

0301 Delphi Engine Electronic Control System

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1.1 Overview

Engine SQR477F applies the Delphi MT80 engine management system to control the closed-loop control unit, the sequential fuel injection, the distributorless group direct ignition and the three-way catalytic converter aftertreatment.

The MT80 engine management system mainly consists of three parts: electronic control module (ECM), sensor and actuator. The sensor is used to detect the physical signals (temperature, pressure, speed, etc.) of the vehicle, convert them to voltage signals and send them to the ECM. The ECM calculates and analyzes the electric signal data input by the sensor according to the preset program after receiving them, and then sends the corresponding control command to the power drive circuit. The power drive circuit will drive each actuator to perform according to the command, thus enabling the engine to run efficiently and smoothly.

The fault diagnosis system of the engine electronic control module (ECM) is used to monitor every sensor and controller in the system randomly. If detecting and confirming a fault signal, it will store the relevant fault code and activate the "Limp Home" function to run the engine. If detecting that the fault has been eliminated, it will reactivate the normal engine function.

Functions of the engine management system

Intake air pressure/temperature sensor control:

1. Engine torque output control
2. Overall vehicle main power relay control
3. Sequential fuel injection closed-loop control
4. Fuel pump operation control
5. Knock control
6. Electronic throttle control
7. A/C control
8. Cooling fan control
9. Carbon canister solenoid valve control
10. System self-diagnosis
11. ECM anti-theft control
12. Built-in ignition drive module of ECM, distributorless group direct ignition

Features of ECM in the engine management system

1. ECM developed by the high-end market
2. Latest electronic hardware technology
3. High performance 32-bit microprocessor (CPU) is applied
4. High performance-cost ratio

5. I/O input/output port is flexibly customized
6. Meeting the Euro IV emission standards and the EOBD (European On-Board Diagnostics) technology

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1.2 System functions

Calculation of air flow by engine aerothermodynamics

The ECM calculates the air flow and air mass entering the cylinder via signals of the intake air pressure/temperature sensor, and then corrects the injection volume to make the air-fuel ratio meet the requirements of various conditions.

Torque control

The ECM estimates the current torque output required by the engine according to signals of the accelerator pedal position sensor, and controls the engine torque output via sensor information.

Measurement of crankshaft position and engine speed

The ECM determines the crankshaft position and the engine speed according to signals from the 58X ring gear, and accurately controls the engine ignition and the injection timing.

Determination of working sequence of engine cylinders

The ECM recognizes the top dead center of one cylinder via the camshaft position sensor, so as to determine the working sequence of engine cylinders.

Fuel control

There are two modes of fuel control: closed-loop fuel control and open-loop fuel control. The closed-loop fuel control can accurately regulate engine's air-fuel ratio, thus effectively controlling emissions. The open-loop fuel control is applied when the engine is starting or warming up or the oxygen sensor is malfunctioning.

Ignition control

The ignition control system of the engine applies group control.

Knock control

When a knocking is detected by the knock sensor, the system will calculate the ignition advance angle that needs to be delayed or advanced according to the current condition and knock intensity, and adjusts it to the proper ignition angle, thus avoiding or reducing knocking.

Emission control

The three-way catalytic converter can convert the engine exhaust into harmless gas and discharge it to the air. When the engine reaches the normal temperature after warming up, the ECM will activate the closed-loop fuel control to correct the air-fuel ratio, thus realizing the optimum conversion efficiency of the three-way catalytic converter.

Three-way catalytic converter protection

The engine management system has the function to protect the three-way catalytic converter. The ECM estimates the temperature of the three-way catalytic converter according to engine's operation. When it is estimated that the exhaust temperature will exceed converter's maximum permissible temperature for a long time, the ECM will automatically activate the function of three-way catalytic converter protection to keep it at a normal temperature.

System voltage protection

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When the charging system malfunction causes an excessive system voltage, the engine electronic control system will activate the protection program to limit the engine speed, thus avoiding damage to ECM and battery.

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1.3 System control logic

Fuel pump control logic

Fuel pump operation logic:

When the ignition switch is turned on, the fuel pump will operate for 2 seconds. If no valid crankshaft position sensor signal is detected, the fuel pump will stop. Once the valid crankshaft position sensor signal is detected by the ECM, the fuel pump will start to operate.

Fuel pump cut-off logic:

When the crankshaft position sensor signal is lost after 0.6 second or the fuel pump is required to stop by the anti-theft control, the fuel pump will stop operating.

Start-up pilot injection

Start-up pilot injection enables the injectors to spray fuel once when starting the engine and it occurs when:

The engine starts to run (valid 58X signal detected).

The fuel pump relay is operating.

The operating time of fuel pump exceeds the delay time of accumulator.

Start-up pilot injection has not occurred yet.

Once the above conditions are met, the start-up pilot injection will enable the injectors in all the cylinders to inject fuel one time.

Protective fuel cut-off

When one of the following conditions is met, the system will stop the fuel injection:

- The fuel is cut off when the engine speed is higher than 6400 rpm and supplied again when the engine speed is lower than 6000 rpm.
- The fuel is cut off when the system detects the ignition system has a malfunction.
- When the system voltage is higher than 16 V, it enters the electronic throttle function limitation mode (compulsory idling mode).

Ignition coil magnetizing control

The magnetizing time of ignition coil determines the ignition energy of spark plugs. If the magnetizing time is too long, the ignition coil or ignition coil driver will be damaged. If the magnetizing time is too short, the misfire will be caused.

Start-up mode

In the start-up mode, the system uses a fixed ignition angle to ensure the gas mixture in the cylinders is ignited. After the engine runs normally, the start-up mode is exited.

Ignition advance angle

Main ignition advance angle:

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- The main ignition angle is the minimum ignition angle or knocking critical point (KBL) at the optimal torque point (MBT).

Ignition advance angle correction:

- Water temperature correction
- Intake air correction
- Altitude compensation correction
- Idling speed correction
- Acceleration correction
- Power rich correction
- Deceleration fuel cut-off correction
- A/C control correction

Idling control

Basic target idling speed

Setting the basic target idling speed:

Coolant temperature °C	Target idling speed rpm	Coolant temperature °C	Target idling speed rpm	Coolant temperature °C	Target idling speed rpm	Coolant temperature °C	Target idling speed rpm
<-20	1175	20	1150	60	850	100	750
-10	1200	30	1150	70	800	110	750
0	1200	40	1000	80	750	>120	800
10	1150	50	900	90	750		

Knocking control logic

The operation conditions of knocking control are:

- The engine running time should exceed 2 seconds.
- The engine coolant temperature is higher than 70°C.
- The engine speed is higher than 800 rpm.

When the system detects the engine knocking, it quickly delays the ignition advance angle for 3 to 5 degrees depending on different engine speeds, and restores to the normal control within the subsequent 2 to 3 seconds.

Carbon canister solenoid valve control logic

The following conditions must be met before the carbon canister solenoid valve is switched on:

- The system voltage is less than 18 V and more than 8 V.
- The engine coolant temperature is higher than 0°C.
- The engine intake air temperature is higher than 0°C.
- There is no relevant system fault.

The opening angle of carbon canister solenoid valve is determined by the ECM according to engine duty ratio signals.

Cooling fan control logic

The way and conditions in which the cooling fan operates are:

- When the coolant temperature is higher than 95°C, the cooling fan starts operating at low speed.
- When the coolant temperature is higher than 99°C, the cooling fan starts operating at high speed.
- When the coolant temperature is lower than 95°C, the cooling fan stops operating at high speed.
- When the coolant temperature is lower than 90°C, the cooling fan stops operating at low speed.
- When the air conditioner is switched on, the cooling fan starts operating.

Control strategy of the accelerator pedal position sensor

When the ignition switch is in ON position, the system starts self check. If the fault code of accelerator pedal position sensor is not stored in the ECM, the engine malfunction indicator in the dashboard will go out in several seconds after the engine starts. If the system detects that the accelerator pedal position sensor fails, the fault code generated will be stored in the ECM, and the engine MIL will light up permanently.

Operating conditions of the A/C

The A/C system will operate when the following conditions are met:

- The engine running time exceeds 7 seconds.
- The A/C switch is switched on.
- The engine coolant temperature is normal.
- The A/C pressure switch is connected when in medium pressure.

A/C off mode

1. The A/C off mode when the engine speed is excessive:

- The A/C compressor is allowed to activate only when the engine speed is less than 4900 rpm while A/C switch is switched off.
- The A/C compressor will stop operating when the engine speed is more than 5100 rpm while A/C switch is switched on.

2. The A/C off mode when the engine coolant temperature is excessive:

- The A/C compressor is allowed to activate only when the coolant temperature is less than 106°C while A/C switch is switched off.
- The A/C compressor will stop operating when the coolant temperature is more than 108°C while A/C switch is switched on.

3. The disconnect mode of the evaporation tank temperature control:

- When the A/C evaporator temperature is lower than 3°C, the A/C compressor will be disconnected; and when the A/C evaporator temperature is higher than 4°C, the A/C compressor will restart.
- If the A/C evaporator temperature sensor fails, the A/C compressor will be disconnected.

4. The disconnect mode of the A/C pressure switch control:

- When the A/C system pipe pressure is 0.12 Mpa, the A/C compressor will be disconnected.

- When the A/C system pipe pressure is 3.2 Mpa, the A/C compressor will be disconnected.

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1.4 Product specifications**Torque specifications**

Item	Value (N.m)
Crankshaft position sensor	8±2
Camshaft position sensor	8±2
Knock sensor	20±3
Intake air pressure/temperature sensor	6±1
Electronic throttle	10±1
Coolant temperature sensor	22±2
Accelerator pedal assembly	10±2
Oxygen sensor	45±5
Ignition coil	6±1

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1.5 Failures of the engine management system input and output devices

No.	Component name	Symptoms	Maintenance recommendations
1	Crankshaft position sensor	- Engine start failure - Frequent engine flameout - Sporadic flameout - Maximum engine speed of less than 3800 rpm	Replace the crankshaft position sensor
2	Camshaft position sensor	- Engine start failure - Maximum engine speed of less than 4000 rpm - Increased fuel consumption	Replace the camshaft position sensor
3	Knock sensor	- Knocking when accelerating - Incorrect ignition timing - Increased fuel consumption - Inadequate engine power	Replace the knock sensor
4	Intake air pressure/temperature sensor	- High fuel consumption - Frequent engine flameout - Rough idling - Rich gas mixture - Inadequate engine power	Replace the intake air pressure/temperature sensor
5	Electronic throttle	- Engine start failure - No idling speed - Frequent engine flameout - Poor engine operation - Poor engine acceleration performance - Frequent engine flameout	Replace or clean the electronic throttle
6	Coolant temperature sensor	- Engine start difficulty - Rough idling - Disabled cooling fan - Poor engine performance - Incorrect ignition timing	Replace the coolant temperature sensor
7	Oxygen sensor	Improper air-fuel ratio and high exhaust emission	Replace the oxygen sensor

No.	Component name	Symptoms	Maintenance recommendations
		High fuel consumption	
8	A/C pressure switch	- The cooling fan operating at low speed with the A/C turned on - Poor cooling effect with the A/C turned on - The electromagnetic clutch relay out of work with the A/C turned on	Replace the A/C pressure switch
9	Power steering switch	- Engine vibration when turning the steering wheel at idling - The engine cannot be compensated and is easily shut down when idling	Replace the power steering switch
10	Brake switch	- Unsmooth fueling - Abnormal driving	Replace the brake switch
11	Accelerator pedal position sensor	- Limited engine speed - Delayed engine output response - Limited engine output torque	Replace the accelerator pedal position sensor
12	Ignition coil	- Engine start failure - Inadequate engine power and disabled acceleration - Incomplete combustion - Unstable engine operation	Replace the ignition coil
13	Carbon canister solenoid valve	- Unstable engine operation - Poor idling - Incorrect air-fuel ratio	Replace the carbon canister solenoid valve
14	Fuel injector	- Engine start failure or difficulty - Unstable engine operation and vibration - Frequent engine flameout - Black smoke in emissions	Replace the fuel injector
15	Fuel pump	- Engine start failure - Inadequate engine power and disabled acceleration - Engine start difficulty	Replace the fuel pump

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No.	Component name	Symptoms	Maintenance recommendations
		Poor acceleration performance	
16	Cooling fan	- Excessive engine coolant temperature - Intermittent operation of the air conditioner - Low engine coolant temperature	Replace the cooling fan

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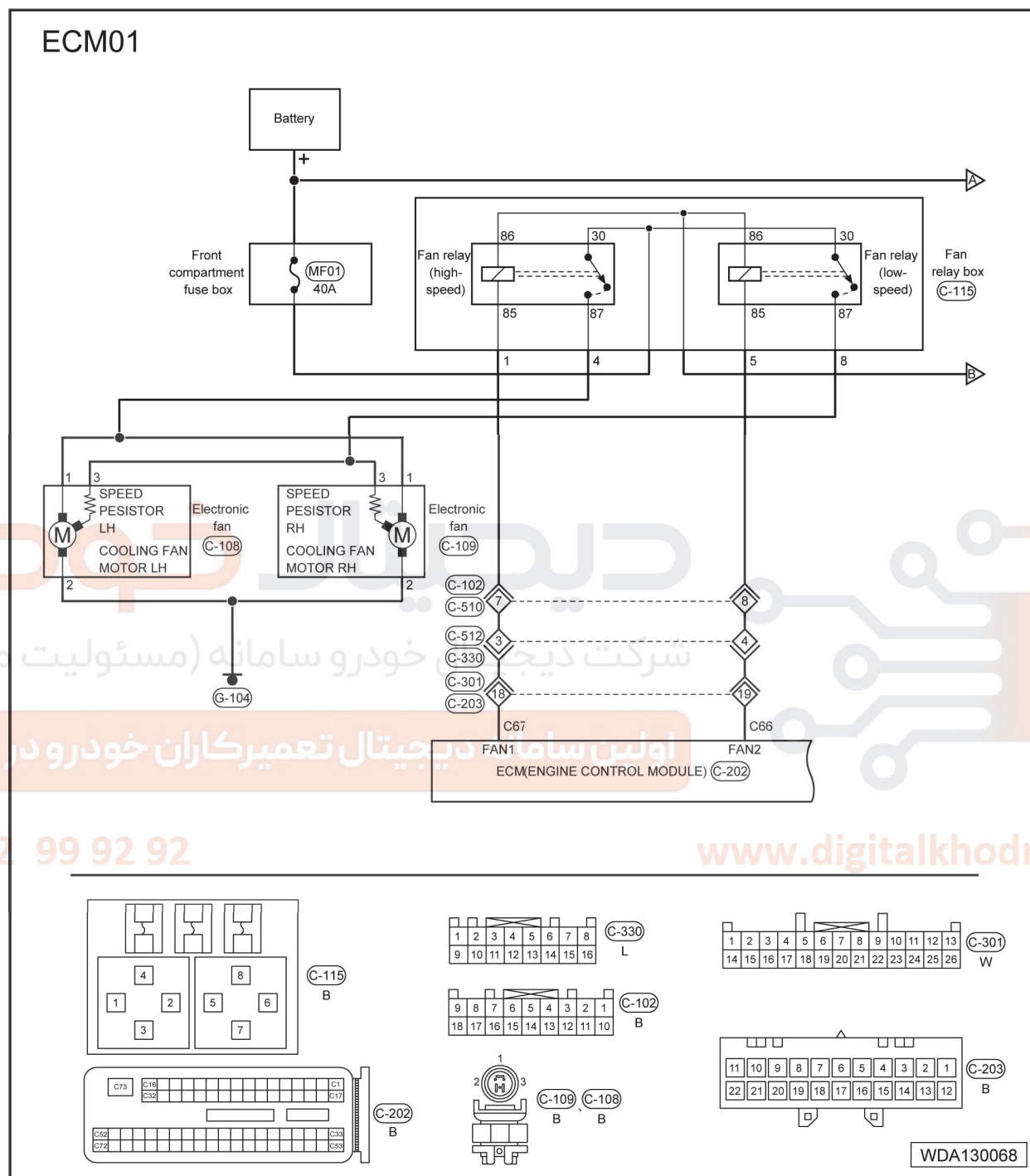


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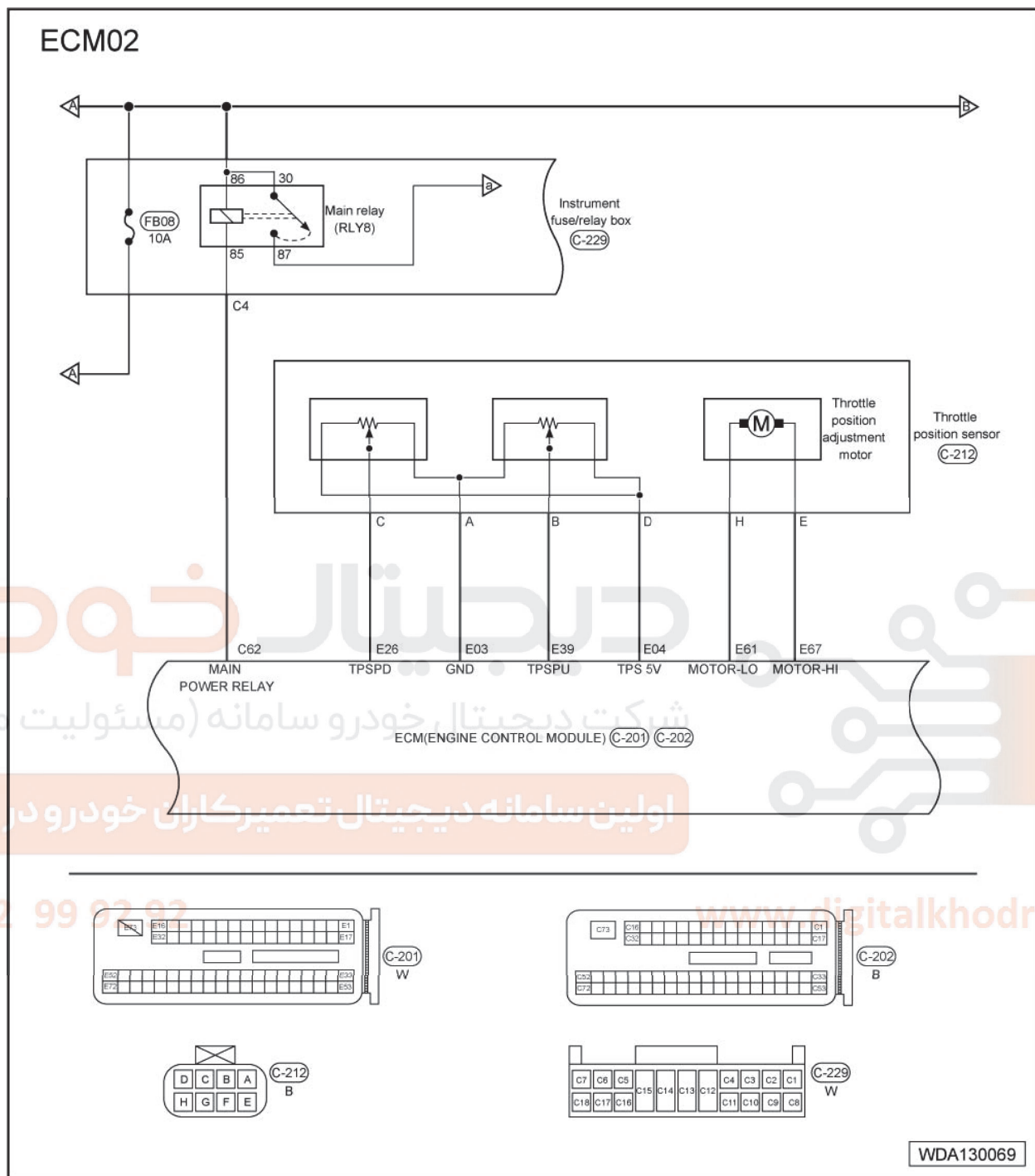
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1.6 Delphi engine electronic control system circuit diagrams

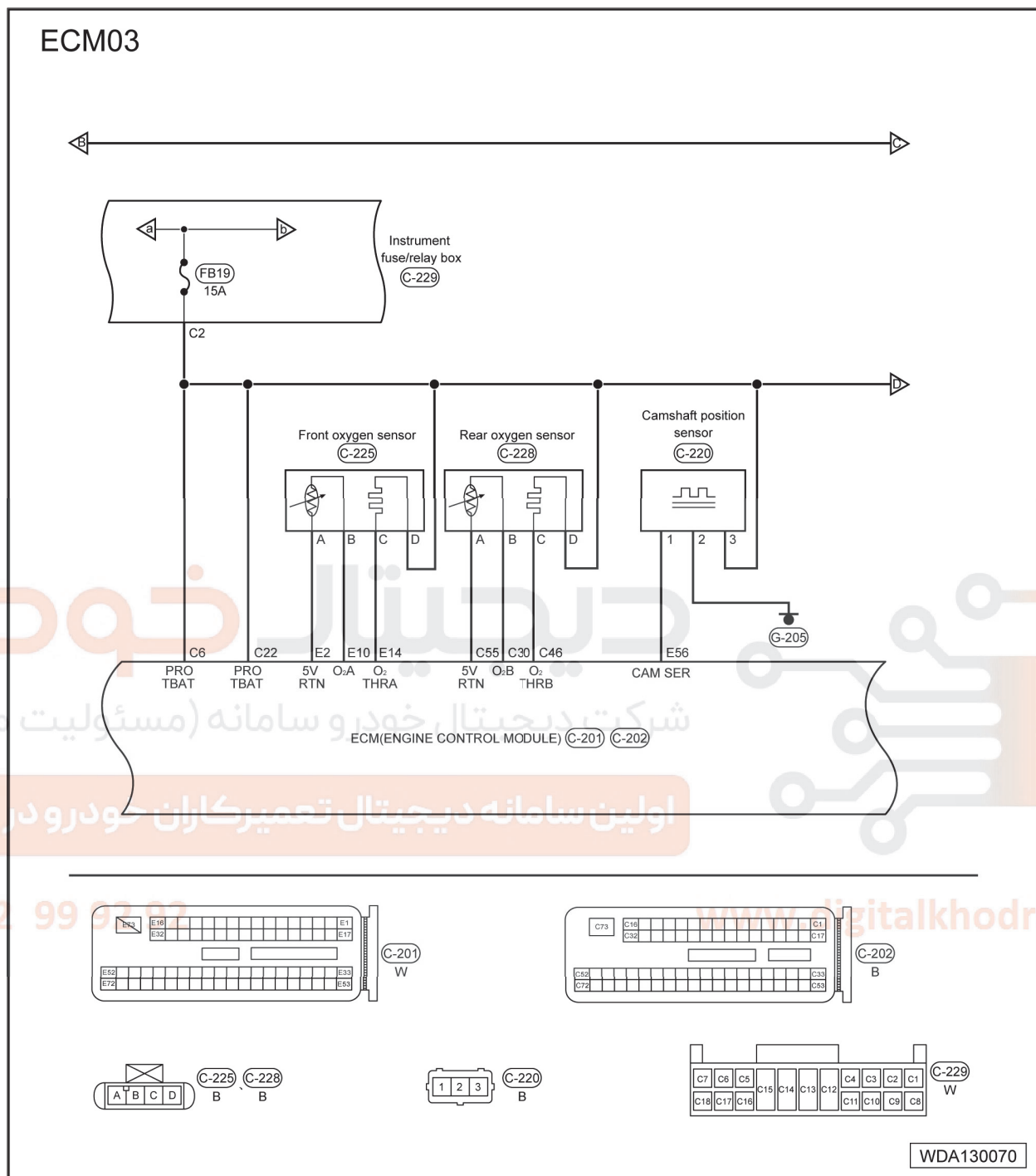
Engine circuit diagram (page 1)



Engine circuit diagram (page 2)

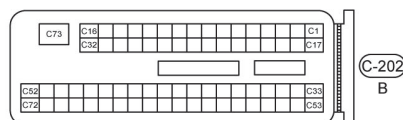
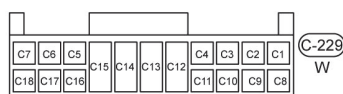
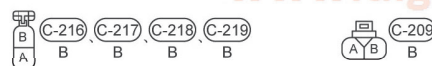
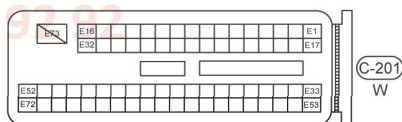
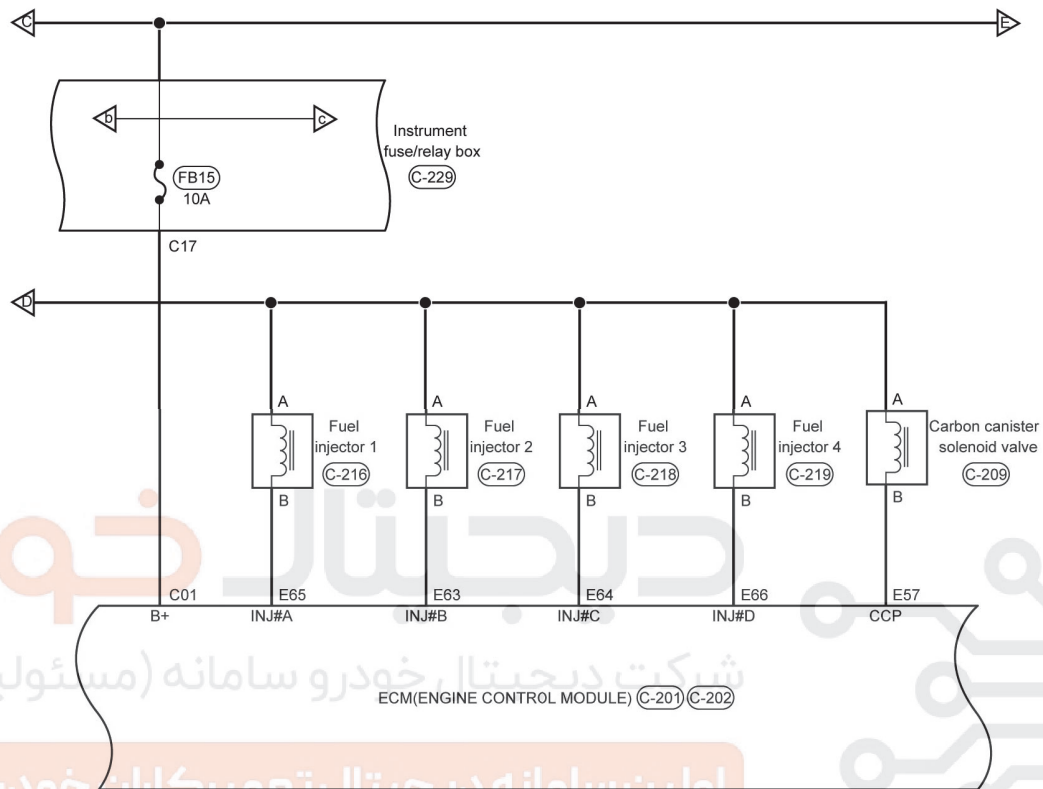


Engine circuit diagram (page 3)



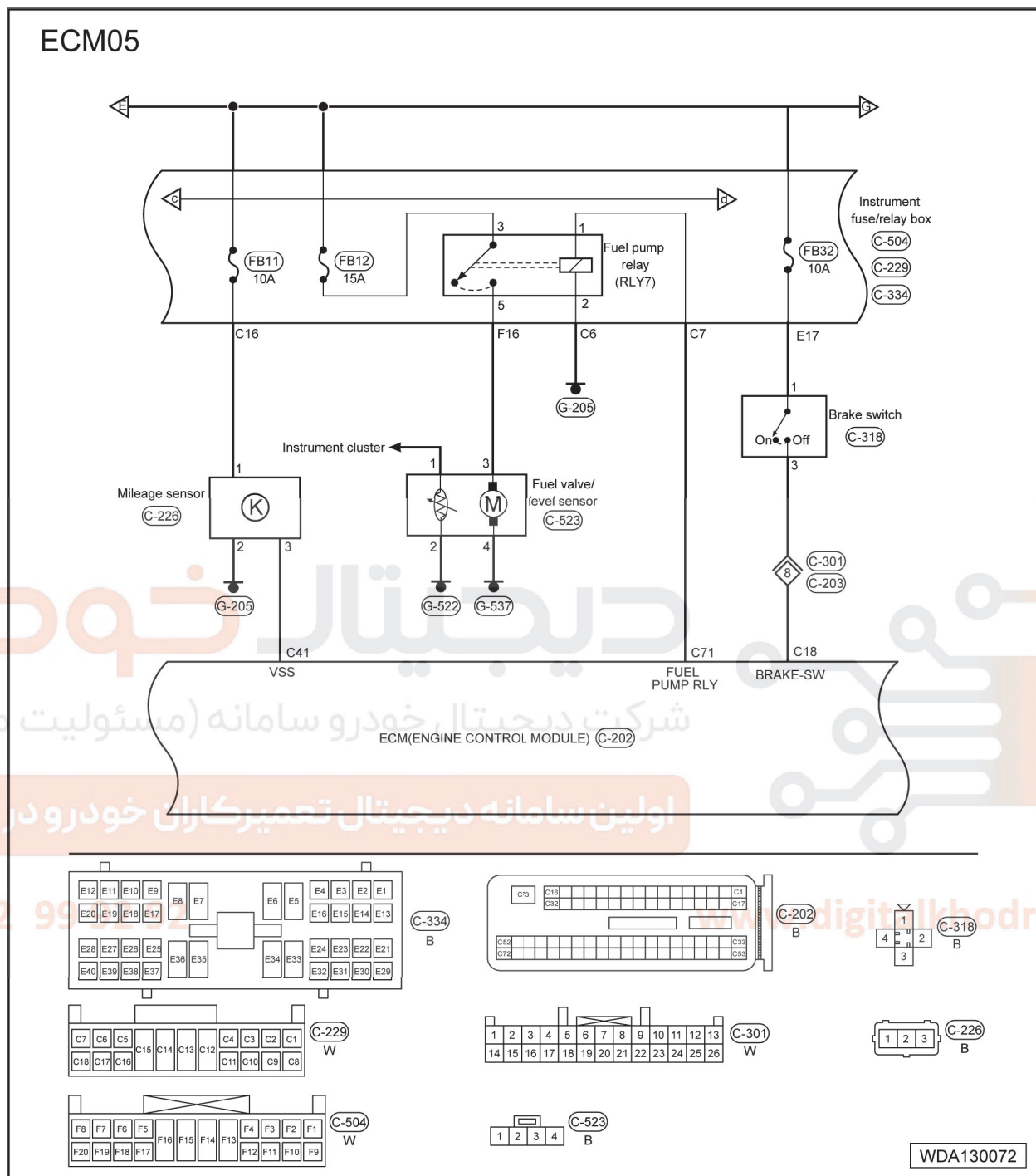
Engine circuit diagram (page 4)

ECM04

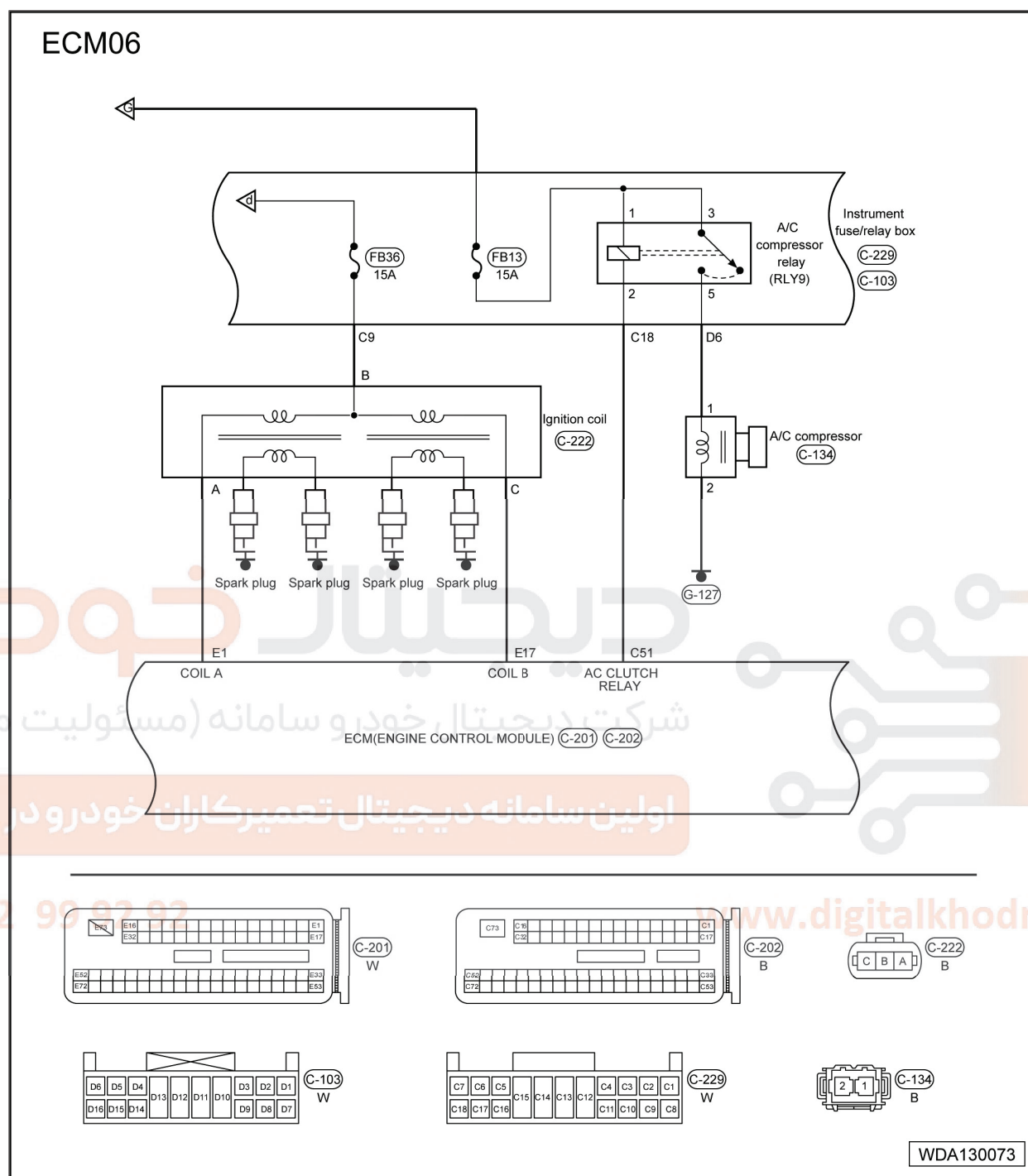


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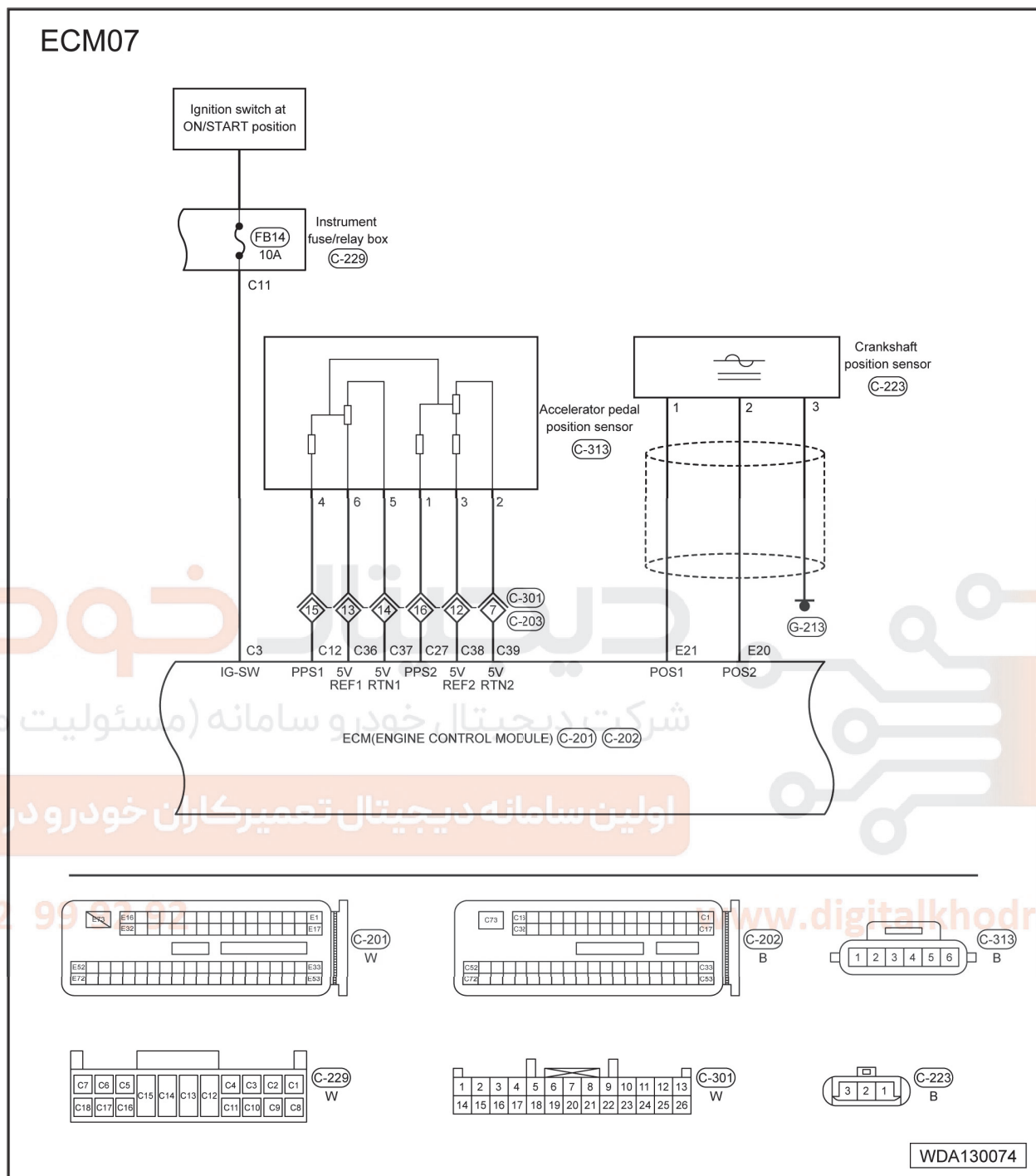
Engine circuit diagram (page 5)



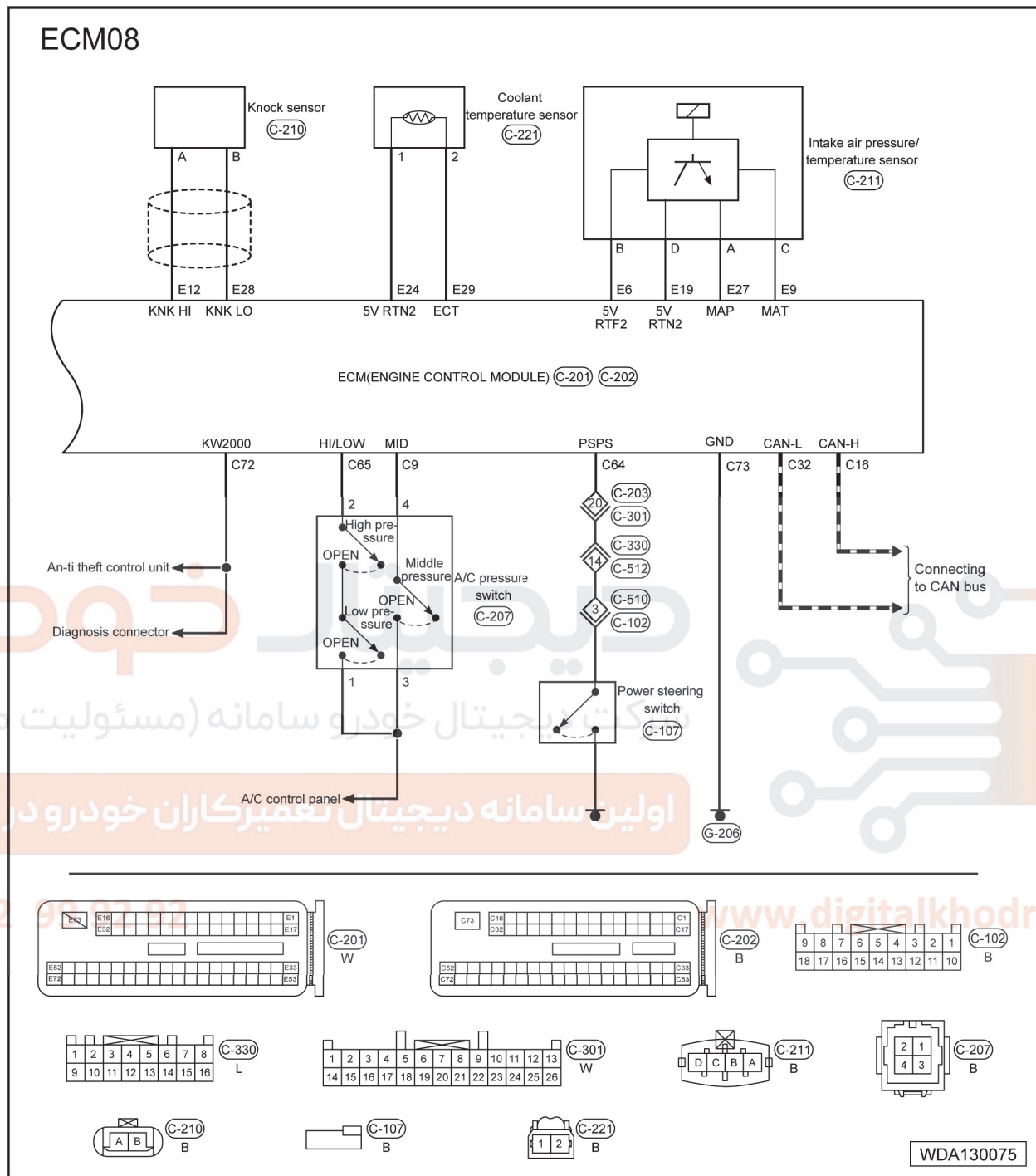
Engine circuit diagram (page 6)



Engine circuit diagram (page 7)



Engine circuit diagram (page 8)



2 Diagnosis and Inspection

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2.1 Diagnosis and troubleshooting of sporadic faults

Diagnosis and inspection for sporadic DTC

If the sporadic DTC faults occur, please check the following items:

- Check if the connector of the DTC-related actuator or sensor is properly installed.
- Check the connector pins of the actuator or sensor for leakage and corrosion.
- Check the leads for bending or squeezing.
- Check the sensor for dirt or damage.
- Check if the routing of wiring harness is correct and proper.

