ENGINE IMMOBILIZER

GENERAL INFORMATION

Description

Immobilizer system consists of key assembly (including transponder), immobilizer coil, immobilizer controller (IMMO) and engine control module (ECM). Immobilizer control module is the main body, which realizes communication with transponder and engine control module. When key is inserted into ignition switch, if immobilizer control module and transponder are certificated successfully at specified time, engine control module sends a signal to engine so as to start vehicle.

Components Introduction

1. Body control module

   Main function of immobilizer control is realized in BCM, only engine immobilizer function of BCM is described in this section for convenience of narrative. IMMO is used to refer to immobilizer function, and hardware of IMMO is BCM. This is an electronic control module which includes microprocessor and various semiconductor elements; it stores authentication algorithm with transponder and ECM as well as necessary date for normal system operation and after-sale diagnostic service, such as key information, match information and trouble codes, etc. It controls realization mechanism of immobilizer function, works with each component in harmony and transfers command and data.

2. Transponder and immobilizer coil

   Transponder exists in each key of vehicle, and it is a passive device, that is, no batteries are needed. During system operation, this component completes crypto certification of IMMO together with immobilizer coil. Effective transmission distance for transponder information is 2 cm to 3 cm.

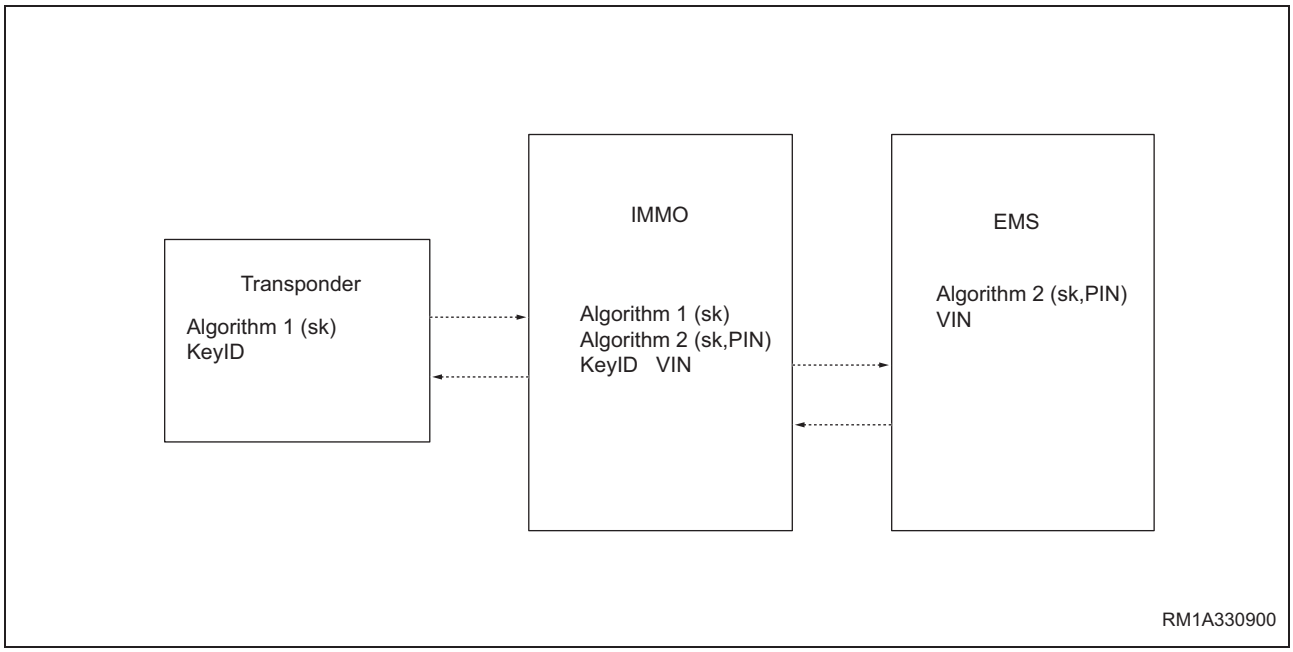
   Immobilizer coil is installed on ignition switch and connects with BCM through wire harness, to provide energy for signal transmission between BCM and transponder.

3. Engine Control Module (ECM)

   Engine control module is service supplier of system, realizes authentication algorithm with IMMO, stores matching information, and sends certification request when power is on.

Operation

1. After key is inserted into ignition switch and turned from OFF to ON, IMMO enters wireless certification status and outputs energy and data to transponder through immobilizer coil, ECM also sends certification request to IMMO.
2. IMMO may not response immediately after receiving certification request from ECM, but response to ECM until IMMO and transponder certification completes.
3. After receiving correct wireless signal, transponder performs crypto certification with IMMO. If certification is successful, IMMO will response crypto certification from ECM; if certification fails, it will response nothing.
4. After receiving response from IMMO, ECM performs crypto certification again, if certification is successful, ECM allows to ignite; if certification fails, ECM does not start engine.



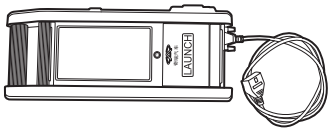
Specifications

Torque Specifications

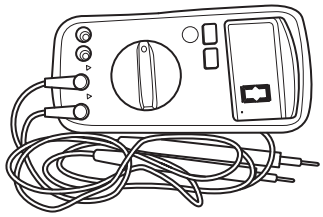
Description	Torque (N·m)
Instrument Panel Relay Box Fixing Bolt	0.7 ± 0.2
BCM Fixing Bolt	0.7 ± 0.2

Tools

Special Tool

X-431 3G Diagnostic Tester	 RCH0000001

General Tool

Digital Multimeter	 RCH0000002

Special Attention

Never reset any control module during operation (unless under guidance of after-sale service department). If version of PC diagnostic tester must be 3.31 or higher, version of X-431 must be 56.80 or higher. When wrong security codes are input continuously, turn ignition switch to ON and input it again after waiting for a specified time.

Waiting Time for Continuously Inputting Wrong Code

Number for Inputting Wrong Code	Recorded Number by Internal Calculator	Waiting Time
0	0	0 s
1	1	10 s
2	2	10 s
3	3	10 min
4	4	20 min
5	5	40 min
6	6	80 min
7	7	160 min
8	8	320 min
9	9	640 min
10	10	1280 min
> 10	10	1280 min

Note:

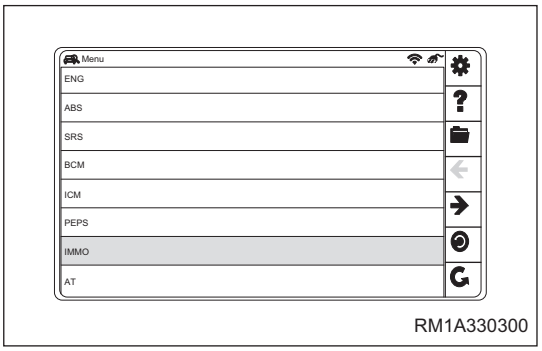
It is necessary to turn on ignition switch and wait for 10 seconds to enter again when entering wrong security code twice continuously. If wrong security code is entered again after 10 seconds, wrong numbers cannot be accumulated.

