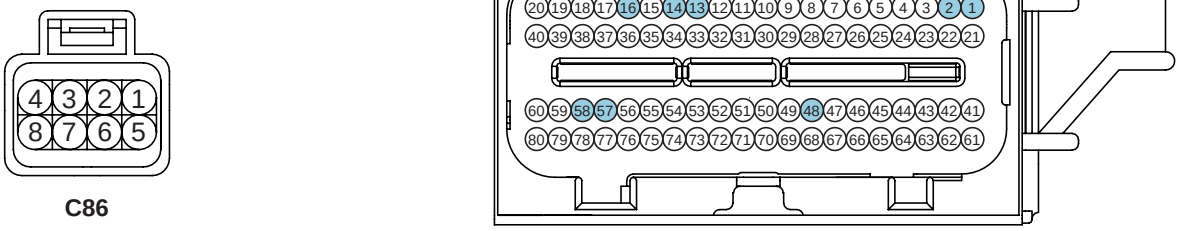
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE

C30-B

PCM

SCMF16101L

FAIL-SAFE MODE

Mode	Description	Symptom	Possible Cause
MODE 1	FORCED ENGINE SHUTDOWN	Engine stop	• ETC system can't proceed reliable algorithm procedure - Fatal PCM internal programming error - Faulty intake system or throttle body
MODE 2	FORCED IDLE & POWER MANAGEMENT	Forced idle state controlled by fuel quantity regulation and ignition timing adjustment	• ETC system can't control engine power via throttle device • Disabled throttle control or broken throttle position information
MODE 3	FORCED IDLE	Forced idle state and no response for accelerator activation	• No information about the accelerator position - Malfuctioning APS 1 and 2, faulty A/D converter or internal controller
MODE 4	LIMIT PERFORMANCE & POWER MANAGEMENT	Engine power is determined by accelerator position and idle power requirement (Limited vehicle running)	• ETC system can't securely control engine power
MODE 5	LIMIT PERFORMANCE	1. Engine power varies with accelerator position, but driver perceives lack of engine power. 2. MIL ON (Normal vehicle running)	• Not reliable accelerator position signal or bad maximum power generation - Faulty APS, ignition voltage or internal controller
MODE 6	NORMAL	Normal	

COMPONENT INSPECTION

THROTTLE POSITION SENSOR (TPS)

1. Connect a scantool on Diagnoisis Link Connector (DLC).

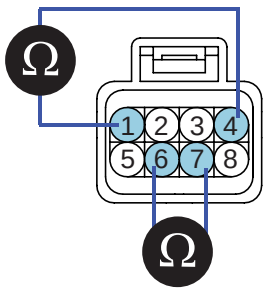
2. Start engine and check output voltages of TPS 1 and 2 at C.T and W.O.T.

Condition	Output Voltage (V)	
	TPS 1	TPS 2
C.T	0.25 ~ 0.9V	Min. 4.0V
W.O.T	Min. 4.0V	0.25 ~ 0.9V

3. Turn ignition switch OFF and disconnect the scantool from the DLC.

4. Disconnect ETC module connector and measure resistance between ETC module terminals 4 and 1 (TPS 1).

5. Measure resistance between ETC module terminals 7 and 6 (TPS 2).

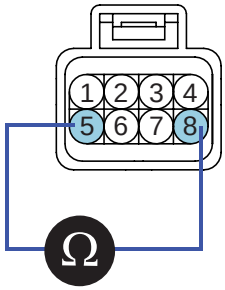


SCMF16102L

Specification: Refer to SPECIFICATION.

ETC MOTOR

1. Disconnect ETC module connector and measure resistance between ETC module terminals 5 and 8.



SCMF16103L

Specification: Refer to SPECIFICATION.

ETC SYSTEM INITIALIZATION

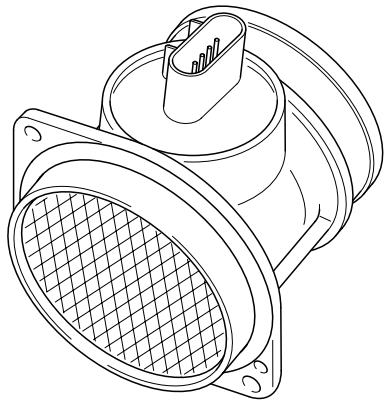
1. Erase DTC(s) memorized in PCM with a scan tool.
2. Turn ignition switch off and wait for about 10 seconds.
3. Turn ignition switch on for more then 1 second. (At this time, the PCM records initial position of ETC motor on its EEPROM).

MASS AIR FLOW SENSOR (MAFS)

INSPECTION ECF3BEA5

FUNCTION AND OPERATION PRINCIPLE

Mass Air Flow Sensor (MAFS) is a hot-film type sensor and is located in between the air cleaner and the throttle body. It consists of a tube, a sensor assembly and honeycomb cell and detects intake air quantity flowing into the intake manifold. Air flows from the air cleaner assembly through the honeycomb cell and over the hot film element. At this time, heat transfer is generated by convection and this sensor loses its energy. This sensor detects the mass air flow by using the energy loss and transfers the information to the PCM by frequency. The PCM calculates fuel quantity and ignition timing.



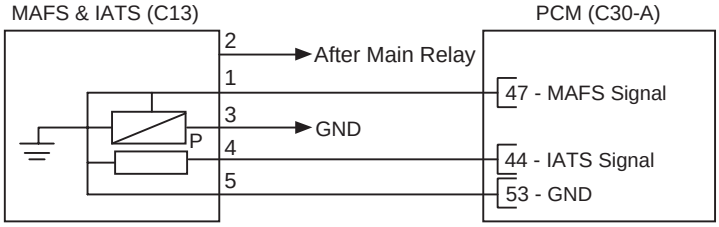
KFCF1021

SPECIFICATION

Air Flow (kg/h)	Output Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz
486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

CIRCUIT DIAGRAM

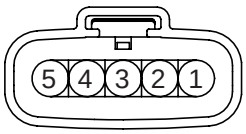
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

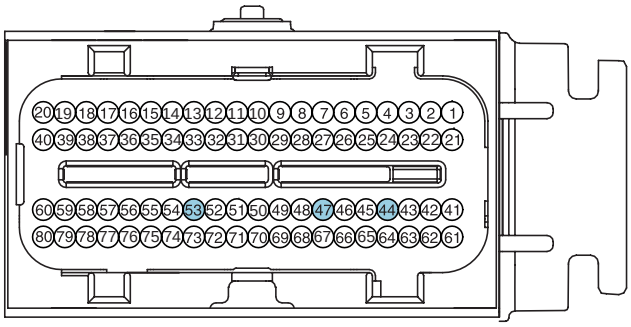
Terminal	Connected to	Function
1	PCM C30-A (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C30-A (44)	IATS Signal
5	PCM C30-A (53)	Sensor Ground

[HARNESS CONNECTORS]



C13

MAFS & IATS



C30-A

PCM

SCMF16104L

COMPONENT INSPECTION

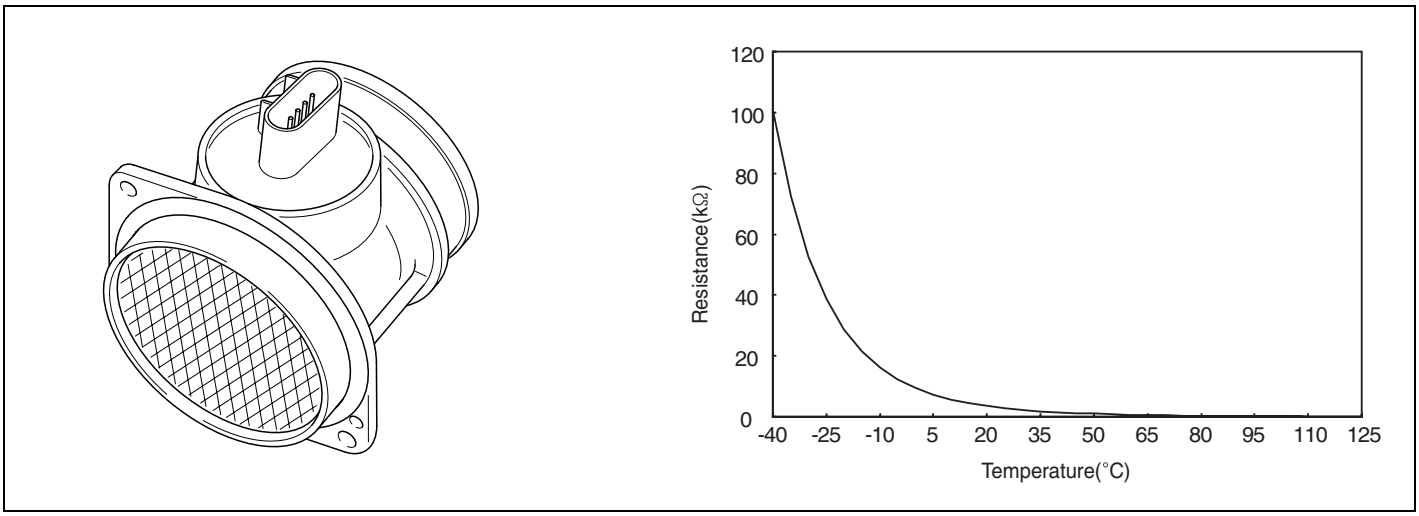
1. Check the MAFS visually.
   - Mounting direction correct.
   - Any contamination, corrosion or damage on connector.
   - Air cleaner's clogging or wet.
   - MAFS cylinder's deforming or blocking by any foreign material.

2. Check any leakage on intake system and intercooler system.

INTAKE AIR TEMPERATURE SENSOR (IATS)

INSPECTION EF56EBCD

FUNCTION AND OPERATION PRICIPLE



EGRF238A

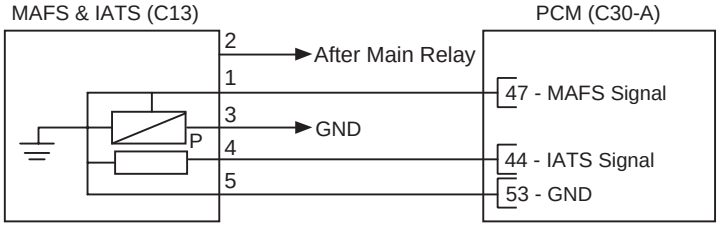
Intake Air Temperature Sensor (IATS) is installed inside the Mass Air Flow Sensor (MAFS) and detects the intake air temperature. To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the PCM uses not only MAFS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the temperature.

SPECIFICATION

Temperature		Resistance (kΩ)
℃	˚F	
-40	-40	100.87
-20	-4	28.58
0	32	9.40
10	50	5.66
20	68	3.51
40	104	1.47
60	140	0.67
80	176	0.33

CIRCUIT DIAGRAM

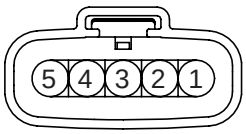
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

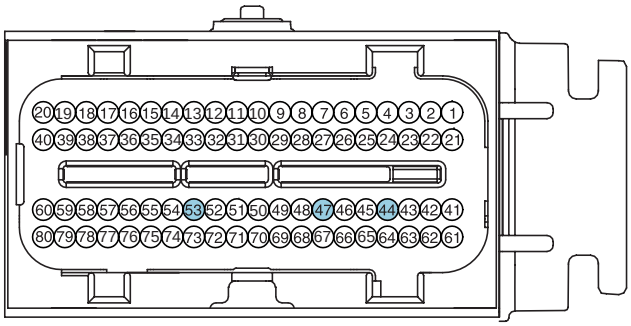
Terminal	Connected to	Function
1	PCM C30-A (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C30-A (44)	IATS Signal
5	PCM C30-A (53)	Sensor Ground

[HARNESS CONNECTORS]



C13

MAFS & IATS



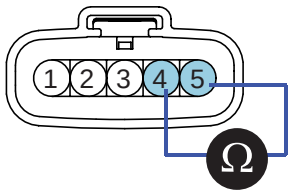
C30-A

PCM

SCMF16104L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect IATS connector.
3. Measure resistance between IATS terminals 4 and 5.



SCMF16146L

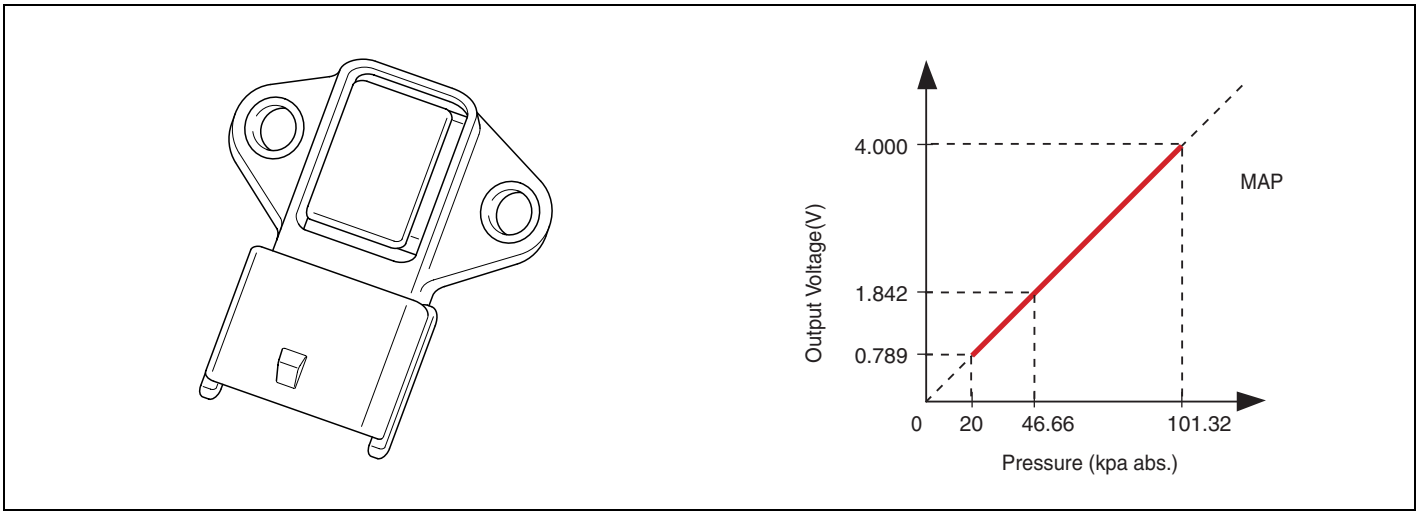
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAPS)

INSPECTION E99BD12F

FUNCTION AND OPERATION PRICIPLE



LGLG002A

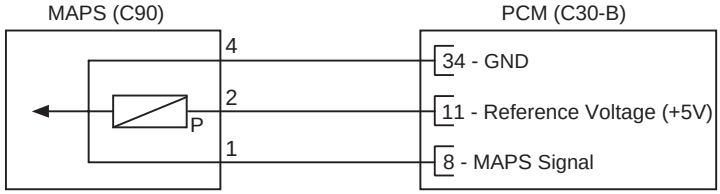
Manifold Absolute Pressure Sensor (MAPS) is speed-density type sensor and is installed on the surge tank. This MAPS senses absolute pressure in surge tank and transfers this analog signal proportional to the pressure to the PCM. The PCM calculates the intake air quantity and engine speed based on this signal. This MAPS consists of piezo-electric element and hybrid IC that amplifies the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. 100% vacuum and the manifold pressure applies to both sides of it respectively. That is, this sensor outputs the silicon variation proportional to pressure change by voltage.

SPECIFICATION

Pressure(kPa)	Output Voltage (V)
20.0	0.79
46.66	1.84
101.32	4.0

CIRCUIT DIAGRAM

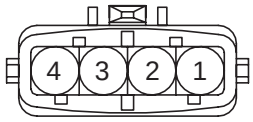
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

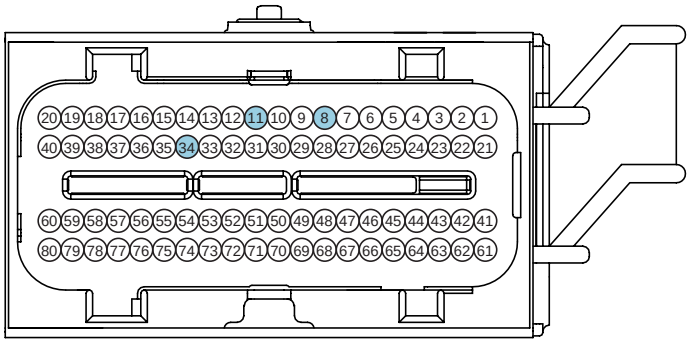
Terminal	Connected to	Function
1	PCM C30-B (8)	MAPS Signal
2	PCM C30-B (11)	Reference Voltage (+5V)
3	-	-
4	PCM C30-B (34)	Sensor ground

[HARNESS CONNECTORS]



C90

MAPS



C30-B

PCM

SCMF16105L

COMPONENT INSPECTION

1. Connect a scantool on Diagnisis Link Connector (DLC).

2. Check MAPS output voltage at idle and IG ON.

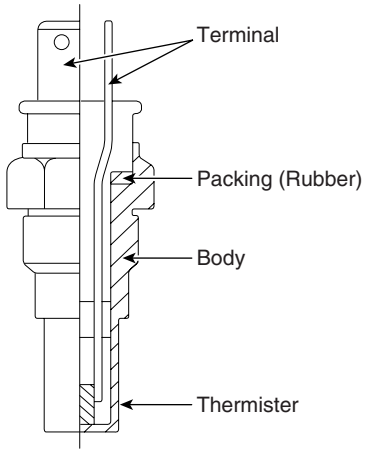
Condition	Output Voltage (V)
Idle	0.8V ~ 1.6V
IG ON	3.9V ~ 4.1V

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

INSPECTION E6DCDBAC

FUNCTION AND OPERATION PRICIPLE

Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the PCM is supplied to the ECTS via a resistor in the PCM.That is, the resistor in the PCM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the PCM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



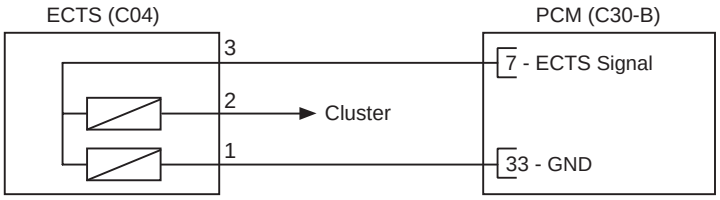
EGRF241A

SPECIFICATION

Temperature		Resistance(kΩ)
℃	˚F	
-40	-40	48.14
-20	-4	14.13 ~ 16.83
0	32	5.79
20	68	2.31 ~ 2.59
40	104	1.15
60	140	0.59
80	176	0.32

CIRCUIT DIAGRAM

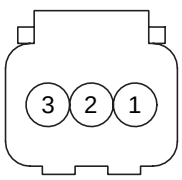
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

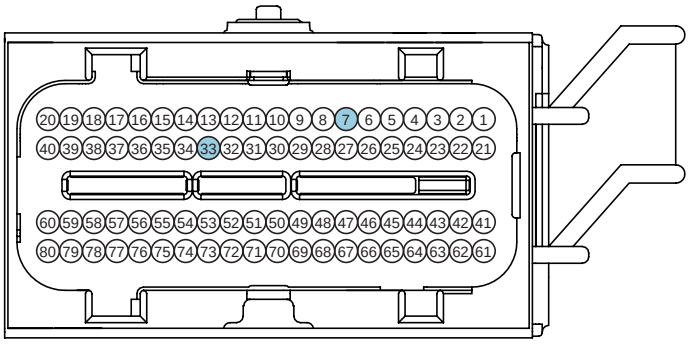
Terminal	Connected to	Function
1	PCM C30-B (33)	Sensor ground
2	Cluster	-
3	PCM C30-B (7)	ECTS Signal

[HARNESS CONNECTORS]



C04

ECTS



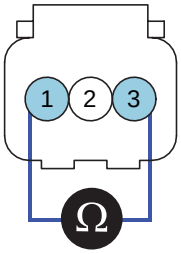
C30-B

PCM

SCMF16106L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect ECTS connector.
3. Remove the ECTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS terminals 1 and 3.

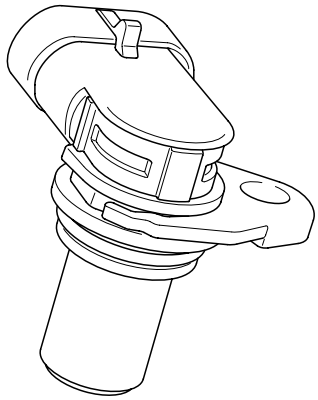


SCMF16107L

5. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

CAMSHAFT POSITION SENSOR (CMPS)

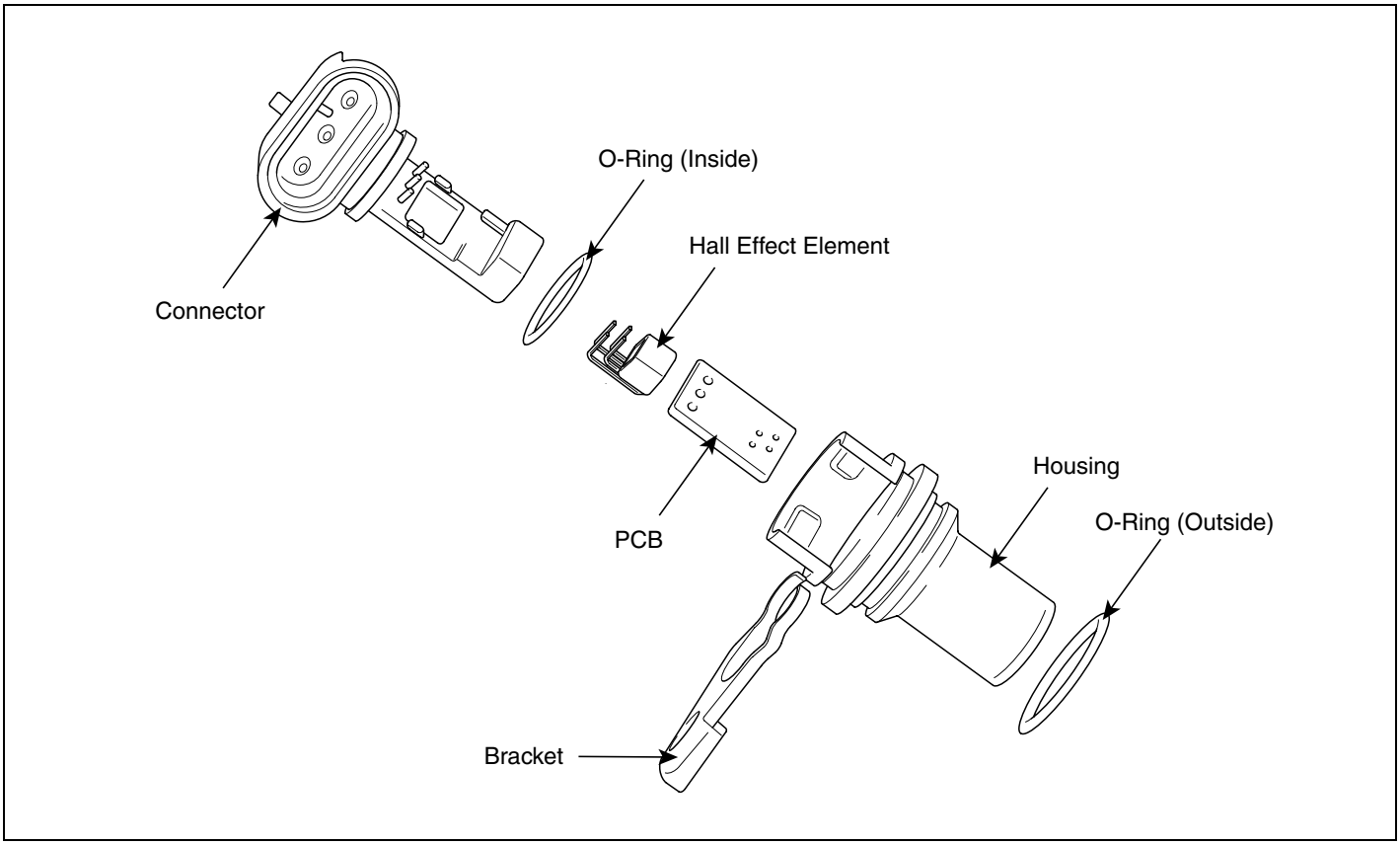


KFCF1022

INSPECTION E2A0AFAD

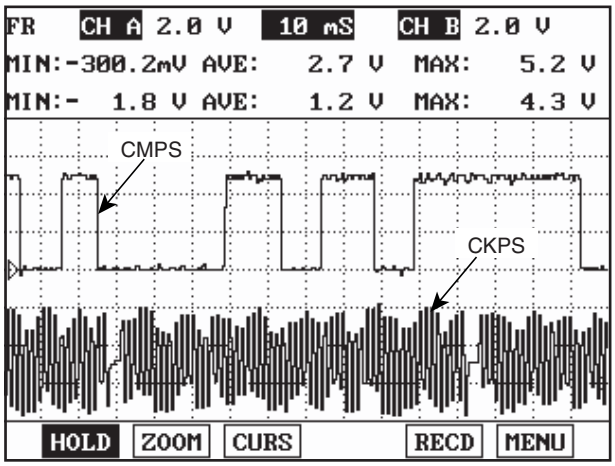
FUNCTION AND OPERATION PRICIPLE

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 each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover of bank 1 and 2 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.

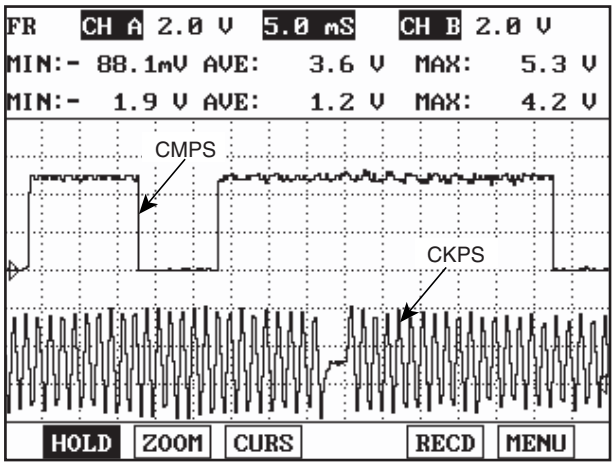


EGRF243A

WAVEFORM



At Idle

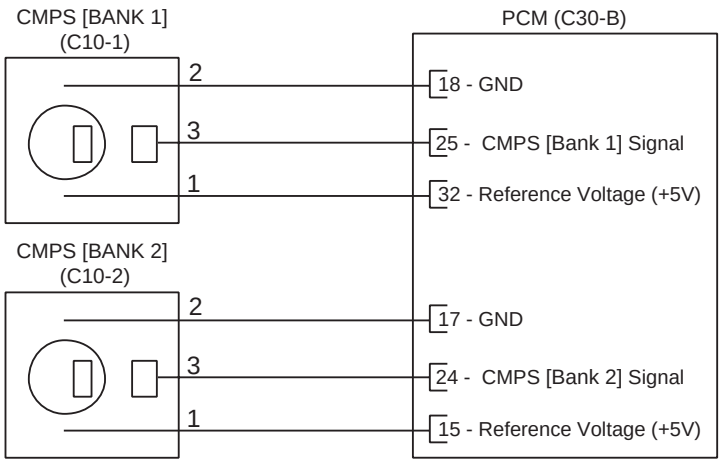


At Idle

LGLG002C

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

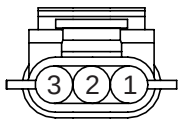
CMPS [BANK 1]

Terminal	Connected to	Function
1	PCM C30-B (32)	Reference Voltage (+5V)
2	PCM C30-B (18)	Sensor ground
3	PCM C30-B (25)	CMPS [Bank 1] signal

CMPS [BANK 2]

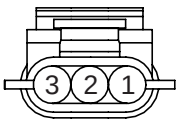
Terminal	Connected to	Function
1	PCM C30-B (15)	Reference Voltage (+5V)
2	PCM C30-B (17)	Sensor ground
3	PCM C30-B (24)	CMPS [Bank 2] signal

[HARNESS CONNECTORS]



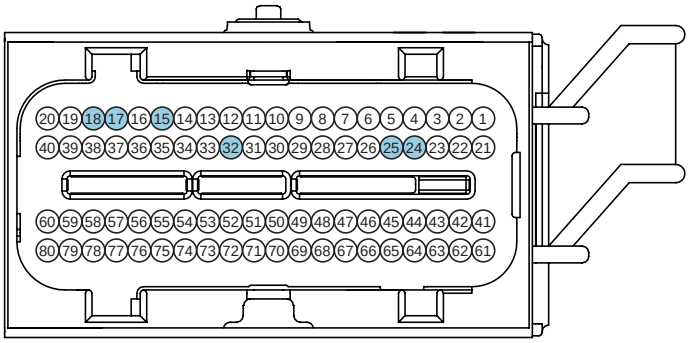
C10-1

CMPS [BANK 1]



C10-2

CMPS [BANK 2]



C30-B

PCM

SCMF16108L

COMPONENT INSPECTION

1. Check signal waveform of CMPS and CKPS using a scantool.

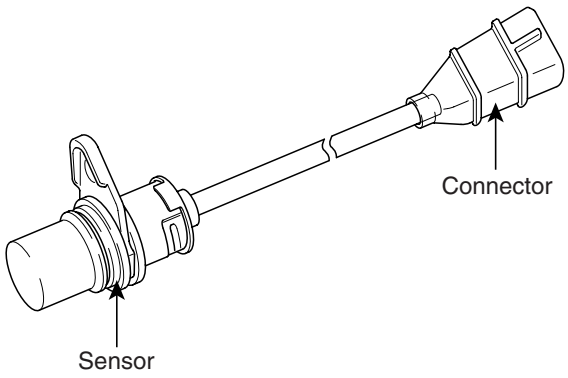
Specification : Refer to "WAVE FORM"

CRANKSHAFT POSITION SENSOR (CKPS)

INSPECTION EE4B998F

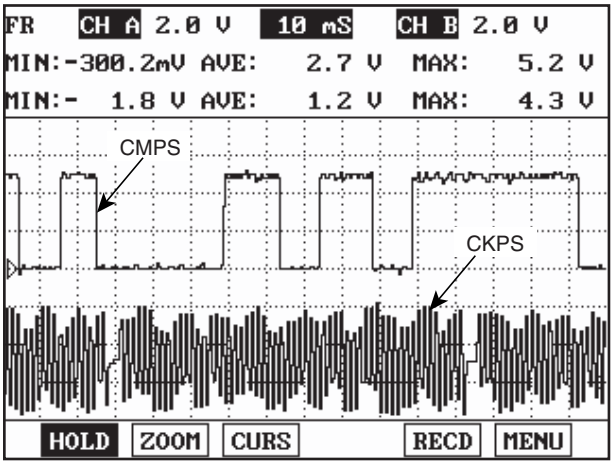
FUNCTION AND OPERATION PRICIPLE

Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, fuel is not supplied and the main relay does not operate. That is, vehicle can't run without CKPS signal. This sensor is installed on transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs. The target wheel consists of 58 slots and 2 missing slots on 360 CA (Crank Angle).

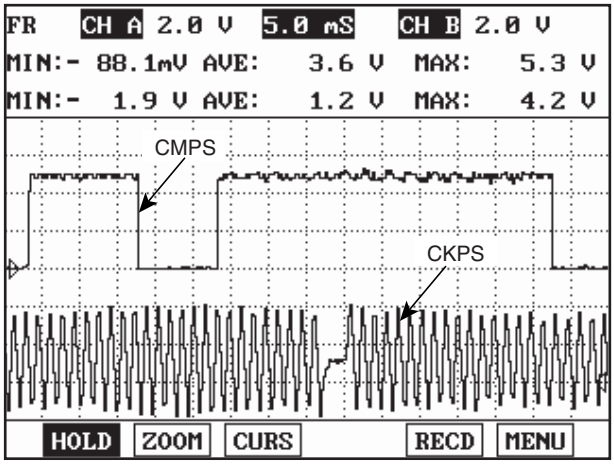


LGLG002D

WAVEFORM



At Idle

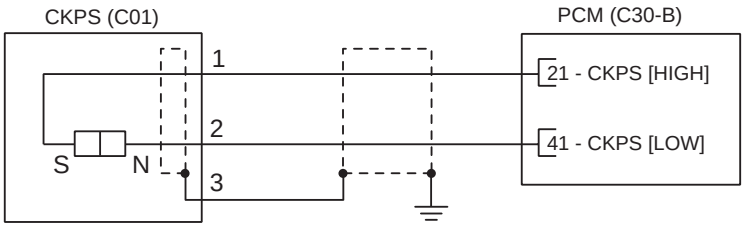


At Idle

LGLG002C

CIRCUIT DIAGRAM

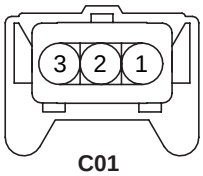
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

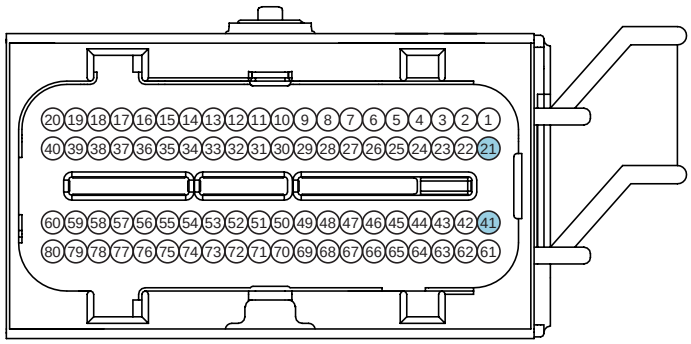
Terminal	Connected to	Function
1	PCM C30-B (21)	CKPS [HIGH] Signal
2	PCM C30-B (41)	CKPS [LOW] Signal
3	Chassis Ground	Sensor Shield

[HARNESS CONNECTORS]



C01

CKPS



C30-B

PCM

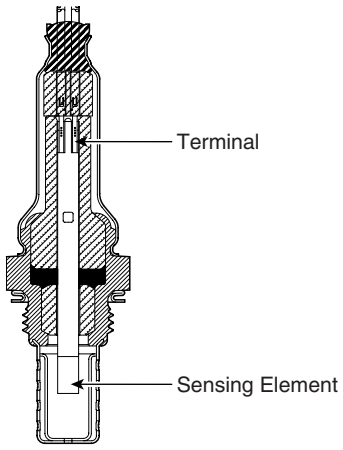
SCMF16109L

COMPONENT INSPECTION

1. Check signal waveform of CKPS and CMPS using a scantool.

Specification : Refer to "WAVE FORM"

HEATED OXYGEN SENSOR (HO2S)

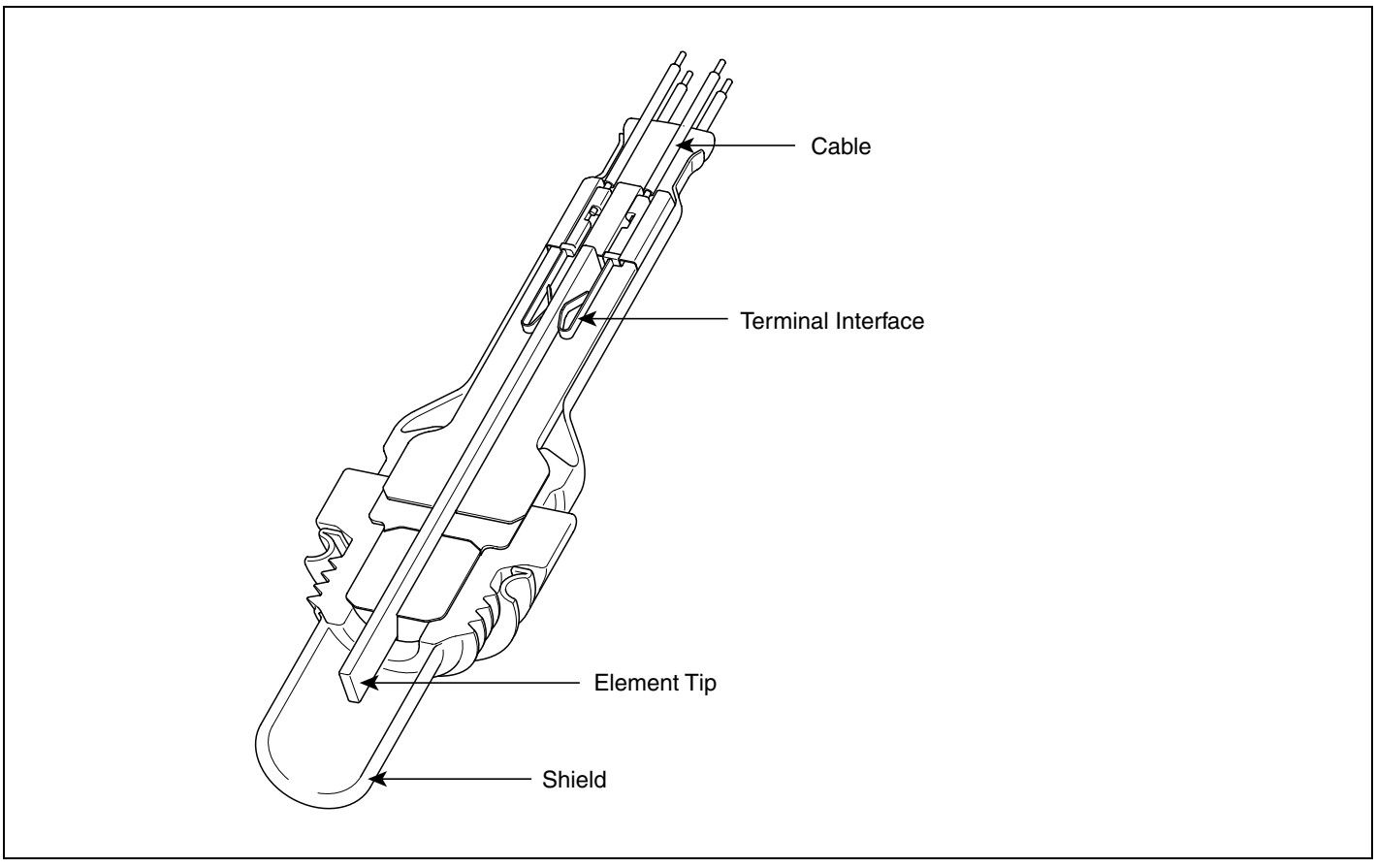


EGRF247A

INSPECTION E1DADE40

FUNCTION AND OPERATION PRICIPLE

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalyst Converter (MCC). After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the oxygen consistency of the exhaust gas to the PCM. When A/F ratio is rich or lean, it generates approximately 1V or 0V respectively. In order that this sensor normally operates, the temperature of the sensor tip is higher than 370℃ (698˚F). So it has a heater which is controlled by the PCM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



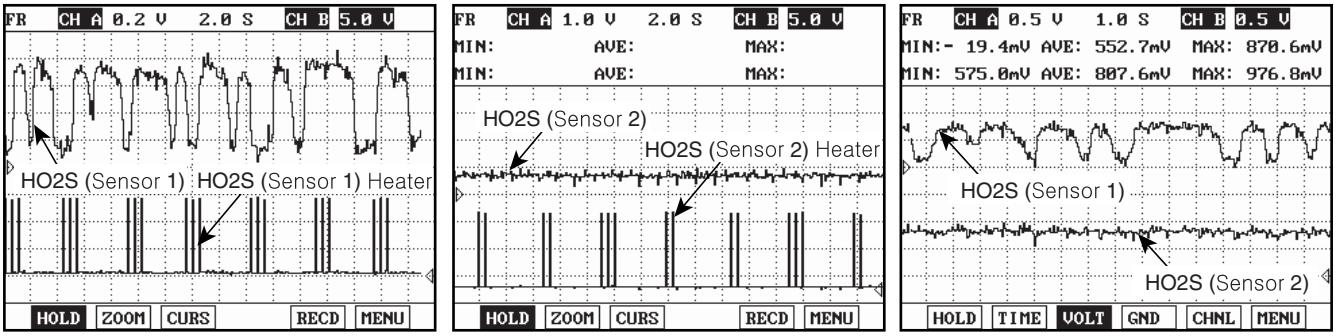
EGRF248A

SPECIFICATION

A/F Ratio	Output Voltage (V)
RICH	0.80 ~ 0.92
LEAN	0.1

Item	Specification
Heater Resistance (Ω)	3.0 ~ 4.0Ω at 21℃ (69.8˚F)

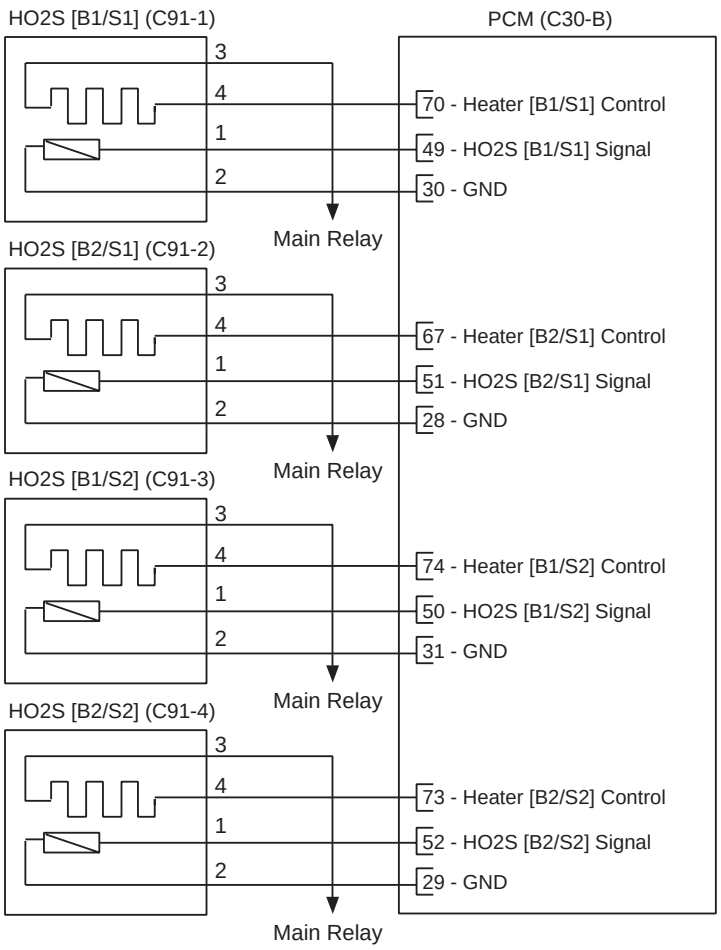
WAVEFORM



LGLG002E

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

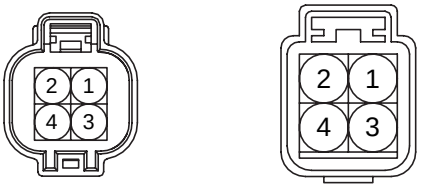
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]

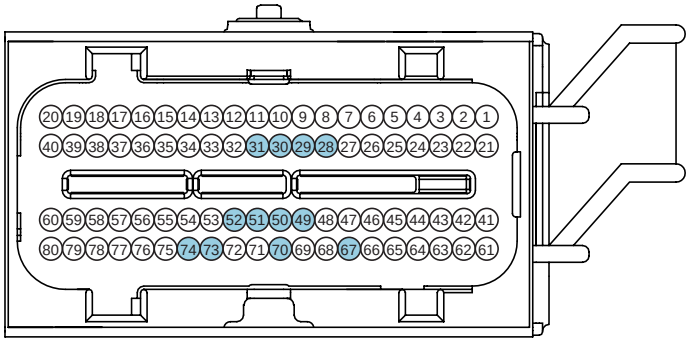


C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]

C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

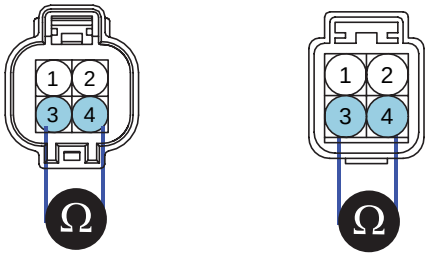
SCMF16110L

COMPONENT INSPECTION

1. Check signal waveform of HO2S using a scantool.

Specification: Refer to "waveform".

2. Disconnet the HO2S connector.
3. Measure resistance between HO2S heater terminals 3 and 4.

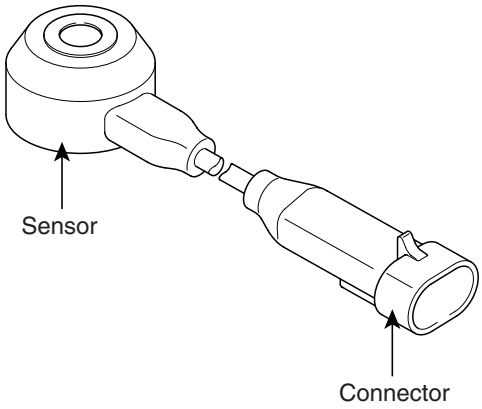


SCMF16111L

4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

KNOCK SENSOR (KS)

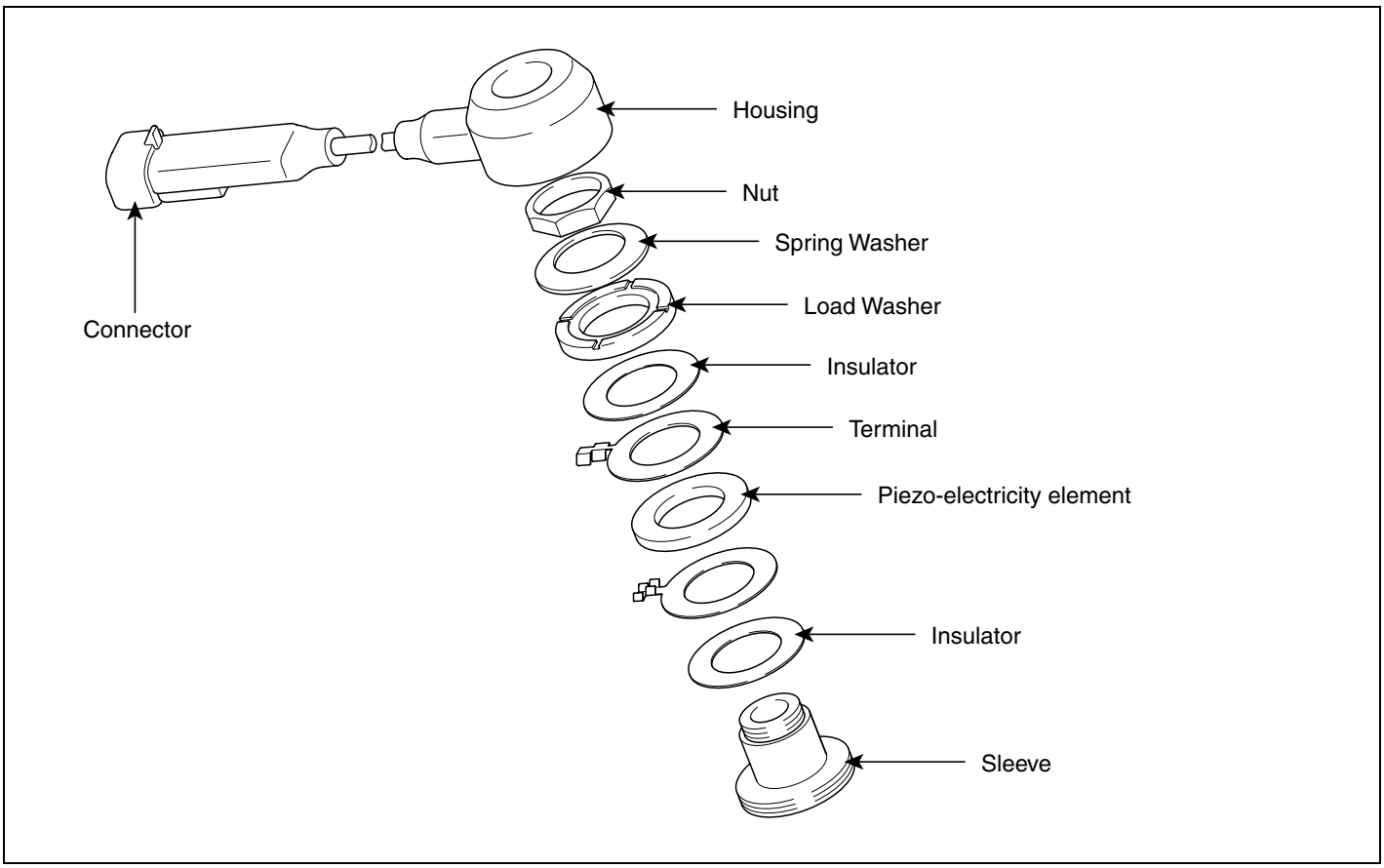


EGRF251A

INSPECTION EC4B1DA6

FUNCTION AND OPERATION PRICIPLE

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) senses engine knocking and the two sensors are installed inside the V-valley of the cylinder block. When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. At this time, this sensor transfers the voltage signal higher than the specified value to the PCM and the PCM retards the ignition timing. If the knocking disappears after retarding the ignition timing, the PCM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.

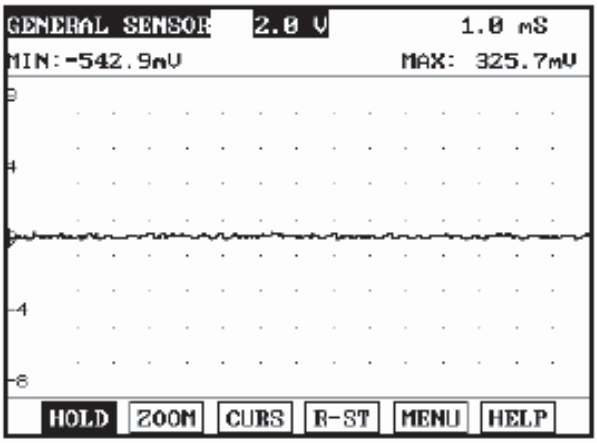


EGRF252A

SPECIFICATION

Item	Specification
Capacitance (pF)	950 ~ 1,350pF

WAVEFORM

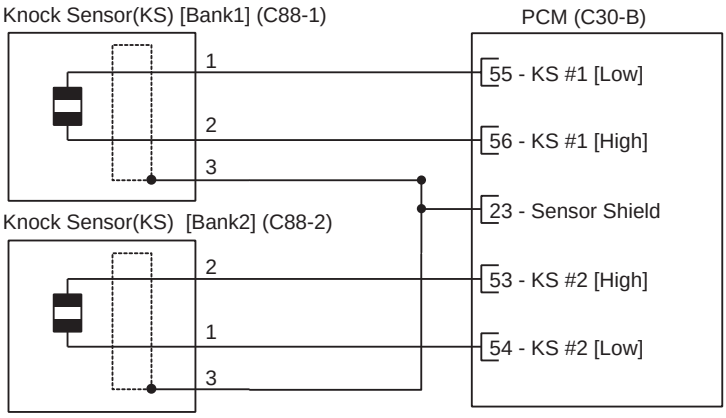


The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

EGRF610B

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

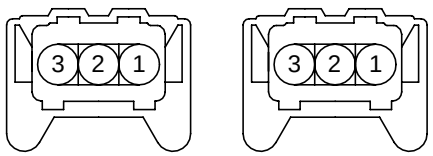
KS [Bank1]

Terminal	Connected to	Function
1	PCM C30-B (55)	KS #1 [Low] signal
2	PCM C30-B (56)	KS #1 [High] signal
3	PCM C30-B (23)	Shield ground

KS [Bank2]

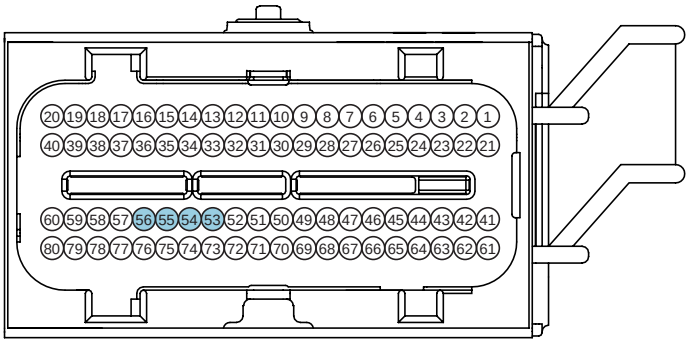
Terminal	Connected to	Function
1	PCM C30-B (54)	KS #2 [Low] signal
2	PCM C30-B (53)	KS #2 [High] signal
3	PCM C30-B (23)	Shield ground

[HARNESS CONNECTORS]



C88-1
KS [Bank1]

C88-2
KS [Bank2]



C30-B
PCM

SCMF16112L

INJECTOR

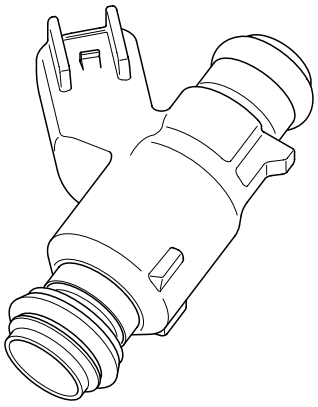
INSPECTION EBCA1EAE

FUNCTION AND OPERATION PRICIPLE

Based on information from various sensors, the PCM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time that the fuel injector is held open. The PCM controls each injector by grounding the control circuit. When the PCM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

CAUTION

If an injector connector is disconnected for more than 46 seconds while the engine runs, the PCM will determine that the cylinder is misfiring and cut fuel supply. So be careful not to exceed 46 seconds. But the engine runs normally in 10 seconds after turning the ignition key off.



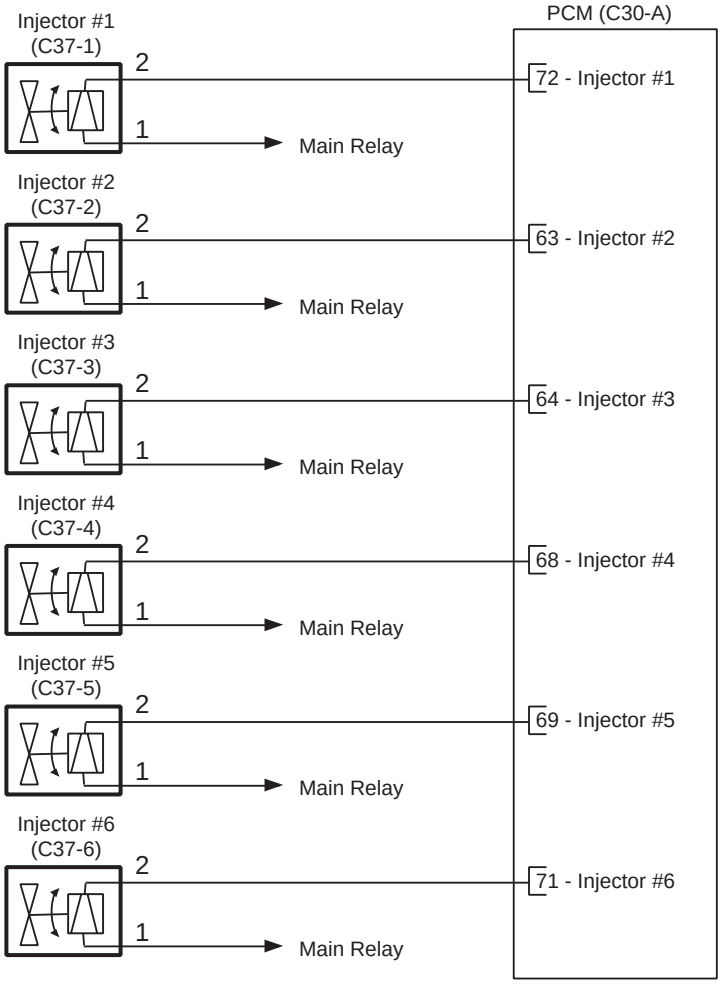
KFCF1026

SPECIFICATION

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

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C30-A (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C30-A (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C30-A (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C30-A (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

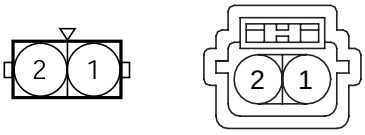
Injector #5

Terminal	Connected to	Function
1	PCM C30-A (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

Injector #6

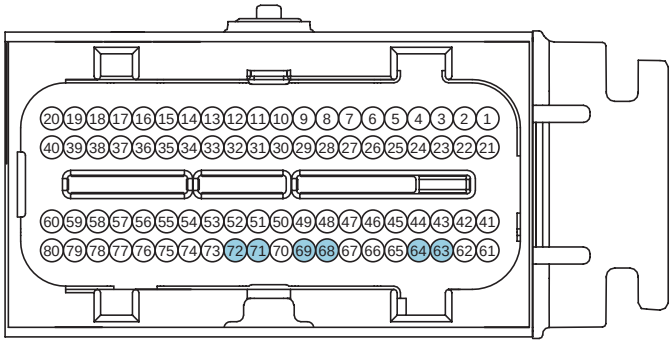
Terminal	Connected to	Function
1	PCM C30-A (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



C37-1,3,5
Injector #1,3,5

C37-2,4,6
Injector #2,4,6

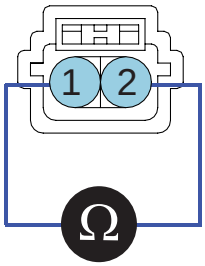


C30-A
PCM

SCMF16113L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect injector connector.
3. Measure resistance between injector terminals 1 and 2.

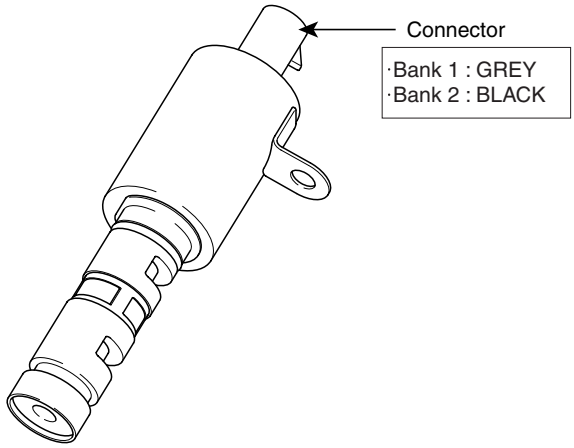


SCMF16114L

4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

CVVT OIL CONTROL VALVE (OCV)



EFBF1027

INSPECTION E4CF7FB9

FUNCTION AND OPERATION PRICIPLE

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into an assembly mounted on each intake camshaft through PCM control of an oil control valve. This system uses two oil control valves, one on each bank. An Oil Temperature Sensor (OTS) is used to allow PCM monitoring of engine oil temperature. As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements..

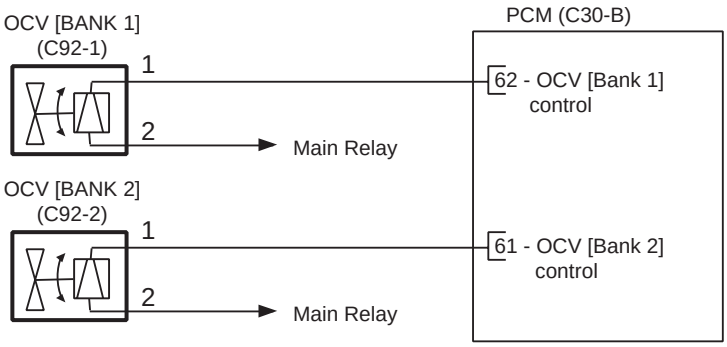
1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7Ω at 20℃ (68˚F)

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

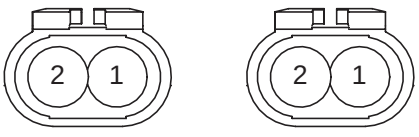
OCV [BANK 1]

Terminal	Connected to	Function
1	PCM C30-B (62)	OCV [Bank 1] control
2	Main Relay	Battery Voltage (B+)

OCV [BANK 2]

Terminal	Connected to	Function
1	PCM C30-B (61)	OCV [Bank 2] control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]

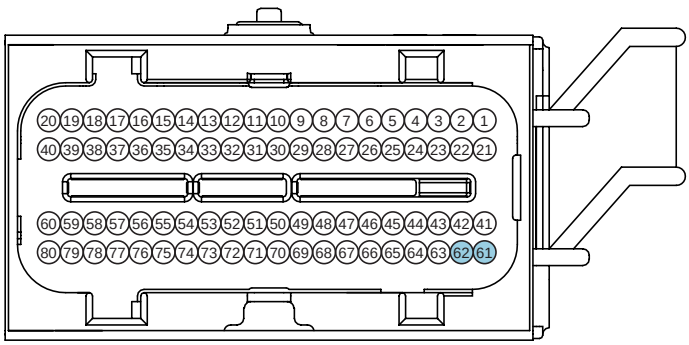


C92-1

OCV [Bank 1]

C92-2

OCV [Bank 2]



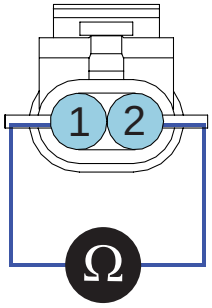
C30-B

PCM

SCMF16115L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect OCV connector.
3. Measure resistance between OCV terminals 1 and 2.



SCMF16116L

Specification: Refer to SPECIFICATION.

INSTALLATION E4DB08BD

CAUTION

If the OCVs are installed incorrectly, the vehicle may be damaged.
So when installing them, ensure the OCV and harness connector colors match(Components and harness side).

4. Check that the resistance is within the specification.

[BANK AND ITS COLOR]

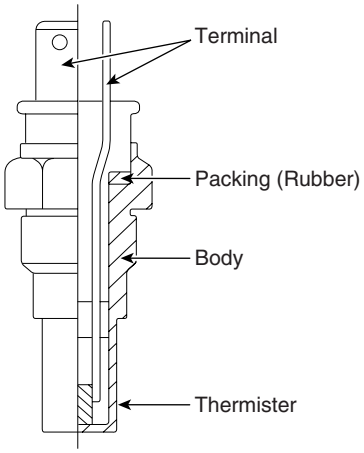
Bank	Component side	Harness side
Bank 1 (RH)	Grey	Grey
Bank 2 (LH)	Black	Black

CVVT OIL TEMPERATURE SENSOR(OTS)

INSPECTION E046CB17

FUNCTION AND OPERATION PRICIPLE

The CVVT Oil Temperature Sensor (OTS) is a negative coefficient thermistor used by the PCM tl measure engine oil temperature for the purpose of adjusting CVVT calculations.



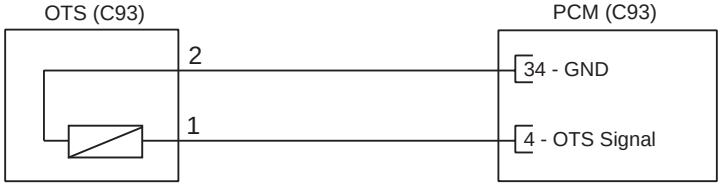
EGRF241A

SPECIFICATION

Temperature		Resistance (kΩ)
℃	°F	
-40	-40	52.0
-20	-4	16.5
0	32	6.0
20	68	2.45
40	104	1.10
60	140	0.544
80	176	0.290
100	212	0.164
120	248	0.099

CIRCUIT DIAGRAM

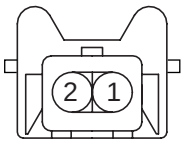
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

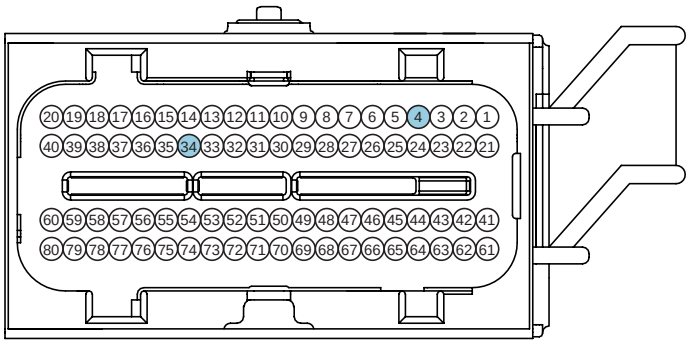
Terminal	Connected to	Function
1	PCM C30-B (4)	OTS Signal
2	PCM C30-B (34)	Sensor ground

[HARNESS CONNECTORS]



C93

OTS



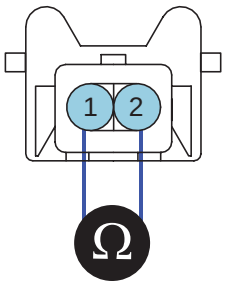
C30-B

PCM

SCMF16117L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect OTS connector.
3. Remove the OTS.
4. After immersing the thermistor of the sensor into water (or engine coolant), measure resistance between OTS terminals 1 and 2.

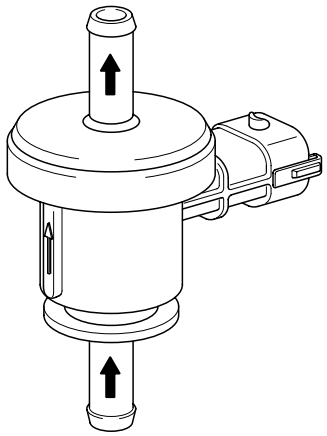


SCMF16118L

5. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

PURGE CONTROL SOLENOID VALVE (PCSV)



KGBF004W

INSPECTION EDCE4B32

FUNCTION AND OPERATION PRICIPLE

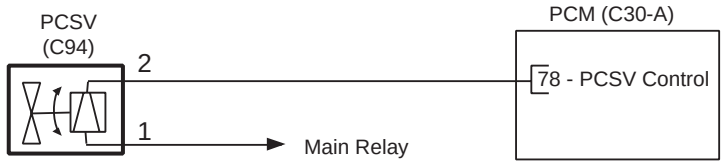
Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the PCM grounds the valve control line. When the passage is open (PCSV ON), fuel vapors stored in the canister is transferred to the intake manifold.

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	14.0 ~ 18.0Ω at 20℃ (68˚F)

CIRCUIT DIAGRAM

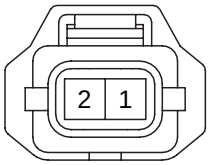
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

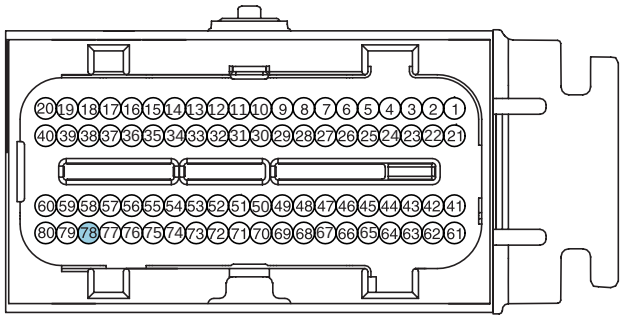
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	PCM C30-A (78)	PCSV Control

[HARNESS CONNECTORS]



C94

PCSV



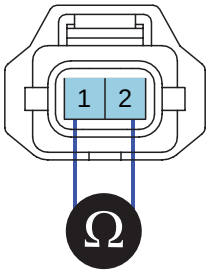
C30-A

PCM

SCMF16119L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect PCSV connector.
3. Measure resistance between PCSV terminals 1 and 2.



SCMF16120L

4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

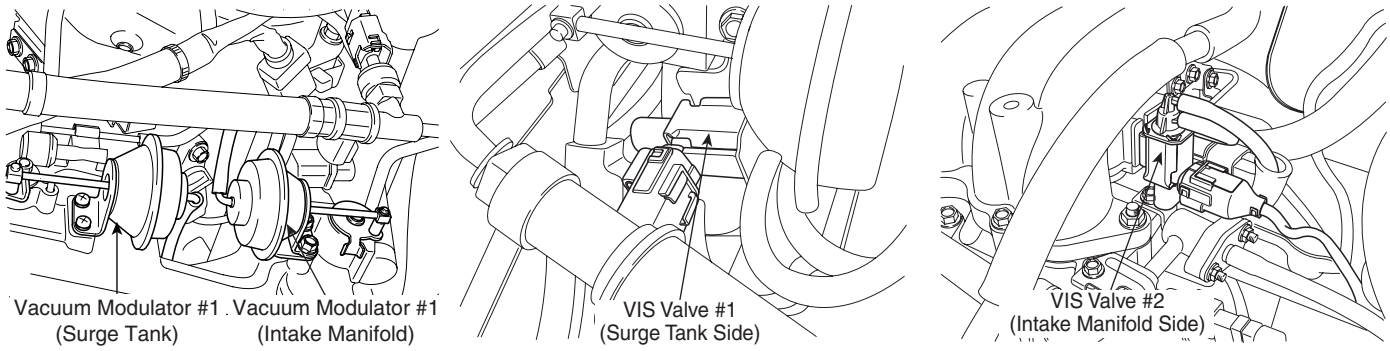
VARIABLE INTAKE SOLENOID (VIS) VALVE

INSPECTION E7DF6662

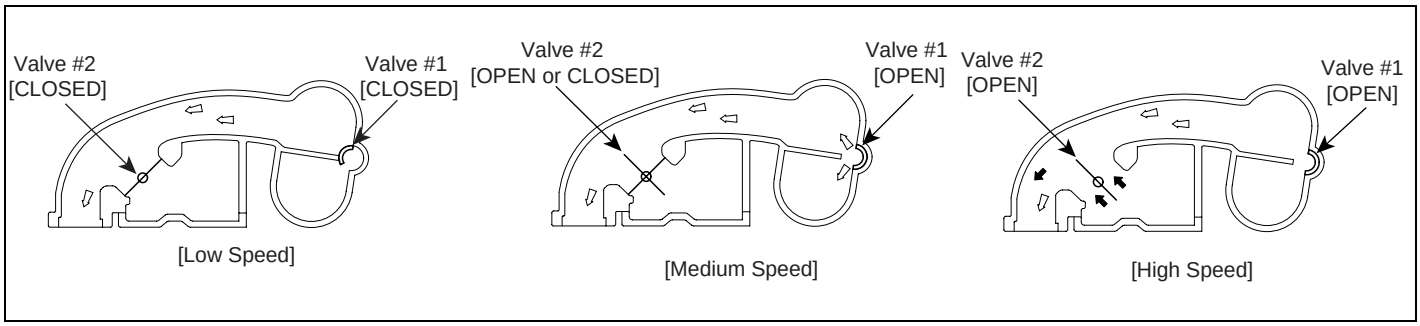
FUNCTION AND OPERATION PRICIPLE

Variable Intake manifold Solenoid (VIS) valves are installed on surge tank (VIS Valve #1) and intake manifold (VIS Valve #2). These VIS valve #1 and #2 control vacuum modulators which activate valves in surge tank and intake manifold. These valves are opened or closed by PCM according to engine condition (Refer to below table).

Engine Condition	VIS Valve #1 (Surge Tank)	VIS Valve #2 (In-manifold)	Operation
Low Speed	Closed	Closed	Increasing engine performance in low engine speed by reducing intake interference among cylinders
Medium Speed	Open	Open or closed	Increasing intake efficiency
High Speed	Open	Open	Minimizing intake resistance by shortening intake manifold length and increasing area of air entrance



LGLG002K

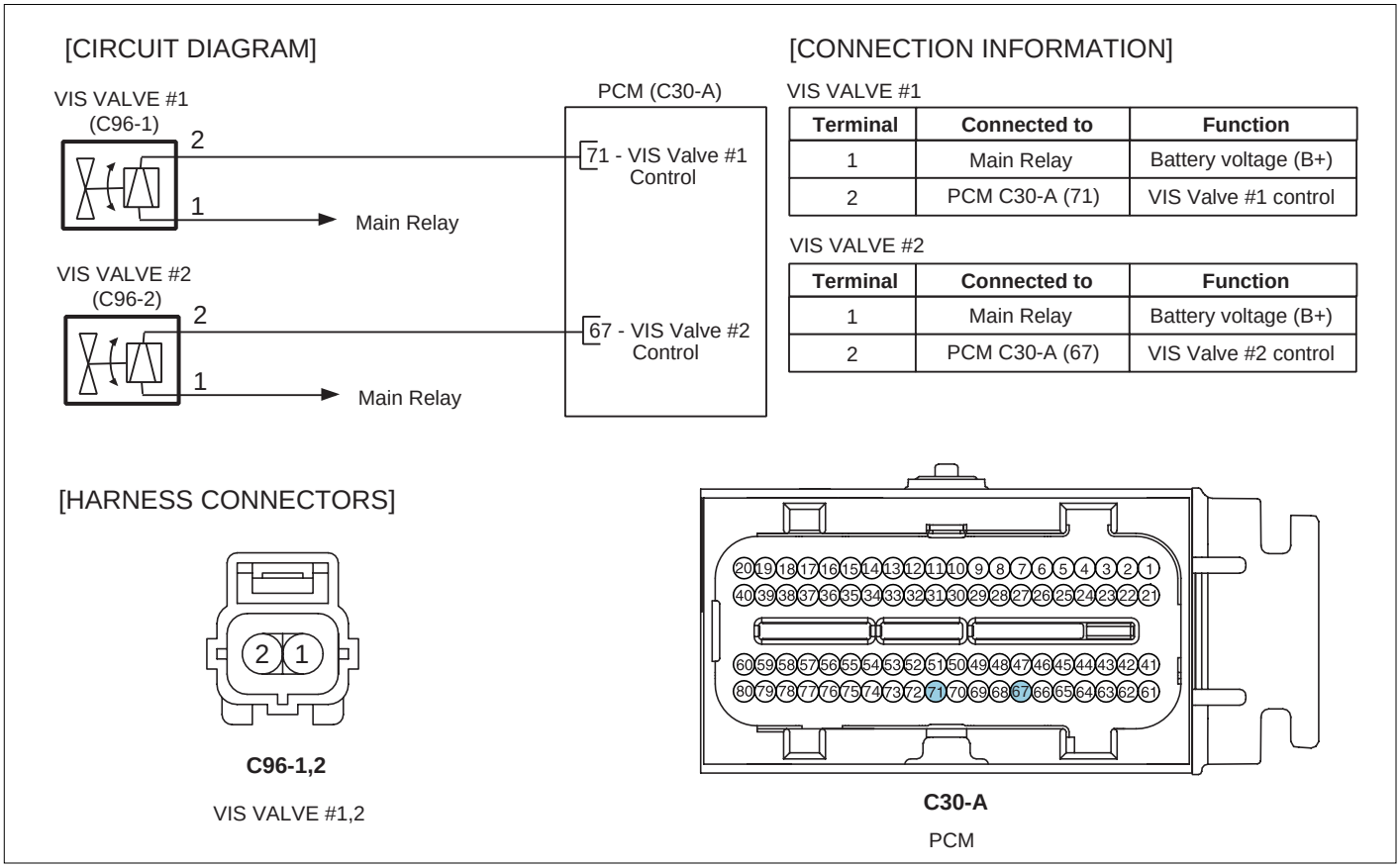


SCMF16004L

SPECIFICATION

Item	Specification
Coil Resistance (Ω)	29.0 ~ 35.0 Ω at 20℃ (68˚F)

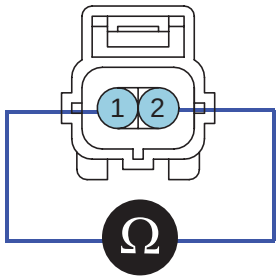
CIRCUIT DIAGRAM



SCMF16121L

COMPONENT INSPECTION

1. Turn ignition switch OFF.
2. Disconnect VIS Valve connector.
3. Measure resistance between VIS Valve #1,2 terminals 1 and 2.



SCMF16122L

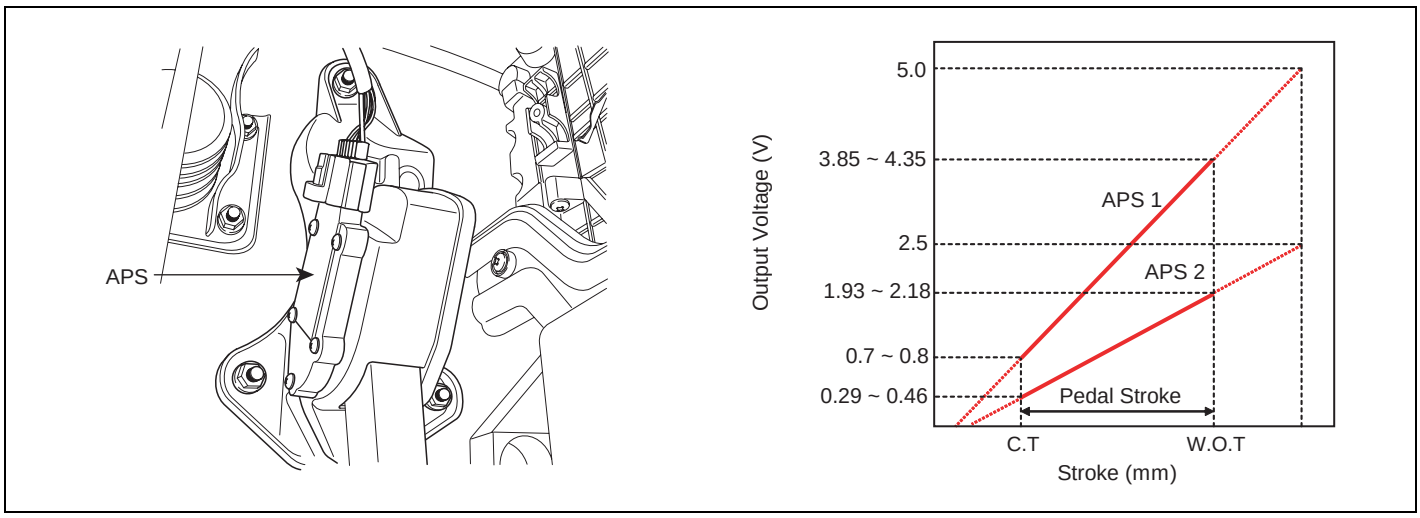
4. Check that the resistance is within the specification.

Specification: Refer to SPECIFICATION.

ACCELERATOR POSITION SENSOR (APS)

INSPECTION EFDE8560

FUNCTION AND OPERATION PRICIPLE



SCMF16123L

Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that a malfunction has occurred.

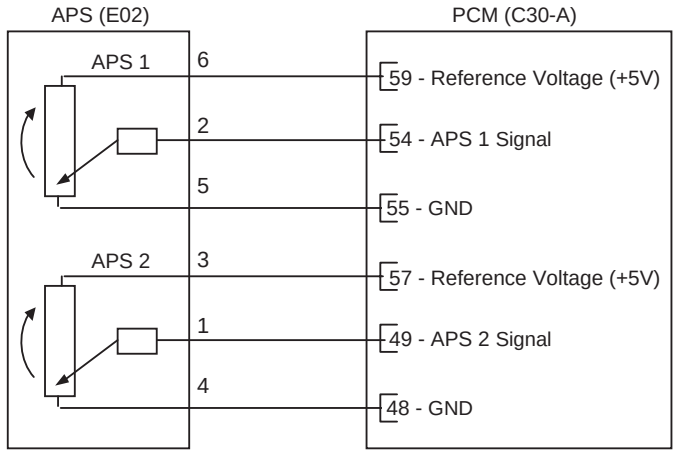
SPECIFICATION

Pedal Position	Output Voltage (V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

Item	Sensor Resistance
APS1	0.7 ~ 1.3kΩ at 20℃ (68°F)
APS2	1.4 ~ 2.6kΩ at 20℃ (68°F)

CIRCUIT DIAGRAM

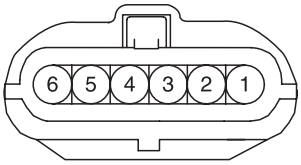
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

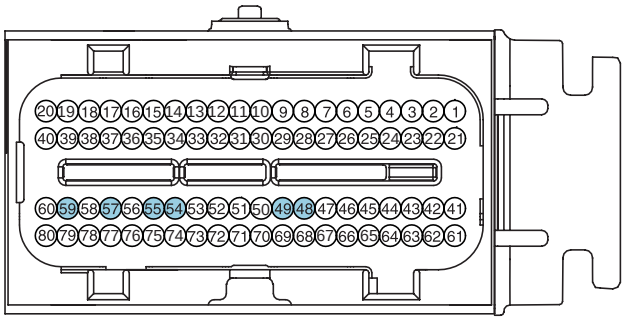
Terminal	Connected to	Function
1	PCM C30-A (49)	APS 2 Signal
2	PCM C30-A (54)	APS 1 Signal
3	PCM C30-A (57)	APS 2 Reference Voltage (+5V)
4	PCM C30-A (48)	APS 2 Ground
5	PCM C30-A (55)	APS 1 Ground
6	PCM C30-A (59)	APS 1 Reference Voltage (+5V)

[HARNESS CONNECTORS]



E02

APS



C30-A

PCM

SCMF16124L

COMPONENT INSPECTION

1. Connect a scantool on Diagnoisis Link Connector (DLC).
2. Start engine and check output voltages of APS 1 and 2 at C.T and W.O.T.

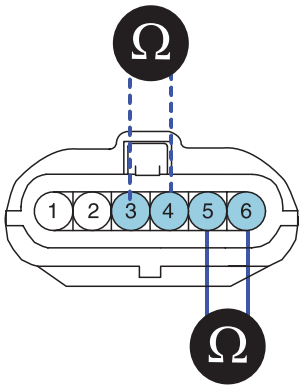
SPECIFICATION

Condition	Output Voltage (V)	
	APS1	APS2
C.T	0.70 ~ 0.80	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

3. Turn ignition switch OFF and disconnect the scantool from the DLC.
4. Disconnect APS connector and measure resistance between APS terminals 5 and 6 (APS 1).

Specification: Refer to SPECIFICATION.

5. Disconnect APS connector and measure resistance between APS terminals 3 and 4 (APS 2).



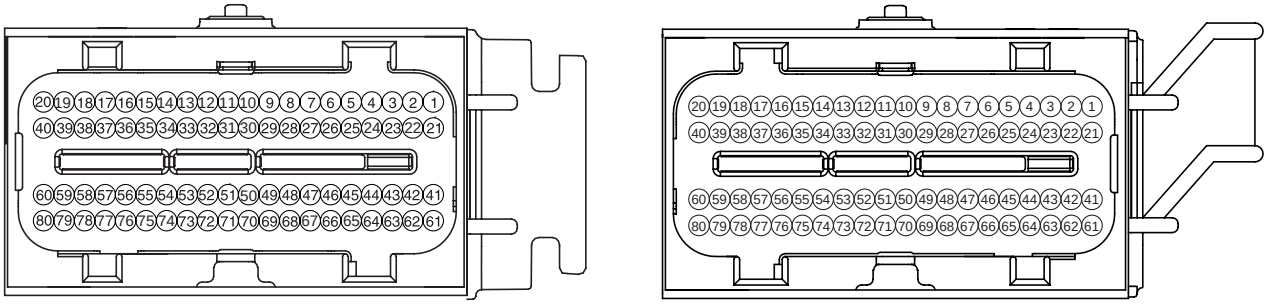
SCMF16125L

Specification: Refer to SPECIFICATION.

POWERTRAIN CONTROL MODULE (PCM)

POWERTRAIN CONTROL MODULE (PCM) E75F1EFA

1. HARNESS CONNECTOR



SCMF16126L

2. TERMINAL FUNCTION

CONNECTOR [C30-A]

Pin No.	Description	Connected to
1	2nd CAN [High]	Multi-Purpose Check Connector
2	2nd CAN [Low]	Multi-Purpose Check Connector
3	-	
4	-	
5	-	
6	-	
7	-	
8	-	
9	-	
10	Power Steering Switch signal input	Power Steering Switch
11	-	
12	-	
13	Clutch Switch signal input	Clutch Switch
14	-	
15	Alternator load signal input	Alternator
16	Cruise Switch ground	Cruise Switch
17	-	
18	A/C switch "ON" signal input	A/C Switch
19	-	
20	-	

Pin No.	Description	Connected to
21	Brake switch signal input	Brake Switch
22	-	
23	Brake lamp signal input	Brake Switch
24	-	
25	Cruise Switch signal input	Cruise Switch
26	A/C thermal switch signal input	A/C Thermal Switch
27	Diagnostic Data Line (K-Line)	Data Link Connector (DLC)
28	-	
29	-	
30	-	
31	-	
32	A/C Pressure Transducer signal input	A/C Pressure Transducer (APT)
33	Sensor ground	A/C Pressure Transducer (APT)
34	-	
35	-	
36	-	
37	-	
38	Battery voltage supply after main relay	Main Relay
39	Battery voltage supply after main relay	Main Relay
40	Battery voltage supply after main relay	Main Relay
41	CAN [High]	ABS/ESP Control Module, 4WD ECM, etc.
42	CAN [Low]	ABS/ESP Control Module
43	Main Relay control output	Main Relay
44	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)
45	Immobilizer communication line	Immobilizer control module
46	-	
47	Mass Air Flow Sensor signal input	Mass Air Flow Sensor (MAFS)
48	Sensor ground	Accelerator Position Sensor (APS) #2
49	Accelerator Position Sensor #2 signal input	Accelerator Position Sensor (APS) #2
50	-	
51	Cruise "SET" lamp control output	Cruise "SET" Lamp
52	Vehicle speed signal input	ABS/ESP Control Module (With ABS/ESP [Euro-Ⅲ/Ⅳ])
		Vehicle Speed Sensor (VSS) (Except Euro-Ⅲ/Ⅳ)
53	Sensor ground	Intake Air Temperature Sensor (IATS)
54	Accelerator Position Sensor #1 signal input	Accelerator Position Sensor (APS) #1
55	Sensor ground	Accelerator Position Sensor (APS) #1
56	-	

Pin No.	Description	Connected to
57	Reference voltage (+5V)	Accelerator Position Sensor (APS) #2
58	Reference voltage (+5V)	A/C Pressure Transducer (APT)
59	Reference voltage (+5V)	Accelerator Position Sensor (APS) #1
60	-	
61	Engine speed signal output	Cluster (Tachometer)
		4WD ECM
62	Fuel consumption signal output	Trip Computer
63	Malfunction Indicator Lamp (MIL) control output	Cluster (Malfunction Indicator Lamp)
64	A/C Compressor Relay control output	A/C Compressor Relay
65	Cooling Fan [Low] control output	Cooling Fan Relay [Low]
66	Cooling Fan [High] control output	Cooling Fan Relay [High]
67	Variable Intake Solenoid Valve #2 control output	Variable Intake Solenoid (VIS) Valve #2 [Intake Manifold Side]
68	Throttle Position Sensor signal (PWM) output	ABS/ESP Control Module
69	Cruise "MAIN" lamp control output	Cruise "MAIN" Lamp
70	Fuel Pump Relay control output	Fuel Pump Relay
71	Variable Intake Solenoid Valve #1 control output	Variable Intake Solenoid (VIS) Valve #1 Surge Tank Side]
72	Immobilizer lamp control output	Immobilizer Lamp
73	-	
74	-	
75	-	
76	-	
77	-	
78	Purge Control Solenoid Valve control output	Purge Control Solenoid Valve (PCSV)
79	Wheel Speed Sensor [Low] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESP [Euro-Ⅲ/Ⅳ])
80	Wheel Speed Sensor [High] signal input	Wheel Speed Sensor (WSS)(Without ABS/ESP [Euro-Ⅲ/Ⅳ])

CONNECTOR [C30-B]

Pin No.	Description	Connected to
1	ETC Motor [-] control output	ETC Motor (in ETC Module)
2	ETC Motor [+] control output	ETC Motor (in ETC Module)
3	-	
4	CVVT Oil Temperature Sensor signal input	CVVT Oil Temperature Sensor (OTS)
5	-	
6	-	
7	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)

Pin No.	Description	Connected to
8	Manifold Absolute Pressure Sensor signal input	Manifold Absolute Pressure Sensor (MAPS)
9	-	
10	-	
11	Reference voltage (+5V)	Manifold Absolute Pressure Sensor (MAPS)
12	Battery voltage supply after ignition switch	Ignition Switch
13	Reference voltage (+5V)	Throttle Position Sensor (TPS) #2
14	Sensor ground	Throttle Position Sensor (TPS) #1
15	Reference voltage (+5V)	Camshaft Position Sensor (CMPS) [Bank 2]
16	Reference voltage (+5V)	Throttle Position Sensor (TPS) #1
17	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 2]
18	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1]
19	Ignition Coil (Cylinder #6) control output	Ignition Coil (Cylinder #6)
20	-	
21	Crankshaft Position Sensor [High] signal input	Crankshaft Position Sensor (CKPS)
22	-	
23	Sensor Shield	Knock Sensor (KS) [Bank 1], Knock Sensor (KS) [Bank 2]
24	Camshaft Position Sensor [Bank 2] signal input	Camshaft Position Sensor (CMPS) [Bank 2]
25	Camshaft Position Sensor [Bank 1] signal input	Camshaft Position Sensor (CMPS) [Bank 1]
26	-	
27	-	
28	Sensor ground	HO2S [B2 / S1] [Except for LEADED]
29	Sensor ground	HO2S [B2 / S2] [Euro-Ⅲ/Ⅳ]
30	Sensor ground	HO2S [B1 / S1] [Except for LEADED]
31	Sensor ground	HO2S [B1 / S2] [Euro-Ⅲ/Ⅳ]
32	Reference voltage (+5V)	Camshaft Position Sensor (CMPS) [Bank 1]
33	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Manifold Absolute Pressure Sensor (MAPS), CVVT Oil Temperature Sensor (OTS)
35	Power ground	Chassis Ground
36	Power ground	Chassis Ground
37	Power ground	Chassis Ground
38	Power ground	Chassis Ground
39	Power ground	Chassis Ground
40	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4)
41	Crankshaft Position Sensor [Low] signal input	Crankshaft Position Sensor (CKPS)
42	-	
43	-	

Pin No.	Description	Connected to
44	-	
45	-	
46	-	
47	-	
48	Throttle Position Sensor #1 signal input	Throttle Position Sensor (TPS) #1
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	HO2S (B1/S1) [Except for LEADED]
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	HO2S (B1/S2) [Euro-Ⅲ/Ⅳ]
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	HO2S (B2/S1) [Except for LEADED]
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	HO2S (B2/S2) [Euro-Ⅲ/Ⅳ]
53	Knock Sensor (KS) [Bank 2] [High] signal input	Knock Sensor (KS) [Bank 2]
54	Knock Sensor (KS) [Bank 2] [Low] signal input	Knock Sensor (KS) [Bank 2]
55	Knock Sensor (KS) [Bank 1] [Low] signal input	Knock Sensor (KS) [Bank 1]
56	Knock Sensor (KS) [Bank 1] [High] signal input	Knock Sensor (KS) [Bank 1]
57	Throttle Position Sensor #2 signal input	Throttle Position Sensor (TPS) #2
58	Sensor ground	Throttle Position Sensor (TPS) #2
59	-	
60	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2)
61	CVVT Oil Control Valve [Bank 2] control output	CVVT Oil Control Valve (OCV) [Bank 2]
62	CVVT Oil Control Valve [Bank 1] control output	CVVT Oil Control Valve (OCV) [Bank 1]
63	Injector (Cylinder #2) control output	Injector (Cylinder #2)
64	Injector (Cylinder #3) control output	Injector (Cylinder #3)
65	-	
66	-	
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	HO2S [B2 / S1] [Except for LEADED]
68	Injector (Cylinder #4) control output	Injector (Cylinder #4)
69	Injector (Cylinder #5) control output	Injector (Cylinder #5)
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	HO2S [B1 / S1] [Except for LEADED]
71	Injector (Cylinder #6) control output	Injector (Cylinder #6)
72	Injector (Cylinder #1) control output	Injector (Cylinder #1)
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	HO2S [B2 / S2] [Euro-Ⅲ/Ⅳ]
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	HO2S [B1 / S2] [Euro-Ⅲ/Ⅳ]
75	-	
76	Battery Power	Battery

Pin No.	Description	Connected to
77	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3)
78	Ignition Coil (Cylinder #5) control output	Ignition Coil (Cylinder #5)
79	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1)
80	-	

3. TERMINAL INPUT/OUTPUT SIGNAL

CONNECTOR [C30-A]

Pin No.	Description	Condition	Type	Level	Test Result
1	2nd CAN [High]	Idle	DC	2.0 ~ 3.0V	2.5V
2	2nd CAN [Low]	Idle	DC	2.0 ~ 3.0V	2.5V
3	-				
4	-				
5	-				
6	-				
7	-				
8	-				
9	-				
10	Power Steering Switch signal input	S/W ON	DC	Max. 0.5V	-0.125V
		S/W OFF		Battery Voltage	13.47V
11	-				
12	-				
13	Clutch Switch signal input				
14	-				
15	Alternator load signal input	Idle	Pulse	Hi: Battery Voltage	13.67V
				Lo: Max 1.5 V	-0.125mV
16	Cruise Switch ground	Idle	DC	Max. 50 mV	22.44mV
17	-				
18	A/C switch "ON" signal input	A/C Relay OFF	DC	Battery Voltage	12.37V
		A/C Relay ON		Max. 1.0V	-25mV
19	-				
20	-				
21	Brake switch signal input	Pedal Release	DC	Battery Voltage	13.97V
		Pedal Push		Max. 0.5V	-25mV
22	-				
23	Brake lamp signal input	Pedal Release	DC	Max. 0.5V	-225mV
		Pedal Push		Battery Voltage	12.97V
24	-				
25	Cruise Switch signal input	All Release	DC	4.3 ~ 4.7V	4.39V
		Main SW		Battery Voltage	13.37V
		Set SW		1.3 ~ 1.7V	1.38V
		Resume SW		2.8 ~ 3.2V	2.82V
		Cancel SW		-0.2 ~ 0.2V	-37.54mV
26	A/C thermal switch signal input	A/C OFF	DC	Max. 1.0V	-25mV
		A/C ON		Battery Voltage	12.57V

Pin No.	Description	Condition	Type	Level	Test Result
27	Diagnostic Data Line (K-Line)	When transmitting	Pulse	Hi: Min. Vbatt × 80%	11.57V
				Lo: Max. Vbatt × 20%	175mV
		When receiving		Hi: Min. Vbatt × 70%	
				Lo: Max. Vbatt × 30%	
28	-				
29	-				
30	-				
31	-				
32	A/C Pressure Transducer signal input	A/C OFF	DC	0 ~ 5V	1.36V
		A/C ON			1.83V
33	Sensor ground	Idle	DC	Max. 50 mV	22.66mV
34	-				
35	-				
36	-				
37	-				
38	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.77V
39	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.77V
40	Battery voltage supply after main relay	IG OFF	DC	Max. 1.0 V	-25mV
		IG ON		Battery Voltage	12.37V
41	CAN [High]	Recessive	Pulse	2.0 ~ 3.0 V	2.4V
		Dominant		2.75～4.5 V	3.56V
42	CAN [Low]	Recessive	Pulse	2.0 ~ 3.0 V	2.42V
		Dominant		0.5～2.25 V	1.62V
43	Main Relay control output	Relay ON	DC	Battery Voltage	0.875V
		Relay OFF		Max. 1.0V	12.47V
44	Intake Air Temperature Sensor signal input	Idle	Analog	0 ~ 5V	2.05V
45	Immobilizer communication line	When communicating after IG ON	Pulse	Hi: Min. 8.5V	11.87V
				Lo: Max. 3.5V	875mV
46	-				
47	Mass Air Flow Sensor signal input	Idle	Pulse	Hi: Vcc	4.97V
				Lo: Max. 0.5V	70mV
48	Sensor ground	Idle	DC	Max. 50 mV	22.52mV

Pin No.	Description	Condition	Type	Level	Test Result
49	Accelerator Position Sensor #2 signal input	C.T	Analog	0.3 ~ 0.9V	0.38V
		W.O.T		1.5 ~ 3.0V	2V
50	-				
51	Cruise "SET" lamp control output	Cruise OFF	DC	Battery Voltage	12.57V
		Cruise ON		Max. 1.0V	-25mV
52	Vehicle speed signal input	Vehicle Run	Pulse	Hi: Min. 5.0V	11.07V
				Lo: Max. 1.0V	-125mV
53	Sensor ground	Idle	DC	Max. 50 mV	22.37mV
54	Accelerator Position Sensor #1 signal input	C.T	Analog	0.3 ~ 0.9V	819mV
		W.O.T		4.0 ~ 4.8V	4.01V
55	Sensor ground	Idle	DC	Max. 50mV	22.6mV
56	-				
57	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
58	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
59	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.95V
		IG ON		4.9 ~ 5.1V	-10mV
60	-				
61	Engine speed signal output	Idle	Pulse	Hi: Battery Voltage	13.57V
				Lo: Max. 0.5V	-25mV
				20 ~ 26Hz	
62	Fuel consumption signal output	Idle	Pulse	Hi: Battery Voltage	13.57V
				Lo: Max. 0.5V	-25mV
63	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Hi: Battery Voltage	13.37V
		Lamp ON		Lo: Max. 2.0V	-25mV
64	A/C Compressor Relay control output	A/C OFF	DC	Battery Voltage	13.97V
		A/C ON		Max. 1.0V	175mV
65	Cooling Fan [Low] control output	Fan OFF	DC	Battery Voltage	13.77V
		Fan ON		Max. 1.0V	175mV
66	Cooling Fan [High] control output	Fan OFF	DC	Battery Voltage	13.57V
		Fan ON		Max. 1.0V	-25mV
67	Variable Intake Solenoid Valve #2 control output	Active	DC	Max. 1.0 V	13.77
		Inactive		Battery Voltage	-25mV
68	Throttle Position Sensor signal (PWM) output	Idle	Pulse	Hi: Battery Voltage	13.37V
				Lo: 0 ~ 0.5 V	-25mV
69	Cruise "MAIN" lamp control output	Cruise OFF	DC	Battery Voltage	12.37V
		Cruise ON		Max. 1.0V	-25mV

Pin No.	Description	Condition	Type	Level	Test Result
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.57V
		Relay ON		Max. 1.0V	-25mV
71	Variable Intake Solenoid Valve #1 control output	Active	DC	Max. 1.0 V	175mV
		Inactive		Battery Voltage	13.77V
72	Immobilizer lamp control output	Lamp OFF	DC	Battery Voltage	12.77V
		Lamp ON		Max. 1.0V	-25mV
73	-				
74	-				
75	-				
76	-				
77	-				
78	Purge Control Solenoid Valve control output	Inactive	Pulse	Hi: Battery Voltage	13.83V
		Active		Lo: Max. 1.0V	31.54mV
79	Wheel Speed Sensor [Low] signal input				
80	Wheel Speed Sensor [High] signal input				

CONNECTOR [C30-B]

Pin No.	Description	Condition	Type	Level	Test Result
1	ETC Motor [-] control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max . 1.0V	-125mV
2	ETC Motor [+] control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max . 1.0V	-325mV
3	-				
4	CVVT Oil Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	282mV at 96℃
5	-				
6	-				
7	Engine Coolant Temperature Sensor signal input	Idle	Analog	0 ~ 5.0V	1.88V
8	Manifold Absolute Pressure Sensor signal input	IG ON	Analog	3.9 ~ 4.1V	3.96V
		Idle		0.8 ~ 1.6V	1.31V
9	-				
10	-				
11	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
12	Battery voltage supply after ignition switch	IG OFF	DC	Max. 0.5 V	13.87V
		IG ON		Battery Voltage	-125mV

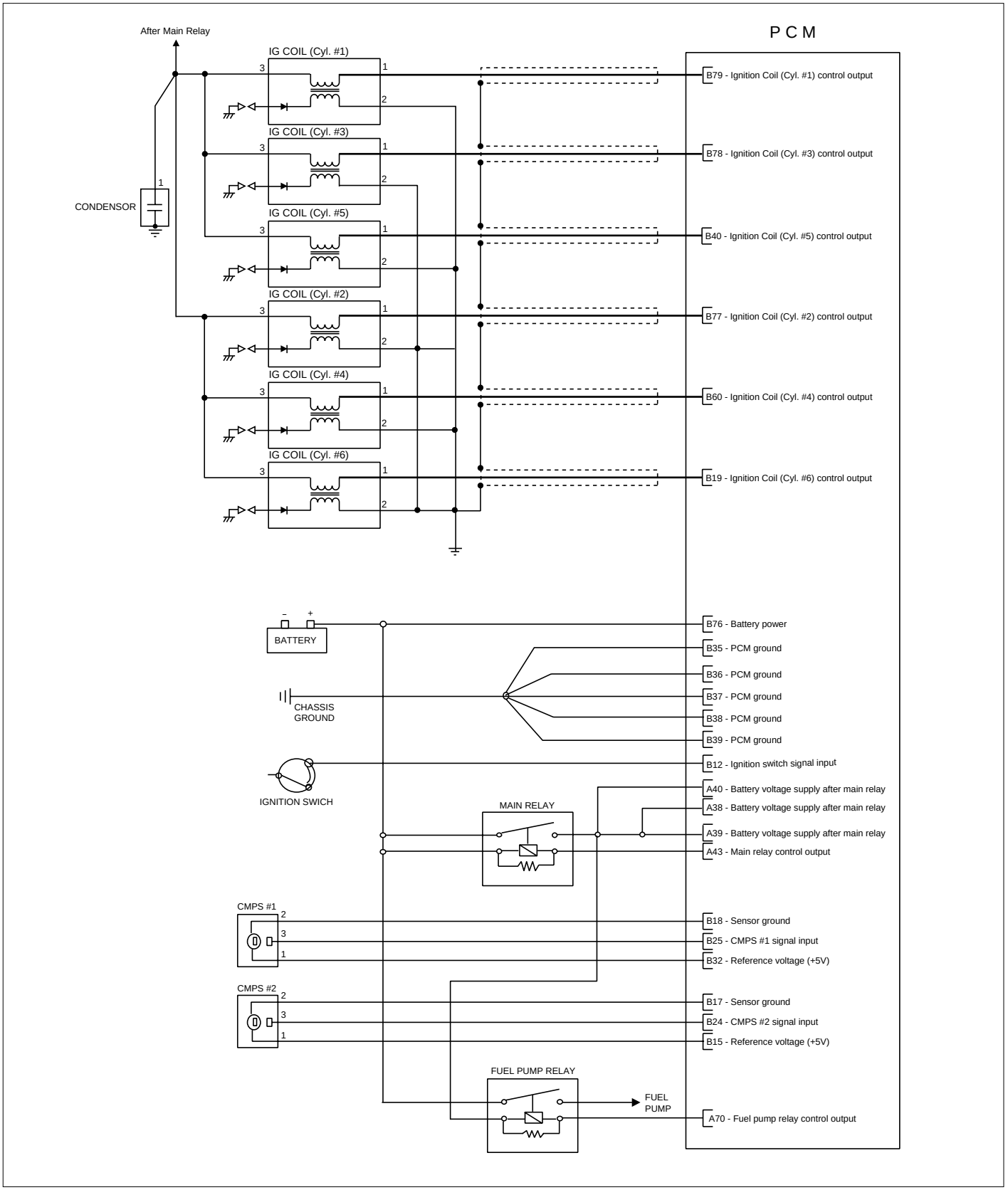
Pin No.	Description	Condition	Type	Level	Test Result
13	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.89V
		IG ON		4.9 ~ 5.1V	-70mV
14	Sensor ground	Idle	DC	Max. 50 mV	19.77mV
15	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
16	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
17	Sensor ground	Idle	DC	Max. 50 mV	21.1mV
18	Sensor ground	Idle	DC	Max. 50 mV	20.87mV
19	Ignition Coil (Cylinder #6) control output	Idle	Pulse	1st Voltage: 200~400V	278V
				ON Voltage: Max. 2V	1.97V
20	-				
21	Crankshaft Position Sensor [High] signal input	Idle	SINE WAVE	Vp_p : Min.1.0V	41.6V
22	-				
23	Sensor Shield	Idle	DC	Max. 50 mV	21.41mV
24	Camshaft Position Sensor [Bank 2] signal input	Idle	Pulse	Hi: Vcc	4.95V
				Lo: Max . 0.5V	-10mV
25	Camshaft Position Sensor [Bank 1] signal input	Idle	Pulse	Hi: Vcc	4.95V
				Lo: Max . 0.5V	-10mV
26	-				
27	-				
28	Sensor ground	Idle	DC	Max. 50 mV	20.73mV
29	Sensor ground	Idle	DC	Max. 50 mV	21.9mV
30	Sensor ground	Idle	DC	Max. 50 mV	20.16mV
31	Sensor ground	Idle	DC	Max. 50 mV	20.63mV
32	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V	4.91V
		IG ON		4.9 ~ 5.1V	-50mV
33	Sensor ground	Idle	DC	Max. 50 mV	22.52mV
34	Sensor ground	Idle	DC	Max. 50 mV	20.99mV
35	Power ground	Idle	DC	Max. 50 mV	
36	Power ground	Idle	DC	Max. 50 mV	
37	Power ground	Idle	DC	Max. 50 mV	
38	Power ground	Idle	DC	Max. 50 mV	
39	Power ground	Idle	DC	Max. 50 mV	
40	Ignition Coil (Cylinder #4) control output	Idle	Pulse	1st Voltage: 2300~400V	294V
				ON Voltage: Max. 2V	1.93V

Pin No.	Description	Condition	Type	Level	Test Result
41	Crankshaft Position Sensor [Low] signal input	Idle	SINE WAVE	Vp_p: Min.1.0V	8.24V
42	-				
43	-				
44	-				
45	-				
46	-				
47	-				
48	Throttle Position Sensor #1 signal input	C.T	Analog	0.25 ~ 0.9V	0.68V
		W.O.T		Min. 4.0V	4.27V
49	Heated Oxygen Sensor [Bank 1 / Sensor 1] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	774mV
				Lean: 0 ~ 0.4V	137mV
50	Heated Oxygen Sensor [Bank 1 / Sensor 2] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	
				Lean: 0 ~ 0.4V	
51	Heated Oxygen Sensor [Bank 2 / Sensor 1] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	705.2mV
				Lean: 0 ~ 0.4V	82mV
52	Heated Oxygen Sensor [Bank 2 / Sensor 2] signal input	Racing	DC	Rich: 0.6 ~ 1.0V	
				Lean: 0 ~ 0.4V	
53	Knock Sensor (KS) [Bank 2] [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
54	Knock Sensor (KS) [Bank 2] [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
55	Knock Sensor (KS) [Bank 1] [Low] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
56	Knock Sensor (KS) [Bank 1] [High] signal input	Knocking	Variable Frequency	-0.3 ~ 0.3 V	
		Normal		0 V	
57	Throttle Position Sensor #2 signal input	C.T	Analog	Min. 4.0V	4.23V
		W.O.T		0.25 ~ 0.9V	703mV
58	Sensor ground	Idle	DC	Max. 50 mV	21.64mV
59	-				
60	Ignition Coil (Cylinder #2) control output	Idle	Pulse	1st Voltage: 200~400V	305V
				ON Voltage: Max. 2V	1.85V

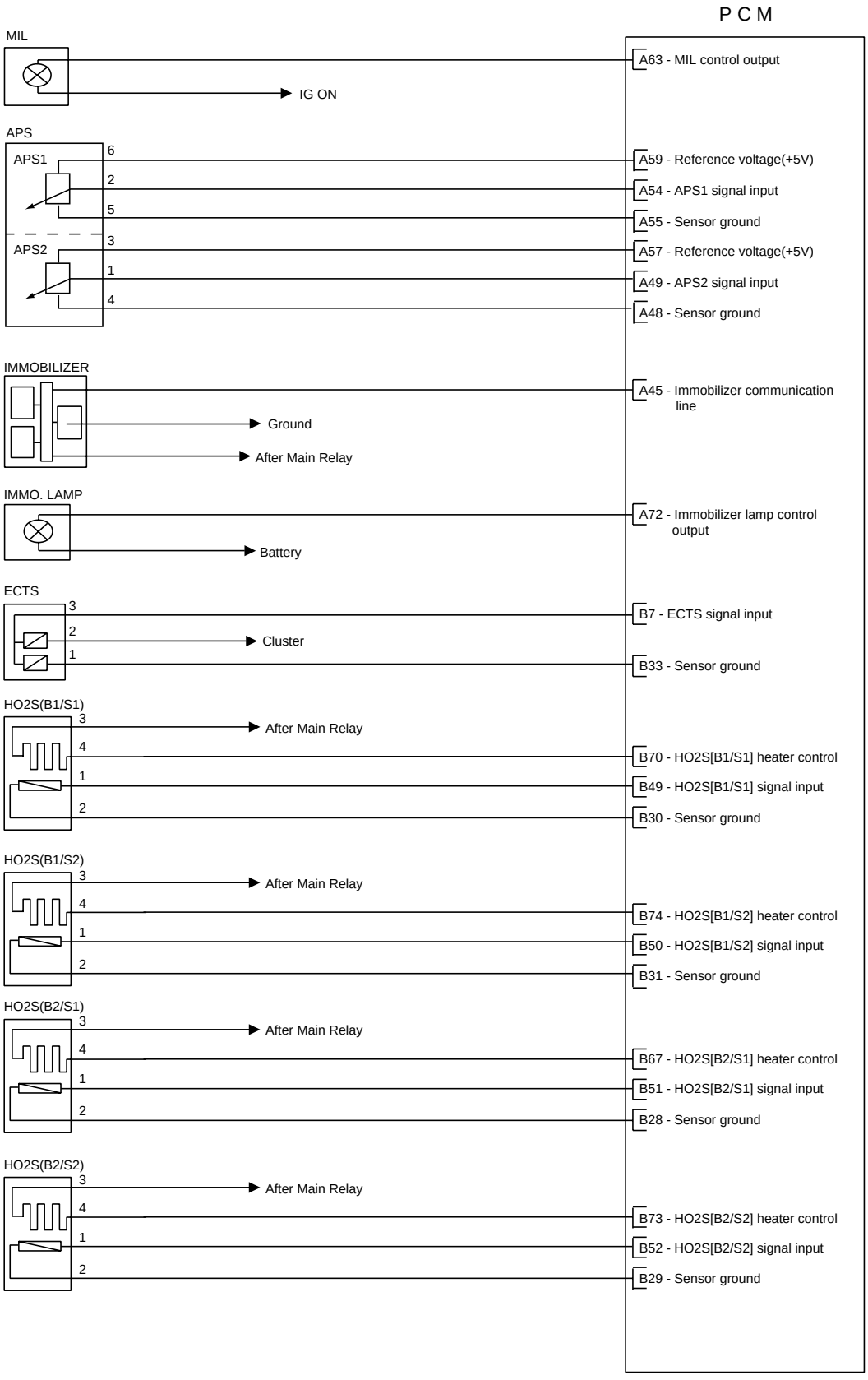
Pin No.	Description	Condition	Type	Level	Test Result
61	CVVT Oil Control Valve [Bank 2] control output	Idle	Pulse	Battery Voltage	14.45V
				Max. 1.0V	50mV
62	CVVT Oil Control Valve [Bank 1] control output	Idle	Pulse	Battery Voltage	14.47V
				Max. 1.0V	75mV
63	Injector (Cylinder #2) control output	Idle	Pulse	Battery Voltage	14.06V
				Max. 1.0V	44.2mV
64	Injector (Cylinder #3) control output	Idle	Pulse	Battery Voltage	14V
				Max. 1.0V	38.31mV
65	-				
66	-				
67	Heated Oxygen Sensor [Bank 2 / Sensor 1] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
68	Injector (Cylinder #4) control output	Idle	Pulse	Hi: Battery Voltage	13.96V
				Lo: Max. 1.0V	55.71mV
69	Injector (Cylinder #5) control output	Idle	Pulse	Hi: Battery Voltage	14V
				Lo: Max. 1.0V	40.82mV
70	Heated Oxygen Sensor [Bank 1 / Sensor 1] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
71	Injector (Cylinder #6) control output	Idle	Pulse	Hi: Battery Voltage	13.95mV
				Lo: Max. 1.0V	55.77mV
72	Injector (Cylinder #1) control output	Idle	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	56.7mV
73	Heated Oxygen Sensor [Bank 2 / Sensor 2] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	13.87V
				Lo: Max. 1.0V	275mV
74	Heated Oxygen Sensor [Bank 1 / Sensor 2] Heater control output	Engine Run	Pulse	Hi: Battery Voltage	14.07V
				Lo: Max. 1.0V	275mV
75	-				
76	Battery Power	Always	DC	Battery Voltage	12.39V
				1.0 mA or below 1.5 mA	0.34mA
77	Ignition Coil (Cylinder #3) control output	Idle	Pulse	1st Voltage: 200~400V	289V
				ON Voltage: Max. 2V	1.87V
78	Ignition Coil (Cylinder #5) control output	Idle	Pulse	1st Voltage: 200~400V	279V
				ON Voltage: Max. 2V	1.93V

Pin No.	Description	Condition	Type	Level	Test Result
79	Ignition Coil (Cylinder #1) control output	Idle	Pulse	1st Voltage: 200~400V	269V
				ON Voltage: Max. 2V	1.91V
80	-				

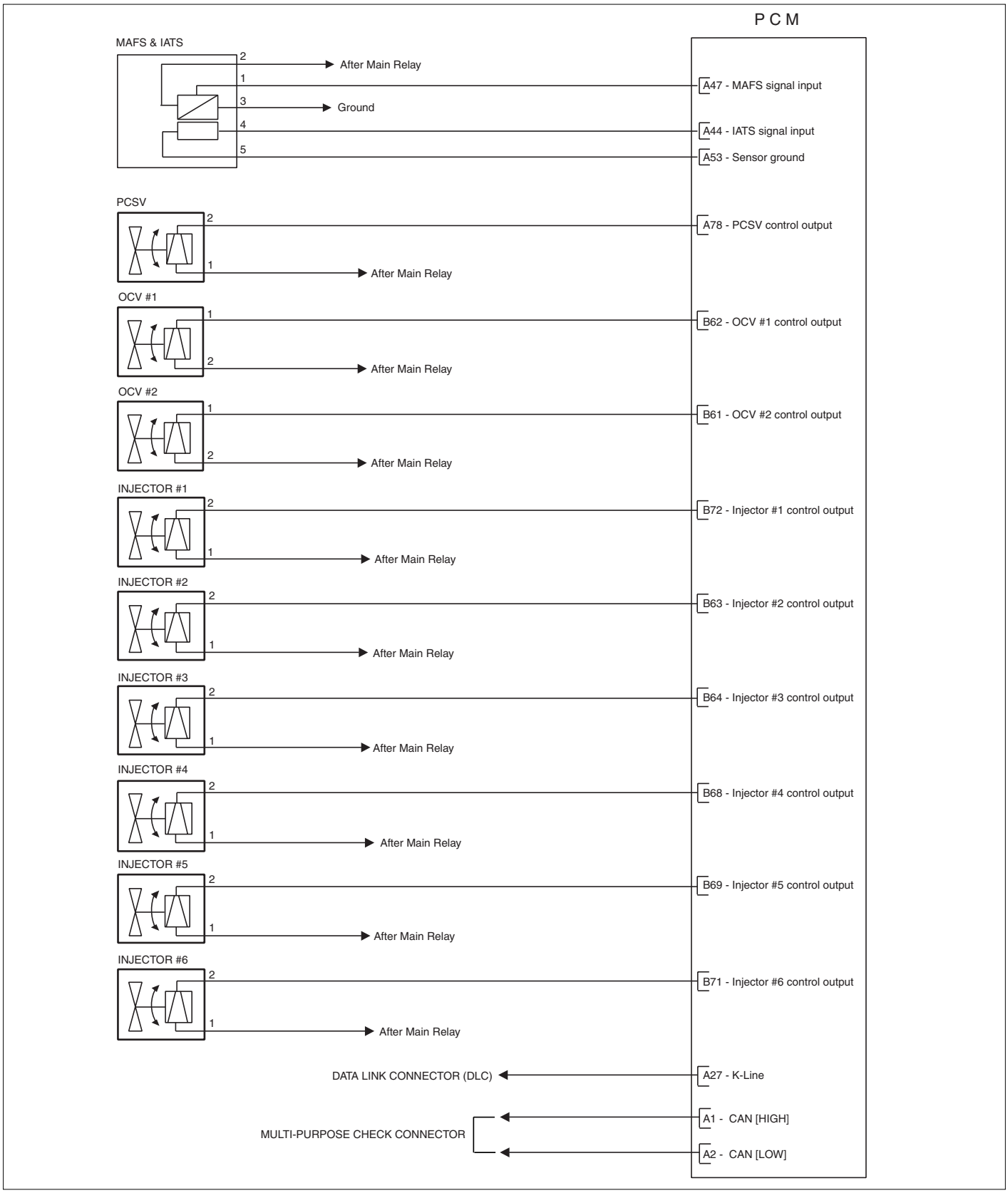
CIRCUIT DIAGRAM E5D4988C



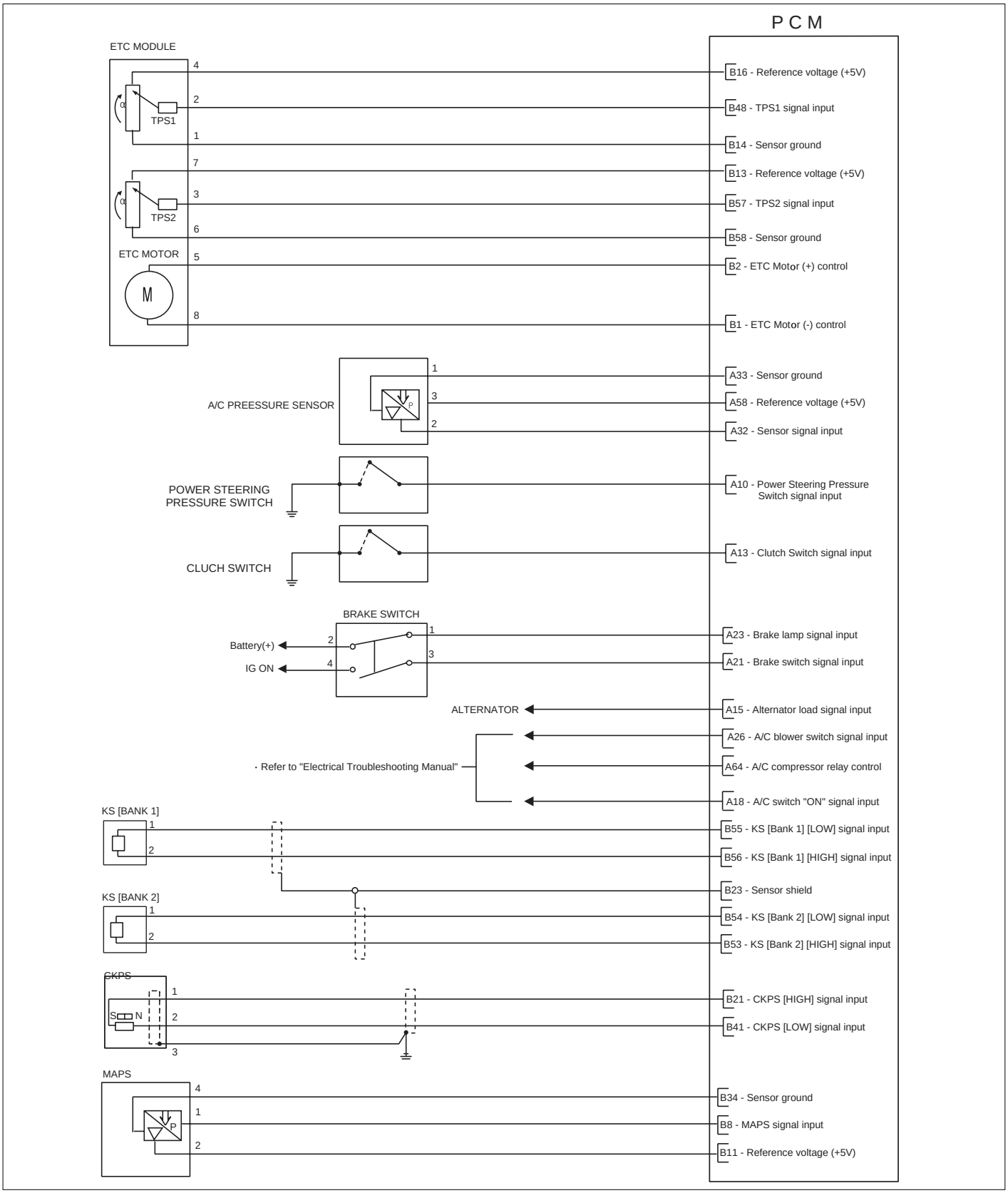
SCMF16127L


P C M
MIL
IG ON
A63 - MIL control output
APS
APS1
APS2
6
2
5
3
1
4
A59 - Reference voltage(+5V)
A54 - APS1 signal input
A55 - Sensor ground
A57 - Reference voltage(+5V)
A49 - APS2 signal input
A48 - Sensor ground
IMMOBILIZER
Ground
After Main Relay
A45 - Immobilizer communication line
IMMO. LAMP
Battery
A72 - Immobilizer lamp control output
ECTS
3
2
1
Cluster
B7 - ECTS signal input
B33 - Sensor ground
HO2S(B1/S1)
After Main Relay
B70 - HO2S[B1/S1] heater control
B49 - HO2S[B1/S1] signal input
B30 - Sensor ground
HO2S(B1/S2)
After Main Relay
B74 - HO2S[B1/S2] heater control
B50 - HO2S[B1/S2] signal input
B31 - Sensor ground
HO2S(B2/S1)
After Main Relay
B67 - HO2S[B2/S1] heater control
B51 - HO2S[B2/S1] signal input
B28 - Sensor ground
HO2S(B2/S2)
After Main Relay
B73 - HO2S[B2/S2] heater control
B52 - HO2S[B2/S2] signal input
B29 - Sensor ground

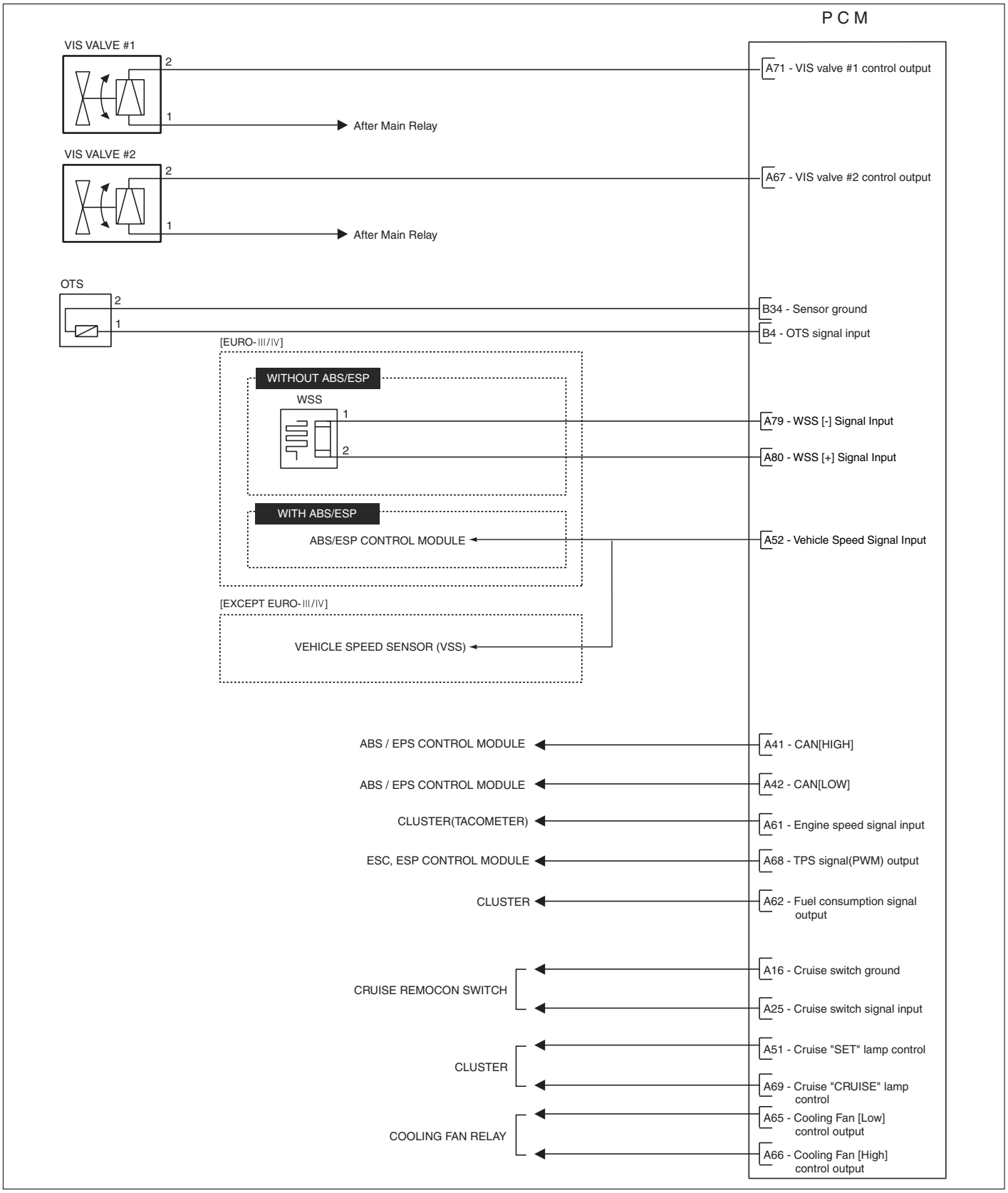
SCMF16128L


P C M
MAFS & IATS
2
After Main Relay
1
A47 - MAFS signal input
3
Ground
4
A44 - IATS signal input
5
A53 - Sensor ground
PCSV
2
A78 - PCSV control output
1
After Main Relay
OCV #1
1
B62 - OCV #1 control output
2
After Main Relay
OCV #2
1
B61 - OCV #2 control output
2
After Main Relay
INJECTOR #1
2
B72 - Injector #1 control output
1
After Main Relay
INJECTOR #2
2
B63 - Injector #2 control output
1
After Main Relay
INJECTOR #3
2
B64 - Injector #3 control output
1
After Main Relay
INJECTOR #4
2
B68 - Injector #4 control output
1
After Main Relay
INJECTOR #5
2
B69 - Injector #5 control output
1
After Main Relay
INJECTOR #6
2
B71 - Injector #6 control output
1
After Main Relay
DATA LINK CONNECTOR (DLC)
A27 - K-Line
A1 - CAN [HIGH]
MULTI-PURPOSE CHECK CONNECTOR
A2 - CAN [LOW]

LGLG002V


P C M
ETC MODULE
TPS1
TPS2
ETC MOTOR
M
4
2
1
7
3
6
5
8
B16 - Reference voltage (+5V)
B48 - TPS1 signal input
B14 - Sensor ground
B13 - Reference voltage (+5V)
B57 - TPS2 signal input
B58 - Sensor ground
B2 - ETC Motor (+) control
B1 - ETC Motor (-) control
A/C PREESSURE SENSOR
1
3
2
A33 - Sensor ground
A58 - Reference voltage (+5V)
A32 - Sensor signal input
POWER STEERING PRESSURE SWITCH
A10 - Power Steering Pressure Switch signal input
CLUCH SWITCH
A13 - Clutch Switch signal input
BRAKE SWITCH
Battery(+)
IG ON
2
4
1
3
A23 - Brake lamp signal input
A21 - Brake switch signal input
ALTERNATOR
A15 - Alternator load signal input
A26 - A/C blower switch signal input
· Refer to "Electrical Troubleshooting Manual"
A64 - A/C compressor relay control
A18 - A/C switch "ON" signal input
KS [BANK 1]
1
2
B55 - KS [Bank 1] [LOW] signal input
B56 - KS [Bank 1] [HIGH] signal input
B23 - Sensor shield
KS [BANK 2]
1
2
B54 - KS [Bank 2] [LOW] signal input
B53 - KS [Bank 2] [HIGH] signal input
CKPS
S
N
1
2
3
B21 - CKPS [HIGH] signal input
B41 - CKPS [LOW] signal input
MAPS
4
1
2
B34 - Sensor ground
B8 - MAPS signal input
B11 - Reference voltage (+5V)

SCMF16129L


P C M
VIS VALVE #1
2
1
After Main Relay
A71 - VIS valve #1 control output
VIS VALVE #2
2
1
After Main Relay
A67 - VIS valve #2 control output
OTS
2
1
B34 - Sensor ground
B4 - OTS signal input
[EURO-III/IV]
WITHOUT ABS/ESP
WSS
1
2
A79 - WSS [-] Signal Input
A80 - WSS [+] Signal Input
WITH ABS/ESP
ABS/ESP CONTROL MODULE
A52 - Vehicle Speed Signal Input
[EXCEPT EURO-III/IV]
VEHICLE SPEED SENSOR (VSS)
ABS / EPS CONTROL MODULE
A41 - CAN[HIGH]
ABS / EPS CONTROL MODULE
A42 - CAN[LOW]
CLUSTER(TACOMETER)
A61 - Engine speed signal input
ESC, ESP CONTROL MODULE
A68 - TPS signal(PWM) output
CLUSTER
A62 - Fuel consumption signal output
CRUISE REMOCON SWITCH
A16 - Cruise switch ground
A25 - Cruise switch signal input
CLUSTER
A51 - Cruise "SET" lamp control
A69 - Cruise "CRUISE" lamp control
COOLING FAN RELAY
A65 - Cooling Fan [Low] control output
A66 - Cooling Fan [High] control output

LGLG002X

PCM PROBLEM INSPECTION PROCEDURE E8D133BD

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

Specification (Resistance): 1Ω or less

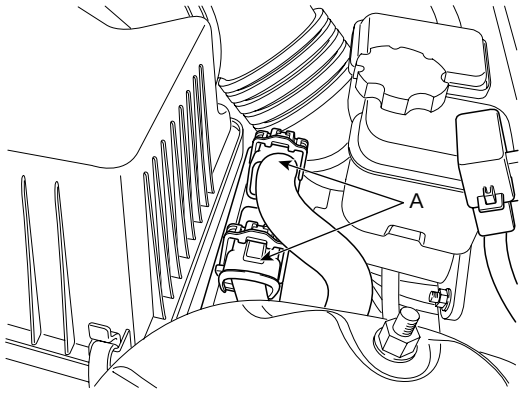
2. TEST PCM CONNECTOR: Disconnect the PCM connector and visually check the ground terminals on PCM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.

