Section 1

Engine

CONTENTS

Precautions

Precautions

Precautions for Engine

S4RS0B1000001

Air Bag Warning
Refer to “Air Bag Warning: in Section 00”.

Precautions on Engine Service
Refer to “Precautions on Engine Service: in Section 1A”.

Precautions in Diagnosing Trouble
Refer to “Precautions in Diagnosing Trouble: in Section 1A”.

Precautions of ECM Circuit Inspection
Refer to “Precautions of ECM Circuit Inspection: in Section 1A”.

Precautions on Fuel System Service
Refer to “Precautions on Fuel System Service: in Section 1G”.

Precaution for CAN Communication System
Refer to “Precaution for CAN Communication System: in Section 00”.

Precautions for Catalytic Converter
Refer to “Precautions for Catalytic Converter: in Section 00”.

Precautions for Electrical Circuit Service
Refer to “Precautions for Electrical Circuit Service: in Section 00”.

Engine General Information and Diagnosis

Precautions

Precautions on Engine Service

S4RS0B1100001

⚠ CAUTION

The following information on engine service should be noted carefully, as it is important in preventing damage, and in contributing to reliable engine performance.

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer, resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.
  When performing any work where electrical terminals can be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.

Precautions in Diagnosing Trouble

S4RS0B1100002

- Don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM memory. Such disconnection will erase memorized information in ECM memory.
- Diagnostic information stored in ECM memory can be cleared as well as checked by using SUZUKI scan tool or OBD generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
  It is indistinguishable which module turns on MIL because not only ECM but also TCM (for A/T or Automated Manual Transaxle model) turns on MIL (For details of on-board diagnostic system for A/T or Automated Manual Transaxle model, refer to "On-Board Diagnostic System Description: in Section 5A" for A/T or "On-Board Diagnostic System Description: in Section 5D" for Automated Manual Transaxle). Therefore, check both ECM and TCM (for A/T or Automated Manual Transaxle model) for DTC when MIL lights on.
  When checking ECM for DTC, keep in mind that DTC is displayed on the scan tool as follows depending on the scan tool used.
  – SUZUKI scan tool displays DTC detected by ECM.
  – OBD-II generic scan tool displays DTC detected by each of ECM and TCM (for A/T or Automated Manual Transaxle model) simultaneously.
- Priorities for diagnosing troubles
  If two or more DTCs are stored, proceed to the DTC flow which has been detected earliest in the order and follow the instruction in that flow.
  If no instructions are given, troubleshoot DTCs according to the following priorities.
  a. DTCs other than DTC P0171 / P0172 (Fuel system too lean / too rich), DTC P0300 / P0301 / P0302 / P0303 / P0304 (Misfire detected) and DTC P0401 / P0402 (EGR flow malfunction)
  b. DTC P0171 / P0172 (Fuel system too lean / too rich) and DTC P0401 / P0402 (EGR flow malfunction)
  c. DTC P0300 / P0301 / P0302 / P0303 / P0304 (Misfire detected)
- Be sure to read "Precautions for Electrical Circuit Service: in Section 00" before inspection and observe what is written there.
- ECM replacement:
  When substituting a known-good ECM, check for the following conditions. Neglecting this check may cause damage to a known-good ECM.
  – Resistance value of all relays, actuators is as specified respectively.
  – MAP sensor, A/C refrigerant pressure sensor (if equipped with A/C), accelerator pedal position (APP) sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.
- Communication of ECM, BCM, combination meter, keyless start control module (if equipped with keyless start control system) and TCM (for A/T or Automated Manual Transaxle model), is established by CAN (Controller Area Network). (For more detail of CAN communication for ECM, refer to "CAN Communication System Description: "). Therefore, handle CAN communication line with care referring to "Precaution for CAN Communication System: in Section 00".
- Immobilizer transponder code registration after replacing ECM
  When ECM is replaced with new one or with another one, make sure to register immobilizer transponder code to ECM correctly according to "Procedure after ECM Replacement: in Section 10C".

Precautions of ECM Circuit Inspection

S4RS0B1100003

- ECM connectors are waterproofed. Each terminal of the ECM connectors is sealed up with the grommet. Therefore, when measuring circuit voltage, resistance and/or pulse signal at ECM connector, do not insert the tester's probe into the sealed terminal at the harness side. When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to the ECM connectors. And, insert the tester's probe into the special tool's connectors at the harness side, and then measure voltage, resistance and/or pulse signal. Or, ECM and its circuits may be damaged by water.
- Wire colors of the special tool's connectors are different from the ones of the ECM connectors. However, the circuit arrangement of the special tool's connectors is same as the one of the ECM connectors. Therefore, measure circuit voltage and resistance by identifying the terminal location subject to the measurement.

Precautions of Electric Throttle Body System Calibration (For Automated Manual Transaxle Model)

S4RS0B1100004

After performing one of works described below, it is necessary to re-register the completely closed throttle valve reference position stored in memory of ECM. (For detailed information, refer to "Description of Electric Throttle Body System Calibration (For Automated Manual Transaxle Model): ".) For the procedure to register such data in ECM, refer to "Electric Throttle Body System Calibration (For Automated Manual Transaxle Model): in Section 1C".

- To shut off backup power of ECM for such purposes of battery replacement and "RADIO" fuse removal
- To erase DTCs P0122, P0123, P0222, P0223, P2101, P2102, P2103, P2111, P2112, P2119 and/or P2135
- To replace ECM
- To replace throttle body and/or accelerator pedal position (APP) sensor assembly

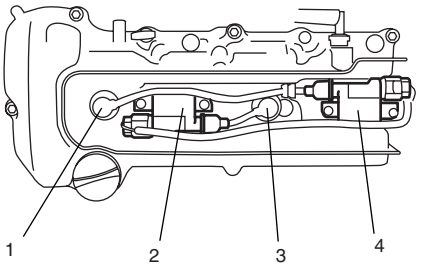
General Description

Statement on Cleanliness and Care

S4RS0B1101001

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of an inch).
Accordingly, when any internal engine parts are serviced, care and cleanliness are important.
It should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
  At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine.
  Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- The four cylinders of the engine are identified by numbers; No.1 (1), No.2 (2), No.3 (3) and No.4 (4) counted from crankshaft pulley side to flywheel side.



I3RM0A110001-01

Engine Diagnosis General Description

S4RS0B1101002

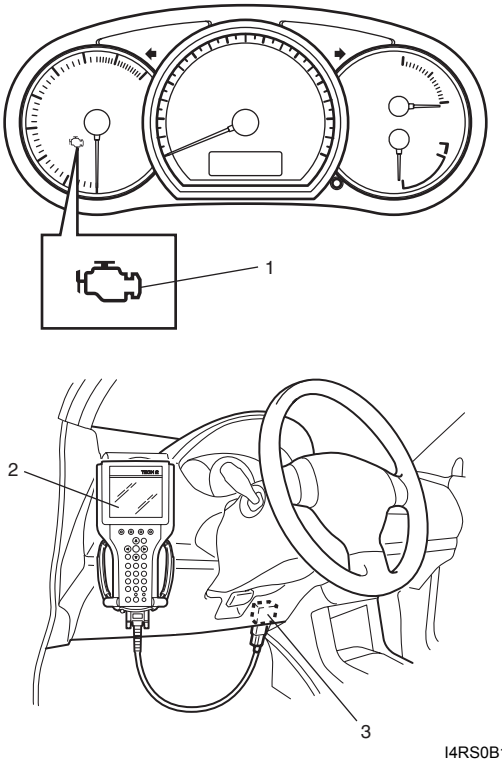
This vehicle is equipped with an engine and emission control system which are under control of ECM.
The engine and emission control system in this vehicle are controlled by ECM. ECM has an On-Board Diagnostic system which detects a malfunction in this system and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, be sure to have full understanding of the outline of "On-Board Diagnostic System Description: " and each item in "Precautions in Diagnosing Trouble: " and execute diagnosis according to "Engine and Emission Control System Check: ".
There is a close relationship between the engine mechanical, engine cooling system, ignition system, exhaust system, etc. and the engine and emission control system in their structure and operation. In case of an engine trouble, even when the malfunction indicator lamp (MIL) doesn't turn ON, it should be diagnosed according to "Engine and Emission Control System Check: ".

On-Board Diagnostic System Description

S4RS0B1101003

ECM in this vehicle has the following functions.

- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) (1) turns ON to check the circuit of the malfunction indicator lamp (1).
- When ECM detects a malfunction which gives an adverse effect to vehicle emission while the engine is running, it makes the malfunction indicator lamp (1) in the meter cluster of the instrument panel turn ON or flash (flashing only when detecting a misfire which can cause damage to the catalyst) and stores the malfunction area in its memory.
  (If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL (1) turn OFF although DTC stored in its memory will remain.)
- As a condition for detecting a malfunction in some areas in the system being monitored by ECM and turning ON the malfunction indicator lamp (1) due to that malfunction, 2 driving cycle detection logic is adopted to prevent erroneous detection.
- When a malfunction is detected, engine and driving conditions then are stored in ECM memory as freeze frame data. (For the details, refer to description on “Freeze Frame Data: ”.)
- It is possible to communicate by using not only SUZUKI scan tool (2) but also OBD generic scan tool. (Diagnostic information can be accessed by using a scan tool.)



I4RS0B110001-01

3. DLC

Warm-Up Cycle

A warm-up cycle means sufficient vehicle operation such that the coolant temperature has risen by at least 22 °C (40 °F) from engine starting and reaches a minimum temperature of 70 °C (160 °F).

Driving Cycle

A “Driving Cycle” consists of engine startup and engine shutoff.

2 Driving Cycle Detection Logic

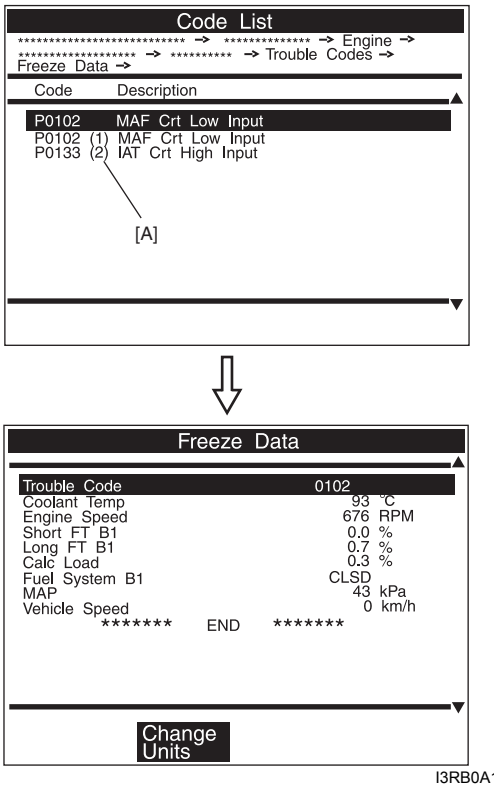
The malfunction detected in the first driving cycle is stored in ECM memory (in the form of pending DTC) but the malfunction indicator lamp does not light at this time. It lights up at the second detection of same malfunction also in the next driving cycle.

Pending DTC

Pending DTC means a DTC detected and stored temporarily at 1 driving cycle of the DTC which is detected in the 2 driving cycle detection logic.

Freeze Frame Data

ECM stores the engine and driving conditions (in the form of data as shown in the figure) at the moment of the detection of a malfunction in its memory. This data is called “Freeze frame data”.
Therefore, it is possible to know engine and driving conditions (e.g., whether the engine was warm or not, where the vehicle was running or stopped, where air/fuel mixture was lean or rich) when a malfunction was detected by checking the freeze frame data. Also, ECM has a function to store each freeze frame data for three different malfunctions in the order as each malfunction is detected. Utilizing this function, it is possible to know the order of malfunctions that have been detected. Its use is helpful when rechecking or diagnosing a trouble.



I3RB0A110002-01

[A]: 1st or 2nd in parentheses here represents which position in the order the malfunction is detected.

Priority of freeze frame data:

ECM has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described. (If malfunction as described in the upper square “1” is detected while the freeze frame data in the lower square “2” has been stored, the freeze frame data “2” will be updated by the freeze frame data “1”.)

Priority	Freeze frame data in frame 1
1	Freeze frame data at initial detection of malfunction among misfire detected (P0300 – P0304), fuel system too lean (P0171) and fuel system too rich (P0172)
2	Freeze frame data when a malfunction other than those in “1” is detected

In the 2nd through the 4th frames, the freeze frame data of each malfunction is stored in the order as each malfunction is detected. These data are not updated.

Shown in the table are examples of how freeze frame data are stored when two or more malfunctions are detected.

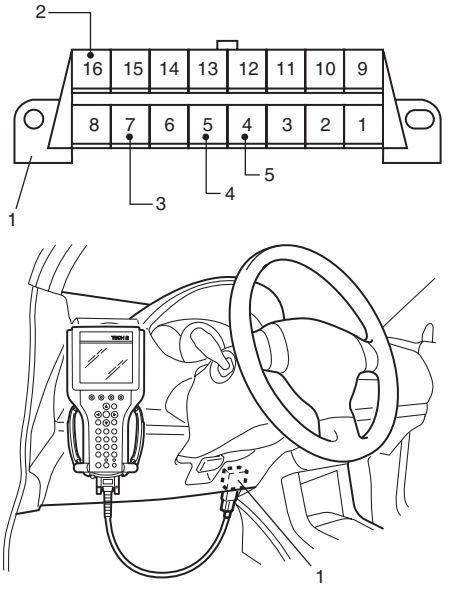
Malfunction detected order		Frame			
		Frame 1	Frame 2	Frame 3	Frame 4
		Freeze frame data to be updated	1st freeze frame data	2nd freeze frame data	3rd freeze frame data
No malfunction		No freeze frame data			
1	P0401 (EGR) detected	Data at P0401 detection	Data at P0401 detection	—	—
2	P0171 (Fuel system) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	—
3	P0300 (Misfire) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	Data at P0300 detection
4	P0301 (Misfire) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	Data at P0300 detection

Freeze frame data clearance:

The freeze frame data is cleared at the same time as clearance of DTC.

Data Link Connector (DLC)

DLC (1) is in compliance with SAE J1962 in the shape of connector and pin assignment.
OBD serial data line (3) (K line of ISO 9141) is used for SUZUKI scan tool or OBD generic scan tool to communicate with ECM, Air bag SDM, immobilizer control module (in ECM), BCM (Body electrical Control Module), TCM (Transmission Control Module (for A/T or Automated Manual Transaxle model)) and ABS control module.



I4RS0B110002-01

2.	B + (Unswitched vehicle battery positive)
4.	ECM ground (Signal ground)
5.	Vehicle body ground (Chassis ground)

Engine and Emission Control System Description

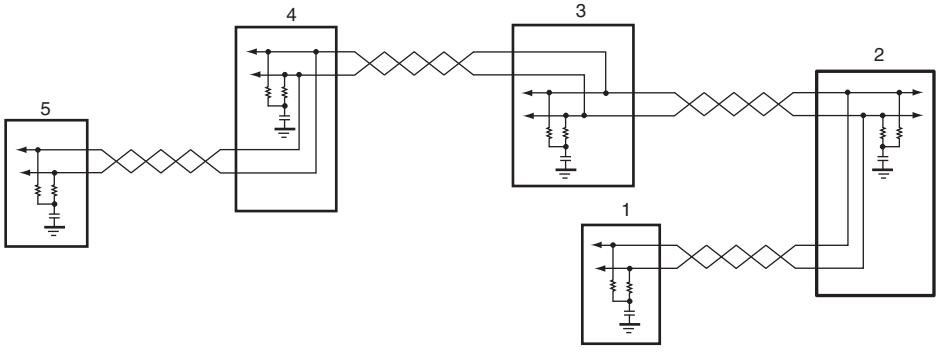
S4RS0B1101004

The engine and emission control system is divided into 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.
Air intake system includes air cleaner, throttle body, IAC valve (for A/T and M/T models) and intake manifold.
Fuel delivery system includes fuel pump, delivery pipe, etc.
Electronic control system includes ECM, various sensors and controlled devices.
Emission control system includes EGR, EVAP and PCV system.

CAN Communication System Description

S4RS0B1101005

ECM (2), TCM (for A/T or Automated Manual Transaxle model) (1), BCM (3), combination meter (4) and keyless start control module (if equipped with keyless start control system) of this vehicle communicate control data between each control module.
Communication of each control module is established by CAN (Controller Area Network) communication system.



I4RS0B110003-01

CAN communication system uses the serial communication in which data is transmitted at a high speed. It uses a twisted pair of two communication lines for the high-speed data transmission. As one of its characteristics, multiple control modules can communicate simultaneously. In addition, it has a function to detect a communication error automatically. Each module reads necessary data from the received data and transmits data. ECM communicates control data with each control module as follows.

ECM Transmission Data

				TCM (for A/T model)	TCM (for Automated Manual Transaxle model)	BCM	Combination Meter	Keyless Start Control Module (if equipped with keyless start control system)
ECM	Transmit	DATA	Engine torque driver requested	○				
			Engine speed	○	○		○	
			Top gear inhibit	○				
			Torque converter clutch control inhibit	○				
			Lock up / slip control inhibit signal	○				
			Throttle position	○	○			
			Immobilizer indication				○	
			Engine emissions related malfunction				○	
			Vehicle speed		○	○	○	○
			Engine coolant temperature	○	○	○	○	
			Brake pedal switch active	○				
			A/C refrigerant pressure (if equipped with A/C)			○		
			Distance kilometers per liter of fuel			○		
			Stand by to engage air conditioning compressor clutch	○				
			Accelerator pedal position		○			
			Intake air temperature		○			

I4RS0B110004-04

NOTE

In communication between ECM and combination meter and between ECM and keyless start control module (if equipped with keyless start control system), data is transmitted only from ECM to combination meter and keyless start control module (if equipped with keyless start control system). (Combination meter and keyless start control module (if equipped with keyless start control system) does not transmit data to ECM.)

ECM Reception Data

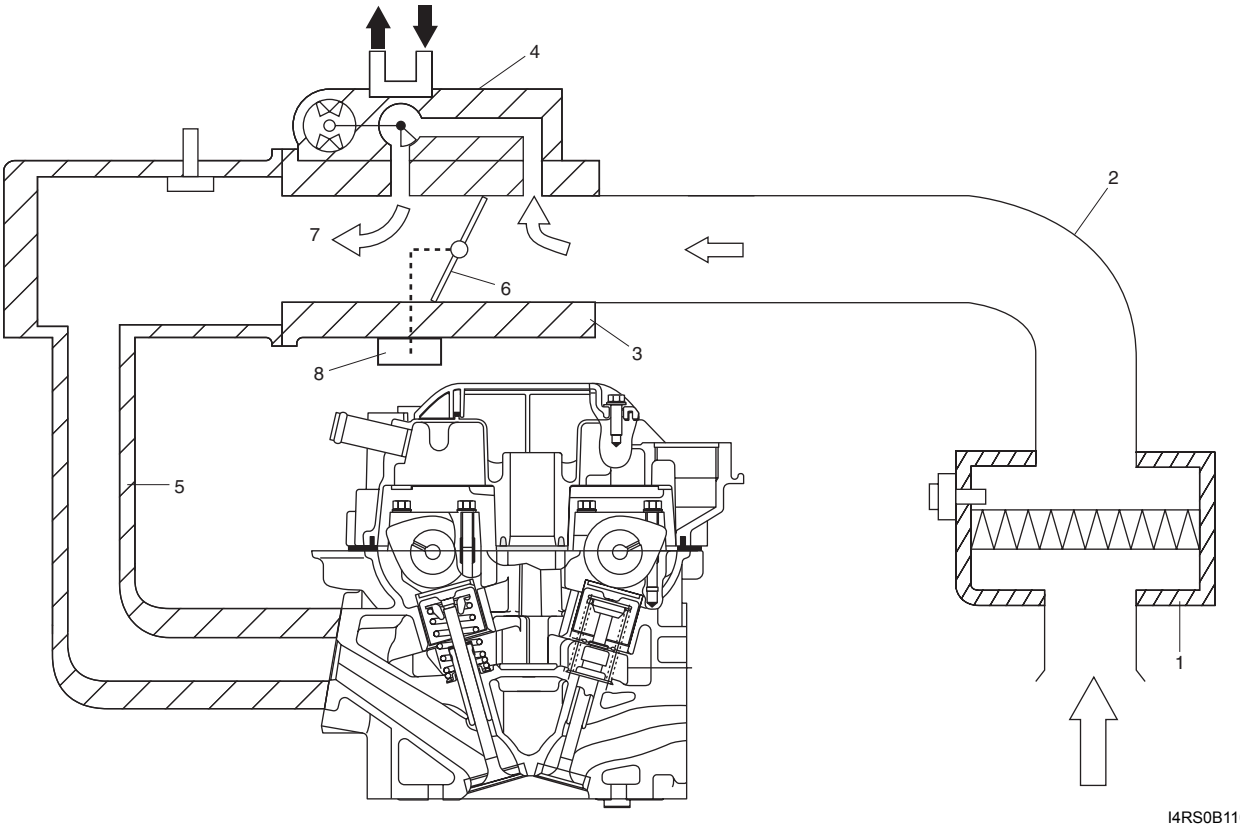
				TCM (for A/T model)	TCM (for Automated Manual Transaxle model)	BCM	Keyless Start Control Module (if equipped with keyless start control system)
ECM	Receive	DATA	Torque down ignition delay request	○			
			Coast slip control signal	○			
			Vehicle speed pulse	○			
			TCM data validity	○			
			Transmission gear selector position	○			
			Transmission actual gear	○			
			A/C switch ON (if equipped with A/C)			○	
			Electric load active (clearance light)			○	
			Electric load active (rear defogger)			○	
			Ignition key switch ON			○	
			Actual gear position		○		
			ECO mode		○		
			Clutch engaging flag		○		
			ID code				○

I4RS0B110005-04

Air Intake System Description

S4RS0B1101006

The main components of the air intake system are air cleaner (1), air cleaner outlet hose (2), throttle body (3), idle air control valve (4) (for A/T and M/T models) and intake manifold (5).
The air (by the amount corresponding to throttle valve (6) opening and engine speed) is filtered by the air cleaner, passes through the throttle body, distributed by the intake manifold and finally drawn into each combustion chamber.
For A/T and M/T models, when the idle air control valve is opened according to the signal from ECM, the air (7) bypasses the throttle valve through bypass passage and is finally drawn into the intake manifold.
For Automated Manual Transaxle model, throttle body is not equipped with IAC valve for idle speed control. Idle speed control is done by the throttle actuator (8) which opens/closes the throttle valve. (For the details, refer to “Description of Electric Throttle Body System (For Automated Manual Transaxle Model): ”.)



I4RS0B110006-01

Description of Electric Throttle Body System (For Automated Manual Transaxle Model)

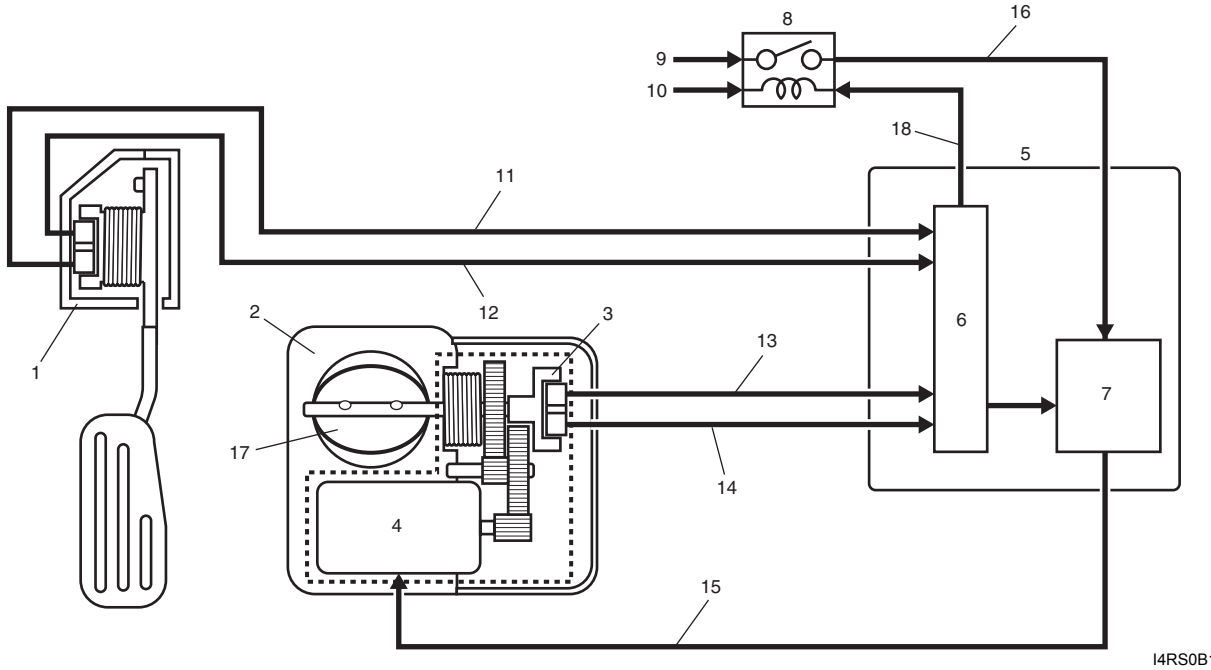
S4RS0B1101009

The Electric Throttle Body System consists of electric throttle body assembly, accelerator position (APP) sensor assembly, ECM and throttle actuator control relay.
Among them, assembly components are as follows.

- Electric throttle body assembly: throttle valve, throttle actuator, 2 throttle position sensors
- Accelerator pedal position (APP) sensor assembly: Accelerator pedal, 2 accelerator position sensors

Operation Description

ECM (5) detects opening (depressed extent of pedal) of the accelerator pedal based on signal voltage of the accelerator pedal position (APP) sensor (1) and using that data and engine operation condition, it calculates the optimum throttle valve opening. On the other hand, it detects the throttle valve opening based on the signal voltage of the throttle position sensor (3) included in the throttle body (2) and compares it with the above calculated optimum throttle valve opening. When there is a difference between them, ECM controls the duty ratio (100% – 0%) according to this difference to drive the throttle actuator (motor) (4) included in the throttle body. When there is no difference, ECM controls the duty ratio to about 15% to maintain the throttle valve opening. In this way, the throttle valve (17) is opened and closed to achieve the optimum throttle valve opening.
In this system, as the throttle position sensor and accelerator pedal position (APP) sensor have 2 sensors (main and sub) each, highly accurate and highly reliable control and abnormality detection are assured. Also, when ECM detects an abnormality in the system, it turns off the throttle actuator control relay (8) to stop controlling the throttle actuator. When the throttle actuator control relay is turned off, the throttle valve is fixed at the opening of about 8° from its completely closed position (default opening) by the force of the return spring and open spring included in the throttle body.
This throttle body is not equipped with IAC valve for idle speed control. Idle speed control is done by the throttle actuator which opens/closes the throttle valve.



I4RS0B110007-02

6. CPU	11. Accelerator pedal position (APP) sensor (main) signal	15. Drive signal of throttle actuator
7. Drive circuit of throttle actuator	12. Accelerator pedal position (APP) sensor (sub) signal	16. Power supply of throttle actuator
9. From “TH MOT” fuse	13. Throttle position sensor (main) signal	18. Control signal of throttle actuator control relay
10. From main relay	14. Throttle position sensor (sub) signal	

Description of Electric Throttle Body System Calibration (For Automated Manual Transaxle Model)

S4RS0B1101010

ECM calculates controlled opening of the throttle valve on the basis of the completely closed throttle valve position of the electric throttle body system. The completely closed position data is saved in memory of ECM. However, the completely closed position of the throttle valve of the electric throttle body system (signal voltage from throttle position sensor when throttle is completely closed) differs one from the other depending on individual differences of the throttle valve and throttle position sensor. As such individual differences must be taken into account for controlling the throttle valve, it is necessary to register the completely closed throttle valve position data in ECM. When such data is registered in ECM, it is saved in RAM (memory) of ECM and used as the base data for controlling the throttle valve. This data is cleared, when any of the works described in “Precautions of Electric Throttle Body System Calibration (For Automated Manual Transaxle Model): ” is performed.
Also, after replacement of the throttle body and/or accelerator pedal position (APP) sensor assembly, the completely closed position data in memory of ECM must be cleared once and a new one must be registered, or ECM cannot judge the complete closure position properly.
For the procedure to register such data, refer to “Electric Throttle Body System Calibration (For Automated Manual Transaxle Model): in Section 1C”. (After the completely closed position data is cleared, ECM, for the first time only, opens and closes the throttle valve for about 5 seconds after the ignition switch is turned ON position, for registration of the completely closed throttle valve position. If the engine is started during this registration process, such symptom as “longer cranking time” or “slow rise of revolution speed immediately after start-up” may occur. However, turning OFF the ignition switch once and restarting will set correct registration.)