For example: if entering wrong security code twice continuously, but wrong security code is entered again after 10 seconds, internal counter will not record the current number and keep original number. If turning off ignition switch without waiting specified time, waiting time will be reset to 0 and recount, so be sure to wait and turn ignition switch to ON.

Engine Immobilizer System Match

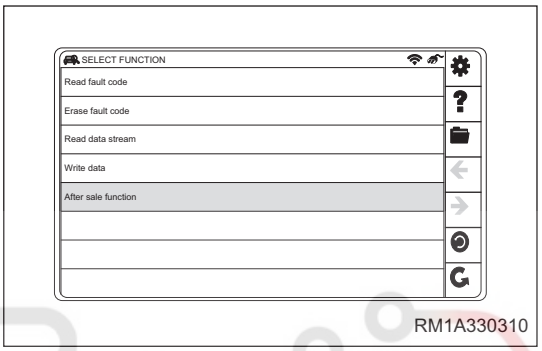
Match engine immobilizer system after ECM replacement

- 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. Then select corresponding model (M1A) on X-431 3G diagnostic tester (the latest software) to enter the system and select "IMMO" system.



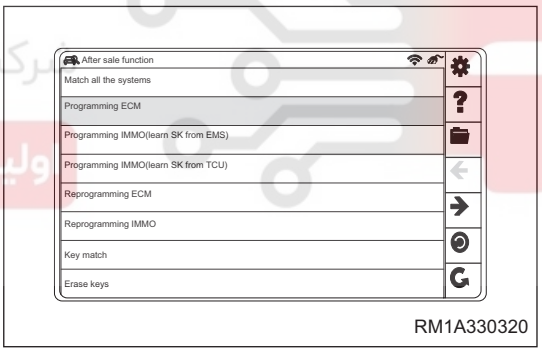
RM1A330300

- Please select [After sale function] on SELECT FUNCTION screen.



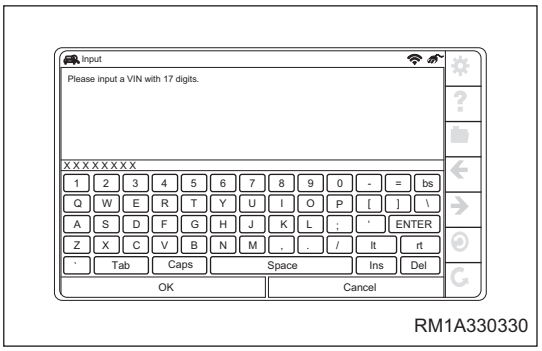
RM1A330310

- Please select [Programming ECM] on After sale function screen.



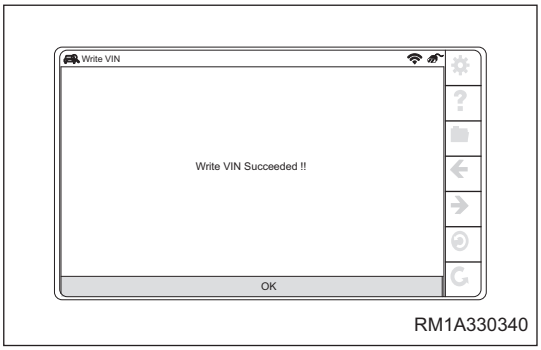
RM1A330320

- Please input a VIN with 17 digits.



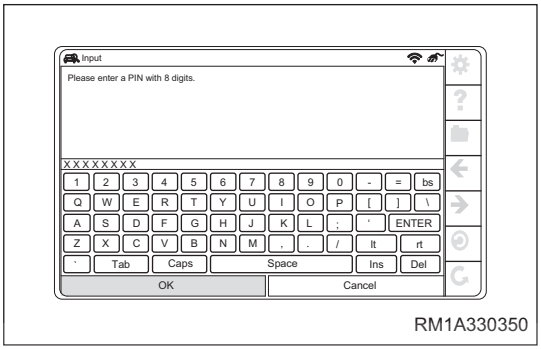
RM1A330330

- When "Write VIN succeeded" is displayed on Write VIN screen, click "OK".



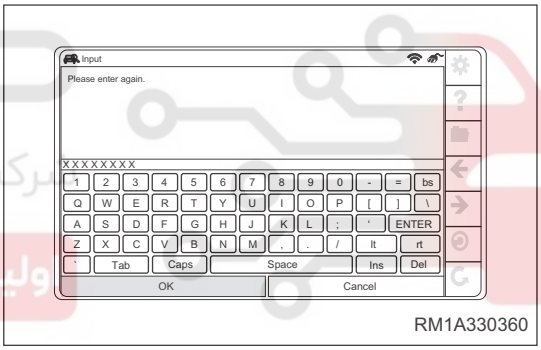
RM1A330340

- When "Please enter a PIN with 8 digits" is displayed on Input screen, input PIN code and click "OK".



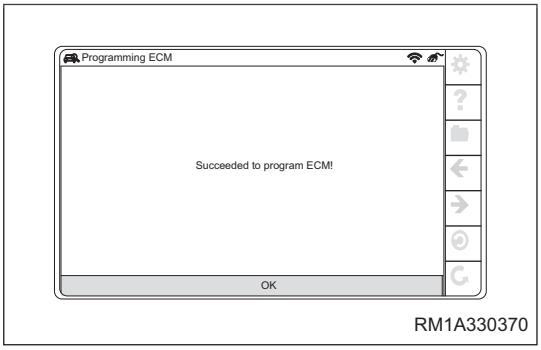
RM1A330350

- When "Please enter again" is displayed on Input screen, input PIN code again and click "OK".



RM1A330360

- When "Succeeded to program ECM" is displayed on Programming ECM screen, click "OK".



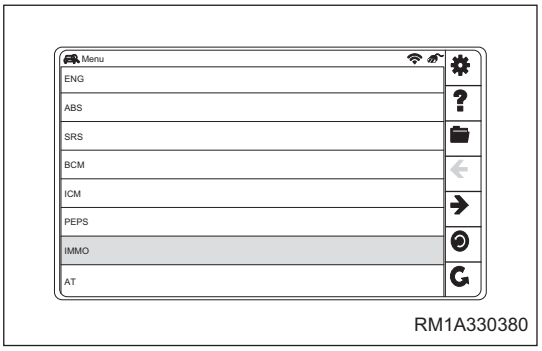
RM1A330370

- Program for ECM is completed.

  After matching is completed, turn ignition switch to OFF, disconnect diagnostic tester and wait for approximately 10 seconds, then turn ignition switch to ON and wait for approximately 10 seconds so that system certification is successful.

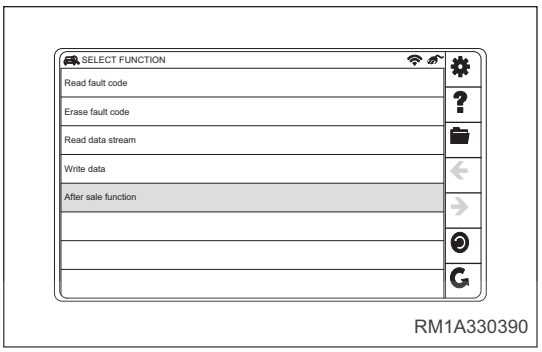
Match engine immobilizer system after BCM replacement

- 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. Then select corresponding model (ARRIZO 7) on X-431 3G diagnostic tester (the latest software) to enter the system and select "IMMO" system.