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2.2 Checking earth connection

A good earth connection is prerequisite for ensuring the normal operation of the circuit. If the earth terminal of the circuit is always exposed to the wet and dusty environment, the metal of the earth terminal will corrode and affect the circuit smoothness, thus causing various electrical system malfunctions. As the control circuit is very sensitive, the loosened or corroded wires may significantly affect the transmission of various signals in the electronic control circuit. Therefore, please note the followings when inspecting:

- Replace the earth bolts or nuts.
- Check the earth terminal and coil for corrosion.
- Clean and polish the earth terminal and coil when necessary to ensure good contact.
- Check if there is any accessory interfering with the earth circuit.



2.3 Learning process of the electronic throttle main control

If the following occurs, please perform learning on the electronic throttle main control:

- Replace the engine control module.
- Connect the engine control module again after disconnecting it.
- Replace the accelerator pedal.
- Replace or clean the electronic throttle.

Self-learning process of the electronic throttle actuator:

Learning conditions:

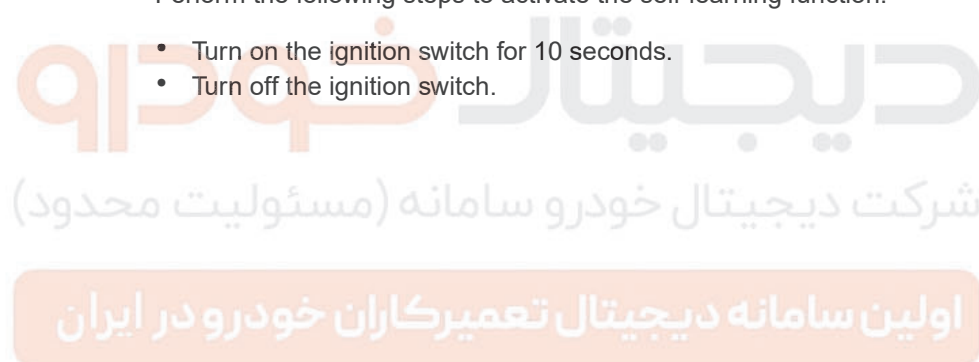
- The battery voltage is within the normal range.
- The cooling fan stops after operating.
- The engine stops running.
- The engine has no fault and fault code.
- The accelerator pedal is fully released.
- The engine performance is normal.

Self-learning operation steps:

Perform the following steps to activate the self-learning function:

- Turn on the ignition switch for 10 seconds.
- Turn off the ignition switch.

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2.4 DTC fault diagnosis list

P 0068	Incorrect electronic throttle air flow
P 0106	Rationality failure of the intake air pressure/accelerator pedal position
P 0107	Intake air pressure sensor circuit low voltage or open circuit
P 0108	Intake air pressure sensor circuit high voltage
P 0112	Intake air temperature sensor circuit low voltage
P 0113	Intake air temperature sensor circuit high voltage or open circuit
P 0117	Coolant temperature sensor circuit low voltage
P 0118	Coolant temperature sensor circuit high voltage or open circuit
P 0122	Electronic throttle position sensor circuit 1 low voltage
P 0123	Electronic throttle position sensor circuit 1 high voltage
P 0131	Front oxygen sensor short to low voltage
P 0132	Front oxygen sensor short to high voltage
P 0133	Slow response of front oxygen sensor
P 0134	Front oxygen sensor open circuit
P 0135	Failure of the front oxygen sensor heater
P 0137	Rear oxygen sensor short to low voltage
P 0138	Rear oxygen sensor short to high voltage
P 0140	Rear oxygen sensor open circuit
P 0141	Failure of the rear oxygen sensor heater
P 0171	Fuel system too lean
P 0172	Fuel system too rich
P 0222	Electronic throttle position sensor circuit 2 low voltage
P 0223	Electronic throttle position sensor circuit 2 high voltage
P 0230	Failure of the fuel pump relay
P 0261	Fuel injector 1 circuit low voltage
P 0262	Fuel injector 1 circuit high voltage
P 0264	Fuel injector 2 circuit low voltage
P 0265	Fuel injector 2 circuit high voltage
P 0267	Fuel injector 3 circuit low voltage
P 0268	Fuel injector 3 circuit high voltage
P 0270	Fuel injector 4 circuit low voltage
P 0271	Fuel injector 4 circuit high voltage
P 0300	Misfire of the single cylinder or multiple cylinders
P 0324	Failure of the knock control system
P 0325	Failure of the knock sensor
P 0335	No signal in the crankshaft position sensor circuit

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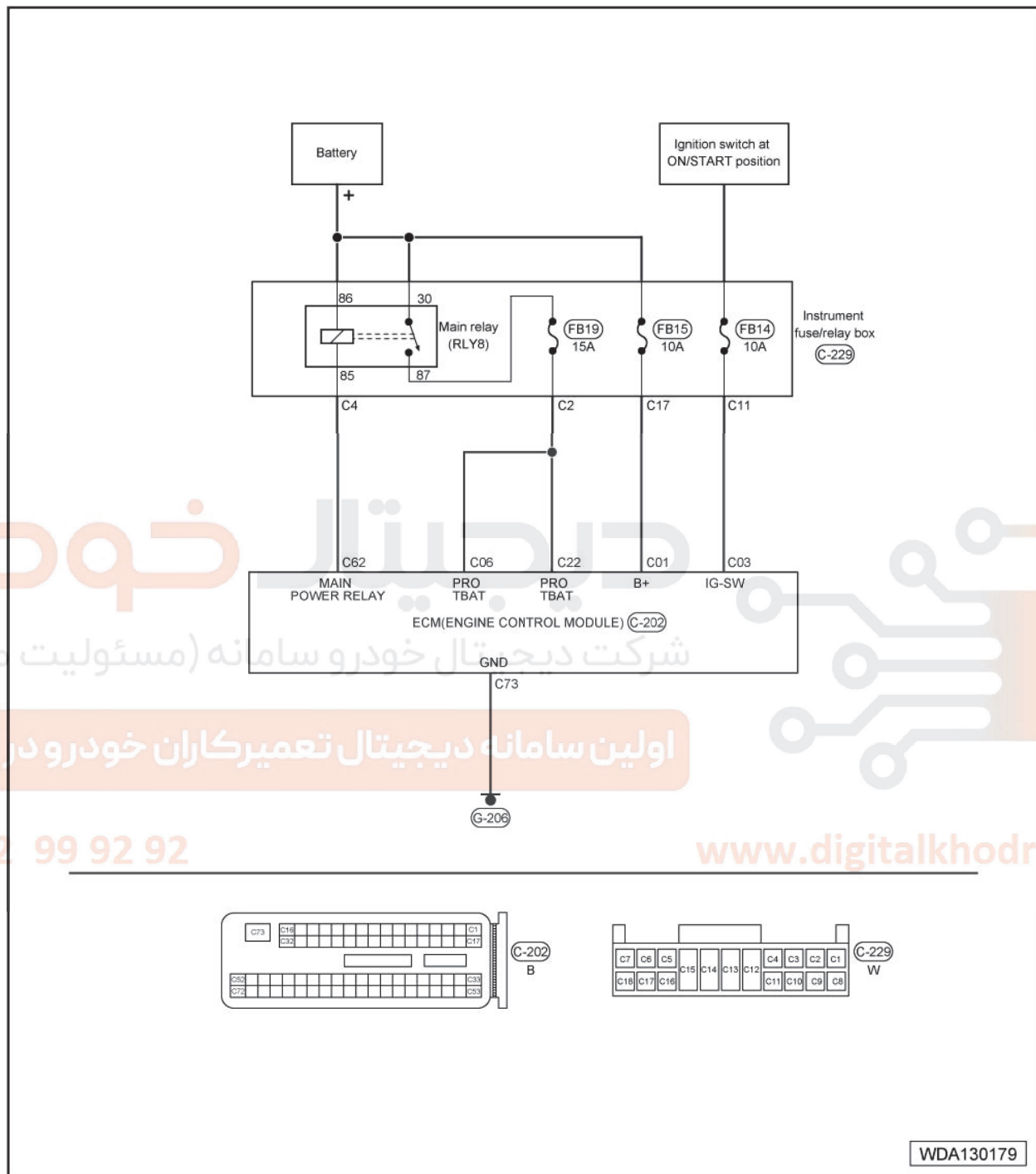
P 0336	Signal interference in the crankshaft position sensor circuit
P 0340	No signal in the camshaft position sensor circuit
P 0341	Rationality failure of the camshaft position sensor circuit
P 0351	Failure of the ignition coil 1
P 0352	Failure of the ignition coil 2
P 0420	Low catalytic converter efficiency
P 0458	Carbon canister solenoid valve circuit short to low voltage or open circuit
P 0459	Carbon canister solenoid valve circuit short to high voltage
P 0462	Accelerator pedal position sensor circuit short to low voltage
P 0463	Accelerator pedal position sensor circuit short to high voltage
P 0480	Failure of the low speed cooling fan
P 0481	Failure of the high speed cooling fan
P 0502	No signal in the vehicle speed sensor
P 0504	Correlation failure of the brake switch
P 0537	A/C evaporator temperature sensor circuit short to low voltage
P 0538	A/C evaporator temperature sensor circuit short to high voltage or open circuit
P 0551	Failure of the power steering switch circuit voltage range/performance
P 0552	Power steering switch circuit short to low voltage
P 0553	Power steering switch circuit short to high voltage
P 0562	System voltage low
P 0563	System voltage high
P 0571	No change in the brake lamp switch during braking
P 0601	ROM error
P 0602	Failure of the ECM processor
P 0604	RAM error
P 0606	Failure of the ECM processor
P 060A	Failure of the ECM programming
P 0633	Anti-theft control not learned
P 0641	ETC reference voltage amplitude value A error
P 0646	A/C clutch relay circuit short to low voltage or open circuit
P 0647	A/C clutch relay circuit short to high voltage
P 0650	Failure of the failure indicator
P 0651	ETC reference voltage amplitude value B error
P 0685	Failure of the main relay

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P 1167	Front oxygen too rich when decelerating and cutting off fuel
P 1171	Front oxygen too lean when accelerating and becoming rich
P 1336	58-tooth gear tolerance not learned
P 1397	No signal in the wheel speed sensor
P 1516	ETC driver two-phase diagnosis error
P 2101	ETC driver stable state diagnosis error
P 2104	Engine compulsory idling
P 2105	Engine compulsory stopping
P 2106	Engine performance limitation
P 2110	Engine power management
P 2119	Return failure of the electronic throttle
P 2122	Electronic accelerator pedal position sensor circuit 1 low voltage
P 2123	Electronic accelerator pedal position sensor circuit 1 high voltage
P 2127	Electronic accelerator pedal position sensor circuit 2 low voltage
P 2128	Electronic accelerator pedal position sensor circuit 2 high voltage
P 2135	Correlation failure of the electronic throttle position sensor circuit 1 and 2
P 2138	Correlation failure of the electronic accelerator pedal position sensor circuit 1 and 2
P 2610	Failure of LPC
P 2610	Reset failure of LPC
U 0167	No response in the anti-theft control
U 0426	Failure of the anti-theft control authentication

2.5 Testing the ECM power and ground circuit

2.5.1 Testing the ECM power circuit



Values of the ECM power supply line

ECM pin No.	Function	Condition	Value (DC voltage range)
C1	Providing power constantly	The ignition switch in the LOCK, ON or START position	Battery voltage
C3	ECM energized	The ignition switch in the ON position	Battery voltage

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:

1. Check if the ECM power supply fuses FB14 (10A) and FB15 (10A) are normal.

- If yes, go to step 2.
- If not, replace the failed fuse. ■

2. Check if the lead between the battery positive terminal and the FB15 (10A) fuse pin has short or open circuit.

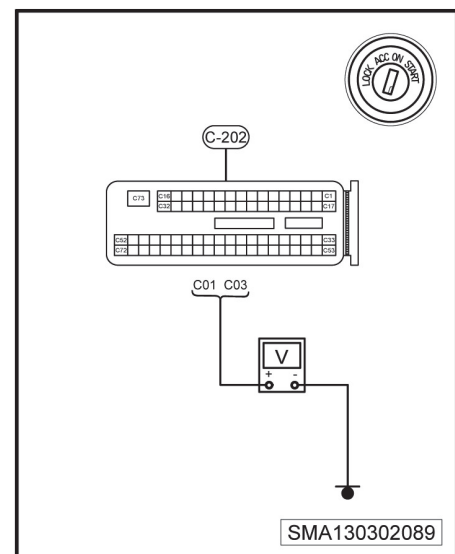
- If yes, repair the defective lead. ■
- If not, go to step 3.

3. Check if the lead between the ignition switch and the FB14 (10A) fuse pin has short or open circuit.

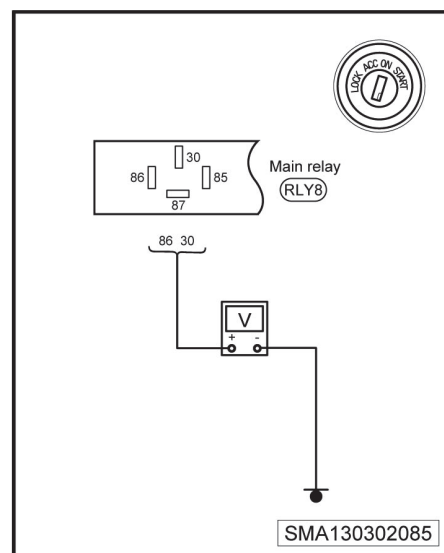
- If yes, repair the defective lead. ■
- If not, go to step 4.

4. Turn the ignition switch to the ON position, disconnect the ECM connector C-202 and check if the voltage between the pins C1 and C3 of C-202 is battery voltage.

- If yes, go to step 5.
- If not, the lead between the ECM connector and the fuse/relay box fails and please repair the defective lead. ■



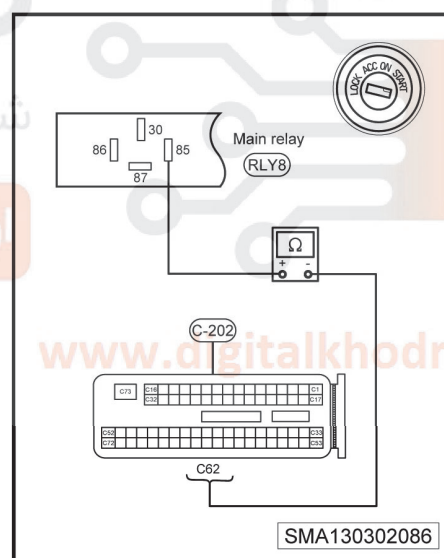
5. Pull out the main relay (RLY8), and check if the voltage between the pins 86 and 30 of the relay is battery voltage.
 - If yes, go to step 6.
 - If not, the lead between the fuse/relay box and the battery positive terminal fails or the fuse/relay box fails. ■



6. Check if the relay is normal.
 - If yes, go to step 7.
 - If not, the main relay fails and please replace it. ■

7. Check if the lead between the pin 85 of the main relay and the pin C62 of the ECM C-202 has short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 8.



8. Check if the ECM power supply fuse FB19 (15A) is normal.

- If yes, go to step 9.
- If not, replace the fuse FB19. ■

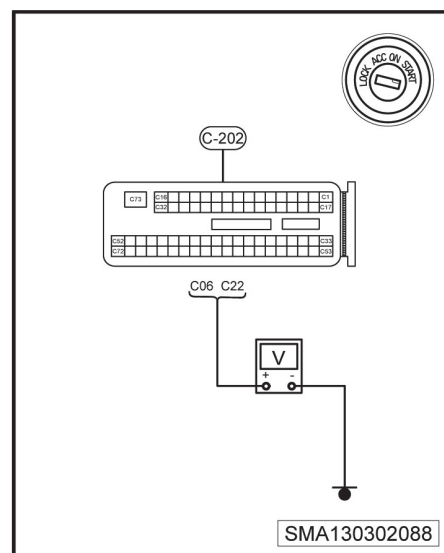
9. Pull out the main relay (RLY8) and the fuse FB19 (15A) and check if the circuit between the main relay and the fuse pin FB19 is conducted.

- If yes, go to step 10.
- If not, the fuse/relay box fails. ■

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10. Disconnect the ECM connectors C-201 and C-202, and pull out the main relay (RLY8). Short-circuit the main relay pins 30 and 87 with the short connector, and check if the voltage between the pins C6 and C22 of C-202 is battery voltage.

- If yes, go to step 11.
- If not, the lead between the pins C6 and C22 of C-202 and the main relay fails and please repair the defective lead. ■



11. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

03

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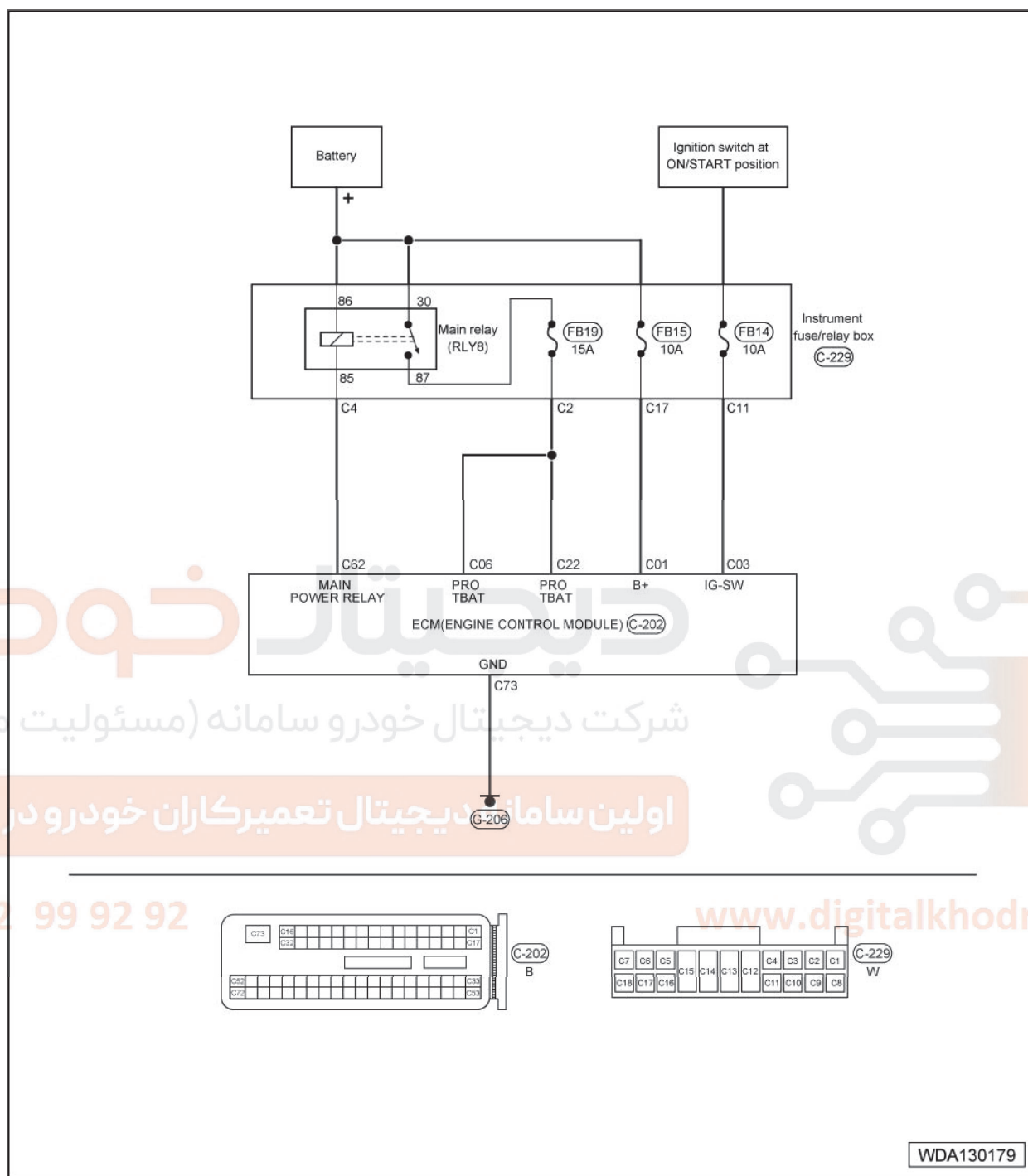
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2.5.2 Testing the ECM ground circuit



03

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.

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- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:

1. Disconnect the battery negative terminal, and pull out the ECM connectors C-201 and C-202. Check if the circuit between the pin C73 of ECM C-202 and the battery negative terminal is conducted.
 - If yes, go to step 4.
 - If not, go to step 2.
2. Unscrew the earth terminal G206 from the ECM, and check if the lead between the pin C73 of the ECM C-202 and the earth terminal has short or open circuit.
 - If yes, repair the defective lead. ■
 - If not, go to step 3.
3. Check if the earth terminal has oxide and corrosion.
 - If yes, clean the earth terminal G206. ■
 - If not, go to step 4.
4. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.
 - If yes, find the fault cause from other symptoms.
 - If not, the fault has been rectified. ■

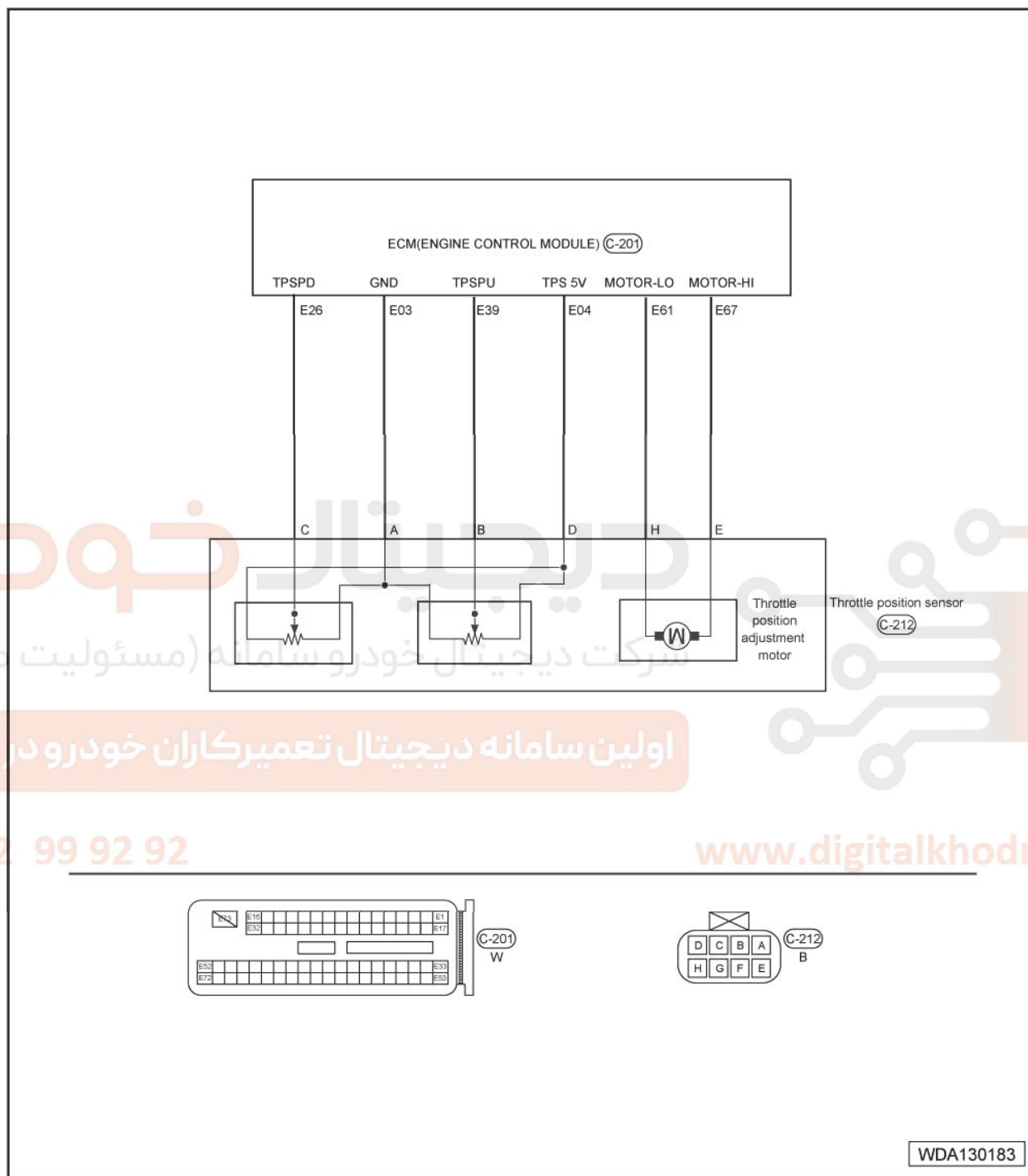
03



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2.6 DTC diagnosis procedures

2.6.1 P0068 Incorrect electronic throttle air flow



Values between the ECM and the electronic throttle

ECM pin No.	Function	Condition	Value (DC voltage range)
E3	Sensor grounded	The ignition switch in the ON position	0 V
E4	Sensor power supply	The ignition switch in the ON position	5 V

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ECM pin No.	Function	Condition	Value (DC voltage range)
E26	"1" sensor signal	The ignition switch in the ON position	0 V
E39	"2" sensor signal	The ignition switch in the ON position	0 V
E61	Throttle position adjustment motor	The ignition switch in the ON position	0.5 V
E67	Throttle position adjustment motor	The ignition switch in the ON position	5 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0068	Incorrect electronic throttle air flow	Start the engine and there is no failure of intake air pressure/temperature sensor	There is deviation between the air flow calculated by a speed-density method and the predicted electronic throttle position air flow	• Failure of the electronic throttle • Intake system leakage • Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:

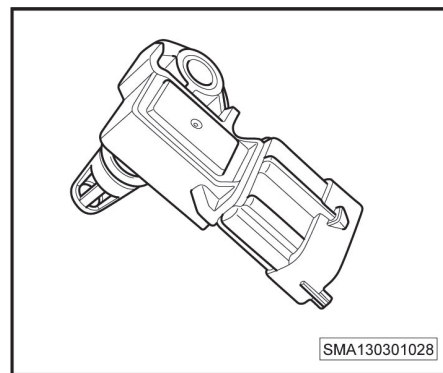
i Note

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check for leakage of the intake systems such as the vacuum booster pump hose, crankcase ventilation hose and activated carbon canister intake hose.
 - If yes, the intake system fails and please repair the leak point. ■
 - If not, go to step 2.

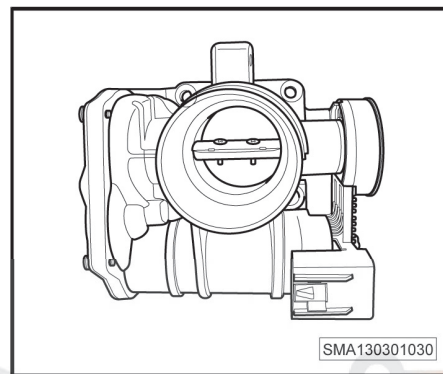
2. Remove the intake air pressure/temperature sensor and check if the sensor has any dust or other foreign matters on it.

- If yes, clean or replace the intake air pressure/temperature sensor. ■
- If not, go to step 3.



3. Remove the air filter assembly and check if the electronic throttle plate has carbon deposit or dust.

- If yes, clean the electronic throttle. ■
- If not, go to step 4.

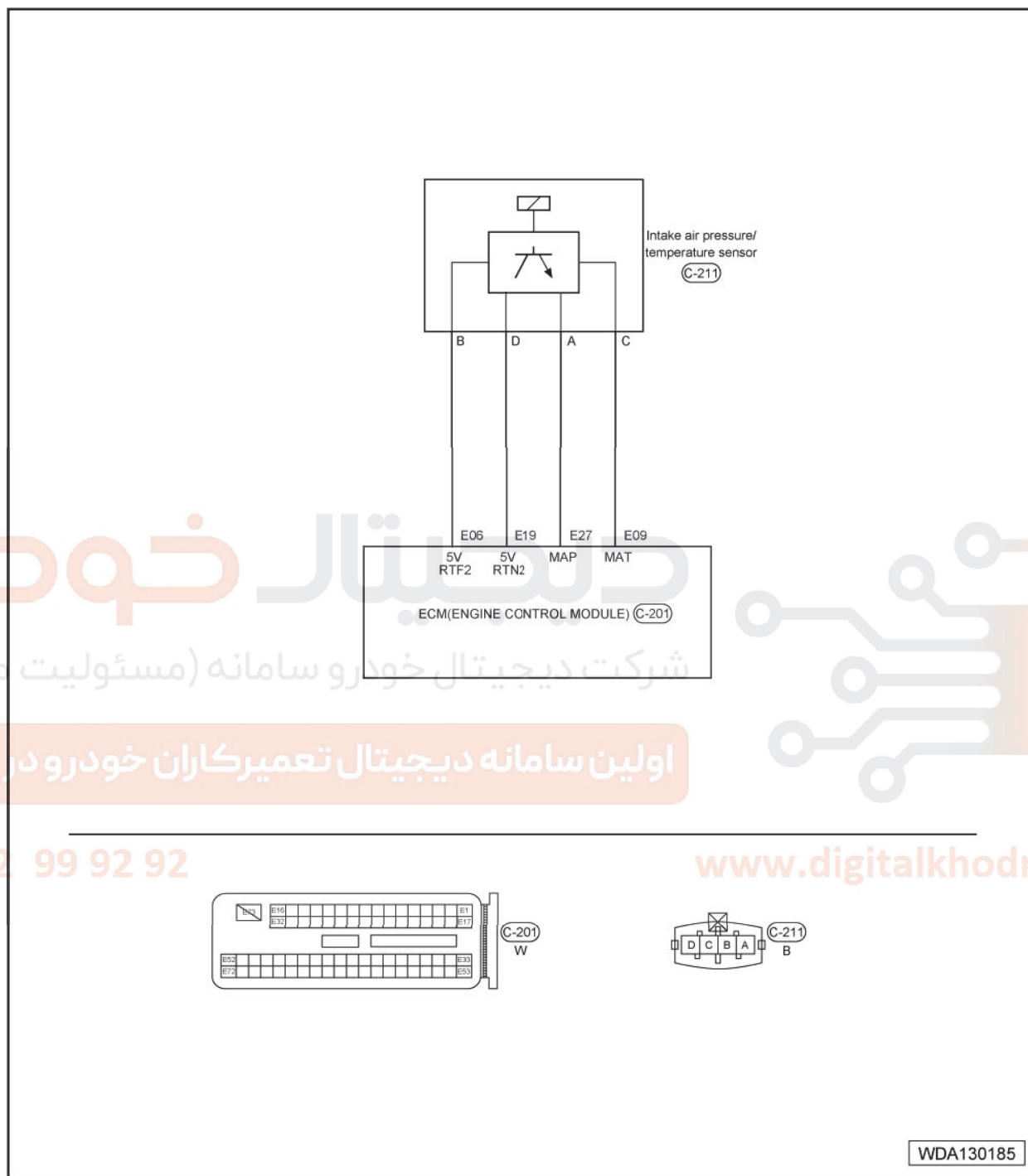


4. Restore the vehicle to its normal state, connect the diagnostic device and check if the reading of the "electronic throttle related data flow" is normal.

- If yes, go to step 5.
- If not, refer to the information related to the electronic throttle failure and eliminate the electronic throttle failure. ■

5. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.2 P0107 Intake air pressure sensor circuit low voltage or open circuit**P0108 Intake air pressure sensor circuit high voltage**

Values between the ECM and the intake air pressure/temperature sensor

ECM pin No.	Function	Condition	Value (DC voltage range)
E6	Sensor power supply	The ignition switch in the ON position	5 V
E9	Intake air temperature sensor signal	The ignition switch in the ON position	0 V

ECM pin No.	Function	Condition	Value (DC voltage range)
E19	Sensor grounded	The ignition switch in the ON position	5 V
E27	Intake air pressure sensor signal	The ignition switch in the ON position	0 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0107	Intake air pressure sensor circuit low voltage or open circuit	Under the idling condition	Intake air pressure sensor circuit low voltage or open circuit	- Failure of the intake air pressure sensor - Failure of the intake air pressure sensor circuit - Failure of the engine control module
P0108	Intake air pressure sensor circuit high voltage	Under the idling condition	Intake air pressure sensor circuit high voltage	- Failure of the intake air pressure sensor - Failure of the intake air pressure sensor circuit - Failure of the engine control module

03

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

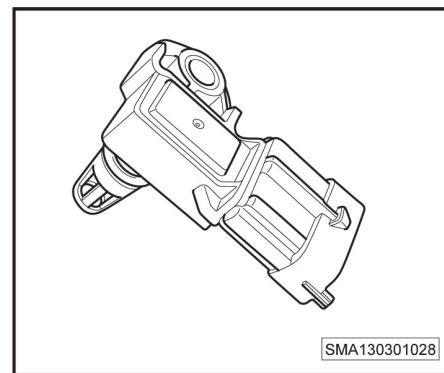
Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

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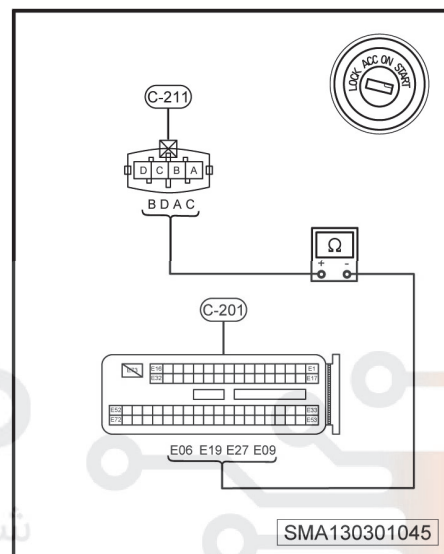
1. Remove the intake air pressure/temperature sensor and check if the sensor has any dust, oil stains or other foreign matters on it.

- If yes, clean or replace the intake air pressure/temperature sensor. ■
- If not, go to step 2.



2. Disconnect the battery negative terminal, disconnect the ECM connector C-201 and intake air pressure/temperature sensor connector C-211 and check if the leads between the pins of E6, E19, E27, E9 of C-201 and the pins of B, D, A, C of C-211 have short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 3.



3. Connect the diagnostic device and check if the reading of "intake air pressure sensor data flow" is normal.

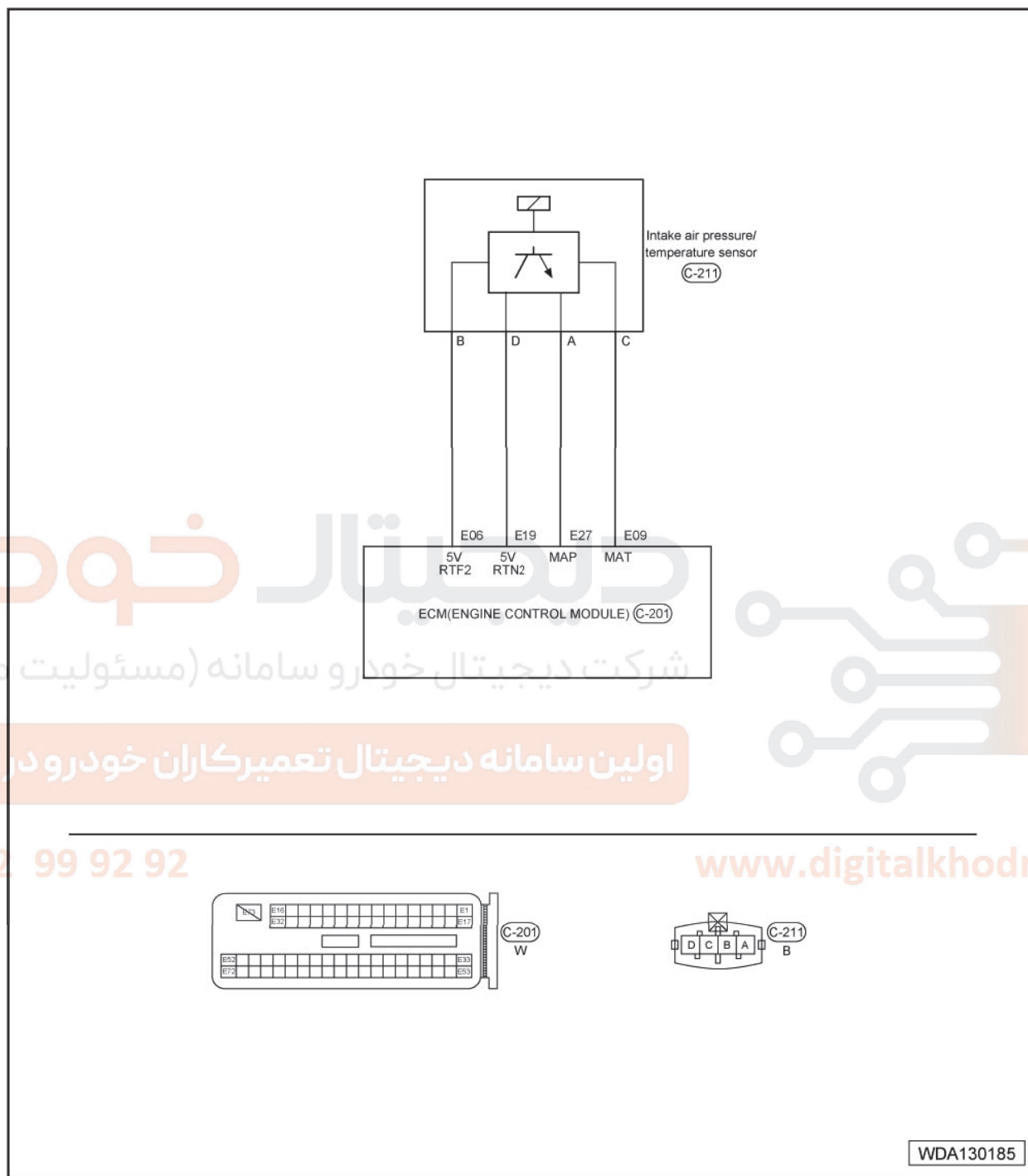
- If yes, go to step 4.
- If not, replace the intake air pressure/temperature sensor. ■

Intake air pressure sensor

Pressure (KPa)	15	40	94	102
Output voltage (V)	0.12~0.38	1.52~1.68	4.44~4.60	4.86~5.04

4. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.3 P0112 Intake air temperature sensor circuit low voltage**P0113 Intake air temperature sensor circuit high voltage or open circuit**

03

Values between the ECM and the intake air pressure/temperature sensor

ECM pin No.	Function	Condition	Value (DC voltage range)
E6	Sensor power supply	The ignition switch in the ON position	5 V
E9	Intake air temperature sensor signal	The ignition switch in the ON position	0 V

03 - Engine Electronic Controls

ECM pin No.	Function	Condition	Value (DC voltage range)
E19	Sensor grounded	The ignition switch in the ON position	5 V
E27	Intake air pressure sensor signal	The ignition switch in the ON position	0 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0112	Intake air temperature sensor circuit low voltage	Vehicle speed more than 50 km/h	Intake air temperature sensor circuit low voltage	- Failure of the intake air pressure sensor - Failure of the intake air temperature sensor circuit - Failure of the engine control module
P0113	Intake air temperature sensor circuit high voltage or open circuit	Vehicle speed less than 25 km/h	Intake air temperature sensor circuit high voltage or open circuit	- Failure of the intake air pressure sensor - Failure of the intake air temperature sensor circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

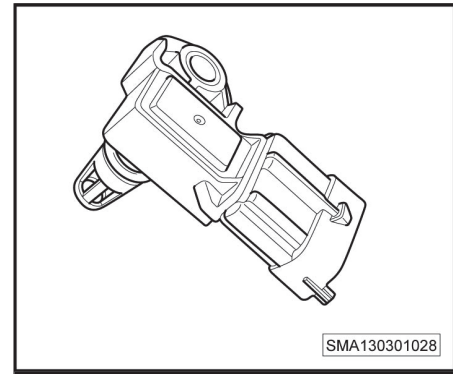
Diagnosis procedures:

i Note

- Please verify again if the DTC and its symptoms are present after fault is rectified.

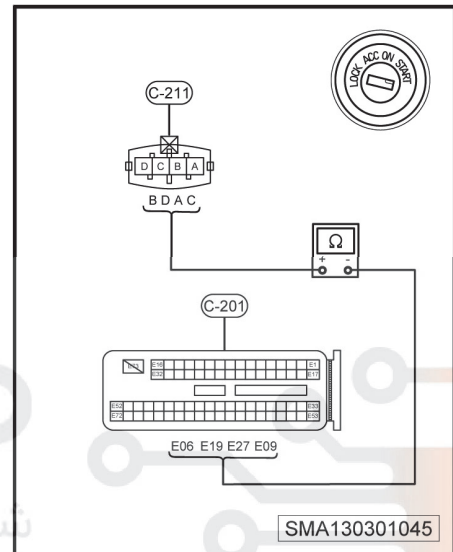
1. Remove the intake air pressure/temperature sensor and check if the sensor has any dust, oil stains or other foreign matters on it.

- If yes, clean or replace the intake air pressure/temperature sensor. ■
- If not, go to step 2.



2. Disconnect the battery negative terminal, disconnect the ECM connector C-201 and intake air pressure/temperature sensor connector C-211 and check if the leads between the pins of E6, E19, E27, E9 of C-201 and the pins of B, D, A, C of C-211 have short or open circuit.

