
STEERING COLUMN MODULE (SCM)

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30.1 STEERING COLUMN MODULE (SCM)

1 Warnings and Precautions

1.1 Precautions

In order to avoid dangerous operation and damage to the vehicle before repair in this section, the following instructions must be observed.

- (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.

1.2 Precautions

In order to avoid dangerous operation and damage to the vehicle before repair in this section, the following instructions must be observed.

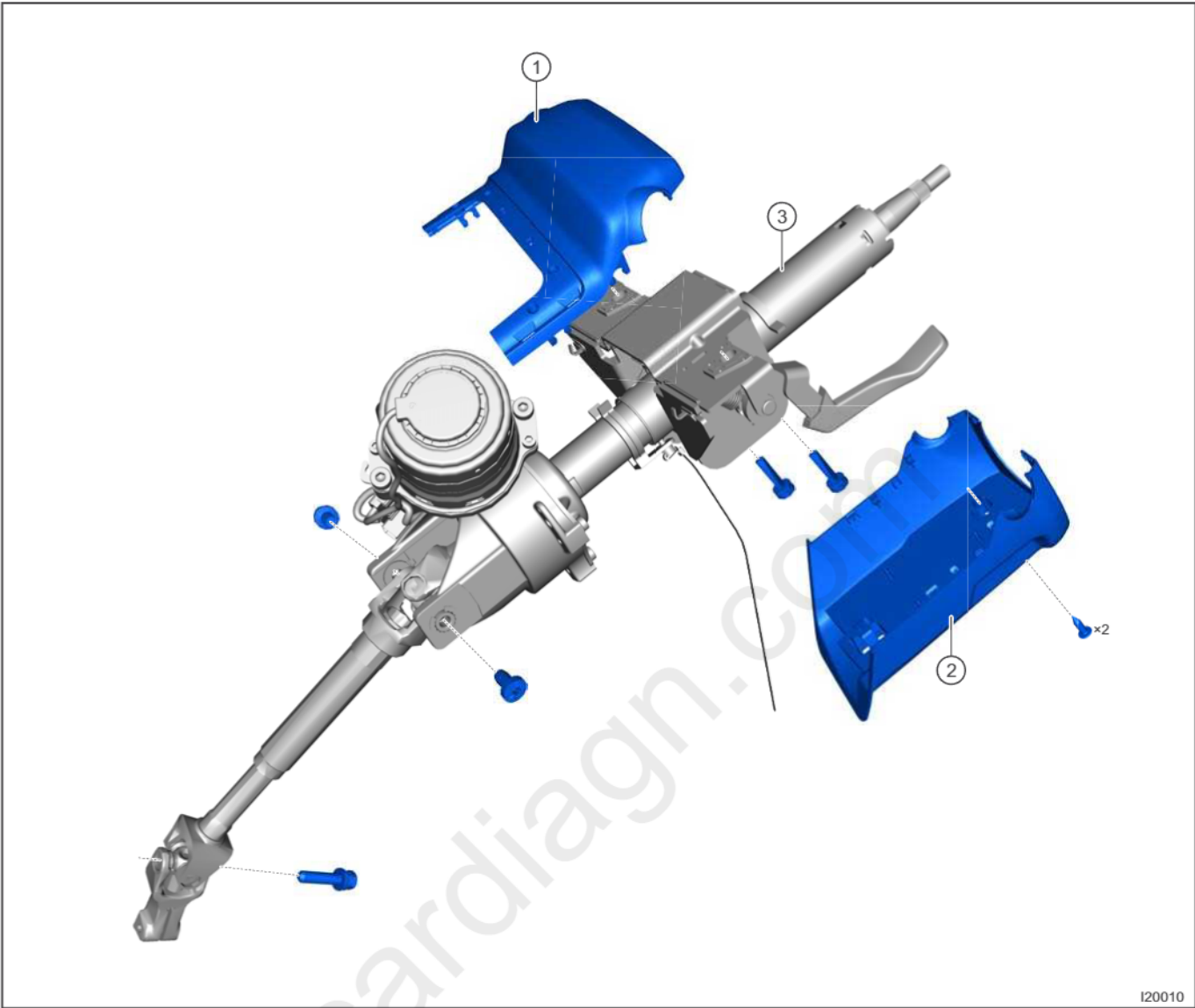
- (1) Wait at least 90 seconds after disconnecting the negative battery cable to prevent airbag and belt pretensioner from being activated.
- (2) Vehicle SAM angle sensor provides angle signal to ESP and other related controllers; Motor position sensor in EPS module provides steering angle signal for 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

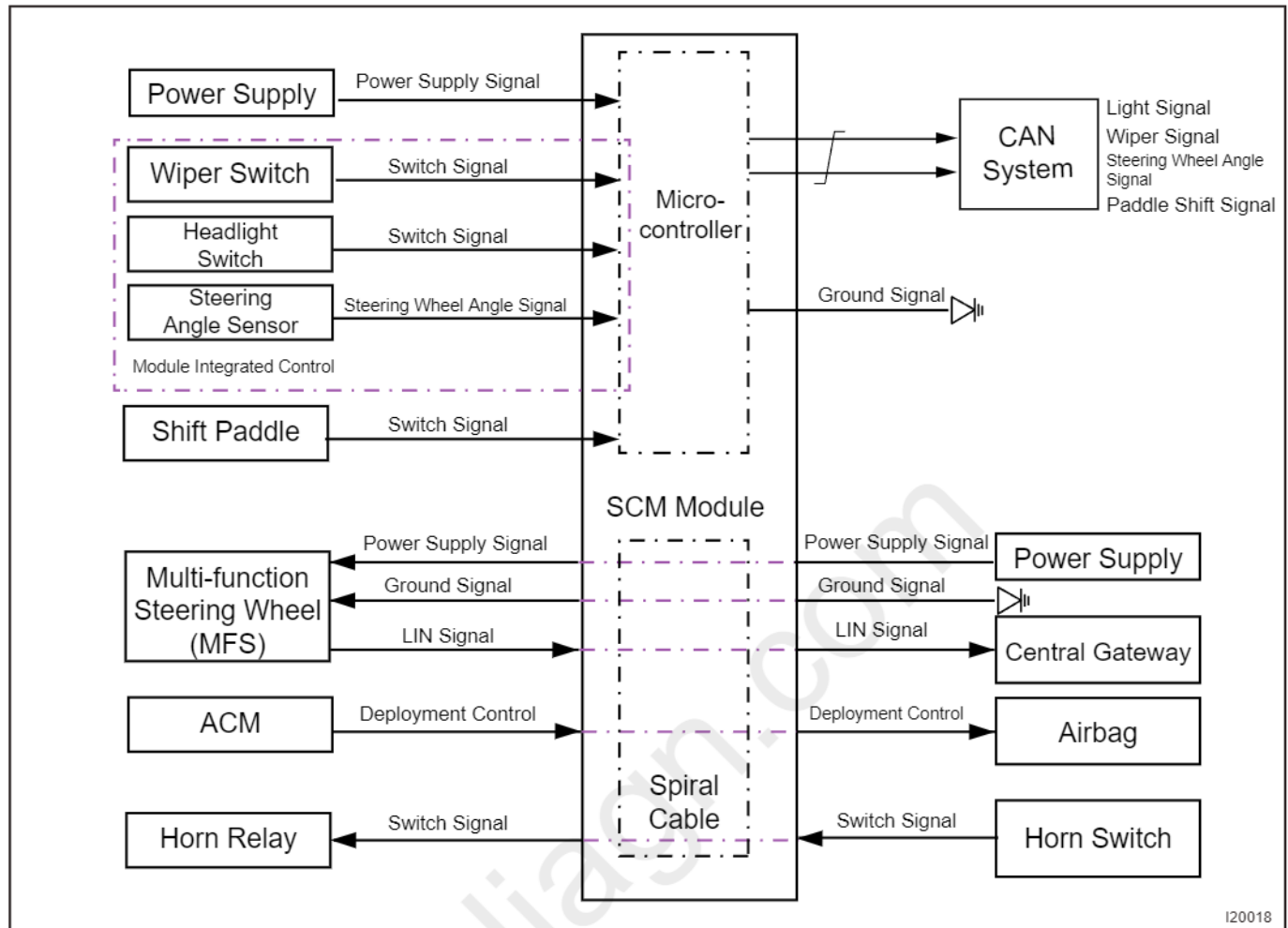
The steering column is the component of the steering system that connects the steering wheel and the steering gear. Through the steering column, the driver transfers torque to the steering gear, which drives the steering gear to achieve steering.