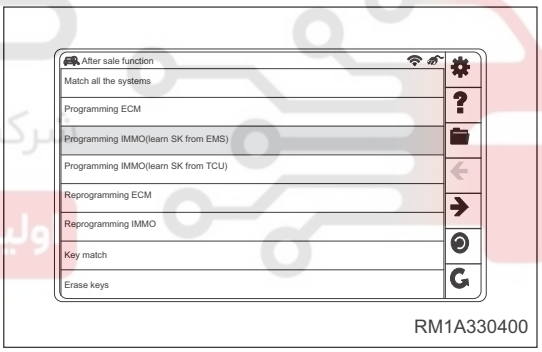
RM1A330380

- Please select [After sale function] on SELECT FUNCTION screen.



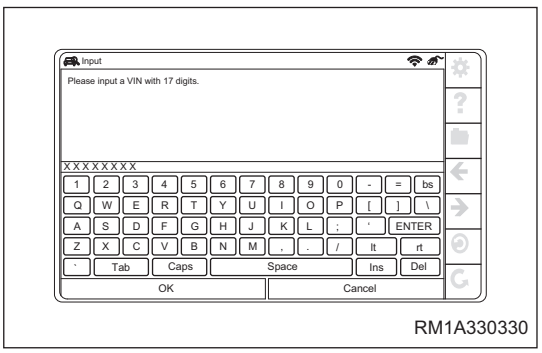
RM1A330390

- Please select [Programming IMMO (learn SK from EMS)] on After sale function screen.



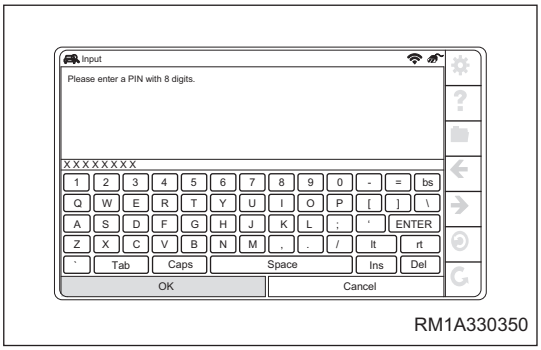
RM1A330400

- Please input a VIN with 17 digits.



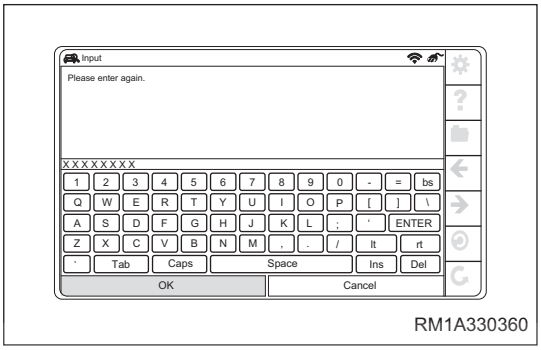
RM1A330330

- When "Please enter a PIN with 8 digits" is displayed on Input screen, input PIN code and click "OK".



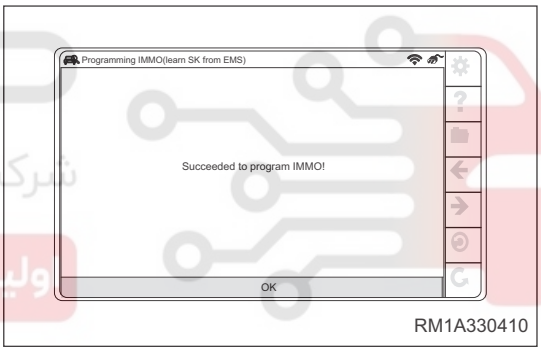
RM1A330350

- When "Please enter again" is displayed on Input screen, input PIN code again and click "OK".



RM1A330360

- When "Succeeded to program IMMO" is displayed on Programming IMMO (learn SK from EMS) screen, click "OK".



RM1A330410

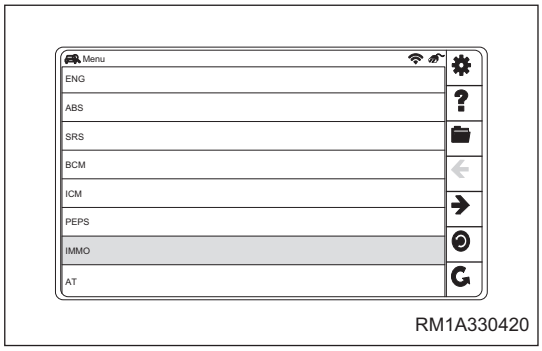
- Program for IMMO is completed.

CAUTION

- After matching is completed, turn ignition switch to OFF, disconnect diagnostic tester and wait for approximately 10 seconds, then turn ignition switch to ON and wait for approximately 10 seconds so that system certification is successful. After replacing BCM, perform "Add the old keys" and "wireless key match" operations for original key.

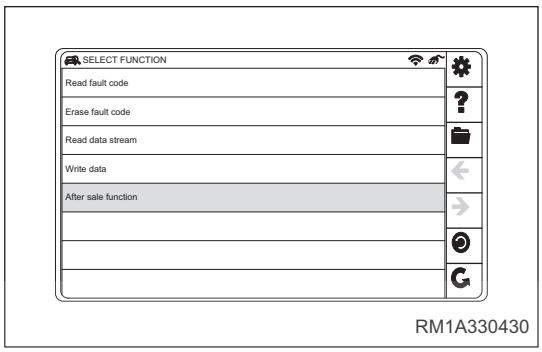
Add old keys

- 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. Then select corresponding model (M1A) on X-431 3G diagnostic tester (the latest software) to enter the system and select "IMMO" system.



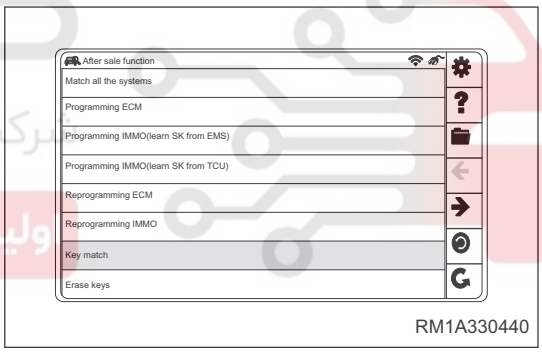
RM1A330420

- Please select [After sale function] on SELECT FUNCTION screen.



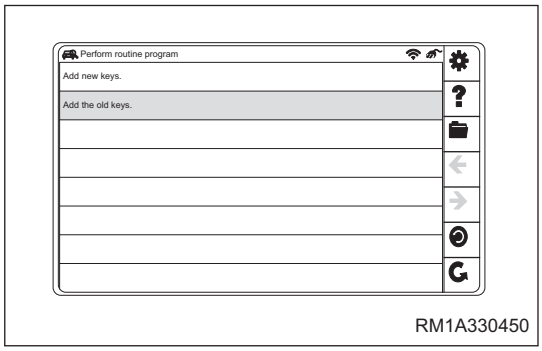
RM1A330430

- Please select [Key match] on After sale function screen.



