
BODY ELECTRICAL

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38.1 Blind Spot Monitoring System

1 System Overview

1.1 System Description

During actual driving, due to the blind spots on both sides of the vehicle, the driver may not pay attention to or fail to observe the situation in the side lane when changing lanes and overtaking, which may cause an accident. The blind spot detection system assists the driver to drive safely, which does not belong to vehicle driving safety system and cannot replace driver's control. It is only used to supplement the deficiencies of inside and outside rear view mirrors, and cannot replace the inside and outside rear view mirrors.

- The Blind Spot Detection System (BSD) consists of 2 24G millimeter wave radar sensors, 2 millimeter wave radar sensor shields, 2 millimeter wave radar sensor brackets and 2 warning lights.
- The millimeter wave radar sensor is responsible for the alarm strategy and sends out an alarm signal. The shield of millimeter wave radar sensor absorbs the clutter signal reflected from multipath.
- The millimeter wave radar sensor bracket is used to install the sensor and must meet the installation specifications.
- The warning light is used to prompt the driver for warning information of blind spots.

■ System Self-check

The radar system malfunction warning function means that the system will perform self-check every time it is powered on. When the radar system controller detects that the system is faulty, it will send out the visual and audible warning to notify the driver, and record the corresponding diagnostic trouble code.

■ Detection Target

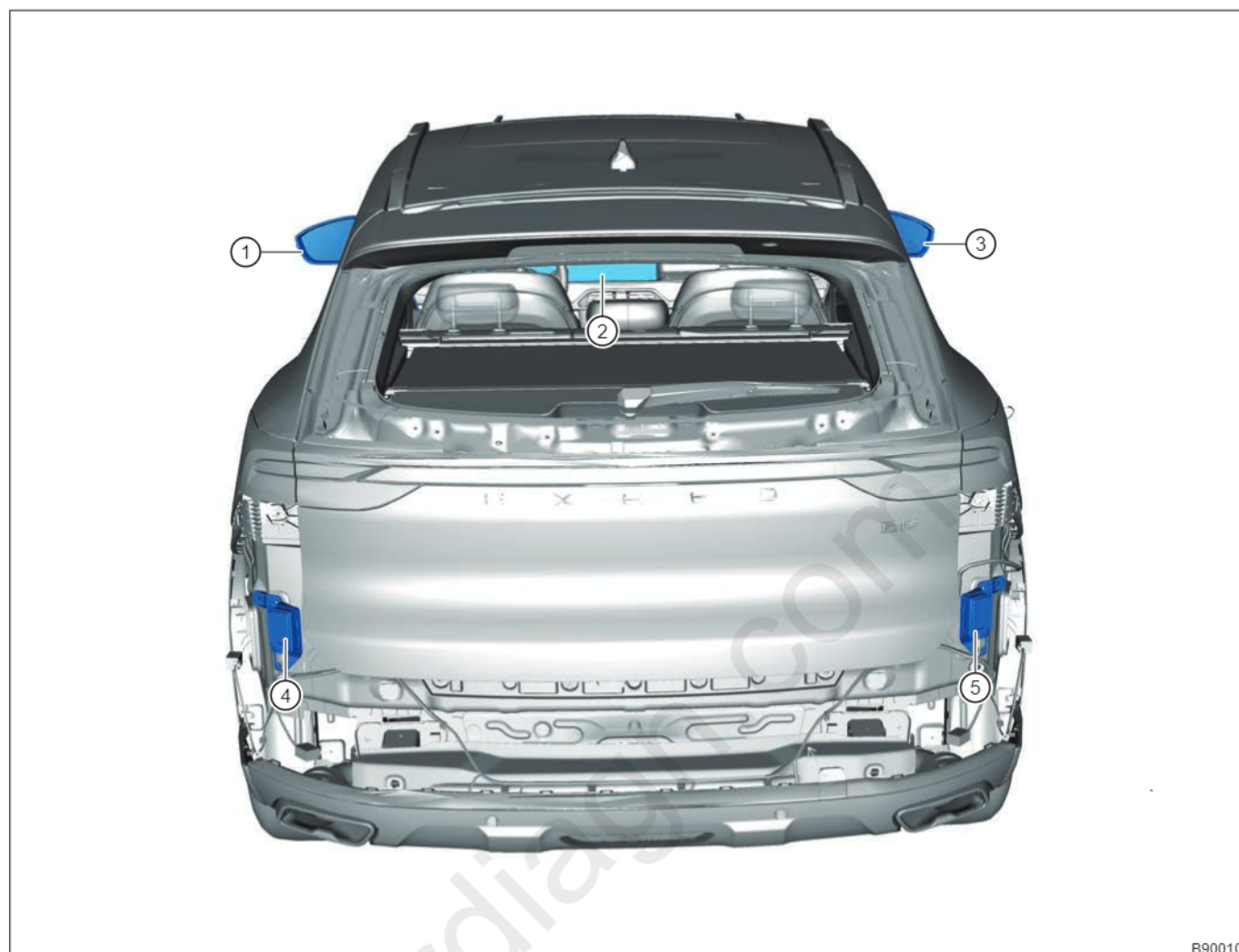
Detection target: Car, truck, motorcycle, bicycle. Because the reflection cross-sectional areas of motorcycle and bicycle are relatively small, the detection distance will be shorter than that of car and truck. The blind spot detection system does not alarm for stationary objects, and the minimum detection speed is 5 km/h. The blind spot detection function does not give an alarm to the stationary target in the alarm area. Such as stopped vehicles, vegetation, guardrails, tunnels, etc.

■ System Alert Level

When the alarm conditions are met, the blind spot detection system prompts the alarm through visual and sound methods. The alarm level is divided into two levels:

- Level 1, the measured target meets the alarm conditions, the first level alarm, the warning light remains ON to reminding the driver to drive carefully.
- Level 2, the measured target meets the alarm conditions, the driver turns on the corresponding side turn signal light, the second level alarm, to remind the driver of the risk of lane change with flashing and warning sound.

1.2 Description



B90010

1	Left LED Light	2	Hyperscreen
3	Right LED Light	4	Master Blind Spot Detection Module
5	Sub Blind Spot Detection Module		

1.3 System Principle

The control module is integrated inside the radar sensor. The radar communicates with the vehicle network through CAN bus. The communication between left radar sensor and right radar sensor is carried out through private CAN. BSDL receives vehicle speed signal, ignition switch status signal, turn signal light switch, yaw rate sensor data, steering wheel position signal, background light status, light intensity, wheel speed signal (- four wheels), gear position signal through CAN, and transmit the warning information to instrument cluster through CAN network. BSDR receives vehicle speed signal, ignition switch status signal, turn signal light switch, yaw rate sensor data, steering wheel position signal, background light status, light intensity, wheel speed signal (four wheels), gear position signal through CAN, and transmit the warning information and warning stop information to instrument cluster through CAN network.

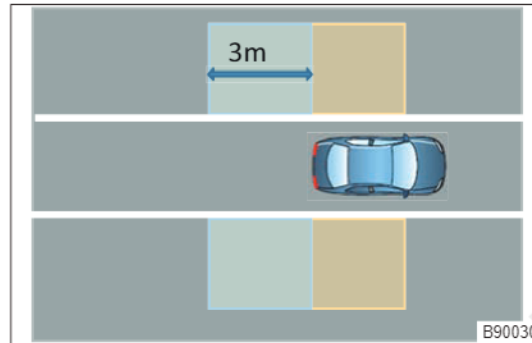
1.4 System Function

Blind spot radar needs to implement the following functions: Blind Spot Detection (BSD), Lane Change Assist (LCA), Rear Cross Traffic Alert (RCTA), Door Opening Warning (DOW), Close Vehicle Warning (CVW) when moving forward, Rear Collision Warning (RCW) when reversing. Lane change assist function, blind spot

detection function, front door opening warning function, reversing lateral warning function, and reversing rear collision warning function share warning lights and buzzers. The rear door opening warning function enables the LED lights on rear door, and the rear collision warning uses the turn signal light to alert target vehicle driver when moving forward.

■ Blind Spot Detection (BSD)

Blind spot detection function: If there is a moving vehicle in the driver's blind spot area, the system will provide warning information. The blind spot detection function is designed to assist driver to drive safely, which does not belong to vehicle driving safety system. Therefore, it only used to supplement the deficiencies of inside and outside rear view mirrors, not to replace the inside and outside rear view mirrors. The blind spot detection function is auxiliary function and cannot replace the driver's control.



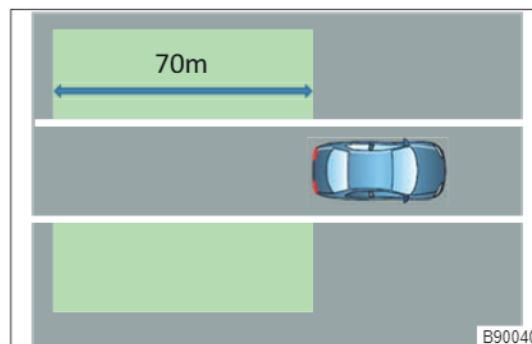
- Blind spot detection function is activated: the vehicle is activated in forward gear or neutral gear, and the vehicle speed is higher than or equal to 5 km/h.

The blind spot detection areas are as follows:

- When the vehicle overtakes the target vehicle, the target vehicle will enter from the front of alarm area, and there will be an alarm suppression time of 2 seconds, that is, the target vehicle stays in the alarm area monitored by the blind spot for more than 2 seconds, and the driver does not turn on the turn signal light, then the corresponding side warning light is come on; if the driver turns on the turn signal light at this time, the corresponding side warning light flashes.
- When the target vehicle overtaking this vehicle, the target vehicle will enter from behind of the warning area. When the vehicle enters the warning area, and the driver does not turn on the turn signal light, the corresponding side warning light will come on; if the driver turns on the turn signal light at this time, the corresponding side warning light will flash and sound. (At this time, it is no relationship with relative speed)

■ Lane Change Assist (LCA)

Lane change assist function: When the rear vehicle is approaching quickly from the adjacent lane, according to the collision time, the radar will alert the dangerous vehicle in blind spot. The maximum alarm distance can up to 70 m. Lane change assist is designed to supplement the blind spots that cannot be eliminated by the vehicle inside and outside rear view mirrors (but cannot replace the rear view mirrors). It uses two radars at the rear of vehicle to detect the sides back and sides of the vehicle at all times. Evaluate the lane change situation when the vehicle wants to change lanes, and give early warning of possible collisions when there are moving vehicles in the blind spot area of the driver and approaching the vehicle quickly, so as to ensure the safety of the driver when changing lanes and greatly reduce traffic accidents.



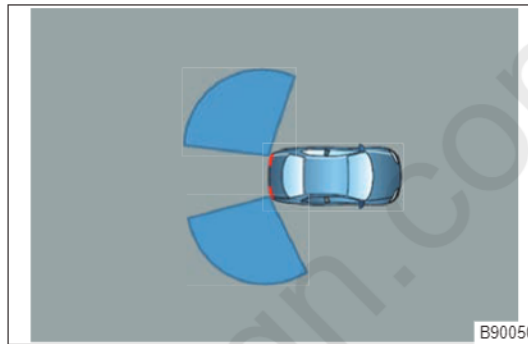
- Lane change assist function is activated: the vehicle is activated in forward gear or neutral gear, and the vehicle speed is higher than or equal to 5 km/h.

The detection area of lane change assist is as follows:

- The lane change assist alarm evaluation algorithm is: An alarm will be sound when the Time to Collision (TTC) between the rear fast approaching vehicle and this vehicle is less than the alarm threshold of 3.5s. The driver does not turn on the turn signal light, the corresponding side warning light will come on; if the driver turns on the turn signal light at this time, the corresponding side warning light will flash and sound.
- The lane change assist area is not fixed, but changes with the shape of the road. The road shape can be calculated using yaw rate, steering wheel angle and vehicle speed. In order to ensure the function of the system, the turning radius of the road is greater than 500 m. According to the state of the turn signal light, LCA provides two different levels of alarm, including the light remains on and flashing, as well as sound alarm.

■ Rear Cross Traffic Alert (RCTA)

Reversing assist function: When the driver is reversing from parking area, especially in a very narrow and crowded parking area, because the sights on both sides of the vehicle are blocked by nearby vehicles, the driver cannot observe whether there are oncoming vehicles on both sides of the rear of the vehicle. An alarm is provided to the driver if a moving vehicle running behind crosses the route of the vehicle. This function is effective when reversing in a crowded area and the driver's view is blocked by buildings, vegetation or other parked vehicles. The reversing assist system is a comfort system that reminds the driver when the driver's reversing view is affected.



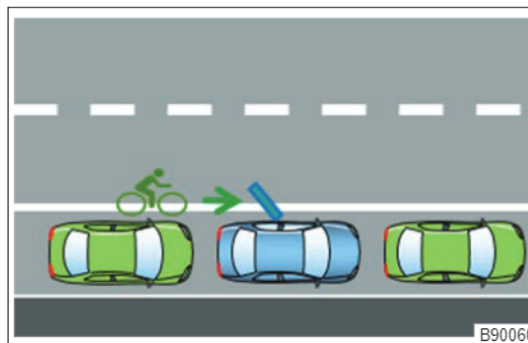
- Reversing assist function is activated: The vehicle is in reverse gear and the reverse speed is lower than 10 km/h.

The detection area of reversing assist is as follows:

- When the vehicle is reversing, an alarm will be sound when there is a possibility of collision between this vehicle and the vehicle in detection area and the Time to Collision (TTC) is less than the alarm threshold of 2 seconds. The corresponding side warning light flashes.

■ Door Opening Warning (DOW)

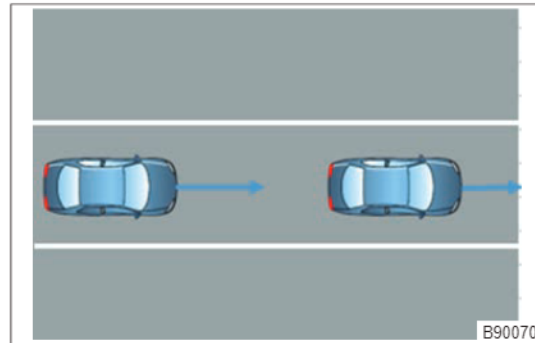
The door opening warning function detects the approaching vehicles and bicycles in the rear of the adjacent lanes through sensors, and gives an alarm when there is a risk of the door opening, so as to prompt the driver not to open the door at this time.



- Function activation condition: Any gear, vehicle speed is between 0 and 3 km/h.
- The target driving direction is toward the crash box of this vehicle (width is 1.5 m, length is 3 m). The radius of sector area is 48 meters. When the target vehicle enters the detection area, an alarm is generated when TTC is less than 3 seconds, and when driver opens the door, the alarm will be upgraded to level 2. LED flashes with sound alarm.

■ Close Vehicle Warning (CVW) When Moving Forward

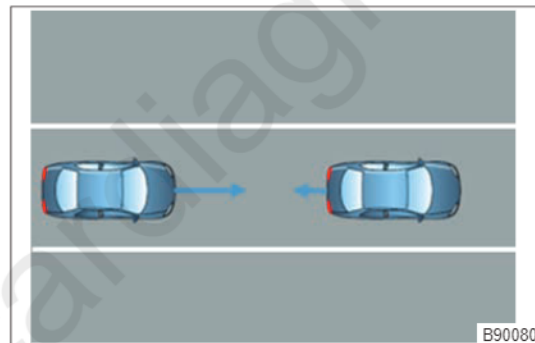
Close Vehicle Warning (CVW) when moving forward function: When this vehicle is moving forward or stationary in the lane. The target vehicle quickly approaches this vehicle in the same lane. At this time, the target vehicle is at risk of collision with this vehicle. The target vehicle will be warned by flashing turn signal light.



- Activation condition: When the vehicle is in forward gear or neutral gear, the vehicle speed is higher than or equal to 0 km/h, then CVW function will be activated.
- Warning condition: When the driving direction of target vehicle is towards this vehicle, and the vehicle speed is lower than 30 km/h, TTC is lower than the relative speed $\times 30/2.4s$, this vehicle will flash the turn signal light to warn the target vehicle, when the speed of this vehicle is higher than 30 km/h, TTC is lower than 2.4 seconds, the vehicle will flash the turn signal light to warn the target vehicle.

■ Rear Collision Warning (RCW) When Reversing

Rear collision warning function when reversing: When this vehicle is reversing or stationary in the lane. The target vehicle quickly approaches this vehicle in the same lane. At this time, the target vehicle is at risk of collision with this vehicle. Flashing LED lights and sound alarm to warn the driver to stop reversing or driving forward instead.



- Activation condition: When this vehicle is in reverse gear, and vehicle speed is lower than 8 km/h, the RCW function is activated.
- Warning condition: When the target vehicle is driving towards this vehicle and the relative speed is 5~63 km/h, and when the pre-collision time between the target vehicle and this vehicle is less than 2.2 seconds or the target vehicle enters the mandatory alarm area (8.5 m behind the vehicle).

1.5 Component Operation Description

■ Blind Spot Detection Radar (24G Millimeter Wave Radar Sensor)

The blind spot detection module uses the principle of ultrasonic reflection to detect. It sends out ultrasonic and receive back wave from obstacle, controller calculates obstacle position and distance according to ultrasonic distance measuring principle, and sends data to display terminal to remind.

■ Blind Spot Detection Module Cover Plate

It absorbs the clutter signal reflected from multipath.

■ Blind Spot Detection Module Bracket

It is used to install the sensor and must meet the installation specifications.

■ Warning Light

It is used to prompt the driver that the warning information of blind spots.

2 DIAGNOSIS & TESTING

2.1 Problem Symptoms Table

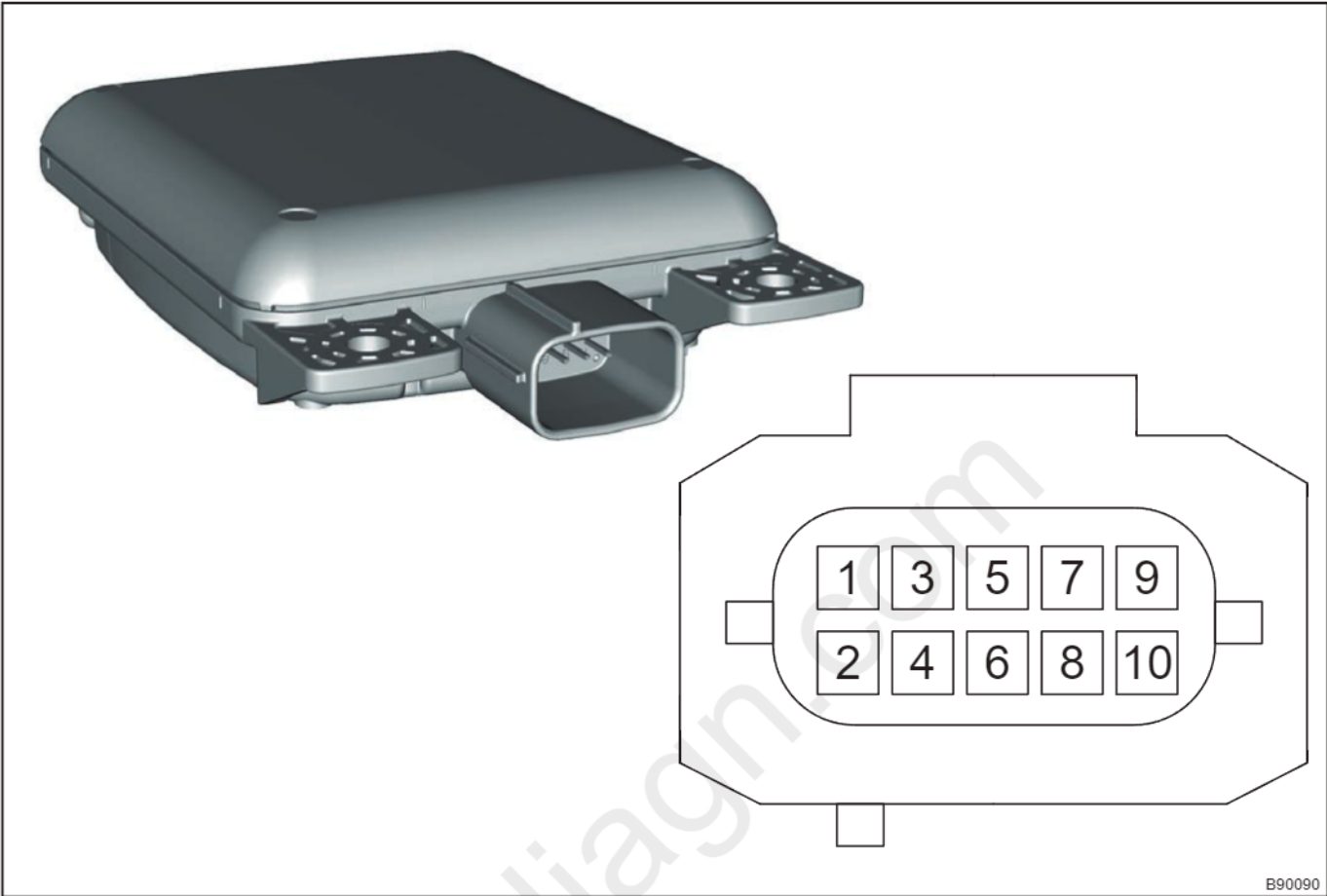
Hint:

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

Symptom	Possible Cause
Blind spot detection does not operate	Add-on components leads to shielding or system interference
	Add-on components leads to shielding or system interference, or blind spot detection function off
	Module power supply ground fails
	Module itself fails
Blind spot detection abnormal	System voltage is abnormal
	Module installation location is improper
	Module fails
LED warning indicator abnormal	Rear view mirror is damaged
	Connection wiring is abnormal
	Module fails

2.2 Blind Spot Detection Module Terminal Definition

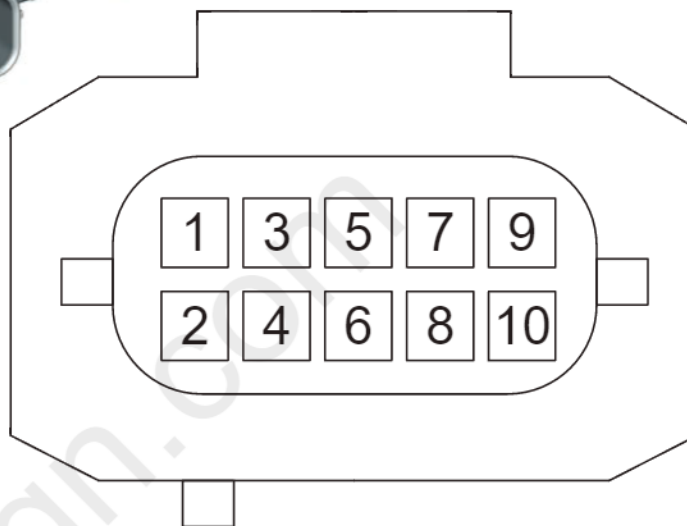
■ Left Blind Spot Detection Module Terminal Definition



B90090

PIN	Description	PIN	Description
1	\	6	\
2	\	7	CCAN-H
3	CCAN-L	8	HMI driver
4	Special CAN-H	9	Ground
5	Power supply	10	Special CAN-L

■ Right Blind Spot Detection Module Terminal Definition



B90100

PIN	Description	PIN	Description
1	\	6	\
2	\	7	CAN-H
3	CAN-L	8	HMI driver
4	Special CAN-H	9	Ground
5	Power supply	10	Special CAN-L

2.3 DTC Confirmation Procedure

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

- (1) Turn ENGINE START STOP switch to LOCK.
- (2) Connect diagnostic tester (the latest software) to diagnostic interface.
- (3) Connect diagnostic tester (the latest software) to diagnostic interface.
- (4) Use the diagnostic tester to record and clear DTCs stored in the blind spot detection system.
- (5) Turn ENGINE START STOP switch to LOCK and wait for a few seconds.
- (6) Turn ENGINE START STOP switch to ON, and then select read DTC.
- (7) If DTC is detected, it indicates current malfunction. Go to inspection procedure - Step 1.
- (8) If no DTC is detected, malfunction indicated by the DTC is intermittent.

