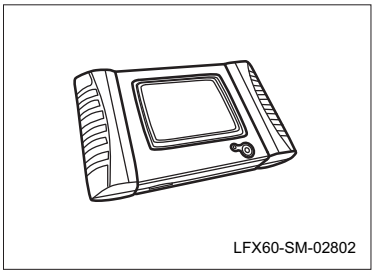
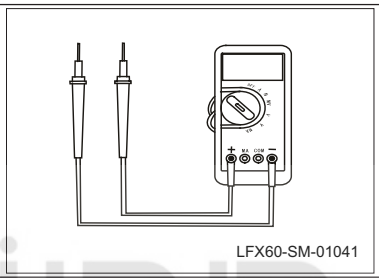
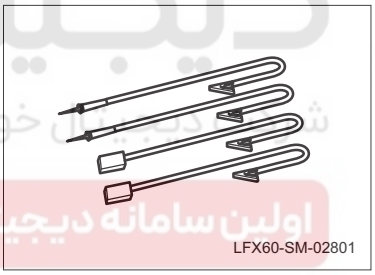
02- Engine

Engine anti-theft system

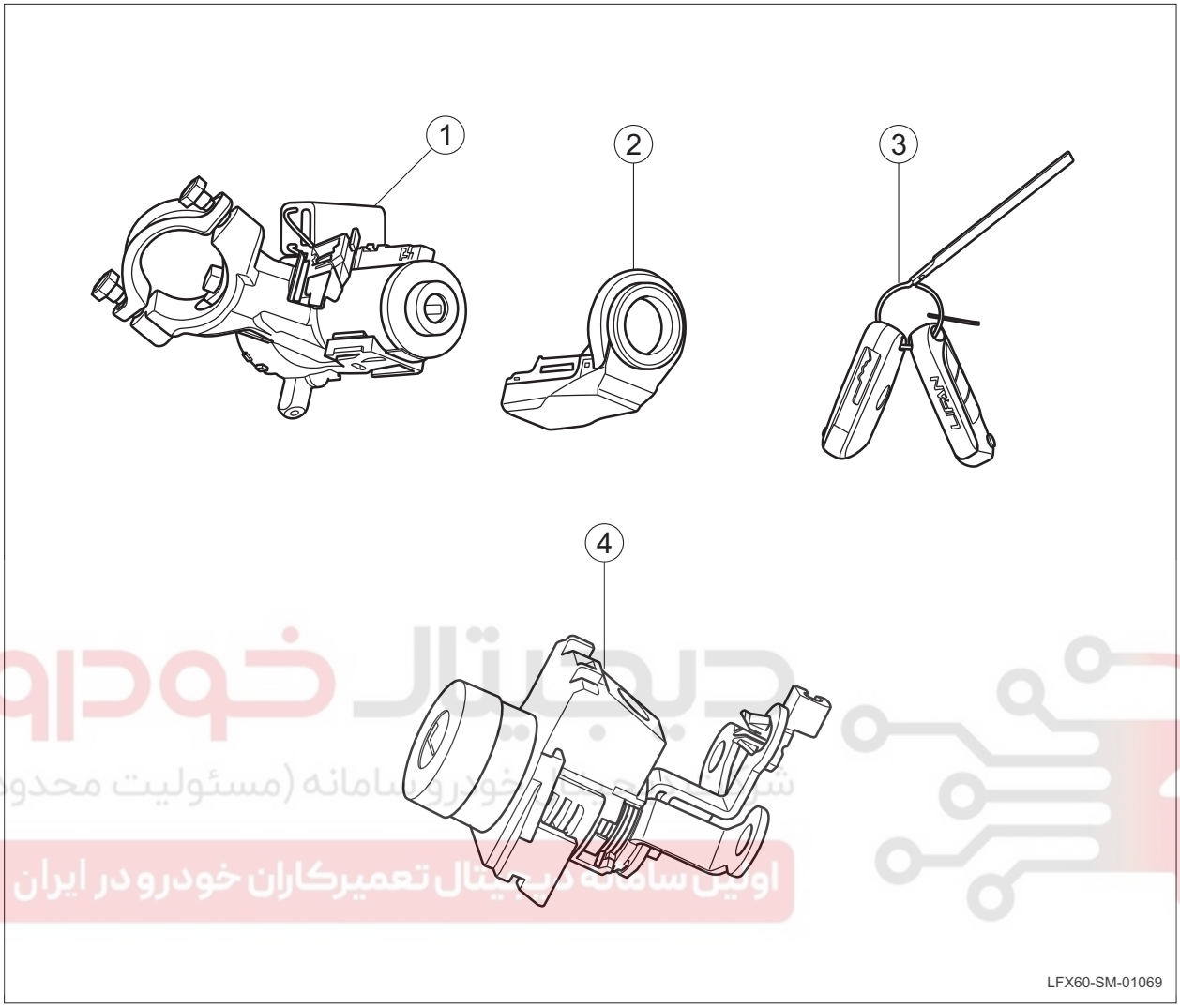
Preparation

General maintenance tools

No.	Tool name	Tool figure	Tool code	Remarks
1	Diagnosis equipment	 LFX60-SM-02802	-	Read immobilizer DTC and data flow etc.
2	Digital universal meter	 LFX60-SM-01041	-	Measure the voltage and resistance
3	Conductor assembly	 LFX60-SM-02801	-	Testing circuit

Structure and installation location

Part figure



No.	Part name
1	Ignition switch components
2	Security read-write recognition coil

No.	Part name
3	Fold the key
4	Left front door lock cylinder

Operating Principle

System Overview

Auto electronic anti-theft system is a kind of world-class new auto anti-theft system. It is generally known as Immobilizer in the industry. This system uses RFID wireless identification technology and radio-frequency signal for transmission, calculation and validation. Compared with traditional after-sales anti-theft system and AlarmSystem, electronic anti-theft system features the following advantages:

- Electronic Alarm System (EAS), consisting of key, immobilizer and ECU, provides direct protection to the engine, which greatly improved the overall security of car.
- EAS adopts multi-level password verification by key, immobilizer and ECU for stronger system security.
- EAS adopts sensing method without any moving parts.
- No sound and light pollution, no malfunction.
- No extra operation, easy to use, no feeling of the existence of the system during normal use.
- It's not allowed to start the engine with jumper wires.

Note

The electronic immobilizer is integrated in the front BCM assembly to realize the anti-theft function.

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System components

Electronic Alarm System is designed for engine. The system consists of a front body controller, a security read-write recognition coil and two remote keys with security cylinders. The security read-write recognition coil is installed on the head of the ignition lock cylinder. The security cylinder is installed in the plastic housing of the remote key.

Front BCM (Body Control Module)