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

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

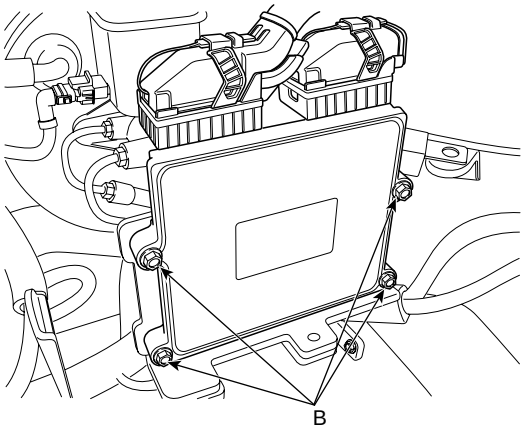
REPLACEMENT E46FE7BF

1. Turn ignition switch off.
2. Disconnect the battery (-) cable from the battery.
3. Disconnect the PCM connectors (A).



SCMF16130L

4. Unscrew the PCM mounting bolts (B) and remove the PCM from the air cleaner assembly.



SCMF16131L

5. Install a new PCM.

PCM mounting bolts: 9.8 ~ 11.8 N·m (1.0 ~ 1.2 kgf·m, 7.2 ~ 8.7 lbf·ft)

DTC TROUBLESHOOTING PROCEDURES

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (DTC) EDC4C348

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0012	"A" Camshaft Position-Timing Over-Retarded (Bank 1)	●	▲	▲	FLA-87
P0016	Crankshaft Position-Camshaft Position Correlation (Bank 1 Sensor A)	●	▲	▲	FLA-92
P0018	Crankshaft Position-Camshaft Position Correlation (Bank 2 Sensor A)	●	▲	▲	FLA-99
P0022	"A" Camshaft Position-Timing Over-Retarded (Bank 2)	●	▲	▲	FLA-87
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	●	▲	▲	FLA-103
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	●	▲	▲	FLA-103
P0030	HO2S Heater Control Circuit (Bank 1 / Sensor 1)	●			FLA-110
P0031	HO2S Heater Circuit Low (Bank 1 / Sensor 1)	●	▲		FLA-115
P0032	HO2S Heater Circuit High (Bank 1 / Sensor 1)	●	▲		FLA-118
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	●			FLA-121
P0037	HO2S Heater Circuit Low (Bank 1 / Sensor 2)	●			FLA-126
P0038	HO2S Heater Circuit High (Bank 1 / Sensor 2)	●			FLA-129
P0050	HO2S Heater Control Circuit (Bank 2 / Sensor 1)	●			FLA-132
P0051	HO2S Heater Circuit Low (Bank 2 / Sensor 1)	●	▲		FLA-137
P0052	HO2S Heater Circuit High (Bank 2 / Sensor 1)	●	▲		FLA-140
P0056	HO2S Heater Control Circuit (Bank 2 / Sensor 2)	●			FLA-143
P0057	HO2S Heater Circuit Low (Bank 2 / Sensor 2)	●			FLA-148
P0058	HO2S Heater Circuit High (Bank 2 / Sensor 2)	●			FLA-151
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	●	▲	▲	FLA-154
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	●	▲	▲	FLA-160
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	●	▲	▲	FLA-154
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	●	▲	▲	FLA-160
P0101	Mass or Volume Air Flow Circuit Range/Performance	●	▲	▲	FLA-163
P0102	Mass or Volume Air Flow Circuit Low Input	●	●	●	FLA-170
P0103	Mass or Volume Air Flow Circuit High Input	●	●	●	FLA-175

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	▲			FLA-178
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	●	●	●	FLA-186
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	●	●	●	FLA-190
P0110	Intake Air Temperature Sensor1 Circuit	▲			FLA-194
P0111	Intake Air Temperature Sensor1 Circuit Range/Performance	▲			FLA-201
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	●	▲	▲	FLA-205
P0113	Intake Air Temperature Sensor 1 Circuit High Input	●	▲	▲	FLA-209
P0115	Engine Coolant Temperature Circuit	▲			FLA-214
P0117	Engine Coolant Temperature Circuit Low Input	●	●	●	FLA-220
P0118	Engine Coolant Temperature Circuit High Input	●	●	●	FLA-224
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	●	●	●	FLA-228
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	●	●	●	FLA-234
P0131	HO2S Circuit Low Voltage (Bank 1 / Sensor 1)	●	▲		FLA-238
P0132	HO2S Circuit High Voltage (Bank 1 / Sensor 1)	●	▲		FLA-245
P0133	HO2S Circuit SlowResponse (Bank 1 / Sensor 1)	●			FLA-248
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	●	▲		FLA-250
P0137	HO2S Circuit Low Voltage (Bank 1 / Sensor 2)	●			FLA-253
P0138	HO2S Circuit High Voltage (Bank 1 / Sensor 2)	●			FLA-260
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	●			FLA-263
P0151	HO2S Circuit Low Voltage (Bank 2 / Sensor 1)	●	▲		FLA-267
P0152	HO2S Circuit High Voltage (Bank 2 / Sensor 1)	●	▲		FLA-274
P0153	HO2S Circuit SlowResponse (Bank 2 / Sensor 1)	●			FLA-277
P0154	HO2S Circuit No Activity Detected (Bank 2 / Sensor 1)	●	▲		FLA-279
P0157	HO2S Circuit Low Voltage (Bank 2 / Sensor 2)	●			FLA-282
P0158	HO2S Circuit High Voltage (Bank 2 / Sensor 2)	●			FLA-289
P0160	HO2S Circuit No Activity Detected (Bank 2 / Sensor 2)	●			FLA-292
P0171	System Too Lean (Bank 1)	●	▲		FLA-295
P0172	System Too Rich (Bank 1)	●	▲		FLA-301
P0174	System Too Lean (Bank 2)	●	▲		FLA-295
P0175	System Too Rich (Bank 2)	●	▲		FLA-301
P0196	Engine Oil Temp. Sensor Range / Performance	▲			FLA-305

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0197	Engine Oil Temp. Sensor Low Input	●	▲	▲	FLA-311
P0198	Engine Oil Temp. Sensor High Input	●	▲	▲	FLA-314
P0217	Engine Coolant Over Temperature Condition	▲			FLA-318
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input	●	●	●	FLA-325
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input	●	●	●	FLA-332
P0230	Fuel Pump Primary Circuit	▲	▲	▲	FLA-336
P0261	Cylinder 1-Injector Circuit Low	●	●	●	FLA-341
P0262	Cylinder 1-Injector Circuit High	●	●	●	FLA-347
P0264	Cylinder 2-Injector Circuit Low	●	●	●	FLA-341
P0265	Cylinder 2-Injector Circuit High	●	●	●	FLA-347
P0267	Cylinder 3-Injector Circuit Low	●	●	●	FLA-341
P0268	Cylinder 3-Injector Circuit High	●	●	●	FLA-347
P0270	Cylinder 4-Injector Circuit Low	●	●	●	FLA-341
P0271	Cylinder 4-Injector Circuit High	●	●	●	FLA-347
P0273	Cylinder 5-Injector Circuit Low	●	●	●	FLA-341
P0274	Cylinder 5-Injector Circuit High	●	●	●	FLA-347
P0276	Cylinder 6-Injector Circuit Low	●	●	●	FLA-341
P0277	Cylinder 6-Injector Circuit High	●	●	●	FLA-347
P0300	Random/Multiple Cylinder Misfire Detected	●			FLA-350
P0301	Cylinder 1-Misfire detected	●			FLA-350
P0302	Cylinder 2-Misfire detected	●			FLA-350
P0303	Cylinder 3-Misfire detected	●			FLA-350
P0304	Cylinder 4-Misfire detected	●			FLA-350
P0305	Cylinder 5-Misfire detected	●			FLA-350
P0306	Cylinder 6-Misfire detected	●			FLA-350
P0315	Segment Time Acquisition Incorrect	▲			FLA-357
P0325	Knock Sensor 1 Circuit	▲	▲	▲	FLA-359
P0326	Knock Sensor 1 Circuit Range/Performance (Bank 1)	▲	▲	▲	FLA-363
P0330	Knock Sensor 2 Circuit	▲	▲	▲	FLA-359
P0331	Knock Sensor 2 Circuit Range/Performance (Bank 2)	▲	▲	▲	FLA-363
P0335	Crankshaft Position Sensor A Circuit	●	▲	▲	FLA-365
P0336	Crankshaft Position Sensor A Circuit Range/Performance	●	▲	▲	FLA-371

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0340	Camshaft Position Sensor A Circuit Malfunction (Bank 1 or Single Sensor)	●	▲	▲	FLA-375
P0341	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or Single Sensor)	●	▲	▲	FLA-381
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	●	▲	▲	FLA-384
P0351	Ignition Coil 'A' Primary / Secondary Circuit	●	▲	▲	FLA-391
P0352	Ignition Coil 'B' Primary / Secondary Circuit	●	▲	▲	FLA-391
P0353	Ignition Coil 'C' Primary / Secondary Circuit	●	▲	▲	FLA-391
P0354	Ignition Coil 'D' Primary / Secondary Circuit	●	▲	▲	FLA-391
P0355	Ignition Coil 'E' Primary / Secondary Circuit	●	▲	▲	FLA-391
P0356	Ignition Coil 'F' Primary / Secondary Circuit	●	▲	▲	FLA-391
P0420	Catalyst System Efficiency below Thershold (Bank 1)	●			FLA-398
P0430	Catalyst System Efficiency below Thershold (Bank 2)	●			FLA-398
P0444	Evap. Emission System-Purge Ctrl. Valve Circuit Open	●			FLA-401
P0445	Evap. Emission System-Purge Ctrl. Valve Circuit Shorted	●			FLA-407
P0501	Vehicle Speed Sensor A Range/Performance	●	●	●	FLA-410
P0504	Brake pedal position A/B correaltion	●	▲	▲	FLA-421
P0506	Idle Air Control System-RPM lower than expected	●			FLA-426
P0507	Idle Air Control System-RPM Higher than expected	●			FLA-430
P0532	A/C Refrigerant Pressure Sensor "A" Circuit Low Input	▲	▲	▲	FLA-433
P0533	A/C Refrigerant Pressure Sensor "A" Circuit High Input	▲	▲	▲	FLA-439
P0562	System Voltage Low	●	▲	▲	FLA-443
P0563	System Voltage High	●	▲	▲	FLA-451
P0571	Brake Switch "A" Circuit	●	▲	▲	FLA-456
P0601	EEPROM-Check sum Error	●	▲	▲	FLA-461
P0602	EEPROM-Programing Error	●	▲	▲	FLA-464
P0604	Internal Control Module Random Access Memory (RAM) Error	●	▲	▲	FLA-465
P0606	ECM/PCM Processor(ECM-SELF TEST Failed)	●	▲	▲	FLA-466
P0638	Throttle Actuator Control Range/Performance	●	▲	▲	FLA-467
P0641	Sensor Reference Voltage "A" Circuit Open	●	▲	▲	FLA-475
P0646	A/C Clutch Relay Control Circuit Low	▲	▲	▲	FLA-480
P0647	A/C Clutch Relay Control Circuit High	▲	▲	▲	FLA-486
P0650	Malfunction Indicator Lamp(MIL) Control Circuit	▲			FLA-489

DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P0651	Sensor Reference Voltage "B" Circuit Open	●	▲	▲	FLA-494
P0660	Intake Manifold Tuning Valve Control Circuit/Open (Bank 1)	●	▲	▲	FLA-499
P0663	Intake Manifold Tuning Valve Control Circuit/Open (Bank 2)	●	▲	▲	FLA-505
P0685	ECM/PCM Power Relay Control Circuit /Open	▲	▲	▲	FLA-509
P1106	Manifold Absolute Pressure Sensor Circuit Short - Intermittent High Input	▲	▲	▲	FLA-515
P1107	Manifold Absolute Pressure Sensor Circuit Short - Intermittent Low Input	▲	▲	▲	FLA-522
P1111	Intake Air Temperature Sensor Circuit Short - Intermittent High Input	▲	▲	▲	FLA-526
P1112	Intake Air Temperature Sensor Circuit Short - Intermittent Low Input	▲	▲	▲	FLA-534
P1114	Engine Coolant Temperature Sensor Circuit - Intermittent Low Input	▲	▲	▲	FLA-538
P1115	Engine Coolant Temperature Sensor Circuit - Intermittent High Input	▲	▲	▲	FLA-544
P1295	ETC (Electronic Throttle Control) System Malfunction - Power Management	●	●	●	FLA-548
P1523	ETC (Electronic Throttle Control) System Malfunction - Throttle Valve Stuck	▲	▲	▲	FLA-551
P2104	ETC (Electronic Throttle Control) System Malfunction - Forced Idle	●	●	●	FLA-556
P2105	ETC (Electronic Throttle Control) System Malfunction - Forced Engine Shutdown	●	●	●	FLA-559
P2106	ETC (Electronic Throttle Control) System Malfunction - Forced Limited Power	●	●	●	FLA-561
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	●	▲	▲	FLA-563
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	●	▲	▲	FLA-569
P2127	Throttle/Pedal Position Sensor/Switch "E" Circuit Low Input	●	▲	▲	FLA-572
P2128	Throttle/Pedal Position Sensor/Switch "E" Circuit High Input	●	▲	▲	FLA-578
P2135	Throttle/Pedal Position Sensor/Switch "A" / "B" Voltage Correlation	●	▲	▲	FLA-581
P2138	Throttle/Pedal Position Sensor/Switch "D" / "E" Voltage Correlation	●	▲	▲	FLA-587
P2173	ETC (Electronic Throttle Control) System Malfunction - High Air flow Detected	●	▲	▲	FLA-593
P2187	System Too Lean at Idle (←Additive) (Bank 1)	●	▲		FLA-599
P2188	System Too Rich at Idle (Bank 1)	●	▲		FLA-605
P2189	System Too Lean at Idle (←Additive) (Bank 2)	●	▲		FLA-599
P2190	System Too Rich at Idle (Bank 2)	●	▲		FLA-605

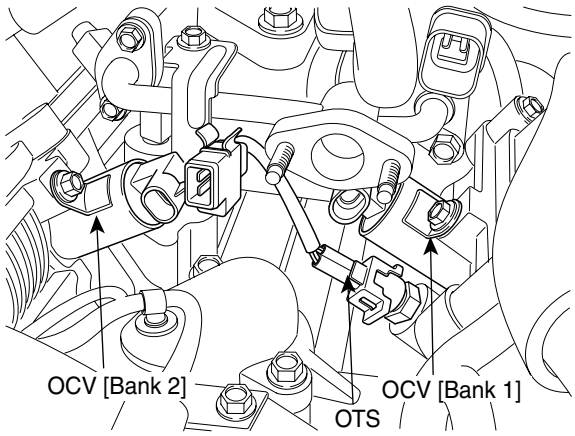
DTC	Description	MIL			Page
		Euro-III/IV	Euro-II	Leaded	
P2195	HO2S Signal Stuck Lean (Bank 1 / Sensor 1)	●	▲		FLA-609
P2196	HO2S Signal Stuck Rich (Bank 1 / Sensor 1)	●	▲		FLA-615
P2197	HO2S Signal Stuck Lean (Bank 2 / Sensor 1)	●	▲		FLA-617
P2198	HO2S Signal Stuck Rich (Bank 2 / Sensor 1)	●	▲		FLA-623
P2270	HO2S Signal Stuck Lean (Bank 1 / Sensor 1)	●			FLA-625
P2271	HO2S Signal Stuck Rich (Bank 1 / Sensor 1)	●			FLA-631
P2272	HO2S Signal Stuck Lean (Bank 2 / Sensor 2)	●			FLA-633
P2273	HO2S Signal Stuck Rich (Bank 2 / Sensor 2)	●			FLA-639
P2610	ECM/PCM Internal Engine Off Timer Performance	●	▲	▲	FLA-641
U0001	CAN Communication Malfunction	●	▲	▲	FLA-644

NOTE

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

DTC P0012 "A" CAMSHAFT POSITION-TIMING OVER-RETARDED (BANK 1)
DTC P0022 "A" CAMSHAFT POSITION-TIMING OVER-RETARDED (BANK 2)

COMPONENT LOCATION EB1C8851



LGLG500A

GENERAL DESCRIPTION E79D28F8

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION E2078BC1

Figure1. illustrates the method for detecting unresolved phasing steady-state error.
The figure shows two cases, case 1 to the left of the dashed line, and case 2 to the right of the dashed line. In case 1,the duty cycle command is considered high, or above a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the maximum position, but the position remains at a medium level. The range of positions considered ' medium' is defined by calibrations.
In case 2, the duty cycle command is considered low, or below a calibration threshold memorized in PCM. This should cause the cam phaser to move toward the minimum position, but the position remains at a medium level.
Each of these cases is a phaser position error failure. Each case is also considered to be due to a phaser seizure. When either case is detected, a timing counter begins to increment. If the counter exceeds a calibration threshold memorized in PCM, the failure criteria is TRUE.
Another similar diagnostic test is performed to check steady-state error. In this test, no consideration is given to the duty cycle command versus phaser position. This test is only a check of the phasing position error. In the test, if the phaser error is greater than a calibration threshold memorized in PCM,a timing counter increments. If the counter exceeds the calibration threshold memorized in PCM,the failure criteria is TRUE.

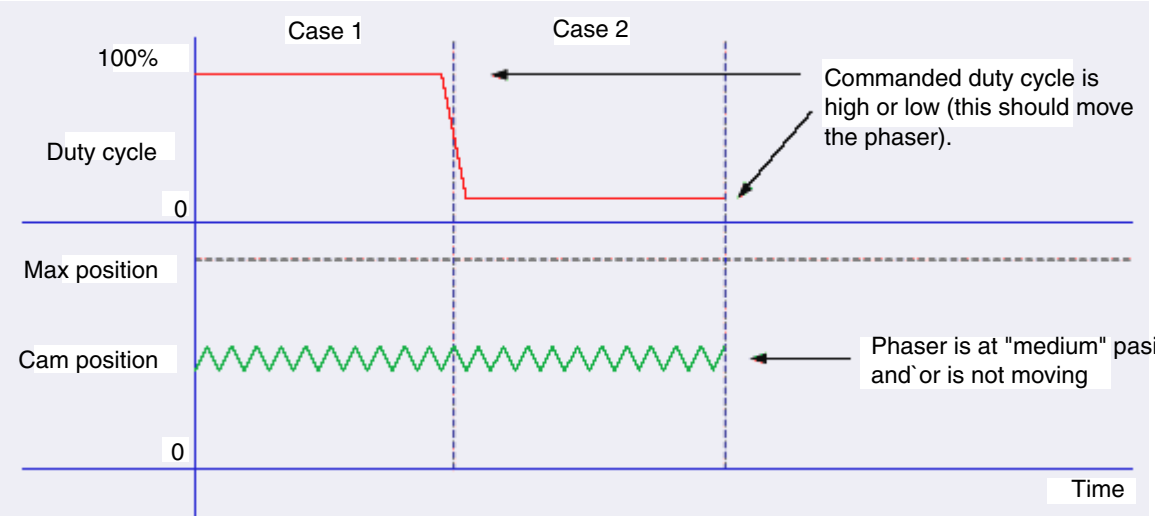


Fig. 1

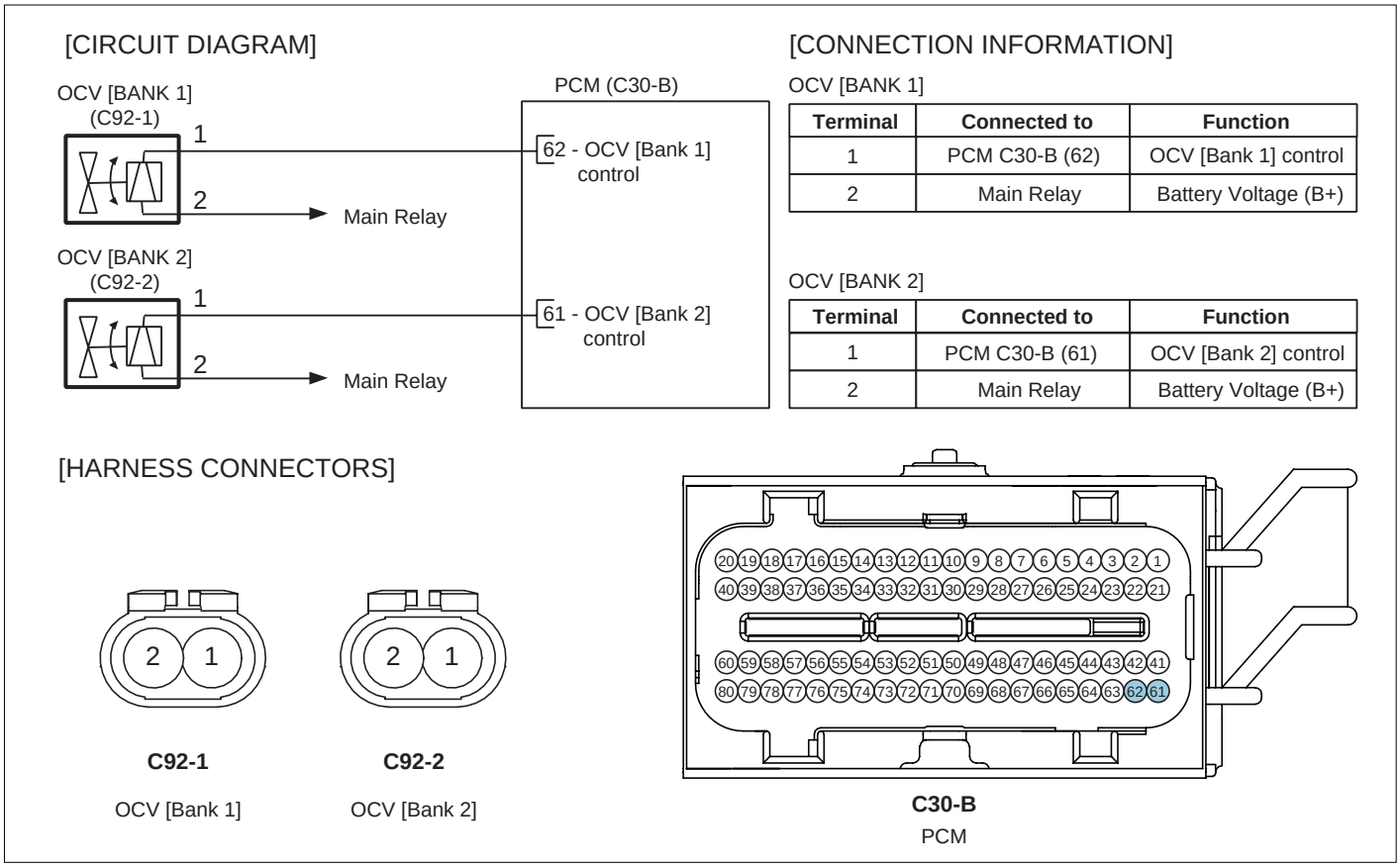
LGLG100A

PCM monitors CAM phaser error while both cam offset is available and cam velocity is below 15CAD/s .If the CAM phaser does not move although PCM commands OCV duty cycle, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E2DF22AE

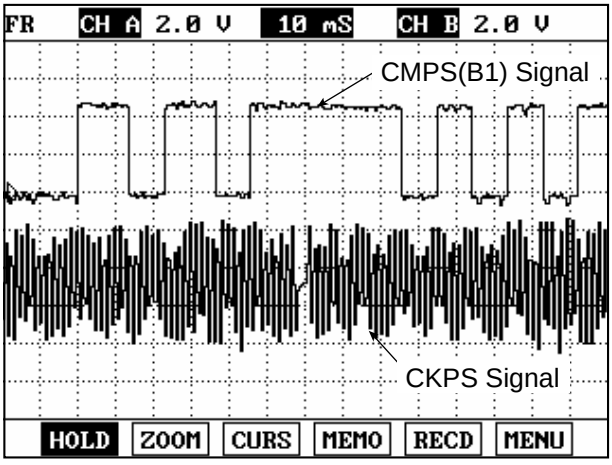
Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if the phaser is stuck or has steady-state error	• Engine Oil • OCV • CVVT stuck • PCM
Enable Conditions		• Offsets available • Cam velocity below threshold 〈 15 CAD/s	
Threshold value	Case 1	• 5 CAD 〈 Cam position 〈 50 CAD • Duty Cycle 〉 90% • Duty Cycle 〈 10% • Timing Counter 〉 80	
	Case 2	• Cam Position error 〉 15 CAD • Timing Counter 〉 80	
Diagnosis Time		• Continuous (More than 0.75sec. Test failure for every 90sec tests)	
MIL On Condition		• 2 Driving Cycles	

SCHEMATIC DIAGRAM E6FF558E



SCMF16115L

SIGNAL WAVEFORM AND DATA ED93FF6C



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. If the Cam Phasing is generated by PCM, the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

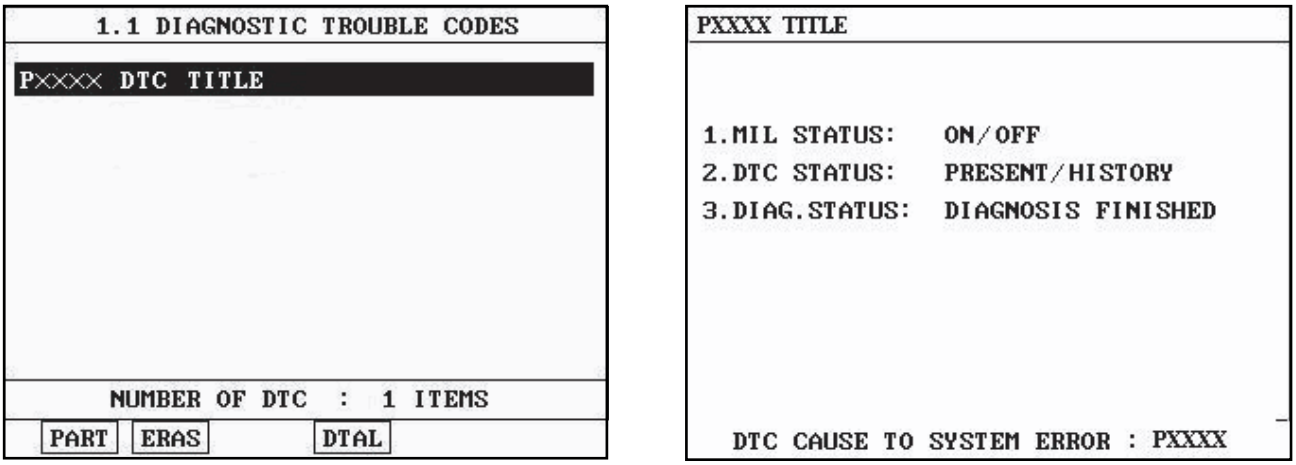
EFBF600B

MONITOR DTC STATUS E962DDB8

1. Check DTC Status
   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

SYSTEM INSPECTION E77A6F95

1. Visual Inspection

1) Check oil level is O.K.

2) Check oil is contaminated.

3) Has a problem been found ?

YES

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

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E696E30F

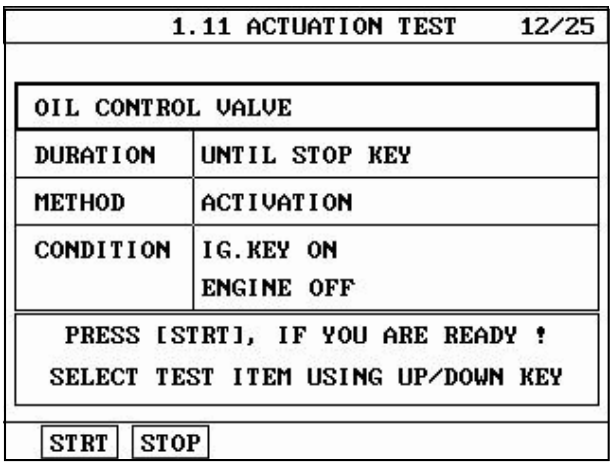
1. Check OCV

1) Connect scantool and IG "ON"

2) Select "OCV" on the Actuation Test

3) Activate "OCV" by pressing "STRT(F1)" key
(should hear a faint click from Oil Control solenoid Valve)

4) Repeat this procedure 4 or 5 times to ensure reliability



EGRF600H

5) Has a problem been found ?

YES

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

NO

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

VERIFICATION OF VEHICLE REPAIR ED5C3394

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

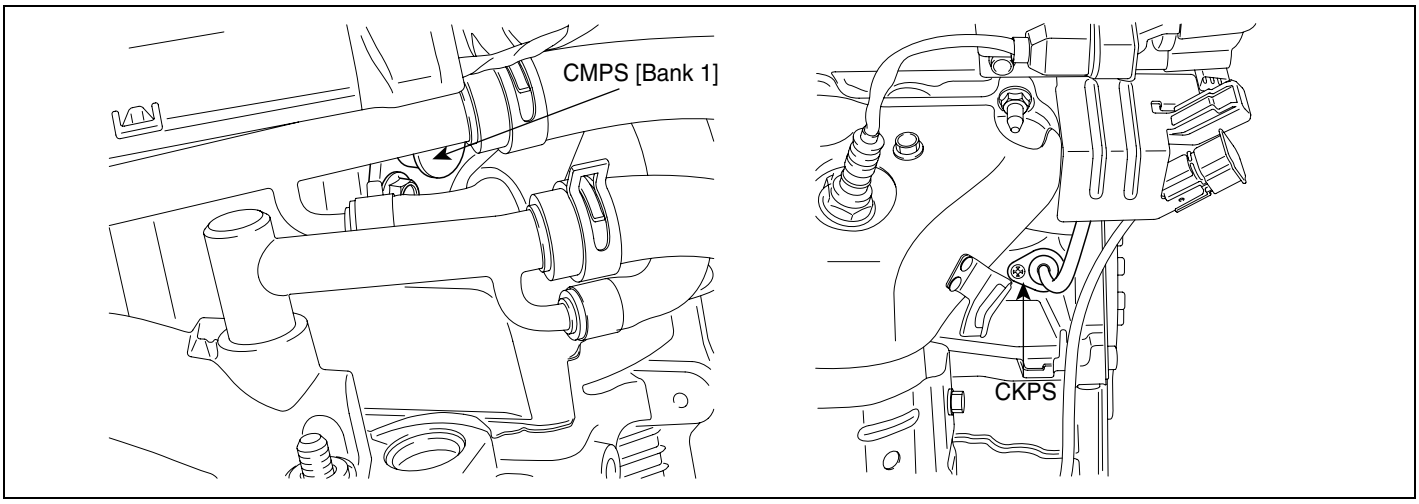
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0016 CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION (BANK 1 SENSOR A)

COMPONENT LOCATION EAA97372



LGLG501A

GENERAL DESCRIPTION E10B26F9

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

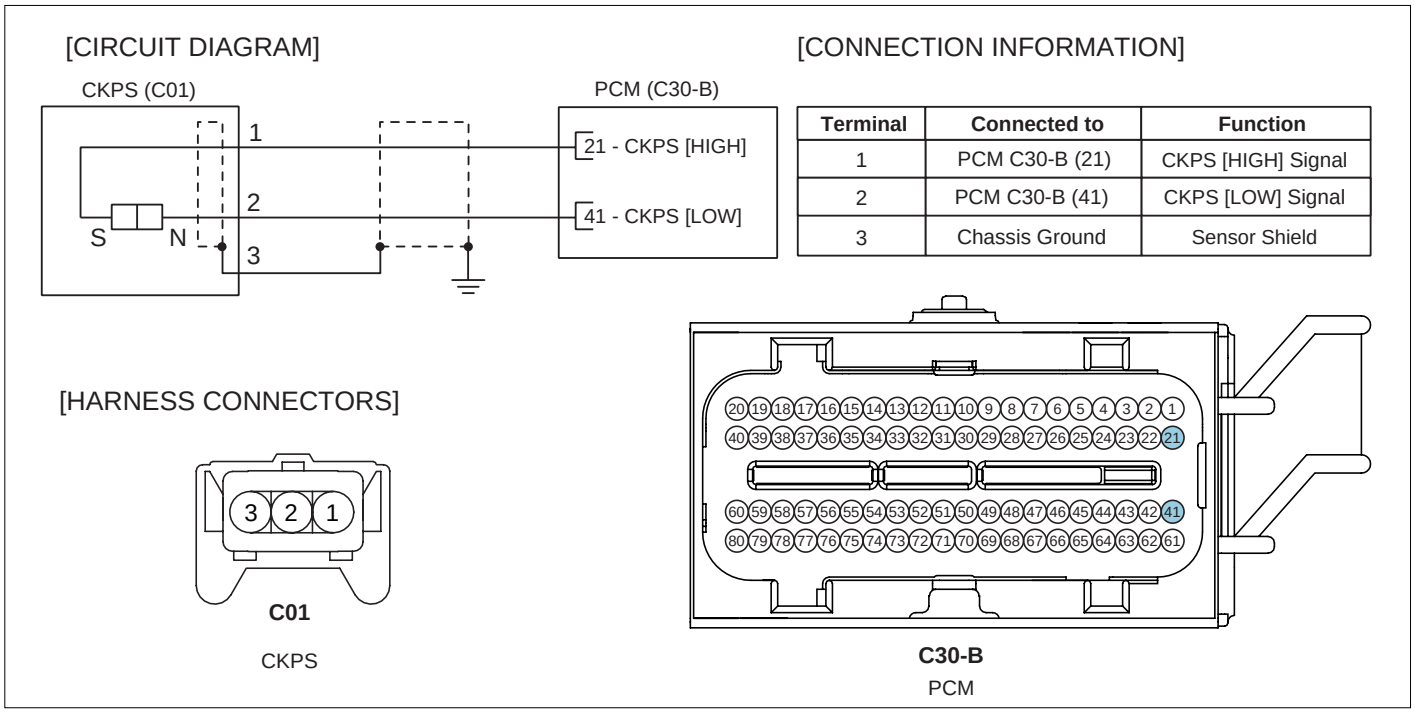
DTC DESCRIPTION EAEA7CB5

Tooth offsets are learned, updated, stored and initialized. For a given cam target wheel and systemcalibration, the tooth offsets should maintain relatively steady values. If the values of tooth offsets are observed to drift outside of an established range, then a failure is present for measuring cam phasing.
This diagnosis is to verify that learned tooth offsets are within an acceptable range.
PCM monitors tooth offset while no active faults is present.If the tooth offsets is out of threshold during more than 6 offset learning for 36 offset learning, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION EB7F927C

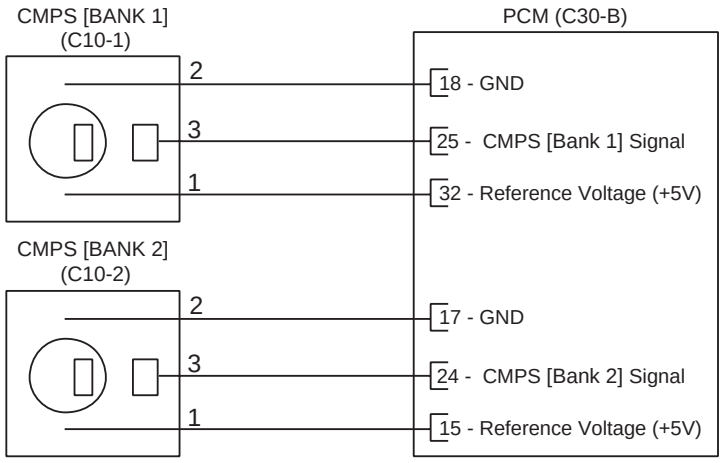
Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if CAM target is aligned correctly to crank	• CKPS, CMPS • CVVT • Timing Misalignment • PCM
Enable Conditions		• No active faults	
Thresh old value	Case 1	• Real Offset Value 〈 Min. Cam Offset programmed in PCM	
	Case 2	• Real Offset Value 〉 Max. Cam Offset programmed in PCM	
Diagnosis Time		• Continuous (More than 6 offset learning failure for 36 offset learning)	
MIL On Condition		• 2 driving Cycles	

SCHEMATIC DIAGRAM E40CE2FC



SCMF16109L

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

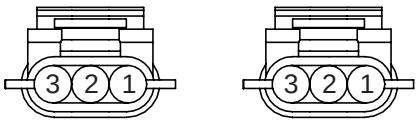
CMPS [BANK 1]

Terminal	Connected to	Function
1	PCM C30-B (32)	Reference Voltage (+5V)
2	PCM C30-B (18)	Sensor ground
3	PCM C30-B (25)	CMPS [Bank 1] signal

CMPS [BANK 2]

Terminal	Connected to	Function
1	PCM C30-B (15)	Reference Voltage (+5V)
2	PCM C30-B (17)	Sensor ground
3	PCM C30-B (24)	CMPS [Bank 2] signal

[HARNESS CONNECTORS]

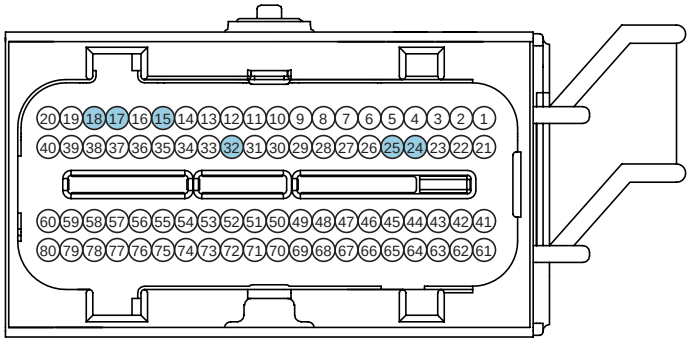


C10-1

CMPS [BANK 1]

C10-2

CMPS [BANK 2]

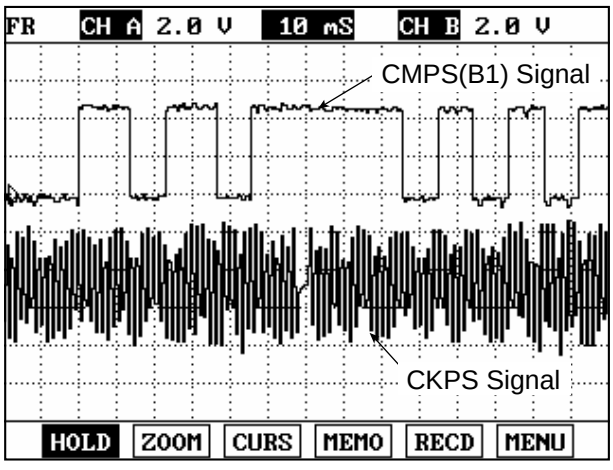


C30-B

PCM

SCMF16108L

SIGNAL WAVEFORM AND DATA E9F99F59



This example shows a typical Crankshaft Position Sensor(CKPS) and Camshaft Position Sensor(CMPS) waveform at idle. If the Cam Phasing is generated by PCM, the offset of cam target wheel tooth varies against 58X reference tooth of CKPS. Cam phasing can be detected from offset variation.

EFBF600B

MONITOR DTC STATUS E1D9C4AB

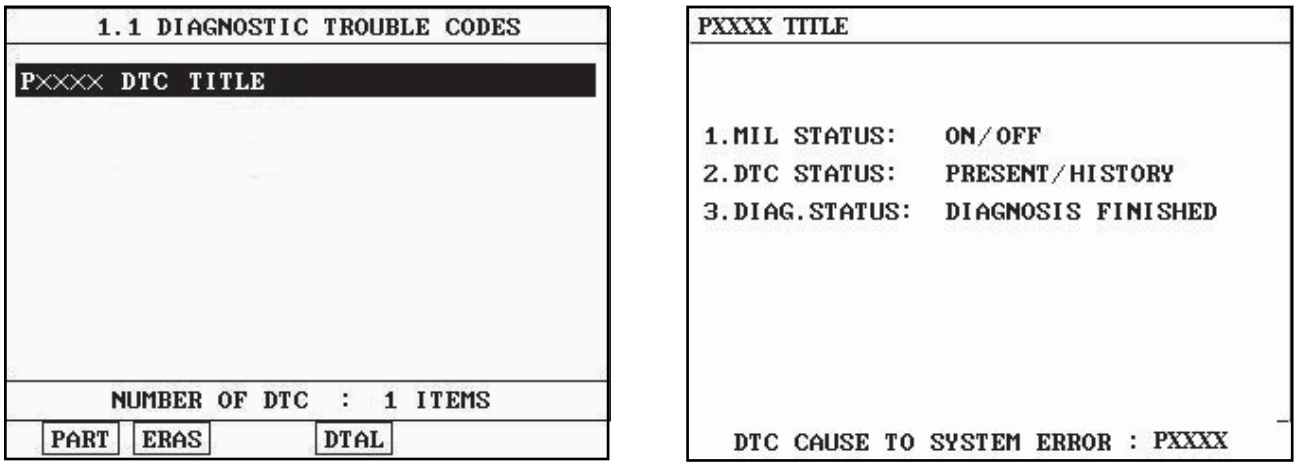
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EB913DDC

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

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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 "System inspection" procedure.

SYSTEM INSPECTION EA5E9A5E

1. Check CMPS

   1) IG "OFF" & Disconnect CMPS connector.

   2) IG "ON" & Measure voltage between terminal 1,2 & 3 of CMPS(B1) harness connector and chassis ground.

Specification :
Terminal 1. approx. 5V
Terminal 2. approx. below 1V
Terminal 3. approx. 5V

   3) Is the measured voltage within specification ?

   YES

   ▶ Go to Check "CKPS" as follow.

   NO

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

2. Check CKPS

   1) IG "OFF" and disconnect CKPS connector.

   2) IG "ON" & Measure voltage between terminal 1 & 2 of CKPS harness connecotor and chassis ground.

Specification : Approximately 1.4V

   3) 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 E593726E

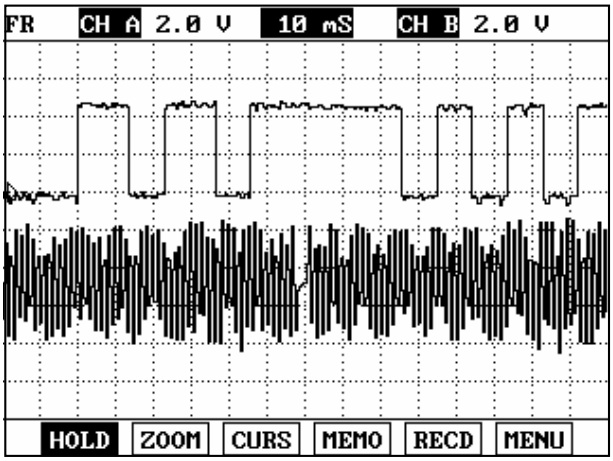
1. CMPS, CKPS Inspection

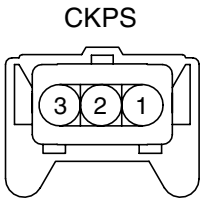
   1) IG "OFF" and connect scantool.

   2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

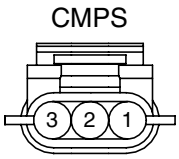
   3) Measure signal waveform at terminal 1 or 2 of CKPS.

SPECIFICATION :





1. CKPS Signal HIGH
2. CKPS Signal LOW
3. Shield ground



1. Sensor Power
2. Sensor Ground
3. CMPS Signal

LGLG106A

4) Is the measured signal waveform O.K ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

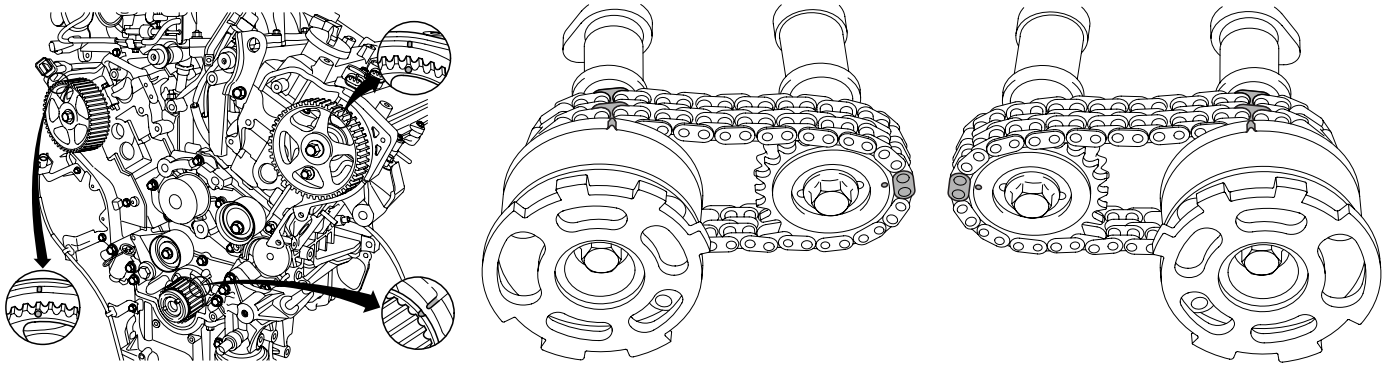
NO

▶ Go to "Timing Mark Inspection" procedure as follow.

2. Timing Mark Inspection.

1) IG "OFF" and check the timing mark is correctly aligned.

REFERENCE :



[Timing Belt] [Cam (Bank 1)] [Cam (Bank 2)]

LGLG502A

2) Is the timing mark correctly aligned ?

YES

▶ Substitute with a known - good CVVT and check for proper operation. If the problem is corrected, replace CVVT 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 ED8E6F21

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

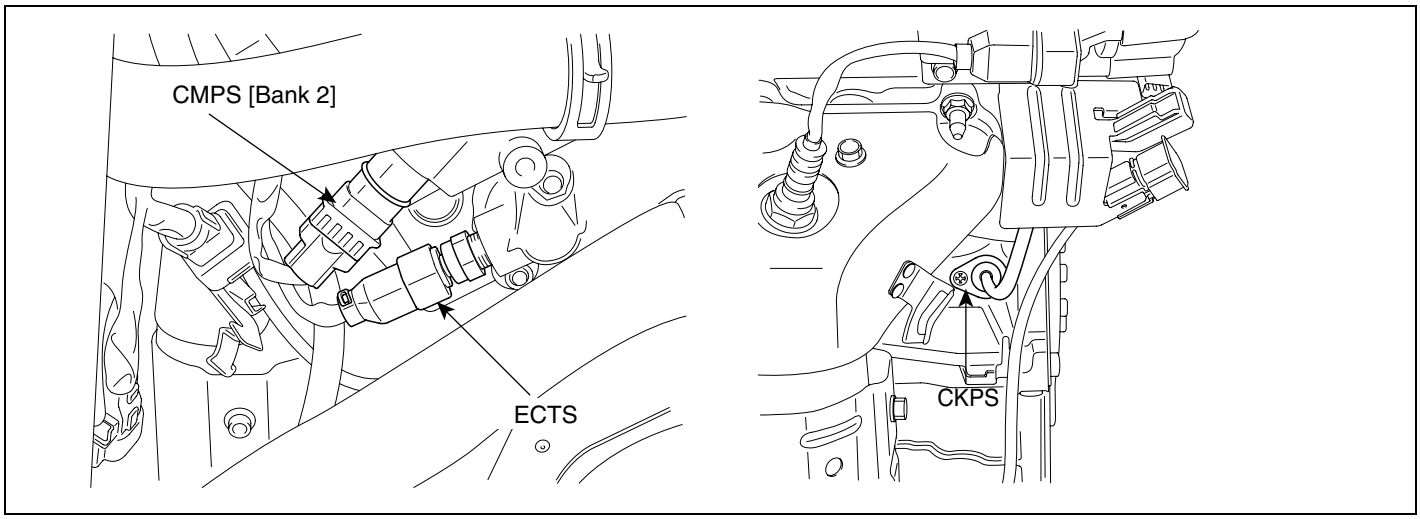
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0018 CRANKSHAFT POSITION-CAMSHAFT POSITION CORRELATION (BANK 2 SENSOR A)

COMPONENT LOCATION E9A57234



LGLG503A

GENERAL DESCRIPTION E89D6CDB

Refer to DTC P0016.

DTC DESCRIPTION EC70DF23

Tooth offsets are learned, updated, stored and initialized. For a given cam target wheel and systemcalibration, the tooth offsets should maintain relatively steady values. If the values of tooth offsets are observed to drift outside of an established range, then a failure is present for measuring cam phasing.
This diagnosis is to verify that learned tooth offsets are within an acceptable range.
PCM monitors tooth offset while no active faults is present. If the tooth offsets is out of threshold during more than 6 offset learning for 36 offset learning, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E48B7379

Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if CAM(B2) target is aligned correctly to crank	• CKPS, CMPS(B2) • CVVT • Timing Misalignment • PCM
Enable Conditions		• No active faults	
Thresh old value	Case 1	• Real Offset Value 〈 Min. Cam Offset programmed in PCM	
	Case 2	• Real Offset Value 〉 Max. Cam Offset programmed in PCM	
Diagnosis Time		• Continuous (More than 6 offset learning failure for 36 offset learning)	
MIL On Condition		• 2 driving Cycles	

SCHEMATIC DIAGRAM EE238604

Refer to DTC P0016.

SIGNAL WAVEFORM AND DATA E3BBA697

Refer to DTC P0016.

MONITOR DTC STATUS EF8C30BD

Refer to DTC P0016.

TERMINAL AND CONNECTOR INSPECTION E227E5BF

Refer to DTC P0016.

SYSTEM INSPECTION EBF927C6

1. Check CMPS

   1) IG "OFF" & Disconnect CMPS connector.

   2) IG "ON" & Measure voltage between terminal 1,2 & 3 of CMPS(B2) harness connector and chassis ground.

Specification :
Terminal 1. approx. 5V
Terminal 2. approx. below 1V
Terminal 3. approx. 5V

   3) Is the measured voltage within specification ?

   YES

   ▶ Go to Check "CKPS" as follow.

   NO

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

2. Check CKPS

   1) IG "OFF" and disconnect CKPS connector.

   2) IG "ON" & Measure voltage between terminal 1 & 2 of CKPS harness connecotor and chassis ground.

Specification : Approximately 1.4V

   3) 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 E5A686E6

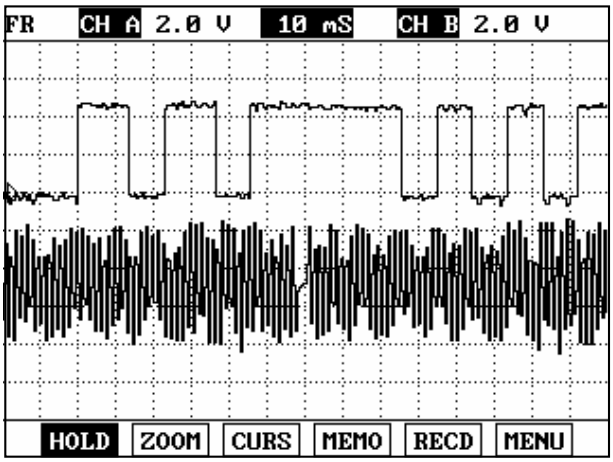
1. CMPS, CKPS Inspection

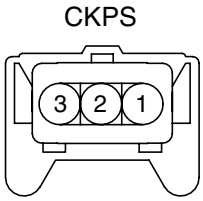
   1) IG "OFF" and connect scantool.

   2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

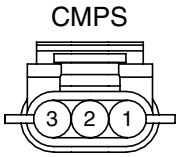
   3) Measure signal waveform at terminal 1 or 2 of CKPS.

SPECIFICATION :





1. CKPS Signal HIGH
2. CKPS Signal LOW
3. Shield ground



1. Sensor Power
2. Sensor Ground
3. CMPS Signal

LGLG106A

   4) Is the measured signal waveform O.K ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

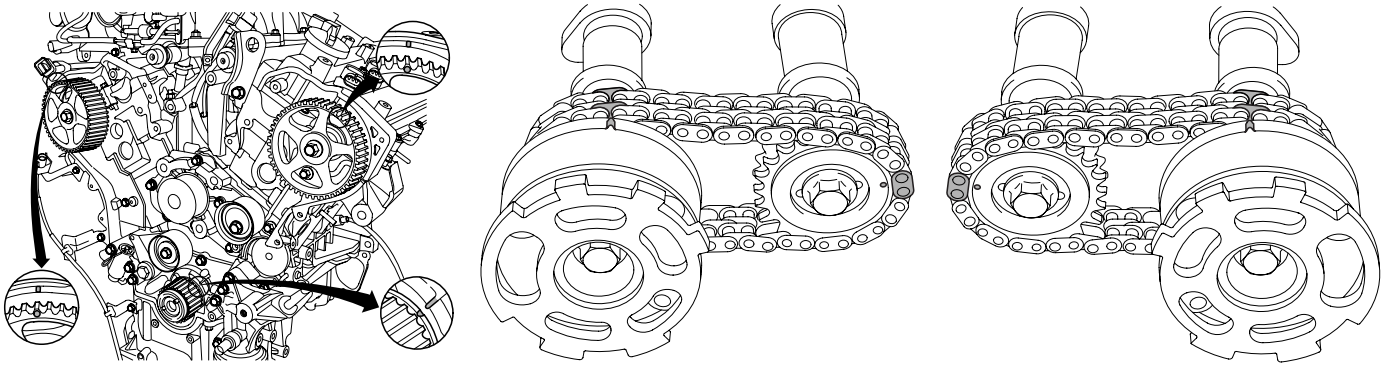
NO

▶ Go to "Timing Mark Inspection" procedure as follow.

2. Timing Mark Inspection

   1) IG "OFF" and check the timing mark is correctly aligned.

REFERNCE :



[Timing Belt] [Cam (Bank 1)] [Cam (Bank 2)]

LGLG502A

2) Is the timing mark correctly aligned ?

YES

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

NO

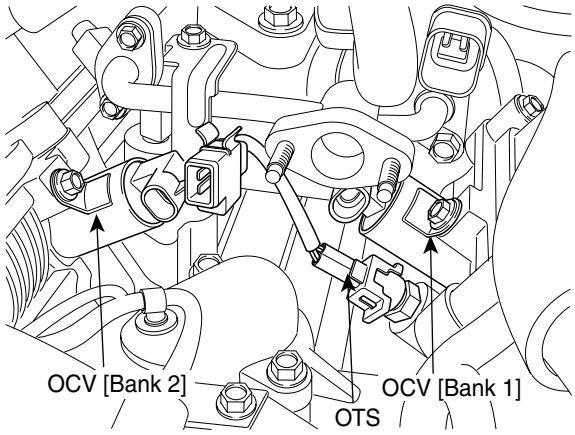
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4E5B1F3

Refer to DTC P0016.

DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1) DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2)

COMPONENT LOCATION EDDDD8B9



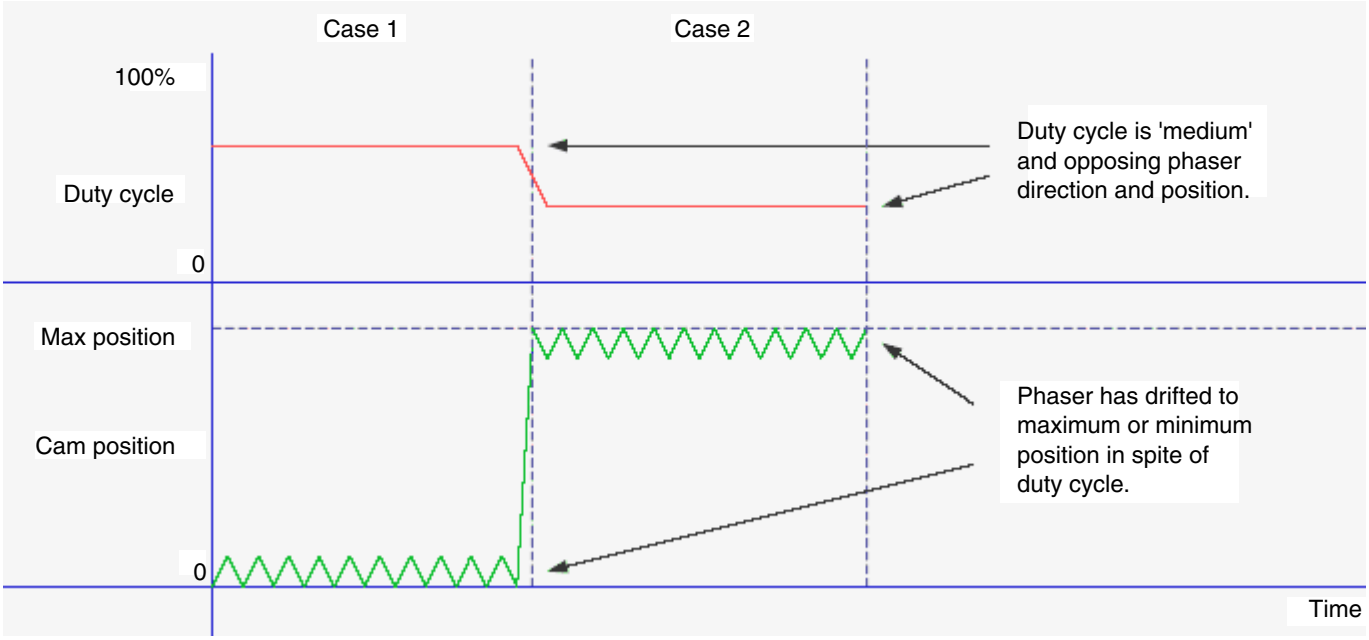
LGLG500A

GENERAL DESCRIPTION E58BBD36

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION EB3171E9

Small particles in the engine oil may cause the oil control valve to bind or otherwise get stuck at certain spool positions. A test is used in this diagnostic to detect a stuck valve spool. A cleaning function is then used to try and free the spool. If unsuccessful, the diagnostic test is failed.
Figure 1. illustrates the principle of the valve stuck diagnostic test. As in the phaser error diagnostic illustration, there are two cases shown in the figure. The case on the left shows a case where the dutycycle is above a calibration threshold, yet the phaser position is near the minimum position. Under normal operation, such a duty cycle command would move the phaser toward its maximum position.The case on the right shows the opposite situation. The duty cycle command is below a threshold, yet the phaser position is near its maximum.



LGLG107A

PCM monitors OCV stuck while cam offset is available and Valve cleaning is not in progress .If the PCM detects that CAM position angle is over 20 CAD(Crank Angle Degree) than expected cam positionthat PCM controls the OCV while cam position is in designated crank angle degree, PCM determines that a faultexists and a DTC is stored.

DTC DETECTING CONDITION E737CEC5

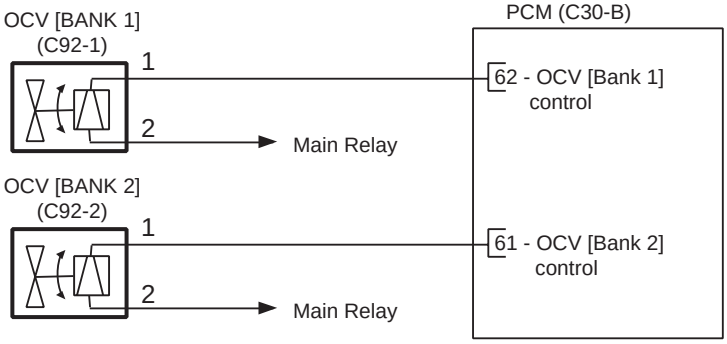
Item		Detecting Condition	Possible cause
DTC Strategy		• Determines if oil control valve is stuck	• Oil Pressure Loss • OCV seizure • PCM
Enable Conditions		• Valve cleaning not in progress • Offsets available	
Thresh old value	Case 1	• Cam position 〉 50 CAD • Cam position Error 〉 20 CAD • Timing counter 〉 56 count	
	Case 2	• Cam position 〈 5 CAD • Cam position Error 〉 20 CAD • Timing counter 〉 56 count	
Diagnosis Time		• Continuous (More than 0.75sec failure for every 56.25 sec. tests)	
MIL On Condition		• 2 driving Cycle	

SPECIFICATION E8D9F224

Resistance (Ω)	6.7 ~ 7.7Ω [20℃(68˚F)]

SCHEMATIC DIAGRAM E83D0BA2

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

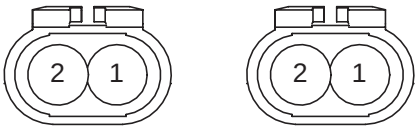
OCV [BANK 1]

Terminal	Connected to	Function
1	PCM C30-B (62)	OCV [Bank 1] control
2	Main Relay	Battery Voltage (B+)

OCV [BANK 2]

Terminal	Connected to	Function
1	PCM C30-B (61)	OCV [Bank 2] control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]

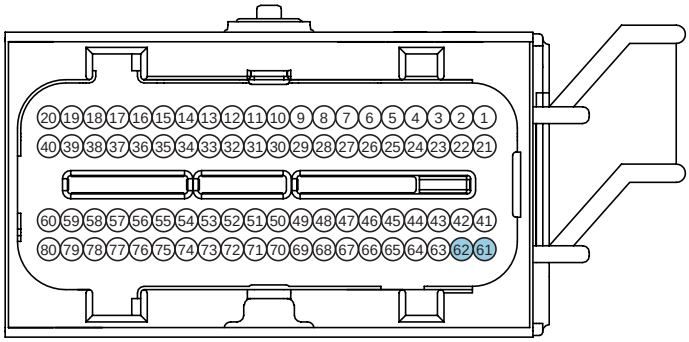


C92-1

OCV [Bank 1]

C92-2

OCV [Bank 2]



C30-B

PCM

SCMF16115L

SIGNAL WAVEFORM AND DATA E6E35DB1

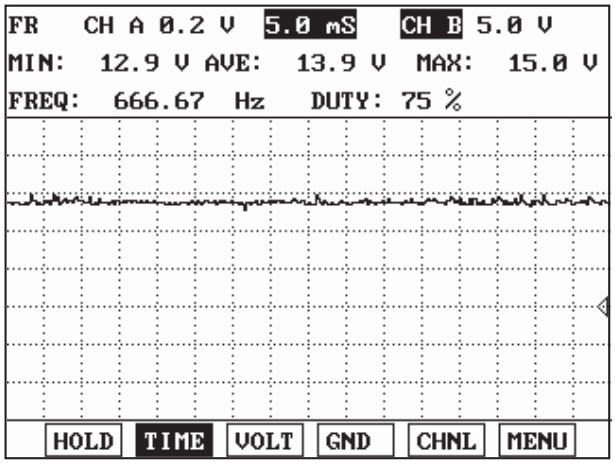


Fig. 1

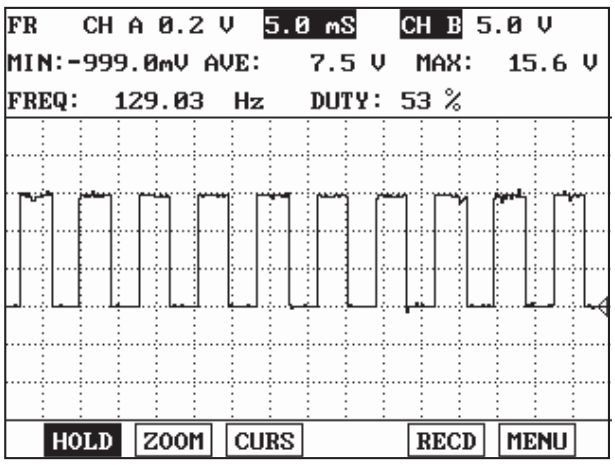


Fig. 2

Fig. 1 : Idle - normal Condition
Fig. 2 : Acceleration

EGRF600T

MONITOR DTC STATUS EAADDE1F

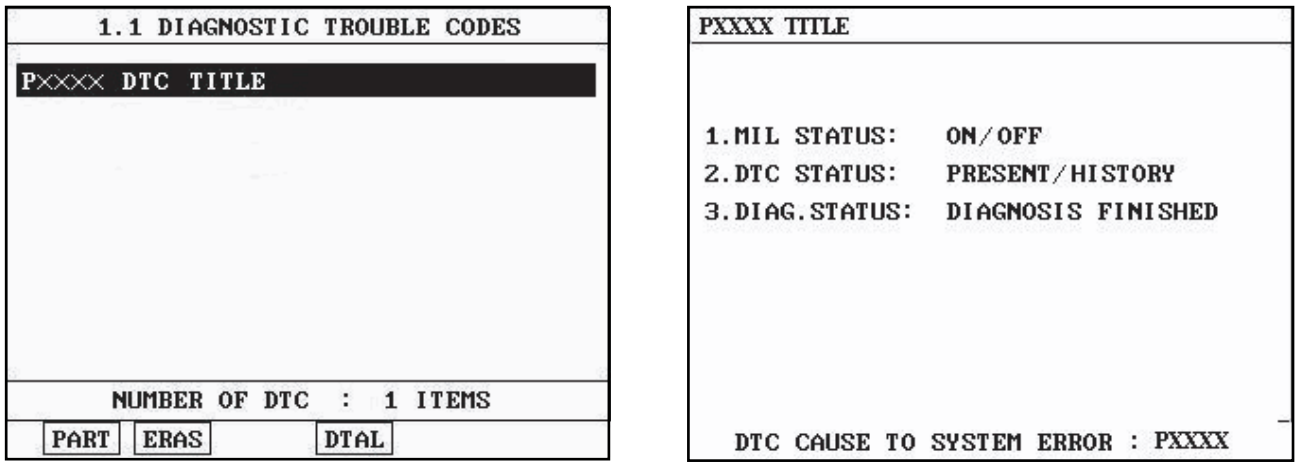
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E5C05A43

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 " as follow

POWER CIRCUIT INSPECTION EEA8DFAC

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

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to " Control Circuit Inspection " procedure.

NO

▶ Check that Fuse between Main Relay and OCV is open.
▶ Check open between main relay and OCV.
▶ Check short to ground between Main Relay and OCV.
▶ Repair or replace as necessay go to "Verification of Vehicle Repair " procedure.

CONTROL CIRCUIT INSPECTION E28BCFE0

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

Specification : Approx. below 1V

4. Is the measured voltage within specification ?

YES

▶ Go to "System Inspection" procedure.

NO

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

SYSTEM INSPECTION E4EDBFFC

1. Visual Inspection
   1) Check oil level is O.K.
   2) Check oil is contaminated.
   3) Check that any oil leakage is occurred around CVVT system.
   4) Has a problem been found ?

YES

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

NO

▶ Go to "Component Inspection" procedure

COMPONENT INSPECTION E3F590A1

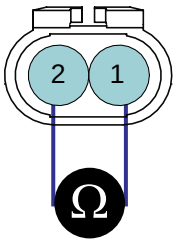
1. OCV Inspection

   1) IG "OFF" & Disconnect OCV connector.

   2) Measure resistance between terminal 1 and 2 of OCV connector (Component Side)

SPECIFICATION :

Resistance (Ω)	6.7 ~ 7.7Ω [20℃(68°F)]



1. OCV control
2. OCV power

SCMF16999L

   3) Is the measured resistance within specification?

YES

▶ Go to "Actuation Test" as follow.

NO

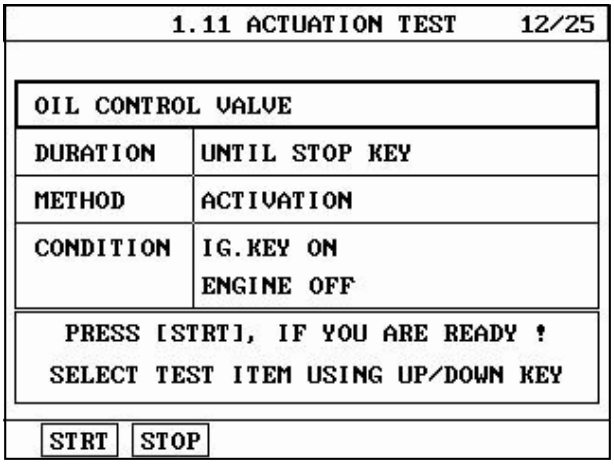
▶ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

2. Actuation Test

   1) IG "OFF" and connect OCV connector

   2) IG "ON" & ENG "OFF"

   3) Check that click sound can be heard when actuation operates with scantool.



EGRF600Y

4) Does the OCV operate corectly when actuation operates ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

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

VERIFICATION OF VEHICLE REPAIR E0050497

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

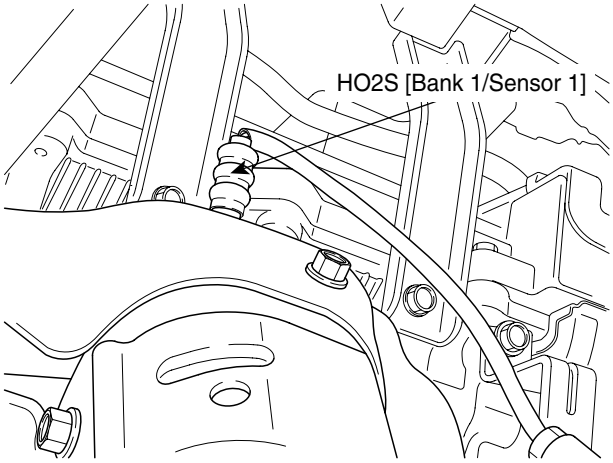
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 / SENSOR 1)

COMPONENT LOCATION ECC4F0DF



LGLG504A

GENERAL DESCRIPTION E7D9053E

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION E55501AD

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0030. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1805512

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor the current through the heater	• Poor Connection • Contact Resistance • HO2S(B1/S1) • PCM
Enable Conditions	• Engine Running > 60 sec. • Heater Duty Cycle > 40% • Max. Duty Cycle - Min. Duty Cycle < 5%	
Threshold value	• Filtered Heater Current < threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

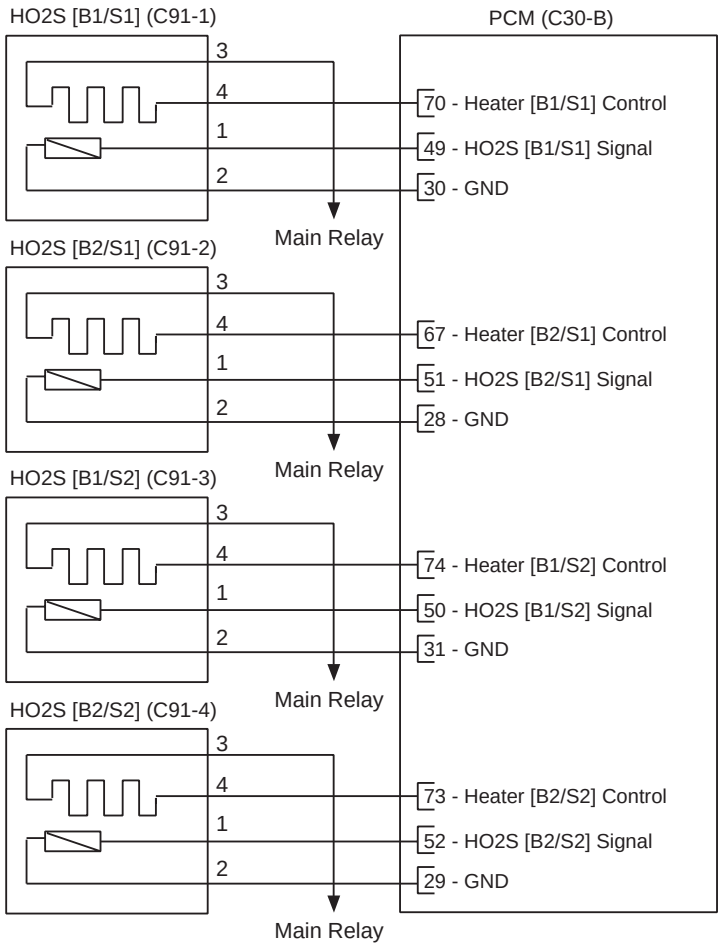
SPECIFICATION E50E2A42

(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450℃(842°F) Exhaust	0.52 ± 0.1

SCHEMATIC DIAGRAM ECB89579

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

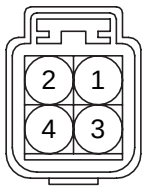
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



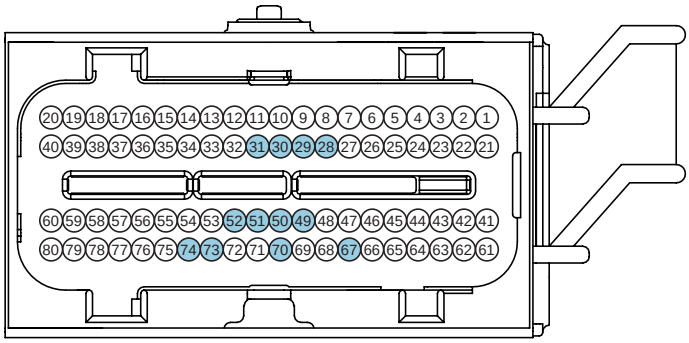
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA E80309D1

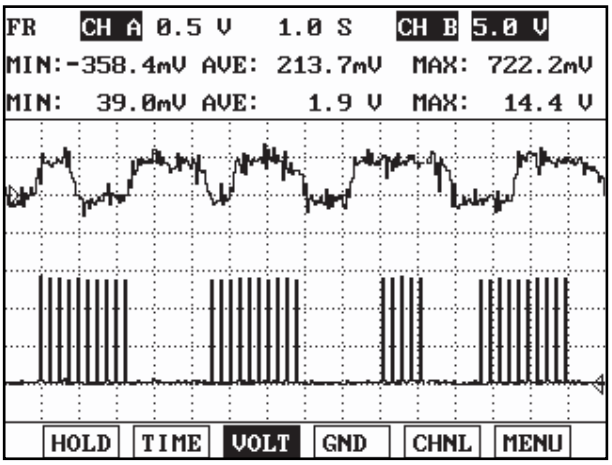


Fig. 1

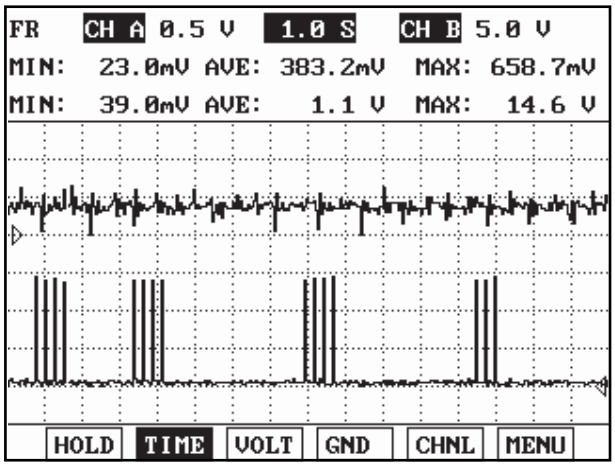


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle
Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

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 PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS EF54E3EB

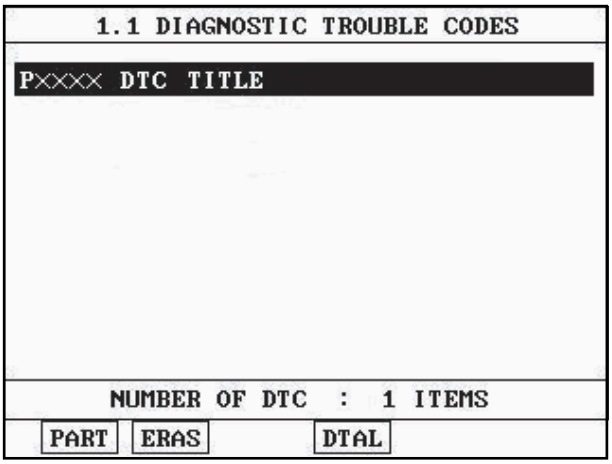
1. Check DTC Status

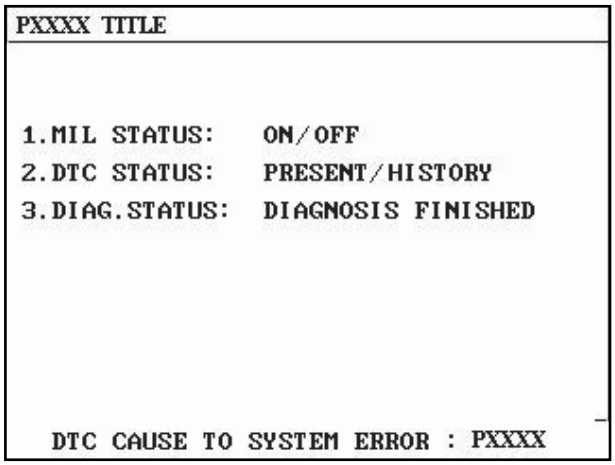
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EB00C1F9

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 " Component Inspection " procedure.

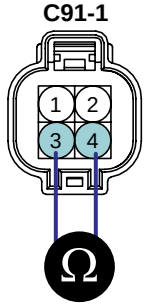
COMPONENT INSPECTION E55A281F

1. Check HO2S(B1/S1) Heater resistance

1) IG "OFF" and disconnect HO2S(B1/S1) connector

2) Measure resistance between terminal 3 and 4 of HO2S(B1/S1)(Component Side)

Specification : 3.0 ~ 4.0Ω [21℃(69.8°F)]



1. HO2S(B1/S1) Signal
2. Sensor Ground
3. **HO2S(B1/S1) Heater Power**
4. **HO2S(B1/S1) Heater Control**

SCMF16227L

3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

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

VERIFICATION OF VEHICLE REPAIR E96ADDF1

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

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

COMPONENT LOCATION E5C4139A

Refer to DTC P0030.

GENERAL DESCRIPTION EE8AA40E

Refer to DTC P0030.

DTC DESCRIPTION ECB1D247

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0031. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E809EBA1

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E96D15EC

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]

SCHEMATIC DIAGRAM E2CB83CC

Refer to DTC P0030.

SIGNAL WAVEFORM AND DATA E16B27DA

Refer to DTC P0030.

MONITOR DTC STATUS E1583243

Refer to DTC P0030.

TERMINAL AND CONNECTOR INSPECTION E56AA16C

Refer to DTC P0030.

POWER CIRCUIT INSPECTION E647A962

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

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in HO2S(B1/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EC89450E

1. Check short to ground in harness.
   1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   2) Measure resistance between terminal 4 of HO2S(B1/S1) harness connector and chassis ground.

Specification : Infinite

   3) Is the measured resistance within specification ?

YES

▶ Go to "Check Open in harness" as follows.

NO

▶ Repair short to ground in HO2S (B1/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   1) IG "OFF" and disconnect HO2S(B1/S1) and PCM connector.
   2) Measure resistance between terminal 4 of HO2S(B1/S1) harness connector and terminal C30-B (70) of PCM harness connector.

Specification : Approx. below 1Ω

   3) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in HO2S(B1/S1) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION EBB5CE11

1. Check HO2S(B1/S1) Heater resistance.

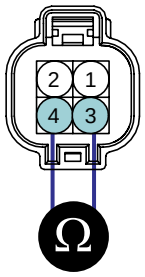
   1) IG "OFF" and disconnect HO2S(B1/S1) connector.

   2) Measure resistance between terminal 3 and 4 of HO2S(B1/S1)connector (Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]

C91-1



1. HO2S(B1/S1) Signal
2. Sensor Ground
3. **HO2S(B1/S1) Heater Power**
4. **HO2S(B1/S1) Heater Control**

SCMF16163L

   3) Is the measured resistance within specification ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

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 EBD805B8

Refer to DTC P0030.

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

COMPONENT LOCATION EFE79781

Refer to DTC P0030.

GENERAL DESCRIPTION E79B51DC

Refer to DTC P0030.

DTC DESCRIPTION E1669157

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0032. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE656AA3

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • short to battery in control circuit • HO2S(B1/S1) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EB8FE3AB

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8℉)]

SCHEMATIC DIAGRAM E08966A6

Refer to DTC P0030.

SIGNAL WAVEFORM AND DATA E4237B7E

Refer to DTC P0030.

MONITOR DTC STATUS E420D820

Refer to DTC P0030.

TERMINAL AND CONNECTOR INSPECTION E80CA6DA

Refer to DTC P0030.

CONTROL CIRCUIT INSPECTION E2F69A02

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

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

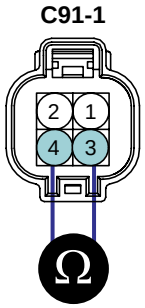
▶ Repair short to battery in HO2S(B1/S1) Heater control circuit and go to "Verification of Vhicle Repair" procedure.

COMPONENT INSPECTION E2CB890D

1. Check HO2S(B1/S1) Heater resistance.
   1) IG "OFF" and disconnect HO2S(B1/S1) connector.
   2) Measure resistance between terminal 4 and 3 of HO2S(B1/S1)connector (Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8℉)]



1. HO2S(B1/S1) Signal
2. Sensor Ground
3. **HO2S(B1/S1) Heater Power**
4. **HO2S(B1/S1) Heater Control**

SCMF16163L

   3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

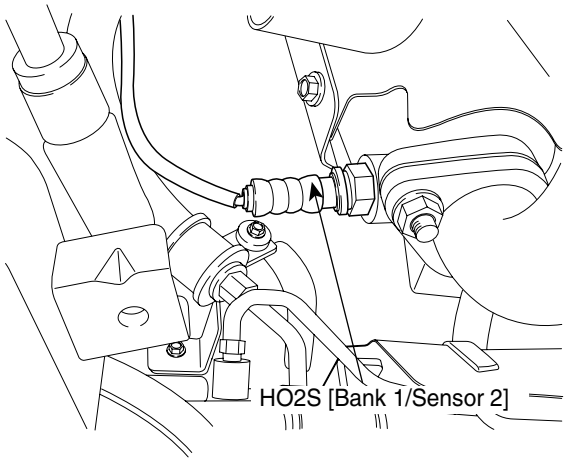
▶ Substitute with a known - good HO2S(B1/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E1B49251

Refer to DTC P0030.

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

COMPONENT LOCATION EA389A6C



LGLG505A

GENERAL DESCRIPTION E910D173

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION EC6D53A3

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0036. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA44BBFC

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor the current through the heater	• Poor Connection • HO2S(B1/S2) • PCM
Enable Conditions	• Engine Running > 60 sec. • Heater Duty Cycle > 18% • Max. Duty Cycle - Min. Duty Cycle < 5%.	
Threshold value	• Filtered Heater Current < threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

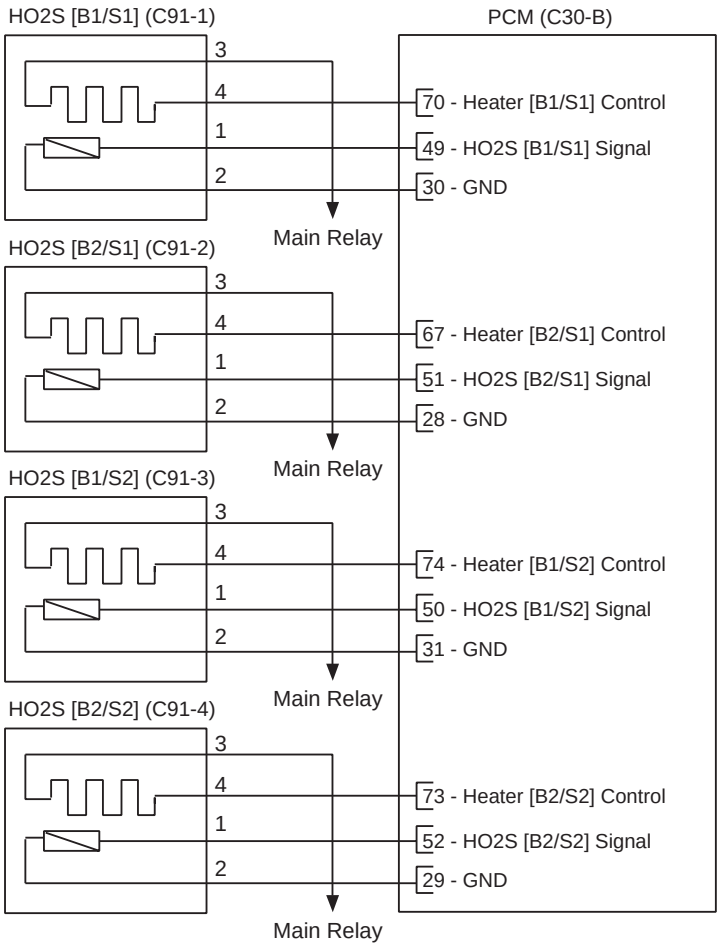
SPECIFICATION E337F0B9

(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450℃(842°F) Exhaust	0.52 ± 0.1

SCHEMATIC DIAGRAM EEE0FE0F

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

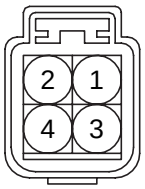
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



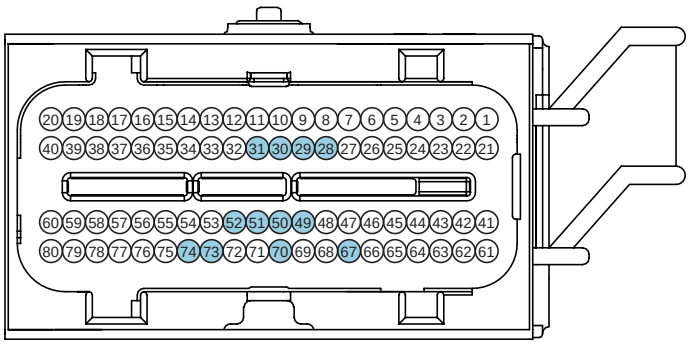
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA EF4B0BDB

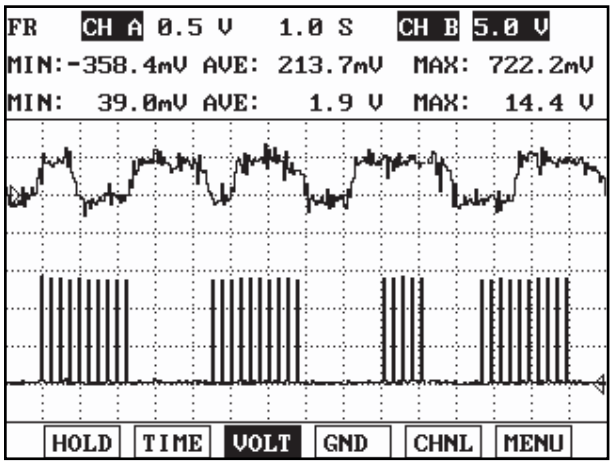


Fig. 1

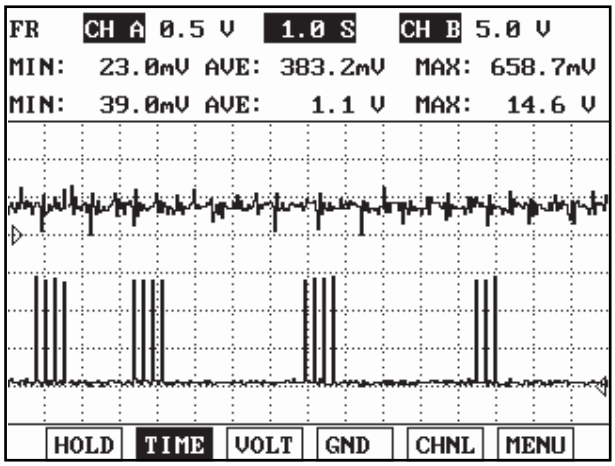


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle
Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

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 PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS E34A309F

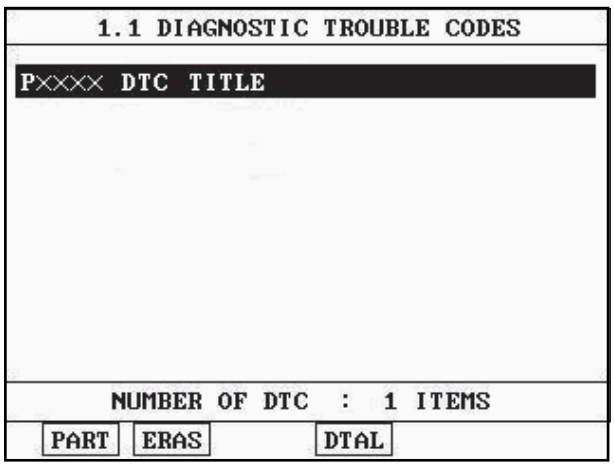
1. Check DTC Status

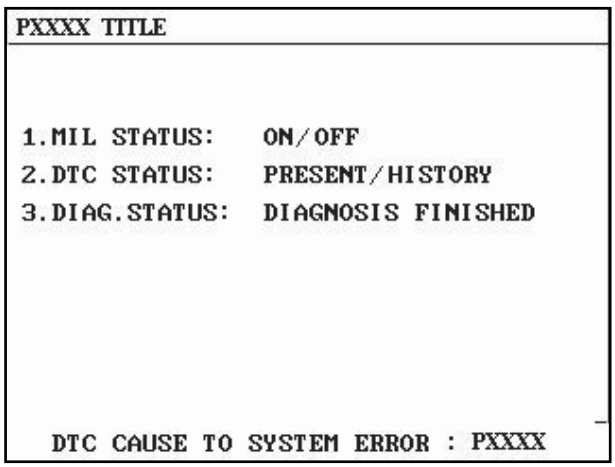
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E1293BD8

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 " Component Inspection " procedure.

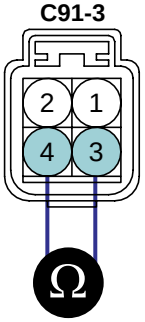
COMPONENT INSPECTION EA730770

1. Check HO2S(B1/S2) Heater resistance

1) IG "OFF" and disconnect HO2S(B1/S2) connector

2) Measure resistance between terminal 3 and 4 of HO2S(B1/S2)(Component Side)

Specification : 3.0 ~ 4.0Ω [21℃(69.8˚F)]



1. HO2S(B1/S2) Signal
2. Sensor Ground
3. **HO2S(B1/S2) Heater Power**
4. **HO2S(B1/S2) Heater Control**

SCMF16232L

3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

VERIFICATION OF VEHICLE REPAIR E6E28F0E

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

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

COMPONENT LOCATION ED71BF6C

Refer to DTC P0036.

GENERAL DESCRIPTION E90D395B

Refer to DTC P0036.

DTC DESCRIPTION EC23A286

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0037. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E382D1D3

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EE1EF805

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]

SCHEMATIC DIAGRAM E78EA1CB

Refer to DTC P0036.

SIGNAL WAVEFORM AND DATA E3963534

Refer to DTC P0036.

MONITOR DTC STATUS E92EBECC

1. Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E7779CB6

Refer to DTC P0036.

POWER CIRCUIT INSPECTION E4F406C9

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

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in HO2S(B1/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EF0AC0A7

1. Check short to ground in harness.
   1) IG "OFF" and disconnect HO2S(B1/S2) connector.
   2) Measure resistance between terminal 4 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Infinite

   3) Is the measured resistance within specification ?

YES

▶ Go to "Check Open in harness" as follows.

NO

▶ Repair short to ground in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   1) IG "OFF" and disconnect HO2S(B1/S2) and PCM connector.
   2) Measure resistance between terminal 4 of HO2S(B1/S2) harness connector and terminal C30-B (74) of PCM harness connector.

Specification : Approx. below 1Ω

   3) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in HO2S(B1/S2) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION E3364B45

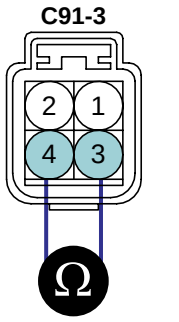
1. Check HO2S(B1/S2) Heater resistance

   1) IG "OFF" and disconnect HO2S(B1/S2) connector

   2) Measure resistance between terminal 3 and 4 of HO2S(B1/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]



1. HO2S(B1/S2) Signal
2. Sensor Ground
3. **HO2S(B1/S2) Heater Power**
4. **HO2S(B1/S2) Heater Control**

SCMF16169L

   3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

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

VERIFICATION OF VEHICLE REPAIR E112D008

Refer to DTC P0036.

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

COMPONENT LOCATION EB6C74B6

Refer to DTC P0036.

GENERAL DESCRIPTION EB7DD26F

Refer to DTC P0036.

DTC DESCRIPTION ECA58DC4

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0038. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EB9C76A0

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • short to battery in control circuit • HO2S(B1/S2) • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EEFFC06F

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8˚F)]

SCHEMATIC DIAGRAM EE3BACB2

Refer to DTC P0036.

SIGNAL WAVEFORM AND DATA EF09793A

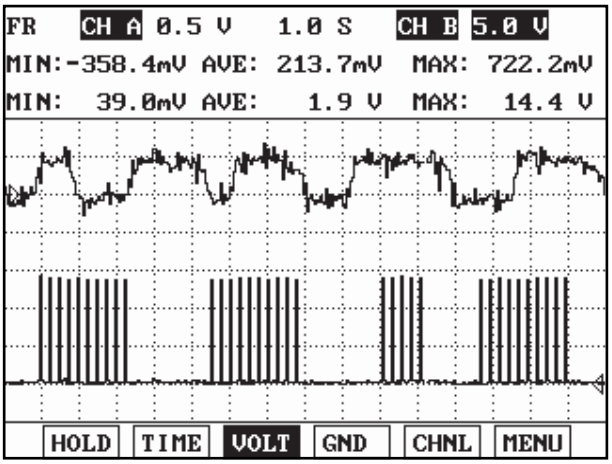


Fig. 1

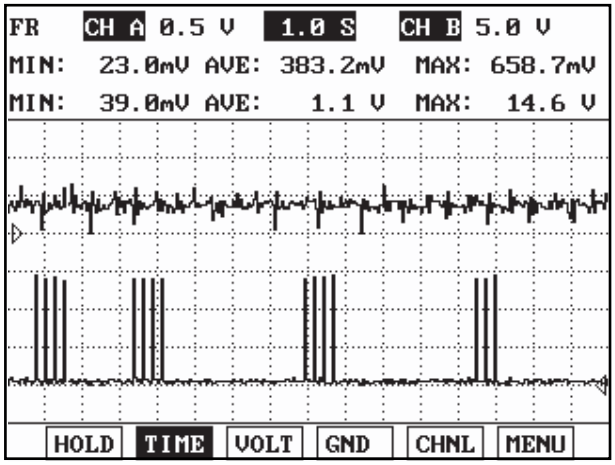


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle
Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

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 PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS E7B82B16

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E15C4596

Refer to DTC P0036.

CONTROL CIRCUIT INSPECTION E24CC29E

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

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

▶ Go to HO2S(B1/S2) "Component Inspection" procedure.

NO

▶ Repair short to battery in HO2S (B1/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0BA325D

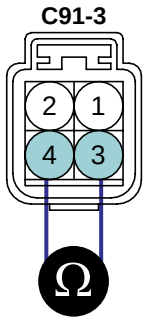
1. Check HO2S(B1/S2) Heater resistance

   1) IG "OFF" and disconnect HO2S(B1/S2) connector

   2) Measure resistance between terminal 3 and 4 of HO2S(B1/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8℉)]



1. HO2S(B1/S2) Signal
2. Sensor Ground
3. **HO2S(B1/S2) Heater Power**
4. **HO2S(B1/S2) Heater Control**

SCMF16169L

   3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

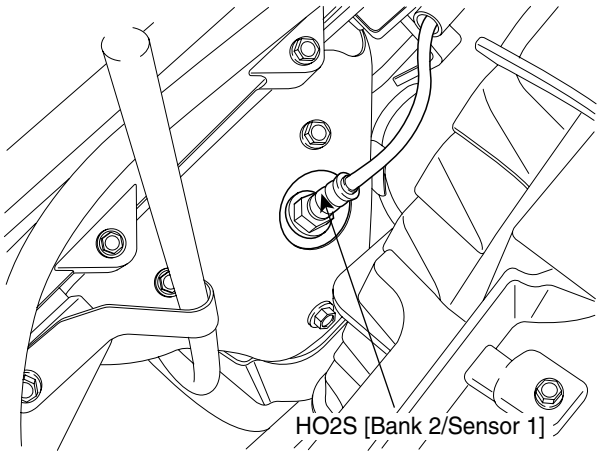
▶ Substitute with a known - good HO2S(B1/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8682525

Refer to DTC P0036.

DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 / SENSOR 1)

COMPONENT LOCATION EFDFCD54



LGLG506A

GENERAL DESCRIPTION E396D5EE

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION EC4910CB

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0050. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E470B0D8

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor the current through the heater	• Poor Connection • HO2S(B2/S1) • PCM
Enable Conditions	• Engine Running > 60 sec. • Heater Duty Cycle > 40% • Max. Duty Cycle - Min. Duty Cycle < 5%	
Threshold value	• Filtered O2 Heater Current < threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

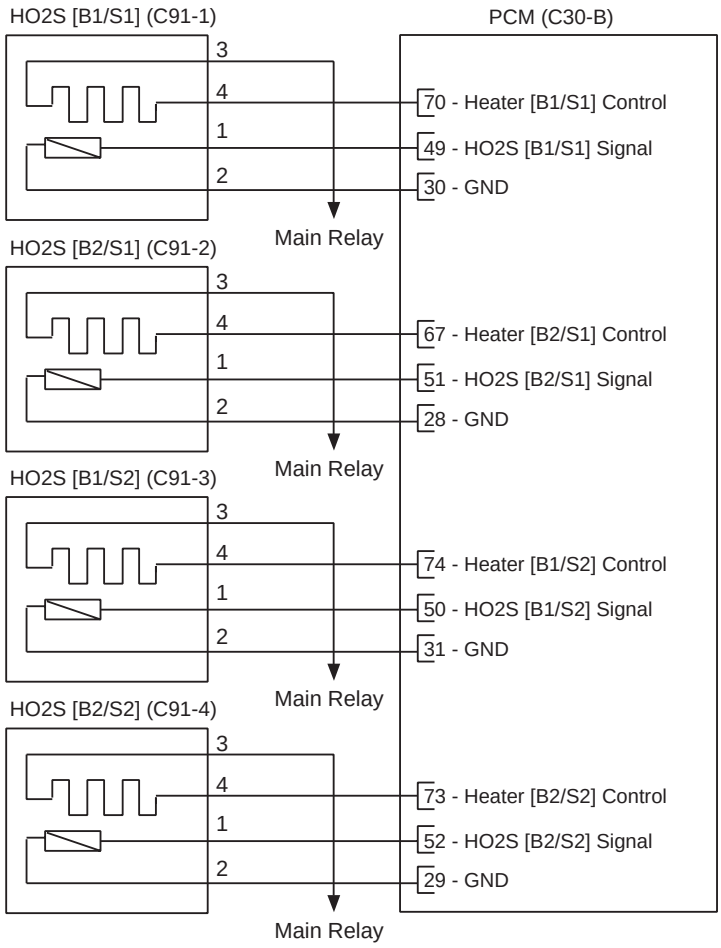
SPECIFICATION E323CB65

(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450℃(842°F) Exhaust	0.25 ± 0.1

SCHEMATIC DIAGRAM E698EE52

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

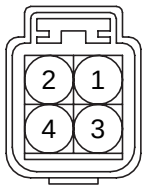
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



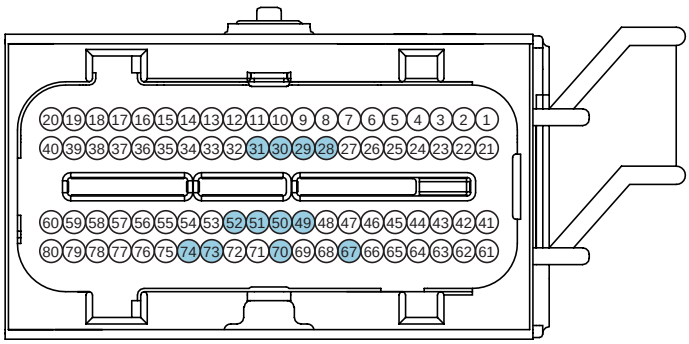
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA E8CA1A5D

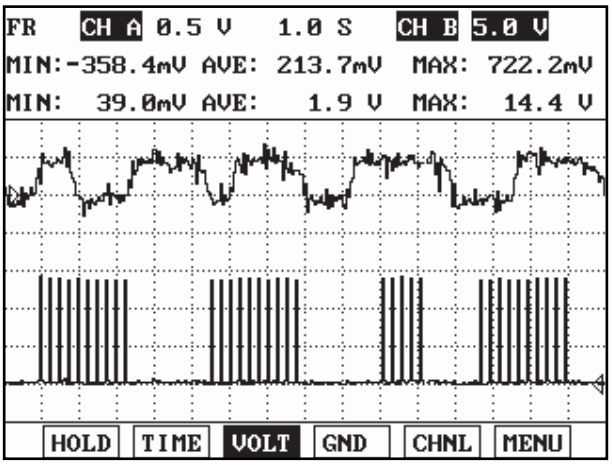


Fig. 1

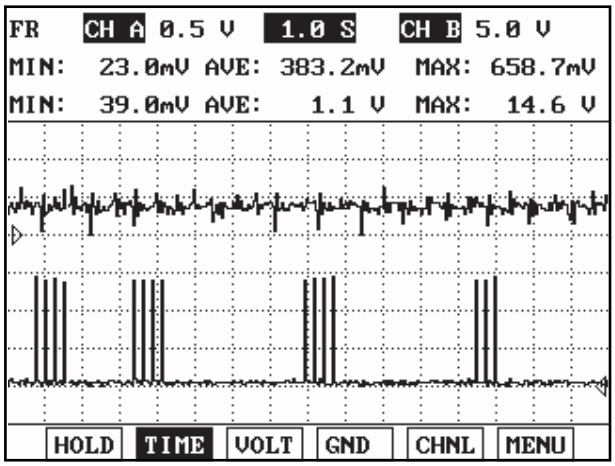


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle
Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

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 PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS EA87FFAE

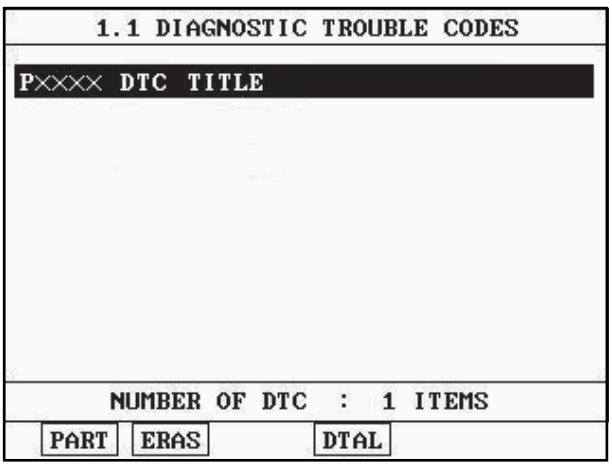
1. Check DTC Status

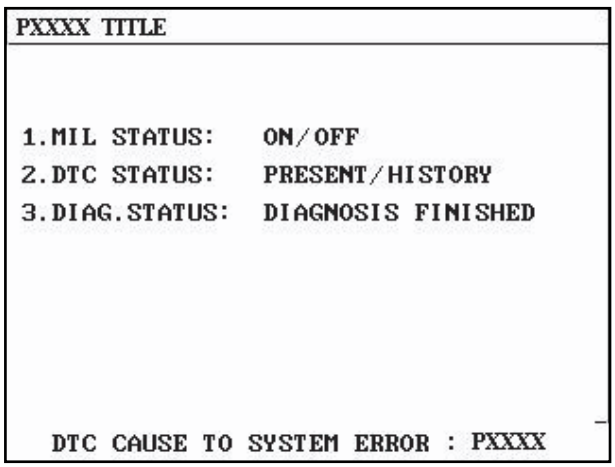
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E039415D

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 "Component Inspection" procedure.

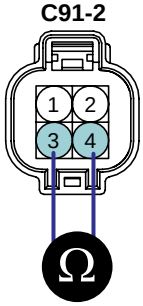
COMPONENT INSPECTION ECD12C61

1. Check HO2S(B2/S1) Heater resistance

1) IG "OFF" and disconnect HO2S(B2/S1) connector

2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)

Specification : 3.0 ~ 4.0Ω [21℃(69.8°F)]



1. HO2S(B2/S1) Signal
2. Sensor Ground
3. **HO2S(B2/S1) Heater Power**
4. **HO2S(B2/S1) Heater Control**

SCMF16233L

3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Substitute with a known - good HO2S(B2/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E726D4B8

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0051 HO2S HEATER CIRCUIT LOW (BANK 2 / SENSOR 1)

COMPONENT LOCATION E4992107

Refer to DTC P0050.

GENERAL DESCRIPTION E535D4BE

Refer to DTC P0050.

DTC DESCRIPTION E6923814

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0051. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E394EBCE

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E6E87FC9

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]

SCHEMATIC DIAGRAM E501720E

Refer to DTC P0050.

SIGNAL WAVEFORM AND DATA ECAD7DFA

Refer to DTC P0050.

MONITOR DTC STATUS EFF5CF05

1. Refer to DTC P0050.

TERMINAL AND CONNECTOR INSPECTION EF2EFE36

Refer to DTC P0050.

POWER CIRCUIT INSPECTION E9385DF1

1. IG "OFF" & Disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 3 of HO2S(B2/S1) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in HO2S(B2/S1) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EBFE5349

1. Check short to ground in harness.
   1) IG "OFF" and disconnect HO2S(B2/S1) connector.
   2) Measure resistance between terminal 4 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Infinite

   3) Is the measured resistance within specification ?

YES

▶ Go to "Check Open in harness" as follows.

NO

▶ Repair short to ground in HO2S (B2/S1) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   1) IG "OFF" and disconnect HO2S(B2/S1) and PCM connector.
   2) Measure resistance between terminal 4 of HO2S(B2/S1) harness connector and terminal C30-B (67) of PCM harness connector.

Specification : Approx. below 1Ω

   3) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in HO2S(B2/S1) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION E3ED50EA

1. Check HO2S(B2/S1) Heater resistance

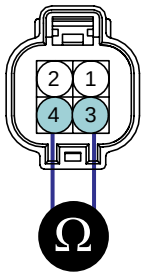
   1) IG "OFF" and disconnect HO2S(B2/S1) connector

   2) Measure resistance between terminal 1 and 2 of HO2S(B2/S1)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]

C91-2



1. HO2S(B2/S1) Signal
2. Sensor Ground
3. **HO2S(B2/S1) Heater Power**
4. **HO2S(B2/S1) Heater Control**

SCMF16174L

   3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▶ Substitute with a known - good HO2S(B2/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E0F55148

Refer to DTC P0050.

DTC P0052 HO2S HEATER CIRCUIT HIGH (BANK 2 / SENSOR 1)

COMPONENT LOCATION E91F4CFC

Refer to DTC P0050.

GENERAL DESCRIPTION E2AC4FB7

Refer to DTC P0050.

DTC DESCRIPTION EE86C43C

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0052. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EF44CFAB

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • Short to battery in control circuit • HO2S(B2/S1) • PCM
Enable Conditions	• No disabling Faults • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E9CF71E6

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8℉)]

SCHEMATIC DIAGRAM E7A3435D

Refer to DTC P0050.

SIGNAL WAVEFORM AND DATA E6595DDC

Refer to DTC P0050.

MONITOR DTC STATUS E73C5F88

Refer to DTC P0050.

TERMINAL AND CONNECTOR INSPECTION E4364E96

Refer to DTC P0050.

CONTROL CIRCUIT INSPECTION EA6A8A29

1. IG "OFF" & disconnect HO2S(B2/S1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 4 of HO2S(B2/S1) harness connector and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

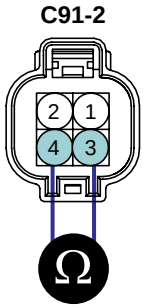
▶ Repair short to battery in HO2S(B2/S1) Heater control circuit and go to "Verification of Vhicle Repair" procedure.

COMPONENT INSPECTION E7B3B30E

1. Check HO2S(B2/S1) Heater resistance
   1) IG "OFF" and disconnect HO2S(B2/S1) connector
   2) Measure resistance between terminal 3 and 4 of HO2S(B2/S1)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8℉)]



1. HO2S(B2/S1) Signal
2. Sensor Ground
3. **HO2S(B2/S1) Heater Power**
4. **HO2S(B2/S1) Heater Control**

SCMF16174L

   3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

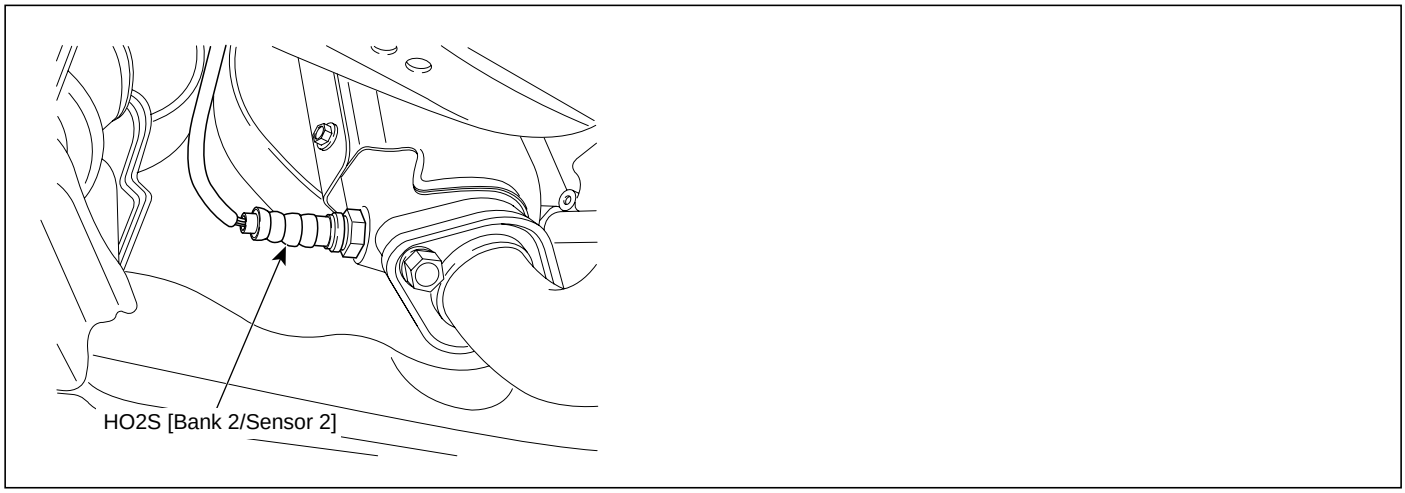
▶ Substitute with a known - good HO2S(B2/S1) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EBC231F8

Refer to DTC P0050.

DTC P0056 HO2S HEATER CONTROL CIRCUIT (BANK 2 / SENSOR 2)

COMPONENT LOCATION E817128B



SCMF16176L

GENERAL DESCRIPTION EE20DCF2

The normal operating temperature of the HO2S(Heated Oxygen Sensor) ranges from 350 to 850°C(662 to 1562°F). The HO2S heater greatly decreases the amount of time required for fuel control to become active. The ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

DTC DESCRIPTION E95D0768

Checking current from HO2S under detecting condition,if the heater current is below a certain threshold for more than predeterminate time, PCM sets P0056. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E8E45268

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor the current through the heater	• Poor connection • HO2S(B2/S2) • PCM
Enable Conditions	• Engine Running > 60 sec. • Heater Duty Cycle > 18% • Max. Duty Cycle - Min. Duty Cycle < 5%	
Threshold value	• Filtered Heater Current < threshold value	
Diagnosis Time	• Continuous (More than 2.5 second failure for every 5 second test)	
MIL On Condition	• 2 Driving Cycles	

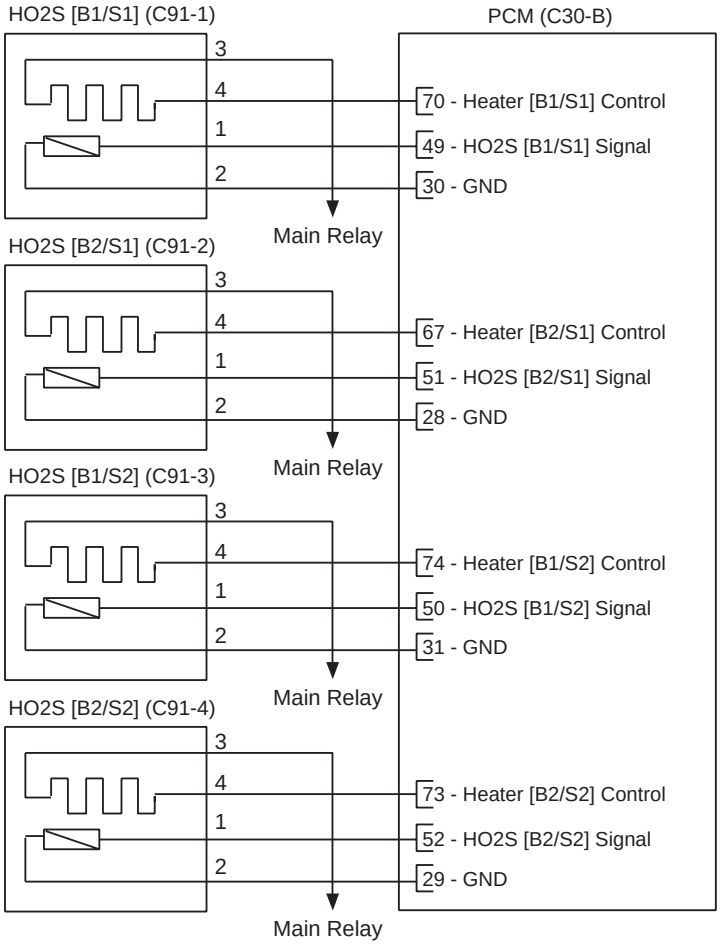
SPECIFICATION E28FDF13

(REFERENCE ONLY)

Condition	Current(A)
Heater Current at 13.5V, 450℃(842°F) Exhaust	0.52 ± 0.1

SCHEMATIC DIAGRAM E14CB6D5

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

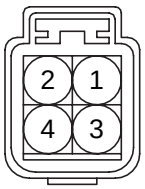
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



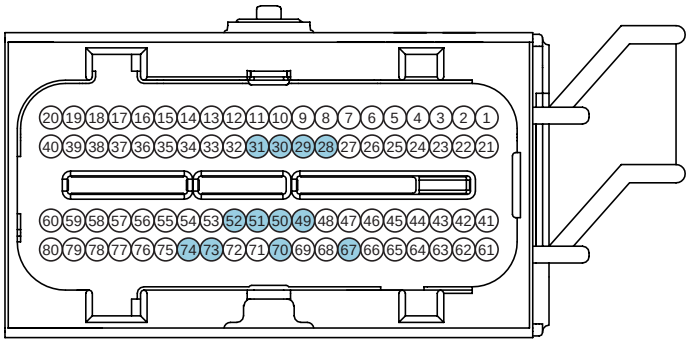
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA E0BCDEF2

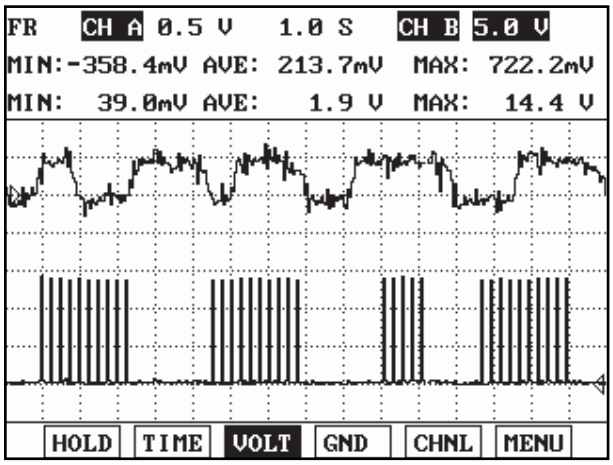


Fig. 1

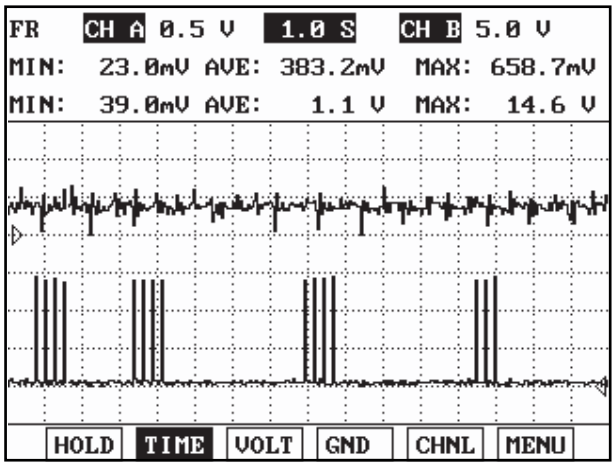


Fig. 2

Fig1) The signal waveforms of front HO2S(the upper) and heater(the lower) at idle
Fig2) The signal waveforms of rear HO2S(the upper) and heater(the lower) at idle

SCMF16158L

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 PCM controls this heater element by duty cycle. The main relay supplies voltage to the heater and the PCM provides a ground circuit for activating the heater.