2.4 Diagnostic Help

- (1) Connect diagnostic tester X-431 3G (the latest software) to Data Link Connector (DLC), 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 electronic 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 system grounds related to the latest DTCs.
- (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.

2.5 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.
- Monitor diagnostic tester (the latest software) data that is related to this circuit.
- Wiggle related wire harnesses and connectors and observe if signal is interrupt in related circuit.
- If possible, try to duplicate the 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 airbag components 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.

2.6 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.

2.7 Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition
B124011	Power Supply Voltage Out Of Range
B124015	Warning LED Open Circuit / Short to Battery
B12411C	Power Supply Voltage Out Of Range
B124243	Non Volatile Memory Failure (EEPROM Error)
B124244	Data Integrity Fault in Volatile Memory (RAM)
B124245	Program Memory Failure (Code Flash Error)
B124246	Local Configuration Parameters (LCP) Invalid

DTC	DTC Definition
B124257	Incompatible Software Component
B124296	BSD Internal Failure
B124378	BSD Misalignment Error
B124555	Car Configuration Not Done
B124397	BSD Blockage
B1244F0	Other BSD Defected
U124188	Private CAN Bus off

2.8 DTC Diagnosis Procedure

DTC	B124243	Non Volatile Memory Failure (EEPROM Error)
DTC	B124244	Data Integrity Fault in Volatile Memory (RAM)
DTC	B124245	Program Memory Failure (Code Flash Error)
DTC	B124246	Local Configuration Parameters (LCP) Invalid
DTC	B124257	Incompatible Software Component
DTC	B124296	BSD Internal Failure
DTC	B124378	BSD Misalignment Error
DTC	B124397	BSD Blockage
DTC	B1244F0	Other BSD Defected

DTC	DTC Definition	Possible Malfunction Reason
B124243	Non Volatile Memory Failure (EEPROM Error)	- There are sand or foreign objects on the inner and outer surfaces of the rear bumper. - Blind spot detection module
B124244	Data Integrity Fault in Volatile Memory (RAM)	
B124245	Program Memory Failure (- Code Flash Error)	
B124246	Local Configuration Parameters (LCP) Invalid	
B124257	Incompatible Software Component	
B124296	BSD Internal Failure	
B124378	BSD Misalignment Error	
B124397	BSD Blockage	
B1244F0	Other BSD Defected	

■ DTC Confirmation Procedure

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.

- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check for DTCs
----------	-----------------------

Use circuit diagram as a guide to perform the following inspection procedures:

- (a) Using diagnostic tester, clear DTCs and read blind spot detection control module system DTCs again.
- (b) Check if DTCs occur again.

OK

System is normal

NG

2	Check if the inner and outer surfaces of the rear bumper have mud and sand or foreign objects
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- (a) Check if the surface of the rear bumper radar and inner and outer of rear bumper have mud and sand or foreign objects.

NG

Clean the mud and sand or foreign objects

OK

3	Check if the vehicle blind spot detection control function is normal
----------	---

OK

Turn off vehicle power supply (disconnect the negative battery cable), then clear DTC again

NG

Replace blind spot detection module

DTC	B12411C	Power Supply Voltage Out Of Range
DTC	DTC Definition	Possible Malfunction Reason
B12411C	Power Supply Voltage Out Of Range	• Module assembly

■ DTC Confirmation Procedure

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Reconfirm DTCs
----------	-----------------------

Use circuit diagram as a guide to perform the following inspection procedures:

- (a) Turn ENGINE START STOP switch to ON.
- (b) Use diagnostic tester (the latest software) to reread DTC in blind spot detection system.

OK

System is normal

NG

Replace module assembly

DTC	B124011	Warning LED Short to Ground
DTC	DTC Definition	Possible Malfunction Reason
B124011	Warning LED Short to Ground	- Wire harness is damaged - Rear view mirror lens

■ DTC Confirmation Procedure

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

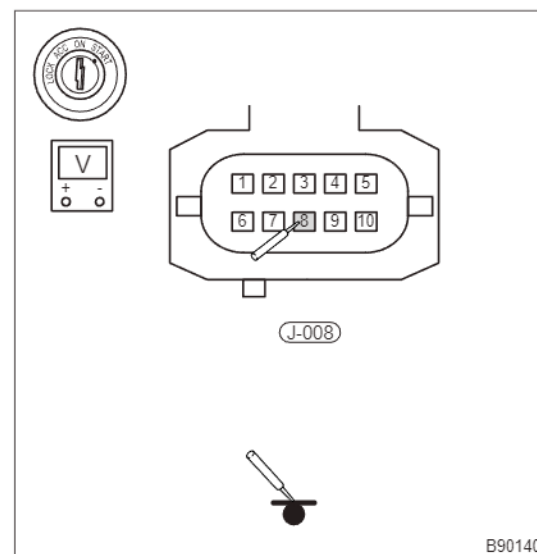
When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

1

Check module output

Use circuit diagram as a guide to perform the following inspection procedures:

- Turn ENGINE START STOP switch to ON.
- Use a digital multimeter to check the voltage of left blind spot detection module connector J-008 (8) to ground, and it should not be lower than 1 V.



OK

Exchange the warning LED test. (rear view mirror lens)

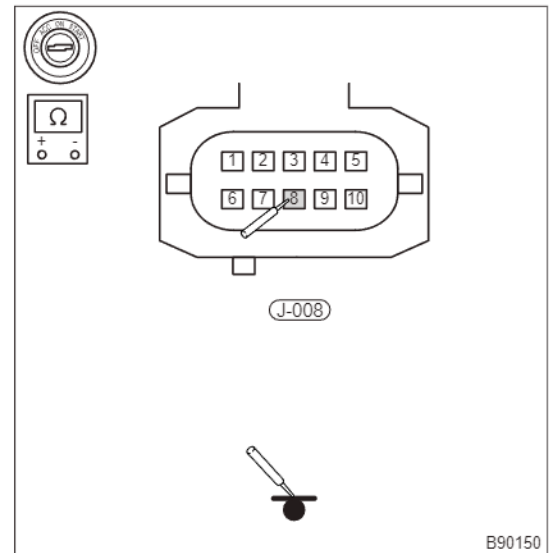
NG

2

Check the connection line

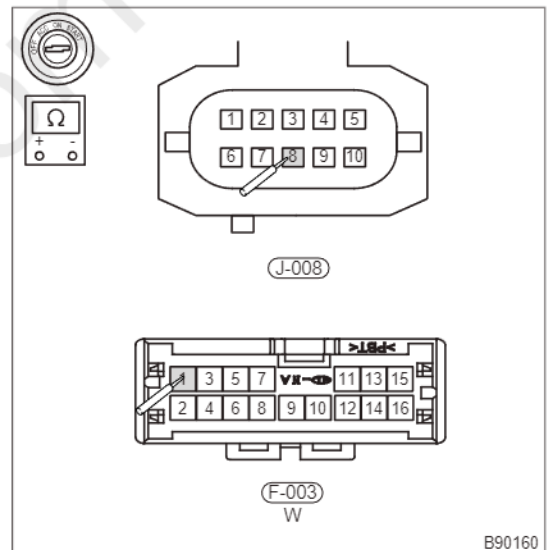
- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect left blind spot detection module connector J-008 and left outside rear view mirror connector F-003.
- (c) Using ohm band of digital multimeter, measure the resistance value of J-008 (8) to ground.

Multimeter Connection	Condition	Specified Condition
J-008 (8) - Body ground	ENGINE START STOP switch OFF	∞



- (d) Using ohm band of digital multimeter, measure the resistance value between cables J-008 (8) and F-003 (1).

Multimeter Connection	Condition	Specified Condition
J-008(8) - F-003(1)	ENGINE START STOP switch OFF	$\leq 1 \Omega$



NG	Repair or replace faulty wire harness
OK	Replace warning LED. (rear view mirror lens)

DTC	B124015	Warning LED Open Circuit / Short to Battery
DTC	DTC Definition	Possible Malfunction Reason
B124015	Warning LED Open Circuit / Short to Battery	- Wire harness is damaged - Rear view mirror lens

■ DTC Confirmation Procedure

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

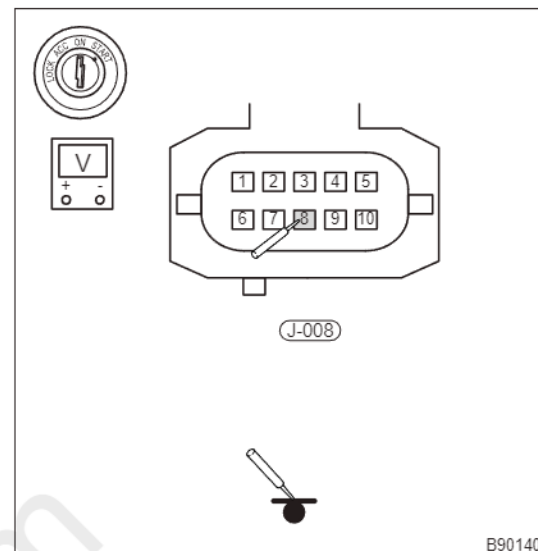
When performing circuit diagnosis and test, always refer to the circuit diagram for specific circuit and component information.

1 Check module output

Use circuit diagram as a guide to perform the following inspection procedures:

- Turn ENGINE START STOP switch to ON.
- Disconnect left blind spot detection module connector J-008 and left outside rear view mirror connector F-003.
- Using voltage band of digital multimeter, measure the voltage value of J-008 (8) to ground.

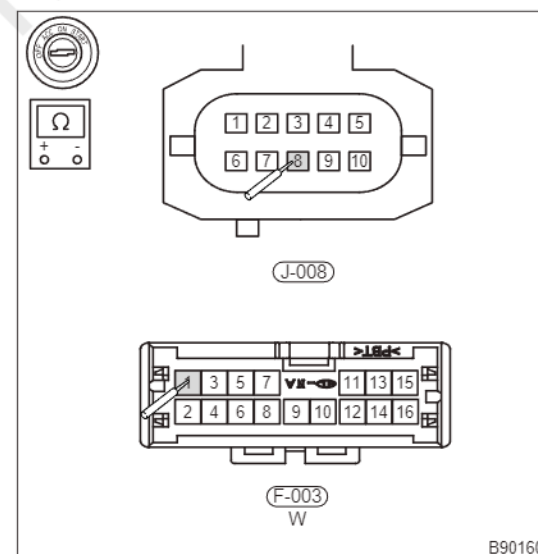
Multimeter Connection	Condition	Specified Condition
J-008 (8) - Body ground	ON	0V



B90140

- Using ohm band of digital multimeter, measure the resistance value between cables J-008 (8) and F-003 (1).

Multimeter Connection	Condition	Specified Condition
J-008(8) - F-003(1)	OFF	$\leq 1 \Omega$



B90160

OK

Replace warning LED (rear view mirror lens).

NG

Handle and repair related wire harness.

DTC	B124555	Car Configuration Not Done
DTC	DTC Definition	Possible Malfunction Reason
B124555	Car Configuration Not Done	Car Configuration Not Done

■ DTC Confirmation Procedure

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Reconfiguration
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Use circuit diagram as a guide to perform the following inspection procedures:

(a) Use the diagnostic tester to perform module configuration.

OK

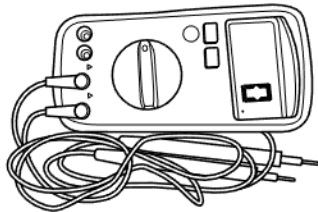
Perform running test after clearing DTCs

DTC	U124188	Private CAN Bus off
DTC	DTC Definition	Possible Malfunction Reason
U124188	Private CAN Bus off	/

1	Refer to “CAN COMMUNICATION” for troubleshooting
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3 ON-VEHICLE SERVICE

3.1 Tools

Tool Name	Tool Drawing
X-431 PAD Diagnostic Tester	 RCH0001006
Digital Multimeter	 RCH000206

3.2 Blind Spot Detection Module

■ Removal

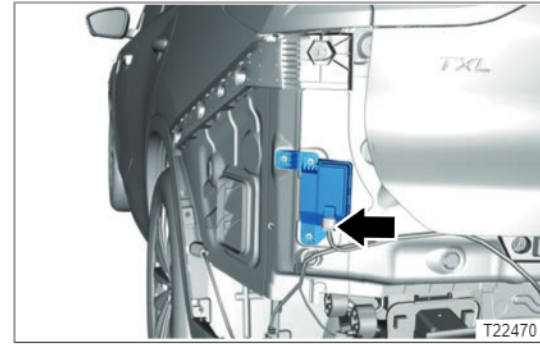
Warning

- Be sure to wear safety equipment to prevent accidents, when removing blind spot detection module.
- Operate carefully to prevent damage to blind spot detection module, when removing blind spot detection module.

(1) Turn off all electrical equipment and ENGINE START STOP switch

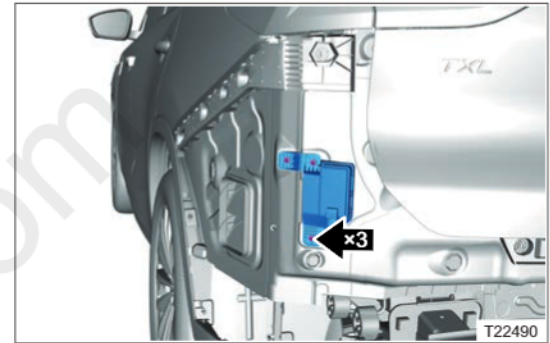
(2) Disconnect the negative battery cable for more than 1 minute

- (3) Remove the rear bumper assembly
- (4) Disconnect the left blind spot detection radar module connector.



- (5) Remove 3 fixing screws from left blind spot detection radar module and remove the left blind spot detection radar module assembly.

Tightening torque
 $2 \pm 0.5 \text{ N m}$



■ Installation

Caution

- Install connector in place when installing blind spot detection module.
- Check blind spot detection module system for proper operation after installing blind spot detection module.
- When sheet metal paint operation is performed on the rear bumper, there should not be a sudden change in the thickness of rear bumper. Dielectric constant of paint < 100: Thickness of paint is less than 15um, weight of metal component is about 7%) dielectric constant of paint < 50 (Thickness of paint is less than 45um)

- (1) Installation is in the reverse order of removal.

.1 Precaution

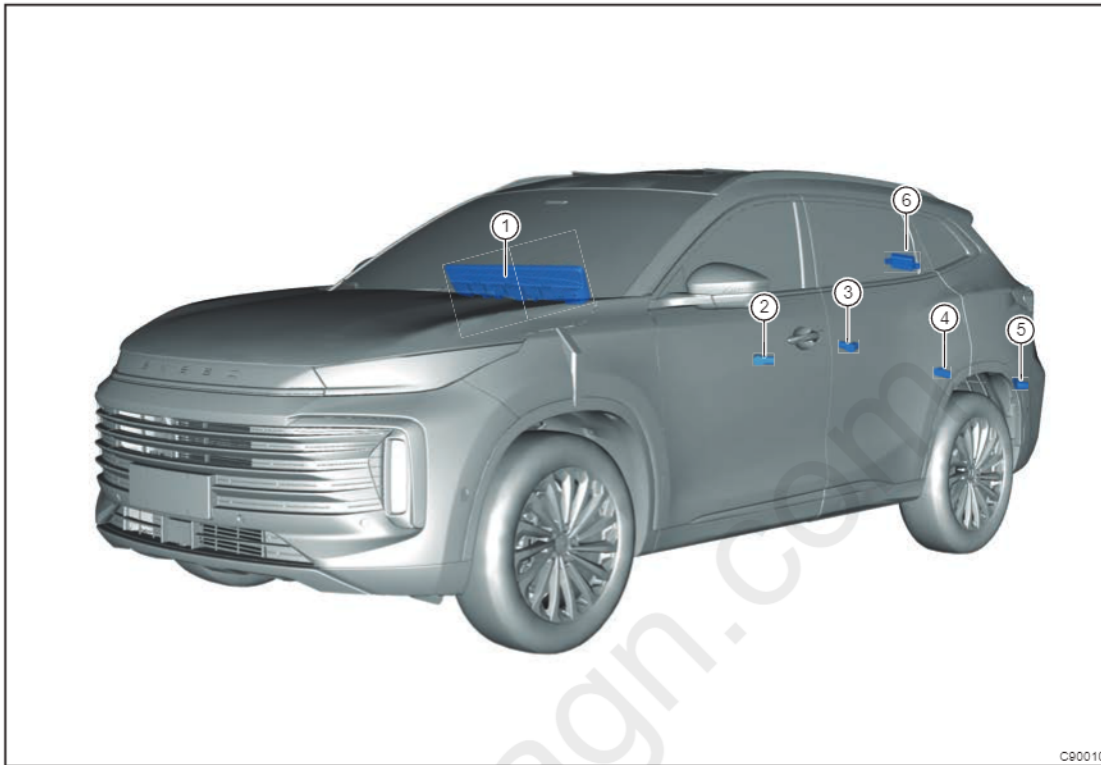
In order to avoid dangerous operation and damage to the vehicle before repair in this section, the following instructions must be observed.

- (1) Be sure to wear necessary safety equipment to prevent accidents, when removing reversing radar sensors.
- (2) Operate carefully to avoid damaging reversing radar sensors, when removing reversing radar sensors.
- (3) Be sure to wear necessary safety equipment to prevent accidents, when removing front radar sensor.
- (4) Operate carefully to avoid damaging reversing radar sensor, when removing front radar sensor.
- (5) Be sure to wear necessary safety equipment to prevent accidents, when removing rear camera assembly.
- (6) Appropriate force should be applied when removing rear camera assembly. Be careful not to operate roughly.
- (7) Be sure to wear necessary safety equipment to prevent accidents, when removing front camera assembly.
- (8) Appropriate force should be applied when removing front camera assembly. Be careful not to operate roughly.
- (9) As side camera is installed inside the outside rear view mirror assembly, it must be replaced together with outside rear view mirror assembly when damaged.
- (10) Install connector in place and tighten fixing nuts to the specified torque, when installing the outside rear view mirror assembly.
- (11) Make sure the outside rear view mirror assembly can move smoothly, flexibly and reliably after installing.
- (12) After installing outside rear view mirror assembly, it is necessary to perform panoramic image calibration.
- (13) Be sure to wear necessary safety equipment to prevent accidents, when removing reversing radar control module assembly.
- (14) Appropriate force should be applied when removing reversing radar control module assembly. Be careful not to operate roughly.
- (15) Tighten fixing bolts to the specified torque, when installing reversing radar control module assembly.
- (16) Install connector in place when installing reversing radar control module assembly.
- (17) Check reversing radar system for proper operation, after installing reversing radar control module assembly.
- (18) Be sure to wear necessary safety equipment to prevent accidents, when removing panoramic control system module assembly.
- (19) Appropriate force should be applied, when removing panoramic control system module assembly. Be careful not to operate roughly.
- (20) Tighten fixing bolts to the specified torque, when installing panoramic control system module assembly.
- (21) Install connector in place when installing panoramic control system module assembly.
- (22) Check reversing radar system for proper operation, after installing panoramic control system module assembly.

