
BODY ELECTRICAL

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40.1 Head Up Display

1 Warnings and Precautions

1.1 Precautions

Be sure to observe following instructions before servicing any parts in this section to avoid possible asset loss, personal injury or even death.

- (1) Be sure to wear safety equipment to prevent accidents, when removing head up display.
- (2) Appropriate force should be applied when removing head up display. Be careful not to operate roughly.
- (3) Try to prevent interior and body paint surface from being scratched when removing head up display.

2 System Overview

2.1 System Description

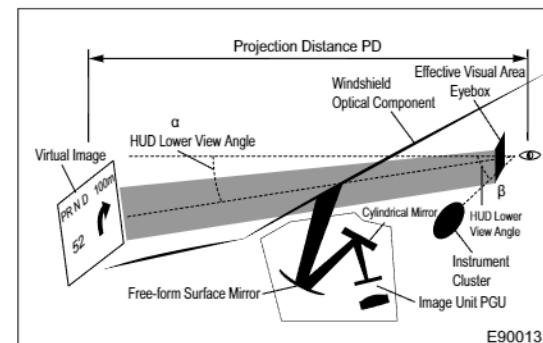
Head up display, call HUD for short, is a driving assist instrument used in vehicle. It is a kind of integrated optical electronic equipment composed of electronic components, display components, controllers, etc. Through optical system and electronic control, HUD projects driving information (such as speed, turning, driving range, etc.), navigation information, driving assistance (ADAS) and other information to front windshield in the form of images and characters, forming a virtual image in front of driver field of vision, so that driver can obtain corresponding information in real time without adjusting line of sight; HUD can adaptively adjust brightness of virtual image to match visual requirements by capturing brightness signal of external environment; At the same time, adjust image position to fully meet needs of drivers of different heights. Through the application of HUD, driving safety and comfort can be greatly improved.

■ Running noise

Under the whole vehicle environment, when adjusting HUD, the noise of test motor is no more than 40 dB at 50 cm away from HUD.

■ Optical principle

The optical imaging principle of HUD is: HUD drives the image unit to emit a light beam, which is reflected by a cylindrical mirror and a free-form surface mirror, then the light beam is projected to the front windshield, and then front windshield reflects the light beam to driver's eyes, so that the driver can see an enlarged virtual image at a greater distance ahead.



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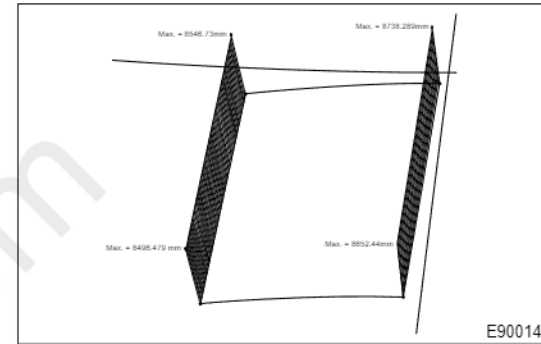
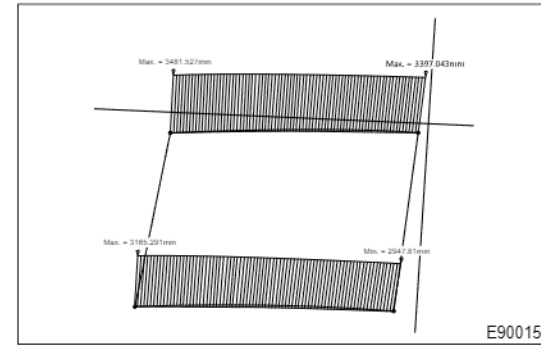
■ Windshield demand

As a part of the imaging system, the front windshield has certain requirements on radius of curvature, variation range and wedge angle. The curvature radius parameter information of front windshield of M32T in the HUD projection area is shown in illustration:

Curvature radius analysis of front windshield of M32T (-transverse direction)

Curvature radius analysis of front windshield of M32T (-vertical direction)

- Variation range of glass curvature radius in horizontal direction: 8500-8700.
- Variation range of glass curvature radius in vertical direction: 2950 - 3500.



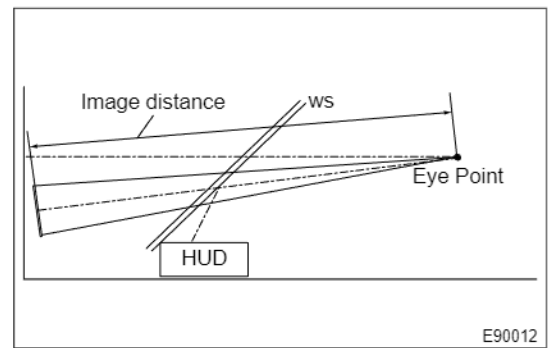
■ Image parameters

(1) The main parameters of M32T HUD image are as follows:

Type	Parameters	Tolerance Requirements	Note
Image size	241 mm x 80 mm	$\pm 6 \%$	Calculated based on FOV and projection distance
Image distance	2300 mm	$\pm 6 \%$	/
Field of view angle	$6^\circ \times 2^\circ$	$\pm 6 \%$	/
Lower view angle	3.5°	$\pm 0.3^\circ$	/
Left view angle	0°	$\pm 0.5^\circ$	
Eye box size	130 mm $\times$ 50 mm	/	Whole image seen within eye box
Eye movement range	± 50 mm	/	Whole image seen within moving range of eye box
HUD virtual image brightness	$\geq 10,000$ cd/m ²	/	White light brightness, highest brightness
Ghosting	/	Central eye box ≤ 2 mm, total eye box ≤ 3 mm	/
Distortion	/	5%	HUD factory status

(2)

The image distance is the distance from the eye point to the actual virtual image center, and the HUD projection distance is 2300 mm.



- (3) The field of view angle is the opening angle of the left and right edges and the top and bottom edges of the virtual image seen at the eye point. The field of view angle of HUD is $6^\circ \times 2^\circ$.
- (4) The lower view angle is the angle between the line connecting eye point and center point of virtual image and horizontal plane. The lower view angle of M32T HUD is 3.5° .
- (5) The left view angle is the angle between line connecting eye point and center point of image and vertical plane. The left visual angle of M32T HUD is 0° .
- (6) The size of the eye box indicates the range of eye movement in which whole image can be seen on driver side for the virtual image. The size of the eye box of M36T HUD is 130 mm x 50 mm.
- (7) The eye movement range indicates the adjustable amount of eye box. The eye movement range of M32T HUD is ± 50 mm.
- (8) HUD virtual image brightness is the brightness of HUD virtual image projected on front windshield. The maximum brightness of virtual image of HUD is required to be $\geq 10,000$ cd/m².
- (9) The ghosting defines the overlapping degree of different virtual images formed by reflection of inner and outer surfaces of glass when HUD is projected on the front windshield. The ghosting of HUD requires that the measured value of central eye box ≤ 2 mm, and the range of whole eye box ≤ 3 mm.
- (10) The distortion is that the actual HUD image will deviate from ideal value, which leads to a certain degree of distortion of image. This distortion degree is usually described by a ratio. The distortion requirement of HUD at factory is $\leq 5\%$.