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



The steering column module is integrated inside the combination switch.

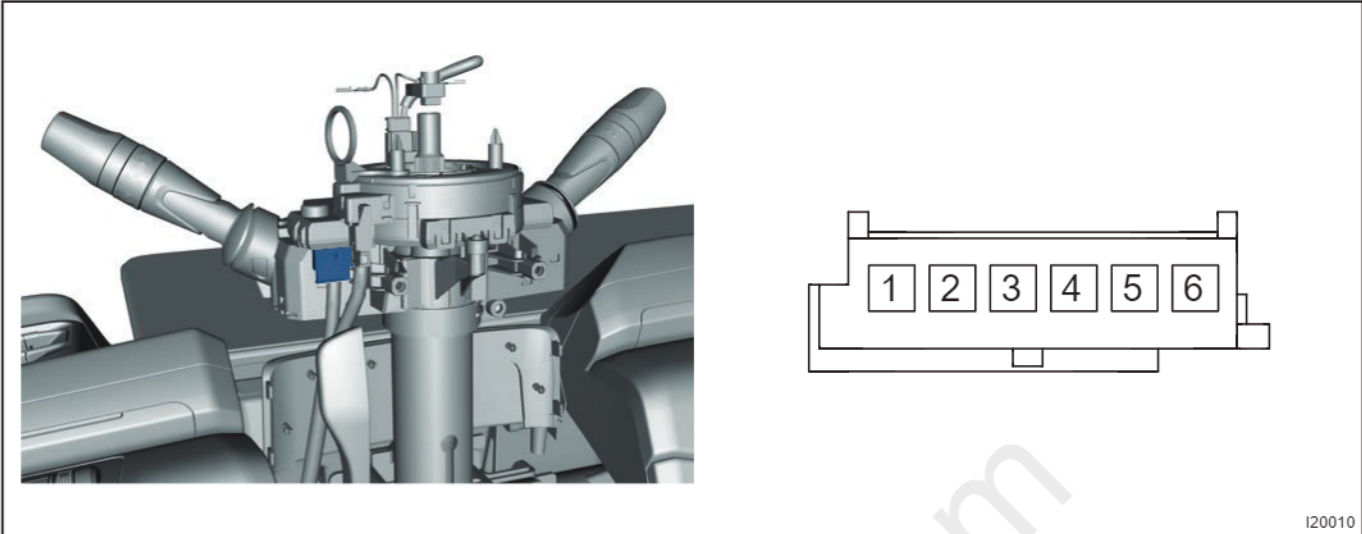
2.4 Component Operation Description

■ Steering angle sensor

The steering angle sensor is used to detect the rotation angle and the steering direction of the steering wheel. Turning the steering wheel to the left or right will be detected by the steering angle sensor, so that the vehicle electronic control unit will send out correct steering command. The rotation angle of the steering wheel provides a basis for vehicle to achieve steering range, so that the vehicle can drive according to driver's steering intention.

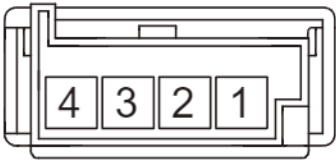
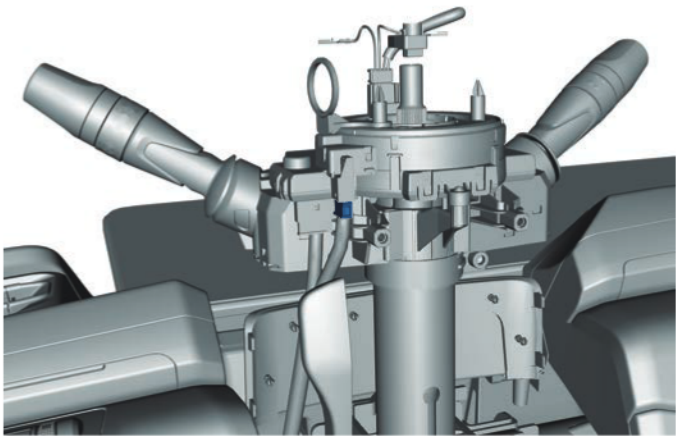
3 System Circuit Diagram

3.1 Module Terminal Definition



Steering column module lower connector (6 PIN)

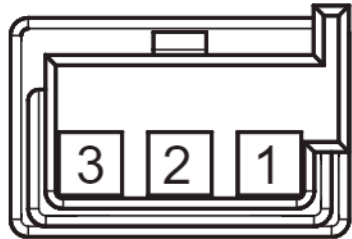
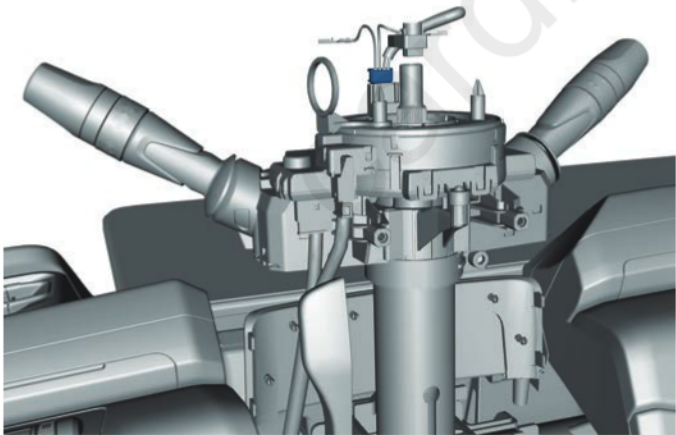
Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Positive (+) of Multimeter	Negative (-) of Multimeter			
1	Body ground	Battery +	Power supply "ON"	12 V
2	/	/	/	/
3	Body ground	CAN L	Power supply "ON"	2.3 V
4	Body ground	CAN H	Power supply "ON"	2.7 V
5	Body ground	Multi-function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



I20010

Steering column module lower connector (4 PIN)

