ELECTRONIC ENGINE CONTROLS
03

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GENERAL INFORMATION

Description

The Engine Control Module (ECM) consists of a microcomputer and electrical connectors containing circuits for signal input, output, power supply and ground. The ECM controls the engine functions.

The following are the input and output components monitored by the ECM. The monitored functions include components from the engine, ignition, transaxle, air conditioning, or any other ECM supported subsystem.

ECM Inputs

- Brake Switch Sensor
- Refrigerant Pressure Sensor
- Camshaft Position (CMP) Sensor
- Crankshaft Position (CKP) Sensor
- Engine Coolant Temperature (ECT) Sensor
- Manifold Absolute Pressure (MAP) Sensor (1.6L)
- Air Flow Sensor (1.8L)
- Throttle Position Sensor (Integral with Electronic Throttle Control Actuator)
- Power Steering Switch
- Accelerator Pedal Position (APP) Sensor
- Knock Sensor
- Oxygen Sensor (Upstream & Downstream)
- Vehicle Speed Sensor
- Clutch Pedal Switch (Manual transaxle only)

ECM Outputs

- Canister Control Valve
- Fuel Injectors
- Fuel Pump Relay
- Electronic Throttle Control Actuator
- Ignition Coil
- A/C Compressor
- Cooling Fan
- Oxygen Sensor Heater (Upstream & Downstream)

Operation

The ECM monitors components and circuits, and tests them in various ways depending on the hardware, function, and type of signal. For example, analog inputs, such as throttle position or engine coolant temperature are typically checked for opens, shorts and out-of-range values. This type of monitoring is carried out continuously. Some digital inputs like vehicle speed or crankshaft position rely on rationality checks - checking to see if the input value makes sense at the current engine operating conditions. These types of tests may require monitoring several components and can only be carried out under appropriate test conditions.

The ECM is a pre-programmed, microprocessor-based digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The ECM can adapt its programming to meet changing operating conditions.

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Electronic Engine Control Input & Output Device Failure Modes

NUMBER	ITEM	FAILURE MODE	CORRECTION
1	CKP	• Engine is hard to start. • The engine RPM will be limited after the engine starts. • The highest RPM is less than 3800. • Excessive exhaust emissions. • No ignition signal to the ECM. • The tachometer does not work. • Rough engine operation.	Replace
2	CMP	• The fuel injector ON time may vary from 720 degrees to 360 degrees. • The sensor output is not correct, the MIL light will turn on when with the second revolution after the engine starts. • Engine is hard to start. • The highest RPM is less than 4000.	Replace
3	APPS	• The MIL light will turn on. • Poor acceleration. • The engine RPM will be limited after the engine starts.	Replace
4	ECT	• Engine hard to start when cold. • Engine hard to start when hot. • Poor driving capability. • If the sensor circuit is shorted to power, the engine will run under the default values. • The temperature gauge indicates too high. • The temperature gauge indicates too low. • The cooling fan operates continuously on high speed. • The high temperature warning lamp will flash when the IP indicates low temperature.	Replace
5	MAF	• The cooling fan will operate for approximately 60 seconds on high speed after the ignition switch is turned off. • Poor acceleration. • Poor driving capability.	Replace
6	O_2 Sensor	• Poor fuel economy. • Excessive exhaust emissions. • Sluggish acceleration. • Poor driving capability.	Replace
7	Knock Sensor	• The engine produces an engine knock. • Overheated engine. • Excessive exhaust emissions. • Poor fuel economy. • Lack of engine power. • Internal engine damage.	Replace
8	ECM	• Unstable engine idle. • Poor acceleration. • Unable to start. • High engine idle. • The engine exhaust exceeds emission standards. • Engine is hard to start. • Air conditioner does not operate. • Fuel injector control failure. • Engine stalls out.	Replace
9	Ignition Coil	• Unstable idle. • Lack of engine power. • Poor fuel economy. • Excessive exhaust emissions. • Weak spark.	Replace

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NUMBER	ITEM	FAILURE MODE	CORRECTION
10	Fuel Injector	• Unstable idle. • Lack of engine power. • Poor acceleration. • Engine will not start. • Plugged injector.	Replace
11	TPS	• Poor acceleration. • The MIL light will turn on.	Replace
12	EVAP	• The engine base fuel closed-loop control self-learning will be shut off. • The engine idle air control self-learning will be shut off. • Unstable idle or high idle.	Replace
13	Fuel Pump	• Noisy fuel pump operation. • Poor acceleration. • Engine will not start.	Replace
14	MAP	• Poor acceleration. • Unstable idle. • Rough engine operation.	Replace
15	IAT	• Intake air temperature will be equal to the coolant temperature.	Replace
16	Cooling Fan	• High engine temperature. • Poor air conditioner performance.	Replace
17	Accelerator Sensor	• Misfire • Poor driving capability. • Rough engine operation.	Replace

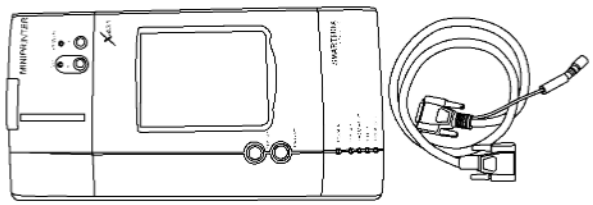
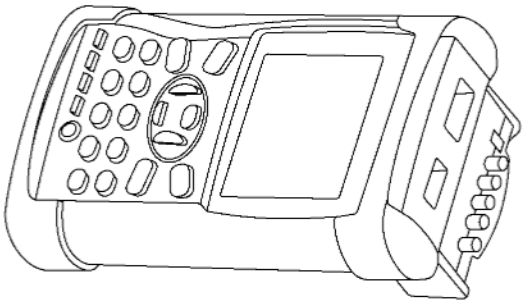
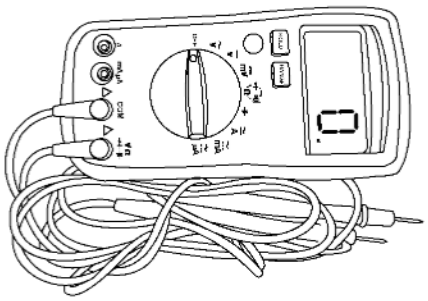
Specifications

Torque Specifications

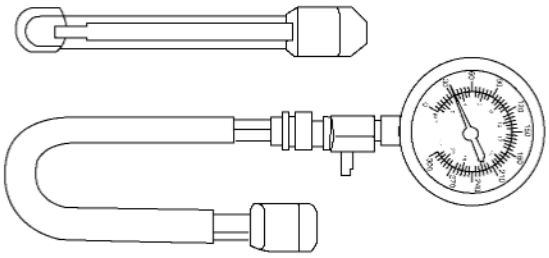
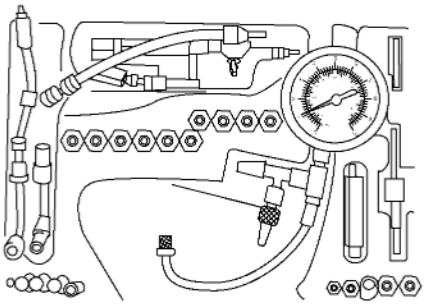
DESCRIPTION	TORQUE (N·m)
Engine Coolant Temperature (ECT) Sensor	20
Knock Sensor	20
Oxygen Sensors	45
Crankshaft Position (CKP) Sensor	10
Camshaft Position (CMP) Sensor	7
Air Flow Sensor Bolts	5
Engine Control Module (ECM) Bolts	10
Accelerator Pedal Position (APP) Sensor	11
Electronic Throttle Control Actuator	10
Vehicle Speed Sensor	10
Manifold Absolute Pressure (MAP) Sensor	6

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Special Tools

Diagnostic Scan Tool X-431	 besm030001
Engine Analyzer KES-200	 ltsmd030069
Digital Multimeter Fluke 15B & 17B	 besm030002

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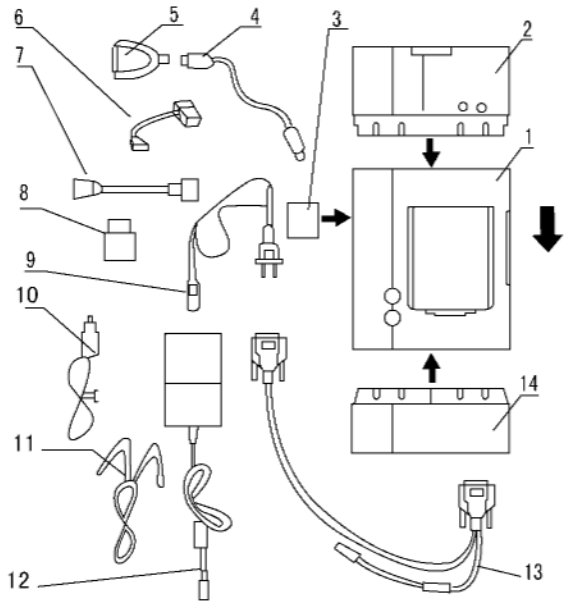
Compression Gauge	 besm030009
Fuel Pressure Gauge	 besm030008

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Hardware Requirements

The hardware configuration of X-431 is as follows:

Diagnostic Scan Tool Configuration



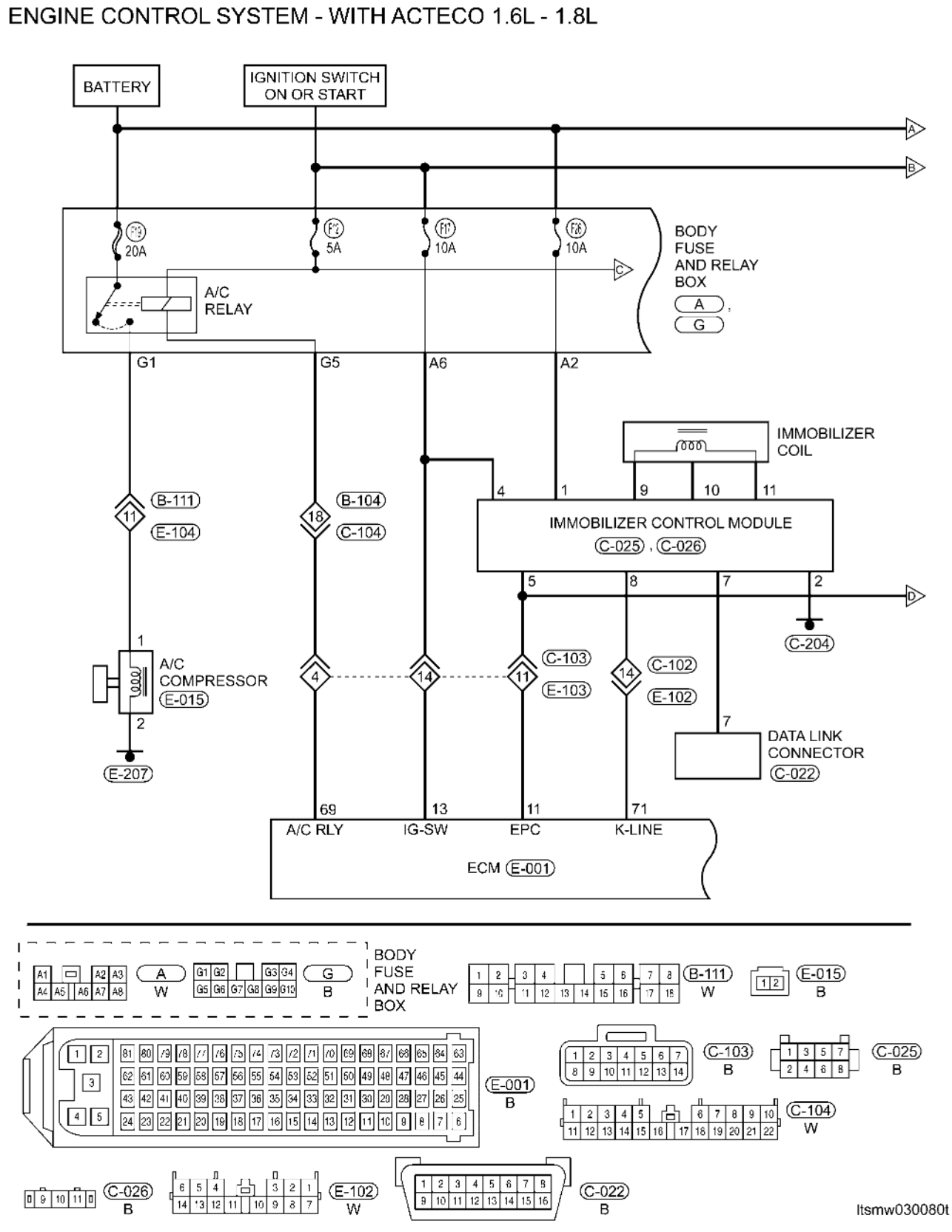
ITEM	NAME	FUNCTION
1	X-431 Main Unit	To Display Operational Buttons, Test Results, Help Information, etc.
2	Mini-Printer	To Print Test Results. (Optional)
3	CF Card	To Store Diagnostic Software and Data
4	USB Cable	To Connect CF Card Reader/Writer and Computer
5	CF Card Reader/Writer	To Read or Write Data On The CF Card
6	Mitsubishi-12+16 Pin Connector	To Diagnose Mitsubishi Electronic Control Systems On Chery B11 Series
7	Fiat-3 Pin Connector	To Diagnose Vehicles With Fiat-3 Pin Diagnostic Connector

ITEM	NAME	FUNCTION
8	Smart OBDII-16 Pin Connector	To Diagnose Other Systems Of Vehicle With OBDII-16 Pin Diagnostic Connector
9	Power Cord	To Connect AC 100 - 240 V Outlet and Power Adapter
10	Cigarette Lighter Cable	To Get Power From Vehicle Cigarette Lighter
11	Battery Cable W/Two Clips	To Get Power From Vehicle Battery
12	Power Adapter	To Convert 100 - 240 V AC Power Into 12 V DC Power
13	Main Cable	To Connect The Diagnostic Connector and Smartbox
14	Smartbox	To Perform Vehicle Diagnosis

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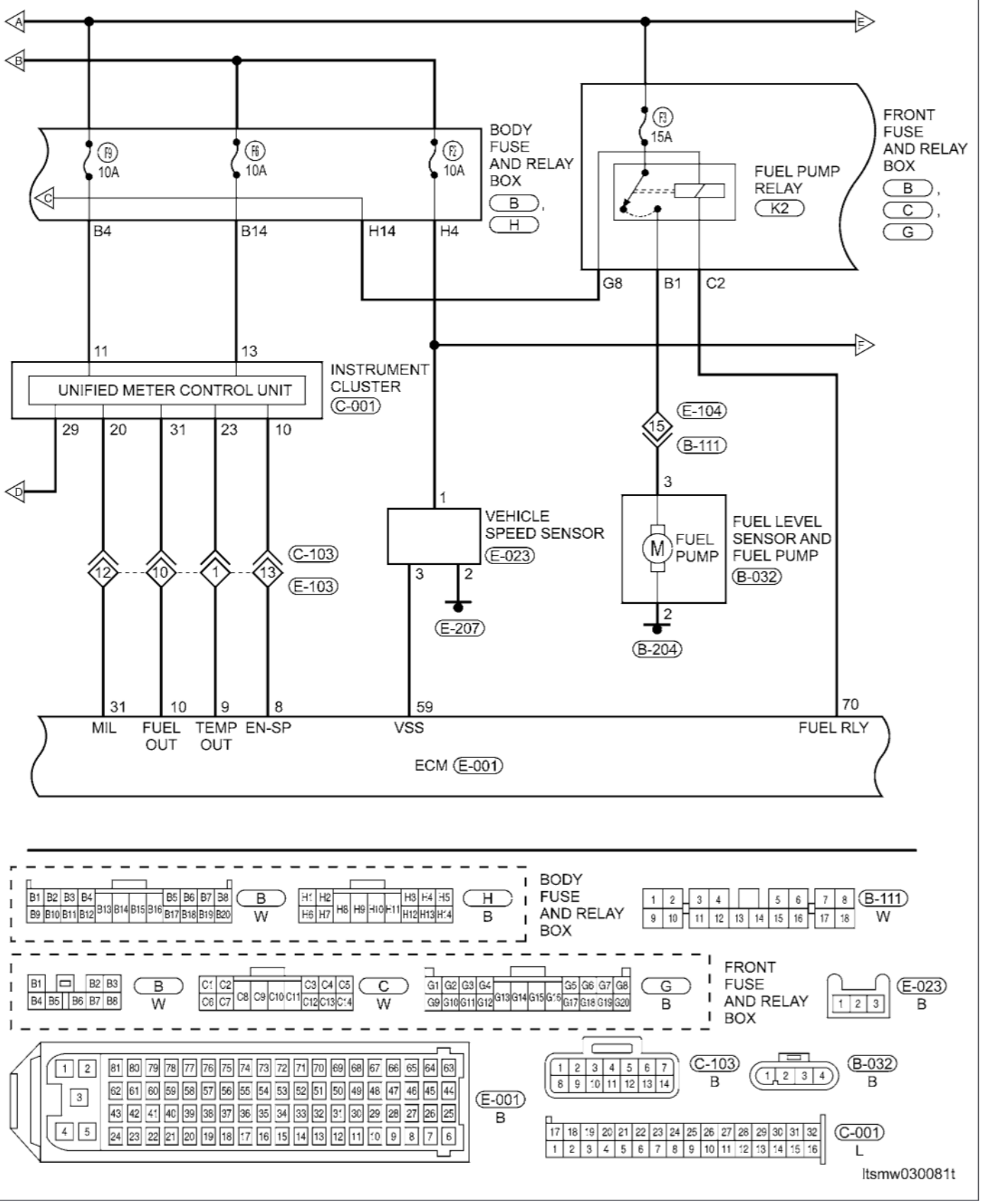
Electrical Schematics

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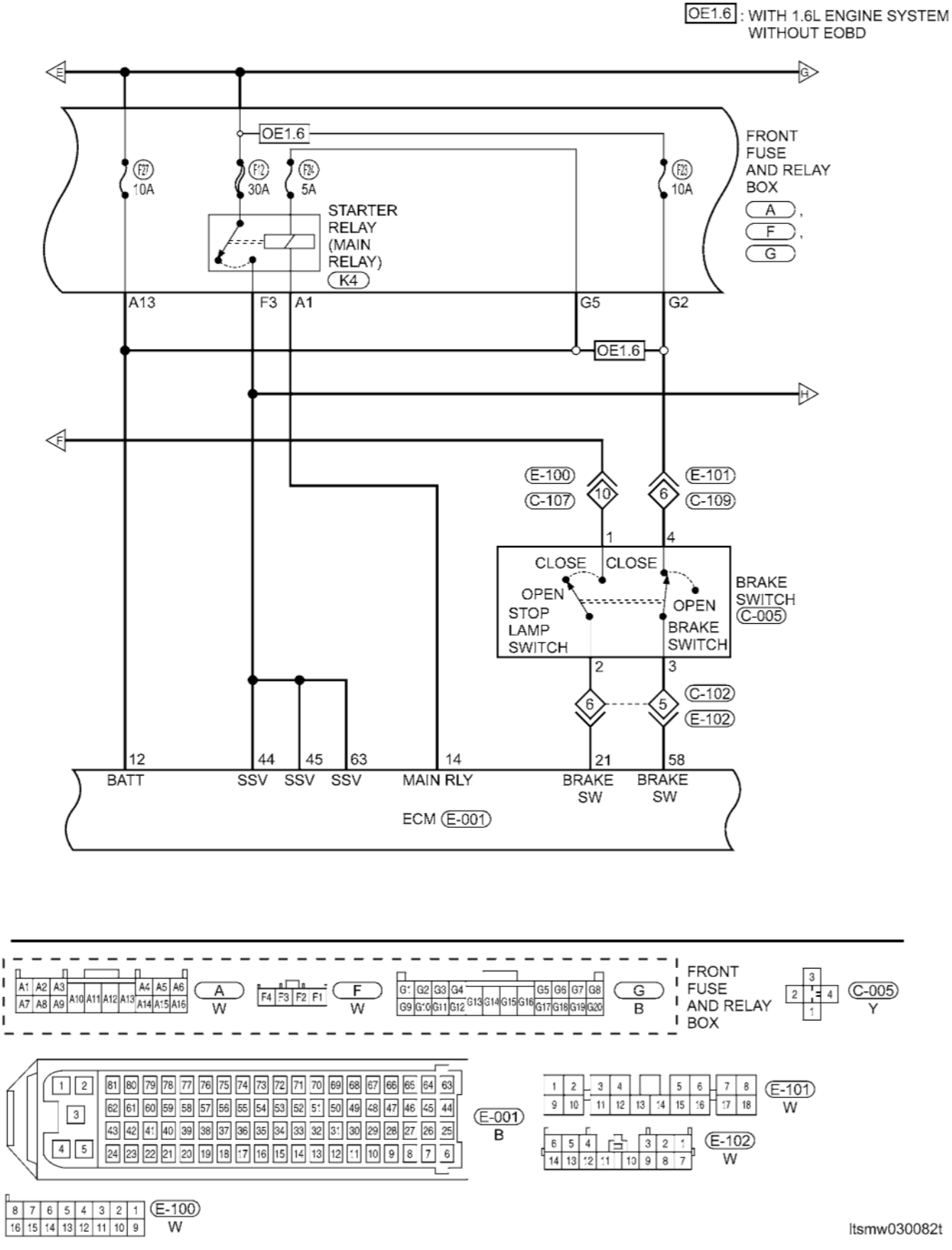
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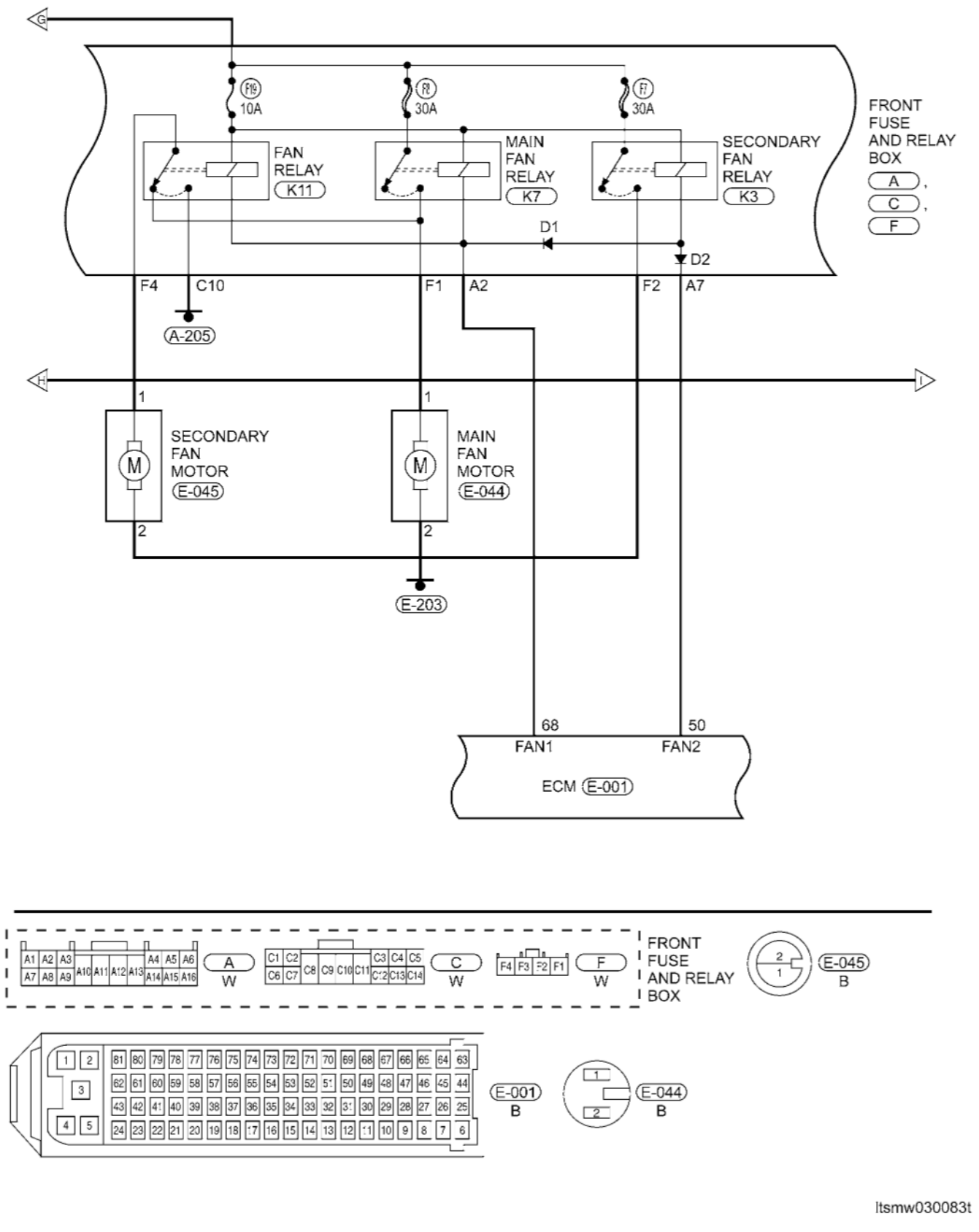
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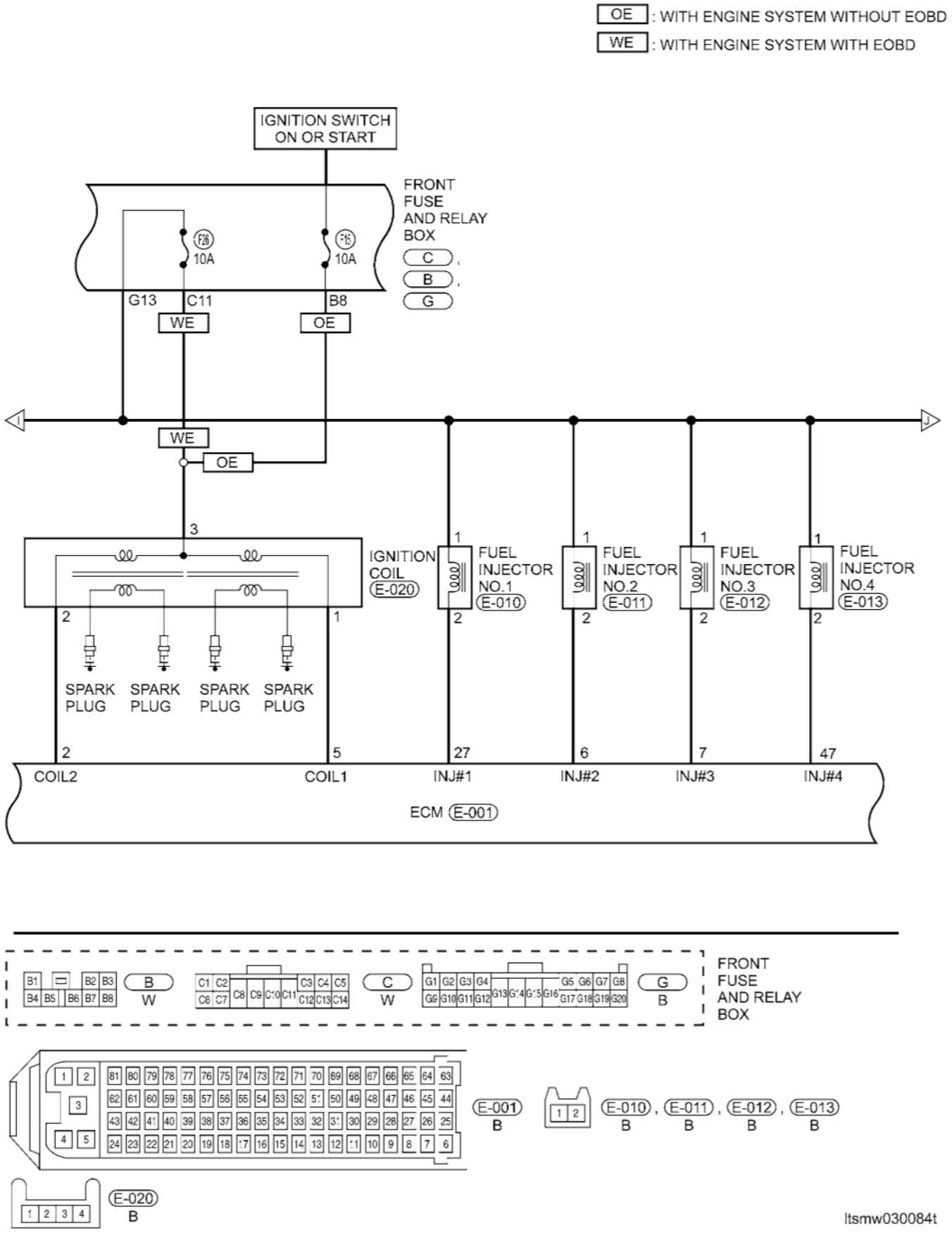
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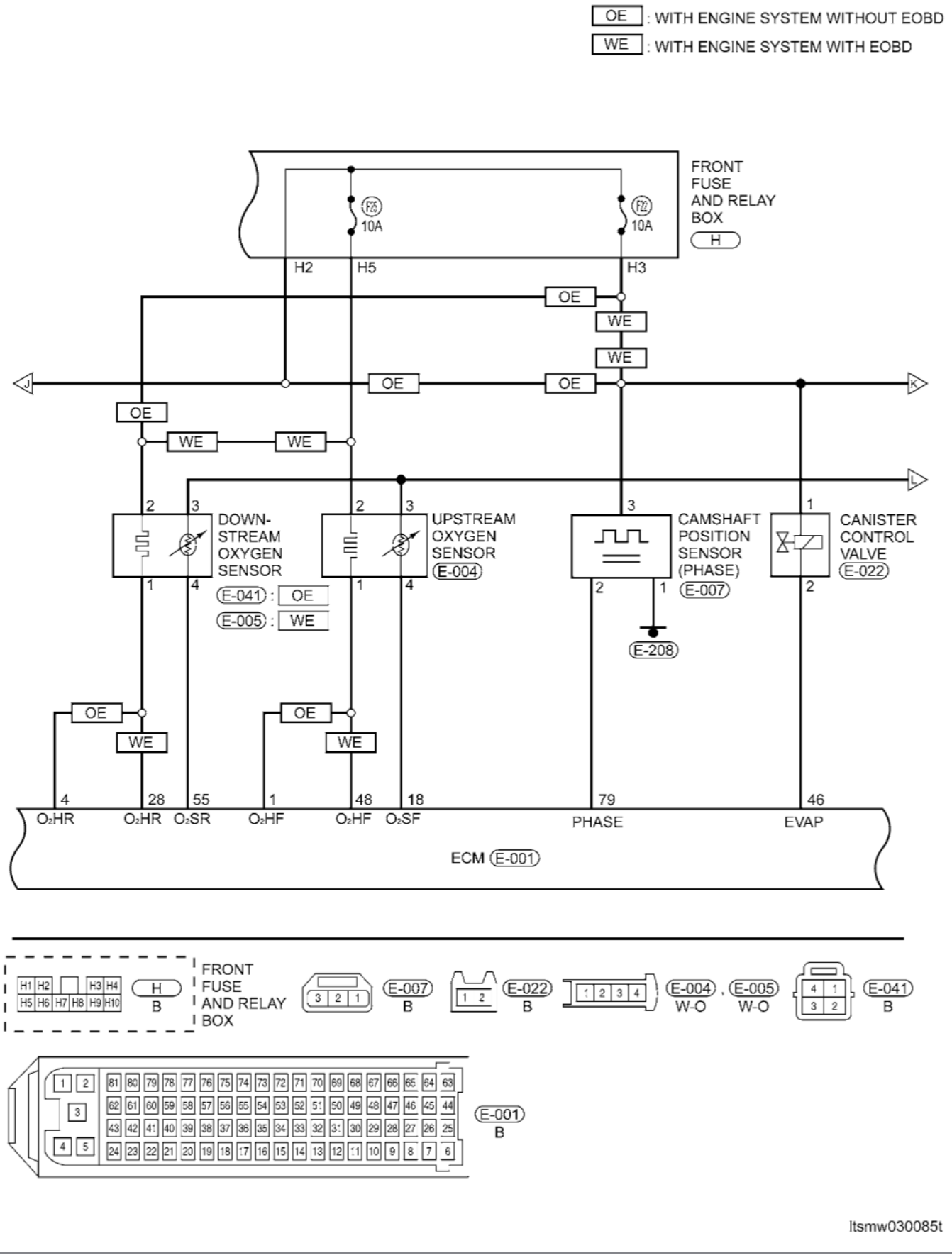
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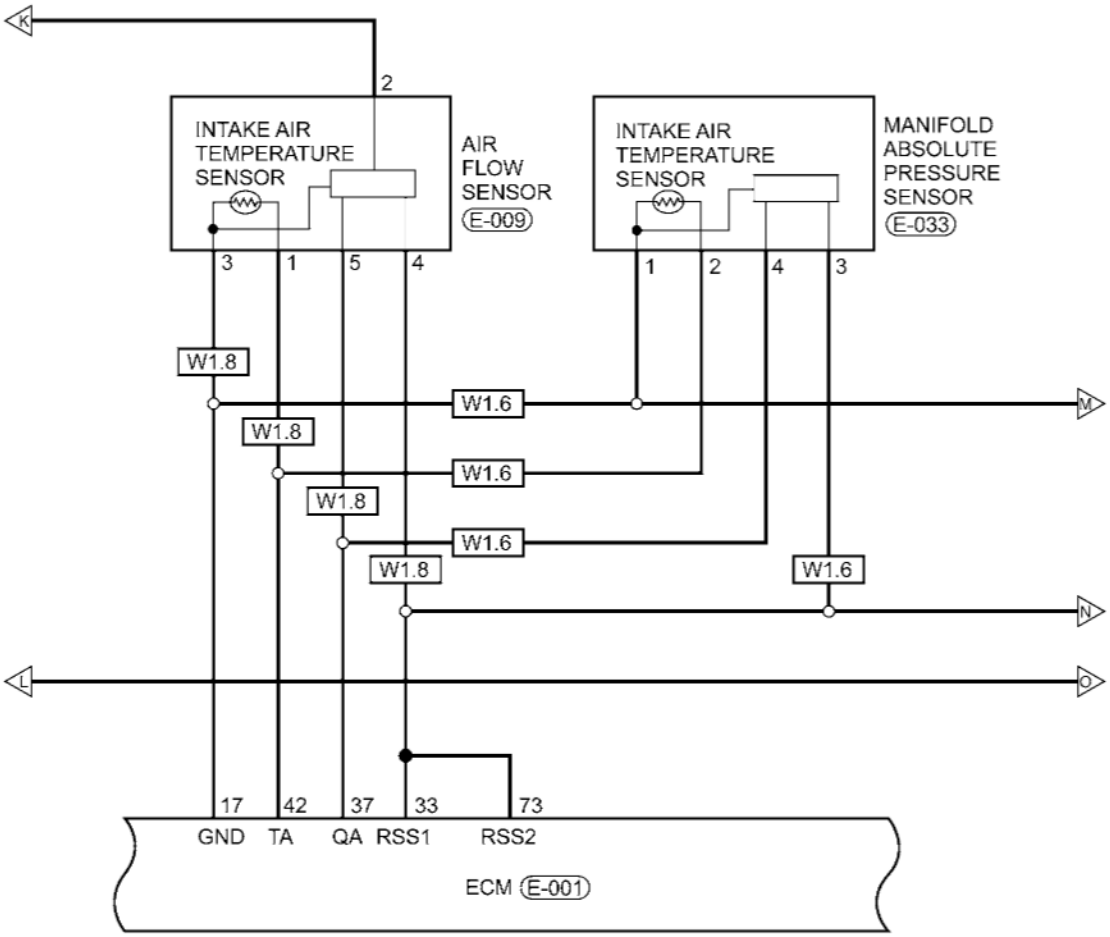
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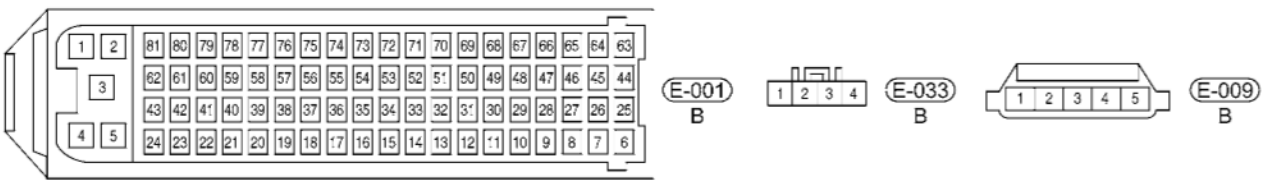


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W1.6 : WITH 1.6L ENGINE SYSTEM
W1.8 : WITH 1.8L ENGINE SYSTEM

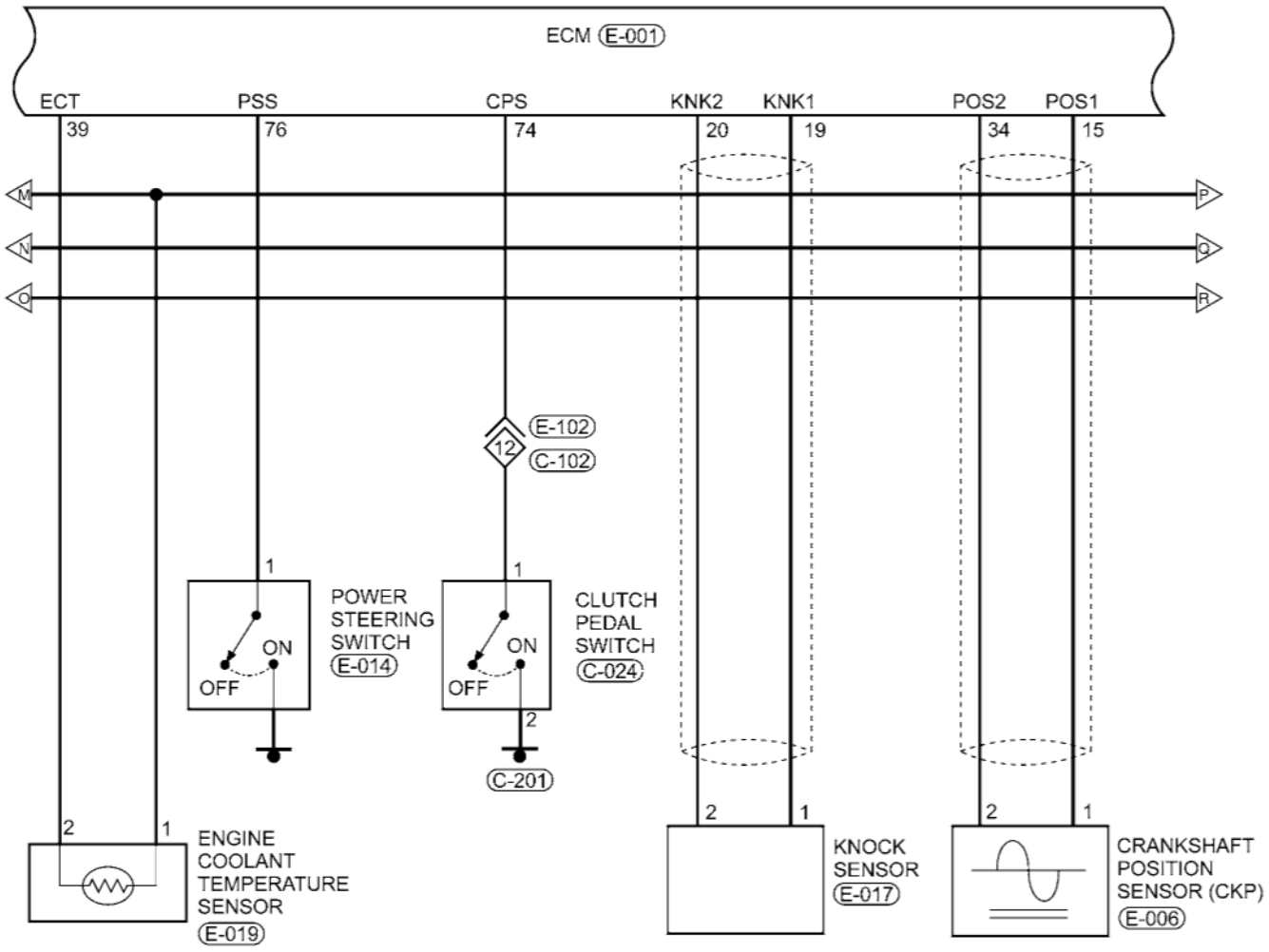


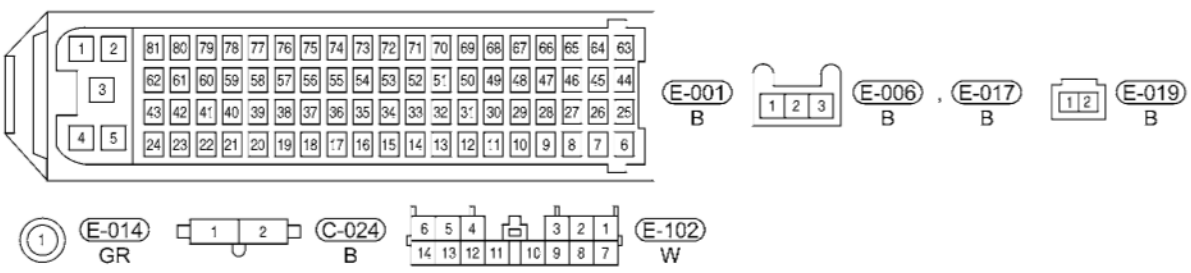


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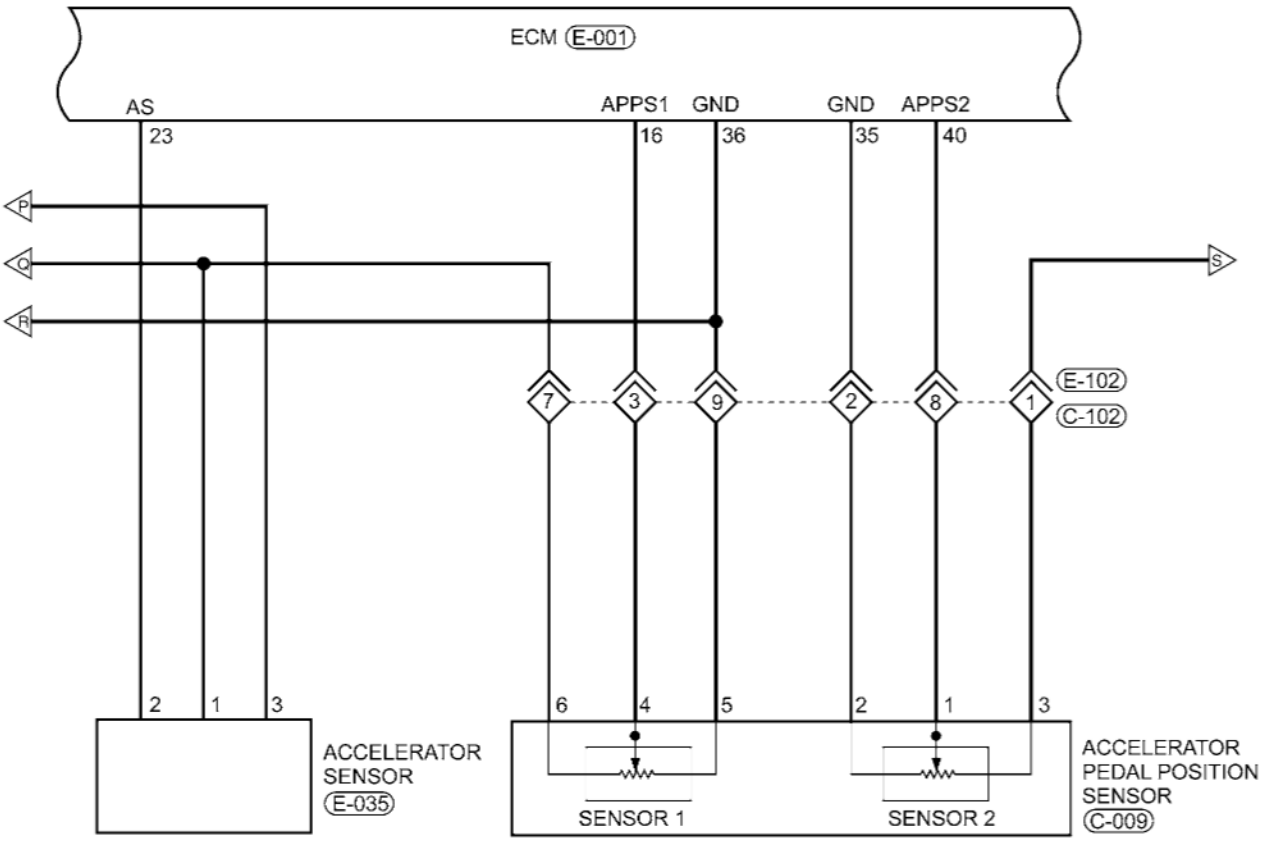


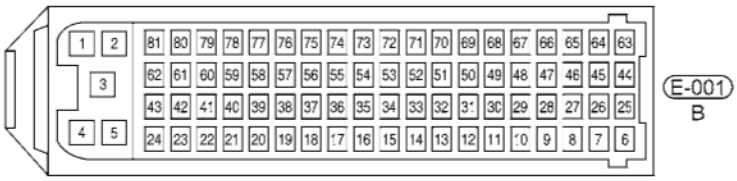


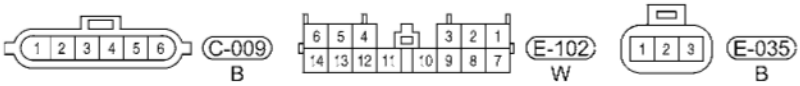
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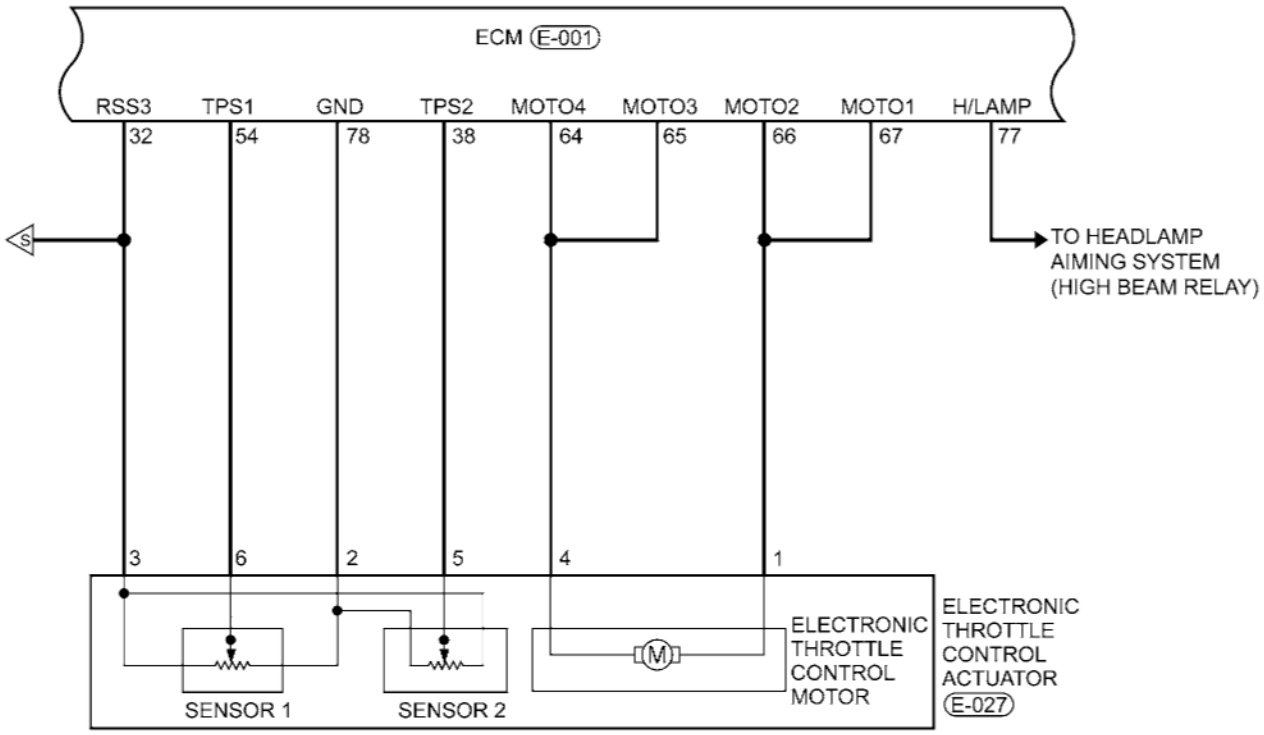


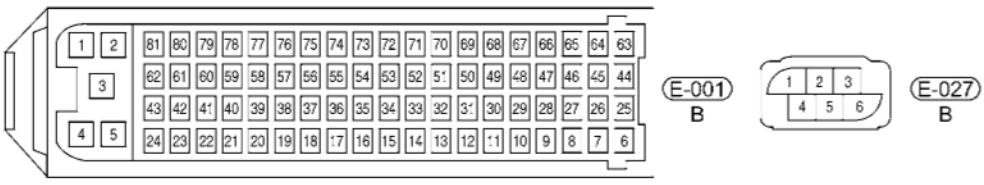


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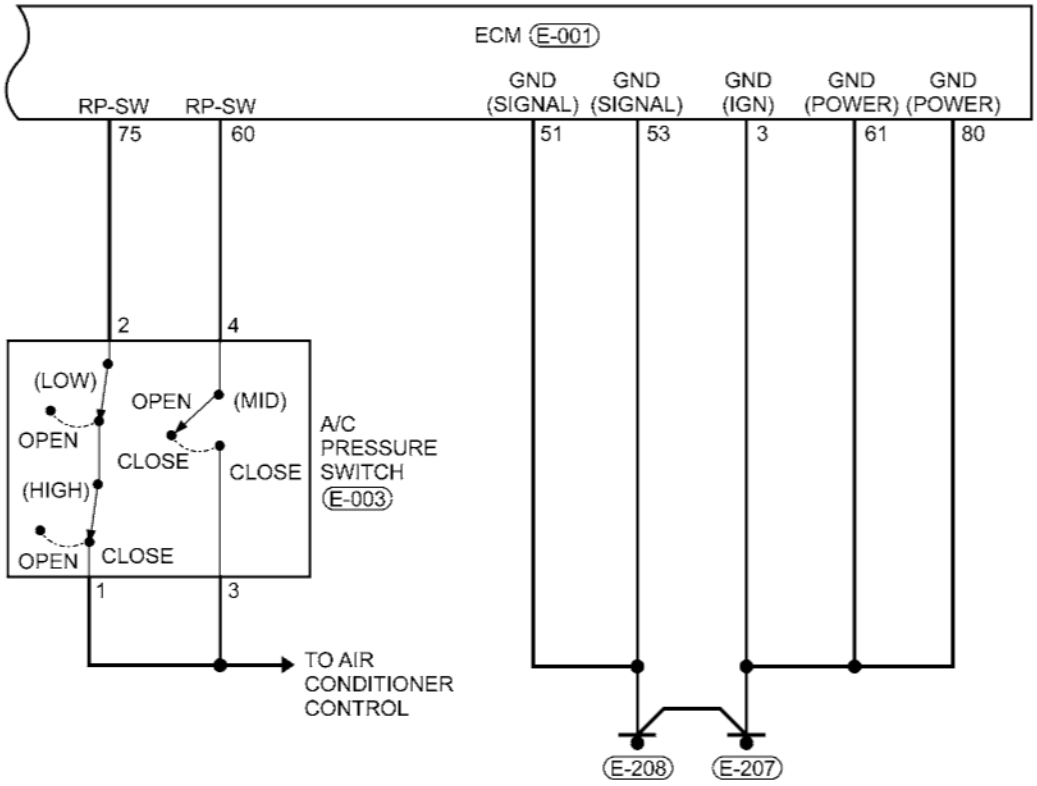


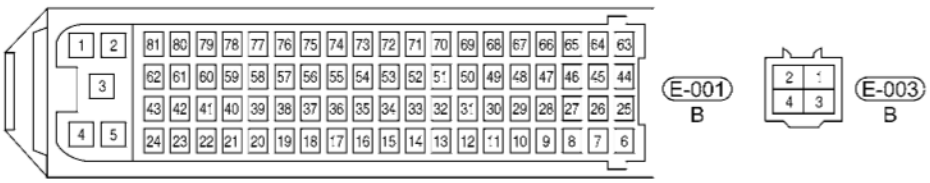


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ECM Connector Pin-Out Table

ECM PIN-OUT TABLE

PIN	CIRCUIT IDENTIFICATION	PIN	CIRCUIT IDENTIFICATION
1	(With EOBD) Upstream Oxygen Sensor Heater (Without EOBD)	42	Intake Air Temperature Sensor
2	Ignition Coil 2	43	-
3	GND (Ignition)	44	Switched Supply Voltage
4	(With EOBD) Downstream Oxygen Sensor Heater (Without EOBD)	45	Switched Supply Voltage
5	Ignition Coil 1	46	Canister Control Valve
6	Injector 2	47	Injector 4
7	Injector 3	48	Upstream Oxygen Sensor Heater (With EOBD) (Without EOBD)
8	Engine Speed Output	49	-
9	Coolant Temperature Output	50	Fan Relay Control
10	Fuel Consumption Output	51	GND (Signal)
11	EPC Lamp	52	-
12	Continuous Supply Voltage	53	GND (Signal)
13	Ignition Switch	54	Electronic Throttle Control Actuator
14	EMS Relay (Main Relay)	55	Downstream Oxygen Sensor
15	Crankshaft Position Sensor	56	-
16	Accelerator Position Sensor	57	-
17	Sensor (GND)	58	Brake Switch
18	Upstream Oxygen Sensor	59	Vehicle Speed Sensor
19	Knock Sensor 1	60	A/C Middle Pressure Switch
20	Knock Sensor 2	61	GND (Power)
21	Brake Switch	62	-
22	-	63	Switched Supply Voltage
23	Accelerator Sensor	64	Electronic Throttle Control Actuator
24	-	65	Electronic Throttle Control Actuator
25	-	66	Electronic Throttle Control Actuator
26	-	67	Electronic Throttle Control Actuator
27	Injector 1	68	Fan Relay Control 2
28	Downstream Oxygen Sensor Heater (With EOBD) (Without EOBD)	69	Air Compressor Relay
29	-	70	Fuel Pump Relay
30	-	71	Diagnostic Link K
31	MIL Lamp	72	-
32	Regulated Sensor Supply 3	73	Regulated Sensor Supply 2
33	Regulated Sensor Supply 1	74	Clutch Pedal Switch
34	Crankshaft Position Sensor	75	A/C Stand By

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PIN	CIRCUIT IDENTIFICATION	PIN	CIRCUIT IDENTIFICATION
35	Sensor (GND)	76	Power Steering Switch
36	Sensor (GND)	77	Headlamp Switch
37	Manifold Absolute Pressure Sensor (With 1.6L Engine)	78	Sensor (GND)
	Air Flow Sensor (With 1.8L Engine)		
38	Electronic Throttle Control Actuator (Position Sensor)	79	Camshaft Position Sensor
39	Engine Coolant Temperature Sensor	80	GND (Power)
40	Accelerator Pedal Position Sensor	81	-
41	-		

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DIAGNOSIS & TESTING

Diagnostic Help

1. The X-431 scan tool connects to the Data Link Connector (DLC) and communicates with the vehicle electronic modules through the data network.
2. Confirm that the malfunction is current and carry-out the diagnostic tests and repair procedures.
3. If the Diagnostic Trouble Code (DTC) cannot be deleted, it is a current fault.
4. Use only a digital multimeter to perform voltage readings on electronic systems.
5. Refer to any Technical Bulletins that may apply to the failure.
6. Visually inspect the related wiring harness.
7. Inspect and clean all Engine Control Module (ECM) grounds that are related to the most current DTC.
8. If numerous trouble codes were set, use a wiring schematic and look for any common ground circuits or voltage supply circuits that may apply to the DTC.

Intermittent DTC Troubleshooting

If the failure is intermittent perform the following:

- Check for loose connectors.
- Look for any chafed, pierced, pinched, or partially broken wires.
- Monitor the scan tool data relative to this circuit.
- Wiggle the related wiring harness and connectors while looking for an interrupted signal on the affected circuit.
- If possible, try to duplicate the conditions under which the DTC set.
- Look for the data to change or for the DTC to reset during the wiggle test.
- Look for broken, bent, pushed out or corroded terminals.
- Inspect the sensor and mounting area for any condition that would result in an incorrect signal, such as damage, or foreign material.
- A data recorder, and/or oscilloscope should be used to help diagnose intermittent conditions.
- Remove the Engine Control Module (ECM) from the troubled vehicle and install in a new vehicle and test. If the DTC cannot be deleted, the ECM is malfunctioning. If the DTC can be deleted, return the ECM to the original vehicle.

Ground Inspection

Ground connections are very important to the proper operation of electrical and electronic circuits. Ground connections are often exposed to moisture, dirt and other corrosive elements. The corrosion (rust) can become an unwanted resistance. This added resistance can alter the way a circuit works.

Electronically controlled circuits are very sensitive to proper grounding. A loose or corroded ground can drastically affect an electronically controlled circuit. A poor or corroded ground can effect the circuit. Perform the following when inspecting a ground connection:

1. Remove the ground bolt or screw.
2. Inspect all mating surface for tarnish, dirt, rust, etc.
3. Clean as required to assure good contact.
4. Reinstall bolt or screw securely.
5. Inspect for ″add-on″ accessories which may be interfering with the ground circuit.
6. If several wires are crimped into one ground eyelet terminal, check for proper crimps. Make sure all of the wires are clean, securely fastened and providing a good ground path. If multiple wires are crimped to one eyelet, make sure no excess wire insulation has been crimped creating a bad ground.

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Electronic Throttle Control Actuator Self-Learning Operation Introduction

EPC Lamp Control Strategy

The Electronic Pedal Control (EPC) lamp will be on for a few seconds and turn off after the ignition switch is turned on and the engine is not running. After the engine started, the EPC lamp will go off if the DTC is not existent in ECM. If the internal self-check failed, the EPC lamp will continue to light.

Electronic Throttle Control Actuator Self-Learning Condition

- Engine stopped and the ignition switch on.
- Vehicle speed is 0 km/h.
- The Engine Coolant Temperature (ECT) is between 5.25°C and 100.5°C.
- The intake air temperature is more than 5.25°C.
- The accelerator pedal fully released.
- Battery voltage is more than 12 V.

Electronic Throttle Control Actuator Self-Learning Operating Procedure

Turn the ignition switch on for 10 seconds, then turn the ignition switch off. During the procedure, do not operate any other components.

Self-Learning Components

Perform the self-learning process when the following repairs have been made:

- Replaced the ECM
- ECM which was disconnected and reconnected
- Replaced the Accelerator Pedal
- Replaced the Electronic Throttle Control Actuator

Self-Learning Operating Procedure

Turn the ignition switch on for 10 seconds, then turn the ignition switch off. During the procedure, do not operate any other components.

Self-Learning Condition

The self-learning condition as the ″Electronic Throttle Control Actuator Self-Learning Condition″.

CAUTION:

Ensure that the Electronic Throttle Control Actuator self-learning process lasts for at least 10 seconds according to the Electronic Throttle Control Actuator self-learning condition. If the self-learning process fails, the engine can't be started or the EPC lamp will be on. If this condition occurs, perform the Self-Learning operating again after the DTCs be erased in ECM.

Diagnostic Trouble Code (DTC) List

DTC	DTC DEFINITION
P000A	″A″ Camshaft Position Slow Response
P000B	″B″ Camshaft Position Slow Response
P0010	″A″ Camshaft Position Actuator Circuit/Open
P0011	″A″ Camshaft Position - Timing Over - Advanced or System Performance
P0012	″A″ Camshaft Position - Timing Over - Retarded
P0013	″B″ Camshaft Position - Actual Circuit/Open
P0014	″B″ Camshaft Position - Timing Over - Advanced or System Performance
P0015	″B″ Camshaft Position - Timing Over - Retarded
P0016	Crankshaft - Camshaft Position Correlation
P0030	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 1)
P0031	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 1) Low

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DTC	DTC DEFINITION
P0032	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 1) High
P0036	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 2)
P0037	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 2) Low
P0038	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 2) High
P0053	O_2 Sensor Heater Resistance (Bank 1 Sensor 1)
P0054	O_2 Sensor Heater Resistance (Bank 1 Sensor 2)
P0101	Mass or Volume Air Flow Circuit Range/Performance (1.8L)
P0102	Mass or Volume Air Flow Circuit Low Input (1.8L)
P0103	Mass or Volume Air Flow Circuit High Input (1.8L)
P0105	Manifold Absolute Pressure or Barometric Pressure Circuit (1.6L)
P0106	Manifold Absolute Pressure or Barometric Pressure Range/Performance (1.6L)
P0107	Manifold Absolute Pressure or Barometric Pressure Low Input (1.6L)
P0108	Manifold Absolute Pressure or Barometric Pressure High Input (1.6L)
P0112	Intake Air Temperature Circuit Low Input
P0113	Intake Air Temperature Circuit High Input
P0116	Engine Coolant Temperature Circuit Range/Performance
P0117	Engine Coolant Temperature Circuit Low Input
P0118	Engine Coolant Temperature Circuit High Input
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance
P0122	Throttle/Pedal Position Sensor A Circuit Low Input
P0123	Throttle/Pedal Position Sensor A Circuit High Input
P0130	O_2 Sensor Circuit Bank 1 - Sensor 1 Malfunction
P0131	O_2 Sensor Circuit Bank 1 - Sensor 1 Low Voltage
P0132	O_2 Sensor Circuit Bank 1 - Sensor 1 High Voltage
P0133	O_2 Sensor Circuit Bank 1 - Sensor 1 Slow Response
P0134	O_2 Sensor Circuit Bank 1 - Sensor 1 No Activity Detected
P0136	O_2 Sensor Circuit Bank 1 - Sensor 2 Malfunction
P0137	O_2 Sensor Circuit Bank 1 - Sensor 2 Low Voltage
P0138	O_2 Sensor Circuit Bank 1 - Sensor 2 High Voltage
P0140	O_2 Sensor Circuit Bank 1 - Sensor 2 No Activity Detected
P0170	Fuel Trim, Bank 1 Malfunction
P0171	Fuel Trim, Bank 1 System too Lean
P0172	Fuel Trim, Bank 1 too Rich
P0201	Cylinder 1 - Injector Circuit
P0202	Cylinder 2 - Injector Circuit
P0203	Cylinder 3 - Injector Circuit
P0204	Cylinder 4 - Injector Circuit
P0219	Engine Overspeed Condition
P0221	Throttle/Pedal Position Sensor/Switch B Range/Performance
P0222	Throttle/Pedal Position Sensor/Switch B Low Input
P0223	Throttle/Pedal Position Sensor/Switch B High Input
P0261	Cylinder 1 - Injector Circuit Low
P0262	Cylinder 1 - Injector Circuit High

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DTC	DTC DEFINITION
P0264	Cylinder 2 - Injector Circuit Low
P0265	Cylinder 2 - Injector Circuit High
P0267	Cylinder 3 - Injector Circuit Low
P0268	Cylinder 3 - Injector Circuit High
P0270	Cylinder 4 - Injector Circuit Low
P0271	Cylinder 4 - Injector Circuit High
P0300	Random/Multiple Cylinder Misfire Detected
P0301	Cylinder 1 Misfire Detected
P0302	Cylinder 2 Misfire Detected
P0303	Cylinder 3 Misfire Detected
P0304	Cylinder 4 Misfire Detected
P0318	Rough Road Sensor "A" Signal Circuit
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal
P0324	Knock Control System Error
P0327	Knock Sensor 1 Circuit Low Input
P0328	Knock Sensor 1 Circuit High Input
P0340	Camshaft Position Sensor Circuit
P0341	Camshaft Position Sensor Circuit Range/Performance
P0342	Camshaft Position Sensor Circuit Low Input
P0343	Camshaft Position Sensor Circuit High Input
P0444	Evaporative Emission System Purge Control Valve Circuit Open
P0458	Evaporative Emission System Purge Control Valve Circuit Low
P0459	Evaporative Emission System Purge Control Valve Circuit High
P0480	Cooling Fan 1 Control Circuit
P0481	Cooling Fan 2 Control Circuit
P0501	Vehicle Speed Sensor Range/Performance
P0506	Idle Control System RPM Lower than Expected
P0507	Idle Control System RPM High than Expected
P0508	Idle Air Control System Circuit Low
P0509	Idle Air Control System Circuit High
P0511	Idle Air Control Circuit
P0532	A/C Refrigerant Pressure Sensor Circuit Low Input
P0533	A/C Refrigerant Pressure Sensor Circuit High Input
P0537	A/C Evaporator Temperature Sensor Circuit Low
P0538	A/C Evaporator Temperature Sensor Circuit High
P0560	System Voltage Malfunction
P0562	System Voltage Low Voltage
P0563	System Voltage High Voltage
P0571	Brake Switch "A" Circuit
P0601	Internal Control Module EEPROM Error
P0602	Control Module Programming Error
P0604	Internal Control Module Random Access Memory (RAM) Error

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DTC	DTC DEFINITION
P0605	Internal Control Module ROM Test Error
P0606	ECM Processor
P0627	Fuel Pump ″A″ Control Circuit/Open
P0628	Fuel Pump ″A″ Control Circuit Low
P0629	Fuel Pump ″A″ Control Circuit High
P0645	A/C Clutch Relay Circuit
P0646	A/C Clutch Relay Control Circuit Low
P0647	A/C Clutch Relay Control Circuit High
P0650	Malfunction Indicator Lamp Control Circuit
P0688	EMC/ECM Power Relay Sense Circuit Open
P0691	Cooling Fan 1 Control Circuit Low
P0692	Cooling Fan 1 Control Circuit High
P0693	Cooling Fan 2 Control Circuit Low
P0694	Cooling Fan 2 Control Circuit High
P0700	Transmission Control System Malfunction
P0704	Clutch Switch Input Circuit
P1297	Manufacturer Controlled Computer And Auxiliary Outputs
P1336	Engine Torque Control Adaptation at Limit
P1545	Throttle Position Control Malfunction
P1558	Throttle Actuator Electrical Malfunction
P1559	Idle Speed Control Throttle Position Adaptation Malfunction
P1564	Idle Speed Control Throttle Position Low Voltage During Adaptation
P1565	Idle Speed Control Throttle Position Lower Limit not Attained
P1568	Idle Speed Control Throttle Position Mechanical Malfunction
P1579	Idle Speed Control Throttle Position Adaptation Not Started
P1604	Internal Control Module Driver Error
P1610	Manufacture Controlled Computer and Auxiliary Outputs
P1611	Manufacture Controlled Computer and Auxiliary Outputs
P1612	Manufacture Controlled Computer and Auxiliary Outputs
P1613	Manufacture Controlled Computer and Auxiliary Outputs
P1614	Manufacture Controlled Computer and Auxiliary Outputs
P1651	Manufacture Controlled Computer and Auxiliary Outputs
P2106	Throttle Actuator Control System Forced Limited Power
P2122	Throttle/Pedal Position Sensor/Switch D Circuit Low Input
P2123	Throttle/Pedal Position Sensor/Switch D Circuit High Input
P2127	Throttle/Pedal Position Sensor/Switch E Circuit Low Input
P2128	Throttle/Pedal Position Sensor/Switch E Circuit High Input
P2138	Accelerator Pedal Position Sensor Signal Correlation Error
P2177	System Too Lean off Idle
P2178	System Too Rich off Idle
P2187	System Too Lean at Idle
P2188	System Too Rich at Idle
P2195	O_2 Sensor Signal Stuck Lean; Bank 1 Sensor 1

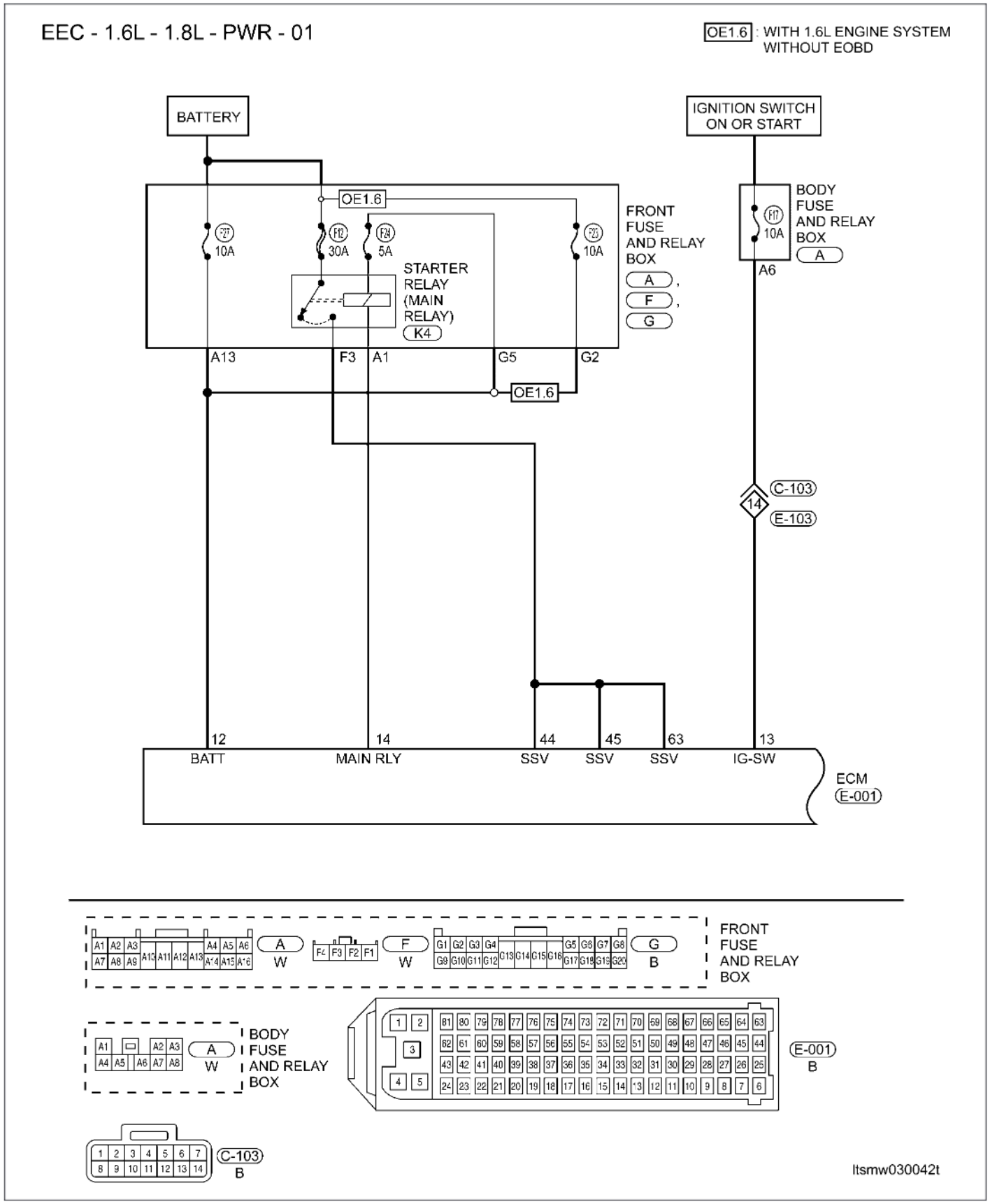
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DTC	DTC DEFINITION
P2196	O_2 Sensor Signal Stuck Rich; Bank 1 Sensor 1
P2270	O_2 Sensor Signal Stuck Lean; Bank 1 Sensor 2
P2271	O_2 Sensor Signal Stuck Rich; Bank 1 Sensor 2
U0001	High Speed CAN Defective
U0101	Lost Communication with ECM
U104	Lost Communication with Cruise Control Module
U0121	Lost Communication with Anti-Lock Brake System (ABS) Control Module
U0155	Lost Communication with Instrument Panel Cluster Control Module
U0415	Invalid Data Received from ABS Control Module

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ECM Power Supply and Ground Circuit Test

Power Supply and Ground Circuit



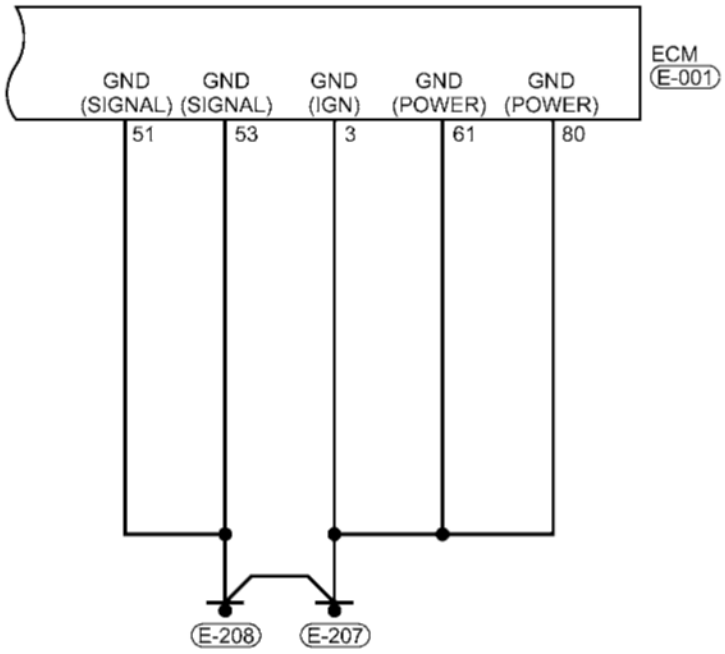
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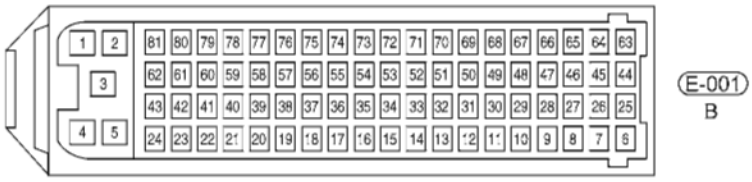
Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
12	Continuous Supply Voltage	-	Voltage (11 - 14 V)
13	Ignition Switch	• Ignition switch: ON	Voltage (11 - 14 V)
		Ignition switch: OFF	Approximately 0 V
14	EMS Relay (Main Relay)	• Ignition switch: OFF More than a few seconds after turning ignition switch OFF	Voltage (11 - 14 V)
44	Switched Supply Voltage (SSV)	• Ignition switch: ON	Voltage (11 - 14 V)
45			
63			

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
3	GND (IGN)	Ignition switch: ON	Approximately 0 V
51	GND (Signal)	Ignition switch: ON	Approximately 0 V
53	GND (Signal)	Ignition switch: ON	Approximately 0 V
61	GND (Power)	Ignition switch: ON	Approximately 0 V
80	GND (Power)	Ignition switch: ON	Approximately 0 V

Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Start the engine and warm it to normal operating temperature.
- With the scan tool, select view data stream.
- If the data stream is not detected, the condition is current. Go to Diagnostic Procedure - Step 1.
- If the data stream is detected, the condition is intermittent (See Diagnostic Help and Intermittent DTC Trouble-shooting in Section 03 Electronic Engine Controls for more information).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. PRELIMINARY INSPECTION

- Attempt to start the engine.

Does the engine start?

Yes >> Go to step 7.

No >> Go to step 2.

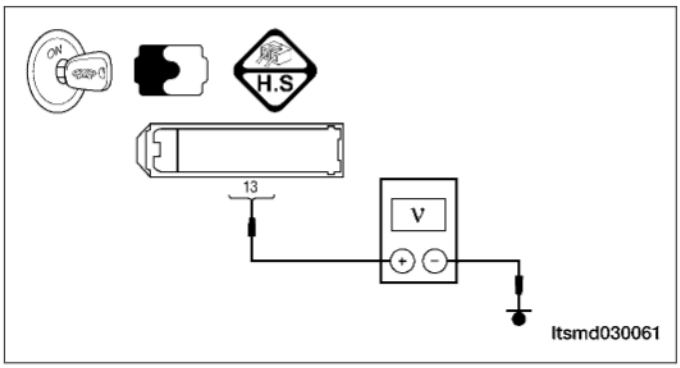
2. CHECK ECM POWER SUPPLY CIRCUIT - (1)

- Turn ignition switch off and then on.
- Check voltage between the ECM terminal 13 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 4.

No >> Go to step 3.



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3. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse 17
  - Harness connectors C-103, E-103, terminal 14
  - Front fuse and relay box connector A
  - Harness for an open or short between ECM and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short in harness or connectors.

4. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

5. CHECK ECM GROUND CIRCUIT FOR AN OPEN OR SHORT

- Disconnect ECM harness connector.
- Check harness continuity between ECM terminals 3, 51, 53, 61, 80 and ground.
- Continuity should exist.
- Also check harness for short to power.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

6. DETECT MALFUNCTIONING PART

- Check harness for open or short between ECM terminals 3, 51, 53, 61, 80 and ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

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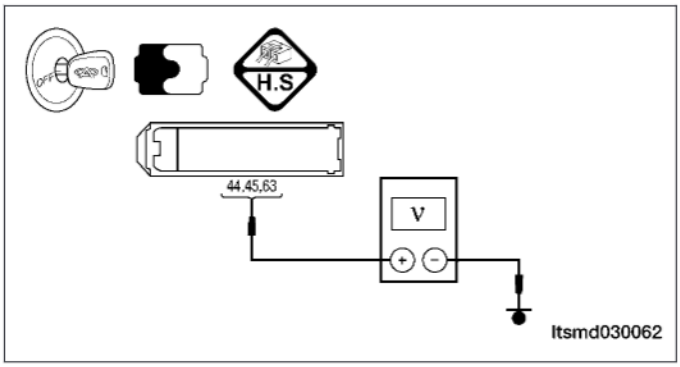
7. CHECK ECM POWER SUPPLY CIRCUIT - (2)

- Check voltage between ECM terminals 44, 45, 63 and ground.
- Voltage: Turn ignition switch on, battery voltage should exist and after turning ignition switch off, battery voltage will exist a few seconds, then drop to approximate 0 V.

Is the check result normal?

Yes >> Check the starting system.

No >> Go to the next step.



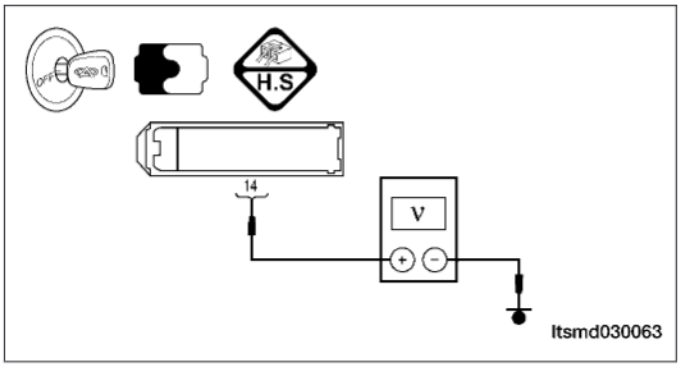
8. CHECK STARTER RELAY (K4) SUPPLY VOLTAGE

- Turn ignition switch off. Wait for at least 10 seconds.
- Check voltage between the ECM terminal 14 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Go to step 10.



9. CHECK ECM POWER SUPPLY CIRCUIT - (3)

- Disconnect ECM harness connector.
- Disconnect ECM power supply circuit connector F in front fuse and relay box harness connector.
- Check harness continuity between ECM terminals 44, 45, 63 and front fuse and relay box terminal F3.
- Continuity should exist.
- Also check harness for a short to ground and short to power.

Is the check result normal?

Yes >> Go to step 11.

No >> Repair circuit for an open or short to power in harness or connectors.

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10. CHECK STARTER RELAY (K4) CIRCUIT

- Disconnect ECM harness connector.
- Disconnect front fuse and relay box harness connector A.
- Check harness continuity between ECM terminal 14 and front fuse and relay box terminal A1.
- Check harness continuity between front fuse and relay box terminal G2 and A13.
- If not equipped with EOBD (1.6L): Check harness continuity between front fuse and relay box terminal G2 and G5.
- Continuity should exist.
- Also check harness for a short to ground and short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to ground or short to power in harness or connectors.

11. CHECK FUSE

- Disconnect fuse 27 (10A), fuse 24 (5A) in the front fuse and relay box.
- If Without EOBD (1.6L): Disconnect fuse 23 (10A), fuse 24 (5A) front fuse and relay box.
- Check fuses.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace fuse 23, fuse 24 or fuse 27.

12. CHECK FRONT FUSE AND RELAY BOX

- Check front fuse and relay box.

Is the check result normal?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

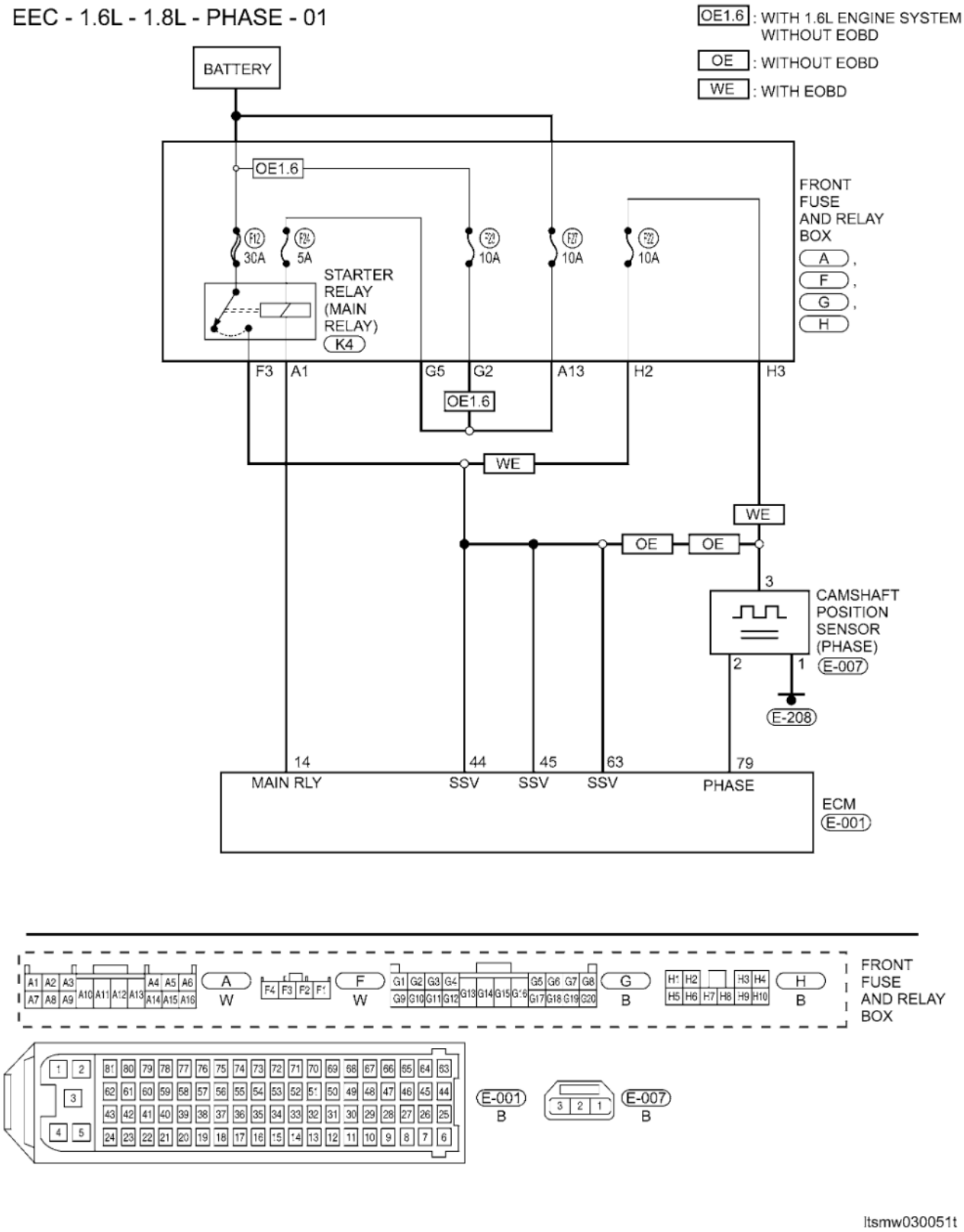
No >> Replace front fuse and relay box.

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Diagnostic Trouble Code (DTC) Tests

P0016 - Camshaft Position-Crankshaft Position Correlation Error

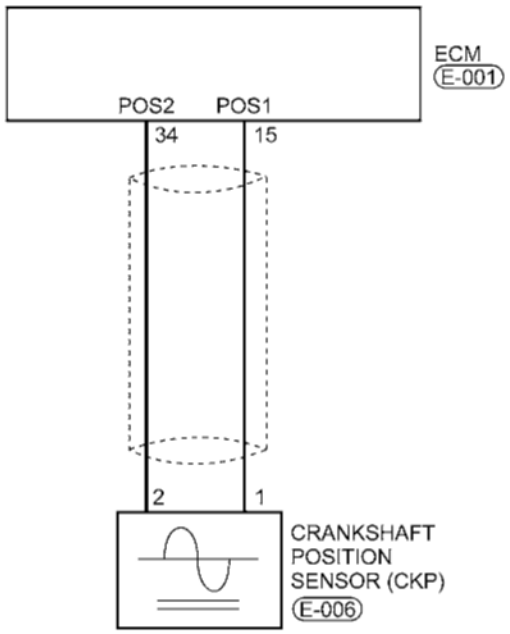
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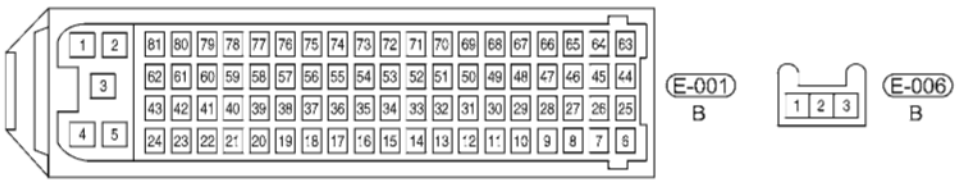


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EEC - 1.6L - 1.8L - POS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
15	Crankshaft Position (CKP) sensor	• Ignition switch: ON • Engine: Not cranking	3 V
34			
79	Camshaft Position (CMP) sensor	• Ignition switch: ON • Engine: Not cranking	11 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0016	Camshaft position-Crankshaft position correlation error	Engine is running	ECM detected that the CMP sensor is out of phase with CKP sensor.	• CMP sensor • CKP sensor • Harness or connectors (The sensor circuit is open or shorted) • Crankshaft signal plate • Camshaft and camshaft signal plate • Timing misalignment • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

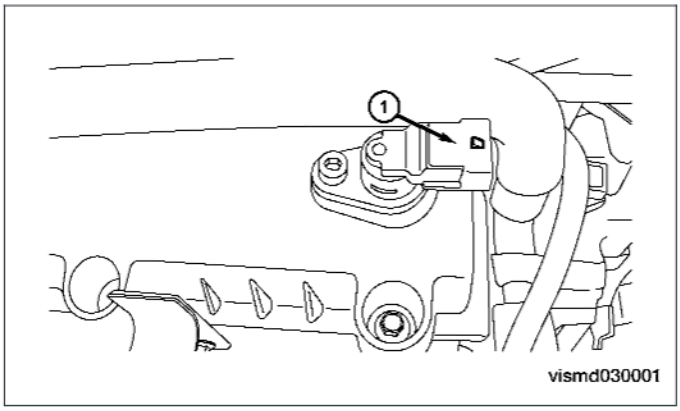
2. CHECK CMP SENSOR ELECTRICAL CONNECTOR

- Disconnect the CMP sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



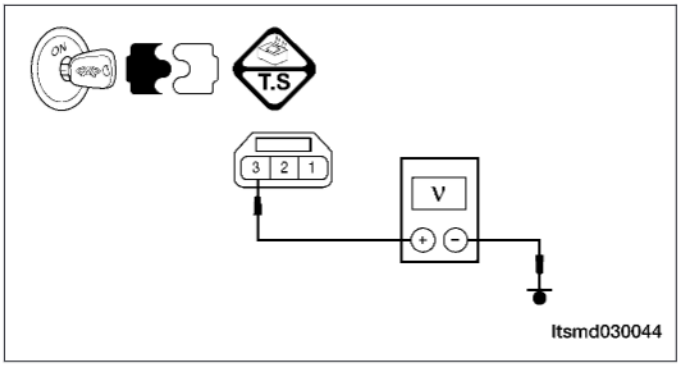
3. CHECK THE CMP SENSOR POWER SUPPLY CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check CMP sensor supply voltage between sensor connector E-007, terminal 3 and ground in the sensor electrical connector.
- 12 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:

1.6L Without EOBD

- Front fuse and relay box G2, G5, A1, F3
- Fuse 23, fuse 12, fuse 24

Without EOBD

- Front fuse and relay box A1, F3, G5, A13
- Fuse 27, fuse 12, fuse 24

With EOBD

- Front fuse and relay box H3, H2, ,G5, A1, F3, A13
- Fuse 27, fuse 12, fuse 24, fuse 22

- Harness for an open or short between CMP sensor and fuse
- Check the relay or replace the relay if necessary.
- Repair circuit in harness or connectors.
- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0016 still present?

Yes >> Go to the next step.

No >> The system is operating properly at this time.

5. CHECK THE CMP SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Check continuity between CMP sensor terminal 1 and ground.
- Continuity should exist.
- Also check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

6. CHECK THE CMP SENSOR INPUT SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check voltage between CMP sensor terminal 2 and ground.
- 11 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power or short to ground in harness or connectors. If circuit is normal, go to the next step.

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7. CHECK CMP SENSOR SIGNAL

- Turn ignition switch off.
- Connect CMP sensor connector.
- Check signal between CMP sensor terminal 2 and ground when engine is running.
- Approximately 6 V square wave signal should exist.

	CMP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030003

Is the CMP output signal normal?

Yes >> Go to step 10.

No >> Go to the next step.

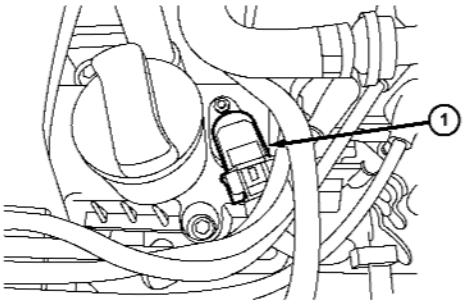
8. CHECK CMP SENSOR

- Remove the CMP sensor (1).
- Inspect and clean the CMP sensor and mounting area for any condition that would result in an incorrect signal, such as damage, foreign material, or excessive movement.

Is the sensor mounting area OK?

Yes >> Go to the next step.

No >> Repair or replace the sensor as necessary.

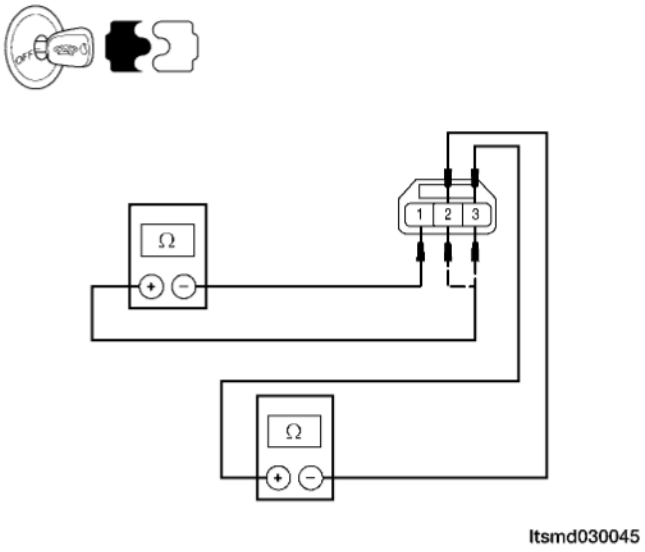


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9. CHECK CMP SENSOR RESISTANCE

- Check resistance between the following CMP sensor terminals, component side:

TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Except 0 or ∞	
1 & 3		
2 & 3		

Is the check result normal?

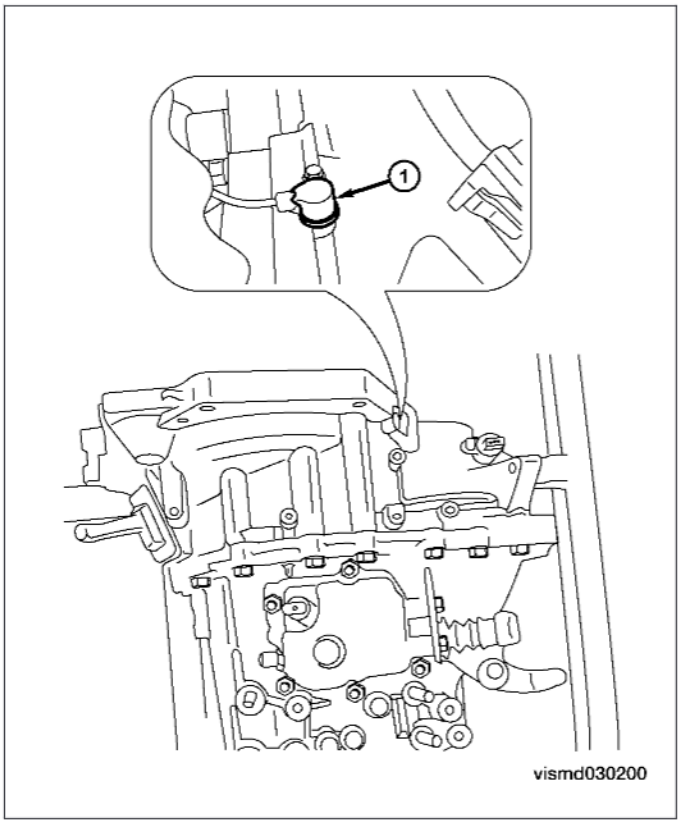
Yes >> Replace the CMP sensor with a known good CMP sensor.
Monitor the CMP sensor signal on the KES-200 screen.
- If the CMP sensor signals were normal, the system is OK.
- If the CMP sensor signals were still irregular or missing, go to step 13.

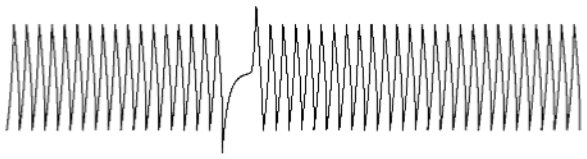
No >> Replace CMP sensor.

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10. CHECK CKP SENSOR SIGNAL WAVE PATTERN

- Check signal between CKP sensor (1) terminal 1 and ground, terminal 2 and ground when engine is running.



	CKP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030002

Is the CKP output signal normal?

Yes >> Go to step 16.

No >> Go to the next step.

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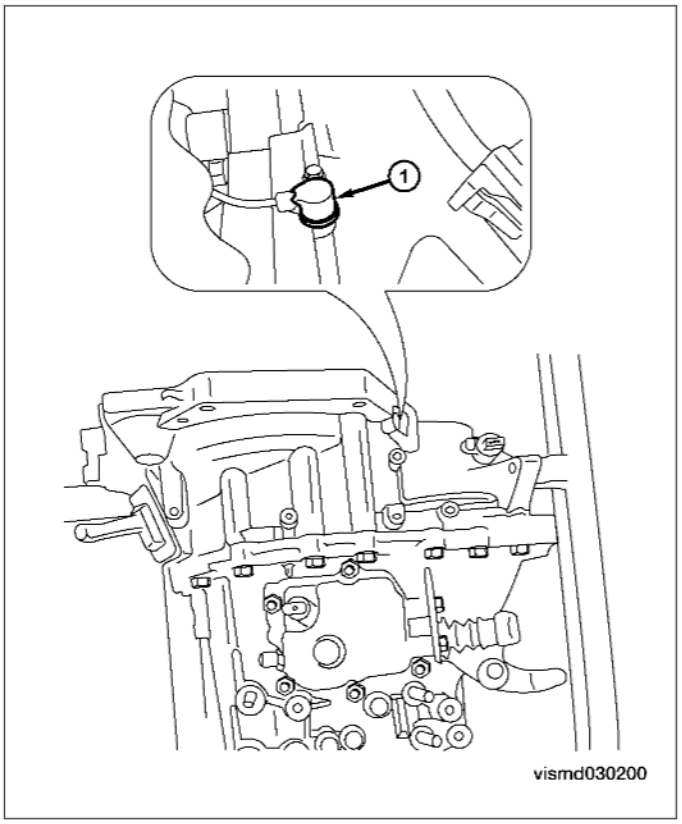
11. CHECK CKP SENSOR

- Remove the CKP sensor (1).
- Inspect and clean the CKP sensor and mounting area for any condition that would result in an incorrect signal, such as damage, foreign material, or excessive movement.

Is the sensor mounting area OK?

Yes >> Go to the next step.

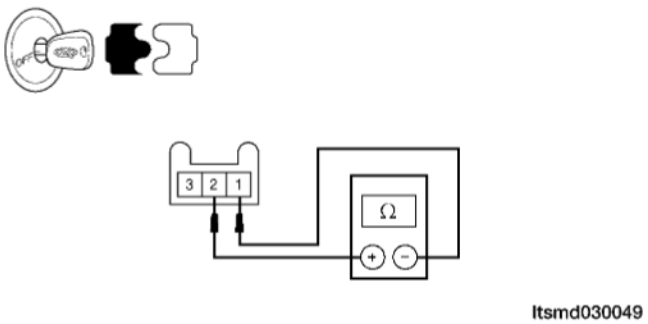
No >> Repair or replace the sensor as necessary.



12. CHECK CKP SENSOR RESISTANCE

- Check the resistance of the CKP sensor, component side.

TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Approximately 1000 Ω	



Is the check result normal?

Yes >> Replace the CKP sensor with a known good CKP sensor.
Monitor the CKP sensor signal on the KES-200 screen.
- If the CKP sensor signals were normal, the system is OK.
- If the CKP sensor signals were still irregular or missing, go to step 14.

No >> Replace CKP sensor.

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13. CHECK THE CAMSHAFT AND CAMSHAFT SIGNAL PLATE

- Remove the cylinder head cover and timing belt cover (See Timing Belt Removal & Installation in Section 02 Engine).
- Check the installed clearance (See CMP Sensor Removal & Installation in Section 03 Electronic Engine Controls).
- 0.8 - 1.2 mm should exist.
- Check the camshaft and camshaft signal plate for any condition that would result in an incorrect signal, such as damage, become flexible, foreign material when rotate the camshaft.

Were any problems found?

Yes >> Remove debris and clean the signal plate of camshaft rear end or replace camshaft.
Reinstall CMP sensor.

No >> Go to step 16.

14. CHECK THE CRANKSHAFT AND CRANKSHAFT SIGNAL PLATE

- Check the installed clearance (See CKP Sensor Removal & Installation in Section 08 Transaxle & Transfer Case).
- 0.8 - 1.2 mm should exist.
- Check the crankshaft and crankshaft signal plate for any condition that would result in an incorrect signal, such as damage, become flexible, foreign material when rotate the crankshaft.

Were any problems found?

Yes >> Remove debris and clean the signal plate of crankshaft rear end or replace crankshaft.
Reinstall the CKP sensor.

No >> Go to the next step.

15. CHECK THE TIMING

- Check the timing for misalignment.

Is the timing misaligned?

Yes >> Align the engine timing belt (See Timing Belt Removal & Installation in Section 02 Engine).

No >> Go to the next step.

16. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0016 still present?

Yes >> Replace the ECM.

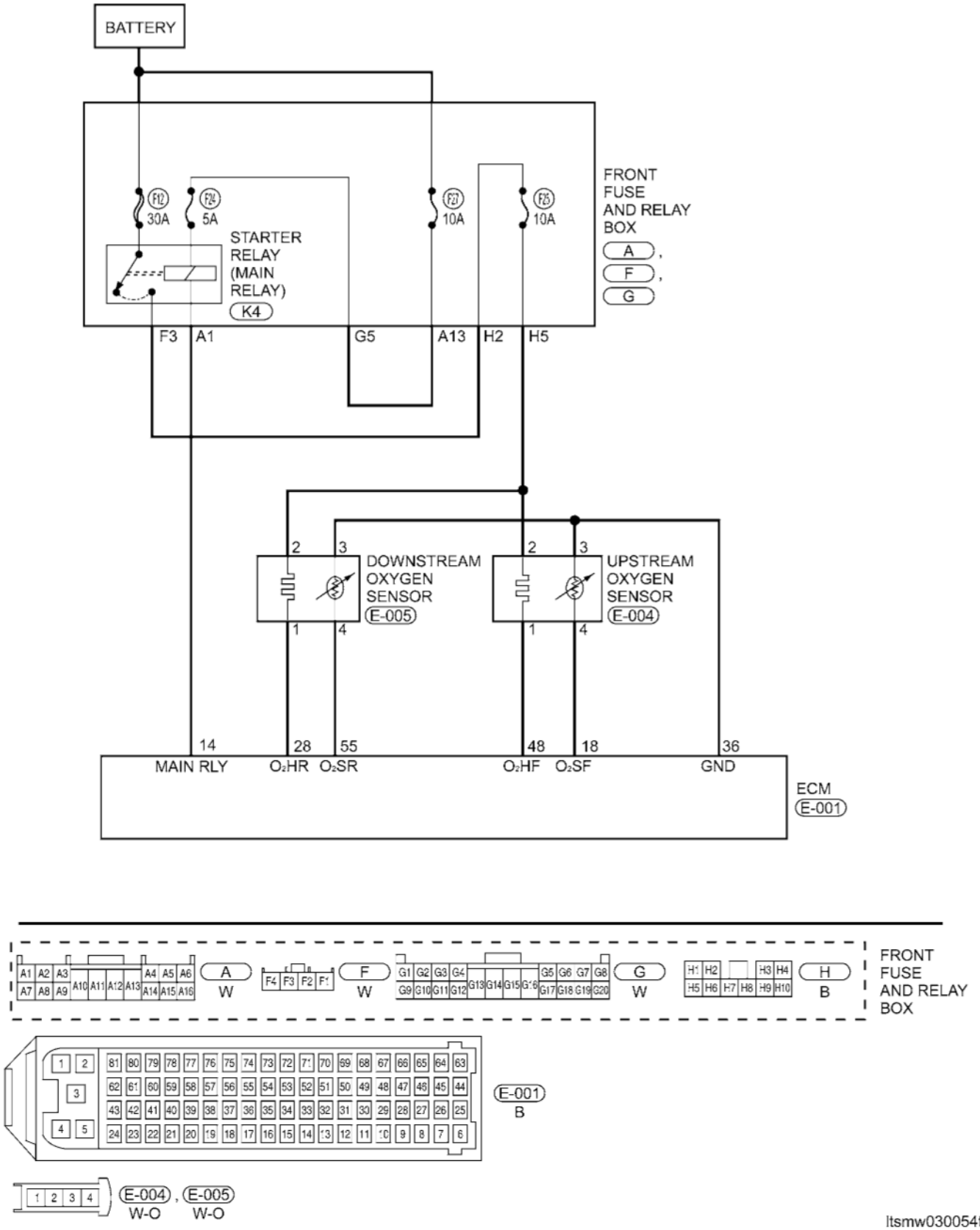
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0031 - O_2 Sensor 1 Heater Control Circuit Low

EEC - 1.6L - 1.8L - O_2S - 01 - WITH EOBD

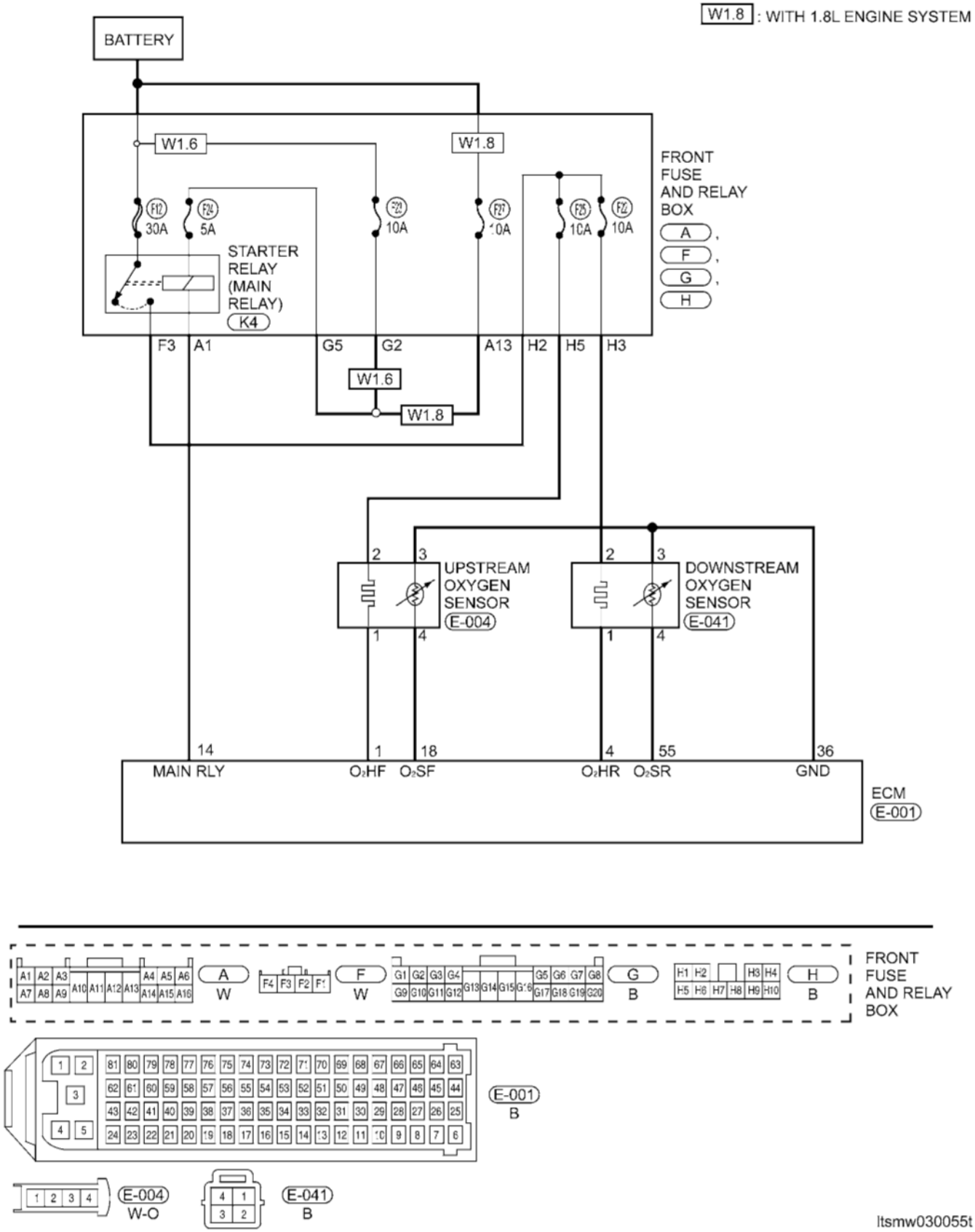


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EEC - 1.6L - 1.8L - O_2S - 02 - WITHOUT EOBD

W1.6 : WITH 1.6L ENGINE SYSTEM
W1.8 : WITH 1.8L ENGINE SYSTEM



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
18	Upstream oxygen sensor	• Engine is running • Warm-up condition • Keep the engine speed 2000 RPM	Approximately 0.1 V - 0.9 V (change 5 - 8 times in 10 seconds periodically)
28 (With EOBD) 4 (Without EOBD)	Downstream oxygen sensor heating	-	-
36	Sensor (GND)	• Warm-up condition • Idle speed	Approximately 0 V
48 (With EOBD) 1 (Without EOBD)	Upstream oxygen sensor heating	-	-
55	Downstream oxygen sensor	• Engine is running • Warm-up condition • Keep the engine speed 2000 RPM	Approximately 100 mV

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0031	O_2 sensor 1 heater control circuit low	Engine is running	• Oxygen sensor • Harness or connectors (The sensor circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on and select record and erase data stream and DTC.
- Start engine and warm it up to the normal operating temperature.
- Turn ignition switch off and wait at least 10 seconds.
- Start engine and keep the engine speed 2000 RPM for at least 1 minute.
- Let engine idle for 2 minutes.
- With the scan tool, select view DTCs in the ECM.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Is ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

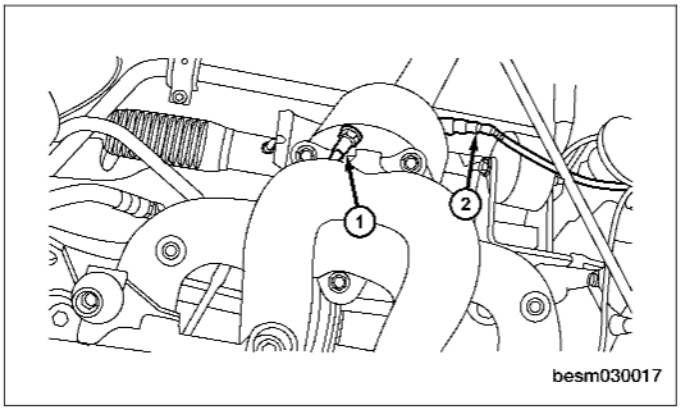
2. CHECK O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the O_2 sensor (1) electrical connector E-004.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



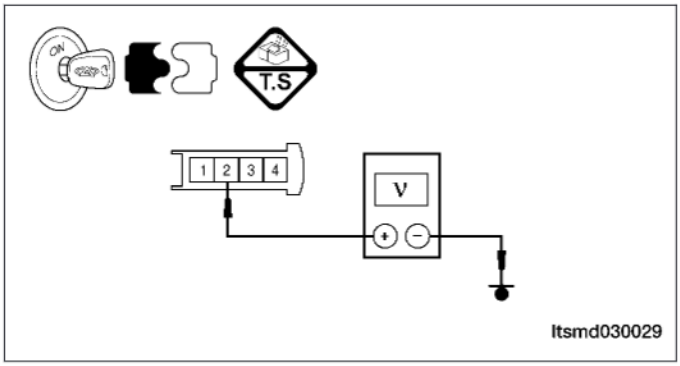
3. CHECK O_2 SENSOR HEATER POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between O_2 sensor terminal 2 and ground in the O_2 sensor electrical connector E-004.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to Step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:

With EOBD (1.6L and 1.8L)

- Fuse 25, fuse 12, fuse 27, fuse 24
- Front fuse and relay box H2, H5, F3, A1, A13, G5
- Harness between O_2 sensor and fuse

Without EOBD (1.6L)

- Fuse 23, fuse 12, fuse 27, fuse 22, fuse 25
- Front fuse and relay box H2, H5, H3, F3, A1, G2, G5
- Harness between O_2 sensor and fuse

Without EOBD (1.8L)

- Fuse 22, fuse 25, fuse 12, fuse 27, fuse 24
- Front fuse and relay box H2, H3, H5, F3, A1, A13, G5
- Harness between O_2 sensor and fuse

- Repair or replace if necessary.
- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0031 still present?

Yes >> Go to the next step.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

5. CHECK O_2 SENSOR HEATER CONTROL CIRCUIT FOR OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM connector.
- Check harness continuity between ECM terminal and O_2 sensor terminal.
- Continuity should exist.
- Check sensor heater control circuit.

O_2 SENSOR	TERMINAL	
	ECM	Oxygen sensor
Upstream O_2 sensor heater	• 48 (With EOBD) • 1 (Without EOBD)	1

- Check harness short to ground.

Is the check result normal?

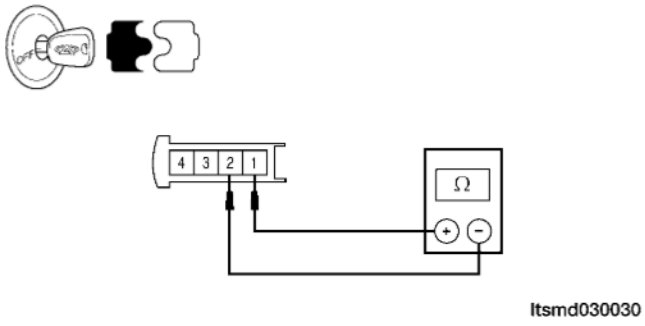
Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short in harness or connectors.

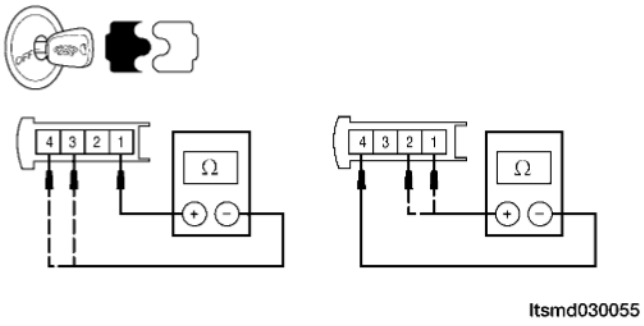
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6. CHECK O_2 SENSOR HEATER

- Check the resistance between O_2 sensor heater terminals, component side.

TERMINAL NO.	RESISTANCE	
1 and 2 (including cable and connector)	Approximately 9 Ω	

- Check the resistance between O_2 sensor terminals, component side.

TERMINAL NO.	RESISTANCE	
1 and 3 & 4	∞ Ω (Continuity should not exist)	
4 and 1 & 2		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace O_2 sensor.

7. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0031 still present?

Yes >> Replace the ECM.

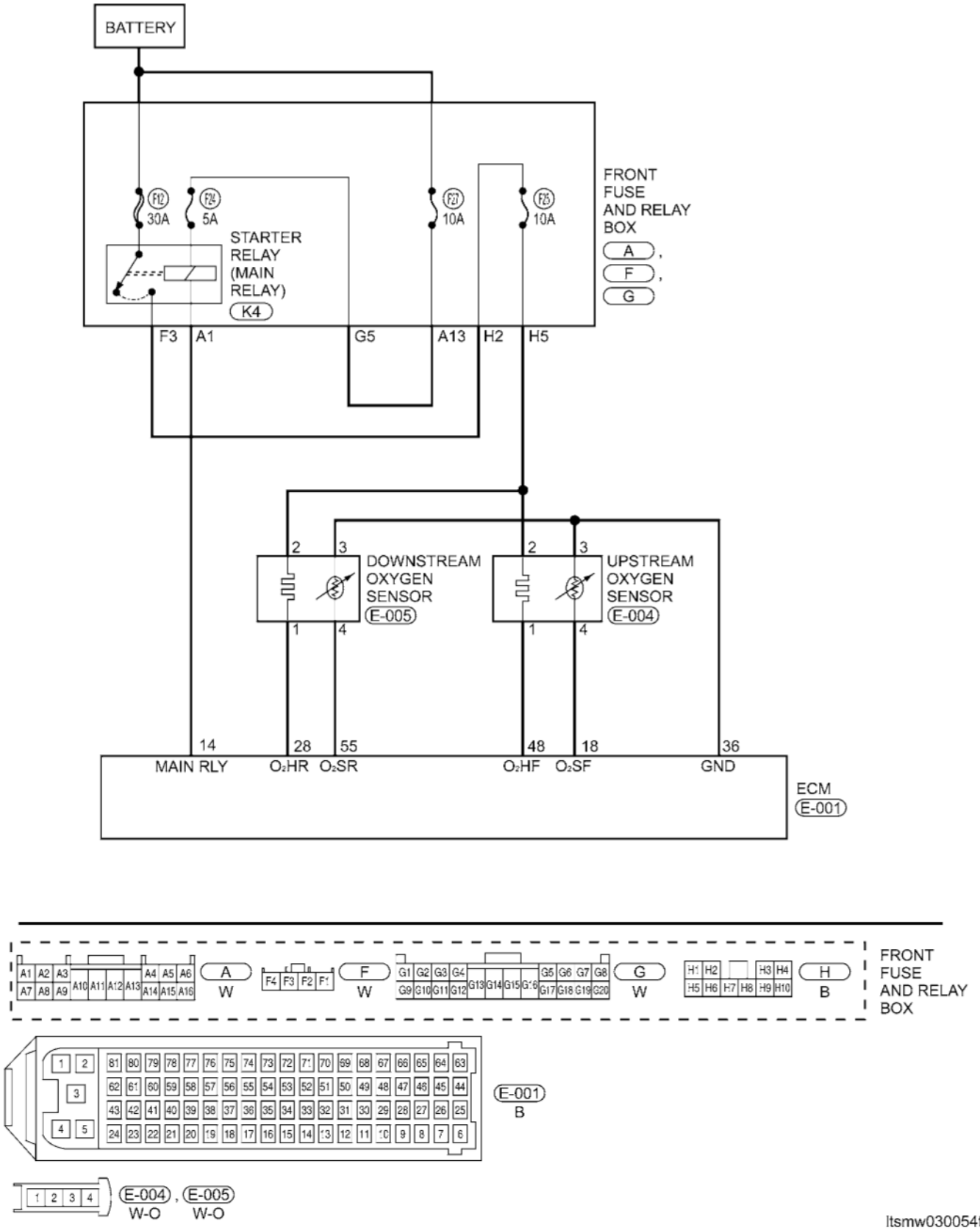
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0032 - O_2 Sensor 1 Heater Control Circuit High

EEC - 1.6L - 1.8L - O_2S - 01 - WITH EOBD

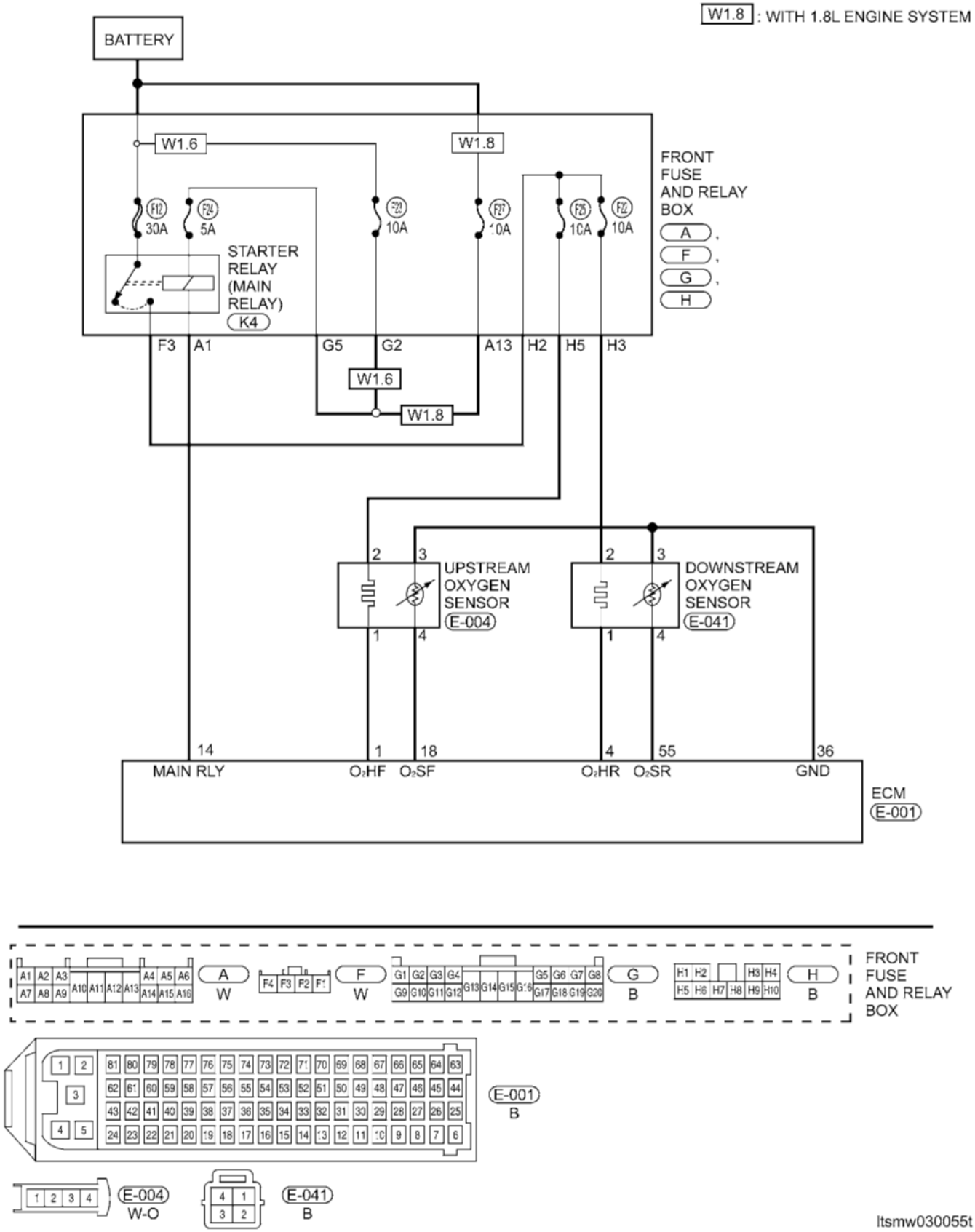


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EEC - 1.6L - 1.8L - O_2S - 02 - WITHOUT EOBD

W1.6 : WITH 1.6L ENGINE SYSTEM
W1.8 : WITH 1.8L ENGINE SYSTEM



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
18	Upstream O_2 sensor	• Engine is running • Warm-up condition	Approximately 0.1 V - 0.9 V (Change 5 - 8 times in 10 seconds periodically)
28 (With EOBD) 4 (Without EOBD)	Downstream O_2 sensor heating	-	-
36	Sensor (GND)	• Warm-up condition • Idle	Approximately 0 V
48 (With EOBD) 1 (Without EOBD)	Upstream O_2 sensor heating	-	-
55	Downstream O_2 sensor	• Engine is running • Warm-up condition	Approximately 100 mV

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0032	O_2 sensor 1 heater control circuit high	Engine is running.	• Fuel quality • Oxygen Sensor •Harness or connectors (The sensor circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on and select view data stream.
- Start engine and warm it up to the normal operating temperature.
- Turn ignition switch off and wait at least 10 seconds.
- Start engine and keep the engine speed 2000 RPM for at least 1 minute.
- Let engine idle for 2 minutes.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Is ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

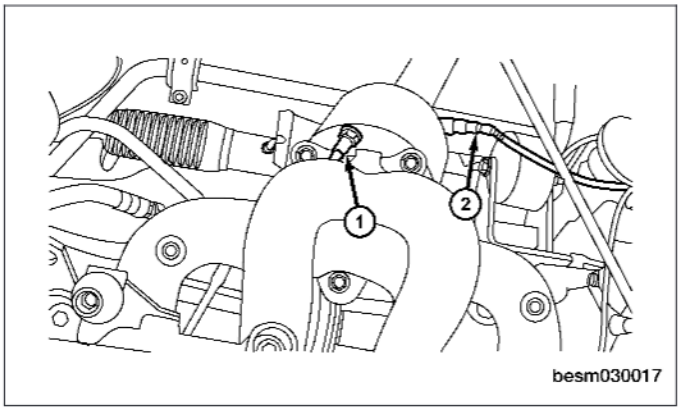
2. CHECK O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the O_2 sensor (1) electrical connector E-004.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



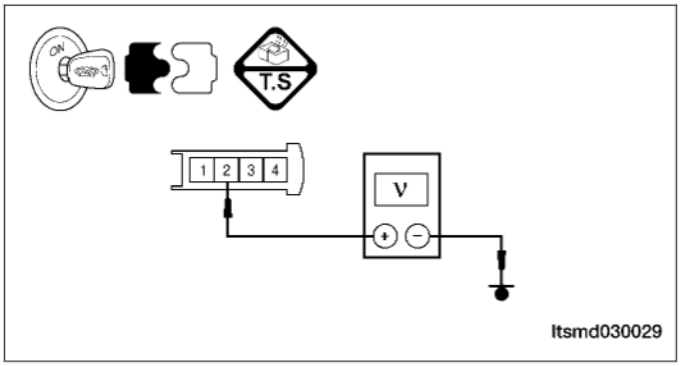
3. CHECK O_2 SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check O_2 sensor supply voltage between O_2 sensor terminal 2 and ground in the O_2 sensor electrical connector E-004.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to Step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:

With EOBD (1.6L and 1.8L)

- Front fuse and relay box H2, H5, F3, A1, A13, G5
- Fuse 25, fuse 12, fuse 27, fuse 24

Without EOBD (1.6L)

- Front fuse and relay box H2, H5, H3, F3, A1, G2, G5
- Fuse 23, fuse 12, fuse 27, fuse 22, fuse 25

Without EOBD (1.8L)

- Front fuse and relay box H2, H3, H5, F3, A1, A13, G5
- Fuse 22, fuse 25, fuse 12, fuse 27, fuse 24

- Check the harness for an open or a short between the O_2 sensor and fuse.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning parts as necessary.

5. CHECK THE O_2 SENSOR HEATER CONTROL CIRCUIT FOR SHORT

- Turn ignition switch off.
- Disconnect ECM connector.
- Check harness continuity between ECM terminal and O_2 sensor terminal.
- Continuity should exist.
- Check the control circuit of the sensor heater.

O_2 SENSOR	ECM TERMINAL	O_2 SENSOR TERMINAL
Upstream O_2 sensor heater (With EOBD)	48	1
Upstream O_2 sensor heater (Without EOBD)	1	1

- Check harness short to power supply circuit.

Is the check result normal?

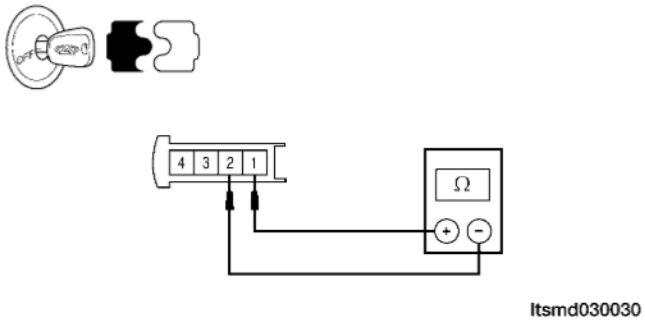
Yes >> Go to the next step.

No >> Repair or replace circuit for a short to power in harness or connectors.

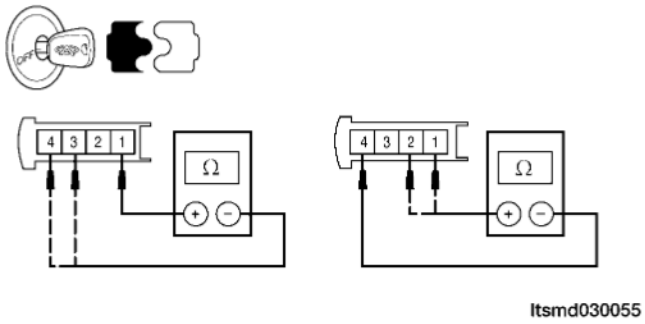
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6. CHECK THE O_2 SENSOR HEATER

- Check the resistance between O_2 sensor heater terminals, component side.

TERMINAL NO.	RESISTANCE	
1 and 2 (including cable and connector)	Approximately 9 Ω	 ltsmd030030

- Check the resistance between O_2 sensor terminals, component side.

TERMINAL NO.	RESISTANCE	
1 and 3 & 4	∞ Ω (Continuity should not exist)	 ltsmd030055
4 and 1 & 2		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the O_2 sensor.

7. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to "DTC Confirmation Procedure".

Is DTC P0032 still present?

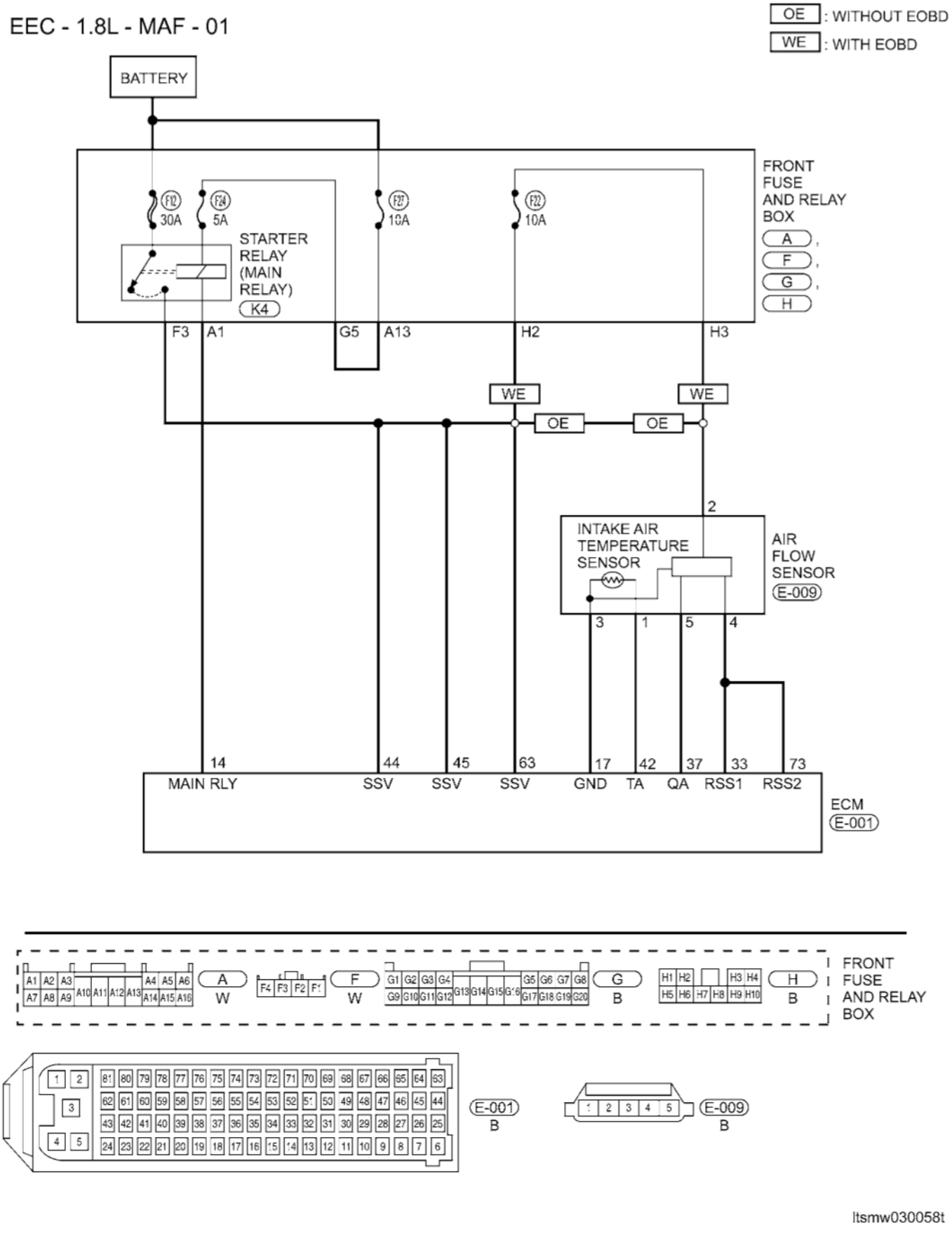
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0102 - Mass Or Volume Air Flow Circuit Low Input



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
17	Sensor (GND)	• Engine is running • Warm-up condition: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal voltage: 1.88 V	Approximately 0 V
33	Regulated sensor supply 1		5 V
37	Air flow sensor		Approximately 322 kg/h
			Approximately 1.39 V
73	Regulated sensor supply 1		5 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0102	Mass or Volume Air Flow (MAF) circuit low input	Ignition switch on or engine is running	ECM detected that the input signal is out of the acceptable range.	• MAF sensor • Intake air leaks • Harness or connectors (The sensor circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Is ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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2. CHECK INTAKE SYSTEM

- Check the following:
  - Air duct
  - Vacuum hoses
  - Intake air passage between air duct and manifold

Is the check result normal?

Yes >> Go to the next step.

No >> Reconnect the connectors or replace the malfunctioning part.

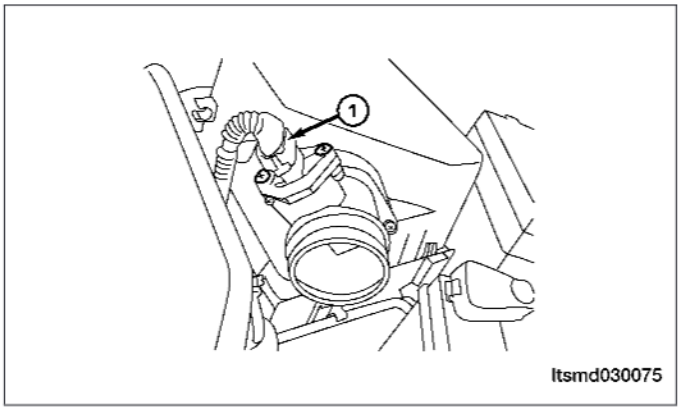
3. CHECK MASS AIR FLOW (MAF) SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAF sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



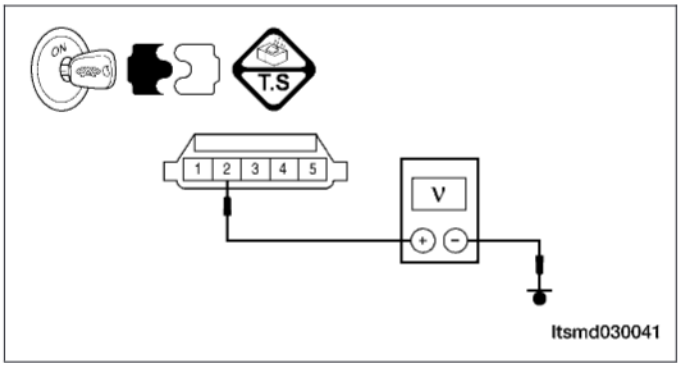
4. CHECK THE MASS AIR FLOW (MAF) SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check voltage between MAF sensor terminal 2 and ground in the MAF sensor electrical connector E-009.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.



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5. DETECT MALFUNCTIONING PART

- Check the following:

With EOBD

- Fuse 21, fuse 22, fuse 24, fuse 27
- Front fuse and relay box H2, H3, F3, A1, A13, G5
- Harness between air flow sensor and fuse

Without EOBD

- Fuse 21, fuse 24, fuse 27
- Front fuse and relay box F3, A1, A13, G5
- Harness between air flow sensor and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning parts as necessary.

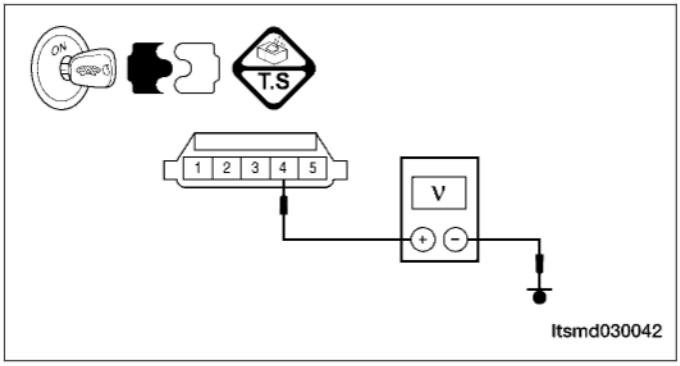
6. CHECK THE MAF SENSOR REFERENCE CIRCUIT

- Check voltage between MAF sensor terminal 4 and ground in the MAF sensor electrical connector E-009.
- 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short to ground in harness or connectors.
If circuit is normal, go to the next step.



7. CHECK THE MAF SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between MAF sensor terminal 3 and ECM terminal 17.
- Continuity should exist.
- Check harness for short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open in harness or connectors.

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8. CHECK THE MAF SENSOR OUTPUT SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between MAF sensor terminal 5 and ECM terminal 37.
- Continuity should exist.
- Check harness for a short to ground.

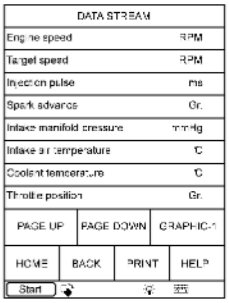
Is the check result normal?

Yes >> Go to the next step.

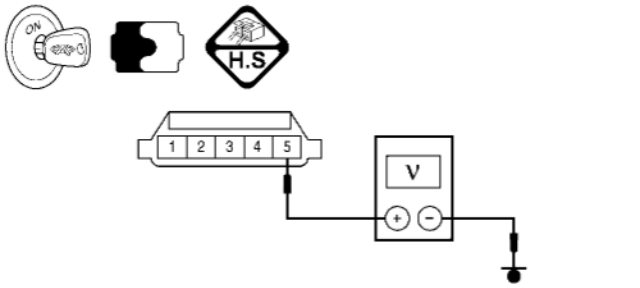
No >> Repair or replace the circuit for an open or short to ground in harness or connectors.

9. CHECK THE MAF SENSOR

- Install all removed parts.
- Start engine.
- Check MAF sensor signal in data stream with the X-431.

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)	
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 322 kg/h	 ltsmd030001t
			Approximately 1.39 V	

- If without the X-431, check voltage between MAF sensor terminal 5 and ground.

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)	
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 1.39 V	 ltsmd030043

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- If the voltage is out of specification, proceed the following:

Check for the cause of uneven air flow through MAF sensor.

- Air cleaner seal
- Crushed air ducts
- Uneven dirt of air cleaner element

- If the parts malfunctioning, repair or replace them.
- If the parts OK, clean the MAF sensor, then check the signal of the MAF sensor.

Is the MAF signal normal?

Yes >> Go to the next step.

No >> Replace MAF sensor.

10. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0102 still present?

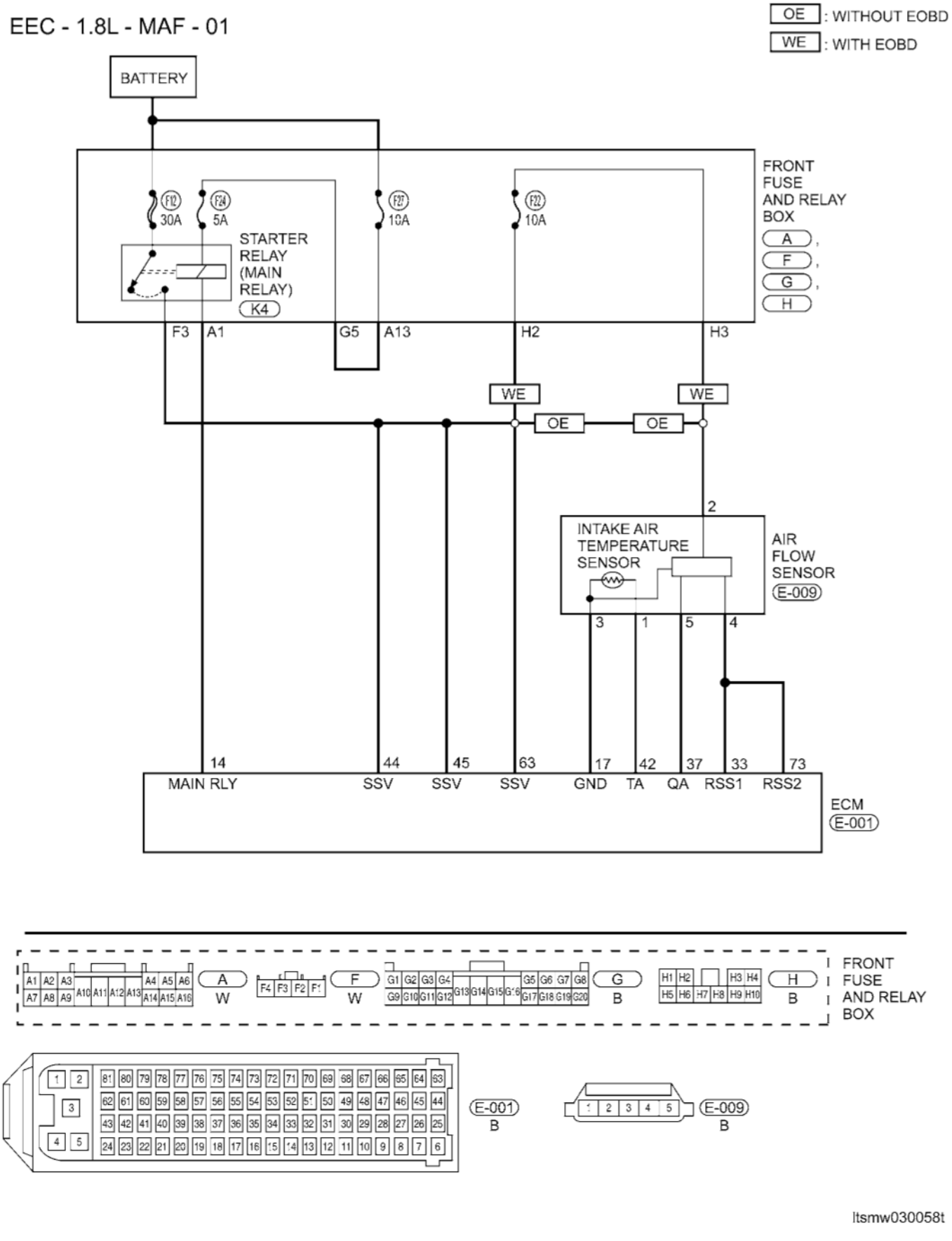
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0103 - Mass Or Volume Air Flow Circuit High Input



ltsmw030058t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
17	Sensor (GND)	Ignition switch on	Approximately 0 V
33	Regulated sensor supply 1		5 V
37	Air flow sensor	• Engine is running • Warm-up condition ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 322 kg/h or approximately 1.39 V
		• Engine is running • Warm-up condition ECT: 52°C • Idle: 910 RPM • IAT: 30°C • IAT signal: 2.17 V	Approximately 420 kg/h or approximately 1.52 V
73	Regulated sensor supply 1	Ignition switch on	5 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0103	Mass or Volume Air Flow (MAF) circuit high input	Ignition switch on or engine is running	ECM detected that the input signal is out of the acceptable range.	• Mass or Volume Air Flow (MAF) sensor • Harness or connectors (The sensor circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Is ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

2. CHECK INTAKE SYSTEM

- Check the following for connection.
  - Air cleaner
  - Intake air duct

Is the check result normal?

Yes >> Go to the next step.

No >> Clean or replace the components.