Front BCM contains controller inside, and it consists of microprocessors and peripheral components for the communication between the security cylinder and ECU. When the power state is ON, if the remote key (security cylinder) and ECU are successfully authenticated during the specified short time, the ECU will release the engine, and the car can be started; on the contrary, the engine will not be started, and the anti-theft indicator will be flashing to alert the driver.

Front BCM is connected to the engine ECU through the body harness while following the communication protocol with ECU.

Logic description of body anti-theft function

Anti-theft status management

Initial power-up: The undefended status of the body should be stored in the Electrically Erasable Programmable Read-Only Memory (EEPROM). When BCM is normally on, the undefended status stored in EEPROM shall govern; but when the undefended status of the body changes later, the current status should be written to the EEPROM right now. When the current status is defended, cut off the normally-on state and restore it again, then the status becomes anti-theft status; when the current state is undefended, cut off the normally-on state and restore it again, then the status is still undefended; when the current status is alarm-triggered, cut off the normally-on state and restore it again, then the status is still alarm-triggered.

Alarm settings

To avoid body theft, BCM sets alarm conditions for the closed 4 doors, hood and trunk door.

Set the alarm conditions (or):

1. Remote locking;
2. Secondary locking.

Note

- **When we've set alarm conditions for the car, the opened doors only perform the locking function, and the car gives sound and light hint that the doors are not closed; at this time, if the doors are closed, then we've set alarm conditions for the doors (except for the left front door, because it will be unlocked from locked when it's closed due to its mechanical structure).**
- **When the current status is defended, central unlocking and locking functions not valid.**

Alarm release

Release the alarm conditions (or):

1. Remote unlocking (doors and trunk door);
2. IMMO certified.

Action to release the alarm conditions:

Hazard warning light stops flashing and the speaker stops beeping.