■ Operating voltage range

HUD		CAN		Description
Data Stream/ Others	Voltage Value	Data Stream/ Others	Voltage Value	
Low voltage function prohibition	8.5 V	Low voltage network prohibition	5.8 V	Drop from normal voltage to the lowest voltage that cannot work
Low voltage function recovery	9 V	Low voltage network recovery	6 V	Recover from low voltage to the lowest voltage that can work normally
High voltage function prohibition	16.5 V	High voltage network prohibition	18.5 V	Recover from normal voltage to the highest voltage that cannot work normally
High voltage function recovery	16 V	High voltage network recovery	18 V	Drop from high voltage to the highest voltage that can work normally
Low voltage recovery time	200 ms $\pm$ 10 %	Low voltage recovery time	< 500 ms $\pm$ 10 %	Delay time from low voltage to normal voltage

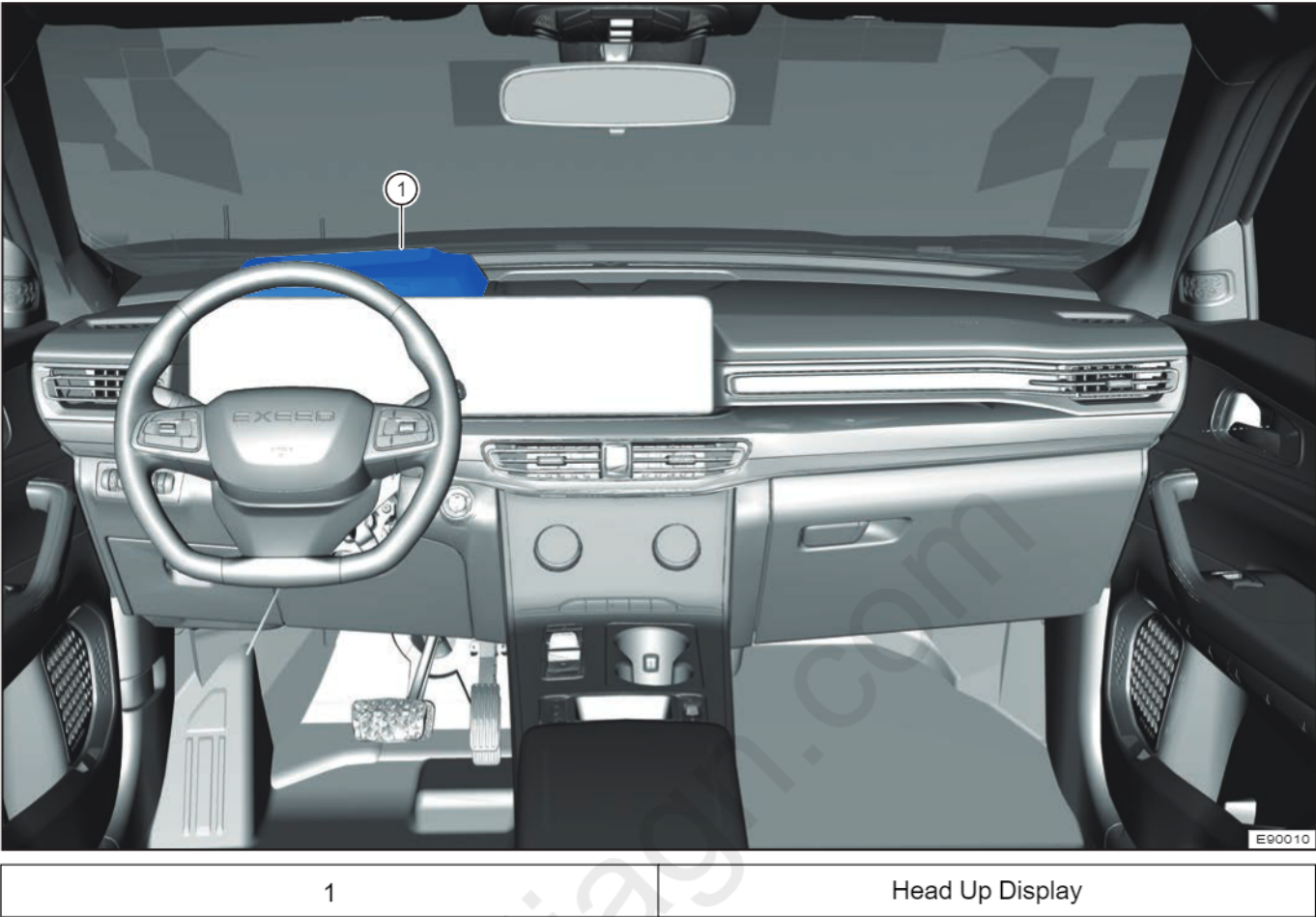
HUD		CAN		Description
Data Stream/ Others	Voltage Value	Data Stream/ Others	Voltage Value	
High voltage recovery time	200 ms $\pm$ 10 %	High voltage recovery time	< 500 ms $\pm$ 10 %	Delay time from high voltage to normal voltage
Note description: - Setting voltage of DTC is 9 ~ 16 V and delay time is 200 ms $\pm$ 10 %. - CAN voltage is defined by network platform department. If there is conflict with the above table, the network platform department shall prevail. - Deviation of above voltage is controlled within $\pm$ 0.1 V.				

- (1) Normal operating voltage range: 9 V to 16.0 V, including 9 V and 16.0 V (all voltages refer to the voltage at HUD power supply connection):
- When battery voltage is below 8.5 V, HUD output will be controlled according to the definition of low voltage protection.
 - When battery voltage is higher than 16.5 V, HUD output will be controlled according to the function definition of high voltage protection.
 - When battery voltage returns from abnormal to normal, all outputs will return to the output defined by respective function definitions.
- (2) High voltage protection function:
- If voltage is higher than 16.5 V, function output will be suspended in order to protect HUD.
 - If voltage drops from high voltage to 16 V or below, HUD will resume function output.
- (3) Low voltage protection function:
- If voltage is lower than 8.5 V, in order to save power, HUD will turn off output except CAN communication port.
 - If voltage rises from low voltage to 9 V or above, HUD output will resume.
- (4) Voltage range of 6 V ~ 16 V ensures CAN communication is normal.

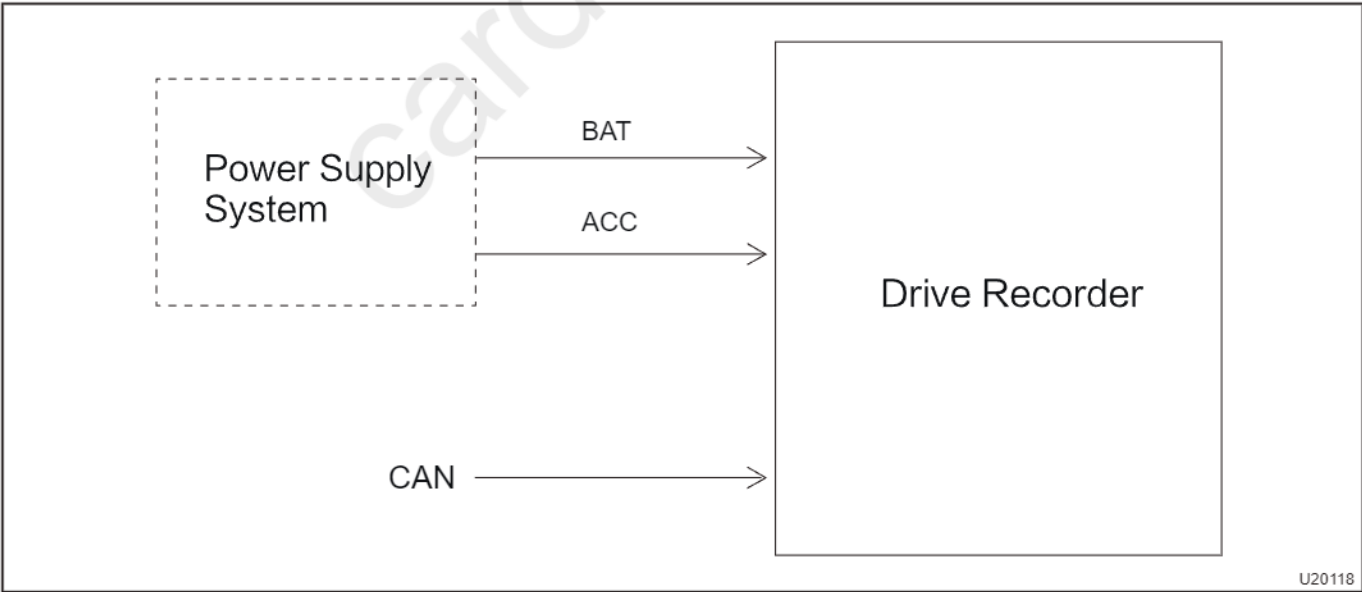
■ Operating current range

Operating current	Sleep current
< 1 A (HUD current under long-term stable operation condition)	$\leq$ 0.2 mA

2.2 System Component Diagram



2.3 System Schematic Diagram

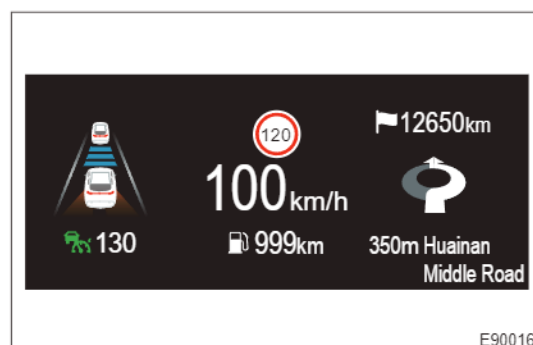


The head up display receives image signal, setting signal, switch signal and rain sensor signal in head unit through CAN and projects driving information, navigation information and driving assistance information to windshield in front of driver through the internal control unit.