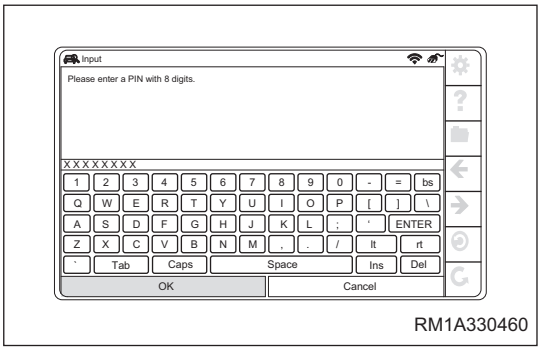
RM1A330440

- Please select [Add the old keys] on Perform routine program screen.

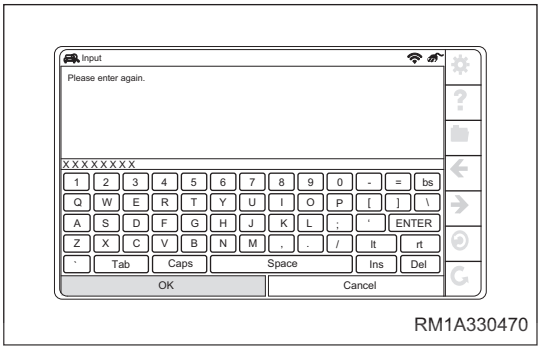


RM1A330450

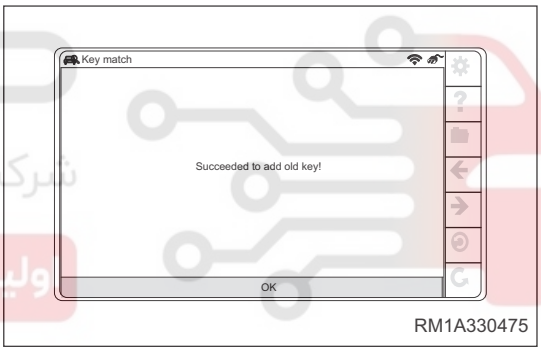
- When "Please enter a PIN with 8 digits" is displayed on Input screen, input PIN code and click "OK".



- When "Please enter again" is displayed on Input screen, input PIN code again and click "OK".

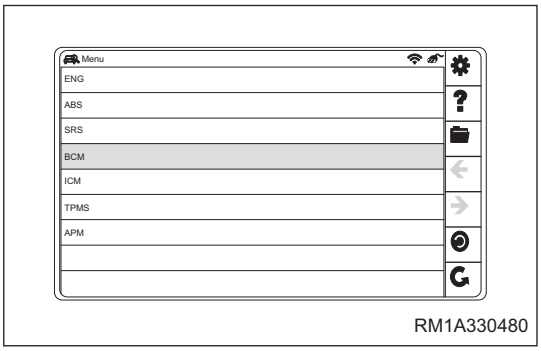


- When "Succeeded to add old key" is displayed on Key match screen, click "OK".

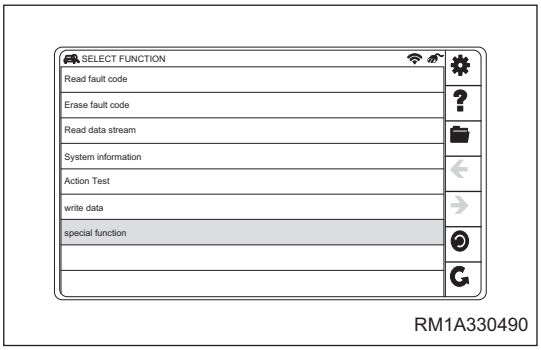


Wireless key match

- 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. Then select corresponding model (M1A) on X-431 3G diagnostic tester (the latest software) to enter the system and select "BCM" system.

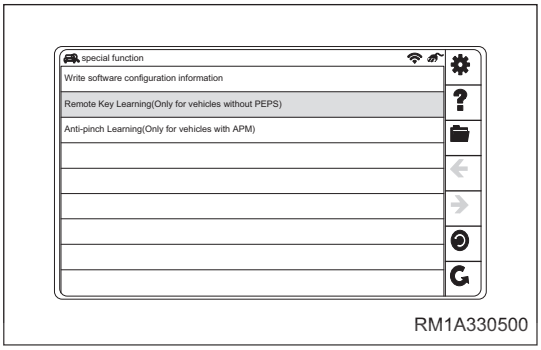


- Please select [Special function] on SELECT FUNCTION screen.



RM1A330490

- Please select [Remote Key Learning (Only for vehicles without PEPS)] on special function screen.



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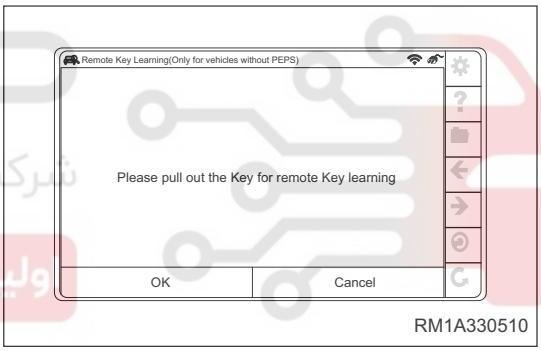
- Pull out key from key cylinder.



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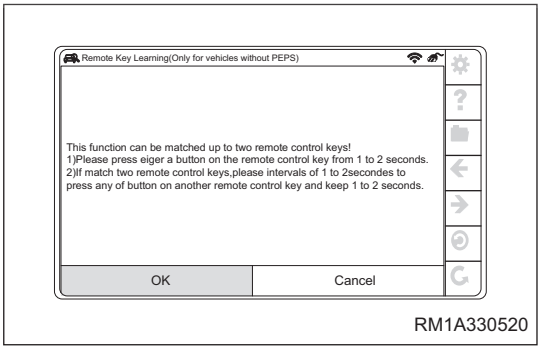
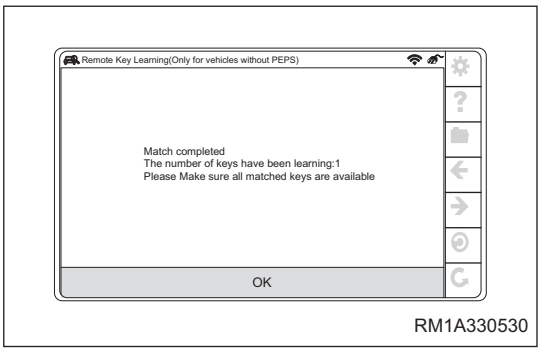
- After pulling out key, click "OK".