Trigger alarm

Trigger the alarm conditions (or):

1. Power supply (IG ON) is shorted;
2. Any of 4 doors and trunk door is Illegally opened.

Action to trigger the alarm conditions:

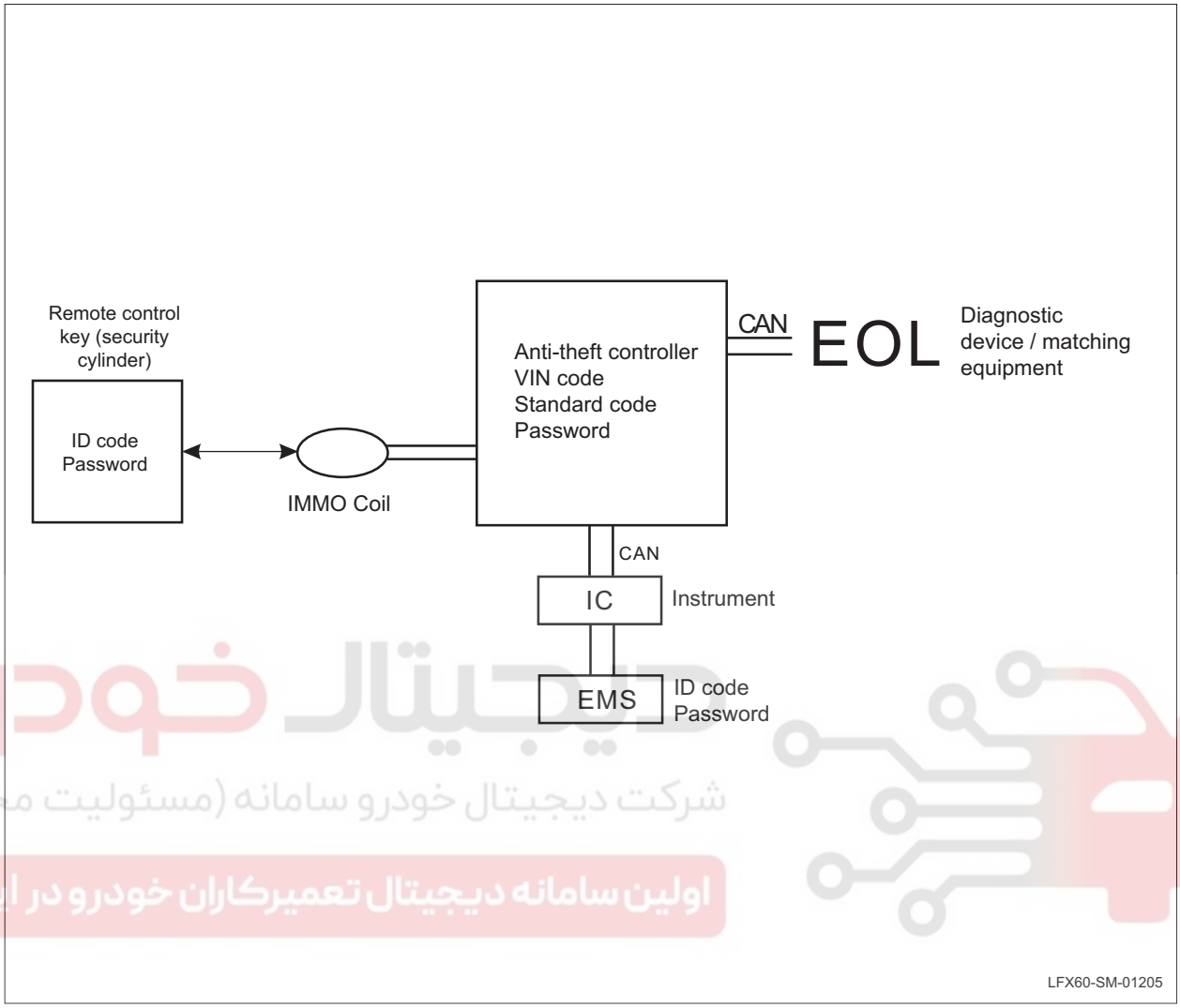
Hazard warning light flashes for 30s, and the speaker beeps 20 times.

