
STEERING SYSTEM

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8.1 ELECTRONIC POWER STEERING CONTROL SYSTEM

1 Warnings and Precautions

1.1 Precautions

In order to avoid dangerous operation and damage to the vehicle, always follow the instructions below before repair:

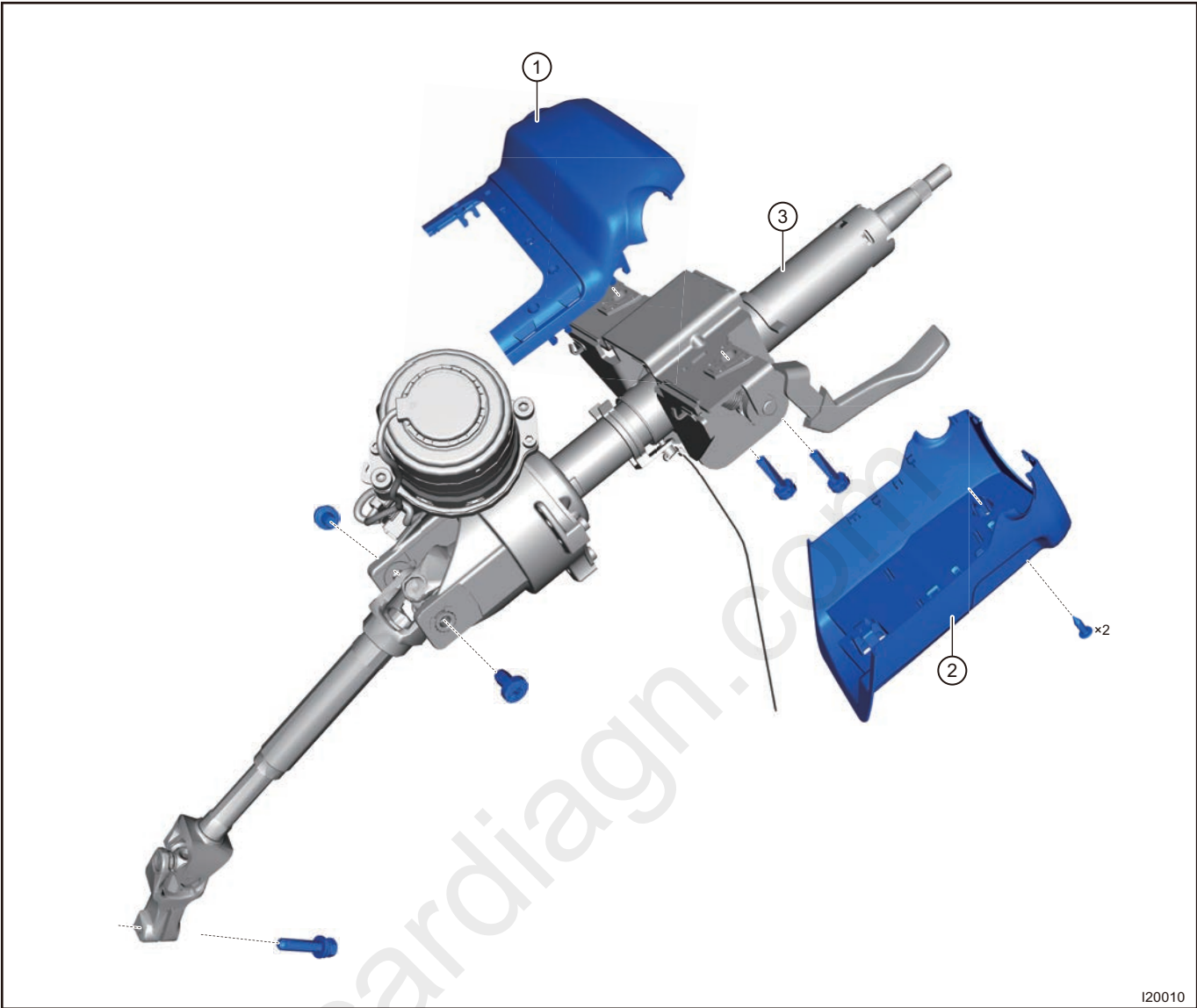
- (1) Calibration requirements: Keep vehicle stationary and steering wheel centered to ensure that the left and right errors are within 10°.
- (2) Battery voltage is higher than 10 V and lower than 16 V.
- (3) When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.
- (4) It is necessary to perform steering angle calibration after replacing electronic power steering column assembly, steering gear, four-wheel alignment etc.
- (5) When removing and installing steering system, suspension system, brake, tire, etc., it is necessary to turn off power supply of EPS (vehicle power supply is turned off), so as to avoid reverse impact, resulting in EPS internal protection circuit breakdown.

2 System Overview

2.1 System Description

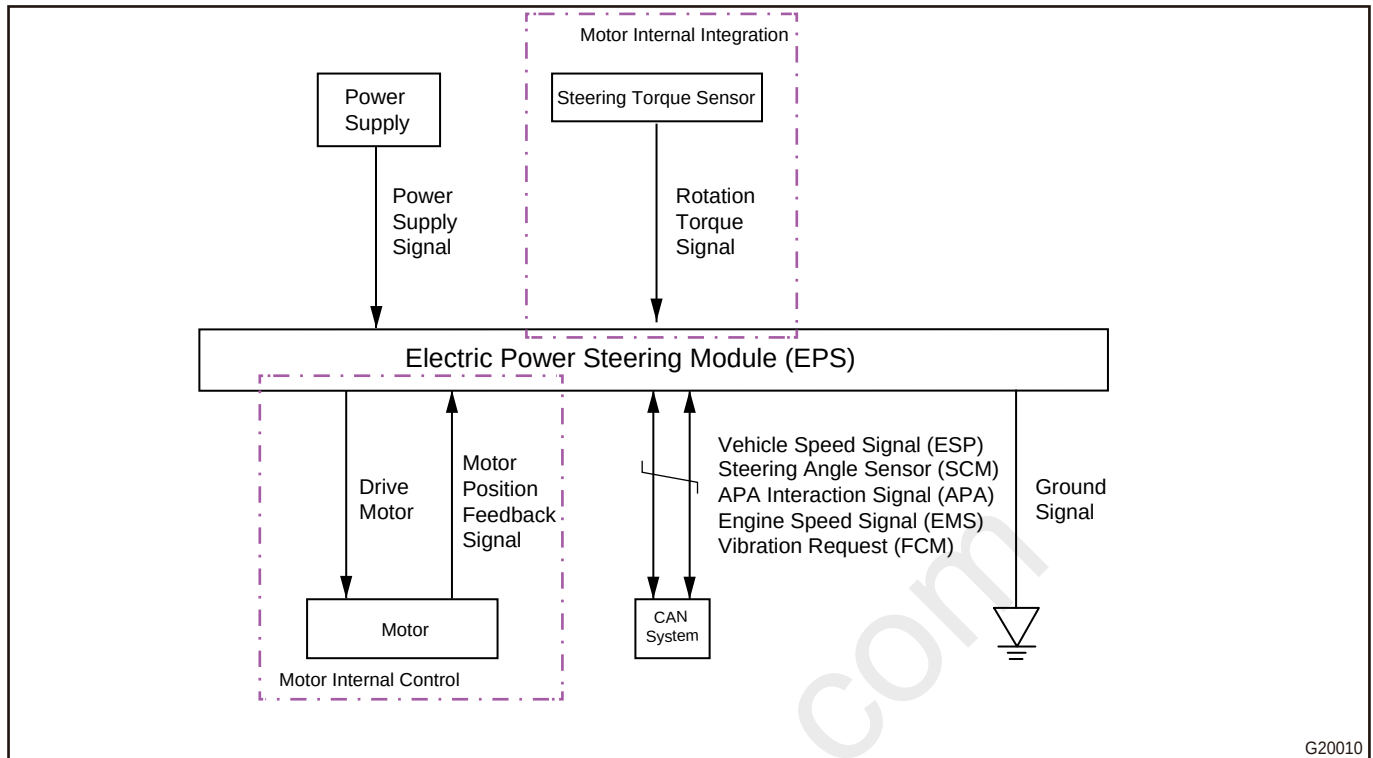
The steering column is the component of the steering system that connects the steering wheel and the steering gear. Through the steering column, the driver transfers torque to the steering gear, which drives the steering gear to achieve steering.

2.2 System Components Diagram



1	Combination Switch Upper Cover	3	Electric Steering Column with Intermediate Shaft Assembly
2	Combination Switch Lower Cover		

2.3 System Schematic Diagram



Electric power steering module is integrated into steering column.

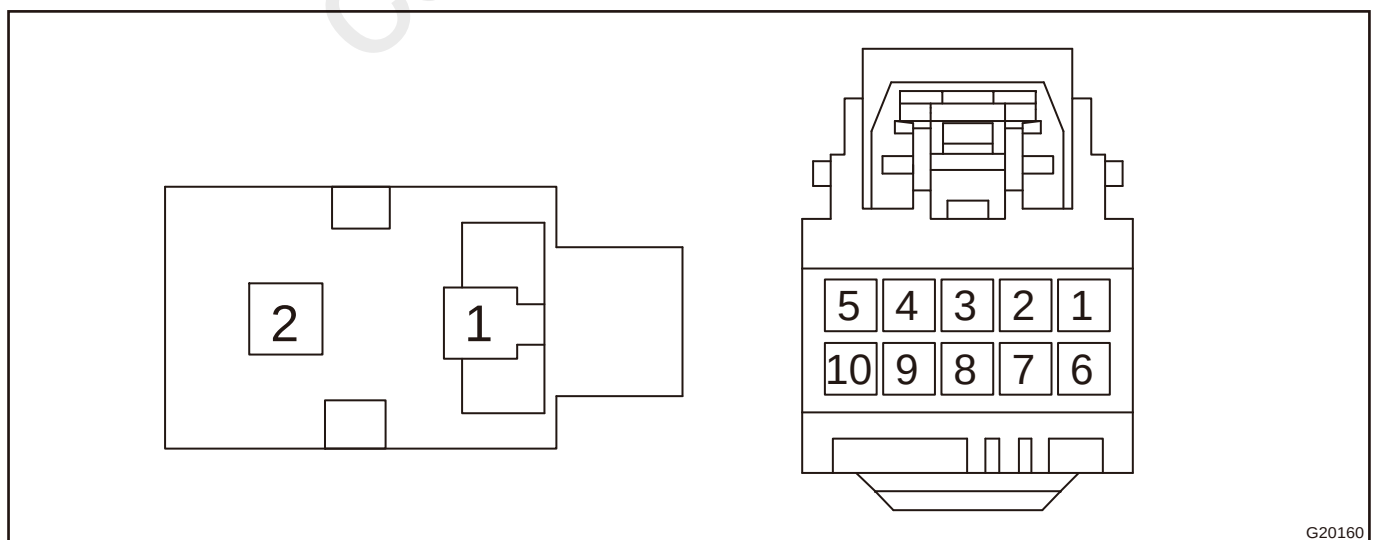
2.4 Component Operation Description

■ Steering Angle Sensor

The steering angle sensor of vehicle is used to detect rotation angle and direction of steering wheel. Turning steering wheel to left and right will be detected by steering angle sensor, so as to make electronic control unit of vehicle send correct steering command. Rotation angle of steering wheel provides basis for steering extent of vehicle, so that the vehicle drives according to driver's steering intention.

3 System Circuit Diagram

3.1 Module Terminal Diagram



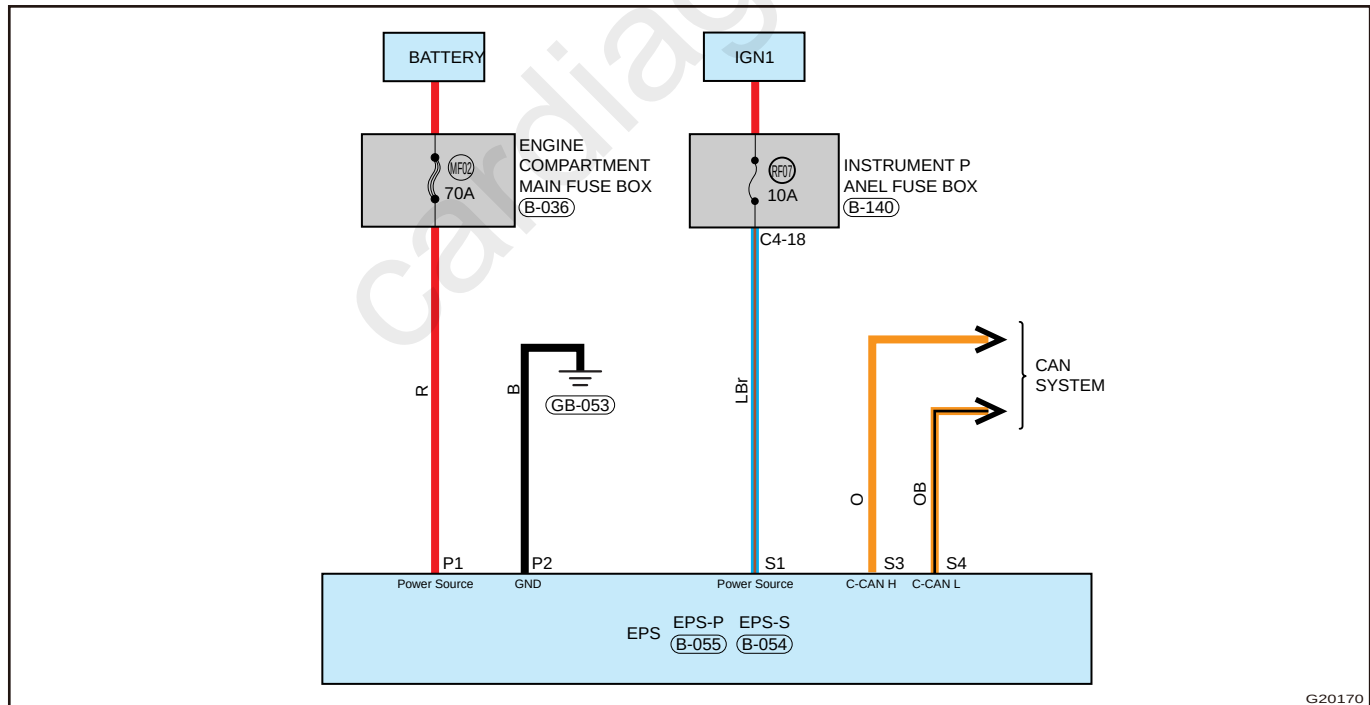
Vehicle power supply: Controller power supply connector (connector A)

Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Multimeter Positive	Multimeter Negative			
P1	Body ground	KL30	Power supply "ON"	12V
P2	Body ground	POWER GND	Power supply "ON"	0 V

Vehicle power supply: Controller power supply connector (connector B)

Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Multimeter Positive	Multimeter Negative			
S1	Body ground	KL15	Power supply "ON"	12V
S2	Body ground	CAN-H	Power supply "ON"	-
S3	Body ground	C CAN-H	Power supply "ON"	2.78V
S4	Body ground	C CAN-L	Power supply "ON"	2.28V
S5	Body ground	CAN-L	Power supply "ON"	-

3.2 Circuit Diagram



4 Diagnostic Information and Steps

4.1 Diagnostic Help

- (1) Connect diagnostic tester (the latest software) to diagnostic connector, and make it communicate with vehicle electronic module through data network.
- (2) Confirm that malfunction is current, and carry out diagnostic test and repair procedures.
- (3) If Diagnostic Trouble Code (DTC) cannot be cleared, it indicates that there is a current malfunction.
- (4) Only use a digital multimeter to measure voltage of brake control system.
- (5) Refer to any Technical Bulletin that may apply to this malfunction.
- (6) Visually check related wire harness and connector.
- (7) Check and clean all wire harness connectors and ground parts related to DTC.
- (8) If numerous trouble codes are set, refer to circuit diagram and look for any common ground circuit or power supply circuit applied to DTC.

4.2 Intermittent Troubleshooting

If malfunction is intermittent, perform the followings:

- (1) Check if connector is loose.
- (2) Check if wire harness is worn, pierced, pinched or partially broken.
- (3) Wiggle related wire harness and connector and observe if signal in related circuit is interrupted.
- (4) If possible, try to duplicate the conditions under which DTC was set.
- (5) Look for data that has changed or DTC to reset during wiggle test.
- (6) Look for broken, bent, protruded or corroded terminals.
- (7) Inspect the mounting areas of brake control system, wire harness or wire harness connector and so on for damage, foreign matter, etc. that will cause incorrect signals.
- (8) Check and clean all wire harness connectors and ground parts related to DTC.
- (9) Refer to any Technical Bulletin that may apply to this malfunction.

4.3 Ground Inspection

Ground points are very important to normal work of circuit, and they are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) may increase load resistance. This situation may change the way in which a circuit operates. Circuits are very sensitive to proper grounding. A loose or corroded ground can seriously affect the control circuit. Check the ground points as follows:

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

4.4 DTC Confirmation Procedure

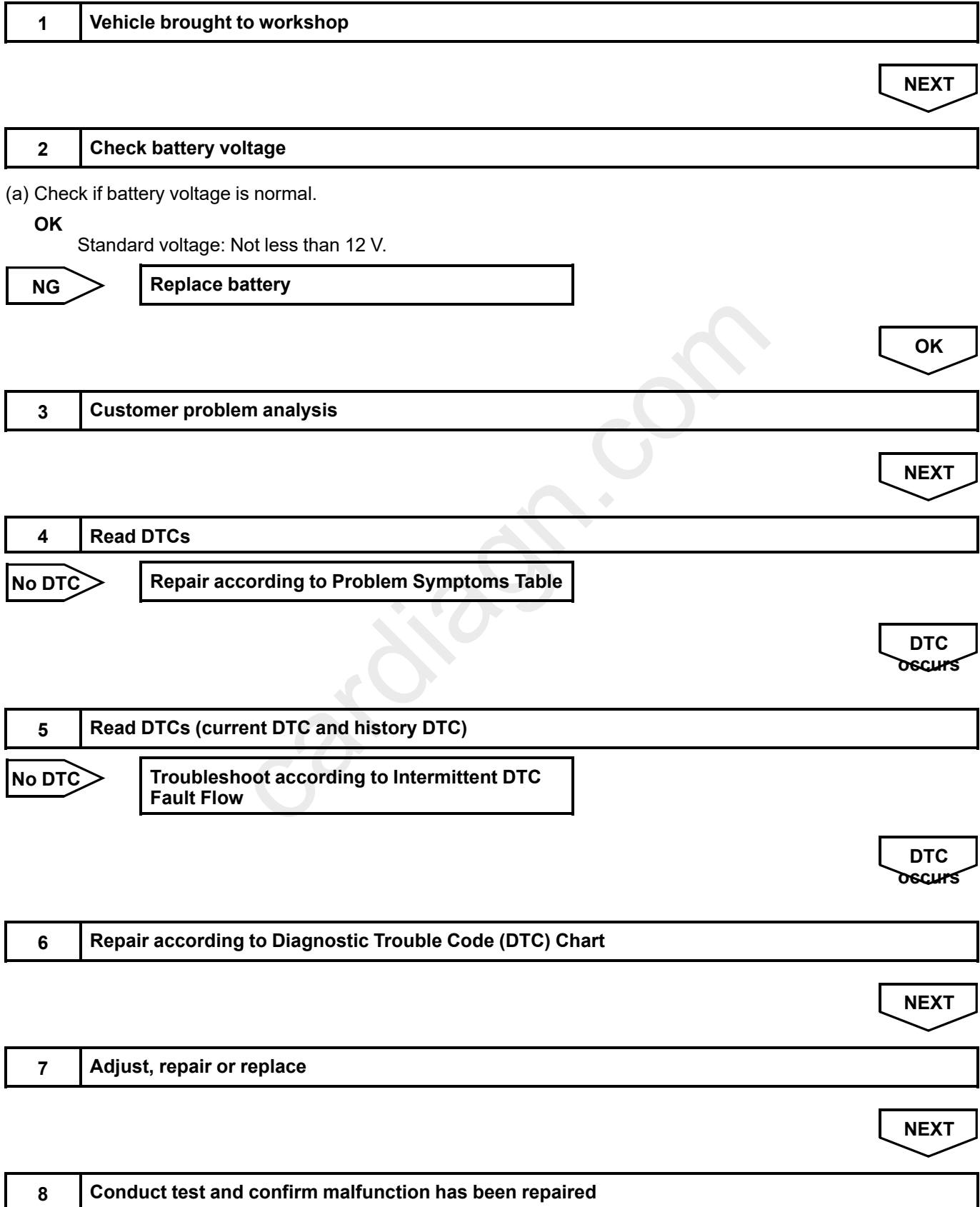
Confirm that battery voltage is not less than 12 V before performing following procedures:

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic connector, and make it communicate with vehicle electronic module through data network.
- Turn ENGINE START STOP switch to ON.
- Use diagnostic tester to record and clear DTCs stored in EPB system.
- Turn the ENGINE START STOP switch to OFF and wait for several seconds.
- Turn the ENGINE START STOP switch to ON, select "Read DTC" .
- If DTC is not detected, malfunction indicated by DTC is intermittent.

4.5 System Diagnosis Procedure

Hint:

- Use following procedures to troubleshoot the electronic parking control system (EPB).