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

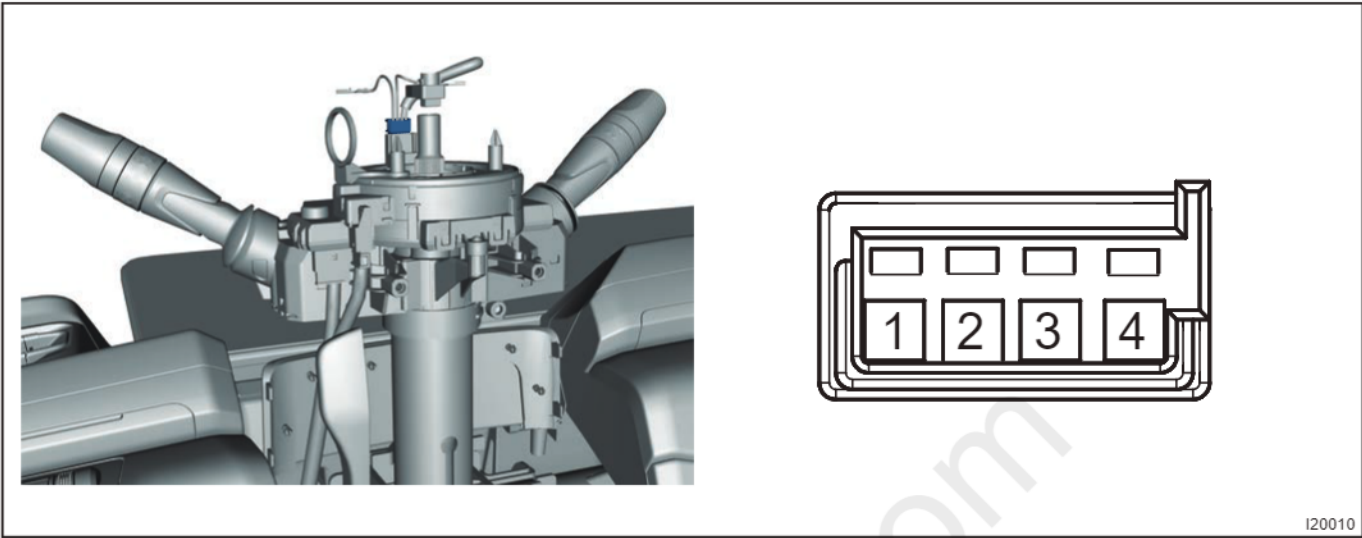


I20010

Steering column module upper connector (3 PIN)

Terminal Inspection		Terminal Definition	Detection Condition	Measured Value
Positive (+) of Multimeter	Negative (-) of Multimeter			
1	Body ground	Power supply	Power supply "ON"	12 V

2	Body ground	LIN	Power supply “ON”	7.7 V
3	Body ground	GND	Power supply “ON”	0 V

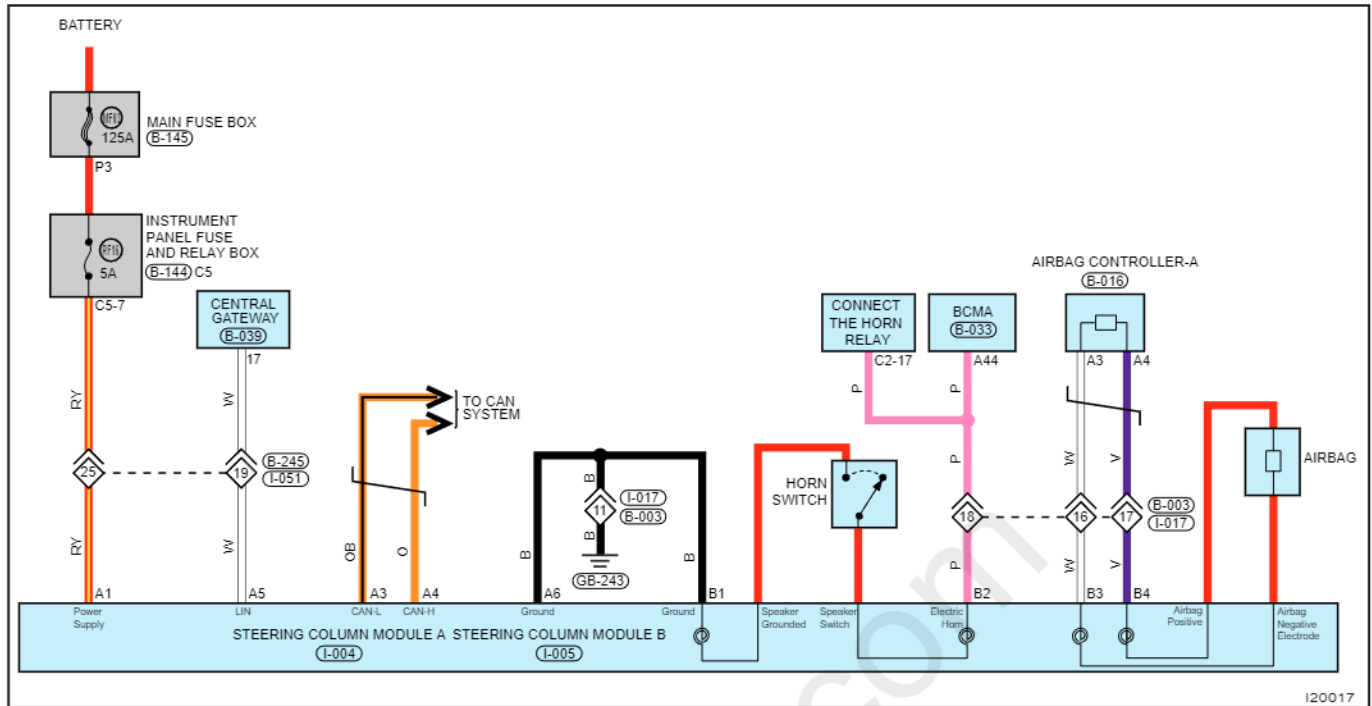


I20010

Steering column module upper connector (4 PIN)

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

3.2 Circuit Diagram



4 Diagnostic Information and Steps

4.1 Problem Symptoms Table

Hint:

Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair, replace or adjust faulty components as necessary.