1 System Overview

1.1 System Components Diagram

■ REVERSE RADAR SYSTEM



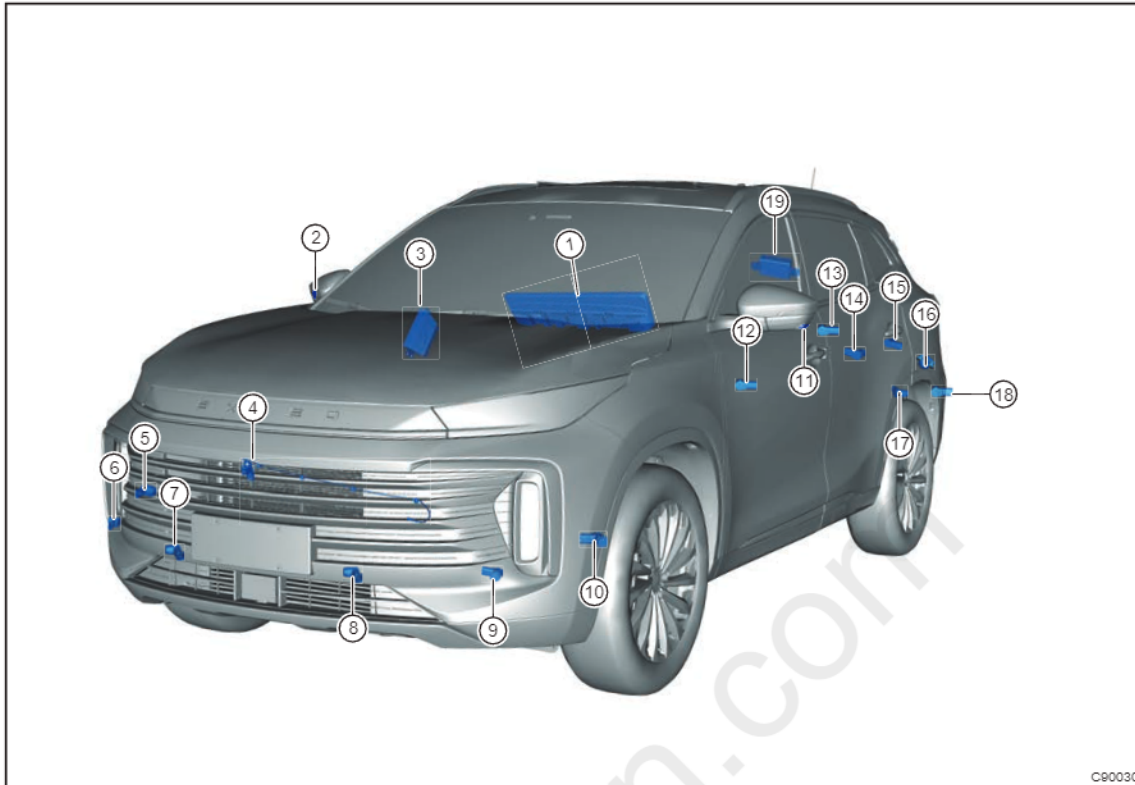
1	Hyperscreen	2	Rear Right Radar Sensor
3	Rear Right Center Radar Sensor	4	Rear Left Center Radar Sensor
5	Rear Left Radar Sensor	6	Reversing Radar Module

■ Dynamic Track HD Visual Parking Assist System



1	Hyperscreen	2	Rear Right Radar Sensor
3	Rear Right Center Radar Sensor	4	Rear Left Center Radar Sensor
5	Rear Left Radar Sensor	6	Reversing Radar Module
7	Rear Camera Assembly		

■ 360 Panoramic View Monitor System



C90030

1	Hyperscreen	2	Right Camera Assembly
3	Panoramic Control System Module (AVM)	4	Front Camera Assembly
5	Front Right Side Radar Sensor	6	Front Right Center Radar Sensor
7	Front Center Radar Sensor	8	Front Center Radar Sensor
9	Front Left Center Radar Sensor	10	Front Left Side Radar Sensor
11	Left Camera Assembly	12	Rear Right Side Radar Sensor
13	Rear Right Center Radar Sensor	14	Rear Center Radar Sensor
15	Rear Center Radar Sensor	16	Rear Camera Assembly
17	Rear Left Center Radar Sensor	18	Rear Left Side Radar Sensor
19	Reversing Radar Module		

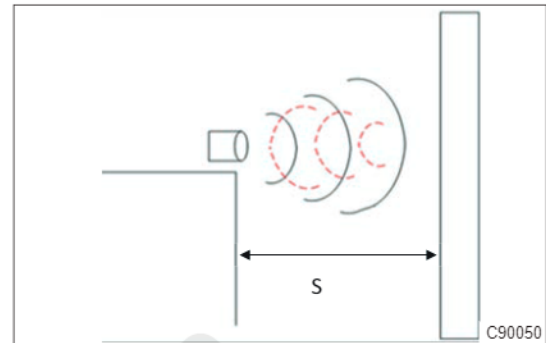
1.2 REVERSE RADAR SYSTEM

■ System Schematic Diagram

Parking radar auxiliary system uses digital sensors and ultrasonic technology to measure distance, which can remind the driver of the distance between the rear of vehicle and other objects, and give sound prompts and image display to reduce personnel injury or vehicle damage caused by reversing.

■ Operating Principle

Parking radar system uses ultrasonic reflection principle to detect distance. After parking radar sensors send out ultrasonic and receive back wave from obstacle, control module calculates obstacle distance ($S = t \times 340 \div 2$) according to ultrasonic distance measuring principle, and sends data to display terminal to display and alarm.



■ System Composition

Reversing radar system consists of instrument cluster, 1 radar control module and 4 sensors (digital ultrasonic sensors) or 8 sensors. Sensors adopt separated structure. Sensor bodies are same, but installation angles are different. Parts related to system consist of ENGINE START STOP switch, reverse switch, instrument cluster or DVD, PAS switch and vehicle speed (8 sensors system). ENGINE START STOP switch provides operating power for system; Reverse switch provides operation activation signal for system; Instrument cluster or DVD is end terminal of the system and provides sound alarm prompt and distance display function for driver. The PAS switch is only related with the 8 sensors system.

■ Reversing Radar Normal Alarm Display

When ENGINE START STOP switch is turned on, shift lever is moved to R and vehicle is reversing at a speed below 8 km/h, reversing radar is activated. The corresponding measured message will be displayed on multi-information display and alarms with buzzer in instrument cluster. The response way of reversing radar system is buzzer sounding. The table below shows the correspondence between buzzer response frequency and actual obstacle distance:

Alarm Type	1st Section	2nd Section	3rd Section	4th Section	5th Section
Displayed Area	Safe area	Pre-warning area	Amble area	Park area	Park area
Alarm Distance Range (cm)	> 150	95 - 150	65 - 90	40 - 60	≤ 35
Buzzer Sound Frequency	No sound (OFF)	1Hz (ON 500 ms / OFF 500 ms)	2Hz (ON 250ms / OFF 250 ms)	4Hz (ON 125 ms / OFF 125 ms)	Continuous sound

Hint

- When ignition switch is ON and shift lever is in R, small vehicle screen is displayed on instrument cluster. If no obstacle information is detected (obstacle distance is more than 150 cm), only small vehicle is displayed on instrument cluster, while arc is not displayed.
- If multiple sensors have detected an obstacle, instrument cluster will display distances between each sensor and obstacle, sound alarm will be sound from nearest obstacle, and processed based on signal from radar.

1.3 Dynamic Track HD Visual Parking Assist System

■ Operation

Consists of: Instrument cluster, navigation, camera, 4 rear radar sensors and radar module. Reversing view monitor system consists of radar sensor (sensor), camera, control module and display alarm device etc. After starting vehicle, reversing radar system functions when shifting to reverse gear. When the radars detects an

obstacle, multi-information display in instrument cluster will display distance information and buzzer sounds. Navigation system displays color image behind vehicle in real time and provides static or dynamic guidelines for driver reference. By this way, the system can help driver to eliminate blind areas and blurred vision, improving driving safety.

■ Reversing View Display

Caution

In the panoramic view monitor system, rear camera of high configuration model is connected to panoramic view monitor system controller, and rear camera of medium configuration model is connected to navigation system.

(1) Description

- High and medium configuration models are fitted with reversing camera. The camera captures the views behind the vehicle which will be presented to driver by navigation system. Also, navigation system provides static guidelines or dynamic guidelines that move as turning of steering wheel so as to estimate the vehicle's reversing track lines.

(2) Dynamic back guidelines and local view of rear area

- After entering surrounding + rear view screen by shifting to reverse gear, static/dynamic back guidelines and local view of rear area will be displayed on rear view image.

(3) Definition of static back guidelines

- Red guidelines indicate about 0.5 m away from bumper;
- Yellow guidelines indicate about 1 m away from bumper;
- The closer green guidelines indicate about 2 m away from bumper;
- The far green guidelines indicate about 3 m away from bumper.

(4) Dynamic track lines

- Dynamic track lines are used for prejudging the vehicle's traveling trace, which varies as the wheel rotation.

1.4 360 Panoramic View Monitor System

■ Function

Composition: Panoramic view monitor system consists of four HD (100W) cameras (front camera, rear camera, left camera and right camera), controller, AVM system switch, LVDS video transmission line and connecting wire harness. Controller and head unit are connected by shielded wire. Function description: Panoramic view monitor system consists of a controller, four ultra wide angle cameras and LVDS video transmission lines, etc. It captures images from four directions (front, rear, left and right) and splices them into an aerial view around the vehicle using image processing algorithms, then displays it on the navigation display. Panoramic view monitor system provides surrounding view + single side view, three-dimensional surrounding view roaming, three-dimensional left/right side view, and dynamic/static reversing track. Side camera is integrated into the outside rear view mirror assembly. Panoramic control system module is located inside the glove box on front passenger side and shares a bracket with central gateway; front camera is located on the middle grille of front bumper and installed on the front bumper; rear camera is located under the back door and installed on the back door open switch assembly.

Function	Description
Single side and birds-eye view	Single side view of front, rear, left and right, and splicing view. Single side view can be switched
3D view and birds-eye view	Click on the birds-eye view to switch the corresponding 3D view, and the 3D view can be switched to any viewpoint by sliding
Wide-angle view	Combine the front view/rear view into a triplet wide-angle view through distortion correction
Panoramic startup animation	When AVM is starting, surround the vehicle all around
Turn signal light activating panoramic	When the turn signal light switch is turned on, the 3D view of rear left or rear right side of vehicle is displayed

Function	Description
Steering wheel steering angle activating panoramic	When steering wheel angle is higher than 180°, the 3D view of rear left or rear right side of vehicle is displayed
Enlarging view	Click on the enlarging view button to display the front/rear enlarged view. When the auto enlarge setting option is turned on, it will receive the ultrasonic radar information, and automatically switch to the front/rear enlarged view when it is less than 30 cm
Virtual door opening view	Receive door signal, engine hood signal and sliding roof signal, and display the corresponding view on the birds-eye view and 3D view when the four doors, engine hood, back door and sliding roof are opened
Vehicle guideline	Click on to select the opening and closing of the vehicle guideline
Visual radar	Ultrasonic radar transmits the distance information to the panoramic controller, and displays the distance or alarm prompt information on the panoramic screen
License plate number setting	Receive the license plate number sent by audio head unit and display it in 3D vehicle icon
3D view switch button	Click the button around the vehicle to switch the corresponding view of 3D view
Front wheel steering	Receive the steering wheel angle signal and accurately display the steering angle of front wheels in 3D view
Real-time wheel speed	Receive the wheel speed signal and accurately display the wheel speed in 3D view
Real-time turn signal light display	Real-time display of turn signal light information when switch the turn signal light switch
RCTA warning information	Integrate BSD radar information, and display warning information in the view when RCTA alarms
Obstacles activating panoramic	Activate the panoramic view monitor after receiving the parking radar information

■ System activation and exiting mode

Caution

- Panoramic view monitor system has professionally calibrated before leaving factory. Any removal and installation behaviors without permission that cause changes in installation position and angle of camera may affect the function and effect of panoramic view monitor system.
- Panoramic view monitor system functions to provide driving assist, however, object in image does not indicate the actual size and distance from it. There is a slight delay and blind spot in image relative to the actual condition, so this function is not a substitute for driver's operation and judgment. During on, off and use of the function, driver should pay attention to the surroundings to ensure safe driving.
- Never use panoramic view monitor when outside rear view mirrors are folded. Make sure to close back door securely when operating vehicle using panoramic view monitor.
- Distance from object seen from panoramic view monitor is different from the actual distance.
- Cameras are installed on front grille, outside rear view mirrors and above the rear license plate. Do not put anything on the camera.
- Do not spray water around the camera when washing vehicle with high pressure water. Otherwise, water drop may enter camera and condense on the lens, causing malfunction, fire or electric shock.
- Do not tap the cameras. They are precision instruments. Failure to do so may cause malfunction or damage, leading to fire or electric shock.

Hint

- Be careful not to scratch the lens when cleaning dirt or snow on the surface of camera.
- Use the displayed route and aerial view as reference. Displayed route and aerial view are greatly affected by numbers of passenger in vehicle, fuel amount, vehicle location, road surface condition and road surface grade.

Activation Condition		System Activation	Exit Condition	
Preconditions	Trigger Conditions		Corresponding Exit Condition	Priority Exit Condition
Vehicle speed < 20 km/h	Shift to R	R is activated	Exit R position, the duration is longer than 15 seconds, and there is no effective operation within the duration	Vehicle speed > 30 km/h
	AVM switch is pressed	AVM switch is activated	Press AVM switch again	
			Operate other high priority switches	
	Turn on the turn signal light	Turn signal light is activated	Turn off the turn signal light and there is no effective operation within 500 ms	
			Operate other high priority switches	
	Steering wheel angle > 190°	Steering wheel angle is activated	Steering wheel angle is less than 180° and the duration is longer than 1 seconds, and there is no effective	

Activation Condition		System Activation	Exit Condition	
Preconditions	Trigger Conditions		Corresponding Exit Condition	Priority Exit Condition
			operation within the duration time	
			Operate other high priority switches	
D	Parking radar obstacle distance signal is received	Obstacles is activated	Exit after 15 seconds after obstacle-free distance information	Press the AVM switch, operate other high-priority switches, N or P, press the exit button
			N or P	
Vehicle speed = 0KM/h, remote start mode	Remote AVM request to turn on	Remote AVM is activated	Remote AVM request to turn off	Remote start mode is exited

1.5 Automatic Parking Assist System (APA)

■ System Principle

The Automatic Parking Assist System (APA) can assist the driver to park the vehicle in or out of the parking space identified by the system. The system can help the driver search and confirm the target parking space. The driver can also choose a parking space through the central control display. After the target parking space is confirmed, the system will realize the automatic parking function under the driver's supervision. The types of parking spaces supported by the system include parallel parking space, vertical parking space, inclined parking spaces, parallel boundary parking space and vertical boundary parking space. When the vehicle moving out from parallel boundary parking space, the driver can use the automatic moving out function. Under the supervision of the driver, the system will control the vehicle to travel to a position that is easy to move out to complete the moving out assistance.

■ Automatic Parking In

Operation Step

- (1) Keep the vehicle driving normally.
- (2) When the vehicle speed is lower than 25 km/h, and the lateral distance between driving path and available parking space is about 0.5 m-1.9 m, press the central control APA switch to turn on the automatic parking function.
- (3) User controls the vehicle to keep driving. The vehicle searches for the surrounding parking spaces while driving. The system searches for the right parking space by default. The left turn signal light can be turned on to search for the left parking space. Each time a parking space is found, the central control display will display the parking information at the corresponding position, then depress the brake pedal to brake the vehicle. If there are multiple alternative parking spaces, you can click on the parking space through the central control display.
- (4) After confirming the parking space to be parked, press the central control APA switch and release the brake pedal to start parking. Do not touch the steering wheel and shift lever during parking, pay close attention to the surrounding environment, and be ready to brake the vehicle at any time.
- (5) After the vehicle is parked in the target parking space, the system will prompt the user the parking is finished, and the system will automatically switch the gear into P position and apply the park brake to complete the automatic parking.

■ Self-selected Parking Space Parking In

Operation Step

- (1) Brake the driving vehicle to stop and depress the brake pedal, press the central control APA switch, and click the self-selected parking spaces. The APA system provides vertical parking spaces, horizontal parking spaces, and oblique parking spaces for selection.
- (2) After clicking the parking space type, you can fine tune the target parking space posture through the large screen interface of the central control and click OK button.

- (3) After confirming the parking space to be parked, follow the prompts on the display interface to start the automatic parking procedure. During automatic parking in, the driver does not need to perform vehicle operations, but needs to pay attention to the surroundings at all times. Be ready to brake vehicle at any time to ensure that the vehicle can be controlled in dangerous situations.
- (4) After the vehicle is parked in the target parking space, the system will prompt the user the parking is finished, and the system will automatically switch the gear into P position and apply the park brake to complete the automatic parking.

■ Automatic Moving Out

Operation Step

- (1) With the vehicle is stationary, start the engine and turn on the central control display.
- (2) Press the parking switch button of center console, wait for the switch indicator to come on, the central control screen displays the parking operation interface, click "Automatically Moving Out" to enter the automatic moving out interface.
- (3) The driver can confirm the moving out direction by turning the turn signal light lever.
- (4) Follow the instructions on display interface to start the automatic moving out program.
- (5) After the parking operation is completed, the system will automatically apply the electronic park brake and shift to P position. At this time the driver takes over the operation of the vehicle.

Hint

The automatic parking assist system may exit the program under the following conditions:

- The vehicle speed is higher than 25km/h when looking for a parking space;
- Associated system controller malfunction;
- Turn off the Electronic Stability System (ESP);
- During parking, driver did not fasten the seat belt as required or did not close the door, etc. within 30 seconds;
- During parking, driver actively controls the steering wheel;
- During parking, driver actively operates the shift lever;
- During parking, driver actively depress the accelerator pedal;
- During parking, driver actively turns on the Electronic Parking Brake System (EPB);
- During parking, driver presses the automatic parking assist system switch again;
- During parking, there are fixed obstacles around the vehicle, and the vehicle cannot avoid it;
- The system whose arbitration logic is higher than automatic parking assist system s activated;
- The parking trajectory exceeds the planning.

Hint

- When the vehicle speed is lower than 25 km/h, the system has the function of searching parking spaces in the background, but the longest memory distance is not more than 15 m. In order to improve the recognition rate, it is advisable to control the vehicle speed at about 10 km/h.
- When searching for a parking space, the distance between vehicle and obstacles that make up the parking space should be 0.5 m - 1.9 m. The parking space may not be found if exceeds the range.
- When searching for a parking space, try to keep the vehicle passing through the parking space in a straight line, thus to achieve a better parking space detection effect.
- When selecting a parking space, the vehicle must be kept in a stopped state.
- The rattling sound during parking is the normal operating noise of brake system, and it is no need to worry about it.
- During parking, the steering, braking, accelerator pedal and gear position are controlled by the system. The driver can operate the brake pedal to control vehicle speed or stop the vehicle. The vehicle can continue to park after release the brake pedal.
- When parking on uneven road, fluctuation may occur in parking speed, and the vehicle may bump. Try to avoid using this system on uneven road.
- The system only supports the moving out function of parallel parking spaces. Appropriate adjustment space is required in front and rear of vehicle body. The moving out function may not be available when there is abnormal change in the parking space.

Caution

- To ensure safety, before activating the automatic parking assist system, make sure that the driver's seat belt is fastened and the doors, engine hood and back door are all closed;
- The system does not consider the changes in recognized target parking space, which may cause parking failure.
- When using automatic parking assist system, the vehicle may cross or hit the curbs during steering. Therefore, the driver must ensure that the brake intervention can be performed at any time, otherwise it may cause wheel or vehicle damage.
- Target recognition is restricted by the ultrasonic measurement physical laws and camera vision algorithms. The ability to recognize person, animals and various obstacles around the vehicle is limited. In addition, external sound sources or light and shadow may cause interference to the system, resulting in missing recognition or misrecognition of system. Therefore, before confirming the target parking space, the driver is responsible for paying attention to the surroundings of vehicle and confirming the availability of target parking space.

Caution**Some cases that may not be recognized**

- Trailer towing bar and towing hook;
- Slender or wedge-shaped objects;
- Objects that are high and protruding, such as wall projections or loads;
- Objects with corners and sharp edges;
- Objects with fine surfaces or structures, such as fences;
- Barbed wire fence, fluffy snow, potholes in the ground;
- Object that above the detection range and the sensor cannot detect accurately;
- Certain objects whose surfaces do not reflect detection signals and persons wearing clothing of such materials;
- Other situations that affect target recognition.

Warning

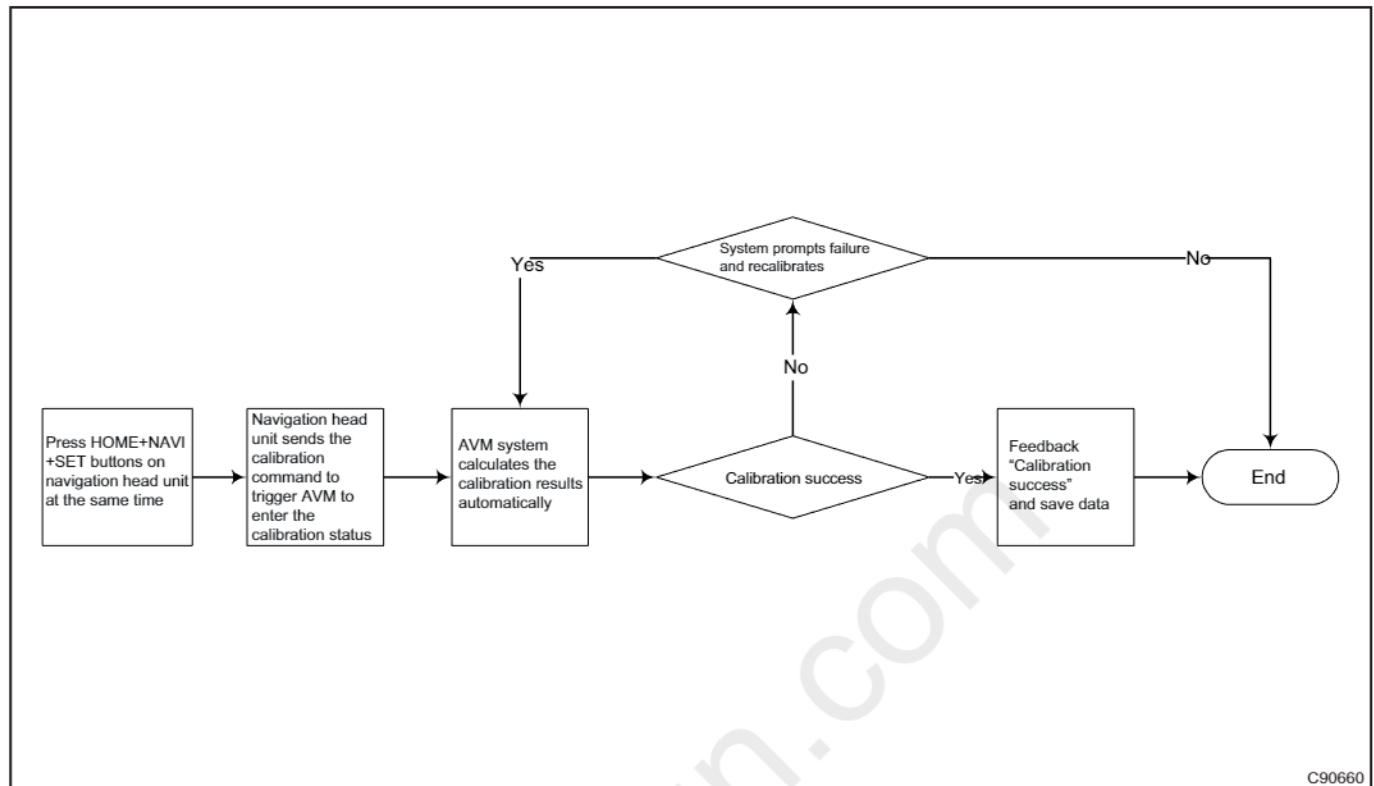
- When using the automatic parking assist system, the driver must comply with the Road Traffic Safety Law of the People's Republic of China.
- The automatic parking assist system only provides assistance to the driver, and cannot operate normally under all driving conditions, weather conditions, traffic or road conditions.
- When using the system, the driver has responsibility to control the vehicle, monitor the system operation and intervene when necessary to avoid danger.

Caution**The use of the system is prohibited in the following cases:**

- Severe weather such as rain, snow, heavy fog, etc.;
- There are three-wheeled or two-wheeled non-motorized vehicles, low obstacles (such as parking lines, ground locks, stones, etc.) or vehicles with no continuous physical form of the lower body (such as large trucks, oil tankers, trailer, etc.) near the alternative parking spaces;
- Potholes on the road near the alternative parking spaces, or there are sidewalks or parking spaces with elevation difference on the road and cliffs (danger);
- The wheel size is different from the original wheel size. For example: installing non-original size wheels, spare wheels, snow chains or tires with non-standard tire pressure;
- Vehicle modification causes the size of vehicle to change or there is an extended load outside the vehicle during parking.