NEXT

END

4.6 Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition	Detection Condition	Possible Cause
C120500	External Function Fault - Invalid LKA Torque	Lane keeping assist torque is high	- Intermittent fault - EPS module failure
C200100	EPS Internal Software Error - Dataflash Operation Error	- Nv Ram reading failure - Nv Ram writing failure	EPS module failure
C200200	EPS Internal Software Error - Dataflash Verify Error	- Incorrect NvRam configuration or initialization - Software label error in NvRam - Incorrect data exists in NvShare	
C200300	EPS Internal Hardware Error - ECU Hardware Error	- SPI communication timeout - Watchdog enabled/disabled failure - ASIC start failure - ADC operation failure - Error in RAM - Built-in software test failed - Different outputs for incorrect pin - Registration read back failure - SGA error in single-chip microcomputer - Improper reset	
C200400	EPS Internal Software Error - ECU Reset	Improper reset of ECU	
C200500	EPS Internal Software Error - ECU Software Monitor Error	- OS monitoring routine for OS error detection - Design problem or timing problem (load when running) or unauthorized interrupt latch - Comparison failure in level 1 of comparator - Comparison failure in level 2 of comparator - Rotor position angle error; - Software default branch failure - Error handling process monitoring failure	

DTC	DTC Definition	Detection Condition	Possible Cause
		- CodeFlash implausibility - Problem in error event reaction component - Different applied torque and calculated torque.	
C200600	EPS Internal Hardware Error - Flash Code Verify Error	Code flash corrupted	
C200700	EPS Steering Column Error - High Friction	Steering friction too high	Steering column stuck
C200800	EPS Internal Hardware Error - Index Sensor Error	Index sensor failure	EPS module failure
C200900	EPS Internal Hardware Error - Output Stage Error	- SPI communication failure due to flag inconsistency or error frame response - Output stage failure - Output stage drive failure - Measured output stage PWM error	EPS module failure
C200A00	EPS Internal Hardware Error - Phase Current Error	- Motor phase current out of range - Motor phase current offset out of range	
C200B00	EPS Internal Hardware Error - RPS Error	- RPS radius error - DRPS sensor plausibility	
C200C00	EPS Internal Hardware Error - Steering Oscillation Error	Reduction of assistance is within 0 - 40% due to steering oscillation. Note: 100 % = Full assistance	Mechanical components loose
C200D00	EPS Internal Software Error - Steering Angle Implausible Error	Different iLWS and steering wheel speed angle	- Configuration error - EPS failure
C200E00	EPS Internal Software Error - Steering Angle Not Initialized Error	iLWS not initialized	- Steering angle not calibrated - Low software version - EPS failure
C200F00	EPS Internal Software Error - Steering Angle Not Calibrated Error	iLWS not calibrated	
C201100	EPS Internal Hardware Error - Steer Ang Sens Self Test Error	Internal steering angle sensor self test failure	EPS module failure
C201200	Voltage Out of Range - Power Supply Voltage Abnormal at Start	Battery voltage less than 8.3 or more than 18 V at start	- Battery fault - Wire harness or connector fault - ECU intermittent fault - EPS failure
C201300	Voltage Out of Range - Power Supply Voltage too High Warn	When battery voltage is higher than 16 V for at least 1.5 s	

DTC	DTC Definition	Detection Condition	Possible Cause
C201400	Voltage Out of Range - Reduction Due to High Power Supply Voltage	Battery voltage is within 16 - 18 V and assistance reduces to 0 - 40%	
C201500	Voltage Out of Range - Power Supply Voltage too High OFF	When battery voltage is higher than 18 V for at least 20 ms	
C201600	Voltage Out of Range - Power Supply Voltage too Low Warn	When battery voltage is lower than 10 V for at least 9 s	
C201700	Voltage Out of Range - Reduction Due to Low Power Supply Voltage	When battery voltage is within 6.5 - 10 V and reduction of assistance is within 0 - 60%. Note: 100 % = Full assistance	
C201800	Voltage Out of Range - Power Supply Voltage too High OFF	When battery voltage is lower than 6.5 V for at least 20 ms	
C201900	Temperature Error - Over Temperature Reduction	- When PCB temperature is higher than 85°C and the reduction of assistance is within 0 - 40% - When FET temperature is higher than 100 °C and the reduce of assistance is within 0 - 60% - Motor temperature is higher than 150°C, and the reduction of assistance is within 0 - 40%; Note: 100 % = Full assistance	- System overheating - ECU intermittent fault - EPS failure
C201A00	Temperature Error - Temperature Out of Range	- PCB temperature is out of range - Temperature difference between NTC1 and NTC2 is within -24 to 27 °C for at least 2 s	
C201B00	EPS Internal Hardware Error - Torque Sensor Error	- Torque sensor passage is not available, power supply of sensor is undervoltage and torque difference between A and B is too large - SENT driver protocol is faulty	- Torque sensor failure - EPS failure
C201C00	EPS Internal Software Error - Flash Memory Changed via XCP	When it does not flash properly via XCP, this will be detected if the CRC fails while part of flashing is adjusted.	- Intermittent fault - Low software version - EPS failure

DTC	DTC Definition	Detection Condition	Possible Cause
C201D00	EPS Internal Software Error - ECU Software Info Error	- OEM task running fails - Floating point overflows/underflows; Software is corrupted	
C201E46	EPS Internal Software Error - Vehicle Configuration Not Programmed	Vehicle configuration data is not programmed	Configuration writing is not performed or configuration is lost

■ DTC Diagnosis Procedure

DTC	C120500	External Function Fault - Invalid LKA Torque
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Caution

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

1	Reduce lane keeping assist torque to less than 3 Nm and reset ECU
---	---

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Reduce lane keeping assist torque to less than 3 Nm.
 (c) Reset the ECU.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC	C201200	Voltage Out of Range - Power Supply Voltage Abnormal at Start
DTC	C201300	Voltage Out of Range - Power Supply Voltage too High Warn
DTC	C201400	Voltage Out of Range - Reduction Due to High Power Supply Voltage
DTC	C201500	Voltage Out of Range - Power Supply Voltage too High OFF
DTC	C201600	Voltage Out of Range - Power Supply Voltage too Low Warn
DTC	C201700	Voltage Out of Range - Reduction Due to Low Power Supply Voltage
DTC	C201800	Voltage Out of Range - Power Supply Voltage too High OFF

Caution

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

1	Check battery voltage
---	-----------------------

- (a) Check if battery voltage is normal.
 (b) Check battery voltage with voltage band of multimeter.

OK

Standard voltage: Not less than 12 V.

NG

Check and repair battery

OK

2 Check fuse

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Remove fuses MF02 (70 A) and RF07 (10 A) from engine compartment fuse and relay box.
 (d) Check if fuse is blown.

NG

Replace fuse

OK

3 Check power supply voltage

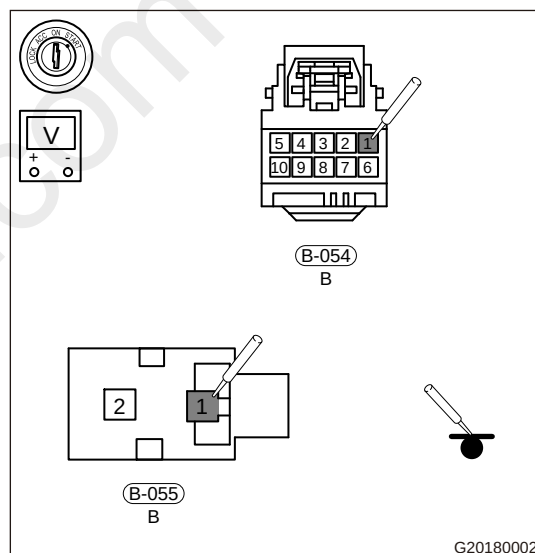
- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect electronic power steering module connectors B-055 and B-054.
 (c) Turn ENGINE START STOP switch to ON.
 (d) Check voltage between B-055 (1) and body ground with voltage band of multimeter, and check if 21 W test light comes on.
 Check voltage between B-054 (1) and body ground with voltage band of multimeter, and check if 21 W test light comes on.
 Standard Voltage

Multimeter Connection	Detection Condition	Specified Condition
B-055 (1) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V
B-054 (1) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V
B-054 (1) - Body ground	ENGINE START STOP switch "ON"	On
B-055 (1) - Body ground	ENGINE START STOP switch "ON"	On

NG

Repair or replace power supply wire harness

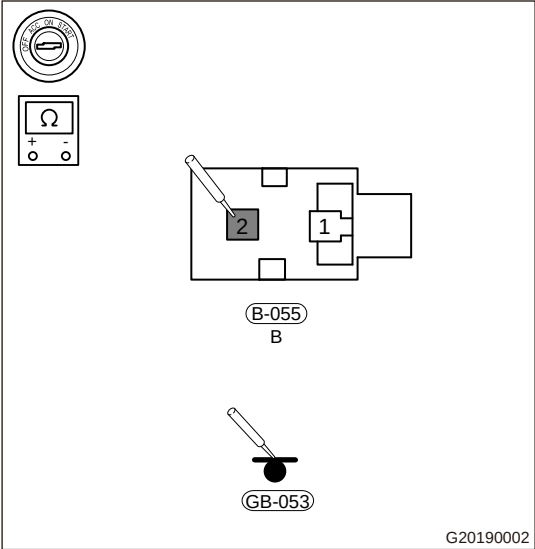
OK

4 Check ground

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the electronic power steering module connector B-055.
- (c) Check for continuity between B-055 (2) and body ground GB-053 with ohm band of multimeter.

Standard Resistance

Multimeter Connection	Detection Condition	Specified Condition
B-055 (2) - Body ground GB-053	Always	$\leq 1 \Omega$



NG

Repair or replace ground point

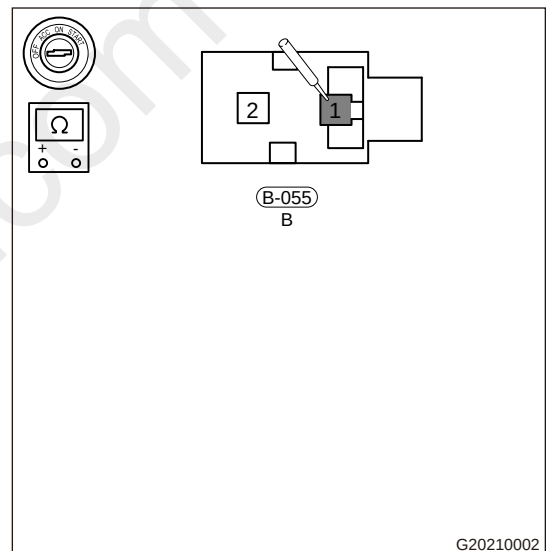
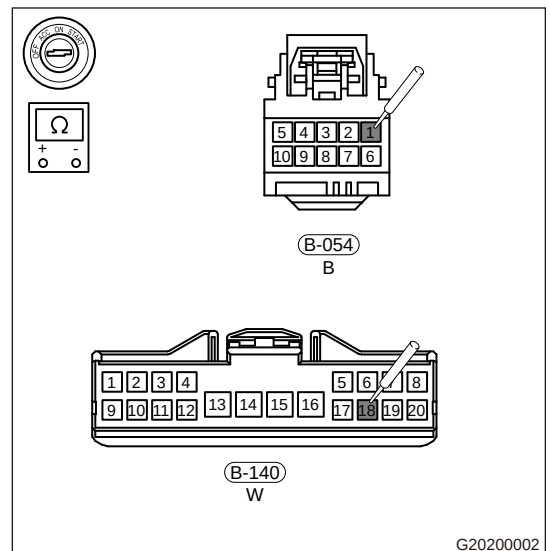
OK

5	Check wire harness and connector
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- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect electronic power steering module connectors B-054 and B-055.
- (c) Using ohm band of multimeter, check for continuity between B-054(1) and C4-18 of instrument panel fuse and relay box B-140, B-055 (1) and engine compartment fuse and relay box B-036.

Standard Resistance

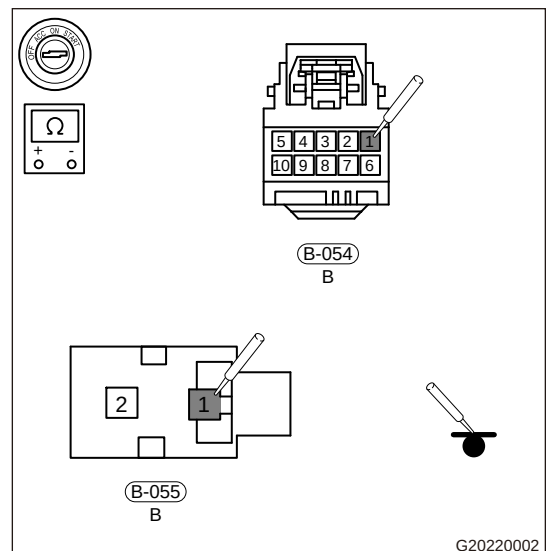
Multimeter Connection	Detection Condition	Specified Condition
B-054(1)- B-140 (C4-18)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$
B-055 (1) - B-036	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$



- (d) Check for continuity between B-055 (1) and body ground, B-054 (1) and body ground with ohm band of multimeter.

Standard Resistance

Multimeter Connection	Detection Condition	Specified Condition
B-055 (1) - Body ground	ENGINE START STOP switch "OFF"	∞
B-054 (1) - Body ground	ENGINE START STOP switch "OFF"	∞



NG

Repair or replace control circuit wire harness and connector

OK

6 Reconfirm DTCs

- (a) Use diagnostic tester to clear DTCs.
(b) Start the engine.
(c) Check if the same DTCs are still output.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC	C200300	EPS Internal Hardware Error - ECU Hardware Error
-----	---------	--

 **Caution**

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

1 Check fuse

- (a) Turn ENGINE START STOP switch to OFF.
(b) Check if MF02 70A fuse of engine compartment main fuse box B-036 is blown.
(c) Check if RF07 10A fuse in instrument panel fuse box B-140 is blown.

NG

Replace fuse

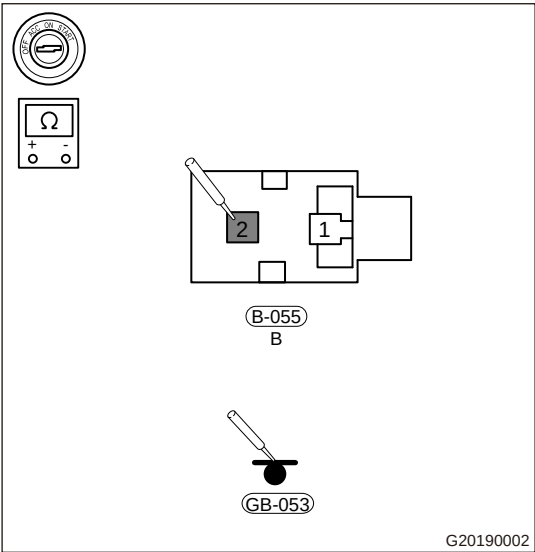
OK

2 Inspect EPS power supply and ground circuit

- (a) Turn ENGINE START STOP switch to OFF.
(b) Disconnect the electronic power steering module connector B-055.
(c) Using a multimeter, check for continuity between terminal 2 of EPS connector B-055 and ground point GB-053.

Standard Resistance

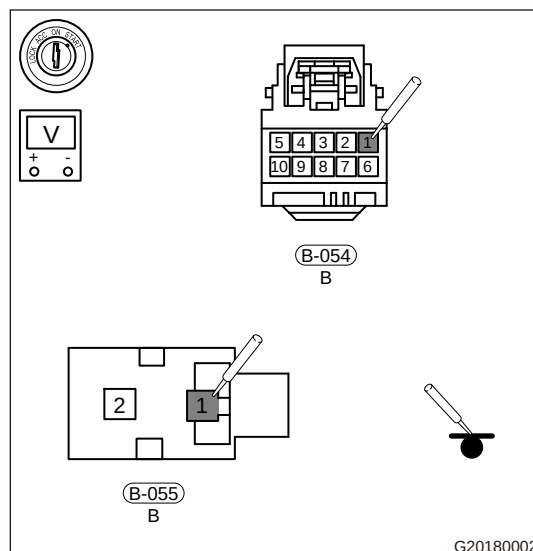
Multimeter Connection	Detection Condition	Specified Condition
B-055 (2) - Ground point GB-053	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$



- (d) Turn ENGINE START STOP switch to ON.
- (e) Measure voltage between B-055 (1) and body ground, B-054 (1) and body ground with voltage band of multimeter.

Standard Voltage

Multimeter Connection	Detection Condition	Specified Condition
B-055 (1) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V
B-054 (1) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V



NG

Repair or replace power supply wire harness

OK

3

Reconfirm DTCs

- (a) Use diagnostic tester to clear DTCs.
- (b) Start the engine.
- (c) Check if the same DTCs are still output.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC	C200100	EPS Internal Software Error - Dataflash Operation Error
DTC	C200200	EPS Internal Hardware Error - ECU Hardware Error
DTC	C200300	EPS Internal Software Error - Dataflash Verify Error
DTC	C200500	EPS Internal Software Error - ECU Software Monitor Error
DTC	C200600	EPS Internal Hardware Error - Flash Code Verify Error
DTC	C200800	EPS Internal Hardware Error - Index Sensor Error
DTC	C200900	EPS Internal Hardware Error - Output Stage Error
DTC	C200A00	EPS Internal Hardware Error - Phase Current Error
DTC	C200B00	EPS Internal Hardware Error - RPS Error
DTC	C200C00	EPS Internal Hardware Error - Steering Oscillation Error
DTC	C200D00	EPS Internal Software Error - Steering Angle Implausible Error
DTC	C200E00	EPS Internal Software Error - Steering Angle Not Initialized Error

DTC	C200F00	EPS Internal Software Error - Steering Angle Not Calibrated Error
DTC	C201100	EPS Internal Hardware Error - Steer Ang Sens Self Test Error

 Caution

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

1	Check battery voltage
---	-----------------------

(a) Connect negative battery terminal cable, and turn ENGINE START STOP switch to ON to make engine run normally.

(b) Check battery voltage with voltage band of multimeter.

OK

Standard voltage: Not less than 12 V

NG

Check and repair battery

OK

2	Check ground
---	--------------

(a) Turn ENGINE START STOP switch to OFF.

(b) Disconnect negative battery cable, and check EPS ground point.

OK

Ground point is well.

NG

Repair or replace ground wire circuit or ground point

OK

3	Reconfirm DTCs
---	----------------

(a) Use diagnostic tester to clear DTCs.

(b) Start the engine.

(c) Check if the same DTCs are still output.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC	C200700	EPS Steering Column Error - High Friction
-----	---------	---

 Caution

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

1	Check tire pressure
---	---------------------

- (a) Check tire for wear.
 (b) Use tire pressure gauge to check tire pressure, and standard pressure value is required.

NG

Check and repair or replace tire

OK

2

Check mechanical steering gear and chassis system

- (a) Check if mechanical steering gear runs smoothly or is stuck.
 (b) Check if chassis area is damaged.

NG

Replace steering gear or chassis components

OK

3

Check EPS motor and universal joint

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Check if mechanical universal joint is damaged.
 (c) Check if electric steering column motor is damaged.

NG

Replace electric steering column or universal joint

OK

4

Reconfirm DTCs

- (a) Use diagnostic tester to clear DTCs.
 (b) Start the engine.
 (c) Check if the same DTCs are still output.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC

C201E46

EPS Internal Software Error - Vehicle Configuration Not Programmed

 Caution

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

1

Check configuration code of EPS controller

- (a) Turn ENGINE START STOP switch to ON.
 (b) Use diagnostic tester (the latest software) to read configuration code in EPS system.
 (c) Check if configuration code is written and correct.

NG

Rewrite correct configuration code

OK

2 Check EPS motor calibration

- (a) Keep battery voltage sufficient.
 (b) Park vehicle on a level ground and keep it straight ahead.
 (c) Connect diagnostic tester, and recalibrate EPS motor according to prompted requirements.

NG

Recalibrate it several times if necessary

OK

3 Reconfirm DTCs

- (a) Use diagnostic tester to clear DTCs.
 (b) Start the engine.
 (c) Check if the same DTCs are still output.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC	C201900	Temperature Error - Over Temperature Reduction
DTC	C201A00	Temperature Error - Temperature Out of Range

⚠ Caution

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

1 Decrease ambient temperature, and avoid strong steering movement

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Park vehicle on a level ground and cool it for a while.

NG

Read DTCs again

OK

2 Check if EPS is assembled correctly and tire pressure is sufficient

- (a) Check steering column for mechanical friction or interference.
 (b) Check steering gear for mechanical friction or interference or damage.
 (c) Check if tire pressure is sufficient.

NG

Readjust assembly

OK

3 Reconfirm DTCs

- (a) Use diagnostic tester to clear DTCs.
 (b) Start the engine.
 (c) Check if the same DTCs are still output.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC	C201B00	EPS Internal Hardware Error - Torque Sensor Error
DTC	C201C00	EPS Internal Software Error - Flash Memory Changed via XCP
DTC	C201D00	EPS Internal Software Error - ECU Software Info Error

⚠ Caution

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

1

Recheck torque sensor connection and reset ECU

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Recheck the torque sensor connection.
 (c) Reset the ECU.

NG

Replace torque sensor

OK

2

Refresh software

- (a) Refresh the software.

NG

Refresh software

OK

3

Reconfirm DTCs

- (a) Use diagnostic tester to clear DTCs.
 (b) Start the engine.
 (c) Check if the same DTCs are still output.

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

DTC	U000188	High Speed CAN Communication Bus
DTC	U010087	CAN Communication Error - Lost Communication with EMS
DTC	U010187	CAN Communication Error - Lost Communication with TCU
DTC	U012287	CAN Communication Error - Lost Communication with ESC

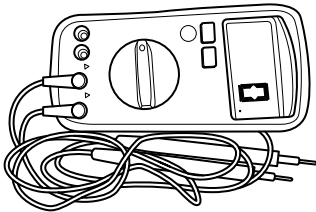
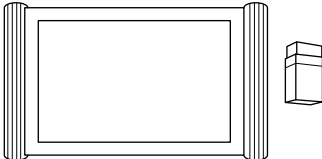
DTC	U015587	CAN Communication Error - Lost Communication with IPC
DTC	U015987	CAN Communication Error - Lost Communication with PDC_APA
DTC	U023987	CAN Communication Error - Lost Communication with FCM
DTC	U024887	CAN Communication Error - Lost Communication with PEPS
DTC	U040181	CAN Communication Error - Invalid DLC Received from EMS
DTC	U040281	CAN Communication Error - Invalid DLC Received from TCU
DTC	U041681	CAN Communication Error - Invalid DLC Received from ESC
DTC	U042381	CAN Communication Error - Invalid DLC Received from IPC
DTC	U042681	CAN Communication Error - Invalid DLC Received from PEPS
DTC	U053A81	CAN Communication Error - Invalid DLC Received from FCM
DTC	U200281	CAN Communication Error - Invalid DLC Received from PDC_APA

Refer to CAN network malfunction diagnosis.

5 On-vehicle Service

5.1 Tools

■ General Tools

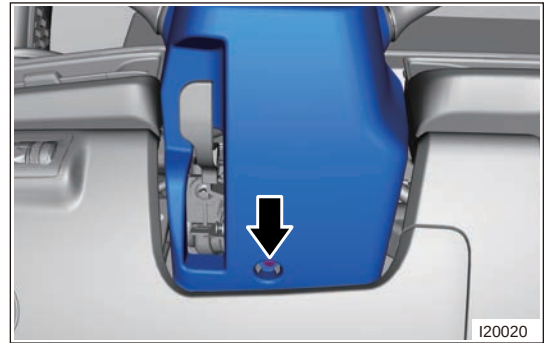
Tool Name	Tool Drawing
Digital Multimeter	 S00002
Diagnostic Tester	 S00001

5.2 Replacement of Combination Switch Cover Assembly

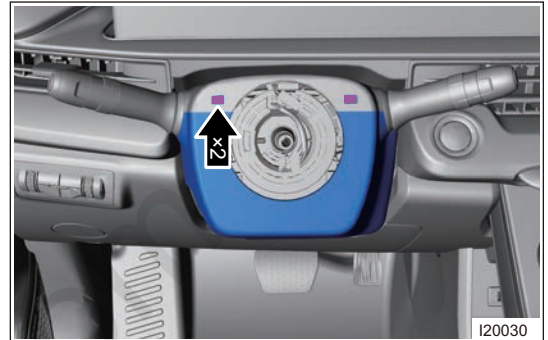
■ Removal

- (1) Set the steering wheel to straight-ahead position.
- (2) Turn off all electrical equipment and ENGINE START STOP switch.
- (3) Disconnect the negative battery cable.
- (4) Remove the driver airbag assembly.
- (5) Remove the steering wheel assembly.

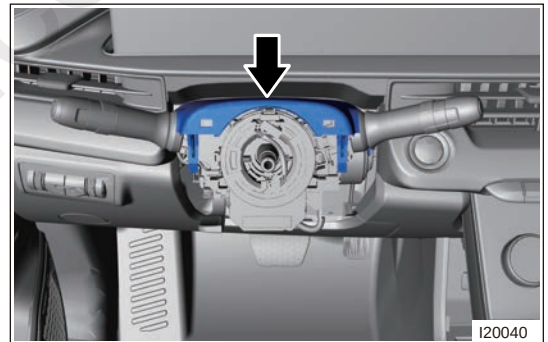
- (6) Remove the combination switch lower cover fixing screw. (arrow).



- (7) Disengage connecting clips between upper cover and lower cover, and separate upper cover and lower cover, then remove lower cover.



- (8) Disengage combination switch upper cover from DVD trim panel, and remove upper cover.



Caution

- Operate carefully to prevent damage to components during removal.

Hint:

- Check combination switch upper and lower covers for damage or deformation. Replace upper and lower covers if necessary.
- Check if upper and lower cover clips are normal. Replace upper and lower covers if necessary.

■ Installation

- (1) Loosen steering wheel adjusting handle, and adjust steering column assembly to uppermost position, then tighten adjusting handle to uppermost position.
- (2) Insert steering column lower cover from right side of combination switch at an angle, and then install adjusting handle into cover hole.
- (3) After adjusting lower cover, install upper cover and fix upper and lower cover clips in place.
- (4) Install fixing screw to combination switch lower cover.

Caution

- Tighten fixing screw in place.
- Operate carefully to prevent damage to components during installation.