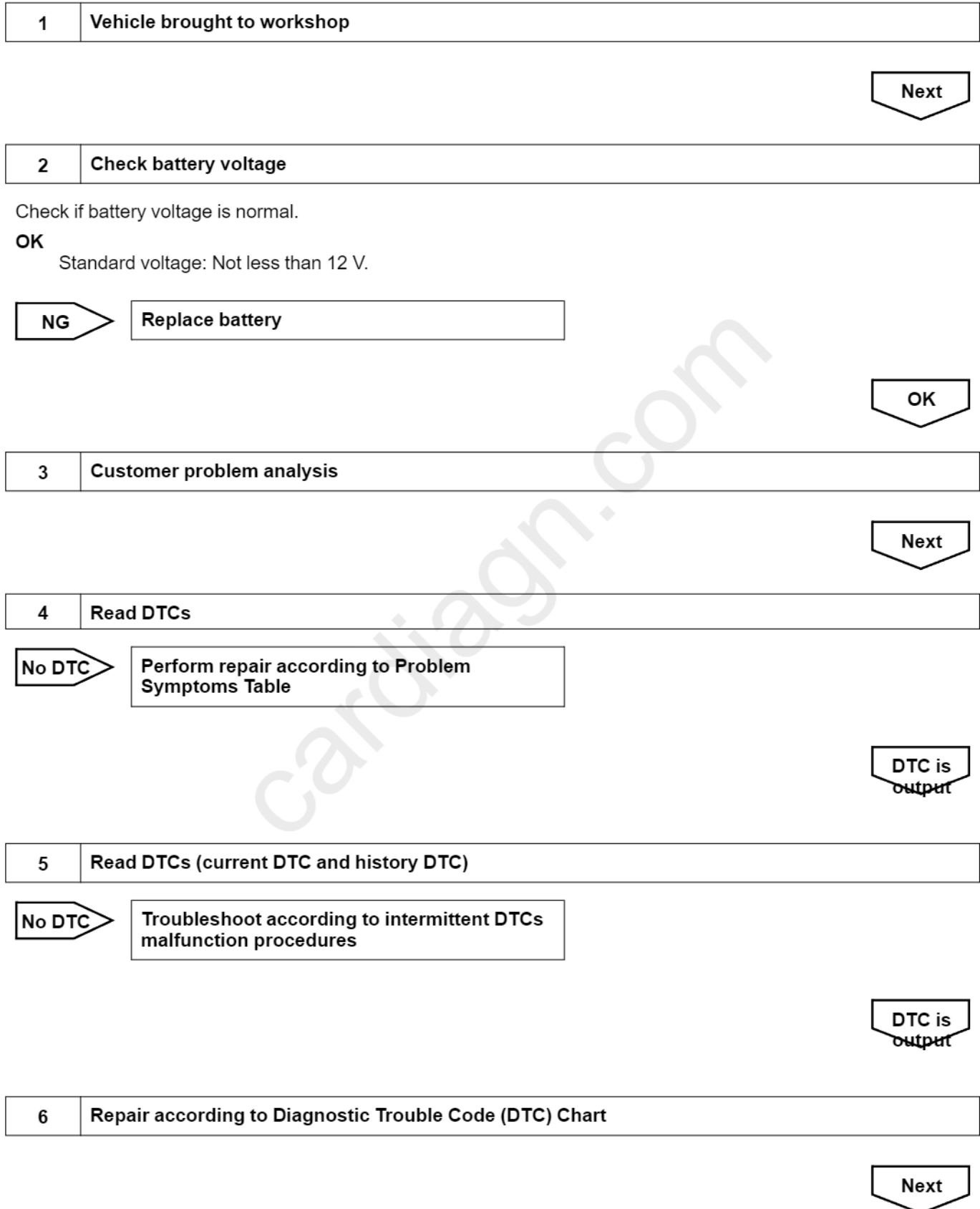
Brake control system:

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 Diagnosis Procedure

Hint:

Use following procedures to troubleshoot steering column module (SCM).



7	Adjust, repair or replace
---	---------------------------

Next

8	Conduct test and confirm malfunction has been repaired
---	--

Next

End

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 the diagnostic tester (the latest software).
- Turn ENGINE START STOP switch to ON.
- Use the diagnostic tester to record and clear DTCs stored in the system.
- Turn ENGINE START STOP switch to OFF and wait several seconds.
- Turn ENGINE START STOP switch to ON and check the DTCs in system again.
- If DTC is detected, it indicates current malfunction.
- If no DTC is detected, malfunction indicated by the DTC is intermittent.

4.4 Intermittent DTC Troubleshooting

If malfunction is intermittent, perform the followings:

- 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.
- 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.

4.5 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.

4.6 Diagnostic Trouble Code (DTC) Chart

■ SCM Power Supply Part DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12A017	ECU Power Supply Voltage Above Threshold	1. Microcontroller is not in calibration state. 2. SCM is awake.	1. Power system voltage is too high; 2. Wiring harness connector failure; 3. SCM failure.	1. Check whether power supply voltage is in effective range (9 - 16 V). 2. Check wire harness. 3. Clear DTC and test again. If DTC still exists, replace SCM.
B12A116	ECU Power Supply Voltage Below Threshold	1. Ignition signal state is not in "start" state. 2. Microcontroller is not in calibration state. 3. SCM is awake	1. Power system voltage is too low; 2. Wiring harness connector failure; 3. SCM failure.	

■ SCM Light Part DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12A214	Turn Light Switch Short to GND	1. Voltage condition is in valid range (9 - 16 V). 2. Microcontroller is not in calibration state. 3. SCM is awake	1. Wire harness connector failure; 2. SCM failure.	1. Check whether power supply voltage is in effective range. 2. Check wire harness. 3. 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			
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	1. Voltage condition is in valid range (9 - 16 V). 2. Microcontroller is not in calibration state. 3. SCM is awake	1. Wire harness connector failure; 2. SCM failure.	1. Check whether power supply voltage is in effective range. 2. Check wire harness. 3. 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			
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	1. Voltage condition is in valid range (9 - 16 V). 2. Microcontroller is not in calibration state. 3. SCM is awake	1. Wire harness connector failure; 2. SCM failure.	1. Check whether power supply voltage is in effective range. 2. Check wire harness. 3. Clear DTC and test again. If DTC still exists, replace SCM.
B12B061	Steering Angle Sensor Algorithm Based Failures			
B12B185	Steering Angle Sensor Overflow			

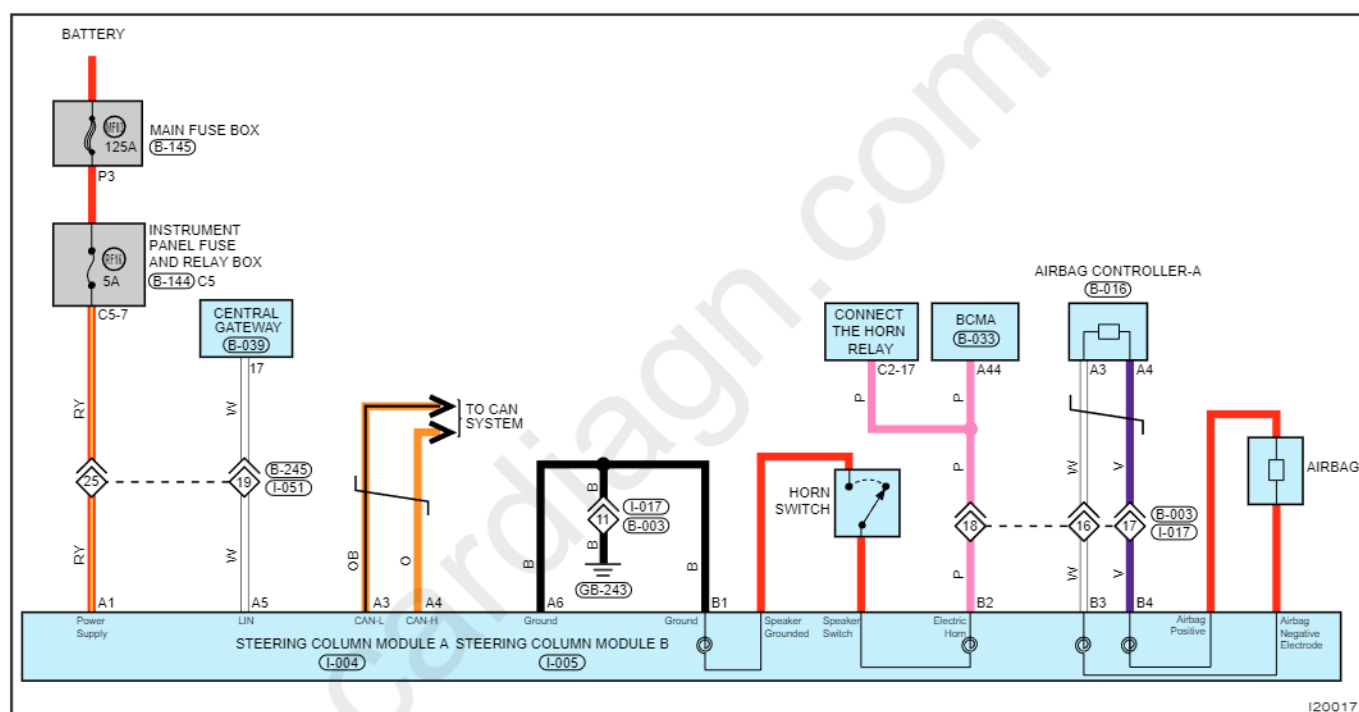
■ SCM Control Part DTC

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B12B292	Control Module Program Memory Failure	1. Voltage condition is in valid range (9 - 16 V). 2. Microcontroller is not in calibration state. 3. SCM is awake	1. Wire harness connector failure; 2. SCM failure.	1. Check whether power supply voltage is in effective range.
B12B3A3	Control Module Data Memory Failure			2. Check wire harness.
B12B4A0	Calibration Parameter Memory Failure			3. Clear DTC and test again. If DTC still exists, replace SCM.
B12B5B8	SCM Zero Calibration			1. Check whether power supply is in effective range. 2. Check wire harness. 3. Clear DTCs, perform zero point calibration.