Action to release the alarm conditions:

Hazard warning light stops flashing, the speaker stops beeping, and doors or trunk gets unlocked.

Electronic anti-theft system

Connection between the electronic anti-theft system and the car is shown as below:



Diagnostic Information and Procedures

Diagnosis Instructions

Before starting to diagnose a fault in the IMMO (immobilizer), familiarize yourself with the operating principle of the IMMO, and then start the system diagnostics, which helps to determine the correct troubleshooting steps in the event of a failure. More importantly, this also helps to determine whether the customer's situation belongs to normal operation.

Any troubleshooting of the IMMO should begin with the IMMO check, so as to instruct the service personnel to take the next logical step to troubleshoot. Comprehend and correctly use the diagnostic flow chart to shorten the diagnosis time and avoid the misjudgement.

General equipment

Digital universal meter
Diagnostic equipment of vehicle

Visual Inspection

1. Confirm the problem of the customer.
2. Visually check whether there is any obvious mechanical or electrical damage sign.

Visual inspection table

Mechanical	Electrical
• Key battery • Ignition key • Immobilizer identification coil	• Fuse • Harness or plug • BCM • ECM

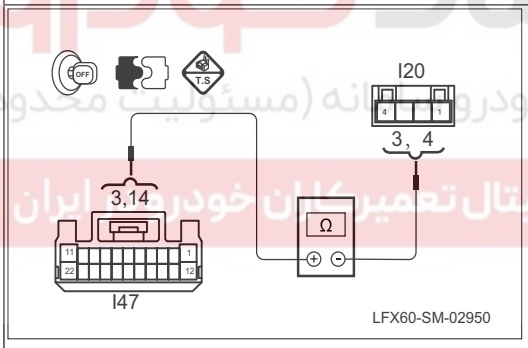
3. If the observed or proposed problem is obvious and its cause is identified, rectify the cause before proceeding with next step.
4. If for the problem, there are no obvious findings, then confirm the fault and refer to the symptom table.

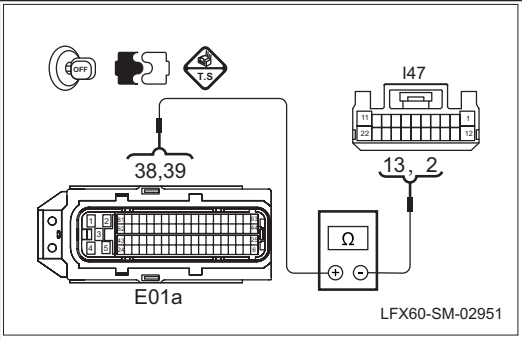
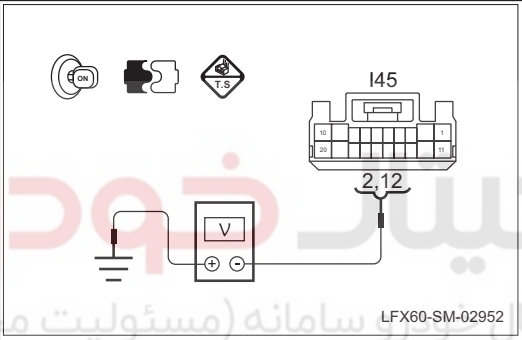
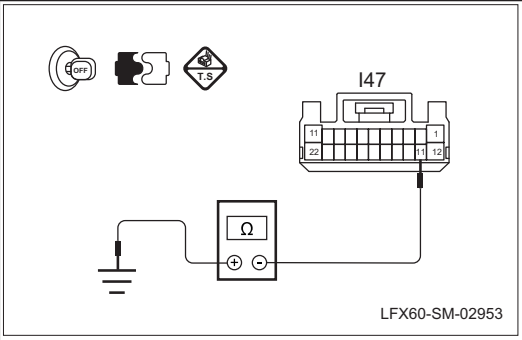
List of fault symptoms

