12- Electrical system

Communication system

Operating principle

System overview

The vehicle is equipped with two data communication modes of CAN and LIN.

Description of CAN Bus

CAN bus communication medium is a twisted pair; the vehicle is equipped with high-speed CAN bus, with the communication rate of 500kbps. 120Ω termination resistors in CAN network are located in the engine control system (EMS) and the instrument clusteration (IC).

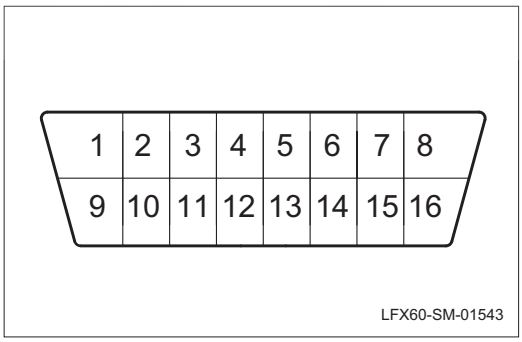
CAN network has the diagnosis function nodes, including:

- Engine control system (ECM)
- Transmission control system (TCM)
- Anti-lock braking system/electronic stability system (ABS/ESP)
- Instrument clusteration (IC)
- Body control system (BCM)
- Anti-theft system (PEPS)
- Tire pressure monitoring system (TPMS)
- Airbag system (ACU)

LIN bus description

LIN bus is a low cost serial communication system for automotive distributed electronic control system. LIN communication mode is used between ESCL and PEPS.

Fault diagnosis interface definition

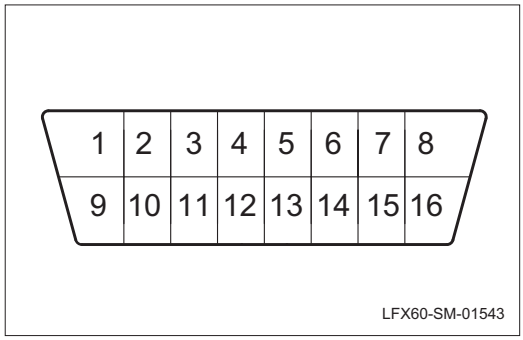


PIN	Definition	PIN	Definition
1		9	
2		10	
3		11	
4	GND	12	
5	GND	13	
6	CANH	14	CANL
7		15	
8		16	BAT

CAN bus integrity inspection

1. Operate the start switch to set the power mode under OFF status.
2. Disconnect the negative battery connector.
3. Measure the resistance between Terminals 6 and 14 of DLC diagnosis interface.

Standard value: 55~63Ω



4. If the displayed resistance value is 110 ~ 125Ω or the line is disconnected, it will indicate CAN bus fault, must inspect the wiring harness connectors of ECM and the instrument cluster; if there is open circuit, poor connection and other abnormities, must repair it.

Diagnosis information and procedures

Diagnosis Instructions

Before the on-board network troubleshooting, must understand and familiarize its working principle, and then perform its diagnosis, so as to determine the correct fault diagnosis procedure in case of fault, and more importantly, to determine whether the situations described by the user are normal.

For any on-board network fault diagnosis, must inspect it firstly, and then guide the maintenance staff to take the next logical steps for fault diagnosis. Comprehend and correctly use the diagnostic flow chart to shorten the diagnosis time and avoid the misjudgement.

General equipment

Name
Diagnostic equipment of vehicle
Digital multimeter

Visual Inspection

1. Confirm the problem raised by the customer.
2. Check for evident mechanical and electrical faults.

Visual inspection table

Electrical
• Battery • Fuse • Loosening or aging of wiring harness connector • Harness

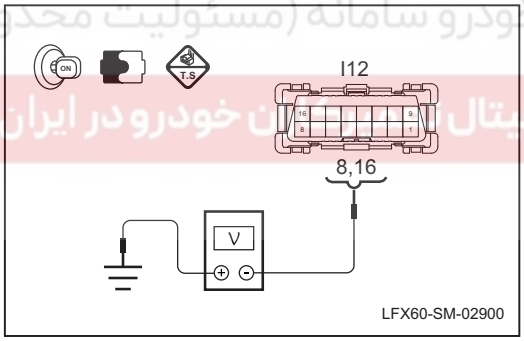
3. Check the system lines easy to see or can be seen.
4. If the observed or raised problem is the evident and the cause has been found, ensure to fix this fault before proceeding with the next step.
5. If no problem is found through the visual check, confirm the fault and refer to the fault symptom list.