MONITOR DTC STATUS E22844FA

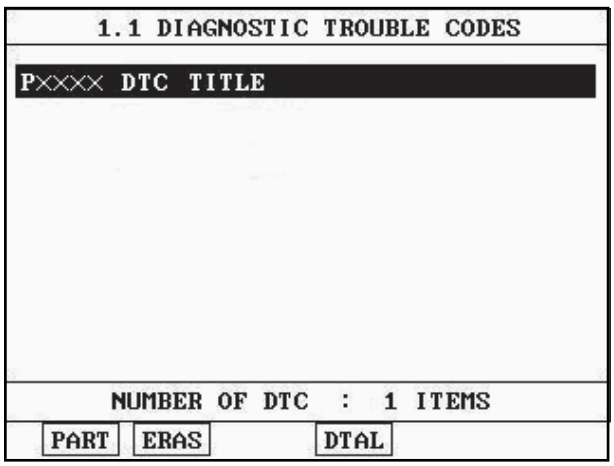
1. Check DTC Status

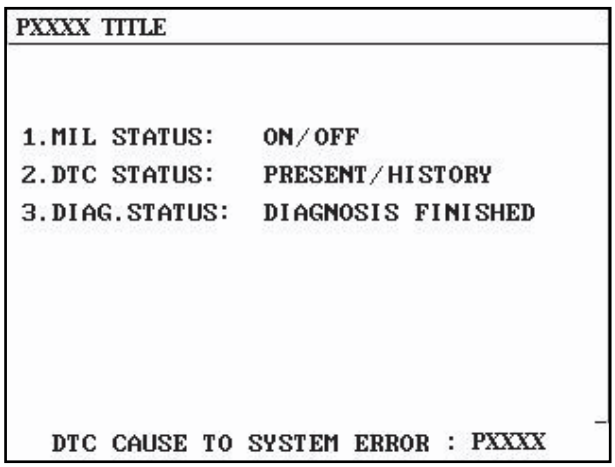
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION ED0B2600

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 " Component Inspection " procedure.

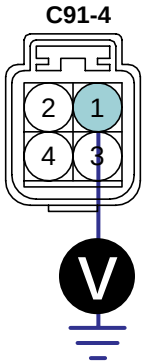
COMPONENT INSPECTION E806FF18

1. Check HO2S(B2/S2) Heater resistance

   1) IG "OFF" and disconnect HO2S(B2/S2) connector

   2) Measure resistance between terminal 3 and 4 of HO2S(B2/S2)(Component Side)

Specification : 3.0 ~ 4.0Ω [21℃(69.8˚F)]



1. HO2S(B2/S2) Signal
2. Sensor Ground
3. HO2S(B2/S2) Heater Power
4. HO2S(B2/S2) Heater Control

SCMF16234L

2. Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Substitute with a known - good HO2S(B2/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E63568BB

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0057 HO2S HEATER CIRCUIT LOW (BANK 2 / SENSOR 2)

COMPONENT LOCATION ED7330BE

Refer to DTC P0056.

GENERAL DESCRIPTION EFE22A4A

Refer to DTC P0056.

DTC DESCRIPTION E9551803

If the PCM detects short to ground or open in heater under detecting conditions, PCM sets P0057. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE2A5032

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION ED43F551

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]

SCHEMATIC DIAGRAM E7BE250F

Refer to DTC P0056.

SIGNAL WAVEFORM AND DATA E27F14FA

Refer to DTC P0056.

MONITOR DTC STATUS E63177D2

Refer to DTC P0056.

TERMINAL AND CONNECTOR INSPECTION ED10E4DC

Refer to DTC P0056.

POWER CIRCUIT INSPECTION EC78498B

1. IG "OFF" & Disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 3 of HO2S(B2/S2) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in HO2S(B2/S2) Heater power circuit then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EA808408

1. Check short to ground in harness.
   1) IG "OFF" and disconnect HO2S(B2/S2) connector.
   2) Measure resistance between terminal 4 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Infinite

   3) Is the measured resistance within specification ?

YES

▶ Go to "Check Open in harness" as follows.

NO

▶ Repair short to ground in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness
   1) IG "OFF" and disconnect HO2S(B2/S2) and PCM connector.
   2) Measure resistance between terminal 4 of HO2S(B2/S2) harness connector and terminal C30-B (73) of PCM harness connector.

Specification : Approx. below 1Ω

   3) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in HO2S(B2/S2) heater control circuit and go to "Verifiction of Vehicle Repair" procedure.

COMPONENT INSPECTION E31E12EC

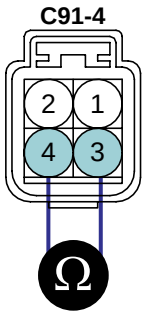
1. Check HO2S(B2/S2) Heater resistance

   1) IG "OFF" and disconnect HO2S(B2/S2) connector

   2) Measure resistance between terminal 3 and 4 of HO2S(B2/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]



1. HO2S(B2/S2) Signal
2. Sensor Ground
3. **HO2S(B2/S2) Heater Power**
4. **HO2S(B2/S2) Heater Control**

SCMF16180L

   3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

▶ Substitute with a known - good HO2S(B2/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ED007C94

Refer to DTC P0056.

DTC P0058 HO2S HEATER CIRCUIT HIGH (BANK 2 / SENSOR 2)

COMPONENT LOCATION E8EECFBE

Refer to DTC P0056.

GENERAL DESCRIPTION EBFDC1AC

Refer to DTC P0056.

DTC DESCRIPTION E1B31BA2

If the PCM detects short to battery in heater under detecting conditions, PCM sets P0058. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E95AA488

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery	• Poor Connection • Short to battery in control circuit • HO2S(B2/S2) • PCM
Enable Conditions	• No disabling Faults • Engine Running • 11V ≤ Battery Voltage ≤ 16V	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E72F6E7E

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8℉)]

SCHEMATIC DIAGRAM EDAC9D24

Refer to DTC P0056.

SIGNAL WAVEFORM AND DATA EA7786A6

Refer to DTC P0056.

MONITOR DTC STATUS E0E1DEC1

Refer to DTC P0056.

TERMINAL AND CONNECTOR INSPECTION EBFA41CB

Refer to DTC P0056.

CONTROL CIRCUIT INSPECTION EBF34ABE

1. IG "OFF" & disconnect HO2S(B2/S2) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 4 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in HO2S (B2/S2) heater control circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E516F026

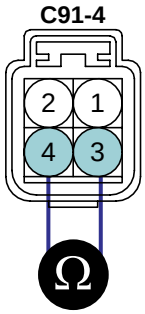
1. Check HO2S(B2/S2) Heater resistance

   1) IG "OFF" and disconnect HO2S(B2/S2) connector

   2) Measure resistance between terminal 1 and 2 of HO2S(B2/S2)(Component Side)

SPECIFICATION :

Heater	
Resistance (Ω)	3.0 ~ 4.0Ω [21℃(69.8°F)]



1. HO2S(B2/S2) Signal
2. Sensor Ground
3. **HO2S(B2/S2) Heater Power**
4. **HO2S(B2/S2) Heater Control**

SCMF16180L

   3) Is the measured resistance within specification ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

NO

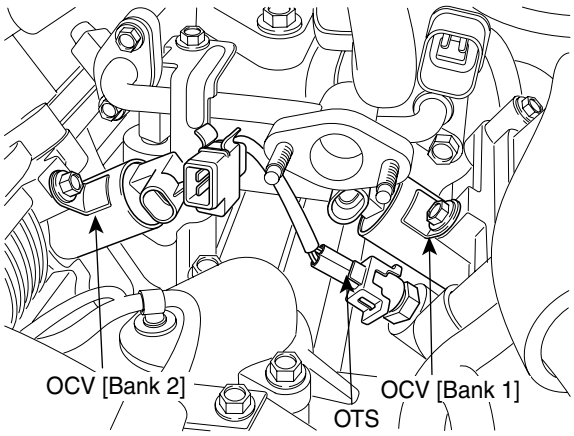
▶ Substitute with a known - good HO2S(B2/S2) and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3725F3E

Refer to DTC P0056.

DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)
DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

COMPONENT LOCATION EC804154



LGLG500A

GENERAL DESCRIPTION EC183A40

The CVVT (Continuously Variable Valve Timing) system is installed to the chain sprocket of the intake camshaft. This system controls the intake camshaft to provide the optimal valve timing for every driving condition. The ECM controls the Oil Control Valve(OCV), based on the signals output from mass air flow, throttle position and engine coolant temperature. The CVVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft becomes optimal, and the engine torque improves, fuel economy improves, exhaust emissions decrease under overall driving conditions.

DTC DESCRIPTION E095E210

When the enable condition is satisfied, the PCM checks that OCV outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second), the test is failed and DTC is stored. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E0F366C7

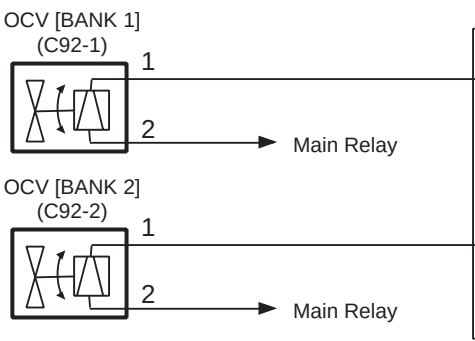
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground or open circuit of OCV circuit	• Poor Connection • Open in Power Circuit • Open or short to ground in control circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to ground or open circuit	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EF9008C7

Resistance (Ω)	6.7 ~ 7.7Ω [20℃(68˚F)]

SCHEMATIC DIAGRAM E6F09AA7

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

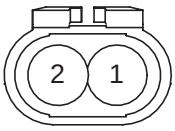
OCV [BANK 1]

Terminal	Connected to	Function
1	PCM C30-B (62)	OCV [Bank 1] control
2	Main Relay	Battery Voltage (B+)

OCV [BANK 2]

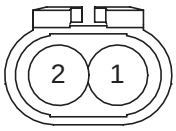
Terminal	Connected to	Function
1	PCM C30-B (61)	OCV [Bank 2] control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



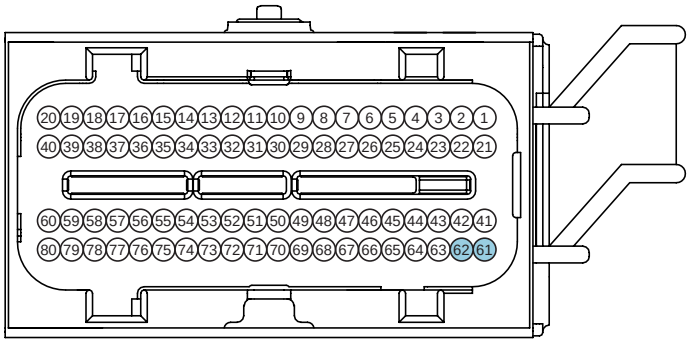
C92-1

OCV [Bank 1]



C92-2

OCV [Bank 2]



C30-B

PCM

SCMF16115L

SIGNAL WAVEFORM AND DATA E64712E4

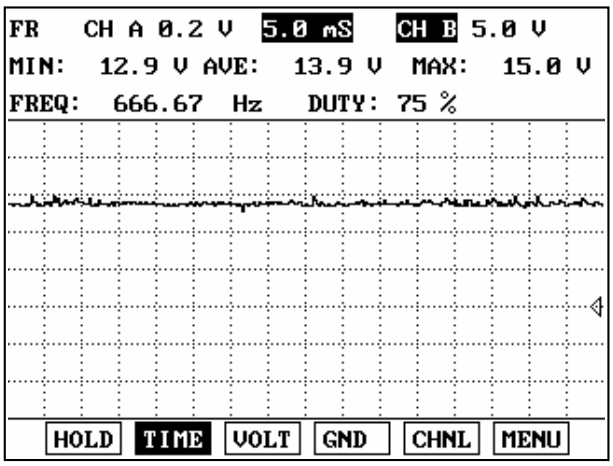


Fig. 1

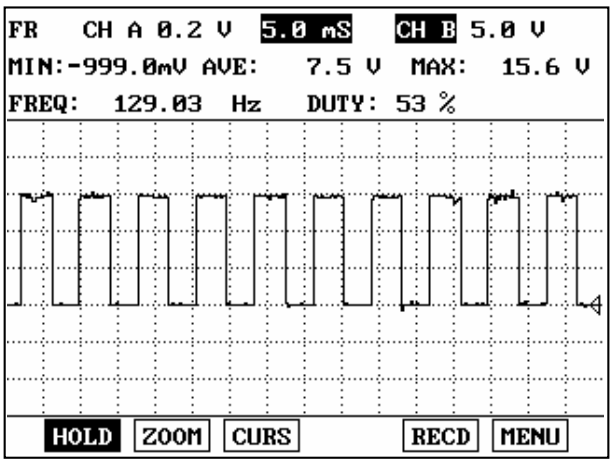


Fig. 2

Fig. 1 : Idle
Fig. 2 : Accelleration

EGRF602G

The oil control valve is commanded by a pulse-width-modulated signal from the engine control unit. A duty cycle of zero commands the cam phaser to its default position. A duty cycle of 100% commands the phaser to its maximum phased position. When the phaser must be controlled to an intermediate position, the duty cycle is maintained in the region of the 'hold position'. This is a medium duty cycle, usually between 35% and 65%, depending on temperature and voltage conditions.

MONITOR DTC STATUS E3EDACBF

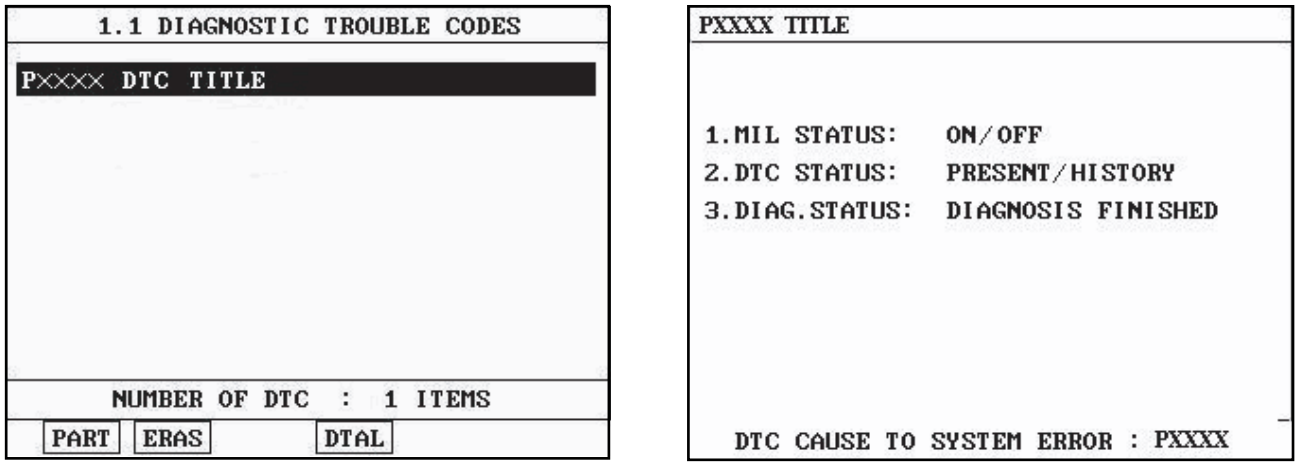
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E701FE1C

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 EB17C5EC

1. IG "OFF" & Disconnect OCV(B1) connector.
2. IG "ON" & ENG "OFF".
3. Measure voltage between terminal 2 of OCV(B1) harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check fuse between Main Relay and OCV is open or not installed.
▶ Check open in power circuit between Main Relay and OCV power circuit.
▶ Repair or repalce as necessary and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E49A77A9

1. Check short to ground in harness.
   1) IG "OFF" and disconnect OCV connector.
   2) IG "ON" & ENG "OFF".
   3) Measure resistance between terminal 1 of OCV harness connector and chassis ground.

Specification : Infinite

   4) Is the measured resistance within specification ?

YES

▶ Go to "Check open in harness" as follows

NO

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

2. Check open in harness
   1) IG "OFF" and disconnect OCV and PCM connector.

2) [P0076] Measure resistance between terminal 1 of OCV harness connector and terminal C30-B (62) of PCM harness connector.
[P0082] Measure resistance between terminal 1 of OCV harness connector and terminal C30-B (61) of PCM harness connector.

Specification : Approx. below 1Ω

3) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

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

COMPONENT INSPECTION EEFE7202

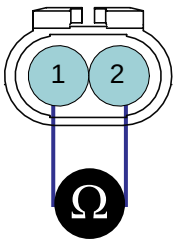
1. Check OCV

1) IG "OFF" and disconnect OCV connector.

2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

SPECIFICATION :

Resistance (Ω)	6.7 ~ 7.7Ω [20℃(68˚F)]



1. OCV control
2. OCV power

SCMF16998L

3) Is the measured resistance within specification ?

YES

▶ Go to "OCV Actuation Test" as follows.

NO

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

2. OCV Actuation Test

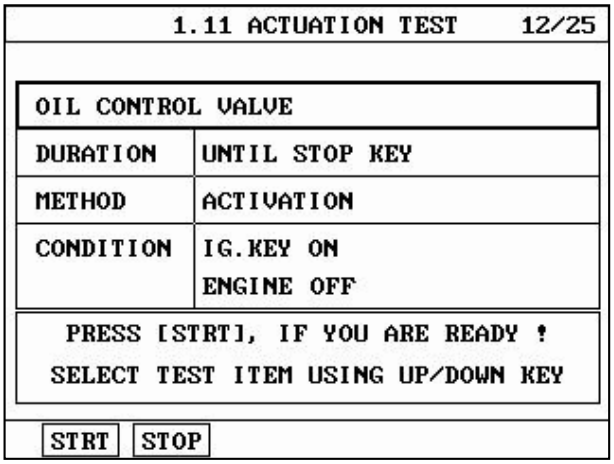
1) Connect scantool and IG "ON".

2) Select "OCV" on the Actuation Test.

3) Activate "OCV" by pressing "STRT(F1)" key.

(should hear a faint click from Oil Control solenoid Valve)

4) Repeat this procedure 4 or 5 times to ensure reliability



EGRF602M

5) Does OCV generate click sound during acutation test ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

VERIFICATION OF VEHICLE REPAIR E68A0D99

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)
DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

COMPONENT LOCATION EBE4B7B4

Refer to DTC P0076.

GENERAL DESCRIPTION E3EE6112

Refer to DTC P0076.

DTC DESCRIPTION E6C94604

When the enable condition is satisfied, the PCM checks that OCV outputs (Voltage level) are observed when OCVs are commanded. When a OCV output failure is detected, the appropriate fail counter is incremented.
If the failure threshold is exceeded 5 seconds during one diagnostic test(10second),the test is failed and DTC is stored.
MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E5241C91

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to battery of OVC circuit	• Poor Connection • Short to battery in Control Circuit • OCV • PCM
Enable Conditions	• No disabling Faults Present • Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec	
Threshold value	• Short to battery	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EBE87B33

Refer to DTC P0076.

SCHEMATIC DIAGRAM ED688252

Refer to DTC P0076.

SIGNAL WAVEFORM AND DATA E2078BE7

Refer to DTC P0076.

MONITOR DTC STATUS E5EBE25E

Refer to DTC P0076.

TERMINAL AND CONNECTOR INSPECTION E57DBE3C

Refer to DTC P0076.

CONTROL CIRCUIT INSPECTION E6D7EE7A

1. IG "OFF" and Disconnect OCV connector.
2. Measure resistance between terminal 1 and 2 of OCV harness connector.

Specification : Infinite

3. Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

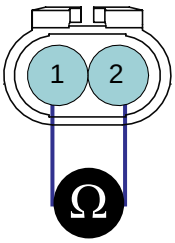
▶ Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFD05898

1. Check OCV
   1) IG "OFF" and disconnect OCV connector.
   2) Measure resistance between terminal 1 and 2 of OCV. (Component Side)

SPECIFICATION :

Resistance (Ω)	6.7 ~ 7.7Ω [20℃(68˚F)]



1. OCV control
2. OCV power

SCMF16998L

   3) Is the measured resistance within specification ?

YES

▶ Go to "OCV Actuation Test" as follows.

NO

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

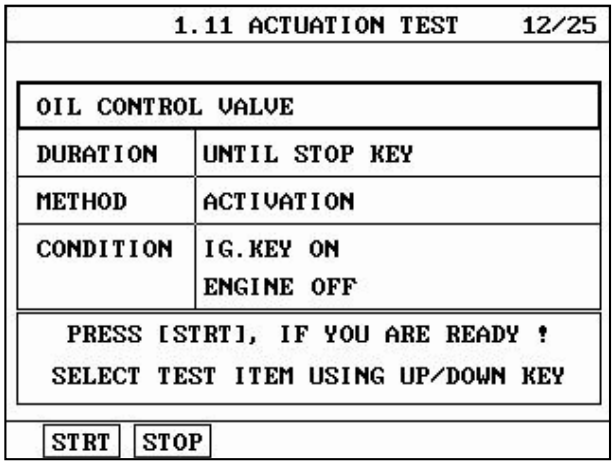
2. OCV Actuation Test

1) Connect scantool and IG "ON".

2) Select "OCV" on the Actuation Test.

3) Activate "OCV" by pressing "STRT(F1)" key.
(should hear a faint click from Oil Control solenoid Valve)

4) Repeat this procedure 4 or 5 times to ensure reliability



EGRF602M

5) Does OCV generate click sound during acutation test ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

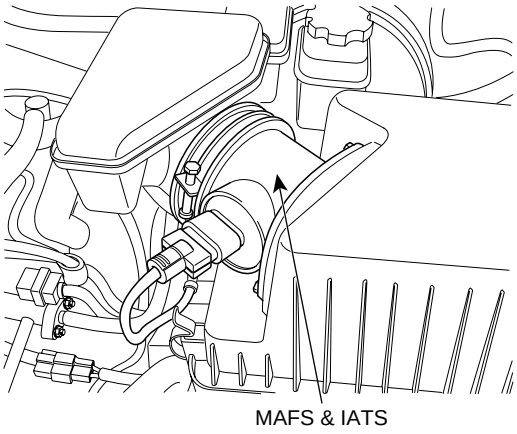
▶ Substitute with a known - good OCV and check for proper operation. If the problem is corrected, replace OCV and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E240091F

Refer to DTC P0076.

DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E45377FC



SCMF16185L

GENERAL DESCRIPTION E1F15262

The Mass Air Flow Sensor (MAFS) is located between the air cleaner assembly and the throttle body. The MAFS uses a hot film type sensing element to measure the mass of intake air entering the engine. This hot film type air flow sensor consists of a hot film sensor, housing and metering ducts. Mass air flow rate is measured by detection of heat transfer from a hot film probe. The change in air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air. A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle. The mass of intake air should increase at acceleration and be stable during constant engine speed. The ECM uses this information to determine the injection duration and ignition timing for the desired air/fuel ratio.

DTC DESCRIPTION E06B8990

The difference between values coming from the MAF Sensor and those are calculated is analyzed. This difference, or error, is then compared to high and low limit calibration values, which are functions of engine speed. PCM compares MAFS output to calculated flow rate value while enable condition is met.
If the actual air flow is higher than Maximum threshold, or lower than Minimum threshold for more than 75 seconds failure for every 125 seconds test. PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E930E251

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the difference between MAF Sensor output and calculated flow rate value to a calibration value	• Poor connection • Open or short in harness • Clogged air cleaner • MAFS • PCM
Enable Conditions	• Barometric Pressure enable conditions criteria met • Engine Coolant Temperature ≥ 60℃ • 600rpm 〈 Engine Speed 〈 3000rpm • Air Conditioning Clutch not transitioning • Torque Control is not Active • Traction Control is not Active • Brake switch is not active • Current Transmission Torque Converter Clutch State same as previous • Power Steering is not Cramped • Engine Speed difference ≤ 300rpm • TPS value difference ≤ 5% • MAP value difference ≤ 7 kPa • Idle Airflow difference ≤ 10% • Cam phasing control changes ≤ 10% • MAP/TPS Rationality High Power Condition Fail Criteria Not Met • MAP/TPS Rationality Low Power Condition Fail Criteria Not Met • MAP/TPS Rationality Decel. Condition Fail Criteria Not Met • BARO Update Enable Criteria Met • Enable Timer ≥ 1.5s	
Thresh old value	• Comparision result value is out of calibration value	
Diagnosis Time	• Continuous (More than 75 seconds failure for every 125 seconds test)	
MIL On Condition	• 2 driving cycles	

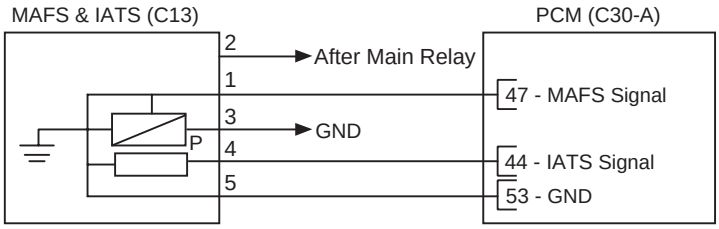
SPECIFICATION EFBE022F

Air Flow (kg/h)	Frequency (Hz)
12.6 kg/h	2,617Hz
18.0 kg/h	2,958Hz
23.4 kg/h	3,241Hz
32.4 kg/h	3,653Hz
43.2 kg/h	4,024Hz
57.6 kg/h	4,399Hz
72.0 kg/h	4,704Hz
108.0 kg/h	5,329Hz
144.0 kg/h	5,897Hz
198.0 kg/h	6,553Hz
270.0 kg/h	7,240Hz
360.0 kg/h	7,957Hz

486.0 kg/h	8,738Hz
666.0 kg/h	9,644Hz
900.0 kg/h	10,590Hz

SCHEMATIC DIAGRAM E99FB490

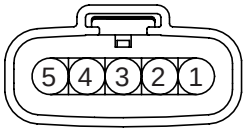
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

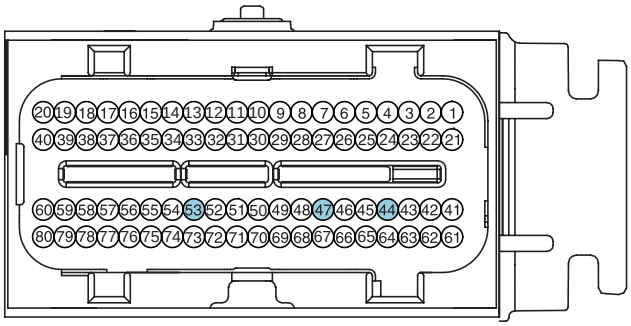
Terminal	Connected to	Function
1	PCM C30-A (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C30-A (44)	IATS Signal
5	PCM C30-A (53)	Sensor Ground

[HARNESS CONNECTORS]



C13

MAFS & IATS



C30-A

PCM

SCMF16104L

MONITOR DTC STATUS EBC98EAC

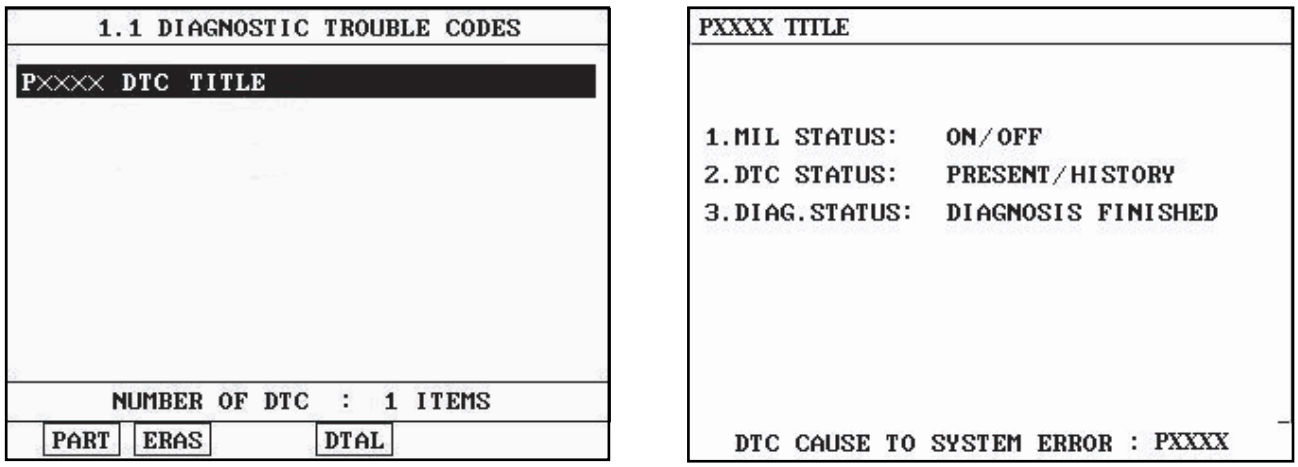
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EFBEBE2F

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 EC357CC1

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

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" proceudure.

NO

▶ Check that fuse between MAFS and Main Relay is open or not installed.
▶ Check open in power circuit between MAFS and Main Relay.
▶ Go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E716B66B

1. IG "OFF" and disconnect MAFS connector.
2. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair contact resistance or open in harnesss and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E88E4F5E

1. IG "OFF" and disconnect MAFS connector.
2. IG "ON' & ENG "OFF".
3. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.

Specification : Approx. 5V

4. 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 E6A7DABE

1. Visual Inspection

   1) Check that MAFS is damaged, contaminated or deformed.

   2) Check tha air cleaner is clogged.

   3) Has a problem been found ?

   YES

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

   NO

   ▶ Go to "Check MAFS" as follows

2. Check MAFS

   1) IG "OFF" and install a scantool

   2) ENG "ON" and monitor "MAFS" data on the service data.

   3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

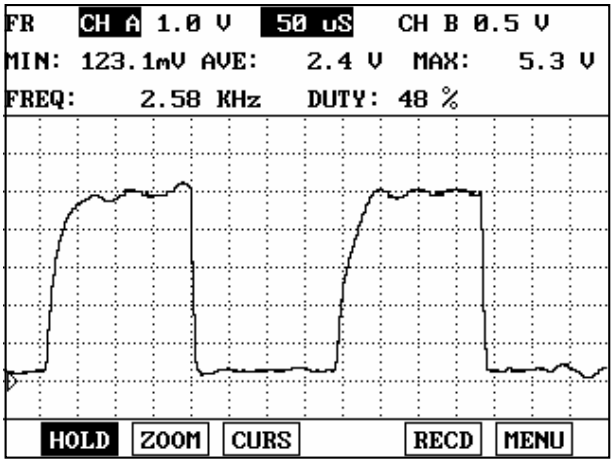


Fig. 1

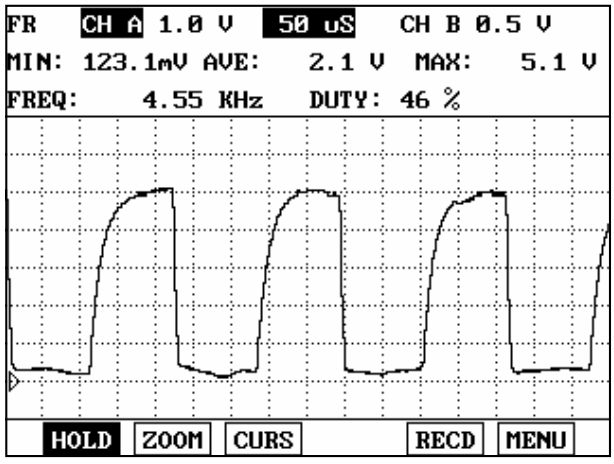


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

EGRF603D

4) Are both service data and signalwave form dispayed correctly ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

VERIFICATION OF VEHICLE REPAIR E1B5FE68

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

COMPONENT LOCATION EA92D299

Refer to DTC P0101.

GENERAL DESCRIPTION ECAA2EB9

Refer to DTC P0101.

DTC DESCRIPTION E4654CDA

The PCM compares the airmeter input frequency to low and high limits. When the frequency is outside the allowable limits, the circuit is determined to be failed.
If PCM detects that frequency signal of MAFS is lower than 1000Hz for more than 75 second failure during one dignostic test(125 second) while enable condition is met, PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EF0585E2

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the airmeter input frequency to a low limit	• Poor Connection • Open or short in harness • MAFS • PCM
Enable Conditions	• Engine Speed ≥ 500 rpm • Engine Running Time ≥ 5 second • Ignition Voltage ≥ 11V • Conditions met delay time ≥ 1 second	
Threshold value	• MAF frequency signal 〈 1000Hz	
Diagnosis Time	• Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E68C1575

Refer to DTC P0101.

SCHEMATIC DIAGRAM EA1D4DF0

Refer to DTC P0101.

MONITOR DTC STATUS E9A71DE1

Refer to DTC P0101.

TERMINAL AND CONNECTOR INSPECTION E72B5CFD

Refer to DTC P0101.

POWER CIRCUIT INSPECTION E01EFF96

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

Specification : B+

4. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" Procedure.

NO

▶ Check fuse between MAFS and main relay is open or not installed.
▶ Repair open in power harness between MAFS and main relay and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EDB71EDC

1. Check voltage
   1) IG "OFF" and disconnect MAFS connector.
   2) IG "ON' & ENG "OFF".
   3) Measure voltage between terminal 1 of MAFS harness connector and chassis ground.

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ If the measured voltage is "0", go to "Check open in harness" as follows. If the measured voltage is over "5V", go to " Check short to battery in harness" as follows.

2. Check short to battery in harness
   1) IG "OFF" and disconnect MAFS and PCM connector.
   2) Measure resistance between terminal 1 and 2 of MAFS harness connector.
   3) Measure resistance between terminal 1 and 4 of MAFS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification ?

YES

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

NO

▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness

   1) IG "OFF" and disconnect MAFS and PCM connector.

   2) Measure resistance between terminal 1 of MAFS harness connector and chassis ground.

Specification : Infinite

   3) 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.

4. Check open in harness

   1) IG "OFF" and disconnect MAFS and PCM connector.

   2) Measure resistance between terminal 1 of MAFS harness connector and terminal C30-A (47) of PCM harness connector.

Specification : Approx. below 1Ω .

   3) Is the measured resistance within specification ?

YES

▶ Go to "Ground circuit Inspection" procedure.

NO

▶ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0C934B8

1. IG "OFF" and disconnect MAFS connector.
2. Measure voltage between terminal 1 of MAFS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair contact resistance or open in harnesss and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EB5DFEB3

1. Visual Inspection

   1) Check that MAFS is damaged, contaminated or deformed.

   2) Has a problem been found ?

      YES

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

      NO

      ▶ Go to "Check MAFS" as follows

2. Check MAFS

   1) IG "OFF" and install a scantool

   2) ENG "ON" and monitor "MAFS" data on the service data.

   3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

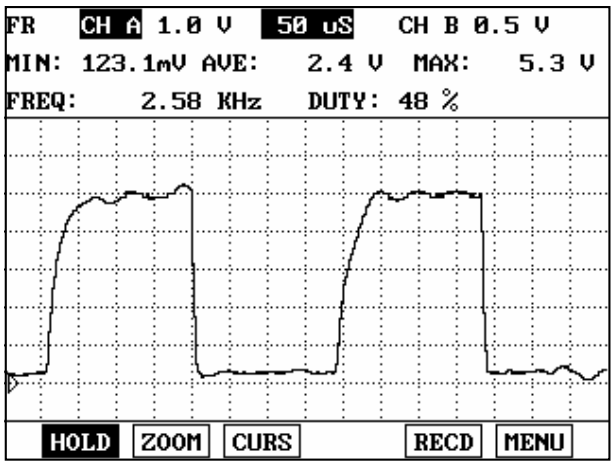


Fig. 1

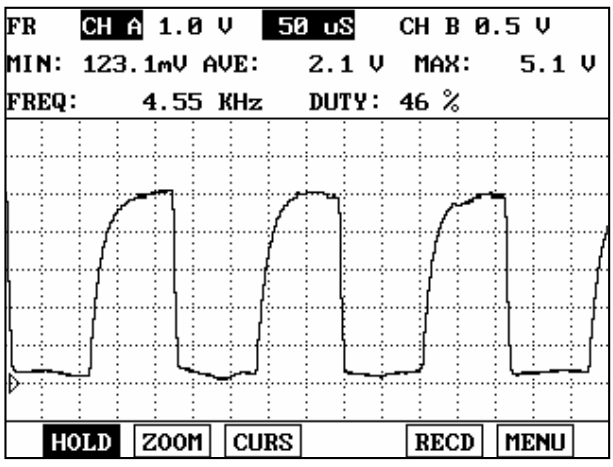


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

EGRF603D

   4) Are both service data and signalwave form dispayed correctly ?

      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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

VERIFICATION OF VEHICLE REPAIR EBBF5268

Refer to DTC P0101.

DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

COMPONENT LOCATION E9D056EB

Refer to DTC P0101.

GENERAL DESCRIPTION EC05A3D3

Refer to DTC P0101.

DTC DESCRIPTION E9038980

The PCM compares the airmeter input frequency to low and high limits.
If PCM detects that frequency signal of MAFS is higher than 11900Hz for more than 75 second failure during 125 second dignostic test while enable condition is met, PCM determines that a fault exists and a DTC is stored.MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7DFA25A

Item	Detecting Condition	Possible cause
DTC Strategy	• Compares the airmeter input frequency to a high limit	• Noise • MAFS • PCM
Enable Conditions	• Engine Speed ≥ 500 rpm • Engine Running Time ≥ 5 second • Ignition Voltage ≥ 11V • Conditions met delay time ≥ 1 second	
Threshold value	• MAF frequency signal 〉 11900Hz	
Diagnosis Time	• Continuous (More than 75 second failure for every 125 second tests)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E751A027

Refer to DTC P0101.

SCHEMATIC DIAGRAM E2026F7A

Refer to DTC P0101.

MONITOR DTC STATUS EBFDBB23

Refer to DTC P0101.

TERMINAL AND CONNECTOR INSPECTION EEE097C3

Refer to DTC P0101.

GROUND CIRCUIT INSPECTION E04A4C53

1. IG "OFF"

2. Disconnector MAFS connector.
3. Measure the voltage between terminal 1 of MAFS harness connector.
4. Measure the voltage between terminal 1 and 3 of MAFS harness connector.

Specification : Voltage difference and "A" and B" is below 200mV

5. Is the measured voltage within the specification?

YES

▶ Go to "Component Inspection".

NO

▶ After repairing or replacing contact resistance in ground circuit and open in the MAFS circuit, go to "Verification and Vehicle Repair".

COMPONENT INSPECTION E6DE5338

1. Visual Inspection
   1) Check that MAFS is damaged, contaminated or deformed.
   2) Has a problem been found ?

YES

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

NO

▶ Go to "Check MAFS" as follows

2. Check MAFS
   1) IG "OFF" and install a scantool
   2) ENG "ON" and monitor "MAFS" data on the service data.
   3) Monitor signal waveform at terminal 1 of MAFS with scantool.

Specification :Signal waveform will be displayed as follows. (Be aware that the signal of MAFS is not voltage display but frequency display.)

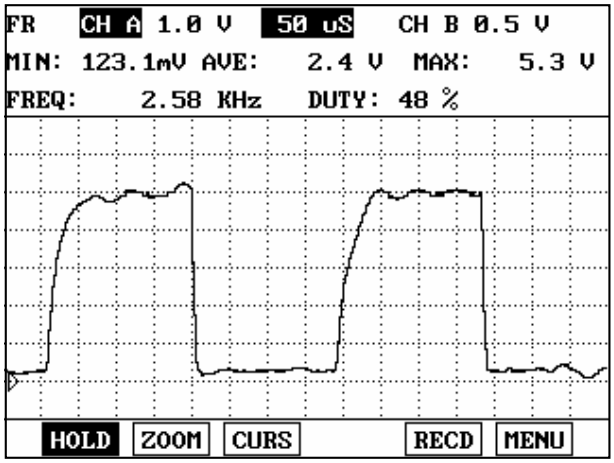


Fig. 1

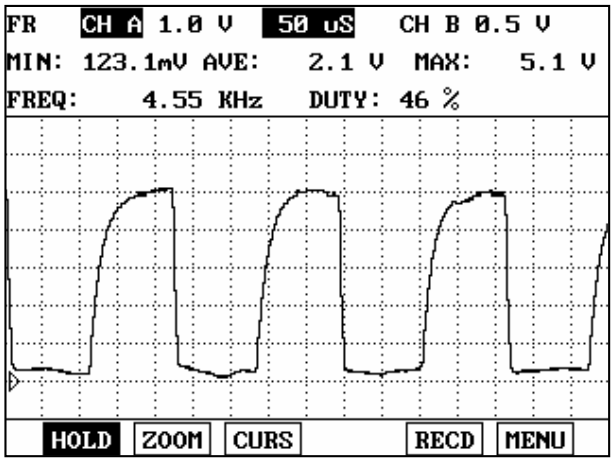


Fig. 2

Fig. 1 : Idle
Fig. 2 : Acceleration

EGRF603D

4) Are both service data and signalwave form dispayed correctly ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

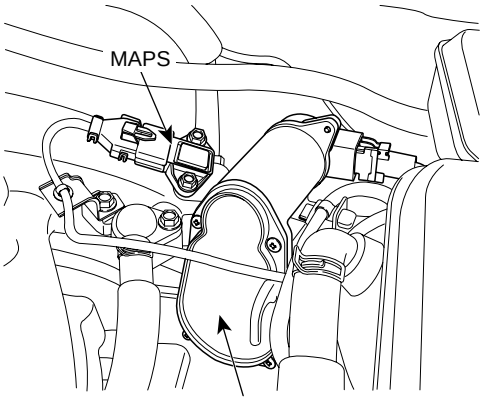
▶ Substitute with a known - good MAFS and check for proper operation. If the problem is corrected, replace MAFS and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR ECC266EC

Refer to DTC P0101.

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

COMPONENT LOCATION ED009E33



SCMF16192L

GENERAL DESCRIPTION EFA5C66C

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 also 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 outputted by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION E377698C

PCM compares the MAPS output and calculated MAPS value while enable condition ismet. If the acutal MAP value is higher than Maximum threshold or lower than Minimum threshold for 15 secondfailure during one diagnostic test(32 second),PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E0A4A66A

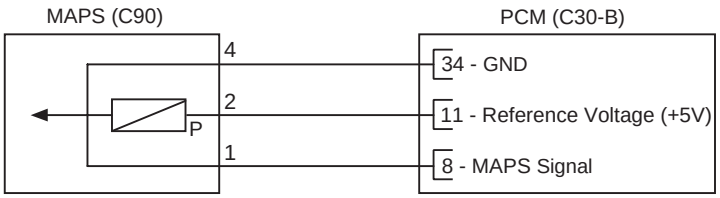
Item		Detecting Condition	Possible cause
DTC Strategy		• The MAP reading is compared to expected MAP high and low limits based on engine speed & Throttle Position	• Poor connection • Open or short in harness • MAPS • PCM
Enable	Case 1	**Power conditions** • Engine running • Disabling faults present • Power stable conditions present • 1300rpm ≤ Engine speed ≤ 4000rpm • The minimum consecutive time 〉 1.5 s	
	Case 2	**Deceleration conditions** • Engine running • Disabling faults present • Transmission torque convert clutch condition stable • Decel stable conditions present • 1200rpm ≤ Engine speed ≤ 4500rpm • Trottle position 〈 7.9% • Vehicle speed ≥ 30kph • The minimum consecutive time 〉 1.5 s	
Thresh-old	Case 1	**Power Test** • Altitude compensated MAP 〈 Memorized min. MAP data • Altitude compensated MAP 〉 Memorized max. MAP data	
	Case 2	**Deceleration Test** • Altitude compensated MAP 〈 Memorized MAP data	
Diagnosis Time		• Continuous (More than 15 seconds failure for every 32 seconds test)	
MIL On Condition		• No MIL ON (DTC only)	

SPECIFICATION EFAF42F3

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				

SCHEMATIC DIAGRAM E596AE25

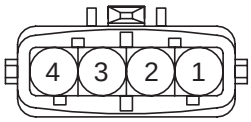
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

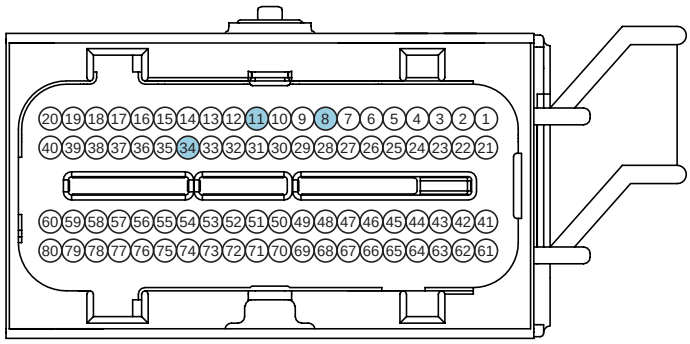
Terminal	Connected to	Function
1	PCM C30-B (8)	MAPS Signal
2	PCM C30-B (11)	Reference Voltage (+5V)
3	-	-
4	PCM C30-B (34)	Sensor ground

[HARNESS CONNECTORS]



C90

MAPS

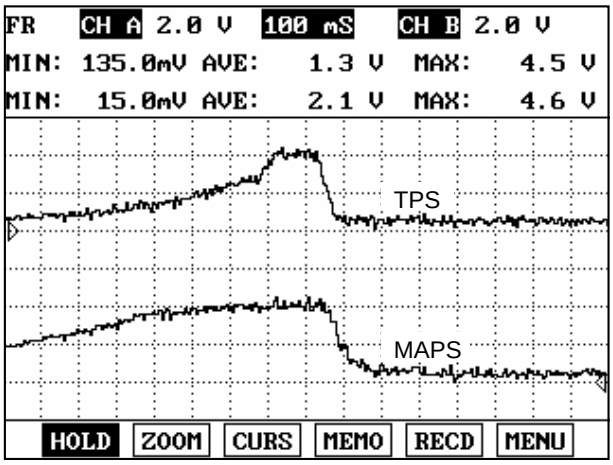


C30-B

PCM

SCMF16105L

SIGNAL WAVEFORM AND DATA E8C9C339



EGRF603O

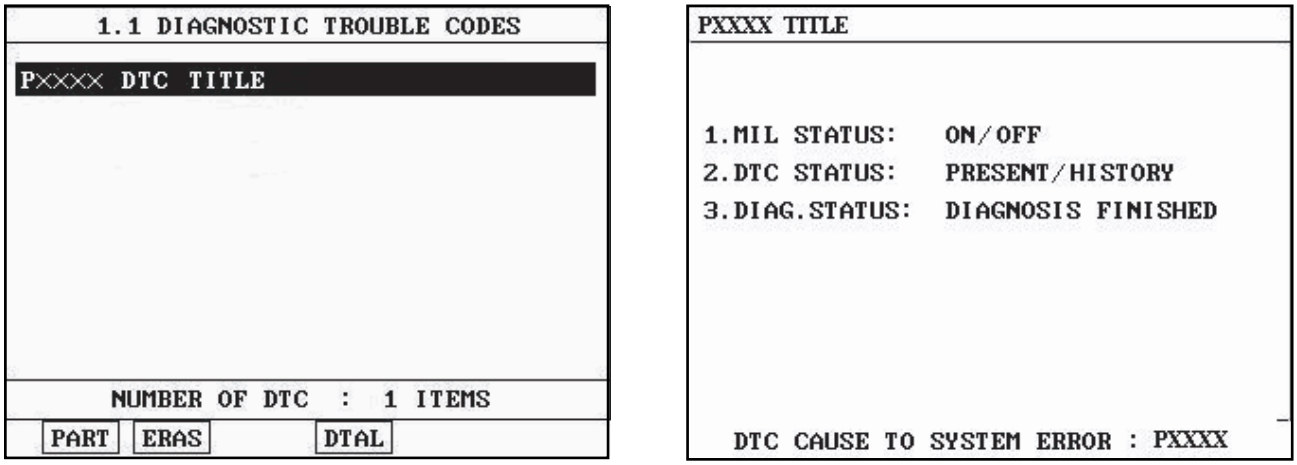
It is necessary that MAPS should be checked along with TPS. Because The MAP/TPS Rationality Diagnostic is comprised of two tests. A deceleration test is performed to provide a robust method for detection of an altitude compensated MAP value that is too high for the deceleration condition. The second test compares the altitude compensated MAP value to both high and low limits, dependent upon throttle position and engine speed. When the MAP value is out of the threshold range, the MAP/TPS system is determined to be failed.

MONITOR DTC STATUS EEBDFC81

1. Check DTC Status
   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EC4BF9BB

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 E00C3490

1. IG "OFF" and disconnect MAPS connector.

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

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0B574AA

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

Specification : Voltage difference between Measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E4B8CBED

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

Specification : Approx. 0V

   4) Is the measured voltage within specification ?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF" and disconnet MAPS and PCM connector.

2) Measure resistance between terminal 1 of MAPS harness connector and terminal C201-2 (8) of PCM harness connector.

Specification : Approx. Below 1 Ω

3) Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EADD83A9

1. Check MAPS Performance

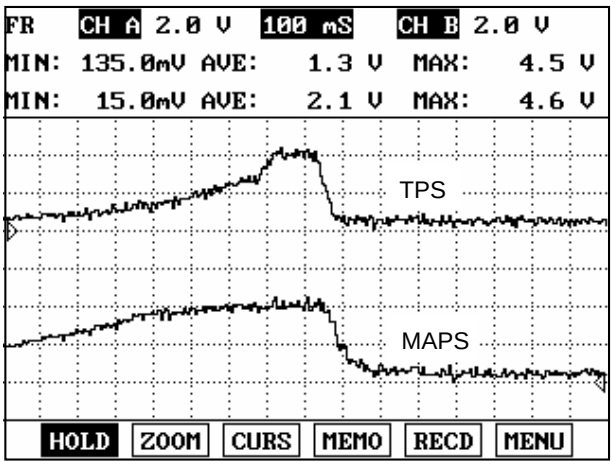
1) IG "OFF" and install scatool.

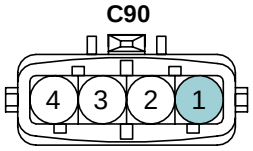
2) Connect probe to MAPS and TPS to check signal waveform by using oscilloscope function.

3) ENG "ON" and monitor signal waveform during accelleration and decelleration.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16197L

4) Is the measured signal waveform(MAP/TPS Rationality) O.K ?

YES

▶ Go to "Check PCM" 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.

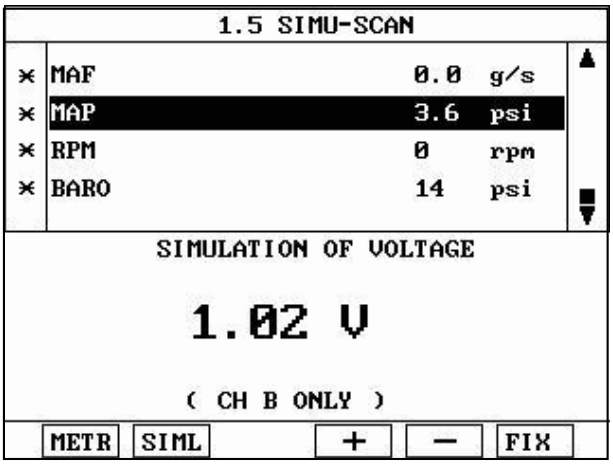
2. Check PCM

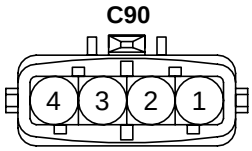
1) IG "OFF" disconnect MAPS connector

2) Connect Scantool and IG "ON" & ENG "OFF"

3) Select simulation function on scantool.

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





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16198L

5) Does the signal value of MAP sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E72837AD

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

COMPONENT LOCATION E6BC03D5

Refer to DTC P0106.

GENERAL DESCRIPTION E98C4468

Refer to DTC P0106.

DTC DESCRIPTION EE077925

Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is below 0.25V for more than 2.5 sec., PCM sets P0107. MIL(Malfuction Indication Lamp) turns on when the malfunction lasts till continuous 2 driving cycle.

DTC DETECTING CONDITION EC82B062

Item		Detecting Condition	Possible cause
DTC Strategy		• This code detects a continuous short to low or open in either the signal circuit or the MAP	• Connecting condition • Open or short to ground in power circuit • Open or short to ground in signal circuit • MAPS • PCM
Enable Condi-tions	Case 1	• No TPS Active Fault Present • Ignition Voltage ≥ 11V • Engine Speed ≤ 1000rpm • Throttle Position ≥ 0%	
	Case 2	• No TPS Active Fault Present • Ignition Voltage ≥ 11V • Engine Speed 〉 1000rpm • Throttle Position ≥ 30%	
Threshold value		• MAP Signal 〈 0.25V	
Diagnosis Time		• Continuous (More than 2.5 seconds failure for every 5 seconds test)	
MIL On Condition		• 2 Driving Cycle	

SPECIFICATION ED30BA2C

Refer to DTC P0106.

SCHEMATIC DIAGRAM E4E6E1E6

Refer to DTC P0106.

SIGNAL WAVEFORM AND DATA EB4EC3FE

Refer to DTC P0106.

MONITOR DTC STATUS E4465B0E

Refer to DTC P0106.

TERMINAL AND CONNECTOR INSPECTION E7BD305E

Refer to DTC P0106.

POWER CIRCUIT INSPECTION E6A16B22

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

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" of MAPS.

NO

▶ After repairing open or short to ground in circuits and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION E3918D36

1. Check short to ground in harness.
   1) IG "OFF"
   2) Disconnect MAPS and PCM connector.
   3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

Specification : Infinite

   4) Is the measured resistance within the specification?

YES

▶ Go to "Check open in the harness" procedure.

NO

▶ After repairing short to ground in harness and go to "Verification of Vehicle Repair"

2. Check open in the harness
   1) IG "OFF"
   2) Disconnect MAPS and PCM connector.

3) Measure the resistance between terminal 1 of MAPS harness connector and terminal C30-B (8) of PCM harness connector

Specification : Approx. below 1 Ω

4) Is the measured resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in the harness and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION E8D15C53

1. MAPS performance test

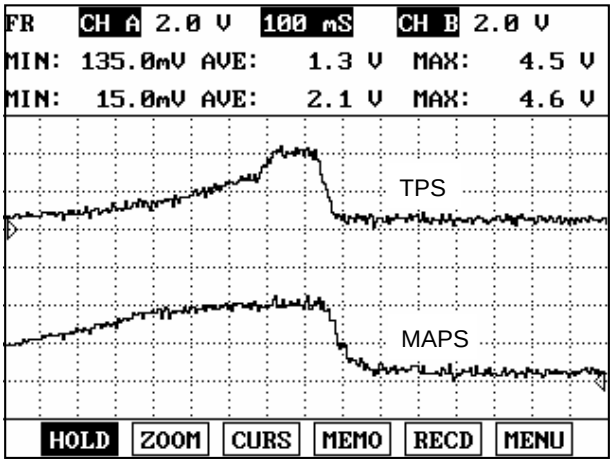
1) IG "OFF"

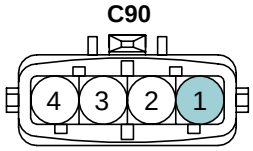
2) Connect scantool to Data Link Connector(DLC) and selest "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating

3) ENG "ON" and monitor signal waveform during accelleration and decelleration.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16197L

4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

▶ Go to "Check PCM".

NO

▶ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

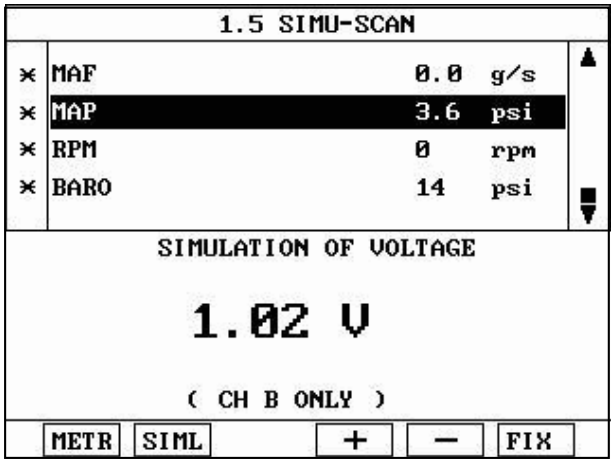
2. Check PCM

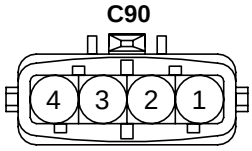
1) IG "OFF" disconnect MAPS connector

2) Connect Scantool and IG "ON" & ENG "OFF"

3) Select simulation function on scantool.

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





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16198L

5) Does the output voltage response to the change of signal by simulation?

YES

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

NO

▶ 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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E9C5B29D

Refer to DTC P0106.

DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E6C6809E

Refer to DTC P0106.

GENERAL DESCRIPTION EC7E4A76

Refer to DTC P0106.

DTC DESCRIPTION E7F708B4

Checking output signals of MAPS every 5 sec. under detecting condition, if an output signal is above 4.5V for more than 2.5 sec., PCM sets P0108. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4CDE73D

Item		Detecting Condition	Possible cause
DTC Strategy		• This code detects a continuous short to high in either the signal circuit or the MAP sensor	• Connecting condition • Short to battery in Signal Circuit • Open in Ground Circuit • Faulty MAPS • Faulty PCM
Enable Condi-tions	Case 1	• No TPS Active Fault Present • Engine Running Time 〉 10sec. • Engine Speed ≤ 2500rpm • Throttle Position ≤ 30%	
	Case 2	• No TPS Active Fault Present • Engine Running Time 〉 10sec. • Engine Speed 〉 2500rpm • Throttle Position ≤ 40%	
Threshold value		• MAP Signal 〉 4.5V	
Diagnosis Time		• Continuous (More than 2.5 seconds failure for every 5 seconds test)	
MIL On Condition		• 2 Driving Cycle	

SPECIFICATION EA6ABE01

Refer to DTC P0106.

SCHEMATIC DIAGRAM EC026FEC

Refer to DTC P0106.

SIGNAL WAVEFORM AND DATA E311481A

Refer to DTC P0106.

MONITOR DTC STATUS EEDDA889

Refer to DTC P0106.

TERMINAL AND CONNECTOR INSPECTION E6706E2D

Refer to DTC P0106.

POWER CIRCUIT INSPECTION EFB51A55

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

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ If the voltage is over 5.1V, check short to battery in harness.
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E66AA21D

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

Specification : "A" - "B" = : Approx. below 200mV

6. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E772F55B

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

Specification : Infinite

4. Is the measured resistance within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7F6EABB

1. MAPS performance test

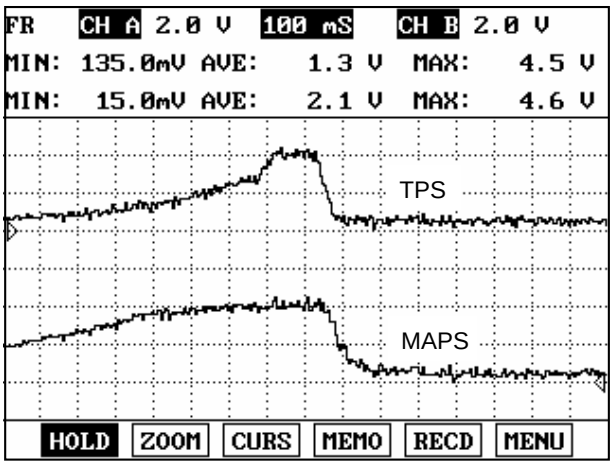
   1) IG "OFF"

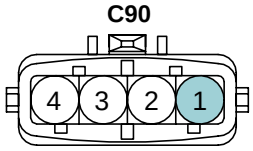
   2) Connect scantool to Data Link Connector(DLC) and select "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating

   3) ENG "ON" and monitor signal waveform during accelleration and decelleration.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16197L

   4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

▶ Go to "Check PCM".

NO

▶ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

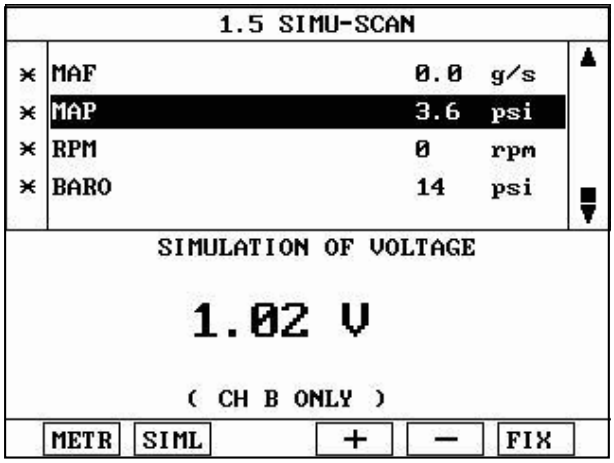
2. Check PCM

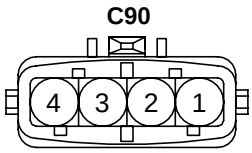
1) IG "OFF" disconnect MAPS connector

2) Connect Scantool and IG "ON" & ENG "OFF"

3) Select simulation function on scantool.

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





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16198L

5) Does the output voltage response to the change of signal by simulation?

YES

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

NO

▶ 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.

NOTE

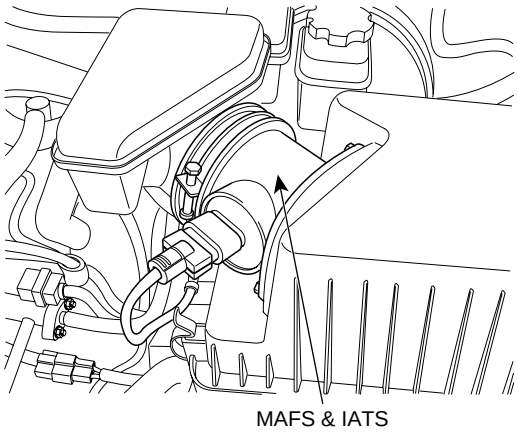
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E359DA4A

Refer to DTC P0106.

DTC P0110 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT

COMPONENT LOCATION E2939C87



SCMF16185L

GENERAL DESCRIPTION E9DAB32E

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5 V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

DTC DESCRIPTION EACF4291

PCM monitors difference between MAX. and MIN IATS in order to detect movement in IATS therough Start Test and Drive Test while enable condition is met. If PCM detects intake air temperature does not change, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E7D8BB2A

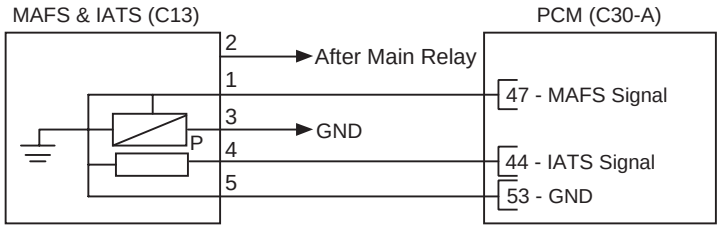
Item		Detecting Condition	Possible cause
DTC Strategy	Case 1	• Start Test: Monitors the difference between max and min IAT in order to detect movement in IAT for a certain time.	• Poor connection • Open or short in harness • IATS • PCM
	Case 2	• Drive test: Performs the max and min delta check while driving under load for a length of time followed by an idle for a certain time.	
Enable Conditions		• Engine soaked time 〉 360min • Engine Running State • No disabling fault present • IAT stored previous trip • No IAT Tests pending	
Thresh old value	Case 1	• Max IAT - Min IAT ≤ 3℃ • Start Test Counter ≥ 120	
	Case 2	• Max IAT - Min IAT ≤ 3℃ • Idle Test Counter ≥ 120	
MIL On Condition		• No MIL ON (DTC only)	

SPECIFICATION E11F4E69

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM E383B48B

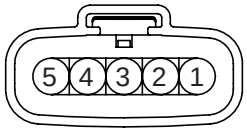
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

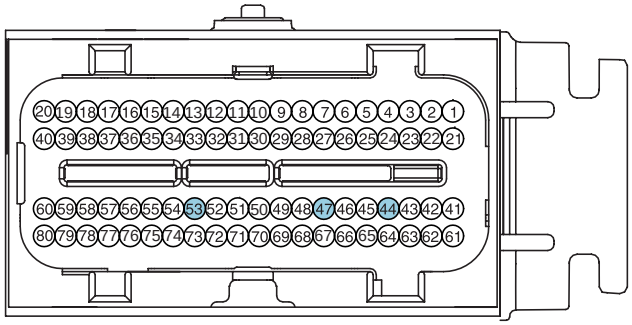
Terminal	Connected to	Function
1	PCM C30-A (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C30-A (44)	IATS Signal
5	PCM C30-A (53)	Sensor Ground

[HARNESS CONNECTORS]



C13

MAFS & IATS

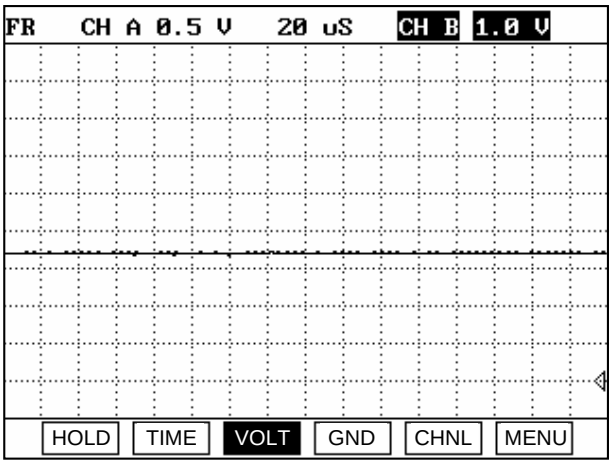


C30-A

PCM

SCMF16104L

SIGNAL WAVEFORM AND DATA E74A022E



EGRF604E

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS EAE59C54

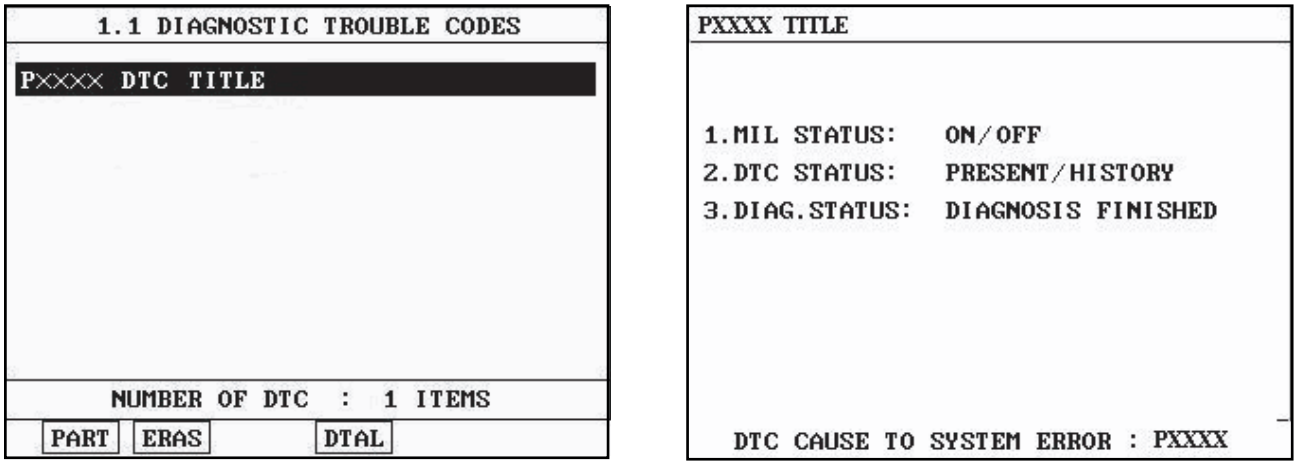
1. Check DTC Status

    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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EDAB98BB

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 EEB2E54B

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

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EFF73DC7

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage terminal 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

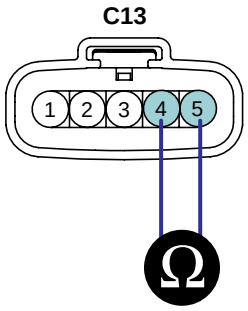
▶ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EF987E04

1. Check resistance of IATS
   1) IG "OFF" and disconnect IATS connector.
   2) Measure resistance between terminal 4 and 5 of IATS connector.(Component Side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16204L

3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" 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.

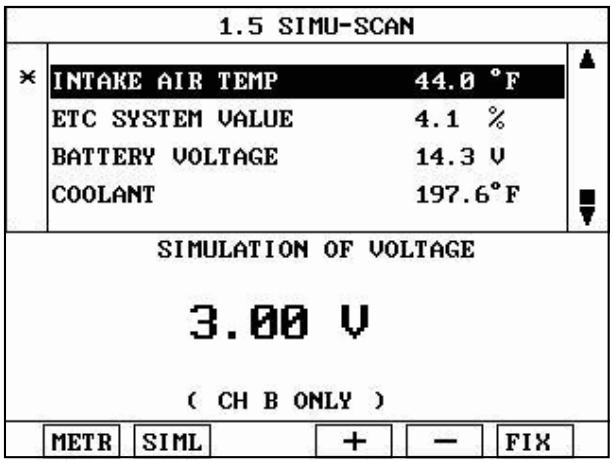
2. Check PCM

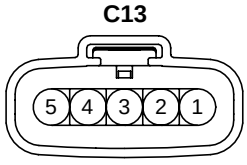
1) IG "OFF" and connect scantool.

2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 4 of IATS harness connector.





1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16205L

5) Does the signal value of IAT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EA2B60BB

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0111 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION EE5B6B5D

Refer to DTC P0110.

GENERAL DESCRIPTION E2159E6C

Refer to DTC P0110.

DTC DESCRIPTION EEA95955

PCM monitors difference between the startup coolant and IAT values. If the difference between the startup coolant and startup IAT exceeds a maximum allowed value, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION E88201A7

Item		Detection condition	Possible cause
DTC Strategy	Case 1	• Skew Low Test: Monitors the difference between the startup coolant and IAT values	• Poor Connection • Open or short in harness • IATS • PCM
	Case 2	• Skew High Test: Monitors the difference between the startup IAT and coolant values	
Enable-Condi-tions	Case 1	• Engine soaked time ≥ 360min • Engine running state • No disabling faults present • IAT stored previous trip • IAT Skewed Test Not Complete • Startup Coolant Temperature 〉 -20°C • Airflow 〉 15 g/s • Vehicle speed 〉 40kph	
	Case 2	• Engine soaked time ≥ 360min • Engine running state • No disabling faults present • IAT stored previous trip • IAT Skewed Test Not Complete • Airflow 〉 15 g/s • Vehicle speed 〉 40kph	
Thresh old value	Case 1	• Startup Coolant - Startup IAT ≥ 30°C	
	Case 2	• Startup IAT - Startup Coolant ≥ 20°C	
Diagnosis Time		• Continuous (More than 1.25 second failure)	
MIL On Condition		• No MIL ON (DTC only)	

SPECIFICATION E59D6FB6

Refer to DTC P0110.

SCHEMATIC DIAGRAM E0C08B0E

Refer to DTC P0110.

SIGNAL WAVEFORM AND DATA EEB56960

Refer to DTC P0110.

MONITOR DTC STATUS EBDF8E0D

Refer to DTC P0110.

TERMINAL AND CONNECTOR INSPECTION E978E804

Refer to DTC P0110.

SIGNAL CIRCUIT INSPECTION E7CB410B

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

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

- ▶ Check short to battery in harness.
- ▶ If O.K, go to "Ground Circuit Inspection" procedure.
- ▶ If N.G, repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair open or short to ground in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION ED483916

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage terminal 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

- ▶ Go to "Component Inspection" procedure.

NO

▶ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E44DDF98

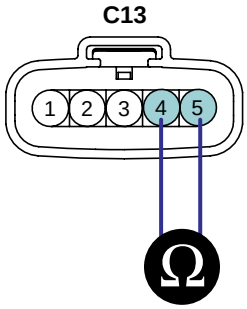
1. Check resistance of IATS

   1) IG "OFF" and disconnect IATS connector.

   2) Measure resistance between terminal 4 and 5 of IATS connector.(Component Side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16204L

   3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" 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.

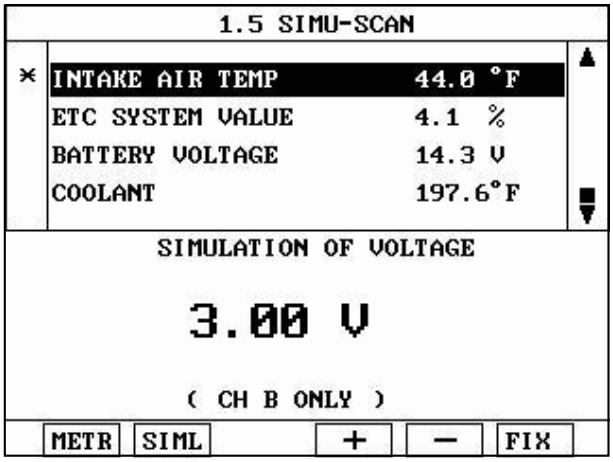
2. Check PCM

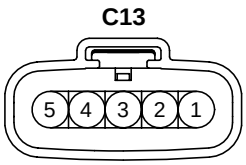
   1) IG "OFF" and connect scantool.

   2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

   3) IG "ON" and ENG "OFF" and simulation Function on scantool.

   4) Simulate voltage at terminal 4 of IATS harness connector.





1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16205L

5) Does the signal value of IAT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EFA6A207

Refer to DTC P0110.

DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

COMPONENT LOCATION EC387A43

Refer to DTC P0110.

GENERAL DESCRIPTION EA0589DC

Refer to DTC P0110.

DTC DESCRIPTION E3FD8660

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is below 0.1V for more than 10 sec., PCM sets P0112. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E698C5D0

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground in either the signal circuit or the sensor	• Poor connection • Short to ground in harness • IATS • PCM
Enable-Condi-tions	Case 1	• Engine running state • No Vehicle speed sensor fault • Vehicle speed 〉 50kph(30mph)	
	Case 2	• Engine running time 〉 120 sec. or Time from IG "OFF" to IG "ON" 〉 360 min.	
Threshold value		• Intake air temperature sensor's voltage 〈 0.1V	
Diagnosis Time		• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION EAFF2A60

Refer to DTC P0110.

SCHEMATIC DIAGRAM E2EA293C

Refer to DTC P0110.

SIGNAL WAVEFORM AND DATA E05C8192

Refer to DTC P0110.

MONITOR DTC STATUS E72AC1B9

Refer to DTC P0110.

TERMINAL AND CONNECTOR INSPECTION E056E9B4

Refer to DTC P0110.

SIGNAL CIRCUIT INSPECTION E66614F6

1. Check voltage

   1) IG "OFF" and disconnect IATS connector.

   2) IG "ON" and ENG "OFF"

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

   YES

   ▶ Go to "Component Inspection" procedure.

   NO

   ▶ Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness

   1) IG "OFF" and disconnect IATS connector and PCM connector.

   2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.

   3) Measure resistance between terminals 4 and 5 of IATS harness connector.

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

Specification : Infinite

   5) Is the measured resistance within specification?

   YES

   ▶ Go to "Component inspection" procedure.

   NO

   ▶ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E421DC2E

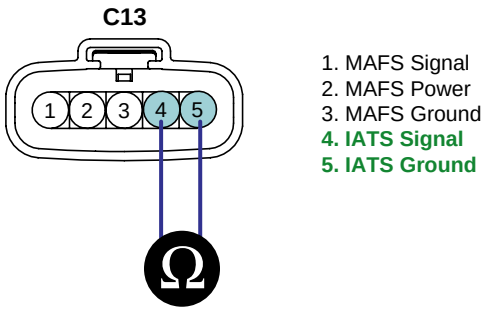
1. Check IATS

   1) IG "OFF" and disconnect IATS connector.

   2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16204L

3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" 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.

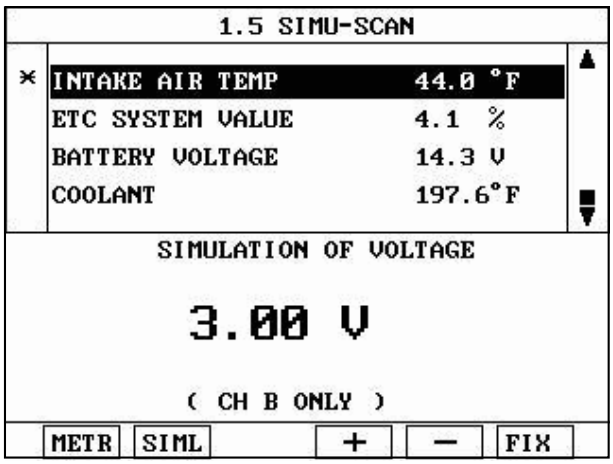
2. Check PCM

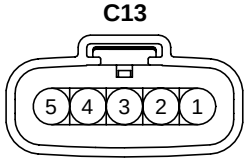
1) IG "OFF" and connect scantool.

2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 4 of IATS harness connector.





1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16205L

5) Does the signal value of IAT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E876B71E

Refer to DTC P0110.

DTC P0113 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT HIGH INPUT

COMPONENT LOCATION E3BEBEF2

Refer to DTC P0110.

GENERAL DESCRIPTION E577857C

Refer to DTC P0110.

DTC DESCRIPTION ECA49F73

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is over 4.9V for more than 10 sec., PCM sets P0113. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E3A9AE8F

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects a continuous short to high in either the signal circuit or the sensor	• Poor connection • Open or short to battery in harness • Open in ground harness • IATS • PCM
Enable Conditions	• No vehicle speed sensor fault • No ECTS fault • No MAFS fault • Vehicle speed 〈 25 kph (9.3 mph) • Intake airflow 〈 15 g/s • 50°C (122°F) and Engine running time 〉 120 s or Time from IG "OFF" to IG "ON" 〉 360 min and ECT 〉 -10°C (14°F) • Engine running state	
Threshold value	• Intake air temperature sensor's voltage 〉 4.9V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EDD6F718

Refer to DTC P0110.

SCHEMATIC DIAGRAM E41DAC06

Refer to DTC P0110.

SIGNAL WAVEFORM AND DATA E83E665B

Refer to DTC P0110.

MONITOR DTC STATUS EFCD2818

Refer to DTC P0110.

TERMINAL AND CONNECTOR INSPECTION E570B72D

Refer to DTC P0110.

SIGNAL CIRCUIT INSPECTION E1D80CD4

1. Check voltage

   1) IG "OFF" and disconnect IATS connector.

   2) IG "ON" and ENG "OFF"

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

   YES

   ▶ Go to "Ground Circuit Inspection" procedure.

   NO

   ▶ If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

   1) IG "OFF" and disconnect IATS connector and PCM connector.

   2) Measure resistance between terminals 2 and 4 of IATS harness connector.

   3) Measure resistance between terminals 1 and 4 of IATS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

   YES

   ▶ Go to "Component Inspection" procedure.

   NO

   ▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

   1) IG "OFF" and disconnect IATS connector and PCM connctor.

   2) Measure resistance between terminal 4 of IATS harness connector and C30-A (44) of PCM harness connector.

Specification : below 1Ω

   3) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E9C2613F

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

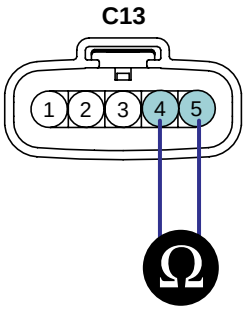
▶ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E544C3E7

1. Check IATS
   1) IG "OFF" and disconnect IATS connector.
   2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16204L

3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" 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.

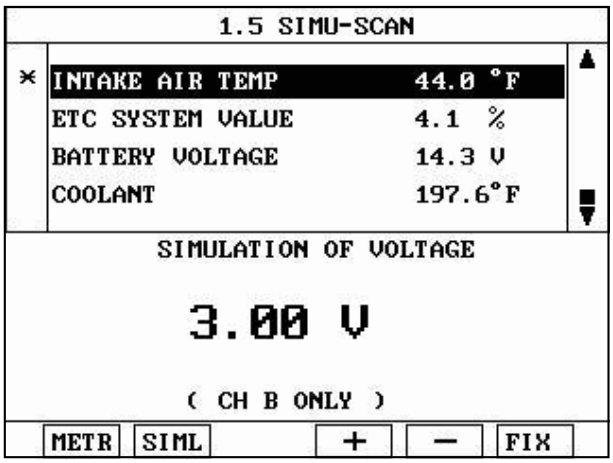
2. Check PCM

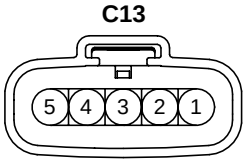
1) IG "OFF" and connect scantool.

2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 4 of IATS harness connector.





1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16205L

5) Does the signal value of IAT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

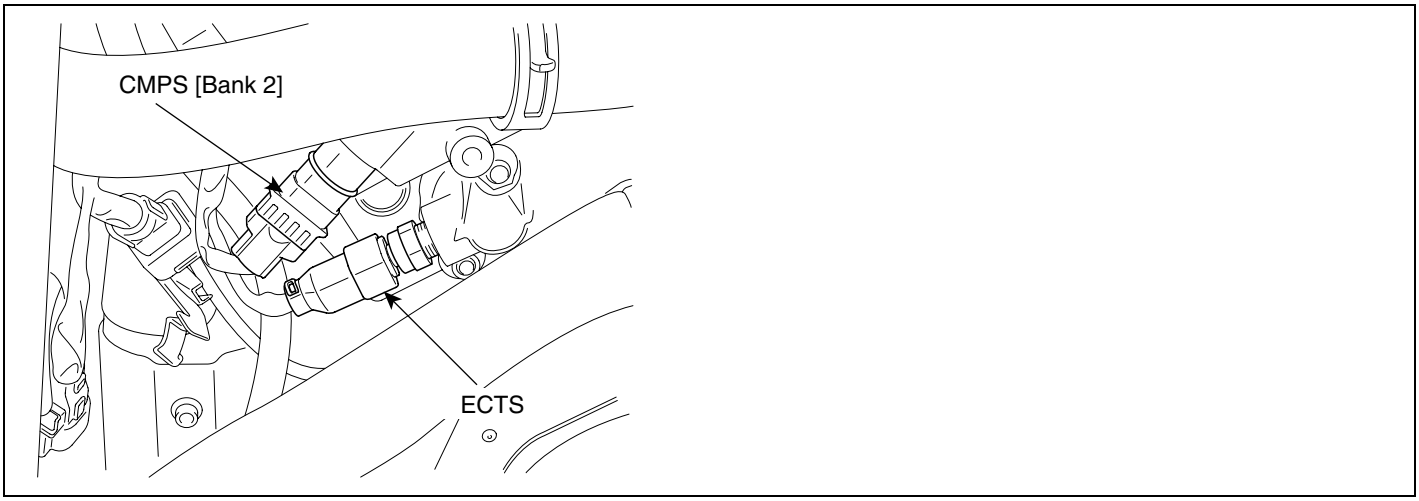
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E1AFF304

Refer to DTC P0110.

DTC P0115 ENGINE COOLANT TEMPERATURE CIRCUIT

COMPONENT LOCATION ED5B7286



LGLG510A

GENERAL DESCRIPTION ECEA26F1

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION E0246E52

PCM calculates the difference between the starup and current coolant temperatures and compares against the threshold. So if the difference is less than 3°C over certain period of time. PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION EA636012

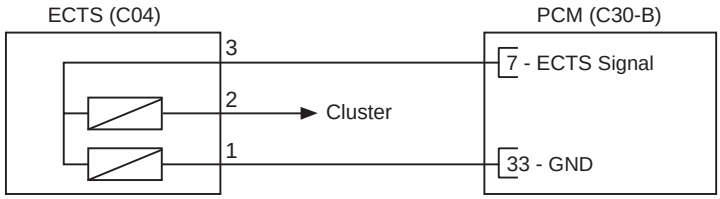
Item	Detecting Condition	Possible cause
DTC Strategy	• Rationality check	• Poor connection • Low level of Engine Coolant • Improperly installed ECTS • Open or short in circuit • ECTS • PCM
Enable Conditions	• Engine Run state • Time from IG "OFF" to IG "ON" 〉 360min • No Disabling Faults Present	
Threshold value	• Difference between startup and current ECT 〈 3 ℃(5.4˚F)	
Diagnosis Time	• Continuous (More than 120 seconds failure within 150 second test)	
MIL On Condition	• No MIL ON (DTC only)	

SPECIFICATION EB62D6F7

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM EDD92ADB

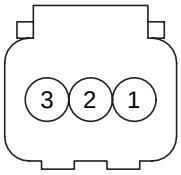
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

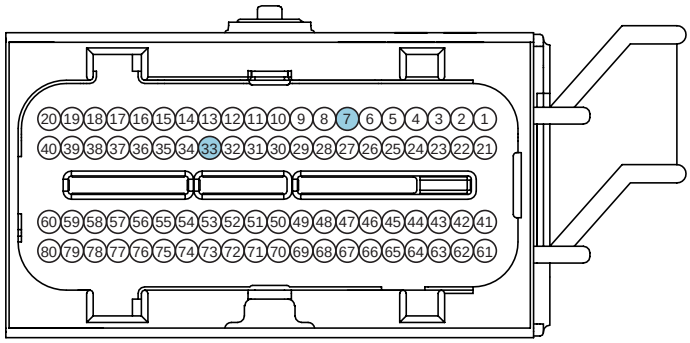
Terminal	Connected to	Function
1	PCM C30-B (33)	Sensor ground
2	Cluster	-
3	PCM C30-B (7)	ECTS Signal

[HARNESS CONNECTORS]



C04

ECTS

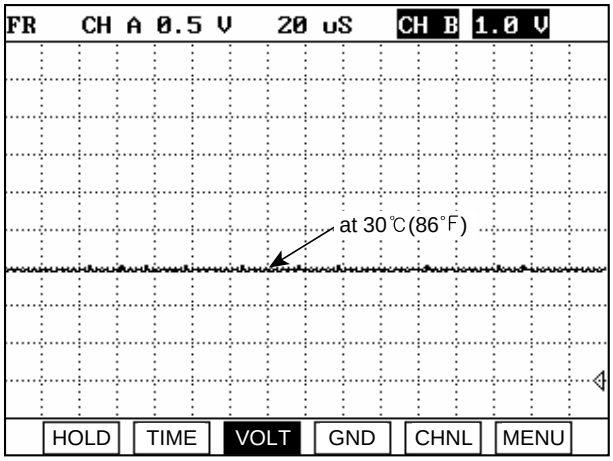


C30-B

PCM

SCMF16106L

SIGNAL WAVEFORM AND DATA EFF63D09



EGRF604P

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on

the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS EB4DAF51

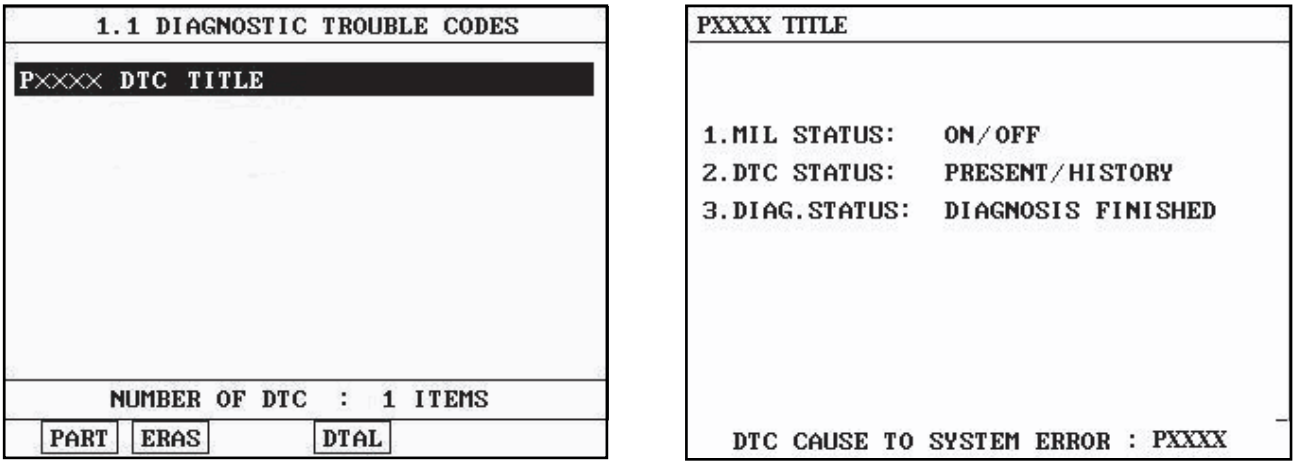
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E64601E0

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 E7A4FDA8

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

Specification : Approx. 5V

4. 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 E3E0634A

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminal 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification ?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Repair contact resistance and open in harness and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EBD7264B

1. Check Engine coolant level is O.K
2. Check that ECTS is correctly installed.
3. Has a problem been found ?

YES

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

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION ED73FDED

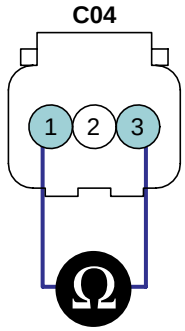
1. Check resistance of ECTS

   1) IG "OFF" and disconnect ECTS connector.

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

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16211L

   3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" 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.

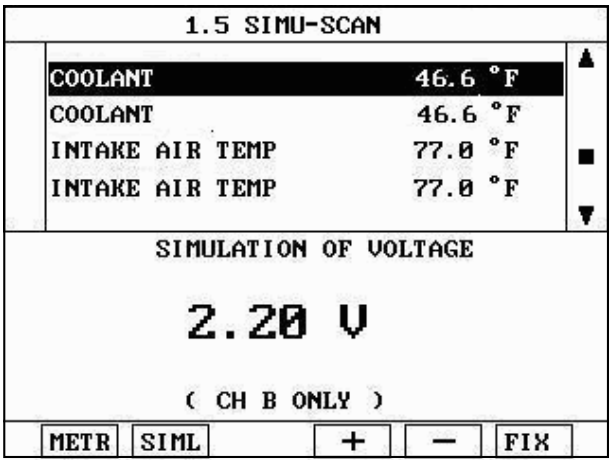
2. Check PCM

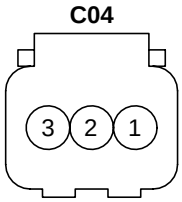
   1) IG "OFF" and connect scantool.

   2) Connect probe to terminal 3 of ECTS harness connector.

   3) IG "ON" and ENG "OFF" and simulation Function on scantool.

   4) Simulate voltage at terminal 3 of ECTS harness connector.





1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16212L

5) Does the signal value of ECT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EDB33B7C

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

COMPONENT LOCATION E8BA96C1

Refer to DTC P0115.

GENERAL DESCRIPTION EE2E48C5

Refer to DTC P0115.

DTC DESCRIPTION EAAEF50E

Checking output signals from ECTS every 80 sec. under detecting condition, if an output signal is below 0.1V for more than 40 sec., PCM sets P0117. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E268CE7B

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Short to ground in harness • ECTS • PCM
Enable Condi-tions	Case 1	• Time after start-up 〉 120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" 〉 360 min. • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage 〈 0.1V	
Diagnosis Time		• Continuous (More than 40 seconds failure for every 80 second test)	
MIL On Condition		• 2 Driving Cycle	

SPECIFICATION E073B461

Refer to DTC P0115.

SCHEMATIC DIAGRAM EE348B41

Refer to DTC P0115.

SIGNAL WAVEFORM AND DATA EBAD21D7

Refer to DTC P0115.

MONITOR DTC STATUS EBEC7FB1

Refer to DTC P0115.

TERMINAL AND CONNECTOR INSPECTION E7DD93A9

Refer to DTC P0115.

SIGNAL CIRCUIT INSPECTION E7A87D49

1. Check voltage

   1) IG "OFF" and disconnect ECTS connector.

   2) IG "ON" and ENG "OFF"

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

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

2. Check short to ground in harness

   1) IG "OFF" and disconnect ECTS connector and PCM connector.

   2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.

   3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5A14E1D

1. Check ECTS

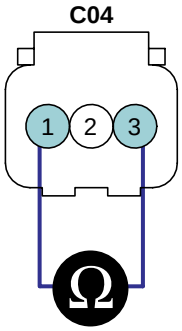
   1) IG "OFF" and disconnect ECTS connector.

   2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59

0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16211L

3) Is the measured resistance within specification?

YES

▶ Go to "Check PCM" 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.

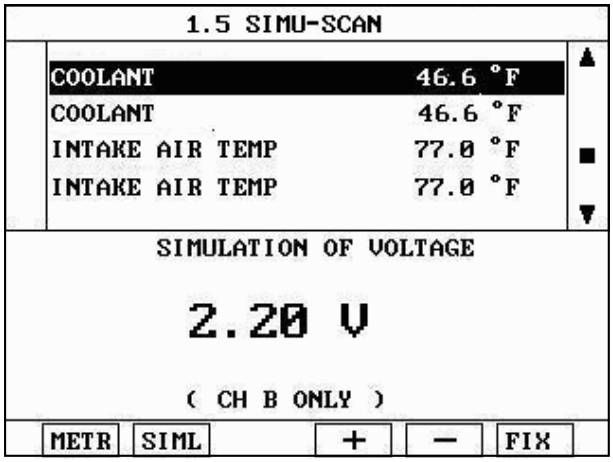
2. Check PCM

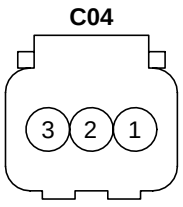
1) IG "OFF" and connect scantool.

2) Connect probe to terminal 3 of ECTS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 3 of ECTS harness connector.





1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16212L

5) Does the signal value of ECT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E1A96D6E

Refer to DTC P0115.

DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION E39FB981

Refer to DTC P0115.

GENERAL DESCRIPTION E69DC80F

Refer to DTC P0115.

DTC DESCRIPTION EBA41CAA

Checking output signals from ECTS every 80 sec. under detecting condition, if an output signal is above 4.9V for more than 40 sec., PCM sets P0118. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E3D5A198

Item		Detecting Condition	Possible cause
DTC Strategy		• Open, Signal high	• Poor connection • Open or short to battery in signal harness • Open in ground harness • ECTS • PCM
Enable Condi-tions	Case 1	• Time after start-up 〉 120 sec.	
	Case 2	• Time from IG "OFF" to IG "ON" 〉 360 min. • Intake air temperature ≥ -10℃(14˚F) • Engine running state	
Threshold value		• Engine coolant temperature sensor's voltage 〉 4.9V	
Diagnosis Time		• Continuous (More than 40 sec. failure for every 80 sec. test)	
MIL On Condition		• 2 Driving Cycle	

SPECIFICATION E813F79D

Refer to DTC P0115.

SCHEMATIC DIAGRAM ED53CE9E

Refer to DTC P0115.

SIGNAL WAVEFORM AND DATA E36568DB

Refer to DTC P0115.

MONITOR DTC STATUS EB1CC283

Refer to DTC P0115.

TERMINAL AND CONNECTOR INSPECTION E42A0DDA

Refer to DTC P0115.

SIGNAL CIRCUIT INSPECTION EF57F5F5

1. Check voltage

   1) IG "OFF" and disconnect ECTS connector.

   2) IG "ON" and ENG "OFF"

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

   YES

   ▶ Go to "Ground Circuit Inspection" procedure.

   NO

   ▶ If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness

   1) IG "OFF" and disconnect ECTS connector and PCM connector.

   2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

Specification : Infinite

   3) Is the measured resistance within specification?

   YES

   ▶ Go to "Component Inspection" procedure.

   NO

   ▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

   1) IG "OFF" and disconnect ECTS connector and PCM connector.

   2) Measure resistance between terminal 3 of ECTS harness connector and terminal C30-B (7) of PCM harness connector.

Specification : Below 1Ω

   3) Is the measured resistance within specification?

   YES

   ▶ Go to "Ground Circuit Inspection" procedure.

   NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION ED915B6F

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

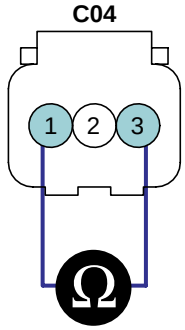
▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E86B0A34

1. Check ECTS
   1) IG "OFF" and disconnect ECTS connector.
   2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16211L

   3) Is the measured resistance within specification?

YES

▶ Go to "Check PCM" 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.

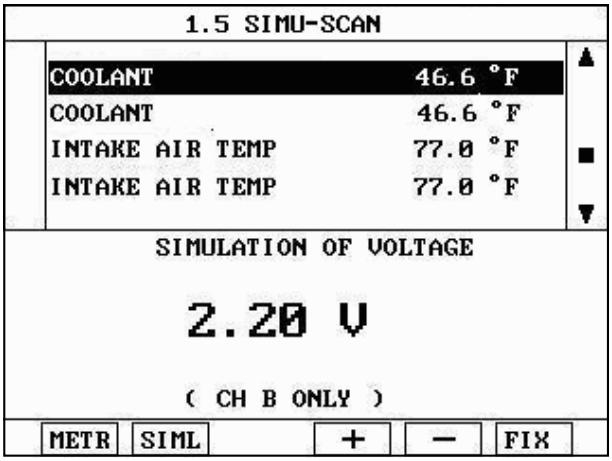
2. Check PCM

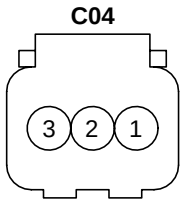
1) IG "OFF" and connect scantool.

2) Connect probe to terminal 3 of ECTS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 3 of ECTS harness connector.





1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16212L

5) Does the signal value of ECT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

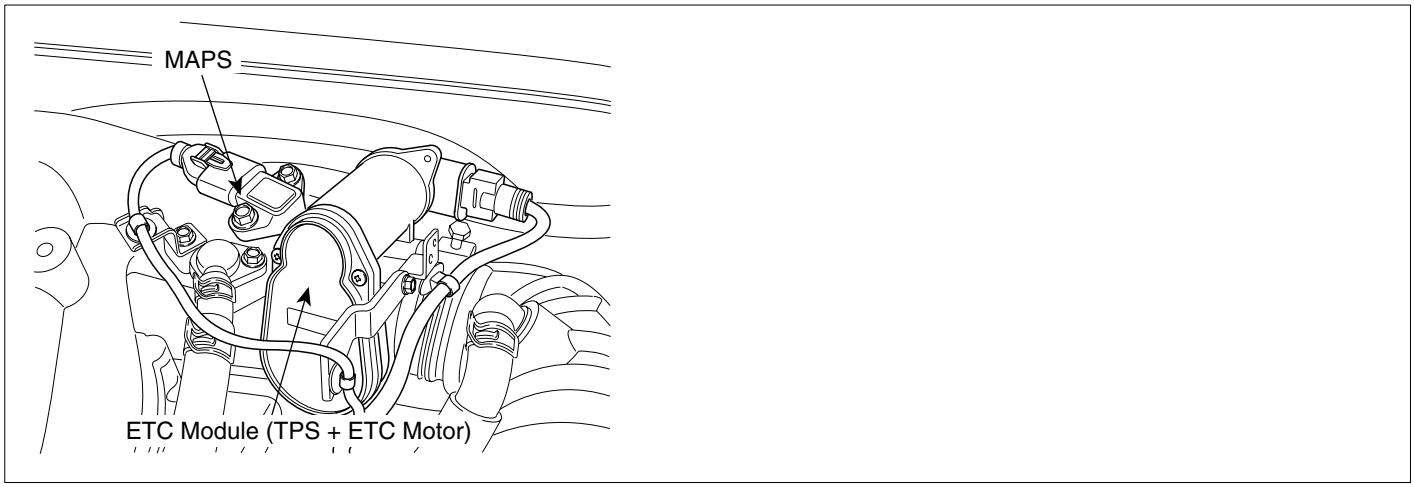
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E39E2BF2

Refer to DTC P0115.

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

COMPONENT LOCATION E99DDCBA



LGLG509A

GENERAL DESCRIPTION EA17E0B5

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1&2 and Accelerator Position Sensor(APS) 1&2. TPS1&2 are sharing the same source voltage and ground.The throttle valve opening is control by throttle motor which is controlled by Engine Control Module(ECM).The opposite position indicator shows inverted signal characteristics.TPS1 output voltage increases smoothly in proportion with the throttle valve opening angle after starting. TPS2 output voltage decreases in inverse proportion with the throttle valve opening angle after starting. TPS provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION ECD19B0F

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec., PCM sets P0122. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E9D5EB68

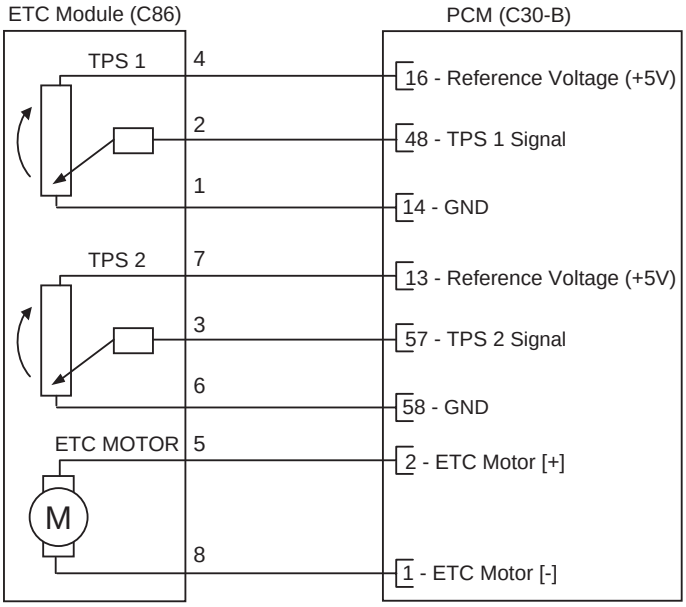
Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON	
threshold value	• The voltage of TPS 〈 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION EB32305D

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM EB8A3F43

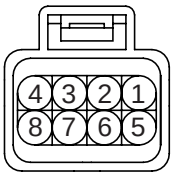
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

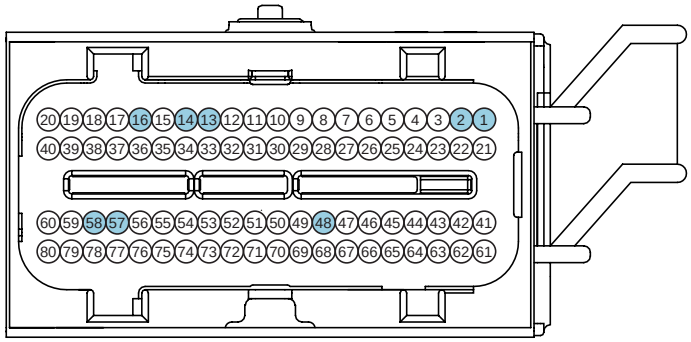
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE

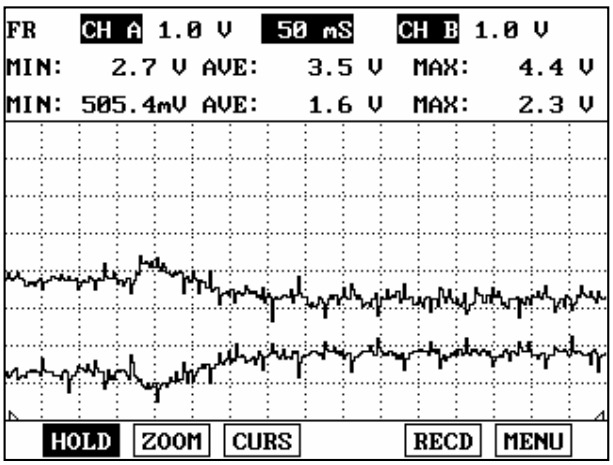


C30-B

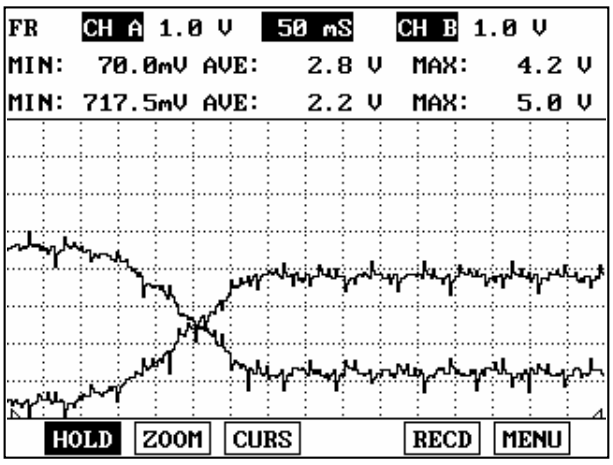
PCM

SCMF16101L

SIGNAL WAVEFORM AND DATA EA4AD1D5



Hit the accelerator at IG ON



Open the throttle valve by force at IG ON

EGRF604Z

MONITOR DTC STATUS E531A752

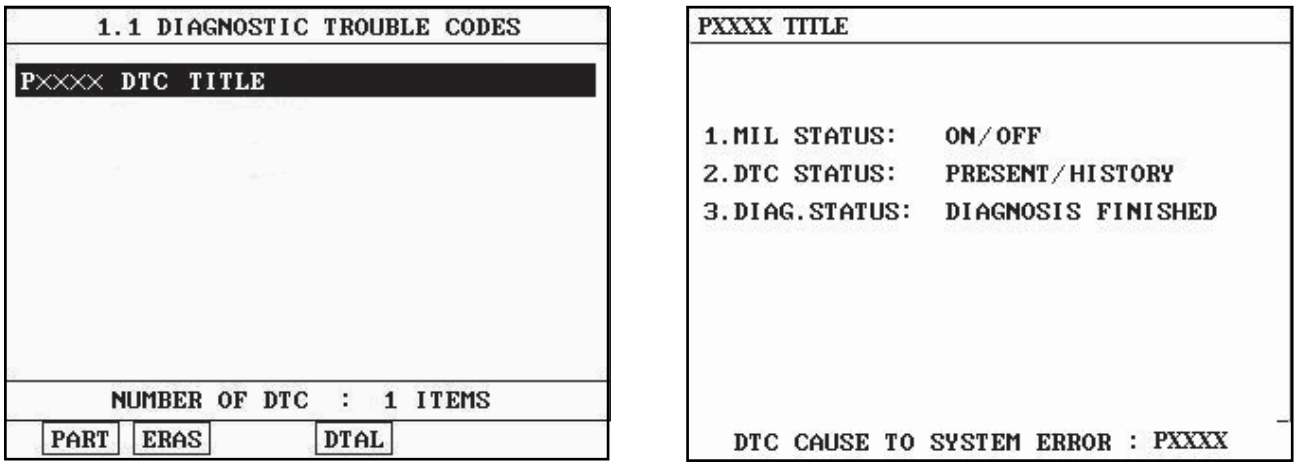
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION ED208D6D

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 EFEBCB7E

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

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EE62AB39

1. Check short to ground in harness
   1) IG "OFF" and disconnect TPS connector and PCM connector.
   2) Measure resistance between terminal 2 of TPS harness connector and chassis ground.
   3) Measure resistance between terminals 2 and 6(1) of TPS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

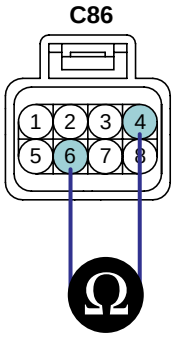
NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA894B1C

1. Check TPS
   1) IG "OFF" and disconnect TPS connector.
   2) Measure resistance between terminals 4 and 6 of TPS connector.(component side)

Specificaton : 4 ~ 6kΩ



1. TPS1 ground
2. TPS1 signal
3. TPS2 signal
4. **TPS1 supply**
5. ETS motor control(+)
6. **TPS2 ground**
7. TPS2 supply
8. ETS motor control(-)

SCMF16218L

3) Is the measured resistance within specification?

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 ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.

CAUTION

Procedure of ETS Initialization

1. ***Erase the trouble codes on PCM***
2. ***Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)***
3. ***Turn ignition key on more than 1second to record the throttle motor position on the EEPROM***

VERIFICATION OF VEHICLE REPAIR EE0ABC4F

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

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

COMPONENT LOCATION E34BDD3C

Refer to DTC P0122.

GENERAL DESCRIPTION EC220AC2

Refer to DTC P0122.

DTC DESCRIPTION ED5835FD

Checking output signals from TPS1 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0123. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4B633B0

Item	Detecting Condition	Possible Cause
DTC Strategy	• signal high	• Poor connection • Open or short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON
threshold value	• The voltage of TPS 〉 4.75V
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)
MIL ON condition	• 2 driving cycles

SPECIFICATION E8877DEC

Refer to DTC P0122.

SCHEMATIC DIAGRAM EAE92A53

Refer to DTC P0122.

SIGNAL WAVEFORM AND DATA E4E9A992

Refer to DTC P0122.

MONITOR DTC STATUS E50CACAF

Refer to DTC P0122.

TERMINAL AND CONNECTOR INSPECTION EC2C6DE2

Refer to DTC P0122.

SIGNAL CIRCUIT INSPECTION E3E9DEDF

1. Check voltgae

   1) IG "OFF" and disconnect TPS connector.

   2) IG "ON" and ENG "OFF"

   3) Measure voltage between terminal 2 of TPS harness connector and chassis ground.

Specification : Approx. 5V

   4) Is the measured voltage within specification?

   YES

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

   NO

   ▶ Go to "Check open in harness" as follows.

2. Check open in harness

   1) IG "OFF" and disconnect TPS connector and PCM connector.

   2) Measure resistance between terminal 2 of TPS harness connector and terminal C30-B (48) of PCM harness connector.

Specification : Below 1Ω

   3) Is the measured resistance within specification?

   YES

   ▶ Go to "Ground Circuit Inspection" procedure.

   NO

   ▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to battery in harness

   1) IG "OFF" and disconnect TPS connector and PCM connector.

   2) Measure resistance between terminals 4 and 2 of TPS harness connector.

   3) Measure resistance between terminals 7 and 2 of TPS harness connector.

   4) Measure resistance between terminals 5 and 2 of TPS harness connector.

   5) Measure resistance between terminals 8 and 2 of TPS harness connector.

Specification : Infinite

   6) Is the measured resistance within specification?

   YES

▶ Go to "Ground circuit inspection " procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0E47490

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 4 of TPS harness connector and chassis ground.
4. Measure voltage between terminals 4 and 1 of TPS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

5. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

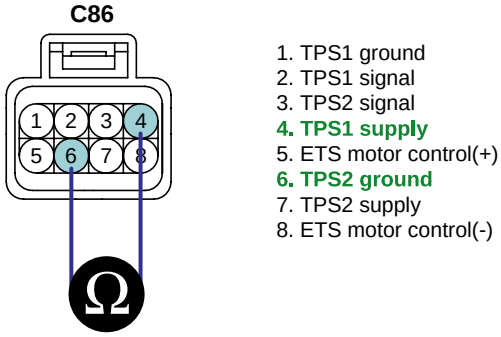
NO

▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EE1B17BA

1. Check TPS
   1) IG "OFF" and disconnect TPS connector.
   2) Measure resistance between terminals 4 and 6 of TPS connector.(component side)

Specificaton : 4 ~ 6kΩ



1. TPS1 ground
2. TPS1 signal
3. TPS2 signal
4. **TPS1 supply**
5. ETS motor control(+)
6. **TPS2 ground**
7. TPS2 supply
8. ETS motor control(-)

SCMF16218L

   3) Is the measured resistance within specification?

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 ECT motor & TPS and check for proper operation. If the problem is corrected, replace ECT motor & TPS and go to "Verification of Vehicle Repair" procedure.

CAUTION

Procedure of ETS Initialization

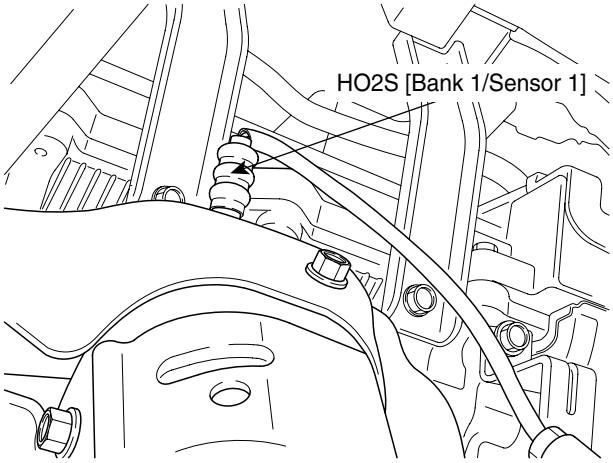
1. ***Erase the trouble codes on PCM***
2. ***Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)***
3. ***Turn ignition key on more than 1second to record the throttle motor position on the EEPROM***

VERIFICATION OF VEHICLE REPAIR E2A3F96D

Refer to DTC P0122.

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

COMPONENT LOCATION E5E16663



LGLG504A

GENERAL DESCRIPTION E9CECC3F

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 oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is " rich," there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E8D2EB10

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predeterminate time, PCM sets P0131. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2DEFF6E

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor Connection • Short to ground in harness • HO2S(B1/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B1/S1) < 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

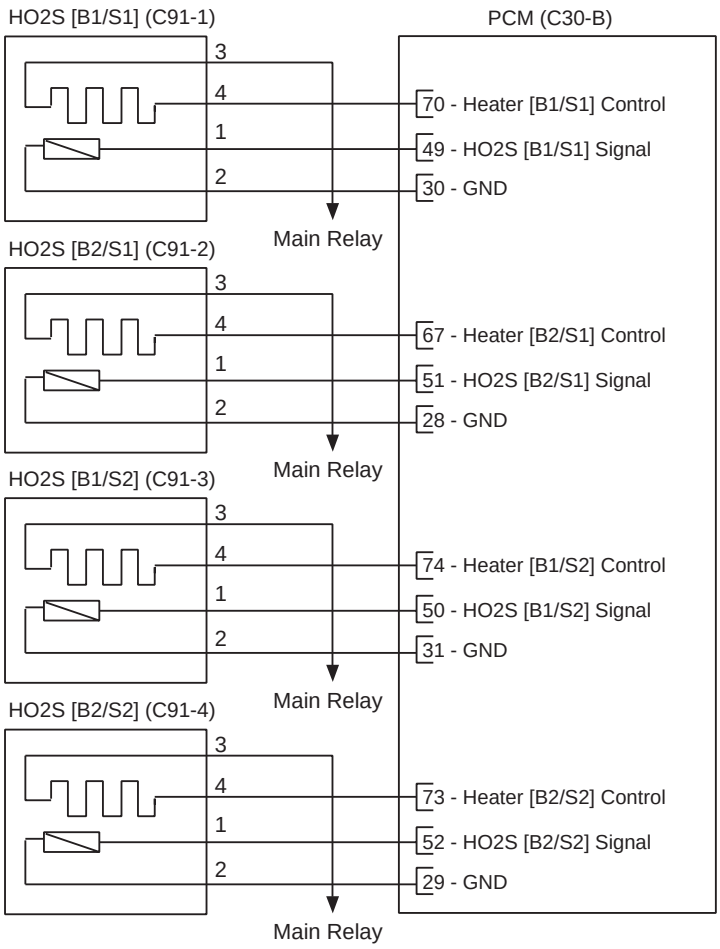
SPECIFICATION EB86DDBC

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E57946F9

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

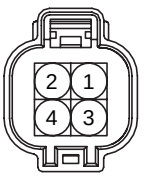
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

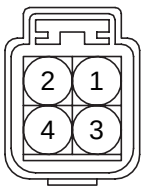
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



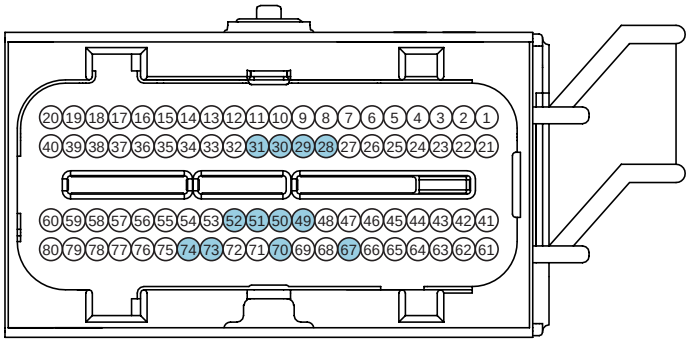
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA E59FF425

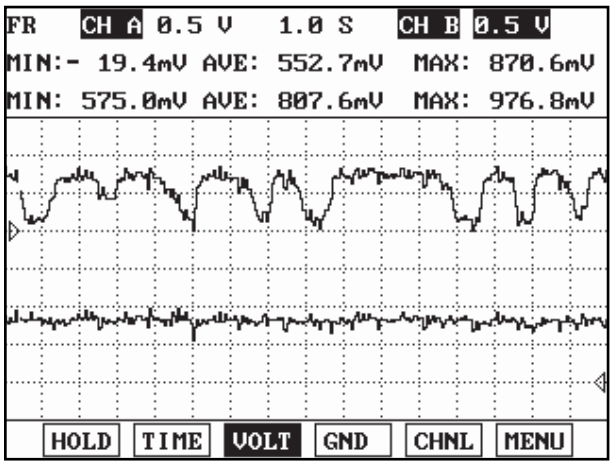


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS EFA6B287

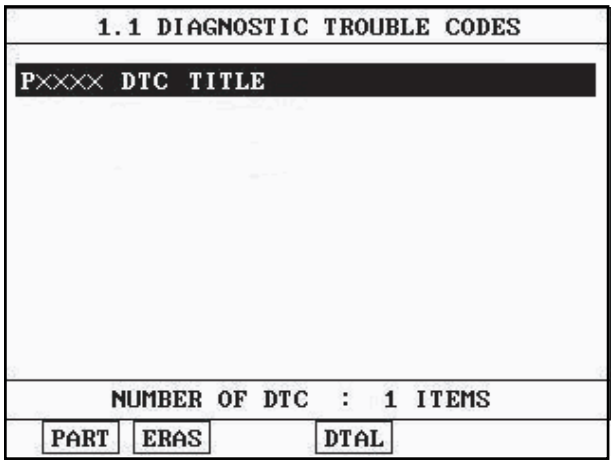
1. Check DTC Status

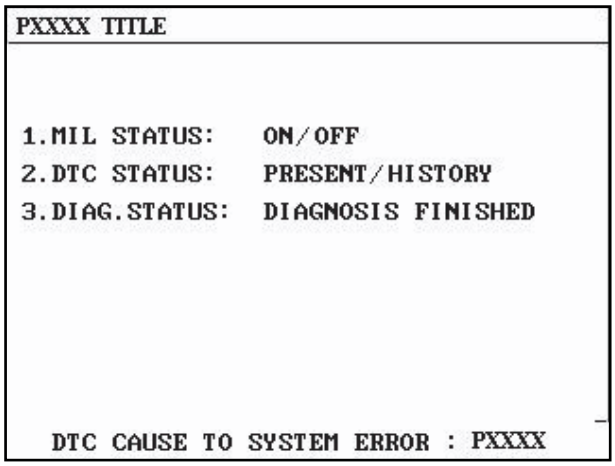
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E95CE0B0

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 ECA7A130

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

Specification : Approx. 3.5V - when pumping current is ON Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EA7C37B2

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

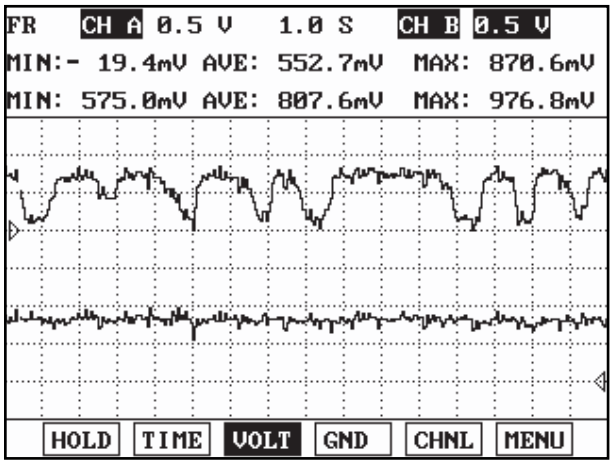


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EC73FB01

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

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

COMPONENT LOCATION E34D7E43

Refer to DTC P0131.