2.4 Human-computer Interaction

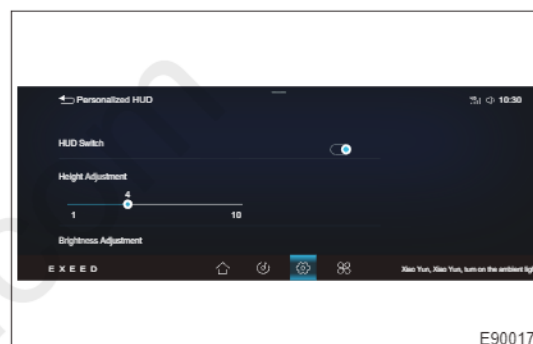
■ HUD display image

HUD display image signal is sent by DMC through CAN. HUD projects image on front windshield after receiving CAN signal. HUD can display driving status, ADAS signal, entertainment, navigation and other information as needed. HUD display information is as shown in illustration:



■ Head up display adjustment/setting

Through the touch screen menu setting, HUD display ON/OFF function can be controlled, image brightness and position can be adjusted, and normal mode/snow mode and other display styles can be switched. As shown in illustration below, brightness, height, function customization and mode switching are only effective when HUD is on.



Setting Item	Function	Description
ON/OFF	Turn HUD display information on or off	Control whether HUD is displayed.
Image height adjustment	Manually adjust the height of HUD display image	Adjust HUD height to adapt to use habits of different drivers.
Image brightness adjustment	Automatic adjustment	Vehicle collects ambient light brightness through rain light sensor, and HUD automatically adjusts HUD display image brightness according to the collected ambient brightness signal value, so as to adapt to different ambient brightness.
	Manual Adjustment	After HUD brightness is adjusted automatically, driver can fine-tune brightness to adapt to usage habits of different drivers
Snow mode switch	Normal mode/snow mode	HUD display style (including normal mode and snow mode) is selected according to the external environment. Snow mode: Due to white and bright background of external environment, HUD is required to adjust display style to meet requirements of user to recognize display content normally.
HUD display mode	Display interface settings	Navigation/ADAS interface interchanges left and right.

2.5 HUD functional requirements

According to CAN signal, HUD displays vehicle information, navigation information, active safety information and entertainment information through optical projection on front windshield. At the same time, the user can turn on/off HUD display, adjust HUD display brightness and height, and switch display mode through touch screen of central console.

It takes about 6 seconds for HUD from wake-up to normal display.

■ HUD function display

(1) Driving information display

- HUD displays current speed and driving mileage.

(2) Active safety display

- When adaptive cruise system operates, HUD displays adaptive cruise state, set target speed information, following distance information and icon of vehicle in front;
- When lane departure system operates, HUD displays different lane information, and prompts warning/alarm status through left and right deviation of vehicle;
- When front collision warning system/automatic emergency braking system operates, HUD displays the warning information of front collision warning system/automatic emergency braking system;
- When traffic signal recognition system operates, HUD displays speed limit information; When driving speed exceeds set speed, HUD displays speed limit information;
- When blind spot monitoring system operates, HUD displays blind spot monitoring information.

(3) Navigation information display

- HUD displays steering angle (straight, right turn, U-turn, left front turn, roundabout and other relevant navigation steering information).

(4) Bluetooth phone information display

- When Bluetooth phone function operates, HUD displays name of corresponding person.

■ HUD action sequence

- (1) When there is no memorized height information, HUD height is 6th gear (a total of 10 gears, 1 gear is the lowest virtual image, 10 gear is the highest virtual image);
- (2) When there is no memorized brightness level information and no RLS valid signal is received, HUD brightness is 25% of the maximum virtual image brightness when backlight is turned on;
- (3) When there is no memorized HUD switch status information, HUD status information is OFF (HUD factory setting is ON);
- (4) When there is no memorized snow mode switch status information, snow mode switch status information is OFF;
- (5) When there is no memorized ADAS position status information, HUD shows that ADAS is on left side;
- (6) The setting interface status of IHU should be displayed according to HUD feedback signal.

■ Over temperature protection

HUD is ON:

Function overview	Through obtaining HUD internal temperature information, judge whether TFT screen is in over temperature state. If TFT temperature is too high, HUD will gradually reduce display brightness.
Basic process	When internal temperature of HUD exceeds a certain value (threshold 1, to be calibrated), HUD will reduce image brightness; If HUD internal detection temperature > 85 °C (to be calibrated), HUD screen will pop up the text "HUD temperature is too high, turn off HUD" for 3 s, at the same time, set STAT_HUDDisplayOnOff value to 0, and then turn off HUD display; When HUD detects that temperature drops to 45 °C, HUD will turn on again, and brightness will be displayed according to gear value and RLS signal value saved during manual adjustment.

Signal process	Precondition satisfied → internal temperature information (sensor) → HUD drives LED → image brightness adjustment.
Others	Vehicle collects ambient light brightness through rain light sensor, and HUD automatically adjusts HUD display image brightness according to the collected ambient brightness signal value, so as to adapt to different ambient brightness.
	When HUD goes to sleep, rotate lens back to Park position to prevent sunlight from shining on screen.

3 DIAGNOSIS & TESTING

3.1 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.

3.2 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.

3.3 Ground Inspection

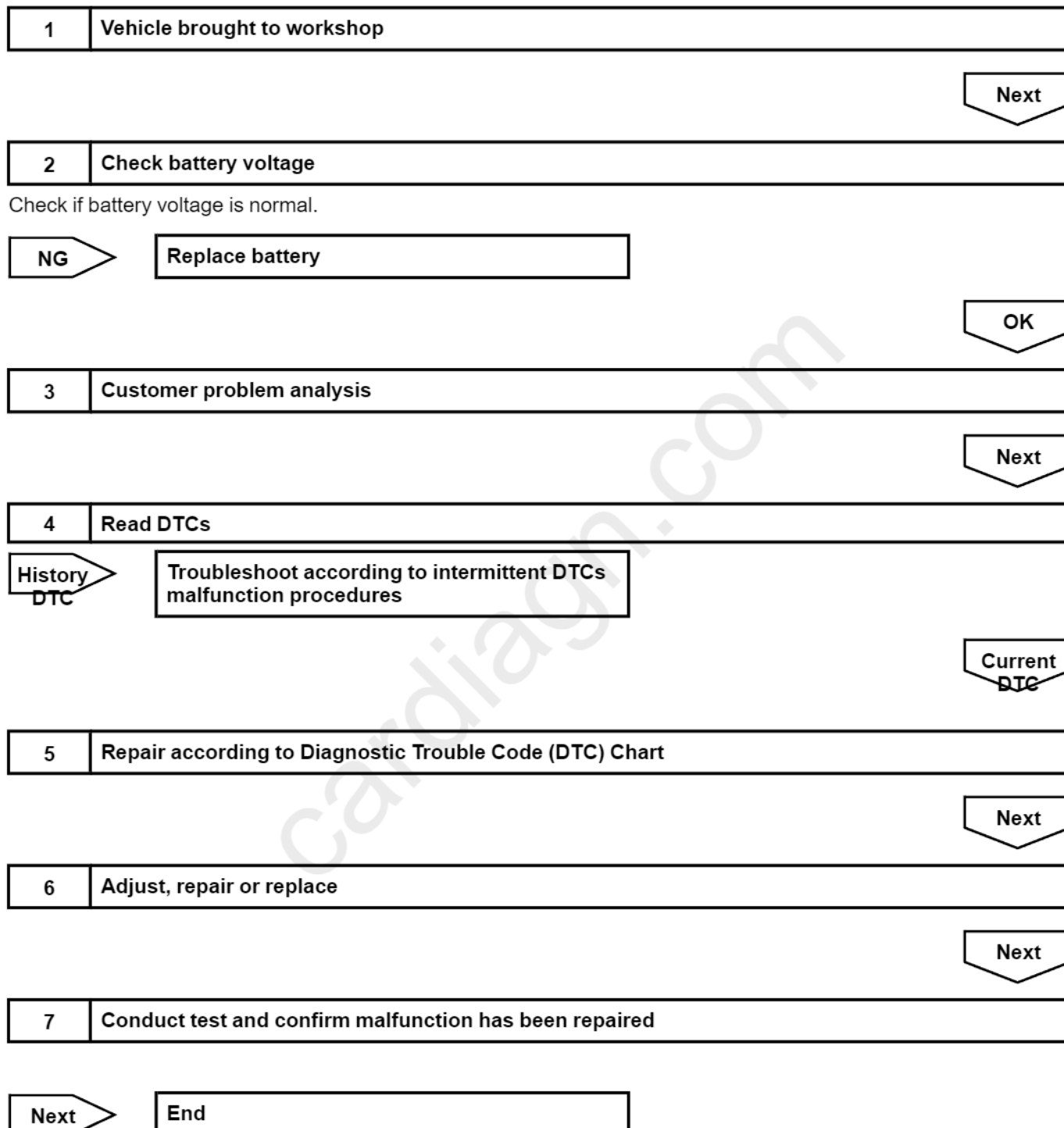
Ground points are very important to the proper operation of circuits. Ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) may increase load resistance. This situation may change the way in which a circuit operates. Circuits are very sensitive to proper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

