

CAN COMMUNICATION

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دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



دیجیتال خودرو

67 شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



GENERAL INFORMATION

Description

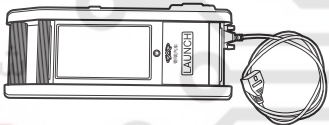
This vehicle is equipped with CAN bus. CAN bus is a kind of fieldbus, and a serial communication network which supports distributed control system effectively. It mainly consists of CAN controller, CAN transceiver, data transmission line and data transmission terminating resistor. BCM, diagnostic interface, audio, radar control module, IC, TCU, ECM, ABS/ESP, SAS, SRS, A/C control panel, PEPS, AVM, SAS, EPS, A/C control module are connected via CAN bus, CAN controller and CAN transceiver are integrated into electronic control unit. Terminating resistors are respectively integrated into IC, BCM and ECM, forming CAN bus with IC and BCM as terminating resistors, ECM and BCM drive CAN bus as terminating resistors.

Operation

CAN bus is also called vehicle bus, and full name is "Controller Area Network" which means local area network, it connects all control units together in some way to form a complete system. Each control unit collects different signals by each sensor, and transmits data between modules under the same rules. Network information can be priority to meet different real-time requirements. Data transmitted via CAN bus control unit is level model of binary format, and data transmission line transmits the voltage signal.

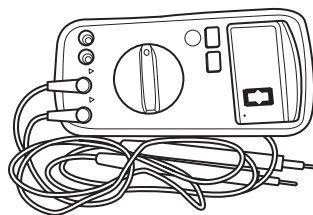
Tools

Special Tools

X-431 3G Diagnostic Tester	 RCH0000001
Oscilloscope	 RCH0000061

General Tool

Digital Multimeter



RCH0000002

دیجیتال خودرو

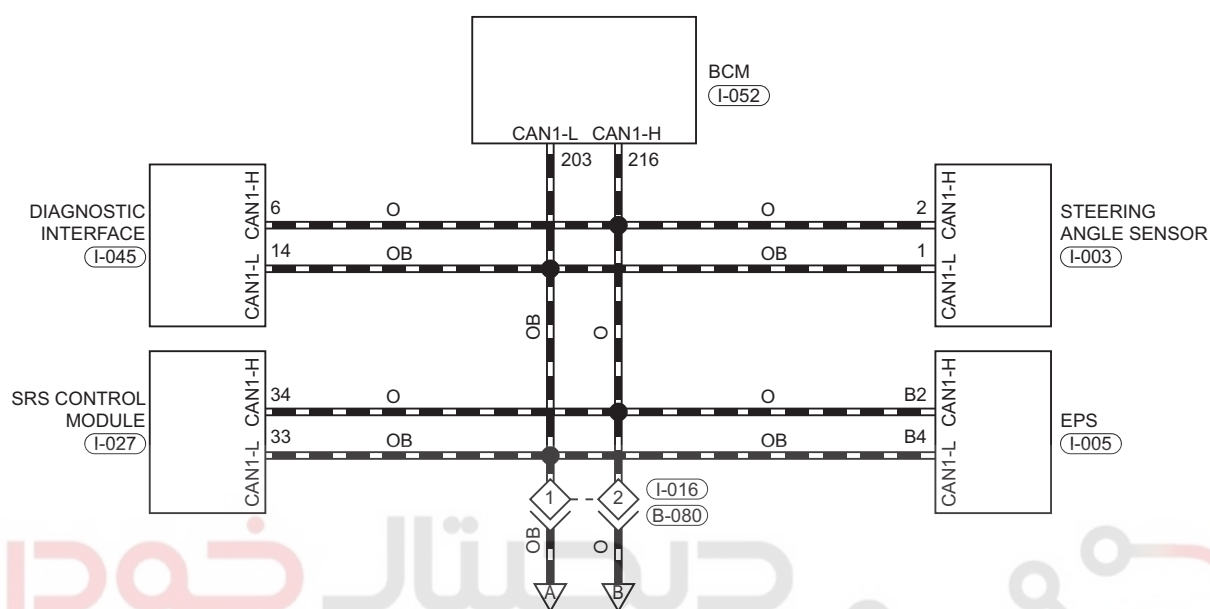
67 شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

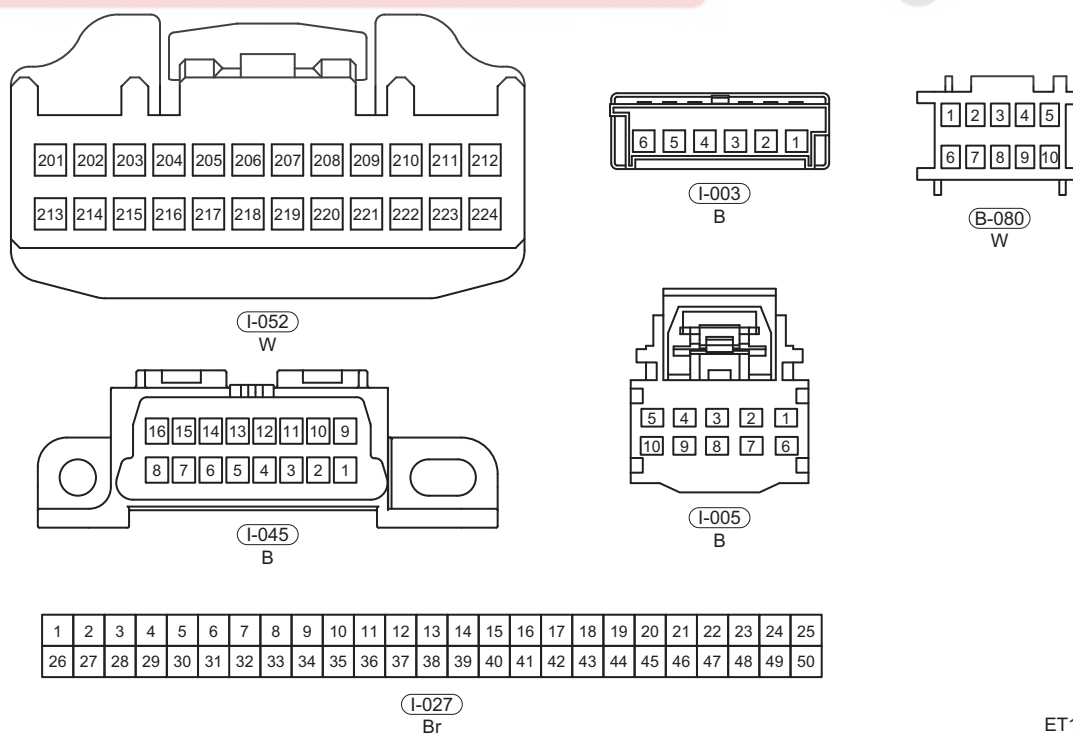


Circuit Diagram

CAN Bus (Page 1 of 4)