GENERAL DESCRIPTION E8459360

Refer to DTC P0131.

DTC DESCRIPTION E74110AE

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predeterminate time, PCM sets P0132. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E0C6706A

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor Connection • Short to battery in harness • HO2S(B1/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B1/S1) > 1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E8E22996

Refer to DTC P0131.

SCHEMATIC DIAGRAM E2838EC3

Refer to DTC P0131.

SIGNAL WAVEFORM AND DATA EC655E30

Refer to DTC P0131.

MONITOR DTC STATUS EB5D5CFA

Refer to DTC P0131.

TERMINAL AND CONNECTOR INSPECTION E340BB9F

Refer to DTC P0131.

SIGNAL CIRCUIT INSPECTION E702180A

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

Specification : Approx. 3.5V - when pumping current is ON Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBFB56A3

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.
   3) After warming-up, monitor signal waveform of HO2S with scantool.?

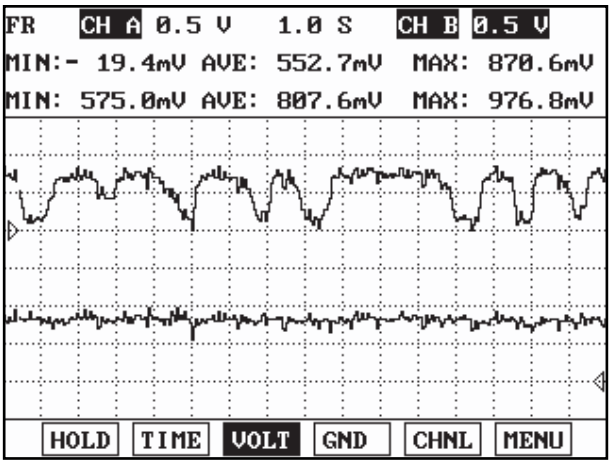


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E57C1154

Refer to DTC P0131.

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

COMPONENT LOCATION E7CE00FE

Refer to DTC P0131.

GENERAL DESCRIPTION E2028FB5

Refer to DTC P0131.

DTC DESCRIPTION E6CF7AD6

Checking output signals from HO2S under detecting condition, if PCM judges it's signals too slow, PCM sets P0133. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EB2A1D25

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's response rate	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• Engine warm-up sufficiently • Engine run time > 60sec • Drive at a steady speed between 45-55 mph(72-88 km/h) • Engine Coolant > 70℃(158 °F) • No disabling faults	
Threshold value	• The calculated response rate is too slow (out of threshold in PCM)	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EE815218

Refer to DTC P0131.

SCHEMATIC DIAGRAM E191554F

Refer to DTC P0131.

SIGNAL WAVEFORM AND DATA EC985B21

Refer to DTC P0131.

MONITOR DTC STATUS E9343755

Refer to DTC P0131.

COMPONENT INSPECTION E419B061

1. Replace the HO2S.

2. Clear DTC with scantool.
3. Start the engine and warm it up until the radiator fan comes on(more than at least 10 minutes).
4. Drive at a steady speed between 45-55 mph(72-88 km/h) for 120 sec.
5. Stop and then maintain idle state.
6. Check if O2 sensor monitoring readiness is complete.
7. Does the scan tool show DTC P0133?

YES

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

NO

▶ Troubleshooting is finished.

VERIFICATION OF VEHICLE REPAIR EC3749F2

Refer to DTC P0131.

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

COMPONENT LOCATION EC04207D

Refer to DTC P0131.

GENERAL DESCRIPTION E000B34D

Refer to DTC P0131.

DTC DESCRIPTION EBB9E980

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predeterminate time, PCM sets P0134. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E768B6A1

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor connection • Open in harness • HO2S(B1/S1) • PCM
Enable Conditions		• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh old value	Case 1	• 1.2V ≤ Voltage of HO2S ≤ 3.9V (at pumping current ON)	
	Case 2	• 0.415V ≤ Voltage of HO2S ≤ 0.515V (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION E61464A0

Refer to DTC P0131.

SCHEMATIC DIAGRAM E4E20A98

Refer to DTC P0131.

SIGNAL WAVEFORM AND DATA E4D090D2

Refer to DTC P0131.

MONITOR DTC STATUS EDFACD48

Refer to DTC P0131.

TERMINAL AND CONNECTOR INSPECTION E0773217

Refer to DTC P0131.

SIGNAL CIRCUIT INSPECTION EB3A1908

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

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" prcedure.

GROUND CIRCUIT INSPECTION E9B8BED9

1. IG "ON" and disconnect HO2S(B1/S1) connector.
2. Measure voltage between terminal 1 of HO2S(B1/S1) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B1/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION EA53DB05

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.
   3) After warming-up, monitor signal waveform of HO2S with scantool.?

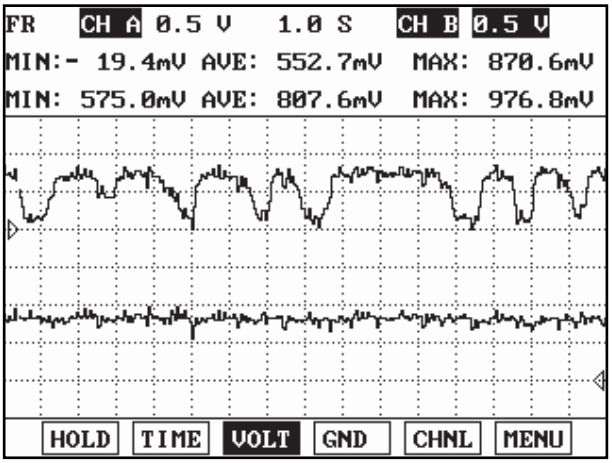


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

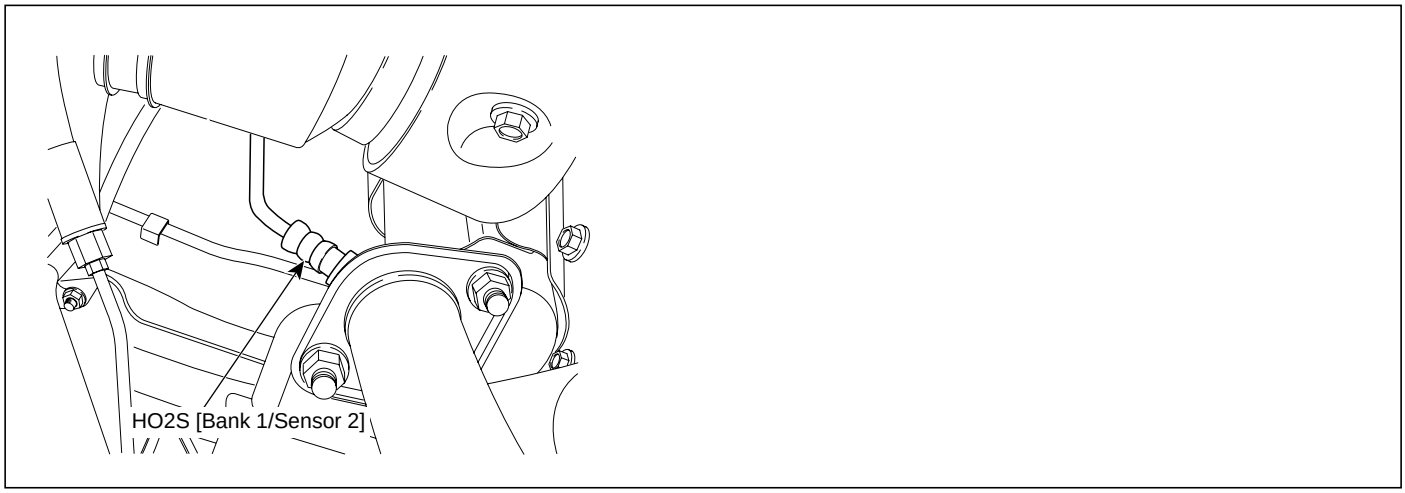
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E39CB705

Refer to DTC P0131.

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

COMPONENT LOCATION EA538A1A



SCMF16165L

GENERAL DESCRIPTION E8446B63

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION E79D0981

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predeterminate time, PCM sets P0137. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE412DD5

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor Connection • Short to ground in harness • HO2S(B1/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B1/S2) < 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

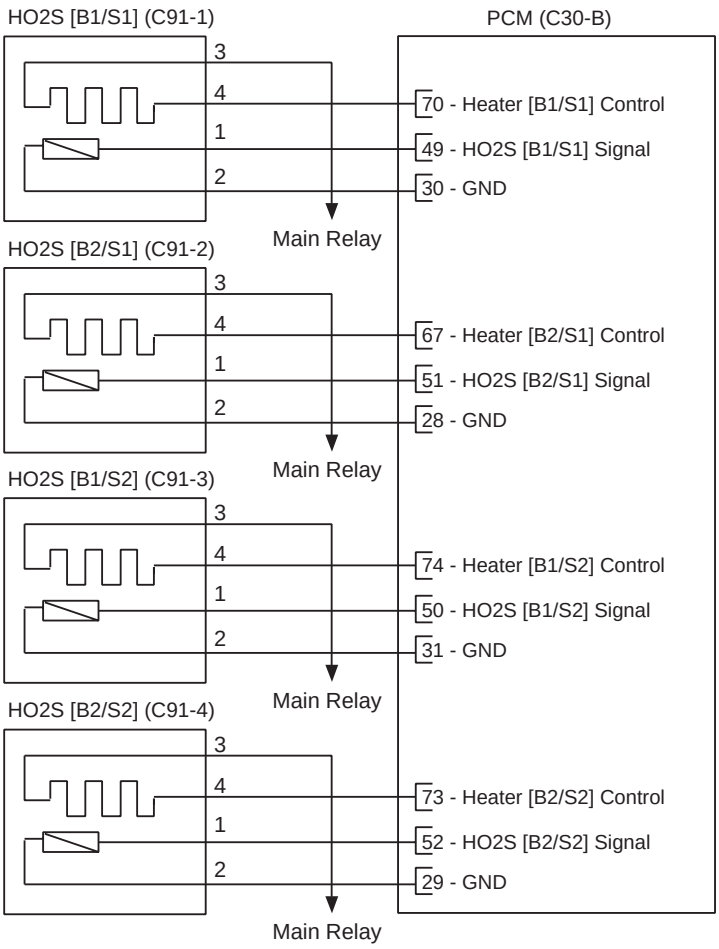
SPECIFICATION EFA42C60

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM EDFB2BD8

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

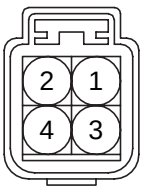
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



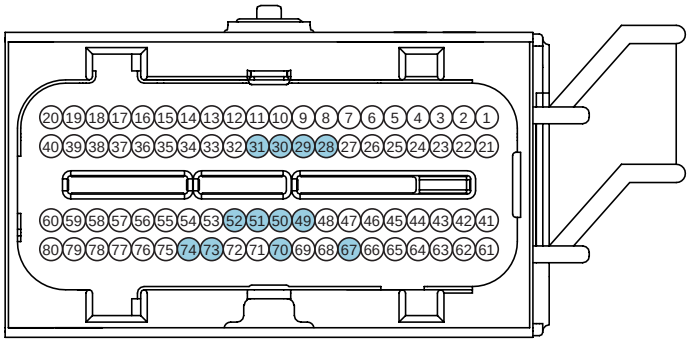
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA E00C0EDC

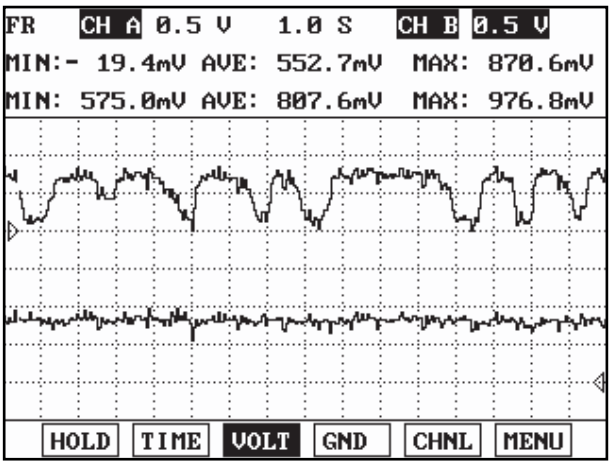


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS E0480FCB

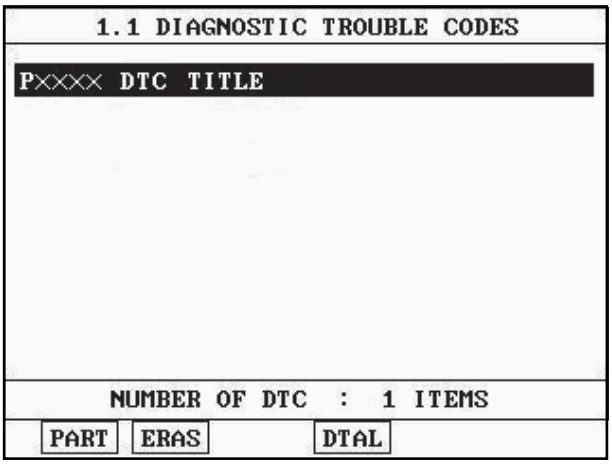
1. Check DTC Status

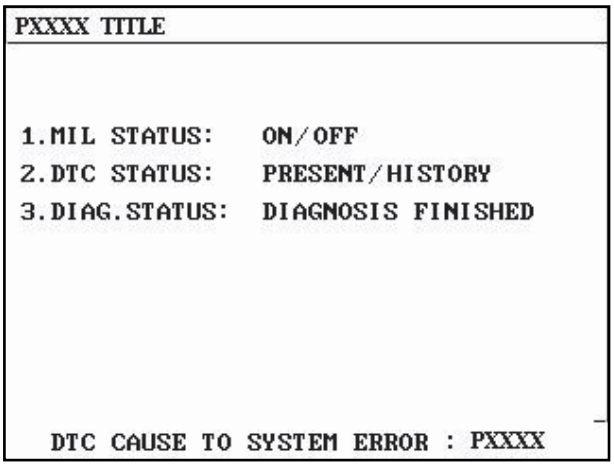
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E4CC3E07

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 E46755BD

1. IG "OFF" and disconnect HO2S(B1/S2)
2. IG "ON"
3. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E9A07236

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

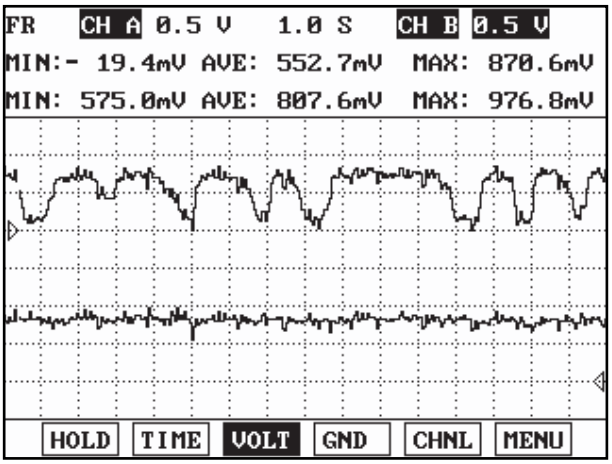


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E8544C8A

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

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

COMPONENT LOCATION E47EE366

Refer to DTC P0137.

GENERAL DESCRIPTION EDFEEB95

Refer to DTC P0137.

DTC DESCRIPTION E1CC9CD2

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predeterminate time, PCM sets P0138. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E5E6FDFA

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor connection • Short to battery in harness • HO2S(B1/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60 sec • Engine warm-up state	
Threshold value	• The voltage of HO2S(B1/S2) > 1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E5165F35

Refer to DTC P0137.

SCHEMATIC DIAGRAM E0F689E6

Refer to DTC P0137.

SIGNAL WAVEFORM AND DATA E3809D65

Refer to DTC P0137.

MONITOR DTC STATUS EB4B82C9

Refer to DTC P0137.

TERMINAL AND CONNECTOR INSPECTION EF5D7B77

Refer to DTC P0137.

SIGNAL CIRCUIT INSPECTION E63979A1

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

Specification : Approx. 3.5V - when pumping current is ON Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7837436

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.
   3) After warming-up, monitor signal waveform of HO2S with scantool.?

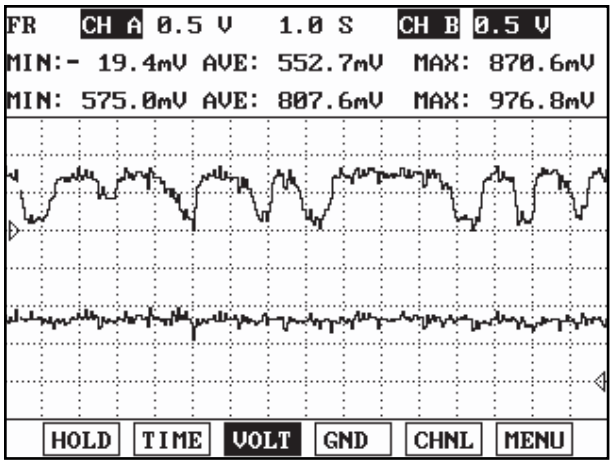


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EC5462E1

Refer to DTC P0137.

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

COMPONENT LOCATION EEBC2F3C

Refer to DTC P0137.

GENERAL DESCRIPTION ECB75069

Refer to DTC P0137.

DTC DESCRIPTION EF2F1633

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predeterminate time, PCM sets P0140. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EFF97065

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor Connection • Open in harness • HO2S(B1/S2) • PCM
Enable Conditions		• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh-old value	Case 1	• 1.2V ≤ Voltage of HO2S ≤ 3.9V (at pumping current ON)	
	Case 2	• 0.415V ≤ Voltage of HO2S ≤ 0.515V (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 driving cycles	

SPECIFICATION E0BF53DA

Refer to DTC P0137.

SCHEMATIC DIAGRAM E35BC6DB

Refer to DTC P0137.

SIGNAL WAVEFORM AND DATA E4AE5538

Refer to DTC P0137.

MONITOR DTC STATUS EB63EA5F

Refer to DTC P0137.

TERMINAL AND CONNECTOR INSPECTION E6400FE2

Refer to DTC P0137.

SIGNAL CIRCUIT INSPECTION E7FA65CA

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

Specification : Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E909D35D

1. IG "ON" and disconnect HO2S(B1/S2) connector.
2. Measure voltage between terminal 1 of HO2S(B1/S2) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B1/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION EE664101

1. Check the Signal waveform of HO2S

   1) IG "OFF" and connect HO2S connector.

   2) Engine start.

   3) After warming-up, monitor signal waveform of HO2S with scantool.?

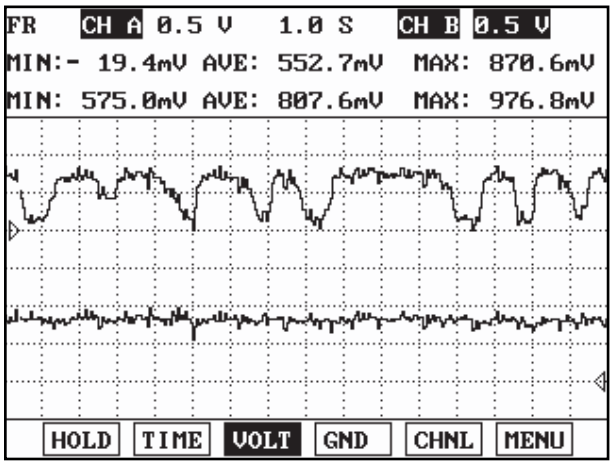


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

   YES

   ▶ Go to "Check HO2S" as below.

   NO

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

2. Check HO2S

   1) IG "OFF" and disconnect HO2S connector.

   2) Check that the HO2S is securely installed.

   3) Check the HO2S for contamination or damage

   4) Is the sensor normal?

   YES

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

   NO

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

NOTE

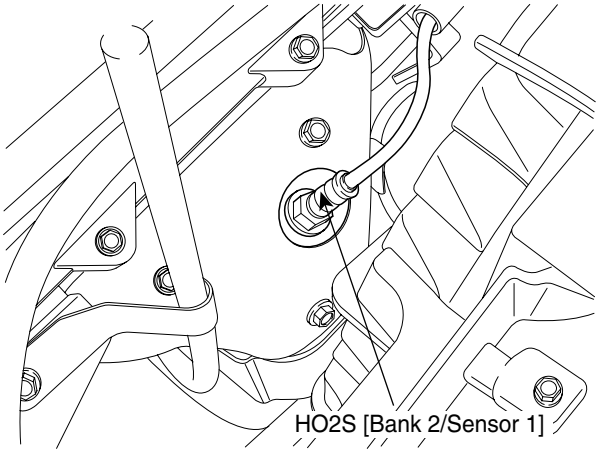
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EF632C17

Refer to DTC P0137.

DTC P0151 HO2S CIRCUIT LOW VOLTAGE (BANK 2 / SENSOR 1)

COMPONENT LOCATION ED40F14F



LGLG506A

GENERAL DESCRIPTION E6FB2D8C

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 oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is " rich," there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E2B9F456

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predeterminate time, PCM sets P0151. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2E6D8F9

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor connection • Short to ground in harness • HO2S(B2/S1) • PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B2/S1) < 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

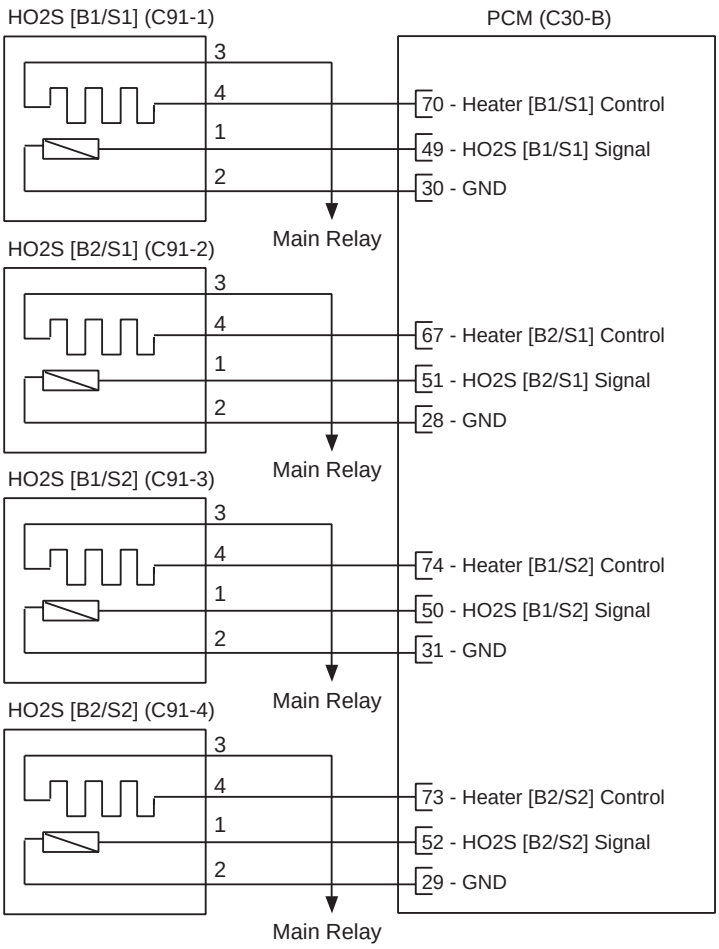
SPECIFICATION EFE431CF

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E719BBFC

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

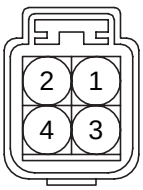
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



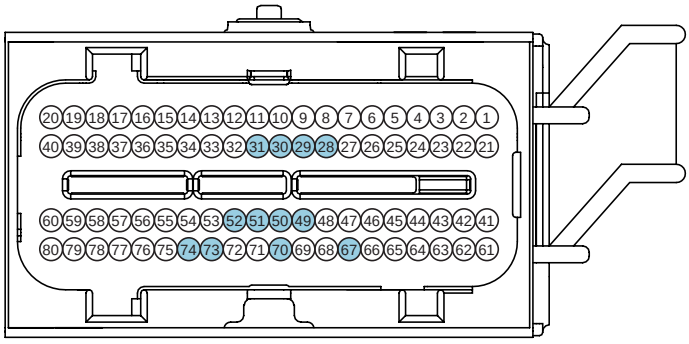
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA EAF4A1D8

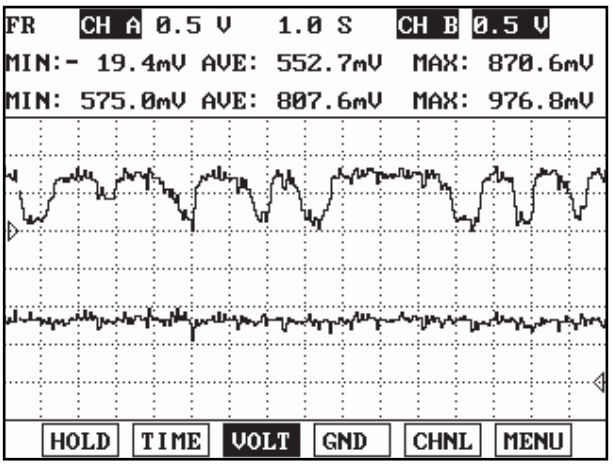


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS ECF25ABB

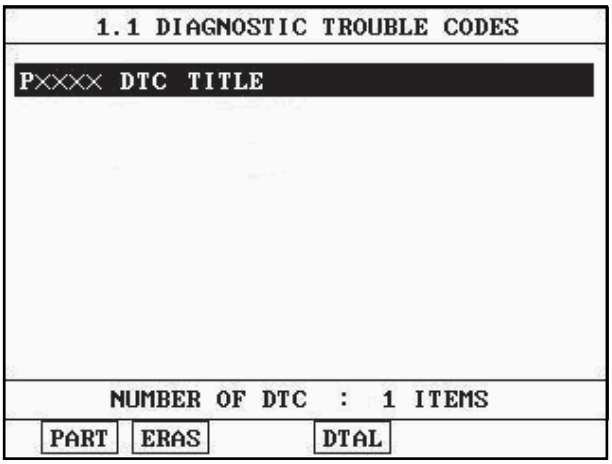
1. Check DTC Status

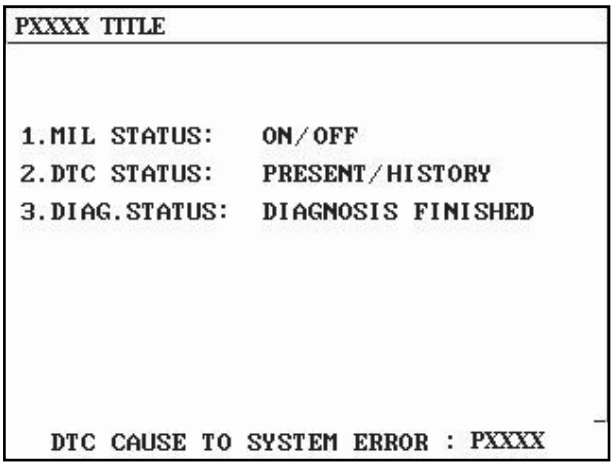
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E8A43B9B

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 E785105E

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6F6E618

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.

2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

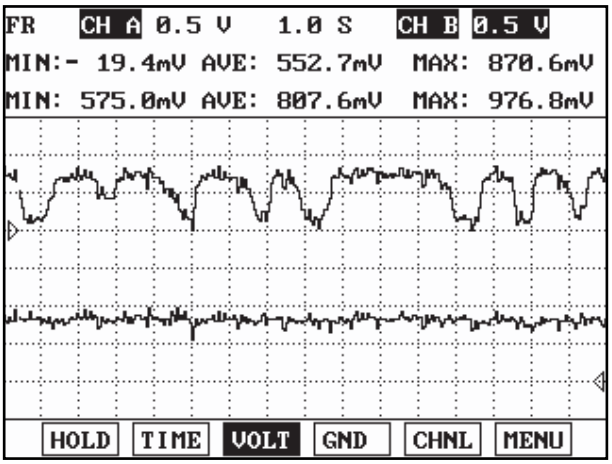


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EF0DAD4D

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0152 HO2S CIRCUIT HIGH VOLTAGE (BANK 2 / SENSOR 1)

COMPONENT LOCATION E73AFB1C

Refer to DTC P0151.

GENERAL DESCRIPTION EFF8EE63

Refer to DTC P0151.

DTC DESCRIPTION E92FC465

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predeterminate time, PCM sets P0152. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E504302B

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor connection • Short to battery in harness • HO2S(B2/S1) • PCM
Enable Conditions	• attery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B2/S1) > 1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E64EEB11

Refer to DTC P0151.

SCHEMATIC DIAGRAM EC852741

Refer to DTC P0151.

SIGNAL WAVEFORM AND DATA E7BF889E

Refer to DTC P0151.

MONITOR DTC STATUS E632FE80

Refer to DTC P0151.

TERMINAL AND CONNECTOR INSPECTION EDA7B9B8

Refer to DTC P0151.

SIGNAL CIRCUIT INSPECTION E724643F

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EFE36D91

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.
   3) After warming-up, monitor signal waveform of HO2S with scantool.?

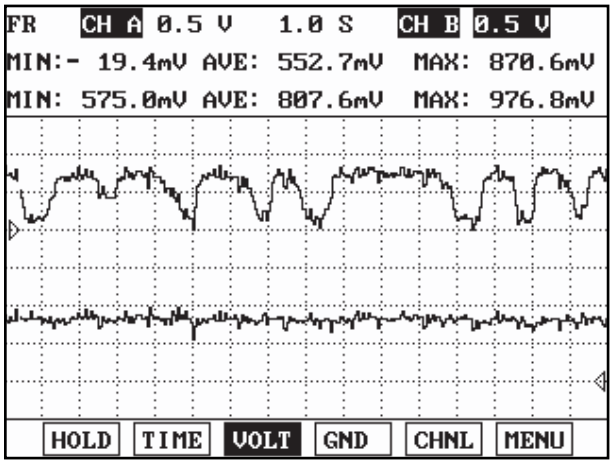


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EF53775E

Refer to DTC P0151.

DTC P0153 HO2S CIRCUIT SLOW RESPONSE (BANK 2 / SENSOR 1)

COMPONENT LOCATION E5394BE4

Refer to DTC P0151.

GENERAL DESCRIPTION E352B807

Refer to DTC P0151.

DTC DESCRIPTION EAD91003

Checking output signals from HO2S under detecting condition, if PCM judges it's signals too slow, PCM sets P0153. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EC1F151B

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's response rate	• Poor connection • Faulty HO2S • Faulty PCM
Enable Conditions	• Engine warm-up sufficiently • Engine run time > 60sec • Drive at a steady speed between 45-55 mph(72-88 km/h) • Engine Coolant > 70℃(158 °F) • No disabling faults	
Threshold value	• The calculated response rate is too slow (out of threshold in PCM)	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E40CCCA6

Refer to DTC P0151.

SCHEMATIC DIAGRAM E00FE44D

Refer to DTC P0151.

SIGNAL WAVEFORM AND DATA E30C4E04

Refer to DTC P0151.

MONITOR DTC STATUS E7045E97

Refer to DTC P0151.

COMPONENT INSPECTION EEA2F864

1. Replace the HO2S.

2. Clear DTC with scantool.
3. Start the engine and warm it up until the radiator fan comes on(more than at least 10 minutes).
4. Drive at a steady speed between 45-55 mph(72-88 km/h) for 120 sec.
5. Stop and then maintain idle state.
6. Check if O2 sensor monitoring readiness is complete.
7. Does the scan tool show DTC P0153?

YES

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

NO

▶ Troubleshooting is finished.

VERIFICATION OF VEHICLE REPAIR EC659C03

Refer to DTC P0151.

DTC P0154 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 2 / SENSOR 1)

COMPONENT LOCATION E927328A

Refer to DTC P0151.

GENERAL DESCRIPTION E6703041

Refer to DTC P0151.

DTC DESCRIPTION E6CCAEA2

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predeterminate time, PCM sets P0154. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EEBE7B45

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor connection • Open in harness • HO2S(B2/S1) • PCM
Enable Conditions		• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh-old value	Case 1	• 1.2V ≤ Voltage of HO2S ≤ 3.9V (at pumping current ON)	
	Case 2	• 0.415V ≤ Voltage of HO2S ≤ 0.515V (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 driving cycles	

SPECIFICATION E3400454

Refer to DTC P0151.

SCHEMATIC DIAGRAM E529691E

Refer to DTC P0151.

SIGNAL WAVEFORM AND DATA E3453427

Refer to DTC P0151.

MONITOR DTC STATUS E5E864C4

Refer to DTC P0151.

TERMINAL AND CONNECTOR INSPECTION EEA2C5E9

Refer to DTC P0151.

SIGNAL CIRCUIT INSPECTION E2E9407E

1. IG "OFF" and disconnect HO2S(B2/S1) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between termianl 1 of HO2S(B2/S1) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" prcedure.

GROUND CIRCUIT INSPECTION ED75DEA6

1. IG "ON" and disconnect HO2S(B2/S1) connector.
2. Measure voltage between terminal 1 of HO2S(B2/S1) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B2/S1) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" prcedure.

COMPONENT INSPECTION EFACB6A1

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.
   3) After warming-up, monitor signal waveform of HO2S with scantool.?

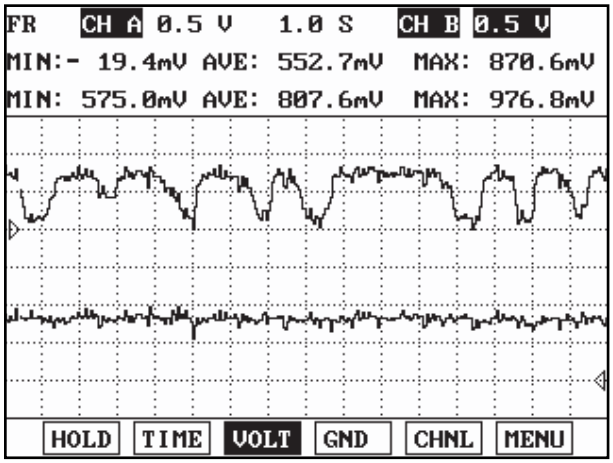


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

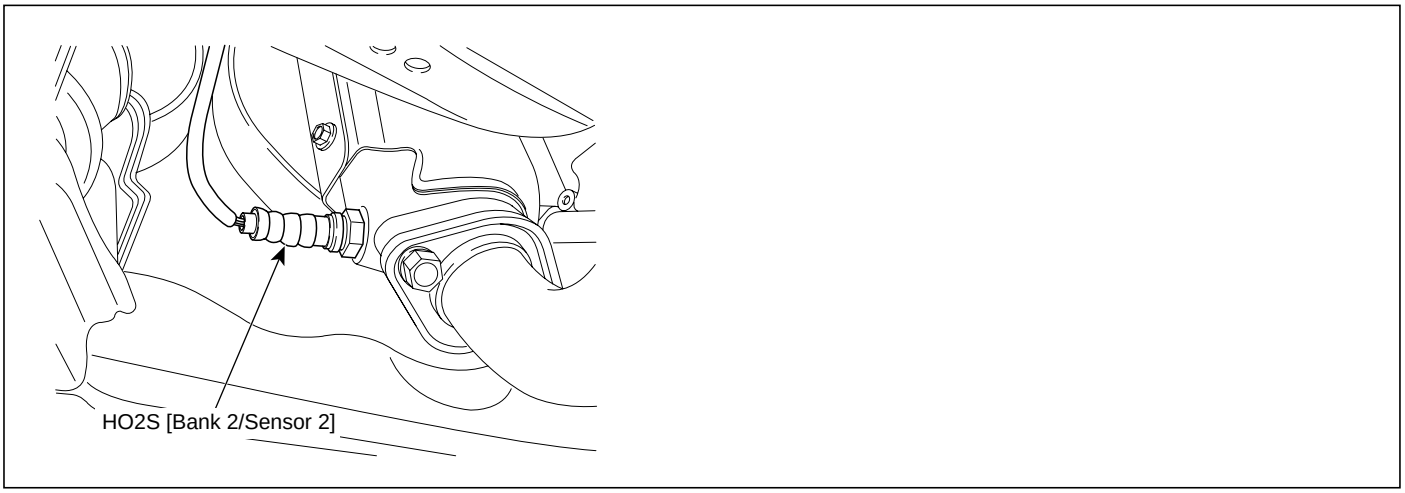
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EEA84363

Refer to DTC P0151.

DTC P0157 HO2S CIRCUIT LOW VOLTAGE (BANK 2 / SENSOR 2)

COMPONENT LOCATION EC466B58



SCMF16176L

GENERAL DESCRIPTION E68CCF51

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION EE482644

Checking output signals from HO2S under detecting condition, if an output signal is below 0.04V for more than predeterminate time, PCM sets P0157. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E814A11A

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor connection • Short to ground in harness • HO2S(B2/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B2/S2) < 0.04V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

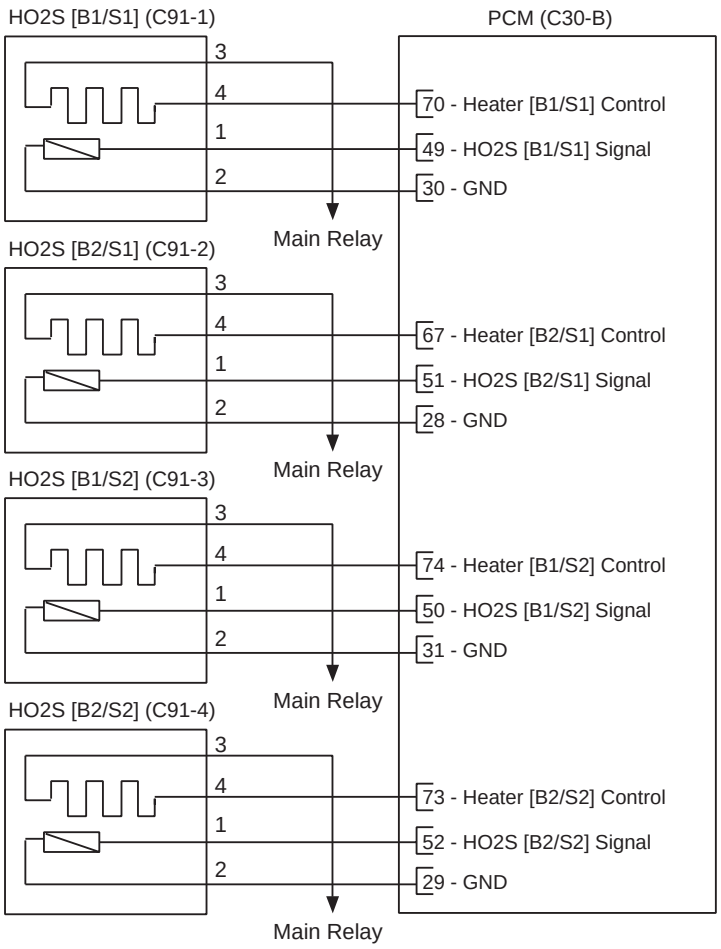
SPECIFICATION ECAFA1F6

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E9EEF01F

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

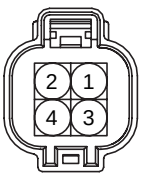
HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

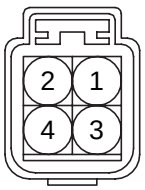
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



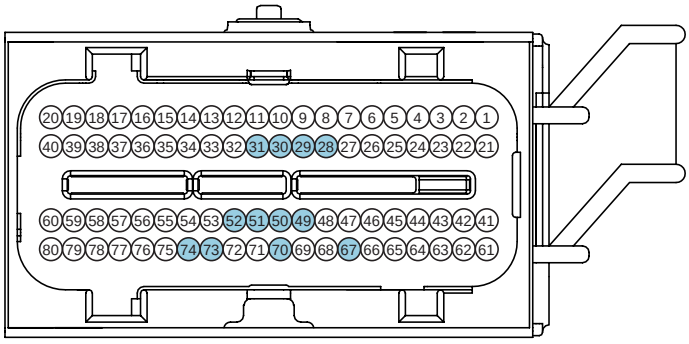
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA EBC8409A

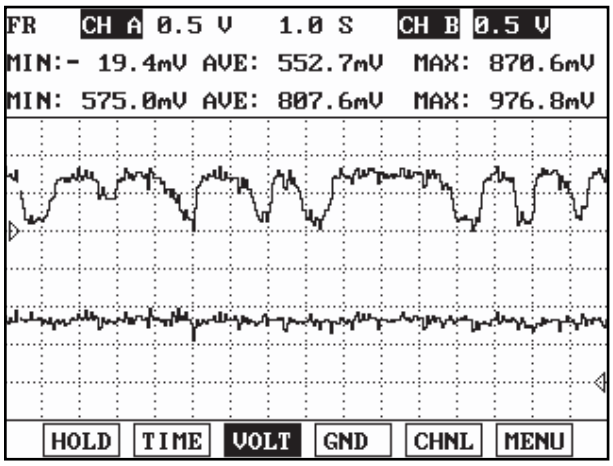


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS EC7B4E32

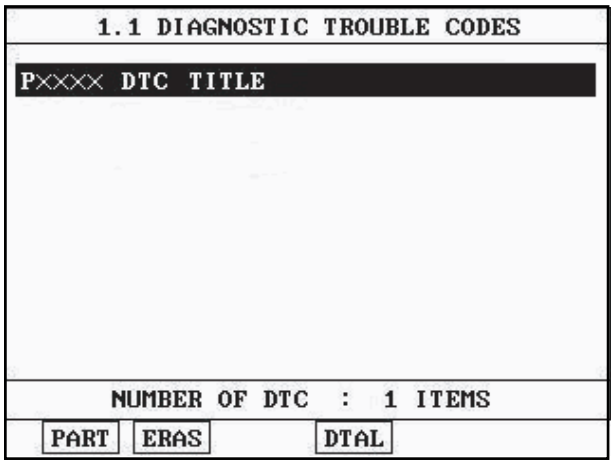
1. Check DTC Status

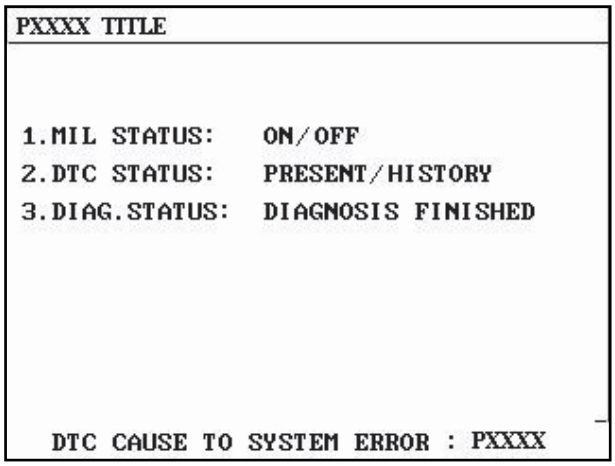
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EE7F7D7E

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 E9A8FDF3

1. IG "OFF" and disconnect HO2S(B2/S2)
2. IG "ON"
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification : Approx. 3.5V - when pumping current is ON Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E45EBFF8

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

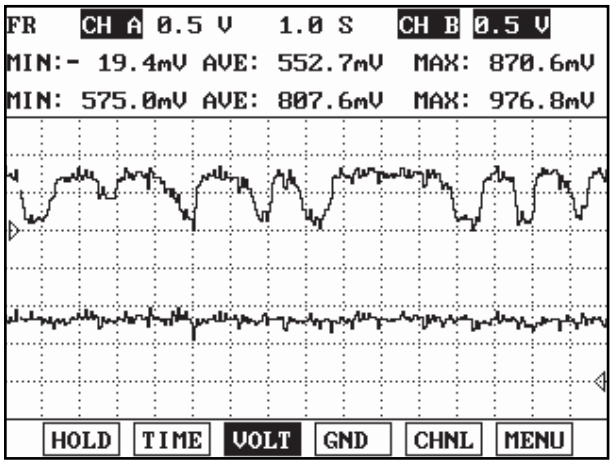


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E16A8B88

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0158 HO2S CIRCUIT HIGH VOLTAGE (BANK 2 / SENSOR 2)

COMPONENT LOCATION ED02A084

Refer to DTC P0157.

GENERAL DESCRIPTION E80B453F

Refer to DTC P0157.

DTC DESCRIPTION E20AA58E

Checking output signals from HO2S under detecting condition, if an output signal is above 1.3V for more than predeterminate time, PCM sets P0158. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E08BFD99

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor signal voltage	• Poor connection • Short to ground in harness • HO2S(B2/S2) • PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state	
Threshold value	• The voltage of HO2S(B2/S2) > 1.3V	
Diagnosis Time	• Continuous (more than 12.5 sec. failure for every 15 sec.test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EC808963

Refer to DTC P0157.

SCHEMATIC DIAGRAM E358095F

Refer to DTC P0157.

SIGNAL WAVEFORM AND DATA EBB7BB8A

Refer to DTC P0157.

MONITOR DTC STATUS E7193974

Refer to DTC P0157.

TERMINAL AND CONNECTOR INSPECTION EE41B826

Refer to DTC P0157.

SIGNAL CIRCUIT INSPECTION E9F3F25A

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E67626BE

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.
   3) After warming-up, monitor signal waveform of HO2S with scantool.?

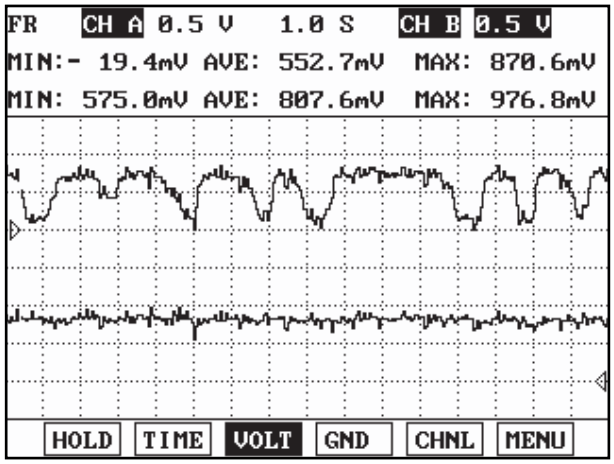


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E1B0F3D0

Refer to DTC P0157.

DTC P0160 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 2 / SENSOR 2)

COMPONENT LOCATION E7ECD0FE

Refer to DTC P0157.

GENERAL DESCRIPTION E40C3747

Refer to DTC P0157.

DTC DESCRIPTION EA1246BA

Checking output signals from HO2S under detecting condition, if an output voltage is approx.0.45V or 3.5V for more than predeterminate time, PCM sets P0160. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E60838DA

Item		Detecting Condition	Possible cause
DTC Strategy		• Monitor signal voltage	• Poor connection • Open in harness • HO2S(B2/S2) • PCM
Enable Conditions		• Battery voltage ≥ 10V • Engine running ≥ 60 sec. • Engine warm-up state • No disable faults	
Thresh-old value	Case 1	• 1.2V ≤ Voltage of HO2S ≤ 3.9V (at pumping current ON)	
	Case 2	• 0.415V ≤ Voltage of HO2S ≤ 0.515V (at pumping current OFF)	
Diagnosis Time		• Continuous (more than 76.5 sec.failure for every 90 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION EF953B16

Refer to DTC P0157.

SCHEMATIC DIAGRAM E08EF8CF

Refer to DTC P0157.

SIGNAL WAVEFORM AND DATA EC950F42

Refer to DTC P0157.

MONITOR DTC STATUS E38A5341

Refer to DTC P0157.

TERMINAL AND CONNECTOR INSPECTION EA9C0DA4

Refer to DTC P0157.

SIGNAL CIRCUIT INSPECTION E4F75E95

1. IG "OFF" and disconnect HO2S(B2/S2) connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.

Specification :
Approx. 3.5V - when pumping current is ON
Approx. 0.45V - when pumping current is OFF

4. Is the measured voltage within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E77D1325

1. IG "ON" and disconnect HO2S(B2/S2) connector.
2. Measure voltage between terminal 1 of HO2S(B2/S2) harness connector and chassis ground.
3. Measure voltage between terminals 1 and 2 of HO2S(B2/S2) harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E279C52A

1. Check the Signal waveform of HO2S
   1) IG "OFF" and connect HO2S connector.
   2) Engine start.
   3) After warming-up, monitor signal waveform of HO2S with scantool.?

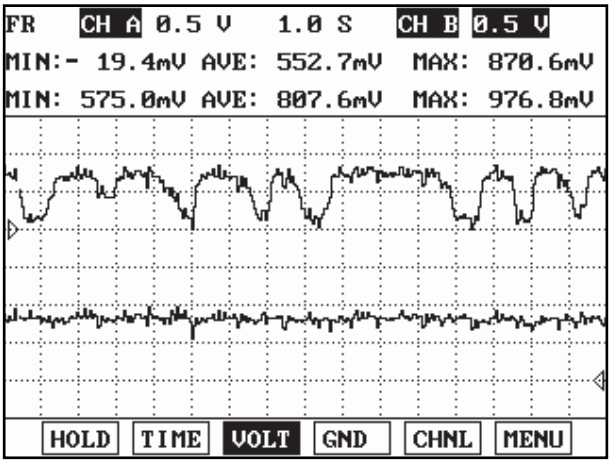


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

YES

▶ Go to "Check HO2S" as below.

NO

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

2. Check HO2S

1) IG "OFF" and disconnect HO2S connector.

2) Check that the HO2S is securely installed.

3) Check the HO2S for contamination or damage

4) Is the sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EB601912

Refer to DTC P0157.

DTC P0171 SYSTEM TOO LEAN (BANK 1)
DTC P0174 SYSTEM TOO LEAN (BANK 2)

GENERAL DESCRIPTION E0E9D636

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION EB85DC59

Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0171/P0174. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E461125D

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Air leakage • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60℃(140˚F) ≤ Engine coolant temperature ≤ 115℃(239˚F) • -10℃(14˚F) ≤ Intake air temperature ≤ 60℃(140˚F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Average of short term fuel trim 〉 1.2 • Average of long term fuel trim 〉 0.8	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS EA2D7ED9

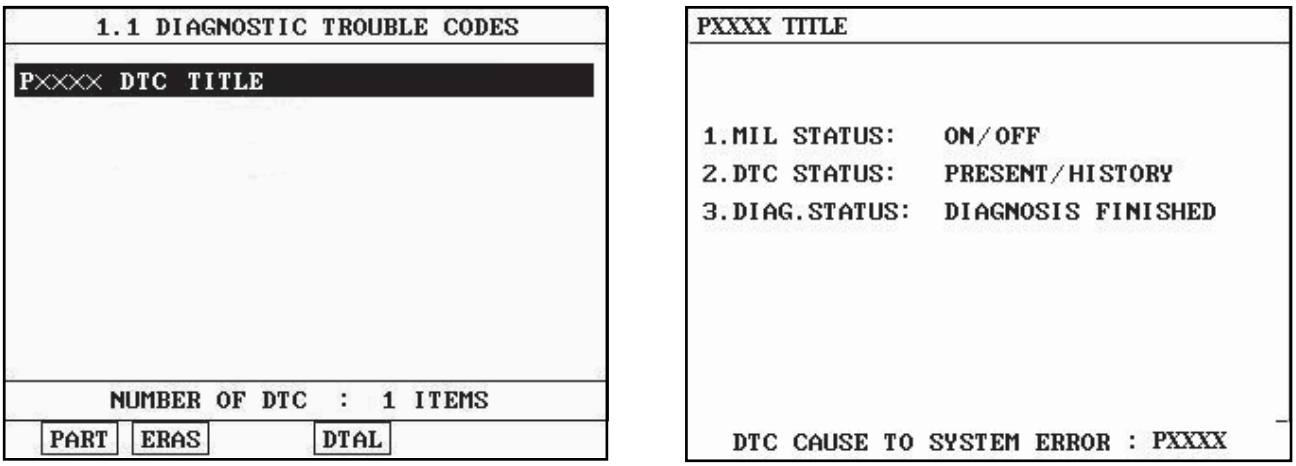
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E791F73B

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 E77E6B06

1. Check air leakage

1) Visually/physically inspect the air leakage in intake/exhaust system for 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 found in this procedure?

YES

▶ Repair or replace it which has a problem, and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Check the fuel line" as follows

2. Check the fuel line

1) Check the fuel line for following items
- ▶ Connector connection state
- ▶ Damage/ connection state for vacuum hoses connected to fuel line
- ▶ Bent/ pressed/ twisted fuel line or fuel leakage

2) Has a problem found in this procedure?

YES

▶ Repair or replace it which has a problem, and go to " Verification of Vehicle Repair" procedure.

NO

▶ Go to "Check fuel pressure" as follows

3. Check fuel pressure

NOTE

- *Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.*
- *The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.*

1) Start the engine and disconnect the fuel pump relay.

2) Wait until fuel in fuel line is exhausted and the engine stalls.

3) Turn the ignition switch OFF position.

4) Install the special service tool for measuring the fuel pressure between the delivery pipe and the fuel feed hose.

5) Connect the fuel pump relay.

6) With fuel pressure applied, check the three is no fuel leakage from the fuel pressure gauge or connection part.

7) Start the engine and measure the fuel pressure at idle.

Specification : 374 ~ 384 kpa (3.82 ~ 3.92 kg/㎠, 54.3 ~ 55.8psi)

8) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for about 5 minutes.

9) Is the measured fuel pressure within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair or replace according to the table below.
▶ And then, go to " Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected area
Fuel pressure too low	Clogged 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
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

COMPONENT INSPECTION E8FB3042

1. Check PCV

1) IG "OFF" and remove PCV valve from cylinder head

2) With engine idling, block PCV valve and confirm that vacuum is felt.

3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

4) Is the PCV valve normally moving?

YES

▶ Go to "Check PCSV as follows.

NO

▶ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

1) IG "OFF" and disconnect PCSV and vacuum hose.

2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

3) Is the vacuum maintained ?

YES

▶ Go to " Check injector" as follows.

NO

▶ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector

   1) IG "OFF" and disconnect injector.

   2) Check it for blocking caused by any foreign substance.

   3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)

SPECIFICATION :

Temp	Coil's resistance
20℃(68°F)	13.8 ~ 15.2 Ω

   4) Is the measured resistance within specification?

YES

▶ Go to "Check sensor/actuator related to fuel system" as follows

NO

▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system

   1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on) (Refer to each DTC diagnostic procedure)

   2) Are all of these items 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

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

VERIFICATION OF VEHICLE REPAIR ECCEB299

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0172 SYSTEM TOO RICH (BANK 1)
DTC P0175 SYSTEM TOO RICH (BANK 2)

GENERAL DESCRIPTION EE18D8D2

Refer to DTC P0171.

DTC DESCRIPTION E62A3E5F

Checking air-fuel ratio correction value every 0.75 sec. under detecting condition, if an value is within detecting condition for more than 0.3 sec., PCM sets P0172/P0175. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E8FF59ED

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Limits Exceeded	• Poor connection • Relevant sensor/actuator • Blocking of Intake system • Fuel leakage in injector • Improper fuel line pressure • PCM
Enable Conditions	• 550rpm ≤ Engine speed ≤ 4000rpm • 60℃(140˚F) ≤ Engine coolant temperature ≤ 115℃(239˚F) • -10℃(14˚F) ≤ Intake air temperature ≤ 60℃(140˚F) • 0° ≤ Throttle position ≤ 80° • 25kPa ≤ Engine load ≤ 90kPa • 1.5g/s ≤ Intake air flow ≤ 80g/s • Barometric pressure ≥ 72kPa • Vehicle speed ≤ 130km/h • System voltage ≥ 11V • Feed-back control state • No other diagnostic fault	
Threshold value	• Average of short term fuel trim 〈 0.8 • Average of long term fuel trim 〈 1.23	
Diagnosis Time	• Continuous (More than 0.3 second failure for every 0.75 second test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS EFA8AB09

Refer to DTC P0171.

TERMINAL AND CONNECTOR INSPECTION E192A2EE

Refer to DTC P0171.

SYSTEM INSPECTION EF26692D

1. Check blocking of intake system

   1) Visually/physically inspect the blocking in intake system for following items
      ▶ Throttle body gasket and damage
      ▶ Clogging of Air cleaner

▶ Blocking in intake manifold and injector caused by any foreign substance

2) Has a problem found?

YES

▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to " Check fuel pressure" as follows.

2. Check fuel pressure

NOTE

- *Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.*
- *The fuel system remains under pressure when the engine is not running. Release fuel systempressure before disconnecting any fuel line to reduce the chance of presonal injury orfire damage to vehicle components.*

1) Start the engine and disconnect the fuel pump relay.

2) Wait until fuel in fuel line is exhausted and the engine stalls.

3) Turn the ignition switch OFF position.

4) Install the special service tool for measuring the fuel pressure between the delivery pipe and the fuel feed hose.

5) Connect the fuel pump relay.

6) With fuel pressure applied, check the three is no fuel leakage from the fuel pressure gauge or connection part.

7) Start the engine and measure the fuel pressure at idle.

Specification : 374 ~ 384 kpa (3.82 ~ 3.92 kg/㎠, 54.3 ~ 55.8psi)

8) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for about 5 minutes.

9) Is the measured fuel pressure within specification?

YES

▶ Go to "Check fuel leakage in injector" procedure.

NO

▶ Repair or replace according to the table below.
▶ And then, go to " Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected area
Fuel pressure too low	Clogged 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
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

3. Check fuel leakage in injector

   1) IG "OFF" after checking the fuel pressure test.

   2) Stop engine and check for a change in the fuel pressure gauge reading for 5 minutes.

Specification : After engine stops, fuel gauge reading is maintained for 5 minutes.

   3) Is the fuel gauge reading within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ There is a fuel leakage in injector. Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5B498B0

1. Check PCV

   1) IG "OFF" and remove PCV valve from cylinder head

   2) With engine idling, block PCV valve and confirm that vacuum is felt.

   3) Insert thin stick into the screwed PCV valve and verify that the plunger is moving.

   4) Is the PCV valve normally moving?

YES

▶ Go to "Check PCSV as follows.

NO

▶ Replace it, and go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

   1) IG "OFF" and disconnect PCSV and vacuum hose.

   2) Connect hand-vacuum gage with PCSV and supply vacuum to it.

3) Is the vacuum maintained ?

YES

▶ Go to " Check injector" as follows.

NO

▶ Repair or replace it, and go to " Verification of Vehicle Repair" procedure.

3. Check injector

1) IG "OFF" and disconnect injector.

2) Check it for blocking caused by any foreign substance.

3) Measure resistance between terminals 1 and 2 of Injector connector.(Component side)

SPECIFICATION :

Temp	Coil's resistance
20℃(68°F)	13.8 ~ 15.2 Ω

4) Is the measured resistance within specification?

YES

▶ Go to "Check sensor/actuator related to fuel system" as follows

NO

▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

4. Check sensor/actuator related to fuel system

1) Check the signal of sensor/actuator related to fuel system(HO2S, MAFS,MAPS, TPS, ECTS, PCSV, Injector and so on) (Refer to each DTC diagnostic procedure)

2) Are all of these items 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

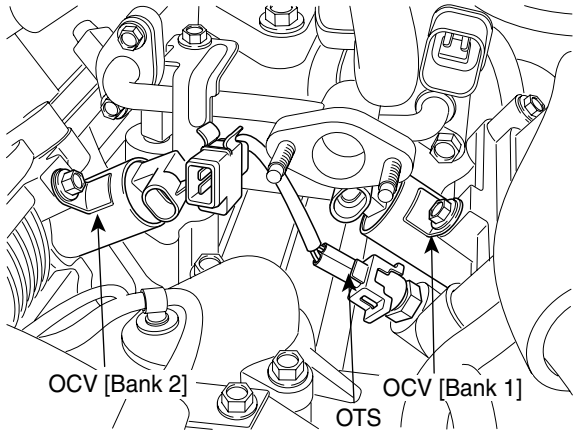
▶ Repair it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E3C739E0

Refer to DTC P0171.

DTC P0196 ENGINE OIL TEMP. SENSOR RANGE / PERFORMANCE

COMPONENT LOCATION E2609C65



LGLG500A

GENERAL DESCRIPTION E4B4433D

The fluid of the CVVT is the engine oil and its density changes according to the engine oil temperature. At this time the Oil Temperature Sensor (OTS) helps compensation against the temperature differences. The Oil Temperature Sensor measures the engine oil temperature before the engine oil comes into the Oil-flow Control Valve (OCV).
According to the measured temperature, the Engine Control Module (ECM) compensates the oil-flow control valve operation time.

DTC DESCRIPTION E70307F1

Checking the oil temperture , coolant temperature and intake air temperature every 25 sec. under detecting condition, if the difference in temperature at start-up exceeds threshold value, PCM sets P0196.

DTC DETECTING CONDITION E86D378A

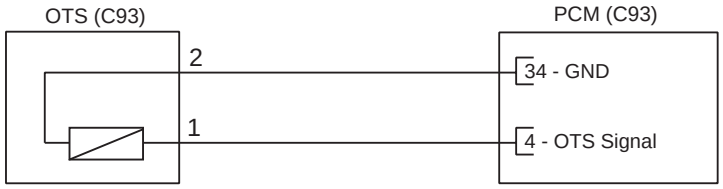
Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if the oil temperature value is rational, compared to coolant and intake air temperature.	• Poor connection • Open or short in harness • Faulty OTS • PCM
Enable Conditions	• Engine run time after startup 〈 30 sec • Minimum soak period required 〉 270 min	
Threshold value	• The difference in temperature between oil and coolant temperatures at startup. 〉 35℃(63°F) • The difference in temperature between oil temperature and intake air temperature at startup 〉 35℃(63°F)	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 25 sec.test)	
MIL On Condition	• No MIL ON (DTC only)	

SPECIFICATION ED3ED1AA

Temperature(℃/˚F)	Resistance(kΩ)
-20℃/ -4˚F	16.52kΩ
20℃/ 68˚F	2.45kΩ
80℃/ 176˚F	0.29kΩ

SCHEMATIC DIAGRAM ED41B1F3

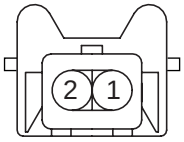
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

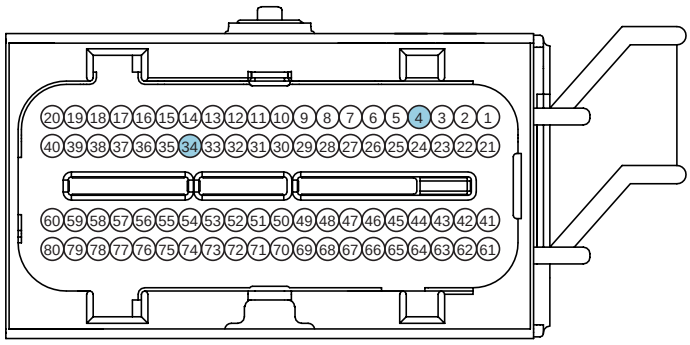
Terminal	Connected to	Function
1	PCM C30-B (4)	OTS Signal
2	PCM C30-B (34)	Sensor ground

[HARNESS CONNECTORS]



C93

OTS



C30-B

PCM

SCMF16117L

MONITOR DTC STATUS EC77D6B7

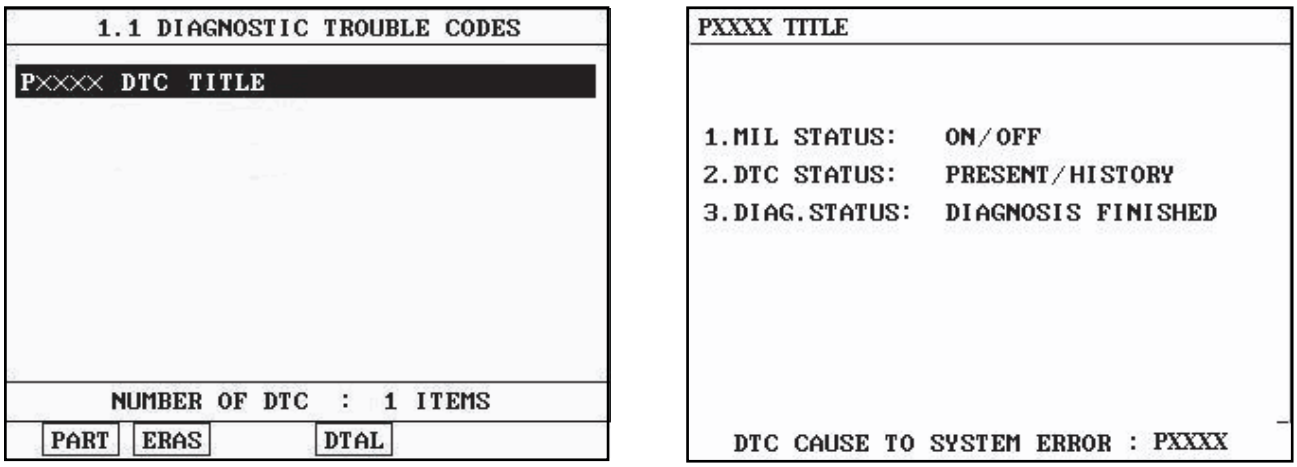
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E779F4E1

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

NO

▶ Go to "signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E257DE74

1. Check Voltage
   1) IG "OFF" & ENG "OFF"
   2) Disconnect OTS connector
   3) IG "ON" & ENG "OFF"

4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V

5) Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Go to "Check open in harness" as follow.

2. Check open in harness

1) IG "OFF" & ENG "OFF"

2) Disconnect OTS and PCM connector.

3) Measure resistance between terminal 1 of OTS harness connector and terminal C30-B (4) of PCM harness connector.

Specification : Approx. below 1Ω

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 E76FA851

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

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

5. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E28EB9B6

1. Check resistance of OTS

   1) IG "ON" & ENG "OFF"

   2) Monitor Oil Temperature parameter on the scantool

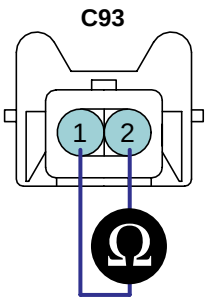
   3) IG "OFF" & ENG "OFF"

   4) Disconnect OTS connector.

   5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

SPECIFICATION :

Temperature(℃/℉)	Resistance(kΩ)
-20℃/ -4℉	16.52kΩ
20℃/ 68℉	2.45kΩ
80℃/ 176℉	0.29kΩ



1. OTS Signal
2. OTS Ground

SCMF16241L

   6) Is the measured resistance within specification ?

   YES

   ▶ Go to "Check PCM" as follows.

   NO

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

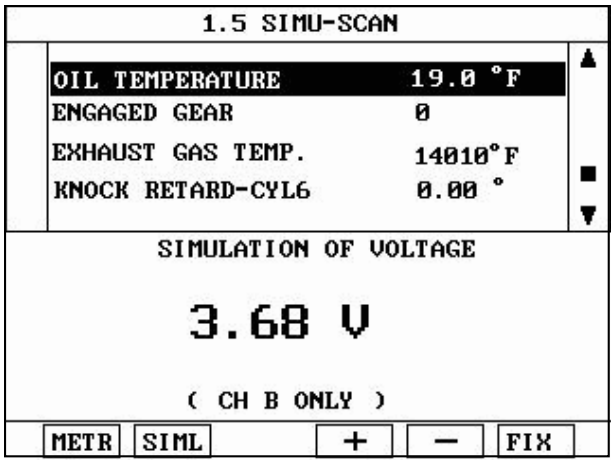
2. Check PCM

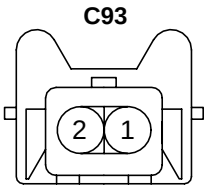
   1) Ignition "OFF" and Connect Scantool

   2) Ignition"ON " & Engine "OFF"

   3) Select simulation function on scantool.

   4) Simulate voltage at terminal "1" of OTS signal harness connector.





1. OTS Signal
2. OTS Ground

SCMF16242L

5) Does the OTS signal value changes according to simulation voltage ?

YES

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

NO

▶ 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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E8F9366F

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0197 ENGINE OIL TEMP. SENSOR LOW INPUT

COMPONENT LOCATION E8C526BB

Refer to DTC P0196.

GENERAL DESCRIPTION E2BA831A

Refer to DTC P0196.

DTC DESCRIPTION EF5561C5

Checking output signals from oil temperture sensor every 15 sec. under detecting condition, if an signal is low for more than 12.5 sec., PCM sets P0197. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7D73AB2

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Short to ground in harness • Oil temp.sensor • PCM
Enable Condi-tions	Case 1	• Engine running state 〉 60 sec • Coolant temperature 〈 110 ℃(230˚F)	
	Case 2	• Engine running state 〉 90 sec.	
Thresh old value		• Oil temperature sensor's signal 〈 0.1V	
Diagnosis Time		• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION E3F3FD1B

Refer to DTC P0196.

SCHEMATIC DIAGRAM EA8CF7F5

Refer to DTC P0196.

MONITOR DTC STATUS E2E8A6EC

Refer to DTC P0196.

TERMINAL AND CONNECTOR INSPECTION EE8567D3

Refer to DTC P0196.

SIGNAL CIRCUIT INSPECTION E24C1B27

1. Check Voltage

    1) IG "OFF" & ENG "OFF"

2) Disconnect OTS connector

3) IG "ON" & ENG "OFF"

4) Measure voltage between harness terminal 1 of OTS 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 harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E0E32B66

1. Check resistance of OTS

1) IG "ON" & ENG "OFF"

2) Monitor Oil Temperature parameter on the scantool

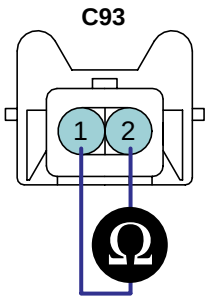
3) IG "OFF" & ENG "OFF"

4) Disconnect OTS connector.

5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

SPECIFICATION :

Temperature(℃/℉)	Resistance(kΩ)
-20℃/ -4℉	16.52kΩ
20℃/ 68℉	2.45kΩ
80℃/ 176℉	0.29kΩ



1. OTS Signal
2. OTS Ground

SCMF16241L

6) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" as follows.

NO

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

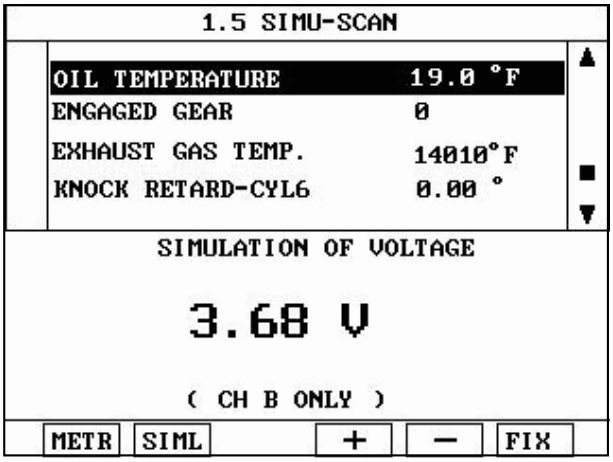
2. Check PCM

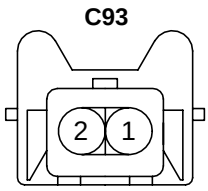
1) Ignition "OFF" and Connect Scantool

2) Ignition"ON " & Engine "OFF"

3) Select simulation function on scantool.

4) Simulate voltage at terminal "1" of OTS signal harness connector.





1. OTS Signal
2. OTS Ground

SCMF16242L

5) Does the OTS signal value changes according to simulation voltage ?

YES

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

NO

▶ 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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EE96ADAA

Refer to DTC P0196.

DTC P0198 ENGINE OIL TEMP. SENSOR HIGH INPUT

COMPONENT LOCATION E42E33E2

Refer to DTC P0196.

GENERAL DESCRIPTION E64334B1

Refer to DTC P0196.

DTC DESCRIPTION E4558250

Checking output signals from oil temperture sensor every 15 sec. under detecting condition, if an signal is high for more than 12.5 sec., PCM sets P0198. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EE0B5425

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal low	• Poor connection • Open or short to battery in signal harness • Open in ground harness • Oil temp.sensor • PCM
Enable Condi-tions	Case 1	• Engine running state 〉 60 sec • Coolant temperature 〈 110 ℃(230˚F)	
	Case 2	• Engine running state 〉 90 sec.	
Thresh old value		• Oil temperature sensor's signal 〉 4.9V	
Diagnosis Time		• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition		• 2 Driving Cycles	

SPECIFICATION E8CC49CD

Refer to DTC P0196.

SCHEMATIC DIAGRAM EAD51BEB

Refer to DTC P0196.

MONITOR DTC STATUS E6142301

Refer to DTC P0196.

TERMINAL AND CONNECTOR INSPECTION E23DAE00

Refer to DTC P0196.

SIGNAL CIRCUIT INSPECTION E3ECF421

1. Check Voltage

   1) IG "OFF" & ENG "OFF"

2) Disconnect OTS connector

3) IG "ON" & ENG "OFF"

4) Measure voltage between harness terminal 1 of OTS and chassis ground.

Specification : Approx. 5V

5) Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Go to "Check open in harness" as follow.

2. Check open in harness

1) IG "OFF" & ENG "OFF"

2) Disconnect OTS and PCM connector.

3) Measure resistance between terminal 1 of OTS harness connector and terminal C30-B (4) of PCM harness connector.

Specification : Approx. below 1Ω

4) Is the measured resistance within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair or replace open in harness, and then go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E9529310

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

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

5. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure

NO

▶ Repair or replace contact resistance or open in harness and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E406B793

1. Check resistance of OTS

   1) IG "ON" & ENG "OFF"

   2) Monitor Oil Temperature parameter on the scantool

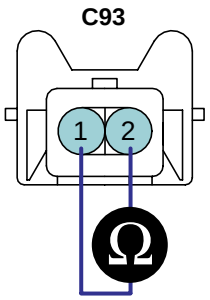
   3) IG "OFF" & ENG "OFF"

   4) Disconnect OTS connector.

   5) Measure resistance between terminal 1 and 2 of OTS connector(Component Side)

SPECIFICATION :

Temperature(℃/°F)	Resistance(kΩ)
-20℃/ -4°F	16.52kΩ
20℃/ 68°F	2.45kΩ
80℃/ 176°F	0.29kΩ



1. OTS Signal
2. OTS Ground

SCMF16241L

   6) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" as follows.

NO

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

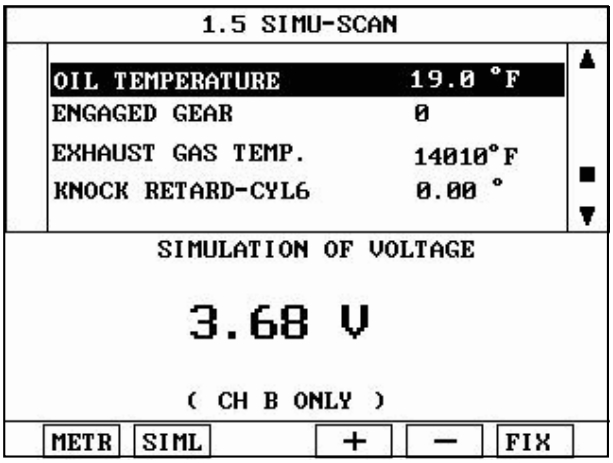
2. Check PCM

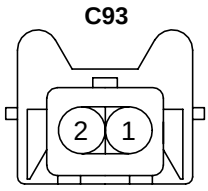
   1) Ignition "OFF" and Connect Scantool

   2) Ignition"ON " & Engine "OFF"

   3) Select simulation function on scantool.

4) Simulate voltage at terminal "1" of OTS signal harness connector.





1. OTS Signal
2. OTS Ground

SCMF16242L

5) Does the OTS signal value changes according to simulation voltage ?

YES

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

NO

▶ 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.

NOTE

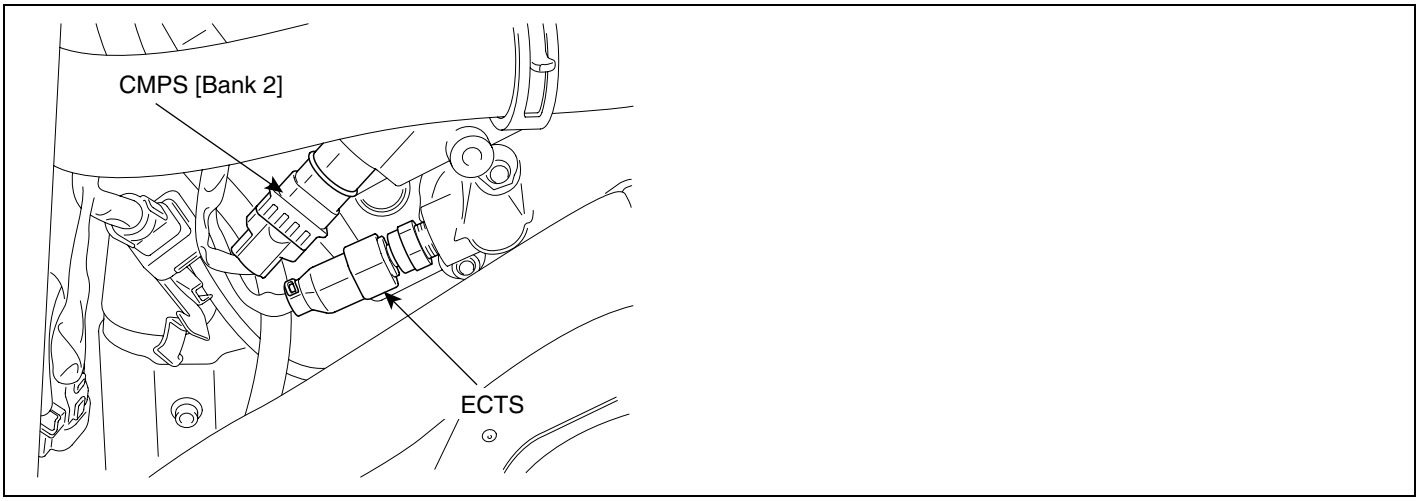
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E344162C

Refer to DTC P0196.

DTC P0217 ENGINE COOLANT OVER TEMPERATURE CONDITION

COMPONENT LOCATION E72AF219



LGLG510A

GENERAL DESCRIPTION E8DE49EF

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION E351C025

The Engine Coolant Temperature High Rationality Diagnostic checks for unusually high engine coolant temperatures under normal operating loads.
PCM monitors difference between the startup and current coolant temperature and compares agaist the threshold while enable condition is met. If the PCM detects that the coolant temperature exceeds the limit under normal operating condition, PCM determines that a fault exists and a DTC is stored.

DTC DETECTING CONDITION EF2AA66C

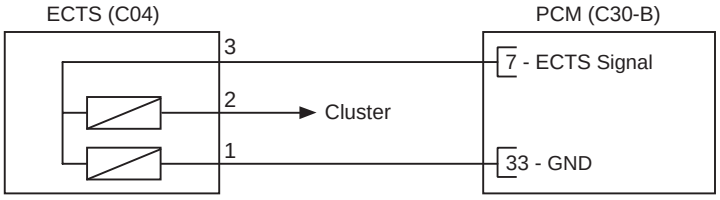
Item	Detecting Condition	Possible cause
DTC Strategy	• This diagnostic introduces a calibratable delay and simultaneously looks out for excessive engine loads. Once the delay period passes and excessive loads have not been experienced, the diagnostic checks whether the undefaulted coolant temperature has exceeded a maximum threshold in order to make a PASS/FAIL determination.	• Poor connection • Lack of engine coolant • Water pump • ECTS • PCM
Enable Conditions	• Engine Running status • No disabling faults present • Coolant Sensor within range • Undefaulted Coolant Temp ≥ 50℃(122 °F) • Undefaulted IAT ≥ 35℃(95 °F) • Soak time ≥ 360min or Undefaulted Coolant temp ≤ 45℃(113 °F)	
Thresh old value	• Coolant temperature ≥ 110℃ (230 °F) • Average airflow 〈 30 g/s and filtered airflow 〈 50 g/s.	
Diagnosis Time	• Continuous (More than 12.5 sec.failure for every 15 sec.test)	
MIL On Condition	• No MIL ON (DTC only)	

SPECIFICATION E32110CD

Temp. (℃/°F)	Resistance (kΩ)	Temp. (℃/°F)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM E2AF1CCA

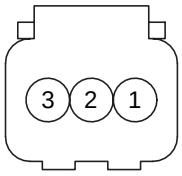
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

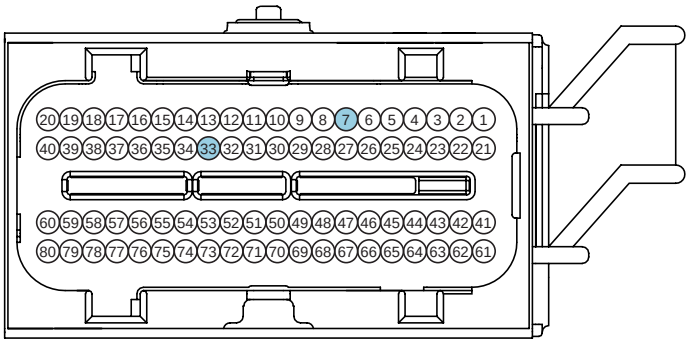
Terminal	Connected to	Function
1	PCM C30-B (33)	Sensor ground
2	Cluster	-
3	PCM C30-B (7)	ECTS Signal

[HARNESS CONNECTORS]



C04

ECTS

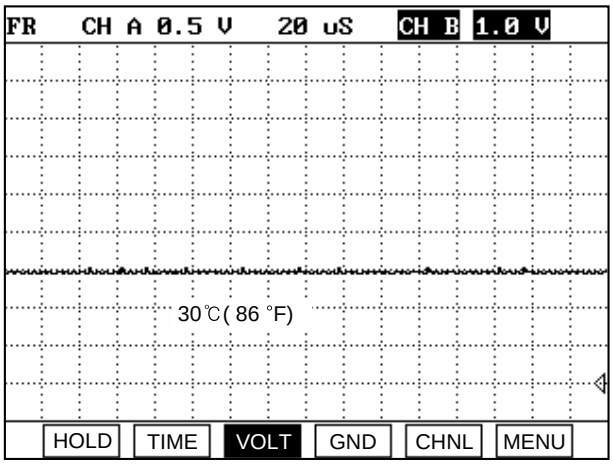


C30-B

PCM

SCMF16106L

SIGNAL WAVEFORM AND DATA EBCA080D



EGRF700B

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS E7EB0ABB

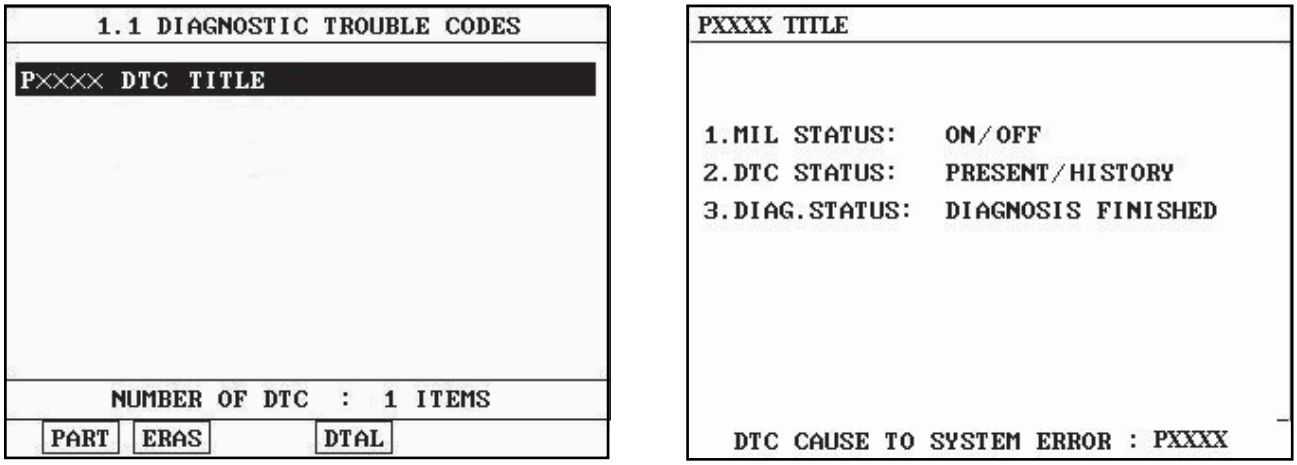
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E7B88213

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 E2D431E4

1. IG "OFF" and disconnect ECTS connector.

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

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

▶ Go to "System Inspection" procedure.

NO

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

5. Check short to ground in harness
   1) IG "OFF" and disconnect ECTS connector and PCM connector.
   2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.
   3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EB9F1FF7

1. Check if Engine coolant level is O.K
2. Check if that water pump is operating correctly.
3. Has a problem been found ?

YES

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

NO

▶ Go to "Component Inspection" procedure.

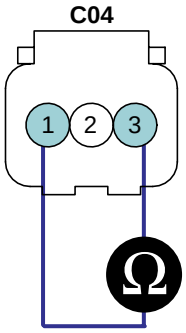
COMPONENT INSPECTION EB452CFD

1. Check resistance of ECTS
   1) IG "OFF" and disconnect ECTS connector.

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

SPECIFICATION :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16245L

3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" procedure.

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.

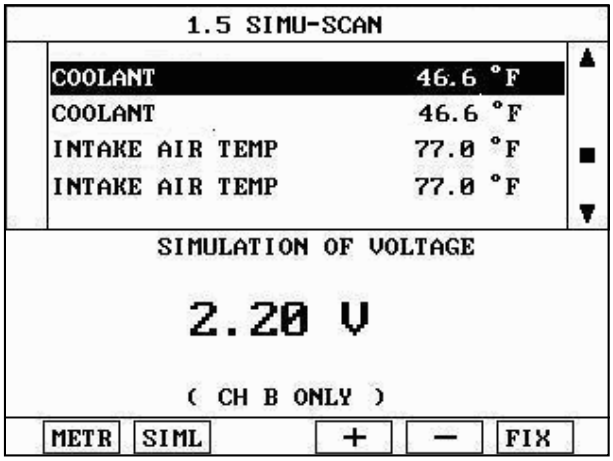
2. Check PCM

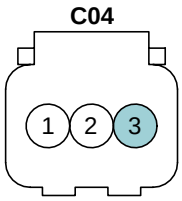
1) IG "OFF" and connect scantool.

2) Connect probe to terminal 3 of ECTS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 3 of ECTS harness connector.





1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16246L

5) Does the signal value of ECT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E61CE6CB

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

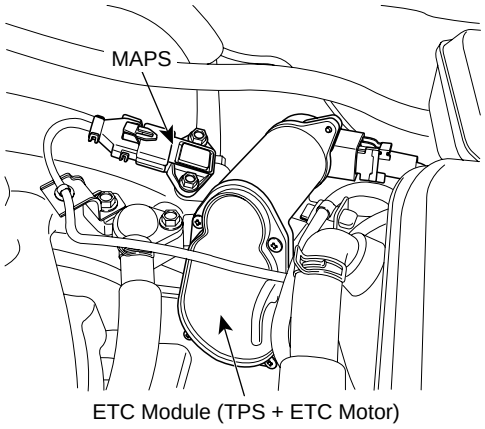
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW INPUT

COMPONENT LOCATION E6D96587



SCMF16192L

GENERAL DESCRIPTION E89080A0

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1&2 and Accelerator Position Sensor(APS) 1&2. TPS1&2 are sharing the same source voltage and ground.The throttle valve opening is control by throttle motor which is controlled by Engine Control Module(ECM).The opposite position indicator shows inverted signal characteristics.TPS1 output voltage increases smoothly in proportion with the throttle valve opening angle after starting. TPS2 output voltage decreases in inverse proportion with the throttle valve opening angle after starting. TPS provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION EC64320B

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is below 0.25V for more than 0.1 sec, PCM sets P0222. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1FB6E8A

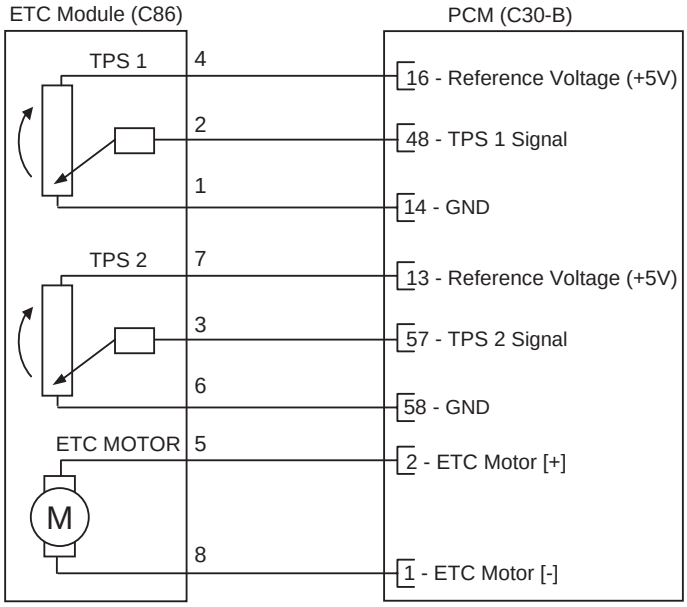
Item	Detecting Condition	Possible Cause
DTC Strategy	• signal low	• Poor connection • Open or short to ground in power harness • Open or short to ground in signal harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS 〈 0.25V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION E70D3209

Throttle opening (°)	Output voltage(V) [Vref=5.0]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM EF39B8B3

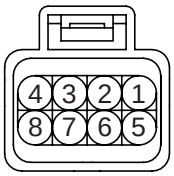
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

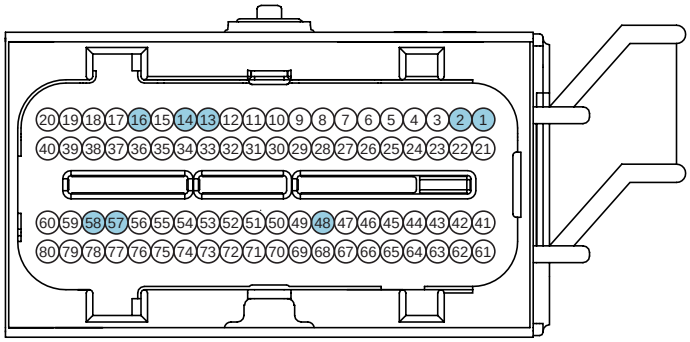
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE

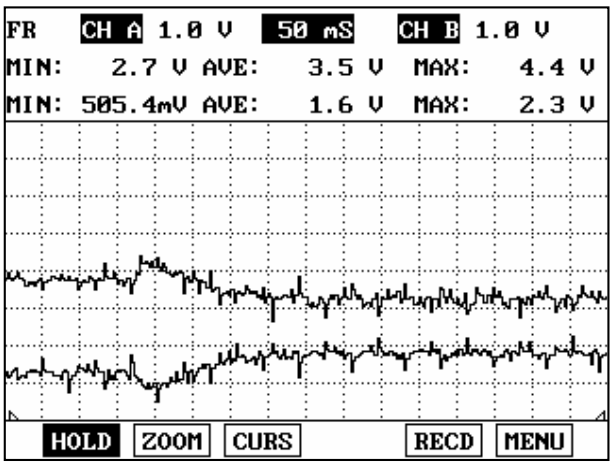


C30-B

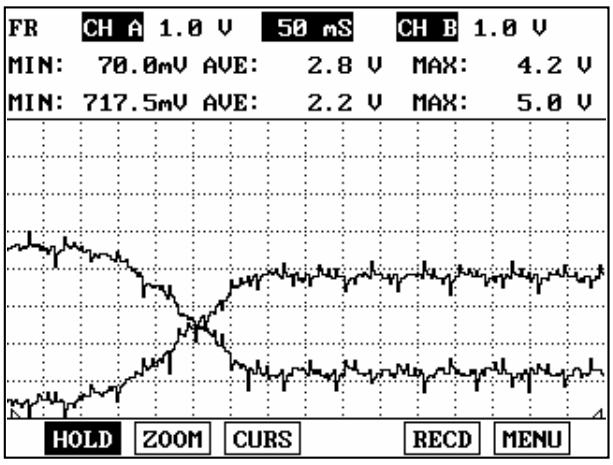
PCM

SCMF16101L

SIGNAL WAVEFORM AND DATA E24A5BA6



Hit the accelerator at IG ON



Open the throttle valve by force at IG ON

EGRF604Z

MONITOR DTC STATUS E7C113D0

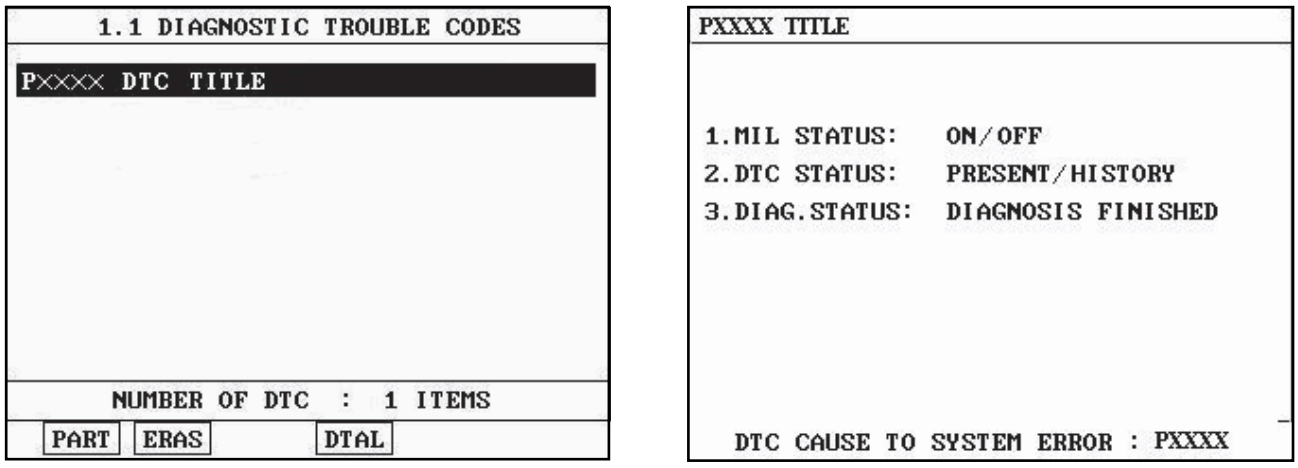
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

   YES

   ▶ Go to "Terminal and connector inspection" procedure.

   NO

   ▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EBF4C90A

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 E9ED0C51

1. IG "OFF" and disconnect TPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 7 of TPS harness connector and chassis ground.

Specification : Approx. 5V

4. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair open or short to ground in power harness, and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E2A4F904

1. Check short to ground in harness
   1) IG "OFF" and disconnect TPS connector and PCM connector.
   2) Measure resistance between terminal 3 of TPS harness connector and chassis ground.
   3) Measure resistance between terminals 3 and 6(1) of TPS harness connector.

Specification : Infinite

   4) 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 open in harness
   1) IG "OFF" and disconnect TPS connector and PCM connector.
   2) Measure resistance between terminal 3 of TPS harness connector and terminal C30-B (57) of PCM harness connector.

Specification : Below 1Ω

   3) Is the measured resistance within specification?

YES

▶ Go to " Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Repair" procedure.

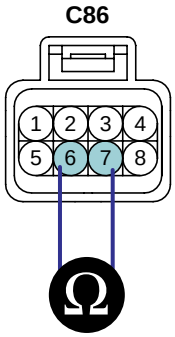
COMPONENT INSPECTION EADB26DA

1. Check TPS

   1) IG "OFF" and disconnect TPS connector.

   2) Measure resistance between terminals 7 and 6 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1kΩ



1. TPS1 ground
2. TPS1 signal
3. TPS2 signal
4. TPS 1 Reference Voltage (+5V)
5. ETC motor[+] Control
6. **TPS2 ground**
7. **TPS 2 Reference Voltage (+5V)**
8. ETC motor[-] Control

SCMF16250L

   3) Is the measured resistance within specification?

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 TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

CAUTION

Procedure of ETS Initialization

1. ***Erase the trouble codes on PCM***
2. ***Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)***
3. ***Turn ignition key on more than 1second to record the throttle motor position on the EEPROM***

VERIFICATION OF VEHICLE REPAIR ECE0E273

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.

2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH INPUT

COMPONENT LOCATION E2DDF6EC

Refer to DTC P0222.

GENERAL DESCRIPTION E1F46B90

Refer to DTC P0222.

DTC DESCRIPTION E99F7095

Checking output signals from TPS2 every 8.5 sec. under detecting condition, if an output signal is above 4.75V for more than 0.1 sec., PCM sets P0223. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E0998B07

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in signal harness • Open in ground harness • TPS • PCM
Enable condition	• IG "ON"	
threshold value	• The signal voltage of TPS 〉 4.75V	
diagnosis time	• Continuous (more than 0.1 sec. failure for every 8.5 sec.test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION EF1158C6

Refer to DTC P0222.

SCHEMATIC DIAGRAM EB52B2D8

Refer to DTC P0222.

SIGNAL WAVEFORM AND DATA EDE87B15

Refer to DTC P0222.

MONITOR DTC STATUS EFDFE57A

Refer to DTC P0222.

TERMINAL AND CONNECTOR INSPECTION ED7A94AD

Refer to DTC P0222.

SIGNAL CIRCUIT INSPECTION E2452337

1. Check voltage

   1) IG "OFF" and disconnect TPS connector.

   2) IG "ON and ENG "OFF"

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

Specification : Approx. 0V

   4) Is the measured voltage within specification?

   YES

   ▶ Go to "Ground Circuit Inspection" procedure.

   NO

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

2. Check short to battery in harness

   1) IG "OFF" and disconnect TPS connector and PCM connector.

   2) Measure resistance between terminals 7 and 3 of TPS harness connector.

   3) Measure resistance between terminals 4 and 3 of TPS harness connector.

   4) Measure resistance between terminals 5 and 3 of TPS harness connector.

   5) Measure resistance between terminals 8 and 3 of TPS harness connector.

Specification : Infinite

   6) Is the measured resistance within specification?

   YES

   ▶ Go to " Ground Circuit Inspection" procedure.

   NO

   ▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E060618D

1. IG "OFF" and disconnect TPS connector.

2. IG "ON" and ENG "OFF"

3. Measure voltage between terminal 8 of TPS harness connector and chassis ground.

4. Measure voltage between terminals 8 and 6 of TPS harness connector.

Specification : Measurement "A" - Measurement ’B’ = Approx. below 200mV

5. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open or contact resistance inharness, and go to "Verification of Vehicle Repair: procedure.

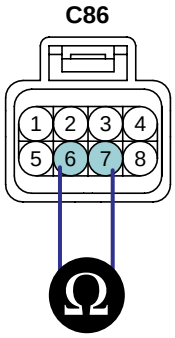
COMPONENT INSPECTION E2BE8CB7

1. Check TPS

   1) IG "OFF" and disconnect TPS connector.

   2) Measure resistance between terminals 7 and 6 of TPS connector.(Component side)

Specification : 2.7 ~ 4.1kΩ



1. TPS1 ground
2. TPS1 signal
3. TPS2 signal
4. TPS 1 Reference Voltage (+5V)
5. ETC motor[+] Control
6. **TPS2 ground**
7. **TPS 2 Reference Voltage (+5V)**
8. ETC motor[-] Control

SCMF16250L

   3) Is the measured resistance within specification?

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 TPS and check for proper operation. If the problem is corrected, replace TPS and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

CAUTION

Procedure of ETS Initialization

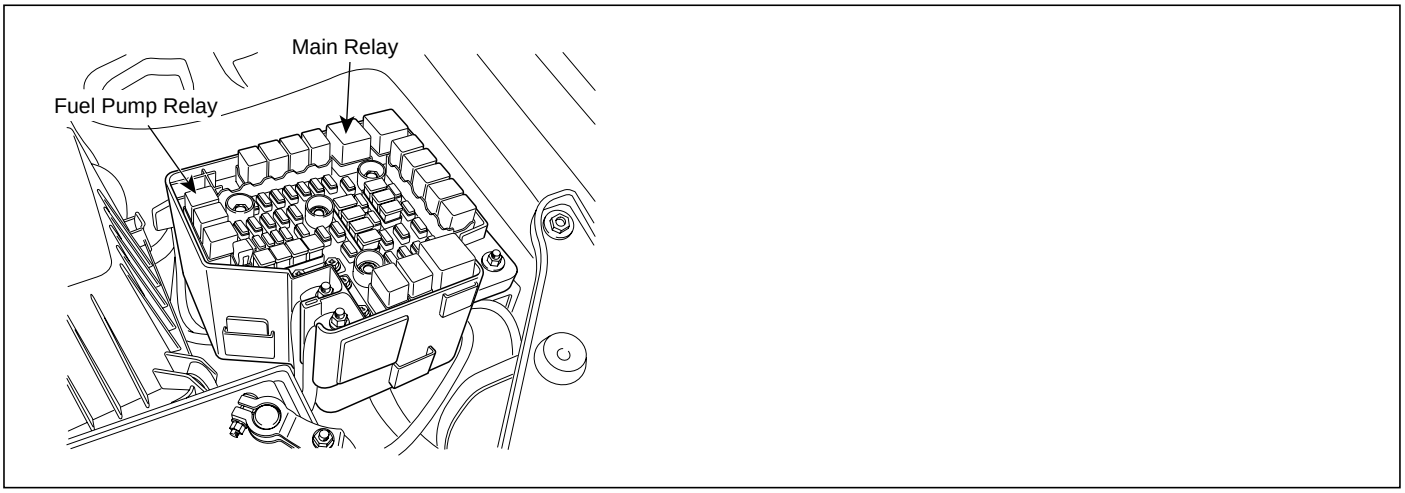
1. ***Erase the trouble codes on PCM***
2. ***Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)***
3. ***Turn ignition key on more than 1second to record the throttle motor position on the EEPROM***

VERIFICATION OF VEHICLE REPAIR E2F56A35

Refer to DTC P0222.

DTC P0230 FUEL PUMP PRIMARY CIRCUIT

COMPONENT LOCATION ECC8A902



SCMF16254L

GENERAL DESCRIPTION E6E9EF13

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

DTC DESCRIPTION E614D1F8

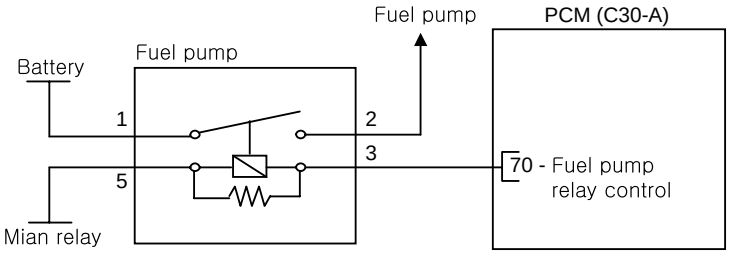
Checking fuel pump relay circuit continuously under detecting condition, if open or short in the circuit is detected, PCM sets P0230.In addition, Take note that open circuit in Main Relay may cause this P0230 code.
※ In addition, Take note that open circuit in Main Relay may cause this P0230 code.

DTC DETECTING CONDITION EBBFCDBE

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low or High	• Poor connection • Open or short in fuel pump relay circuit • Open in Main Relay circuit • Fuel Pump Relay • PCM
Enable condition	• 11V ≤ Battery Voltage ≤ 16V	
threshold value	• Open or short	
diagnosis time	• Continuous	
MIL ON condition	• NO MIL ON(DTC only)	

SCHEMATIC DIAGRAM E60A2C29

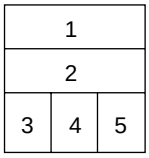
[CIRCUIT DIAGRAM]

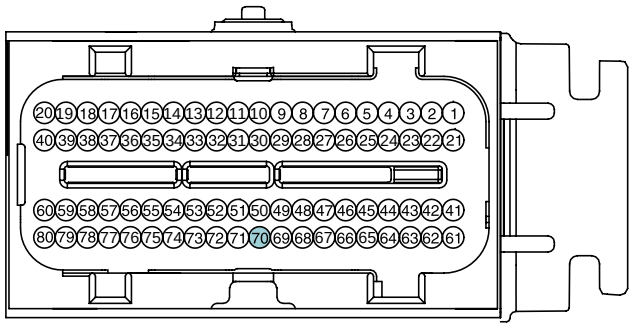


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Battery	Battery power (B+)
2	Fuel pump	Power Supply to fuel pump (B+)
3	PCM C30-A (70)	Relay control
5	Mian relay	Battery power (B+)

[HARNESS CONNECTOR]





C30-A

PCM

SCMF16255L

MONITOR DTC STATUS EE0FF7EC

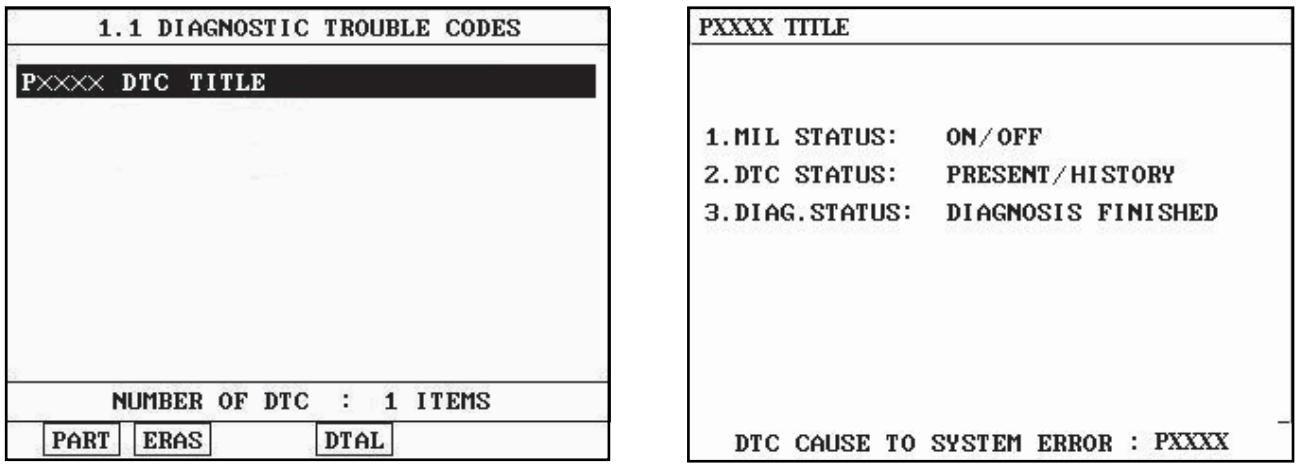
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E4D51B0A

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

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION EB120C99

1. IG "OFF" & ENG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 1(5) of chassis ground.

Specification : B+

5. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check "Fuse" between fuel pump relay and main relay is not installed or blown off
▶ Check "Fuse" between fuel pump relay and battery is not installed or blown off
▶ Especially, if battery voltage at terminal 5 is not detected, replace the Main Relay.
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E800A71E

1. IG "OFF"
2. Disconnect fuel pump relay.
3. IG "ON" & ENG "OFF"
4. Measure voltage between harness terminal 3 and chassis ground.

Specification : Approx. 2.5V

5. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

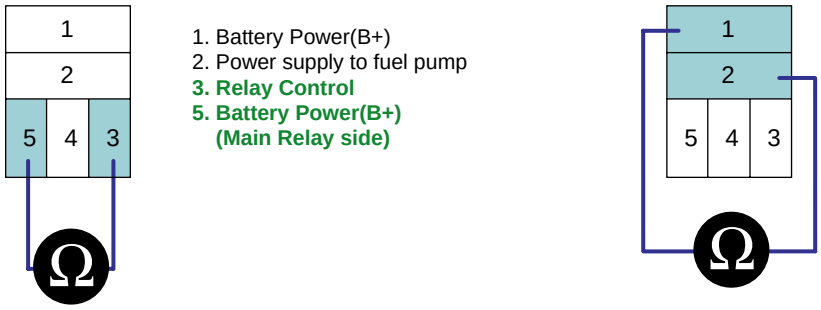
▶ Repair or repalce as necessary and then, go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E6D72E04

1. Check fuel pump relay
   1) IG "OFF"
   2) Disconnect Fuel Pump Relay
   3) Measure resistance between terminal 1 and 2 of Fuel Pump Relay
   4) Measure resistance between terminal 3 and 5 of Fuel Pump Relay

SPECIFICATION :

Terminal	continuity
1~2	NO
3~5	YES (Approx. 70Ω ~ 120Ω)



EFBF607R

5) Is the measured resistance within specification ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

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 EE7C6F22

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

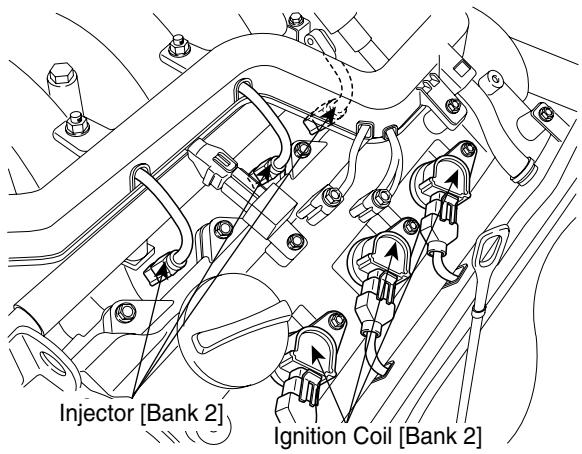
▶ Go to the applicable troubleshoooting procedure.

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
DTC P0273 CYLINDER 5-INJECTOR CIRCUIT LOW
DTC P0276 CYLINDER 6-INJECTOR CIRCUIT LOW

COMPONENT LOCATION EA07F81A



LGLG512A

GENERAL DESCRIPTION EBE9969F

Based on information from various sensors, the ECM measures the fuel injection amount. The fuel injector is a solenoid-operated valve and the fuel injection amount is controlled by length of time the fuel injector is held open. The ECM controls each injector by grounding the control circuit. When the ECM energizes the injector by grounding the control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the ECM de-energizes the injector by opening the control circuit, the fuel injector is closed and circuit voltage should momentarily peak.

DTC DESCRIPTION E0829D7F

Checking output signals from injectors. Under detecting condition, if an output signal is low, PCM sets P0261/P0264/P0267/P0270/P0273/P0276. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EFE811AE

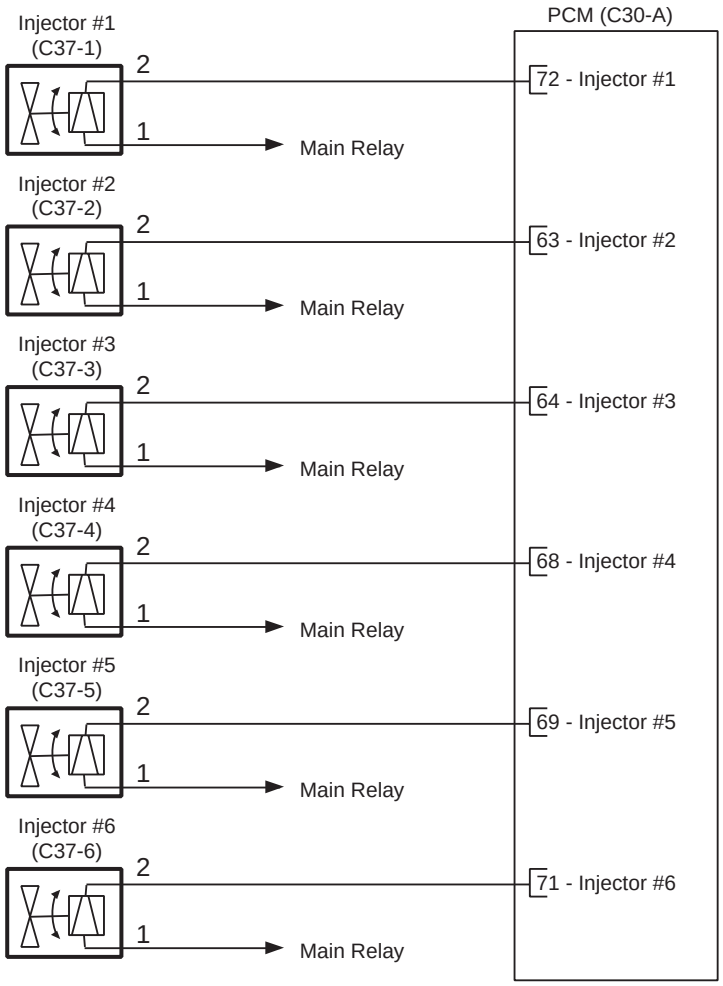
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal Low	• Poor connection • Open or short to ground in power harness • Open or short to ground in control harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met 〉 0.5sec. • No disabling faults present	
threshold value	• Open or short to ground	
diagnosis time	• Continuous	
MIL ON condition	• 2 driving cycles	

SPECIFICATION ECC7150B

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2Ω [20℃(68°F)]

SCHEMATIC DIAGRAM E6B67638

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Injector #1

Terminal	Connected to	Function
1	PCM C30-A (72)	Injector #1 control
2	Main Relay	Battery Voltage (B+)

Injector #2

Terminal	Connected to	Function
1	PCM C30-A (63)	Injector #2 control
2	Main Relay	Battery Voltage (B+)

Injector #3

Terminal	Connected to	Function
1	PCM C30-A (64)	Injector #3 control
2	Main Relay	Battery Voltage (B+)

Injector #4

Terminal	Connected to	Function
1	PCM C30-A (68)	Injector #4 control
2	Main Relay	Battery Voltage (B+)

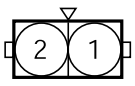
Injector #5

Terminal	Connected to	Function
1	PCM C30-A (69)	Injector #5 control
2	Main Relay	Battery Voltage (B+)

Injector #6

Terminal	Connected to	Function
1	PCM C30-A (71)	Injector #6 control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



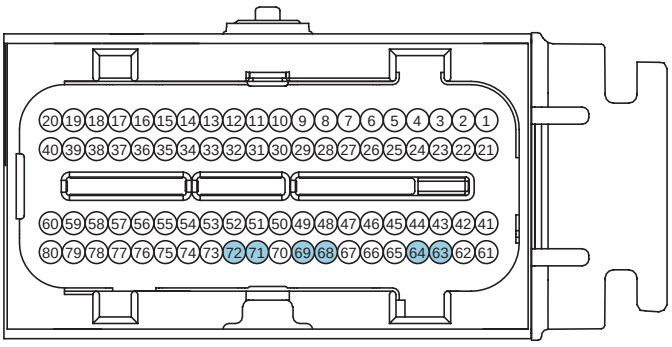
C37-1,3,5

Injector #1,3,5



C37-2,4,6

Injector #2,4,6

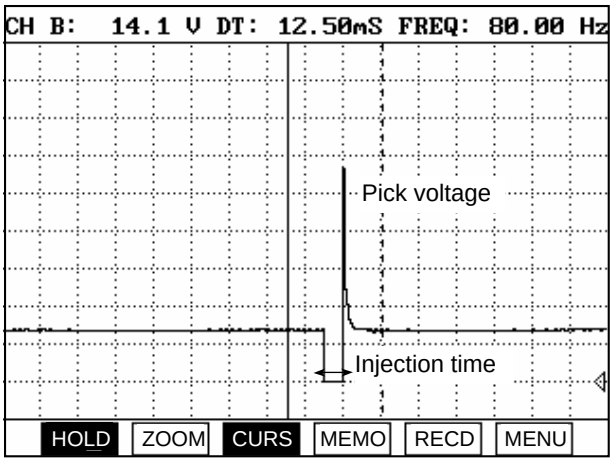


C30-A

PCM

SCMF16113L

SIGNAL WAVEFROM AND DATE E16CB445



EGRF607S

When the PCM energizes the injector by grounding control circuit, the circuit voltage should be low (theoretically 0V) and the fuel is injected. When the PCM de-energizes the injector by opening control circuit, the fuel injector is closed and circuit voltage should be peak at a moment.

MONITOR DTC STATUS E4BF54AA

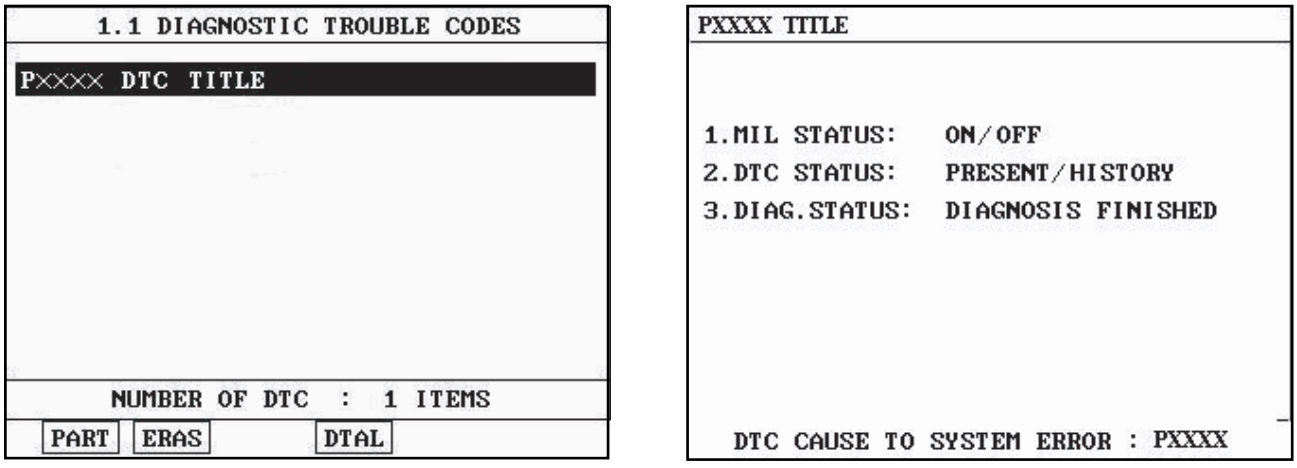
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION ECB23331

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 E37F10FF

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

Specification : B+

4. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check open or connection of the fuse connected to injector power supply.
▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair' procedure.

CONTROL CIRCUIT INSPECTION EDC281C2

1. Check short to ground in harness
   1) IG "OFF" and disconnect injector connector and PCM connector.
   2) Measure resistance between terminal 2 of injector harness connector and chassis ground.

Specification : Infinite

3) 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 open in harness

1) IG "OFF" and disconnect injector connector and PCM connector.

2) [P0261] Measure resistance between terminal 2 of injector harness connector and C30-B (72) of PCM harness connector.
[P0264] Measure resistance between terminal 2 of injector harness connector and C30-B (63) of PCM harness connector.
[P0267] Measure resistance between terminal 2 of injector harness connector and C30-B (64) of PCM harness connector.
[P0270] Measure resistance between terminal 2 of injector harness connector and C30-B (68) of PCM harness connector.
[P0273] Measure resistance between terminal 2 of injector harness connector and C30-B (69) of PCM harness connector.
[P0276] Measure resistance between terminal 2 of injector harness connector and C30-B (71) of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E36E5AB0

1. Check injector

1) IG "OFF" and disconnect injector connector.

2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	13.8 ~ 15.2Ω [20℃(68˚F)]

3) Is the measured resistance within specification?

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 injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EEE753BC

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting 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
DTC P0274 CYLINDER 5-INJECTOR CIRCUIT HIGH
DTC P0277 CYLINDER 6-INJECTOR CIRCUIT HIGH

COMPONENT LOCATION E150E0E6

Refer to DTC P0261.

GENERAL DESCRIPTION EEF3FBEA

Refer to DTC P0261.

DTC DESCRIPTION E8A8A39D

Checking output signals from injectors. Under detecting condition, if an output signal is high, PCM sets P0262/P0265/P0268/P0271/P0274/P0277. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1EF623E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal High	• Poor connection • Short to battery in harness • Injector • PCM
Enable condition	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above conditions are met 〉 0.5sec. • No disabling faults present	
threshold value	• Short to battery	
diagnosis time	• Continuous	
MIL ON condition	• 2 driving cycles	

SPECIFICATION E7E796A6

Refer to DTC P0261.

SCHEMATIC DIAGRAM ECE17432

Refer to DTC P0261.

SIGNAL WAVEFROM AND DATA E1FF3458

Refer to DTC P0261.

MONITOR DTC STATUS E59DA212

Refer to DTC P0261.

TERMINAL AND CONNECTOR INSPECTION EA245884

Refer to DTC P0261.

CONTROL CIRCUIT INSPECTION E76F012F

1. Check voltage

   1) IG "OFF" and disconnect injector connector.

   2) IG "ON" and ENG "OFF"

   3) Measure voltage between terminal 2 of injector harness connector and chassis ground.

Specification : Approx. 0V

   4) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

2. Check short to battery in harness

   1) IG "OFF" and disconnect injector connector and PCM connector.

   2) Measure resistance between terminals 1 and 2 of injector harness connector.

Specification : Infinite

   3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2DB98CB

1. Check injector

   1) IG "OFF" and disconnect injector connector.