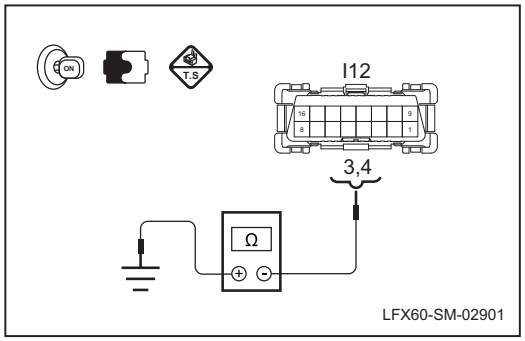
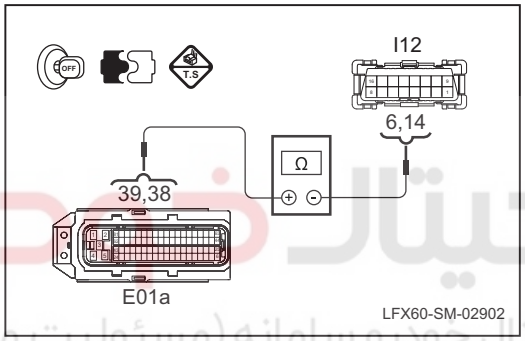
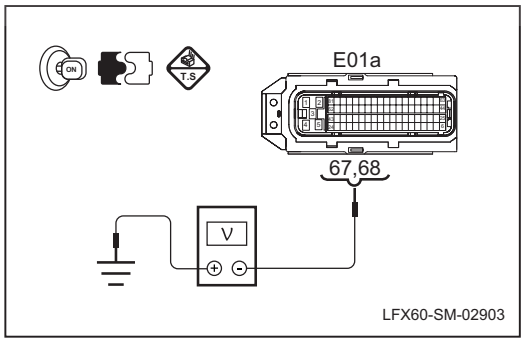
Fault symptoms table

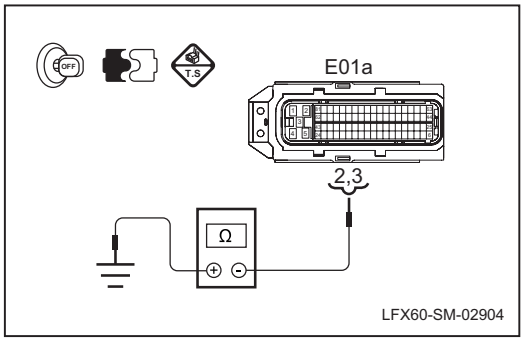
If there is a fault but the fault diagnosis code (DTC) is not stored in the control module and the fault causes can not be confirmed in the basic inspection, must perfrom the fault diagnosis and troubleshooting with the steps listed in the table below.

Symptom	Possible point of failure	Recommended measure
The diagnosiss instrument can not perform CAN communication with ECM	• Diagnostic meter • Line • ECM module	**Refer to: Diagnosis procedure about the diagnosiss instrument can not perform CAN communication with ECM**
The diagnosiss instrument can not perform CAN communication with TCM	• Diagnostic meter • Line • TCM module	• The fault diagnosis flow is similar to that of ECM **Refer to: The diagnostic meter unable to communicate CAN diagnosis flow with ECM**
The diagnosiss instrument can not perform CAN communication with ABS/ ESP	• Line • Instrument cluster • ABS/ESP module	• The fault diagnosis flow is similar to that of ECM **Refer to: The diagnostic meter unable to communicate CAN diagnosis flow with ECM**
The diagnosiss instrument can not perform CAN communication with BCM	• Diagnostic meter • Line • BCM module	• The fault diagnosis flow is similar to that of ECM **Refer to: The diagnostic meter unable to communicate CAN diagnosis flow with ECM**
The diagnosiss instrument can not perform CAN communication with PEPS	• Diagnostic meter • Line • PEPS module	• The fault diagnosis flow is similar to that of ECM **Refer to: The diagnostic meter unable to communicate CAN diagnosis flow with ECM**
The diagnosis instrument can not perfrom CAN communication with the instrument cluster	• Diagnostic meter • Line • Instrument cluster	• The fault diagnosis flow is similar to that of ECM **Refer to: The diagnostic meter unable to communicate CAN diagnosis flow with ECM**
The diagnosiss instrument can not perform CAN communication with TPMS	• Diagnosis equipment • Line • TPMS	• The fault diagnosis flow is similar to that of ECM **Refer to: The diagnostic meter unable to communicate CAN diagnosis flow with ECM**
The diagnosis instrument can not perform CAN communication with the airbag module	• Diagnostic meter • Line • Airbag module	• The fault diagnosis flow is similar to that of ECM **Refer to: The diagnostic meter unable to communicate CAN diagnosis flow with ECM**