- If yes, go to step 3.
- If not, repair the defective lead. ■



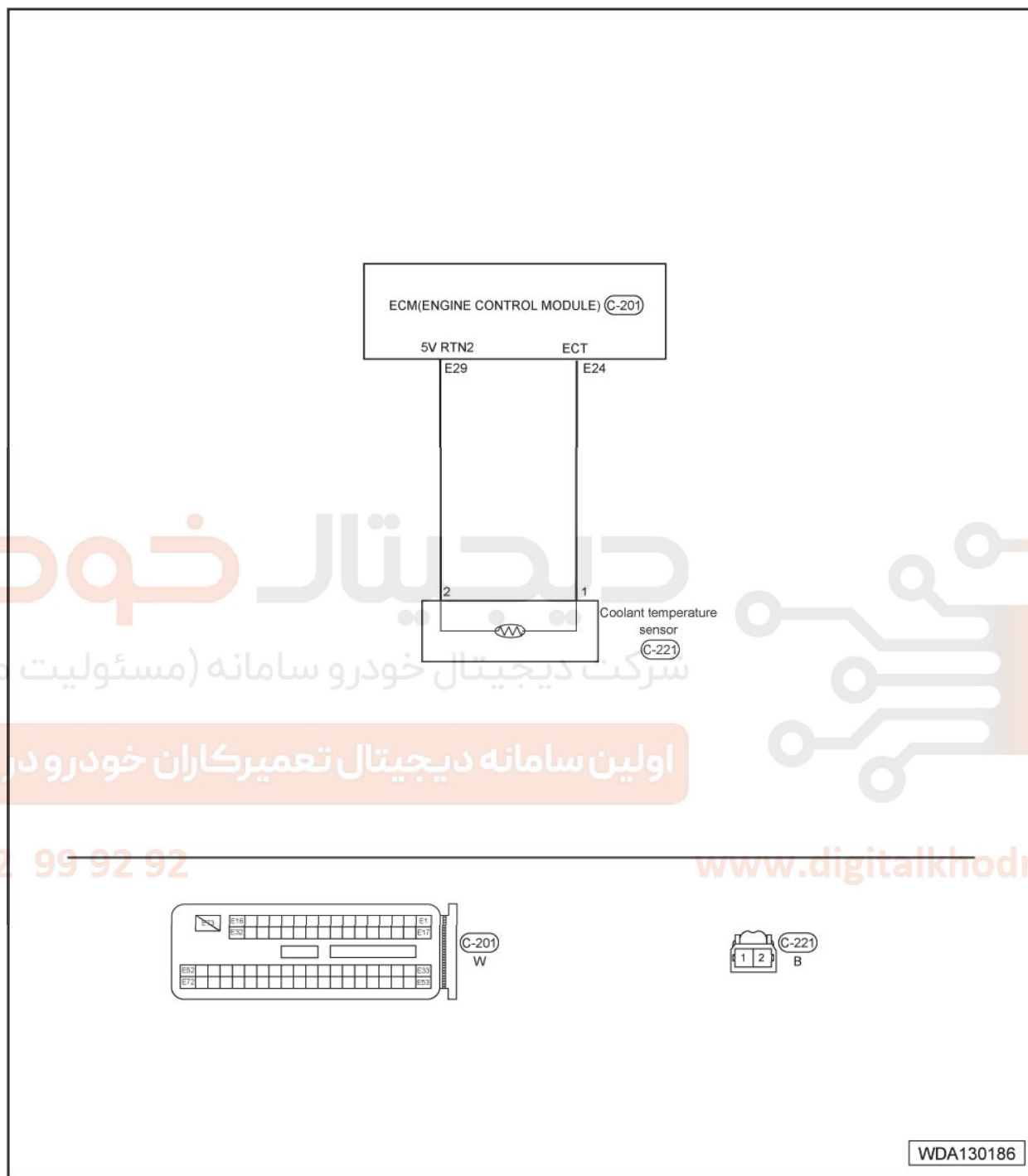
3. Disconnect the intake air pressure/temperature sensor connector and measure if the resistance value of intake air temperature sensor is normal.

- If yes, go to step 4.
- If not, the intake air pressure/temperature sensor fails and please replace it. ■

Intake air temperature sensor				
Temperature (°C)	15	20	30	40
Resistance value (KΩ)	5.65	3.51	2.24	1.46

4. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.4 P0117 Coolant temperature sensor circuit low voltage**P0118 Coolant temperature sensor circuit high voltage or open circuit****Values between the ECM and the coolant temperature sensor**

ECM pin No.	Function	Condition	Value (DC voltage range)
E24	Coolant temperature sensor signal	The ignition switch in the ON position	5 V
E29	Coolant temperature sensor signal	The ignition switch in the ON position	3.6 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0117	Coolant temperature sensor circuit low voltage	Under the idling condition	Coolant temperature sensor signal wire short to ground	- Failure of the coolant temperature sensor - Failure of the coolant temperature sensor circuit - Failure of the engine control module
P0118	Coolant temperature sensor circuit high voltage or open circuit	Under the idling condition	Coolant temperature sensor circuit high voltage or open circuit	- Failure of the coolant temperature sensor - Failure of the coolant temperature sensor circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

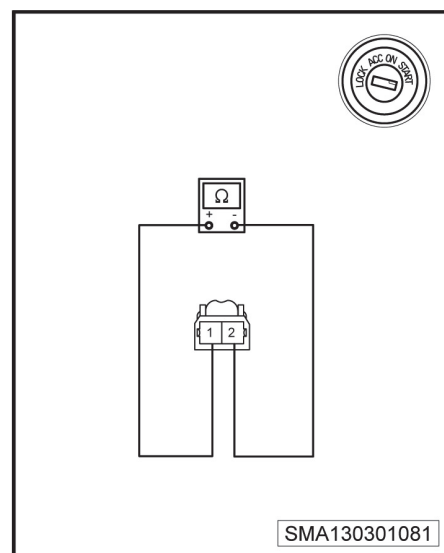
- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Connect the diagnostic device, start the engine and check if the reading of "coolant temperature sensor data flow" is normal under the operating conditions.
 - If yes, go to step 3.
 - If not, go to step 2.

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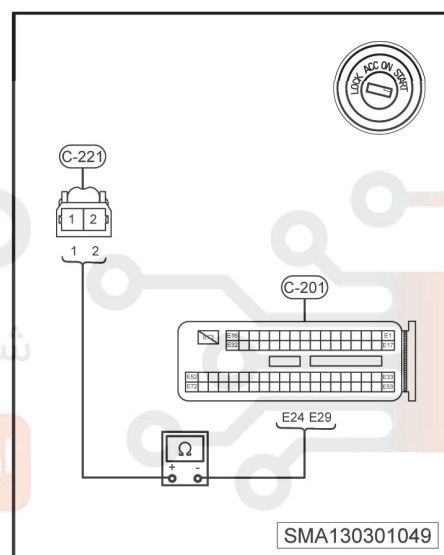
2. Remove the coolant temperature sensor and measure if the resistance value between both terminals of the coolant temperature sensor is normal. (The rated resistance is $2.5\text{ k}\Omega \pm 5\%$ at 20°C)

- If yes, go to step 3.
- If not, the coolant temperature sensor fails and please replace it. ■



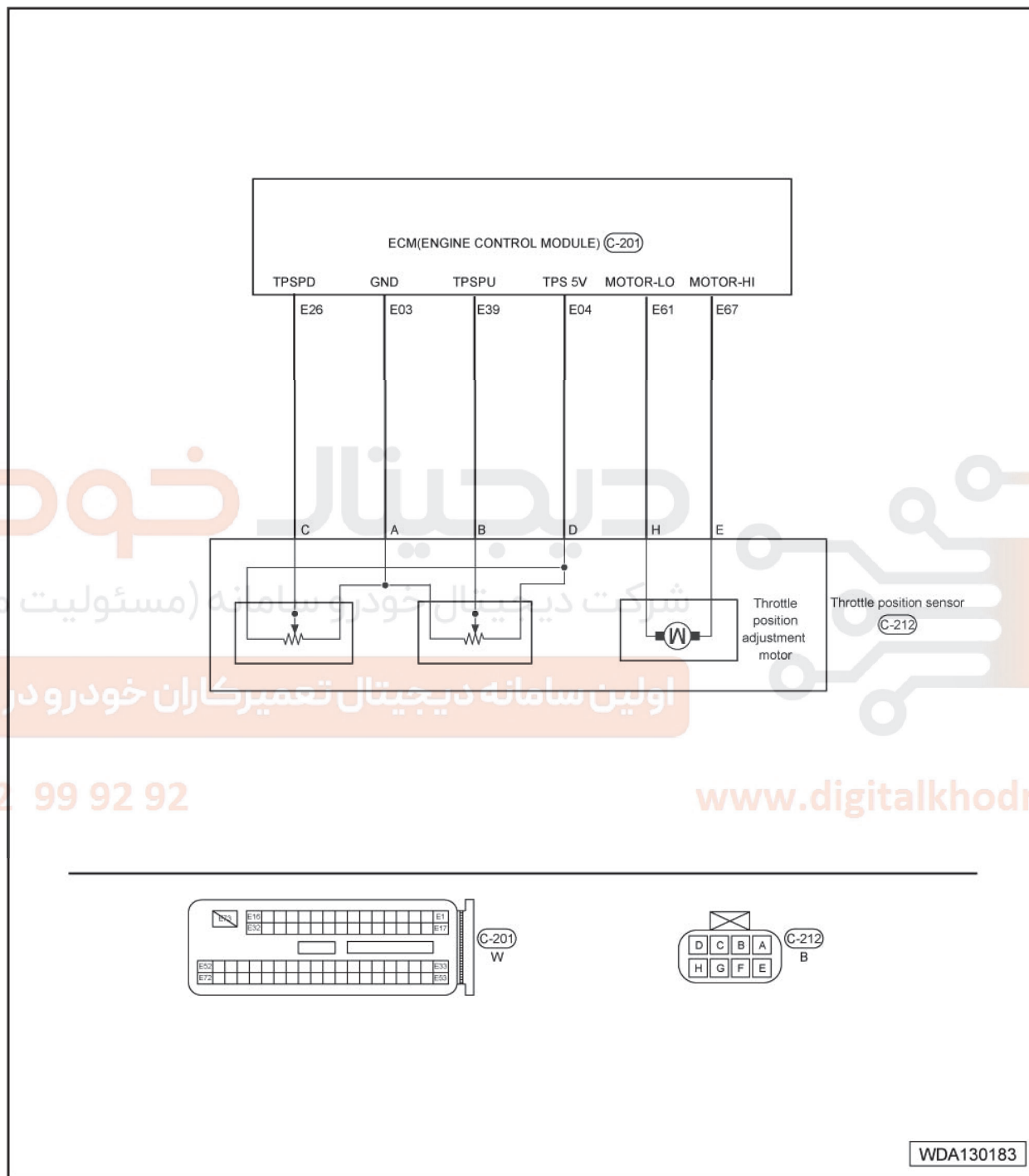
3. Disconnect the coolant temperature sensor connector C-221 and ECM connector C-201, and check if the leads between the pins E24, E29 of C-201 and the pins 1, 2 of C-221 have short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 4.



4. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.5 P0122 Electronic throttle position sensor circuit 1 low voltage**P0123 Electronic throttle position sensor circuit 1 high voltage****P0222 Electronic throttle position sensor circuit 2 low voltage****P0223 Electronic throttle position sensor circuit 2 high voltage**

Values between the ECM and the electronic throttle position sensor

ECM pin No.	Function	Condition	Value (DC voltage range)
E3	Sensor grounded	The ignition switch in the ON position	0 V

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ECM pin No.	Function	Condition	Value (DC voltage range)
E4	Sensor power supply	The ignition switch in the ON position	5 V
E26	"1" sensor signal	The ignition switch in the ON position	0 V
E39	"2" sensor signal	The ignition switch in the ON position	5 V
E61	Throttle position adjustment motor	The ignition switch in the ON position	0.5 V
E67	Throttle position adjustment motor	The ignition switch in the ON position	5 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0122	Electronic throttle position sensor circuit 1 low voltage	Engine running conditions depending on the ETC modes	Electronic throttle position sensor circuit 1 grounded or open circuit	- Failure of the electronic throttle position sensor - Failure of the electronic throttle position sensor circuit - Failure of the engine control module
P0123	Electronic throttle position sensor circuit 1 high voltage	Engine running conditions depending on the ETC modes	Electronic throttle position sensor circuit 1 short to the sensor power supply line	- Failure of the electronic throttle position sensor - Failure of the electronic throttle position sensor circuit - Failure of the engine control module
P0222	Electronic throttle position sensor circuit 2 low voltage	Engine running conditions depending on the ETC modes	Electronic throttle position sensor circuit 2 grounded or open circuit	- Failure of the electronic throttle position sensor - Failure of the electronic throttle position sensor circuit - Failure of the engine control module
P0223	Electronic throttle position sensor circuit 2 high voltage	Engine running conditions depending on the ETC modes	Electronic throttle position sensor circuit 2 short to the sensor power supply line	- Failure of the electronic throttle position sensor - Failure of the electronic throttle position sensor circuit

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
				position sensor circuit Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

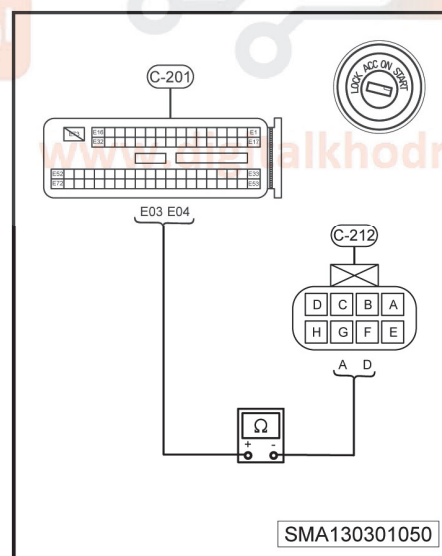
- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Disconnect the battery negative terminal, disconnect the ECM connector C-201 and the electronic throttle control unit connector C-212 and check if the leads between the pins E3, E4 of C-201 and pins A, D of C-212 have short or open circuit.

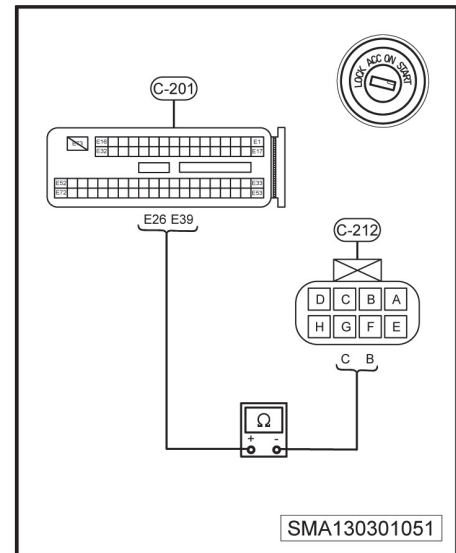
- If yes, repair the defective lead. ■
- If not, go to step 2.



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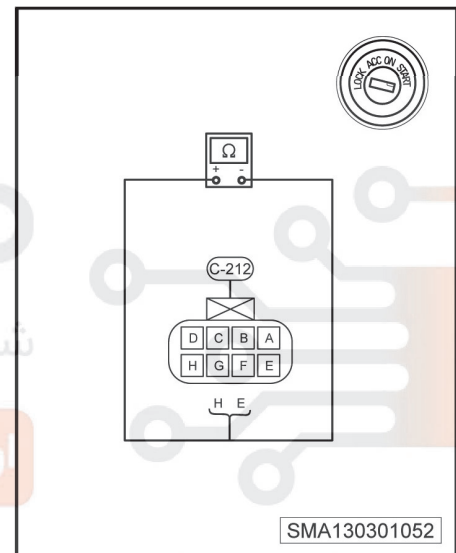
2. Check if the leads between the pins E26, E39 of C-201 and the pins C, B of C-212 have short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 3.



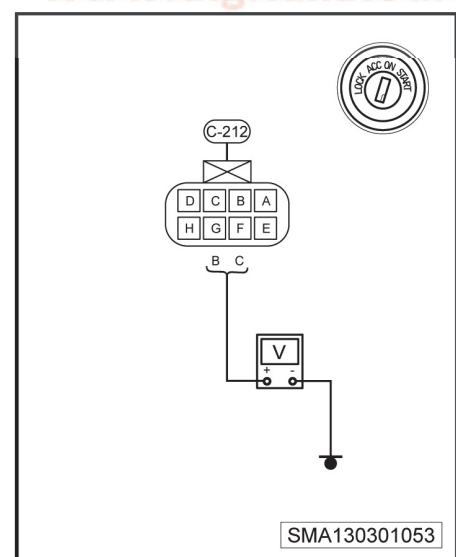
3. Disconnect the electronic throttle connector C-212 and measure if the resistance value between the pins H and E of throttle position adjustment motor is 3.93Ω .

- If yes, go to step 4.
- If not, the electronic throttle position adjustment motor fails and please replace the electronic throttle. ■



4. Restore the vehicle to its normal state, start the engine and check if the signals of throttle position sensor signal wires B and C are normal without disconnecting the throttle position sensor connector.

- If yes, go to step 5.
- If not, the electronic throttle position sensor fails and please replace the electronic throttle. ■

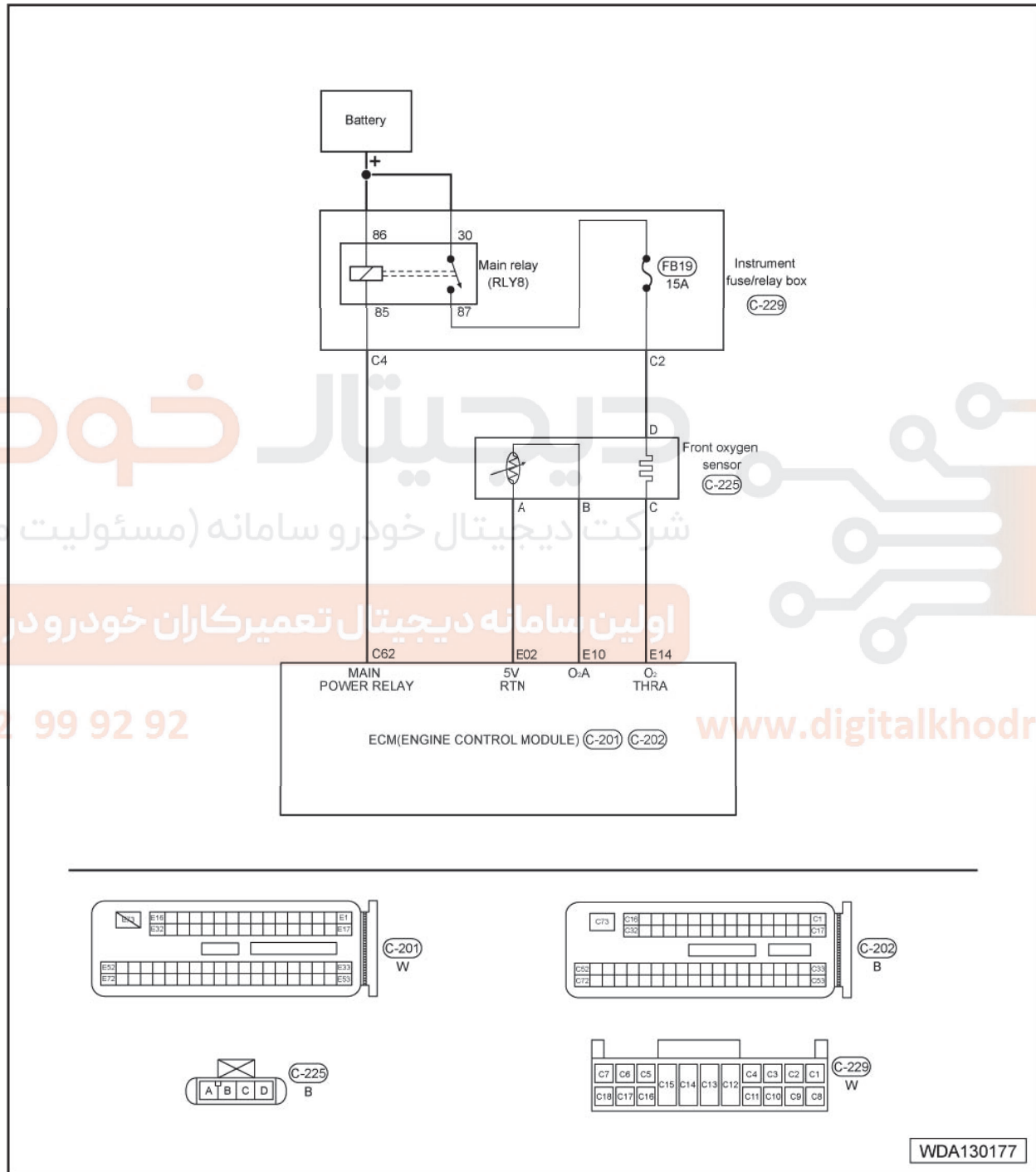


5. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.6 P0131 Front oxygen sensor short to low voltage

P0132 Front oxygen sensor short to high voltage



Values between the ECM and the front oxygen sensor

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ECM pin No.	Function	Condition	Value (DC voltage range)
E2	Front oxygen sensor signal	The ignition switch in the ON position	0 V
E10	Front oxygen sensor signal	The ignition switch in the ON position	2.3 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0131	Front oxygen sensor short to low voltage	Engine runs for over 60 seconds and the coolant temperature is below 70°C	The front oxygen sensor signal keeps 0 for over 25 seconds	- Failure of the front oxygen sensor - Failure of the front oxygen sensor circuit - Failure of the engine control module
P0132	Front oxygen sensor short to high voltage	Engine runs for over 60 seconds and the coolant temperature is above 70°C	Front oxygen sensor signal wire short to power	- Failure of the front oxygen sensor - Failure of the front oxygen sensor wiring - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

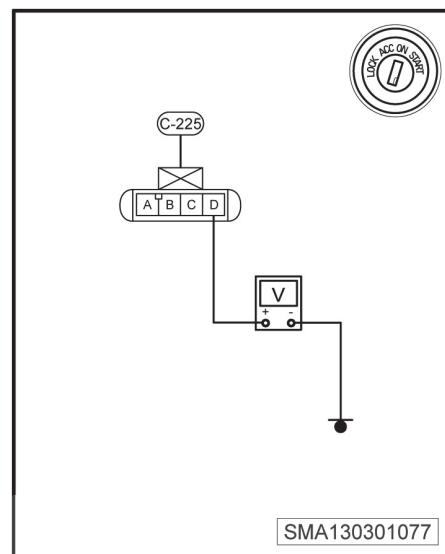
Diagnosis procedures:

i Note

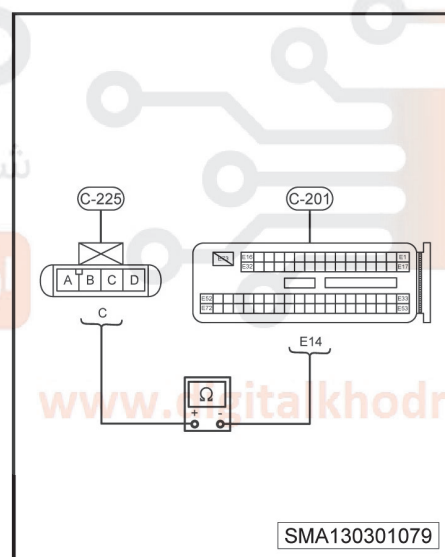
- Please verify again if the DTC and its symptoms are present after fault is rectified.

- Check if the heating fuse FB19 (15A) of the front oxygen sensor is normal.

- If yes, go to step 2.
 - If not, the fuse fails and please replace the fuse FB19. ■
2. Turn the ignition switch to the ON position, disconnect the front oxygen sensor connector C-225 and check if the voltage at the pin D of C-225 is battery voltage.
- If yes, go to step 3.
 - If not, the lead between the fuse FB19 and the pin D of C-225 fails and please repair the defective lead. ■



3. Disconnect the battery negative terminal, disconnect the front oxygen sensor connector C-225 and the ECM connector C-201 and check if the lead between the pin C of C-225 and the pin E14 of C-201 has short or open circuit.
- If yes, repair the defective lead. ■
 - If not, go to step 4.

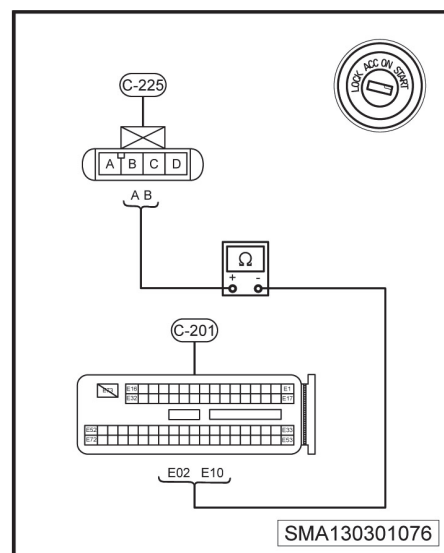


03

4. Connect the diagnostic device and start the engine. When the engine warms up, check if the voltage of the "front oxygen sensor data flow" fluctuates between 0 V and 0.9 V.
- If yes, go to step 5.
 - If not, the front oxygen sensor fails and please replace it. ■

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5. Disconnect the battery negative terminal, disconnect the front oxygen sensor connector C-225 and the ECM connector C-201 and check if the leads between the pins A, B of C-225 and the pins E2, E10 of C-201 have short or open circuit.
- If yes, repair the defective lead. ■
 - If not, go to step 6.



6. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.
- If yes, find the fault cause from other symptoms.
 - If not, the fault has been rectified. ■

03

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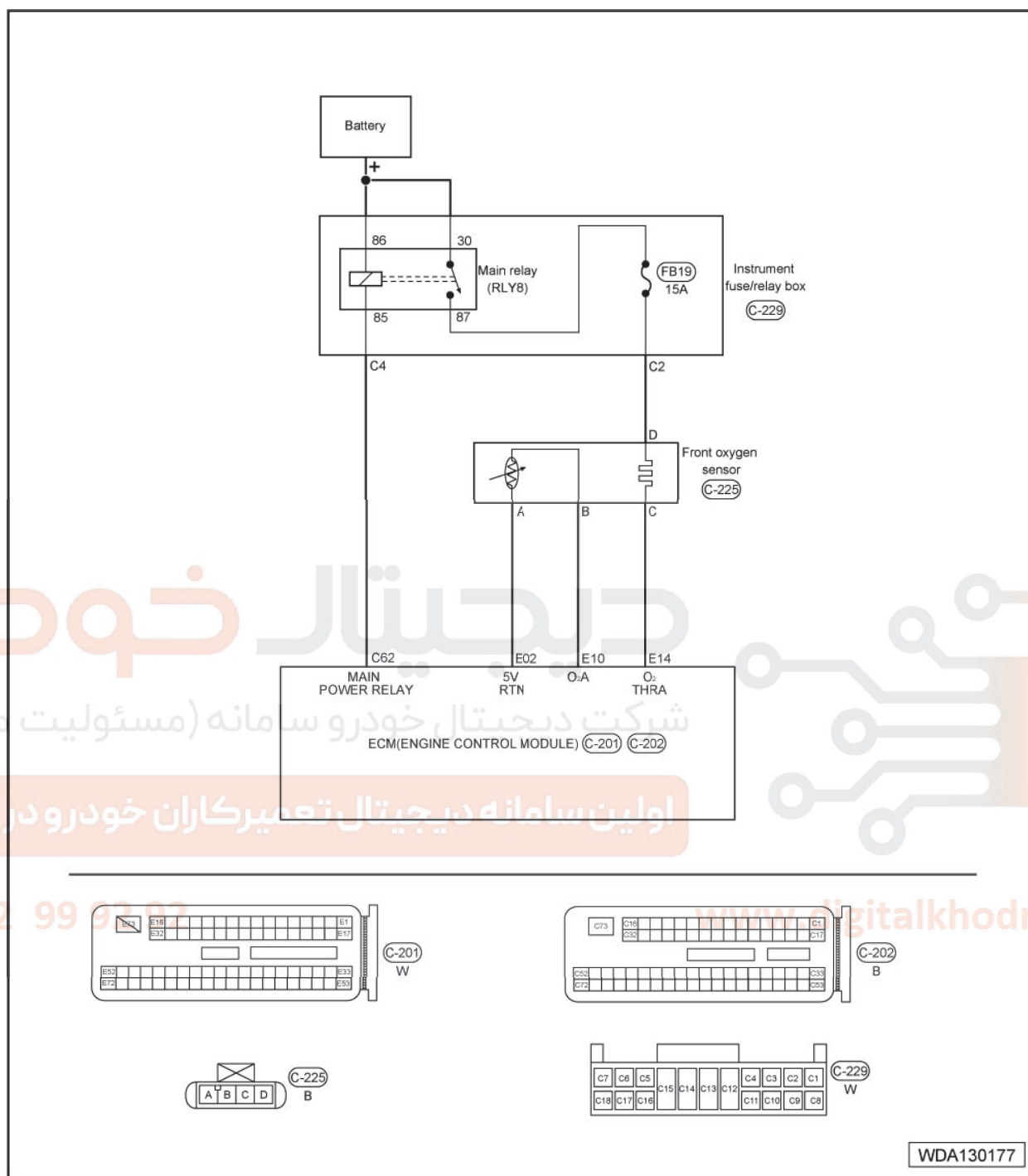
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2.6.7 P0133 Slow response of the front oxygen sensor



Values between the ECM and the front oxygen sensor

ECM pin No.	Function	Condition	Value (DC voltage range)
E2	Front oxygen sensor signal	The ignition switch in the ON position	5 V
E10	Front oxygen sensor signal	The ignition switch in the ON position	2.3 V
E14	Front oxygen sensor heater control	The ignition switch in the ON position	3.6 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0133	Front oxygen sensor short or open circuit	Engine runs for over 60 seconds and the coolant temperature is above 70°C	Slow response of the oxygen sensor and low system set value when the engine speed is about 2000 rpm	- Failure of the front oxygen sensor - Failure of the front oxygen sensor circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

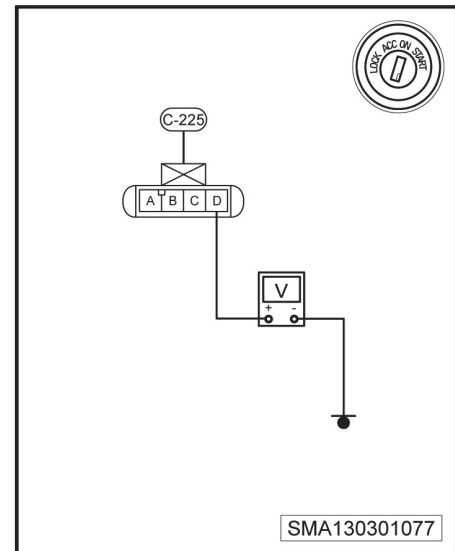
Diagnosis procedures:

Note
• Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the heating fuse FB19 (15A) of the front oxygen sensor is normal.
 - If yes, go to step 2.
 - If not, the fuse fails and please replace the fuse FB19. ■

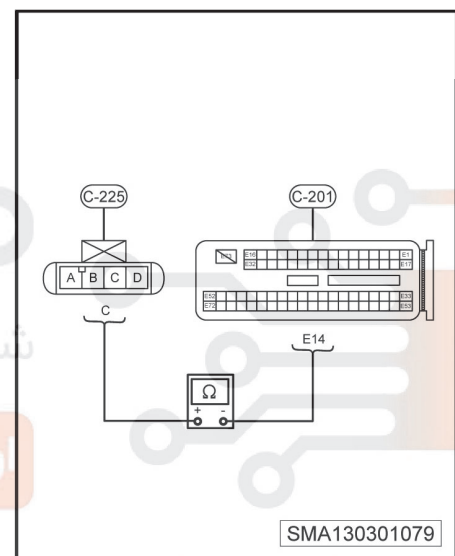
2. Turn the ignition switch to the ON position, disconnect the front oxygen sensor connector C-225 and check if the voltage at the pin D of C-225 is battery voltage.

- If yes, go to step 3.
- If not, the lead between the fuse FB19 and the pin D of C-225 fails and please repair the defective lead. ■



3. Disconnect the battery negative terminal, disconnect the front oxygen sensor connector C-225 and the ECM connector C-201 and check if the lead between the pin C of C-225 and the pin E14 of C-201 has short or open circuit.

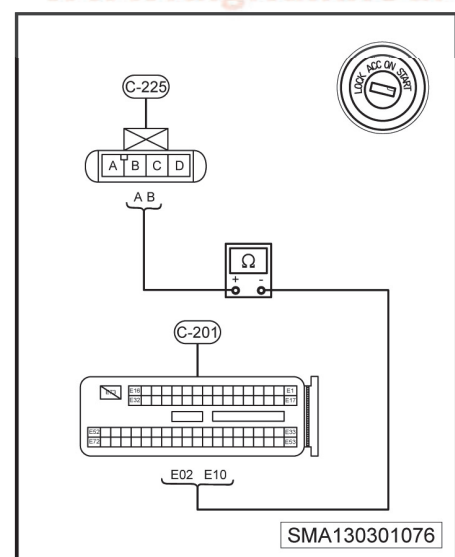
- If yes, repair the defective lead. ■
- If not, go to step 4.



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4. Disconnect the battery negative terminal, disconnect the front oxygen sensor connector C-225 and the ECM connector C-201 and check if the leads between the pins A, B of C-225 and the pins E2, E10 of C-201 have short or open circuit.

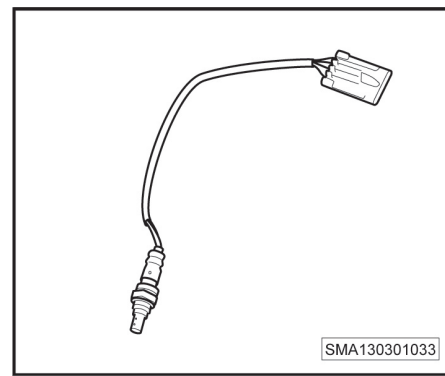
- If yes, repair the defective lead. ■
- If not, go to step 5.



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5. Disconnect the battery negative terminal, remove the front oxygen sensor and carry out a visual inspection to see if the sensor has carbon deposit or turns white, brown or black.

- If yes, replace the oxygen sensor and fuel, and clean the fuel tank. ■
- If not, go to step 6.



6. Restore the vehicle to its normal state, and start the engine. When the engine warms up, read out "front oxygen sensor data flow" and observe the time of the front oxygen sensor voltage changing from lean to rich and from rich to lean and check if the voltage is normal.

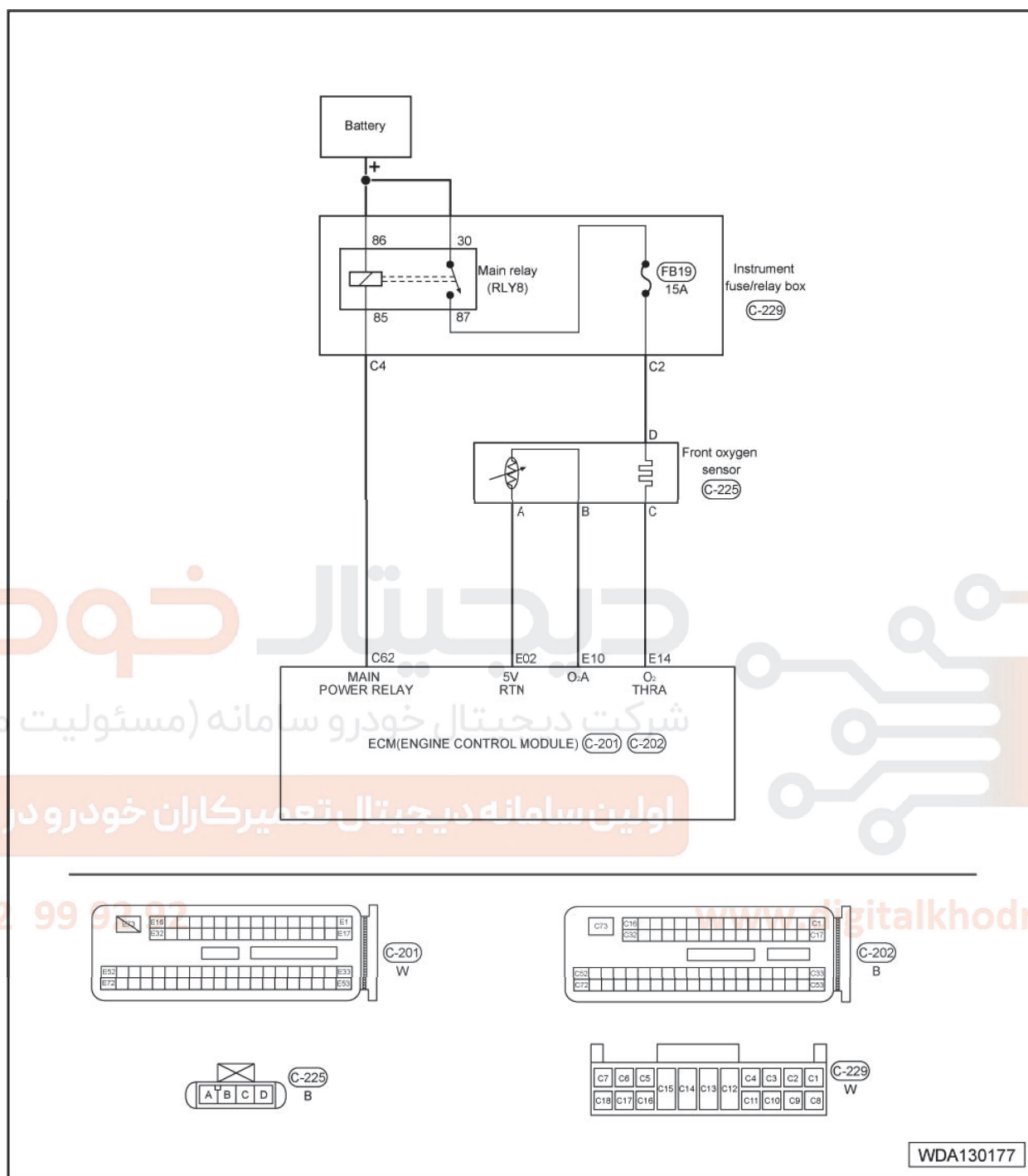
- If yes, go to step 7.
- If not, the front oxygen sensor fails and please replace it. ■

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Oxygen sensor			
Temperature	260°C	450°C	595°C
Rich-oxygen output voltage (mV)	>800	>800	>750
Lean-oxygen output voltage (mV)	<200	<200	<150
Response time from lean to rich (mS)	<75	<75	<50
Response time from rich to lean (mS)	<150	<125	<90
Internal resistance (Ω)	<100 K		

7. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.8 P0135 Failure of the front oxygen sensor heater**Values between the ECM and the front oxygen sensor heater**

ECM pin No.	Function	Condition	Value (DC voltage range)
E14	Front oxygen sensor heater control	The ignition switch in the ON position	3.6 V

Fault code definition and fault causes

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0135	Failure of the front oxygen sensor heater	Engine runs for over 60 seconds at the idling speed and the front oxygen sensor heater is working	The heater control wire of the front oxygen sensor is disconnected within 20 seconds	- Failure of the front oxygen sensor - Failure of the front oxygen sensor circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

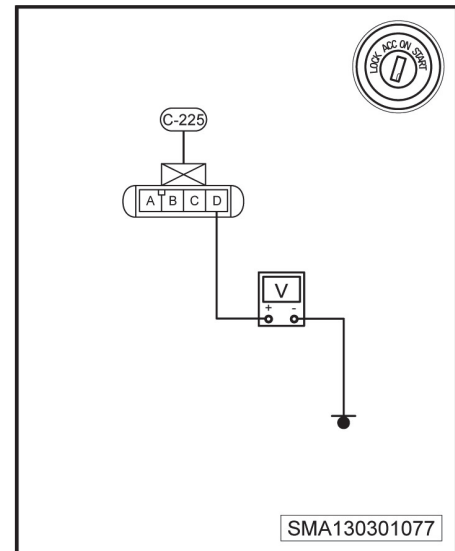
Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the heating fuse FB19 (15A) of the front oxygen sensor is normal.
 - If yes, go to step 2.
 - If not, the fuse fails and please replace the fuse FB19. ■

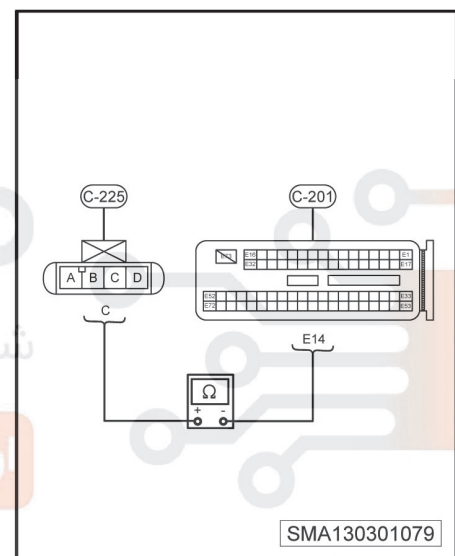
2. Turn the ignition switch to the ON position, disconnect the front oxygen sensor connector C-225 and check if the voltage at the pin D of C-225 is battery voltage.

- If yes, go to step 3.
- If not, the lead between the fuse FB19 and the pin D of C-225 fails and please repair the defective lead. ■



3. Disconnect the battery negative terminal, disconnect the front oxygen sensor connector C-225 and the ECM connector C-201 and check if the lead between the pin C of C-225 and the pin E14 of C-201 has short or open circuit.