   2) Measure resistance between terminals 1 and 2 of injector connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
Injector	

3) Is the measured resistance within specification?

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 injector and check for proper operation. If the problem is corrected, replace injector and go to "Verification of Vehicle Repair" procedure.

NOTE

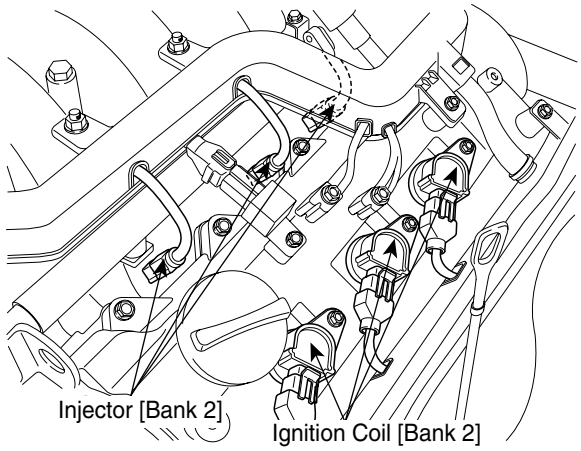
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E12658ED

Refer to DTC P0261.

DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED
DTC P0301 CYLINDER 1-MISFIRE DETECTED
DTC P0302 CYLINDER 2-MISFIRE DETECTED
DTC P0303 CYLINDER 3-MISFIRE DETECTED
DTC P0304 CYLINDER 4-MISFIRE DETECTED
DTC P0305 CYLINDER 5-MISFIRE DETECTED
DTC P0306 CYLINDER 6-MISFIRE DETECTED

COMPONENT LOCATION E595915F



LGLG512A

GENERAL DESCRIPTION E8981F68

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor 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 E8D0ED27

The PCM measures reference event times and calculates the positive and negative acceleration of the crank wheel to detrmine whether a misfire has occurred.
When the rate of misfire exceeds a threshold where the catalyst reaches a temperature where permanent damage can ocur. PCM sets this DTC. In case that misfire affects Catalyst damage, MIL(Malfunction Indication Lamp) will be illuminating and blinking at 1HZ frequency. However, In case of Indivisual and Emission damaging misfire, MIL will be turned on when the malfunction is detected.
Especially, if injector connector is disconnected for more than 46 sec., PCM sets DTC relating to misfire and conducts the fuel-cut to protect the catalyst.

DTC DETECTING CONDITION E554E741

Item		Detecting Condition	Possible Cause
DTC Strategy		• Determine if a multiple cylinder misfire or a cylinder specific misfire is occurring by monitoring crankshaft acceleration.	• Faulty Spark plugs • Faulty Spark plug cables • Air Leakage • Belt deflection and Air gap of CKPS • Incorrect timing • Faulty injector • Improper fuel pressure • Improper engine compression • Faulty PCM
Enable condition		• No sudden change in throttle opening • Torque management control is not functioning • Not deceleration fuel cut off • Not fuel cut off during high speed operation • Not negative torque driving conditions • Not fuel level low • TEC is learned • Coolant temperature is outside the window • 500 〈 Engine speed 〈 6600 • 11 〈 Battery vlotage 〈 16 • TPS/MAP sensor/CAMS/CKPS/ECT sensor are normal	
Thresh old value	Case 1	• Individual event misfire detection 〉 Threshold	
	Case 2	• Emissions damaging 〉 Threshold	
	Case 3	• Catalyst damaging 〉 Threshold	
Diagnosis time		• Continuous	
MIL ON condition		• 2 driving cycles	

MONITOR DTC STATUS EAAAD21E

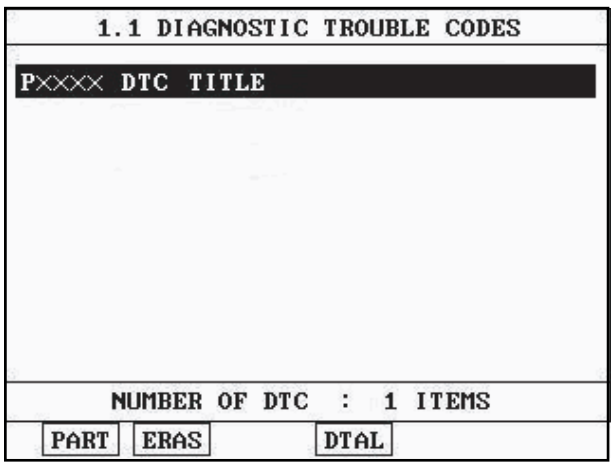
1. Check DTC Status

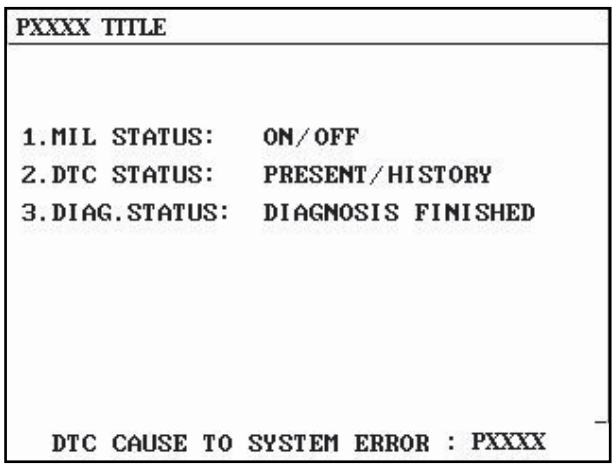
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

SYSTEM INSPECTION EB1FBE92

1. Check Spark Pulg

   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 "Check Air Leakage " as below

2. Check Air Leakage

   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 "Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

3. Check for air leakage in Positive Crankcase Ventilation Valve(PCV)

   1) Remove PCV valve from cylinder head cover by puling ventilation hose

   2) With engine idling block PCV valve opening

3) Verify that vacuum is felt

4) Remove PCV valve

5) Blow through valve from prot "A" and verify that air comes out of prot "B"

6) Blow through valve from prot "B" and verifty that no air comes out of port "A"

7) Has a problem been found ?

YES

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

NO

▶ Go to "Check Compression pressure" as below

4. Check Compression pressure

1) Warm up the engine to normal operating temperature

2) Disconnect the spark plug cables and remove the spark plugs.

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

4) Put compression pressure gauge into spark pulg hole

5) Crank the engine with widely opend throttle valve and check compression pressure at each cylinder

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

Specification : 1323kPa(13.5 kg/cm^2,192 psi)

YES

▶ Go to "Check Timing " as below

NO

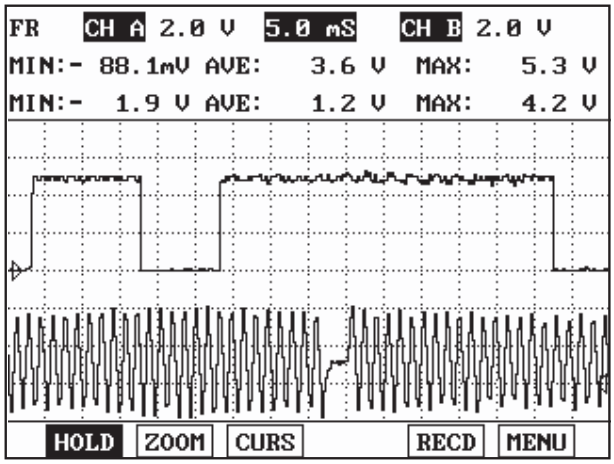
▶ Add a small amount of oil through the spark plug hole, and repeat above steps. If the addition of oil causes the compression to rise, the cause is a worn or damaged piston ring or cylinder inner surface.
▶ If the compression remains the same, the cause is a burnt or defective valve seat, or pressure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

5. Check Timing

1) Ignition "OFF"

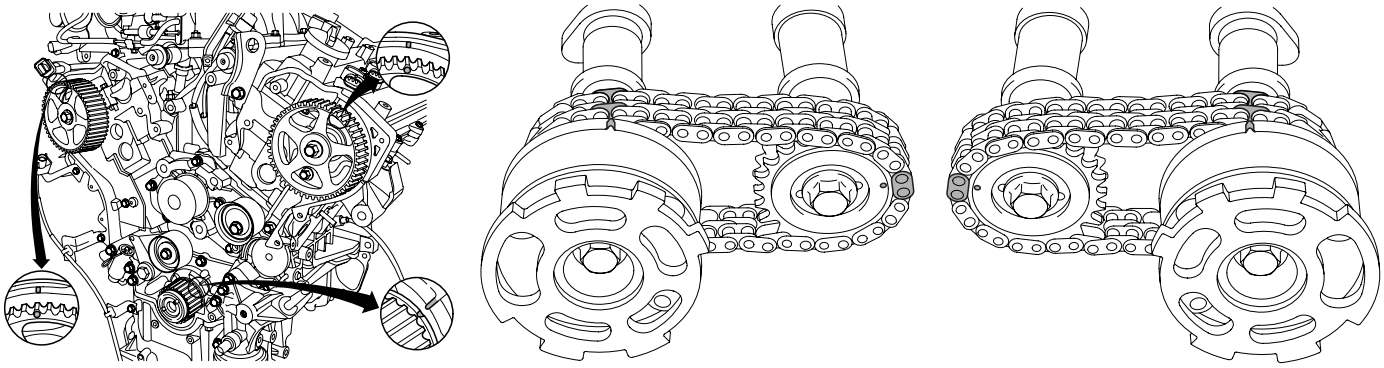
2) Check that Cam, Crank and Oil pump sprocket timing marks are correctly in alignment

3) Monitor these signal waveforms from CMPS and CKPS position Sensor are correctly in alignment



LGLG513A

4) Are all timing marks alligned correctly ?



[Timing Belt] [Cam (Bank 1)] [Cam (Bank 2)]

LGLG502A

YES

▶ Go to "Check Fuel Pressure Test" as below

NO

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

6. Check Fuel Pressure Test

NOTE

- *Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.*
- *The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.*

1) Start the engine and disconnect the fuel pump relay.

2) Wait until fuel in fuel line is exhausted and the engine stalls.

3) Turn the ignition switch OFF position.

4) Install the special service tool for measuring the fuel pressure between the delivery pipe and the fuel feed hose.

5) Connect the fuel pump relay.

6) With fuel pressure applied, check the three is no fuel leakage from the fuel pressure gauge or connection part.

7) Start the engine and measure the fuel pressure at idle.

Specification : 374 ~ 384 kpa (3.82 ~ 3.92 kg/㎠, 54.3 ~ 55.8psi)

8) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for about 5 minutes.

9) Is the measured fuel pressure within specification?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Repair or replace according to the table below.
▶ And then, go to " Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected area
Fuel pressure too low	Clogged 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
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

VERIFICATION OF VEHICLE REPAIR E8FA8100

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0315 SEGMENT TIME ACQUISITION INCORRECT

GENERAL DESCRIPTION E6DFE6D5

The Crankshaft Position Sensor (CKPS) is a magnetic field sensitive 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. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The ECM calculates engine RPM by using the sensor's signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the ECM identifies which cylinder is at top dead center.

DTC DESCRIPTION E90F99E4

Checking tooth error correction under detecting condition, if the TEC is out of Threshold value, PCM sets P0315.

DTC DETECTING CONDITION E1D3BE8C

Item	Detecting Condition	Possible cause
DTC Strategy	• This DTC indicates that crankwheel tooth error has not been learned.	• CKPS • Target wheel • PCM
Enable Conditions	• 12 ≤ Ignition Voltage ≤ 16 (V) • 10 ≤ Engine load 〈 90 (%) • 1500 ≤ engine speed ≤ 4000 (rpm) • Vehicle speed 〈 5kph(3.106856 mph) • Tec RPM stability timer 〉 10sec • 0℃(32°F) 〈 coolant temp 〈 110℃(230°F) • Not active disabling faults • Not key on disabling faults	
Threshold value	• Distance driven without learning tooth error ≥ 4000km(2485.484769 mile) or • Maximum allowed number of tooth error correction samples taken in the On The Road(OTR)learning mode 〈 250 or • Sum of tooth error factors variation outside calibratable range ≥ 250	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycles	

COMPONENT INSPECTION E28BECE8

1. Visually check CKPS and target wheel

   1) IG "OFF"

   2) Check CKPS and target wheel for deformation or damage visually

   3) Is the above items normal ?

   YES

   ▶ Go to "Verification of Vehicle Repair" procedure.

   NO

▶ 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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E588DEEC

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

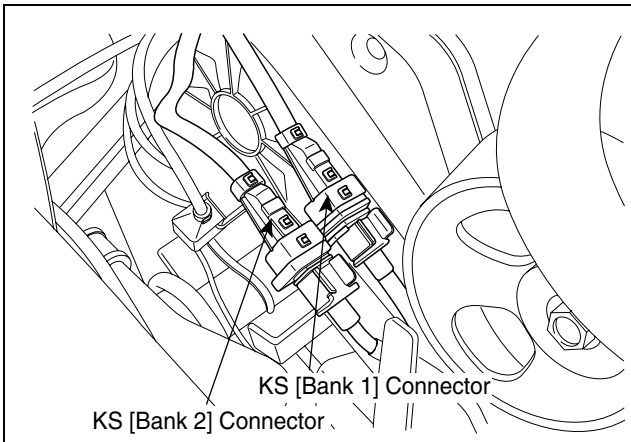
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0325 KNOCK SENSOR 1 CIRCUIT
DTC P0330 KNOCK SENSOR 2 CIRCUIT

COMPONENT LOCATION E3047497



LGLG514A

GENERAL DESCRIPTION EDCF3B21

The knock sensor is attached to the cylinder block and senses engine knocking. The sensor contains a piezoelectric element that converts vibration (or noise) into voltage signal and sends this signal to ECM. With input signals from camshaft position and crankshaft position sensor, ECM can identify which cylinder is knocking. ECM filters vibrations and determines if the vibrations are knocking signal. The Engine Control Module (ECM) uses this signal to suppress knocking by retarding ignition timing. The ECM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the Knock sensor's output voltage falls below minimum threshold. This code indicates an unexpected vibration is being read by the Knock sensor or ECM under normal engine operation.

DTC DESCRIPTION E72F24F7

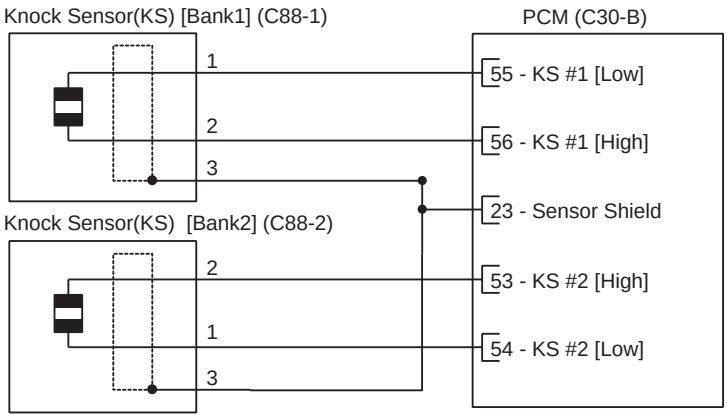
Checking the range of input signal with a knock sensor under detecting condition, PCM senses open in knock sensor circuit or malfunction of sensor. If a knock signal or noise level is inputted without the specified value during standard duration, PCM sets P0325/P0330.

DTC DETECTING CONDITION EF01E762

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal open	• Poor connection • Open in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≥ 2200 rpm	
Threshold value	• Filter coefficient 〈 1.0	
Diagnosis Time	• Continuous	
MIL On Condition	• No MIL ON (DTC only)	

SCHEMATIC DIAGRAM EAFA3B05

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

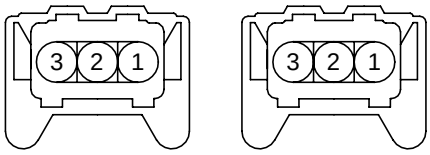
KS [Bank1]

Terminal	Connected to	Function
1	PCM C30-B (55)	KS #1 [Low] signal
2	PCM C30-B (56)	KS #1 [High] signal
3	PCM C30-B (23)	Shield ground

KS [Bank2]

Terminal	Connected to	Function
1	PCM C30-B (54)	KS #2 [Low] signal
2	PCM C30-B (53)	KS #2 [High] signal
3	PCM C30-B (23)	Shield ground

[HARNESS CONNECTORS]

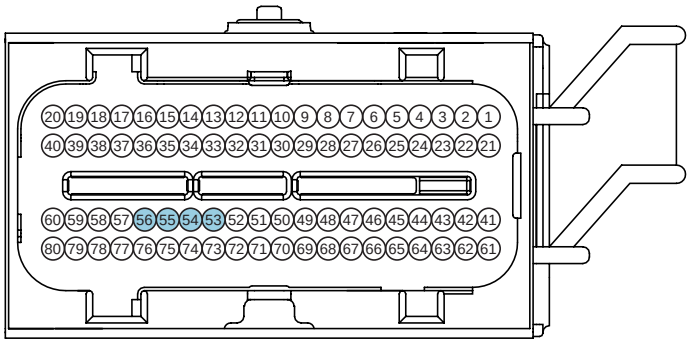


C88-1

KS [Bank1]

C88-2

KS [Bank2]

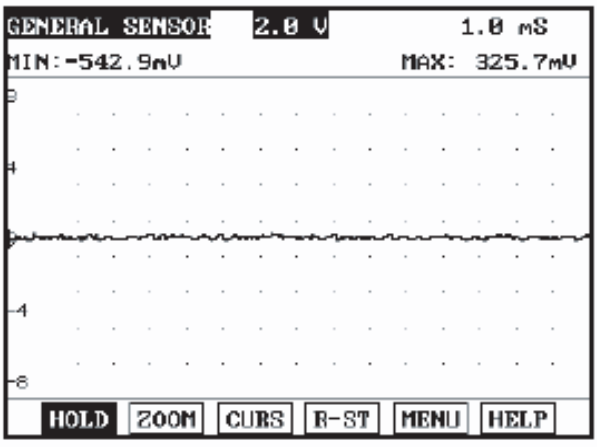


C30-B

PCM

SCMF16112L

SIGNAL WAVEFROM AND DATE E358942B



The knock sensor is installed at cycliner block to detect the vibration effectively during engine running.
The above waveform shows the signal waveform of knock sensor when knock dosen't happen. Generally, knock signal has more noise than other sensor.

EGRF610B

MONITOR DTC STATUS EFC32C61

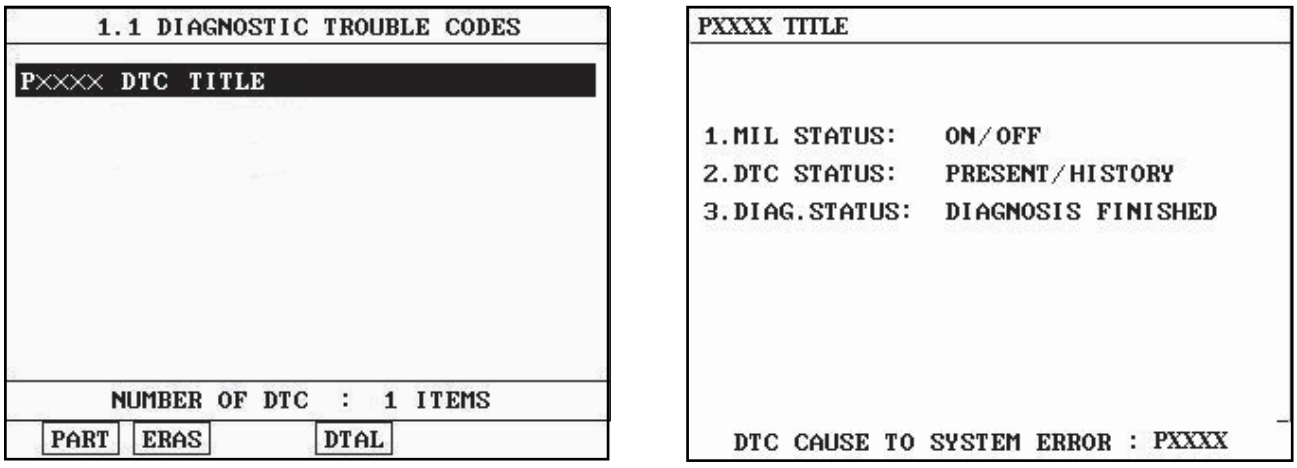
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION ED11003D

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 E115CF36

1. Check open in harness

   1) IG "OFF" and disconnect knock sensor connector and PCM connector.

   2) [P0325] Measure resistance between terminal 1 of knock sensor harness connector and terminal C30-B (55) of PCM harness connector.
   [P0330] Measure resistance between terminal 1 of knock sensor harness connector and terminal C30-B (54) of PCM harness connector.

   3) [P0325] Measure resistance between terminal 2 of knock sensor harness connector and terminal C30-B (56) of PCM harness connector.
   [P0330] Measure resistance between terminal 2 of knock sensor harness connector and terminal C30-B (53) of PCM harness connector.

Specification : Below 1Ω

   4) Is the measured resistance within specification?

YES

▶ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E280243E

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0326 KNOCK SENSOR 1 CIRCUIT RANGE/PERFORMANCE (BANK 1)
DTC P0331 KNOCK SENSOR 2 CIRCUIT RANGE/PERFORMANCE (BANK 2)

COMPONENT LOCATION E2355273

Refer to DTC P0325.

GENERAL DESCRIPTION E2072671

Refer to DTC P0325.

DTC DESCRIPTION EDCE93A8

Checking the range of input signal with a knock sensor under detecting condition, PCM senses short in knock sensor circuit or malfunction of sensor. If the average value of the knok signals is out of the threshold value during standard duration, PCM sets P0326/P0331.

DTC DETECTING CONDITION E259A1C9

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal short	• Poor connection • Short in harness • Knock sensor • PCM
Enable Conditions	• Pressure in intake manifold is normal. • Engine speed ≥ 2000 rpm	
Threshold value	• Knock Filtered Value 〈 5 or 〉 65	
Diagnosis Time	• Continuous	
MIL On Condition	• No MIL ON (DTC only)	

SCHEMATIC DIAGRAM E21E4991

Refer to DTC P0325.

SIGNAL WAVEFROM AND DATE EA0EA640

Refer to DTC P0325.

MONITOR DTC STATUS E5BA4F02

Refer to DTC P0325.

TERMINAL AND CONNECTOR INSPECTION EC85DE4C

Refer to DTC P0325.

SIGNAL CIRCUIT INSPECTION E61F4E74

1. Check short to battery in harness

    1) IG "OFF" and disconnect knock sensor connector.

    2) IG "ON" and ENG "OFF"

3) Measure voltage between terminal 1 of knock sensor harness connector and chassis ground.

4) Measure voltage between terminal 2 of knock sensor harness connector and chassis ground.

Specification : Approx. 1.5V

5) Is the measured voltage within specification?

YES

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

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness

1) IG "OFF" and disconnect knock sensor connector and PCM connector.

2) Measure resistance between terminal 1 of knock sensor harness connector and chassis ground.

3) Measure resistance between terminal 2 of knock sensor harness connector and chassis ground.

4) Measure resistance between terminal 1 and 3 of knock sensor harness connector.

5) Measure resistance between terminal 2 and 3 of knock sensor harness connector.

Specification : Infinite

6) Is the measured resistance within specification ?

YES

▶ If the problem is corrected after substituting with a known - good knock sensor, replace it. If the problem is pending, check for proper operating after substituting with a known - good PCM. and then if the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

NOTE

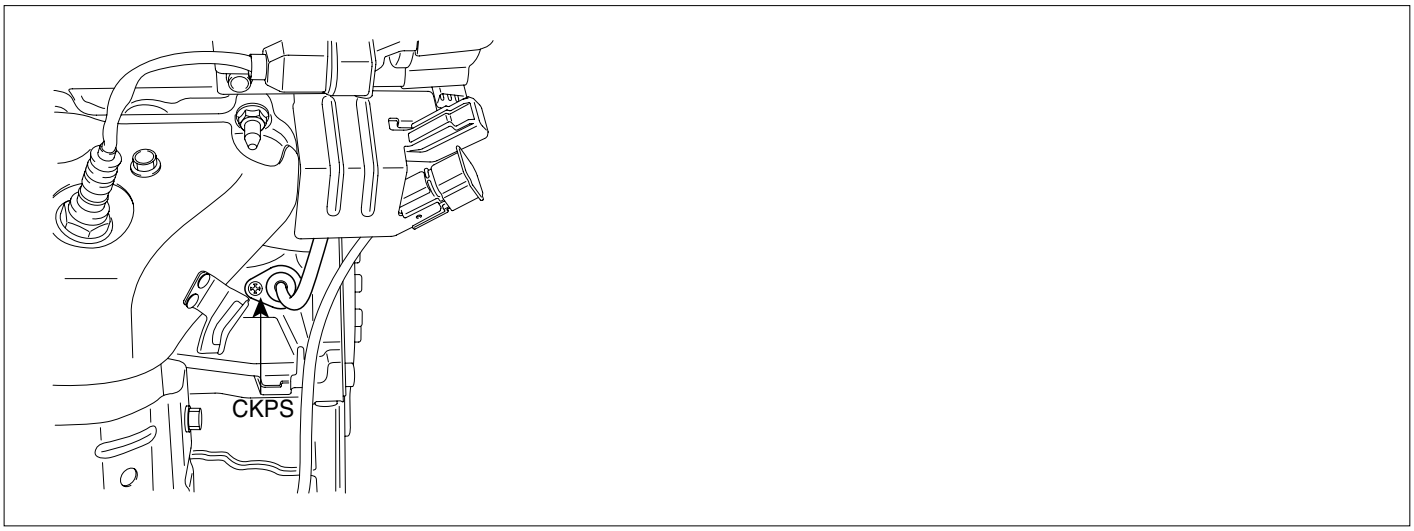
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E8B2B29F

Refer to DTC P0325.

DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

COMPONENT LOCATION EF1D1FC6



LGLG515A

GENERAL DESCRIPTION ECF67ABB

The Crankshaft Position Sensor (CKPS) is a magnetic field sensitive 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. During one crankshaft rotation there are 58 rectangular signals and one longer signal. The ECM calculates engine RPM by using the sensor's signal and controls the injection duration and the ignition timing. Using the signal differences caused by the longer slot, the ECM identifies which cylinder is at top dead center.

DTC DESCRIPTION E2BEDA83

Checking reference signals from CKPS under detecting condition, if any signal is not detected for more than 0.15 sec., PCM sets P0335. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

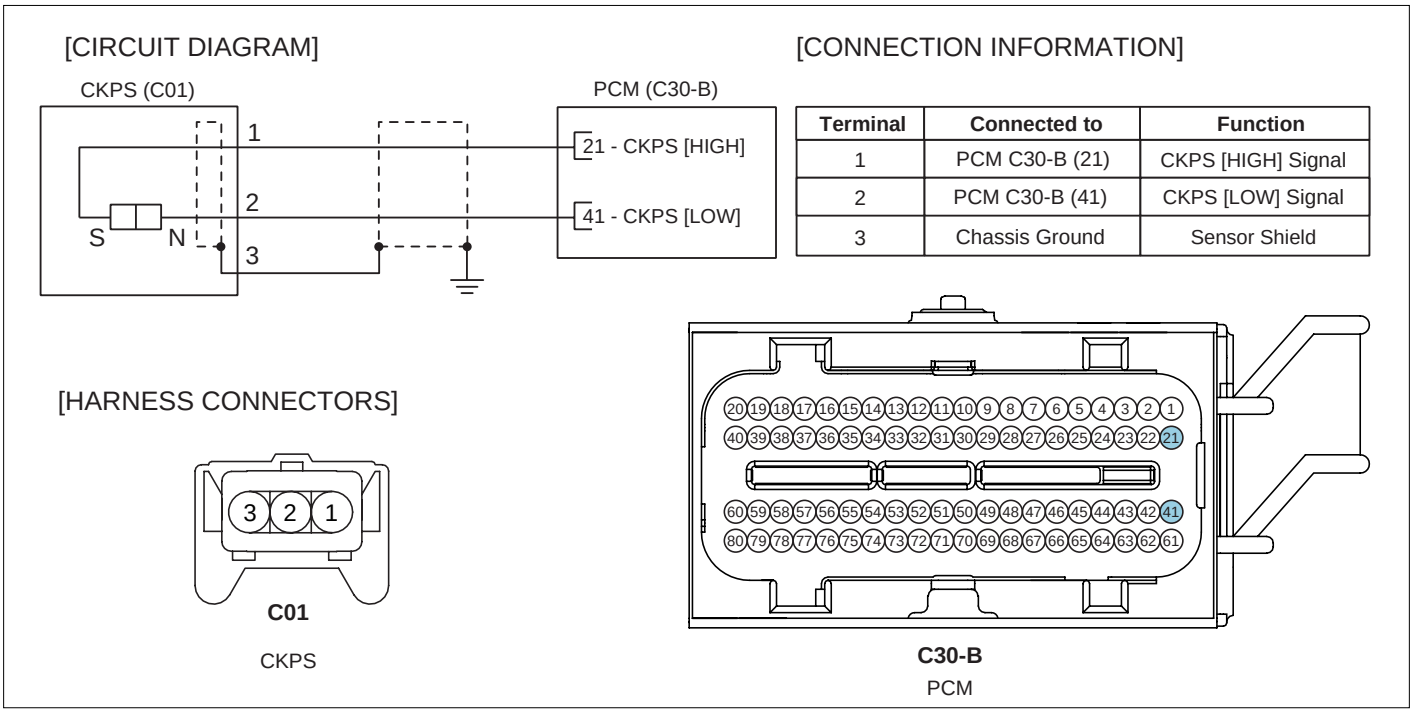
DTC DETECTING CONDITION E8F43B64

Item	Detecting Condition	Possible cause
DTC Strategy	• Check reference wave during cranking	• Poor connection • Open in harness • CKP sensor • PCM
Enable Conditions	• IG "ON", Cranking or engine-off during driving • No DTC related to CAM • Camshaft position sensor state change	
Threshold value	• No reference signal over 0.15 sec.	
Diagnosis Time	• 0.15 sec.	
MIL On Condition	• 2 driving cycles	

SPECIFICATION E0F9ABBE

Resistance	825 ± 100Ω

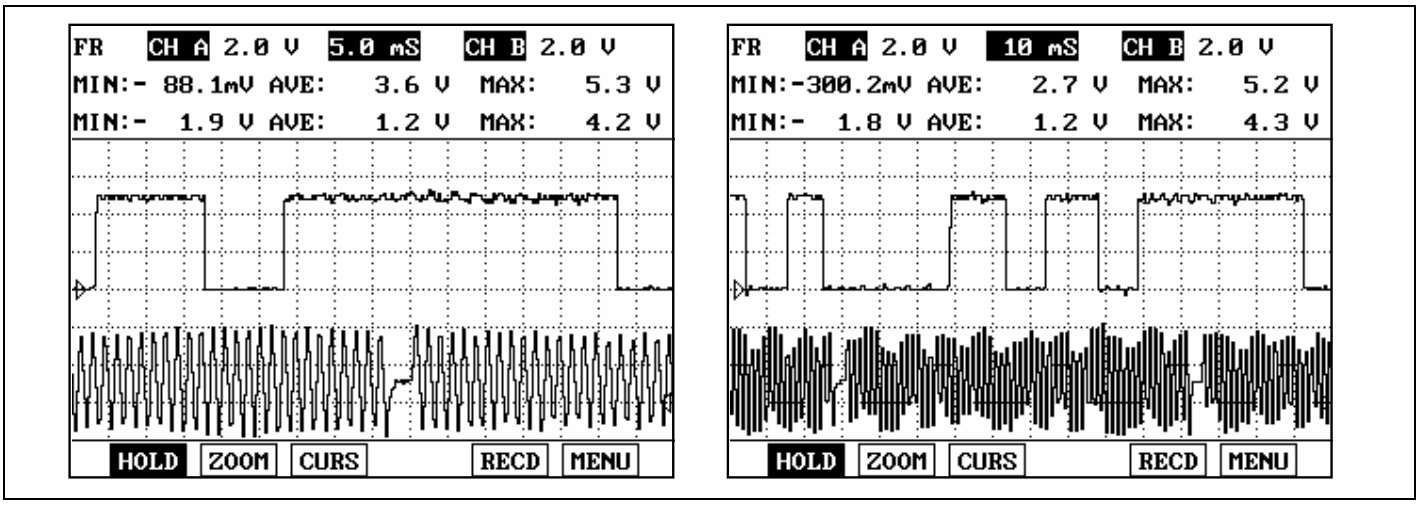
SCHEMATIC DIAGRAM E5041BCF



Terminal	Connected to	Function
1	PCM C30-B (21)	CKPS [HIGH] Signal
2	PCM C30-B (41)	CKPS [LOW] Signal
3	Chassis Ground	Sensor Shield

SCMF16109L

SIGNAL WAVEFROM AND DATE EB93BDD5



EGRF610K

MONITOR DTC STATUS E152D6C1

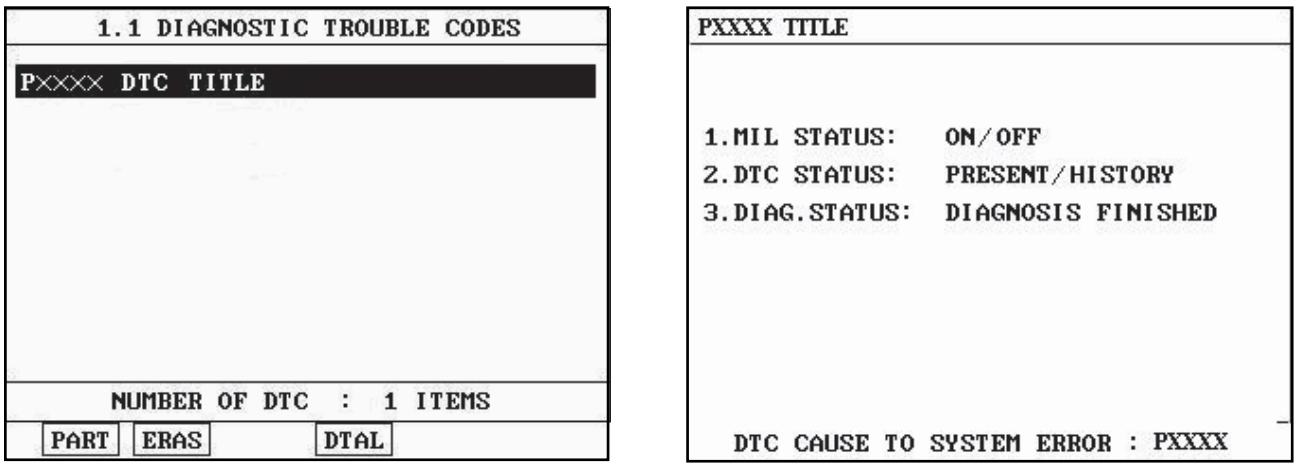
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EB412486

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 ECDD9E7E

1. Check voltage
   1) IG "OFF" and disconnect CKPS connector.
   2) IG "ON" and ENG "OFF"
   3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.

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

Specification : Approx. 1.4V

5) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Go to "Check open in harness" as follows.

2. Check open in harness

1) IG "OFF" and disconnect CKPS connector and PCM connector.

2) Measure resistance between terminal 1 of CKPS harness connector and terminal C30-B (41) of PCM harness connector.

3) Measure resistance between terminal 2 of CKPS harness connector and terminal C30-B (21) of PCM harness connector.

Specification : Below 1Ω

4) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E67111F8

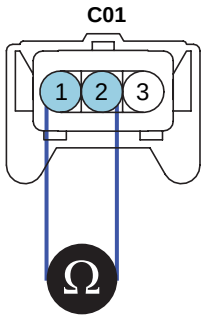
1. Check CKPS

1) IG "OFF" and disconnect CKPS connector.

2) Measure resistance between terminals 1 and 2 of CKPS connector.(Component side)

SPECIFIATION :

Resistance	825 ± 100Ω



1. CKPS [LOW] Signal
2. CKPS [HIGH] Signal
3. Shield ground

SCMF16304L

3) Is the measured resistance within specification?

YES

▶ Go to "Check signal waveform of CKPS" as follows.

NO

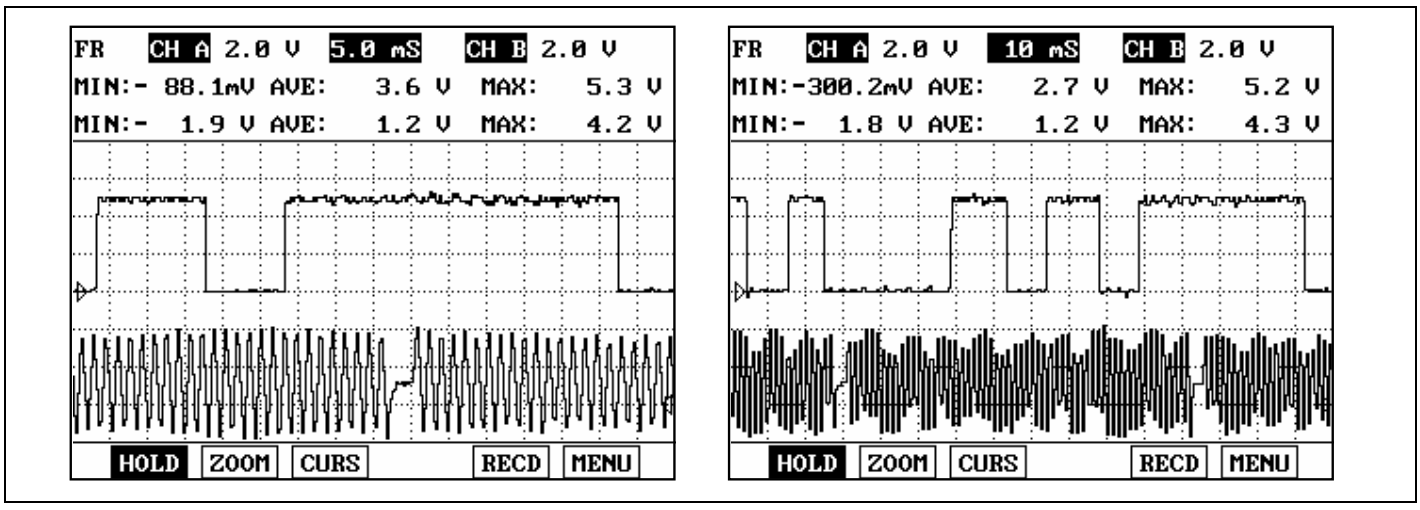
▶ Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

2. Check signal waveform of CKPS

1) IG "OFF" and connect scantool.

2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

REFERENCE SIGNAL WAVEFORM :



EGRF610K

3) Is the measured siganl waveform normal?

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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E6F57B93

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0336 CRANKSHAFT POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE

COMPONENT LOCATION E841DF15

Refer to DTC P0335.

GENERAL DESCRIPTION EBDF7934

Refer to DTC P0335.

DTC DESCRIPTION ED49DB3E

Checking output signals from CKPS every 7.8 sec. under detecting condition, if an output signal is missing or redundant for more than 1.56 sec., PCM sets P0336. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA703496

Item	Detecting Condition	Possible cause
DTC Strategy	• Detecting extra/missing pulses between consecutive 58X reference pulses	• Poor connection • Noise • Short in harness • Target wheel • PCM
Enable Conditions	• Engine running state	
Threshold value	• Extra/ missing pulses 〉 2 pulse	
Diagnosis Time	• Continuous (More than 1.56 sec.failure for every 7.8 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION E2C1013E

Refer to DTC P0335.

SCHEMATIC DIAGRAM E0DE8501

Refer to DTC P0335.

SIGNAL WAVEFROM AND DATA E6425136

Refer to DTC P0335.

MONITOR DTC STATUS EDF2DA1D

Refer to DTC P0335.

TERMINAL AND CONNECTOR INSPECTION E825C7C2

Refer to DTC P0335.

SIGNAL CIRCUIT INSPECTION EAFA6CC0

1. Check voltage
   1) IG "OFF" and disconnect CKPS connector.
   2) IG "ON" and ENG "OFF"
   3) Measure voltage between terminal 1 of CKPS harness connector and chassis ground.
   4) Measure voltage between terminal 2 of CKPS harness connector and chassis ground.

Specification : Approx. 1.4V

   5) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

2. Check short in harness
   1) IG "OFF" and disconnect CKPS connector and PCM connector.
   2) Measure resistance between terminal 1(2) of CKPS harness connector and chassis ground.
   3) Measure resistance between terminals 1 and 2 of CKPS harness connector.
   4) Measure resistance between terminals 1(2) and 3 of CKPS harness connector.

Specification : Infinite

   5) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E7D8DBBA

1. Visually check CKPS and Target wheel
   1) IG "OFF"
   2) Check CKPS and target wheel for deformation or damage visually
   3) Is the above items normal ?

YES

▶ Go to "Check CKPS resistance" as follows.

NO

▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

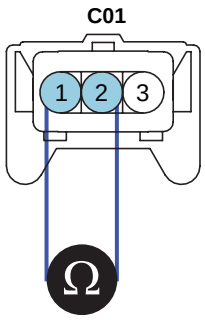
2. Check CKPS resistance

1) IG "OFF" and disconnect CKPS connector.

2) Measure resistance between terminals 1 and 2 of CKPS connector. (Component side)

SPECIFIATION :

Resistance	825 ± 100Ω



1. CKPS [LOW] Signal
2. CKPS [HIGH] Signal
3. Shield ground

SCMF16304L

3) Is the measured resistance within specification?

YES

▶ Go to "Check signal waveform of CKPS" as follows.

NO

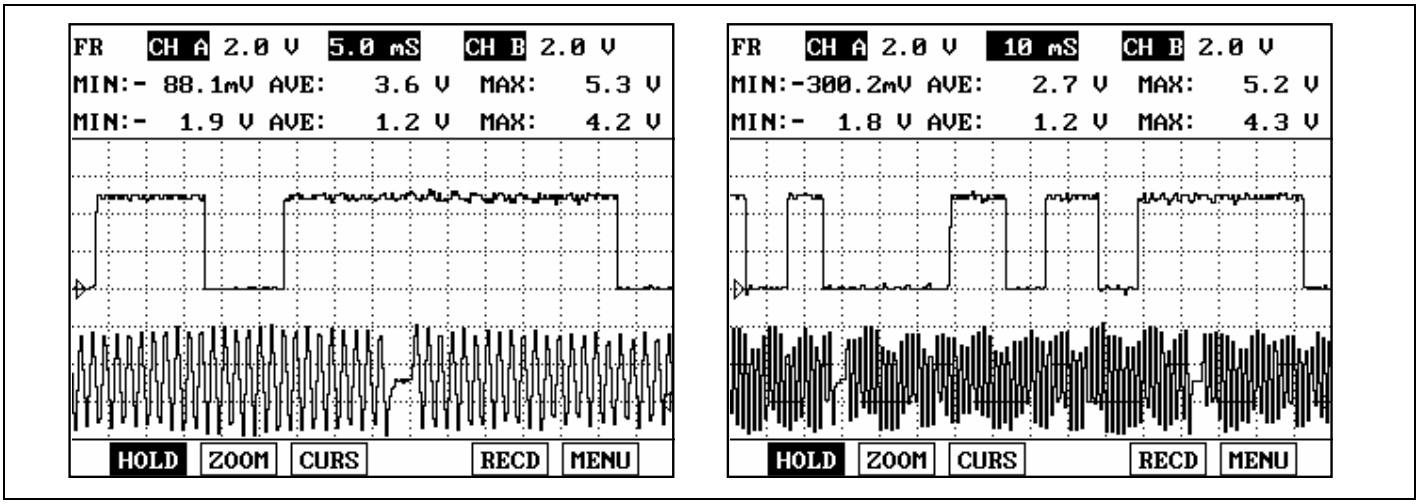
▶ Substitute with a known - good CKPS and check for proper operation. If the problem is corrected, replace CKPS and go to "Verification of Vehicle Repair" procedure.

3. Check signal waveform of CKPS

1) IG "OFF" and connect scantool.

2) ENG "ON" and Measure signal waveform at terminal 1 or 2 of CKPS.

REFERENCE SIGNAL WAVEFORM :



EGRF610K

3) Is the measured siganl waveform normal?

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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

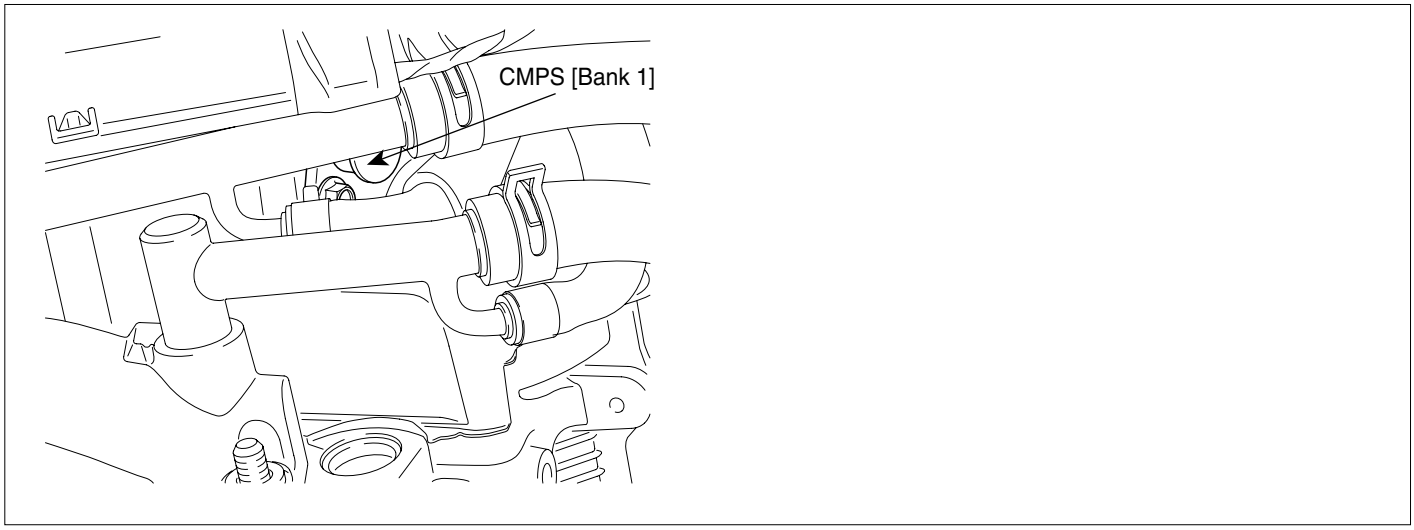
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EF39C360

Refer to DTC P0335.

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

COMPONENT LOCATION EB1D0C8C



LGLG516A

GENERAL DESCRIPTION E64D42CB

The Camshaft Position Sensor (CMPS) is a sensor that detects the compression TDC of the NO. 1 cylinder. The CMPS consists of a hall type sensor and a target on the end of the intake camshaft. When the target triggers the sensor, the sensor voltage is 5V. If not, the sensor voltage is 0V. These CMPS signal is sent to the ECM and the ECM uses the CMPS signal for synchronizing the firing of sequential fuel injectors.

DTC DESCRIPTION EA360937

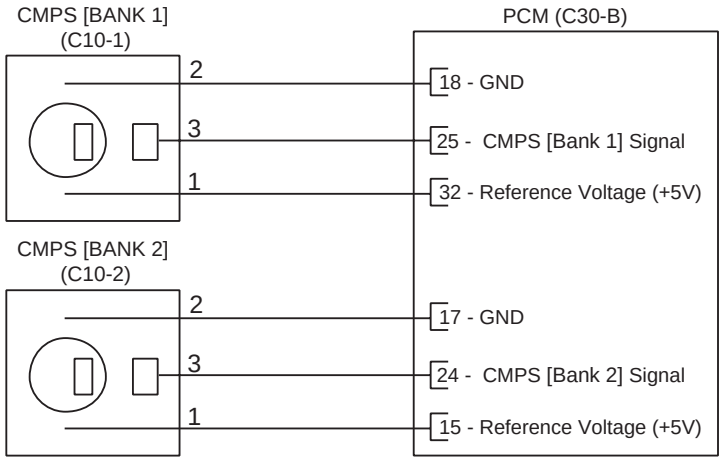
If PCM detects that cam event signal count is over 3 under detecting condition, PCM sets P0340. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7BF5DA1

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Open in harness • CMPS(Bank 1) • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam event signal count ≥ 3	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycles	

SCHEMATIC DIAGRAM EB501374

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

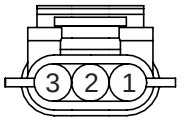
CMPS [BANK 1]

Terminal	Connected to	Function
1	PCM C30-B (32)	Reference Voltage (+5V)
2	PCM C30-B (18)	Sensor ground
3	PCM C30-B (25)	CMPS [Bank 1] signal

CMPS [BANK 2]

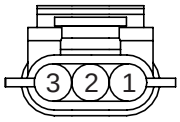
Terminal	Connected to	Function
1	PCM C30-B (15)	Reference Voltage (+5V)
2	PCM C30-B (17)	Sensor ground
3	PCM C30-B (24)	CMPS [Bank 2] signal

[HARNESS CONNECTORS]



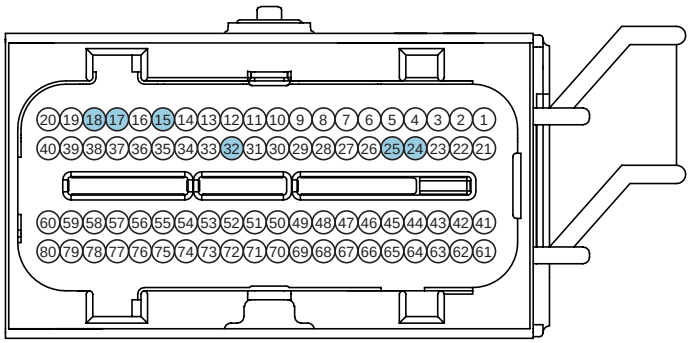
C10-1

CMPS [BANK 1]



C10-2

CMPS [BANK 2]

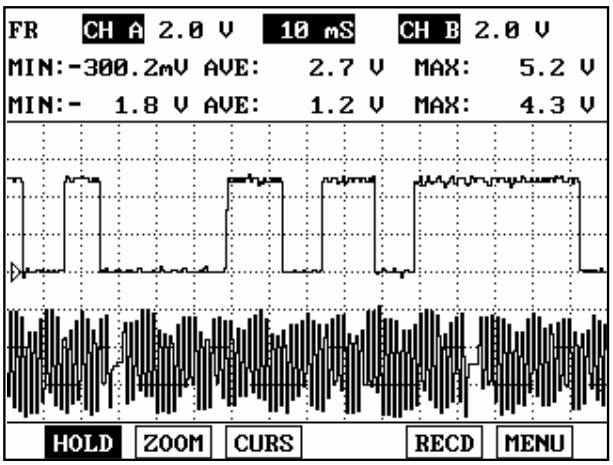


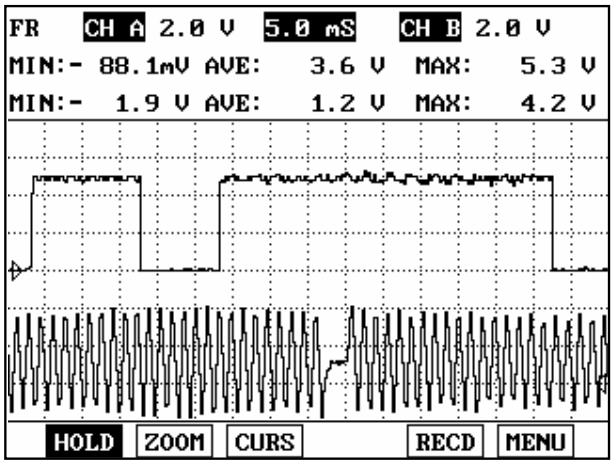
C30-B

PCM

SCMF16108L

SIGNAL WAVEFROM AND DATE E3522305





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.

EGRF610R

MONITOR DTC STATUS E94F1D1C

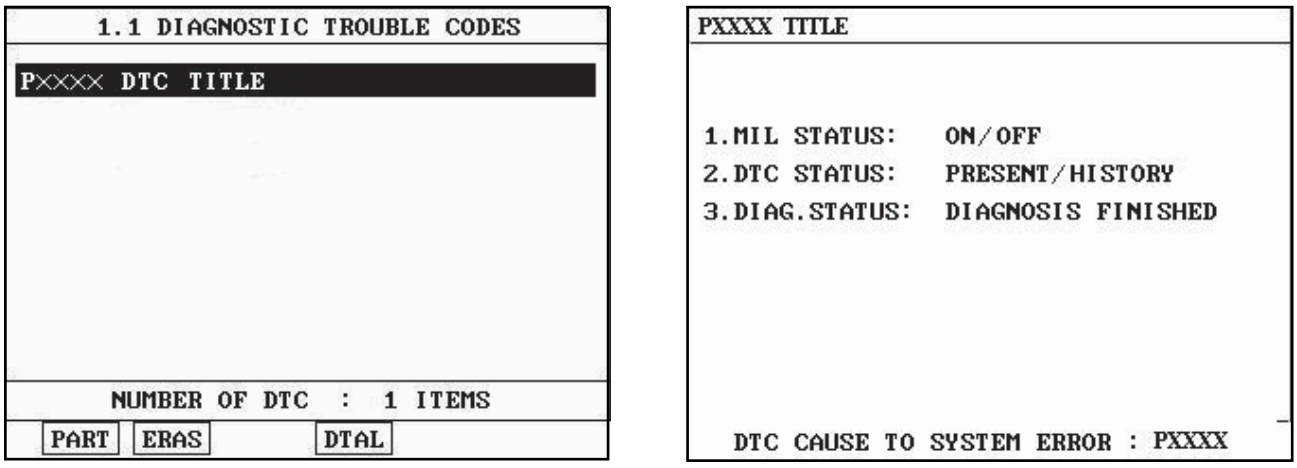
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E84D9A8F

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 E889698F

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V

4. 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 E6AE2417

1. Check voltage
   1) IG "OFF" and disconnect CMPS connector.
   2) IG "ON" and ENG "OFF"
   3) Measure voltage between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V

   4) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" as follows.

NO

▶ Go to "Check open in harness' as follows.

2. Check open in harness
   1) IG "OFF" and disconnect CMPS connector and PCM connector.
   2) Measure resistance between terminal 3 of CMPS harness connector and terminal C30-B (25) of PCM harness connector.

Specification : Below 1Ω

   3) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EA1D6745

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

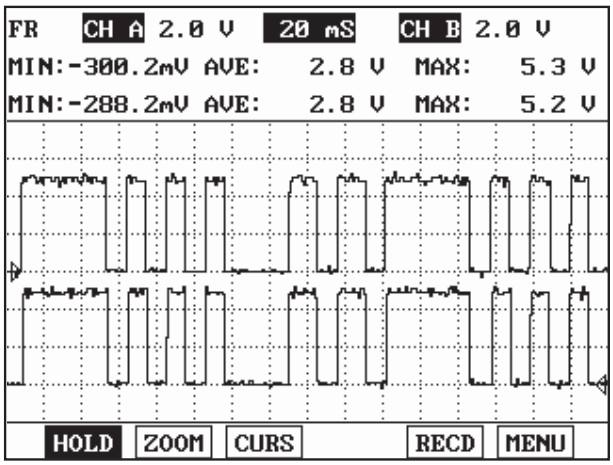
NO

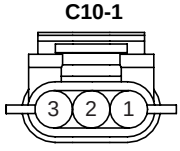
▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E94AD601

1. Check CMPS
   1) IG "OFF" and connect scantool.
   2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

REFERENCE SIGNAL WAVEFORM :





1. Reference Voltage (+5V)
2. Sensor ground
3. CMPS [Bank 1] signal

SCMF16310L

   3) Is the measured siganl 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 CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E54AD5D6

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0341 CAMSHAFT POSITION SENSOR A CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

COMPONENT LOCATION E0B45A3C

Refer to DTC P0340.

GENERAL DESCRIPTION E840146B

Refer to DTC P0340.

DTC DESCRIPTION E0819699

Checking oputput signals from CMP during engine running, if the expected number of cam tooth count is not observed. PCM sets P0341. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EACE8905

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count ≠ 6	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM E2AE546B

Refer to DTC P0340.

SIGNAL WAVEFROM AND DATA E32A4B2F

Refer to DTC P0340.

MONITOR DTC STATUS E6D69B5E

Refer to DTC P0340.

TERMINAL AND CONNECTOR INSPECTION E176A700

Refer to DTC P0340.

POWER CIRCUIT INSPECTION E099D74C

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B1) harness connector and chassis ground.

Specification : Approx. 5V

4. 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 E1FE1902

1. Check short in harness

   1) IG "OFF" and disconnect CMPS connector.

   2) Measure resistance between terminals 1 and 3 of CMPS(B1) harness connector.

Specification : Infinite

   3) Is the measured resistance within specification?

YES

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

NO

▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness

   1) IG "OFF" and disconnect CMPS connector and PCM connector.

   2) Measure resistance between terminal 3 of CMPS(B1) harness connector and chassis ground.

Specification : Infinite

   3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

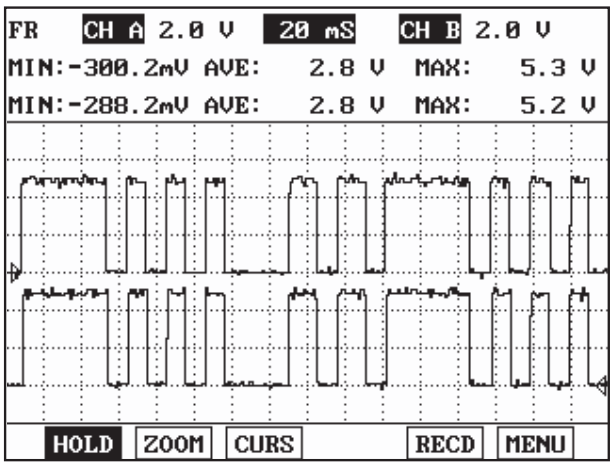
COMPONENT INSPECTION E544CFDB

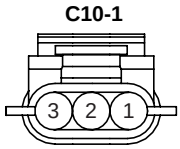
1. Check CMPS

   1) IG "OFF" and connect scantool.

   2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

REFERENCE SIGNAL WAVEFORM :





1. Reference Voltage (+5V)
2. Sensor ground
3. CMPS [Bank 1] signal

SCMF16310L

3) Is the measured siganl 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 CMPS and check for proper operation. If the problem is corrected, replace CMPS and go to "Verification of Vehicle Repair" procedure.

NOTE

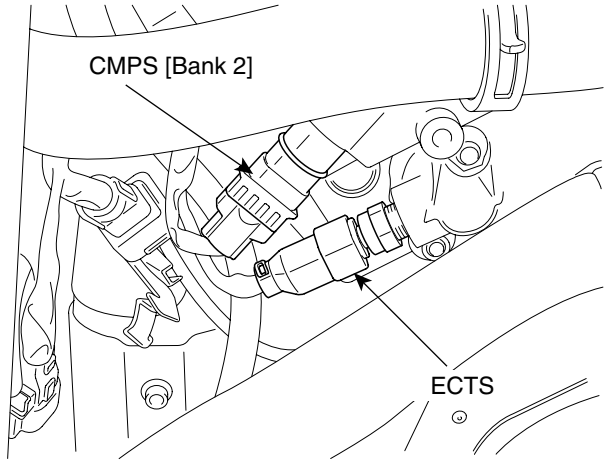
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EFE1E6C7

Refer to DTC P0340.

DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2)

COMPONENT LOCATION EE329BAD



LGLG510A

GENERAL DESCRIPTION ECCCBCC7

The Camshaft Position Sensor (CMPS) is a sensor that detects the compression TDC of the NO. 1 cylinder. The CMPS consists of a hall type sensor and a target on the end of the intake camshaft. When the target triggers the sensor, the sensor voltage is 5V. If not, the sensor voltage is 0V. These CMPS signal is sent to the ECM and the ECM uses the CMPS signal for synchronizing the firing of sequential fuel injectors.

DTC DESCRIPTION E7C4F9E2

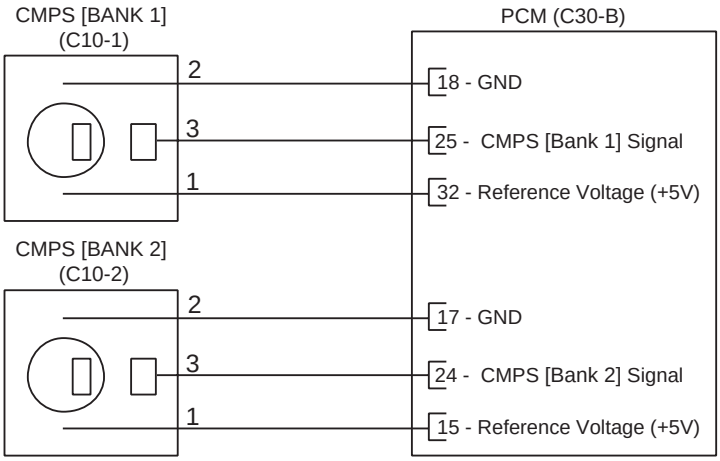
Checking oputput signals from CMP during engine running, if the expected number of cam tooth count is not observer. PCM sets P0346. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E6BFC1A6

Item	Detecting Condition	Possible cause
DTC Strategy	• Check if CAM sensor is synchronized correctly	• Poor connection • Open or short in harness • electrical noise • Target wheel • CMPS • PCM
Enable Conditions	• Engine running state	
Threshold value	• Cam tooth count ≠ 6	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM E43C80D5

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

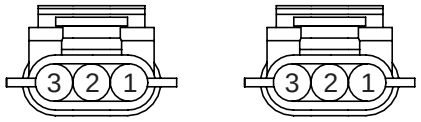
CMPS [BANK 1]

Terminal	Connected to	Function
1	PCM C30-B (32)	Reference Voltage (+5V)
2	PCM C30-B (18)	Sensor ground
3	PCM C30-B (25)	CMPS [Bank 1] signal

CMPS [BANK 2]

Terminal	Connected to	Function
1	PCM C30-B (15)	Reference Voltage (+5V)
2	PCM C30-B (17)	Sensor ground
3	PCM C30-B (24)	CMPS [Bank 2] signal

[HARNESS CONNECTORS]

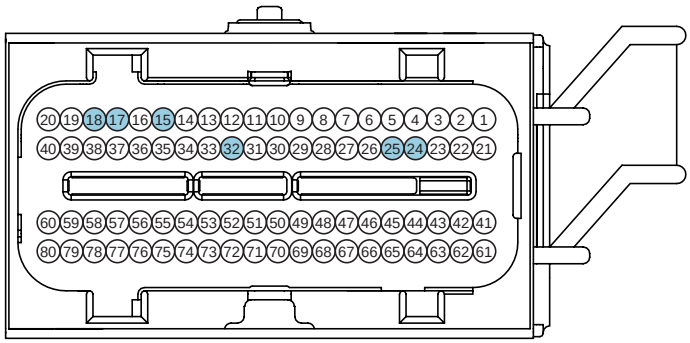


C10-1

CMPS [BANK 1]

C10-2

CMPS [BANK 2]

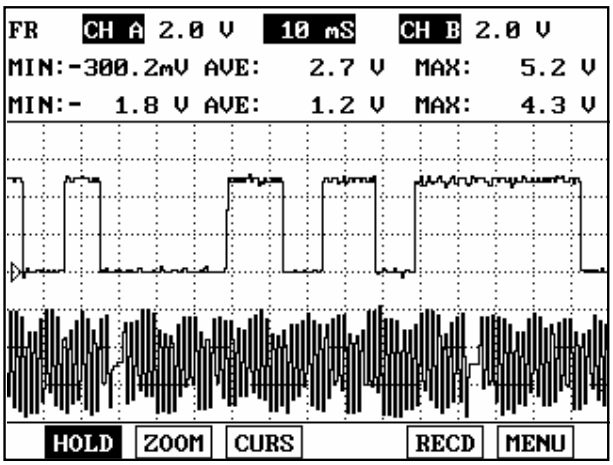


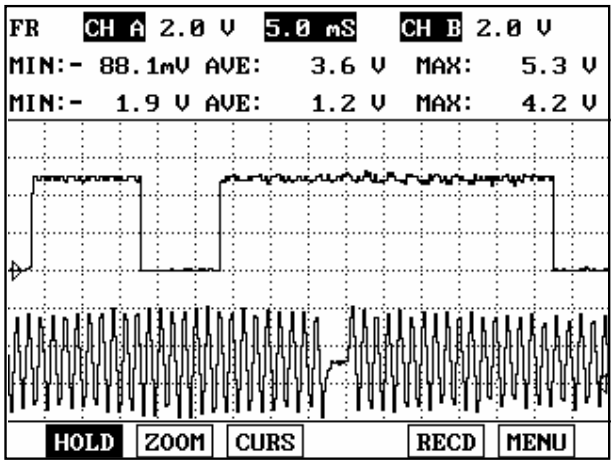
C30-B

PCM

SCMF16108L

SIGNAL WAVEFROM AND DATA E536A47E





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.

EGRF610R

MONITOR DTC STATUS EAA40E85

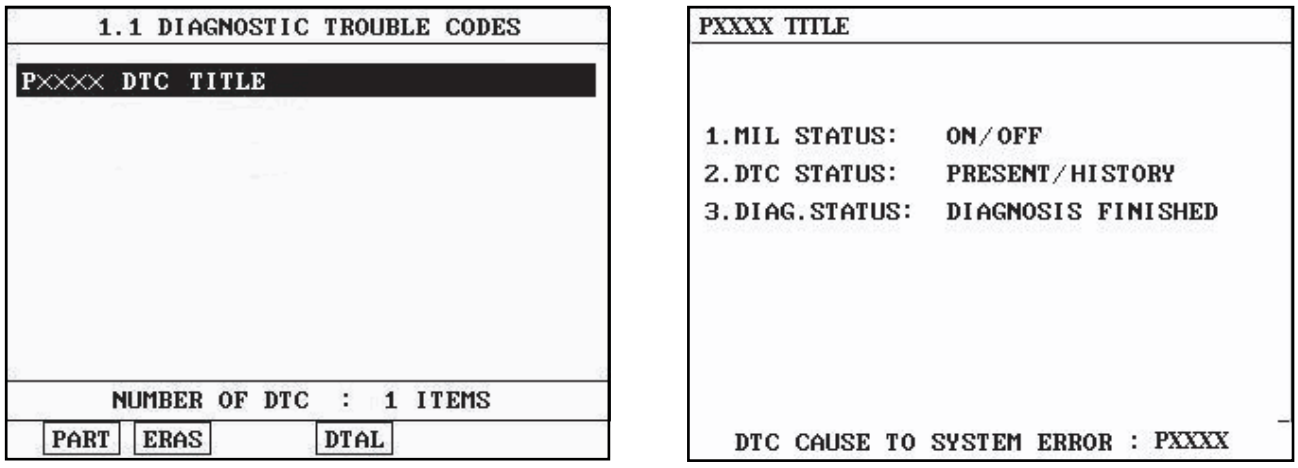
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

   YES

   ▶ Go to "Terminal and connector inspection" procedure.

   NO

   ▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION ECCDDFC8

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 E53D0B80

1. IG "OFF" and disconnect CMPS connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of CMPS(B2) harness connector and chassis ground.

Specification : Approx. 5V

4. 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 E3ED19ED

1. Check voltage
   1) IG "OFF" and disconnect CMPS connector.
   2) IG "ON" and ENG "OFF"
   3) Measure voltage between terminal 3 of CMPS(B2) harness connector and chassis ground.

Specification : Approx. 5V

   4) Is the measured voltage within specification?

YES

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

NO

▶ Go to "Check open in harness" as follows.

2. Check short in harness
   1) IG "OFF" and disconnect CMPS connector.
   2) Measure resistance between terminals 1 and 3 of CMPS(B2) harness connector.

Specification : Infinite

   3) Is the measured resistance within specification?

YES

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

NO

▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check short to ground in harness

   1) IG "OFF" and disconnect CMPS connector and PCM connector.

   2) Measure resistance between terminal 3 of CMPS(B2) harness connector and chassis ground.

Specification : Infinite

   3) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

4. Check open in harness

   1) IG "OFF" and disconnect CMPS connector and PCM connector.

   2) Measure resistance between terminal 3 of CMPS harness connector and terminal C30-B (24) of PCM harness connector.

Specification : Below 1Ω

   3) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E8222698

1. IG "OFF" and disconnect CMPS connector.
2. Measure voltage between terminal 3 of CMPS harness connector and chassis ground.
3. Measure voltage between terminals 2 and 3 of CMPS harness connector.

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

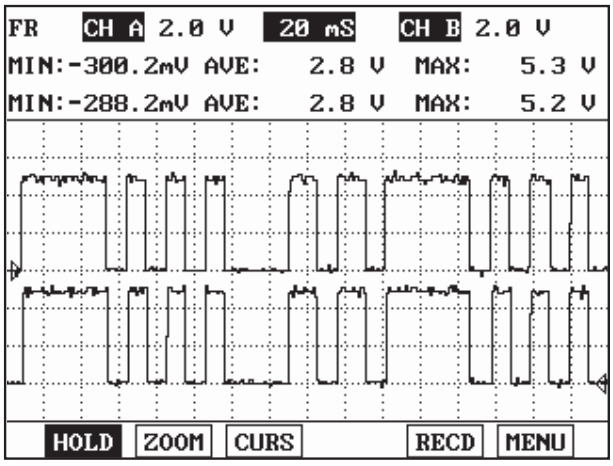
COMPONENT INSPECTION EEDE8846

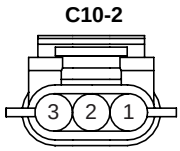
1. Check CMPS

   1) IG "OFF" and connect scantool.

   2) ENG "ON" and Measure signal waveform at terminal 3 of CMPS.

REFERENCE SIGNAL WAVEFORM :





1. Reference Voltage (+5V)
2. Sensor ground
3. CMPS [Bank 2] signal

SCMF16319L

   3) Is the measured siganl 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

▶ Check the electrical noise of siganl waveform, and go to "Check target wheel of CAM shaft" as follows.

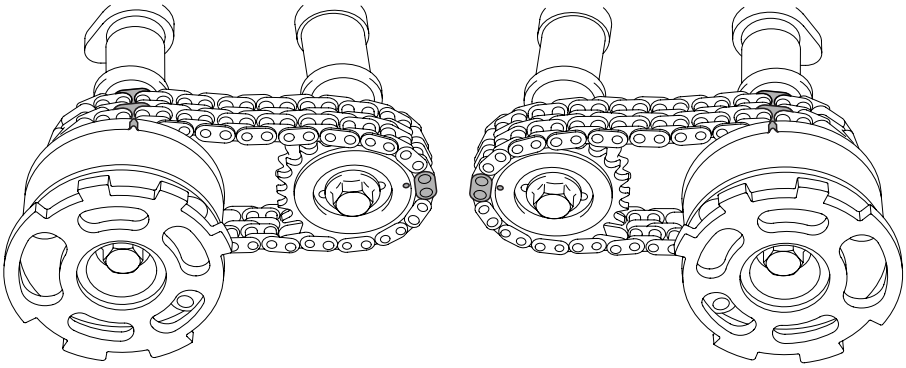
NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

2. Check target wheel of CAM shaft

   1) IG "OFF"

   2) Remove the cover of cylinder head and check target wheel state of bank 2.



[Bank 1] [Bank 2]

LGLG517A

3) Is the target wheel state normal?

YES

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

NO

▶ Repair or replace it, and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6B12409

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

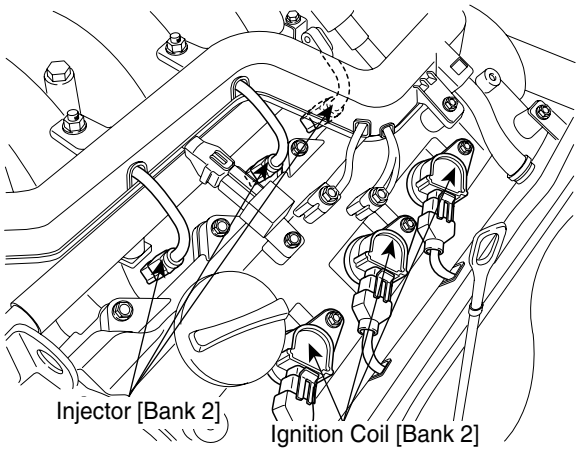
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0351 IGNITION COIL "A" PRIMARY / SECONDARY CIRCUIT
DTC P0352 IGNITION COIL "B" PRIMARY / SECONDARY CIRCUIT
DTC P0353 IGNITION COIL "C" PRIMARY / SECONDARY CIRCUIT
DTC P0354 IGNITION COIL "D" PRIMARY / SECONDARY CIRCUIT
DTC P0355 IGNITION COIL "E" PRIMARY / SECONDARY CIRCUIT
DTC P0356 IGNITION COIL "F" PRIMARY / SECONDARY CIRCUIT

COMPONENT LOCATION E166C0D7



LGLG512A

GENERAL DESCRIPTION EB407262

With the ignition switch in the ON or START position, voltage is applied to the ignition coil. Each ignition coil consists of two coils. High tension leads go to each cylinder from the ignition coils. The ignition coils fire two spark plugs on every power stroke (the cylinder under compression and the cylinder on the exhaust stroke). The Engine Control Module (ECM) provides a switching circuit to ground for energizing the primary ignition coils. The ECM uses the crankshaft position sensor and camshaft position sensor signal to time the energizing of the coil. When a primary ignition coil is energized and de-energized, the secondary coil produces a high voltage spike to the attached spark plugs.

DTC DESCRIPTION EF4C2929

Checking output signals from ignition coils every 10 sec. under detecting condition, if signals indicating open of short in the circuit are detected for more than 5 sec., PCM sets P0351/P0352/P0353/P0354/P0355/P0356. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION ED68F9E2

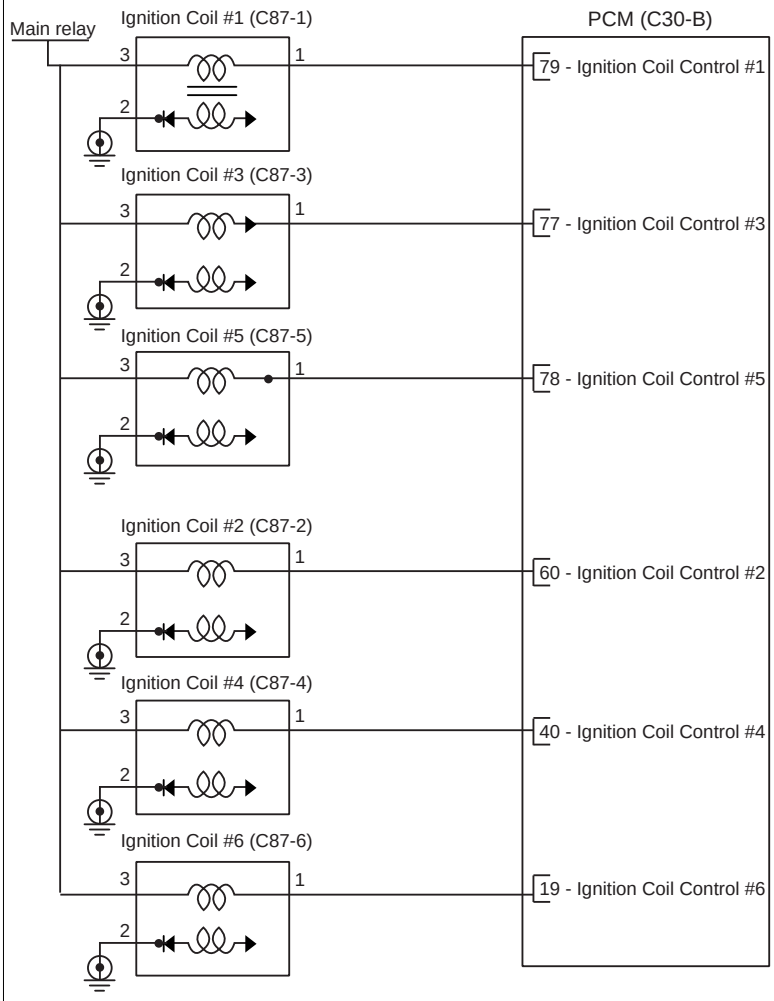
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit	• Poor connection • Open or short in harness • Ignition Coil • PCM
EnableConditions	• NO DTC related to this item • Engine running state • 11V ≤ Battery voltage ≤ 16V • The above conditions are met > 0.5 sec.	
Threshold value	• Open or short	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION E33EDA43

	Primary Coil	Secondary Coil
Resistance	0.62Ω ± 10% [20℃(68°F)]	7.0kΩ ± 15% [20℃(68°F)]

SCHEMATIC DIAGRAM EC3E9EC0

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Ignition Coil #1

Terminal	Connected to	Funtion
1	PCM C30-B (79)	Ignition Coil #1 control
2	Chassis ground	Ground
3	Main Relay	Battery (B+)

Ignition Coil #3

Terminal	Connected to	Funtion
1	PCM C30-B (77)	Ignition Coil #3 control
2	Chassis ground	Ground
3	Main Relay	Battery (B+)

Ignition Coil #5

Terminal	Connected to	Funtion
1	PCM C30-B (78)	Ignition Coil #5 control
2	Chassis ground	Ground
3	Main Relay	Battery (B+)

Ignition Coil #2

Terminal	Connected to	Funtion
1	PCM C30-B (60)	Ignition Coil #2 control
2	Chassis ground	Ground
3	Main Relay	Battery (B+)

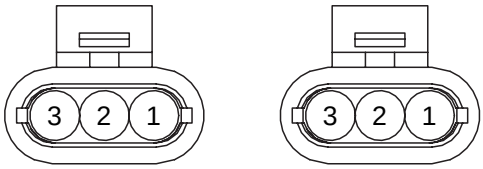
Ignition Coil #4

Terminal	Connected to	Funtion
1	PCM C30-B (40)	Ignition Coil #4 control
2	Chassis ground	Ground
3	Main Relay	Battery (B+)

Ignition Coil #6

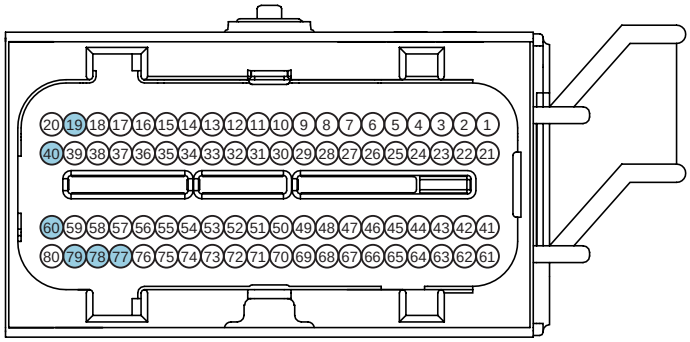
Terminal	Connected to	Funtion
1	PCM C30-B (19)	Ignition Coil #6 control
2	Chassis ground	Sensor ground
3	Main Relay	Battery (B+)

[HARNESS CONNECTORS]



C87-1,3,5
Ignition Coil #1,3,5

C87-2,4,6
Ignition Coil #2,4,6



C30-B
PCM

SCMF16320L

MONITOR DTC STATUS E8EA5E1F

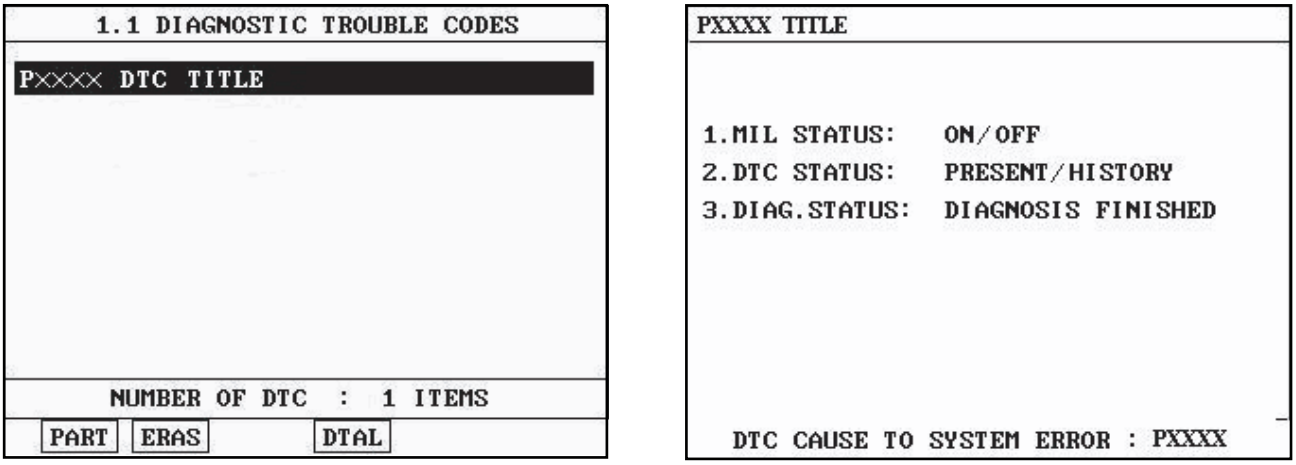
1. Check DTC Status

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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EB4A8784

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 INSEPCTION E79BA4AA

1. Check voltage

   1) IG "OFF" and disconnect Ignition Coil connector.

   2) IG "ON" and ENG "OFF"

   3) Measure voltage between terminal 3 of ignition coil harness connector and chassis ground.

Specification : Approx. B+

   4) Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check fuse connected to ignition coil for open.
▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EF5F3B09

1. Check short to battery in harness.

   1) IG "OFF" and disconnect ignitioncoil connector and PCM connector.

   2) Measure resistance between terminals 1 and 3 of ignition coil harness connector.

Specification : Infinite

   3) Is the measured resistance within specification?

YES

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

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check short to ground in harness

   1) IG "OFF" and disconnect ignition coil connector and PCM connector.

   2) Measure resistance between terminal 1 of ignition coil harness connector and chassis ground.

Specification : Infinite

   3) 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.

3. Check open in harness

1) IG "OFF" and disconnect Ignition Coil connector and PCM connector.

2) [P0351] Measure resistance between terminal 1 of Ignition Coil harness connector and terminal C30-B (79) of PCM harness connector.
[P0352] Measure resistance between terminal 1 of Ignition Coil harness connector and terminal C30-B (60) of PCM harness connector.
[P0353] Measure resistance between terminal 1 of Ignition Coil harness connector and terminal C30-B (77) of PCM harness connector.
[P0354] Measure resistance between terminal 1 of Ignition Coil harness connector and terminal C30-B (40) of PCM harness connector.
[P0355] Measure resistance between terminal 1 of Ignition Coil harness connector and terminal C30-B (78) of PCM harness connector.
[P0356] Measure resistance between terminal 1 of Ignition Coil harness connector and terminal C30-B (19) of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E401C34A

1. Check Ignition Coil

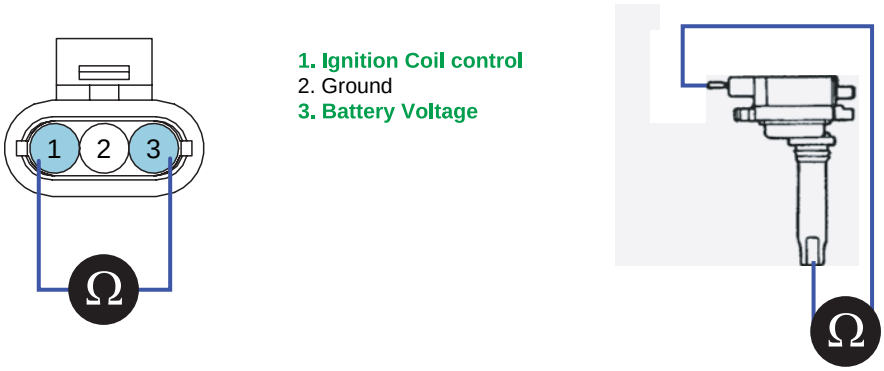
1) IG "OFF" and disconnect ignition coil connector.

2) Measure resistance between terminals 3 and 1 of ignition coil connector.(Component side)

3) Measure resistance between terminal 2 of ignition coil connector and out terminal of secondary ignition coil.

SPECIFICATION :

	Primary Coil	Secondary Coil
Resistance	0.62Ω ± 10% [20℃(68°F)]	7.0kΩ ± 15% [20℃(68°F)]



1. Ignition Coil control
2. Ground
3. Battery Voltage

SCMF16997L

4) Is the measured resistance within specification?

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 Ignition Coil and check for proper operation.
- ▶ If the problem is corrected, replace Ignition Coil and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR ECD7629D

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

- ▶ Go to the applicable troubleshoooting procedure.

NO

- ▶ System is performing to specification at this time.

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) DTC P0430 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 2)

GENERAL DESCRIPTION EBD941FC

The ECM uses dual oxygen sensors to monitor the efficiency of the manifold catalytic converter (warm-up catalytic converter). By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream (front) HO2S is used to detect the amount of oxygen in the exhaust gas before it enters the catalytic converter. A low voltage indicates high oxygen contents (lean air mixture). A high voltage indicates low oxygen contents (rich air mixture). When the catalyst efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same at the rear as it is at the front.

DTC DESCRIPTION ED6771A8

If the oxygen storage time for Bank 1 is lower than threshold , the PCM determines that a fault exists and a DTC is stored and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E28777BF

Item	Detecting Condition	Possible cause
DTC Strategy	• Manipulates Airfuel and stores the times it takes for the pre and post converter oxygen sensors to switch.	• Catalyst Converter
EnableConditions	• Engine Runtime ≥ 580 sec. • Purge Concentration Learned • 3 g/s ≤ Airflow ≤ 10 g/s • Throttle closed ≤ 1.5% • 70℃(158 °F) ≤ Coolant Temp. ≤ 120℃(248 °F) • -7℃(19.4 °F) ≤ Ambient Temp. ≤ 105℃(221 °F) • Barometer ≥ 72 kPa • Max number of test attempts ≤ 12 • Closed Loop • 250℃(482 °F) ≤ Catalyst Temp. ≤ 950℃(1742 °F) • Fuel learning completed • Vehicle speed ≤ 3 kph(1.8 mph) • Not airfuel ramping • Max idle time(about 60 sec.) not exceeded • No disabling faults present • No instrumentation slews active	
Threshold value	• Oxygen Storage Time < 3.25 sec.	
DiagnosisTime	• 15 sec.	
MIL On Condition	• 1 Driving cycle	

MONITOR SCANTOOL DATA E2E931EC

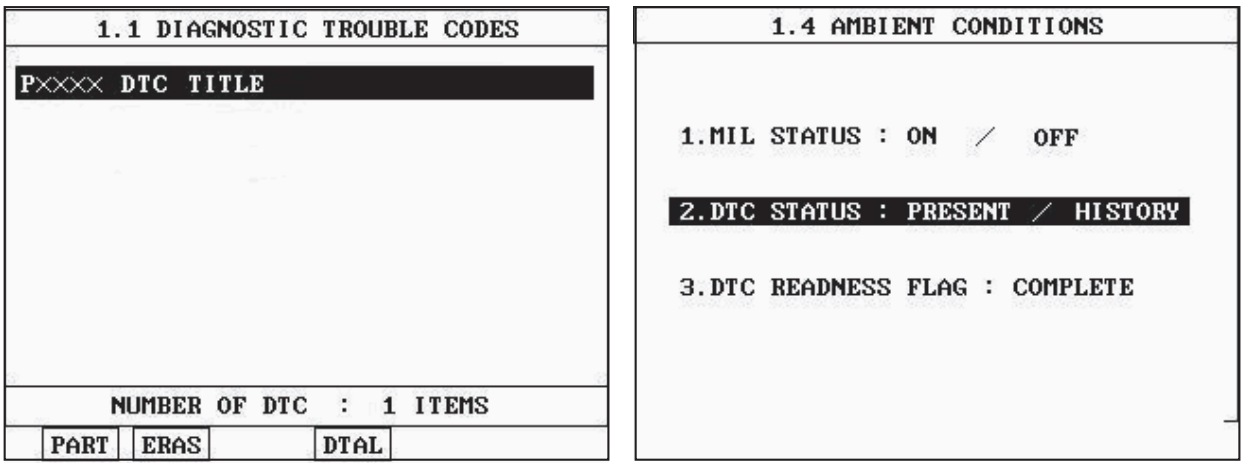
1. Check DTC Status

   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) Read "DTC Status" parameter.



LGLG311A

5) Is parameter displayed "Present fault"?

YES

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

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EC580A1F

1. Monitor the Catalyst Converter

1) IG "OFF" and then reset the PCM.

2) Start the engine and warm it up until the radiator fan comes on(more than at least 10 minutes).

3) Drive at a steady speed between 45-55 mph(72-88 km/h) for 30 seconds.

4) Stop and then maintain idle state for 30 seconds in D-position.

5) Repeat step 3 once again.

6) Stop and then keep it in idle state(D-positon) for 30 seconds.

7) IG "OFF"

8) Repeat steps 3 through 7 three times.

9) Check if catalyst monitoring readiness is complete. so, if the readiness is incomplete, repeat steps 2 through 8.

10) Does the scan tool show DTC P0420?

YES

▶ Substitute with a known - good Catalyst Converter and check the signal waveform of HO2S for proper operation. If the problem is corrected, Go to "Verification of Vehicle Repair" procedure.

NO

▶ It was intermittent failure.

VERIFICATION OF VEHICLE REPAIR E504AFAE

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

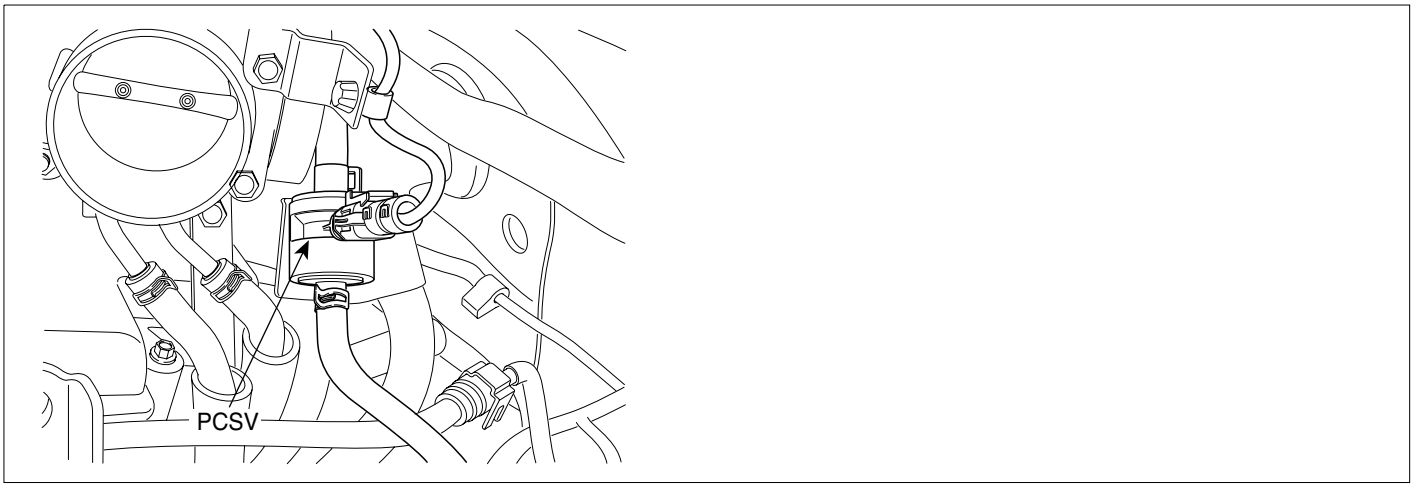
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

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

COMPONENT LOCATION E330C105



LGLG518A

GENERAL DESCRIPTION E9E8ED36

The evaporative emission control system prevents hydrocarbon (HC) vapors from the fuel tank from escaping into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The ECM controls the Purge Control Solenoid Valve (PCSV) to purge any collected vapors from the canister back to the engine for combustion. This valve is actuated by the purge control signal from the ECM and controls fuel vapor from the canister to the intake manifold.

DTC DESCRIPTION E1673907

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating open or short to ground in the circuit are detected for more than 5 sec., PCM sets P0444. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

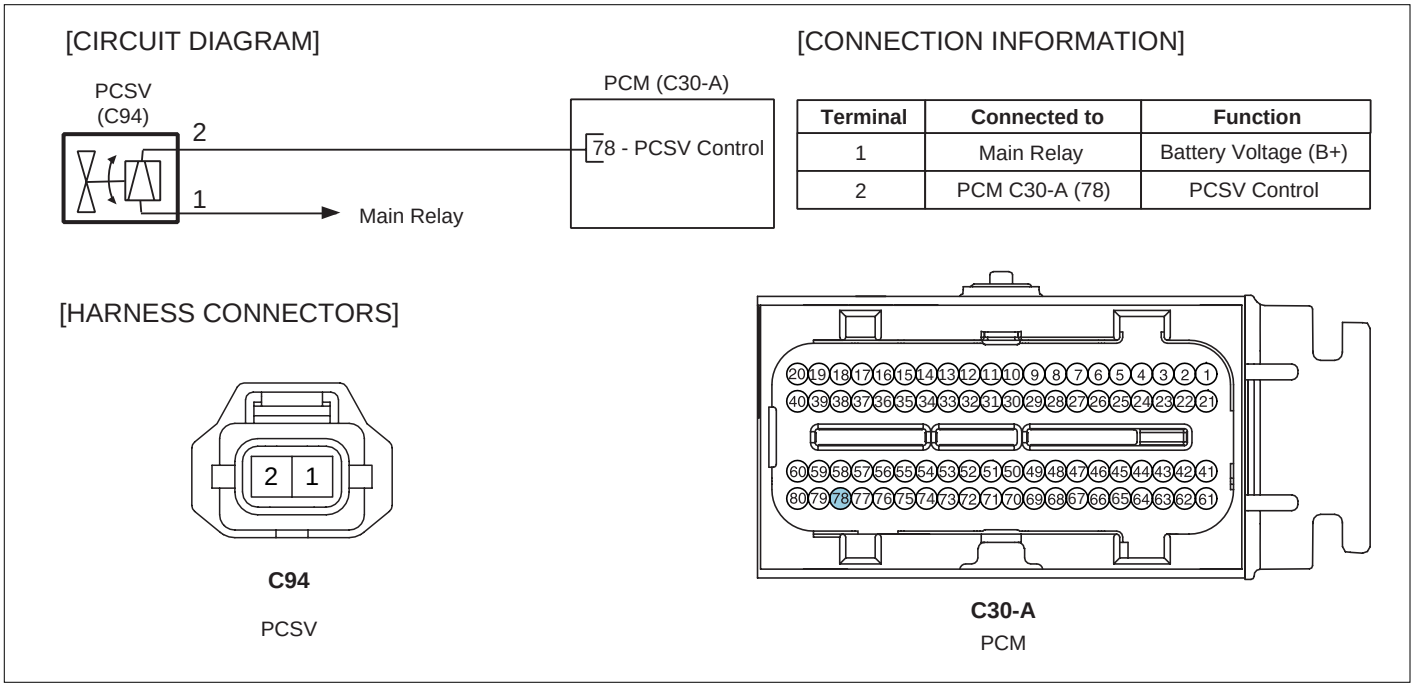
DTC DETECTING CONDITION E6795A6C

Item	Detecting Condition	Possible cause
DTC Strategy	• Open, short to ground	• Poor connection • Open or short to ground in harness • PCSV • PCM
EnableConditions	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above enable conditions are met > 0.5 sec.	
Threshold value	• Open or short to ground	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION E8F8828A

Item	Coil resistance(Ω)
PCSV	14.0 ~ 18.0Ω [20℃ (68°F)]

SCHEMATIC DIAGRAM E4472935



SCMF16119L

SIGNAL WAVEFORM EF5B67EC

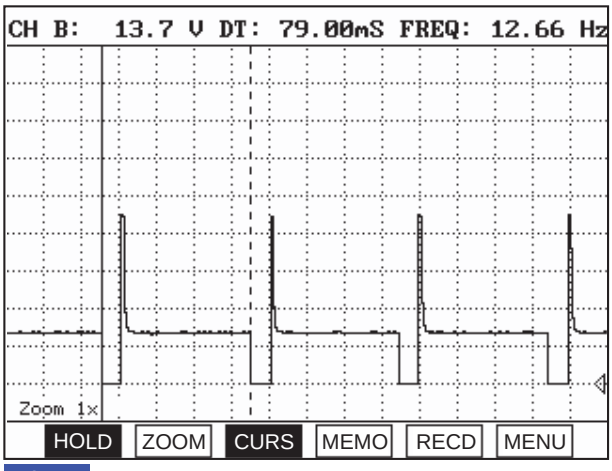


Fig. 1

The Purge Control Solenoid Valve(PCSV) is open or closed by PCM and vacuum of intake manifold.
At opening, fuel vapor from canister enters into intake manifold. To prevent vacuum from forming inside canister, PCM controls to open it. This photo shows the signal waveform of PCSV operating normally.

EGRF848A

MONITOR DTC STATUS EB7ED820

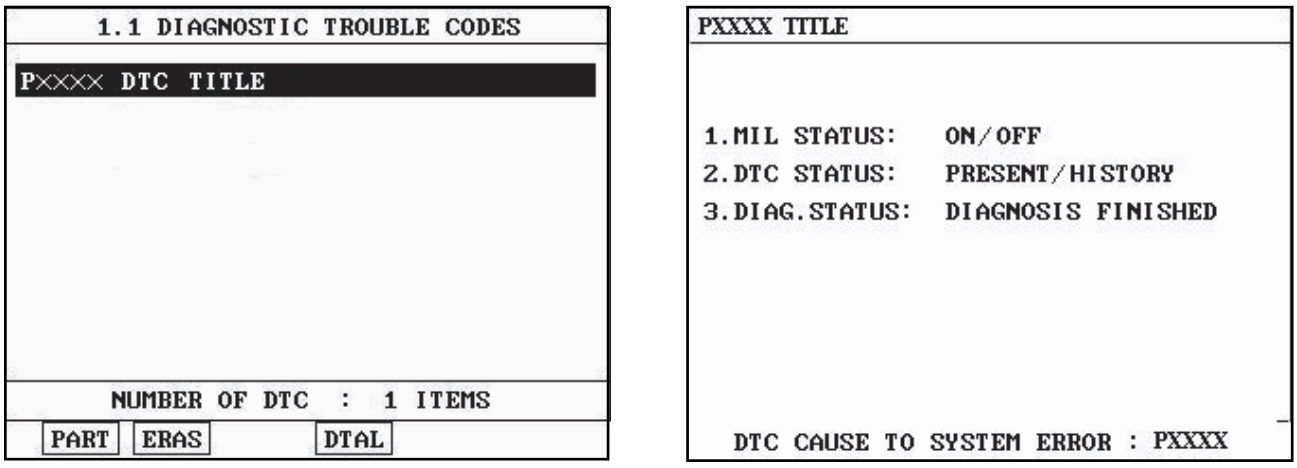
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

   YES

   ▶ Go to "Terminal and connector inspection" procedure.

   NO

   ▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E7A93020

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 INSEPCTION E823F06B

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of PCSV harness connector and chassis ground.

Specification : B+

4. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Repair open or short to ground in harness, and go to " Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EF47BBB0

1. Check short to ground in harness.
   1) IG "OFF" and disconnect PCSV connector.
   2) IG "ON"
   3) Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V

   4) Is the measured voltage 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 open in harness.
   1) IG "OFF" and disconnect PCSV connector and PCM connector.
   2) Measure resistance between terminal 2 of PCSV harness connector and terminal C30-A (78) of PCM harness connector.

Specification : Below 1Ω

   3) Is the measured resistance within specification?

YES

▶ Go to " Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E3AE3F51

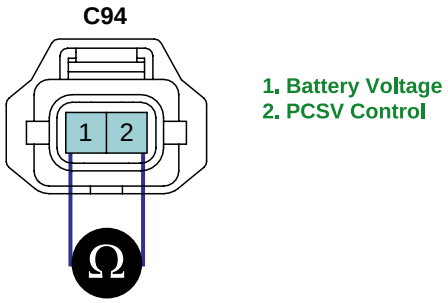
1. Check PCSV

   1) IG "OFF" and disconnect PCSV connector.

   2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
PCSV	14.0 ~ 18.0Ω [20℃ (68°F)]



SCMF16356L

   3) Is the measured resistance within specification?

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 PCSV and check for proper operation.
▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EEA6BD74

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0445 EVAP. EMISSION SYSTEM-PURGE CTRL. VALVE CIRCUIT SHORTED

COMPONENT LOCATION EA49A992

Refer to DTC P0444.

GENERAL DESCRIPTION E67CE4F2

Refer to DTC P0444.

DTC DESCRIPTION E00E371F

Checking output signals from PCSV every 10 sec. under detecting condition, if signals indicating short to battery in the circuit are detected for more than 5 sec., PCM sets P0445. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E9146E29

Item	Detecting Condition	Possible cause
DTC Strategy	• Short to battery	• Poor connection • Short to battery in harness • PCSV • PCM
EnableConditions	• Engine running state • 11V ≤ Battery voltage ≤ 16V • Above enable conditions are met > 0.5 sec.	
Threshold value	• Short to battery	
DiagnosisTime	• Continuous (More than 5 sec.failure for every 10 sec.test)	
MIL On Condition	• 2 driving cycles	

SPECIFICATION EF7575BD

Refer to DTC P0444.

SCHEMATIC DIAGRAM E71171CC

Refer to DTC P0444.

SIGNAL WAVEFORM E219B974

Refer to DTC P0444.

MONITOR DTC STATUS ED8A58B2

Refer to DTC P0444.

TERMINAL AND CONNECTOR INSPECTION EF9207D3

Refer to DTC P0444.

CONTROL CIRCUIT INSPECTION E96A7FBB

1. IG "OFF" and disconnect PCSV connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 2 of PCSV harness connector and chassis ground.

Specification : Approx. 0.5V

4. Is the measured voltage within specification?

YES

▶ Go to "Component Insepction" procedure.

NO

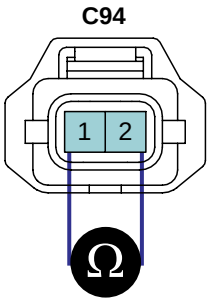
▶ Repair short to battery in harness, and go to " Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E5DDBC8E

1. Check PCSV
   1) IG "OFF" and disconnect PCSV connector.
   2) Measure resistance between terminals 1 and 2 of PCSV connector.(Component side)

SPECIFICATION :

Item	Coil resistance(Ω)
PCSV	14.0 ~ 18.0Ω [20℃(68°F)]



1. Battery Voltage
2. PCSV Control

SCMF16356L

   3) Is the measured resistance within specification?

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 PCSV and check for proper operation.
▶ If the problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

NOTE

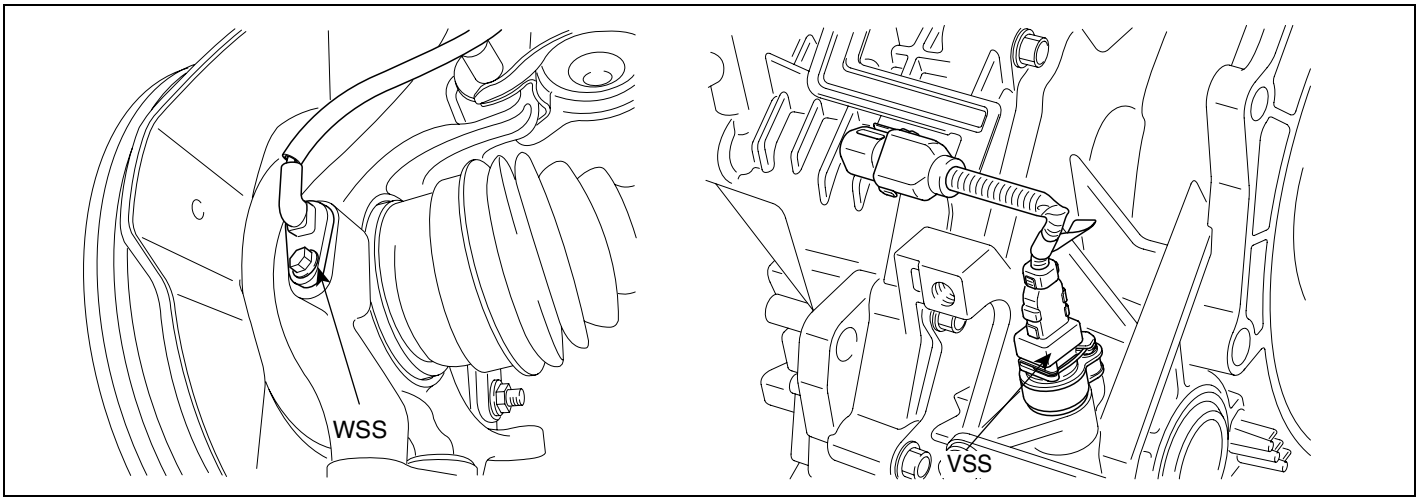
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E86F6EB7

Refer to DTC P0444.

DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

COMPONENT LOCATION EBF7FFDF



LGLG519A

GENERAL DESCRIPTION E30F80CC

The Wheel Speed Sensor (WSS) generates a waveform with a frequency proportional 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 if the vehicle is or is not moving. The ECM uses this signal to control the fuel injection, ignition timing, transaxle shift scheduling and torque converter clutch scheduling. The WSS signal is also used to detect rough road conditions.

DTC DESCRIPTION E24AFA68

Checking output signals from wheel speed sensor or ABS control unit or VSS every 30 sec. under detecting condition, if an signal is in the detecting condition for more than 20 sec., PCM sets P0501. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

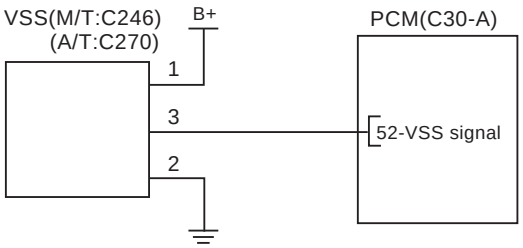
DTC DETECTING CONDITION E2265246

Item		Detecting Condition	Possible cause
DTC Strategy		• Detects the lack of vehicle speed signal	• Poor connection • Open or short in harness • Wheel speed sensor(FR) • Vehicle speed sensor • ABS or ESP control unit • PCM
Enable Condi-tions	Case 1(Power)	• Engine Running • No VSS disabling malfunction present • No TPS fault present • No MAP fault present • 11V 〈 Ignition Voltage 〈 16V • Engine Coolant Temperature 〉 60℃ (140˚F) • MAP 〉 55kPa • 25% ≤ TPS ≤ 60% • 1200rpm ≤ Engine Speed ≤ 4000rpm • Vehicle Speed derived from transmission ≥ 10 kph (6.2 mph)	
	Case 2(Decel)	• Engine Running • No VSS disabling malfunction present • No TPS fault present • No MAP fault present • 11V 〈 Ignition Voltage 〈 16V • Engine Coolant Temperature 〉 60℃ (140˚F) • MAP 〈 32kPa • TPS 〈 1% • 1800rpm ≤ Engine Speed ≤ 6000rpm • Transmission in gear	
Thresh old value	Case 1(Power)	• VSS Fault Vehicle Speed ≤ 10kph	
	Case 2(Decel)	• Vehicle Speed 〈 5kph • Delta Engine Speed ≥ 100rpm	
Diagnosis Time		• Continuous (More than 20 seconds failure for every 30 seconds test)	
MIL On Condition		• 2 driving cycles	

SCHEMATIC DIAGRAM EB698BAE

[EXCEPT EURO-Ⅲ/Ⅳ]

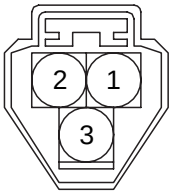
[CIRCUIT DIAGRAM]



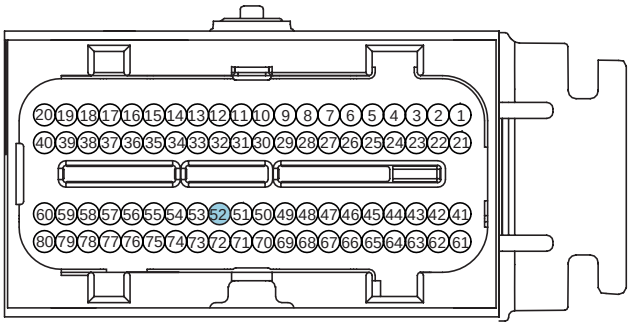
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Engine compartment juntion block	Battery voltage(B+)
2	Chassis ground	Sensor ground
3	PCM C30-A (52)	VSS signal

[HARNESS CONNECTOR]



M/T:C246
A/T:C270
VSS

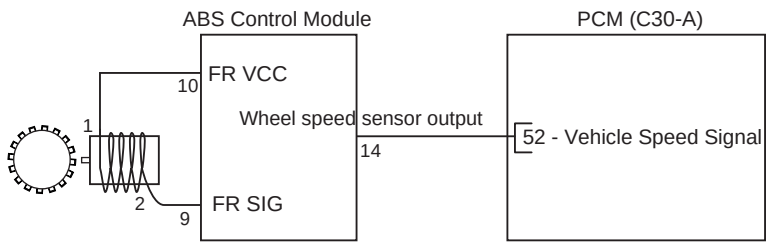


C30-A
PCM

SCMF16357L

[EURO-Ⅲ/Ⅳ WITH ABS (OR ESP)]

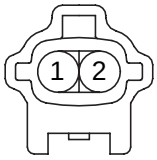
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

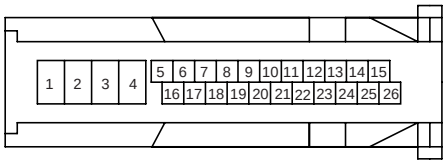
Terminal	Connected to	Function
3	PCM C30-A (52)	Vehicle Speed Signal

[HARNESS CONNECTOR]



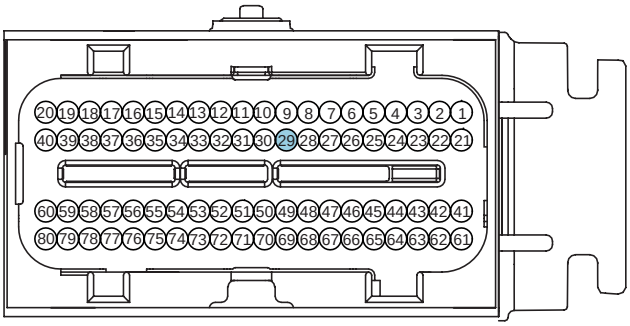
C274

Right Front Wheel Sensor



C280 (GSL)

ABS CONTROL MODULE



C30-A

PCM

SCMF16358L

SIGNAL WAVEFROM AND DATA E66D7EAA

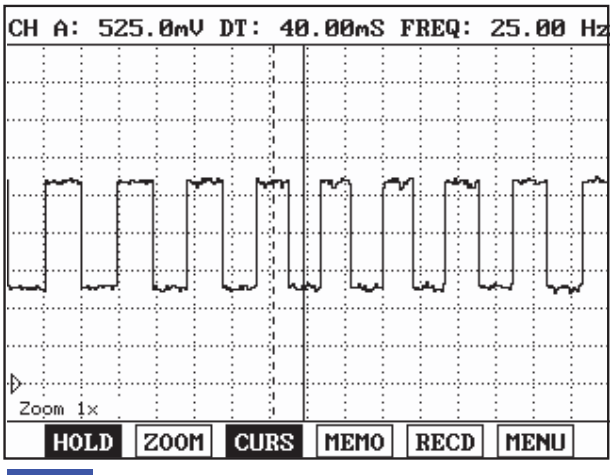


Fig. 1

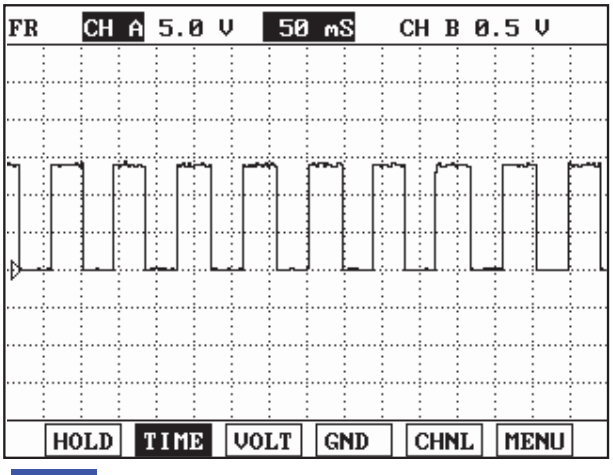


Fig. 2

Fig.1 : Signal waveform [EURO-Ⅲ/Ⅳ]
Fig.2 : Signal waveform [Except EURO-Ⅲ/Ⅳ]

LGLG437A

MONITOR DTC STATUS E7EC0FD2

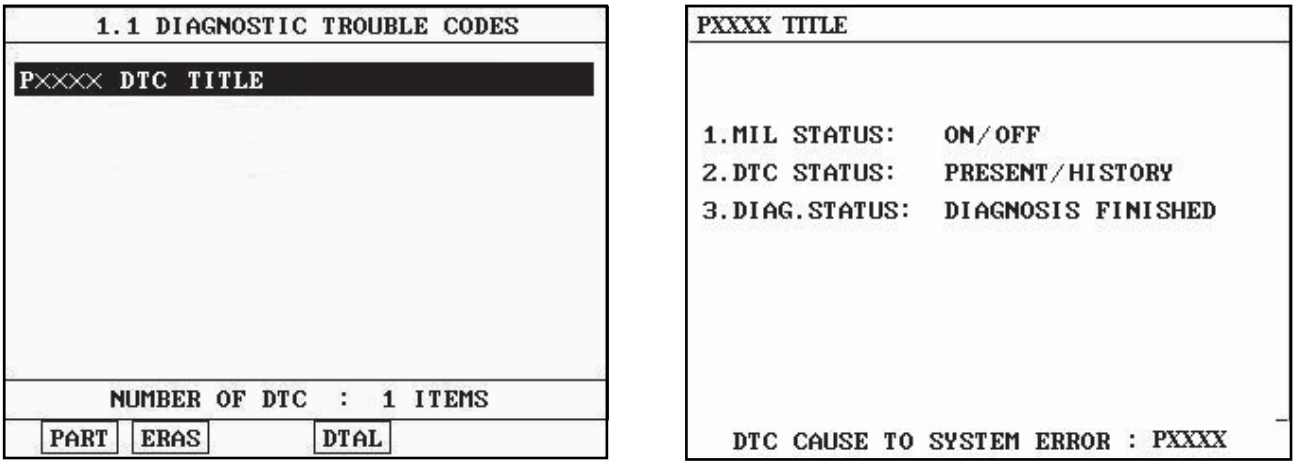
1. Check DTC Status

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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

[EURO-Ⅲ/Ⅳ] E91E55BF

TERMINAL AND CONNECTOR INSPECTION

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 EA61C2F8

WARNING

This procedure is applied to vehicle with ABS (or ESP). In case of no ABS(or ESP), refer to "C1203 Wheel speed sensor front-RH open/short".

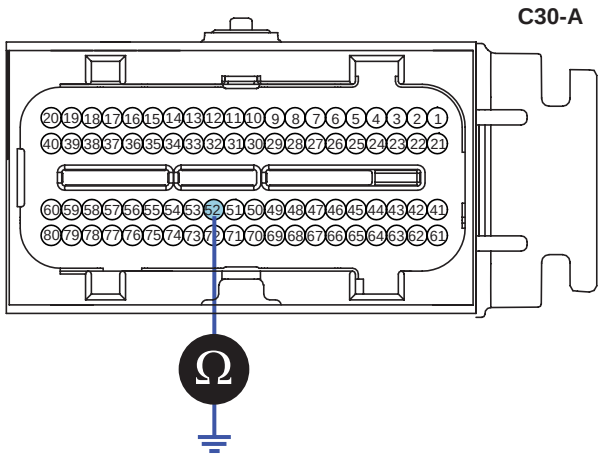
1. Check short to ground in harness

   1) IG "OFF"

   2) Disconnect PCM connector and ABS or ESP control module connector.

   3) Measure resistance between terminal C30-A (52) of PCM harness connector and chassis ground.

52. Wheel speed sensor output(FR)



SCMF16359L

Specification : Infinite

   4) Is the measured resistance within specifications?

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

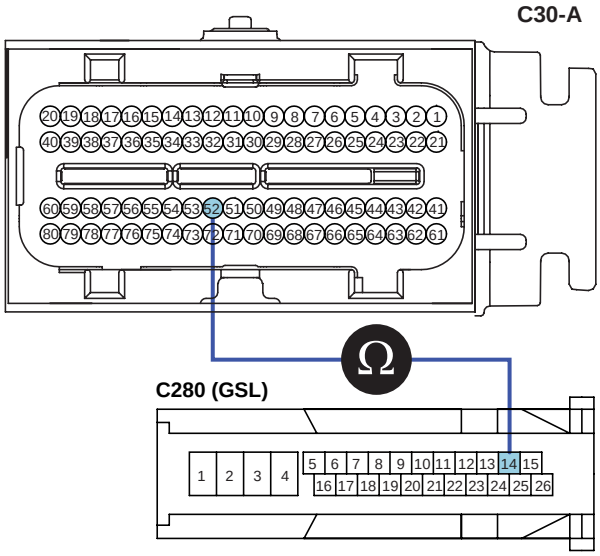
   1) Ignition "OFF"

   2) Disconnect PCM connector and ABS or ESP control module connector.

   3) Measure resistance between terminal C30-A (52) of PCM harness connector and terminal "3(With ESP: terminal 6)" of ABS control module harness connector.

Specification : Approx. below 1Ω

52. Wheel speed sensor output(FR)



SCMF16360L

NOTE

Note: This picture is only applied to vehicle with ABS

4) Is the measured resistance within specifications?

YES

▶ Go to " Check wheel speed sensor " procedure.

NO

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

3. Check wheel speed sensor

1) IG "OFF"

2) Check open or short in wheel speed sensor (Refer to "C1203 Wheel speed sensor front-RH open/short")

3) Is the wheel speed sensor normal?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

[EXCEPT EURO-Ⅲ/Ⅳ]

TERMINAL AND CONNECTOR INSPECTION

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

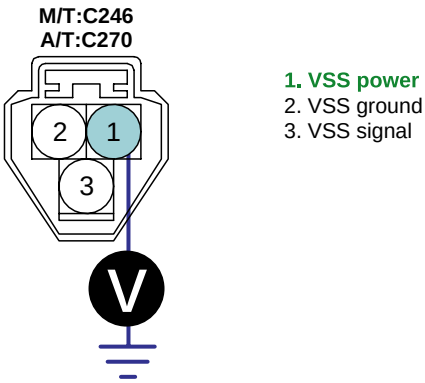
NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION

1. Check voltage
   1) IG "OFF"
   2) Disconnect vehicle speed sensor connector.
   3) IG "ON" and ENG "OFF"
   4) Measure voltage between terminal 1 of vehicle speed sensor harness connector and chassis ground.

Specification : Approx. 11.5 ~ 13V



1. VSS power
2. VSS ground
3. VSS signal

SCMF16361L

   5) Is the measured voltage within specifications?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.
Especially Check the fuse related to Power for blown-off.

SIGNAL CIRCUIT INSPECTION

1. Check voltage from sensor side

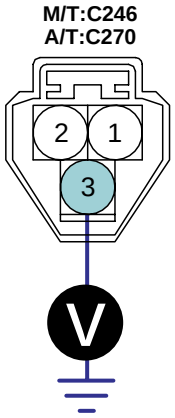
   1) IG "OFF"

   2) Disconnect vehicle speed sensor connector.

   3) IG "ON" and ENG "OFF"

   4) Measure voltage between terminal 3 of vehicle speed sensor harness connector and chassis ground.

Specification : Approx. 8 ~ 11.5V



1. VSS power
2. VSS ground
3. **VSS signal**

SCMF16362L

   5) Is the measured voltage within specifications?

   YES

   ▶ Go to "Check voltage from PCM side" as follows.

   NO

   ▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

2. Check voltage from PCM side

   1) IG "OFF"

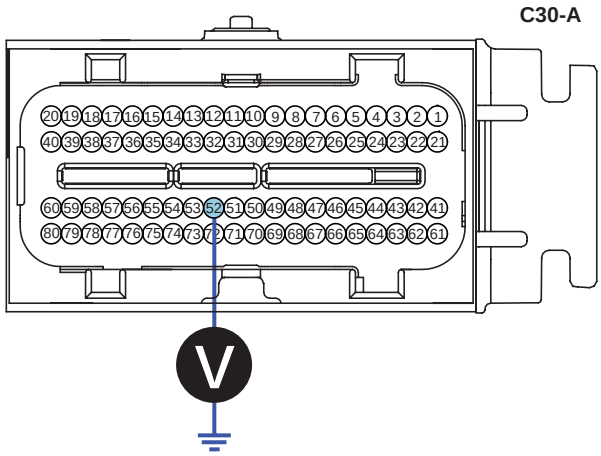
   2) Disconnect PCM connector and vehicle speed sensor connector.

   3) IG "ON" and ENG "OFF"

   4) Measure voltage between terminal C30-A (52) of PCM harness connector and chassis ground.

Specification : Approx. 8 ~ 11.5V

52. Wheel speed sensor output(FR)



SCMF16363L

5) Is the measured voltage within specifications?

YES

▶ Go to " Ground circuit inspection " procedure.