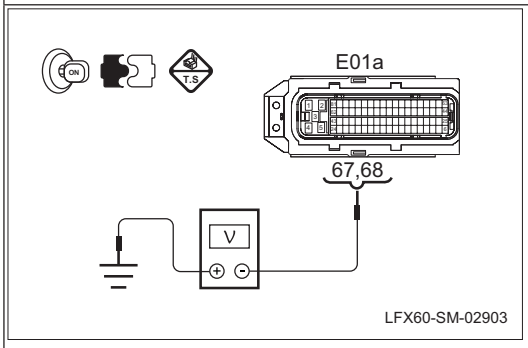
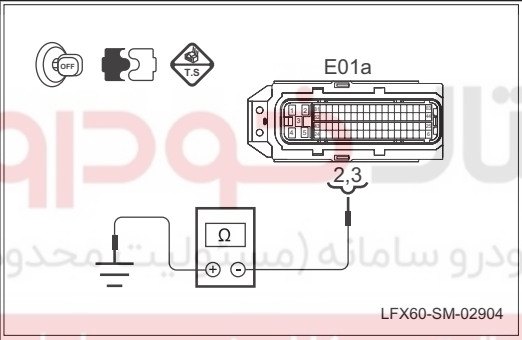
If the vehicle failed, where the control module did not detect the fault code, and visual inspection and general inspection did not locate the fault, it is recommended to troubleshoot according to the following table's diagnostic strategy and process.

Symptom	Possible point of failure	Recommended Measures
Key mismatch	• Wiring harness plug	• Check the harness plug
	• Ignition key	• Check or replace the key
	• Immobilizer identification coil	• Check or replace the security recognition coil
	• BCM	• Replace ECM **Refer to: Replacement of ECM**
	• ECM	• Replace the BCM **Refer to:Replacement of BCM**
ECM always detects that IMMO is not released	• Wiring harness plug	**Refer to: Diagnostic process for the problem that ECM always detects that IMMO is not released**
	• External environment signal interference	
	• Ignition key	
	• Immobilizer identification coil	
	• BCM	
	• ECM	
Automobile diagnosis device is not able to communicate with IMMO	• Harness or plug	**Refer to: Diagnostic process for the problem that the automobile diagnosis device is not able to communicate with IMMO**
	• Diagnostic interface	
	• BCM	

Diagnostic process for the problem that ECM always detects that IMMO is not released

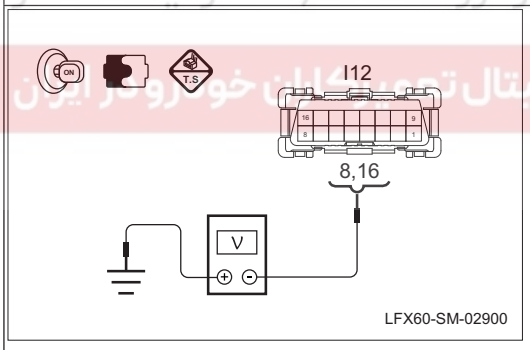
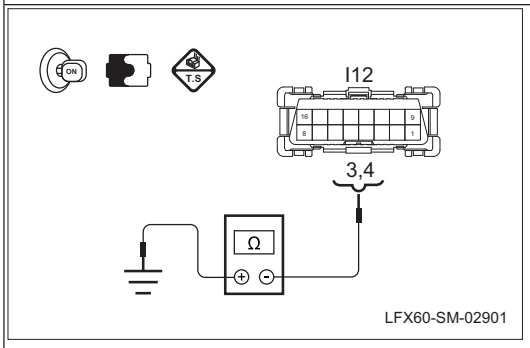
Test condition	Details/results/measures
1. Check the IMMO key.	
	A. Check if the key battery voltage is normal. B. Check if the key is evidently damaged. Is it OK after checking? →**Yes** To step 2. →**No** Replace the ignition key battery or the ignition key.
2. Re-match IMMO	
	A. Operate the ignition switch to turn the power to OFF and connect the diagnostic meter. B. Operate the ignition switch to turn the power to ON state. C. Re-match IMMO. Check whether it is normal? →**Yes** IMMO re-matched. →**No** To step 3.
3. Check the security recognition coil circuit.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the anti-theft identification coil harness plug I20. D. Disconnect BCM harness plug I47. E. Use a multimeter to measure the resistance between terminals 3 and 4 of harness plug I20 of security recognition coil and terminals 3 and 14 of BCM harness plug I47, respectively. **Standard value:Less than 5Ω** Is it OK after checking? →**Yes** To step 4. →**No** Check the security recognition coil circuit for fault; and replace the harness, if necessary.
4. Repair the CAN bus between BCM and ECM.	