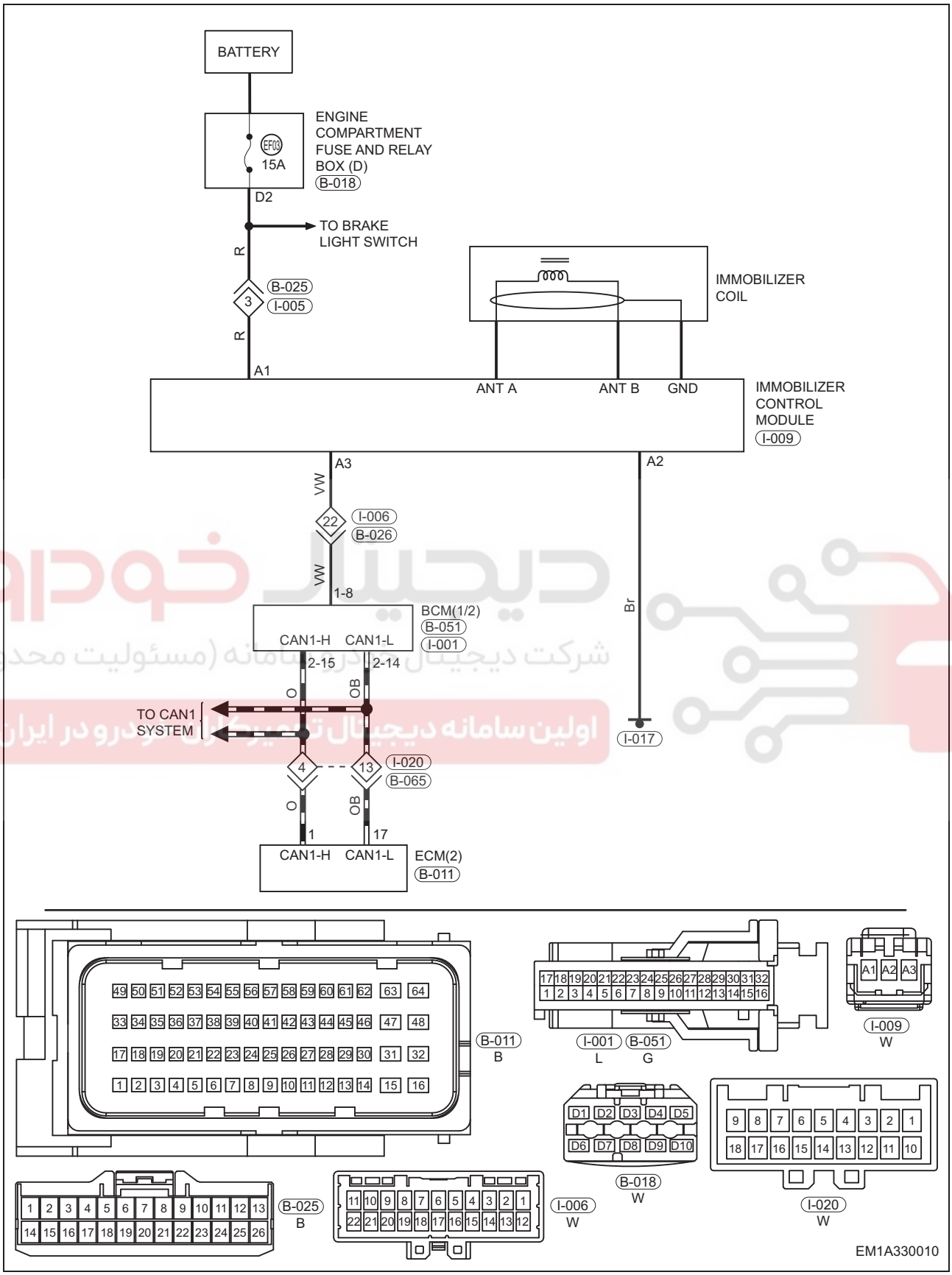
RM1A330520

- After operation is completed, click "OK".



- Wireless key match is completed.

Circuit Diagram



DIAGNOSIS & TESTING

Problem Symptoms Table

HINT:
Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair or adjust faulty components, or replace as necessary.

Symptom	Suspected Area	See page
Engine cannot be started	Wire harness or connector	-
	Immobilizer coil	33-30
	ECM	06-290
	Key transponder	33-26
	IMMO (BCM)	33-28
Diagnostic tester cannot communicate with immobilizer system	Wire harness or connector	-
	Diagnostic interface	-
	IMMO (BCM)	33-28
Diagnostic tester cannot communicate with ECM	Wire harness or connector	-
	Diagnostic interface	-
	ECM	06-290
Key cannot be matched	Wire harness or connector	-
	Immobilizer coil	33-30
	Key assembly	33-26
	IMMO (BCM)	33-28

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 the 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.

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 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 immobilizer system ground points 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 is interrupted in related circuit.
- If possible, try to duplicate conditions under which DTC was set.
- Look for data that has changed or the DTC to reset during wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect mounting areas of Engine Control Module (ECM), IMMO 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 current DTC.

Ground Inspection

Groundings are very important to entire circuit system, which are normal or not can seriously affect 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 if they are installed correctly. Make sure all wire harnesses are clean, securely fastened and providing a good ground path.

Diagnosis Procedure

HINT:
Use following procedures to troubleshoot the engine immobilizer 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

