
ELECTRONIC POWER STEERING CONTROL SYSTEM

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28.1 ELECTRONIC POWER STEERING CONTROL SYSTEM

1 Warnings and Precautions

1.1 Precautions

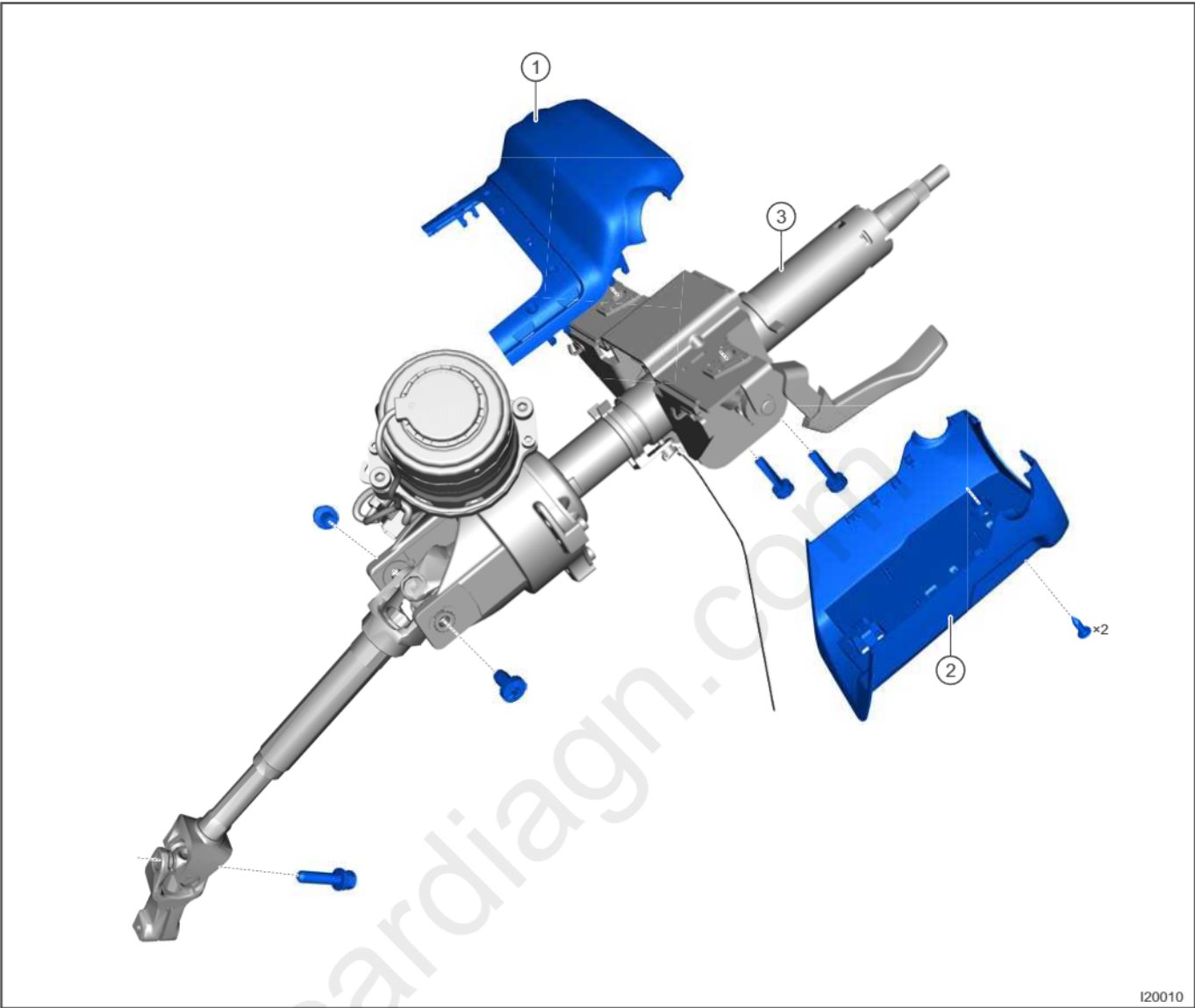
- (1) Calibration requirements: Keep vehicle stationary and steering wheel centered to ensure that the left and right errors are within 10°.
- (2) Battery voltage is higher than 10 V and lower than 16 V.
- (3) When performing circuit diagnosis and test, always refer to the circuit diagram for specific 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

Steering column is an element of the steering system that connects steering wheel and steering gear. Driver transmits torque to steering gear through steering column, driving steering gear to achieve steering.

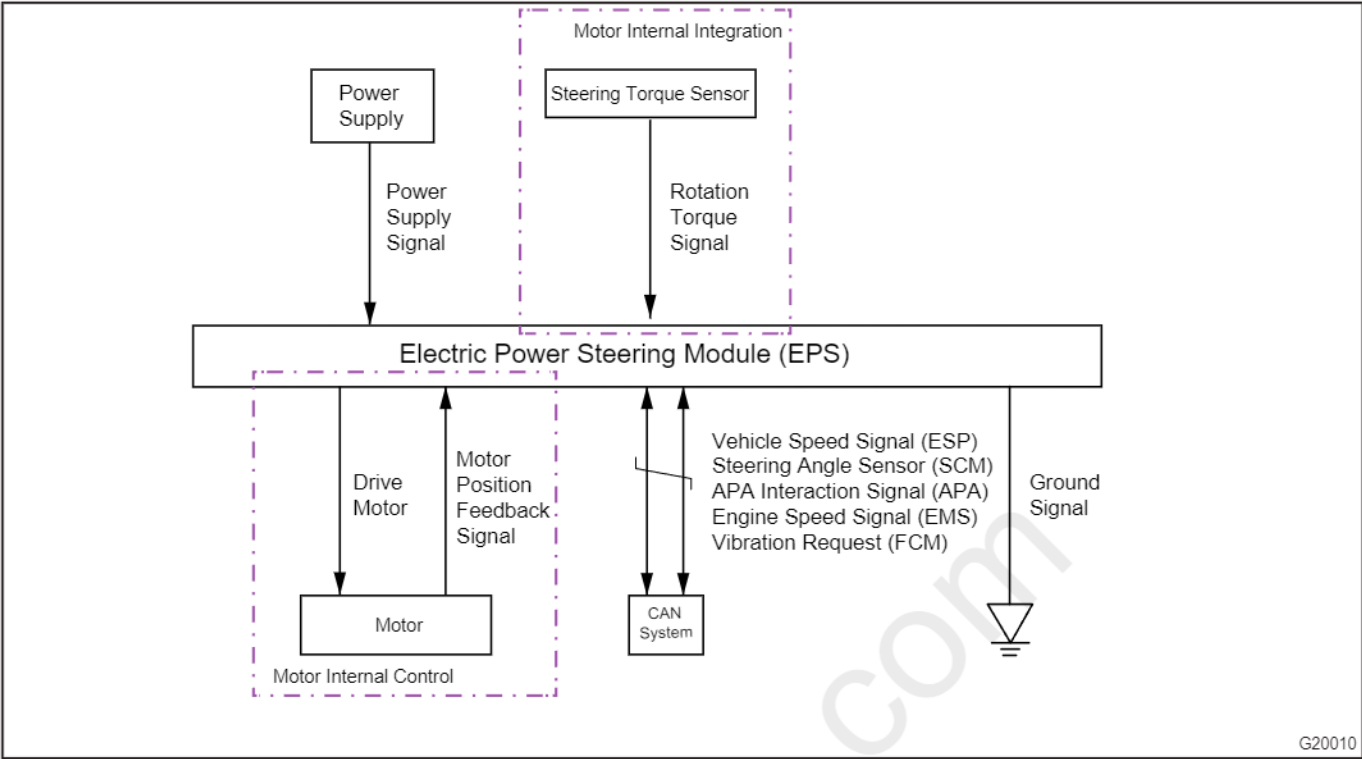
2.2 System Components Diagram



I20010

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

2.3 System Schematic Diagram



Electronic power steering module is integrated into steering column.