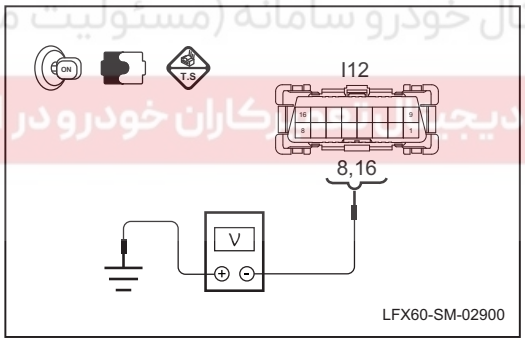
The diagnostic meter unable to communicate CAN diagnosis flow with ECM (Delphi)

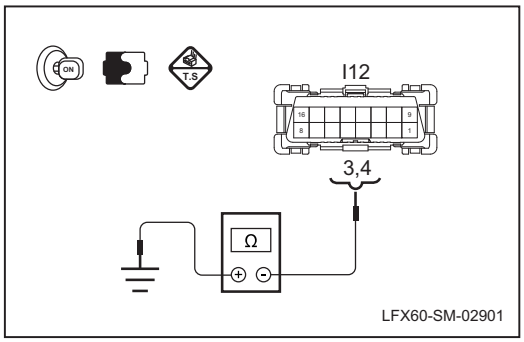
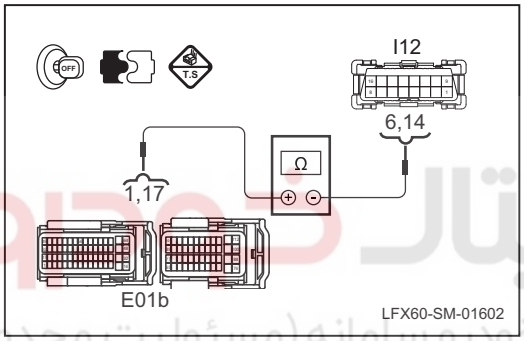
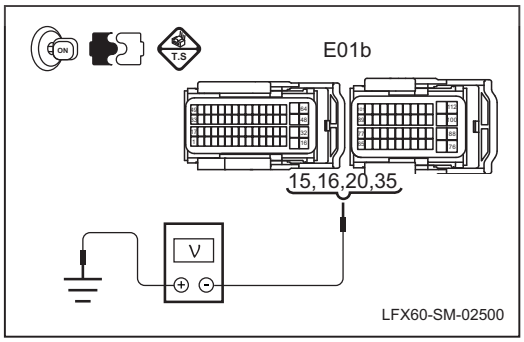
Test condition	Details/results/measures
1. Check the engine data.	
	A. Operate the ignition switch to turn the power to OFF and connect the diagnostic meter. B. Operate the ignition switch to turn the power to ON state. Turn on the diagnostic meter - use the latest software version. C. Read the engine data display in the diagnostic meter. D. Can the diagnostic meter access to the ECM to read the data stream? →**Yes** There is intermittent fault and check the fault. →**No** To step 2.
2. Check the other module data.	
	A. Read the airbag and ABS/ESP system data. B. Can the diagnostic meter access to the airbag system or ABS system 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 ~ 14 V** Is the voltage is OK? →**No** Repair the diagnostic interface power line fault and replace the harness if necessary. →**Yes** To step 4.