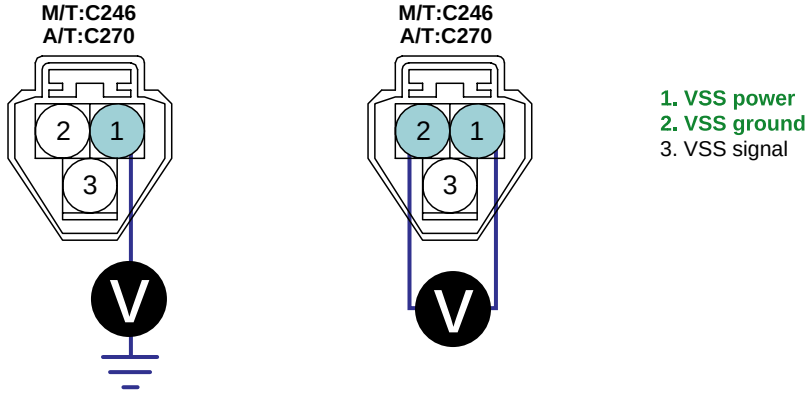
NO

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

GROUND CIRCUIT INSPECTION

1. IG "OFF"
2. Disconnect vehicle speed sensor connector.
3. IG "ON" and ENG "OFF"
4. Measure voltage between terminal 1 of vehicle speed sensor harness connector and chassis ground.(Fig.A)
5. Measure voltage between terminals 1 and 2 of vehicle speed sensor harness connector.(Fig.B)

Specification : Measurement "A" - Measurement 'B' = Approx. below 200mV



1. VSS power
2. VSS ground
3. VSS signal

SCMF16364L

6. Is the measured voltage within specifications?

YES

▶ Substitute with a known - good vehicle speed sensor and check for proper operation. If the problem is not correctd, substitute with a known - good PCM and check for proper operation. And go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EEFA2461

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0504 BRAKE SWITCH "A"/"B" CORRELATION

GENERAL DESCRIPTION EB611534

The Stop lamp switch is used to judge whether the acceleration system is abnormal or not. The stop lamp switch has a duplex system(signals brake test or brake light) to memorize the abnormality when the signals of depressing and releasing the brake pedal are detected simultaneously.

DTC DESCRIPTION E8706E64

Checking output signals from both brake switch. when all of them are On or OFF simultaneously, if abnormal signal is detected for more than 0.5 sec., an error is recognized. And if this condition lasts for certain period, PCM sets P0504. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION E1833C1F

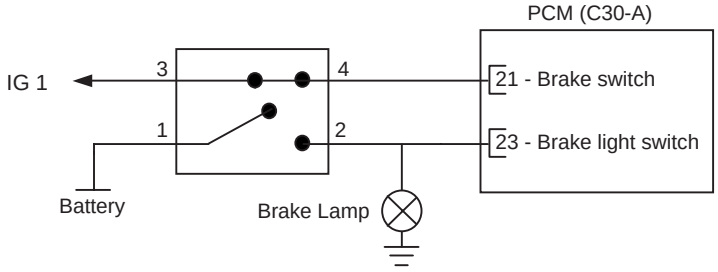
Item		Detecting Condition	Possible cause
DTC Strategy		• Comparing 2 brake signals during driving	• Poor connection • Open or Short • Faulty PCM
Enable Condi-tions	Case 1	• Engine works • Vehicle Speed Sensor is abnormal.	
	Case 2	• Engine works • Vehicle Speed Sensor is normal and Vehicle Speed is over 20kph during 1sec or more.	
Threshold value		• The one brake signal's change duration when another signal has been changed 〉 0.5 sec	
Diagnosis Time		• Continuous	
MIL On Condition		• 2 driving cycles	

SPECIFICATION E1C5364F

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

SCHEMATIC DIAGRAM EE9EC90A

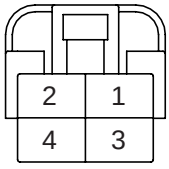
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

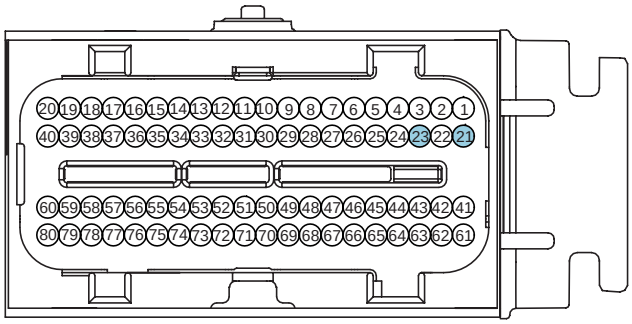
Terminal	Connected to	Function
2	PCM C30-A (23)	Brake light switch
1	Battery	Power Supply (12V)
4	PCM C30-A (21)	Brake switch
3	Battery	Power Supply (12V)

[HARNESS CONNECTOR]



C54

STOP LAMP SWITCH



C30-A

PCM

SCMF16365L

MONITOR DTC STATUS E0862CEB

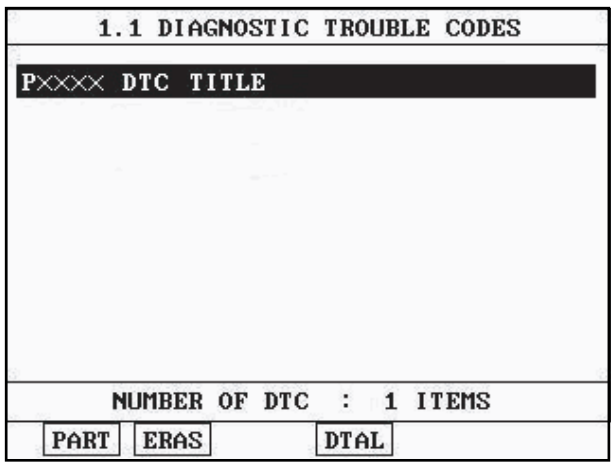
1. Check DTC Status

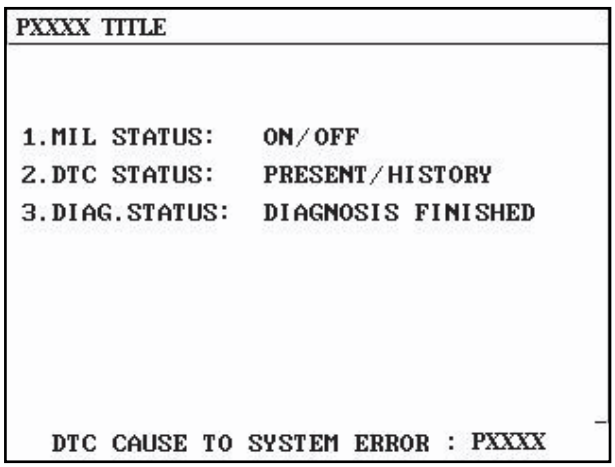
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EEADF250

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 E758E10E

1. Check voltage
   1) IG Key "OFF".
   2) Disconnect the PCM connector.
   3) IG Key "ON" and keep the brake taking off.
   4) Measure the voltage between terminal C30-A (21) of PCM connector and chassis ground.
   5) Measure the voltage between terminal C30-A (23) of PCM connector and chassis ground .
   6) Keep the brake stepping on.
   7) Measure the voltage between terminal C30-A (21) of PCM connector and chassis ground.
   8) Measure the voltage between terminal C30-A (23) of PCM connector and chassis ground .

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

9) Is the measured voltage within specification ?

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

▶ Go to "Check open in harness" as follows.

2. Check open in harness

1) IG Key "OFF".

2) Disconnect the brake switch and PCM connector.

3) Measure the resistance between terminal C30-A(21) of PCM harness connector and terminal 4 of Brake switch harness side.

4) Measure the resistance between terminal C30-A(23) of PCM harness connector and terminal 2 of Brake switch harness side.

Specification : Approx. below 1Ω

5) Is the measured resistance within specification ?

YES

▶ Go to "Check voltagen" procedure.

NO

▶ Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage

1) IG Key "OFF".

2) Disconnect the brake switch connector.

3) Measure the voltage between brake lamp switch terminal and chassis ground.

4) Measure the voltage between brake switch terminal and chassis ground.

5) IG Key "ON".

6) Measure the voltage between brake lamp switch terminal and chassis ground.

7) Measure the voltage between brake switch terminal and chassis ground.

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

8) Is the measured voltage within specification ?

YES

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

NO

▶ Check the fuse between battery and brake switch.
▶ Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E8BE4E53

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

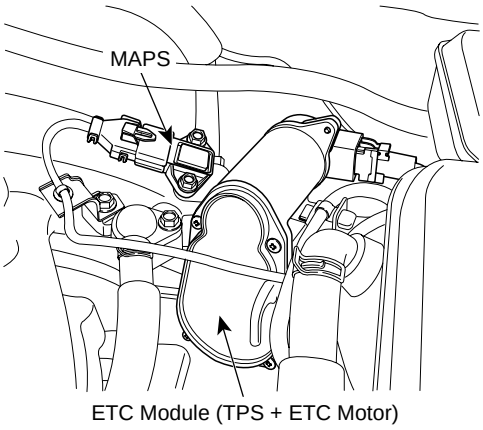
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

COMPONENT LOCATION EA62E8A4



SCMF16192L

GENERAL DESCRIPTION E4D4857B

The idle speed is controlled by the Electrical Throttle Control(ETC) System. ETC system is composed of the throttle motor to operate the throttle valve and the throttle position sensor to detect the opening angle of the throttle valve, the accelerator pedal position sensor to detect the accelerator pedal position and the one valve type throttle body. The ECM controls the throttle motor to provide the proper throttle valve opening angle for the target idle speed.

DTC DESCRIPTION E0E16B88

Checking idle RPM under detecting condition, if if the idle speed is 100RPM below desired idle speed, PCM sets P0506. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION EBD800A3

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if a low idle condition exists.	• Poor connection • Intake/Exhaust system for blockage • Throttle plate for carbon deposits • Faulty ETS motor • Faulty TPS • Faulty ETS system • Faulty PCM
Enable Conditions	• Normal Idle conditions • Canister Purge Fuel Flow ≤ 100 • Barometric Pressure 〉 72kPa • Engine running ≥ 2 sec • Air Intake Temperature ≥ -20℃ (-4˚F) • Coolant Temperature ≥ 0℃ (32˚F) • 11V ≤ Ignition Voltage ≤ 16V • Above conditions met period 〉 3 sec	
Thresh old value	• Real engine speed - Target engine speed 〈 -100rpm	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR DTC STATUS E6751FA9

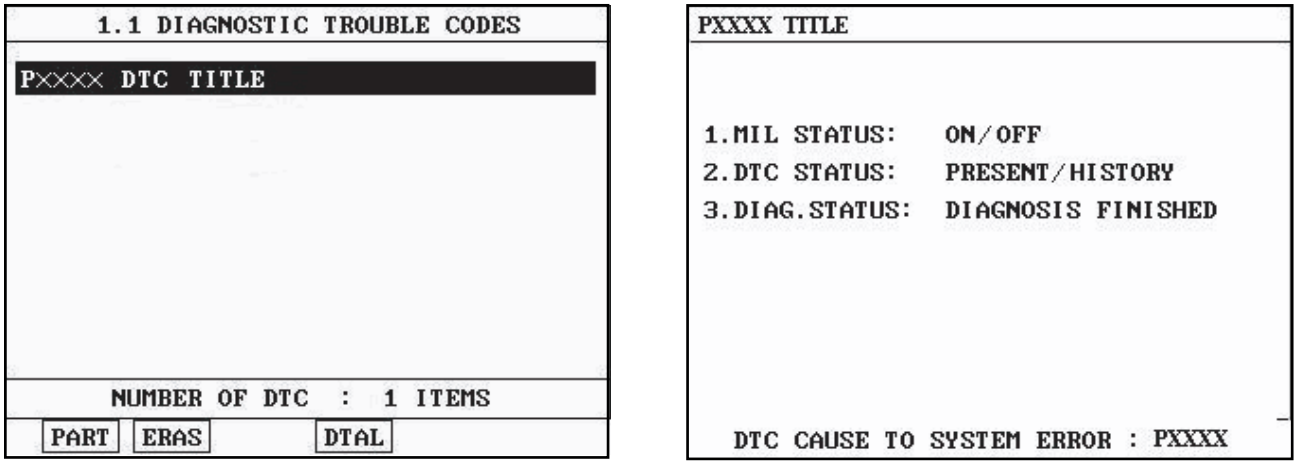
1. Check DTC Status

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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EAC4DDC3

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 ECD0849A

1. Check intake/exhaust system for blockage

   1) Visually/physically inspect the following items:
      - Air cleaner filter element for excessive dirt or for any foreign objects
      - Hoses of intake system for blockage
      - Throttle body inlet for damage or for any foreign objects
      - Throttle plate for carbon deposits
      - Restricted exhaust system

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

      YES

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

      NO

      ▶ Go to "Visually check ETS System" as below

2. Visually check ETS System

   1) Ignition "OFF"

   2) Remove the air hose between MAF sensor and Throttle body.

   3) Visually check the overall ETS system(Throttle valve,ETS motor,APS and TPS).

   4) Has a problem been found?

      YES

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

      NO

      ▶ Go to " Component Inspection" procedure.

COMPONENT INSPECTION EDF78774

1. Check ETS motor

   1) Ignition "OFF"

   2) Disconnect ETS motor connector

   3) Measure resistance between terminals "1" and "2" of the ETS motor connector.

Specification: Approx. 1.275 ~ 1.725Ω at 20℃(68 °F)

   4) Is the measured resistance within specifications?

      YES

      ▶ Go to "Check TPS" as below

      NO

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

2. Check TPS

1) Disconnect TPS connector and measure resistance between terminals 4 and 8 of the TPS connector.

Specification : Approx. 4.0~6.0kΩ (with throttle valve fully closed) at 20°C(68°F)

2) Disconnect TPS connector and measure resistance between terminals 1 and 5 of the TPS connector.

SPECIFICATION:

Item	Sensor Resistance at 20℃ (68°F)
TPS 1	4.0 ~ 6.0 kΩ
TPS 2	2.72 ~ 4.08 kΩ

3) Are the TPS resistance within specifications?

YES

▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure. If PCM needs to be replaced, do "ETS Initialization" after it is replaced.

NO

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

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR EDACDFAA

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0507 IDLE AIR CONTROL SYSTEM-RPM HIGHER THAN EXPECTED

COMPONENT LOCATION EECC48BE

Refer to DTC P0506.

GENERAL DESCRIPTION E1B8DE35

Refer to DTC P0506.

DTC DESCRIPTION EC7F26BC

Checking idle RPM from under detecting condition, if the idle speed is more than 200 RPM above desired idle speed, PCM sets P0507. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION E4304A42

Item	Detecting Condition	Possible cause
DTC Strategy	• Determines if a high idle condition exists.	• Poor connection • Intake system/Vapor hoses for air leakage or disconnection • Faulty Accelerator cable • Faulty ETS motor • Faulty TPS • Faulty ETS system • Faulty PCM
Enable Conditions	• Normal Idle conditions • Canister Purge Fuel Flow ≤ 100 • Barometric Pressure 〉 72kPa • Engine running ≥ 2 sec • Air Intake Temperature ≥ -20℃ (-4˚F) • Coolant Temperature ≥ 0℃ (32˚F) • 11V ≤ Ignition Voltage ≤ 16V • Above conditions met period 〉 3 sec	
Thresh old value	• Real engine speed - Target engine speed 〉 200rpm	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

MONITOR DTC STATUS EB848DDC

Refer to DTC P0506.

TERMINAL AND CONNECTOR INSPECTION E294E0D6

Refer to DTC P0506.

SYSTEM INSPECTION E41F9115

1. Check intake/exhaust system for blockage

   1) Visually/physically inspect the following items:
      - Intake system for air leakage
      - Vapor hoses for cracks or disconnection

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

      YES

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

NO

▶ Go to "Visually check ETS System" as below

2. Visually check ETS System

1) Ignition "OFF"

2) Remove the air hose between MAF sensor and Throttle body.

3) Visually check the overall ETS system(Throttle valve,ETS motor,APS and TPS).

4) Has a problem been found?

YES

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

NO

▶ Go to " Component Inspection" procedure.

COMPONENT INSPECTION E38D6FBD

1. Check Accelerator Cable

1) Ignition "OFF" & Engine "OFF"

2) Check free play of accelerator Cable

Specification 1.0 ~ 3.0mm(0.04 ~ 0.12 in)

3) Is the measured resistance within specifications?

YES

▶ Go to "Check TPS" as below

NO

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

2. Check ETS motor

1) Ignition "OFF"

2) Disconnect ETS motor connector

3) Measure resistance between terminals "1" and "2" of the ETS motor connector.

Specification: Approx. 1.275 ~ 1.725Ω at 20℃(68 °F)

Item	Sensor Resistance
Coll Resistance (Ω)	1.275 ~ 1.725Ω (20℃)

4) Are the TPS resistance within specifications?

YES

▶ Go to "Check TPS" as below

NO

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

3. Check TPS

1) Disconnect TPS connector and measure resistance between terminals 4 and 8 of the TPS connector.

Specification : Approx. 4.0~6.0kΩ (with throttle valve fully closed) at 20°C(68°F)

2) Disconnect TPS connector and measure resistance between terminals 1 and 5 of the TPS connector.

SPECIFICATION:

Item	Sensor Resistance
TPS 1	4.0 ~ 6.0 kΩ (20℃)
TPS 2	2.72 ~ 4.08 kΩ (20℃)

3) Are the TPS resistance within specifications?

YES

▶ Substitute with a known-good PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure. If PCM needs to be replaced, do "ETS Initialization" after it is replaced.

NO

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

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E77B3B94

Refer to DTC P0506.

DTC P0532 A/C REFRIGERANT PRESSURE SENSOR "A" CIRCUIT LOW INPUT

COMMPONENT LOCATION ECBA4F4B



SCMF16368L

GENERAL DESCRIPTION E092D000

The ECM(Engine Control Module) receives pressure signal in the A/C refrigerant high pressure side from the A/C refrigerant pressure sensor. This input indicates how much load the A/C compressor is putting on the engine and is one of the factors used by the ECM in order to determine the idle air control position for the idle speed. The circuits consist of a 5V reference and a ground, both provided by the ECM, and a signal from the sensor. The signal is a voltage which is proportional to the A/C pressure from 0 to 5V. Low pressure produces a low voltage signal and high pressure a high-voltage signal.

DTC DESCRIPTION EC914995

Checking output signals from A/C pressure sensor under detecting condition, if an signal below 0.25V lasts for more than 10 sec., PCM sets P0532.

DTC DETECTING CONDITION E858ED9E

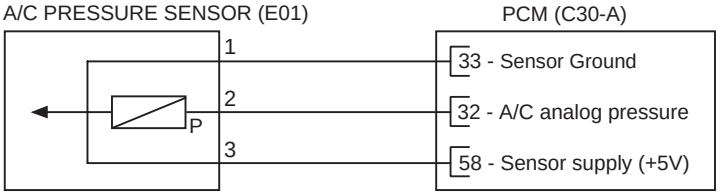
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to low voltage	• Poor connection • Open in power circuit • Open or short to ground in signal circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage 〈 0.25V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E428FF4C

Pressure(psi)	13.7	127.4	241.2	355.0	468.8
Voltage(V)	0.5	1.5	2.5	3.5	4.5

SCHEMATIC DIAGRAM E445C178

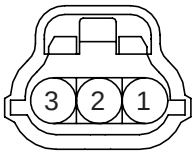
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

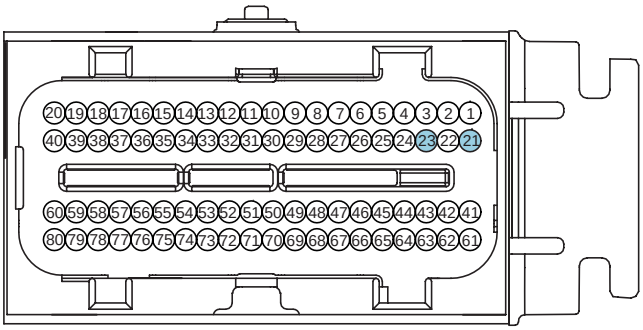
Terminal	Connected to	Function
1	PCM C30-A (33)	Sensor Ground
2	PCM C30-A (32)	A/C analog pressure
3	PCM C30-A (58)	Sensor supply (+5V)

[HARNESS CONNECTOR]



E01

A/C PRESSURE SENSOR

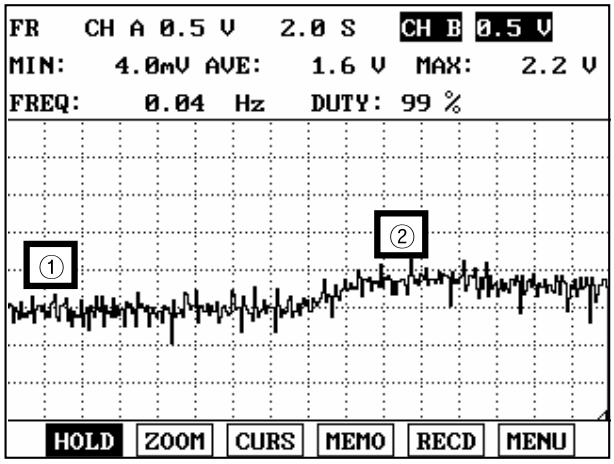


C30-A

PCM

SCMF16369L

SIGNAL WAVEFORM AND DATA EB03F274



① - A/C OFF & idle state
② - A/C ON & idle state

EGRF884A

MONITOR DTC STATUS EB6B770A

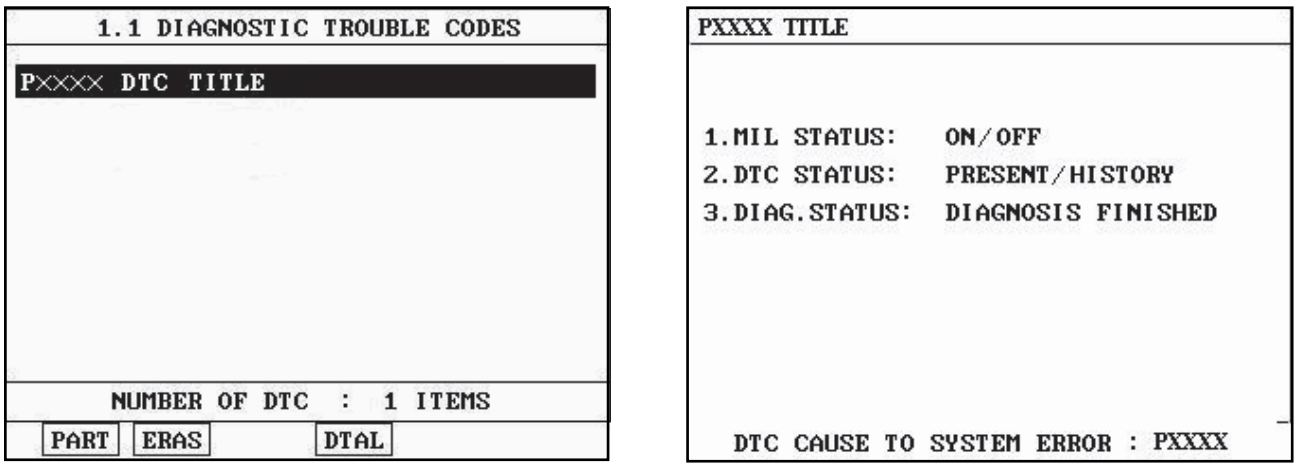
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E243BD27

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 EF2BA5DE

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V

5. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

▶ Repair Open or Short to ground in A/C pressure sensor power circuit and go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E5715370

1. Check short to ground inspection

   1) IG Key "OFF".

   2) Disconnect A/C pressure sensor and PCM connector.

   3) Measure the resistance between terminal 2 of A/C pressure sensor harness connector and chassis ground.

Specification : Infinite

   4) Is the measured resistance within specification ?

YES

▶ Go to "Check open in harness" procedure.

NO

▶ Repair Short to ground in A/C pressure sensor signal circuit and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

   1) IG Key "OFF".

   2) Disconnect A/C pressure sensor and PCM connector.

   3) Measure the resistance between terminal C30-A (2) of A/C pressure sensor harness connector and terminal 32 of PCM harness connector.

Specification : Approx. below 1Ω

   4) Is the measured resistance within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in A/C pressure signal circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E4DCCBE8

1. A/C pressure sensor inspection

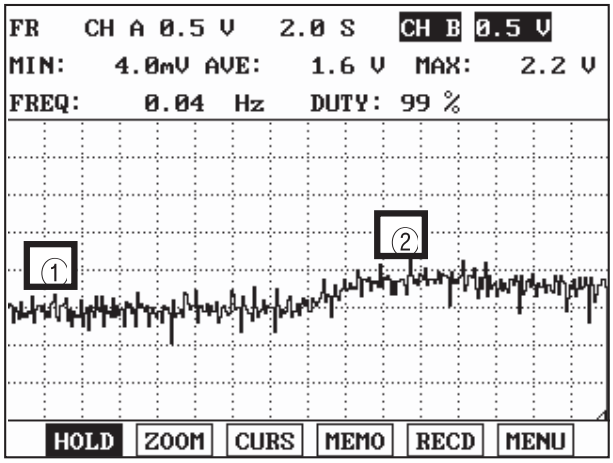
   1) IG Key "OFF" and connect the scantool.

   2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.

   3) Check the waveform with acceleration and deceleration after engine start.

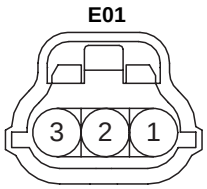
SPECIFICATION :

Pressure(psi)	13.7	127.4	241.2	355.0	468.8
Voltage(V)	0.5	1.5	2.5	3.5	4.5



① - A/C OFF & Idle

② - A/C ON & Idle



1. A/C pressure sensor ground
2. A/C pressure sensor signal
3. A/C pressure sensor power

SCMF16373L

   4) Is the measured waveform of A/C pressure sensor 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 A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E2DAA8D6

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.

2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0533 A/C REFRIGERANT PRESSURE SENSOR "A" CIRCUIT HIGH INPUT

COMMPONENT LOCATION EA049922

Refer to DTC P0532.

GENERAL DESCRIPTION E2E00DD0

Refer to DTC P0532.

DTC DESCRIPTION EFD3B85E

Checking output signals from A/C pressure sensor under detecting condition, if an signal above 4.65V lasts for more than 10 sec., PCM sets P0533.

DTC DETECTING CONDITION EC676D4D

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects sensor signal short to high voltage	• Poor connection • Short to battery in signal circuit • Open in ground circuit • Faulty A/C pressure sensor • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• Sensor output voltage 〉 4.65V	
Diagnosis Time	• Continuous (More than 10 seconds failure for every 20 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION EF478CAD

Refer to DTC P0532.

SCHEMATIC DIAGRAM E4925B57

Refer to DTC P0532.

SIGNAL WAVEFORM AND DATA E636CEEB

Refer to DTC P0532.

MONITOR DTC STATUS E263372C

Refer to DTC P0532.

TERMINAL AND CONNECTOR INSPECTION EECBB251

Refer to DTC P0532.

POWER CIRCUIT INSPECTION E24F7E47

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground.

Specification : approx. 5V

5. Is the measured voltage within specification ?

YES

▶ Go to "Ground circuit inspection" procedure.

NO

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

GROUND CIRCUIT INSPECTION EE3A1DF0

1. IG Key "OFF".
2. Disconnect the A/C pressure sensor connector.
3. IG Key "ON".
4. Measure the voltage between terminal 3 of A/C pressure sensor harness connector and chassis ground. (Fig A)
5. Measure the voltage between terminal 3 and terminal 1 of A/C pressure sensor harness connector. (Fig B)

Specification : The Difference between "A" and "B" is below 200mV.

6. Is the measured voltage within specification ?

YES

▶ Go to "Signal circuit inspection" procedure.

NO

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

SIGNAL CIRCUIT INSPECTION EDC3237B

1. Voltage inspection
   1) IG Key "OFF".
   2) Disconnect the A/C pressure sensor connector.
   3) IG Key "ON".
   4) Measure the voltage between terminal 2 of A/C pressure sensor harness connector and chassis ground.

Specification : Approx. 0V

5) Is the measured voltage within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Go to "Check short to battery in harness" procedure.

2. Check short to battery in harness

1) IG Key "OFF".

2) Disconnect A/C pressure sensor connector and PCM connector.

3) Measure the resistance between terminal 2 and terminal 3 of A/C pressure sensor harness connector.

Specification : Infinite

4) Is the measured resistance within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

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

COMPONENT INSPECTION E5E87679

1. A/C pressure sensor inspection

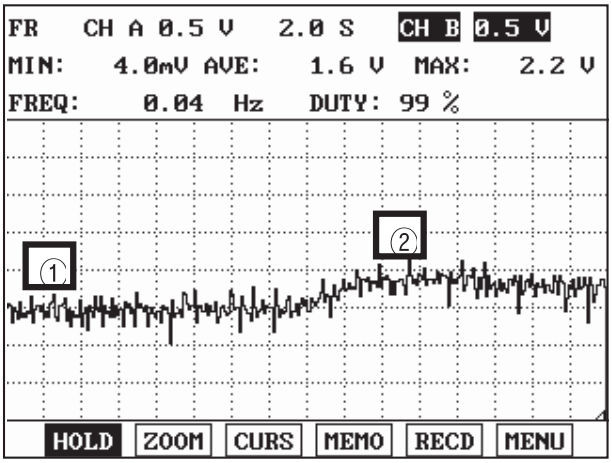
1) IG Key "OFF" and connect the scantool.

2) Connect the probe to A/C pressure sensor signal and select the oscilloscope in the menu.

3) Check the waveform with acceleration and deceleration after engine start.

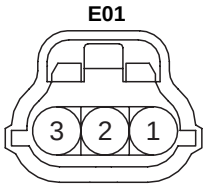
SPECIFICATION :

Pressure(psi)	13.7	127.4	241.2	355.0	468.8
Voltage(V)	0.5	1.5	2.5	3.5	4.5



① - A/C OFF & Idle

② - A/C ON & Idle



1. A/C pressure sensor ground
2. A/C pressure sensor signal
3. A/C pressure sensor power

SCMF16373L

4) Is the measured waveform of A/C pressure sensor 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 A/C pressure sensor and check for proper operation. If the problem is corrected, replace A/C pressure sensor and go to "Verification of Vehicle Repair" procedure.

NOTE

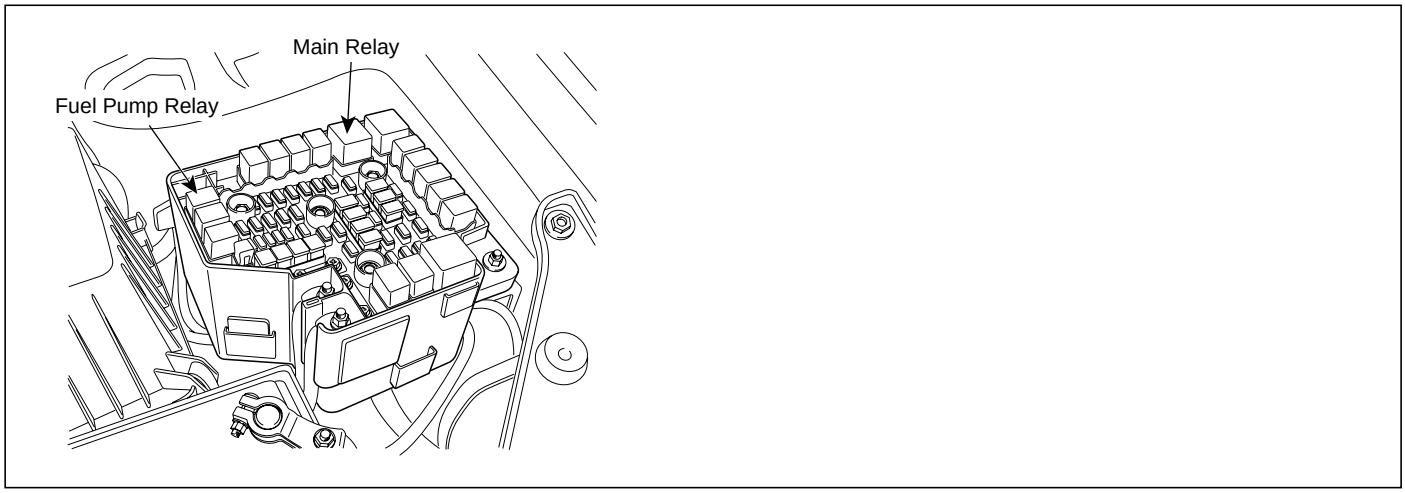
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E04CD0ED

Refer to DTC P0532.

DTC P0562 SYSTEM VOLTAGE LOW

COMMPONENT LOCATION E4822353



SCMF16254L

GENERAL DESCRIPTION EE0D9898

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION E745289C

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.
During engine running, if battery voltage is below 11V, PCM sets P0562. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION ED806959

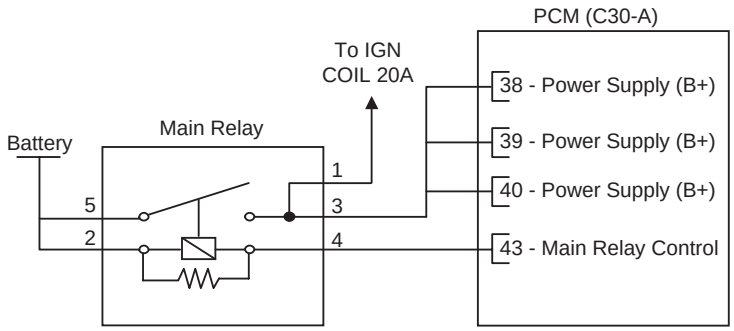
Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage too low	• Poor connection • Open in power circuit • Faulty charging system • Faulty main relay • Faulty PCM
Enable Conditions	• Engine works • 11V ≤ Battery voltage ≤ 16V	
Thresh old value	• System voltage 〈 11V	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

SPECIFICATION EC9C973F

Coil Resistance	70Ω ~ 120Ω

SCHEMATIC DIAGRAM EAED338F

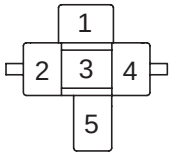
[CIRCUIT DIAGRAM]



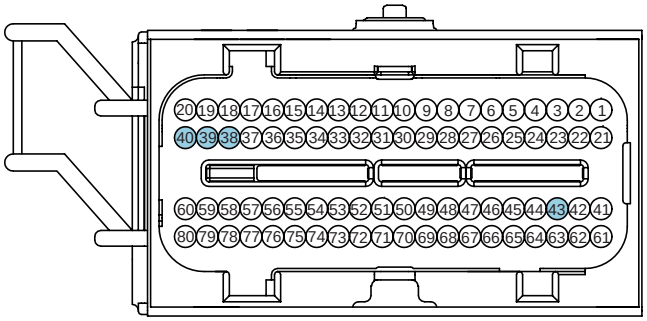
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	IGN COIL 20A	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C30-A (38)	Power Supply (B+)
	PCM C30-A (39)	
	PCM C30-A (40)	
4	PCM C30-A (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



Main Relay



C30-A
PCM

SCMF16377L

MONITOR DTC STATUS EADFFF7A

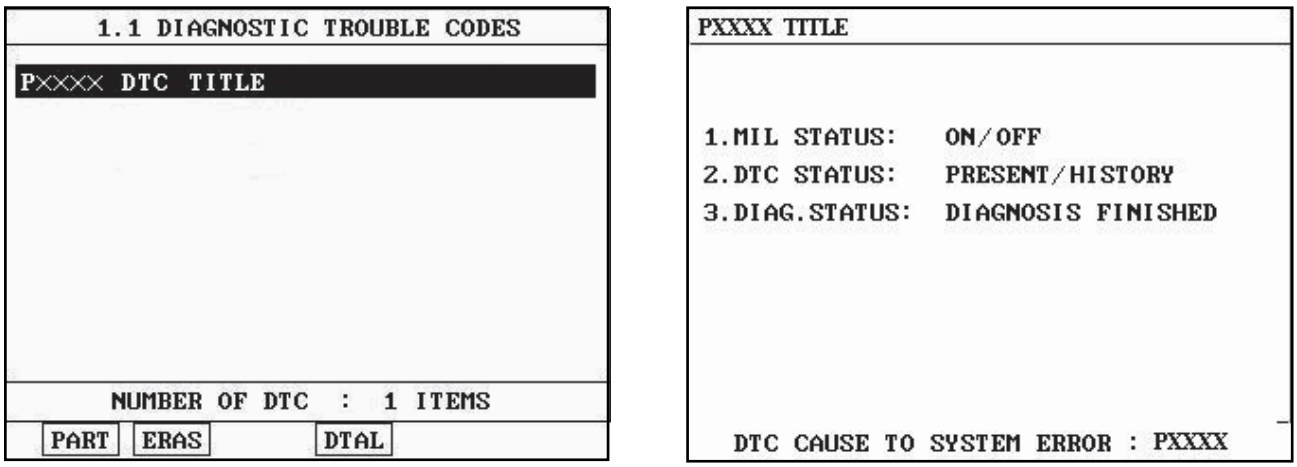
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EA71A57C

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 EC50FD09

1. Power circuit inspection
   1) Key "OFF".
   2) Disconnect the main relay connector.
   3) Key "ON".

4) Measure the voltage between terminal 2 of main relay harness connector and chassis ground.

5) Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

Specification : B+

6) Is the measured voltage within specification ?

YES

▶ Go to "Check open in harness" procedure.

NO

▶ Check the fuse between battery and main relay.
▶ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure

2. Check open in harness

1) Key "OFF".

2) Disconnect main relay and PCM connector.

3) Measure the resistance between terminal 3 of main relay harness connector and terminals C30-A (38,39,40) of PCM connector.

Specification : Approx. below 1Ω

4) Is the measured resistance within specification ?

YES

▶ Go to "Check short in harness" procedure.

NO

▶ Repair open in harness and go to "Verification of Vehicle Repair" procedure .

3. Check short in harness

1) Key "OFF".

2) Disconnect main relay and PCM connector.

3) Measure the resistance between terminal 3 of main relay harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specification ?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Repair short in harness and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E8FBAF69

1. Check short in harness

   1) Key "OFF".

   2) Disconnect main relay and PCM connector.

   3) Measure the resistance between terminal 4 of main relay harness connector and chasses ground.

Specification : Infinite

   4) Is the measured resistance within specification ?

   YES

   ▶ Go to "Check open in harness" procedure.

   NO

   5) ▶ Repair short in control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

   1) Key "OFF".

   2) Disconnect main relay and PCM connector.

   3) Measure the resistance between terminal 4 of main relay harness connector and terminal C30-A (43) of PCM connector.

Specification : Approx. below 1Ω

   4) Is the measured resistance within specification ?

   YES

   ▶ Go to "Ground circuit inspection" procedure.

   NO

   ▶ Repair Open in control harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E7E80518

1. Open in circuit inspection

   1) Key "OFF".

   2) Disconnect PCM connector.

   3) Measure the resistance between terminals C30-B (35,36) of PCM connector and chassis ground.

   4) Measure the resistance between terminals C30-B (37,38,39) of PCM connector and chassis ground.

Specification : Approx. blow 1Ω

   5) Is the measured resistance within specification ?

YES

▶ Go to "System inspection" procedure.

NO

▶ Repair Open in control harness and go to "Verification of Vehicle Repair" procedure.

SYSTEM INSPECTION EDF7965B

1. Check Alternator circuit

   1) Key "OFF".

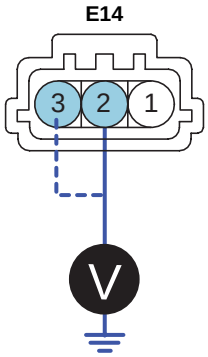
   2) Disconnect alternator connector.

   3) Key "ON".

   4) Measure the voltage between terminal 2 of alternator and chassis gound.

   5) Measure the voltage between terminal 3 of alternator and chassis gound.

Specification : B+



2. Cluster
(Charging MIL)
3. Sensing

SCMF16381L

   6) Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ In case terminal 2 : Repair MIL circuit, MIL resistor or Open in circuit and go to "Verification of Vehicle Repair" procedure.
▶ In case terminal 3 : Repair the fuse between battery and Ignition switch, the fuse between Ignition switch and alternator or Open in circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EDCC3570

1. Main relay inspection

1) Key "OFF".

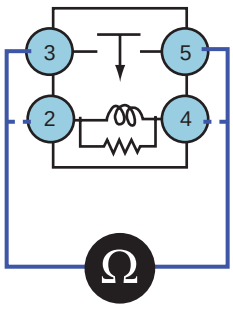
2) Disconnect the main relay.

3) Measure the resistance between terminal 3 and 5 of main relay.

4) Measure the resistance between terminal 2 and 4 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



EGRF912A

5) Is the measured resistance within specification ?

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 Main relay and check for proper operation. If the problem is corrected, replace Main relay and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E558CCE6

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0563 SYSTEM VOLTAGE HIGH

COMMPONENT LOCATION E0D02FB6

Refer to DTC P0562.

GENERAL DESCRIPTION E325E8A3

Refer to DTC P0562.

DTC DESCRIPTION EEB19291

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.
During engine running, if battery voltage is above 16V, PCM sets P0563. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION E9F3B8D2

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage too high	• Poor connection • Short in circuit • Faulty charging system • Faulty main relay • Faulty PCM
Enable Conditions	• Engine works	
Thresh old value	• System voltage 〉 16V	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

SPECIFICATION EDE82ED2

Refer to DTC P0562.

SCHEMATIC DIAGRAM E7F9ACF9

Refer to DTC P0562.

MONITOR DTC STATUS E3098E3B

Refer to DTC P0562.

TERMINAL AND CONNECTOR INSPECTION E7B7184C

Refer to DTC P0562.

POWER CIRCUIT INSPECTION E52F7AA5

1. Power circuit inspection
   1) Key "OFF".
   2) Disconnect the main relay connector.

3) Key "ON".

4) Measure the voltage between terminal 2 of main relay harness connector and chassis ground.

5) Measure the voltage between terminal 5 of main relay harness connector and chassis ground.

Specification : B+

6) Is the measured voltage within specification ?

YES

▶ Go to "Check short in harness" procedure.

NO

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

2. Check short in harness

1) Key "ON".

2) Measure the voltage between terminal C30-A (38, 39, 40) of PCM harness terminal and chassis ground.

Specification : B+

3) Is the measured voltage within specification ?

YES

▶ Go to "System inspection" procedure.

NO

▶ Repair short in power harness and go to "Verification of Vehicle Repair" procedure .

SYSTEM INSPECTION ED02C2D0

1. Check Alternator circuit

1) Key "OFF".

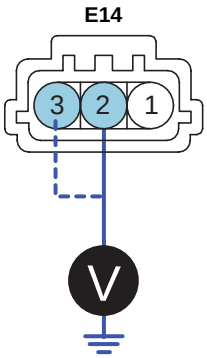
2) Disconnect alternator connector.

3) Key "ON".

4) Measure the voltage between terminal 2 of alternator and chassis gound.

5) Measure the voltage between terminal 3 of alternator and chassis gound.

Specification : B+



2. Instrument Panel
3. Sensing

SCMF16383L

6) Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair short in Sensing circuit or MIL circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2DE47BB

1. Main relay inspection

1) Key "OFF".

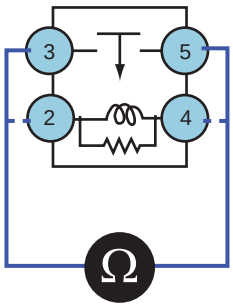
2) Disconnect the main relay.

3) Measure the resistance between terminal 3 and 5 of main relay.

4) Measure the resistance between terminal 2 and 4 of main relay.

Specification : 70 ~ 120Ω

Terminal	Power approval
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



EGRF912A

5) Is the measured resistance within specification ?

YES

▶ Go to "Check Alternator" 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. Check Alternator

1) Key "OFF".

2) Check the tension of the belt.

3) Check Battery terminal and Alternator B+ terminal for looseness, corrosion or damage.

4) Engine "ON".

5) Operate electric equipments (Head lamp, Hot wire, etc).

6) accelerate engine to 2000 RPM and measure the battery voltage.

Specification : Approx. 12.5V ~ 14.5V

7) Is the measured voltage within specification ?

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 Alternator and check for proper operation. If the problem is corrected, replace Alternator and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E12F704A

Refer to DTC P0562.

DTC P0571 BRAKE SWITCH "A" CIRCUIT

GENERAL DESCRIPTION E05F03C8

The Stop lamp switch is used to judge whether the acceleration system is abnormal or not. The stop lamp switch has a duplex system(signals brake test or brake light) to memorize the abnormality when the signals of depressing and releasing the brake pedal are detected simultaneously.

DTC DESCRIPTION E729BD31

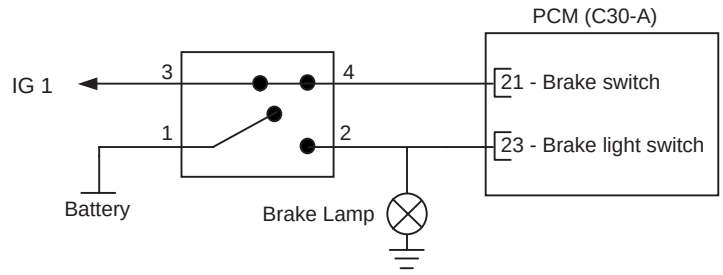
Checking input signals from brake lamp switch under detecting condition, if the operation state of brake lamp switch does not change for more than 3 sec., PCM sets P0571. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till cosecutive 2 driving cycle.

DTC DETECTING CONDITION E26B2635

Item	Detecting Condition	Possible cause
DTC Strategy	• PCM detects brake lamp input signal when vehicle stops.	• Poor connection • Open or short to ground in signal circuit • Faulty PCM
Enable Conditions	• Engine works • Vehicle speed signal is normal. • Vehicle speed 〉 20kph (during 1sec or more)	
Threshold value	• Vehicle speed 〈 3kph • Vehicle acceleration 〈 -6kph/s • Brake lamp "OFF" and not changing of brake lamp signal for more 3 sec.	
Diagnosis Time	• Continuous	
MIL On Condition	• 2 driving cycles	

SCHEMATIC DIAGRAM E3311F66

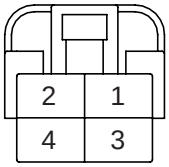
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

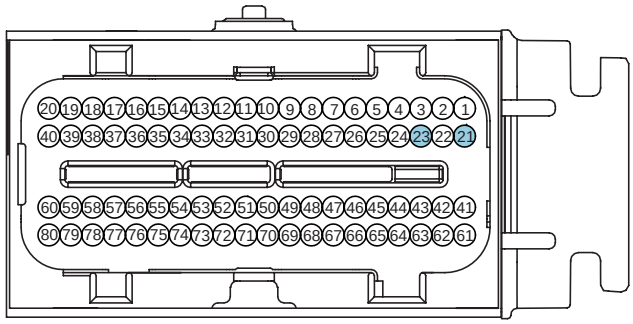
Terminal	Connected to	Function
2	PCM C30-A (23)	Brake light switch
1	Battery	Power Supply (12V)
4	PCM C30-A (21)	Brake switch
3	Battery	Power Supply (12V)

[HARNESS CONNECTOR]



C54

STOP LAMP SWITCH



C30-A

PCM

SCMF16365L

MONITOR DTC STATUS EDDDACD9

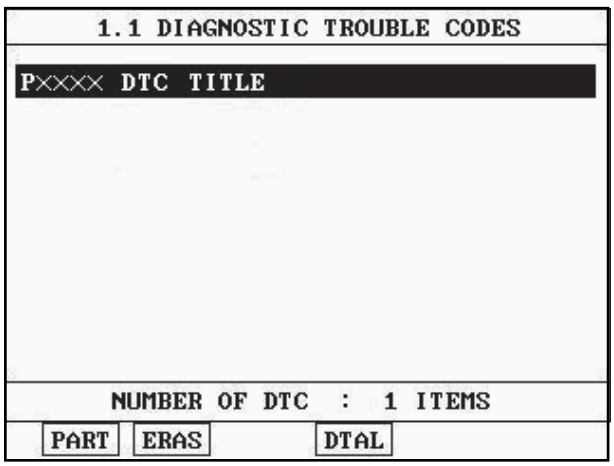
1. Check DTC Status

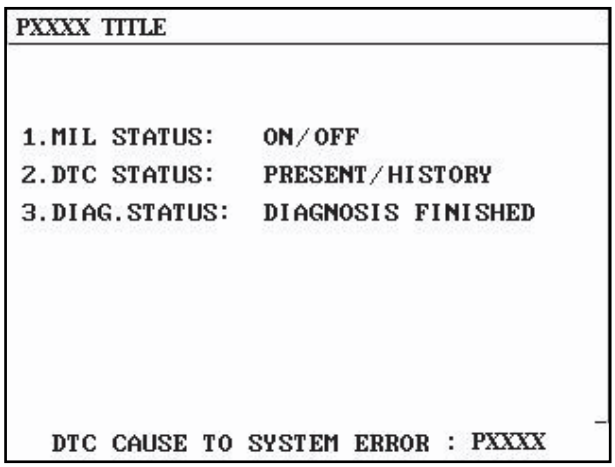
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EC369B30

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 E96451A9

1. Check voltage
   1) IG "OFF".
   2) Disconnect the PCM connector.
   3) IG "ON" and ENG "OFF"
   4) During taking off the brake : Measure the voltage between terminal C30-A (23) of PCM harness connector and chassis ground.
   5) During stepping on the brake : Measure the voltage between terminal C30-A (23) of PCM harness connector and chassis ground.

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	0V	Battery voltage
Brake Switch	Battery voltage	0V

6) Is the measured voltage within specification ?

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

▶ Go to "Check open in harness" as follows.

2. Check open in harness

1) IG "OFF".

2) Disconnect the brake switch and PCM connector.

3) Measure the resistance between terminal 23 of PCM harness connector and terminal 2 of Brake switch harness side.

Specification : Approx. below 1Ω

4) Is the measured resistance within specification ?

YES

▶ Go to "Check voltage" as follows.

NO

▶ Repair open in circuit and go to "Verification of Vehicle Repair" procedure.

3. Check voltage

1) IG "OFF".

2) Disconnect the brake switch connector.

3) Measure the voltage between brake lamp switch terminal and chassis ground.

4) IG "ON" and ENG "OFF"

5) Measure the voltage between brake lamp switch terminal and chassis ground.

SPECIFICATION :

Item	During taking off the brake	During stepping on the brake
Brake Lamp Switch	Battery voltage	Battery voltage
Brake Switch	0V	Battery voltage

6) Is the measured voltage within specification ?

YES

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

NO

▶ Check the fuse between battery and brake switch.
▶ Repair open or short in power circuit of brake switch and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E279FF74

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

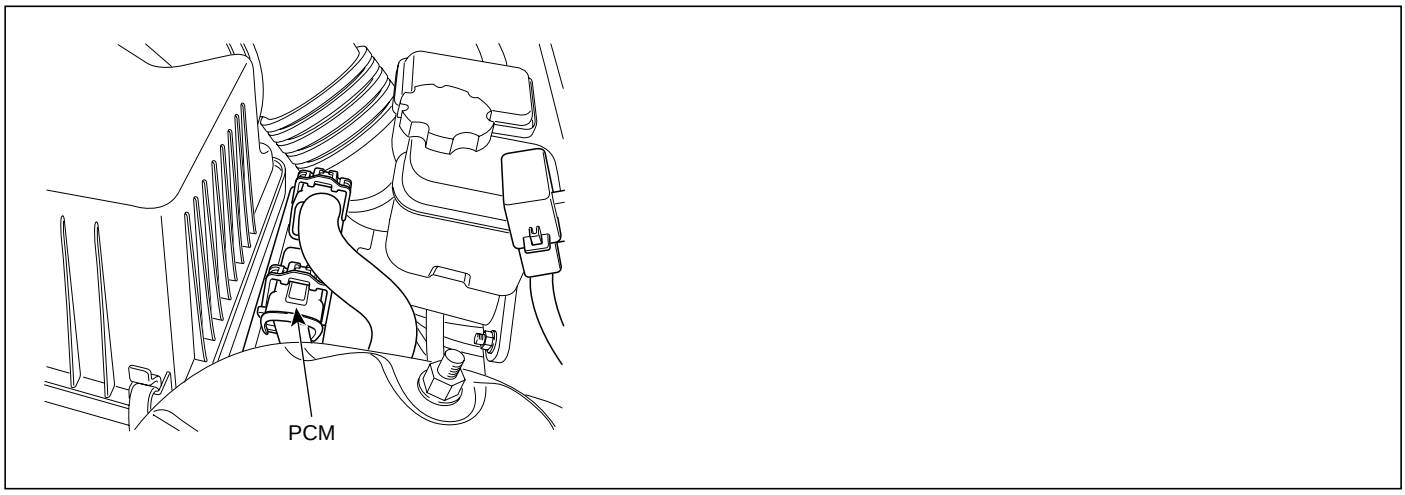
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0601 EEPROM-CHECK SUM ERROR

COMPONENT LOCATION E229539F



SCMF16386L

GENERAL DESCRIPTION E87E4D85

A malfunction is detected by using a checksum technique for verifying data. The digital data is composed of zeros and ones. A checksum is the total of all ones in a string of data. By comparing the checksum value with a stored value, a malfunction can be detected.

DTC DESCRIPTION E65068E8

If real checksum does not accord with memory checksum, PCM sets P0601 and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E38A3627

Item	Detecting Condition	Possible cause
DTC Strategy	• Checksum check	• Faulty PCM
Enable Conditions	• -	
Threshold value	• Discordance between the real checksum and the memorized checksum	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR DTC STATUS E7BDFDA8

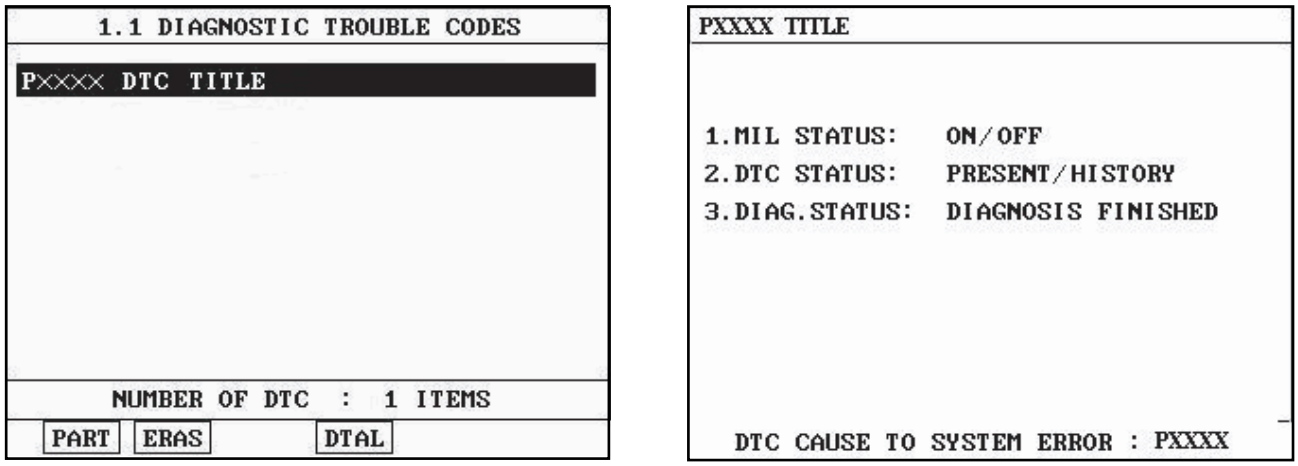
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E2E5805E

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 PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR EDF49698

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0602 EEPROM-PROGRAMING ERROR

COMPONENT LOCATION E6E49C3C

Refer to DTC P0601.

GENERAL DESCRIPTION EECB64CE

Refer to DTC P0601.

DTC DESCRIPTION E0CE496F

If CPU software version dose not accord with main CPU, PCM sets P0602.

DTC DETECTING CONDITION E88A3072

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable Conditions	• -	
Threshold value	• The version discordance among PCU S/W or Calibration	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR DTC STATUS ED153DB8

Refer to DTC P0601.

TERMINAL AND CONNECTOR INSPECTION EB336C96

Refer to DTC P0601.

VERIFICATION OF VEHICLE REPAIR E499B411

Refer to DTC P0601.

DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

COMPONENT LOCATION ECDD00AC

Refer to DTC P0601.

GENERAL DESCRIPTION EC8E0935

Refer to DTC P0601.

DTC DESCRIPTION E7CA500D

If the RAM in PCM has errors, PCM sets P0604 and MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E848AF67

Item	Detecting Condition	Possible cause
DTC Strategy	• Check internal CPU	• Faulty PCM
Enable Conditions	• -	
Threshold value	• RAM has errors	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR DTC STATUS ECC7C404

Refer to DTC P0601.

TERMINAL AND CONNECTOR INSPECTION E6886EBD

Refer to DTC P0601.

VERIFICATION OF VEHICLE REPAIR EF1A07CB

Refer to DTC P0601.

DTC P0606 ECM/PCM PROCESSOR(ECM-SELF TEST FAILED)

COMPONENT LOCATION E6BA7101

Refer to DTC P0601.

GENERAL DESCRIPTION E8AE56A0

Refer to DTC P0601.

DTC DESCRIPTION E3F9D10A

Checking PCM under detecting condition, if internal error is detected, PCM sets P0606. And MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EA082F6D

Item	Detecting Condition	Possible cause
DTC Strategy	• Check PCM internal error	• Faulty PCM
Enable Conditions	• 7V 〈 Battery voltage 〈 20V	
Threshold value	• PCM internal error (A/D unit error)	
Diagnosis Time	• Continuous	
MIL On Condition	• 1 driving cycle	

MONITOR DTC STATUS EB03A742

Refer to DTC P0601.

TERMINAL AND CONNECTOR INSPECTION E4C51C74

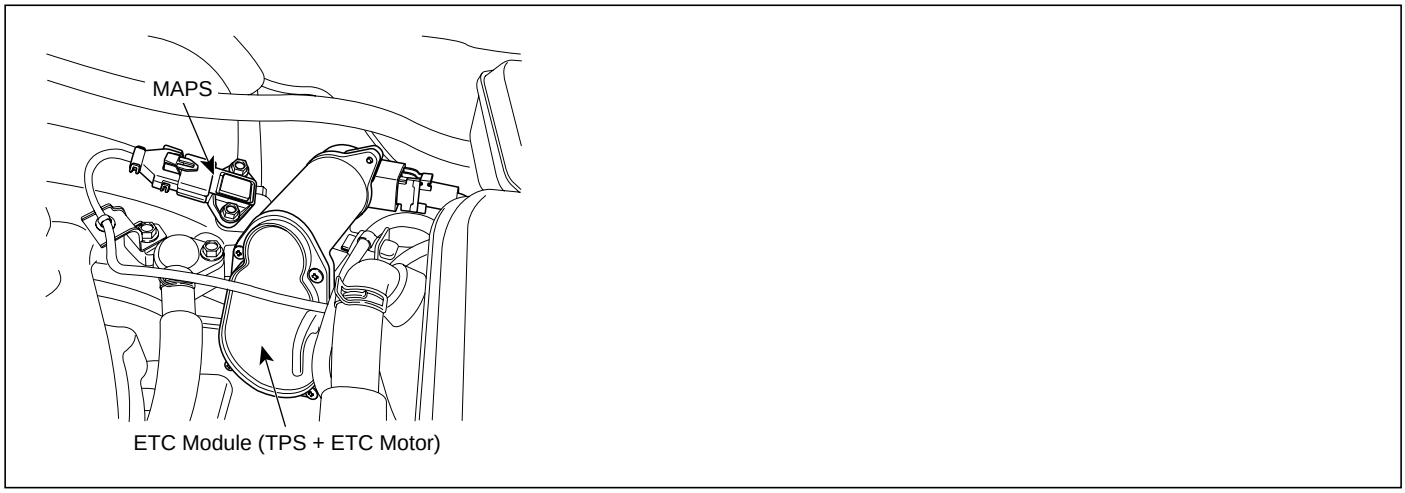
Refer to DTC P0601.

VERIFICATION OF VEHICLE REPAIR EB22E942

Refer to DTC P0601.

DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE

COMPONENT LOCATION E39F0565



SCMF16192L

GENERAL DESCRIPTION EDD2D537

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION EA375F92

Checking output signals from TPS every 8.5 sec. under detecting condition, if the difference between real and target throttle position is above the specified value, PCM sets P0638 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E411BDA4

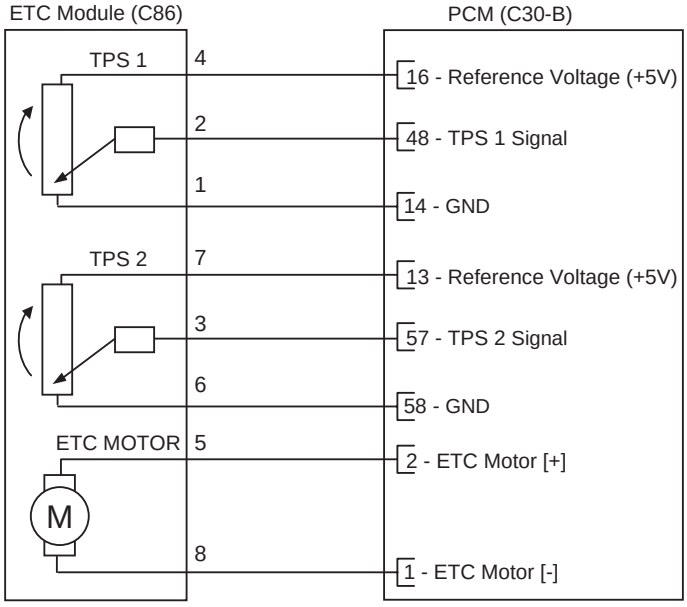
Item		Detecting Condition	Possible cause
DTC Strategy		• ETS position control malfunction	• Throttle stuck • Open in motor circuit • Faulty motor • Faulty PCM
Enable Conditions		• Engine works • Battery voltage 〉 5V	
Thresh old value	Case1	• l real ETS motor & TPS value - target ETS motor & TPS value l 〉 4.5°	
	Case2	• When real Throttle position 〈36°, real throttle position - target throttle position 〈 - 4.5°	
	Case3	• real throttle position - target throttle position 〈 - 18°	
Diagnosis Time		• Continuous (More than 0.6 seconds failure for every 15.6 seconds test)	
MIL On Condition		• 1 driving cycle	

SPECIFICATION E58C81DC

Throttle opening (°)	Output voltage (V) [Verf = 5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM E32258ED

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

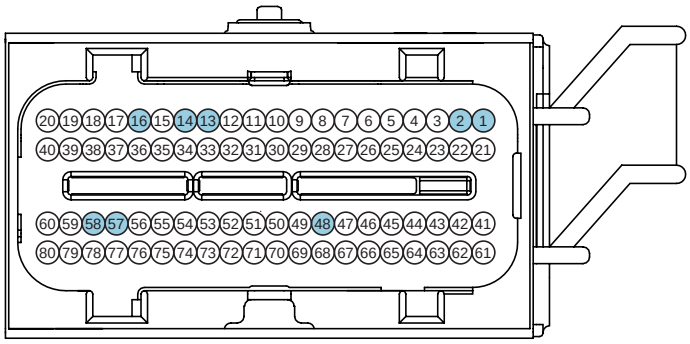
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE



C30-B

PCM

SCMF16101L

SIGNAL WAVEFORM E48A6E0B

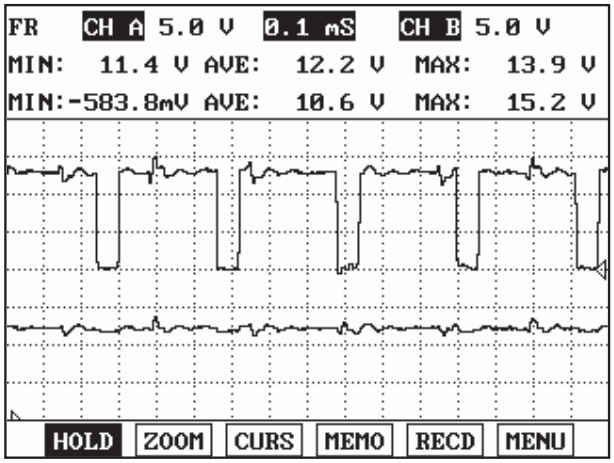


Fig. 1

Fig1) Signal waveform(+/-) instantly with accelerating

EGRF921A

MONITOR DTC STATUS EBABB1E4

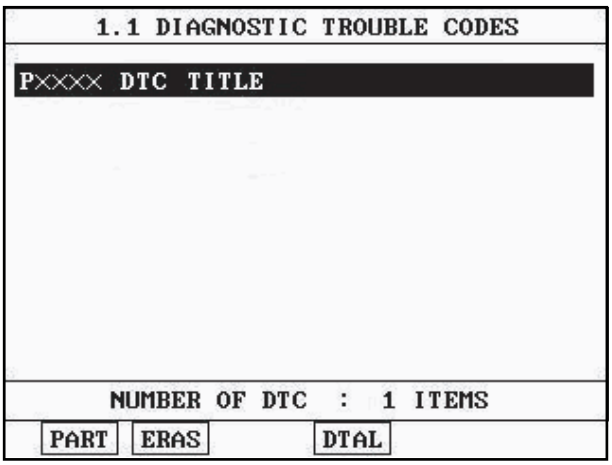
1. Check DTC Status

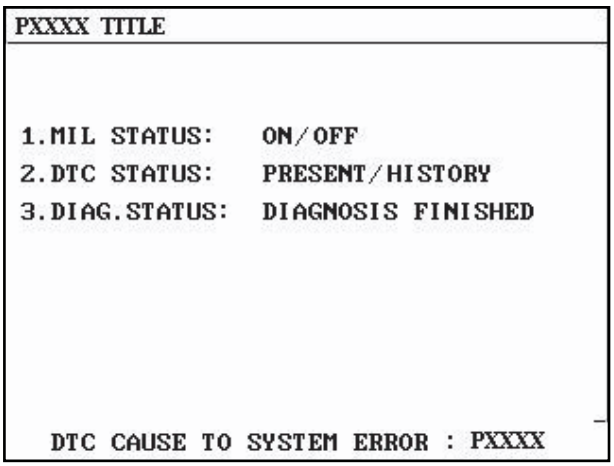
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

   YES

   ▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E49C836E

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 E3BADF5F

1. Check voltage
   1) IG "OFF".
   2) Disconnect ETS motor & TPS connector.
   3) IG "ON" and ENG "OFF"
   4) Measure the voltage between terminal 5,8 of ETS motor & TPS harness connector and chassis ground.

Specification : Approx. 12V

   5) Is the measured voltage within specification?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Go to "Check open in harness" as follows.

2. Open in control circuit inspection
   1) IG "OFF"
   2) Disconnect ETS motor & TPS connector and PCM connector.
   3) Measure the resistance between terminal 5 of ETS motor & TPS harness connector and terminal C30-B (2) of PCM harness connector.

4) Measure the resistance between terminal 8 of ETS motor & TPS harness connector and terminal C30-B (1) of PCM harness connector.

Specification : Approx. below 1Ω

5) Is the measured resistance within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in motor harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EC9FEB92

1. Check throttle valve for stuck

1) IG "OFF".

2) Disconnect the air hose between throttle body and air mass flow sensor.

3) Check stuck on throttle valve.

4) Is the throttle valve normal?

YES

▶ Go to check "ETS motor resistance" as follows.

NO

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

2. Check ETS motor resistance

1) IG "OFF".

2) Disconnect ETS motor & TPS connector.

3) Measure the resistance between terminal 5 and 8 of ETS motor & TPS connector(component side).

Specification : Approx. 1.275 ~ 1.725Ω @ 23℃ (73.4°F)

4) Is the measured resistance within specification?

YES

▶ Go to "ETC motor actuation test" procedure.

NO

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

※ Procedure of ETS Initialization

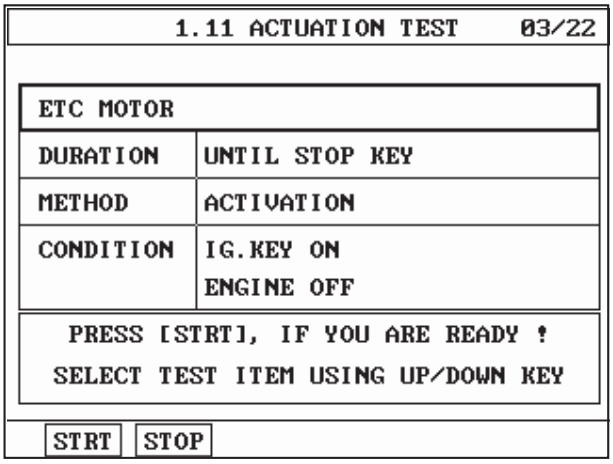
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

3. ETC motor actuation test

1) IG "OFF".

2) Connect ETS motor & TPS connector.

3) After IG "ON", execute the "ETC motor actuation test" by Scantool.



EGRF926A

4) Does the "ETC motor actuation test" execute normally?

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 ETC motor and check for proper operation. If the problem is corrected, replace ETC motor and go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR EEB6DD19

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.

2. Using a Scantool, Clear the DTCs

3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions

4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0641 SENSOR REFERENCE VOLTAGE "A" CIRCUIT OPEN

GENERAL DESCRIPTION E15F66A1

The ECM provides a 5volt reference voltage to Throttle Position Sensor 1(TPS1). The ECM monitors reference voltage deviation from the power supply circuit of the sensors.

DTC DESCRIPTION EF6A2456

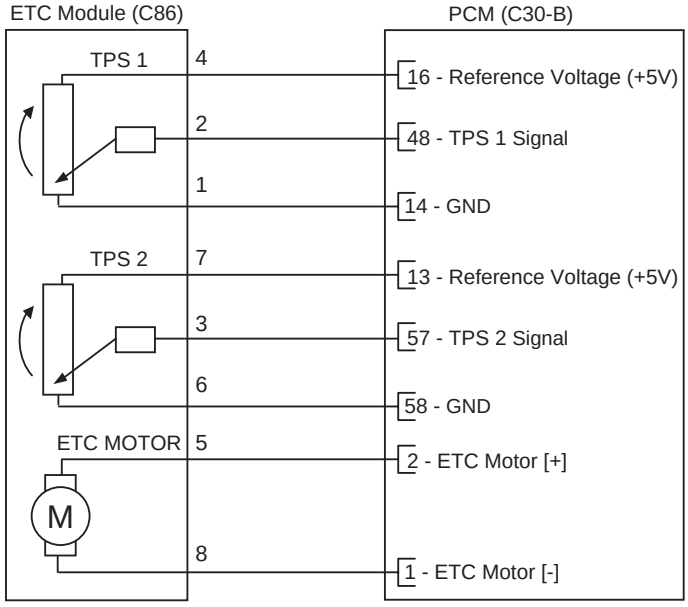
Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0641. MIL(Malfunction Indicatin Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E7552101

Item	Detecting Condition	Possible cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable Conditions	• IG "ON"	
Threshold value	• Sensor supply power 〈 4.5V or 〉 5.5V	
Diagnosis Time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL On Condition	• 2 driving cycle	

SCHEMATIC DIAGRAM EC1AC7D9

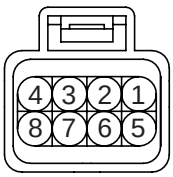
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

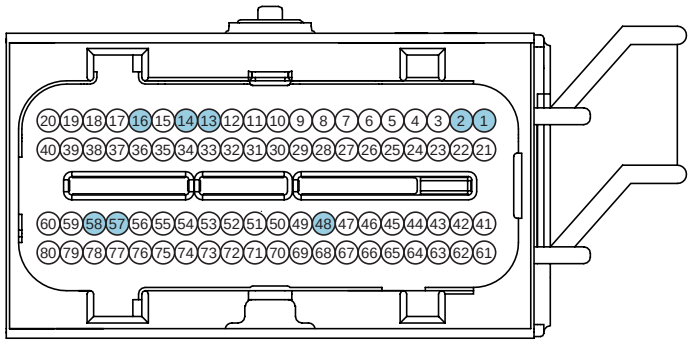
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE



C30-B

PCM

SCMF16101L

MONITOR DTC STATUS EDB80F42

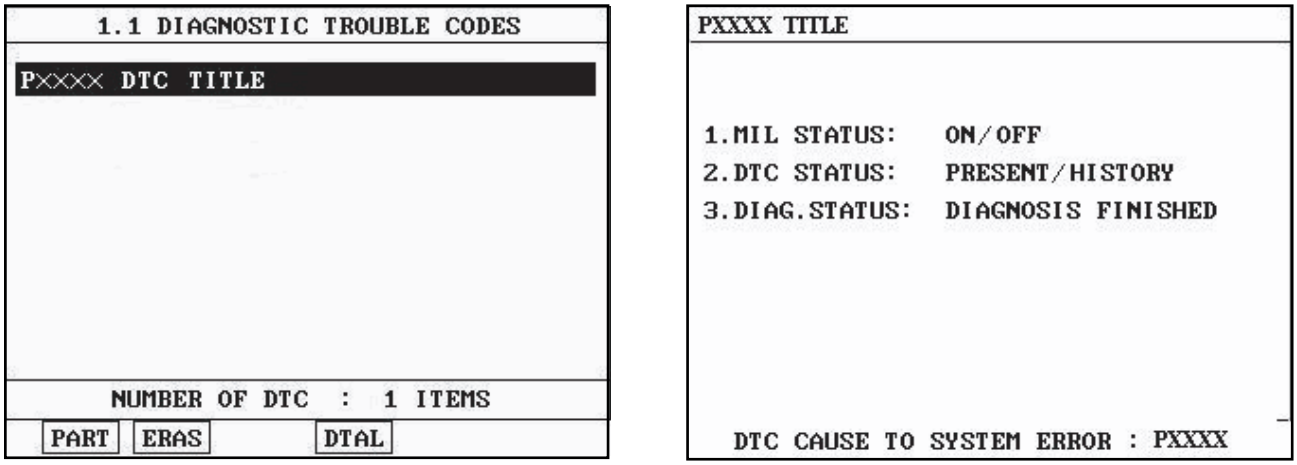
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EC1C2088

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 E1B2DC07

1. Check voltage
   1) IG "OFF".
   2) Disconnect TPS connector.
   3) IG "ON" and ENG "OFF"

4) Measure the voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V

5) Is the measured voltage within specification ?

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

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

2. Check short in power harness

1) IG "OFF".

2) Disconnect TPS connector and PCM connector.

3) Measure the resistance between terminal 4 and 5 of TPS harness connector.

4) Measure the resistance between terminal 4 and 8 of TPS harness connector.

5) Measure the resistance between terminal 4 and 6 of TPS harness connector.

6) Measure the resistance between terminal 4 and 1 of TPS harness connector.

Specification : Infinite

7) Is the measured resistance within specification ?

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

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

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E34B8F1E

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0646 A/C CLUTCH RELAY CONTROL CIRCUIT LOW

GENERAL DESCRIPTION EDDD5D8D

The A/C clutch relay is activated if the A/C switch is operated while the blower is running and system operation is enabled by the ECM. When A/C is requested, the Engine Control Module(ECM) provides a ground path to the A/C clutch relay control circuit. When the relay circuit is grounded, the A/C clutch relay is energized. The ECM delays grounding the relay circuit for a short time, so the ECM can adjust the engine idle speed for the additional load. The ECM will temporarily de-energized the A/C clutch relay for one or more of the following conditions:

- Full acceleration when the throttle is at WOT.(Wide Open Throttle)
- Risk of overheating: Engine coolant temp. exceeds threshold value
- A/C system pressure exceeds threshold value
- Engine starting

DTC DESCRIPTION E104ED52

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage lower than the specified value is detected for more than 5 sec., PCM sets P0646.

DTC DETECTING CONDITION EC2A54B9

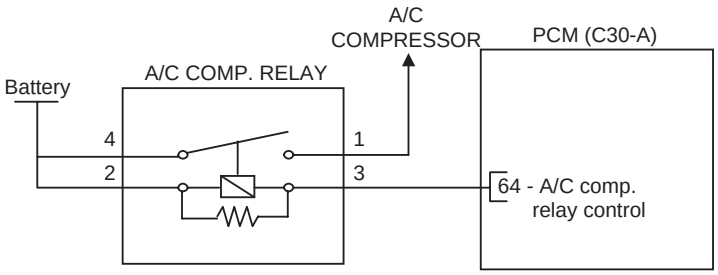
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to low voltage	• Poor connection • Open or short to ground in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short to ground	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E4795868

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM E7EB010D

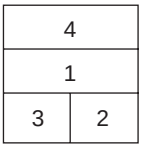
[CIRCUIT DIAGRAM]

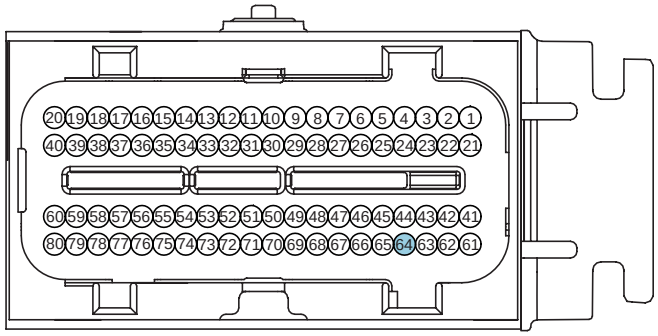


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	A/C COMPRESSOR	COMPRESSOR Supply
2	Battery	Power Supply (B+)
3	PCM C30-A (64)	A/C comp. relay control
4	Battery	Power Supply (B+)

[HARNESS CONNECTOR]





C30-A
PCM

SCMF16392L

MONITOR DTC STATUS E94C88FB

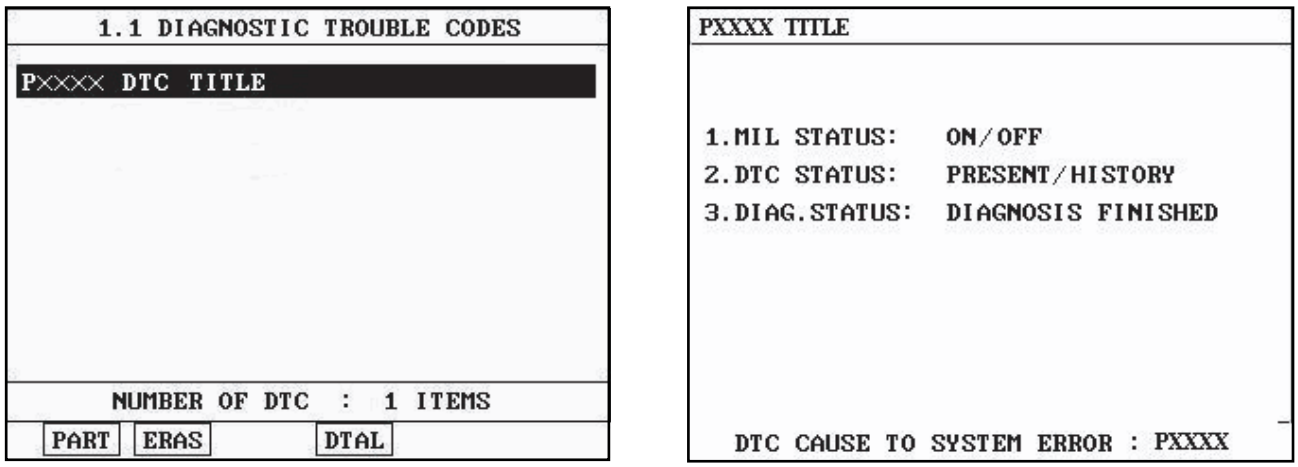
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E6FB52BA

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 E716BEFB

1. Check voltage
   1) IG "OFF".
   2) Disconnect A/C relay connector.
   3) IG "ON" and ENG "OFF"

4) Measure the voltage between terminal 2 of A/C relay harness connector and chassis ground.

5) Measure the voltage between terminal 4 of A/C relay harness connector and chassis ground.

Specification : B+

6) Is the measured voltage normal?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Check the fuse between Battery and A/C relay.
▶ Check Chassis ground 1 and 2 for looseness.
▶ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E771FA95

1. Check short in harness

1) IG "OFF".

2) Disconnect A/C relay and PCM connector.

3) Measure the resistance between terminal 3 of A/C relay harness connector and chassis ground.

Specification : Infinite

4) Is the measured resistance within specification ?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

2. Check open in harness

1) IG "OFF".

2) Disconnect A/C relay and PCM connector.

3) Measure the resistance between terminal 3 of A/C relay harness connector and terminal C30-A (64) of PCM harness connector.

Specification : Approx. below 1Ω

4) Is the measured resistance within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Open in Coil control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E51102A9

1. Check A/C relay

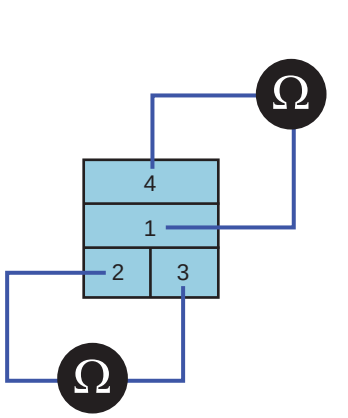
   1) IG "OFF".

   2) Disconnect A/C relay.

   3) Measure the resistance between terminal 2 and 3 of A/C relay.

   4) Measure the resistance between terminal 1 and 4 of A/C relay.

Terminal	Power approval
1~4	NO
2~3	YES (70Ω ~ 120Ω)



1. Power supply to A/C compressor
2. A/C relay control power
3. A/C relay control
4. A/C relay switch power

EFBF936A

   5) Is the measured resistance within specification ?

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 A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E90B3F6D

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0647 A/C CLUTCH RELAY CONTROL CIRCUIT HIGH

GENERAL DESCRIPTION E1B5EB25

Refer to DTC P0646.

DTC DESCRIPTION ECC5A729

PCM monitors inputted voltage through A/C compressor relay. Checking voltage every 10 sec. under detecting condition, if the voltage higher than the specified value is detected for more than 5 sec., PCM sets P0647.

DTC DETECTING CONDITION ECABD7EA

Item	Detecting Condition	Possible cause
DTC Strategy	• Detects circuit short to high voltage	• Poor connection • Short to power in A/C relay circuit • Faulty A/C relay • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • No DTC exists • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Short to power	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E468E9AC

Refer to DTC P0646.

SCHEMATIC DIAGRAM E034F9E5

Refer to DTC P0646.

MONITOR DTC STATUS EB070E3B

Refer to DTC P0646.

TERMINAL AND CONNECTOR INSPECTION E5D3822E

Refer to DTC P0646.

POWER CIRCUIT INSPECTION EEB7A706

1. Check voltage
   1) IG "OFF".
   2) Disconnect A/C relay connector.
   3) IG "ON" and ENG "OFF"
   4) Measure the voltage between terminal 2 of A/C relay harness connector and chassis ground.

5) Measure the voltage between terminal 4 of A/C relay harness connector and chassis ground.

Specification : B+

6) Is the measured voltage normal?

YES

▶ Go to "Control circuit inspection" procedure.

NO

▶ Check the fuse between Battery and A/C relay.
▶ Check Chassis ground 1 and 2 for looseness.
▶ Repair Open or Short to ground in power circuit and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E1F331DD

1. Check short in harness

1) IG "ON".

2) Disconnect A/C relay.

3) Measure the voltage between terminal 3 of A/C relay harness connector and chassis ground.

Specification : Approx. 0V

4) Is the measured voltage within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

▶ Repair Short in Coil control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E2F87DF4

1. Check A/C relay

1) IG "OFF".

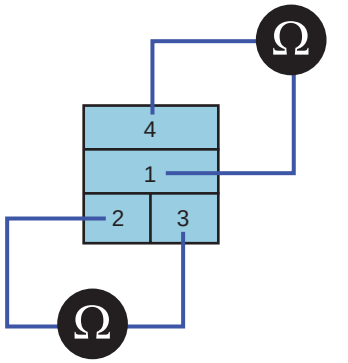
2) Disconnect A/C relay.

3) Measure the resistance between terminal 2 and 3 of A/C relay.

4) Measure the resistance between terminal 1 and 4 of A/C relay.

SPECIFICATION

Terminal	Power approval
1~4	NO
2~3	YES (APPROX. 70Ω ~ 120Ω)



1. Power supply to A/C compressor
2. A/C relay control power
3. A/C relay control
4. A/C relay switch power

EFBF936A

5) Is the measured resistance within specification ?

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 A/C relay and check for proper operation. If the problem is corrected, replace A/C relay and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E1B4FDE5

Refer to DTC P0646.

DTC P0650 MALFUNCTION INDICATOR LAMP(MIL) CONTROL CIRCUIT

GENERAL DESCRIPTION E8471A68

The Malfunction Indicator Lamp (MIL), which is located in the instrument cluster, comes on to notify the driver that there may be a problem with the vehicle and that service is needed. Immediately after the ignition switch turns on, the malfunction indicator lamp is lit to indicate that the MIL operates normally and goes off after starting.

DTC DESCRIPTION E6FE14C0

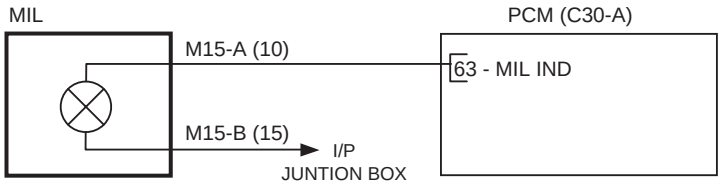
Checking input signal of engine check lamp every 10 sec. under detecting condition, if open, or short to battery or ground is detected for more than 5 sec., PCM sets P0650.

DTC DETECTING CONDITION EC425377

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal low, high	• Poor connection • Open or short in MIL circuit • Faulty MIL • Faulty PCM
Enable Conditions	• After 0.5 sec under conditions below • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short	
Diagnosis Time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL On Condition	• DTC only (NO MIL ON)	

SCHEMATIC DIAGRAM E50746B1

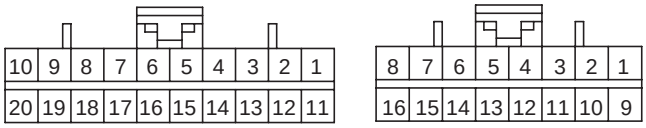
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

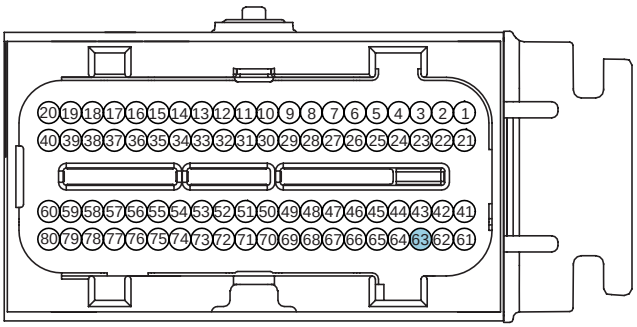
Terminal	Connected to	Function
M15-B (15)	Junction BOX	Power Supply (B+)
M15-A (10)	PCM C30-A (63)	MIL IND

[HARNESS CONNECTOR]



M15-A **M15-B**

INSTRUMENT CLUSTER



C30-A
PCM

SCMF16394L

MONITOR DTC STATUS E3BAD8B2

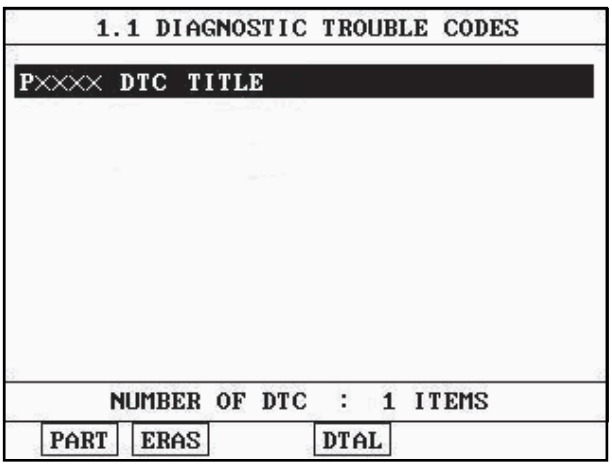
1. Check DTC Status

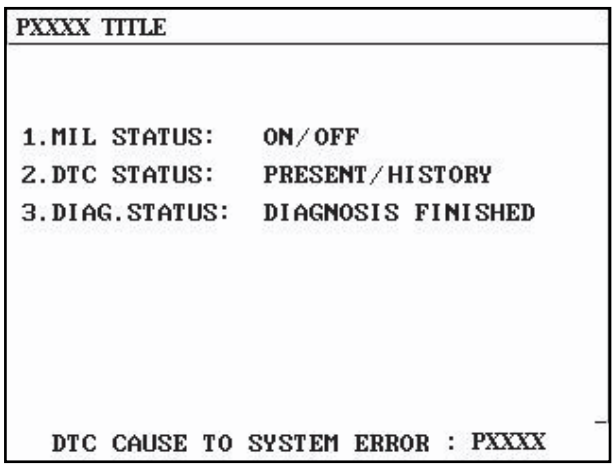
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E6FEECF1

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

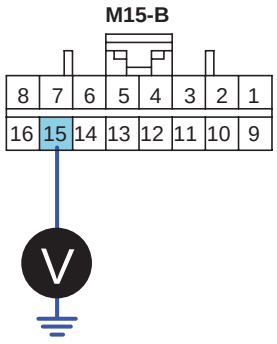
NO

▶ Go to " Power Circuit Inspection " procedure.

POWER CIRCUIT INSPECTION E27E1DEF

1. IG "OFF" and disconnect Instrument cluster connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 15 of instrument cluster harness connector and chassis ground.

Specification : Approx. B+



15. Battery voltage

SCMF16395L

4. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

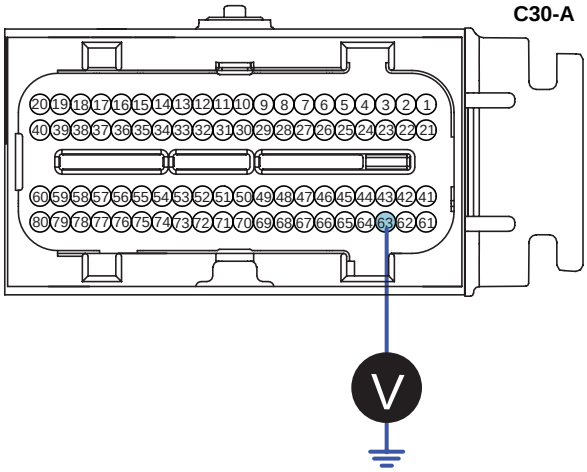
NO

▶ Check fuse between battery and instrument cluster for open or blown-off.
▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E61B233E

1. IG "OFF" and disconnect PCM connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between C30-A (63) of PCM harness connector and chassis ground.

Specification : Approx. B+



SCMF16396L

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check open in Engine warning lamp's filament.
▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E94A91A9

1. Check instrument cluster
   1) IG "OFF"
   2) Substitute with a known - good instrument cluster and check for proper operation.
   3) Does it normally operate after replacement?

YES

▶ Replace instrument cluster and go to "Verification of Vehicle Repair" procedure.

NO

▶ 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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E19DDF35

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0651 SENSOR REFERENCE VOLTAGE "B" CIRCUIT OPEN

GENERAL DESCRIPTION E90B3CC0

The ECM provides a 5volt reference voltage to Throttle Position Sensor 2(TPS2). The ECM monitors reference voltage deviation from the power supply circuit of the sensors.

DTC DESCRIPTION E5E773D1

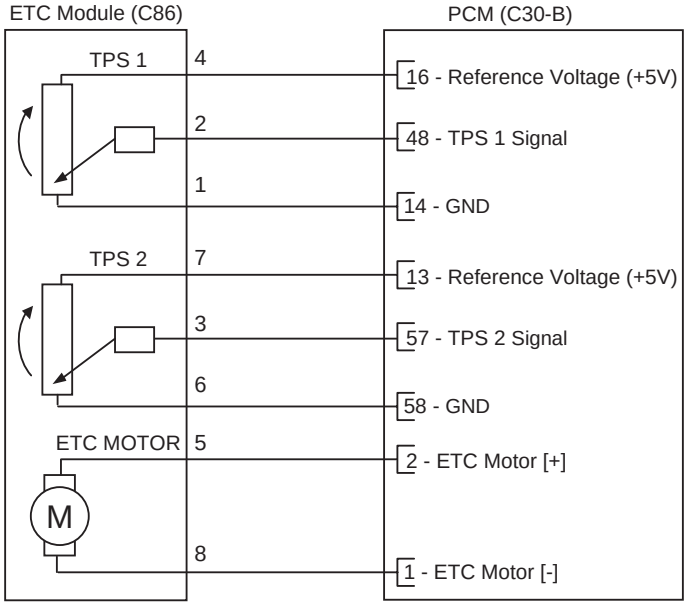
Checking the voltage from sensor power supply every 1.87 sec. under detecting condition, if the value within detecting condition lasts for more than 0.2 sec., PCM sets P0651. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2B19B8E

Item	Detecting Condition	Possible Cause
DTC Strategy	• Sensor reference voltage check	• Short in sensor power supply line • Faulty PCM
Enable Conditions	• IG Key "ON"	
Threshold value	• Sensor supply power 〈 4.5V or 〉 5.5V	
Diagnosis time	• Continuous (More than 0.2 seconds failure for every 1.87 seconds test)	
MIL ON condition	• 2 driving cycles	

SCHEMATIC DIAGRAM EDC1C559

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

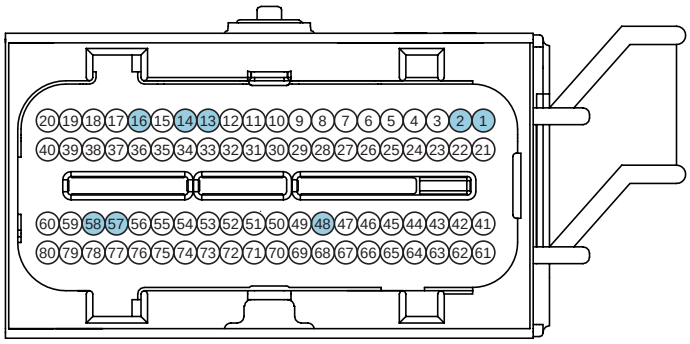
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE



C30-B

PCM

SCMF16101L

MONITOR DTC STATUS E62A3E7B

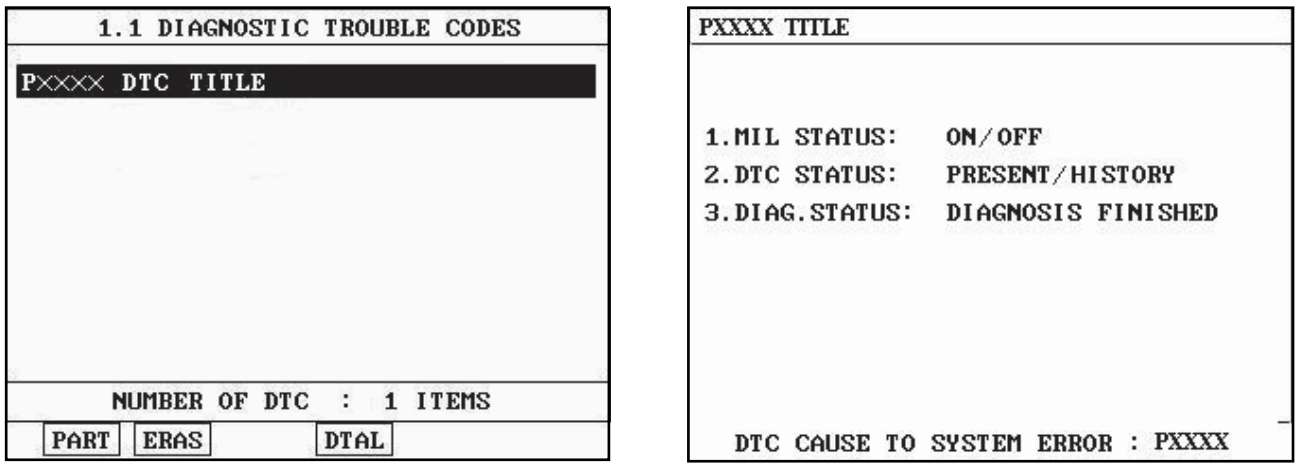
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION ECD1D181

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 E00FDD8B

1. Check voltage
   1) IG "OFF".
   2) Disconnect TPS connector.
   3) IG "ON" and ENG "OFF"

4) Measure the voltage between terminal 7 of TPS harness connector and chassis ground.

Specification : Approx. 5V

5) Is the measured voltage within specification ?

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

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

2. Check short in harness

1) IG "OFF".

2) Disconnect TPS connector and PCM connector.

3) Measure the resistance between terminal 7 and 5 of TPS harness connector.

4) Measure the resistance between terminal 7 and 8 of TPS harness connector.

5) Measure the resistance between terminal 7 and 6 of TPS harness connector.

6) Measure the resistance between terminal 7 and 1 of TPS harness connector.

Specification : Infinite

7) Is the measured resistance within specification ?

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

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

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10 second)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E81DCD4F

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "

5. Are any DTCs present ?

YES

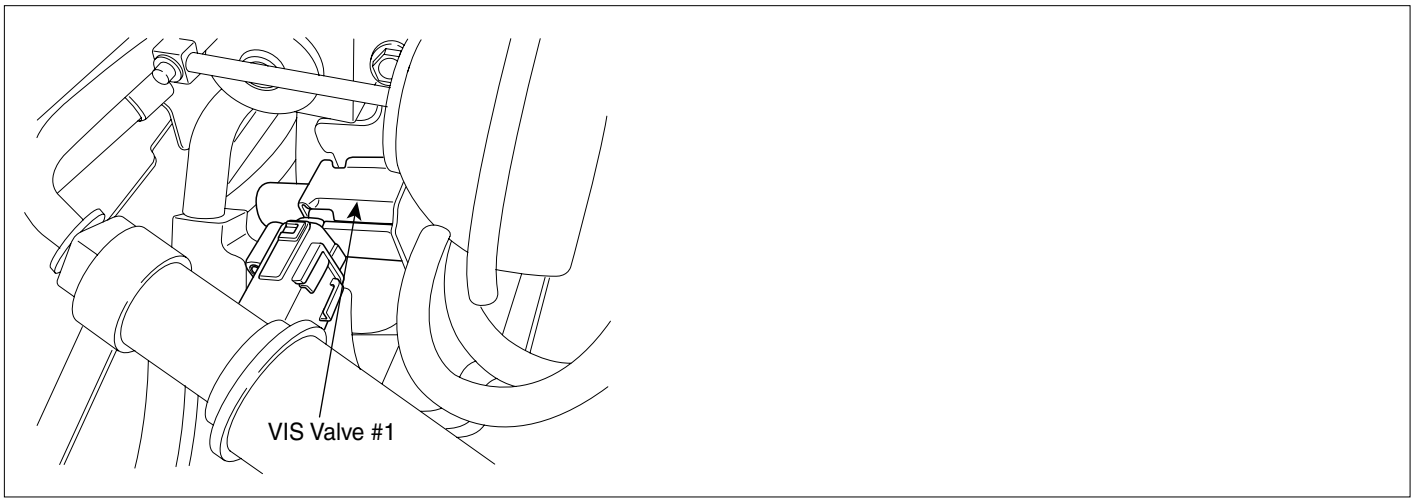
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0660 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT/OPEN (BANK 1)

COMPONENT LOCATION ED18CA5D



LGLG522A

GENERAL DESCRIPTION E049CBFC

VIS(Variable intake system) is a device which varies the length of intake manifold to genetate maximum power at certain RPM. VIS lengthens intake manifold to improve the torque at low RPM when vehicle speed is low while it shortens intake manifold to raise torque at high RPM when vehicle speed is high. PCM controlls VIS using RPM signal.

DTC DESCRIPTION E8779C5F

Checking the output voltage from VIS #1 every 10 sec. under detecting condition, if the value within detecting condition lasts for more than 5 sec., PCM sets P0660. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E2A153B1

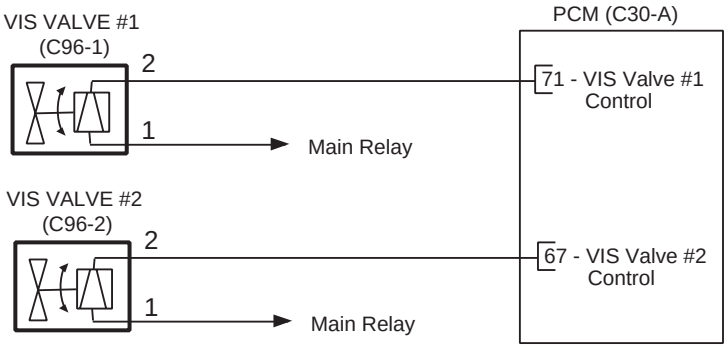
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal low, high	• Poor connection • Open or short in VIS #1 circuit • Faulty VIS #1 • Faulty PCM
Enable condition	• After 0.5 sec under conditions below • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short	
Diagnosis time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION E73DA467

Item	Specification
Coil Resistance (Ω)	32 ± 3Ω [20℃ (68˚F)]

SCHEMATIC DIAGRAM E219059A

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

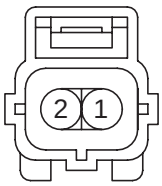
VIS VALVE #1

Terminal	Connected to	Function
1	Main Relay	Battery voltage (B+)
2	PCM C30-A (71)	VIS Valve #1 control

VIS VALVE #2

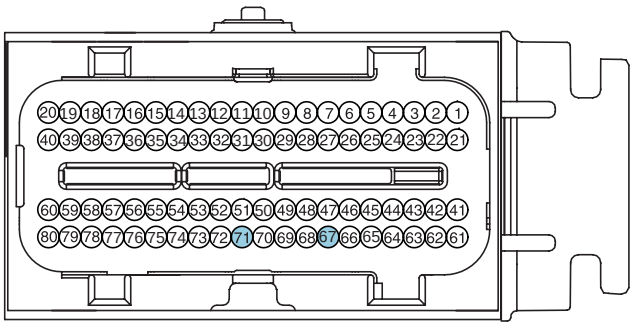
Terminal	Connected to	Function
1	Main Relay	Battery voltage (B+)
2	PCM C30-A (67)	VIS Valve #2 control

[HARNESS CONNECTORS]



C96-1,2

VIS VALVE #1,2



C30-A

PCM

SCMF16121L

MONITOR DTC STATUS ED4CF13B

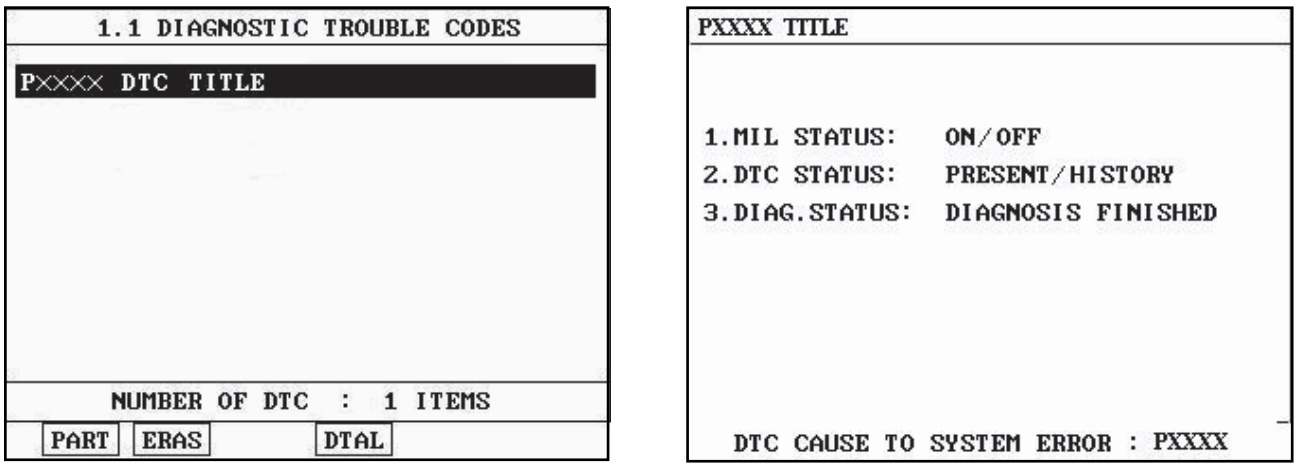
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION ED053940

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 EDD22D0E

1. IG "OFF" and disconnect VIS #1 connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of VIS #1 harness connector and chassis ground.

Specification : Approx. B+

4. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check fuse connected to power of VIS #1 for open or blown-off.
▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E742D31F

1. Check voltage

   1) IG "OFF" and disconnect VIS #1 connector.

   2) IG "ON" and ENG "OFF"

   3) Measure voltage between terminal 2 of VIS #1 harness connector and chassis ground.

Specification : Approx. 2.5V

   4) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

2. Check short in harness

   1) IG "OFF" and disconnect VIS #1 connector and PCM connector.

   2) Measure resistance between terminal 2 of VIS #1 harness connector and chassis ground.

   3) Measure resistance between terminals 1 and 2 of VIS #1 harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

1) IG "OFF" and disconnect VIS #1 connector and PCM connector.

2) Measure resistance between terminal 2 of VIS #1 harness connector and terminal C30-A (71) of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

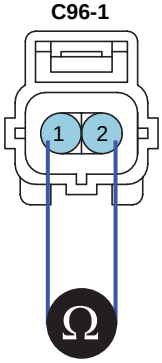
COMPONENT INSPECTION E902D8C9

1. Check VIS #1

1) IG "OFF" and disconnect VIS #1 connector.

2) Measure resistance between terminals 1 and 2 of VIS #1 connector.(Component side)

Specification : 32 ± 3 Ω [20℃(68˚F)]



1. VIS Power
2. VIS Control

SCMF16403L

3) Is the measured resistance within specification?

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 VIS #1 and check for proper operation. If the problem is corrected, replace VIS #1 and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E0A64B5A

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P0663 INTAKE MANIFOLD TUNING VALVE CONTROL CIRCUIT/OPEN (BANK 2)

COMPONENT LOCATION EFCAD4B7



LGLG523A

GENERAL DESCRIPTION ECB5E846

Refer to DTC P0660.

DTC DESCRIPTION E3722C51

Checking the output voltage from VIS #2 every 10 sec. under detecting condition, if the value within detecting condition lasts for more than 5 sec., PCM sets P0663. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E9057D69

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal low, high	• Poor connection • Open or short in VIS #2 circuit • Faulty VIS #2 • Faulty PCM
Enable condition	• After 0.5 sec under conditions below • Engine works • 11V ≤ Battery voltage ≤ 16V	
Threshold value	• Open or short	
Diagnosis time	• Continuous (More than 5 seconds failure for every 10 seconds test)	
MIL ON condition	• 2 driving cycles	

SPECIFICATION E8B478B3

Refer to DTC P0660.

SCHEMATIC DIAGRAM E2689279

Refer to DTC P0660.

MONITOR DTC STATUS E46376D8

Refer to DTC P0660.

TERMINAL AND CONNECTOR INSPECTION E25928CF

Refer to DTC P0660.

POWER CIRCUIT INSPECTION EE80590E

1. IG "OFF" and disconnect VIS #2 connector.
2. IG "ON" and ENG "OFF"
3. Measure voltage between terminal 1 of VIS #2 harness connector and chassis ground.

Specification : Approx. B+

4. Is the measured voltage within specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

▶ Check fuse connected to power of VIS #2 for open or blown-off.
▶ Repair open or short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION E0E6175D

1. Check voltage
   1) IG "OFF" and disconnect VIS #2 connector.
   2) IG "ON" and ENG "OFF"
   3) Measure voltage between terminal 2 of VIS #2 harness connector and chassis ground.

Specification : Approx. 2.5V

   4) Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

2. Check short in harness
   1) IG "OFF" and disconnect VIS #2 connector and PCM connector.
   2) Measure resistance between terminal 2 of VIS #2 harness connector and chassis ground.

3) Measure resistance between terminals 1 and 2 of VIS #21 harness connector.

Specification : Infinite

4) Is the measured resistance within specification?

YES

▶ Go to "Check open in harness" as follows.

NO

▶ Repair short in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

1) IG "OFF" and disconnect VIS #2 connector and PCM connector.

2) Measure resistance between terminal 2 of VIS #2 harness connector and terminal C30-A (67) of PCM harness connector.

Specification : Below 1Ω

3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

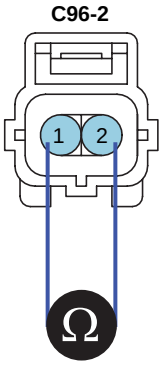
COMPONENT INSPECTION EBB1C557

1. Check VIS #2

1) IG "OFF" and disconnect VIS #2 connector.

2) Measure resistance between terminals 1 and 2 of VIS #2 connector.(Component side)

Specification : 32 ± 3 Ω [20℃(68˚F)]



1. VIS Power
2. VIS Control

SCMF16408L

3) Is the measured resistance within specification?

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 VIS #2 and check for proper operation. If the problem is corrected, replace VIS #2 and go to "Verification of Vehicle Repair" procedure.

NOTE

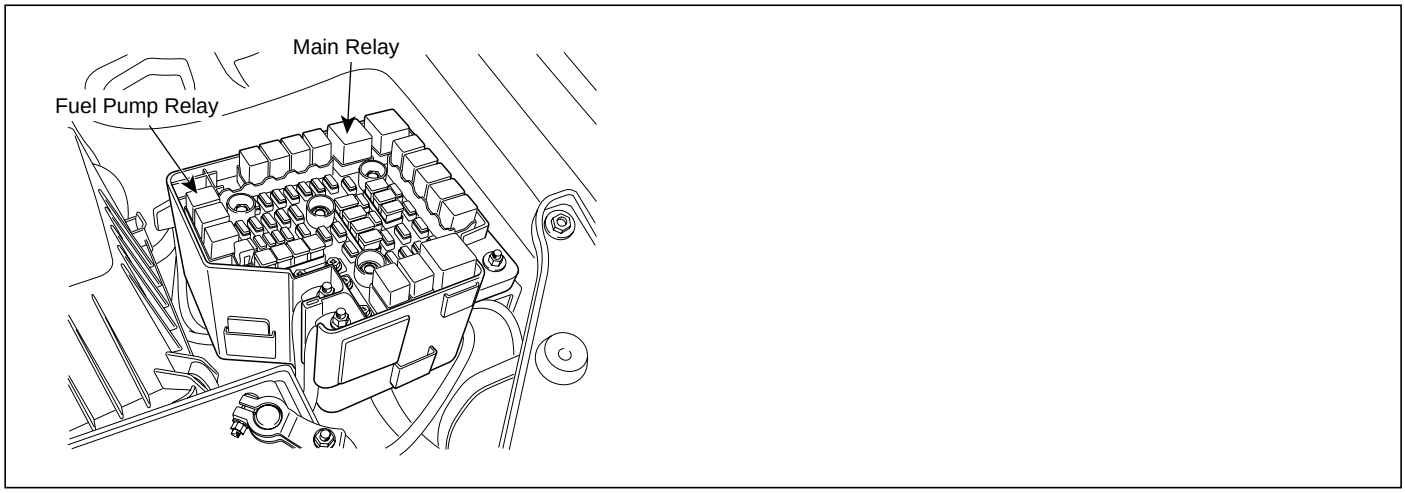
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. After testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E121C656

Refer to DTC P0660.

DTC P0685 ECM/PCM POWER RELAY CONTROL CIRCUIT /OPEN

COMPONENT LOCATION E032C31A



SCMF16254L

GENERAL DESCRIPTION E8B88C29

The ECM provides ground to one side of the coil of the main relay and the other side is connected to the battery. The ECM monitors battery voltage and the voltage after the main relay.

DTC DESCRIPTION E931EEBC

Checking the contolling state of main relay every 10 sec. under detecting condition, if open or short in the circuit is detected for more than 5 sec., PCM sets P0685.

DTC DETECTING CONDITION ED8CA705

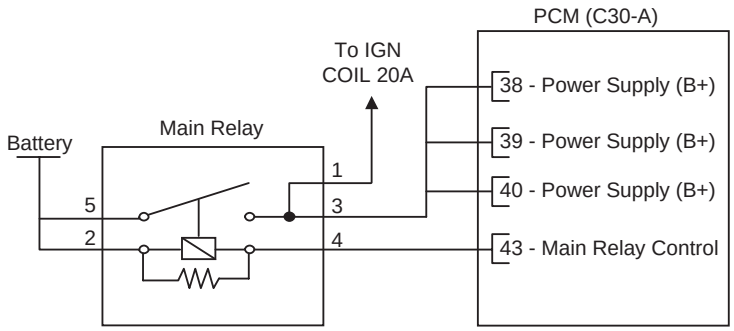
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects a short to ground, to battery or open circuit on Main Relay output Fault information provided by an output driver chip.	• Poor Connection • Open or short in control circuit. • Main Relay • PCM
EnableConditions	• Engine Running • 11V ≤ Ignition Voltage ≤ 16V • Enable Time delay ≥ 0.5sec.	
Threshold value	• Open or Short	
DiagnosisTime	• Contineous (More than 5sec. Failure for every 10 sec. test)	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E9BBD35F

Coil Resistance
70Ω ~ 120Ω

SCHEMATIC DIAGRAM EDE659D9

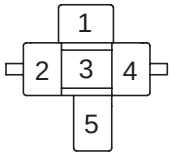
[CIRCUIT DIAGRAM]



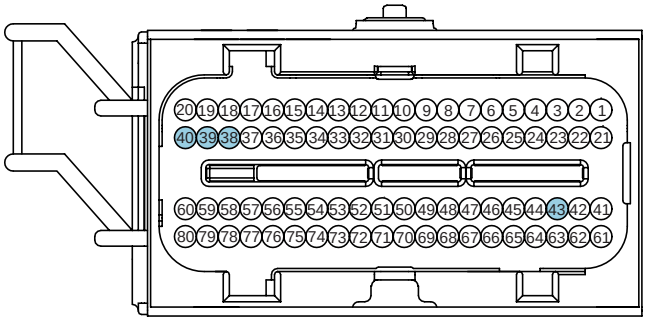
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	IGN COIL 20A	Power Supply (B+)
2	Battery	Battery Power (B+)
3	PCM C30-A (38)	Power Supply (B+)
	PCM C30-A (39)	
	PCM C30-A (40)	
4	PCM C30-A (43)	Main Relay Control
5	Battery	Battery Power (B+)

[HARNESS CONNECTOR]



Main Relay



C30-A
PCM

SCMF16377L

MONITOR DTC STATUS EFABA80E

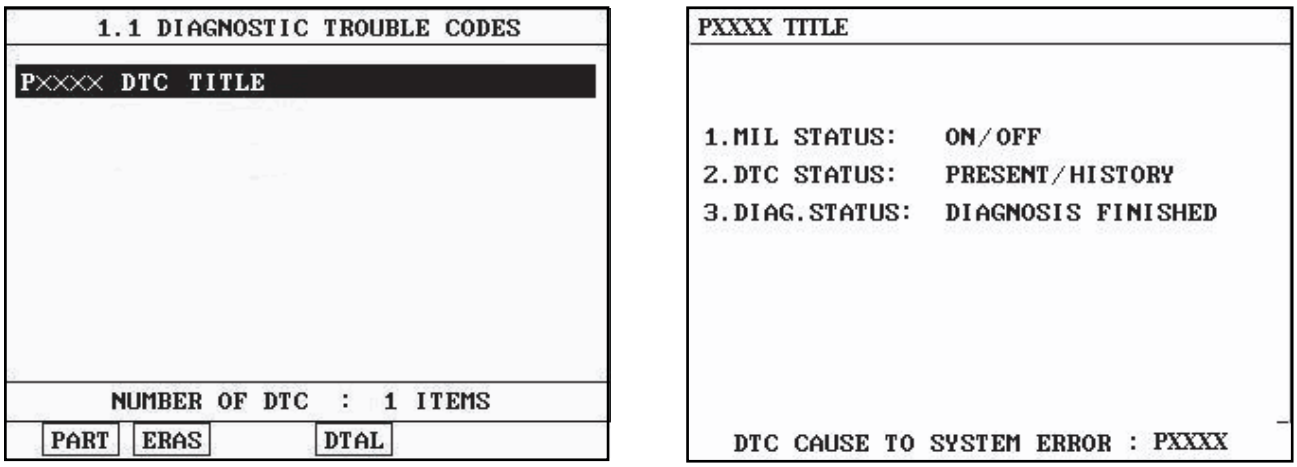
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E746E19E

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 INSEPCTION EDD8F603

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

5. Measure voltage between harness terminal 5 of Main Relay and chassis ground.

Specification : B+

6. Is the measured voltage within specification ?

YES

▶ Go to "Control Circuit Inspecition" procedure.

NO

▶ Check fuse between battery and main relay is disconnected.
▶ Repair or replace open or short in harness and then go to "Verification of Vehicle Repair" procedure.

CONTROL CIRCUIT INSPECTION EFF0D404

1. Check short in coil control

   1) IG "OFF".

   2) Disconnect Main Relay and PCM connector.

   3) Measure resistance between harness terminal 4 and chassis ground.

   4) Measure resistance between harness terminal 4 and 5 of Main Relay.

Specification : Infinite

   5) Is the measured resistance within specification ?

YES

▶ Go to "Check open in coil control" as follows.

NO

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

2. Check open in coil control

   1) IG "OFF".

   2) Disconnect Main Relay and PCM connector.

   3) Measure resistance between harness terminal 4 of Main Relay and harness terminal C30-A (43) of PCM harness connector.

Specification : Approx. below 1Ω

   4) Is the measured resistance within specifications ?

YES

▶ Go to "Component Inspection" procedure.

NO

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

COMPONENT INSPECTION E3822814

1. Check Main Relay

   1) IG "OFF"

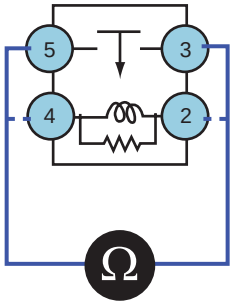
   2) Disconnect Main Relay

   3) Measure resistance between terminal 5 and 3 of Main Relay

   4) Measure resistance between terminal 4 and 2 of Main Relay.

SPECIFICATION :

Terminal	continuity
3 ~ 5	NO
2 ~ 4	YES (Approx. 70Ω ~ 120Ω)



EGRF957A

   5) Is the measured reisistance within specification ?

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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.

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.

VERIFICATION OF VEHICLE REPAIR EDA192E3

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

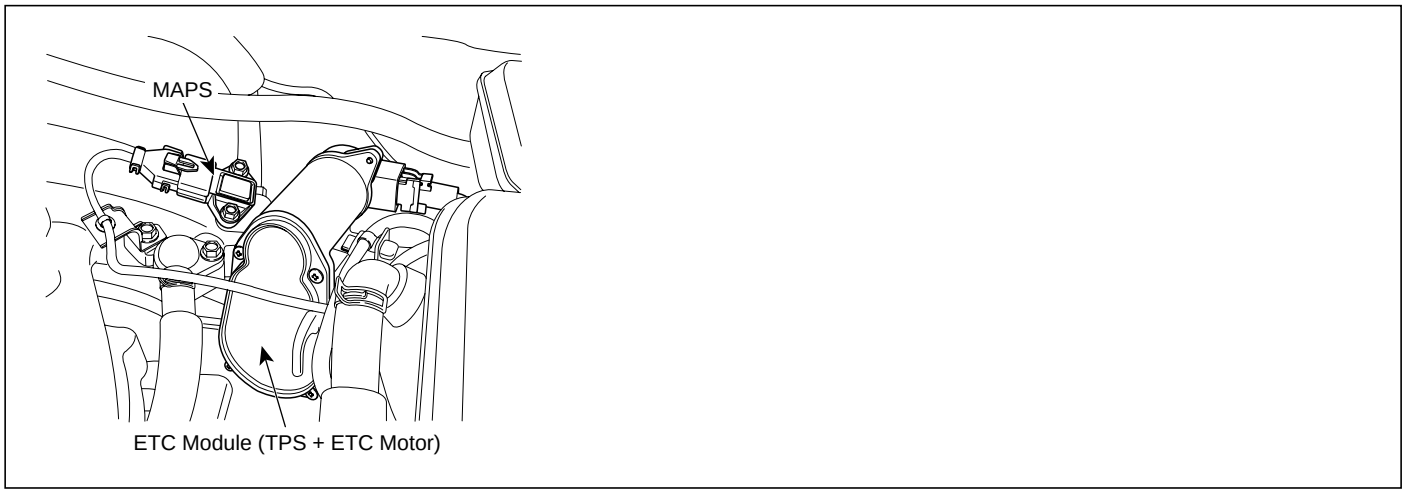
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P CONTROL MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT SHORT - INTERMITTENT HIGH INPUT

COMPONENT LOCATION EA2D644F



SCMF16192L

GENERAL DESCRIPTION E944F092

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 also 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 outputted by the transformation of diagphragm according to the change of pressure inside of intake manifold.

DTC DESCRIPTION EDFAE6EB

Checking output signals of MAPS every 60 sec. under detecting condition, if an output signal is above 4.5V for more than 2 sec., PCM sets P1106.