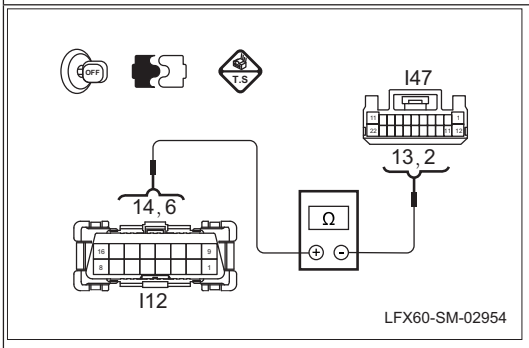
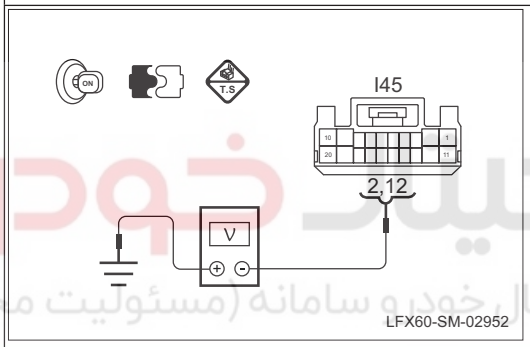
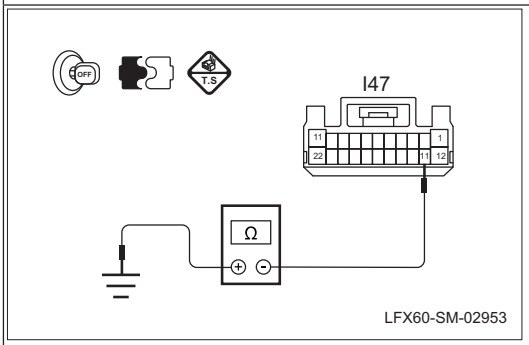
Test condition	Details/results/measures
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the BCM harness plug I47. D. Disconnect the EMC harness plug E01a. E. Use a multimeter to measure the resistance between terminals 13 and 2 of BCM harness plug I47 and terminals 38 and 39 of ECM harness plug E01a, respectively. **Standard value:Less than 5Ω** Is it OK after checking? **→Yes** To step 5. **→No** Repair the CAN bus between BCM and ECM; replace the harness, if necessary.
5. Check the BCM power line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the BCM harness plug I45. D. Connect the battery negative terminal. E. Operate the ignition switch to turn the power to ON state. F. Measure the voltage between the BCM harness plug I45 terminal 12, 2 and fixed ground point with the multimeter. **Standard value:11 ~ 14V** Is the voltage normal? **→Yes** To step 6. **→No** Repair the BCM power line fault and replace the harness if necessary.
6. Check the BCM ground line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the BCM harness plug I47. D. Use a multimeter to measure the resistance between terminal 11 of BCM harness plug I47 and the ground point. **Standard value:Less than 5Ω** Is the resistance normal? **→Yes** To step 7. **→No** Repair the BCM ground line fault and replace the harness if necessary.

Test condition	Details/results/measures
7. Check the ECM power supply line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the EMC harness plug E01a. D. Connect the battery negative terminal. E. Operate the ignition switch to turn the power to ON state. F. Use a multimeter to measure the voltage between terminals 67 and 68 of ECM harness plug E01a and the reliable ground point. **Standard value:11 ~ 14V** Is the voltage normal? →**Yes** To step 8. →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.
8. Check the ECM grounding line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. A. Disconnect the EMC harness plug E01a. B. Use a multimeter to measure the resistance between terminals 2 and 3 of BCM harness plug E01a and the ground point G102a, respectively. **Standard value:Less than 5Ω** Is the resistance normal? →**Yes** To step 9. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.
9. Check the security recognition coil.	
	A. Replace the immobilizer identification coil. Refer to: Replacement of security recognition coil Is the system normal? →**Yes** Replace the security recognition coil. →**No** To step 10.
10. Check the BCM.	

Test condition	Details/results/measures
	A. Replace the BCM. Refer to:Replacement of BCM Is the system normal? →**Yes** Replace the BCM. →**No** To step 11.
11. Check ECM.	
	A. Replace ECM. **Refer to: Replacement of ECM** Confirm that the fault has been ruled out.