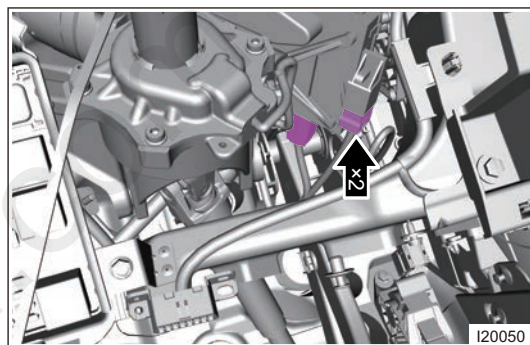
- (5) Install the steering wheel assembly.

- (6) Install the driver airbag assembly.
- (7) Install the negative battery cable.
- (8) Press ENGINE START STOP switch and perform running test.

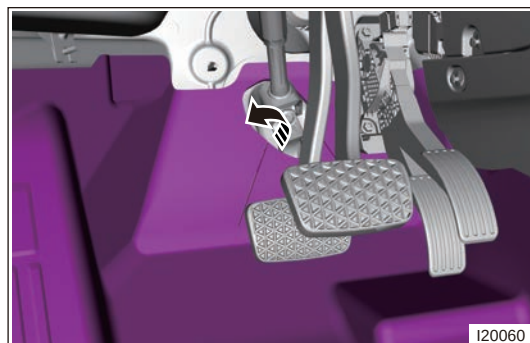
5.3 Replacement of Steering Column with Intermediate Shaft Assembly

■ Removal

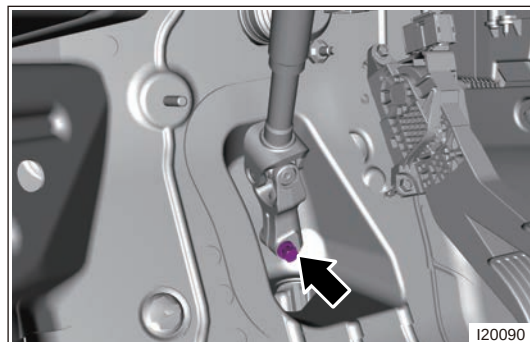
- (1) Set the steering wheel to straight-ahead position.
- (2) Turn off all electrical equipment and ENGINE START STOP switch.
- (3) Disconnect the negative battery cable.
- (4) Remove the driver airbag assembly.
- (5) Remove the steering wheel assembly.
- (6) Remove the combination switch cover.
- (7) Remove the spiral cable.
- (8) Remove the light combination switch assembly.
- (9) Disconnect 2 connectors (arrow) from EPS controller.



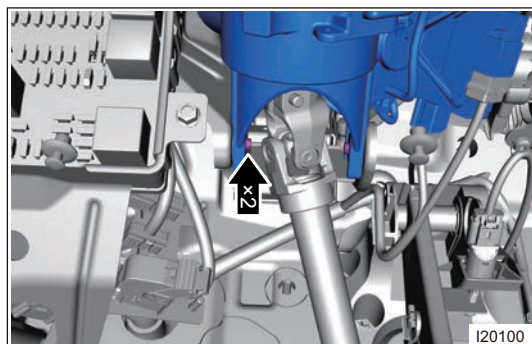
- (10) Turn over carpet under driver seat in the direction of arrow.



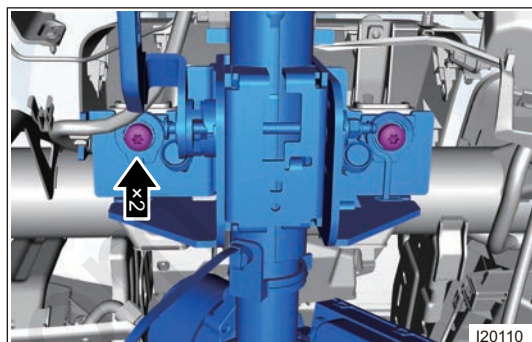
- (11) Remove the coupling bolt (arrow) between steering column with intermediate shaft assembly and steering gear input shaft.



- (12) Remove 2 fixing bolts (arrow) from steering column lower bracket.



- (13) Remove 2 fixing bolts (arrow) from steering column upper bracket.



- (14) Remove the steering column with intermediate shaft assembly.

⚠ Caution

- Check steering column assembly for wear, crack or deformation. As welding or correction is not allowed, replace steering column assembly if necessary.
- Check steering column bearing for looseness, wear or sticking. Replace steering column assembly if necessary.

■ Installation

- (1) Install the steering column with intermediate shaft assembly.
- (2) Install 2 fixing bolts to steering column upper bracket.

Tightening torque: 25 ± 2 N·m

- (3) Install 2 fixing bolts to steering column lower bracket.

Tightening torque: 25 ± 2 N·m

- (4) Install coupling bolt between steering column with intermediate shaft assembly and steering gear input shaft.

Tightening torque: 40 ± 3 N·m

- (5) Place the carpet under driver seat in a suitable position.
- (6) Connect 2 connectors to EPS controller.
- (7) Install the light combination switch assembly.
- (8) Install the spiral cable.
- (9) Install the combination switch cover.
- (10) Install the steering wheel assembly.
- (11) Install the driver airbag assembly.
- (12) Install the negative battery cable.
- (13) Press ENGINE START STOP switch and perform running test.
- (14) Connect EXEED special diagnostic tester, read and clear DTCs.

■ Replacement and Matching Overview

Hint:

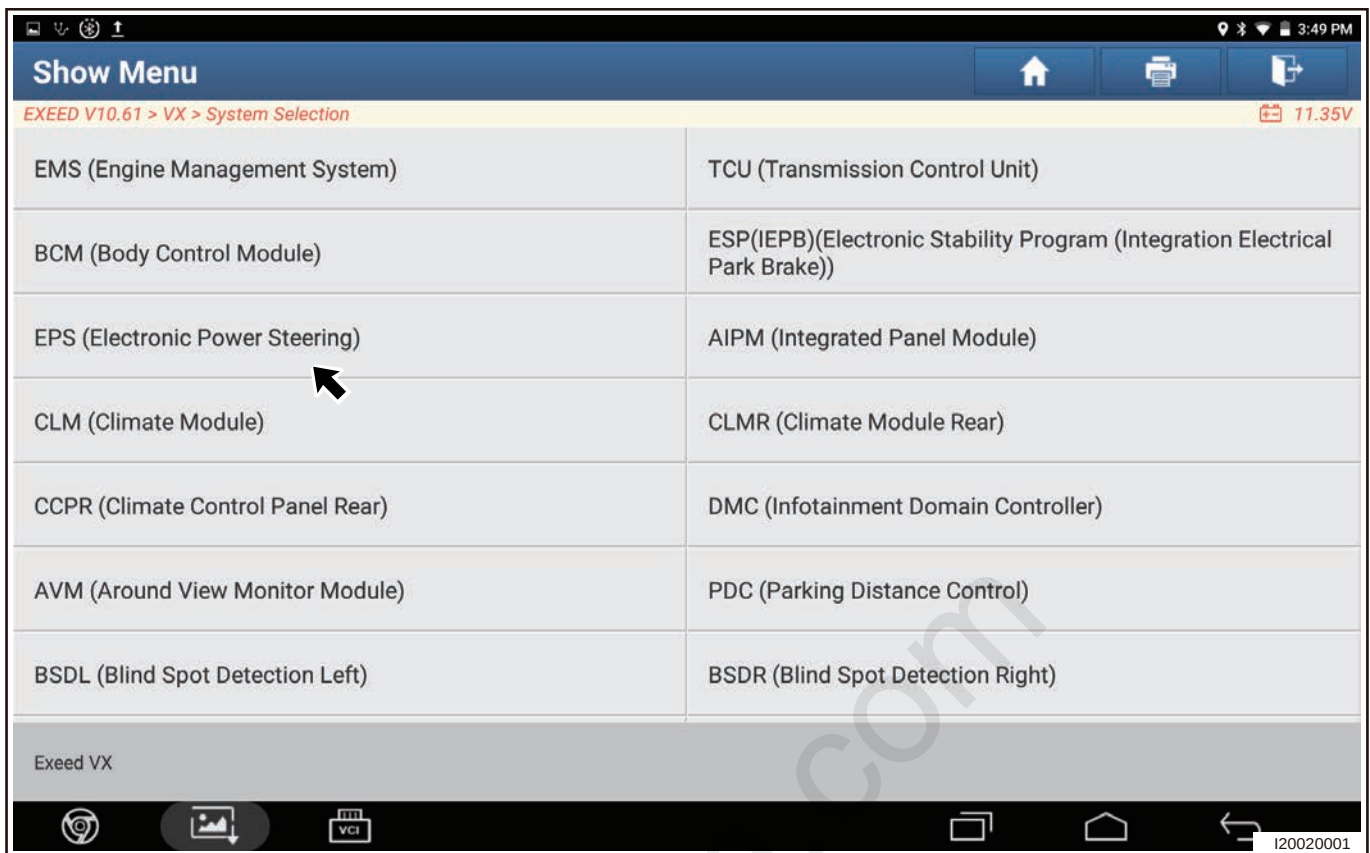
- Before performing matching and learning of vehicle module, be sure to carefully read the related precautions and perform the operation strictly according to standard working procedures.

For details of matching and learning of Electronic Power Steering (EPS) system performed under different situations, see table below:

Items	Applicable Situations	Actions Required by Diagnostic Tester	Note
Module replacement	• Module damage • Module failure	Writing VIN code	Relearning steering angle calibration is not necessary when writing VIN code, they are not affected each other.
		Software configuration information writing	
		Steering angle calibration	
Software upgrading	• Low software version • Software error	Controller software refreshing	/
Calibration	• Replacement of steering wheel • Replacement of EPS motor assembly • Steering gear • Four-wheel alignment	Steering angle calibration	When recalibrating steering angle, it is necessary to clear calibrated data
Configuration writing	• Replacement of module • Modification of configuration	Software configuration information writing	If configuration code cannot be read in the original module, try to get it from same configuration model or EXEED after-sales service department

■ Writing VIN Code

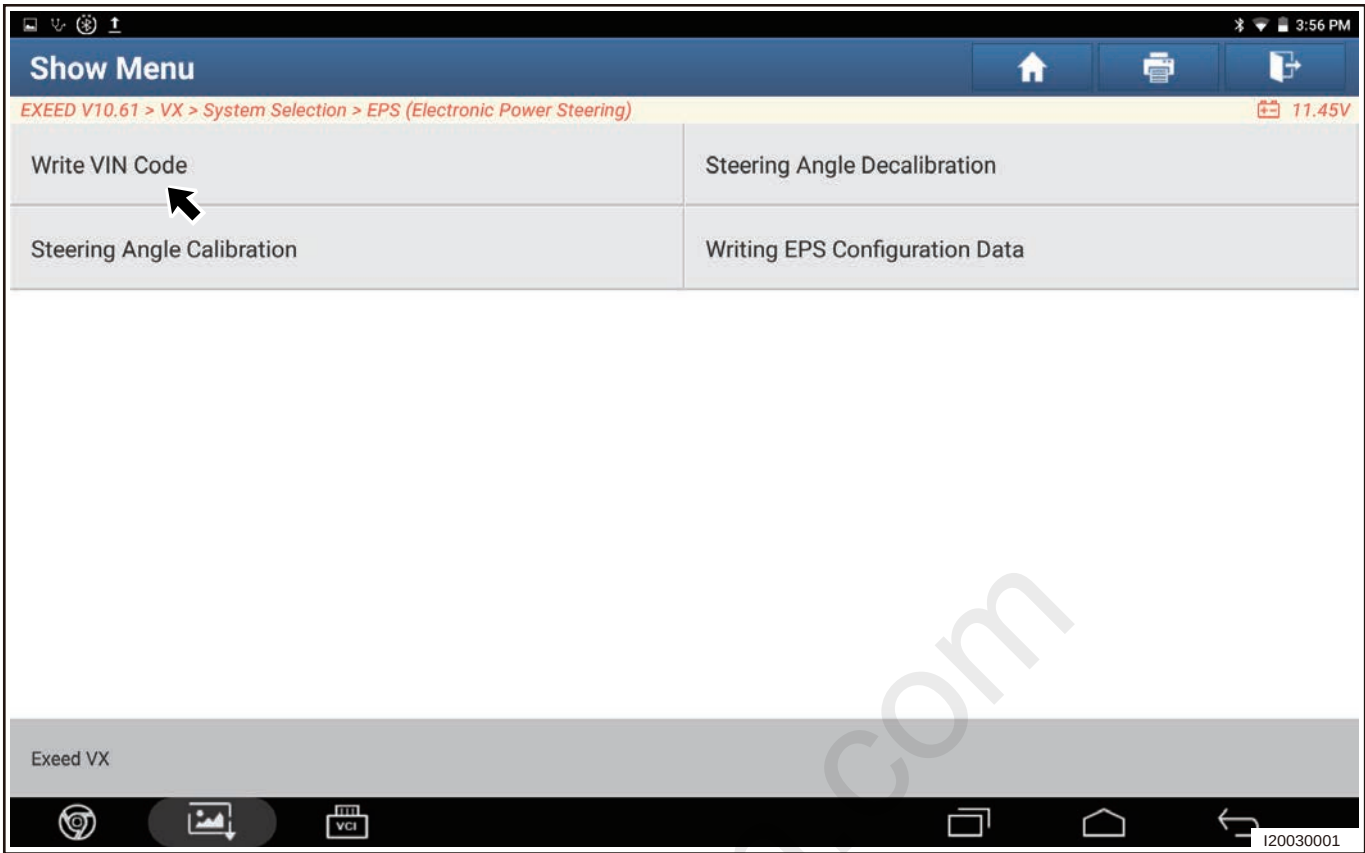
- (1) Connect diagnostic tester, turn ignition switch ON.
- (2) Enter “EPS (Electronic Power Steering System)” .



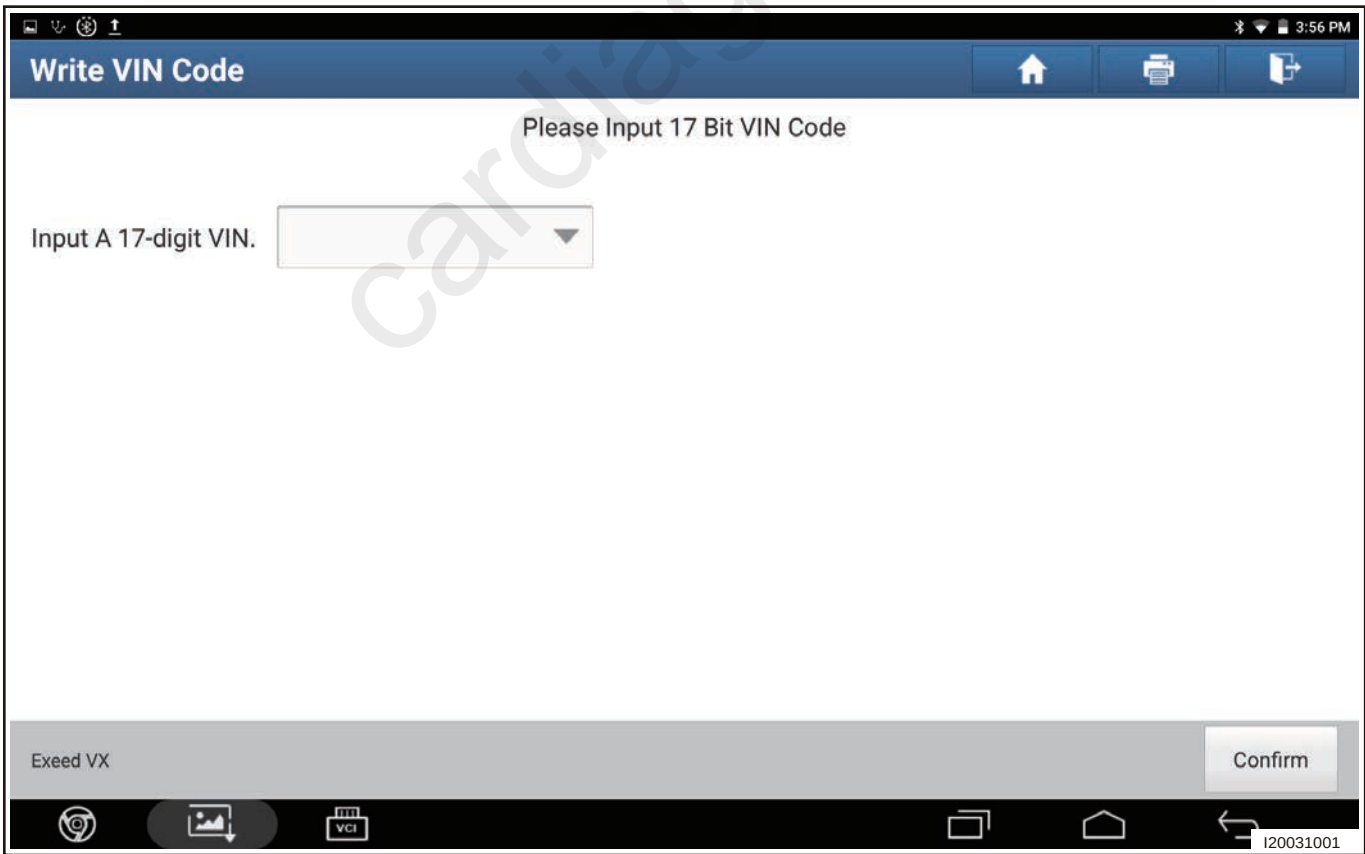
(3) Click “Special Function” .



(4) Enter next screen and click “Writing VIN Code” .



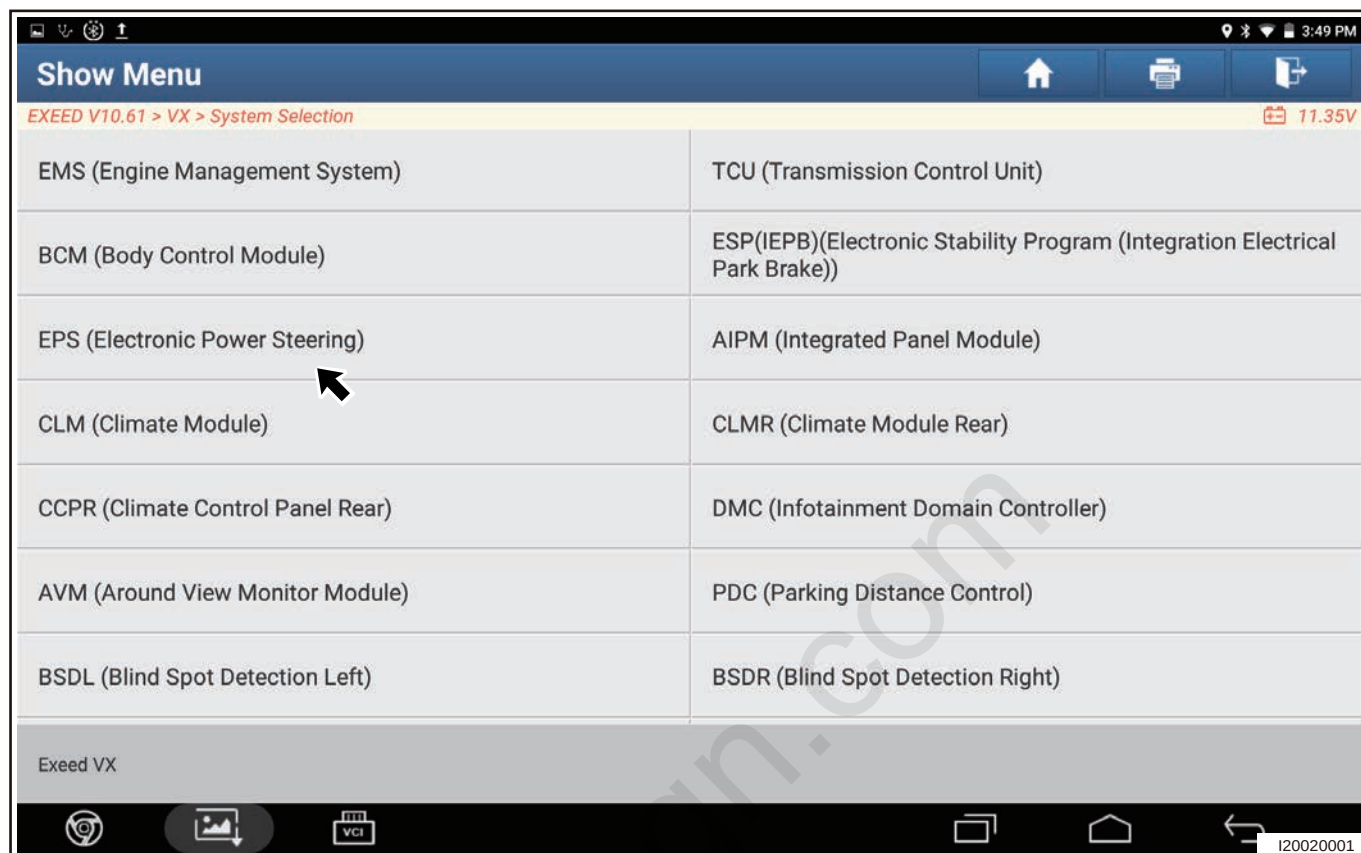
- (5) It prompts” “VIN code is detected, please compare with the VIN code on the front windshield or vehicle nameplate” . Click "Yes" after confirming that they are consistent.



- (6) The screen displays “Write VIN Code Successfully” after a short wait.

■ Configuration Information Writing

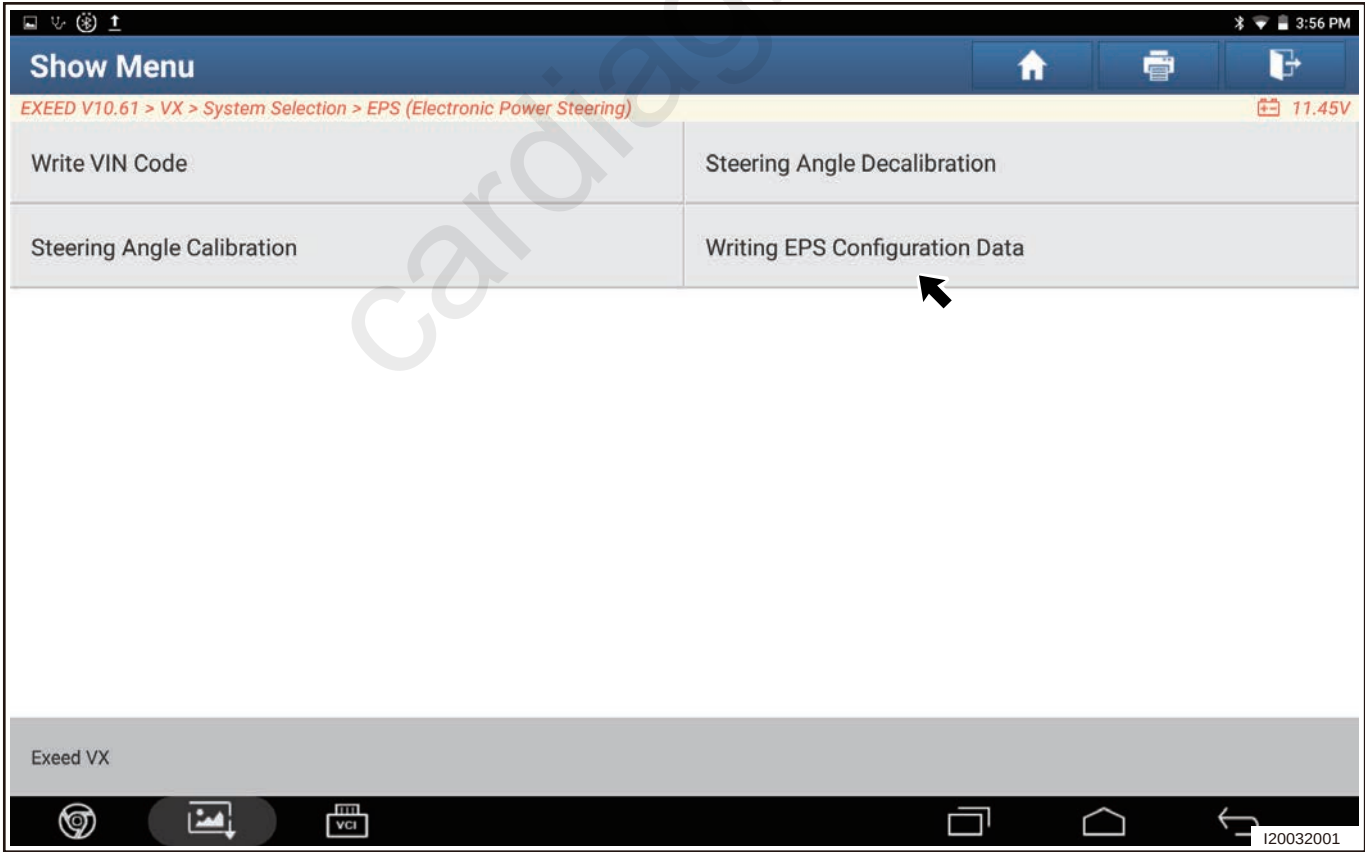
(1) Enter “EPS (Electronic Power Steering)” .