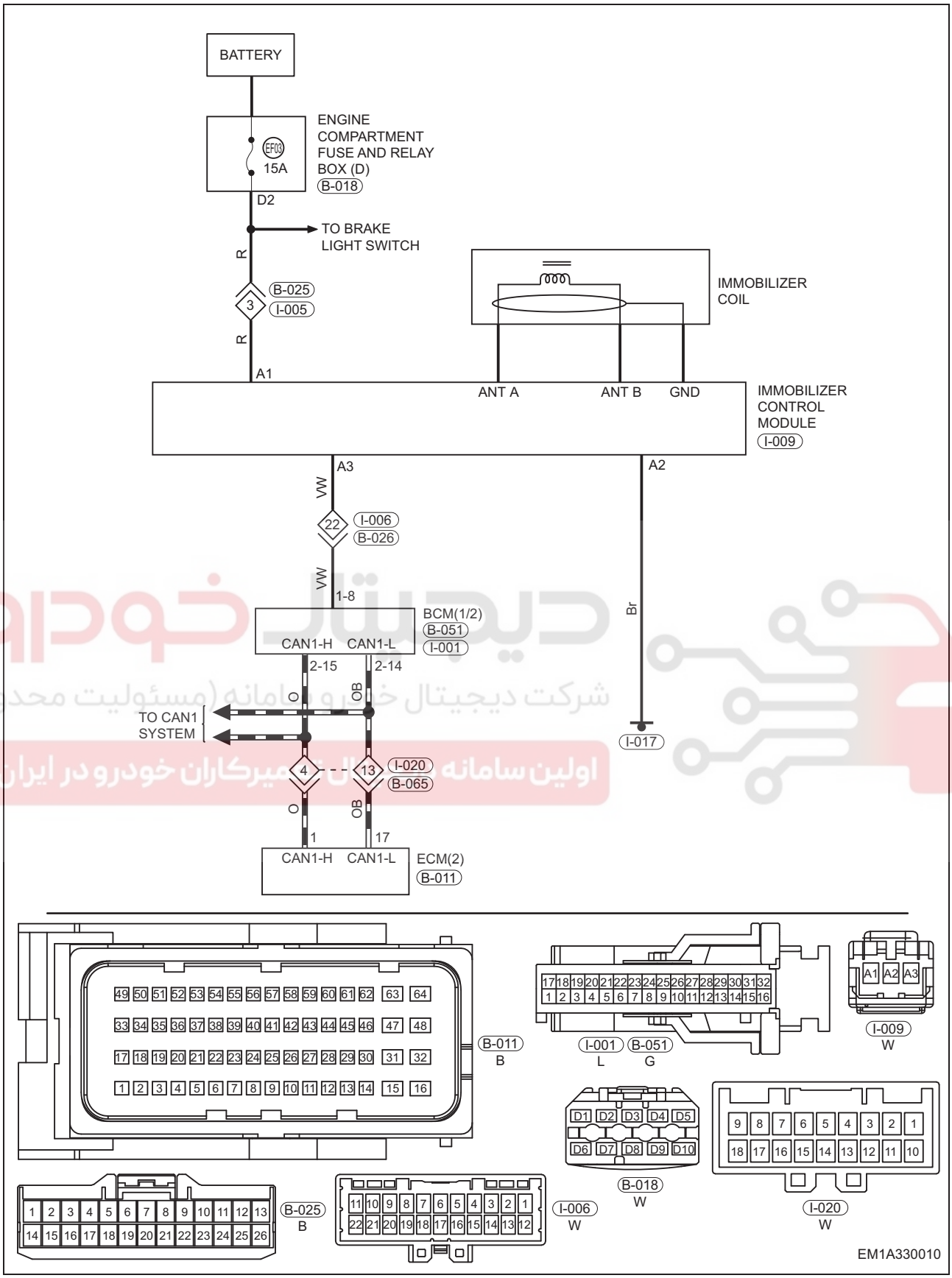
NEXT

10	End

Diagnostic Trouble Code (DTC) Chart

DTC Code	DTC Definition
P1610-00	Immo Secret Key and Security Code Not Programmed
P1611-00	Immo Wrong Security Code Received
P1616-00	Authentication Not OK
P1617-00	No Response from SIM During Challenge Period
P1618-00	Fail to Write EOL Confiditional Data into EEProm
P1619-00	ECM Not Programed (Virgin State)
P1612-00	Immo Challenge Service Not Received
P1613-00	Immo Immo-code Service Not Received
P1614-00	Immo Transferred Transponder Response was Corrupted
P1615-00	ECM Status Unknown

DTC	P1610-00	Immo Secret Key and Security Code Not Programmed
DTC	P1612-00	Immo Challenge Service Not Received
DTC	P1611-00	Immo Wrong Security Code Received
DTC	P1614-00	Immo Transferred Transponder Response was Corrupted



Self-diagnosis Detection Logic

DTC Code	DTC Definition	DTC Detection Condition	Possible Cause
P1610-00	Immo Secret Key and Security Code Not Programmed	Ignition switch ON	• IMMO, key assembly
P1612-00	Immo Challenge Service Not Received	Ignition switch ON	• Wire harness connector, immobilizer coil, key assembly, ECM, IMMO
P1611-00	Immo Wrong Security Code Received	Ignition switch ON	• ECM, IMMO
P1614-00	Immo Transferred Transponder Response was Corrupted	Ignition switch ON	• Wire harness connector, immobilizer coil, key assembly, IMMO

DTC Confirmation Procedure

Confirm that battery voltage is between 11 and 14 V before performing following procedures.

- Turn ignition switch to LOCK.
- 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.
- Turn ignition switch to ON.
- Use X-431 3G diagnostic tester to record and clear DTCs stored in engine immobilizer system.
- Turn ignition switch to LOCK and wait for a few seconds.
- Turn ignition switch to ON, and then select Read Code.
- If DTC is detected, malfunction indicated by DTC is current. Go to diagnosis procedure - Step 1.
- If DTC is not detected, malfunction indicated by DTC is intermittent (See page 33-16).

CAUTION

- When performing circuit diagnosis and test, always refer to circuit diagram for specific circuit and component information.

Diagnosis Procedure

1	**Check key assembly**

a. Connect diagnostic tester to malfunctioning vehicle, turn ignition switch to ON and read key status using diagnostic tester. Read transponder programming status and transponder ID position in engine immobilizer system.

b. If response status of transponder is "unprogrammed", enter "Add new keys" operation procedure;

c. If response status of transponder is "programmed" and transponder ID is not in engine immobilizer system, enter "Add the old keys" operation procedure;

d. If response status of transponder is "programmed" and transponder ID is in engine immobilizer system, and SK in key is different from SK in IMMO, replace transponder and enter "Add new keys" operation procedure.

e. If response status of transponder is "unprogrammed" and transponder ID is in engine immobilizer system, and SK in key is same as SK in IMMO, continue to troubleshoot.

NG → Replace key assembly

OK

2	Reconfirm DTCs

a. Turn ignition switch to ON.
b. Use X-431 3G diagnostic tester (the latest software) to record and clear DTCs stored in engine immobilizer system.
c. Turn ignition switch to LOCK and wait for a few seconds.
d. Turn ignition switch to ON.
e. Use X-431 3G diagnostic tester (the latest software) to read DTCs stored in engine immobilizer system again.
f. Read DTCs.

Result	Proceed to
DTCs P1614-00, P1610-00 and P1612-00 are output	NG
No DTC is output	OK

NG → Go to step 3

OK

System is normal

3	Check immobilizer coil

a. Check coil appearance for obvious damage.
b. Remove immobilizer coil from malfunctioning vehicle, then install it to a new vehicle and perform test.
c. Check the system operation.

NG → Replace immobilizer coil

OK

4	Check IMMO

a. Turn ignition switch to ON. Connect X-431 3G diagnostic tester to enter diagnostic IMMO status of engine immobilizer system.
b. Read IMMO electronic tag, trouble code, data flow, and print these information using diagnostic tester; if communication cannot be established, fill information such as trouble description etc. into trouble feedback table, and then proceed to CAN network troubleshooting.

NG → Replace IMMO and BCM with new ones and rematch with diagnostic tester

OK

5	Check engine control module

a. Turn ignition switch to ON. Connect X-431 3G diagnostic tester to enter diagnosis ECM status of engine control module.

b. Read ECM electronic tag, trouble codes, data flow, and print these information using diagnostic tester. If communication cannot be established, fill information such as trouble description etc. into trouble feedback table, and then proceed to CAN network troubleshooting.

NG → **Replace ECM with a new one and rematch it with diagnostic tester**

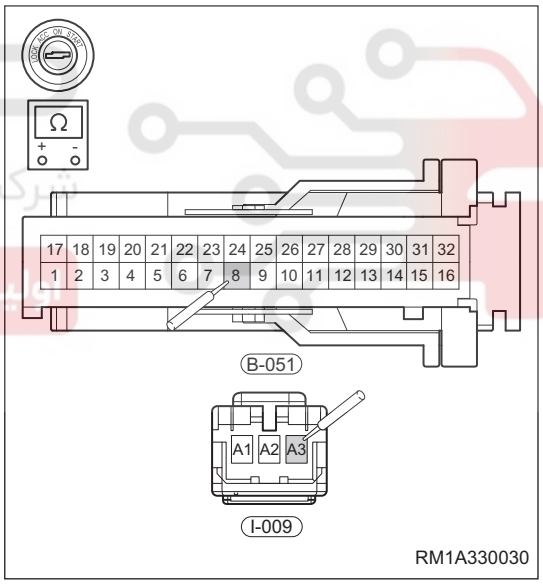
OK

6	Check wire harness connectors of entire vehicle

1. Check CAN network (See page 53-19).
2. Check wire harness connectors of entire vehicle.
   a. Turn ignition switch to LOCK.
   b. Disconnect the negative battery cable.
   c. Disconnect BCM connector B-051 and immobilizer coil connector I-009.
   d. Using a digital multimeter, check for continuity between BCM connector B-051 and immobilizer coil connector I-009 according to table below.