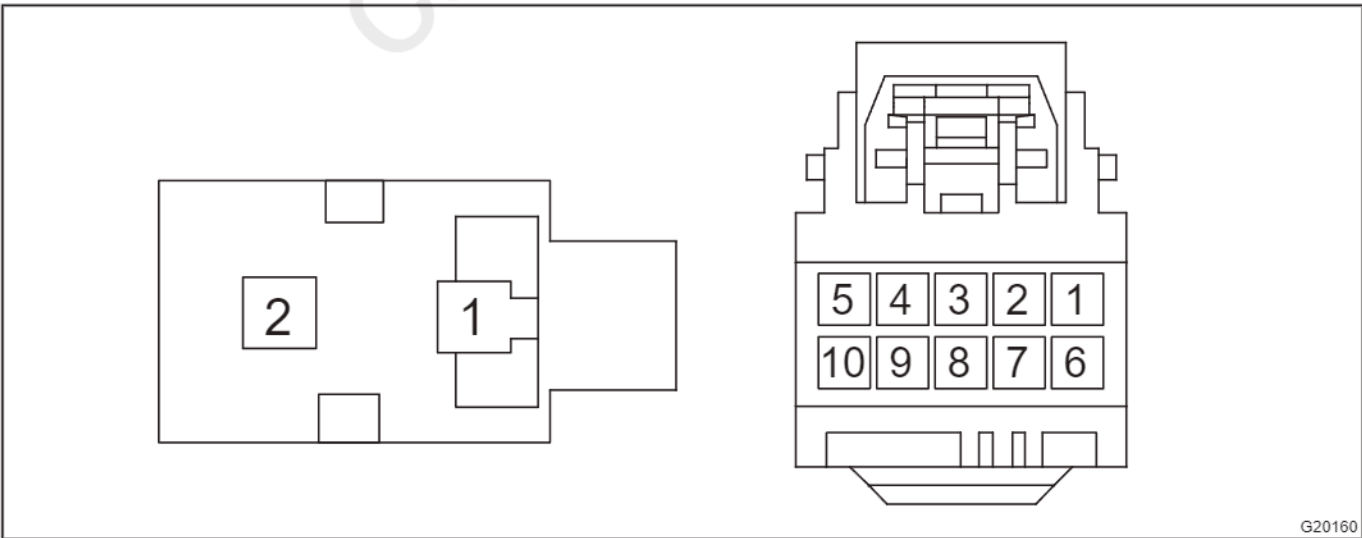
2.4 Component Operation Description

■ 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 Definition



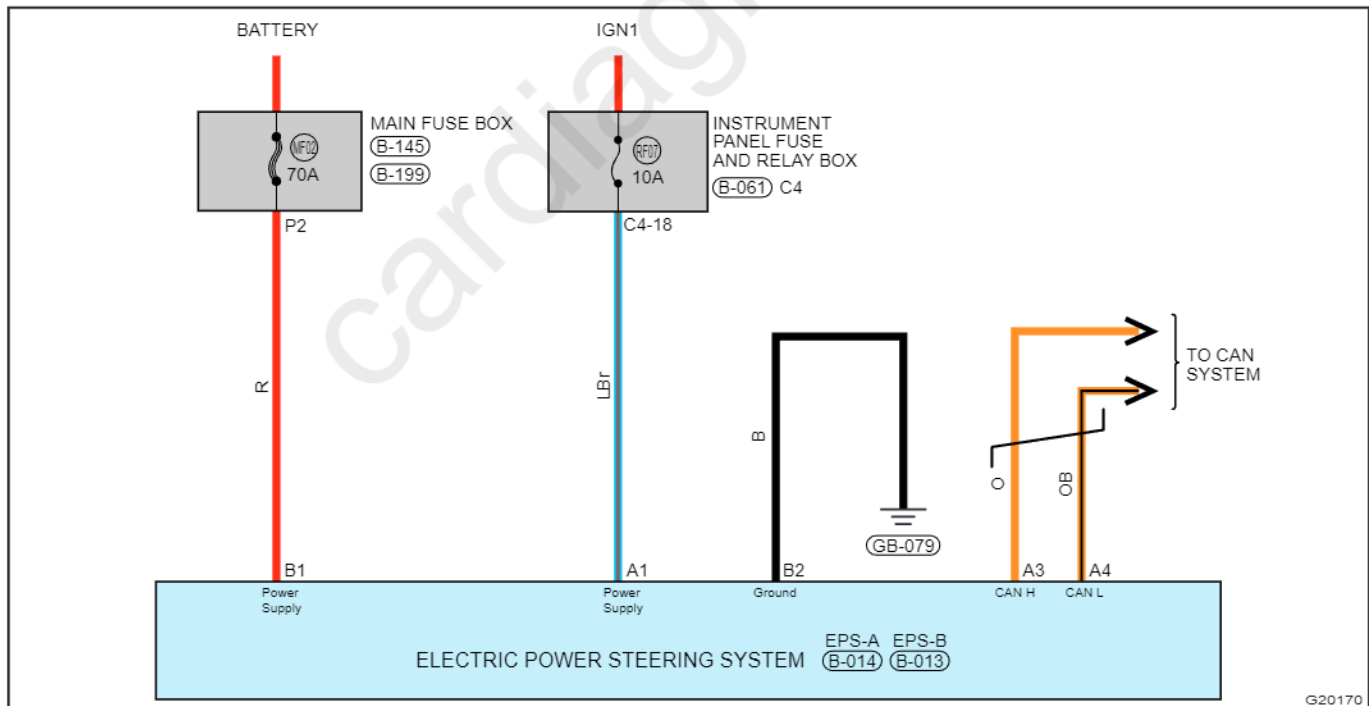
Vehicle power supply: Controller power supply connector (connector A)

Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Multimeter Positive	Multimeter Negative			
B1	Body ground	Power supply	Power supply in "ON" status	12 V
B2	Body ground	Ground	Power supply in "ON" status	0 V

Vehicle signal: Controller signal connector (connector B)

Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Positive of Digital Multimeter	Negative of Digital Multimeter			
A1	Body ground	Ignition signal	Power supply in "ON" status	12 V
A2	Body ground	C CAN-H	Power supply in "ON" status	2.78 V
A3	Body ground	CAN-H	Power supply in "ON" status	Real vehicle pin not connected
A4	Body ground	C CAN-L	Power supply in "ON" status	2.28 V
A5	Body ground	CAN-L	Power supply in "ON" status	Real vehicle pin not connected

3.2 Circuit Diagram



G20170

4 Diagnostic Information and Steps

4.1 Diagnostic Help

- Connect diagnostic tester and make it communicate with vehicle electronic module through data network.
- Confirm that malfunction is current, and carry out diagnostic test and repair procedures.

- If DTC cannot be deleted, malfunction is current.
- Only use a digital multimeter to measure voltage of electronic system.
- Refer to any Technical Bulletin that applied to the malfunction.
- Visually check the related wire harness.
- Check and clean Electronic Power Steering controller (EPS controller) ground related to latest DTC.
- If multiple trouble codes were set, use circuit diagrams and look for any common ground circuit or power supply circuit applied to DTC.

4.2 Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the following:

- Check if connector is loose.
- Check if wire harness is worn, pierced, pinched or partially broken.
- Wiggle related wire harness and connector and observe if signal in related circuit is interrupted.
- If possible, try to duplicate conditions under which DTC was set.
- Look for data that has changed or DTC to reset during wiggle test.
- Look for broken, bent, protruded or corroded terminals.
- Inspect sensors and mounting areas for damage, foreign matter, etc. that will cause incorrect signals.
- Check and clean all wire harness connectors and ground parts related to DTC.
- If multiple trouble codes were set, refer to circuit diagrams to look for any common ground circuit or power supply circuit applied to DTC.
- Refer to any Technical Bulletin that may apply to this malfunction.

4.3 Ground Inspection

Ground points are very important to the proper operation of circuits. Ground points 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 Diagnostic Trouble Code (DTC) Chart