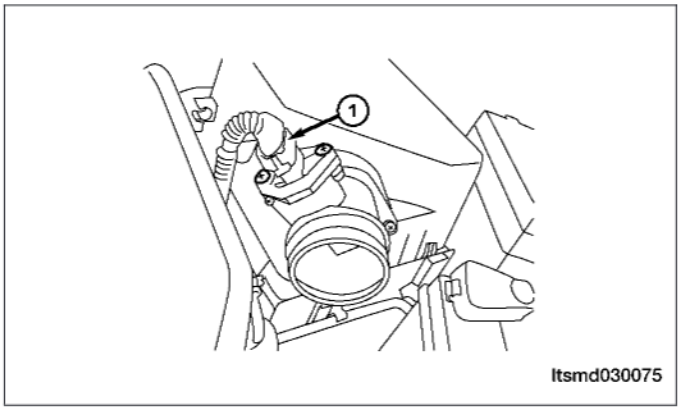
3. CHECK MASS AIR FLOW (MAF) SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAF sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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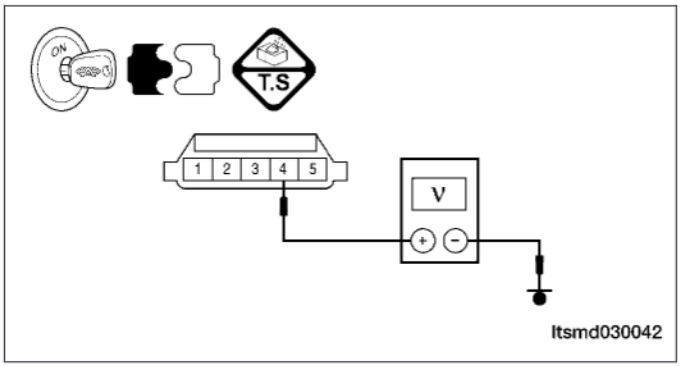
4. CHECK THE MASS AIR FLOW (MAF) SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check voltage between the MAF sensor terminal 4 and ground in the MAF sensor electrical connector E-009.
- 5 V should exist.

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.



5. DETECT MALFUNCTIONING PART

- Check harness for short to power between air flow sensor and ECM.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for short to power in harness or connectors.

6. CHECK THE MAF SENSOR GROUND CIRCUIT FOR A SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between MAF sensor terminal 3 and ECM terminal 17.
- Continuity should exist.
- Also check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to power in harness or connectors.

7. CHECK THE MAF SENSOR OUTPUT SIGNAL CIRCUIT FOR SHORT TO POWER

- Check harness continuity between MAF sensor terminal 5 and ECM terminal 37.
- Continuity should exist.
- Also check harness for short to power.

Is the check result normal?

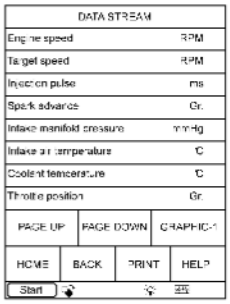
Yes >> Go to the next step.

No >> Repair or replace circuit for short to power in harness or connectors.

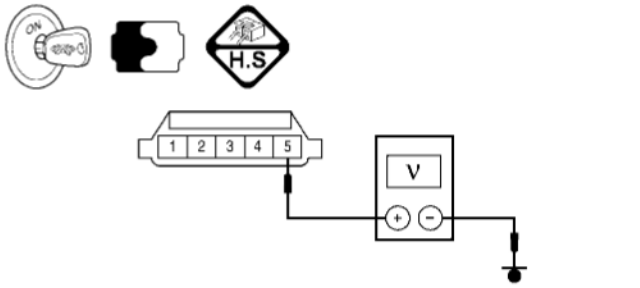
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8. CHECK THE MAF SENSOR

- Install all removed parts.
- Start engine.
- Check air flow signal in data stream with the X-431.

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)	
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 322 kg/h	
			Approximately 1.39 V	ltsmd030001t

- If without the X-431, check voltage between MAF sensor terminal 5 and ground.

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)	
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 1.39 V	 ltsmd030043

Is the signal voltage of MAF normal?

Yes >> Go to the next step.

No >> Replace the MAF sensor.

9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to "DTC Confirmation Procedure".

Is DTC P0103 still present?

Yes >> Replace the ECM.

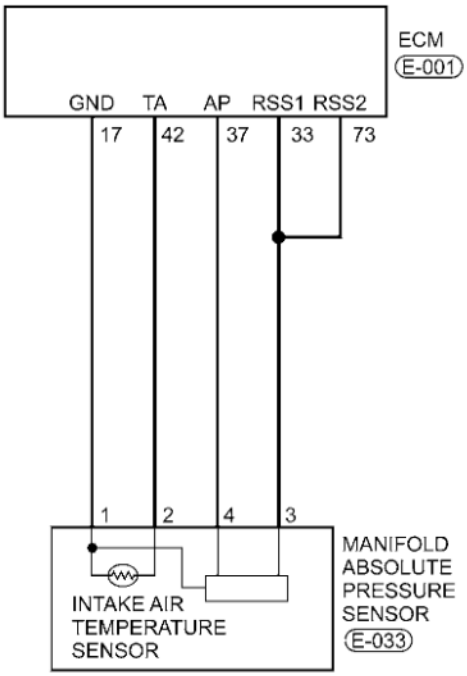
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

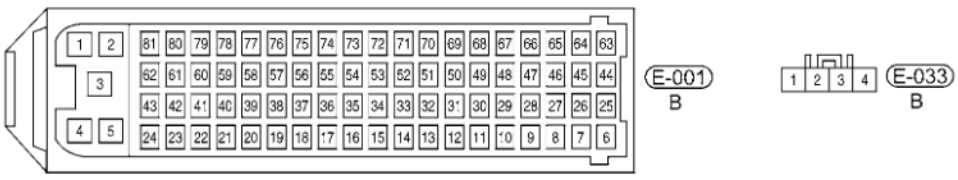
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0105 - Manifold Absolute Pressure/Barometric Pressure Circuit
P0106 - Manifold Absolute Pressure Or Barometric Pressure Range/Performance

EEC - 1.6L - MAP - 01





ltsmw030052t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Engine: Running	-	Approximately 0 V
33	Regulated sensor supply 1		-	Approximately 5 V
37	Manifold Absolute Pressure (MAP) sensor		• Engine running: Idle • Press accelerator pedal slowly.	Approximately 1.3 V
			• Press accelerator pedal quickly.	Up to Approximately 4 V (instantaneous)
73	Sensor power supply 1		-	Approximately 5 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0105 (1.6L)	Manifold absolute pressure/barometric pressure circuit	• Ignition switch:ON • Engine: Running	Signal output is out of acceptable range for a few seconds continuously.	• MAP sensor • Harness or connectors • ECM
P0106 (1.6L)	Manifold absolute pressure or barometric pressure range/performance			• MAP sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Is ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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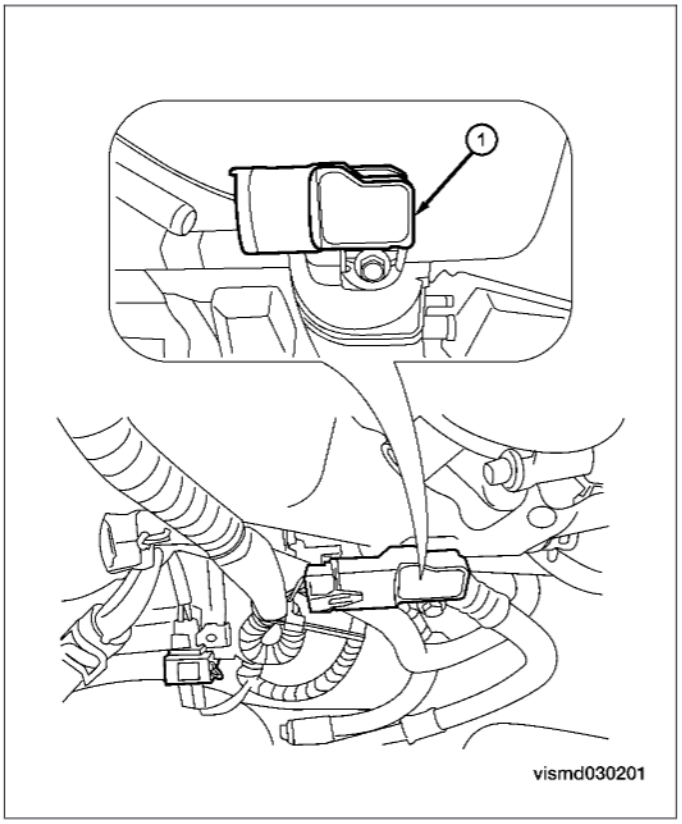
2. CHECK MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAP sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



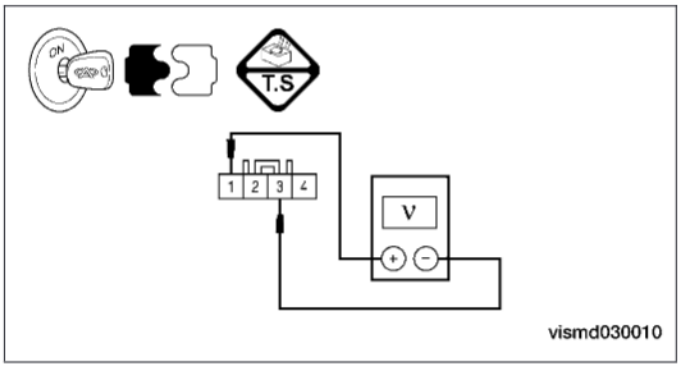
3. CHECK MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR POWER SUPPLY

- Turn ignition switch on.
- Check MAP sensor supply between MAP sensor connector terminal 1 and 3.
- 5 V should exists.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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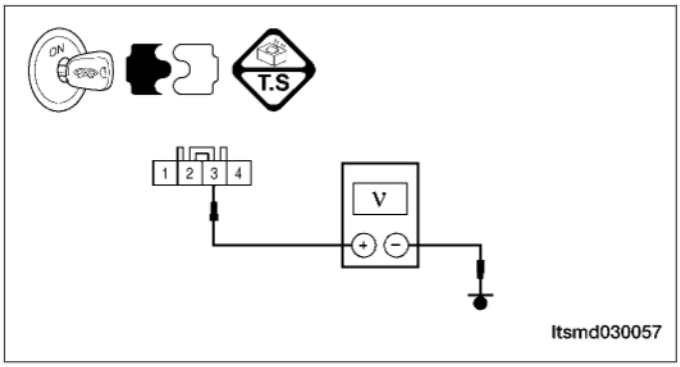
4. CHECK THE MAP SENSOR POWER SUPPLY CIRCUIT FOR OPEN OR SHORT

- Check MAP sensor supply voltage between sensor connector E-033, terminal 3 and ground in the sensor electrical connector.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to ground or short to power in harness or connectors.
If circuit is normal, go to the next step.



5. CHECK THE MAP SENSOR GROUND CIRCUIT FOR AN OPEN

- Turn ignition switch off.
- Disconnect ECM sensor harness connector.
- Check for harness continuity between terminal 1 in MAP sensor connector E-033 and terminal 17 in ECM connector E-001.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open in harness or connectors.

6. CHECK THE MAP SENSOR OUTPUT SIGNAL CIRCUIT FOR AN OPEN OR HIGH RESISTANCE

- Check for harness continuity between MAP sensor terminal 4 and ECM terminal 37.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

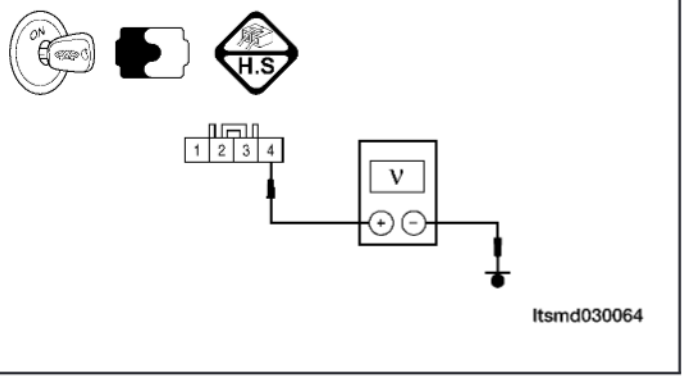
No >> Repair or replace circuit for an open or high resistance in harness or connectors.

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7. CHECK MAP SENSOR SIGNAL

- Check MAP sensor signal between sensor terminal 4 and ground.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
4	MAP sensor	Engine: Running	• Engine running: Idle • Press accelerator pedal slowly	Approximately 1.3 V
			• Press accelerator pedal quickly	Up to approximately 4 V (instantaneous)



Is the check result normal?

Yes >> Go to step 9.

No >> Go to the next step.

8. CHECK THE MAP SENSOR

- Check sensor as follow:
  - Remove the sensor.
  - Visually check and clean the pressure entrance of the sensor for chipping and damage.

Is the check result normal?

Yes >> Replace the MAP sensor with a known good MAP sensor.
Select view DTC on the X-431 screen.
- If DTC P0105 or P0106 is not current present, the system is OK.
- If DTC P0105 or P0106 is current present, go to step 8.

No >> Clear or replace the MAP sensor.

9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0105 or P0106 still present?

Yes >> Replace the ECM.

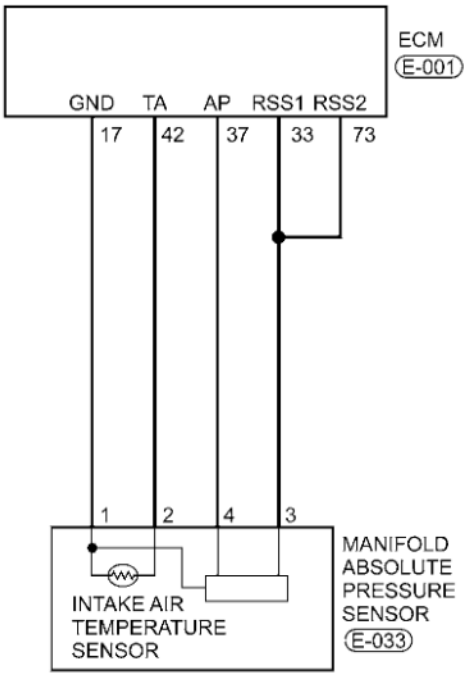
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

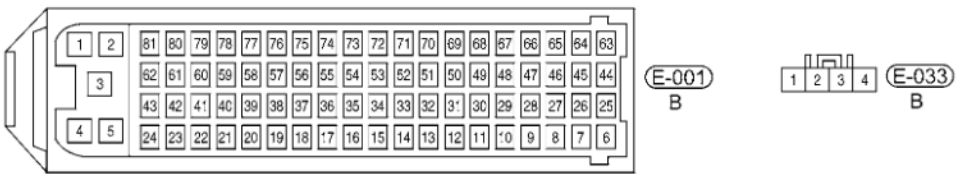
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0107 - Manifold Absolute Pressure Or Barometric Pressure Low Input
P0108 - Manifold Absolute Pressure Or Barometric Pressure High Input

EEC - 1.6L - MAP - 01





ltsmw030052t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Ignition switch: ON	-	Approximately 0 V
33	Regulated sensor supply 1		-	Approximately 5 V
37	Manifold Absolute Pressure (MAP) sensor		Engine running: Idle	Approximately 1.3 V
			Engine running: 2000 RPM	Approximately 1.5 V
73	Regulated sensor supply 1		-	Approximately 5 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0107 (1.6L)	Manifold absolute pressure or barometric pressure low input	• Ignition switch: ON • Engine: Running	Signal output is below minimum acceptable range for a few seconds continuously.	• MAP sensor • Harness or connectors • ECM
P0108 (1.6L)	Manifold Absolute Pressure or Barometric Pressure High Input		Signal output is above maximum acceptable range for a few seconds continuously.	• MAP sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See DIAGNOSIS & TESTING Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Is ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

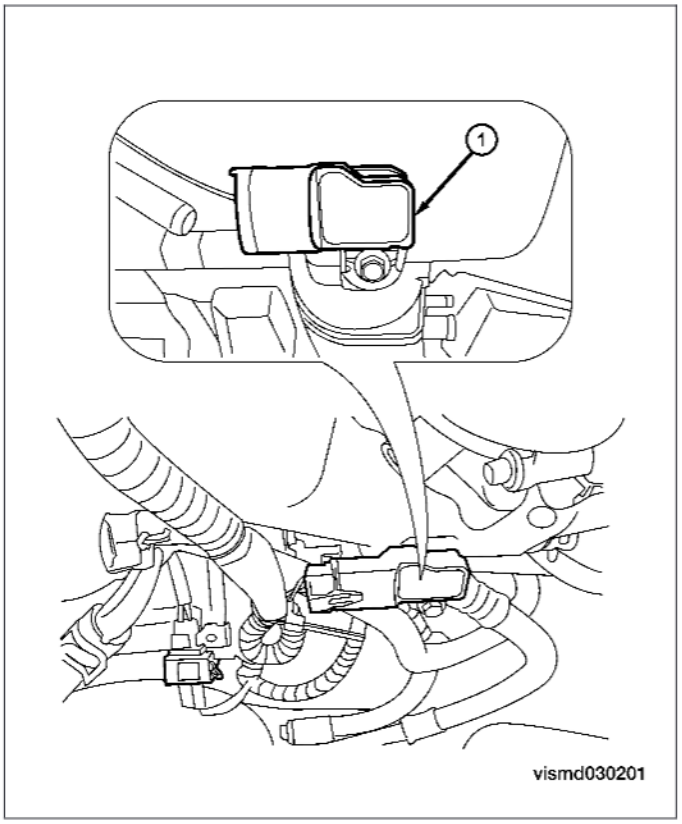
2. CHECK MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAP sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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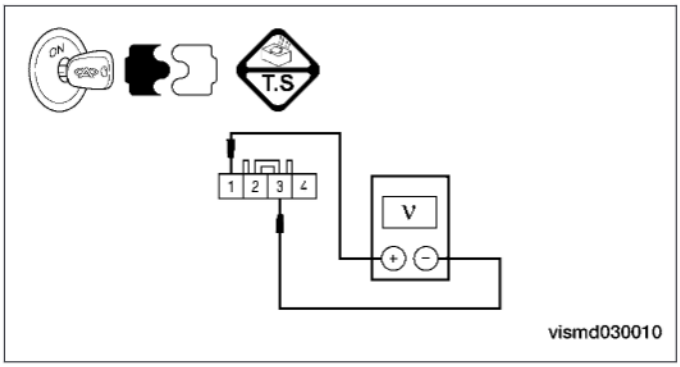
3. CHECK THE MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR POWER SUPPLY

- Turn ignition switch on.
- Check MAP sensor supply between MAP sensor connector terminal 1 and 3.
- 5 V should exists.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



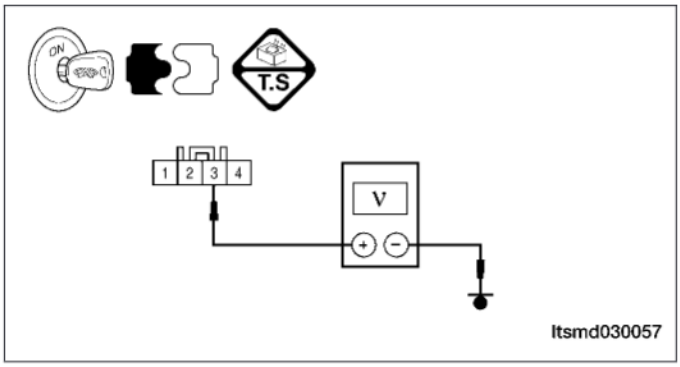
4. CHECK THE MAP SENSOR POWER SUPPLY CIRCUIT FOR AN OPEN OR SHORT

- Check MAP sensor supply voltage between sensor connector E-033, terminal 3 and ground in the sensor electrical connector.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to ground in harness or connectors. If circuit is normal, go to the next step.



5. CHECK THE MAP SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM sensor harness connector E-001.
- Check for harness continuity between MAP sensor terminal 1 and ECM terminal 17.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or high resistance or short to power in harness or connectors.

6. CHECK THE MAP SENSOR OUTPUT SIGNAL CIRCUIT FOR OPEN OR SHORT

- Check for harness continuity between MAP sensor terminal 4 and ECM connector E-001, terminal 37.
- Continuity should exist.
- Check harness short to ground or short to power.

Is the check result normal?

Yes >> Go to the next step.

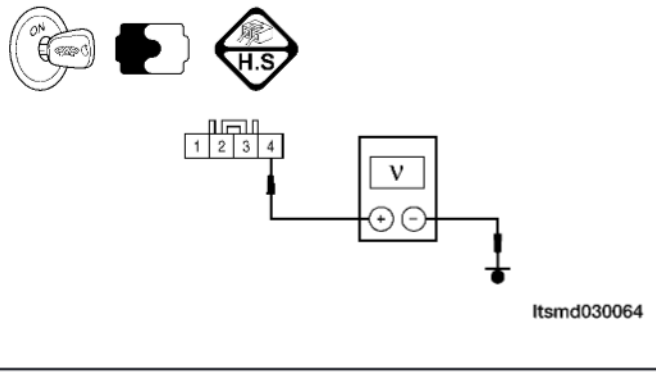
No >> Repair or replace the circuit for open or short to ground or short to power in harness or connectors.

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7. CHECK THE MAP SENSOR SIGNAL

- Check MAP sensor signal between sensor terminal 4 and ground.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
4	MAP sensor	Engine: Running	• Press accelerator pedal slowly.	Approximately 1.3 V
			• Press accelerator pedal quickly.	Up to approximately 4 V (instantaneous)



Is the check result normal?

Yes >> Go to step 9.

No >> Go to the next step.

8. CHECK AND REPLACE THE MAP SENSOR

- Check sensor as follow.
  - Remove the sensor.
  - Visually check and clean the pressure entrance of the sensor for chipping.

Is the check result normal?

Yes >> Replace the MAP sensor with a known good MAP sensor.
Select view DTC on the X-431 screen.
- If DTC P0107 or P0108 is not current present, the system is OK.
- If DTC P0107 or P0108 is current present, go to step 9.

No >> Clear or replace the MAP sensor.

9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0107 or P0108 still present?

Yes >> Replace the ECM.

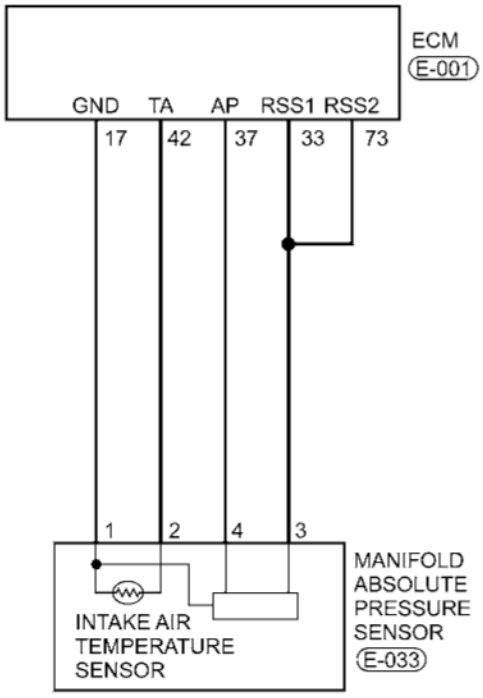
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

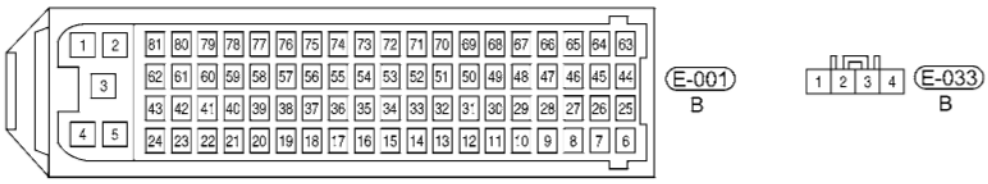
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0112 - Intake Air Temperature Circuit Low Input

EEC - 1.6L - MAP - 01

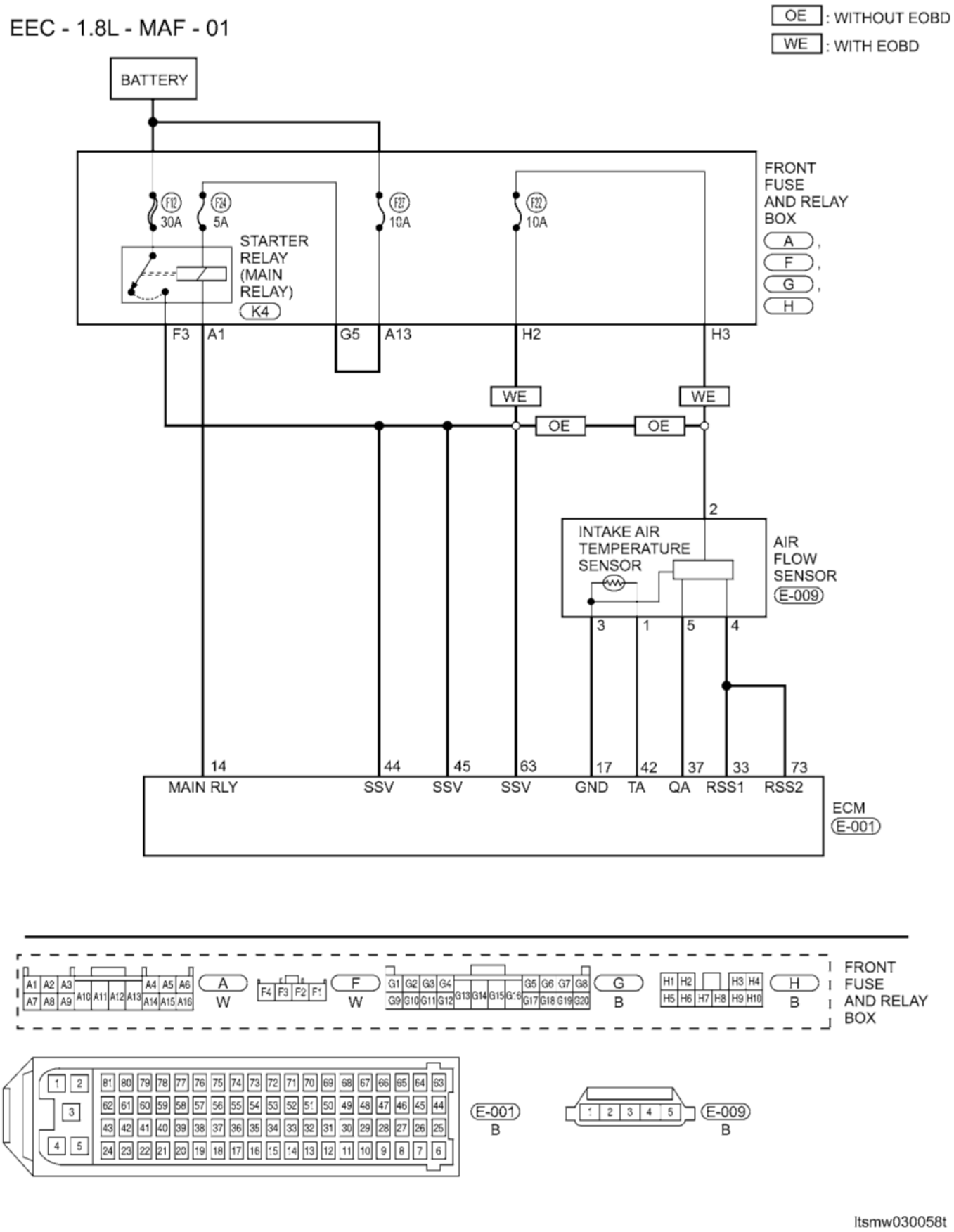




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EEC - 1.8L - MAF - 01



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Ignition switch: ON		0 V
42	Intake Air Temperature (IAT) sensor	Ignition switch: ON	Intake Air Temperature (IAT): 36°C	1.88 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0112	Intake Air Temperature (IAT) circuit low input	• Ignition switch: ON • Engine: Running	Output signal is wrong or out of acceptable range.	• IAT sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> For 1.8L engine go to next step.
For 1.6L engine go to Step 4.

No >> Repair or replace ground connections.

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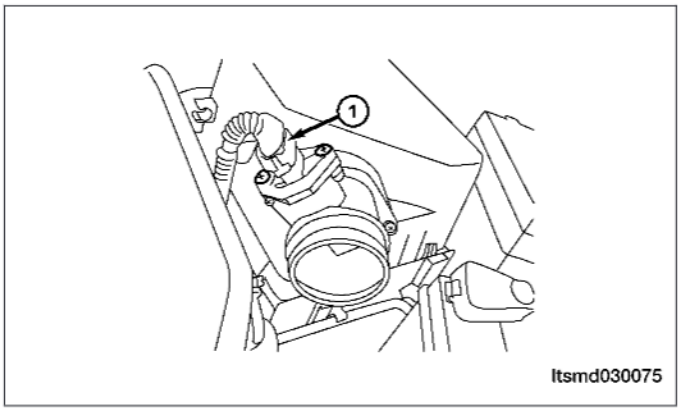
2. 1.8L ENGINE - CHECK INTAKE AIR TEMPERATURE (IAT) SENSOR ELECTRICAL CONNECTOR

- Disconnect the IAT sensor (1) (For 1.8L engine: IAT sensor is built-into MAF sensor) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



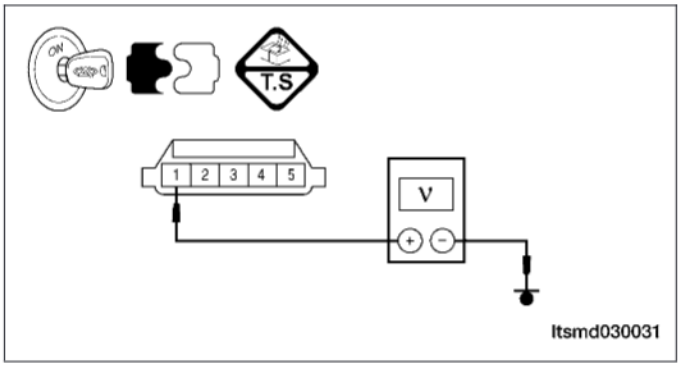
3. 1.8L ENGINE - CHECK THE INTAKE AIR TEMPERATURE (IAT) SENSOR SIGNAL CIRCUIT

- Turn ignition switch on.
- Check reference voltage between IAT sensor terminal 1 and ground in the IAT sensor electrical connector E-009.
- 5 V should exist.

Is the check result normal?

Yes >> Go to Step 6.

No >> Repair circuit for an open or short to power in harness or connectors.



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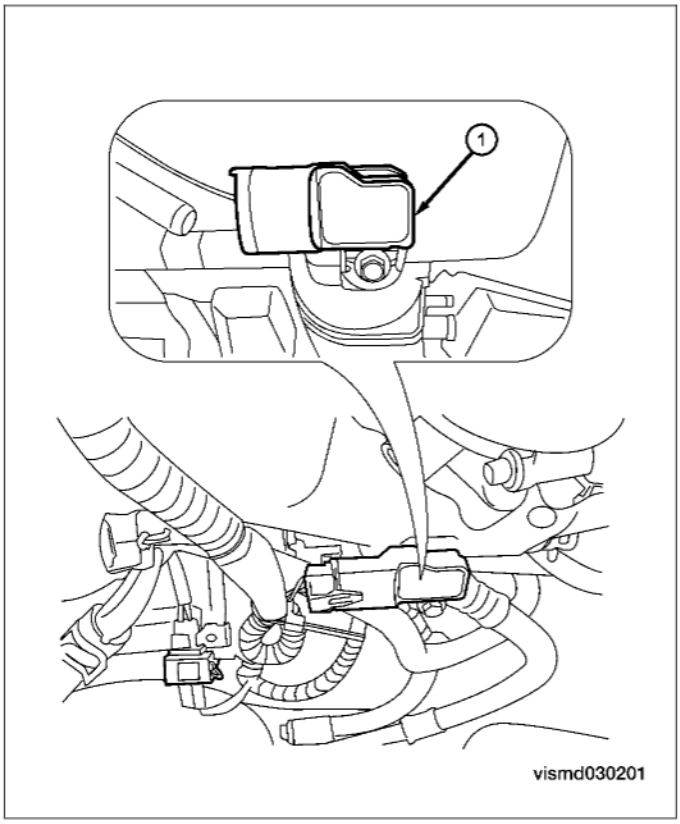
4. 1.6L ENGINE - CHECK MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAP sensor (1) (For 1.6L engine: IAT sensor is built-into MAP sensor) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



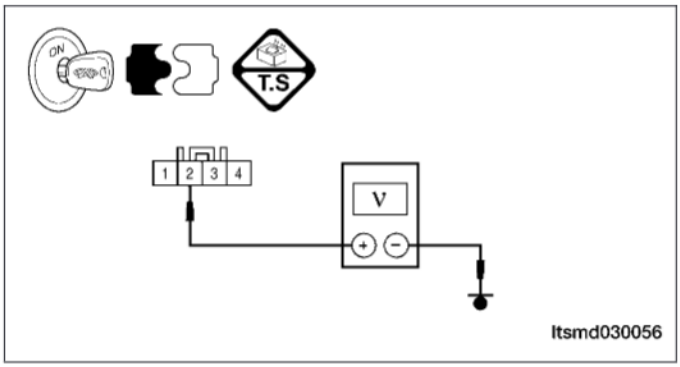
5. 1.6L ENGINE - CHECK THE INTAKE AIR TEMPERATURE (IAT) SENSOR SIGNAL CIRCUIT VOLTAGE

- Check supply voltage between IAT sensor terminal 2 and ground in the IAT sensor electrical connector E-033.
- 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.



6. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness for a short to ground between IAT connector terminal 1 and ECM connector E-001, terminal 42.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for a short to ground in harness or connectors.

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7. CHECK THE IAT SENSOR

- Connect IAT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check signal between IAT sensor terminal 1 and ground under the following conditions:

IAT SENSOR TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
1 (For 1.8L engine)	IAT sensor	Ignition switch: ON	IAT: 36°C	1.88 V
2 (For 1.6L engine)				

Is the check result normal?

Yes >> Go to the next step.

No >> Replace IAT sensor.

8. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0112 still present?

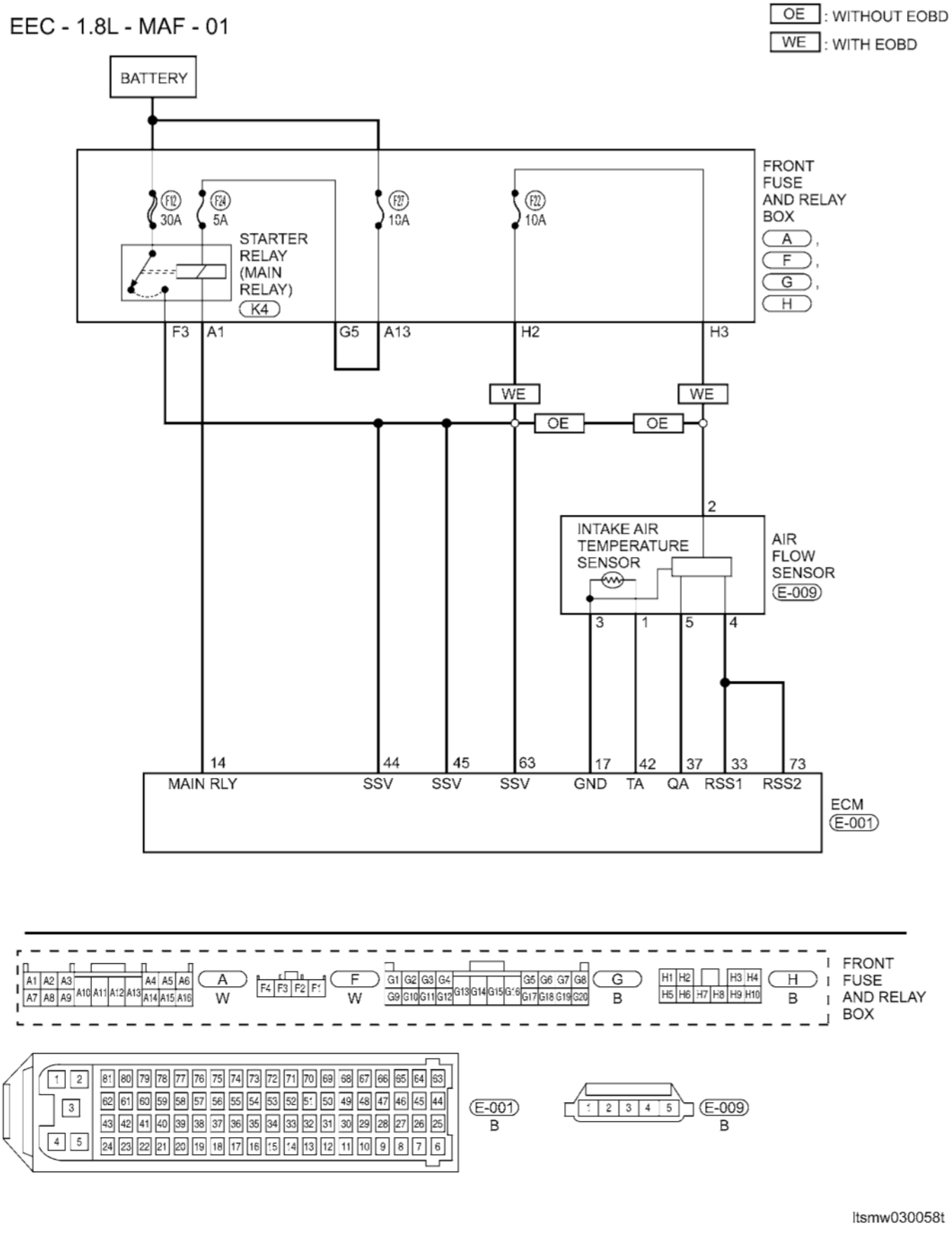
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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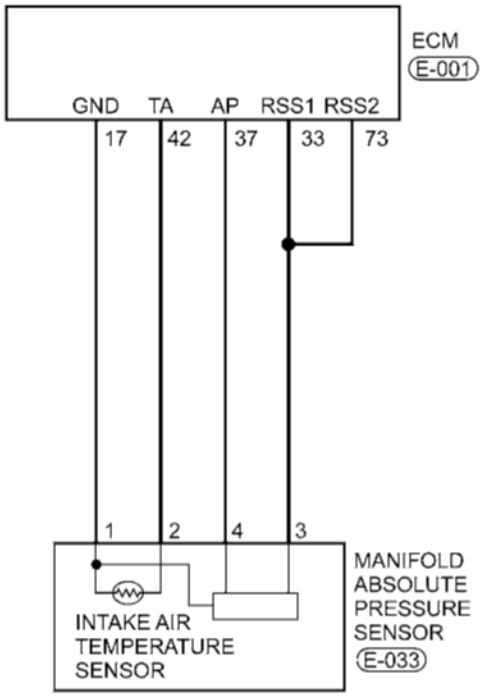
P0113 - Intake Air Temperature Circuit High Input

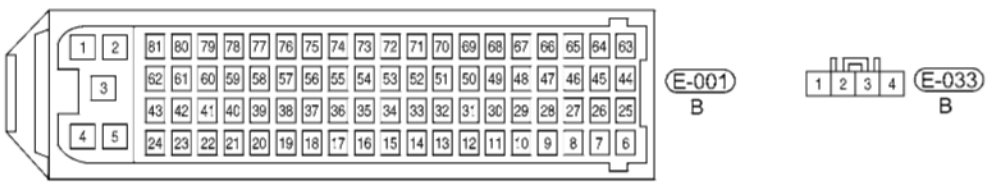


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EEC - 1.6L - MAP - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Ignition switch: ON		0 V
42	Intake Air Temperature (IAT) sensor	Ignition switch: ON	IAT: 36°C	Approximately 1.88 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	SET CONDITION	POSSIBLE CAUSE
P0113	Intake Air Temperature (IAT) circuit high input	• Ignition switch: ON • Engine: Running	Output signal is wrong or out of acceptable range.	• IAT sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> For 1.8L engine go to next step.
For 1.6L engine go to Step 4.

No >> Repair or replace ground connections.

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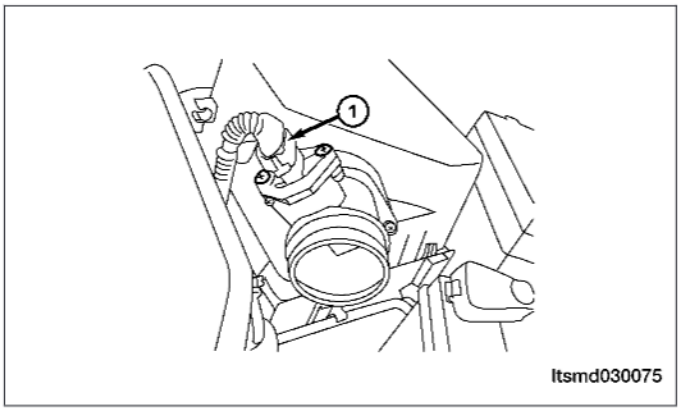
2. 1.8L ENGINE - CHECK INTAKE AIR TEMPERATURE (IAT) SENSOR ELECTRICAL CONNECTOR

- Disconnect the IAT sensor (1) (For 1.8L engine: IAT sensor is built-into MAF sensor) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



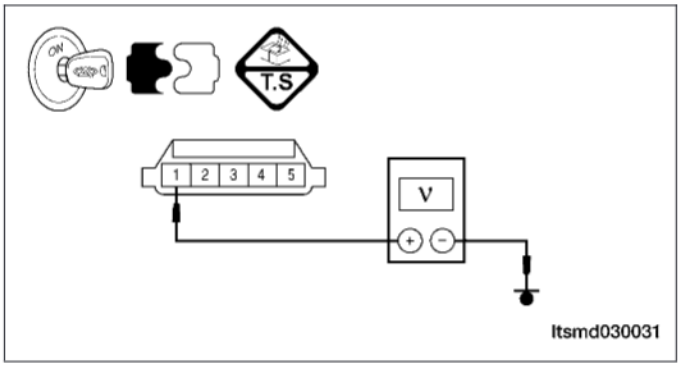
3. 1.8L ENGINE - CHECK THE INTAKE AIR TEMPERATURE (IAT) SENSOR SIGNAL CIRCUIT

- Turn ignition switch on.
- Check supply voltage between IAT sensor terminal 1 and ground in the IAT sensor electrical connector E-009.
- 5 V should exist.

Is the check result normal?

Yes >> Go to Step 6.

No >> Repair circuit for an open or short to power in harness or connectors.



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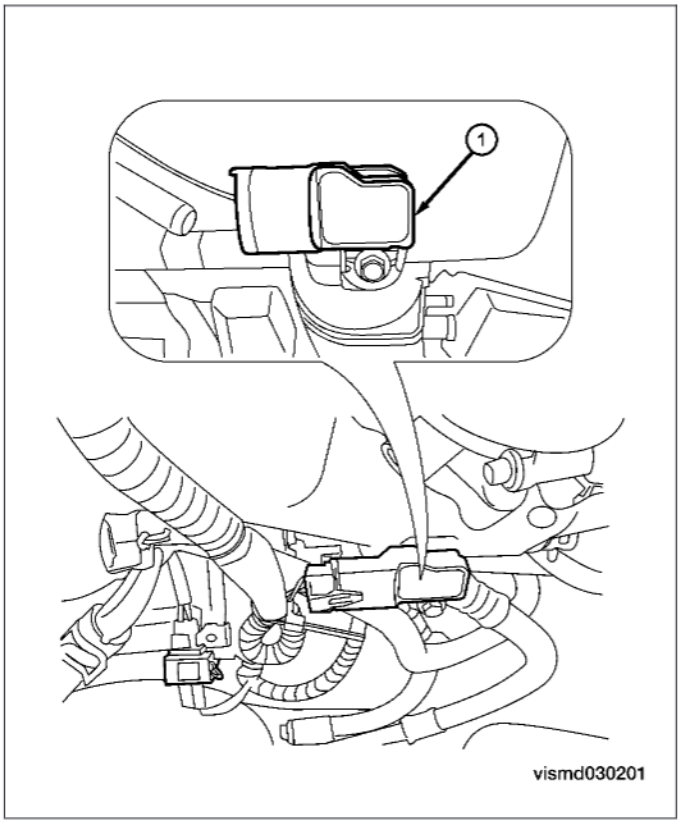
4. 1.6L ENGINE - CHECK MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAP sensor (1) (For 1.6L engine: IAT sensor is built-into MAP sensor) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



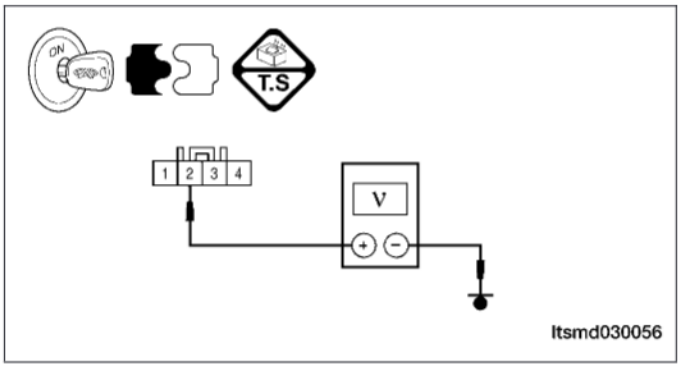
5. 1.6L ENGINE - CHECK THE INTAKE AIR TEMPERATURE (IAT) SENSOR SIGNAL CIRCUIT

- Check supply voltage between IAT sensor terminal 2 and ground in the IAT sensor electrical connector E-033.
- 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

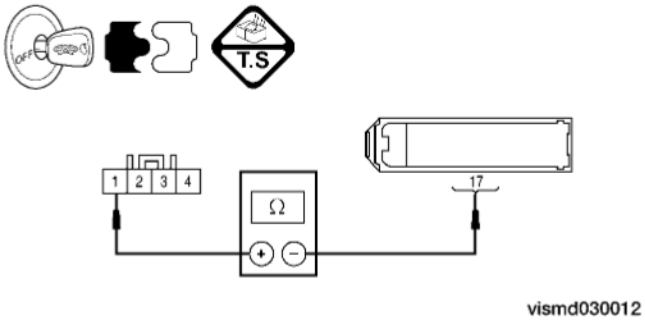
No >> Repair circuit for an open or short to power in harness or connectors.



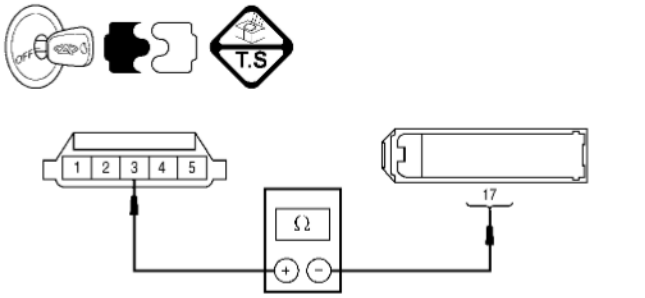
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6. CHECK THE IAT SENSOR GROUND CIRCUIT FOR OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check for harness continuity between following terminals.
- For 1.6L engine, check continuity between IAT sensor terminal 1 and ECM terminal 17.

IAT SENSOR CONNECTOR TERMINAL	ECM CONNECTOR TERMINAL	
1	17	 vismd030012

- For 1.8L engine, check continuity between IAT sensor terminal 3 and ECM terminal 17.

IAT SENSOR CONNECTOR TERMINAL	ECM CONNECTOR TERMINAL	
3	17	 ltsmd030067

- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

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7. CHECK THE IAT SENSOR

- Connect IAT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check signal between the IAT sensor terminal 1 and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
42	IAT sensor	Ignition switch: ON	IAT: 78°C	Approximately 1.88 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the IAT sensor.

8. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0113 still present?

Yes >> Replace the ECM.

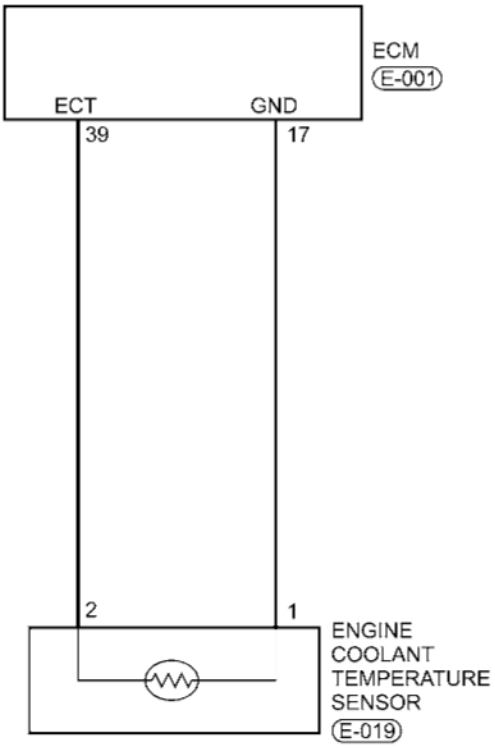
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

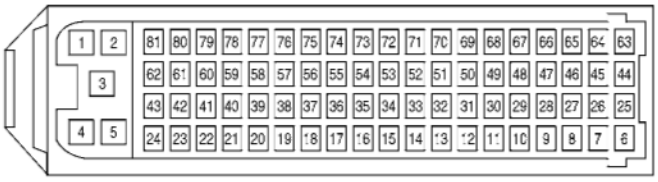
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0117 - Engine Coolant Temperature Circuit Low Input

EEC - 1.6L - 1.8L - ECT - 01





E-001
B



E-019
B

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Ignition switch: ON	-	Approximately 0 V
39	Engine Coolant Temperature (ECT) sensor		ECT: 59°C	1.89 V
			ECT: 78°C	1.25 V
			ECT: 90°C	0.94 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0117	Engine Coolant Temperature (ECT) circuit low input	Ignition switch on or after engine start	Signal output is below minimum acceptable range for a few seconds continuously.	• ECT sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

- Before performing this DTC diagnostic procedure, verify that the engine coolant temperature is normal.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

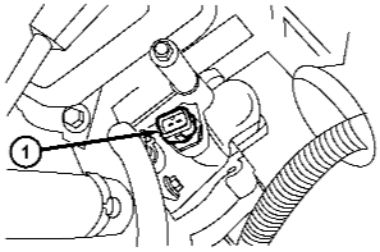
2. CHECK ECT SENSOR ELECTRICAL CONNECTOR

- Disconnect the ECT sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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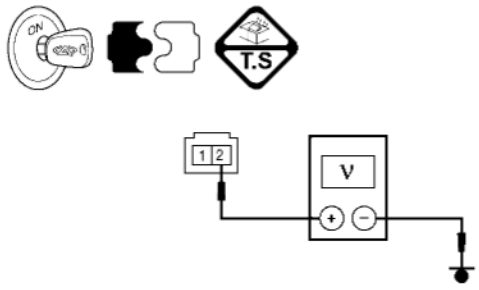
3. CHECK THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR SIGNAL CIRCUIT FOR A SHORT

- Turn ignition switch on.
- Check ECT sensor reference voltage between sensor terminal 2 and ground in the sensor electrical connector E-019.
- 5 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness for short to ground between ECT sensor connector terminal 2 and ECM connector terminal 39.

Is the check result normal?

Yes >> Replace the ECM.

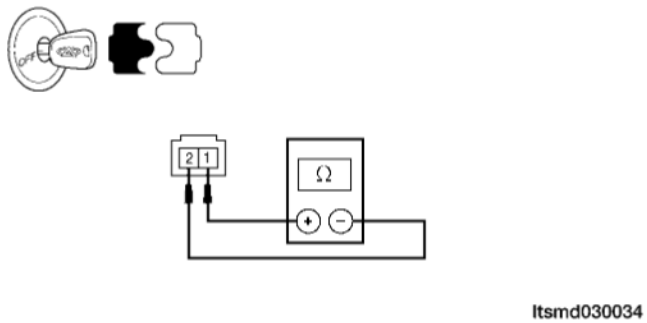
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair or replace circuit for a short to ground in harness or connectors.

5. CHECK THE ECT SENSOR

- Check the resistance between ECT sensor terminal 1 and 2, component side.

ECT°C	RESISTANCE KΩ
-10°C	8.62 - 10.28
20°C	2.37 - 2.63
80°C	0.299 - 0.345



- Connect the ECT sensor connector.
- Connect the ECM connector.
- Turn ignition switch on.
- Check ECT sensor signal output.

ECT TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
39	ECT sensor	Ignition switch on	ECT: 59°C	1.89 V
			ECT: 78°C	1.25 V
			ECT: 90°C	0.94 V
17	Sensor (GND)		-	Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace ECT sensor.

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6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0117 still present?

Yes >> Replace the ECM.

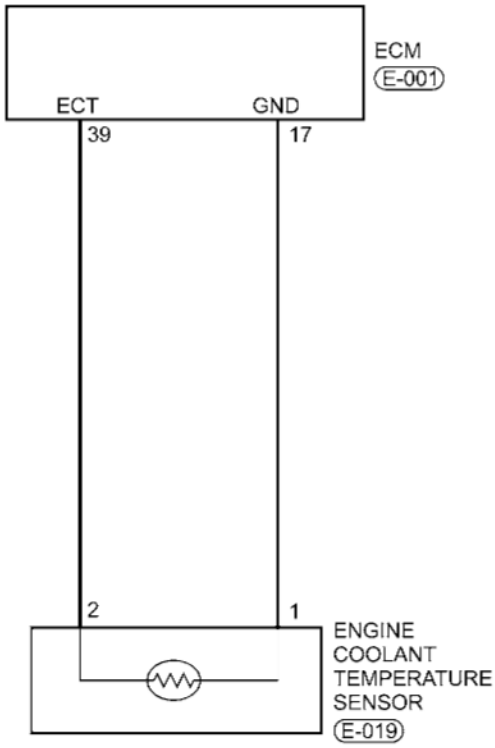
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

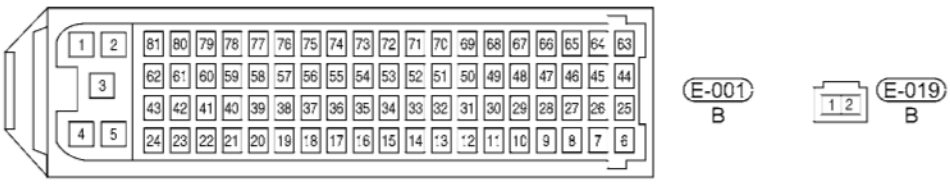
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0118 - Engine Coolant Temperature Circuit High Input

EEC - 1.6L - 1.8L - ECT - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Ignition switch on	-	Approximately 0 V
39	Engine Coolant Temperature (ECT) sensor		ECT: 59°C	Approximately 1.89 V
			ECT: 78°C	Approximately 1.25 V
			ECT: 90°C	Approximately 0.94 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0118	Engine coolant temperature circuit high input	• Ignition switch: ON • Engine: Running	Signal output is above maximum acceptable range for a few seconds continuously.	• ECT • Harness or connectors (The sensor circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

- Before performing this DTC diagnostic procedure, verify that the Engine coolant temperature is normal.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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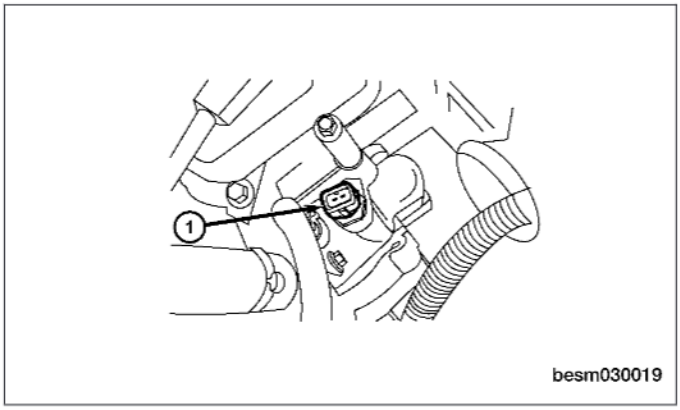
2. CHECK ECT SENSOR ELECTRICAL CONNECTOR

- Disconnect the ECT sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



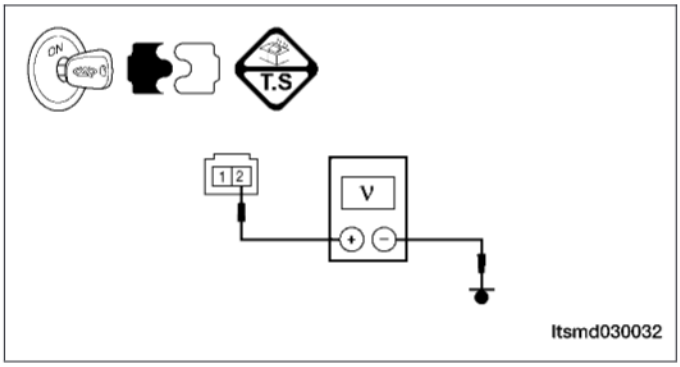
3. CHECK THE ENGINE COOLANT TEMPERATURE SENSOR SIGNAL CIRCUIT FOR AN OPEN AND SHORT

- Turn ignition switch on.
- Check ECT sensor reference voltage between sensor terminal 2 and ground in the sensor electrical connector E-019.
- 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace harness for an open or short to power between ECT connector terminal 2 and ECM connector E-001, terminal 39.
If harness is normal, replace the ECM.

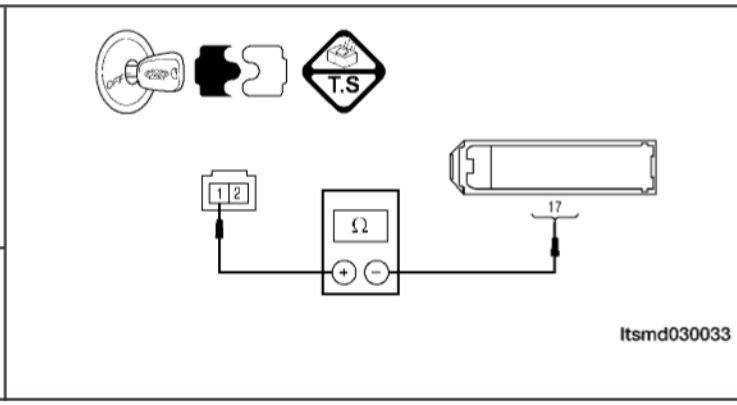


NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

4. CHECK ECT SENSOR GROUND CIRCUIT FOR AN OPEN AND SHORT TO POWER

- Check harness continuity between following terminals.

ECT SENSOR CONNECTOR TERMINAL	ECM CONNECTOR TERMINAL	CONTINUITY
1	17	Yes



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- Continuity should exist.
- Check the ECT ground circuit for an open.
- Check harness for short to power.

Is the check result normal?

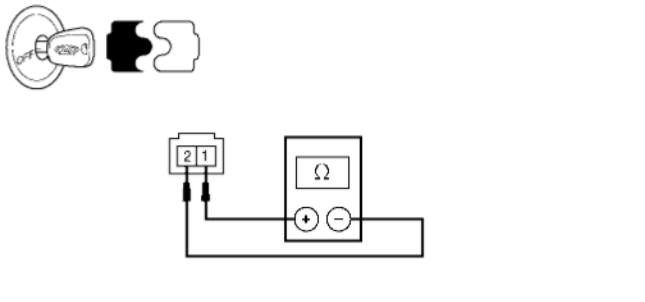
Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

5. CHECK ECT SENSOR

- Check the resistance between ECT sensor terminal 1 and 2, component side.

ECT°C	RESISTANCE KΩ
-10°C	8.62 - 10.28
20°C	2.37 - 2.63
80°C	0.299 - 0.345



- Connect ECT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check ECT sensor signal output.

ECT TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
39	ECT sensor	Ignition switch on	ECT: 59°C	1.89 V
			ECT: 78°C	1.25 V
			ECT: 90°C	0.94 V
17	Sensor (GND)		-	Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace ECT sensor.

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6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0118 still present?

Yes >> Replace the ECM.

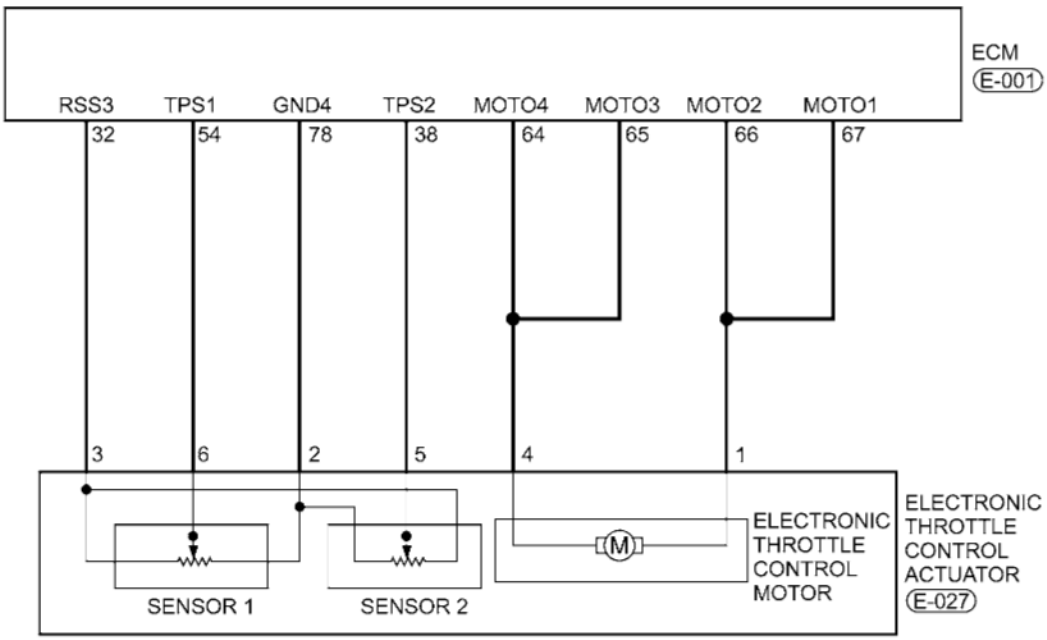
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

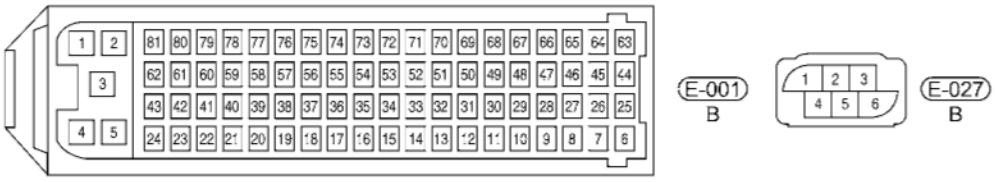
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0122 - Throttle Position Sensor A Circuit Low Input

EEC - 1.6L - 1.8L - TPS - 01





ltsmw030044t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (Position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
64	Motor 4		-	12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			
78	Sensor (GND)			Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0122	Throttle Position Sensor (TPS) A circuit low input	• Ignition switch: ON • Engine: Running	Signal output is below minimum acceptable range for a few seconds continuously.	• Throttle Position Sensor (TPS) or misalignment • Harness or connectors (Signal circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

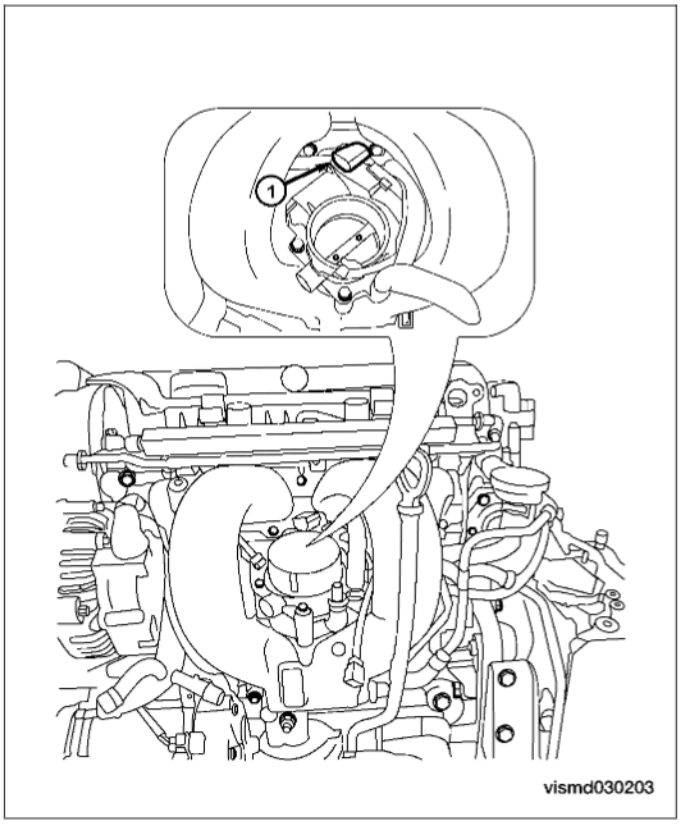
2. CHECK TPS ELECTRICAL CONNECTOR

- Disconnect the TPS (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

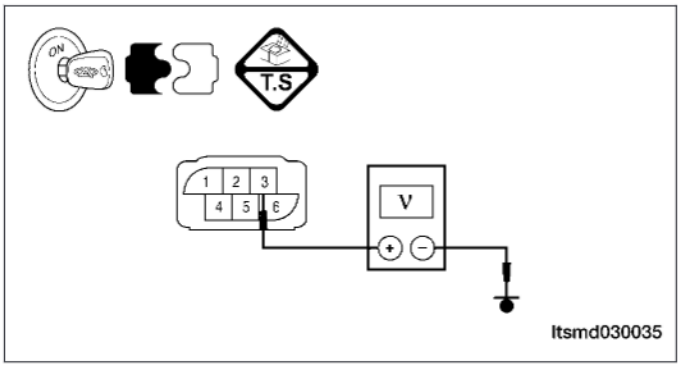
No >> Repair or replace the electrical connector as necessary.



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3. CHECK THE THROTTLE POSITION SENSOR (TPS) POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between the TPS terminal 3 and ground in the sensor electrical connector E-027.
- 5 V should exist.



Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to ground in harness or connectors.
If harness is normal, replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

4. CHECK TPS SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

TPS SENSOR CONNECTOR TERMINAL	ECM CONNECTOR TERMINAL
3	32

- Continuity should exist.
- Check TPS signal circuit
- Check harness for a short to power.

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.

5. DETECT MALFUNCTIONING PART

- Check harness for an open or short to ground between TPS connector terminal 2 and ECM connector E-001, terminal 78.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace harness or connectors.

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6. CHECK THE TPS RESISTANCE

- Check resistance between TPS terminal 2 and terminal 3.
- 2 kΩ ± 20 % (20°C) should exist.
- Also check the resistance between TPS terminal 6 and terminal 2 while turn the throttle.
- The resistance should linear change.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.
Perform the TPS self-learning.

7. CHECK THE TPS SIGNAL

- Turn ignition switch off.
- Connect ECM connector.
- Connect TPS connector.
- Turn ignition switch on.
- Check voltage between TPS terminal 3 and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (Position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
78	Sensor (GND)		-	Approximately 0 V
64	Motor 4			12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.
Perform the TPS self-learning.

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8. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0122 still present?

Yes >> Replace the ECM.

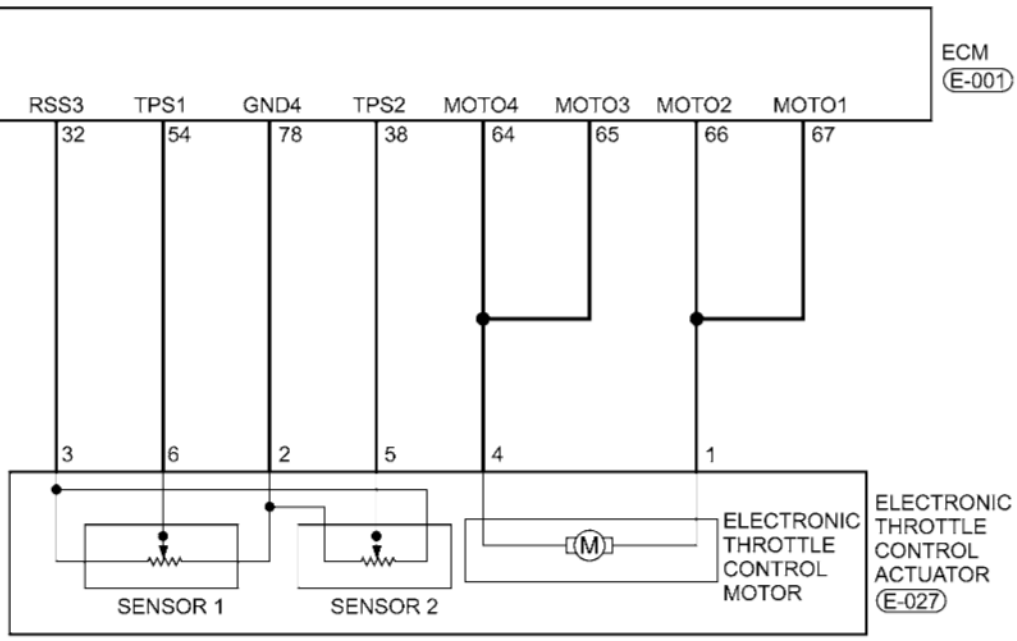
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

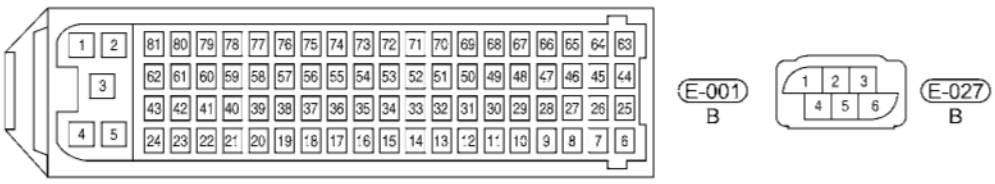
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0123 - Throttle Position Sensor A Circuit High Input

EEC - 1.6L - 1.8L - TPS - 01





ltsmw030044t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (Position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
78	Sensor (GND)		-	Approximately 0 V
64	Motor 4			12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0123	TPS A circuit high input	• Ignition switch: ON • Engine: Running	Signal output is above maximum acceptable range for a few seconds continuously.	• Throttle Position Sensor (TPS) or misalignment • Harness or connectors (The sensor signal circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

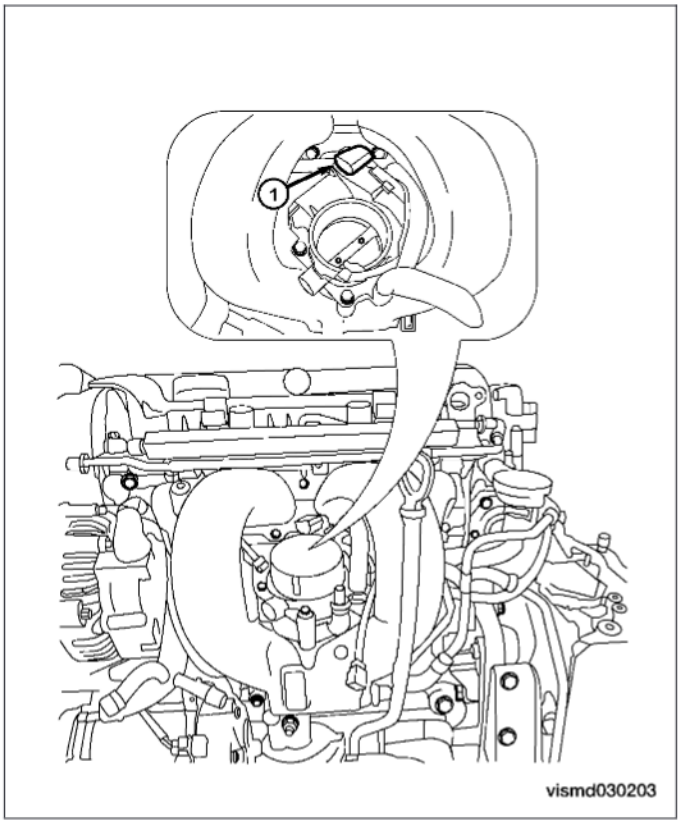
2. CHECK TPS ELECTRICAL CONNECTOR

- Disconnect the TPS (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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3. CHECK THE THROTTLE POSITION SENSOR (TPS) POWER SUPPLY CIRCUIT

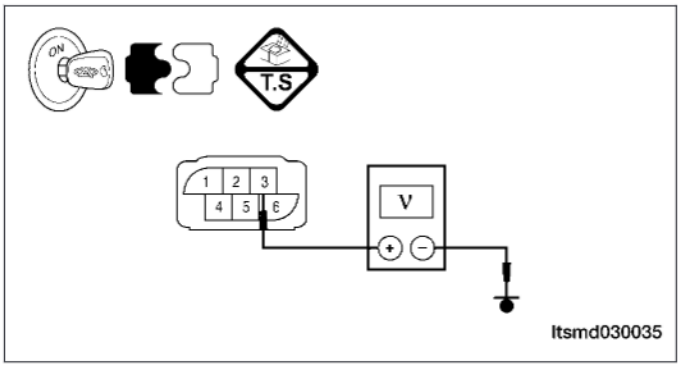
- Turn ignition switch on.
- Check supply voltage between TPS terminal 3 and ground in the TPS electrical connector E-027.
- 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair short to power in harness or connectors.
If circuit is normal, replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).



4. CHECK THE TPS SIGNAL CIRCUIT FOR A SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness for short to power.

Is the check result normal?

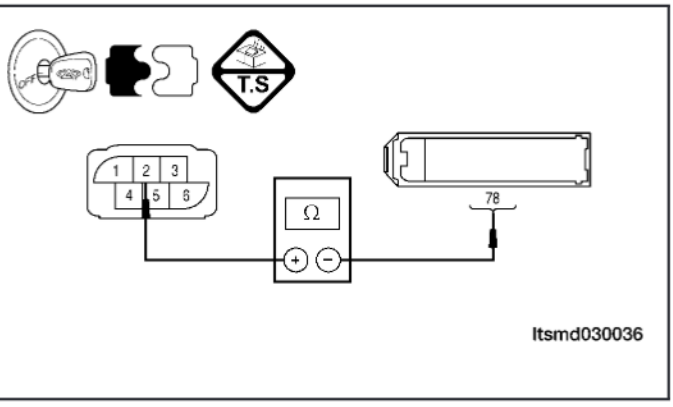
Yes >> Go to step 6.

No >> Go to the next step.

5. CHECK THE TPS GROUND CIRCUIT FOR AN OPEN AND SHORT

- Check harness continuity between following terminals.

TPS CONNECTOR TERMINAL	ECM CONNECTOR TERMINAL
2	78



- Continuity should exist.
- Check the TPS ground circuit for an open.
- Check harness for a short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

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6. CHECK TPS

- Check resistance between TPS terminal 2 and 3.
- 2 kΩ ± 20 % (20°C) should exist.
- Turn ignition switch off.
- Connect ECM connector.
- Connect TPS connector.
- Turn ignition switch on.
- Check voltage between TPS terminal 3 and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (Position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
78	Sensor (GND)		-	Approximately 0 V
64	Motor 4			12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.

7. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0123 still present?

Yes >> Replace the ECM.

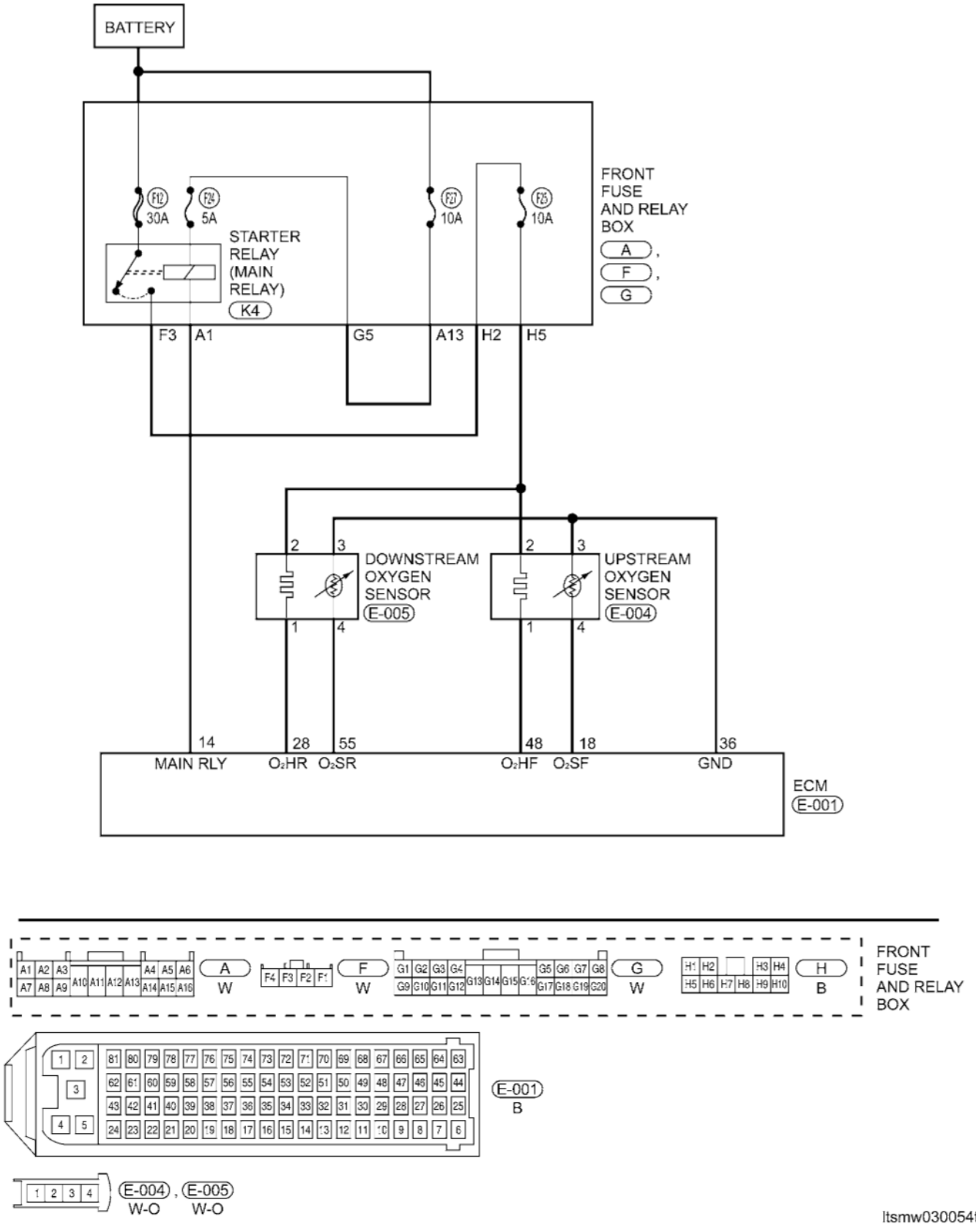
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0132 - O_2 Sensor 1 Circuit High Voltage

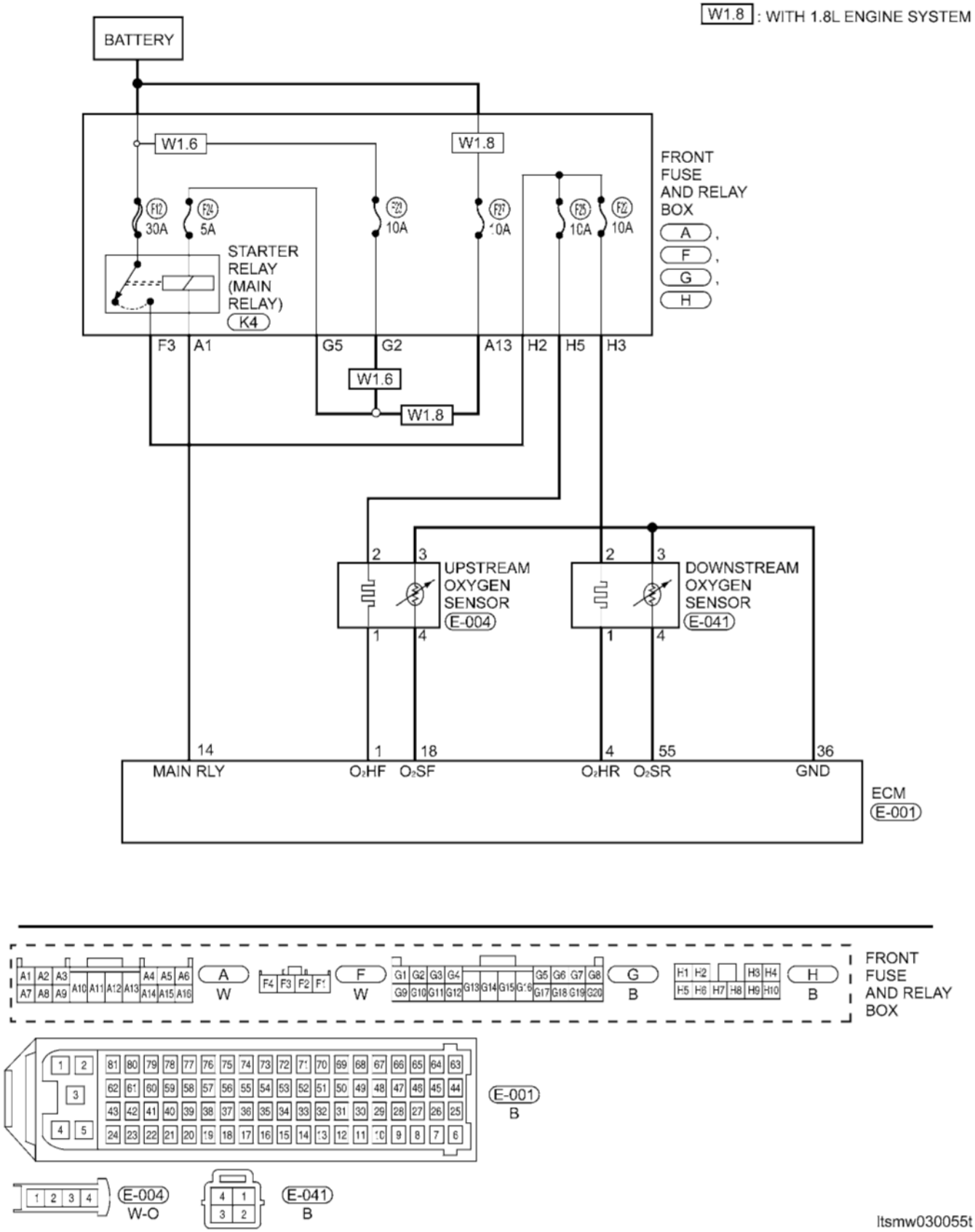
EEC - 1.6L - 1.8L - O_2S - 01 - WITH EOBD



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EEC - 1.6L - 1.8L - O_2S - 02 - WITHOUT EOBD

W1.6 : WITH 1.6L ENGINE SYSTEM
W1.8 : WITH 1.8L ENGINE SYSTEM



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
18	Upstream O_2 sensor	• Engine is running • Warm-up condition	Approximately 0.1 V - 0.9 V (Change 5 - 8 times in 10 seconds periodically)
4 (Without EOBD) 28 (With EOBD)	Downstream O_2 sensor heating	-	-
36	Sensor (GND)	• Warm-up condition • Idle	Approximately 0 V
1 (Without EOBD) 48 (With EOBD)	Upstream O_2 sensor heating	-	-
55	Downstream O_2 sensor	• Engine is running • Warm-up condition	Approximately 100 mV

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0132	O_2 sensor 1 (upstream) circuit high voltage	Engine is running	• Fuel quality • O_2 Sensor 1 (upstream) • Harness or connectors (The sensor circuit is open or shorted) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature.
- Turn ignition switch off and wait at least 10 seconds.
- Start engine and keep the engine speed 2000 RPM for at least 1 minute.
- Let engine idle for 2 minutes.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

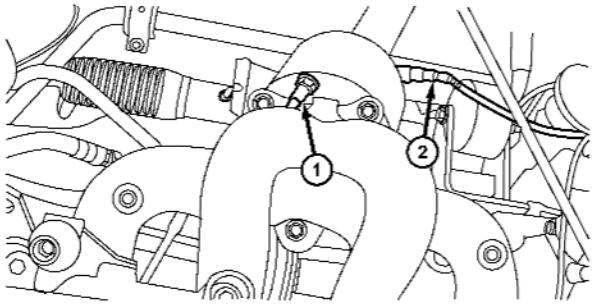
2. CHECK O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the O_2 sensor (1) electrical connector E-004.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



3. CHECK O_2 SENSOR GROUND CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between ECM terminal 18 and O_2 sensor terminal 4.
- Continuity should exist.
- Check harness open and short to power supply circuit.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short to power in harness or connectors.

4. CHECK O_2 SENSOR INPUT SIGNAL CIRCUIT FOR AN OPEN AND SHORT

- Check harness continuity between ECM terminal and O_2 sensor terminal as follows.

O_2 SENSOR	ECM TERMINAL	O_2 SENSOR TERMINAL
Upstream O_2 sensor	18	4

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- Continuity should exist.
- Check harness short to power supply circuit.

Is the check result normal?

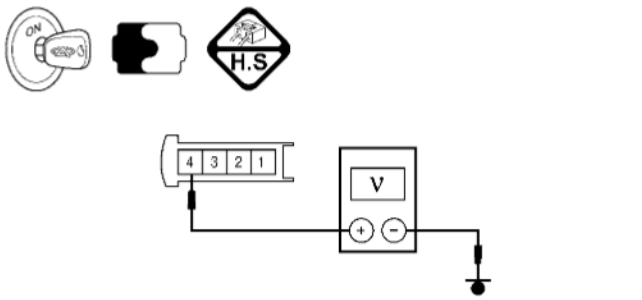
Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short to power in harness or connectors.

5. CHECK O_2 SENSOR

- Connect O_2 sensor connector.
- Connect ECM connector.
- If with the X-431, reference data stream value.
- If without the X-431, check as following:
  - Start engine and warm it up to normal operating temperature.
  - Turn ignition switch off.
  - Start engine and keep the engine speed between 3,500 and 4,000 RPM for at least 1 minute.
  - Let engine idle for 1 minute.
  - Set the digital multimeter probes between ECM terminal 4 and ground.
  - Check sensor output signal.

CHECK ITEM	CHECK CONTENT		NORMAL VALUE
Oxygen sensor	• Warm-up condition • Become lean while decelerate	Decelerate from 4,000 RPM suddenly	Below 200 mV
	• Warm-up condition • Become rich while accelerate	Accelerate suddenly	600 - 1,000 mV
	• Warm-up condition • Check with O_2 sensor signal	Idle	100 - 900 mV
		2500 RPM	600 - 1,000 mV



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Is the check result normal?

Yes >> Go to the next step.

No >> Replace the O_2 sensor.

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6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See DTC Confirmation Procedure.

Is DTC P0132 still present?

Yes >> Replace the ECM.

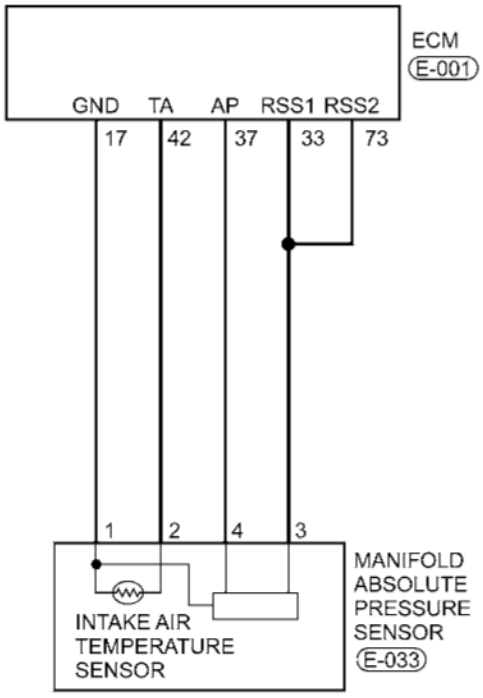
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

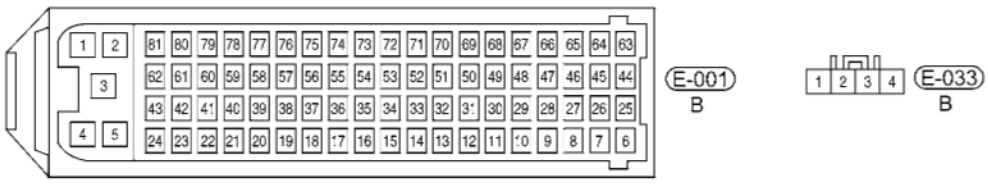
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0171 - Fuel Trim System Too Lean

EEC - 1.6L - MAP - 01



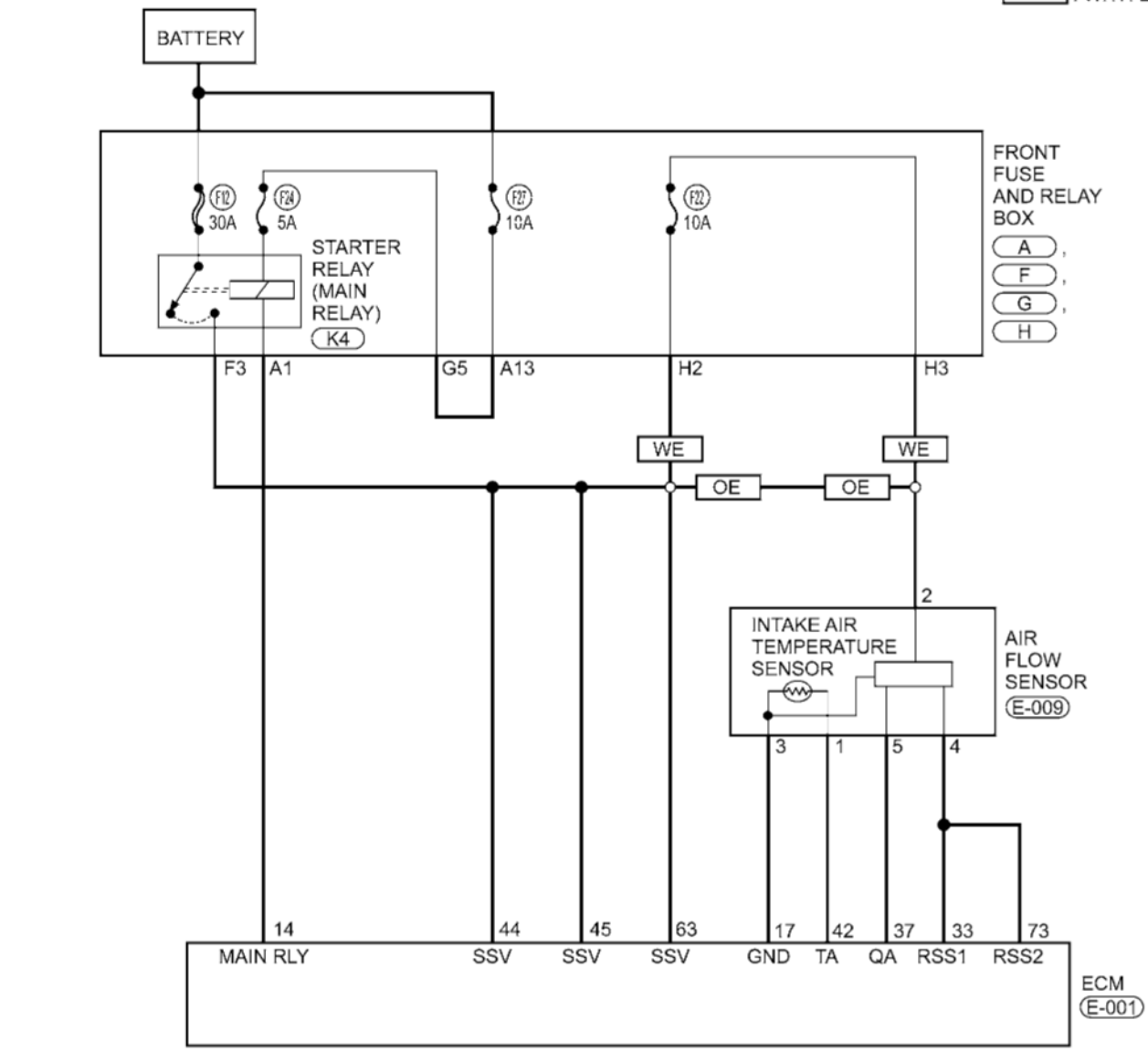


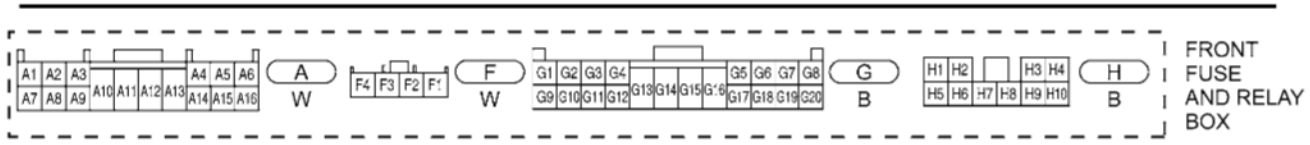
ltsmw030052t

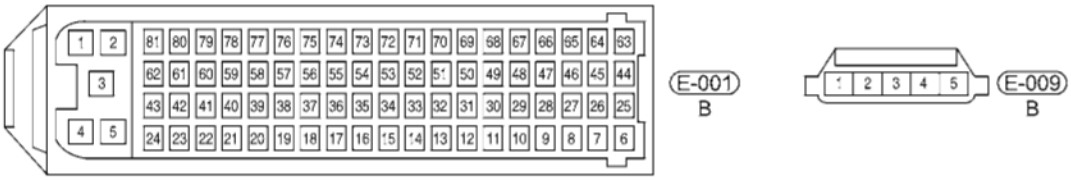
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EEC - 1.8L - MAF - 01

OE : WITHOUT EOBD
WE : WITH EOBD





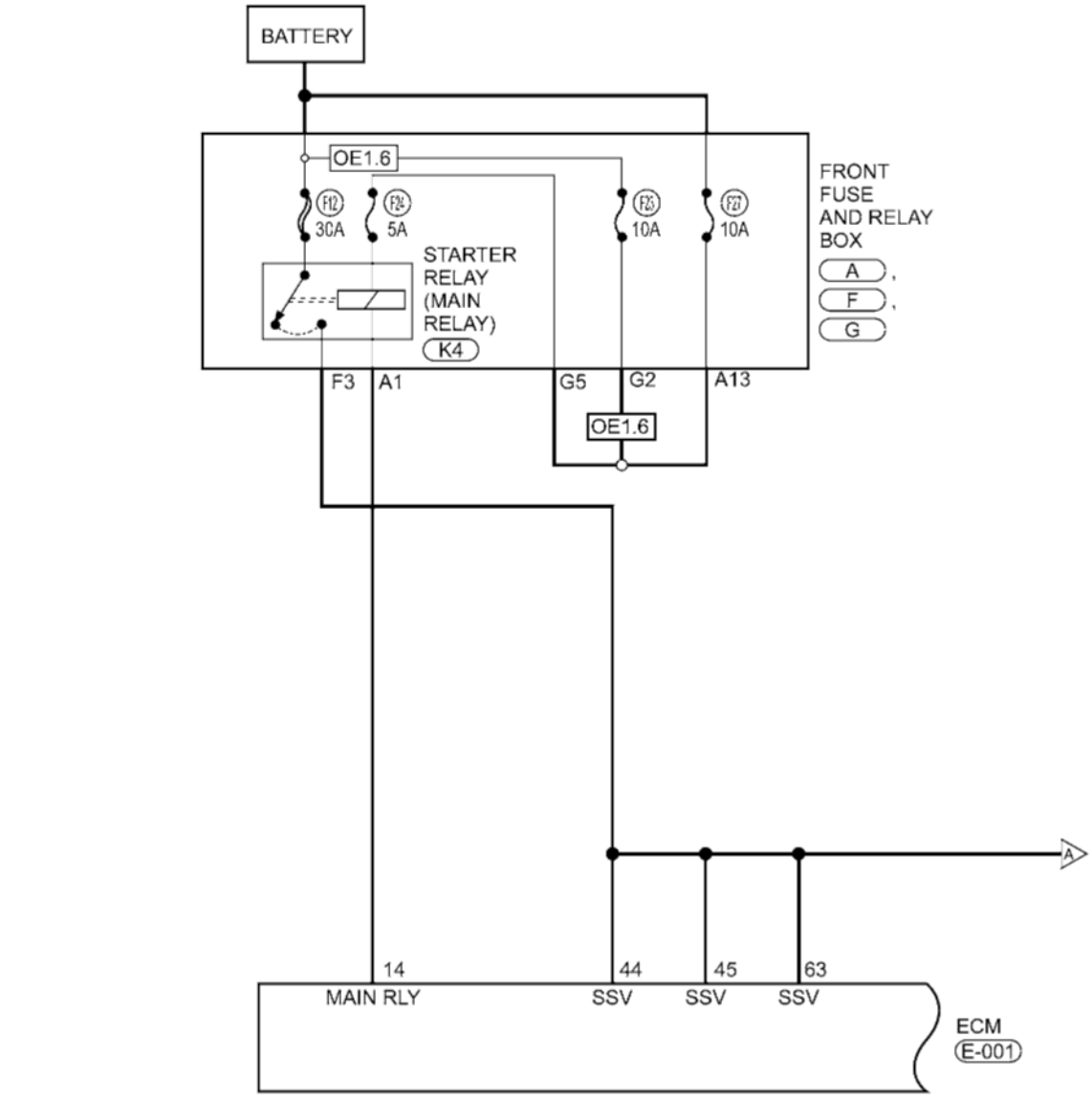


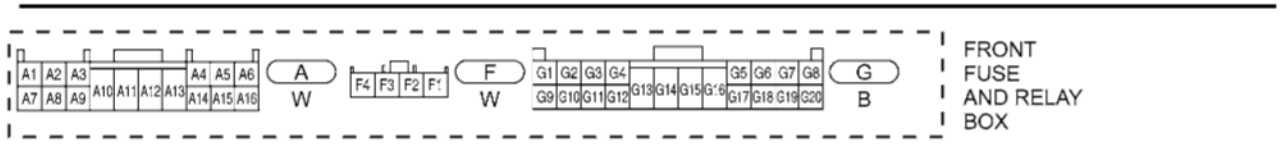
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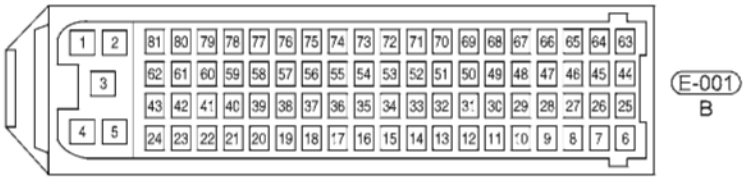
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EEC - 1.6L - 1.8L - INJ - 01

OE1.6 : WITH 1.6L ENGINE SYSTEM WITHOUT EOBD



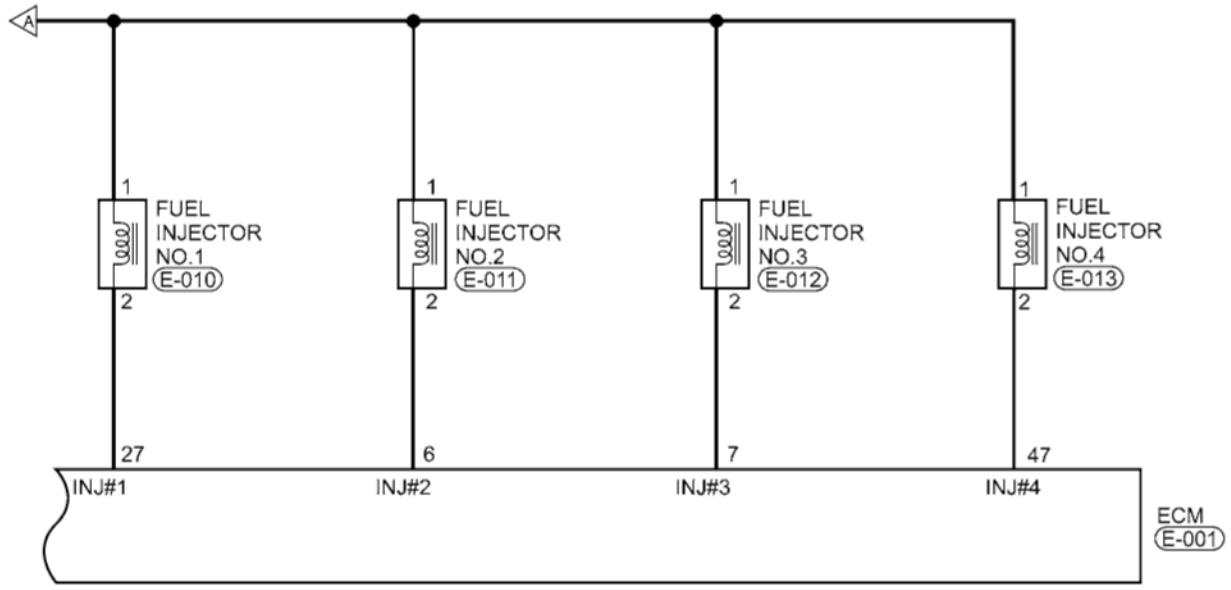


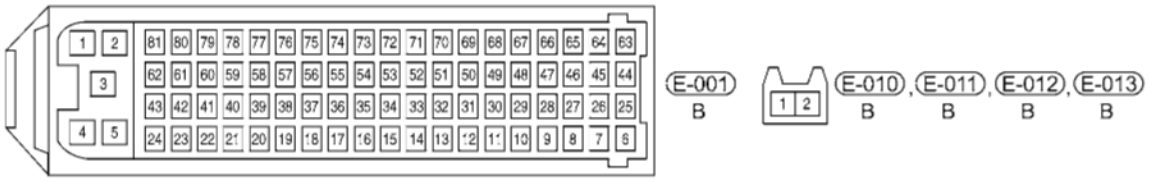


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EEC - 1.6L - 1.8L - INJ - 02





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Idle • Engine is running • Warm-up condition • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
17	Sensor (GND)	• Engine is running • Warm-up condition: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal voltage: 1.88 V	0 V
33	Regulated sensor supply 1		5 V
37	Air flow sensor (1.8L)		Approximately 322 kg/h
			Approximately 1.39 V
73	Regulated sensor supply 1		5 V

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
37	Manifold Absolute Pressure (MAP) sensor (1.6L)	• Engine running: Idle • Press accelerator pedal slowly	Approximately 1.3 V
		• Engine running: 2000 RPM	Approximately 1.5 V
		• Press accelerator pedal quickly	Up to Approximately 4 V (instantaneous)

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0171	Fuel trim system too lean	Engine is running	The amount of mixture ratio compensation is too large (The mixture ratio is too lean).	• Intake air leaks • Air flow sensor • Fuel injector • Exhaust gas leaks • Incorrect fuel pressure • lack of fuel • Incorrect PCV hose connection • Upstream O_2 sensor • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.

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- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK EXHAUST GAS LEAK

- Start engine and run it at idle.
- Listen exhaust gas leak before three way catalyst.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace.

2. CHECK FOR INTAKE AIR LEAK

- Listen for intake air leak after the air flow sensor.
- Check PCV hose connector.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace.

3. CHECK ECM CONTROL SIGNAL IN DATA STREAM

- With the X-431, select view data stream.

MONITOR ITEM	CONDITION		DATA
Injector pulse	• Engine: Warm up • Shift: P or N • Air condition: Off • No load	Idle	Approximately 2.5 ms

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.

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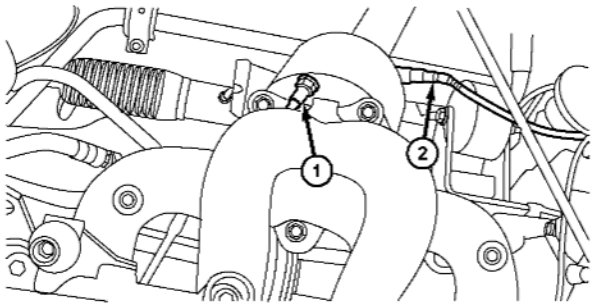
4. CHECK O_2 SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the O_2 sensor (1) electrical connector E-004.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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5. CHECK UPSTREAM O_2 SENSOR SIGNAL CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between the following terminals.

COMPONENT TERMINAL	ECM TERMINAL	O_2 SENSOR TERMINAL
TERMINAL	36	3
	18	4

- Continuity should exist.
- Check harness for short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

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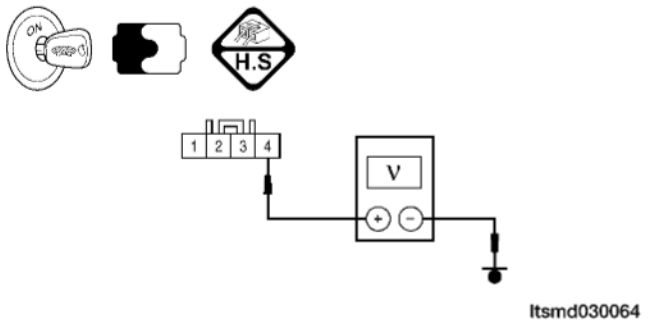
6. CHECK MAF SENSOR

- For 1.8L engine, check air flow in data stream.

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
37	Sensor signal	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal voltage: 1.88 V	Approximately 322 kg/h
			Approximately 1.39 V

- For 1.6L engine, check MAP sensor signal voltage.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
4	MAP sensor	Engine: Running	• Engine running: Idle • Press accelerator pedal slowly	Approximately 1.3 V
			• Press accelerator pedal quickly	Up to Approximately 4 V (instantaneous)



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Is the check result normal?

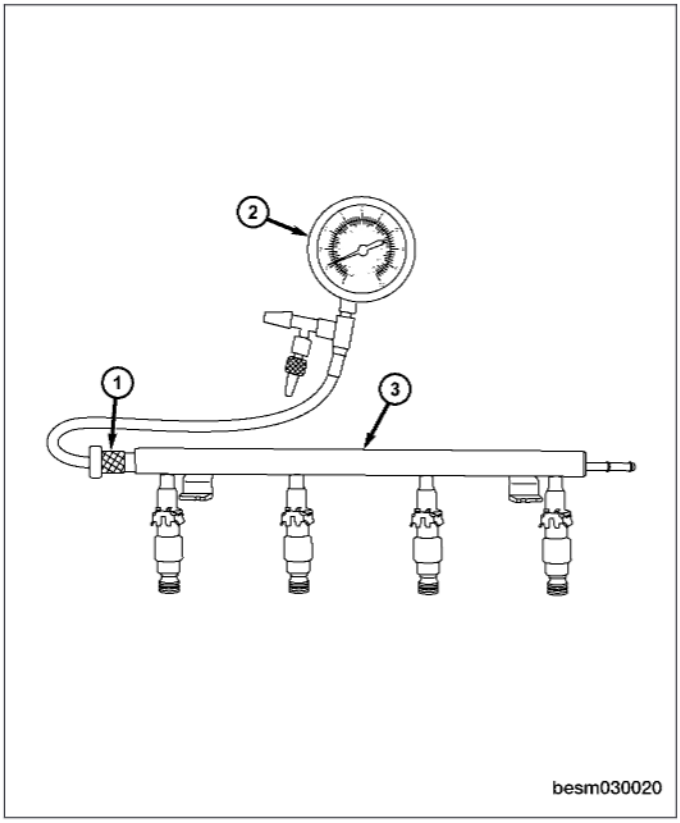
Yes >> Go to the next step.

No >> Check connectors for rusted terminals or loose connectors in the air flow sensor circuit or ground.

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7. CHECK THE FUEL PRESSURE

- Release fuel pressure to zero.
- Install fuel pressure gauge (2) and check fuel pressure.



- Observe the following fuel pressures when testing (See Fuel Pressure Test in Section 04 Fuel Delivery).

FUEL PRESSURES	
Key On	400 kPa (4.0 bar)
Key Off	380 kPa (3.8 bar) in 10 minutes
Engine: Idle	400 - 420 kPa (4.0 - 4.2 bar)

Is the check result normal?

Yes >> Go to step 9.

No >> Go to the next step.

8. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuel pump and circuit
  - Fuel pressure regulator
  - Fuel lines
  - Fuel filter for clogging

Is the check result normal?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 10.

No >> Repair or replace malfunctioning part.

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9. PERFORM ACTIVE TEST FUNCTION

- Start engine.
- Select ″ACTIVE TEST″ menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 12.

No >> Go to the next step.

10. CHECK FUNCTION OF INJECTOR

- Listen to each injector operating sound.
- Operating sound should exist.

Is the check result normal?

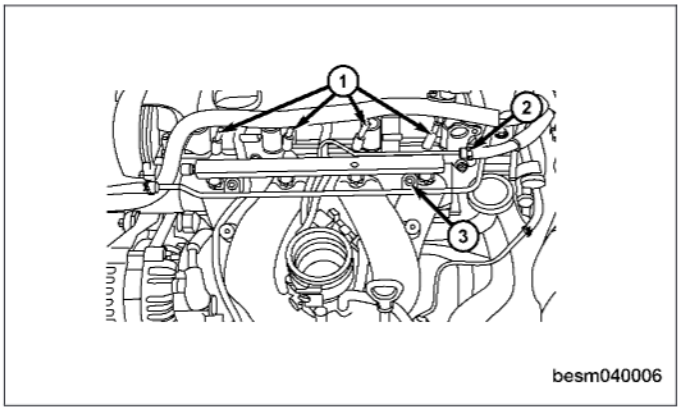
Yes >> Go to step 12.

No >> Go to the next step.

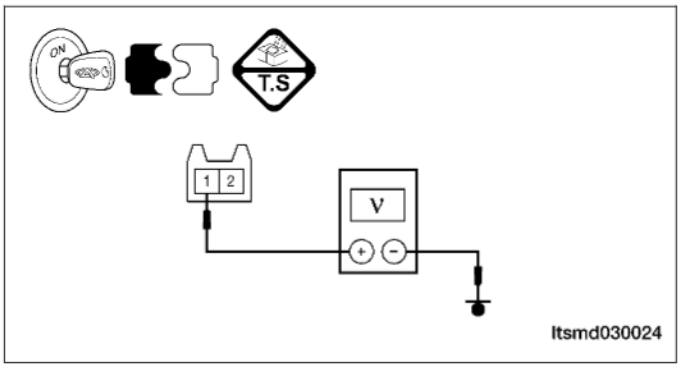
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11. CHECK INJECTOR POWER SUPPLY CIRCUIT AND CONTROL CIRCUIT

- Turn ignition switch off.
- Disconnect injector harness connector (1).

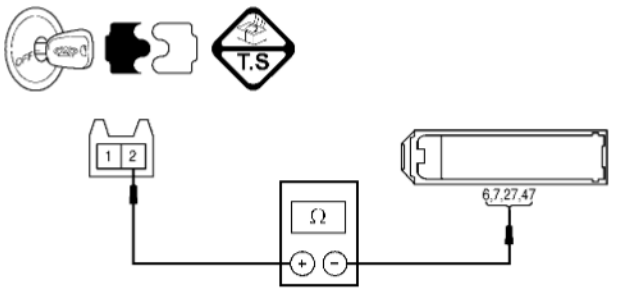


- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.



- Battery voltage should exist.
- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

INJECTOR NO.	ECM TERMINAL	INJECTOR TERMINAL
1	27	2
2	6	2
3	7	2
4	47	2



- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to step next step.

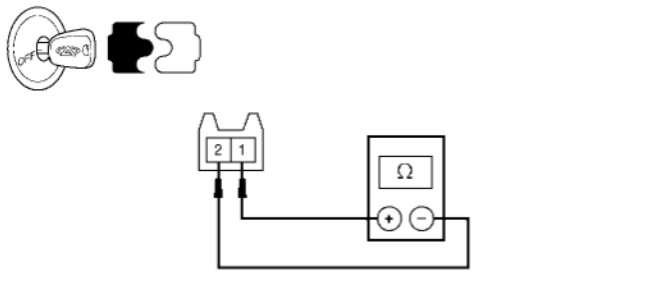
No >> Repair or replace circuit for an open or short to power or short to ground in harness or connectors.

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12. CHECK INJECTOR RESISTANCE

- Disconnect injector harness connectors (See Fuel Pressure Test in Section 04 - Fuel Delivery).
- Check the resistance of the injectors.

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)
1	1 & 2	16
2	1 & 2	
3	1 & 2	
4	1 & 2	



Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.
Go to step 14.

13. CHECK INJECTOR

WARNING!

Confirm that the engine is cooled down and there are no fire hazards near the vehicle.

- Remove fuel delivery rail with injectors (See Fuel Injector Rail Removal & Installation 1.6L & 1.8L & 2.0L in Section 04 Fuel Delivery).

NOTE :
Be careful not to drop the fuel injectors when removing the fuel delivery rail.
- Keep fuel hose and all injectors connected to injector rail.
- Disconnect all ignition coil harness connectors.
- Prepare pans or saucers under each injector.
- Observe the fuel injectors and crank engine for about 3 seconds.
- Fuel should be sprayed evenly by each injector.

Is the check result normal?

Yes >> Go to next step.

No >> Clean any injector that sprays unevenly or replace any injector that does not spray fuel.

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14. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See DTC ″Confirmation Procedure″.

Is DTC P0171 still present?

Yes >> Replace the ECM.

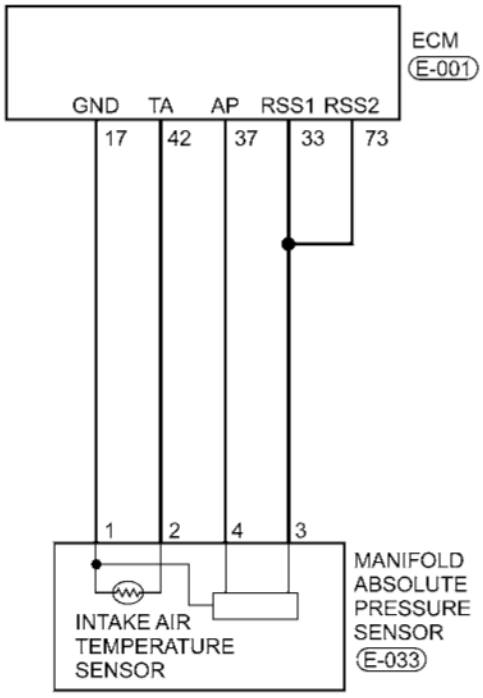
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

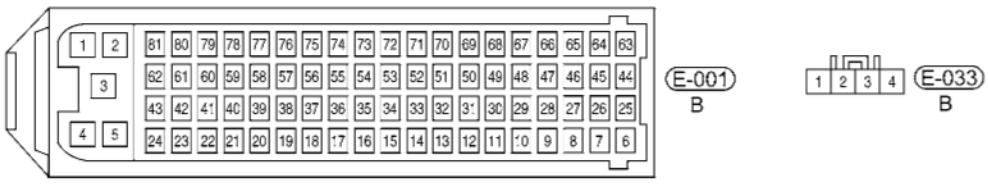
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0172 - Fuel Trim System Too Rich

EEC - 1.6L - MAP - 01



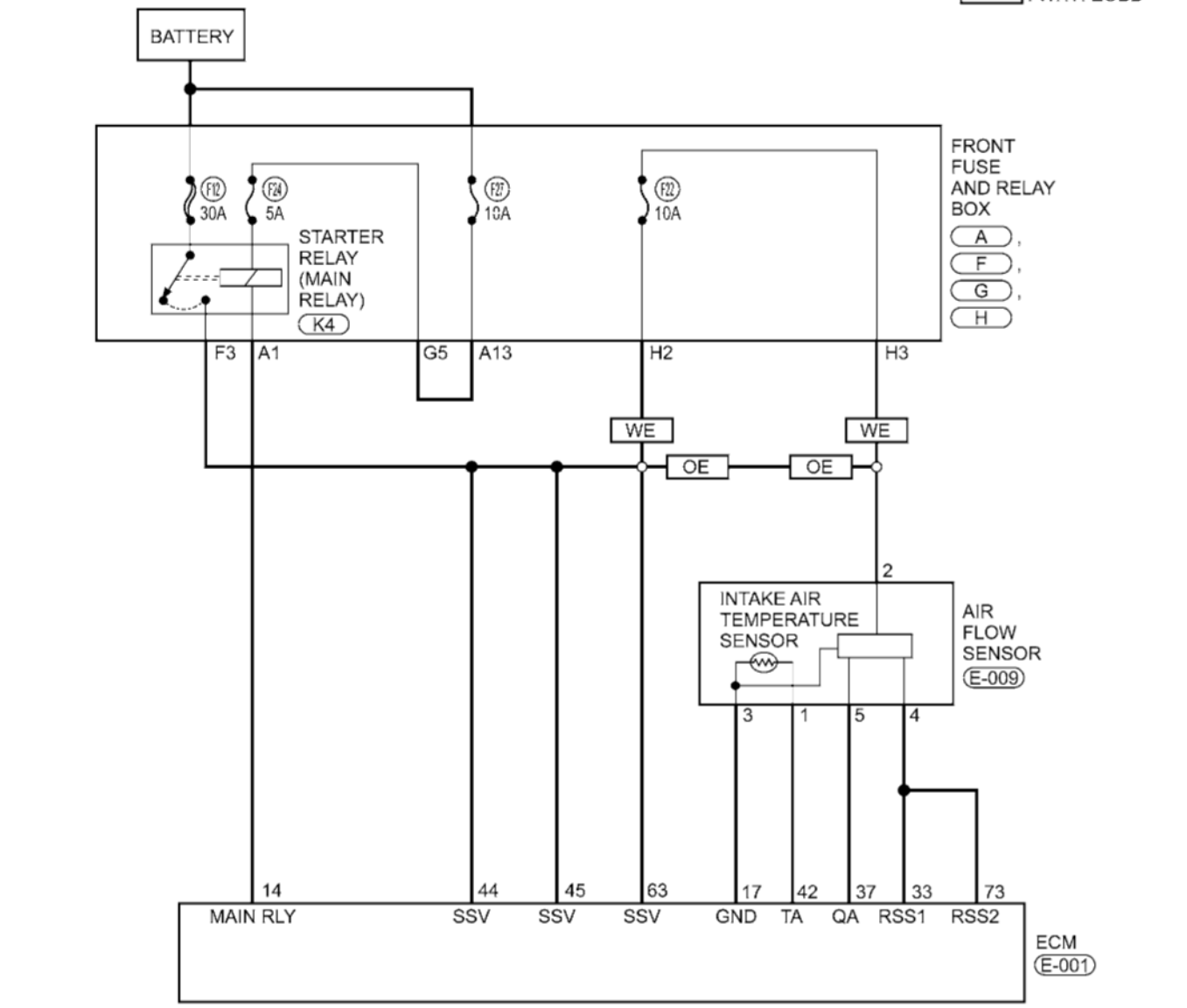


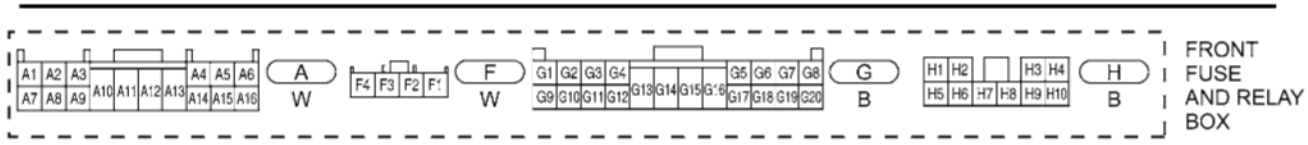
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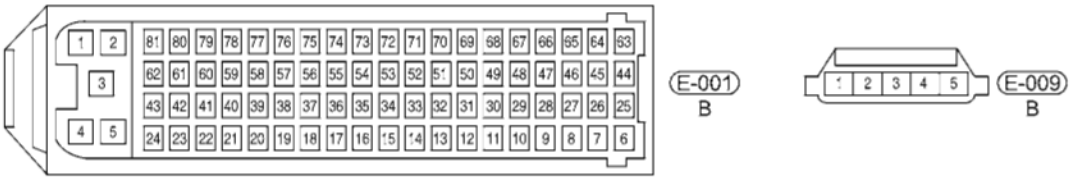
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EEC - 1.8L - MAF - 01

OE : WITHOUT EOBD
WE : WITH EOBD





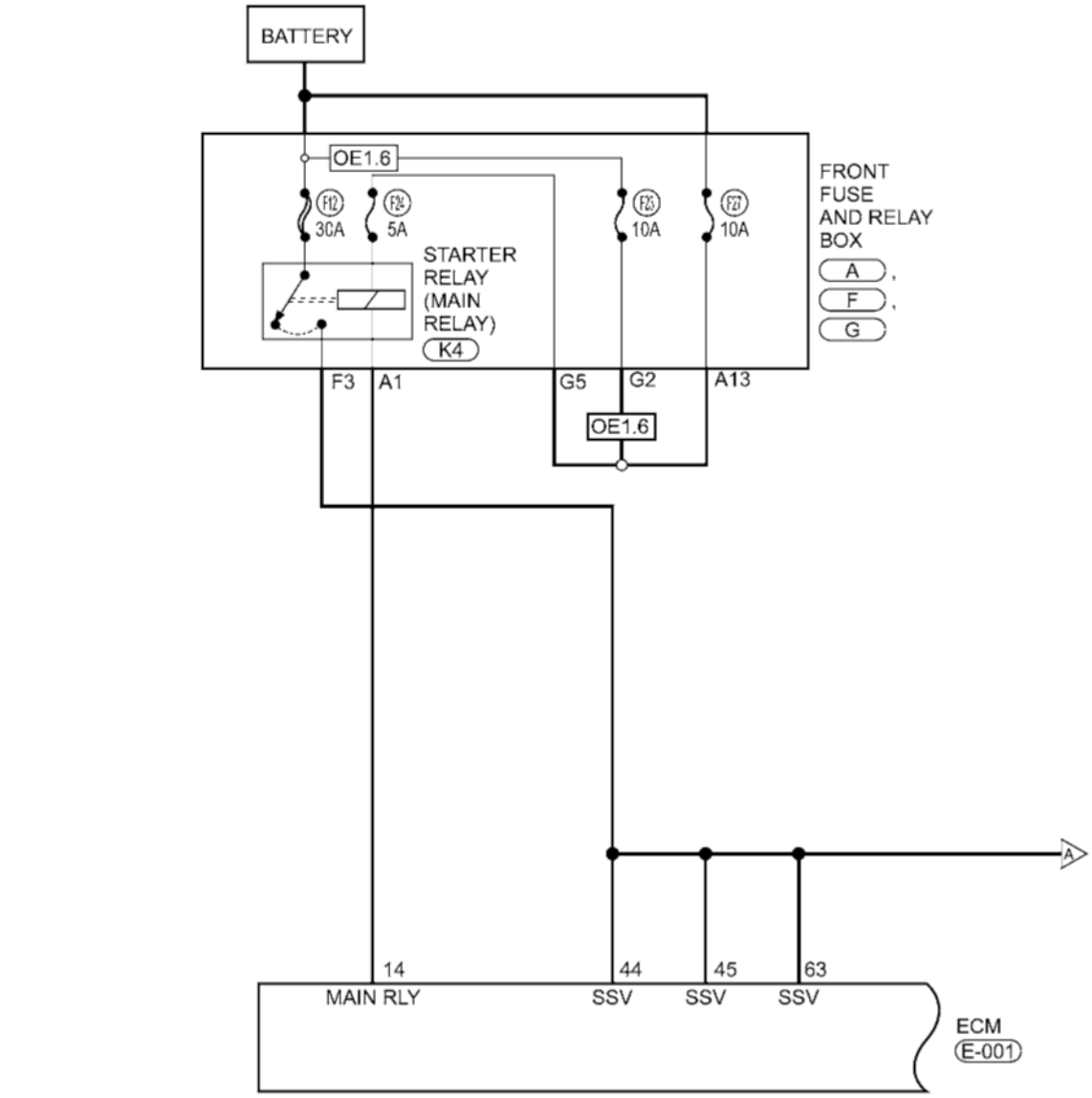


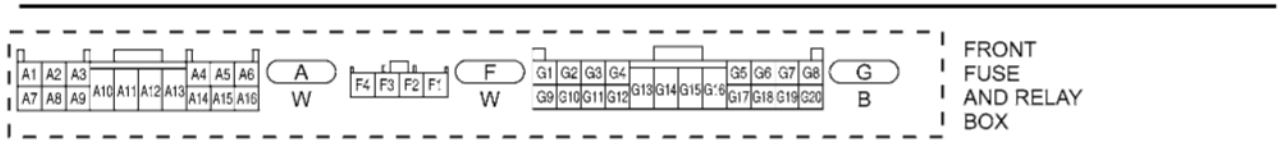
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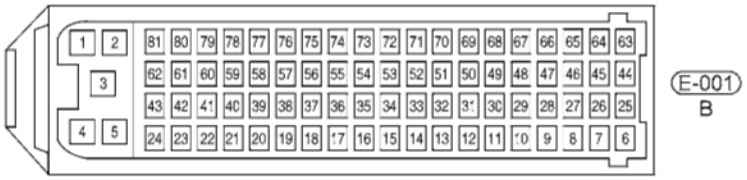
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EEC - 1.6L - 1.8L - INJ - 01

OE1.6 : WITH 1.6L ENGINE SYSTEM WITHOUT EOBD



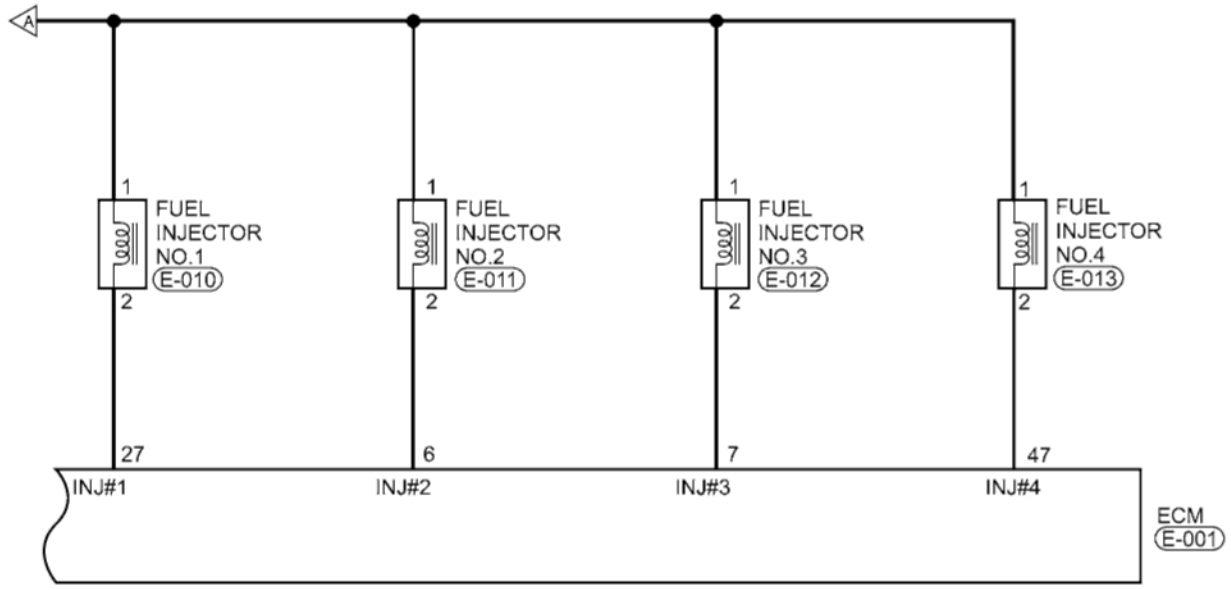


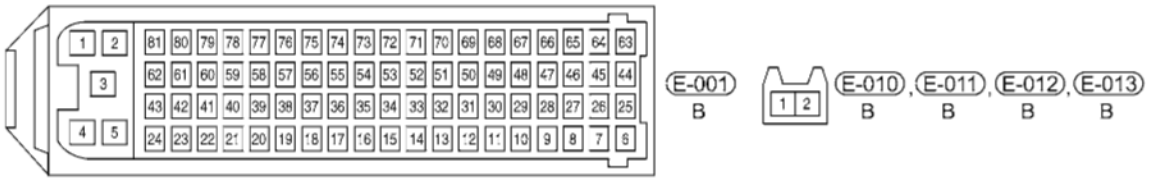


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EEC - 1.6L - 1.8L - INJ - 02





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
17	Sensor (GND)	• Engine is running • Warm-up condition: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	0 V
33	Regulated sensor supply 1		5 V
37	Air flow sensor (1.8L)		322 kg/h
			1.39 V
73	Regulated sensor supply 1		5 V

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
37	Manifold Absolute Pressure (MAP) sensor (1.6L)	• Engine running: Idle • Press accelerator pedal slowly	Approximately 1.3 V
		• Engine running: 2000 RPM	Approximately 1.5 V
		• Press accelerator pedal quickly	Up to approximately 4 V (instantaneous)

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0172	Fuel trim system too rich	Engine is running	The amount of mixture ratio compensation is too large (The mixture ratio is too rich)	• Air flow sensor • Manifold Absolute Pressure (MAP) sensor • Fuel injector • Exhaust gas leaks • Incorrect fuel pressure • Upstream O_2 sensor • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.

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- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK EXHAUST GAS LEAK

- Start engine and run it at idle.
- Listen for exhaust leak before three way catalyst.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace.

2. CHECK ECM CONTROL SIGNAL IN DATA STREAM

- With the X-431, select view data stream.

MONITOR ITEM	CONDITION		DATA
Injector pulse	• Engine: Warm up • Shift: P or N • Air condition: Off • No load	Idle	Approximately 2.5 ms

Is the check result normal?

Yes >> Go to next 5.

No >> Go to the next step.

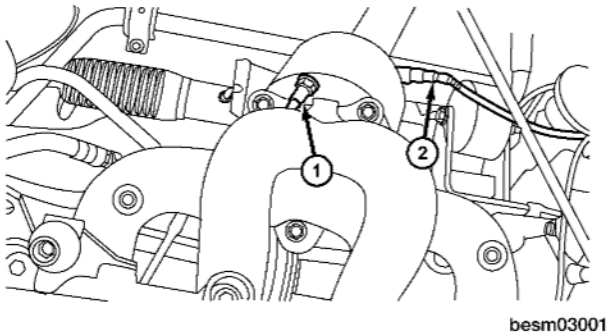
3. CHECK O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect upstream O_2 sensor (1) harness connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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4. CHECK UPSTREAM O_2 SENSOR SIGNAL CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between the following terminals.

COMPONENT TERMINAL	ECM TERMINAL	O_2 SENSOR TERMINAL
TERMINAL	36	3
	18	4

- Continuity should exist.
- Check harness for short to power.

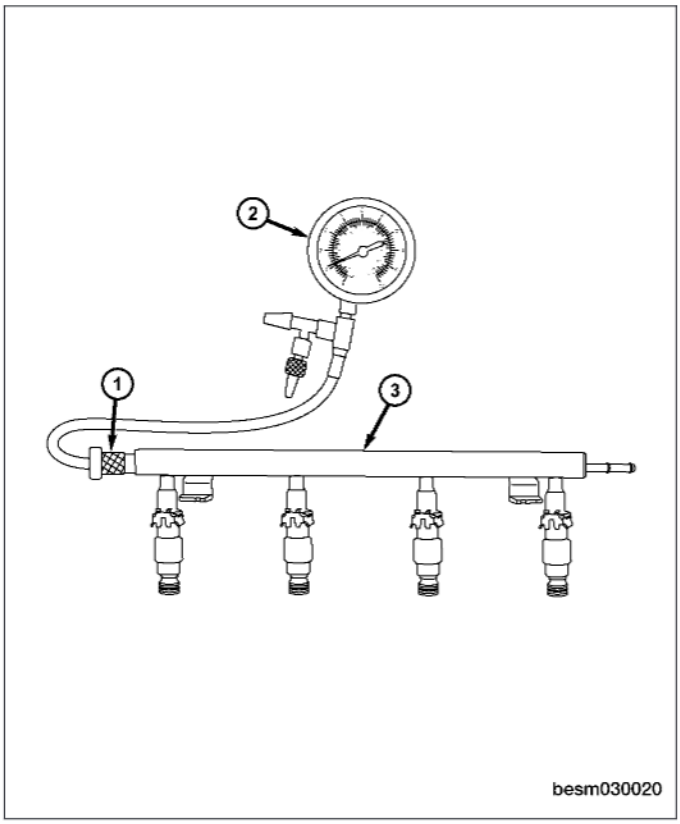
Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

5. CHECK THE FUEL PRESSURE

- Release fuel pressure to zero.
- Install fuel pressure gauge (2) and check fuel pressure.



- Observe the following fuel pressures when testing (See Fuel Pressure Test in Section 04 Fuel Delivery).

FUEL PRESSURES	
Key On	400 kPa (4.0 bar)
Key Off	380 kPa (3.8 bar) in 10 minutes
Engine: Idle	400 - 420 kPa (4.0 - 4.2 bar)

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Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

6. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuel pump and circuit
  - Fuel pressure regulator

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace.

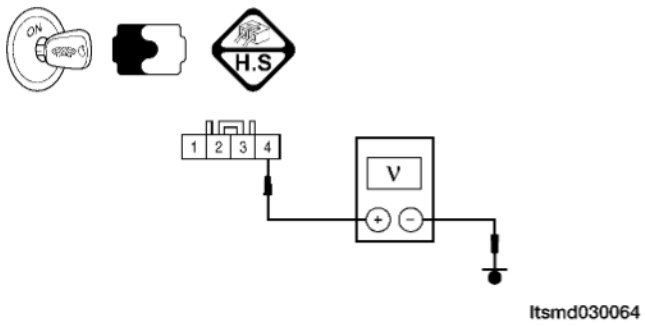
7. CHECK MAF/MAP SENSOR

- Turn ignition switch off.
- Install all removed parts.
- For 1.8L engine, check MAF signal in data stream.

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
37	MAF sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	322 kg/h
			1.39 V

- For 1.6L engine, check MAP sensor signal voltage.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
4	MAP sensor	Engine: Running	• Engine running: Idle • Press accelerator pedal slowly.	Approximately 1.3 V
			• Press accelerator pedal quickly.	Up to approximately 4 V (Instantaneous)



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Is the check result normal?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 9.

No >> Check connectors for damaged or air flow signal circuit for short to power.

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8. PERFORM ACTIVE TEST FUNCTION

- Start engine.
- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 11.

No >> Go to the next step.

9. CHECK FUNCTION OF INJECTOR

- Listen to each injector operating sound.
- Operating sound should exist.

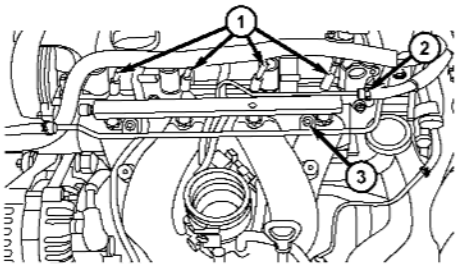
Is the check result normal?

Yes >> Go to step 11.

No >> Go to the next step.

10. CHECK INJECTOR CONTROL CIRCUIT

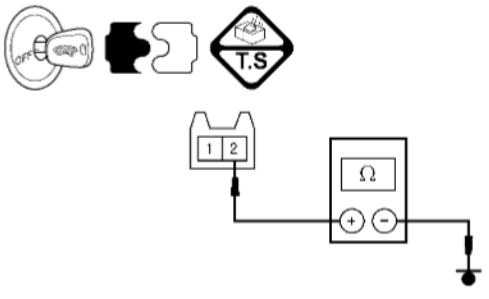
- Turn ignition switch off.
- Disconnect injector harness connector (1).



besm040006

- Disconnect ECM harness connector.
- Check harness for a short to ground between the following terminals.

INJECTOR NO.	ECM TERMINAL	INJECTOR TERMINAL
1	27	2
2	6	2
3	7	2
4	47	2



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- Continuity should not exist.

Is the check result normal?

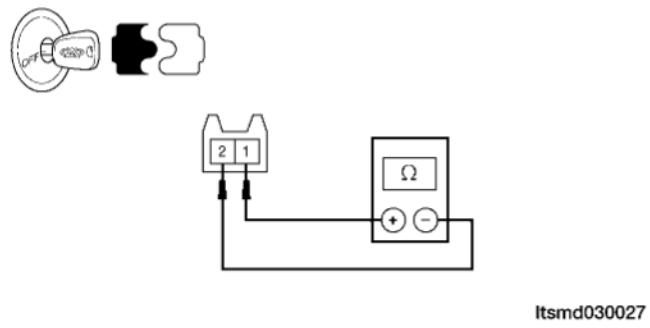
Yes >> Go to the next step.

No >> Repair or replace circuit for short to ground in harness or connectors.

11. CHECK INJECTOR RESISTANCE

- Disconnect injector harness connectors (See Fuel Pressure Test in Section 04 Fuel Delivery).
- Check the resistance of the injectors.

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)
1	1 & 2	16
2	1 & 2	
3	1 & 2	
4	1 & 2	



Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.
Go to step 13.

12. CHECK INJECTOR

WARNING!

Confirm that the engine is cooled down and there are no fire hazards near the vehicle.

- Remove fuel delivery rail with injectors (See Fuel Injector Rail Removal & Installation 1.6L & 1.8L & 2.0L in Section 04 Fuel Delivery).

NOTE :
Be careful not to drop the fuel injectors when removing the fuel delivery rail.
- Keep fuel hose and all injectors connected to injector rail.
- Disconnect all injector harness connectors.
- Disconnect all ignition coil harness connectors.
- Prepare pans or saucers under each injector.
- Crank engine for about 3 seconds.
- Make sure fuel does not drip from injector.

Is the check result normal?

Yes >> Go to next step.

No >> Replace the injectors from which fuel is dripping. Always replace O-ring with new one.

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13. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0172 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

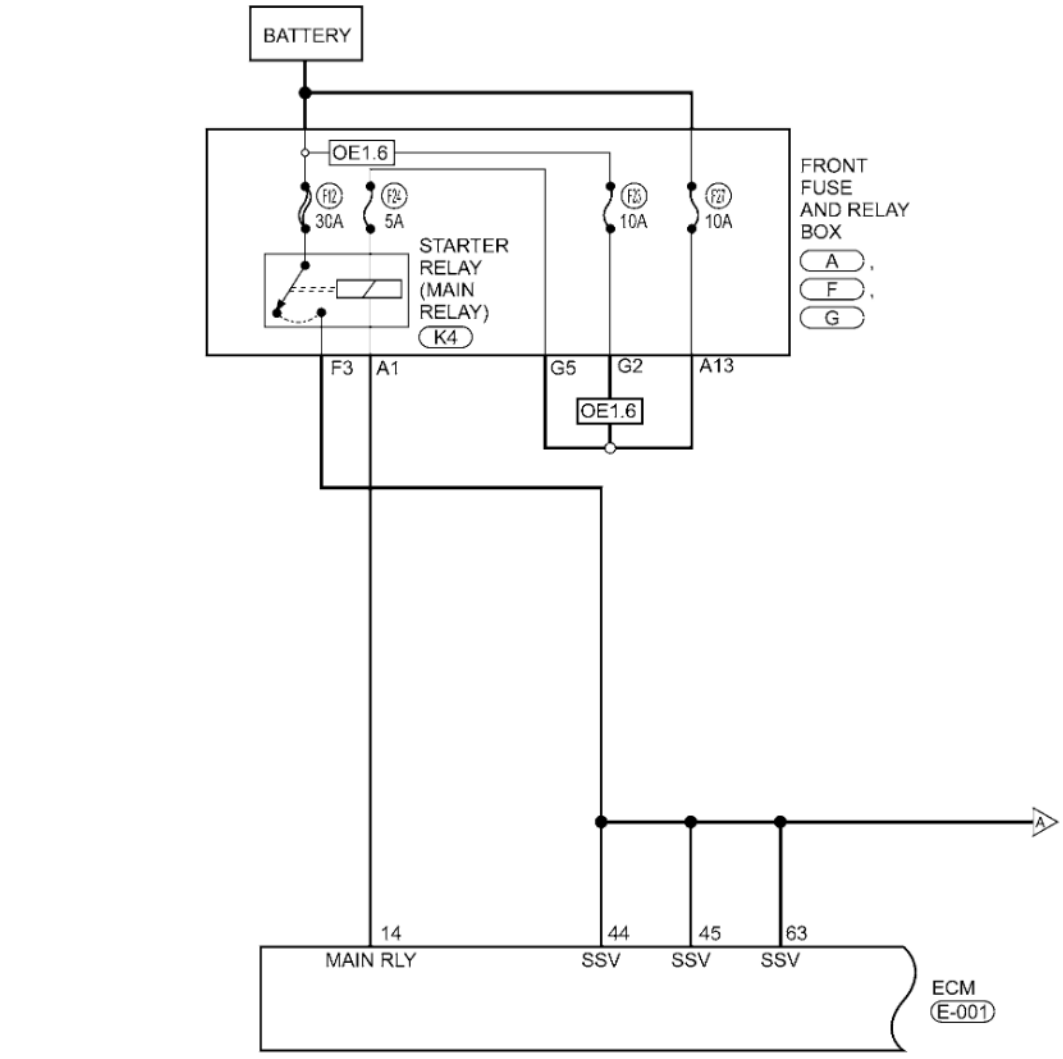
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

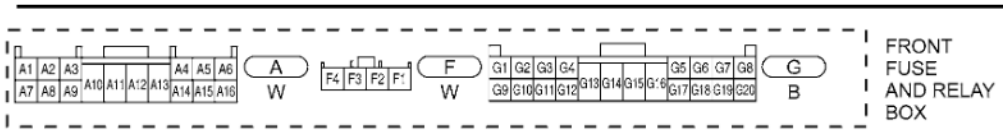
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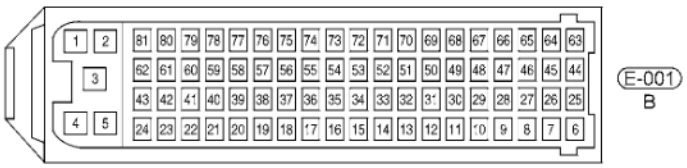
P0201 - Cylinder 1 - Injector Circuit
P0202 - Cylinder 2 - Injector Circuit
P0203 - Cylinder 3 - Injector Circuit
P0204 - Cylinder 4 - Injector Circuit

EEC - 1.6L - 1.8L - INJ - 01

OE1.6 : WITH 1.6L ENGINE SYSTEM WITHOUT EOBD



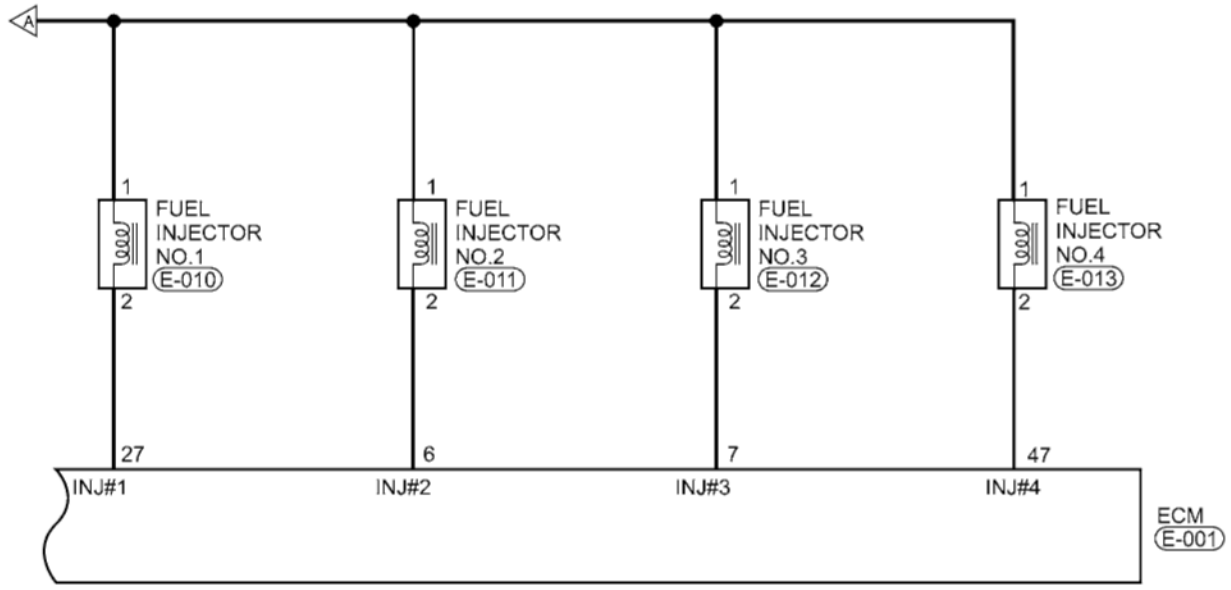


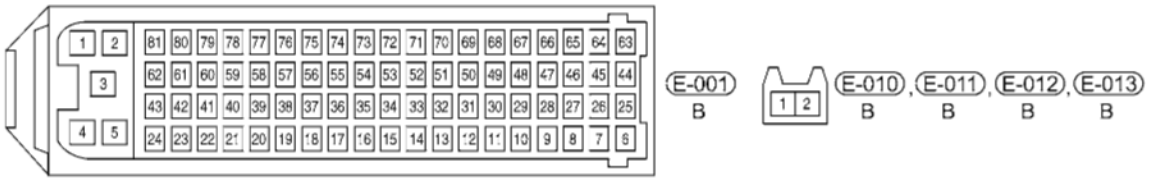


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EEC - 1.6L - 1.8L - INJ - 02





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0201	Cylinder 1 - Injector Circuit	Engine is running	• Injector • Harness or connectors • ECM
P0202	Cylinder 2 - Injector Circuit		
P0203	Cylinder 3 - Injector Circuit		
P0204	Cylinder 4 - Injector Circuit		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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2. INSPECTION START

- Start the engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 5.