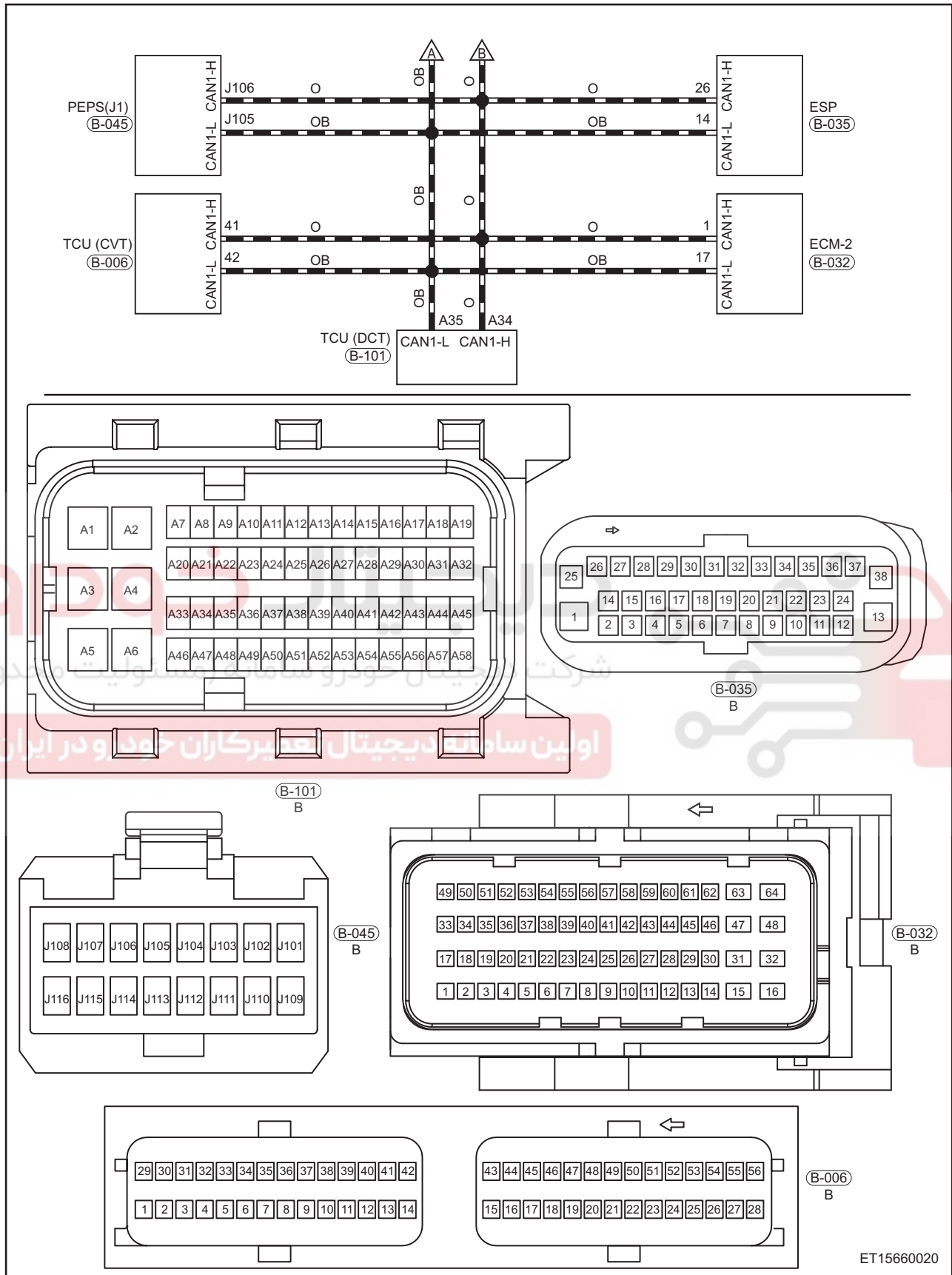


67

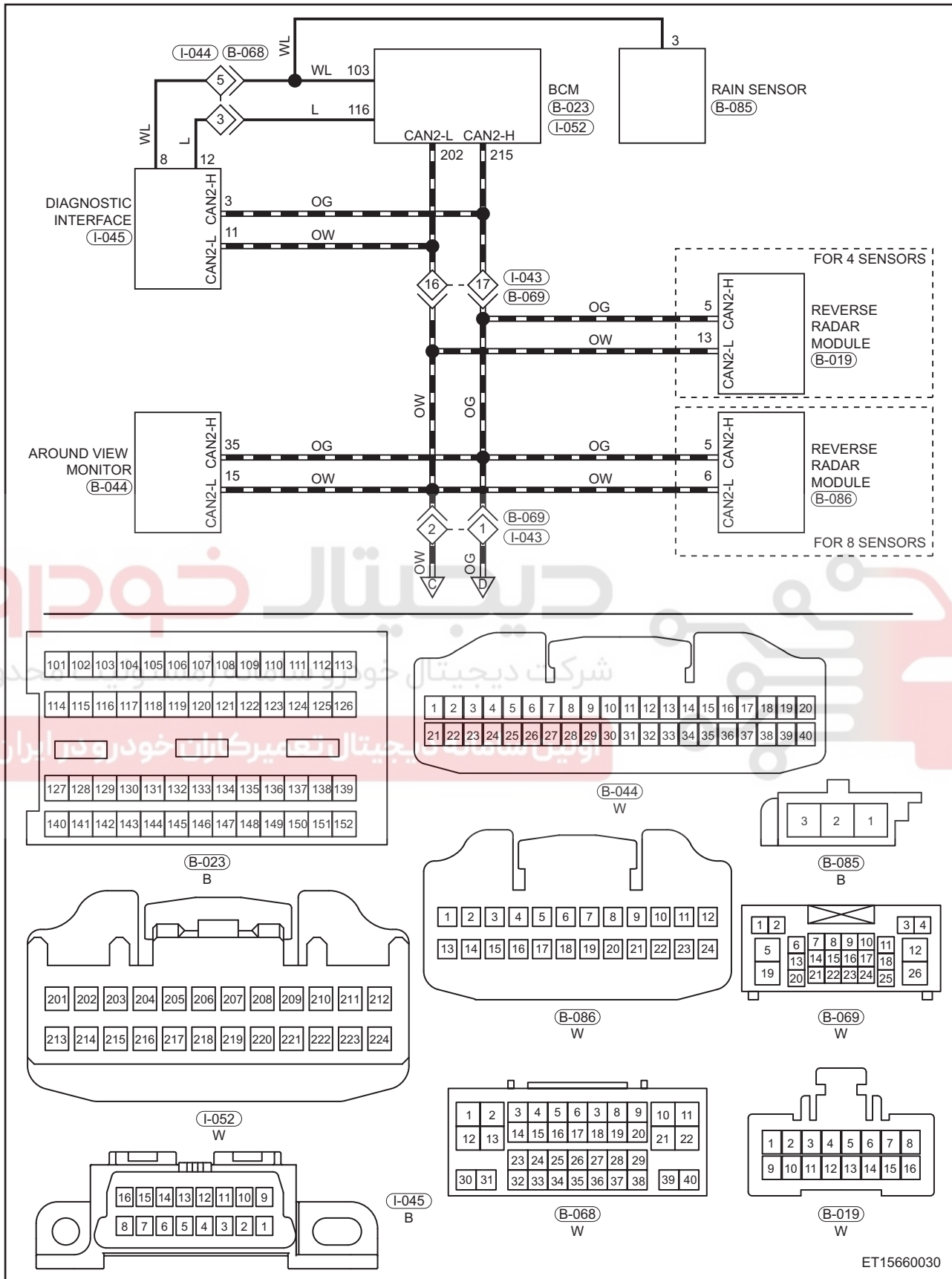


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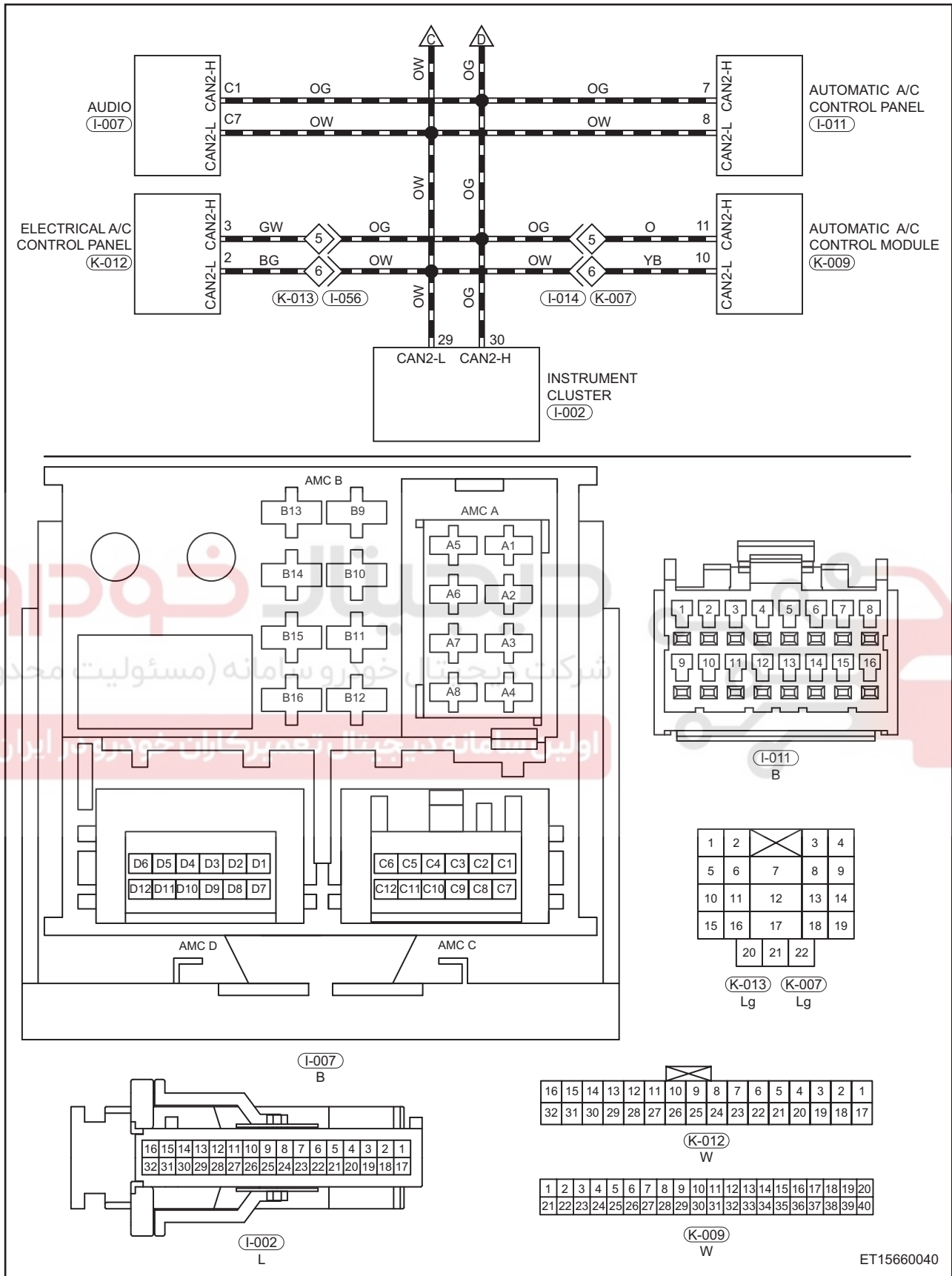
CAN Bus (Page 2 of 4)



CAN Bus (Page 3 of 4)



CAN Bus (Page 4 of 4)



ET15660040

DIAGNOSIS & TESTING

Problem Symptoms Table

Symptom	Suspected Area	See page
Diagnostic interface cannot connect to system	CAN bus	-
	BCM failure	-
	Instrument cluster failure	52-68
	ECM failure	06-248
Engine control system failure	CAN bus	-
	Module damage	06-248
	Module (damaged)	06-248
	Ground wire harness	-
Brake control system failure	Wheel speed	-
	Wire harness or connector	-
	Instrument cluster	52-68
Airbag system failure	Engine speed sensor	06-241
	Wire harness and connector	-
	Instrument cluster	52-68
	Airbag module failure	45-10
Body electrical failure	Body Control Module (BCM) failure	-
	Wire harness or connector	-
	Instrument cluster	52-68
Immobilizer system failure	Turn signal light switch (steering switch)	49-80
	Wire harness or connector	-
	Body Control Module (BCM)	-
	Instrument cluster	52-68
Transmission failure	Transmission Control Unit (TCU) failure	30-158
	Wire harness or connector	-
	Sensor failure	-
	Instrument cluster	52-68

Diagnosis Tools

X-431 3G Diagnostic Tester

When connecting X-431 3G diagnostic tester:

- Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC) for communication with vehicle.
- DLC is located at driver side instrument panel crossmember.
- DLC uses a trapezoidal design which can hold 16 terminals.

Digital Multimeter

When using digital multimeter:

- Troubleshoot electrical malfunctions and wire harness system.
- Look for basic fault.
- Measure voltage, current and resistance.

Oscilloscope

- Troubleshoot electrical malfunctions and wire harness system.
- Look for basic fault.
- Measure CAN network output waveform.

Diagnostic Help

1. Connect X-431 3G diagnostic tester (the latest software) to Data Link Connector (DLC), and make it communicate with vehicle electronic module through data network.
2. Confirm that malfunction is current, and carry out diagnostic test and repair procedures.
3. If DTC cannot be deleted, the malfunction is current.
4. Only use a digital multimeter to measure the voltage of electronic system.
5. Refer to any Technical Bulletin that may apply to the malfunction.
6. Visually check the related wire harness.