■ SCM Power Supply DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
C120500	External Function Fault - Invalid LKA Torque	Lane keeping assist torque is high	Intermittent fault	1. Reset ECU; 2. Reduce lane keeping assist torque to less than 3 Nm
C200100	EPS Internal Software Error - Dataflash Operation Error	1. Nv Ram reading failure (or) 2. Nv Ram writing failure	EPS module failure	Step 1: Clear error and reset ECU; Step 2: If problem is not solved, refresh the software; Step 3: If error still exists, replace EPS
C200200	EPS Internal Software Error - Dataflash Verify Error	1. Incorrect NvRam configuration or initialization; 2. Incorrect software		

		label in NvRam; 3. Incorrect data in NvShare		
C200300	EPS Internal Hardware Error - ECU Hardware Error	1. SPI communication timeout; 2. Watchdog enabled/disabled failure; 3. ASIC start failure; 4. ADC operation failure; 5. Error in RAM; 6. Measured voltage plausibility; 7. Build-in software test failure; 8. Different outputs for incorrect pin; 9. Registration read back failure; 10. Error in singlechip SGA; 11. Improper reset.		Replace EPS module
C200400	EPS Internal Software Error - ECU Reset	Improper reset of ECU		
C200500	EPS Internal Software Error - ECU Software Monitor Error	1. OS Monitoring routine for OS error detection; 2. Design problem or timing problem (load when running) or unauthorized interrupt latch; 3. Comparison failure in level1 of comparator; 4. Comparison failure in level2 of comparator; 5. Rotor position angle error; 6. Software default branch failure; 7. Error handling process monitoring failure; 8. Code flash implausibility; 9. Problem in error event reaction component; 10. Different applied torque and calculated torque.		Step 1: Clear error and reset ECU; Step 2: If problem is not solved, refresh the software; Step 3: If error still exists, replace EPS
C200600	EPS Internal Hardware Error - Flash Code Verify Error	Code flash corrupted		Replace EPS module
C200700	EPS Steering Column Error - High Friction	Steering friction too high	Steering column stuck	Check and replace mechanical

				component that causes high friction
C200800	EPS Internal Hardware Error - Index Sensor Error	Index sensor failure.	EPS module failure	Replace EPS module
C200900	EPS Internal Hardware Error - Output Stage Error	1. SPI communication failure due to flag inconsistency or error frame response; 2. Output stage failure; 3. Output stage drive failure; 4. Measured output stage PWM error	EPS module failure	Replace EPS module
C200A00	EPS Internal Hardware Error - Phase Current Error	1. Motor phase current out of range; 2. Motor phase current offset out of range		
C200B00	EPS Internal Hardware Error - RPS Error	1. RPS radius error; 2. 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	Check and replace mechanical component that causes steering oscillation
C200D00	EPS Internal Software Error - Steering Angle Implausible Error	1. Arrangement plausible; 2. iLWS implausibility; 3. Different iLWS and steering wheel speed angle	Configuration error; EPS failure	Step 1: Clear error and reset ECU; Step 2: If problem is not solved, refresh the software; Step 3: If error still exists, replace EPS
C200E00	EPS Internal Software Error - Steering Angle Not Initialized Error	iLWS not initialized	Steering angle not calibrated; Software version low; EPS failure	Step 1: Initialize steering angle - fully rotate steering wheel from one side to the other side or drive vehicle straight at more than 5 kph; Step 2: Clear error and reset ECU; Step 3: If problem is not solved, refresh the software; Step 4: If error still exists, replace EPS
C200F00	EPS Internal Software Error - Steering Angle Not Calibrated Error	iLWS not calibrated		Step 1: Recalibrate steering angle; Step 2: Clear error and reset ECU; Step 3: If problem is not

				solved, refresh the software; Step 4: If error still exists, replace EPS
C201100	EPS Internal Hardware Error - Steer Ang Sens Self Test Error	Internal steering angle sensor self test failure	EPS module failure	Replace EPS module
C201200	Voltage Out of Range - Power Supply Voltage Abnormal at Start	Battery voltage less than 8.3 or more than 18 V at start	1: Battery voltage; 2: Wire harness and connector; 3: ECU intermittent failure; 4: EPS failure	Voltage should be maintained in normal operating range of ECU. Step 1: Check battery voltage; Step 2: Check wire harness and connector; Step 3: Clear error and reset ECU; Step 4: If error still exists, replace EPS
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		
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 Low OFF	When battery voltage is lower than 6.5 V for at least 20 ms		
C201900	Temperature Error - Over Temperature Reduction	1. When PCB temperature is higher than 85°C and the reduction of assistance is within 0 - 40%; 2. When FET temperature is higher than 100°C and the reduction of assistance is within 0 - 60%; 3. Motor temperature is higher than 150°C and the reduction of assistance is within	1: System overheating; 2: ECU intermittent failure; 3: EPS failure	Step 1: Decrease EPS temperature and avoid strong steering movement, place EPS at room temperature for about 2 hours; Step 2: Clear error and reset ECU; Step 3: If error still exists, replace EPS

		0 - 40%; Note: 100 % = Full assistance		
C201A00	Temperature Error - Temperature Out of Range	1. PCB temperature is out of range; 2. 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	1. Torque sensor passage is not available, power supply of sensor is undervoltage and torque difference between A and B is too large; 2. SENT driver protocol is faulty	1. Torque sensor; 2. EPS	Step 1: Recheck torque sensor connection and reset ECU. Step 2: If error still exists, replace EPS
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.	1. Intermittent failure; 2. Software version low; 3. EPS	Step 1: Clear error and reset ECU; Step 2: If problem is not solved, refresh the software; Step 3: If error still exists, replace EPS
C201D00	EPS Internal Software Error - ECU Software Info Error	1. OEM task running fails; 2. 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	Set vehicle configuration and reset ECU

DTC	C120500	External Function Fault - Invalid LKA Torque
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1	Reduce lane keeping assist torque to less than 3 Nm and reset ECU
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- (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**

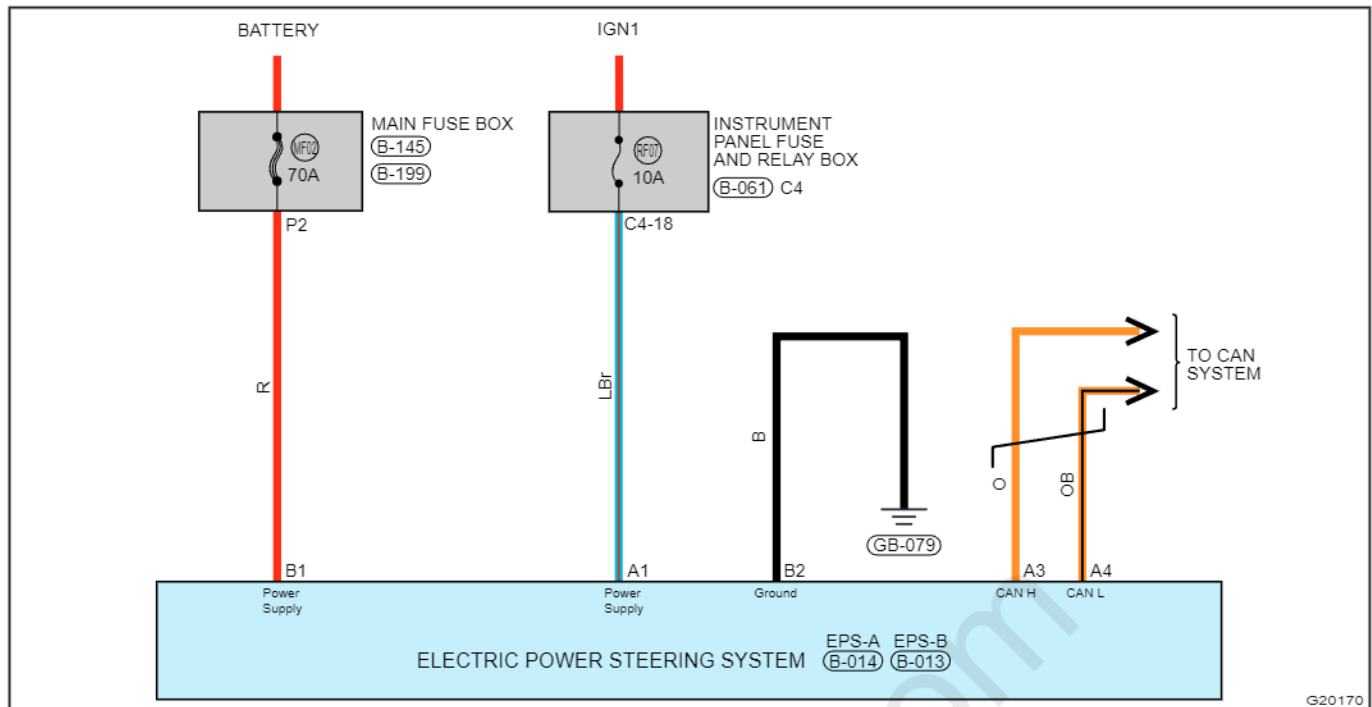
■ Description

DTC	DTC Definition	DTC Detection Condition	Possible Cause
C201200	Voltage Out of Range - Power Supply Voltage Abnormal at Start	ENGINE START STOP switch "OFF" , engine is not running	Circuit voltage below threshold; Circuit voltage above threshold; Component internal fault
C201300	Voltage Out of Range - Power Supply Voltage too High Warn		
C201400	Voltage Out of Range - Reduction Due to High Power Supply Voltage		
C201500	Voltage Out of Range - Power Supply Voltage too High OFF		
C201600	Voltage Out of Range - Power Supply Voltage too Low Warn		
C201700	Voltage Out of Range - Reduction Due to Low Power Supply Voltage		
C201800	Voltage Out of Range - Power Supply Voltage too Low OFF		

⚠ Caution

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

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 Low OFF



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

- Check if battery voltage is normal.
- 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
---	------------

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

OK

Fuse is not blown.