Electronic Control System Description

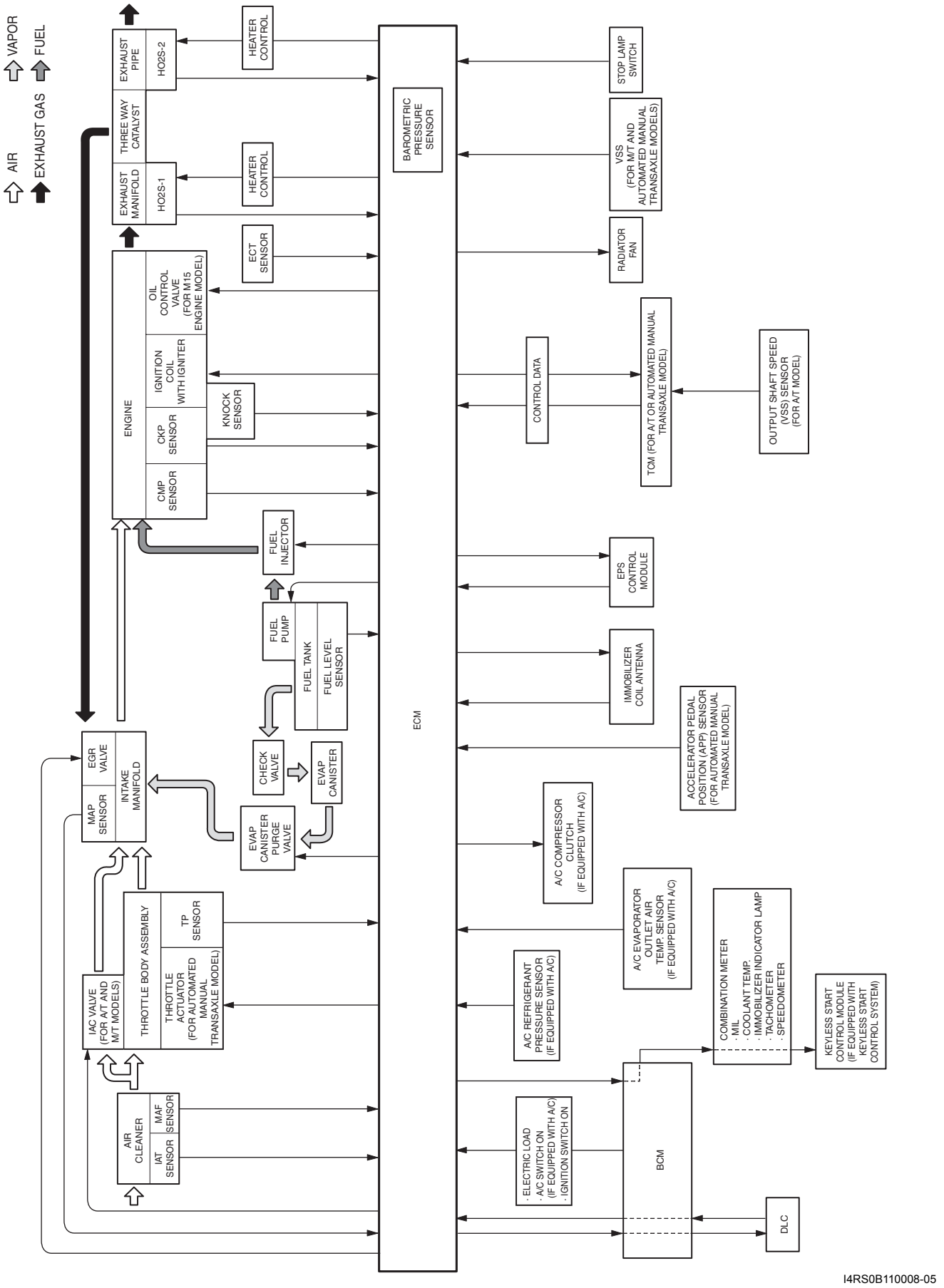
S4RS0B1101007

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices. Functionally, it is divided into the following sub systems:

- Fuel injection control system
- Ignition control system
- Idle speed control system (for A/T and M/T models)
- Electric Throttle Body Control System (for Automated Manual Transaxle model)
- Fuel pump control system
- Radiator cooling fan control system
- Evaporative emission control system
- EGR system
- Oxygen sensor heater control system
- A/C control system (if equipped with A/C)
- Camshaft position control system
- Immobilizer control system
- Controller (computer) communication system

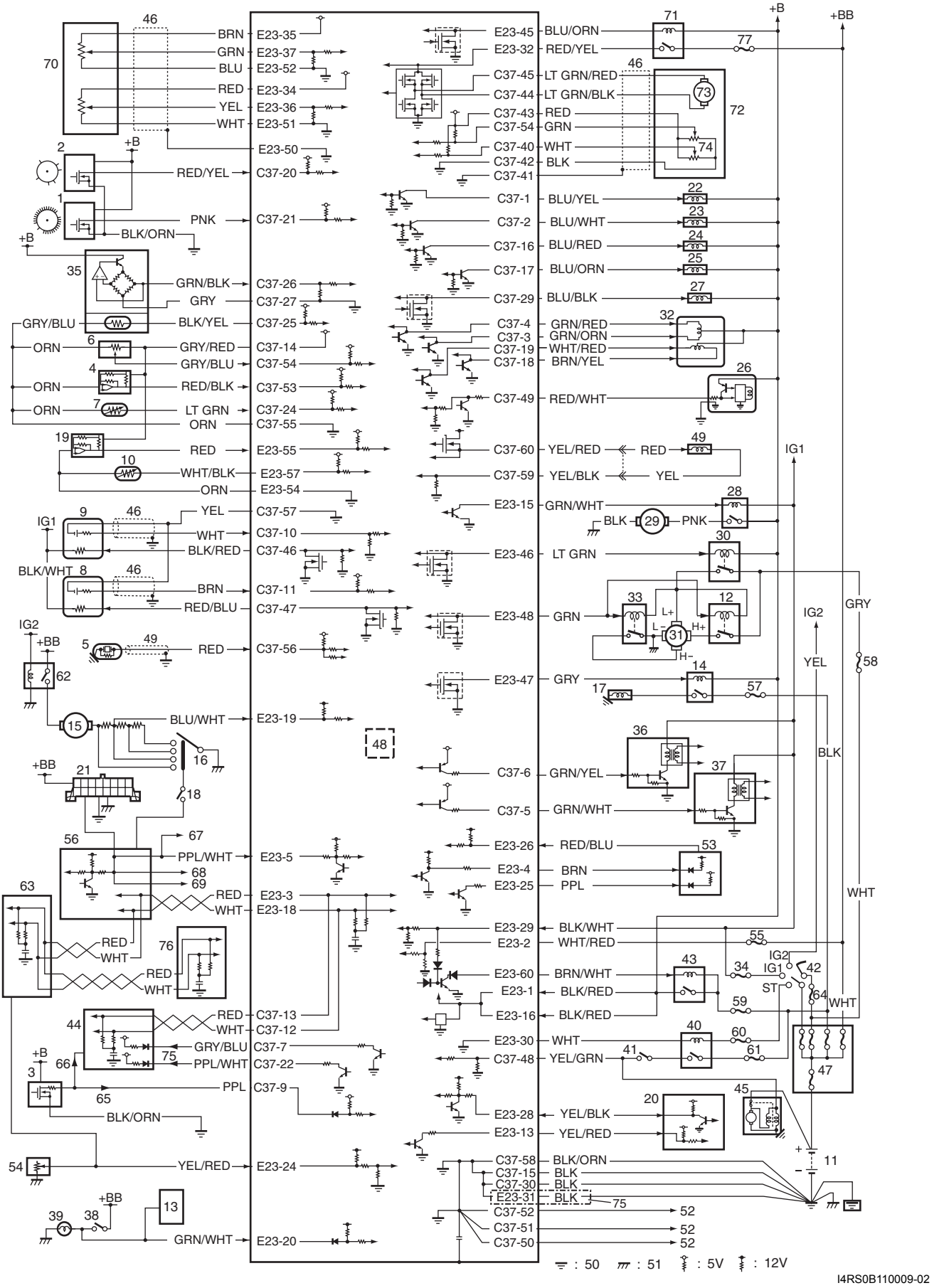
Especially, ECM (Engine Control Module), BCM (Body electrical Control Module), combination meter, TCM (Transmission Control Module (For A/T or Automated Manual Transaxle model)) and keyless start control module (if equipped with keyless start control system) intercommunicate by means of CAN (Controller Area Network) communication.

Engine and Emission Control System Flow Diagram



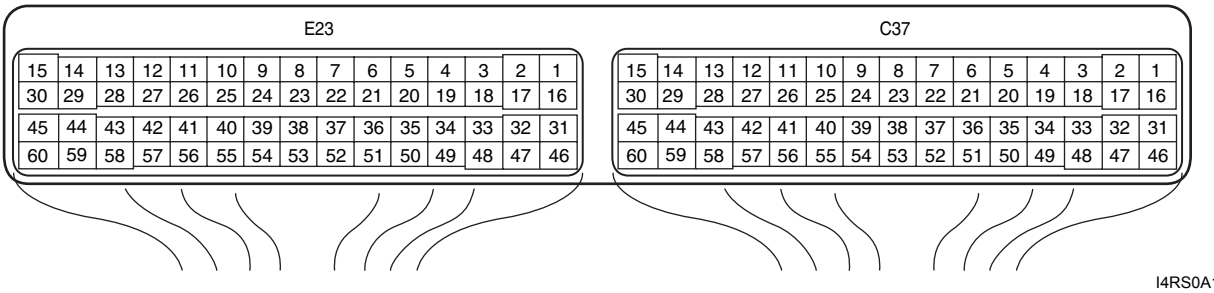
I4RS0B110008-05

ECM Input / Output Circuit Diagram



1. CKP sensor	27. EVAP canister purge valve	53. EPS control module
2. CMP sensor	28. Fuel pump relay	54. Fuel level sensor
3. VSS	29. Fuel pump	55. “RADIO” fuse
4. MAP sensor	30. Radiator cooling fan relay No.1	56. BCM
5. Knock sensor	31. Radiator cooling fan motor	57. “A/C COMP” fuse (if equipped with A/C)
6. TP sensor (for A/T and M/T models)	32. EGR valve	58. “RDTR FAN” fuse
7. ECT sensor	33. Radiator cooling fan relay No.3	59. “FI” fuse
8. Heated oxygen sensor-2	34. “IG COIL” fuse	60. “ST SIG” fuse
9. Heated oxygen sensor-1	35. MAF and IAT sensor	61. “ST MOT” fuse
10. A/C evaporator outlet air temp. sensor (if equipped with A/C)	36. Ignition coil assembly (for No.1 and No.4 spark plugs)	62. Blower motor relay
11. Battery	37. Ignition coil assembly (for No.2 and No.3 spark plugs)	63. Combination meter
12. Radiator cooling fan relay No.2	38. Stop lamp switch	64. “IG ACC” fuse
13. ABS control module	39. Stop lamp	65. Only for M/T and Automated Manual Transaxle models
14. A/C compressor relay (if equipped with A/C)	40. Starting motor control relay	66. Only for A/T model
15. Blower motor	41. Transmission range switch (for A/T model)	67. To TCM (for A/T model)
16. Blower speed selector	42. Ignition switch	68. To SDM
17. Magnet clutch of compressor (if equipped with A/C)	43. Main relay	69. To EPS control module
18. A/C switch (if equipped with A/C)	44. TCM (for A/T or Automated Manual Transaxle model)	70. Accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)
19. A/C refrigerant pressure sensor (if equipped with A/C)	45. Starting motor	71. Throttle actuator control relay (for Automated Manual Transaxle model)
20. Immobilizer coil antenna	46. Shield wire	72. Electric throttle body assembly (for Automated Manual Transaxle model)
21. Data link connector	47. Main fuse box	73. Throttle actuator (for Automated Manual Transaxle model)
22. Injector No.1	48. Barometric pressure sensor	74. Throttle position sensor (for Automated Manual Transaxle model
23. Injector No.2	49. Oil control valve (Camshaft position control) (for M15 engine model)	75. Only for Automated Manual Transaxle model
24. Injector No.3	50. Engine ground	76. Keyless start control module (if equipped with keyless start control system)
25. Injector No.4	51. Body ground	77. “TH MOT” fuse
26. IAC valve (for A/T and M/T models)	52. Shield ground	

Terminal Arrangement of ECM Coupler (Viewed from Harness Side)



I4RS0A110008-01

Connector: C37

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
1	BLU/YEL	Fuel injector No.1 output	31	—	—
2	BLU/WHT	Fuel injector No.2 output	32	—	—
3	GRN/ORN	EGR valve (stepper motor coil 2) output	33	—	—
4	GRN/RED	EGR valve (stepper motor coil 1) output	34	—	—
5	GRN/WHT	Ignition coil No.2 and No.3 output	35	—	—
6	GRN/YEL	Ignition coil No.1 and No.4 output	36	—	—

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
7	GRY/BLU	Engine revolution signal output for TCM (for Automated Manual Transaxle model)	37	—	—
8	—	—	38	—	—
9	PPL	Vehicle speed sensor signal (for M/T and Automated Manual Transaxle models)	39	—	—
10	WHT	Oxygen signal of heated oxygen sensor-1	40	WHT	Throttle position sensor (sub) signal (for Automated Manual Transaxle model)
11	BRN	Oxygen signal of heated oxygen sensor-2	41	—	Ground for shield wire of TP sensor circuit (for Automated Manual Transaxle model)
12	WHT	CAN (low) communication line (active low signal) to TCM (for A/T and Automated Manual Transaxle models)	42	BLK	Ground for throttle position sensor (for Automated Manual Transaxle model)
13	RED	CAN (high) communication line (active high signal) to TCM (for A/T and Automated Manual Transaxle models)	43	RED	Output for 5 V power source of throttle position sensor (for Automated Manual Transaxle model)
14	GRY/RED	Output of 5 V power source for TP sensor (for A/T and M/T models), MAP sensor, A/C refrigerant pressure sensor (if equipped with A/C)	44	LT GRN/BLK	Output of throttle actuator (for Automated Manual Transaxle model)
15	BLK	Ground for ECM	45	LT GRN/RED	Output of throttle actuator (for Automated Manual Transaxle model)
16	BLU/RED	Fuel injector No.3 output	46	BLK/RED	Heater output of heated oxygen sensor-1
17	BLU/ORN	Fuel injector No.4 output	47	RED/BLU	Heater output of heated oxygen sensor-2
18	BRN/YEL	EGR valve (stepper motor coil 4) output	48	YEL/GRN	Starting motor signal
19	WHT/RED	EGR valve (stepper motor coil 3) output	49	RED/WHT	IAC valve output (for A/T and M/T models)
20	RED/YEL	CMP sensor signal	50	—	Ground of ECM for shield wire
21	PNK	CKP sensor signal	51	—	Ground of ECM for shield wire
22	PPL/WHT	Vehicle speed signal output for TCM (for Automated Manual Transaxle model)	52	—	Ground of ECM for shield wire
23	—	—	53	RED/BLK	Manifold absolute pressure (MAP) sensor signal
24	LT GRN	Engine coolant temp. (ECT) sensor signal	54	GRY/BLU	Throttle position (TP) sensor signal (for A/T and M/T models)
				GRN	Throttle position sensor (main) signal (for Automated Manual Transaxle model)
25	BLK/YEL	Intake air temp. (IAT) sensor signal	55	ORN	Ground for sensors
26	GRN/BLK	Mass air flow (MAF) sensor signal	56	RED	Knock sensor signal
27	GRY	Ground for MAF sensor	57	YEL	Ground for sensors
28	—	—	58	BLK/ORN	Ground for ECM
29	BLU/BLK	EVAP canister purge valve output	59	YEL/BLK	Oil control valve ground (for M15 engine model)

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
30	BLK	Ground for ECM	60	YEL/RED	Oil control valve output (for M15 engine model)

Connector: E23

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
1	BLK/RED	Main power supply	31	BLK	Ground for ECM (for Automated Manual Transaxle model)
2	WHT/RED	Power source for ECM internal memory	32	RED/YEL	Power supply of throttle actuator drive circuit. (for Automated Manual Transaxle model)
3	RED	CAN communication line (active high signal) for BCM, combination meter	33	—	—
4	BRN	Engine revolution signal output for EPS control module	34	RED	Output for 5 V power source of accelerator pedal position (APP) sensor (sub) (for Automated Manual Transaxle model)
5	PPL/WHT	12 V serial communication line of data link connector	35	BRN	Output for 5 V power source of accelerator pedal position (APP) sensor (main) (for Automated Manual Transaxle model)
6	—	—	36	YEL	Accelerator pedal position (APP) sensor (sub) signal (for Automated Manual Transaxle model)
7	—	—	37	GRN	Accelerator pedal position (APP) sensor (main) signal (for Automated Manual Transaxle model)
8	—	—	38	—	—
9	—	—	39	—	—
10	—	—	40	—	—
11	—	—	41	—	—
12	—	—	42	—	—
13	YEL/RED	Clock signal for immobilizer coil antenna	43	—	—
14	—	—	44	—	—
15	GRN/WHT	Fuel pump relay output	45	BLU/ORN	Throttle actuator control relay output (for Automated Manual Transaxle model)
16	BLK/RED	Main power supply	46	LT GRN	Radiator cooling fan relay No.1 output
17	—	—	47	GRY	A/C compressor relay output (if equipped with A/C)
18	WHT	CAN communication line (active low signal) for BCM, combination meter	48	GRN	Radiator cooling fan relay No.2 and No.3 output
19	BLU/WHT	Electric load signal for heater blower motor	49	—	—
20	GRN/WHT	Stop lamp switch signal	50	—	Ground for shield wire of accelerator pedal position (APP) sensor (for Automated Manual Transaxle model)

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
21	—	—	51	WHT	Ground for accelerator pedal position (APP) sensor (sub) signal (for Automated Manual Transaxle model)
22	—	—	52	BLU	Ground for accelerator pedal position (APP) sensor (main) signal (for Automated Manual Transaxle model)
23	—	—	53	—	—
24	YEL/RED	Fuel level sensor signal	54	ORN	Ground for sensors
25	PPL	Vehicle speed signal output for EPS control module	55	RED	A/C refrigerant pressure sensor signal (if equipped with A/C)
26	RED/BLU	EPS signal	56	—	—
27	—	—	57	WHT/BLK	A/C evaporator outlet air temp. sensor signal (if equipped with A/C)
28	YEL/BLK	Serial communication line for immobilizer coil antenna	58	—	—
29	BLK/WHT	Ignition switch signal	59	—	—
30	WHT	Starting motor control relay output	60	BRN/WHT	Main power supply relay output

Engine and Emission Control Input / Output Table

S4RS0B1101008

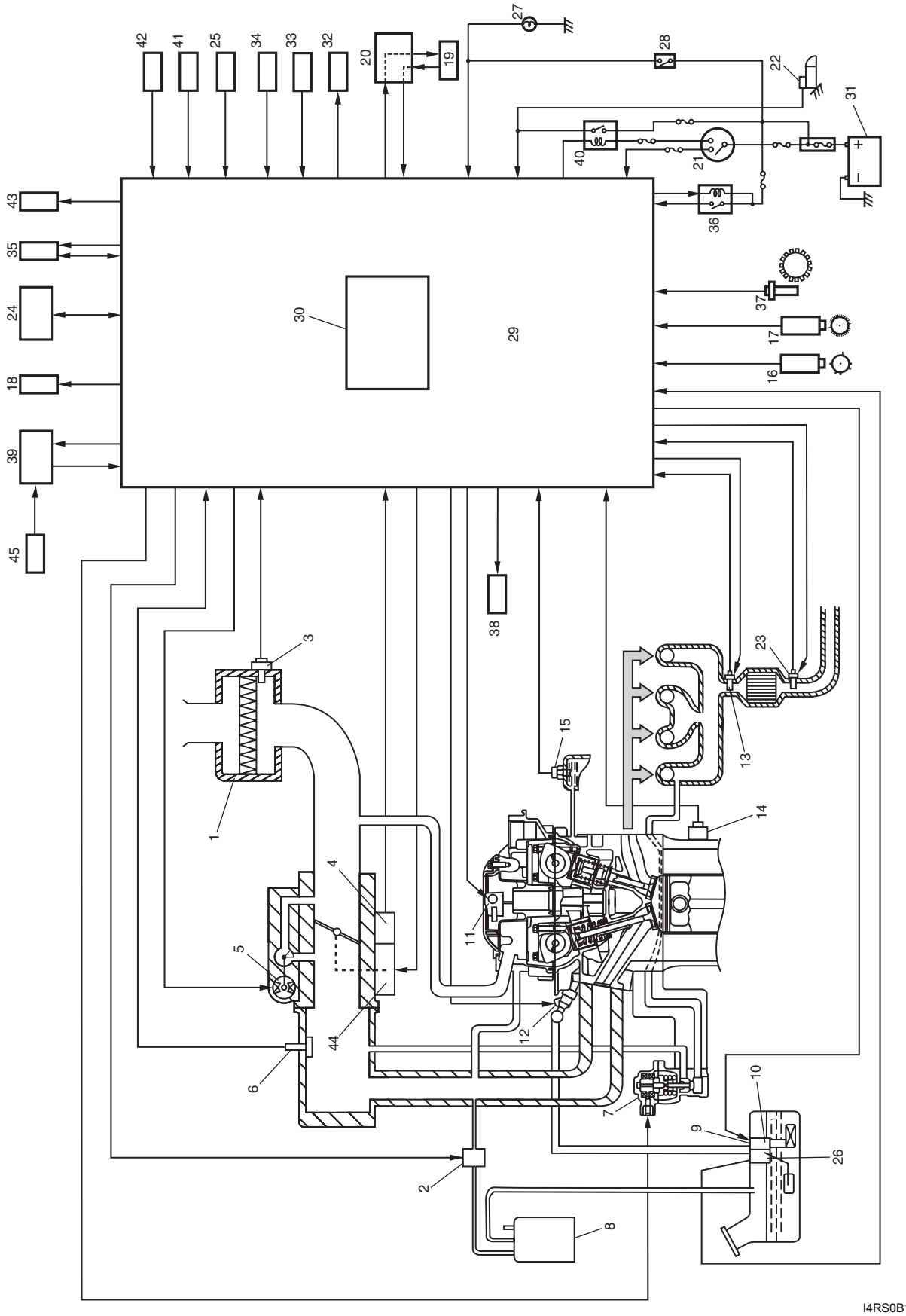
INPUT \ OUTPUT		ELECTRIC CONTROL DEVICE													
		FUEL PUMP RELAY	FUEL INJECTOR	HO2S HEATER	IAC VALVE (for A/T and M/T models)	THROTTLE ACTUATOR (for Automated Manual Transaxle model)	IGNITION COIL WITH IGNITER	EGR VALVE	EVAP CANISTER PURGE VALVE	A/C COMPRESSOR RELAY (if equipped with A/C)	RADIATOR FAN RELAY	MIL	MAIN RELAY	OIL CONTROL VALVE (for M15 engine model)	THROTTLE ACTUATOR CONTROL RELAY (for Automated Manual Transaxle model)
SIGNAL FROM SENSOR, SWITCH AND CONTROL MODULE	FUEL LEVEL SENSOR	For detecting fuel level													
	BAROMETRIC PRESSURE SENSOR		○		○	○	○	○	○			○			
	STOP LAMP SWITCH		○		○	○									
	START SWITCH	○	○		○	○	○			○					
	IGNITION SWITCH	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	A/C REFRIGERANT PRESSURE SENSOR (if equipped with A/C)		○		○	○				○	○				
	BLOWER SWITCH				○	○				○					
	A/C SWITCH (if equipped with A/C)		○		○	○			○	○	○				
	A/C EVAP OUTLET AIR TEMP. SENSOR (if equipped with A/C)		○		○	○				○	○				
	VSS		○	○	○	○	○	○	○	○	○	○		○	
	HEATED OXYGEN SENSOR-1		○						○			○			
	HEATED OXYGEN SENSOR-2		○									○			
	MAF SENSOR OF MAF AND IAT SENSOR		○	○	○	○	○	○	○			○		○	
	IAT SENSOR OF MAF AND IAT SENSOR		○		○	○	○	○	○			○		○	
	ECT SENSOR		○	○	○	○	○	○	○	○	○	○		○	
	TP SENSOR (for A/T and M/T models)		○	○	○		○	○	○	○		○		○	
	TP SENSOR (for Automated Manual Transaxle model)		○	○		○	○	○	○	○		○			○
	ACCELERATOR PEDAL POSITION (APP) SENSOR (for Automated Manual Transaxle model)					○						○			○
	MAP SENSOR		○				○	○				○			
	CMP SENSOR		○				○					○		○	
	CKP SENSOR	○	○	○	○	○	○	○	○	○		○		○	
	KNOCK SENSOR						○					○			
	ABS CONTROL MODULE				○	○									
	IMMOBILIZER CONTROL MODULE (in ECM)	○	○				○					○			
	TCM (for Automated Manual Transaxle model)					○									

I4RS0B110023-05

Schematic and Routing Diagram

Engine and Emission Control System Diagram

S4RS0B1102001



I4RS0B110024-02

1. Air cleaner	16. CMP sensor	31. Battery
2. EVAP canister purge valve	17. CKP sensor	32. A/C compressor relay (if equipped with A/C)
3. MAF and IAT sensor	18. Radiator cooling fan	33. A/C switch (if equipped with A/C)
4. TP sensor	19. Combination meter	34. A/C evaporator outlet air temp. sensor (if equipped with A/C)
5. IAC valve (for A/T and M/T models)	20. BCM	35. Immobilizer coil antenna
6. MAP sensor	21. Ignition switch	36. Main relay
7. EGR valve	22. Starter magnetic switch	37. VSS (for M/T and Automated Manual Transaxle models)
8. EVAP canister	23. Heated oxygen sensor (HO2S)-2	38. Oil control valve (for M15 engine model)
9. Tank pressure control valve (built-in fuel pump)	24. DLC	39. TCM (for A/T or Automated Manual Transaxle model)
10. Fuel pump (with pressure regulator)	25. Electric load	40. Starting motor control relay
11. Ignition coil assembly	26. Fuel level sensor	41. A/C refrigerant pressure sensor (if equipped with A/C)
12. Fuel injector	27. Stop lamp	42. Accelerator pedal position (APP) sensor (for Automated Manual Transaxle model)
13. Heated oxygen sensor (HO2S)-1	28. Stop lamp switch	43. Throttle actuator control relay (for Automated Manual Transaxle model)
14. Knock sensor	29. ECM	44. Throttle actuator (for Automated Manual Transaxle model)
15. ECT sensor	30. Barometric pressure sensor	45. Output shaft speed (VSS) sensor (for A/T model)

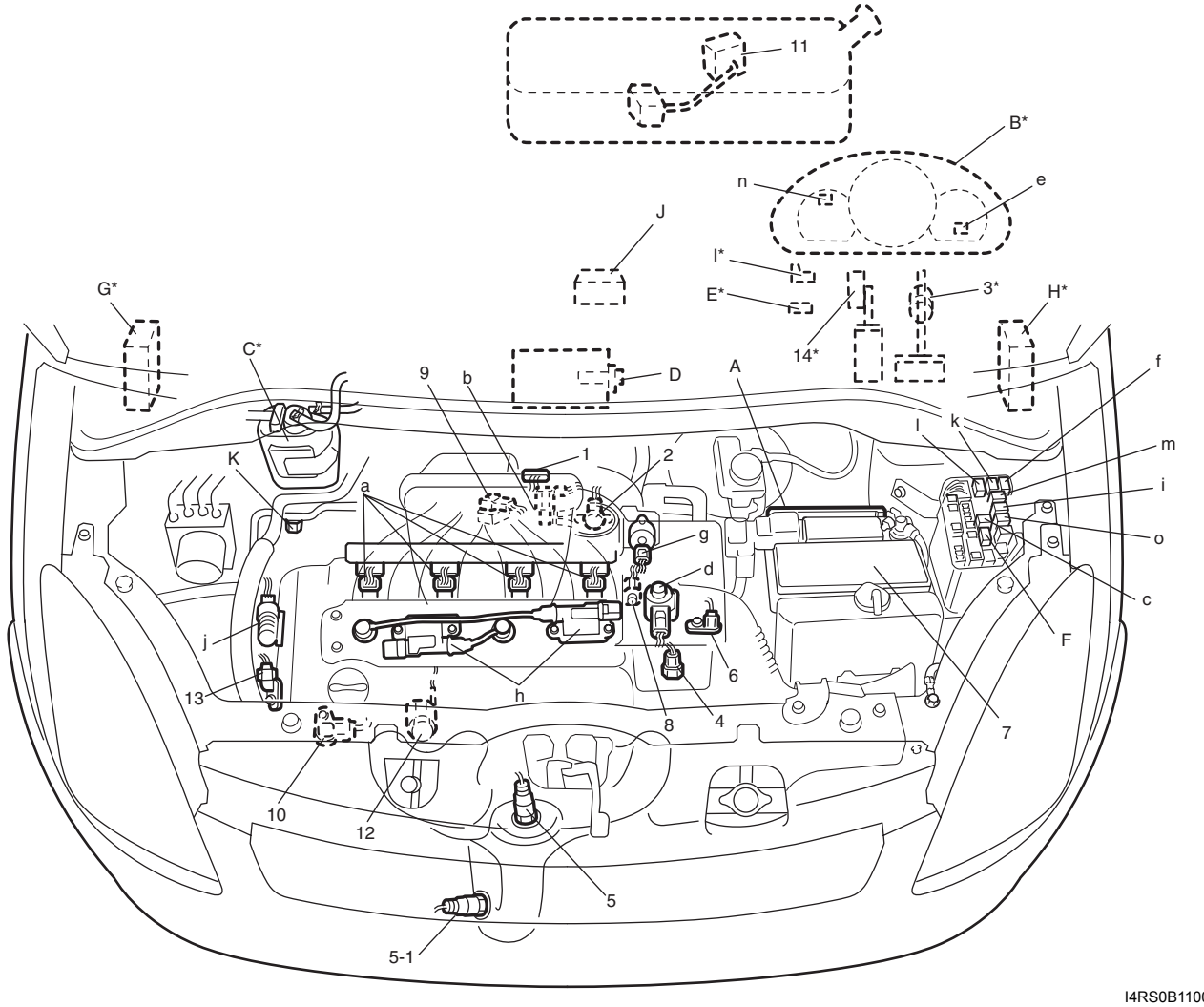
Component Location

Electronic Control System Components Location

S4RS0B1103001

NOTE

The figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the opposite side.