1.6 Panoramic View Monitor System Calibration

■ Calibration Procedure



■ Calibration Steps

Status confirmation before calibration In order to ensure the success rate and effect of the calibration, the following status should be confirmed before calibration:

- (1) All components on vehicle have been installed (including: spare tires, on-board tools, etc.), and all liquids have been filled to the state of leaving the factory (such as: brake fluid, coolant, washer fluid, gasoline, etc.);
- (2) The vehicle has completed the calibration of steering system and four-wheel alignment, and has passed the inspection;
- (3) The grid of calibration site are not obviously damaged/dirty, the guide rails are not loose or poorly fixed, and the lights above the site have been turned on;
- (4) There are no people, vehicles or other obstacles in the area of the calibration site;
- (5) There is no malfunction prompt of panoramic view monitor or camera in the vehicle instrument cluster;
- (6) Four cameras (front/rear/left/right) lens surface is not covered by plastic protective film or has been removed;
- (7) During the calibration process, please make sure that there is no other person on the vehicle, and only the driver is allowed to perform calibration operations on driver seat.

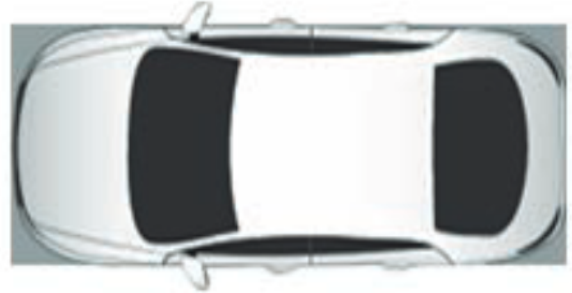
Caution

When parts are supplied, in order to avoid accidental wear on the surface of panoramic view monitor system camera lens, a plastic protective film is usually attached to the lens. Please confirm whether it has been removed before calibration? If it is not removed, please remove the protective film before performing the calibration operation.

■ Calibration step 1 (vehicle enters the calibration station)

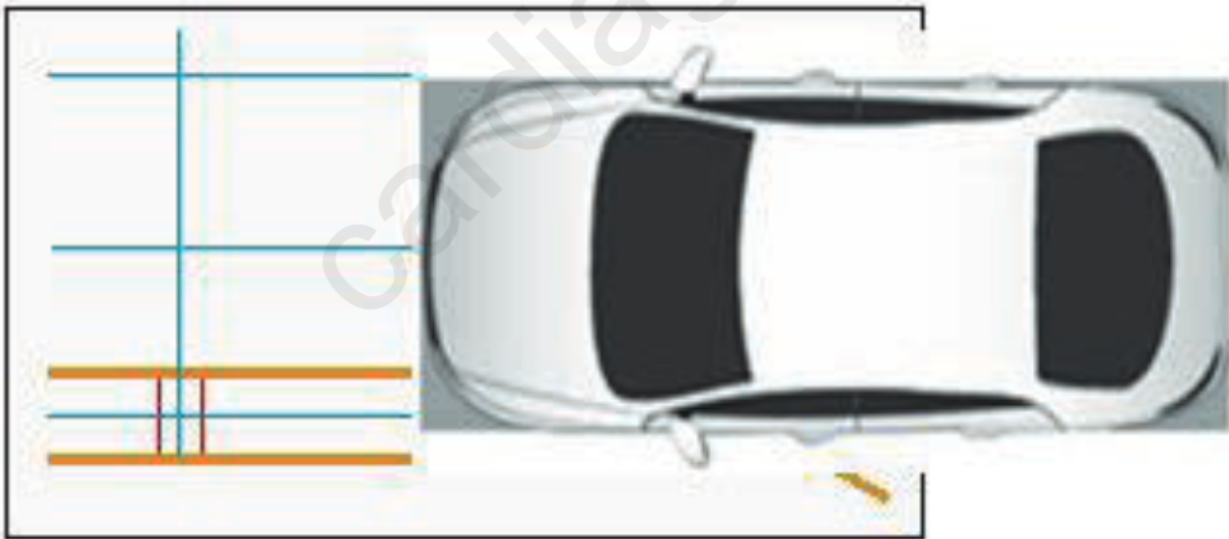
When the vehicle to be calibrated enters the calibration station, the steps are as follows:

- (1) After coming out from last station, adjust the position of the vehicle so that the front and rear center of the vehicle is consistent with the center line of the guide rail, as shown in the illustration:



C90670

- (2) Driving the vehicle forward, slightly adjust the steering wheel and make the front wheels enter the guide rails, as shown in the illustration:



C90680

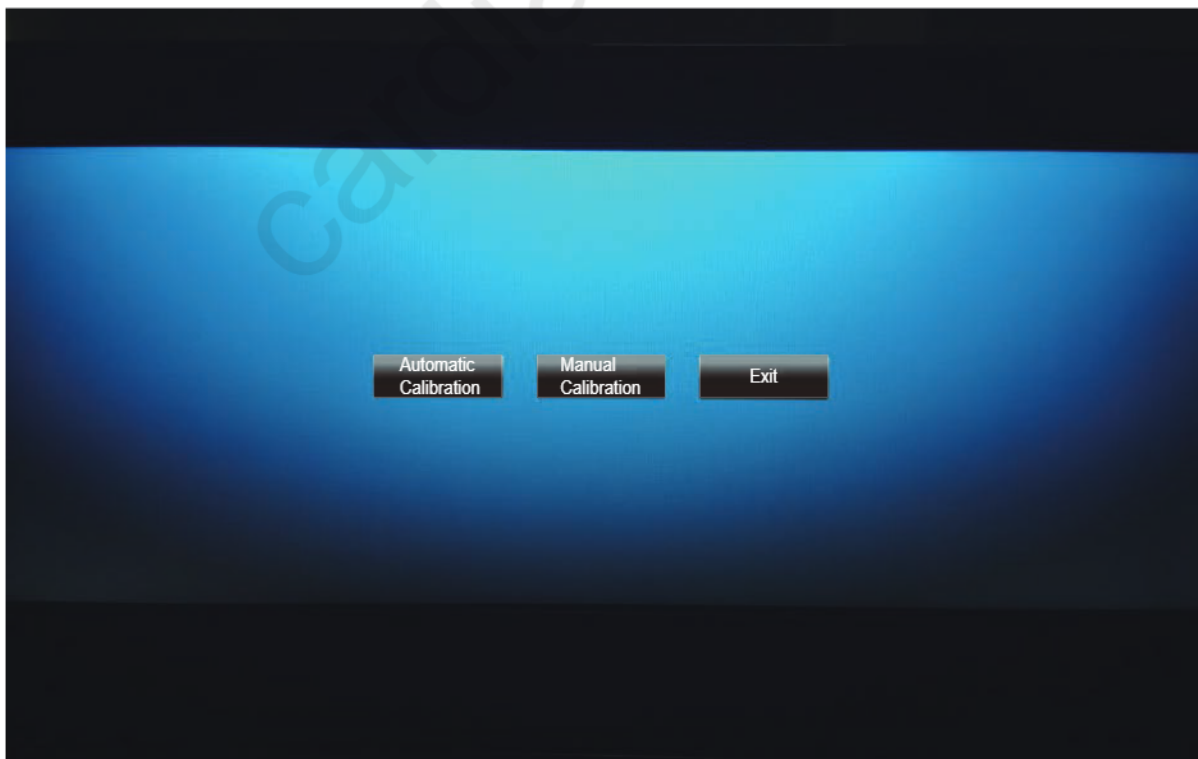
- (3) Continues to drive along the guide rail, stops after front wheel enters the position, so that the two front wheels naturally enter the slot, and confirm that the front wheel axis is consistent with the center position of slot, as shown in the following illustration:



C90690

■ Calibration step 2 (calibration function activated)

In the IGN-ON or Start state, press and release the three buttons "HOME + NAVI + SET" on the central console panel at the same time; if the operation is valid, the following interface will appear on the audio display. For the calibration operation on production line, please select the "Automatic Calibration" button. The "Manual Calibration" function is mainly used for after-sales calibration.



C90700

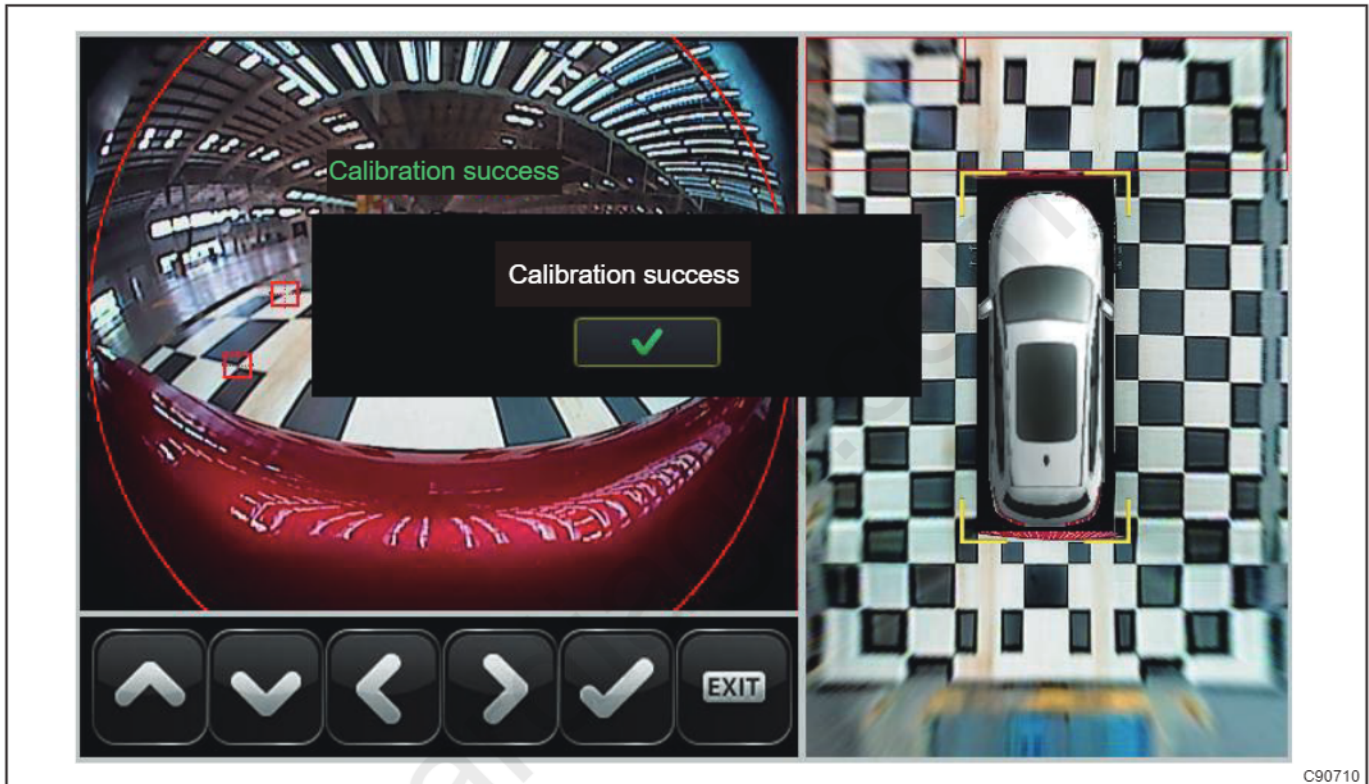
Caution

The command is valid only when three buttons are pressed at the same time and then released. If there is no response on the audio display after one operation, repeat the operation several times until prompt appears.

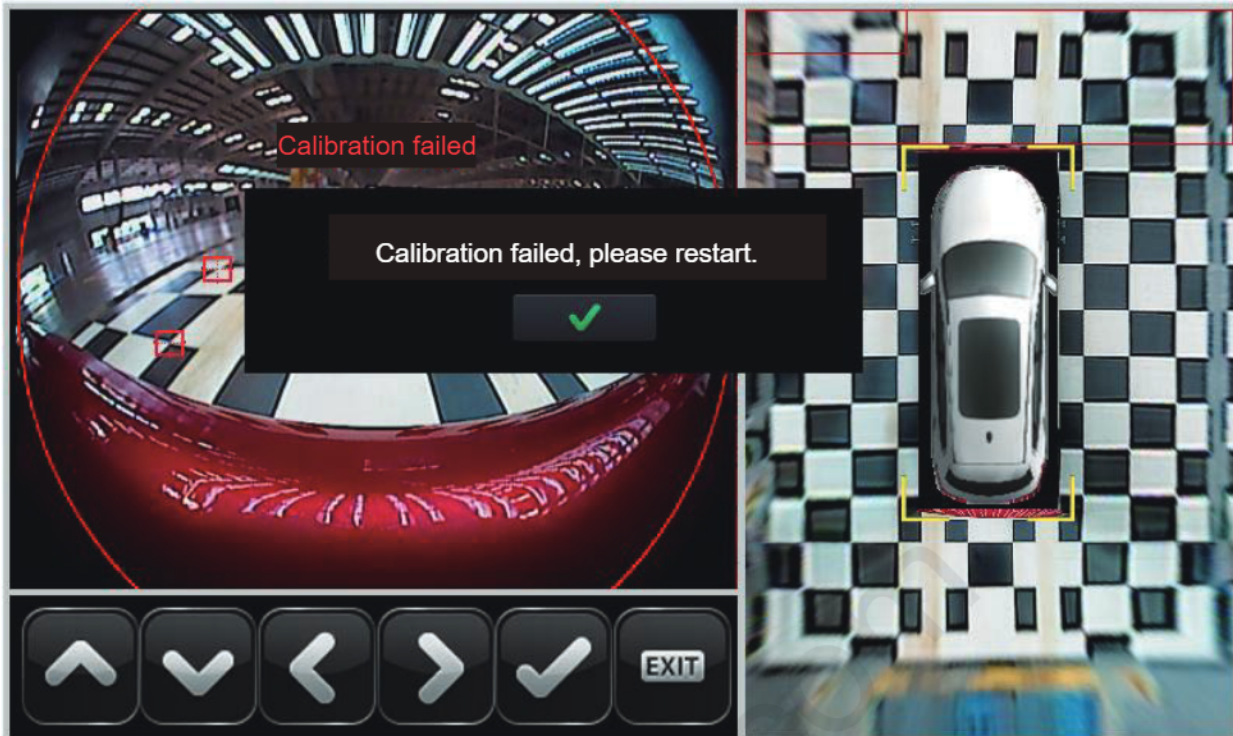
■ **Calibration step 3 (automatic calibration process)**

After step 2, the panoramic view monitor system will restart and automatically start the calibration action. After about 10 seconds, the audio display will prompt the calibration result.

- (1) Calibration successful: prompt "Calibration success", click "✓" to confirm, the system restarts and calibration is completed, then drive the vehicle out of calibration station.



- (2) Calibration failed: prompt "Calibration failed, please restart", after clicking "✓", the system restarts and the calibration ends. If you need to re-calibrate, please re-adjust the vehicle and repeat the calibration step 1 to step 3 again.



C90720

Caution

- During the automatic calibration, the panoramic view monitor system restarts twice, during which a brief blue screen or blurry screen may appear on the audio display; this state is normal and will automatically return to normal after the panoramic view monitor system restarts.
- After the calibration fails, please exit the system directly and do not save the data;
- If the vehicle is not at the calibration station, do not perform calibration operations.

■ Introduction of Automatic Calibration and Determination Scheme

■ Main Content

The automatic calibration of panoramic view monitor system needs to automatically identify the preset calibration points in image, and calculate the relevant camera parameters by combining the image coordinates and physical coordinates of the calibration points to complete the calibration work. The time from when the system starts to enter the calibration state to its completion should be within 10 seconds. The automatic calibration result evaluation mainly completes the following two tasks:

- (1) Determine whether the calibration point identification is accurate, and whether the calibration point can be correctly identified directly determines whether the calibration work can be successfully completed.
- (2) Calibration effect evaluation: In the actual use environment, due to various deviation factors, even if the calibration point can be accurately identified, the calibration result will have a certain deviation. The deviation in mosaic image is mainly reflected in the image distortion, mosaic dislocation.

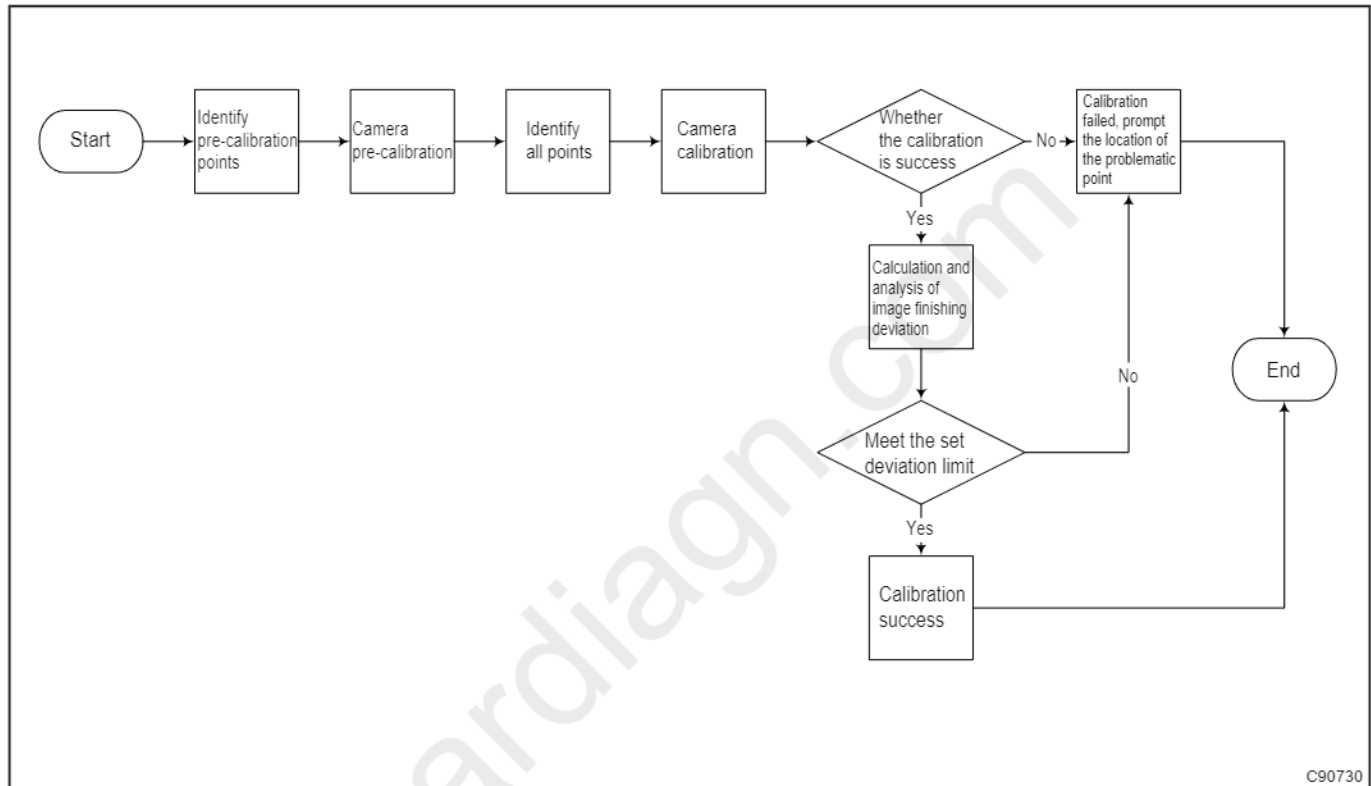
■ Solution Method

- At present, automatic calibration adopts a redundant calibration point. In addition to the image points that must be used for calibration, automatic calibration will also identify some auxiliary calibration points at the same time. It mainly use the necessary points to complete the calibration, and then use some auxiliary calibration points to verify whether the calibration point recognition is successful.
- By using the calibration data to calculate the physical coordinates corresponding to the auxiliary calibration points in the image, the deviation between calculated physical coordinates and real physical coordinates will fluctuate within a relatively small range, and the calibration can be determined to be successful if the deviation is within a certain threshold; Otherwise, the calibration fails.

■ Judgment Principle

- After calibration is completed, the physical point coordinate P_{phy} corresponding to any point coordinate P_{img} in the camera image can be obtained through calculation. Ideally, the calculated physical coordinate P_{phy} and its corresponding real physical coordinate P_{PHY} should be exactly the same. In the actual case, there will be a certain deviation $E_{pos} = P_{phy} - P_{PHY}$.
- Calculate the mean square deviation S ($S = (1/n * \sum(E_{pos_i}^2))^{(1/2)}$) between physical coordinates and real physical coordinates of all auxiliary points.
- The splicing effect is evaluated by the mean square deviation between calculated physical coordinates and the real physical coordinates of the calibration points in the splicing area.

■ Calibration Procedure



■ Calibration Environment Requirement and Condition Layout

■ Site Requirement

Calibration site size: about 5.6 meters wide and about 8.4 meters long. The black blocks in picture are 60 cm*60 cm, 30 cm*30 cm, 20 cm*60 cm, 30 cm*60 cm, 40 cm*60 cm, and the accuracy is controlled within +/-5 mm. Make sure the black block is on the corresponding straight line with the deviation within 5mm on one side of the line. The vertical and vertical extension lines of any black square intersect at 90° with an deviation of $\pm 0.5^\circ$. Please refer to the illustration below for detailed dimensions.

The calibration site can be adapted to the vehicle with length of 4.4 m to 4.95 m and width of shorter than 2 m.

In order to ensure the calibration effect, the flatness of the ground after laying is required to be high, the flatness deviation is required to be within the maximum deviation of $\pm 10\text{mm}$ for any 2 meters length. If the construction conditions permit, it is recommended to be controlled within $\pm 5\text{ mm}$.