NG	Replace fuse
----	--------------

OK

3

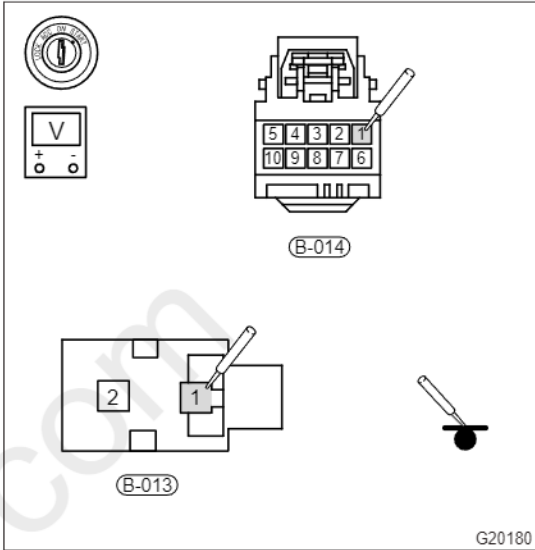
Check power supply voltage

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect electronic power steering module connectors B-013 and B-014.
- (c) Turn ENGINE START STOP switch to ON.
- (d) Check voltage between B-013 (1) and body ground with voltage band of multimeter, and check if 21 W test light comes on. Check voltage between B-014 (1) and body ground with voltage band of multimeter, and check if 21 W test light comes on.

OK

Power supply voltage is normal.

Multimeter Connection	Condition	Normal Condition
B-013 (1) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V
B-014 (1) - Body ground	ENGINE START STOP switch "ON"	On



Result

NG

Repair and replace power supply wire harness

OK

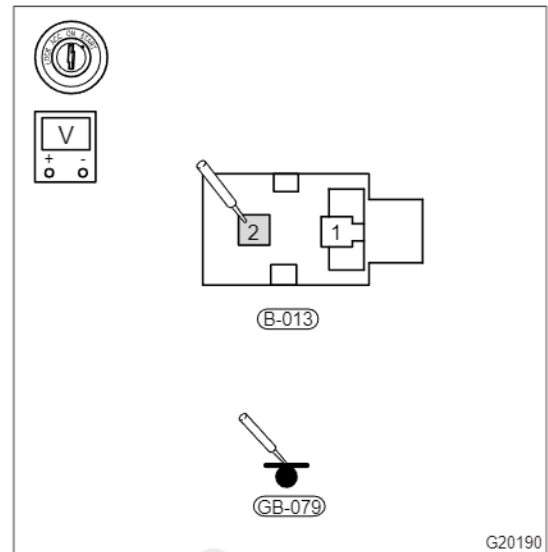
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Check ground

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the electronic power steering module connector B-013.

- (c) Check for continuity between B-013 (2) and body ground GB-079 with ohm band of multimeter.

Multimeter Connection	Condition	Normal Condition
B-013 (2) - Body ground GB-079	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$



Result

NG

Repair or replace ground point

OK

5

Check wire harness and connector

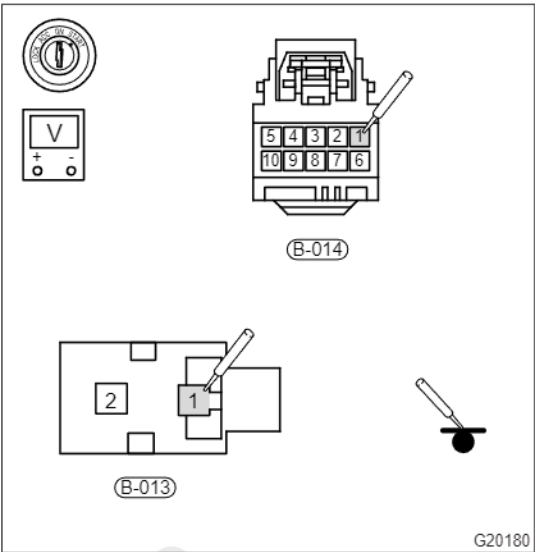
- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect electronic power steering module connectors B-013 and B-014.
 (c) Using ohm band of multimeter, check for continuity between B-014(1) and instrument panel fuse and relay box RF07.
 (d) Check for continuity between B-013 (1) and main fuse box B-145 with ohm band of multimeter.

Multimeter Connection	Condition	Normal Condition
B-014(1) - Instrument panel fuse and relay box RF07	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$
B-013 (1) - B-145	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$

(e) Check for continuity between B-013 (1) and body ground, B-014 (1) and body ground with ohm band of multimeter.

Check for Short

Multimeter Connection	Condition	Normal Condition
B-013 (1) - Ground	ENGINE START STOP switch "OFF"	∞
B-014 (1) - Ground	ENGINE START STOP switch "OFF"	∞



OK
Wire harness and connector are normal.

Result

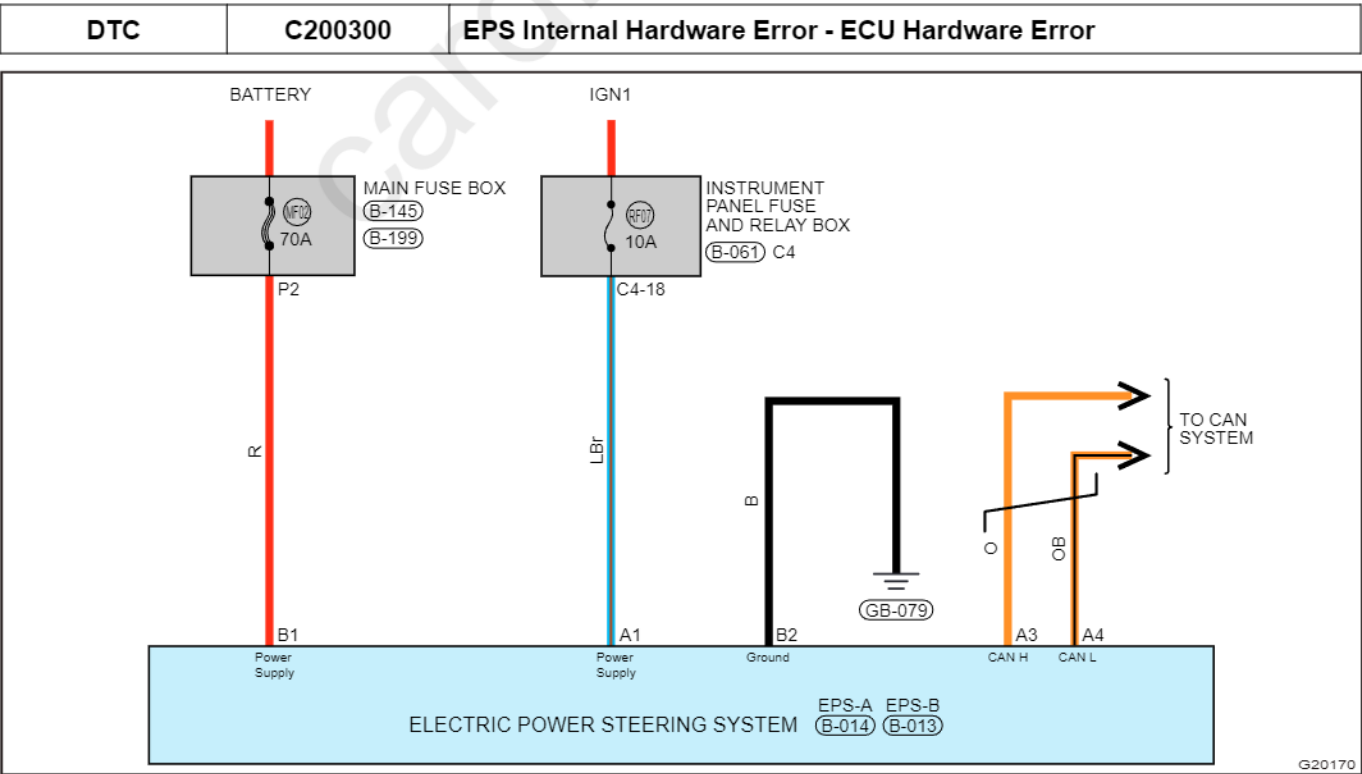
OK

Conduct test and confirm malfunction has been repaired

NG

Repair or replace control circuit wire harness and connector

Description



 **Caution**

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

1

Check EPS fuse

- (a) Turn ENGINE START STOP switch to ON.
- (b) Check if MF02 70A fuse of engine compartment main fuse box B-145 is blown.
- (c) Check if RF07 10A fuse in instrument panel fuse box B-061 is blown.