I4RS0B110025-01

Information sensors	Control devices	Others
1. MAF and IAT sensor	a: Fuel injector	A: ECM
2. TP sensor (for A/T and M/T models) or electric throttle body assembly (built-in throttle position sensor and throttle actuator) (for Automated Manual Transaxle model)	b: EVAP canister purge valve	B: Combination meter
3. Stop lamp switch	c: Fuel pump relay	C: EVAP canister
4. ECT sensor	d: EGR valve	D: A/C evaporator outlet air temp. sensor (if equipped with A/C)
5. Heated oxygen sensor-1	e: Malfunction indicator lamp	E: Data link connector
5-1. Heated oxygen sensor-2	f: Radiator cooling fan relay No.1	F: A/C compressor relay (if equipped with A/C)
6. VSS	g: IAC valve (for A/T and M/T models)	G: TCM (for A/T or Automated Manual Transaxle model)
7. Battery	h: Ignition coil assembly (with ignitor)	H: BCM (included in junction block assembly)
8. CMP sensor (for M15 engine model)	i: Main relay	I: Immobilizer coil antenna
9. MAP sensor	j: Oil control valve (for M15 engine model)	J: EPS control module
10. CKP sensor	k: Radiator cooling fan relay No.2	K: A/C refrigerant pressure sensor (if equipped with A/C)
11. Fuel level sensor	l: Radiator cooling fan relay No.3	
12. Knock sensor	m: Starting motor control relay	
13. CMP sensor (for M13 engine model)	n: Immobilizer indicator lamp	
14. Accelerator pedal position (APP) sensor (for Automated Manual Transaxle model)	o: Throttle actuator control relay (for Automated Manual Transaxle model)	

Diagnostic Information and Procedures

Engine and Emission Control System Check

S4RS0B1104001

Refer to the following items for the details of each step.

Step	Action	Yes	No
1	☞ **Customer complaint analysis** 1) Perform customer complaint analysis referring to “Customer Complaint Analysis”. *Was customer complaint analysis performed?*	Go to Step 2.	Perform customer complaint analysis.
2	☞ **DTC / Freeze frame data check, record and clearance** 1) Check for DTC (including pending DTC) referring to “DTC / Freeze Frame Data Check, Record and Clearance”. *Is there any DTC(s)?*	Print DTC and freeze frame data or write them down and clear them by referring to “DTC Clearance: ”, and go to Step 3.	Go to Step 4.
3	☞ **Visual inspection** 1) Perform visual inspection referring to “Visual Inspection”. *Is there any faulty condition?*	Repair or replace malfunction part, and go to Step 11.	Go to Step 5.
4	☞ **Visual inspection** 1) Perform visual inspection referring to “Visual Inspection”. *Is there any faulty condition?*	Repair or replace malfunction part, and go to Step 11.	Go to Step 8.
5	☞ **Trouble symptom confirmation** 1) Confirm trouble symptom referring to “Trouble Symptom Confirmation”. *Is trouble symptom identified?*	Go to Step 6.	Go to Step 7.
6	☞ **Rechecking and record of DTC / Freeze frame data** 1) Recheck for DTC and freeze frame data referring to “DTC Check: ”. *Is there any DTC(s)?*	Go to Step 9.	Go to Step 8.

Step	Action	Yes	No
7	☞ **Rechecking and record of DTC / Freeze frame data** 1) Recheck for DTC and freeze frame data referring to "DTC Check: ". *Is there any DTC(s)?*	Go to Step 9.	Go to Step 10.
8	☞ **Engine basic inspection and engine symptom diagnosis** 1) Check and repair according to "Engine Basic Inspection: " and "Engine Symptom Diagnosis: ". *Are check and repair complete?*	Go to Step 11.	Check and repair malfunction part(s), and go to Step 11.
9	☞ **Troubleshooting for DTC** 1) Check and repair according to applicable DTC diag. flow. *Are check and repair complete?*	Go to Step 11.	Check and repair malfunction part(s), and go to Step 11.
10	☞ **Intermittent problems check** 1) Check for intermittent problems referring to "Intermittent Problems Check". *Is there any faulty condition?*	Repair or replace malfunction part(s), and go to Step 11.	Go to Step 11.
11	☞ **Final confirmation test** 1) Clear DTC if any. 2) Perform final confirmation test referring to "Final Confirmation Test". *Is there any problem symptom, DTC or abnormal condition?*	Go to Step 6.	End.

Step 1: Customer Complaint Analysis
Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

Customer problem inspection form (Example)

User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
☐ **Difficult Starting** ☐ No cranking ☐ No initial combustion ☐ No combustion ☐ Poor starting at (☐cold ☐warm ☐always) ☐ Other_____	☐ **Poor Driveability** ☐ Hesitation on acceleration ☐ Back fire/☐After fire ☐ Lack of power ☐ Surging ☐ abnormal knocking ☐ Other_____
☐ **Poor Idling** ☐ Poor fast idle ☐ Abnormal idling speed (☐High ☐Low) (r/min.) ☐ Unstable ☐ Hunting (r/min. to r/min.) ☐ Other_____	☐ **Engine Stall when** ☐ Immediately after start ☐ Accel. pedal is depressed ☐ Accel. pedal is released ☐ Load is applied ☐ A/C ☐Electric load ☐P/S ☐ Other_____ ☐ Other_____
☐ OTHERS:	

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather Temperature Frequency Road	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other_____ ☐Hot ☐Warm ☐Cool ☐Cold (°F/ °C) ☐Always ☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition ☐Urban ☐Suburb ☐Highway ☐Mountainous (☐Uphill ☐Downhill) ☐Tarmacadam ☐Gravel ☐Other_____
Vehicle Condition	
Engine condition	☐Cold ☐Warming up phase ☐Warmed up ☐Always ☐Other at starting ☐Immediately after start ☐Racing without load ☐Engine speed (r/min)
Vehicle condition	During driving: ☐Constant speed ☐Accelerating ☐Decelerating ☐Right hand corner ☐Left hand corner ☐When shifting (Lever position) ☐At stop ☐Vehicle speed when problem occurs (km/h, Mile/h) ☐Other

Malfunction indicator lamp condition	☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition
Diagnostic trouble code	First check: ☐No code ☐Malfunction code ( )
	Second check: ☐No code ☐Malfunction code ( )

I2RH01110010-01

NOTE

This form is a standard sample. It should be modified according to conditions characteristic of each market.

Step 2: DTC / Freeze Frame Data Check, Record and Clearance
First, check DTC (including pending DTC), referring to "DTC Check: ". If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to "DTC Clearance: ". DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 5 and recheck DTC according to Step 6 and 7.
Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

Step 3 and 4: Visual Inspection
As a preliminary step, be sure to perform visual check of the items that support proper function of the engine referring to "Visual Inspection: ".

Step 5: Trouble Symptom Confirmation
Based on information obtained in "Step 1: Customer Complaint Analysis: " and "Step 2: DTC / Freeze Frame Data Check, Record and Clearance: ", confirm trouble symptoms. Also, reconfirm DTC according to "DTC Confirmation Procedure" described in each DTC diag. flow.

Step 6 and 7: Rechecking and Record of DTC / Freeze Frame Data
Refer to "DTC Check: " for checking procedure.

Step 8: Engine Basic Inspection and Engine Symptom Diagnosis
Perform basic engine check according to "Engine Basic Inspection: " first. When the end of the flow has been reached, check the parts of the system suspected as a possible cause referring to "Engine Symptom Diagnosis: " and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

Step 9: Troubleshooting for DTC (See each DTC Diag. Flow)
Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM or other part and repair or replace faulty parts.

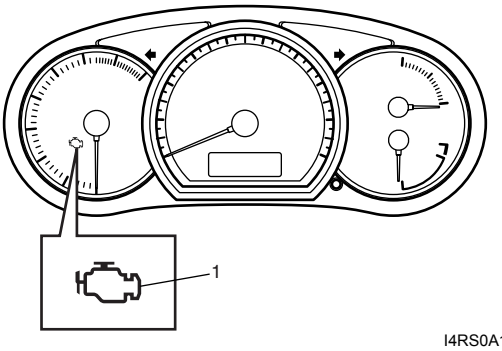
Step 10: Intermittent Problems Check
Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to "Intermittent and Poor Connection Inspection: in Section 00" and related circuit of DTC recorded in Step 2.

Step 11: Final Confirmation Test
Confirm that the problem symptom has gone and the engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no DTC is indicated.

Malfunction Indicator Lamp (MIL) Check

S4RS0B1104002

1) Turn ON ignition switch (with engine at stop) and check that MIL (1) lights.
   If MIL does not light up (or MIL dims) but engine can be starting, go to "Malfunction Indicator Lamp Does Not Come ON with Ignition Switch ON and Engine Stop (but Engine Can Be Started): " for troubleshooting.
   If MIL does not light with ignition switch ON and engine does not start though it is cranked up, go to "ECM Power and Ground Circuit Check: ".
2) Start engine and check that MIL turns OFF.
   If MIL remains ON and no DTC is stored in ECM, go to "Malfunction Indicator Lamp Remains ON after Engine Starts: " for troubleshooting.



I4RS0A110012-01

DTC Check

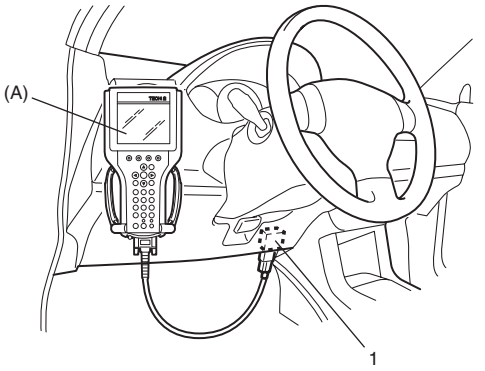
S4RS0B1104003

NOTE

The MIL is turned on when the ECM and/or TCM detect malfunction(s). Each ECM and TCM stores diagnostic information as the diagnostic trouble code (DTC) in its memory and outputs the DTC to the scan tool. Therefore, check both of the ECM and TCM for any DTC with the scan tool because the DTC stored in ECM and TCM is not read and displayed at a time. However, each of the ECM and TCM needs not to be checked with the generic scan tool because the DTC stored in ECM and TCM is read and displayed at a time.

1) Prepare OBD generic scan tool or SUZUKI scan tool.
2) With ignition switch turned OFF, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

Special tool
(A): SUZUKI scan tool



I4RS0B110026-01

3) Turn ignition switch ON and confirm that MIL lights.
4) Read DTC, pending DTC and freeze frame data according to instructions displayed on scan tool and print them or write them down. Refer to scan tool operator's manual for further details.
If communication between scan tool and ECM is not possible, check if scan tool is communicable by connecting it to ECM in another vehicle. If communication is possible in this case, scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible. If connector and circuit are OK, check that power supply and ground circuits of ECM and DLC are in good condition referring to "ECM Power and Ground Circuit Check: ".
5) After completing the check, turn ignition switch OFF and disconnect scan tool from data link connector.

DTC Clearance

S4RS0B1104004

1) Connect OBD generic scan tool or SUZUKI scan tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch OFF and then ON.
3) Erase DTC and pending DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch OFF and disconnect scan tool from data link connector.

NOTE

DTC and freeze frame data stored in ECM memory are also cleared in the following cases. Be careful not to clear them before keeping their record.

- **When power to ECM is cut off (by disconnecting battery cable, removing fuse or disconnecting ECM connectors).**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles. (See "Warm-Up Cycle" of "On-Board Diagnostic System Description: ".)**

DTC Table

S4RS0B1104005

NOTE

- **With the generic scan tool, only star (*) marked DTC No. in the following table can be read.**
- **1 driving cycle: MIL lights up when DTC is detected during 1 driving cycle.**
- **2 driving cycles: MIL lights up when the same DTC is detected also in the next driving cycle after DTC is detected and stored temporarily in the first driving cycle.**
- ***2 driving cycles:**
MIL blinks or lights up. Refer to "DTC P0300 / P0301 / P0302 / P0303 / P0304: Random Misfire Detected / Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 Misfire Detected: " for details.

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P0010	Camshaft position actuator circuit (for M15 engine model)	Oil control valve circuit open or short.	1 driving cycle
☞ *P0011	Camshaft position – timing over-advanced or system performance (for M15 engine model)	Actual value of advanced valve timing does not reach target value, or valve timing is advanced although ECM command is most retarding.	2 driving cycles
☞ *P0012	Camshaft position – timing over-retarded (for M15 engine model)		2 driving cycles
☞ *P0031	HO2S heater control circuit low (Sensor-1)	Heater current is less than specification while heater ON.	2 driving cycles
☞ *P0032	HO2S heater control circuit high (Sensor-1)	Heater current is more than specification while heater ON.	2 driving cycles

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P0037	HO2S heater control circuit low (Sensor-2)	Heater current is less than specification while heater ON.	2 driving cycles
☞ *P0038	HO2S heater control circuit high (Sensor-2)	Heater current is more than specification while heater ON.	2 driving cycles
☞ *P0101	Mass air flow circuit range/ performance	MAF sensor volume is more than specification or less than specification.	2 driving cycles
☞ *P0102	Mass air flow circuit low input	Output voltage of MAF sensor is less than specification.	1 driving cycle
☞ *P0103	Mass air flow circuit high input	Output voltage of MAF sensor is more than specification.	1 driving cycle
☞ *P0106	Manifold absolute pressure circuit range/performance	Difference between Max. manifold absolute pressure value and Min. manifold pressure value is less than specification or difference between barometric pressure value and manifold pressure value is less than specification	2 driving cycles
☞ *P0107	Manifold absolute pressure circuit low input	Output voltage of MAP sensor is less than specification.	1 driving cycle
☞ *P0108	Manifold absolute pressure circuit high input	Output voltage of MAP sensor is more than specification.	1 driving cycle
☞ *P0111	Intake air temperature sensor circuit range/performance	Variation of intake air temperature from engine start is less than specification.	2 driving cycles
☞ *P0112	Intake air temperature sensor circuit low	Circuit voltage of IAT sensor is less than specification.	1 driving cycle
☞ *P0113	Intake air temperature sensor circuit high	Circuit voltage of IAT sensor is more than specification.	1 driving cycle
☞ *P0116	Engine coolant temperature circuit range/performance	Engine coolant temperature is less than specified temperature for specified time from engine start.	2 driving cycles
☞ *P0117	Engine coolant temperature circuit low	Circuit voltage of ECT sensor is less than specification.	1 driving cycle
☞ *P0118	Engine coolant temperature circuit high	Circuit voltage of ECT sensor is more than specification.	1 driving cycle
☞ *P0121	Throttle position sensor circuit range/performance (for A/T and M/T models)	Difference between actual throttle opening and opening calculated by ECM is out of specification.	2 driving cycles
☞ *P0122	Throttle position sensor circuit low (for A/T and M/T models)	Output voltage of TP sensor is less than specification.	1 driving cycle
☞ *P0122	Throttle position sensor (main) circuit low (for Automated Manual Transaxle model)	Output voltage of throttle position sensor (main) is lower than specification.	1 driving cycle
☞ *P0123	Throttle position sensor circuit high (for A/T and M/T models)	Output voltage of TP sensor is more than specification.	1 driving cycle
☞ *P0123	Throttle position sensor (main) circuit high (for Automated Manual Transaxle model)	Output voltage of throttle position sensor (main) is higher than specification.	1 driving cycle
☞ *P0131	O2 sensor (HO2S) circuit low voltage (Sensor-1)	Max. output voltage of HO2S-1 is less than specification.	2 driving cycles
☞ *P0132	O2 sensor (HO2S) circuit high voltage (Sensor-1)	Min. output voltage of HO2S-1 is more than specification.	2 driving cycles
☞ *P0133	O2 sensor (HO2S) circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles
☞ *P0134	O2 sensor (HO2S) circuit no activity detected (Sensor-1)	Output voltage of HO2S-1 is more than specification or less than specification. (or HO2S-1 circuit open or short)	2 driving cycles
☞ *P0137	O2 sensor (HO2S) circuit low voltage (Sensor-2)	Output voltage of HO2S-2 is less than specification while engine is idling after driving with high engine load and Max. output voltage of HO2S-2 minus Min. output voltage of HO2S-2 is less than specification.	2 driving cycles

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P0138	O2 sensor (HO2S) circuit high voltage (Sensor-2)	Output voltage of HO2S-2 is more than specification while engine is idling after driving with high engine load and Max. output voltage of HO2S-2 minus Min. output voltage of HO2S-2 is less than specification.	2 driving cycles
☞ *P0140	O2 sensor (HO2S) circuit no activity detected (Sensor-2)	Output voltage of HO2S-2 is more than specification after warming up engine.	2 driving cycles
☞ *P0171	System too lean	Total fuel trim is larger than specification for specified time or longer. (Fuel trim toward rich side is large.)	2 driving cycles
☞ *P0172	System too rich	Total fuel trim is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles
☞ *P0222	Throttle position sensor (sub) circuit low (for Automated Manual Transaxle model)	Output voltage of throttle position sensor (sub) is lower than specification.	1 driving cycle
☞ *P0223	Throttle position sensor (sub) circuit high (for Automated Manual Transaxle model)	Output voltage of throttle position sensor (sub) is higher than specification.	1 driving cycle
☞ *P0300	Random misfire detected	Misfire of such level as to cause damage to three way catalyst.	*2 driving cycles
☞ *P0301 / *P0302 / *P0303 / *P0304	Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected Cylinder 4 misfire detected	Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst.	*2 driving cycles
☞ *P0327	Knock sensor circuit low	Output voltage of knock sensor is less than specification.	1 driving cycle
☞ *P0328	Knock sensor circuit high	Output voltage of knock sensor is more than specification.	1 driving cycle
☞ *P0335	Crankshaft position sensor circuit	No signal of CKP sensor for specified time even if starting motor signal is input.	1 driving cycle
☞ *P0340	Camshaft position sensor circuit	CMP sensor pulse is out of specification.	1 driving cycle
☞ *P0401	Exhaust gas recirculation flow detected as insufficient	Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is less than specification.	2 driving cycles
☞ *P0402	Exhaust gas recirculation flow detected as excessive	Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is more than specification.	2 driving cycles
☞ *P0403	Exhaust gas recirculation control circuit	Output voltage is different from output command with more than one pole out of 4 poles.	1 driving cycle
☞ *P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar.	2 driving cycles
☞ *P0443	Evaporative emission system purge control valve circuit	Monitor signal of EVAP canister purge valve is different from command signal. (circuit open or shorted to ground)	2 driving cycles
☞ P0462	Fuel level sensor circuit low	Circuit voltage of fuel level sensor is less than specification.	—
☞ P0463	Fuel level sensor circuit high	Circuit voltage of fuel level sensor is more than specification.	—
☞ *P0480	Fan 1 (Radiator cooling fan) control circuit	Monitor signal of radiator cooling fan relay is different from command signal.	1 driving cycle
☞ *P0500	Vehicle speed sensor (VSS) malfunction	No VSS signal during fuel cut for specified time or longer, or VSS signal is not input even if vehicle is driving with more than specified engine speed and D-range (for A/T model).	2 driving cycles
☞ *P0505	Idle air control system (for A/T and M/T models)	IAC control duty pulse is not detected in its monitor signal.	2 driving cycles
☞ P0532	A/C refrigerant pressure sensor circuit low	Output voltage of A/C refrigerant pressure sensor is less than specification.	—
☞ P0533	A/C refrigerant pressure sensor circuit high	Output voltage of A/C refrigerant pressure sensor is more than specification.	—

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P0601	Internal control module memory check sum error	Data write error or check sum error.	1 driving cycle
☞ P0602	Control module programming error	Data programming error.	1 driving cycle
☞ *P0607	Control module performance (for Automated Manual Transaxle model)	Data programming error.	1 driving cycle
☞ *P0616	Starter relay circuit low	Starter signal is low voltage even though engine is started with vehicle at stop.	2 driving cycles
☞ *P0617	Starter relay circuit high	Starter signal is high voltage for specified time while engine is running.	2 driving cycles
☞ *P1510	ECM backup power supply malfunction	Backup power voltage is out of specification after starting engine.	1 driving cycle
☞ *P1603	TCM trouble code detected	When ECM receives a trouble code from TCM, which indicates that some problem occurred in sensor circuits and its calculated values used for operations such as idle speed control, engine power control and so on by TCM, this DTC is detected by ECM.	1 driving cycle
☞ *P1674	CAN communication (buss off error)	Transmission error that is inconsistent between transmission data and transmission monitor (CAN bus monitor) data is detected more than 7 times continuously.	1 driving cycle
☞ *P1675	CAN communication (transmission error)	Transmission error of communication data for ECM is detected for longer than specified time continuously.	1 driving cycle
☞ *P1676	CAN communication (reception error for TCM)	Reception error of communication data for TCM is detected for longer than specified time continuously.	1 driving cycle
☞ P1678	CAN communication (reception error for BCM)	Reception error of communication data for BCM is detected for longer than specified time continuously.	—
☞ *P2101	Throttle actuator control motor circuit range/performance (for Automated Manual Transaxle model)	Monitor signal of throttle actuator output (duty output) is inconsistent with throttle actuator control command.	1 driving cycle
☞ *P2102	Throttle actuator control motor circuit low (for Automated Manual Transaxle model)	Power supply voltage of throttle actuator control circuit is lower than specification even if throttle actuator control relay turned on.	1 driving cycle
☞ *P2103	Throttle actuator control motor circuit high (for Automated Manual Transaxle model)	Power supply voltage of throttle actuator control circuit is higher than specification even if throttle actuator control relay turned off.	1 driving cycle
☞ *P2111	Throttle actuator control system – stuck open (for Automated Manual Transaxle model)	Throttle valve default opening is greater than 8° from complementary closed position when diagnosing throttle valve at ignition switch turned OFF.	1 driving cycle
☞ *P2112	Throttle actuator control system – stuck closed (for Automated Manual Transaxle model)	Throttle valve default opening is smaller than 8° from complementary closed position when diagnosing throttle valve at ignition switch turned OFF.	1 driving cycle
☞ *P2119	Throttle actuator control throttle body range/performance (for Automated Manual Transaxle model)	Difference between actual throttle valve opening angle and opening angle calculated by ECM is more than specification.	1 driving cycle
☞ *P2122	Pedal position sensor (main) circuit low input (for Automated Manual Transaxle model)	Output voltage of pedal position sensor (main) is lower than specification.	1 driving cycle
☞ *P2123	Pedal position sensor (main) circuit high input (for Automated Manual Transaxle model)	Output voltage of pedal position sensor (main) is higher than specification.	1 driving cycle
☞ *P2127	Pedal position sensor (sub) circuit low input (for Automated Manual Transaxle model)	Output voltage of pedal position sensor (sub) is lower than specification.	1 driving cycle

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P2128	Pedal position sensor (sub) circuit high input (for Automated Manual Transaxle model)	Output voltage of pedal position sensor (sub) is higher than specification.	1 driving cycle
☞ *P2135	Throttle position sensor (main / sub) voltage correlation (for Automated Manual Transaxle model)	Difference between the opening angle based on throttle position sensor (main) and the opening angle based on throttle position sensor (sub) is more than specification.	1 driving cycle
☞ *P2138	Pedal position sensor (main / sub) voltage correlation (for Automated Manual Transaxle model)	Difference between the opening angle based on accelerator pedal position sensor (main) and the opening angle based on accelerator pedal position sensor (sub) is more than specification.	1 driving cycle
☞ *P2227	Barometric pressure circuit range/performance	Difference of barometric pressure value and intake manifold pressure value is more than specification at engine start.	2 driving cycles
☞ *P2228	Barometric pressure circuit low	Barometric pressure sensor voltage is less than specification.	1 driving cycle
☞ *P2229	Barometric pressure circuit high	Barometric pressure sensor voltage is more than specification.	1 driving cycle
P1614	Transponder response error	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle
*P1615	ID code does not registered (vehicle equipped with keyless start system only)	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle
*P1616	Different registration ID codes (vehicle equipped with keyless start system only)	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle
*P1618	CAN communication error (reception error for keyless start control module) (vehicle equipped with keyless start system only)	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle
P1621	Immobilizer communication line error	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle
P1622	EEPROM error	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle
P1623	Unregistered transponder	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle
P1625	Immobilizer antenna error	Refer to “Diagnostic Trouble Code (DTC) Table: in Section 10C”.	1 driving cycle

For Vehicle Equipped with A/T

When using OBD generic scan tool, not only the previous star (*) marked ECM DTC(s) but also the following DTC(s) is displayed on OBD generic scan tool simultaneously.

DTC No.	Detecting item	Detecting condition (DTC will set when detecting)
*P0705	Transmission range sensor circuit malfunction (PRNDL input)	Refer to “DTC Table: in Section 5A”.
*P0707	Transmission range sensor circuit low	
*P0712	Transmission fluid temperature sensor circuit low	
*P0713	Transmission fluid temperature sensor circuit high	
*P0717	Input / Turbine speed sensor circuit no signal	
*P0722	Output speed sensor circuit no signal	
*P0741	Torque converter clutch circuit performance or stuck off	
*P0742	Torque converter clutch circuit stuck on	
*P0751	Shift solenoid-A (No.1) performance or stuck off	
*P0752	Shift solenoid-A (No.1) stuck on	
*P0756	Shift solenoid-B (No.2) performance or stuck off	
*P0757	Shift solenoid-B (No.2) stuck on	
*P0787	Shift / Timing solenoid control circuit low	
*P0788	Shift / Timing solenoid control circuit high	
*P0962	Pressure control solenoid control circuit low	
*P0963	Pressure control solenoid control circuit high	
*P0973	Shift solenoid-A (No.1) control circuit low	
*P0974	Shift solenoid-A (No.1) control circuit high	
*P0976	Shift solenoid-B (No.2) control circuit low	
*P0977	Shift solenoid-B (No.2) control circuit high	
*P1702	Internal control module memory check sum error	
*P1774	Control module communication bus off	
*P1775	High speed can communication bus (Transmission error)	
*P1777	TCM lost communication with ECM (Reception error)	
*P2763	Torque converter clutch pressure control solenoid control circuit high	
*P2764	Torque converter clutch pressure control solenoid control circuit low	

For Vehicle Equipped with Automated Manual Transaxle

When using OBD generic scan tool, not only the previous star (*) marked ECM DTC(s) but also the following DTC(s) is displayed on OBD generic scan tool simultaneously.

DTC No.	Detecting item	Detecting condition (DTC will set when detecting)
*P0807	Clutch position sensor circuit low	Refer to “DTC Table: in Section 5D”.
*P0808	Clutch position sensor circuit high	
*P0906	Gate select position circuit low	
*P0907	Gate select position circuit high	
*P0916	Gate shift position circuit low	
*P0917	Gate shift position circuit high	
*P1774	Control module communication bus off	
*P1777	TCM (Automated Manual Transaxle) lost communication with ECM	
*P1840	TCM (Automated Manual Transaxle) system voltage	
*P1856	Clutch position sensor “B” circuit low	
*P1857	Clutch position sensor “B” circuit high	
*P1858	Gate select position “B” circuit low	
*P1859	Gate select position “B” circuit high	
*P1882	Gate shift position circuit “B” low	
*P1883	Gate shift position circuit “B” high	

Fail-Safe Table

S4RS0B1104006

When any of the following DTCs is detected, ECM enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM detects normal condition after that.

DTC No.	Detected item	Fail-safe operation
☞ P0102	Mass air flow circuit low input	• ECM controls injector drive time (fuel injection volume) according to throttle valve opening (closed throttle position or not). • ECM stops EGR control.
☞ P0103	Mass air flow circuit high input	
☞ P0112	Intake air temperature sensor circuit low	ECM controls actuators assuming that intake air temperature is 20 °C (68 °F).
☞ P0113	Intake air temperature sensor circuit high	
☞ P0117	Engine coolant temperature circuit low	• ECM controls actuators assuming that engine coolant temperature is 80 °C (176 °F). • ECM operates radiator cooling fan.
☞ P0118	Engine coolant temperature circuit high	
☞ P0122 (for A/T and M/T models)	Throttle position sensor circuit low (for A/T and M/T models)	ECM controls actuators assuming that throttle opening is about 20°.
☞ P0122 (for Automated Manual Transaxle model)	Throttle position sensor (main) circuit low (for Automated Manual Transaxle model)	• ECM turns off throttle actuator control relay and throttle valve is fixed at the opening of about 8° from its completely closed position (default opening). • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P0123 (for A/T and M/T models)	Throttle position sensor circuit high (for A/T and M/T models)	ECM controls actuators assuming that throttle opening is about 20°.
☞ P0123 (for Automated Manual Transaxle model)	Throttle position sensor (main) circuit high (for Automated Manual Transaxle model)	• ECM turns off throttle actuator control relay and throttle valve is fixed at the opening of about 8° from its completely closed position (default opening). • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P0222 (for Automated Manual Transaxle model)	Throttle position sensor (sub) circuit low (for Automated Manual Transaxle model)	
☞ P0223 (for Automated Manual Transaxle model)	Throttle position sensor (sub) circuit high (for Automated Manual Transaxle model)	
☞ P0335	Crankshaft position sensor circuit	• Ignition timing is fixed. • ECM changes injection control system from sequential injection to simultaneous one.
☞ P0340	Camshaft position sensor circuit	ECM changes injection control system from sequential injection to simultaneous one.
☞ P0500	Vehicle speed sensor	• ECM controls actuators assuming that vehicle speed is 0 km/h (0 mile/h). • ECM stops IAC feedback control.