■ Light Condition

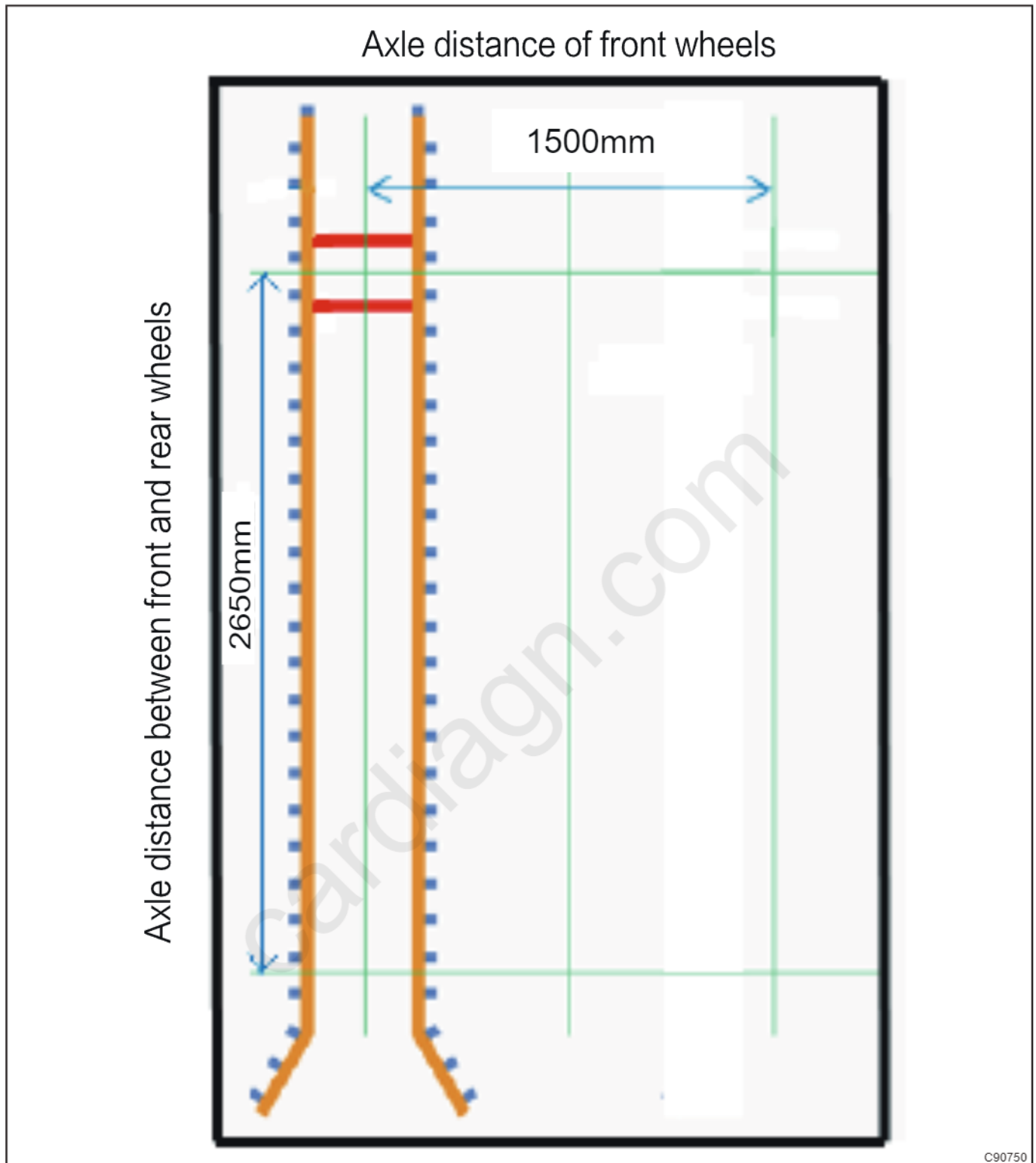
The ambient lighting requirements of the calibration site are mainly diffuse light, LED lighting (LED tube specification: 1.2 meters long, 6500 K color temperature, power above 16 W), using LED tube vertical lighting, requiring ambient brightness between 300 lux and 1000 lux (It is recommended to use at least three rows of LED tubes, and at least 7 LED tubes in each row). The lighting LED tubes should be installed at a height of 3 to 5 meters directly above the calibration field. In order to prevent sunlight from entering the calibration field through doors and windows, it is required the doors and windows around the field are covered with thick white cloth or shading plates.

■ Floor Materials Requirements

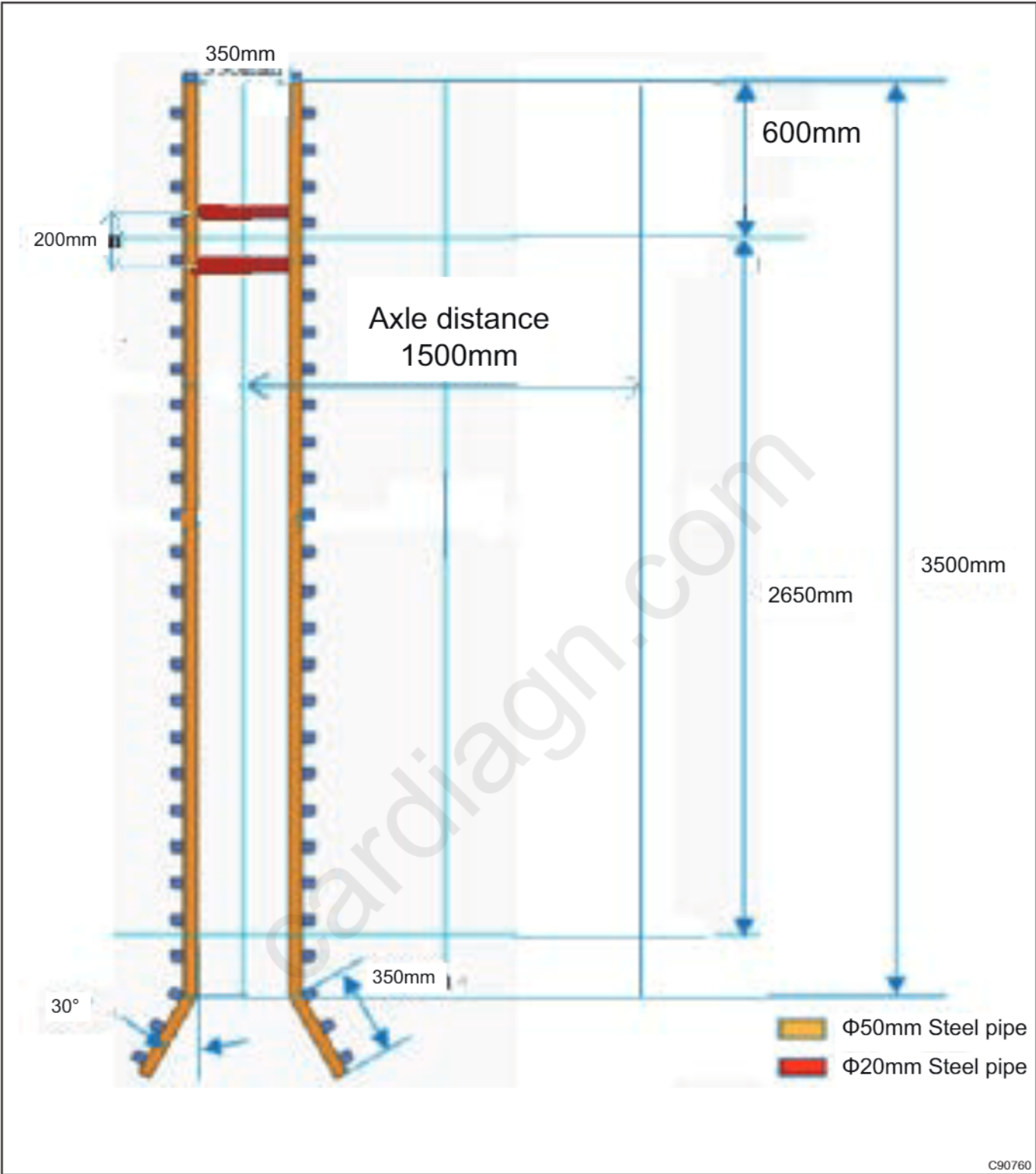
It is recommended to use black and white acrylic matt outdoor paint (for example: Nadis acrylic outdoor paint) for the calibration of the site. When it comes to wear resistance and matt performance, a better matt paint specification can be selected according to the actual situation to achieve better wear resistance requirements. The checkerboard burr must be within ± 1 mm, and no spots larger than 2 mm are allowed inside the grid.

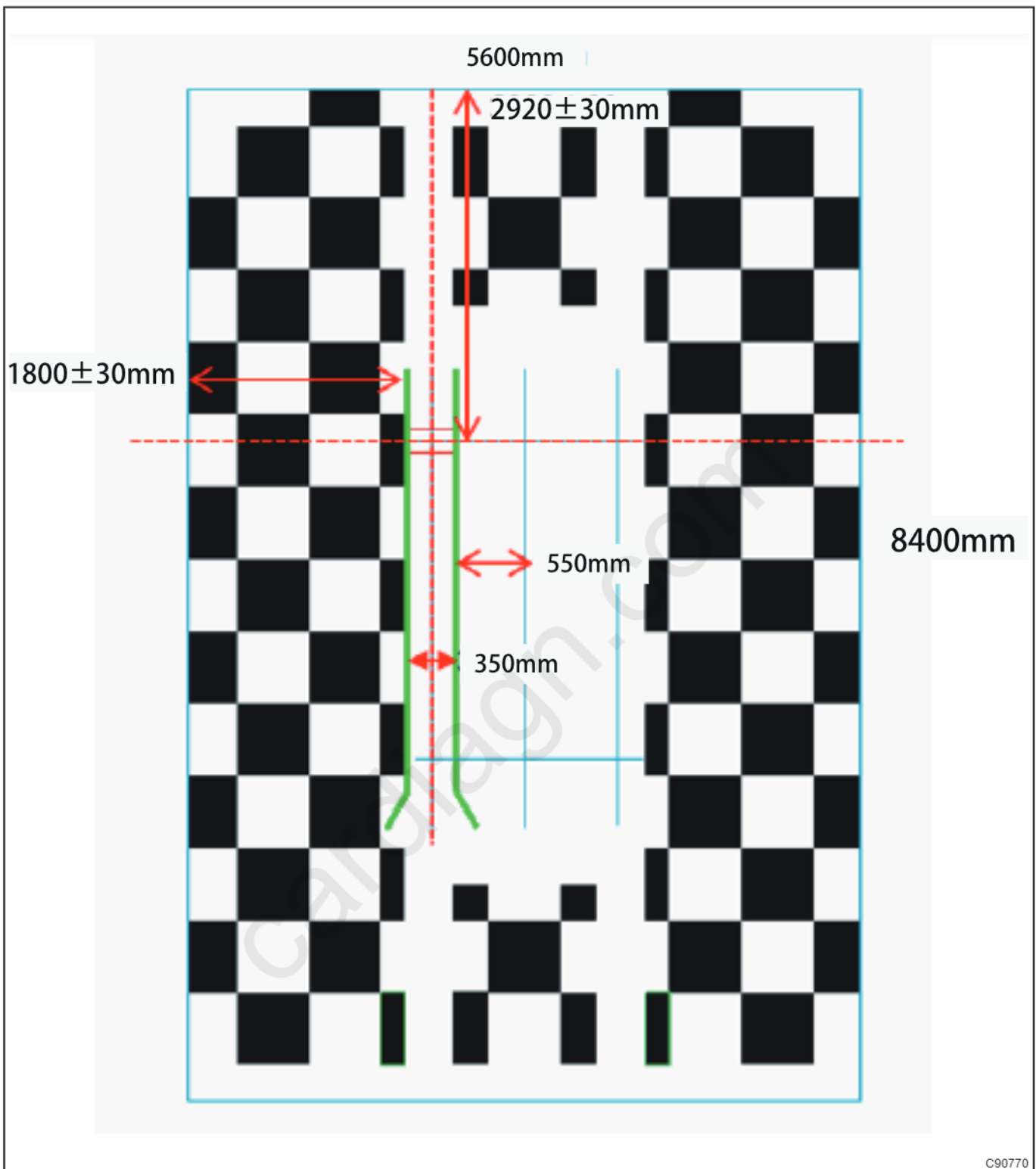
■ Design Requirements for Vehicle Body Area

- (1) Ground construction and laying: The cement floor is used to ensure that the cement floor and the surrounding floors are laid on the same plane, and treat the cement surface with a matte.
- (2) Vehicle positioning device: The vehicle positioning adopts a single-sided and dual-rail positioning method, and the card position accuracy is required to be controlled within ± 5 cm, as shown in illustration.



- (3) The type and design requirements of the guide rail: It is recommended to use steel pipes as the material for the guide rail used in calibration site. The type and size requirements are shown in illustration below.





C90770

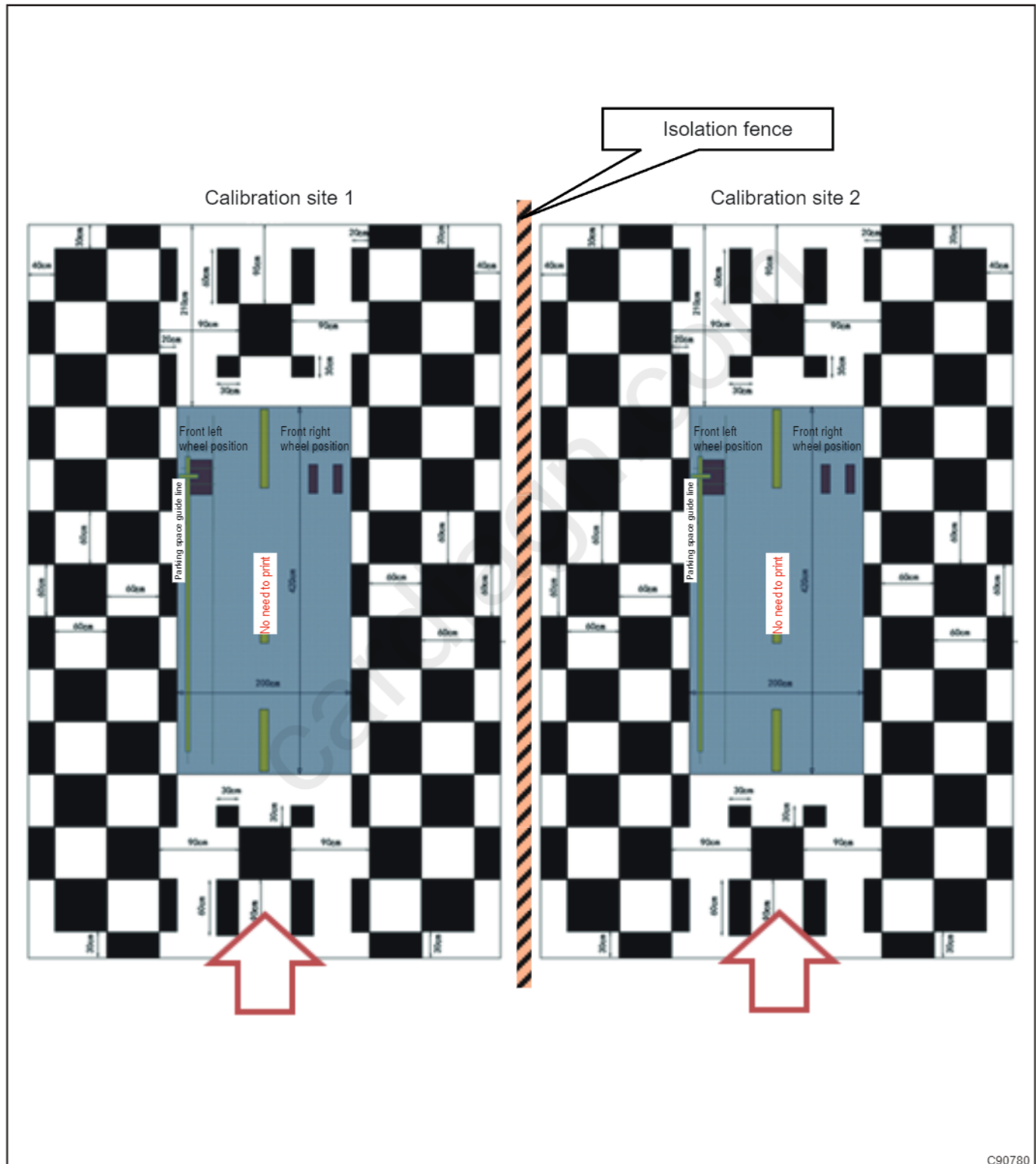
Caution

The calibration site can be adapted to the vehicle range: 4.4 m ~ 4.95 m of length and shorter than 2 m of width.

(4) Fixation requirements of the guide rail and ground:

- 1) Use expansion screws to fix it on the cement floor with ears around guide rail;
- 2) The thickness of the fixed ears is recommended to choose a material of 5 mm ~ 10 mm;

- 3) The fixed point arrangement needs to be on the same horizontal line as the center point of each grid side line (Note: When the fixed point is on the outer side, it needs to be performed according to this, if it is on the inner side, it can be implemented according to the actual situation).
- (5) Isolation requirements between two sites: If two calibration sites are together (as shown in illustration below), they need to be isolated or shielded in the middle of the sites to avoid mutual interference during the calibration (recommended isolation fence height is higher than 1.2 meters, length is longer than 8.4 meters, the surface material is recommended to be white matte material).



C90780

■ Personnel Requirements

Operators who perform the calibration of the panoramic view monitor system need to undergo calibration training, and a dedicated person is recommended.

■ Maintenance and Repair of Site

In order to ensure the service life of calibration site and the calibration effect of panoramic view monitor, it is recommended that a dedicated person be responsible for the daily repair and maintenance of calibration site. Precautions as follows:

- (1) Daily cleaning is recommended once a day; deep cleaning is recommended once a month; annual site inspection is recommended once a year; if the calibration chart is obviously dirty, damaged, or the calibration success rate is significantly reduced, immediate repair and maintenance are required;
- (2) The site needs to be equipped with special and clean cleaning tools, such as mops or clothes, etc., and cannot be mixed with tools at other stations to avoid contamination with oil and ground reflections;
- (3) In the calibration site area, it is necessary to avoid the entry, exit, stepping, etc. of irrelevant personnel, vehicles, etc., to avoid damage to the site.

2 DIAGNOSIS & TESTING

2.1 Problem Symptoms Table

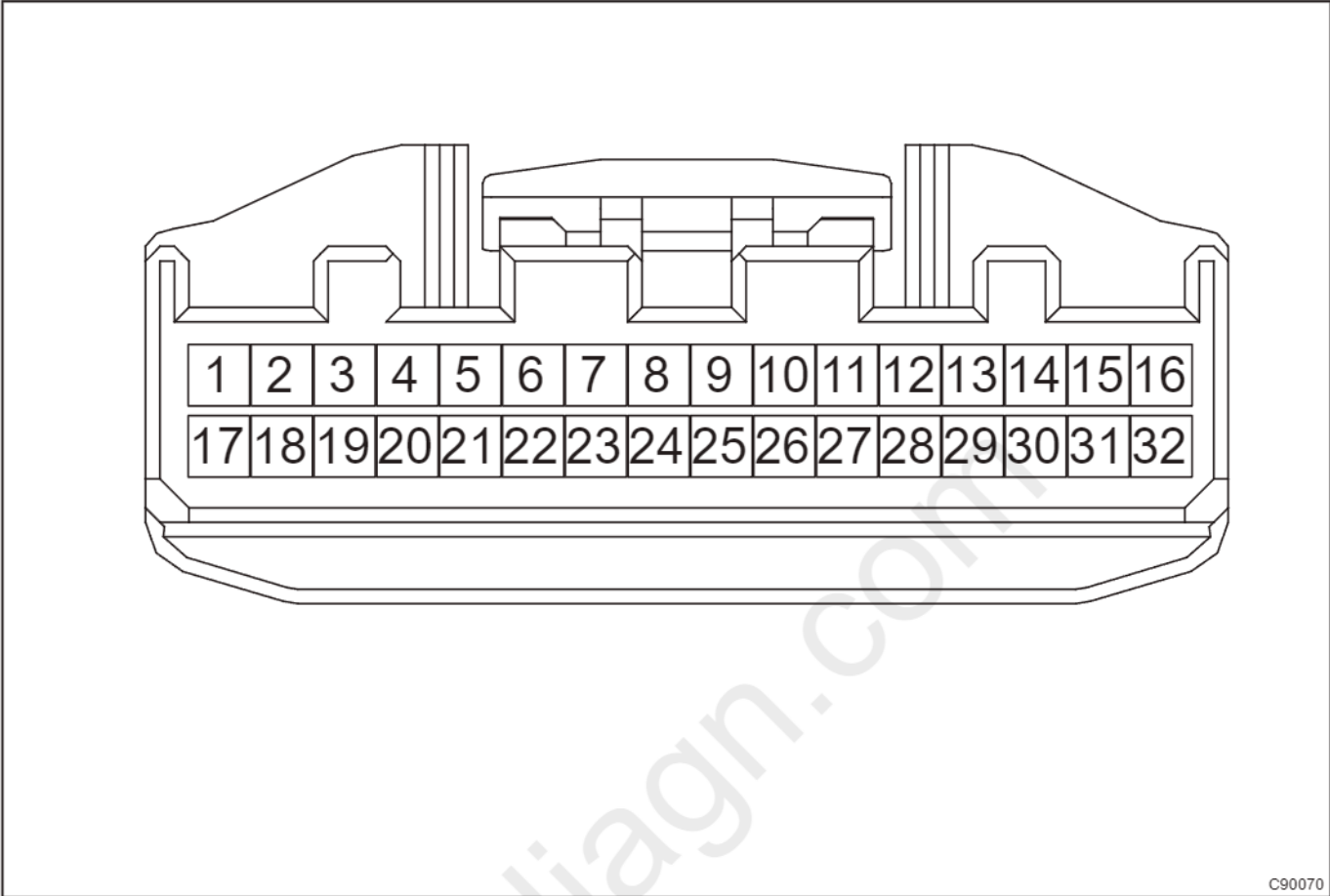
Hint:

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

Symptom	Suspected Area
After reverse gear is engaged, there is no reversing view monitor and the meter does not display the reverse distance	Observe whether the back-up light is come on: If it is come on, check the reverse signal input of DVD/navigation system and BCM. If it is not come on, check the back-up light switch and line
After reverse gear is engaged, there is no reversing view monitor and the meter display the reverse distance	Check the reverse signal input of DVD/navigation system, camera and line.
After reverse gear is engaged, there is reversing view monitor (if equipped with reversing view monitor) but the meter does not display the reverse distance	Check the reverse signal input of BCM, the LIN of BCM and reversing radar controller, and check the reversing radar controller
Sensor failure, and instrument cluster send an alarm	Check whether there is dirt on reversing radar sensor. If so, remove the dirt on the sensor and check whether the sensor is damaged. If necessary, replace the inspection sensor wire harness