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

■ Circuit Diagram



■ Description

⚠ Caution

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

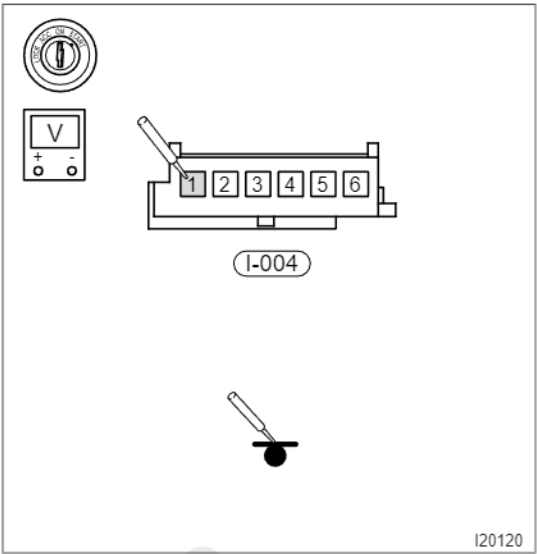
1 Inspect power supply voltage

- Turn ENGINE START STOP switch to OFF.
- Disconnect steering column module connector I-004.
- Turn ENGINE START STOP switch to ON.

(d) Using voltage band of digital multimeter, measure voltage between I-004 (1) and body ground.

Standard Condition

Multimeter Connection	Condition	Normal Condition
I-004 (1) - Body ground	ENGINE START STOP switch "ON"	9 - 16 V



Result

Result	Go to
OK	A
NG	B

B

Repair or replace power supply wire harness

A

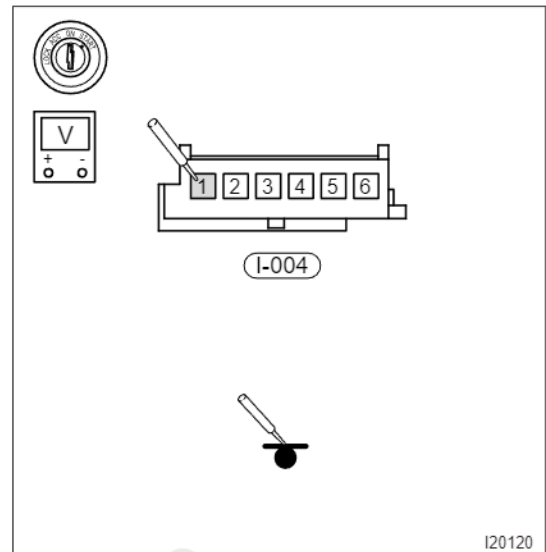
2	Check wire harness
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- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect steering column module connector I-004.

- (c) Using ohm band of multimeter, check for continuity between I-004 (1) and ground.

Check for short

Multimeter Connection	Condition	Normal Condition
I-004 (1) - Body ground	ENGINE START STOP switch "OFF"	∞



Result

Result	Go to
OK	A
NG	B

B	Repair or replace faulty wire harness
----------	---------------------------------------

A

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

Result

Go to
OK
NG

OK	System operates normally
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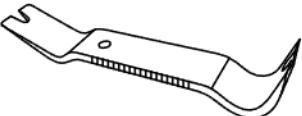
NG

Replace SCM module

cardiagn.com

30.2 ON-VEHICLE SERVICE

1 Tool

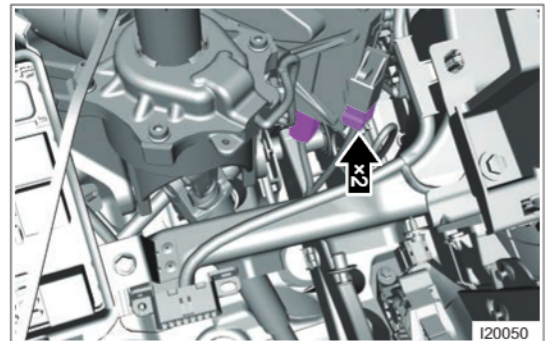
Tool Name	Tool Drawing
Interior Crow Plate	 S00020

2 Replacement of Steering Column with Intermediate Shaft Assembly

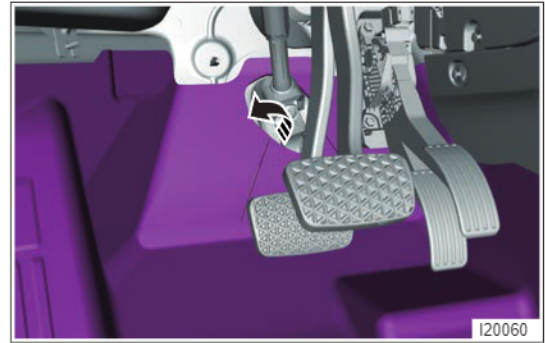
2.1 Removal

Procedures listed below are removal procedures for electronic steering column.

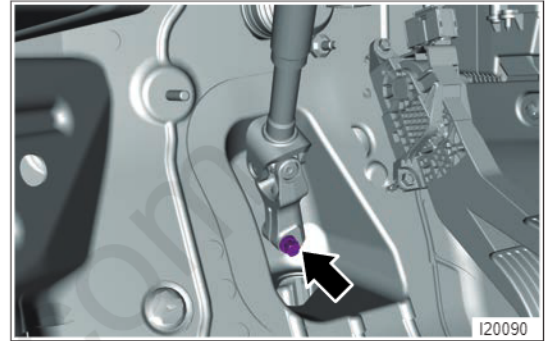
- (1) Set the steering wheel to straight-ahead position.
- (2) Turn off all electrical equipment and ENGINE START STOP switch.
- (3) Disconnect the negative battery cable.
- (4) Remove the driver airbag assembly.
- (5) Remove the steering wheel assembly.
- (6) Remove the combination switch cover.
- (7)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



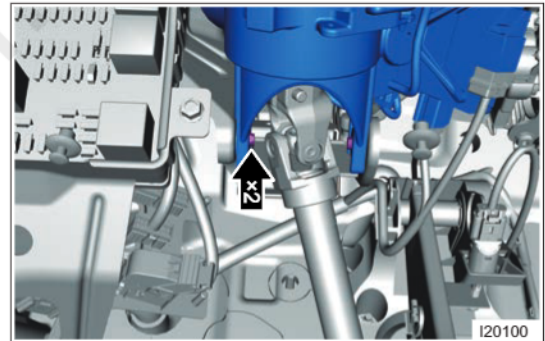
- (10) Turn over carpet under driver seat in the direction of arrow.