DTC No.	Detected item	Fail-safe operation
☞ P2101 (for Automated Manual Transaxle model)	Throttle actuator control motor circuit range / performance (for Automated Manual Transaxle Model	• ECM turns off throttle actuator control relay and throttle valve is fixed at the opening of about 8° from its completely closed position (default opening). • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P2102 (for Automated Manual Transaxle model)	Throttle actuator control motor circuit low (for Automated Manual Transaxle Model)	
☞ P2103 (for Automated Manual Transaxle model)	Throttle actuator control motor circuit high (for Automated Manual Transaxle Model)	ECM controls fuel cut at specified engine speed.
☞ P2111 (for Automated Manual Transaxle model)	Throttle actuator control system – stuck open (for Automated Manual Transaxle Model	• ECM turns off throttle actuator control relay and throttle valve is fixed at the opening of about 8° from its completely closed position (default opening). • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P2112 (for Automated Manual Transaxle model)	Throttle actuator control system – stuck closed (for Automated Manual Transaxle Model	
☞ P2119 (for Automated Manual Transaxle model)	Throttle actuator control throttle body range / performance (for Automated Manual Transaxle Model	• ECM turns off throttle actuator control relay and throttle valve is fixed at the opening of about 8° from its completely closed position (default opening). • ECM controls fuel cut at specified engine speed.

DTC No.	Detected item	Fail-safe operation
☞ P2122 (for Automated Manual Transaxle model)	Pedal position sensor (main) circuit low input (for Automated Manual Transaxle Model	• ECM turns off throttle actuator control relay and throttle valve is fixed at the opening of about 8° from its completely closed position (default opening). • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P2123 (for Automated Manual Transaxle model)	Pedal position sensor (main) circuit high input (for Automated Manual Transaxle Model	
☞ P2127 (for Automated Manual Transaxle model)	Pedal position sensor (sub) circuit low input (for Automated Manual Transaxle Model	
☞ P2128 (for Automated Manual Transaxle model)	Pedal position sensor (sub) circuit high input (for Automated Manual Transaxle Model	
☞ P2135 (for Automated Manual Transaxle model)	Throttle position sensor (main) / (sub) voltage correlation (for Automated Manual Transaxle Model	
☞ P2138 (for Automated Manual Transaxle model)	Pedal position sensor (main) / (sub) voltage correlation (for Automated Manual Transaxle Model	
☞ P2227	Barometric pressure sensor performance problem	ECM controls actuators assuming that barometric pressure is 101.33 kPa (762 mmHg).

Scan Tool Data

S4RS0B1104007

As the data values are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.
Also, conditions that can be checked by the scan tool are those detected by ECM and output from ECM as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool. Be sure to use the timing light to check the ignition timing.

NOTE

- **With the generic scan tool, only star (*) marked data in the following table can be read.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T or Automated Manual Transaxle gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C (if equipped with A/C), all electric loads, P/S and all the other necessary switches.**

	Scan tool data	Vehicle condition	Normal condition / reference values
*	☞COOLANT TEMP (ENGINE COOLANT TEMP.)	At specified idle speed after warming up	80 – 100 °C, 176 – 212 °F
*	☞INTAKE AIR TEMP.	At specified idle speed after warming up	–5 °C (23 °F) + environmental temp. to 40 °C (104 °F) + environmental temp.
*	☞ENGINE SPEED	It idling with no load after warming up	Desired idle speed ± 50 rpm

	Scan tool data	Vehicle condition		Normal condition / reference values
	☞INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH)	At specified idle speed with no load after warming up		2.0 – 4.0 msec.
		At 2500 r/min. with no load after warming up		2.0 – 3.6 msec.
	☞TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE) (for A/T and M/T models)	Ignition switch ON / warmed up engine stopped	Accelerator pedal released	0.5 – 1.0 V
			Accelerator pedal depressed fully	Less than 4.8 V
	☞DESIRED IDLE (DESIRED IDLE SPEED)	It idling with radiator cooling fan stopped and all electrical parts turned OFF after warming up, M/T at neutral		700 rpm
	☞IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY) (for A/T and M/T models)	It idling with no load after warming up		5 – 55%
*	☞SHORT FT B1 (SHORT TERM FUEL TRIM)	At specified idle speed after warming up		–20 – +20%
*	☞LONG FT B1 (LONG TERM FUEL TRIM)	At specified idle speed after warming up		–20 – +20%
	☞TOTAL FUEL TRIM B1	At specified idle speed after warming up		–35 – +35%
*	☞MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		1.0 – 4.0 g/s 0.14 – 0.52 lb/ min.
		At 2500 r/min. with no load after warming up		4.0 – 12.0 g/s 0.53 – 1.58 lb/ min.
*	☞CALC LOAD (CALCULATED LOAD VALUE)	At specified idle speed with no load after warming up		0 – 10%
		At 2500 r/min. with no load after warming up		0 – 10%
*	☞THROTTLE POSITION (ABSOLUTE THROTTLE POSITION) (for A/T and M/T models)	Ignition switch ON / warmed up engine stopped	Accelerator pedal released	0 – 5%
			Accelerator pedal depressed fully	90 – 100%
*	☞O2S B1 S1 (HEATED OXYGEN SENSOR-1)	At specified idle speed after warming up		0.1 – 0.95 V
*	☞O2S B1 S2 (HEATED OXYGEN SENSOR-2)	At 2000 r/min. for 3 min. or longer after warming up.		0.1 – 0.95 V
*	☞FUEL SYSTEM B1 (FUEL SYSTEM STATUS)	At specified idle speed after warming up		CLSD (closed loop)
*	☞MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after warming up		24 – 38 kPa, 7.1 – 11.2 in.Hg
	☞BAROMETRIC PRES	—		Barometric pressure is displayed
	☞STEP EGR FLOW DUTY	At specified idle speed after warming up		0%
	☞FUEL CUT	Engine at fuel cut condition		ON
		Engine at other than fuel cut condition		OFF
	☞A/C PRESSURE (A/C REFRIGERANT ABSOLUTE PRESSURE)	Engine running	A/C ON (A/C is operating) at ambient temperature: 30 °C (86 °F) and humidity: 50%	1350 – 1650 kPa For more details, refer to pressure of high pressure gage under “A/C System Performance Inspection: in Section 7B”.
			A/C OFF (A/C is not operating) at ambient temperature: 30 °C (86 °F) and engine coolant temperature: 90 – 100 °C (194 – 212 °F)	600 – 1000 kPa After longer than 10 min from A/C switch turned off
	☞CLOSED THROTTLE POS (CLOSED THROTTLE POSITION)	Throttle valve at idle position		ON
		Throttle valve opens larger than idle position		OFF

	Scan tool data	Vehicle condition		Normal condition / reference values
	☞CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY)	At specified idle speed after warming up		0%
*	☞IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER)	At specified idle speed with no load after warming up		5 – 15° BTDC (for M13 engine model), 3 – 13° BTDC (for M15 engine model)
	☞BATTERY VOLTAGE	Ignition switch ON / engine at stop		10 – 14 V
	☞FUEL PUMP	Within 2 seconds after ignition switch ON or engine running		ON
		Engine at stop with ignition switch ON		OFF
	☞ELECTRIC LOAD	Ignition switch ON / Headlight, small light, all turned OFF		OFF
		Ignition switch ON / Headlight, small light, turned ON		ON
	☞BRAKE SWITCH	Ignition switch ON	Brake pedal is released	OFF (for A/T and M/T models), CANCEL (for Automated Manual Transaxle model)
			Brake pedal is depressed	ON (for A/T and M/T models), SET (for Automated Manual Transaxle model)
	☞RADIATOR FAN (RADIATOR COOLING FAN CONTROL RELAY)	Ignition switch ON	Engine coolant temp.: Lower than 95 °C (203 °F)	OFF
			Engine coolant temp.: 97.5 °C (208 °F) or higher	ON
	☞BLOWER FAN	Ignition switch ON	Blower fan switch: 3rd speed position or more	ON
			Blower fan switch: under 2nd speed position	OFF
	☞A/C SWITCH	Engine running after warming up, A/C not operating		OFF
		Engine running after warming up, A/C operating		ON
	☞A/C COMP RELAY	Engine running	A/C switch and blower motor switch turned ON	ON
			A/C switch and blower motor switch turned OFF	OFF
*	☞VEHICLE SPEED	At stop		0 km/h (0 mph)
	☞VVT GAP (TARGET-ACTUAL POSITION) (for M15 engine model)	At specified idle speed after warming up		0 – 3°
	☞TP SENSOR 1 VOLT (THROTTLE POSITION SENSOR (MAIN) OUTPUT VOLTAGE) (for Automated Manual Transaxle model)	Ignition switch ON after warmed up engine	Accelerator pedal released	0.6 – 1.0 V
			Accelerator pedal depressed fully	3.37 – 4.55 V
	☞TP SENSOR 2 VOLT (THROTTLE POSITION SENSOR (SUB) OUTPUT VOLTAGE) (for Automated Manual Transaxle model)	Ignition switch ON after warmed up engine	Accelerator pedal released	1.4 – 1.8 V
			Accelerator pedal depressed fully	3.58 – 4.76 V
	☞APP SENSOR 1 VOLT (ACCELERATOR PEDAL POSITION (APP) SENSOR (MAIN) OUTPUT VOLTAGE) (for Automated Manual Transaxle model)	Ignition switch ON after warmed up engine	Accelerator pedal released	0.5 – 0.9 V
			Accelerator pedal depressed fully	3.277 – 3.915 V

	Scan tool data	Vehicle condition		Normal condition / reference values
	☞APP SENSOR 2 VOLT (ACCELERATOR PEDAL POSITION (APP) SENSOR (SUB) OUTPUT VOLTAGE) (for Automated Manual Transaxle model)	Ignition switch ON after warmed up engine	Accelerator pedal released	1.3 – 1.7 V
			Accelerator pedal depressed fully	4.077 – 4.715 V
	☞ACCEL POSITION (ABSOLUTE ACCELERATOR PEDAL POSITION) (for Automated Manual Transaxle model)	Ignition switch ON after warmed up engine	Accelerator pedal released	0 – 5%
			Accelerator pedal depressed fully	90 – 100%
	☞THROTTLE TARGET POSI (TARGET THROTTLE VALVE POSITION) (for Automated Manual Transaxle model)	Ignition switch ON after warmed up engine	Accelerator pedal released	0 – 5%
			Accelerator pedal depressed fully	90 – 100%

Scan Tool Data Definitions

COOLANT TEMP (ENGINE COOLANT TEMPERATURE, °C, °F)
It is detected by engine coolant temp. sensor.

INTAKE AIR TEMP. (°C, °F)
It is detected by intake air temp. sensor.

ENGINE SPEED (rpm)
It is computed by reference pulses from the camshaft position sensor.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec.)
This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (but injector drive time of NO.1 cylinder for multiport fuel injection).

TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE, V) (for A/T and M/T models)
The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

DESIRED IDLE (DESIRED IDLE SPEED, rpm)
The Desired Idle Speed is an ECM internal parameter which indicates the ECM requested idle. If the engine is not running, this number is not valid.

IAC FLOW DUTY (IDLE AIR (SPEED) CONTROL DUTY, %) (for A/T and M/T models)
This parameter indicates current flow time rate within a certain set cycle of IAC valve (valve opening rate) which controls the amount of bypass air (idle speed).

SHORT FT B1 (SHORT TERM FUEL TRIM, %)
Short term fuel trim value represents short term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

LONG FT B1 (LONG TERM FUEL TRIM, %)
Long term fuel trim value represents long term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

TOTAL FUEL TRIM B1 (%)
The value of Total Fuel Trim is obtained by calculating based on values of Short Term Fuel Trim and Long Term Fuel Trim. This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

MAF (MASS AIR FLOW RATE, g/s, lb/min.)
It represents total mass of air entering intake manifold which is measured by mass air flow sensor.

CALC LOAD (CALCULATED LOAD VALUE, %)
Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume × 100%

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %) (for A/T and M/T models)
When throttle position sensor is at fully closed position, throttle opening is indicated as 0 – 5% and 90 – 100% full open position.

O2S SENSOR B1 S1 (HEATED OXYGEN SENSOR-1, V)
It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

O2S SENSOR B1 S2 (HEATED OXYGEN SENSOR-2, V)
It indicates output voltage of HO2S-2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

FUEL SYSTEM (FUEL SYSTEM STATUS)
Air/fuel ratio feedback loop status displayed as one of the followings.
OPEN: Open-loop has not yet satisfied conditions to go closed loop.
CLOSED: Closed-loop using oxygen sensor(s) as feedback for fuel control.
OPEN-DRIVE COND: Open-loop due to driving conditions (Power enrichment, etc.).
OPEN SYS FAULT: Open-loop due to detected system fault.

MAP (MANIFOLD ABSOLUTE PRESSURE, in.Hg, kPa)
This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.
It is detected by manifold absolute pressure sensor.

BAROMETRIC PRESS (kPa, in.Hg)
This parameter represents a measurement of barometric air pressure and is used for altitude correction of the fuel injection quantity and IAC valve control.

STEP EGR FLOW DUTY (%)
This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

FUEL CUT (ON/OFF)
ON: Fuel being cut (output signal to injector is stopped)
OFF: Fuel not being cut

A/C PRESSURE (A/C REFRIGERANT ABSOLUTE PRESSURE, kPa)
This parameter indicates A/C refrigerant absolute pressure calculated by ECM.

CLOSED THROTTLE POS (CLOSED THROTTLE POSITION, ON/OFF)
This parameter reads ON when throttle valve is fully closed, or OFF when it is not fully closed.

CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY, %)
This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP canister purge valve which controls the amount of EVAP purge.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)
Ignition timing of No.1 cylinder is commanded by ECM. The actual ignition timing should be checked by using the timing light.

BATTERY VOLTAGE (V)
This parameter indicates battery positive voltage inputted from main relay to ECM.

FUEL PUMP (ON/OFF)
ON is displayed when ECM activates the fuel pump via the fuel pump relay switch.

ELECTRIC LOAD (ON/OFF)
ON: Headlight or small light ON signal inputted.
OFF: Above electric loads all turned OFF.

BRAKE SW (ON/OFF: for A/T and M/T models, CANCEL / SET: for Automated Manual Transaxle model)
This parameter indicates the state of the brake switch.

RADIATOR COOLING FAN (RADIATOR COOLING FAN CONTROL RELAY, ON/OFF)
ON: Command for radiator cooling fan control relay operation being output.
OFF: Command for relay operation not being output.

BLOWER FAN (ON/OFF)
This parameter indicates the state of the blower fan motor switch.

A/C SWITCH (ON/OFF)
ON: Command for A/C operation being output from ECM to HVAC.
OFF: Command for A/C operation not being output.

A/C COMP RELAY (A/C COMPRESSOR RELAY, ON/OFF)
This parameter indicates the state of the A/C switch.

VEHICLE SPEED (km/h, mph)
It is computed based on pulse signals from vehicle speed sensor.

VVT GAP (TARGET-ACTUAL POSITION, °) (for M15 engine model)
It is calculated using the formula: target valve timing advance – actual valve timing advance.

TP SENSOR 1 VOLT (THROTTLE POSITION SENSOR (MAIN) OUTPUT VOLTAGE, V) (for Automated Manual Transaxle model)
The Throttle Position Sensor (Main) reading provides throttle valve opening information in the form of voltage.

TP SENSOR 2 VOLT (THROTTLE POSITION SENSOR (SUB) OUTPUT VOLTAGE, V) (for Automated Manual Transaxle model)
The Throttle Position Sensor (Sub) reading provides throttle valve opening information in the form of voltage.

APP SENSOR 1 VOLT (ACCELERATOR PEDAL POSITION (APP) SENSOR (MAIN) OUTPUT VOLTAGE, V) (for Automated Manual Transaxle model)
The Accelerator Pedal Position (APP) Sensor (Main) reading provides accelerator pedal opening information in the form of voltage.

APP SENSOR 2 VOLT (ACCELERATOR PEDAL POSITION (APP) SENSOR (SUB) OUTPUT VOLTAGE, V) (for Automated Manual Transaxle model)
The Accelerator Pedal Position (APP) Sensor (Sub) reading provides accelerator pedal opening information in the form of voltage.

ACCEL POSITION (ABSOLUTE ACCELERATOR PEDAL POSITION, %) (for Automated Manual Transaxle model)
When accelerator pedal is at fully released position, accelerator pedal is indicated as 0 – 5% and 90 – 100% fully depressed position.

THROTTLE TARGET POSI (TARGET THROTTLE VALVE POSITION, %) (for Automated Manual Transaxle model)
Target Throttle Valve Position is ECM internal parameter which indicates the ECM requested throttle valve position.

Visual Inspection

S4RS0B1104008

Visually check the following parts and systems.

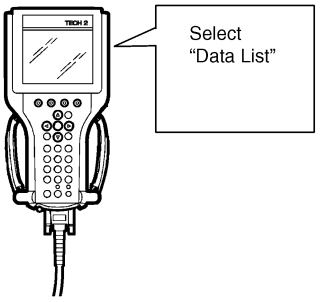
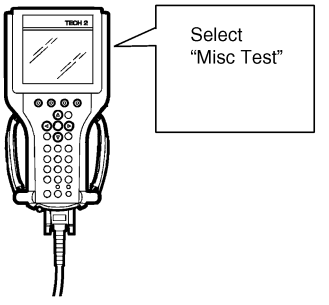
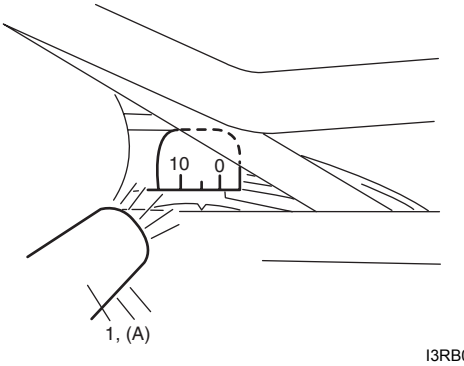
Inspection item	Reference section
• Engine oil – level, leakage	"Engine Oil and Filter Change: in Section 0B"
• Engine coolant – level, leakage	"Coolant Level Check: in Section 1F"
• Fuel – level, leakage	"Fuel Lines and Connections Inspection: in Section 0B"
• Air cleaner element – dirt, clogging	"Air Cleaner Filter Inspection: in Section 0B"
• Battery – fluid level, corrosion of terminal	"Battery Description: in Section 1J"
• Water pump belt – tension damage	"Accessory Drive Belt Inspection: in Section 0B"
• Throttle cable (for A/T and M/T models) – play (under warm engine), installation	"Accelerator Cable Adjustment (For A/T and M/T Models): in Section 1D"
• Throttle valve (for Automated Manual Transaxle model) – operating sound	"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"
• Vacuum hoses of air intake system – disconnection, looseness, deterioration, bend	"Vacuum Hose and Purge Valve Chamber Inspection: in Section 1B"
• Connectors of electric wire harness – disconnection, friction	
• Fuses – burning	
• Parts – installation, bolt – looseness	
• Parts – deformation	
• Other parts that can be checked visually	
Also check the following items at engine start, if possible	
• Malfunction indicator lamp – Operation	"Malfunction Indicator Lamp (MIL) Check: "
• Charge warning lamp – Operation	"Generator Symptom Diagnosis: in Section 1J"
• Engine oil pressure warning lamp – Operation	"Oil Pressure Switch Inspection: in Section 9C"
• Engine coolant temp. meter – Operation	"Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C"
• Fuel level meter – Operation	"Fuel Level Sensor Inspection: in Section 9C"
• Tachometer – Operation	
• Abnormal air being inhaled from air intake system	
• Exhaust system – leakage of exhaust gas, noise	
• Other parts that can be checked visually	

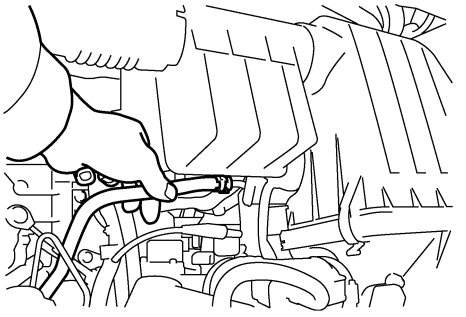
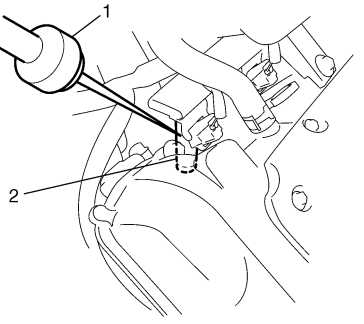
Engine Basic Inspection

S4RS0B1104009

This check is very important for troubleshooting when ECM has detected no DTC and no abnormality has been found in "Visual Inspection: ".
Follow the flow carefully.

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Check battery voltage** *Is it 11 V or more?*	Go to Step 3.	Charge or replace battery.
3	*Is vehicle equipped with keyless start control system?*	Go to Step 4.	Go to Step 5.
4	**Check keyless start control system malfunction** 1) Check keyless start control system referring to "Keyless Start System Operation Inspection: in Section 10E". *Is check result satisfactory?*	Go to Step 5.	Keyless start control system malfunction.
5	*Is engine cranked?*	Go to Step 6.	Go to "Cranking System Symptom Diagnosis: in Section 1I".
6	*Does engine start?*	Go to Step 7.	Go to Step 9.

Step	Action	Yes	No
7	**Check idle speed** 1) Warm up engine to normal operating temperature. 2) Shift transmission to neutral position for M/T and Automated Manual Transaxle models (“P” position for A/T). 3) Make sure that all electrical loads are switched off. 4) Check engine idle speed with scan tool.  I2RH01110005-01 *Is it 650 – 750 r/min.?*	Go to Step 8.	Go to “Engine Symptom Diagnosis: ”.
8	**Check ignition timing** 1) Using SUZUKI scan tool, select “Misc Test” mode on SUZUKI scan tool and fix ignition timing to initial one.  I2RH01110006-01 2) Using timing light (1), check initial ignition timing. **Special tool** **(A): 09930–76420**  I3RB0A180004-01 *Is it 5 °± 3 °BTDC at specified idle speed?*	Go to “Engine Symptom Diagnosis: ”.	Check ignition control related parts referring to “Ignition Timing Inspection: in Section 1H”.
9	**Check immobilizer system malfunction** 1) Check immobilizer indicator lamp for flashing. *Is it flashing when ignition switch is turned to ON position?*	Go to “Diagnostic Trouble Code (DTC) Check: in Section 10C”.	Go to Step 10.

Step	Action	Yes	No
10	**Check fuel supply** 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 2 seconds and then OFF. 3) Repeat Step 2) a few times. *Is fuel pressure felt from fuel feed hose when ignition switch is turned ON?*  I3RM0A110014-01	Go to Step 12.	Go to Step 11.
11	**Check fuel pump for operation** *Was fuel pump operating sound heard from fuel filler for about 2 seconds after ignition switch ON and stop?*	Go to “Fuel Pressure Check: ”.	Go to “Fuel Pump and Its Circuit Check: ”.
12	**Check ignition spark** 1) Disconnect injector couplers. 2) Remove spark plugs and connect them to high-tension cords or ignition coil assemblies. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. *Is it in good condition?*	Go to Step 13.	Go to “Ignition Spark Test: in Section 1H”.
13	**Check fuel injector for operation** 1) Install spark plugs and connect injector connectors. 2) Using sound scope (1), check operating sound of each injector (2) when cranking engine.  I3RM0A110015-01 *Was injector operating sound heard from all injectors?*	Go to “Engine Symptom Diagnosis: ”.	Go to “Fuel Injector Circuit Check: ”.

Engine Symptom Diagnosis

S4RS0B1104010

Perform troubleshooting referring to the followings when ECM has detected no DTC and no abnormality has been found in “Visual Inspection: ” and “Engine Basic Inspection: ”.

Condition	Possible cause	Correction / Reference Item
Hard starting (Engine cranks OK)	Faulty spark plug	*“Spark Plug Inspection: in Section 1H”*
	Leaky high-tension cord	*“High-Tension Cord Inspection: in Section 1H”*
	Loose connection or disconnection of high-tension cord(s) or lead wire(s)	*“High-Tension Cord Removal and Installation: in Section 1H”*
	Faulty ignition coil	*“Ignition Coil Assembly (Including ignitor) Inspection: in Section 1H”*
	Dirty or clogged fuel hose or pipe	*“Fuel Pressure Check: ”*
	Malfunctioning fuel pump	*“Fuel Pressure Check: ”*
	Air drawn in through intake manifold gasket or throttle body gasket	
	Faulty idle air control system	*“Idle Air Control System Check (For A/T and M/T models): ”*
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*“Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C”*
	Faulty accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)	*“Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C”*
	Faulty ECT sensor or MAF sensor	*“Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C” or “Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C”*
	Faulty ECM	
	Low compression	*“Compression Check: in Section 1D”*
	Poor spark plug tightening or faulty gasket	*“Spark Plug Removal and Installation: in Section 1H”*
	Compression leak from valve seat	*“Valves and Valve Guides Inspection: in Section 1D”*
	Sticky valve stem	*“Valves and Valve Guides Inspection: in Section 1D”*
	Weak or damaged valve springs	*“Valve Spring Inspection: in Section 1D”*
	Compression leak at cylinder head gasket	*“Cylinder Head Inspection: in Section 1D”*
	Sticking or damaged piston ring	*“Cylinders, Pistons and Piston Rings Inspection: in Section 1D”*
	Worn piston, ring or cylinder	*“Cylinders, Pistons and Piston Rings Inspection: in Section 1D”*
	Malfunctioning PCV valve	*“PCV Valve Inspection: in Section 1B”*
	Camshaft position control (VVT) system out of order (for M15 engine model)	*“Oil Control Valve Inspection (For Engine with VVT): in Section 1D”*
	Faulty EGR system	*“EGR System Inspection: in Section 1B”*
Low oil pressure	Improper oil viscosity	*“Engine Oil and Filter Change: in Section 0B”*
	Malfunctioning oil pressure switch	*“Oil Pressure Switch Inspection: in Section 9C”*
	Clogged oil strainer	*“Oil Pan and Oil Pump Strainer Cleaning: in Section 1E”*
	Functional deterioration of oil pump	*“Oil Pump Inspection: in Section 1E”*
	Worn oil pump relief valve	*“Oil Pump Inspection: in Section 1E”*
	Excessive clearance in various sliding parts	

Condition	Possible cause	Correction / Reference Item
Engine noise – Valve noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Improper valve lash	*"Camshaft, Tappet and Shim Inspection: in Section 1D"*
	Worn valve stem and guide	*"Valves and Valve Guides Inspection: in Section 1D"*
	Weak or broken valve spring	*"Valve Spring Inspection: in Section 1D"*
	Warped or bent valve	*"Valves and Valve Guides Inspection: in Section 1D"*
Engine noise – Piston, ring and cylinder noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Worn piston, ring and cylinder bore	*"Cylinders, Pistons and Piston Rings Inspection: in Section 1D"*
Engine noise – Connecting rod noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Worn piston, ring and cylinder bore	*"Cylinders, Pistons and Piston Rings Inspection: in Section 1D"*
	Worn rod bearing	*"Crank Pin and Connecting Rod Bearings Inspection: in Section 1D"*
	Worn crank pin	*"Crank Pin and Connecting Rod Bearings Inspection: in Section 1D"*
	Loose connecting rod nuts	*"Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation: in Section 1D"*
	Low oil pressure	*Condition "Low oil pressure"*
Engine noise – Crankshaft noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Low oil pressure	*Condition "Low oil pressure"*
	Worn bearing	*"Main Bearings Inspection: in Section 1D"*
	Worn crankshaft journal	*"Crankshaft Inspection: in Section 1D"*
	Loose bearing cap bolts	*"Main Bearings, Crankshaft and Cylinder Block Removal and Installation: in Section 1D"*
	Excessive crankshaft thrust play	*"Crankshaft Inspection: in Section 1D"*