DTC DETECTING CONDITION E75C117E

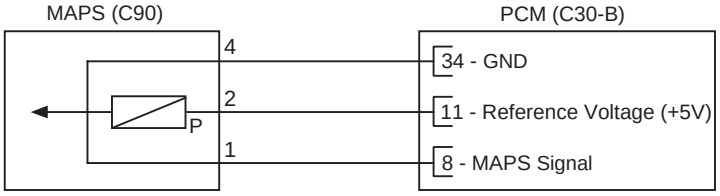
Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent short to high in either the signal circuit or the MAP sensor	• Poor connection • Short to battery in signal circuit • Open in ground circuit • Faulty MAPS • Faulty PCM
Enable-Condi-tions	Case 1	• No TPS Active Fault Present • No TPS Short Fail Criteria Met • Engine Speed 〈 2500rpm • Throttle Position ≤ 30%	
	Case 2	• No TPS Active Fault Present • No TPS Short Fail Criteria Met • Engine Speed 〉 2500rpm • Throttle Position 〉 40%	
Threshold value		• MAP signal 〉 4.5V	
Diagnosis Time		• Continuous (More than 2 sec. failure for every 60 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SPECIFICATION E4530A26

Pressure(kPa)	20	35	60	95	101.32
Voltage(V)	0.789	1.382	2.369	3.75	4
Allowable error(V)	± 0.045				

SCHEMATIC DIAGRAM E75BE5E6

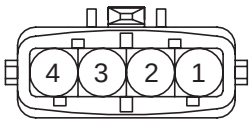
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

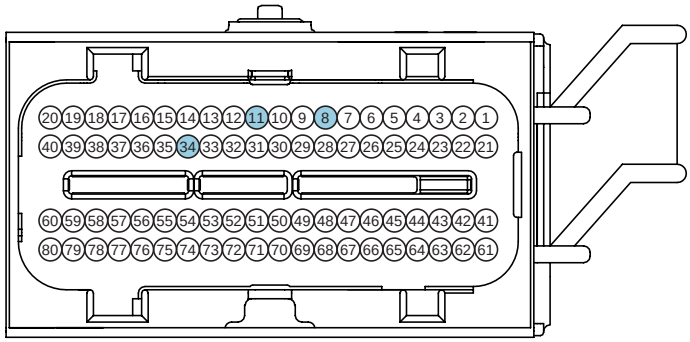
Terminal	Connected to	Function
1	PCM C30-B (8)	MAPS Signal
2	PCM C30-B (11)	Reference Voltage (+5V)
3	-	-
4	PCM C30-B (34)	Sensor ground

[HARNESS CONNECTORS]



C90

MAPS

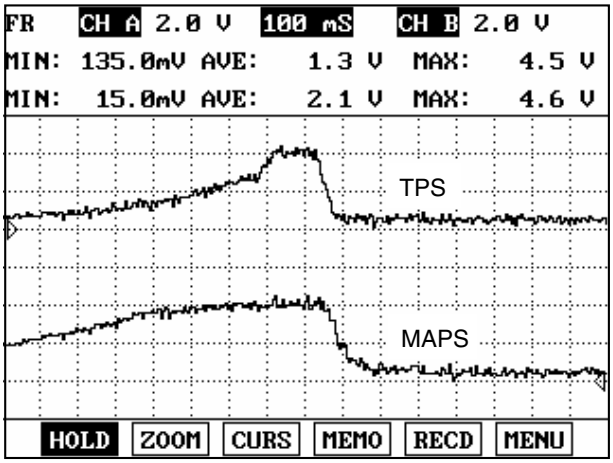


C30-B

PCM

SCMF16105L

SIGNAL WAVEFROM AND DATA ED735DEE



EGRF603X

omparing MAPS and TPS, signals of MAPS and TPS increasess and decrease simultaneously.

MONITOR DTC STATUS E9765A45

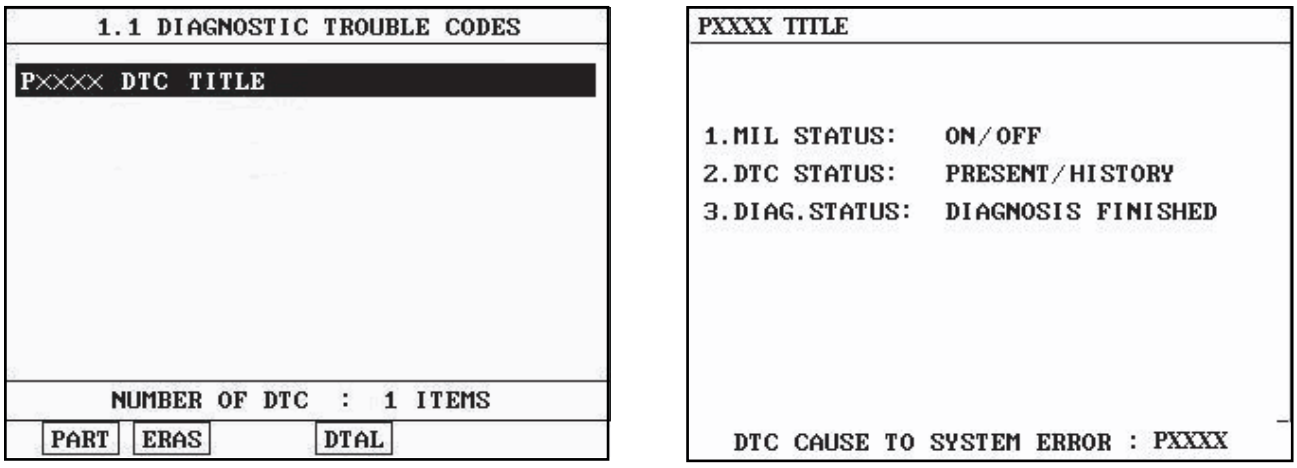
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E76D2E43

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

NO

▶ Go to "Power Circuit Inspection" procedure.

POWER CIRCUIT INSPECTION ECD3BC60

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

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ If the voltage is over 5.1V, check short to battery in harness.
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E0628D5D

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

Specification : "A" - "B" = : Approx. below 200mV

6. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair contact reistance or open in harness and then go to "Verification of Vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION EF6F1F34

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

Specification : Infinite

4. Is the measured resistance within specification ?

YES

▶ Go to "Component inspection" procedure.

NO

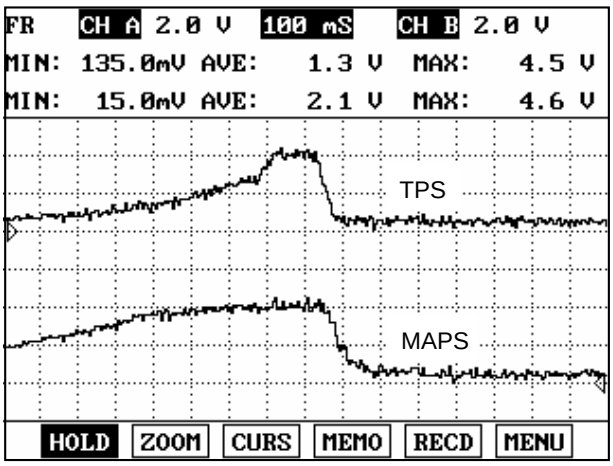
▶ Repair short to battery in harness and then go to "Verification of Vehicle Repair" procedure.

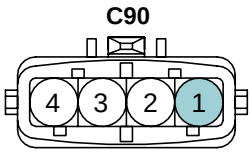
COMPONENT INSPECTION E22196FB

1. MAPS performance test
   1) IG "OFF"
   2) Connect scantool to Data Link Connector(DLC) and select "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating
   3) Start engine and monitor signal waveform during accelleration and decelleration.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16197L

4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

▶ Go to "Check PCM".

NO

▶ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

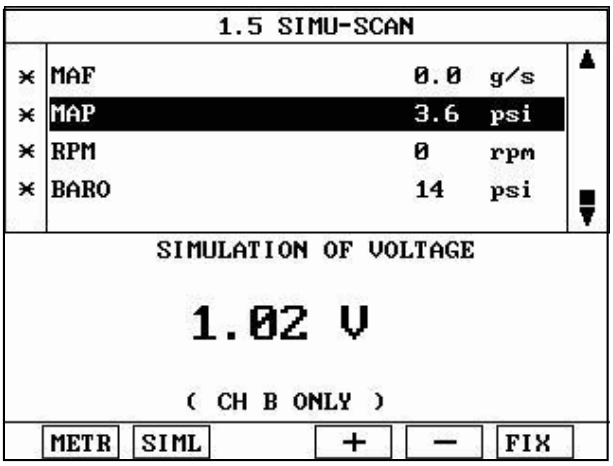
2. Check PCM

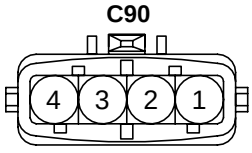
1) IG "OFF" and disconnect MAPS connector.

2) Connect scantool and IG "ON" & ENG "OFF"

3) Select simulation function on scantool.

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





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16198L

5) Does the output voltage response to the change of signal by simulation?

YES

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

NO

▶ 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.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E2F62850

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1107 MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT SHORT - INTERMITTENT LOW INPUT

COMPONENT LOCATION E5265DAD

Refer to DTC P1106.

GENERAL DESCRIPTION E1649484

Refer to DTC P1106.

DTC DESCRIPTION EA745EA1

Checking output signals of MAPS every 60 sec. under detecting condition, if an output signal is below 0.25V for more than 2 sec., PCM sets P1107.

DTC DETECTING CONDITION EBDC59F1

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent short to low or open in either the signal circuit or the MAP	• Poor Connection • Open or Short to ground in Power Circuit • Open or short to ground in Signal Circuit. • Faulty MAPS • Faulty PCM
Enable Condi-tions	Case 1	• No TPS Active Fault Present • No TPS Short Fail Criteria Met • Ignition Voltage ≥ 11V • Engine Speed 〈 1000rpm • Throttle Position ≤ 0%	
	Case 2	• No TPS Active Fault Present • Ignition Voltage ≥ 11V • Engine Speed 〉 1000rpm • Throttle Position 〉 30%	
Threshold value		• MAP signal 〈 0.25V	
Diagnosis Time		• Continuous (More than 2 sec. failure for every 60 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SPECIFICATION EB133088

Refer to DTC P1106.

SCHEMATIC DIAGRAM E4D4E2C8

Refer to DTC P1106.

SIGNAL WAVEFORM AND DATA EB5BF0EA

Refer to DTC P1106.

MONITOR DTC STATUS EE990409

Refer to DTC P1106.

TERMINAL AND CONNECTOR INSPECTION E1AD95A0

Refer to DTC P1106.

POWER CIRCUIT INSPECTION EC3C4E38

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

Specification : Approx. 5V

5. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" of MAPS.

NO

▶ After repairing open or short to ground in harness and go to "Verification of Vehicle Repair"

SIGNAL CIRCUIT INSPECTION E46CA26A

1. Check short to ground in harness
   1) IG "OFF"
   2) Disconnect MAPS and PCM connector.
   3) Measure the resistance between terminal 1 of MAPS harness connector and ground.

Specification : Infinite

   4) Is the measured resistance within the specification?

YES

▶ Go to "Check open in the harness" of MAPS.

NO

▶ After repairing short to ground in circuits and go to "Verification of Vehicle Repair"

2. Check open in the harness
   1) IG "OFF"
   2) Disconnect MAPS and PCM connector.
   3) Measure the resistance between terminal 1 of MAPS harness connector and terminal C30-B (8) of PCM harness connector

Specification : Approx. below 1 Ω

4) Is the measured resistance within the specification?

YES

▶ Go to "Component Inspection" of MAPS.

NO

▶ Repair open in the harness and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION EFD44281

1. MAPS performance test

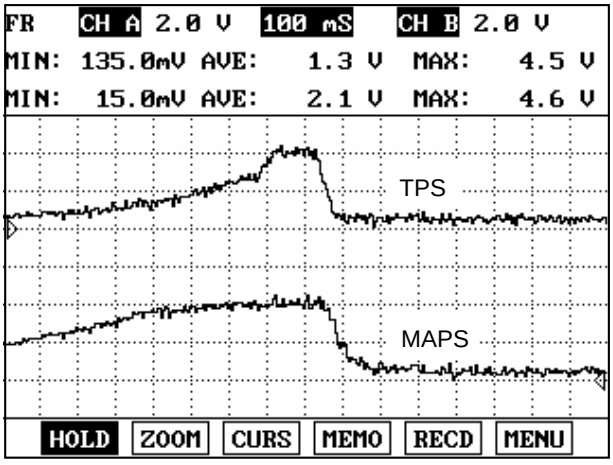
1) IG "OFF"

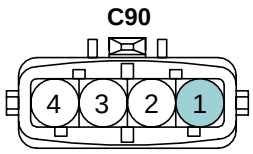
2) Connect scantool to Data Link Connector(DLC) and select "Oscilloscope" then, connect probes to output signal lines of MAPS and TPS.Turn engine "ON" and monitor the waveforms accelerating or decelerating

3) ENG "ON" and monitor signal waveform during accelleration and decelleration.

SPECIFICATON :

Pressure (kPa)	20	35	60	95	101.32
Voltage (V)	0.789	1.382	2.369	3.75	4
Tolerance (V)	± 0.045				





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16197L

4) Is the waveform displayed correctly?(Compare the response time of TPS and MAPS)

YES

▶ Go to "Check PCM".

NO

▶ After replacing MAPS with new one, if it operates normally, replace MAPS and go to "Verification of Vehicle Repair".

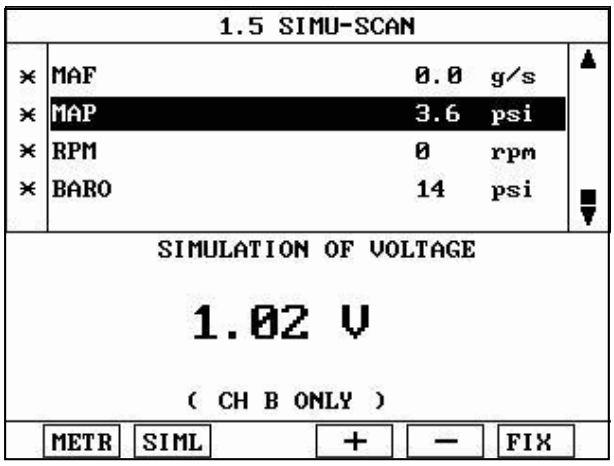
2. Check PCM

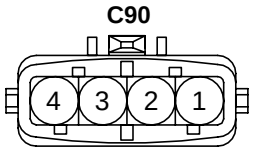
   1) IG "OFF" disconnect MAPS connector

   2) Connect Scantool and IG "ON" & ENG "OFF"

   3) Select simulation function on scantool.

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





1. MAPS Signal
2. MAPS Power
3. -
4. MAPS Ground

SCMF16198L

   5) Does the output voltage response to the change of signal by simulation?

YES

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

NO

▶ 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.

NOTE

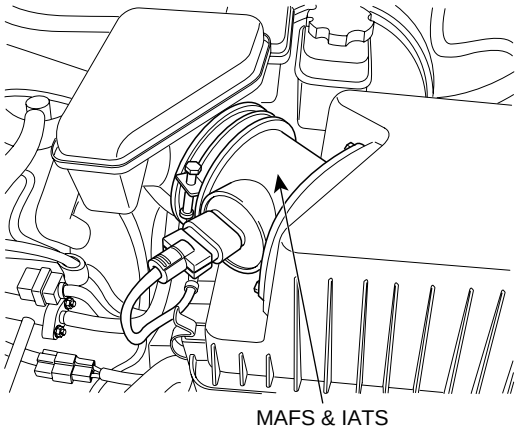
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

VERIFICATION OF VEHICLE REPAIR E478E394

Refer to DTC P1106.

DTC P1111 INTAKE AIR TEMPERATURE SENSOR CIRCUIT SHORT - INTERMITTENT HIGH INPUT

COMPONENT LOCATION EF01B093



SCMF16185L

GENERAL DESCRIPTION E0E1407B

The Intake Air Temperature Sensor (IATS) is installed into the Mass Air Flow Sensor (MAFS). The IATS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the IATS decreases as the temperature increases, and increases as the temperature decreases. The 5 V power source in the ECM is supplied to the IATS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the IATS are connected in series. When the resistance value of the thermistor in IATS changes according to the intake air temperature, the signal voltage also changes. Using this signal, the information of the intake air temperature, the ECM corrects basic fuel injection duration and ignition timing.

DTC DESCRIPTION E0F8336B

Checking output signals of IATS every 120 sec. under detecting condition, if an ouput signal is over 4.9V for more than 4 sec., PCM sets P1111.

DTC DETECTING CONDITION E1AFC8CB

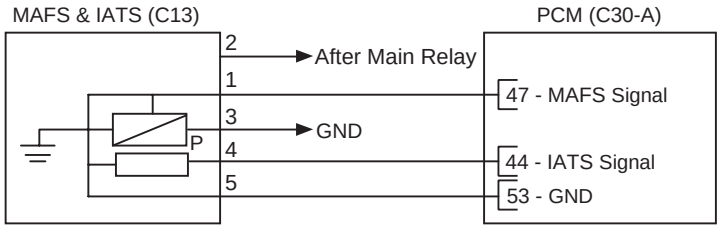
Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to high in either the signal circuit or the sensor	• Poor Connection • Open or short in signal circuit • Open in ground circuit • Faulty IATS • Faulty PCM
Enable Condi-tions	Case 1	• No VSS Fault Active (No P0501) • No Coolant Short Active Fault Present • No MAF Active Fault Present • Engine Air Flow 〈 15 g/s • Vehicle Speed 〈 25kph • Engine Coolant Temperature 〉 50℃(122 °F) • Engine Running Time 〉 120 sec.	
	Case 2	• No VSS Fault Active (No P0501) • No Coolant Short Active Fault Present • No MAF Active Fault Present • Engine Air Flow 〈 15 g/s • Vehicle Speed 〈 25kph • Ignition off time 〉 360 min. • Engine Coolant Temperature 〉 -10℃(14 °F) • Engine Running	
Threshold value		• IATS signal 〉 4.9V	
Diagnosis Time		• Continuous (More than 4 sec. failure for every 120 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SPECIFICATION ED73A718

Temp. (℃/°F)	Resistance (kΩ)	Temp. (℃/°F)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34

SCHEMATIC DIAGRAM E43D15D8

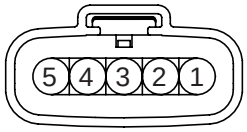
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

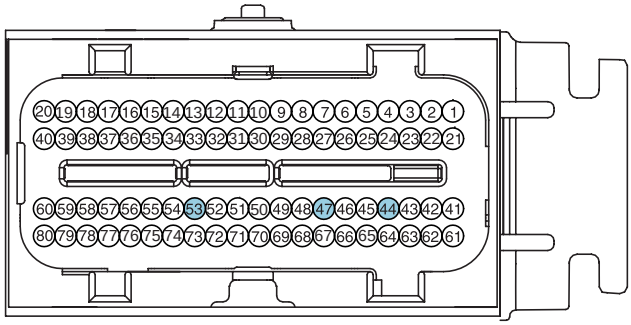
Terminal	Connected to	Function
1	PCM C30-A (47)	MAFS Signal
2	Main Relay	Battery Voltage (B+)
3	Chassis Ground	Ground
4	PCM C30-A (44)	IATS Signal
5	PCM C30-A (53)	Sensor Ground

[HARNESS CONNECTORS]



C13

MAFS & IATS

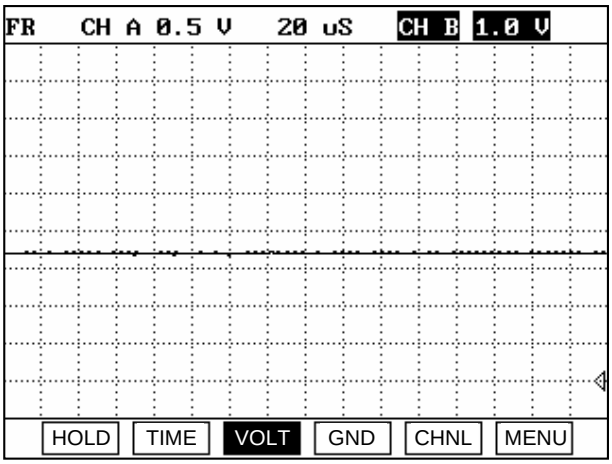


C30-A

PCM

SCMF16104L

SIGNAL WAVEFORM AND DATA E1E6FAE0



EGRF604E

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS EA02AEA0

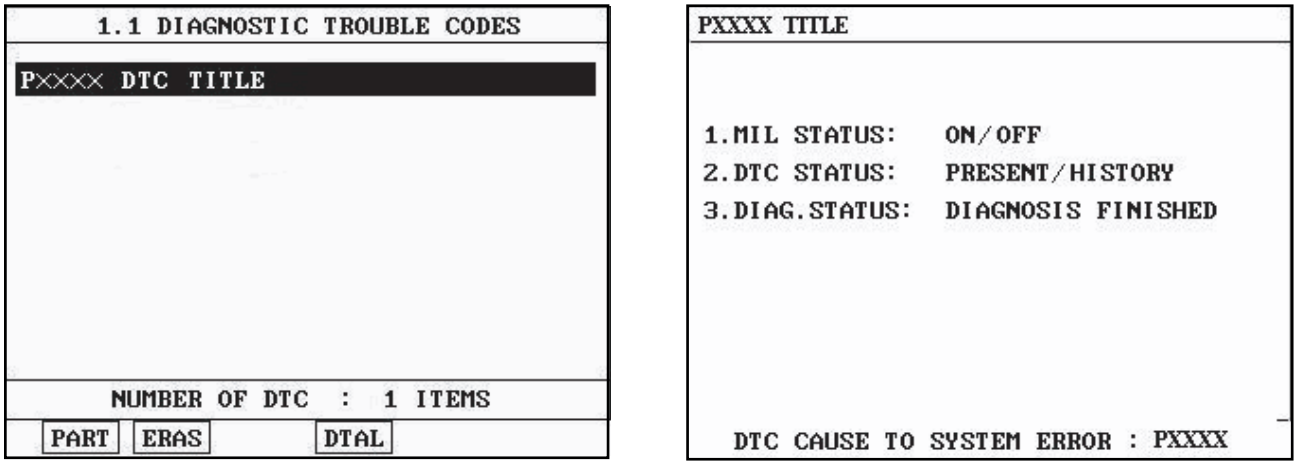
1. Check DTC Status

    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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E84E251C

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 EFB4B430

1. Check voltage

   1) IG "OFF" and disconnect IATS connector.

   2) IG "ON" and ENG "OFF"

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ If the voltage is 0V, go to "Check open in harness" as follows. If the voltage is more than 5.1V, go to "Check short to battery in harness" as follows.

2. Check short to battery in harness

   1) IG "OFF" and disconnect IATS connector and PCM connector.

   2) Measure resistance between terminals 2 and 4 of IATS harness connector.

   3) Measure resistance between terminals 1 and 4 of IATS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

   1) IG "OFF" and disconnect IATS connector and PCM connctor.

   2) Measure resistance between terminal 4 of IATS harness connector and C30-A (44) of PCM harness connector.

Specification : below 1Ω

   3) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EBAC49D2

1. IG "OFF" and disconnect IATS connector.
2. Measure voltage between terminal 4 of IATS harness connector and chassis ground.
3. Measure voltage between terminals 4 and 5 of IATS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.



SCMF16203L

4. Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

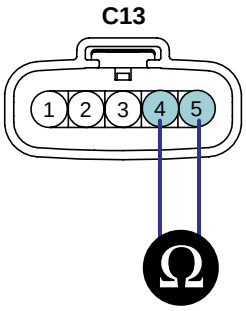
▶ Repair contact resistance or open in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EABFAED3

1. Check IATS
   1) IG "OFF" and disconnect IATS connector.
   2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16204L

3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" 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.

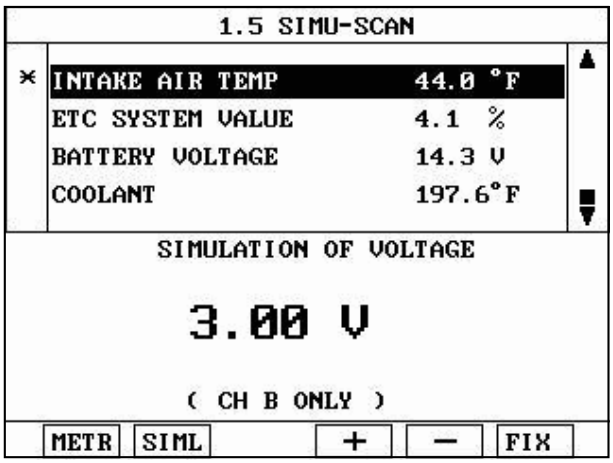
2. Check PCM

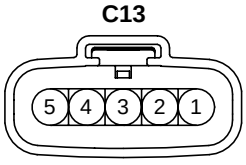
1) IG "OFF" and connect scantool.

2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 4 of IATS harness connector.





1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16205L

5) Does the signal value of IAT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E33673FE

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1112 INTAKE AIR TEMPERATURE SENSOR CIRCUIT SHORT - INTERMITTENT LOW INPUT

COMPONENT LOCATION EE64C5F4

Refer to DTC P1111.

GENERAL DESCRIPTION E1876C90

Refer to DTC P1111.

DTC DESCRIPTION E8A6F59D

Checking output signals of IATS every 20 sec. under detecting condition, if an ouput signal is below 0.1V for more than 10 sec., PCM sets P1112.

DTC DETECTING CONDITION EB10DA7C

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a continuous short to ground in either the signal circuit or the sensor	• Poor Connection • Short to ground in signal circuit. • Faulty IATS • Faulty PCM
Enable Condi-tions	Case 1	• Engine Run State • No VSS Fault Active • Vehicle Speed 〉 50kph(31mph) • IAT Short Low Enable Criteria Met	
	Case 2	• Engine Running Time 〉 120sec. • IG "OFF" time 〉 360min. • IAT Short Low Enable Criteria Met	
Threshold value		• IATS signal 〈 0.1V	
Diagnosis Time		• Continuous (More than 10 sec. failure for every 20 sec. test)	
MIL On Condition		• DTC only	

SPECIFICATION E8D6E9DC

Refer to DTC P1111.

SCHEMATIC DIAGRAM EF759E70

Refer to DTC P1111.

SIGNAL WAVEFORM AND DATA E01DD8F1

Refer to DTC P1111.

MONITOR DTC STATUS EF79ACC8

Refer to DTC P1111.

TERMINAL AND CONNECTOR INSPECTION E58ED658

Refer to DTC P1111.

SIGNAL CIRCUIT INSPECTION EF4CCDA1

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Go to " Check short to ground in harness" procedure.

2. Check short to ground in harness
   1) IG "OFF" and disconnect IATS connector and PCM connector.
   2) Measure resistance between terminal 4 of IATS harness connector and chassis ground.
   3) Measure resistance between terminals 4 and 5 of IATS harness connector.
   4) Measure resistance between terminals 4 and 3 of IATS harness connector.

Specification : Infinite

   5) Is the measured resistance within specification?

YES

▶ Go to "Component inspection" procedure.

NO

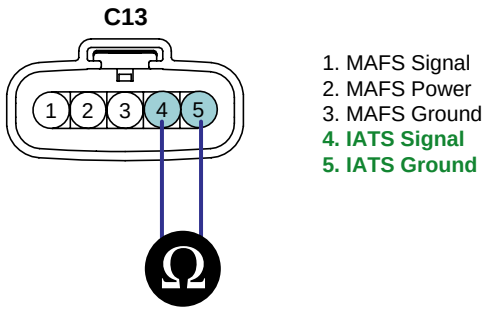
▶ Repair short to ground in harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E57797EC

1. Check IATS
   1) IG "OFF" and disconnect IATS connector.
   2) Measure resistance between teminals 4 and 5 of IATS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	95.95 ~ 105.78	20(68)	3.42 ~ 3.61
-20(-4)	27.4 ~ 29.77	40(104)	1.43 ~ 1.5
0(32)	9.08 ~ 9.72	60(140)	0.66 ~ 0.69
10(50)	5.49 ~ 5.83	80(176)	0.33 ~ 0.34



1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16204L

3) Is the measured resistance within specification ?

YES

▶ Go to "Check PCM" 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.

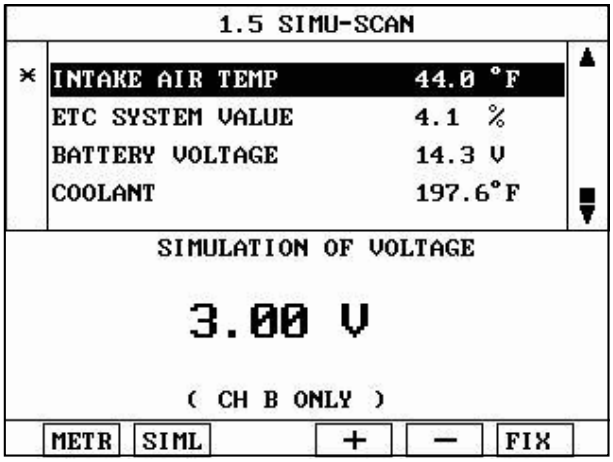
2. Check PCM

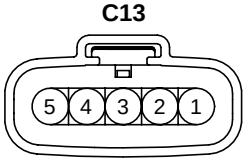
1) IG "OFF" and connect scantool.

2) Disconnect IATS connector and connect probe to terminal 4 of IATS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 4 of IATS harness connector.





1. MAFS Signal
2. MAFS Power
3. MAFS Ground
4. IATS Signal
5. IATS Ground

SCMF16205L

5) Does the signal value of IAT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

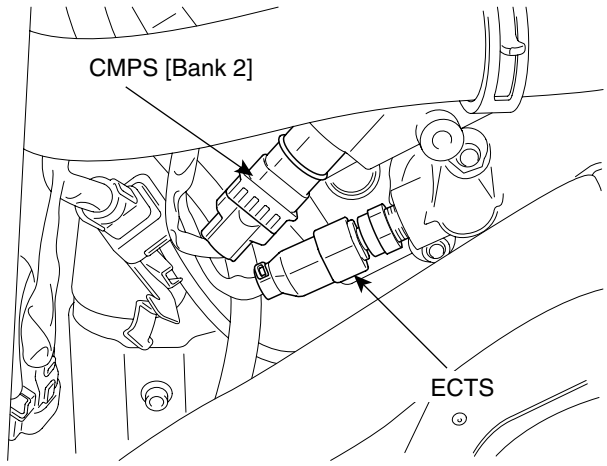
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EAB20578

Refer to DTC P1111.

DTC P1114 ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT INTERMITTENT LOW INPUT

COMPONENT LOCATION E5C90ED0



LGLG510A

GENERAL DESCRIPTION ED9EA229

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

DTC DESCRIPTION E3E7E1FA

Checking output signals from ECTS every 120 sec. under detecting condition, if an output signal is below 0.1V for more than 4 sec., PCM sets P1114.

DTC DETECTING CONDITION EB0C21F2

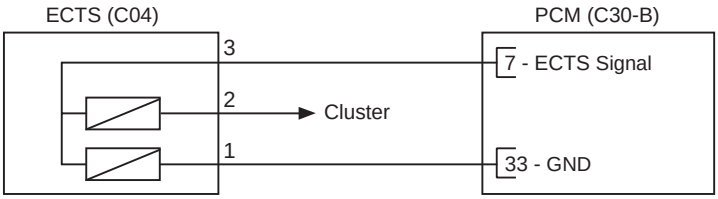
Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent short to ground in the signal circuit or the sensor	• Poor Connection • Short to ground in signal Circuit • Faulty ECTS • Faulty PCM
Enable Conditions	Case 1	• Engine Running Time 〉 120sec.	
	Case 2	• Soak Time 〉 360min. • Engine Running	
Threshold value		• Coolant signal 〈 0.1V	
Diagnosis Time		• Continuous (More than 4 sec. failure for every 120 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SPECIFICATION E44D6B52

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		

SCHEMATIC DIAGRAM E3EDDA96

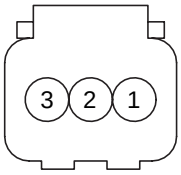
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

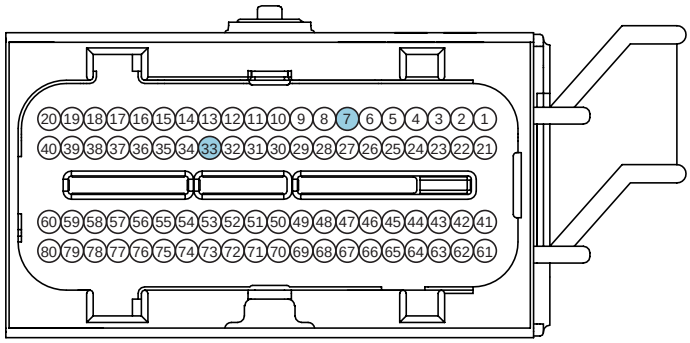
Terminal	Connected to	Function
1	PCM C30-B (33)	Sensor ground
2	Cluster	-
3	PCM C30-B (7)	ECTS Signal

[HARNESS CONNECTORS]



C04

ECTS

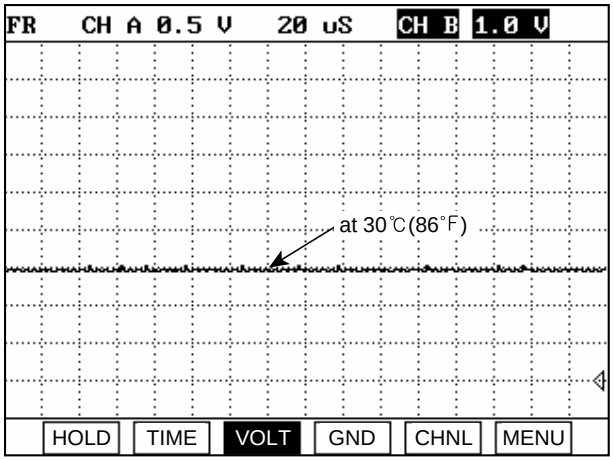


C30-B

PCM

SCMF16106L

SIGNAL WAVEFORM AND DATA E667E278



EGRF604P

The output signals of IATS & ECTS change smoothly without any rapid changes. Those have almost same characteristic signal during the early period after start. It means that the temperatures of intake air and engine coolant are depended on

the temperature of atmosphere. Meanwhile, during the warming up, the output signal of ECTS is going up increasingly. but, the output signal of IATS changes a little bit. even it may not change almost. It means that the heat of engine does not affect on the temperature of intake air.

MONITOR DTC STATUS EF86F17F

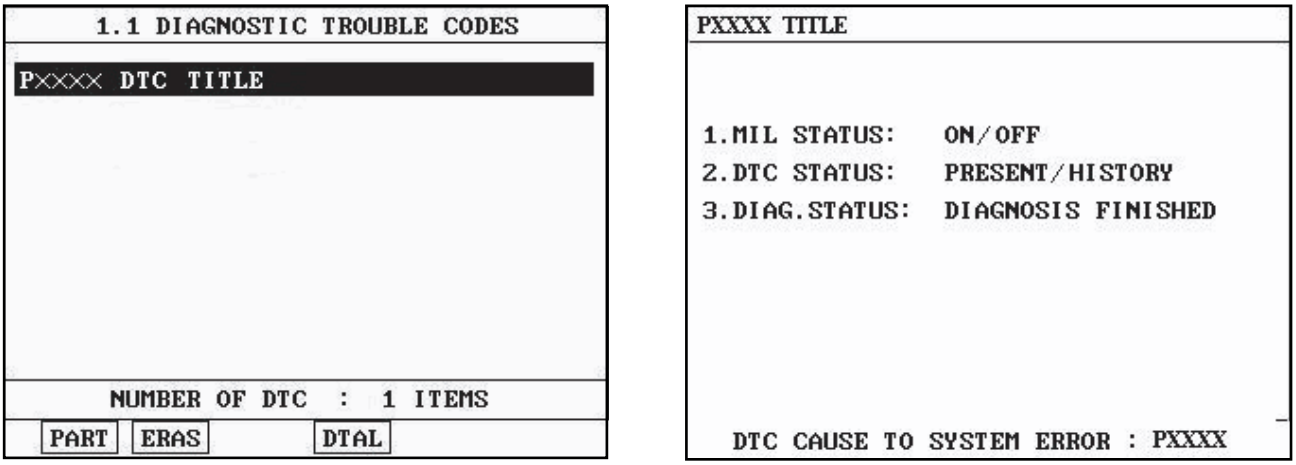
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E8321A87

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 E1B03909

1. Check voltage

   1) IG "OFF" and disconnect ECTS connector.

   2) IG "ON" and ENG "OFF"

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

      YES

      ▶ Go to "Component Inspection" procedure.

      NO

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

2. Check short to ground in harness

   1) IG "OFF" and disconnect ECTS connector and PCM connector.

   2) Measure resistance between terminal 3 of ECTS harness connector and chassis ground.

   3) Measure resistance between terminals 1 and 3 of ECTS harness connector.

Specification : Infinite

   4) Is the measured resistance within specification?

      YES

      ▶ Go to "Component Inspection" procedure.

      NO

      ▶ Repair short to ground in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION ED03F372

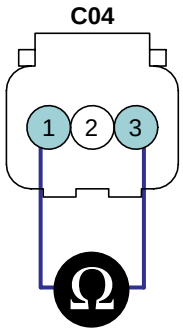
1. Check ECTS

   1) IG "OFF" and disconnect ECTS connector.

   2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16211L

3) Is the measured resistance within specification?

YES

▶ Go to "Check PCM" 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.

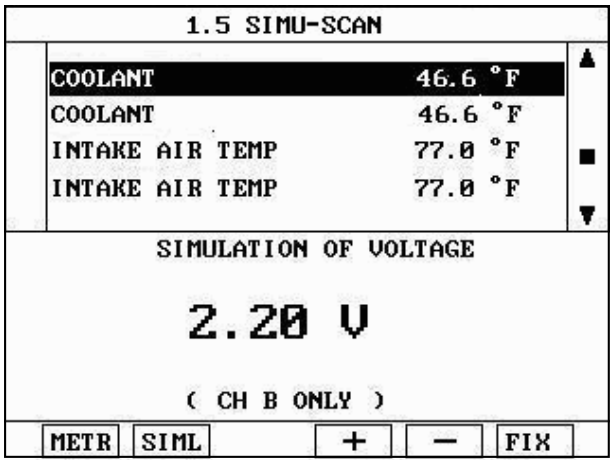
2. Check PCM

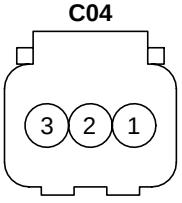
1) IG "OFF" and connect scantool.

2) Connect probe to terminal 3 of ECTS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 3 of ECTS harness connector.





1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16212L

5) Does the signal value of ECT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EB43BBD0

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1115 ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT - INTERMITTENT HIGH INPUT

COMPONENT LOCATION E6E3F387

Refer to DTC P1114.

GENERAL DESCRIPTION ED21BC73

Refer to DTC P1114.

DTC DESCRIPTION EF56256D

Checking output signals from ECTS every 120 sec. under detecting condition, if an output signal is above 4.9V for more than 4 sec., PCM sets P1115.

DTC DETECTING CONDITION EE0C1355

Item		Detecting Condition	Possible Cause
DTC Strategy		• This code detects a intermittent open or short to battey in the signal circuit or the sensor	• Poor Connection • Open or short to battery in signal Circuit • Open in Ground Circuit. • Faulty ECTS • Faulty PCM
Enable Condi-tions	Case 1	• Engine Running Time 〉 120sec.	
	Case 2	• Soak Time 〉 360min. • Engine Running	
Threshold value		• Coolant signal 〉 4.9V	
Diagnosis Time		• Continuous (More than 4 sec. failure for every 120 sec. test)	
MIL On Condition		• DTC only (NO MIL ON)	

SPECIFICATION E10F035E

Refer to DTC P1114.

SCHEMATIC DIAGRAM EDE41432

Refer to DTC P1114.

SIGNAL WAVEFORM AND DATA E9107FF0

Refer to DTC P1114.

MONITOR DTC STATUS EEDAEBB3

Refer to DTC P1114.

TERMINAL AND CONNECTOR INSPECTION E08DB827

Refer to DTC P1114.

SIGNAL CIRCUIT INSPECTION EB1410D1

1. Check voltage

   1) IG "OFF" and disconnect ECTS connector.

   2) IG "ON" and ENG "OFF"

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

Specification : Approx. 5V

   4) Is the measured voltage within specification ?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ If voltage is 0V, go to "Check open in harness" as follows. If it is more than 5.1V, go to "Check short to battery in harness" as follows

2. Check short to battery in harness

   1) IG "OFF" and disconnect ECTS connector and PCM connector.

   2) Measure resistance between terminals 2 and 3 of ECTS harness connector.

Specification : Infinite

   3) Is the measured resistance within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to battery in harness, and go to "Verification of Vehicle Repair" procedure.

3. Check open in harness

   1) IG "OFF" and disconnect ECTS connector and PCM connector.

   2) Measure resistance between terminal 3 of ECTS harness connector and terminal C30-B (7) of PCM harness connector.

Specification : Below 1Ω

   3) Is the measured resistance within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Repair open in harness, and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EE4A2CDF

1. IG "OFF" and disconnect ECTS connector.
2. Measure voltage between terminal 3 of ECTS harness connector and chassis ground.
3. Measure voltage between terminals 1 and 3 of ECTS harness connector.

Specification : Voltage difference between measurement "A" and "B" is below 200mV.

4. Is the measured voltage within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

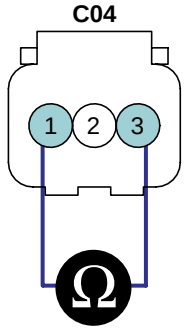
▶ Repair open or contact resistance in harness, and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E296506E

1. Check ECTS
   1) IG "OFF" and disconnect ECTS connector.
   2) Measure resistance between terminals 1 and 3 of ECTS connector.(Component side)

SPECIFICATON :

Temp. (℃/℉)	Resistance (kΩ)	Temp. (℃/℉)	Resistance (kΩ)
-40(-40)	48.14	40(104)	1.15
-20(-4)	14.13 ~ 16.83	60(140)	0.59
0(32)	5.79	80(176)	0.32
20(68)	2.31 ~ 2.59		



1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16211L

   3) Is the measured resistance within specification?

YES

▶ Go to "Check PCM" 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.

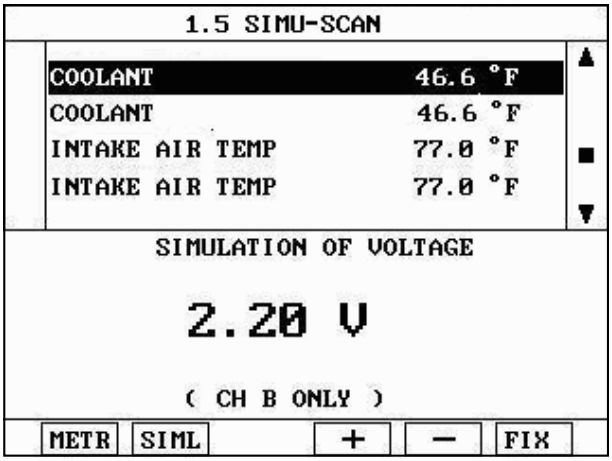
2. Check PCM

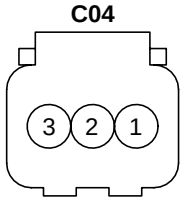
1) IG "OFF" and connect scantool.

2) Connect probe to terminal 3 of ECTS harness connector.

3) IG "ON" and ENG "OFF" and simulation Function on scantool.

4) Simulate voltage at terminal 3 of ECTS harness connector.





1. ECTS Ground
2. To Gauge
3. ECTS Signal

SCMF16212L

5) Does the signal value of ECT sensor 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 PCM and check for proper operation. If the problem is corrected, replace PCM and go to "Verification of Vehicle Repair" procedure.

NOTE

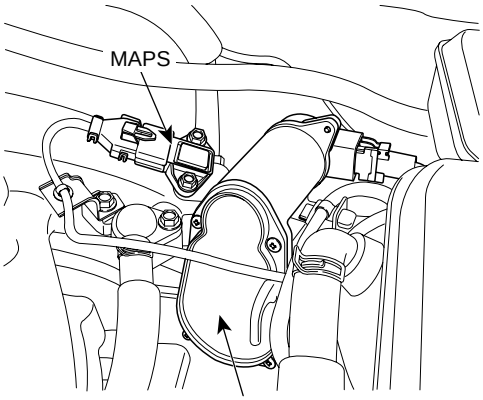
There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR EEAC6FF5

Refer to DTC P1114.

DTC P1295 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - POWER MANAGEMENT

COMPONENT LOCATION E6E0C9FA



SCMF16192L

GENERAL DESCRIPTION EC81A79C

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION E476FA42

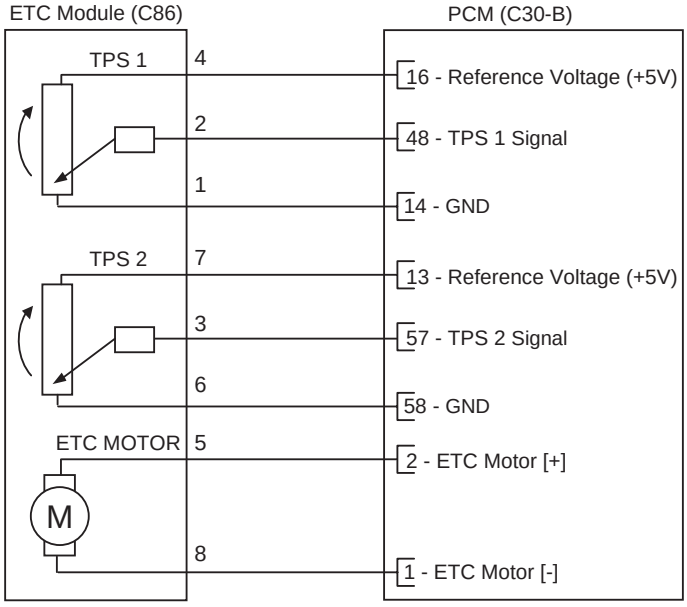
If power management mode is recognized under detecting condition, PCM sets P1295. And MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION ED114BD2

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Power Management Mode	• TPS Malfunction • TPS Malfunction + MAFSMalfunction • MAP Malfunction + TPSMalfunction • Faulty PCM
EnableConditions	• Ignition On	
Threshold value	• Power Management Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM EF168216

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

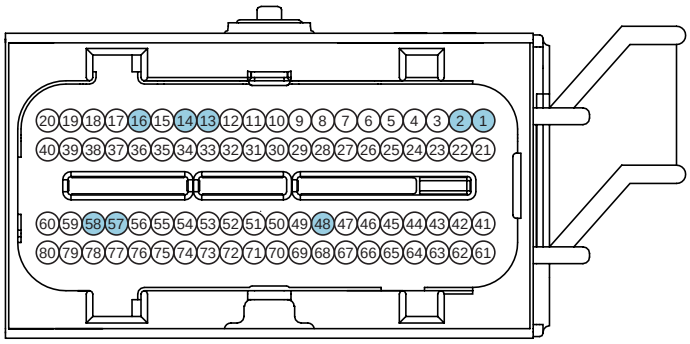
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE



C30-B

PCM

SCMF16101L

MONITOR DTC STATUS ECC8FD7A

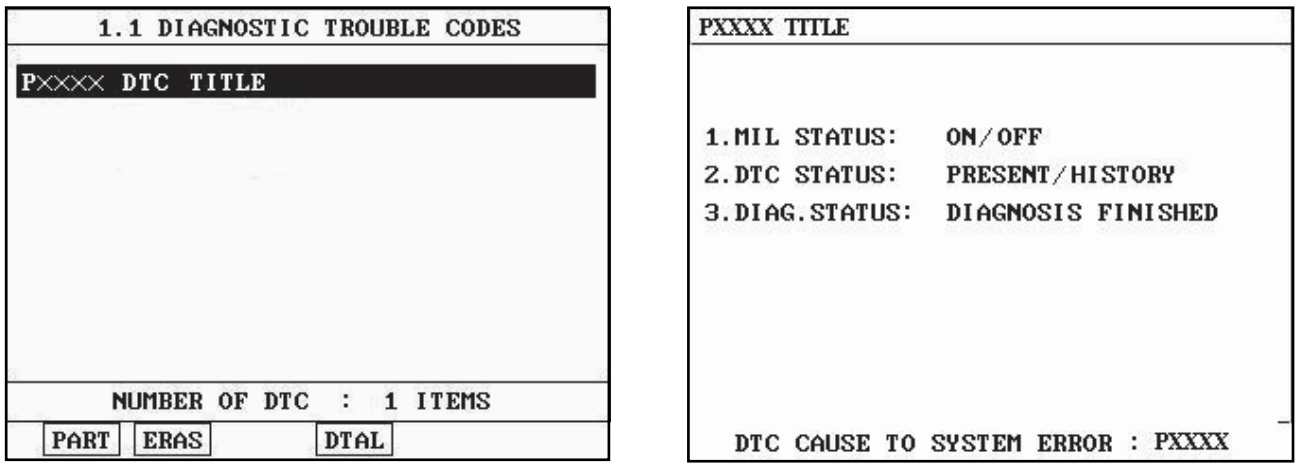
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

VERIFICATION OF VEHICLE REPAIR E003F048

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

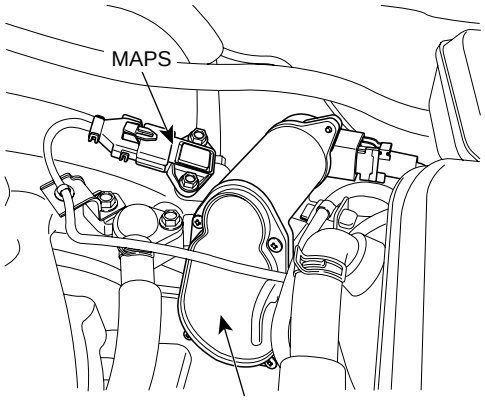
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P1523 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - THROTTLE VALVE STUCK

COMPONENT LOCATION EB59E45B



SCMF16192L

GENERAL DESCRIPTION EE5F5D1C

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION EB974B1A

Checking throttle valve return state, under detecting condition, if an output signal is within the threshold value for more than designated time, PCM sets P1523.

DTC DETECTING CONDITION E50C17A4

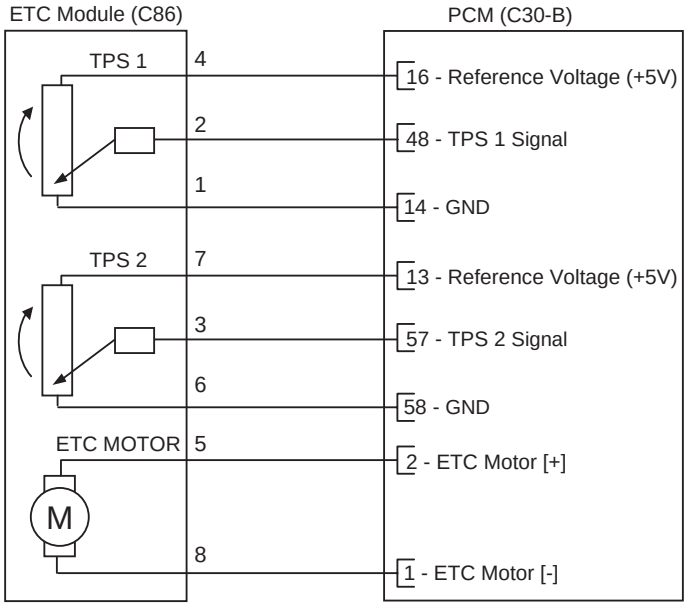
Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects when throttle fails to return to the unpowered default position when power to the ETC motor is turned off.	• Carbon in throttle • Broken Throttle return spring • throttle sticky • throttle icy • PCM
EnableConditions	• Throttle Actuation Mode Previous NOT Off • Throttle Actuation Mode is Off • ETC Power Control Mode = Normal • TPS 1 & 2 = normal • Sensor Supply voltage = Normal	
Threshold value	• If throttle did not return to default range within calculated seconds of turning off, increment fail count.	
DiagnosisTime	• Continuous	
MIL On Condition	• DTC only (NO MIL ON)	

SPECIFICATION E619966F

Throttle opening (°)	Output voltage (V) [Vref = 5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

SCHEMATIC DIAGRAM ED82E1D0

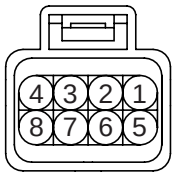
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

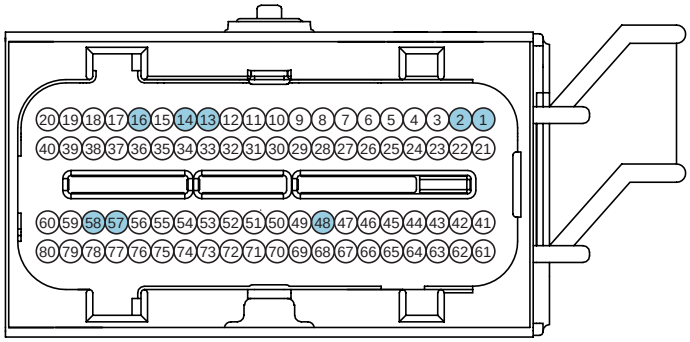
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE

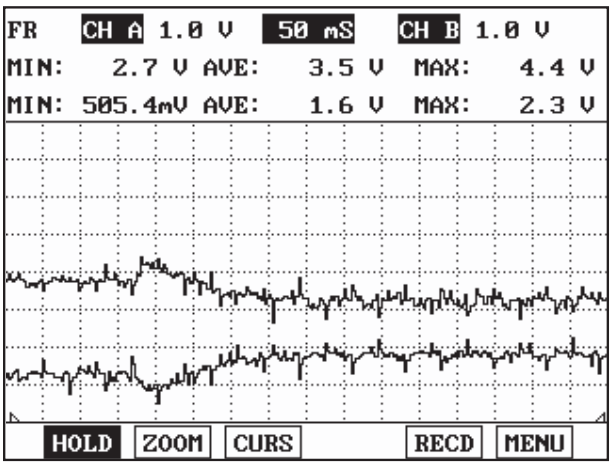


C30-B

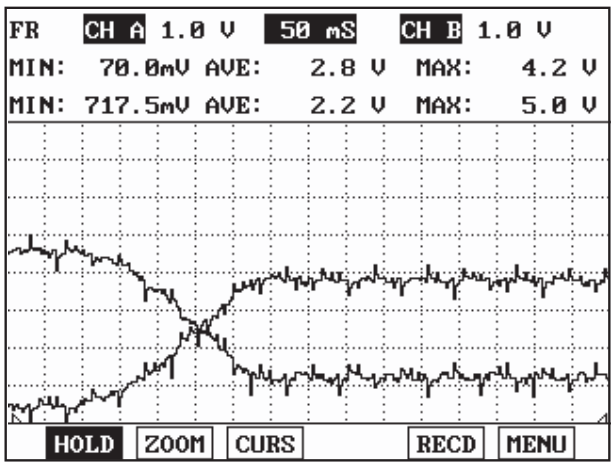
PCM

SCMF16101L

SIGNAL WAVEFROM AND DATA EE3582E5



Stepping on accelleraton pedal.



Pulling out accelleration cable with hand.

EGRF963A

MONITOR DTC STATUS E4C7F759

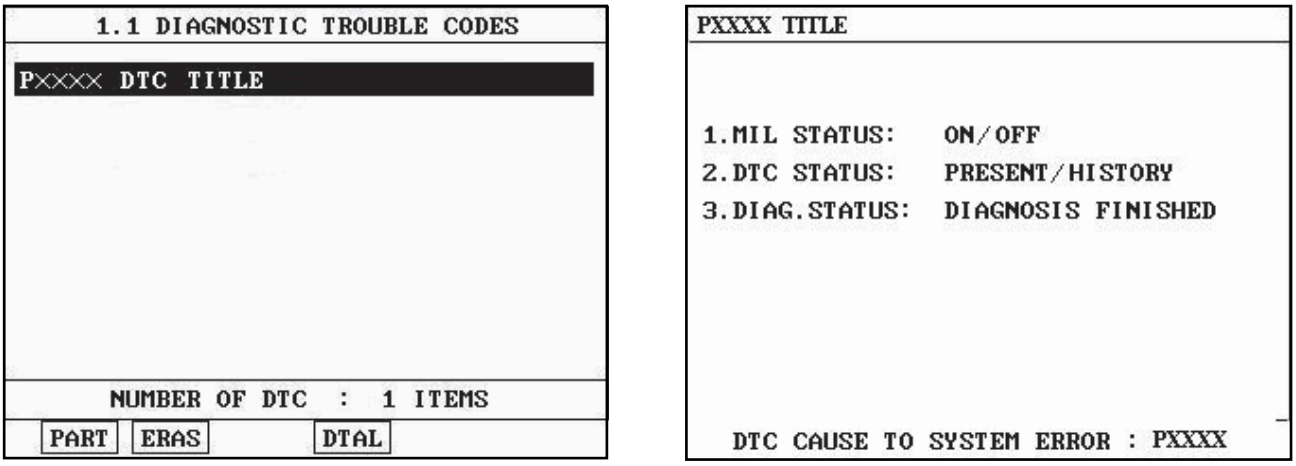
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

SYSTEM INSPECTION E088FCD7

1. Visual Inspection

   1) IG "OFF".

   2) Check throttle valve after removing air duct.
      - Carbon deposit.
      - Throttle icy
      - Broken return spring.
      - Throttle sticky

   3) Is the throttle valve return O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E5449986

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

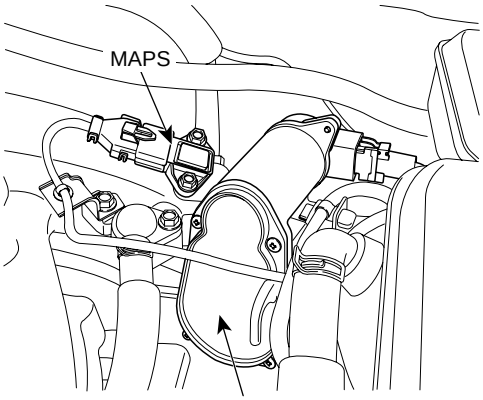
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2104 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - FORCED IDLE

COMPONENT LOCATION EAF6C0A5



SCMF16192L

GENERAL DESCRIPTION E672DD19

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION E079537C

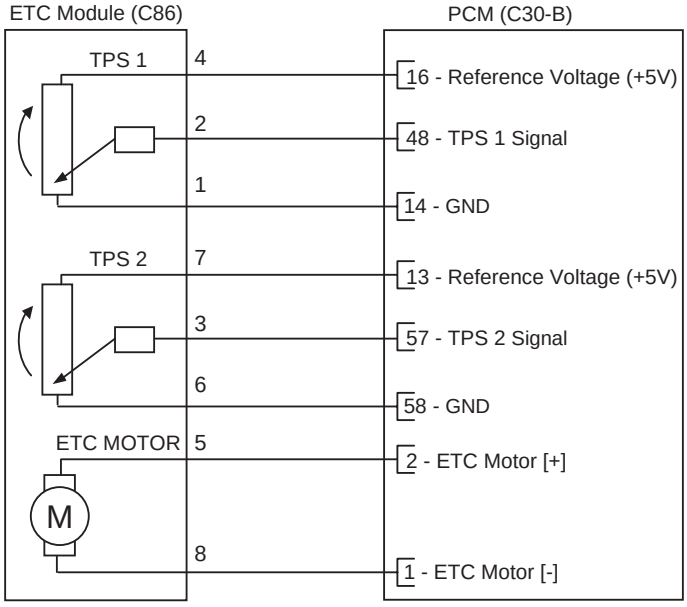
PCM recognizes vehicle state as forced idle under detecting condition, and sets P2104 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EA11BB7A

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Forced Idle Mode	• Faulty APS • Faulty APS+Brake • Faulty APS + Vehicle speed sensor • Faulty APS + Vehicle speed sensor + Brake • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold value	• Forced Idle Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM EEFB2F29

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

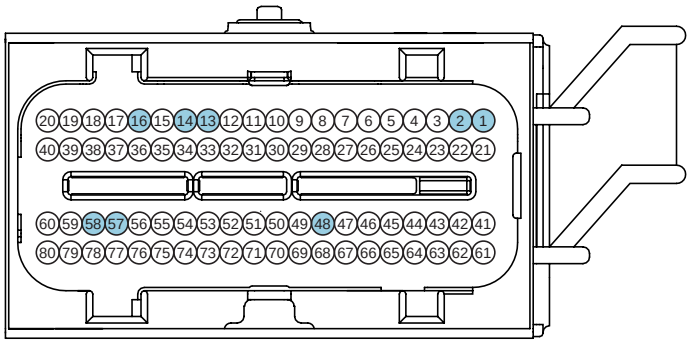
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE



C30-B

PCM

SCMF16101L

MONITOR SCANTOOL DATA E02E6F62

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2104 to retrieve)
3. Repair the DTCs cause DTC P2104 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2104 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E595CAE4

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2105 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - FORCED ENGINE SHUTDOWN

COMPONENT LOCATION EA5E2801

Refer to DTC P2104.

GENERAL DESCRIPTION E4E6418B

Refer to DTC P2104.

DTC DESCRIPTION E6116072

PCM recognizes vehicle state as forced engine stop under detecting condition, and sets P2105 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E09C8745

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Forced Engine Shutdown Mode	• Faulty AFS+MAPS+ETS • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold value	• Forced Engine Shutdown Mode Active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM EB102176

Refer to DTC P2104.

MONITOR SCANTOOL DATA ECA63EBC

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2105 to retrieve)
3. Repair the DTCs cause DTC P2105 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2105 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Go to "Verification of Vehicle Repair" procedure.

※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E7707F60

Refer to DTC P2104.

DTC P2106 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - FORCED LIMITED POWER

COMPONENT LOCATION E8EA6F9D

Refer to DTC P2104.

GENERAL DESCRIPTION E9FD069C

Refer to DTC P2104.

DTC DESCRIPTION EAA5A429

PCM recognizes vehicle state as forced limited power mode under detecting condition, and sets P2106 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E4E9FD11

Item	Detecting Condition	Possible cause
DTC Strategy	• This code detects if the system is in Limit Performance Mode	• Faulty APS • Faulty APS+Brake • Faulty APS + Vehicle speed sensor • Faulty APS + Vehicle speed sensor + Brake • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold value	• Limit Performance Mode is active	
DiagnosisTime	• -	
MIL On Condition	• 1 Driving Cycle	

SCHEMATIC DIAGRAM E62C293C

Refer to DTC P2104.

MONITOR SCANTOOL DATA EF3BB7D0

1. Connect scantool to DLC(Data Link Connector)
2. IG "ON" & Monitor that any different DTC(Diagnostic Trouble Code) is existed.
   (There will be at least one more DTC which causes this DTC P2106 to retrieve)
3. Repair the DTCs cause DTC P2106 first according to the designated trouble shooting guide.
   (After repairing the DTCs cause DTC P2106 , don't forget to do "ETC Initialization" as follows.
4. Is the same DTC occurred ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Go to "Verification of Vehicle Repair" procedure.

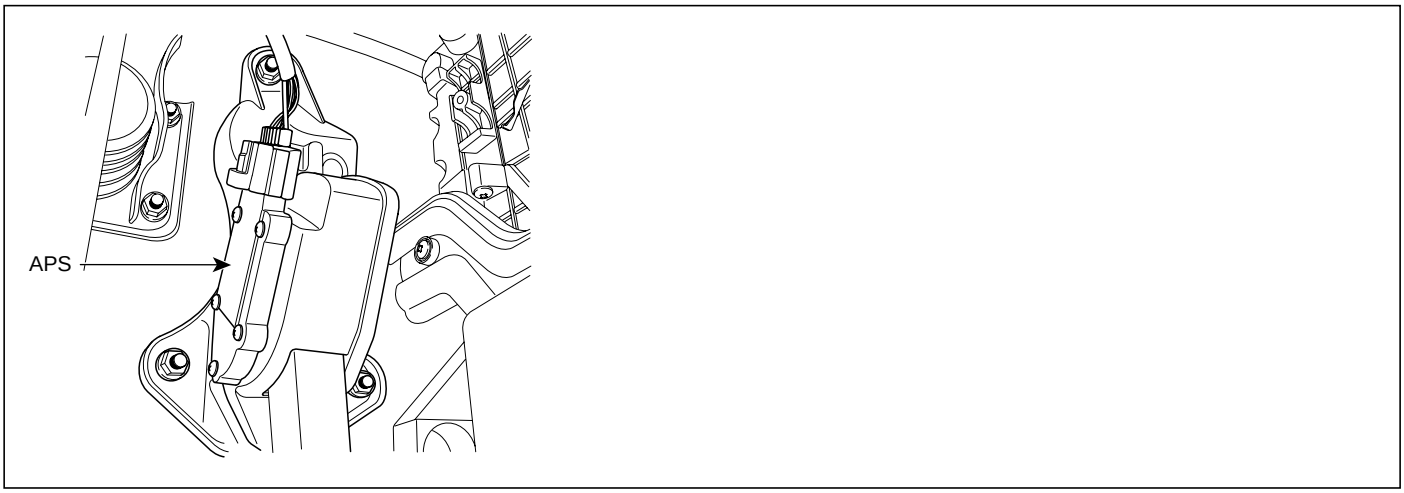
※ Procedure of ETS Initialization
1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR E76BBC64

Refer to DTC P2104.

DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

COMPONENT LOCATION E0BE8A33



SCMF16410L

GENERAL DESCRIPTION E88851B5

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS) 1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The APS is mounted in the accelerator pedal to detect the opening angle of the accelerator pedal. It has 2 sensors to detect the accelerator position and a malfunction of the accelerator position sensor. The ECM judges the current opening angle of the accelerator pedal from APS1 & 2, and the ECM controls the throttle motor based on these signals.

DTC DESCRIPTION E1F29B0E

Checking output signals from APS 1, under detecting condition, if output signals are below the threshold, PCM sets P2122 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E55FAB15

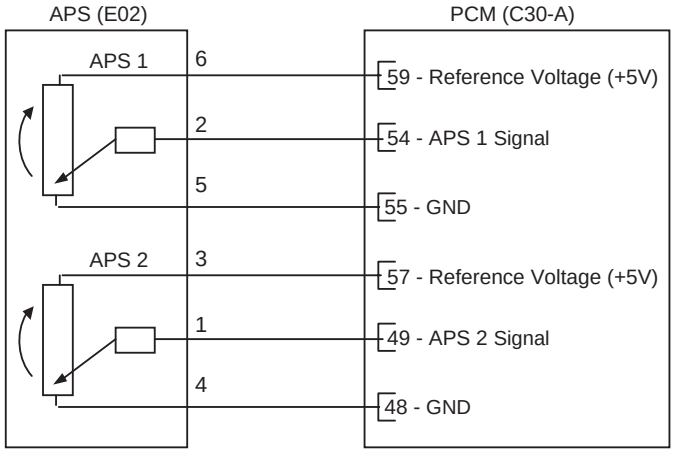
Item	Detecting Condition	Possible Cause
DTC Strategy	• This code detects a continuous short to ground or open in either the circuit or the sensor (0-100%)	• Poor connection • Open or short to ground in Power circuit • Open or short to ground in Signal Circuit • Faulty APS • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold	• APS1 〈 0.125V	
Diagnosis Time	• Contineous (More than 0.18sec. Failure for every 7.8sec. Test)	
MIL On Condition	• 1 Driving Cycle	

SPECIFICATION E25F0160

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM EBAF75D1

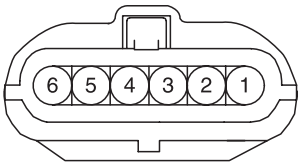
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

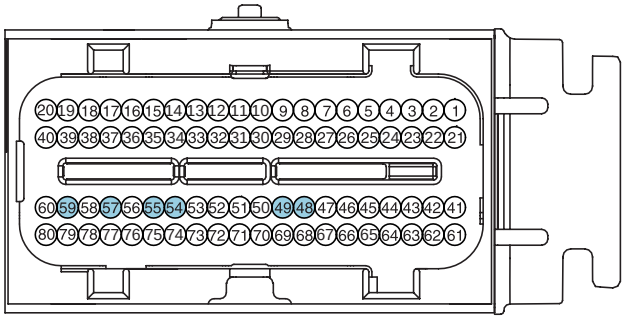
Terminal	Connected to	Function
1	PCM C30-A (49)	APS 2 Signal
2	PCM C30-A (54)	APS 1 Signal
3	PCM C30-A (57)	APS 2 Reference Voltage (+5V)
4	PCM C30-A (48)	APS 2 Ground
5	PCM C30-A (55)	APS 1 Ground
6	PCM C30-A (59)	APS 1 Reference Voltage (+5V)

[HARNESS CONNECTORS]



E02

APS



C30-A

PCM

SCMF16124L

SIGNAL WAVEFROM AND DATA E2434D88

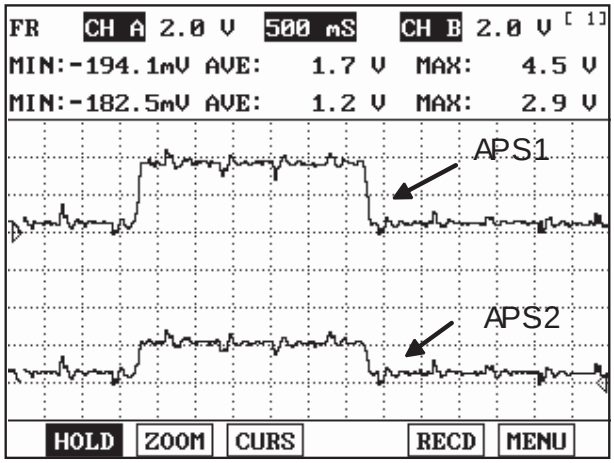


Fig. 1

Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

EGRF970A

MONITOR DTC STATUS EFFCAAE2

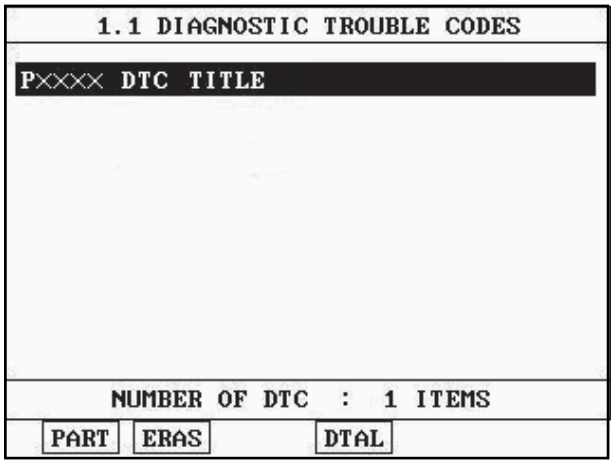
1. Check DTC Status

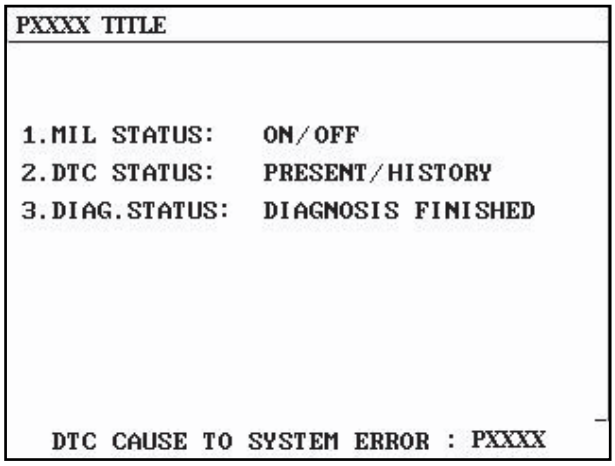
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E3ADD732

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 ED8D9E1F

1. IG "OFF" and disconnect APS connector.
2. IG "ON" & ENG "OFF"
3. Measure voltage between harness terminal 6 of APS and chassis ground.

Specification : Approx. 5V

4. 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 E9B78805

1. Check short to ground in harness
   1) IG "OFF".
   2) Disconnect APS & PCM connector.
   3) Measure resistance between terminal 2 of APS harness connector and chassis ground.
   4) Measure resistance between terminal 2 and 5 of APS harness connector.

5) Measure resistance between terminal 2 and 4 of APS harness connector.

Specification : Infinite

6) Is the measured resistance within specification ?

YES

▶ Go to "Check open in harness" as follows.

NO

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

2. Check open in harness

1) IG "OFF"

2) Disconnect "APS" and "PCM" connector.

3) Measure resistance between terminal 2 of APS harness connector and terminal C30-A (54) of PCM harness connector.

Specification : Approx. below 1Ω

4) Is the measured resistance within in specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

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

COMPONENT INSPECTION E1388164

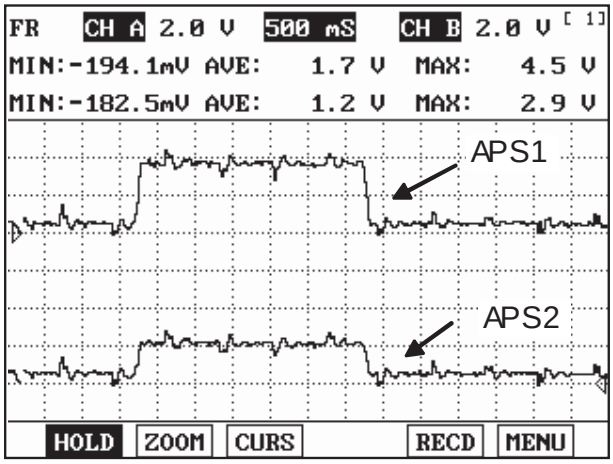
1. Check APS

1) IG "ON" & ENG "OFF".

2) Measure signal waveform of APS by pressing and depressing accellerator pedal.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF975A

3) Is the measured signal waveform O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

VERIFICATION OF VEHICLE REPAIR EF0B52E1

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT

COMPONENT LOCATION EC80C888

Refer to DTC P2122.

GENERAL DESCRIPTION E0ED6377

Refer to DTC P2122.

DTC DESCRIPTION EEE20455

Checking output signals from APS 1, under detecting condition, if output signals are above the threshol, PCM sets P2123 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EC4C88A8

Item	Detecting Condition	Possible Cause
DTC Strategy	• This code detects a short to high in either the circuit or the sensor	• Poor connection • Short to battery in Signal Circuit • Open in Ground Circuit • Faulty APS • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold	• APS1 〉 4.5V	
Diagnosis Time	• Continuous (More than 0.18sec. Failure for every 7.8sec. Test)	
MIL On Condition	• 1 Driving Cycle	

SPECIFICATION ED0F7FE7

Refer to DTC P2122.

SCHEMATIC DIAGRAM EAB55143

Refer to DTC P2122.

SIGNAL WAVEFROM AND DATA E7B2C861

Refer to DTC P2122.

MONITOR DTC STATUS EB28C76E

Refer to DTC P2122.

TERMINAL AND CONNECTOR INSPECTION E8D924E5

Refer to DTC P2122.

SIGNAL CIRCUIT INSPECTION E294F1F8

1. Check short to battery in harness

   1) IG "OFF".

   2) Disconnect APS and PCM connector.

   3) Measure resistance between terminal 3 and 2 of APS harness connector.

   4) Measure resistance between terminal 2 and 6 of APS harness connector.

Specification : Infinite

   5) 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 E7F55DD4

1. Check open in harness

   1) IG "OFF".

   2) Disconnect APS connector.

   3) Measure voltage between terminal 6 of APS harness connector and chassis ground.(Fig. A)

   4) Measure voltage between terminal 6 and 5 of APS harness connector.(Fig. B)

Specification : Fig. "A" - Fig. "B" = approx. below. 200mV.

   5) Is the measured voltage within specification ?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair or replace contact resistance or open in harness and then, go to "Verification of VehicleRepair" procedure.

COMPONENT INSPECTION EF093B88

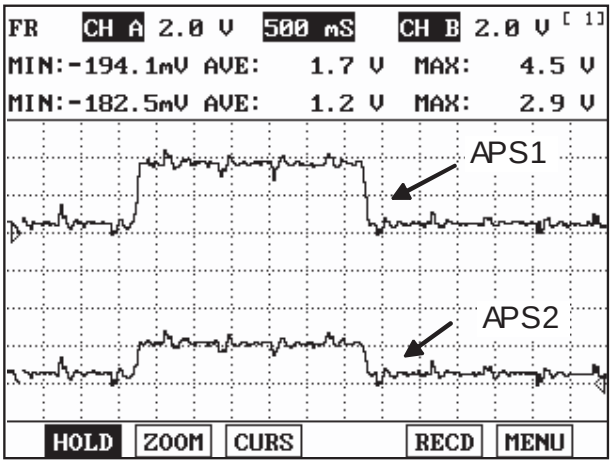
1. Check APS

   1) Ignition "ON" & ENG "OFF".

   2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF975A

3) Is the measured signal waveform O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

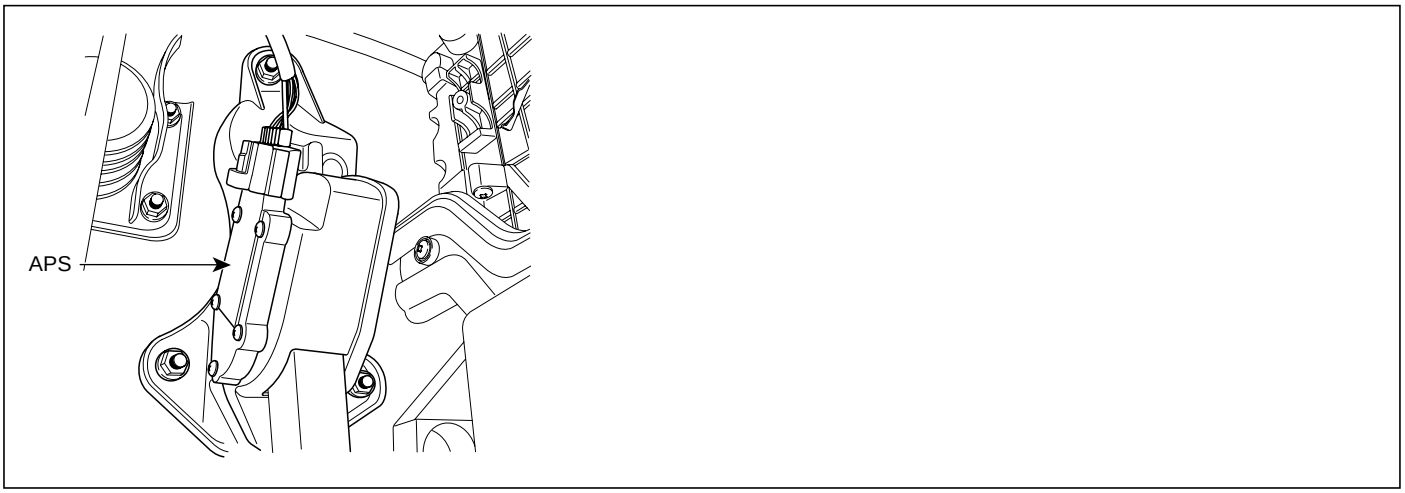
▶ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E9D238F9

Refer to DTC P2122.

DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT

COMPONENT LOCATION E25E809E



SCMF16410L

GENERAL DESCRIPTION EB95F666

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS) 1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The APS is mounted in the accelerator pedal to detect the opening angle of the accelerator pedal. It has 2 sensors to detect the accelerator position and a malfunction of the accelerator position sensor. The ECM judges the current opening angle of the accelerator pedal from APS1 & 2, and the ECM controls the throttle motor based on these signals.

DTC DESCRIPTION ED213EE1

Checking output signals from APS 2, under detecting condition, if output signals are below the threshold, PCM sets P2127 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EA171D94

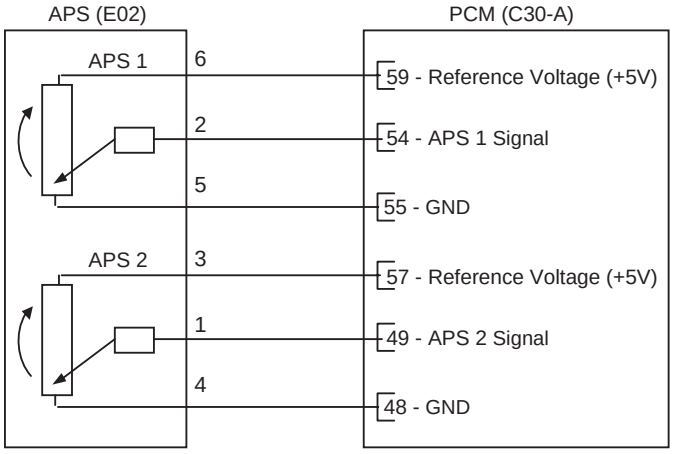
Item	Detecting Condition	Possible Cause
DTC Strategy	• This code detects a continuous short to ground or open in either the circuit or the sensor	• Poor connection • Open or short to ground in Power Circuit • Open or short to ground in Signal Circuit • Faulty APS • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold	• APS1 〈 0.125V	
Diagnosis Time	• Contineous (More than 0.18sec. Failure for every 7.8sec. Test)	
MIL On Condition	• 1 Driving Cycle	

SPECIFICATION E2CFB9C8

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM EAB6B552

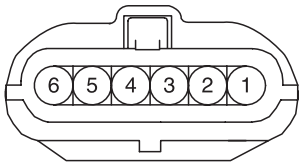
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

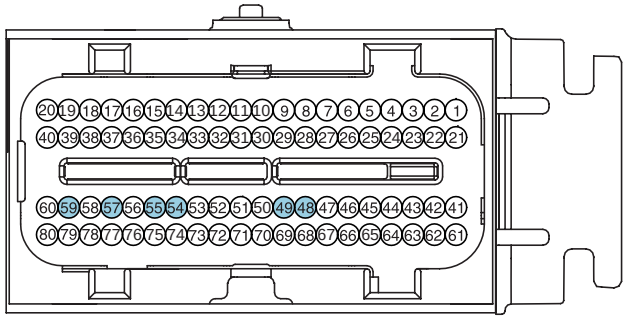
Terminal	Connected to	Function
1	PCM C30-A (49)	APS 2 Signal
2	PCM C30-A (54)	APS 1 Signal
3	PCM C30-A (57)	APS 2 Reference Voltage (+5V)
4	PCM C30-A (48)	APS 2 Ground
5	PCM C30-A (55)	APS 1 Ground
6	PCM C30-A (59)	APS 1 Reference Voltage (+5V)

[HARNESS CONNECTORS]



E02

APS



C30-A

PCM

SCMF16124L

SIGNAL WAVEFROM AND DATA E0A303E9

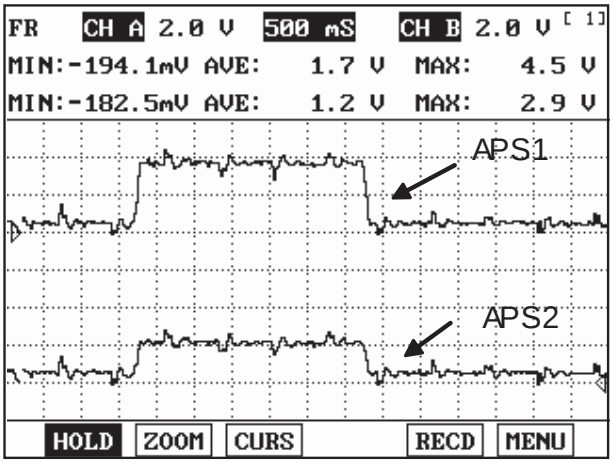


Fig. 1

Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

EGRF970A

MONITOR DTC STATUS E088E573

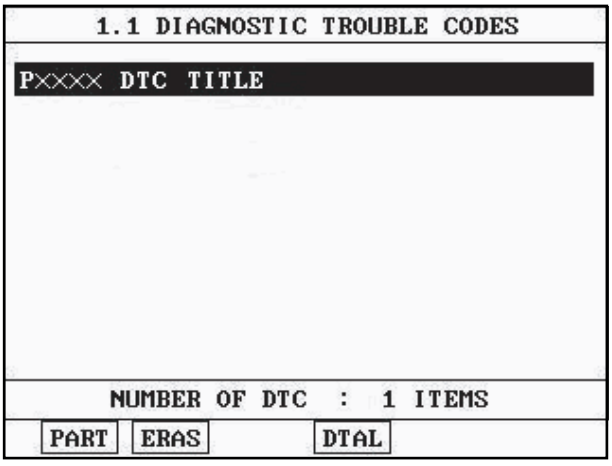
1. Check DTC Status

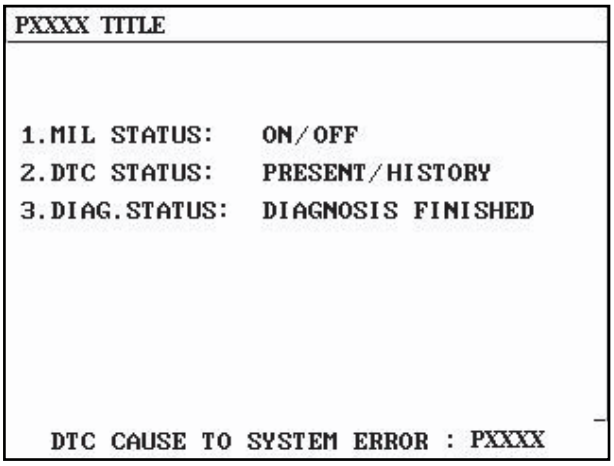
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E782158C

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 E32CA386

1. IG "OFF".
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between termial 3 of APS 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 E046360C

1. Check short to ground in harness
   1) IG "OFF".
   2) Disconnect APS and PCM connector.
   3) Measure resistance between terminal 1 of APS harness connector and chassis ground.

4) Measure resistance between terminal 1 and 5 of APS harness connector.

5) Measure resistance between terminal 1 and 4 of APS harness connector.

Specification : Infinite

6) Is the measured resistance within specification ?

YES

▶ Go to "Check open in harness" as follows.

NO

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

2. Check open in harness

1) IG "OFF".

2) Disconnect APS and PCM connector.

3) Measure resistance between terminal 1 of APS harness connector and terminal C30-A (49) of PCM harness connector.

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 E95BEDB4

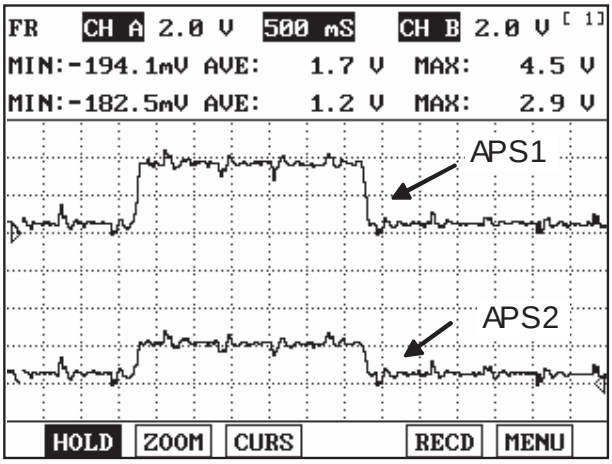
1. Check APS

1) Ignition "ON" & ENG "OFF".

2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF975A

3) Is the measured signal waveform O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

VERIFICATION OF VEHICLE REPAIR E4CF9F32

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT

COMPONENT LOCATION E7A0BA19

Refer to DTC P2127.

GENERAL DESCRIPTION EB70AF82

Refer to DTC P2127.

DTC DESCRIPTION E8C2A639

Checking output signals from APS 2, under detecting condition, if output signals are above the threshold, PCM sets P2128 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E50B99ED

Item	Detecting Condition	Possible Cause
DTC Strategy	• This code detects a continuous short to ground or open in either the circuit or the sensor	• Poor connection • Short to battery in Signal Circuit • Open in Ground Circuit • Faulty APS • Faulty PCM
Enable Conditions	• Ignition "ON"	
Threshold	• APS2 〉 3V	
Diagnosis Time	• Continuous (More than 0.18sec. Failure for every 7.8sec. Test)	
MIL On Condition	• 1 Driving Cycle	

SPECIFICATION ED176FA6

Refer to DTC P2127.

SCHEMATIC DIAGRAM EB805662

Refer to DTC P2127.

SIGNAL WAVEFROM AND DATA E2F1536A

Refer to DTC P2127.

MONITOR DTC STATUS ECDE74E9

Refer to DTC P2127.

TERMINAL AND CONNECTOR INSPECTION E9E39273

Refer to DTC P2127.

SIGNAL CIRCUIT INSPECTION EEFFBACB

1. Check short to battery in harness

   1) IG "OFF".

   2) Disconnect APS and PCM connector.

   3) Measure resistance between terminal 1 and 3 of APS harness connector.

   4) Measure resistance between terminal 1 and 6 of APS harness connector.

Specification : Infinite

   5) Is the measured reisistance within specification ?

YES

▶ Go to "Ground Circuit Inpsection" procedure.

NO

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

GROUND CIRCUIT INSPECTION E3E6D32A

1. Check open in harness

   1) IG "OFF"

   2) Disconnect APS connector.

   3) Measure voltage between terminal 3 of APS harness connector and chassis ground.(Fig. A)

   4) Measure voltage between terminal 3 and 4 of APS harness connector.(Fig. B)

Specification : Fig."A" - Fig. "B" = Approx. below 200mV

   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 EA552CA3

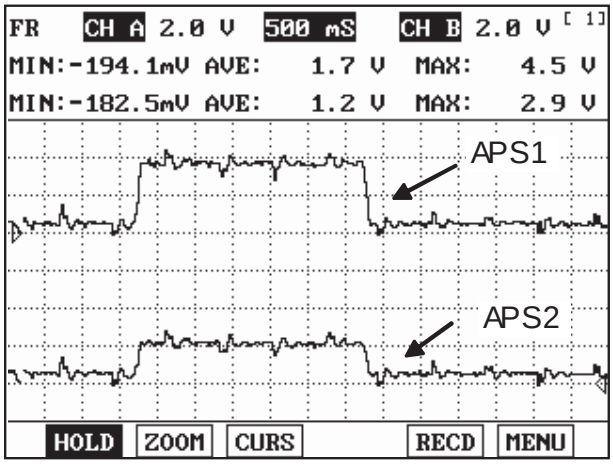
1. Check APS

   1) Ignition "ON" & ENG "OFF".

   2) Measure waveform of APS by pressing and depressing accellerator pedal with scantool.

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF975A

3) Is the measured signal waveform O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

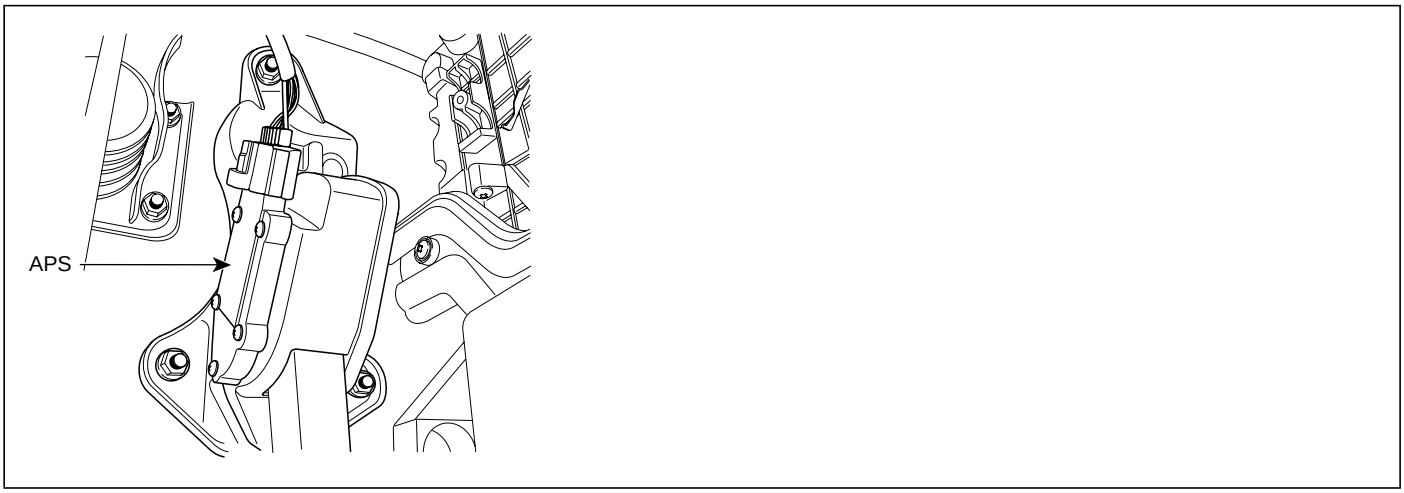
▶ Substitute with a known-good APS and check for proper operation. If the problem is corrected,replace APS and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EFB6E222

Refer to DTC P2127.

DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" / "B" VOLTAGE CORRELATION

COMPONENT LOCATION E54108CE



SCMF16410L

GENERAL DESCRIPTION EE7EF8F3

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. TPS1 & 2 are sharing the same source voltage and ground.The throttle valve opening is control by throttle motor which is controlled by Engine Control Module(ECM).The opposite position indicator shows inverted signal characteristics.TPS1 output voltage increases smoothly in proportion with the throttle valve opening angle after starting. TPS2 output voltage decreases in inverse proportion with the throttle valve opening angle after starting. TPS provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION EF544ACE

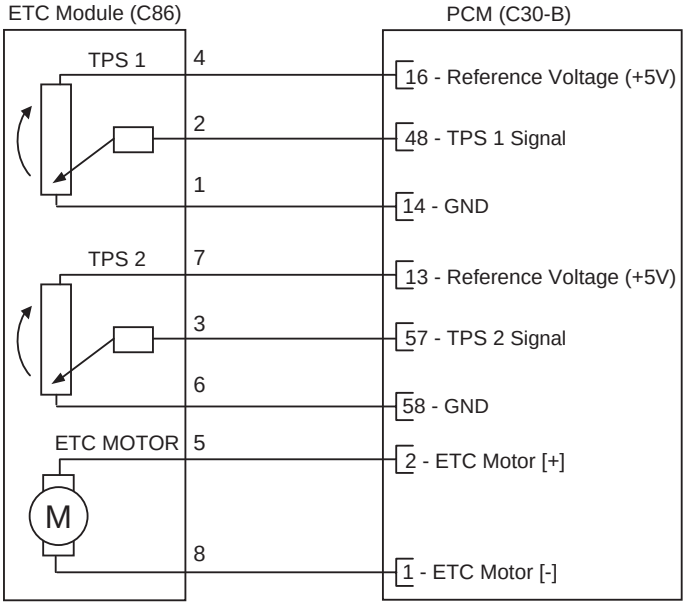
Checking output signals from TPS 1 and 2, under detecting condition, if output signals difference between TPS1 and TPS2 are detected more than 4.5% for the specified number of times., PCM sets P2135. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E5764B91

Item	Detecting Condition	Possible Cause
DTC Strategy	• Determines if TPS # 1 disagrees with TPS # 2	• Poor connection • Open or short in TPS circuit • Faulty TPS • Faulty PCM
Enable condition	• Ignition "ON"	
Threshold value	• Difference between average values of TPS1 and TPS2 〉 4.5%	
Diagnosis time	• Continuous (More than 0.34sec failure for every 10.92sec. Test)	
MIL ON condition	• 1 driving cycles	

SCHEMATIC DIAGRAM E6FFC24B

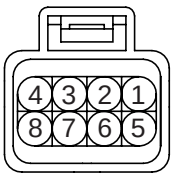
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

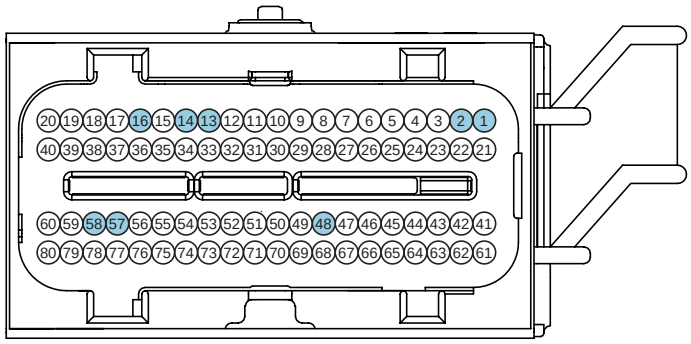
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE



C30-B

PCM

SCMF16101L

SPECIFICATION E6C4A697

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V

90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

MONITOR DTC STATUS E52B2098

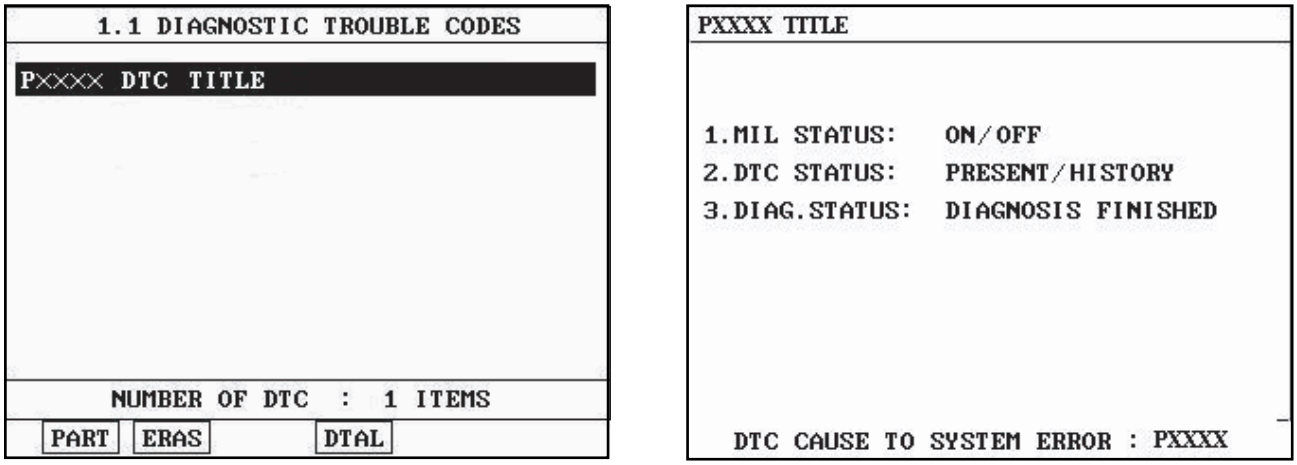
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E18311F3

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 E9FFC195

1. IG "OFF".
2. Disconnect TPS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 7 of TPS harness connector and chassis ground.
5. Measure voltage between terminal 4 of TPS harness connector and chassis ground.

Specification : Approx. 5V

6. 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 EF8A326B

1. IG "OFF".
2. Disconnect TPS & PCM connector.
3. Measure resistance between terminal 5 and 2 of TPS harness connector.

Specification : Infinite

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 ED70587B

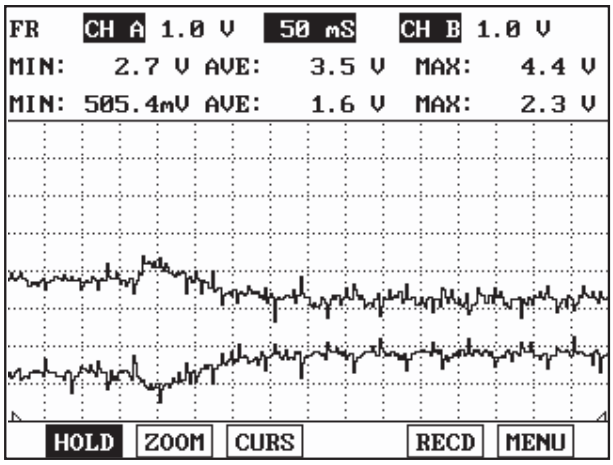
1. Check TPS

1) Ignition "ON" & ENG "OFF".

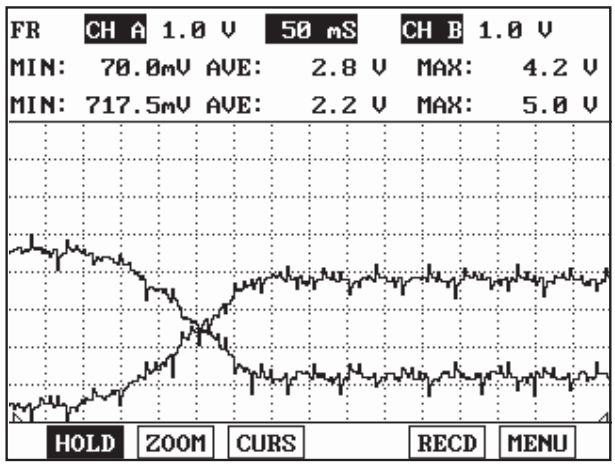
2) Monitor signal waveform of TPS by stepping on and off the accellerator padel on scantool

SPECIFICATION :

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V
20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V



Pressing acllerator pedal at idle



Pulling out accellerator cable with hand at idle

EGRF986A

3) Is the measured signal waveform O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

▶ Substitute with a known-good TPS and check for proper operation. If the problem is corrected,replace TPS and then go to "Verification of Vehicle Repair" procedure.
(After replacing ETC, do initialization of ETC as follows)

※ **PROCEDURE OF ETS INITIALIZATION**

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR ECE44003

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

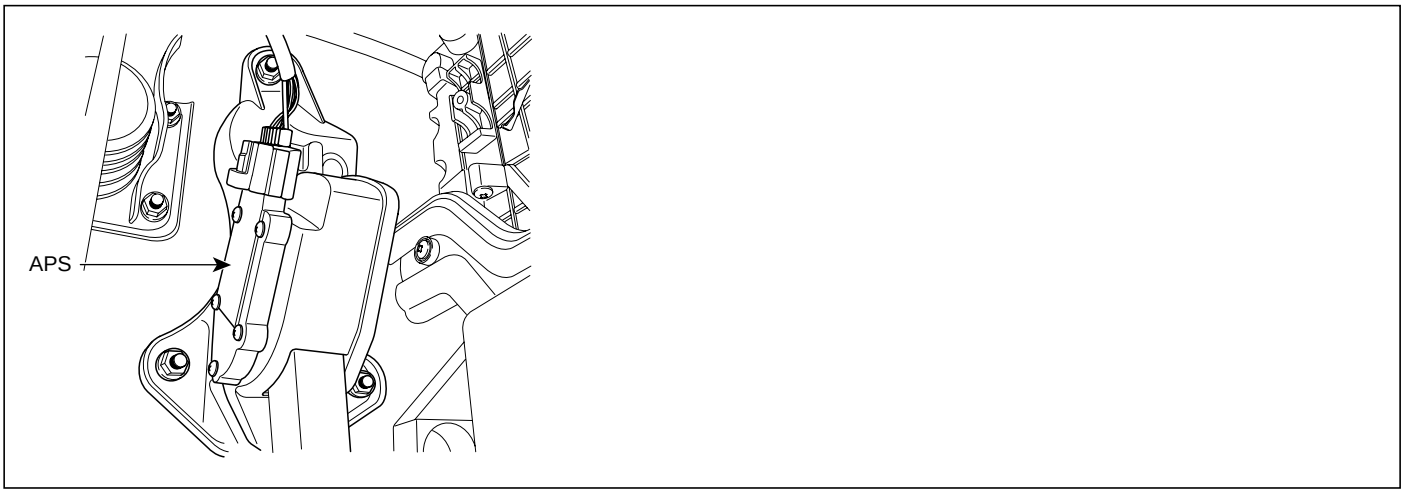
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" / "E" VOLTAGE CORRELATION

COMPONENT LOCATION EC293548



SCMF16410L

GENERAL DESCRIPTION EE42BF44

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS) 1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The APS is mounted in the accelerator pedal to detect the opening angle of the accelerator pedal. It has 2 sensors to detect the accelerator position and a malfunction of the accelerator position sensor. The ECM judges the current opening angle of the accelerator pedal from APS1 & 2, and the ECM controls the throttle motor based on these signals.

DTC DESCRIPTION E52F0EF2

Checking output signals from APS 1 and 2, under detecting condition, if output signals difference between APS 1 and 2 are detected more than 4.5% for the specified number of times., PCM sets P2138 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION E658889F

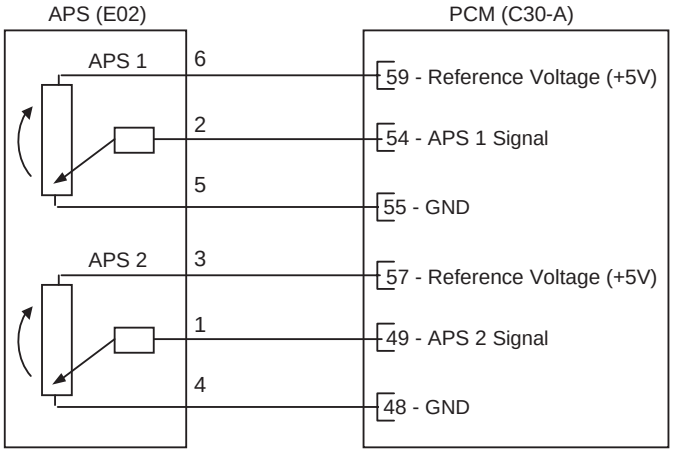
Item	Detecting Condition	Possible Cause
DTC Strategy	• This code detects a correlation error between APS 1 and APS 2	• Poor connection • Open or short in APS Circuit • Faulty APS • Faulty PCM
Enable condition	• Ignition "ON"	
Threshold value	• Difference between APS1 and APS2 Normalized values 〉 4.5%	
Diagnosis time	• Contineous (More than 0.32sec. Failure for every 9.36sec. Test)	
MIL ON condition	• 1 Driving Cycle	

SPECIFICATION E5ADAEB3

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V

SCHEMATIC DIAGRAM EB14BE4E

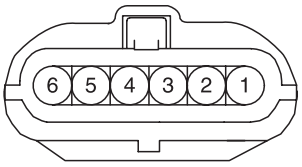
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

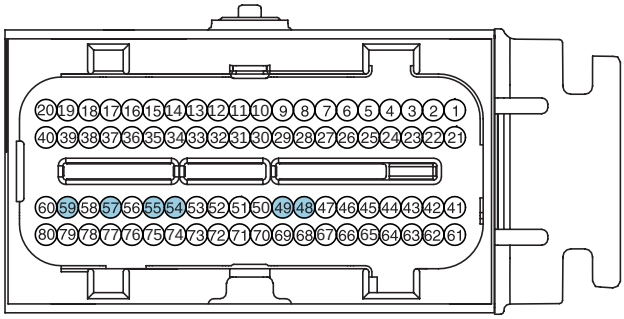
Terminal	Connected to	Function
1	PCM C30-A (49)	APS 2 Signal
2	PCM C30-A (54)	APS 1 Signal
3	PCM C30-A (57)	APS 2 Reference Voltage (+5V)
4	PCM C30-A (48)	APS 2 Ground
5	PCM C30-A (55)	APS 1 Ground
6	PCM C30-A (59)	APS 1 Reference Voltage (+5V)

[HARNESS CONNECTORS]



E02

APS



C30-A

PCM

SCMF16124L

SIGNAL WAVEFROM AND DATA E2010367

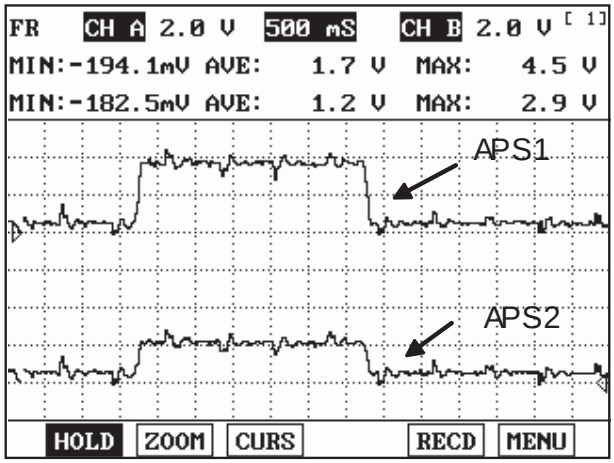


Fig. 1

Fig. 1 : This is a signal waveform of APS 1 & 2 which shows that APS 2 increases voltage just half of APS 1 voltage increase when accelleration.

EGRF970A

MONITOR DTC STATUS EF6ECCAA

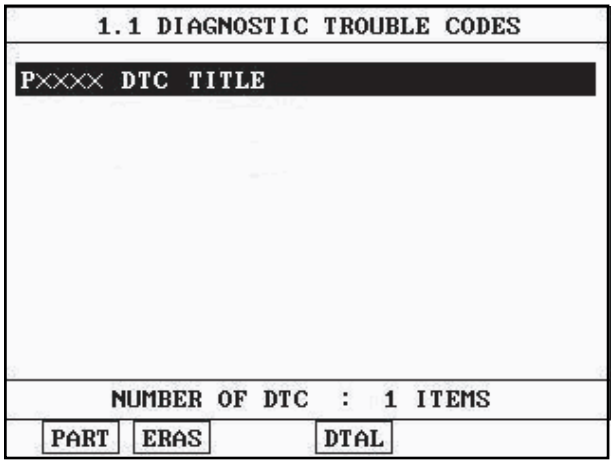
1. Check DTC Status

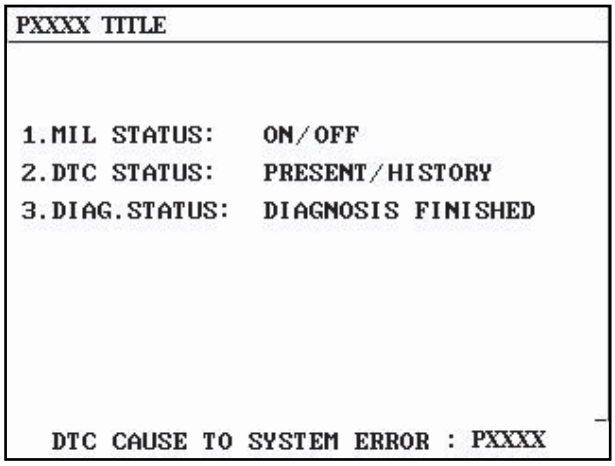
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

   YES

   ▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION EFE15F35

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 EEB805D6

1. IG "OFF"
2. Disconnect APS connector.
3. IG "ON" & ENG "OFF".
4. Measure voltage between terminal 3 of APS harness connector and chassis ground.
5. Measure voltage between terminal 6 of APS harnesss connector and chassis ground.

Specification : Approx. 5V

6. Is the measured voltage within specification ?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Repair or replace as necessary and then, go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION ECC0CD0B

1. IG "OFF".
2. Disconnect APS and PCM connector.
3. Measure resistance between terminal 1 and 2 of APS harness connector.

Specification : Infinite

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 E5400450

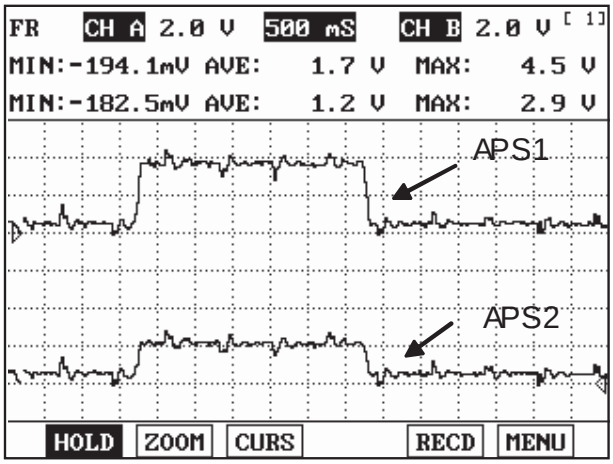
1. Check APS

   1) IG "ON" & ENG "OFF".

   2) Measure signal waveform of APS 1 and APS 2 by stepping on and off with scantool

SPECIFICATION :

Pedal Position	Output Voltage(V) [Vref = 5.0V]	
	APS1	APS2
C.T	0.7 ~ 0.8V	0.29 ~ 0.46V
W.O.T	3.85 ~ 4.35V	1.93 ~ 2.18V



EGRF986E

   3) Is the measured signal waveform O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

NO

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

VERIFICATION OF VEHICLE REPAIR EE76DF17

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

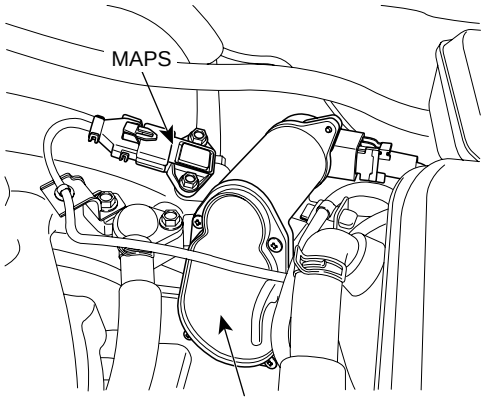
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2173 ETC (ELECTRONIC THROTTLE CONTROL) SYSTEM MALFUNCTION - HIGH AIR FLOW DETECTED

COMPONENT LOCATION EFFBE3B3



SCMF16192L

GENERAL DESCRIPTION E292F965

The Electronic Throttle Control(ETC) system is made of the components throttle body, Throttle Position Sensor(TPS)1 & 2 and Accelerator Position Sensor(APS) 1 & 2. The throttle body contains the actuator, the throttle plate and the throttle position sensor (potentiometer), which are integrated in one housing. The actuator consists of a DC motor with a two-stage gear. The opening angle of the throttle valve is detected by the throttle position sensor which is mounted on the throttle body. And it provides feedback to the ECM to control the throttle motor in order to control the throttle valve opening angle properly in response to the driving condition.

DTC DESCRIPTION E2141A89

Comparing real intake air flow and the intake air flow calculated by ETS, under detecting condition, if the difference of air flow more than threshold is detected for more than 3.9 sec., PCM sets P2173 and then MIL(Malfunction Indication Lamp) turns on.

DTC DETECTING CONDITION EE78EB92

Item		Detecting Condition	Possible Cause
DTC Strategy		• The engine airflow measurements not based on throttle position are compared with throttle position based estimated airflow.	• Air Leakage between TPS and MAFS • Faulty throttle body • Faulty PCM
Enable Conditions		• Engine running • Throttle Actuation Mode is not OFF • MAP Sensor is not failed • MAF Sensor is not failed • IAT sensor is not failed	
Thresh-old	Case 1	• Speed-Density Airflow - ETC estimated airflow 〉 9 g/s	
	Case 2	• MAF reading - ETC estimated airflow 〉 7g/s	
Diagnosis Time		• Contineous (More than 3.9sec. Failure for every 15.6sec. Test)	
MIL On Condition		• 1 Driving Cycle	

SPECIFICATION E6F349EF

MAFS

Air flow (kg/h)	Frequency (Hz)
0 kg/h	720 ~ 880 Hz
12.6 kg/h	2,595 Hz
18.0 kg/h	2,930 Hz
23.4 kg/h	3,208 Hz
32.4 kg/h	3,609 Hz
43.2 kg/h	3,975 Hz
57.6 kg/h	4,361 Hz
72.0 kg/h	4,683 Hz
108.0 kg/h	5,362 Hz
144.0 kg/h	5,885 Hz
198.0 kg/h	6,527 Hz
270.0 kg/h	7,219 Hz
360.0 kg/h	7,945 Hz
486.0 kg/h	8,736 Hz
666.0 kg/h	9,660 Hz
900.0 kg/h	10,613 Hz

TPS

Throttle opening (°)	Output voltage(V) [Vref=5.0V]	
	TPS1	TPS2
0°	0.0V	5.0V
10°	0.5V	4.5V

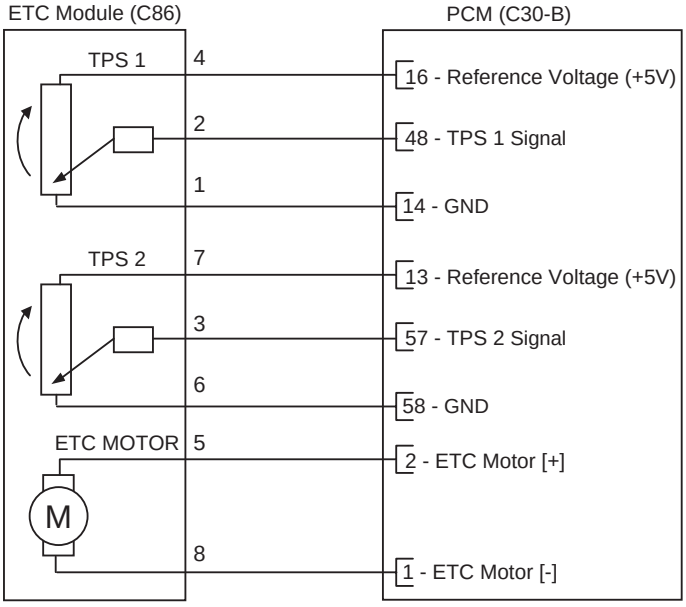
V20°	0.9V	4.1V
30°	1.4V	3.6V
40°	1.8V	3.2V
50°	2.3V	2.7V
60°	2.7V	2.3V
70°	3.2V	1.8V
80°	3.6V	1.4V
90°	4.1V	0.9V
100°	4.5V	0.5V
110°	5.0V	0.0V

MAPS

Pressure(kPa)(kPa)	Output voltage(V)
20.0kPa	0.79V
35kPa	1.382V
46.66kPa	1.84V
60kPa	2.369V
90kPa	3.75V
101.32kPa	4.00V

SCHEMATIC DIAGRAM E4E2CD87

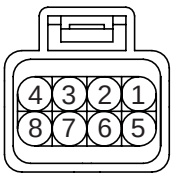
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

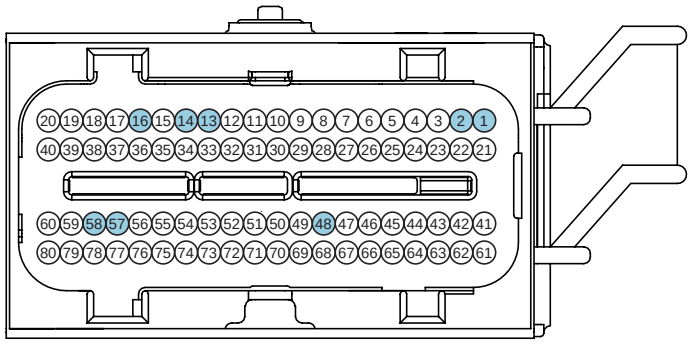
Terminal	Connected to	Function
1	PCM C30-B (14)	TPS 1 Ground
2	PCM C30-B (48)	TPS 1 Signal
3	PCM C30-B (57)	TPS 2 Signal
4	PCM C30-B (16)	TPS 1 Reference Voltage (+5V)
5	PCM C30-B (2)	ETC Motor [+] Control
6	PCM C30-B (58)	TPS 2 Ground
7	PCM C30-B (13)	TPS 2 Reference Voltage (+5V)
8	PCM C30-B (1)	ETC Motor [-] Control

[HARNESS CONNECTORS]



C86

ETC MODULE



C30-B

PCM

SCMF16101L

MONITOR DTC STATUS EAB43615

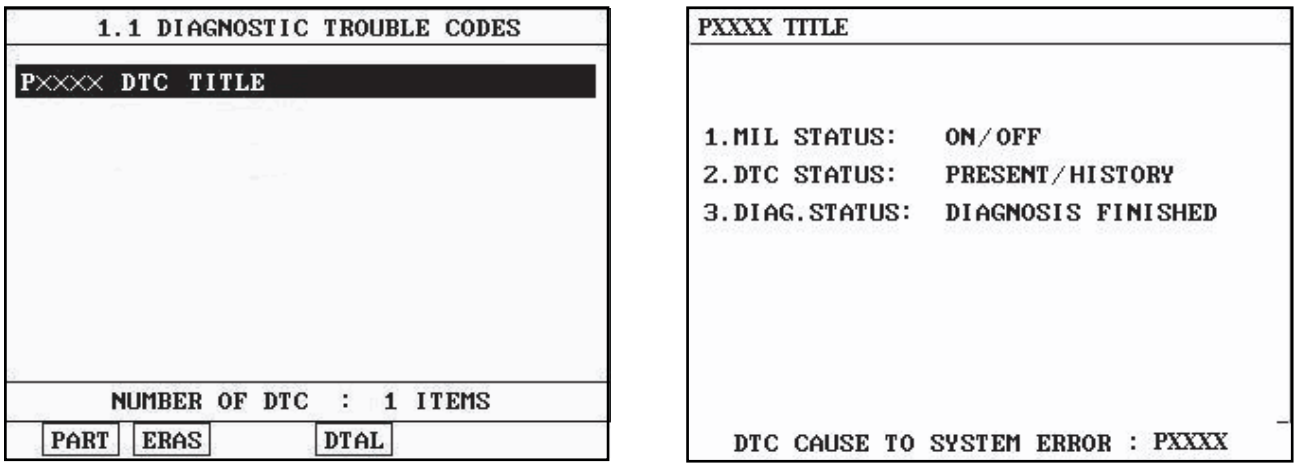
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "System Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

SYSTEM INSPECTION EFDBC19F

1. Visual Inspection

1) Check the air hose between MAFS and throttle body is torn or installation.

2) Check deforamtion, crack or installation of throttle valve(body)

3) Has a problem been found ?

YES

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

NO

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.
Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others

※ PROCEDURE OF ETS INITIALIZATION

1. Erase the trouble codes on PCM
2. Turn the ignition key off and keep this condition until the main relay is turned off.(It will takes 10sec.)
3. Turn ignition key on more than 1second to record the throttle motor position on the EEPROM

VERIFICATION OF VEHICLE REPAIR ED410949

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2187 SYSTEM TOO LEAN AT IDLE (←ADDITIVE) (BANK 1)
DTC P2189 SYSTEM TOO LEAN AT IDLE (←ADDITIVE) (BANK 2)

GENERAL DESCRIPTION EC6A1680

In order to provide the best possible combination of drivability, fuel economy and emission control, the ECM uses a closed loop air/fuel metering system. The ECM monitors the HO2S signal voltage and adjusts fuel delivery based it in closed loop fuel control. Changes in fuel delivery will be indicated by the long-term and the short-term fuel trim values. The ideal fuel trim value is around 0%. The ECM will add fuel when the HO2S signal is indicating a lean condition. Additional fuel is indicated by fuel trim values that are above 0%. The ECM will reduce fuel when the HO2S signal is indicating a rich condition. Reduction in fuel is indicated by fuel trim values that are below 0%. The DTC relevant to fuel trim will be set when the amount reaches excessive levels because of a lean or rich condition.