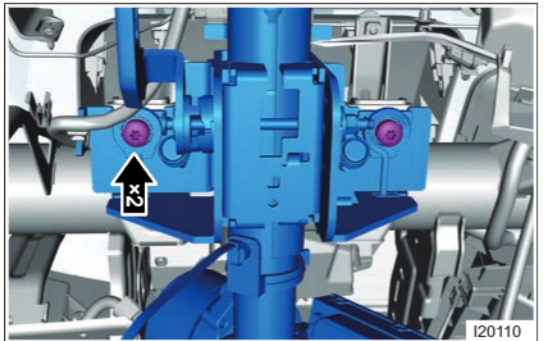
- (11) Remove coupling bolt between steering column with intermediate shaft assembly and steering gear input shaft.



- (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, cracks 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 ± 2 N·m
- (3) Install 2 fixing bolts to steering column lower bracket.
Torque: 25 ± 2 N·m
- (4) Install coupling bolt between steering column with intermediate shaft assembly and steering gear input shaft.
Torque: 40 ± 3 N·m
- (5) Place the carpet under driver seat in a suitable position.
- (6) Connect 2 connectors of 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.

3 Steering Column Module

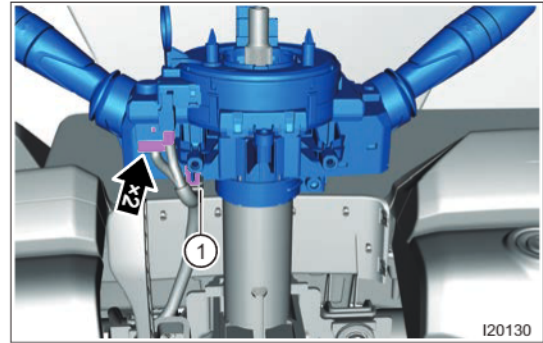
3.1 Removal

Caution

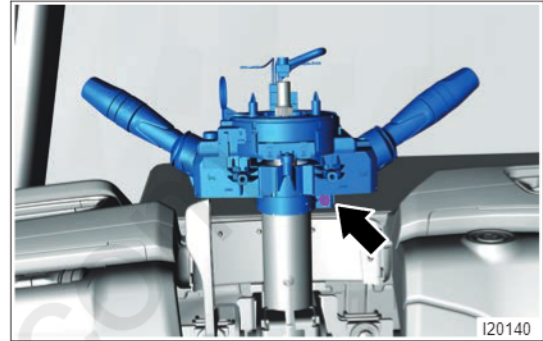
- Be sure to wear necessary safety equipment to prevent accidents, when removing steering column module.
- Appropriate force should be applied when removing steering column module. Be careful not to operate roughly.
- Try to prevent interior and body paint surface from being scratched when removing steering column module.
- Disconnect the negative battery cable for more than 90 s 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 disengage wire harness clip (1).



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



■ Inspection

⚠ Caution

- 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.

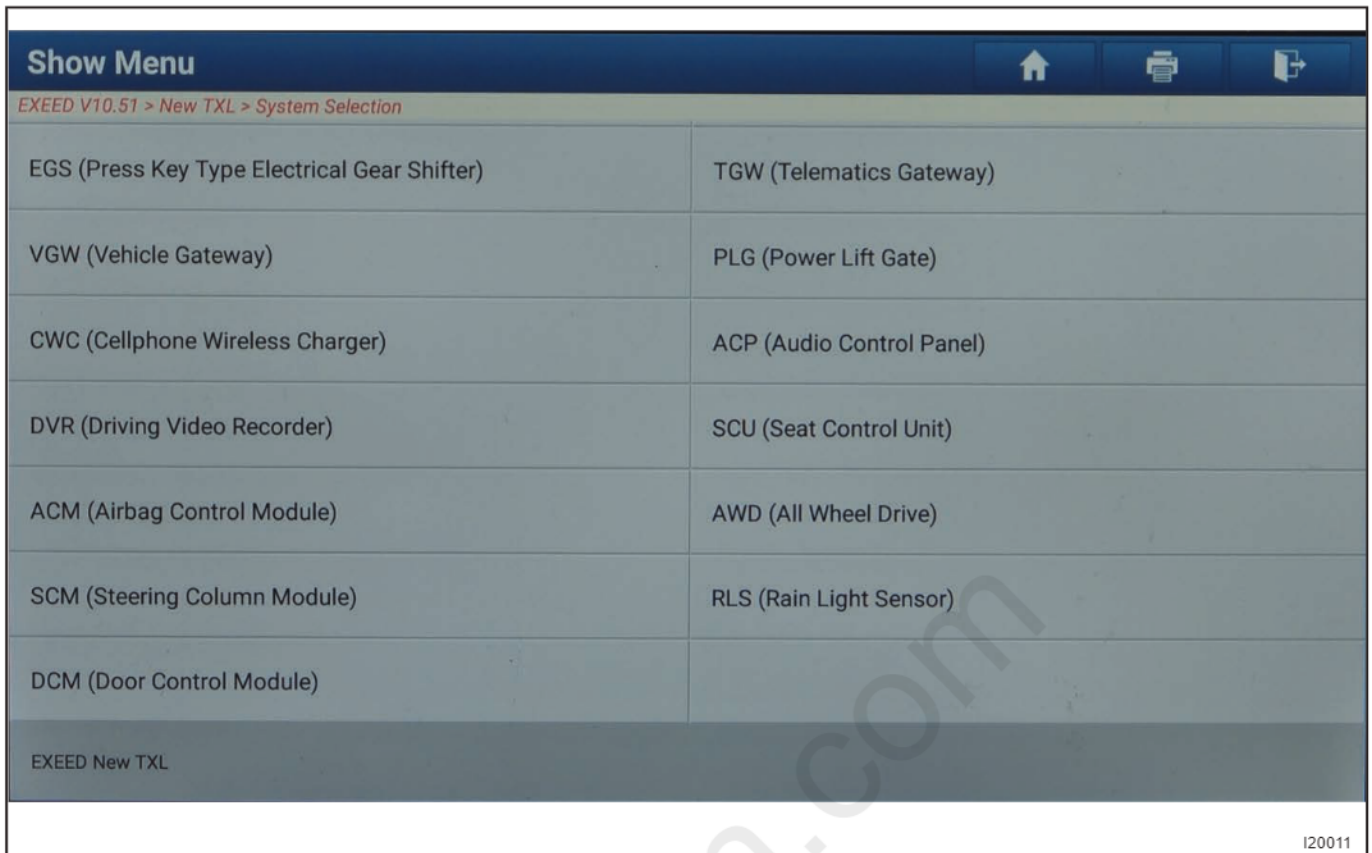
- (1) Install 1 fixing screw to steering column module.
- (2) Install connector to steering column module.
- (3) Install the combination switch lower cover assembly.
- (4) Install the steering wheel assembly.
- (5) Install the driver airbag.
- (6) Connect the negative battery cable.