- (1) Remove ground bolt or nut.
- (2) Check all contact surfaces for tarnish, dirt and rust, etc.
- (3) Clean as necessary to ensure that contact is in good condition.
- (4) Reinstall ground bolt or nut securely.
- (5) Check if any additional accessories interfere with ground circuit.

- (6) If several wire harnesses are crimped into one ground terminal, check for proper crimp condition. Make sure that all wire harnesses are clean and securely fastened while providing a proper ground path.

3.4 Diagnosis Procedure

Use following procedures to troubleshoot the system.



3.5 Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition
B136016	Supply Voltage Too Low
B136017	Supply Voltage Too High

DTC	DTC Definition
B136102	HUD Motor Drive Failure
B136203	HUD LED Drive Circuit Short Circuit
B136301	HUD Overheating (Temperature Too High)
B136471	HUD Mirror Position Switch Failure
B136517	HUD TFT Signal Line Error
B136602	HUD FPD Link (Flat Panel Display Link) Lock Error
B136766	HUD Abnormal Reset Error
B136892	HUD EEPROM Error
B136992	HUD FLASH Error
B136A92	HUD RAM Error
U012287	Lost Communication With ESC
U014087	Lost Communication With BCM
U015587	Lost Communication With IPC
U024587	Lost Communication With IHU
U024887	Lost Communication With PEPS
U041681	Invalid Data Received From ESC
U042281	Invalid Data Received From BCM
U042381	Invalid Data Received From IPC
U042681	Invalid Data Received From PEPS
U054681	Invalid Data Received From IHU
U135088	CAN Bus Off

3.6 DTC Diagnosis Procedure

DTC	B1360-16	Supply Voltage Too Low
DTC	B1360-17	Supply Voltage Too High
DTC	B1365-17	HUD TFT Signal Line Error
DTC	B1367-66	HUD Abnormal Reset Error
DTC	B1368-92	HUD EEPROM Error
DTC	B1369-92	HUD FLASH Error
DTC	B136A-92	HUD RAM Error

DTC	DTC Definition	Possible Cause
B1360-16	Supply Voltage Too Low	- Power supply fault; - Line connection fault; - HUD intermittent fault; - HUD motor fault.
B1360-17	Supply Voltage Too High	
B1365-17	HUD TFT Signal Line Error	
B1367-66	HUD Abnormal Reset Error	

DTC	DTC Definition	Possible Cause
B1368-92	HUD EEPROM Error	
B1369-92	HUD FLASH Error	
B136A-92	HUD RAM Error	

■ 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:

- (a) Start engine, and use voltage band of multimeter to check if battery voltage is normal. (Rated voltage: Not less than 12 V)

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

NG

Repair or replace battery/alternator.

OK

2 Check fuse

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

- (a) Turn ENGINE START STOP switch to OFF.
 (b) Disconnect the negative battery cable.
 (c) Check continuity of fuse MF03 (125A), RF16 (5A) and RF08 (5A) in instrument panel fuse and relay box and engine compartment assembly with digital multimeter.

NG

Replace fuse

OK

3 Check interior power supply wire harness

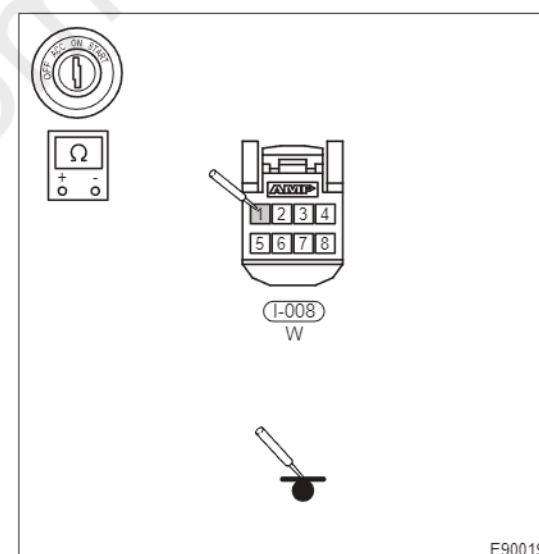
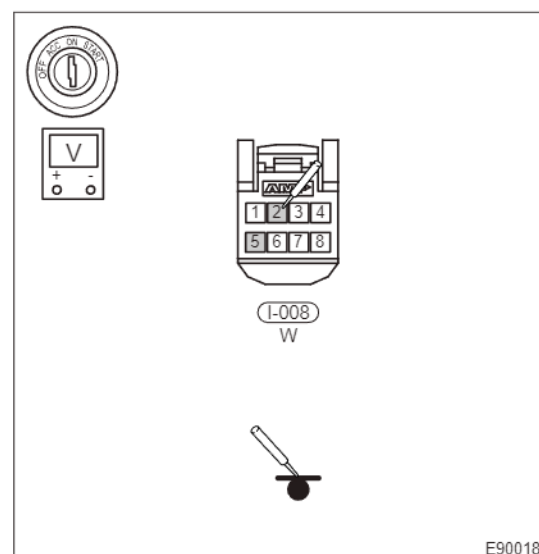
Use circuit diagram as a guide to perform the following inspection procedures:

- Turn ENGINE START STOP switch to OFF.
- Disconnect the negative battery cable.
- Disconnect the head up display connector I-008.
- Connect the negative battery cable.
- Turn ENGINE START STOP switch to ON.
- Using a digital multimeter, separately measure the voltage between connectors I-008 (5), I-008 (2) and ground according to table below.

Multimeter Connection	Condition	Specified Condition
I-008 (5) - Body ground	ENGINE START STOP switch "ON"	Not less than 12 V
B-008 (2) - Body ground		Not less than 12 V

- Using a digital multimeter to measure the resistance between interior wire harness connector I-008 (1) and ground according to table below.

Multimeter Connection	Condition	Specified Condition
I-008 (1) - Body ground	ENGINE START STOP switch "OFF"	∞



NG

Repair or replace related wire harness.

OK

4

Reconfirm DTCs

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

- Connect the negative battery cable.
- Use diagnostic tester to clear DTCs.
- Start the engine.
- Check if the same DTCs are still output.

NG

Replace the head up display module.

OK

System is normal

DTC	U012287	Lost Communication With ESC
DTC	U014087	Lost Communication With BCM
DTC	U015587	Lost Communication With IPC
DTC	U024587	Lost Communication With IHU
DTC	U024887	Lost Communication With PEPS
DTC	U041681	Invalid Data Received From ESC
DTC	U042281	Invalid Data Received From BCM
DTC	U042381	Invalid Data Received From IPC
DTC	U042681	Invalid Data Received From PEPS
DTC	U054681	Invalid Data Received From IHU
DTC	U135088	CAN Bus Off

■ 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.