7. Check and clean all system grounds related to the latest DTC.
8. If multiple trouble codes were set, use circuit diagrams and look for any common ground circuit or power supply circuit applied to the DTC.

Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the followings:

- Check if connectors are loose.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Wiggle related wire harnesses and connectors and observe if signal in related circuit is interrupted.
- If possible, try to duplicate the conditions under which DTC was set.
- Look for data that has changed or DTC to reset during wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect mounting areas of instrument cluster, wire harness or wire harness connector and so on for damage, foreign matter, etc. that will cause incorrect signals.
- Check and clean all wire harness connectors and grounding parts related to the DTC.
- Remove instrument cluster from malfunctioning vehicle, and install it to a new vehicle to perform a test. If DTC cannot be cleared, instrument cluster is malfunctioning. If DTC can be cleared, reinstall instrument cluster to original vehicle.
- If multiple trouble codes were set, refer to circuit diagrams to look for any common ground circuit or power supply circuit applied to the DTC.
- Refer to any Technical Bulletin that may apply to the malfunction.

Ground Inspection

Groundings are very important to entire circuit system, which are normal or not can seriously affect the entire circuit system. Ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) and oxidation may increase load resistance. This situation will seriously affect normal operation of circuit. Check ground points as follows:

1. Remove ground bolt or nut.
2. Check all contact surfaces for tarnish, dirt and rust, etc.
3. Clean as necessary to ensure that contacting is in good condition.
4. Reinstall ground bolt or nut securely.
5. Check if add-on accessories interfere with ground circuit.
6. If several wire harnesses are crimped into one ground terminal, check for proper crimps. Make sure all wire harnesses are clean, securely fastened and providing a good ground path.

Diagnosis Procedure

HINT:

Use following procedures to troubleshoot the CAN system.

1 Vehicle brought to workshop

NEXT

2 Check battery voltage

Standard voltage: 11 to 14 V

If voltage is below 11 V, recharge or replace battery before proceeding to next step.