Condition	Possible cause	Correction / Reference Item
Engine overheating	Inoperative thermostat	*"Thermostat Inspection: in Section 1F"*
	Poor water pump performance	*"Water Pump Inspection: in Section 1F"*
	Clogged or leaky radiator	*"Radiator On-Vehicle Inspection and Cleaning: in Section 1F"*
	Improper engine oil grade	*"Engine Oil and Filter Change: in Section 0B"*
	Clogged oil filter or oil strainer	*"Oil Pressure Check: in Section 1E"*
	Poor oil pump performance	*"Oil Pressure Check: in Section 1E"*
	Faulty radiator cooling fan control system	*"Radiator cooling fan Low Speed Control System Check: " or "Radiator cooling fan High Speed Control System Check: "*
	Dragging brakes	*Condition "Dragging brakes" in "Brakes Symptom Diagnosis: in Section 4A"*
	Slipping clutch	*Condition "Slipping clutch" in "Clutch System Symptom Diagnosis: in Section 5C" for M/T model or "Slipping clutch" in "Automated Manual Transaxle Symptom Diagnosis: in Section 5D" for Automated Manual Transaxle model.*
	Blown cylinder head gasket	*"Cylinder Head Inspection: in Section 1D"*
	Air mixed in cooling system	
Poor gasoline mileage	Leaks or loose connection of high-tension cord	*"High-Tension Cord Removal and Installation: in Section 1H"*
	Faulty spark plug (improper gap, heavy deposits and burned electrodes, etc.)	*"Spark Plug Inspection: in Section 1H"*
	Malfunctioning EGR valve	*"EGR Valve Inspection: in Section 1B"*
	High idle speed	*Condition "Improper engine idling or engine fails to idle"*
	Poor performance of ECT sensor, TP sensor (for A/T and M/T models) or MAF sensor	*"Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C", "Throttle Position (TP) Sensor On-Vehicle Inspection (For A/T and M/T Models): in Section 1C" or "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)	*"Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty fuel injector(s)	*"Fuel Injector Circuit Check: "*
	Faulty ECM	
	Low compression	*"Compression Check: in Section 1D"*
	Poor valve seating	*"Valves and Valve Guides Inspection: in Section 1D"*
	Dragging brakes	*Condition "Dragging brakes" in "Brakes Symptom Diagnosis: in Section 4A"*
	Slipping clutch	*Condition "Slipping clutch" in"Clutch System Symptom Diagnosis: in Section 5C" for M/T model or "Slipping clutch" in "Automated Manual Transaxle Symptom Diagnosis: in Section 5D" fractionated Manual Transaxle model*
	Thermostat out of order	*"Thermostat Inspection: in Section 1F"*
	Improper tire pressure	*"Tires Description: in Section 2D"*
	Camshaft position control (VVT) system out of order (for M15 engine model)	*"Oil Control Valve Inspection (For Engine with VVT): in Section 1D"*
Excessive engine oil consumption – Oil leakage	Blown cylinder head gasket	*"Cylinder Head Inspection: in Section 1D"*
	Leaky camshaft oil seals	*"Camshaft, Tappet and Shim Inspection: in Section 1D"*

Condition	Possible cause	Correction / Reference Item
Excessive engine oil consumption – Oil entering combustion chamber	Sticky piston ring	*"Cylinders, Pistons and Piston Rings Inspection: in Section 1D"*
	Worn piston and cylinder	*"Cylinders, Pistons and Piston Rings Inspection: in Section 1D"*
	Worn piston ring groove and ring	*"Cylinders, Pistons and Piston Rings Inspection: in Section 1D"*
	Improper location of piston ring gap	*"Pistons, Piston Rings, Connecting Rods and Cylinders Disassembly and Assembly: in Section 1D"*
	Worn or damaged valve stem seal	*"Valves and Valve Guides Inspection: in Section 1D"*
	Worn valve stem	*"Valves and Valve Guides Inspection: in Section 1D"*
Engine hesitates – Momentary lack of response as accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make vehicle move, as from a stop sign.	Spark plug faulty or plug gap out of adjustment	*"Spark Plug Inspection: in Section 1H"*
	Leaky high-tension cord	*"High-Tension Cord Inspection: in Section 1H"*
	Fuel pressure out of specification	*"Fuel Pressure Check: "*
	Malfunctioning EGR valve	*"EGR Valve Inspection: in Section 1B"*
	Poor performance of TP sensor (for M/T and A/T models), ECT sensor or MAF sensor	*"Throttle Position (TP) Sensor On-Vehicle Inspection (For A/T and M/T Models): in Section 1C", "Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C" or "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)	*"Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty fuel injector	*"Fuel Injector Circuit Check: "*
	Faulty ECM	
	Engine overheating	*Condition "Engine overheating"*
	Low compression	*"Compression Check: in Section 1D"*
	Camshaft position control (VVT) system out of order (forM15 engine model)	*"Oil Control Valve Inspection (For Engine with VVT): in Section 1D"*
Surge – Engine power variation under steady throttle or cruise. Feels like vehicle speeds up and down with no change in accelerator pedal.	Leaky or loosely connected high-tension cord	*"High-Tension Cord Removal and Installation: in Section 1H"*
	Faulty spark plug (excess carbon deposits, improper gap, burned electrodes, etc.)	*"Spark Plug Inspection: in Section 1H"*
	Variable fuel pressure	*"Fuel Pressure Check: "*
	Kinky or damaged fuel hose and lines	
	Faulty fuel pump (clogged fuel filter)	
	Malfunctioning EGR valve	*"EGR Valve Inspection: in Section 1B"*
	Poor performance of MAF sensor	*"Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty fuel injector	*"Fuel Injector Circuit Check: "*
	Faulty ECM	
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)	*"Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C"*

Condition	Possible cause	Correction / Reference Item
Excessive detonation – Engine makes continuously sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.	Faulty spark plug	*"Spark Plug Inspection: in Section 1H"*
	Loose connection of high-tension cord	*"High-Tension Cord Removal and Installation: in Section 1H"*
	Engine overheating	*Condition "Engine overheating"*
	Clogged fuel filter (faulty fuel pump) or fuel lines	*"Fuel Pressure Check: " or "Fuel Pump and Its Circuit Check: "*
	Air drawn in through intake manifold or throttle body gasket	
	Malfunctioning EGR valve	*"EGR Valve Inspection: in Section 1B"*
	Poor performance of knock sensor, ECT sensor or MAF sensor	*"DTC P0327 / P0328: Knock Sensor Circuit Low / High: ", "Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C" or "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty fuel injector(s)	*"Fuel Injector Circuit Check: "*
	Faulty ECM	
	Excessive combustion chamber deposits	*"Cylinders, Pistons and Piston Rings Inspection: in Section 1D" and/or "Piston Pins and Connecting Rods Inspection: in Section 1D"*
	Camshaft position control (VVT) system out of order (for M15 engine model)	*"Oil Control Valve Inspection (For Engine with VVT): in Section 1D"*

Condition	Possible cause	Correction / Reference Item
Engine has no power	Faulty spark plug	*"Spark Plug Inspection: in Section 1H"*
	Faulty ignition coil with ignitor	*"Ignition Coil Assembly (Including ignitor) Inspection: in Section 1H"*
	Leaks, loose connection or disconnection of high-tension cord	*"High-Tension Cord Removal and Installation: in Section 1H"*
	Faulty knock sensor	*"DTC P0327 / P0328: Knock Sensor Circuit Low / High: "*
	Clogged fuel hose or pipe	*"Fuel Pressure Check: "*
	Malfunctioning fuel pump	*"Fuel Pump and Its Circuit Check: "*
	Air drawn in through intake manifold gasket or throttle body gasket	
	Engine overheating	*Condition "Engine overheating"*
	Malfunctioning EGR valve	*"EGR Valve Inspection: in Section 1B"*
	Maladjusted accelerator cable play (for A/T and M/T models)	*"Accelerator Cable Adjustment (For A/T and M/T Models): in Section 1D"*
	Poor performance of TP sensor (for A/T and M/T models), ECT sensor or MAF sensor	*"Throttle Position (TP) Sensor On-Vehicle Inspection (For A/T and M/T Models): in Section 1C", "Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C" or "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)	*"Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty fuel injector(s)	*"Fuel Injector Circuit Check: "*
	Faulty ECM	
	Dragging brakes	*Condition "Dragging brakes" in "Brakes Symptom Diagnosis: in Section 4A"*
	Slipping clutch	*Condition "Slipping clutch" in "Clutch System Symptom Diagnosis: in Section 5C" for M/T model or "Slipping clutch" in "Automated Manual Transaxle Symptom Diagnosis: in Section 5D" for Automated Manual Transaxle model*
	Low compression	*"Compression Check: in Section 1D"*
	Camshaft position control (VVT) system out of order (for M15 engine model)	*"Oil Control Valve Inspection (For Engine with VVT): in Section 1D"*

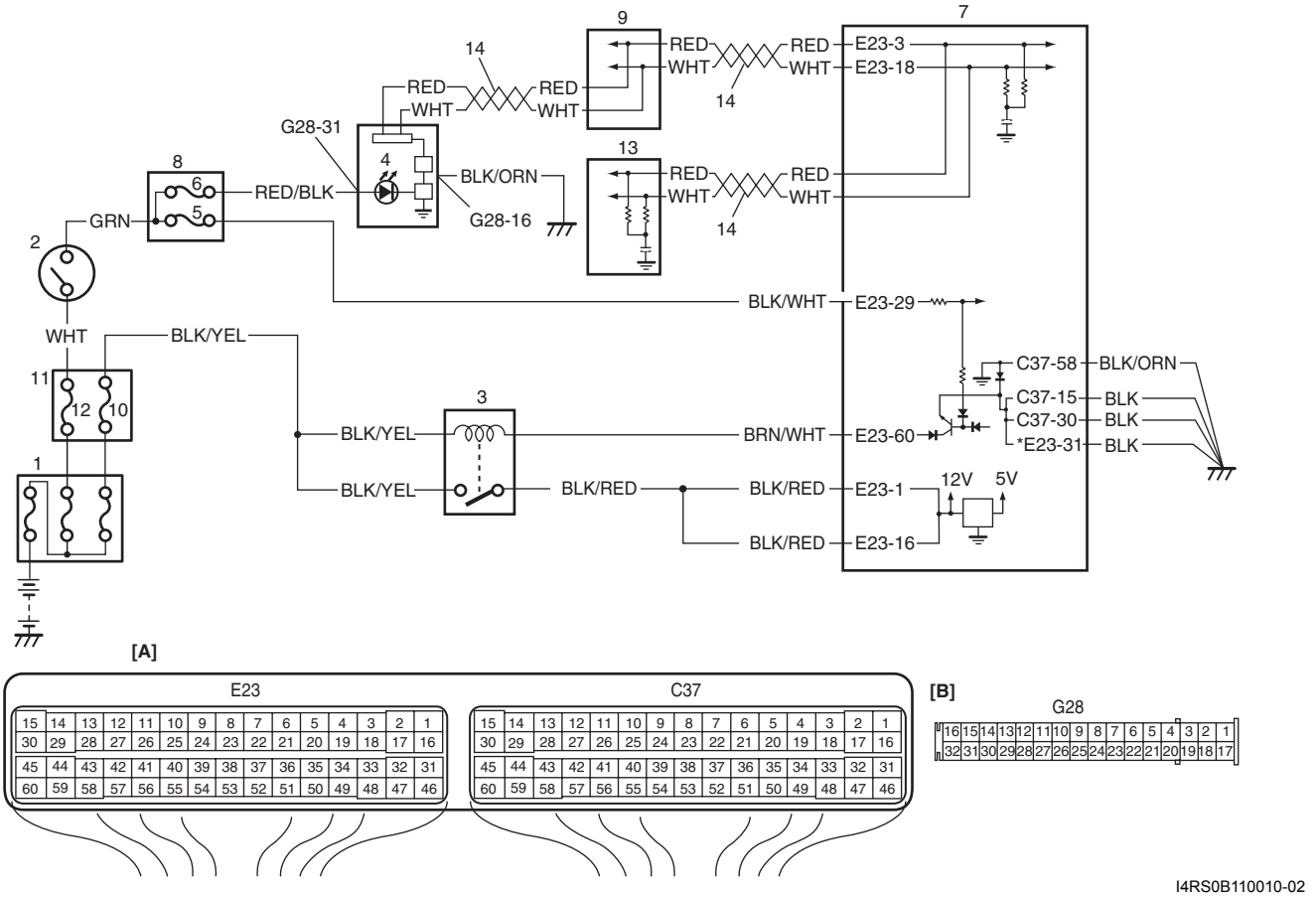
Condition	Possible cause	Correction / Reference Item
Improper engine idling or engine fails to idle	Faulty spark plug	*"Spark Plug Inspection: in Section 1H"*
	Leaky or disconnected high-tension cord	*"High-Tension Cord Removal and Installation: in Section 1H"*
	Faulty ignition coil with ignitor	*"Ignition Coil Assembly (Including ignitor) Inspection: in Section 1H"*
	Fuel pressure out of specification	*"Fuel Pressure Check: "*
	Leaky manifold, throttle body, or cylinder head gasket	
	Malfunctioning EGR valve	*"EGR Valve Inspection: in Section 1B"*
	Faulty idle air control system	*"Idle Air Control System Check (For A/T and M/T models): "*
	Faulty evaporative emission control system	*"EVAP Canister Purge Inspection: in Section 1B"*
	Faulty EGR system	*"EGR System Inspection: in Section 1B"*
	Faulty fuel injector(s)	*"Fuel Injector Circuit Check: "*
	Poor performance of ECT sensor, TP sensor (for A/T and M/T models) or MAF sensor	*"Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C", "Throttle Position (TP) Sensor On-Vehicle Inspection (For A/T and M/T Models): in Section 1C" or "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty accelerator pedal position(APP) sensor assembly (for Automated Manual Transaxle model)	*"Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty ECM	
	Loose connection or disconnection of vacuum hoses	
	Malfunctioning PCV valve	*"PCV Valve Inspection: in Section 1B"*
	Engine overheating	*Condition "Engine overheating"*
	Low compression	*"Compression Check: in Section 1D"*
	Camshaft position control (VVT) system out of order (for M15 engine model)	*"Oil Control Valve Inspection (For Engine with VVT): in Section 1D"*

Condition	Possible cause	Correction / Reference Item
Excessive hydrocarbon (HC) emission or carbon monoxide (CO)	Faulty spark plug	*"Spark Plug Inspection: in Section 1H"*
	Leaky or disconnected high-tension cord	*"High-Tension Cord Removal and Installation: in Section 1H"*
	Faulty ignition coil with ignitor	*"Ignition Coil Assembly (Including ignitor) Inspection: in Section 1H"*
	Low compression	*"Compression Check: in Section 1D"*
	Lead contamination of three way catalytic converter	*Check for absence of filler neck restrictor.*
	Faulty evaporative emission control system	*"EVAP Canister Purge Inspection: in Section 1B"*
	Fuel pressure out of specification	*"Fuel Pressure Check: "*
	Closed loop system (A/F feedback compensation) fails (Faulty TP sensor, Poor performance of ECT sensor or MAF sensor)	*"Throttle Position (TP) Sensor On-Vehicle Inspection (For A/T and M/T Models): in Section 1C", "Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C", "Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C" or "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)	*"Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty injector(s)	*"Fuel Injector Circuit Check: "*
	Faulty ECM	
	Engine not at normal operating temperature	
	Clogged air cleaner	*"Air Cleaner Element Inspection and Cleaning: in Section 1D"*
	Vacuum leaks	*"Engine Vacuum Check: in Section 1D"*
	Camshaft position control (VVT) system out of order (for M15 engine model)	*"Oil Control Valve Inspection (For Engine with VVT): in Section 1D"*
Excessive nitrogen oxides (NOx) emission	Improper ignition timing	*"Ignition Timing Inspection: in Section 1H"*
	Lead contamination of catalytic converter	*Check for absence of filler neck restrictor.*
	Faulty EGR system	*"EGR System Inspection: in Section 1B"*
	Fuel pressure out of specification	*"Fuel Pressure Check: "*
	Closed loop system (A/F feedback compensation) fails (Faulty TP sensor, Poor performance of ECT sensor or MAF sensor)	*"Throttle Position (TP) Sensor On-Vehicle Inspection (For A/T and M/T Models): in Section 1C", "Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C", "Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C" or "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C"*
	Faulty electric throttle body assembly (for Automated Manual Transaxle model)	*"Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty accelerator pedal position (APP) sensor assembly (for Automated Manual Transaxle model)	*"Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C"*
	Faulty injector(s)	*"Fuel Injector Circuit Check: "*
	Faulty ECM	
	Camshaft position control (VVT) system out of order (for M15 engine model)	*"Oil Control Valve Inspection (For Engine with VVT): in Section 1D"*

Malfunction Indicator Lamp Does Not Come ON with Ignition Switch ON and Engine Stop (but Engine Can Be Started)

S4RS0B1104011

Wiring Diagram



I4RS0B110010-02

[A]: ECM connector (viewed from harness side)	5. "IG COIL" fuse	11. Individual circuit fuse box No.1
[B]: Combination meter connector (viewed from harness side)	6. "METER" fuse	12. "IG ACC" fuse
1. Main fuse box	7. ECM	13. TCM (for A/T or Automated Manual Transaxle model)
2. Ignition switch	8. Junction block assembly	14. CAN communication line
3. Main relay	9. BCM	*: For Automated Manual Transaxle model
4. Malfunction indicator lamp in combination meter	10. "FI" fuse	

Circuit Description

When the ignition switch is turned ON, ECM causes the main relay to turn ON (close the contact point). Then, ECM being supplied with the main power, transmits indication ON signal of malfunction indicator lamp (MIL) to combination meter in order to turn MIL ON. And then, combination meter turns MIL ON. When the engine starts to run and no malfunction is detected in the system, ECM transmits MIL indication OFF signal to combination meter in order to turn MIL OFF. And then, combination meter turns MIL OFF, but if a malfunction was or is detected, MIL remains ON even when the engine is running.

Troubleshooting

NOTE

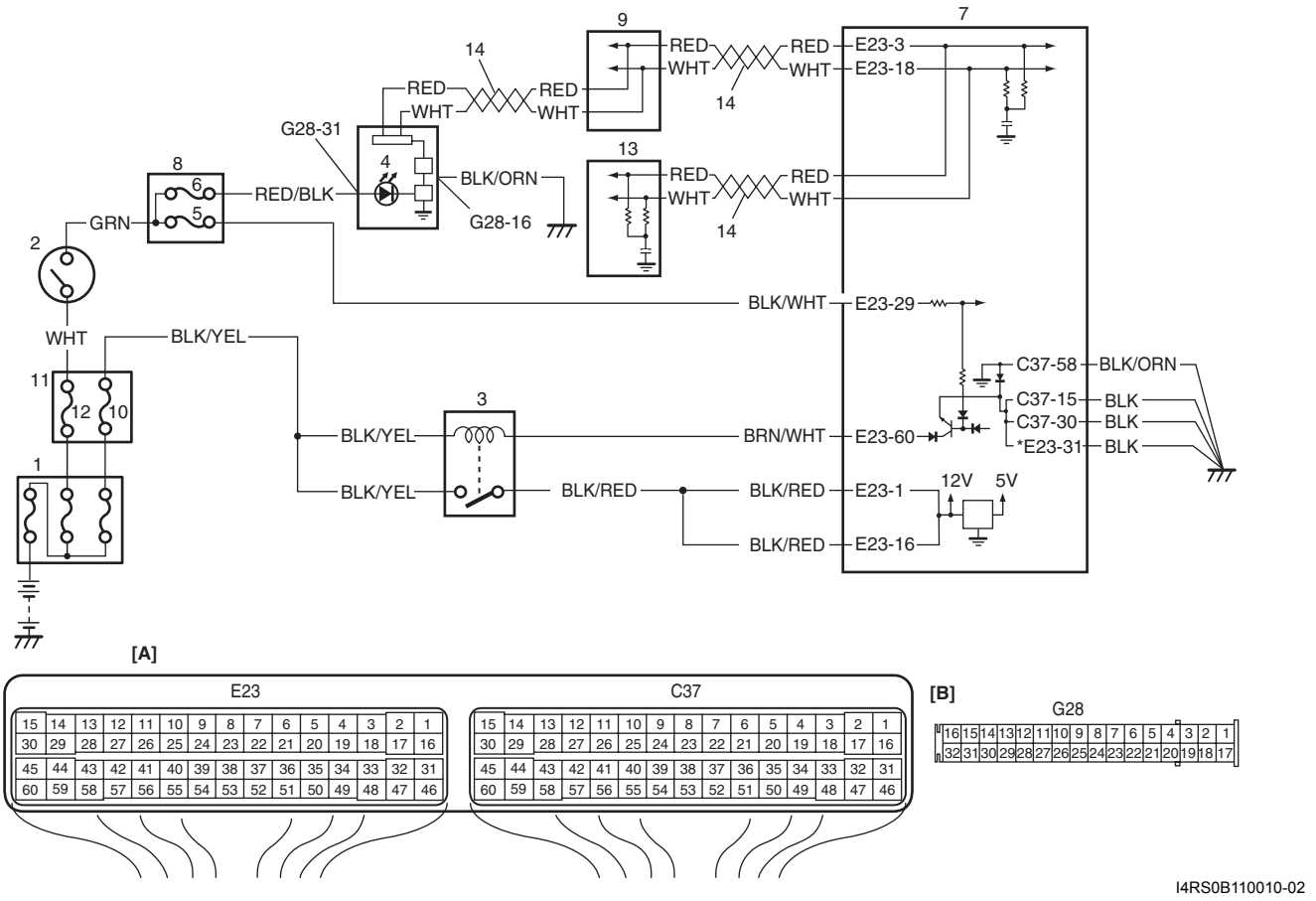
- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**

Step	Action	Yes	No
1	**MIL power supply check** 1) Turn ignition switch to ON position. *Do other warning lights come ON?*	Go to Step 2.	Go to Step 3.
2	**DTC check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch and check DTC. *Is there DTC(s) P1674, P1675 and/or P1678?*	Go to applicable DTC diag. flow.	Substitute a known-good combination meter and recheck. If MIL still remains OFF, substitute a known-good ECM and recheck.
3	**CAN communication line circuit check** 1) Check CAN communication circuit between combination meter and ECM, TCM (for A/T or Automated Manual Transaxle model) referring to Step 9 to 15 of "DTC P1674: CAN Communication (Bus Off Error): " *Is circuit in good condition?*	Go to Step 4.	Repair or replace.
4	**"METER" fuse check** 1) Turn ignition switch to OFF position. 2) Check for fuse blown at "METER" fuse in junction block assembly. *Is "METER" fuse in good condition?*	Go to Step 5.	Replace "METER" fuse and check for short.
5	**Combination meter power supply check** 1) Remove combination meter referring to "Combination Meter Removal and Installation: in Section 9C". 2) Check for proper connection to combination meter connector at "G28-31" and "G28-16" terminals. 3) If OK, then turn ignition switch to ON position and measure voltage between combination meter connector at "G28-31" terminal and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 6.	"RED/BLK" wire is open circuit.
6	**Combination meter circuit check** 1) Turn ignition switch to OFF position. 2) Measure resistance between "G28-16" terminal of combination meter connector and vehicle body ground. *Is resistance 1 Ω or less?*	Substitute a known-good combination meter and recheck. If MIL still remains OFF, substitute a known-good ECM and recheck.	"BLK/ORN" wire is open or high resistance circuit.

Malfunction Indicator Lamp Remains ON after Engine Starts

S4RS0B1104012

Wiring Diagram



I4RS0B110010-02

[A]: ECM connector (viewed from harness side)	5. "IG COIL" fuse	11. Individual circuit fuse box No.1
[B]: Combination meter connector (viewed from harness side)	6. "METER" fuse	12. "IG ACC" fuse
1. Main fuse box	7. ECM	13. TCM (for A/T or Automated Manual Transaxle model)
2. Ignition switch	8. Junction block assembly	14. CAN communication line
3. Main relay	9. BCM	*: For Automated Manual Transaxle model
4. Malfunction indicator lamp in combination meter	10. "FI" fuse	

Circuit Description

When the ignition switch is turned ON, ECM causes the main relay to turn ON (close the contact point). Then, ECM being supplied with the main power, transmits indication ON signal of malfunction indicator lamp (MIL) to combination meter in order to turn MIL ON. And then, combination meter turns MIL ON. When the engine starts to run and no malfunction is detected in the system, ECM transmits MIL indication OFF signal to combination meter in order to turn MIL OFF. And then, combination meter turns MIL OFF, but if a malfunction was or is detected, MIL remains ON even when the engine is running.

Troubleshooting

NOTE

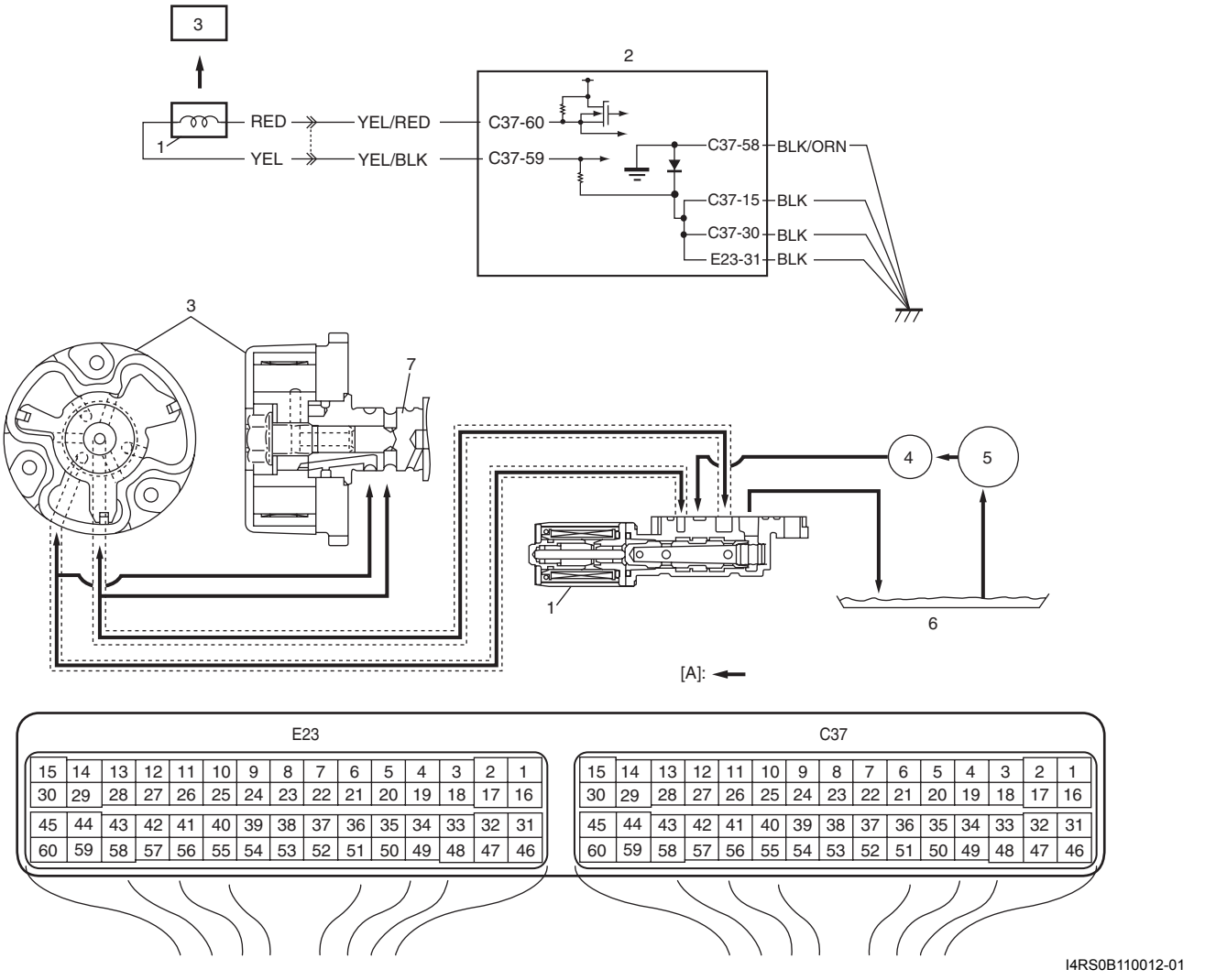
- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**

Step	Action	Yes	No
1	**DTC check** 1) Start engine and recheck DTC of ECM and TCM (for A/T or Automated Manual Transaxle model) while engine running. *Is there any DTC(s)?*	Go to Step 2 of "Engine and Emission Control System Check: ", Step 2 of "A/T System Check: in Section 5A" or "Automated Manual Transaxle System Check: in Section 5D".	Go to Step 2.
2	**CAN communication line circuit check** 1) Check CAN communication line circuit between combination meter and ECM, TCM (for A/T or Automated Manual Transaxle model) referring to Step 9 to 15 "DTC P1674: CAN Communication (Bus Off Error): ". *Is circuit in good condition?*	Substitute a known-good combination meter and recheck. If MIL still remains OFF, substitute a known-good ECM and recheck.	Repair or replace CAN communication circuit.