No >> Go to step 6.

3. PERFORM ACTIVE TEST FUNCTION

- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 11.

No >> Go to step 6.

4. CHECK FUNCTION OF INJECTOR

- Listen to injector operating sound one by one.

Do all injectors clicking noise exist?

Yes >> Go to step 11.

No >> Go to the next step.

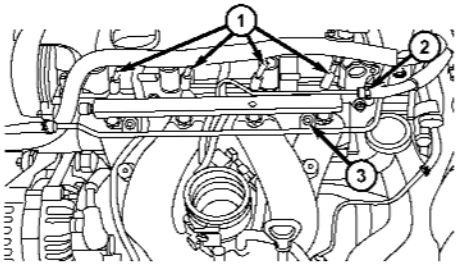
5. CHECK INJECTOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the injector electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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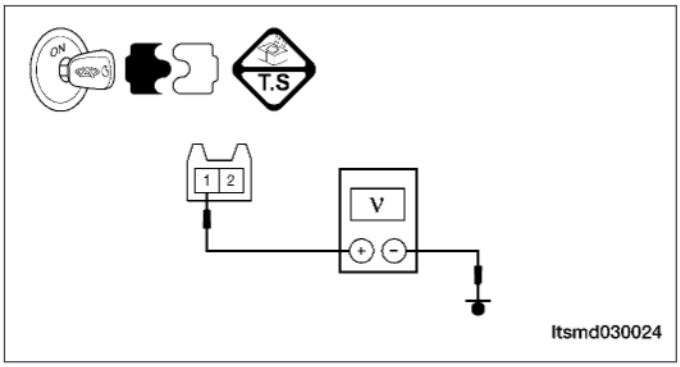
6. CHECK INJECTOR POWER SUPPLY CIRCUIT FOR OPEN

- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Check the following:
  - Front fuse and relay box F3, A13, G5
  - Fuse 12, fuse 24, fuse 27

Without EOBD (1.6L)

  - Front fuse and relay box F3, G2, G5
  - Fuse 12, fuse 23, fuse 24
  - harness between injector and fuse

Is the check result normal?

Yes >> With the X-431, check the system, If OK, go to the next step.

No >> Repair or replace malfunctioning parts.

8. CHECK INJECTOR CONTROL CIRCUITS FOR AN OPEN

- Check injector control circuit voltage.
- 3.6 V should exist.

Is the check result normal?

Yes >> Go to step 10.

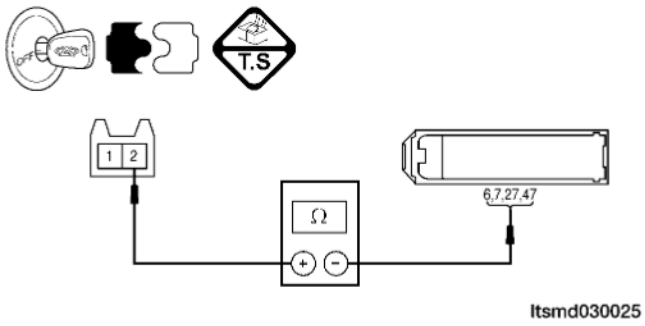
No >> Go to the next step.

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9. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

INJECTOR NO.	ECM TERMINAL	INJECTOR TERMINAL
1	27	2
2	6	2
3	7	2
4	47	2



- Continuity should exist.

Is the check result normal?

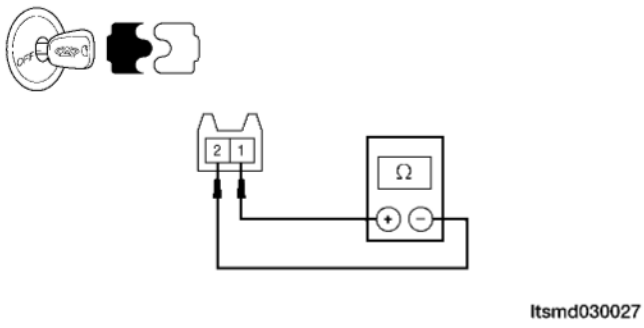
Yes >> Go to the next step.

No >> Repair circuit for an open in harness or connectors.

10. CHECK INJECTOR RESISTANCE

- Check fuel injector resistance between the following terminals.

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)
1	1 & 2	12
2	1 & 2	
3	1 & 2	
4	1 & 2	



- Check sensor signal output.
- Connect ECM connector.
- Connect injector connector.
- Check fuel injector voltage between the following terminals and ground.

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7			
27			
47			

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Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See ″DTC Confirmation Procedure″.

Is DTC P0201, P0202, P0203 or P0204 still present?

Yes >> Replace the ECM.

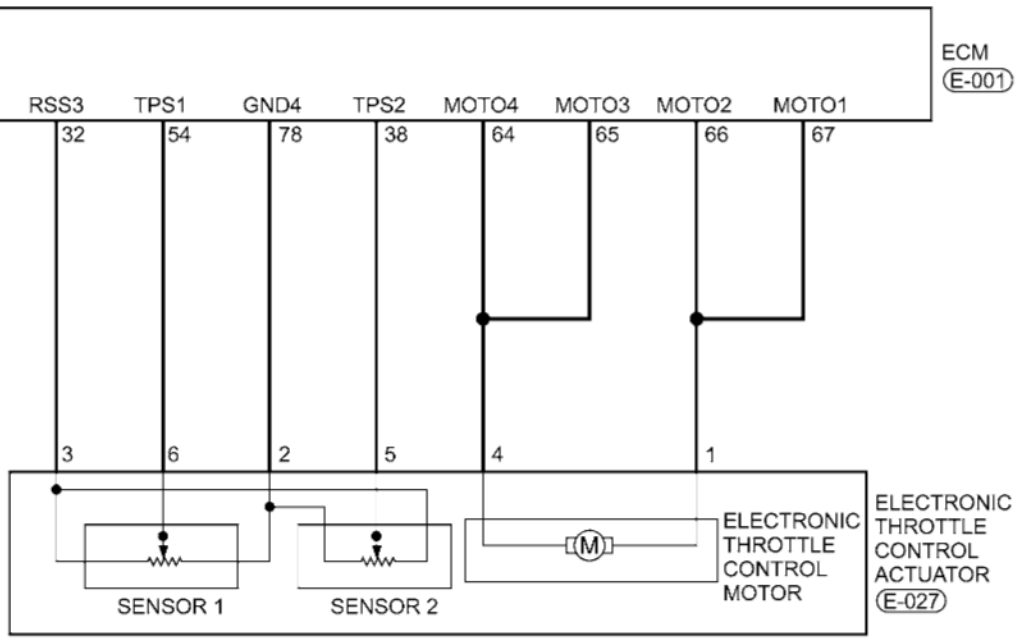
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

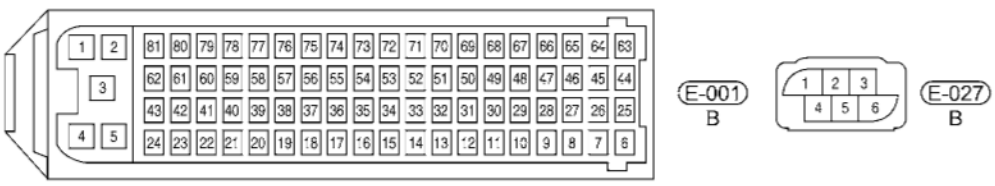
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0221 - Throttle Position Sensor B Performance

EEC - 1.6L - 1.8L - TPS - 01

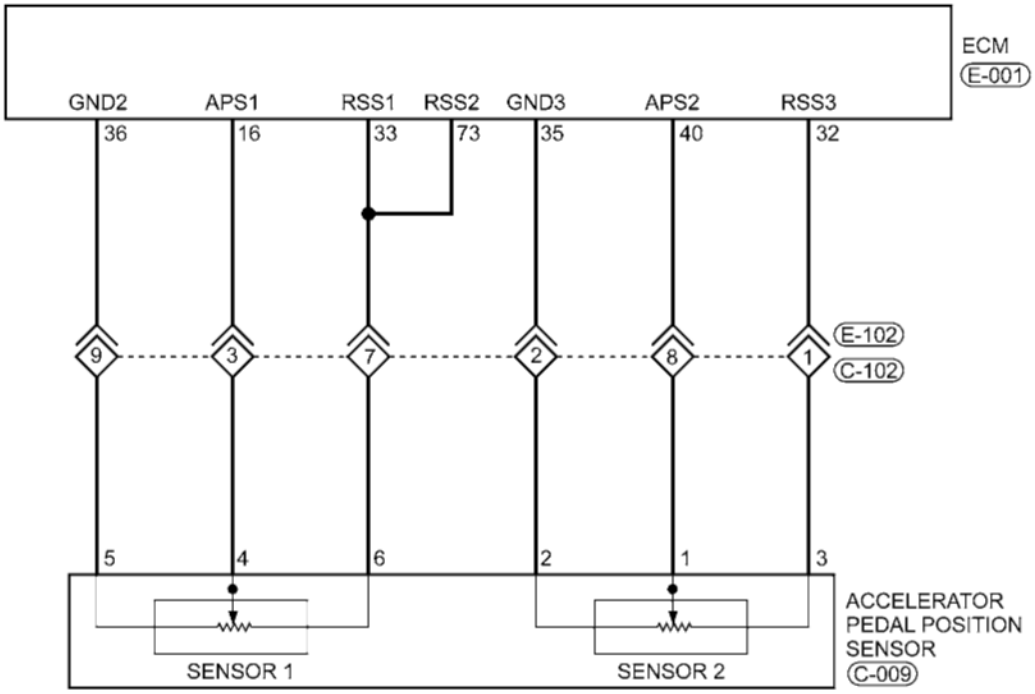


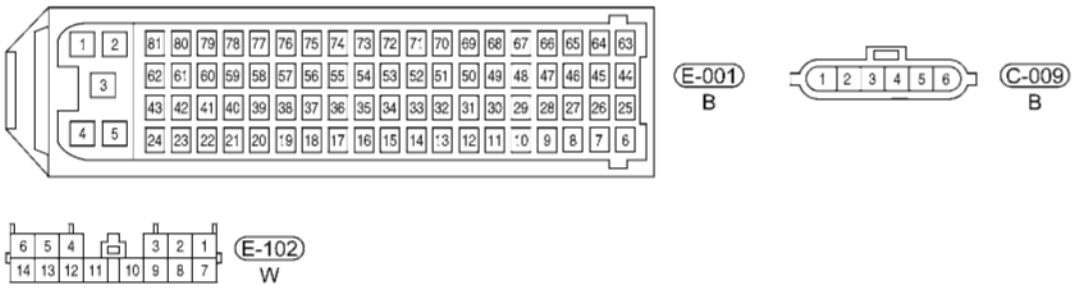


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EEC - 1.6L - 1.8L - APS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (Position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
78	Sensor (GND)		-	Approximately 0 V
64	Motor 4			0 V or 12 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0221	Throttle Position Sensor (TPS) B performance	Ignition switch on or after engine start	Rationally incorrect voltage is sent to ECM compared with the signals from TPS1 and TPS2.	• Electronic throttle control actuator (TPS1 and TPS2) • Harness or connectors (The sensor signal circuit is open or shorted) • Accelerator pedal position sensor 2 • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

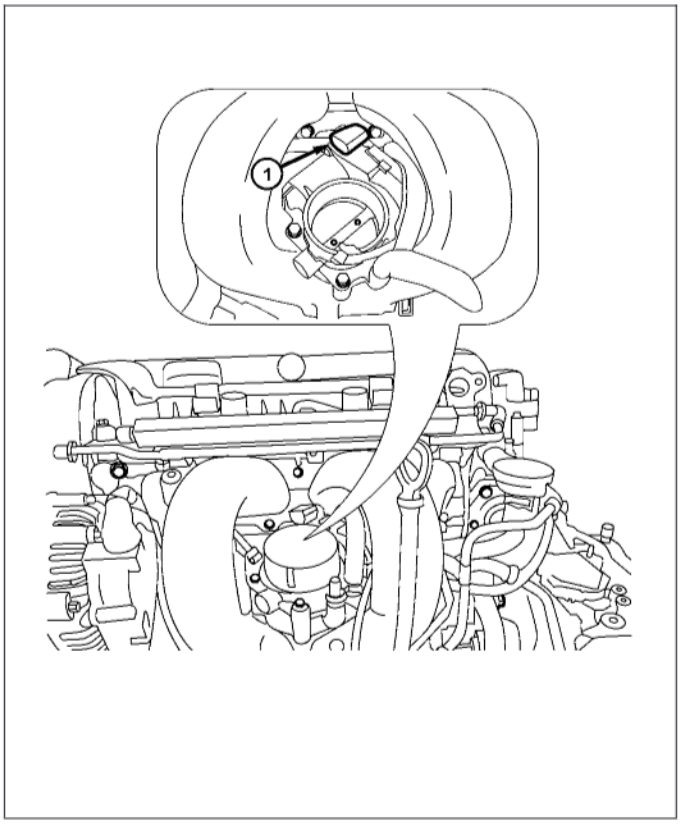
2. CHECK THROTTLE POSITION SENSOR (TPS) ELECTRICAL CONNECTOR

- Disconnect the TPS (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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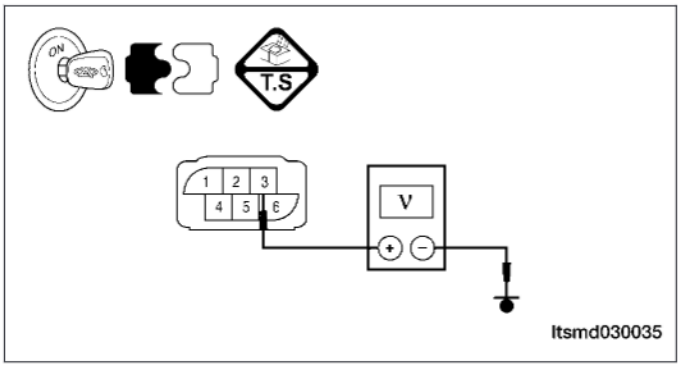
3. CHECK THE THROTTLE POSITION SENSOR (TPS) POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check TPS supply voltage between TPS terminal 3 and ground in the TPS electrical connector E-027.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



4. CHECK THE TPS POWER SUPPLY CIRCUIT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between TPS terminal 3 and ECM terminal 32.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open.
If the circuit is normal, go to the next step.

5. CHECK THE TPS AND THE ACCELERATOR PEDAL POSITION (APP) SENSOR POWER SUPPLY CIRCUIT

- Check harness for short to power and short to ground between following terminals.

ECM TERMINAL	TPS/APS TERMINAL
32	TPS terminal 3
32	APP sensor terminal 3
33	APP sensor terminal 6

Is the check result normal?

Yes >> Go to the next step.

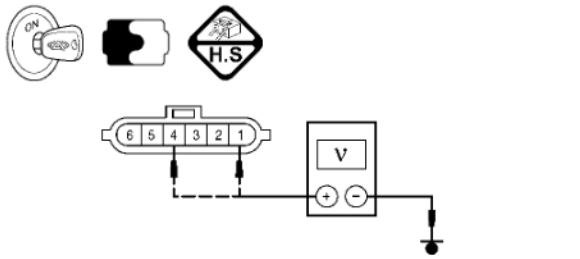
No >> Repair circuit for short to ground or short to power in harness or connectors.

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6. CHECK THE APP SENSOR

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 16 (APP sensor 1 signal), 40 (APP sensor 2 signal) and ground under the following conditions:

ECM TERMINAL NO.	APP SENSOR TERMINAL	ITEM	CONDITION		VOLT (DC VOLTAGE)
16	APP sensor terminal 4	Accelerator Pedal Position Sensor 1 (APPS1)	Turn ignition switch on	• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
				• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	APP sensor terminal 1	Accelerator Pedal Position Sensor 2 (APPS2)		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
				• Engine stopped • Accelerator pedal: Fully depressed	1.97 V



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Is the check result normal?

Yes >> Go to step 10.

No >> Replace the Accelerator Pedal Assembly (See Accelerator Pedal Position Sensor Removal & Installation in Section 03 Electronic Engine Controls).

7. CHECK THE TPS SIGNAL CIRCUIT FOR AN OPEN AND SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between electronic throttle control actuator terminal 5 and ECM terminal 38.
- Continuity should exist.
- Also check harness for a short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

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8. CHECK THE TPS SENSOR GROUND CIRCUIT FOR AN OPEN AND SHORT

- Check harness continuity between electronic throttle control actuator terminal 2 and ECM terminal 78.
- Continuity should exist.
- Check harness for short to power and short to ground.

Is the check result normal?

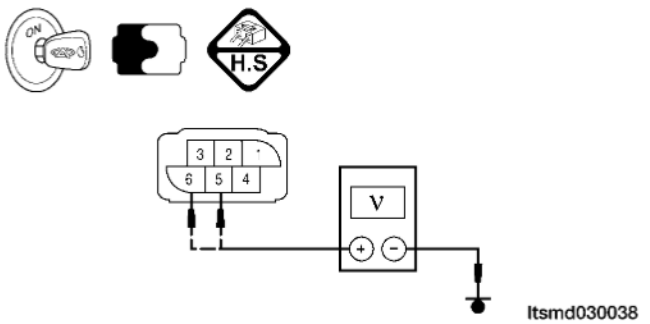
Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power or short to ground in harness or connectors.

9. CHECK TPS

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between TPS terminals 6 (TPS1) and ground, terminal 5 (TPS2) and ground under the following conditions:

TPS TERMINAL NO.	ITEM	CONDITION		VOLTAGE (DC VOLTAGE)
5	Throttle Position Sensor 2 (TPS2)	Ignition switch: ON	• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
6	Throttle Position Sensor 1 (TPS1)		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V



Is the check result normal?

Yes >> Go to the next step.

No >> Replace electronic throttle control actuator, and perform throttle valve position learning.

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10. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0221 still present?

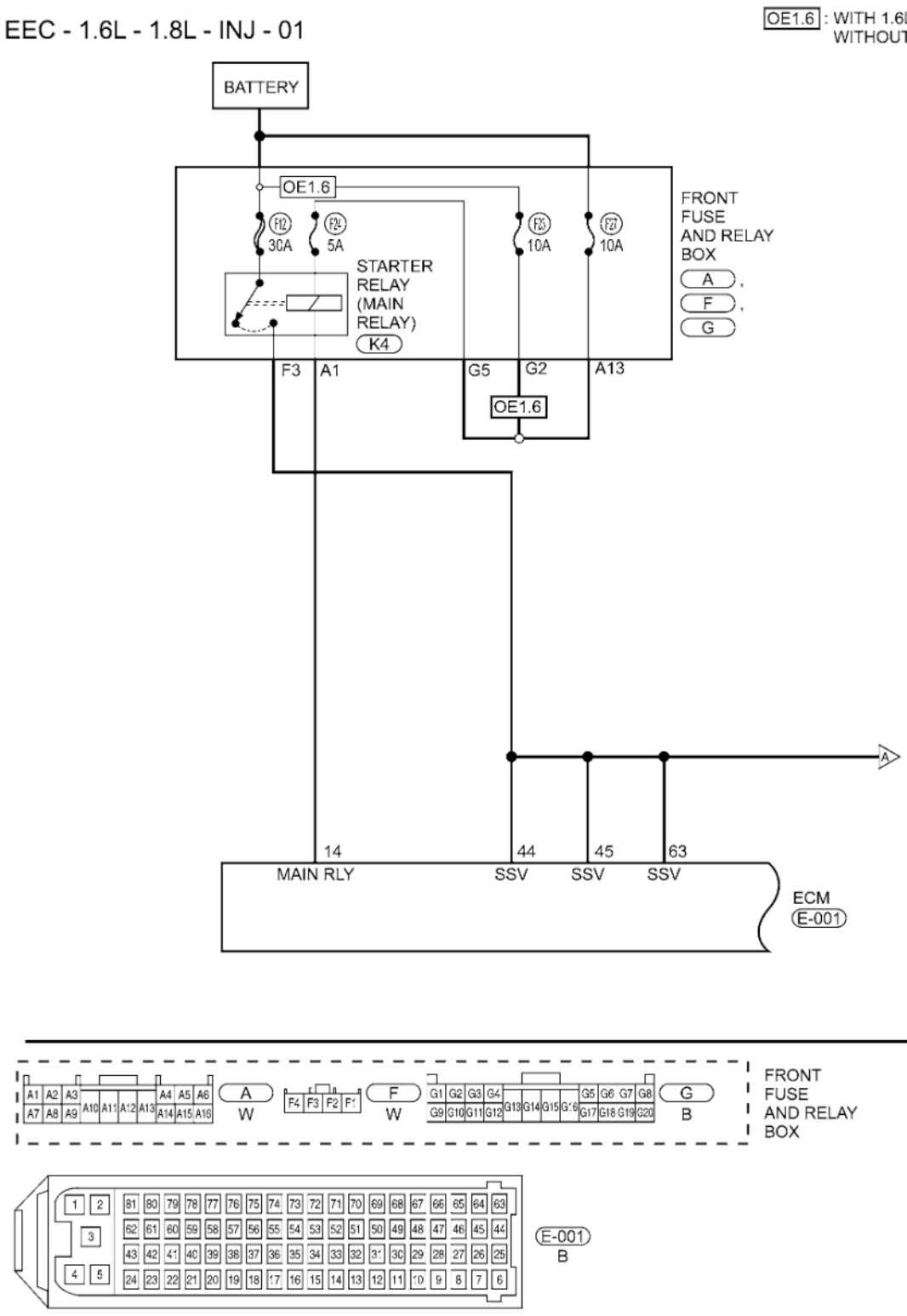
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

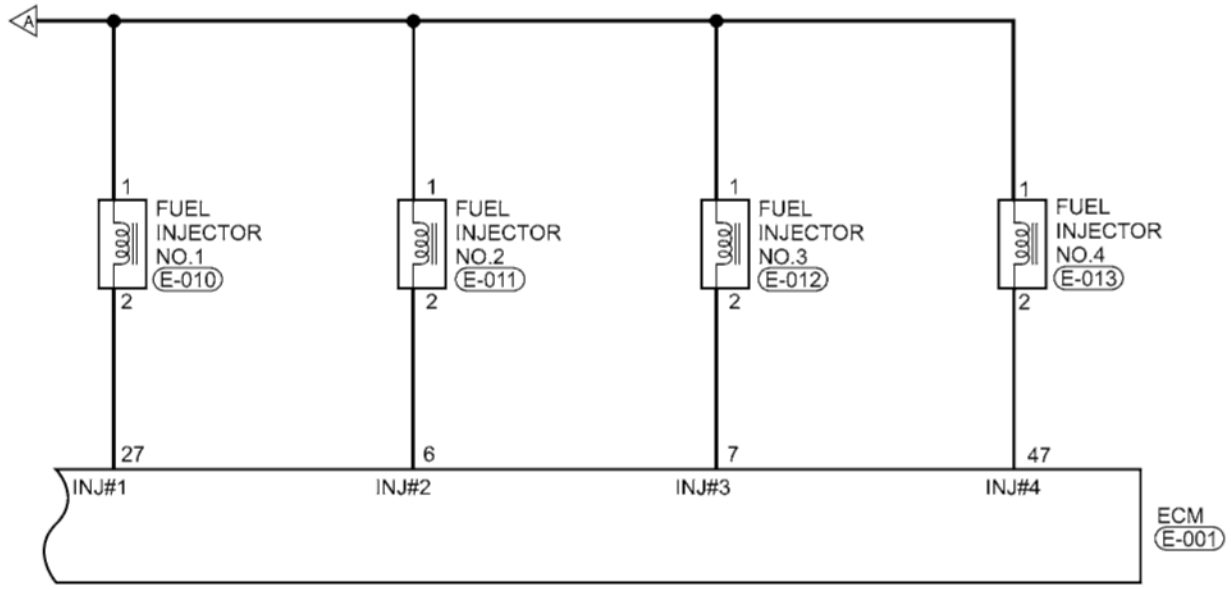
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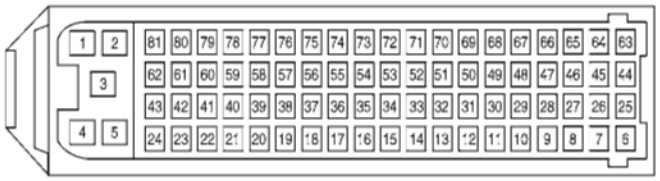
P0261 - Cylinder 1 Injector Circuit Low
P0264 - Cylinder 2 Injector Circuit Low
P0267 - Cylinder 3 Injector Circuit Low
P0270 - Cylinder 4 Injector Circuit Low



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EEC - 1.6L - 1.8L - INJ - 02





E-001
B



E-010, E-011, E-012, E-013
B B B B

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0261	Cylinder 1 - Injector Circuit Low	Engine is running	• Injector • Harness or connectors • ECM
P0264	Cylinder 2 - Injector Circuit Low		
P0267	Cylinder 3 - Injector Circuit Low		
P0270	Cylinder 4 - Injector Circuit Low		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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2. INSPECTION START

- Start engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 4.

No >> Go to step 5.

3. PERFORM ACTIVE TEST FUNCTION

- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to step 5.

4. CHECK FUNCTION OF INJECTOR

- Listen to injector operating sound one by one.

Do all injectors clicking noise exist?

Yes >> Go to step 10.

No >> Go to the next step.

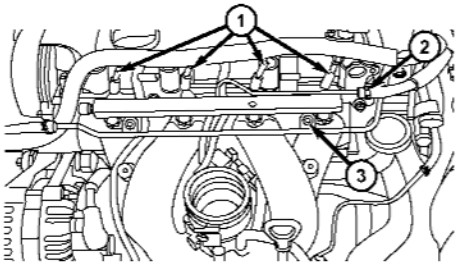
5. CHECK INJECTOR ELECTRICAL CONNECTOR

- Disconnect the Injector (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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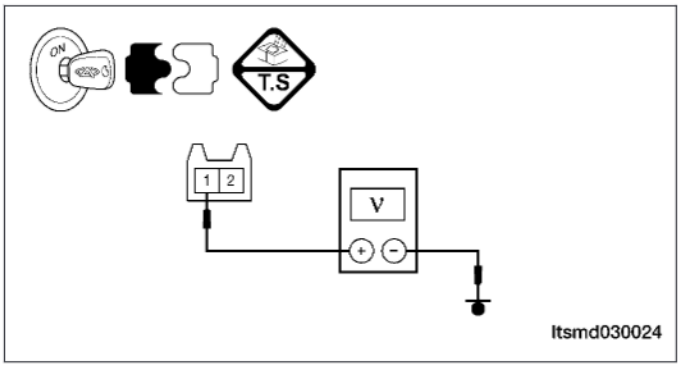
6. CHECK INJECTOR POWER SUPPLY CIRCUIT FOR SHORT TO GROUND

- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Check the following:
  - Front fuse and relay box F3, A13, G5
  - Fuse 12, fuse 24, fuse 27

Without EOBD (1.6L).

- Front fuse and relay box F3, G2, G5
- Fuse 12, Fuse 23, Fuse 24
- harness between injector and fuse

Is the check result normal?

Yes >> With the X-431, check the system, If OK, go to the next step.

No >> Repair malfunctioning parts.

8. CHECK INJECTOR CONTROL CIRCUITS FOR A SHORT

- Check injector control circuit voltage.
- 3.6 V should exist.

Is the check result normal?

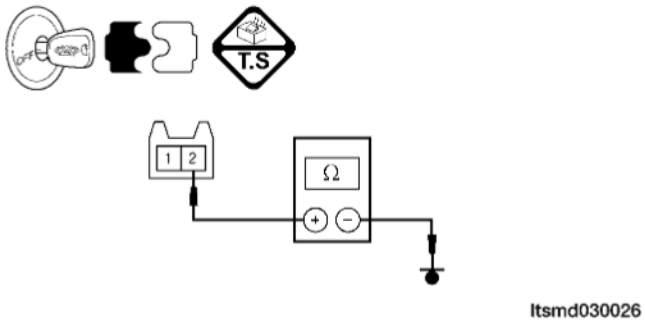
Yes >> Go to step 10.

No >> Go to the next step.

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9. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.
- Continuity should not exist.

INJECTOR NO.	INJECTOR TERMINAL	GROUND	
1	2	Ground	
2	2		
3	2		
4	2		

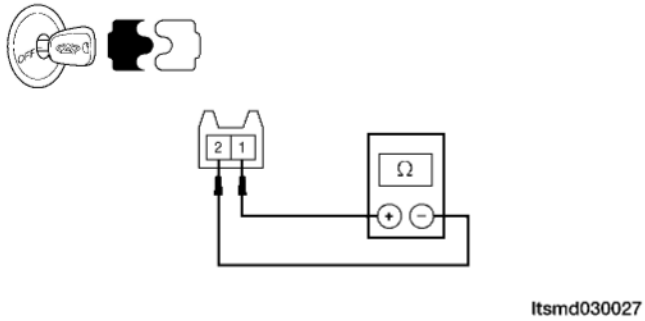
Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short in harness or connectors.

10. CHECK INJECTOR RESISTANCE

- Check the fuel injector resistance as shown in the following:

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)	
1	1 & 2	12	
2	1 & 2		
3	1 & 2		
4	1 & 2		

- Check sensor signal output.
- Connect ECM connector.
- Connect injector connectors.
- Check the fuel injector voltage as shown in the following:

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

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Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0261, P0264, P0267 or P0270 still present?

Yes >> Replace the ECM.

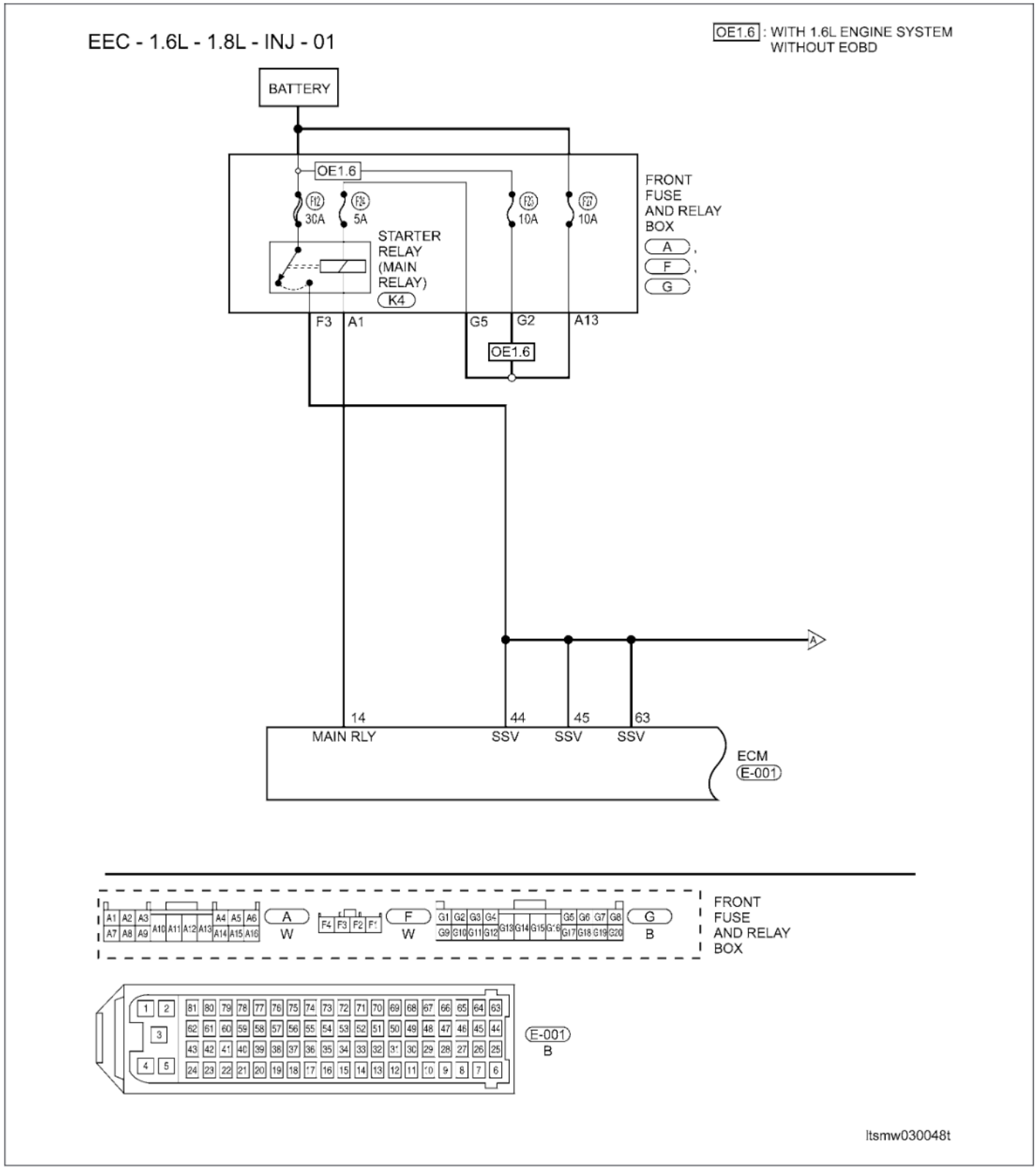
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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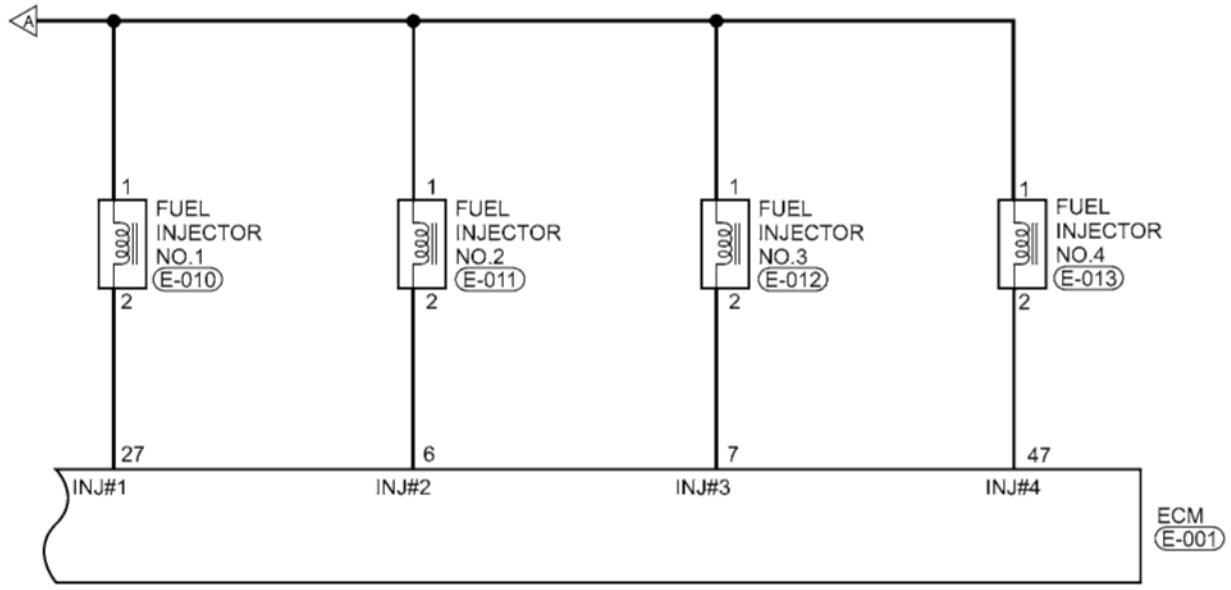
P0262 - Cylinder 1 Injector Circuit High
P0265 - Cylinder 2 Injector Circuit High
P0268 - Cylinder 3 Injector Circuit High
P0271 - Cylinder 4 Injector Circuit High

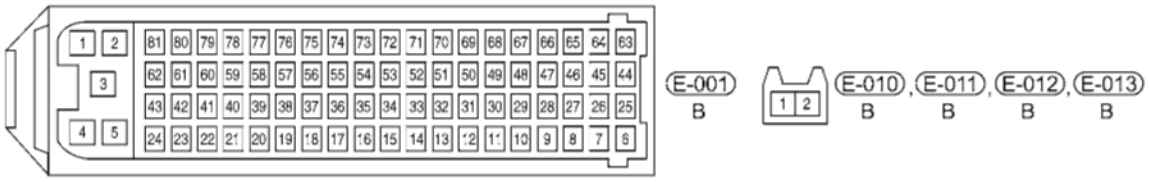
Injector Circuit High



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EEC - 1.6L - 1.8L - INJ - 02





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Check reference values between ECM terminals and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0262	Cylinder 1 - Injector Circuit High	Engine is running	• Injector • Harness or connectors • ECM
P0265	Cylinder 2 - Injector Circuit High		
P0268	Cylinder 3 - Injector Circuit High		
P0271	Cylinder 4 - Injector Circuit High		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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2. INSPECTION START

- Start engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 4.

No >> Go to step 5.

3. PERFORM ACTIVE TEST FUNCTION

- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to step 5.

4. CHECK FUNCTION OF INJECTOR

- Listen to injector operating sound one by one.

Do all injectors clicking noise exist?

Yes >> Go to step 10.

No >> Go to the next step.

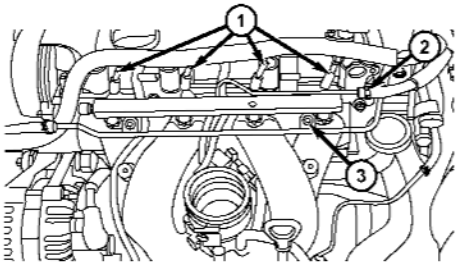
5. CHECK INJECTOR ELECTRICAL CONNECTOR

- Disconnect the Injector (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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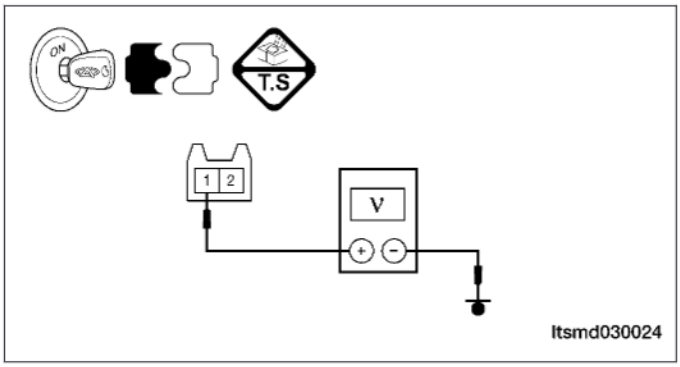
6. CHECK INJECTOR POWER SUPPLY CIRCUIT FOR SHORTED

- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Check the following:
  - Front fuse and relay box F3, A13, G5
  - Fuse 12, fuse 24, fuse 27

Without EOBD (1.6L)

  - Front fuse and relay box F3, G2, G5
  - Fuse 12, Fuse 23, Fuse 24
- Check harness for open or shorted between injector and fuse.

Is the check result normal?

Yes >> With the X-431, check the system, If OK, go to the next step.

No >> Repair or replace malfunctioning parts.

8. CHECK INJECTOR CONTROL CIRCUITS FOR A SHORT

- Check injector control circuit voltage.
- 3.6 V should exist.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to the next step.

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9. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check the injector control circuits for short to power supply circuits.
- Check the following.
- Voltage should not exist.

INJECTOR NO.	POWER SUPPLY CIRCUIT	INJECTOR TERMINAL
1	Power supply circuit	2
2		2
3		2
4		2

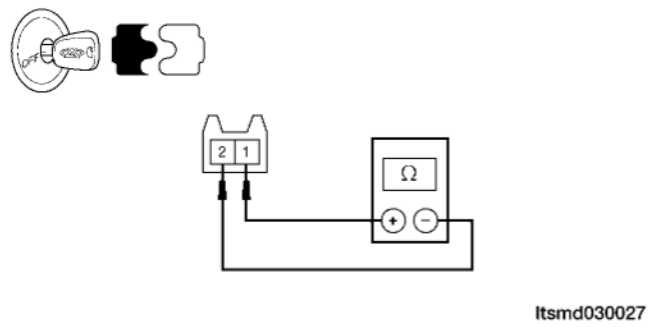
Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short in harness or connectors.

10. CHECK INJECTOR RESISTANCE

- Check resistance as table shown.
- Check the fuel injector resistance as shown in the following:

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)	
1	1 & 2	16	
2	1 & 2		
3	1 & 2		
4	1 & 2		

- Check signal output.
- Connect ECM connector.
- Connect injector connectors.
- Check the fuel injector voltage as shown in the following:

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.

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11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See ″DTC Confirmation Procedure″.

Is DTC P0262, P0265, P0268 or P0271 still present?

Yes >> Replace the ECM.

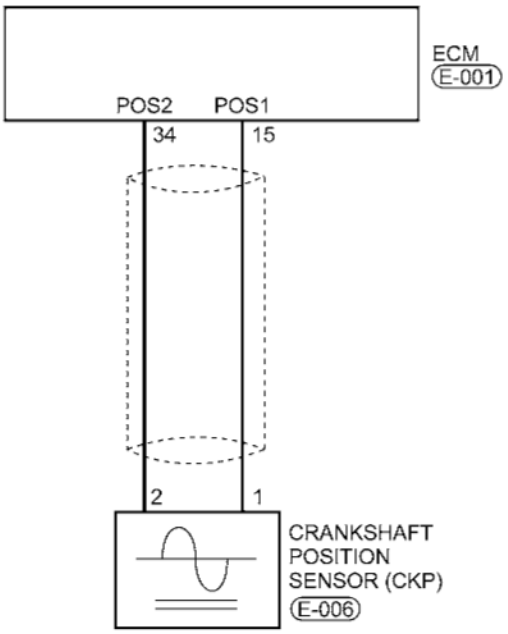
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

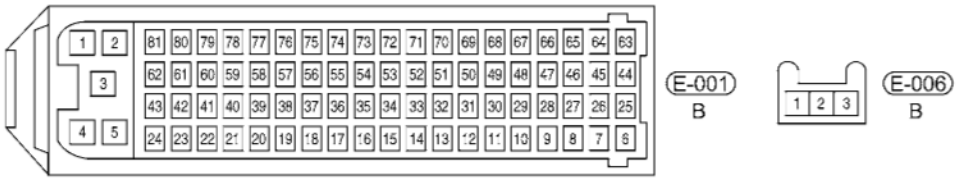
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0321 - Distributor Engine Speed In Phase Circuit Performance

EEC - 1.6L - 1.8L - POS - 01





ltsmw030046t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
15 34	Crankshaft Position (CKP) sensor	• Ignition switch: ON • Engine: Not cranking	3 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0321	Distributor engine speed in phase circuit performance	Engine is running	ECM detected that the input signal is out of the acceptable range.	• CKP sensor • Crankshaft signal plate • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Crank engine for a few seconds and run it for a few seconds then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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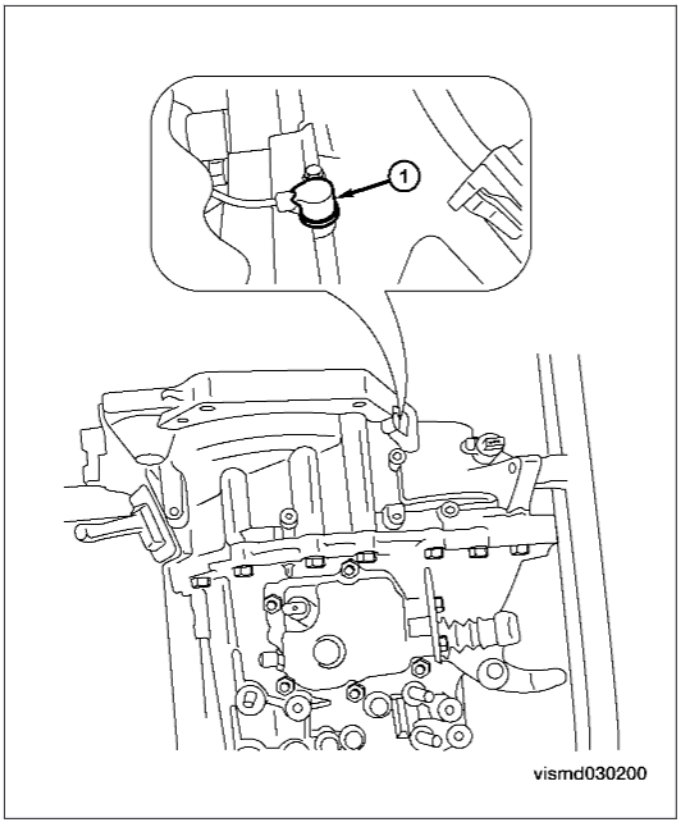
2. CHECK CRANKSHAFT POSITION (CKP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the Injector (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



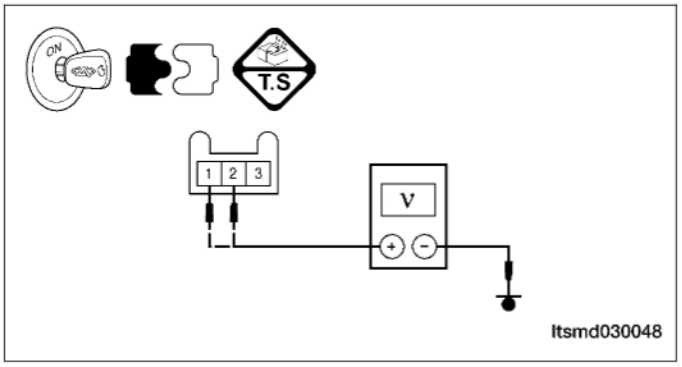
3. CHECK CRANKSHAFT POSITION (CKP) SENSOR REFERENCE VOLTAGE

- Turn ignition switch on.
- Check CKP sensor supply voltage between sensor connector E-006, terminal 1 and ground, terminal 2 and ground in the sensor electrical connector.
- 3 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check harness for an open or short between CKP sensor and ECM.

Is the check result normal?

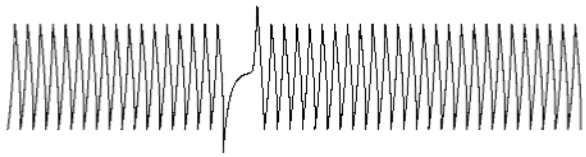
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair circuit for open or short in harness or connectors.

5. CHECK CKP SENSOR SIGNAL WAVE PATTERN

- Connect ECM connector.
- Connect CKP sensor connector.
- Check sensor output signal when engine is running.

	CKP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030002

Is the CKP sensor output signal normal?

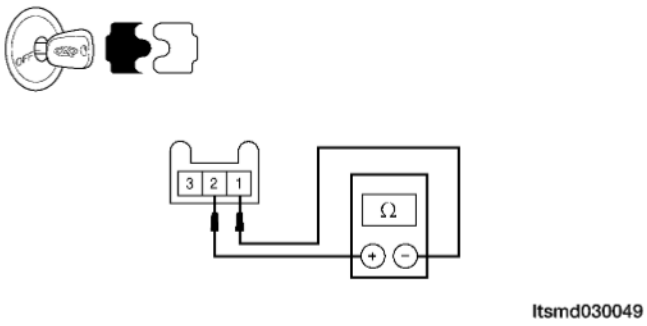
Yes >> Go to step 9.

No >> Go to the next step.

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6. CHECK CKP SENSOR

- Check resistance as table shown.
- Remove the sensor.
- Visually check the sensor for chipping.

TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Approximately 860 Ω	

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Is the check result normal?

Yes >> Replace the CKP sensor with a known good CKP sensor.
Monitor the CKP sensor signal on the KES-200 screen.
- If the CKP sensor signals were normal, the system is OK.
- If the CKP sensor signals were still irregular or missing, go to step 7.

No >> Replace or clear CKP sensor.

7. CHECK INSTALLED CLEARANCE

- Check the installed clearance (See Crankshaft Position (CKP) Sensor Removal & Installation in Section 08 Transaxle & Transfer Case).
- 0.8 - 1.2 mm should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Reinstall CKP sensor.

8. CHECK GEAR TOOTH

- Visually check for chipping signal plate gear tooth.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the signal plate

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9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0321 still present?

Yes >> Replace the ECM.

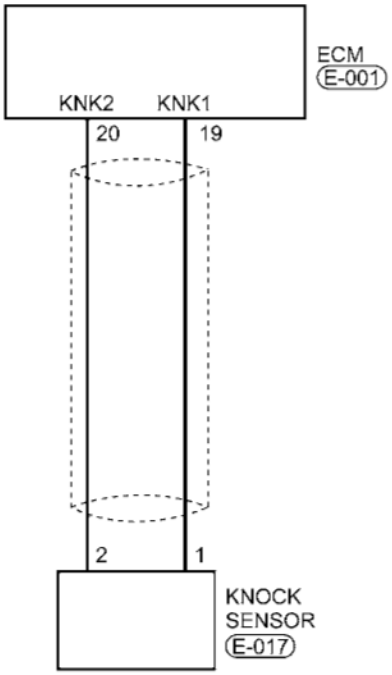
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

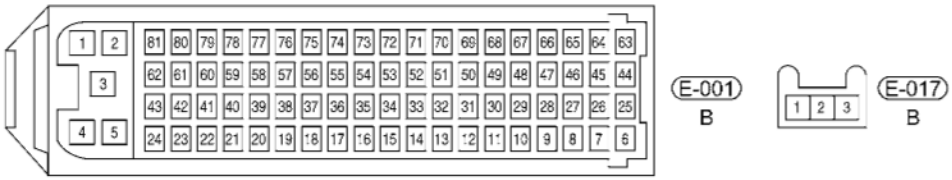
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0324 - Knock Control System Error

EEC - 1.6L - 1.8L - KNK - 01





ltsmw030047t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	TEST METHOD	DATA (AVERAGE DC VOLTAGE)
19	Knock sensor 1	• Test Method 1: Knock at cylinder with rubber hammer • Test Method 2: Knock at sensor slightly	Output signal voltage should exist.
20	Knock sensor 2		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC SET CONDITION	POSSIBLE CAUSE
P0324	Knock control system error	ECM detected that the input signal is out of the acceptable range.	• Knock sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Run engine for a while then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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2. CHECK KNOCK SENSOR RESISTANCE

- Disconnect knock sensor harness connector.
- Check resistance between knock sensor connector E-017, terminal 1 and terminal 2.
- The resistance should be above 1 MΩ.

Is the check result normal?

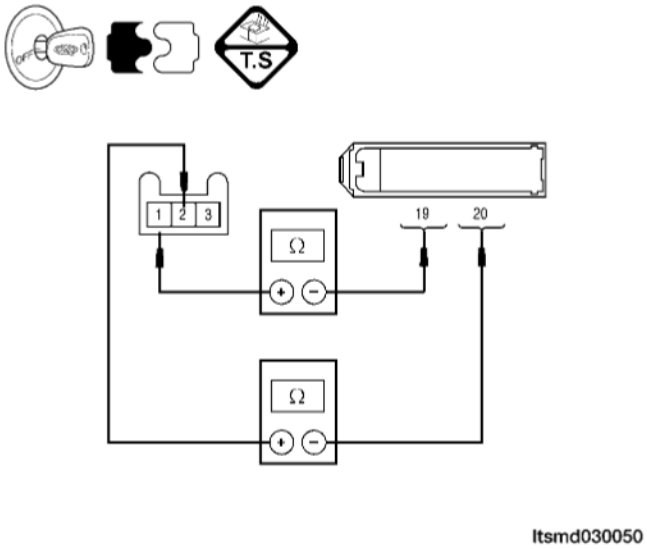
Yes >> Go to the next step.

No >> Replace knock sensor.

3. CHECK KNOCK SENSOR INPUT SIGNAL CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between sensor connector E-017, terminal 1 and ECM terminal 19, sensor terminal 2 and ECM terminal 20.

ECM CONNECTOR TERMINAL	KNOCK SENSOR CONNECTOR TERMINAL
19	1
20	2



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- Continuity should exist.
- Check harness for short to ground and short to power.

Is the check result normal?

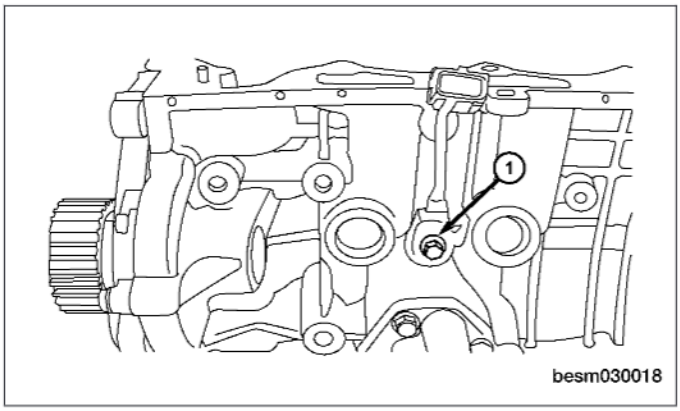
Yes >> Go to step 4.

No >> Repair circuit for an open or short in harness or connectors.

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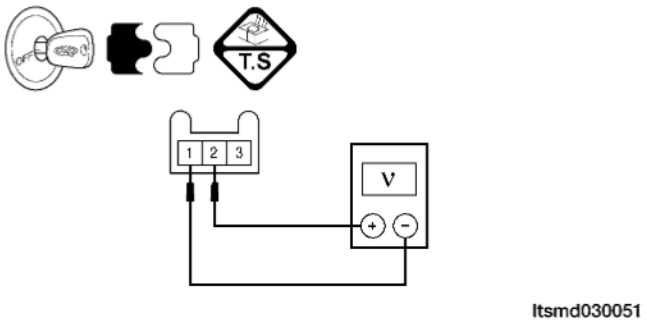
4. CHECK KNOCK SENSOR SIGNAL

- Check knock sensor (1) output signal as table shown.



- Set the digital multimeter to the voltage range.

KNOCK SENSOR TERMINAL NO.	TEST METHOD
1 & 2	Test Method 1: Knock at cylinder with rubber hammer
	Test Method 2: Knock at sensor slightly



- Output signal voltage should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace knock sensor.

5. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0324 still present?

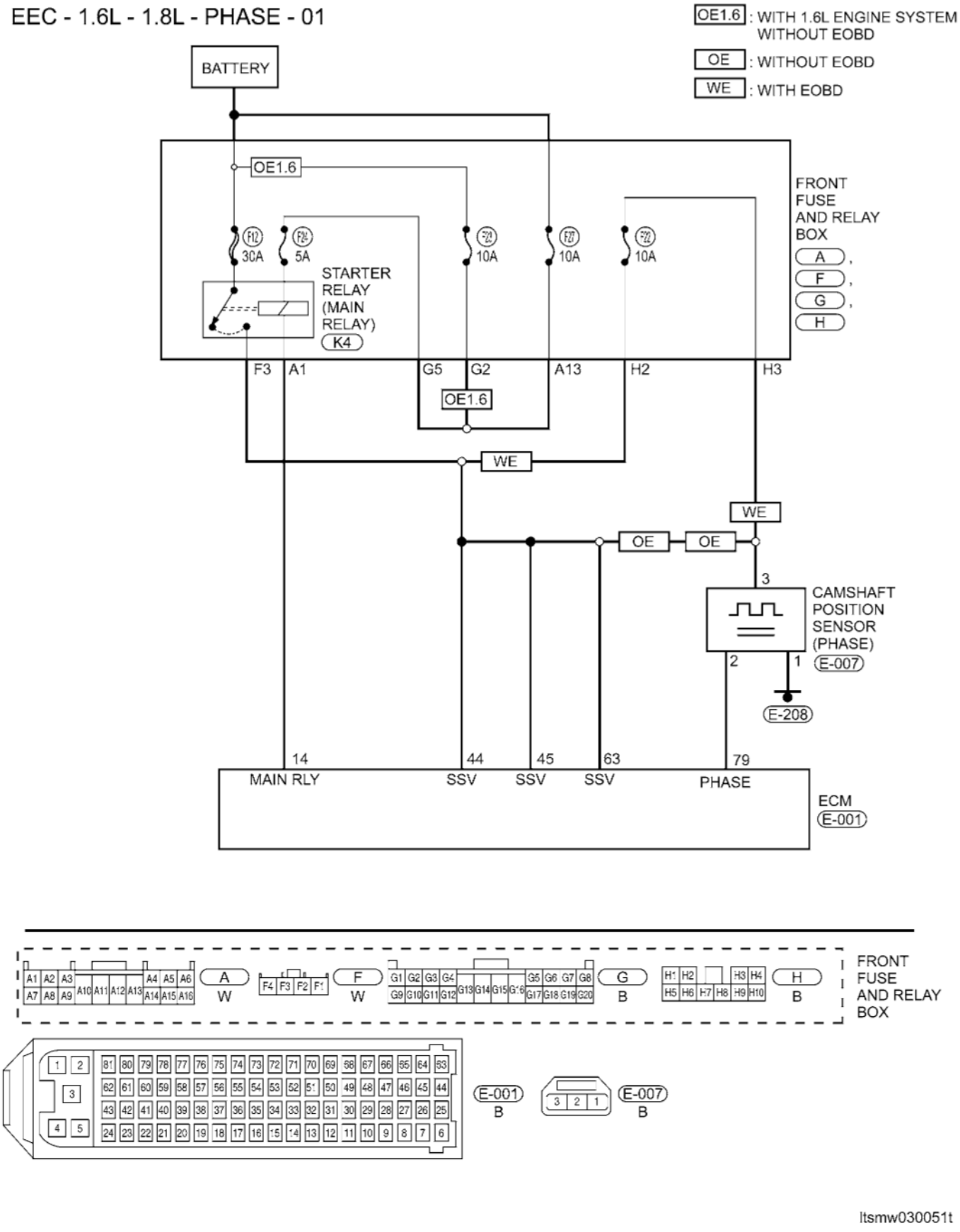
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0343 - Camshaft Position Sensor Circuit High Input



ltsmw030051t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	VOLT (AVERAGE DC VOLTAGE)
79	Camshaft Position (CMP) sensor	• Ignition switch: ON • Engine: Not cranking	11 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0343	Camshaft Position (CMP) sensor circuit high input	Engine is running	ECM detected that the input signal is out of the acceptable range.	• CMP sensor • Camshaft • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Run engine for a while then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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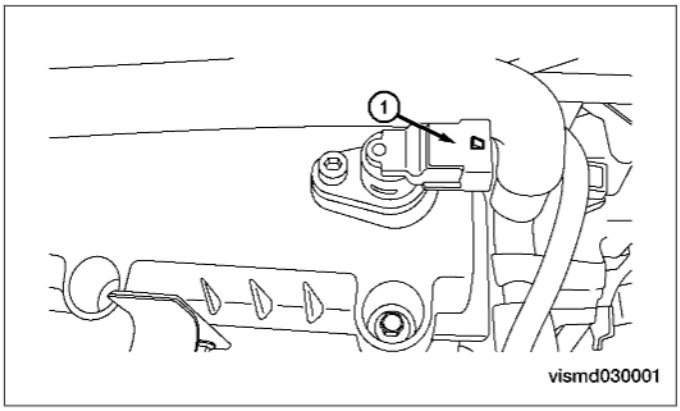
2. CHECK CAMSHAFT POSITION (CMP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the CMP sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



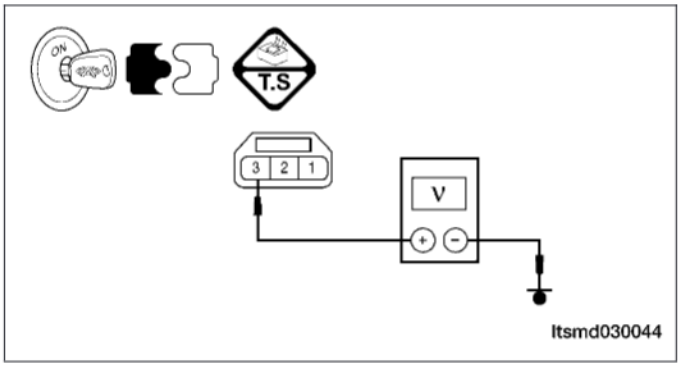
3. CHECK THE CAMSHAFT POSITION SENSOR POWER SUPPLY CIRCUIT FOR AN OPEN AND SHORT

- Turn ignition switch on.
- Check CMP sensor supply voltage between sensor connector E-007, terminal 3 and ground in the sensor electrical connector.
- 12 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



4. DETECT MALFUNCTIONING PART

- Check harness for an open or short between EVAP canister control valve and fuse.
- Check the following:

Without EOBD (1.6L)

- Front fuse and relay box F3, A1, G2, G5
- Fuse 23, fuse 24, fuse 12

Without EOBD

- Front fuse and relay box F3, A1, A13, G2, G5
- Fuse 23, fuse 24, fuse 12, fuse 27

WITH EOBD

- Front fuse and relay box F3, A1, A13, G5, H2, H3
- Fuse 22, fuse 24, fuse 12, fuse 27

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the malfunctioning parts.

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5. CHECK THE CMP SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Check harness continuity between CMP sensor terminal 1 and ground.
- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

6. CHECK THE CMP SENSOR INPUT SIGNAL CIRCUIT FOR OPEN OR SHORT TO POWER

- Turn ignition switch on.
- Check voltage between CMP sensor terminal 2 and ground.
- 11 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace open circuit or short to power in harness or connectors.
If circuit is normal, go to the next step.

7. CHECK CMP SENSOR SIGNAL

- Connect CMP sensor connector.
- Check signal voltage between CMP sensor terminal 2 and ground when engine is running.
- Approximately 6 V square wave signal should exist.

	CMP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030003

Is the CMP output signal normal?

Yes >> Go to step 10.

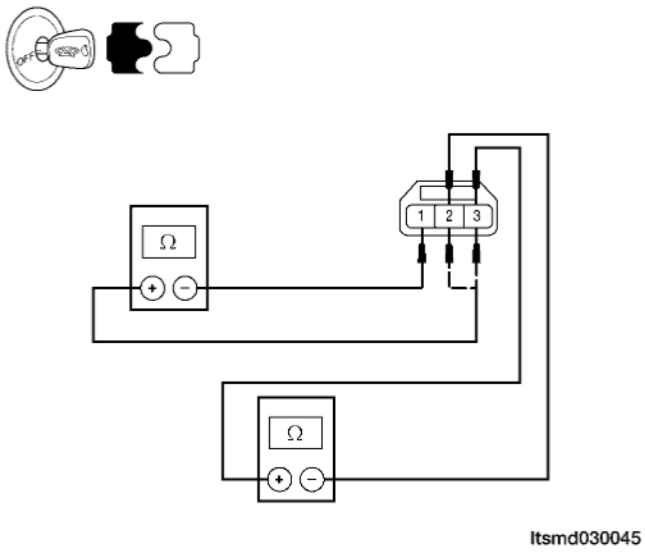
No >> Go to the next step.

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8. CHECK CMP SENSOR

- Check resistance as table shown.
- Remove the sensor.
- Visually check and clean the sensor for chipping.

TERMINAL NO.	RESISTANCE Ω (25°C)
1 & 2	Except 0 or ∞
1 & 3	
2 & 3	



Is the check result normal?

Yes >> Replace the CMP sensor with a known good CMP sensor.
Monitor the CMP sensor signal on the KES-200 screen.
- If the CMP sensor signals were normal, the system is OK.
- If the CMP sensor signals were still irregular or missing, go to Step 9.

No >> Replace CMP sensor.

9. CHECK INSTALLED CLEARANCE

- Check the installed clearance (See CMP Sensor Removal & Installation in Section 03 Electronic Engine Controls).
- 0.8 - 1.2 mm should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Reinstall CMP sensor.

10. CHECK CAMSHAFT

- Check the following:
  - Accumulation of debris to the signal plate of camshaft rear end
  - Chipping signal plate of camshaft rear end

Is the check result normal?

Yes >> Go to the next step.

No >> Remove debris and clean the signal plate of camshaft rear end or replace camshaft.

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11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0343 still present?

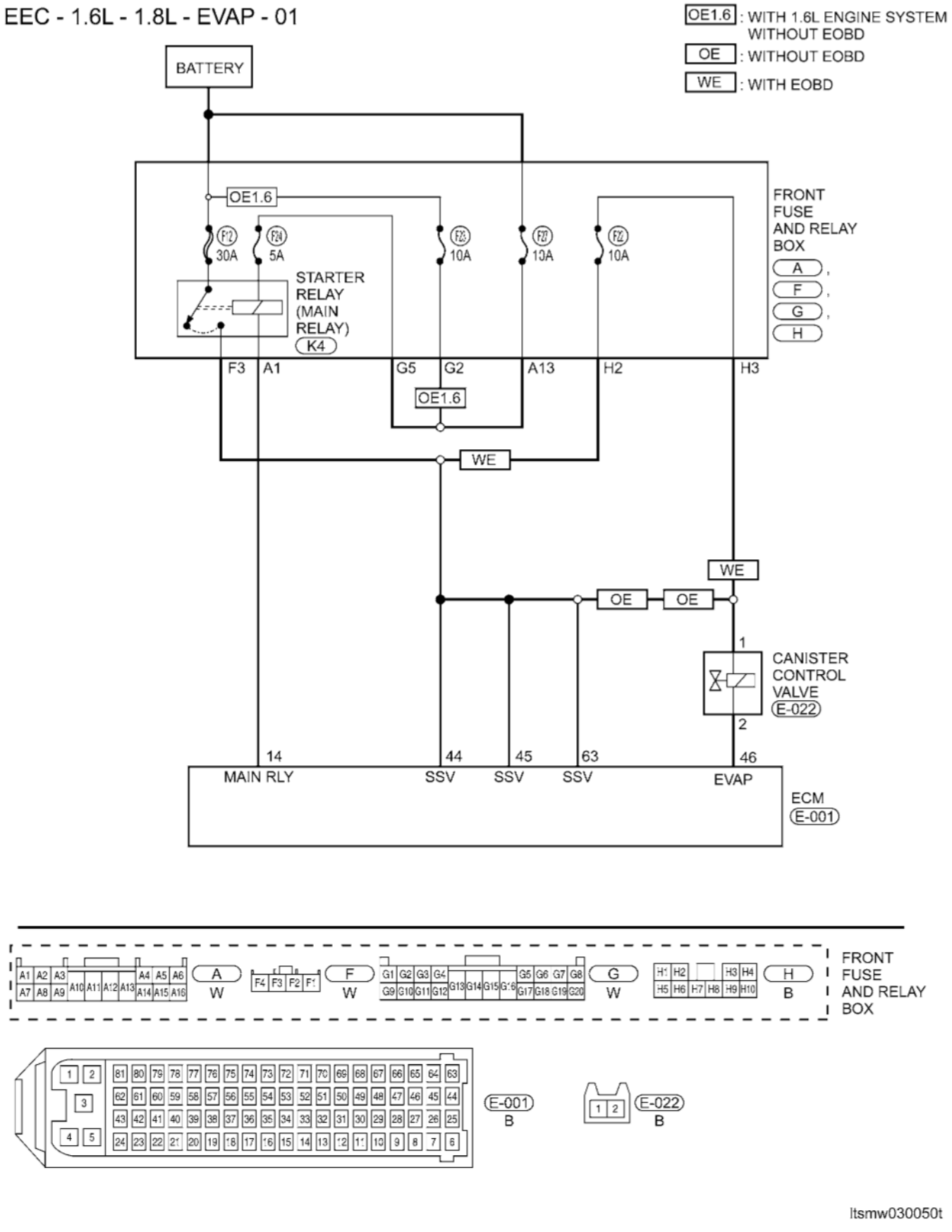
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0444 - Evaporative Emission System Purge Control Valve Circuit Open



ltsmw030050t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	X-431 DATA STREAM
46	Canister control valve	When engine is running	0 % - 99.9 %

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0444	Evaporative emission system purge control valve circuit open	Engine is running	ECM detected that the improper voltage signal is sent to ECM.	• EVAP canister control valve • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

2. CHECK EVAP CANISTER CONTROL VALVE ACTION

- Start engine and warm it up to the normal operating temperature then select view DTC.
- Touch the EVAP canister valve body, raise engine speed up to 2,000 RPM.
- Use the scan tool X-431 ″ACTIVE TEST″ function of the EVAP canister valve, touch the EVAP canister valve body, perform the action test.
- A slight vibration should exist.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

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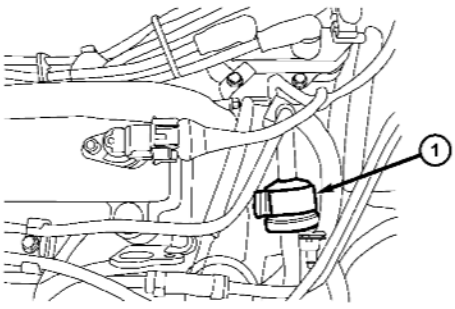
3. CHECK EVAP CANISTER CONTROL VALVE ELECTRICAL CONNECTOR

- Disconnect the EVAP canister control valve (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



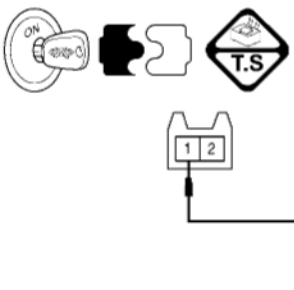
4. CHECK EVAP CANISTER CONTROL VALVE POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between EVAP canister control valve terminal 1 and ground.
- 12 V should exist.

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.



5. DETECT MALFUNCTIONING PART

- Check harness for an open or short between EVAP canister control valve and fuse.
- Check the following:

Without EOBD (1.6L)

- Front fuse and relay box F3, A1, G2, G5
- Fuse 23, fuse 24, fuse 12

Without EOBD

- Front fuse and relay box F3, A1, A13, G2, G5
- Fuse 23, fuse 24, fuse 12, fuse 27

With EOBD

- Front fuse and relay box F3, A1, A13, G5, H2, H3
- Fuse 22, fuse 24, fuse 12, fuse 27

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

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6. CHECK EVAP CANISTER CONTROL VALVE CONTROL CIRCUIT FOR AN OPEN

- Check voltage between EVAP canister control valve terminal 2 and ground.
- Approximately 3.6 V should exist.

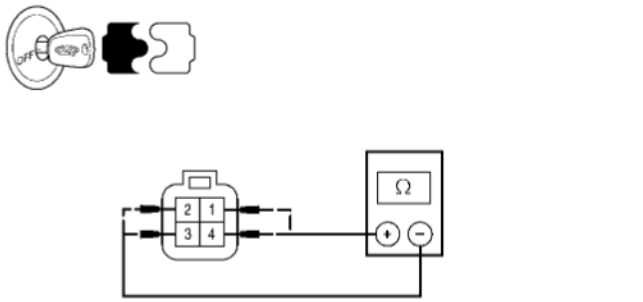
Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace open circuit in harness or connectors.
If harness is normal, go to the next step.

7. CHECK EVAP CANISTER CONTROL VALVE

- Turn ignition switch off.
- Remove EVAP canister control valve.
- Check resistance as table shown.

EVAP CANISTER CONTROL VALVE TERMINAL NO.	RESISTANCE Ω (20°C)	
1 & 2	Approximately 26 Ω	

- Check air passage continuity and operation when apply 12 V current supply voltage between terminal 1 and 2.
- The check results should match specification.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace EVAP canister control valve.

8. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0444 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0506 - Idle Control System RPM Lower Than Expected

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0506	Idle control system RPM lower than expected	• Engine is running. • With the engine idling in drive, the brake applied, engine run time below a calibrated minimum value, and no VSS, MAF/MAP, ECT, TPS, ETC, Crankshaft Position sensor, fuel system, or injector DTCs present.	ECM detected that the idle speed is less than the acceptable range.	• Electronic throttle control actuator • Intake air leak • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
If DTC P0506 is displayed with other DTCs, perform this diagnostic procedure before other DTCs.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK INTAKE AIR LEAK

- Start engine and let it idle.
- Listen for an intake air leak after the mass air flow sensor.

Is the check result normal?

Yes >> Go to the next step.

No >> Discover air leak location and repair.

2. CHECK THE ELECTRIC THROTTLE CONTROL ACTUATOR

- Check the electronic throttle open degree.
- Check the electronic throttle clearance.

Is the check result normal?

Yes >> Go to the next step.

No >> Clean or replace as necessary.

3. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0506 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0601 - Internal Control Module Memory Check Sum Error
P0604 - Internal Controller Module Random Access Memory (RAM) Error
P0605 - Internal Controller Module ROM Test Error
P0606 - ECM Processor

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0601	Internal control module memory check sum error	ECM detected an internal failure.	• ECM
P0604	Internal control module Random Access Memory (RAM) error		
P0605	Internal control module ROM test error		
P0606	ECM processor		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Run engine for a while then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK DTC

- Perform DTC confirmation procedure.

Is DTC P0601, P0604, P0605 or P0606 present?

Yes >> Go to the next step.

No >> The DTC condition is intermittent (See Diagnostic Help in Section 03 Electronic Engine Controls).

2. CHECK ECM POWER SUPPLY AND GROUND

- Check if the ECM supply voltage circuit, ground circuit open, high resistance or short circuits existing.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short in harness or connectors.

3. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0601, P0604, P0605 or P0606 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0602 - ECM Programming Error

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	POSSIBLE CAUSE
P0602	ECM programming error	• ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Run engine for a while then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK DTC

- Perform DTC confirmation procedure.

Is DTC P0602 present?

Yes >> Go to the next step.

No >> The DTC condition is intermittent (See Diagnostic Help in Section 03 Electronic Engine Controls).

2. CHECK ECM POWER SUPPLY AND GROUND

- Check if the ECM supply voltage circuit, ground circuit open, high resistance or short circuits existing.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for open or short in harness and connectors.

3. MATCH ECM

- With the scan tool X-431, match the ECM before replacing it (See ECM Removal & Installation in Section 03 Electronic Engine Controls), and view the DTC with the X-431.

Is DTC P0602 still present?

Yes >> Go to the next step.

No >> The DTC was caused by a programming error.

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4. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0602 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

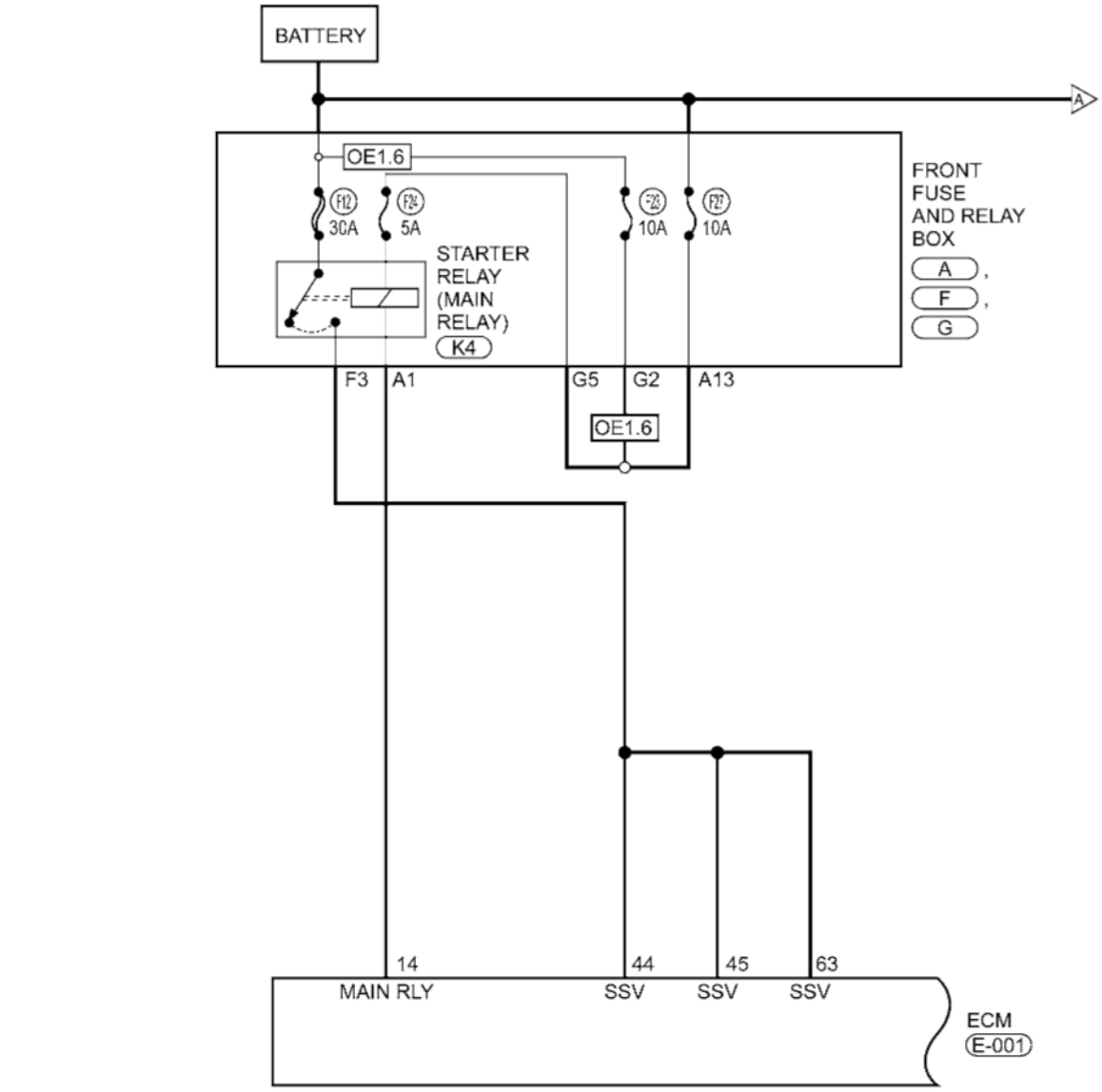
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

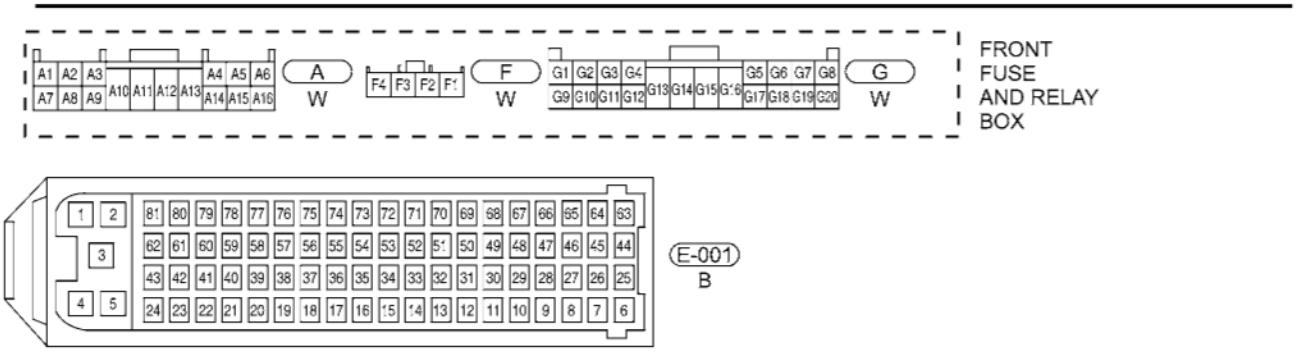
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P0645 - A/C Clutch Relay Circuit

EEC - 1.6L - 1.8L - A/C - 01

OE1.6 : WITH 1.6L ENGINE SYSTEM WITHOUT EOBD

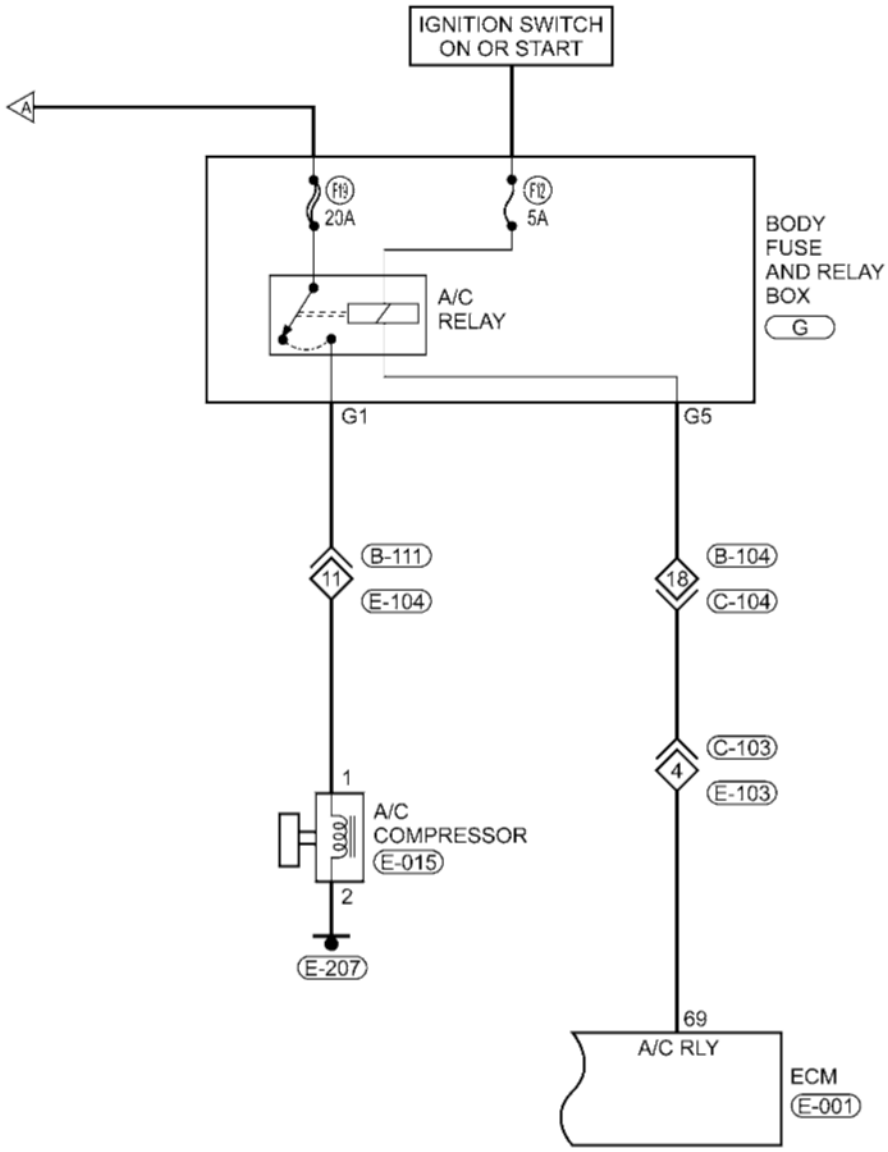


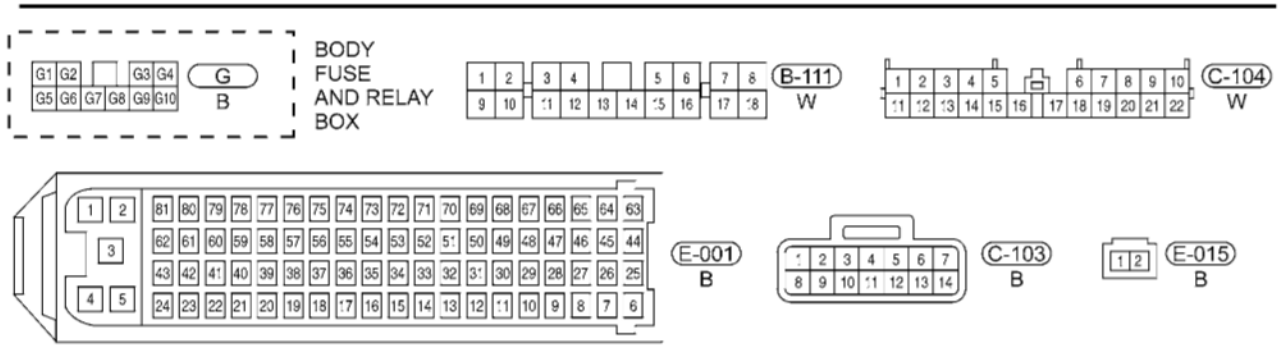


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EEC - 1.6L - 1.8L - A/C - 02





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
69	Air compressor relay	• After engine has been started for 5 seconds, A/C can be turned on. • If IAT is above 140.3°C , A/C will be shut off. • If ECT is above 140.3°C, A/C will be shut off. If ECT is below 111.8°C, A/C will resume. • If A/C high side pressure is above 20.0 bar, A/C will be shut off. If A/C high side pressure is below 19.5 bar, A/C will resume. • If evaporator temperature is below 1.5°C, A/C will be shut off. If evaporator temperature is above 4.5°C, A/C will resume. • If system voltage is below 8.04 V, A/C will be shut off. If system voltage is above 10.01 V, A/C will resume.	0 V or 12 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0645	A/C clutch relay circuit	Engine is running	ECM detected that the input signal is out of the acceptable range.	• Fuse • A/C compressor relay • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature.
- Turn A/C switch on then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

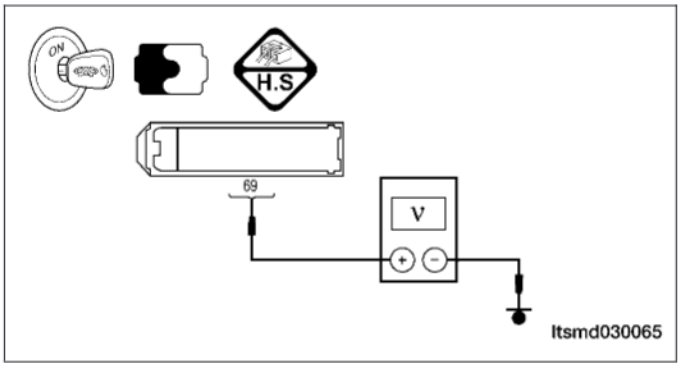
Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

2. CHECK A/C CLUTCH RELAY CONTROL CIRCUIT

- Turn off A/C switch.
- Check A/C clutch relay control circuit supply voltage between ECM terminal 69 and ground in the ECM electrical connector E-001.
- Battery voltage should exist.



Is the check result normal?

Yes >> Go to step 4.

No >> Go to the next step.

3. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse FB18, SB2
  - Front fuse and relay box K, E, J
  - A/C compressor relay, EMS relay (R2)
  - Check harness for an open or short between ECM terminal 69 and fuse 12.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

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4. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See ″DTC Confirmation Procedure″.

Is DTC P0645 still present?

Yes >> Replace the ECM.

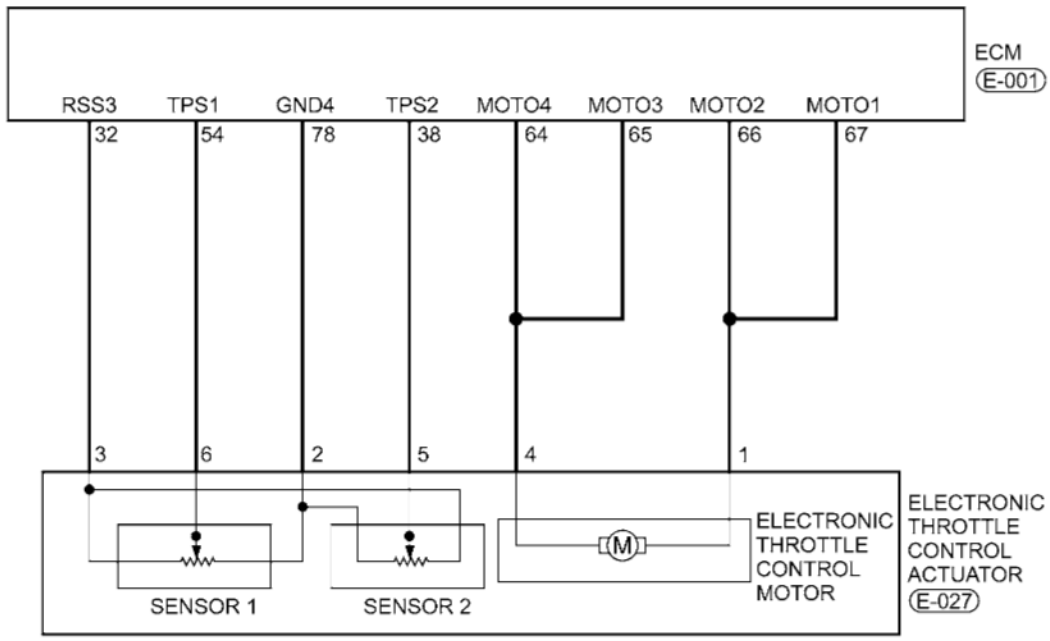
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

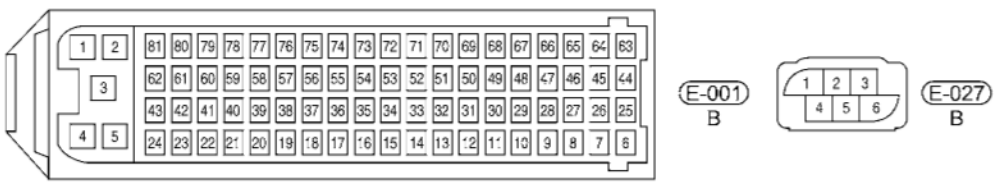
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P1545 - Throttle Position Control Malfunction

EEC - 1.6L - 1.8L - TPS - 01

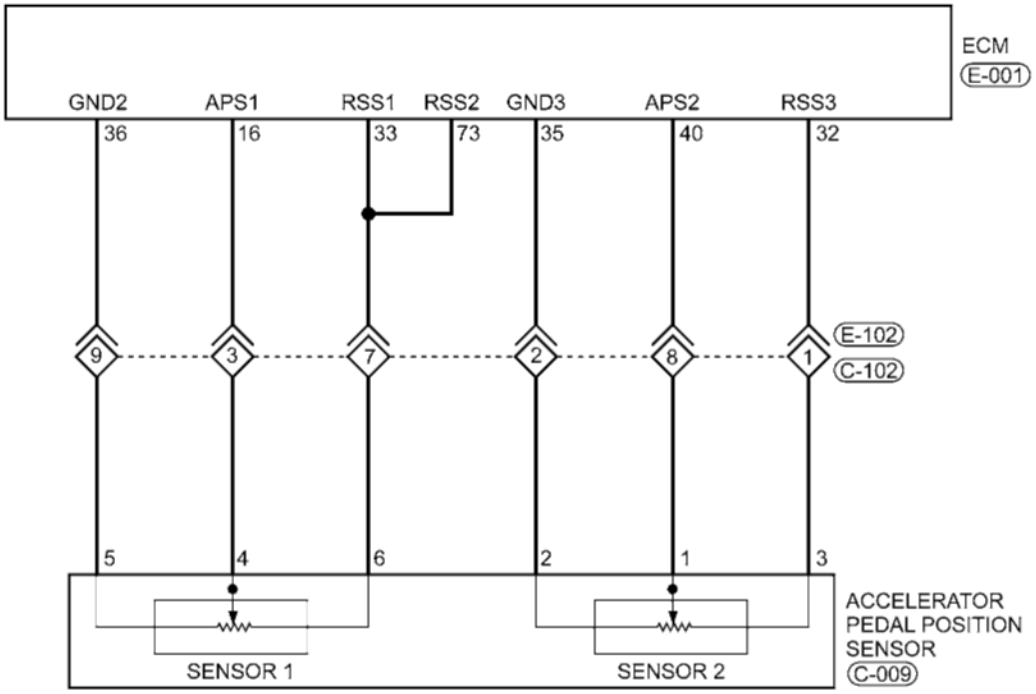


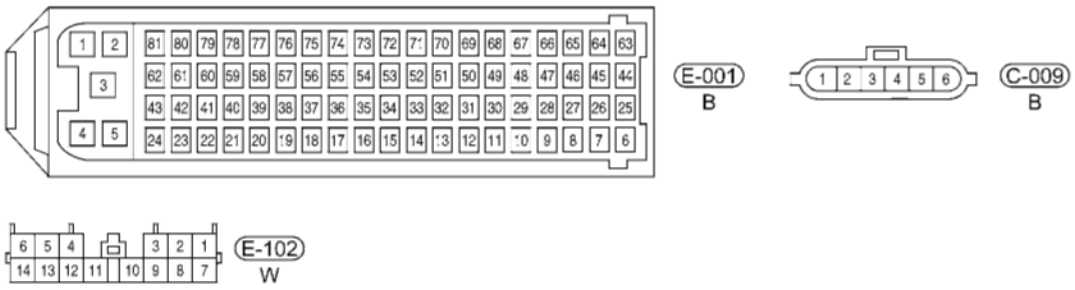


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EEC - 1.6L - 1.8L - APS - 01





ltsmw030045t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch on	-	Approximately 5 V
38	Electronic throttle control actuator (Position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
78	Sensor (GND)		-	Approximately 0 V
64	Motor 4			12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P1545	Throttle position control malfunction	Ignition switch on or after engine start.	Rationally incorrect voltage is sent to ECM compared with the signals from TPS1 and TPS2.	• Electronic throttle control actuator (TPS1 and TPS2) • Harness or connectors • Accelerator pedal position sensor 2 • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

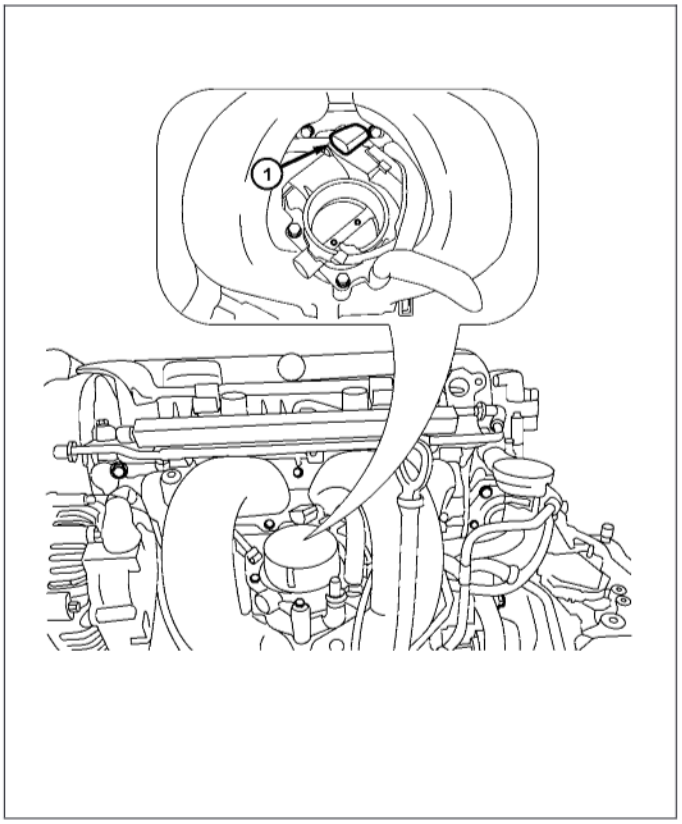
2. CHECK THROTTLE POSITION SENSOR (TPS) ELECTRICAL CONNECTOR

- Disconnect the TPS (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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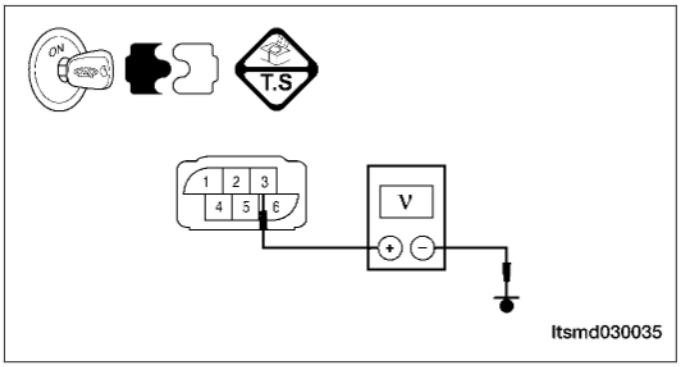
3. CHECK THE THROTTLE POSITION SENSOR (TPS) POWER SUPPLY CIRCUIT - (1)

- Turn ignition switch on.
- Check supply voltage between TPS terminal 3 and ground in the TPS electrical connector E-027.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



4. CHECK THE TPS POWER SUPPLY CIRCUIT - (2)

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between TPS terminal 3 and ECM terminal 32.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open.

5. CHECK THE TPS POWER SUPPLY CIRCUIT - (3)

- Check harness for short to power or short to ground, between following terminals.

ECM TERMINAL	TPS TERMINAL
32	TPS terminal 3
32	APP sensor terminal 3
33	APP sensor terminal 6

Is the check result normal?

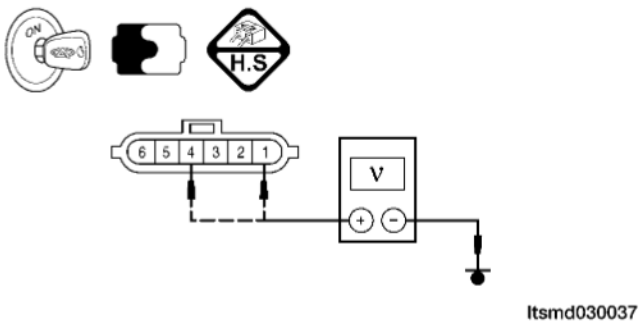
Yes >> Go to the next step.

No >> Repair circuit for short to ground or short to power in harness or connectors.

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6. CHECK THE ACCELERATOR PEDAL POSITION (APP) SENSOR

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 16 (APP sensor 1) and ground, terminal 40 (APP sensor 2) and ground under the following conditions:

ECM TERMINAL	APP SENSOR TERMINAL	
16	APP sensor terminal 4	
40	APP sensor terminal 1	

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
16	Accelerator Pedal Position Sensor 1 (APPS1)	Turn ignition switch on	• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	Accelerator Pedal Position Sensor 2 (APPS2)		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
			• Engine stopped • Accelerator pedal: Fully depressed	1.97 V

Is the check result normal?

Yes >> Go to step 10.

No >> Replace the Accelerator Pedal Assembly (See Accelerator Pedal Position Sensor Removal & Installation in Section 03 Electronic Engine Controls).

7. CHECK THE TPS SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between electronic throttle control actuator terminal 5 and ECM terminal 38, electronic throttle control actuator terminal 6 and ECM terminal 54.
- Continuity should exist.
- Check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

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8. CHECK THE TPS GROUND CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between electronic throttle control actuator terminal 2 and ECM terminal 78.
- Continuity should exist.
- Check harness for short to power and short to ground.

Is the check result normal?

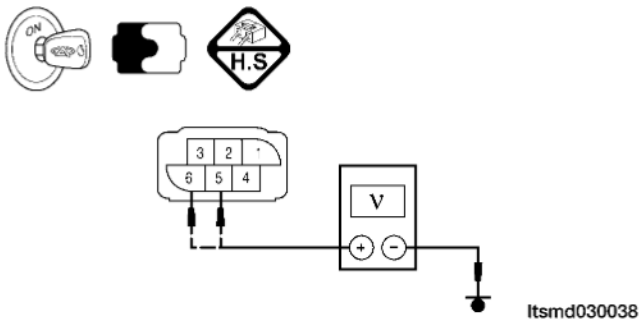
Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

9. CHECK TPS

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 54 (TP sensor 1) and ground, terminal 38 (TP sensor 2) and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
38 (TPS connector terminal 5)	Electronic throttle control actuator (Position sensor)	Ignition switch on	• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54 (TPS connector terminal 6)	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V



Is the check result normal?

Yes >> Go to the next step.

No >> Replace electronic throttle control actuator, and perform throttle valve position learning.

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10. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See DTC Confirmation Procedure.

Is DTC P1545 still present?

Yes >> Replace the ECM.

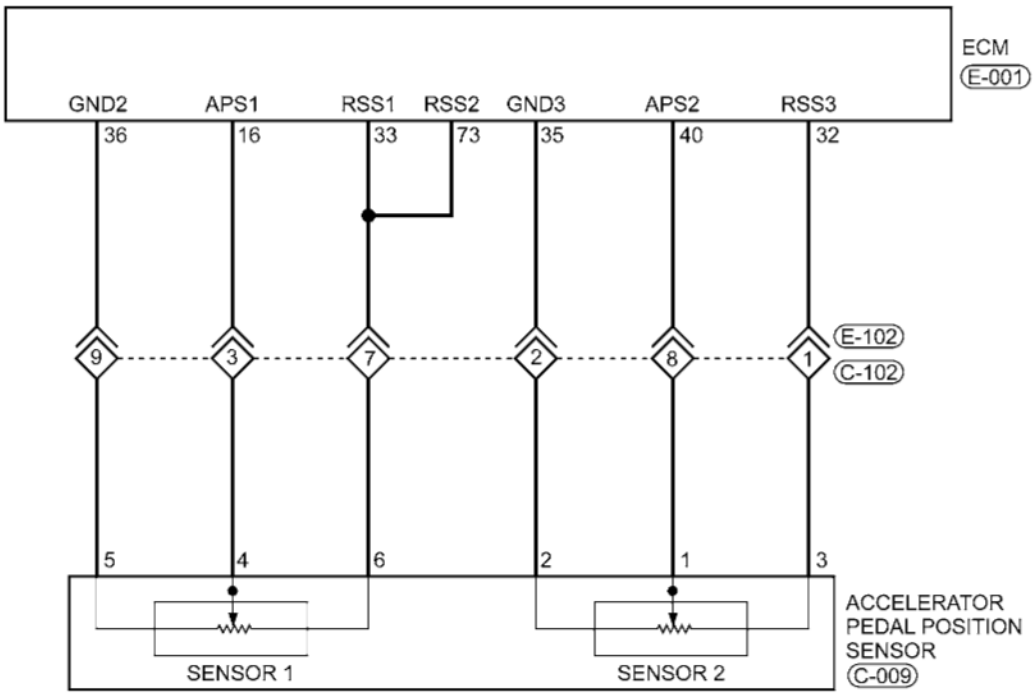
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

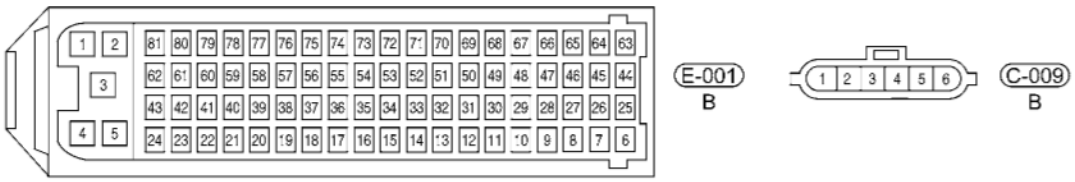
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

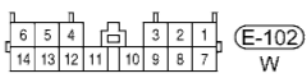
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P2138 - Pedal Position Sensor Performance

EEC - 1.6L - 1.8L - APS - 01



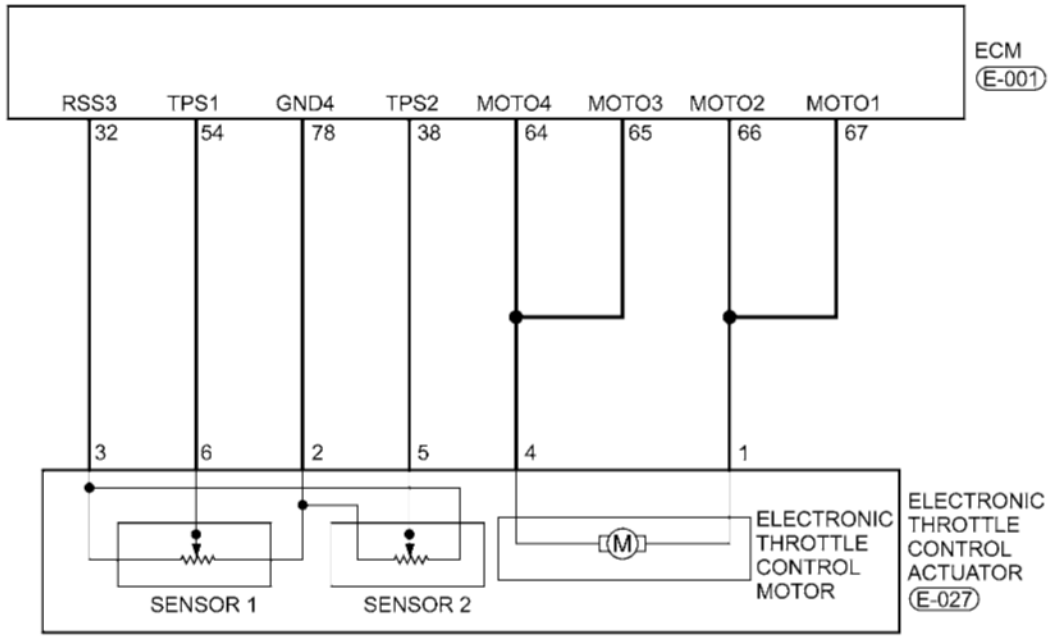


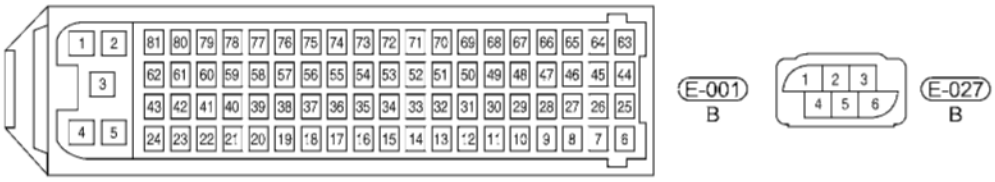


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EEC - 1.6L - 1.8L - TPS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
33	Regulated sensor supply 1		-	Approximately 5 V
16	Accelerator Pedal Position Sensor 1 (APPS1)		• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	Accelerator Pedal Position Sensor 2 (APPS2)		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
			• Engine stopped • Accelerator pedal: Fully depressed	1.97 V
35	Sensor (GND)		-	Approximately 0 V
36	Sensor (GND)		-	Approximately 0 V
73	Regulated sensor supply 1		-	Approximately 5 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P2138	Accelerator pedal position sensor performance	Ignition switch on or after engine start	Rationally incorrect voltage is sent to ECM compared with the signals from APPS1 and APPS2.	• Accelerator pedal position sensor 1 and 2 • Harness or connectors • Electronic throttle control actuator (TPS1 and TPS2) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 1.6L/1.8L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

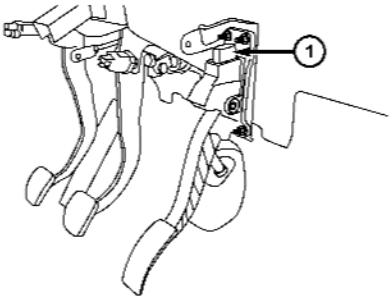
2. CHECK ACCELERATOR PEDAL POSITION SENSOR 1 (APPS1) ELECTRICAL CONNECTOR

- Disconnect the APPS1 electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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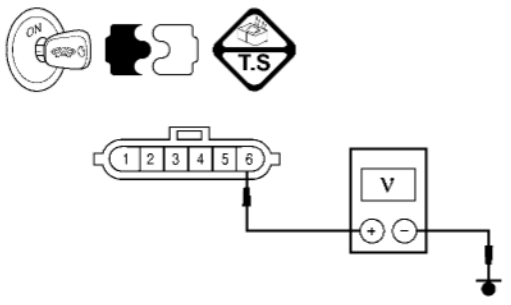
3. CHECK ACCELERATOR PEDAL POSITION SENSOR 1 (APPS1) POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between sensor terminal 6 and ground in the APP sensor electrical connector C-009.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check harness connectors E-102, C-102.
- Check harness for an open and short between APP sensor 1 and ECM.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

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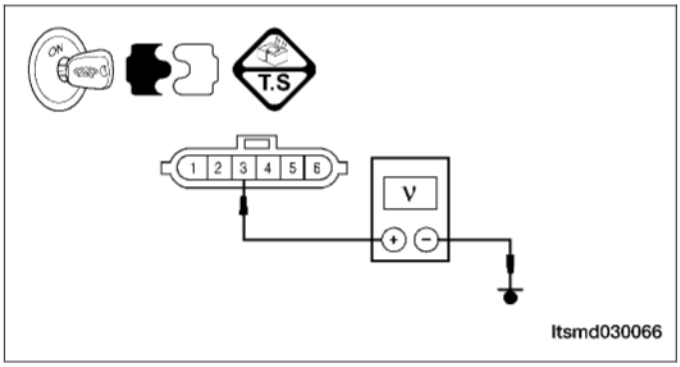
5. CHECK APP SENSOR 2 POWER SUPPLY CIRCUIT

- Check supply voltage between APP sensor terminal 3 and ground in the APP sensor electrical connector C-009.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.



6. DETECT MALFUNCTIONING PART

- Check harness connectors E-102, C-102.
- Check harness for an open and short between APPS2 and ECM.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

7. CHECK TPS POWER SUPPLY CIRCUIT

- Check harness for short to power and short to ground between following terminals.

ECM TERMINAL	TPS TERMINAL
32	3

Is the check result normal?

Yes >> Go to the next step.

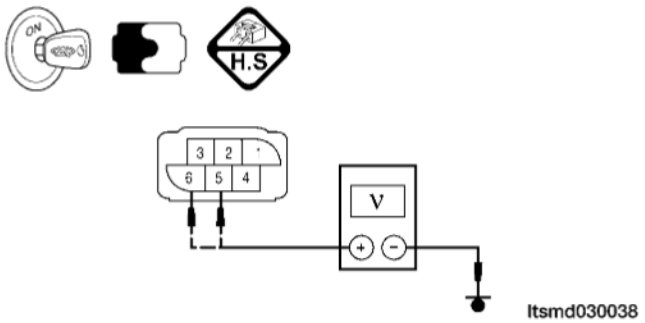
No >> Repair circuit for short to ground or short to power in harness or connectors.

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8. CHECK TPS

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 54 (TPS1) and ground, terminal 38 (TPS2) and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
38	Electronic throttle control actuator (Position sensor)	Ignition switch: ON	• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V



Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace TPS circuits for open or short.
If the TPS circuits are normal, replace electronic throttle control actuator. Perform throttle valve position self-learning.

9. CHECK APP SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between APP sensor 2 terminal 2 and ECM terminal 35, APP sensor 1 terminal 5 and ECM terminal 36.
- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

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10. CHECK APP SENSOR SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between APP sensor 1 terminal 4 and ECM terminal 16, APP sensor 2 terminal 1 and ECM terminal 40.
- Continuity should exist.
- Check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

11. CHECK APP SENSOR

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 16 (APP sensor 1) and ground, terminal 40 (APP sensor 2) and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
16	Accelerator Pedal Position Sensor 1 (APPS1)	Ignition switch: ON	• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	Accelerator Pedal Position Sensor 2 (APPS2)		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
			• Engine stopped • Accelerator pedal: Fully depressed	1.97 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace accelerator pedal assembly.
Perform Accelerator pedal position self-learning.

12. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P2138 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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Engine Coolant Temperature (ECT) Sensor

Description

The Engine Coolant Temperature (ECT) sensor threads into the coolant outlet connector. The ECT is a negative thermal coefficient sensor.

Operation

The ECT provides an input to the Engine Control Module (ECM). As temperature increases, resistance of the sensor decreases. As coolant temperature varies, the ECT sensor resistance changes resulting in a different voltage value at the ECT sensor signal circuit. The ECM uses the input to control air-fuel mixture, timing, A/C compressor and radiator fan on/off times.

Removal & Installation

1. Disconnect the negative battery cable.
2. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).

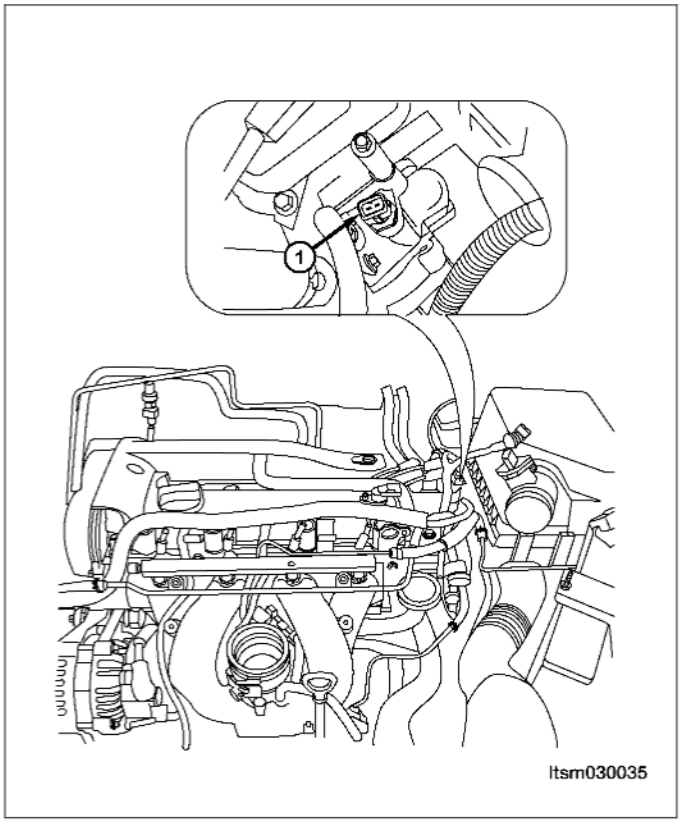
WARNING!

Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in serious personal injury.

3. Disconnect the coolant temperature sensor electrical connector.

CAUTION:
Remove the coolant temperature sensor when the engine is cold.

4. Remove the engine coolant temperature sensor (1).
   (Tighten: Engine coolant temperature sensor to 20 N·m)



5. Discard the O-ring.

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6. Installation is in the reverse order of removal.

NOTE :
After installed the engine coolant temperature sensor, check the coolant level.

Knock Sensor

Description

The knock sensor is attached to the cylinder block. The knock sensor is designed to detect engine vibration that is caused by detonation.

Operation

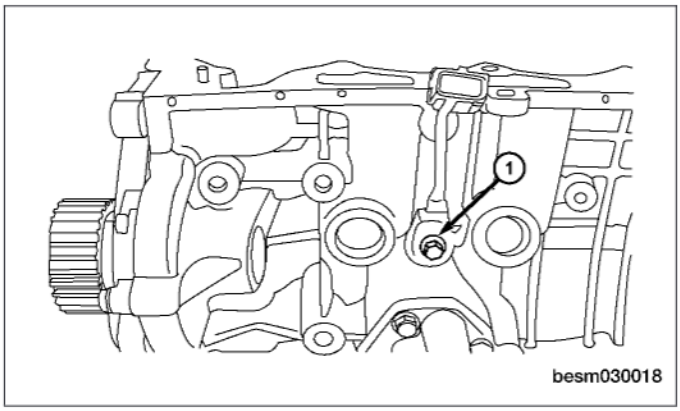
When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the Engine Control Module (ECM). In response, the ECM retards ignition timing for all cylinders by a specified amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the ECM while the engine operates. As the intensity of the crystal's vibration increases, the knock sensor output voltage also increases.

The ECM ignores knock sensor input during engine idle conditions. Once the engine speed exceeds a specified value, knock retard is allowed.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the knock sensor electrical connector.
3. Remove the knock sensor retaining bolt (1) and remove the knock sensor.
   (Tighten: Knock sensor retaining bolt to 20 N·m)



4. Installation is in the reverse order of removal.

Oxygen Sensor

Description

This vehicle is equipped with two oxygen sensors (upstream oxygen sensor & downstream oxygen sensor). The oxygen sensors are located before and after the three way catalyst. The oxygen sensors continually monitor the oxygen level in the exhaust gas. The sensor is made of ceramic zirconia. The zirconia generates voltage from approximately 1 volt in richer conditions to 0 volt in leaner conditions.

Operation

The O_2 sensors produce voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas. When a large amount of oxygen is present (caused by a lean air/fuel mixture, can be caused by misfire and exhaust leaks), the sensors produces a low voltage. When there is a lesser amount of oxygen present (caused by a rich air/fuel mixture, can be caused by internal engine problems) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensors act as a rich-lean switch.

The oxygen sensors are equipped with a heating element that keeps the sensors at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

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Upstream Oxygen Sensor

The input from the upstream heated oxygen sensor tells the Engine Control Module (ECM) the oxygen content of the exhaust gas. Based on this input, the ECM fine tunes the air-fuel ratio by adjusting injector pulse width.

Downstream Oxygen Sensor

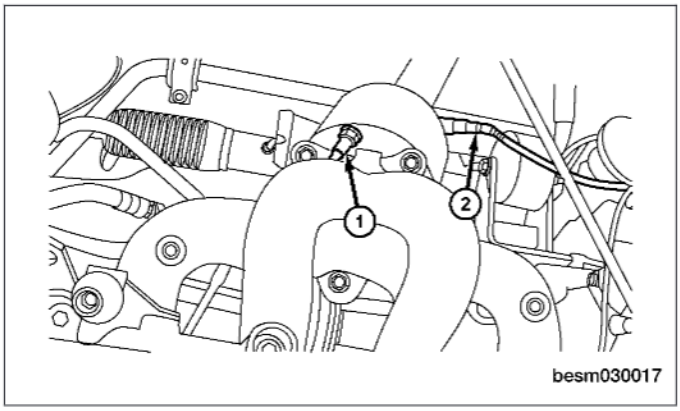
The downstream heated oxygen sensor signal is used to detect catalytic convertor deterioration. As the convertor deteriorates, the signal from the downstream sensor begins to match the upstream sensor signal except for a slight time delay. By comparing the downstream heated oxygen sensor signal to the signal from the upstream sensor, the ECM calculates catalytic convertor efficiency. This calculation is also used to establish the upstream O2 goal voltage (switching point).

Removal & Installation - Upstream Oxygen Sensor

1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor electrical connector.

CAUTION:
Remove the oxygen sensor after the exhaust pipe has cooled.

3. Remove the upstream oxygen sensor (1).
   (Tighten: Upstream oxygen sensor to 45 N·m)



4. Installation is in the reverse order of removal.

Installation Notes:

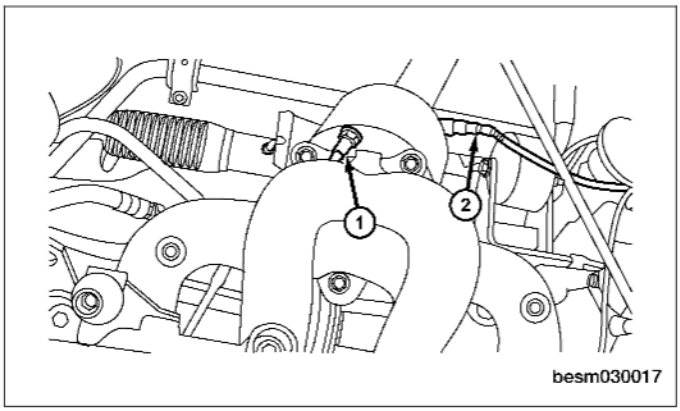
- Before installing the oxygen sensor, coat the threads with rust inhibiting lubricant.

Removal & Installation - Downstream Oxygen Sensor

1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor electrical connector.

CAUTION:
Remove the oxygen sensor after the exhaust pipe has cooled.

3. Remove the downstream oxygen sensor (2).
   (Tighten: Downstream oxygen sensor to 45 N·m)



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4. Installation is in the reverse order of removal.

Installation Notes:

- Before installing the oxygen sensor, coat the threads with rust inhibiting lubricant.

Crankshaft Position (CKP) Sensor

Description

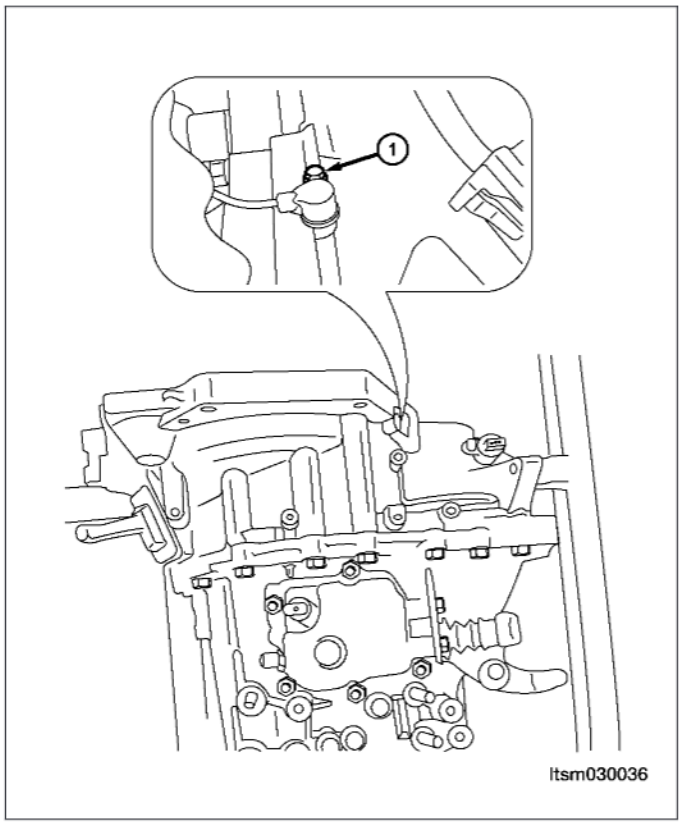
The Crankshaft Position (CKP) sensor is located on the flywheel shell facing the gear teeth of the signal plate. It detects the fluctuation of the engine revolution. The sensor consists of a permanent magnet and induction coil.

Operation

The crankshaft sensor is made of a toothed metal disk mounted on the crankshaft and a stationary detector that covers a magnetic coil that the current passes through. As the metal teeth move past the coil, its magnetic field is disturbed. This causes a stream of pulses in the current. The Engine Control Module (ECM) can calculate the speed of the engine from the crankshaft's frequency of pulses

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the CKP sensor electrical connector.
3. Remove the CKP sensor retaining bolt (1) and remove the CKP sensor.
   (Tighten: Crankshaft position sensor retaining bolt to 10 N·m)



4. Installation is in the reverse order of removal.

Camshaft Position (CMP) Sensor

Description

The Camshaft Position (CMP) sensor senses the protrusion of inlet valve cam sprocket to identify a particular cylinder. The CMP sensor senses the piston position. When the Crankshaft Position (CKP) sensor becomes inoperative, the CMP sensor provides various controls of engine parts instead, utilizing timing of cylinder identification signals. The sensor consists of a permanent magnet and Hall IC.

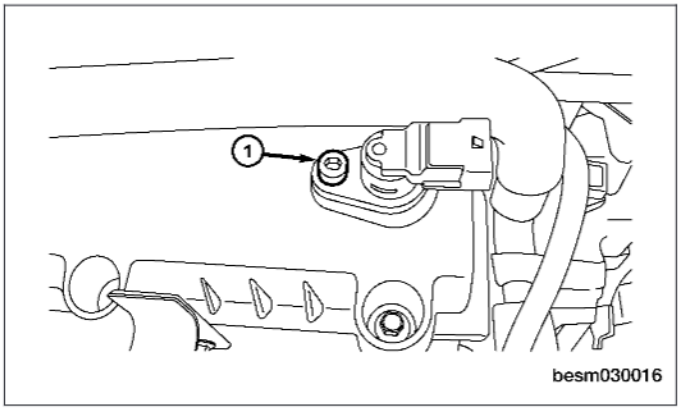
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Operation

When engine is running, the high and low parts of the teeth causes the gap with the sensor to change. The changing gap causes the magnetic field near the sensor to change. Due to the changing magnetic field, the voltage from the sensor changes. The Engine Control Module (ECM) detects the voltage signal and identify piston position and cylinder timing.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the CMP sensor electrical connector.
3. Remove the CMP sensor (1) retaining bolt.
   (Tighten: Camshaft position sensor retaining bolt to 7 N·m)
4. Pull the CMP sensor up and take out of the cylinder head cover.
5. Installation is in the reverse order of removal.



Vehicle Speed Sensor

Description

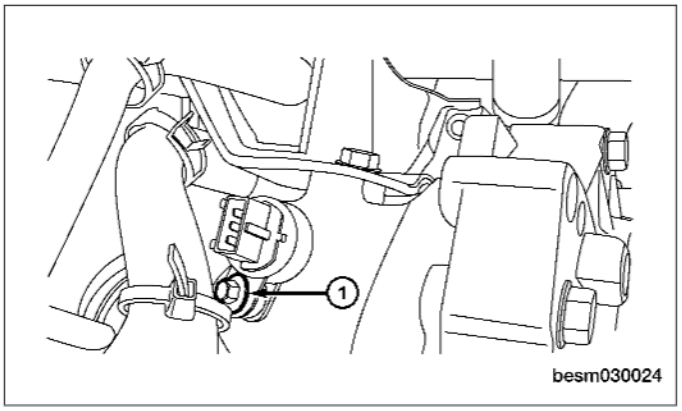
The vehicle speed sensor is mounted to the transaxle housing.

Operation

The vehicle speed sensor generates a signal sent to the Engine Control Module (ECM) and the Transaxle Control Module (TCM) utilize to perform engine and transaxle functions.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the vehicle speed sensor connector.
3. Remove the vehicle speed sensor mounting bolt (1).
   (Tighten: Vehicle speed sensor mounting bolt to 10 N·m)
4. Remove the vehicle speed sensor carefully.
5. Installation is in the reverse order of removal.



Accelerator Sensor

Description

The accelerator sensor is located on the right front crossbeam.

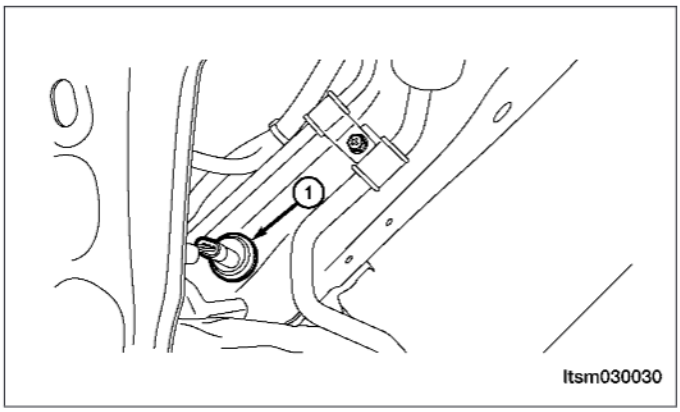
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Operation

The accelerator sensor monitors the road conditions. It sends a signal to the ECM, the ECM determines if a possible misfire condition exists.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the accelerator sensor electrical connector.
3. Remove the accelerator sensor (1).



4. Installation is in the reverse order of removal.

Manifold Absolute Pressure Sensor - 1.6L

Description

The Manifold Absolute Pressure (MAP) sensor, is mounted to the front of the engine on the intake manifold.

Operation

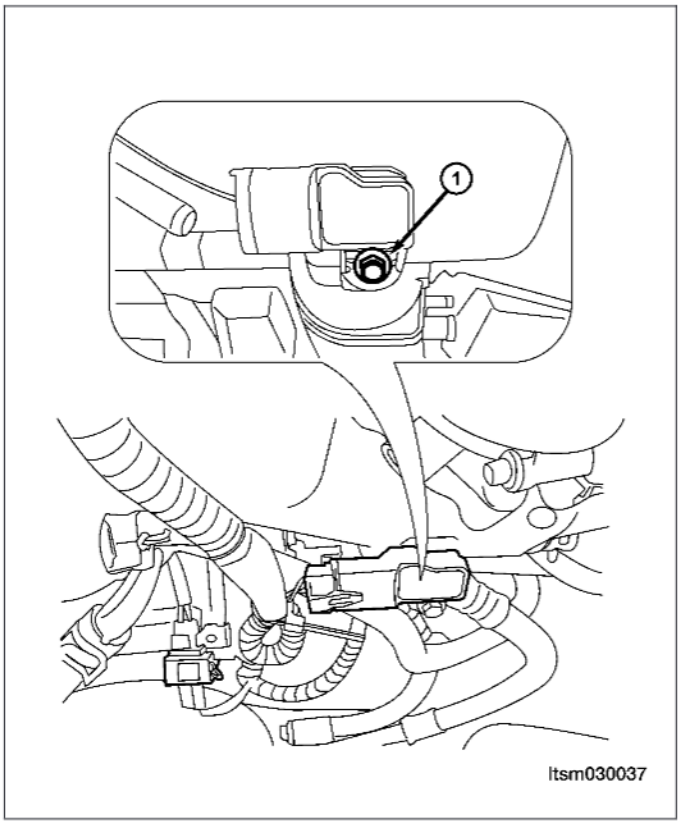
The MAP sensor monitors the pressure in the intake manifold. The pressure in the manifold moves a diaphragm connected to resistors which alter their resistance values. The output voltage of the MAP sensor signals the ECM about the pressure in the intake manifold.

Removal & Installation

1. Disconnect the negative battery cable.

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2. Disconnect the MAP sensor electrical connector.
3. Remove the MAP sensor mounting bolt (1). (Tighten: MAP sensor mounting bolt to 6 N·m)
4. Remove the MAP sensor.
5. Installation is in the reverse order of removal.



Air Flow Sensor - 1.8L

Description

The air flow sensor is placed in the air intake hose. The air flow sensor measures the intake flow rate by measuring a part of the entire intake flow. The air flow sensor converts the amount of air drawn into the engine into a voltage signal. The Engine Control Module (ECM) needs to know intake air volume to calculate engine load. This is necessary to determine how much fuel to inject.

Operation

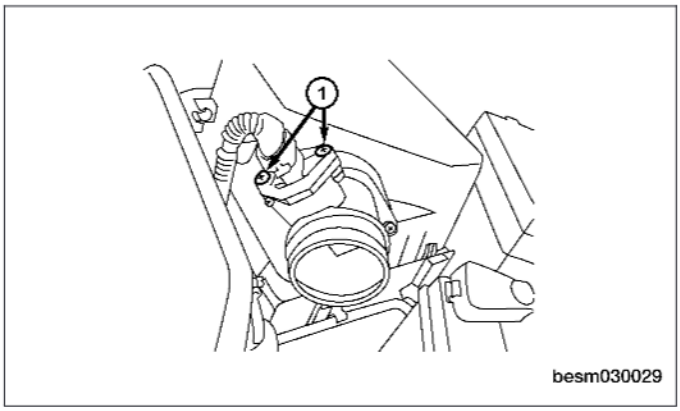
The air flow sensor controls the temperature of the hot wire to a certain amount. The heat generated by the hot wire is reduced as the intake air flows around it. The more air, the greater the heat loss. Therefore, the electric current supplied to the hot wire is changed to maintain the temperature of the hot wire as air flow increases. The ECM detects the air flow by means of this voltage signal change.

Removal & Installation

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Disconnect the air flow sensor electrical connector.

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4. For 2.0L engine, remove the air flow sensor retaining bolts (1).
   (Tighten: Air flow sensor retaining bolts to 5 N·m)



5. Pull sensor up and take out of the air cleaner case.
6. Installation is in the reverse order of removal.

Accelerator Pedal Position Sensor

Description

The Accelerator Pedal Position (APP) sensor is located inside the accelerator pedal. The accelerator pedal position sensor can not be disassembled by itself. The accelerator pedal must be replaced as a unit.

Operation

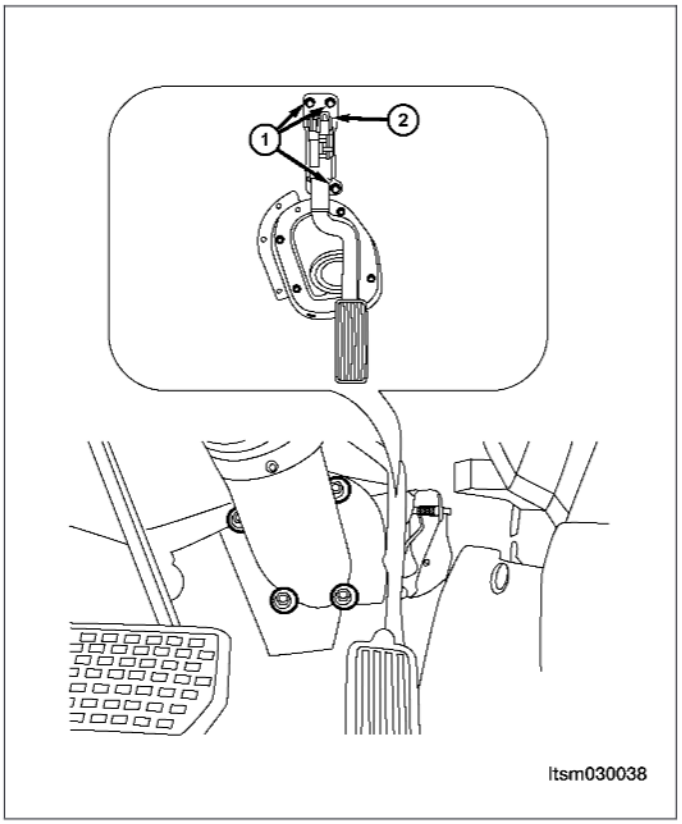
The accelerator pedal position (APP) sensor on the accelerator pedal works according to the Hall principal. the sensor is integrated into the pedal lever axis. It consists of a shaft with a ring magnet. This rotates in a printed circuit board with a stator in the fixed Hall elements. This produces a change in the voltage. The accelerator pedal position sensor is supplied with 5 V from the Engine Control Module (ECM). The information regarding accelerator position is supplied to the ECM by means of two voltages.

Removal & Installation

1. Disconnect the negative battery cable.
2. Remove the instrument panel lower trim panel.

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3. Disconnect the APP sensor electrical connector (2).
4. Remove the three APP sensor mounting bolts (1). (Tighten: APP sensor mounting bolts to 11 N·m)
5. Remove the APP sensor with the pedal.
6. Installation is in the reverse order of removal.



Electronic Throttle Control Actuator

Description

The throttle body is located on the intake manifold. It controls air into the intake manifold. The electronic throttle control actuator consists of throttle control motor, throttle position sensor, etc. The throttle control motor is operated by the Engine Control Module (ECM) and it opens and closes the throttle valve. The throttle position sensor detects the throttle valve position.

Operation

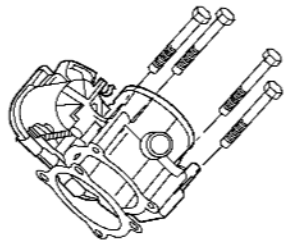
Filtered air from the air cleaner enters the intake manifold through the throttle body. A throttle valve (plate) is used to supply air for idle and driving conditions. The throttle position sensor is part the throttle body. The throttle position sensor signal is used by the ECM to determine throttle position. The ECM controls the electronic throttle control to meter air into the engine. This regulates engine power. The vehicle is in sense a “Drive by Wire” system.

Removal & Installation

1. Remove the engine cover.
2. Disconnect the negative battery cable.

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3. Disconnect the electronic throttle control actuator connector.
4. Remove two hoses on electronic throttle control actuator.
5. Remove four electronic throttle control actuator mounting bolts.
   (Tighten: Electronic throttle control actuator bolts to 10 N·m)
6. Remove the throttle control actuator carefully.
7. Installation is in the reverse order of removal.



besm030022

Engine Control Module (ECM)

Description

The Engine Control Module (ECM) for this model is serviced only as a complete unit.

Operation

The ECM is a pre-programmed, microprocessor-based digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The ECM can adapt its programming to meet changing operating conditions.

Removal & Installation

1. Disconnect the negative battery cable.
2. Remove the glove box (See Instrument Panel Removal & Installation in Section 15 Body).
3. Disconnect the ECM electrical connector.
4. Remove the ECM retaining bolts (1).
   (Tighten: ECM retaining bolts to 10 N·m)
5. Remove the ECM.
6. Installation is in the reverse order of removal.

Installation Notes:

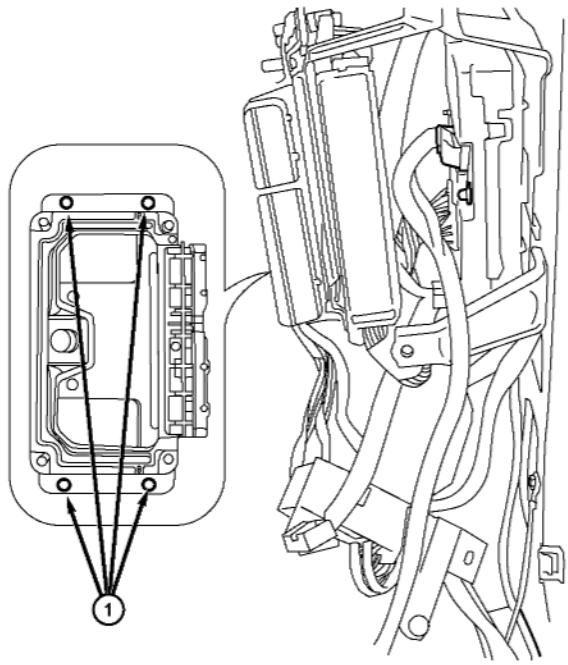
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NOTE :
The Immobilizer control module must be matched to the new ECM before the vehicle will start.

Matching Immobilizer Control Module to New Engine Control Module (ECM)

Perform the following to match the Immobilizer control module to the new ECM:

- With the X-431 scan tool, choose T11 series.
- Choose ″immobilize″.
- Choose ″input code″.
- Input the safety code.
- Click the small keyboard.
- Click ″OK″.
- Choose ″Immobilizer adapt″.
- Choose ″read Immobilizer to ECM″ immediately.
- Click ″OK″.



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Description

The Engine Control Module (ECM) utilizes integrated circuitry and information carried on the Controller Area Network (CAN) data bus along with many hard wired inputs to monitor many sensors and switches inputs throughout the vehicle. In response to those inputs, the internal circuitry and programming of the ECM allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the CAN data bus.

The following are the input and output components monitored by the ECM. The monitored functions include components from the engine, ignition, transaxle, air conditioning, or any other ECM supported subsystem.

ECM Inputs

- Brake Switch Sensor
- A/C Pressure Switch
- Camshaft Position (CMP) Sensor
- Crankshaft Position (CKP) Sensor
- Engine Coolant Temperature (ECT) Sensor
- Intake Air Temperature (IAT) Sensor
- Air Flow Sensor
- Throttle Position Sensor (integral with Electronic Throttle Control Actuator)
- Power Steering Switch
- Accelerator Pedal Position (APP) Sensor
- Knock Sensor
- Oxygen Sensor (Upstream & Downstream)
- Clutch Pedal Switch (manual transaxle only)

ECM Outputs

- Canister Control Valve
- Fuel Injectors
- Fuel Pump Relay
- Electronic Throttle Control Actuator
- Ignition Coil
- A/C Compressor
- Cooling Fan
- Oxygen Sensor heating coil (Upstream & Downstream)

Operation

The ECM monitors components and circuits and tests them in various ways depending on the hardware, function, and type of signal. For example, analog inputs such as throttle position or engine coolant temperature are typically checked for opens, shorts and out-of-range values. This type of monitoring is carried out continuously. Some digital inputs like vehicle speed or crankshaft position rely on rationality checks - checking to see if the input value makes sense at the current engine operating conditions. These types of tests may require monitoring several components and can only be carried out under appropriate test conditions.

The ECM is a pre-programmed, microprocessor-based digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The ECM can adapt its programming to meet changing operating conditions.