2.2 Module Terminal List

■ Panoramic Control System (AVM) (With APA) Terminal List

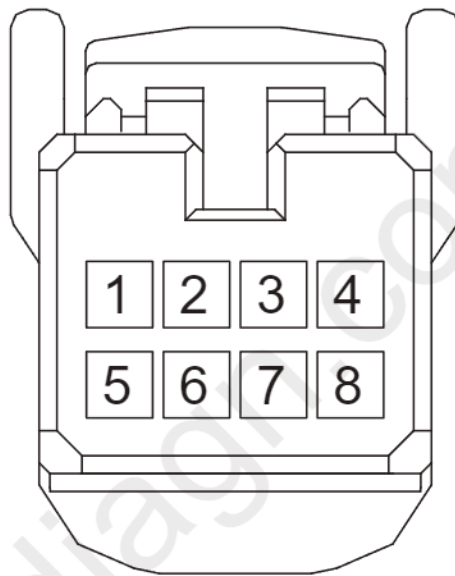


C90070

PIN	Description	PIN	Description
1	APA-LED	17	APA switch signal (low level)
2	PDC-LED	18	PDC switch signal (low level)
3	Signal ground (rear)	19	Signal power supply (rear)
4	Signal (rear right)	20	Signal (rear left)
5	Signal (rear left)	21	Signal (rear left center)
6	Signal (rear right center)	22	Signal (rear right)
7	Signal ground (front)	23	Signal power supply (front)
8	Signal (front right)	24	Signal (front left)
9	Signal (front left)	25	Signal (center left)
10	Signal (center right)	26	Signal (front right)
11	-	27	AVM switch signal (low level)

PIN	Description	PIN	Description
12	-	28	-
13	-	29	-
14	Chassis - CAN_L	30	Chassis - CAN_L
15	-	31	Power supply
16	Ground	32	Power supply

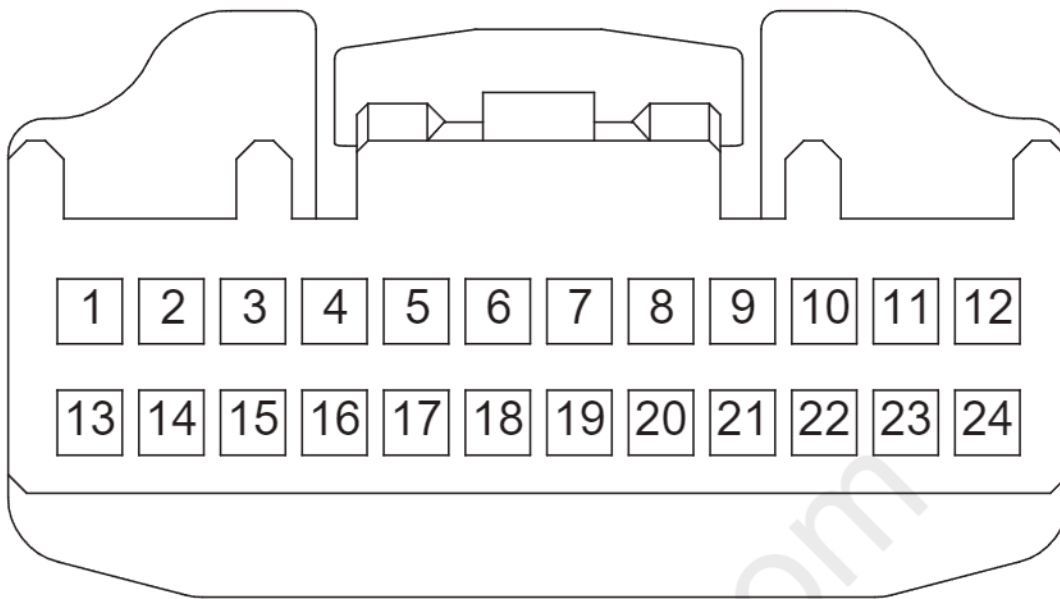
■ Panoramic Controller (Without APA) - A Terminal Definition



C90080

PIN	Description	PIN	Description
1	-	5	-
2	CAN H	6	CAN L
3	Ignition Signal	7	Switch signal
4	Ground	8	Power supply

■ Reverse Distance Assist System (PDC) Terminal List



C90090

PIN	Description	PIN	Description
1	–	13	–
2	–	14	–
3	Power supply	15	Right reversing radar sensor signal
4	Center right reversing radar sensor signal	16	Ground
5	CAN-H	17	Left parking assist radar sensor signal
6	CAN-L	18	Center left parking radar sensor signal
7	Left reversing radar sensor signal	19	Center right parking radar sensor signal
8	Center left reversing radar sensor signal	20	Right parking radar sensor signal
9	–	21	–
10	–	22	PDC warning sound off indicator

PIN	Description	PIN	Description
11	Center left reversing radar sensor power supply	23	PDC warning sound off
12	Right reversing radar sensor ground	24	–

2.3 Diagnostic Help

- (1) Connect diagnostic tester X-431 3G (the latest software) to Data Link Connector (DLC), 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 electronic 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 system grounds related to the latest DTCs.
- (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.

2.4 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.
- Monitor diagnostic tester (the latest software) data that is related to this circuit.
- Wiggle related wire harnesses and connectors and observe if signal is interrupt in related circuit.
- If possible, try to duplicate the 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 airbag components 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.

2.5 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.

2.6 Diagnosis Procedure

Use following procedures to troubleshoot the parking assist system.

1	Vehicle brought to workshop
---	-----------------------------

Next

2 Check battery voltage

Standard voltage: Not less than 12 V

NG

Replace battery

OK

3 Customer problem analysis

Next

4 Read DTCsHistory
DTCTroubleshoot according to intermittent DTC
malfunction proceduresCurrent
DTC**5 Repair according to Diagnostic Trouble Code (DTC) Chart**

Next

6 Adjust, repair or replace

Next

7 Conduct test and confirm malfunction has been repaired

Next

End

2.7 Reversing Radar System Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition
B16000C	PDC ECU Failure
B160117	Supply Voltage Error - High Voltage
B165616	Supply Voltage Error - Low Voltage
B161004	Sensor for PDC Front Left Outer No Signal / No Communication
B161106	Sensor for PDC Front Left Outer Short Circuit to Ubat
B161209	Sensor for PDC Front Left Outer Open Circuit or Short Circuit to Ground

DTC	DTC Definition
B16130C	Sensor for PDC Front Left Outer Defect
B161404	Sensor for PDC Front Left Inner No Signal / No Communication
B161506	Sensor for PDC Front Left Inner Short Circuit to Ubat
B161609	Sensor for PDC Front Left Inner Open Circuit or Short Circuit to Ground
B16170C	Sensor for PDC Front Left Inner Defect
B161804	Sensor for PDC Front Right Inner No Signal / No Communication
B161906	Sensor for PDC Front Right Inner Short Circuit to Ubat
B162009	Sensor for PDC Front Right Inner Open Circuit or Short Circuit to Ground
B16210C	Sensor for PDC Front Right Inner Defect
B162204	Sensor for PDC Front Right Outer No Signal / No Communication
B162306	Sensor for PDC Front Right Outer Short Circuit to Ubat
B162409	Sensor for PDC Front Right Outer Open Circuit or Short Circuit to Ground
B16250C	Sensor for PDC Front Right Outer Defect
B162604	Sensor for PDC Rear Left Outer No Signal / No Communication
B162706	Sensor for PDC Rear Left Outer Short Circuit to Ubat
B162809	Sensor for PDC Rear Left Outer Open Circuit or Short Circuit to Ground
B16290C	Sensor for PDC Rear Left Outer Defect
B163004	Sensor for PDC Rear Left Inner No Signal / No Communication
B163106	Sensor for PDC Rear Left Inner Short Circuit to Ubat
B163209	Sensor for PDC Rear Left Inner Open Circuit or Short Circuit to Ground
B16330C	Sensor for PDC Rear Left Inner Defect
B163404	Sensor for PDC Rear Right Inner No Signal / No Communication
B163506	Sensor for PDC Rear Right Inner Short Circuit to Ubat
B163609	Sensor for PDC Rear Right Inner Open Circuit or Short Circuit to Ground
B16370C	Sensor for PDC Rear Right Inner Defect
B163804	Sensor for PDC Rear Right Outer No Signal / No Communication
B163906	Sensor for PDC Rear Right Outer Short Circuit to Ubat

DTC	DTC Definition
B164009	Sensor for PDC Rear Right Outer Open Circuit or Short Circuit to Ground
B16410C	Sensor for PDC Rear Right Outer Defect
B165006	PDC Beepoff Switch Indicator Short to Ubat
B165107	PDC Beepoff Switch Indicator Short to Ground
B165407	PDC Beep Off Switch Short to Ground
B16B800	Configuration Error - Not Coded

2.8 DTC Diagnosis Procedure

DTC	B16000C	PDC ECU Failure
DTC	DTC Definition	Possible Cause
B16000C	PDC ECU Failure	Controller is damaged

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Check controller
---	------------------

Use circuit diagram as a guide to perform the following inspection procedures:

- (a) Using a diagnostic tester to clear DTCs, perform running test to check if malfunction occurs again.

NG	Replace the controller
OK	System is normal

DTC	B160117	Supply Voltage Error - High Voltage
DTC	B165616	Supply Voltage Error - Low Voltage

DTC	DTC Definition	Possible Cause
B160117	Supply Voltage Error - High Voltage	- Power supply system malfunction - Wire harness connector malfunction
B165616	Supply Voltage Error - Low Voltage	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).

- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check system voltage

Start engine, and use voltage band of multimeter to check if battery voltage is normal (minimum voltage is not less than 12 V).

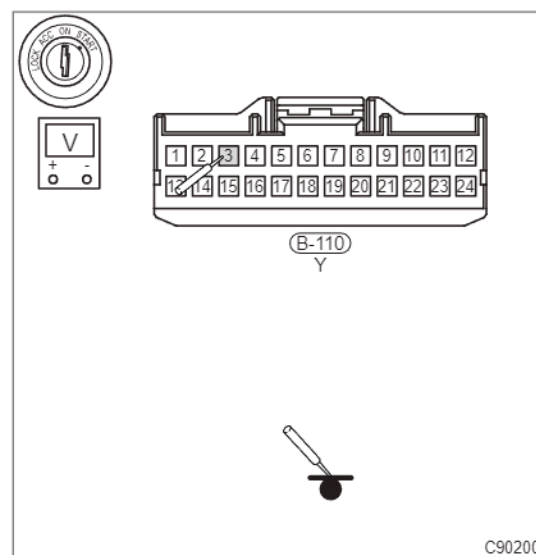
NG**Repair or replace battery/alternator****OK****2 Check fuse**

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Check continuity of fuse RF35 in instrument panel fuse box with a digital multimeter.

NG**Replace fuse****OK****3 Check module power supply**

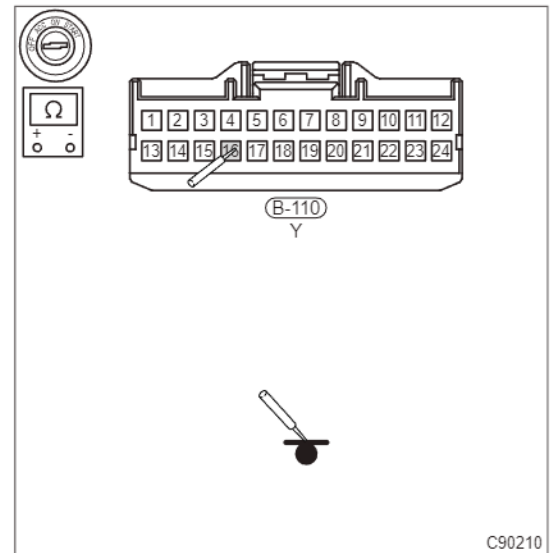
- (a) Turn ENGINE START STOP switch to OFF and connect the negative battery cable.
 (b) Turn ENGINE START STOP switch to ON and use a digital multimeter to measure voltage of power. If the voltage is as required, make tests with a 21 W bulb. Bright test lamp indicates that power supply is sufficient, and dim test lamp indicates that power supply is insufficient and poor contact of wire harness may occur.

Multimeter Connection	Condition	Specified Condition
B-110 (3) - ground	ENGINE START STOP switch "ON"	Not less than 12 V

**NG****Repair wire harness****OK****4 Check the module ground**

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the component connector.
- (c) Use ohm band of digital multimeter to detect the continuity between B-110 (16) and ground.

Multimeter Connection	Condition	Specified Condition
B-110 (16) - ground	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$



OK	Replace module assembly
NG	Check or repair the module ground

DTC	B161106	Sensor for PDC Front Left Outer Short Circuit to Ubat
DTC	B161506	Sensor for PDC Front Left Inner Short Circuit to Ubat
DTC	B161906	Sensor for PDC Front Right Inner Short Circuit to Ubat
DTC	B162306	Sensor for PDC Front Right Outer Short Circuit to Ubat
DTC	B162706	Sensor for PDC Rear Left Outer Short Circuit to Ubat
DTC	B163106	Sensor for PDC Rear Left Inner Short Circuit to Ubat
DTC	B163506	Sensor for PDC Rear Right Inner Short Circuit to Ubat
DTC	B163906	Sensor for PDC Rear Right Outer Short Circuit to Ubat
DTC	B165006	PDC Beepoff Switch Indicator Short to Ubat

DTC	DTC Definition	Possible Cause
B161106	Sensor for PDC Front Left Outer Short Circuit to Ubat	- Sensor failure - Wire harness connector malfunction
B161506	Sensor for PDC Front Left Inner Short Circuit to Ubat	
B161906	Sensor for PDC Front Right Inner Short Circuit to Ubat	
B162306	Sensor for PDC Front Right Outer Short Circuit to Ubat	
B162706	Sensor for PDC Rear Left Outer Short Circuit to Ubat	
B163106	Sensor for PDC Rear Left Inner Short Circuit to Ubat	
B163506	Sensor for PDC Rear Right Inner Short Circuit to Ubat	

DTC	DTC Definition	Possible Cause
B163906	Sensor for PDC Rear Right Outer Short Circuit to Ubat	
B165006	PDC Beepoff Switch Indicator Short to Ubat	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

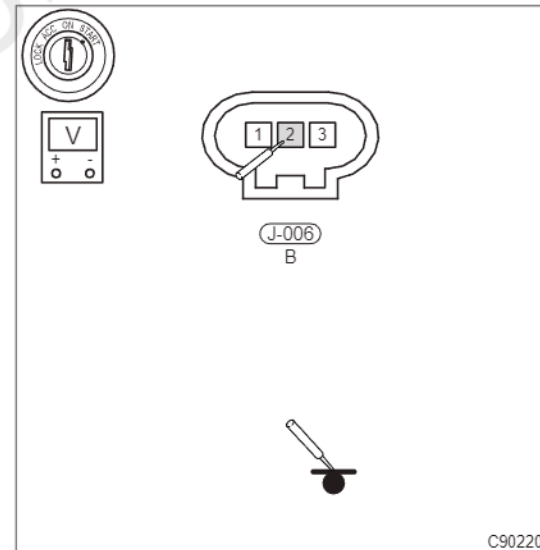
Hint:

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

1 Check the malfunction of sensor for PDC rear left outer Open circuit or short circuit to ground

- Check sensor connectors, controller connectors for corrosion, poor contact, displacement and repair it if any symptom occurs.
- Check the continuity of sensor wire harness and replace wire harness if open circuit malfunction occurs.
- Turn ENGINE START STOP switch to "OFF", disconnect the negative battery cable.
- Disconnect the parking radar controller connector (B-110) and rear left radar sensor connector (J-006).
- Use ohm band of digital multimeter to detect the voltage between J -006(2) and body ground.

Multimeter Connection	Condition	Specified Condition
J-006(2) - Ground	ENGINE START STOP switch "ON"	0V



OK

Clear DTCs

NG

Repair or replace wire harness / connector

DTC	B161209	Sensor for PDC Front Left Outer Short Circuit to Ubat
DTC	B161609	Sensor for PDC Front Left Inner Short Circuit to Ubat
DTC	B162009	Sensor for PDC Front Right Inner Short Circuit to Ubat
DTC	B162409	Sensor for PDC Front Right Outer Short Circuit to Ubat
DTC	B162809	Sensor for PDC Rear Left Outer Short Circuit to Ubat
DTC	B163209	Sensor for PDC Rear Left Inner Short Circuit to Ubat
DTC	B163609	Sensor for PDC Rear Right Inner Short Circuit to Ubat
DTC	B164009	Sensor for PDC Rear Right Outer Short Circuit to Ubat

DTC	B165107	PDC Beepoff Switch Indicator Short to Ubat
DTC	B165407	PDC Beep Off Switch Short to Ground

DTC	DTC Definition	Possible Cause
B161209	Sensor for PDC Front Left Outer Open Circuit or Short Circuit to Ground	• Sensor failure • Wire harness connector malfunction
B161609	Sensor for PDC Front Left Inner Open Circuit or Short Circuit to Ground	
B162009	Sensor for PDC Front Right Inner Open Circuit or Short Circuit to Ground	
B162409	Sensor for PDC Front Right Outer Open Circuit or Short Circuit to Ground	
B162809	Sensor for PDC Rear Left Outer Open Circuit or Short Circuit to Ground	
B163209	Sensor for PDC Rear Left Inner Open Circuit or Short Circuit to Ground	
B163609	Sensor for PDC Rear Right Inner Open Circuit or Short Circuit to Ground	
B164009	Sensor for PDC Rear Right Outer Open Circuit or Short Circuit to Ground	
B165107	PDC Beepoff Switch Indicator Short to Ground	
B165407	PDC Beep Off Switch Short to Ground	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

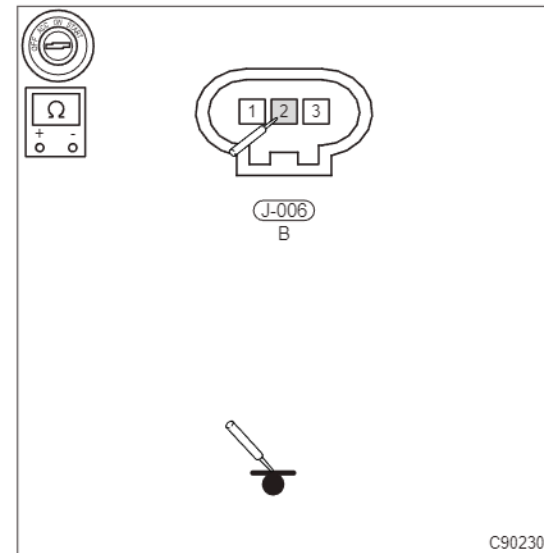
Hint:

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

1	Check the malfunction of sensor for PDC rear left open circuit or short circuit to ground
----------	--

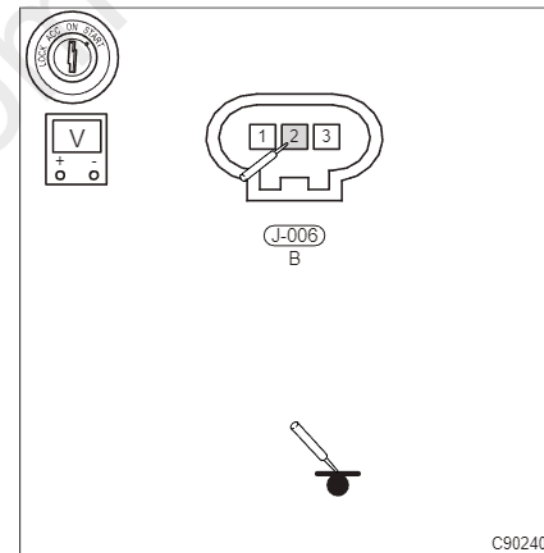
- (a) Turn ENGINE START STOP switch to "OFF", disconnect the negative battery cable.
- (b) Disconnect the parking radar controller connector (B-110) and rear left radar sensor connector (J-006).
- (c) Check for continuity between J-006 (2) and body ground with ohm band of digital multimeter.

Multimeter Connection	Condition	Specified Condition
J-006(2) - Ground	ENGINE START STOP switch "ON"	∞



- (d) Check for continuity between J-006 (2) and body ground with ohm band of digital multimeter.

Multimeter Connection	Condition	Specified Condition
B-110(12) - J- 006 (2)	Always	$\leq 1 \Omega$



OK

Clear DTCs

NG

Repair or replace wire harness / connector

DTC	B16B800	Configuration Error - Not Coded
DTC	DTC Definition	Possible Cause
B16B800	Configuration Error - Not Coded	Not Coded

Hint:

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

1

Use the diagnostic tester to perform writing configuration data

DTC	B161404	Sensor for PDC Front Left Inner No Signal / No Communication
DTC	B16170C	Sensor for PDC Front Left Inner Defect

DTC	B161804	Sensor for PDC Front Right Inner No Signal / No Communication
DTC	B16210C	Sensor for PDC Front Right Inner Defect
DTC	B162204	Sensor for PDC Front Right Outer No Signal / No Communication
DTC	B16250C	Sensor for PDC Front Right Outer Defect
DTC	B162604	Sensor for PDC Rear Left Outer No Signal / No Communication
DTC	B16290C	Sensor for PDC Rear Left Outer Defect
DTC	B163004	Sensor for PDC Rear Left Inner No Signal / No Communication
DTC	B16330C	Sensor for PDC Rear Left Inner Defect
DTC	B163404	Sensor for PDC Rear Right Inner No Signal / No Communication
DTC	B16370C	Sensor for PDC Rear Right Inner Defect
DTC	B163804	Sensor for PDC Rear Right Outer No Signal / No Communication
DTC	B16410C	Sensor for PDC Rear Right Outer Defect

DTC	DTC Definition	Possible Cause
B161004	Sensor for PDC Front Left Outer No Signal / No Communication	• Sensor failure • Wire harness connector malfunction
B16130C	Sensor for PDC Front Left Outer Defect	
B161404	Sensor for PDC Front Left Inner No Signal / No Communication	
B16170C	Sensor for PDC Front Left Inner Defect	
B161804	Sensor for PDC Front Right Inner No Signal / No Communication	
B16210C	Sensor for PDC Front Right Inner Defect	
B162204	Sensor for PDC Front Right Outer No Signal / No Communication	
B16250C	Sensor for PDC Front Right Outer Defect	
B162604	Sensor for PDC Rear Left Outer No Signal / No Communication	
B16290C	Sensor for PDC Rear Left Outer Defect	
B163004	Sensor for PDC Rear Left Inner No Signal / No Communication	
B16330C	Sensor for PDC Rear Left Inner Defect	
B163404	Sensor for PDC Rear Right Inner No Signal / No Communication	
B16370C	Sensor for PDC Rear Right Inner Defect	

DTC	DTC Definition	Possible Cause
B163804	Sensor for PDC Rear Right Outer No Signal / No Communication	
B16410C	Sensor for PDC Rear Right Outer Defect	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check the status of radar sensor and connector line

- Check the appearance of radar sensor body without scratches, breakage or damage, etc.
- Check the status of corresponding connector, and there should be no damage and open circuit, etc.; measure and check the reversing radar module connector and component connector without open circuit or misalignment, etc.