DTC P0010: Camshaft Position Actuator Circuit (For M15 Engine Model)

S4RS0B1104013

System and Wiring Diagram



I4RS0B110012-01

[A]: Oil flow	3. Camshaft timing sprocket	6. Oil pan
1. Oil control valve	4. Oil filter	7. Intake camshaft
2. ECM	5. Oil pump	

Circuit Description

Actual valve timing fails to become close to target advance level of each function although advance control function or retarded advance control function is at work.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Monitor signal of oil control valve is different from command signal. (Circuit open or short) (1 driving cycle detection logic)	• Oil control valve • Oil control valve circuit • ECM

DTC Confirmation Procedure

1) Clear DTC. Refer to “DTC Clearance: ”.
2) Start engine and keep it at idle for 10 seconds.
3) Check DTC. Refer to “DTC Check: ”.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Oil control valve electrical circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection at "C37-60" and "C37-59" terminals of ECM connector. 3) If OK, measure resistance between "C37-60" and "C37-59" terminals of ECM connector. *Is resistance below 10 Ω?*	Go to Step 3.	Go to Step 8.
3	**Oil control valve electrical circuit check** *Was resistance more than 6.5 Ω in Step 2?*	Go to Step 4.	Go to Step 7.
4	**Oil control valve electrical circuit for power short check** 1) Turn ON ignition switch. 2) Measure voltage between "C37-60" terminal of ECM connector and engine ground. *Is voltage below 1 V?*	Go to Step 5.	"RED", "YEL/RED", "YEL" or "YEL/BLK" wire is shorted to power supply circuit.
5	**Oil control valve electrical circuit for ground short check** 1) Disconnect connector from oil control valve with ignition switch turned OFF. 2) Measure resistance between "C37-60" terminal of ECM connector and engine ground. *Is resistance infinity?*	Go to Step 6.	"YEL/RED" wire is shorted to ground circuit.
6	**Oil control valve electrical circuit for ground short check** 1) Measure resistance between "C37-59" terminal of ECM connector and engine ground. *Is resistance infinity?*	Go to Step 9.	"YEL/BLK" wire is shorted to ground circuit.
7	**Oil control valve electrical circuit for short check** 1) Disconnect connector from oil control valve with ignition switch turned OFF. 2) Measure resistance between "C37-60" and "C37-59" terminals of ECM connector. *Is resistance infinity?*	Go to Step 9.	"YEL/RED" wire is shorted to "YEL/BLK" wire.

Step	Action	Yes	No
8	**Oil control valve electrical circuit check** 1) Disconnect connector from oil control valve with ignition switch turned OFF. 2) Measure resistance between “C37-60” terminal of ECM connector and “YEL/RED” wire terminal of oil control valve connector and between “C37-59” terminal of ECM connector and “YEL/BLK” wire terminal of oil control valve connector. *Is resistance below 1 Ω?*	Go to Step 9.	“YEL/RED” wire or “YEL/BLK” wire circuit is open or high resistance.
9	**Oil control valve check** Check oil control valve referring to “Oil Control Valve Inspection (For Engine with VVT): in Section 1D”. *Is resistance within specified value?*	Substitute a known-good ECM and recheck.	Faulty oil control valve.

DTC P0011 / P0012: Camshaft Position - Timing Over-Advanced or System Performance / -Retarded (For M15 Engine Model)

S4RS0B1104014

System Description

Actual value of advanced valve timing does not reach target value.
Valve timing is advanced although ECM command is most retarding.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Actual value of advanced valve timing does not reach target value, or valve timing is advanced although ECM command is most retarding. (2 driving cycle detection logic)	• Oil control valve • Oil galleries of timing sprocket • Intake camshaft timing sprocket (Camshaft position control (VVT) actuator) • Oil control valve circuit • ECM

DTC Confirmation Procedure

⚠ WARNING

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out by 2 persons, a driver and tester, on a level road.**

NOTE

Check to make sure that the following conditions are satisfied when using this “DTC Confirmation Procedure”.

- **altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Clear DTC. Refer to “DTC Clearance: ”.
2) Start engine and drive vehicle under usual driving condition for 5 minutes or longer until engine is warmed up to normal operating temperature.
3) Stop vehicle.
4) Run engine at idle speed for 1 minute.
5) Start vehicle and increase vehicle speed up to 80 km/h (50 mile/h).
6) Keep vehicle speed at 80 km/h (50 mile/h) for 1 minute or longer at 5th gear position or D range.
7) Decrease vehicle speed gradually.
8) Stop vehicle and turn OFF ignition switch.
9) Repeat Step 4) to 7) one time.

10) Stop vehicle.
11) Check DTC. Refer to “DTC Check: ”.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the “Precautions of ECM Circuit Inspection: ”.**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits: ”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that the trouble has been corrected.**

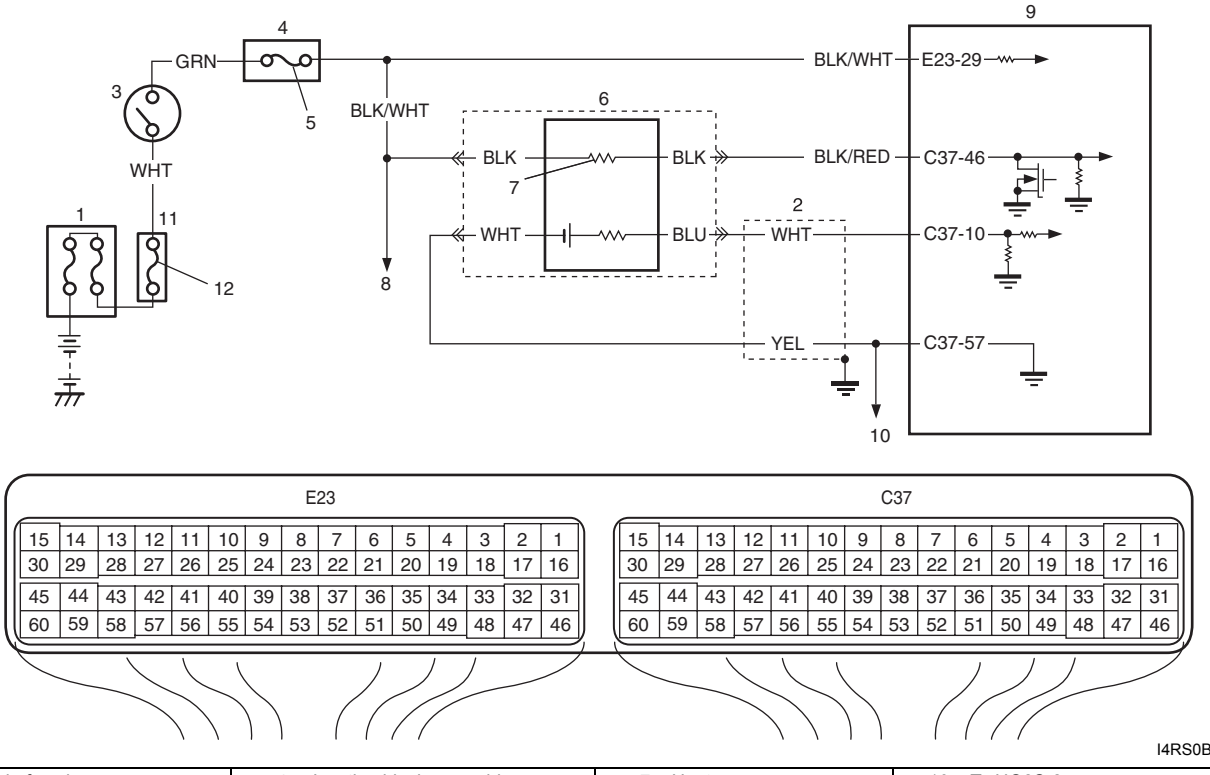
Step	Action	Yes	No
1	*Is DTC P0010 detected together?*	Go to “DTC P0010: Camshaft Position Actuator Circuit (For M15 Engine Model): ”.	Go to Step 2.
2	*Do you have SUZUKI scan tool?*	Go to Step 3.	Go to Step 5.
3	**Camshaft position control check** 1) With ignition switch turned OFF, connect SUZUKI scan tool. 2) Start engine and warm up to normal operating temperature. 3) Select menu to DATA LIST. 4) Check that “VVT GAP” displayed on SUZUKI scan tool is 0 – 5°. *Is it OK?*	Go to Step 4.	Check valve timing referring to “Timing Chain and Chain Tensioner Removal and Installation: in Section 1D”. If OK, go to Step 5.
4	**Camshaft position control check** 1) Drive vehicle under following conditions. • Vehicle speed at 80 km/h (50 mile/h). • Gear position at 5th or D range. 2) Check that “VVT GAP” displayed on SUZUKI scan tool is 0 – 5°. *Is it OK?*	Substitute a known-good ECM and recheck.	Go to Step 5.
5	**Oil control circuit visual inspection** 1) Remove cylinder head cover referring to “Cylinder Head Cover Removal and Installation: in Section 1D”. 2) Check oil pressure leakage from oil control circuit. *Is it in good condition?*	Go to Step 6.	Repair or replace.
6	**Oil control valve and oil gallery pipe check** 1) Remove oil control valve referring to “Oil Control Valve Removal and Installation (For Engine with VVT): in Section 1D”. 2) Remove oil gallery pipe referring to “Timing Chain Cover Removal and Installation: in Section 1D”. 3) Check oil gallery pipe and oil control valve for clog or sludge. *Are they in good condition?*	Go to Step 7.	Clean oil control valve and oil gallery pipe. Replace oil control valve if a problem is not solved after cleaning oil control valve and oil gallery pipe.

Step	Action	Yes	No
7	**Oil control valve electrical circuit check** 1) Check that oil control valve circuit is in good condition referring to “DTC P0010: Camshaft Position Actuator Circuit (For M15 Engine Model): ”. *Is circuit in good condition?*	Repair circuit.	Go to Step 8.
8	**Oil control valve check** 1) Check oil control valve referring to“Oil Control Valve Inspection (For Engine with VVT): in Section 1D”. *Is it in good condition?*	Replace camshaft timing sprocket.	Replace oil control valve.

DTC P0031 / P0032: HO2S Heater Control Circuit Low / High (Sensor-1)

S4RS0B1104015

Wiring Diagram



I4RS0B110013-02

1. Main fuse box	4. Junction block assembly	7. Heater	10. To HO2S-2
2. Shield wire	5. “IG COIL” fuse	8. To HO2S-2 heater	11. Individual circuit fuse box No.1
3. Ignition switch	6. HO2S-1	9. ECM	12. “IG ACC” fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Current of HO2S-1 heater is more than specified value or lower than specified value for 5 seconds continuously. (2 driving cycle detection logic)	• HO2S-1 heater circuit • HO2S-1 heater • ECM

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Run engine at idle speed for 1 min. or more.
5) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

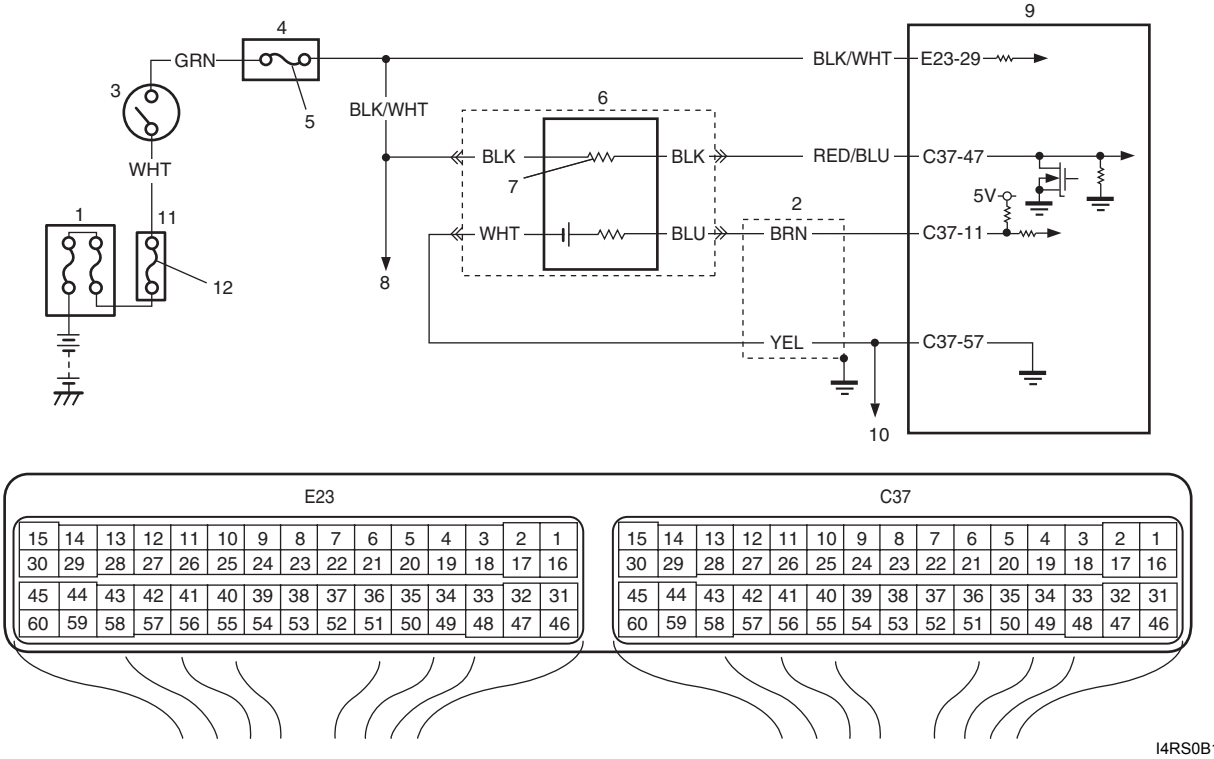
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**HO2S-1 heater power circuit check** 1) Disconnect connector from HO2S-1 with ignition switch turned OFF. 2) Check for proper connection to HO2S-1 at "BLK/WHT" and "BLK/RED" wire terminals. 3) If wire and connection are OK, measure voltage between "BLK/WHT" wire terminal and engine ground with ignition switch turned ON. *Is voltage over 10 V?*	Go to Step 3.	"BLK/WHT" wire is open circuit or shorted to ground circuit.
3	**HO2S-1 heater power circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "BLK/WHT" wire terminal of HO2S-1 connector and "E23-29" terminal of ECM connector. *Is resistance below 5 Ω?*	Go to Step 4.	"BLK/WHT" wire is high resistance circuit.
4	**HO2S-1 heater drive circuit check** 1) Measure resistance between "C37-46" terminal of ECM connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	"BLK/RED" wire is shorted to ground circuit.
5	**HO2S-1 heater drive circuit check** 1) Turn ON ignition switch. 2) Measure voltage between "C37-46" terminal of ECM connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 6.	"BLK/RED" wire is shorted to power circuit.
6	**HO2S-1 heater drive circuit check** 1) Connect connector to HO2S-1 with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between "C37-46" terminal of ECM connector and vehicle body ground with connector disconnected from ECM. *Is voltage over 10 V?*	Go to Step 7.	"BLK/RED" wire is open circuit.

Step	Action	Yes	No
7	**HO2S-1 heater check** 1) Disconnect HO2S-1 connector with ignition switch turned OFF. 2) Check HO2S-1 heater resistance referring to "Heated Oxygen Sensor (HO2S-1 and HO2S-2) Heater On-Vehicle Inspection: in Section 1C". *Is resistance within specified value range?*	Go to Step 8.	Replace HO2S-1.
8	**HO2S-1 heater power circuit check** 1) Connect connector to HO2S-1 with ignition switch turned OFF. 2) Measure resistance between "E23-29" and "C37-46" terminals of ECM connector. *It resistance below 12 Ω?*	HO2S-1 heater circuit is OK. Substitute a known-good ECM and recheck.	"BLK/WHT", "BLK/RED" and / or "BLK" wire is high resistance circuit.

DTC P0037 / P0038: HO2S Heater Control Circuit Low / High (Sensor-2)

S4RS0B1104016

Wiring Diagram



I4RS0B110014-01

1. Main fuse box	4. Junction block assembly	7. Heater	10. To HO2S-1
2. Shield wire	5. "IG COIL" fuse	8. To HO2S-1 heater	11. Individual circuit fuse box No.1
3. Ignition switch	6. HO2S-2	9. ECM	12. "IG ACC" fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Current of HO2S-2 heater is more than specified value or less than specified value for 5 seconds continuously (2 driving cycle detection logic)	• HO2S-2 heater • HO2S-2 heater circuit • ECM

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.

3) Start engine and warm up to normal operating temperature.
4) Run engine at idle speed for 1 min.
5) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

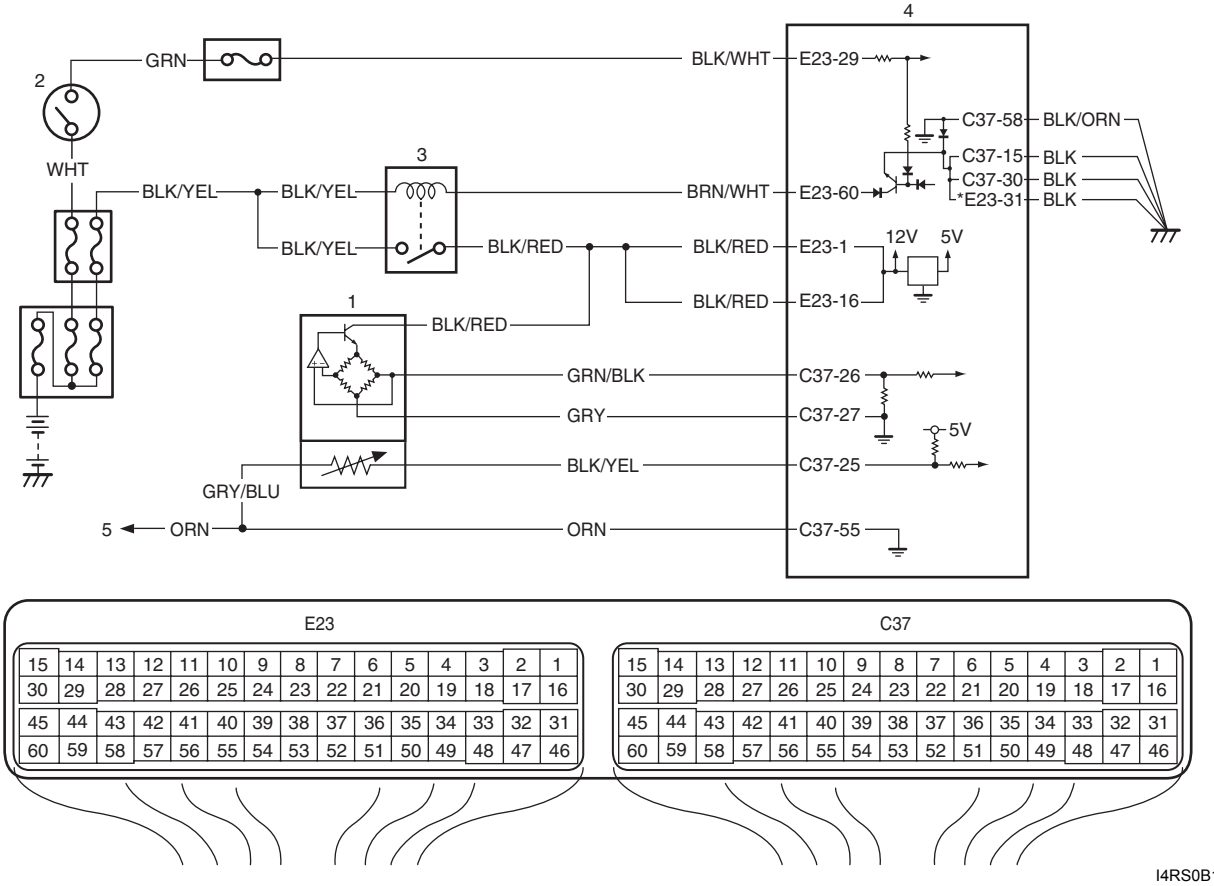
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**HO2S-2 heater power circuit check** 1) Disconnect connector from HO2S-2 with ignition switch turned OFF. 2) Check for proper connection to HO2S-2 at "BLK/WHT" and "RED/BLU" wire terminals. 3) If wire and connection are OK, measure voltage between "BLK/WHT" wire terminal of HO2S-2 connector and engine ground with ignition switch turned ON. *Is voltage over 10 V?*	Go to Step 3.	"BLK/WHT" wire is open circuit or shorted to ground circuit.
3	**HO2S-2 heater power circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "BLK/WHT" wire terminal of HO2S-2 connector and "E23-29" terminal wire of ECM connector. *Is resistance below 5 Ω?*	Go to Step 4.	"BLK/WHT" wire is high resistance circuit.
4	**HO2S-2 heater drive circuit check** 1) Measure resistance between "RED/BLU" wire terminal of HO2S-2 connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	"RED/BLU" wire is shorted to ground circuit.
5	**HO2S-2 heater drive circuit check** 1) Turn ON ignition switch. 2) Measure voltage between "RED/BLU" wire terminal of HO2S-2 connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 6.	"RED/BLU" wire is shorted to power circuit.
6	**HO2S-2 heater drive circuit check** 1) Connect connector to HO2S-2 with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between "C37-47" terminal of disconnected ECM connector and vehicle body ground. *Is voltage over 10 V?*	Go to Step 7.	"RED/BLU" wire is open circuit.

Step	Action	Yes	No
7	**HO2S-2 heater check** 1) Disconnect HO2S-2 connector with ignition switch turned OFF. 2) Check HO2S-2 heater resistance referring to “Heated Oxygen Sensor (HO2S-1 and HO2S-2) Heater On-Vehicle Inspection: in Section 1C”. *Is resistance within specified value?*	Go to Step 8.	Replace HO2S-2.
8	**HO2S-2 heater power circuit check** 1) Connect connector to HO2S-2 with ignition switch turned OFF. 2) Measure resistance between “E23-9” and “C37-47” terminals of ECM connector. *Is resistance below 30 Ω?*	HO2S-2 heater circuit is OK. Substitute a known-good ECM and recheck.	“RED/BLU” wire is high resistance circuit.

DTC P0101: Mass Air Flow Circuit Range / Performance

S4RS0B1104017

Wiring Diagram



I4RS0B110015-02

1. MAF and IAT sensor	3. Main relay	5. To other sensors
2. Ignition switch	4. ECM	*: For Automated Manual Transaxle model

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
• MAF volume is greater than 20 g/sec even if engine revolution is less than 900 rpm and intake manifold pressure is less than 40 kPa (5.80 psi) with TP less than 1.5°. • MAF volume is lower than 10 g/sec even if engine revolution is more than 2500 rpm and intake manifold pressure is more than 60 kPa (8.70 psi) with TP more than 12°. (2 driving cycle detection logic)	• Air intake system (clog or leakage) • MAF sensor circuit • MAF sensor • TP sensor and/or its circuit • MAP sensor and/or its circuit • ECM

DTC Confirmation Procedure

⚠ WARNING

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out by 2 persons, a driver and a tester, on a level road.**

NOTE

Check to make sure that the following conditions are satisfied when using this "DTC Confirmation Procedure".

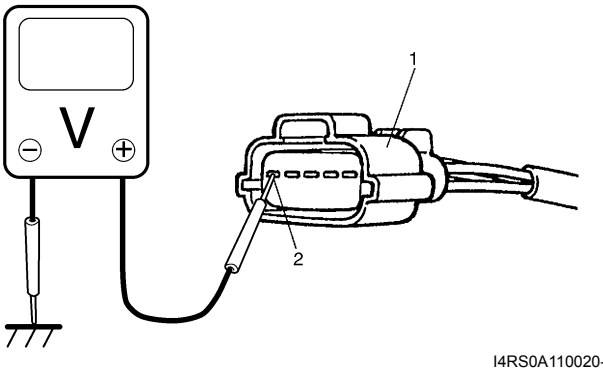
- **Intake air temperature at engine start: -10 °C (14°F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature. (ECT approx. 90 – 95 °C, 194 – 203 °F)
4) Drive vehicle with engine speed: more than 2500 rpm for 1 min.
5) Increase vehicle speed to 80 km/h (45 mile/h) at 5th gear or D range.
6) Release accelerator pedal to decrease vehicle speed to 40 km/h (25 mile/h).
7) Stop vehicle and run it idle for 1 min.
8) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

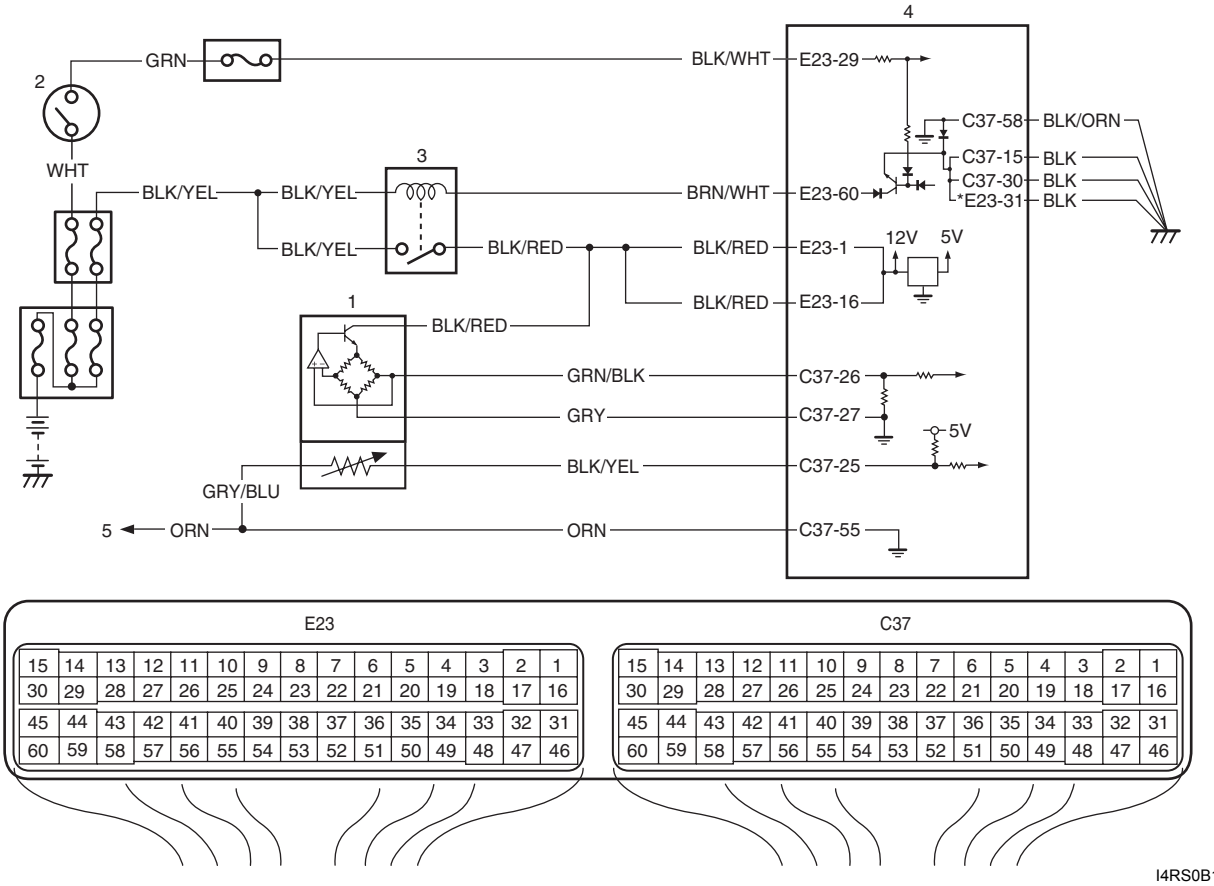
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Visual inspection** Check MAF sensor and air intake system for: • Objects which block measuring duct and resistor of MAF sensor. • Other air flow which does not pass the MAF sensor. *Are they in good condition?*	Go to Step 3.	Repair or replace.
3	**MAF sensor and its circuit check** 1) With ignition switch turned OFF, install scan tool. 2) Start engine and warm up to normal operation temperature. 3) Check MAF value using scan tool. (Refer to "Scan Tool Data: " for normal value.) *Is each value within specified range?*	Go to Step 11.	Go to Step 4.
4	**MAF sensor output voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Measure voltage between "C37-26" and "C37-27" terminals of ECM connector referring to "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor On-Vehicle Inspection: in Section 1C". *Is each value within specified range?*	Poor "C37-26" and/or "C37-27" terminal connection. If OK, substitute a known-good ECM and recheck.	Go to Step 5.
5	**MAF sensor power supply voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "BLK/RED" wire terminal (2) of MAF and IAT sensor connector (1).  I4RS0A110020-01 *Is voltage 10 – 14 V?*	Go to Step 6.	"BLK/RED" wire is open circuit.
6	**MAF sensor ground circuit check** 1) Turn OFF ignition switch, measure resistance between "GRY" wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 8.	Go to Step 7.

Step	Action	Yes	No
7	**Ground circuit check** 1) Measure resistance between “C37-27” terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	“GRY” wire is open or high resistance circuit.	ECM grounds “C37-58”, “C37-15”, “C37-30” and/or “E23-31” (for Automated Manual Transaxle model) circuit is open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
8	**MAF sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between “GRN/BLK” wire terminal of MAF and IAT sensor connector and engine ground. *Is voltage 0 V?*	Go to Step 9.	“GRN/BLK” wire is shorted to others circuit.
9	**MAF sensor signal circuit check** 1) Turn OFF ignition switch, measure resistance between “GRN/BLK” wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance infinity?*	Go to Step 10.	“GRN/BLK” wire is shorted to ground circuit.
10	**MAF sensor signal circuit check** 1) Measure resistance between “GRN/BLK” wire terminal of MAF and IAT sensor connector and “C37-26” terminal of ECM connector. *Is resistance below 3 Ω?*	Faulty MAF and IAT sensor.	“GRN/BLK” wire is open or high resistance circuit.
11	*Is DTC P0121 detected?*	Go to “DTC P0121: Throttle Position Sensor Circuit Range / Performance (For A/T and M/T Models): ”.	Go to Step 12.
12	*Is DTC P0106 displayed?*	Go to “DTC P0106: Manifold Absolute Pressure Range / Performance: ”.	Substitute a known-good ECM and recheck.