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Electronic Engine Control Input & Output Device Failure Modes

NUMBER	ITEM	FAILURE MODE	CORRECTION
1	CKP	• Engine is hard to start. • The engine RPM will be limited after the engine starts. • The highest RPM is less than 3800. • Excessive exhaust emissions. • No ignition signal to the ECM. • The tachometer does not work. • Rough engine operation.	Replace
2	CMP	• The fuel injector ON time may vary from 720 degrees to 360 degrees. • The sensor output is not correct, the MIL light will turn on when with the second revolution after the engine starts. • Engine is hard to start. • The highest RPM is less than 4000.	Replace
3	APPS	• The MIL light will turn on. • Poor acceleration. • The engine RPM will be limited after the engine starts.	Replace
4	ECT	• Engine hard to start when cold. • Engine hard to start when hot. • Poor driving capability. • If the sensor circuit is shorted to power, the engine will run under the default values. • The temperature gauge indicates too high. • The temperature gauge indicates too low. • The cooling fan operates continuously on high speed. • The high temperature warning lamp will flash when the IP indicates low temperature.	Replace
5	MAF	• The cooling fan will operate for approximately 60 seconds on high speed after the ignition switch is turned off. • Poor acceleration. • Poor driving capability.	Replace
6	O_2 Senser	• Poor fuel economy. • Excessive exhaust emissions. • Sluggish acceleration. • Poor driving capability.	Replace
7	Knock Sensor	• The engine produces an engine knock. • Overheated engine. • Excessive exhaust emissions. • Poor fuel economy. • Lack of engine power. • Internal engine damage.	Replace
8	ECM	• Unstable engine idle. • Poor acceleration. • Unable to start. • High engine idle. • The engine exhaust exceeds emission standards. • Engine is hard to start. • Air conditioner does not operate. • Fuel injector control failure. • Engine stalls out.	Replace
9	Ignition Coil	• Unstable idle. • Lack of engine power. • Poor fuel economy. • Excessive exhaust emissions. • Weak spark.	Replace

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NUMBER	ITEM	FAILURE MODE	CORRECTION
10	Fuel Injector	• Unstable idle. • Lack of engine power. • Poor acceleration. • Engine will not start. • Plugged injector.	Replace
11	TPS	• Poor acceleration. • The MIL light will turn on.	Replace
12	EVAP	• The engine base fuel closed-loop control self-learning will be shut off. • The engine idle air control self-learning will be shut off. • Unstable idle or high idle.	Replace
13	Fuel Pump	• Noisy fuel pump operation. • Poor acceleration. • Engine will not start.	Replace
14	MAP	• Poor acceleration. • Unstable idle. • Rough engine operation.	Replace
15	IAT	• Intake air temperature will be equal to the coolant temperature.	Replace
16	Cooling Fan	• High engine temperature. • Poor air conditioner performance.	Replace
17	Accelerator Sensor	• Misfire • Poor driving capability. • Rough engine operation.	Replace

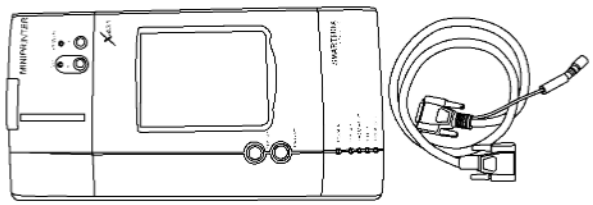
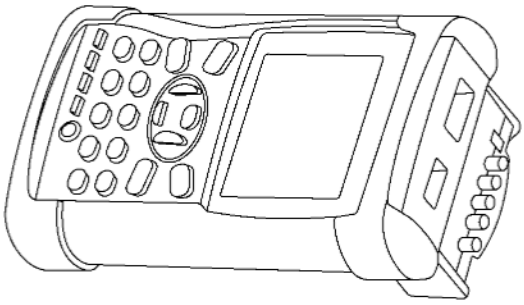
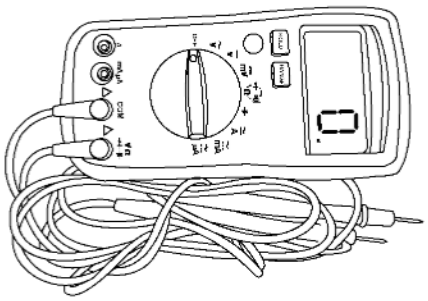
Specifications

Torque Specifications

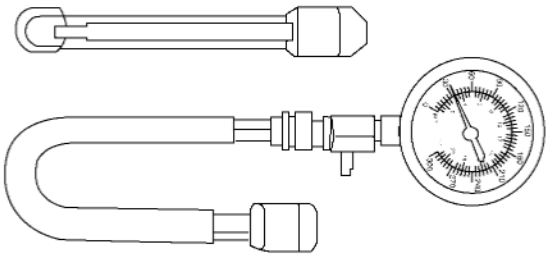
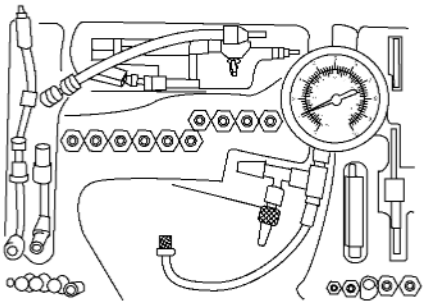
DESCRIPTION	TORQUE (N·m)
Engine Coolant Temperature Sensor	20
Knock Sensor	20
Oxygen Sensors	45
Crankshaft Position Sensor	10
Camshaft Position Sensor	7
Air Flow Sensor	5
Engine Control Module	10
Accelerator Pedal Position Sensor	11
Electronic Throttle Control Actuator	10
Vehicle Speed Sensor	10

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Special Tools

Diagnostic Scan Tool X-431	 besm030001
Engine Analyzer KES-200	 ltsmd030069
Digital Multimeter Fluke 15B & 17B	 besm030002

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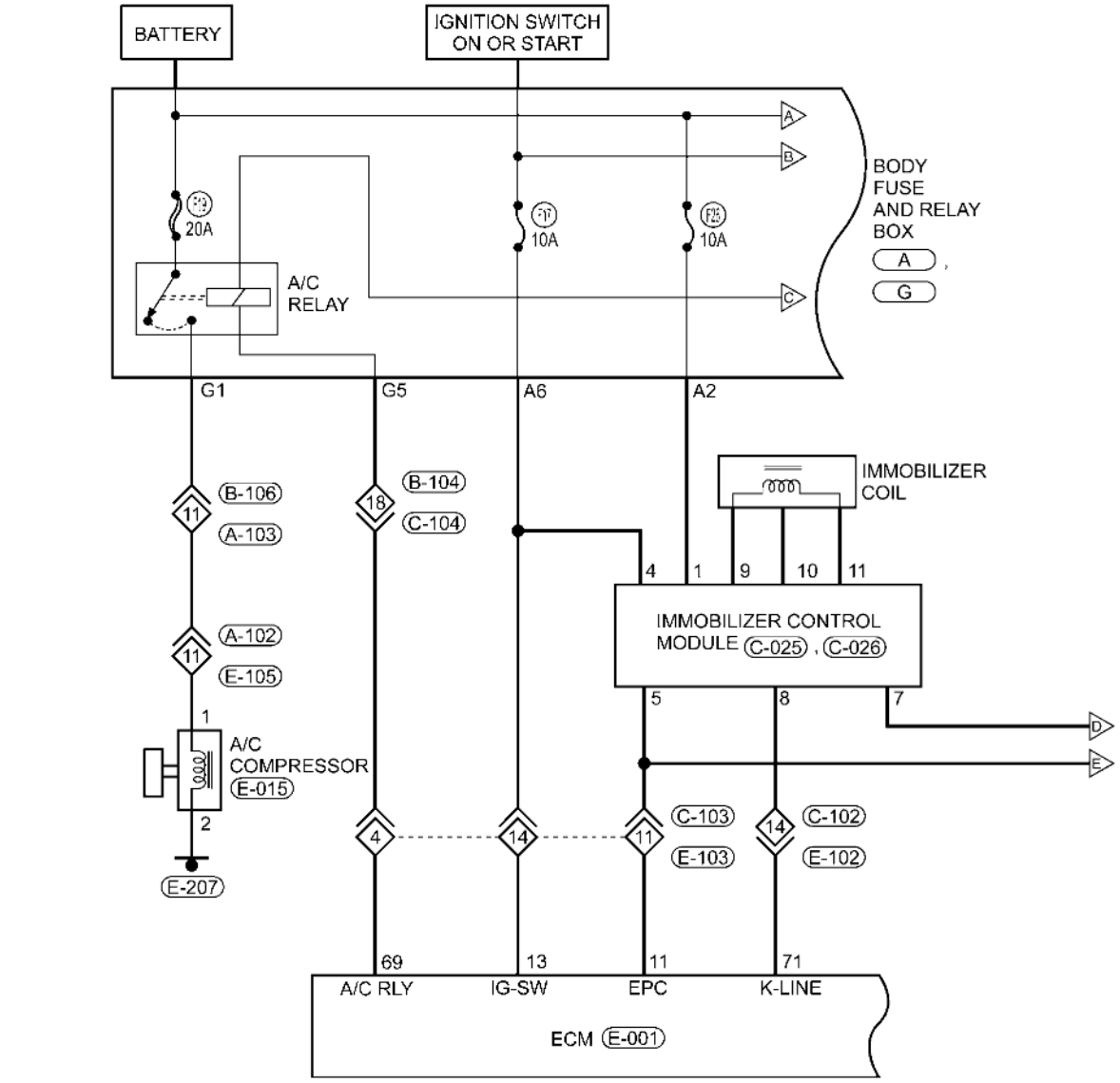
Compression Gauge	 besm030009
Fuel Pressure Gauge	 besm030008

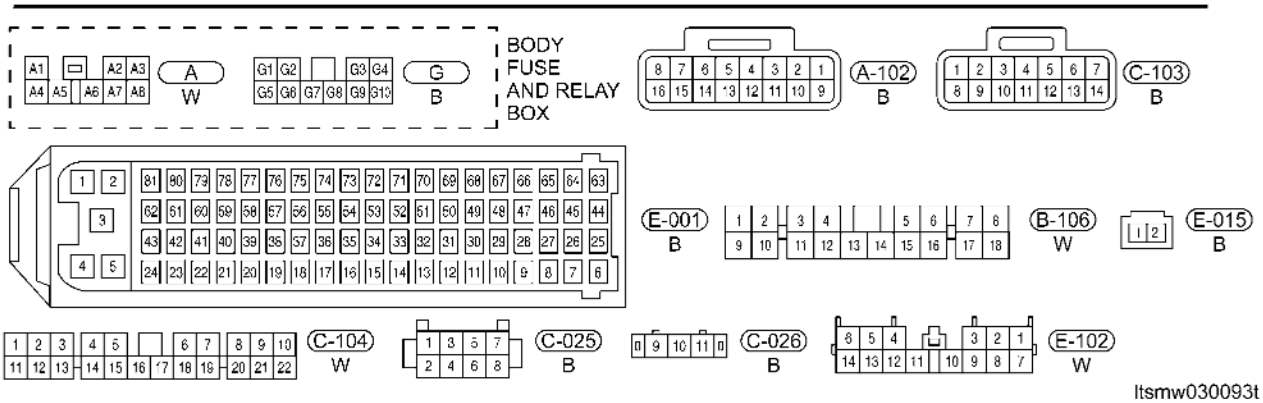
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Electrical Schematics

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ENGINE CONTROL SYSTEM - WITH ACTECO 2.0L WITH DP0 SYSTEM

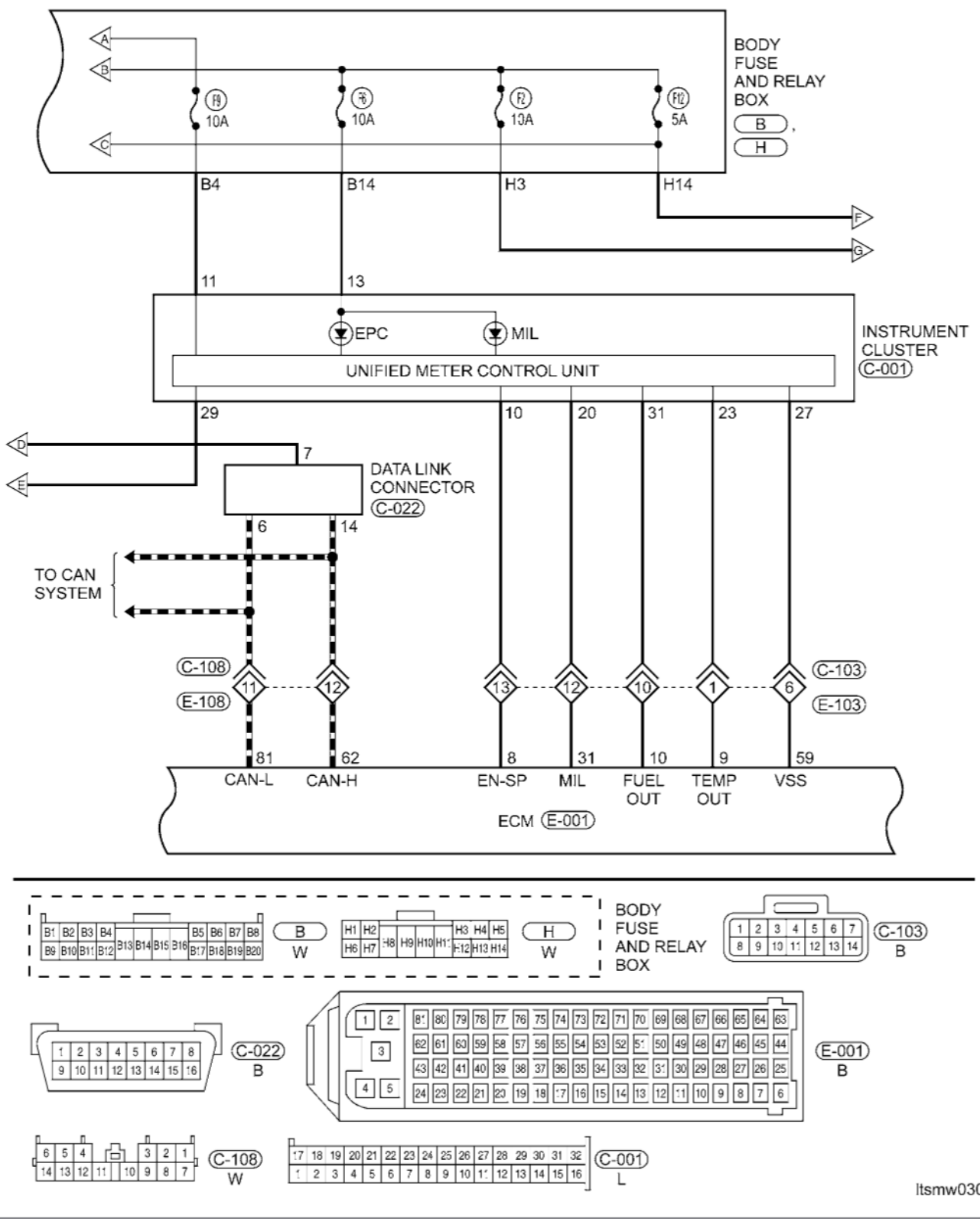




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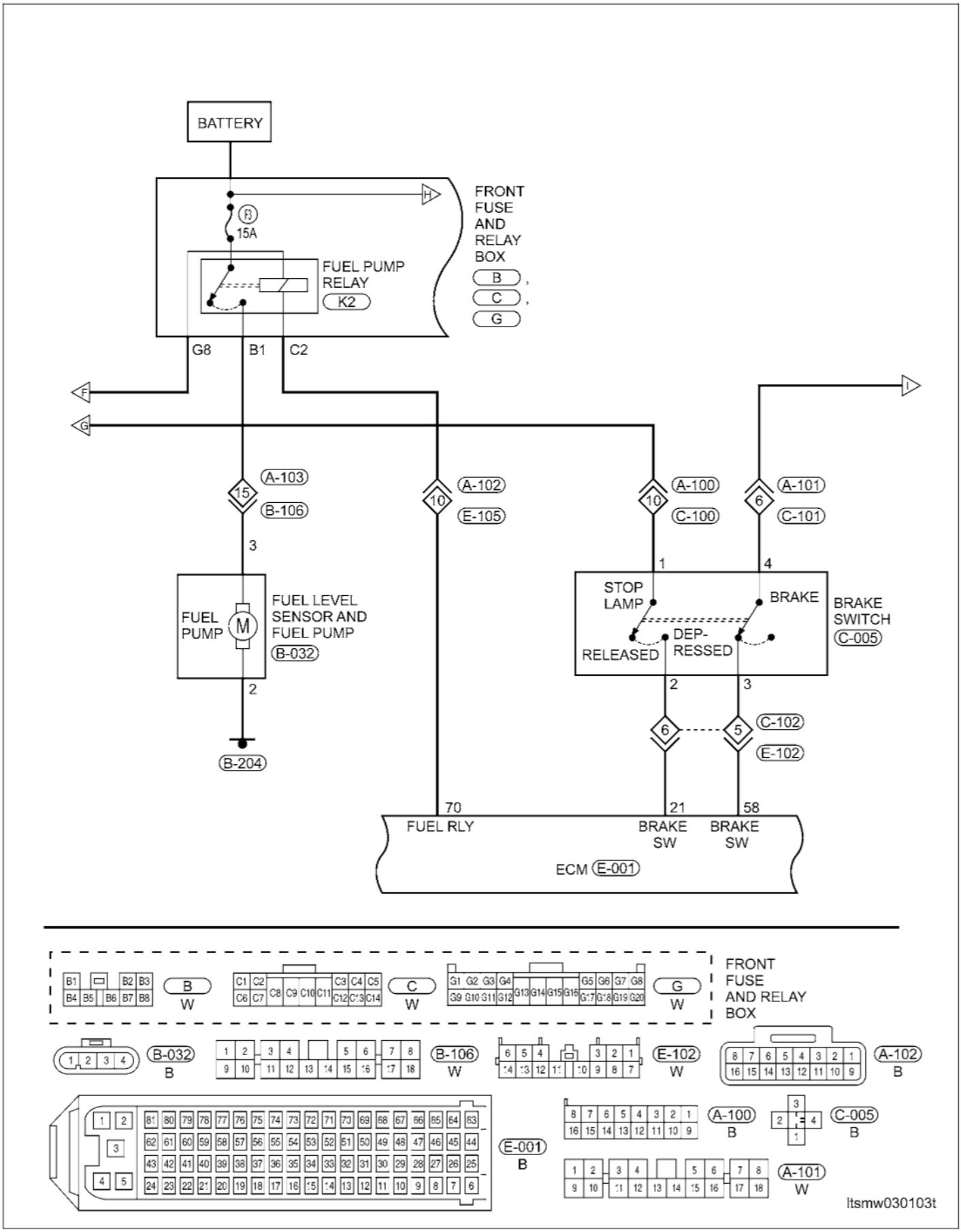
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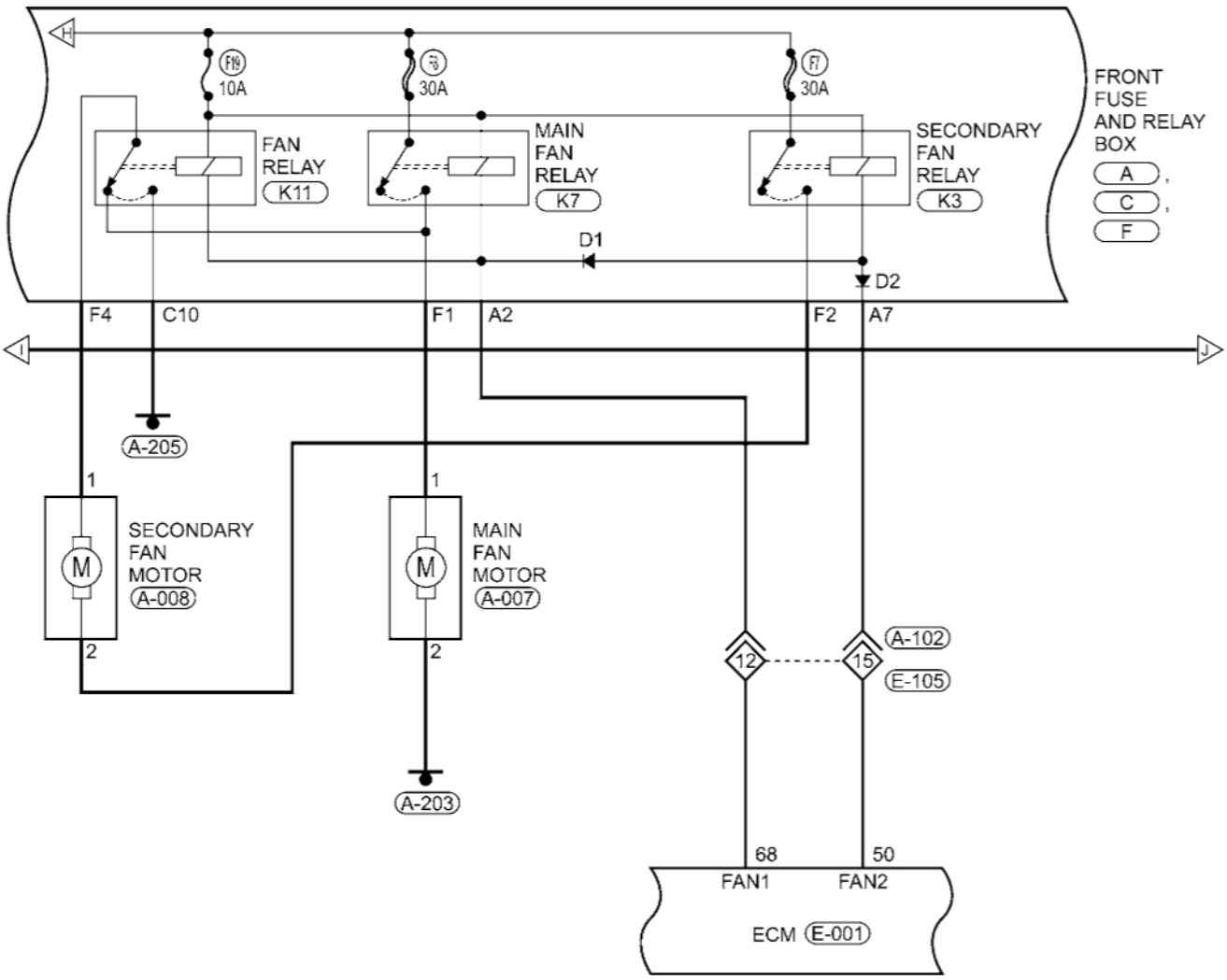
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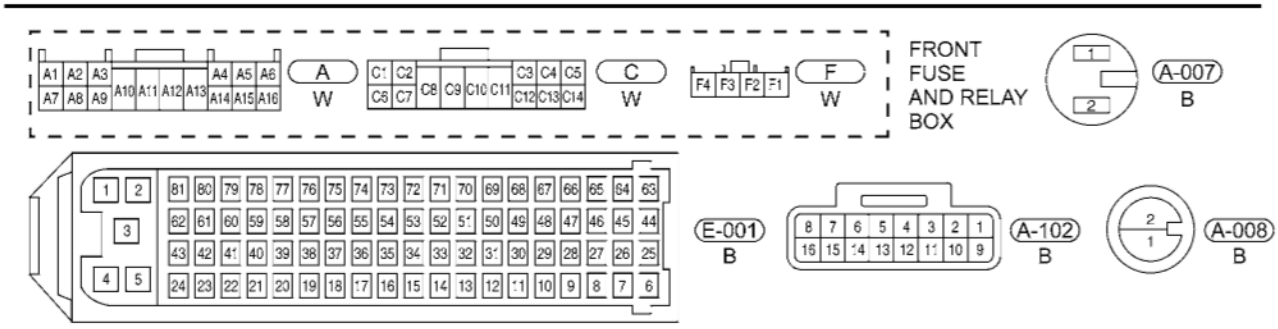
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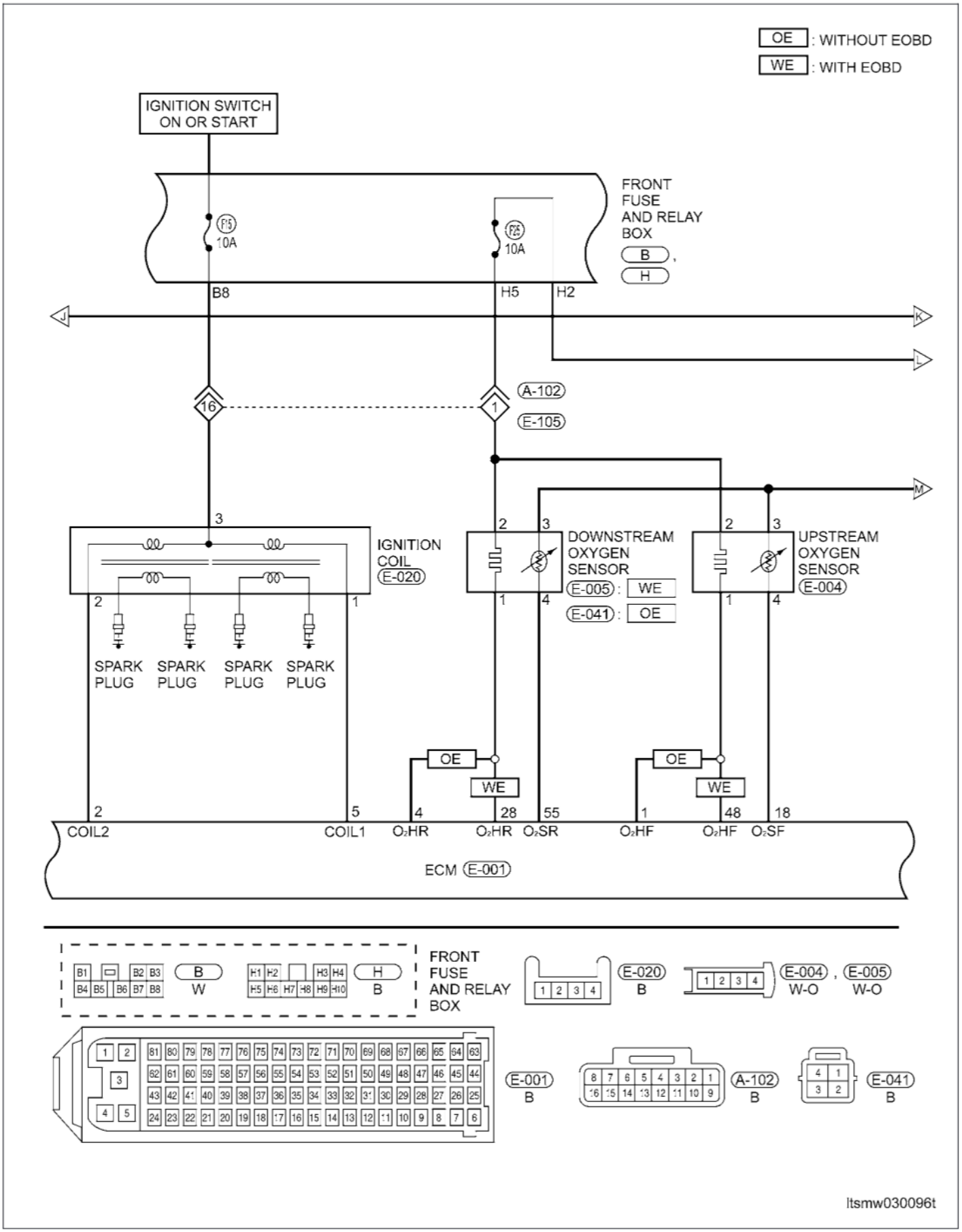




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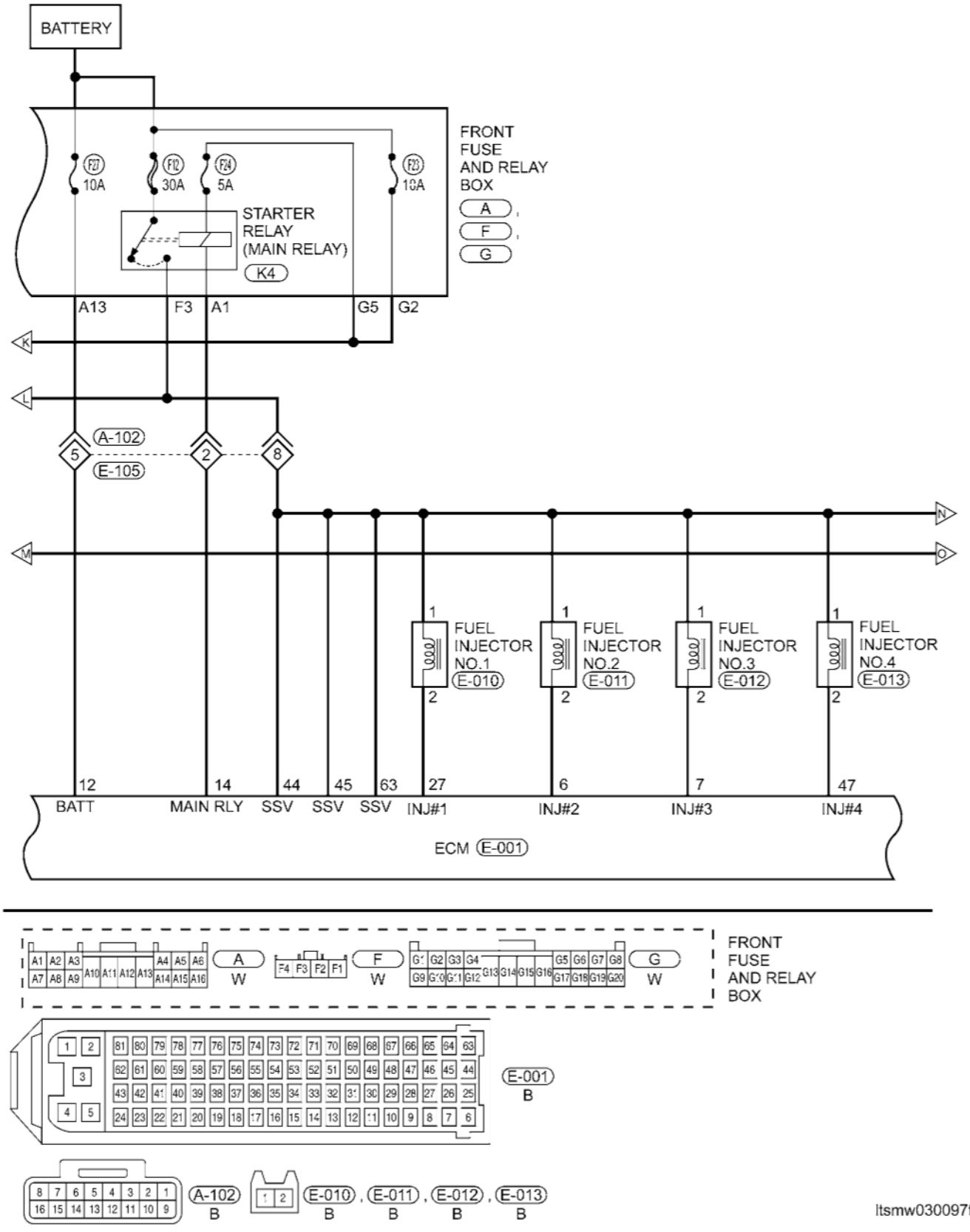
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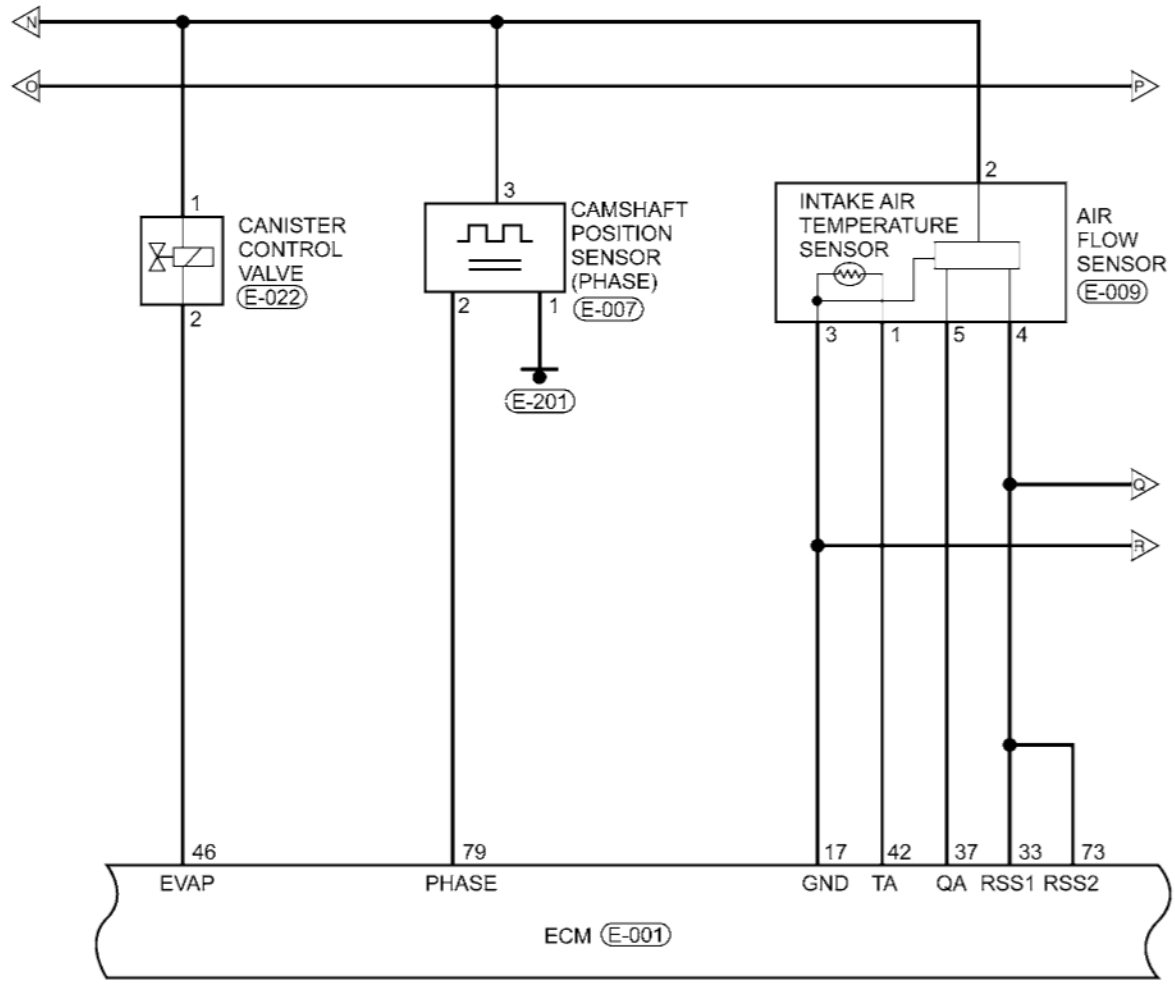
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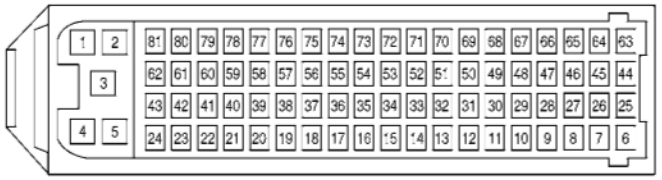
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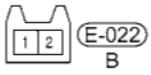
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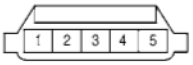
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E-022
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E-007
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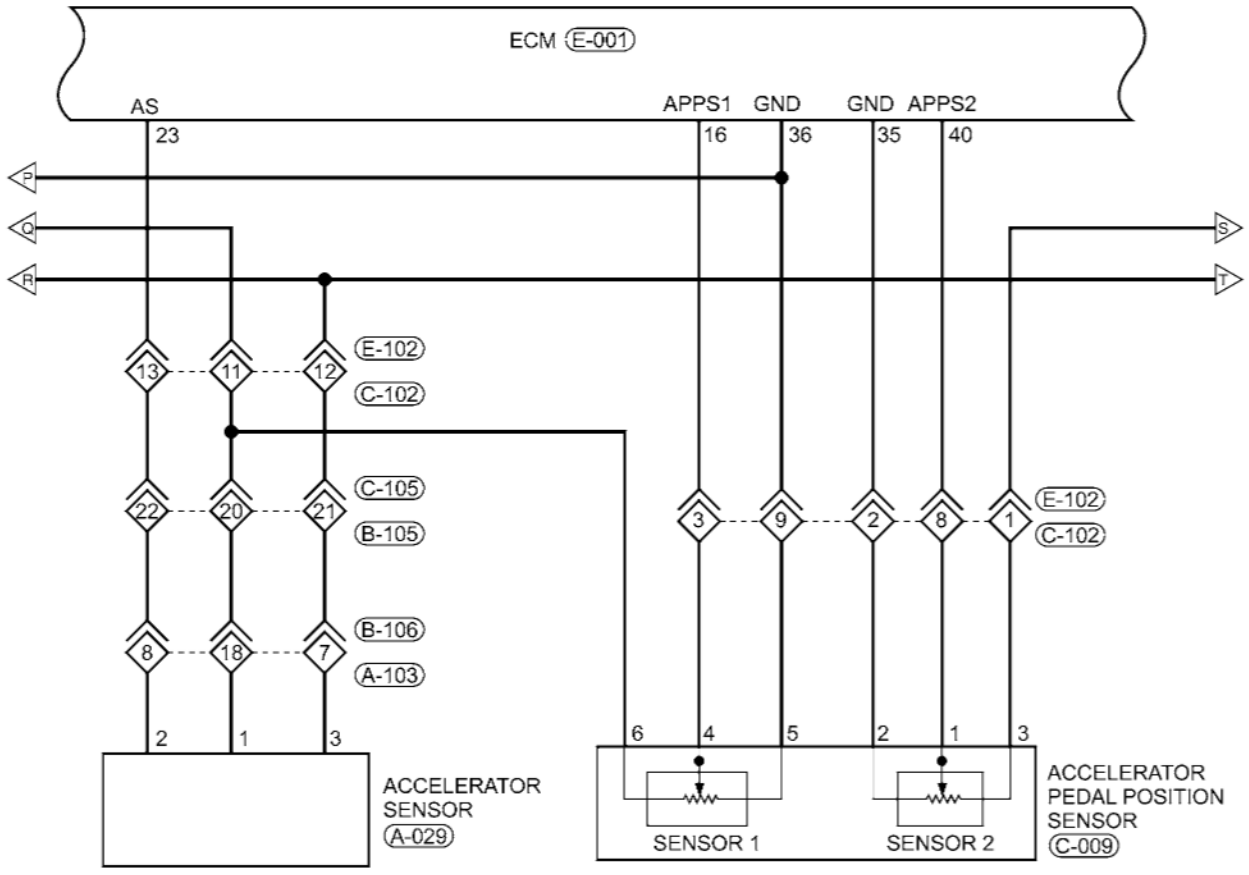


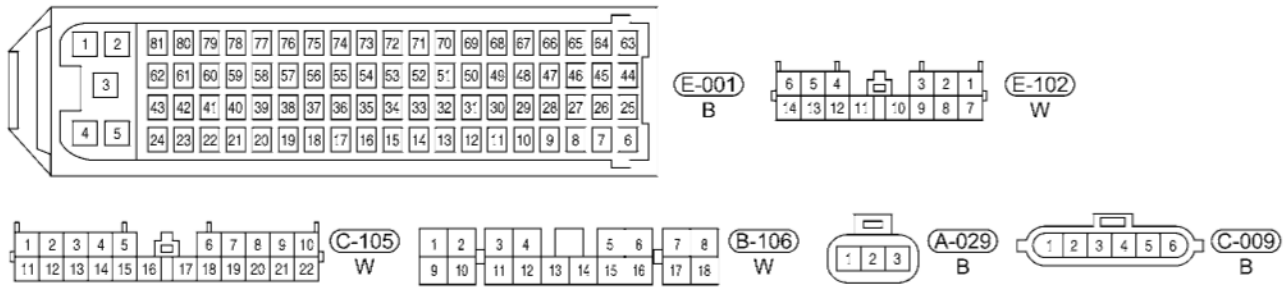
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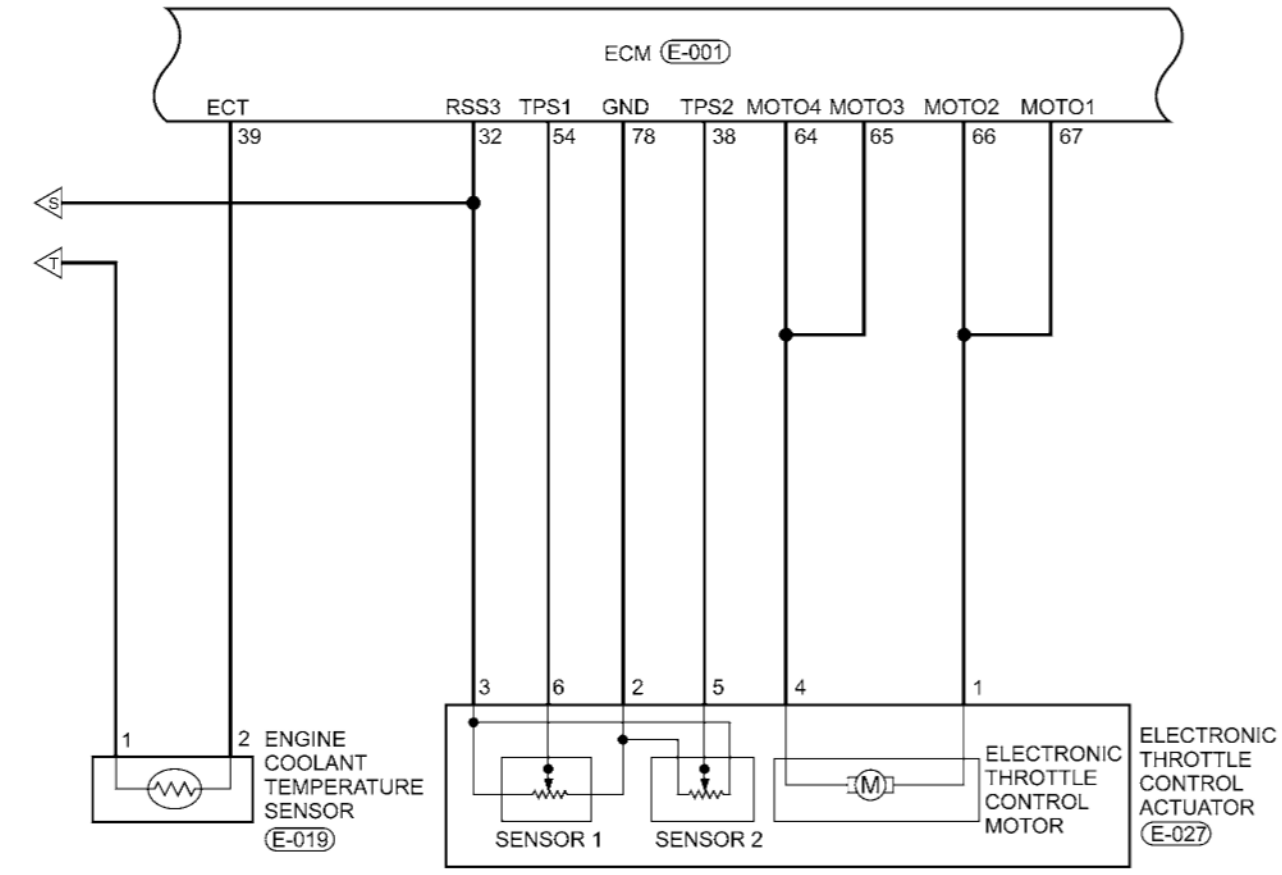


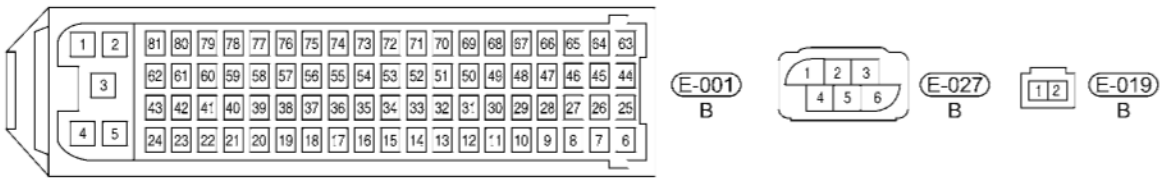


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Electronic Engine Controls (Page 9 of 11)

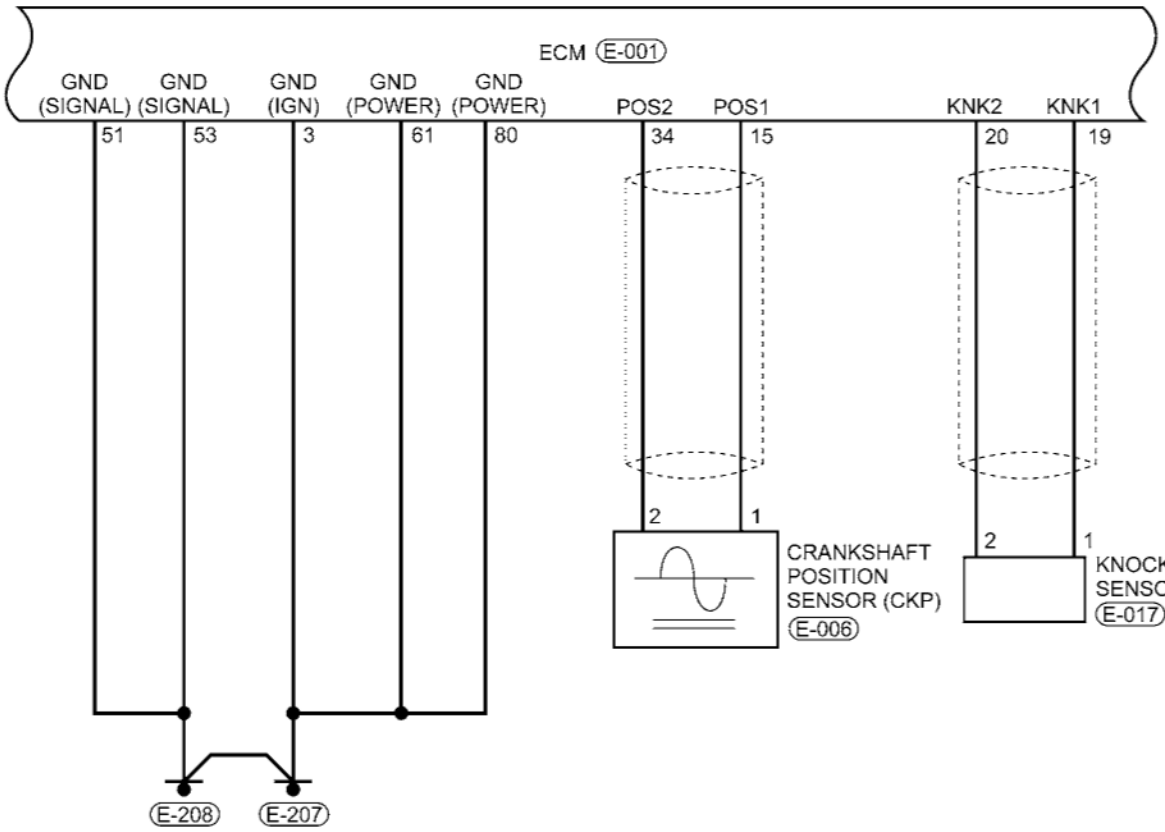


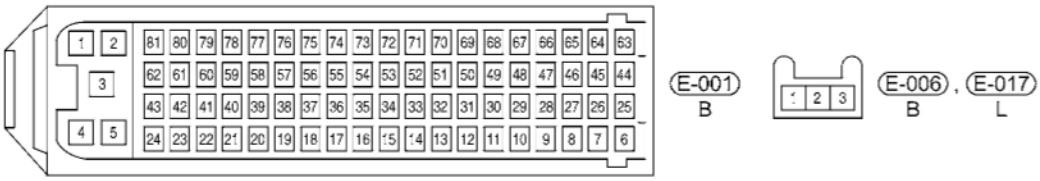


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Electronic Engine Controls (Page 10 of 11)

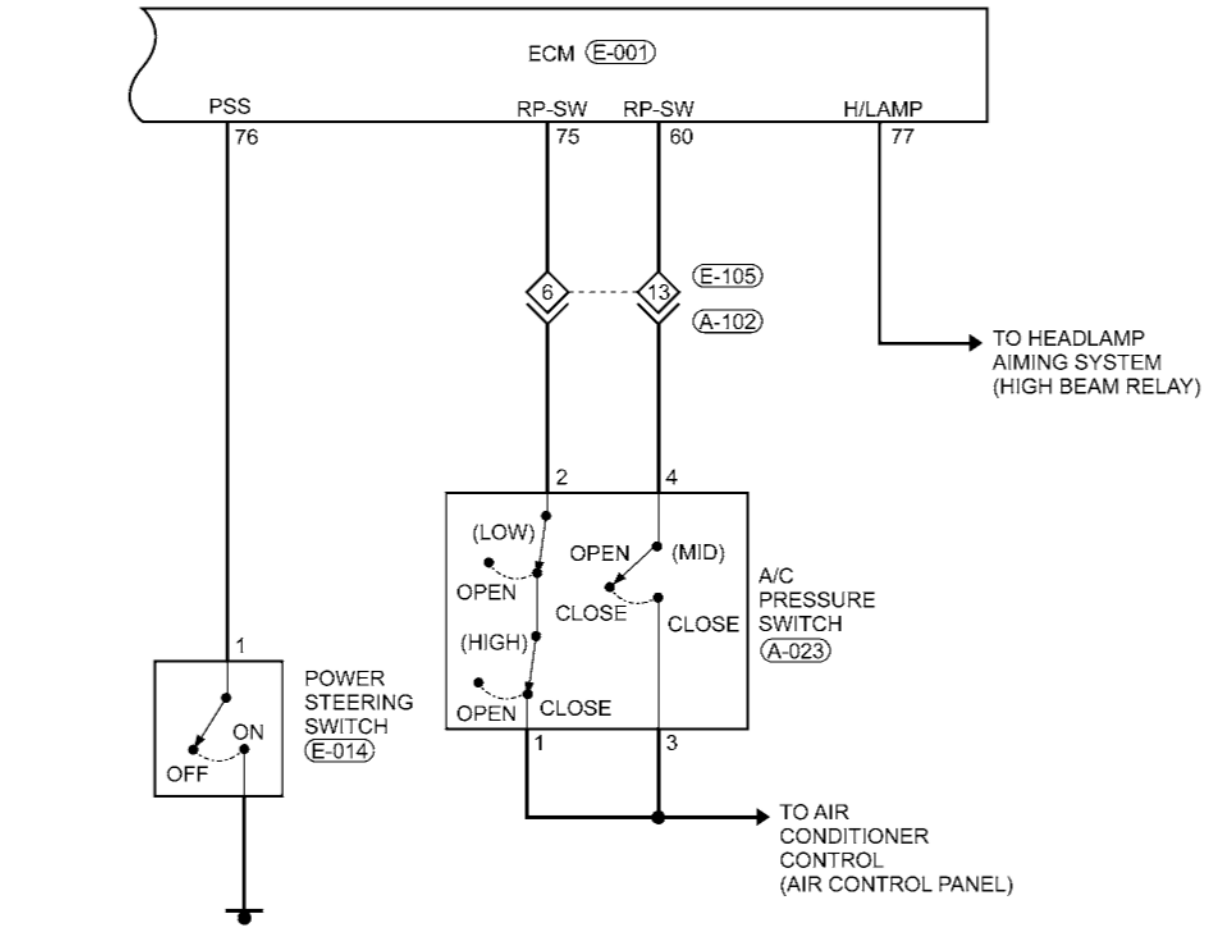


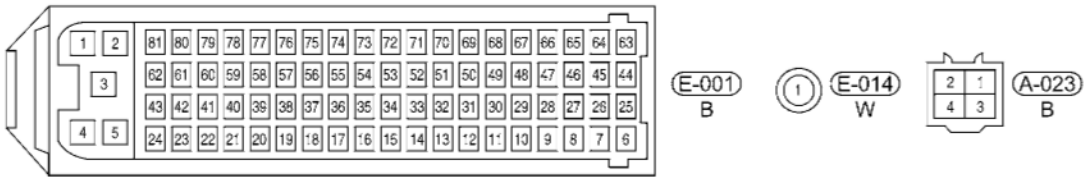


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Electronic Engine Controls (Page 11 of 11)

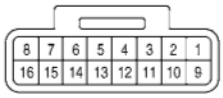




E-001 B

E-014 W

A-023 B



A-102 B

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ECM Connector Pin-Out Table

ECM PIN-OUT TABLE

PIN	CIRCUIT IDENTIFICATION	PIN	CIRCUIT IDENTIFICATION
1	(With EOBD) Upstream Oxygen Sensor Heater (Without EOBD)	42	Intake Air Temperature Sensor
2	Ignition Coil 2	43	-
3	GND (Ignition)	44	Switched Supply Voltage
4	(With EOBD) Downstream Oxygen Sensor Heater (Without EOBD)	45	Switched Supply Voltage
5	Ignition Coil 1	46	Canister Control Valve
6	Injector 2	47	Injector 4
7	Injector 3	48	Upstream Oxygen Sensor Heater (With EOBD) (Without EOBD)
8	Engine Speed Output	49	-
9	Coolant Temperature Output	50	Fan Relay Control
10	Fuel Consumption Output	51	GND (Signal)
11	EPC Lamp	52	-
12	Continuous Supply Voltage	53	GND (Signal)
13	Ignition Switch	54	Electronic Throttle Control Actuator
14	EMS Relay (Main Relay)	55	Downstream Oxygen Sensor
15	Crankshaft Position Sensor	56	-
16	Accelerator Position Sensor	57	-
17	Sensor (GND)	58	Brake Switch
18	Upstream Oxygen Sensor	59	-
19	Knock Sensor 1	60	A/C Middle Pressure Switch
20	Knock Sensor 2	61	GND (Power)
21	Brake Switch	62	CAN-H
22	-	63	Switched Supply Voltage
23	Accelerator Sensor	64	Electronic Throttle Control Actuator
24	-	65	Electronic Throttle Control Actuator
25	-	66	Electronic Throttle Control Actuator
26	-	67	Electronic Throttle Control Actuator
27	Injector 1	68	Fan Relay Control 2
28	Downstream Oxygen Sensor Heater (With EOBD) (Without EOBD)	69	Air Compressor Relay
29	-	70	Fuel Pump Relay
30	-	71	Diagnostic Link K
31	MIL Lamp	72	-
32	Regulated Sensor Supply 3	73	Regulated Sensor Supply 2
33	Regulated Sensor Supply 1	74	-
34	Crankshaft Position Sensor	75	A/C Stand By

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PIN	CIRCUIT IDENTIFICATION	PIN	CIRCUIT IDENTIFICATION
35	Sensor (GND)	76	Power Steering Switch
36	Sensor (GND)	77	Headlamp Switch
37	Air Flow Sensor	78	Sensor (GND)
38	Electronic Throttle Control Actuator (Position Sensor)	79	Camshaft Position Sensor
39	Engine Coolant Temperature Sensor	80	GND (Power)
40	Accelerator Pedal Position Sensor	81	CAN-L
41	-		

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DIAGNOSIS & TESTING

Diagnostic Help

1. Confirm that the malfunction is current and carry-out the diagnostic tests and repair procedures.
2. If the Diagnostic Trouble Code (DTC) cannot be deleted, it is a current fault.
3. Use a digital multimeter to perform voltage readings on the Electronic Fuel Injection (EFI) system.
4. Program the vehicle Immobilizer control module whenever the Engine Control Module (ECM) is replaced.
5. The scan tool connects to the Data Link Connector (DLC) and communicates with the ECM.
6. If the failure is intermittent perform the following:
   - Check for loose connectors.
   - Look for any chafed, pierced, pinched, or partially broken wires.
   - Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.
   - Look for the data to change or for the DTC to reset during the wiggle test.
   - Look for broken, bent, pushed out or corroded terminals.
   - Inspect the sensor and mounting area for any condition that would result in an incorrect signal, such as damage or foreign material.
7. Remove the ECM from the troubled vehicle and install in a new vehicle and test. If the DTC can not be deleted, the ECM is malfunctioning. If the DTC can be deleted, return the ECM to the original vehicle.

Ground Inspection

Ground connections are very important to the proper operation of electrical and electronic circuits. Ground connections are often exposed to moisture, dirt and other corrosive elements. The corrosion (rust) can become an unwanted resistance. This added resistance can alter the way a circuit works.

Electronically controlled circuits are very sensitive to proper grounding. A loose or corroded ground can drastically affect an electronically controlled circuit. A poor or corroded ground can effect the circuit. Perform the following when inspecting a ground connection:

1. Remove the ground bolt or screw.
2. Inspect all mating surface for tarnish, dirt, rust, etc.
3. Clean as required to assure good contact.
4. Reinstall bolt or screw securely.
5. Inspect for ″add-on″ accessories which may be interfering with the ground circuit.
6. If several wires are crimped into one ground eyelet terminal, check for proper crimps. Make sure all of the wires are clean, securely fastened and providing a good ground path. If multiple wires are crimped to one eyelet, make sure no excess wire insulation has been crimped creating a bad ground.

Electronic Throttle Control Actuator Self-Learning Operation Introduction

EPC Lamp Control Strategy

The EPC lamp will be on for a few seconds and turn off after the ignition switch is turned on and the engine is not running. After the engine started, the EPC lamp will go off if the DTC is not existent in ECM. If the internal self-check failed, the EPC lamp will continue to light.

Electronic Throttle Control Actuator Self-Learning Condition

- Engine stopped and the ignition switch is on.
- Vehicle speed is 0 km/h.
- The Engine Coolant Temperature (ECT) is between 5.25°C and 100.5°C.
- The intake air temperature is more than 5.25°C.
- The accelerator pedal fully released.
- Battery voltage is more than 12 V.

Electronic Throttle Control Actuator Self-Learning Operating Procedure

Turn the ignition switch on for 10 seconds, then turn the ignition switch off. During the procedure, do not operate any other components.

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Self-Learning Components

Perform the self-learning process when the following repairs have been made:
- Replaced the ECM
- ECM which was disconnected and reconnected
- Replaced the Accelerator Pedal
- Replaced the Electronic Throttle Control Actuator

Self-Learning Operating Procedure

Turn the ignition switch on for 10 seconds, then turn the ignition switch off. During the procedure, do not operate any other components.

Self-Learning Condition

The self-learning condition as the ″Electronic Throttle Control Actuator Self-Learning Condition″.

CAUTION:
Make sure that the Electronic Throttle Control Actuator self-learning process lasts for at least 10 seconds according to the Electronic Throttle Control Actuator self-learning condition. If the self-learning process fails, the engine can't be started or the EPC lamp will be on. If this condition occurs, perform the Self-Learning operating again after the DTCs be erased in ECM.

Diagnostic Tools

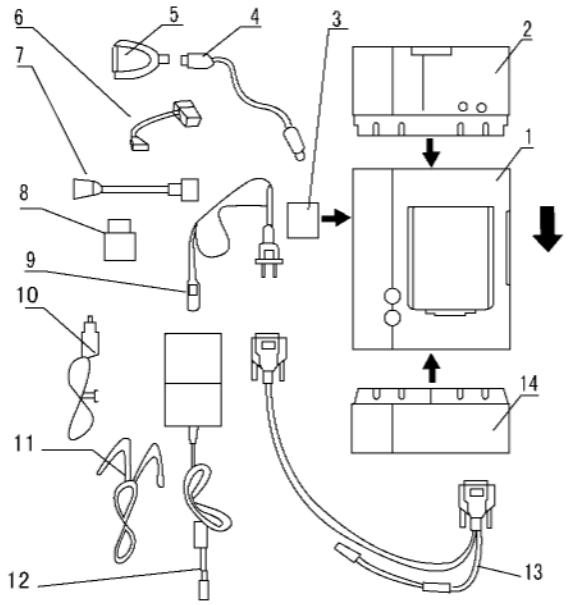
- Scan Tool X-431
- Engine Analyzer KES-200
- Digital Multimeter
- Jumper Wire

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Hardware Requirements

The hardware configuration of X-431 is as follows:

Diagnostic Scan Tool Configuration



ITEM	NAME	DESCRIPTION
1	X-431 Main Unit	To Display Operational Buttons, Test Results, Help Information, etc.
2	Mini-Printer	To Print Test Results. (Optional)
3	CF Card	To Store Diagnostic Software and Data
4	USB Cable	To Connect CF Card Reader/Writer and Computer
5	CF Card Reader/Writer	To Read or Write Data On The CF Card
6	Mitsubishi-12+16 Pin Connector	To Diagnose Mitsubishi Electronic Control Systems On Chery B11 Series
7	Fiat-3 Pin Connector	To Diagnose Vehicles With Fiat-3 Pin Diagnostic Connector

ITEM	NAME	DESCRIPTION
8	Smart OBDII-16 Pin Connector	To Diagnose Other Systems Of Vehicle With OBDII-16 Pin Diagnostic Connector
9	Power Cord	To Connect AC 100-240 V Outlet and Power Adapter
10	Cigarette Lighter Cable	To Get Power From Vehicle Cigarette Lighter
11	Battery Cable W/Two Clips	To Get Power From Vehicle Battery
12	Power Adapter	To Convert 100-240 V AC Power Into 12 V DC Power
13	Main Cable	To Connect The Diagnostic Connector and Smartbox
14	Smartbox	To Perform Vehicle Diagnosis

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Diagnostic Trouble Code (DTC) List

DTC	DTC DEFINITION
P000A	″A″ Camshaft Position Slow Response
P000B	″B″ Camshaft Position Slow Response
P0010	″A″ Camshaft Position Actuator Circuit/Open
P0011	″A″ Camshaft Position - Timing Over - Advanced or System Performance
P0012	″A″ Camshaft Position - Timing Over - Retarded
P0013	″B″ Camshaft Position - Actual Circuit/Open
P0014	″B″ Camshaft Position - Timing Over - Advanced or System Performance
P0015	″B″ Camshaft Position - Timing Over - Retarded
P0016	Crankshaft - Camshaft Position Correlation
P0030	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 1)
P0031	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 1) Low
P0032	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 1) High
P0036	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 2)
P0037	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 2) Low
P0038	O_2 Sensor Heater Control Circuit (Bank 1 Sensor 2) High
P0053	O_2 Sensor Heater Resistance (Bank 1 Sensor 1)
P0054	O_2 Sensor Heater Resistance (Bank 1 Sensor 2)
P0101	Mass or Volume Air Flow Circuit Range/Performance
P0102	Mass or Volume Air Flow Circuit Low Input
P0103	Mass or Volume Air Flow Circuit High Input
P0112	Intake Air Temperature Circuit Low Input
P0113	Intake Air Temperature Circuit High Input
P0116	Engine Coolant Temperature Circuit Range/Performance
P0117	Engine Coolant Temperature Circuit Low Input
P0118	Engine Coolant Temperature Circuit High Input
P0121	Throttle/Pedal Position Sensor A Circuit Range/Performance
P0122	Throttle/Pedal Position Sensor A Circuit Low Input
P0123	Throttle/Pedal Position Sensor A Circuit High Input
P0130	O_2 Sensor Circuit Bank 1 - Sensor 1 Malfunction
P0131	O_2 Sensor Circuit Bank 1 - Sensor 1 Low Voltage
P0132	O_2 Sensor Circuit Bank 1 - Sensor 1 High Voltage
P0133	O_2 Sensor Circuit Bank 1 - Sensor 1 Slow Response
P0134	O_2 Sensor Circuit Bank 1 - Sensor 1 No Activity Detected
P0136	O_2 Sensor Circuit Bank 1 - Sensor 2 Malfunction
P0137	O_2 Sensor Circuit Bank 1 - Sensor 2 Low Voltage
P0138	O_2 Sensor Circuit Bank 1 - Sensor 2 High Voltage
P0140	O_2 Sensor Circuit Bank 1 - Sensor 2 No Activity Detected
P0170	Fuel Trim, Bank 1 Malfunction
P0171	Fuel Trim, Bank 1 System too Lean
P0172	Fuel Trim, Bank 1 too Rich
P0201	Cylinder 1 - Injector Circuit
P0202	Cylinder 2 - Injector Circuit

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DTC	DTC DEFINITION
P0203	Cylinder 3 - Injector Circuit
P0204	Cylinder 4 - Injector Circuit
P0219	Engine Overspeed Condition
P0221	Throttle/Pedal Position Sensor/Switch B Range/Performance
P0222	Throttle/Pedal Position Sensor/Switch B Low Input
P0223	Throttle/Pedal Position Sensor/Switch B High Input
P0261	Cylinder 1 - Injector Circuit Low
P0262	Cylinder 1 - Injector Circuit High
P0264	Cylinder 2 - Injector Circuit Low
P0265	Cylinder 2 - Injector Circuit High
P0267	Cylinder 3 - Injector Circuit Low
P0268	Cylinder 3 - Injector Circuit High
P0270	Cylinder 4 - Injector Circuit Low
P0271	Cylinder 4 - Injector Circuit High
P0300	Random/Multiple Cylinder Misfire Detected
P0301	Cylinder 1 Misfire Detected
P0302	Cylinder 2 Misfire Detected
P0303	Cylinder 3 Misfire Detected
P0304	Cylinder 4 Misfire Detected
P0318	Rough Road Sensor "A" Signal Circuit
P0321	Ignition/Distributor Engine Speed Input Circuit Range/Performance
P0322	Ignition/Distributor Engine Speed Input Circuit No Signal
P0324	Knock Control System Error
P0327	Knock Sensor 1 Circuit Low Input
P0328	Knock Sensor 1 Circuit High Input
P0340	Camshaft Position Sensor Circuit
P0341	Camshaft Position Sensor Circuit Range/Performance
P0342	Camshaft Position Sensor Circuit Low Input
P0343	Camshaft Position Sensor Circuit High Input
P0420	Catalyst System, Bank 1 Efficiency Below Threshold
P0444	Evaporative Emission System Purge Control Valve Circuit Open
P0458	Evaporative Emission System Purge Control Valve Circuit Low
P0459	Evaporative Emission System Purge Control Valve Circuit High
P0480	Cooling Fan 1 Control Circuit
P0481	Cooling Fan 2 Control Circuit
P0501	Vehicle Speed Sensor Range/Performance
P0506	Idle Control System RPM Lower than Expected
P0507	Idle Control System RPM High than Expected
P0508	Idle Air Control System Circuit Low
P0509	Idle Air Control System Circuit High
P0511	Idle Air Control Circuit
P0532	A/C Refrigerant Pressure Sensor Circuit Low Input
P0533	A/C Refrigerant Pressure Sensor Circuit High Input

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DTC	DTC DEFINITION
P0537	A/C Evaporator Temperature Sensor Circuit Low
P0538	A/C Evaporator Temperature Sensor Circuit High
P0560	System Voltage Malfunction
P0562	System Voltage Low Voltage
P0563	System Voltage High Voltage
P0571	Brake Switch ″A″ Circuit
P0601	Internal Control Module EEPROM Error
P0602	Control Module Programming Error
P0604	Internal Control Module Random Access Memory (RAM) Error
P0605	Internal Control Module ROM Test Error
P0606	ECM Processor
P0627	Fuel Pump ″A″ Control Circuit Open
P0628	Fuel Pump ″A″ Control Circuit Low
P0629	Fuel Pump ″A″ Control Circuit High
P0645	A/C Clutch Relay Circuit
P0646	A/C Clutch Relay Control Circuit Low
P0647	A/C Clutch Relay Control Circuit High
P0650	Malfunction Indicator Lamp Control Circuit
P0688	EMC/ECM Power Relay Sense Circuit Open
P0691	Cooling Fan 1 Control Circuit Low
P0692	Cooling Fan 1 Control Circuit High
P0693	Cooling Fan 2 Control Circuit Low
P0694	Cooling Fan 2 Control Circuit High
P0700	Transmission Control System Malfunction
P0704	Clutch Switch Input Circuit
P1297	Manufacturer Controlled Computer And Auxiliary Outputs
P1336	Engine Torque Control Adaptation at Limit
P1545	Throttle Position Control Malfunction
P1558	Throttle Actuator Electrical Malfunction
P1559	Idle Speed Control Throttle Position Adaptation Malfunction
P1564	Idle Speed Control Throttle Position Low Voltage during Adaptation
P1565	Idle Speed Control Throttle Position Lower Limit not Attained
P1568	Idle Speed Control Throttle Position Mechanical Malfunction
P1579	Idle Speed Control Throttle Position Adaptation not Started
P1604	Internal Control Module Driver Error
P1610	Manufacture Controlled Computer and Auxiliary Outputs
P1611	Manufacture Controlled Computer and Auxiliary Outputs
P1612	Manufacture Controlled Computer and Auxiliary Outputs
P1613	Manufacture Controlled Computer and Auxiliary Outputs
P1614	Manufacture Controlled Computer and Auxiliary Outputs
P1651	Manufacture Controlled Computer and Auxiliary Outputs
P2106	Throttle Actuator Control System Forced Limited Power
P2122	Throttle/Pedal Position Sensor/Switch D Circuit Low Input

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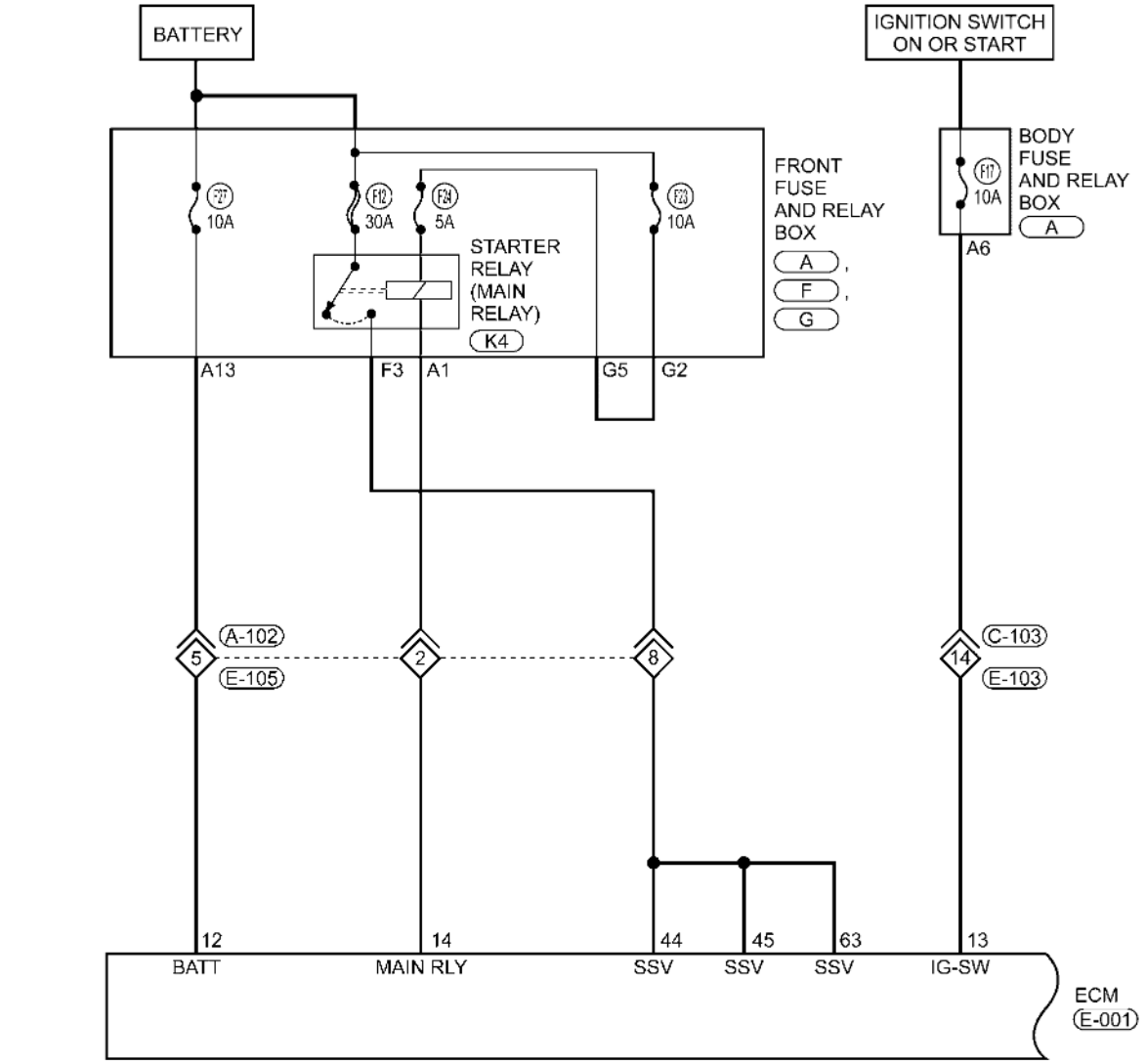
DTC	DTC DEFINITION
P2123	Throttle/Pedal Position Sensor/Switch D Circuit High Input
P2127	Throttle/Pedal Position Sensor/Switch E Circuit Low Input
P2128	Throttle/Pedal Position Sensor/Switch E Circuit High Input
P2138	Accelerator Pedal Position Sensor Signal Correlation Error
P2177	System Too Lean off Idle
P2178	System Too Rich off Idle
P2187	System Too Lean at Idle
P2188	System Too Rich at Idle
P2195	O_2 Sensor Signal Stuck Lean; Bank 1 Sensor 1
P2196	O_2 Sensor Signal Stuck Rich; Bank 1 Sensor 1
P2270	O_2 Sensor Signal Stuck Lean; Bank 1 Sensor 2
P2271	O_2 Sensor Signal Stuck Rich; Bank 1 Sensor 2
U0001	High Speed CAN Defective
U0101	Lost Communication with ECM
U0104	Lost Communication with Cruise Control Module
U0121	Lost Communication with Anti-Lock Brake System (ABS) Control Module
U0155	Lost Communication with Instrument Panel Cluster Control Module
U0415	Invalid Data Received from ABS Control Module

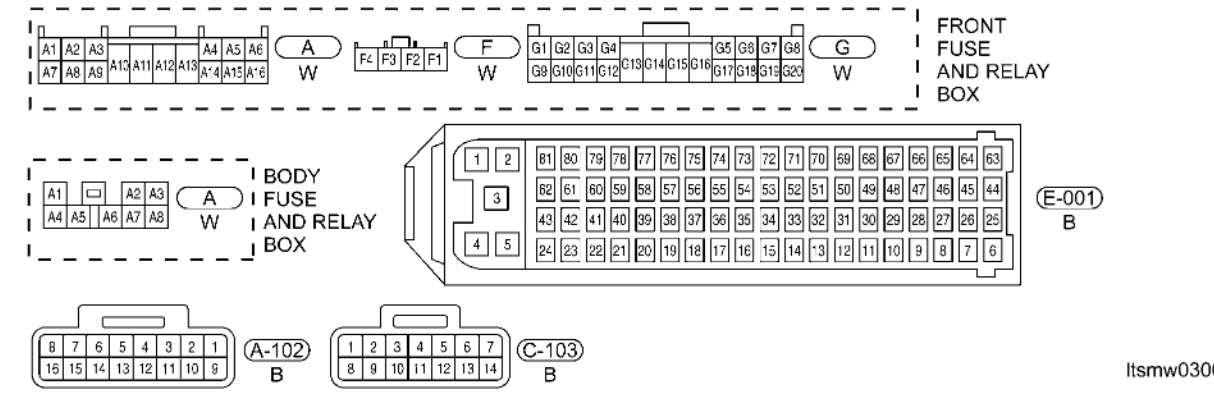
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ECM Power Supply and Ground Circuit Test

Power Supply And Ground Circuit Diagnostic Check

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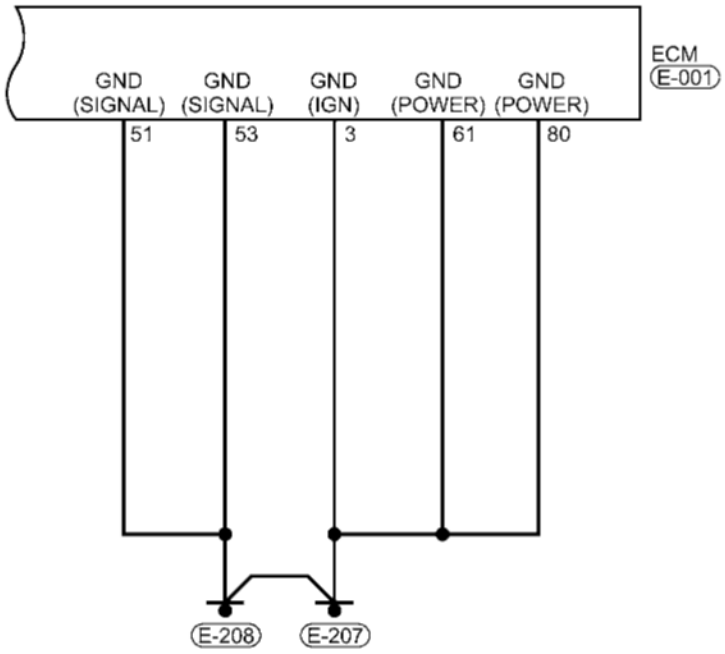
Check reference values between ECM terminals and ground under the following conditions:

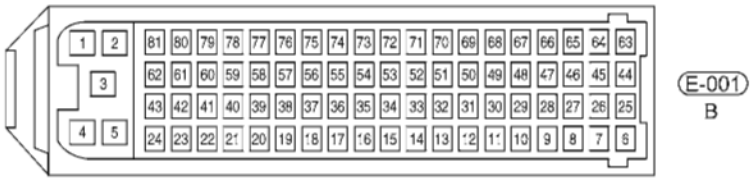
ECM Power Supply Circuits

TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
12	Battery	-	Battery Voltage (11 - 14 V)
13	Ignition switch	Ignition switch: ON	Battery Voltage (11 - 14 V)
		Ignition switch: OFF	Approximately 0 V
14	ECM main relay	• Ignition switch: OFF • More than a few seconds after turning ignition switch OFF	Battery Voltage (11 - 14 V)
44	Power supply for ECM	Ignition switch: ON	Battery Voltage (11 - 14 V)
45			
63			

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EEC - 2.0L - PWR - 02





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
3	ECM ground (IGN)	Ignition switch: ON	Approximately 0 V
51	ECM ground (Signal)	Ignition switch: ON	Approximately 0 V
53	ECM ground (Signal)	Ignition switch: ON	Approximately 0 V
61	ECM ground (Power)	Ignition switch: ON	Approximately 0 V
80	ECM ground (Power)	Ignition switch: ON	Approximately 0 V

Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- Start engine then select view data stream.
- If the data stream is detected, the condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).
- If data stream is not detected, go to Diagnostic Procedure - Step 1.

1. INSPECTION START

- Start engine.

Is engine running?

Yes >> Go to step 7.

No >> Go to step 2.

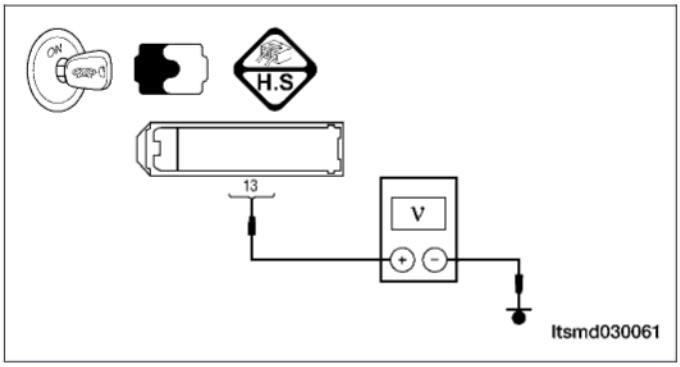
2. CHECK ECM POWER SUPPLY CIRCUIT - (1)

- Turn ignition switch off and then on.
- Check voltage between ECM terminal 13 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 4.

No >> Go to step 3.



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3. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors C-103, E-103, terminal 14
  - Front fuse and relay box connector A
  - Fuse 17
- Check harness for open or short between ECM and fuse.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

4. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten one ground screw on the body.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

5. CHECK ECM GROUND CIRCUIT FOR AN OPEN OR SHORT

- Disconnect ECM harness connector.
- Check harness continuity between ECM terminals 3, 51, 53, 61, 80 and ground.
- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

6. DETECT MALFUNCTIONING PART

- Check harness for open or short between ECM terminals 3, 51, 53, 61, 80 and ground.
- Check harness for an open or short to power in harness or connectors.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short to power in harness or connectors.

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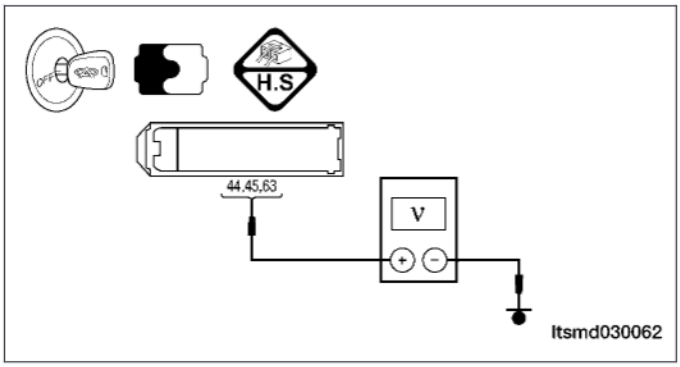
7. CHECK ECM POWER SUPPLY CIRCUIT - (2)

- Turn ignition switch on and then off.
- Check voltage between ECM terminals 44, 45, 63 and ground.
- Voltage: Turn the ignition switch on and battery voltage should exist. Turning the ignition switch OFF, battery voltage will exist for a few seconds, then drop to approximately 0 V.

Is the check result normal?

Yes >> Check the starting system.

No >> Go to the next step.



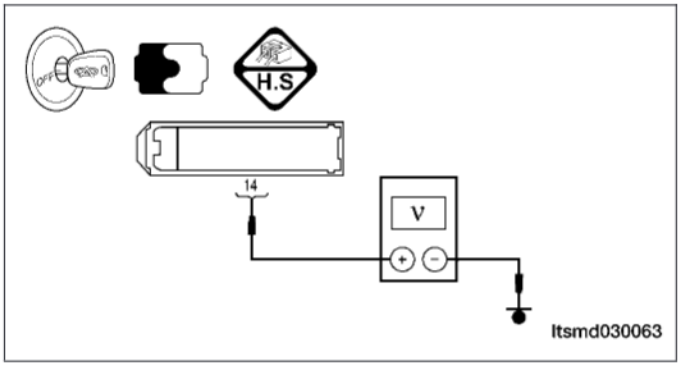
8. CHECK THE STARTER RELAY CONTROL CIRCUIT

- Turn ignition switch OFF. Wait for at least 10 seconds.
- Check voltage between ECM terminal 14 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Go to step 10.



9. CHECK ECM POWER SUPPLY CIRCUIT - (3)

- Disconnect ECM harness connector.
- Disconnect front fuse and relay box harness connector F.
- Check harness continuity between ECM terminals 44, 45, 63 and front fuse and relay box terminal F3.
- Continuity should exist.
- Check harness for short to ground and short to power.

Is the check result normal?

Yes >> Go to step 12.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

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10. CHECK STARTER RELAY CONTROL CIRCUIT

- Disconnect ECM harness connector.
- Disconnect front fuse and relay box harness connector A.
- Check harness continuity between ECM terminal 14 and front fuse and relay box terminal A1.
- Check harness continuity between front fuse and relay box terminal G2 and G5.
- Continuity should exist.
- Also check harness for short to ground and short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to ground or short to power in harness or connectors.

11. CHECK FUSE

- Disconnect fuse 23 (10A), fuse 24 (5A) in front fuse and relay box.
- Check fuses.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace fuse 23 or 24.

12. CHECK FRONT FUSE AND RELAY BOX

- Check the front fuse and relay box for damage.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace front fuse and relay box.

13. REPLACE AND PROGRAM ECM

- Replace the ECM.

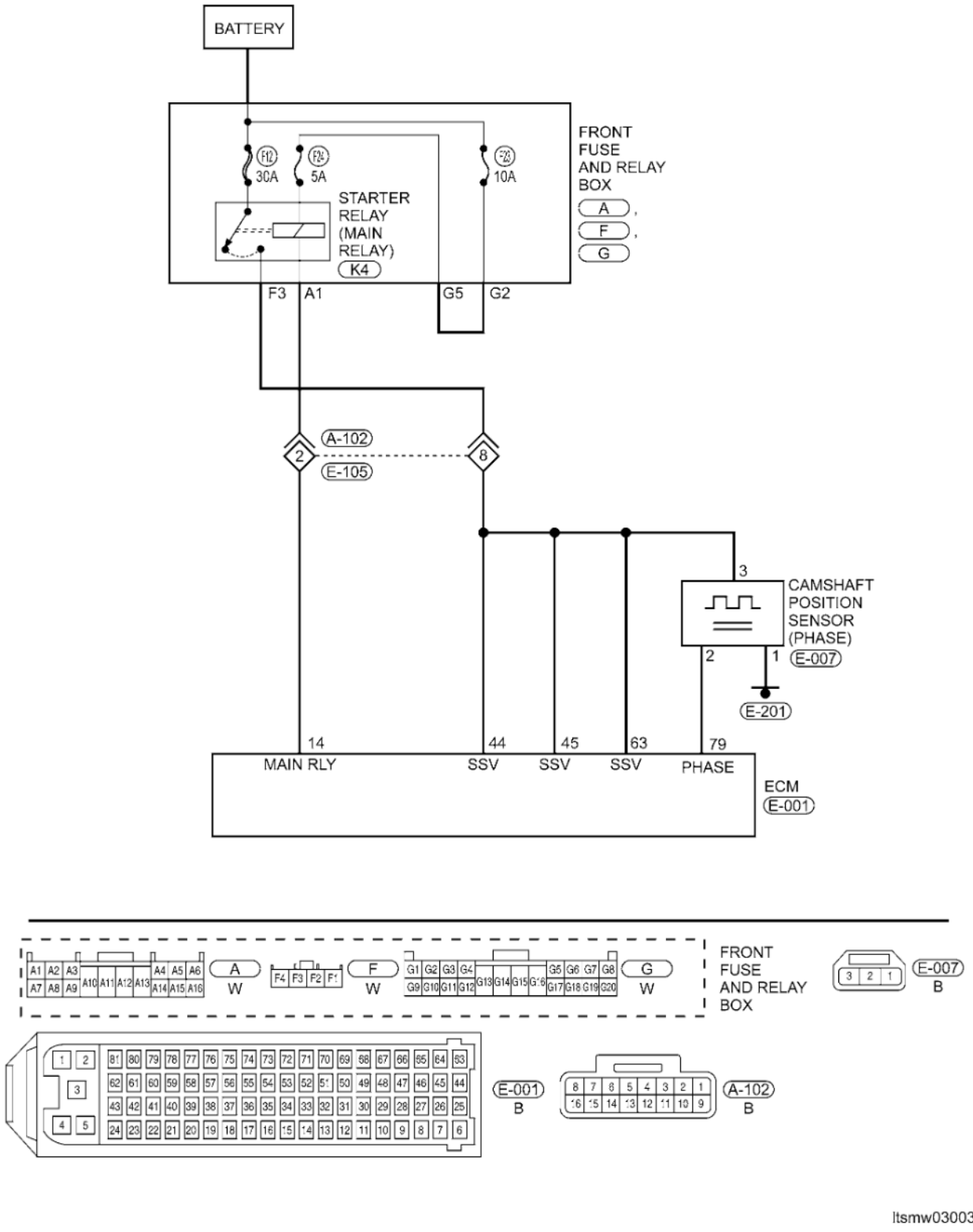
NOTE :
The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

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Diagnostic Trouble Code (DTC) Tests

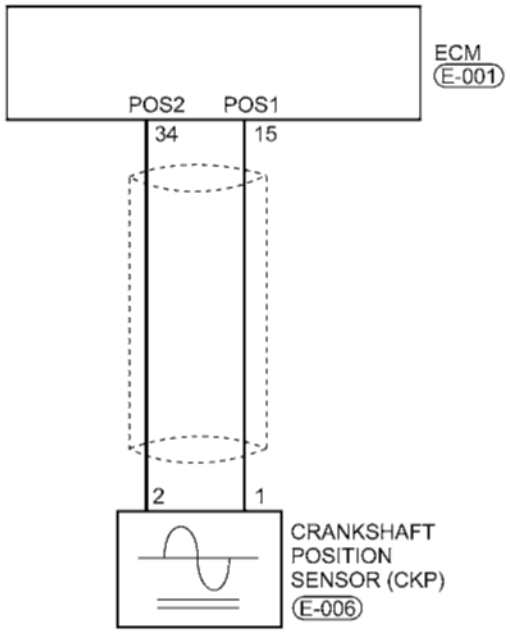
P0016 - Camshaft Position-Crankshaft Position Correlation Error

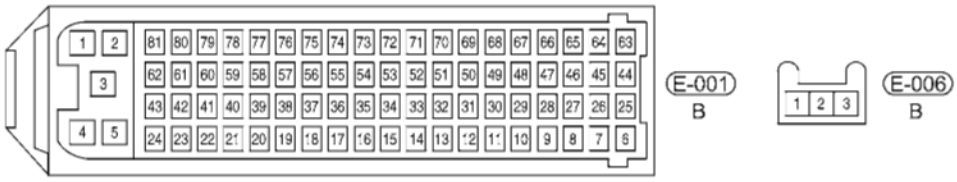
EEC - 2.0L - PHASE - 01



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EEC - 2.0L - POS - 01





ltsmw030027t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
15	Crankshaft Position (CKP) sensor	• Ignition switch: ON • Engine: Not cranking	3 V
34			
79	Camshaft Position (CMP) sensor	• Ignition switch: ON • Engine: Not cranking	11 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0016	Camshaft position-Crankshaft position correlation error	Engine is running	ECM detects that the CMP sensor is out of phase with CKP sensor.	• Crankshaft Position (CKP) sensor • Camshaft Position (CMP) sensor • Harness or connectors • Crankshaft signal plate • Camshaft signal plate • Timing misalignment • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Connect the X-431 scan tool to the diagnostic connector (DLC) - use the most current software available, press the POWER key to start the X-431.
- Turn ignition switch on and record and erase DTC.
- Start engine and warm it up to the normal operating temperature.
- With the scan tool, select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

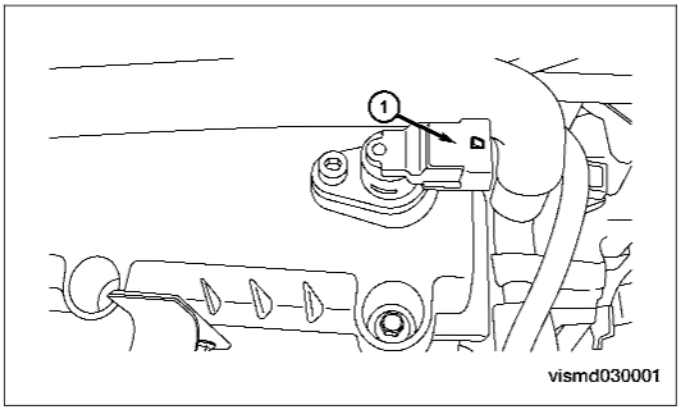
2. CHECK CMP SENSOR ELECTRICAL CONNECTOR

- Disconnect the CMP sensor electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



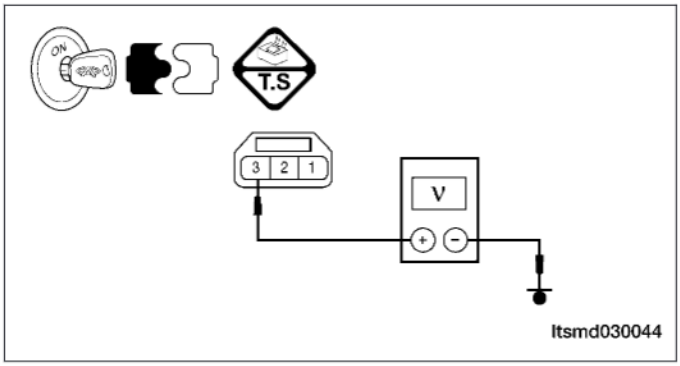
3. CHECK CMP SENSOR POWER SUPPLY CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check CMP sensor supply voltage between sensor connector E-007, terminal 3 and ground in the sensor electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box F3
  - Fuse 22, Fuse 12
  - Check harness for open or short between CMP sensor and fuse.
- With the X-431 scan tool, read ECM DTCs.

Is DTC P0016 still present?

Yes >> Go to the next step.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

5. CHECK CMP SENSOR GROUND CIRCUIT FOR AN OPEN AND SHORT

- Turn ignition switch off.
- Check harness continuity between CMP sensor terminal 1 and ground.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

6. CHECK CMP SENSOR INPUT SIGNAL CIRCUIT FOR AN OPEN AND SHORT

- Turn ignition switch on.
- Check voltage between CMP sensor terminal 2 and ground.
- 11 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power or short to ground in harness or connectors.
If circuit is normal, go to the next step.

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7. CHECK CMP SENSOR SIGNAL

- Turn ignition switch off.
- Connect CMP sensor connector.
- Check signal voltage between CMP sensor terminal 2 and ground when engine is running.
- Approximately 6 V square wave signal should exist.

	CMP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030003

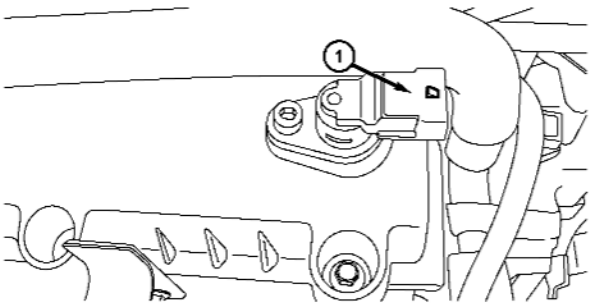
Is the CMP output signal normal?

Yes >> Go to step 10.

No >> Go to the next step.

8. CHECK CMP SENSOR

- Remove the CMP sensor (1).
- Inspect and clean the CMP sensor and mounting area for any condition that would result in an incorrect signal, such as damage, foreign material, or excessive movement.



vismd030001

Is the mounting area OK?

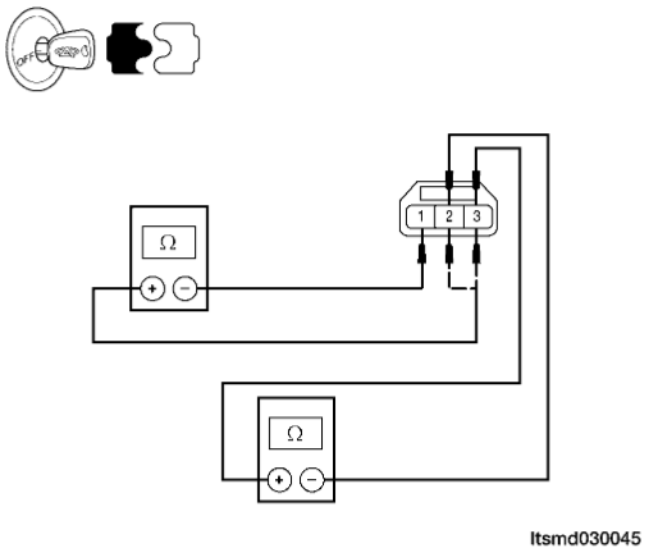
Yes >> Go to the next step.

No >> Repair or replace the sensor as necessary.

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9. CHECK CMP SENSOR RESISTANCE

- Check the resistance of the CMP sensor, component side.

TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Except 0 or ∞	
1 & 3		
2 & 3		

Is the check result normal?

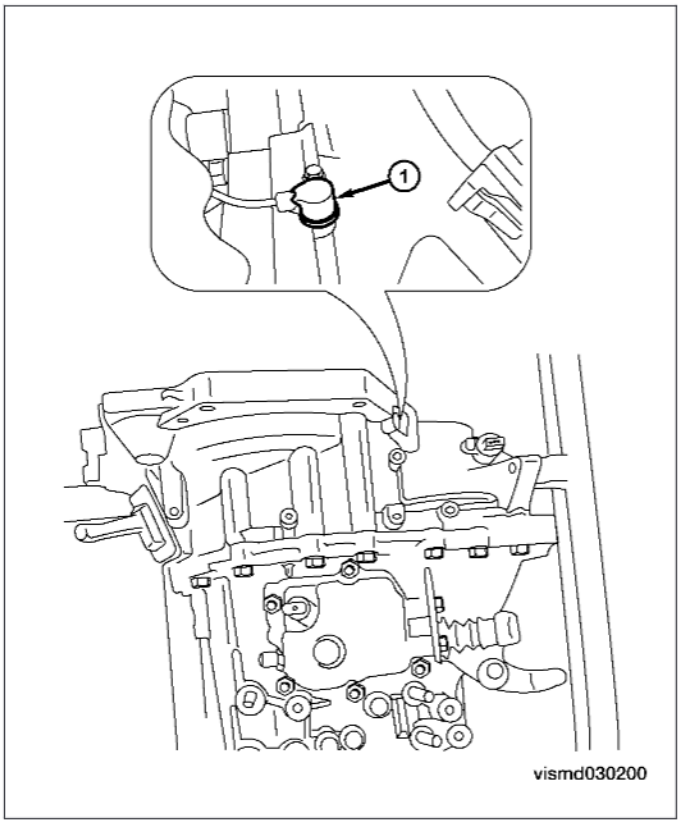
Yes >> Replace the CMP sensor with a known good CMP sensor.
Monitor the CMP sensor signal on the KES-200 screen.
- If the CMP sensor signals were normal, the system is OK.
- If the CMP sensor signals were still irregular or missing, go to step 14.

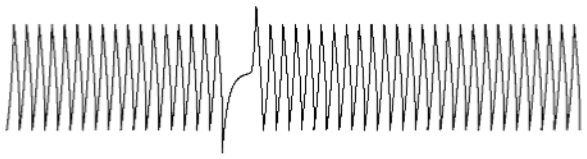
No >> Eliminate any condition that would result in an incorrect signal.

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10. CHECK CKP SENSOR SIGNAL

- Check signal between CKP sensor (1) terminal 1 or 2 and ground when engine is running.



	CKP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030002

Is the CKP output signal normal?

Yes >> Go to step 12.

No >> Go to the next step.

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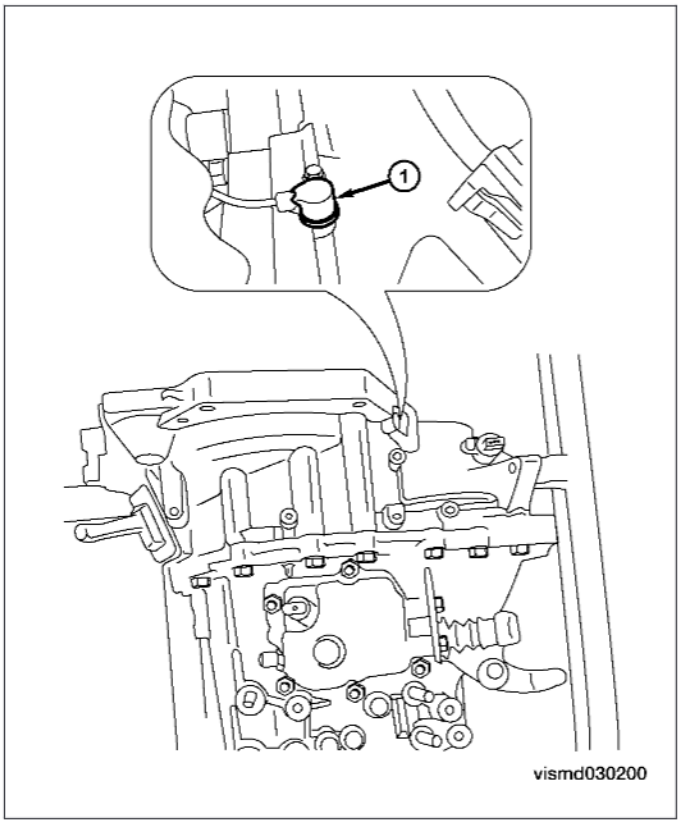
11. CHECK CKP SENSOR ELECTRICAL CONNECTOR

- Disconnect the CKP sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



12. CHECK CKP SENSOR

- Remove the CKP sensor.
- Inspect and clean the CKP sensor and mounting area for any condition that would result in an incorrect signal, such as damage, foreign material, or excessive movement.

Is the mounting area OK?

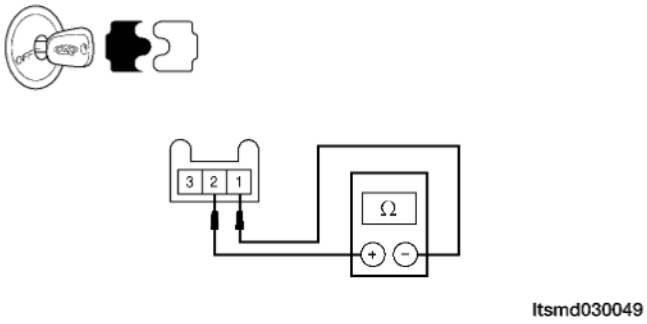
Yes >> Go to the next step.

No >> Repair or replace the sensor as necessary.

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13. CHECK CKP SENSOR RESISTANCE

- Check the resistance of the CKP sensor, component side.

TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Approximately 860 Ω	

Is the check result normal?

Yes >> Replace the CKP sensor with a known good CKP sensor.
Monitor the CKP sensor signal on the KES-200 screen.
- If the CKP sensor signals were normal, the system is OK.
- If the CKP sensor signals were still irregular or missing, go to step 15.

No >> Replace the CKP sensor.

14. CHECK CAMSHAFT AND CAMSHAFT SIGNAL PLATE

- Remove the cylinder head cover and timing belt cover (See timing belt removal and installation in Section 02 engine).
- Check the installed clearance (See CMP sensor Removal & Installation in Section 03 Electronic Engine Controls).
- 0.8 - 1.2 mm should exist.
- Check the camshaft and camshaft signal plate for any condition that would result in an incorrect signal, such as damage, become flexible, foreign material when rotate the camshaft.

Were any problems found?

Yes >> Remove debris and clean the signal plate of camshaft rear end or replace camshaft.
Reinstall CMP sensor.

No >> Go to step 17.

15. CHECK THE CRANKSHAFT AND CRANKSHAFT SIGNAL PLATE

- Check the installed clearance (See CKP sensor Removal & Installation in Section 08 Transaxle & Transfer Case).
- 0.8 - 1.2 mm should exist.
- Check the crankshaft and camshaft signal plate for any condition that would result in an incorrect signal, such as damage, become flexible, foreign material when rotate the camshaft.

Were any problems found?

Yes >> Remove debris and clean the signal plate of crankshaft rear end or replace crankshaft.
Reinstall the CKP sensor.

No >> Go to the next step.

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16. CHECK TIMING

- Check for timing misalignment.

Is the timing misaligned?

Yes >> Align the engine timing belt (See Timing Belt Removal & Installation in Section 02 Engine).

No >> Go to the next step.

17. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0016 still present?

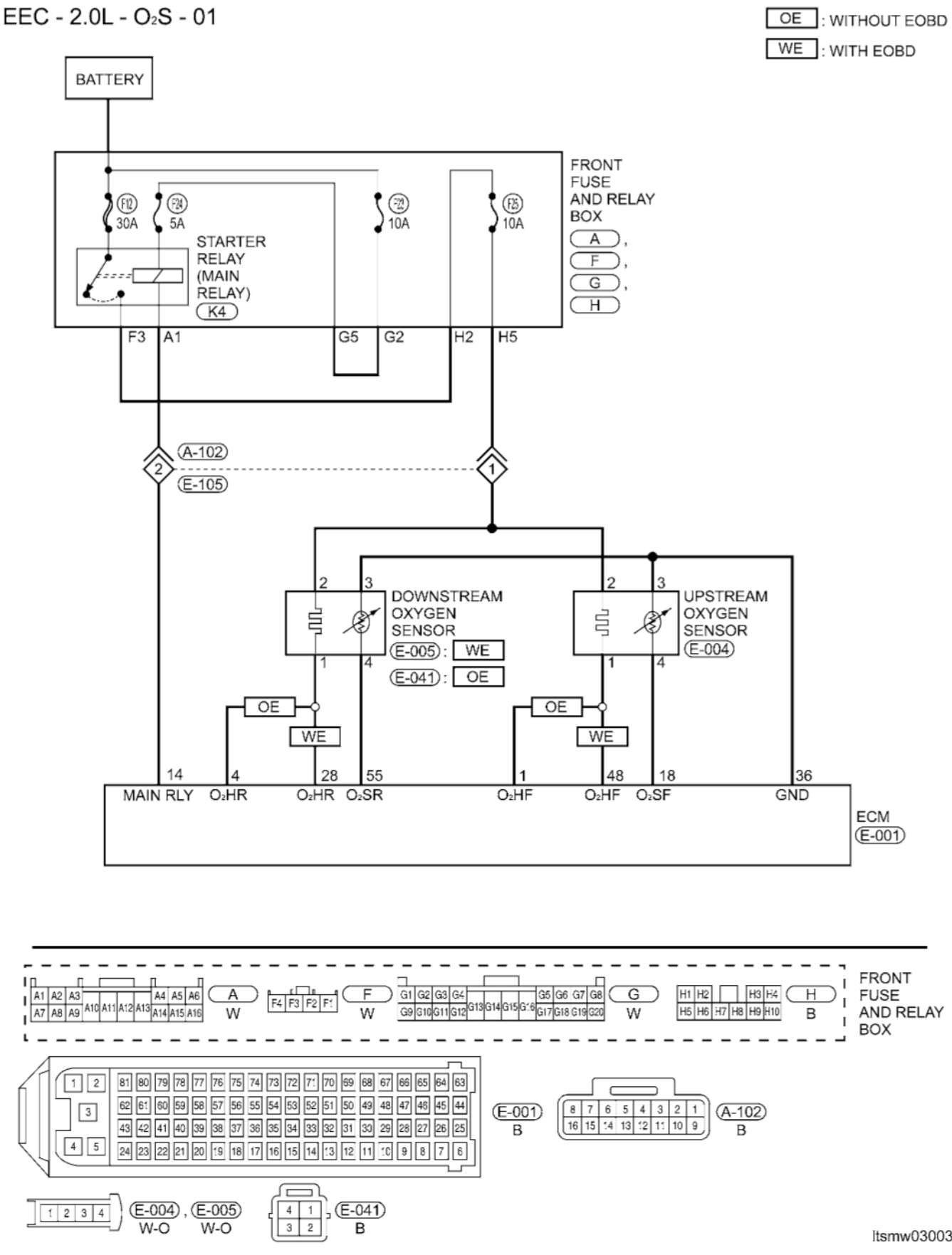
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0031 - O_2 Sensor 1 Heater Control Circuit Low



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
18	Upstream oxygen sensor	• Engine is running • Warm-up condition • Keep the engine speed 2000 RPM	Approximately 0.1 - 0.9 V (change 5 - 8 times in 10 seconds periodically)
28	Downstream oxygen sensor heating	-	-
36	Sensor (GND)	• Warm-up condition • Idle speed	Approximately 0 V
48	Upstream oxygen sensor heating	-	-
55	Downstream oxygen sensor	• Engine is running • Warm-up condition • Keep the engine speed 2000 RPM	Approximately 100 mV

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0031	O_2 sensor 1 heater control circuit low	Engine is running	• Fuel quality • Upstream O_2 sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on and record and erase DTC.
- Start engine and warm it up to the normal operating temperature.
- Turn ignition switch off and wait at least 10 seconds.
- Start engine and keep the engine speed 2000 RPM for at least 1 minute.
- Let engine idle for 2 minutes, select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-20 7 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

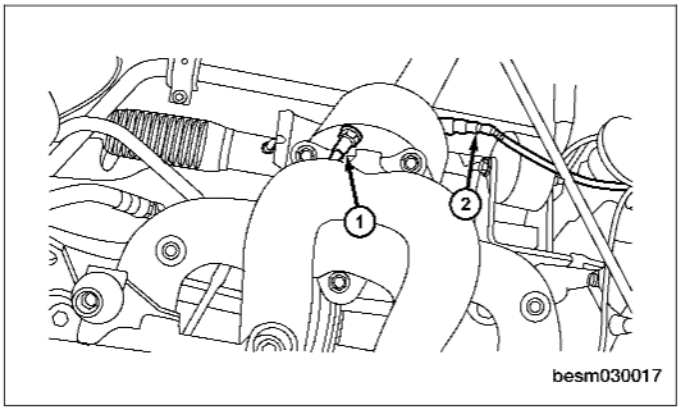
2. CHECK UPSTREAM O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the upstream O_2 sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



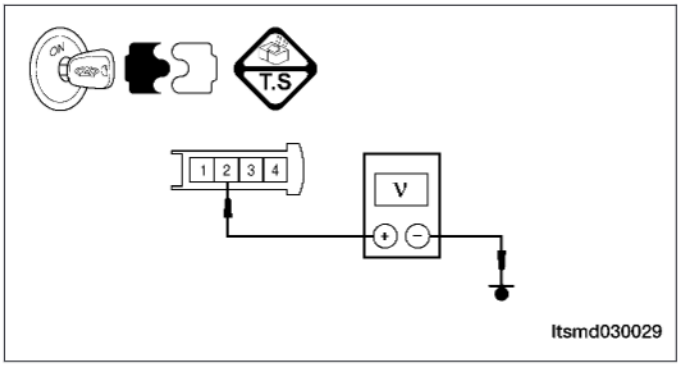
3. CHECK UPSTREAM O_2 SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between O_2 sensor terminal 2 and ground in the O_2 sensor electrical connector E-005.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to Step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box H2, H5
  - Fuse 25, fuse 12, fuse 23, fuse 24
- Check harness for an open or short between O_2 sensor and fuse.
- Repair or replace malfunctioning part.
- With the X-431, select view DTC.

Is DTC P0031 still present?

Yes >> Go to the next step.

No >> The system is normal now.

5. CHECK O_2 SENSOR HEATER CONTROL CIRCUIT FOR OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM connector.
- Check harness continuity between ECM terminal and O_2 sensor terminal.

COMPONENT	ECM	UPSTREAM O_2 SENSOR
TERMINAL	• 48 (With EOBD) • 1 (Without EOBD)	1

- Continuity should exist.
- Check harness for short to ground.

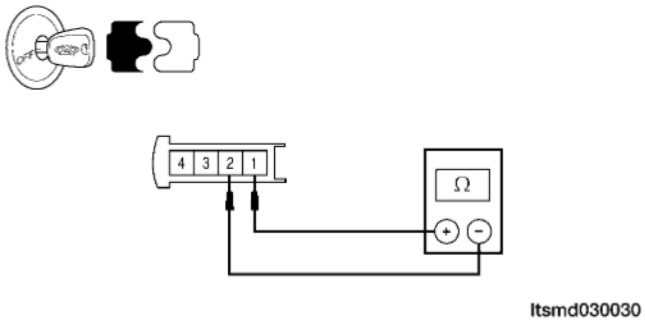
Is the check result normal?

Yes >> Go to the next step.

No >> Repair the circuit for an open or short in harness or connectors.

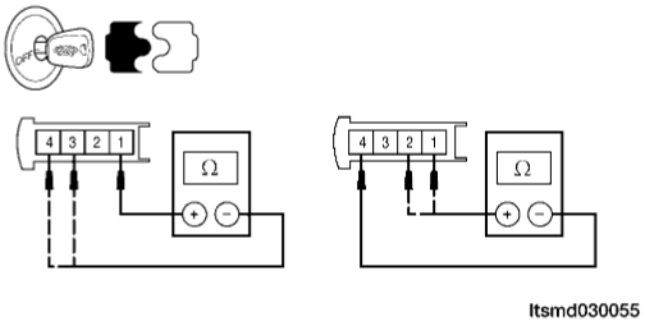
6. CHECK O_2 SENSOR HEATER

- Check resistance between O_2 sensor heater terminals.

TERMINAL NO.	RESISTANCE	
1 and 2 (including cable and connector)	Approximately 9 Ω	 Itsmd030030

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- Check resistance between O_2 sensor terminals.

TERMINAL NO.	RESISTANCE	
1 & 3 and 1 & 4	∞ Ω (Continuity should not exist)	
4 & 1 and 4 & 2		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace O_2 sensor.

7. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0031 still present?

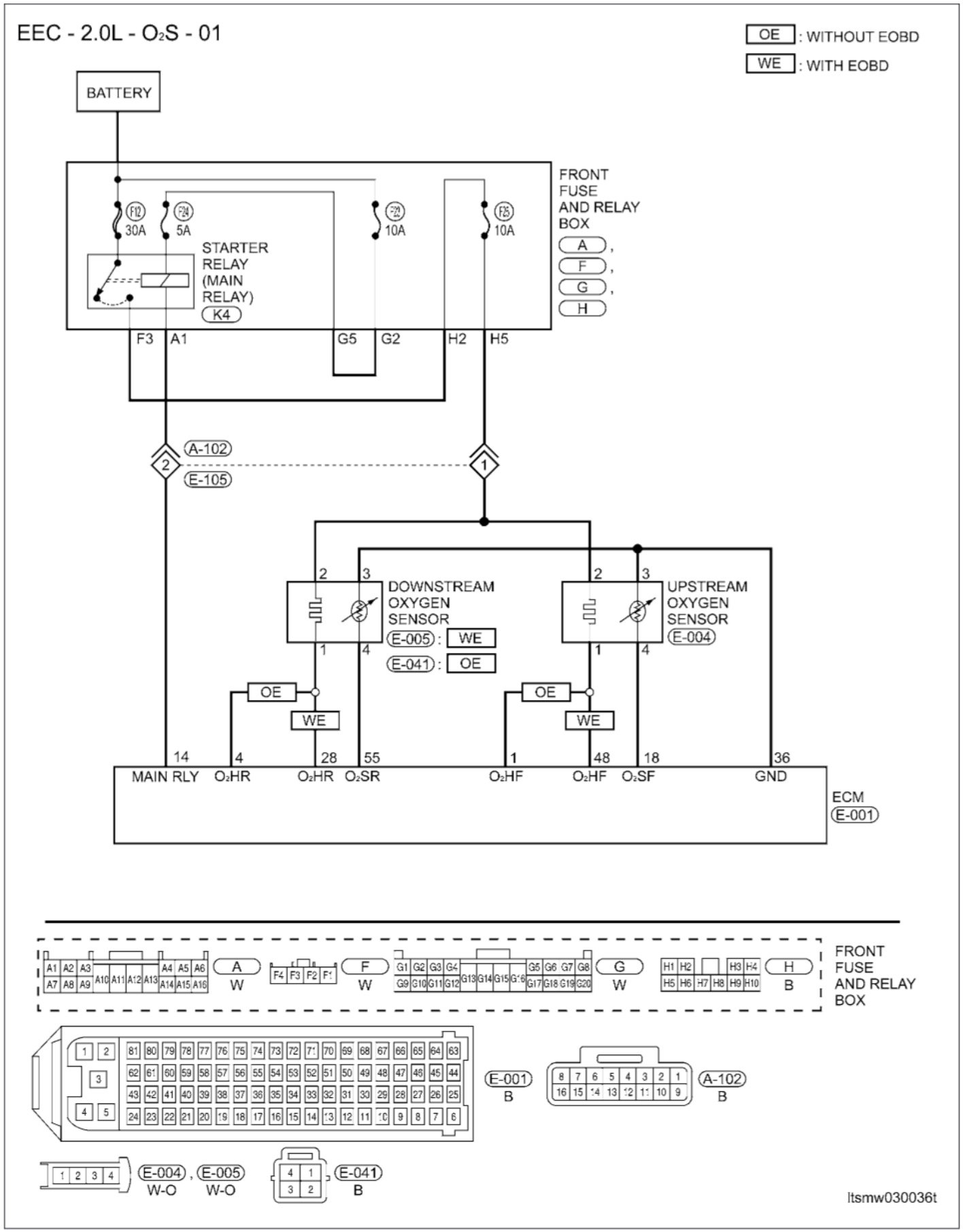
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0032 - O_2 Sensor 1 Heater Control Circuit High



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Specification data are reference values and are measured between each terminal and ground.

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
18	Upstream oxygen sensor	• Engine is running • Warm-up condition	Approximately 0.1 - 0.9 V (change 5 - 8 times in 10 seconds periodically)
28	Downstream oxygen sensor heating (with EOBD)	-	-
36	Sensor (GND)	• Warm-up condition • Idle speed	Approximately 0 V
48	Upstream oxygen sensor heating (without EOBD)	-	-
55	Downstream oxygen sensor	• Engine is running • Warm-up condition	Approximately 100 mV

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0032	O_2 sensor 1 heater control circuit high	Engine is running	• Upstream Oxygen Sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on and record and erase DTC.
- Start engine and warm it up to the normal operating temperature.
- Turn ignition switch off and wait at least 10 seconds.
- Start engine and keep the engine speed 2000 RPM for at least 1 minute.
- Let engine idle for 2 minutes, select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

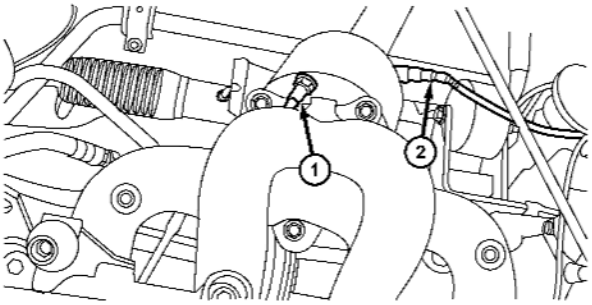
2. CHECK UPSTREAM O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the upstream O_2 sensor (1) electrical connector E-004.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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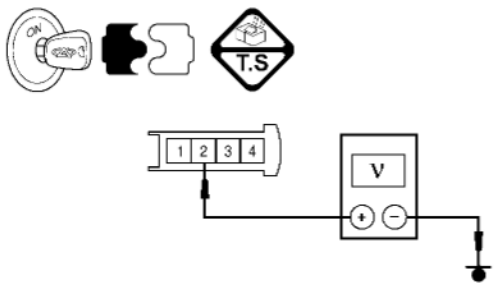
3. CHECK UPSTREAM O_2 SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between upstream O_2 sensor terminal 2 and ground in the O_2 sensor electrical connector E-004.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to Step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box H2, H5
  - Fuse 25, Fuse 12, Fuse 23, Fuse 24
- Check harness for open or short between O_2 sensor and fuse.
- Repair or replace malfunctioning part.
- With the X-431, select view DTC.

Is DTC P0032 still present?

Yes >> Go to the next step.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

5. CHECK O_2 SENSOR HEATER CONTROL CIRCUIT FOR A SHORT

- Turn ignition switch off.
- Disconnect ECM connector.
- Check harness continuity between ECM terminal and O_2 sensor terminal.

COMPONENT	ECM	UPSTREAM O_2 SENSOR
TERMINAL	• 48 (With EOBD) • 1 (Without EOBD)	1

- Continuity should exist.
- Check harness short to power supply circuit.

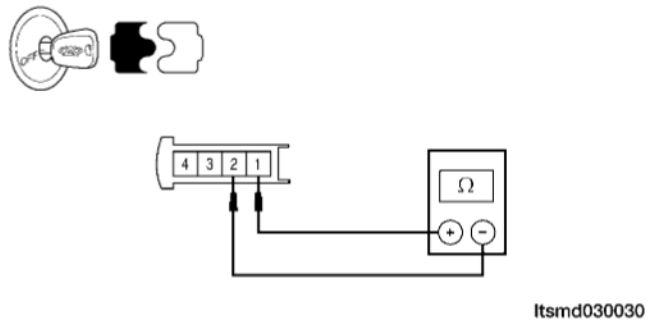
Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for a short to power in harness or connectors.

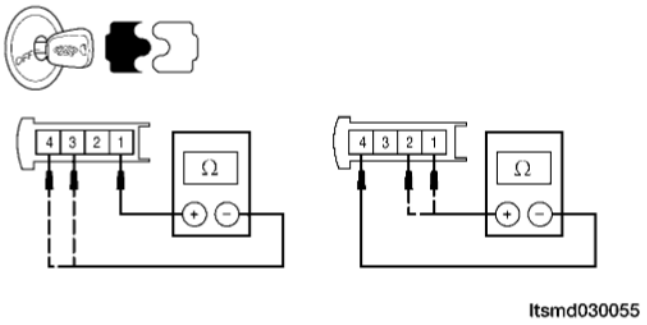
6. CHECK THE O_2 SENSOR HEATER

- Check resistance between O_2 sensor heater terminals.

TERMINAL NO.	RESISTANCE	
1 & 2 (including cable and connector)	Approximately 9 Ω	 Itsmd030030

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- Check resistance between O_2 sensor terminals.

TERMINAL NO.	RESISTANCE	
1 & 3 and 1 & 4	∞ Ω (Continuity should not exist)	
4 & 1 and 4 & 2		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace O_2 sensor.

7. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0032 still present?

Yes >> Replace the ECM.

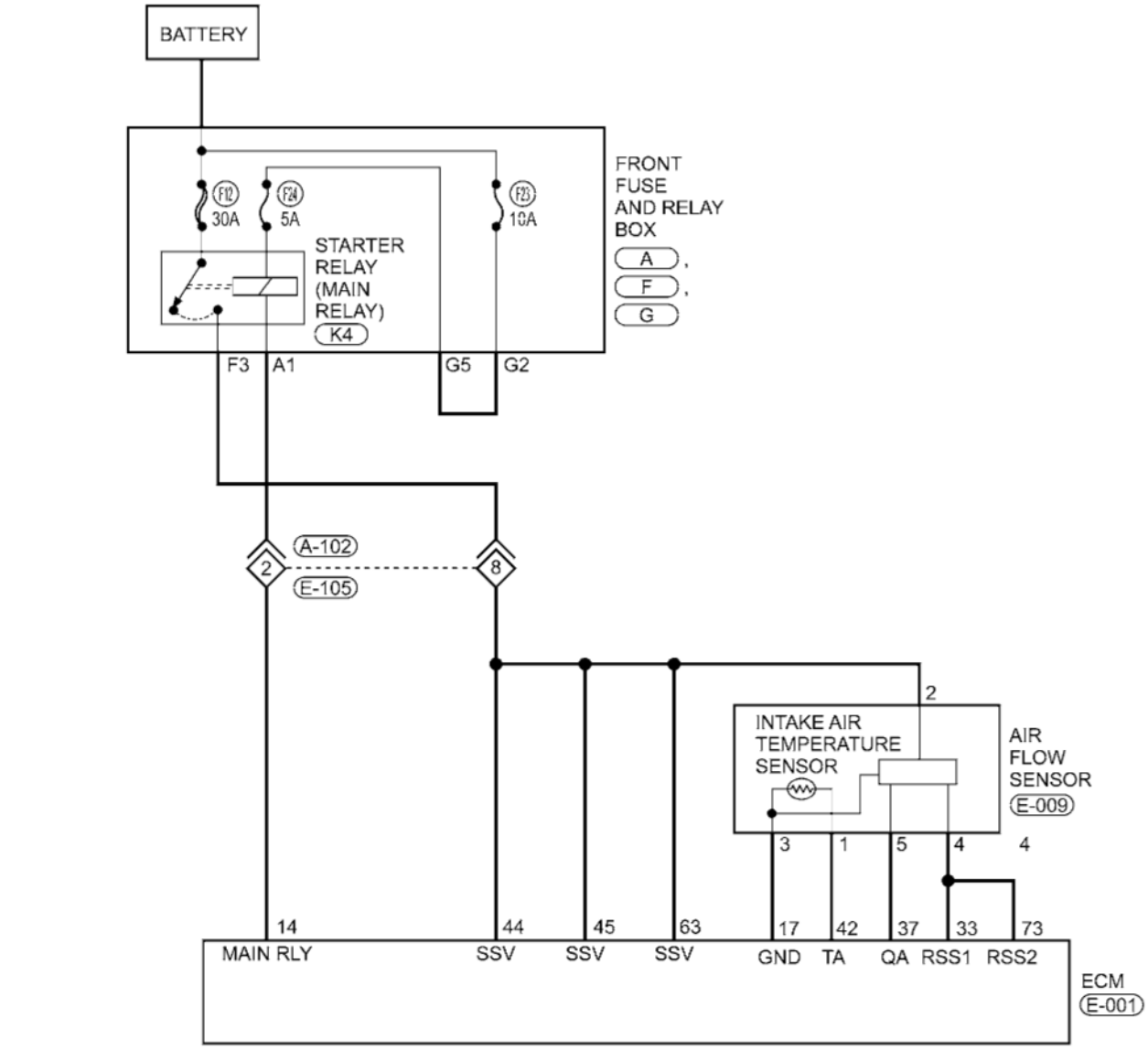
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

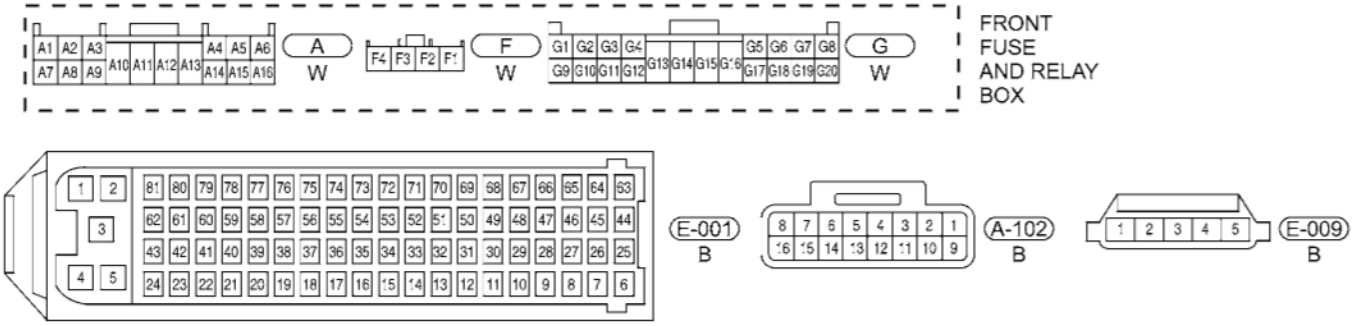
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0102 - Mass Or Volume Air Flow Circuit Low Input

EEC - 2.0L - MAF - 01





ltsmw030033t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
17	Sensor (GND)	• Engine is running • Warm-up condition: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 0 V
33	Regulated sensor supply		5 V
37	Air flow sensor		Approximately 322 kg/h
			Approximately 1.39 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0102	Mass or Volume Air Flow (MAF) circuit low input	Ignition switch on or engine is running	ECM detected that the input signal is out of the acceptable range.	• MAF sensor • Intake air leaks • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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2. CHECK INTAKE SYSTEM

- Check the following for proper connection.
  - Air duct
  - Vacuum hoses
  - Intake air passage between air duct and manifold

Is the check result normal?

Yes >> Go to the next step.

No >> Reconnect the connectors or replace the malfunctioning part.

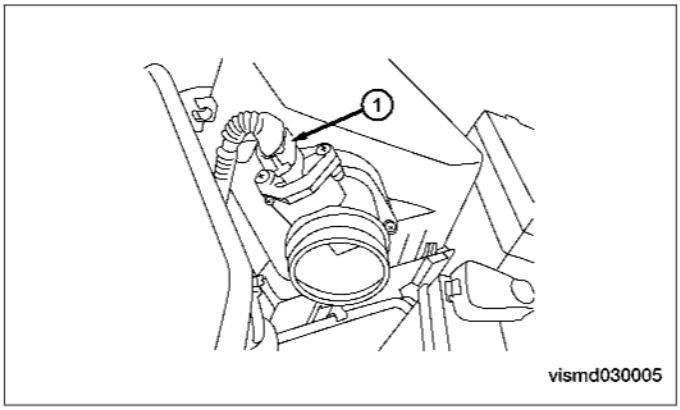
3. CHECK MAF SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAF sensor electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



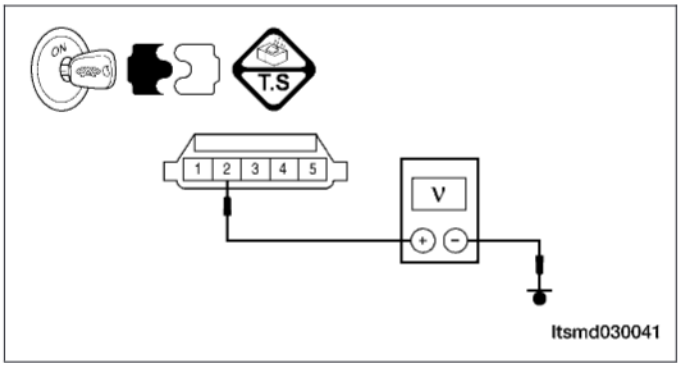
4. CHECK THE MAF SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check voltage between MAF sensor terminal 2 and ground in the MAF sensor electrical connector E-009.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.



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5. DETECT MALFUNCTIONING PART

- Check the following parts:
  - Relay
  - Fuse 23, fuse 24, fuse 12
  - Harness connectors A-102, E-105
- Check harness for an open or short between MAF sensor and fuse.
- Repair an open circuit or short to ground in harness or connectors.
- With the X-431, view DTC in ECM.

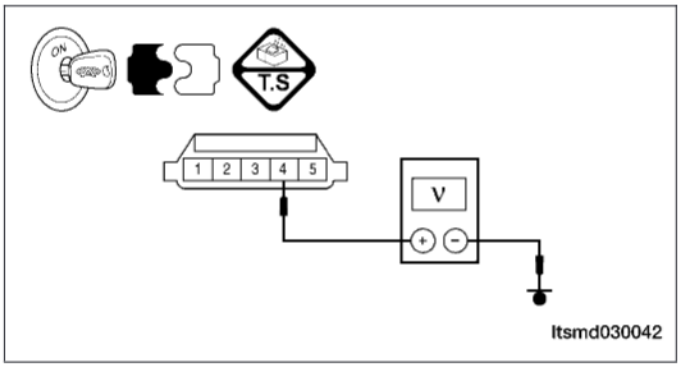
Is DTC P0102 present?

Yes >> Go to the next step.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

6. CHECK MAF SENSOR REFERENCE VOLTAGE

- Check voltage between MAF sensor terminal 4 and ground in the MAF sensor electrical connector E-009.
- 5 V should exist.



Is the check result normal?

Yes >> Go to the next step.

No >> Repair the circuit for an open or short to ground in harness or connectors.
If circuit is normal, replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

7. CHECK MAF SENSOR GROUND CIRCUIT FOR OPEN AND SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between MAF sensor terminal 3 and ECM terminal 17.
- Continuity should exist.
- Check harness for short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace open circuit or short to ground in harness or connectors.

8. CHECK THE MAF SENSOR OUTPUT SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between MAF sensor terminal 5 and ECM terminal 37.
- Continuity should exist.
- Check harness for a short to ground or power.

Is the check result normal?

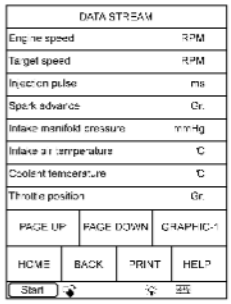
Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to ground in harness or connectors.

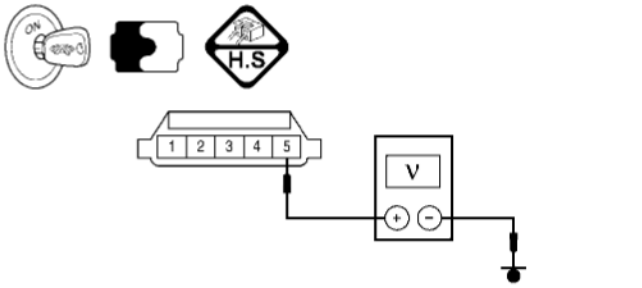
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9. CHECK MAF SENSOR SIGNAL

- Install all removed parts.
- Start engine.
- Check MAF sensor signal with the X-431.

ECM TERMINAL NO.	ITEM	CONDITION	DATA	
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal voltage: 1.88 V	Approximately 322 kg/h	
			Approximately 1.39 V	ltsmd030001t

- If without the X-431, check voltage between MAF sensor terminal 5 and ground.

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)	
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 1.39 V	 ltsmd030043

- If the signal voltage is out of specification, proceed with the following.
- Check for the causes of uneven air flow through the MAF sensor.
  - Crushed air ducts
  - Air cleaner seal
  - Uneven dirt of air cleaner element
- If the parts malfunctioning, repair or replace them.
- If the parts OK, clean the MAF sensor, then check the signal of the MAF sensor.

Is the signal voltage of MAF normal?

Yes >> Go to the next step.

No >> Replace MAF sensor.

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10. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0102 still present?

Yes >> Replace the ECM.

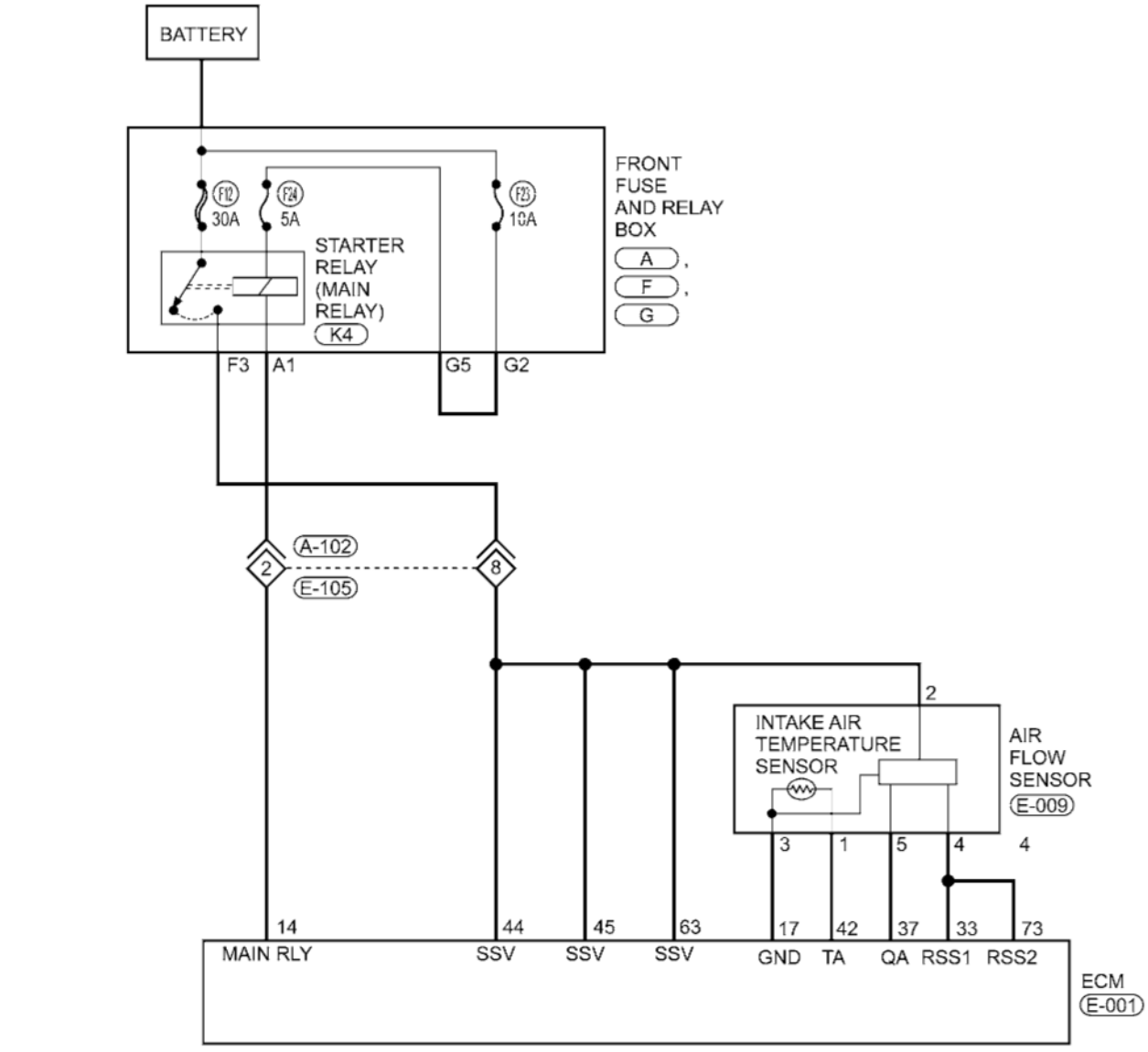
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

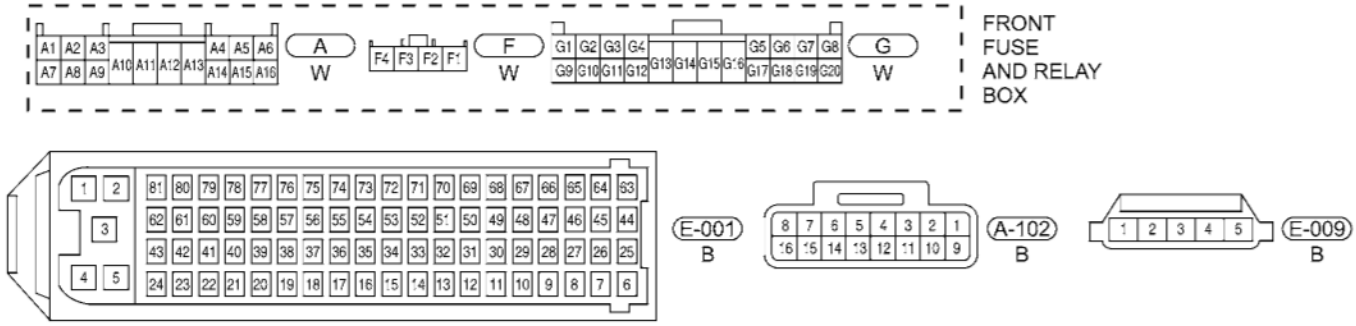
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0103 - Mass Or Volume Air Flow Circuit High Input

EEC - 2.0L - MAF - 01





ltsmw030033t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA
17	Sensor (GND)	Ignition switch on	Approximately 0 V
33	Regulated sensor supply 1		5 V
37	Air flow sensor	• Engine is running • Warm-up condition ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	• Approximately 322 kg/h • Approximately 1.39 V
		• Engine is running • Warm-up condition ECT: 52°C • Idle: 910 RPM • IAT: 30°C • IAT signal: 2.17 V	• Approximately 420 kg/h • 1.52 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0103	Mass or Volume Air Flow (MAF) circuit high input	Ignition switch on or engine is running	ECM detected that the input signal is out of the acceptable range.	• MAF sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

2. CHECK INTAKE SYSTEM

- Check the following for connection:
  - Air cleaner
  - Intake air duct

Is the check result normal?

Yes >> Go to the next step.

No >> Clean or replace the components.

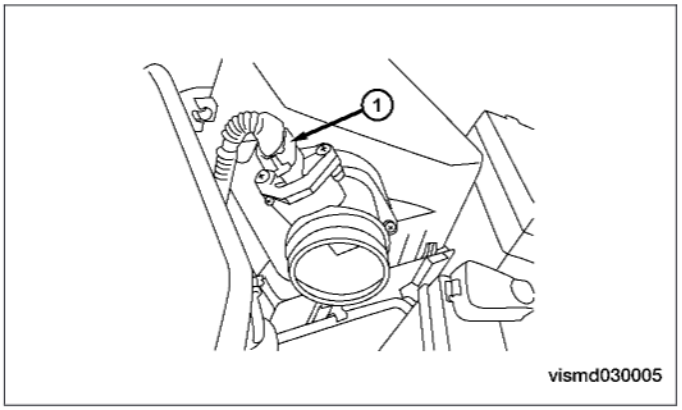
3. CHECK MAF SENSOR ELECTRICAL CONNECTOR

- Disconnect the MAF sensor electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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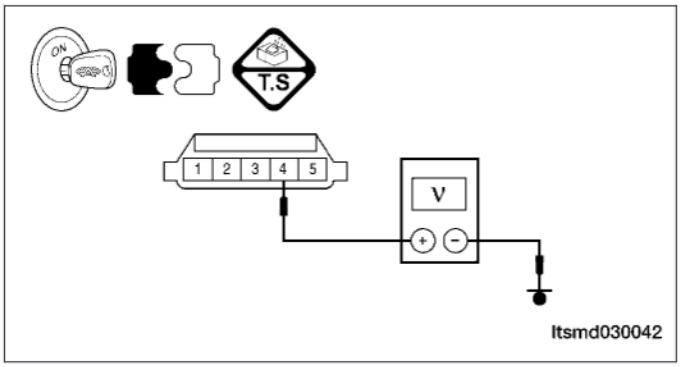
4. CHECK MAF SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check voltage between MAF sensor terminal 4 and ground in the MAF sensor electrical connector E-009.
- 5 V should exist.

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.



5. DETECT MALFUNCTIONING PART

- Check harness for short to power between air flow sensor and ECM.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for a short to power in harness or connectors.

6. CHECK MAF SENSOR GROUND CIRCUIT FOR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between MAF sensor terminal 3 and ECM terminal 17.
- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for short to power in harness or connectors.

7. CHECK MAF SENSOR OUTPUT SIGNAL CIRCUIT

- Check harness continuity between MAF sensor terminal 5 and ECM terminal 37.
- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

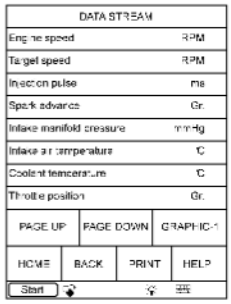
Yes >> Go to the next step.

No >> Repair or replace circuit for short to power in harness or connectors.

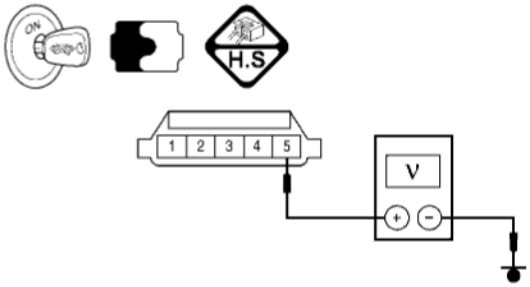
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8. CHECK MAF SENSOR

- Install all removed parts.
- Check MAF signal in data stream with the X-431.

ECM TERMINAL NO.	ITEM	CONDITION	DATA	
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 322 kg/h	 ltsmd030001t
			Approximately 1.39 V	

- If without the X-431, check voltage between MAF sensor terminal 5 and ground.

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)	
37 (MAF sensor connector terminal 5)	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 1.39 V	 ltsmd030043

Is the signal voltage of MAF normal?

Yes >> Go to the next step.

No >> Replace MAF sensor.

9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See DTC Confirmation Procedure.

Is DTC P0103 still present?

Yes >> Replace the ECM.