Result

NG

Replace fuse

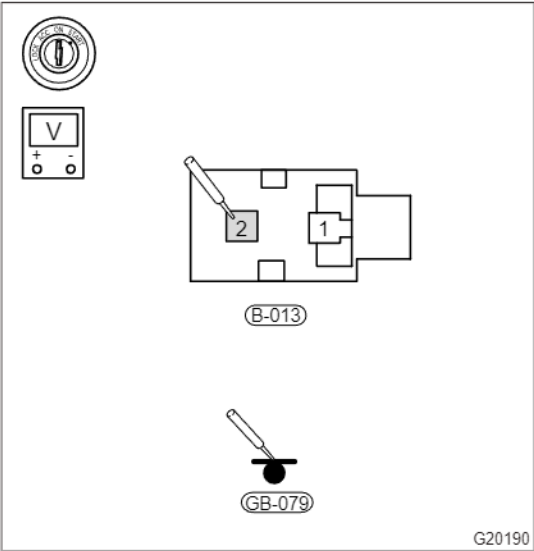
OK

2

Inspect EPS power supply and ground circuit

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the EPS steering module connector B-013.
- (c) Using a multimeter, check for continuity between terminal 2 of EPS connector B-013 and ground point GB-079.

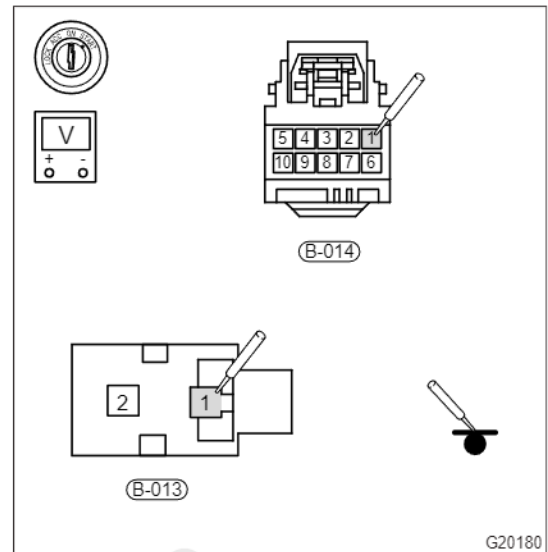
Multimeter Connection	Condition	Normal Condition
B-013 (2) - Ground point GB-079	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$



- (d) Turn ENGINE START STOP switch to ON.

- (e) Check voltage between B-014 (1) and body ground with voltage band of multimeter, and check if 21 W test light comes on. Check voltage between B-013 (1) and body ground with voltage band of multimeter, and check if 21 W test light comes on.

Multimeter Connection	Condition	Normal Condition
B-014 (1) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V
B-013 (1) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V



Result

NG

Repair or replace power supply and ground wire harness

OK

3

Reconfirm DTCs

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect the EPS controller connector.
 (c) Check EPS controller terminals for bending, deformation or displacement.
 (d) Use diagnostic tester (the latest software) to read EPS system DTC again.

Result

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

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.

Specified Condition

Multimeter Connection	Condition	Normal Condition
Battery (+) - Battery (-)	ENGINE START STOP switch "ON"	Not less than 12 V

OK

Standard voltage: Not less than 12 V

Result

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.

Result

OK	End
----	-----

NG	Replace electronic power steering module
----	--

DTC	C200700	EPS Steering Column Error - High Friction
1	Check tire pressure	
(a) Turn ENGINE START STOP switch to OFF. (b) Check tire for wear. (c) Use tire pressure gauge to check tire pressure, and standard pressure value is required.		
Result		
NG Replace tires OK		
2	Check mechanical steering gear and chassis system	
(a) Turn ENGINE START STOP switch to OFF. (b) Check if mechanical steering gear runs smoothly or is stuck. (c) Check if chassis area is damaged.		
Result		
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 electronic steering column motor is damaged.		
Result		
NG Replace electronic steering column or universal joint OK		
4	Reconfirm DTCs	

- (a) Turn ENGINE START STOP switch to ON.
- (b) Use diagnostic tester (the latest software) to record and clear DTC stored in EPS system.
- (c) Turn ENGINE START STOP switch to OFF and wait for a few seconds.
- (d) Turn ENGINE START STOP switch to ON.
- (e) Use diagnostic tester (the latest software) to read EPS system DTC again.

Result**OK**

Conduct test and confirm malfunction has been repaired

NG

Replace Electronic Power Steering (EPS) assembly

■ Description

DTC	C201E46	EPS Internal Software Error - Vehicle Configuration Not Programmed
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.

Result**NG**

Rewrite correct configuration code

OK

2	Check EPS motor calibration
---	-----------------------------

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

Result**NG**

Recalibrate it several times if necessary

OK

3 Reconfirm DTCs

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Use diagnostic tester (the latest software) to record and clear DTC stored in EPS system.
- (c) Turn ENGINE START STOP switch to OFF and wait for a few seconds.
- (d) Turn ENGINE START STOP switch to ON.
- (e) Use diagnostic tester (the latest software) to read EPS system DTC again.

Result**OK**

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

Description

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

1 Decrease ambient temperature, and avoid strong steering movement

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Avoid the strong steering movement.
- (c) Park vehicle on a level ground and cool it for a while.
- (d) Connect diagnostic tester and read DTCs again.

Result**NG**

Read DTCs again

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

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Check steering column for mechanical friction or interference.
- (c) Check steering gear for mechanical friction or interference or damage.
- (d) Check if tire pressure is sufficient.

Result**NG**

Readjust assembly

OK

3 Reconfirm DTCs

- (a) Turn ENGINE START STOP switch to ON.
- (b) Use diagnostic tester (the latest software) to record and clear DTC stored in EPS system.
- (c) Turn ENGINE START STOP switch to OFF and wait for a few seconds.
- (d) Turn ENGINE START STOP switch to ON.
- (e) Use diagnostic tester (the latest software) to read EPS system DTC again.

Result

OK

Conduct test and confirm malfunction has been repaired

NG

Replace EPS controller assembly

■ Description

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

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.

Result

NG

Replace torque sensor

OK

2 Refresh software

- (a) Refresh the software.

Result

NG

Refresh software

OK

3 Reconfirm DTCs

- (a) Turn ENGINE START STOP switch to ON.
- (b) Use diagnostic tester (the latest software) to record and clear DTC stored in EPS system.
- (c) Turn ENGINE START STOP switch to OFF and wait for a few seconds.
- (d) Turn ENGINE START STOP switch to ON.
- (e) Use diagnostic tester (the latest software) to read EPS system DTC again.

Result

OK

Conduct test and confirm malfunction has been repaired

NG

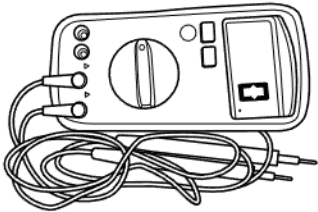
Replace EPS controller assembly

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 9.16 CAN Network Malfunction Diagnosis.

28.2 ON-VEHICLE SERVICE

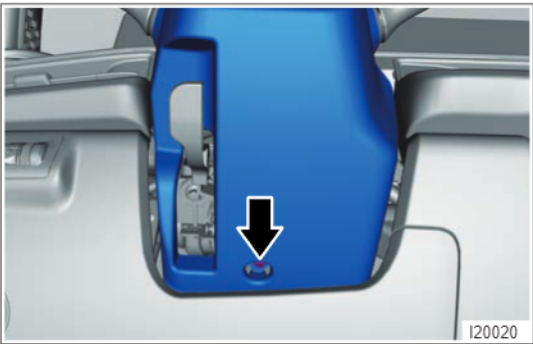
1 Tools

Tool Name	Tool Drawing
Digital Multimeter	 S00002
Diagnostic Tester	 S00001

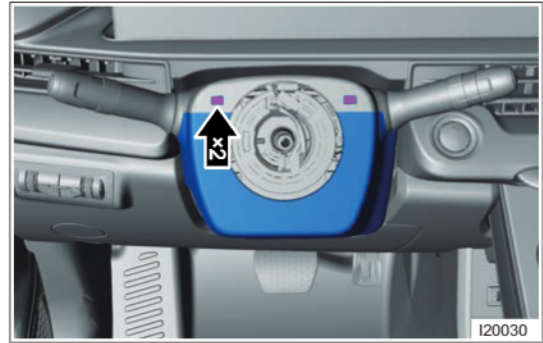
2 Replacement of Combination Switch Cover Assembly