DTC P0102: Mass Air Flow Circuit Low Input

S4RS0B1104018

Wiring Diagram



I4RS0B110015-02

1. MAF and IAT sensor	4. ECM
2. Ignition switch	5. To other sensors
3. Main relay	*: For Automated Manual Transaxle model

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC will be set when all of following conditions are detected for 0.5 seconds continuously. • Engine is running • Voltage of MAF sensor output is less than specified value for specified time continuously. (1 driving cycle detection logic)	• Open or short in MAF sensor circuit • MAF sensor • ECM

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

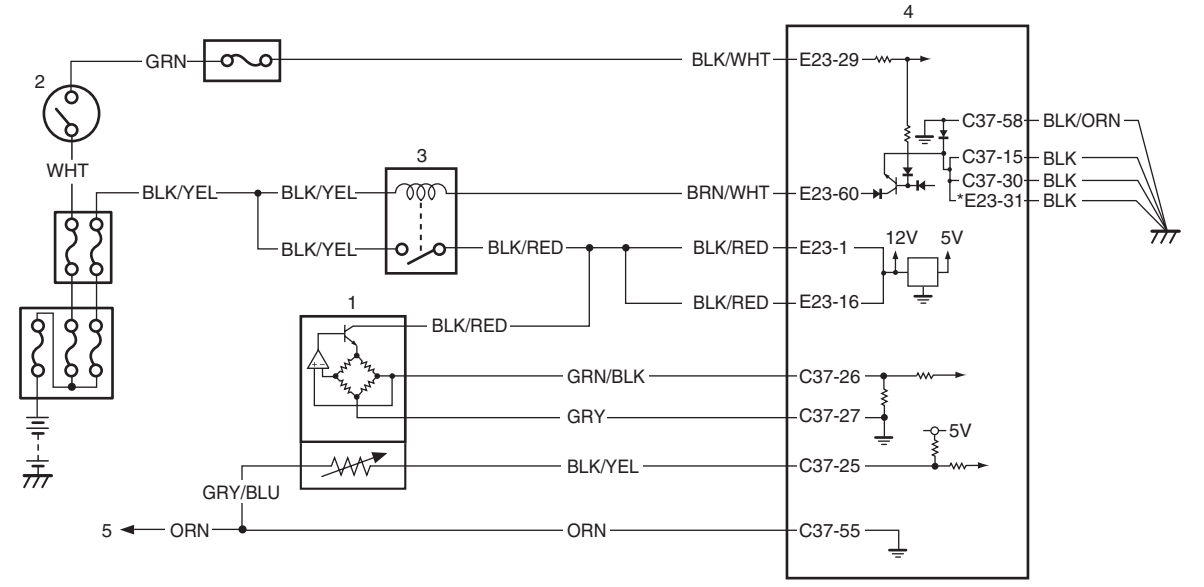
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**MAF sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to "Scan Tool Data: " for normal value.) *Is normal value indicated?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".	Go to Step 3.
3	**MAF sensor power supply voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "BLK/RED" wire terminal of MAF and IAT sensor connector. *Is voltage 10 – 14 V?*	Go to Step 4.	"BLK/RED" wire is open circuit.
4	**MAF sensor ground circuit check** 1) Turn OFF ignition switch, measure resistance between "GRY" wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 6.	Go to Step 5.
5	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between "C37-27" terminal of ECM connector and engine ground. *Is resistance below 5 Ω?*	"GRY" wire is open or high resistance circuit.	ECM grounds "C37-58", "C37-15", "C37-30" and/or "E23-31" (for Automated Manual Transaxle model) circuit is open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
6	**MAF sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure voltage between "GRN/BLK" wire terminal of MAF and IAT sensor connector and engine ground with ignition switch turned ON. *Is voltage 0 V?*	Go to Step 7.	"GRN/BLK" wire is shorted to other circuit.
7	**MAF sensor signal circuit check** 1) Measure resistance between "GRN/BLK" wire terminal of MAF and IAT sensor connector and engine ground with ignition switch turned OFF. *Is resistance infinity?*	Go to Step 8.	"GRN/BLK" wire is shorted to ground circuit.

Step	Action	Yes	No
8	**MAF sensor signal circuit check** 1) Measure resistance between “GRN/BLK” wire terminal of MAF and IAT sensor connector and “C37-26” terminal of ECM connector. *Is resistance below 3 Ω?*	Go to Step 9.	“GRN/BLK” wire is open or high resistance circuit.
9	**MAF sensor output signal check** 1) Connect connectors to MAF and IAT sensor and ECM with ignition switch turned OFF. 2) Measure voltage between “C37-26” and “C37-27” terminals of ECM connector referring to “Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor On-Vehicle Inspection: in Section 1C”. *Is each value within specified range?*	Substitute a known-good ECM and recheck.	Faulty MAF and IAT sensor.

DTC P0103: Mass Air Flow Circuit High Input

S4RS0B1104019

Wiring Diagram



I4RS0B110015-02

1. MAF and IAT sensor	4. ECM
2. Ignition switch	5. To other sensors
3. Main relay	*: For Automated Manual Transaxle model

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC will be set when all of following conditions are detected for 0.5 seconds continuously. • Engine is running • Voltage of MAF sensor output is more than specified value for specified time continuously. (1 driving cycle detection logic)	• Open or short in MAF sensor circuit • MAF sensor • ECM

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

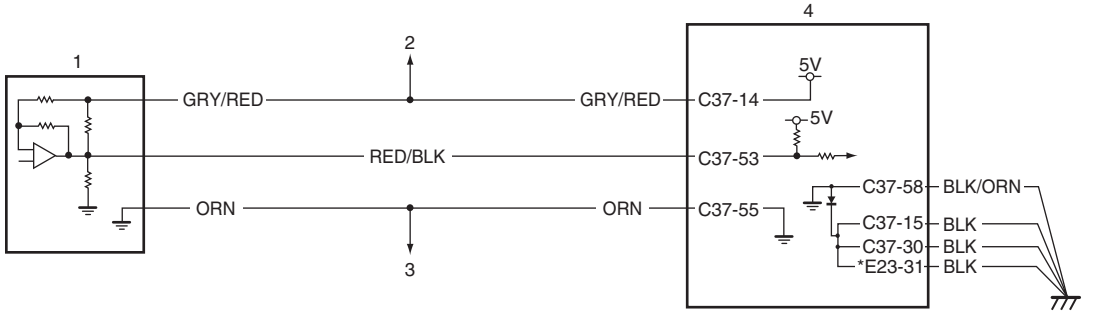
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**MAF sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to "Scan Tool Data: " for normal value.) *Is normal value indicated?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".	Go to Step 3.
3	**MAF sensor power supply voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch tuned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "BLK/RED" wire terminal of MAF and IAT sensor connector. *Is voltage 10 – 14 V?*	Go to Step 4.	"BLK/RED" wire is open circuit.
4	**MAF sensor ground circuit check** 1) Turn OFF ignition switch, measure resistance between "GRY" wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 6.	Go to Step 5.

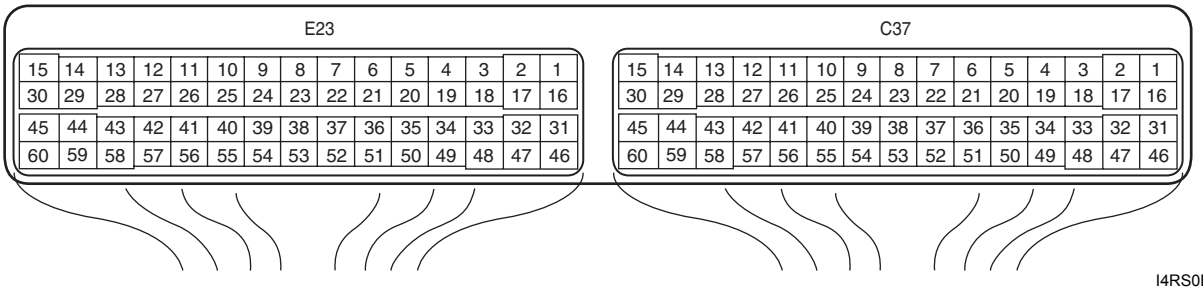
Step	Action	Yes	No
5	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between “C37-27” terminal of ECM connector and engine ground. *Is resistance below 5 Ω?*	“GRY” wire is open or high resistance circuit.	ECM grounds “C37-58”, “C37-15”, “C37-30” and/or “E23-31” (for Automated Manual Transaxle model) circuit are open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
6	**MAF sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure voltage between “GRY/BLK” wire terminal of MAF and IAT sensor connector and engine ground. *Is voltage 0 V?*	Go to Step 7.	“GRY/BLK” wire is shorted to other circuit.
7	**MAF sensor output signal check** 1) Connect connector to MAF and IAT sensor and ECM with ignition switch turned OFF. 2) Measure voltage between “C37-26” and “C37-27” terminal of ECM connector referring to “Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor On-Vehicle Inspection: in Section 1C”. *Is each value within specified range?*	Substitute a known-good ECM and recheck.	Faulty MAF and IAT sensor.

DTC P0106: Manifold Absolute Pressure Range / Performance

S4RS0B1104020

Wiring Diagram





I4RS0B110017-03

1. Manifold absolute pressure sensor	3. To other sensors	*: For Automated Manual Transaxle model
2. To TP sensor and A/C refrigerant pressure sensor (if equipped with A/C)	4. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
• Difference between Max. manifold absolute pressure value and Min. manifold pressure value is less than 1.3 kPa (0.19 psi) when engine running at idle speed. • Difference between barometric pressure value and manifold pressure value is less than 33.3 kPa (4.83 psi) for 2 sec. at 2000 r/mini. or more. (2 driving cycle detection logic)	• Manifold absolute pressure sensor • Manifold absolute pressure sensor vacuum passage • Air intake system • ECM

DTC Confirmation Procedure

NOTE

Check to make sure that the following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

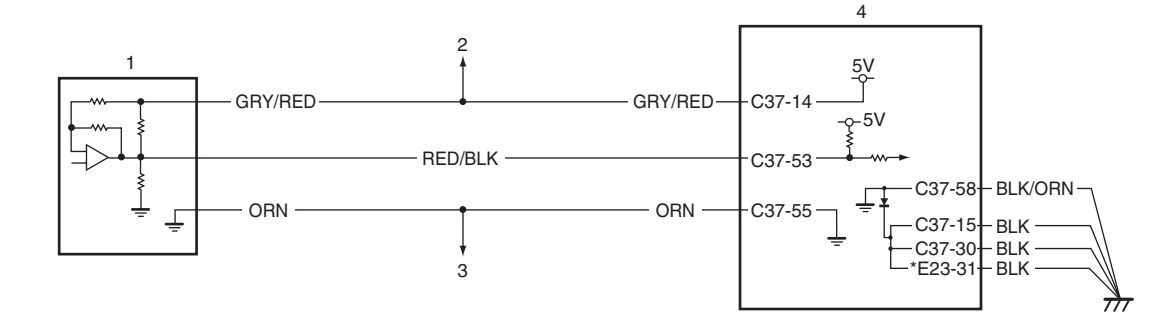
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**MAP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check DTC. *Is there DTC P0107 or DTC P0108?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**MAP sensor output signal check** 1) Check MAP sensor according to "Manifold Absolute Pressure (MAP) Sensor Inspection: in Section 1C". *Is it in good condition?*	Go to Step 4.	Faulty MAP sensor.
4	**MAP sensor circuit check** 1) Check MAP sensor circuit referring to Step 3 to 6 of "DTC P0107: Manifold Absolute Pressure Circuit Low Input: " or Step 3 to 8 of "DTC P0108: Manifold Absolute Pressure Circuit High Input: ". *Is circuit in good condition?*	Go to Step 5.	Repair or replace.

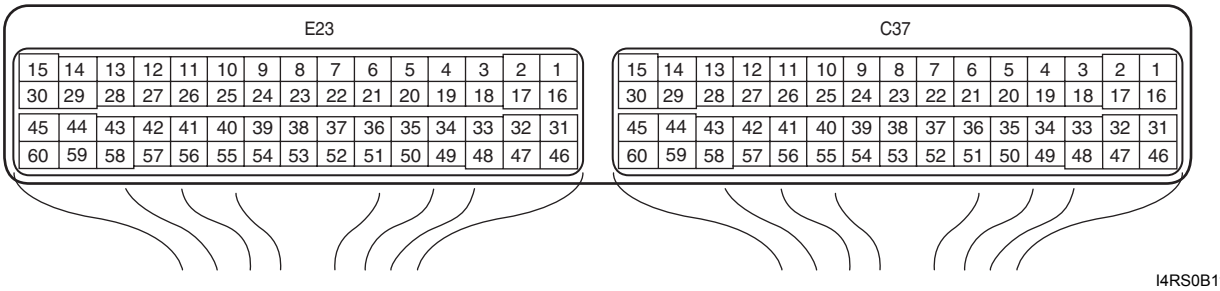
Step	Action	Yes	No
5	**Air intake system check** 1) Check air intake system for clog or leak. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Repair or replace.

DTC P0107: Manifold Absolute Pressure Circuit Low Input

S4RS0B1104021

Wiring Diagram





I4RS0B110017-03

1. Manifold absolute pressure sensor	3. To other sensors	*: For Automated Manual Transaxle model
2. To TP sensor and A/C refrigerant pressure sensor (if equipped with A/C)	4. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Manifold absolute pressure sensor output voltage is lower than specified value for specified time continuously. (1 driving cycle detection logic)	• Manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • TP sensor • A/C refrigerant pressure sensor (if equipped with A/C) • ECM

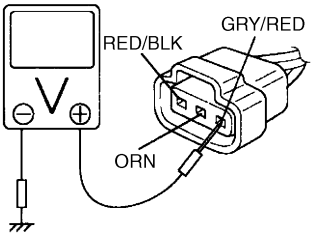
DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

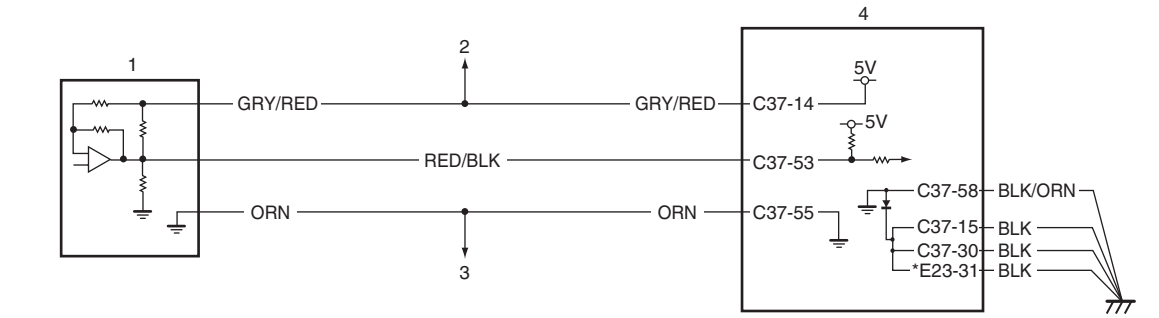
- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

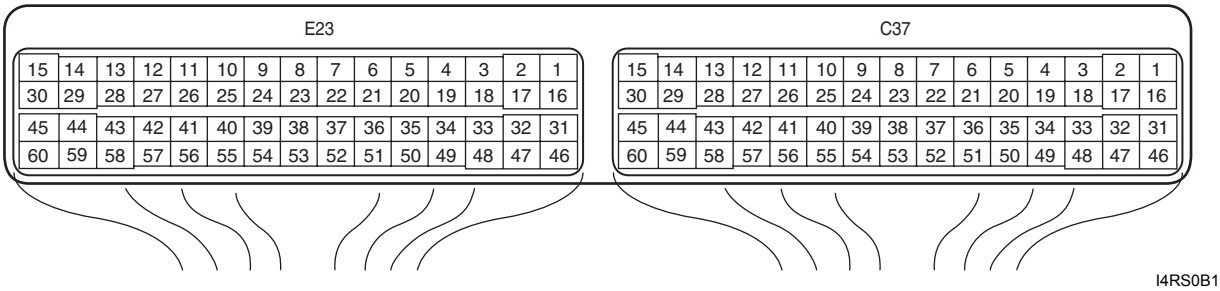
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**MAP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake manifold pressure displayed on scan tool. *Is it 0 kPa (0 in.Hg)?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
3	**MAP sensor power supply voltage check** 1) Disconnect connector from MAP sensor with ignition switch turned OFF. 2) Check for proper connection of MAP sensor at "GRY/RED", "RED/BLK" and "ORN" wire terminals. 3) Turn ON ignition switch, measure voltage between engine ground and "GRY/RED" wire terminal of MAP sensor connector.  I4RS0B110019-03 *Is voltage 4 – 6 V?*	Go to Step 5.	Go to Step 4.
4	**MAP sensor power supply circuit check** 1) Disconnect connectors from TP sensor and A/C refrigerant pressure sensor (if equipped with A/C) with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "GRY/RED" wire terminal of MAP sensor connector. *Is voltage 4 – 6 V?*	Faulty TP sensor and/or A/C refrigerant pressure sensor (if equipped with A/C).	"GRY/RED" wire is shorted to ground circuit. If wires are OK, substitute a known-good ECM and recheck.
5	**MAP sensor signal circuit check** 1) Measure voltage between "RED/BLK" wire terminal of MAP sensor connector and engine ground. *Is voltage 4 – 6 V?*	Go to Step 7.	Go to Step 6.
6	**MAP sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "C37-53" terminal of ECM connector and vehicle body ground. *Is resistance infinity?*	Go to Step 7.	"RED/BLK" wire is shorted to ground circuit.
7	**MAP sensor output signal check** 1) Check MAP sensor according to "Manifold Absolute Pressure (MAP) Sensor Inspection: in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Faulty MAP sensor.

DTC P0108: Manifold Absolute Pressure Circuit High Input

S4RS0B1104022

Wiring Diagram





I4RS0B110017-03

1. Manifold absolute pressure sensor	3. To other sensors	*: For Automated Manual Transaxle model
2. To TP sensor and A/C refrigerant pressure sensor (if equipped with A/C)	4. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Manifold absolute pressure sensor output voltage is higher than specified value for specified time continuously. (1 driving cycle detection logic)	• Manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • TP sensor • A/C refrigerant pressure sensor (if equipped with A/C) • ECM

NOTE

When DTC P0113, P0118 and P0123 (for A/T and M/T models) are indicated together, it is possible that "ORN" wire circuit is open.

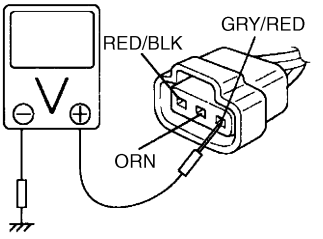
DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

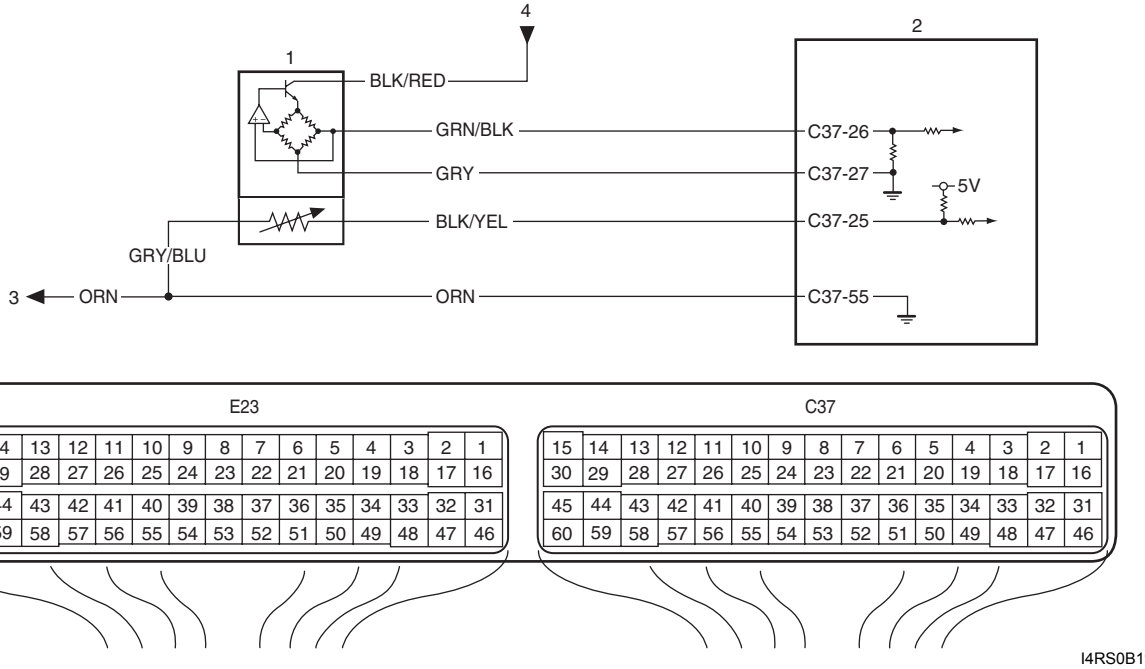
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**MAP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake manifold pressure displayed on scan tool. *Is it 127 kPa (37.5 in.Hg)?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
3	**MAP sensor power supply voltage check** 1) Disconnect connector from MAP sensor with ignition switch turned OFF. 2) Check for proper connection of MAP sensor at "GRY/RED", "RED/BLK" and "ORN" wire terminals. 3) Turn ON ignition switch, measure voltage between engine ground and "GRY/RED" wire terminal of MAP sensor connector.  I4RS0B110019-03 *Is voltage 4 – 6 V?*	Go to Step 5.	Go to Step 4.
4	**MAP sensor power supply circuit check** 1) Disconnect connectors from TP sensor and A/C refrigerant pressure sensor (if equipped with A/C) with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "GRY/RED" wire terminal of MAP sensor connector. *Is voltage 4 – 6 V?*	Faulty TP sensor and/or A/C refrigerant pressure sensor (if equipped with A/C).	"GRY/RED" wire is open or shorted to power circuit.
5	**MAP sensor ground circuit check** 1) Measure resistance between "ORN" wire terminal of MAP sensor connector and engine ground with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 7.	Go to Step 6.

Step	Action	Yes	No
6	**Ground circuit check** 1) Measure resistance between “C37-55” terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	“ORN” wire is open or high resistance circuit.	ECM grounds “C37-58”, “C37-15”, “C37-30” and/or “E23-31” (for Automated Manual Transaxle model) circuit are open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
7	**MAP sensor signal circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “RED/BLK” wire terminal of MAP sensor connector and engine ground. *Is voltage 4 – 6 V?*	Go to Step 9.	Go to Step 8.
8	**MAP sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “RED/BLK” wire terminal of MAP sensor connector and “C37-53” terminal of ECM connector. *Is resistance below 2 Ω?*	“RED/BLK” wire is shorted to power supply circuit.	“RED/BLK” wire is open or high resistance circuit.
9	**MAP sensor output signal check** 1) Check MAP sensor according to “Manifold Absolute Pressure (MAP) Sensor Inspection: in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Faulty MAP sensor.

DTC P0111: Intake Air Temperature Circuit Range / Performance

S4RS0B1104023

Wiring Diagram



I4RS0B110018-01

1. MAF and IAT sensor	3. To other sensors
2. ECM	4. From main relay

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference of maximum IAT minus minimum IAT is less than 0.3 °C (32.5 °F) while ECT is over 70 °C (158 °F) after 10 min from cold engine start (ECT is lower than 30°C (86 °F) at engine start). (2 driving cycle detection logic)	• High resistance circuit • MAF and IAT sensor • ECM

DTC Confirmation Procedure

NOTE

Check to make sure that following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature at engine start: less than 30 °C (86 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

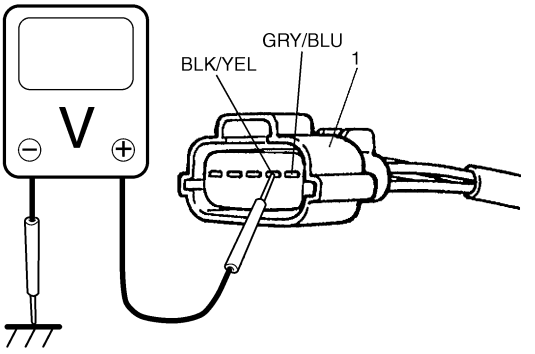
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch, clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature. (ECT approx. 70 – 205°C, 158 – 401°F)
4) Run engine at idle speed for 10 min. or more.
5) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**IAT sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch to ON position. 3) Check intake air temp. displayed on scan tool. *Is –40 °C (–40 °F) or 119 °C (246 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".

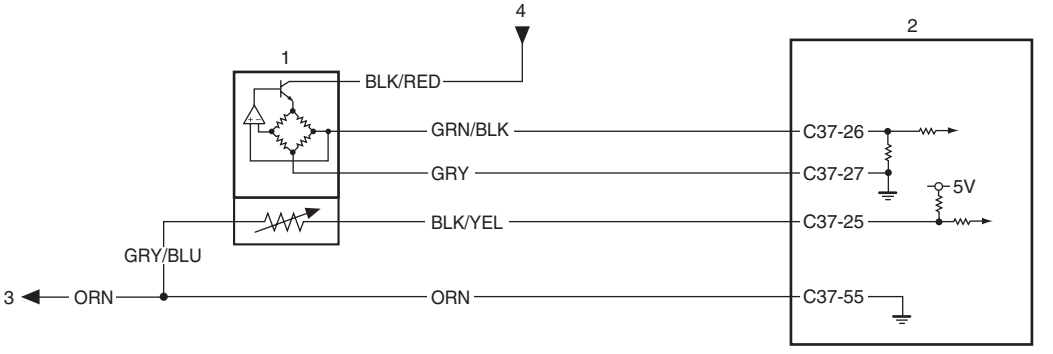
Step	Action	Yes	No
3	**Wire harness check** 1) Disconnect MAF and IAT sensor connector (1) with ignition switch turned OFF. 2) Check for proper connection to MAF and IAT sensor connector (1) at "BLK/YEL" and "ORN" wire terminals. 3) If OK, then with ignition switch turned ON, measure voltage between "BLK/YEL" wire terminal of MAF and IAT sensor connector and vehicle body ground.  I4RS0B110020-01 *Is measured voltage applied to "BLK/YEL" wire terminal about 4 – 6 V?*	Go to Step 8.	Go to Step 4.
4	**ECM voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Check for proper connection of ECM connector at "C37-25" terminal. 4) If OK, then turn ON ignition switch, measure voltage between "C37-25" terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V at terminal?*	"BLK/YEL" wire is open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "BLK/YEL" wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is resistance infinity?*	Go to Step 6.	"BLK/YEL" wire is shorted to ground or other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**Wire circuit check** 1) Turn ignition switch to ON position. 2) Measure voltage between "BLK/YEL" wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 7.	"BLK/YEL" wire shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
7	**Wire circuit check** 1) Measure resistance between "C37-25" terminal of ECM connector and "BLK/YEL" wire terminal of MAF and IAT sensor connector with ignition switch turned OFF. *Is resistance below 3 Ω?*	Go to Step 8.	"BLK/YEL" wire is high resistance circuit.

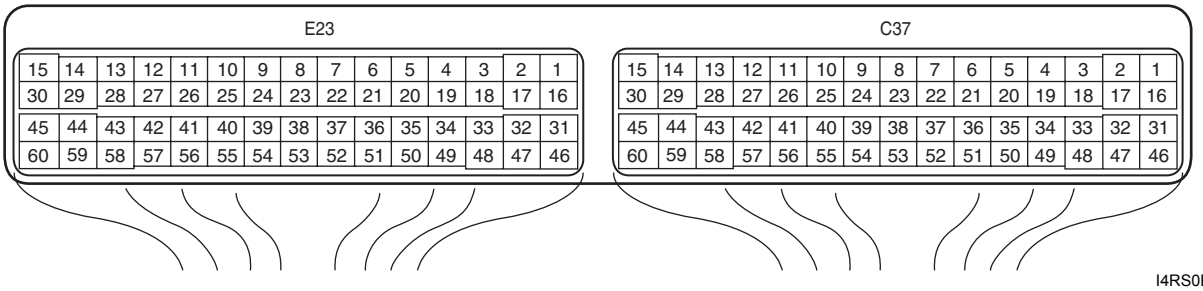
Step	Action	Yes	No
8	**Ground circuit check** 1) Connect connectors to ECM. 2) Check for proper connection of MAF and IAT sensor connector at “GRY/BLU” wire terminal. 3) Measure resistance between “GRY/BLU” wire terminal of MAF and IAT sensor connector and vehicle body ground with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 10.	Go to Step 9.
9	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between “C37-55” terminal of ECM connector and vehicle body ground. *Is resistance below 3 Ω?*	“GRY/BLU” wire and/or “ORN” wire is open or high resistance circuit. Poor “C37-55” connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
10	**IAT sensor check** 1) Check IAT sensor according to “Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.