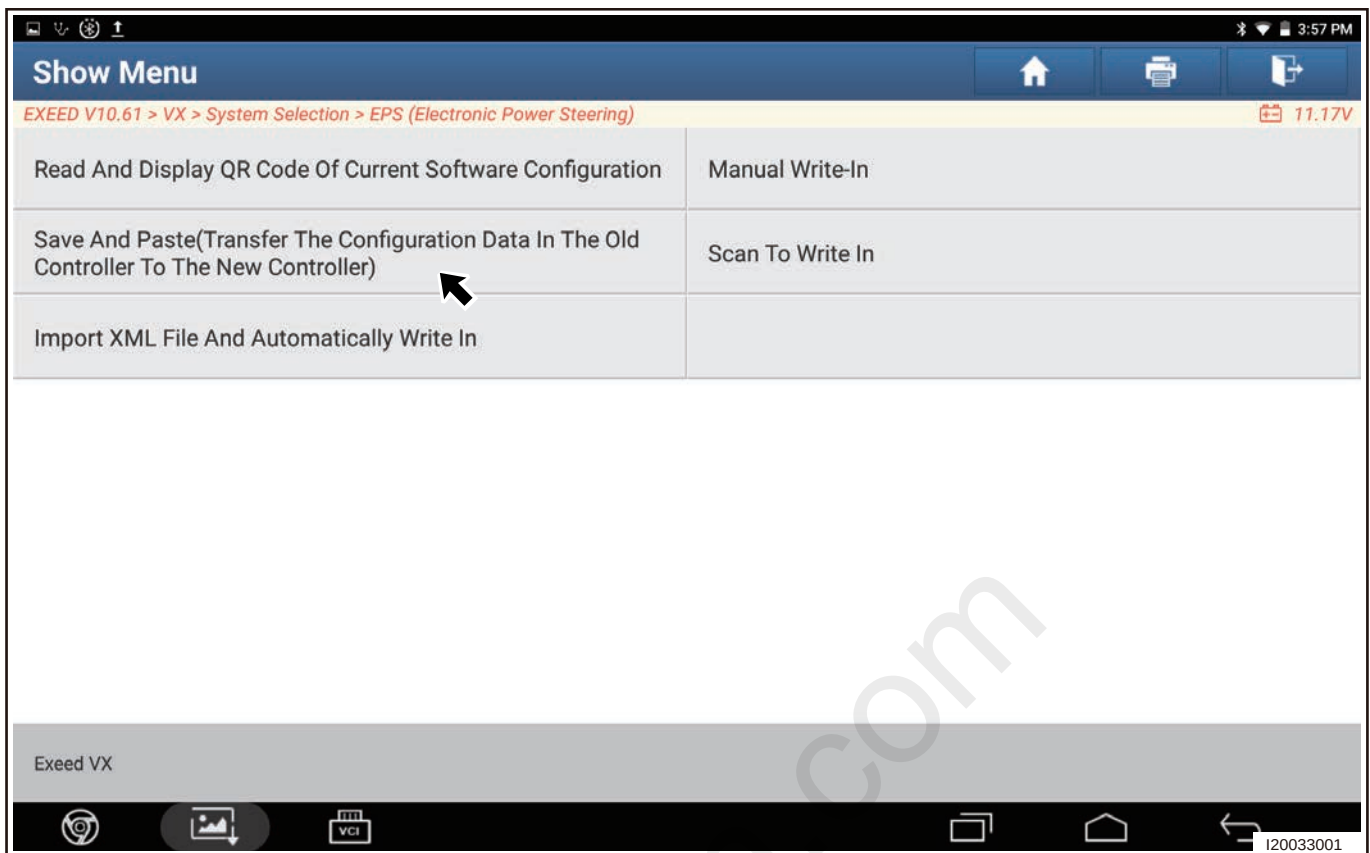
(2) Click “Special Function” .



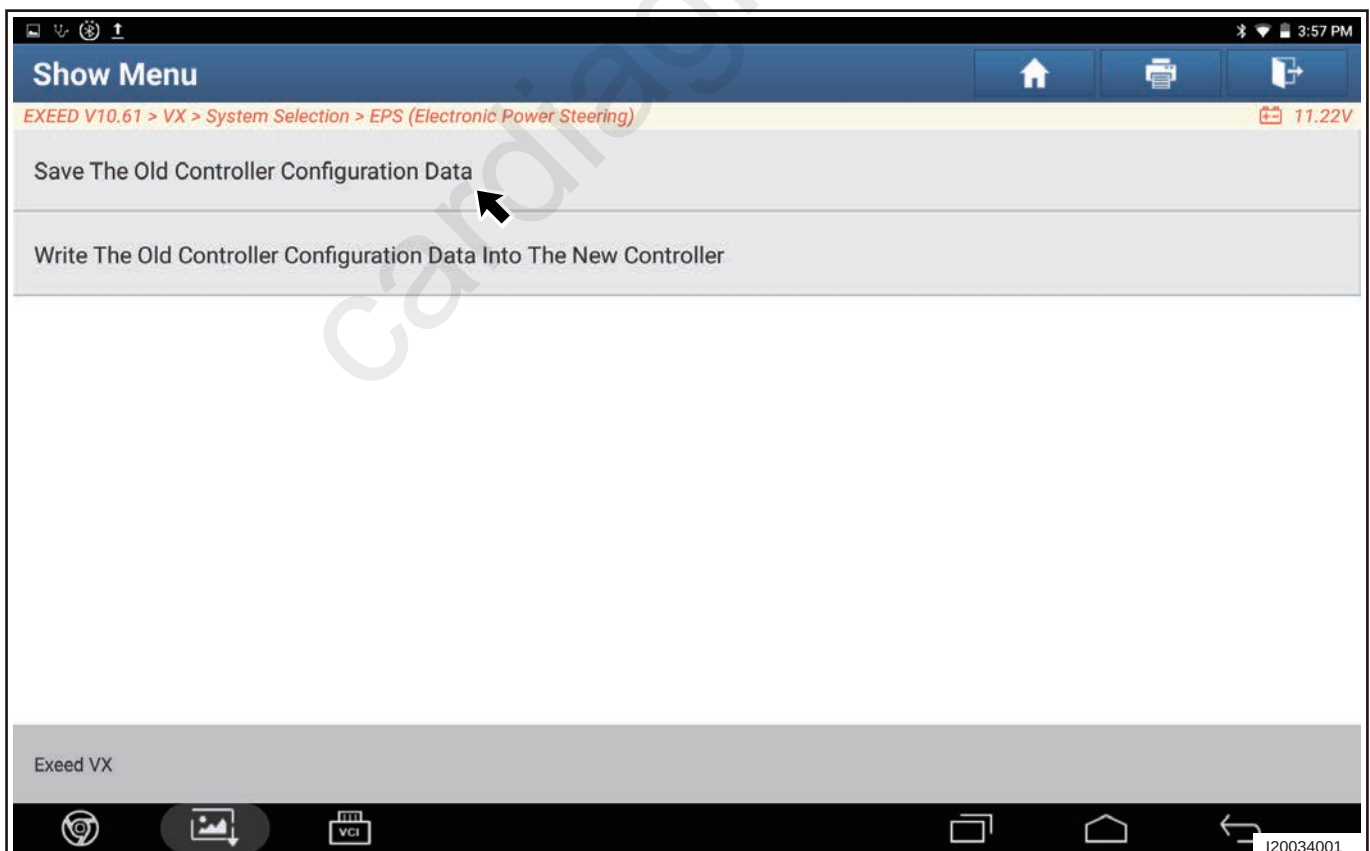
(3) Enter next screen, click “Writing EPS Configuration Data” .



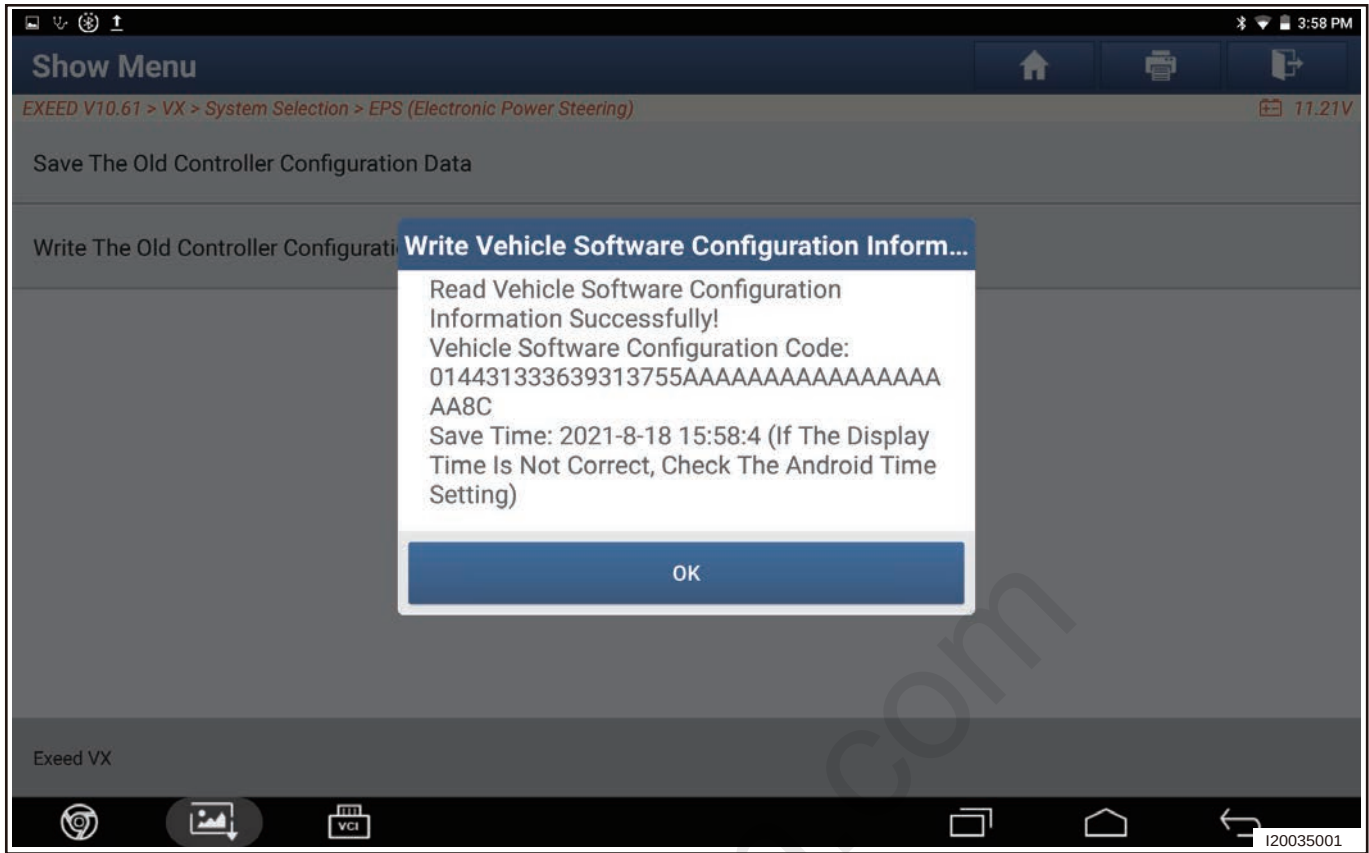
(4) Click “Save And Paste (Transfer The Configuration Data In The Old Controller To The New Controller)” .



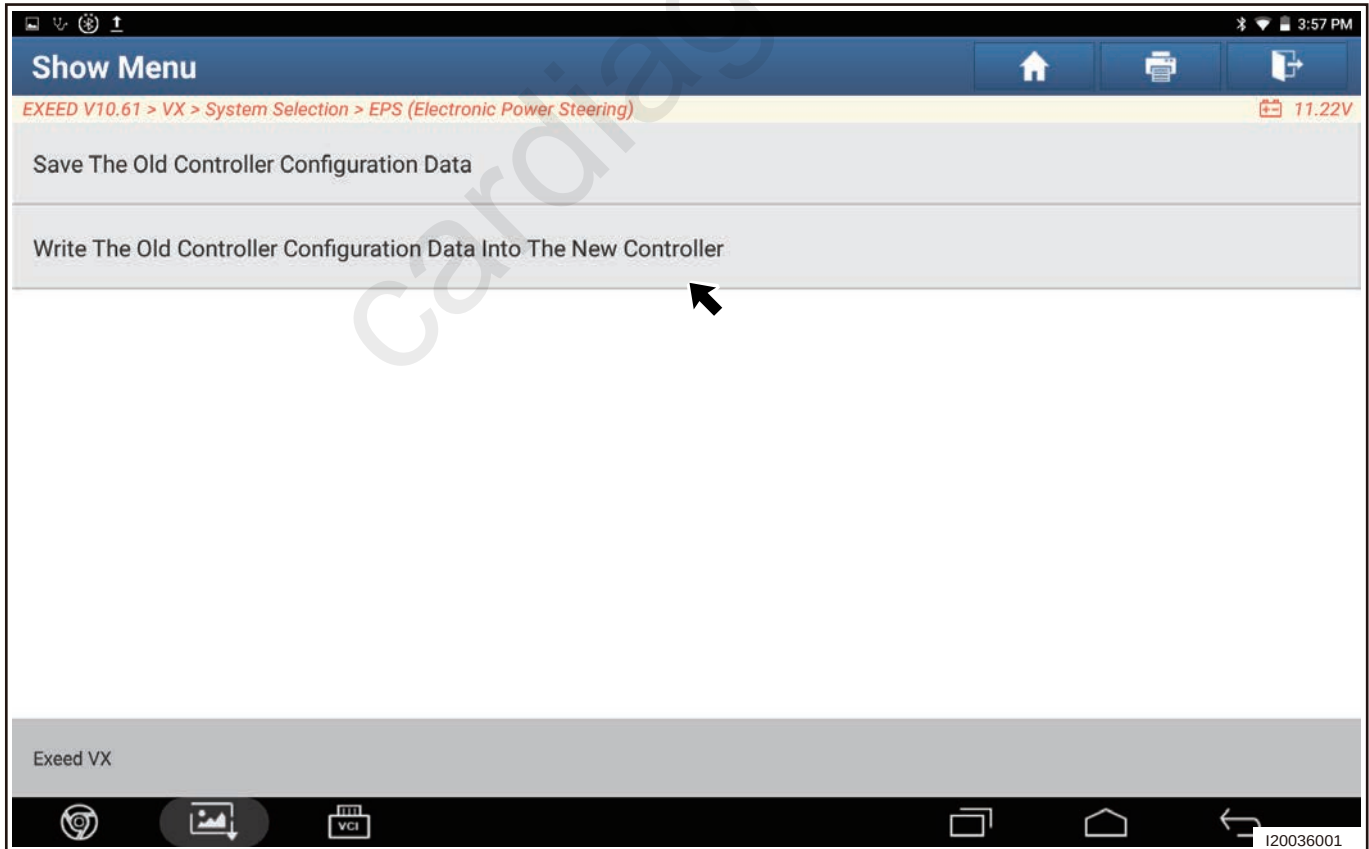
(5) Click “Save The Old Controller Configuration Data” .



(6) It prompts “Read and save whole vehicle configuration code successfully” , the click “OK” to return to previous screen.



(7) Click “Write The Old Controller Configuration Data Into The New Controller” .



(8) It prompts “Please Enter 12-Digit Repair Code” . Click “Confirm” after entering.

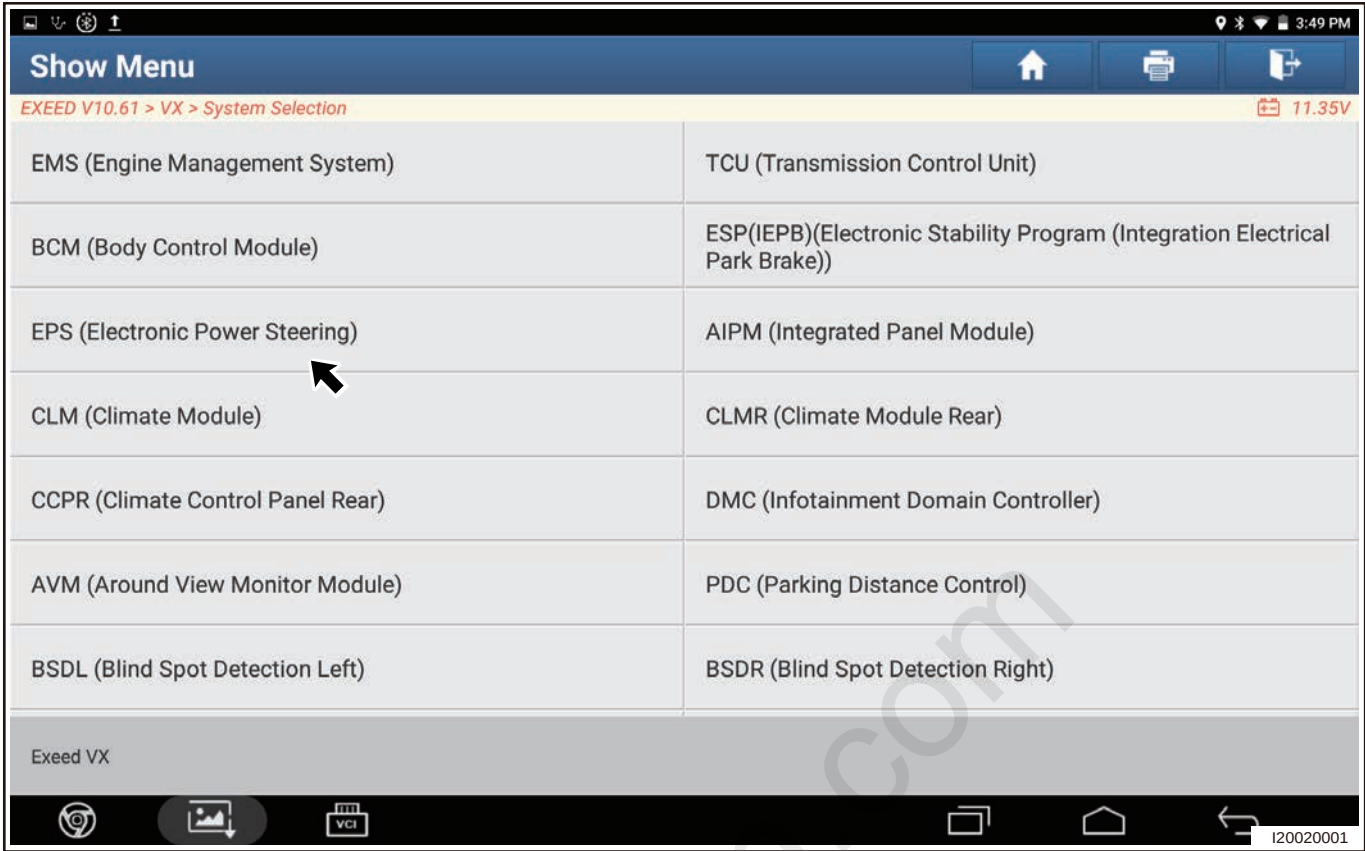
⚠ Caution

- **The first 5 digits of the 12-digit repair shop code are the dealer code (ERP), and the last 7 digits can be entered at will.**

- (9) Click “YES” after confirming that repair shop code is correct again
- (10) It prompts “Saved Vehicle Configuration Code Last Time” . Click "Yes" after confirming that they are consistent.
- (11) It prompts “Write Configuration Data Successfully” . Click “OK” .
- (12) It prompts “Configuration Data Backup Succeeded”. Click “OK” .
- (13) It prompts “Configuration Data Check is Valid” . Click “OK” .

■ Calibration of Steering Angle

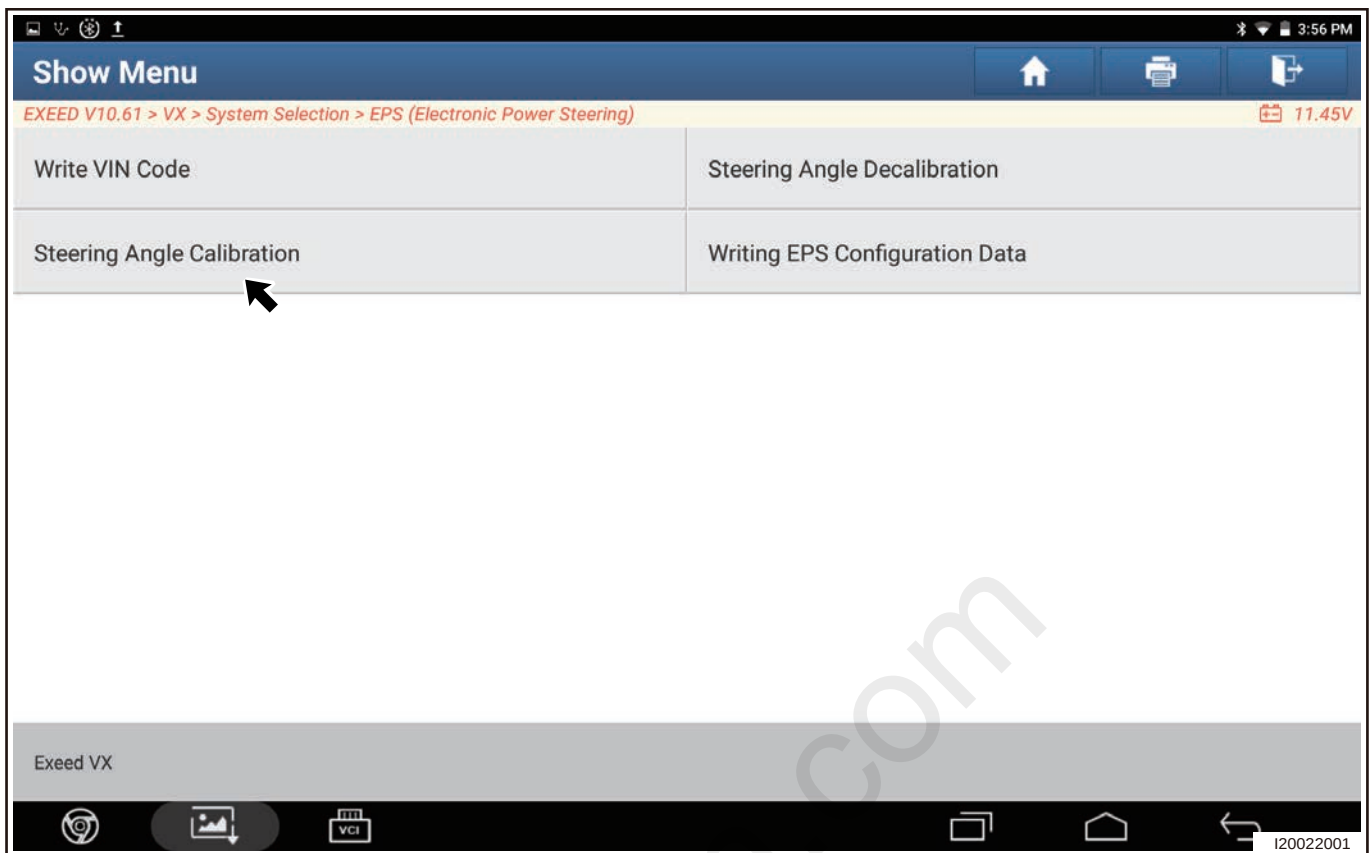
- (1) Enter “EPS (Electronic Power Steering System)” .