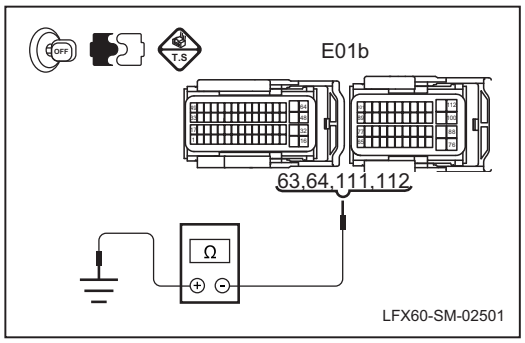
Test condition	Details/results/measures
4. Check the diagnostic interface ground circuit.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Measure the resistance between the terminal 3 and 4 of the diagnostic interface I12 and fixed ground point with the multimeter. **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.
5. Check the ECM communication line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness plug E01a. D. Measure the resistance between the terminal 38, 39 of E01a and the terminal 14 and 6 of diagnostic interface I12 with the multimeter. **Standard value: Less than 5Ω** Is the resistance normal? **→Yes** To step 6. **→No** Repair the communication line fault between the ECM and diagnostic interface and replace the harness if necessary.
6. Check the ECM power.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness plug E01a. D. Connect the battery negative terminal. E. Operate the ignition switch to turn the power to ON state. F. Measure the voltage between the terminal 67, 68 of E01a plug and the fixed ground point with the multimeter. **Standard value: 11 ~ 14 V** Is the voltage is OK? **→Yes** To step 7. **→No** Repair the ECM power line fault and replace the harness if necessary.

Test condition	Details/results/measures
7. Check the ECM grounding line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Measure the resistance between the terminal 2, 3 of E01a plug and the fixed ground point with the multimeter. **Standard value: Less than 5Ω** Is the resistance normal? →**Yes** To step 8. →**No** Repair the ECM ground circuit fault and replace the harness if necessary.
8. Check ECM.	
	A. Replace ECM. **Refer to: ECM** Confirm that troubleshooting is completed.

The diagnostic meter unable to communicate CAN diagnosis flow with ECM (UMC)

Test condition	Details/results/measures
1. Check the engine 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 engine data display in the diagnostic meter. Can the diagnostic meter access to the ECM to read the data stream? →**Yes** There is intermittent fault and check the fault. →**No** To step 2.
2. Check the other module data.	
	A. Read the airbag and ABS/ESP system data. Can the diagnostic meter access to the airbag system or ABS system 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 ~ 14 V** Is the voltage is OK? →**No** Repair the diagnostic interface power line fault and replace the harness if necessary. →**Yes** To step 4.

Test condition	Details/results/measures
4. Check the diagnostic interface ground circuit.	
	A. Operate the ignition switch to turn the power to OFF state. B. VDisconnect the battery negative connector. Measure the resistance between the terminal 3 and 4 of the diagnostic interface I12 and fixed ground point with the multimeter. **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.
5. Check the ECM communication line.	
	A. Operate the ignition switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness plug E01a. D. Measure the resistance between Terminals 1 and 17 of E01b and Terminals 6 and 14 of the diagnosis interface I12 with a multimeter seperately. **Standard value: Less than 5Ω** Is the resistance normal? →**Yes** To step 6. →**No** Repair the communication line fault between the ECM and diagnostic interface and replace the harness if necessary.
6. Check the ECM power supply line.	
	A. Operate the start switch to turn the power to ON state. B. Measure the voltage between terminals 15, 16, 20, 35 of the ECM harness connector E01b and the reliable ground point, respectively, with a multimeter. **Standard value: 11 ~ 14V** Is the voltage is OK? →**Yes** To step 7. →**No** Troubleshoot the ECM power supply line and replace the harness if necessary.
7. Check the ECM grounding line.	

Test condition	Details/results/measures
	A. Operate the start switch to turn the power to OFF state. B. Disconnect the battery negative connector. C. Disconnect the ECM harness connector E01b. D. Measure the resistance between the terminals 63, 64, 111, 112 of the ECM harness connector E01b and the reliable ground point with a multimeter. **Standard value: Less than 5Ω** Is the resistance normal? →**Yes** To step 8. →**No** Troubleshoot the ECM grounding line and replace the harness if necessary.
8. Check ECM.	
	A. Replacement of the engine control module. **Refer to: Replacement of the engine control module (ECM)** Confirm that troubleshooting is completed.