NEXT

3 Customer problem analysis

NEXT

4 Check for DTCs (current DTC and history DTC)

DTC
occurs

For current DTC, go to step 6

No
DTC

For history DTC, go to step 7

5 Problem repair (no DTC), then go to step 8

NEXT

6

Troubleshoot according to Diagnostic Trouble Code (DTC) chart, then go to step 8

NEXT

7

Troubleshoot according to Problem Symptoms Table, then go to step 8

NEXT

8

Adjust, repair or replace

NEXT

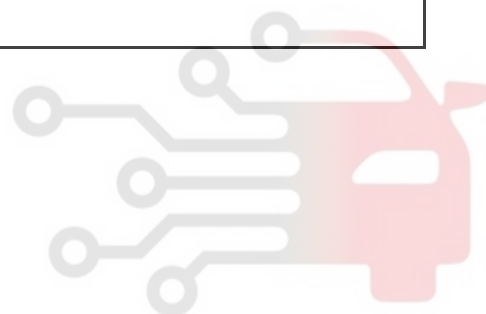
9

Conduct test and confirm malfunction has been repaired

NEXT

10

End



Diagnostic Interface Cannot Connect To System

CAN-H Open to Ground

CAN-L Open to Ground

ECU Internal Open

BCM Internal Open

Instrument Cluster Internal Open

1 Check battery voltage

- Using a digital multimeter, measure voltage between positive battery terminal and negative battery terminal.
- Battery voltage should be between 11 and 14 V.

NG

Recharge or replace battery

OK

Check battery terminals

NEXT

2 Check battery terminals

- Check if battery terminals are loose or corroded.

NG

Tighten or replace battery terminals

OK

Check BCM

67

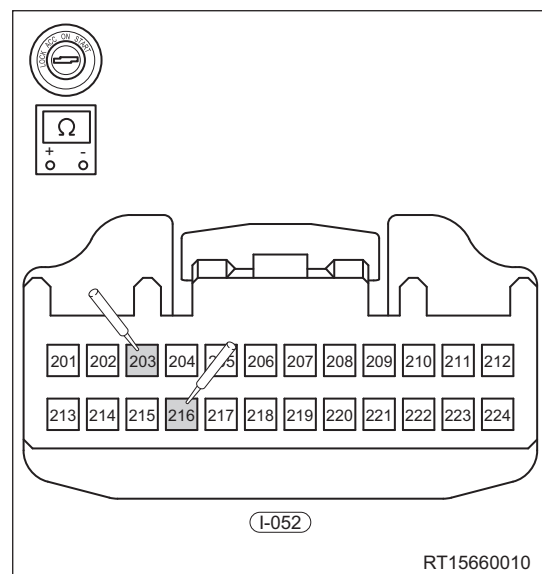
NEXT

3 Check BCM

- Disconnect the Body Control Module (BCM) connector I-052.
- Using ohm band of multimeter, measure resistance between I-052 (203) and I-052 (216) (standard resistance is 120 Ω).

Normal Condition

Multimeter Connection	Condition	Specified Condition
I-052 (203) - I-052 (216)	Engine switch OFF	120 Ω



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- c. Using ohm band of multimeter, measure resistance between I-052 (202) and I-052 (215) (standard resistance is 120 Ω).

Normal Condition

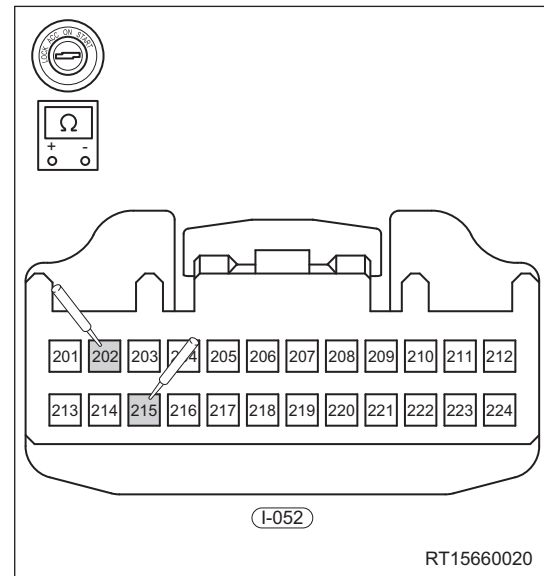
Multimeter Connection	Condition	Specified Condition
I-052 (202) - I-052 (215)	Engine switch OFF	120 Ω

NG

Replace BCM

OK

Check instrument cluster



NEXT

4

Check instrument cluster

- a. Disconnect the instrument cluster connector I-002.
- b. Using ohm band of multimeter, measure resistance between I-002 (29) and I-002 (30) (standard resistance is 120 Ω).

Normal Condition

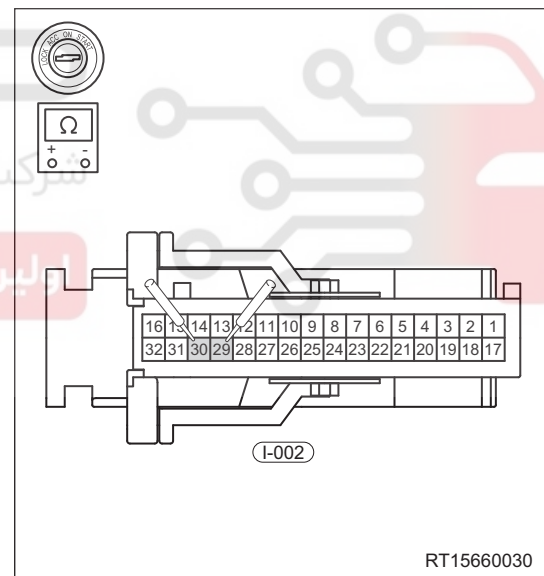
Multimeter Connection	Condition	Specified Condition
I-002 (29) - I-002 (30)	Engine switch OFF	120 Ω

NG

Replace instrument cluster assembly

OK

Check ECM



NEXT

5

Check ECM

- Disconnect the Engine Control Module (ECM) connector B-032.
- Using ohm band of multimeter, measure resistance between B-032 (1) and B-032 (17) (standard resistance is 120 Ω).

Normal Condition

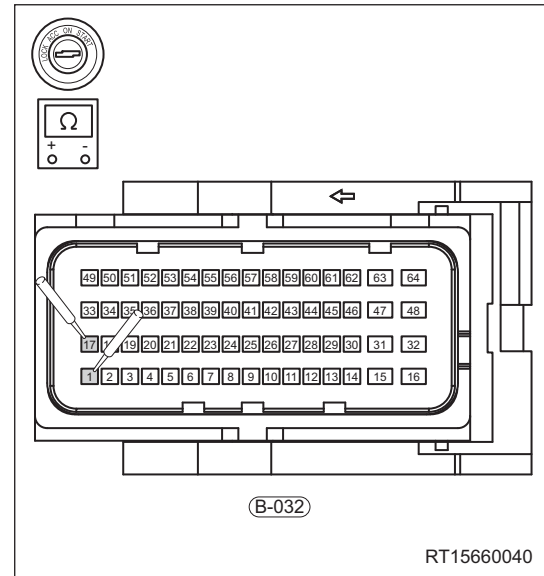
Multimeter Connection	Condition	Specified Condition
B-032 (1) - B-032 (17)	Engine switch OFF	120 Ω

NG

Replace ECM

OK

Check CAN network resistance



RT15660040

NEXT

6

Check CAN network resistance

- Using ohm band of multimeter, measure resistance between diagnostic interfaces I-045 (3) and I-045 (11) (standard resistance is 60 Ω).
- Using ohm band of multimeter, measure resistance between diagnostic interfaces I-045 (6) and I-045 (14) (standard resistance is 60 Ω).