2.1 Removal

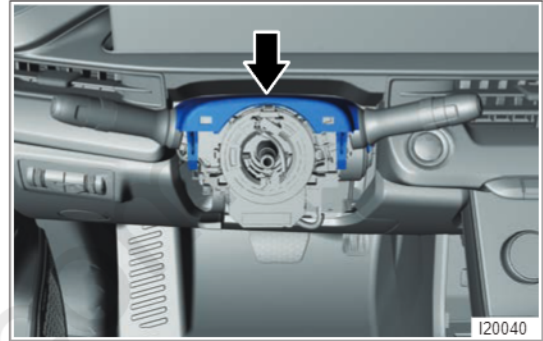
- (1) Set the steering wheel to straight-ahead position.
- (2) Turn off all electrical equipment and ENGINE START STOP switch.
- (3) Disconnect the negative battery cable.
- (4) Remove the driver airbag assembly.
- (5) Remove the steering wheel assembly.
- (6) Remove the combination switch lower cover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



- (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.**

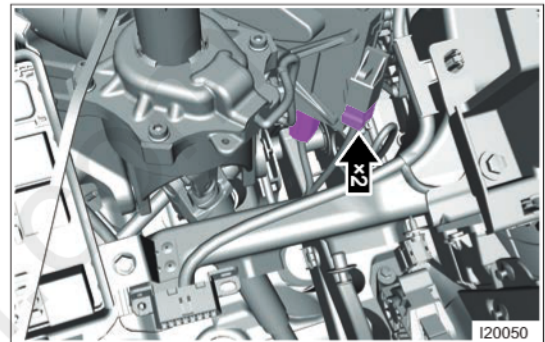
- (5) Install the steering wheel assembly.
- (6) Install the driver airbag assembly.
- (7) Connect the negative battery cable.
- (8) Press ENGINE START STOP switch and perform running test.

3 Replacement of Steering Column with Intermediate Shaft Assembly

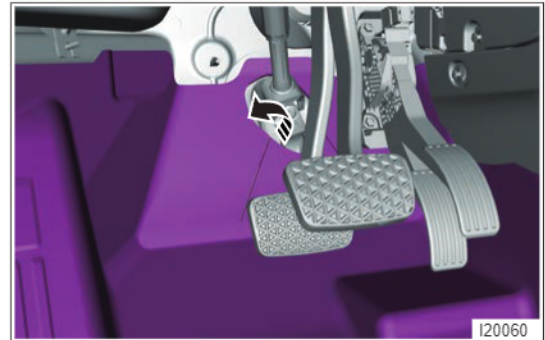
3.1 Removal

Procedures listed below are removal procedures for electronic steering column.

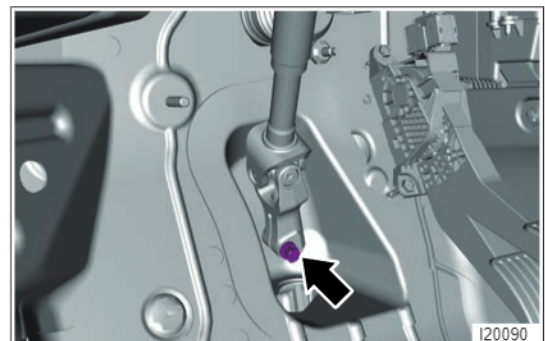
- (1) Set the steering wheel to straight-ahead position.
- (2) Turn off all electrical equipment and ENGINE START STOP switch.
- (3) Disconnect the negative battery cable.
- (4) Remove the driver airbag assembly.
- (5) Remove the steering wheel assembly.
- (6) Remove the combination switch cover.
- (7)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



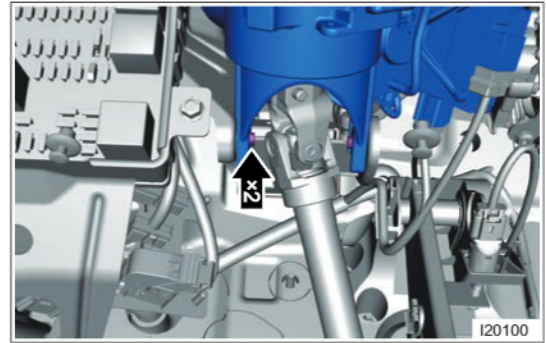
- (10) Turn over carpet under driver seat in the direction of arrow.



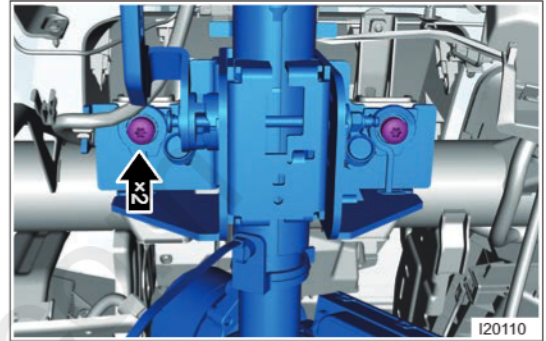
- (11) Remove coupling bolt between steering column with intermediate shaft assembly and steering gear input shaft.



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



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



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

Hint:

- 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.

Torque: $25 \pm 2 \text{ N}\cdot\text{m}$

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

Torque: $25 \pm 2 \text{ N}\cdot\text{m}$

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

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

- (5) Place the carpet under the driver in a proper position.
- (6) Connect 2 connectors to EPS controller.
- (7) Install the combination light 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) Connect the negative battery cable.
- (13) Press ENGINE START STOP switch and perform running test.
- (14) Connect EXEED dedicated diagnostic tester, read and clear DTCs.

3.2 Replacement and Matching Overview

Hint:

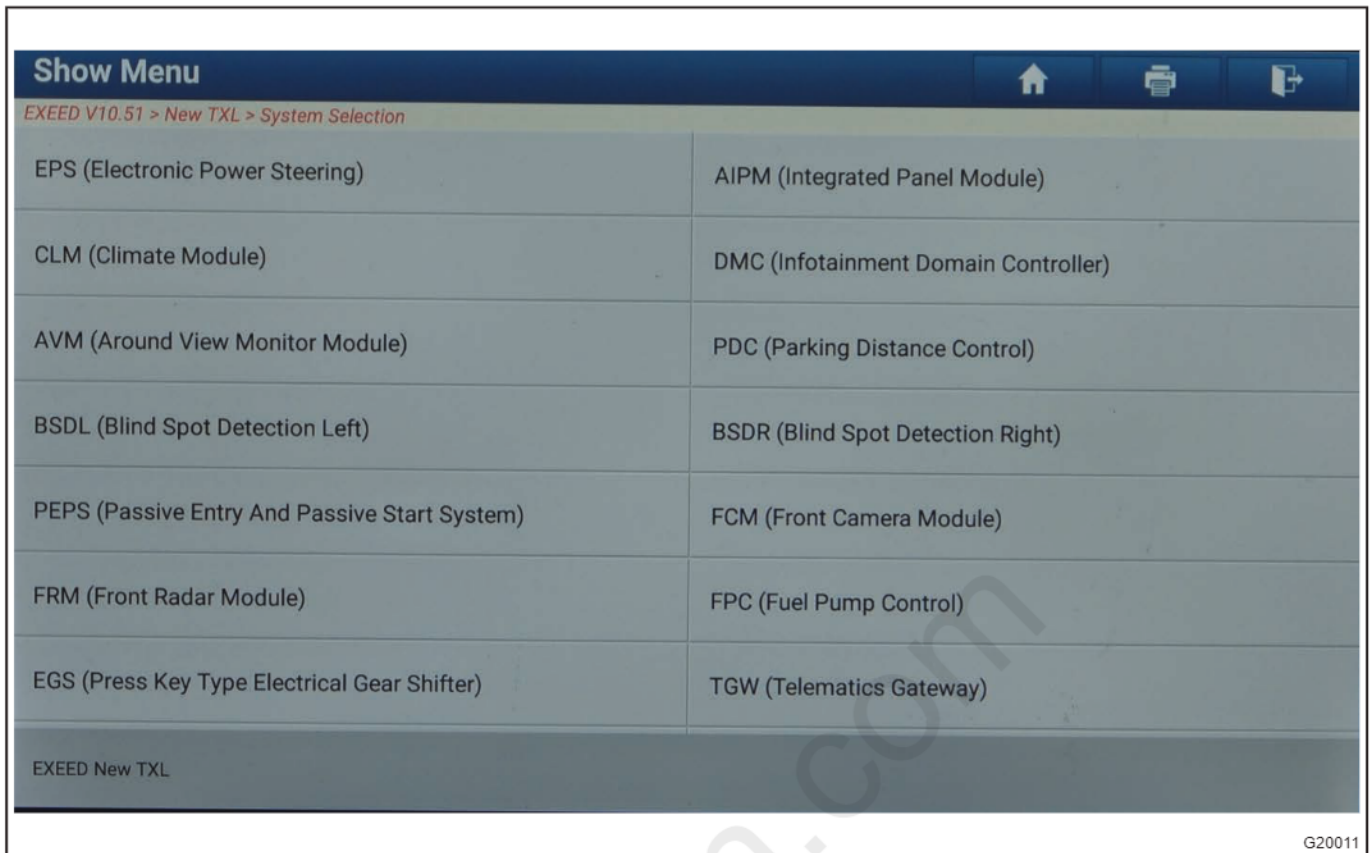
Before performing matching and learning of vehicle module, be sure to carefully read the related precautions and perform the operation strictly according to standard working procedures.