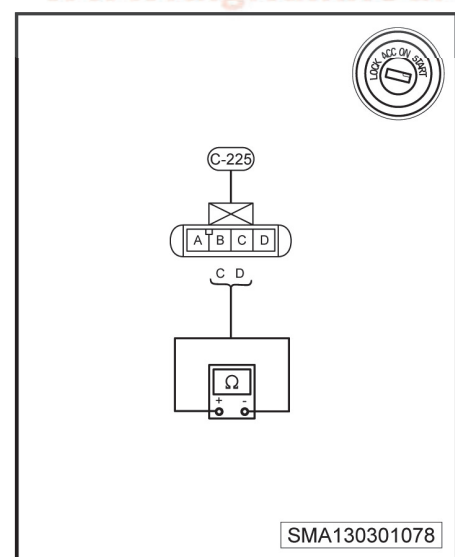
- If yes, repair the defective lead. ■
- If not, go to step 4.



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4. Disconnect the front oxygen sensor connector C-225 and measure if the heater resistance value between the pin C and the pin D of the front oxygen sensor is normal. The resistance value is 9.2Ω at normal temperature (actual measured value).

- If yes, go to step 5.
- If not, the front oxygen sensor fails and please replace it. ■



5. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

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- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

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2.6.9 P0261 Fuel injector 1 circuit low voltage

P0262 Fuel injector 1 circuit high voltage

P0264 Fuel injector 2 circuit low voltage

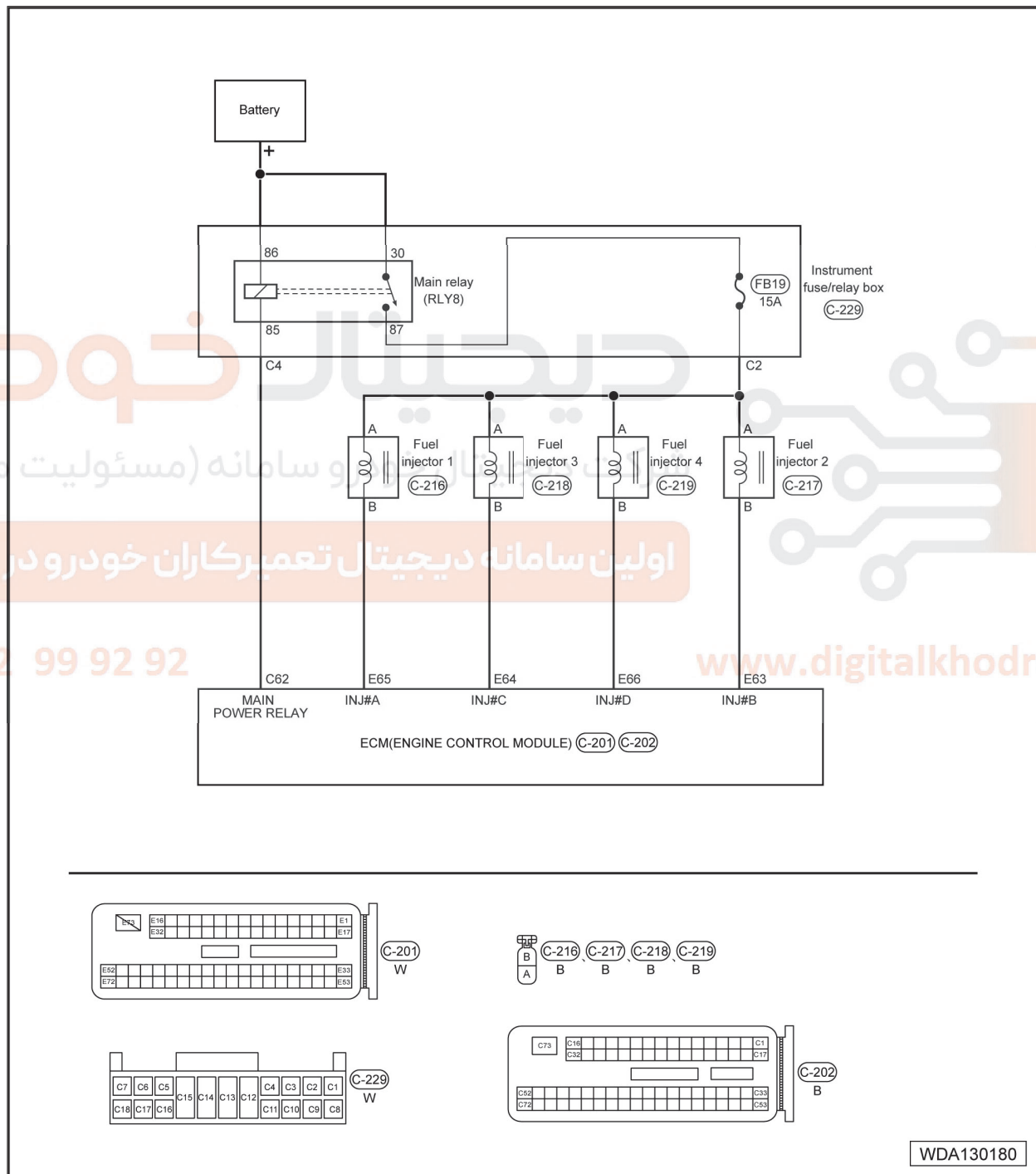
P0265 Fuel injector 2 circuit high voltage

P0267 Fuel injector 3 circuit low voltage

P0268 Fuel injector 3 circuit high voltage

P0270 Fuel injector 4 circuit low voltage

P0271 Fuel injector 4 circuit high voltage



Values between the ECM and the fuel injector

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ECM pin No.	Function	Condition	Value (DC voltage range)
E63	Fuel injector 2	The ignition switch in the ON position	3.6 V
E64	Fuel injector 3	The ignition switch in the ON position	3.6 V
E65	Fuel injector 1	The ignition switch in the ON position	3.6 V
E66	Fuel injector 4	The ignition switch in the ON position	3.6 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0261	Fuel injector 1 circuit low voltage	Engine idle running	Fuel injector 1 control circuit grounded or open circuit	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module
P0262	Fuel injector 1 circuit high voltage	Engine idle running	Fuel injector 1 control circuit short to power	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module
P0264	Fuel injector 2 circuit low voltage	Engine idle running	Fuel injector 2 control circuit grounded or open circuit	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module
P0265	Fuel injector 2 circuit high voltage	Engine idle running	Fuel injector 2 control circuit short to power	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module
P0267	Fuel injector 3 circuit low voltage	Engine idle running	Fuel injector 3 control circuit grounded or open circuit	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0268	Fuel injector 3 circuit high voltage	Engine idle running	Fuel injector 3 control circuit short to power	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module
P0270	Fuel injector 4 circuit low voltage	Engine idle running	Fuel injector 4 control circuit grounded or open circuit	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module
P0271	Fuel injector 4 circuit high voltage	Engine idle running	Fuel injector 4 control circuit short to power	- Failure of the fuel injector - Failure of the fuel injector circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**i Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.
- The control principles and methods of the four cylinder fuel injectors are the same. The inspection of the fuel injector 1 is taken as an example here.

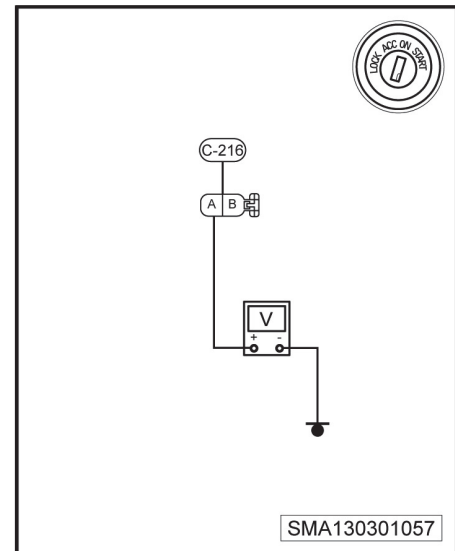
1. Check if the power supply fuse FB19 (15A) of the fuel injector is normal.

- If yes, go to step 2.
- If not, replace the fuse FB19. ■

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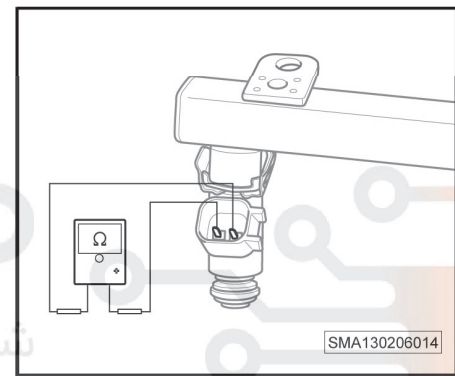
2. Turn the ignition switch to the ON position, disconnect the fuel injector connector C-216 and check if the voltage at the pin A of C-216 is battery voltage.

- If yes, go to step 3.
- If not, the lead between the fuse FB19 and the fuel injector connector C-216 fails and please repair the defective lead. ■



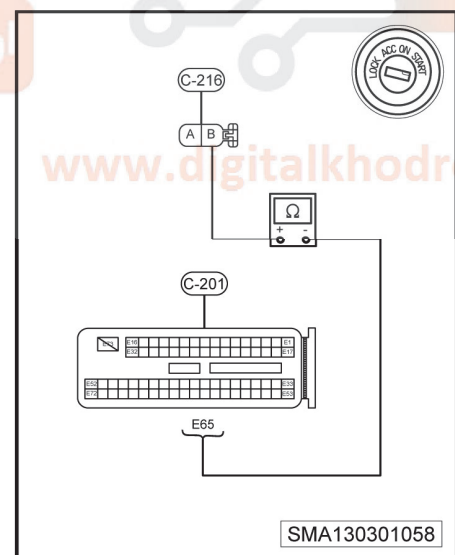
3. Disconnect the fuel injector connector C-216 and measure if the resistance value between two fuel injector pins is normal. The rated resistance is 11-16 Ω at 20°C.

- If yes, go to step 4.
- If not, the fuel injector fails and please replace it. ■



4. Disconnect the fuel injector connector C-216 and the ECM connector C-201 and check if the lead between the pin B of C-216 and the pin E65 of C-201 has short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 5.



5. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.10 P0300 Misfire of the single cylinder or multiple cylinders**Fault code definition and fault causes**

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0300	Misfire of the single cylinder or multiple cylinders	Vehicle driving at a constant speed	ECM monitors that the fluctuation of the crankshaft rotation speed goes beyond the normal range.	• Failure of the ignition coil • Failure of the ignition cable • Failure of the spark plug • Failure of the fuel injector • Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the air intake system leaks.
 - If yes, rectify the fault. ■
 - If not, go to step 2.
2. Check if the fuel injector is normal. (Please refer to the fault diagnosis content related to fuel injectors)
 - If yes, go to step 3.
 - If not, the fuel injector fails and please replace it. ■

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3. Check if the spark plug and the ignition cable are normal.
 - If yes, go to step 4.
 - If not, the spark plug or the ignition cable fails and please replace the spark plug or the ignition cable. ■

4. Check if the ignition coil is normal. (Please refer to the fault diagnosis content related to ignition coils)
 - If yes, go to step 5.
 - If not, the ignition coil fails and please replace it. ■

5. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.
 - If yes, find the fault cause from other symptoms.
 - If not, the fault has been rectified. ■

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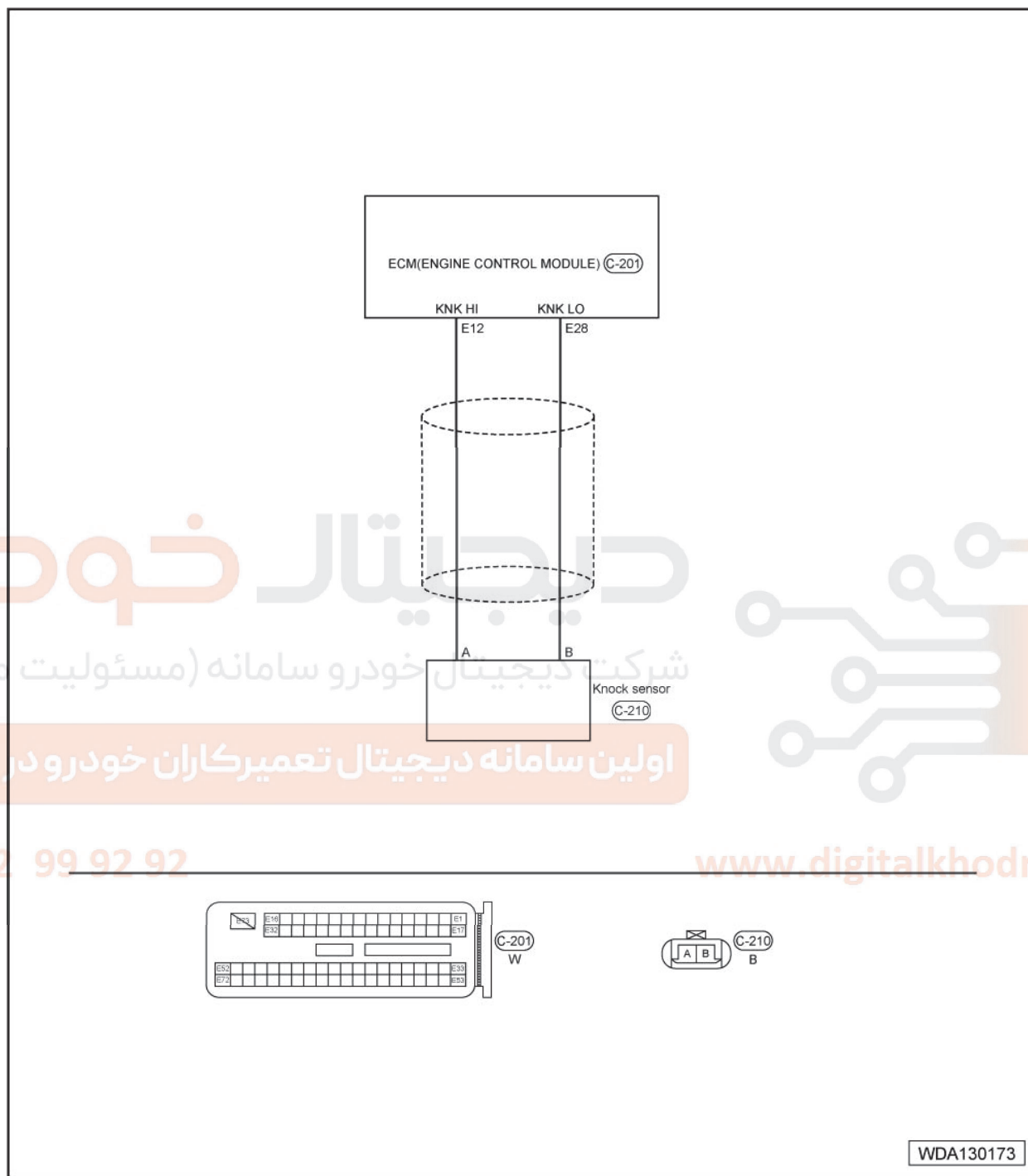
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2.6.11 P0324 Failure of the knock control system**P0325 Failure of the knock sensor****Values between the ECM and the knock sensor**

ECM pin No.	Function	Condition	Value (DC voltage range)
E12	Knock sensor signal	The ignition switch in the ON position	1.6 V
E28	Knock sensor signal	The ignition switch in the ON position	1.6 V

Fault code definition and fault causes

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0324	Failure of the knock control system	The engine reaches a speed of 1600 rpm and is subject to a certain load	A certain signal wire of the knock sensor open circuit	- Failure of the knock sensor - Failure of the knock sensor circuit - Failure of the engine control module
P0325	Failure of the knock sensor	The engine reaches a speed of 1600 rpm and is subject to a certain load	A certain signal wire of the knock sensor grounded	- Failure of the knock sensor - Failure of the knock sensor circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

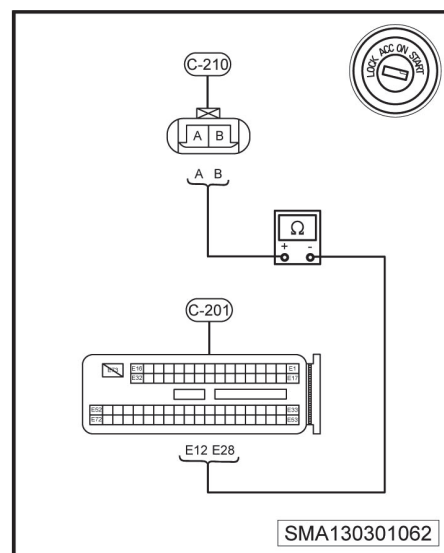
Diagnosis procedures:**i Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the knock sensor connector is fixed in the right position.
 - If yes, go to step 2.
 - If not, re-position the knock sensor connector. ■
2. Check if the fixing bolt type and torque of the knock sensor are correct.
 - If yes, go to step 3.
 - If not, replace the bolts and tighten the knock sensor with the specified torque. ■

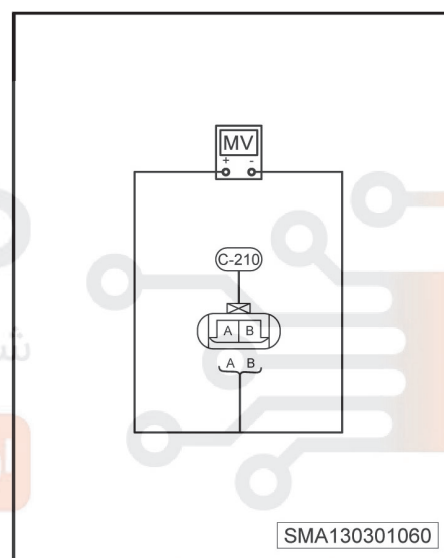
3. Disconnect the battery terminal, disconnect the ECM connector C-201 and the knock sensor connector C-210 and check if the leads between the pins E12, E20 of C-201 and the pins A, B of C-210 have short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 4.



4. Disconnect the knock sensor connector, turn the multimeter to the "mv" position, connect the two probes of the multimeter to the two connectors of the knock sensor and knock the engine cylinder block with a rubber hammer (please note that do not damage the sensor). At this moment, there shall be voltage output in the knock sensor. Check if the sensor has a voltage output.

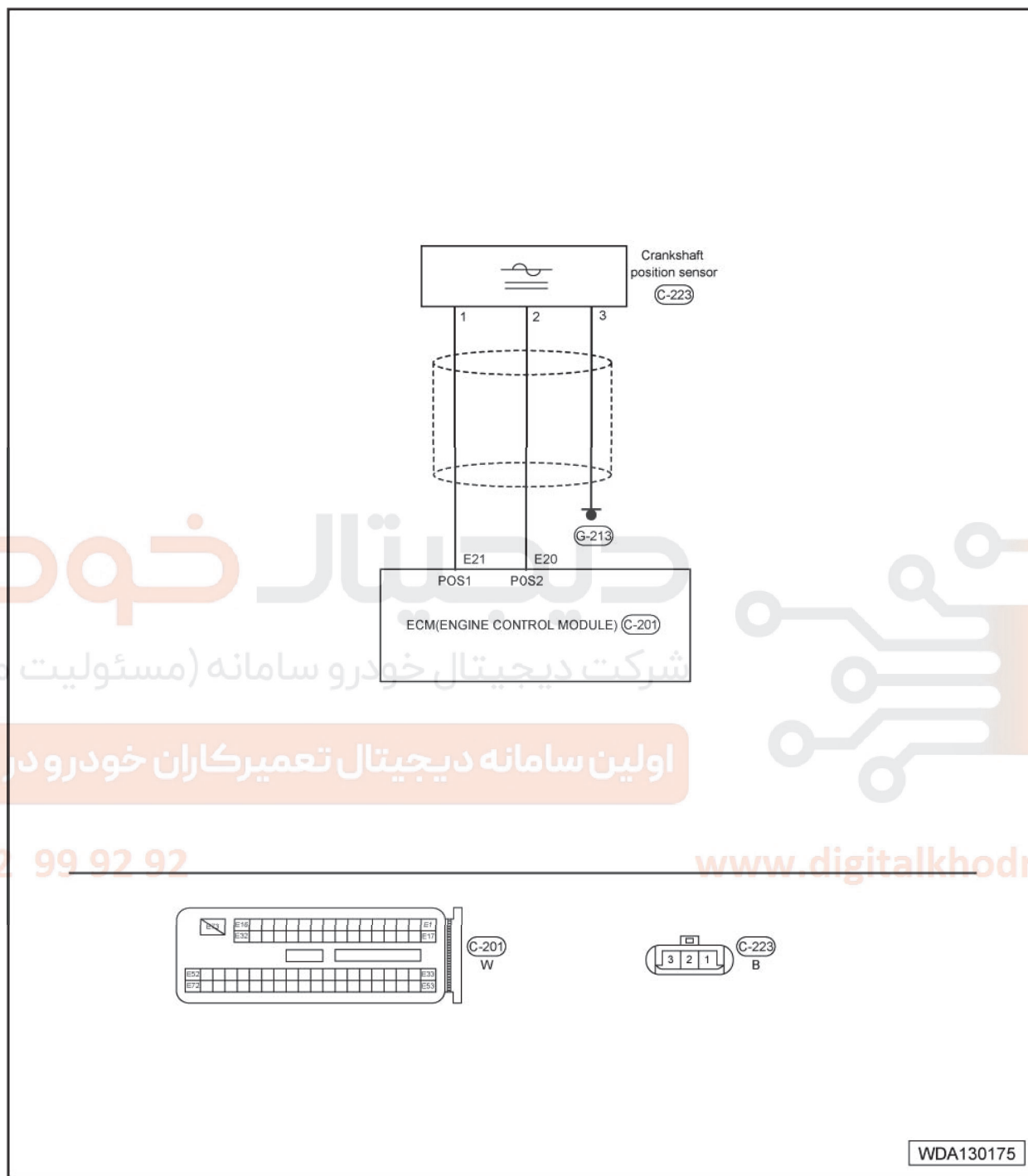
- If yes, go to step 5.
- If not, the knock sensor fails and please replace it. ■



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5. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.12 P0335 No signal in the crankshaft position sensor circuit**P0336 Signal interference in the crankshaft position sensor circuit****Values between the ECM and the crankshaft position sensor**

ECM pin No.	Function	Condition	Value (DC voltage range)
E20	Crankshaft position sensor signal	The ignition switch in the ON position	2.5 V
E21	Crankshaft position sensor signal	The ignition switch in the ON position	2.5 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0335	No signal in the crankshaft position sensor circuit	During engine start	The sensor short or open circuit	- Failure of the crankshaft position sensor - Failure of the crankshaft position sensor circuit - Failure of the engine control module
P0336	Signal interference in the crankshaft position sensor circuit	Engine running	10% failure rate of crankshaft rotations	- Failure of the crankshaft position sensor - Failure of the crankshaft position sensor circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

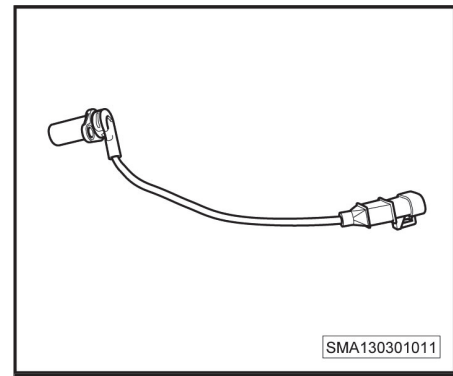
Diagnosis procedures:

i Note
• Please verify again if the DTC and its symptoms are present after fault is rectified.

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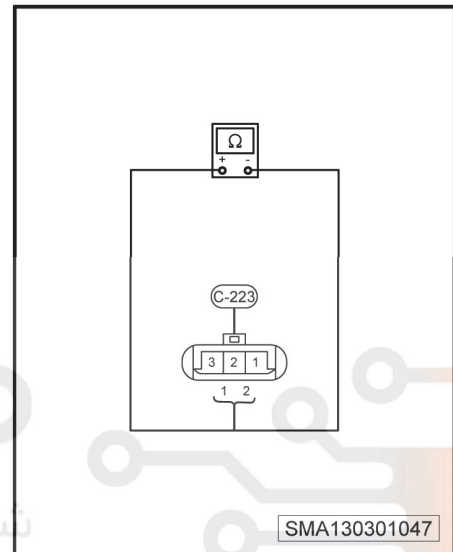
1. Remove the crankshaft position sensor and check if the crankshaft position sensor absorbs the iron chips or is damaged.

- If yes, the sensor fails and please replace or clean the crankshaft position sensor. ■
- If not, go to step 2.



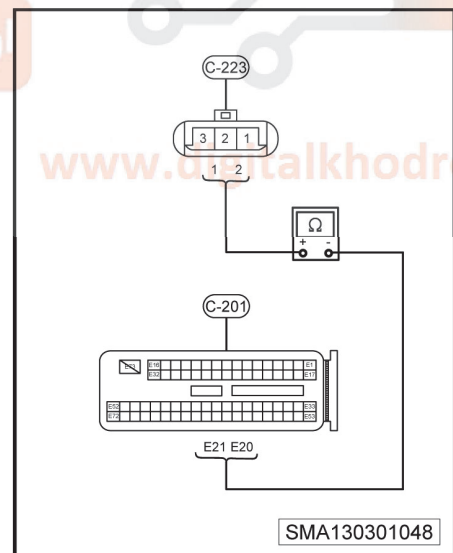
2. Disconnect the crankshaft position sensor connector C-223 and check if the resistance value between the pins 1 and 2 of C-223 is normal. (Coil resistance: $560 \Omega \pm 10\%$)

- If yes, go to step 3.
- If yes, the sensor fails and please replace the crankshaft position sensor. ■



3. Disconnect the battery terminal, disconnect the ECM connector C-201 and the crankshaft position sensor connector C-223 and check if the leads between the pins E21, E20 of C-201 and the pins 1, 2 of C-223 have short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 4.

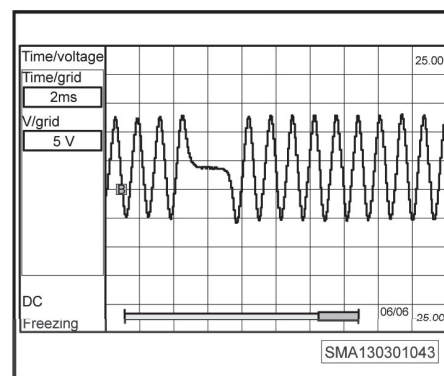


4. Disconnect the battery terminal, disconnect the crankshaft position sensor connector C-223 and check if the lead between the pin 3 of C-223 and the earth terminal G213 has short or open circuit.

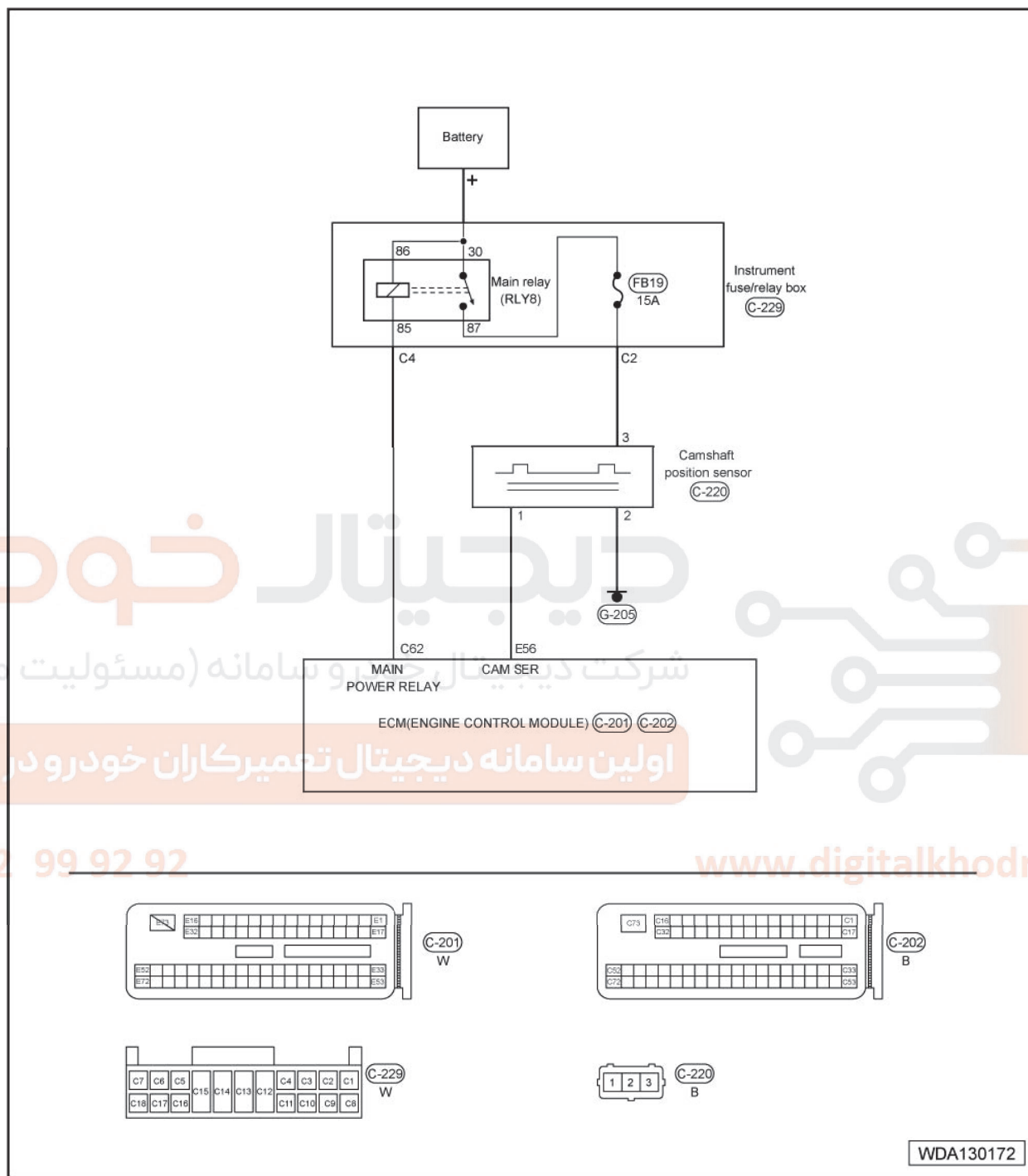
- If yes, repair the defective lead. ■
- If not, go to step 5.

5. Check if the clearance between the crankshaft signal gear ring on the flywheel and the crankshaft position sensor is normal (the clearance shall be 0.3~1.5 mm).
 - If yes, go to step 6.
 - If not, the flywheel gear ring or the transaxle housing fails and please replace or repair the flywheel gear ring or the transaxle housing. ■

6. Connect the wave analyzer and check if the waveform of the crankshaft position sensor is normal.
 - If yes, go to step 7.
 - If not, replace the crankshaft position sensor. ■



7. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.
 - If yes, find the fault cause from other symptoms.
 - If not, the fault has been rectified. ■

2.6.13 P0335 No signal in the camshaft position sensor circuit**P0336 Signal interference in the camshaft position sensor circuit**

Values between the ECM and the camshaft position sensor

ECM pin No.	Function	Condition	Value (DC voltage range)
E56	Camshaft position sensor signal	The ignition switch in the ON position	5 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0340	No signal in the camshaft position sensor circuit	Engine running	The sensor short or open circuit	- Failure of the camshaft position sensor - Failure of the camshaft position sensor circuit - Failure of the engine control module
P0341	Signal interference in the camshaft position sensor circuit	Engine running	The camshaft position sensor signal deviating from the system set range	- Failure of the camshaft position sensor - Failure of the camshaft position sensor circuit - Failure of the engine control module

DTC test procedures:

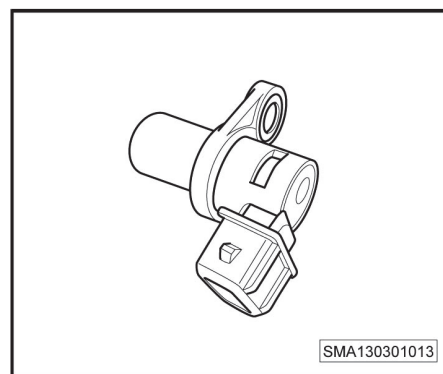
Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**i Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

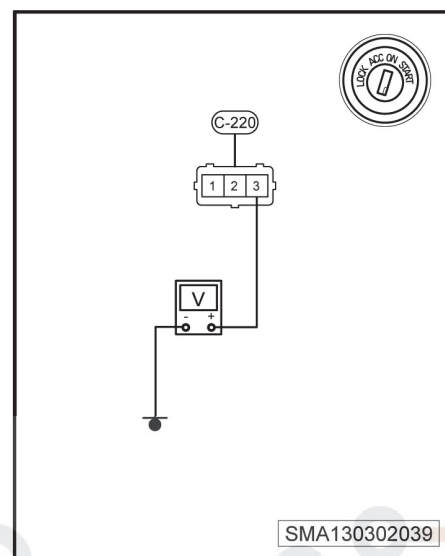
- Remove the camshaft position sensor and check if the camshaft position sensor has iron chips, oil sludge, carbon deposit and cracks.
 - If yes, clean or replace the camshaft position sensor. ■
 - If not, go to step 2.



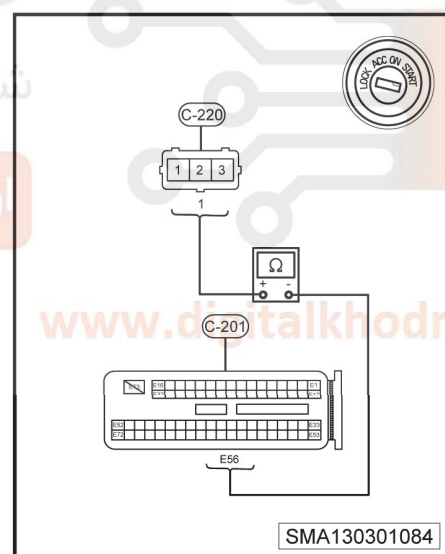
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2. Check if the power supply fuse FB19 (15A) of the camshaft position sensor is normal.
 - If yes, go to step 3.
 - If not, the fuse fails and please replace the fuse FB19. ■

3. Turn the ignition switch to the ON position, disconnect the camshaft position sensor connector C-220 and check if the pin 3 of C-220 is battery voltage.
 - If yes, go to step 4.
 - If not, the lead between the fuse FB19 and the pin C of C-220 fails and please repair the defective lead. ■

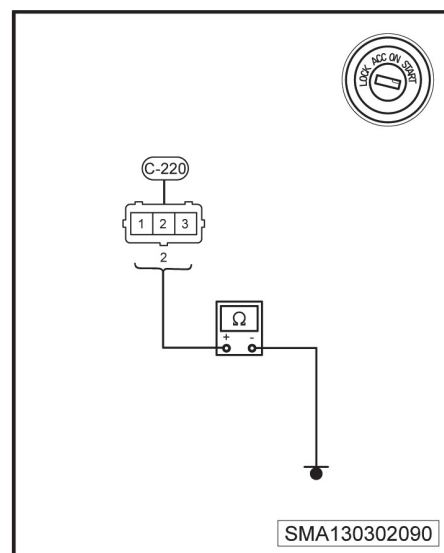


4. Disconnect the battery terminal, disconnect the ECM connector C-201 and the camshaft position sensor connector C-220 and check if the lead between the pin E56 of C-201 and the pin 1 of C-220 has short or open circuit.
 - If yes, repair the defective lead. ■
 - If not, go to step 4.



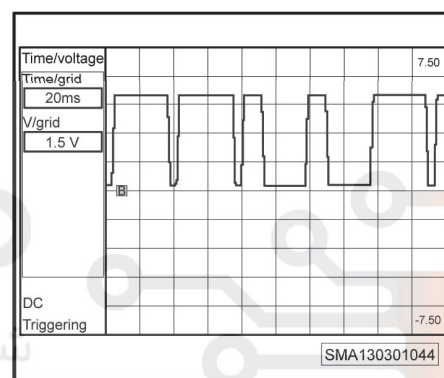
5. Disconnect the battery terminal, disconnect the camshaft position sensor connector C-220 and check if the lead between the pin 2 of C-220 and the earth terminal has short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 6.



6. Connect the oscilloscope and check if the waveform of the camshaft position sensor is normal.

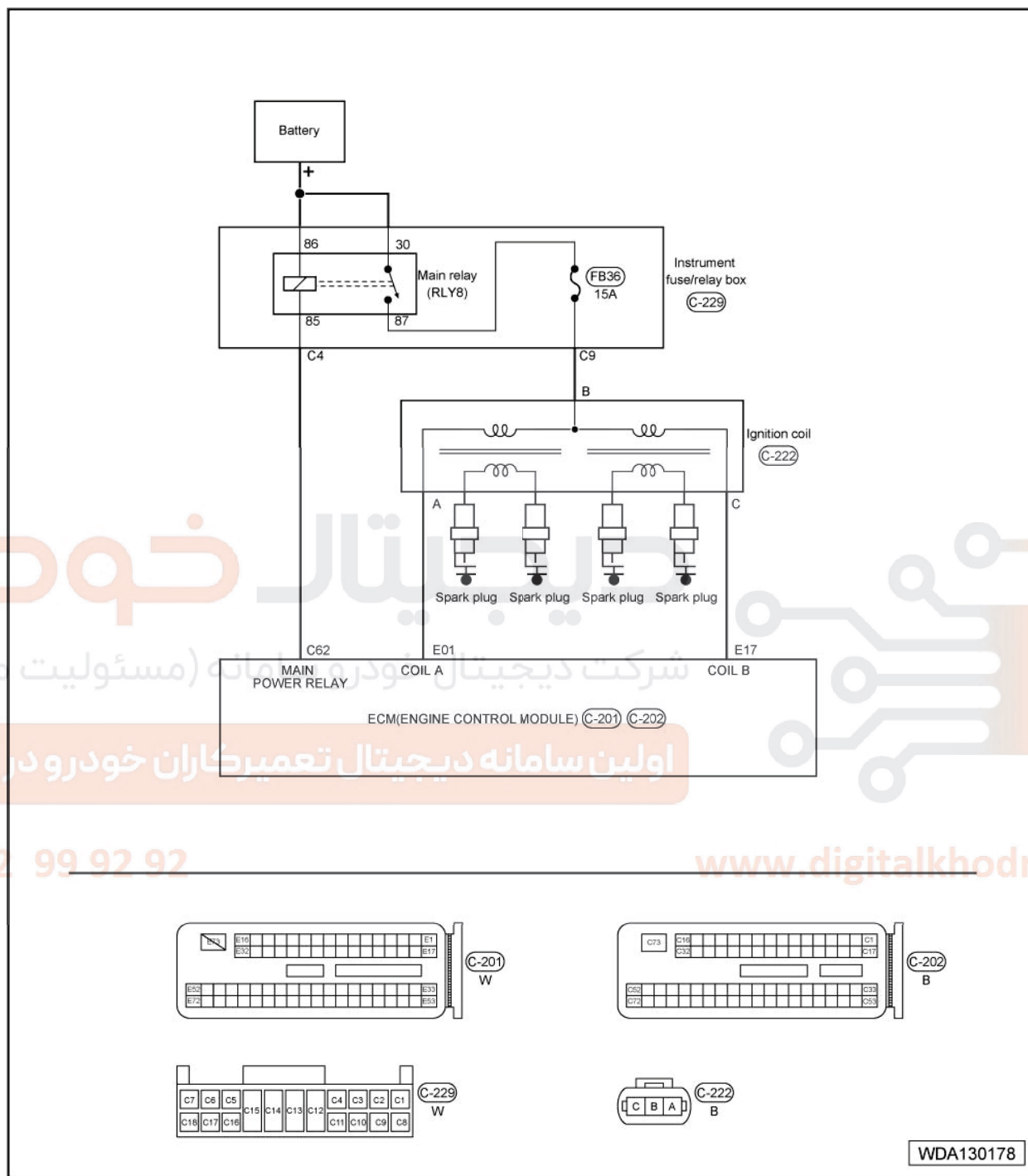
- If yes, go to step 7.
- If not, the camshaft position sensor fails and please replace it. ■



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7. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.14 P0351 Failure of the ignition coil 1**P0352 Failure of the ignition coil 2****Values between the ECM and the ignition coils**

ECM pin No.	Function	Condition	Value (DC voltage range)
E1	Ignition coil control	The ignition switch in the ON position	3.6 V
E17	Ignition coil control	The ignition switch in the ON position	3.6 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0351	Failure of the ignition coil 1	Engine idle running	The ignition coil control circuit open circuit or short to ground or short to power	- Failure of the ignition coil - Failure of the ignition coil circuit - Failure of the engine control module
P0352	Failure of the ignition coil 2	Engine idle running	The ignition coil control circuit open circuit or short to ground or short to power	- Failure of the ignition coil - Failure of the ignition coil circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

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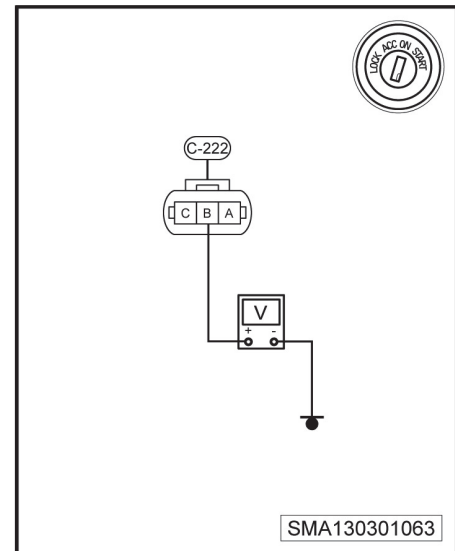
Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

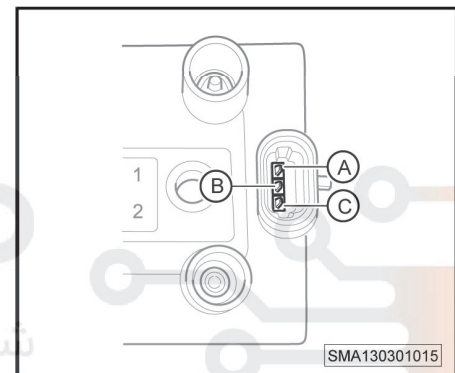
1. Check if the power supply fuse FB36 (15A) of the ignition coil is normal.
 - If yes, go to step 2.
 - If not, the fuse fails and please replace the fuse FB36. ■

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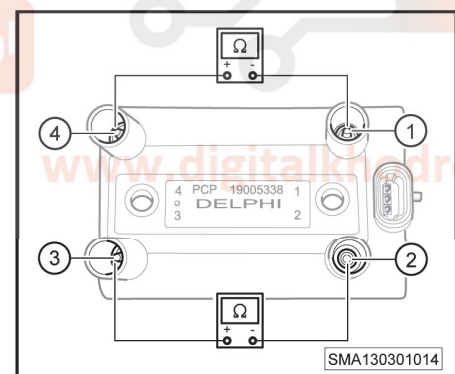
2. Disconnect the ignition coil connector C-222 and check if the pin B of C-222 is battery voltage.
 - If not, go to step 3.
 - If not, the lead between the fuse FB36 and the pin B of C-222 fails and please repair the defective lead. ■



3. Disconnect the ignition coil connector C-222 and measure if the resistance value between the ignition coil primary coils A and B or the ignition coil primary coils B and C is normal. (The resistance value of the primary coils shall be $0.45 \sim 0.55 \Omega$)
 - If yes, the ignition coil fails and please replace it. ■
 - If not, go to step 4.