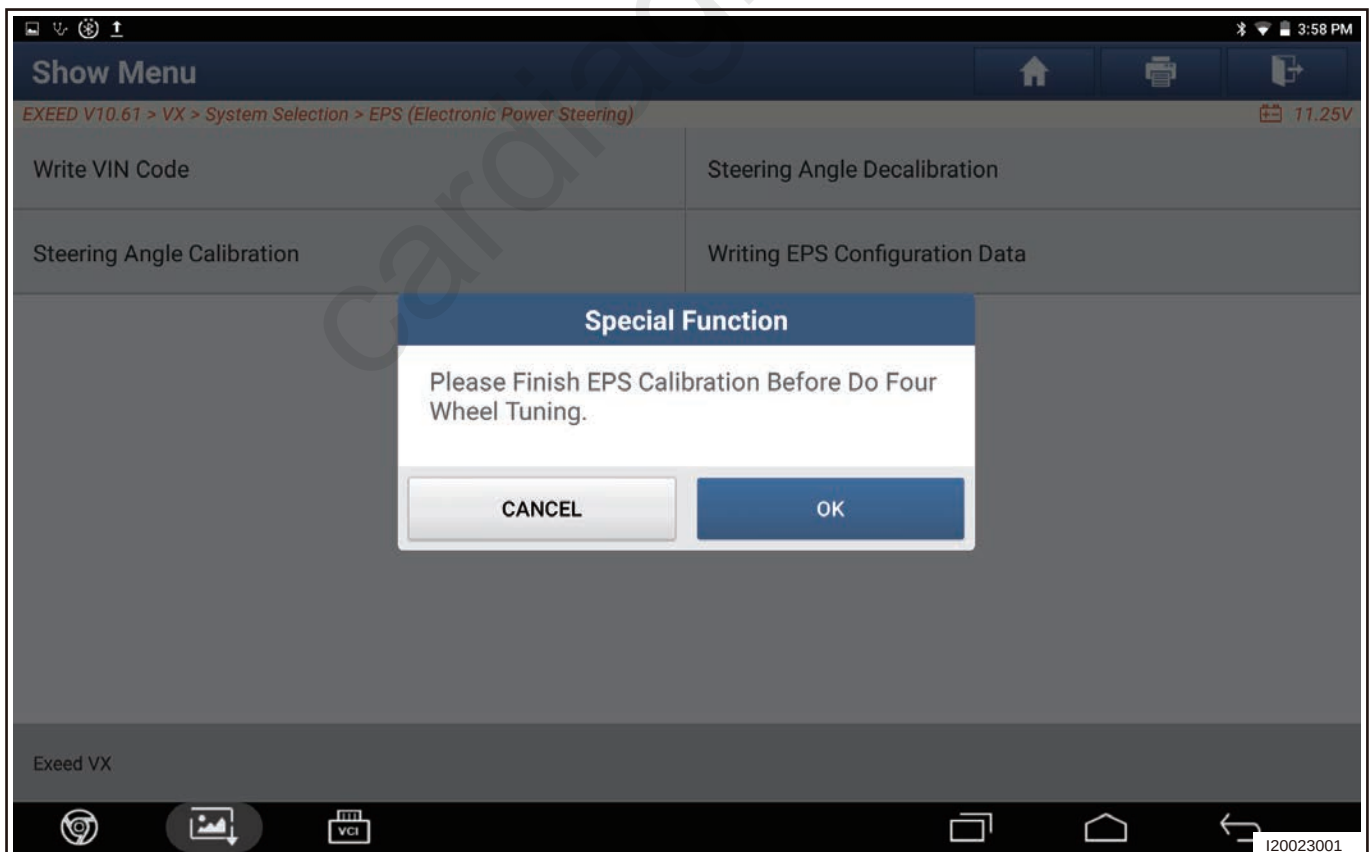
(2) Click “Special Function” .



(3) Enter next interface and click “Steering Angle Calibration” .

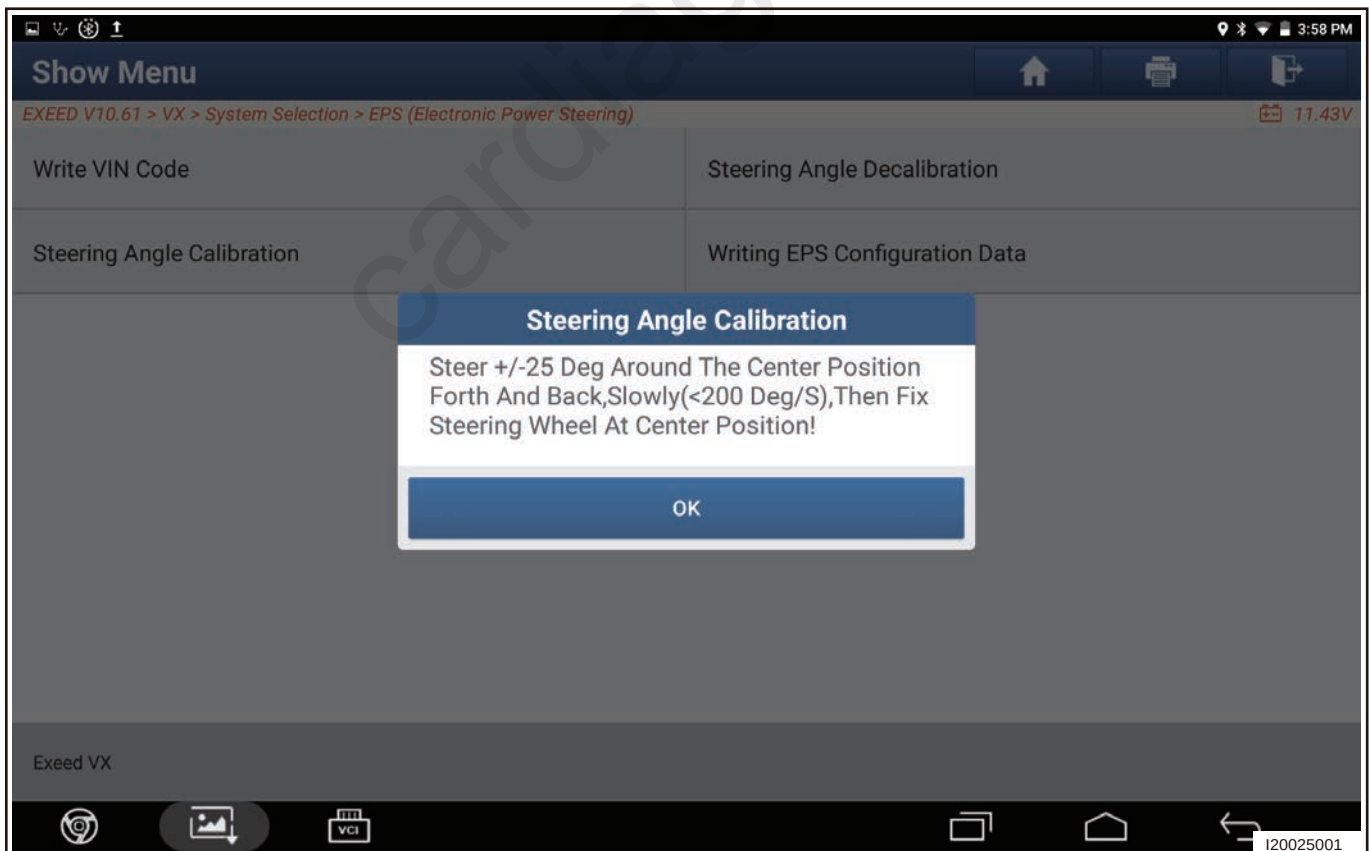


(4) It prompts “Pre-Condition Check” is prompted, then click “OK” .





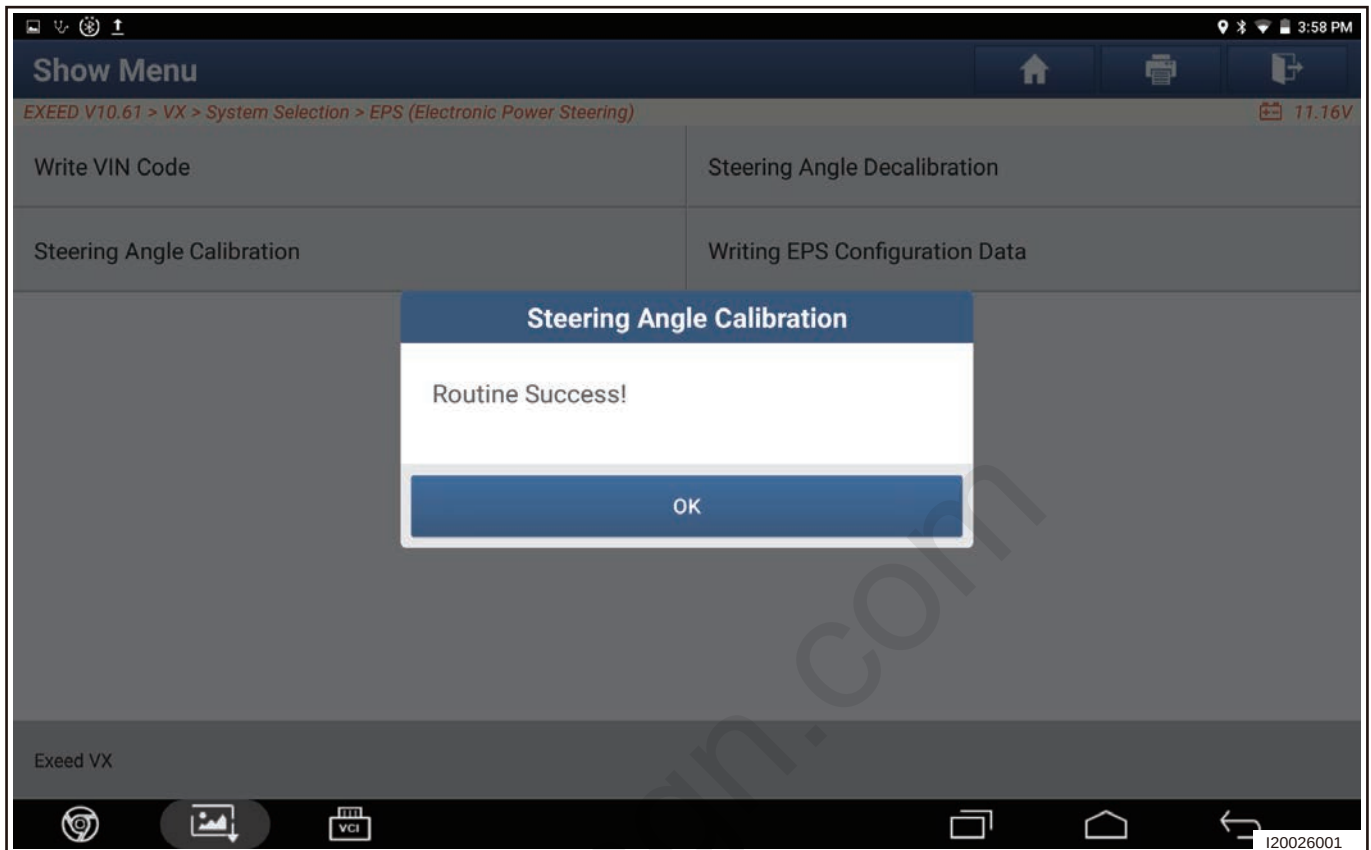
- (5) Hint: "System ready to calibrate! Please turn the steering wheel slowly to the left and right about 25 degrees in sequence, then return the steering wheel to original position." Then click "OK" .



Hint:

- About 25 degrees is full rotation of the steering wheel

(6) Hint: "Calibration is successful!" Then click "OK" .



8.2 STEERING WHEEL

1 Warnings and Precautions

1.1 Warnings

In order to avoid dangerous operation and damage to the vehicle, always follow the instructions below before repair:

- (1) Be sure to read precautions for SRS airbag before removing steering wheel.
- (2) Be sure to read precautions for SRS airbag before removing multi-function switch.
- (3) Be sure to read precautions for SRS airbag before removing shift fork.

1.2 Precautions

In order to avoid dangerous operation and damage to the vehicle, always follow the instructions below before repair:

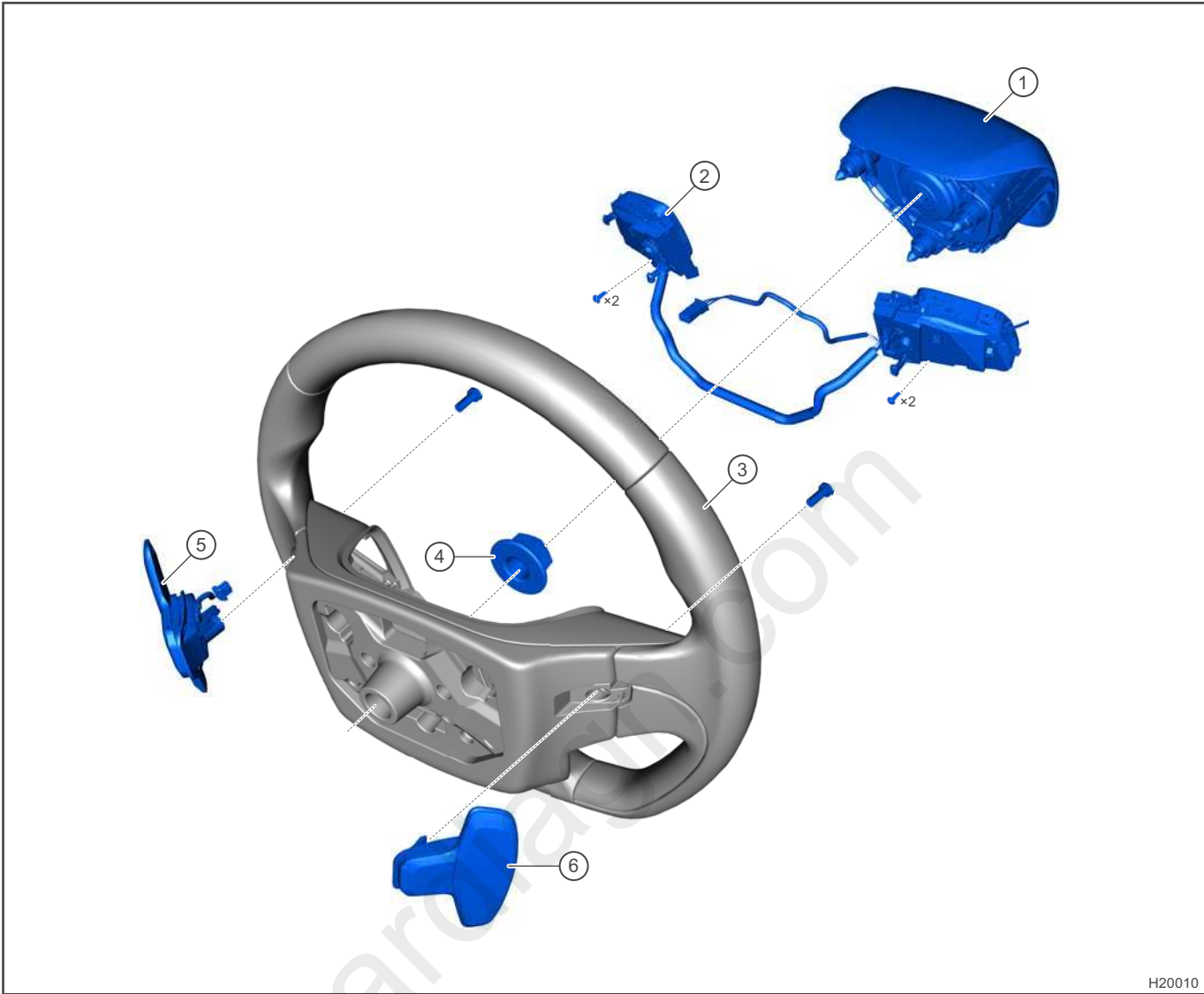
- (1) Wait at least 90 seconds after disconnecting the negative battery cable to prevent airbag and belt pretensioner from being activated.
- (2) Vehicle SAM angle sensor provides angle signal to ESP and other related controllers; Motor position sensor in EPS module provides steering angle signal for EPS; Therefore, after replacing electric steering column assembly, steering gear and performing four-wheel alignment, it is necessary to calibrate zero point of SAM steering angle and motor position sensor in EPS module.
- (3) When removing and installing steering system, suspension system, brake, tire, etc., it is necessary to turn off power supply of EPS (vehicle power supply is turned off), so as to avoid reverse impact, resulting in EPS internal protection circuit breakdown.

2 System Overview

2.1 System Description

Steering wheel is the device that driver controls the driving direction. Through the steering mechanism, steering wheel controls wheels to left and right to change driving direction or keep vehicle driving straight.

2.2 System Components Diagram

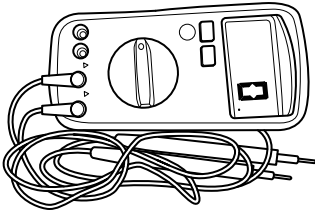


1	Driver Airbag	4	Steering Wheel Locking Nut
2	Steering Wheel Multi-function Switch	5	Right Shift Paddle
3	Steering Wheel Body	6	Left Shift Paddle

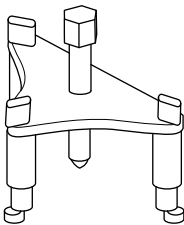
3 ON-VEHICLE SERVICE

3.1 Tools

■ General tool

Tool Name	Tool Drawing
Digital Multimeter	 S00002

■ Special tool

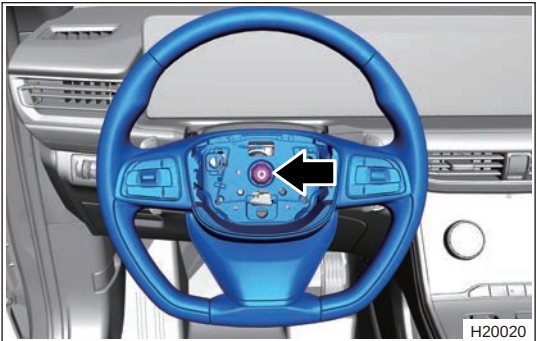
Tool Name	Part No.	Tool Drawing
Steering Wheel Remover	ECH-0008	 S00085

3.2 Replacement of Steering Wheel Body

■ Removal

 Caution
• After removing steering wheel, install spiral cable stopper pin fixing combination switch.

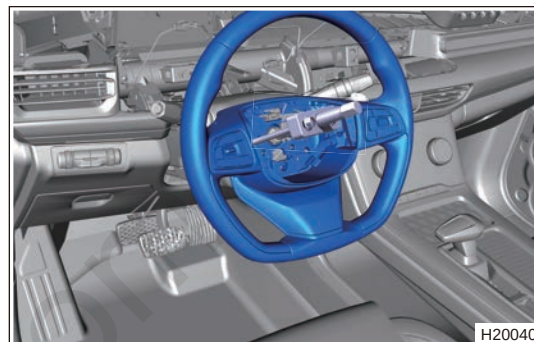
- (1) Adjust steering wheel to the centered position (visually check tire is straight-ahead).
- (2) Turn ENGINE START STOP switch to OFF.
- (3) Disconnect the negative battery cable.
- (4) Remove the combination switch lower cover.
- (5) Remove the driver airbag.
- (6) Remove the steering wheel locking nut (arrow).



- (7) Disconnect the steering wheel multi-function switch connector.



- (8) Use steering wheel remover to remove steering wheel.



- (9) Install spiral cable stopper pin fixing combination switch.

■ Inspection

Steering wheel centering or steering performance are affected by manufacturing error, requirements for four wheels alignment toe-in and steering wheel centering are as following:

- (1) Confirm the left and right strokes of steering wheel after it is assembled.
- (2) Before performing four-wheel alignment, first rotate steering wheel to left and right to determine rotation angle of one side is not less than 45° , then returns to horizontal position.
- (3) Fix the steering wheel horizontally.
- (4) Use calibration device to complete center position calibration of steering wheel rotation angle (for calibration methods, refer to EPS steering angle calibration).
- (5) When adjusting front wheel toe-in, it is necessary to adjust steering gear left and right tie rods. Loosen locking nut of steering gear tie rod when adjusting, use wrench to rotate inner lever at hexagonal position of outer lever, until toe-in value reaches specified value, then tighten locking nut. If threads exposed outside on left and right levers are greatly not equal (difference between threads exposed outside on left and right levers are more than 3 threads), please recheck if steering wheel is centered. It is necessary to hold the flat and square position of outer lever with wrench while tightening. Tightening torque for nut is $50 \pm 5 \text{ N}\cdot\text{m}$.
- (6) After four-wheel alignment is completed and vehicle drives from four-wheel alignment station, turn the steering wheel left and right to the limit position (make sure steering wheel has hit the limit position) without vehicle moving and return it to the center position, then turn off the vehicle.

■ Installation

Hint:

- The scale marks on steering wheel and steering column can only assist in assembly, and cannot be used on final position, it is necessary to perform toe-in and steering wheel rotation angle adjustment.

- (1) Pull out the spiral cable stopper pin.
- (2) Visually check tire is straight-ahead (adjust steering wheel to the centered position).
- (3) Install the steering wheel.

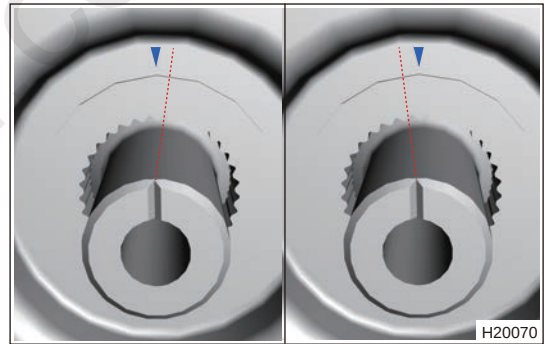
- 1) Align steering wheel scale mark with column scale mark to assemble steering wheel.



- 2) Turn steering wheel left and right to the limit position, and check steering wheel rotation angle.



- 3) Visually check steering wheel rotation angle, and ensure the angle deviation on both sides is no more than 10°. If the deviation is more than 10°, check after adjusting one gear tooth.



- (4) Install the steering wheel locking nut.

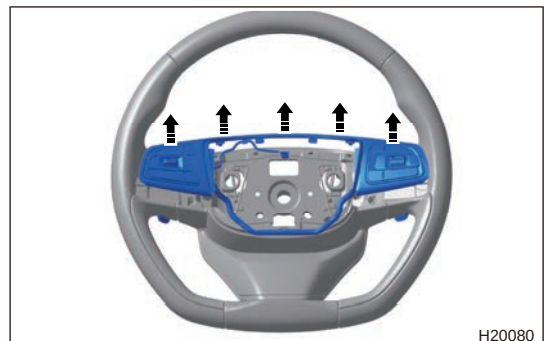
Torque: 48 ± 4 N·m

- (5) Connect the steering wheel multi-function switch connector.
- (6) Install the driver airbag.

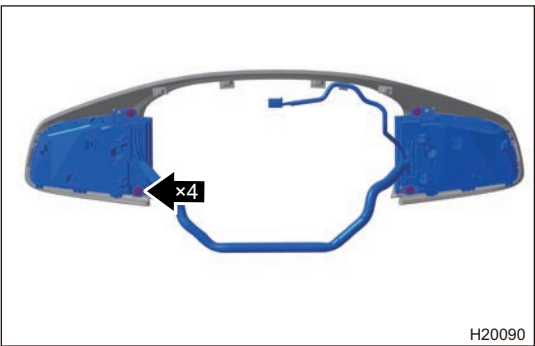
3.3 Replacement of Steering Wheel Multi-function Switch

■ Removal

- (1) Remove the driver airbag.
- (2) Squeeze mounting board clips and steering wheel multi-function switch to push it out.