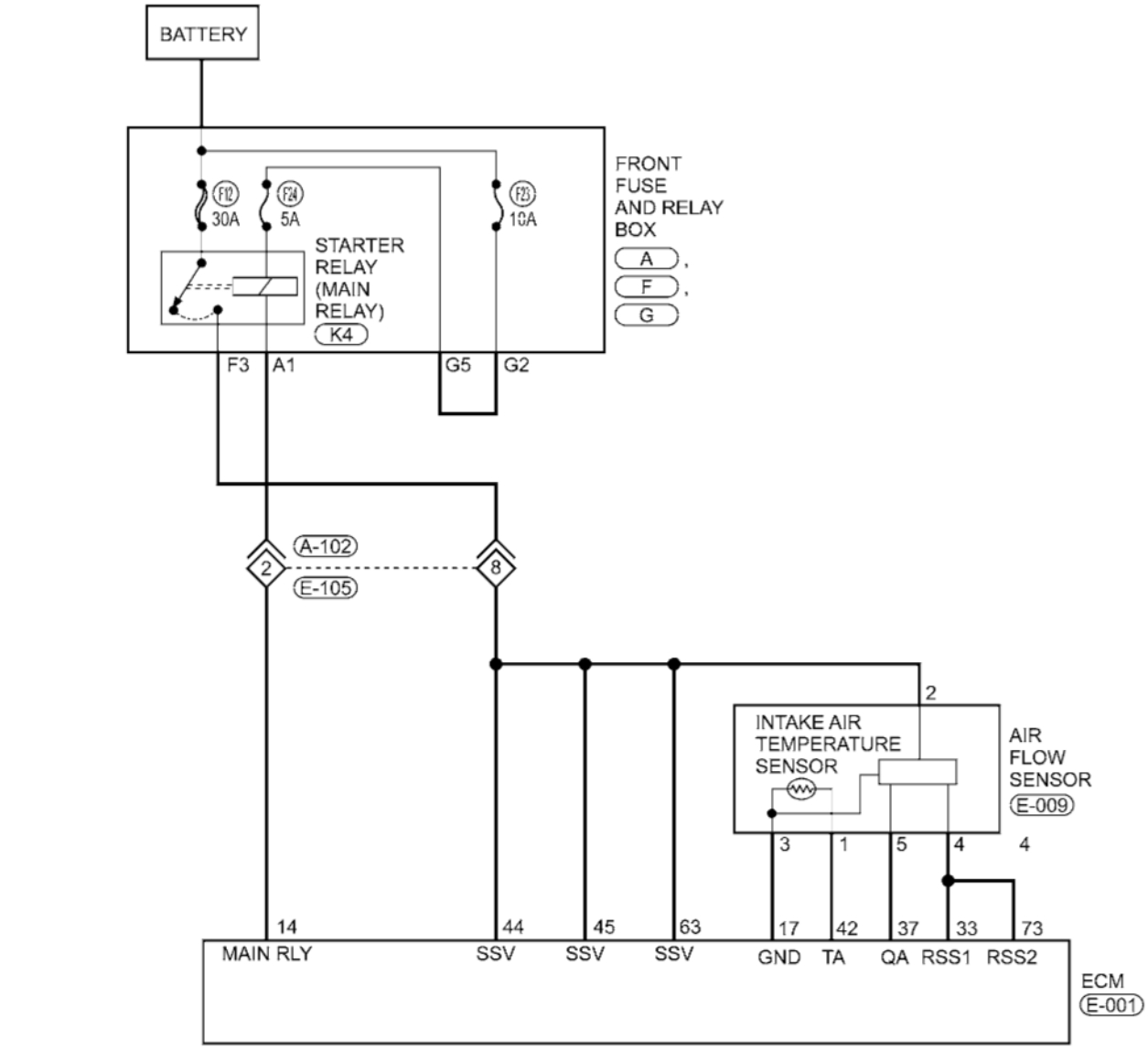
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

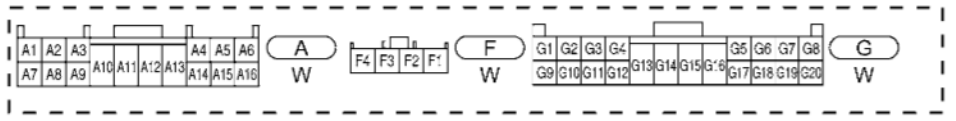
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

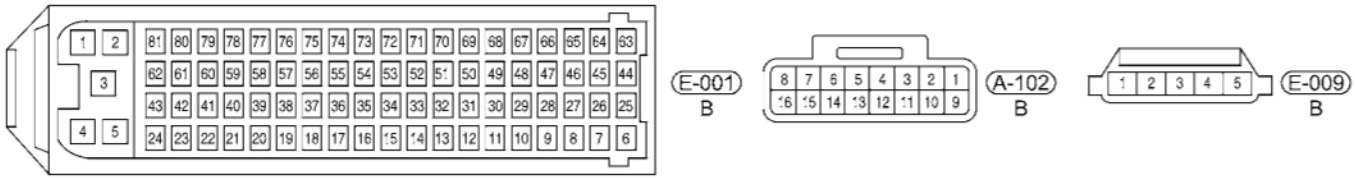
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P0112 - Intake Air Temperature Circuit Low Input

EEC - 2.0L - MAF - 01







ltsmw030033t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Ignition switch: ON		0 V
42	Intake Air Temperature (IAT) sensor	Ignition switch: ON	IAT: 36°C	Approximately 1.88 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0112	Intake Air Temperature (IAT) circuit low input	• Ignition switch: ON • Engine: Running	Output signal is wrong or out of acceptable range.	• IAT sensor • Harness or connectors • Engine temperature • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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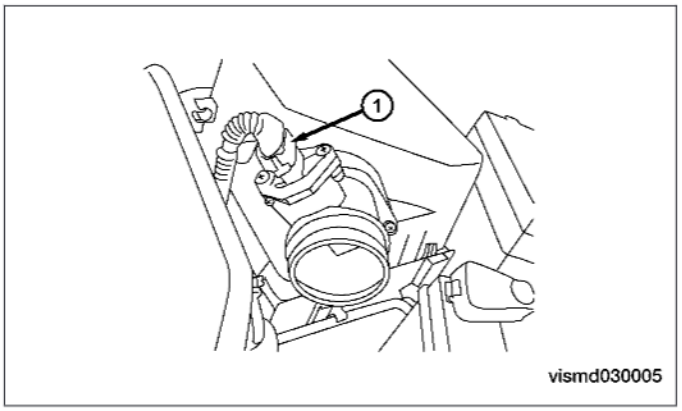
2. CHECK IAT SENSOR ELECTRICAL CONNECTOR

- Disconnect the IAT sensor (IAT sensor is built-into) electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



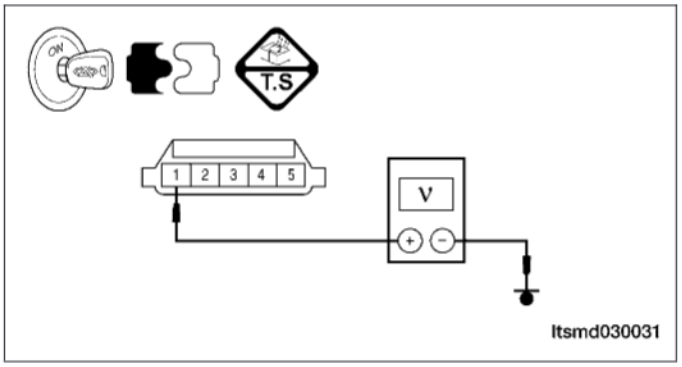
3. CHECK IAT SENSOR SIGNAL CIRCUIT

- Turn ignition switch on.
- Check reference voltage between IAT sensor terminal 1 and ground in the IAT sensor electrical connector E-009.
- 5 V should exist.

Is the check result normal?

Yes >> Go to Step 5.

No >> Go to the next step.



4. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness for short to ground between IAT connector terminal 1 and ECM connector E-001, terminal 42.

Is the check result normal?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair or replace the circuit for short to ground in harness or connectors.

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5. CHECK IAT SENSOR

- Connect IAT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check signal between IAT sensor terminal 1 and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
42	IAT sensor	Ignition switch on	IAT: 36°C	1.88 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace IAT sensor.

6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0112 still present?

Yes >> Replace the ECM.

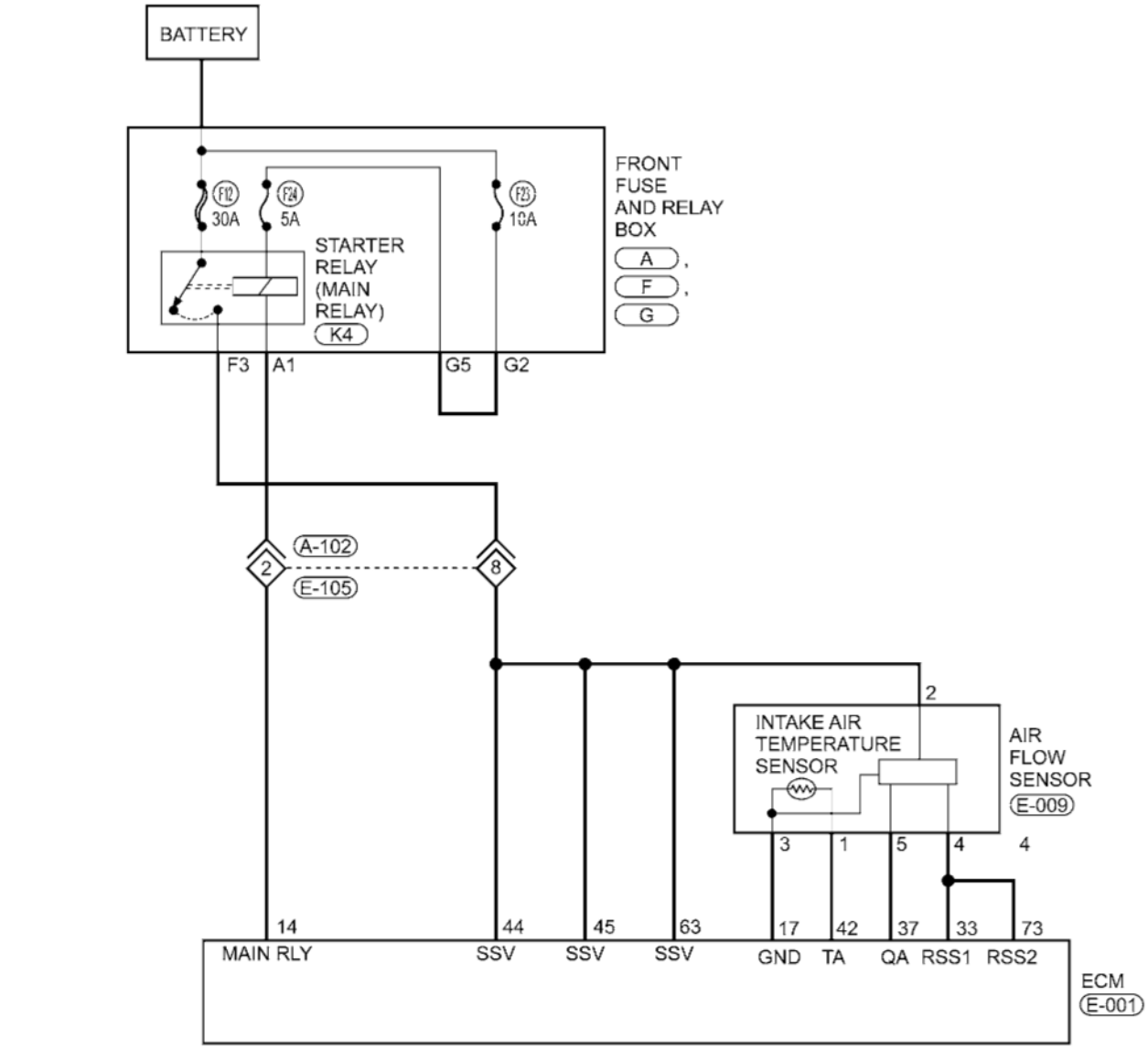
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

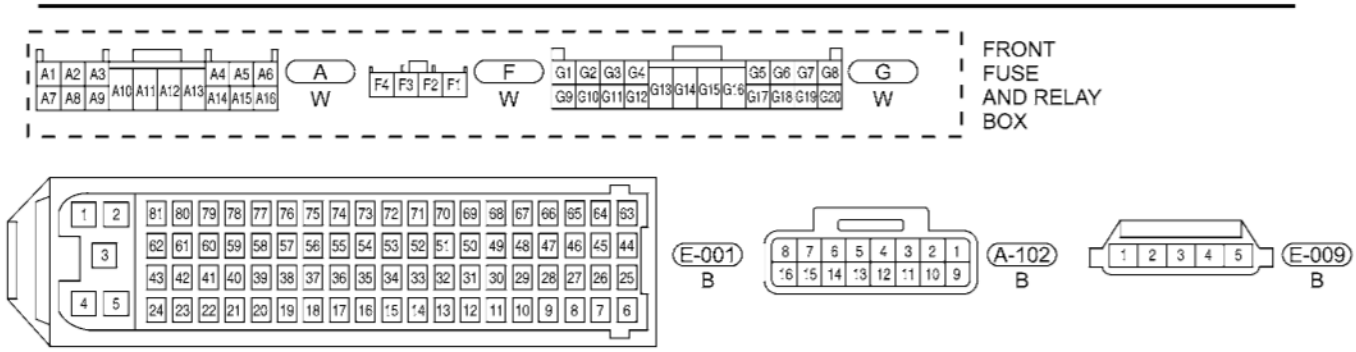
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0113 - Intake Air Temperature Circuit High Input

EEC - 2.0L - MAF - 01





ltsmw030033t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
17	Sensor (GND)	Ignition switch: ON		0 V
42	Intake Air Temperature (IAT) sensor	Ignition switch: ON	IAT: 36°C	Approximately 1.88 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0113	Intake air temperature circuit high input	• Ignition switch: ON • Engine: Running	Output signal is wrong or out of acceptable range.	• IAT sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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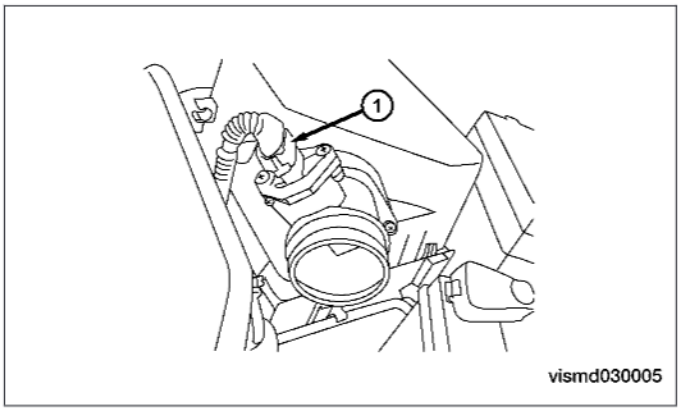
2. CHECK IAT SENSOR ELECTRICAL CONNECTOR

- Disconnect the IAT sensor (IAT sensor is built-into) electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



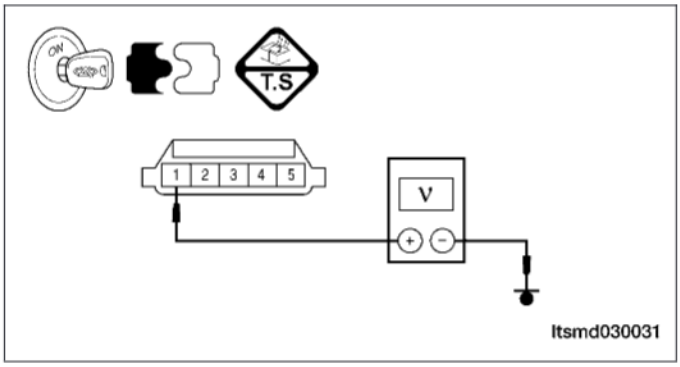
3. CHECK INTAKE AIR TEMPERATURE (IAT) SENSOR SIGNAL CIRCUIT

- Turn ignition switch on.
- Check supply voltage between IAT sensor terminal 1 and ground in the IAT sensor electrical connector E-009.
- 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

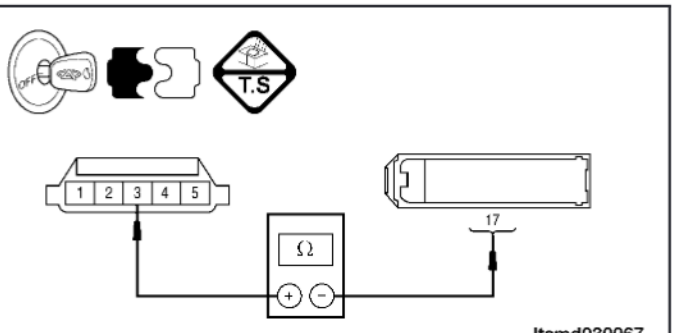
No >> Repair circuit for an open or short to power in harness or connectors.
If circuit is normal, go to the next step.



4. CHECK IAT SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

IAT SENSOR TERMINAL	ECM TERMINAL
3	17



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- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

5. CHECK IAT SENSOR

- Connect IAT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check signal between air flow sensor terminal 1 and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
42	IAT sensor	Ignition switch on	IAT: 36°C	Approximately 1.88 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace IAT sensor.

6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0113 still present?

Yes >> Replace the ECM.

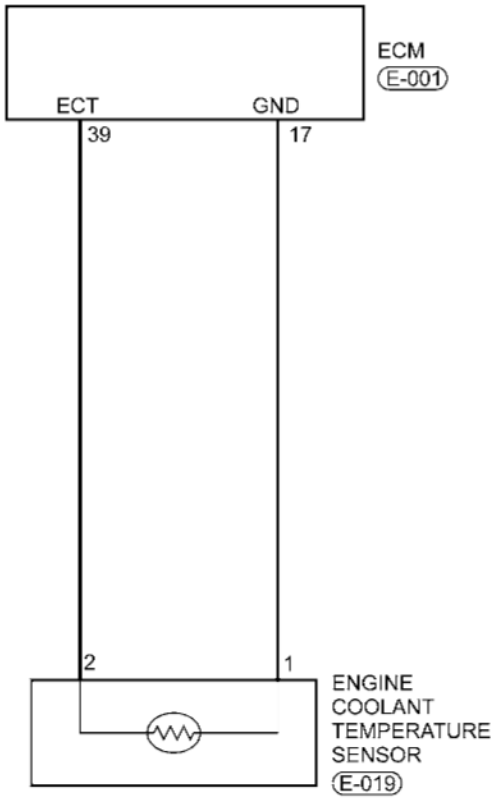
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

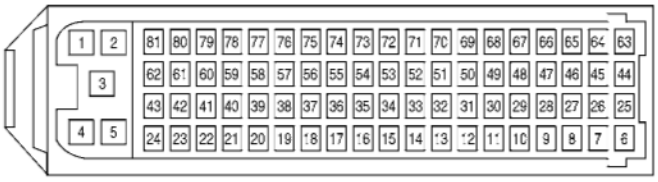
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0117 - Engine Coolant Temperature Circuit Low Input

EEC - 2.0L - ECT - 01





E-001
B



E-019
B

ltsmw030034t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
39	Engine Coolant Temperature (ECT) sensor	Ignition switch: ON	ECT: 59°C	Approximately 1.89 V
			ECT: 78°C	Approximately 1.25 V
			ECT: 90°C	Approximately 0.94 V
17	Sensor (GND)		-	Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0117	Engine coolant temperature circuit low input	• Ignition switch: ON • Engine: Running	Signal output is below minimum acceptable range for a few seconds continuously.	• ECT sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

- Before performing this DTC diagnostic procedure, verify that the engine coolant temperature is normal.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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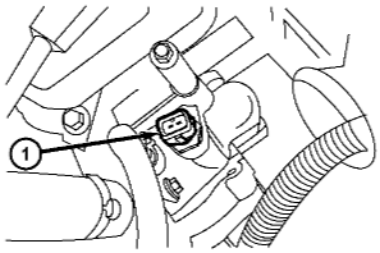
2. CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR ELECTRICAL CONNECTOR

- Disconnect the ECT sensor electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



besm030019

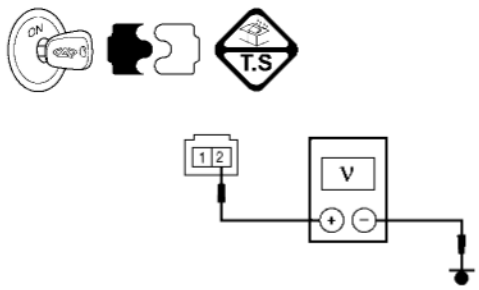
3. CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR SIGNAL CIRCUIT FOR A SHORT

- Turn ignition switch on.
- Check reference voltage between ECT sensor terminal 2 and ground in the sensor electrical connector E-019.
- 4.5 - 4.9 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



ltsmd030032

4. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness for a short to ground between ECT sensor connector terminal 2 and ECM connector E-001, terminal 39.

Is the check result normal?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

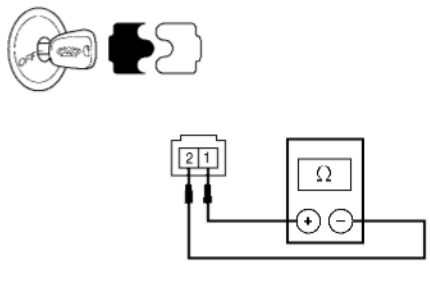
No >> Repair or replace circuit for a short in harness or connectors.

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5. CHECK ECT SENSOR

- Check resistance between ECT sensor terminal 1 and 2.

ECT°C	RESISTANCE KΩ
10°C	8.62 - 10.28
20°C	2.37 - 2.63
80°C	0.299 - 0.345



Itsmd030034

- Connect ECT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check sensor output signal.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
39	ECT sensor	Ignition switch on	ECT: 59°C	Approximately 1.89 V
			ECT: 78°C	Approximately 1.25 V
			ECT: 90°C	Approximately 0.94 V
17	Sensor (GND)		-	Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace ECT sensor.

6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0117 still present?

Yes >> Replace the ECM.

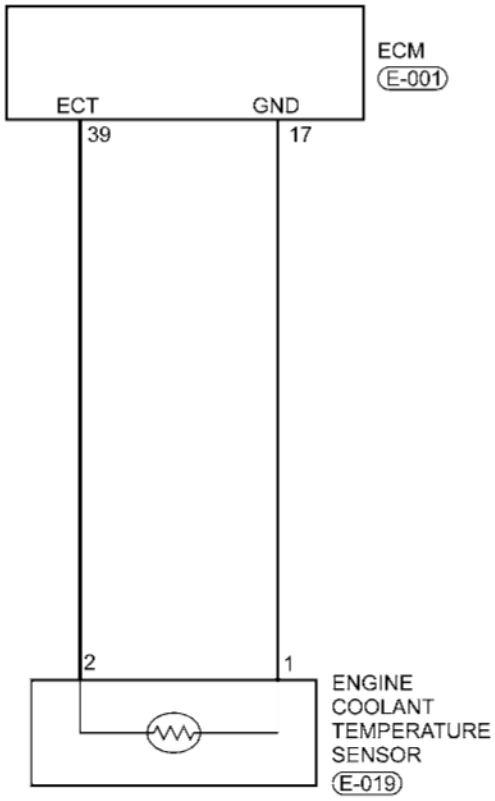
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

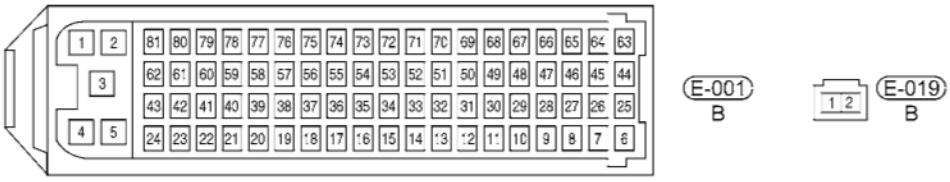
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0118 - Engine Coolant Temperature Circuit High Input

EEC - 2.0L - ECT - 01





ltsmw030034t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
39	Engine Coolant Temperature (ECT) sensor	Ignition switch: ON	ECT: 59°C	Approximately 1.89 V
			ECT: 78°C	Approximately 1.25 V
			ECT: 90°C	Approximately 0.94 V
17	Sensor (GND)		-	Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0118	Engine coolant temperature circuit high input	• Ignition switch: ON • Engine: Running	Signal output is above maximum acceptable range for a few seconds continuously.	• ECT • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

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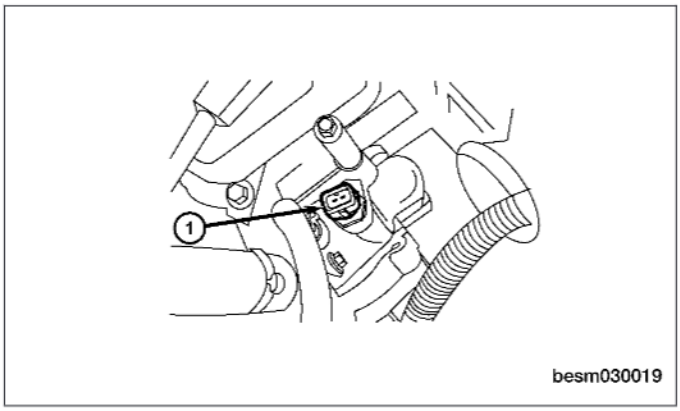
2. CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR ELECTRICAL CONNECTOR

- Disconnect the ECT sensor electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



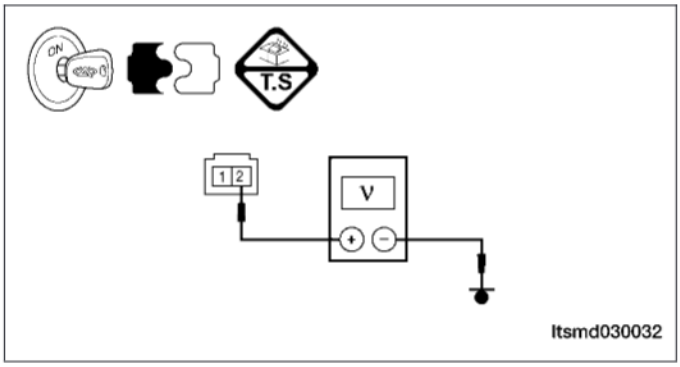
3. CHECK THE ECT SENSOR SIGNAL CIRCUIT FOR A SHORT

- Turn ignition switch on.
- Check ECT sensor reference voltage between sensor terminal 2 and ground in the sensor electrical connector E-019.
- 4.5 - 4.9 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace harness for an open or short to power between ECT connector terminal 2 and ECM connector E-001, terminal 39.
If harness is normal, replace the ECM.

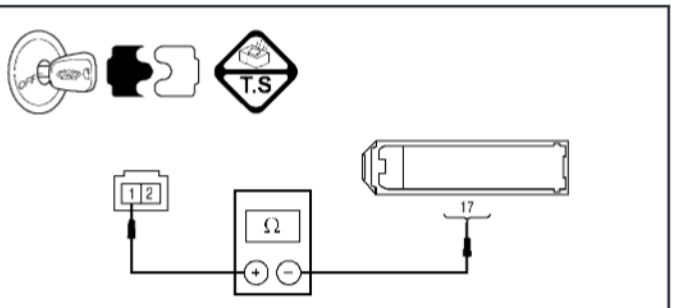


NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

4. CHECK ECT SENSOR GROUND CIRCUIT FOR AN OPEN AND SHORT

- Turn ignition switch off.
- Check harness continuity between following terminals.

ECT SENSOR TERMINAL	ECM TERMINAL	CONTINUITY
1	17	Yes



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- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

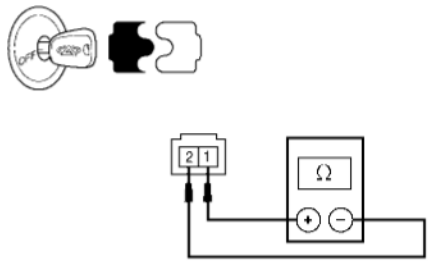
Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

5. CHECK ECT SENSOR

- Check resistance between ECT sensor terminal 1 and 2.

ECT°C	RESISTANCE KΩ
-10°C	8.62 - 10.28
20°C	2.37 - 2.63
80°C	0.299 - 0.345



Itsmd030034

- Connect ECT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check sensor signal output.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
39	ECT sensor	Ignition switch: ON	ECT: 59°C	1.89 V
			ECT: 78°C	1.25 V
			ECT: 90°C	0.94 V
17	Sensor (GND)		-	Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace ECT sensor.

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6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0118 still present?

Yes >> Replace the ECM.

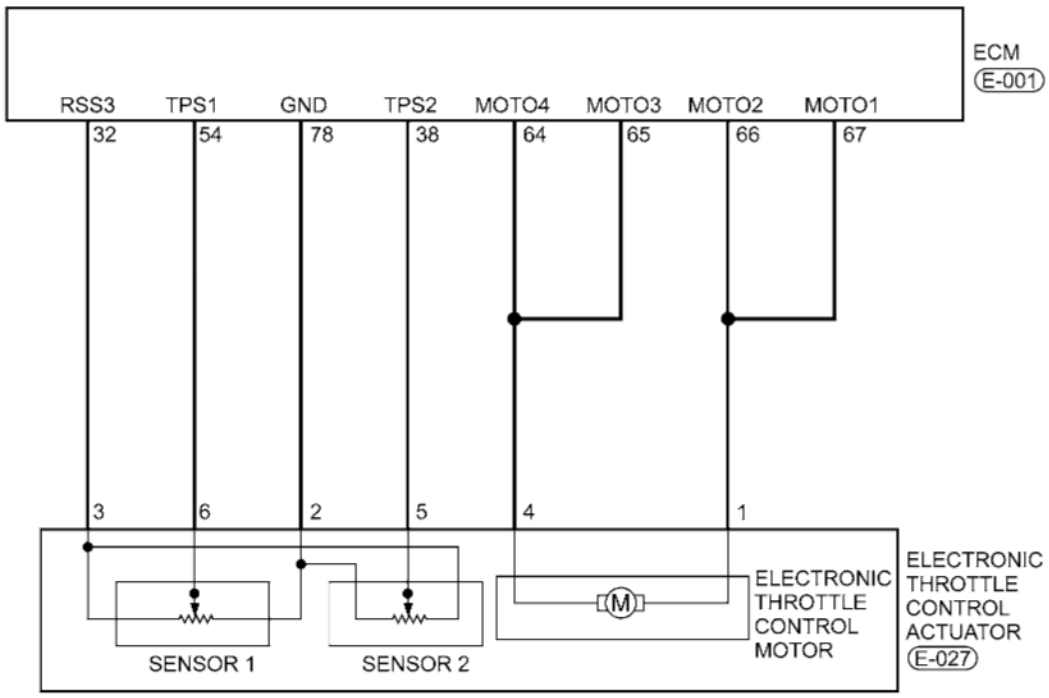
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

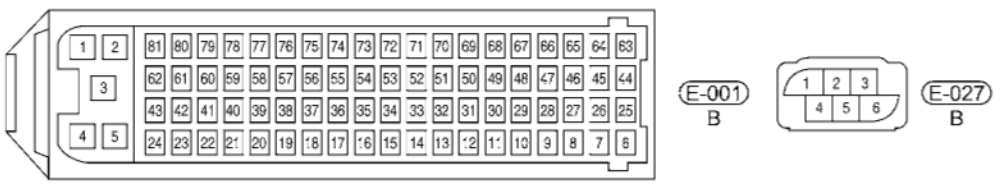
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0122 - Throttle Position Sensor A Circuit Low Input

EEC - 2.0L - TPS - 01





ltsmw030025t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
64	Motor 4		-	12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			
78	Sensor (GND)			Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0122	Throttle position sensor A circuit low input	• Ignition switch: ON • Engine: Running	Signal output is below minimum acceptable range for a few seconds continuously.	• TPS or misalignment • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

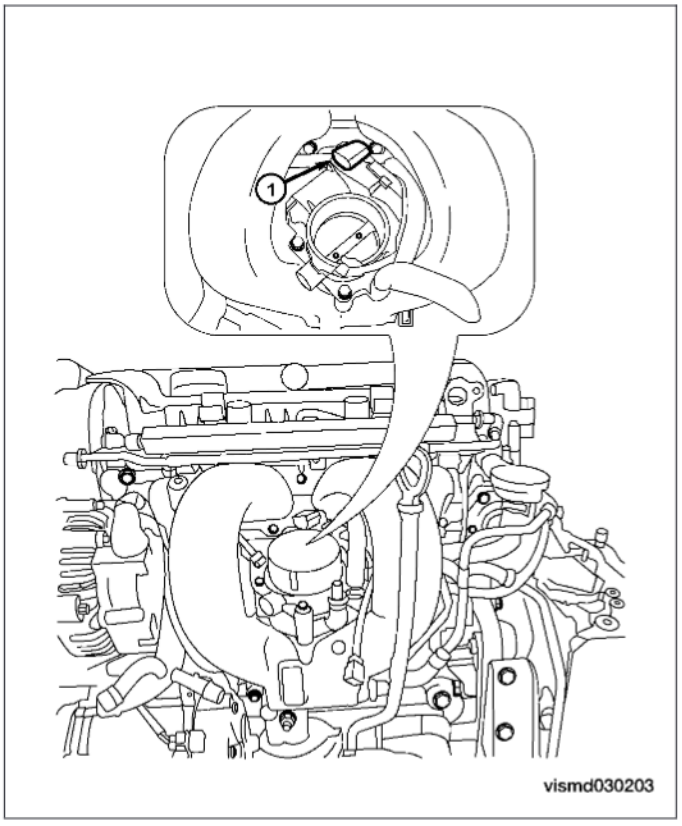
2. CHECK TPS SENSOR ELECTRICAL CONNECTOR

- Disconnect the TPS electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

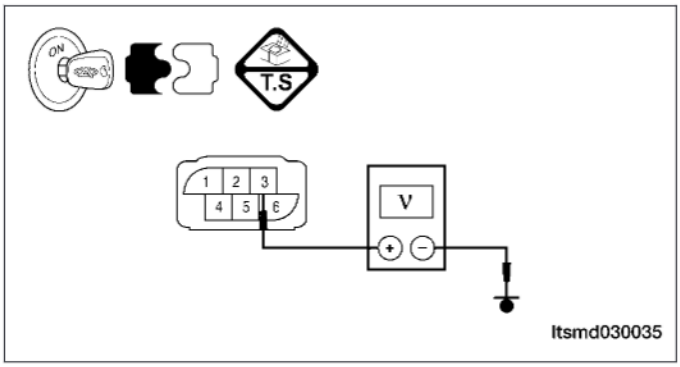
No >> Repair or replace the electrical connector as necessary.



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3. CHECK THE TPS POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check throttle position sensor supply voltage between sensor terminal 3 and ground in the sensor electrical connector E-027.
- 5.0 V should exist.



Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to ground in harness or connectors.
If harness is normal, replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

4. CHECK TPS SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

TPS TERMINAL	ECM TERMINAL
6	54
5	38

- Continuity should exist.
- Check harness for a short to power.

Is the check result normal?

Yes >> Go to step 6.

No >> Go to the next step.

5. DETECT MALFUNCTIONING PART

- Check harness for an open or a short to ground between TPS connector terminal 2 and ECM connector E-001, terminal 78.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace harness or connectors.

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6. CHECK TPS RESISTANCE

- Check resistance between TPS terminal 2 and terminal 3.
- 2 kΩ ± 20 % (20°C) should exist.
- Check the resistance between TPS terminal 6 and terminal 2 while moving the throttle.
- The resistance should be a linear change.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace TPS.
Perform TPS self-learning.

7. CHECK THE TPS

- Turn ignition switch off.
- Connect ECM connector.
- Connect TPS connector.
- Turn ignition switch on.
- Check voltage between TPS terminal 3 and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully pressed	0.72 V
54	Electronic throttle control actuator (position sensor)		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
64	Motor 4		-	12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			
78	Sensor (GND)			Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.
Perform the TPS self-learning.

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8. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0122 still present?

Yes >> Replace the ECM.

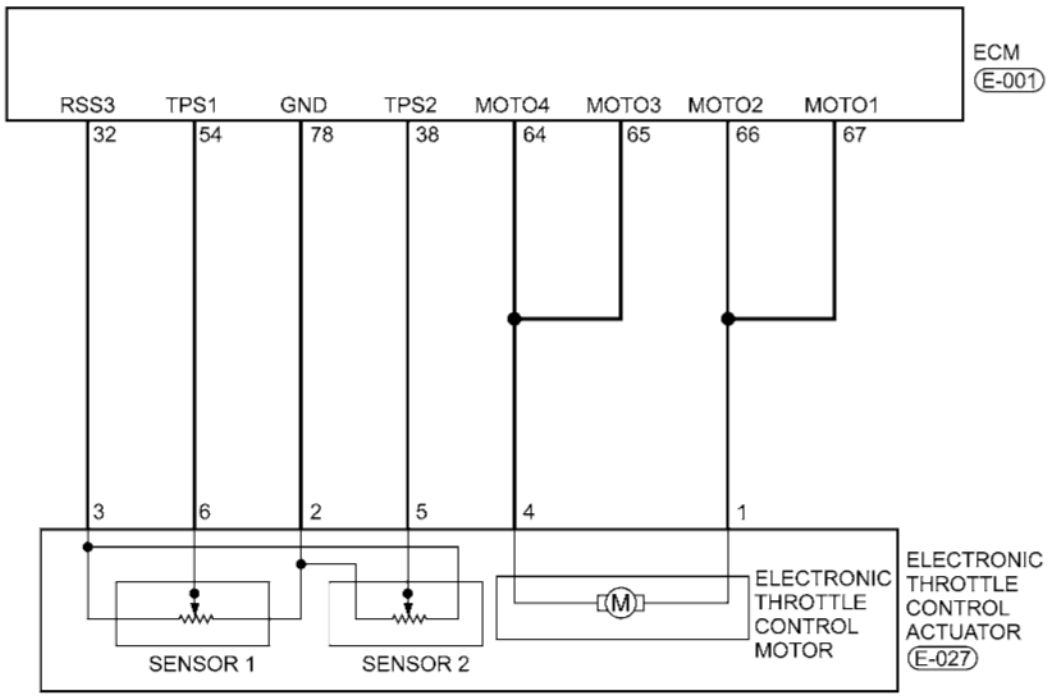
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

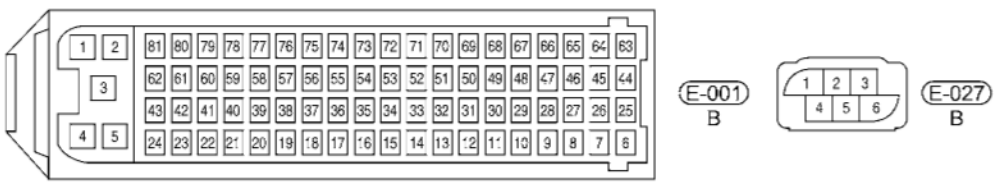
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0123 - Throttle Position Sensor A Circuit High Input

EEC - 2.0L - TPS - 01





ltsmw030025t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
64	Motor 4		-	12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			
78	Sensor (GND)			Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0123	Throttle position sensor A circuit high input	• Ignition switch: ON • Engine: Running	Signal output is above maximum acceptable range for a few seconds continuously.	• TPS or misalignment • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

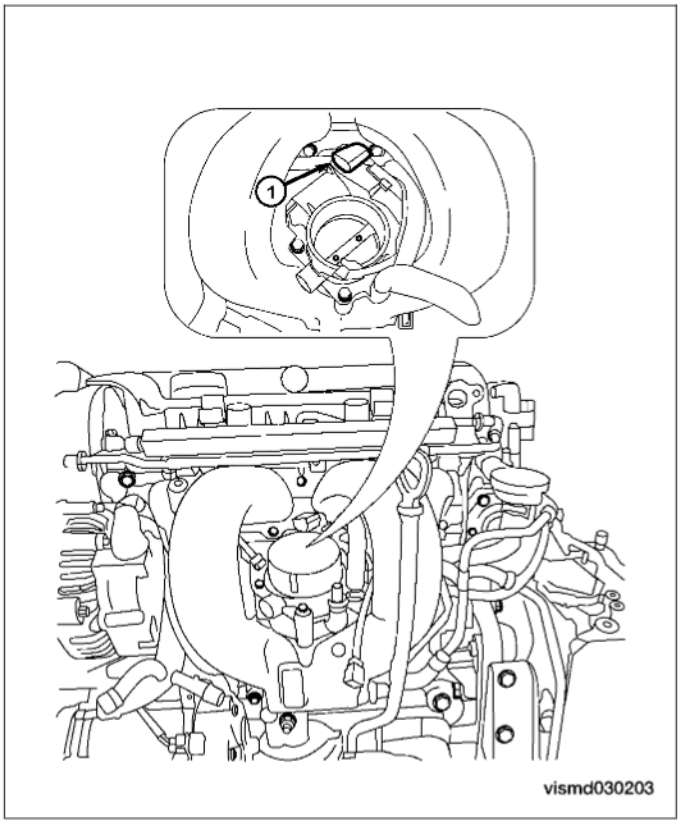
2. CHECK TPS SENSOR ELECTRICAL CONNECTOR

- Disconnect the TPS electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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3. CHECK THE TPS POWER SUPPLY CIRCUIT

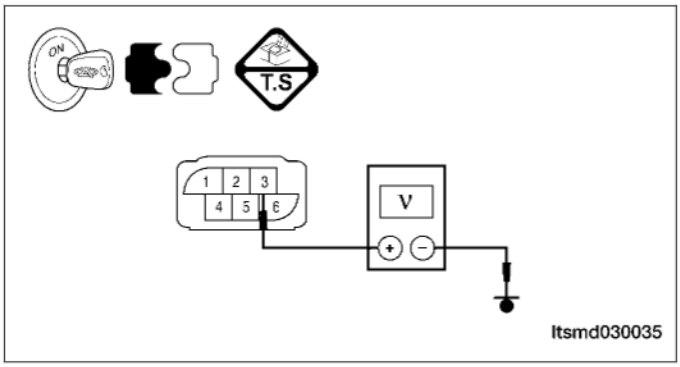
- Turn ignition switch on.
- Check supply voltage between TPS terminal 3 and ground in the TPS electrical connector E-027.
- 5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for a short to power in harness or connectors.
If harness is normal, replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).



4. CHECK TPS SIGNAL CIRCUIT FOR A SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness for short to power.

Is the check result normal?

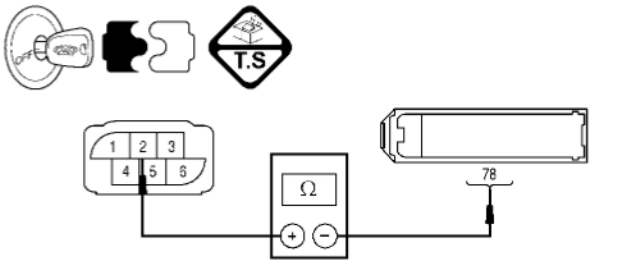
Yes >> Go to step 6.

No >> Go to the next step.

5. CHECK THE TPS GROUND CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between following terminals.

TPS TERMINAL	ECM TERMINAL
2	78



- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair open circuit or short to power in harness or connectors.

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6. CHECK THE TPS RESISTANCE

- Check resistance between the TPS terminal 2 and terminal 3.
- 2 kΩ ± 20 % (20°C) should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.
Perform the TPS self-learning.

7. CHECK THE TPS

- Turn ignition switch off.
- Connect ECM connector.
- Connect TPS connector.
- Turn ignition switch on.
- Check voltage between TPS terminal 3 and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
64	Motor 4		-	12 V or 0 V
65	Motor 3			
66	Motor 2			12 V or 0 V
67	Motor 1			
78	Sensor (GND)			Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.
Perform TPS self-learning.

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8. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0123 still present?

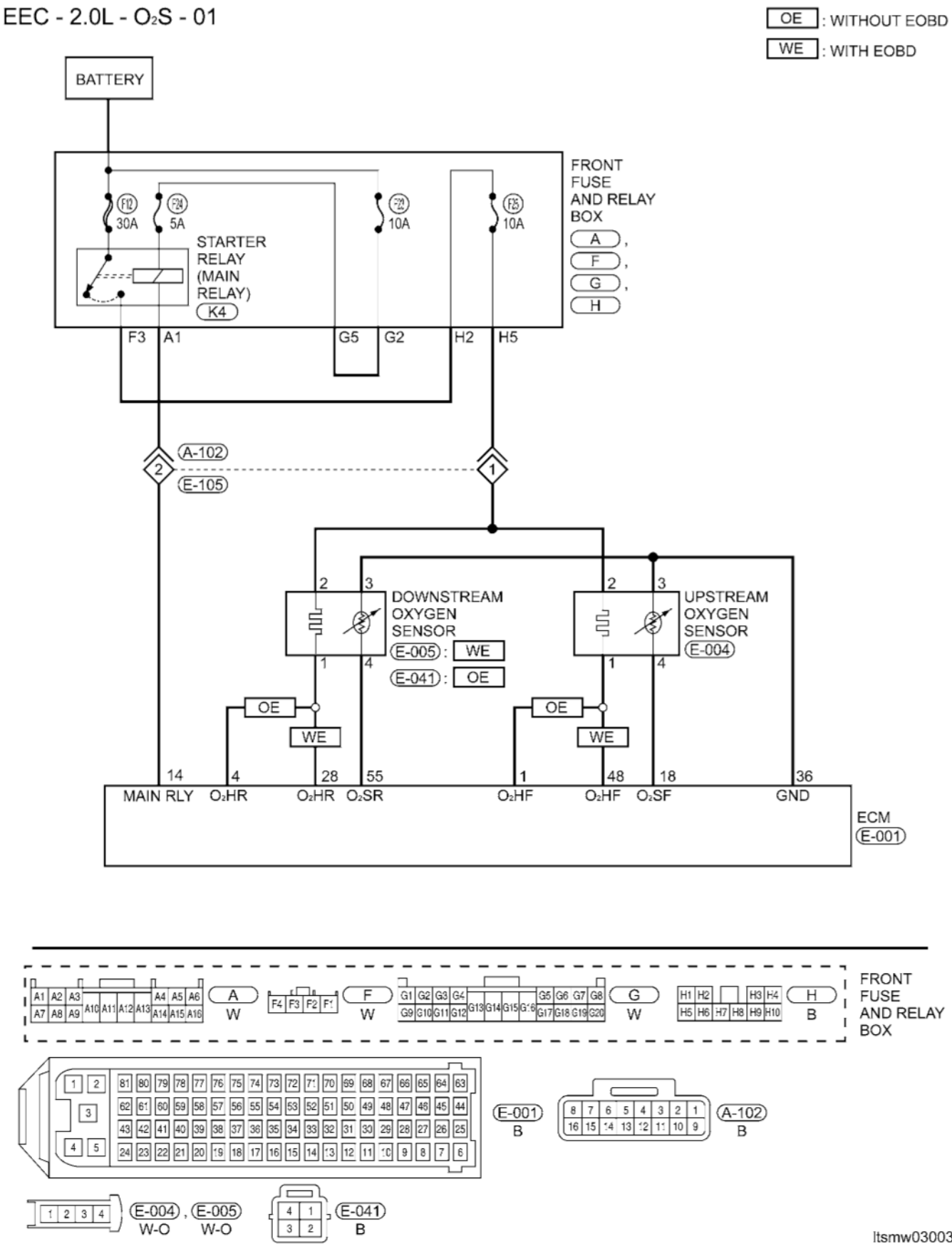
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0132 - O_2 Sensor Circuit 1 High Voltage



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
18	Upstream oxygen sensor	• Engine is running • Warm-up condition	Approximately 0.1 - 0.9 V (change 5 - 8 times in 10 seconds periodically)
28	Downstream oxygen sensor heating (with EOBD)	-	-
36	Oxygen sensor signal ground	• Warm-up condition • Idle	Approximately 0 V
48	Upstream oxygen sensor heating (with EOBD)	-	-
55	Downstream oxygen sensor	• Engine is running • Warm-up condition	Approximately 100 mV

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0132	O_2 sensor 1 (upstream) circuit high voltage	Engine is running	• Fuel quality • Oxygen Sensor 1 (upstream) • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature.
- Turn ignition switch off and wait at least 10 seconds.
- Start engine and keep the engine speed 2000 RPM for at least 1 minute.
- Let engine idle for 2 minutes.
- Select view data stream and DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

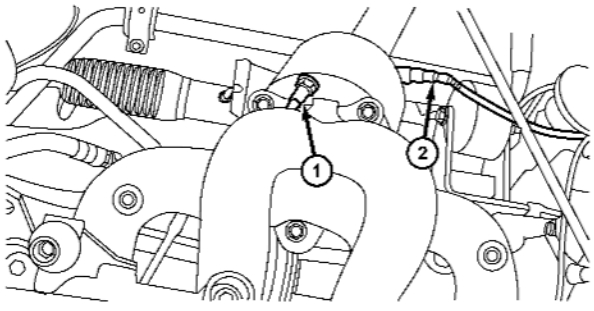
2. CHECK O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the O_2 sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



3. CHECK O_2 SENSOR GROUND CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between ECM terminal 18 and O_2 sensor terminal 4.
- Continuity should exist.
- Check harness for an open and short to power supply circuit.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

4. CHECK O_2 SENSOR INPUT SIGNAL CIRCUIT FOR AN OPEN AND SHORT

- Check harness continuity between ECM terminal and O_2 sensor terminal as follows.

COMPONENT	ECM	UPSTREAM O_2 SENSOR
TERMINAL	18	4

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- Continuity should exist.
- Check harness short to power supply circuit.

Is the check result normal?

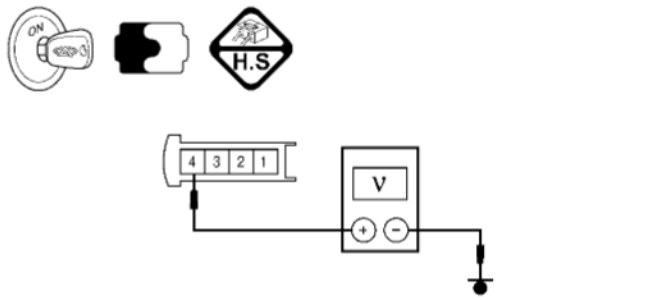
Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

5. CHECK O_2 SENSOR

- Connect O_2 sensor connector.
- Connect ECM connector.
- If with the X-431, refer to data stream value.
- If without the X-431, as following procedure:
  - Start engine and warm it up to normal operating temperature 350°C.
  - Turn ignition switch off.
  - Start engine and keep the engine speed between 3,500 and 4,000 RPM for at least 1 minute.
  - Let engine idle for 1 minute.
  - Set digital multimeter probes between ECM terminal 4 and ground.

CHECK ITEM	CHECK CONTENT		NORMAL VALUE
Oxygen sensor	• Warm-up condition • Become lean while decelerate	Decelerate from 4,000 RPM suddenly	Below 100 mV
	• Warm-up condition • Become rich while accelerate	Accelerate suddenly	Approximately 600 - 900 mV
	• Warm-up condition • Check with O_2 sensor signal	Idle	100 - 900 mV
		2500 RPM	Approximately 600 - 900 mV



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Is the check result normal?

Yes >> Go to the next step.

No >> Replace O_2 sensor.

6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0132 still present?

Yes >> Replace the ECM.

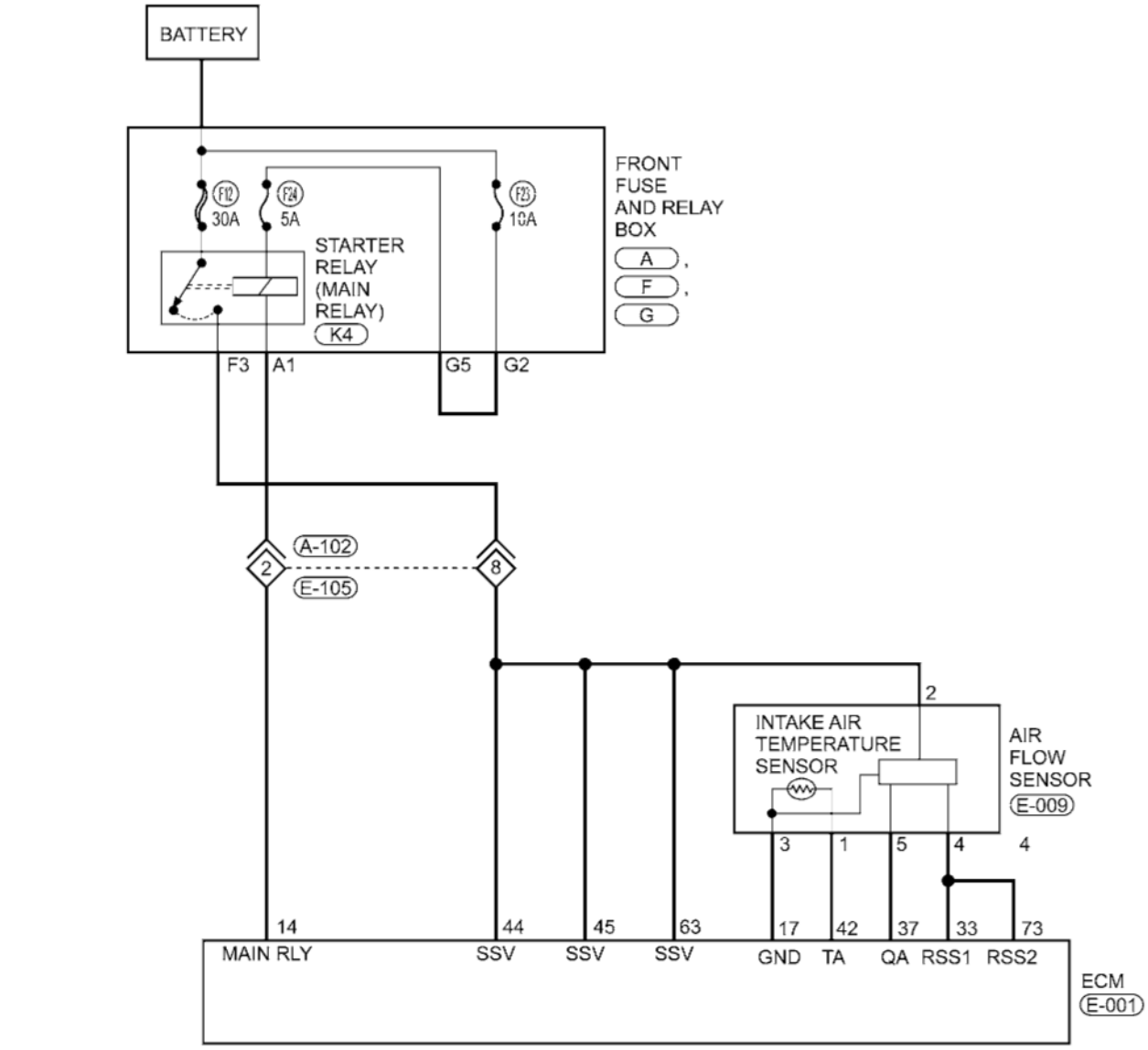
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

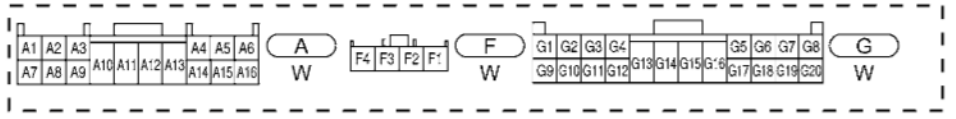
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

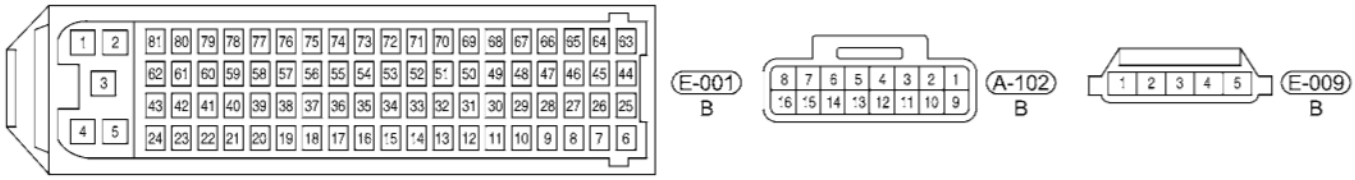
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P0171 - Fuel Trim System Too Lean

EEC - 2.0L - MAF - 01



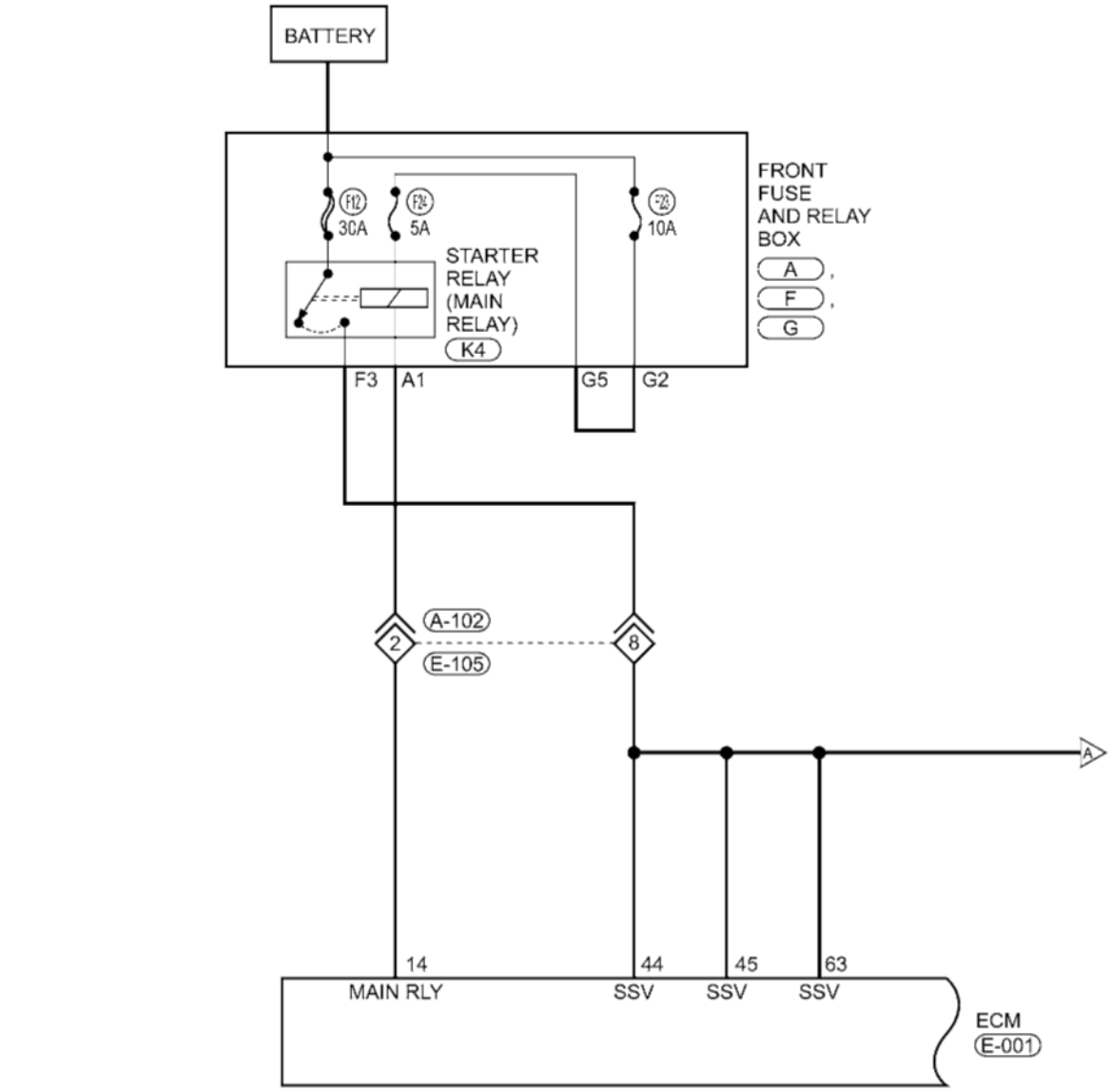


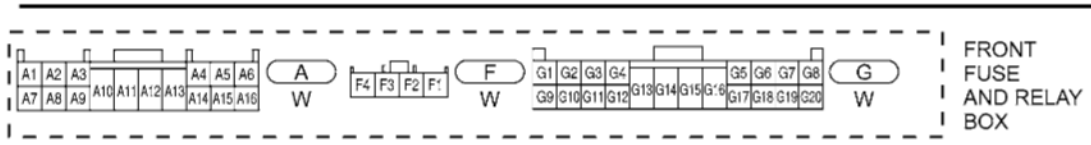


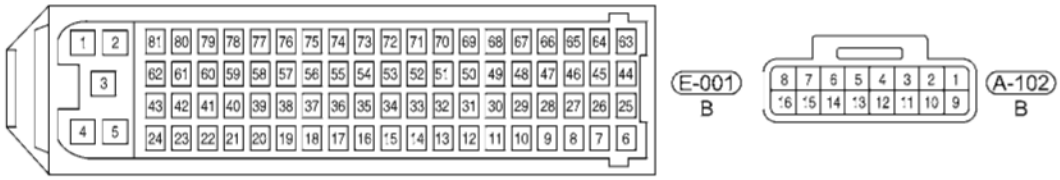
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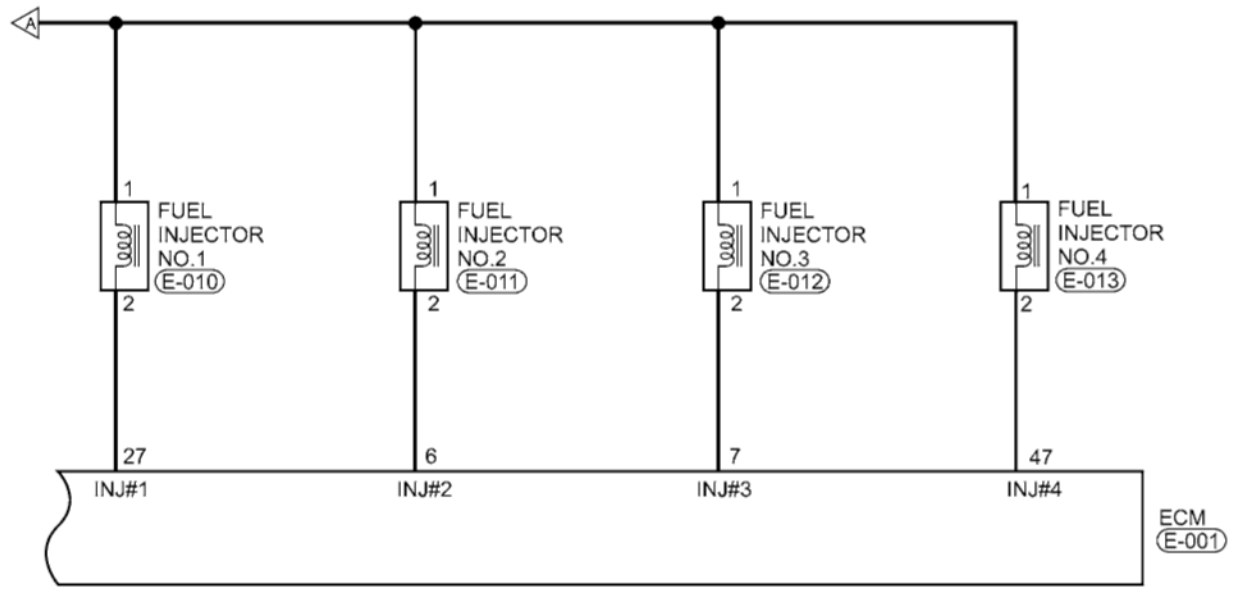


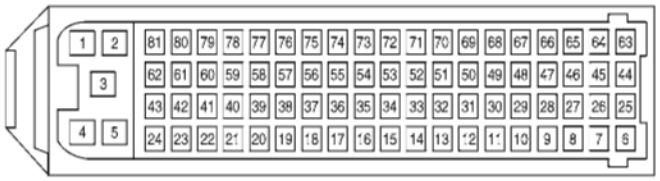


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EEC - 2.0L - INJ - 02





E-001 B



E-010 B, E-011 B, E-012 B, E-013 B

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
17	Sensor (GND)	• Engine is running • Warm-up condition: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	0 V
33	Regulated sensor supply 1		Approximately 5 V
37	Air flow sensor		Approximately 322 kg/h
			Approximately 1.39 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0171	Fuel trim system too lean	Engine is running	The amount of mixture ratio compensation is too large (The mixture ratio is too lean).	• Intake air leaks • Air flow sensor • Fuel injector • Exhaust gas leaks • Incorrect fuel pressure • lack of fuel • Incorrect PCV hose connection • Upstream O_2 sensor • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK EXHAUST GAS LEAK

- Start engine and run it at idle.
- Listen for exhaust gas leak before the three way catalyst.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace.

2. CHECK FOR INTAKE AIR LEAK

- Turn ignition switch on.
- Listen for intake air leak after the air flow sensor.
- Check PCV hose connector.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace.

3. CHECK ECM CONTROL SIGNAL IN DATA STREAM

- With the X-431, select view data stream.

MONITOR ITEM	CONDITION		DATA
Injector pulse	• Engine: warm up • Shift: P or N • Air conditioning: off • No load	Idle	Approximately 2.5 ms

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

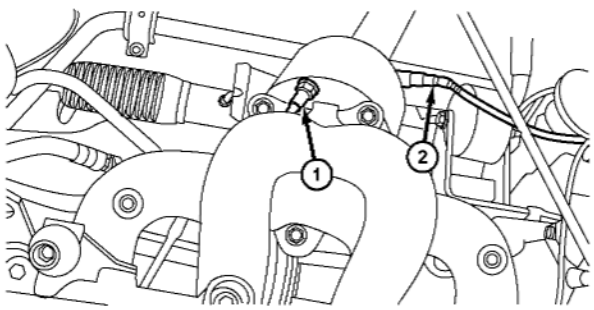
4. CHECK UPSTREAM O_2 SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the upstream O_2 sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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5. CHECK UPSTREAM O_2 SENSOR SIGNAL CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between the following terminals.

UPSTREAM O_2 SENSOR	ECM TERMINAL	O_2 SENSOR TERMINAL
O_2 sensor 1	36	3
	18	4

- Continuity should exist.
- Also check harness for short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to ground in harness or connectors.

6. CHECK AIR FLOW SENSOR SIGNAL

- Check air flow in data stream.

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	Approximately 322 kg/h
			Approximately 1.39 V

Is the check result normal?

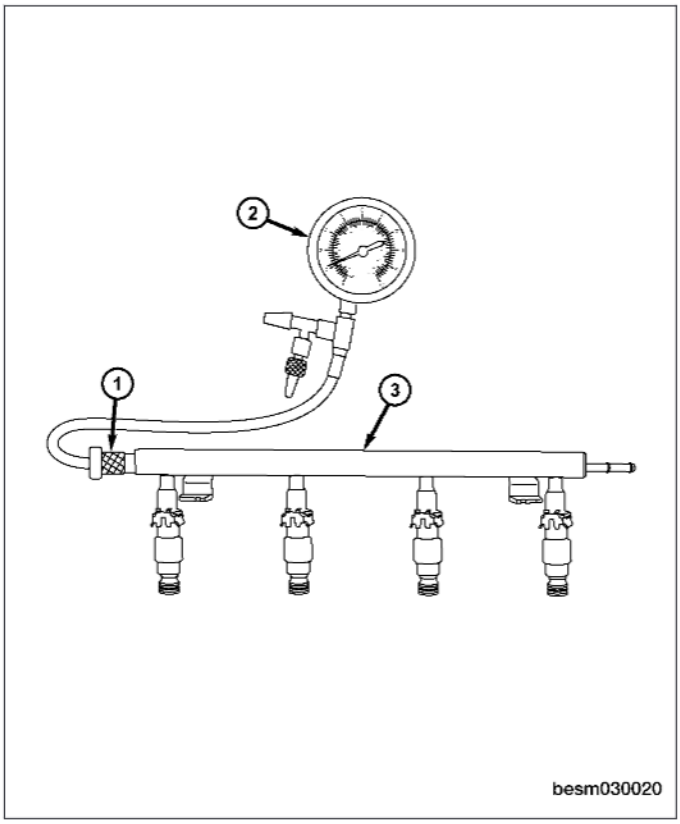
Yes >> Go to the next step.

No >> Check connectors for rusted terminals or loose connectors in the air flow sensor circuit or ground.

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7. CHECK FUEL PRESSURE

- Release fuel pressure to zero.
- Install fuel pressure gauge (2) and check fuel pressure.



- Observe the following fuel pressures when testing (See Fuel Pressure Test in Section 04 Fuel Delivery).

FUEL PRESSURES	
Key On	400 kPa (4.0 bar)
Key Off	380 kPa (3.8 bar) in 10 minutes
Engine Idle	400 kPa (4.0 bar) - 420 kPa (4.2 bar)

Is the check result normal?

Yes >> Go to step 9.

No >> Go to the next step.

8. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuel pump and circuit.
  - Fuel pressure regulator.
  - Fuel lines.
  - Fuel filter for clogging.

Is the check result normal?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 10.

No >> Repair or Replace malfunctioning part.

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9. PERFORM ACTUATE TEST FUNCTION

- Start engine.
- Select ″ACTIVE TEST″ menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 12.

No >> Go to the next step.

10. CHECK FUNCTION OF INJECTOR

- Listen to each injector operating sound.
- Operating sound should exist.

Is the check result normal?

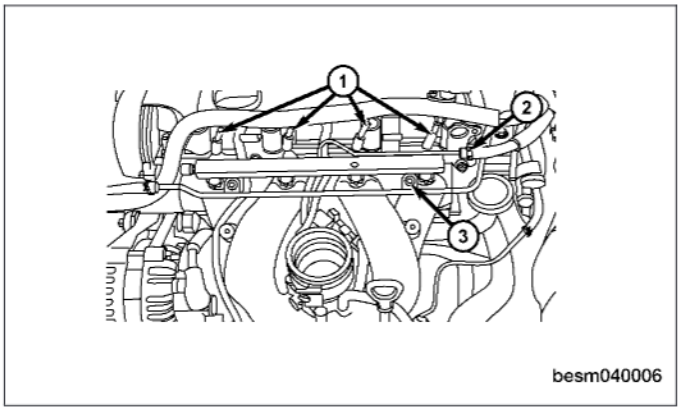
Yes >> Go to step 12.

No >> Go to the next step.

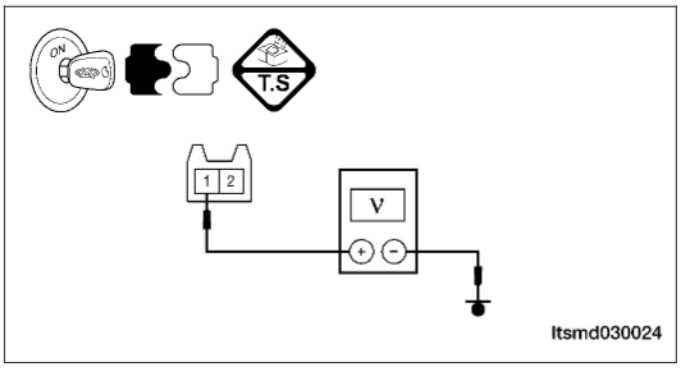
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11. CHECK INJECTOR POWER SUPPLY CIRCUIT AND CONTROL CIRCUIT

- Turn ignition switch off.
- Disconnect injector harness connector (1).

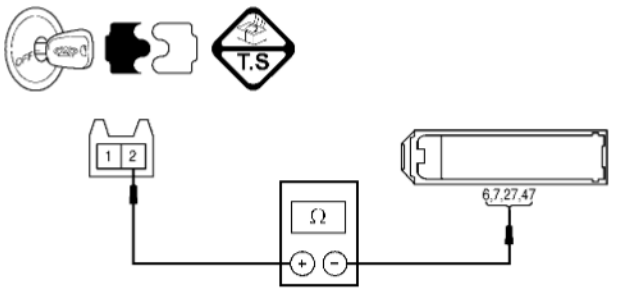


- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.



- Battery voltage should exist.
- Turn ignition switch off
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

INJECTOR NO.	ECM TERMINAL	INJECTOR TERMINAL
1	27	2
2	6	2
3	7	2
4	47	2



- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

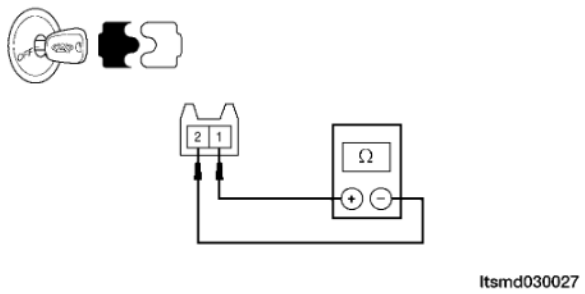
Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power or short to ground in harness or connectors.

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12. CHECK INJECTOR RESISTANCE

- Disconnect injector harness connectors (See Fuel Pressure Test in Section 04 Fuel Delivery).
- Check the resistance of the injectors.

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)	
1	1 & 2	16	
2	1 & 2		
3	1 & 2		
4	1 & 2		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.
Go to step 14.

13. CHECK INJECTOR

- Confirm that the engine is cooled down and there are no fire hazards near the vehicle.
- Remove fuel delivery rail with injectors (See Fuel Injector Rail Removal & Installation 1.6L/1.8L/2.0L in Section 04 Fuel Delivery).

NOTE :
Be careful not to drop the fuel injectors when removing the fuel delivery rail.
- Keep fuel hose and all injectors connected to injector rail.
- Disconnect all ignition coil harness connectors.
- Prepare pans or saucers under each injector.
- Crank engine for about 3 seconds.
- Fuel should be sprayed evenly for each injector.

Is the check result normal?

Yes >> Go to next step.

No >> Clean or replace the defective fuel injector.

14. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See DTC Confirmation Procedure.

Is DTC P0171 still present?

Yes >> Replace the ECM.

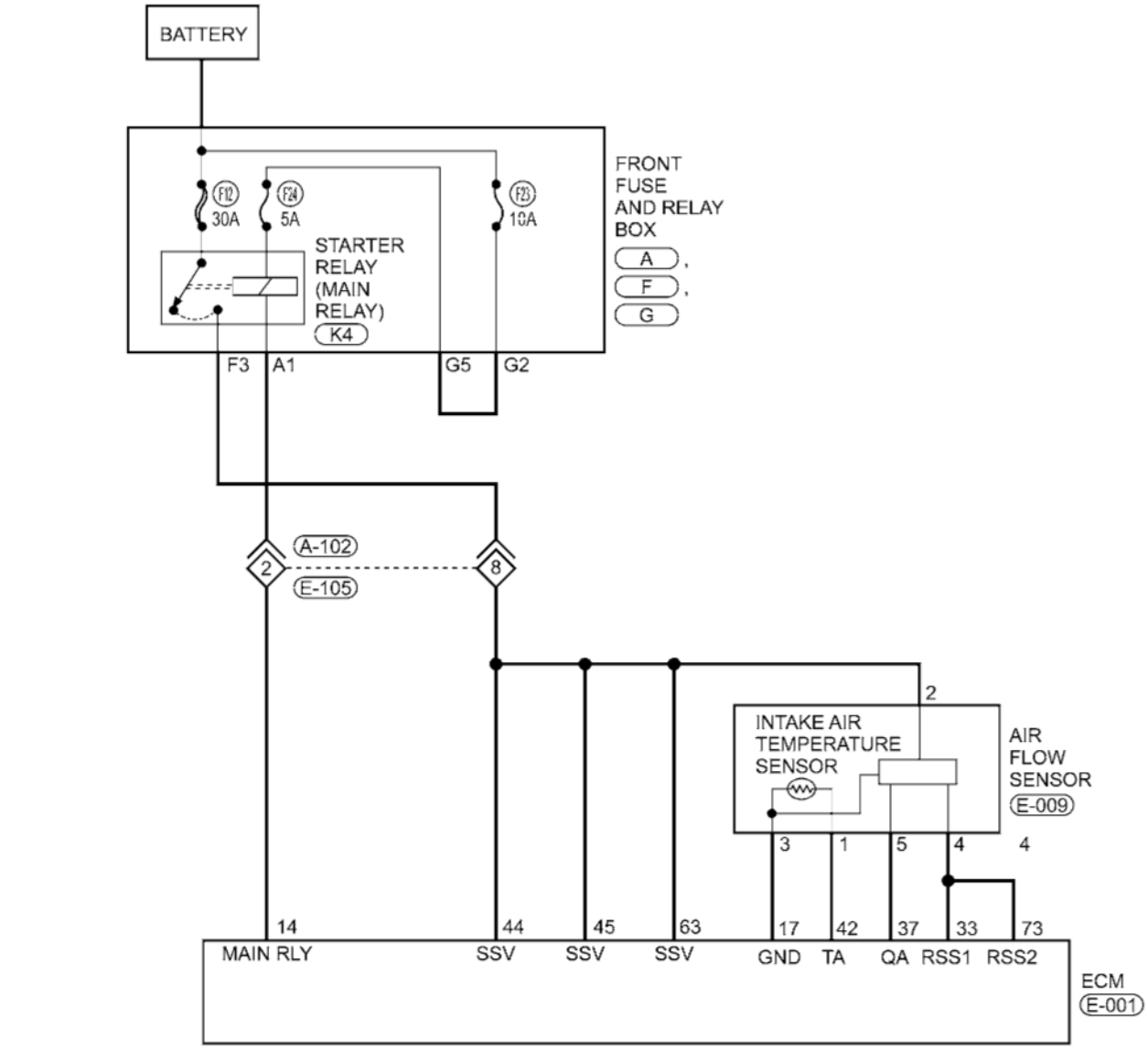
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

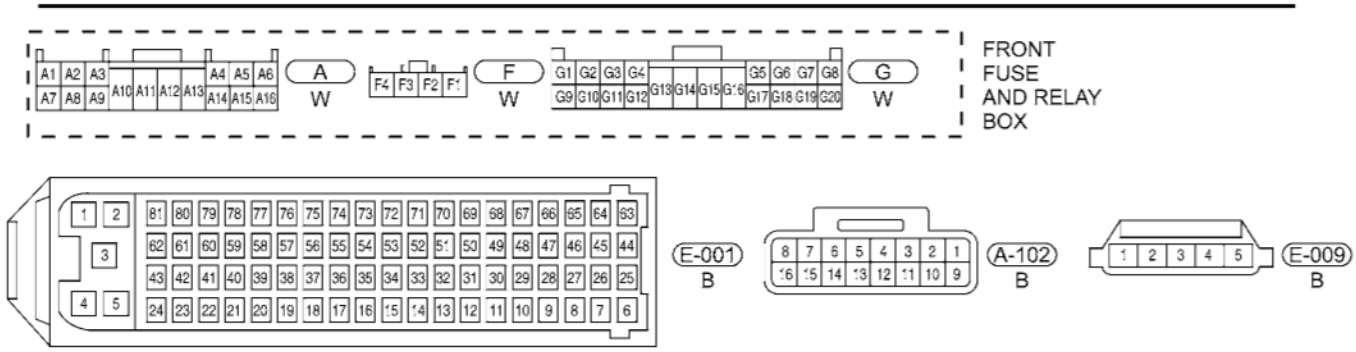
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0172 - Fuel Trim System Too Rich

EEC - 2.0L - MAF - 01

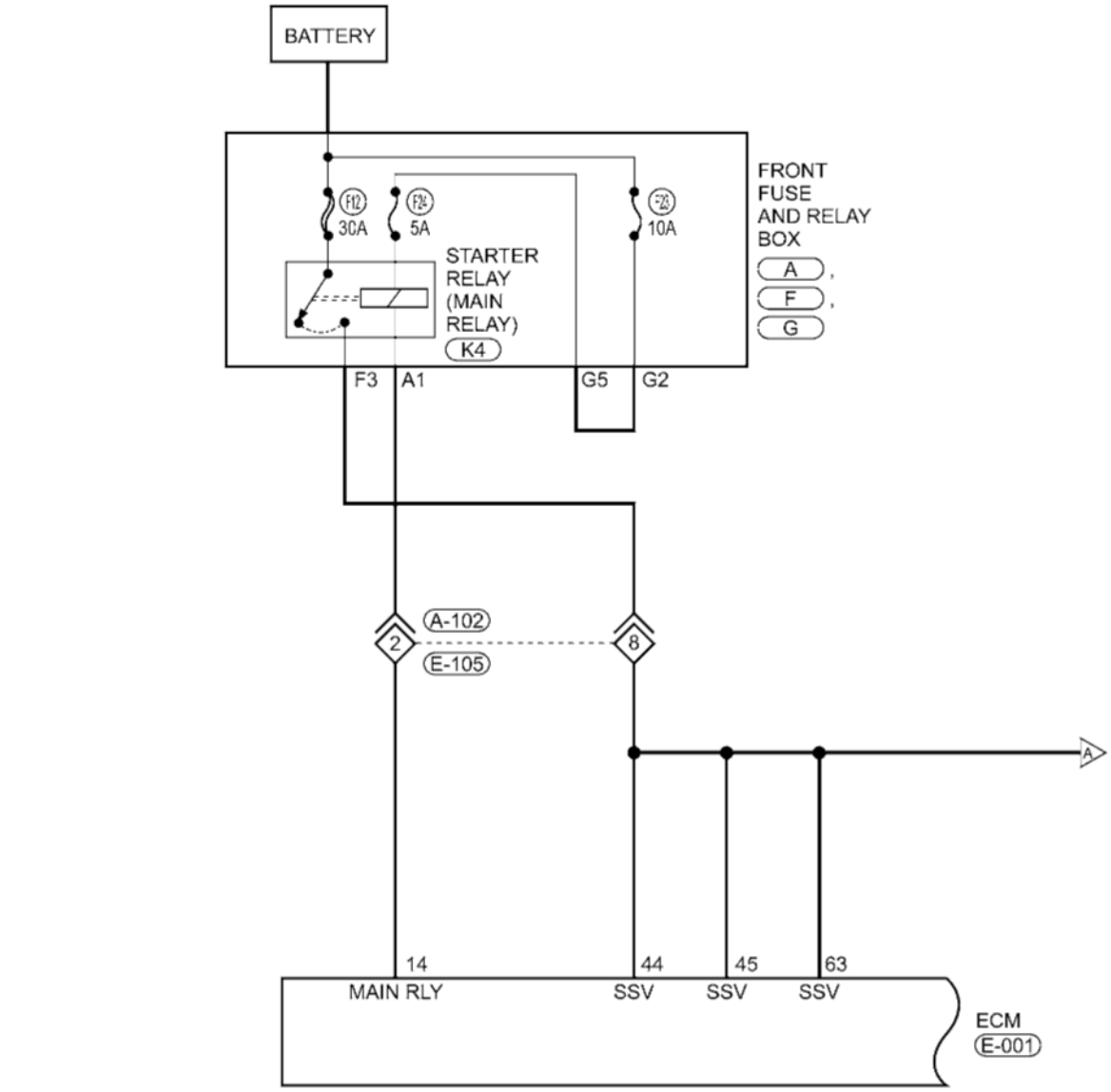


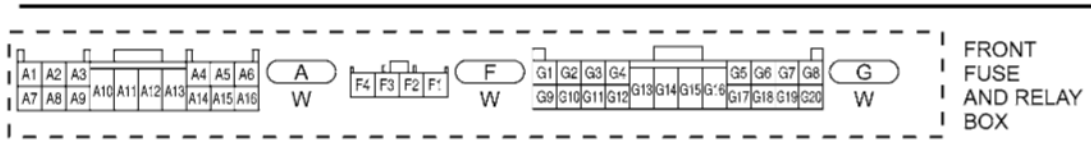


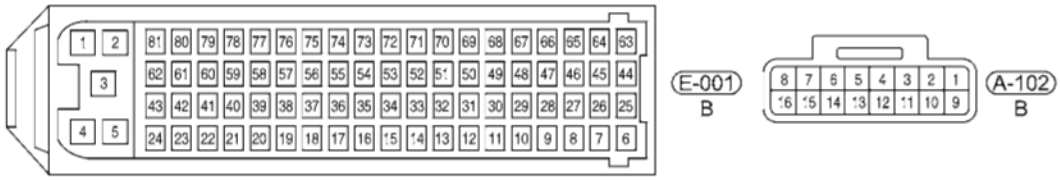
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EEC - 2.0L - INJ - 01



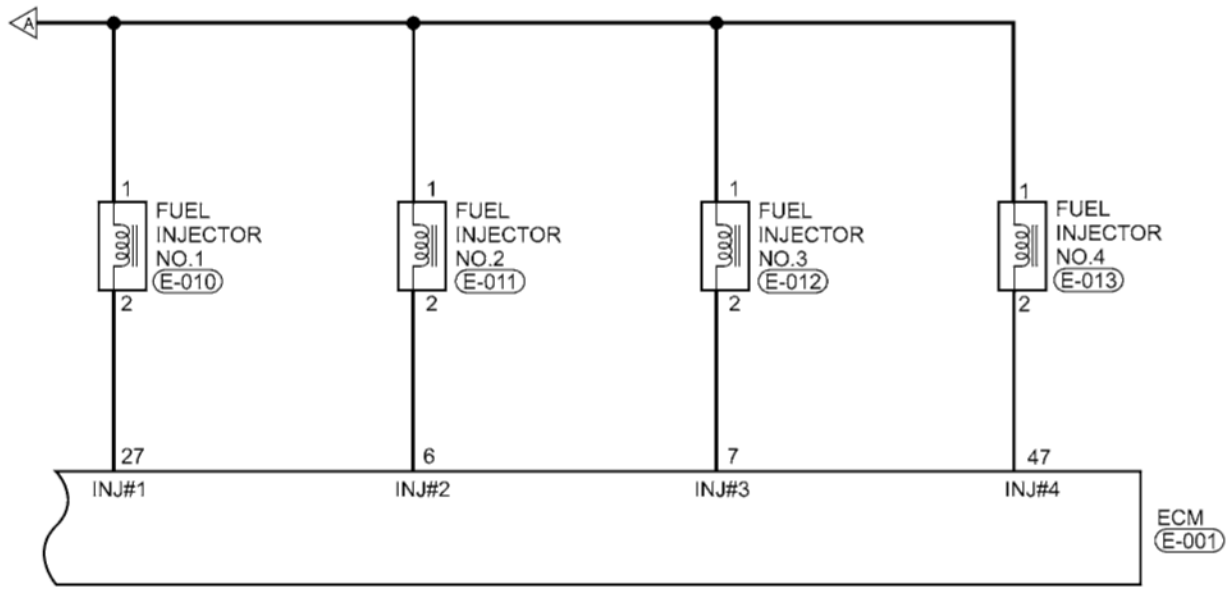


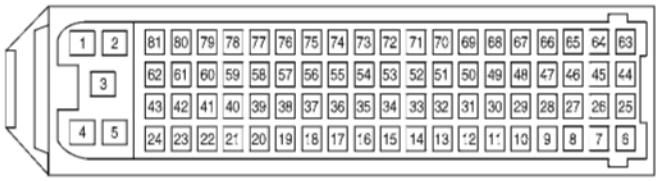


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EEC - 2.0L - INJ - 02





E-001 B



E-010 B, E-011 B, E-012 B, E-013 B

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

ECM TERMINAL NO.	ITEM	CONDITION	DATA
17	Sensor (GND)	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	0 V
33	Regulated sensor supply 1		5 V
37	Air flow sensor		322 kg/h
			1.39 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NUMBER	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0172	Fuel trim system too rich	Engine is running	The amount of mixture ratio compensation is too large (The mixture ratio is too rich).	• MAF sensor • Fuel injector • Exhaust gas leaks • Incorrect fuel pressure • Upstream O_2 sensor • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK EXHAUST GAS LEAK

- Start engine and run it at idle.
- Listen exhaust gas leak before three way catalyst.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace.

2. CHECK ECM CONTROL SIGNAL IN DATA STREAM

- With the X-431, select view data stream.

REFERENCE DATA			
MONITOR ITEM	**CONDITION**		**DATA**
Injector pulse	• Engine: warm up • Shift: P or N • Air condition: Off • No load	Idle	Approximately 2.5 ms

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.

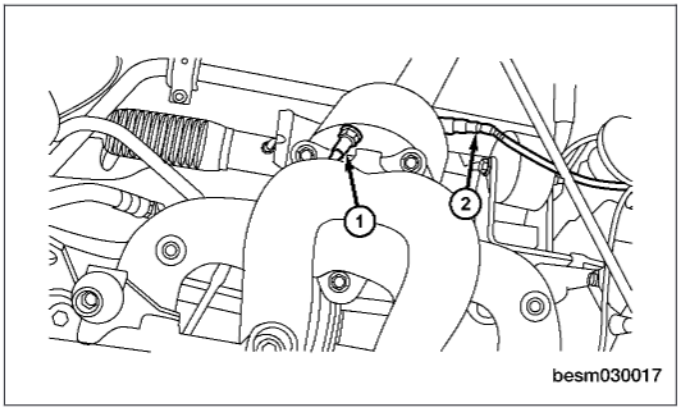
3. CHECK UPSTREAM O_2 SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the upstream O_2 sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



4. CHECK UPSTREAM O_2 SENSOR SIGNAL CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between the following terminals.

UPSTREAM O_2 SENSOR	ECM TERMINAL	O_2 SENSOR TERMINAL
O_2 sensor 1	36	3
	18	4

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- Continuity should exist.
- Also check harness for short to power.

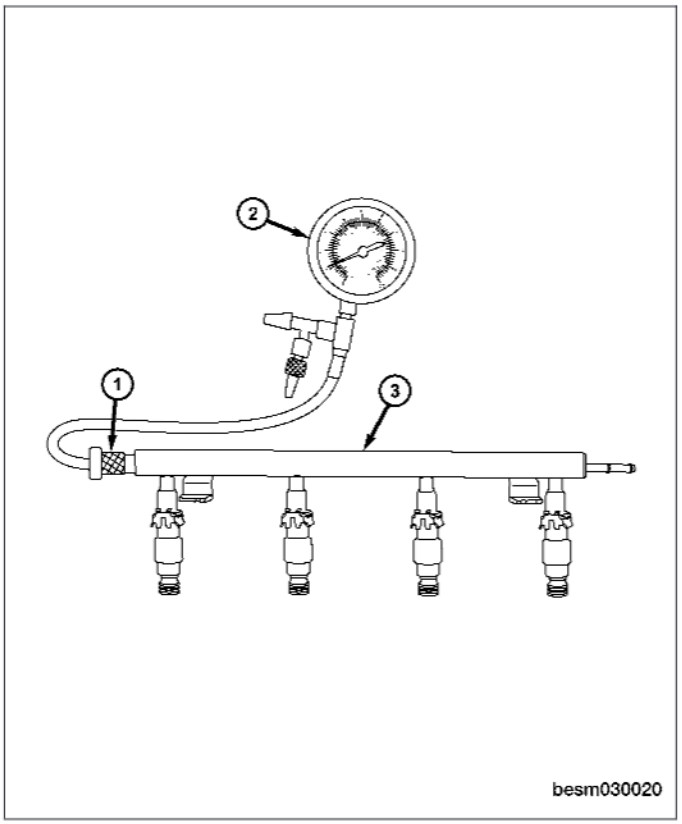
Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short to power in harness or connectors.

5. CHECK FUEL PRESSURE

- Release fuel pressure to zero.
- Install fuel pressure gauge (2) and check fuel pressure.



- Observe the following fuel pressures when testing (See Fuel Pressure Test in Section 04 Fuel Delivery)

FUEL PRESSURES	
Key On	400 kPa (4 bar)
Key Off	380 kPa (3.8 bar) in 10 minutes
Engine Idle	400 kPa (4.0 bar) - 420 kPa (4.2 bar)

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

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6. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuel pump and circuit
  - Fuel pressure regulator

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

7. CHECK MAF SENSOR

- Turn ignition switch off.
- Install all removed parts.
- Check air flow in data stream.

MAF SENSOR SIGNAL			
TERMINAL NO.	**ITEM**	**CONDITION**	**DATA**
37	Air flow sensor	• Engine is running • ECT: 78°C • Idle: 795 RPM • IAT: 36°C • IAT signal: 1.88 V	322 kg/h
			1.39 V

Is the check result normal?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 9.

No >> Check connectors for damaged or air flow signal circuit for short to power.

8. PERFORM ACTIVE TEST FUNCTION

- Start engine.
- Select ″ACTIVE TEST″ menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 11.

No >> Go to the next step.

9. CHECK FUNCTION OF INJECTOR

- Listen to each injector operating sound.
- Operating sound should exist.

Is the check result normal?

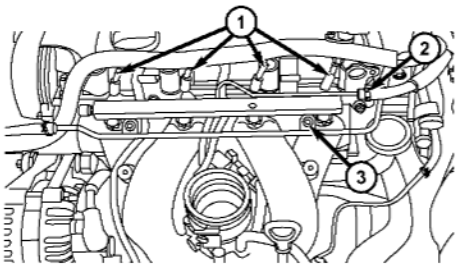
Yes >> Go to step 11.

No >> Go to the next step.

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10. CHECK INJECTOR CONTROL CIRCUIT

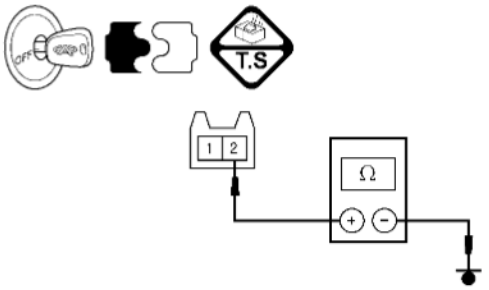
- Turn ignition switch off.
- Disconnect injector harness connector (1).



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- Disconnect ECM harness connector.
- check harness for short to ground between following terminals.
- Continuity should not exist.

INJECTOR NO.	ECM TERMINAL	INJECTOR TERMINAL
1	27	2
2	6	2
3	7	2
4	47	2



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Is the check result normal?

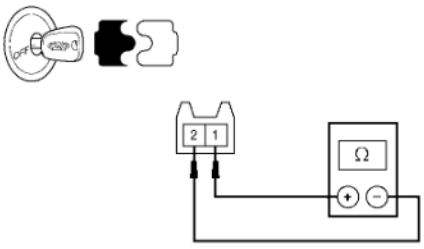
Yes >> Go to the next step.

No >> Repair or replace the circuit for short to ground in harness or connectors.

11. CHECK INJECTOR RESISTANCE

- Disconnect injector harness connectors (See Fuel Pressure Test in Section 04 Fuel Delivery).
- Check the fuel injector resistance as shown in the following:

INJECTOR RESISTANCE			
INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)	
1	1 & 2	11 - 16	
2	1 & 2		
3	1 & 2		
4	1 & 2		



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Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.
Go to step 14.

12. CHECK INJECTOR

WARNING!

Confirm that the engine is cooled down and there are no fire hazards near the vehicle.

- Remove fuel delivery rail with injectors (See Fuel Injector Rail Removal & Installation 1.6L/1.8L/2.0L in Section 04 Fuel Delivery).

NOTE :
Be careful not to drop the fuel injectors when removing the fuel delivery rail.
- Keep fuel hose and all injectors connected to injector rail.
- Disconnect all injector harness connectors.
- Disconnect all ignition coil harness connectors.
- Prepare pans or saucers under each injector.
- Crank engine for about 3 seconds.
- Make sure fuel does not drip from injector.

Is the check result normal?

Yes >> Go to next step.

No >> Replace any leaking injectors as necessary. Always replace the O-ring seal when replacing the fuel injector .

13. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0172 still present?

Yes >> Replace the ECM.

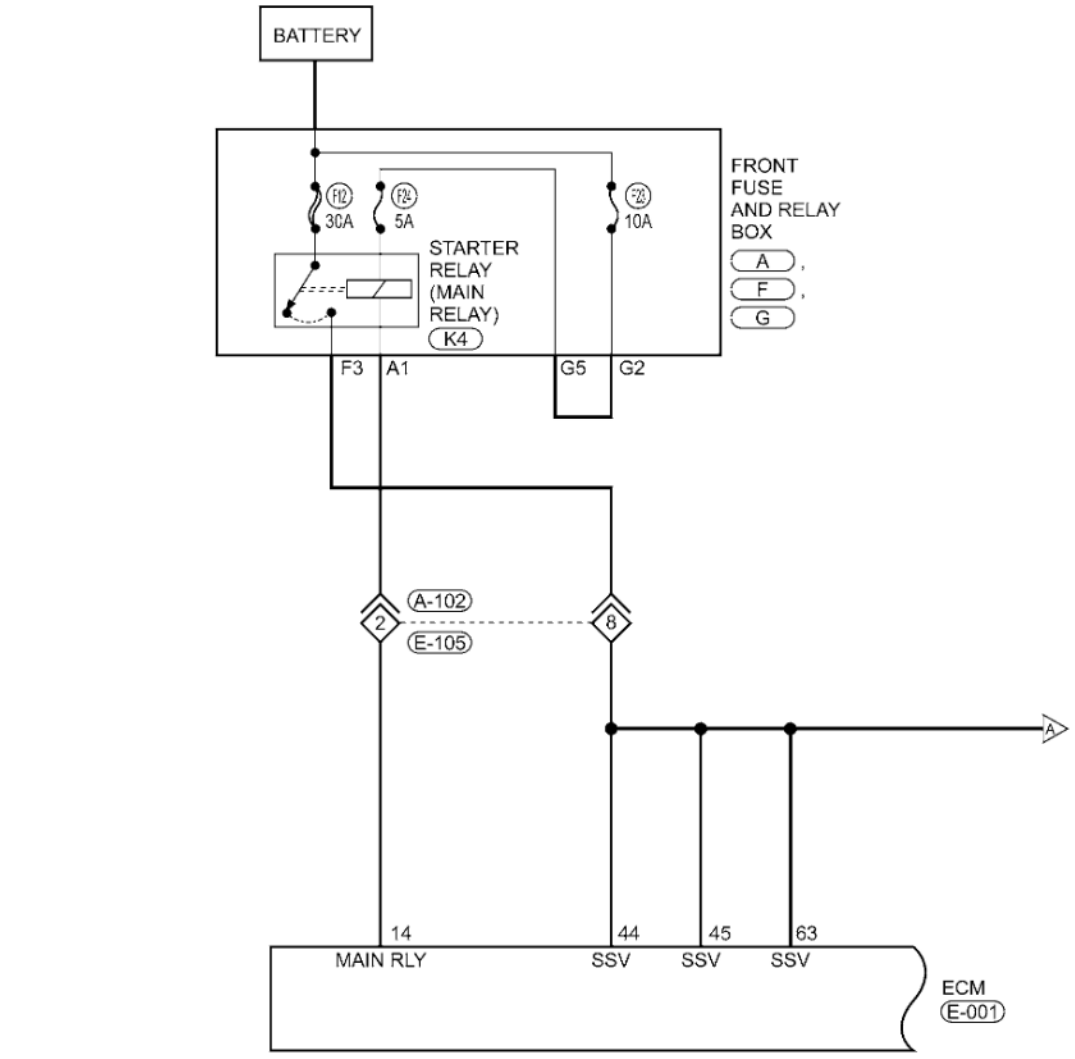
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

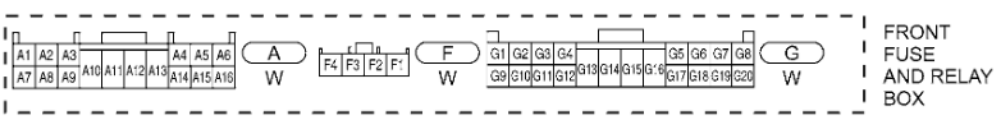
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

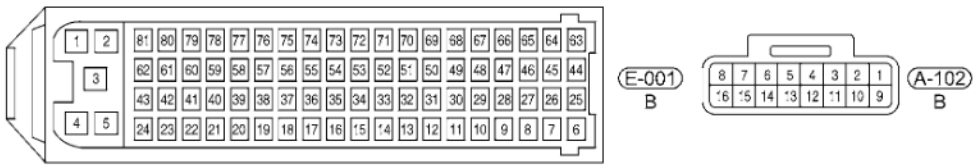
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P0201 - Cylinder 1 - Injector Circuit
P0202 - Cylinder 2 - Injector Circuit
P0203 - Cylinder 3 - Injector Circuit
P0204 - Cylinder 4 - Injector Circuit

EEC - 2.0L - INJ - 01



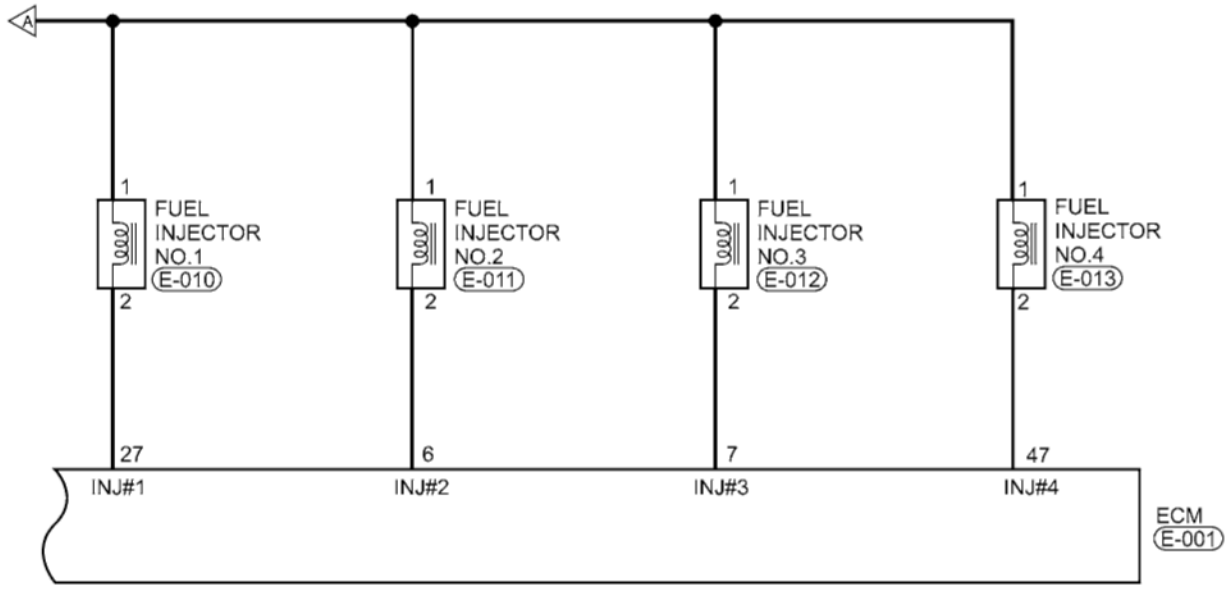


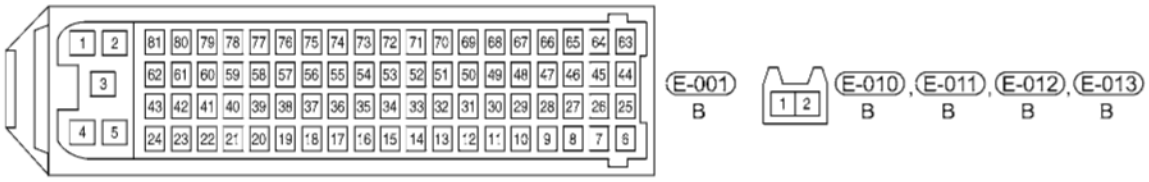


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EEC - 2.0L - INJ - 02





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0201	Cylinder 1 - Injector Circuit	Engine is running	• Injector • Harness or connectors • ECM
P0202	Cylinder 2 - Injector Circuit		
P0203	Cylinder 3 - Injector Circuit		
P0204	Cylinder 4 - Injector Circuit		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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2. INSPECTION START

- Start engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 4.

No >> Go to step 5.

3. PERFORM ACTIVE TEST FUNCTION

- Start engine.
- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 11.

No >> Go to step 5.

4. CHECK FUNCTION OF INJECTORS

- Listen to injectors for operating sound one by one.

Does a clicking noise exist for all injectors?

Yes >> Go to step 11.

No >> Go to the next step.

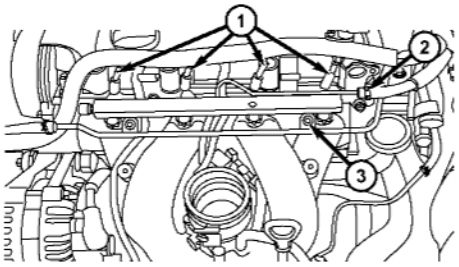
5. CHECK INJECTOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the injector electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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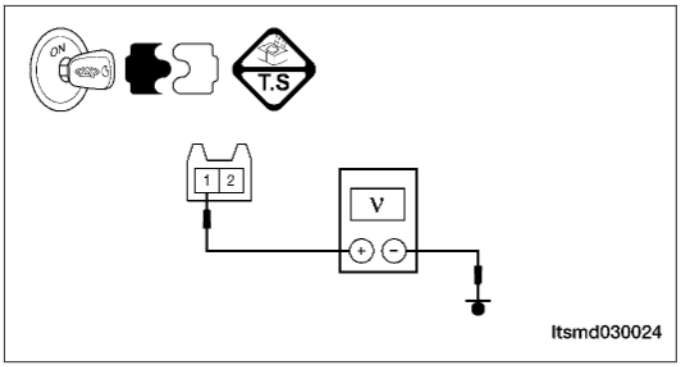
6. CHECK INJECTOR POWER SUPPLY CIRCUIT FOR OPEN

- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box F3
  - Fuse 12, fuse 23, fuse 24
  - Check harness for an open or short to ground between injector and fuse.

Is the check result normal?

Yes >> With the X-431, check the system, If OK, go to the next step.

No >> Repair or replace malfunctioning part.

8. CHECK INJECTOR CONTROL CIRCUITS FOR AN OPEN

- Check injector control circuit voltage.
- 3.6 V should exist.

Is the check result normal?

Yes >> Go to step 10.

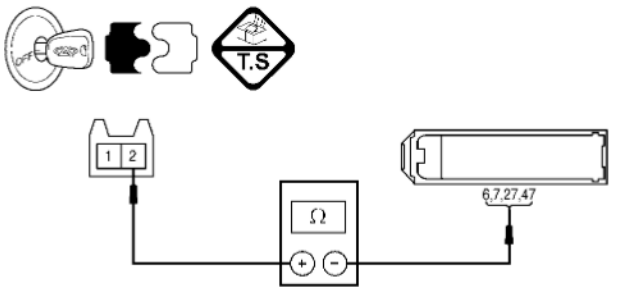
No >> Go to the next step.

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9. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

INJECTOR NO.	ECM TERMINAL	INJECTOR TERMINAL
1	27	2
2	6	2
3	7	2
4	47	2



- Continuity should exist.

Is the check result normal?

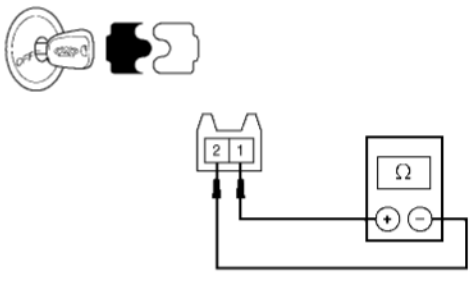
Yes >> Go to the next step.

No >> Repair circuit for an open in harness or connectors.

10. CHECK INJECTOR RESISTANCE

- Check resistance as table shown.
- Check the fuel injector resistance as shown in the following:

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)
1	1 & 2	11 - 16
2	1 & 2	
3	1 & 2	
4	1 & 2	



- Also check sensor signal output.
- Connect ECM connector.
- Connect injector connector.
- Check the fuel injector voltage as shown in the following:

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Idle • Warm-up condition • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

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Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See ″DTC Confirmation Procedure″.

Is DTC P0201, P0202, P0203 or P0204 still present?

Yes >> Replace the ECM.

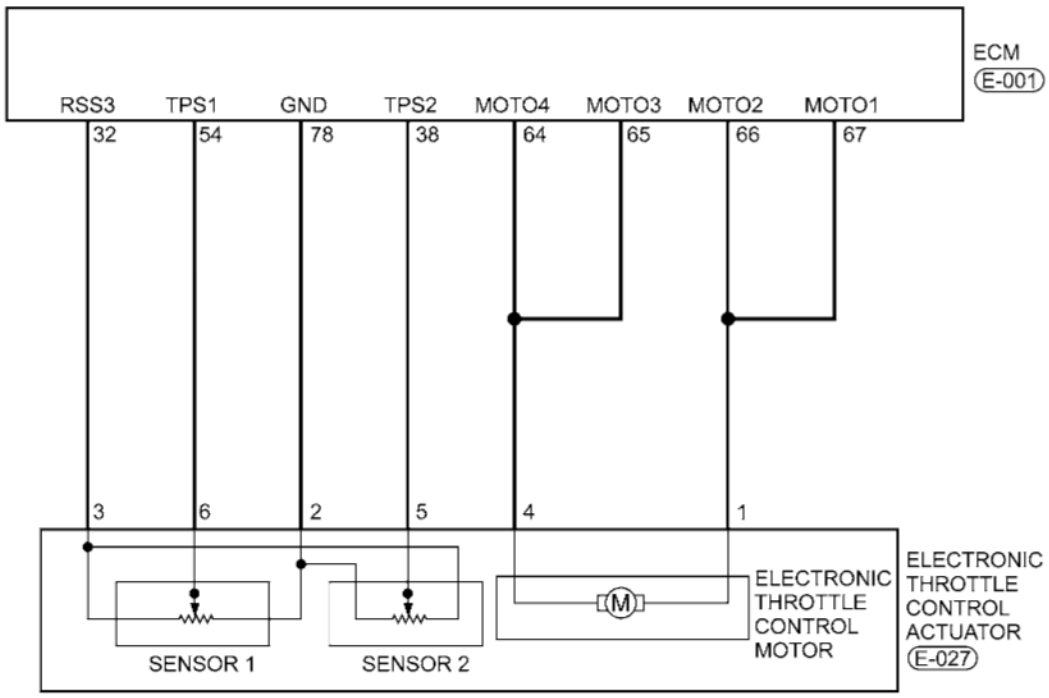
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

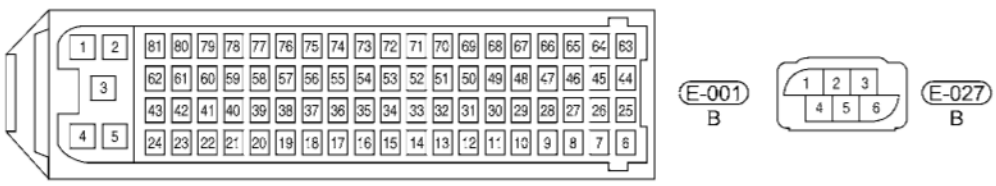
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0221 - Throttle Position Sensor B Performance

EEC - 2.0L - TPS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (Position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
64	Motor 4		-	12 V or 0 V
65	Motor 3			
66	Motor 2			0 V or 12 V
67	Motor 1			
78	Sensor (GND)			Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0221	Throttle position sensor B performance	• Ignition switch: ON • Engine: Running	Rationally incorrect voltage is sent to ECM compared with the signals from TPS1 and TPS2.	• Electronic throttle control actuator (TPS1 and TPS2) • Harness or connectors • Accelerator pedal position sensor 2 • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

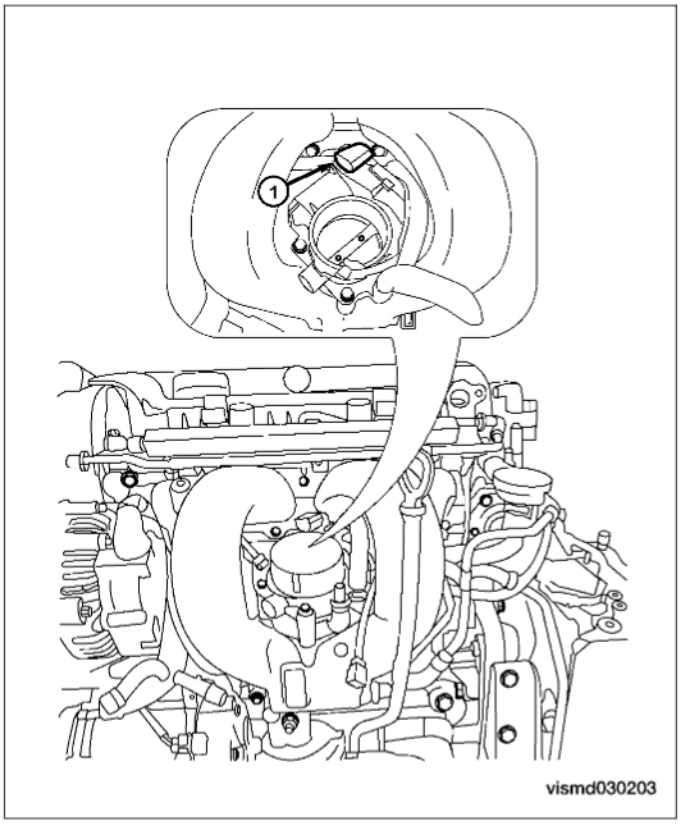
2. CHECK TPS ELECTRICAL CONNECTOR

- Disconnect the TPS electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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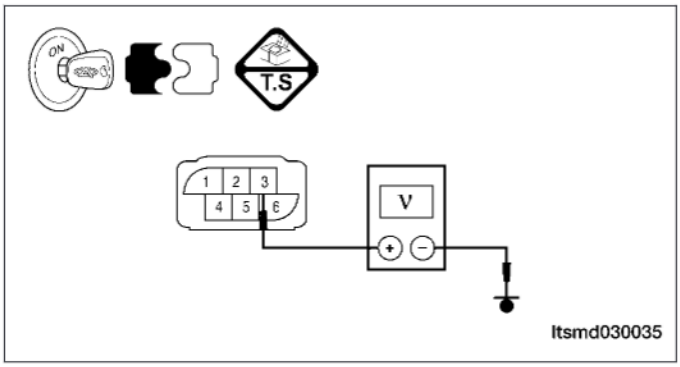
3. CHECK THE TPS POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between TPS terminal 3 and ground in the TPS electrical connector E-027.
- Approximately 5.0 V should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



4. CHECK THE TPS POWER SUPPLY CIRCUIT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between TPS terminal 3 and ECM terminal 32.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open.

5. CHECK THE TPS AND THE ACCELERATOR PEDAL POSITION (APP) SENSOR POWER SUPPLY CIRCUIT

- Check harness for short to power and short to ground between following terminals.

ECM TERMINAL	TPS TERMINAL
32	TPS terminal 3
32	APP sensor terminal 3
33	APP sensor terminal 6

Is the check result normal?

Yes >> Go to the next step.

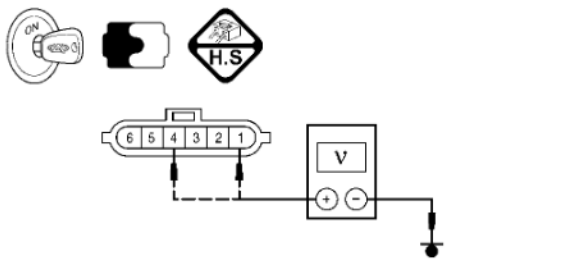
No >> Repair circuit for short to ground or short to power in harness or connectors.

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6. CHECK APP SENSOR

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 16 (APP sensor 1 signal), 40 (APP sensor 2 signal) and ground under the following conditions:

ECM TERMINAL NO.	APP SENSOR TERMINAL	ITEM	CONDITION		DATA (DC VOLTAGE)
16	APP sensor terminal 4	Accelerator pedal position sensor 1	Ignition switch on	• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
				• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	APP sensor terminal 1	Accelerator pedal position sensor 2		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
				• Engine stopped • Accelerator pedal: Fully depressed	1.97 V



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Is the check result normal?

Yes >> Go to step 10.

No >> Replace the Accelerator Pedal Assembly (See Accelerator Pedal Position Sensor Removal & Installation in Section 03 Electronic Engine Controls).

7. CHECK THE TPS SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between TPS terminal 5 and ECM terminal 38.
- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

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8. CHECK THE TPS GROUND CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between electronic throttle control actuator terminal 2 and ECM terminal 78.
- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

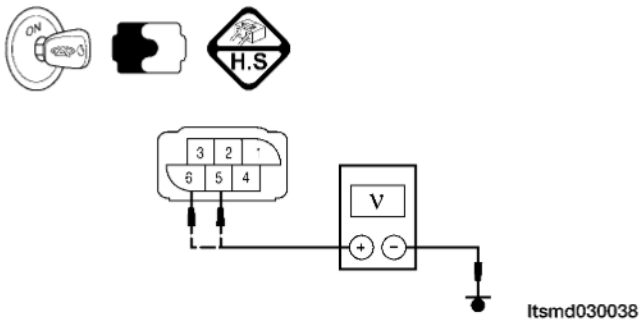
Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power or short to ground in harness or connectors.

9. CHECK TPS

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 54 (TPS1 signal), 38 (TPS2 signal) and ground under the following conditions:

TPS TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
5	Throttle Position Sensor 2 (TPS2)	Ignition switch: ON	• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
6	Throttle Position Sensor 1 (TPS1)		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V



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Is the check result normal?

Yes >> Go to the next step.

No >> Replace the Electronic Throttle Control Actuator (See Electronic Throttle Control Actuator Removal & Installation in Section 03 Electronic Engine Controls).

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10. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0221 still present?

Yes >> Replace the ECM.

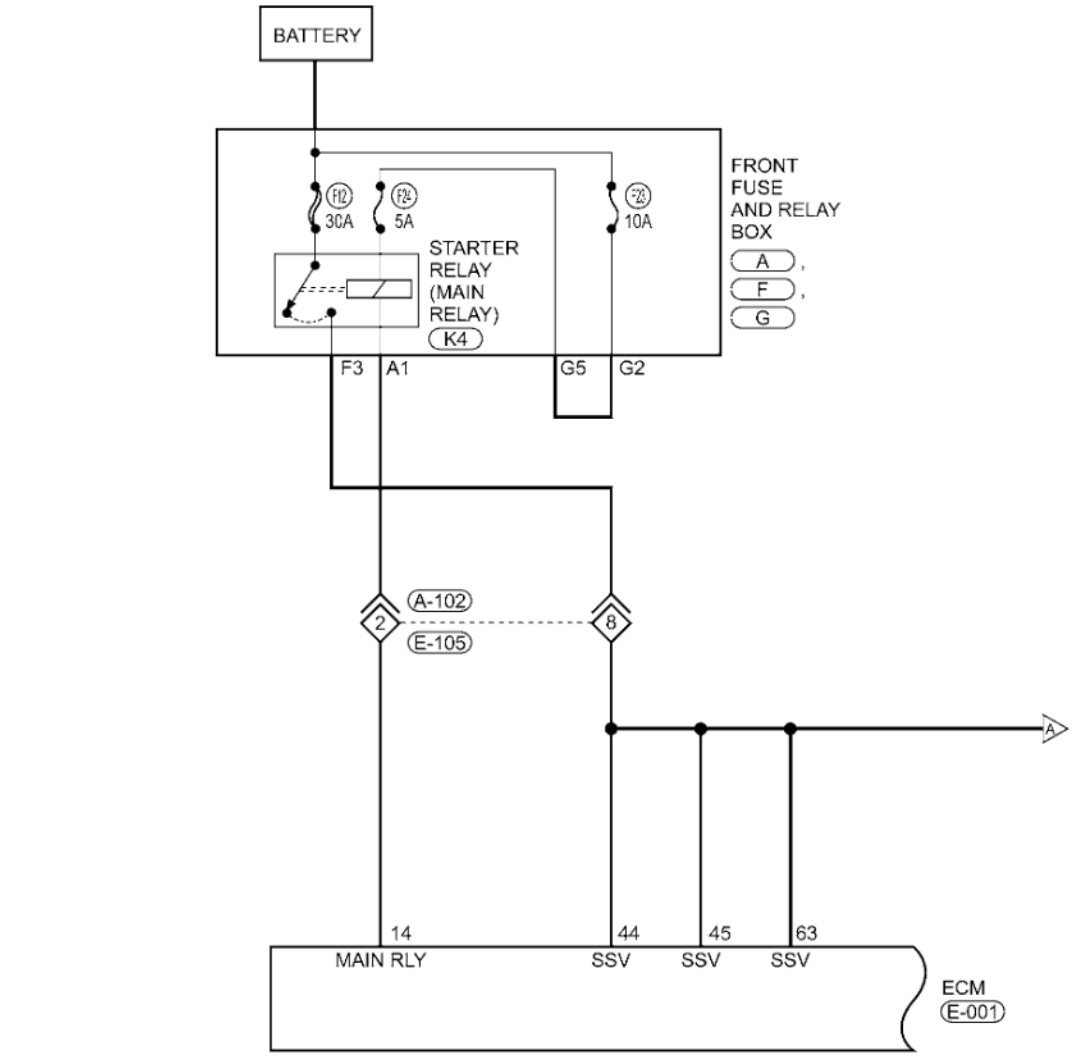
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

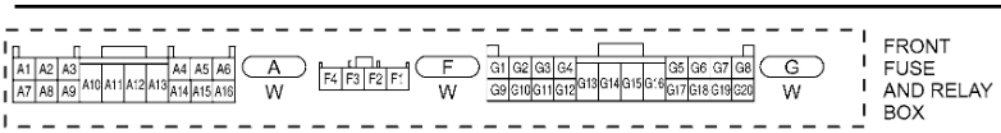
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

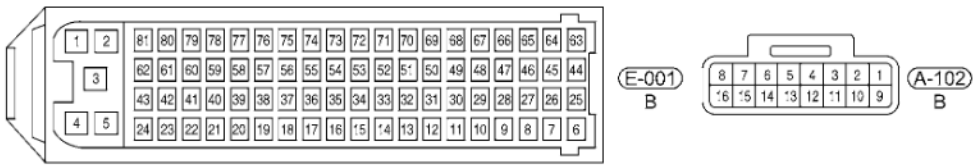
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P0261 - Cylinder 1 Injector Circuit Low
P0264 - Cylinder 2 Injector Circuit Low
P0267 - Cylinder 3 Injector Circuit Low
P0270 - Cylinder 4 Injector Circuit Low

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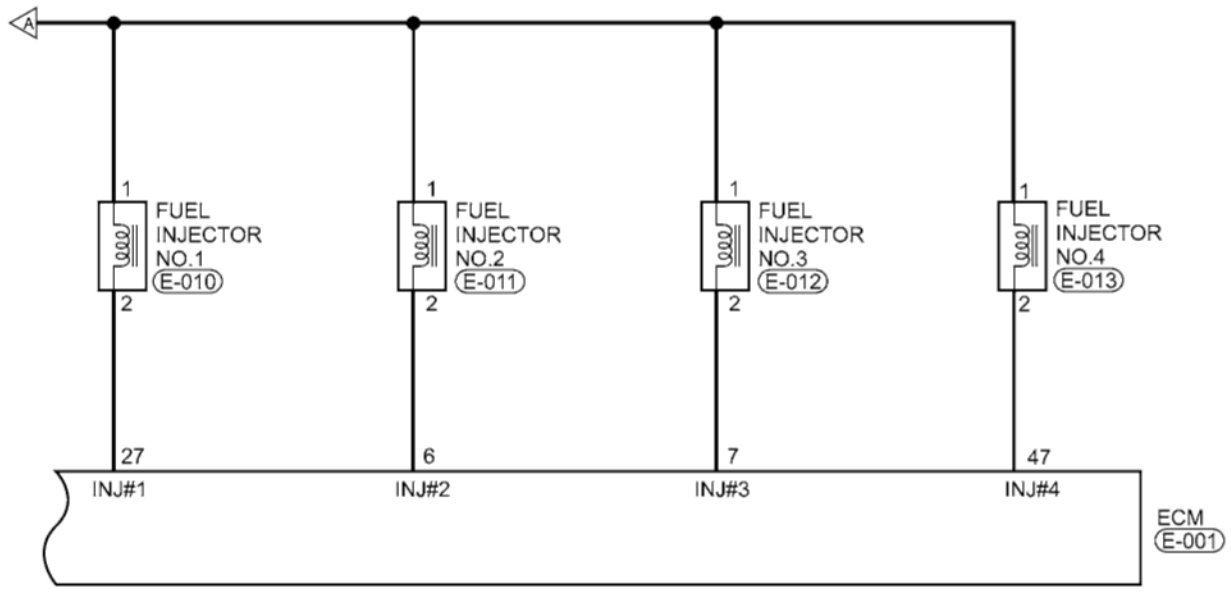


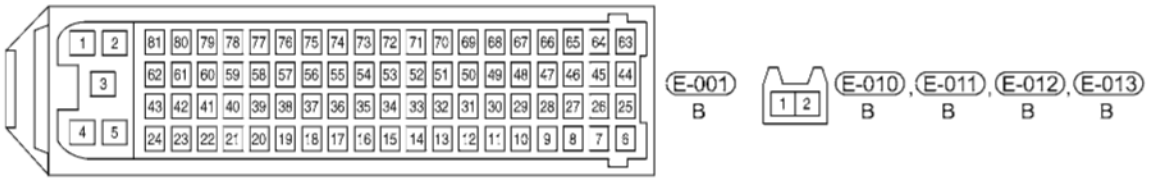


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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0261	Cylinder 1 - Injector Circuit Low	Engine is running	• Injector • Harness or connectors • ECM
P0264	Cylinder 2 - Injector Circuit Low		
P0267	Cylinder 3 - Injector Circuit Low		
P0270	Cylinder 4 - Injector Circuit Low		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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2. INSPECTION START

- Start the engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 4.

No >> Go to step 5.

3. PERFORM ACTIVE TEST FUNCTION

- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to step 5.

4. CHECK FUNCTION OF INJECTOR

- Listen to injector operating sound one by one.

Do all injectors clicking noise exist?

Yes >> Go to step 10.

No >> Go to the next step.

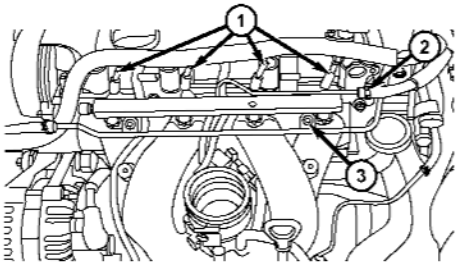
5. CHECK INJECTOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the injector electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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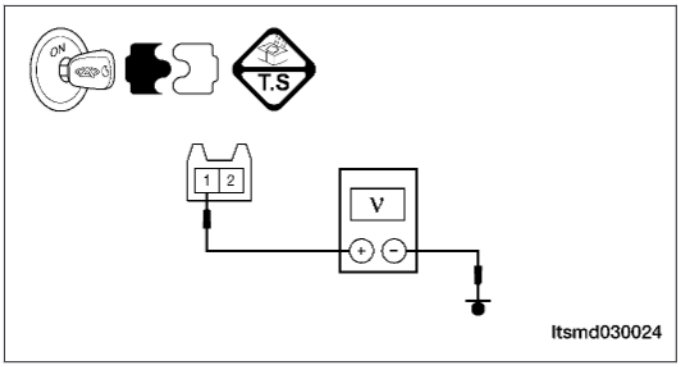
6. CHECK INJECTOR POWER SUPPLY CIRCUIT FOR AN OPEN

- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box F3
  - Fuse 12, fuse 23, fuse 24
  - Harness for shorted between injector and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair malfunctioning part.

8. CHECK INJECTOR CONTROL CIRCUITS FOR A SHORT

- Check injector control circuit voltage.
- 3.6 V should exist.

Is the check result normal?

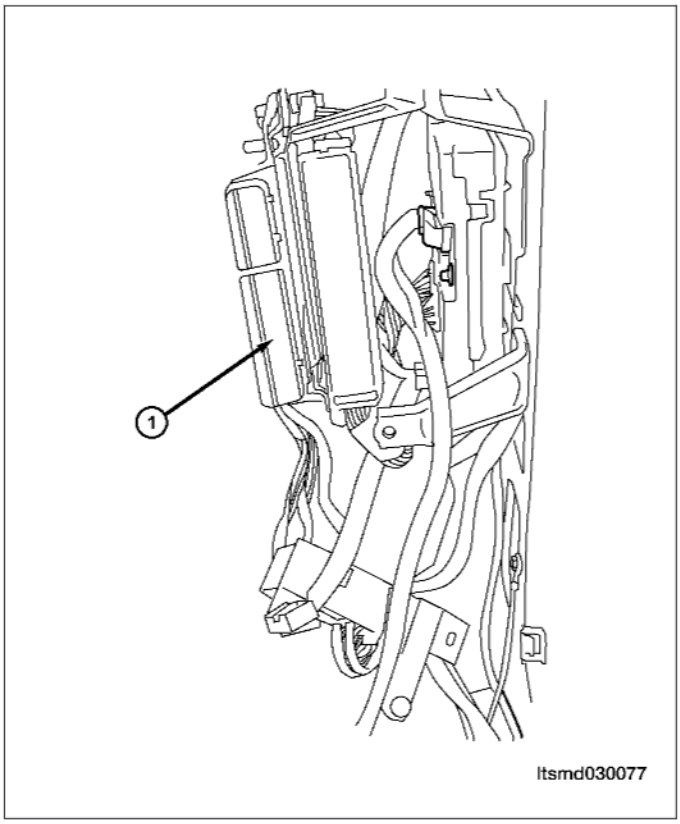
Yes >> Go to step 10.

No >> Go to the next step.

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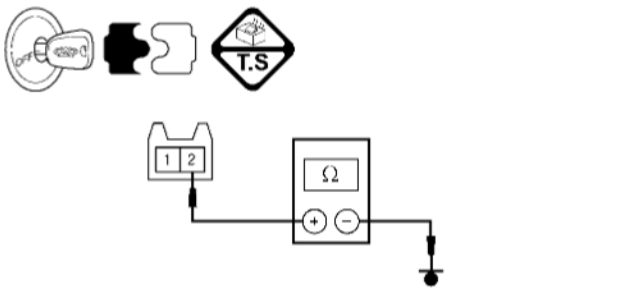
9. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector (1).



- Check for harness continuity between the following terminals.
- Continuity should not exist.

INJECTOR NO.	INJECTOR TERMINAL	GROUND
1	2	Ground
2	2	
3	2	
4	2	



Is the check result normal?

Yes >> Replace the ECM.

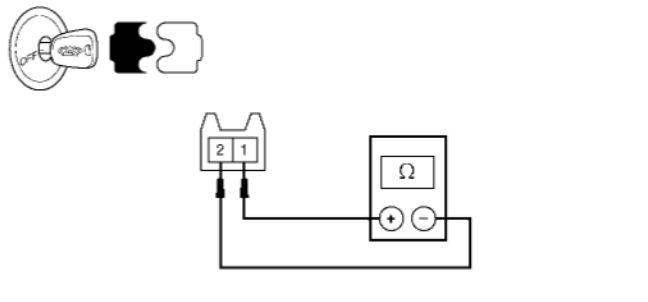
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair circuit for a short in harness or connectors.

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10. CHECK INJECTOR RESISTANCE

- Check resistance as table shown.
- Check the fuel injector resistance as shown in the following:

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)	
1	1 & 2	11 - 16	
2	1 & 2		
3	1 & 2		
4	1 & 2		

- Connect ECM connector.
- Connect injector connector.
- Check the fuel injector voltage as shown in the following:

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See ″DTC Confirmation Procedure″.

Is DTC P0261, P0264, P0267 or P0270 still present?

Yes >> Replace the ECM.

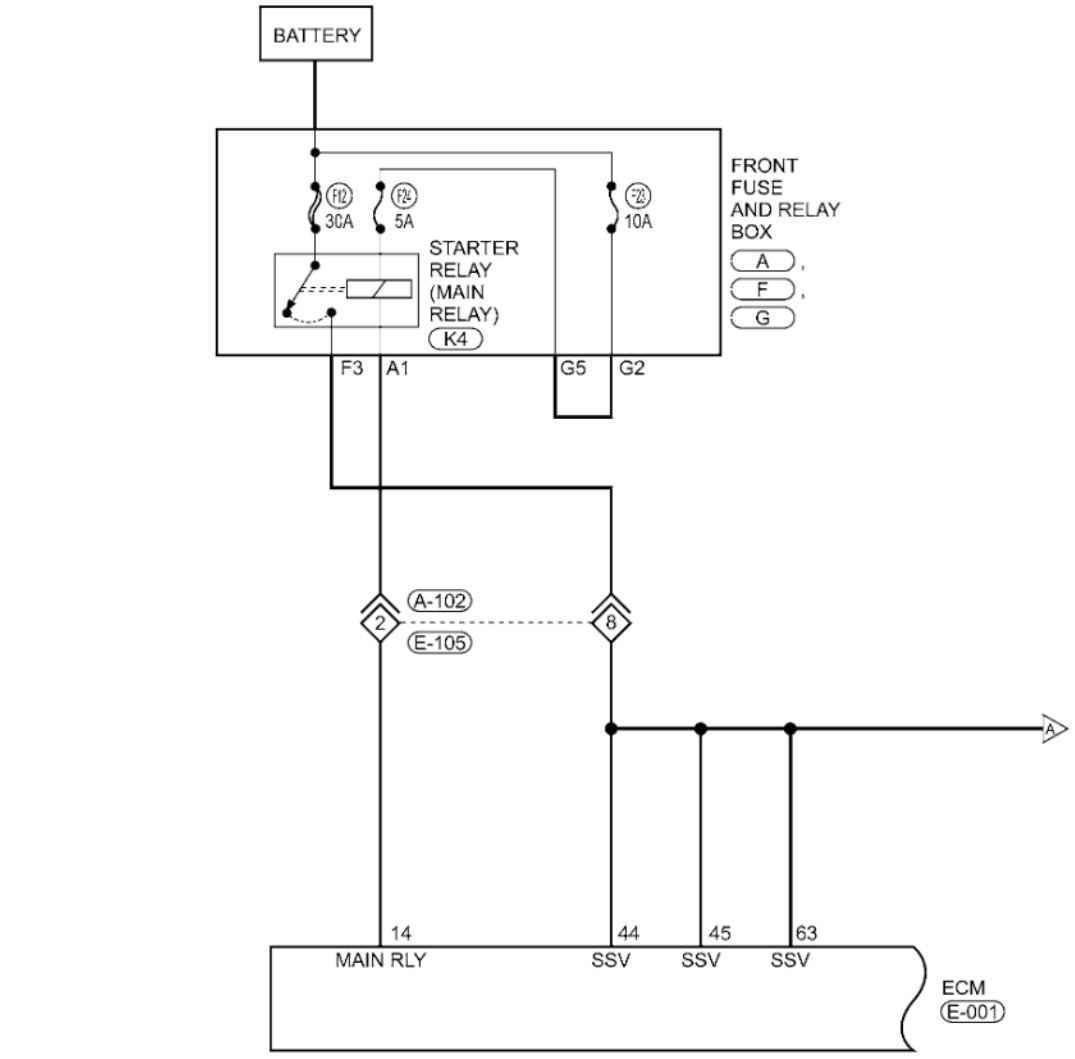
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

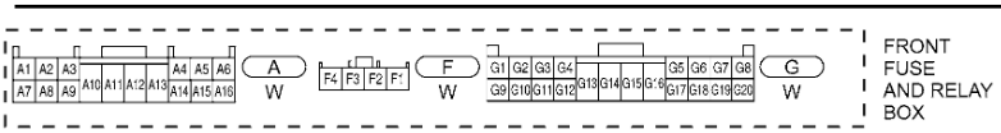
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

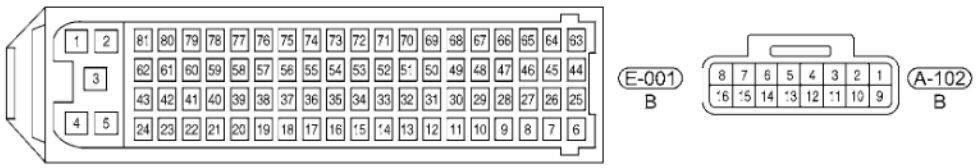
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P0262 - Cylinder 1 Injector Circuit High
P0265 - Cylinder 2 Injector Circuit High
P0268 - Cylinder 3 Injector Circuit High
P0271 - Cylinder 4 Injector Circuit High

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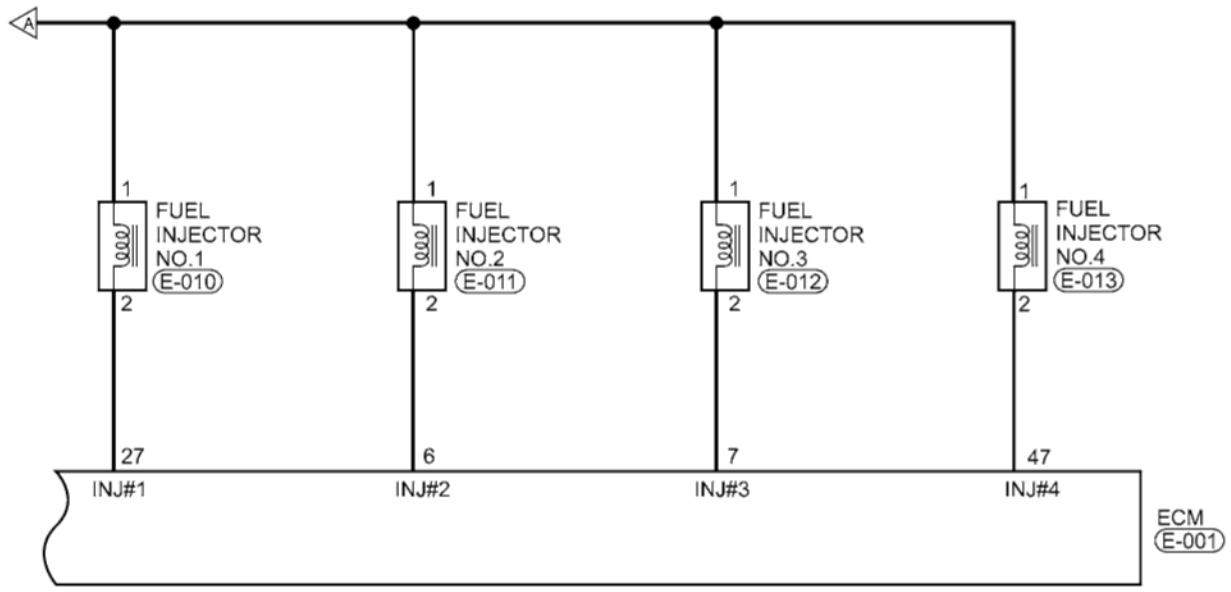


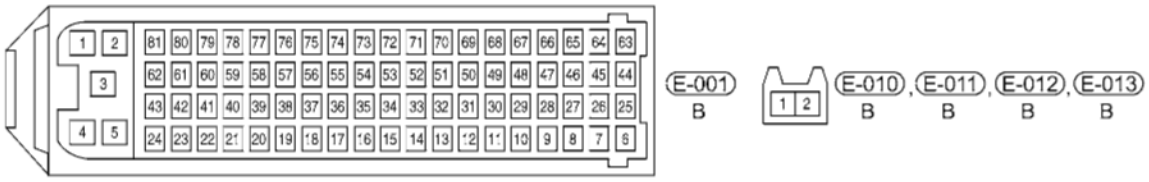


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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 V - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0262	Cylinder 1 - Injector Circuit High	Engine is running	• Injector • Harness or connectors • ECM
P0265	Cylinder 2 - Injector Circuit High		
P0268	Cylinder 3 - Injector Circuit High		
P0271	Cylinder 4 - Injector Circuit High		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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2. INSPECTION START

- Start the engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 4.

No >> Go to step 5.

3. PERFORM ACTIVE TEST FUNCTION

- Start engine.
- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to step 5.

4. CHECK FUNCTION OF INJECTOR

- Listen to injector operating sound one by one.

Do all injectors clicking noise exist?

Yes >> Go to step 10.

No >> Go to the next step.

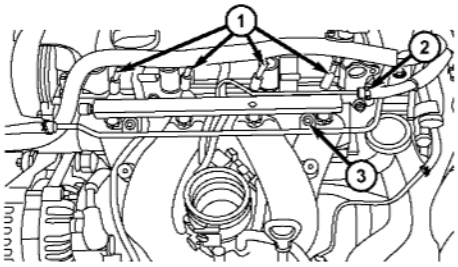
5. CHECK INJECTOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the injector electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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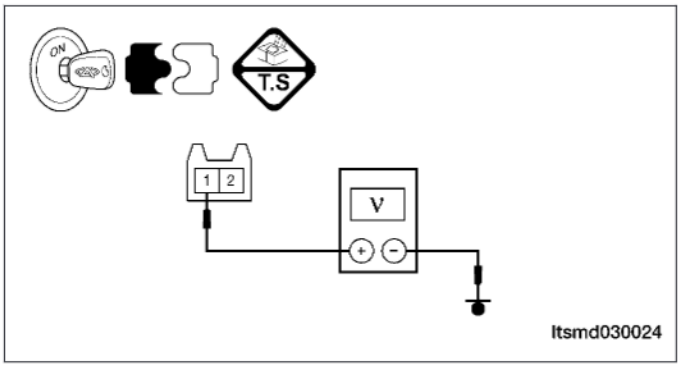
6. CHECK INJECTOR POWER SUPPLY CIRCUIT FOR SHORTED

- Turn ignition switch on.
- Check injector supply voltage between sensor terminal and ground in the electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box F3
  - Fuse 12, fuse 23, fuse 24
  - Harness for an open or short between injector and fuse

Is the check result normal?

Yes >> With the X-431, check the system, If OK, go to the next step.

No >> Repair malfunctioning part.

8. CHECK INJECTOR CONTROL CIRCUITS FOR A SHORT

- Check injector control circuit voltage.
- 3.6 V should exist.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to the next step.

9. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check if the injector control circuits short to power supply circuits.
- Check the following.
- Voltage should not exist.

INJECTOR NO.	POWER SUPPLY CIRCUIT	INJECTOR TERMINAL
1	Power supply circuit	2
2		2
3		2
4		2

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Is the check result normal?

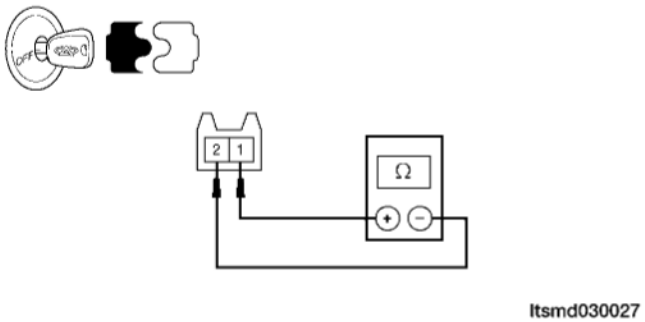
Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair circuit for a short in harness or connectors.

10. CHECK INJECTOR RESISTANCE

- Check resistance as table shown.
- Check the fuel injector resistance as shown in the following:

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)	
1	1 & 2	11 - 16	
2	1 & 2		
3	1 & 2		
4	1 & 2		

- Connect ECM connector.
- Connect injector connector.
- Check the fuel injector voltage as shown in the following:

TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
6	Injector 2	• Engine is running • Warm-up condition • Idle • Accelerate suddenly	Voltage: 11 V - 14 V
7	Injector 3		
27	Injector 1		
47	Injector 4		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.

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11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See ″DTC Confirmation Procedure″.

Is DTC P0262, P0265, P0268 or P0271 still present?

Yes >> Replace the ECM.