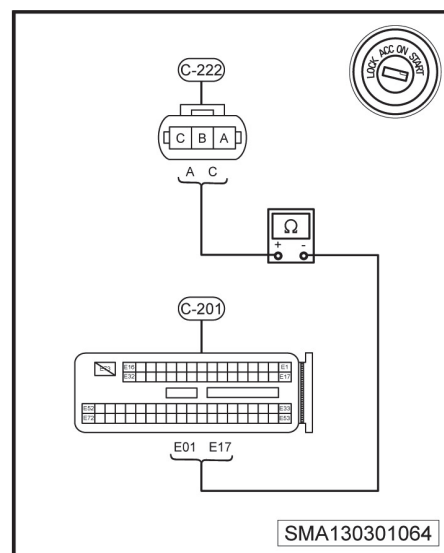


4. Disconnect the ignition coil connector C-222, pull out the ignition cable and measure if the resistance value between the ignition coil secondary coils 1 and 4 or the ignition coil secondary coils 2 and 3 is normal. (The resistance value of the secondary coils shall be $8.8 \sim 10.8K \Omega$)
 - If yes, go to step 5.
 - If not, the ignition coil fails and please replace it. ■



5. Disconnect the ignition coil connector C-222 and the ECM connector C-201 and check if the leads between the pins A and C of C-222 and the pins E1 and E17 of C-201 have short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 6.



6. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

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03

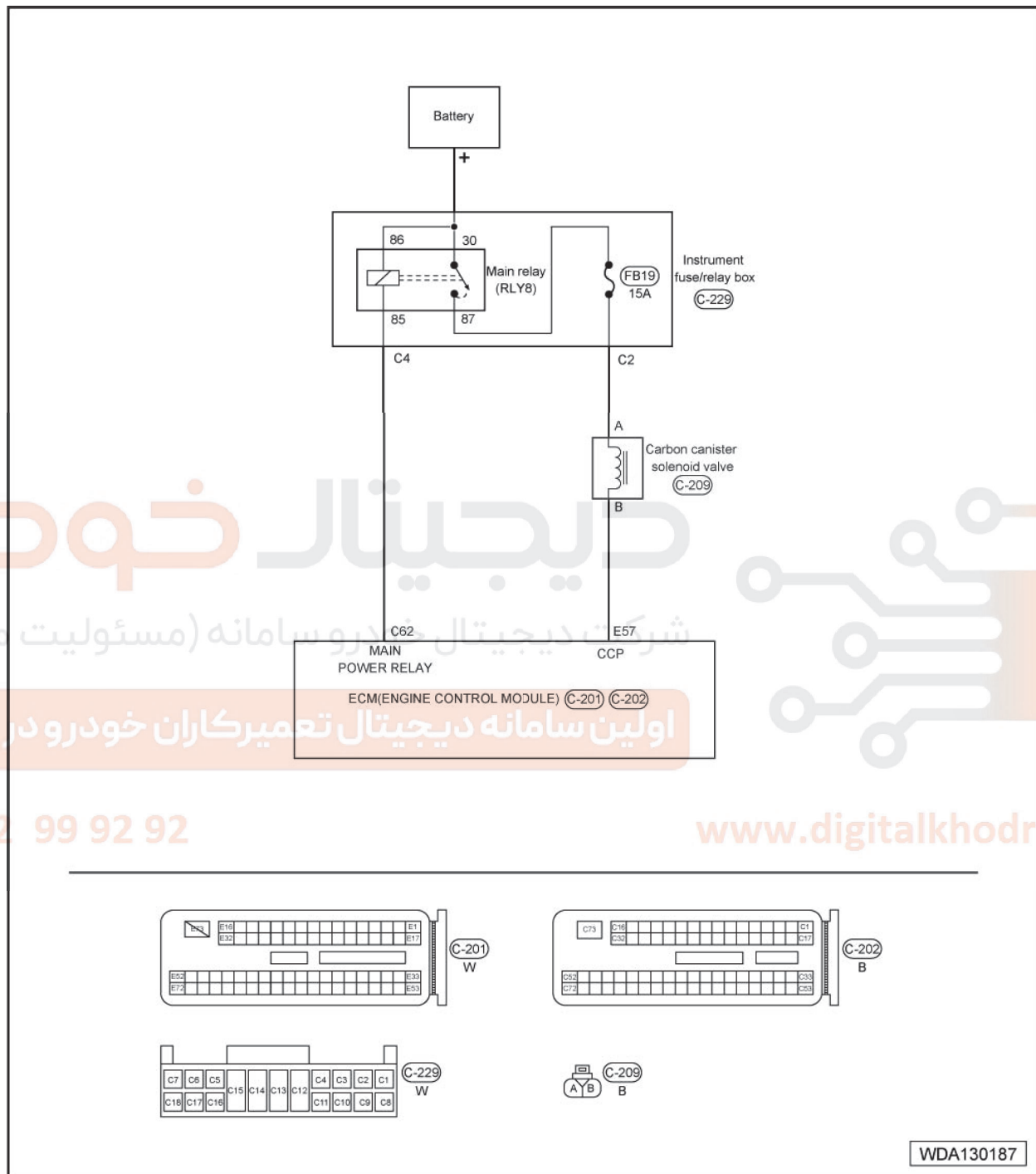


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2.6.15 P0458 Carbon canister solenoid valve circuit short to low voltage or open circuit

P0459 Carbon canister solenoid valve circuit short to high voltage



Values between the ECM and the carbon canister solenoid valve

ECM pin No.	Function	Condition	Value (DC voltage range)
E57	Carbon canister solenoid valve control wire	The ignition switch in the ON position	3.6 V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0458	Carbon canister solenoid valve circuit short to low voltage or open circuit	Engine idle running	Carbon canister solenoid valve control terminal grounded or open circuit when the solenoid valve does not work	- Failure of the carbon canister solenoid valve - Failure of the carbon canister solenoid valve circuit - Failure of the engine control module
P0459	Carbon canister solenoid valve circuit short to high voltage	Engine idle running	Carbon canister solenoid valve control terminal short to power when the solenoid valve works	- Failure of the carbon canister solenoid valve - Failure of the carbon canister solenoid valve circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

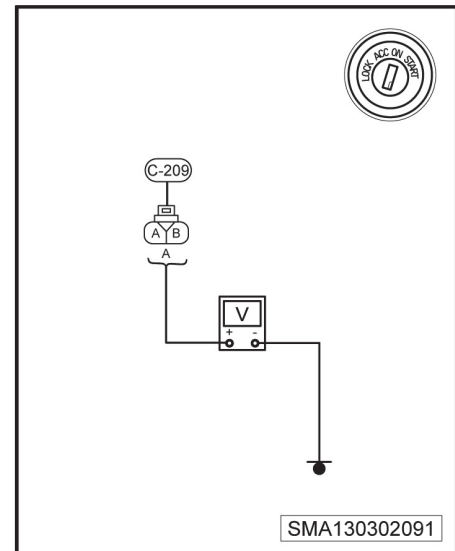
- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the power supply fuse FB19 (15A) of the carbon canister solenoid valve is normal.
 - If yes, go to step 2.
 - If not, the fuse fails and please replace the fuse FB19. ■

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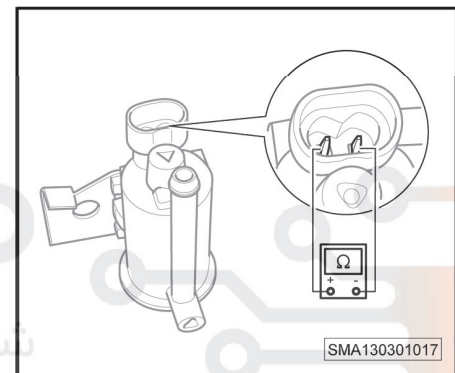
2. Disconnect the carbon canister solenoid valve connector C-209 and check if the pin A of C-209 is battery voltage.

- If yes, go to step 3.
- If not, the lead between the fuse FB36 and the pin A of C-209 fails and please repair the defective lead. ■



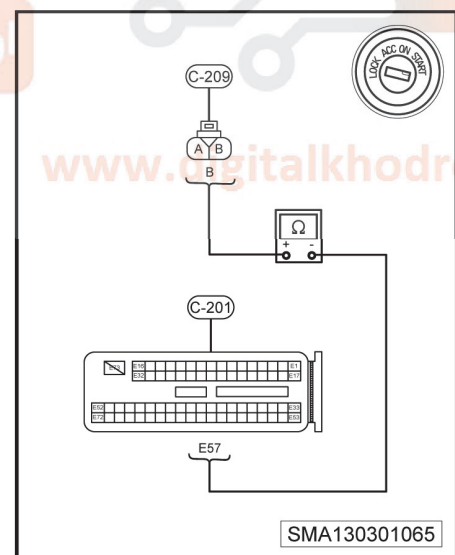
3. Disconnect the carbon canister solenoid valve connector C-209 and measure if the resistance value of the carbon canister solenoid valve coil is normal. (The resistance value of the carbon canister solenoid valve coil shall be $19 \sim 22 \Omega$).

- If yes, go to step 4.
- If not, the carbon canister solenoid valve fails and please replace it. ■



4. Disconnect the carbon canister solenoid valve connector C-209 and the ECM connector C-201 and check if the lead between the pin B of C-209 and the pin E57 of C-201 has short or open circuit.

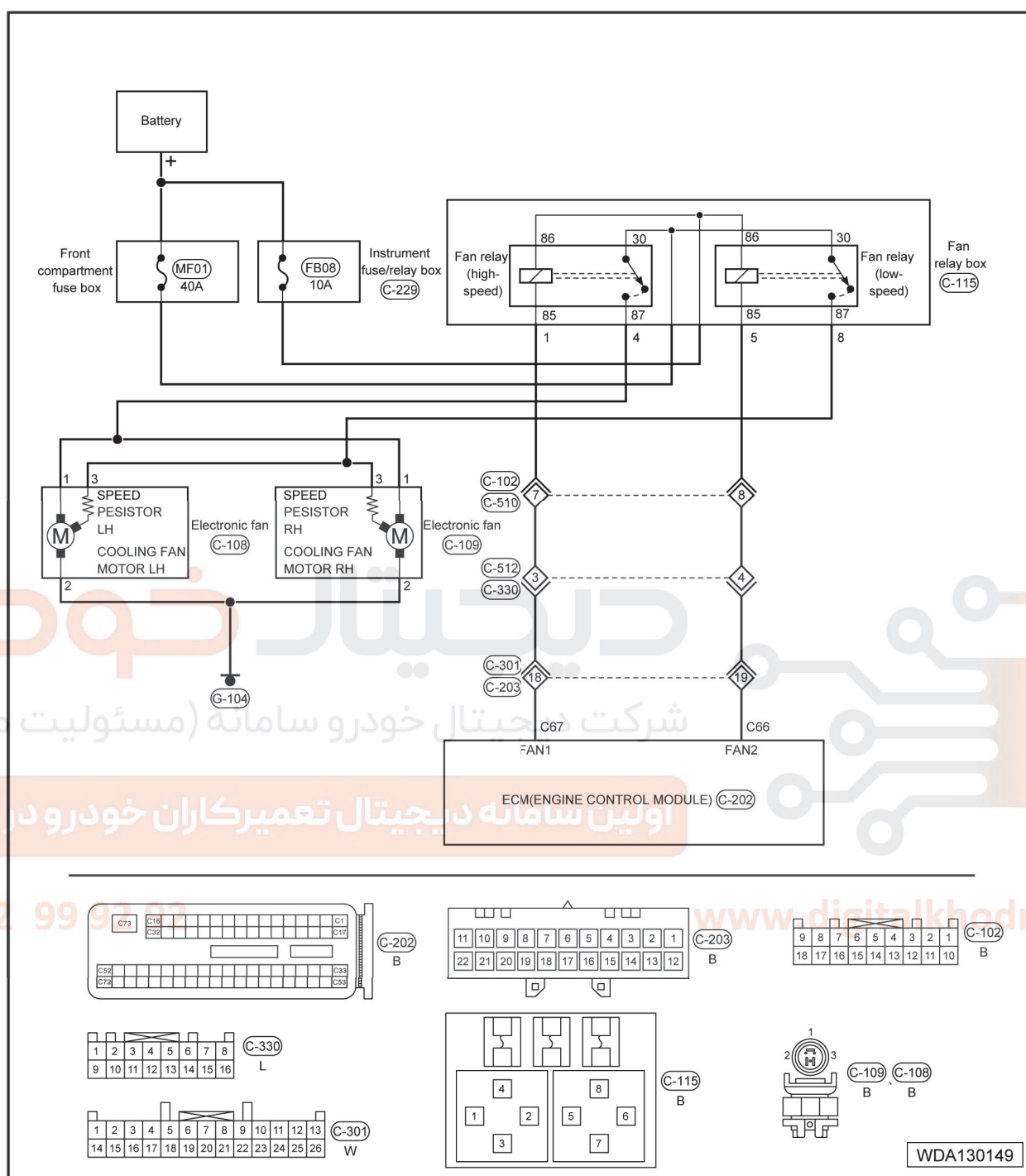
- If yes, repair the defective lead. ■
- If not, go to step 6.



5. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.16 P0480 Failure of the low speed cooling fan



Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0480	Failure of the low speed cooling fan	Engine idle running when the cooling fan is working	The low speed cooling fan control terminal short to power	- Failure of the low speed cooling fan relay - Failure of the low speed cooling fan relay circuit

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
				Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

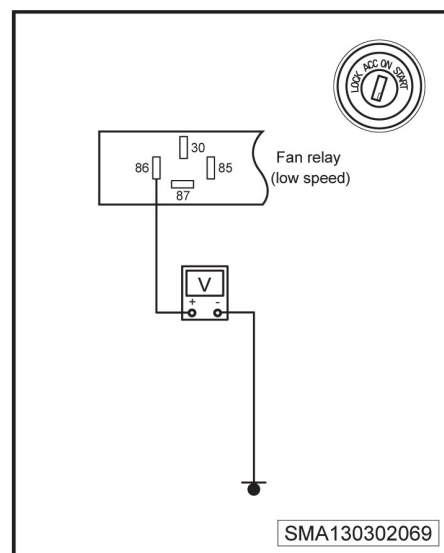
1. Check if the fuses FB08 (15A) and MFO1 (40A) of the cooling fan are normal.

- If yes, go to step 2.
- If not, the fuse fails and please replace the fuse FB08 or MFO1. ■

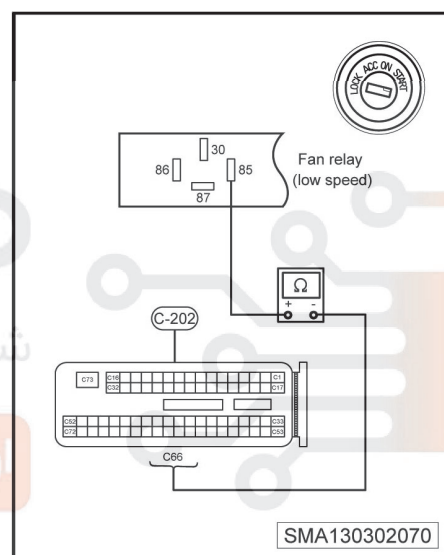
2. Pull out the low speed cooling fan relay and check if the resistance value of the relay coil is normal. Lever out the relay housing and check if the closed contact is normal.

- If yes, go to step 3.
- If not, the low speed cooling fan relay fails and please replace it. ■

3. Pull out the low speed cooling fan relay and check if the voltage of its pin 86 is battery voltage.
 - If yes, go to step 4.
 - If not, the lead between the fuse FB08 and the pin 86 of the low speed cooling fan relay fails and please repair the defective lead. ■

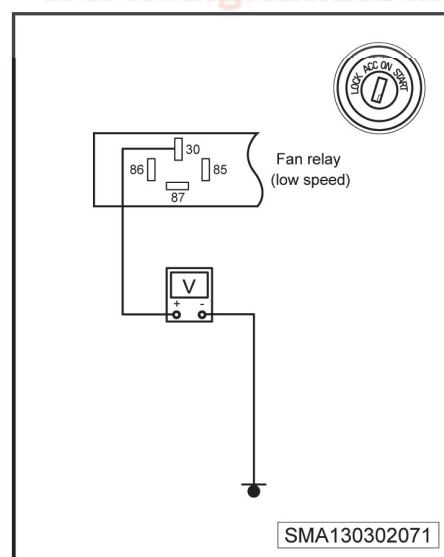


4. Pull out the low speed cooling fan relay, disconnect the ECM connector C-202 and check if the lead between the pin 85 of the low speed cooling fan relay and the pin C66 of C-202 has short or open circuit.
 - If yes, the lead between the pin 85 of the low speed cooling fan relay and the pin C66 of C-202 fails and please repair the defective lead. ■
 - If not, go to step 5.



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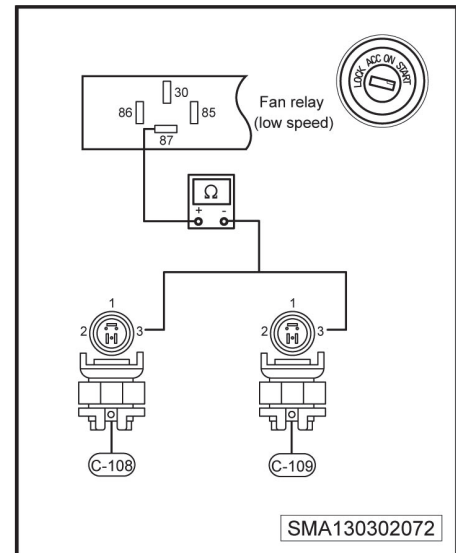
5. Pull out the low speed cooling fan relay and check if the voltage of its pin 30 is battery voltage.
 - If yes, go to step 6.
 - If not, the lead between the fuse MFO1 and the pin 30 of the low speed cooling fan relay fails and please repair the defective lead. ■



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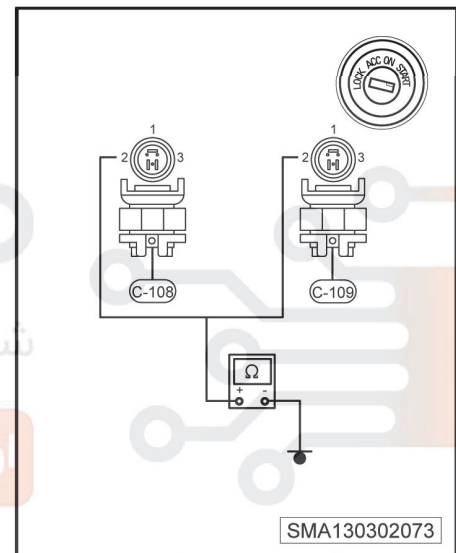
6. Pull out the low speed cooling fan relay, disconnect the cooling fan connectors C-108 and C-109, and check if the lead between the pin 87 of the low speed cooling fan relay and the pins 3 of C-108 and 3 of C-109 has short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 7.



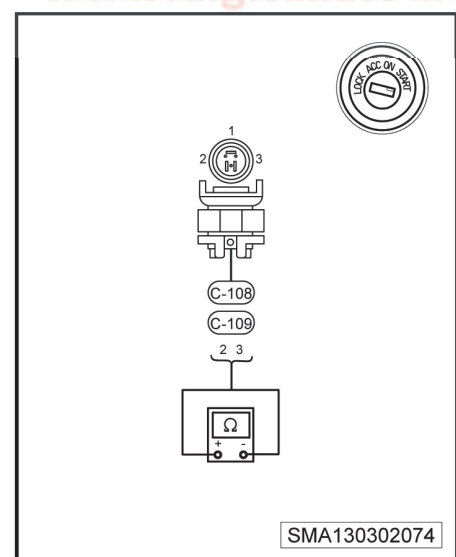
7. Disconnect the cooling fan connectors C-108 and C-109 and check if the lead between the pins 2 of C-108 and 2 of C-109 and the earth terminal has short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 8.



8. Disconnect the cooling fan connectors C-108 and C-109 and check if the resistance value between the pins 2 and 3 of C-108 or the pins 2 and 3 of C-109 is normal. (The measured value is about 0.8Ω)

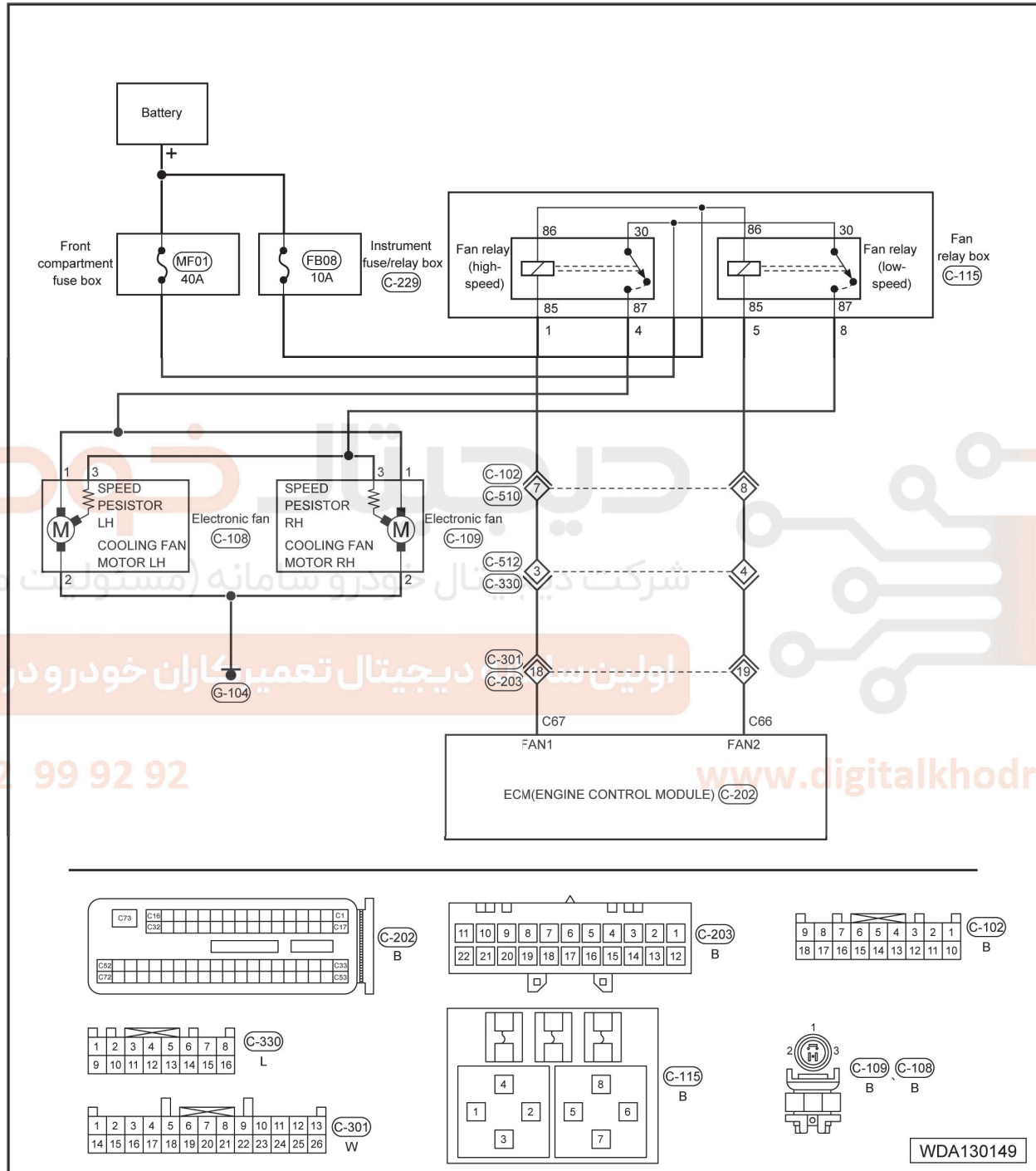
- If yes, go to step 9.
- If not, the cooling fan motor fails and please replace the cooling fan. ■



9. Replace the ECM, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, find the fault cause from other symptoms.
- If not, the fault has been rectified. ■

2.6.17 P0481 Failure of the high speed cooling fan



Fault code definition and fault causes

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0480	Failure of the high speed cooling fan	Engine idle running with the cooling fan working	The high speed cooling fan control terminal short to power	- Failure of the cooling fan high speed relay - Failure of the cooling fan high speed relay control circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

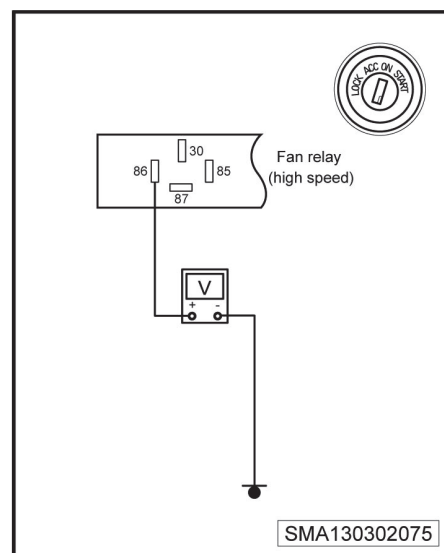
- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach the cooling fan starting temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

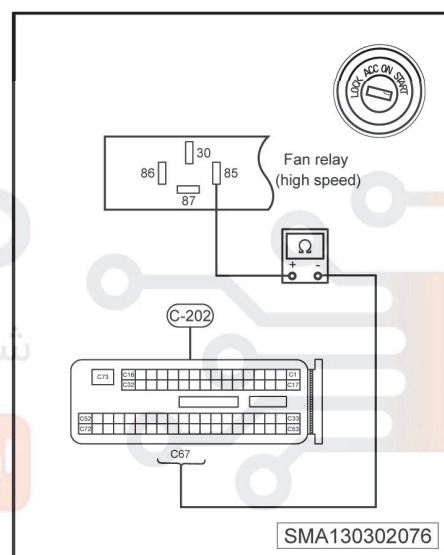
- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the cooling fan fuses FB08 (15A) and MFO1 (40A) are normal.
 - If yes, go to step 2.
 - If not, the fuse fails and replace the fuse FB08 or MFO1. ■
2. Pull out the high speed cooling fan relay to measure if the resistance value of the relay coil is normal. Lever out the relay housing to check if the contact switch is normal.
 - If yes, go to step 3.
 - If not, the high speed cooling fan relay fails and please replace it. ■

3. Pull out the high speed cooling fan relay to check if the voltage of its pin 86 is battery voltage.
- If yes, go to step 4.
 - If not, the lead between the fuse FB08 and the high speed cooling fan relay pin 86 fails and please repair the defective lead. ■

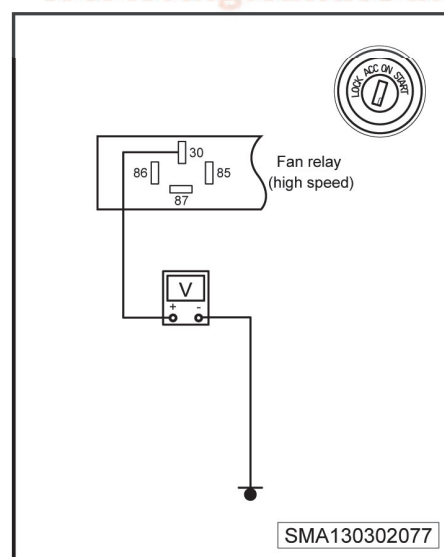


4. Pull out the high speed cooling fan relay, disconnect the ECM connector C-202 and check if the circuit between the pin 85 of the high speed cooling fan relay and the pin C67 of C-202 has short or open circuit.
- If yes, repair the defective lead. ■
 - If not, go to step 5.



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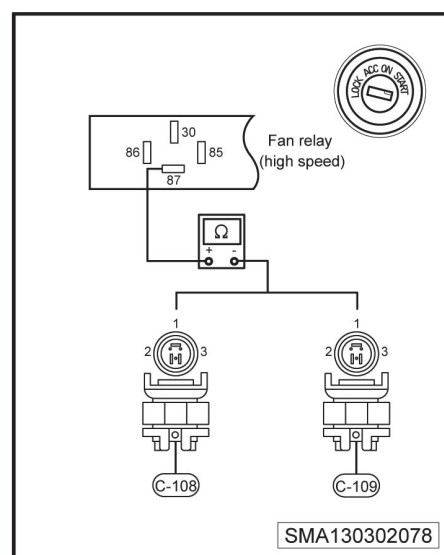
5. Pull out the high speed cooling fan relay to check if the voltage of its pin 30 is battery voltage.
- If yes, go to step 6.
 - If not, the lead between the fuse MFO1 and the high speed cooling fan relay pin 30 fails and please repair the defective lead. ■



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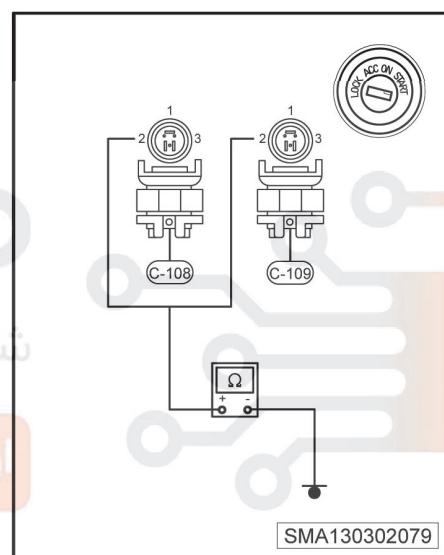
6. Pull out the high speed cooling fan relay, disconnect the cooling fan connectors C-108 and C-109, and check if the circuit between the pin 87 of the high speed cooling fan relay and the pins 1 of C-108 and 1 of C-109 has short or open circuit.

- If yes, repair the defective lead. ■
- If not, go to step 7.



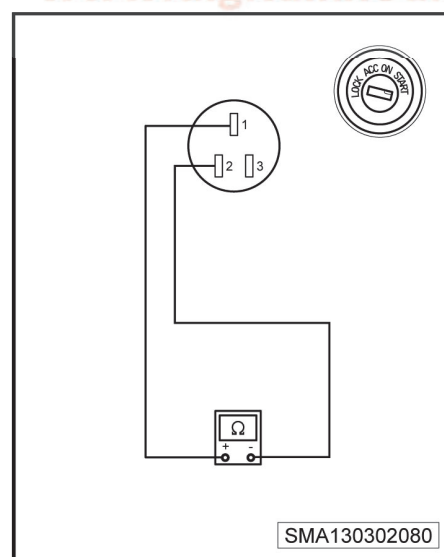
7. Disconnect the cooling fan connectors C-108 and C-109, and check if the lead between the earth terminal and the pins 2 of C-108 and 2 of C-109 is normal.

- If yes, repair the defective lead. ■
- If not, go to step 8.



8. Disconnect the cooling fan connectors C-108 and C-109, and check if the resistance values between the pins 2 and 1 of C-108, and between the pins 2 and 1 of C-109 are normal.

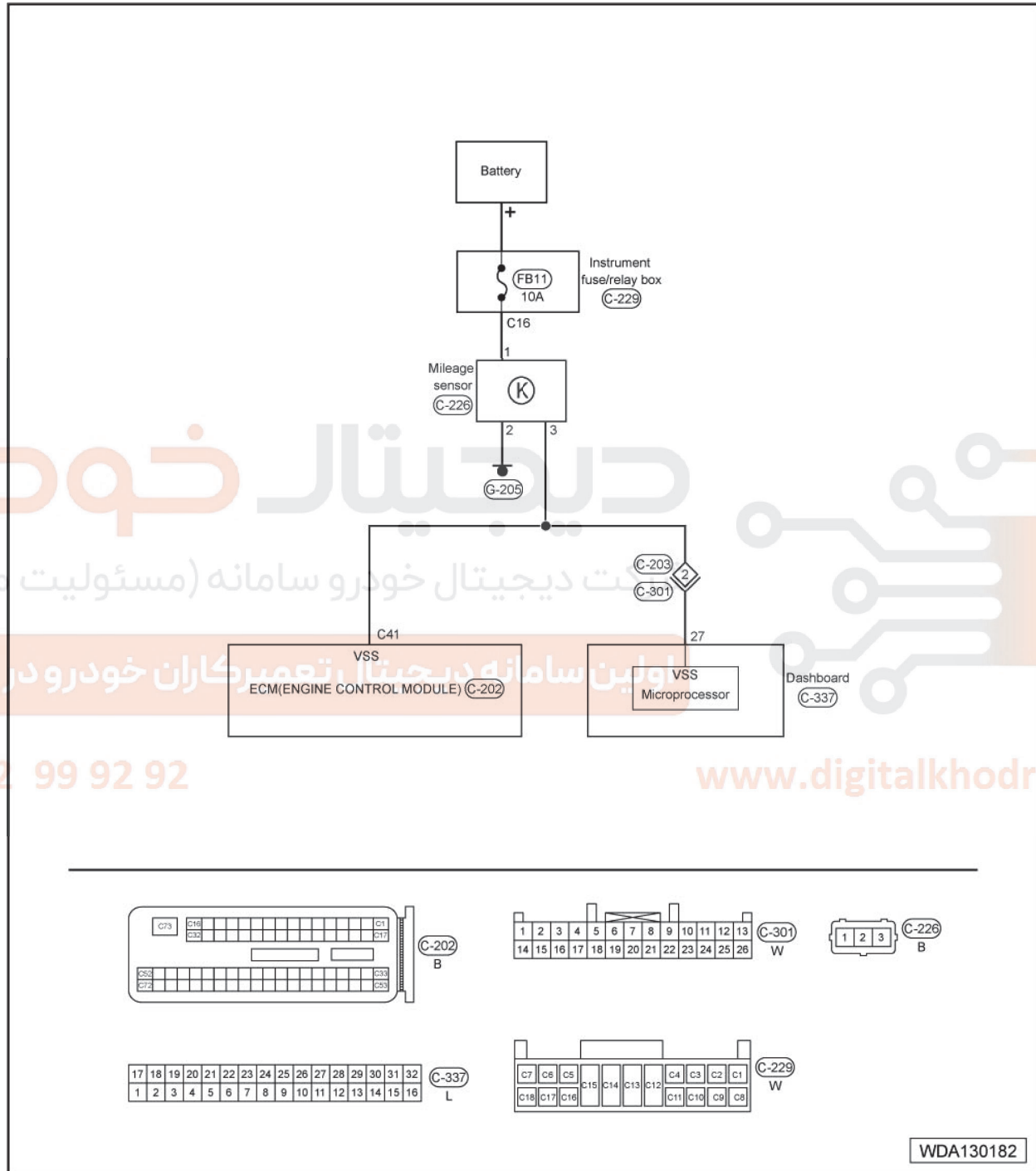
- If yes, go to step 9.
- If not, the cooling fan fails and please repair it. ■



9. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, locate fault causes from other symptoms.
- If not, the fault has been rectified. ■

2.6.18 P0502 No signal in the vehicle speed sensor



Value between the ECM and the vehicle speed sensor

ECM pin No.	Function	Condition	Value (DC voltage range)
C41	Vehicle speed sensor signal	The ignition switch in the ON position	10.7V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0502	No signal in the vehicle speed sensor	The vehicle in hot state and driven at 3rd gear	Cut off the speed sensor signal, press the accelerator pedal hard to accelerate above 4000 rpm and release immediately, then the engine speed, vehicle speed and MAP value will decrease	- Failure of the vehicle speed sensor - Failure of the vehicle speed sensor circuit - Failure of the engine control module
		The vehicle in hot state and driven at 4th gear	Cut off the speed sensor signal and press the accelerator pedal at moderate speed, then the engine speed, vehicle speed and MAP value will decrease	

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DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach the cooling fan high speed operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

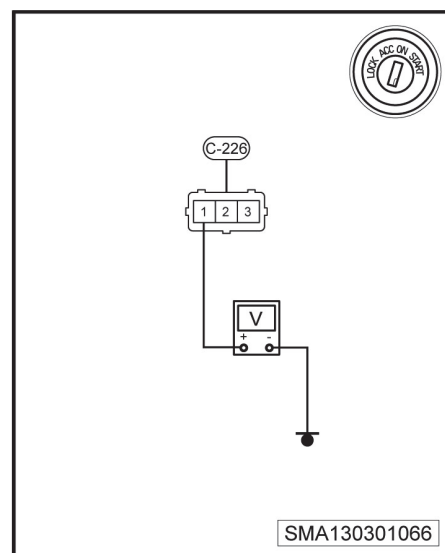
Diagnosis procedures:

i Note

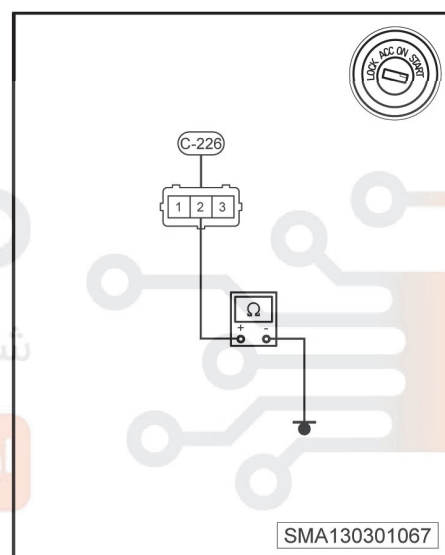
- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the power supply fuse FB11 (10A) of the vehicle speed sensor is normal.
 - If yes, go to step 2.
 - If not, the fuse fails and please replace the fuse FB11. ■

2. Turn the ignition switch to the ON position, disconnect the vehicle speed sensor connector C-226 and check if the voltage at the pin 1 of C-226 is battery voltage.
 - If yes, go to step 3.
 - If not, the lead between the fuse FB11 and the pin 1 of C-226 fails and please repair the defective lead. ■

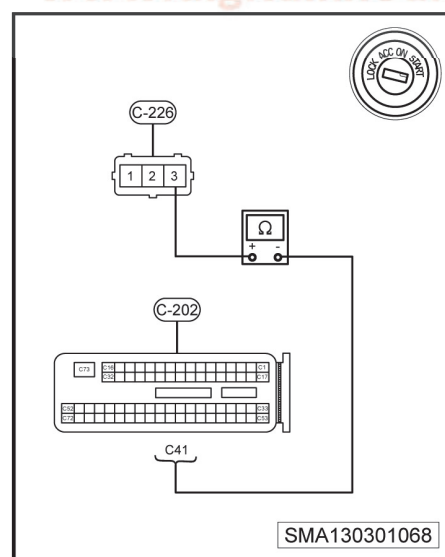


3. Disconnect the vehicle speed sensor connector C-226 and check if the lead between the pin 2 of C-226 and the earth terminal has short or open circuit.
 - If yes, repair the defective lead. ■
 - If not, go to step 4.



03

4. Disconnect the vehicle speed sensor connector C-226 and the ECM connector C-202, and check if the lead between the pin 3 of C-226 and the pin C41 of C-202 has short or open circuit.
 - If yes, repair the defective lead. ■
 - If not, go to step 5.



5. Remove the vehicle speed sensor, connect its connector and rotate the signal wheel of the speed sensor manually to check if the signal voltage at the

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pin 3 of C-226 varies with the speed of the signal wheel.