Diagnostic process for the problem that the automobile diagnosis device is not able to communicate with IMMO

Test condition	Details/results/measures
1. Check BCM data.	
	A. Operate the ignition switch to turn the power to OFF and connect the diagnostic meter. B. Operate the ignition switch to turn the power to ON state. Turn on the diagnostic meter - use the latest software version. C. Read the BCM data on automobile diagnosis device. Can the diagnostic meter access to the engine system to read the data stream? →**Yes** There is intermittent fault and check the fault. →**No** To step 2.
2. Check other module data.	
	A. Read the airbag and ABS system data. Can the automobile diagnosis device enter the SRS, ABS and other systems to read the data stream? →**Yes** To step 5. →**No** To step 3.
3. Check the diagnostic interface power line.	
	A. Operate the ignition switch to turn the power to ON state. B. Measure the voltage between the terminal 8 and 16 of the diagnostic interface I12 and fixed ground point with the multimeter. **Standard value:11 ~ 14V** Is the voltage normal? →**No** Repair the diagnostic interface power line fault and replace the harness if necessary. →**Yes** To step 4.
4. Check the diagnostic interface ground circuit.	
	A. Operate the ignition switch to turn the power to OFF state. B. Use a multimeter to measure the resistance between terminals 3 and 4 of diagnostic interface I12 and the reliable ground point, respectively. **Standard value:Less than 5Ω** Is the resistance normal? →**Yes** To step 5. →**No** Repair the diagnostic interface ground circuit fault and replace the harness if necessary.

Test condition	Details/results/measures
5. Check BCM communication line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the BCM harness plug E01a. D. Use a multimeter to measure the resistance between terminals 13 and 2 of BCM harness plug I47 and terminals 14 and 6 of diagnostic interface I12, respectively. **Standard value:Less than 5Ω** Is the resistance normal? **→Yes** To step 6. **→No** Check the communication line between the BCM and the diagnostic interface, and replace the harness if necessary.
6. Check the BCM power line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the BCM harness plug I45. D. Connect the battery negative terminal. E. Operate the ignition switch to turn the power to ON state. F. Measure the voltage between the BCM harness plug I45 terminal 12, 2 and fixed ground point with the multimeter. **Standard value:11 ~ 14V** Is the voltage normal? **→Yes** To step 7. **→No** Repair the BCM power line fault and replace the harness if necessary.
7. Check the BCM ground line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. A. Disconnect the BCM harness plug I47. B. Use a multimeter to measure the resistance between terminal 11 of BCM harness plug I47 and the ground point. **Standard value:Less than 5Ω** Is the resistance normal? **→Yes** To step 8. **→No** Repair the BCM ground line fault and replace the harness if necessary.

Test condition	Details/results/measures
8. Check the BCM.	
	A. Replace the BCM. **Refer to: Replacement of BCM** Confirm that the fault has been ruled out.

Removal and installation

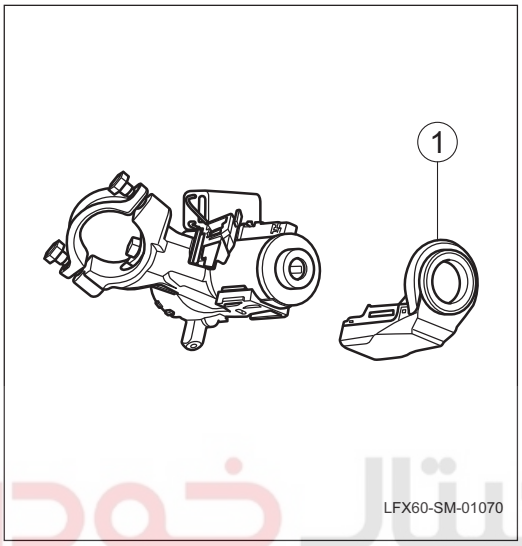
Replacement of security recognition coil

Removal

1. Remove the security recognition coil.

(a). Disconnect the battery negative connector.

(b). Remove the ignition switch components. **Reference: replacement of ignition switch components.**



(c). Use the appropriate tool to remove the security recognition coil.

Installation

1. Install the security recognition coil.

(a). The installation sequence is the reverse of the disassembly order.