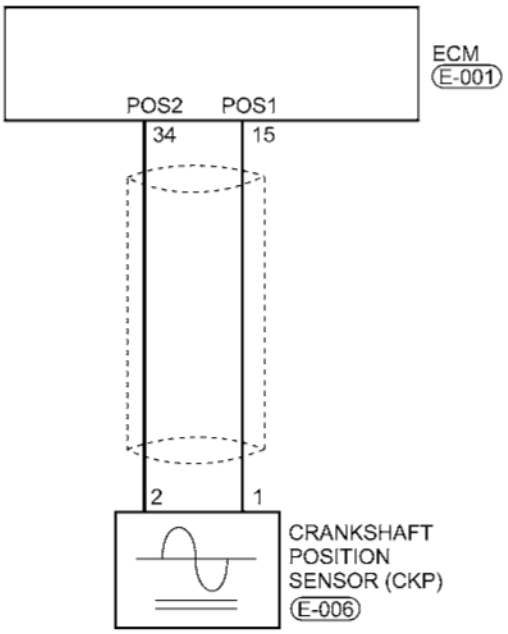
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

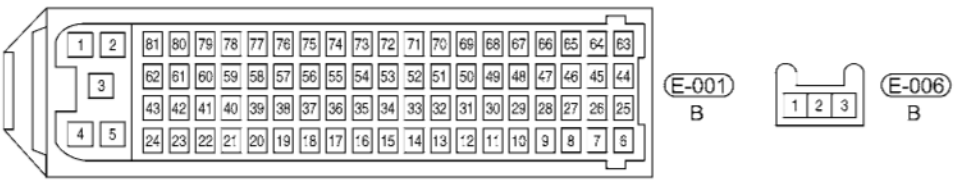
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0321 - Distributor Engine Speed In Phase Circuit Performance

EEC - 2.0L - POS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
15 34	Crankshaft Position (CKP) sensor	• Ignition switch: ON • Engine: Not cranking	3 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0321	Distributor engine speed in phase circuit performance	Engine is running	ECM detected that the input signal is out of the acceptable range.	• CKP • Crankshaft signal plate • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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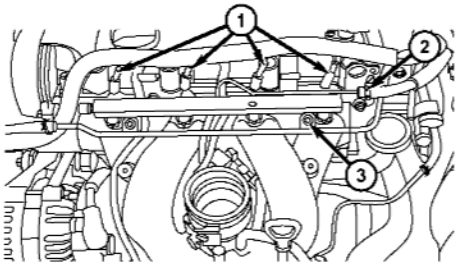
2. CHECK CKP SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the CKP sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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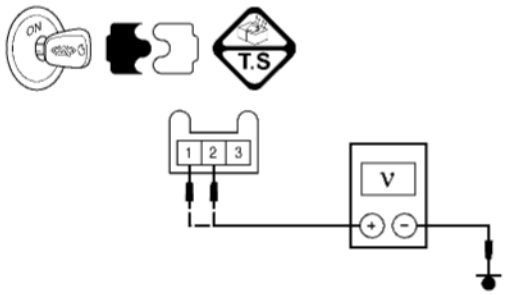
3. CHECK CKP SENSOR REFERENCE VOLTAGE

- Turn ignition switch on.
- Check CKP sensor supply voltage between sensor connector E-006, terminal 1 and ground, terminal 2 and ground in the sensor electrical connector.
- 3 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness for an open or short between CKP sensor and ECM.

Is the check result normal?

Yes >> Replace the ECM.

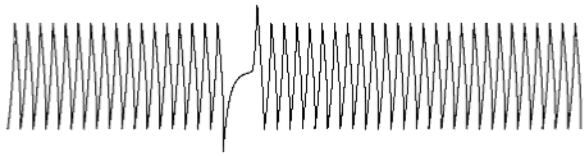
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair circuit for an open or short in harness or connectors.

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5. CHECK CKP SENSOR SIGNAL WAVE PATTERN

- Connect ECM connector.
- Connect CKP sensor connector.
- Check sensor output signal when engine is running.

	CKP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030002

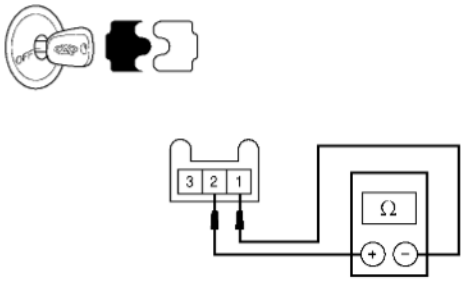
Is the CKP sensor output signal normal?

Yes >> Go to step 9.

No >> Go to the next step.

6. CHECK CKP SENSOR

- Check resistance as table shown.
- Remove the sensor.
- Visually check the sensor for chipping.

TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Approximately 860 Ω	 ltsmd030049

Is the check result normal?

Yes >> Replace the CKP sensor with a known good CKP sensor.
Monitor the CKP sensor signal on the KES-200 screen.
- If the CKP sensor signals were normal, the system is OK.
- If the CKP sensor signals were still irregular or missing, go to step 7.

No >> Replace CKP sensor.

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7. CHECK INSTALLED CLEARANCE

- Check the installed clearance (See CKP sensor Removal & Installation in Section 08 Transaxle & Transfer Case).
- 0.8 - 1.2 mm should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Reinstall CKP sensor.

8. CHECK GEAR TOOTH

- Visually check for chipping signal plate gear tooth.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the signal plate

9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0321 still present?

Yes >> Replace the ECM.

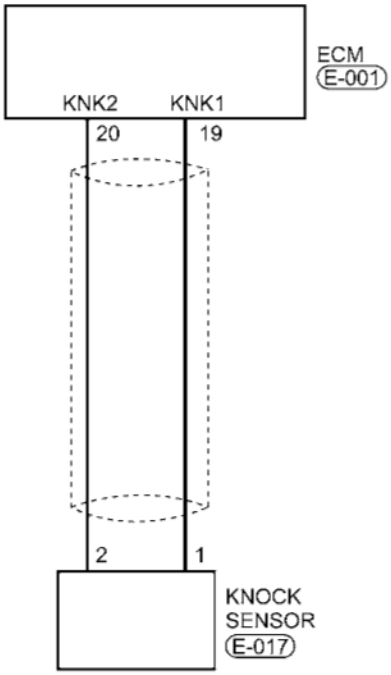
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

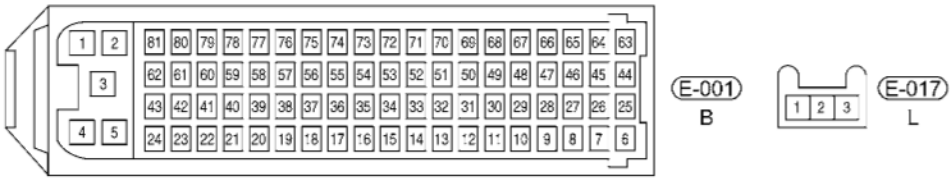
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0324 - Knock Control System Error

EEC - 2.0L - KS - 01





ltsmw030028t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	TEST METHOD	DATA (AVERAGE DC VOLTAGE)
19	Knock sensor 1	• Test Method 1: Knock at cylinder with rubber hammer • Test Method 2: Knock at sensor slightly	Output signal voltage should exist.
20	Knock sensor 2		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC SET CONDITION	POSSIBLE CAUSE
P0324	Knock control system error	ECM detected that the input signal is out of the acceptable range.	• Knock sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Run engine for a while then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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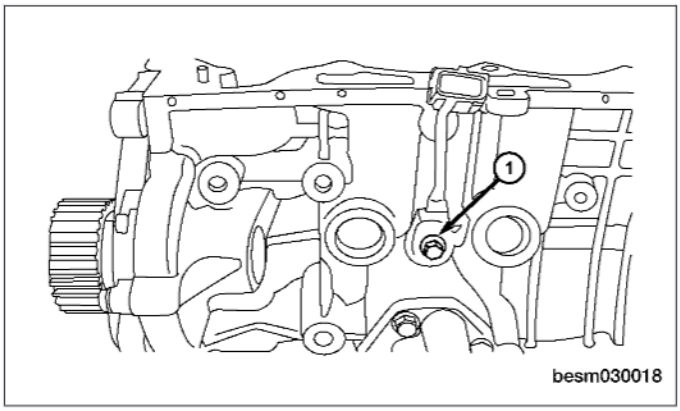
2. CHECK KNOCK SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the knock sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



3. CHECK KNOCK SENSOR RESISTANCE

- Check resistance between knock sensor connector E-017, terminal 1 and terminal 2.
- The resistance should above 1 MΩ.

Is the check result normal?

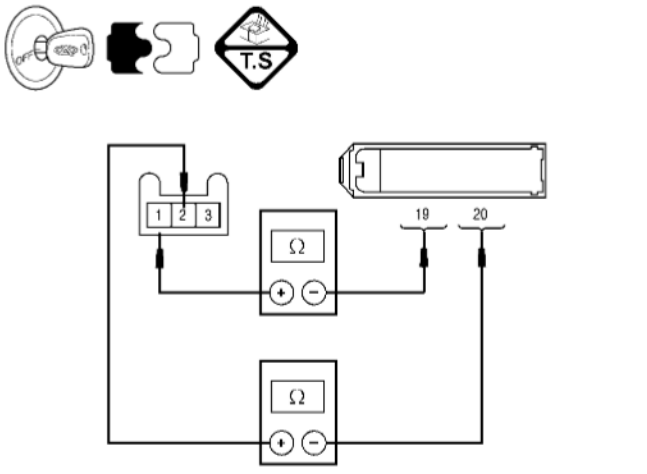
Yes >> Go to the next step.

No >> Replace knock sensor.

4. CHECK KNOCK SENSOR INPUT SIGNAL CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between sensor connector E-017, terminal 1 and ECM terminal 19,, sensor terminal 2 and ECM terminal 20.

ECM TERMINAL	KNOCK SENSOR TERMINAL
19	1
20	2



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- continuity should exist.
- Also check harness for short to ground and short to power.

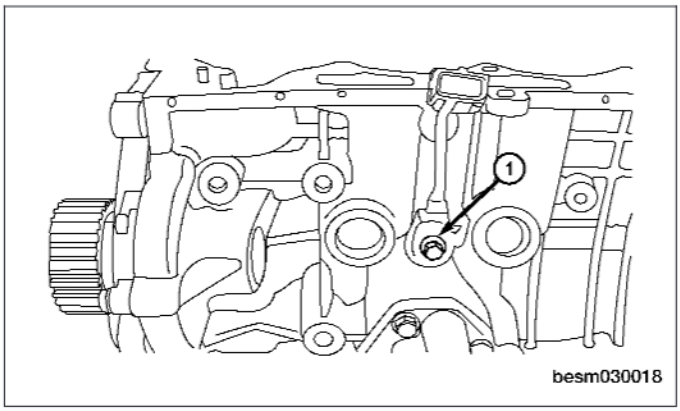
Is the check result normal?

Yes >> Go to step 5.

No >> Repair circuit for an open or short in harness or connectors.

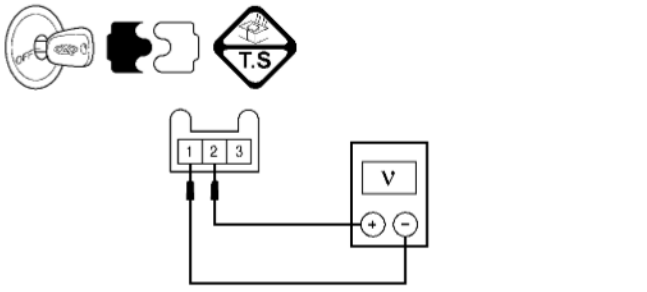
5. CHECK KNOCK SENSOR SIGNAL

- Connect knock sensor connector.
- Check knock sensor (1) output signal as table shown.



- Set digital multimeter to the voltage range.

KNOCK SENSOR TERMINAL NO.	TEST METHOD
1 & 2	Test Method 1: Knock at cylinder with rubber hammer
	Test Method 2: Knock at sensor slightly



- Output signal voltage should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace knock sensor.

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6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0324 still present?

Yes >> Replace the ECM.

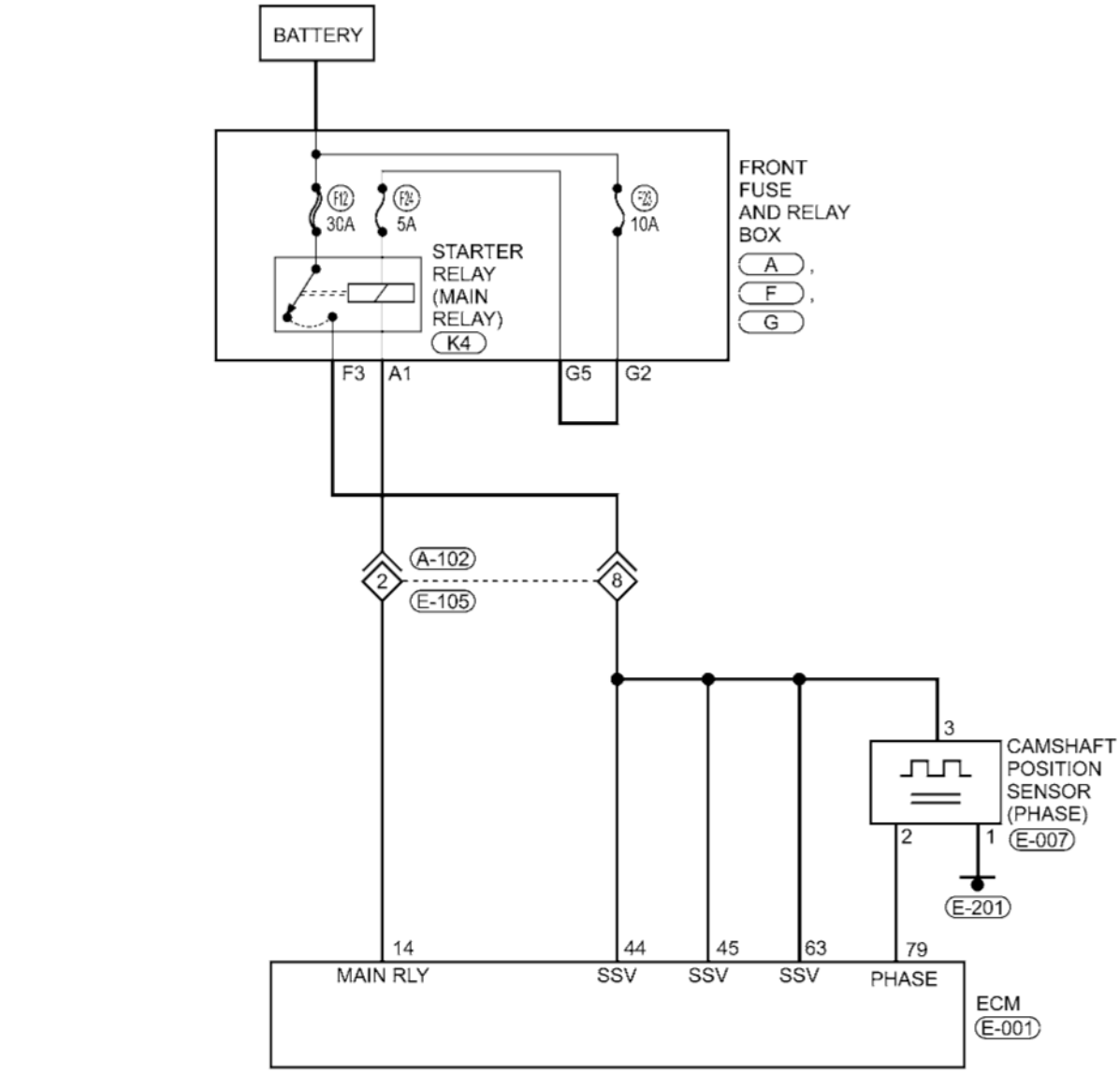
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

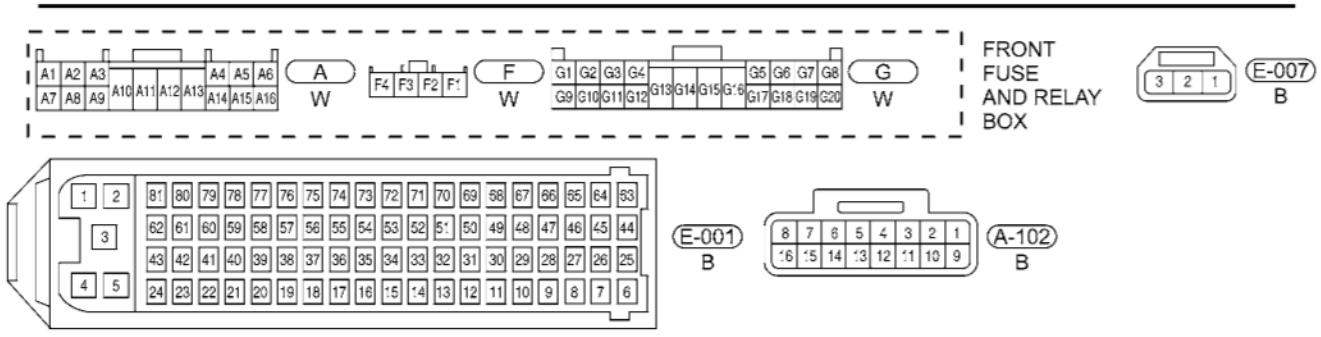
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0343 - Camshaft Position Sensor Circuit High Input

EEC - 2.0L - PHASE - 01





ltsmw030032t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
79	Camshaft Position (CMP) sensor	• Ignition switch: ON • Engine: Not cranking	11 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0343	Camshaft Position (CMP) sensor circuit high input	Engine is running	ECM detected that the input signal is out of the acceptable range.	• CMP sensor • Camshaft • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Run engine for a while then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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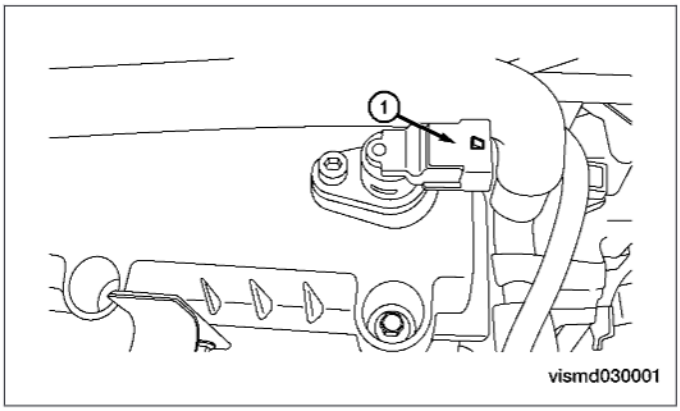
2. CHECK THE CMP SENSOR ELECTRICAL CONNECTOR

- Disconnect the CMP sensor electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



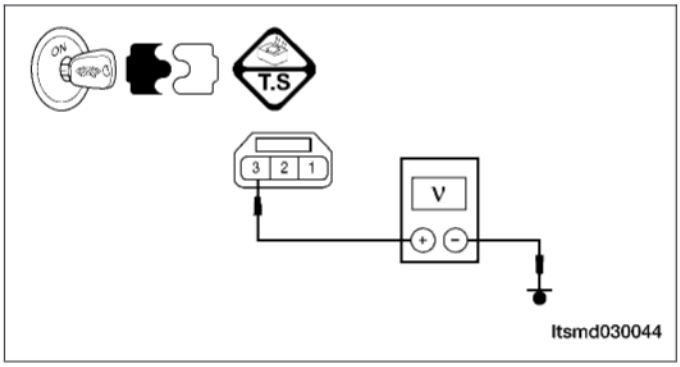
3. CHECK THE CMP SENSOR POWER SUPPLY CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check CMP sensor supply voltage between sensor connector E-007, terminal 3 and ground in the sensor electrical connector.
- 12 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



4. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box F3
  - Fuse 12, fuse 23, fuse 24
  - Harness for an open or short between CMP sensor and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

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5. CHECK THE CMP SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Check harness continuity between CMP sensor terminal 1 and ground.
- Continuity should exist.
- Also check harness for a short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors.

6. CHECK THE CMP SENSOR SIGNAL CIRCUIT FOR AN OPEN OR SHORT TO POWER

- Turn ignition switch on.
- Check voltage between CMP sensor terminal 2 and ground.
- 10 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power in harness or connectors. If circuit is normal, go to the next step.

7. CHECK CMP SENSOR SIGNAL

- Connect CMP sensor connector.
- Check signal voltage between CMP sensor terminal 2 and ground when engine is running.
- Approximately 6 V square wave signal should exist.

	CMP SENSOR SIGNAL
ENGINE ANALYZER (KES-200)	 vismd030003

Is the CMP output signal normal?

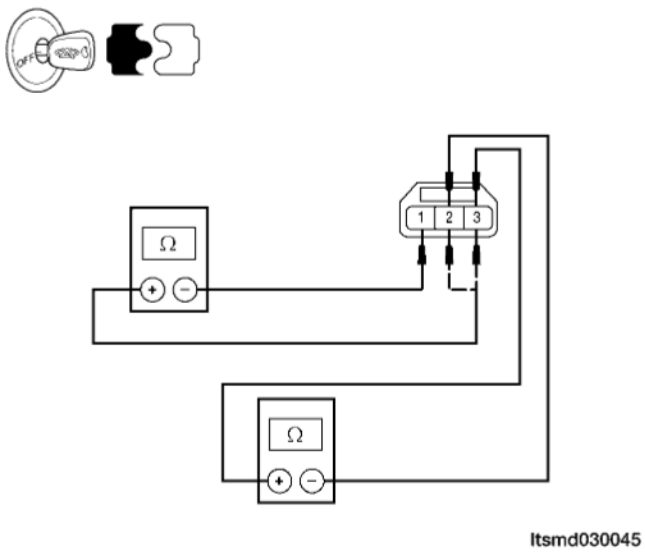
Yes >> Go to step 10.

No >> Go to the next step.

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8. CHECK THE CMP SENSOR

- Turn ignition switch off.
- Disconnect CMP sensor connector.
- Check resistance as table shown.
- Remove the sensor.
- Visually check and clean the sensor for chipping.

TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Except 0 or ∞	
1 & 3		
2 & 3		

Is the check result normal?

Yes >> Replace the CMP sensor with a known good CMP sensor.
Monitor the CMP sensor signal on the KES-200 screen.
- If the CMP sensor signals were normal, the system is OK.
- If the CMP sensor signals were still irregular or missing, go to step 9.

No >> Replace CMP sensor.

9. CHECK INSTALLED CLEARANCE

- Check the installed clearance (See CMP Sensor Removal & Installation in Section 03 Electronic Engine Controls).
- 0.8 - 1.2 mm should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Reinstall CMP sensor.

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10. CHECK CAMSHAFT

- Check the following:
  - Accumulation of debris to the signal plate of camshaft rear end
  - Chipping signal plate of camshaft rear end

Is the check result normal?

Yes >> Go to the next step.

No >> Remove debris and clean the signal plate of camshaft rear end or replace camshaft.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0343 still present?

Yes >> Replace the ECM.

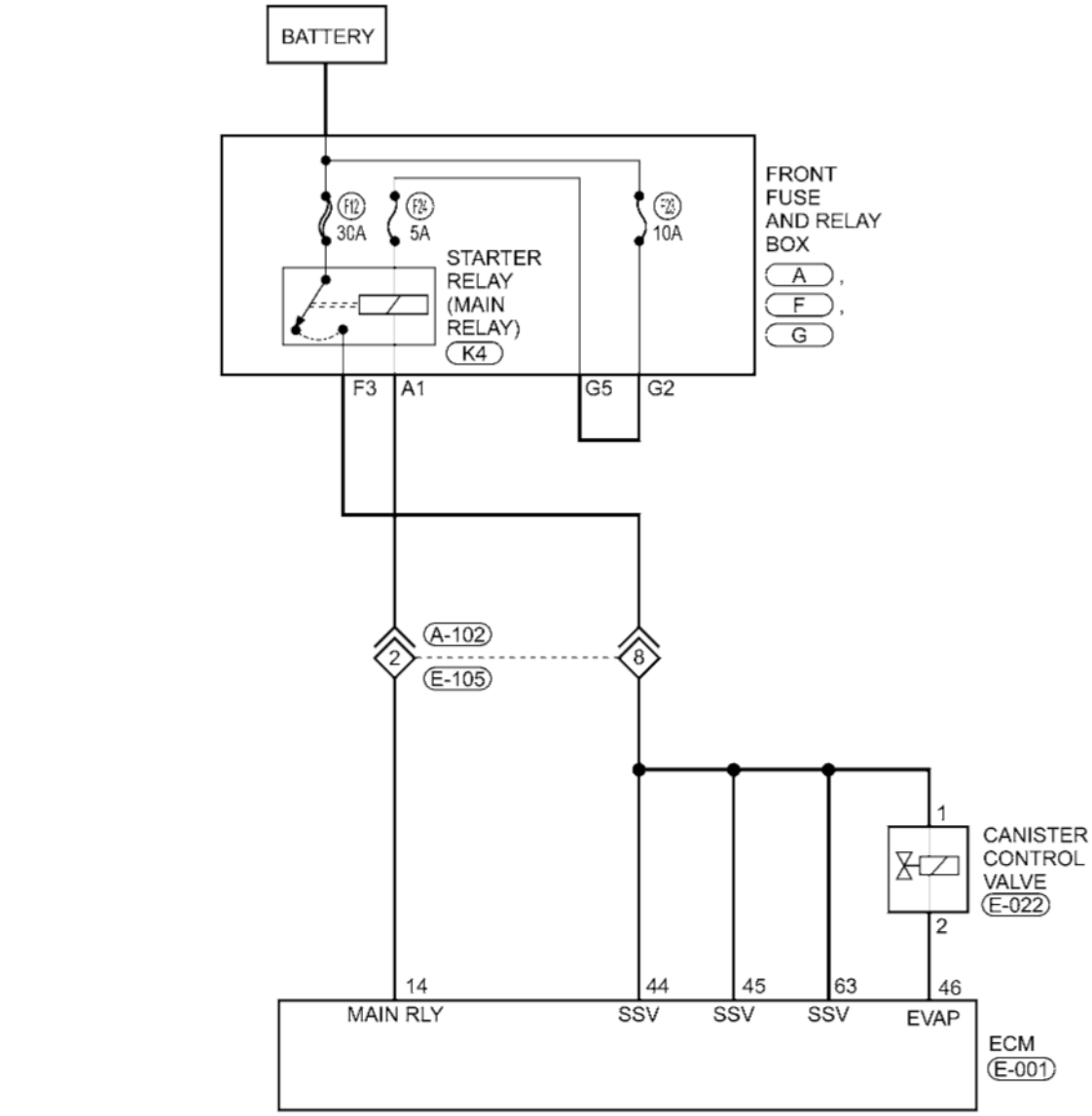
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

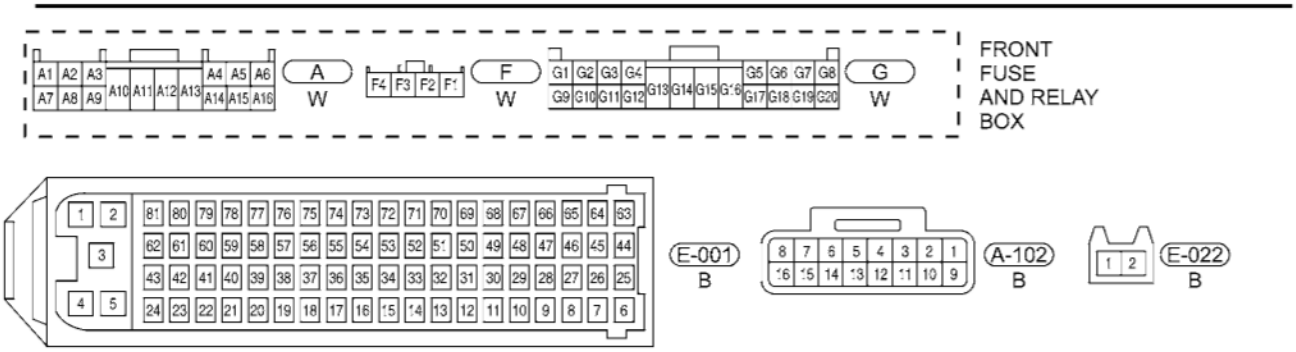
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0444 - Evaporative Emission System Purge Control Valve Circuit Open

EEC - 2.0L - EVAP - 01





ltsmw030031t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	X-431 DATA STREAM
46	Canister control valve	Engine is running	0 % - 99.9 %

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0444	Evaporative emission system purge control valve circuit open	Engine is running	ECM detected that the improper voltage signal is sent to ECM.	• EVAP canister control valve • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

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2. CHECK EVAP CANISTER CONTROL VALVE ACTION

- Start engine and warm it up to the normal operating temperature then select view DTC.
- Touch the EVAP canister valve body, raise engine speed up to 2,000 RPM.
- If the scan tool X-431 with the ″ACTIVE TEST″ function of the EVAP canister valve, touch the EVAP canister valve body, perform the action test.
- Slight vibration and concussion should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.

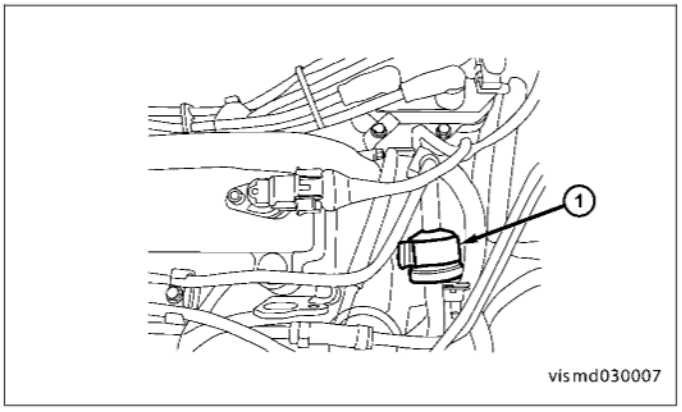
3. CHECK THE EVAP CANISTER CONTROL VALVE ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the EVAP canister control valve (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



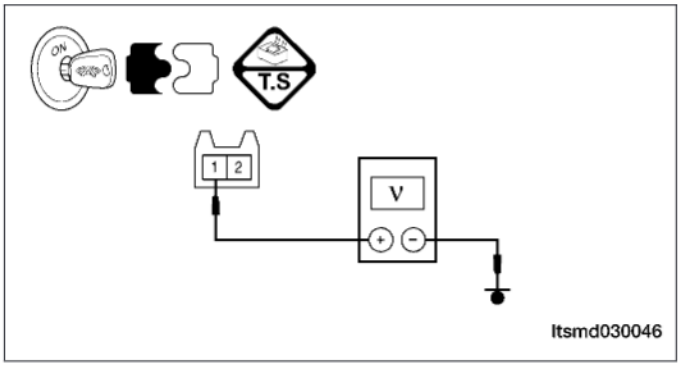
4. CHECK EVAP CANISTER CONTROL VALVE POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between EVAP canister control valve terminal 1 and ground.
- 12 V should exist.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.



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5. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box
  - Fuse 23, fuse 24, fuse 12
  - Harness between EVAP canister control valve and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

6. CHECK EVAP CANISTER CONTROL VALVE CONTROL CIRCUIT FOR AN OPEN

- Check voltage between EVAP canister control valve terminal 2 and ground.
- Approximately 3.6 V should exist.

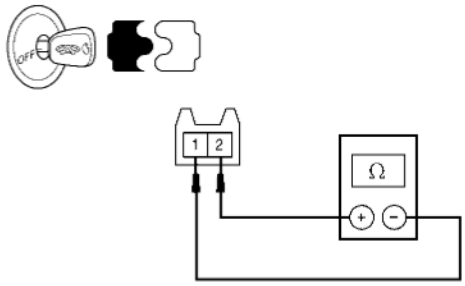
Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open in harness or connectors.
If harness is normal, go to the next step.

7. CHECK EVAP CANISTER CONTROL VALVE

- Turn ignition switch off.
- Remove EVAP canister control valve.
- Check resistance between EVAP canister terminal 1 and 2 as shown in table.

EVAP CANISTER CONTROL VALVE TERMINAL NO.	RESISTANCE Ω (20°C)	
1 - 2	Approximately 26 Ω	 ltsmd030047

- Check air passage continuity and operation when apply 12 V current supply voltage between terminal 1 and 2.
- The check results should match specification.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace EVAP canister control valve.

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8. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0444 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0506 - Idle Control System RPM Lower Than Expected

On Board Diagnostic Logic

- Self-diagnosis detection logic.
- If DTC P0506 is displayed with other DTC, first perform the trouble diagnosis for the other DTC.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0506	Idle control system RPM lower than expected	• Engine is running • With the engine idling in drive, the brake applied, engine run time below a calibrated minimum value, and no VSS, MAF/MAP, ECT, TPS, ETC, Crankshaft Position sensor, fuel system, or injector DTCs present.	ECM detected that the idle speed is less than the acceptable range.	• Electronic throttle control actuator • Intake air leak • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK INTAKE AIR LEAK

- Start engine and let it idle.
- Listen for an intake air leak after the mass air flow sensor.

Is the check result normal?

Yes >> Go to the next step.

No >> Discover air leak location and repair.

2. CHECK THE ELECTRIC THROTTLE CONTROL ACTUATOR

- Check the electronic throttle open degree.
- Check the electronic throttle clearance.

Is the check result normal?

Yes >> Go to the next step.

No >> Clean or replace as necessary.

3. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0506 still present?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P0604 - Internal Controller Module Random Access Memory (RAM) Error
P0605 - Internal Controller Module ROM Test Error
P0606 - ECM Processor

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
P0604	Internal controller module Random Access Memory (RAM) error	ECM detected an internal failure	ECM
P0605	Internal controller module ROM test error		
P0606	ECM processor		

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start the engine and warm it to normal operating temperature.
- With the scan tool, select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK DTC

- Perform DTC confirmation procedure.

Is DTC P0604, P0605 or P0606 present?

Yes >> Go to the next step.

No >> The DTC condition is intermittent (See Diagnostic Help in Section 03 Electronic Engine Controls).

2. CHECK ECM POWER SUPPLY AND GROUND

- Check if the ECM supply voltage circuit, ground circuit open, high resistance or short circuits existing.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for open or short in harness and connectors.

3. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is the check result normal?

Yes >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

No >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

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P0602 - ECM Programming Error

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	POSSIBLE CAUSE
P0602	ECM programming error	ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start the engine and warm it to normal operating temperature.
- With the scan tool, select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK DTC

- Perform DTC confirmation procedure.

Is DTC P0602 present?

Yes >> Go to the next step.

No >> The DTC condition is intermittent (See Diagnostic Help in Section 03 Electronic Engine Controls).

2. CHECK THE ECM POWER SUPPLY AND GROUND

- Check if the ECM supply voltage circuit, ground circuit open, high resistance or short circuits existing.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short in harness and connectors.

3. MATCH ECM

With the scan tool X-431, match ECM before replace it (See ECM Removal & Installation in Section 03 Electronic Engine Controls), and view the DTC with the X-431.

Is DTC P0602 setting again?

Yes >> Go to the next step.
Refer to Technical Bulletin that issued.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

4. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See DTC Confirmation Procedure.

Is DTC P0602 still present?

Yes >> Replace the ECM.

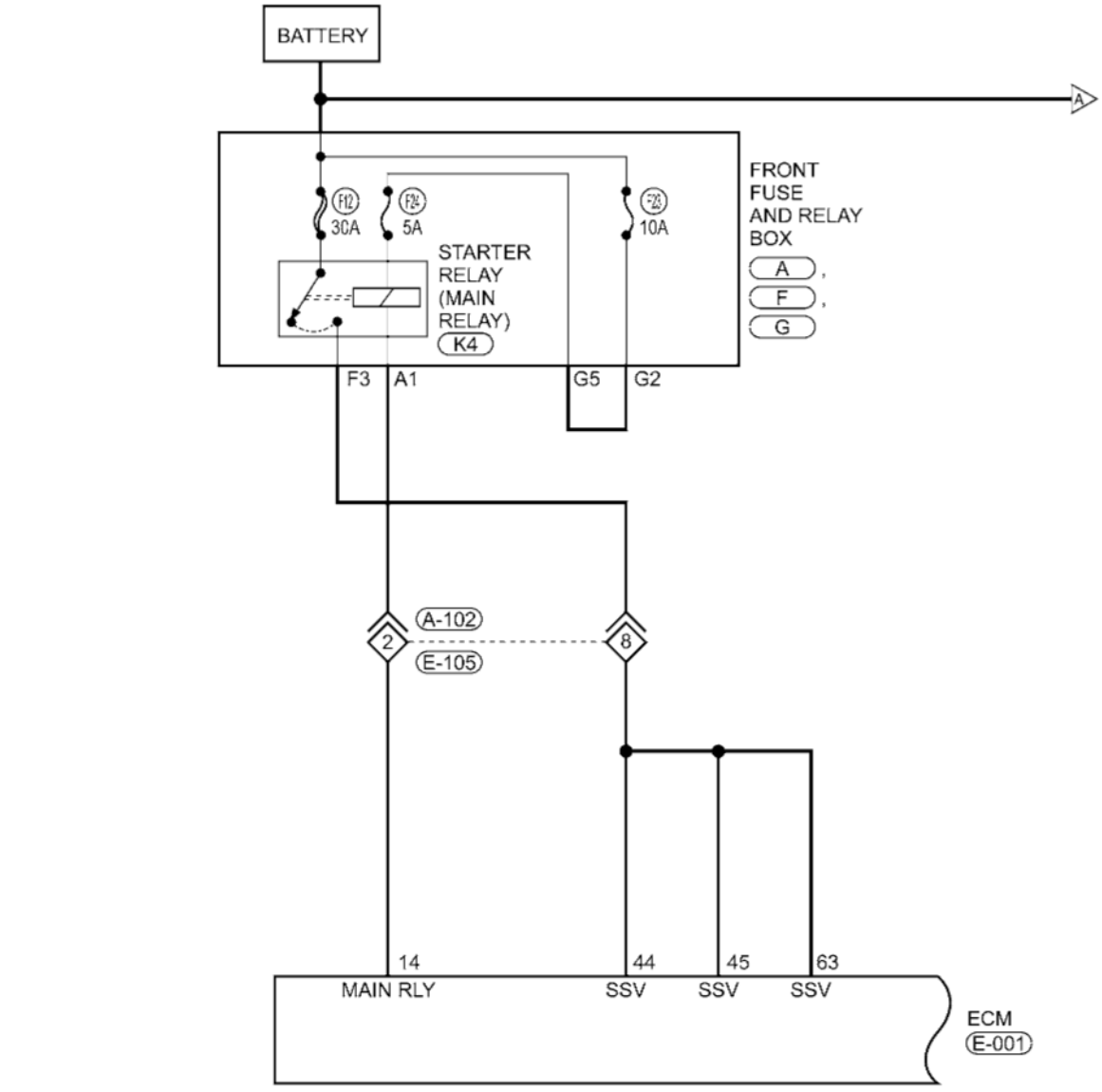
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

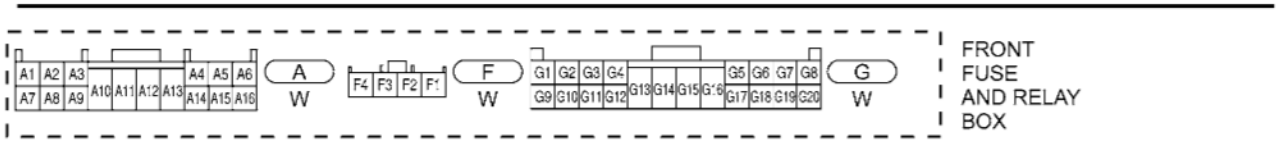
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

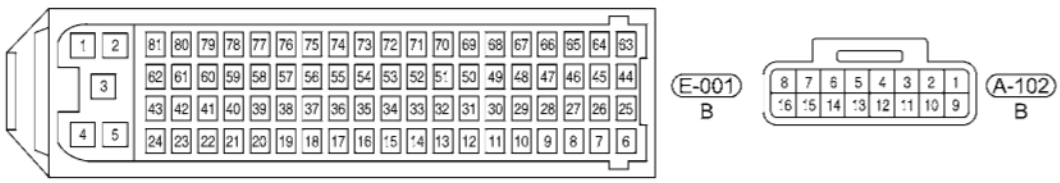
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P0645 - A/C Clutch Relay Circuit

EEC - 2.0L - A/C - 01



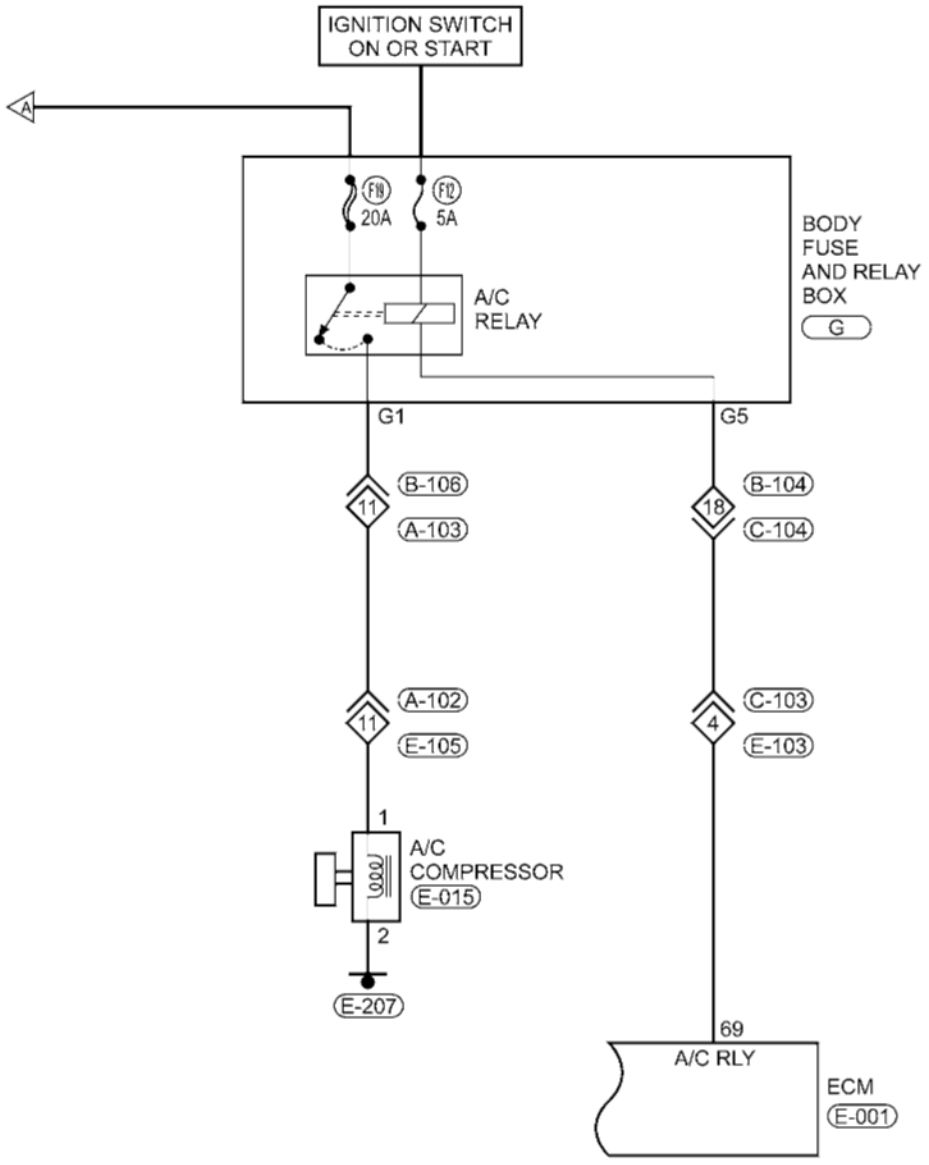


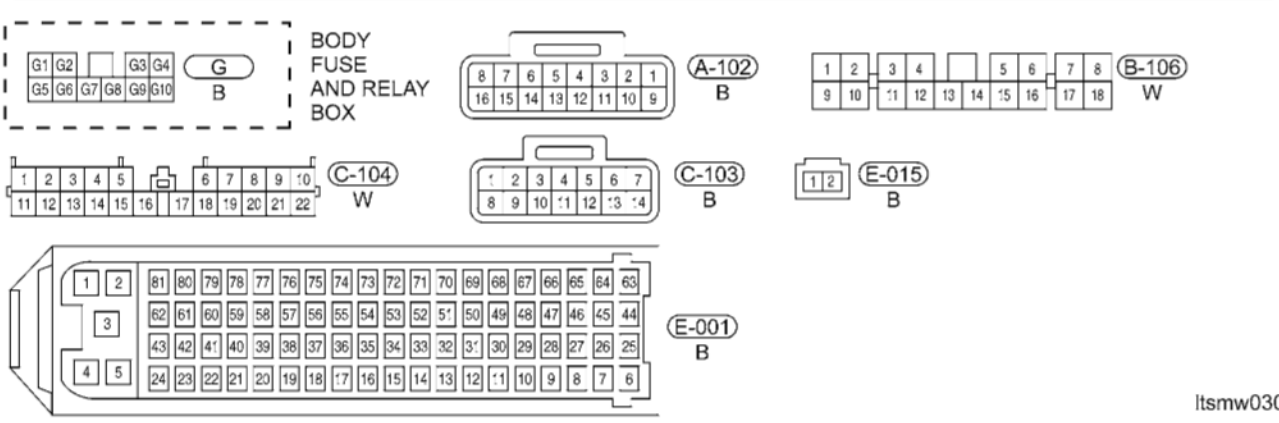


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EEC - 2.0L - A/C - 02





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (AVERAGE DC VOLTAGE)
69	Air Condition (A/C) relay control signal	• After engine is started for 5 seconds, A/C can be turned on. • If IAT above 140.3 , A/C will be shut off. • If ECT is above 140.3°C, A/C will be shut off. If ECT is below 111.8°C, A/C will be resume. • If A/C high pressure is above 20 bar, A/C will be shut off. If A/C high pressure is below 19.5 bar, A/C will be resume. • If evaporator temperature is below 1.5°C, A/C will be shut off. If evaporator temperature is above 4.5°C, A/C will be resume. • If system voltage is below 8.04 V, A/C will be shut off. If system voltage is above 10.01 V, A/C will be resume.	0 V or 12 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P0645	A/C clutch relay circuit	Engine is running	ECM detected that the input signal is out of the acceptable range.	• Fuse • A/C relay • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature.
- Turn A/C switch on, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

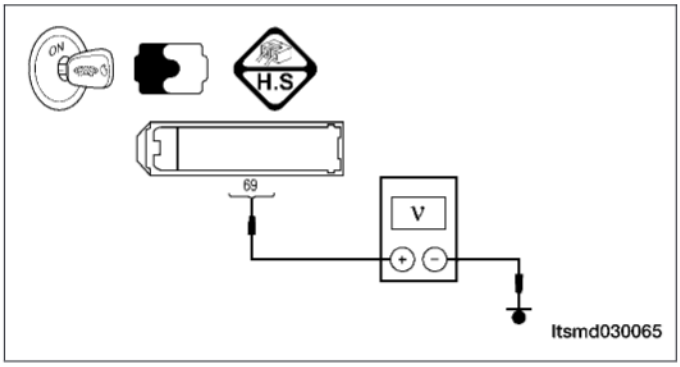
Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

2. CHECK AIR CONDITION CLUTCH RELAY CONTROL CIRCUIT POWER SUPPLY CIRCUIT FOR OPEN

- Turn ignition switch on.
- Turn A/C switch off.
- Check A/C clutch relay control circuit supply voltage between ECM terminal 69 and ground in the ECM electrical connector E-001.
- 12 V should exist.



Is the check result normal?

Yes >> Go to step 4.

No >> Go to the next step.

3. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse 12
  - A/C relay
  - Body fuse and relay box G5
  - Harness connectors C-103, E-103, B-104, C-104
  - Harness for open between ECM terminal 69 and fuse 12

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

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4. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P0645 still present?

Yes >> Replace the ECM.

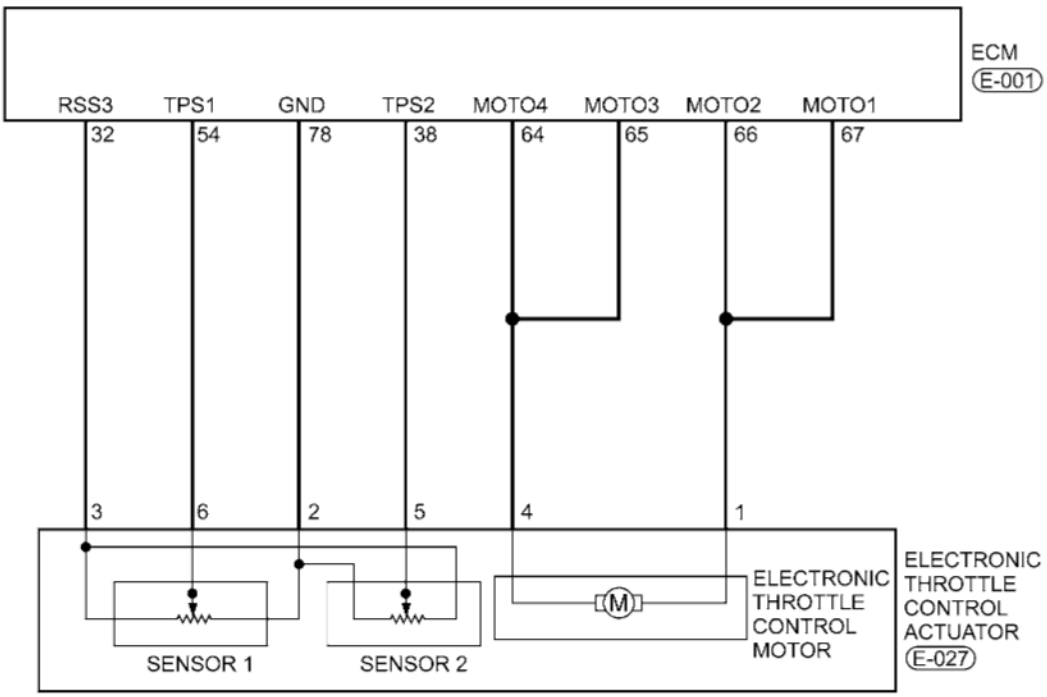
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

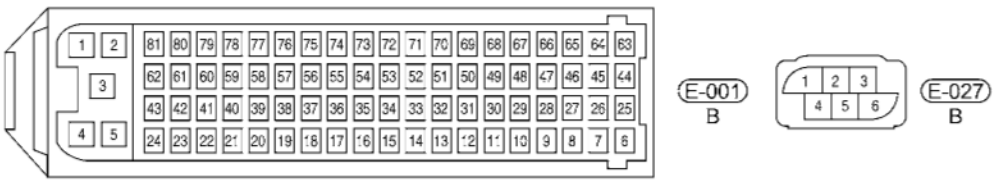
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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P1545 - Throttle Position Control Performance

EEC - 2.0L - TPS - 01

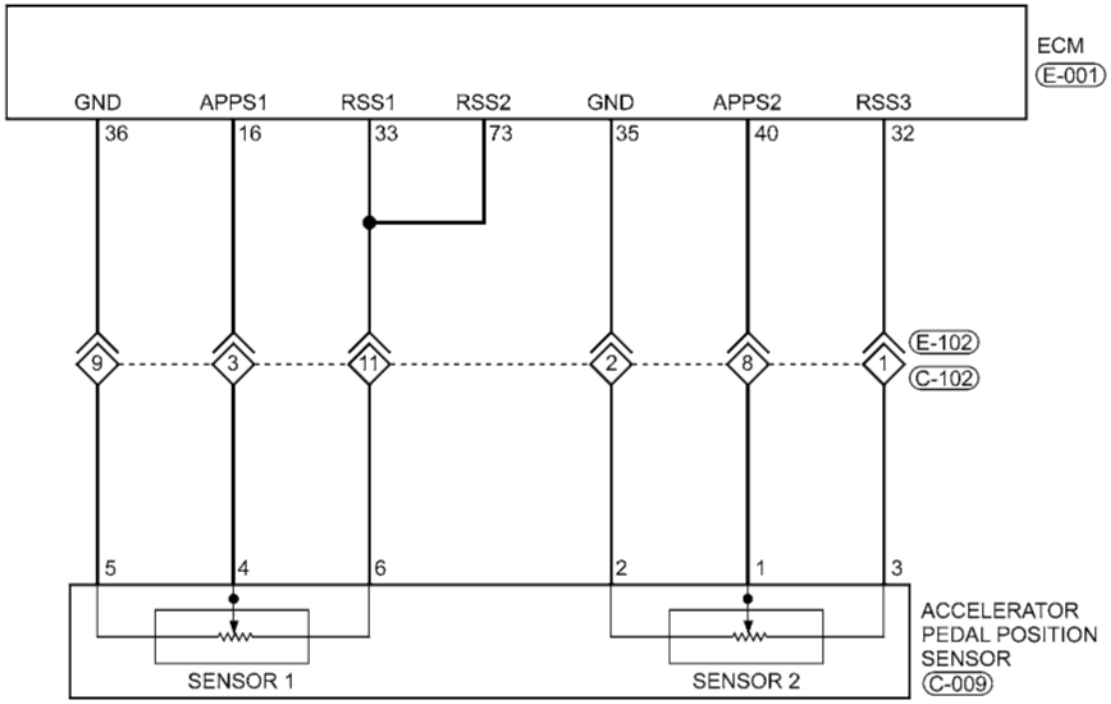


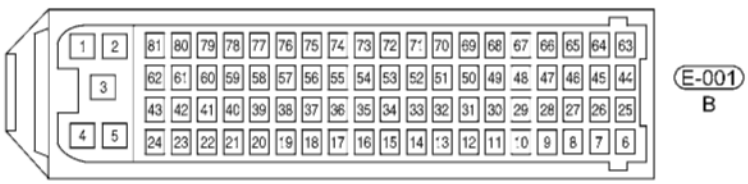


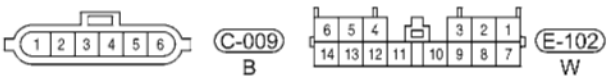
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EEC - 2.0L - APS - 01







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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
38	Electronic throttle control actuator (position sensor)		• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
54	Electronic throttle control actuator		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V
64	Motor 4	-		12 or 0 V
65	Motor 3			
66	Motor 2			12 or 0 V
67	Motor 1			
78	Sensor (GND)			Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P1545	Throttle position control performance	• Ignition switch: ON • Engine: Running	Rationally incorrect voltage is sent to ECM compared with the signals from TPS1 and TPS2.	• Electronic throttle control actuator (TPS1 and TPS2) • Harness or connectors • Accelerator pedal position sensor 2 • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

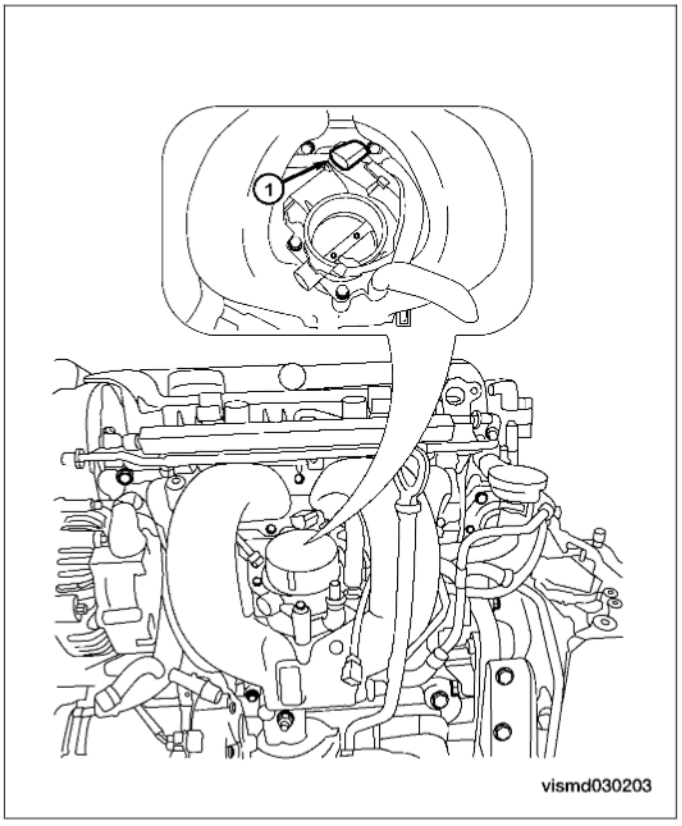
2. CHECK THE TPS ELECTRICAL CONNECTOR

- Disconnect the TPS electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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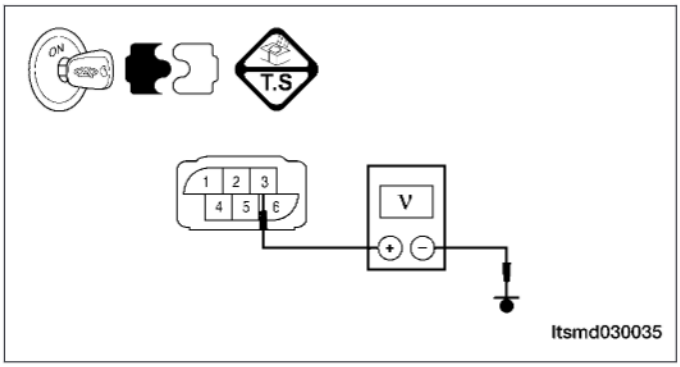
3. CHECK THE TPS POWER SUPPLY CIRCUIT - (1)

- Turn ignition switch on.
- Check TPS supply voltage between sensor terminal 3 and ground in the sensor electrical connector E-027.
- Approximately 5 V should exist.

Is the check result normal?

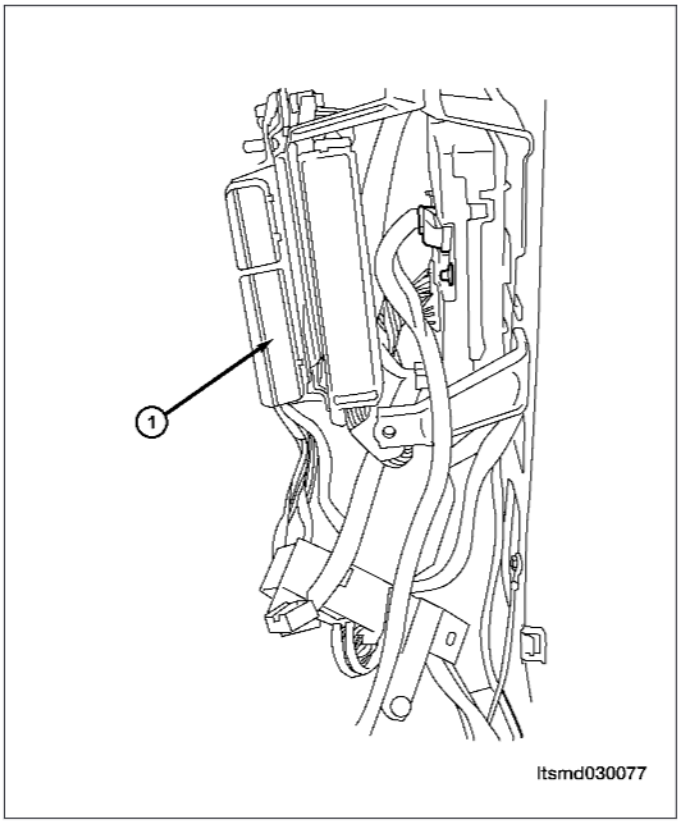
Yes >> Go to step 8.

No >> Go to the next step.



4. CHECK THE TPS POWER SUPPLY CIRCUIT - (2)

- Disconnect ECM harness connector (1).



- Turn ignition switch off.
- Check harness continuity between TPS terminal 3 and ECM terminal 32.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open.

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5. CHECK THE TPS POWER SUPPLY CIRCUIT - (3)

- Check harness for short to power and short to ground, between following terminals.

ECM TERMINAL	TPS TERMINAL
32	TPS terminal 3
32	APP sensor terminal 3
33	APP sensor terminal 6

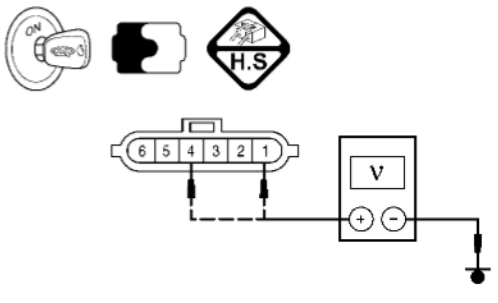
Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for a short to ground or short to power in harness or connectors.

6. CHECK THE APP SENSOR

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 16 (APP sensor 1) and ground, terminal 40 (APP sensor 2) and ground under the following conditions:

ECM TERMINAL	APP SENSOR TERMINAL	
16	APP sensor terminal 4	
40	APP sensor terminal 1	

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
16	Accelerator pedal position sensor	Turn ignition switch on	• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	Accelerator pedal position sensor		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
			• Engine stopped • Accelerator pedal: Fully depressed	1.97 V

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Is the check result normal?

Yes >> Go to step 10.

No >> Replace the Accelerator Pedal Assembly (See Accelerator Pedal Position Sensor Removal & Installation in Section 03 Electronic Engine Controls).

7. CHECK THE TPS SIGNAL CIRCUIT FOR OPEN AND SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between electronic throttle control actuator terminal 5 and ECM terminal 38, electronic throttle control actuator terminal 6 and ECM terminal 54.
- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

8. CHECK THE TPS GROUND CIRCUIT FOR AN OPEN AND SHORT

- Check harness continuity between electronic throttle control actuator terminal 2 and ECM terminal 78.
- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

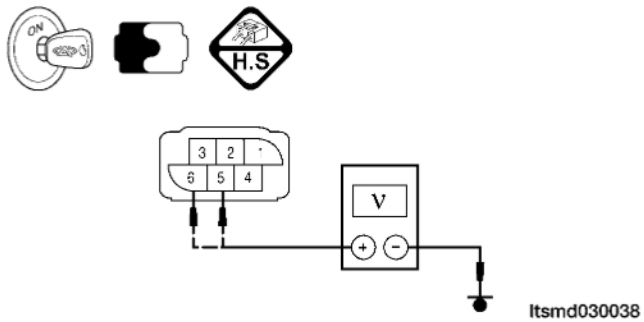
No >> Repair circuit for an open or short to power in harness or connectors.

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9. CHECK TPS

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 54 (TPS1) and ground, terminal 38 (TPS2) and ground under the following conditions:

TPS TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
5	Electronic throttle control actuator (TPS2)	Ignition switch: ON	• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
6	Electronic throttle control actuator (TPS1)		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V



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Is the check result normal?

Yes >> Go to the next step.

No >> Replace electronic throttle control actuator, and perform throttle valve position learning.

10. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- See DTC Confirmation Procedure.

Is DTC P1545 still present?

Yes >> Replace the ECM.

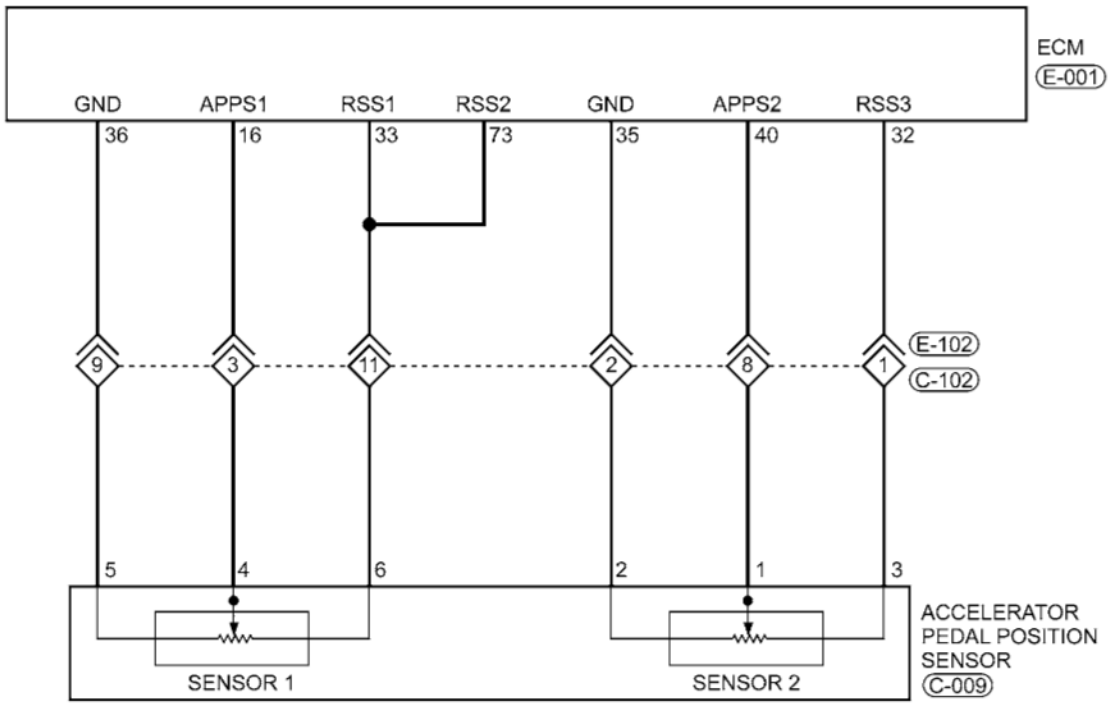
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

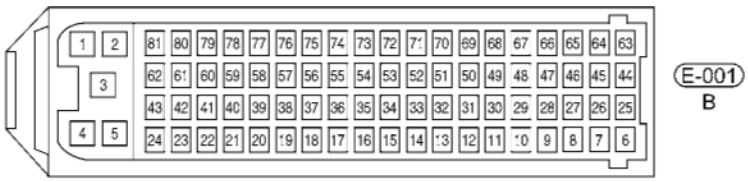
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

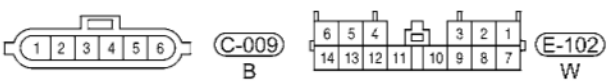
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P2138 - Pedal Position Sensor Performance

EEC - 2.0L - APS - 01



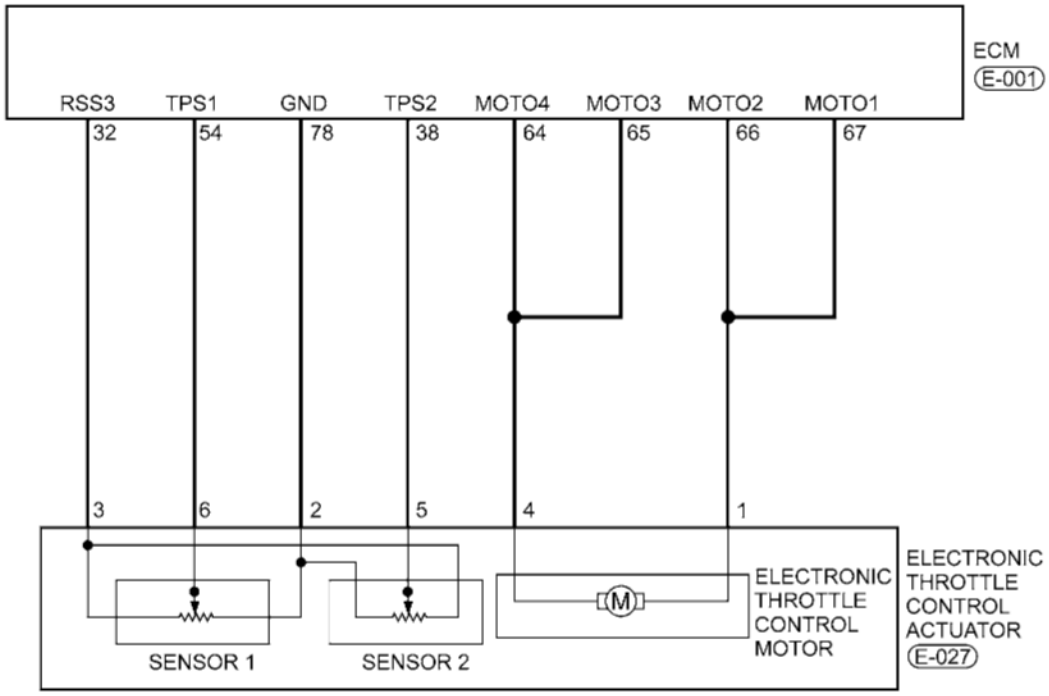


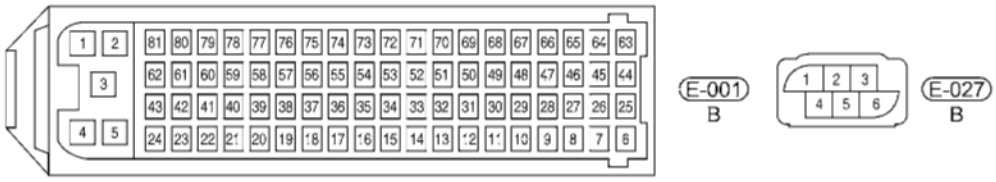


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EEC - 2.0L - TPS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
32	Regulated sensor supply 2	Ignition switch: ON	-	Approximately 5 V
33	Regulated sensor supply 1		-	Approximately 5 V
16	Accelerator pedal position sensor		• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	Accelerator pedal position sensor		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
			• Engine stopped • Accelerator pedal: Fully depressed	1.97 V
35	Sensor (GND)		-	Approximately 0 V
36	Sensor (GND)		-	Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
P2138	Accelerator pedal position sensor performance	• Ignition switch: ON • Engine: Running	Rationally incorrect voltage is sent to ECM compared with the signals from Accelerator Pedal Position (APP) sensor 1 and APP sensor 2.	• Accelerator pedal position sensor 1 and 2 • Harness or connectors • Electronic throttle control actuator (TPS1 and TPS2) • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

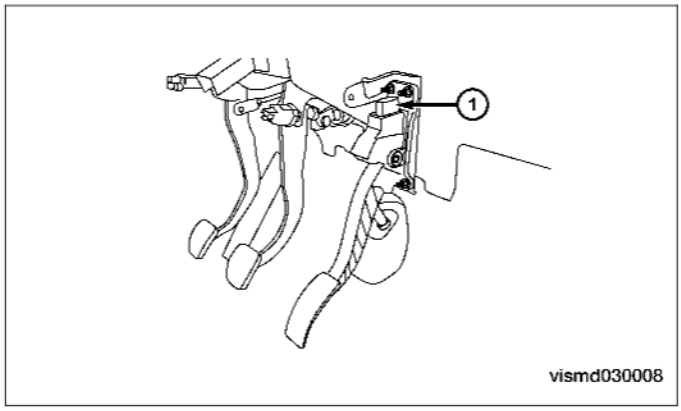
2. CHECK THE ACCELERATOR PEDAL POSITION (APP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the APP sensor electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



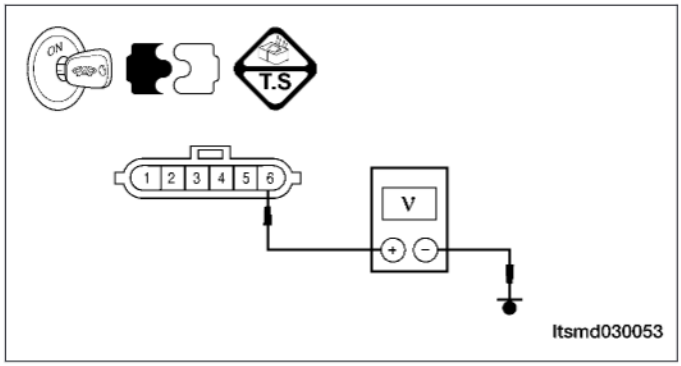
3. CHECK THE ACCELERATOR PEDAL POSITION (APP) SENSOR 1 POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check APP sensor 1 supply voltage between sensor terminal 6 and ground in the sensor electrical connector C-009.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors E-102, C-102
  - Harness open and short between APP sensor 1 and ECM

Is the check result normal?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair or replace malfunctioning part.

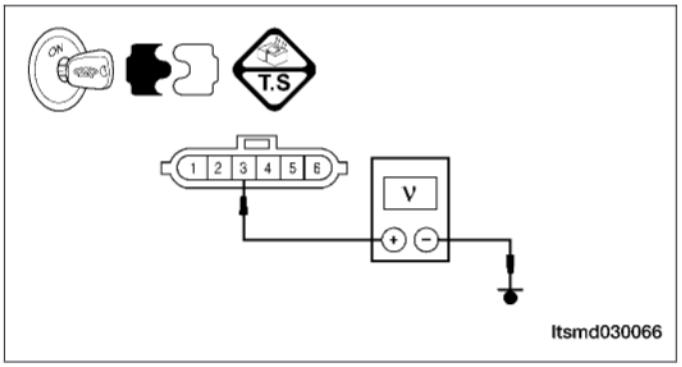
5. CHECK APP SENSOR 2 POWER SUPPLY CIRCUIT

- Check APP sensor supply voltage between sensor terminal 3 and ground in the sensor electrical connector C-009.
- Approximately 5 V should exist.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.



6. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors E-102, C-102
  - Harness open and short between APP sensor 2 and ECM

Is the check result normal?

Yes >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

No >> Repair or replace malfunctioning part.

7. CHECK TPS POWER SUPPLY CIRCUIT

- Check harness for short to power and short to ground, between following terminals.

Check TPS Power Supply

ECM TERMINAL	TPS TERMINAL
32	3

Is the check result normal?

Yes >> Go to the next step.

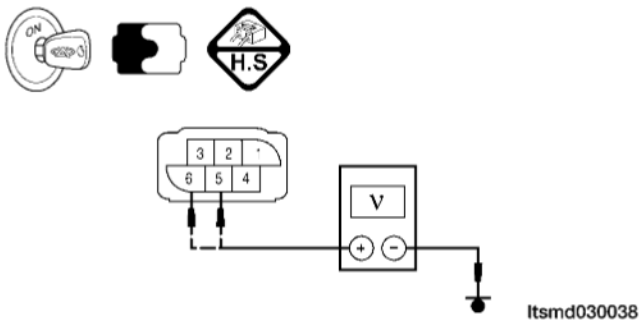
No >> Repair circuit for a short to ground or short to power in harness or connectors.

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8. CHECK TPS

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 54 (TPS1) and ground, terminal 38 (TPS2) and ground under the following conditions:

TPS TERMINAL NO.	ITEM	CONDITION		VOLTAGE (DC VOLTAGE)
5	Electronic throttle control actuator (TPS2)	Ignition switch: ON	• Engine stopped • Accelerator pedal: Fully released	4.24 V
			• Engine stopped • Accelerator pedal: Fully depressed	0.72 V
6	Electronic throttle control actuator (TPS1)		• Engine stopped • Accelerator pedal: Fully released	0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	4.62 V



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Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace TPS circuits for open or short.
If the TPS circuits are normal, replace electronic throttle control actuator. Perform throttle valve position self-learning.

9. CHECK APP SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between APP sensor terminal 2 and ECM terminal 35, APP sensor terminal 5 and ECM terminal 36.
- Continuity should exist.
- Also check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

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10. CHECK APP SENSOR CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between APP sensor 1 terminal 4 and ECM terminal 16, APP sensor 2 terminal 1 and ECM terminal 40.
- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

11. CHECK APP SENSOR

- Connect all harness connectors disconnected.
- Turn ignition switch on.
- Check voltage between ECM terminals 16 (APP sensor 1 signal), 40 (APP sensor 2 signal) and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
16	Accelerator Pedal Position sensor	Turn ignition switch on	• Engine stopped • Accelerator pedal: Fully released	0.72 - 0.74 V
			• Engine stopped • Accelerator pedal: Fully depressed	3.95 V
40	Accelerator Pedal Position sensor		• Engine stopped • Accelerator pedal: Fully released	0.36 - 0.37 V
			• Engine stopped • Accelerator pedal: Fully depressed	1.97 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace accelerator pedal assembly.
Perform Accelerator pedal position self-learning.

12. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC P2138 still present?

Yes >> Replace the ECM.

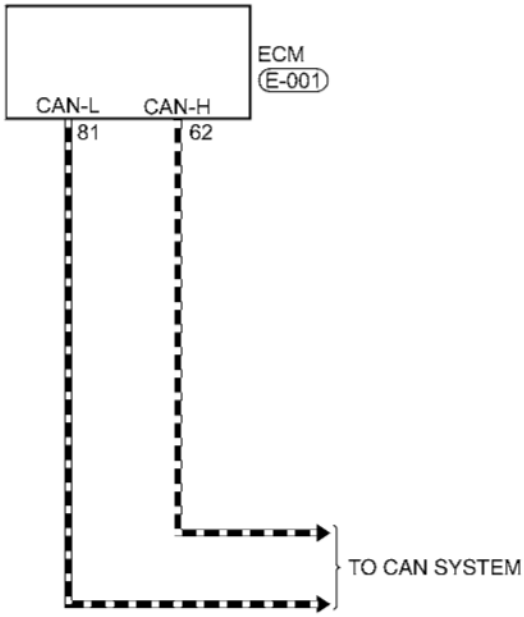
NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

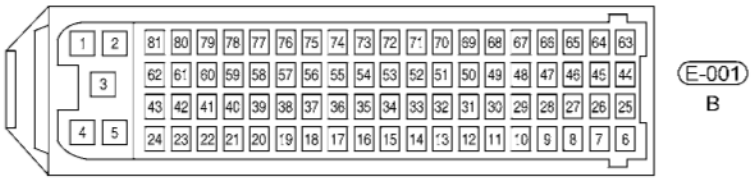
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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U0001 - High Speed CAN Defective

EEC - 2.0L - CAN - 01





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B

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On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
U0001	High speed CAN defective	With the ignition switch on	ECM detected that lost communication over the CAN BUS circuit. The circuit is continuously monitored.	• Harness or connectors • TCM • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Cycle ignition switch several times then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

- Ensure that the battery is fully charged.
- Before performing any DTC diagnostic procedures, verify the ECM power and ground circuits are properly connected.
- Before performing the diagnostic procedure, settle all other ECM DTCs first.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness (With 2.0L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground harness or connections.

2. CHECK DTC

- Turn ignition switch on.
- With the scan tool, select view ECM CAN DTC and data stream.

Is DTC U0001 present?

Yes >> Go to the next step.

No >> The conditions that caused this code to set are not present at this time. See Diagnostic Help in Section 03 Electronic Engine Controls.
Erase all codes and test drive the vehicle to verify the repair is complete.

3. CHECK THE OTHER MODULES CAN DTC

- With the scan tool X-431, enter all the other CAN communication modules such as TCM, CAN converter module.
- Read the CAN DTC.

Were other modules CAN DTCs found?

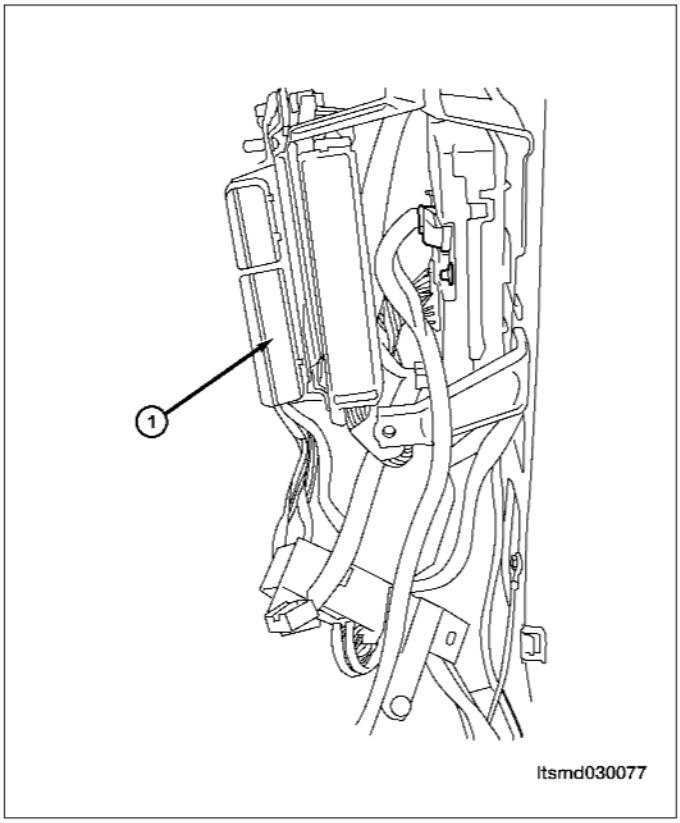
Yes >> If all of the other modules have the same DTC ″CAN Communication″, go to the next step.
If all of the other modules have the DTC ″Lost communication with ECM″, and do not have the ″CAN Communication″, Replace and program the ECM module.

No >> Go to step 8.

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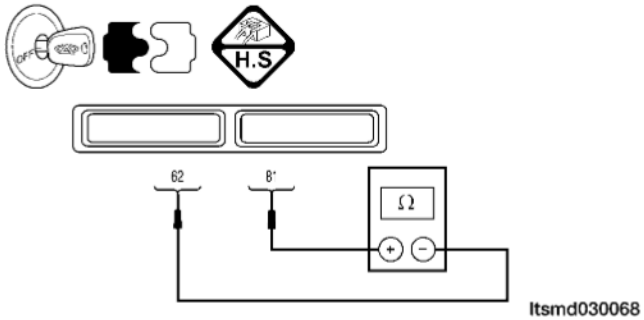
4. CHECK CAN-BUS LINE TERMINAL RESISTANCE IN ECM

- Turn ignition switch off.
- Disconnect battery positive cable.
- Disconnect ECM connector (1).



- Check resistance between ECM connector terminal 62 and 81.

ECM CONNECTOR TERMINAL (CAN-H)	ECM CONNECTOR TERMINAL (CAN-L)	RESISTANCE	
62	81	123 Ω	



Is the check result normal?

Yes >> Go to the next step.

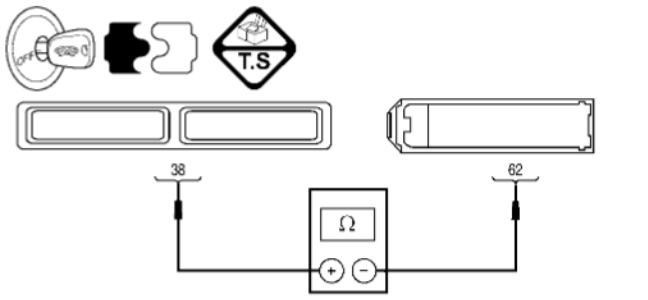
No >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).
The problem caused by ECM internal error.

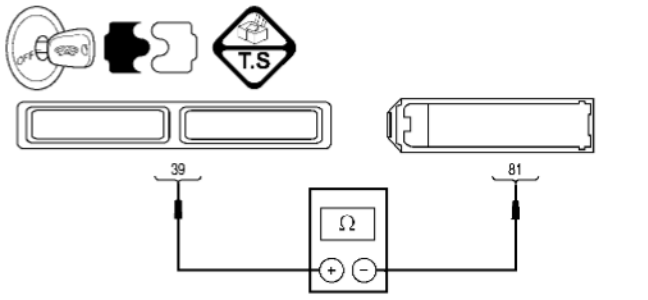
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5. CHECK THE CAN-BUS LINE

- Disconnect TCM and CAN converter connectors (See Transaxle Control Module Remove & Installation in Section 08 Transaxle).
- Check harness (CAN-H) continuity between following terminals.

CAN	TCM CONNECTOR TERMINAL	ECM CONNECTOR TERMINAL	CONTINUITY	
CAN-H	38	62	Yes	

- Check harness (CAN-L) continuity between following terminals.

CAN	TCM CONNECTOR TERMINAL	ECM CONNECTOR TERMINAL	CONTINUITY	
CAN-L	39	81	Yes	

- Also check harness for short to ground and short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the CAN-Bus line.

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6. CHECK CAN-BUS LINE

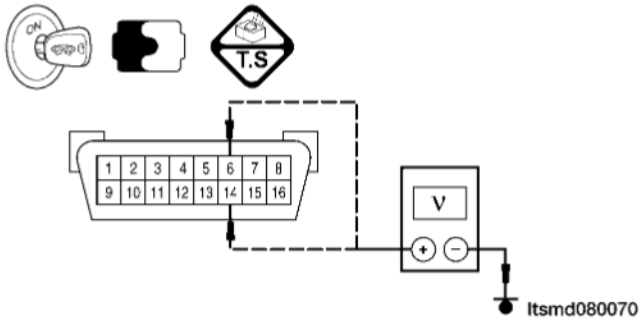
- Connect battery positive cable.
- Connect TCM and ECM connectors (See Transaxle Control Module Remove & Installation in Section 08 Transaxle).
- Turn ignition switch on.
- Check CAN-Bus voltage between following terminals.

CAN-H

- 0.025 V should exist while not activate communication.
- 0.65 V should exist while activate communication.

CAN-L

- 11 V should exist while not activate communication.
- 4.65 V should exist while activate communication.

DLC TERMINAL	GROUND	
6 (CAN-H)	Ground	
14 (CAN-L)		

Is the check result normal and DTC U0001 not present?

Yes >> Replace the CAN converter.
The problem caused by the CAN converter internal error.

No >> Go to the next step.

7. CHECK CAN-BUS LINE

- Turn ignition switch off.
- Connect CAN converter.
- Disconnect TCM connectors (See Transaxle Control Module Remove & Installation in Section 08 Transaxle).
- Turn ignition switch on.
- Check CAN-Bus voltage as the standard value.

Is the check result normal and DTC U0001 not present?

Yes >> Replace TCM.
The problem caused by TCM internal error.

No >> Go to the next step.

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8. CHECK ECM ELECTRICAL CONNECTOR

- Inspect the ECM electrical connector pins for proper fit or any chafed, pierced, pinched, or partially broken wires.
- With the X-431 scan tool, read ECM DTC.

Is the check result normal and DTC U0001 not present?

Yes >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

No >> Replace the ECM.

NOTE : The Immobilizer control module must be matched to the new ECM (See ECM Removal & Installation in Section 03 Electronic Engine Controls).

The problem caused by ECM internal error.

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Engine Coolant Temperature (ECT) Sensor

Description

The Engine Coolant Temperature (ECT) sensor threads into the coolant outlet connector. The ECT is a negative thermal coefficient sensor.

Operation

The ECT provides an input to the Engine Control Module (ECM). As temperature increases, resistance of the sensor decreases. As coolant temperature varies, the ECT sensor resistance changes resulting in a different voltage value at the ECT sensor signal circuit. The ECM uses the input to control air-fuel mixture, timing, A/C compressor and radiator fan on/off times.

Removal & Installation

1. Disconnect the negative battery cable.
2. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).

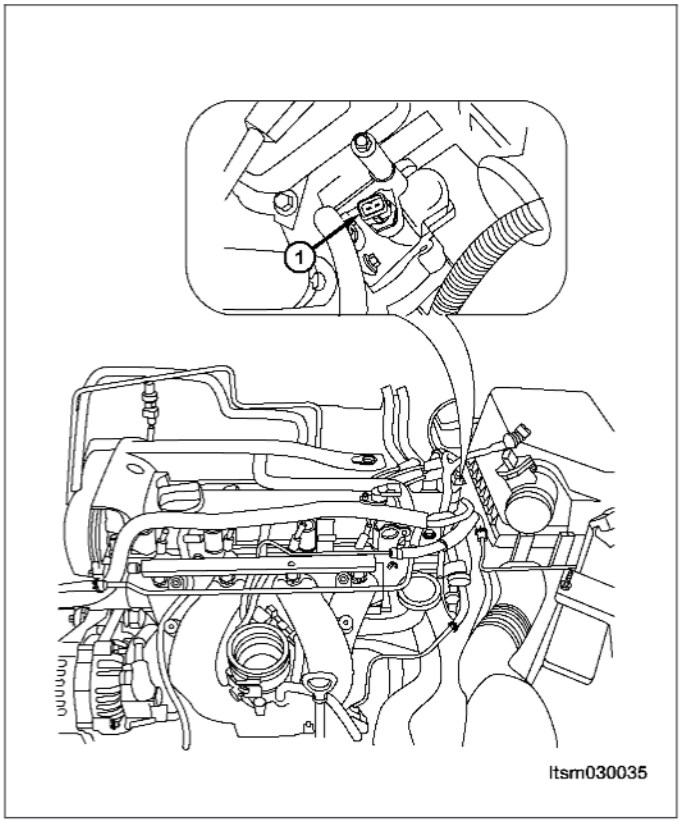
WARNING!

Never remove the pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in series personal injury.

3. Disconnect the coolant temperature sensor electrical connector.

CAUTION:
Remove the coolant temperature sensor when the engine is cold.

4. Remove the engine coolant temperature sensor (1).
   (Tighten: Engine coolant temperature sensor to 20 N·m)



5. Discard the O-ring.

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6. Installation is in the reverse order of removal.

NOTE :
After installing the engine coolant temperature sensor, check the coolant level.

Knock Sensor

Description

The knock sensor is attached to the cylinder block. The knock sensor is designed to detect engine vibration that is caused by detonation.

Operation

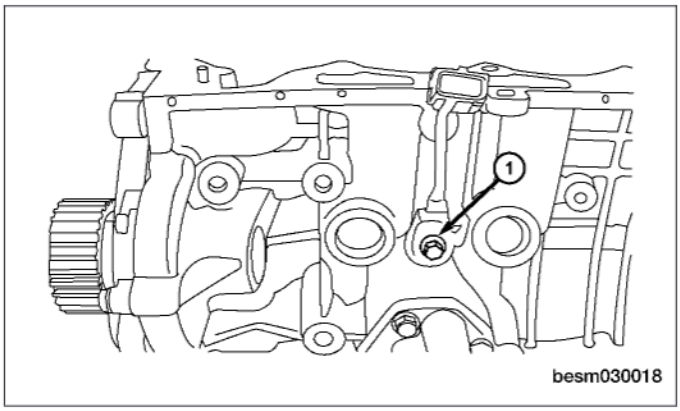
When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the Engine Control Module (ECM). In response, the ECM retards ignition timing for all cylinders by a specified amount.

The knock sensor contains a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the ECM while the engine operates. As the intensity of the vibration increases, the knock sensor output voltage also increases.

The ECM ignores knock sensor input during engine idle conditions. Once the engine speed exceeds a specified value, knock retard is allowed.

Removal & Installation

1. Disconnect and isolate the negative battery cable.
2. Disconnect the knock sensor electrical connector.
3. Remove the knock sensor retaining bolt (1) and remove the knock sensor.
   (Tighten: Knock sensor retaining bolt to 20 N·m)



4. Installation is in the reverse order of removal.

Oxygen Sensor

Description

This vehicle is equipped with two oxygen sensors (upstream oxygen sensor & downstream oxygen sensor). The oxygen sensors are located before and after the three way catalyst. The oxygen sensors continually monitor the oxygen level in the exhaust gas. The sensor is made of ceramic zirconia. The zirconia generates voltage from approximately 1 volt in richer conditions to 0 volt in leaner conditions.

Operation

The O2 sensors produce voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas. When a large amount of oxygen is present (caused by a lean air/fuel mixture, can be caused by misfire and exhaust leaks), the sensors produces a low voltage. When there is a lesser amount of oxygen present (caused by a rich air/fuel mixture, can be caused by internal engine problems) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensors act as a rich-lean switch.

The oxygen sensors are equipped with a heating element that keeps the sensors at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

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Upstream Oxygen Sensor

The input from the upstream heated oxygen sensor tells the Engine Control Module (ECM) the oxygen content of the exhaust gas. Based on this input, the ECM fine tunes the air-fuel ratio by adjusting injector pulse width.

Downstream Oxygen Sensor

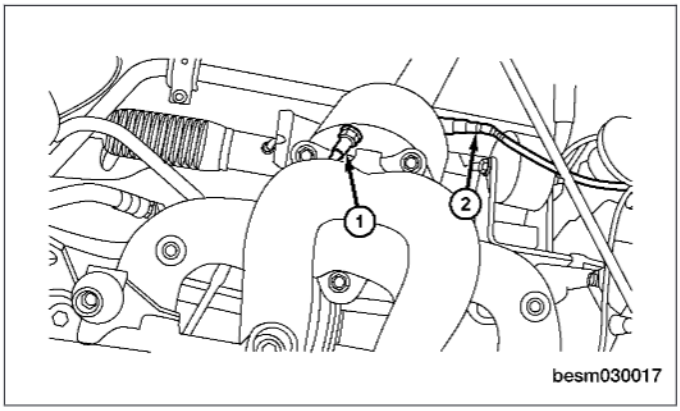
The downstream heated oxygen sensor signal is used to detect catalytic convertor deterioration. As the convertor deteriorates, the signal from the downstream sensor begins to match the upstream sensor signal except for a slight time delay. By comparing the downstream heated oxygen sensor signal to the signal from the upstream sensor, the ECM calculates catalytic convertor efficiency. This calculation is also used to establish the upstream O2 goal voltage (switching point).

Removal & Installation - Upstream Oxygen Sensor

1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor electrical connector.

CAUTION:
Remove the oxygen sensor after the exhaust pipe has cooled.

3. Remove the upstream oxygen sensor (1).
   (Tighten: Upstream oxygen sensor to 45 N·m)



4. Installation is in the reverse order of removal.

Installation Notes:

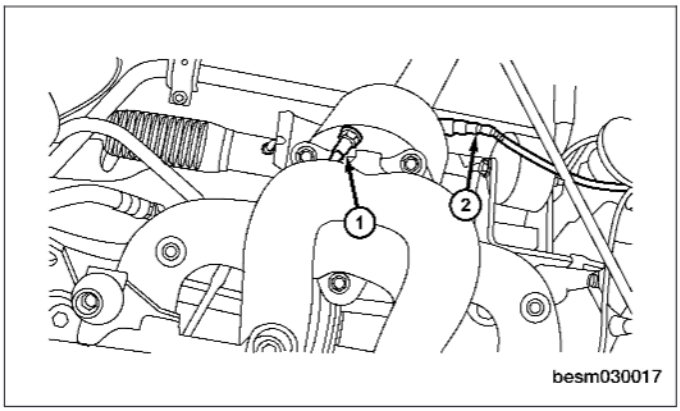
- Before installing the oxygen sensor, coat the threads with rust inhibiting lubricant.

Removal & Installation - Downstream Oxygen Sensor

1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor electrical connector.

CAUTION:
Remove the oxygen sensor after the exhaust pipe has cooled.

3. Remove the downstream oxygen sensor (2).
   (Tighten: Downstream oxygen sensor to 45 N·m)



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4. Installation is in the reverse order of removal.

Installation Notes:

- Before installing the oxygen sensor, coat the threads with rust inhibiting lubricant.

Crankshaft Position (CKP) Sensor

Description

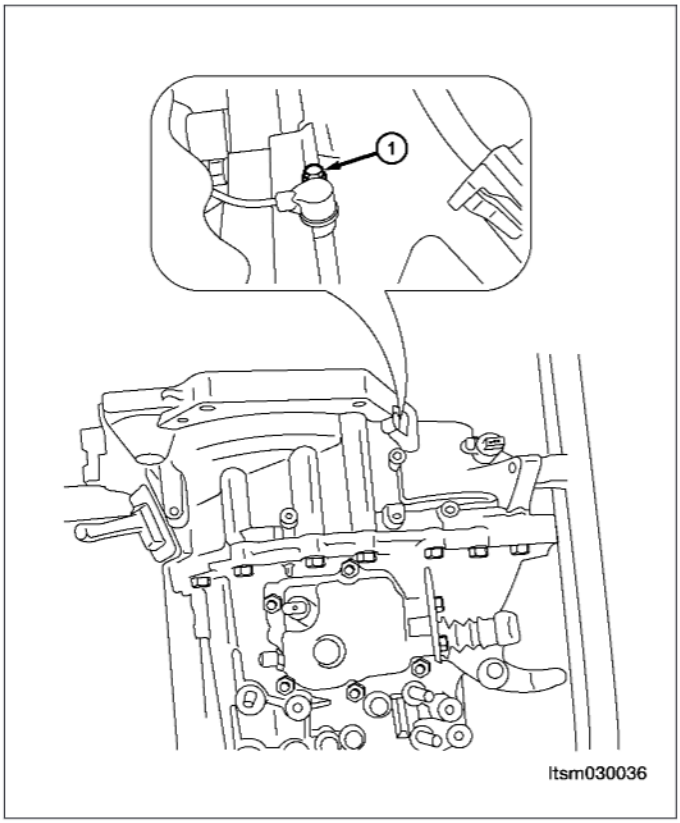
The Crankshaft Position (CKP) sensor is located on the flywheel shell facing the gear teeth of the signal plate. It detects the fluctuation of the engine revolution. The sensor consists of a permanent magnet and Induction coil.

Operation

When the engine is running, the high and low parts of the teeth cause the gap with the sensor to change. The changing gap causes the magnetic field near the sensor to change. Due to the changing magnetic field, the voltage from the sensor changes. The Engine Control Module (ECM) receives the voltage signal and detects the fluctuation of the engine revolution.

Removal & Installation

1. Disconnect and isolate the negative battery cable.
2. Disconnect the CKP sensor electrical connector.
3. Remove the CKP sensor retaining bolt (1) and remove the CKP sensor.
   (Tighten: Crankshaft position sensor retaining bolt to 10 N·m)



4. Installation is in the reverse order of removal.

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Camshaft Position (CMP) Sensor

Description

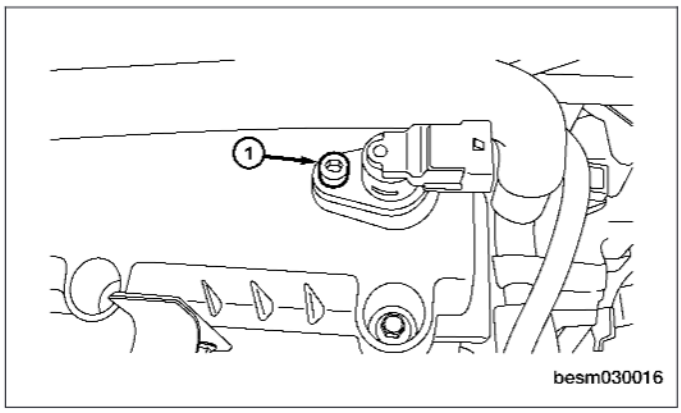
The Camshaft Position (CMP) sensor senses the protrusion of inlet valve cam sprocket to identify a particular cylinder. The CMP sensor senses the piston position. When the Crankshaft Position (CKP) sensor becomes inoperative, the CMP sensor provides various controls of engine parts instead, utilizing timing of cylinder identification signals. The sensor consists of a permanent magnet and Hall IC.

Operation

When engine is running, the high and low parts of the teeth cause the gap with the sensor to change. The changing gap causes the magnetic field near the sensor to change. Due to the changing magnetic field, the voltage from the sensor changes. The Engine Control Module (ECM) detects the voltage signal and identify piston position and cylinder timing.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the CMP sensor electrical connector.
3. Remove the CMP sensor retaining bolt (1).
   (Tighten: Camshaft position sensor retaining bolt to 7 N·m)
4. Remove CMP sensor.
5. Pull sensor up out of the cylinder head cover.
6. Installation is in the reverse order of removal.



Air Flow Sensor

Description

The air flow sensor is placed in the air intake hose. The air flow sensor measures the intake flow rate by measuring a part of the entire intake flow. The air flow sensor converts the amount of air drawn into the engine into a voltage signal. The Engine Control Module (ECM) needs to know intake air volume to calculate engine load. This is necessary to determine how much fuel to inject.

Operation

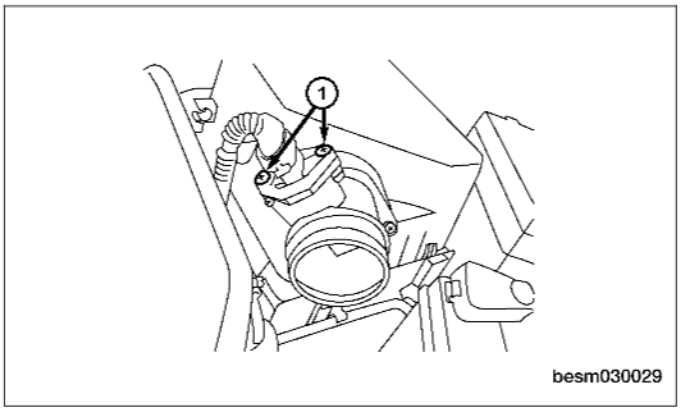
The air flow sensor controls the temperature of the hot wire to a certain amount. The heat generated by the hot wire is reduced as the intake air flows around it. The more air, the greater the heat loss. Therefore, the electric current supplied to the hot wire is changed to maintain the temperature of the hot wire as air flow increases. The ECM detects the air flow by means of this voltage signal change.

Removal & Installation

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Disconnect the air flow sensor electrical connector.

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4. Remove the air flow sensor retaining bolts (1).
   (Tighten: Air flow sensor retaining bolts to 5 N·m)



5. Pull sensor up and take out of the air cleaner case.
6. Installation is in the reverse order of removal.

Accelerator Sensor

Description

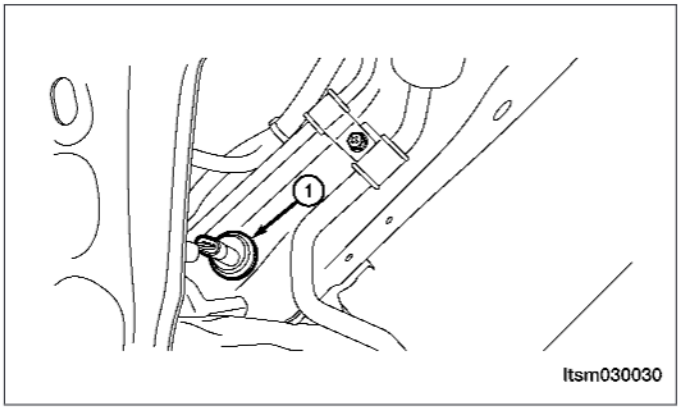
The accelerator sensor is located on the right front crossbeam.

Operation

The accelerator sensor monitors the road conditions. It sends a signal to the ECM, the ECM determines if a possible misfire condition exists.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the accelerator sensor connect.
3. Remove the accelerator sensor (1).



4. Installation is in the reverse order of removal.

Speed Control System

Description

The Speed Control System allows a driver to keep the vehicle at a predetermined speed without depressing the accelerator pedal. The driver can set vehicle speed in advance between approximately 25 km/h and 130 km/h.

ECM controls throttle angle of electronic throttle control actuator to regulate engine speed.

If any malfunction occurs in the Speed Control System, it automatically deactivates the system and the cruise indicator flashes.

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Operation

Set Operation

- Press CRUISE combination switch (ON/OFF switch). The CRUISE indicator in instrument cluster illuminates.
- When vehicle speed reaches a desired speed between approximately 25 km/h and 130 km/h, press SET switch.

Speed Operation

- If the vehicle speed has been increased by during cruise control driving, the SET switch is pressed and then Speed Control System will keep the new set speed.
- If the RESUME/ACC switch is pressed (less than 0.5 seconds) during cruise control operation, the cruising speed is higher than the original speed of 2 km/h.
- If the DEC switch is pressed (less than 0.5 seconds) during cruise control operation, the cruising speed is less than the original speed of 2 km/h.

Cancel Operation

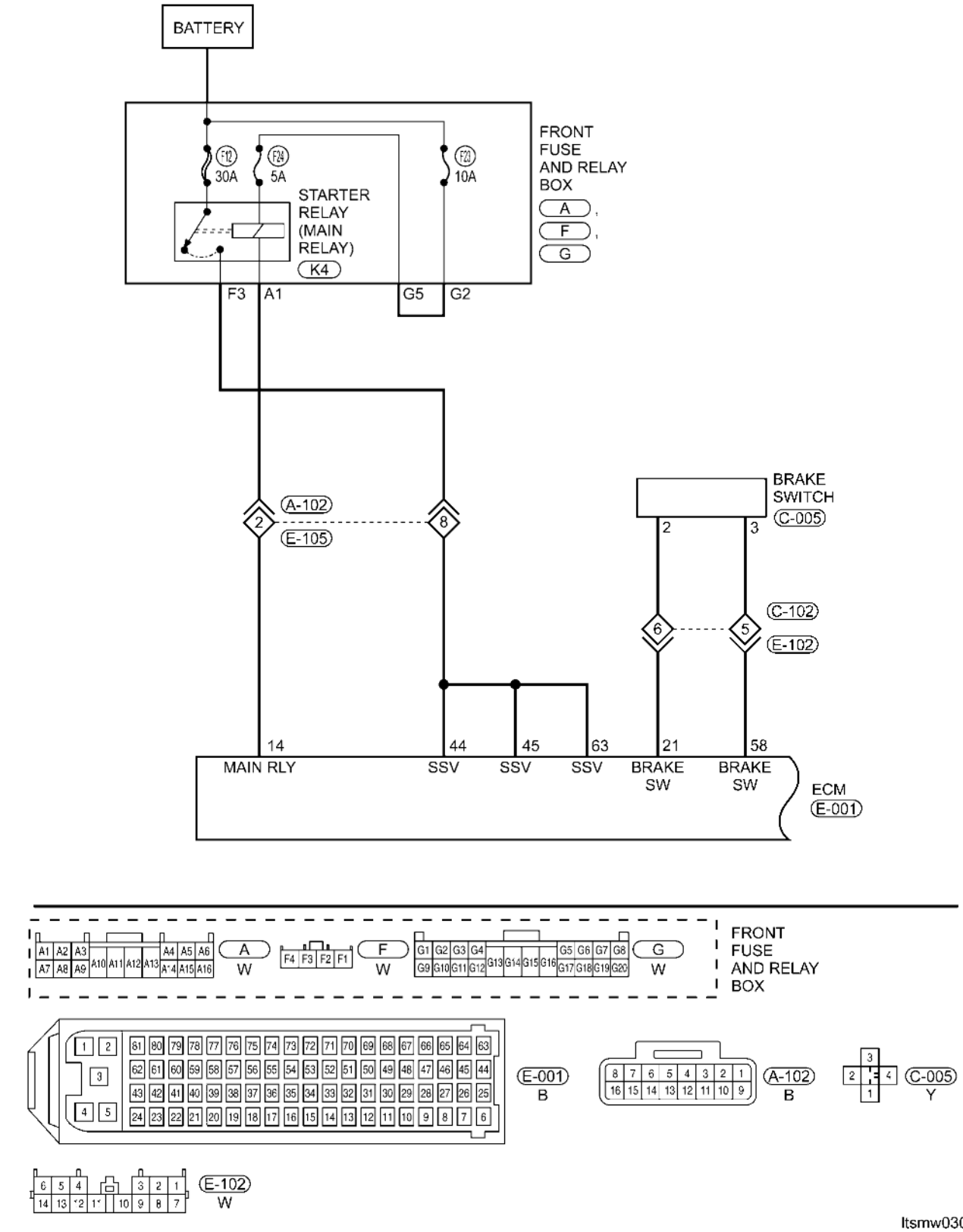
- When any of following conditions exist, cruise operation will be canceled.
  - OFF switch is pressed
  - Brake pedal is depressed
  - If any malfunction occurs in Speed Control System, it automatically deactivates control.

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Electrical Schematics

Speed Control System (page 1 of 4)

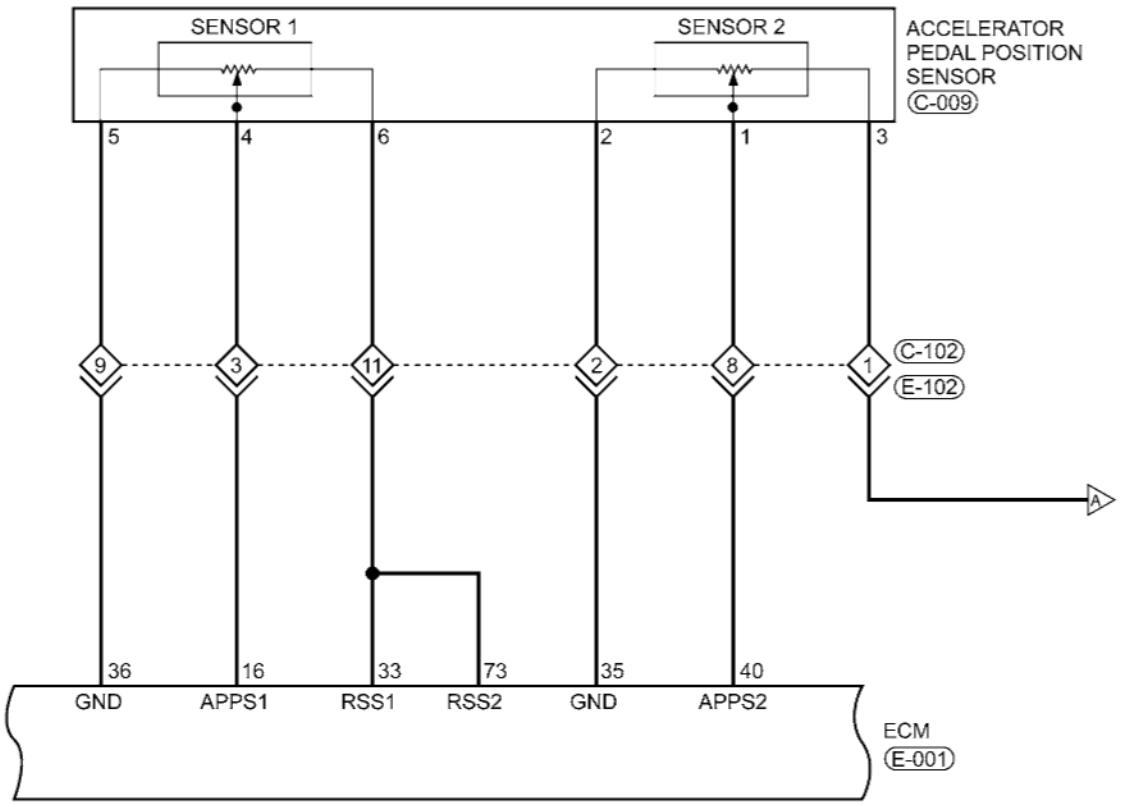
SPEED CONTROL - WITH DP0 TRANSMISSION

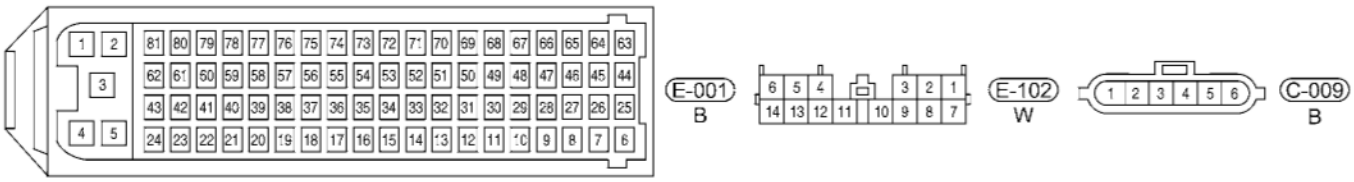


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Speed Control System (page 2 of 4)

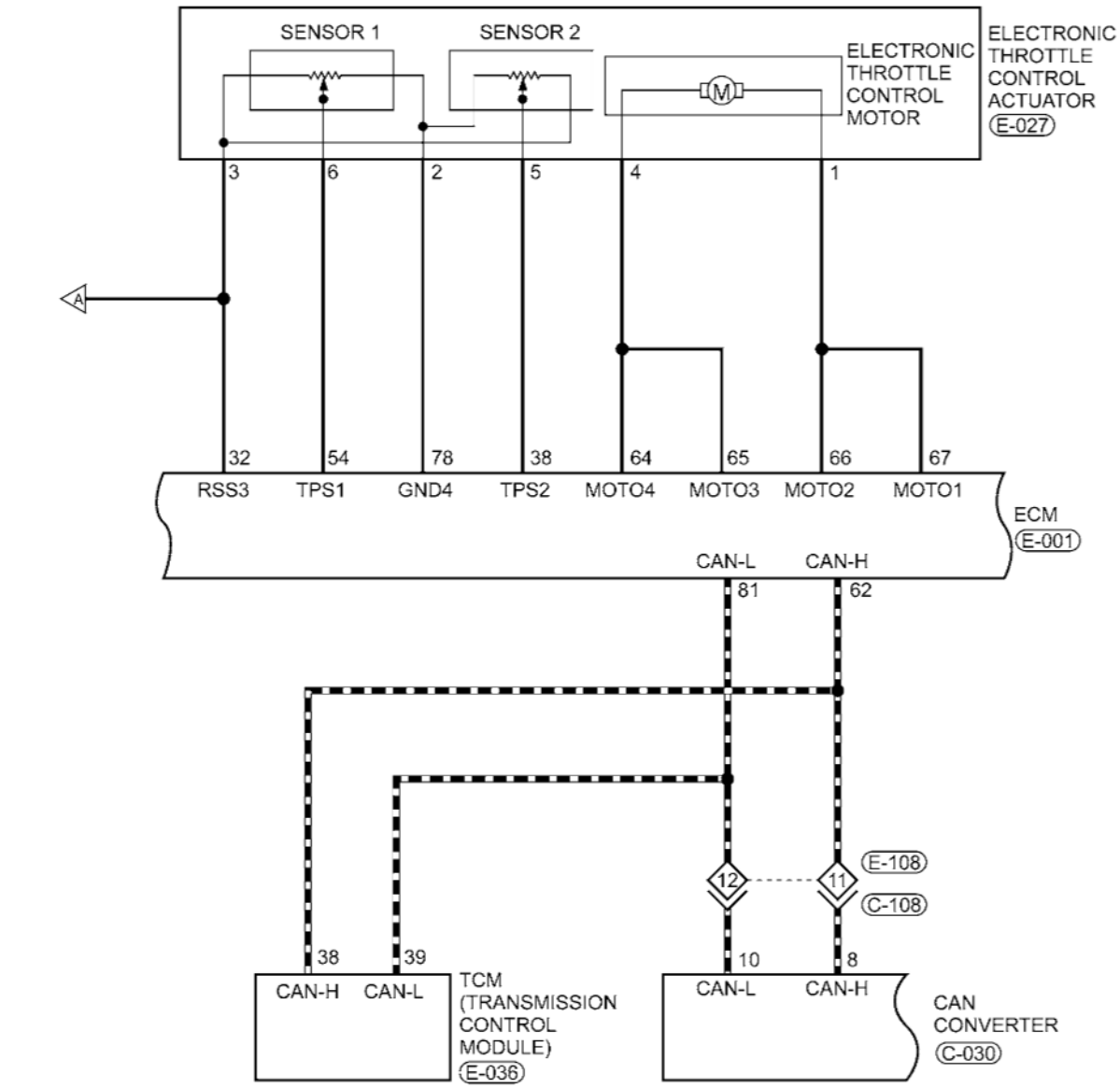


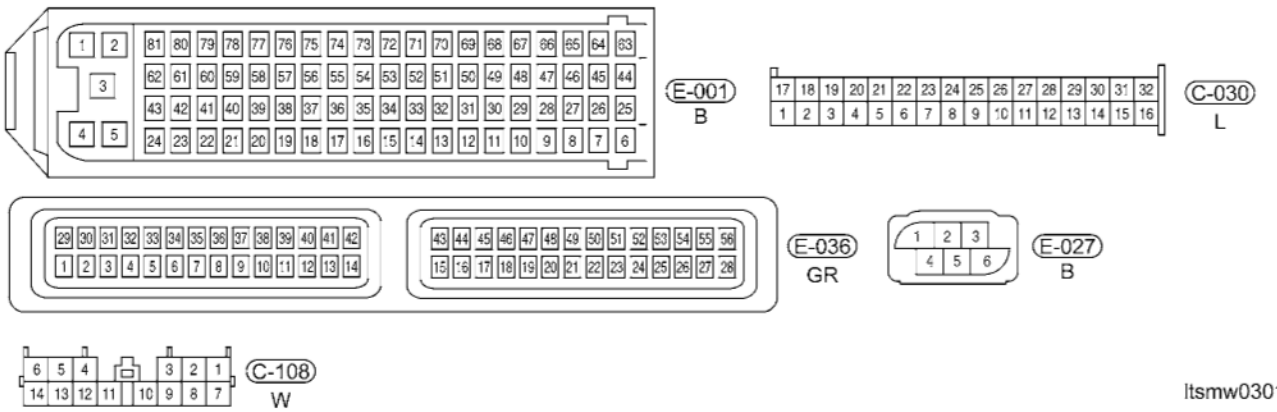


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Speed Control System (page 3 of 4)

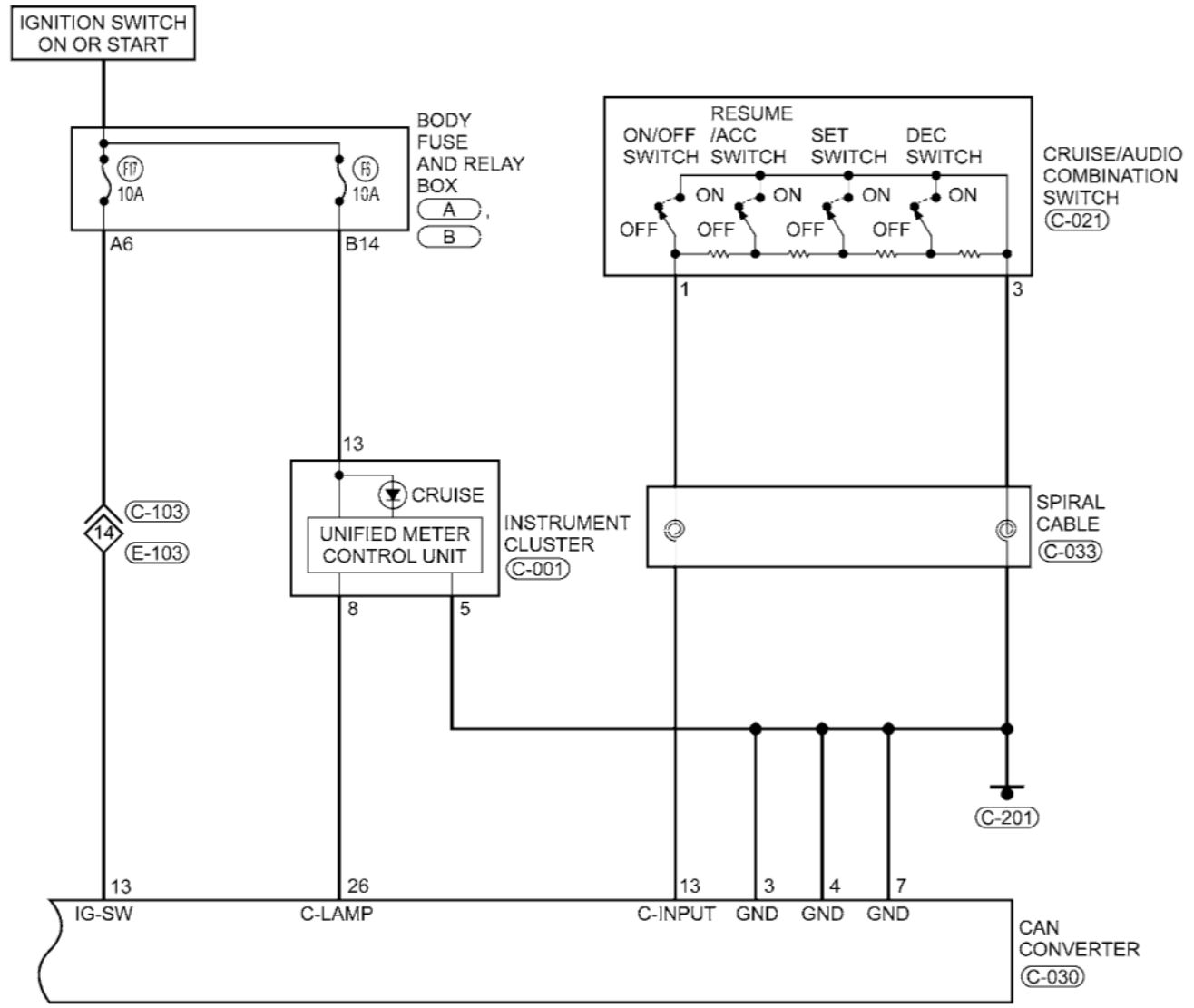


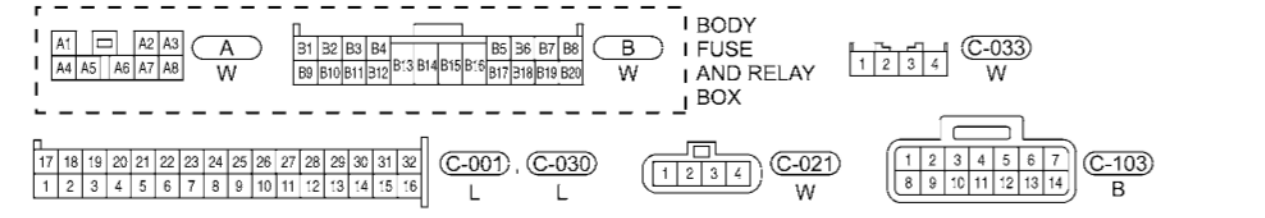


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Speed Control System (page 4 of 4)





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Accelerator Pedal Position (APP) Sensor

Description

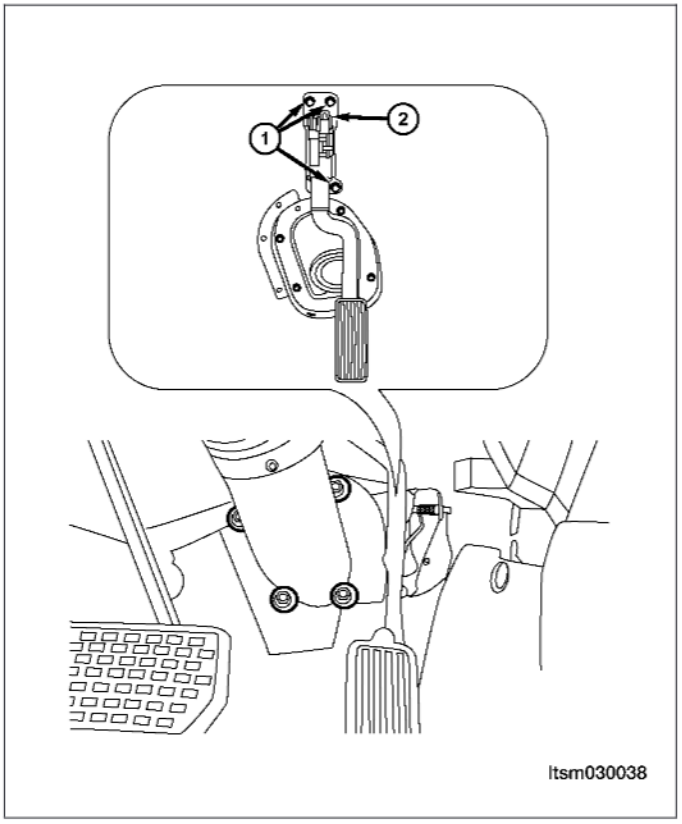
The Accelerator Pedal Position (APP) sensor is located inside the accelerator pedal. The accelerator pedal position sensor cannot be disassembled by itself. The accelerator pedal must be replaced as a unit.

Operation

The Accelerator Pedal Position (APP) sensor on the accelerator pedal works according to the Hall principal. The sensor is integrated into the pedal lever axis. It consists of a shaft with a ring magnet. This rotates in a printed circuit board with a stator in the fixed Hall elements. This produces a change in the voltage. The APP sensor is supplied with 5 V from the Engine Control Module (ECM). The information regarding accelerator position is supplied to the ECM by means of two voltages.

Removal & Installation

1. Disconnect the negative battery cable.
2. Remove the instrument panel lower trim panel.
3. Disconnect the APP sensor electrical connector (2).
4. Remove the three APP sensor mounting bolts (1). (Tighten: APP sensor mounting bolts to 11 N·m)
5. Remove the APP sensor with the pedal.
6. Installation is in the reverse order of removal.



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Electronic Throttle Control Actuator

Description

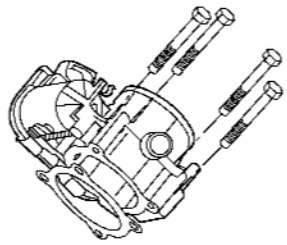
The throttle body is located on the intake manifold. It controls air into the intake manifold. The Electronic Throttle Control Actuator consists of a throttle control motor and the throttle position sensor. The throttle control motor is operated by the ECM and it opens and closes the throttle valve. The throttle position sensor detects the throttle valve position.

Operation

Filtered air from the air cleaner enters the intake manifold through the throttle body. A throttle valve (plate) is used to supply air for idle and driving conditions. The throttle position sensor is part the throttle body. The throttle position sensor signal is used by the ECM to determine throttle position. The ECM controls the electronic throttle control to meter air into the engine. This regulates engine power. The vehicle is in sense a “Drive by Wire” system.

Removal & Installation

1. Remove the engine cover.
2. Disconnect the negative battery cable.
3. Disconnect the electronic throttle control actuator connector.
4. Remove two hoses on electronic throttle control actuator.
5. Remove four electronic throttle control actuator mounting bolts.
   (Tighten: Electronic throttle control actuator bolts to 10 N·m)
6. Remove the throttle control actuator carefully.
7. Installation is in the reverse order of removal.



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Engine Control Module (ECM)

Description

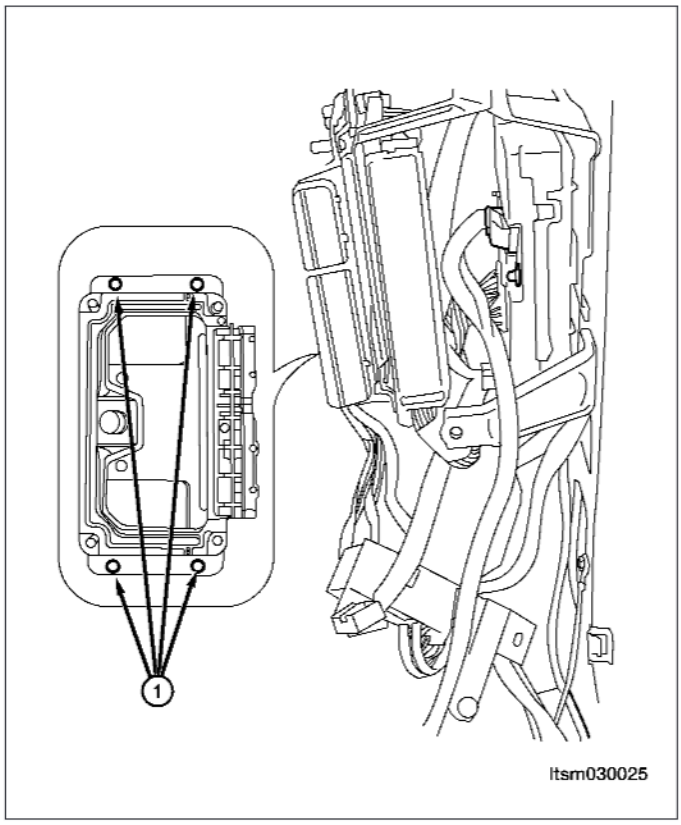
The Engine Control Module (ECM) for this model is serviced only as a complete unit.

Operation

The ECM is a pre-programmed, microprocessor-based digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The ECM can adapt its programming to meet changing operating conditions.

Removal & Installation

1. Disconnect the negative battery cable.
2. Remove the glove box (See Instrument Panel Removal & Installation in Section 15 Body).
3. Disconnect the ECM electrical connector.
4. Remove the ECM retaining bolts (1).
   (Tighten: ECM retaining bolts to 10 N·m)
5. Remove the ECM.
6. Installation is in the reverse order of removal.



Installation Notes:

NOTE :
The Immobilizer control module must be matched to the new ECM before the vehicle will start.

Matching Immobilizer Control Module to New Engine Control Module (ECM)

Perform the following to match the Immobilizer control module to the new ECM:

- With the X-431 scan tool, choose T11 series.
- Choose ″immobilize″.
- Choose ″input code″.
- Input the safety code.
- Click the small keyboard.
- Click ″OK″.
- Choose ″Immobilizer adapt″.
- Choose ″read Immobilizer to ECM″ immediately.
- Click ″OK″.

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GENERAL INFORMATION

Description

The Engine Control Module (ECM) consists of a microcomputer and connectors for signal input and output and for power supply. The ECM controls the engine.

The following are the input and output components monitored by the ECM. The monitored functions include components from the engine, ignition, transaxle, air conditioning, or any other ECM supported subsystem.

ECM Inputs

- Brake Switch Sensor
- Camshaft Position (CMP) Sensor
- Crankshaft Position (CKP) Sensor
- Engine Coolant Temperature (ECT) Sensor
- Air Flow Sensor
- Coolant Temperature Sensor (For Instrument Cluster)
- Throttle Position Sensor (Integral with Electronic Throttle Control Actuator)
- Power Steering Switch
- Knock Sensor
- Oxygen Sensor (Upstream & Downstream)
- Clutch Pedal Switch (Manual transmission only)

ECM Outputs

- Canister Control Valve
- Fuel Injectors
- Fuel Pump Relay
- Electronic Throttle Control Actuator
- Ignition Coil
- A/C Compressor
- Cooling Fan
- Oxygen Sensor heating coil (Upstream & Downstream)

Operation

The ECM monitors components and circuits and tests them in various ways depending on the hardware, function, and type of signal. For example, analog inputs such as throttle position or engine coolant temperature are typically checked for opens, shorts and out-of-range values. This type of monitoring is carried out continuously. Some digital inputs like vehicle speed or crankshaft position rely on rationality checks - checking to see if the input value makes sense at the current engine operating conditions. These types of tests may require monitoring several components and can only be carried out under appropriate test conditions.

The ECM is a pre-programmed, microprocessor-based digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The ECM can adapt its programming to meet changing operating conditions.