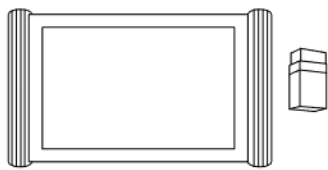
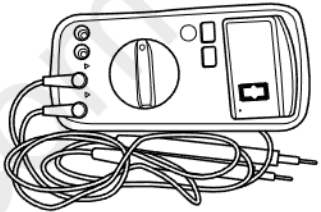
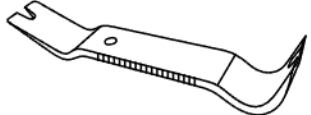
Hint:

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

1	Refer to CAN communication system for the above communication faults.
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4 ON-VEHICLE SERVICE

4.1 Tools

Tool Name	Tool Drawing
Diagnostic Tester	 S00001
Digital Multimeter	 S00002
Interior Crow Plate	 S00020

4.2 Replacement of Head Up Display (HUD)

■ Removal

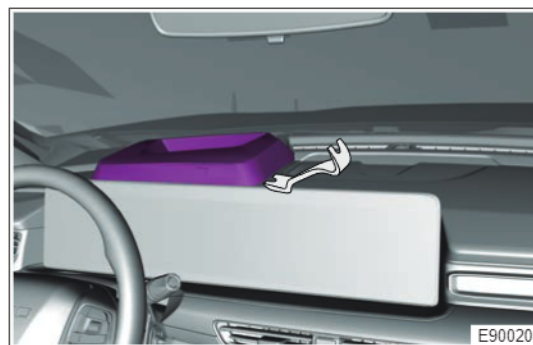
Warning

- Try to prevent interior and body paint surface from being scratched when removing head up display.
- Be sure to wear safety equipment to prevent accidents, when removing head up display.
- Appropriate force should be applied when removing head up display. Be careful not to operate roughly.

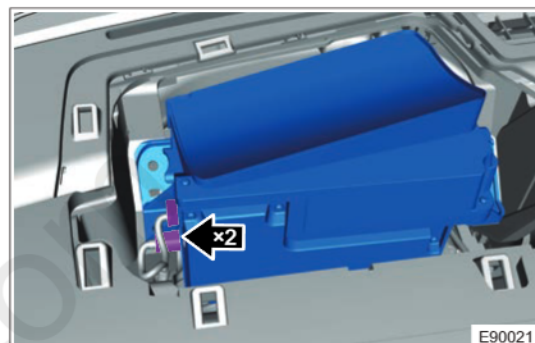
(1) Turn off all electrical equipment and ENGINE START STOP switch.

(2) Disconnect the negative battery cable.

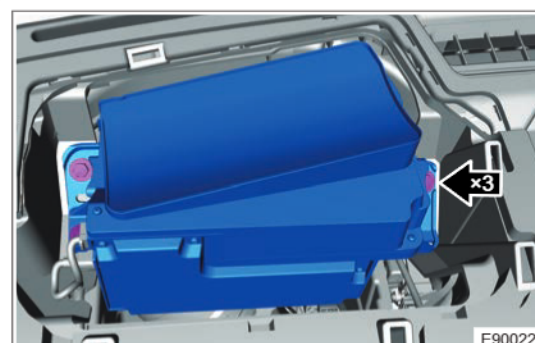
- (3) Remove head up display cover with interior crow plate.



- (4) Disconnect the head up display wire harness connector.



- (5) Remove 3 fixing bolts from head up display.



- (6) Remove the head up display.

■ Installation

- (1) Install head up display to a proper position.
- (2) Fix 3 fixing bolts of head up display.
- (3) Connect the head up display wire harness connector.
- (4) Install the head up display cover.
- (5) Install the negative battery cable.
- (6) Press ENGINE START STOP switch and perform running test.

1 Warnings and Precautions

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

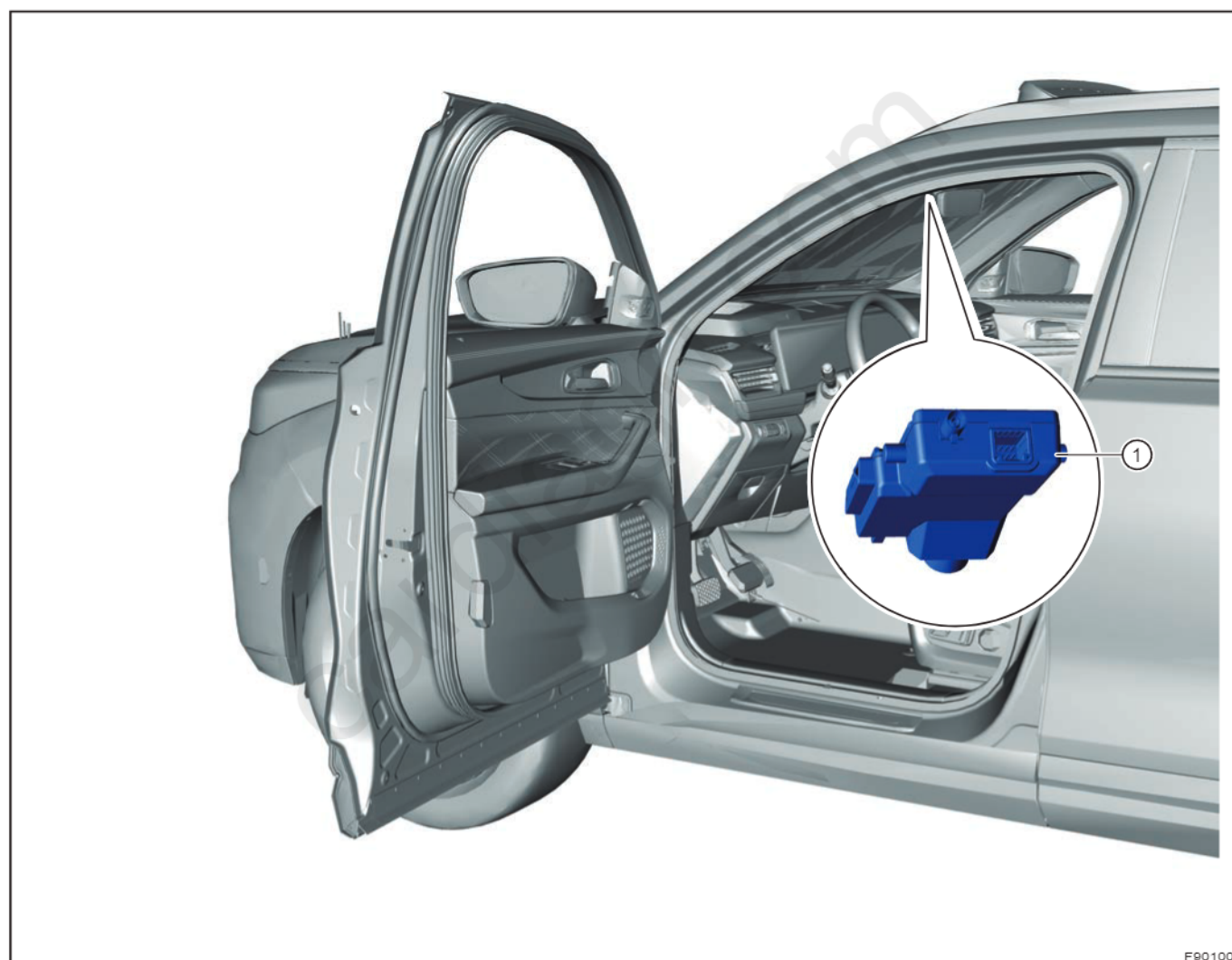
- (1) Prevent camera lens from being scratched during removal and installation of drive recorder.

2 System Overview

2.1 System Description

This product is a two-in-one product with a drive recorder and an AR navigation camera. The video display operation and AR navigation video of drive recorder need to be displayed on central control navigation screen.