DTC DESCRIPTION E072F760

Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2187/P2189. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E36D2926

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
Enable Conditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60℃ (140˚F) ≤ Engine coolant temperature ≤ 114.992℃ (239˚F) • -10℃ (14˚F) ≤ Intake Air Temperature ≤ 60℃ (140˚F) • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Average of short term fuel trim 〉 1.5 • Average of long term fuel trim 〉 0.76	
Diagnosis Time	• Continuous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS ED3BB1B6

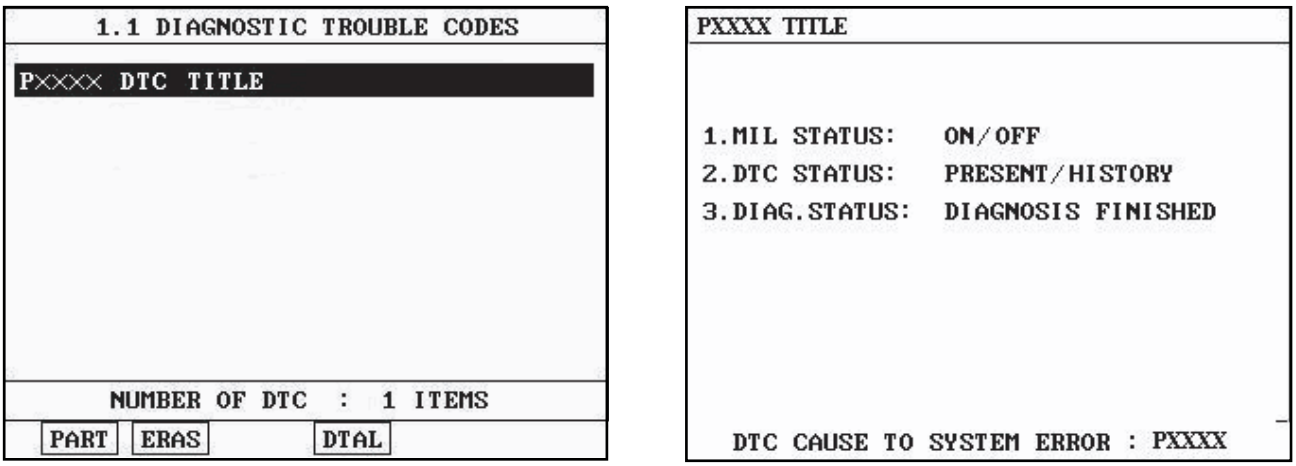
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E26AAA82

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 E2F3961E

1. Check Air leakage

1) Check gasket is contaminated or misinstalled.
▶ Installation or any damage of Throttle body gasket
▶ Installation or any damage of the gasket between intake manifold and surge tank.

- ▶ Clogging of intake manifold or injectors resulting from foreign materials.
- ▶ Open stuck of PCSV caused by foreign materials between surge tank and PCSV.

2) Has a problem been found ?

YES

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

NO

▶ Go to "Check Fuel Line Inspection" as follows.

2. Check Fuel Line Inspection

1) Check clog, contamination and installation of each hose as follows.
- ▶ Check connection of each fuel line.
- ▶ Check damage, interference and installation of vaccum hose connected to fuel line.
- ▶ Check that fuel pipe in the fuel line is bent and sqeezed.
- ▶ Check any fuel leakage from fuel pipe in the fuel line.

2) Has a problem been found ?

YES

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

NO

▶ Go to "Check fuel pressure" as follows.

3. Check Fuel Pressure

NOTE

- *Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.*
- *The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.*

1) Start the engine and disconnect the fuel pump relay.

2) Wait until fuel in fuel line is exhausted and the engine stalls.

3) Turn the ignition switch OFF position.

4) Install the special service tool for measuring the fuel pressure between the delivery pipe and the fuel feed hose.

5) Connect the fuel pump relay.

6) With fuel pressure applied, check the three is no fuel leakage from the fuel pressure gauge or connection part.

7) Start the engine and measure the fuel pressure at idle.

Specification : 374 ~ 384 kpa (3.82 ~ 3.92 kg/㎠, 54.3 ~ 55.8psi)

8) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for about 5 minutes.

9) Is the measured fuel pressure within specification?

YES

▶ Go to "Component Inspection" procedure.

YES

▶ Go to "Verification of Vehicle Repair" procedure.
▶ And then, go to " Verification of Vehicle Repair" procedure, and the go to "Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected area
Fuel pressure too low	Clogged 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
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

COMPONENT INSPECTION E3E5E1E4

1. Check PCV

1) IG "OFF".

2) Remove PCV valve and then, check that plunger in the PCV is moving.

3) Is the PCV normal ?

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 then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

1) IG "OFF".

2) Remove PCSV and Vaccum Hose

3) Check that PCSV is just one way solenoid valve

4) Is the PCSV normal ?

YES

▶ Go to "Check injector" as follows.

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) IG "OFF"

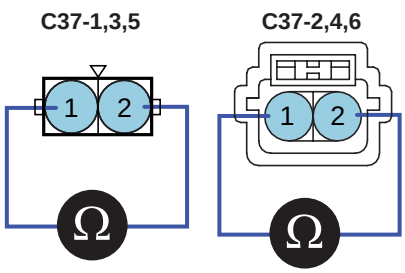
2) Remove injector.

3) Check that injector hole is clogged by foreign materials.

4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

SPECIFICATION :

Temp.	Resistance
20℃ (68°F)	13.8 ~ 15.2Ω



SCMF16425L

5) Is the measured resistance within specification ?

YES

▶ Go to "Check component related to fuel trim" as follows.

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 component related to fuel trim

1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

2) Are those component related to fuel trim O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

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

VERIFICATION OF VEHICLE REPAIR E81D2902

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC P2188 SYSTEM TOO RICH AT IDLE (BANK 1)
DTC P2190 SYSTEM TOO RICH AT IDLE (BANK 2)

GENERAL DESCRIPTION E608ACB0

Refer to DTC P2187.

DTC DESCRIPTION EF24E337

Checking air-fuel ratio correction value every 0.75 sec. at idle, if the value within the detecting condition for more than 0.3 sec., PCM sets P2188/P2190. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1AF6575

Item	Detecting Condition	Possible cause
DTC Strategy	• Fuel Trim Idle Condition Option Limits Exceeded	• Sensors related to Fuel Trim • Intake system • Fuel Pressure • Faulty PCM
Enable Conditions	• 550rpm ≤ Engine Speed ≤ 4000rpm • 60℃ (140˚F) ≤ Engine coolant temperature ≤ 114.992℃ (239˚F) • -10℃ (14˚F) ≤ Intake Air Temperature ≤ 60℃ (140˚F) • 0° ≤ Throttle Position ≤ 72° • 25kPa ≤ Engine Load ≤ 90kPa • 1.5g/s ≤ Intake Air Flow ≤ 80g/s • Barometric Pressure ≥ 72kPa • Vehicle Speed ≤ 130km/h • System Voltage ≥ 11V • Closed Loop Active • Other diagnostic fault not active	
Threshold value	• Average of short term fuel trim 〈 0.8 • Average of long term fuel trim 〈 1.24	
DiagnosisTime	• Continuous (More than 0.375sec. Failure for every 0.75sec. Test)	
MIL On Condition	• 2 Driving Cycles	

MONITOR DTC STATUS EFE1F32A

Refer to DTC P2187.

TERMINAL AND CONNECTOR INSPECTION E563AF09

Refer to DTC P2187.

SYSTEM INSPECTION EC9F9E30

1. Check air clog.

   1) Check Contamination ,Gasket installation as follows
      ▶ Damage or installation of throttle body gasket.
      ▶ Check clog of air cleaner

▶ Clog or contamination of intake manifold or injectors caused by foreign materials
▶ Check vaccum hose connected to surge tank is normal.

2) Has a problem been found ?

YES

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

NO

▶ Go to "Check Fuel Pressure" as follows

2. Check Fuel Pressure.

NOTE

- *Be cautious that Fuel is explosive and an empty fuel tank can still contain explosive gases.When working on fuel system make sure to supply adequate ventilation to the work area. Do not smoke, and keep sparks and open flames away.*
- *The fuel system remains under pressure when the engine is not running. Release fuel system pressure before disconnecting any fuel line to reduce the chance of presonal injury or fire damage to vehicle components.*

1) Start the engine and disconnect the fuel pump relay.

2) Wait until fuel in fuel line is exhausted and the engine stalls.

3) Turn the ignition switch OFF position.

4) Install the special service tool for measuring the fuel pressure between the delivery pipe and the fuel feed hose.

5) Connect the fuel pump relay.

6) With fuel pressure applied, check the three is no fuel leakage from the fuel pressure gauge or connection part.

7) Start the engine and measure the fuel pressure at idle.

Specification : 374 ~ 384 kpa (3.82 ~ 3.92 kg/㎠, 54.3 ~ 55.8psi)

8) Stop the engine and check for a change in the fuel pressure gauge reading.

Specification : After engine stops, the gauge reading should hold for about 5 minutes.

9) Is the measured fuel pressure within specification?

YES

▶ Go to "Component Inspection"procedure.

NO

▶ Repair or replace according to the table below, And then go to " Verification of Vehicle Repair" procedure.

Condition	Possible Cause	Suspected area
Fuel pressure too low	Clogged 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
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

COMPONENT INSPECTION E9FE482D

1. Check PCV

   1) IG "OFF".

   2) Remove PCV valve and then, check that plunger in the PCV is moving.

   3) Is the PCV normal ?

   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 then go to "Verification of Vehicle Repair" procedure.

2. Check PCSV

   1) IG "OFF".

   2) Remove PCSV and Vaccum Hose

   3) Check that PCSV is just one way solenoid valve

   4) Is the PCSV normal ?

   YES

   ▶ Go to "Check injector" as follows.

   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) IG "OFF"

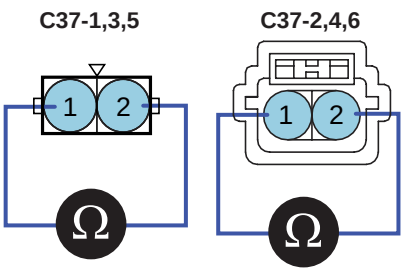
   2) Remove injector.

   3) Check that injector hole is clogged by foreign materials.

4) Measure resistance between terminal 1 an 2 of injector connector.(Component Side)

SPECIFICATION :

Temp.	Resistance
20℃ (68°F)	13.8 ~ 15.2Ω



SCMF16425L

5) Is the measured resistance within specification ?

YES

▶ Go to "Check component related to fuel trim" as follows.

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 component related to fuel trim

1) Check component related to fuel trim such as HO2S, MAFS,MAPS, TPS, ECTS, PCSV and Injectores) - Refer to each designated trouble shooting guide.

2) Are those component related to fuel trim O.K ?

YES

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

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

NO

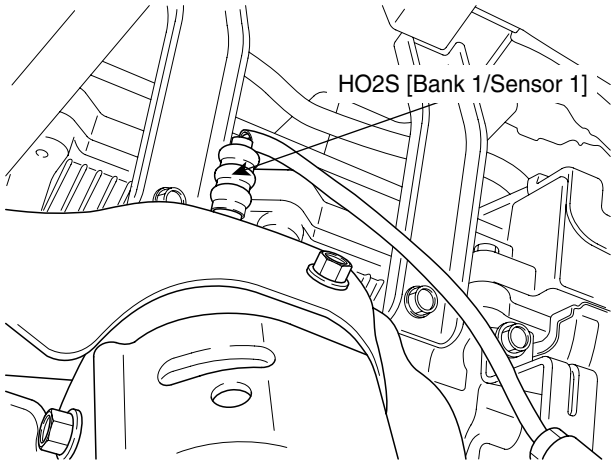
▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4DF84FC

Refer to DTC P2187.

DTC P2195 HO2S SIGNAL STUCK LEAN (BANK 1 / SENSOR 1)

COMPONENT LOCATION E74F8321



LGLG504A

GENERAL DESCRIPTION E72A34C4

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 oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is " rich," there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E622C1AE

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2195. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E1EC9544

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Clogging of fuel filter in fuel pump • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec. • Power Enrichment conditions • Engine warm-up state • Not in Transient Conditions	
Threshold value	• HO2S's signal < 0.35V and Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

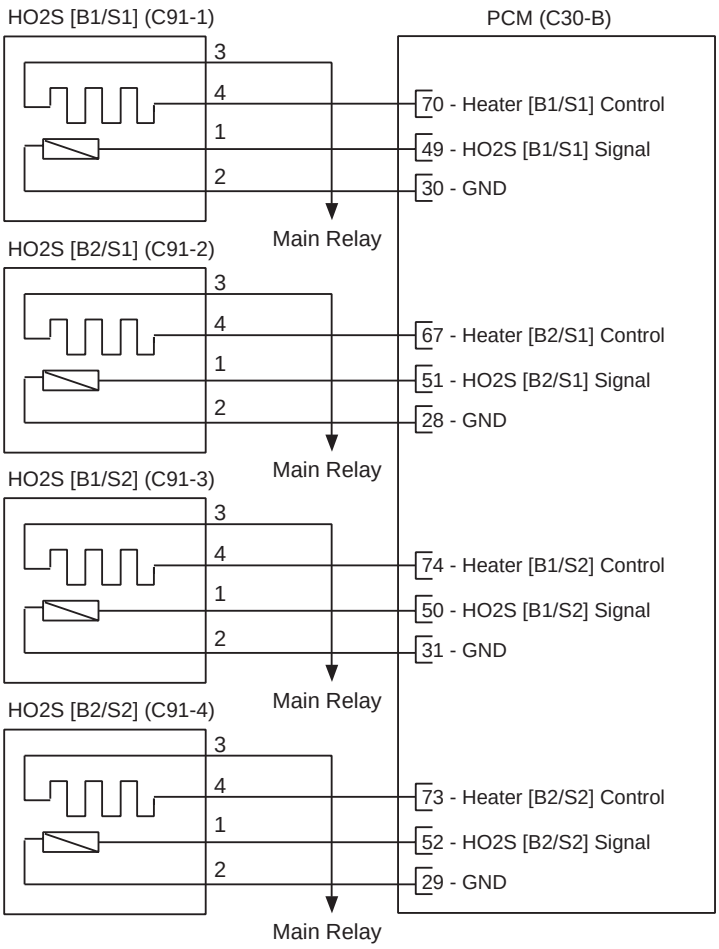
SPECIFICATION EF6C8E54

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM EF321788

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

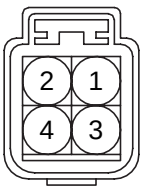
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



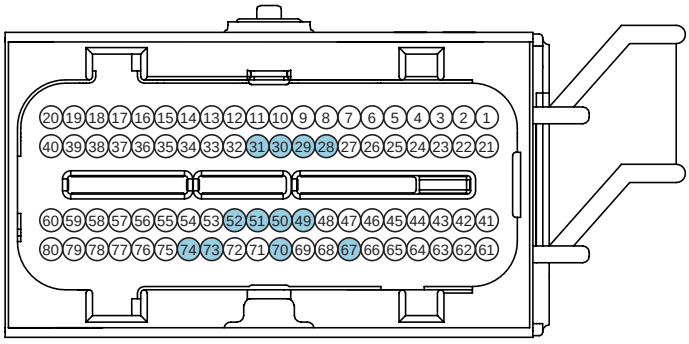
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA ECDD1CFC

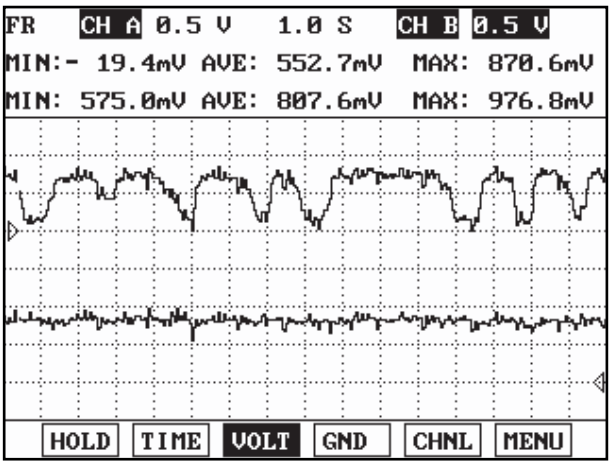


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS EC91DBE0

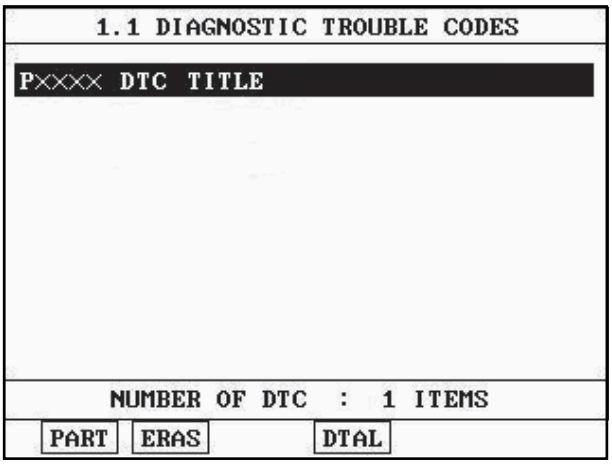
1. Check DTC Status

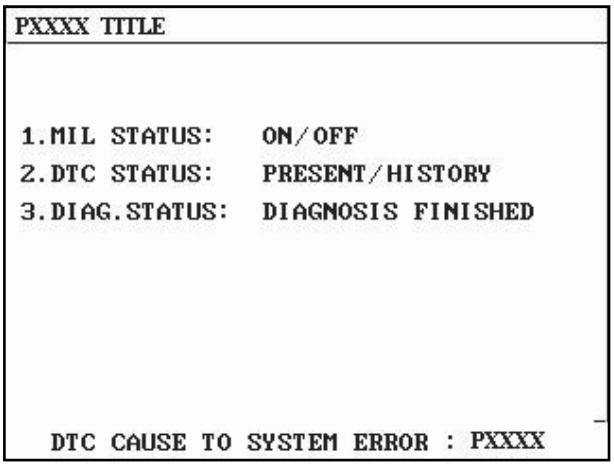
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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..

COMPONENT INSPECTION E30CE7C1

1. Check the condition of HO2S

   1) Check HO2S for poor connection or loose terminal.

   2) Check if HO2S is ensurely installed.

   3) Is the conditions of HO2S normal ?

   YES

   ▶ Go to "Check the Signal waveform of HO2S" as follows.

   NO

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

2. Check the Signal waveform of HO2S

   1) IG "OFF" and connect HO2S connector.

   2) Engine start.

   3) After warming-up, monitor signal waveform of HO2S with scantool.?

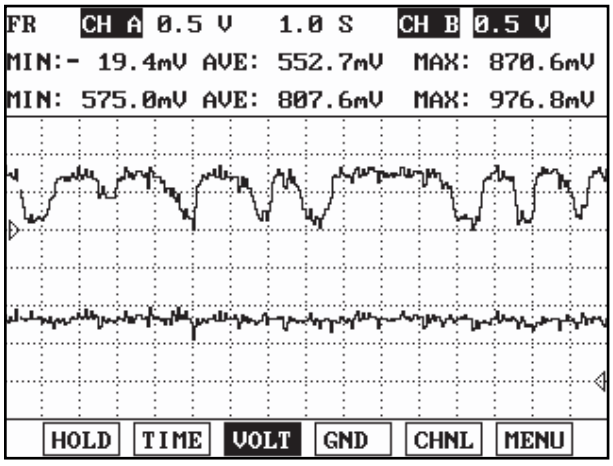


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

   YES

▶ Go to "Check fuel filter" as follows.

NO

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

3. Check the fuel filter of fuel pump

   1) IG "OFF" and disconnect the fuel pump connector.

   2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"

   3) Remove the fuel pump assembly.

   4) Check the fuel filter for clogging by dust, a foreign substance.

   5) Is the fuel filter O.K.?

      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 fuel filter and check for proper operation.
      If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E7B398AA

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

   ▶ Go to the applicable troubleshoooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P2196 HO2S SIGNAL STUCK RICH (BANK 1 / SENSOR 1)

COMPONENT LOCATION E162B279

Refer to DTC P2195.

GENERAL DESCRIPTION E4511625

Refer to DTC P2195.

DTC DESCRIPTION EC9FDB54

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2196. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EED8307F

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec • Fuel cut-off conditions • Engine warm-up state • Not in Transient Conditions	
Threshold value	• HO2S's signal > 0.42V	
DiagnosisTime	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EAB4411D

Refer to DTC P2195.

SCHEMATIC DIAGRAM E973CBAA

Refer to DTC P2195.

SIGNAL WAVEFORM AND DATA E0C0F1BD

Refer to DTC P2195.

MONITOR DTC STATUS E7335320

Refer to DTC P2195.

COMPONENT INSPECTION EA6FE12F

1. Check the condition of HO2S

    1) Check HO2S for poor connection or loose terminal.

2) Check if HO2S is ensurely installed.

3) Is the conditions of HO2S normal ?

YES

▶ Go to "Check the Signal waveform of HO2S" as follows.

NO

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

2. Check the Signal waveform of HO2S

1) IG "OFF" and connect HO2S connector.

2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

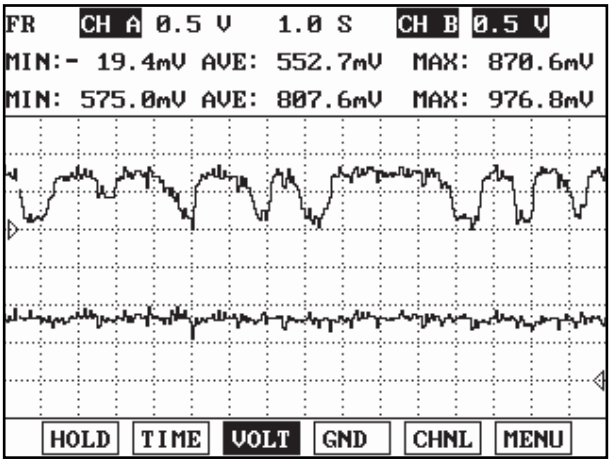


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

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 HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

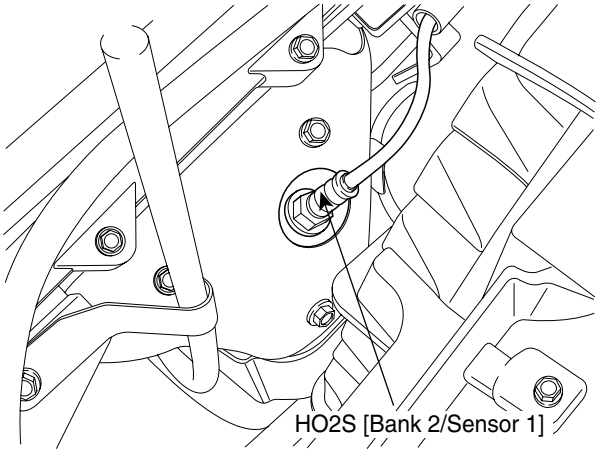
There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E0913C4F

Refer to DTC P2195.

DTC P2197 HO2S SIGNAL STUCK LEAN (BANK 2 / SENSOR 1)

COMPONENT LOCATION ECEB14C1



LGLG506A

GENERAL DESCRIPTION E3645AB8

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 oxygen sensor generates a voltage that indicates the difference between the oxygen content of the exhaust stream and the oxygen content of ambient air. When the exhaust stream is " rich," there is more oxygen in the ambient air than in the exhaust stream, so the voltage will be higher.

DTC DESCRIPTION E21645C5

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2197. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E815CC81

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Clogging of fuel filter in fuel pump • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec. • Power Enrichment conditions • Engine warm-up state • Not in Transient Conditionsatus	
Threshold value	• HO2S's signal < 0.35V and Air Fuel Ratio ≤ 13.5	
DiagnosisTime	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

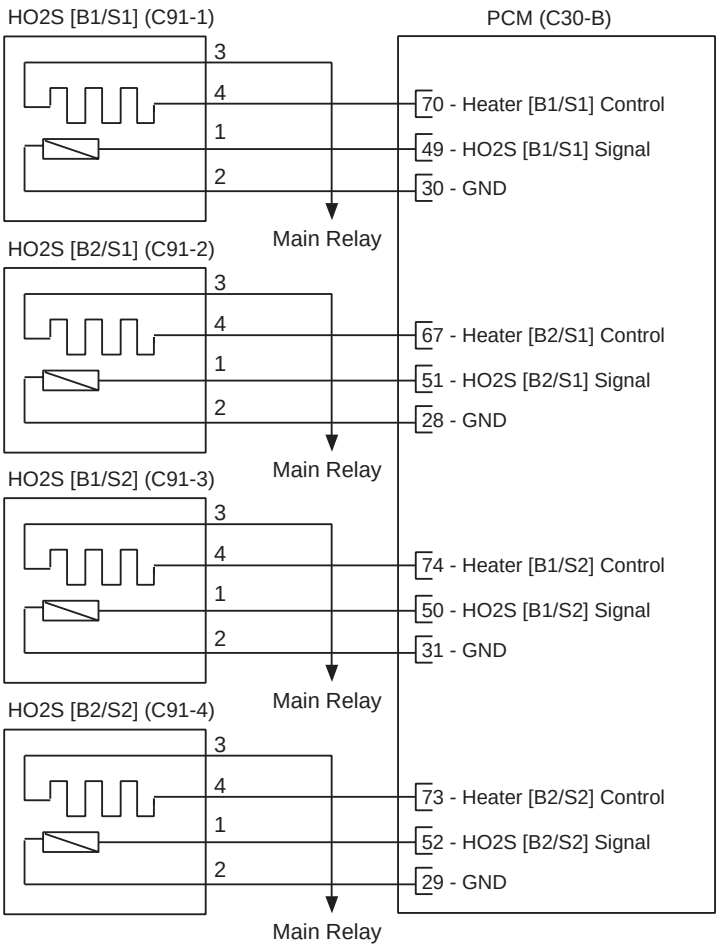
SPECIFICATION E7DC80BC

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E84C21A1

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

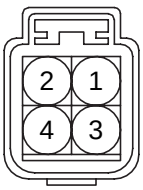
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



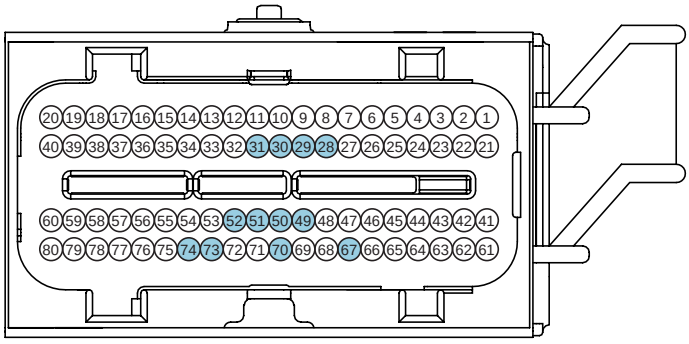
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA EB33658C

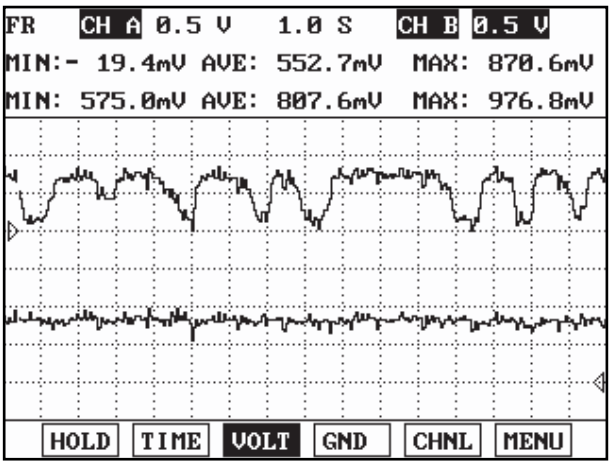


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS E3C15C92

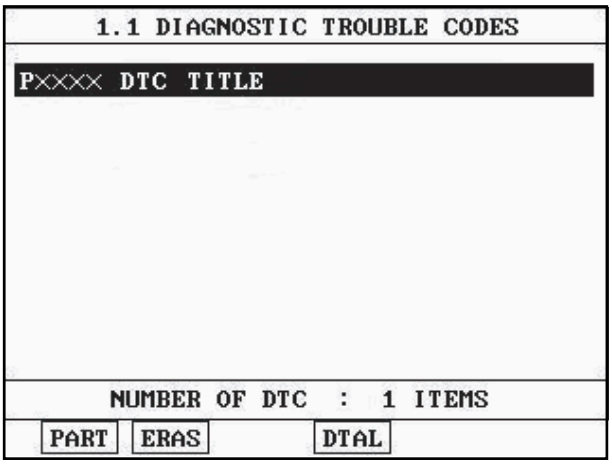
1. Check DTC Status

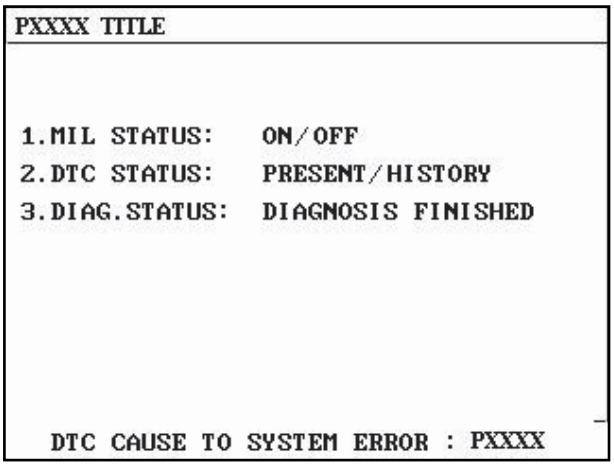
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

COMPONENT INSPECTION E2E4FDEE

1. Check the condition of HO2S

   1) Check HO2S for poor connection or loose terminal.

   2) Check if HO2S is ensurely installed.

   3) Is the conditions of HO2S normal ?

   YES

   ▶ Go to "Check the Signal waveform of HO2S" as follows.

   NO

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

2. Check the Signal waveform of HO2S

   1) IG "OFF" and connect HO2S connector.

   2) Engine start.

   3) After warming-up, monitor signal waveform of HO2S with scantool.?

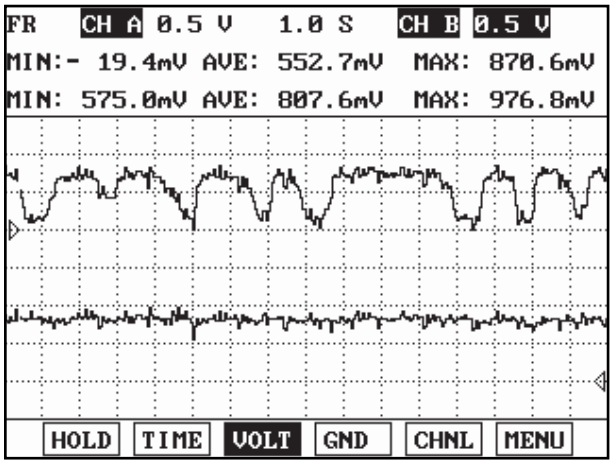


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

   YES

▶ Go to "Check fuel filter" as follows.

NO

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

3. Check the fuel filter of fuel pump

   1) IG "OFF" and disconnect the fuel pump connector.

   2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"

   3) Remove the fuel pump assembly.

   4) Check the fuel filter for clogging by dust, a foreign substance.

   5) Is the fuel filter O.K.?

      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 fuel filter and check for proper operation.
      If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E5D33ACC

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

   ▶ Go to the applicable troubleshoooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P2198 HO2S SIGNAL STUCK RICH (BANK 2 / SENSOR 1)

COMPONENT LOCATION E1A74602

Refer to DTC P2197.

GENERAL DESCRIPTION E3D25E6A

Refer to DTC P2197.

DTC DESCRIPTION E792AE78

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2198. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E576419E

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec. • Fuel cut-off conditions • Engine warm-up state • Not in Transient Conditionsatus	
Threshold value	• HO2S's signal > 0.42V	
DiagnosisTime	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E021974B

Refer to DTC P2197.

SCHEMATIC DIAGRAM E7E982CC

Refer to DTC P2197.

SIGNAL WAVEFORM AND DATA EE49F467

Refer to DTC P2197.

MONITOR DTC STATUS E47391E3

Refer to DTC P2197.

COMPONENT INSPECTION E688A7CE

1. Check the condition of HO2S

    1) Check HO2S for poor connection or loose terminal.

2) Check if HO2S is ensurely installed.

3) Is the conditions of HO2S normal ?

YES

▶ Go to "Check the Signal waveform of HO2S" as follows.

NO

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

2. Check the Signal waveform of HO2S

1) IG "OFF" and connect HO2S connector.

2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

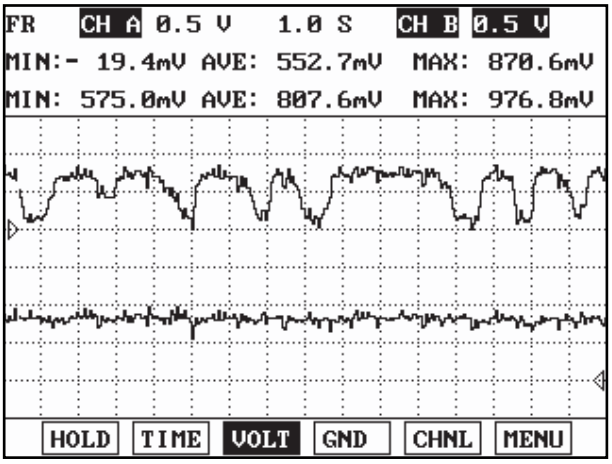


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

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 HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

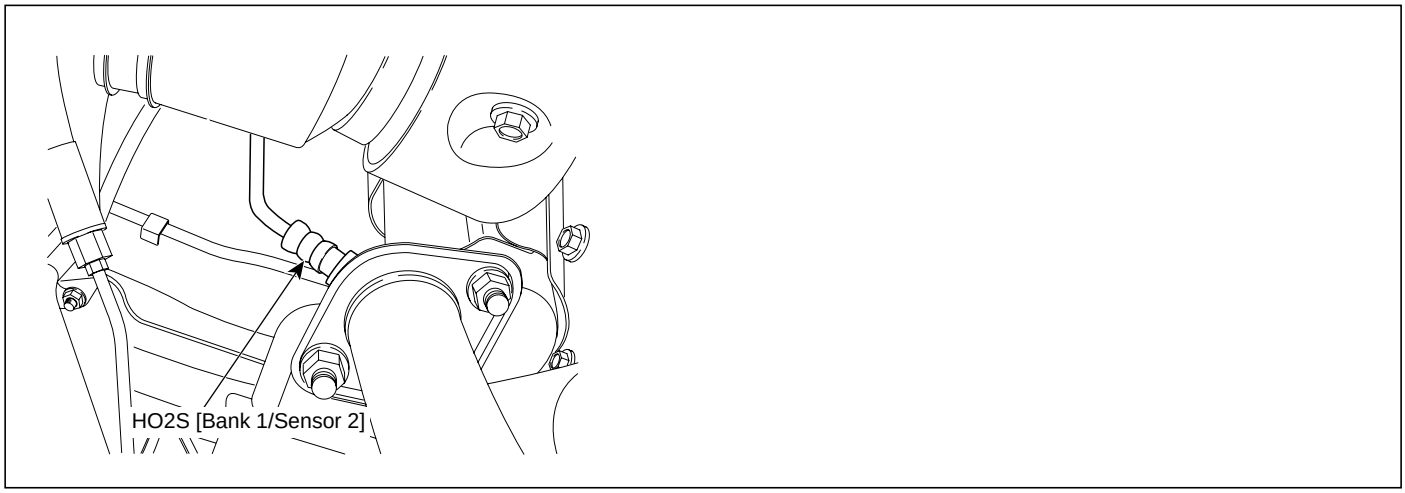
There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR ED59D34E

Refer to DTC P2197.

DTC P2270 O2 SENSOR SIGNAL STUCK LEAN (BANK 1 / SENSOR 2)

COMPONENT LOCATION E0BA2B9F



SCMF16165L

GENERAL DESCRIPTION E1E3E707

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION E3CF5835

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2270. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA5010E1

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Clogging of fuel filter in fuel pump • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec. • Power Enrichment conditions • Engine warm-up state • Not in Transient Conditions	
Threshold value	• HO2S's signal < 0.35V and Air Fuel Ratio ≤ 13.5	
Diagnosis Time	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

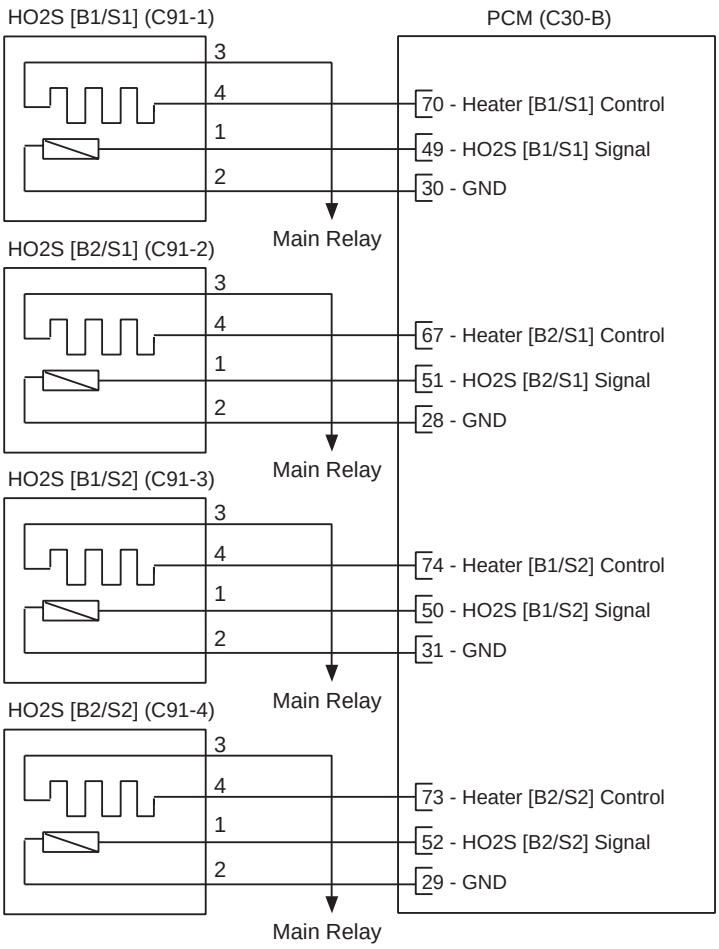
SPECIFICATION E0CB4CF7

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM E9A1FBC4

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

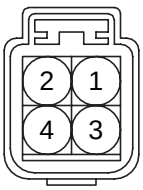
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



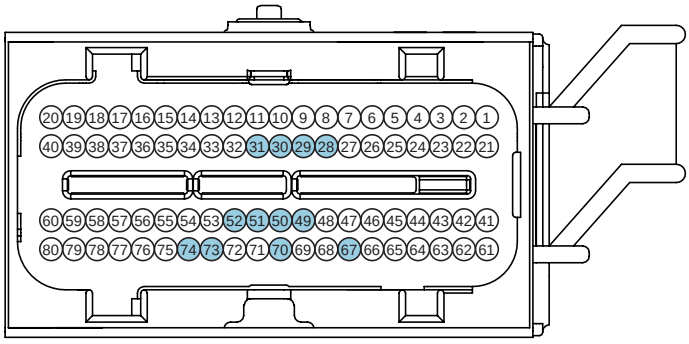
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA EC8D199E

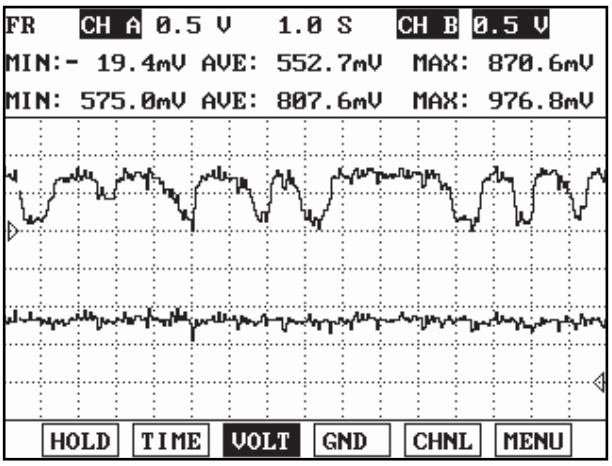


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS E209D901

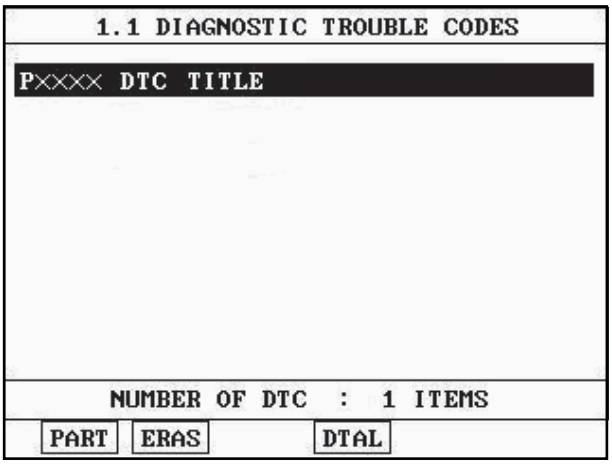
1. Check DTC Status

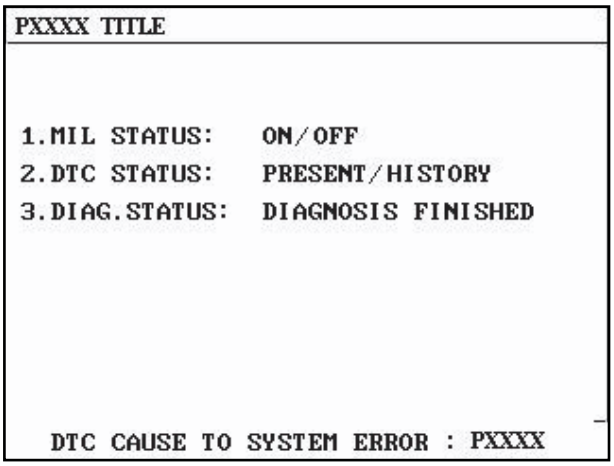
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

COMPONENT INSPECTION E4CFC8AB

1. Check the condition of HO2S

   1) Check HO2S for poor connection or loose terminal.

   2) Check if HO2S is ensurely installed.

   3) Is the conditions of HO2S normal ?

   YES

   ▶ Go to "Check the Signal waveform of HO2S" as follows.

   NO

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

2. Check the Signal waveform of HO2S

   1) IG "OFF" and connect HO2S connector.

   2) Engine start.

   3) After warming-up, monitor signal waveform of HO2S with scantool.?

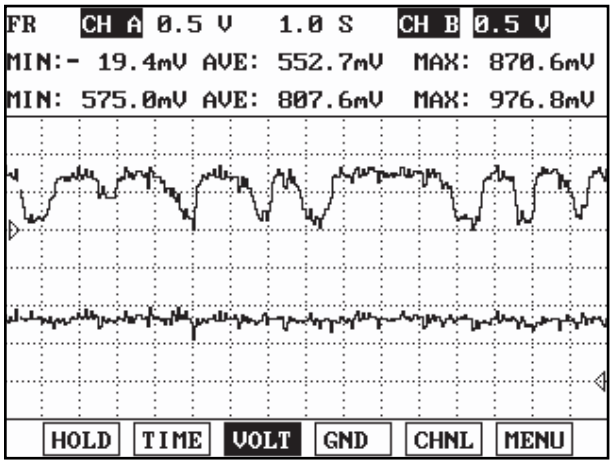


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

   YES

▶ Go to "Check fuel filter" as follows.

NO

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

3. Check the fuel filter of fuel pump

   1) IG "OFF" and disconnect the fuel pump connector.

   2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"

   3) Remove the fuel pump assembly.

   4) Check the fuel filter for clogging by dust, a foreign substance.

   5) Is the fuel filter O.K.?

      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 fuel filter and check for proper operation.
      If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E538C54C

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

   ▶ Go to the applicable troubleshoooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P2271 O2 SENSOR SIGNAL STUCK RICH (BANK 1 / 2 SENSOR 1)

COMPONENT LOCATION EA3D78C1

Refer to DTC P2270.

GENERAL DESCRIPTION EFC7EA8D

Refer to DTC P2270.

DTC DESCRIPTION EEBEAC61

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2271. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EA11B8E6

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec. • Fuel cut-off conditions • Engine warm-up state • Not in Transient Conditions	
Threshold value	• HO2S's signal > 0.42V	
Diagnosis Time	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E92C9C03

Refer to DTC P2270.

SCHEMATIC DIAGRAM E181B282

Refer to DTC P2270.

SIGNAL WAVEFORM AND DATA E9EBFE74

Refer to DTC P2270.

MONITOR DTC STATUS E62EEA8B

Refer to DTC P2270.

COMPONENT INSPECTION E4CCDBB3

1. Check the condition of HO2S

    1) Check HO2S for poor connection or loose terminal.

2) Check if HO2S is ensurely installed.

3) Is the conditions of HO2S normal ?

YES

▶ Go to "Check the Signal waveform of HO2S" as follows.

NO

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

2. Check the Signal waveform of HO2S

1) IG "OFF" and connect HO2S connector.

2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

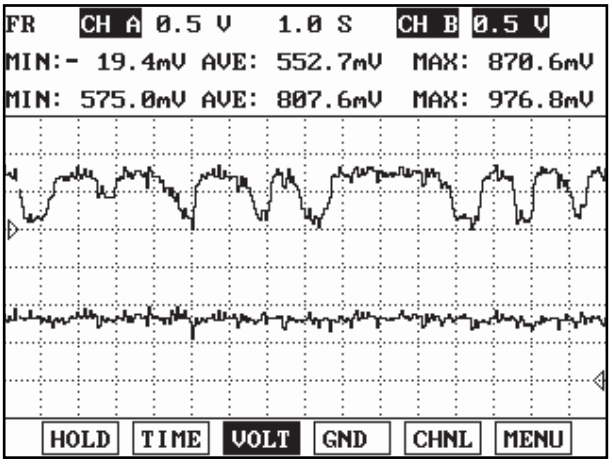


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

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 HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

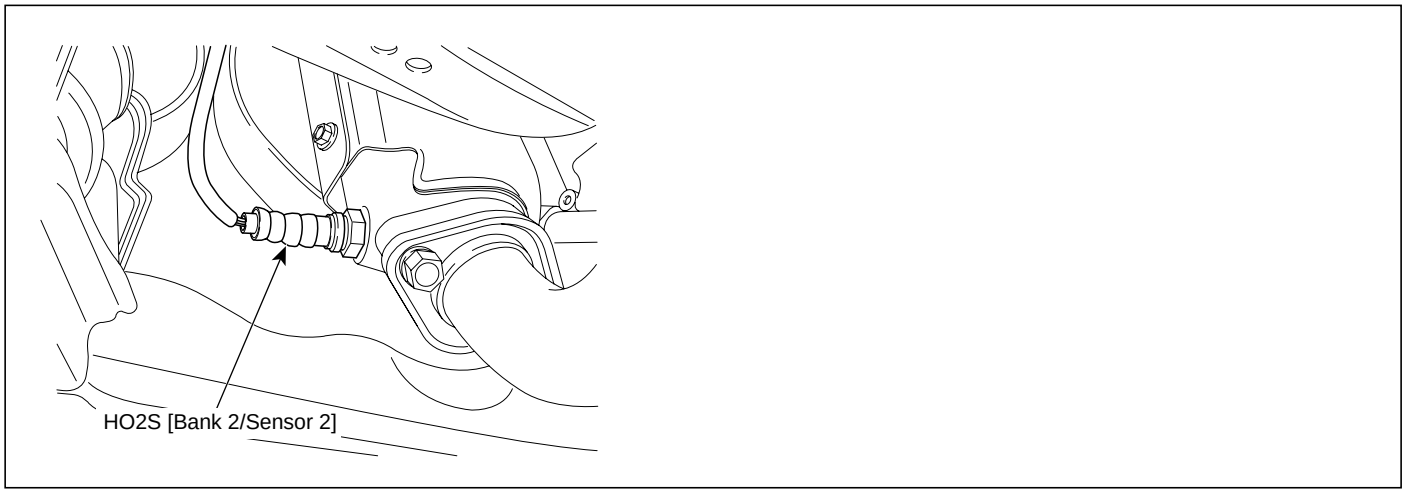
There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E375662C

Refer to DTC P2270.

DTC P2272 HO2S SIGNAL STUCK LEAN (BANK 2 / SENSOR 2)

COMPONENT LOCATION E102FFFA



SCMF16176L

GENERAL DESCRIPTION E19C9915

The rear heated oxygen sensor is mounted on the rear side of the Catalytic Converter (warm-up catalytic converter) or in the rear exhaust pipe, which is able to detect catalyst efficiency. The rear heated oxygen sensor (HO2S) produces a voltage between 0V and 1V. This rear heated oxygen sensor is used to estimate the oxygen storage capability. If a catalyst has good conversion properties, the oxygen fluctuations are smoothed by the oxygen storage capacity of the catalyst. If the conversion provided by the catalyst is low due to aging, poisoning or misfiring, then the oxygen fluctuations are similar to signals from the front oxygen sensor.

DTC DESCRIPTION EA1F9A79

Checking output signals from HO2S under detecting condition, if HO2S's signal is lean during power enrichment conditions, PCM sets P2272. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E544989E

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Clogging of fuel filter in fuel pump • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec. • Power Enrichment conditions • Engine warm-up state • Not in Transient Conditions	
Threshold value	• HO2S's signal < 0.35V and Air Fuel Ratio ≤ 13.5	
Diagnosis Time	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

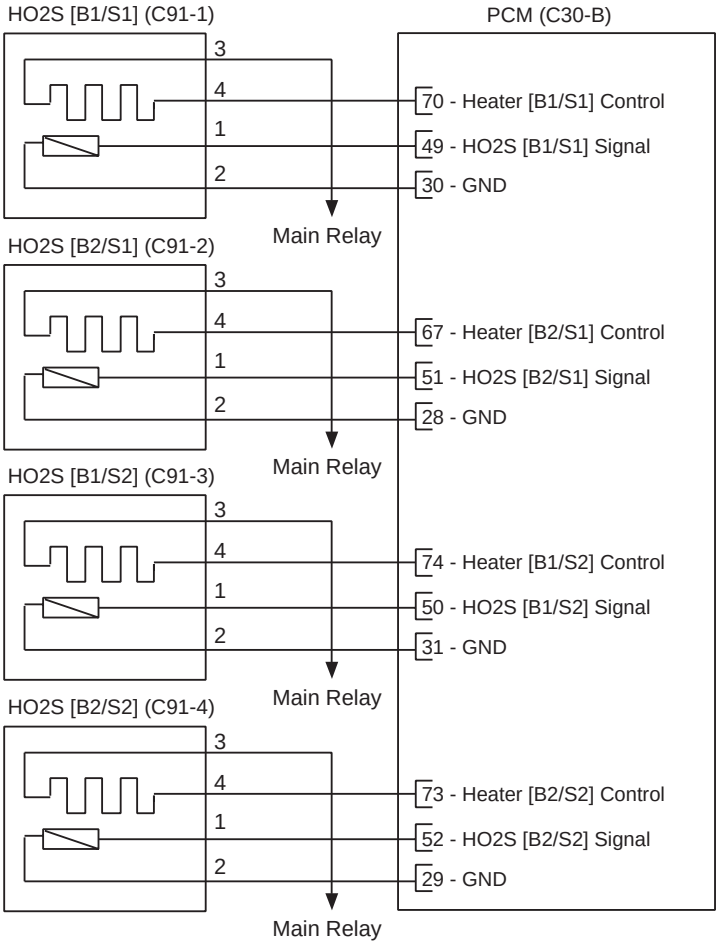
SPECIFICATION EB49A558

(REFERENCE ONLY)

Test Condition	HO2S Voltage(Sensor1)	HO2S Voltage(Sensor2)
HO2S Signal at idle after warm-up	Signal is commonly switching from rich to lean more than 3 times in 10 sec.	Signal is commonly above 0.6V.
HO2S signal at open circuit (Pumping current OFF)	Approx. 0.45V	
HO2S signal at open circuit (Pumping current ON)	Approx. 3.5V	

SCHEMATIC DIAGRAM ED382119

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

HO2S [B1/S1]

Terminal	Connected to	Function
1	PCM C30-B (49)	HO2S [B1/S1] Signal
2	PCM C30-B (30)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (70)	Heater [B1/S1] Control

HO2S [B2/S1]

Terminal	Connected to	Function
1	PCM C30-B (51)	HO2S [B2/S1] Signal
2	PCM C30-B (28)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (67)	Heater [B2/S1] Control

HO2S [B1/S2]

Terminal	Connected to	Function
1	PCM C30-B (50)	HO2S [B1/S2] Signal
2	PCM C30-B (31)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (74)	Heater [B1/S2] Control

HO2S [B2/S2]

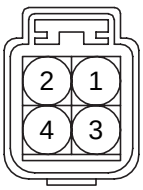
Terminal	Connected to	Function
1	PCM C30-B (52)	HO2S [B2/S2] Signal
2	PCM C30-B (29)	Sensor ground
3	Main Relay	Battery Voltage (B+)
4	PCM C30-B (73)	Heater [B2/S2] Control

[HARNESS CONNECTORS]



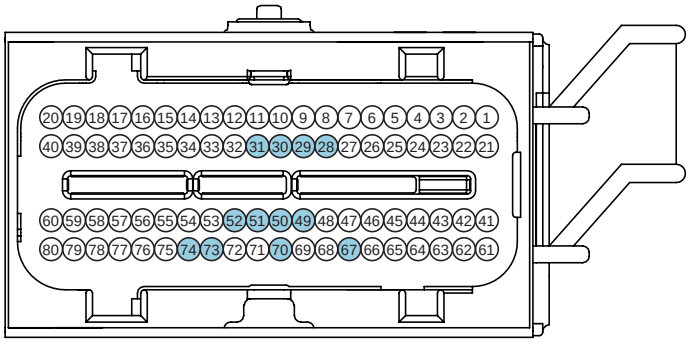
C91-1,2

HO2S [Bank 1/Sensor 1]
HO2S [Bank 2/Sensor 1]



C91-3,4

HO2S [Bank 1/Sensor 2]
HO2S [Bank 2/Sensor 2]



C30-B

PCM

SCMF16110L

SIGNAL WAVEFORM AND DATA E2BA8DCB

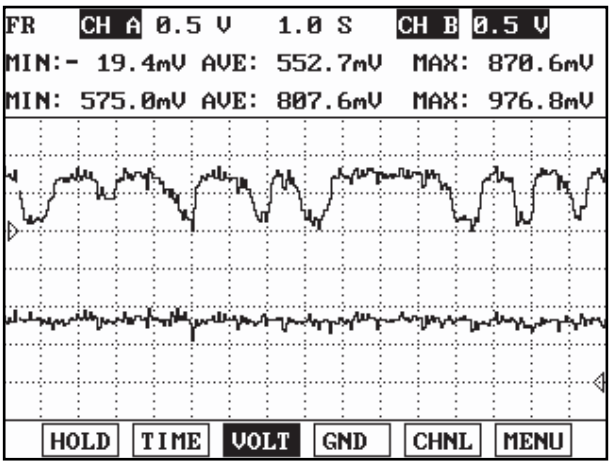


Fig) Signal waveforms of front HO2S(the upper) and rear HO2S(the lower)

SCMF16223L

After warming-up, if accelerator pedal is released suddenly around 4000rpm, the HO2S signal reading will be lower than 200mV resulting from Fuel cut-off for the moment. Conversely, if suddenly accelerator pedal is depressed, HO2S signal reading will be around 0.6V ~1.0V. At idle, Normally HO2S signal will switch from lean to rich with 3 Hz. And as racing, Its frequency rises.

MONITOR DTC STATUS EDE0794A

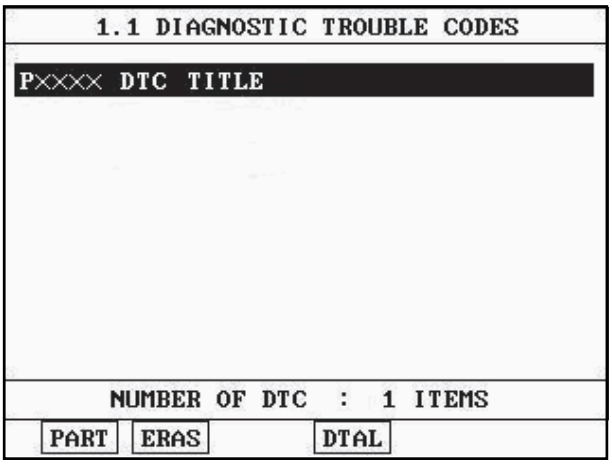
1. Check DTC Status

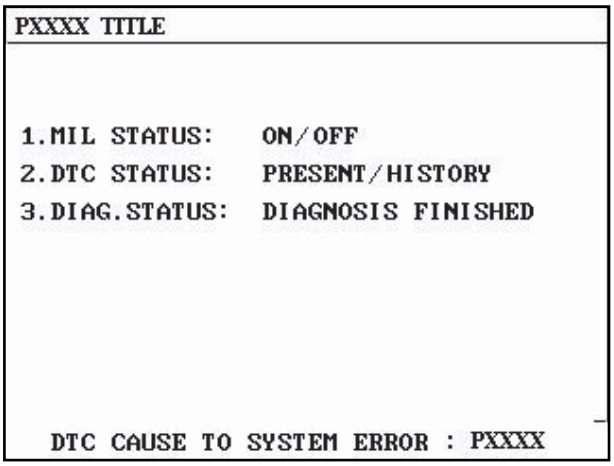
   1) Connect scantool to Data Link Connector(DLC).

   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) Read "DTC Status" parameter.





SCMF16159L

   5) Is parameter displayed "Present fault"?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

COMPONENT INSPECTION E219BE04

1. Check the condition of HO2S

   1) Check HO2S for poor connection or loose terminal.

   2) Check if HO2S is ensurely installed.

   3) Is the conditions of HO2S normal ?

   YES

   ▶ Go to "Check the Signal waveform of HO2S" as follows.

   NO

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

2. Check the Signal waveform of HO2S

   1) IG "OFF" and connect HO2S connector.

   2) Engine start.

   3) After warming-up, monitor signal waveform of HO2S with scantool.?

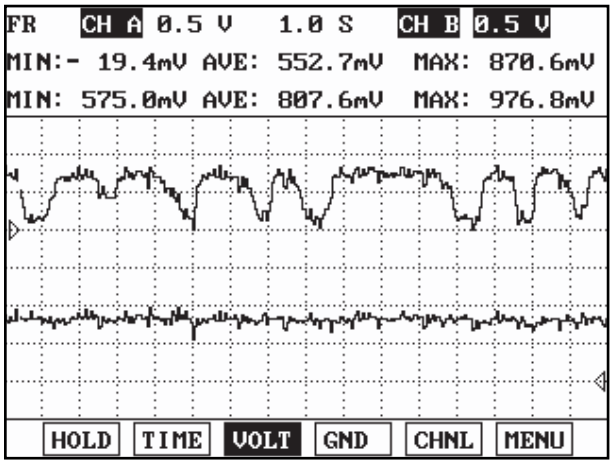


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

   4) Is the sensor switching properly?

   YES

▶ Go to "Check fuel filter" as follows.

NO

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

3. Check the fuel filter of fuel pump

   1) IG "OFF" and disconnect the fuel pump connector.

   2) Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, IG "OFF"

   3) Remove the fuel pump assembly.

   4) Check the fuel filter for clogging by dust, a foreign substance.

   5) Is the fuel filter O.K.?

      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 fuel filter and check for proper operation.
      If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automatically detected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E3AE4890

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

   YES

   ▶ Go to the applicable troubleshoooting procedure.

   NO

   ▶ System is performing to specification at this time.

DTC P2273 HO2S SIGNAL STUCK RICH (BANK 2 / SENSOR 2)

COMPONENT LOCATION E1290AB1

Refer to DTC P2272.

GENERAL DESCRIPTION EACCB643

Refer to DTC P2272.

DTC DESCRIPTION EE9ECA5D

Checking output signals from HO2S under detecting condition, if HO2S's signal is rich during fuel cut-off conditions, PCM sets P2273. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION EC3634CF

Item	Detecting Condition	Possible cause
DTC Strategy	• Monitor HO2S's signal	• Poor Connection • Faulty HO2S • Faulty PCM
Enable Conditions	• Battery voltage ≥ 10V • Engine running ≥ 60sec. • Fuel cut-off conditions • Engine warm-up state • Not in Transient Conditions.	
Threshold value	• HO2S's signal > 0.42V	
Diagnosis Time	• Continuous (More than 8 sec. failure for every 9 sec. Test)	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION EC3DAADD

Refer to DTC P2272.

SCHEMATIC DIAGRAM EDB55561

Refer to DTC P2272.

SIGNAL WAVEFORM AND DATA E4EBDD14

Refer to DTC P2272.

MONITOR DTC STATUS E4037FE2

Refer to DTC P2272.

COMPONENT INSPECTION E00CD08E

1. Check the condition of HO2S

    1) Check HO2S for poor connection or loose terminal.

2) Check if HO2S is ensurely installed.

3) Is the conditions of HO2S normal ?

YES

▶ Go to "Check the Signal waveform of HO2S" as follows.

NO

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

2. Check the Signal waveform of HO2S

1) IG "OFF" and connect HO2S connector.

2) Engine start.

3) After warming-up, monitor signal waveform of HO2S with scantool.?

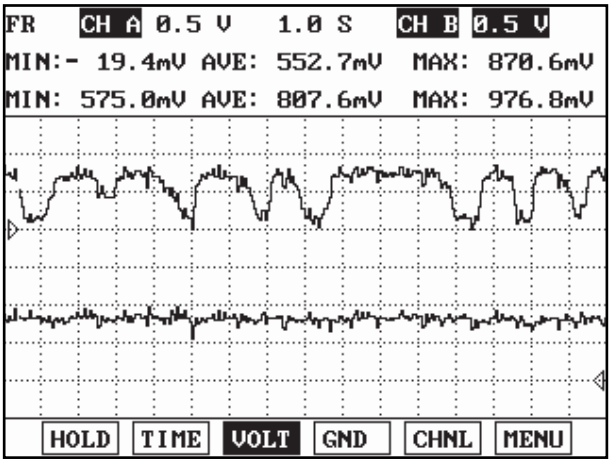


Fig) Signal waveform of front(the upper) and rear(the lower) HO2S at idle

SCMF16225L

4) Is the sensor switching properly?

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 HO2S and check for proper operation.
If the problem is corrected, go to "Verification of Vehicle Repair" procedure.

NOTE

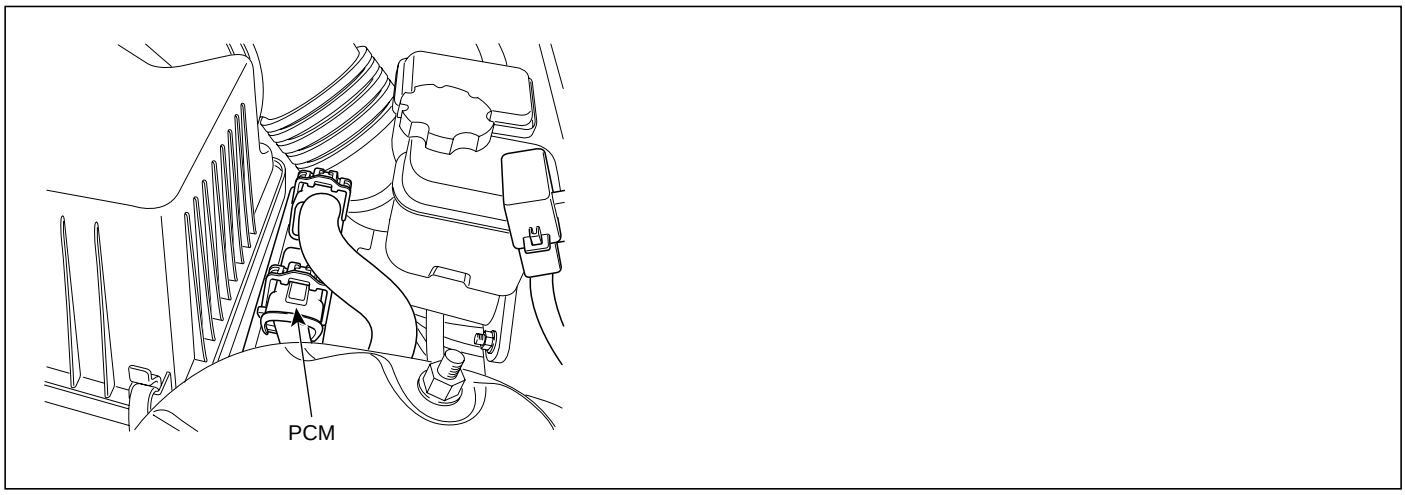
There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM. Before or after testing PCM on the vehicle, use this function to reuse the PCM on the others.

VERIFICATION OF VEHICLE REPAIR E42DD3FF

Refer to DTC P2272.

DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE

COMPONENT LOCATION EF84EAD7



SCMF16386L

GENERAL DESCRIPTION E5334D98

Continuing to calculate data of several sensor despite turning ignition OFF, when ignition turns ON, this enables PCM to be easy using calculated data.

DTC DESCRIPTION E14CFFF7

If abnormal counterdown is detected for a calibratable time, PCM sets P2610. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E4B758C2

ITEM		Detecting Condition	Possible Cause
DTC Strategy	Case 1	• Compares the time elapsed recorded by the LPC against that recorded by the test timer	• PCM
	Case 2	• Checks for abnormal resets of the LPC	
Enable-Condition	Case 1	• Engine running 〉 10sec. • Battery voltage 〉 8V	
	Case 2	• No Memory Failure Occurred	
Thresh-old	Case 1	• The difference between the Counter by the low power counter and the calibration the test timer clocks up 〉 2sec.	
	Case 2	• The LPC is reset to zero abnormally	
Diagnosis Time		• -	
MIL On Condition		• 2 Driving Cycle	

MONITOR DTC STATUS E75D5DB7

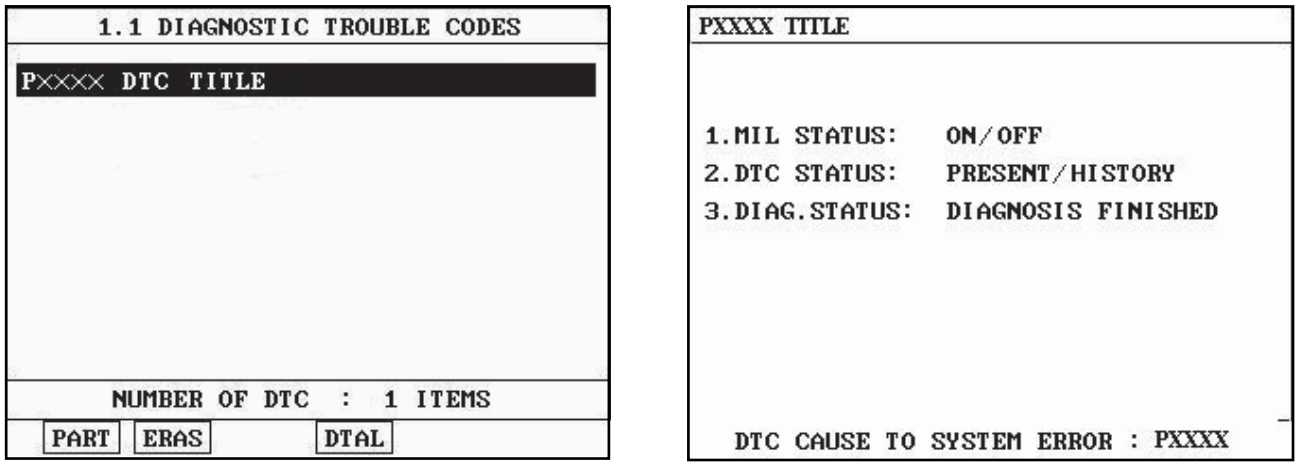
1. Check DTC Status

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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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.

TERMINAL AND CONNECTOR INSPECTION E371FCF4

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 PCM and check for proper operation. If the problem is corrected,replace PCM and then go to "Verification of Vehicle Repair" procedure.

NOTE

There is a memory reset function on scantool that can erase optional parts automaticallydetected and memorized by PCM.

VERIFICATION OF VEHICLE REPAIR E5910E0D

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

DTC U0001 CAN COMMUNICATION MALFUNCTION

GENERAL DESCRIPTION E03A959E

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(PCM, ABS, ESP)
As sharing signals of engine speed, APS, gear shifting, torque reduction in ESP,ABS and various modules, active control is performed.

DTC DESCRIPTION E21BF1DB

Checking CAN communication, under detecting condition, if an error within the detecting condition is detected for more than 1.5 sec., PCM sets U0001. MIL(Malfunction Indication Lamp) turns on when the malfunction lasts till consecutive 2 driving cycle.

DTC DETECTING CONDITION E42C5BA1

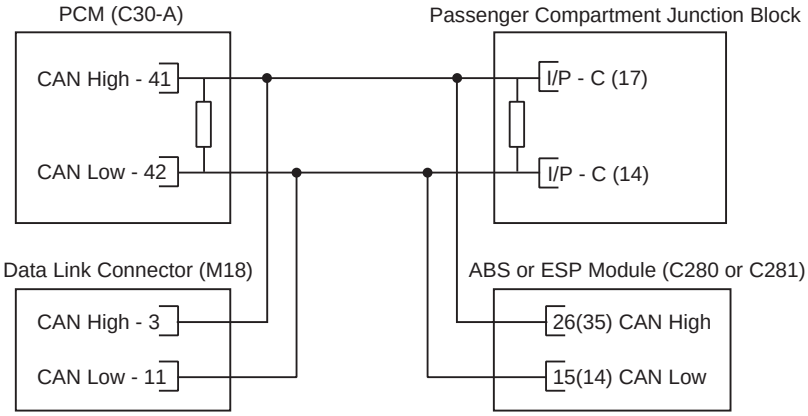
Item	Detecting Condition	Possible cause
DTC Strategy	• Detects failures in communication between the PCM and another or modules in the vehicle which are on the CAN serial bus.	• CAN BUS • CAN communication module component
EnableConditions	• Engine Run Time ≥ 2sec. • Ignition Voltage ≥ 11V	
Threshold value	• CAN communicatin error	
DiagnosisTime	• Continuous	
MIL On Condition	• 2 Driving Cycles	

SPECIFICATION E4BAA2D9

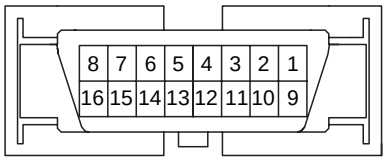
Format	DIGITAL "0"		DIGITAL "1"(BUS IDLE)		CAN Communication Line Resistance	
	HIGH	LOW	HIGH	LOW	PCM	Passenger compartment junction block
CAN 2.0B	3.5V	1.5V	2.5V	2.5V	120Ω (20℃)	120Ω (20℃)

SCHEMATIC DIAGRAM EC3D749D

[CIRCUIT DIAGRAM]

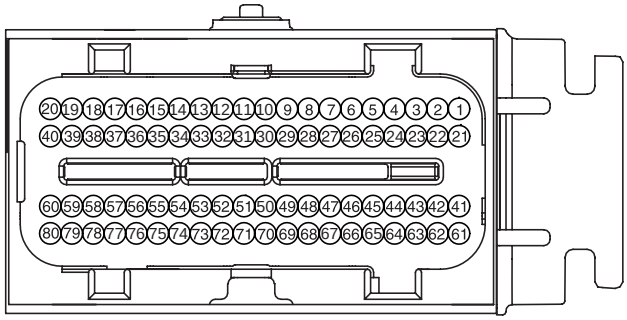


[HARNESS CONNECTORS]



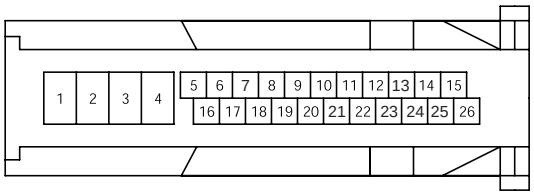
M10

(Data Link Connection)



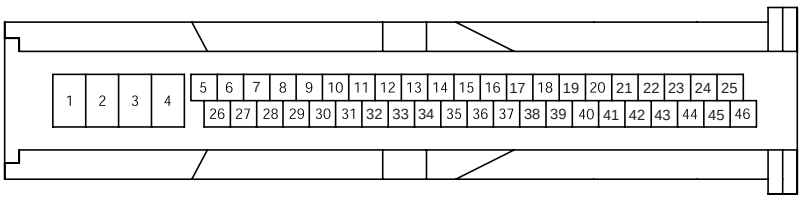
C30-A

PCM



C280

ABS Module



C281

EPS Module

SCMF16426L

SIGNAL WAVEFROM AND DATA EFD86111

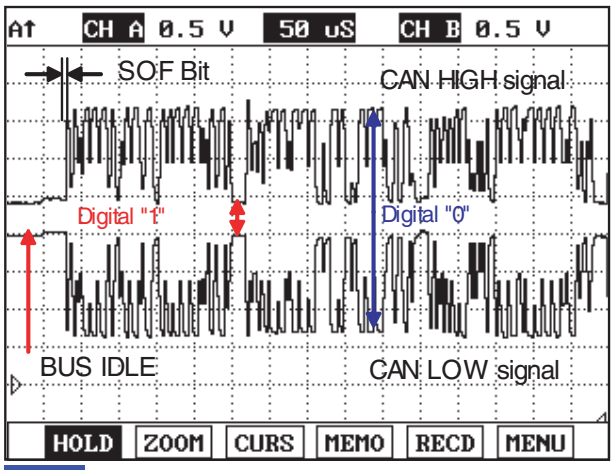


Fig.1

Fig.1) CAN communication waveform

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 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.

LGLG397A

MONITOR DTC STATUS E9EAD6E3

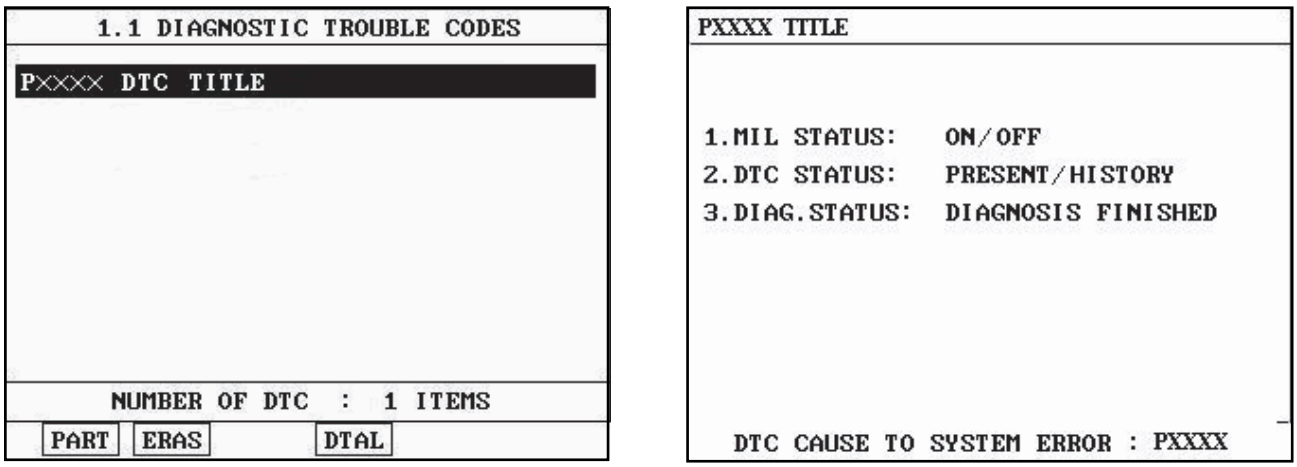
1. Check DTC Status

   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) Read "DTC Status" parameter.



SCMF16159L

5) Is parameter displayed "Present fault"?

YES

▶ Go to "Terminal and connector inspection" procedure.

NO

▶ Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM 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

TERMINAL AND CONNECTOR INSPECTION E0934A34

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

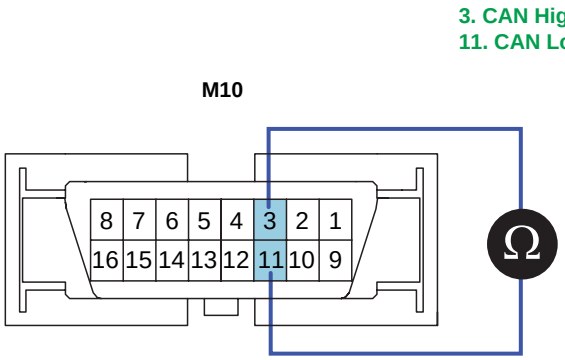
▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION E385D809

1. Check CAN BUS resistance in Data Link Connector
   1) Ignition "OFF"
   2) Measure the resistance between terminals 3 and 11 of data link connector (Test 1)
   3) Disconnect PCM connector.

4) Measure the resistance between terminals 3 and 11 of data link connector (Test 2)

Specification : PCM and ABS(or ESP) connected : 60 ± 3Ω (Test 1)
PCM and ABS(or ESP) disconnected : 120 ± 3Ω (Test 2)



SCMF16428L

5) Is CAN BUS resistance within the specification?

YES

▶ Go to "2.Check short to ground in CAN BUS" as follows.

NO

▶ Below 10Ω for both conditions(disconnected, connected) : Repair short between CAN BUS lines and go to "Verification of Vehicle Repair".
▶ 120Ω for both conditions(disconnected, connected) : Go to "4. Check CAN BUS continuity".
▶ Infinite Ω for both conditions(disconnected, connected) :Repair open in CAN communication circuit between DLC terminal and In-pannel junction box.

2. Check short to ground in CAN BUS

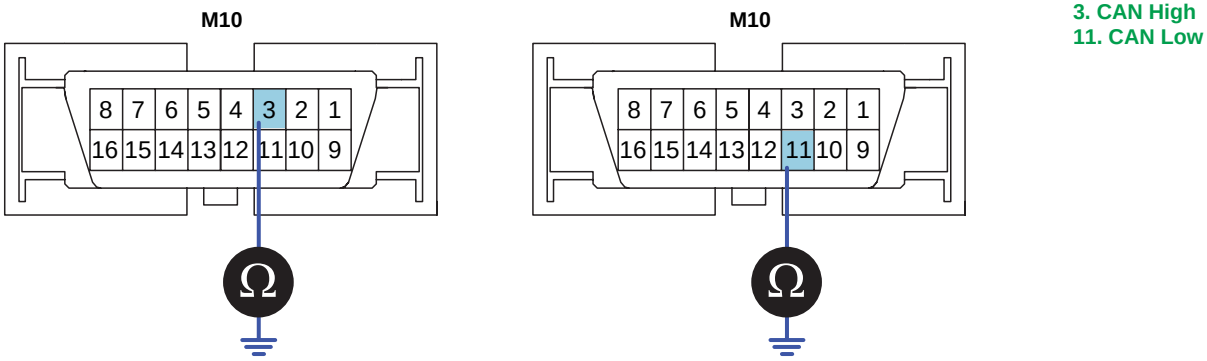
1) Ignition "OFF"

2) Disconnect PCM and ABS(or ESP) connector.

3) Check continuity between DLC terminal 3 and chassis ground. (CAN HIGH line)

4) Check continuity between DLC terminal 11 and chassis ground. (CAN LOW line)

Specification : Discontinuity (Infinite Ω)



3. CAN High
11. CAN Low

SCMF16429L

5) Is measured resistance within the specification?

YES

▶ Go to "3. Check short to battery in CAN BUS".

NO

▶ Repair short to ground in circuit and go to "Verification of Vehicle Repair".

3. Check short to battery in CAN BUS

1) Ignition "OFF"

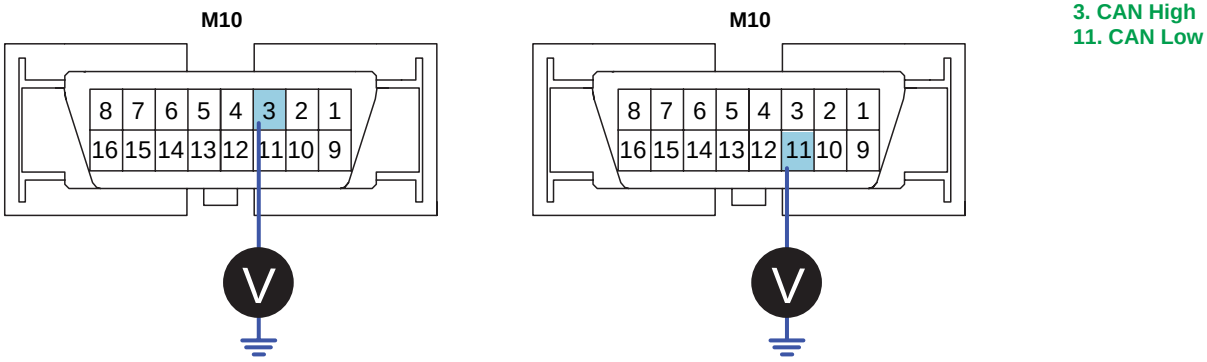
2) Disconnect PCM and ABS(or ESP) connector.

3) Ignition "ON"

4) Measure the voltage of DLC terminal 3. (CAN HIGH line)

5) Measure the voltage of DLC terminal 11. (CAN LOW line)

Specification : 0.0V~0.1V



3. CAN High
11. CAN Low

SCMF16430L

6) Is measured resistance within the specification with both connector disconnected?

YES

▶ Go to"4. Check CAN BUS continuity" as follows.

NO

▶ Repair short to battery and go to "Verification of Vehicle Repair".

4. Check CAN BUS continuity

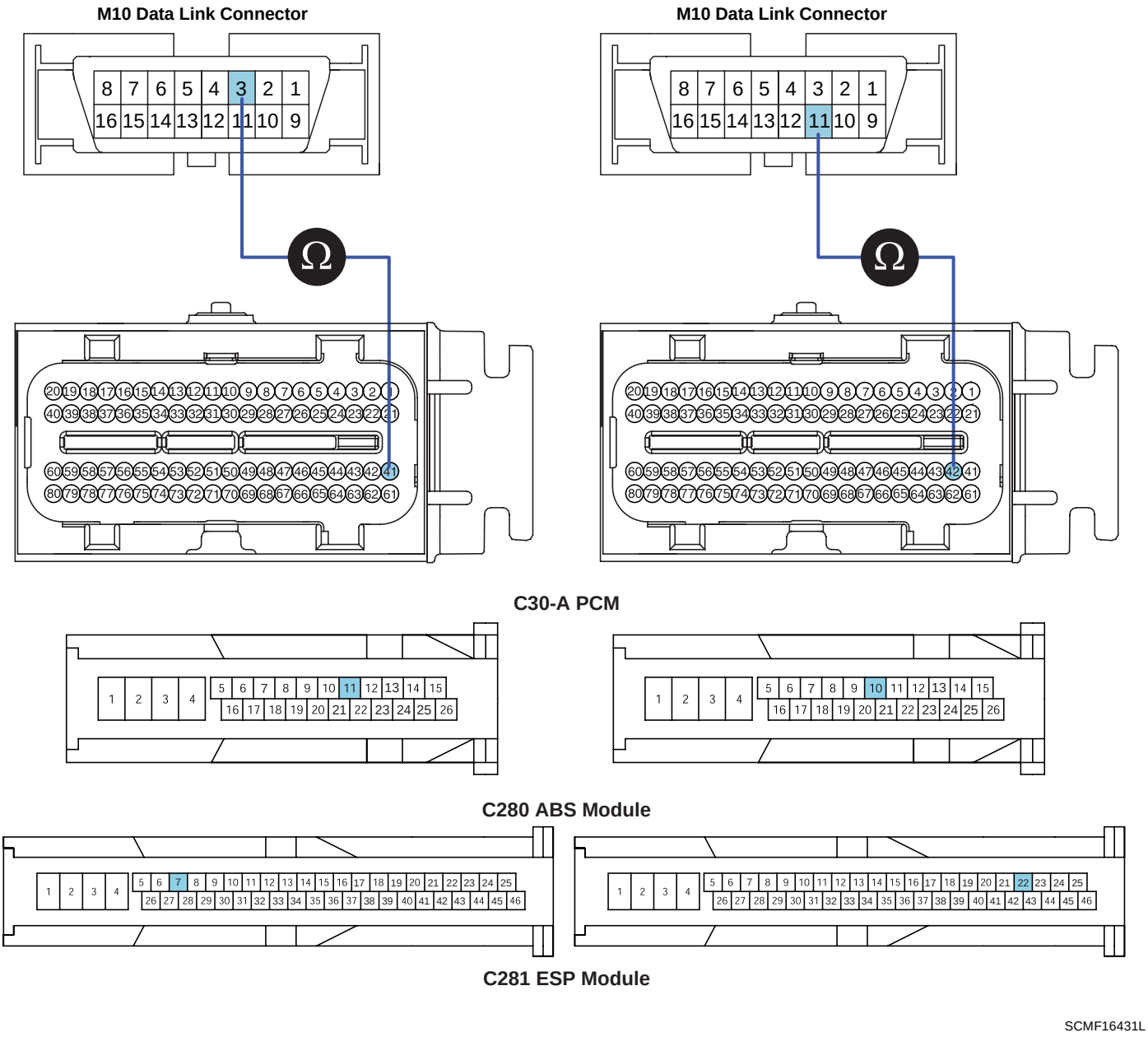
   1) Ignition "OFF"

   2) Disconnect PCM and ABS(or ESP) connector.

   3) Check continuity in CAN HIGH line.
   (CAN HIGH : PCM connector (C201-1) terminal 41, ABS connector terminal 11, ESP connector terminal 7, Data link connector(DLC) terminal 3)

   4) Check continuity CAN LOW line.
   (CAN LOW : PCM connector (C201-1) terminal 42, ABS connector terminal 10, ESP connector terminal 22, Data link connector(DLC) terminal 11)

Specification : Continuity(below 1.0Ω)



5) Is the measured resistance within the specification?

YES

▶ Go to "Component Inspection".

NO

▶ Repair open in CAN BUS line and go to "Verification of Vehicle Repair".

COMPONENT INSPECTION EB35D1E8

1. Check CAN communication waveform generation

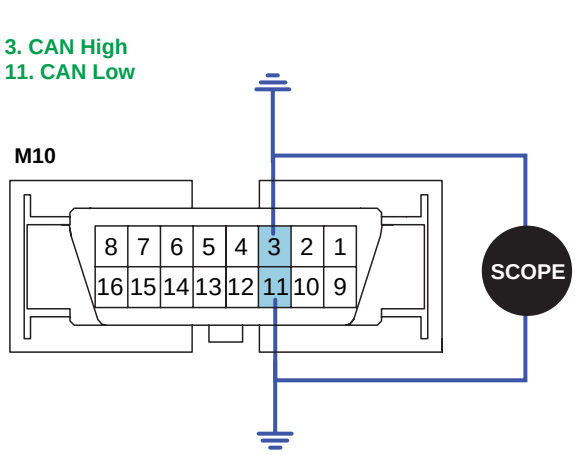
1) Ignition "OFF"

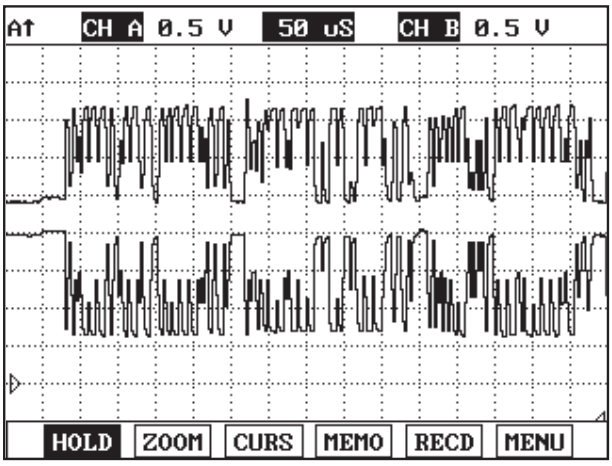
2) Connect 2 channel scope to DLC terminal 3(CAN HIGH) and 11(CAN LOW).

3) Ignition "ON" after connecting only PCM to CAN BUS.

4) Ignition "ON" after connecting only ABS or ESP module to CAN BUS.

Specification : At Ignition "ON", the waveform same as "Signal Waveform & Data" of above signal waveform.
※ Different from "Signal Waveform & Data", if 1) both CAN HIGH and LOW signal are fixed at 2.5 V or 2) HIGH and LOW signal are fixed at 3.5 V and 1.5 V, respectively, it is due to communication error between modules.





SCMF16432L

5) Does correct waveform generate from each module?

YES

▶ Go to "Verification of Vehicle Repair".

NO

▶ Replace the module which generates poor communication waveform, and go to "Verification of Vehicle Repair".

VERIFICATION OF VEHICLE REPAIR EDE62C44

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

1. Monitor and record the Freeze Frame Data for the Diagnostic Trouble Code(DTC) which has been diagnosed.
2. Using a Scantool, Clear the DTCs
3. Operate the vehicle within conditions noted in the freeze frame data or enable conditions
4. Monitor that all rediness test have been verified as " Complete "
5. Are any DTCs present ?

YES

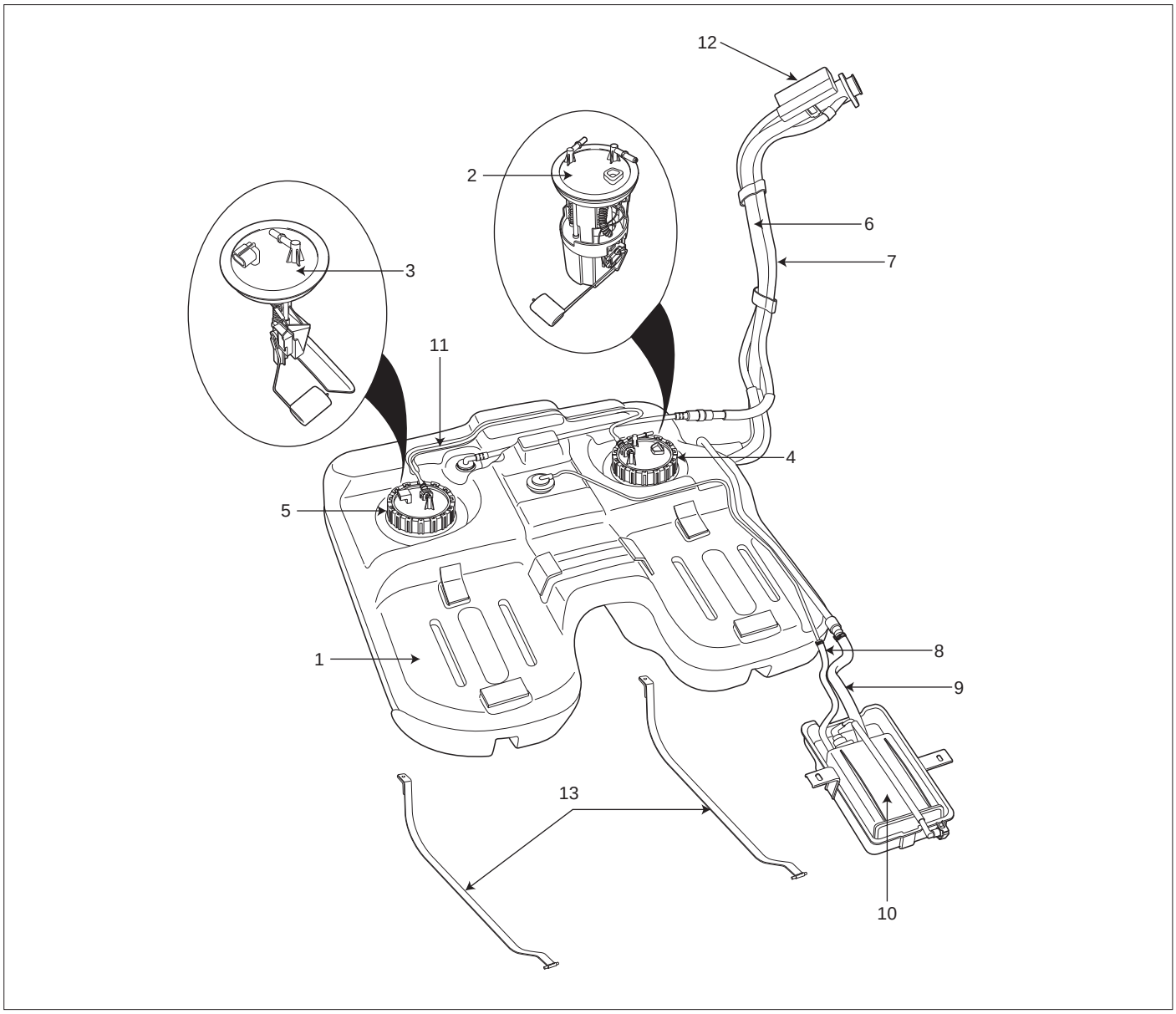
▶ Go to the applicable troubleshoooting procedure.

NO

▶ System is performing to specification at this time.

FUEL DELIVERY SYSTEM

COMPONENT LOCATION E01D0466



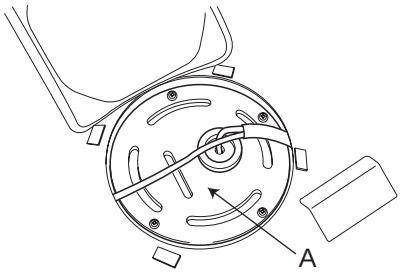
1. Fuel Tank
2. Fuel Pump
   (includig Fuel Filter and Fuel Pressure Regulator)
3. Sub Fuel Sender
4. Plate Cover (Fuel Pump)
5. Plate Cover (Sub Fuel Sender)
6. Fuel Filler Pipe
7. Leveling Pipe
8. Tube (Fuel Tank ↔ Canister)
9. Tube (Canister ↔ Fuel Tank Air Filter)
10. Canister
11. Suction Tube
12. Fuel Tank Air Filter
13. Fuel Tank Band

SCMF16132L

FUEL PRESSURE TEST EE0B21DE

1. PREPARING

1. Remove the 2nd seat (Refer to "BD" group in this SERVICE MANUAL).
2. Open the carpet for fuel pump and remove the service cover for fuel pump (A).

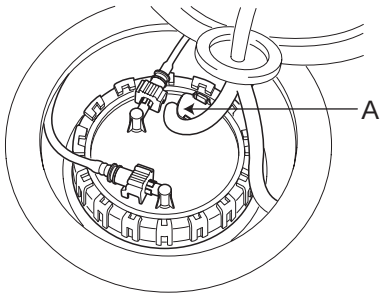


2. RELEASE THE INTERNAL PRESSURE

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 disconnect 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.



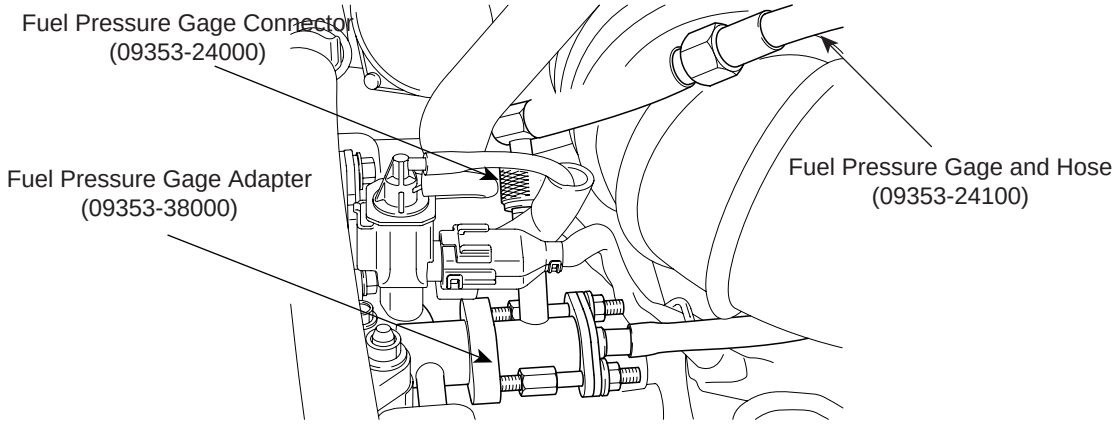
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

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).



SCMF16133L

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: 375 ~ 385 kpa (3.82 ~ 3.92 kgf/㎠, 54.3 ~ 55.8 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.

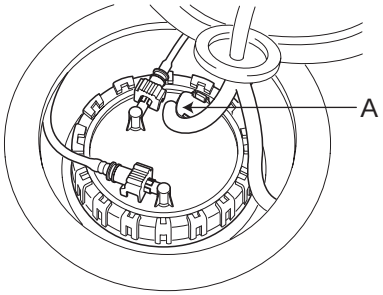
Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

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.

SCMF16134L

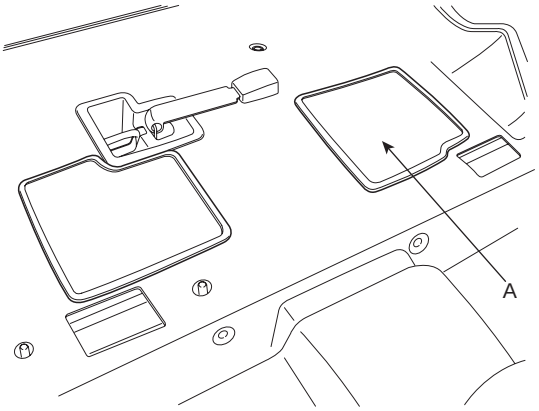
FUEL PUMP

REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) E7DAE93F

1. Preparation

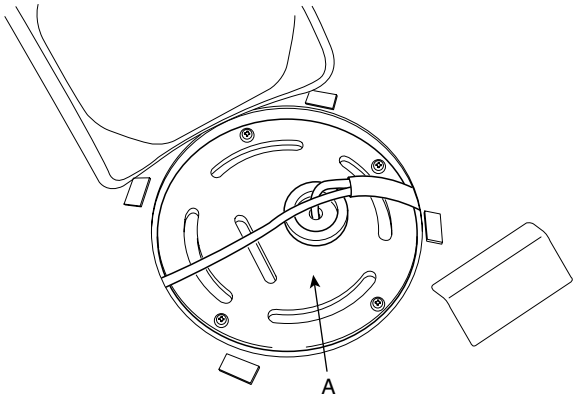
   1) Remove the 2nd seat (Refer to "BD" group in this SERVICE MANUAL).

   2) Open the carpet for fuel pump (A).



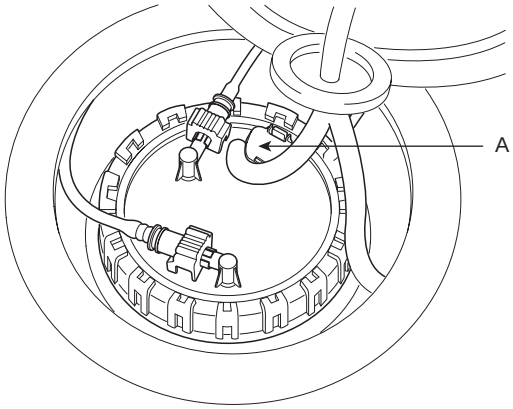
SCMF16135L

   3) Remove the service cover for fuel pump (A).



SCMFL6636D

   4) Disconnect the fuel pump connector (A).

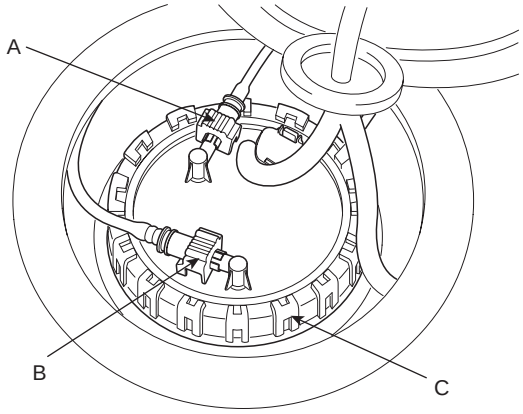


SCMF16137L

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

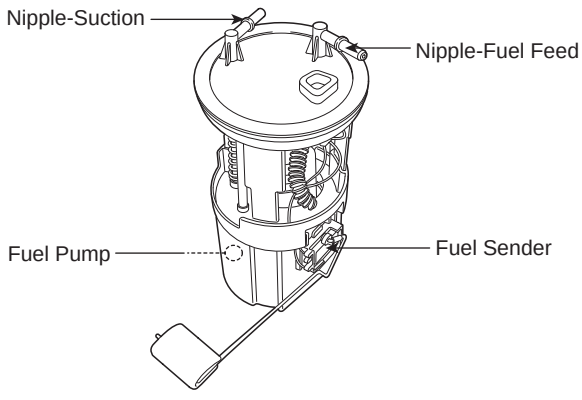
   6) After engine stops, turn the ignition switch off.

2. Disconnect the fuel feed quick-connector (A) and the suction tube quick-connector (B).



SCMF16138L

3. Remove the plate cover (C) with the special service tool (SST No.: 09310-2B100) and the remove the fuel pump from the fuel tank.



SCMF16139L

INSTALLATION EA87EA44

1. Install the fuel pump in according to the reverse order of "REMOVAL" procedure.

Fuel pump plate cover tightening: 58.8 ~ 68.6N·m (6.0~ 7.0kgf·m, 43.4 ~ 50.6lbf·ft)

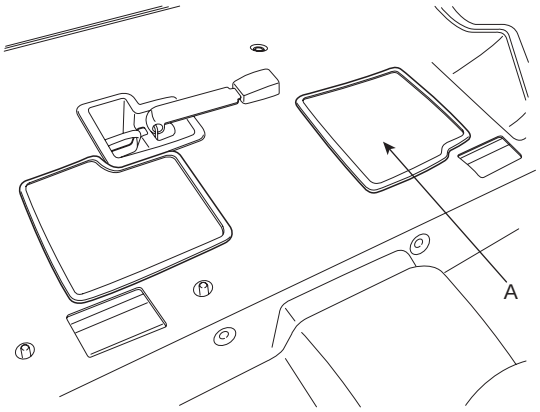
SUB FUEL SENDER

REMOVAL EA9FF7BE

1. Preparation

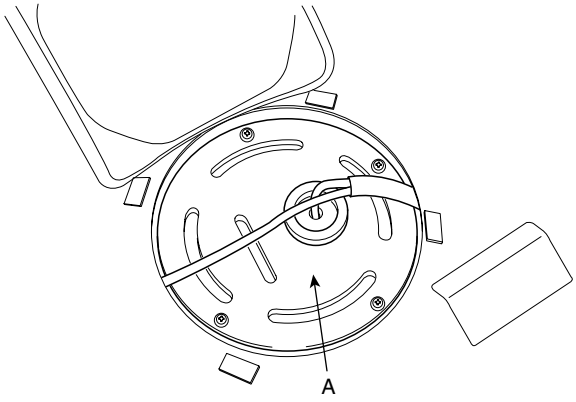
   1) Remove the 2nd seat (Refer to "BD" group in this SERVICE MANUAL).

   2) Open the carpet for fuel pump (A).



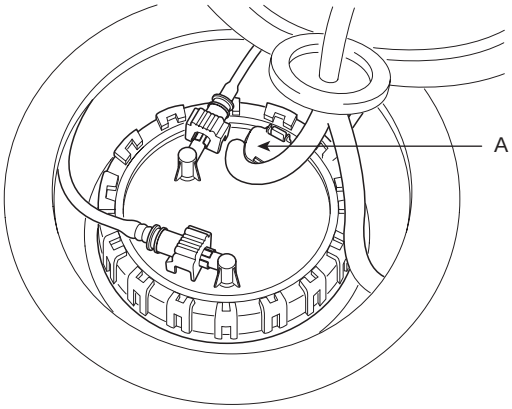
SCMF16135L

   3) Remove the service cover for fuel pump (A).



SCMFL6636D

   4) Disconnect the fuel pump connector (A).

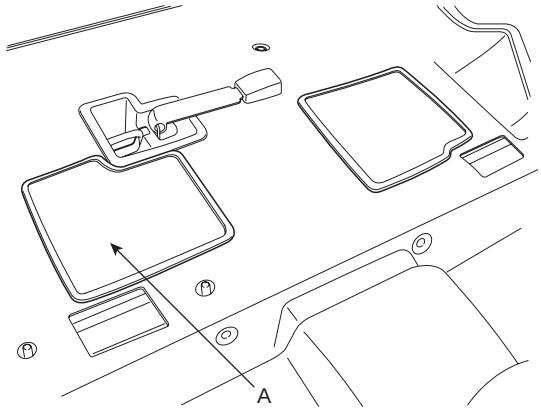


SCMF16137L

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

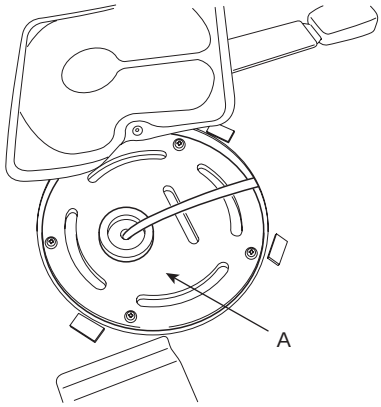
   6) After engine stops, turn the ignition switch off.

2. Open the carpet for sub fuel sender (A).



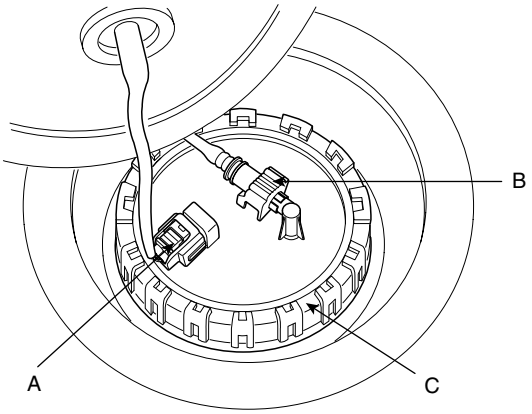
SCMF16140L

3. Open the service cover for sub fuel sender (A).



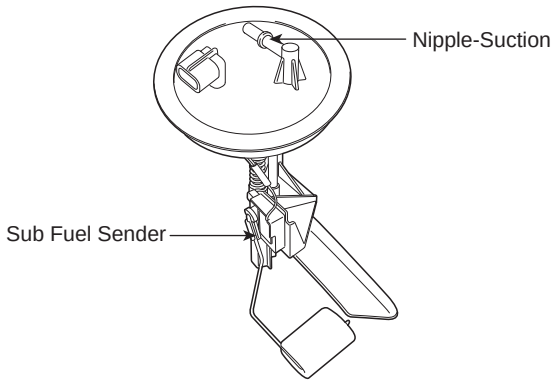
SCMFL6649D

4. Disconnect the sub fuel sender connector (A) and the suction tube quick-connector (B).



SCMFL6650D

5. Remove the plate cover (C) with the special service tool (SST No.: 09310-2B100) and remove the sub fuel sender from the fuel tank.



SCMF16142L

INSTALLATION EA259FCE

1. Install the sub fuel sender in according to the reverse order of "REMOVAL" procedure.

Sub fuel sender plate cover tightening: 58.8 ~ 68.6N·m (6.0~ 7.0kgf·m, 43.4 ~ 50.6lbf·ft)

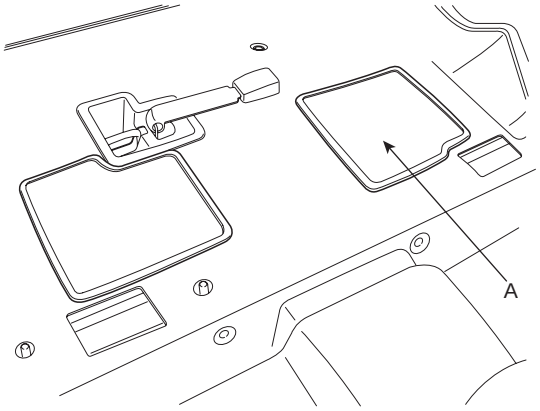
FUEL TANK

REMOVAL ECA56A48

1. Preparation

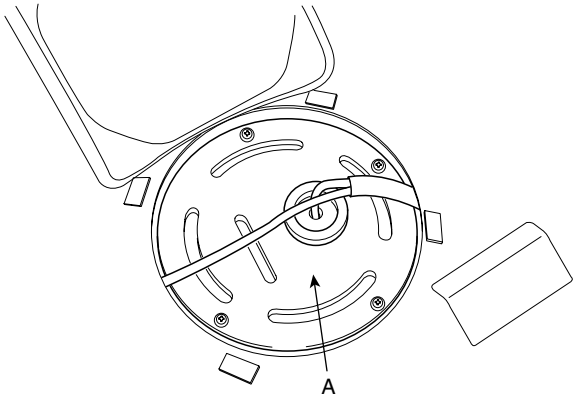
   1) Remove the 2nd seat (Refer to "BD" group in this SERVICE MANUAL).

   2) Open the carpet for fuel pump (A).



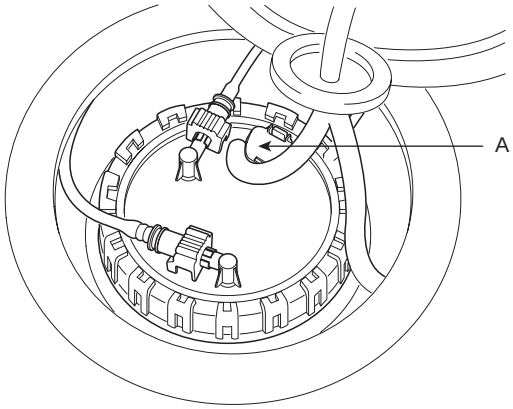
SCMF16135L

   3) Remove the service cover for fuel pump (A).



SCMFL6636D

   4) Disconnect the fuel pump connector (A).

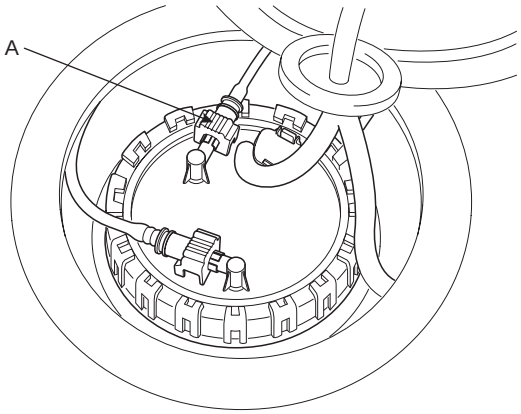


SCMF16137L

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

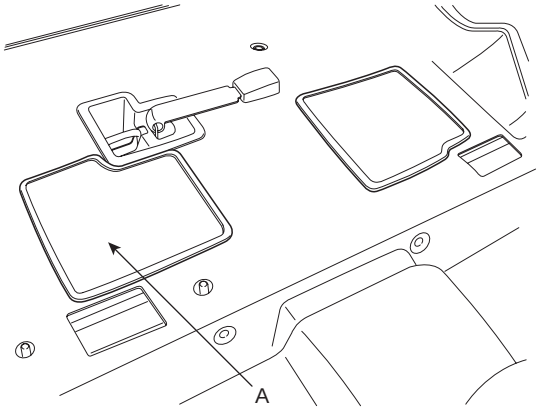
   6) After engine stops, turn the ignition switch off.

2. Disconnect the fuel feed quick-connector (A).



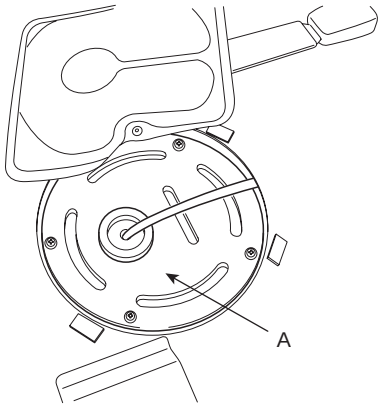
SCMF16143L

3. Open the carpet for sub fuel sender (A).



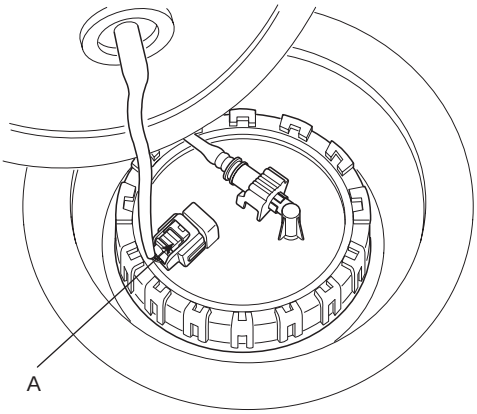
SCMF16140L

4. Open the service cover for sub fuel sender (A).



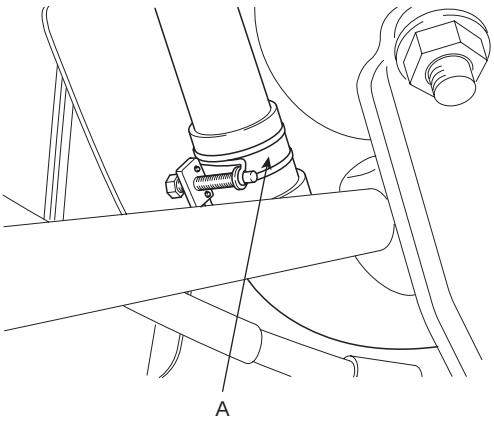
SCMFL6649D

5. Disconnect the sub fuel sender connector (A).



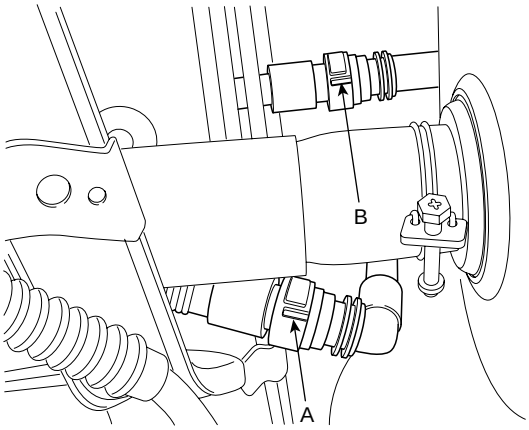
SCMF16144L

6. Lift the vehicle and remove the muffler assembly and the propeller shaft (4WD) (Refer to "EM" and "DS" groups in this SERVICE MANUAL).
7. Support the fuel tank with a jack.
8. Disconnect the fuel filler hose (A).



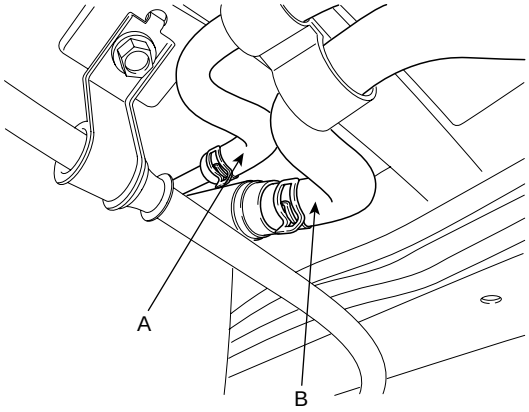
SCMFL6640D

9. Disconnect the leveling hose quick-connector (A) and the vacuum tube quick-connector (B) connecting the canister and the fuel tank air filter.



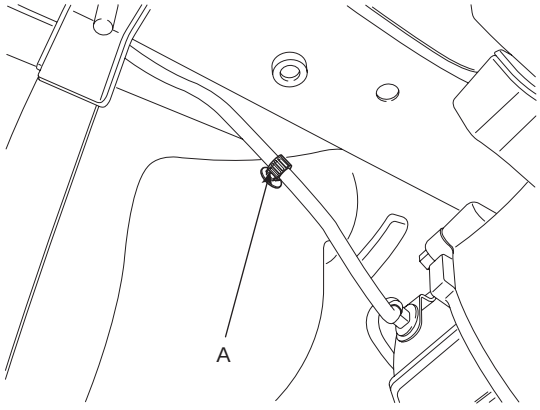
SCMF16013L

10. Disconnect the vacuum hoses (A,B).



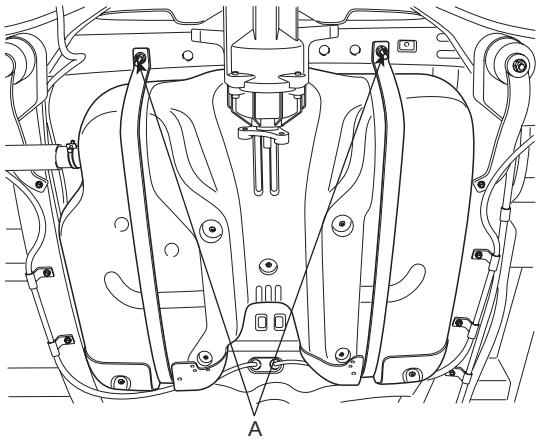
SCMF16145L

11. Disconnect the 4WD coupling control wiring (A) from the fuel tank cover.



SCMFL6642D

12. Unscrew the fuel tank bank mounting nuts (A) and remove the fuel tank from the vehicle.



SCMFL6643D

INSTALLATION EB787B61

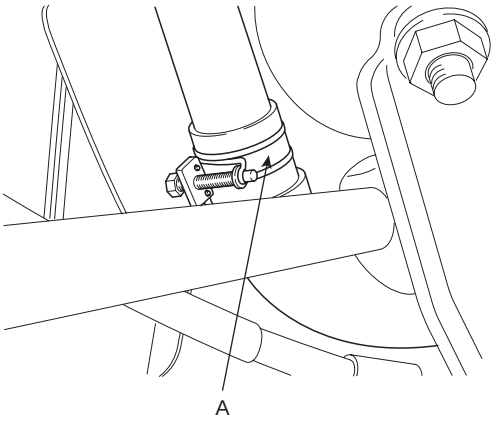
1. Install the fuel tank in according to the reverse order of "REMOVAL" procedure.

Fuel tank band mounting nuts: 39.2 ~ 53.9N·m (4.0 ~ 5.5kgf·m, 28.9 ~ 39.8lbf·ft)

FILLER-NECK ASSEMBLY

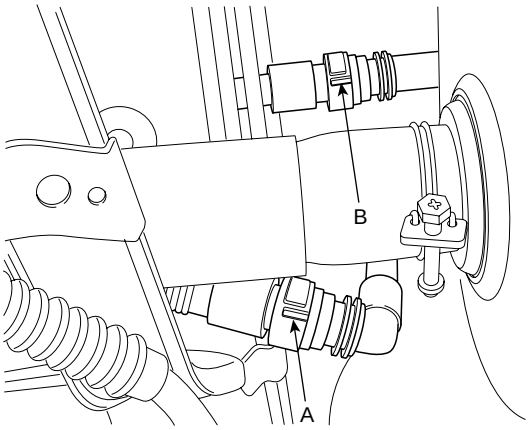
REMOVAL EDDD3969

1. Disconnect the fuel filler hose (A).



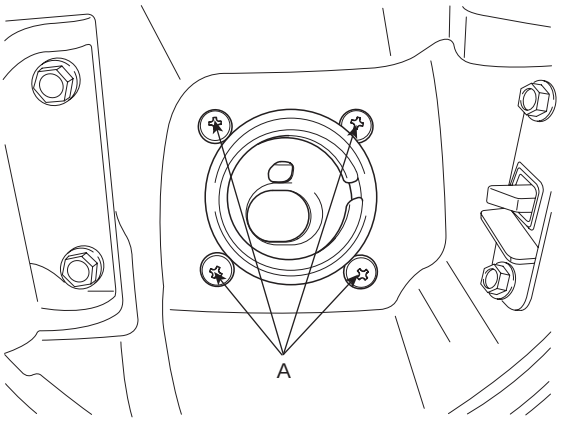
SCMFL6640D

2. Disconnect the leveling hose quick-connector (A) and the vacuum tube quick-connector (B) connecting the canister and the fuel tank air filter.



SCMF16013L

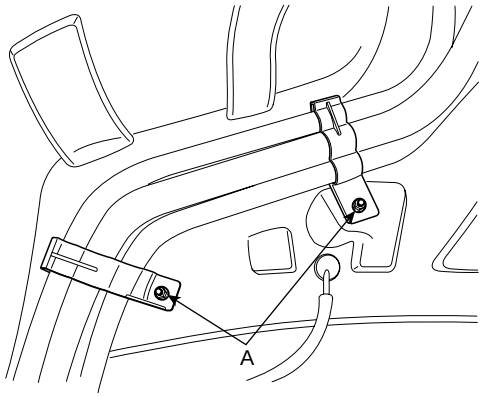
3. Open the fuel filler door and unfasten the filler-neck assembly mounting screws (A).



SCMFL6655D

4. Remove the rear-LH wheel & tire, and the inner wheel house (Refer to "DS" group in this SERVICE MANUAL).

5. Remove the bracket mounting nuts (A) and remove the filler-neck assembly.



SCMF16010L

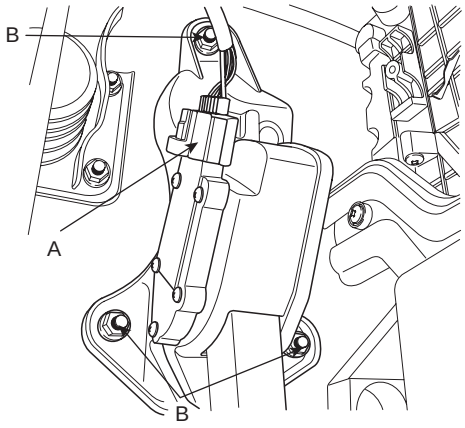
INSTALLATION E099635F

1. Install the filler-neck assembly in according to the reverse order of "REMOVAL" procedure.

ACCELERATOR PEDAL

REMOVAL EEBBB3FC

1. Turn ignition switch off and disconnect the battery (-) cable from the battery.
2. Disconnect the accelerator position sensor connector (A).



SCMFL6656D

3. Unfasten the mounting nuts (B) and remove the accelerator pedal from the vehicle.

INSTALLATION ED3291DE

1. Install the accelerator pedal in according to the reverse order of "REMOVAL" procedure.

Accelerator pedal mounting nuts: 16.7 ~ 25.5N·m (1.7 ~ 2.6kgf·m, 12.3 ~ 18.8lbf·ft)