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Electronic Engine Control Input & Output Device Failure Modes

NUMBER	ITEM	FAILURE MODE	CORRECTION
1	CKP	• Engine is hard to start. • The engine RPM will be limited after the engine starts. • The highest RPM is less than 3800. • Excessive exhaust emissions. • No ignition signal to the ECM. • The tachometer does not work. • Rough engine operation.	Replace
2	CMP	• The fuel injector ON time may vary from 720 degrees to 360 degrees. • The sensor output is not correct, the MIL light will turn on when with the second revolution after the engine starts. • Engine is hard to start. • The highest RPM is less than 4000.	Replace
3	APPS	• The MIL light will turn on. • Poor acceleration. • The engine RPM will be limited after the engine starts.	Replace
4	ECT	• Engine hard to start when cold. • Engine hard to start when hot. • Poor driving capability. • If the sensor circuit is shorted to power, the engine will run under the default values. • The temperature gauge indicates too high. • The temperature gauge indicates too low. • The cooling fan operates continuously on high speed. • The high temperature warning lamp will flash when the IP indicates low temperature.	Replace
5	MAF	• The cooling fan will operate for approximately 60 seconds on high speed after the ignition switch is turned off. • Poor acceleration. • Poor driving capability.	Replace
6	O_2 Sensor	• Poor fuel economy. • Excessive exhaust emissions. • Sluggish acceleration. • Poor driving capability.	Replace
7	Knock Sensor	• The engine produces an engine knock. • Overheated engine. • Excessive exhaust emissions. • Poor fuel economy. • Lack of engine power. • Internal engine damage.	Replace
8	ECM	• Unstable engine idle. • Poor acceleration. • Unable to start. • High engine idle. • The engine exhaust exceeds emission standards. • Engine is hard to start. • Air conditioner does not operate. • Fuel injector control failure. • Engine stalls out.	Replace
9	Ignition Coil	• Unstable idle. • Lack of engine power. • Poor fuel economy. • Excessive exhaust emissions. • Weak spark.	Replace

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NUMBER	ITEM	FAILURE MODE	CORRECTION
10	Fuel Injector	• Unstable idle. • Lack of engine power. • Poor acceleration. • Engine will not start. • Plugged injector.	Replace
11	TPS	• Poor acceleration. • The MIL light will turn on.	Replace
12	EVAP	• The engine base fuel closed-loop control self-learning will be shut off. • The engine idle air control self-learning will be shut off. • Unstable idle or high idle.	Replace
13	Fuel Pump	• Noisy fuel pump operation. • Poor acceleration. • Engine will not start.	Replace
14	MAP	• Poor acceleration. • Unstable idle. • Rough engine operation.	Replace
15	IAT	• Intake air temperature will be equal to the coolant temperature.	Replace
16	Cooling Fan	• High engine temperature. • Poor air conditioner performance.	Replace
17	Accelerator Sensor	• Misfire • Poor driving capability. • Rough engine operation.	Replace

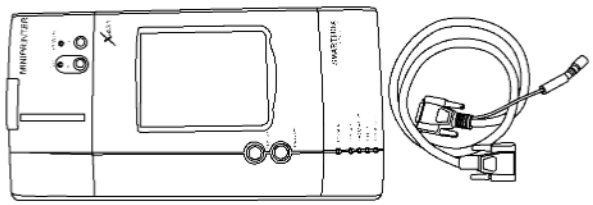
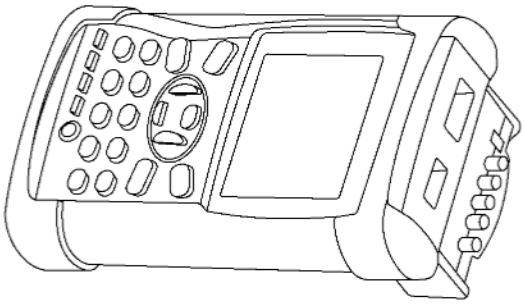
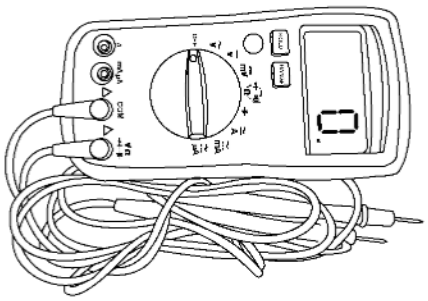
Specifications

Torque Specifications

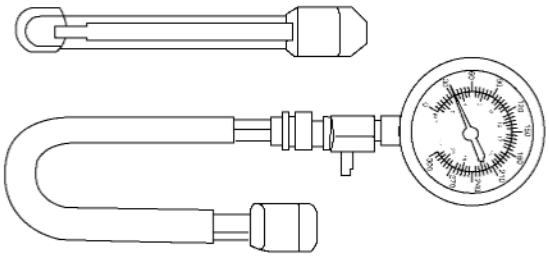
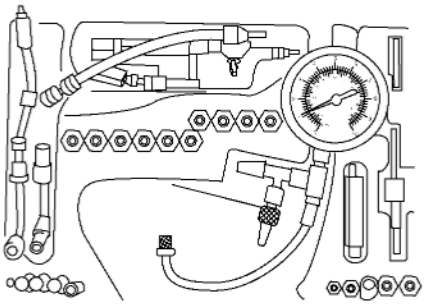
DESCRIPTION	TORQUE (N·m)
Engine Coolant Temperature Sensor	20
Knock Sensor	20
Oxygen Sensors	45
Crankshaft Position Sensor	20
Camshaft Position Sensor	10
Air Flow Sensor	8
Engine Control Module	10
Electronic Throttle Control Actuator	10
Vehicle Speed Sensor	10
Coolant Temperature Sensor (For Instrument Cluster)	14

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Special Tools

Diagnostic Scan Tool X-431	 besm030001
Engine Analyzer KES-200	 ltsmd030069
Digital Multimeter Fluke 15B & 17B	 besm030002

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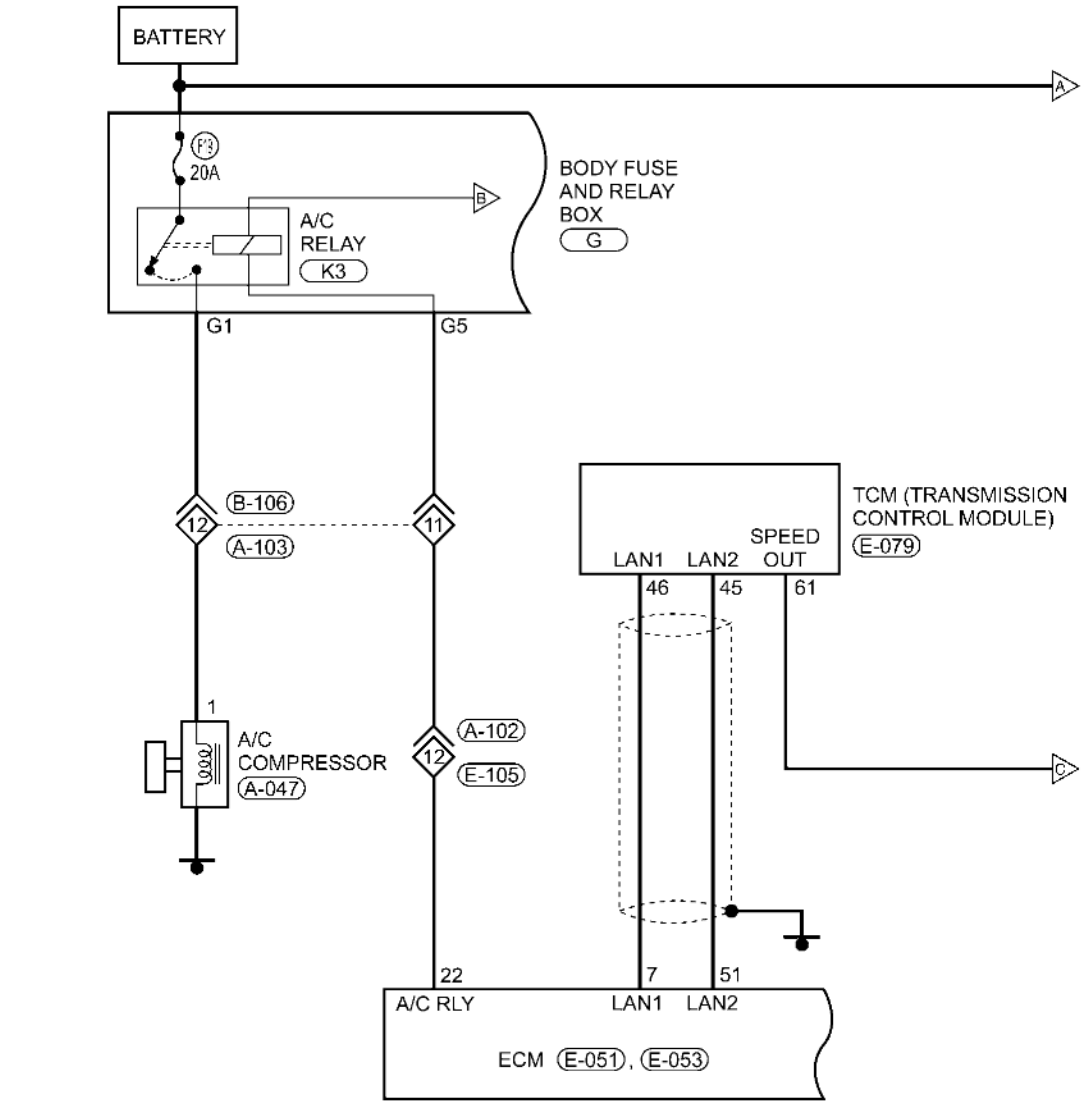
Compression Gauge	 besm030009
Fuel Pressure Gauge	 besm030008

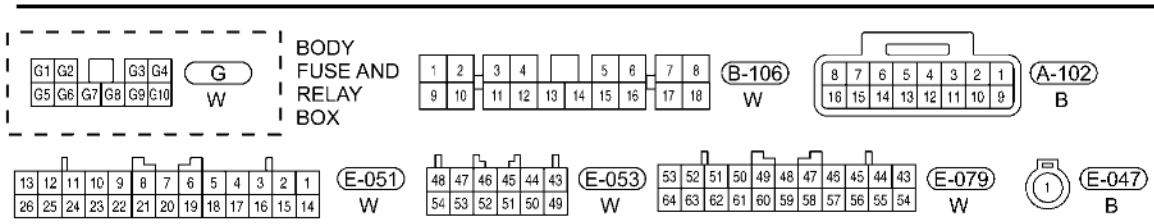
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Electrical Schematics

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ENGINE CONTROL SYSTEM - WITH MITSUBISHI 2.4L

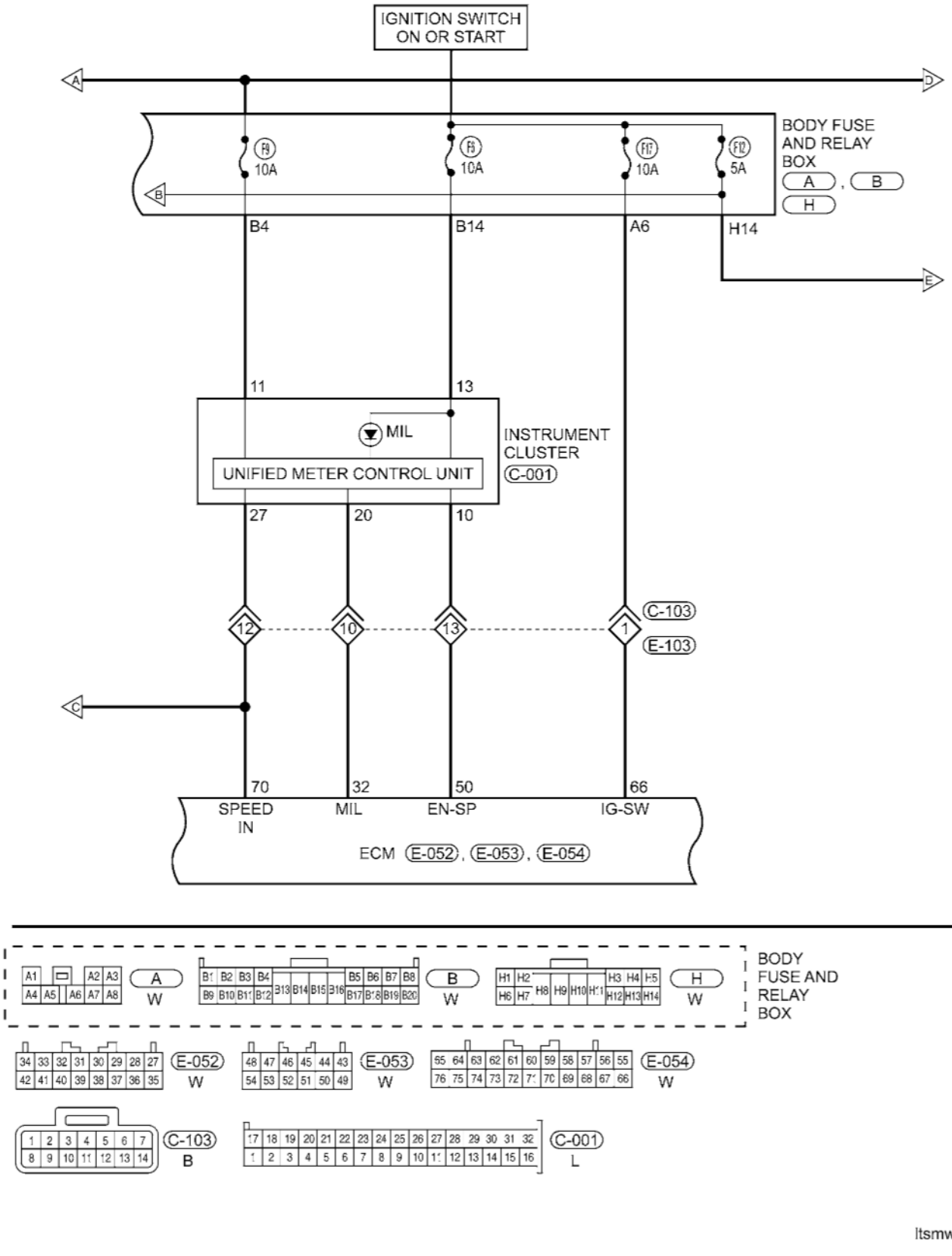




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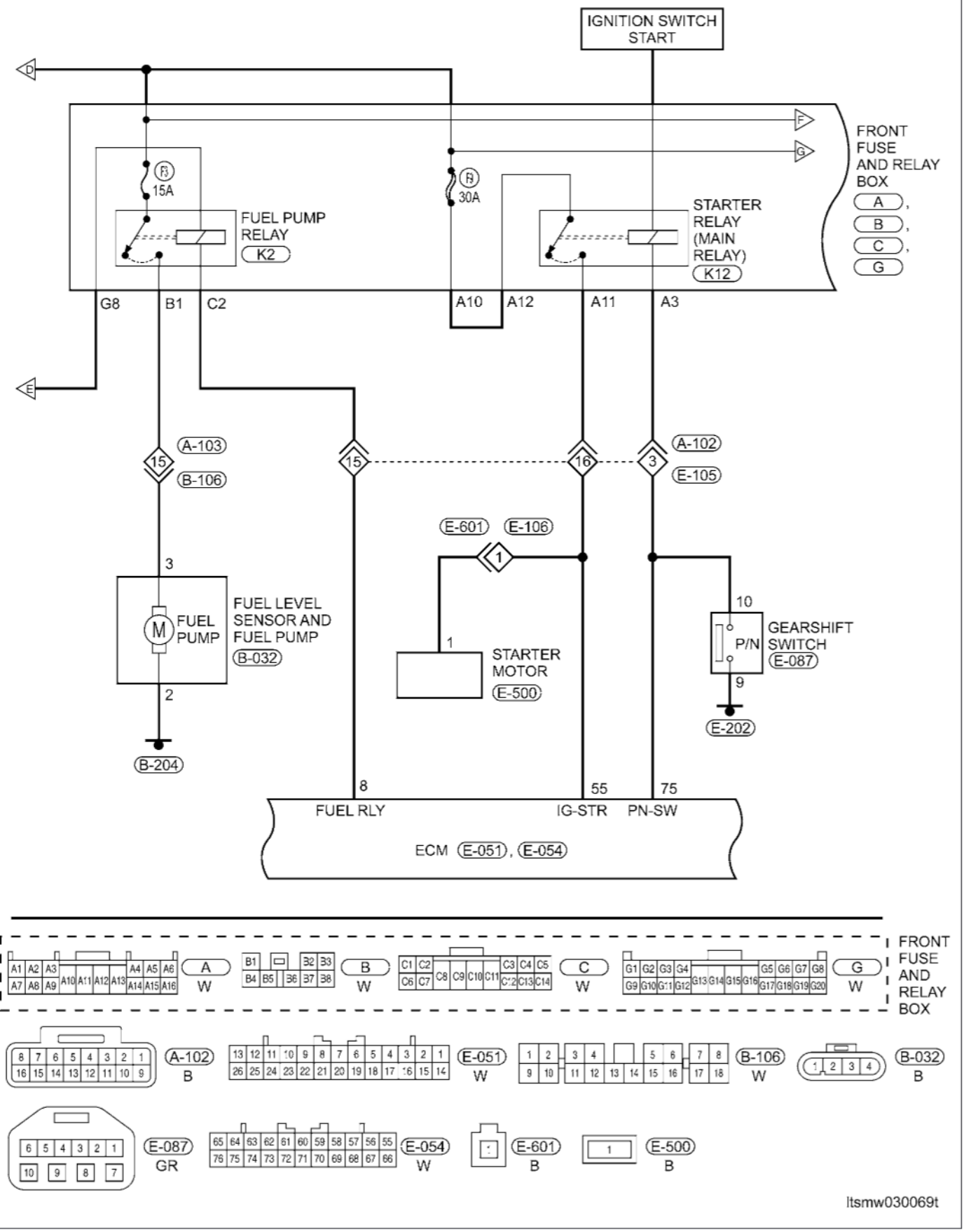
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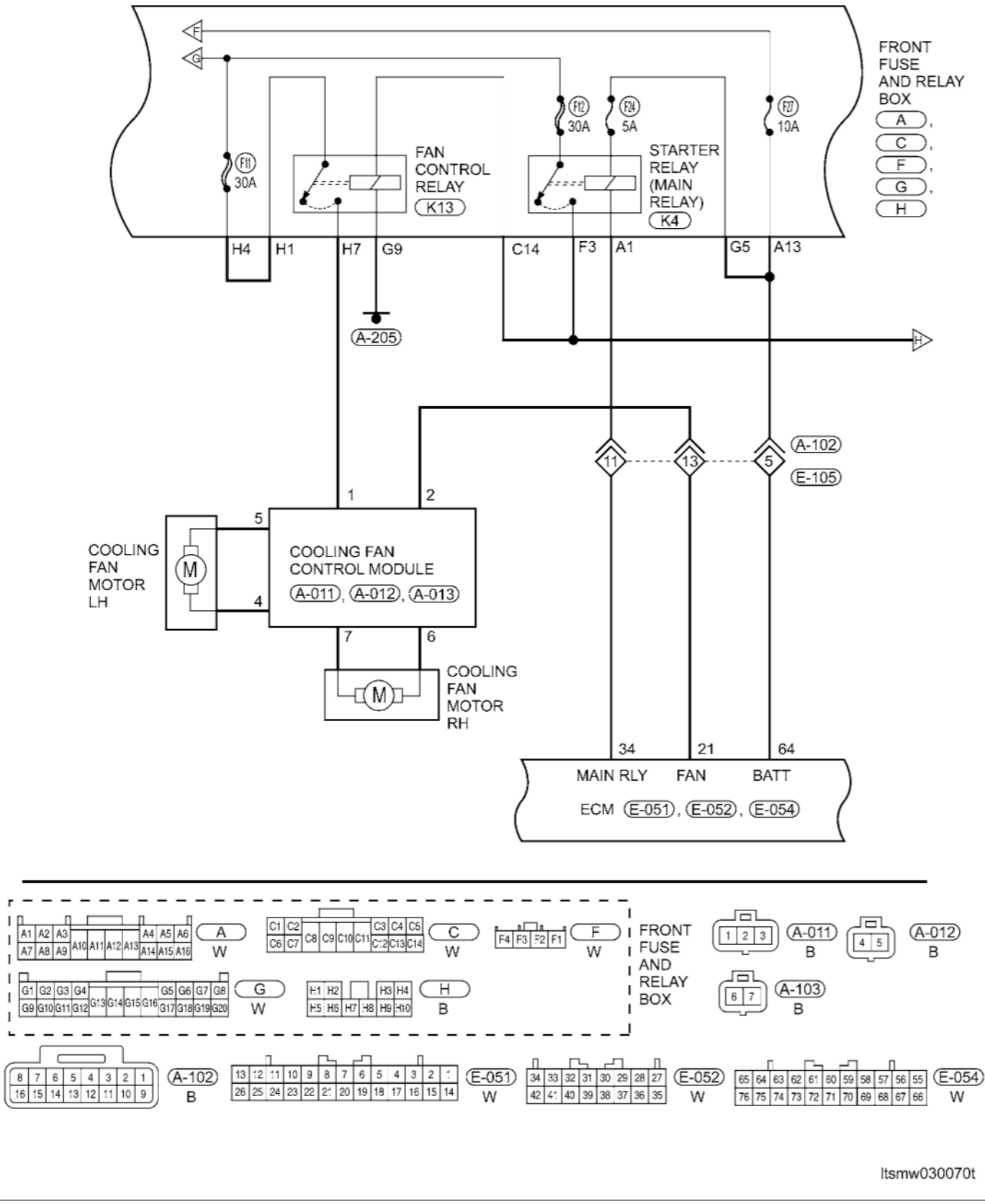
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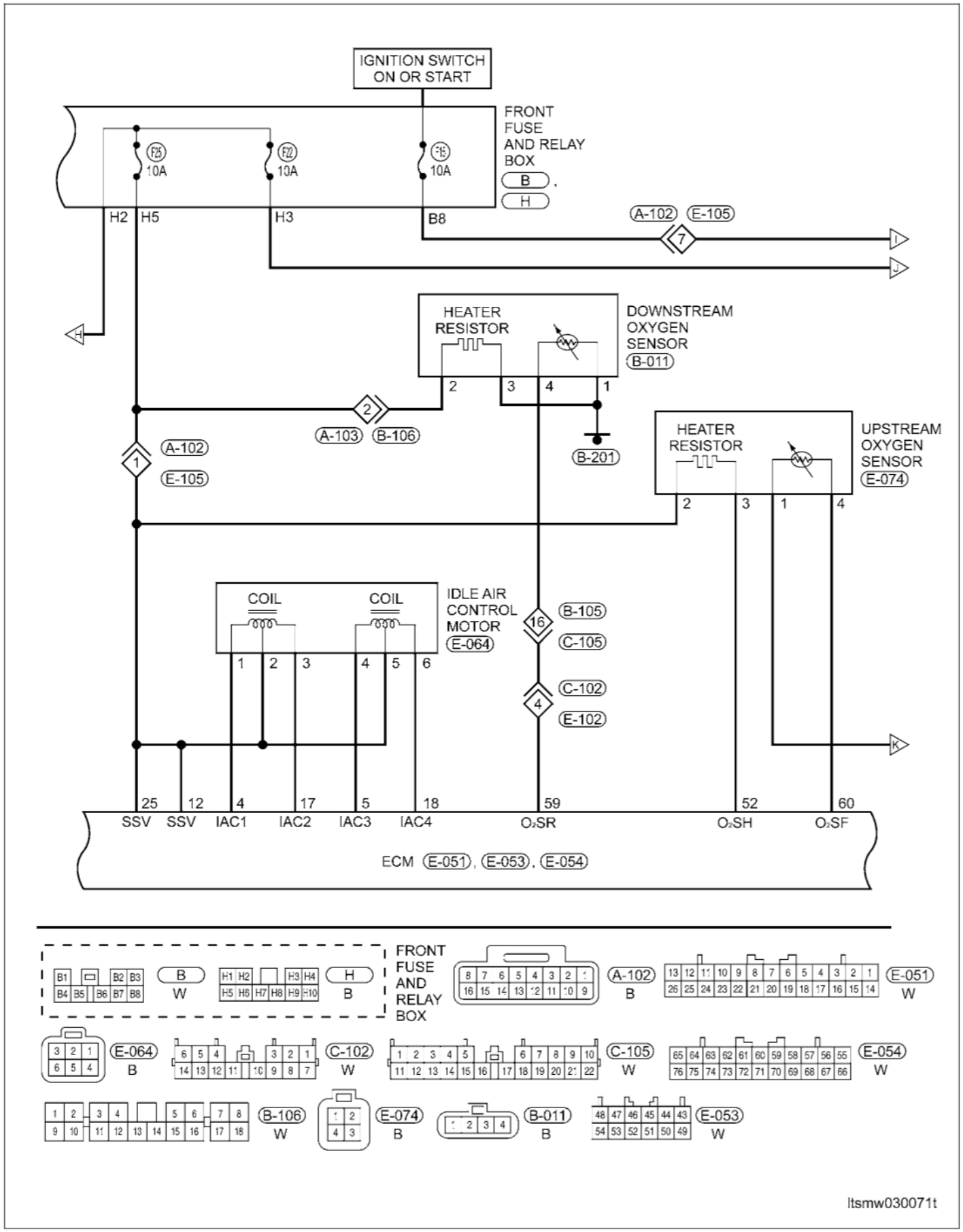
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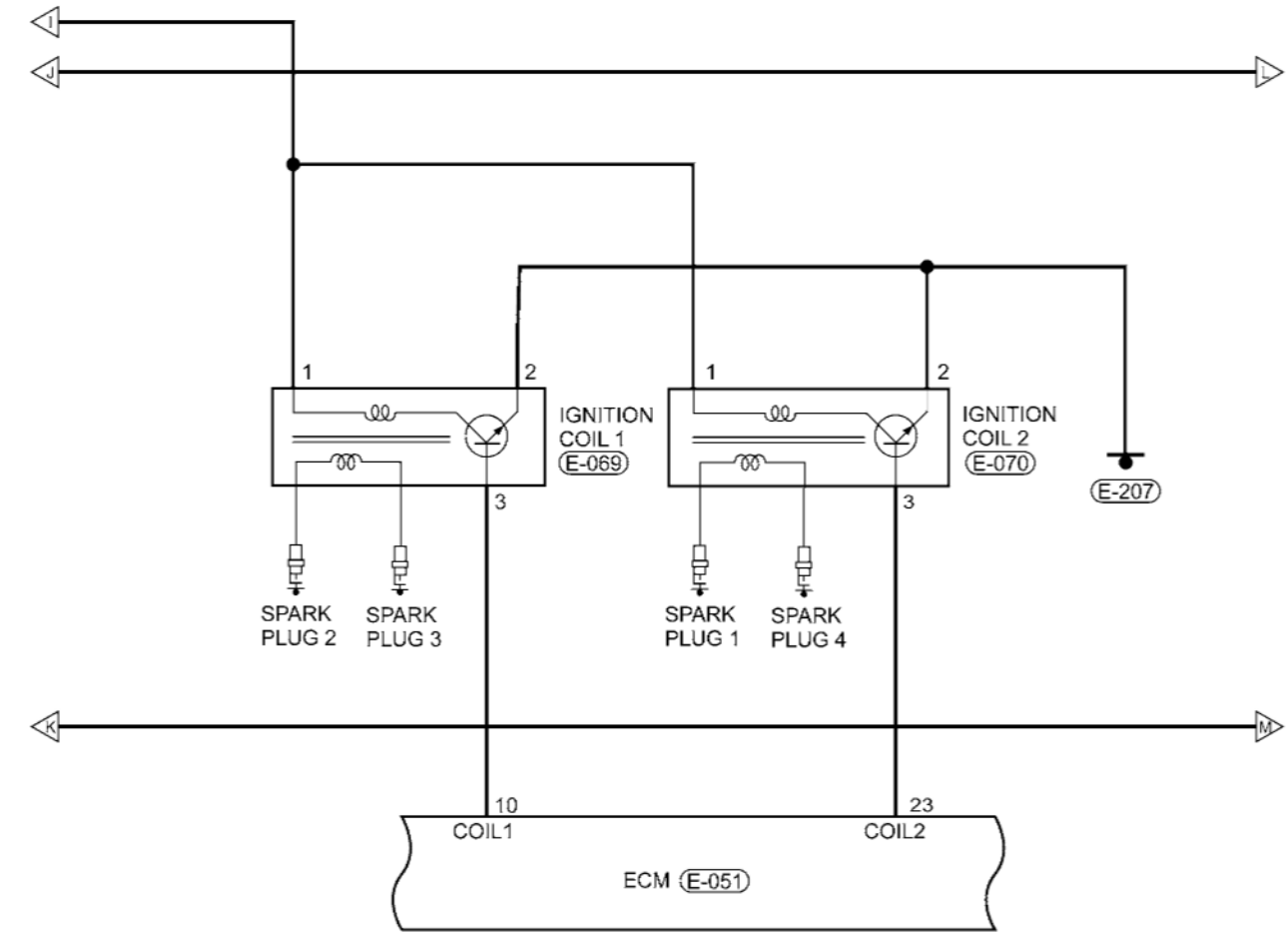
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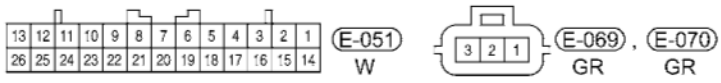
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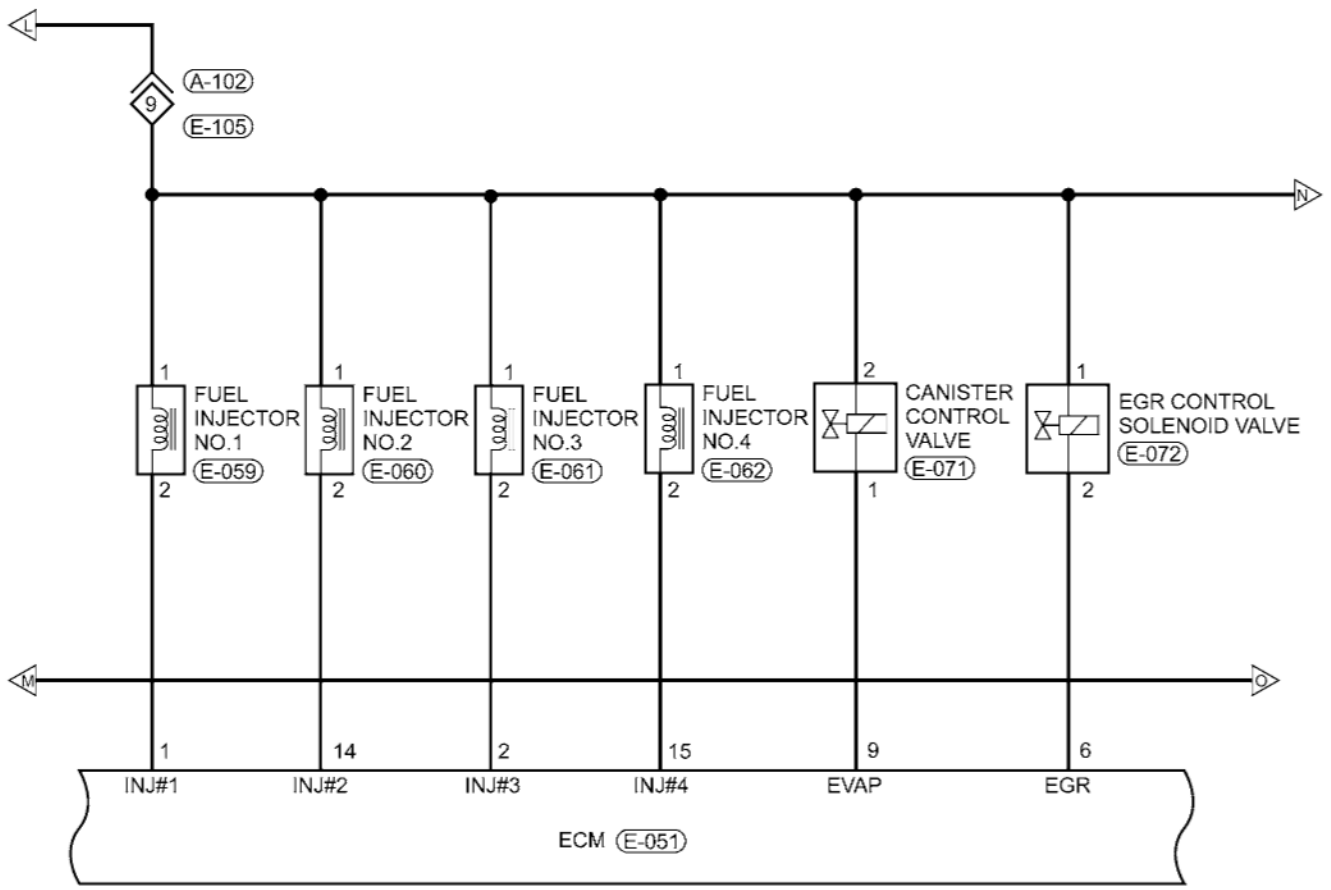


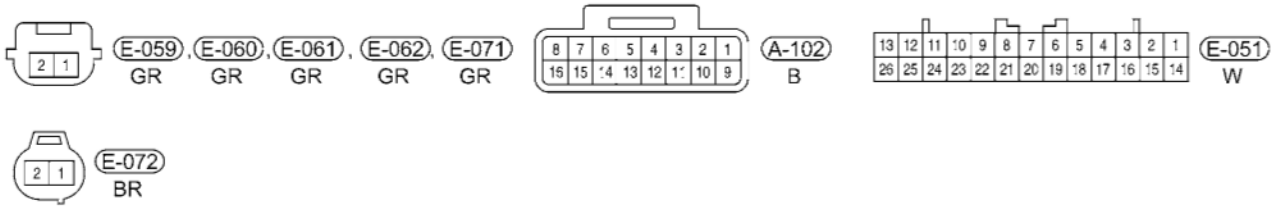


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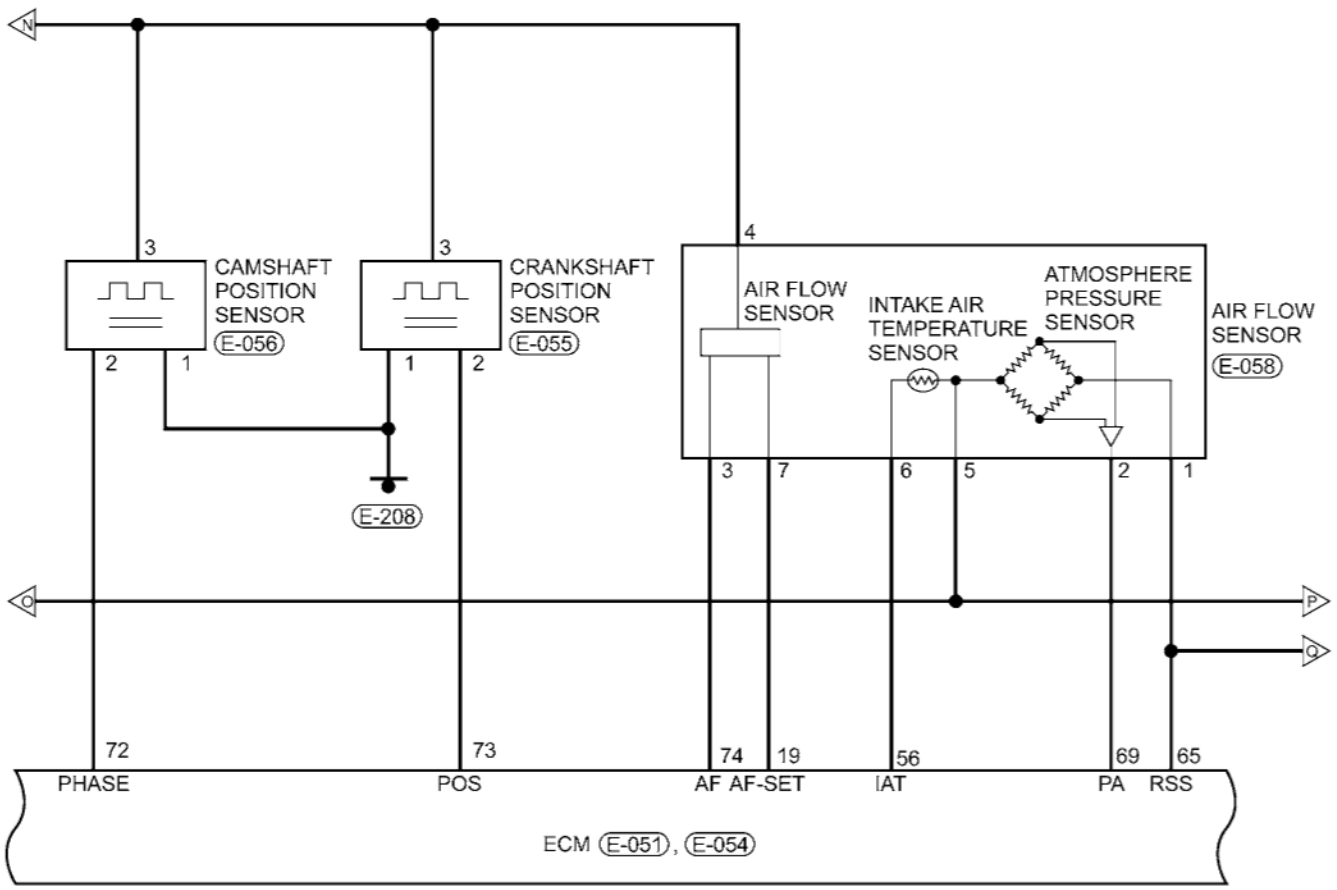


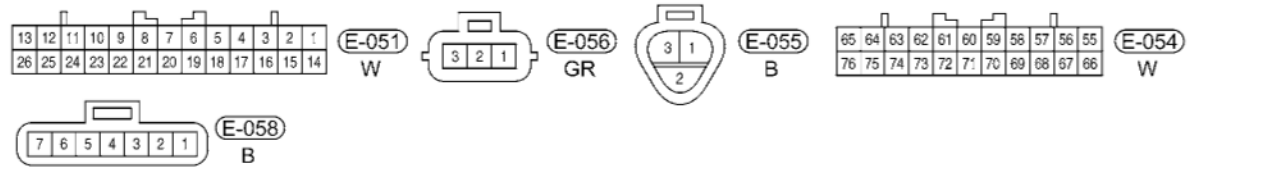


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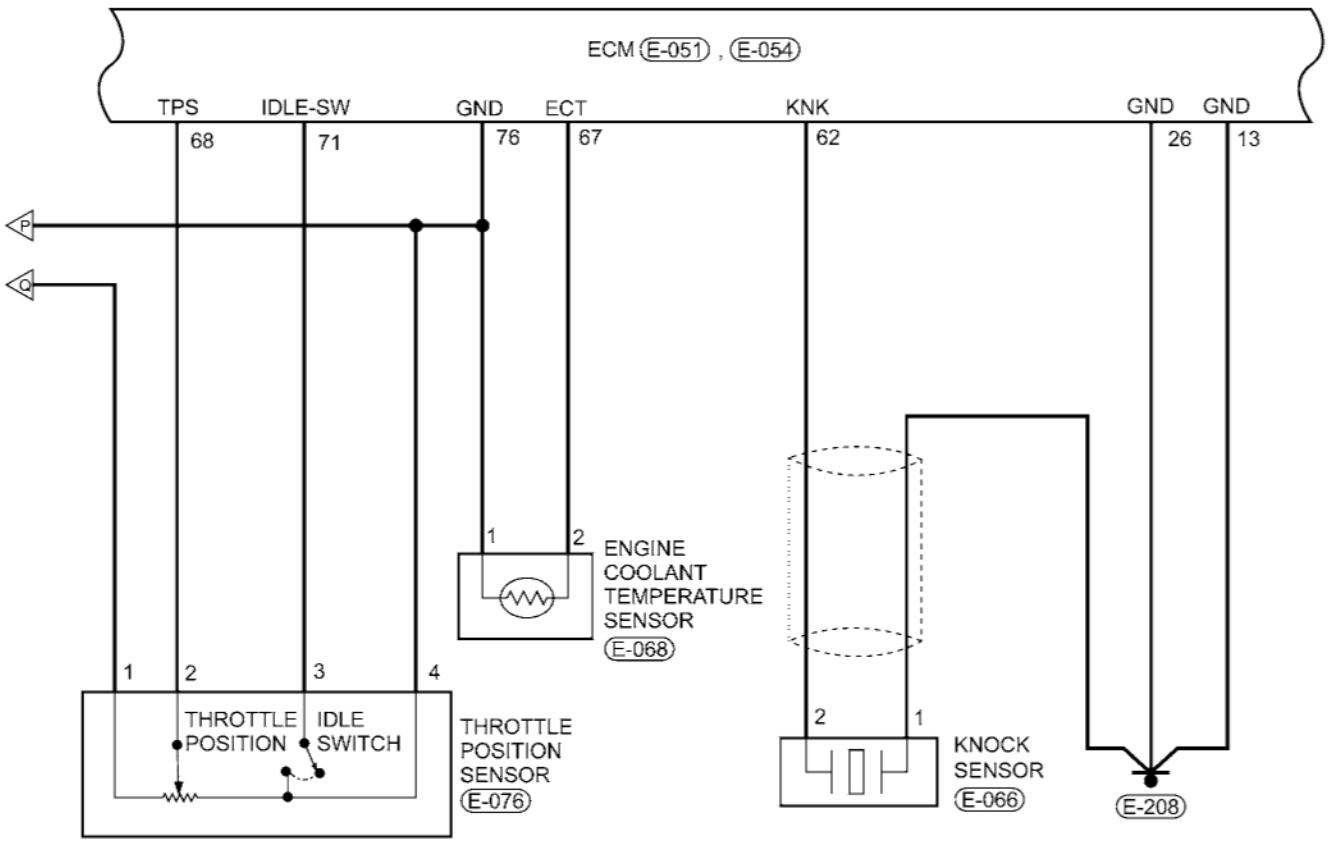


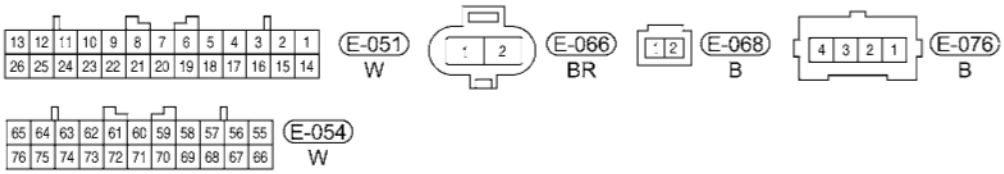


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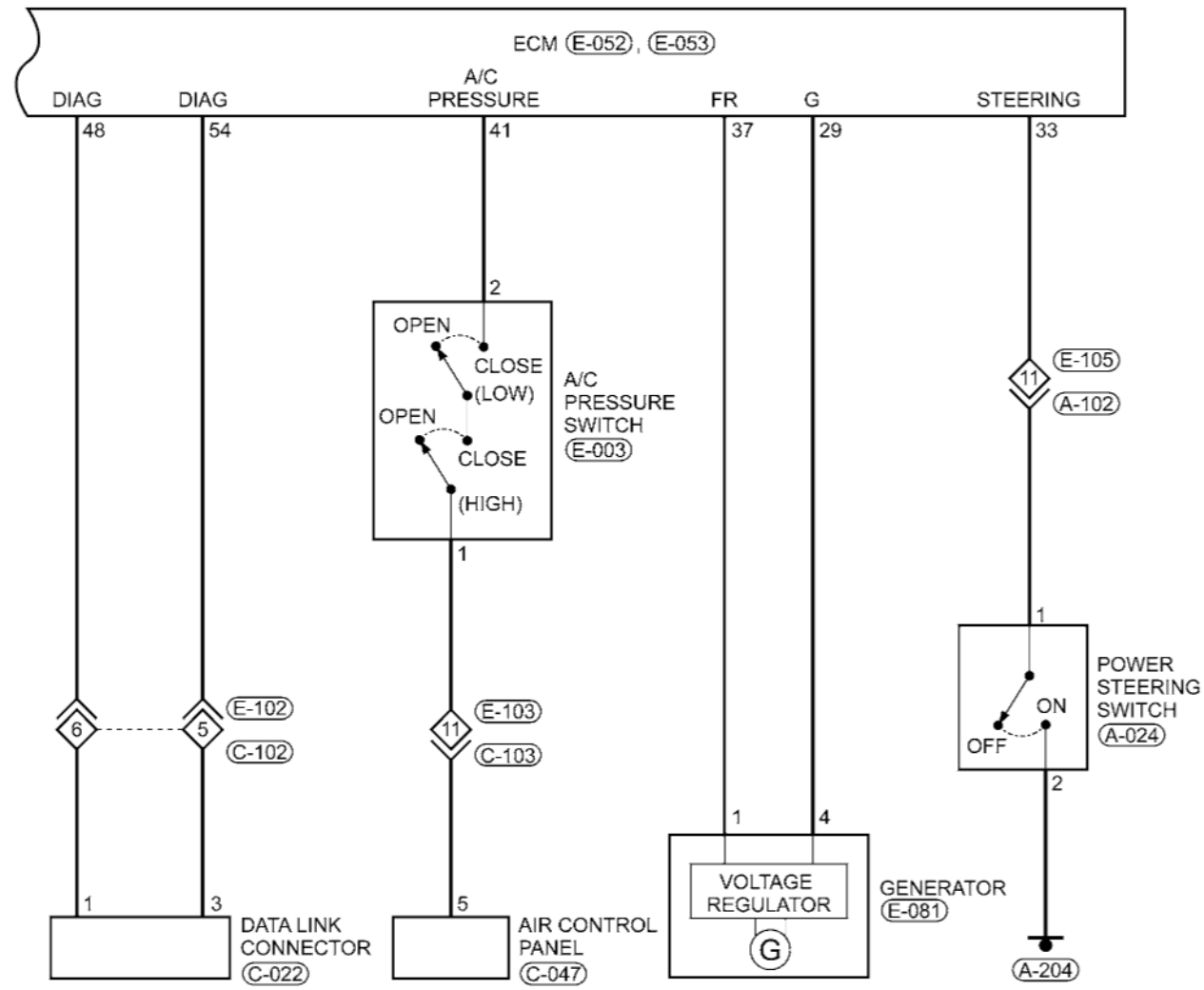


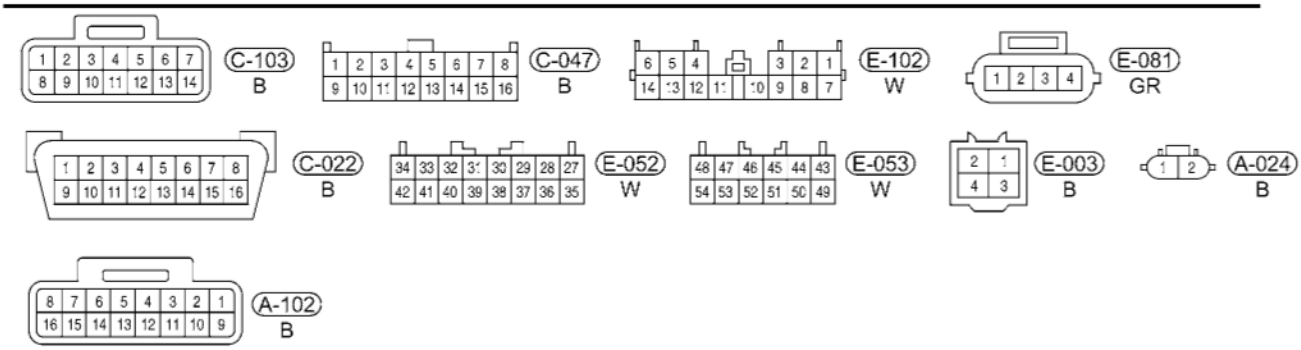


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ECM Connector Pin-Out Table

ECM PIN-OUT TABLE

PIN	CIRCUIT IDENTIFICATION	PIN	CIRCUIT IDENTIFICATION
1	Injector 1	39	-
2	Injector 3	40	-
3	-	41	A/C Pressure Switch
4	Idle Air Control 1	42	-
5	Idle Air Control 3	43	-
6	EGR Control	44	-
7	Lan 1	45	-
8	Fuel Pump Relay	46	-
9	EVAP Control	47	-
10	Ignition Coil 1	48	Diagnostic Link K
11	-	49	-
12	Switched Supply Voltage	50	RPM
13	GND	51	Lan 2
14	Injector 2	52	Upstream Oxygen Sensor Heater
15	Injector 4	53	-
16	-	54	Diagnostic Link K
17	Idle Air Control 2	55	Ignition Switch Start
18	Idle Air Control 4	56	Intake Air Temperature Sensor
19	Air Flow Sensor	57	-
20	-	58	-
21	Cooling Fan Control	59	Downstream Oxygen Sensor
22	A/C Relay	60	Upstream Oxygen Sensor
23	Ignition Coil 2	61	-
24	-	62	Knock Sensor
25	Switched Supply Voltage	63	-
26	GND	64	Continuous Supply Voltage
27	-	65	Regulated Sensor Supply
28	-	66	Ignition Switch On
29	Generator G	67	Engine Coolant Temperature Sensor
30	-	68	Throttle Position Sensor
31	-	69	Atmosphere Pressure Sensor
32	MIL Lamp	70	Speed In
33	Power Steering Switch	71	Idle Position Switch
34	Main Relay	72	Camshaft Position Sensor
35	-	73	Crankshaft Sensor
36	-	74	Air Flow Sensor
37	Generator FR	75	P/N Switch
38	-	76	Sensor (GND)

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DIAGNOSIS & TESTING

Diagnostic Help

1. Confirm that the malfunction is current and carry-out the diagnostic tests and repair procedures.
2. If the Diagnostic Trouble Code (DTC) cannot be deleted, it is a current fault.
3. Use a digital multimeter to perform voltage readings on the Electronic Fuel Injection (EFI) system.
4. The scan tool connects to the Data Link Connector (DLC) and communicates with the ECM.
5. If the failure is intermittent perform the following:
   - Check for loose connectors.
   - Look for any chafed, pierced, pinched, or partially broken wires.
   - Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.
   - Look for the data to change or for the DTC to reset during the wiggle test.
   - Look for broken, bent, pushed out or corroded terminals.
   - Inspect the sensor and mounting area for any condition that would result in an incorrect signal, such as damage or foreign material.
6. Remove the ECM from the troubled vehicle and install in a new vehicle and test. If the DTC can not be deleted, the ECM is malfunctioning. If the DTC can be deleted, return the ECM to the original vehicle.

Diagnostic Logic

If the DTC can not be deleted, it is a current failure.

If the DTC can be deleted, it is an intermittent incident. In many cases, the malfunction resolves itself (the part or circuit function returns to normal without intervention). It is important to realize that the symptoms described in the customer's complaint often do not recur on (1st trip) DTC visits. Realize also that the most frequent causes of intermittent incidents occurrences is poor electrical connections. Because of this, the conditions under which the incident occurred may not be clear. Therefore, circuit checks made as part of the standard diagnostic procedure may not indicate the specific malfunctioning area.

Check if it is because of the loosening of cable joint.

Look for any chafed, pierced, pinched, or partially broken wires.

Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.

Look for the data to change or for the DTC to reset during the wiggle test.

Look for broken, bent, pushed out or corroded terminals.

Inspect the sensor and mounting area for any condition that would result in an incorrect signal, such as damage, foreign material.

Refer to any Technical Service Bulletins that may apply.

DIAGNOSTIC REFERENCE

- Check ground terminals for corroding or loose connection. Refer to ″Ground Inspection″.
- Search for electrical incident. Refer to ″Diagnosis for an Electrical Incident″.
- Check connector terminals. Refer to ″How to Check Terminal″.

DURING ENGINE CHECKS AND REPAIRS USE CAUTION NOT TO HARM THE ENGINE MECHANICAL SYSTEM

- Check cylinder pressure.
- Check ignition timing.
- Check fuel system pressure.
- Check the EVAP system.
- Check for vacuum leaks.
- Check output of the TPS.
- Check the injectors for leaks.

Remove and install the doubtful ECM to a new vehicle and test it. If the DTC can not be deleted, the malfunction is inside of ECM; if the DTC can be deleted, change the original ECM back and check it again according to above items.

Inspect and clean all ECM, engine, and body grounds that are related to the DTC. If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits for any camshaft pulley DTCs inspect for dirt/metal debris.

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Use the scan tool to perform a System Test if one applies to a failing component. A co-pilot, data recorder, and/or oscilloscope should be used to help diagnose intermittent conditions.

CAUTION:
Before starting repairs which do not require battery power:
- **Turn ignition switch off.**
- **Disconnect the negative battery terminal.**

Ground Inspection

Ground connections are very important to the proper operation of electrical and electronic circuits. Ground connections are often exposed to moisture, dirt and other corrosive elements. The corrosion (rust) can become an unwanted resistance. This added resistance can alter the way a circuit works.

Electronically controlled circuits are very sensitive to proper grounding. A loose or corroded ground can drastically affect an electronically controlled circuit. A poor or corroded ground can effect the circuit. Perform the following when inspecting a ground connection:

1. Remove the ground bolt or screw.
2. Inspect all mating surface for tarnish, dirt, rust, etc.
3. Clean as required to assure good contact.
4. Reinstall bolt or screw securely.
5. Inspect for ″add-on″ accessories which may be interfering with the ground circuit.
6. If several wires are crimped into one ground eyelet terminal, check for proper crimps. Make sure all of the wires are clean, securely fastened and providing a good ground path. If multiple wires are crimped to one eyelet, make sure no excess wire insulation has been crimped creating a bad ground.

Diagnostic Tools

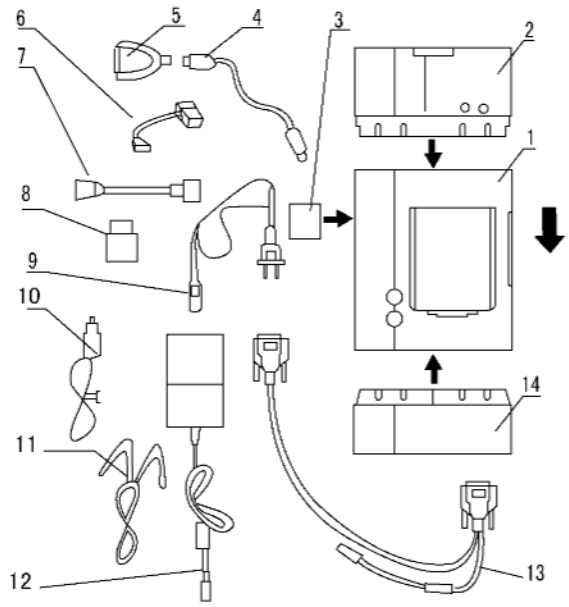
1. Scan Tool X-431
2. Engine Analyzer (KES-200)
3. Digital Multimeter
4. Jumper Wire

Hardware Requirements

The hardware configuration of X-431 is as follows:

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Diagnostic Scan Tool Configuration



besm030003

ITEM	NAME	DESCRIPTION
1	X-431 Main Unit	To Display Operational Buttons, Test Results, Help Information, etc.
2	Mini-Printer	To Print Test Results. (Optional)
3	CF Card	To Store Diagnostic Software and Data
4	USB Cable	To Connect CF Card Reader/Writer and Computer
5	CF Card Reader/Writer	To Read or Write Data On The CF Card
6	Mitsubishi-12+16 Pin Connector	To Diagnose Mitsubishi Electronic Control Systems On Chery B11 Series
7	Fiat-3 Pin Connector	To Diagnose Vehicles With Fiat-3 Pin Diagnostic Connector

ITEM	NAME	DESCRIPTION
8	Smart OBDII-16 Pin Connector	To Diagnose Other Systems Of Vehicle With OBDII-16 Pin Diagnostic Connector
9	Power Cord	To Connect AC 100 - 240 V Outlet and Power Adapter
10	Cigarette Lighter Cable	To Get Power From Vehicle Cigarette Lighter
11	Battery Cable W/Two Clips	To Get Power From Vehicle Battery
12	Power Adapter	To Convert 100 - 240 V AC Power Into 12 V DC Power
13	Main Cable	To Connect The Diagnostic Connector and Smartbox
14	Smartbox	To Perform Vehicle Diagnosis

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Diagnostic Trouble Code (DTC) List

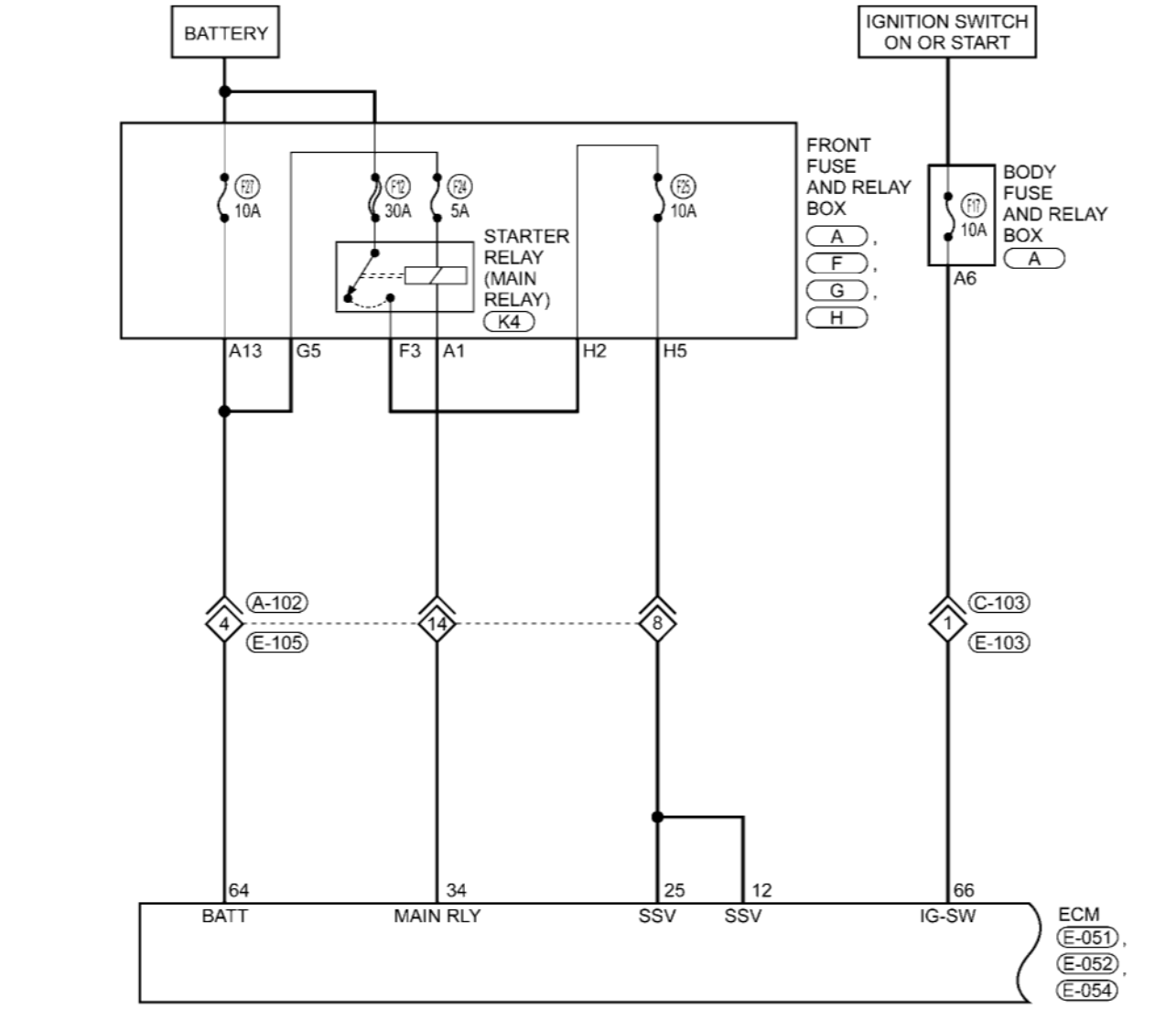
DTC	DTC DEFINITION
11	Oxygen Sensor
12	Air Flow Sensor
13	Air Temperature Sensor
14	Throttle Position Sensor
21	Coolant Temperature Sensor
22	Crankshaft Position Sensor
23	Camshaft Position Sensor
24	Speed Sensor
25	Atmosphere Pressure Sensor
31	Knock Sensor
36	Ignition Signal Terminal
41	Injector
44	Ignition Signal
54	Immobilizer Communication
61	Electronic 4AT Communication
64	ALT FR Signal

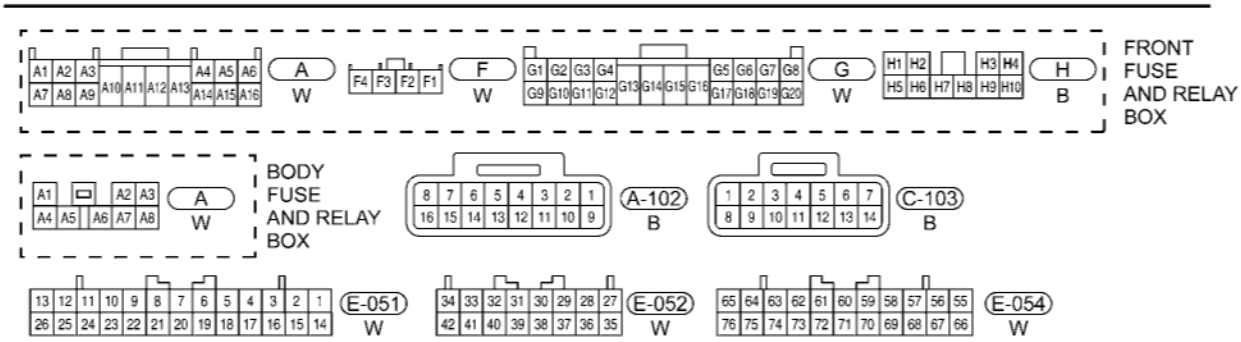
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ECM Power Supply and Ground Circuit Test

Power Supply And Ground Circuit Diagnostic Check

EEC - 2.4L - PWR - 01





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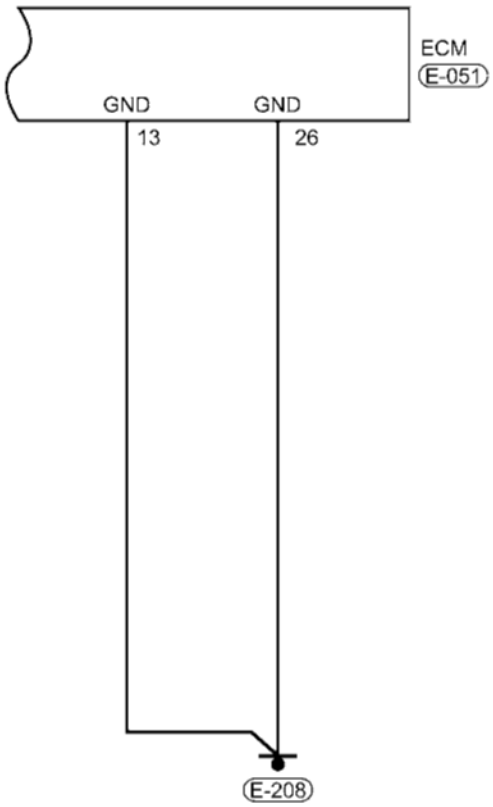
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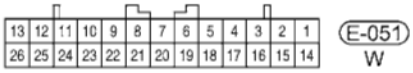
Check reference values between ECM terminals and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
12	Power supply for ECM	Ignition switch: ON	Battery Voltage (11 - 14 V)
25			
34	ECM relay	Ignition switch: OFF More than a few seconds after turning ignition switch OFF	Battery Voltage (11 - 14 V)
64	Battery	All time	Battery Voltage (11 - 14 V)
66	Ignition switch	Ignition switch: ON	Battery Voltage (11 - 14 V)
		Ignition switch: OFF	Approximately 0 V

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EEC - 2.4L - GND - 01





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Specification data are reference values and are measured between each terminal and ground.

TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
13	ECM ground	Ignition switch: ON	Approximately 0 V
26	ECM ground	Ignition switch: ON	Approximately 0 V

Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Start the engine and warm it to normal operating temperature.
- With the scan tool, select view data stream.
- If the data stream is not detected, the condition is current. Go to Diagnostic Procedure Step 1.
- If the data stream is detected, the condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. INSPECTION START

- Start engine.

Is engine running?

Yes >> Go to step 8.

No >> Go to step 2.

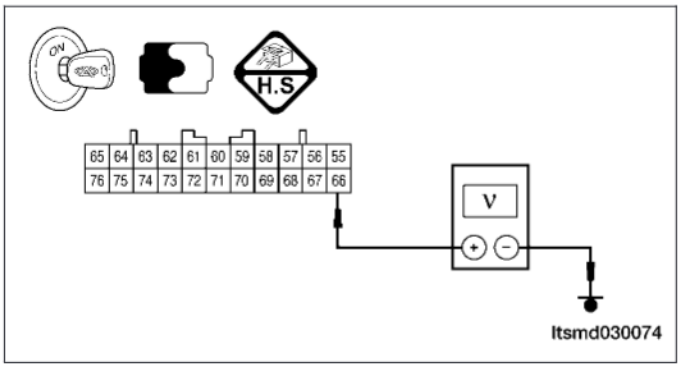
2. CHECK ECM POWER SUPPLY CIRCUIT - (1)

- Turn ignition switch OFF and then ON position.
- Check voltage between ECM terminal 66 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to step 3.



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3. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse 17
  - Harness connectors C-103, E-103, terminal 1
  - Front fuse and relay box connector A
  - Harness open or short between ECM and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning parts.

4. CHECK ECM POWER SUPPLY CIRCUIT - (2)

- Check voltage between ECM terminal 64 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Check the following:

- Harness connectors A-102, E-105, terminal 4
- Front fuse and relay box connector A
- Harness open or short between ECM and battery

5. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace ground connections.

6. CHECK ECM GROUND CIRCUIT FOR AN OPEN OR SHORT

- Disconnect ECM harness connector.
- Check harness continuity between ECM terminals 13, 26 and ground.
- Continuity should exist.
- Also check harness for short to power.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.

7. DETECT MALFUNCTIONING PART

- Check harness for open or short between ECM terminals 13, 26 and ground.
- Repair open circuit or short to power in harness or connectors.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power in harness or connectors.

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8. CHECK ECM POWER SUPPLY CIRCUIT - (3)

- Turn ignition switch on and then off.
- Check voltage between ECM terminals 12, 25 and ground.
- Voltage: Turn ignition switch on battery voltage will be exist and after turning ignition switch off, battery voltage will exist a few seconds, then drop to approximately 0 V.

Is the check result normal?

Yes >> Check the starting system.

No >> Go to the next step.

9. CHECK STARTER RELAY SUPPLY VOLTAGE

- Turn ignition switch off. Wait for at least 10 seconds.
- Check voltage between ECM terminal 34 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Go to step 11.

10. CHECK ECM POWER SUPPLY CIRCUIT - (4)

- Disconnect ECM harness connector.
- Disconnect front fuse and relay box harness connector F.
- Check harness continuity between ECM terminals 12, 25 and front fuse and relay box terminal F3.
- Continuity should exist.
- Also check harness for short to ground and short to power.

Is the check result normal?

Yes >> Go to step 12.

No >> Repair circuit for an open or short in harness or connectors.

11. CHECK STARTER RELAY CIRCUIT

- Disconnect ECM harness connector.
- Disconnect front fuse and relay box harness connector A, G.
- Check harness continuity between ECM terminal 34 and front fuse and relay box terminal A1.
- Check harness continuity between front fuse and relay box terminal A1 and G5,
- Check harness continuity between front fuse and relay box terminal A13 and G5,
- Continuity should exist.
- Also check harness for short to ground and short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to ground or short to power in harness or connectors.

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12. CHECK FUSE

- Disconnect fuse 12 (30A), fuse 24 (5A), fuse 25 (10A), front fuse and relay box.
- Check fuse.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace fuse 12, 23, 24.

13. CHECK FRONT FUSE AND RELAY BOX

- Check front fuse and relay box.
- Check harness continuity between front fuse and relay box and battery.

Is the check result normal?

Yes >> Replace the ECM.

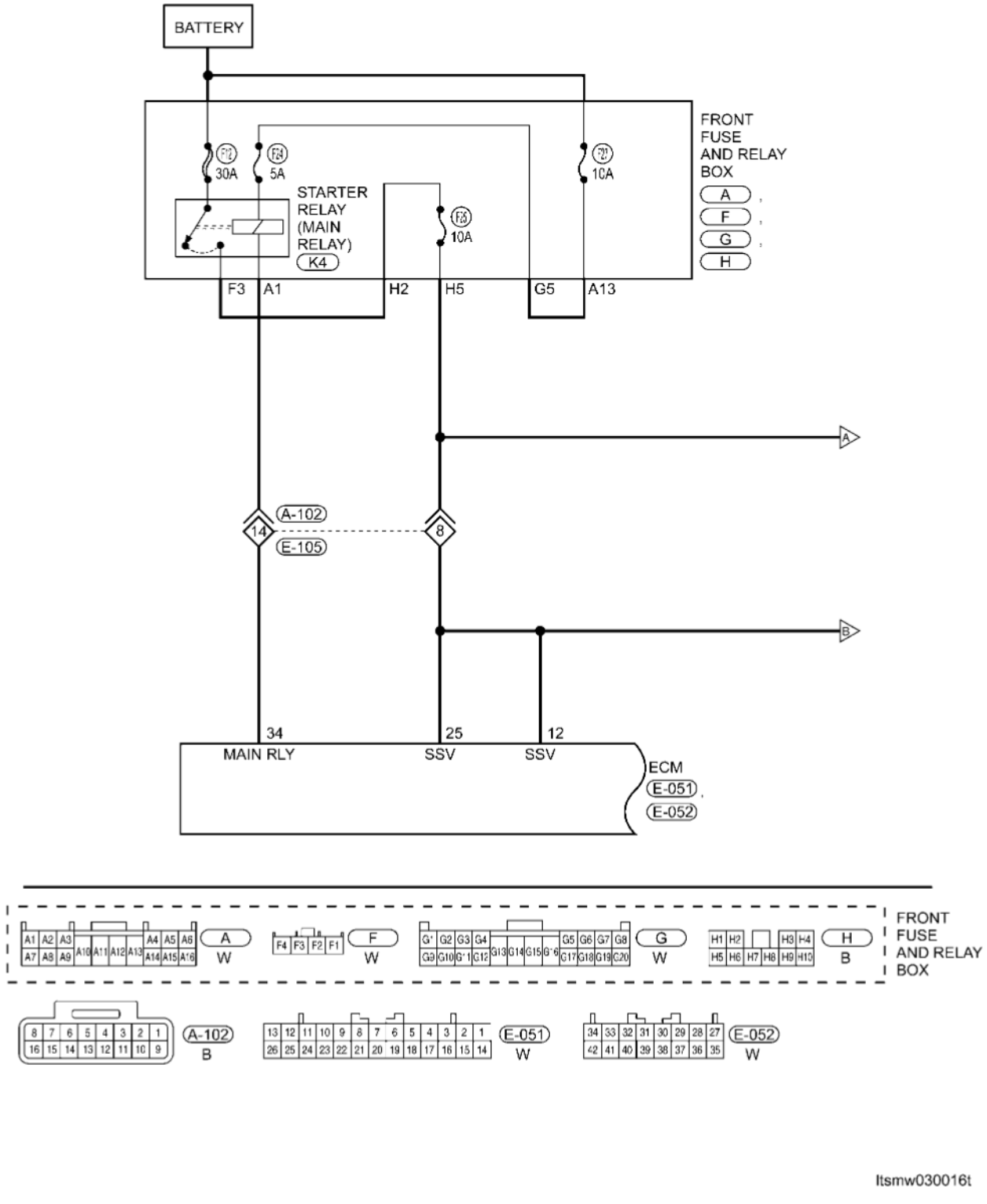
No >> Replace or repair front fuse and relay box or harness.

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Diagnostic Trouble Code (DTC) Tests

11 - Oxygen Sensor

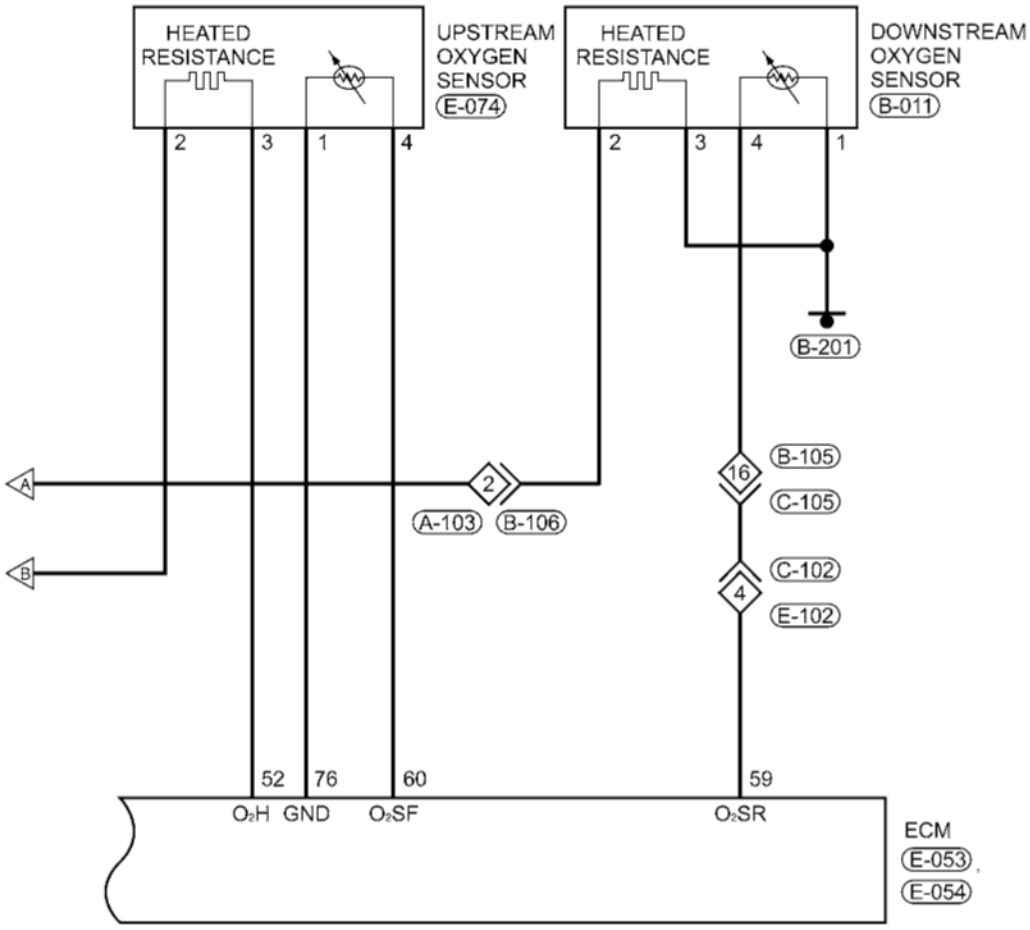
EEC - 2.4L - O_2S - 01

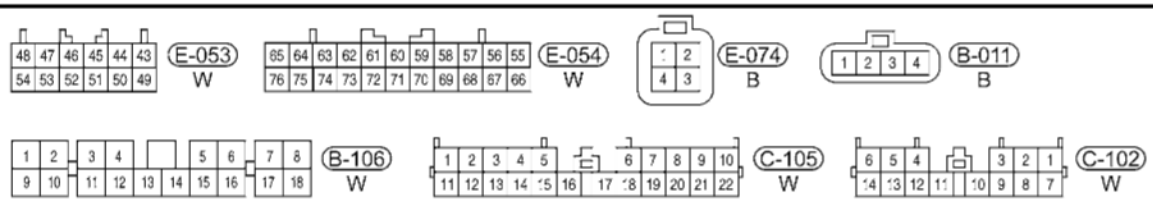


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EEC - 2.4L - O_2S - 02





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ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
52	Upstream oxygen sensor heating	• Warm-up condition • Idle	0 - 3 V
		• Engine is running • Keep the engine speed 5000 RPM	System voltage
59	Downstream oxygen sensor	• Engine is running • Warm-up condition • Keep the engine speed 2000 RPM	0 - 0.8 V (recycle)
60	Upstream oxygen sensor	• Engine is running • Warm-up condition • Keep the engine speed 2000 RPM	0 - 0.8 V (recycle)
76	Sensor (GND)	• Warm-up condition • Idle	Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
11	Oxygen sensor	Engine is running	• Fuel quality • Oxygen sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it up to the normal operating temperature.
- Turn ignition switch off and wait at least 10 seconds.
- Start engine and keep the engine speed 2000 RPM for at least 1 minute.
- Let engine idle for 2 minutes and select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
Before performing the following procedure, make sure that ECM ground connections are in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTION.

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection B-201 (See Vehicle Wiring Harness Layout - Body Harness in Section 16 Wiring).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Control Harness (With MITSUBISHI 2.4L Engine) in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace the ground connection.

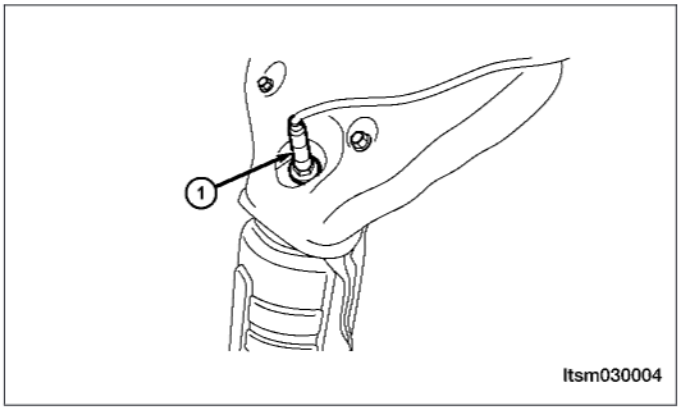
2. CHECK UPSTREAM O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the upstream O_2 sensor (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



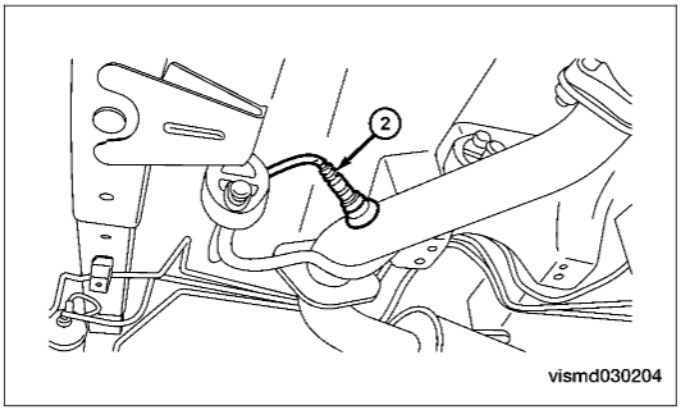
3. CHECK DOWNSTREAM O_2 SENSOR ELECTRICAL CONNECTOR

- Disconnect the downstream O_2 sensor (2) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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4. CHECK THE O_2 SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Disconnect ECM harness connector.
- Check harness continuity between upstream O_2 sensor terminal 1 in connector E-074 and ECM terminal 76 in connector E-054.
- Check harness continuity between downstream O_2 sensor terminal 1 in connector B-011 and ground.
- Continuity should exist.
- Check harness for a short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair the circuits for an open or short to power or short to ground in harness or connectors.

5. CHECK THE O_2 SENSOR INPUT SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between ECM terminal and O_2 sensor terminal as follows.
- Continuity should exist.
- Check harness continuity between following terminals and ground.
- Continuity should not exist.

COMPONENT	ECM TERMINAL	O_2 SENSOR TERMINAL
Upstream O_2 sensor	60	4
Downstream O_2 sensor	59	4

- Also Check harness short to power supply circuit.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

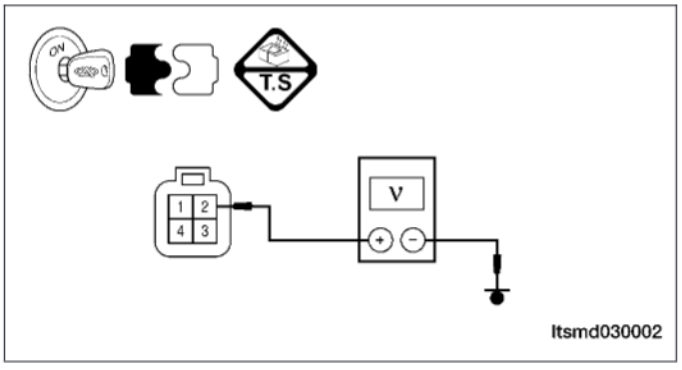
6. CHECK O_2 SENSOR POWER SUPPLY

- Turn ignition switch on.
- Check power supply between O_2 sensor E-074, terminal 2 and ground.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



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7. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse 25, Fuse 12, Fuse 24
  - Front fuse and relay box H5
  - Harness connectors A-102, E-105
  - Harness open or short between O_2 sensor and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning parts.

8. CHECK O_2 SENSOR HEATER CONTROL CIRCUIT FOR AN OPEN AND SHORT

- Turn ignition switch off.
- Check harness continuity between ECM terminal and O_2 sensor terminal.

COMPONENTS	ECM	O_2 SENSOR
TERMINAL	52	3

- Continuity should exist.
- Check harness short to power supply circuit and ground.

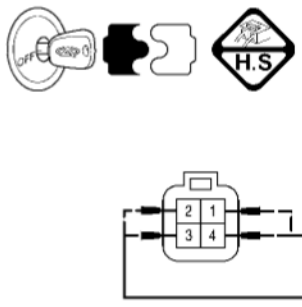
Is the check result normal?

Yes >> Go to the next step.

No >> Repair the circuit for an open or short to power supply circuit or ground in harness or connectors.

9. CHECK O_2 SENSOR HEATER

- Check resistance between O_2 sensor terminals.

TERMINAL NO.	RESISTANCE	
2 & 3 (including cable and connector)	Approximately 9 Ω	
1 & 2 and 1 & 3	∞ Ω (Continuity should not exist)	
4 & 2 and 4 & 3		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace O_2 sensor.

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10. CHECK O_2 SENSOR

- Connect O_2 sensor connector.
- Connect ECM connector.
- If with the X-431, reference data stream value.
- If without the X-431, as following.
  - Start engine and warm it up to normal operating temperature.
  - Turn ignition switch off.
  - Start engine and keep the engine speed between 3.500 and 4,000 RPM for at least 1 minute.
  - Let engine idle for 1 minute.
  - Set digital multimeter probes between ECM terminal 60 and ground.

CHECK ITEM	CHECK CONTENT		NORMAL VALUE
Oxygen sensor	• Warm-up condition • Become lean while decelerate	Decelerate from 4,000 RPM suddenly	below 200 mV
	• Warm-up condition • Become rich while accelerate	Accelerate suddenly	600 - 1,000 mV
	• Warm-up condition • Check with O_2 sensor signal	Idle	100 - 900 mV
		2500 RPM	600 - 1,000 mV

Is the check result normal?

Yes >> Go to the next step.

No >> Replace O_2 sensor.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 11 still present?

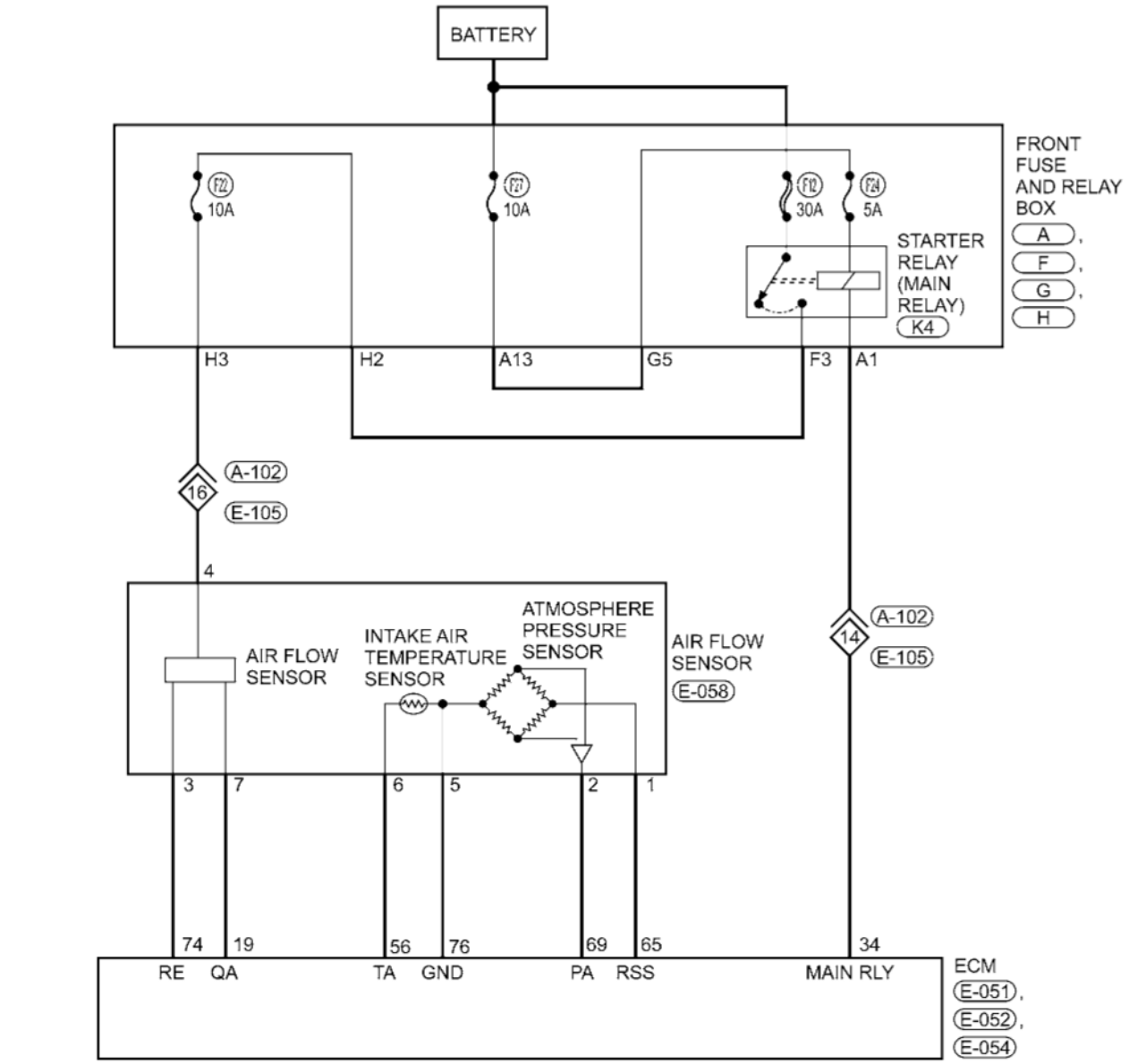
Yes >> Replace the ECM.

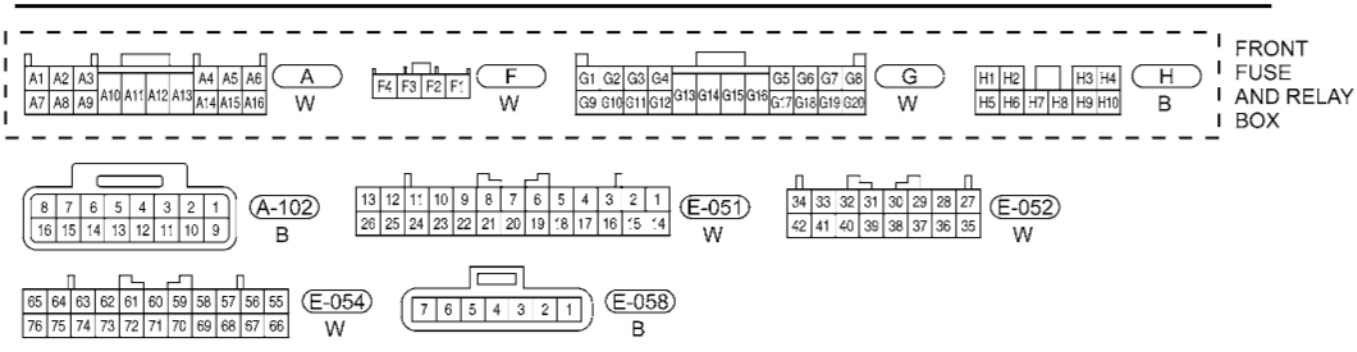
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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12 - Air Flow Sensor

EEC - 2.4L - MAF - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
19	Air flow sensor	• Engine is running • Warm-up condition • Idle	0 - 1 V
		• Engine is running: 3,000 RPM	6 - 9 V
74	Air flow sensor	• Engine is running • Warm-up condition • Idle	2.2 - 3.2 V
		• Engine is running: 2,500 RPM	

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
12	Air flow sensor	Engine speed is above 500 RPM	Sensor output frequency is below 3 HZ for 4 seconds.	• Air flow sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on and record and erase DTC.
- Start engine and keep the engine speed above 500 RPM and select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
Before performing the following procedure, make sure that the ECM connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

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2. CHECK AIR FLOW SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the air flow sensor electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.

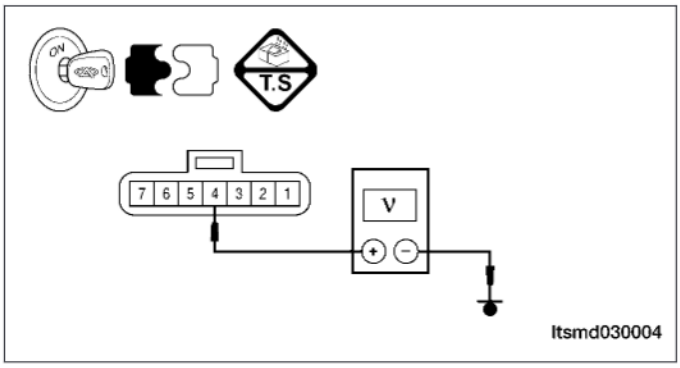
3. CHECK AIR FLOW SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between air flow sensor terminal 4 and ground in the air flow sensor electrical connector E-058.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



4. DETECT MALFUNCTIONING PART

- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box H3
  - Fuse 22, Fuse 12
  - Harness open or short between air flow sensor and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning parts.

5. CHECK MAF SENSOR REFERENCE VOLTAGE

- Check reference voltage between air flow sensor terminal 7 and ground in the air flow sensor electrical connector E-058.
- 4.8 - 5.2 V should exist.

Is the check result normal?

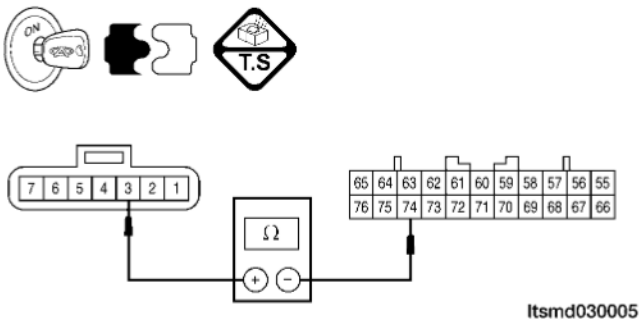
Yes >> Go to step 7.

No >> Go to the next step.

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6. CHECK MAF SENSOR REFERENCE CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

AIR FLOW SENSOR TERMINAL	ECM TERMINAL	
3	74	

- Continuity should exist.
- Check harness for short to power or short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short to power or short to ground in harness or connectors.

7. CHECK MAF SENSOR

- Connect air flow sensor connector.
- Connect ECM connector.
- With digital multimeter and the X-431, check sensor signal output data and data stream value.

CAUTION:
To new vehicle (less than 500 km mileage), the sensor output frequency is 10 % higher than standard value.

CHECK ITEM	CHECK CONTENT		NORMAL VALUE
Air flow sensor	• Engine coolant temperature: 80 - 95°C • Lamp and all other condition: OFF • Transaxle: Neutral	• Engine is running • Warm-up running • Idle	19 - 45 HZ
		• Engine is running: 2,500 RPM	72 - 112 HZ
		• Engine is accelerating	Frequency direct proportion with speed

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- Check the sensor signal output data and data stream value.

TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
19	Air flow sensor	• Engine is running • Warm-up running • Idle	0 - 1 V
		• Engine is running: 3,000 RPM	6 - 9 V
74	Air flow sensor	• Engine is running • Warm-up running • Idle	2.2 - 3.2 V
		• Engine is running: 2,500 RPM	

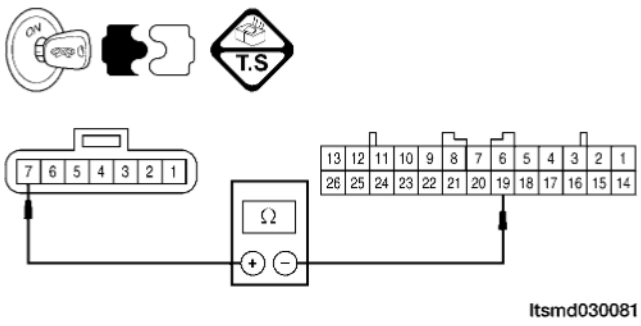
Is the check result normal?

Yes >> Go to step 9.

No >> Go to the next step.

8. CHECK MAF SENSOR REFERENCE CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

AIR FLOW SENSOR TERMINAL	ECM TERMINAL	
7	19	

- Continuity should exist.
- Check harness for short to power or short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuits for an open or short to power or short to ground in harness or connectors.

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9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 12 still present?

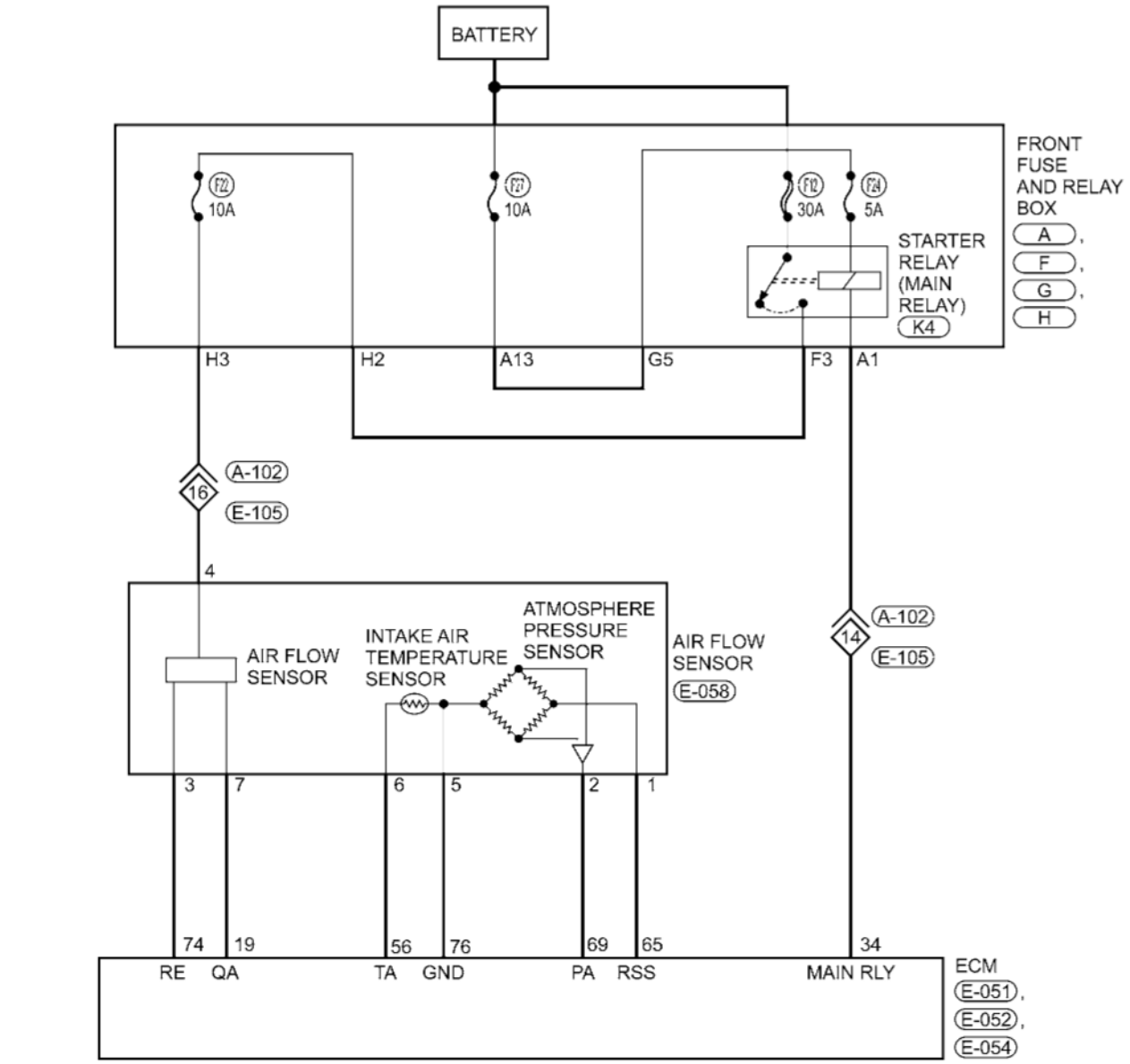
Yes >> Replace the ECM.

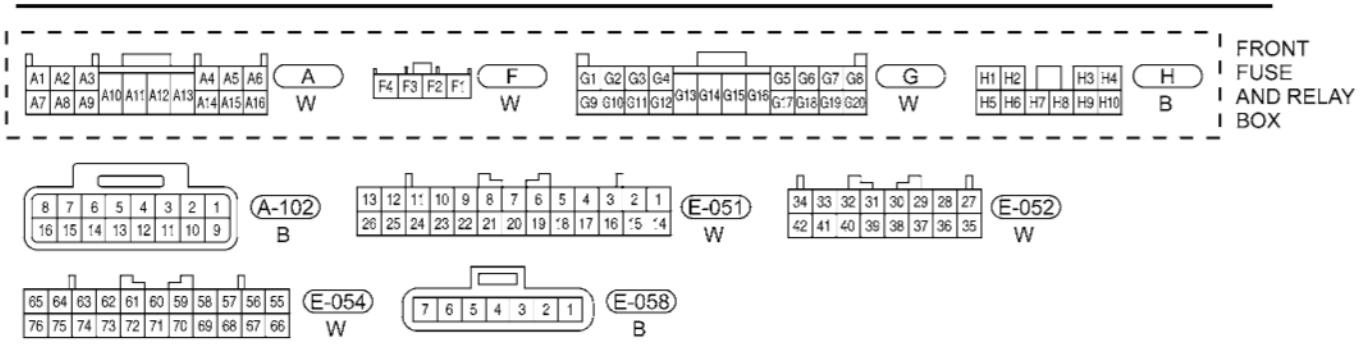
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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13 - Air Temperature Sensor

EEC - 2.4L - MAF - 01





ltsmw030013t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
56	Intake Air Temperature (IAT) sensor	Ignition switch: ON	IAT: 0°C	3.2 - 3.8 V
			IAT: 20°C	2.3 - 2.9 V
			IAT: 40°C	1.5 - 2.1 V
			IAT: 80°C	0.4 - 1.0 V
76	Sensor (GND)	Ignition switch on		0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
13	Air temperature sensor	• Ignition switch ON position for 60 seconds • Engine: Running	• Signal output is over 4.6 V for 4 seconds continuously (amount to -45°C intake air temperature). • Signal output is below 0.2 V for 4 seconds continuously (amount to 125°C intake air temperature).	• Intake Air Temperature (IAT) sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
Before performing the following procedure, make sure that the ECM connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

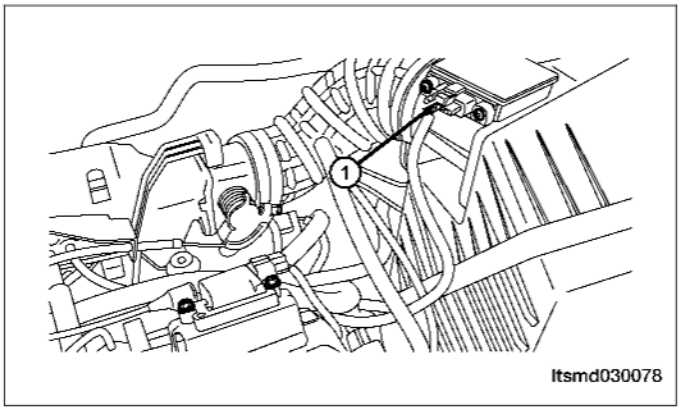
2. CHECK INTAKE AIR TEMPERATURE (IAT) SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the IAT sensor (IAT sensor is built-into) (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



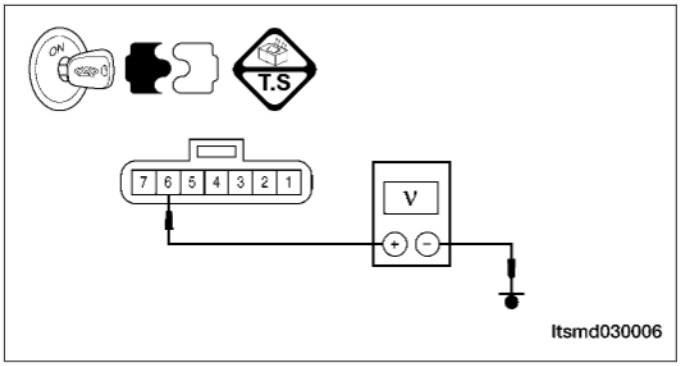
3. CHECK THE INTAKE AIR TEMPERATURE (IAT) SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between IAT sensor terminal 6 and ground in the IAT sensor electrical connector E-058.
- 4.5 - 4.9 V should exist.

Is the check result normal?

Yes >> Go to the next step.

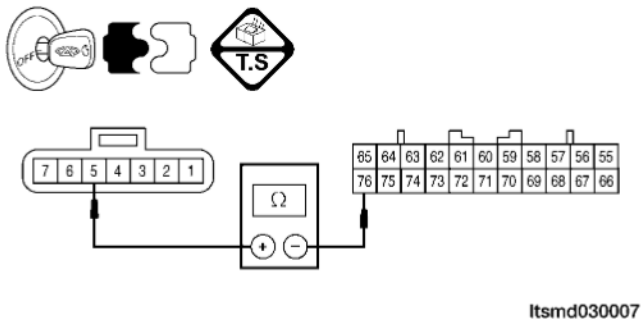
No >> Repair the circuit for an open or short to power or short to ground in harness or connectors.
If the circuit is normal, go to the next step.



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4. CHECK IAT SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

A/T SENSOR TERMINAL	ECM TERMINAL	CONTINUITY	
5	76	Yes	

- Continuity should exist.
- Check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

5. CHECK IAT SENSOR

- Check resistance between MAF sensor terminal 5 and 6 under the following conditions:

IAT°C	RESISTANCE KΩ
20°C	2.3 - 3.0
80°C	0.30 - 0.42

- Connect IAT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check sensor signal output.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
56	IAT sensor	Ignition switch: ON	IAT: 0°C	3.2 - 3.8 V
			IAT: 20°C	2.3 - 2.9 V
			IAT: 40°C	1.5 - 2.1 V
			IAT: 80°C	0.4 - 1.0 V
76	Sensor (GND)	Ignition switch: ON		0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace IAT sensor.

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6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 13 still present?

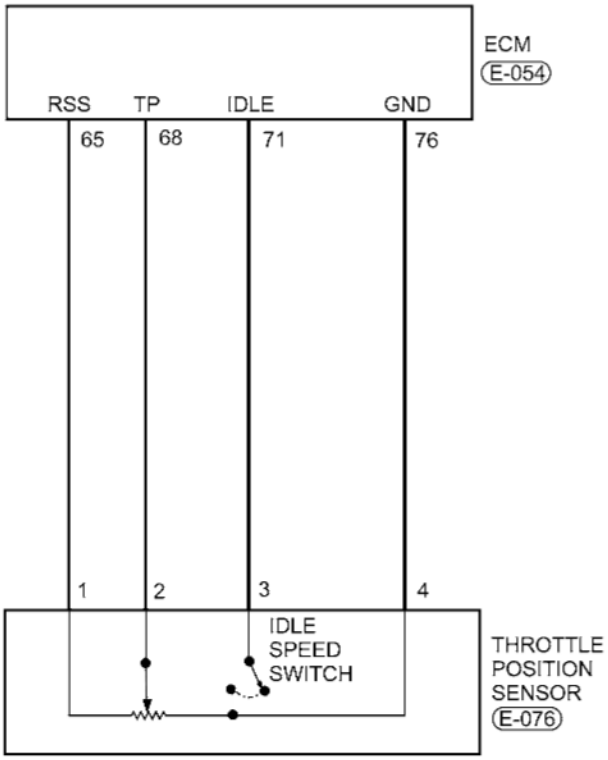
Yes >> Replace the ECM.

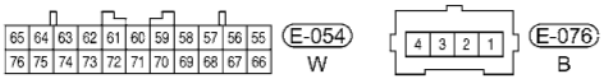
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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14 - Throttle Position Sensor

EEC - 2.4L - TPS - 01





ltsmw030014t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
65	Regulated sensor supply	Ignition switch: ON	-	Approximately 5 V
68	Throttle Position (TP) sensor		TP is in idle position	0.3 - 1.0 V
			TP is full opening	4.5 - 5.5 V
71	Idle position switch		Adjust TP to idle position	0 - 1 V
			TP is ajar	Above 4 V
76	Sensor (GND)		-	Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
14	Throttle position sensor	Ignition switch on for 60 seconds or after engine start	• Idle position switch is in ON position and output is over 2 V for 4 seconds continuously. • Signal output is below 0.2 V for 4 seconds continuously.	• Throttle Position Sensor (TPS) or misalignment • Harness or connectors • Idle position switch ON position is not normal • Idle position switch signal circuit shorted • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
Before performing the following procedure, make sure that the ECM connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

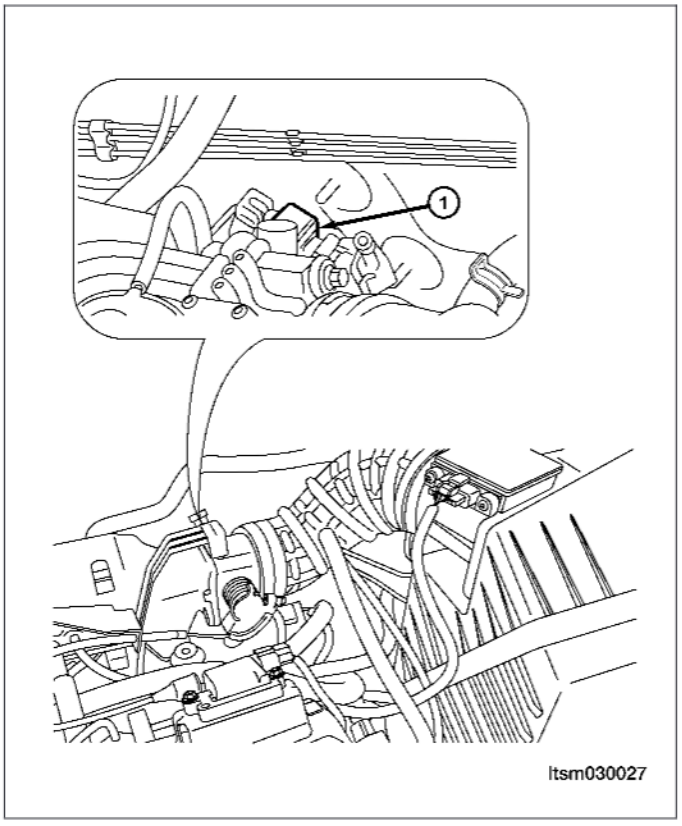
2. CHECK THROTTLE POSITION SENSOR (TPS) ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the TPS (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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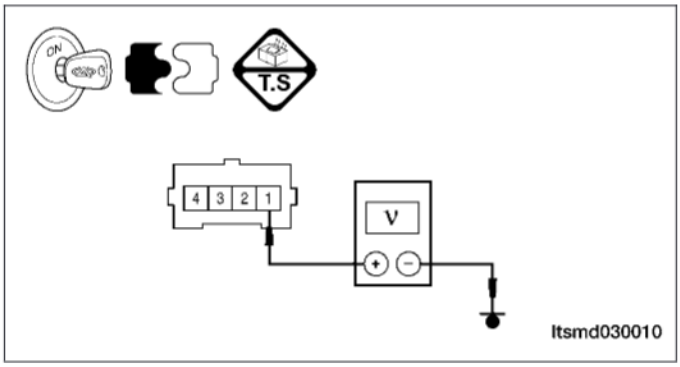
3. CHECK THE THROTTLE POSITION SENSOR (TPS) POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between TPS terminal 1 and ground in the TPS electrical connector E-076.
- 4.5 - 5.5 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair the circuit for an open or short to power supply or ground in harness or connectors.
If the circuit is normal, go to the next step.



4. CHECK THE TPS SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

TPS TERMINAL	ECM TERMINAL
2	68

- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair the circuit for an open or short to power or short to ground in harness or connectors.

5. CHECK TPS IDLE SWITCH CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between following terminals.

TPS TERMINAL	ECM TERMINAL
3	71

- Continuity should exist.
- Check harness for short to power or short to ground.

Is the check result normal?

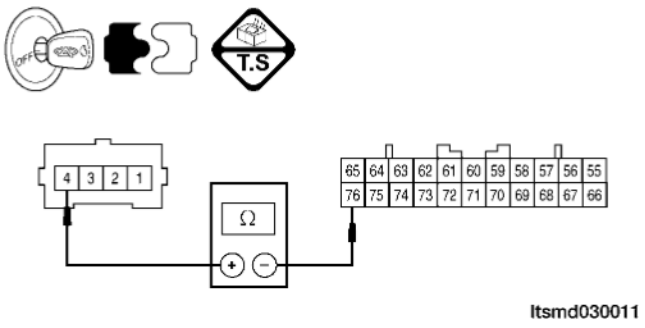
Yes >> Go to the next step.

No >> Repair the circuit for an open or short to power or short to ground in harness or connectors.

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6. CHECK TPS GROUND CIRCUIT FOR AN OPEN OR SHORT

- Check harness continuity between following terminals.

TPS TERMINAL	ECM TERMINAL	
4	76	

- Continuity should exist.
- Check harness for short to power.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair the circuit for an open or short to power in harness or connectors.

7. CHECK THE TPS RESISTANCE

- Check the resistance between TPS terminal 1 and terminal 3.
- 28 - 33 Ω (20°C) should exist.
- Also check the resistance between TPS terminal 2 and terminal 4 while turn the throttle.
- The resistance should linear change.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.

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8. CHECK THE TPS SIGNAL

- Turn ignition switch off.
- Connect ECM connector.
- Connect TPS connector.
- Turn ignition switch on.
- Check voltage between TPS terminal 2 and terminal 3 and ground under the following conditions:

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
65	Regulated sensor supply	Ignition switch: ON	-	Approximately 5 V
68	Throttle Position (TP) sensor		TP is in idle position	0.3 - 1.0 V
			TP is fully opened	4.5 - 5.5 V
			TP is open step by step	Value is directly proportional to TP opening angle
71	Idle position switch		Adjust TP to idle position	0 - 1 V
			TP is ajar	Above 4 V
76	Sensor (GND)		-	Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the TPS.

9. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 14 still present?

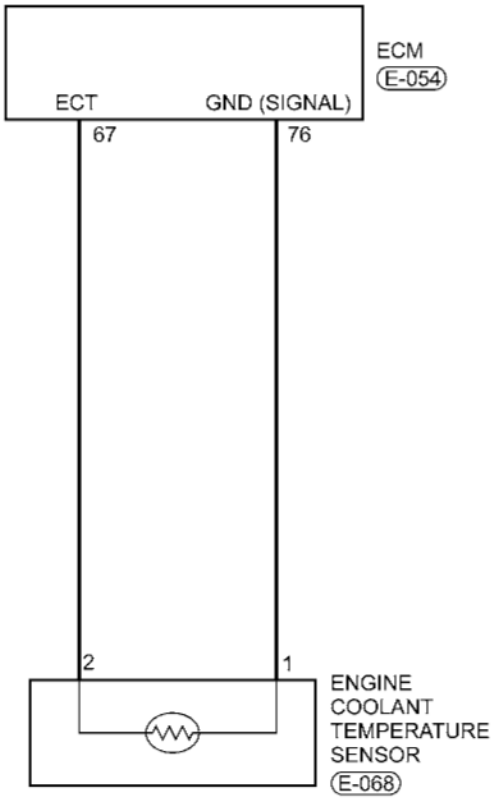
Yes >> Replace the ECM.

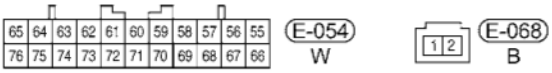
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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21 - Coolant Temperature Sensor

EEC - 2.4L - ECT - 01





ltsmw030005t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
67	Engine Coolant Temperature (ECT) sensor	Ignition switch: ON	ECT: 0°C	3.2 - 3.8 V
			ECT: 20°C	2.3 - 2.9 V
			ECT: 40°C	1.3 - 1.9 V
			ECT: 80°C	0.3 - 0.9 V
76	Sensor (GND)		-	Approximately 0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
21	Coolant temperature sensor	• Ignition switch: ON position for 60 seconds • Engine: Running	• Signal output is above 4.6 V for 4 seconds continuously (amount to -45°C engine coolant temperature). • Signal output is below 0.1 V for 4 seconds continuously (amount to 145°C engine coolant temperature).	• Engine Coolant Temperature (ECT) sensor • Harness or connectors • ECM
		• Ignition switch: ON • Engine speed is above 500 RPM	• Signal output raise from below 1.6 V to above 1.6 V (amount to 40°C engine coolant temperature). • Signal output is above 1.6 V for 5 minutes.	

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
Before performing the following procedure, make sure that the ECM connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

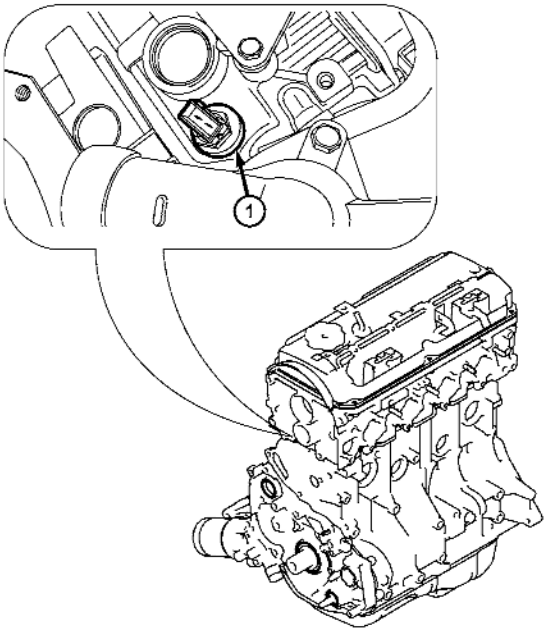
2. CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR ELECTRICAL CONNECTOR

- Disconnect the ECT (1) electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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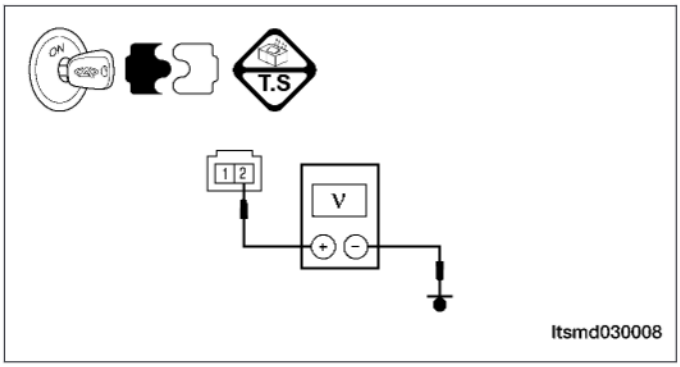
3. CHECK ENGINE COOLANT TEMPERATURE (ECT) SENSOR SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check reference voltage between sensor terminal 2 and ground in the sensor electrical connector E-068.
- 4.5 - 4.9 V should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



4. DETECT MALFUNCTIONING PART

- Turn ignition switch off.
- Disconnect ECM connector.
- Check harness for an open or short between ECT connector terminal 2 and ECM connector E-054, terminal 67.

Is the check result normal?

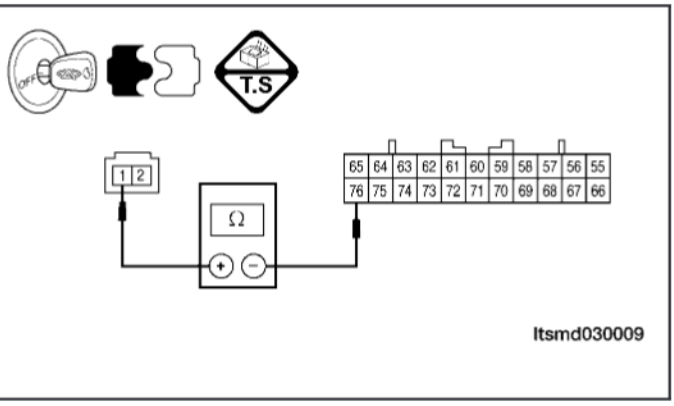
Yes >> Replace the ECM.

No >> Repair circuit for an open or short in harness or connectors.

5. CHECK ECT SENSOR GROUND CIRCUIT FOR AN OPEN AND SHORT

- Check harness continuity between following terminals.

ECT SENSOR TERMINAL	ECM TERMINAL
1	76



- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short to power or short to ground in harness or connectors.

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6. CHECK THE ECT SENSOR

- Check resistance between ECT sensor terminal 1 and 2.

ECT°C	RESISTANCE KΩ
0°C	5.1 - 6.5
20°C	2.1 - 2.7
40°C	0.9 - 1.3
80°C	0.26 - 0.36

- Connect ECT sensor connector.
- Connect ECM connector.
- Turn ignition switch on.
- Check sensor signal output.

TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
67	ECT sensor	Ignition switch: ON	ECT: 0°C	3.2 - 3.8 V
			ECT: 20°C	2.3 - 2.9 V
			ECT: 40°C	1.3 - 1.9 V
			ECT: 80°C	0.3 - 0.9 V
76	Sensor (GND)		-	Approximately 0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace ECT sensor.

7. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 21 still present?

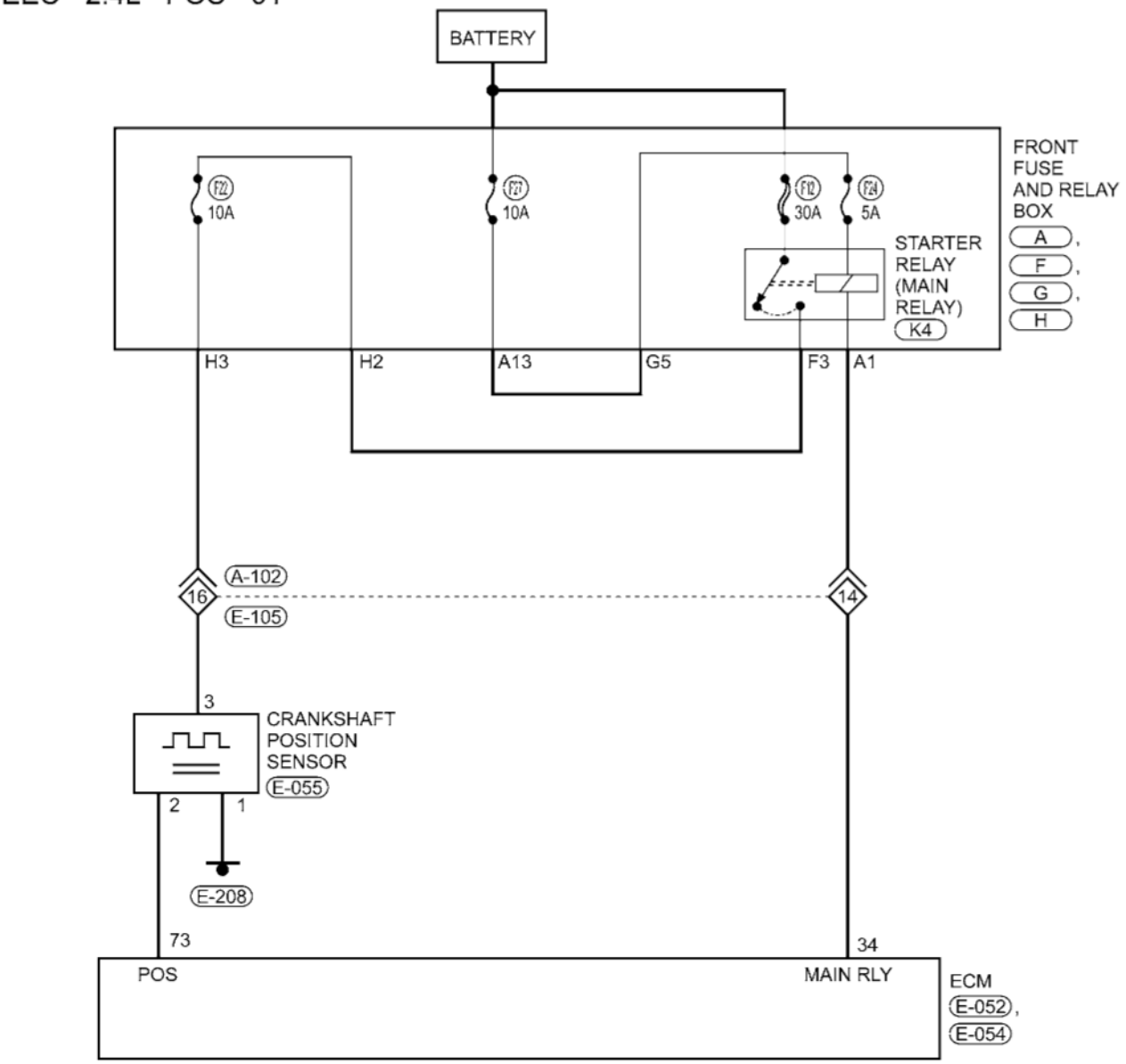
Yes >> Replace the ECM.

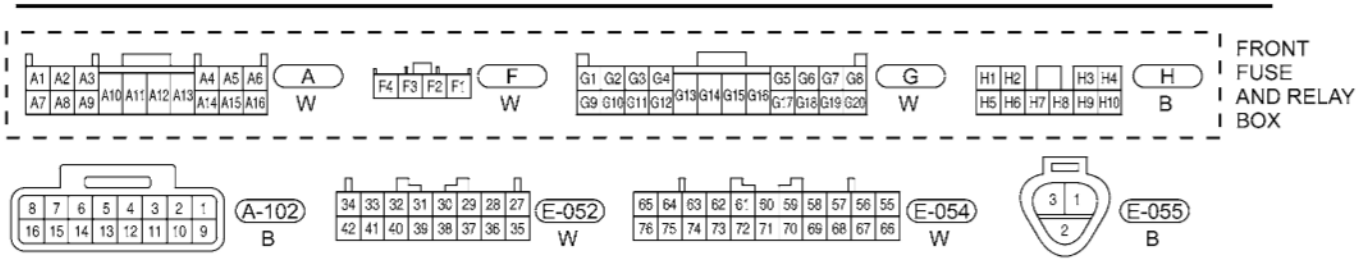
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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22 - Crankshaft Position Sensor

EEC - 2.4L - POS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC Voltage)
73	Crankshaft Position (CKP) sensor	Ignition switch: ON Engine: Not cranking	4.8 - 5.2 V
		Engine: Cranking	0.4 - 4.0 V
		Engine: Idle	1.5 - 2.5 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
22	CKP sensor	Crank engine	Signal output is no variance for 4 seconds continuously (no pulse signal).	• CKP sensor • Harness or connectors • Signal plate gear tooth • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
Before performing the following procedure, make sure that the ECM connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

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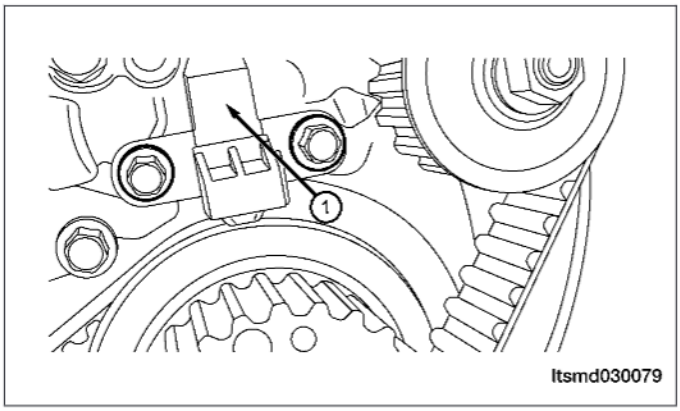
2. CHECK CRANKSHAFT POSITION (CKP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the CKP electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



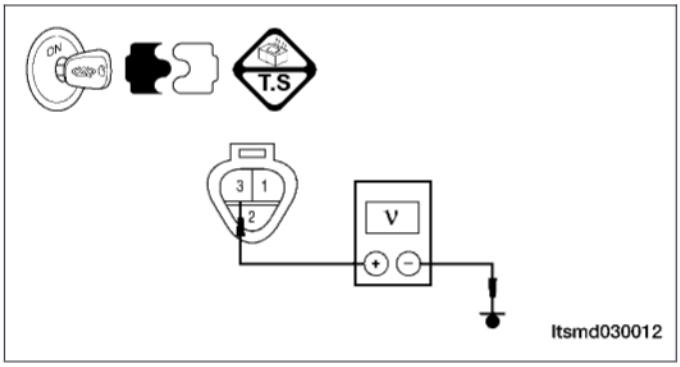
3. CHECK CRANKSHAFT POSITION (CKP) SENSOR POWER SUPPLY CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check supply voltage between CKP sensor terminal 3 and ground in the CKP sensor electrical connector E-055.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



4. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse 22, Fuse 12
  - Front fuse and relay box H3
  - Harness connectors A-102, E-105
  - Harness open or short between CKP sensor and fuse

Is the check result normal?

Yes >> Go to the next step.

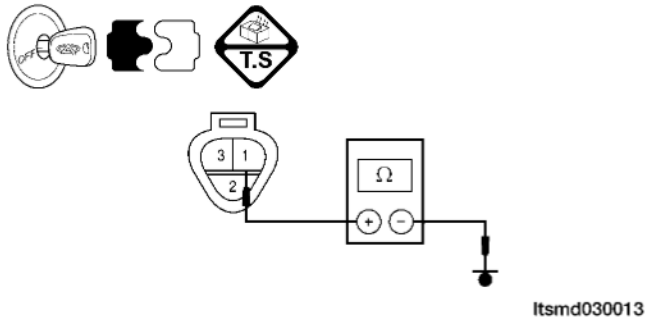
No >> Repair or replace malfunctioning parts.

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5. CHECK CKP SENSOR GROUND CIRCUIT FOR OPEN OR SHORT TO POWER

- Turn ignition switch off.
- Check harness continuity between following terminals.

CKP SENSOR TERMINAL	TERMINAL	CONTINUITY
1	Ground	Yes



- Continuity should exist.
- Also check harness for short to power.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

6. DETECT MALFUNCTIONING PART

- Check harness for an open or short between CKP sensor and ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace harness or connectors.

7. CHECK CKP SENSOR REFERENCE VOLTAGE

- Turn ignition switch on.
- Check voltage between CKP sensor terminal 2 and ground.
- 4.8 - 5.2 V should exist.

Is the check result normal?

Yes >> Go to step 9.

No >> Go to the next step.

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8. CHECK CKP SENSOR INPUT SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM connector.
- Check harness continuity between ECM terminal 73 and CKP sensor terminal 2.
- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Replace the ECM.

No >> Repair circuit for an open or short circuit in harness or connectors.

9. CHECK CKP SENSOR SIGNAL

- Turn ignition switch off.
- Connect ECM connector.
- Connect CKP sensor connector.
- Check sensor signal output.

TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
73	Crankshaft Position (CKP) sensor	• Ignition switch: ON • Engine: Not cranking	4.8 - 5.2 V
		• Engine: Cranking	0.4 - 4.0 V
		• Engine: Idle	1.5 - 2.5 V

Is the check result normal?

Yes >> Go to step 12.

No >> Go to the next step.

10. CHECK CKP SENSOR

- Check resistance as table shown:
  - Remove the sensor.
  - Visually check the sensor for chipping.
  - Continuity should exist.

TERMINAL NO.	RESISTANCE Ω (25°C)
1 & 2	Except 0 or ∞
1 & 3	
2 & 3	

Is the check result normal?

Yes >> Replace the CKP sensor with a known good CKP sensor.
Monitor the CKP sensor signal on the KES-200 screen.
- If the CKP sensor signals were normal, the system is OK.
- If the CKP sensor signals were still irregular or missing, go to step 11.

No >> Replace CKP sensor.

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11. CHECK GEAR TOOTH

- Visually check for chipping signal plate gear tooth.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the signal plate.

12. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is the check result normal?

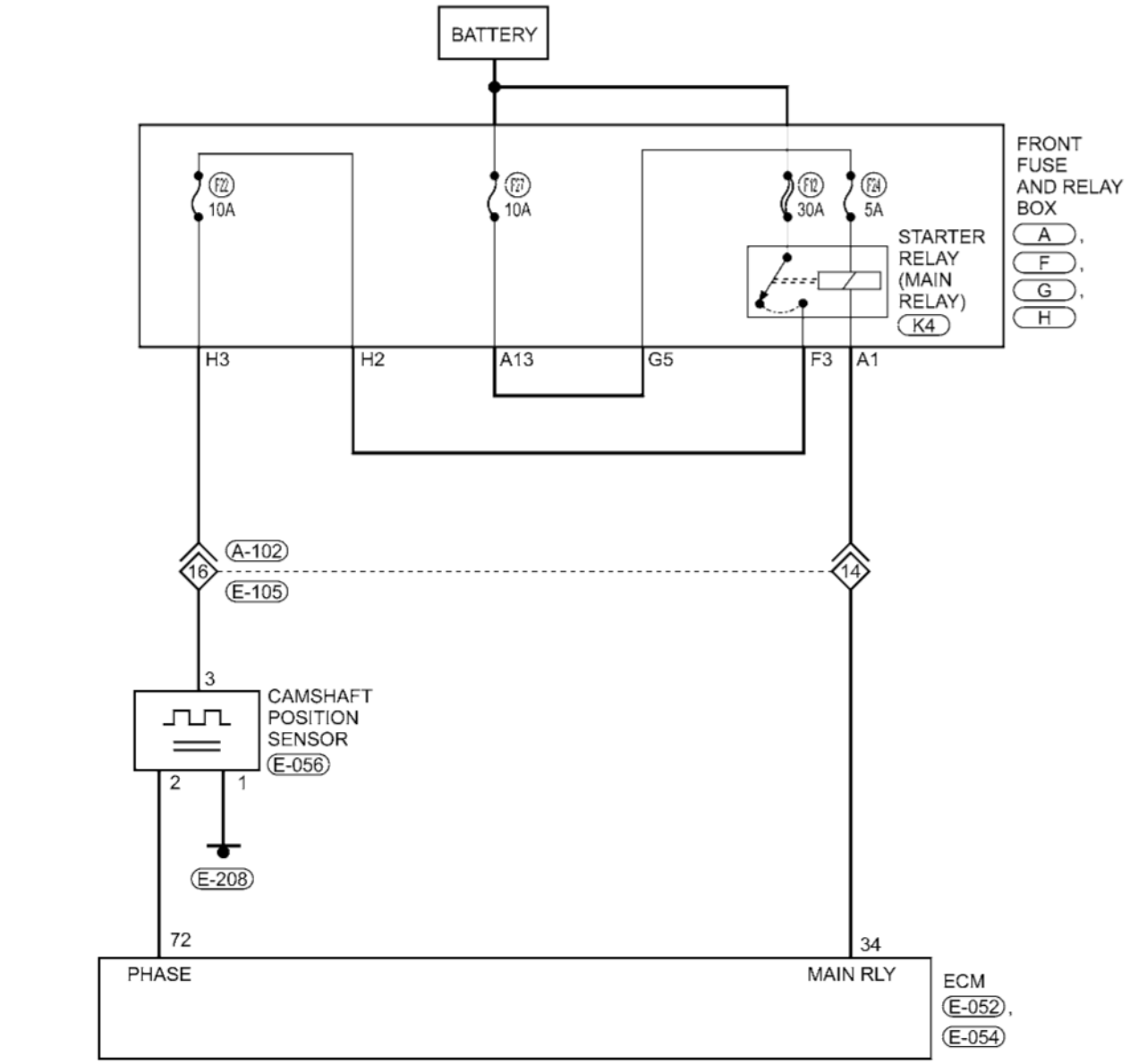
Yes >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

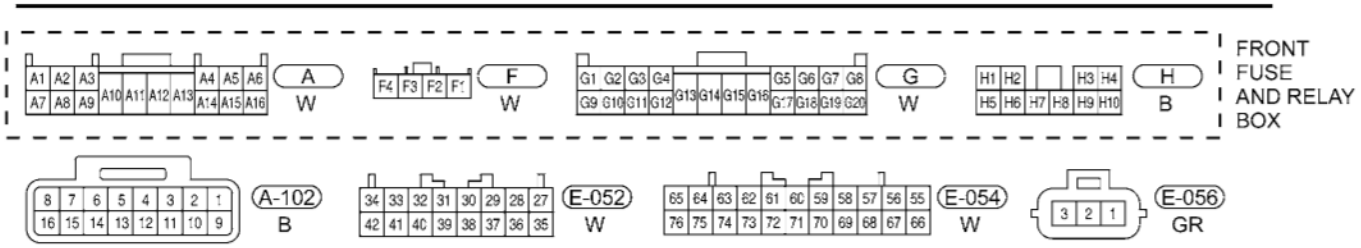
No >> Replace the ECM.

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23 - Camshaft Position Sensor

EEC - 2.4L - PHASE - 01





ltsmw030011t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
72	Camshaft Position (CMP) sensor	• Ignition switch: ON • Engine: Not cranking	4.8 - 5.2 V
		• Engine: Cranking	0.4 - 3.0 V
		• Engine: Idle	0.5 - 2.0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
23	CMP sensor	Crank engine	Signal output is no variance for 4 seconds continuously (no pulse signal).	• CMP sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

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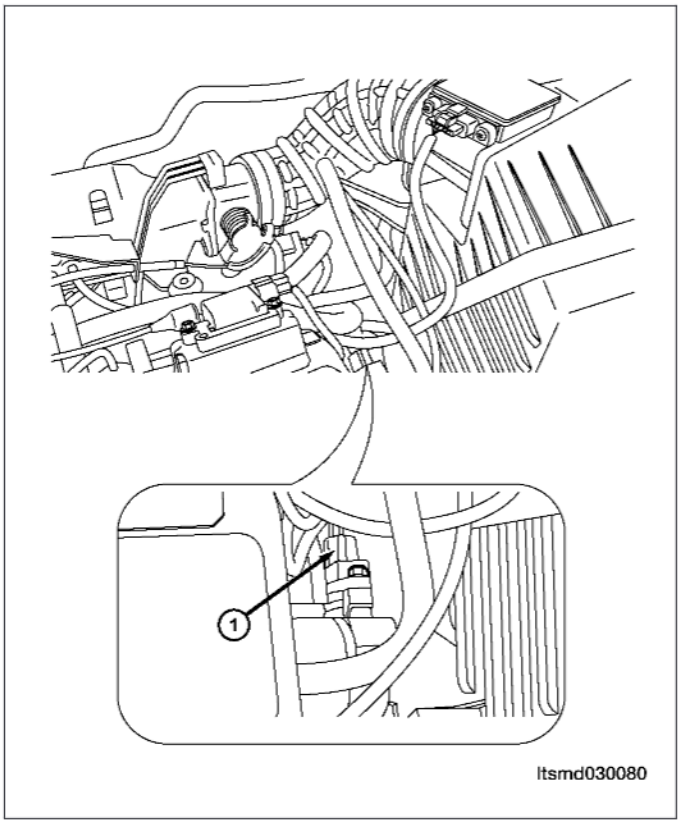
2. CHECK CAMSHAFT POSITION (CMP) SENSOR ELECTRICAL CONNECTOR

- Disconnect the CMP electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



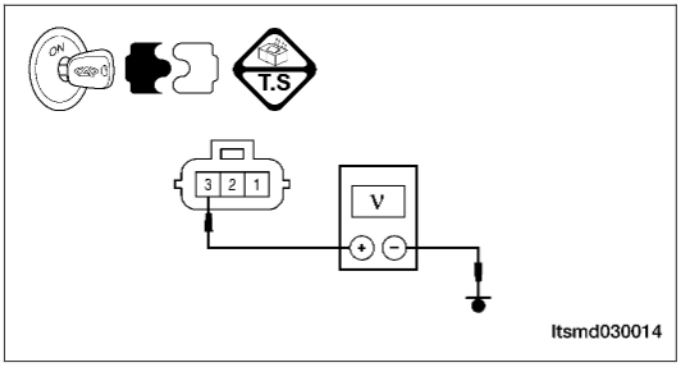
3. CHECK CAMSHAFT POSITION (CMP) SENSOR POWER SUPPLY CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check supply voltage between CMP sensor connector E-056, terminal 3 and ground in the sensor electrical connector E-056.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 5.

No >> Go to the next step.



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4. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse 22, Fuse 12
  - Front fuse and relay box H3
  - Harness connectors A-102, E-105
  - Harness open or short between CMP sensor and fuse

Is the check result normal?

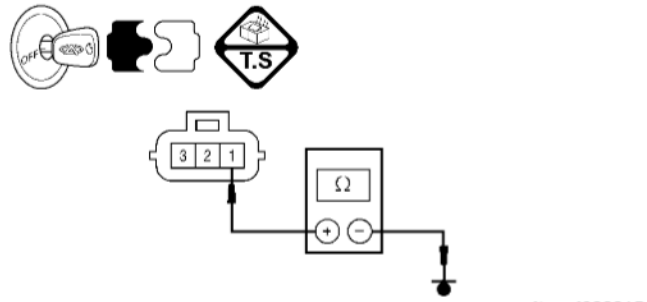
Yes >> Go to the next step.

No >> Repair or replace malfunctioning parts.

5. CHECK THE CMP SENSOR GROUND CIRCUIT FOR AN OPEN

- Turn ignition switch off.
- Check harness continuity between following terminals.

CKP SENSOR TERMINAL	TERMINAL	CONTINUITY
1	Ground	Yes



- Continuity should exist.

Is the check result normal?

Yes >> Go to step 7.

No >> Go to the next step.

6. DETECT MALFUNCTIONING PART

- Check harness for open or short between CMP sensor and ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short in harness or connectors.

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7. CHECK CMP SENSOR INPUT SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check voltage between CMP sensor terminal 2 and ground.
- 4.8 - 5.2 V should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace harness for open or short to power or short to ground between CMP sensor connector terminal 2 and ECM connector E-054, terminal 72.
If the harness is normal, go to the next step.

8. CHECK CMP SENSOR SIGNAL

- Connect ECM connector.
- Connect CMP sensor connector.
- Check signal voltage between CMP sensor terminal 2 and ground.

TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
72	Camshaft Position (CMP) sensor	• Ignition switch: ON • Engine: Not cranking	4.8 - 5.2 V
		• Engine: Cranking	0.4 - 3.0 V
		• Engine: Idle	0.5 - 2.0 V

Is the check result normal?

Yes >> Go to step 11.

No >> Go to the next step.

9. CHECK CMP SENSOR

- Check resistance as table shown.
  - Remove the sensor.
  - Visually check the sensor for chipping.
  - Continuity should exist.

TERMINAL NO.	RESISTANCE Ω (25°C)
1 & 2	Except 0 or ∞
1 & 3	
2 & 3	

Is the check result normal?

Yes >> Replace the CMP sensor with a known good CMP sensor.
Monitor the CMP sensor signal on the KES-200 screen.
- If the CMP sensor signals were normal, the system is OK.
- If the CMP sensor signals were still irregular or missing, go to step 10.

No >> Replace the CMP sensor.

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10. CHECK CAMSHAFT

- Check the following:
  - There should be no accumulation of debris on the signal plate of camshaft rear end.
  - There should be no chip on the signal plate of camshaft rear end.

Is the check result normal?

Yes >> Go to the next step.

No >> Remove debris and clean the signal plate of camshaft rear end or replace camshaft.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

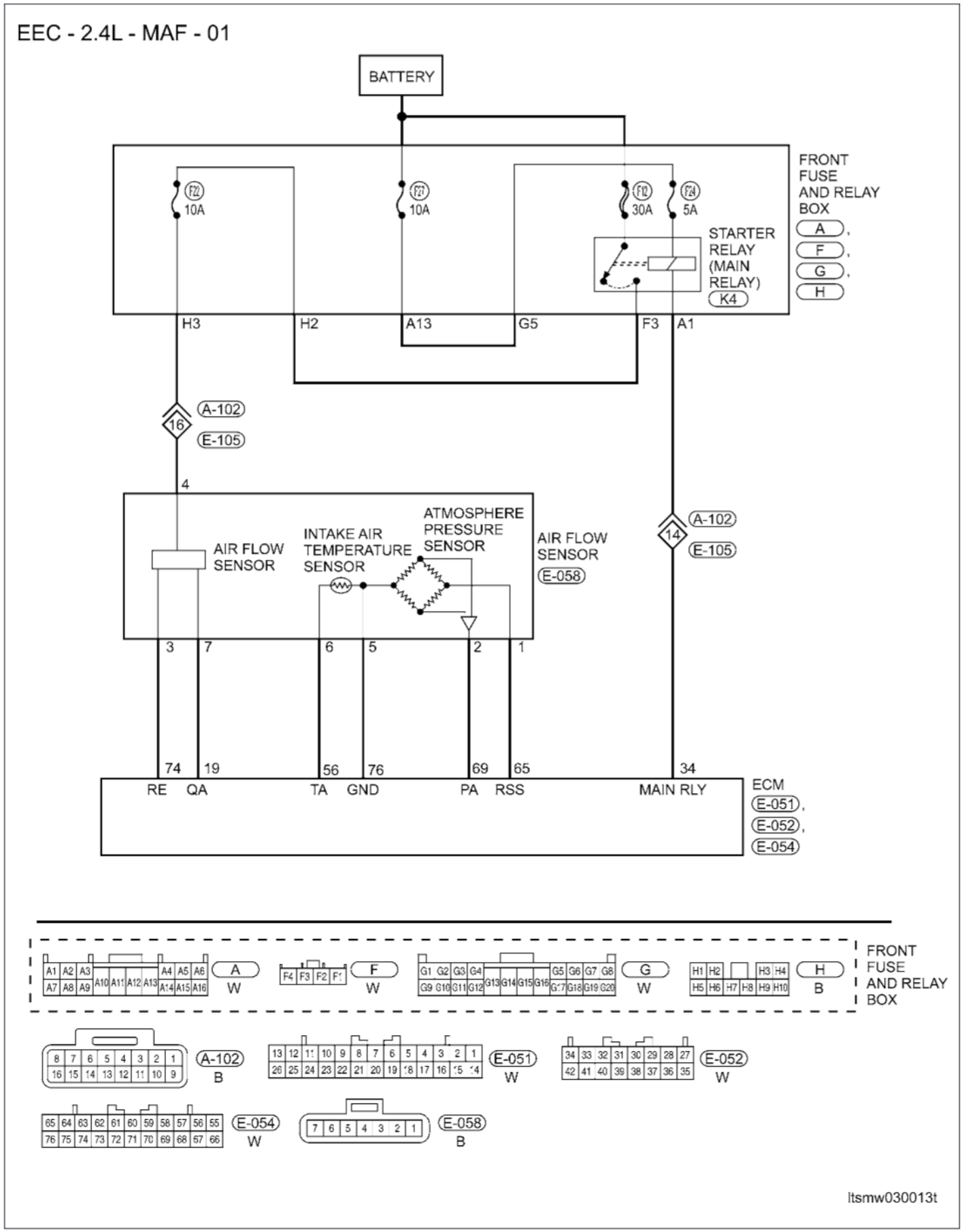
Is DTC 23 still present?

Yes >> Replace the ECM.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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25 - Atmosphere Pressure Sensor



ltsmw030013t

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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION		DATA VOLTAGE
65	Regulated sensor supply	Ignition switch: ON	-	4.8 - 5.2 V
69	Atmosphere pressure sensor		Sea level altitude: 0 M	3.7 - 4.3 V (101 kPa)
			Sea level altitude: 600 M	95 kPa
			Sea level altitude: 1200 M	3.2 - 3.8 V (88 kPa)
			Sea level altitude: 1800 M	81 kPa
76	Sensor (GND)	Ignition switch: ON		0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
25	Atmosphere pressure sensor	• Ignition switch ON position for 60 seconds • Engine: Running	• Signal output is over 4.6 V for 4 seconds continuously (amount to 114 kPa atmosphere pressure). • Signal output is below 0.2 V for 4 seconds continuously (amount to 5.33 kPa atmosphere pressure).	• Atmosphere pressure sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature, then select view DTC and data stream.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 03 Electronic Engine Controls for more information.

NOTE :

Before performing the following procedure, make sure that the ECM ground connection is in good condition.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

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Diagnostic Procedure

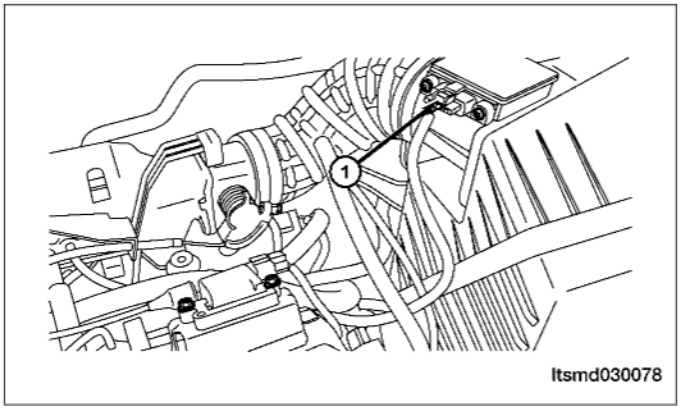
1. CHECK ATMOSPHERE PRESSURE SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the atmosphere pressure sensor (atmosphere pressure sensor is built-into) electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



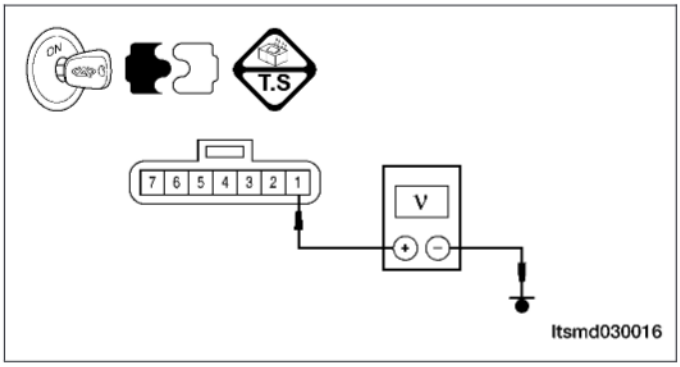
2. CHECK ATMOSPHERE PRESSURE SENSOR POWER SUPPLY CIRCUIT

- Turn ignition switch on.
- Check supply voltage between atmosphere pressure sensor connector E-058, terminal 1 and ground in the atmosphere pressure sensor electrical connector E-058.
- 4.8 - 5.2 V should exist.

Is the check result normal?

Yes >> Go to the next step.

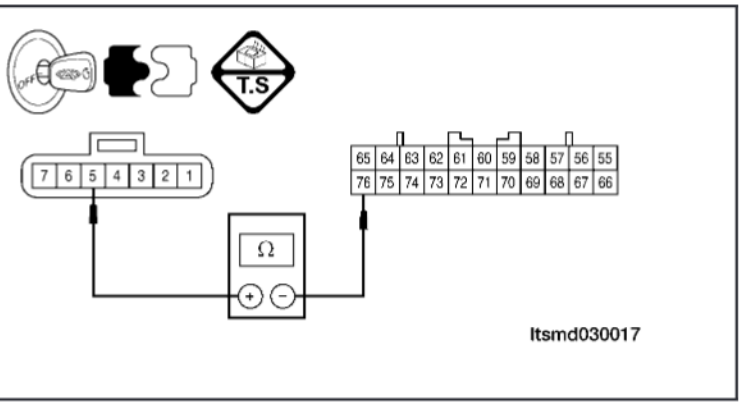
No >> Repair circuit for an open or short in harness or connectors.
If circuit is normal, go to the next step.



3. CHECK ATMOSPHERE PRESSURE SENSOR GROUND CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

ATMOSPHERE PRESSURE SENSOR TERMINAL	ECM TERMINAL
5	76



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- Continuity should exist.
- Also check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace circuit for an open or short to power or short to ground in harness or connectors.

4. CHECK ATMOSPHERE PRESSURE SENSOR SIGNAL CIRCUIT

- Check harness continuity between ECM terminal 69 and atmosphere pressure sensor terminal 2.
- Continuity should exist.
- Also check harness for short to power and short to ground.

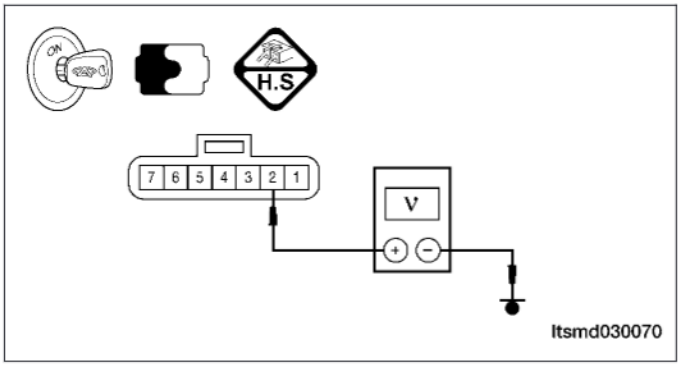
Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace harness or connectors.

5. CHECK ATMOSPHERE PRESSURE SENSOR

- Connect ECM connector.
- Connect atmosphere pressure sensor connector.
- With the X-431, select view data stream.
- Check sensor signal output.



TERMINAL NO.	ITEM	CONDITION		DATA (DC VOLTAGE)
65	Regulated sensor supply	Ignition switch: ON	-	4.8 - 5.2 V
69	Atmosphere pressure sensor		• Sea level altitude: 0 M	3.7 - 4.3 V (101 kPa)
			• Sea level altitude: 600 M	95 kPa
			• Sea level altitude: 1200 M	3.2 - 3.8 V (88 kPa)
			• Sea level altitude: 1800 M	81 kPa
76	Sensor (GND)	Ignition switch: ON		0 V

Is the check result normal?

Yes >> Go to the next step.

No >> Replace atmosphere pressure sensor.

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6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 25 still present?

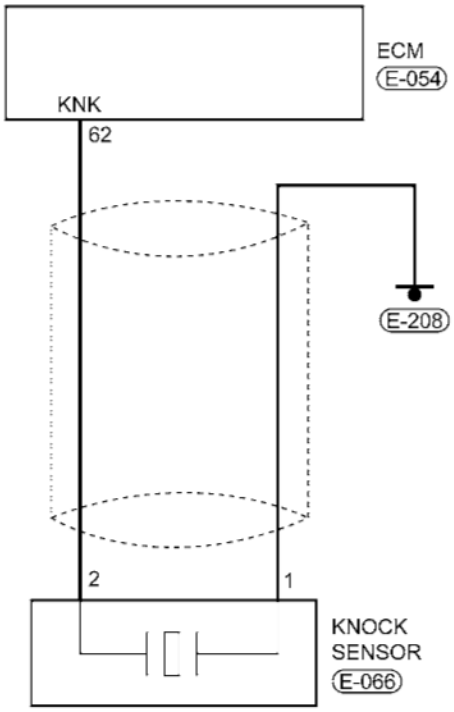
Yes >> Replace the ECM.

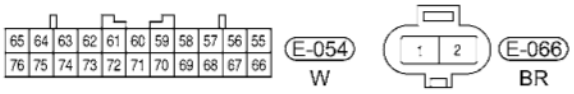
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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31 - Knock Sensor

EEC - 2.4L - KS - 01





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	TEST METHOD	DATA (DC VOLTAGE)
62	Knock sensor	• Test Method 1: Knock at cylinder with rubber hammer • Test Method 2: Knock at sensor slightly	Output signal voltage should exist.

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
31	Knock sensor	An excessive voltage from the sensor is sent to ECM.	• Knock sensor • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Run engine for a while then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
Before performing the following procedure, make sure that the ECM ground connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

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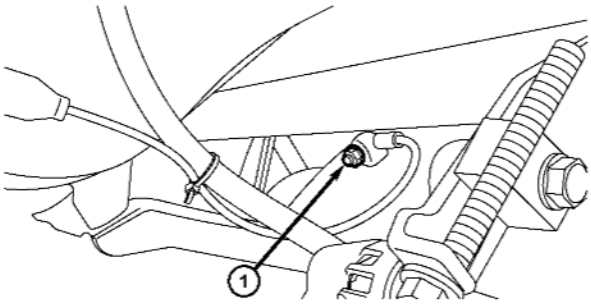
2. CHECK KNOCK SENSOR ELECTRICAL CONNECTOR

- Disconnect the knock sensor electrical connector E-066 (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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3. CHECK THE KNOCK SENSOR GROUND CIRCUIT

- Check continuity between knock sensor terminal 1 and ground.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the knock sensor ground circuit.

4. CHECK KNOCK SENSOR SIGNAL CIRCUIT

- Disconnect ECM harness connector.
- Check harness continuity between sensor connector E-066, terminal 1 and ground, sensor terminal 2 and ECM terminal 62.

CHECK SENSOR CIRCUIT	
ECM TERMINAL	KNOCK SENSOR TERMINAL
62	2

- Also check harness for short to power and short to ground.

Is the check result normal?

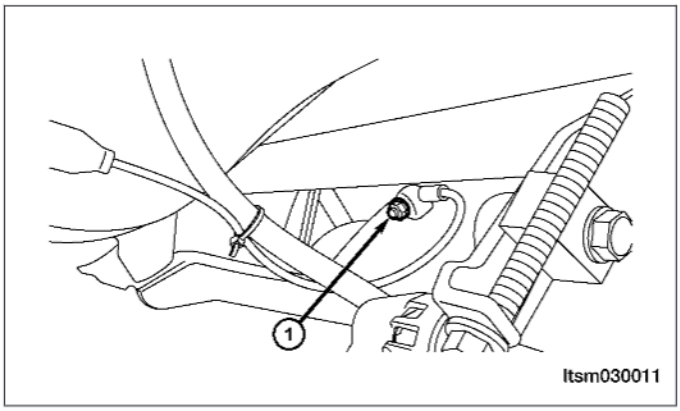
Yes >> Go to the next step.

No >> Repair circuit for an open or short in harness or connectors.

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5. CHECK KNOCK SENSOR SIGNAL

- Connect knock sensor (1) connector.
- Set multimeter to voltage range.
- Check knock sensor (1) output signal as table shown.



CHECK OUTPUT SIGNAL		
KNOCK SENSOR TERMINAL NO.	TEST METHOD	DATA (AVERAGE DC VOLTAGE)
1 & 2	• Test Method 1: Knock at cylinder with rubber hammer. • Test Method 2: Knock at sensor slightly.	Output signal voltage should exist.

- Output signal voltage should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace knock sensor.

6. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

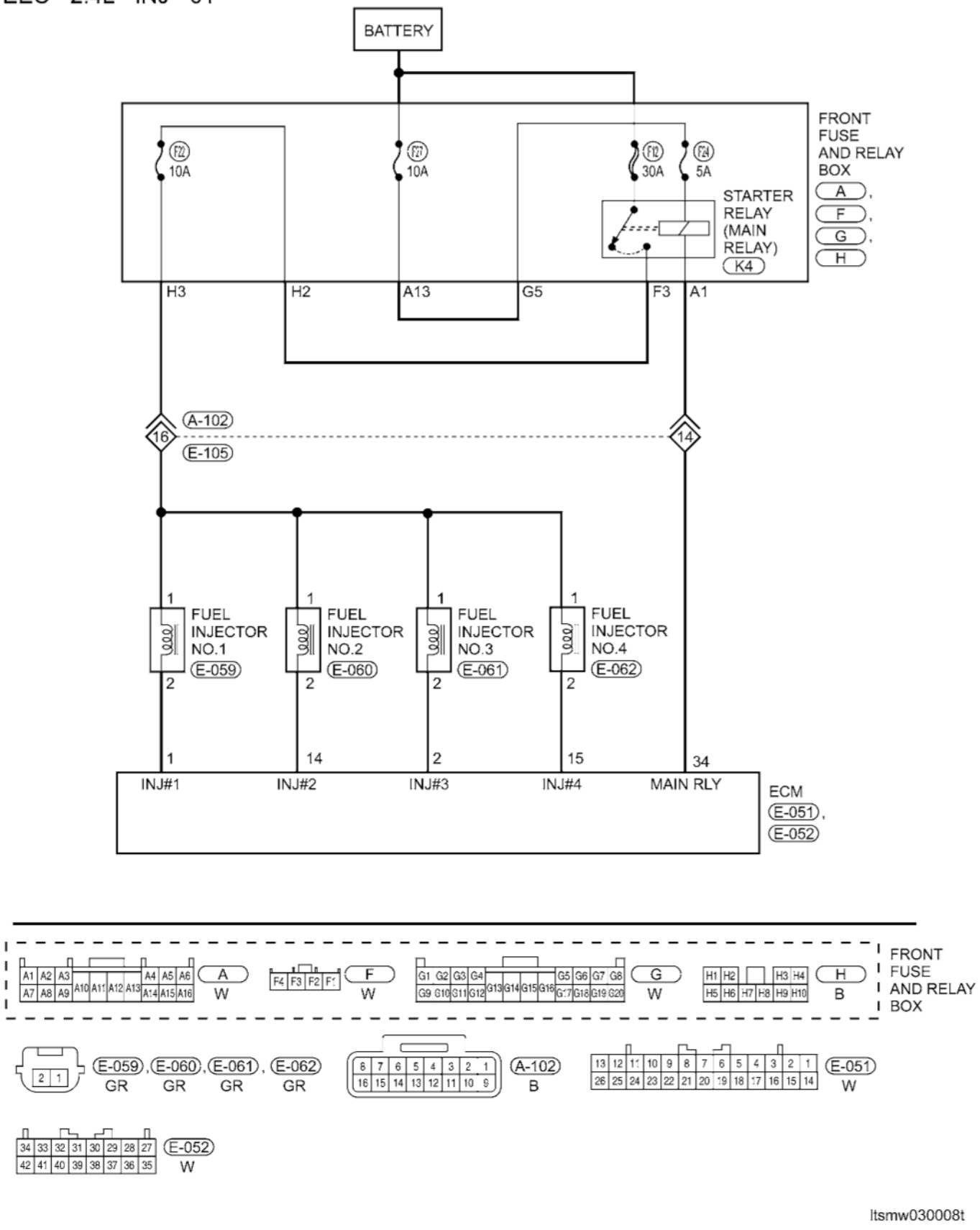
Is DTC 31 still present?

Yes >> Replace the ECM.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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41 - Injector



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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
1	Injector 1	• Engine is running • Warm-up condition • Accelerate suddenly	Voltage: 11 - 14 V
2	Injector 3		
14	Injector 2		
15	Injector 4		

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
41	Injector	Engine is running	• Injector • Harness or connectors • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.
- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
Before performing the following procedure, make sure that the ECM ground connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connection E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

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2. INSPECTION START

- Start engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 4.

No >> Go to step 5.

3. PERFORM ACTIVE TEST FUNCTION

- Select "ACTIVE TEST" menu.
- Perform injector active test.
- Make sure that each test produces a momentary engine speed drop.

Is the check result normal?

Yes >> The system is OK.

No >> Go to step 5.

4. CHECK FUNCTION OF INJECTOR

- Listen to injector operating sound one by one.

Do all injectors clicking noise exist?

Yes >> Go to step 10.

No >> Go to the next step.

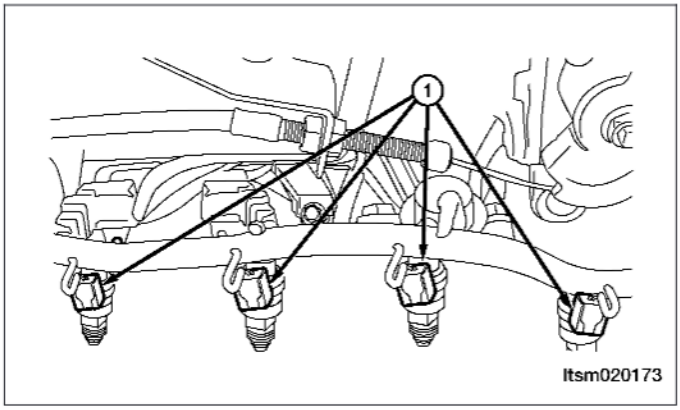
5. CHECK INJECTOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the injector electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



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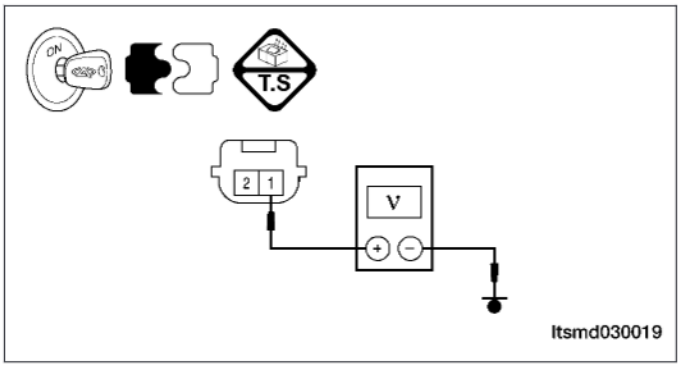
6. CHECK INJECTOR POWER SUPPLY CIRCUIT FOR OPEN OR SHORT

- Turn ignition switch on.
- Check injector supply voltage between sensor terminal 1 and ground in the electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Disconnect injector harness connector.
- Check the following:
  - Harness connectors A-102, E-105
  - Front fuse and relay box H3
  - Fuse 22, Fuse 12
  - Harness for open or short between injector and fuse

Is the check result normal?

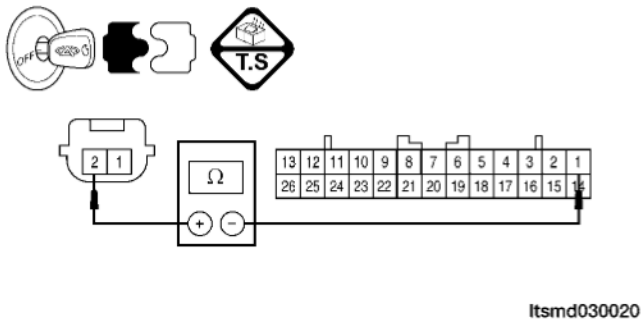
Yes >> Go to the next step.

No >> Repair or replace malfunctioning part.

8. CHECK INJECTOR CONTROL CIRCUITS FOR AN OPEN AND SHORT

- Turn ignition switch off.
- Disconnect ECM harness connector.
- Check harness continuity between following terminals.

INJECTOR NO.	ECM TERMINAL	INJECTOR TERMINAL
1	1	2
2	14	2
3	2	2
4	15	2



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- Continuity should exist.
- Also check harness for short to power or short to ground.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to the next step.

9. DETECT MALFUNCTIONING PART

- Check harness for an open or short between injector control circuit and ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair harness or connectors.

10. CHECK INJECTOR

- Check resistance as table shown.

INJECTOR NO.	INJECTOR TERMINAL	RESISTANCE (APPROXIMATELY) Ω (20°C)
1	1 & 2	13 - 16
2	1 & 2	
3	1 & 2	
4	1 & 2	

- Also check signal output.
- Connect ECM connector.
- Connect injector connector.

TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
1	Injector 1	• Engine is running • Warm-up condition • Accelerate suddenly	Voltage: 11 - 14 V
2	Injector 3		
14	Injector 2		
15	Injector 4		

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- With the X-431, select data stream:
  - Injector (condition 1) - Idle switch is close while TPS signal output is high 50 - 100 mV than signal output in idle position.
  - Injector (condition 2) - This inject control time under two condition: crank speed below 250 RPM, power supply is 11 voltage.

CHECK ITEM	CHECK CONTENT		NORMAL VALUE: MS
Injector (condition 1)	• Engine condition: Running	ECT: 0°C	13 - 20
		ECT: 20°C	27 - 41
		ECT: 80°C	6.8 - 10.2
Injector (condition 2)	• ECT: 80 - 95°C • Lamp and all accessories: OFF • Transaxle: Neutral	Engine condition: Idle	1.9 - 3.1
		2500 RPM	1.7 - 2.9
		Engine high running idle suddenly	Raise

Is the check result normal?

Yes >> Go to the next step.

No >> Replace injector.

11. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 41 still present?

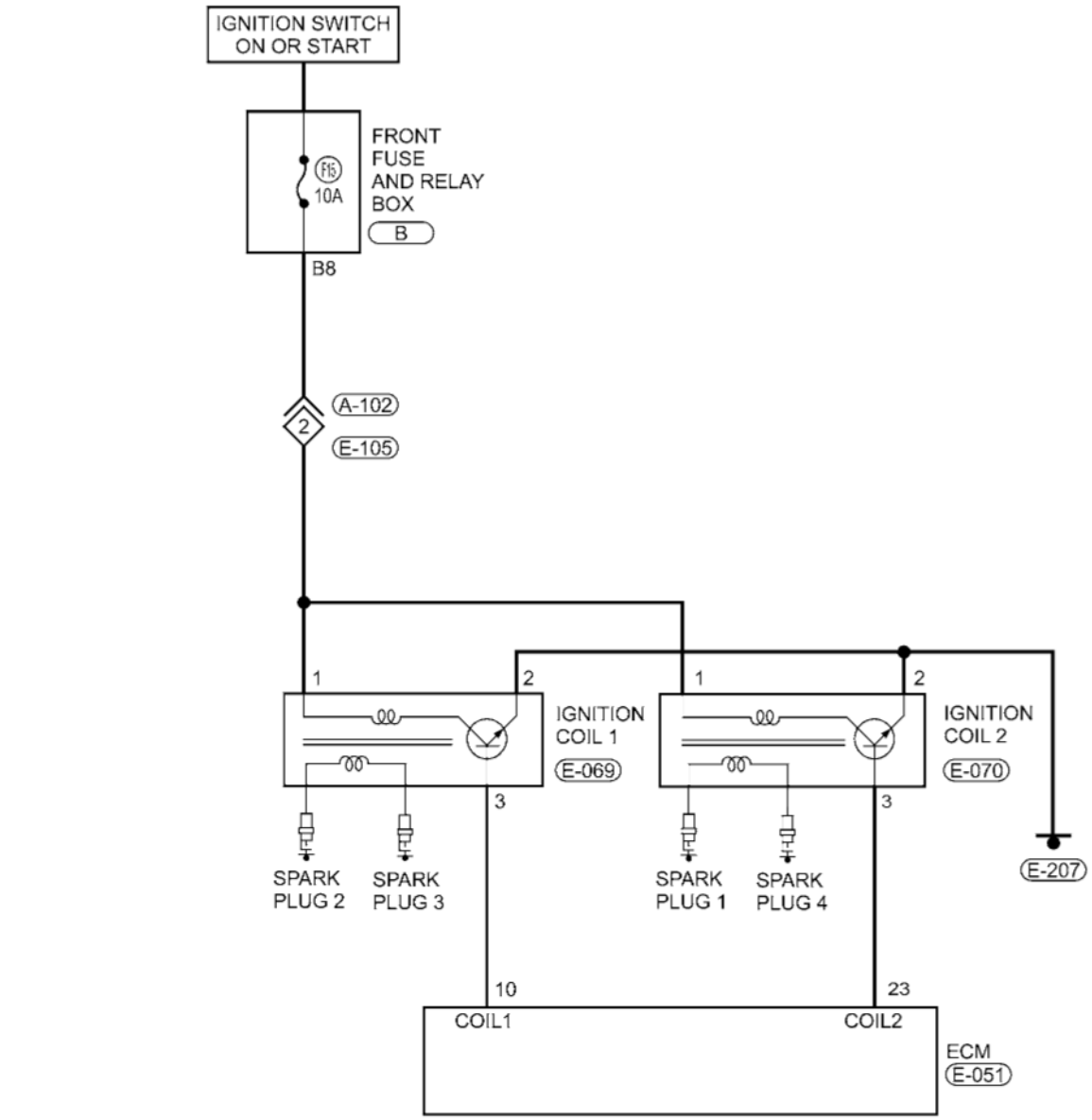
Yes >> Replace the ECM.

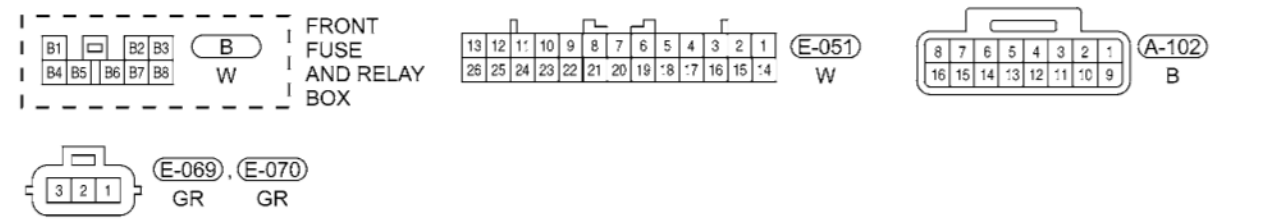
No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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44 - Ignition Signal

IGNITION CONTROL SYSTEM - WITH 2.4L ENGINE SYSTEM





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Check reference values between ECM terminals and ground under the following conditions:

ECM TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)
10	Ignition coil 1	Engine: 3000 RPM	0.3 - 3.0 V
23	Ignition coil 2		0.3 - 3.0 V

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
44	Ignition signal	• Engine speed: 50 - 4000 RPM • Except decelerate and accelerate suddenly or decelerate suddenly	The misfire times of No.1 and No.4 or No.2 and No.3 is more than the reset misfire times of per 1000 RPM.	• Ignition coil • Ignition primary harness or connectors • Spark plug and tension cable • Cylinder pressure • ECM

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ECM.
- Start engine and warm it to normal operating temperature then select view DTC.
- If DTC is detected, go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnosis & Testing Diagnostic Help in Section 03 Electronic Engine Controls).

NOTE :
Before performing the following procedure, make sure that the ECM ground connection is in good condition.

NOTE :
While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTION

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 03 Electronic Engine Controls).
- Inspect the ground connections E-207 and E-208 (See Vehicle Wiring Harness Layout - Engine Room Harness (With Mitsubishi 2.4L Engine) in Section 16 Wiring).

Is the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace ground connection.

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2. CHECK ENGINE START

- Start the engine.

Is any cylinder ignited?

Yes >> If with the X-431, go to the next step.
If without the X-431, go to step 3.

No >> Go to step 4.

3. PERFORM ACTIVE TEST FUNCTION

- Select "ACTIVE TEST" menu.
- Perform ignition active test (If the X-431 has the function).
- Make sure that each test produces a momentary engine speed drop.

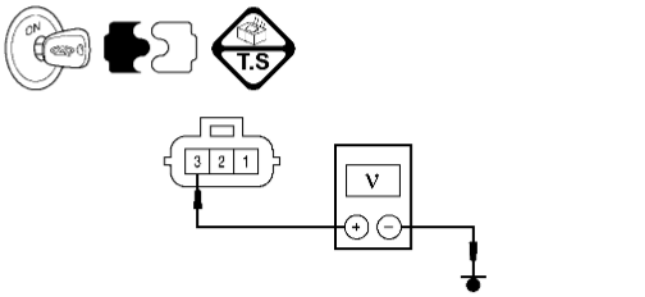
Is the check result normal?

Yes >> Inspection end.

No >> Go to step 4.

4. CHECK FUNCTION OF IGNITION

- Let engine run at 3000 RPM.
- Read voltage signal between ECM terminals 10, 23 and ground.

IGNITION COIL TERMINAL NO.	ITEM	CONDITION	DATA (DC VOLTAGE)	
10	Ignition coil 1 terminal 3	Engine: 3000 RPM	0.3 - 3.0 V	
23	Ignition coil 2 terminal 3		0.3 - 3.0 V	

- If with check tool-timing mark lamp, check the actual ignition time.

CHECK ITEM	CONTENT		NORMAL VALUE
Ignition coil with power transistor	• Engine: Warm-up condition • Timing lamp (For check the actual ignition time)	Engine: Idle	2 - 18° BTDC
		Engine: 2500 RPM	18 - 38° BTDC

Is the check result normal?

Yes >> Go to step 10.

No >> Go to the next step.

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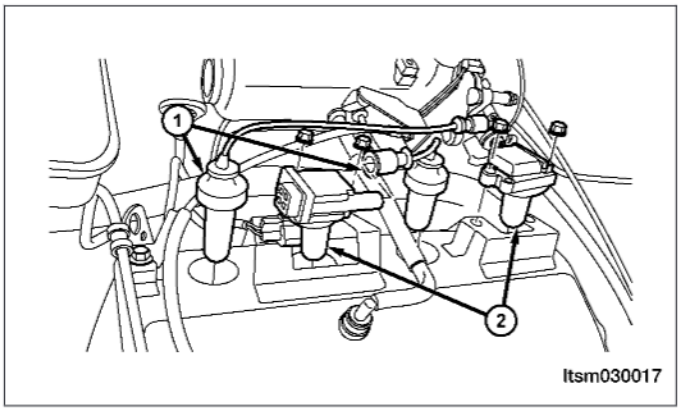
5. CHECK IGNITION COIL ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the ignition coil electrical connector (1).
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



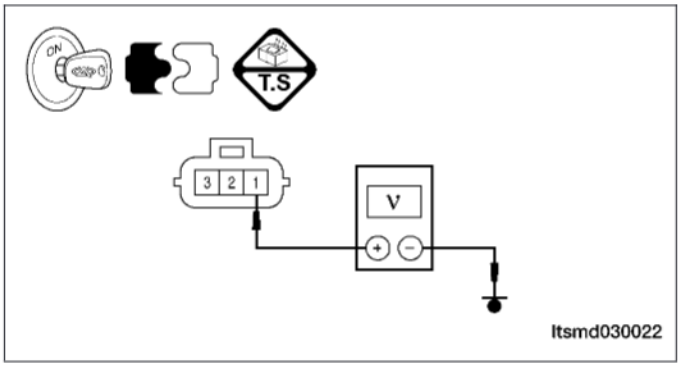
6. CHECK IGNITION COIL POWER SUPPLY CIRCUIT FOR AN OPEN OR SHORT

- Turn ignition switch on.
- Check supply voltage between ignition coil terminal 1 and ground in the ignition coil electrical connector.
- Battery voltage should exist.

Is the check result normal?

Yes >> Go to step 8.

No >> Go to the next step.



7. DETECT MALFUNCTIONING PART

- Check the following:
  - Fuse 15
  - Front fuse and relay box B8
  - Harness connectors A-102, E-105
  - Harness open or short between ignition coil and fuse

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace malfunctioning parts.

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8. CHECK IGNITION COIL GROUND CIRCUIT FOR AN OPEN

- Turn ignition switch off.
- Check harness continuity between ignition coil terminal 2 and ground.
- Continuity should exist.

Is the check result normal?

Yes >> Go to step 10.

No >> Go to the next step.

9. DETECT MALFUNCTIONING PART

- Check harness for an open or short between ignition coil and ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open or short in harness or connectors.

10. CHECK IGNITION COIL INPUT SIGNAL CIRCUIT FOR AN OPEN OR SHORT

- Disconnect ECM connector.
- Check harness continuity between ECM terminal 10, 23 and ignition coil E-069, E-070, terminal 3.
- Continuity should exist.
- Check harness for short to power and short to ground.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair harness in harness or connectors.

11. CHECK IGNITION COIL

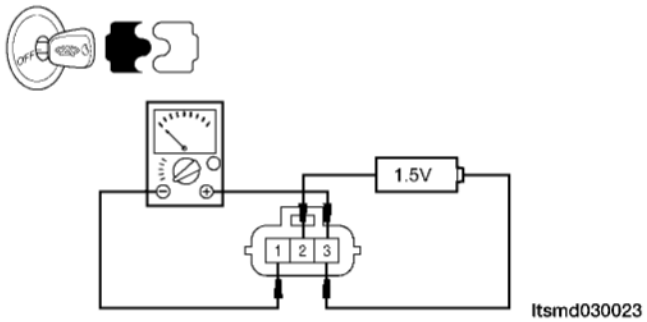
- Check power transistor conducting state.
- Use simulation resistance meter.
- Connect the positive lead of the simulation resistance meter to the terminal of the power transistor.

CAUTION:

This test should be completed quickly (in 10 seconds), to prevent ignition coil from burning and power transistor from damaging.

- Also check resistance between ignition coil terminals as table shown.
- Also check ignition coil signal output.

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TERMINAL NO.	RESISTANCE Ω (25°C)	
1 & 2	Except 0 or ∞	
1 & 3	Except 0	
2 & 3		

Is the check result normal?

Yes >> Go to the next step.

No >> Replace the ignition coil.

12. CHECK HIGH TENSION CABLE RESISTANCE

- Check if there is crack exist.
- Check if the limited resistance value is 22 kΩ.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace high tension cable.

13. CHECK SPARK PLUG

- Remove spark plug high tension cable.
- Remove spark plug.
- Check if there is burned electrode or damaged nonconductor. And check if the burned mark is even.
- Check if there is carbon deposit exist. Use steel wire or tool to eliminate it.
- Check if the clearance meet standard. The standard is: 1.1 mm.

Is the check result normal?

Yes >> Go to the next step.

No >> Replace or eliminate or adjust the spark plug.

14. CHECK DTC

- With the X-431 scan tool, read ECM DTCs.
- Refer to ″DTC Confirmation Procedure″.

Is DTC 44 still present?

Yes >> Replace the ECM.

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

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Engine Coolant Temperature (ECT) Sensor

Description

The Engine Coolant Temperature (ECT) Sensor is beside the thermostat. The ECT Sensor is a negative thermal coefficient sensor.

Operation

The ECT sensor provides an input signal to the ECM. As temperature increases, resistance of the sensor decreases. As coolant temperature varies, the ECT sensor resistance changes resulting in a different voltage value at the ECT sensor signal circuit. The ECM uses the input to control air-fuel mixture, timing, and radiator fan on/off times.

Removal & Installation

1. Disconnect and isolate the negative battery cable.
2. Release the coolant system pressure.

WARNING!

Never remove the radiator pressure relief cap under any conditions while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, (with a cloth) turn and remove the pressure relief cap. Failure to follow these instructions may result in serious personal injury.

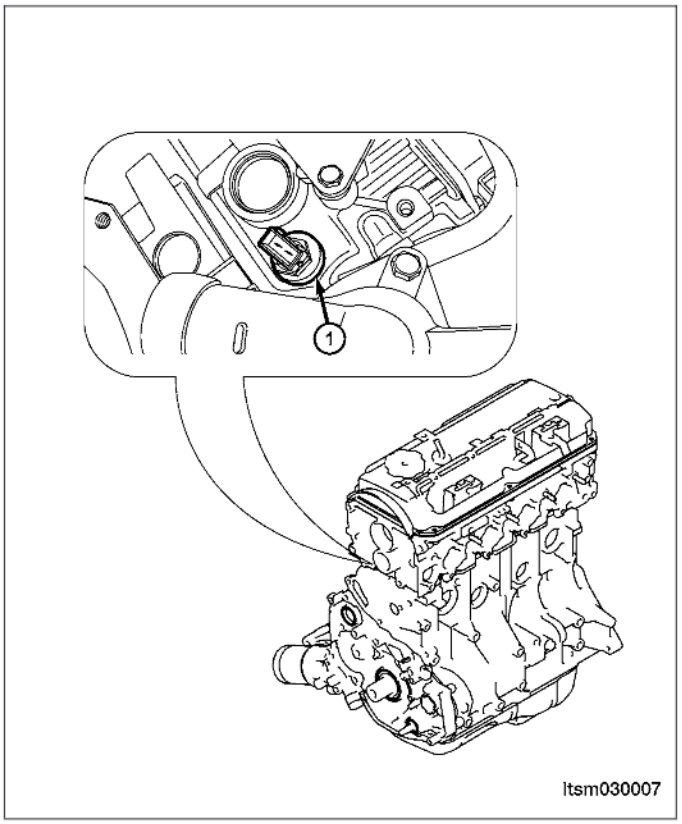
3. Disconnect the coolant temperature sensor electrical connector.

CAUTION:

Remove the coolant temperature sensor when the engine is cold.

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4. Remove the engine coolant temperature sensor (1).
   (Tighten: Engine coolant temperature sensor to 20 N·m).



5. Discard the O-ring.
6. Installation is in the reverse order of removal.
   NOTE: Replace a new O-ring when installing.

Coolant Temperature Sensor (For Instrument Cluster)

Description

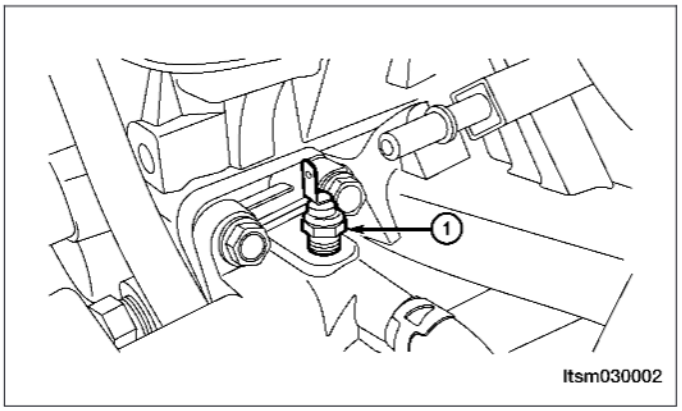
The coolant temperature sensor (for instrument cluster) is located on the water outlet fitting. It is bimetallic strip structure.

Operation

The coolant temperature sensor (for instrument cluster) provides an input to the instrument cluster. With the coolant temperature changes the bimetallic strip will curve complete the circuit and the temperature gauge will change.

Removal & Installation

1. Disconnect and isolate the negative battery cable.
2. Disconnect the coolant temperature sensor (for instrument cluster) electrical connector.
3. Remove the coolant temperature sensor (1) (for instrument cluster).
   (Tighten: Coolant temperature sensor (for instrument cluster) to 14 N·m)



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4. Installation is in the reverse order of removal.

CAUTION:
Before removing the coolant temperature sensor (for instrument cluster), release the coolant pressure and make sure the engine is cold.

Knock Sensor

Description

The knock sensor is attached to the cylinder block. The knock sensor is designed to detect engine vibration that is caused by detonation.

Operation

When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the ECM. In response, the ECM retards ignition timing for all cylinders by a scheduled amount.

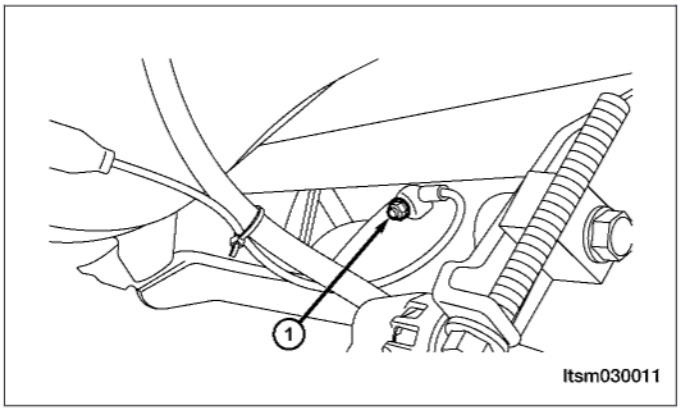
Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the ECM while the engine operates. As the intensity of the vibration increases, the knock sensor output voltage also increases.

The voltage signal produced by the knock sensor increases with the amplitude of vibration. The ECM receives an input knock sensor voltage signal. If the signal rises above a predetermined level, the ECM will store that value in memory and retard ignition timing to reduce engine knock. If the knock sensor voltage exceeds a present value, the ECM retards ignition timing for all cylinders. It is not a selective cylinder retard.

The ECM ignores knock sensor input signal during engine idle conditions. Once the engine speed exceeds a specified value, knock retard is allowed.

Removal & Installation

1. Disconnect and isolate the negative battery cable.
2. Disconnect the knock sensor electrical connector.
3. Remove the knock sensor retaining bolt (1) and remove the knock sensor.
   (Tighten: Knock sensor retaining bolt to 20 N·m).



4. Installation is in the reverse order of removal.

Oxygen Sensor

Description

This vehicle is equipped with two oxygen sensors (upstream oxygen sensor & downstream oxygen sensor). The oxygen sensors are located before and after the three way catalyst. The oxygen sensors continually monitor the oxygen level in the exhaust gas. The sensor is made of ceramic zirconia. The zirconia generates voltage from approximately 1 volt in richer conditions to 0 volt in leaner conditions.

Operation

The O2 sensors produce voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas. When a large amount of oxygen is present (caused by a lean air/fuel mixture, can be caused by misfire and exhaust leaks), the sensors produces a low voltage. When there is a lesser amount of oxygen present (caused by a rich air/fuel mixture, can be caused by internal engine problems) it produces a higher voltage. By monitoring the oxygen content and converting it to electrical voltage, the sensors act as a rich-lean switch.

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The oxygen sensors are equipped with a heating element that keeps the sensors at proper operating temperature during all operating modes. Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

Upstream Oxygen Sensor

The input from the upstream heated oxygen sensor tells the Engine Control Module (ECM) the oxygen content of the exhaust gas. Based on this input, the ECM fine tunes the air-fuel ratio by adjusting injector pulse width.

Downstream Oxygen Sensor

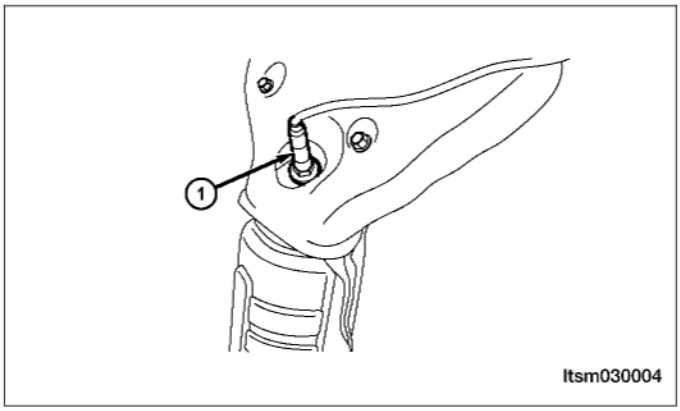
The downstream heated oxygen sensor signal is used to detect catalytic convertor deterioration. As the convertor deteriorates, the signal from the downstream sensor begins to match the upstream sensor signal except for a slight time delay. By comparing the downstream heated oxygen sensor signal to the signal from the upstream sensor, the ECM calculates catalytic convertor efficiency. This calculation is also used to establish the upstream O2 goal voltage (switching point).

Removal & Installation - Upstream Oxygen Sensor

1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor electrical connector.

CAUTION:
Remove the oxygen sensor after the exhaust pipe has cooled.

3. Remove the upstream oxygen sensor (1).
   (Tighten: Upstream oxygen sensor to 45 N·m)



4. Installation is in the reverse order of removal.

Installation Notes:

- Before installing the oxygen sensor, coat the threads with rust inhibiting lubricant.

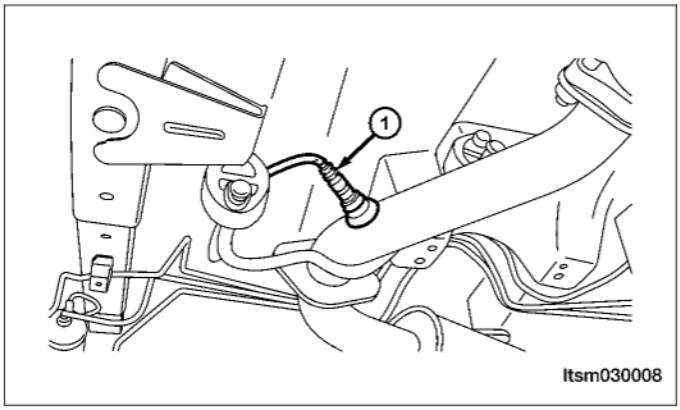
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Removal & Installation - Downstream Oxygen Sensor

1. Disconnect the negative battery cable.
2. Disconnect the oxygen sensor electrical connector.

CAUTION:
Remove the oxygen sensor after the exhaust pipe has cooled.

3. Remove the downstream oxygen sensor (1).
   (Tighten: Downstream oxygen sensor to 45 N·m)



4. Installation is in the reverse order of removal.

Installation Notes:

- Before installing the oxygen sensor, coat the threads with rust inhibiting lubricant.

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Camshaft Position (CMP) Sensor

Description

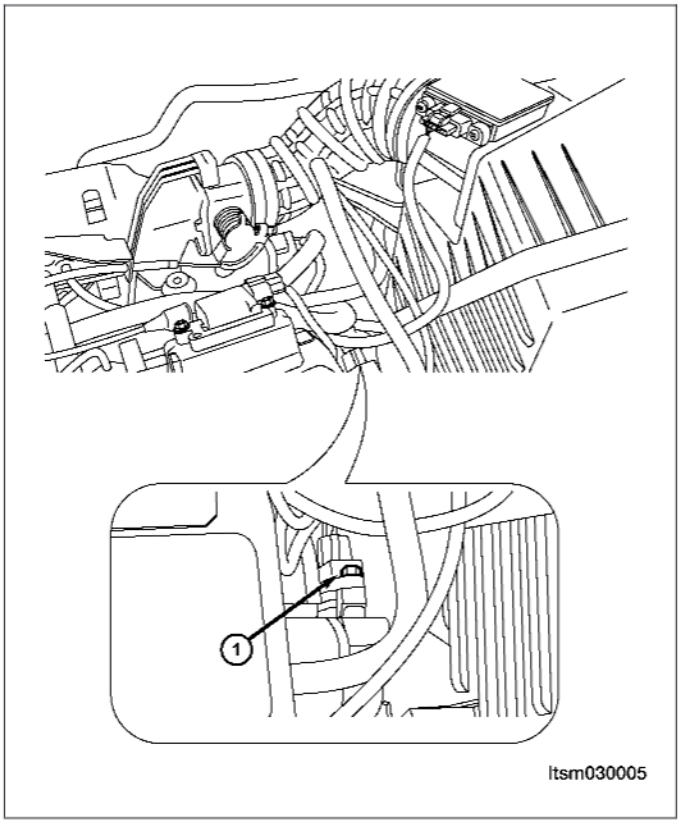
The Camshaft Position (CMP) sensor senses the protrusion of inlet valve cam sprocket to identify a particular cylinder. The CMP sensor senses the piston position. When the Crankshaft Position (CKP) sensor becomes inoperative, the CMP sensor provides various controls of engine parts instead, utilizing timing of cylinder identification signals. The sensor consists of a permanent magnet and Hall IC.

Operation

When engine is running, the high and low parts of the teeth cause the gap with the sensor to change. The changing gap cause the magnetic field near the sensor to change. Due to the changing magnetic field, the voltage from the sensor changes. The Engine Control Module (ECM) detects the voltage signal and identify piston position and cylinder timing.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect camshaft position sensor electrical connector from the wiring harness connector.
3. Remove the camshaft position sensor retaining bolt (1).
   (Tighten: Camshaft position sensor retaining bolt to 10 N·m)



4. Remove camshaft position sensor.
5. Pull sensor up out of the cylinder head cover.
6. Installation is in the reverse order of the removal.

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Air Flow Sensor

Description

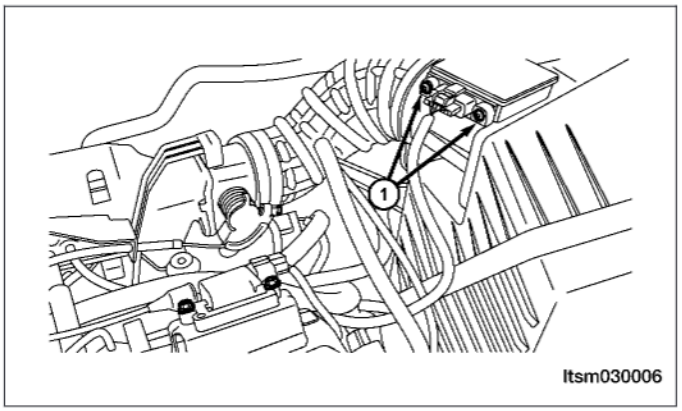
The air flow sensor is placed in the air intake hose. The air flow sensor measures the intake flow rate by measuring a part of the entire intake flow. The air flow sensor converts the amount of air drawn into the engine into a voltage signal. The Engine Control Module (ECM) needs to know intake air volume to calculate engine load. This is necessary to determine how much fuel to inject.

Operation

The air flow sensor controls the temperature of the hot wire to a certain amount. The heat generated by the hot wire is reduced as the intake air flows around it. The more air, the greater the heat loss. Therefore, the electric current supplied to the hot wire is changed to maintain the temperature of the hot wire as air flow increases. The ECM detects the air flow by means of this voltage signal change.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect air flow sensor electrical connector from the wiring harness connector.
3. Remove the air flow sensor retaining bolts (1). (Tighten: Air flow sensor retaining bolt to 8 N·m)



4. Remove the air flow sensor.
5. Installation is in the reverse order of removal.

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Throttle Control Actuator

Description

The throttle body is located on the intake manifold. The throttle body meters air into the intake manifold.

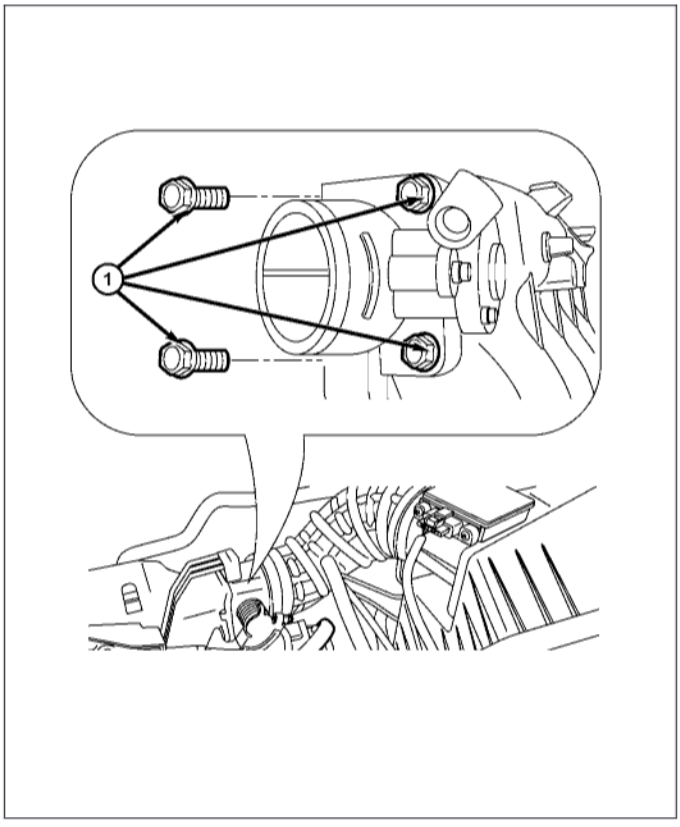
Throttle control actuator consists of throttle control valve, throttle position sensor, idle air control motor, etc.

Operation

Filtered air from the air cleaner enters the intake manifold through the throttle body. A throttle valve (plate) is used to supply air for idle and driving conditions. The throttle position sensor is part the throttle body. The throttle position sensor signal is used by the ECM to determine throttle position. The ECM controls the throttle control to meter air into the engine. This regulates engine power. The vehicle is in sense a “Drive by Wire” system.

Removal & Installation

1. Remove the engine cover.
2. Disconnect the negative battery cable.
3. Disconnect the throttle position sensor and idle air control motor electrical connect on the throttle control actuator.
4. Remove the accelerator cable on the throttle control actuator.
5. Remove three hoses on the throttle control actuator.
6. Remove four throttle control actuator mounting bolts (1).
   (Tighten: Throttle control actuator bolts to 10 N·m)



7. Remove the throttle control actuator and gasket carefully.
8. Installation is in the reverse order of removal.

NOTE :
Replace a new throttle control actuator gasket when installing.

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Engine Control Module (ECM)

Description

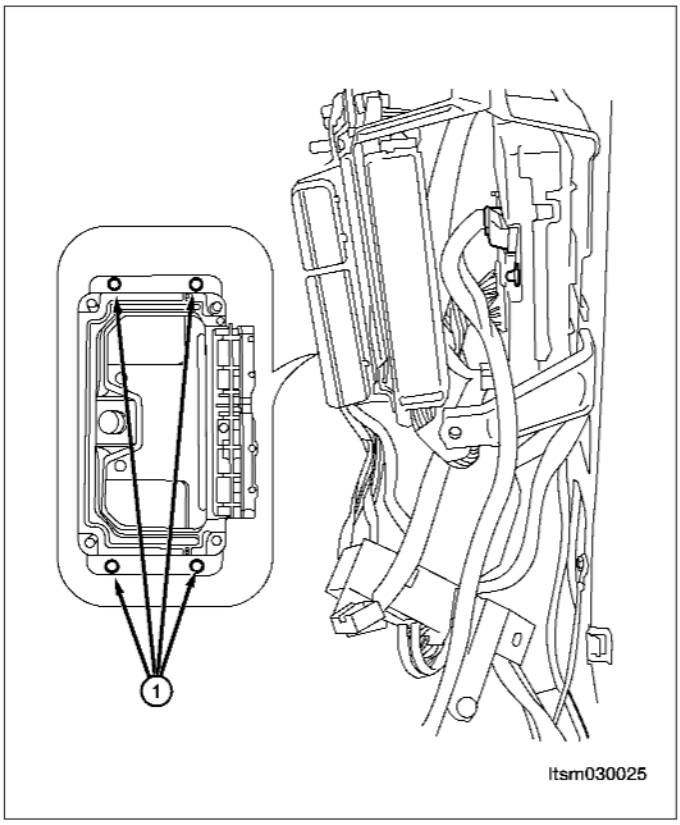
The Engine Control Module (ECM) for this model is serviced only as a complete unit.

Operation

The ECM is a pre-programmed, microprocessor-based digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The ECM can adapt its programming to meet changing operating conditions.

Removal & Installation

1. Disconnect the negative battery cable.
2. Remove the glove box (See Instrument Panel Removal & Installation in Section 15 Body & Accessories).
3. Disconnect the ECM connector.
4. Remove the ECM retaining bolts (1).
   (Tighten: ECM retaining bolts to 10 N·m)



5. Remove the ECM.
6. Installation is in the reverse order of removal.

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Throttle Position Sensor (TPS)

Description

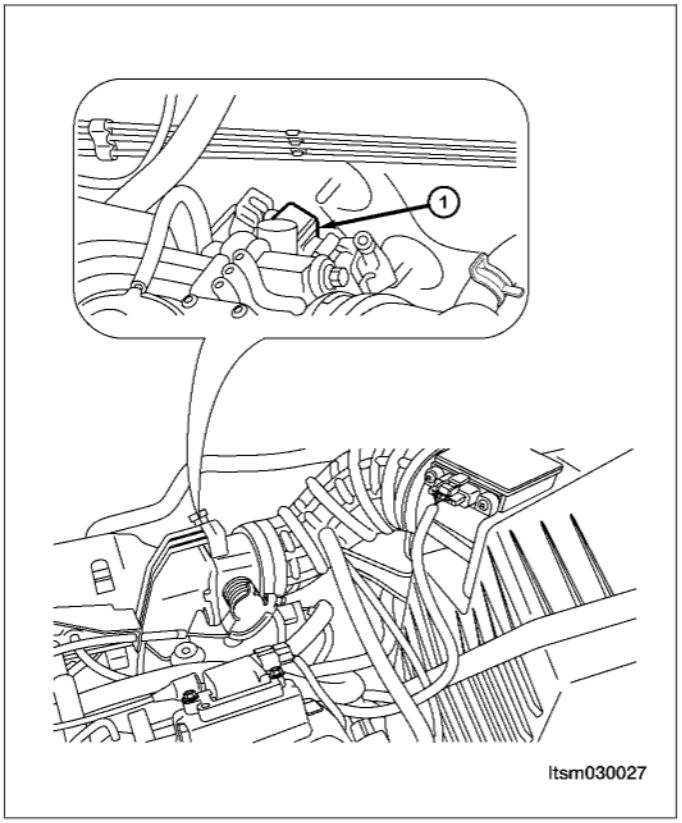
The 4-wire throttle position sensor (TPS) is mounted on the throttle body and is connected to the throttle valve.

Operation

The TPS is a 4-wire variable resistor that provides the Engine Control Module (ECM) with an input signal that represents the throttle valve position of the throttle body. The sensor is connected to the throttle valve shaft. As the position of the throttle valve changes, the resistance (output voltage) of the TPS changes.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect throttle position sensor electrical connector clamp from the wiring harness connector.
3. Remove the throttle position sensor retaining bolts (1).



4. Remove the throttle position sensor.
5. Installation is in the reverse order of removal.

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Idle Air Control (IAC) Motor

Description

The Idle Air Control (IAC) motor is mounted to the throttle body, and regulates the amount of air bypassing the control of the throttle valve. As engine loads and ambient temperatures change, engine RPM changes. A pintle on the IAC motor protrudes into a passage in the throttle body, controlling air flow through the passage. The IAC motor is control by the ECM to maintain the target engine idle speed.

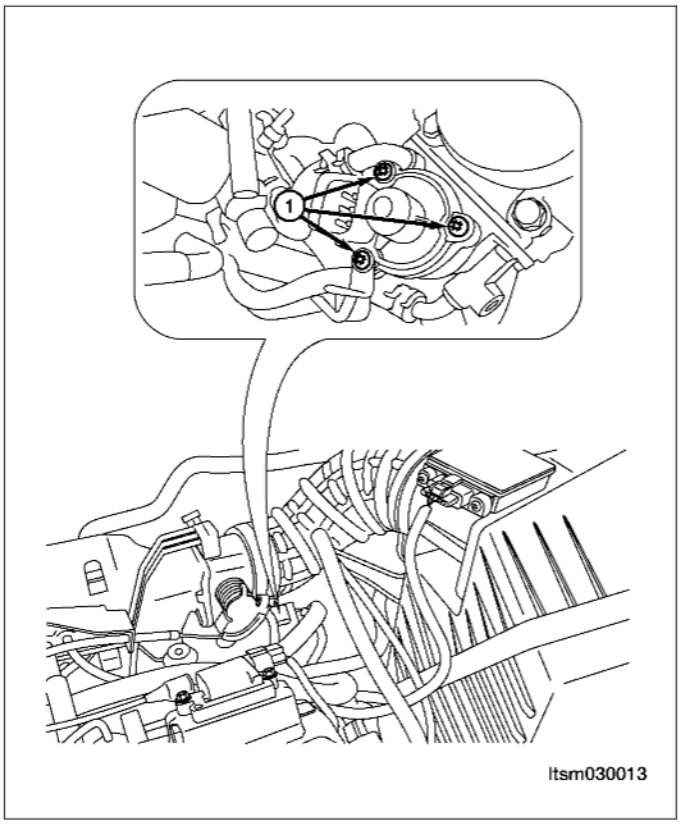
Operation

At idle, engine speed can be increased by retracting the IAC motor pintle and allowing more air to pass through the port, or it can be decreased by restricting the passage with the pintle and diminishing the amount of air bypassing the throttle valve.

The IAC is called a stepper motor because it is moved in steps, or increments. Opening the IAC opens an air passage around the throttle valve with increases RPM.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect idle air control motor electrical connector from the wiring harness connector.
3. Remove the idle air control motor retaining bolts (1).
   (Tighten: Air control motor retaining bolt to 10 N·m)



4. Remove the idle air control motor.
5. Installation is in the reverse order of removal.

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Crankshaft Position (CKP) Sensor

Description

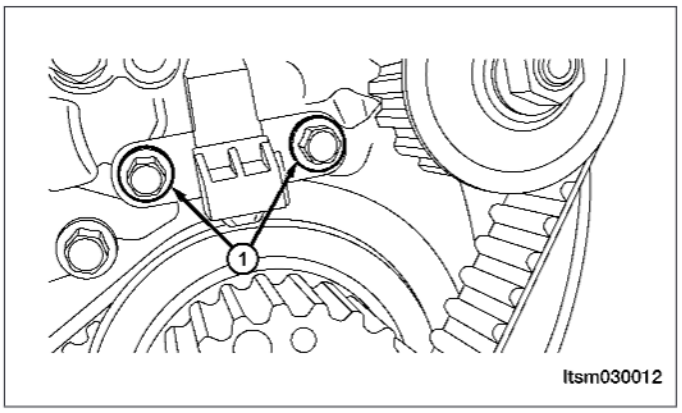
The Crankshaft Position (CKP) sensor is located on the flywheel shell facing the gear teeth of the signal plate. It detects the fluctuation of the engine revolution. The sensor consists of a permanent magnet and Induction coil.

Operation

When the engine is running, the high and low parts of the teeth cause the gap with the sensor to change. The changing gap cause the magnetic field near the sensor to change. Due to the changing magnetic field, the voltage from the sensor changes. The Engine Control Module (ECM) receives the voltage signal and detects the fluctuation of the engine revolution.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the crankshaft position sensor electrical connector from the crankshaft position sensor.
3. Remove the accessory drive belt (See Accessory Drive Belt Removal & Installation in Section 02 Engine).
4. Remove the crankshaft pulley (See Crankshaft Pulley Removal & Installation in Section 02 Engine).
5. Remove the timing belt lower cover (See Timing Belt Lower Cover Removal & Installation in Section 02 Engine).
6. Remove the crankshaft position sensor retaining bolts (1).
   (Tighten: Crankshaft position sensor retaining bolt to 20 N·m)
7. Installation is in the order of removal.



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2.4L ENGINE SYMPTOM DIAGNOSIS

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Symptom Diagnostic Tests

General Troubleshooting Checks

- Confirm the engine trouble light is working properly.
- Confirm that there are no DTCs recorded with the X-431 Scan Tool.
- Confirm that the customer's complaint is current, and the conditions that are causing the failure are present.

Visual Inspection

- Check the fuel system for any fuel leakage.
- Check the vacuum system for any broken, kinked or incorrectly linked vacuum pipes or hoses.
- Check the intake air pipe for being jammed, leaking, or damaged.
- Check the ignition system for any broken or aging spark plug wires and verify the engine firing order is correct.
- Check the engine ground cable and verify a clean and tight connection.
- Check the sensors and actuators electrical connectors and verify good contact and tight connection.

NOTE :
Repair any of the above conditions first before continuing with symptom diagnostics.

Diagnostic Help

- Confirm there are no current engine DTCs.
- Confirm that the failure exists and the customer complaint can be verified.
- Inspect the engine following the above steps and verify all engine features are operating properly.
- While servicing the vehicle, verify the service record, vehicle maintenance, engine compression pressures, mechanical ignition timing and fuel conditions.
- If replacing the Engine Control Module (ECM), carry out the validation test. If the failure no longer exists, the failure is in the ECM; if the failure still exists, reinstall the original ECM and repeat the diagnostic test.

Symptom Diagnostic Test List

SYMPTOM DEFINITION
Engine Cranks Normal But Will Not Start
Engine Will Not Crank
Hard Start / Long Crank Time
Fast Idle
Lack / Loss Of Power
Back Fires
Engine Poor Driveability
Low Idle / Stalls During Deceleration
Idle Speed Slow Return To Normal Idle

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Engine Cranks Normal But Will Not Start
The following conditions apply to this symptom:

- The engine cranks at normal speed.
- The engine will not start.
- The battery is fully charged.

1. PRELIMINARY CHECKS

CAUTION:
Extended cranking because of a No Start can load the exhaust system with raw fuel, damaging the catalytic converter after the engine starts.

- Carry out the following preliminary checks:
  - Fuel quality
  - Electrical connections
  - Intake air tube integrity
  - Fuses and relays

Is the check result normal?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. CHECK DTC

- Turn the ignition switch on.
- With the scan tool X-431, select view DTC.

Are there any DTCs present?

Yes >> See the Diagnostic Trouble Code (DTC) List.
Go to the specific diagnostic test to troubleshoot the DTC.

No >> Go to the next step.

3. TRY TO START THE ENGINE WITH THE THROTTLE CLOSED

- Attempt to start the engine.

Does the engine start now with the throttle closed?

Yes >> Verify the symptom no longer exists.

No >> Go to the next step.

4. CHECK EXHAUST SYSTEM

- Inspect the vehicles exhaust system for restriction.

Is there a restriction in the exhaust system?

Yes >> Repair as necessary.

No >> Go to the next step.

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5. CHECK ENGINE CYLINDER COMPRESSION

- Perform a compression test on the engine.

Is engine compression correct?

Yes >> Verify test results. If OK, see Diagnostic Test List to repair any additional symptoms.

No >> Check for cause.

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Engine Will Not Crank

The following conditions apply to this symptom:

- The engine will not crank.

1. PRELIMINARY CHECKS

- Carry out the following preliminary vehicle inspection:
  - Fuel quality
  - Battery connections
  - Starter relay connections
  - Manual transmission clutch fully depressed
  - Engine immobilizer activated
  - Fuses/Fuse links

Is the check result normal?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. LISTEN FOR STARTER RELAY CLICKING

- Attempt to start the engine.

Is a clicking sound heard from the starter relay when the ignition key is turned to START?

Yes >> Go to the next step.

No >> Go to step 5.

3. CHECK STARTING SYSTEM

- Check the starter, starter ground, starter relay cable to starter and battery.

Is a fault indicated?

Yes >> Repair as necessary.

No >> Go to the next step.

4. CHECK OPERATION OF OTHER ELECTRICAL ACCESSORIES

- Check all accessories.

Do any other electrical accessories work?

Yes >> Go to the next step.

No >> Check the charging system.

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5. CHECK DTC

- Turn the ignition switch on.
- With the scan tool X-431, read the DTC.

Are there any DTCs present?

Yes >> Check for cause.

No >> Go to the next step.

6. CHECK STARTING SYSTEM PRIMARY CIRCUITS

- Check the starting system primary circuits as follows:
  - Starter relay
  - Ignition switch

Are components/systems OK?

Yes >> Ensure customer's concern has been resolved.

No >> Repair as necessary.

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Hard Start / Long Crank / Erratic Start / Erratic Crank
The following conditions apply to this symptom:

- The engine cranks for an extended period of time.
- The engine starts hard during a long cranking time.

1. PRELIMINARY CHECKS

- Confirm that the correct starting procedure was used by the customer before proceeding with diagnosis.
- Carry out the following preliminary checks:
  - Vacuum leaks
  - Fuel quality (concerns such as correct octane, contamination, winter/summer blend)
  - Intake air system (tubes)
  - Air cleaner (restrictions)
  - Battery condition and starter current draw.

Are all checks OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. CHECK ECM DTC

- With scan tool X-431, select view DTC and data stream in ECM.

Are there any DTCs present?

Yes >> See the Diagnostic Trouble Code (DTC) List.
Go to the specific diagnostic test to troubleshoot the DTC.

No >> Go to the next step.

3. CHECK SECONDARY IGNITION SYSTEM

- Perform the following to test the secondary ignition system:
  - Disconnect the injector fuse.
  - Remove any of the 4 spark plugs.
  - Connect the spark plug to spark plug wire.
  - Ground the spark plug on the cylinder block.
  - Crank the engine to test the secondary ignition system with the spark plugs removed.

Is a strong blue spark visible at each spark plug while cranking the engine?

Yes >> Go to the next step.

No >> Check Camshaft Position (CMP) sensor signal at ECM.
If CMP sensor is OK, check the following:
- Crankshaft Position (CKP) sensor malfunction
- Faulty spark plug wires
- Faulty spark plugs

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4. CHECK FUEL SYSTEM PRESSURE

- Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
- Check fuel system pressure (See Fuel Pressure Test in Section 04 Fuel Delivery).

Is fuel pressure correct?

Yes >> Go to the next step.

No >> If the fuel pressure is greater than 400 kPa (4.0 bar):
- Replace the fuel pressure regulator.

If the fuel pressure is less than 400 kPa (4.0 bar):
- Check the fuel supply system for restrictions or leaks.
- If no problems, repair or replace fuel filter, pressure regulator or fuel pump assembly.

5. CHECK EXHAUST SYSTEM

- Check the exhaust system for restrictions.

Is there a restriction in the exhaust system?

Yes >> Repair as necessary.

No >> Go to the next step.

6. CHECK ENGINE OVERHEATING

- Is the engine overheating (hot start concern only)?

For hot start concerns, does engine appear to be overheating?

Yes >> Repair the engine cooling system.

No >> Go to the next step.

7. CHECK POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

- Remove the PCV valve and shake it.

Does PCV valve rattle?

Yes >> Go to the next step.

No >> Replace the PCV valve.

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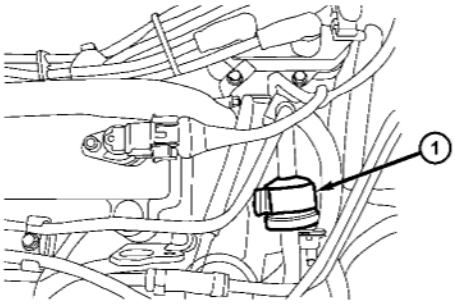
8. CHECK EVAPORATIVE EMISSIONS (EVAP) SYSTEM

- Disconnect the canister control valve (1) hose.
- Place a stiff piece of paper over the hose end and start the engine.

Does vacuum hold the paper?

Yes >> Check for a vacuum leak in EVAP system (refer to EVAP system) and refer to EVAP control circuit relative DTC.

No >> Go to the next step.



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9. CHECK INTAKE AIR SYSTEM

- Check for MAP/MAF sensor.

Is there any contamination?

Yes >> Install a new MAF/IAT or MAP/IAT sensor.

No >> See Diagnostic Help for additional information.

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Fast Idle

The following conditions apply to this symptom:

- The engine idles at a higher than recommended speed.

1. VERIFY ENGINE OPERATES AT NORMAL OPERATING TEMPERATURE

- Check the engine operating temperature.

Does the engine appear to be either overheating or not reaching normal operating temperature?

Yes >> Repair the engine cooling system.

No >> Go to the next step.

2. PRELIMINARY CHECKS

- Carry out the following preliminary checks:
  - Vacuum leaks
  - Throttle plate and linkage
  - Intake air tube (leaks)
  - Correct sealing of intake manifold and components attached to intake air tube

Are all checks OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

3. CHECK ECM DTC

- Turn the ignition switch on.
- With the scan tool X-431, select view DTC and data stream in ECM.

Are there any DTCs present?

Yes >> See the Diagnostic Trouble Code (DTC) List.
Go to the specific diagnostic test to troubleshoot the DTC.

No >> See Diagnostic Help for additional information.

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Lack / Loss Of Power

The following conditions apply to this symptom:

- The engine has poor performance.
- The engine has poor acceleration.

1. PRELIMINARY CHECKS

- Verify symptom is reported under normal driving conditions without excessive engine/vehicle load conditions.
- Carry out the following preliminary checks:
  - Fuel quality
  - Vacuum lines (check for damage and correct routing)
  - Intake air system (check for damaged tubes and dirty air filter)
  - Vehicle wiring (disconnected, corroded/damaged)
  - Throttle linkage
  - Radiator (obstructed)
  - Transaxle

NOTE :
Be aware of the over RPM limiting functions of the ECM.

Are all checks OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. CHECK ECM DTC

- Turn ignition switch on.
- With the scan tool X-431, read the DTC.

Do any DTC displayed on the scan tool?

Yes >> See the Diagnostic Trouble Code (DTC) List.
Go to the specific diagnostic test to troubleshoot the DTC.

No >> Go to the next step.

3. CHECK FUEL SYSTEM PRESSURE

- Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
- Check fuel system pressure (See Fuel Pressure Test in Section 04 Fuel Delivery).

Is fuel pressure correct?

Yes >> Go to the next step.

No >> If the fuel pressure is greater than 400 kPa (4.0 bar):
- Replace the fuel pressure regulator.

If the fuel pressure is less than 400 kPa (4.0 bar):
- Check the fuel supply system for restrictions or leaks.
- If no problems, repair or replace fuel filter, pressure regulator or fuel pump assembly.

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4. CHECK SECONDARY IGNITION SYSTEM

- Perform the following to test the secondary ignition system:
  - Disconnect the injector fuse.
  - Remove any of the 4 spark plugs.
  - Connect the spark plug to spark plug wire.
  - Ground the spark plug on the cylinder block.
  - Crank the engine to test the secondary ignition system with the spark plugs removed.

Is a strong blue spark visible at each spark plug while cranking the engine?

Yes >> Go to the next step.

No >> Check Camshaft Position (CMP) sensor signal at ECM.
If CMP sensor is OK, check the following:
- Crankshaft Position (CKP) sensor malfunction
- Spark plug wires
- Spark plugs

5. CHECK INTAKE AIR SYSTEM

- Check for MAP/MAF sensor.

Is there any contamination?

Yes >> Clean or replace the sensor.

No >> Go to the next step.

6. CHECK EXHAUST SYSTEM

- Check the exhaust system for restrictions.

Is there a restriction in the exhaust system?

Yes >> Repair as necessary.

No >> Go to the next step.

7. CHECK BASE ENGINE CONCERNS

- Check for base engine concerns (such as improper compression, worn camshaft/valve train, gasket leaks).

Is a fault indicated?

Yes >> Repair as necessary.

No >> Go to the next step.

8. CHECK AUTOMATIC/MANUAL TRANSAXLE OPERATION

- Check the operation of the transaxle.

Is the transaxle operation normal?

Yes >> Go to the next step.

No >> Repair as necessary.

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9. CHECK FOR BRAKE SYSTEM CONCERNS

- Check the operation of the brakes.

Is a fault indicated?

Yes >> Repair as necessary.

No >> Go to the next step.

10. ADDITIONAL CHECKS

- Check the following for possible additional causes:
  - Customer driving habits (such as excessive loads or over RPM limiting functions enabled).
  - Clutch.
  - Charging system.
  - Ignition base timing (if not previously checked).
- If the base timing is not correct, align the engine timing belt (See Engine Timing Belt Removal & Installation in 02 Engine).

Are all checks OK?

Yes >> See Diagnostic Help for additional information.

No >> Repair as necessary.
Verify the symptom no longer exists.

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Back Fires

The following conditions apply to this symptom:

- The engine will back fire when operated.
- The engine back fire occurs at all operating parameters.

1. PRELIMINARY CHECKS

- Carry out the following preliminary checks:
  - Vacuum lines (check for damage and correct routing).
  - Spark plug wire routing (correct firing order).

Are all checks OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. CHECK ECM DTC

- Turn the ignition switch on.
- With the scan tool X-431, select view DTC and stream data in ECM.

Are there any DTCs present?

Yes >> See the Diagnostic Trouble Code (DTC) List.
Go to the specific diagnostic test to troubleshoot the DTC.

No >> Go to the next step.

3. CHECK SECONDARY IGNITION SYSTEM

- Perform the following to test the secondary ignition system:
  - Disconnect the injector fuse.
  - Remove any of the 4 spark plugs.
  - Connect the spark plug to spark plug wire.
  - Ground the spark plug on the cylinder block.
  - Crank the engine to test the secondary ignition system with the spark plugs removed.

Is a strong blue spark visible at each spark plug while cranking the engine?

Yes >> Go to the next step.

No >> Check Camshaft Position (CMP) sensor signal at ECM.
If CMP sensor is OK, check the following:
- Crankshaft Position (CKP) sensor malfunction
- Spark plug wires
- Spark plugs

4. CHECK FUEL QUALITY

- Check fuel quality (concerns such as correct octane, contamination).

Is the fuel quality OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

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5. CHECK KNOCK SENSOR

- Check knock sensor.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

6. CHECK TIMING

- Check for the timing misalignment.

Is the check result normal?

Yes >> Go to the next step.

No >> Align the engine timing belt (See Engine Timing Belt Removal & Installation in Section 02 Engine).

7. CHECK FUEL SYSTEM PRESSURE

- Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
- Check fuel system pressure (See Fuel Pressure Test in Section 04 Fuel Delivery).

Is fuel pressure correct?

Yes >> Go to the next step.

No >> If the fuel pressure is greater than 400 kPa (4.0 bar):
- Replace the fuel pressure regulator.

If the fuel pressure is less than 400 kPa (4.0 bar):
- Check the fuel supply system for restrictions or leaks.
- If no problems, repair or replace fuel filter, pressure regulator or fuel pump assembly.

8. CHECK FOR BASE ENGINE CONCERNS

- Check for base engine concerns (such as improper cylinder compression, worn camshaft/valve train, gasket leaks).

Is a fault indicated?

Yes >> Repair as necessary.

No >> See Diagnostic Help for additional information.

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Engine Poor Driveability

The following conditions apply to this symptom:

- Engine stalls/quits, engine runs rough, misses, buck/jerk, hesitation/stumble acceleration, surges, rolling idle.
- Engine stops unexpectedly at beginning of acceleration or during acceleration.
- Engine stops unexpectedly while cruising.
- Engine speed fluctuates during acceleration.
- Engine misses during acceleration.
- Vehicle bucks/jerks during acceleration, cruising or deceleration.
- Momentary pause during acceleration.
- Momentary minor loss in engine output.

1. PRELIMINARY CHECKS

NOTE :
Be aware of the over RPM limiting functions of the ECM.

- Carry out the following preliminary checks:
  - Fuel quality
  - Vacuum lines (check for damage and correct routing)
  - Intake air system (check for damaged tubes and dirty air filter)
  - Vehicle wiring (disconnected, corroded/damaged)
  - Throttle linkage.
  - Radiator (obstructed)
  - Transaxle

Are all checks OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. CHECK FOR STALL AT IDLE

- Check for engine stall at idle.

NOTE :
Confirm that proper vehicle maintenance has been performed before continuing with engine diagnosis.

- Inspect the following components:
  - Clean the injectors
  - Fuel filter
  - Intake air filter
  - Throttle body
  - Spark plugs
  - Spark plug wires

Does the engine now stall at idle?

Yes >> Repair as necessary.

No >> Go to the next step.

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3. CHECK FOR ROUGH IDLE

- Check for engine rough idle.

NOTE :
Confirm that proper vehicle maintenance has been performed before continuing with engine diagnosis.
- Inspect the following components:
  - Clean the carbon deposit on intake and exhaust valves
  - Valve stem
  - Spark plugs
  - Throttle body
  - Spark plugs and combustion chamber

Does the engine idle rough?

Yes >> Repair as necessary.

No >> Go to the next step.

4. CHECK ECM DTC

- Turn the ignition switch on.
- With the scan tool X-431, read the DTC.

Are there any DTCs present?

Yes >> Repair as necessary.

No >> Go to the next step.

5. CHECK THE ELECTRONIC THROTTLE CONTROL (ETC) ACTUATOR

- Start engine and let idle.
- While checking for RPM drop or engine stall, disconnect ETC actuator connector.

Did RPM drop or engine stall when the ETC connector was disconnected?

Yes >> Connect ETC actuator connector.
Go to the next step.

No >> Repair as necessary.

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6. CHECK SECONDARY IGNITION SYSTEM

- Perform the following to test the secondary ignition system:
  - Disconnect the injector fuse.
  - Remove any of the 4 spark plugs.
  - Connect the spark plug to spark plug wire.
  - Ground the spark plug on the cylinder block.
  - Crank the engine to test the secondary ignition system with the spark plugs removed.

Is a strong blue spark visible at each spark plug while cranking the engine?

Yes >> Go to the next step.

No >> Check Camshaft Position (CMP) sensor signal at ECM.
If CMP sensor is OK, check the following:
- Crankshaft Position (CKP) sensor malfunction
- Spark plug wires
- Spark plugs

7. CHECK FUEL SYSTEM PRESSURE

- Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
- Check fuel system pressure (See Fuel Pressure Test in Section 04 Fuel Delivery).

Is fuel pressure correct?

Yes >> Go to the next step.

No >> If the fuel pressure is greater than 400 kPa (4.0 bar):
- Replace the fuel pressure regulator.

If the fuel pressure is less than 400 kPa (4.0 bar):
- Check the fuel supply system for restrictions or leaks.
- If no problems, repair or replace fuel filter, pressure regulator or fuel pump assembly.

8. CHECK EXHAUST SYSTEM

- Check the exhaust system for restrictions.

Is there a restriction in the exhaust system?

Yes >> Repair as necessary.

No >> Go to the next step.

9. CHECK PCV SYSTEM

- Check the Positive Crankcase Ventilation (PCV) system.
- Remove PCV valve and shake it.

Is PCV valve normal?

Yes >> Go to the next step.

No >> Replace the PCV valve.

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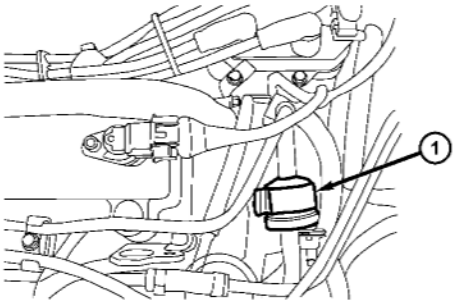
10. CHECK EVAPORATIVE EMISSIONS (EVAP) SYSTEM

- Disconnect the canister control valve (1) hose.
- Place a stiff piece of paper over the hose end, start engine.

Does vacuum hold the paper?

Yes >> Check for a vacuum leak in EVAP system (refer to EVAP system) and refer to EVAP control circuit relative DTC.

No >> Go to the next step.



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11. CHECK ENGINE CYLINDER COMPRESSION

- Check engine cylinder compression.
- Compression should not be less than 1,000 kPa, and not vary more than 25 percent from cylinder to cylinder.

Is engine compression correct?

Yes >> Go to the next step.

No >> Repair as necessary.

12. ADDITIONAL CHECKS

- Check the following for possible additional causes:
  - Driveline
  - Transaxle
  - Charging system
  - A/C system (for surge with A/C on)

Are the checks OK?

Yes >> See Diagnostic Help for additional information.

No >> Repair as necessary.

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Low Idle / Stalls During Deceleration
The following conditions apply to this symptom:

- Engine stops unexpectedly at beginning of deceleration or recovery from deceleration.

1. PRELIMINARY CHECKS

- Carry out the following preliminary checks:
  - Vacuum lines (routing, leaks)
  - Intake air tubes
  - Wiring connections

Are all checks OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. CHECK FOR ROUGH OR STALL AT IDLE

- Check for rough idle or stall at idle.

NOTE :
Confirm that proper vehicle maintenance has been performed before continuing with engine diagnosis.

- Inspect the following components:
  - Clean the carbon deposit on intake and exhaust valves
  - Valve stem
  - Spark plugs and combustion chamber

Does the engine idle rough?

Yes >> Repair as necessary.

No >> Go to the next step.

3. CHECK ECM DTC

- Turn the ignition switch on.
- With the scan tool X-431, read the DTC.

Are there any DTCs present?

Yes >> Repair as necessary.

No >> Go to the next step.

4. CHECK THE ELECTRONIC THROTTLE CONTROL (ETC) ACTUATOR

- Start engine and let idle.
- Disconnect ETC actuator connector and check for RPM drop or engine stall.

Did RPM drop or engine stall when the ETC connector was disconnected?

Yes >> Connect ETC actuator connector.
Go to the next step.

No >> Repair as necessary.

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5. CHECK CLUTCH OPERATION CONDITION

- Check clutch operation condition.

Is the transaxle clutch operation normal?

Yes >> Go to the next step.

No >> Repair as necessary.

6. CHECK A/C SYSTEM OPERATION

- Start engine.
- Cycle A/C switch from on to off (verify A/C clutch engages condition).
- Check the A/C system operation.

Does the A/C system operate normally?

Yes >> Go to the next step.

No >> Repair as necessary.

7. CHECK FUEL SYSTEM PRESSURE

- Release the fuel system pressure (See Fuel Pressure Relief Procedure in Section 04 Fuel Delivery).
- Check fuel system pressure (See Fuel Pressure Test in Section 04 Fuel Delivery).

Is fuel pressure correct?

Yes >> Go to the next step.

No >> If the fuel pressure is greater than 400 kPa (4.0 bar):
- Replace the fuel pressure regulator.

If the fuel pressure is less than 400 kPa (4.0 bar):
- Check the fuel supply system for restrictions or leaks.
- If no problems, repair or replace fuel filter, pressure regulator or fuel pump assembly.

8. CHECK FOR BASE ENGINE CONCERNS

- Check for base engine concerns (such as improper compression, worn camshaft/valve train, gasket leaks).

Is a fault indicated?

Yes >> Repair as necessary.

No >> See Diagnostic Help for additional information.

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Idle Speed Slow Return To Normal Idle
The following conditions apply to this symptom:

- Slow return to idle.

1. PRELIMINARY CHECKS

- Carry out the following preliminary checks:
  - Vacuum leaks
  - Intake air system
  - Throttle body

Are all checks OK?

Yes >> Go to the next step.

No >> Repair as necessary.
Verify the symptom no longer exists.

2. CHECK ECM DTC

- Turn the ignition switch on.
- With the scan tool X-431, read the DTC.

Are there any DTCs present?

Yes >> Repair as necessary.

No >> Go to the next step.

3. CHECK PCV VALVE

- Remove Positive Crankcase Ventilation (PCV) valve and shake it.

Does PCV valve rattle?

Yes >> Install PCV valve, go to the next step.

No >> Replace the PCV valve.

4. CHECK PCV SYSTEM

- Start engine and bring to normal operating temperature. Disconnect crankcase ventilation hose from PCV valve. Place a stiff piece of paper over the hose. Wait 1 minute.

Does vacuum hold paper in place?

Yes >> Verify test results. If OK, see diagnostic index to repair any additional symptom.

No >> Check for vacuum leaks, obstructions in the PCV system, oil cap, PCV valve, rocker cover bolt torque/gasket leak. Repair as necessary.

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IGNITION CONTROL

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GENERAL INFORMATION

Description

The electronic ignition system consists of the following components:

- Engine Control Module (ECM)
- Ignition Coil
- Spark Plugs
- Spark Plug Wires
- Camshaft Position (CMP) Sensor
- Crankshaft Position (CKP) Sensor

Operation

The ignition system utilizes a split ignition coil which supplies secondary voltage to two cylinders. When the ignition coil discharges, two spark plugs fire at the same time. The Engine Control Module (ECM) uses inputs from the Crankshaft Position (CKP) Sensor to determine the Top Dead Center (TDC) position of the piston for cylinder number one, and the Camshaft Position (CMP) Sensor to determine which ignition coil to energize.

Specifications

Torque Specifications

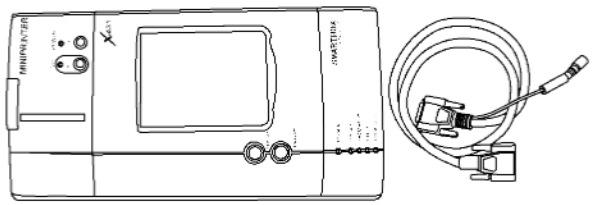
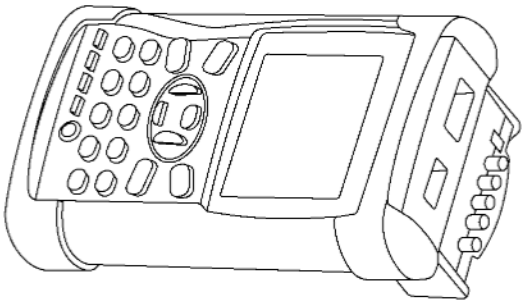
DESCRIPTION	TORQUE (N·m)
Spark Plugs	30
Ignition Coil Bolts	6

Spark Plug Specifications

DESCRIPTION	GAP
FR7DTC	0.7 mm - 1.1 mm

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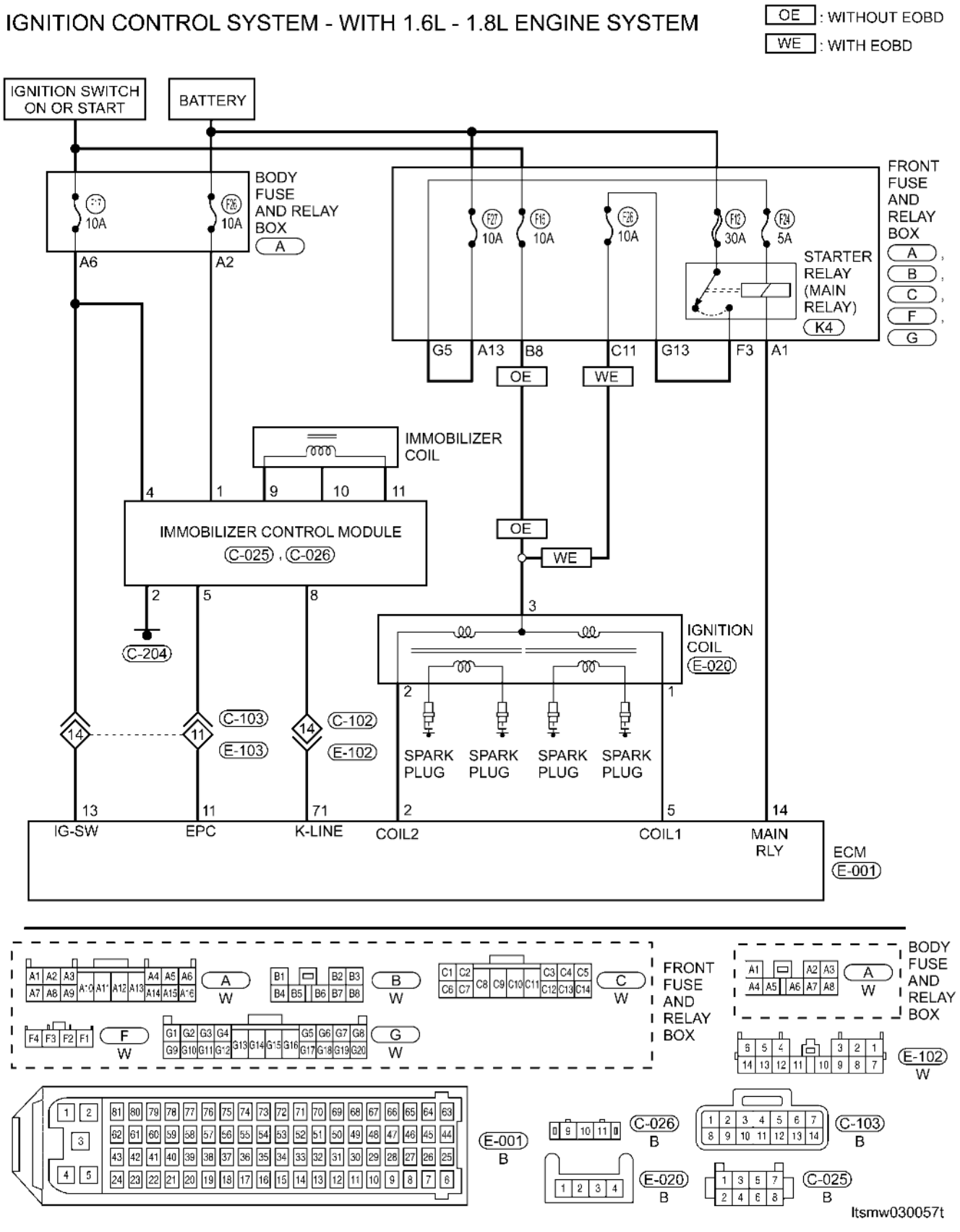
Special Tools

Diagnostic Scan Tool X-431	 besm030001
Engine Analyzer KES-200	 ltsmd030069

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Electrical Schematics

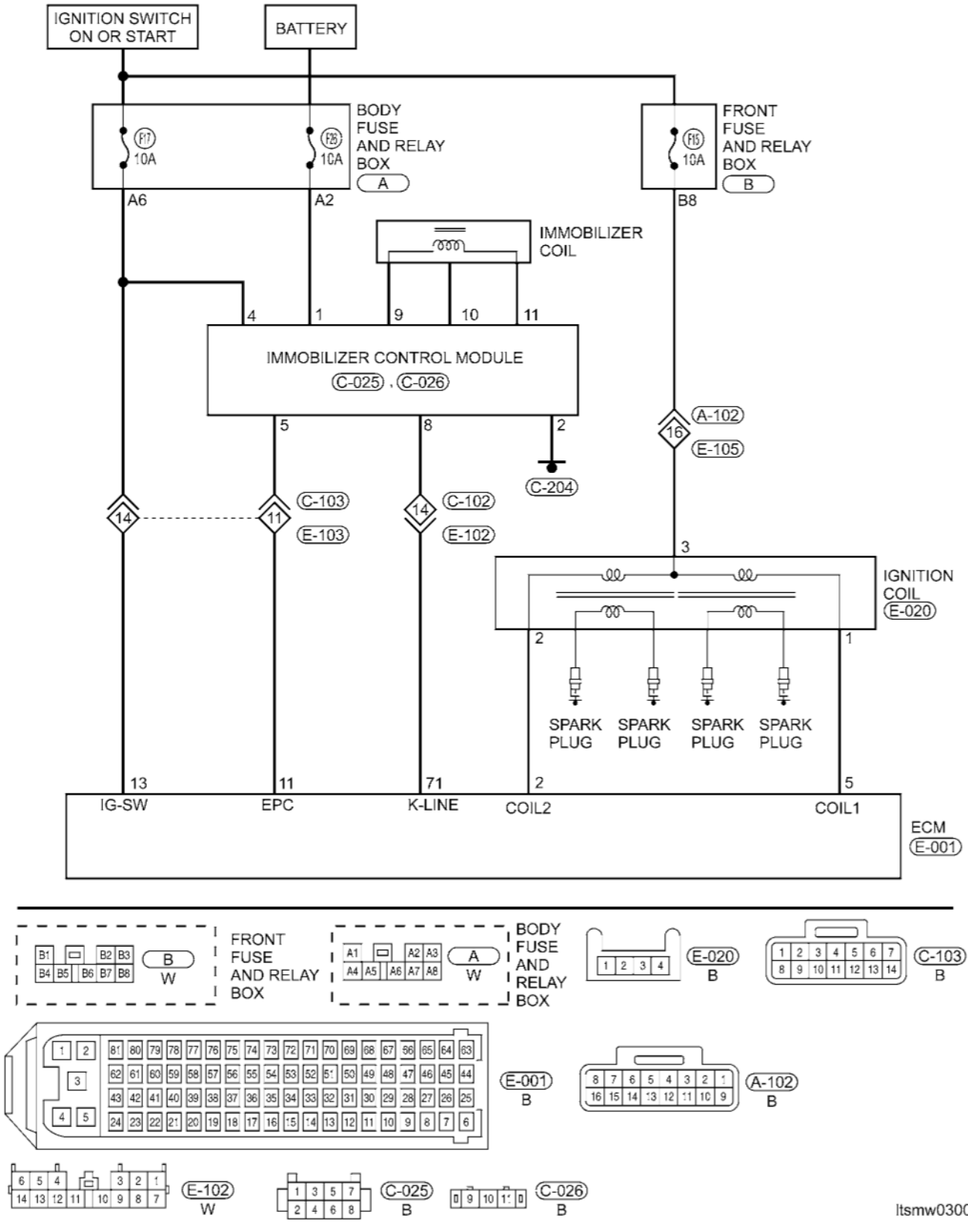
Ignition Control System - 1.6L / 1.8L (Page 1 of 1)



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Ignition Control System - 2.0L (Page 1 of 1)

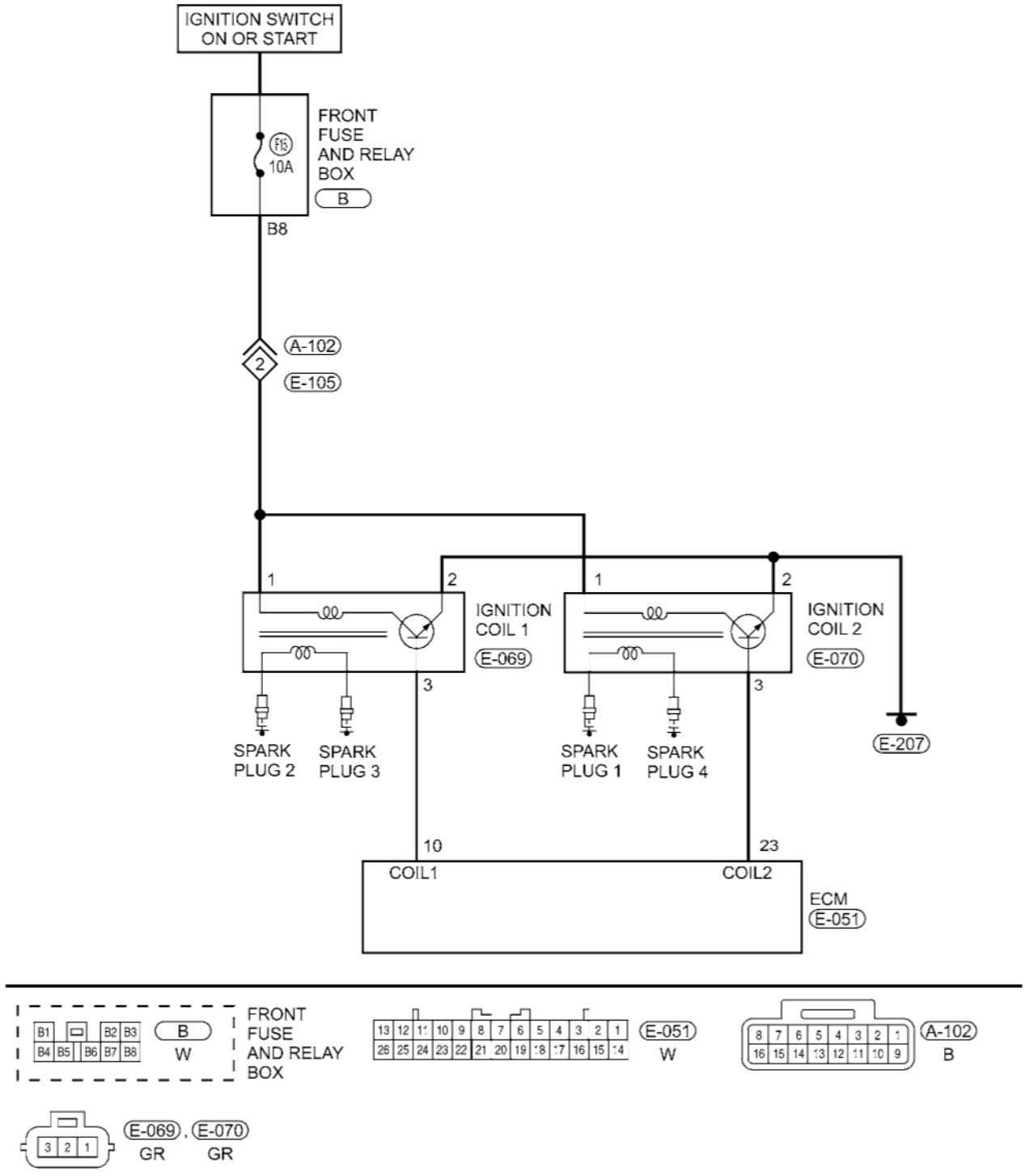
IGNITION CONTROL SYSTEM - WITH 2.0L ENGINE SYSTEM



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Ignition Control System - 2.4L (Page 1 of 1)

IGNITION CONTROL SYSTEM - WITH 2.4L ENGINE SYSTEM



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ON-VEHICLE SERVICE

Ignition Coil 1.6L & 1.8L & 2.0L

Description

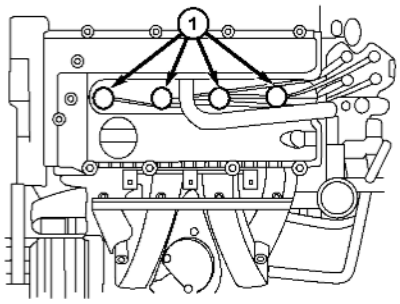
The ignition coil consists of primary and secondary groups of wire. The primary wire is located on one end of the coil. One end of the wire is connected to power and the other end is connected to the Engine Control Module (ECM). The secondary coil connects two spark plugs. They form a loop and provide high-voltage output.

Operation

When the primary wire is connected to power, current will flow causing a strong magnetic field to form. When the primary wire is disconnected, the magnetic field will collapse into the secondary wire causing very high voltage output.

Removal & Installation

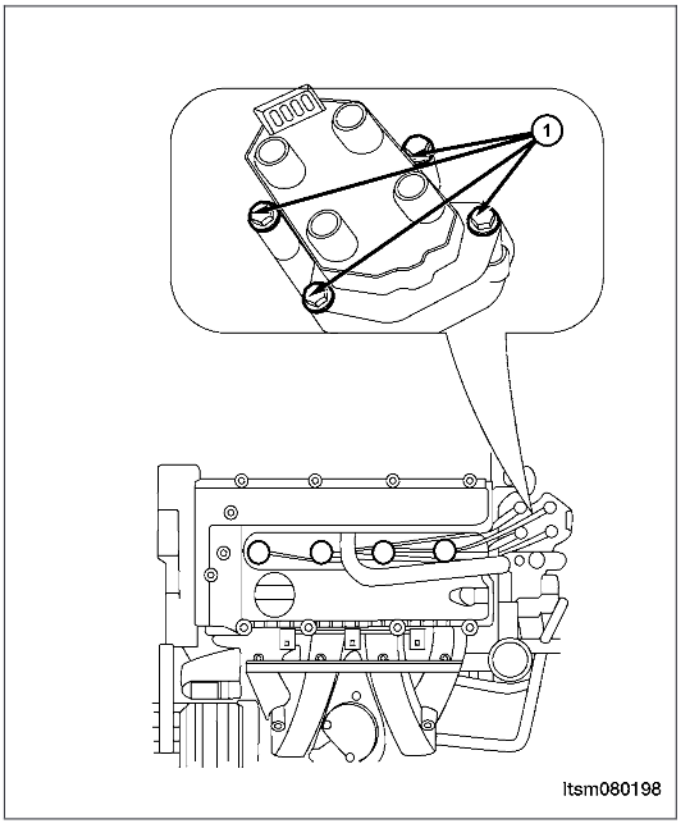
1. Remove the engine cover.
2. Disconnect the negative battery cable.
3. Disconnect the ignition coil electrical connector.
4. Twist the spark plug wires (1) from the ignition coil and remove the four spark plug wires.



besm030028

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5. Remove the 4 ignition coil retaining bolts (1). (Tighten: Ignition coil retaining bolts to 6 N·m)



6. Remove the ignition coil.
7. Installation is in the reverse order of removal.

Ignition Coil 2.4L

Description

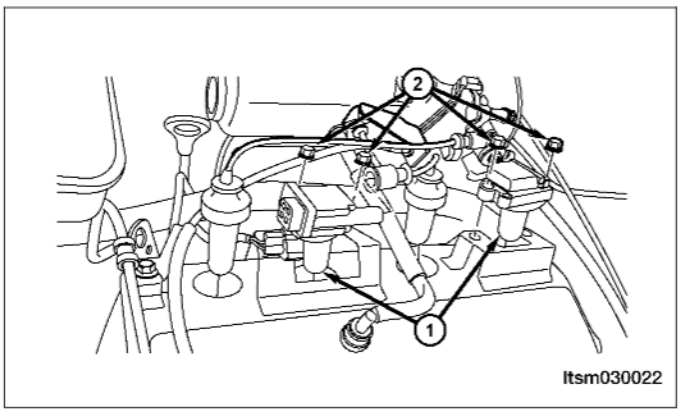
The ignition coil consists of primary and secondary groups of wire. The primary wire is located on one end of the coil. One end of the wire is connected to power and the other end is connected to the Engine Control Module (ECM). The secondary coil connects two spark plugs. They form a loop and provide high-voltage output.

Operation

When the primary wire is connected to power, current will flow causing a strong magnetic field to form. When the primary wire is disconnected, the magnetic field will collapse into the secondary wire causing very high voltage output.

Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the ignition coil connector.
3. Twist the spark plug wire from ignition coils.
4. Remove the ignition coil retaining bolts (2). (Tighten: Ignition coils retaining bolt to 12 N·m)
5. Remove the ignition coils & spark plug wire assembly (1).



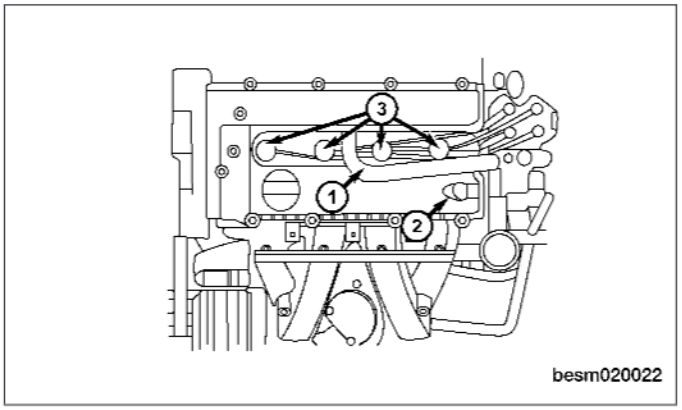
6. Installation is in the reverse order of removal.

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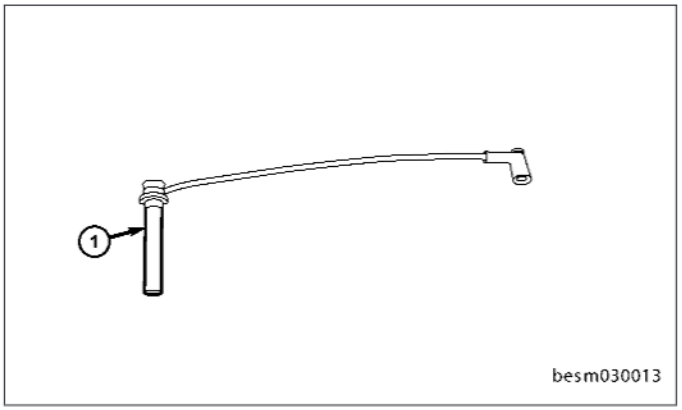
Spark Plug Wire 1.6L & 1.8L & 2.0L

Removal & Installation

1. Remove the engine cover.
2. Disconnect the negative battery cable.
3. Remove the hose (1), if necessary.
4. Disconnect the ignition coil electrical connector (2).
5. Twist the spark plug wire (3) from ignition coil and remove the spark plug wire.
6. Twist the spark plug wire (3) from spark plug then pull the spark plug wire straight up.



7. Remove the spark plug wire (1).
8. Installation is in the reverse order of removal.



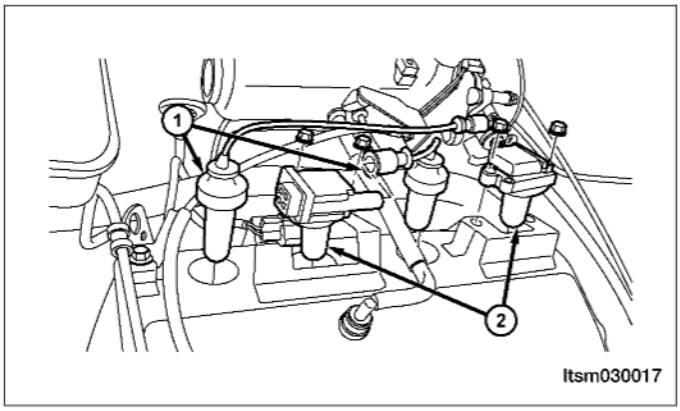
Cylinder Number	1	2	3	4
Part Number	A11-3707130HA	A11-3707140HA	A11-3707150HA	A11-3707160HA
Length (mm)	405	275	165	125
Resistance (KΩ)	6.99 - 12.08	5.32 - 9.59	3.92 - 7.48	3.4 - 6.71

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Spark Plug Wire 2.4L

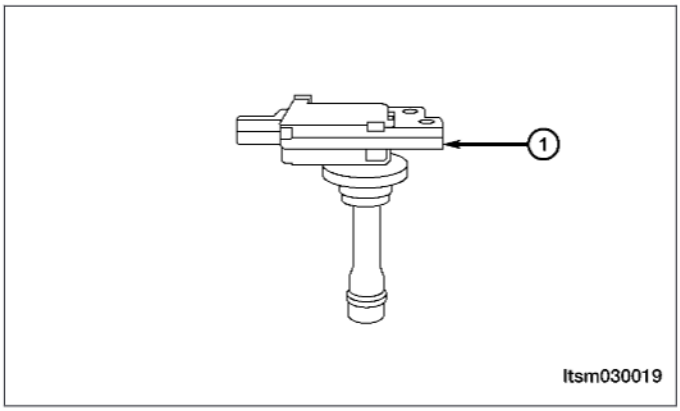
Removal & Installation

1. Disconnect the negative battery cable.
2. Twist the spark plug wire (1) from ignition coils
3. Twist the ignition coils & spark plug wire assembly (2) from spark plug then pull straight up.



ltsm030017

4. Remove the ignition coils & spark plug wire assembly (1).



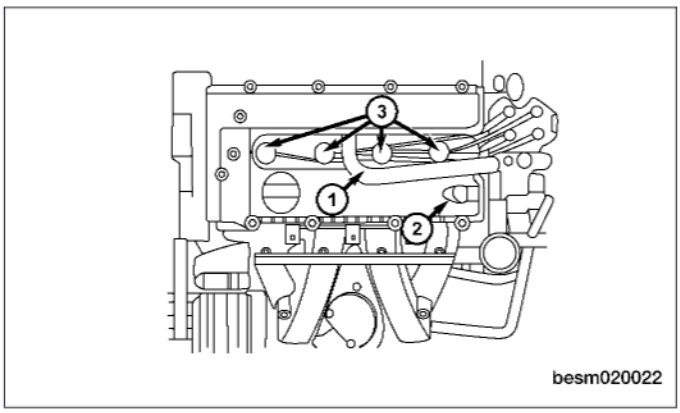
ltsm030019

5. Installation is in the reverse order of removal.

Spark Plug 1.6L & 1.8L & 2.0L

Removal & Installation

1. Remove the engine cover.
2. Disconnect the negative battery cable.
3. Remove the hose (1), if necessary.
4. Twist the spark plug wire (3) from spark plug then pull the spark plug wire straight up.



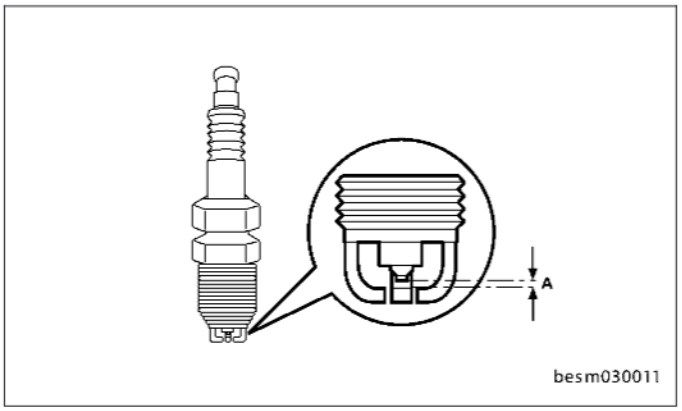
besm020022

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5. Remove the spark plug.
   (Tighten: Spark plugs to 30 N·m)
6. Inspect the spark plug condition.
7. Installation is in the reverse order of removal.

Installation Notes:

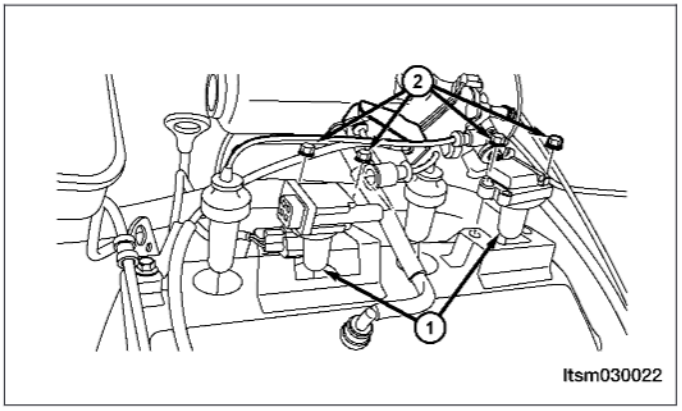
- Verify the proper spark plug gap before installing spark plugs.



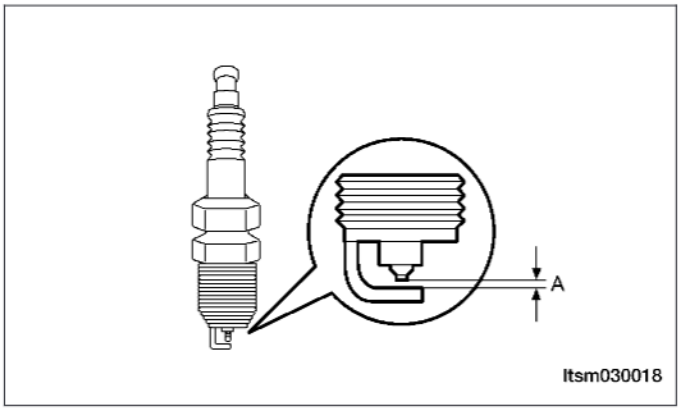
Spark Plug 2.4L

Removal & Installation

1. Disconnect the negative battery cable.
2. Twist the spark plug wire from spark plug then pull straight up.
3. Remove the ignition coils retaining bolts (2).
4. Remove ignition coils (1).



5. Remove the spark plug using a quality socket with a rubber or foam insert.
   (Tighten: Spark plug to 45 N·m)
6. Inspect the spark plug condition.
7. Installation is in the reverse order of removal.



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EVAPORATIVE EMISSIONS

GENERAL INFORMATION 03-577
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- Specifications 03-583
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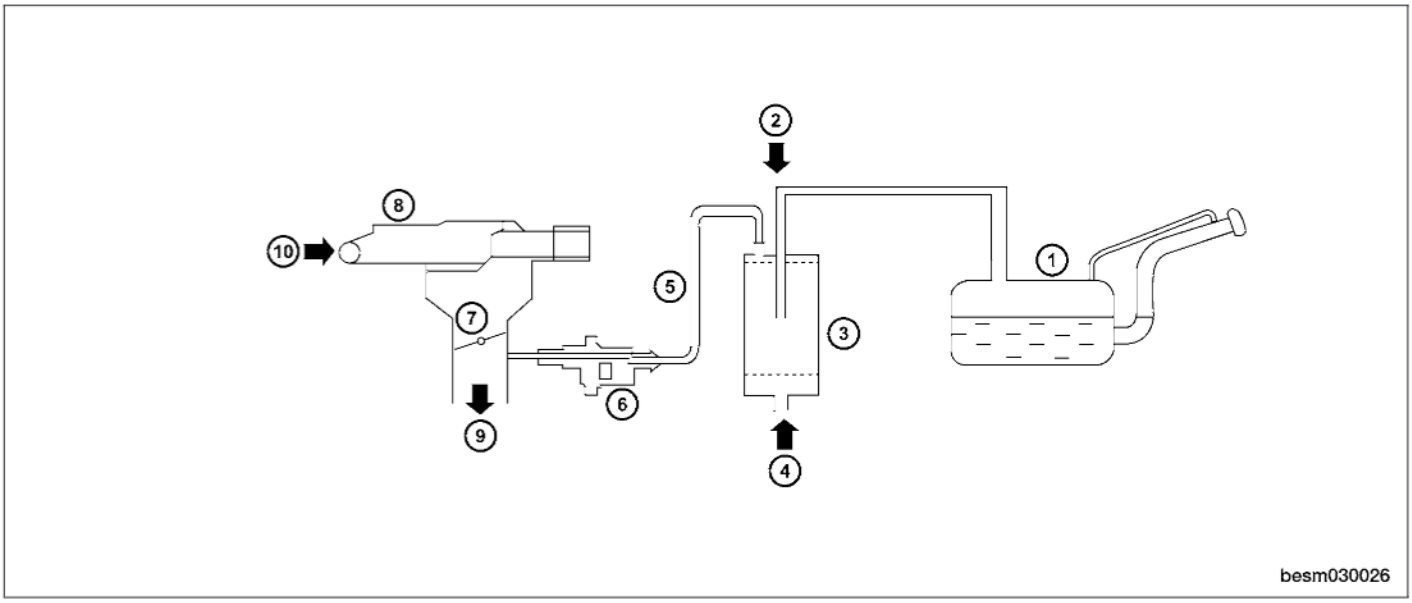
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Description

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to an activated carbon filled evaporative canister. The canister temporarily holds the vapors. The Engine Control Module (ECM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

Operation

1.6L / 1.8L / 2.0L

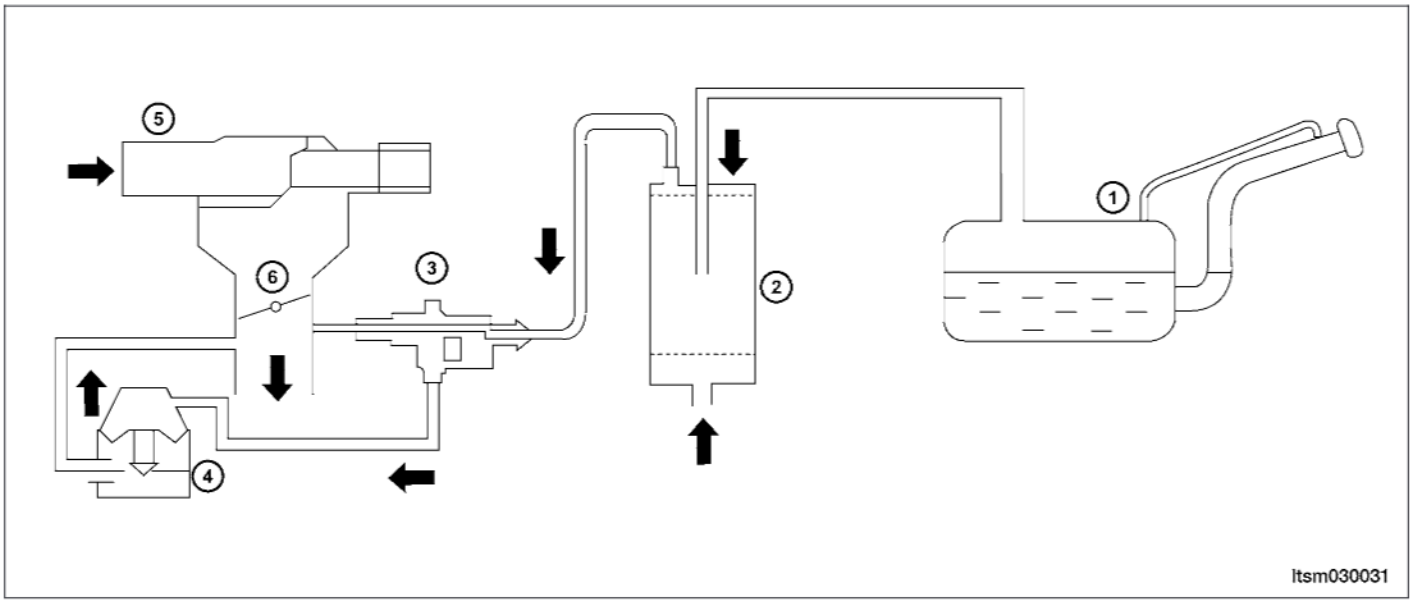


1-Fuel Tank	2-Fuel Vapor
3-Canister	4-Air Intake
5-Hose	6-Canister Control Valve

7-Throttle Valve	8-Air Filter Assembly
9-To Engine	10-Air Intake

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2.4L



1 - Fuel Tank	2 - Canister
3 - Canister Control Valve	4 - EGR Valve

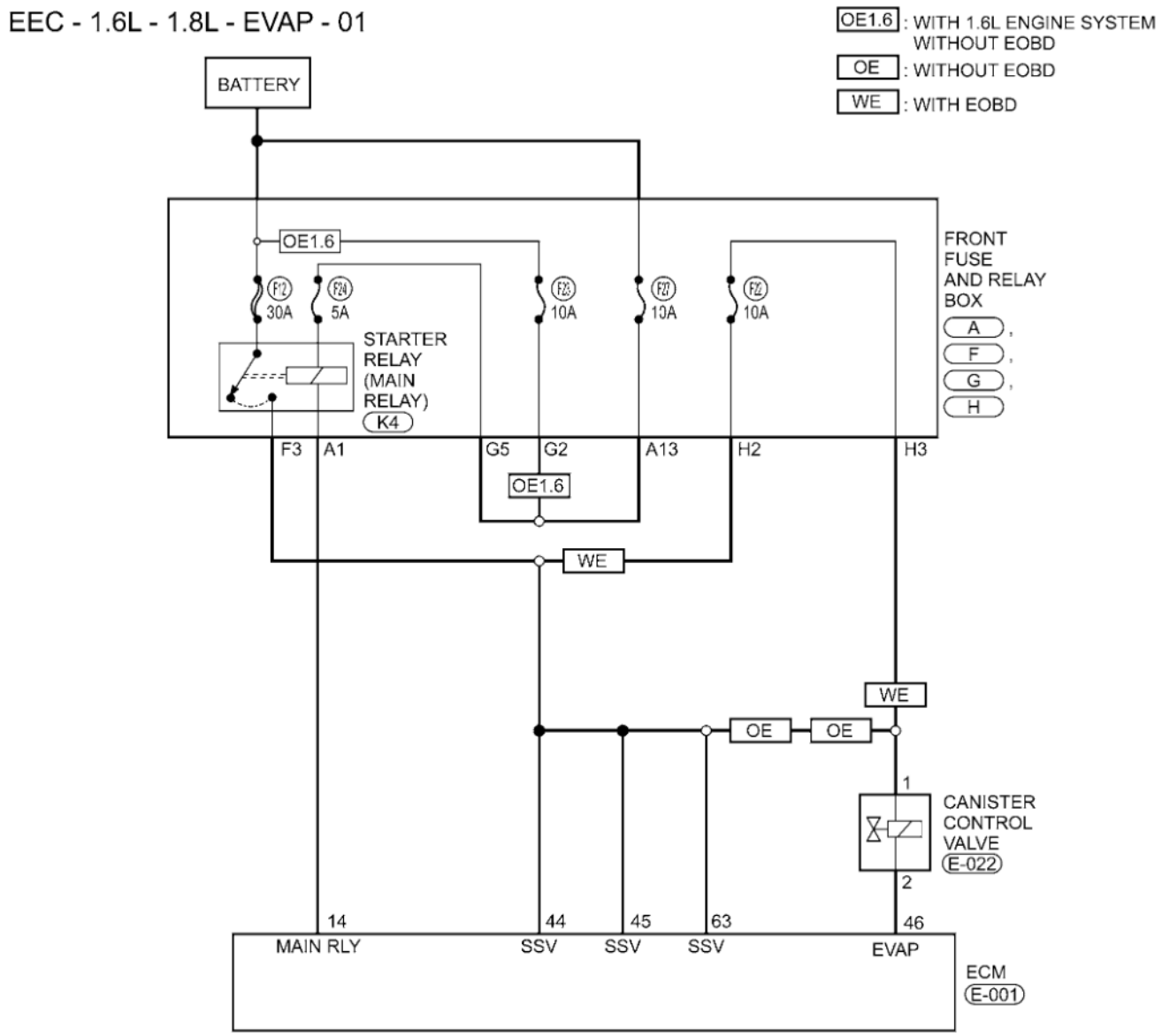
5 - Air Filter Assembly	6 - Throttle Valve

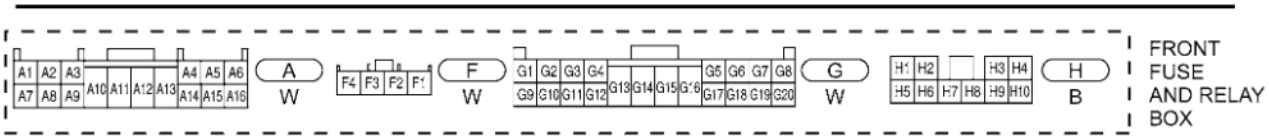
The ECM will only energize the solenoid when the engine is at operating temperature, but will de-energize it during periods of deceleration. When de-energized, no vapors are purged. The pulse-width modulated canister control valve modulates the fuel vapor purge rate from the vapor canister and fuel tank to the engine intake manifold.

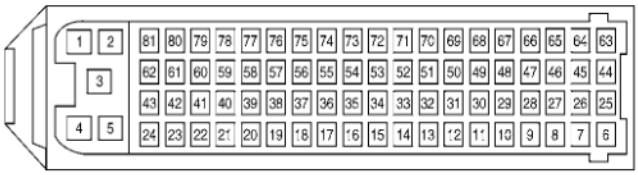
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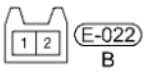
Electrical Schematics

Canister Control Valve 1.6L /1.8L







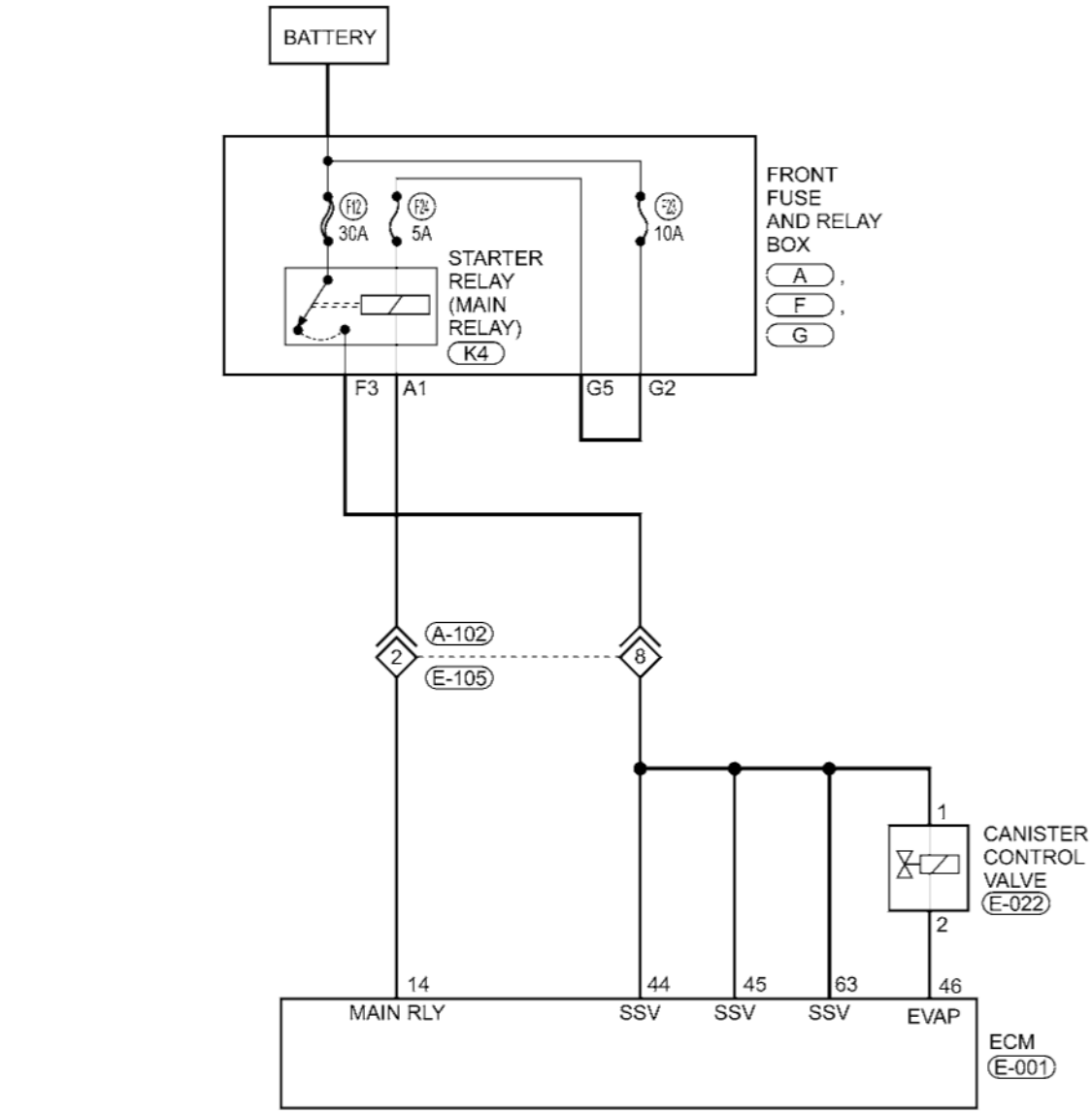


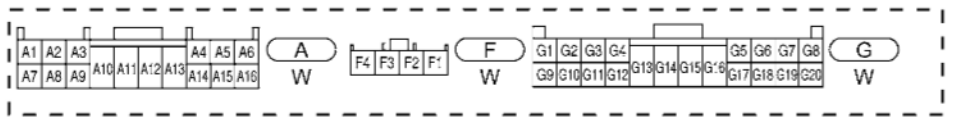
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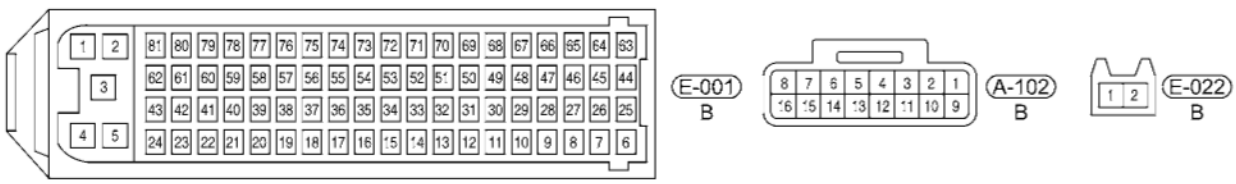
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Canister Control Valve 2.0L

EEC - 2.0L - EVAP - 01





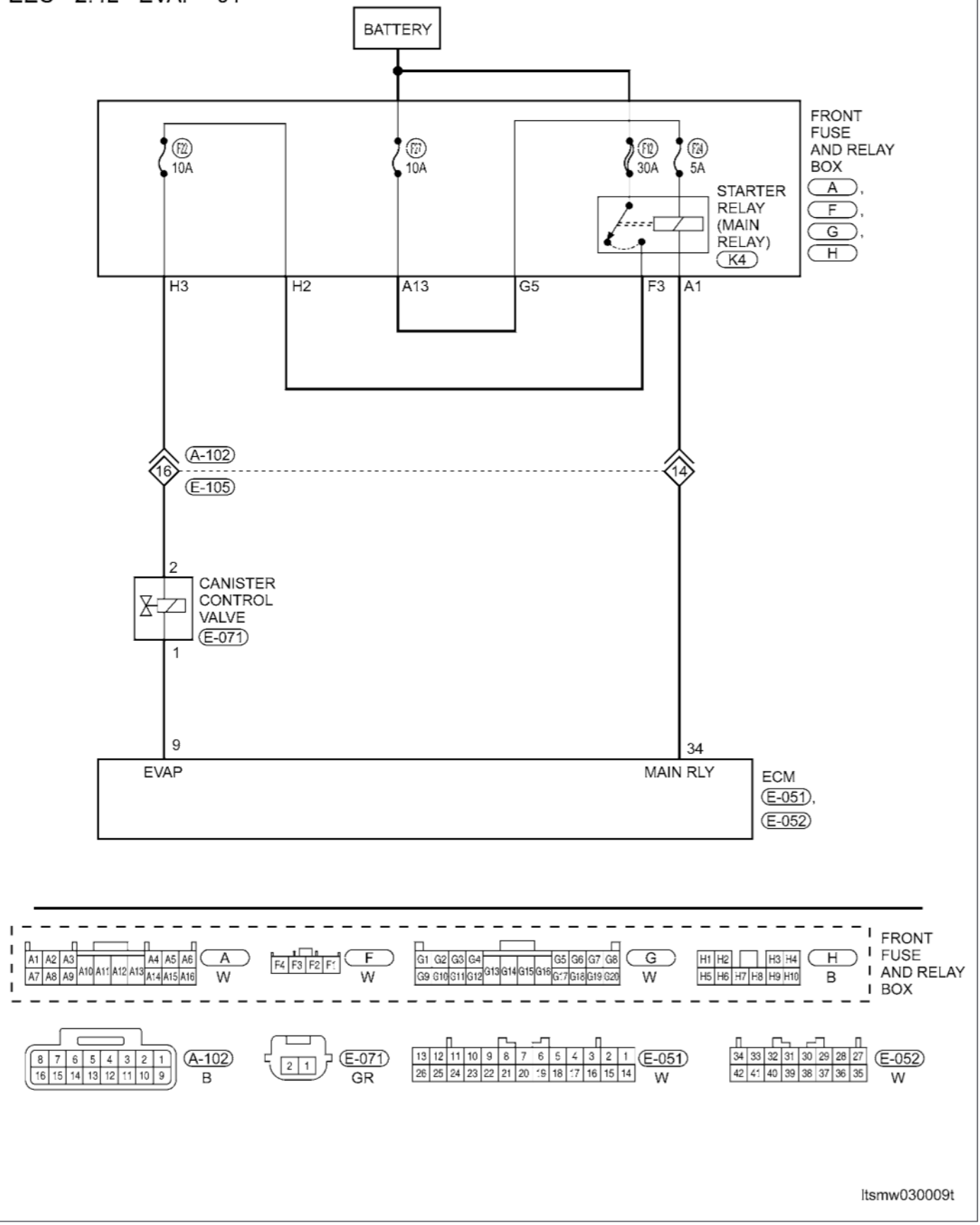


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Canister Control Valve 2.4L

EEC - 2.4L - EVAP - 01

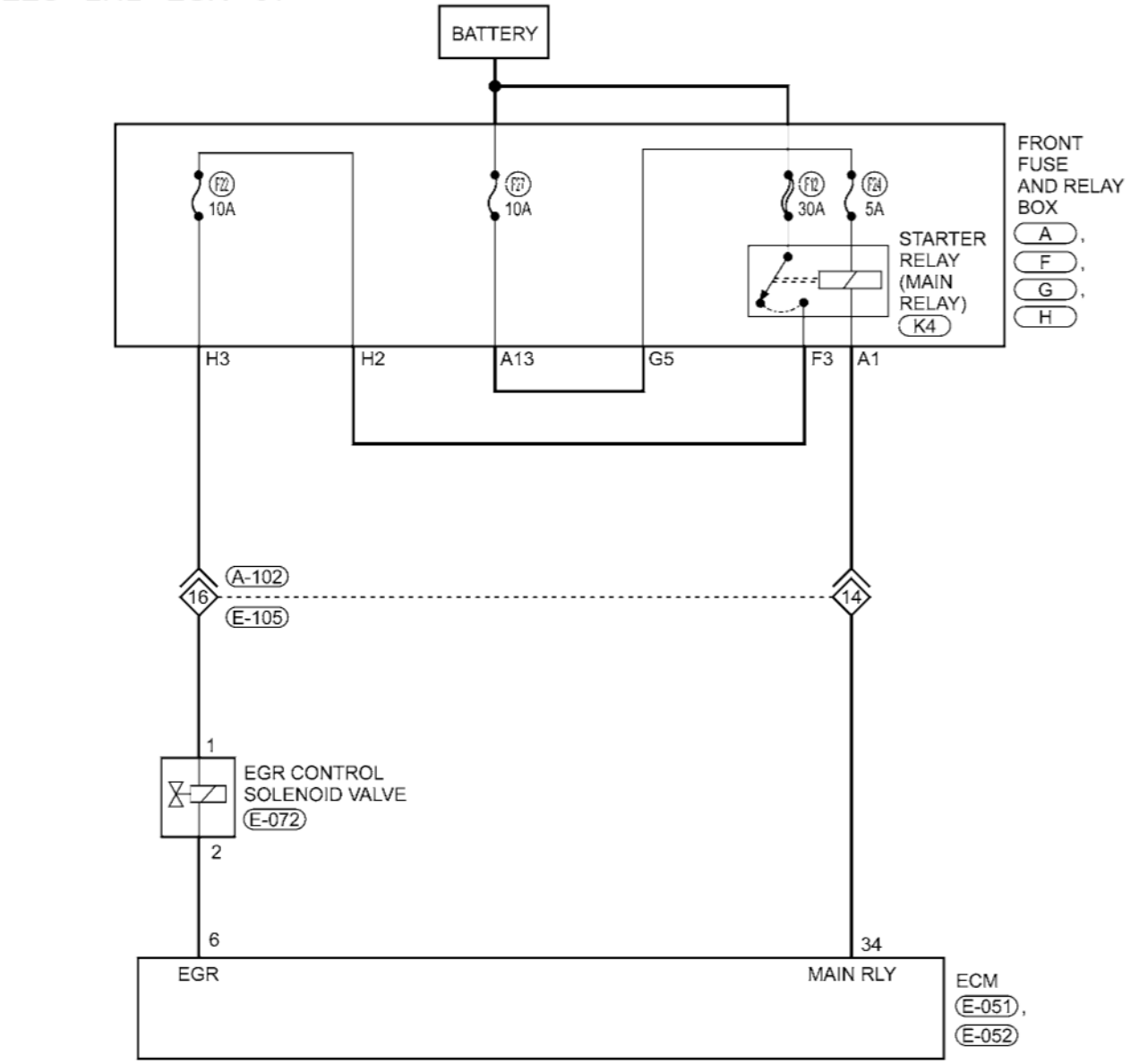


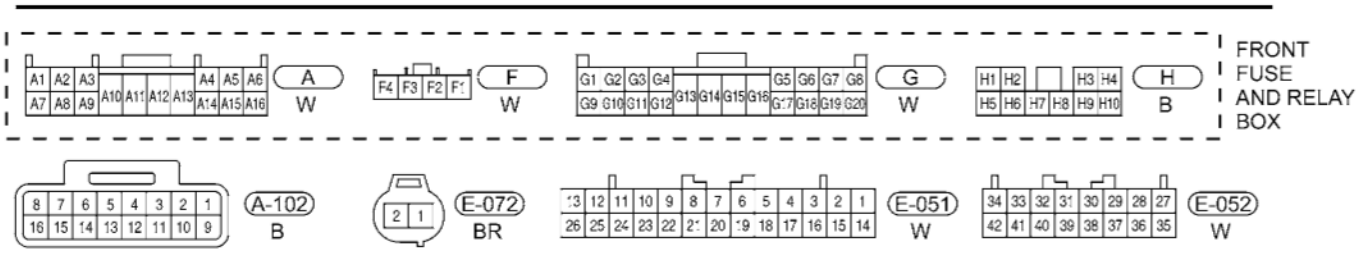
ltsmw030009t

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EGR Control Solenoid Valve 2.4L

EEC - 2.4L - EGR - 01





ltsmw030010t

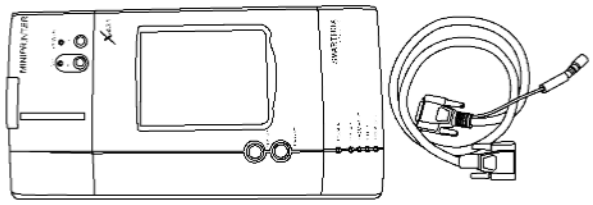
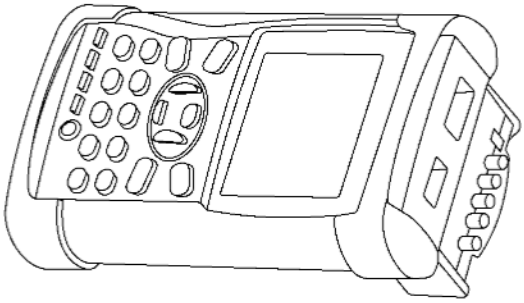
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Specifications

Torque Specifications

DESCRIPTION	TORQUE (N·m)
Vapor Canister Bolts	10

Special Tools

Diagnostic Scan Tool X-431	 besm030001
Engine Analyzer KES-200	 ltsmd030069

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ON-VEHICLE SERVICE

Canister Control Valve 1.6L & 1.8L & 2.0L

Description

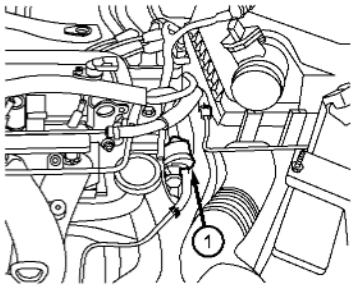
This vehicle uses a pulse-width modulated canister control valve. The canister control valve regulates the rate of vapor flow from the vapor canister to the throttle body. The Engine Control Module (ECM) controls the frequency at which the canister control valve operates in order to accommodate the vapor volume for each cylinder.

Operation

The canister control valve is installed near of the engine air filter. The Engine Control Module (ECM) controls the opening and closing of the canister control valve. When the ECM relay is energized, the canister control valve switches from closed to open.

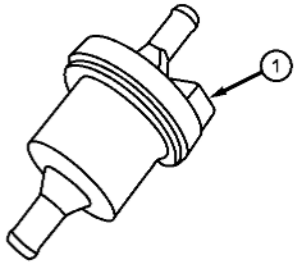
Removal & Installation

1. Disconnect the negative battery cable.
2. Disconnect the canister control valve electrical connector.
3. Disconnect the lines from canister control valve (1).



besm030027

4. Remove canister control valve (1) from the bracket.
5. Installation is in the reverse order of removal.



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Canister Control Solenoid Valve 2.4L

Description

The canister control valve is located near of the engine air filter.

Operation

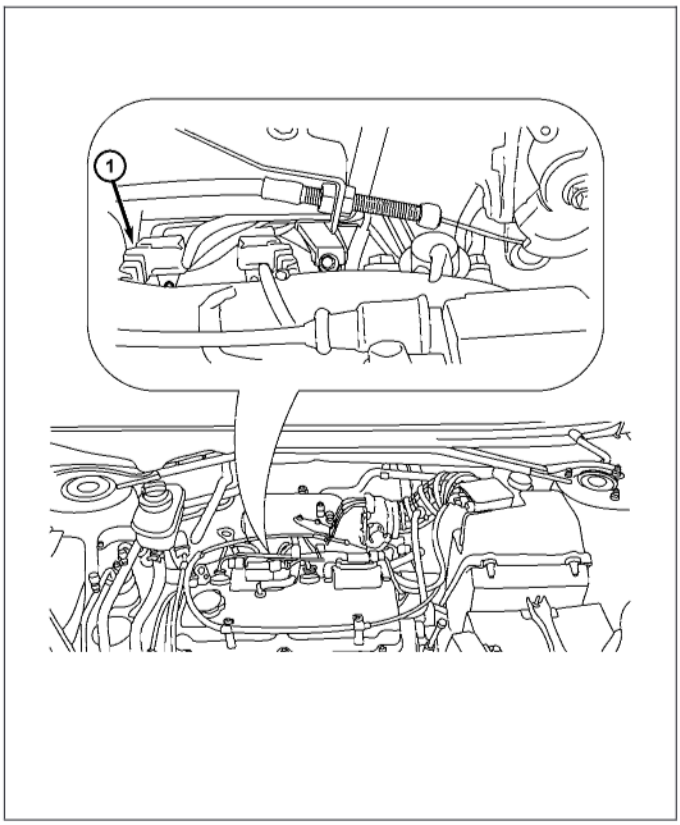
The Engine Control Module (ECM) controls the opening and closing of the canister control valve. When the ECM relay is energized, the canister control valve switches from closed to open. The ECM uses a pulse-width modulated canister control valve to regulates the rate of vapor flow from the vapor canister to the throttle body. The ECM con-

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trols the frequency when the canister control valve operates in order to accommodate the vapor volume for each cylinder.

Removal & Installation

1. Disconnect the battery negative cable.
2. Disconnect canister control solenoid valve electrical connector.
3. Remove the canister control solenoid valve retaining bolt (1).
   (Tighten: Canister control valve retaining bolt to 15 N·m)



4. Remove the canister control valve.
5. Installation is in the reverse order of removal.

Vapor Canister 1.6L & 1.8L & 2.0L

Description

The vapor canister is located on the left side of the core support and is filled with activated carbon granules.

Operation

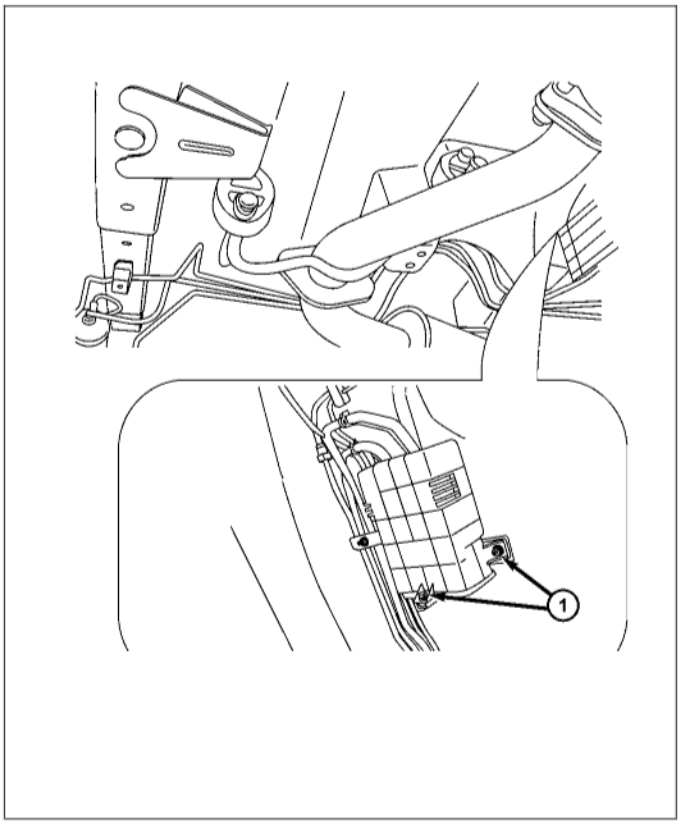
The vapor canister is filled with activated carbon granules. Fuel tank vapors are vented into the canister where they are absorbed by the activated carbon granules. The canister temporarily holds the fuel vapors until intake manifold vacuum draws them into the cylinder chamber. The Engine Control Module (ECM) purges the canister through the pulse-width modulated canister control valve. The ECM purges the canister at predetermined intervals and engine conditions.

Removal & Installation

1. Raise and support the vehicle.

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2. Remove vapor canister retaining bolts (1).
   (Tighten: Vapor canister retaining bolt to 10 N·m)



3. Loosen the vapor canister hose.
4. Pull canister rearward to remove.
5. Installation is in the reverse order of removal.

Vapor Canister 2.4L

Description

The vapor canister is located on the left side of the core support and is filled with activated carbon granules.

Operation

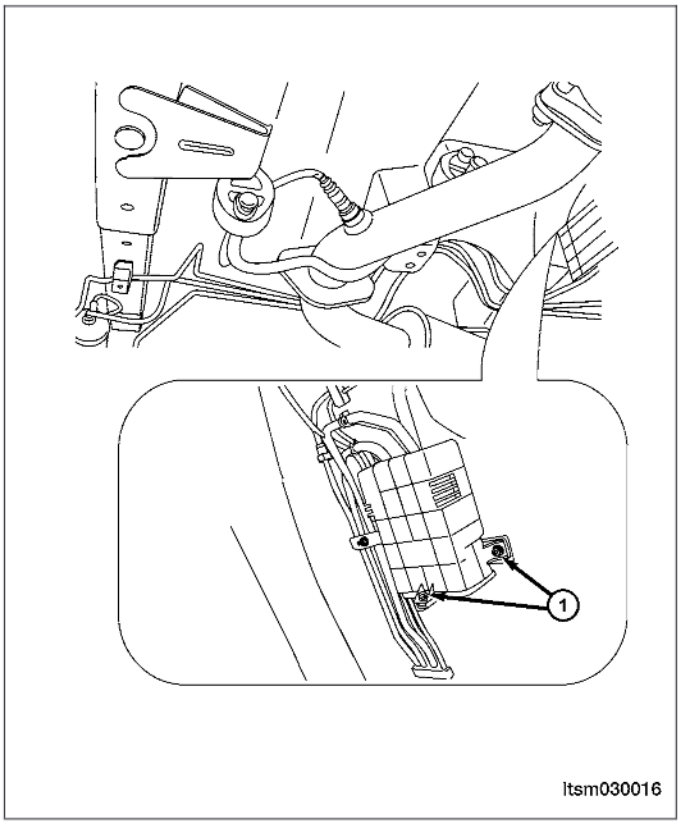
The vapor canister is filled with activated carbon granules. Fuel tank vapors are vented into the canister where they are absorbed by the activated carbon granules. The canister temporarily holds the fuel vapors until intake manifold vacuum draws them into the cylinder chamber. The Engine Control Module (ECM) purges the canister through the pulse-width modulated canister control valve. The ECM purges the canister at predetermined intervals and engine conditions.

Removal & Installation

1. Raise and support the vehicle.

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2. Remove the vapor canister retaining bolts (1).
   (Tighten: Vapor canister retaining bolts to 10 N·m)

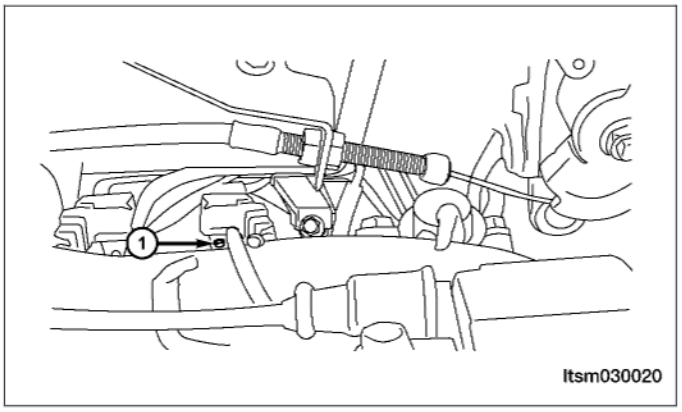


3. Loosen the vapor canister hose.
4. Pull canister rearward to remove.
5. Installation is in the reverse order of removal.

EGR Control Solenoid Valve 2.4L

Removal & Installation

1. Disconnect the battery negative cable.
2. Disconnect EGR control solenoid valve electrical connector from the wiring harness connector.
3. Remove the EGR control solenoid valve retaining bolt (1).
   (Tighten: EGR control solenoid valve retaining bolt to 15 N·m)



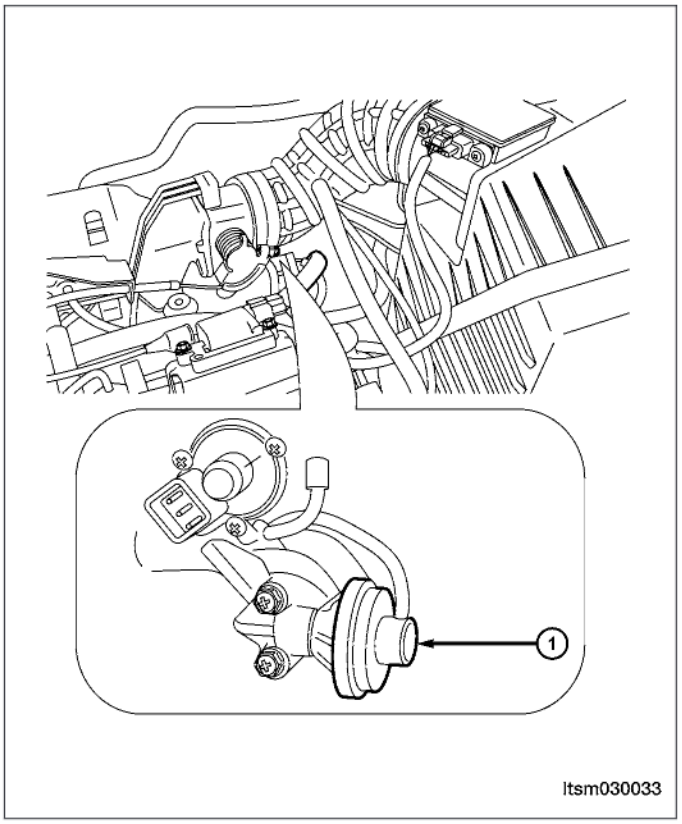
4. Installation is in the reverse order of removal.

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EGR Valve 2.4L

Description

The EGR valve (1) is located on the underside of the idle air control motor. It is controlled by the vacuum hose.



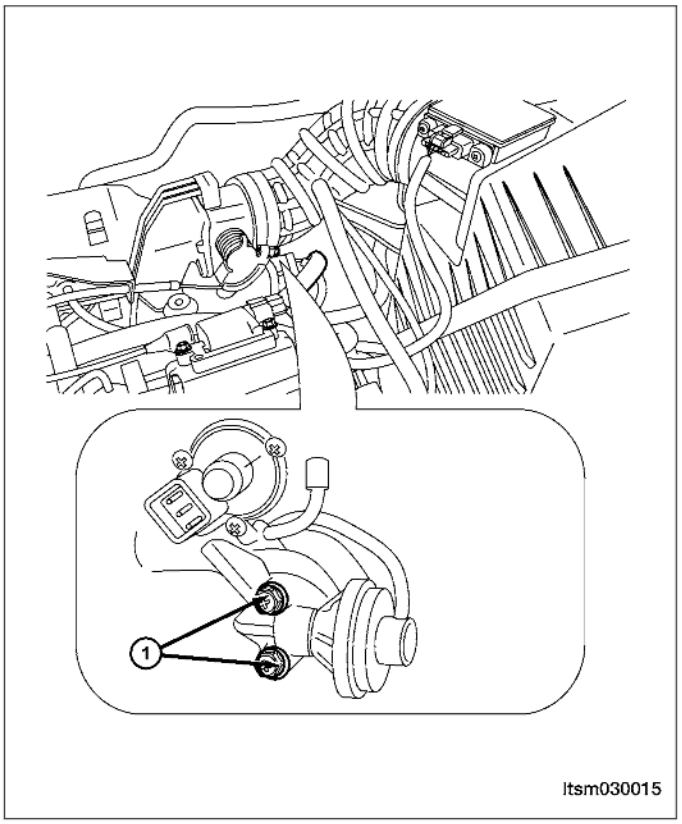
Operation

The EGR valve can heighten the intake air temperature and reduce the NOx content in the exhaust. It is controlled by the coolant temperature sensor and the throttle position sensor.

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Removal & Installation

1. Remove the EGR vacuum hose.
2. Remove the EGR valve retaining bolts (1).
   (Tighten: EGR valve retaining bolts to 25 N·m)



3. Installation is in the reverse order of removal.

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