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

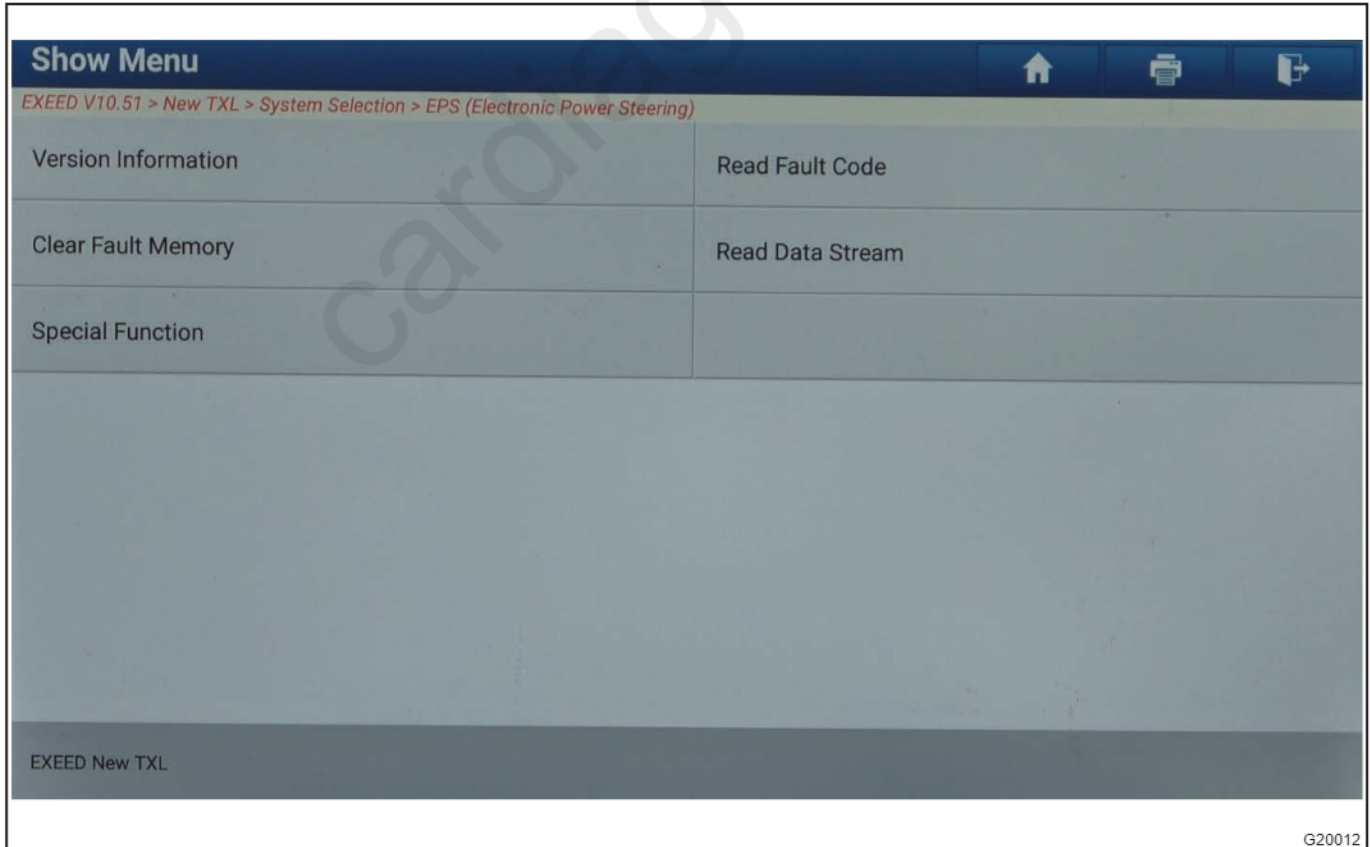
Items	Applicable Situations	Actions Required by Diagnostic Tester	Note
Module replacement	- Module damage - Module failure	Writing VIN code	Relearning steering angle calibration is not necessary when writing VIN code, they are not affected each other.
		Software configuration information writing	
		Steering 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.

3.3 Calibration of Steering Angle

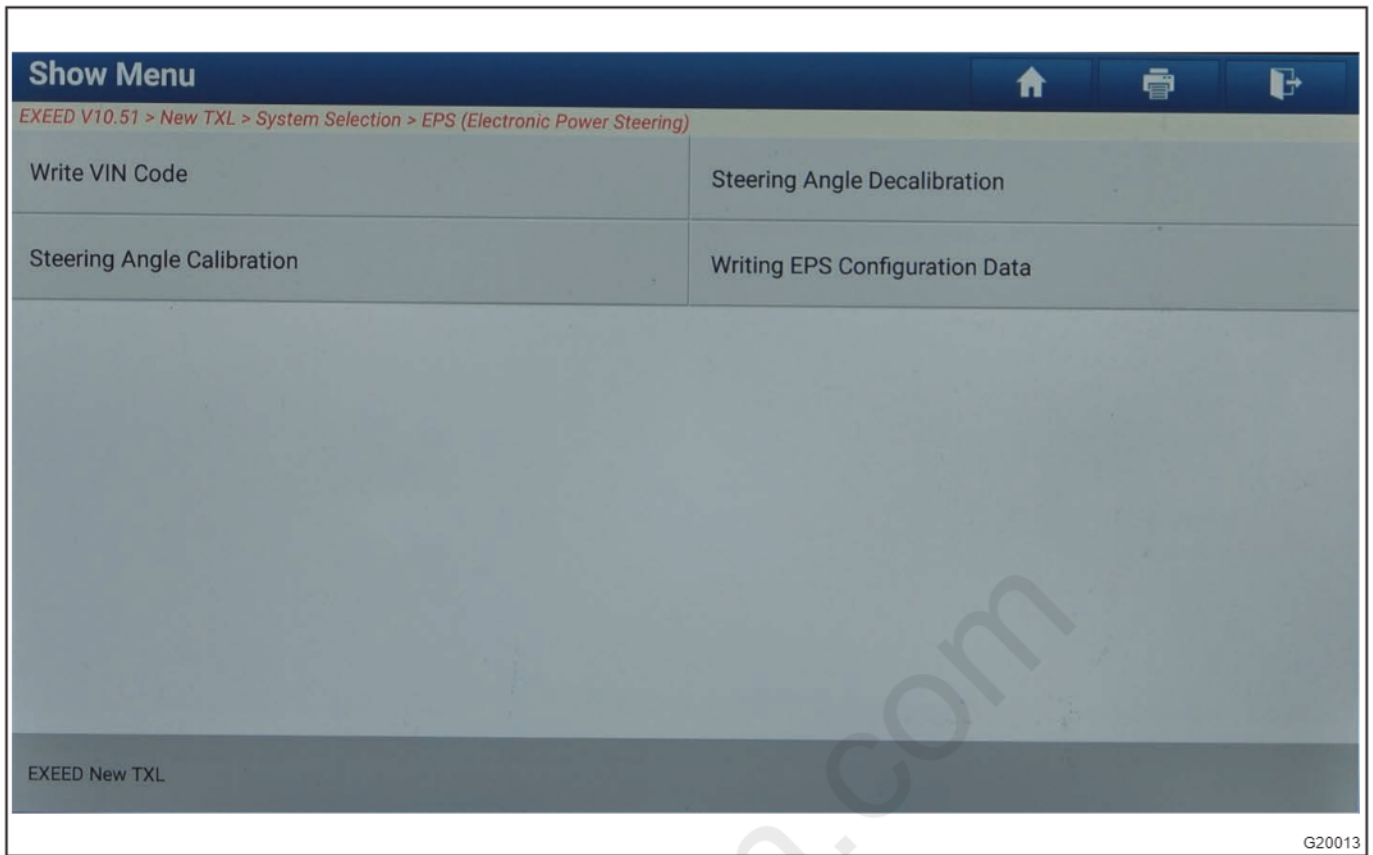
(1) Enter “EPS (Electronic Power Steering)” .