Normal Condition

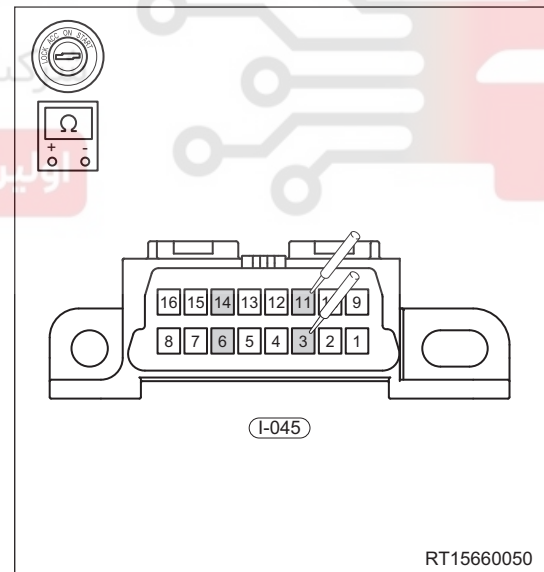
Multimeter Connection	Condition	Specified Condition
I-045 (3) - I-045 (11)	Engine switch OFF	60 Ω
I-045 (6) - I-045 (14)	Engine switch OFF	60 Ω

NG

Replace instrument panel wire harness

OK

Check connector



RT15660050

NEXT

7

Check BCM and diagnostic interface

- Turn engine switch to OFF.
- Disconnect the negative battery cable.

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- c. Disconnect the Body Control Module (BCM) connector I-052.
- d. Check for continuity between I-052 (202) and I-045 (11), and continuity between I-052 (215) and I-045 (3).

Normal Condition

Multimeter Connection	Condition	Specified Condition
I-052 (202) - I-045 (11)	Engine switch OFF	Continuity
I-052 (215) - I-045 (3)	Engine switch OFF	Continuity

- e. Check for continuity between I-052 (203) and I-045 (14), and continuity between I-052 (216) and I-045 (6).

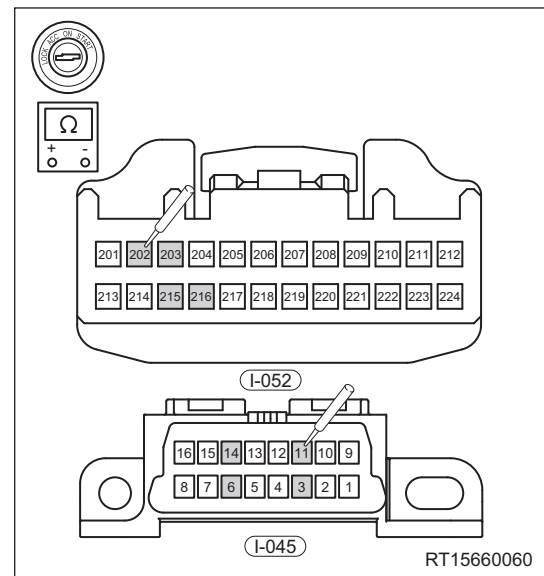
Multimeter Connection	Condition	Specified Condition
I-052 (203) - I-045 (14)	Engine switch OFF	Continuity
I-052 (216) - I-045 (6)	Engine switch OFF	Continuity

NG

Replace instrument panel wire harness

OK

Check diagnostic interface and instrument cluster



67

NEXT

8

Check diagnostic interface and instrument cluster

- a. Disconnect the instrument cluster connector I-002.
- b. Check for continuity between I-045 (3) and I-002 (30), and continuity between I-045 (11) and I-002 (29).

Normal Condition

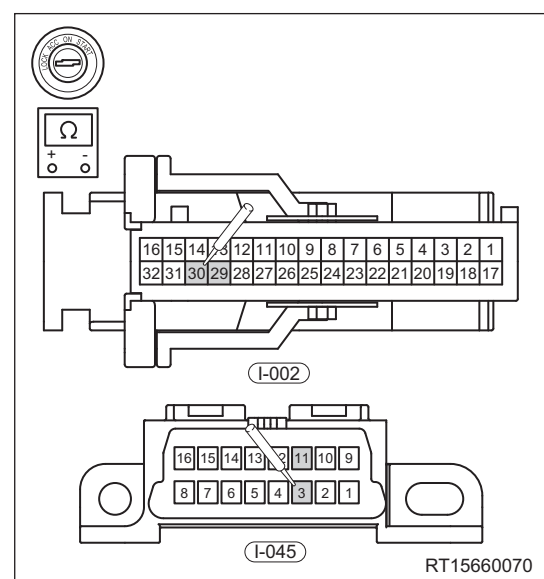
Multimeter Connection	Condition	Specified Condition
I-045 (3) - I-002 (30)	Engine switch OFF	Continuity
I-045 (11) - I-002 (29)	Engine switch OFF	Continuity

NG

Replace instrument panel wire harness

OK

Check audio and diagnostic interface



NEXT

9 Check audio and diagnostic interface

- Disconnect the audio system connector I-007.
- Check for continuity between I-045 (3) and I-007 (C1), and continuity between I-045 (11) and I-007 (C7).

Normal Condition

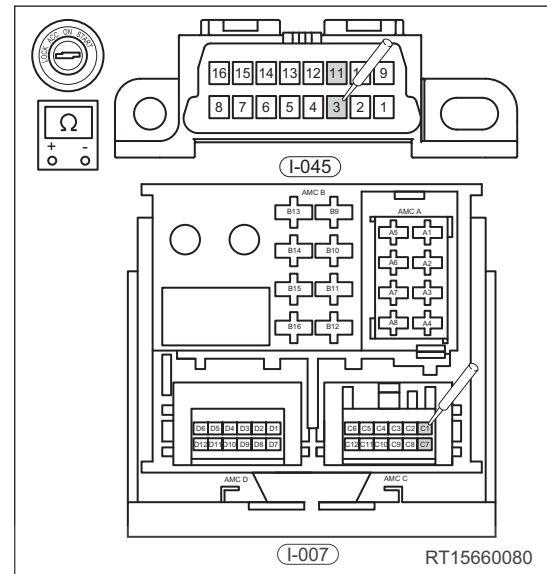
Multimeter Connection	Condition	Specified Condition
I-045 (3) - I-007 (C1)	Engine switch OFF	Continuity
I-045 (11) - I-007 (C7)	Engine switch OFF	Continuity

NG

Replace instrument panel wire harness

OK

Check radar module and diagnostic interface

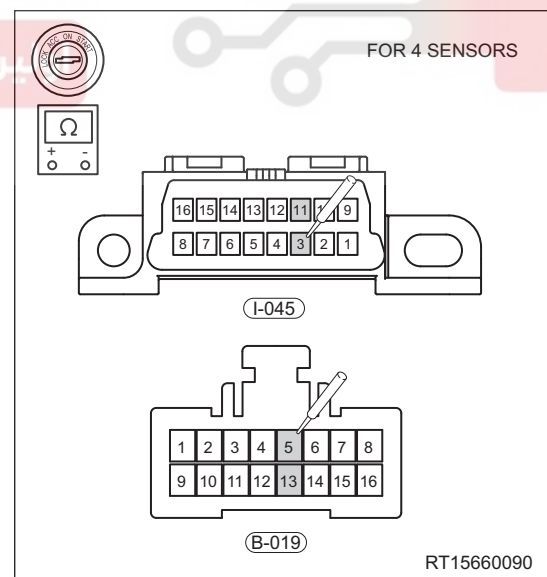


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NEXT

10 Check radar module and diagnostic interface

- Disconnect the radar module connector B-019 (for 4 sensors) or B-086 (for 8 sensors).