- (3) Remove 4 fixing screws between steering wheel multi-function switch and mounting board.



- (4) Remove the steering wheel multi-function switch.

■ Installation

- (1) Install the steering wheel multi-function switch.
- (2) Install 4 fixing screws between steering wheel multi-function switch and mounting board.

Tightening torque: $5 \pm 0.5 \text{ N}\cdot\text{m}$

- (3) Install steering wheel multi-function switch and mounting board to steering wheel, press steering wheel multi-function switch firmly, and clip steering wheel with clips.
- (4) Install the driver airbag.

3.4 Replacement of Shift Paddle

■ Removal

- (1) Remove the steering wheel multi-function switch.
- (2) Remove 2 fixing screws from left/right shift paddle and steering wheel.



- (3) Remove left/right shift paddle.

■ Inspection

- (1) Remove the steering wheel multi-function switch.
- (2) Using ohm band of digital multimeter, measure left/right shift paddle terminal.

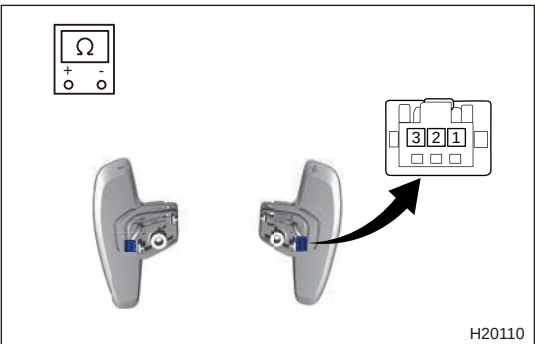
Standard Resistance

Multimeter Connection	Switch Condition	Specified Condition
Terminal 1 - Terminal 2	Pressed	$228 \Omega \leq R \leq 252 \Omega$
Terminal 1 - Terminal 2	Released	$R \geq 10 \text{ M}\Omega$

If measurement result is not as specified, replace shift paddle.

■ Installation

- (1) Install the left/right shift paddle.



- (2) Install 2 fixing screws between left/right shift paddle and steering wheel.

Torque: 5 ± 0.5 N·m

- (3) Install the steering wheel multi-function switch.
- (4) Install the steering wheel.

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8.3 STEERING COLUMN MODULE (SCM)

1 Warnings and Precautions

1.1 Precautions

In order to avoid dangerous operation and damage to the vehicle, always follow the instructions below before repair:

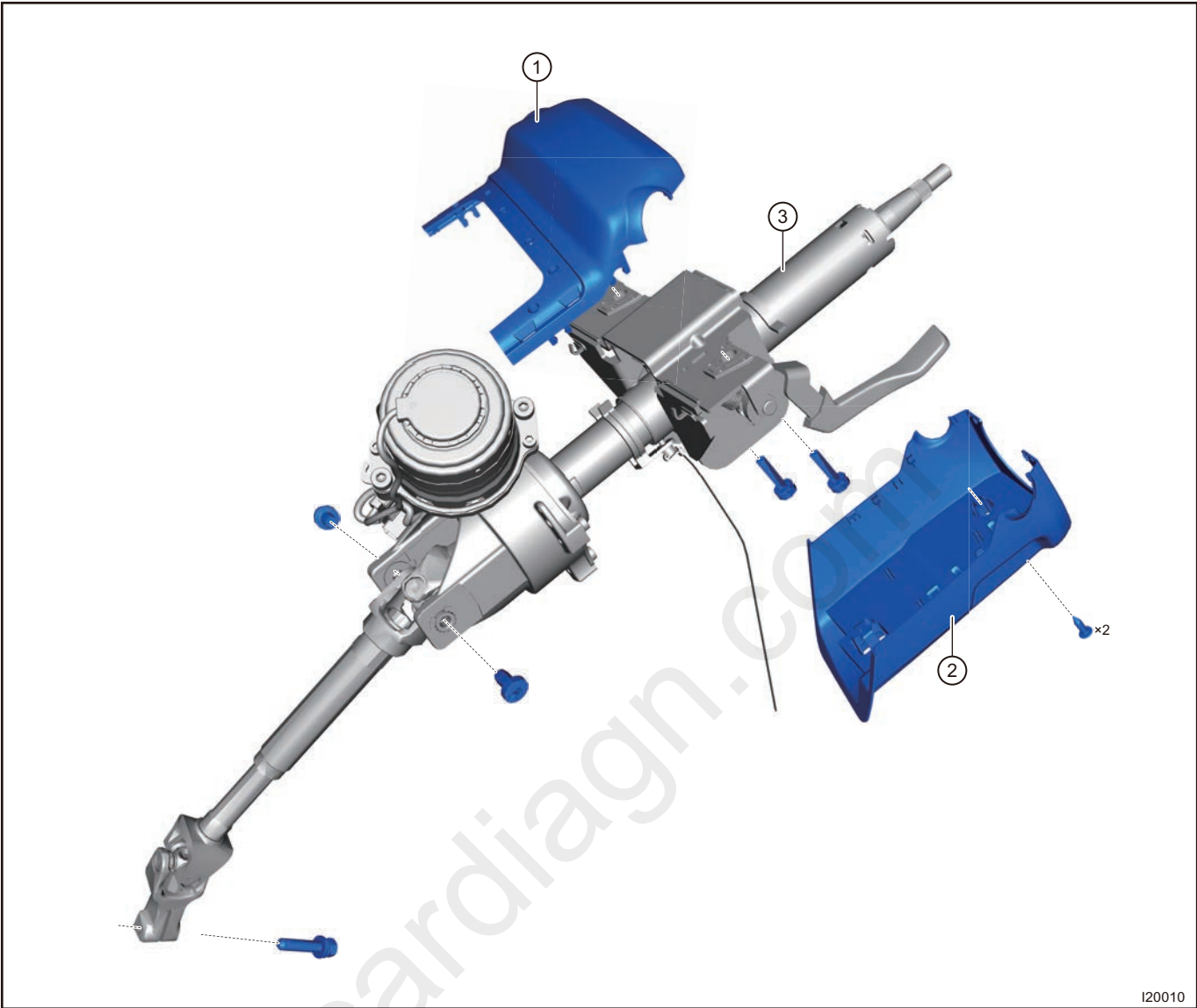
- (1) Wear glove during assembling steering column with intermediate shaft assembly, prevent hands are contacted with steering column, which may cause rust.
- (2) DO NOT hold steering column handle position, but steering column position; do not bump, strike steering column when taking, carrying or assembling it, prevent steering column from collapse.
- (3) Adjustment handle is in locking state after steering column is assembled, do not transfer to next station, prevent handle is knocked during operation, which may cause person damage or handle breakage.
- (4) DO NOT touch interior ornaments when removing steering column with intermediate shaft assembly to avoid scratching interior ornaments.
- (5) The zero point calibration of steering angle sensor must be carried out on four-wheel alignment station, otherwise the zero point calibration of steering angle sensor is not accurate, which will bring the risk of ESP alarm.
- (6) After installing steering column, perform software configuration and center calibration.
- (7) When removing and installing steering column, it is necessary to turn off power supply of EPS (vehicle power supply is turned off), so as to avoid reverse impact, resulting in EPS internal protection circuit breakdown.
- (8) It is necessary to perform steering angle sensor zero point calibration after replacing steering column.

2 System Overview

2.1 System Description

The steering column is the component of the steering system that connects the steering wheel and the steering gear. Through the steering column, the driver transfers torque to the steering gear, which drives the steering gear to achieve steering.

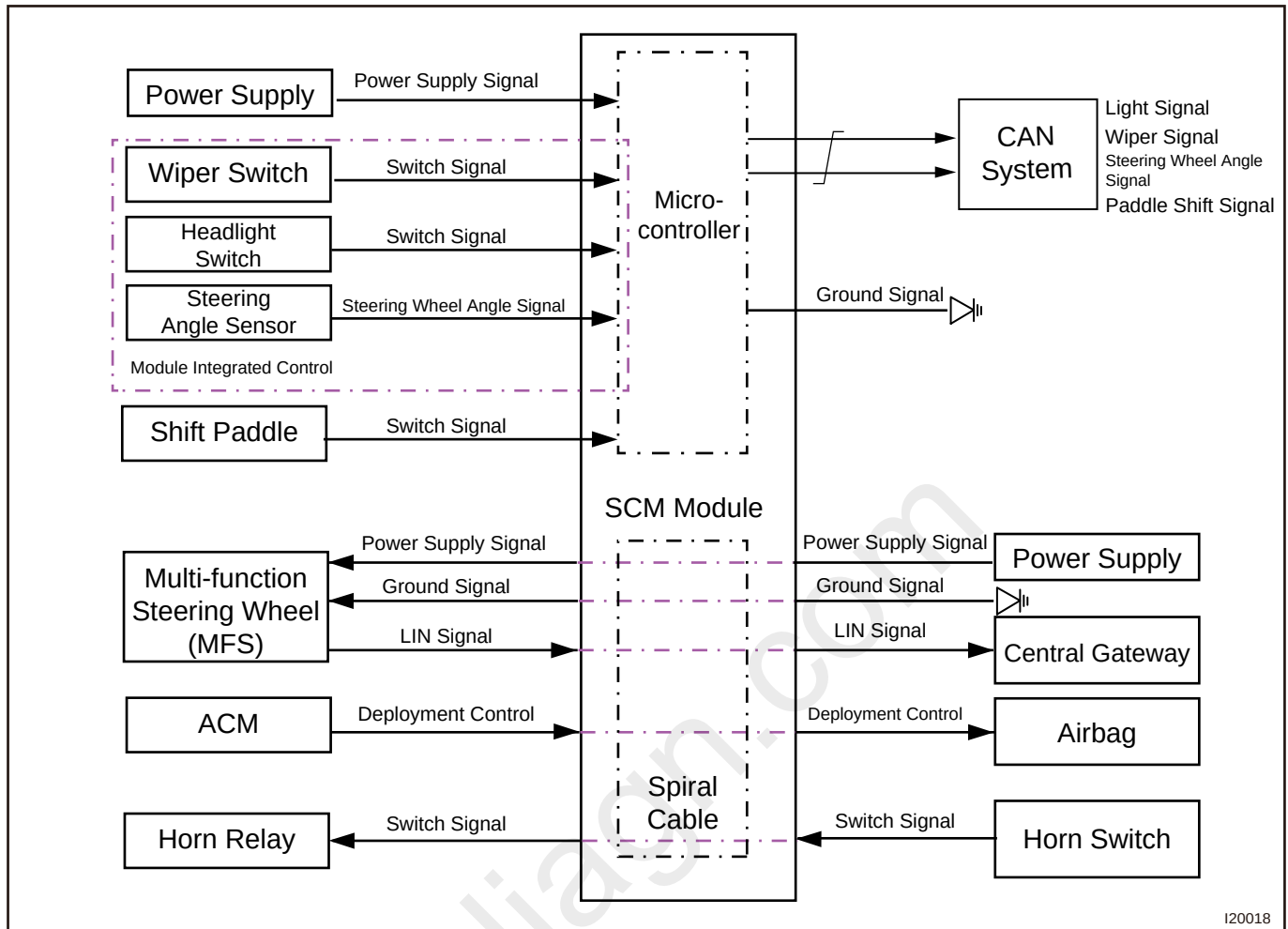
2.2 System Components Diagram



I20010

1	Combination Switch Upper Cover	3	Electric Steering Column with Intermediate Shaft Assembly
2	Combination Switch Lower Cover		

2.3 System Schematic Diagram



The steering column module is integrated inside the combination switch.

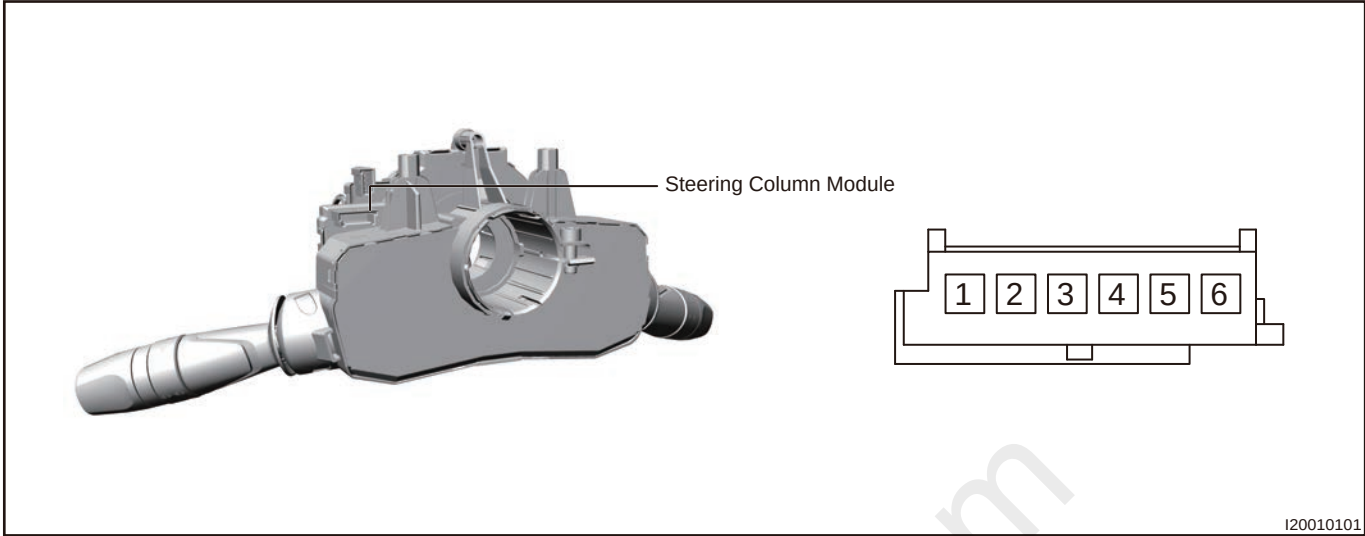
2.4 Component Operation Description

■ Steering angle sensor

The steering angle sensor of vehicle is used to detect rotation angle and direction of steering wheel. Turning steering wheel to left and right will be detected by steering angle sensor, so as to make electronic control unit of vehicle send correct steering command. Rotation angle of steering wheel provides basis for steering extent of vehicle, so that the vehicle drives according to driver's steering intention.

3 System Circuit Diagram

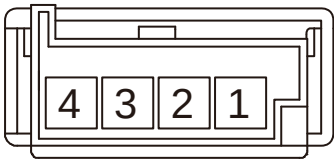
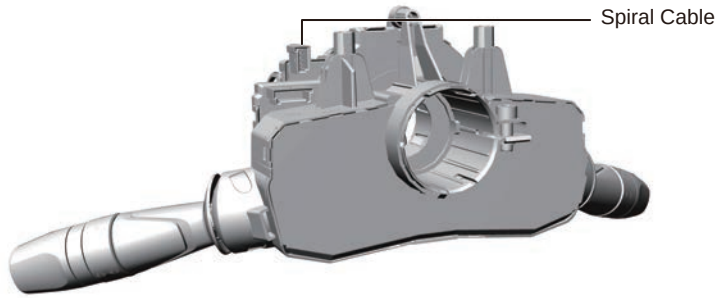
3.1 Module Terminal Definition



I20010101

Steering column module lower connector (6 PIN)

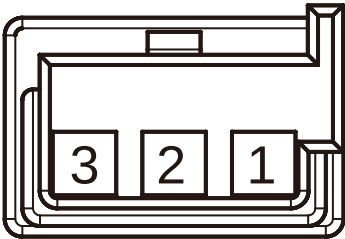
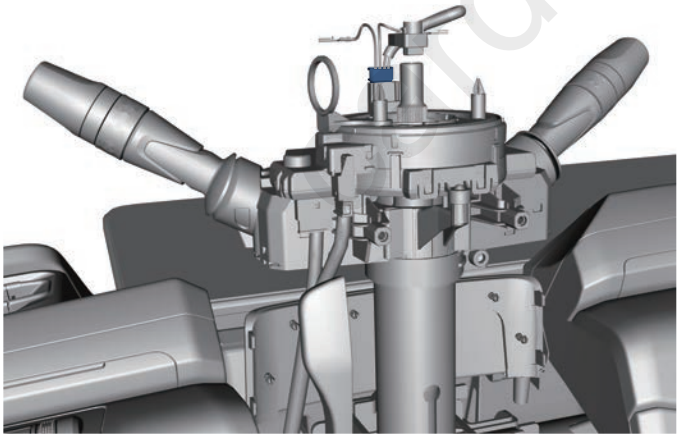
Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Multimeter Positive	Multimeter Negative			
1	Body ground	Battery +	Power supply "ON"	12V
2	/	/	/	/
3	Body ground	CAN L	Power supply "ON"	2.3V
4	Body ground	CAN H	Power supply "ON"	2.7V
5	Body ground	Multi-function switch LIN	Power supply "ON"	7.7V
6	Body ground	GND	Power supply "ON"	0V



I20010201

Steering column module lower connector (4 PIN)

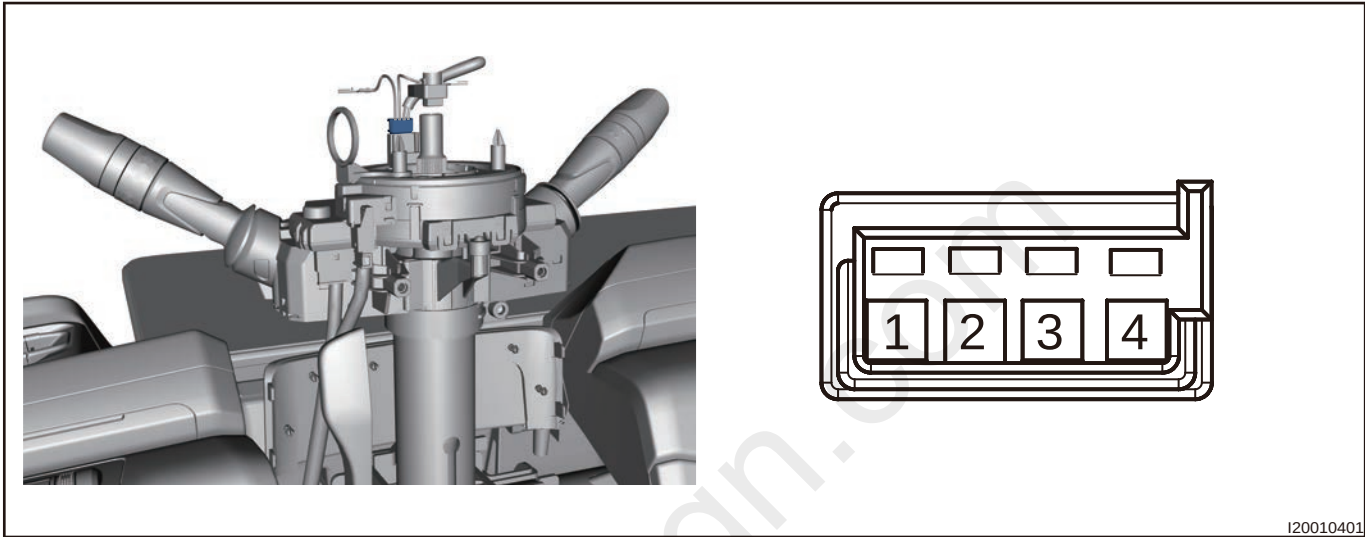
Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Multimeter Positive	Multimeter Negative			
1	Body ground	Horn switch ground	Power supply "ON"	0V
2	Body ground	Horn switch	Power supply "ON"	Do not press 12 V, press 0 V
3	/	Airbag -	/	/
4	/	Airbag +	/	/



I20010301

Steering column module upper connector (3 PIN)

Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Multimeter Positive	Multimeter Negative			
1	Body ground	Power supply	Power supply "ON"	12V
2	Body ground	LIN	Power supply "ON"	7.7V
3	Body ground	GND	Power supply "ON"	0V



Steering column module upper connector (4 PIN)

Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Multimeter Positive	Multimeter Negative			
1	Body ground	Horn switch ground	Power supply "ON"	0V
2	Body ground	Horn switch	Power supply "ON"	Do not press 12 V, press 0 V
3	/	Airbag -	/	/
4	/	Airbag +	/	/

Symptom	Possible Cause
Steering wheel free play is too large	Suspension or steering parts (loose or worn)
	Front hub bearing (worn or loose)
	Steering gear bracket (loose)
	Gear clearance (improper)
	Steering shaft (worn or loose)
Sideslip	Tire pressure
	Brake lag
	Wheel alignment (wrong)
	Steering column (worn or damaged)
	Steering or suspension parts (loose or worn)
Running deviation	Tire pressure (too high or too low)
	Different tire wear (diameter difference occurs)
	Wheel alignment (wrong)

4.2 Diagnostic Help

- (1) Connect diagnostic tester (the latest software) to diagnostic connector, and make it communicate with vehicle electronic module through data network.
- (2) Confirm that malfunction is current, and carry out diagnostic test and repair procedures.
- (3) If Diagnostic Trouble Code (DTC) cannot be cleared, it indicates that there is a current malfunction.
- (4) Only use a digital multimeter to measure voltage of brake control system.
- (5) Refer to any Technical Bulletin that may apply to this malfunction.
- (6) Visually check related wire harness and connector.
- (7) Check and clean all wire harness connectors and ground parts related to DTC.
- (8) If numerous trouble codes are set, refer to circuit diagram and look for any common ground circuit or power supply circuit applied to DTC.

4.3 DTC Confirmation Procedure

Confirm that battery voltage is not less than 12 V before performing following procedures:

- Turn ENGINE START STOP switch to OFF.
- Connect diagnostic tester (the latest software) to diagnostic connector, and make it communicate with vehicle electronic module through data network.
- Turn ENGINE START STOP switch to ON.
- Use diagnostic tester to record and clear DTCs stored in EPB system.
- Turn the ENGINE START STOP switch to OFF and wait for several seconds.
- Turn the ENGINE START STOP switch to ON, select "Read DTC" .
- If DTC is not detected, malfunction indicated by DTC is intermittent.

4.4 Intermittent Troubleshooting

If malfunction is intermittent, perform the followings:

- (1) Check if connector is loose.
- (2) Check if wire harness is worn, pierced, pinched or partially broken.
- (3) Wiggle related wire harness and connector and observe if signal in related circuit is interrupted.
- (4) If possible, try to duplicate the conditions under which DTC was set.

- (5) Look for data that has changed or DTC to reset during wiggle test.
- (6) Look for broken, bent, protruded or corroded terminals.
- (7) Inspect the mounting areas of brake control system, wire harness or wire harness connector and so on for damage, foreign matter, etc. that will cause incorrect signals.
- (8) Check and clean all wire harness connectors and ground parts related to DTC.
- (9) Refer to any Technical Bulletin that may apply to this malfunction.