- If yes, go to step 6.
- If not, the vehicle speed sensor fails and please repair it. ■

6. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, locate fault causes from other symptoms.
- If not, the fault has been rectified. ■

03

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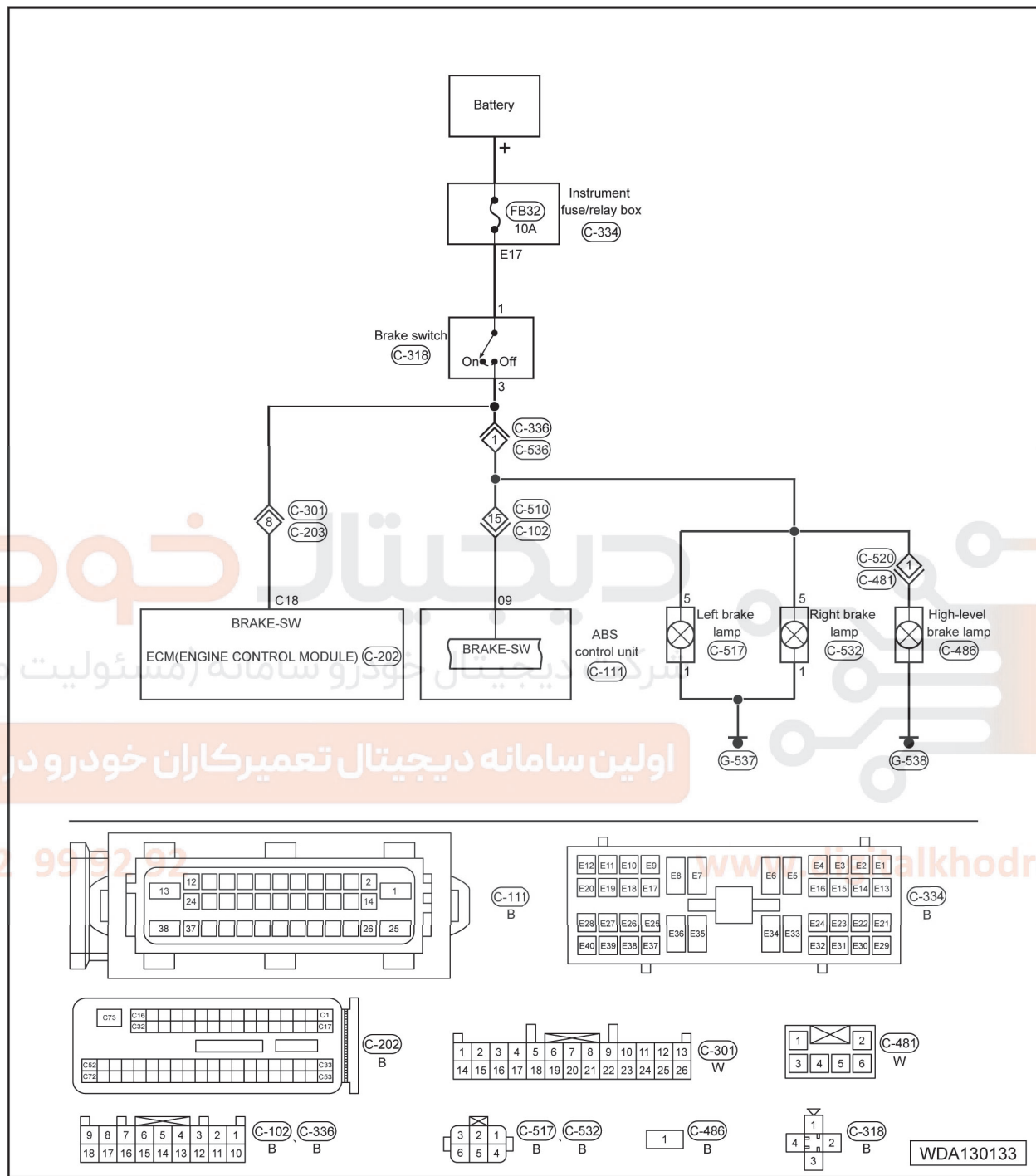


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2.6.19 P0504 Correlation failure of the brake switch

P0571 No change in the brake lamp switch during braking



Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0504	Correlation failure of the brake switch	The ignition switch in the ON position	The brake signal wire disconnected, the vehicle brake entering the diagnosis window	• Failure of the brake switch • Failure of the brake switch circuit

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
			and the fault code appearing several times after braking	
P0571	No change in the brake lamp switch during braking	The ignition switch in the ON position	The brake signal wire disconnected, the vehicle brake entering the diagnosis window and the fault code appearing several times after braking	Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

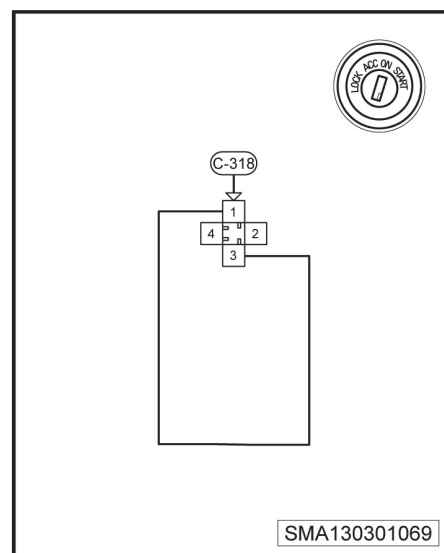
- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine and press the brake switch for several times.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

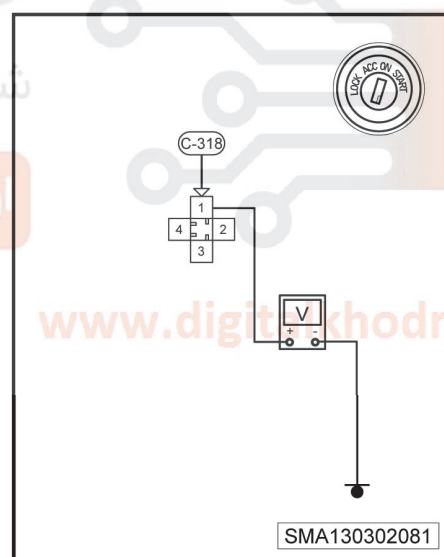
1. Turn the ignition switch to the ON position, press the brake pedal and check if the brake light lights up.
 - If yes, go to step 6.
 - If not, go to step 2.

2. Disconnect the brake switch connector C-318, short-circuit the pins 1 and 3 of C-318 with the short connector and check if the brake light lights up.
 - If yes, the brake switch fails and please replace it. ■
 - If not, go to step 3.



3. Check if the fuse FB32 (10A) of the brake switch is normal.
 - If yes, go to step 4.
 - If not, the fuse fails and please replace the fuse FB32. ■

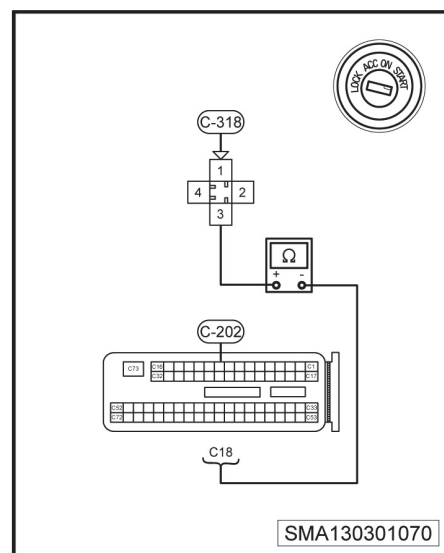
4. Turn the ignition switch to the ON position, disconnect the brake switch connector C-318 and check if the voltage at the pin 1 of C-318 is battery voltage.
 - If yes, go to step 5.
 - If not, the lead between the fuse FB32 and the pin 1 of C-318 fails and please repair the defective lead. ■



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5. Disconnect the brake switch connector C-318 and the ECM connector C-202, and check if the lead between the pin 3 of C-318 and the pin C18 of C-202 has short, open or earthing circuit.

- If yes, repair the defective lead. ■
- If not, go to step 6.



6. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, locate fault causes from other symptoms.
- If not, the fault has been rectified. ■

03

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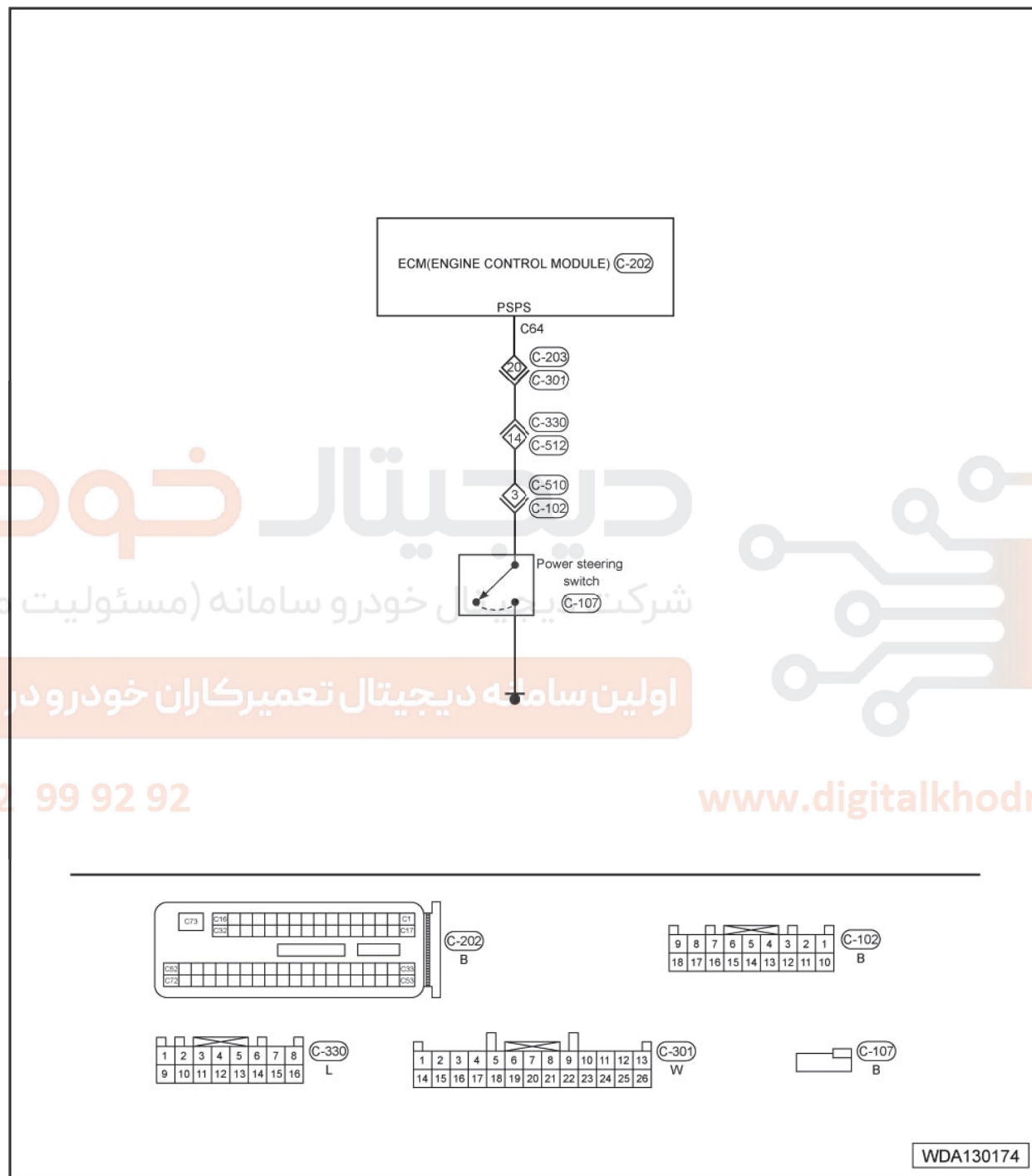
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2.6.20 P0551 Failure of the power steering switch circuit voltage range/performance

P0552 Power steering switch circuit short to low voltage

P0553 Power steering switch circuit short to high voltage



Fault code definition and fault causes

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0551	Failure of the power steering switch circuit voltage range/performance	Engine idle running with the speed of zero	Power steering switch circuit voltage deviating from the system specification	- Failure of the power steering switch - Failure of the power steering switch circuit - Failure of the engine control module
P0552	Power steering switch circuit short to low voltage	Engine idle running with the speed of zero	Power steering switch circuit open circuit or short to ground	- Failure of the power steering switch - Failure of the power steering switch circuit - Failure of the engine control module
P0553	Power steering switch circuit short to high voltage	Engine idle running with the speed of zero	Power steering switch circuit short to power	- Failure of the power steering switch - Failure of the power steering switch circuit - Failure of the engine control module

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

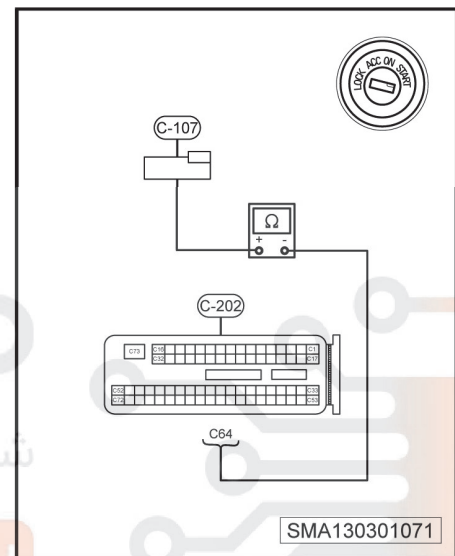
- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**i Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the power steering fluid level is normal.

- If yes, go to step 2.
 - If not, refill the power steering fluid. ■
2. Disconnect the power steering switch connector C-107 and turn the steering wheel to one side as far as it will go. Check if the pin of the power steering switch is grounded.
- If yes, go to step 3.
 - If not, the power steering switch fails and please replace it. ■
3. Disconnect the power steering switch connector C-107 and ECM connector C-202, and check if the lead between the pin of C-107 and the pin C64 of C-202 has short or open circuit.
- If yes, repair the defective lead. ■
 - If not, go to step 4.



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4. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.
- If yes, locate fault causes from other symptoms.
 - If not, the fault has been rectified. ■

2.6.21 P0562 System voltage low

P0563 System voltage high

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0562	System voltage low	The ignition switch in the ON position	The system voltage less than 11V for 40 seconds	- Failure of the generator - Failure of the battery - Failure of the engine control module

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0563	System voltage high	The ignition switch in the ON position	The system voltage more than 16V for 40 seconds	• Failure of the generator • Failure of the battery • Failure of the engine control module

DTC test procedures:

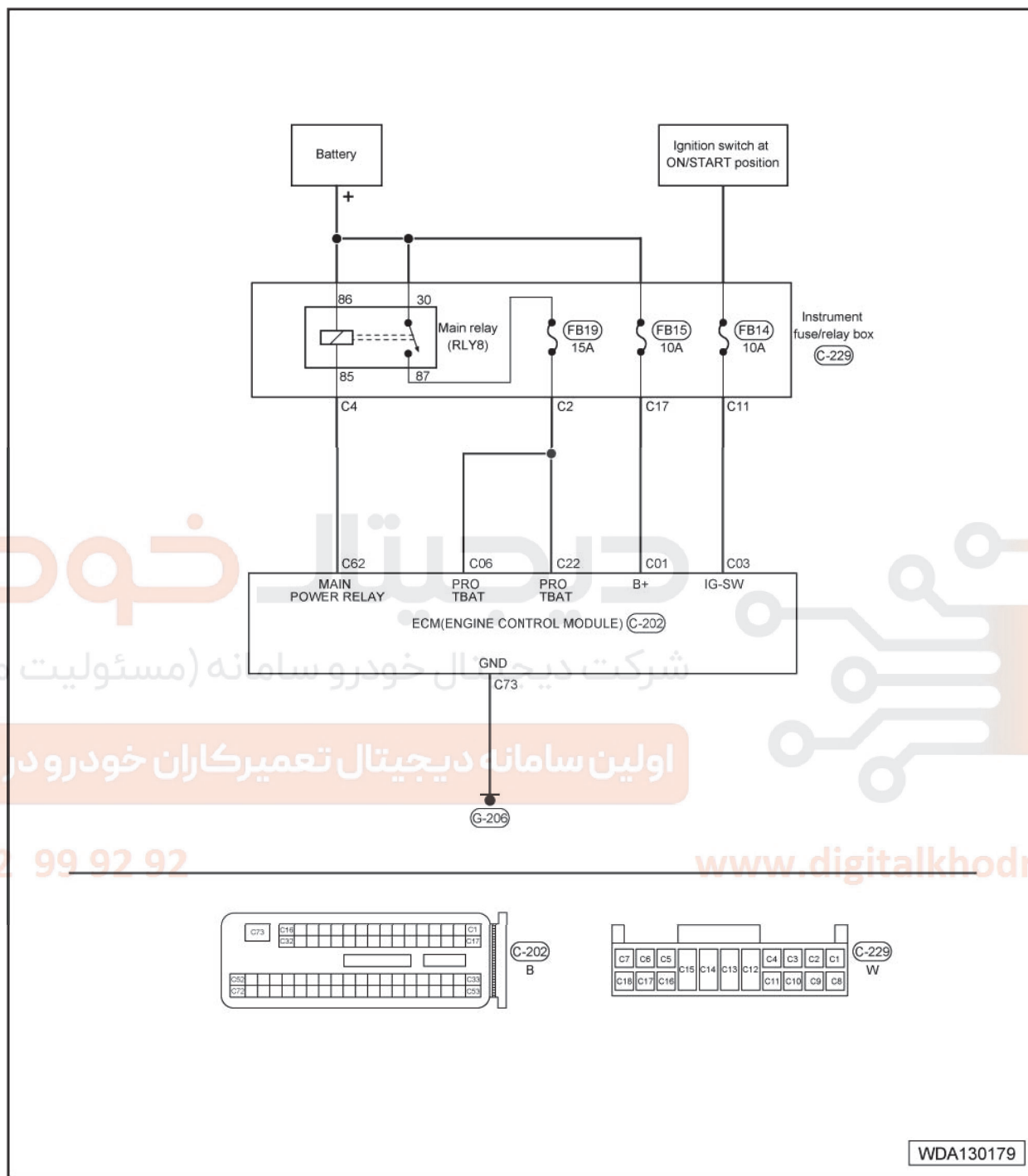
Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Check if the battery voltage is normal (or if the battery separator has short or open circuit).
 - If yes, go to step 2.
 - If not, the battery fails and please replace it. ■
2. Connect the diagnosis device, start the engine to perform road test and check if the "generator voltage data flow" is about 14.5V.
 - If yes, go to step 3.
 - If not, the generator fails and please replace it. ■
3. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.
 - If yes, locate fault causes from other symptoms.
 - If not, the fault has been rectified. ■

2.6.22 P0606 Failure of the ECM processor**P060A Failure of the ECM programming****Values of the ECM power supply line**

ECM pin No.	Function	Condition	Value (DC voltage range)
C1	Control module energized	—	Battery voltage
C3	Control module energized	The ignition switch in the ON/START position	Battery voltage

Fault code definition and fault causes

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0606	Failure of the ECM processor	The ignition switch in the ON position with the ECM working	—	• Failure of the ECM power supply fuse • Failure of the ECM relay • Failure of the ECM circuit • Failure of ECM
P060A	Failure of the ECM programming	The ignition switch in the ON position with the ECM working	—	• Failure of the ECM power supply fuse • Failure of the ECM relay • Failure of the ECM circuit • Failure of ECM

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

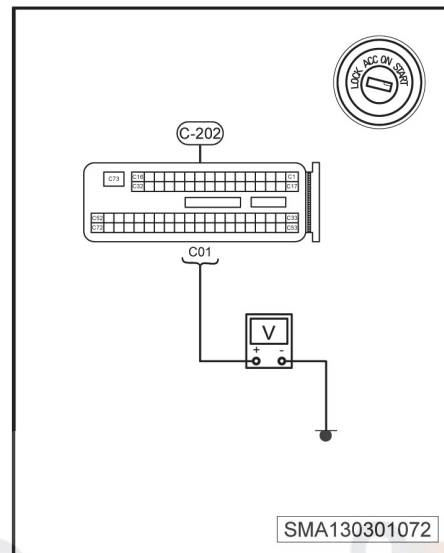
- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**i Note**

- Please verify again if the DTC and its symptoms are present after fault is rectified.

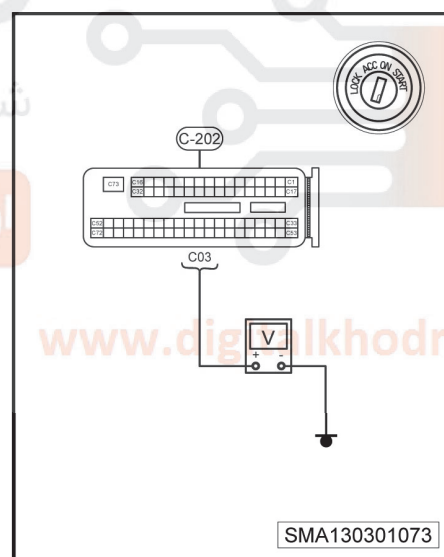
1. Check if the power supply fuses FB19, FB15 and FB14 of the ECM control module are loosened or damaged.
 - If yes, replace the faulty fuse. ■
 - If not, go to step 2.
2. Check if the ECM main relay is loosened or damaged.
 - If yes, the main relay fails and please replace it. ■
 - If not, go to step 3.

3. Check if the ECM control module pins/connectors are corrosive, tainted or loose.
 - If yes, rectify the fault. ■
 - If not, go to step 4.
4. Turn the ignition switch to the OFF position, disconnect the ECM connector C-202 and check if the voltage at the pin C1 of C-202 is battery voltage.
 - If yes, go to step 5.
 - If not, the lead between the pin C1 of C-202 and the fuse box FB15 fails and please repair it. ■



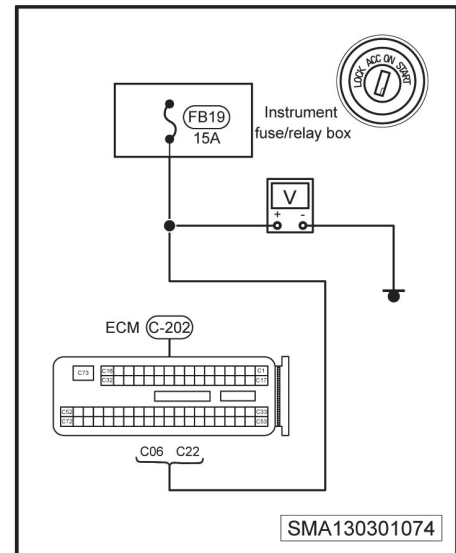
03

5. Turn the ignition switch to the ON position and check if the voltage at the pin C3 of C-202 is battery voltage.
 - If yes, go to step 6.
 - If not, the lead between the pin C3 of C-202 and the fuse box FB14 fails and please repair it. ■

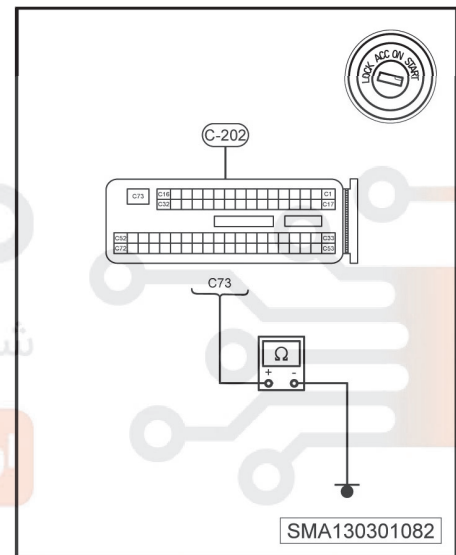


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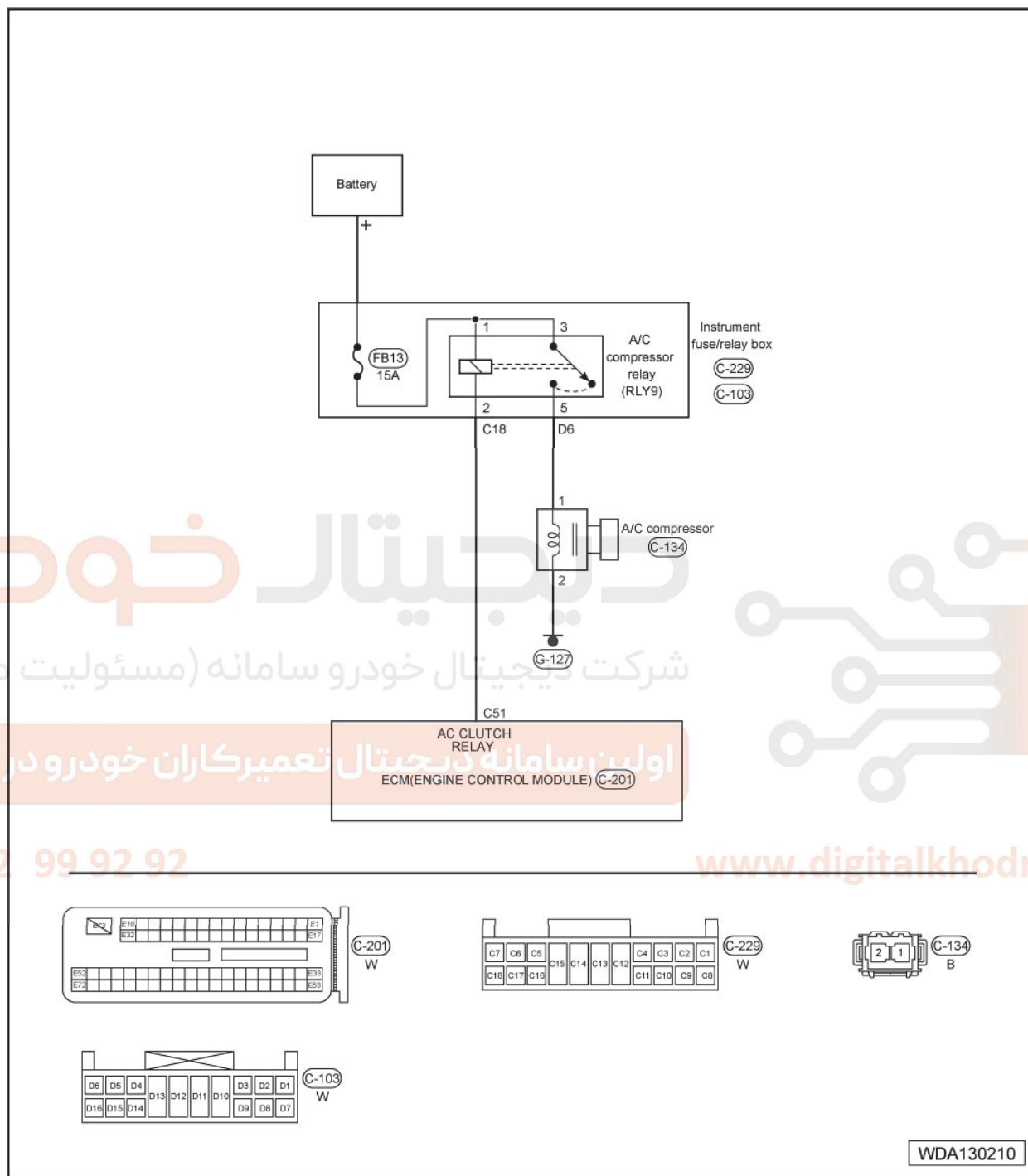
6. Turn the ignition switch to the ON position with the ECM connector connected, and check if the voltage between the pins C6 and C22 of the ECM connector C-202 is battery voltage.
- If yes, go to step 7.
 - If not, the lead between the pin C6 of C-202 and the fuse box FB19 fails and please repair it. ■



7. Check if the lead of the pin C73 of the ECM connector C-202 is properly grounded.
- If yes, go to step 8.
 - If not, the lead between the pin C73 of C-202 and the G-206 earth terminal fails and please repair the defective lead. ■



8. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.
- If yes, locate fault causes from other symptoms.
 - If not, the fault has been rectified. ■

2.6.23 P0646 A/C clutch relay circuit short to low voltage or short circuit**P0647 A/C clutch relay circuit short to high voltage****Fault code definition and fault causes**

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0646	A/C clutch relay circuit short to low voltage or short circuit	The A/C compressor not working	The A/C relay control terminal grounded or open circuit	Failure of the A/C relay

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
				- Failure of the A/C relay circuit - Failure of ECM
P0647	A/C clutch relay circuit short to high voltage	The A/C compressor working	The A/C relay control terminal short to 12V power	- Failure of the A/C relay - Failure of the A/C relay circuit - Failure of ECM

DTC test procedures:

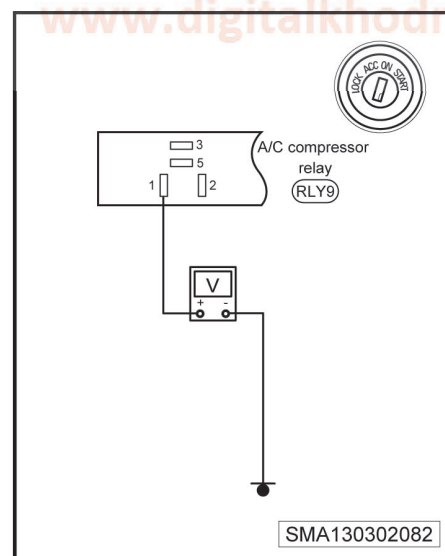
Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, switch on the air conditioner and operate it for several minutes.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Diagnosis procedures:**Note**

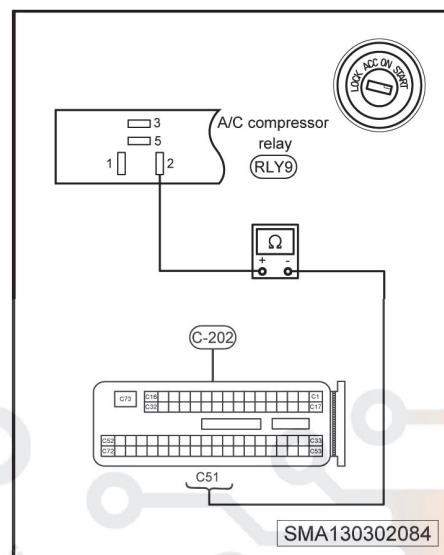
- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Pull out the A/C relay RLY9 and check if the voltage at the pin 1 of the A/C relay RLY9 is battery voltage.
 - If yes, go to step 4.
 - If not, go to step 2.



2. Check if the main relay RLY8 coil has short or open circuit, and if the closed contact has corrosion.
 - If yes, the main relay fails and please replace it. ■

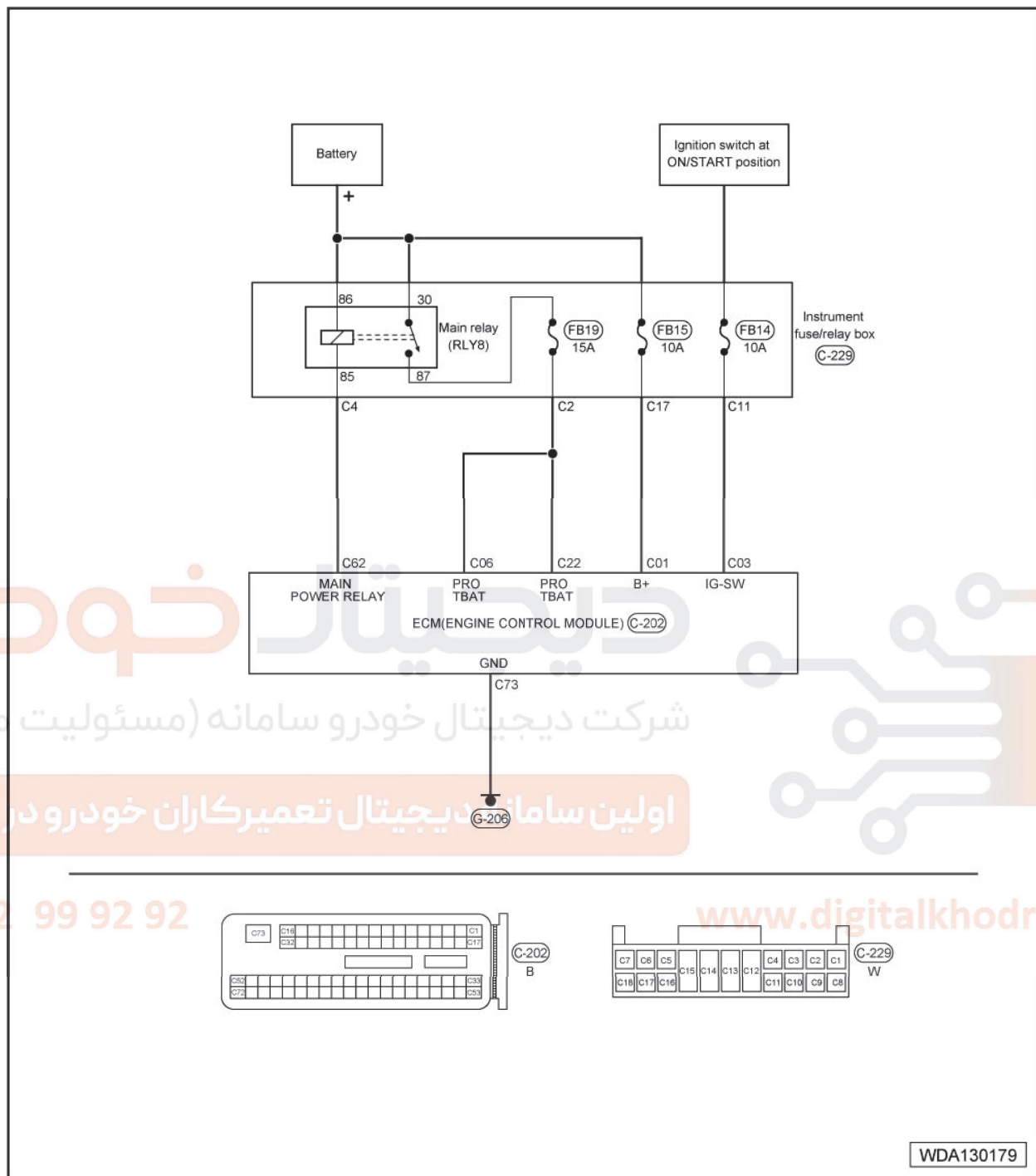
- If not, go to step 3.
3. Check if the A/C clutch relay coil has short or open circuit, and if the closed contact has corrosion.
- If yes, the A/C clutch relay fails and please replace it. ■
 - If not, go to step 4.
4. Disconnect the battery negative terminal, the ECM connector C-202 and check if the lead between the pin 2 of the A/C relay RLY9 and the pin C51 of C-202 has short or open circuit.
- If yes, repair the defective lead. ■
 - If not, go to step 5.



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5. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.
- If yes, locate fault causes from other symptoms.
 - If not, the fault has been rectified. ■

2.6.24 P0685 Failure of the main relay



Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P0685	Failure of the main relay	The ignition switch in the ON position	The main relay control circuit not conform to the expected ECM value	• Failure of the main relay • Failure of the main relay circuit • Failure of the engine control module

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes

DTC test procedures:

Please confirm that the battery voltage is normal before performing the following procedures.

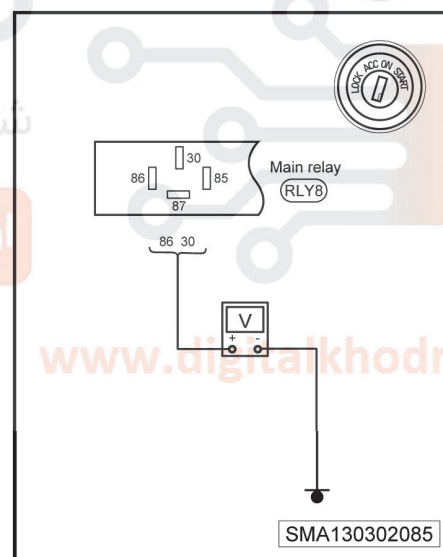
- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

Note

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Pull out the main relay (RLY8), and check if the voltage between the main relay connectors 86 and 30 is battery voltage.

- If yes, go to step 5.
- If not, go to step 2.



2. Disconnect the battery negative terminal and check if the lead between the instrument fuse/relay box B+ stud and the battery positive terminal is conducted.

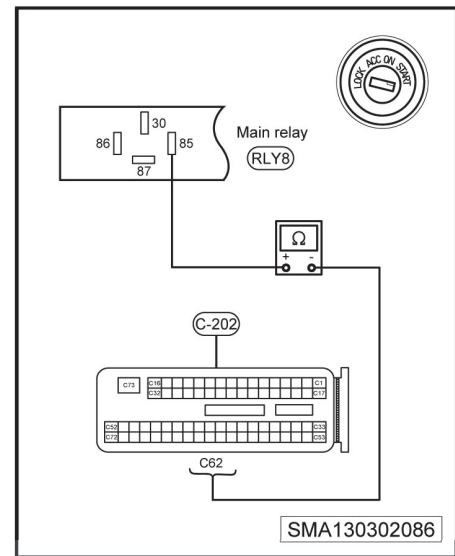
- If yes, go to step 3.
- If not, repair the defective lead. ■

3. Disconnect the battery negative terminal and check if the voltage between the instrument fuse/relay box B+ stud and the pins 86 and 30 of the main relay is battery voltage.

- If yes, go to step 4.

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- If not, the instrument fuse/relay box fails and please replace it. ■
4. Disconnect the battery negative terminal, pull out the main relay (RLY8) and the ECM connector C-202, and check if the lead between the pin 85 of the main relay (RLY8) and the pin C62 of C-202 has short or open circuit.
- If yes, repair the defective lead. ■
 - If not, go to step 5.



5. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.
- If yes, locate fault causes from other symptoms.
 - If not, the fault has been rectified. ■

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2.6.25 P1336 58-tooth gear tolerance not learned

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P1336	58-tooth gear tolerance not learned	Engine running	The gear information not learned	The gear information not learned after replacing the engine

i Note

- The fault code is only applied in the condition that after replacing the engine control module, the 58-tooth gear tolerance is not learned or the learning method is incorrect. If the fault occurs, please make adaption with the following steps.

Learning the crankshaft position sensor target wheel gear tolerance

Preconditions:

- The ECM and the anti-theft control unit will be adapted after replacing the engine control module.
- The gear tolerance is not learned.

- The engine coolant temperature is higher than 60°C.
- Start the engine and turn off all electrical equipment in the vehicle, but do not turn on the air conditioner.
- The vehicle is driven for more than 10 seconds.

Procedures:

1. Turn off the ignition switch, connect the diagnosis device and turn the ignition switch to the ON position.
2. Access the selection menu of the diagnosis device and select "Engine control module" → "Gear information learning".
3. The ECM learns the gear information when the accelerator pedal is fully pressed in a rapid speed and held; while ends learning when the engine speed increases from 1300 rpm to 4500 rpm for 2 to 5 cycles and changes around 4500 rpm. (The above are typical features of the engine speed when the gear information is learned. These features can be used to determine if the gear information learning is performed or completed.)
4. Switch off the engine, turn the ignition switch to the ON position after about 15 seconds to clear the fault code, and then turn off the ignition switch.
5. Start the engine after 15 seconds and check if the fault exists with the diagnosis device. If the fault code P1336 is no longer present, the learning is completed successfully.

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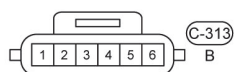
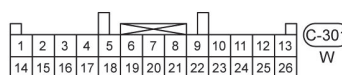
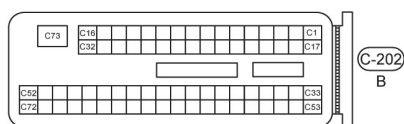
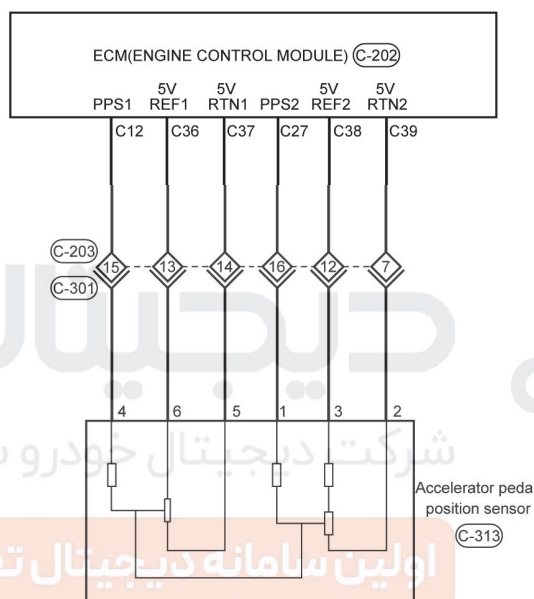
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2.6.26 P2122 Accelerator pedal position sensor circuit 1 low voltage**P2123 Accelerator pedal position sensor circuit 1 high voltage****P2127 Accelerator pedal position sensor circuit 2 low voltage****P2128 Accelerator pedal position sensor circuit 2 high voltage****P2138 Correlation failure of the accelerator pedal position sensor circuit 1 and 2**

WDA130181

Values between the ECM and the accelerator pedal position sensor

ECM pin No.	Function	Condition	Value (DC voltage range)
C12	Signal of sensor 1	The ignition switch in the ON position	0V
C27	Signal of sensor 2	The ignition switch in the ON position	0V
C36	Sensor 1 energized	The ignition switch in the ON position	5V
C37	Sensor 1 grounded	The ignition switch in the ON position	5V
C38	Sensor 2 energized	The ignition switch in the ON position	5V
C39	Sensor 2 grounded	The ignition switch in the ON position	5V

Fault code definition and fault causes

DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
P2122	Accelerator pedal position sensor circuit 1 low voltage	Engine running conditions depending on the ETC modes	Signal terminal APS1 grounded or open with the input signal less than 11%	- Failure of the accelerator pedal position sensor - Failure of the accelerator pedal position sensor circuit - Failure of the engine control module
P2123	Accelerator pedal position sensor circuit 1 high voltage	Engine running conditions depending on the ETC modes	Signal terminal APS1 short to power with the input signal more than 98%	- Failure of the accelerator pedal position sensor - Failure of the accelerator pedal position sensor circuit - Failure of the engine control module
P2127	Accelerator pedal position sensor circuit 2 low voltage	Engine running conditions depending on the ETC modes	Signal terminal APS2 grounded or open with the input signal less than 5.5%	- Failure of the accelerator pedal position sensor - Failure of the accelerator pedal position sensor circuit - Failure of the engine control module
P2128	Accelerator pedal position sensor circuit 2 high voltage	Engine running conditions depending on the ETC modes	Signal terminal APS2 short to power with	Failure of the accelerator pedal position sensor

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DTC	DTC definition	DTC test condition	DTC triggering condition	Possible causes
			the input signal more than 48%	- Failure of the accelerator pedal position sensor circuit - Failure of the engine control module
P213	Correlation failure of the electronic accelerator pedal position sensor circuit 1 and 2	Engine running conditions depending on the ETC modes	Signal terminal APS1 or APS2 short to power or grounded, making the singals of the two circuits incoherent and the input signals difference more than 4%	- Failure of the accelerator pedal position sensor - Failure of the accelerator pedal position sensor circuit - Failure of the engine control module

DTC test procedures:

03

Please confirm that the battery voltage is normal before performing the following procedures.