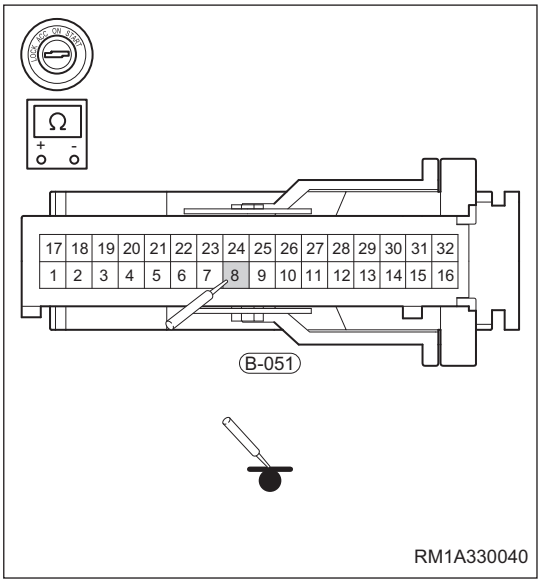
Normal Condition (Open Circuit Test)

Multimeter Connection	Condition	Specified Condition
B-051 (08) - I-009 (A3)	Always	Continuity



Normal Condition (Short Circuit Test)

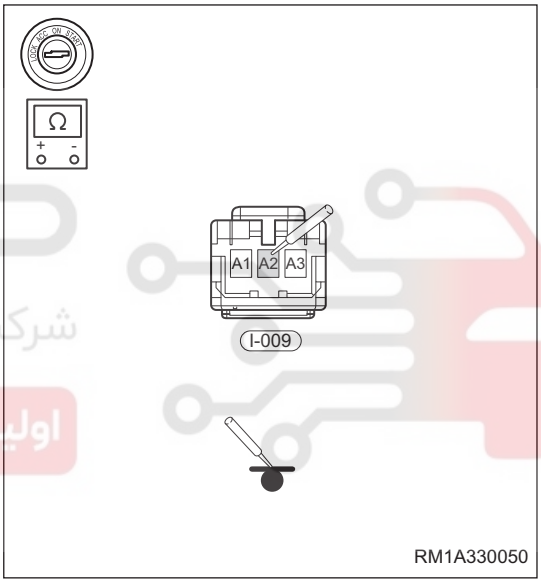
Multimeter Connection	Condition	Specified Condition
B-051 (08) - Body ground	Always	No continuity



e. Using a digital multimeter, check for continuity between immobilizer coil connector I-009 and body ground according to table below.

Normal Condition (Open Circuit Test)

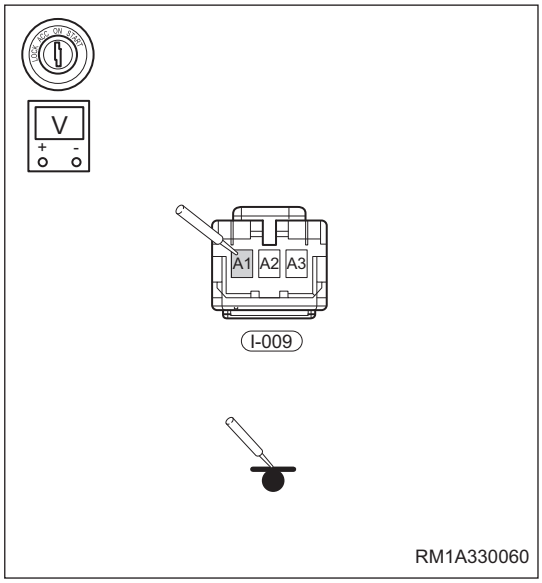
Multimeter Connection	Condition	Specified Condition
I-009 (A2) - Body ground	Always	Continuity



3. Check power supply wire harness of immobilizer coil.
   a. Connect all connectors.
   b. Disconnect the immobilizer coil connector I-009.
   c. Connect the negative battery cable.
   d. Turn ignition switch to ON.
   e. Using a digital multimeter, measure voltage between immobilizer coil connector I-009 and body ground according to table below.

   Normal Condition (Voltage Test)

Multimeter Connection	Condition	Specified Condition
I-009 (A1) - Body ground	Ignition switch ON	11 V or higher



NG → **Repair or replace fuse, wire harness connector**

OK

System is normal

ON-VEHICLE SERVICE

Transponder

HINT:
As transponder in key is an electronic part of high accuracy, pay attention to followings during service:

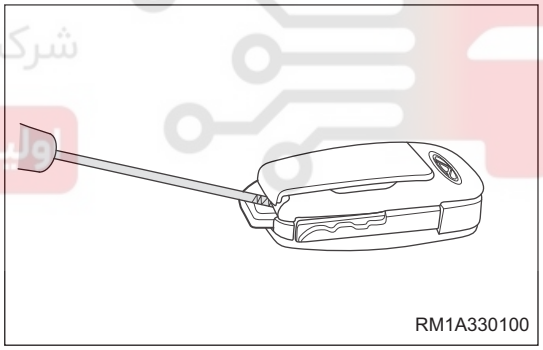
- Do not throw or hit key, which may cause severe impact;
- Do not put key in high temperature (90°C or more) for a long time;
- Do not put key in water or other fluid;
- Do not put key in strong magnetic field or electromagnetic field.

CAUTION

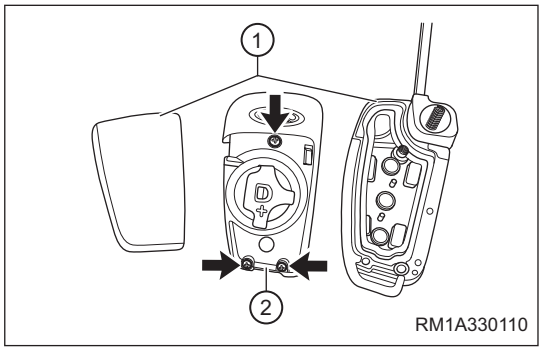
- DO NOT push terminals with hands, when removing wireless key cover.
- Make sure battery positive and negative are installed correctly, when removing wireless key cover.
- DO NOT pry up battery forcibly, after removing wireless key cover. Otherwise, terminals may be damaged.
- DO NOT touch battery with wet hands, after removing wireless key cover. Otherwise, water may cause rust.
- DO NOT touch or move any components inside transmitter, after removing wireless key cover. Failure to do so may interfere with proper operation.

Removal

1. Remove the transponder.
   a. Using a screwdriver wrapped with protective tape, pry off wireless key cover as shown in illustration.