4.5 Ground Inspection

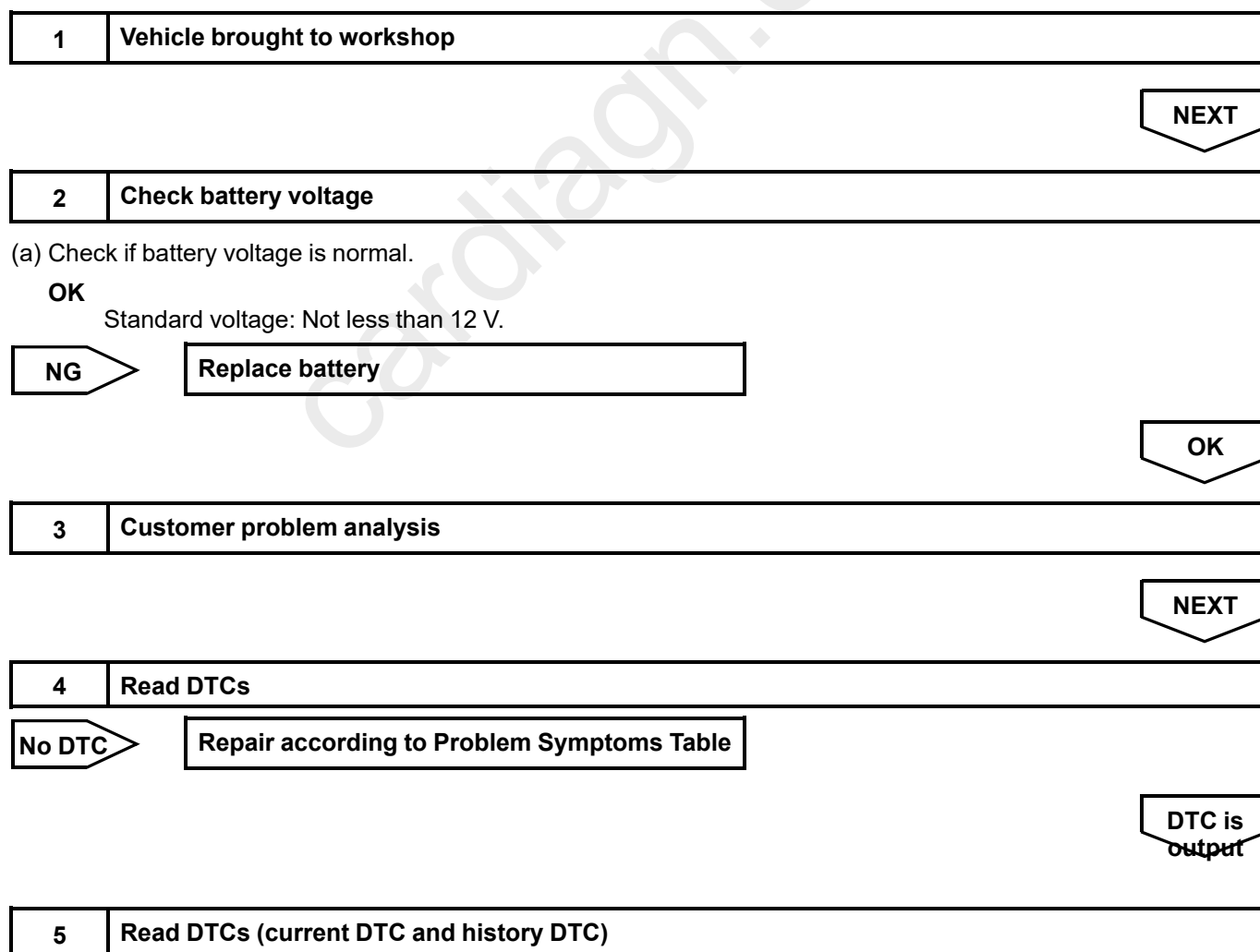
Ground points are very important to normal work of circuit, and they are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) may increase load resistance. This situation may change the way in which a circuit operates. Circuits are very sensitive to proper grounding. A loose or corroded ground can seriously affect the control circuit. Check the ground points as follows:

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

4.6 System Diagnosis Procedure

Hint:

- Use following procedures to troubleshoot Steering Column Module (SCM).



No DTC

Troubleshoot according to Intermittent DTC
Fault Flow

DTC is
output

6 Repair according to Diagnostic Trouble Code (DTC) Chart

NEXT

7 Adjust, repair or replace

NEXT

8 Conduct test and confirm malfunction has been repaired

NEXT

End

4.7 Diagnostic Trouble Code (DTC) Chart

■ SCM power supply DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12A017	ECU Power Supply Voltage Above Threshold	- Microcontroller is not in calibration state - SCM is awake	- Power supply system voltage too high - Wire harness or connector fault - SCM failure	Check whether power supply voltage is in effective range (9 - 16 V)
B12A116	ECU Power Supply Voltage Below Threshold	- Ignition signal state is not in "- start" state - Microcontroller is not in calibration state - SCM is awake	- Power supply system voltage too Low - Wire harness or connector fault - SCM failure	- Check wire harness - Clear DTC and test again. If DTC still exists, replace SCM

■ SCM light part DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12A214	Turn Light Switch Short to GND	- Voltage condition is in valid range (9 - 16 V) - Microcontroller is not in calibration state - SCM is awake	- Wire harness or connector fault - SCM failure	- Check whether power supply voltage is in effective range - Check wire harness - Clear DTC and test again. If DTC still exists, replace SCM
B12A215	Turn Light Switch Short to BAT or Open			
B12A21C	Turn Light Switch Circuit Voltage Invalid			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12A314	HighBeam/FlashLight Switch Short to GND			
B12A315	HighBeam/FlashLight Switch Short to BAT or Open			
B12A31C	HighBeam/FlashLight Switch Circuit Voltage Invalid			
B12A514	Master Light Switch Short to GND			
B12A515	Master Light Switch Short to BAT or Open			
B12A51C	Master Light Switch Circuit Voltage Invalid			

■ SCM wiper part DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12A614	Front Wiper Switch Short to GND	- Voltage condition is in valid range (9 - 16 V) - Microcontroller is not in calibration state - SCM is awake	- Wire harness or connector fault - SCM failure	- Check whether power supply voltage is in effective range - Check wire harness - Clear DTC and test again. If DTC still exists, replace SCM
B12A615	Front Wiper Switch Short to BAT or Open			
B12A61C	Front Wiper Switch Circuit Voltage Invalid			
B12A714	Front Wiper Interval Switch Short to GND			
B12A715	Front Wiper Interval Switch Short to BAT or Open			
B12A71C	Front Wiper Interval Switch Circuit Voltage Invalid			
B12A814	FrontFog/RearFog Switch Short to GND			
B12A815	FrontFog/RearFog Switch Short to BAT or Open			
B12A81C	FrontFog/RearFog Switch Circuit Voltage Invalid			

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12AA14	RearWiper/ RearWasher Switch Short to GND			
B12AA15	RearWiper/ RearWasher Switch Short to BAT or Open			
B12AA1C	RearWiper/ RearWasher Switch Circuit Voltage Invalid			

■ SCM steering angle part DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12B049	Steering Angle Sensor System Internal Failures	- Voltage condition is in valid range (9 - 16 V) - Microcontroller is not in calibration state - SCM is awake	- Wire harness or connector fault - SCM failure	- Check whether power supply voltage is in effective range - Check wire harness - Clear DTC and test again. If DTC still exists, replace SCM
B12B061	Steering Angle Sensor Algorithm Based Failures			
B12B185	Steering Angle Sensor Overflow			

■ SCM control part DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12B292	Control Module Program Memory Failure	- Voltage condition is in valid range (9 - 16 V) - Microcontroller is not in calibration state - SCM is awake	- Wire harness or connector fault - SCM failure	- Check whether power supply voltage is in effective range - Check wire harness - Clear DTC and test again. If DTC still exists, replace SCM
B12B3A3	Control Module Data Memory Failure			
B12B4A0	Calibration Parameter Memory Failure			
B12B5B8	SCM Zero Calibration			- Check whether power supply is in effective range - Check wire harness and connector - Clear DTCs, perform zero point calibration

■ DTC diagnosis procedure

DTC	B12A017	ECU Power Supply Voltage Above Threshold
DTC	B12A116	ECU Power Supply Voltage Below Threshold
DTC	B12A214	Turn Light Switch Short to GND
DTC	B12A215	Turn Light Switch Short to BAT or Open
DTC	B12A21C	Turn Light Switch Circuit Voltage Invalid
DTC	B12A314	HighBeam/FlashLight Switch Short to GND
DTC	B12A315	HighBeam/FlashLight Switch Short to BAT or Open
DTC	B12A31C	HighBeam/FlashLight Switch Circuit Voltage Invalid
DTC	B12A514	Master Light Switch Short to GND
DTC	B12A515	Master Light Switch Short to BAT or Open
DTC	B12A51C	Master Light Switch Circuit Voltage Invalid
DTC	B12A614	Front Wiper Switch Short to GND
DTC	B12A615	Front Wiper Switch Short to BAT or Open
DTC	B12A61C	Front Wiper Switch Circuit Voltage Invalid
DTC	B12A714	Front Wiper Interval Switch Short to GND
DTC	B12A715	Front Wiper Interval Switch Short to BAT or Open
DTC	B12A71C	Front Wiper Interval Switch Circuit Voltage Invalid
DTC	B12A814	FrontFog/RearFog Switch Short to GND
DTC	B12A815	FrontFog/RearFog Switch Short to BAT or Open
DTC	B12A81C	FrontFog/RearFog Switch Circuit Voltage Invalid
DTC	B12AA14	RearWiper/RearWasher Switch Short to GND
DTC	B12AA15	RearWiper/RearWasher Switch Short to BAT or Open
DTC	B12AA1C	RearWiper/RearWasher Switch Circuit Voltage Invalid
DTC	B12B049	Steering Angle Sensor System Internal Failures
DTC	B12B061	Steering Angle Sensor Algorithm Based Failures
DTC	B12B185	Steering Angle Sensor Overflow
DTC	B12B292	Control Module Program Memory Failure
DTC	B12B3A3	Control Module Data Memory Failure
DTC	B12B4A0	Calibration Parameter Memory Failure
DTC	B12B5B8	SCM Zero Calibration

Caution

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

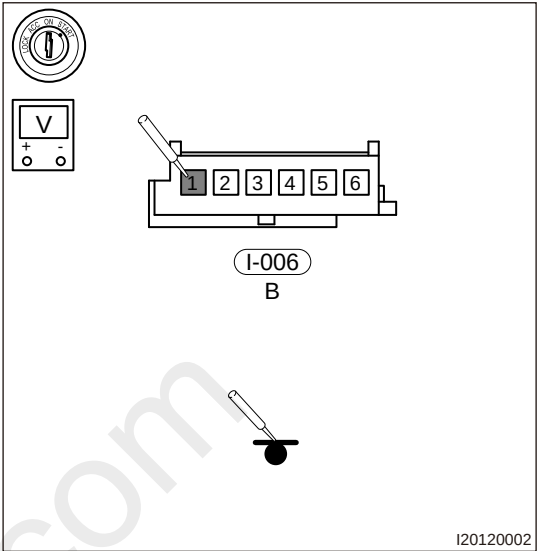
1

Check power supply voltage

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect steering column module connector I-006.
- (c) Turn ENGINE START STOP switch to ON.
- (d) Using voltage band of digital multimeter, measure voltage between I-006 (1) and body ground.

Standard Voltage

Multimeter Connection	Condition	Specified Condition
I-006 (1) - Body ground	ENGINE START STOP switch "ON"	9-16V



NG

Repair or replace power supply wire harness

OK

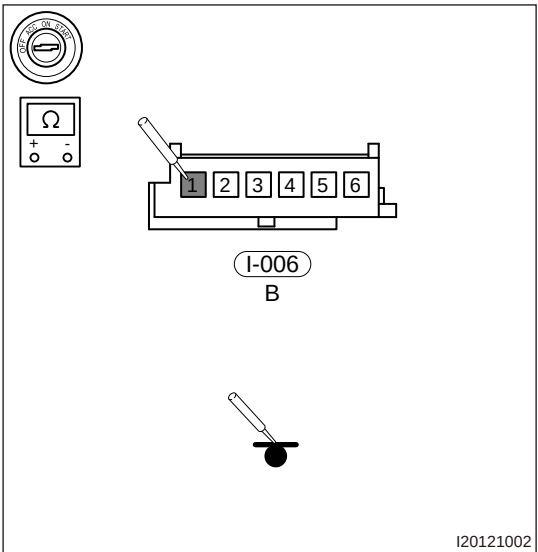
2

Check wire harness and connector

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect steering column module connector I-006.
- (c) Using ohm band of multimeter, check for continuity between I-006 (1) and ground.

Standard Resistance

Multimeter Connection	Condition	Specified Condition
I-006 (1) - Ground	Always	∞



NG

Repair or replace faulty wire harness or connector

OK

3 Reconfirm DTCs

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect the SCM module connector.
 (c) Check whether SCM module terminal is bent, deformed or out of position.
 (d) Use diagnostic tester (the latest software) to reread DTC in SCM system.

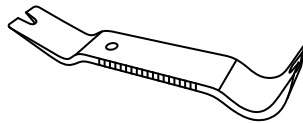
OK

System operates normally

NG

Replace SCM module

5 ON-VEHICLE SERVICE**5.1 Tools****■ General tool**

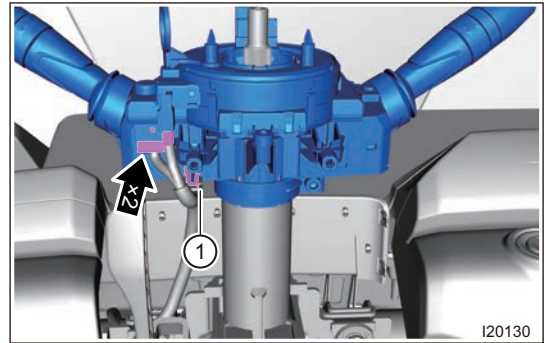
Tool Name	Tool Drawing
Interior Crow Plate	 S00020

5.2 Steering Column Module**■ Removal****⚠ Caution**

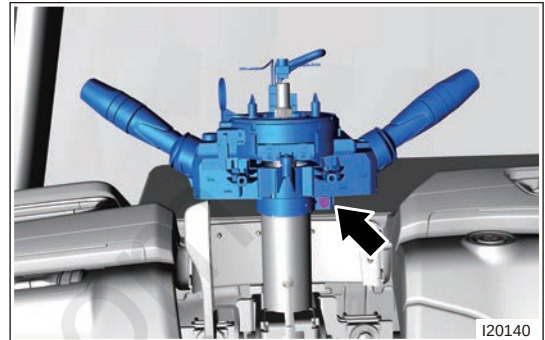
- Be sure to wear necessary safety equipment to prevent accidents, when removing steering column module.
- Appropriate force should be applied when removing steering column module. Be careful not to operate roughly.
- Try to prevent interior and body paint surface from being scratched when removing steering column module.
- Disconnect the negative battery cable for more than 90 seconds when removing airbag.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Disconnect the negative battery cable.
- (3) Remove the combination switch lower cover assembly.
- (4) Remove the combination switch lower cover assembly.
- (5) Remove the driver airbag.
- (6) Remove the steering wheel assembly.

- (7) Disconnect 2 connectors from steering column module, and detach wire harness clip (1).



- (8) Remove 1 fixing screw from steering column module.



■ Inspection

Check the appearance of steering column module for cracks and damages and corrosion of pins.

■ Installation

⚠ Caution

- Always operate carefully to prevent components from being damaged, when installing steering column module.
- Install connector in place when installing steering column module.
- Check switch for proper operation after installing steering column module.

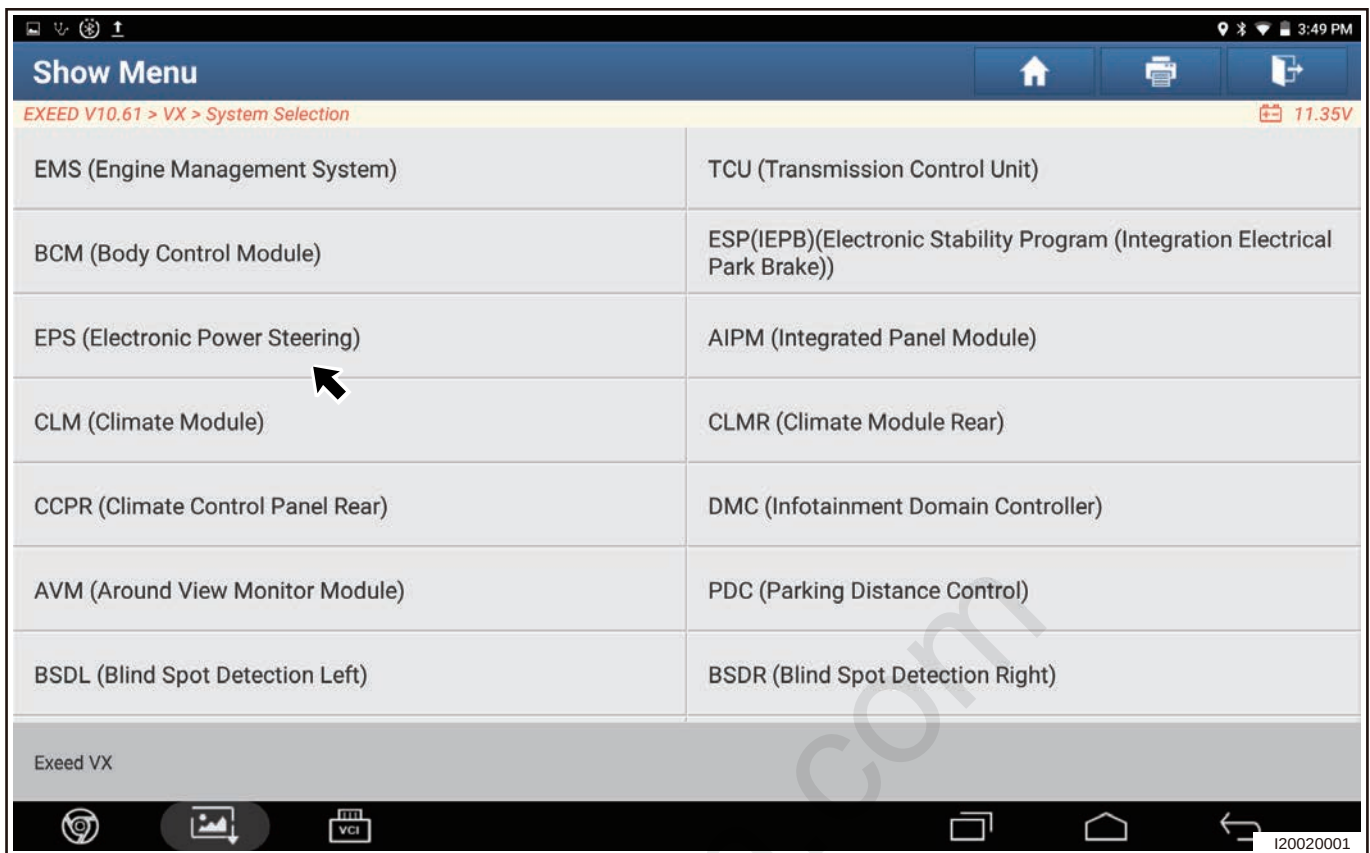
- (1) Install 1 fixing screw to steering column module.
- (2) Install the steering column module connector.
- (3) Install the combination switch lower cover assembly.
- (4) Install the steering wheel assembly.
- (5) Install the driver airbag.
- (6) Connect the negative battery cable.

■ Steering angle calibration

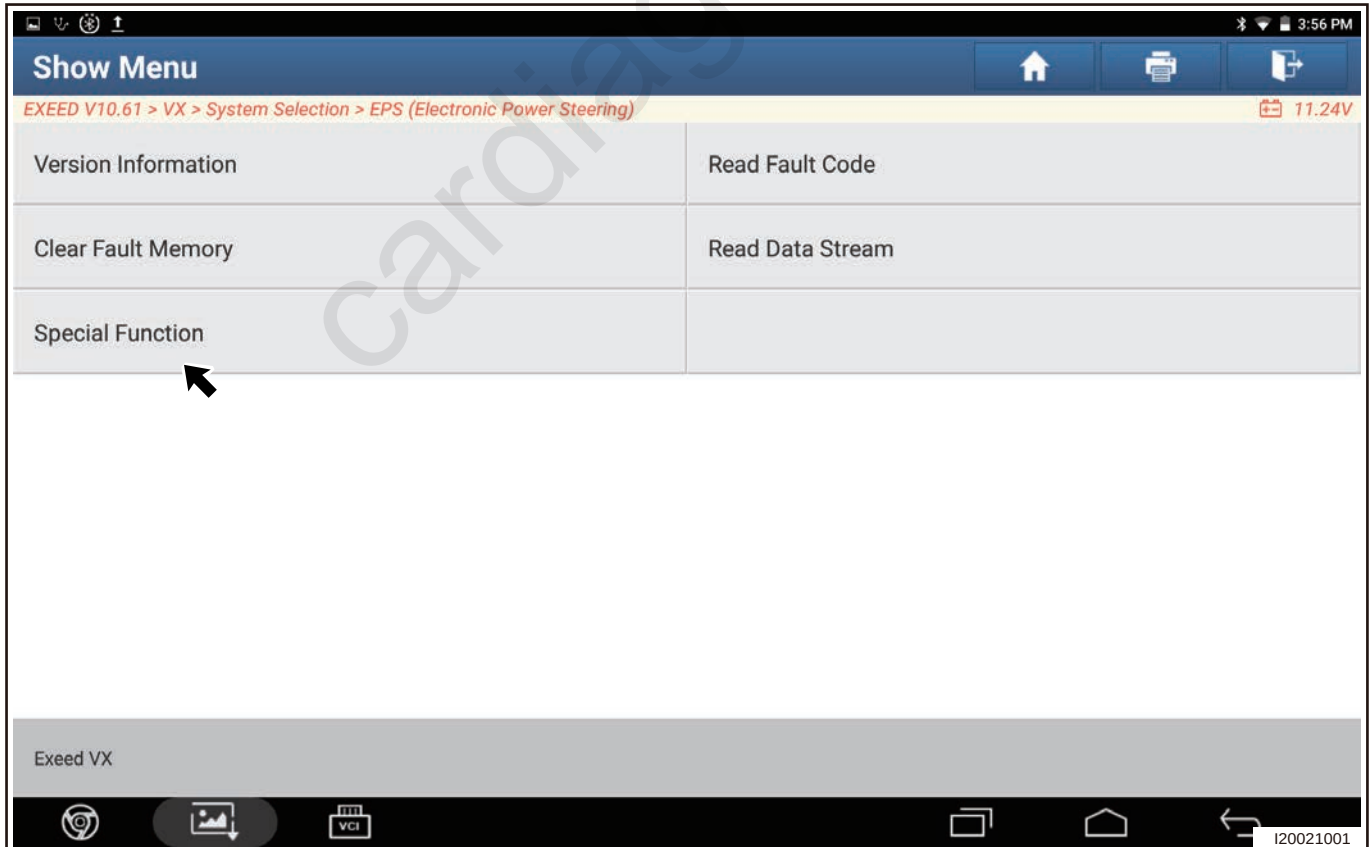
⚠ Caution

- The zero point calibration of steering angle sensor must be carried out on four-wheel alignment station, otherwise the zero point calibration of steering angle sensor is not accurate, which will bring the risk of ESP alarm.