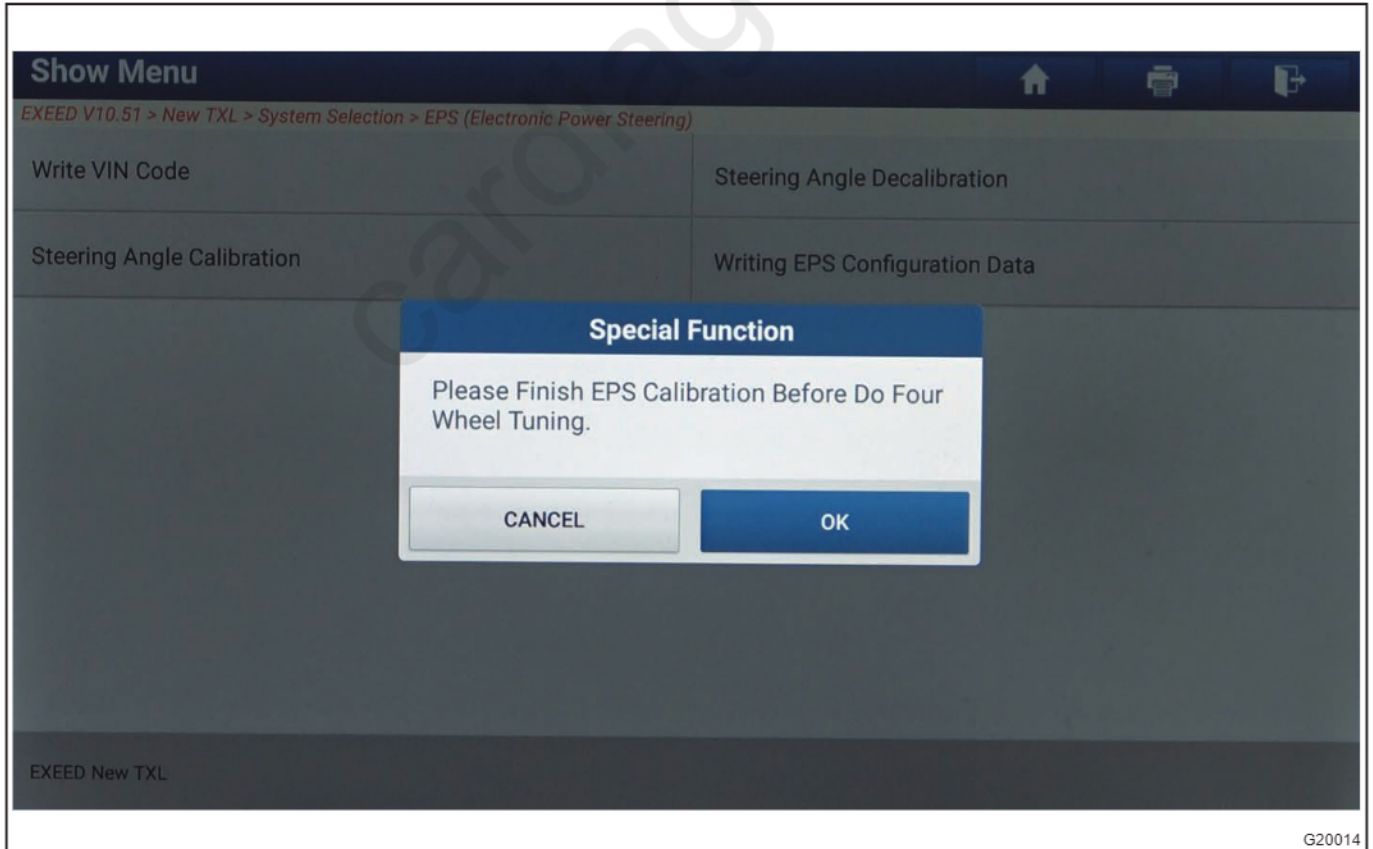
(2) Click “Special Function” .



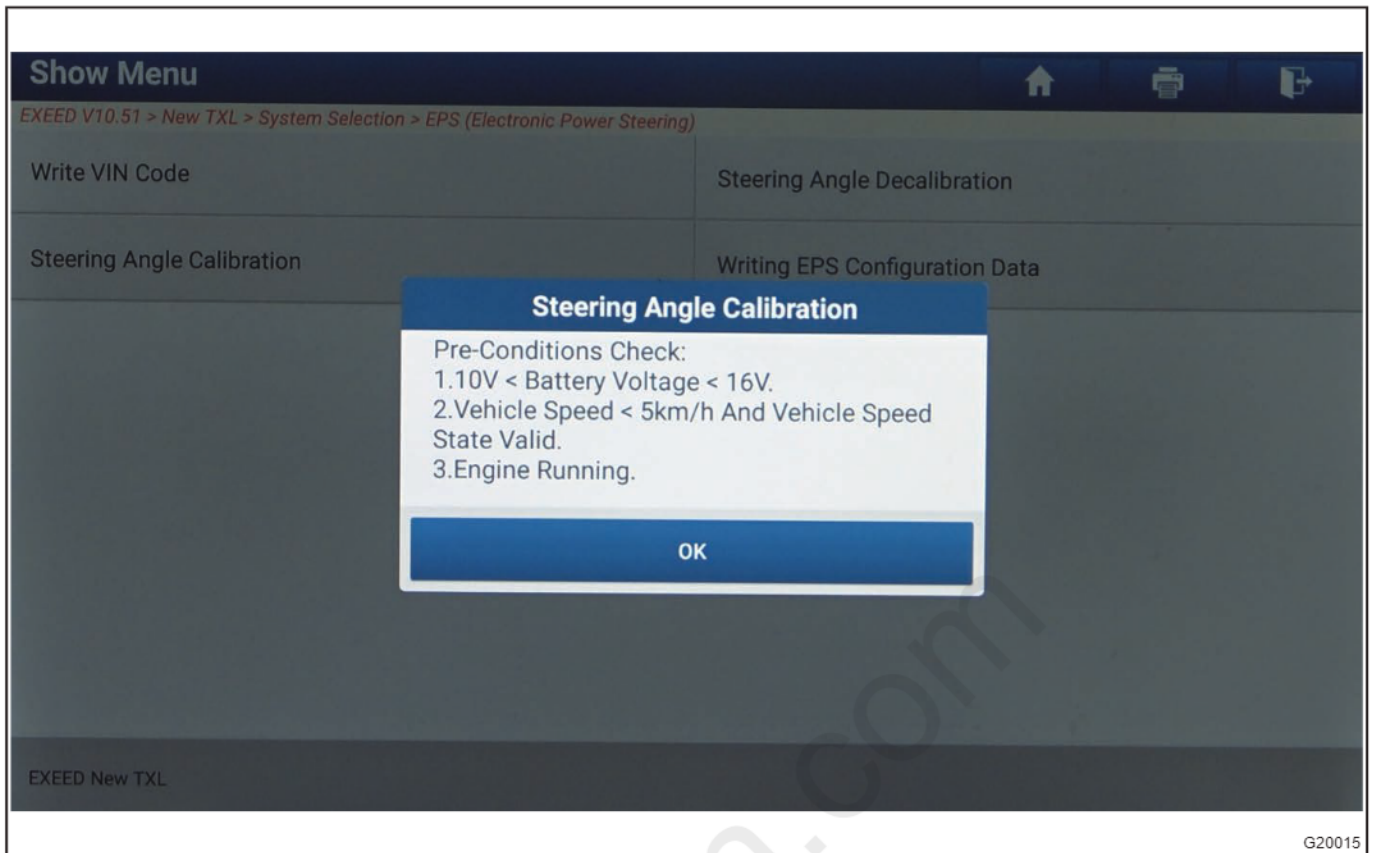
(3) Enter next interface and click “Steering Angle Calibration” .



- (4) “Please Finish EPS Calibration Before Do Four Wheel Tuning.” is prompted, then click “OK” .



- (5) “Calibration Condition Inspection Contents” is prompted, then click “OK” .



- (6) “Steer +/-25 Deg Around The Center Position Forth And Back,Slowly(<200 Deg/S),Then Fix Steering Wheel At Center Position!” is prompted, then click “OK” .



- (7) “Steering Angle Not Calibrated Key Off And Wait For 11 Seconds Without Steering Wheel Movement” is prompted, then click “OK” .