OK

Clear DTCs

2.9 Panoramic Control System (AVM) Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition
B172117	Control Module Battery Voltage is High
B172216	Control Module Battery Voltage is Low
B170013	AVM Front Camera LVDS Cable Open
B170011	AVM Front Camera Power Short to Ground
B170012	AVM Front Camera Power Short to Battery
B170113	AVM Left Camera LVDS Cable Open
B170111	AVM Left Camera Power Supply Short Circuit to Ground
B170112	AVM Left Camera Power Supply Short Circuit to Battery
B170213	AVM Right Camera LVDS Cable Open
B170211	AVM Right Camera Power Supply Short Circuit to Ground
B170212	AVM Right Camera Power Supply Short Circuit to Battery
B170313	AVM Rear Camera LVDS Cable Open
B170311	AVM Rear Camera Power Supply Short Circuit to Ground
B170312	AVM Rear Camera Power Supply Short Circuit to Battery

DTC	DTC Definition
B170571	AVM ON/OFF Switch Mechanical Adhesion
B17061C	APA Function Indicator Light Circuit Failure
B170671	APA ON/OFF Switch Mechanical Adhesion
B17071C	PDC Function Indicator Light Circuit Failure
B170771	PDC ON/OFF Switch Mechanical Adhesion
B170C54	AVM No Calibration
B171204	AVM Controller Malfunction
B171309	Rear Right Long Distance Ultrasonic Sensor Hardware Fault
B171396	Rear Right Long Distance Ultrasonic Sensor Fault
B171409	Rear Right Lateral Ultrasonic Sensor Hardware Fault
B171496	Rear Right Lateral Ultrasonic Sensor Detection Failed
B171509	Rear Right Ultrasonic Sensor Hardware Fault
B171596	Rear Right Ultrasonic Sensor Detection Failed
B171609	Rear Left Ultrasonic Sensor Hardware Fault
B171696	Rear Left Ultrasonic Sensor Detection Failed
B171709	Rear Left Lateral Ultrasonic Sensor Hardware Fault
B171796	Rear Left Lateral Ultrasonic Sensor Detection Failed
B171809	Rear Left Long Distance Ultrasonic Sensor Hardware Fault
B171896	Rear Left Long Distance Ultrasonic Sensor Fault
B171909	Front Right Long Distance Ultrasonic Sensor Hardware Fault
B171996	Front Right Long Distance Ultrasonic Sensor Fault
B171A09	Front Right Lateral Ultrasonic Sensor Hardware Fault
B171A96	Front Right Lateral Ultrasonic Sensor Detection Failed
B171B09	Front Right Ultrasonic Sensor Hardware Fault
B171B96	Front Right Ultrasonic Sensor Detection Failed
B171C09	Front Left Ultrasonic Sensor Hardware Fault
B171C96	Front Left Ultrasonic Sensor Detection Failed
B171D09	Front Left Lateral Ultrasonic Sensor Hardware Fault
B171D96	Front Left Lateral Ultrasonic Sensor Detection Failed
B171E09	Front Left Long Distance Ultrasonic Sensor Hardware Fault
B171E96	Front Left Long Distance Ultrasonic Sensor Fault
B172055	Not Coded

2.10 DTC Diagnosis Procedure

DTC	B172117	Control Module Battery Voltage is High
DTC	B172216	Control Module Battery Voltage is Low

DTC	DTC Definition	Possible Cause
B172117	Control Module Battery Voltage is High	• Battery • AVM module • Wire harness and connector
B172216	Control Module Battery Voltage is Low	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Check battery voltage

Use circuit diagram as a guide to perform the following inspection procedures:

- Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- Check battery voltage (Not less than 12 V) with a digital multimeter.

NG

Replace battery

OK

2 Check charging system

- Turn ENGINE START STOP switch to OFF.
- Check positive and negative battery cables for broken or damage.
- Turn ENGINE START STOP switch to ON.
- Start the engine.
- Check if voltage of positive and negative battery is normal with a digital multimeter (13.5 V - 14.8 V).

NG

Repair or replace positive and negative battery cables and alternator

OK

3 Check AVM module power supply fuse

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Check if AVM module power supply fuses RF35 and RF19 are blown.

NG

Replace power supply fuse

OK

4 Check engine compartment fuse and relay box

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the engine compartment fuse and relay box connector.
- (c) Using digital multimeter, check for continuity between fuse RF35 and Pin C1-14 of engine compartment fuse and relay box.
- (d) Using digital multimeter, check for continuity between fuse RF19 and Pin C3-17 of engine compartment fuse and relay box.

NG

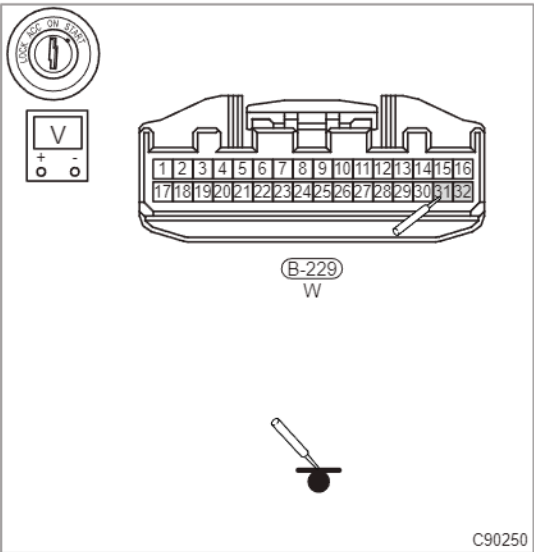
Replace engine compartment fuse and relay box

OK

5 Check AVM module power supply wire harness

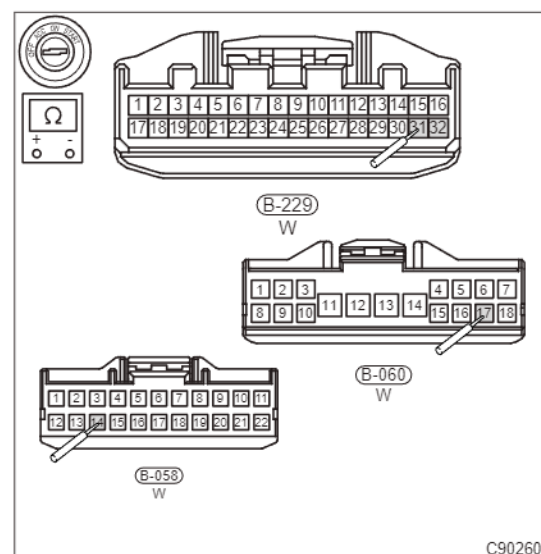
- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the AVM connector B-229.
- (c) Using a digital multimeter, check if the voltage between terminal B-229 (32), (31) and body ground is normal.

Multimeter Connection	Condition	Specified Condition
B-229 (31) - Body ground	Always	Not less than 12 V
B-229 (32) - Body ground	Always	Not less than 12 V



- (d) Using digital multimeter, check for continuity between AVM module connector B-229 (31) - engine compartment fuse and relay box terminal B - 058 (14) and terminal B-229 (32) - B-060 (17) to check power supply wire harness for open.

Multimeter Connection	Condition	Specified Condition
B-229 (31) - B-058 (14)	Always	$\leq 1 \Omega$
B-229 (32) - B-060 (17)	Always	$\leq 1 \Omega$



NG

Repair or replace wire harness

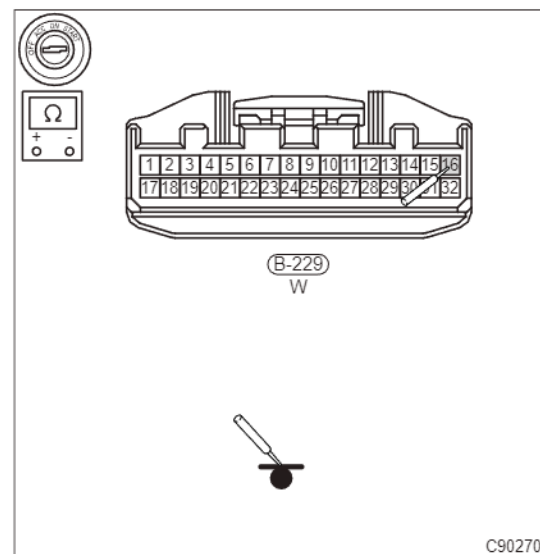
OK

6

Check AVM module ground circuit

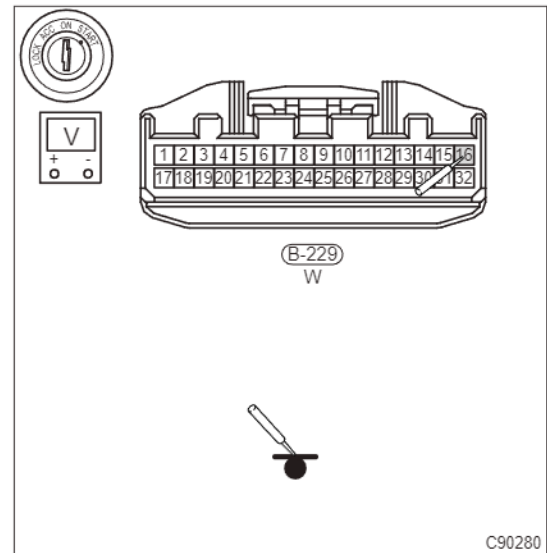
- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect AVM module connector.
 (c) Using digital multimeter, check for continuity between terminals (16) of B -229 and ground wire harness connector GB-136 to check ground wire harness for open.

Multimeter Connection	Condition	Specified Condition
B-229 (16) - GB-136	Always	$\leq 1 \Omega$



- (d) Using voltage band of digital multimeter, measure voltage between B-229 (16) and body ground to check for short to power supply.

Multimeter Connection	Condition	Specified Condition
B-229 (16) - GB-136	Always	0V



NG

Repair or replace wire harness

OK

7

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B170013	AVM Front Camera LVDS Cable Open
DTC	B170011	AVM Front Camera Power Short to Ground
DTC	B170012	AVM Front Camera Power Short to Battery

DTC	DTC Definition	Possible Cause
B170013	AVM Front Camera LVDS Cable Open	- Camera - Wire harness - AVM module
B170011	AVM Front Camera Power Short to Ground	
B170012	AVM Front Camera Power Short to Battery	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Replace camera with a new one
----------	--------------------------------------

Use circuit diagram as a guide to perform the following inspection procedures:

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Replace front camera with a new one, connect negative battery cable, and turn ENGINE START STOP switch to ON. Start panoramic view monitor system and observe if the camera is working properly.

OK

Replace front camera

NG

2	Check wire harness and connector
----------	---

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Disconnect panoramic view monitor control module connector B-226 and front camera connector Q-019.
- (c) Using ohm band of multimeter, check for continuity between B-226 (1) and Q-019 (1).

Multimeter Connection	Condition	Specified Condition
B-226 (1) - Q-019 (1)	Always	$\leq 1 \Omega$

- (d) Using ohm band of multimeter, check for continuity between B-226 (2) and Q-019 (2).

Multimeter Connection	Condition	Specified Condition
B-226 (2) - Q-019 (2)	Always	$\leq 1 \Omega$

NG

Repair or replace wire harness and connector

OK

3	Check for short to ground in wire harness or connector.
----------	--

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Disconnect panoramic view monitor control module connector B-226 and front camera connector Q-019.
- (c) Using ohm band of multimeter, check for continuity between B-226 (1) and ground, B-226 (2) and ground separately.

Multimeter Connection	Condition	Specified Condition
B-226 (1) - Body ground	Always	No continuity
B-226 (2) - Body ground	Always	No continuity

NG

Repair or replace connector or wire harness that is shorted to ground

OK

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B170113	AVM Left Camera LVDS Cable Open
DTC	B170111	AVM Left Camera Power Supply Short Circuit to Ground
DTC	B170112	AVM Left Camera Power Supply Short Circuit to Battery

DTC	DTC Definition	Possible Cause
B170113	AVM Left Camera LVDS Cable Open	• Camera • Wire harness • AVM module
B170111	AVM Left Camera Power Supply Short Circuit to Ground	
B170112	AVM Left Camera Power Supply Short Circuit to Battery	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Replace camera with a new one

Use circuit diagram as a guide to perform the following inspection procedures:

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Replace left camera with a new one, connect negative battery cable, and turn ENGINE START STOP switch to ON. Start panoramic view monitor system and observe if the camera is working properly.

OK

Replace left camera

NG

2 Check wire harness and connector

- (a) Turn ENGINE START STOP switch to "OFF", disconnect the negative battery cable.
- (b) Disconnect panoramic view monitor control module connector B-225 and left rear view mirror camera connector F-015.
- (c) Using ohm band of multimeter, check for continuity between B-225 (1) and F-015 (1), B-225 (2) and F-015 (2) separately.

Multimeter Connection	Condition	Specified Condition
B-225 (1) - F-015 (1)	Always	$\leq 1 \Omega$
B-225 (2) - F-015 (2)	Always	$\leq 1 \Omega$

NG

Repair or replace wire harness and connector

OK

3 Check for short to ground in wire harness and connector

- (a) Turn ENGINE START STOP switch to "OFF", disconnect the negative battery cable.
- (b) Disconnect the panoramic view monitor control module connector B-225.
- (c) Using ohm band of multimeter, check for continuity between B-225 (1) and ground, B-225 (2) and ground separately.

Multimeter Connection	Condition	Specified Condition
B-225 (1) - Body ground	Always	∞
B-225 (2) - Body ground	Always	∞

NG

Repair or replace connector or wire harness that is shorted to ground

OK

4 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B170213	AVM Right Camera LVDS Cable Open
DTC	B170211	AVM Right Camera Power Supply Short Circuit to Ground
DTC	B170212	AVM Right Camera Power Supply Short Circuit to Battery

DTC	DTC Definition	Possible Cause
B170213	AVM Right Camera LVDS Cable Open	• Camera • Wire harness • AVM module
B170211	AVM Right Camera Power Supply Short Circuit to Ground	
B170212	AVM Right Camera Power Supply Short Circuit to Battery	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Replace camera with a new one

Use circuit diagram as a guide to perform the following inspection procedures:

- (a) Turn ENGINE START STOP switch to "OFF", disconnect the negative battery cable.
- (b) Replace right camera with a new one, connect negative battery cable, and turn ENGINE START STOP switch to ON. Start panoramic view monitor system and observe if the camera is working properly.

OK

Replace right camera

NG

2 Check for open in wire harness and connector

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Disconnect panoramic view monitor control module connector B-224 and right rear view mirror camera connector H-012.
- (c) Using ohm band of multimeter, check for continuity between B-224 (1) and H-012 (1), B-224 (2) and H-012 (2) separately.

Multimeter Connection	Condition	Specified Condition
B-224 (1) - H-012 (1)	Always	$\leq 1 \Omega$
B-224 (2) - H-012 (2)	Always	$\leq 1 \Omega$

NG

Repair or replace wire harness and connector

OK

3

Check for short to ground in wire harness and connector

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Disconnect the panoramic view monitor control module connector B-224.
- (c) Using ohm band of multimeter, check for continuity between B-224 (1) and ground, B-224 (2) and ground separately.

Multimeter Connection	Condition	Specified Condition
B-224 (1) - Body ground	Always	∞
B-224 (2) - Body ground	Always	∞

NG

Repair or replace connector or wire harness that is shorted to ground

OK

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B170313	AVM Rear Camera LVDS Cable Open
DTC	B170311	AVM Rear Camera Power Supply Short Circuit to Ground
DTC	B170312	AVM Rear Camera Power Supply Short Circuit to Battery

DTC	DTC Definition	Possible Cause
B170313	AVM Rear Camera LVDS Cable Open	• Camera • Wire harness • AVM module
B170311	AVM Rear Camera Power Supply Short Circuit to Ground	
B170312	AVM Rear Camera Power Supply Short Circuit to Battery	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1	Replace camera with a new one
----------	--------------------------------------

Use circuit diagram as a guide to perform the following inspection procedures:

- Turn ENGINE START STOP switch to "OFF", disconnect the negative battery cable.
- Replace rear camera with a new one, connect negative battery cable, and turn ENGINE START STOP switch to ON. Start panoramic view monitor system and observe if the camera is working properly.

OK

Replace rear camera

NG

2	Check wire harness and connector
----------	---

- Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- Disconnect panoramic view monitor control module connector B-223 and rear camera connector T-009.
- Using ohm band of multimeter, check for continuity between B-223 (1) and T-009 (1), B - 223 (2) and T - 009 (2) separately.

Multimeter Connection	Condition	Specified Condition
B-223 (1) - T-009 (1)	Always	$\leq 1 \Omega$
B-223 (2) - T-009 (2)	Always	$\leq 1 \Omega$

NG

Repair or replace wire harness and connector

OK

3

Check for short to ground in wire harness and connector

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Disconnect the panoramic view monitor control module connector B-223.
- (c) Using ohm band of multimeter, check for continuity between B-223 (1) and body ground, B-223 (2) and body ground separately.

Multimeter Connection	Condition	Specified Condition
B-223 (1) - Body ground	Always	∞
B-223 (2) - Body ground	Always	∞

NG

Repair or replace connector or wire harness that is shorted to ground

OK

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B170571	AVM ON/OFF Switch Mechanical Adhesion
DTC	DTC Definition	Possible Cause
B170571	AVM ON/OFF switch mechanical adhesion	• AVM switch • Wire harness • AVM module

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Enter AVM system and read related data stream

Use circuit diagram as a guide to perform the following inspection procedures:

- Connect the diagnostic tester.
- Read data stream "input status" .
- Press the switch to check the transition of data stream state to check if switch input is normal.

OK

Turn off vehicle power supply (disconnect the negative battery cable), then clear DTC again

NG

2 Replace AVM switch with a new one

- Turn ENGINE START STOP switch to OFF.
- Remove the old AVM switch.
- Install new switch and perform running test.

OK

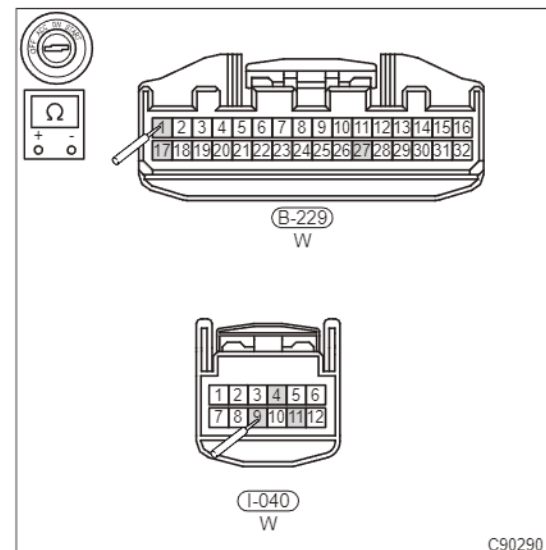
Replace AVM switch

NG

3 Check wire harness for open or short

- Turn ENGINE START STOP switch to OFF.
- Disconnect the negative battery cable.
- Disconnect central console switch connector I-040 and AVM module connector B-229.
- Check if wire harnesses are worn, pierced, pinched or partially broken.
- Check for broken, bent, protruded or corroded terminals.
- Check if related connector pins are in good condition.
- Using ohm band of digital multimeter, check for continuity between I-040 (9) and B-229 (1), I-040 (4) and B-229 (17), I-040 (11) and B-229 (27) to check circuit for open.

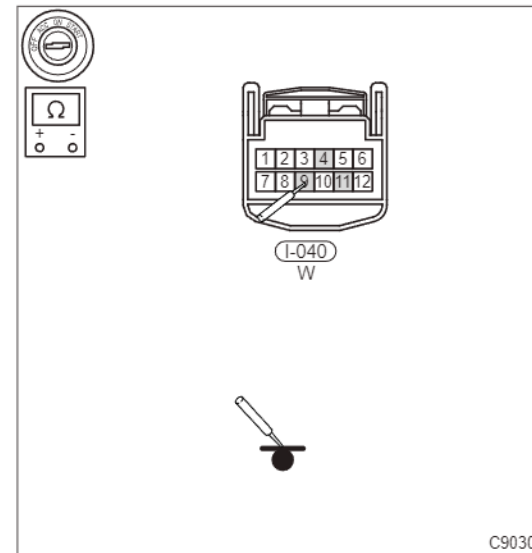
Multimeter Connection	Condition	Specified Condition
I-040 (9) - B-229 (1)	Always	$\leq 1 \Omega$
I-040 (4) - B-229 (17)	Always	$\leq 1 \Omega$
I-040 (11) - B-229 (27)	Always	$\leq 1 \Omega$



C90290

- (h) Using ohm band of digital multimeter, check for continuity between terminals (9), (4) and (11) of connector I-040 and body ground to check instrument panel wire harness for short to ground.

Multimeter Connection	Condition	Specified Condition
I-040 (9) - Body ground	Always	No continuity
I-040 (4) - Body ground	Always	No continuity
I-040 (11) - Body ground	Always	No continuity



NG

Repair or replace connector or wire harness

OK

4

Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
 (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
 (c) Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B17071C	PDC Function Indicator Light Circuit Failure	
DTC	B170771	PDC ON/OFF Switch Mechanical Adhesion	
DTC		DTC Definition	Possible Cause
B17071C		PDC Function Indicator Light Circuit Failure	• PDC Switch • Wire harness • AVM module
B170771		PDC ON/OFF Switch Mechanical Adhesion	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1

Replace PDC switch with a new one

Use circuit diagram as a guide to perform the following inspection procedures:

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Remove the old PDC switch
- (c) Install new switch and perform running test.

OK

Replace PDC switch

NG

2

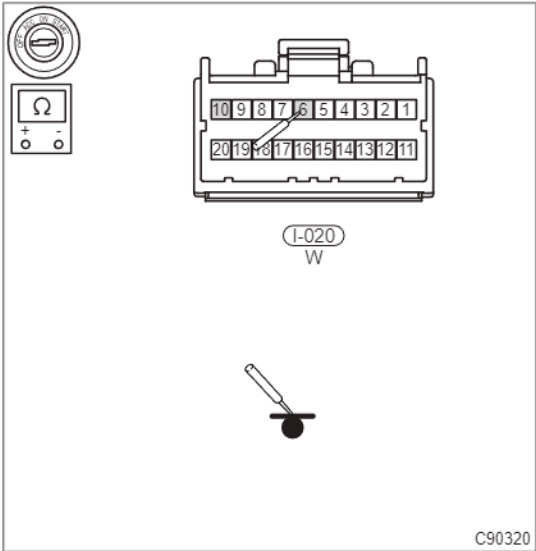
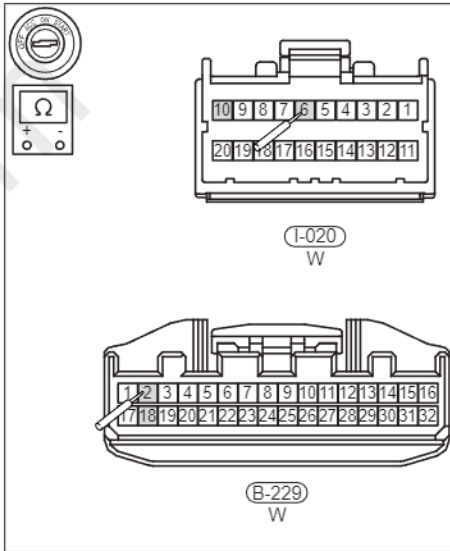
Check wire harness for open or short

- (a) Turn ENGINE START STOP switch to OFF.
- (b) Disconnect the negative battery cable.
- (c) Disconnect PDC switch connector I-020 and AVM module connector B-229.
- (d) Check if wire harnesses are worn, pierced, pinched or partially broken.
- (e) Check for broken, bent, protruded or corroded terminals.
- (f) Check if related connector pins are in good condition.
- (g) Using ohm band of digital multimeter, check for continuity between I-020 (10) and B- 229 (18), I-020 (6) and B-229 (2) to check circuit for open.