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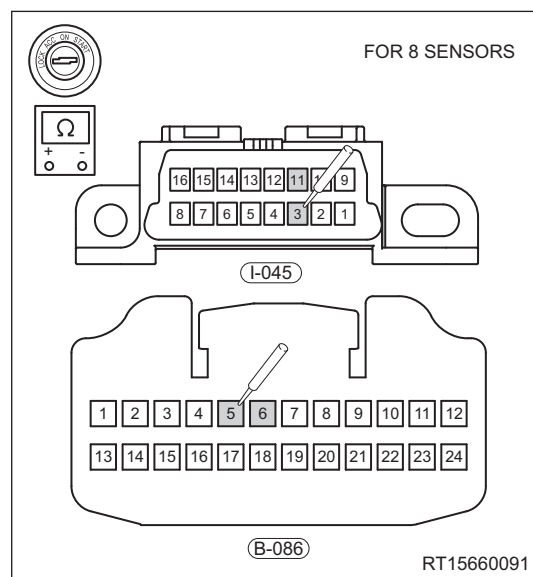
- b. Check for continuity between I-045 (3) and B-019 (5) or B-086 (5), and continuity between I-045 (11) and B-019 (13) or B-086 (6).

Normal Condition (for 4 Sensors)

Multimeter Connection	Condition	Specified Condition
I-045 (3) - B-019 (5)	Engine switch OFF	Continuity
I-045 (11) - B-019 (13)	Engine switch OFF	Continuity

Normal Condition (for 8 Sensors)

Multimeter Connection	Condition	Specified Condition
I-045 (3) - B-086 (5)	Engine switch OFF	Continuity
I-045 (11) - B-086 (6)	Engine switch OFF	Continuity



NG

Replace instrument panel wire harness

OK

Check airbag module

67

NEXT

11 Check airbag module

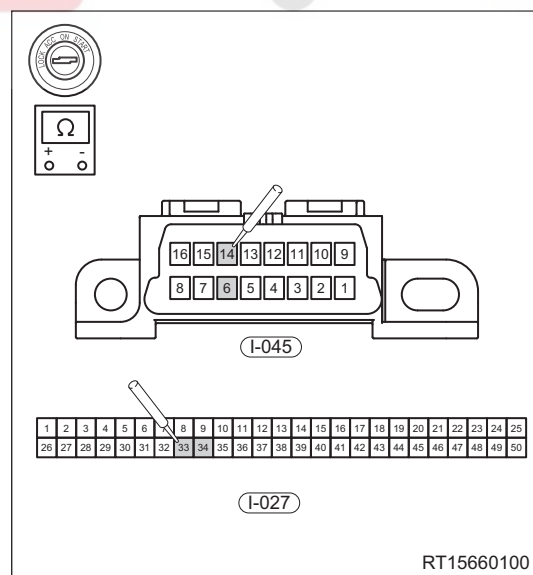
- a. Disconnect the airbag control module connector I-027.
b. Check for continuity between I-045 (14) and I-027 (33), and continuity between I-045 (6) and I-027 (34).

Normal Condition

Multimeter Connection	Condition	Specified Condition
I-045 (14) - I-027 (33)	Engine switch OFF	Continuity
I-045 (6) - I-027 (34)	Engine switch OFF	Continuity

HINT:

- An activation prevention mechanism is built in airbag system connector. When connector is disconnected, this mechanism cuts off circuit by bringing short spring plate into contact with terminals, thus insulating the circuit from external power sources to prevent accidental airbag activation.
- To release activation prevention mechanism, insert a piece of paper with the same thickness as terminal



between terminals and short spring plate to disconnect the connection.

NG

Replace instrument panel wire harness

OK

Check ESP control module

NEXT

12 Check ESP control module

- Disconnect the ABS/ESP control module connector B-035.
- Check for continuity between I-045 (14) and B-035 (14), and continuity between I-045 (6) and B-035 (26).

Normal Condition

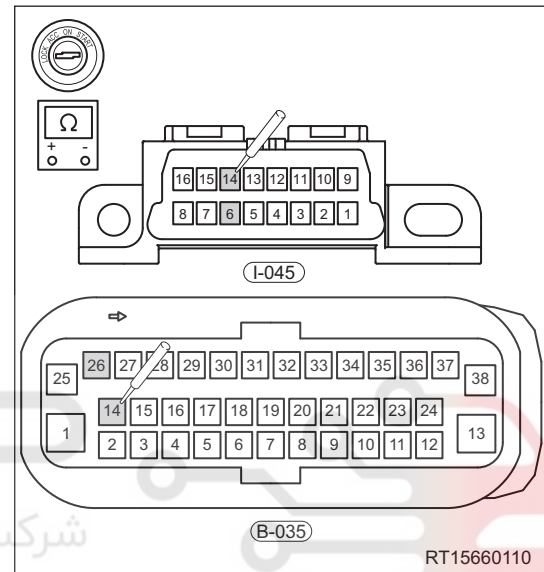
Multimeter Connection	Condition	Specified Condition
I-045 (14) - B-035 (14)	Engine switch OFF	Continuity
I-045 (6) - B-035 (26)	Engine switch OFF	Continuity

NG

Replace instrument panel wire harness

OK

Check TCU module and diagnostic interface

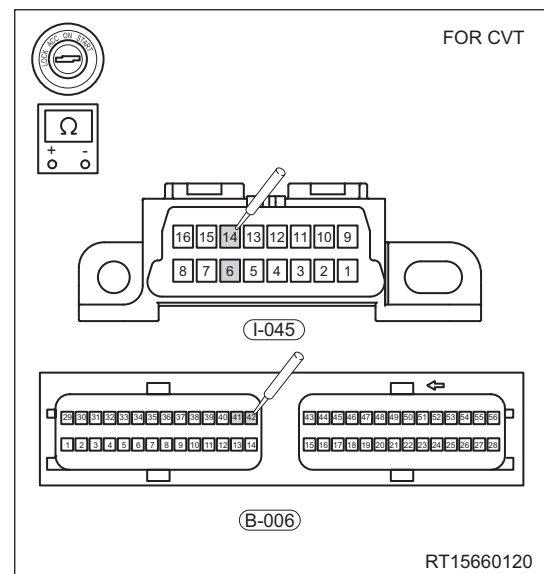


67

NEXT

13 Check TCU module connector B-006 (CVT) or TCU module connector B-101 (DCT)

- Disconnect the TCU connector B-006 or B-101.



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- b. Check for continuity between I-045 (14) and B-006 (42), or I-045 (14) and B-101 (A35); and continuity between I-045 (6) and B-006 (41), or I-045 (6) and B-101 (A35).