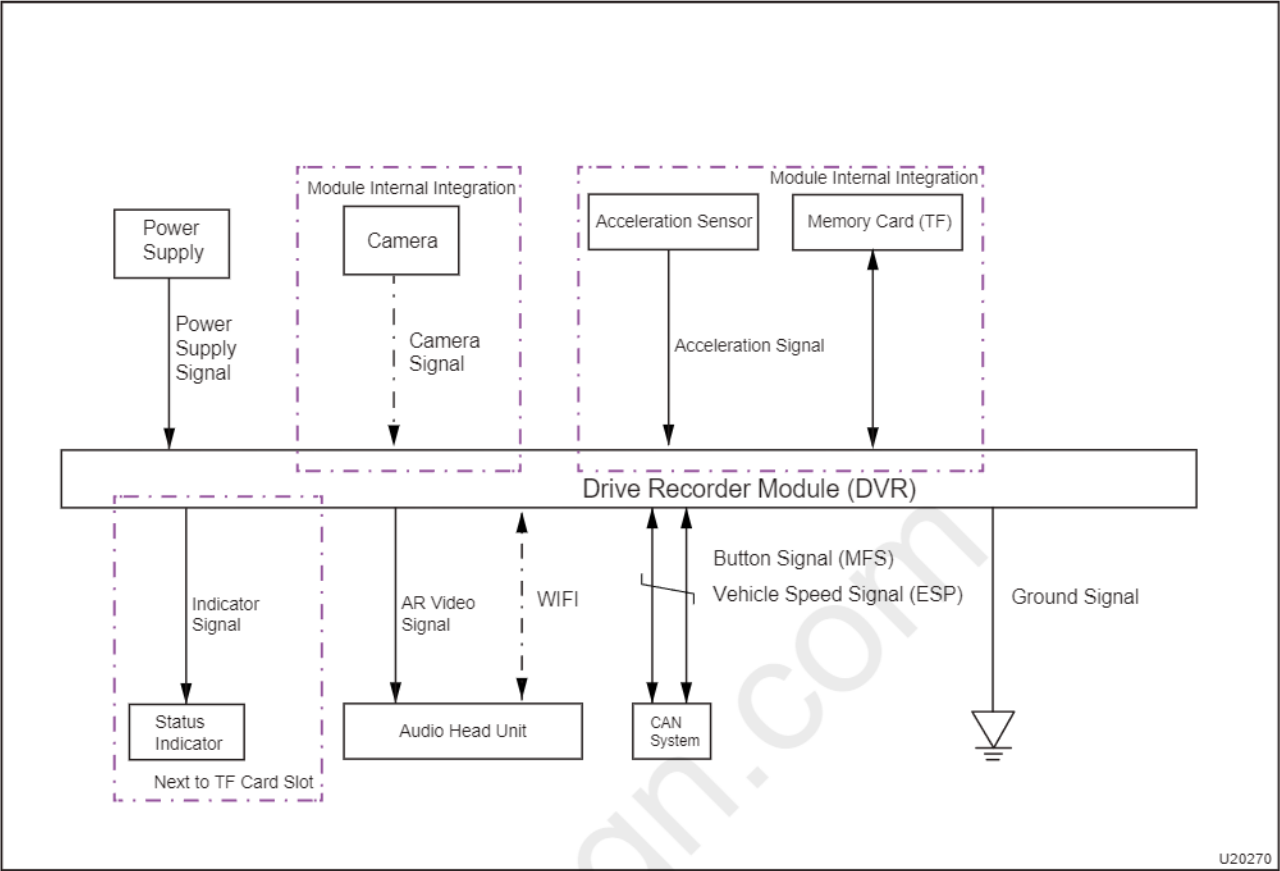
2.2 System Component Diagram



F90100

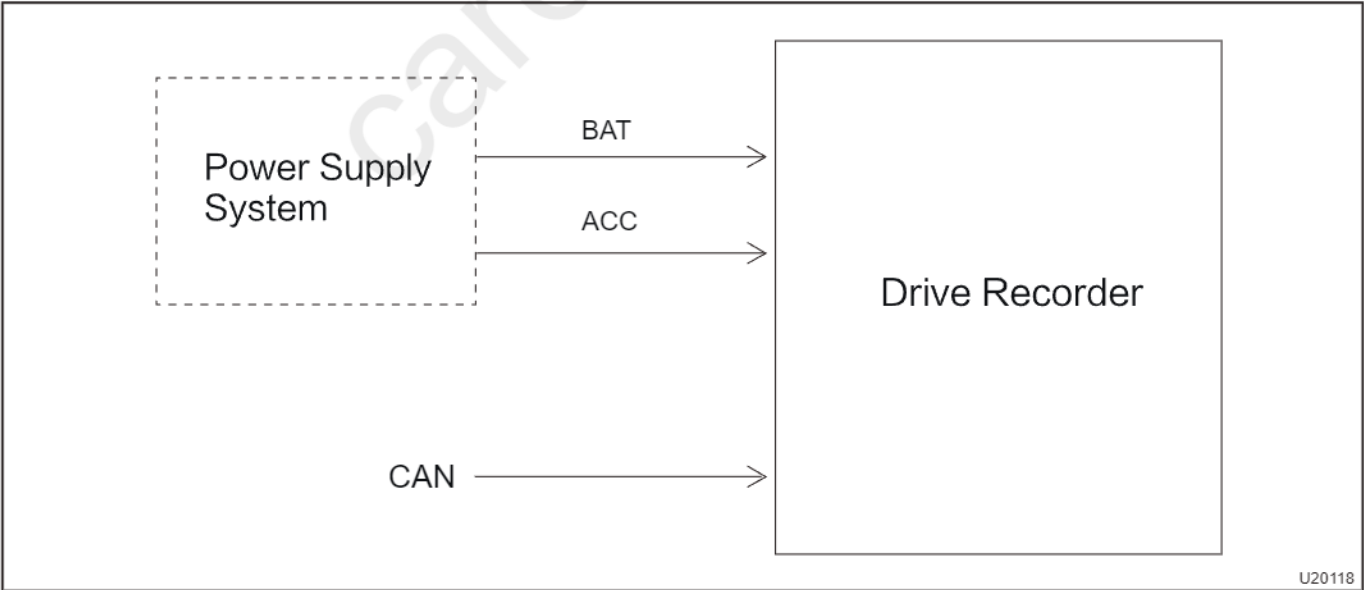
1	Drive Recorder
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2.3 System Schematic



2.4 Function Specification

- (1) Function specification
 - 1) System ON



Under normal operating voltage range, the system ON logic is as shown in table below:

BAT	ON (KL15)	CAN Communication	Parking Monitoring	System Condition
OK	OFF	Available	ON or OFF	System starts and starts to record automatically
		Not available	ON	When vibration intensity of vehicle exceeds the set threshold, the drive recorder will be waken up by the signal from built-in G-sensor to record 20s video. After recording the video, if there is no continuous G-sensor signal, the system will shut down automatically. (no information watermark)
			OFF	Vehicle vibrates and drive recorder cannot be waken up to record video
	ON	Available or not available	ON or OFF	System starts and starts to record automatically
Abnormal	/	/	/	System cannot start

2) System OFF

Under normal operating voltage range, the system OFF logic is as shown in table below:

BAT	ON (KL15)	CAN Communication	System Condition
OK	ON	Available	ON
		Interrupted	Drive recorder can record video properly, but CAN related function cannot operate properly
	OFF	Available	System is in normal operating status, recording is normal and system does not turn off
		Interrupted	System off
Abnormal	/	/	System off

3) Operating current

Single head unit: ≤ 300 mA.

4) Static current

Drive recorder system: ≤ 0.1 mA.

Start drive recorder with BATT terminal of head unit connector connected to multimeter (dialed to current band), cuts off the power supply at ON position under normal operating status, and the stable

current value measured by multimeter after head unit enter sleep mode (CAN network is turned off and system does not operate) is the static current.