- Turn off the ignition switch.
- Connect the X-431 diagnostic device to the DLC and perform the test with the updated software.
- Turn on the ignition switch.
- Measure and clear the DTC with the diagnostic device.
- Start the engine, and make it reach normal operating temperature.
- Turn off the ignition switch and turn it on again after 3 to 5 seconds.
- Measure the DTC with the diagnostic device.
- If a DTC is detected, it indicates that the vehicle is faulty, please perform corresponding diagnostic procedures.
- If no DTC is detected, it indicates that the previously detected faults are sporadic. (Please refer to the chapters on the sporadic DTC and check faults)

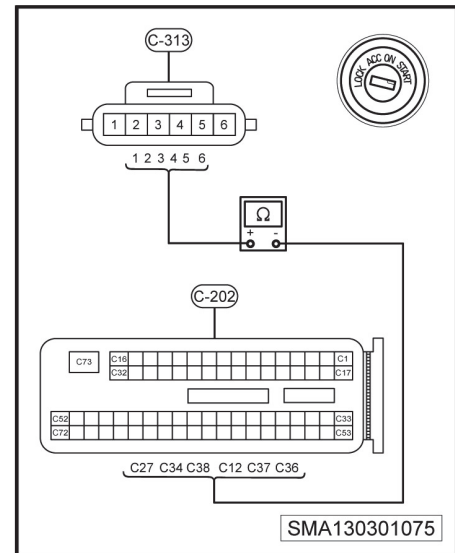
Diagnosis procedures:

i Note

- Please verify again if the DTC and its symptoms are present after fault is rectified.

1. Disconnect the battery negative terminal firstly, and then disconnect the accelerator pedal position sensor connector C-313 and the ECM connector C-202. Check if the leads have short or open circuits between the pin 1 of C-313 and the pin C27 of C-202, between the pin 2 of C-313 and the pin C39 of C-202, between the pin 3 of C-313 and the pin C38 of C-202, between the pin 4 of C-313 and the pin C12 of C-202, between the pin 5 of C-313 and the pin C37 of C-202, between the pin 6 of C-313 and the pin C36 of C-202.

- If yes, repair the defective leads. ■
- If not, go to step 2.



2. Restore the vehicle to its normal state, connect the battery negative terminal, turn the ignition switch to the ON position and start the engine. Check if the output voltage signals of sensors 1 and 2 are normal without pressing the accelerator pedal. (The output voltage signal of the accelerator pedal position sensor 1 is 2.18 V; and the output voltage signal of the accelerator pedal position sensor 2 is 0.21V.)

- If yes, go to step 3.
- If not, the accelerator pedal position sensor fails and please replace it. ■

3. Turn the ignition switch to the ON position, check if the output voltage signals of sensors 1 and 2 are normal by pressing the accelerator pedal fully and without starting the engine. (The output voltage signal of the accelerator pedal position sensor 1 is 4.71 V; and the output voltage signal of the accelerator pedal position sensor 2 is 0.84V.)

- If yes, go to step 4.
- If not, the accelerator pedal position sensor fails and please replace it. ■

4. Replace the ECM control module, carry out the function test again, and read the fault code to verify if it exists or not.

- If yes, locate fault causes from other symptoms.
- If not, the fault has been rectified. ■

3 Engine Electronic Control System Sensor

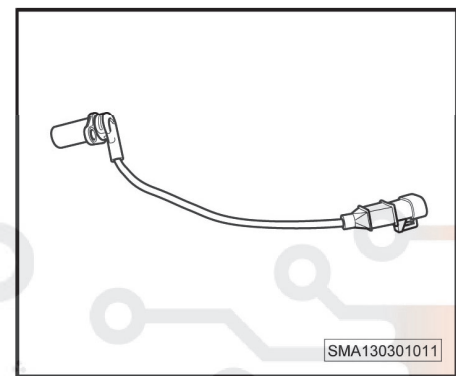
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3.1 Crankshaft position sensor

3.1.1 Overview

The output signal of the crankshaft position sensor is the most important signal in the engine electronic control system, which works with the camshaft position sensor to determine the ignition time.

The sensor is an electromagnetic induction-type sensor and works with the 58x gear ring on the flywheel. When the crankshaft rotates, the tooth top and tooth slot of 58X ring gear pass the sensor at different distances and produces a sudden change with the magnetic resistance of sensor, which enables the sensor to generate a regular waveform signal output to the ECM. The notches on the 58X gear ring match with the top dead center of the engine. At the top dead center of cylinder 1, the sensor is aligned with the notch falling edge of 20th tooth of 58X gear ring. The ECM will determine the crankshaft position and the rotating speed according to this signal.



3.1.2 Technical data

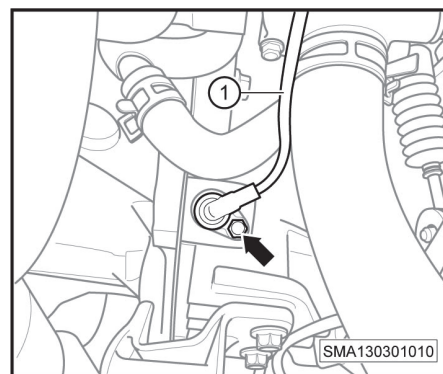
Performance

Item	Value
Coil resistance	560 Ω $\pm$ 10%
Coil inductance	240mH $\pm$ 15%
Gear ring clearance for 58SX	0.3 - 1.5mm

3.1.3 Removing and installing the crankshaft position sensor

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the crankshaft position sensor connector, unscrew the fixing bolt (-arrow-) and remove the crankshaft position sensor (-1-).



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

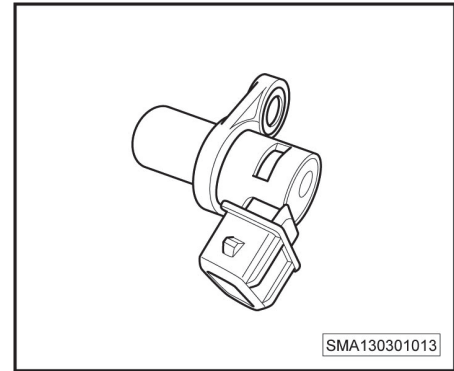
- Visually check for oil stain, scrap iron or other foreign matter on the sensor, if detected, clean it.
- When installing, apply the lubricant to O-ring of the sensor first to avoid damaging to the O-ring during the process.

3.2 Camshaft position sensor

3.2.1 Overview

The camshaft position sensor adopts Hall effect, whose integrated circuit is in front of one permanent magnet pole. When the camshaft is driving the signal wheel to rotate, the tooth profile variety causes changes in the strength of the magnetic field lines, with voltage signal output.

With the camshaft turning one circle, according to Hall effect the sensor produces a series of electromagnetic pulses. After getting this information, the ECM synthetically calculates the ignition timing, at the same time controls the fuel injector to eject fuel into the right cylinder. As an auxiliary sensor, the camshaft position sensor has a great impact on engine emissions.



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3.2.2 Technical data

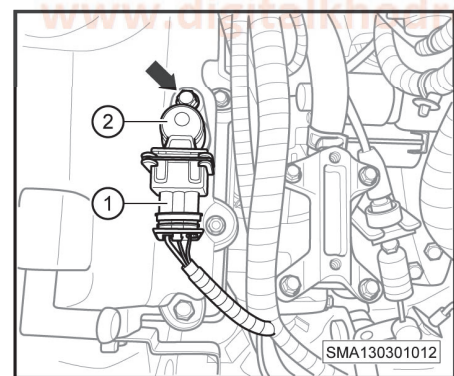
Performance

Item	Value
Operating voltage	4.5 - 1.3V
Operating clearance	0.3 - 1.2m

3.2.3 Removing and installing the camshaft position sensor

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the camshaft position sensor connector (-1-).
4. Unscrew the fixing bolt (-arrow-), and remove the camshaft position sensor (-2-).



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

- Visually check for oil stain, scrap iron or other foreign matter on the sensor, if detected, clean it.

- When installing, apply lubricant to the O-ring of the sensor first to avoid damaging to the O-ring during the process.

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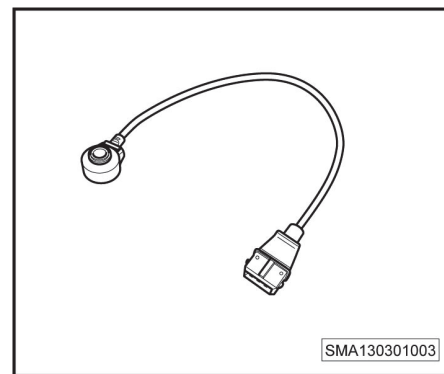
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3.3 Knock sensor

3.3.1 Overview

The knock sensor is used to monitor the gas mixture combustion status and the knocking trend in the engine combustion chamber, and to provide knocking signal to the ECM to better facilitate ECM's control of ignition advance angle.

The knock sensor is a vibration acceleration sensor, which produces an output voltage according to the engine mechanical vibration. If the engine produces knocking, the ECM will receive knocking signal, filter the non-knocking signals and then calculate. The engine position in the working cycle is determined through the camshaft and crankshaft position sensor signal. The ECM thus calculates which cylinder produces knocking, and the ignition advance angle of this cylinder will be delayed until the knocking phenomenon disappears. Then, readjust the ignition advance angle until the ignition angle to the optimal position.



3.3.2 Technical data

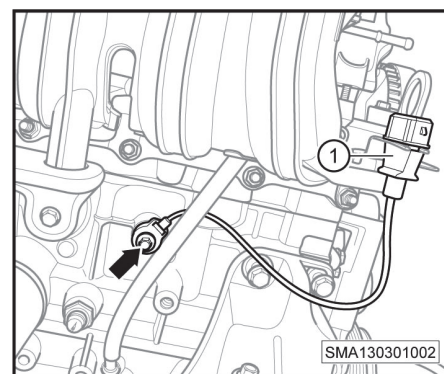
Performance

Frequency response range	Resistance	Capacitance
3 - 18KHz	More than 1 M Ω	1480 - 2220 pf

3.3.3 Removing and installing the knock sensor

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the knock sensor connector.
4. Disengage the knock sensor connector (-1-) from the bracket, unscrew the fixing bolt (-arrow-), and remove the knock sensor.



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

- Check the mounting surface flatness, perpendicularity and surface finish.
- During installation, make sure that the metal part at the sensor bottom have full contact with the engine cylinder block, and the washer cannot be used between the sensor and the engine cylinder block.
- Tightening torque of the bolt: 20 ± 5 Nm.

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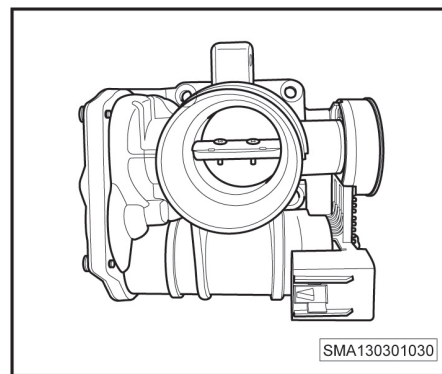
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3.4 Electronic throttle

3.4.1 Overview

The electronic throttle valve opening is determined by the ECM according to the output signal of the accelerator pedal position sensor controlled by the driver, as well as other sensor signals to calculate the engine output power required at this time in this condition; meanwhile to calculate the injection volume to ensure the engine running in the optimal control condition.

The electronic throttle mechanism consists of the components like drive motor, gear unit and throttle position sensor etc..



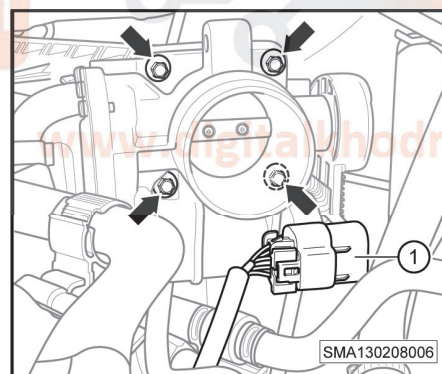
3.4.2 Technical data

Item	Value
Optimal operating temperature	- 40°C ~ 125°C
Impedance between TPS ref and TPS rtn	1.9±0.9 KΩ
Resistance of DC motor	3.93 Ω

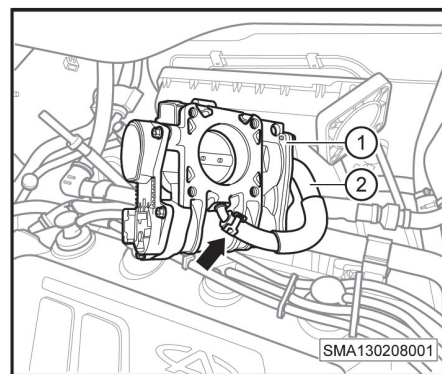
3.4.3 Removing and installing the electronic throttle body

Removal

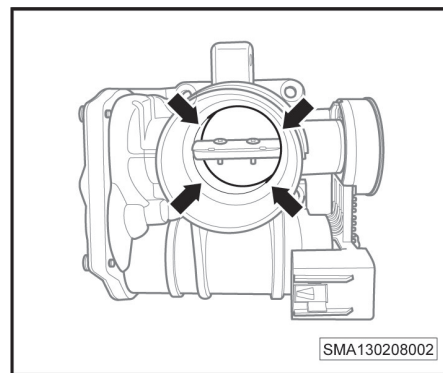
1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Remove the air filter assembly. => refer to page 239
4. Disconnect the electronic throttle connector (-1-) and unscrew the fixing bolts (-arrow-).



5. Loosen the clamp (-arrow-), pull out the hose (-2-) and remove the electronic throttle (-2-).



6. Clean the throttle body.
7. Open the throttle valve by hand and lock it in the fully open position with a proper object.
8. Carefully clean the throttle housing with the acetone and a clean brush, especially the closed throttle area (-arrow-). Then dry the throttle housing with a glabrous fiber cloth. The electronic throttle body can be installed only after the acetone fully evaporates.



Caution

- The acetone is flammable liquid. Please follow the accident prevention and safety regulations and tips when using this kind of flammable liquid.
- Do not use compressed air when cleaning the throttle. Take precautions to avoid the flammable liquid contacting with your skin or causing personal injury.

Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

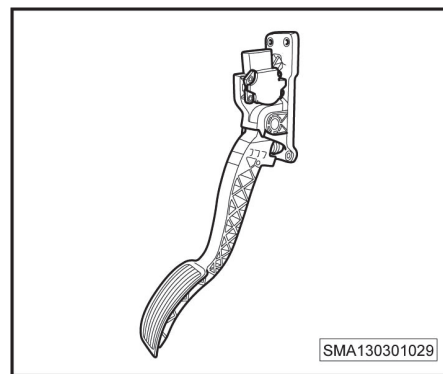
- When replacing the engine control module, you must adapt the electronic throttle and the accelerator pedal position sensor.
- When replacing the electronic throttle body, you must adapt the ECM and the accelerator pedal position sensor.

3.5 Accelerator pedal position sensor

3.5.1 Overview

The accelerator pedal position sensor has two identical potentiometer sensors inside, which provides the ECM with the driving signals based on the driver's requirements; this process is the same operation as that of the current mechanical pedals which adapts the years of driving habits of drivers. The two identical sensors send the throttle signals to the ECM respectively, making the system safer and more reliable.

The ECM uses the ratio value to determine the movement range of the pedal. The ECM compares the input signals from sensor 1 and sensor 2 and verifies the authenticity of the sensor output signals with the other sensor signals such as the engine speed sensor or the load sensor. When a signal from one of the two sensors is abnormal, the ECM will switch the engine into the failure mode while taking appropriate actions so as to maintain the throttle opening at a certain angle, this will allow the vehicle to be driven to an authorized service station for maintenance.



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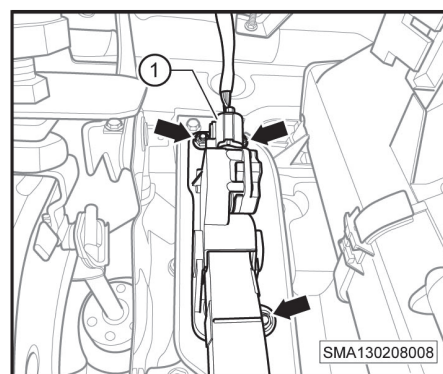
3.5.2 Removing and installing the accelerator pedal position sensor

i Note

- The accelerator pedal and throttle pedal position sensor are a single unit and cannot be disassembled separately.

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the accelerator pedal position sensor connector (-1-).
4. Unscrew the fixing bolts (-arrow-) and remove the accelerator pedal assembly.



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

- When replacing the engine control module, you must adapt the electronic throttle to the accelerator pedal position sensor.
- When replacing the accelerator pedal assembly, you must adapt the engine control module to the electronic throttle.

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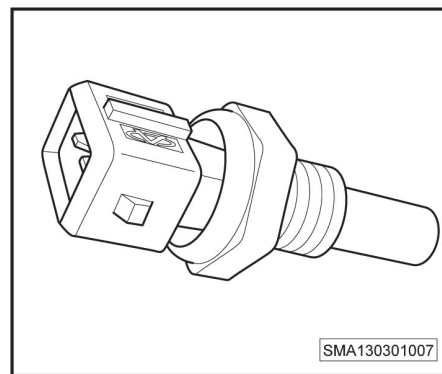
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3.6 Coolant temperature sensor

3.6.1 Overview

The coolant temperature sensor provides coolant temperature information to the engine electronic control module. The engine electronic control module controls the engine starting, idling and ignition timing under normal operations. It also controls the fuel injection pulse width according to the coolant temperature signal. At the same time, the coolant temperature signal is sent to the dashboard via the CAN data communication cable after it is processed by the ECM to display the engine coolant temperature.



3.6.2 Technical data

Coolant temperature sensor

Item	Value
Operating voltage	5V
Operating temperature	- 40~135℃
Rated resistance at 20℃	2.5K Ω $\pm$ 5%

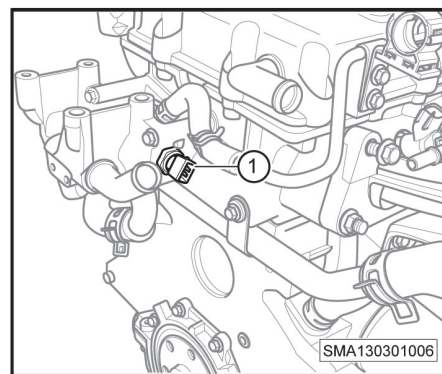
Reference values of the coolant temperature sensor signal voltage

Coolant temperature	Sensor voltage
59℃	1.89V
78℃	1.25V
90℃	0.94V

3.6.3 Removing and installing the coolant temperature sensor

Removal

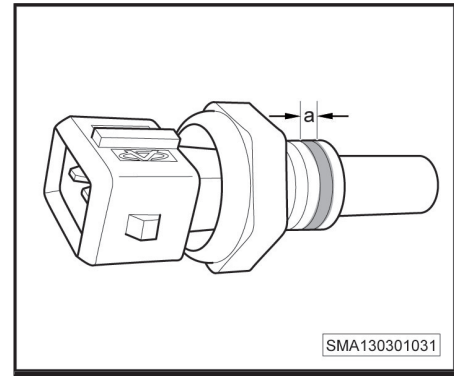
1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the coolant temperature sensor connector and unscrew the coolant temperature sensor (-1-).



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

- As shown in the figure, apply sealant in the area a before the installation of the coolant temperature sensor.
- Tightening torque of the coolant temperature sensor: 20~25 Nm.



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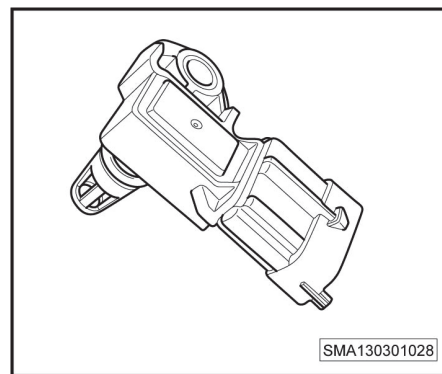
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3.7 Intake air pressure/temperature sensor

3.7.1 Overview

The intake air pressure/temperature sensor measures the intake manifold absolute pressure and temperature changes behind the throttle according to the engine load, and converts them to voltage signals to send to the ECM which corrects the fuel injection quantity according to the voltage signals.



3.7.2 Technical data

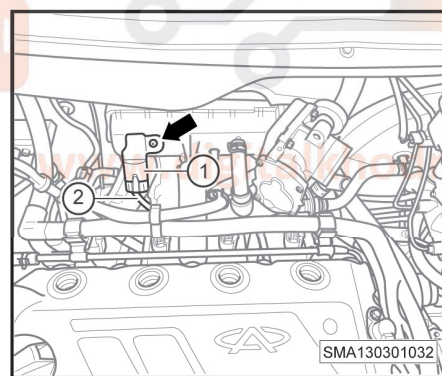
Performance

Item	Value
Operating voltage	5V
Operating current	Max. 12mA
Output impedance	<10 Ω

3.7.3 Removing and installing the intake air pressure/temperature sensor

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the connector (-2-) and unscrew the fixing bolt (-arrow-).
4. Remove the intake air pressure/temperature sensor (-1-).



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

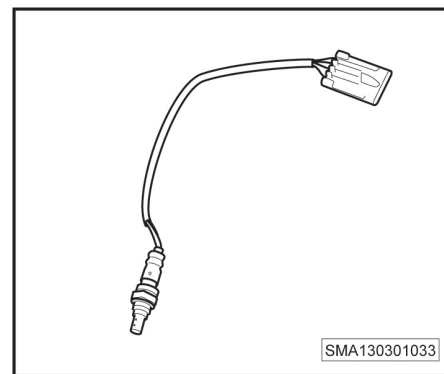
- Visually check for oil stain, scrap iron or other foreign matter on the sensor, if detected, clean it.
- When installing, apply lubricant to the O-ring of the sensor first to avoid damaging to the O-ring during the process.

3.8 Oxygen sensor

3.8.1 Overview

Front oxygen sensor

The front oxygen sensor is used to detect the oxygen content in the engine exhaust and convert this information into voltage signals to the ECM. Depending on the voltage signals, the ECM performs a closed-loop control to trim the fuel injection and reduce the three toxic components in the exhaust, i.e., hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NOX) while enabling the three-way catalytic converter to develop its maximum catalytic conversion efficiency.



Rear oxygen sensor

The rear oxygen sensor monitors the oxygen content in the exhaust after it has passed through the three-way catalytic converters. The ECM makes a comparison based on the signals from the front oxygen sensor and the rear oxygen sensor to monitor the efficiency of the catalytic converter. If the catalytic converter is inefficient or is damaged, the rear oxygen sensor signals will fluctuate drastically. The ECM will light up the engine fault indicator to indicate that the engine exhaust system is faulty, or even carry out restrictive driving measures to avoid damage to the engine and prevent exhaust pollution.

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3.8.2 Technical data

Operating temperature and performance of the oxygen sensor

Temperature	260°C	450°C	595°C
Rich-oxygen output voltage (mV)	>800	>800	>750
Lean-oxygen output voltage (mV)	<200	<200	<150
Response time from lean to rich (ms)	<75	<75	<50
Response time from rich to lean (ms)	<150	<125	<90
Internal resistance (Ω)	<100K		

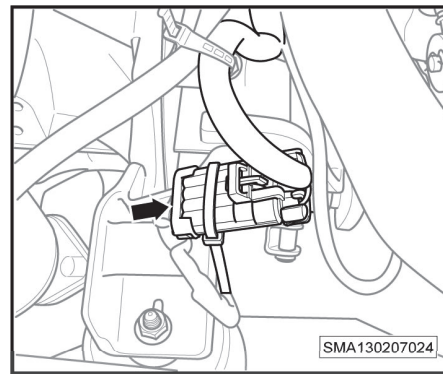
3.8.3 Removing and installing the oxygen sensor

i Note

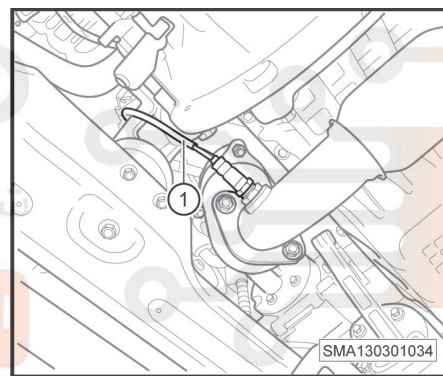
- The removal and installation procedures of the rear oxygen sensor are the same as that of the front oxygen sensor. Here only the removal and installation of the rear oxygen sensor is described.
- The exhaust pipe can only be removed after it has cooled down.

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the oxygen sensor connector (-arrow-).



4. Unscrew the oxygen sensor (-1-).



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

- The oxygen sensor generally uses zirconia (ZrO_2 , a ceramic material) as the sensor element. Do not knock it with a wrench or other hard object to avoid damage, because the ceramic is hard but very brittle. Impacted oxygen sensors cannot be used.
- Tightening torque of the oxygen sensor is 40 to 60 Nm.

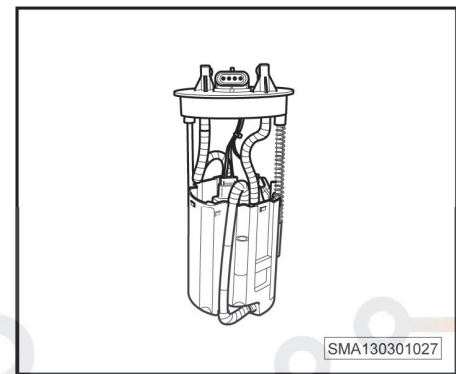
4 Engine Electronic Control System Actuator

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4.1 Fuel pump

4.1.1 Overview

After the ignition switch is switched on, the ECM initiates the fuel pump to work for 2-5 seconds to send fuel from the fuel tank and channel it to the pipeline to build up the startup oil pressure. If the engine is not turned on, the ECM will cut off the fuel pump control circuit to suspend the fuel pump; If the engine starts and continues running, the ECM will control the fuel pump for normal operations.



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i Note

- The fuel temperature has a great impact on the performance of the fuel pump. If it is operating in high temperature conditions for a long time and the fuel temperature passes a certain level, the pumping pressure of the fuel pump will drop dramatically; therefore, when the hot engine cannot start, please carefully check the fuel pump operating performance in high temperature condition.

4.1.2 Technical data

Output pressure	>350KPa	Operating voltage	8 - 16V
Maintenance pressure	≈24KPa	Overvoltage protection	-13.5 - 26V
Output flow	>10g/s	Fuel-free running	<60 seconds

4.1.3 Removing and installing the fuel pump

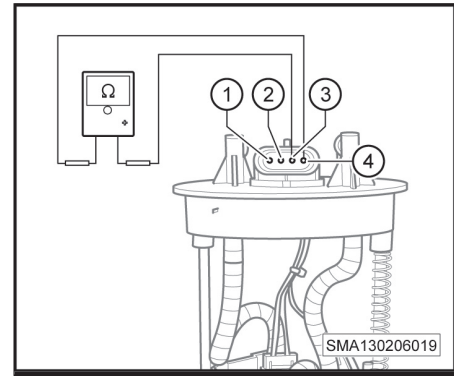
For the removal and installation of the fuel pump, please refer to the Engine Mechanism.=> refer to page 206

4.1.4 Checking the fuel pump

Method:

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1. Disconnect the connector and turn the digital multimeter to the Ohm range, with the two meter probes connecting to the fuel pumps (-3- and -4-) respectively, to measure if the fuel pump resistance is normal.



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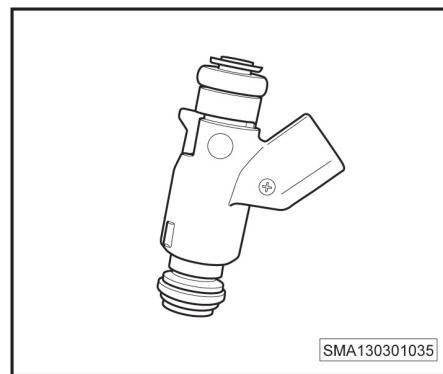
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4.2 Fuel injector

4.2.1 Overview

Function:

The fuel injector jets fuel within the specified time according to ECM's instructions to provide atomized fuel to the engine.



4.2.2 Technical data

Item	Data
Coil resistance	$12 \pm 0.4 \Omega$
Minimum operating voltage	4.5V
Operating temperature	$-40 \sim 130^{\circ}\text{C}$

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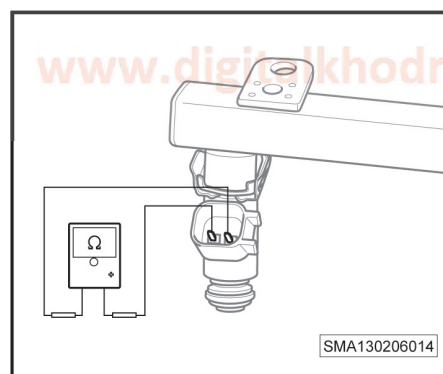
4.2.3 Removing and installing the fuel injector

For the removal and installation of the fuel injector, please refer to the Engine Mechanism. => refer to page 213

4.2.4 Checking the fuel injector

Method:

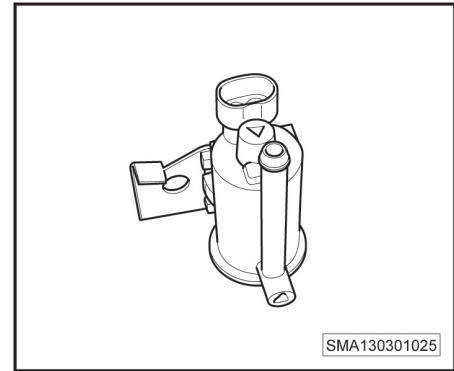
Turn the digital multimeter to the Ohm position, respectively connect the two probes to the two pins of the fuel injector. The rated resistance is $11 \sim 16 \Omega$ at 20°C .



4.3 Activated carbon canister solenoid valve

4.3.1 Overview

The canister control valve, which is comprehensively monitored by the ECM based on a series of other signals such as the engine load, engine temperature and speed, will send out the electrical pulse duration and frequency (i.e. duty cycle) to control the opening frequency of the carbon canister solenoid valve. Over accumulation of the fuel vapor in the activated carbon canister will lead to gasoline leakage and environmental pollution, so the function of the carbon canister is to open the solenoid valve at the right time to allow sufficient mixing of the fuel vapor and air in the canister before entering the intake pipe for combustion.



4.3.2 Technical data

Performance

Rated operating voltage	12V	Operating temperature	140~120℃
Operating voltage range	8~16V	Coil resistance	19 - 22 Ω
Limit voltage	25V	Coil inductance	12 - 15mH

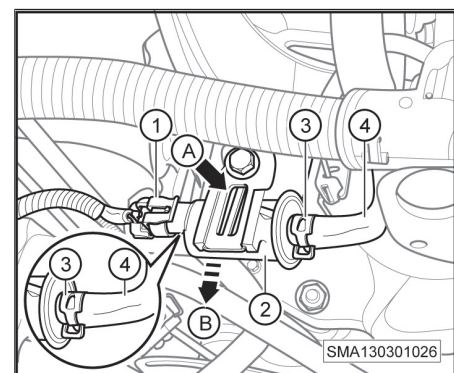
4.3.3 Removing and installing the carbon canister solenoid valve

Note

- Before removing, make identification marks on the inlet and outlet pipes to avoid possible confusions.

Removal

- Switch off all electrical equipment and the ignition switch, and pull out the key.
- Disconnect the battery negative terminal.
- Disconnect the connector (-1-), loosen the clamps (-3-), and pull out the inlet and outlet hoses (-4-).
- Lever out the clip (-arrow A-) and remove the carbon canister solenoid valve (-2-) from the bracket in the (-arrow B-) direction.



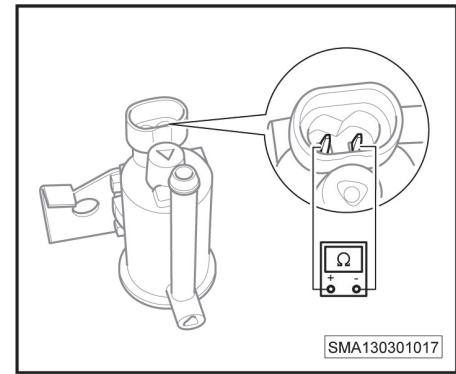
Installation

- Installation shall follow the reverse sequence of the removal procedure.

4.3.4 Checking the activated carbon canister solenoid valve

Inspection

Turn the digital multimeter to the Ohm range, with the two meter probes connecting to the two pins of the activated carbon canister solenoid valve, the rated resistance should be $21 \pm 1 \Omega$ at 20°C .



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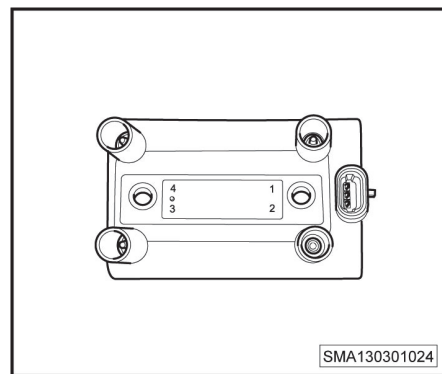
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4.4 Ignition coil

4.4.1 Overview

The ignition coil transforms low voltage of the primary winding to high voltage of the secondary winding, and the high voltage produces spark through the electrode discharge of the spark plug to detonate the flammable gas mixture within the cylinder.

The ignition coil consists of two primary windings, two secondary windings, iron core, shell and so on. When a primary winding is connected to the ground, this primary winding is charged. Once the ECM cuts off the primary winding circuit, the charge will be terminated. At this point, high voltage is induced in the secondary winding to enable the spark plug discharging.



4.4.2 Technical data

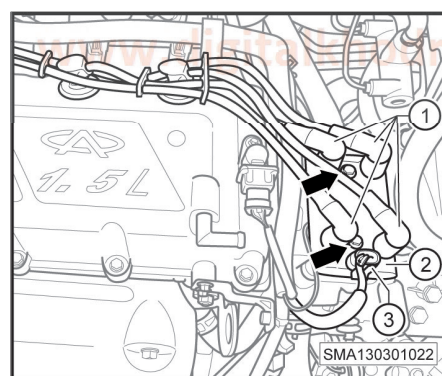
Performance

Primary resistance	$0.5 \pm 0.05 \Omega$	Secondary inductance	$17.5 \pm 1.2 H$
Secondary resistance	$9840 \pm 980 \Omega$	Power-off current peak	9.5A
Primary inductance	$2.75 \pm 0.25 mH$	Secondary output voltage	34KV

4.4.3 Removing and installing the ignition coil

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the ignition coil connector (-3-), and pull out the ignition cables (-1-).
4. Unscrew the fixing bolts (-arrow-), and remove the ignition coil (-2-).



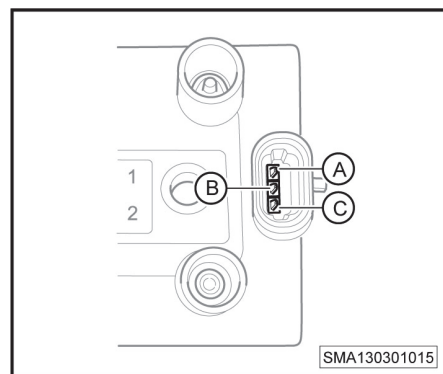
Installation

- Installation shall follow the reverse sequence of the removal procedure.

4.4.4 Checking the ignition coil

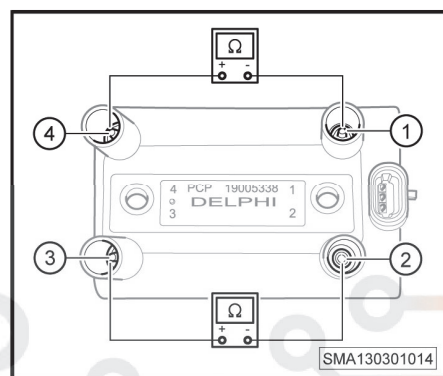
Method:

1. Turn the digital multimeter to the Ohm range, with the two meter probes measuring pins A and B, B and C respectively, the resistance should be $0.42 \sim 0.58 \Omega$.



Method:

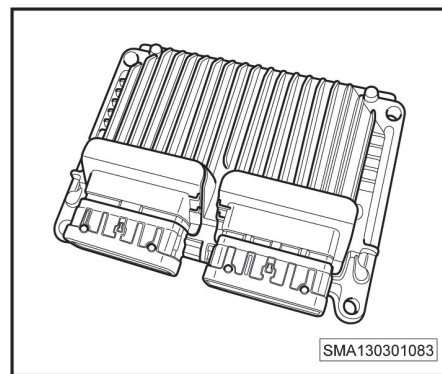
2. Turn the digital multimeter to the Ohm range, with two meter probes measuring pins 1 and 4, 2 and 3, the resistance of the secondary winding should be $11.2 \sim 14.8 \Omega$ at 20°C .



4.5 Engine control module

4.5.1 Overview

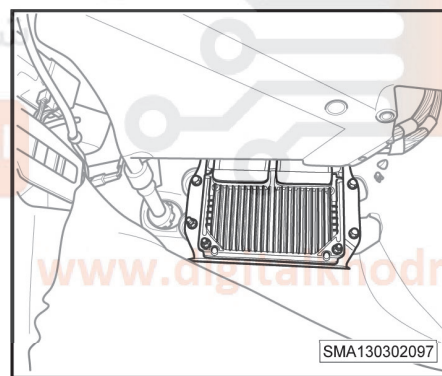
The engine control system functions include: electronic control fuel injection control, electronic ignition control, idle speed control, exhaust emission control, fail-safe, self-diagnosis system, data communication system and anti-theft system etc.. The core of the engine electronic control fuel injection system is the engine control module. This computes the required fuel injection quantity of the combustion cylinders (injection pulse width) based on the sensor feedback signals and various operating condition signals while opening the fuel injector at the right injection timing to inject the appropriate amount of fuel to the air intake channel so as to form the flammable mixture with optimal air-fuel ratio. A series of actuators such as the fuel injector and ignition coil work with together so that the engine works efficiently.



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4.5.2 Installation position

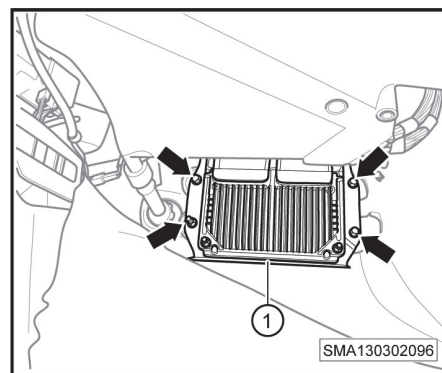
The engine control module is installed on the front passenger side and beneath the evaporation tank assembly.



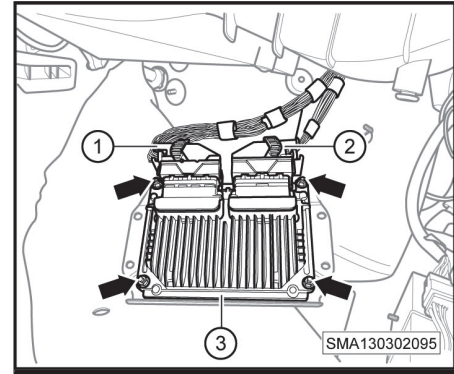
4.5.3 Removing and installing the engine control module

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Remove the front right A-pillar lower trim, and open the front passenger's side carpet.
4. Unscrew the fixing bolts (-arrow-), and take out the engine control module and the bracket (-1-).



5. Disconnect the engine control module connectors (-1-) and (-2-), and unscrew the fixing bolts (-arrow-). Take out the engine control module (-3-).



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

1. The engine control module must be adapted during the replacement or removal of the anti-theft control unit.
2. The anti-theft control unit must be adapted during the replacement of the engine control module.

4.5.4 Adapting the engine control module

i Note

- The security code (PIN code) is only entered through a special diagnostic instrument of Chery; When entering, please note that the letters are case sensitive and the ECM will be locked after entering an erroneous code more than a certain number of times.
- The engine control module must be adapted with the anti-theft system control unit during the replacement of new engine control module.

Preconditions

- The battery voltage is within the normal range.
- There is no fault in the anti-theft system.
- There is no fault in the engine electronic control system actuators and sensors.
- It has been confirmed that the new engine control module model adapts the anti-theft control system.

Procedures

1. Turn off the ignition switch, and replace the engine control module.
2. Connect the diagnostic device.
3. Insert the key into the ignition lock and turn to the ON position.
4. Select the menu "Anti-theft control" → "Adaption function" → "Authorization code setting" → "Enter the security code".
5. Return to the selection menu "Anti-theft control" → "Adaption function" → "Replace the ECM" and perform the adaption operation according to the steps shown on the diagnostic device.
6. After completing the engine adaption, carry out the engine gear information learning.

5 Symptom Diagnosis and Inspection

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5.1 Diagnosis processes of the inspection according to the symptoms

Preliminary inspection:

1. Check if the battery voltage is within the normal range.
2. Check if the engine malfunction indicator works properly.
3. Check if there is any failure record with the diagnostic device.
4. Check if the fault symptoms complained by the owner exists, and confirm its occurrence conditions (like on steep road, on smooth road, in accelerated motion, or at constant speed etc.).

Visual check:

1. Check the fuel pipe for leakage.
2. Check the vacuum pipe for fracture, kink, and correct connection.
3. Check the inlet pipe for blockage, air leakage, crushing or damage.
4. Check the high voltage wire of the ignition system for rupture, aging and ignition sequence.
5. Check the wiring harness grounding area for cleanness and firmness.
6. Check the connectors of the sensors and actuators for looseness or poor contact.

i Note

- If the above phenomenons exist, repair the faults firstly. Then verify again if the failure still exists and carry out the fault diagnosis procedures.

5.2 Diagnostic tips

1. Check if there is any fault record in the engine.
2. Check if the symptom described by the customer exists.
3. The influence of the vehicle maintenance condition, cylinder pressure, ignition timing, fuel situation etc. on the system cannot be ignored in the inspection process.
4. If there is any fault difficult to troubleshoot in the repair process, you can replace the ECM first for testing.

If now the fault symptom disappears, there is fault in the ECM. If the symptom still exists, locate the fault causes from other symptoms.