3.2 Steering Angle Sensor Zero Point Calibration

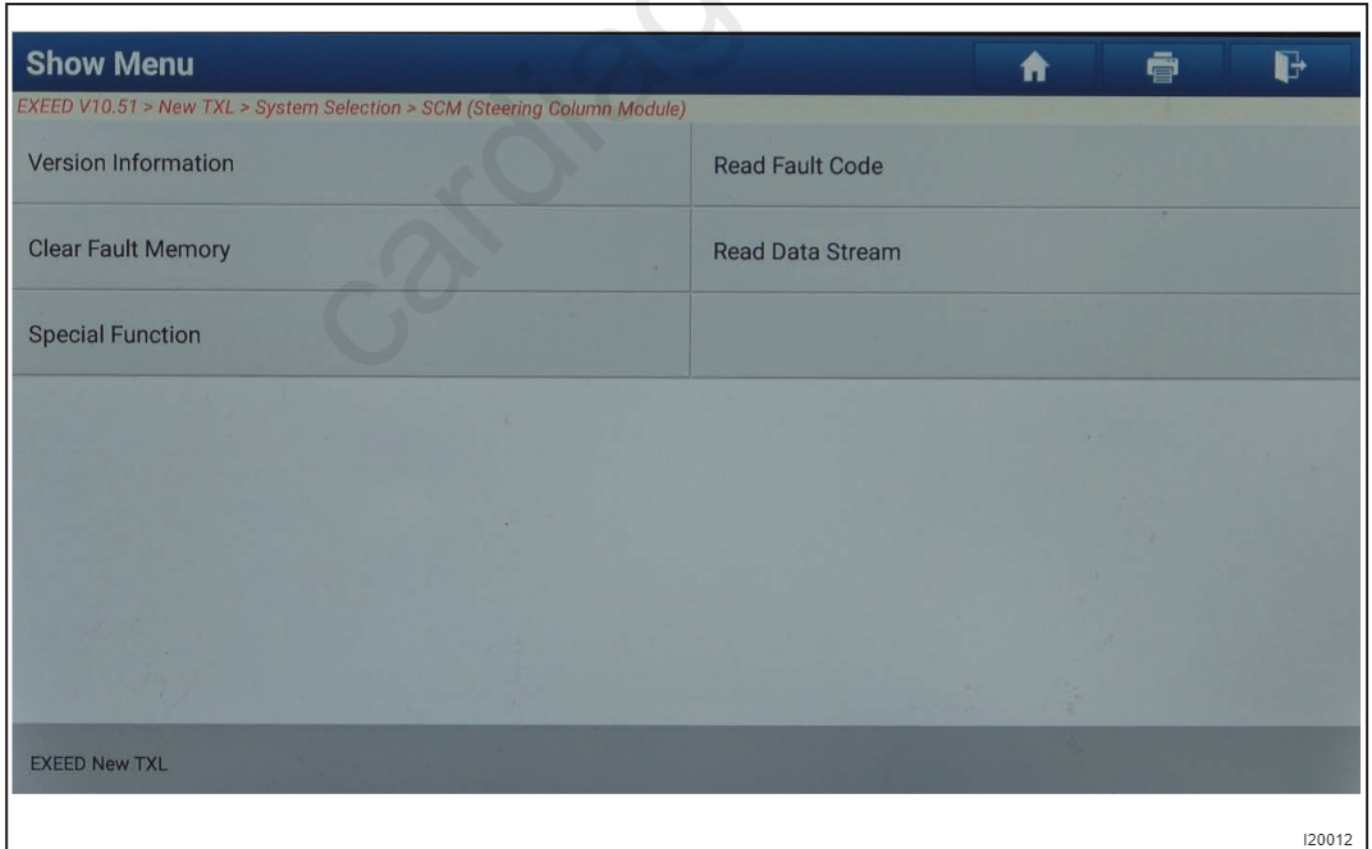
⚠ Caution

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.

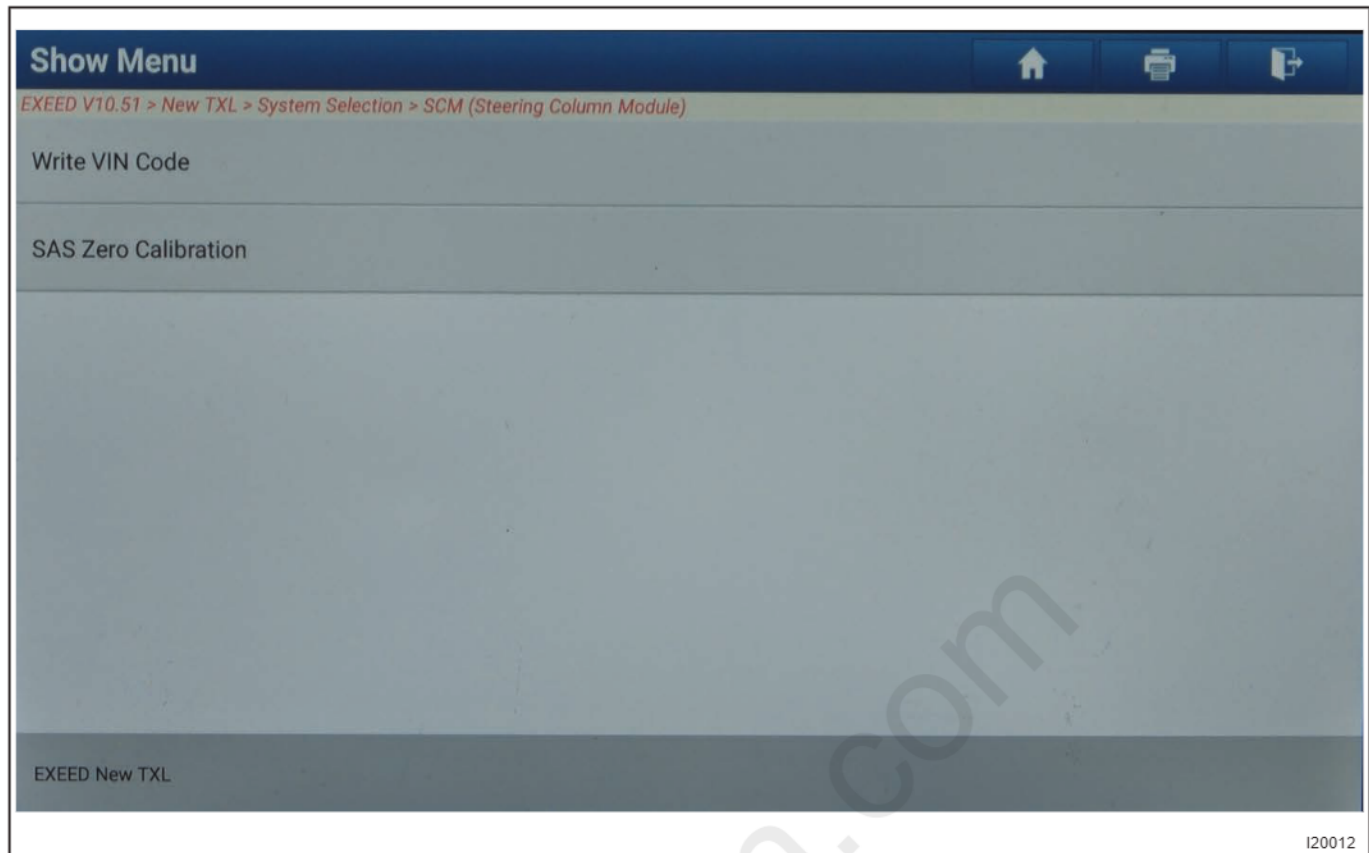
- (1) Enter "SCM (Steering Column Module)".