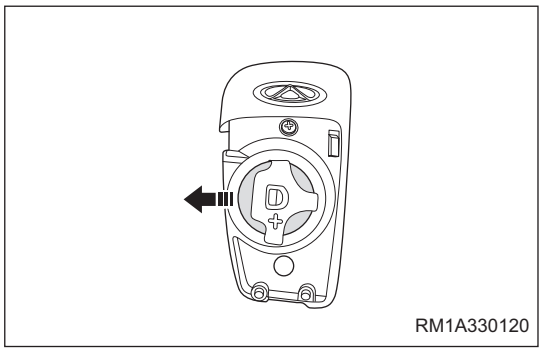

RM1A330100

   b. Remove 3 screws (arrow), separate wireless key covers (1) and chip (2).

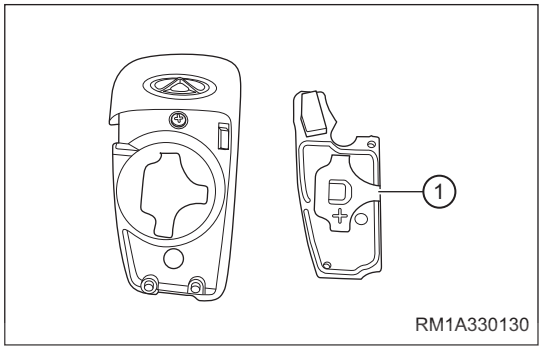


RM1A330110

c. Disengage claws from battery holder, and remove battery in direction of arrow.



d. Remove the transponder (1).



Installation

Installation is in the reverse order of removal.

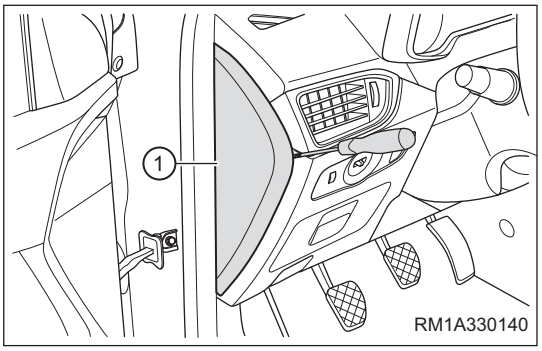
CAUTION

- Check that wireless key and transponder can operate properly, after installing transponder.

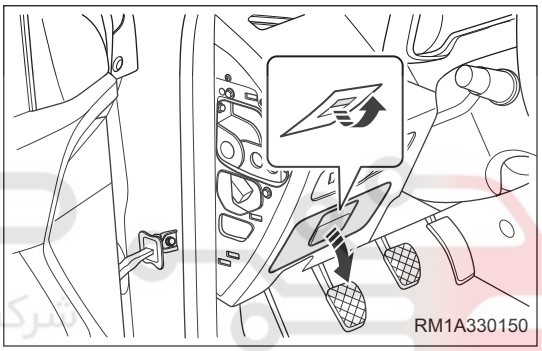
Immobilizer Control Module (BCM)

Removal

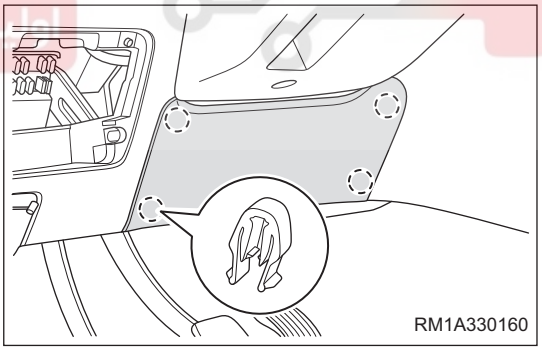
1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the BCM assembly.
   a. Using a screwdriver wrapped with protective tape, pry off clips from instrument panel left end cover assembly, and remove instrument panel left end cover assembly (1).



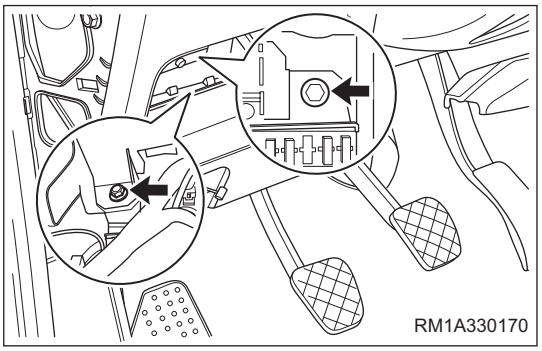
   b. Open instrument panel lower left storage box assembly in direction of arrow as shown in illustration.



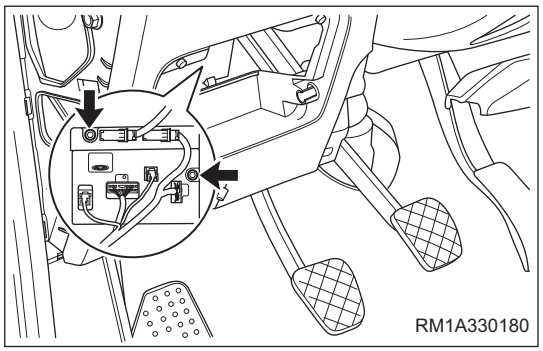
   c. Using a screwdriver wrapped with protective tape, pry off clips from instrument panel lower left protector assembly, and remove instrument panel lower left protector assembly.



   d. Remove 2 bolts (arrow) and move away fuse relay box.



e. Disconnect all connectors from BCM and remove 2 bolts (arrow).



f. Remove the BCM.

Installation

Installation is in the reverse order of removal.

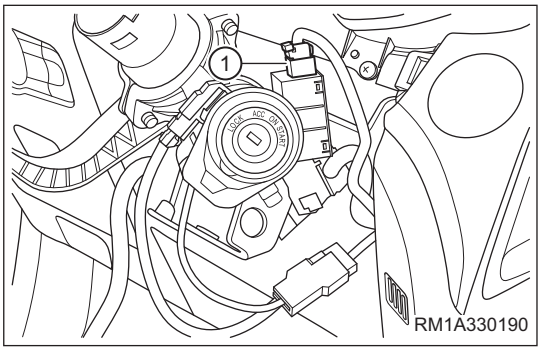
CAUTION

- Be sure to perform match operation so that replaced BCM can operate properly on original vehicle. Make sure input VIN code and PIN code are correct during operation. After replacing BCM, perform "Add the old keys" operation for original key, then it can be available.

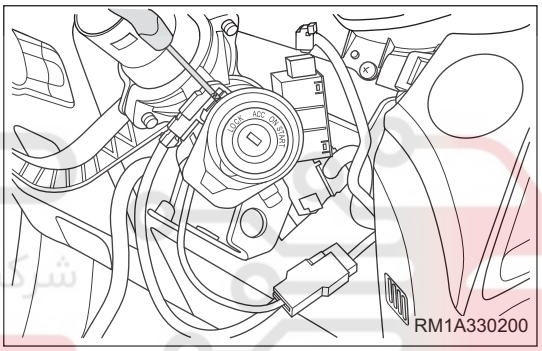
Immobilizer Coil

Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the combination switch cover (See page 28-13).
4. Remove the immobilizer coil.
   a. Disconnect the immobilizer coil connector (1).



   b. Using a screwdriver wrapped with protective tape, pry off connection between immobilizer coil and ignition switch.



   c. Remove the immobilizer coil.

Installation

Installation is in the reverse order of removal.