(2) Product feature

1) Function overview

Function	Description	Note
DVR Video Output	$120^{\circ} \pm 5^{\circ}$ in horizontal, $140^{\circ} \pm 5^{\circ}$ in diagonal	5G WiFi connection, IHU display realizes display function, time delay ≤ 500 ms
AR Navigation Video Output	Angle 55° , intercept video images according to HMI requirements, and meet AR navigation calibration requirements	LVDS connection, IHU display realizes display function, time delay ≤ 30 ms
Frame Rate	30 fps	
Lens Pixels	$\geq 1920 \times 1080$	
Low-light Level	0.1 lux	
Dynamic Range	> 95 dB	
Signal Noise Ratio	> 40 dB	
Storage Medium	TF card (8 GB ~ 128 GB supported)	
Record Function	Support	
Parking Monitoring	Support	
Power-off Storage Protection	Support	
ON Position Signal Detection	Support	
Snapshot	Support	
File Playback	Support	
General/Emergency Recording	Support	
CAN Communication	Support	
Indicator	Two-color indicator of red and blue; device operates normally: Blue light constants on; Wi Fi connection/data interaction: Blue light flashes slowly; device failure/function abnormality: Red light constants on; recording abnormality/no TF card: Red light flashes slowly; software upgrade: Red and blue lights flash alternately	

2) System parameter

Function	Description	Note
Drive Recorder	Starts to record automatically after starting	
Recording Resolution	1080P (by default), 720P	
Recording time	1 minute, 3 minutes (by default), 5 minutes	

Function	Description	Note
Driving Information Overlay	ON (by default), OFF	
Recording	ON, OFF (by default)	
Gravity Sensing Sensitivity	High, Medium (by default), Low	
Wide Dynamic	ON (by default), OFF	
Snapshotting	Taking photo, Short video, Taking photo + Short video (by default)	

3) System features

Primary Function	Secondary Function	Description	Note
General Recording	Video recording	Video recording is circularly covered during recording, video is saved in TF card	
	Video recording switch	Video recording switch	ON by default
	Recording resolution	1920*1080@30 frame/ 1280*720@30 frame	1920*1080@30 frame by default
	Sound recording switch	ON/OFF	Sound recording OFF by default
	Recording file time	1 minute/3 minutes/5 minutes	
	Driving information overlay	Driving information overlay switch	ON by default
		Driving information is from CAN network	
		Driving information includes: Vehicle speed, gear position, accelerator, high beam light, low beam light, front fog light, rear fog light, left turn signal light, right turn signal light, parking brake, foot brake, seat belt	
	Time watermark	When "driving information overlay" is set to on, there is current time watermark in screen of video file; When "driving information overlays" is set to off, time watermark is not overlaid in screen of video file; Time source: DVR RTC clock;	
	HDR switch	HDR switch	ON is for DVR function screen by default
Emergency Recording	Emergency recording	When vibration is greater than vibration acceleration threshold of emergency	When recording is off, emergency recording will not be turned off

Primary Function	Secondary Function	Description	Note
		recording, 10 s video before and after vibration moment is saved in emergency video area separately; Emergency video file is overwritten circularly.	
	Vibration acceleration induction sensitivity	Three vibration acceleration thresholds: High, medium, low	Medium by default
	Emergency recording overwriting	Emergency recording overwrite switch; When it is set to on, if emergency recording storage area is full, the earliest emergency video will be replaced by new emergency video; When it is set to off, if emergency video storage area is full, it will not be replaced, only a reminder will be given;	ON by default; Reminder is only displayed to make a text prompt on central navigation screen when WiFi is connected to central control navigation. If central navigation is not connected, it cannot be displayed.
Parking Monitoring	Parking monitoring	If vibration is greater than the parking monitoring vibration acceleration threshold with drive recorder turned off, it will turn off after turning on to record for 20 seconds.	Duration is the same as that of emergency recording video
	Parking monitoring switch	Parking monitoring switch	ON by default
Taking pictures	Taking pictures	1. Photo resolution is the same as current video resolution; 2. Recording is not paused when taking pictures; 3. The photo is stored in photo storage area of TF card; 4. The photo is overwritten circularly.	
	Steering wheel button control capturing	Respond to steering wheel button to take pictures;	
Playback	Video playback	Play the video file recorded by drive recorder in TF card on central control navigation head unit.	
	Photo playback	Play the photo file recorded by drive recorder in TF card on central control navigation head unit.	
File management	File management	Manage (delete) the video and photo file stored in TF	

Primary Function	Secondary Function	Description	Note
		card of DVR on central control navigation head unit.	
	Formatting TF card	Format the TF card by central control navigation screen operation.	
AR Navigation Video Output	AR navigation video output	Capture video output of corresponding area with a 55° field of view	Specific angle is subject to real vehicle calibration
		AR navigation optical axis calibration, by adjusting AR navigation video interception area location, make AR navigation video center point coincide with theoretical optical axis center point;	
Specific angle is subject to real vehicle calibration	DVR video output and interaction	DVR outputs video and interacts via Wi-Fi	
		After DVR application is turned on by central control navigation head unit, it connects with wifi and starts to transmit data; After exiting DVR application, it stops data transmission and interaction, disconnect wifi connection;	
		WIFI ID and password are transmitted through LVDS (IIC in LVDS);	
		Use RTSP transport protocol to transmit real-time screen	
		Function includes: Real-time preview, normal video playback, taking pictures, file management, setting, etc.	
		Switching between WIFI 2.4G and 5G, controlled by LVDS (IIC in LVDS);	5G channel by default
Power management, CAN network	ON position signal response	When power is turned on in ON position, system turns on and starts recording; When power is turned off in ON position and there is no CAN communication, system turns off and stops recording, and save the video file.	

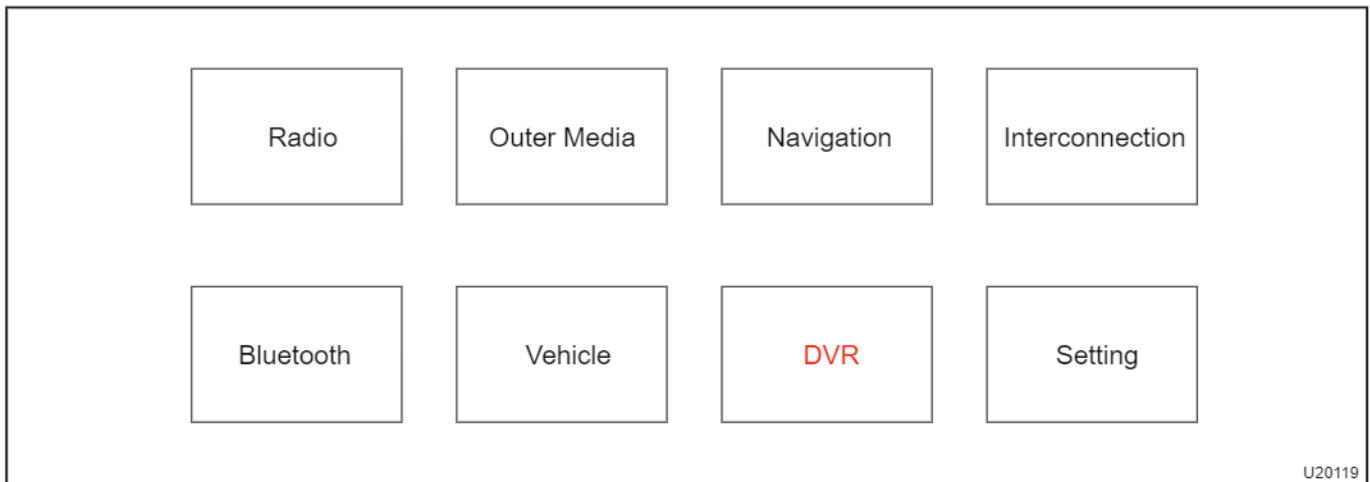
Primary Function	Secondary Function	Description	Note
	Video storage protection with power off	When it detects that power supply is cut off, start to save the video when stopping recording. Use super capacitor to save power and save the recording file before the moment of power off.	
	CAN network wake-up	System starts after receiving wake-up command from CAN network.	
	Transmit information	1. Vehicle driving information	
		2. Wake-up command	
Status indication	Indicator	Two-color indicator of red and blue; device operates normally: Blue light constants on, Wi-Fi connection/data interaction: Blue light flashes slowly; device failure/function abnormality: Red light constants on; recording abnormality/no TF card: Red light flashes slowly; software upgrade: Red and blue indicator blinks alternately	

(3) Functional requirement

Caution

The schematic diagram of UI interface in this chapter is only for the assistance function description. The specific UI is subject to actual design.

This product is a two-in-one product with a drive recorder and an AR navigation camera. The video display operation and AR navigation video of drive recorder need to be displayed on central control navigation screen. The operation method of DVR depends on whether central control navigation head unit supports it. The function introduction in this section takes touch method as an example. Button operation method depends on whether there are buttons on button panel that support DVR operation. The voice control depends on whether voice engine has supported corpus.