Normal Condition (for CVT)

Multimeter Connection	Condition	Specified Condition
I-045 (14) - B-006 (42)	Engine switch OFF	Continuity
I-045 (6) - B-006 (41)	Engine switch OFF	Continuity

Normal Condition (for DCT)

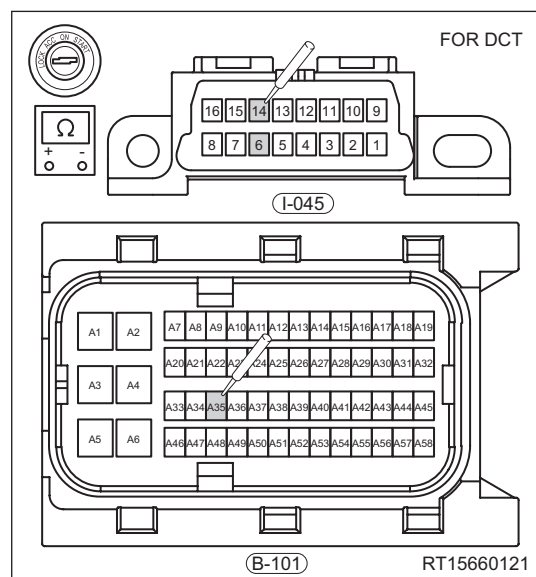
Multimeter Connection	Condition	Specified Condition
I-045 (14) - B-101 (A35)	Engine switch OFF	Continuity
I-045 (6) - B-101 (A35)	Engine switch OFF	Continuity

NG

Replace body wire harness

OK

Check steering angle sensor



67

NEXT

14 Check wire harness between steering angle sensor and diagnostic interface

- a. Disconnect the steering angle sensor connector I-003.
b. Check for continuity between I-045 (14) and I-003 (1), and continuity between I-045 (6) and I-003 (2).

Normal Condition

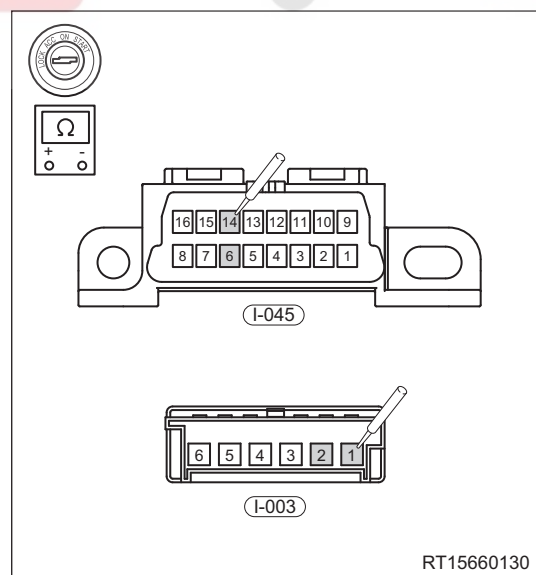
Multimeter Connection	Condition	Specified Condition
I-045 (14) - I-003 (1)	Engine switch OFF	Continuity
I-045 (6) - I-003 (2)	Engine switch OFF	Continuity

NG

Replace body wire harness

OK

Check EPS



NEXT

15 Check wire harness between EPS and diagnostic interface

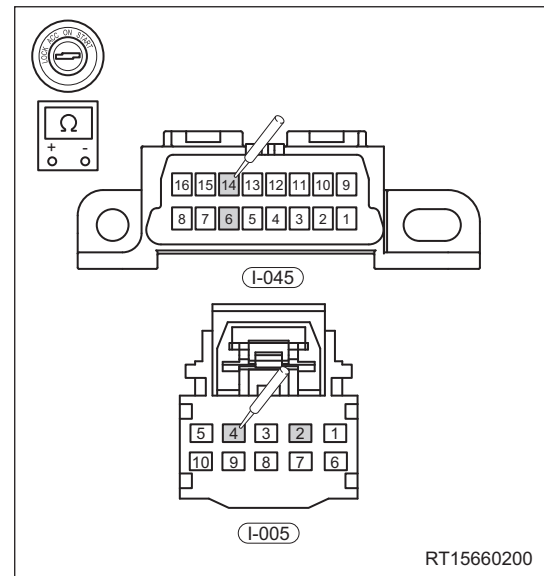
- Disconnect the EPS module connector I-005.
- Check for continuity between I-045 (14) and I-005 (4), and continuity between I-045 (6) and I-005 (2).

Normal Condition

Multimeter Connection	Condition	Specified Condition
I-045 (14) - I-005 (4)	Engine switch OFF	Continuity
I-045 (6) - I-005 (2)	Engine switch OFF	Continuity

NG Replace instrument panel wire harness

OK Check PEPS module

**NEXT****16 Check wire harness between PEPS and diagnostic interface**

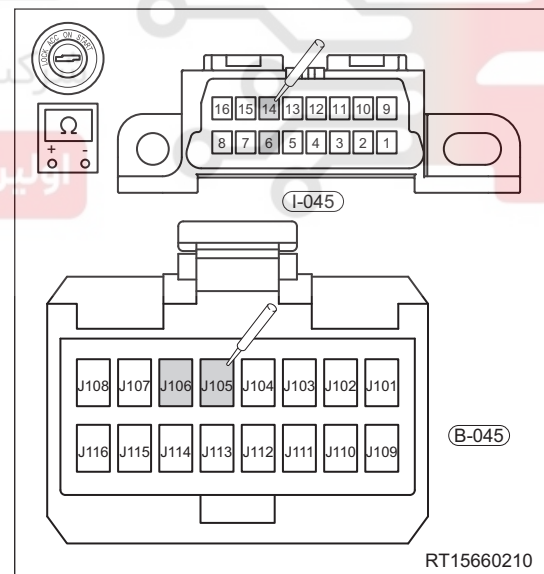
- Disconnect the PEPS module connector B-045.
- Check for continuity between I-045 (14) and B-045 (J105), and continuity between I-045 (6) and B-045 (J106).

Normal Condition

Multimeter Connection	Condition	Specified Condition
I-045 (14) - B-045 (J105)	Engine switch OFF	Continuity
I-045 (6) - B-045 (J106)	Engine switch OFF	Continuity

NG Replace instrument panel wire harness

OK Check panoramic view module wire harness

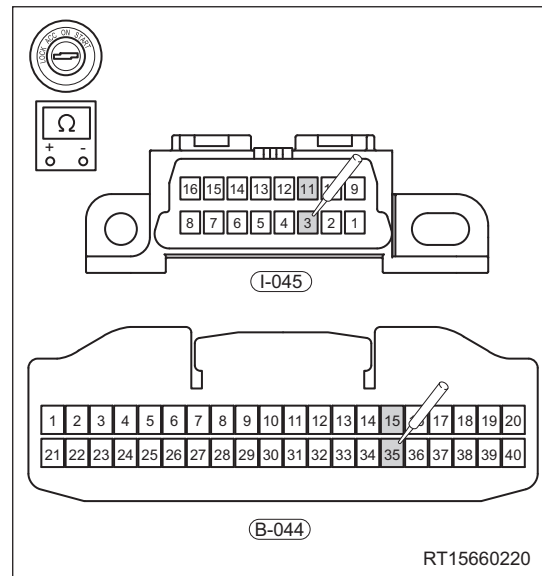
**NEXT**

17**Check wire harness between panoramic view module and diagnostic interface**

- Disconnect the panoramic view module connector B-044.
- Check for continuity between I-045 (3) and B-044 (35), and continuity between I-045 (11) and B-044 (15).

Normal Condition

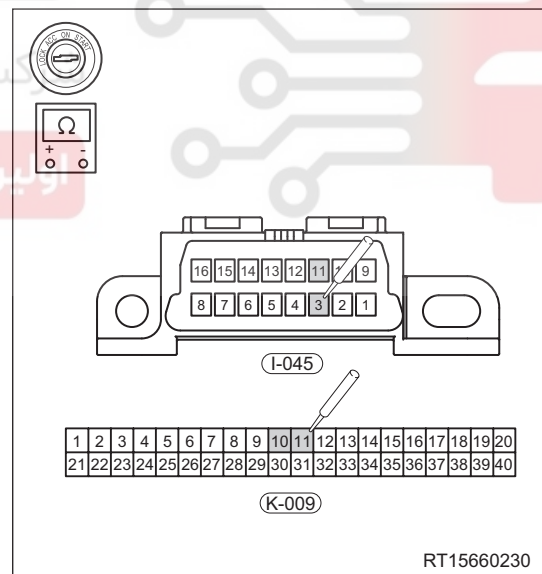
Multimeter Connection	Condition	Specified Condition
I-045 (3) - B-044 (35)	Engine switch OFF	Continuity
I-045 (11) - B-044 (15)	Engine switch OFF	Continuity

NG**Replace instrument panel wire harness****OK****Check automatic A/C control module****NEXT****18****Check automatic A/C control module wire harness connector**

- Disconnect the automatic A/C control module wire harness connector K-009.
- Check for continuity between I-045 (3) and K-009 (11), and continuity between I-045 (11) and K-009 (10).