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5.3 Symptom diagnosis and inspection list

Symptoms
1. Engine failure or low engine speed when started
2. Engine idling with start failure when started
3. Warm start difficulty
4. Cold start difficulty
5. Disabled acceleration and poor performance
6. Engine idling vibration
7. Normal speed but difficult to start all the time
8. Normal start but unstable idling speed all the time
9. Normal start but unstable idling speed during warming up
10. Unstable engine idling speed or even flameout when the throttle is released after acceleration
11. Normal start but excessive idling speed
12. Slow response in acceleration
13. Normal start but unstable idling speed after warming up

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5.4 Symptom diagnosis and inspection

5.4.1 Engine failure or low engine speed when started

Possible causes:

1. Failure of the battery
2. Failure of the starter
3. Failure of the wiring harness
4. Mechanical failure of the engine

Diagnostic procedures

i Note

- If the starter runs slowly, first check if the battery voltage is normal.

1. Check the voltage between the two battery terminals with a digital multimeter, and check if the battery voltage is normal when starting the engine.
 - If yes, go to step 2.
 - If not, the battery fails and please replace it. ■
2. Start the engine to run the starter, and check if the grounding between the battery and the engine is hot.
 - If yes, the engine grounding is poor and please repair it. ■
 - If not, go to step 3.
3. Pull out the starter relay and remove the relay housing to check if the relay pull-in point is rusted or burned.
 - If yes, the relay fails and please repair it. ■
 - If not, go to step 4.
4. Disassemble the starter to mainly check the starter brush for excessive wear, the rotor coil for short circuit and the bearing for damage.
 - If yes, the starter fails and please replace it. ■
 - If not, go to step 5.
5. Check if the resistance of the internal mechanical parts of the engine is excessive that results in abnormal or null operation of the starter.
 - If yes, the mechanical part of the engine fails and please rapair it. ■
 - If not, go to step 6.
6. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.2 Engine idling with start failure when started

Possible causes:

1. Failure of the fuel system
2. Failure of the crankshaft position sensor
3. Failure of the ignition system
4. Mechanical failure of the engine

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Check if the "crankshaft position sensor waveform" is normal with an oscilloscope.
 - If yes, go to step 3.
 - If not, the crankshaft position sensor fails and please replace it. ■
3. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 4.
 - If not, the fuel system fails and please inspect it. ■
4. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
 - If yes, go to step 5.
 - If not, the ignition system fails and please inspect it. ■
5. Disconnect the power supply fuse of the fuel pump, unscrew all spark plugs from the cylinders, connect a cylinder pressure gauge and check if the pressure of each cylinder is normal.
 - If yes, go to step 6.
 - If not, the mechanical part of the engine fails and please repair it. ■
6. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.3 Warm start difficulty

Possible causes:

1. Failure of the coolant temperature sensor
2. Failure of the ignition system
3. Failure of the fuel system

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Check if the model and clearance of the spark plug of each cylinder are up to specifications.
 - If yes, go to step 3.
 - If not, adjust or replace the spark plug. ■
3. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
 - If yes, go to step 4.
 - If not, the ignition system fails and please inspect it. ■
4. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 5.
 - If not, the fuel system fails and please inspect it. ■
5. Check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 6.
 - If not, the coolant temperature sensor fails and please replace it. ■
6. Check if the failure occurs when the fuel is filled.
 - If yes, clean the fuel system and replace the fuel. ■
 - If not, go to step 7.
7. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.4 Cold start difficulty**Possible causes:**

1. Failure of the fuel system
2. Failure of the fuel injector
3. Failure of the throttle
4. Failure of the ignition system
5. Failure of the coolant temperature sensor

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.

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- If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
- If yes, go to step 3.
 - If not, the coolant temperature sensor fails and please replace it. ■
3. Connect the fuel pressure gauge to the common rail. Start the engine for seconds before turning it off, and check if the fuel system pressure is dropping.
- If yes, go to step 4.
 - If not, go to step 7.
4. Visually check the fuel pipe for leakage.
- If not, the fuel pipe leaks and please replace it. ■
 - If not, go to step 5.
5. Disassemble the fuel injector, install it to the injector tester for pressure leak test, and check if the injector leaks.
- If yes, the fuel injector fails and please replace it. ■
 - If not, go to step 6.
6. Connect the fuel pressure gauge to the common rail. Start the engine for seconds before turning it off, and check if the fuel system pressure is dropping.
- If yes, the fuel pump fails and please replace it. ■
 - If not, go to step 7.
7. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
- If yes, go to step 8.
 - If not, the ignition system fails and please inspect it. ■
8. Check if the "electronic throttle data flow" is normal with the diagnostic device.
- If yes, go to step 9.
 - If not, the throttle fails and please clean or replace it. ■
9. Check if the power supply and grounding of the engine control module are normal.
- If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.5 Disabled acceleration and poor performance**Possible causes:**

1. Failure of the air intake system

2. Failure of the exhaust system
3. Failure of the ignition coil
4. Failure of the fuel system
5. Failure of ignition timing

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Disassemble the air filter and check the air filter element for blockage.
 - If yes, replace the air filter element. ■
 - If not, go to step 3.
3. Start the engine and check if the exhaust pipe is smooth.
 - If yes, go to step 4.
 - If not, the three-way catalytic converter is blocked and please replace it. Besides, replace the fuel and clean the fuel system. ■
4. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
 - If yes, go to step 5.
 - If not, the ignition system fails and please inspect it. ■
5. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 6.
 - If not, the fuel system fails and please inspect it. ■
6. Disassemble the timing belt upper guard and check if the timing belt is installed properly.
 - If yes, go to step 7.
 - If not, disassemble the timing belt and reinstall it. ■
7. Check if the reading of the "intake air pressure/temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 8.
 - If not, the intake air pressure/temperature sensor fails and please replace it. ■
8. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.6 Engine idling vibration

Possible causes:

1. Failure of the air intake system
2. Failure of the ignition coil
3. Failure of the fuel system
4. Mechanical failure of the engine

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Disassemble the air filter and check the air filter element for blockage.
 - If yes, replace the air filter element. ■
 - If not, go to step 3.
3. Start the engine and check if the exhaust pipe is smooth.
 - If yes, go to step 4.
 - If not, the three-way catalytic converter is blocked and please replace it. Besides, replace the fuel and clean the fuel system. ■
4. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
 - If yes, go to step 5.
 - If not, the ignition system fails and please inspect it. ■
5. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 6.
 - If not, the fuel system fails and please inspect it. ■
6. Disassemble the timing belt upper guard and check if the timing belt is installed properly.
 - If yes, go to step 7.
 - If not, disassemble the timing belt and reinstall it. ■
7. Check if the reading of the "intake air pressure/temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 8.
 - If not, the intake air pressure/temperature sensor fails and please replace it. ■
8. Disconnect the power supply fuse of the fuel pump, unscrew all spark plugs from the cylinders, connect a cylinder pressure gauge and check if the pressure of each cylinder is normal.
 - If yes, the mechanical part of the engine fails and please rapair it. ■

- If not, go to step 9.
9. Check if the power supply and grounding of the engine control module are normal.
- If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.7 Normal speed, but start difficulty at any time

Possible causes:

1. Failure of the air intake system
2. Failure of the ignition system
3. Failure of the fuel system
4. Failure of the throttle
5. Failure of the coolant temperature sensor
6. Failure of the intake air pressure/temperature sensor
7. Mechanical failure of the engine

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Disassemble the air filter and check the air filter element for blockage.
 - If yes, replace the air filter element. ■
 - If not, go to step 3.
3. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
 - If yes, go to step 4.
 - If not, the ignition system fails and please inspect it. ■
4. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 5.
 - If not, the fuel system fails and please inspect it. ■
5. Disassemble the fuel injector, install it to the injector tester for pressure leak test, and check if the injector leaks.
 - If yes, the fuel injector fails and please replace it. ■
 - If not, go to step 6.
6. Disassemble the timing belt upper guard and check if the timing belt is installed properly.
 - If yes, go to step 7.

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- If not, disassemble the timing belt and reinstall it. ■
7. Remove the air filter assembly and check if there is any carbon deposit on the throttle panel.
 - If yes, clean the throttle. ■
 - If not, go to step 8.
 8. Check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 9.
 - If not, the coolant temperature sensor fails and please replace it. ■
 9. Check if the reading of the "intake air pressure/temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 10.
 - If not, the intake air pressure/temperature sensor fails and please replace it. ■
 10. Disconnect the power supply fuse of the fuel pump, unscrew all spark plugs from the cylinders, connect a cylinder pressure gauge and check if the pressure of each cylinder is normal.
 - If yes, go to step 11.
 - If not, the mechanical part of the engine fails and please repair it. ■
 11. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

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5.4.8 Normal start, but unstable idling speed at any time**Possible causes:**

1. Failure resulting from bad fuel quality
2. Failure of the fuel injector
3. Failure of the spark plug
4. Failure of the throttle
5. Failure of the air intake system
6. Failure of ignition timing
7. Mechanical failure of the engine

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Disassemble the air filter and check the air filter element for blockage.
 - If yes, replace the air filter element. ■
 - If not, go to step 3.

3. Remove the air filter assembly and check if there is any carbon deposit on the throttle.
 - If yes, clean the throttle. ■
 - If not, go to step 4.
4. Check if the model and clearance of the spark plug of each cylinder are up to specifications.
 - If yes, go to step 5.
 - If not, adjust or replace the spark plug. ■
5. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
 - If yes, go to step 6.
 - If not, the ignition system fails and please inspect it. ■
6. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 7.
 - If not, the fuel system fails and please inspect it. ■
7. Disassemble the fuel injector, install it to the injector tester for pressure leak test, and check if the injector leaks.
 - If yes, the fuel injector fails and please replace it. ■
 - If not, go to step 8.
8. Check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 9.
 - If not, the coolant temperature sensor fails and please replace it. ■
9. Check if the reading of the "intake air pressure/temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 10.
 - If not, the intake air pressure/temperature sensor fails and please replace it. ■
10. Disconnect the power supply fuse of the fuel pump, unscrew all spark plugs from the cylinders, connect a cylinder pressure gauge and check if the pressure of each cylinder is normal.
 - If yes, go to step 11.
 - If not, the mechanical part of the engine fails and please repair it. ■
11. Check if the failure occurs when the fuel is filled.
 - If yes, clean the fuel system and replace the fuel. ■
 - If not, go to step 12.
12. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.9 Normal start, but unstable idling speed during warming up**Possible causes:**

1. Failure of the throttle
2. Failure of the coolant temperature sensor
3. Failure of the spark plug
4. Failure of the ignition
5. Failure of the fuel injector
6. Failure of the air intake system
7. Failure of ignition timing
8. Failure resulting from bad fuel quality
9. Mechanical failure of the engine

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Remove the air filter assembly and check if there is any carbon deposit on the throttle panel.
 - If yes, clean the throttle. ■
 - If not, go to step 3.
3. Check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 4.
 - If not, the coolant temperature sensor fails and please replace it. ■
4. Check if the model and clearance of the spark plug of each cylinder are up to specifications.
 - If yes, go to step 5.
 - If not, adjust or replace the spark plug. ■
5. Pull out the ignition cable of each cylinder successively. Connect the spark plug, ground the spark plug housing, start the engine, and check if there is blue and white high-pressure fire.
 - If yes, go to step 6.
 - If not, the ignition system fails and please inspect it. ■
6. Disassemble the fuel injector, install it to the injector tester for pressure leak test, and check if the injector leaks.
 - If yes, the fuel injector fails and please replace it. ■
 - If not, go to step 7.
7. Check the air intake system pipe for air leakage.
 - If yes, repair or replace the leaking pipe. ■
 - If not, go to step 8.

8. Disassemble the timing belt upper guard and check if the timing belt is installed properly.
 - If yes, go to step 9.
 - If not, disassemble the timing belt and reinstall it. ■
9. Check if the failure occurs when the fuel is filled.
 - If yes, clean the fuel system and replace the fuel. ■
 - If not, go to step 10.
10. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.10 Unstable engine idling speed or even flameout when the throttle is released after acceleration

Possible causes:

1. Failure of the exhaust system
2. Failure of the air intake system
3. Failure of the throttle
4. Failure of the spark plug
5. Failure of the ignition
6. Failure of the fuel injector
7. Failure resulting from bad fuel quality

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Start the engine to check if the exhaust emission is smooth.
 - If yes, go to step 3.
 - If not, the three-way catalytic converter is blocked, please replace it and check the fuel quality. ■
3. Disassemble the air filter element and check the air filter element for blockage.
 - If yes, replace the air filter element. ■
 - If not, go to step 4.
4. Remove the air filter assembly and check if there is any carbon deposit on the throttle panel.
 - If yes, clean the throttle. ■
 - If not, go to step 5.
5. Check the air intake system pipe for air leakage.

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- If yes, repair or replace the leaking pipe. ■
 - If not, go to step 6.
6. Disassemble the timing belt upper guard and check if the timing belt is installed properly.
- If yes, go to step 7.
 - If not, disassemble the timing belt and reinstall it. ■
7. Check if the failure occurs when the fuel is filled.
- If yes, clean the fuel system and replace the fuel. ■
 - If not, go to step 8.
8. Check if the power supply and grounding of the engine control module are normal.
- If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.11 Normal start but excessive idling speed**Possible causes:**

1. Failure of the throttle
2. Failure of the air intake system
3. Failure of the coolant temperature sensor
4. Failure of ignition timing

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Remove the air filter assembly and check if there is any carbon deposit on the throttle panel.
 - If yes, clean the throttle. ■
 - If not, go to step 3.
3. Start the engine and when idling, and check the intake manifold for leakage.
 - If yes, repair or replace the leaking pipe. ■
 - If not, go to step 4.
4. Start the engine, check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 5.
 - If not, the coolant temperature sensor fails and please replace it. ■
5. Make sure that the A/C switch is OFF, turn the ignition switch to the "ON" position and check if the "A/C switch" is turned on with a diagnostic device.

- If yes, the A/C line fails. ■
 - If not, go to step 6.
6. Check if the power steering switch is conducted when the steering wheel is returned to the original position .
- If yes, the power steering switch fails and please replace it. ■
 - If not, go to step 7.
7. Disassemble the timing belt upper guard and check if the timing belt is installed properly.
- If yes, go to step 8.
 - If not, reinstall the timing belts. ■
8. Check if the power supply and grounding of the engine control module are normal.
- If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

5.4.12 Slow response in acceleration

Possible causes:

1. Failure of the exhaust system
2. Failure of the air intake system
3. Failure of the throttle
4. Failure of the coolant temperature sensor
5. Failure of the intake air pressure/temperature sensor
6. Failure of ignition timing
7. Failure of the fuel system

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Start the engine to check if the exhaust system is smooth.
 - If yes, go to step 3.
 - If not, the three-way catalytic converter is blocked, please replace it and check the fuel quality. ■
3. Check the air filter element for blockage.
 - If yes, replace the air filter element. ■
 - If not, go to step 4.
4. Remove the air filter assembly and check if the drive motor of the throttle panel is normal.
 - If yes, go to step 5.

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- If not, clean the throttle. ■
- 5. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 6.
 - If not, the fuel system fails and please inspect it. ■
- 6. Start the engine, check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 7.
 - If not, the coolant temperature sensor fails and please replace it. ■
- 7. Start the engine, check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 8.
 - If not, the intake air pressure/temperature sensor fails and please replace it. ■
- 8. Disassemble the timing belt upper guard and check if the timing belt is installed properly.
 - If yes, go to step 9.
 - If not, reinstall the timing belts. ■
- 9. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

03

5.4.13 Normal start but unstable idling speed after warming up**Possible causes:**

1. Failure of the air intake system
2. Failure of the throttle
3. Failure of the fuel system
4. Failure of the coolant temperature sensor
5. Failure of the intake air pressure/temperature sensor

Diagnostic procedures

1. Turn the ignition switch to the ON position and check if there is any failure record with the diagnostic device.
 - If yes, refer to the corresponding diagnostic procedures of the fault codes for troubleshooting based on the fault information. ■
 - If not, go to step 2.
2. Remove the air filter assembly and check if there is any carbon deposit on the throttle panel.
 - If yes, clean the throttle. ■
 - If not, go to step 3.

3. Connect the fuel pressure gauge to the common rail, start the engine and check if the fuel system pressure is normal.
 - If yes, go to step 4.
 - If not, the fuel system fails and please inspect it. ■
4. Disassemble the fuel injector, install it to the injector tester for pressure leak test, and check if the injector leaks.
 - If yes, the fuel injector fails and please replace it. ■
 - If not, go to step 5.
5. Start the engine, check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 6.
 - If not, the coolant temperature sensor fails and please replace it. ■
6. Start the engine, check if the reading of the "coolant temperature sensor data flow" is normal with a diagnostic device.
 - If yes, go to step 7.
 - If not, the intake air pressure/temperature sensor fails and please replace it. ■
7. Check if the power supply and grounding of the engine control module are normal.
 - If yes, locate fault causes from other symptoms.
 - If not, inspect the corresponding lines of the engine control module. ■

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

6 Ignition Control System

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6.1 General information

6.1.1 Overview

- The function of the ignition system is to ignite the flammable mixture in the corresponding cylinder in turn in accordance with a reasonable ignition timing sequence to maintain the normal operation of the engine.
- The ignition control system consists of the following components:
 - Engine control module (ECM)
 - Ignition coil
 - Spark plug
 - Ignition cable
 - Camshaft position sensor
 - Crankshaft position sensor

6.1.2 Product specifications

Torque specifications

Component	Torque (N•m)
Spark plug	30±3
Fixing bolt of the ignition coil	6±1

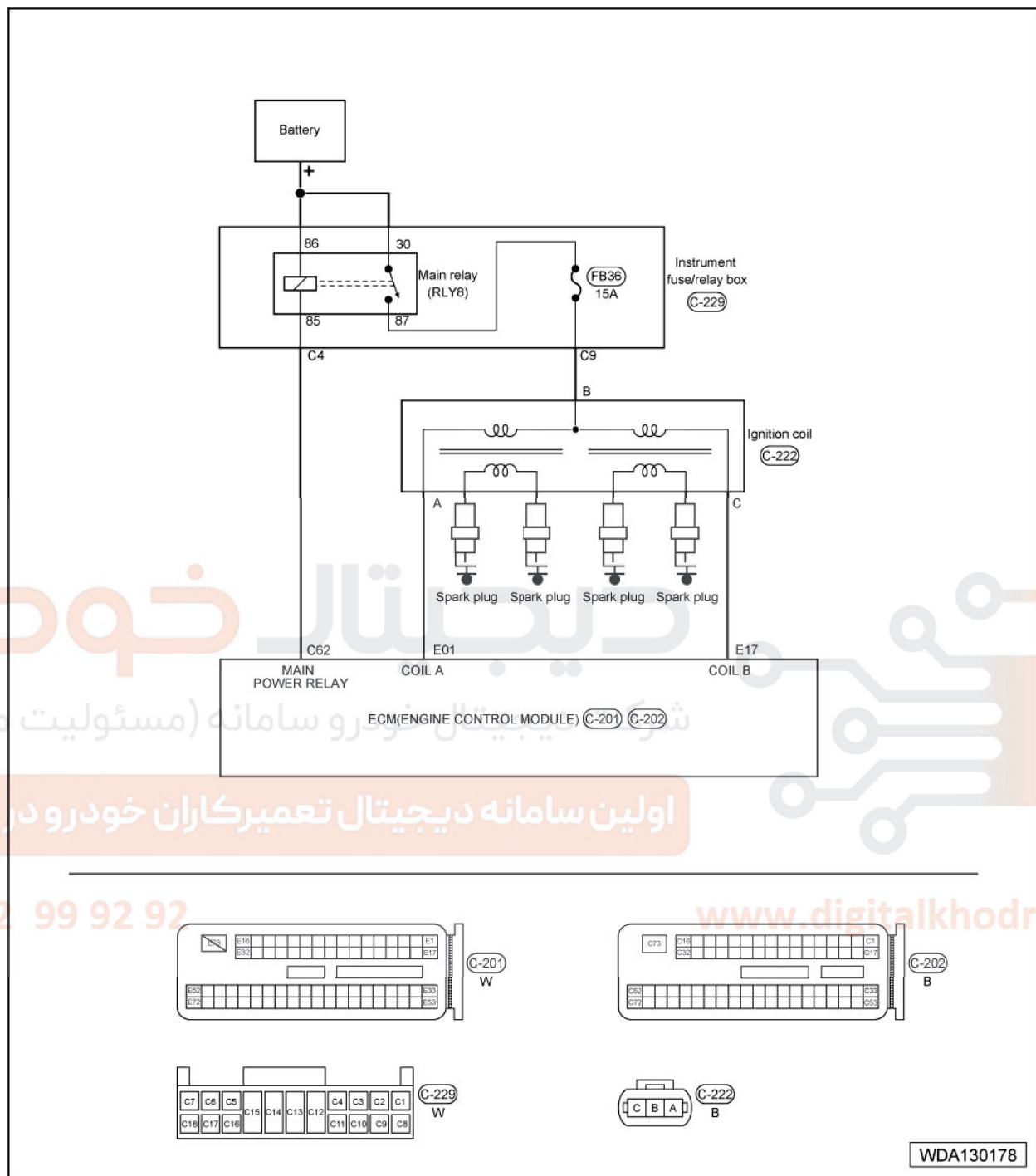
Spark plug

Component	Value
Type of spark plug	FR7DTC
Standard electrode clearance of the spark plug	0.7±0.1 mm

Ignition cable resistance

Component	Resistance value (K Ω)
Cylinder 1 ignition cable	7.5~11.2
Cylinder 2 ignition cable	5.8~9.3
Cylinder 3 ignition cable	4.2~7.7
Cylinder 4 ignition cable	4~7.5

6.1.3 Ignition system circuit diagram



6.2 Diagnosis and inspection**6.2.1 Ignition system troubleshooting**

Symptoms	Possible causes	Maintenance recommendations
Engine idling vibration and disabled acceleration	Excessive spark plug electrode clearance	Replace the spark plug
	Spark plug out of work	Replace the spark plug
	Low ignition voltage of the ignition coil	Replace the ignition coil
	Excessive ignition cable resistance	Replace the ignition cable
	Ignition cable open circuit	Replace the ignition cable

03

دیجیتال خودرو

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6.3 Spark plug

6.3.1 Removing and installing the spark plug

Caution

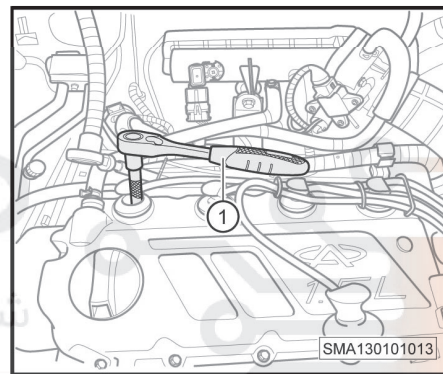
- Do not remove the spark plug when the engine is hot; otherwise, it may cause damage to the spark plug threaded hole on the cylinder head.

Note

- Remove the high voltage wires from the spark plug one by one, and make marks to avoid incorrect installation.
- Remove dust and impurities around the spark plug hole before removal to prevent them from falling into the cylinder.

Removal

- Turn off the ignition switch and wait until the engine cools down.
- Pull out the ignition cable.
- Unscrew the spark plug with a special spark plug socket wrench (-1-).



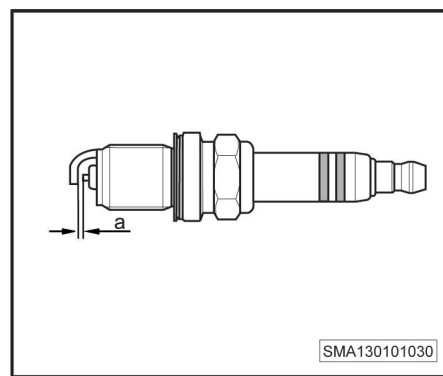
03

Installation

Note

- Check the spark plug type to see if it is applicable.
- Please use special socket for installation so as not to hit the cylinder wall and damage the normal spark plug clearance.

- Manually screw the spark plug into the cylinder head as far as it will go and then tighten the spark plug with a torque wrench during installation.
 - Tightening torque of the spark plug: $30 \pm 3 \text{ N} \cdot \text{m}$
- Check the spark plug for clearance and the related data before installation.



Spark plug	Value
Standard electrode clearance	$0.7 \pm 0.1 \text{ mm}$
Type	FR7DTC

03 - Engine Electronic Controls

Spark plug	Value
Recommended replacement interval	Every 30000 Km or 18 months

03

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

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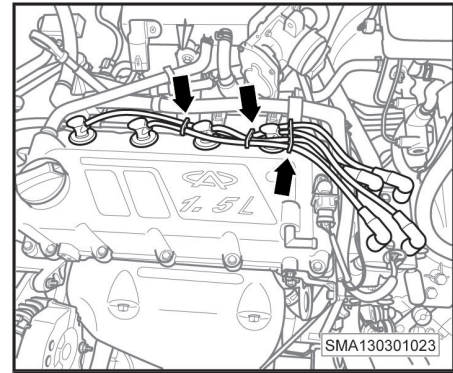
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6.4 Ignition cable

6.4.1 Removing and installing the ignition cable

Removal

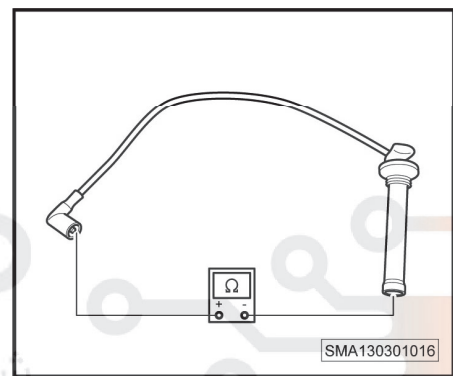
1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Remove the fixing clips of the ignition cables (-arrow-), pull the big ends of the ignition cables out of the spark plugs sequentially and remove the small ends from the ignition coils in turn to take off the ignition cables.



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

1. Pay attention to the installation positions of the ignition cables.
2. Check if the resistance of the ignition cable is normal and measure the resistances of the ignition cable at both ends as shown in the figure.
 - Standard resistance of cylinder 1 ignition cable:
7.5 - 11.2 (K Ω)
 - Standard resistance of cylinder 2 ignition cable:
5.8 - 9.3 (K Ω)
 - Standard resistance of cylinder 3 ignition cable:
4.2 - 7.7 (K Ω)
 - Standard resistance of cylinder 4 ignition cable:
4 - 7.5 (K Ω)

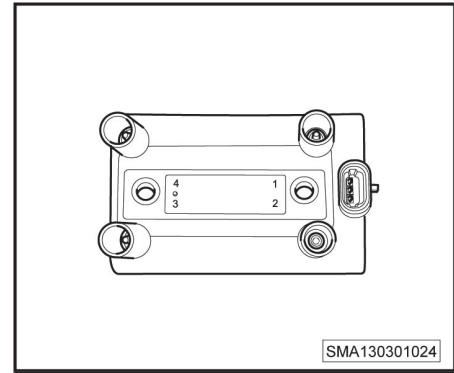


6.5 Ignition coil

6.5.1 Overview

The ignition coil transforms low voltage of the primary winding to high voltage of the secondary winding, and the high voltage produces spark through the electrode discharge of the spark plug to detonate the flammable gas mixture within the cylinder.

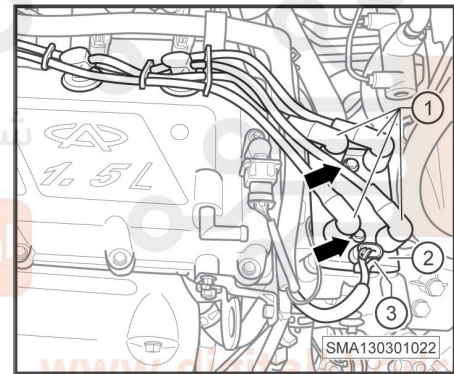
The ignition coil consists of two primary windings, two secondary windings, iron core, shell and so on. When a primary winding is connected to the ground, this primary winding is charged. Once the ECM cuts off the primary winding circuit, the charge will be terminated. At this point, high voltage is induced in the secondary winding to enable the spark plug discharging.



6.5.2 Removing and installing the ignition coil

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Pull out the ignition cable connector (-1-).
4. Disconnect the ignition coil connector (-3-).
5. Unscrew the bolts (-arrow-) and remove the ignition coil (-2-).



Installation

Installation shall follow the reverse sequence of the removal procedure. Please pay attention to the following notes:

- a. The ignition cables must be installed as per the "-1-3-4-2-" ignition sequence.

7 Fuel Vapor Emission Control System

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7.1 General information

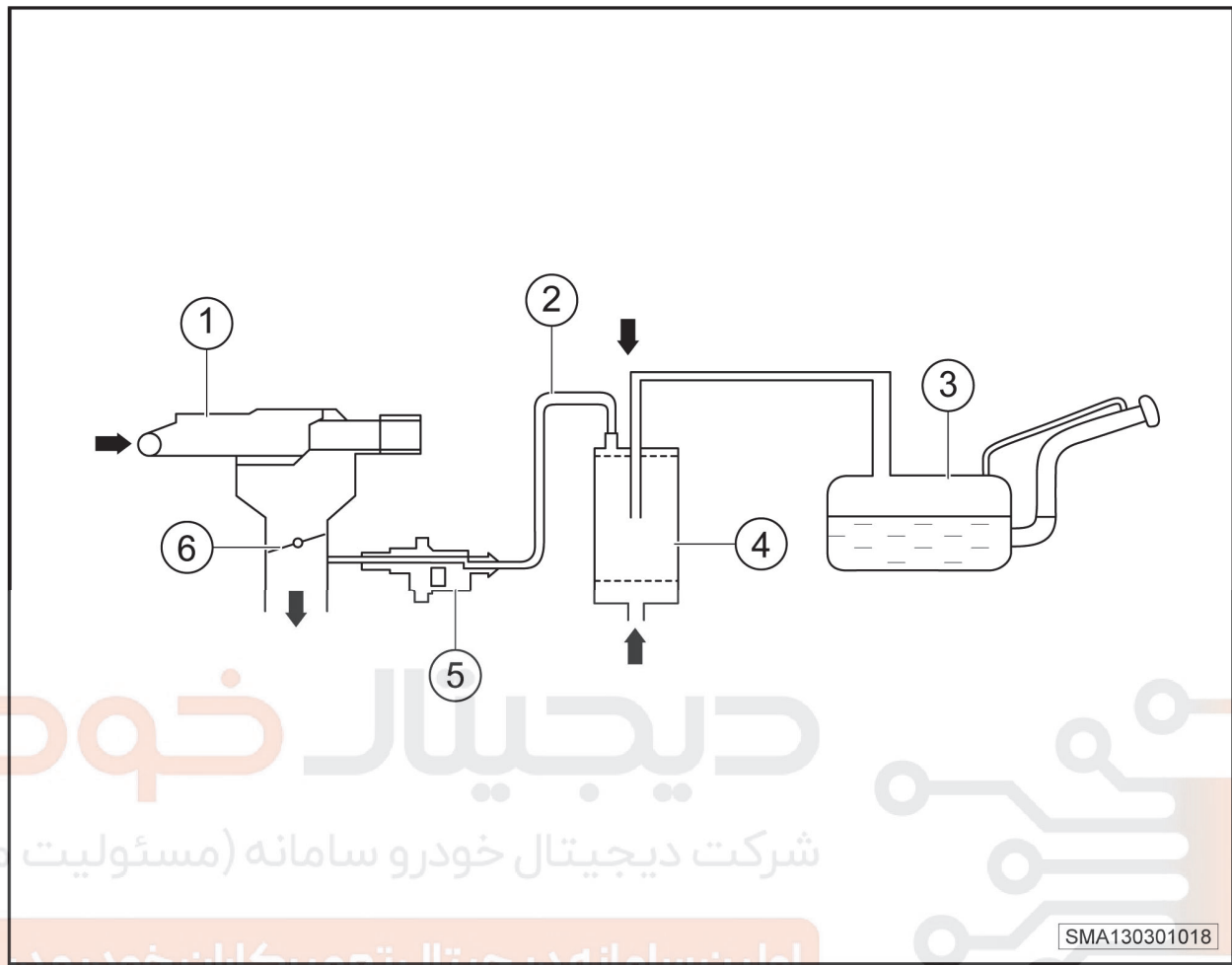
7.1.1 Overview

- The fuel vapor emission control system recovers and burns the fuel vapor so as to prevent the fuel vapor in the fuel tank from being discharged into the atmosphere.
- The activated carbon canister plays an important role in the fuel vapor emission control system. The activated carbon canister is used to absorb and filter the moisture and fuel vapor. The fuel vapor enters the top of the activated carbon canister through the pipe while the fresh air goes to the bottom of the activated carbon canister. When the engine stops, the fuel vapor and fresh air will be stored in the activated carbon canister; and when the canister solenoid valve opens, the fuel vapor will enter the intake manifold for combustion.

7.1.2 Product specifications

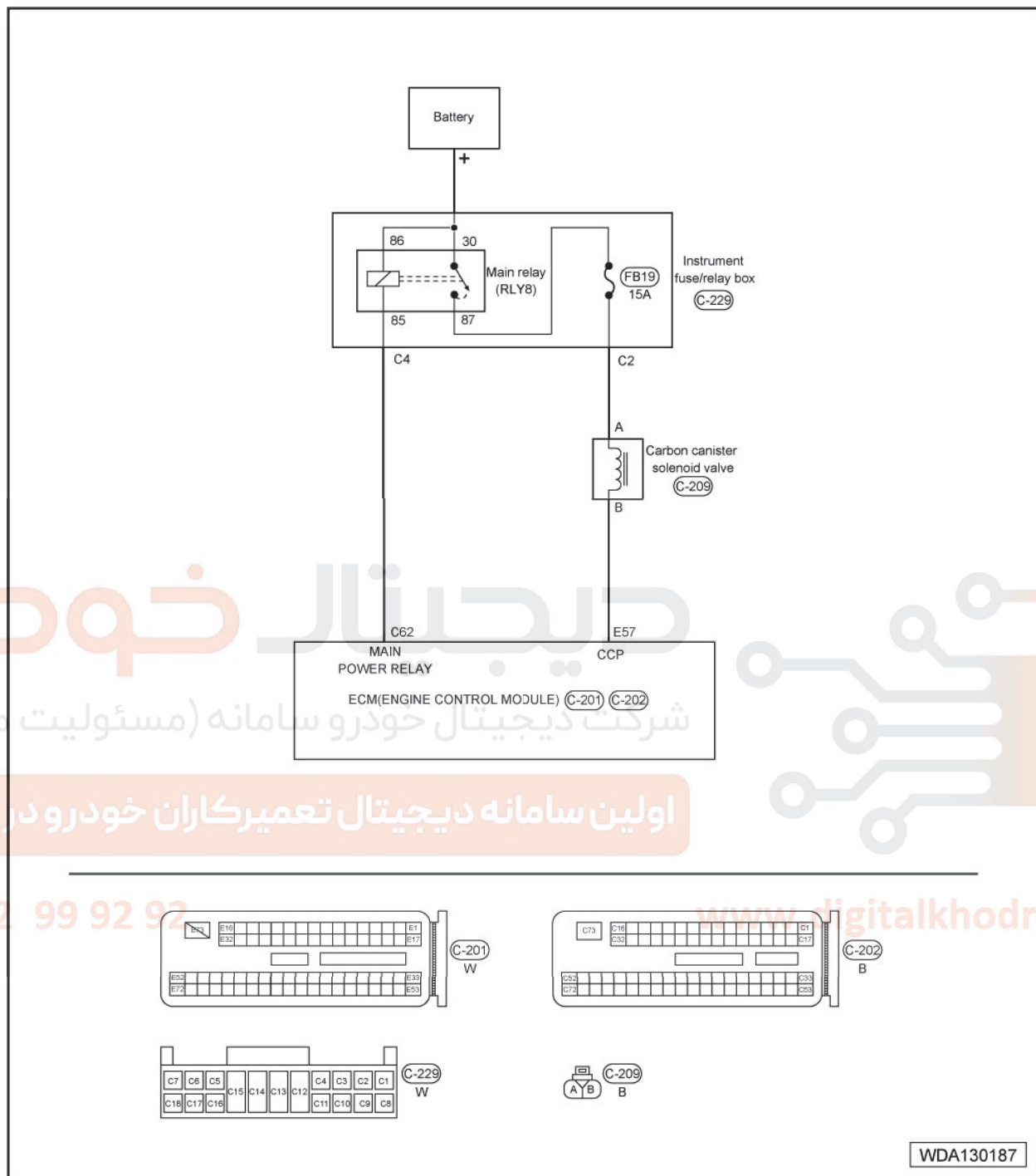
Torque specifications

Component	Torque (N·m)
Mounting bracket of the activated carbon canister solenoid valve	18±2
Activated carbon canister assembly	7±2

7.1.3 The fuel vapor emission control system assembly

1. Air filter	2. Activated carbon canister outlet hose
3. Fuel tank	4. Activated carbon canister
5. Activated carbon canister solenoid valve	6. Throttle

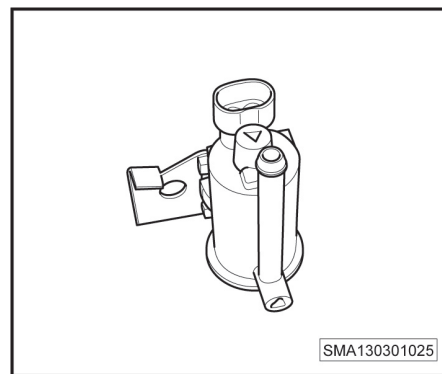
7.1.4 Fuel vapor emission control system circuit diagram



7.2 Activated carbon canister solenoid valve

7.2.1 Overview

Based on signals received from such as engine load, engine temperature and RPMs, the engine control module (ECM) computes the information to send out the electrical pulse duty ratio to control the opening and closing of the activated carbon canister solenoid valve.



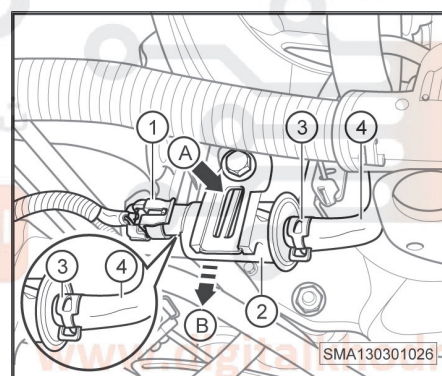
7.2.2 Removing and installing the activated carbon canister solenoid valve

i Note

- Before removal, mark at the inlet and outlet hoses to avoid confusion.

Removal

1. Switch off all electrical equipment and the ignition switch, and pull out the key.
2. Disconnect the battery negative terminal.
3. Disconnect the carbon canister solenoid valve connector (-1-), loosen the clamps (-3-), and pull out the inlet and outlet hoses (-4-).
4. Lever out the clip (-arrow A-), and remove the carbon canister solenoid valve (-2-) in the (-arrow B-) direction.

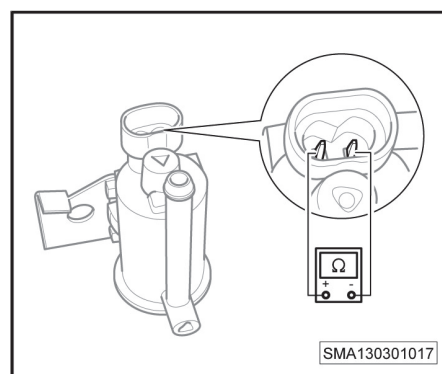


Installation

- Installation shall follow the reverse sequence of the removal procedure.

7.2.3 Checking the activated carbon canister solenoid valve

1. Remove the activated carbon canister solenoid valve.
2. Turn the digital multimeter to the Ohm range, with the two meter probes connecting to the two pins of the activated carbon canister solenoid valve. The measured resistance value should be $21 \pm 1 \Omega$ at 20°C .



7.3 Activated carbon canister

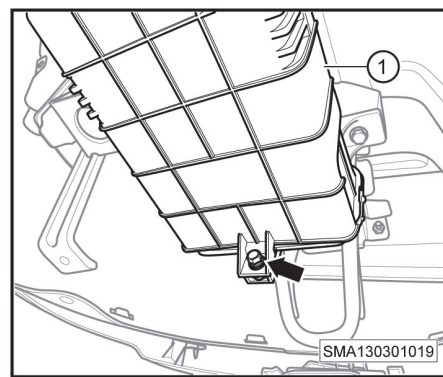
7.3.1 Overview

- The activated carbon canister is filled with activated carbon which can absorb, filter and store the fuel vapor.

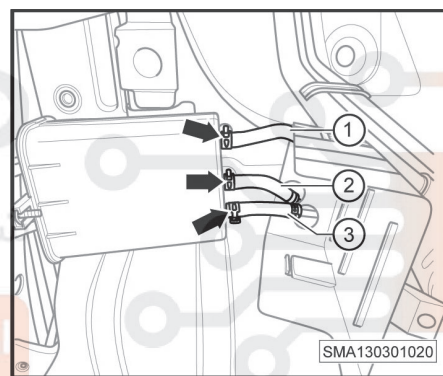
7.3.2 Removing and installing the activated carbon canister

Removal

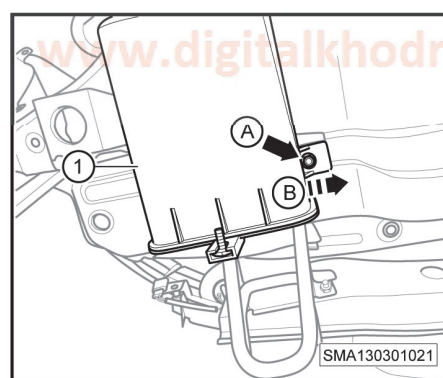
1. Unscrew the nut (-arrow-) and loosen the cover (-1-).



2. Loosen the clamps (-arrow-) and loosen the hoses (-1-, -2- and -3-).



3. Unscrew the bolt (-arrow A-) and loosen the body clip in the (-arrow B-) direction to take out the activated carbon canister (-1-).



Installation

Installation shall follow the reverse sequence of the removal procedure.