Multimeter Connection	Condition	Specified Condition
I-020 (10) - B-229 (18)	Always	$\leq 1 \Omega$
I-020 (6) - B-229 (2)	Always	$\leq 1 \Omega$

- (h) Using ohm band of digital multimeter, check for continuity between terminals (6), (10) of connector I-020 and body ground to check instrument panel wire harness for shortly ground.

Multimeter Connection	Condition	Specified Condition
I-020 (6) - Body ground	Always	No continuity
I-020 (10) - Body ground	Always	No continuity



NG

Replace wire harness

OK

3 Reconfirm DTCs

- (a) Connect diagnostic tester and clear DTCs.
- (b) Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- (c) Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B170C54	AVM No Calibration
DTC	DTC Definition	Possible Cause
B170C54	AVM No Calibration	AVM No Calibration

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Recalibration

DTC	B171204	AVM Controller Malfunction
DTC	DTC Definition	Possible Cause
B171204	AVM Controller Malfunction	AVM Controller Malfunction

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Hint:

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

1 Replace AVM controller

OK

Clear DTCs

DTC	B171309	Rear Right Long Distance Ultrasonic Sensor Hardware Fault
DTC	B171396	Rear Right Long Distance Ultrasonic Sensor Fault
DTC	B171409	Rear Right Lateral Ultrasonic Sensor Hardware Fault
DTC	B171496	Rear Right Lateral Ultrasonic Sensor Detection Failed
DTC	B171509	Rear Right Ultrasonic Sensor Hardware Fault
DTC	B171596	Rear Right Ultrasonic Sensor Detection Failed
DTC	B171609	Rear Left Ultrasonic Sensor Hardware Fault
DTC	B171696	Rear Left Ultrasonic Sensor Detection Failed
DTC	B171709	Rear Left Lateral Ultrasonic Sensor Hardware Fault
DTC	B171796	Rear Left Lateral Ultrasonic Sensor Detection Failed
DTC	B171809	Rear Left Long Distance Ultrasonic Sensor Hardware Fault
DTC	B171896	Rear Left Long Distance Ultrasonic Sensor Fault
DTC	B171909	Front Right Long Distance Ultrasonic Sensor Hardware Fault
DTC	B171996	Front Right Long Distance Ultrasonic Sensor Fault
DTC	B171A09	Front Right Lateral Ultrasonic Sensor Hardware Fault
DTC	B171A96	Front Right Lateral Ultrasonic Sensor Detection Failed
DTC	B171B09	Front Right Ultrasonic Sensor Hardware Fault
DTC	B171B96	Front Right Ultrasonic Sensor Detection Failed
DTC	B171C09	Front Left Ultrasonic Sensor Hardware Fault
DTC	B171C96	Front Left Ultrasonic Sensor Detection Failed
DTC	B171D09	Front Left Lateral Ultrasonic Sensor Hardware Fault
DTC	B171D96	Front Left Lateral Ultrasonic Sensor Detection Failed
DTC	B171E09	Front Left Long Distance Ultrasonic Sensor Hardware Fault
DTC	B171E96	Front Left Long Distance Ultrasonic Sensor Fault

DTC	DTC Definition	Possible Cause
B171309	Rear Right Long Distance Ultrasonic Sensor Hardware Fault	• Ultrasonic sensor • Wire harness • AVM module
B171396	Rear Right Long Distance Ultrasonic Sensor Fault	
B171409	Rear Right Lateral Ultrasonic Sensor Hardware Fault	
B171496	Rear Right Lateral Ultrasonic Sensor Detection Failed	
B171509	Rear Right Ultrasonic Sensor Hardware Fault	
B171596	Rear Right Ultrasonic Sensor Detection Failed	

DTC	DTC Definition	Possible Cause
B171609	Rear Left Ultrasonic Sensor Hardware Fault	
B171696	Rear Left Ultrasonic Sensor Detection Failed	
B171709	Rear Left Lateral Ultrasonic Sensor Hardware Fault	
B171796	Rear Left Lateral Ultrasonic Sensor Detection Failed	
B171809	Rear Left Long Distance Ultrasonic Sensor Hardware Fault	
B171896	Rear Left Long Distance Ultrasonic Sensor Fault	
B171909	Front Right Long Distance Ultrasonic Sensor Hardware Fault	
B171996	Front Right Long Distance Ultrasonic Sensor Fault	
B171A09	Front Right Lateral Ultrasonic Sensor Hardware Fault	
B171A96	Front Right Lateral Ultrasonic Sensor Detection Failed	
B171B09	Front Right Ultrasonic Sensor Hardware Fault	
B171B96	Front Right Ultrasonic Sensor Detection Failed	
B171C09	Front Left Ultrasonic Sensor Hardware Fault	
B171C96	Front Left Ultrasonic Sensor Detection Failed	
B171D09	Front Left Lateral Ultrasonic Sensor Hardware Fault	
B171D96	Front Left Lateral Ultrasonic Sensor Detection Failed	
B171E09	Front Left Long Distance Ultrasonic Sensor Hardware Fault	
B171E96	Front Left Long Distance Ultrasonic Sensor Fault	

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

Caution

The following detection takes the front left long distance ultrasonic sensor as an example.

Hint:

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

1 Check the front left long distance ultrasonic sensor

Use circuit diagram as a guide to perform the following inspection procedures:

- Turn ENGINE START STOP switch to OFF.
- Remove the old front left long distance ultrasonic sensor.
- Install new front left long distance ultrasonic sensor and perform running test.

OK

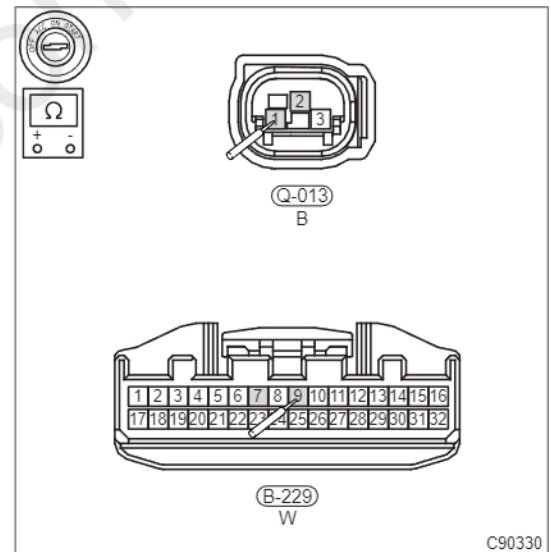
Replace the front left long distance ultrasonic sensor

NG

2 Check wire harness and connector

- Turn ENGINE START STOP switch to OFF.
- Disconnect AVM module connector B-229 and front left long distance ultrasonic sensor connector Q-013.
- Using ohm band of multimeter, check for continuity between front left long distance ultrasonic sensor and AVM controller separately.

Multimeter Connection	Condition	Specified Condition
B-229 (9) - Q-013 (1)	Always	$\leq 1 \Omega$
B-229 (7) - Q-013 (2)	Always	$\leq 1 \Omega$



NG

Replace wire harness and connector

OK

3 Reconfirm DTCs

- Connect diagnostic tester and clear DTCs.
- Run the vehicle as specified procedure. The operating way should meet the conditions for corresponding fault diagnosis.
- Read the fault information and confirm that the fault has been solved.

NG

Replace AVM module

OK

Conduct test and confirm malfunction has been repaired.

DTC	B172055	Not Coded
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DTC	DTC Definition	Possible Cause
B172055	Not Coded	Not Coded

■ DTC Confirmation Procedure

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

- Turn ENGINE START STOP switch to OFF.
- Connect the diagnostic tester (the latest software).
- Start engine and warm it up, and then read DTC again. If DTC is detected, malfunction is current.
- If DTC is not detected, malfunction is intermittent.

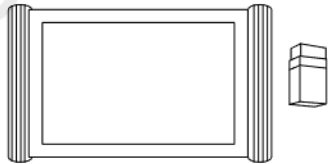
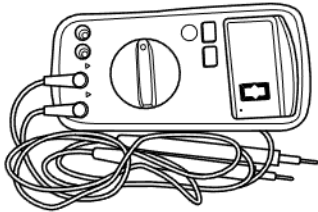
Hint:

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

1 Reconfiguration

3 ON-VEHICLE SERVICE

3.1 Tools

Tool Name	Tool Drawing
Digital Multimeter	 RCH0001006
X-431 PAD Diagnostic Tester	 RCH000206

3.2 Reverse Radar Sensor

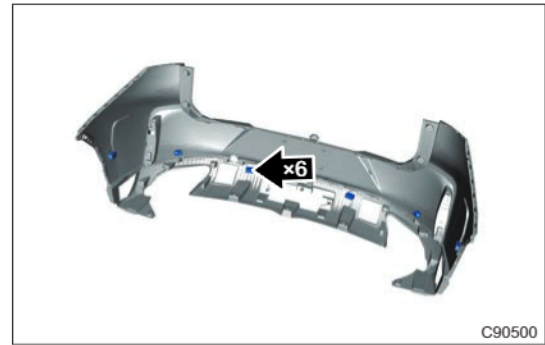
■ Removal

Warning

- Be sure to wear necessary safety equipment to prevent accidents, when removing reversing radar sensors.
- Operate carefully to avoid damaging reversing radar sensors, when removing reversing radar sensors.

- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Remove the rear bumper

- (4) Disconnect the reversing radar sensor connector
- (5) Remove reversing radar sensor from slot of rear bumper assembly



■ Installation

Warning

When installing reversing radar sensor, align the boss at end of reversing radar sensor with the slot on rear bumper assembly, and then firmly install reversing radar sensor.

Caution

- Install connectors in place when installing reversing radar sensors.
- Check reversing radar system for proper operation, after installing reversing radar sensors.

(1) Installation is in the reverse order of removal.

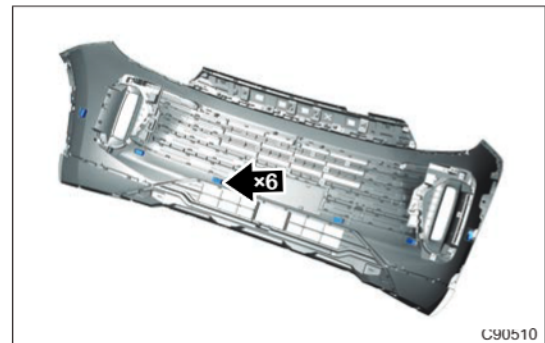
3.3 Front Radar Sensor (If Equipped)

■ Removal

Warning

- Be sure to wear necessary safety equipment to prevent accidents, when removing front radar sensor.
- Operate carefully to avoid damaging reversing radar sensor, when removing front radar sensor.

- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Remove the front bumper assembly
- (4) Disconnect the front radar sensor connector
- (5) Remove front radar sensor from slot of rear bumper assembly



■ Installation

Caution

- Install connectors in place when installing front radar sensor.
- Check front radar system for proper operation, after installing front radar sensor.

- (1) Installation is in the reverse order of removal.

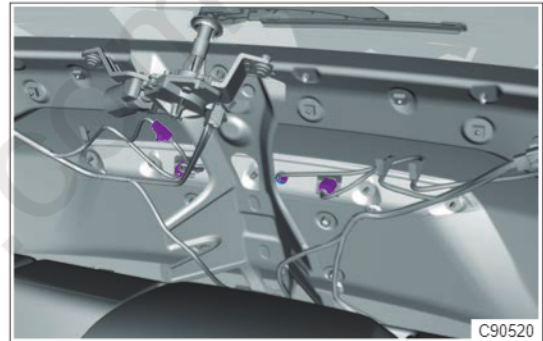
3.4 Rear Camera Assembly (If Equipped)

■ Removal

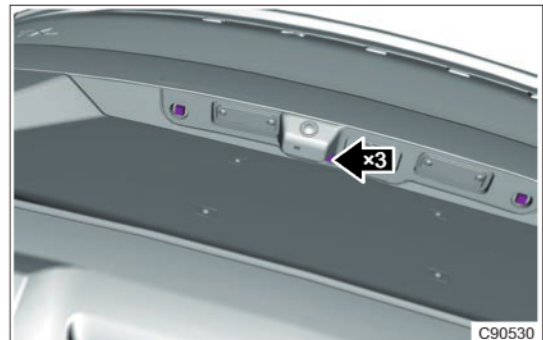
Warning

- **Be sure to wear necessary safety equipment to prevent accidents, when removing rear camera assembly.**
- **Appropriate force should be applied when removing rear camera assembly. Be careful not to operate roughly.**

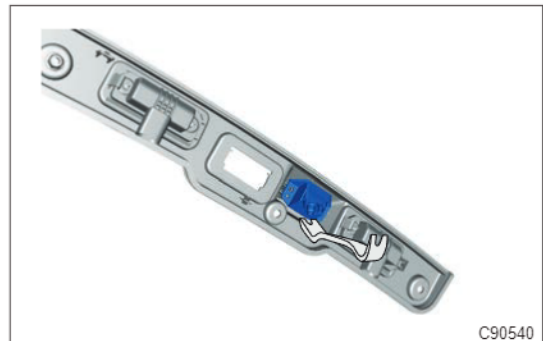
- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Remove the back door lower protector assembly.
- (4) Disconnect the license light connector, back door switch connector and rear camera connector.



- (5) Remove 3 fixing nuts from license plate light protector.



- (6) Remove the license plate light protector.
- (7) Remove the rear camera assembly with interior crow plate.



■ Installation

- (1) Installation is in the reverse order of removal.

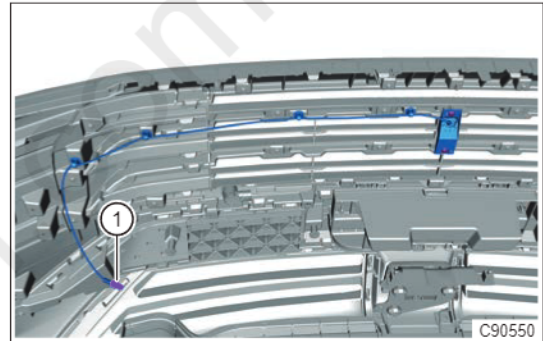
3.5 Front Camera Assembly (If Equipped)

■ Removal

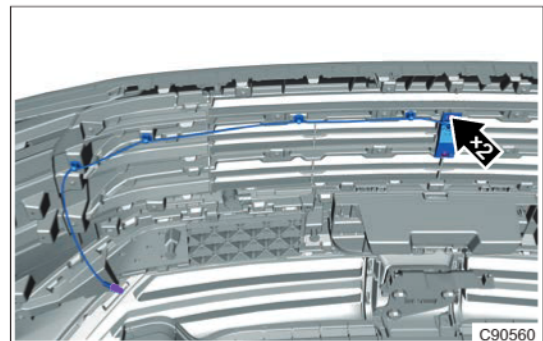
Warning

- Be sure to wear necessary safety equipment to prevent accidents, when removing front camera assembly.
- Appropriate force should be applied when removing front camera assembly. Be careful not to operate roughly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Remove the bumper assembly.
- (4) Remove connector (1) from front camera.



- (5) Using a cross screwdriver, remove the bumper.



- (6) Remove the front camera assembly.

■ Installation

- (1) Installation is in the reverse order of removal.

3.6 Side Camera Assembly (Both Sides) (If Equipped)

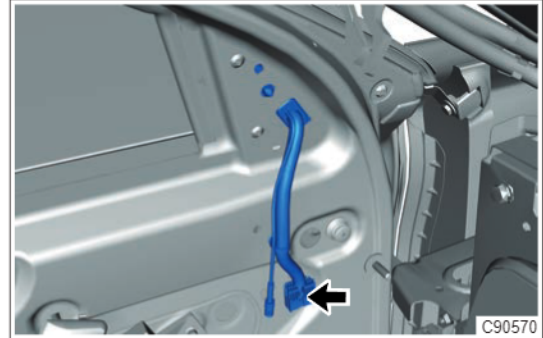
■ Removal (Take left side as an example)

Warning

As side camera is installed inside the outside rear view mirror assembly, it must be replaced together with outside rear view mirror assembly when damaged.

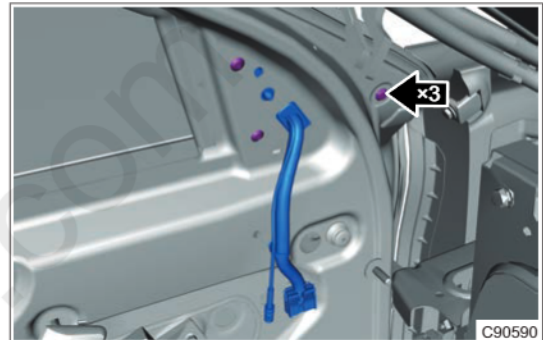
- (1) Turn off all electrical equipment and ENGINE START STOP switch

- (2) Disconnect the negative battery cable
- (3) Remove the front left door protector assembly.
- (4) Disconnect the left outside rear view mirror connector.



- (5) Remove 3 fixing bolts from left outside rear view mirror.

Tightening torque
 $7 \pm 1 \text{ N m}$



- (6) Remove the left outside rear view mirror assembly.

■ Installation

Caution

- Install connector in place and tighten fixing nuts to the specified torque, when installing the outside rear view mirror assembly.
- Make sure the outside rear view mirror assembly can move smoothly, flexibly and reliably after installing.
- After installing outside rear view mirror assembly, it is necessary to perform panoramic image calibration.

- (1) Installation is in the reverse order of removal.

3.7 Reversing Radar Control Module Assembly

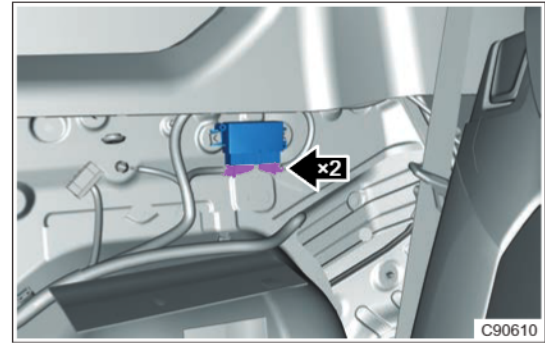
■ Removal

Warning

- Be sure to wear necessary safety equipment to prevent accidents, when removing reversing radar control module assembly.
- Appropriate force should be applied when removing reversing radar control module assembly. Be careful not to operate roughly.

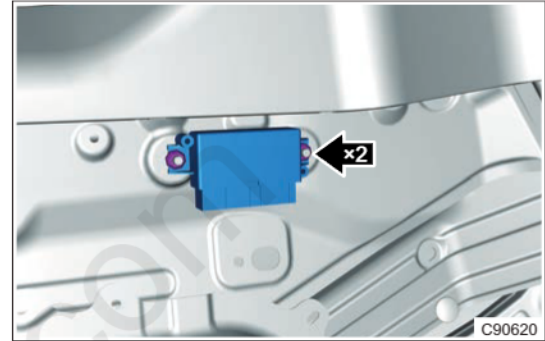
- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Remove the luggage compartment left wheel house assembly

- (4) Disconnect the reversing radar control module assembly connector



- (5) Remove 2 fixing bolts between reversing radar control module assembly and vehicle body

Tightening torque
 $3.5 \pm 0.5 \text{ N m}$



- (6) Remove the reversing radar control module assembly

■ Installation

Warning

- Tighten fixing bolts to the specified torque, when installing reversing radar control module assembly.
- Install connector in place when installing reversing radar control module assembly.
- Check reversing radar system for proper operation, after installing reversing radar control module assembly.

- (1) Installation is in the reverse order of removal.

3.8 Panoramic Control System Module (If Equipped)

■ Removal

Caution

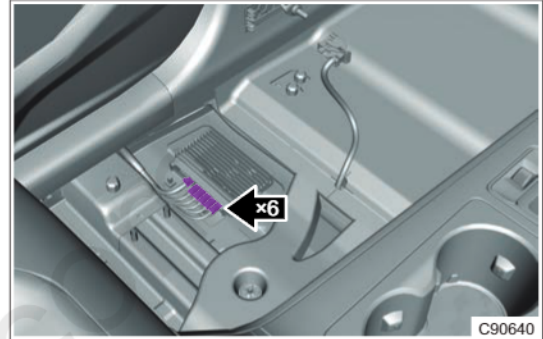
- Be sure to wear necessary safety equipment to prevent accidents, when removing panoramic control system module assembly.
- Appropriate force should be applied, when removing panoramic control system module assembly. Be careful not to operate roughly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Remove the front passenger seat assembly.

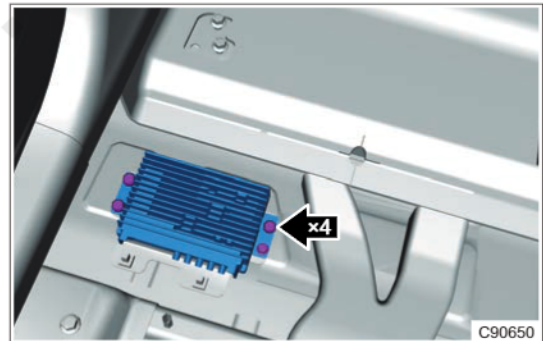
- (4) Turn over the front floor carpet.



- (5) Disconnect panoramic control system module connector.



- (6) Remove 4 bolts from panoramic control system module.



- (7) Remove panoramic control system module assembly.

■ Installation

Caution

- Tighten fixing bolts to the specified torque, when installing panoramic view monitor control module assembly.
- Install connector in place when installing panoramic view monitor control module assembly.
- Check reversing radar system for proper operation, after installing panoramic view monitor control module assembly.

- (1) Installation is in the reverse order of removal.