DTC P0112: Intake Air Temperature Sensor Circuit Low

S4RS0B1104024

Wiring Diagram





I4RS0B110018-01

1. MAF and IAT sensor	3. To other sensors
2. ECM	4. From main relay

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC will be set when all of following conditions are detected for 0.5 seconds continuously. • Engine is running • Voltage of IAT sensor output is less than specified value (High intake air temperature (low voltage / low resistance)) (1 driving cycle detection logic)	• IAT sensor circuit • IAT sensor • ECM

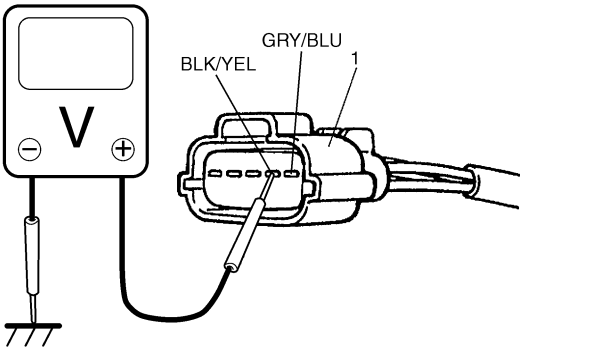
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

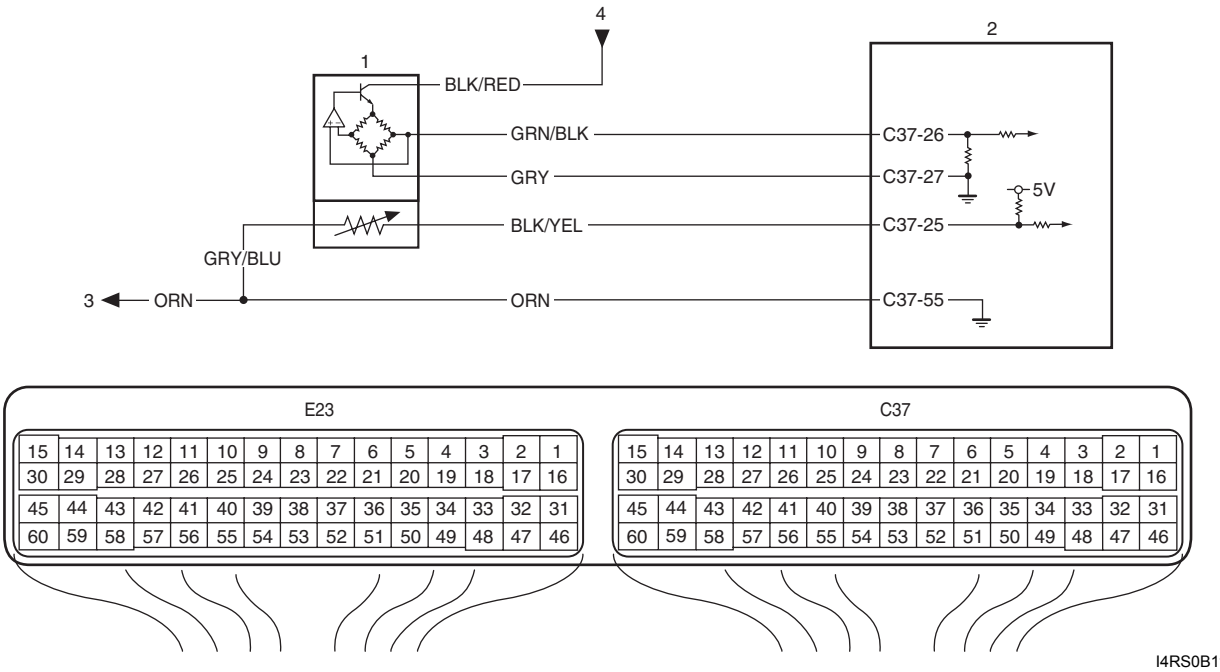
- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**IAT sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake air temp. displayed on scan tool. *Is 119 °C (246 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
3	**ECM voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Check for proper connection to MAF and IAT sensor at "BLK/YEL" and "GRY/BLU" wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between "BLK/YEL" wire terminal of MAF and IAT sensor connector (1) and vehicle body ground.  *Is voltage about 4 – 6 V?*	Go to Step 6.	Go to Step 4.
4	**IAT short circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "BLK/YEL" wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	"BLK/YEL" wire is shorted to ground circuit. If wire is OK, substitute a known-good ECM and recheck.
5	**IAT short circuit check** 1) Turn ON ignition switch. 2) Measure voltage between "BLK/YEL" wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	"BLK/YEL" wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**IAT sensor for performance check** 1) Check IAT sensor according to "Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.

DTC P0113: Intake Air Temperature Sensor Circuit High

S4RS0B1104025

Wiring Diagram



I4RS0B110018-01

1. MAF and IAT sensor	3. To other sensors
2. ECM	4. From main relay

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC will be set when all of following conditions are detected for 0.5 seconds continuously. • Engine is running • Voltage of IAT sensor output is more than specified value (Low intake air temperature (high voltage / high resistance)) (1 driving cycle detection logic)	• IAT sensor circuit • IAT sensor • ECM

NOTE

When DTC P0108, P0118 and P0123 (for A/T and M/T models) are indicated together, it is possible that "ORN" wire circuit is open.

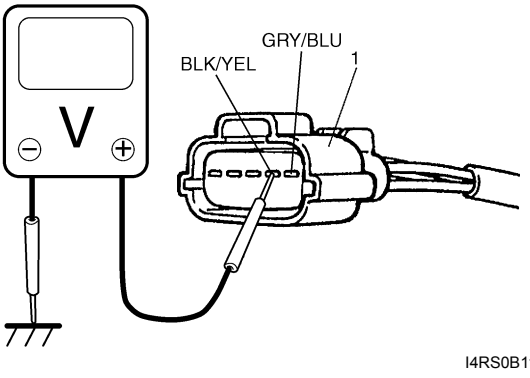
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

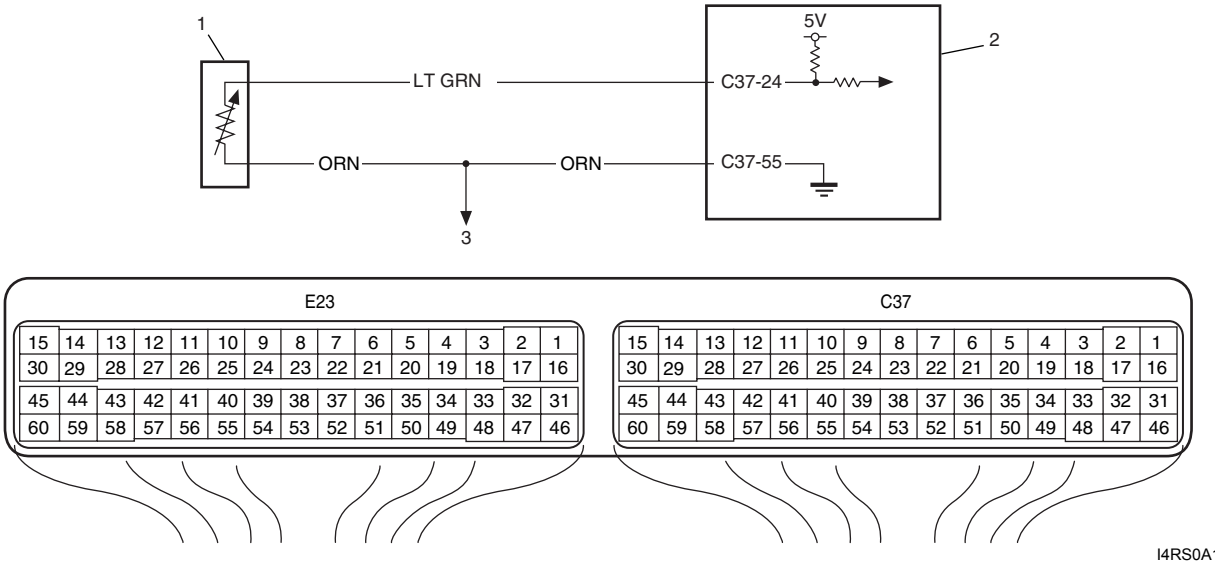
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**IAT sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake air temp. displayed on scan tool. *Is –40 °C (–40 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
3	**IAT sensor voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Check for proper connection to MAF and IAT sensor at "BLK/YEL" and "GRY/BLU" wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between "BLK/YEL" wire terminal of MAF and IAT sensor connector (1) and vehicle body ground.  I4RS0B110020-01 *Is voltage about 4 – 6 V?*	Go to Step 7.	Go to Step 4.
4	**ECM voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Check for proper connection of ECM connector at "C37-25" terminal. 4) If OK, then turn ON ignition switch, measure voltage between "C37-25" terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V?*	"BLK/YEL" wire is open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.

Step	Action	Yes	No
5	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between “BLK/YEL” wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	“BLK/YEL” wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**Wire circuit check** 1) Measure resistance between “C37-25” terminal of ECM connector and “BLK/YEL” wire terminal of MAF and IAT sensor connector with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 7.	“BLK/YEL” wire is high resistance circuit.
7	**Ground circuit check** 1) Connect connectors to ECM. 2) Measure resistance between “GRY/BLU” wire terminal of MAF and IAT sensor connector and vehicle body ground with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 9.	Go to Step 8.
8	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between “C37-55” terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	“GRY/BLU” wire and/or “ORN” wire is open circuit or high resistance circuit. Poor “C37-55” connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
9	**IAT sensor for performance check** 1) Check IAT sensor according to “Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection: in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.

DTC P0116: Engine Coolant Temperature Circuit Range / Performance

S4RS0B1104026

Wiring Diagram



I4RS0A110025-01

1. ECT sensor
2. ECM
3. To other sensors

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
ECT sensor values is less than 5 °C, 41 °F (for M13 engine model) or –5 °C, 23 °F (for M15 engine model) while engine is running under more than specified engine load (more than 1000 rpm) for 2 to 1112 min (depending on ECT at engine start) continuously from engine start. (2 driving cycle detecting logic)	• ECT sensor • ECT sensor circuit • Thermostat • ECM

DTC Confirmation Procedure

⚠ WARNING

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out by 2 persons, a driver and tester, on a level road.**

NOTE

Check to make sure that following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

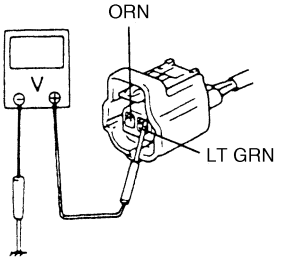
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch, clear DTC.
3) Start engine.
4) Drive vehicle at 40 mph (60 km/h) or higher for 20 min. or more.
5) Stop vehicle.
6) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**DTC check** 1) With ignition switch turned OFF, install scan tool to DLC. 2) Turn ON ignition switch and check DTC with scan tool. *Is DTC P0118 displayed?*	Go to "DTC P0118: Engine Coolant Temperature Circuit High: ".	Go to Step 3.

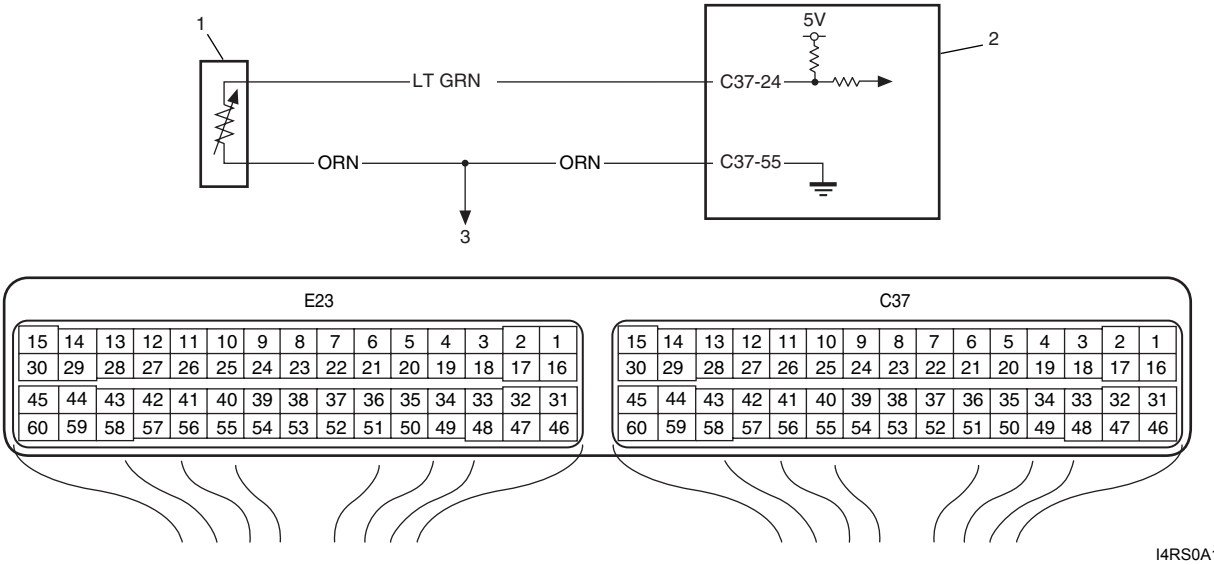
Step	Action	Yes	No
3	**Engine coolant temp. check** 1) Turn ON ignition switch and check engine coolant temp. displayed on scan tool. 2) Warm up engine to normal operating temp. and check engine coolant temp. displayed on scan tool. *Does engine coolant temp. vary more than 1 °C (1 °F) and rise higher than 70 °C (158 °F)?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".	Go to Step 4.
4	**Thermostat check** *Is there a symptom due to thermostat remaining open (it takes a long time before vehicle heater becomes effective or before engine is warmed to normal operating temp., etc.)?*	Check thermostat referring to "Thermostat Inspection: in Section 1F".	Go to Step 5.
5	**Wire harness check** 1) Disconnect ECT sensor connector with ignition switch turned OFF. 2) Check for proper connection to ECT sensor connector at "ORN" and "LT GRN" wire terminals. 3) If OK, then with ignition switch ON, measure voltage between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground.  I2RH01110067-01 *Is measured voltage applied to "LT GRN" wire terminal about 4 – 6 V?*	Go to Step 9.	Go to Step 6.
6	**ECM voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Check for proper connection of ECM connector at "C37-24" terminal. 4) If OK, then turn ON ignition switch, measure voltage between "C37-24" terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V?*	"LT GRN" wire is open circuit. If wire and connection are OK, go to Step 7.	Go to Step 7.
7	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ignition switch to ON position. 3) Measure voltage between "LT GRN" wire terminal of ECT sensor connector and body ground. *Is voltage about 0 V?*	Go to Step 8.	"LT GRN" wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
8	**Wire circuit check** 1) Measure resistance between “C37-24” terminal of ECM connector and “LT GRN” wire terminal of ECT sensor connector with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 9.	“LT GRN” wire is high resistance circuit.
9	**Ground circuit check** 1) Connect connectors to ECM. 2) Check for proper connection of ECT sensor connector at “ORN” wire terminal. 3) Measure resistance between “ORN” wire terminal of ECT sensor connector and vehicle body ground. *Is resistance below 5 Ω?*	Go to Step 11.	Go to Step 10.
10	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between “C37-55” terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	“ORN” wire is high resistance circuit. Poor “C37-55” connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
11	**ECT sensor check** 1) Check ECT sensor according to “Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace ECT sensor.

DTC P0117: Engine Coolant Temperature Circuit Low

S4RS0B1104027

Wiring Diagram



I4RS0A110025-01

1.	ECT sensor
2.	ECM
3.	To other sensors

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC will be set when all of following conditions are detected for 0.5 seconds continuously. • Engine is running • Voltage of ECT sensor output is less than specified value (High engine coolant temperature (low voltage / low resistance)) (1 driving cycle detection logic)	• ECT sensor circuit • ECT sensor • ECM

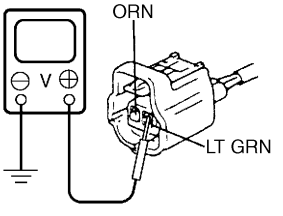
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

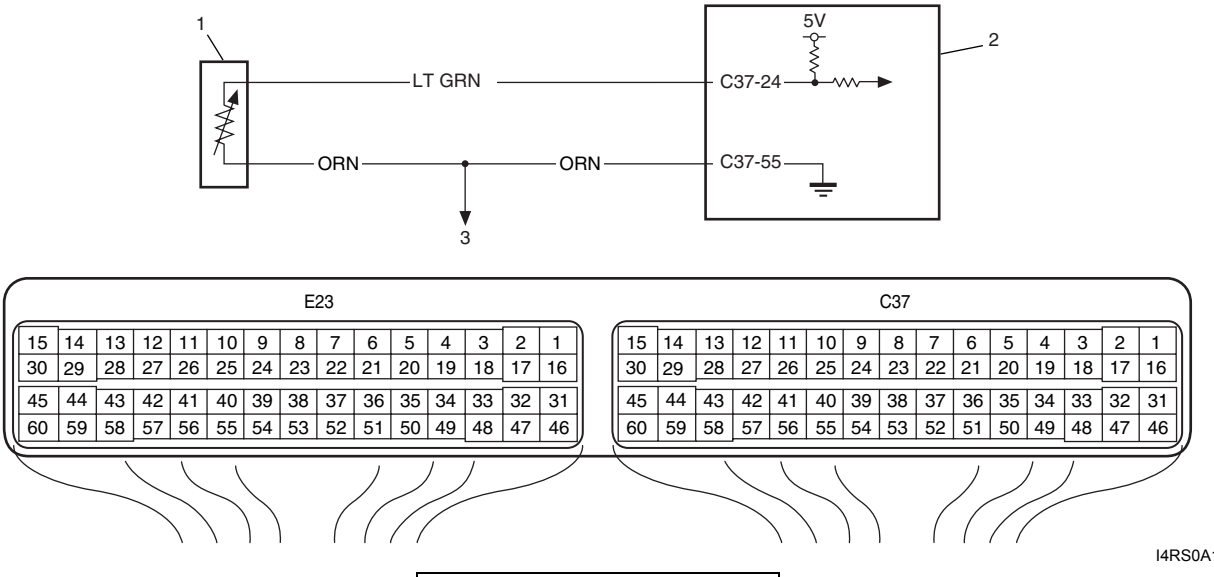
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**ECT sensor and its circuit check** 1) Connect scan tool with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check engine coolant temp. displayed on scan tool. *Is 119 °C (246 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
3	**ECM voltage check** 1) Disconnect connector from ECT sensor with ignition switch turned OFF. 2) Check for proper connection to ECT sensor at "LT GRN" and "ORN" wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground.  I4RS0A110026-01 *Is voltage about 4 – 6 V?*	Go to Step 6.	Go to Step 4.

Step	Action	Yes	No
4	**ECT sensor short circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “LT GRN” wire terminal of ECT sensor connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	“LT GRN” wire is shorted to ground circuit. If wire is OK, substitute a known-good ECM and recheck.
5	**ECT sensor short circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “LT GRN” wire terminal of ECT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	“LT GRN” wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**ECT sensor for performance check** 1) Check ECT sensor according to “Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace ECT sensor.

DTC P0118: Engine Coolant Temperature Circuit High

S4RS0B1104028

Wiring Diagram



I4RS0A110025-01

1. ECT sensor
2. ECM
3. To other sensors

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC will be set when all of following conditions are detected for 0.5 seconds continuously. • Engine is running • Voltage of ECT sensor output is more than specified value (Low engine coolant temperature (high voltage / high resistance)) (1 driving cycle detection logic)	• ECT sensor circuit • ECT sensor • ECM

NOTE

When DTC P0108, P0113 and P0123 (for A/T and M/T models) are indicated together, it is possible that "ORN" wire circuit open.

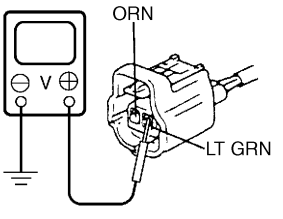
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

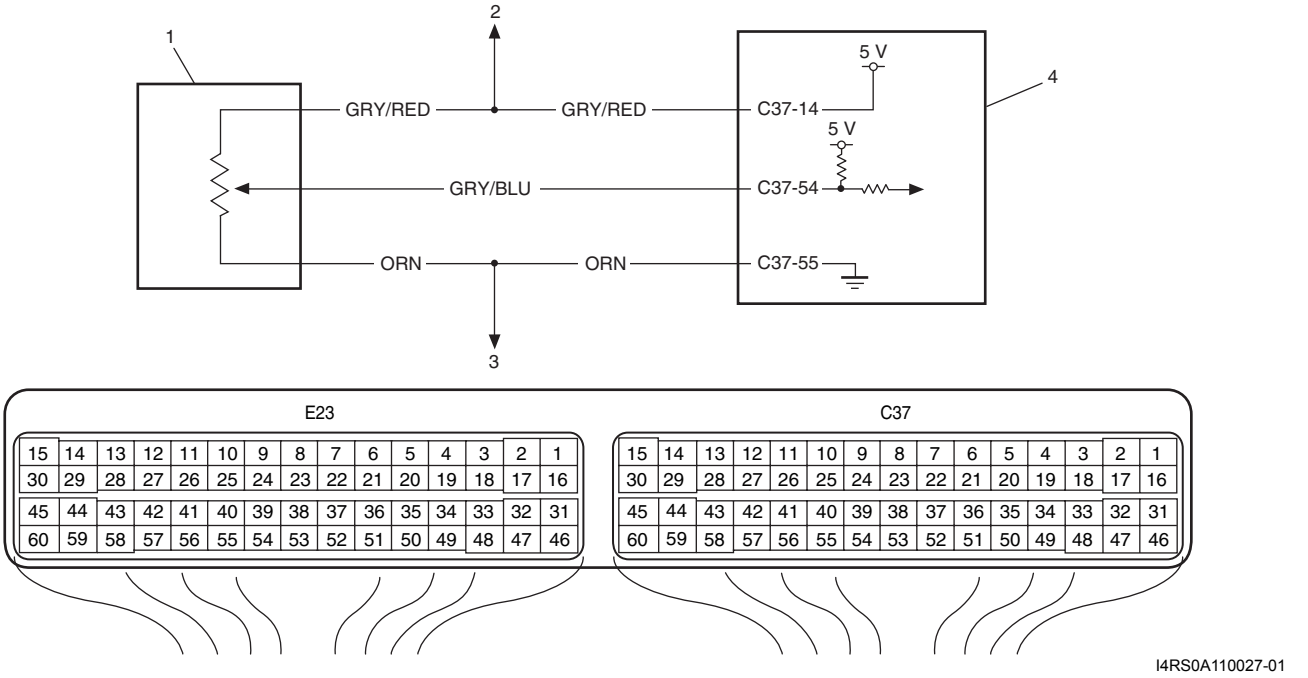
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**ECT sensor and its circuit check** 1) Connect scan tool with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check engine coolant temp. displayed on scan tool. *Is –40 °C (–40 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
3	**ECT voltage check** 1) Disconnect connector from ECT sensor with ignition switch turned OFF. 2) Check for proper connection to ECT sensor at "LT GRN" and "ORN" wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground.  I4RS0A110026-01 *Is voltage about 4 – 6 V?*	Go to Step 6.	Go to Step 4.

Step	Action	Yes	No
4	**ECM voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Check for proper connection of ECM connector at "C37-24" terminal. 4) If OK, then turn ON ignition switch, measure voltage between "C37-24" wire terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V?*	"LT GRN" wire is open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	**ECT sensor harness voltage check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	"LT GRN" wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**ECT sensor harness resistance check** 1) Measure resistance between "C37-24" terminal of ECM connector and "LT GRN" wire terminal of ECT sensor connector with ignition switch turn OFF. *Is resistance below 5 Ω?*	Go to Step 7.	"LT GRN" wire is high resistance circuit.
7	**ECT sensor ground circuit check** 1) Connect connectors to ECM. 2) Check for proper connection of ECT sensor connector at "ORN" wire terminal. 3) Measure resistance between "ORN" wire terminal of ECT sensor connector and vehicle body ground. *Is resistance below 5 Ω?*	Go to Step 9.	Go to Step 8.
8	**ECT sensor ground circuit check** 1) Measure resistance between "C37-55" terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	"ORN" wire is open circuit or high resistance circuit. Poor "C37-55" connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
9	**ECT sensor for performance check** 1) Check ECT sensor according to "Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace ECT sensor.

DTC P0121: Throttle Position Sensor Circuit Range / Performance (For A/T and M/T Models)

S4RS0B1104029

Wiring Diagram



1. TP sensor	3. To other sensors
2. To MAP sensor and A/C refrigerant pressure sensor (if equipped with A/C)	4. ECM

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference between actual throttle opening (detected from TP sensor) and opening calculated by ECM (obtained on the basis of engine speed and mass air flow) is out of specified range (–20 degree to 20 degree). (2 driving cycle detection logic)	• Throttle body • TP sensor • TP sensor circuit • ECM • MAF sensor • Idle air control valve • Air intake system

DTC Confirmation Procedure

⚠ WARNING

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out by 2 persons, a driver and a tester, on a level road.**

NOTE

Check to make sure that following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °C) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °C) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

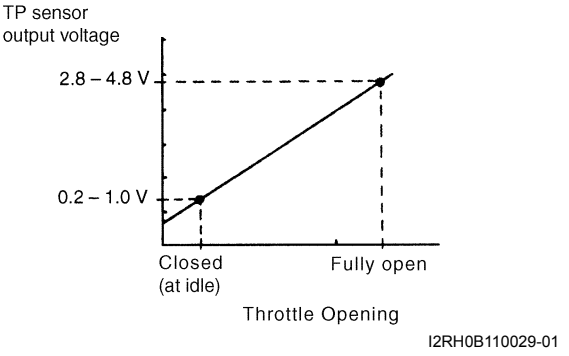
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.

3) Start engine and warm up to normal operating temperature.
4) Drive vehicle at 60 km/h (38 mile/h) at 5th gear or D range.
5) Increase vehicle speed to 65 km/h (40 mile/h) at 5th gear or D range.
6) Release accelerator pedal to decrease vehicle speed to 60 km/h (38 mile/h).
7) Repeat Step 4) to 6) for 3 times.
8) Stop vehicle and check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**TP sensor and its circuit check** 1) Turn OFF ignition switch and connect SUZUKI scan tool to DLC. 2) Turn ON ignition switch and check TP sensor output voltage when throttle valve is at idle position and fully opened.  *Does voltage vary within specified value linearly as shown in the graph?*	Go to Step 14.	Go to Step 3.
3	**TP sensor voltage check** 1) Disconnect connector from TP sensor with ignition switch turned OFF. 2) Check for proper connection to TP sensor connector at "GRY/RED", "GRY/BLU" and "ORN" wire terminals. 3) If OK, then with ignition switch turned ON, check following terminal voltages. • Between "GRY/RED" wire terminal of TP sensor connector and vehicle body ground • Between "GRY/BLU" wire terminal of TP sensor connector and vehicle body ground *Is each terminal voltage about 4 – 6 V?*	Go to Step 11.	Go to Step 4.
4	*Was "GRY/RED" wire terminal voltage in Step 3 within specification?*	Go to Step 7.	Go to Step 5.

Step	Action	Yes	No
5	**Wire harness check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors from MAP sensor and A/C refrigerant pressure sensor (if equipped with A/C). 3) Turn ignition switch to ON position. 4) Measure voltage between “GRY/RED” wire terminal of TP sensor connector and vehicle body ground. *Is terminal voltage about 4 – 6 V?*	Faulty MAP sensor and/or A/C refrigerant pressure sensor (if equipped with A/C), check MAP sensor and/or A/C refrigerant pressure sensor (if equipped with A/C) according to “Manifold Absolute Pressure (MAP) Sensor Inspection: in Section 1C” or “A/C Refrigerant Pressure Sensor and Its Circuit Inspection: in Section 7B”.	Go to Step 6.
6	**ECM voltage check** 1) Turn ignition switch to OFF position. 2) Remove ECM from its bracket with ECM connectors connected. 3) Check for proper connection of ECM connector at “C37-14” terminal. 4) Turn ignition switch to ON position. 5) Measure voltage between “C37-14” terminal of ECM connector and vehicle body ground. *Is terminal voltage about 4 – 6 V?*	“GRY/RED” wire is open or high resistance circuit.	Go to Step 8.
7	**ECM voltage check** 1) Turn ignition switch to OFF position. 2) Check for proper connection of ECM connector at “C37-54” terminal. 3) Turn ignition switch to ON position. 4) Measure voltage between “C37-54” terminal of ECM connector and vehicle body ground. *Is terminal voltage about 4 – 6 V?*	“GRY/BLU” wire is open or high resistance circuit.	Go to Step 8.
8	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “GRY/RED” wire terminal of TP sensor connector and vehicle body ground, between “GRY/BLU” wire terminal of TP sensor connector and body ground and between “GRY/BLU” and “ORN” wire terminals of TP sensor connector. *Is resistance infinity?*	Go to Step 9.	“GRY/RED” and/or “GRY/BLU” wire are shorted to ground circuit and /or “GRY/BLU” wire is shorted to “ORN” wire. If wires are OK, substitute a known-good ECM and recheck.
9	**Wire circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “GRY/RED” wire terminal of ECM connector and vehicle body ground and between “GRY/BLU” wire terminal of ECM connector and vehicle body ground. *Is voltage about 0 V at each terminal?*	Go to Step 10.	“GRY/RED” and/or “GRY/BLU” wire are shorted to power circuit. If wires are OK, substitute a known-good ECM and recheck.