Normal Condition

Multimeter Connection	Condition	Specified Condition
I-045 (3) - K-009 (11)	Engine switch OFF	Continuity
I-045 (11) - K-009 (10)	Engine switch OFF	Continuity

NG**Replace instrument panel wire harness****OK****End**

Short in CAN Network

- CAN-H short to ground.
- CAN-L short to ground.
- CAN-H short to power supply.
- CAN-L short to power supply.
- Short circuit between CAN-H and CAN-L.

Problem causes:

- BCM internal short circuit.
- Instrument cluster internal short circuit.
- ECM internal short circuit.
- CAN-H and CAN-L short circuit

1

Check diagnostic interface

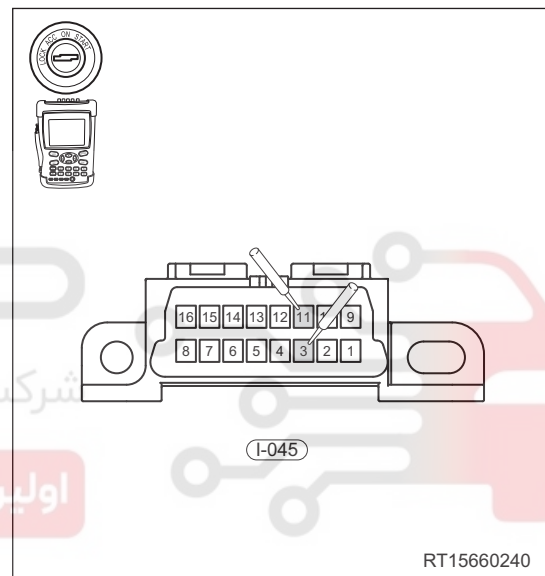
- a. Connect oscilloscope to terminals 3, 11 of diagnostic interface connector I-045, and observe waveform on oscilloscope (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).

NG

Check BCM

OK

Check instrument panel wire harness



NEXT

2

Check BCM

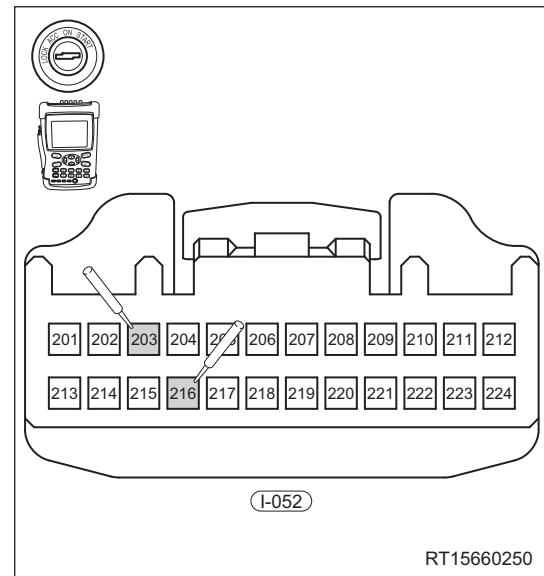
- Connect the Body Control Module (BCM) connector I-052.
- Connect oscilloscope to terminals 203, 216 of body control module connector I-052, and observe waveform (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).

NG

Check instrument cluster

OK

Replace BCM



NEXT

3

Check instrument cluster

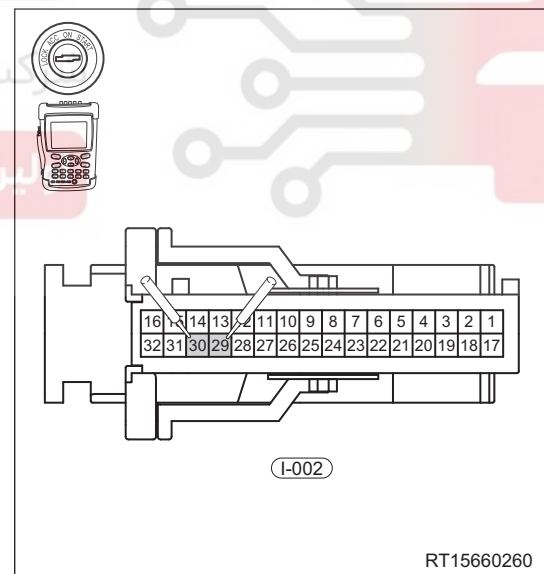
- Connect the instrument cluster connector I-002.
- Connect oscilloscope to terminals 29, 30 of instrument cluster connector I-002, and observe waveform (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).

NG

Check ECM

OK

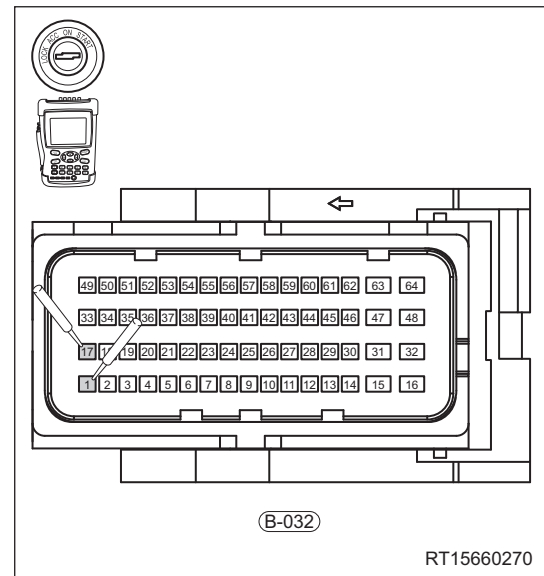
Replace instrument cluster



NEXT

4**Check ECM**

- Connect the ECM connector B-032.
- Connect oscilloscope to terminals 1, 17 of ECM connector B-032, and observe waveform (standard for CAN-H: 2.5 V to 3.5 V, standard for CAN-L: 1.5 V to 2.5 V).

NG**Check audio module****OK****Replace ECM****NEXT****5****Check audio module**

- Remove the audio module connector.

OK**Replace audio module****NG****Check steering angle sensor****NEXT****6****Check steering angle sensor**

- Remove the steering angle sensor connector.

OK**Replace steering angle sensor****NG****Check TCU****NEXT****7****Check TCU**

- Remove the TCU connector.

OK**Replace TCU module****NG****Check ESP module**

NEXT

8 Check ESP module

a. Remove the ESP module connector.

OK

Replace ESP module

NG

Check reversing radar module connector

NEXT

9 Check reversing radar module connector

a. Remove the reversing radar module connector.

OK

Replace reversing radar module

NG

Check airbag module

NEXT

10 Check airbag module

a. Disconnect the airbag module connector.

OK

Replace airbag module

NG

Check PEPS module

NEXT

11 Check PEPS module

a. Disconnect the PEPS module connector.

OK

Replace PEPS module

NG

Check automatic A/C control module

NEXT

12 Check automatic A/C control module

a. Disconnect the automatic A/C control module.

OK

Replace automatic A/C control module

End