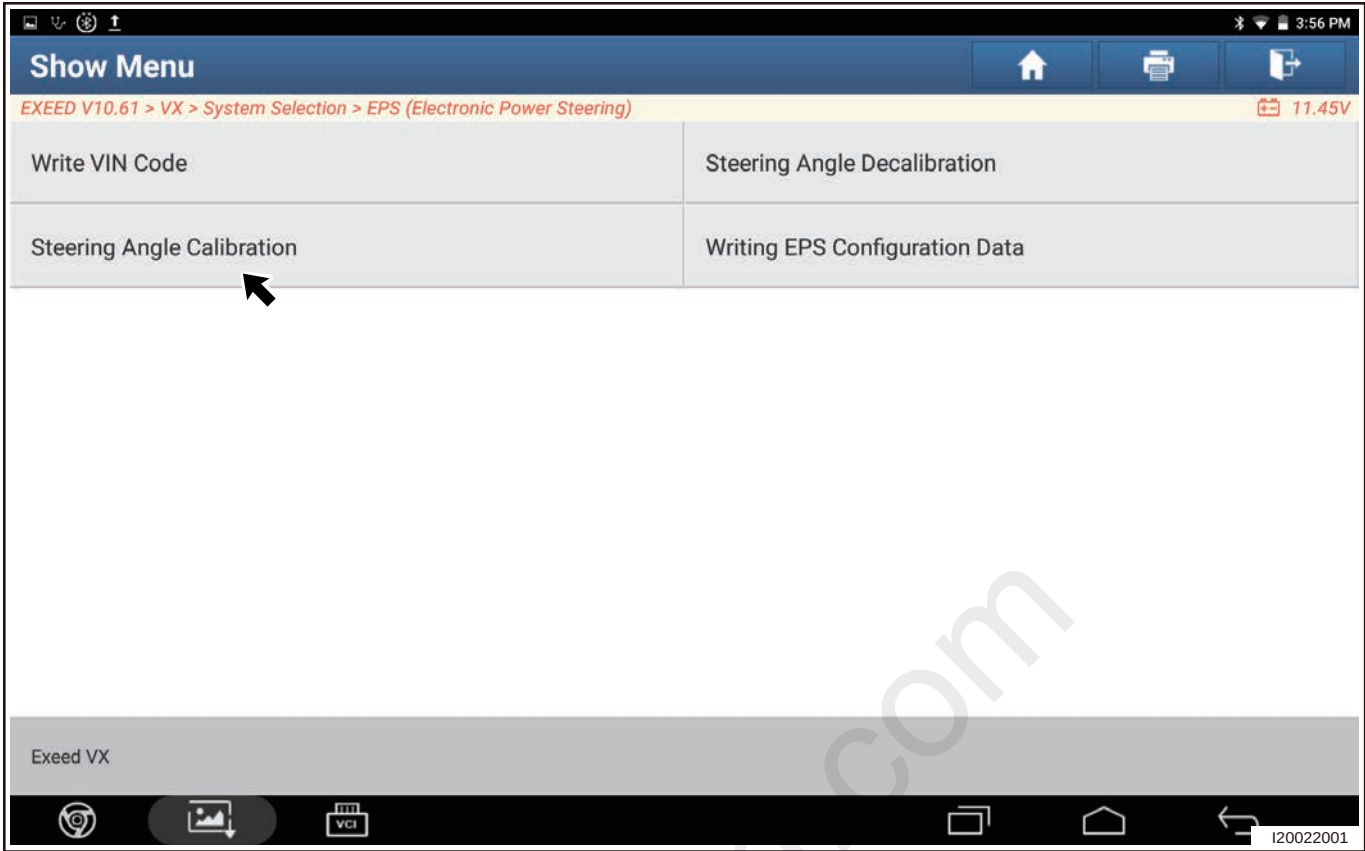
- (1) Enter “EPS (Electronic Power Steering)” .



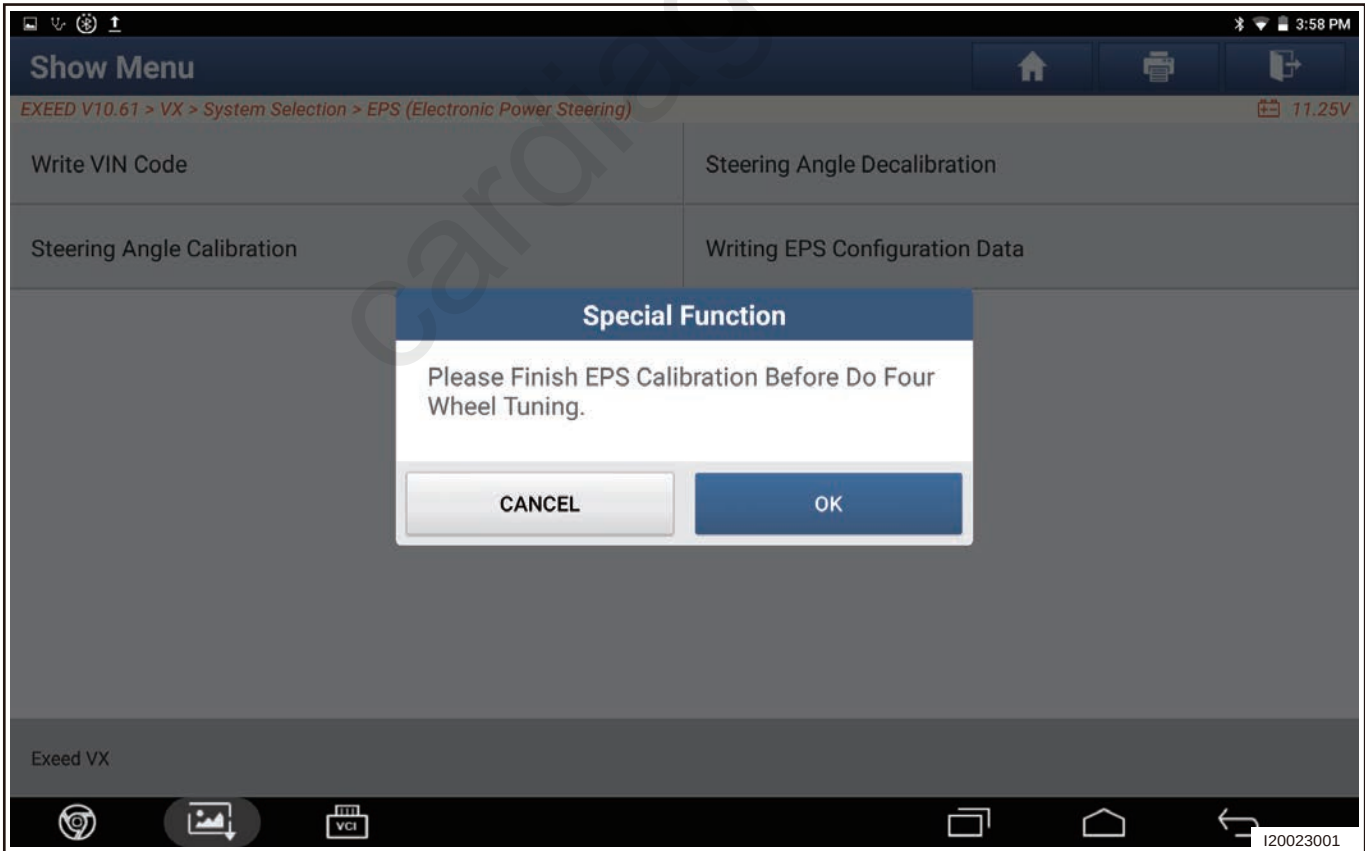
(2) Click “Special Function” .



(3) Go to next interface, click “Steering Angle Sensor Calibration” .



(4) Hint: “Steering Angle Calibration” , then click “OK” .

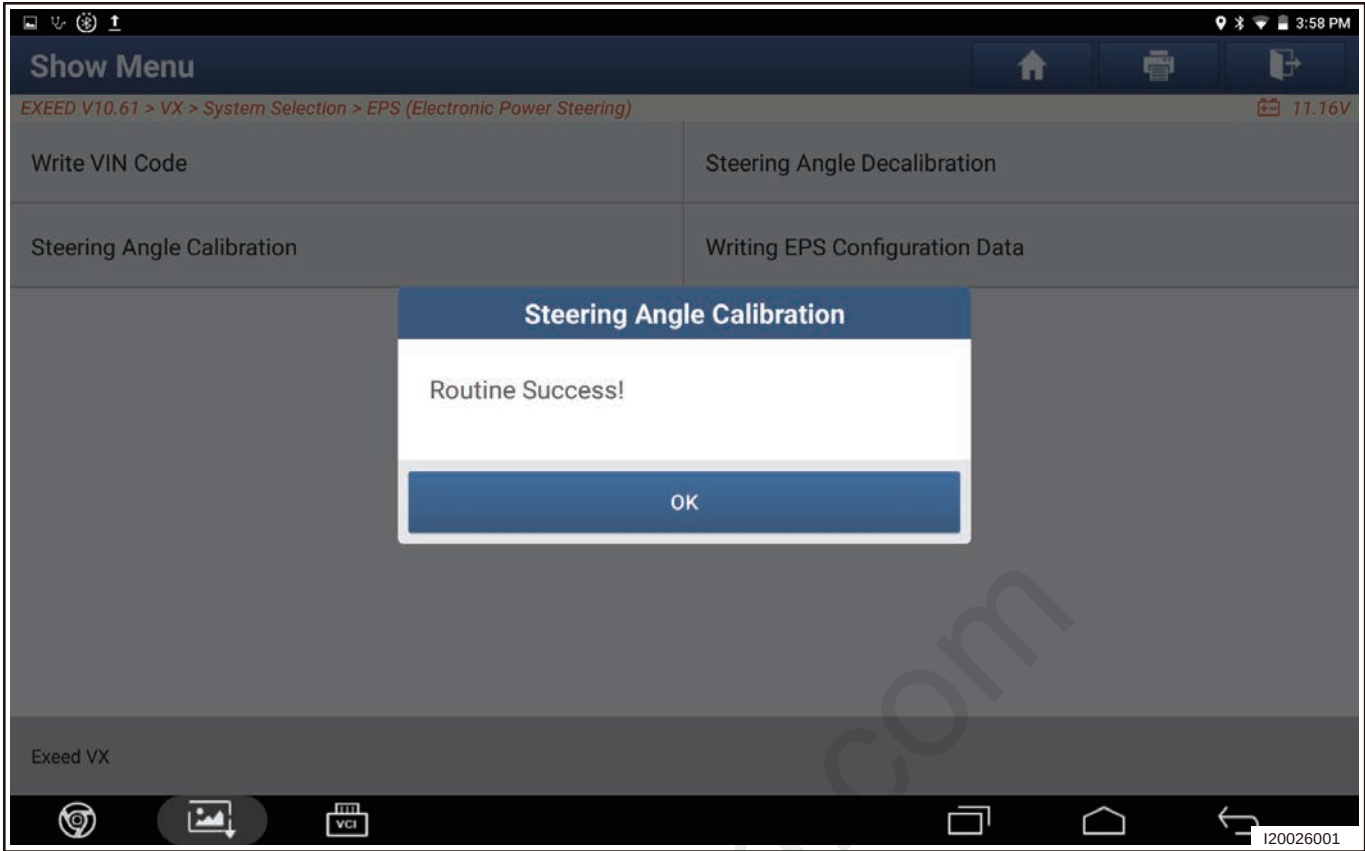




(5) Turn steering wheel according to the hint, then click “OK” .



(6) Hint: “Routine Success!” . Then click “OK” .



8.4 STEERING GEAR

1 Warnings and Precautions

1.1 Precautions

In order to avoid dangerous operation and damage to the vehicle, always follow the instructions below before repair:

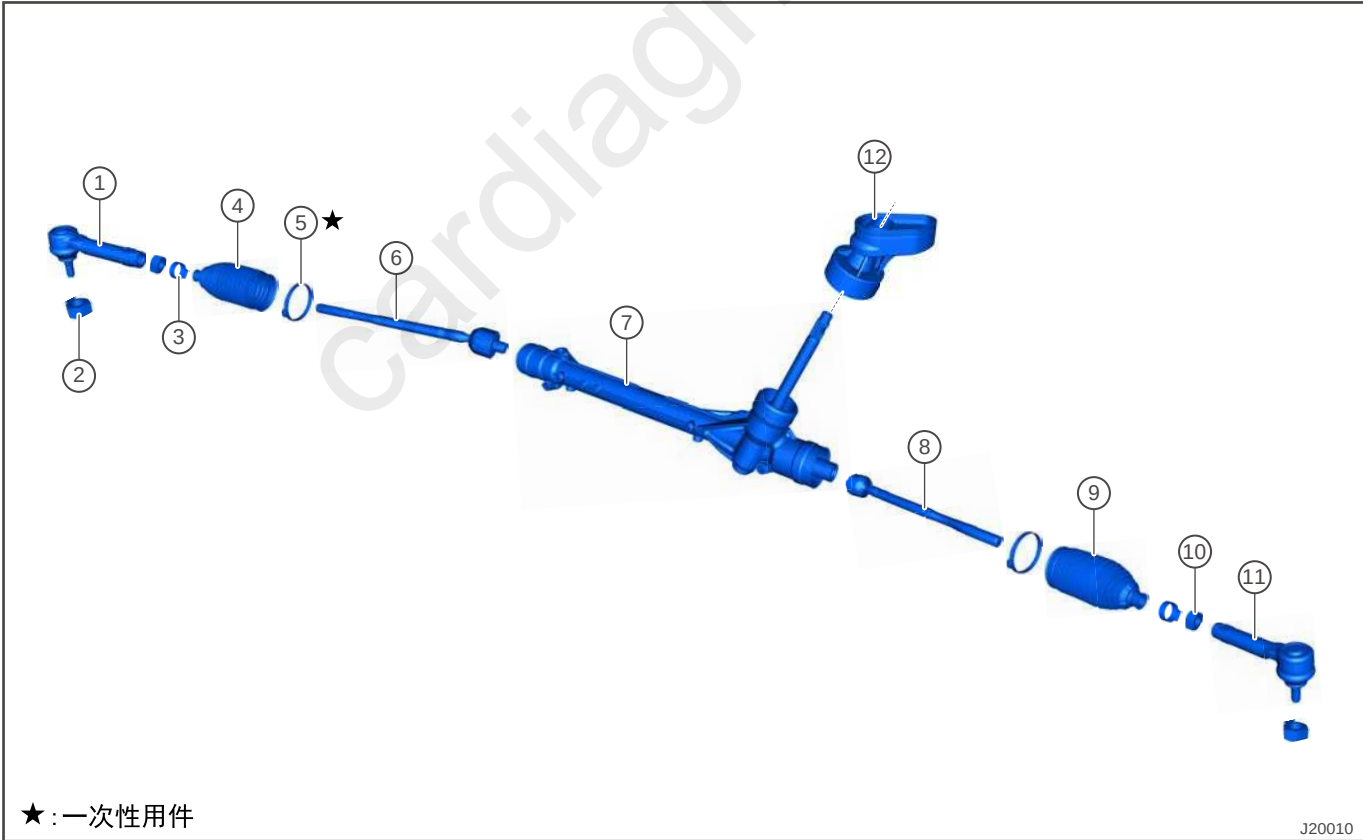
- (1) To replace steering gear, it is necessary to perform four-wheel alignment and center calibration.
- (2) After four-wheel alignment, it is necessary to recalibrate center calibration.
- (3) When removing and installing steering gear, it is necessary to turn off power supply of EPS (vehicle power supply is turned off), so as to avoid reverse impact, resulting in EPS internal protection circuit breakdown.
- (4) It is necessary to perform steering angle sensor zero point calibration after replacing steering gear.
- (5) When removing and installing steering system, suspension system, brake, tire, etc., it is necessary to turn off power supply of EPS (vehicle power supply is turned off), so as to avoid reverse impact, resulting in EPS internal protection circuit breakdown.

2 SYSTEM OVERVIEW

2.1 System Description

This vehicle adopts the electronic power steering system, which can reduce the workload when driver operates the steering wheel, thus improving operation convenience and driving safety.

2.2 System Components Diagram



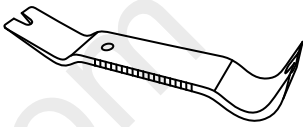
1	Right Steering Tie Rod Ball Pin	7	Steering Gear Body
2	Steering Tie Rod Ball Pin Locking Nut	8	Left Steering Tie Rod Assembly

3	Steel Belt Clamp	9	Left Steering Tie Rod Boot
4	Right Steering Tie Rod Boot	10	Steering Tie Rod Fixing Nut
5	Steel Belt Elastic Clamp	11	Left Steering Tie Rod Ball Pin
6	Right Steering Tie Rod Assembly	2	Boot Assembly

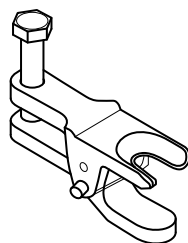
3 ON-VEHICLE SERVICE

3.1 Tools

■ General Tools

Tool Name	Tool Drawing
Interior Crow Plate	 S00020

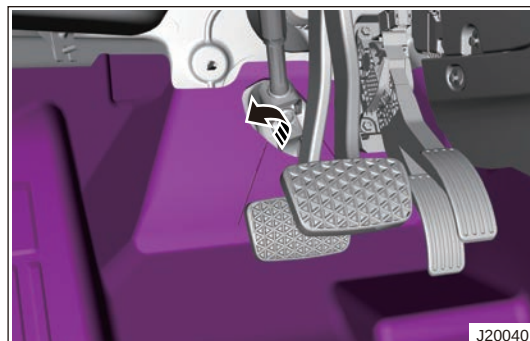
■ Special Tools

Tool Name	Part No.	Tool Drawing
Ball Separator	ECH-0003	 S00019

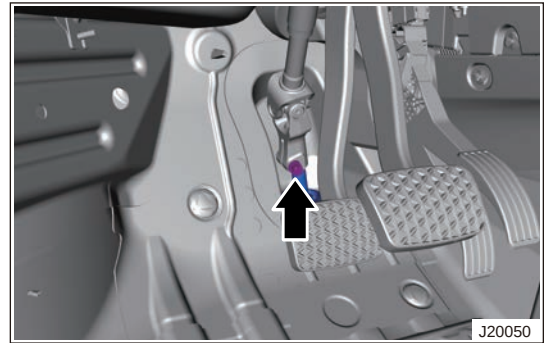
3.2 Replacement of Steering Gear Assembly

■ Removal

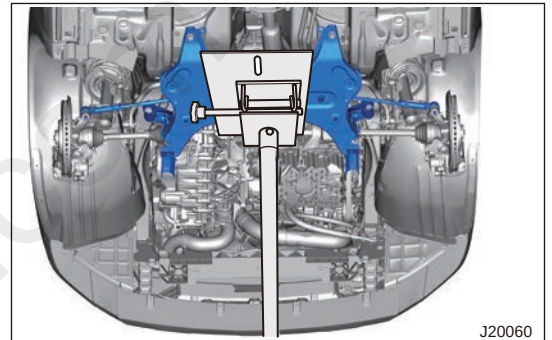
- (1) Set the steering wheel to straight-ahead position.
- (2) Turn off all electrical equipment and ENGINE START STOP switch.
- (3) Disconnect the negative battery cable.
- (4) Turn over carpet under driver seat in the direction of arrow.



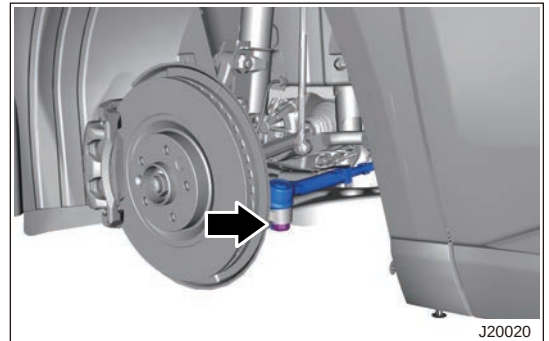
- (5) Remove the coupling bolt (arrow) between steering column with intermediate shaft assembly and steering gear input shaft.



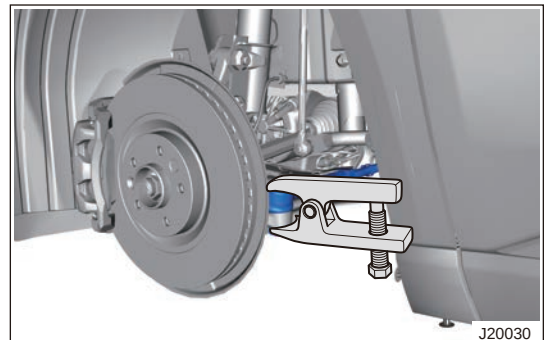
- (6) Remove front left and front right wheels.
 (7) Remove the engine lower protector assembly.
 (8) Remove left and right side rail assembly.
 (9) Remove front left and front right control arm assemblies.
 (10) Remove the rear mounting cushion assembly.
 (11) Using a transmission carrier, support front sub frame welding assembly.



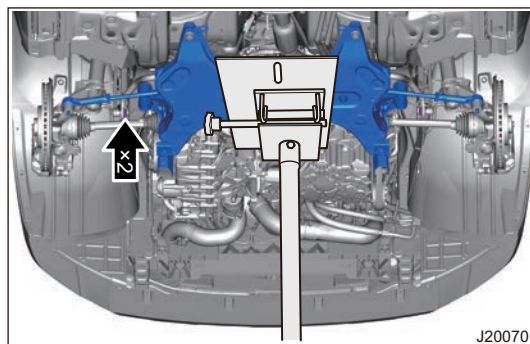
- (12) Remove locking nut (arrow) between left steering tie rod ball pin assembly and front left steering knuckle assembly (the right side is same as left side).



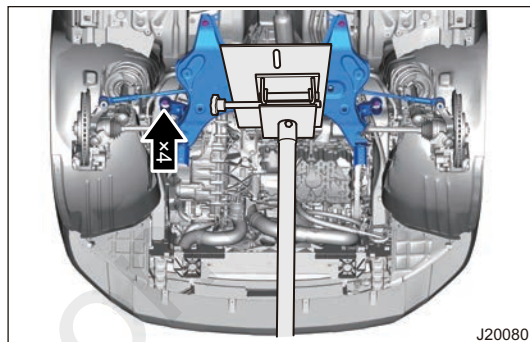
- (13) Install ball pin separator, and separate steering tie rod ball pin from steering knuckle assembly.



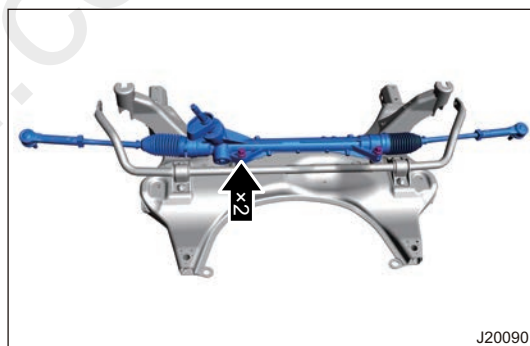
- (14) Remove 2 locking nuts (arrow) between front connecting rod and front stabilizer bar.



- (15) Remove 4 fixing bolts (arrow) between front sub frame and vehicle body, and lower front sub frame slowly.



- (16) Remove 2 fixing bolts (arrow) that fix the steering gear with tie rod assembly from sub frame, and remove steering gear with tie rod assembly.



Hint:

- Check if steering gear dust boot is damaged, clamp is loose. Replace them if necessary to prevent water and micro dust from entering and causing parts failure prematurely.
- Check if steering gear is damaged. Replace the steering gear assembly if necessary.

■ Installation

- (1) Install steering gear with tie rod assembly to sub frame.
- (2) Install 2 fixing bolts that fix the steering gear with tie rod assembly to sub frame.

Torque: $180 \pm 18 \text{ N}\cdot\text{m}$

- (3) Slowly raise sub frame to a proper position and install 2 fixing bolts between sub frame and vehicle body.

Torque: $110 \pm 8 \text{ N}\cdot\text{m}$

- (4) Install 2 fixing bolts between left and right brackets and front sub frame welding assembly.

Torque: $200 \pm 18 \text{ N}\cdot\text{m}$

- (5) Separate transmission carrier from front sub frame welding assembly.
- (6) Install 2 hanger blocks to front sub frame assembly.
- (7) Install steering tie rod ball pin to steering knuckle assembly.
- (8) Install locking nut between left steering tie rod ball pin assembly and front left steering knuckle assembly (the right side is same as left side).

Torque: $60 \pm 5 \text{ N}\cdot\text{m}$

- (9) Install the rear mounting lower body.
- (10) Install front left and front right control arm assemblies.
- (11) Install left and right side rail welding assemblies.
- (12) Install the engine compartment lower protector assembly.
- (13) Install front left and front right wheels.
- (14) Install coupling bolt between steering column with intermediate shaft assembly and steering gear input shaft.

Torque: $40 \pm 3 \text{ N}\cdot\text{m}$

- (15) Place the carpet under driver seat in a suitable position.
- (16) Connect the negative battery cable.
- (17) Press ENGINE START STOP switch, perform four-wheel alignment and perform running test.