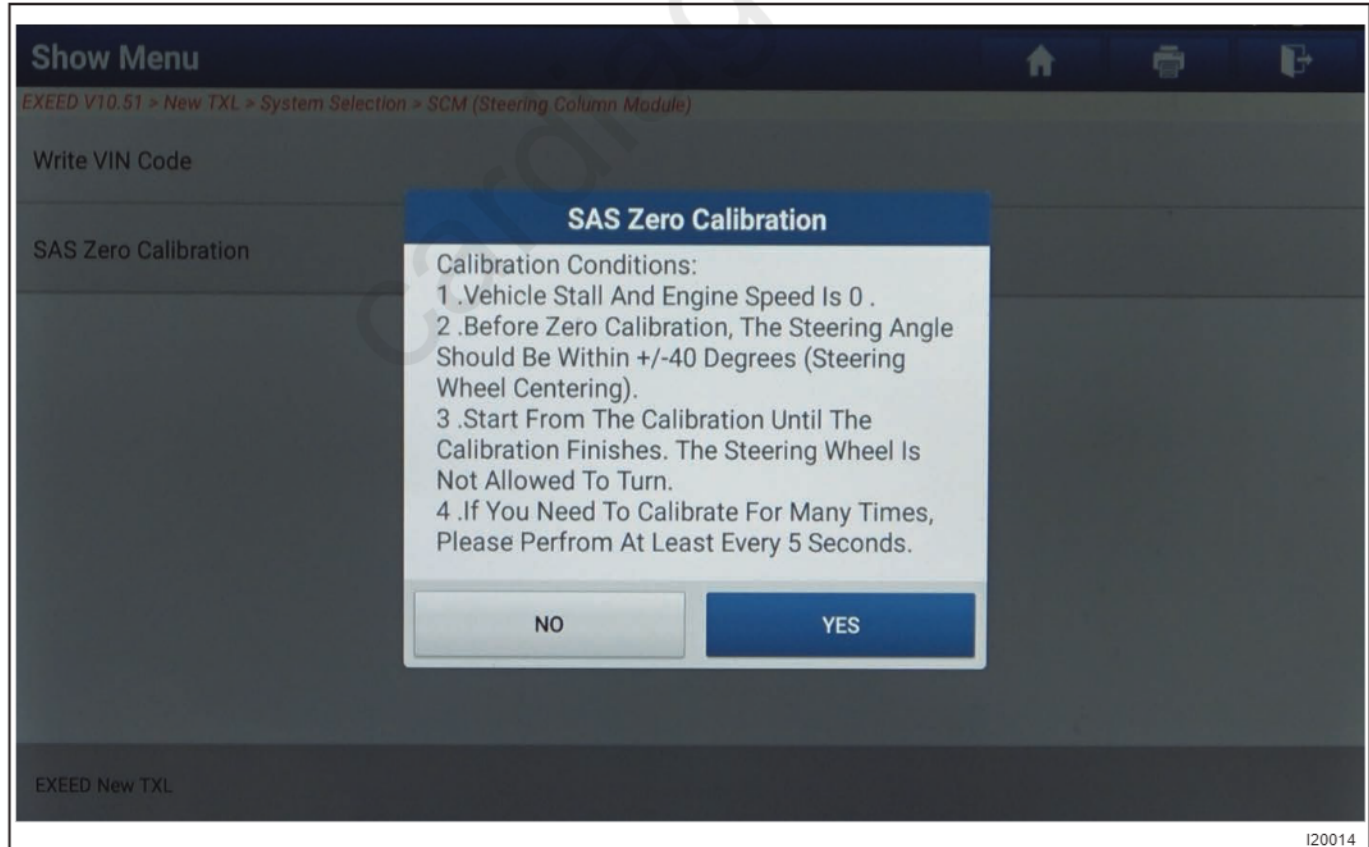
(2) Click "Special Function" .



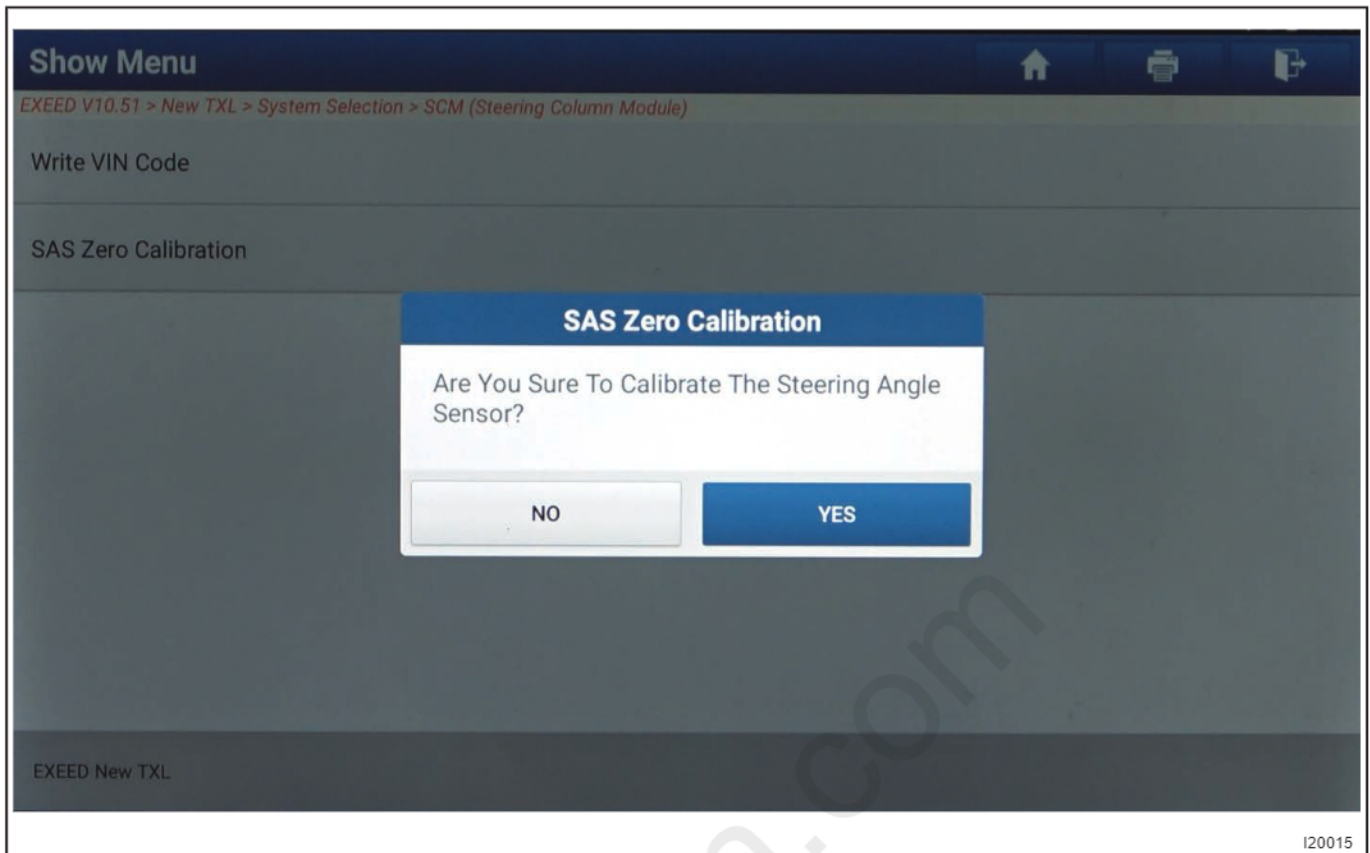
(3) Enter next interface and click "SAS Zero Calibration" .



(4) It shows: "Calibration Conditions" . Then click "YES" .



(5) It shows: "Are You Sure To Calibrate The Steering Angle Sensor?" . Then click "YES" .



(6) It shows: "SAS Zero Calibration Successfully! ". Then click "OK" .