1) Drive recorder connection

Drive recorder is connected with central control navigation through WiFi channel; Without entering DVR function, the WiFi connection between drive recorder and central control navigation is disconnected; When users need to view the video of drive recorder and operate drive recorder, click DVR icon in main interface, and central control navigation communicates through IIC in LVDS, transmits WiFi ID and password, and sends WiFi connection command to DVR; When DVR receives connection command of central control navigation head unit, connect WiFi hotspot of central control navigation head unit; After WiFi connection is successful, central control navigation head unit enters real-time preview interface of drive recorder.

On real-time preview screen, decode and display H.264 video streaming from head unit camera of DVR in real time (there is a certain delay due to video capture, encoding, transmission, decoding and player cache, the delay is less than 500MS).

2) TF card album folder:

i. General recording folder:

- Folder name: "NOR" .
- Internal file name: NOR_date_time A.MP4 (NOR_20180723_123233A.MP4).
- Storage space = (total capacity of TF card - 500M (reserved buffer space)) *3/4.

ii. Emergency recording folder:

- Folder name: "EVT" .
- Internal file name: EVT_date_time A.MP4 (EVT_20180723_123233A.MP4).
- Storage space = (total capacity of TF card - 500M (reserved buffer space)) *1/5.

iii. Photo folder

- Folder name: "PHO" .
- Internal file name: PHO_date_time A.JPG (PHO_20180723_123233A.JPG).
- Storage space = (total capacity of TF card - 500M (reserved buffer space)) *1/20.

3) General recording

i. Recording interface

When B+ and ACC ON signal are powered on, or B+ is powered on and CAN network communication is normal, and voltage and power circuit are normal, drive recorder will automatically start recording.

After the central control navigation is connected with drive recorder, it will enter the real-time preview interface to view the real-time image of the recorder. If the drive recorder is recording video normally, there is REC on the interface accompanied with red dot flashing. If the drive recorder is not recording video normally, only one red dot is always ON but not flashing, and there is no REC.

ii. Video operation

When the drive recorder is in the pause state, click  ICON to continue recording; ICON changes to . When the drive recorder is in the recording state, click ICON  to pause recording; ICON changes to .

The drive recorder is equipped with MIC, which can record audio synchronously while recording video. The user can turn off or turn on the sound recording through the central control navigation screen. Sound recording is OFF by default. In the real-time preview interface, click  ICON to turn on sound recording, ICON changes to . Click ICON  to turn off sound recording, ICON changes to .

iii. Video recording

The video recording of the drive recorder has been continuing. Due to the limited capacity of the TF card, the memory card will be full after the TF card is recorded for a period of time. The drive recorder adopts the logic of cyclic storage of video. When the memory card is full, the latest video will overwrite the earliest recorded video in the folder.

The recorder supports up to 1080P resolution video, and the default is 1920*1080@30 frame; the user can change the resolution to 1280*720@30 frame through the central control navigation screen. After changing to 1280* 720@30 frame, it can also be manually changed back to 1920*1080@30 frame.

The recorded video is stored by time segment. The system default is 3 minutes, which can be manually changed to 1 minute or 5 minutes.

4) Emergency video recording

i. Emergency video trigger

There are two sources of signals that trigger emergency recording: G-sensor of drive recorder and acceleration value of vehicle body. The vehicle transmits the key position status to drive recorder through CAN. When the drive recorder receives the key position status (ignition action) sent by the vehicle, it triggers the emergency recording by judging whether the body gravity acceleration value exceeds the set threshold value (the threshold value needs to be set according to the actual vehicle verification).

When the drive recorder receives the vehicle key position state turns to ON position signal disconnection state after ignition, during ON position signal disconnection and next ignition state, the drive recorder triggers emergency recording through its own G-sensor signal. When the acceleration of vibration exceeds the threshold set by G-sensor, the recorder will be triggered to store an emergency video.

The inductive sensitivity of G-sensor can be set to "high", "medium" and "low" through the large screen navigation of central control. The default is "medium".

ii. Emergency video storage mechanism

The emergency video is a 20s video, which is stored in the "emergency video" folder. The 20s video consists of 10s video before and after the time when the vibration is sensed. The resolution of the emergency video is the same as that of the normal video currently set. If the normal video is set to 1080P or 720P, the resolution of the emergency video is also 1080P or 720P.

Due to the space of the "emergency video" folder is also limited, the memory card in "emergency video" folder will also be full, so the emergency video folder also adopts the mechanism of circular overwrite. When user sets emergency recording overwrite to "ON", when "emergency video" folder is full, the newly generated emergency video will overwrite the earliest recorded emergency video. If user sets emergency recording overwrite to "OFF", when "emergency video" folder is full, the new emergency video will not overwrite any video, only prompt: "Emergency video folder is full, emergency recording overwrite is set to off".

5) Time watermark

The time watermark is corrected by LVDS, and it will be corrected once when starting up. The time watermark contains date and time information in the format of "year-month-day hour: minute: second". The time watermark can be set to off (the same setting switch as driving information overlay setting switch). If user sets it to off, the recorded video does not contain time watermark.

6) Driving information overlay

DVR will receive the vehicle driving information from CAN network and save it in the video recording file in the form of watermark icon. The information watermark of DVR is acquired according to the CAN signal. When there is no CAN signal, the information watermark will not be displayed and CAN network will not actively wake up other ECU. See the table below for driving information.

Display composite information	Vehicle speed	20km/h
	Gear position	D
	Accelerator pedal	
	High beam light	
	Low beam light	
	Rear fog light	
	Right turn signal light	
	Left turn signal light	
	Hand brake	
	Foot brake	
	Safety belt warning status (- consistent with instrument warning light status)	

The watermarks of light, brake and seat belt display as follows:



U20121

Driving information comes from CAN network. When the vehicle performs corresponding actions and the drive recorder receives corresponding CAN information, the corresponding icon will be highlighted; if the corresponding actions are not performed, the corresponding icon will be grayed out; if the high beam light is turned on, the high beam light icon will be highlighted; if the high beam light is turned off, the high beam light icon will be grayed out. Vehicle speed information display: Numbers km / h.

These vehicle status information is not visible on real-time preview interface, but it will be superimposed and recorded on the video stored in TF card. When the user plays back the recorded video, the vehicle driving information can be seen.

7) Video storage protection with power off

When system detects that power supply is cut off, system will immediately start recording stop and recording save action, use super capacitor to store electricity, complete recording file before the moment of power off.

8) Parking monitoring

If the user sets the parking monitoring function as ON, when the vehicle stops and stalls, the ON gear is off, and the drive recorder is shut down, if the vehicle vibrates and the vibration acceleration value exceeds the threshold value of G-sensor, the drive recorder will be awakened and recorded video for a period of 20s after awakening, which is stored in the "emergency video" folder. If G-sensor does not continue to sense vibration, the drive recorder will be shut down.

The parking monitoring function is OFF by default. The user can turn on parking monitoring function through central control navigation.

9) Taking pictures

i. Photograph operation and control

When the drive recorder is on, you can quickly take a picture by pressing TBD button on steering wheel. Press the button once to take a picture. You can take photos by clicking ICON in UI interface of central control navigation. The minimum response interval between two consecutive photographing commands is 500 ms.

ii. Photograph storage

The photos taken are consistent with the currently set video resolution, such as if the set video is 1080P or 720P, and the photos taken are also 1080P or 720P. Photographs are taken during the video recording process, and the video recording is not affected. Photograph storage uses the logic of circular overlay. When the "Photograph" folder is full, the latest photograph will overwrite the earliest photograph.

10) Playback of video/photograph

i. Playback and deleting of video in TF card

On video list interface in TF card, select one video and click "Delete" to delete the video. Long press a video in the list, and the "Select All" option will appear. If all videos are selected, click "-Delete" to delete from the first video, "Delete" icon will change to "Cancel" icon, and click "Cancel" to stop deleting. Deleted videos cannot be recovered.

On video list interface in TF card, select one video and click "Playback" to start playing the current video. If all videos are selected, click "Playback" to start playing from the first video.

Time watermark and driving status information (such as "driving information" setting is on during video capture) can be displayed on the video playback interface. Click  ICON to pause playback, ICON will change to , click  ICON to play continues; ICON will change to . Drag the time progress bar to quickly locate the video playback time.

Click "Return" icon to exit photo playback and return to DVR main interface.

ii. Playback and deleting of photos in TF card

On photo list interface in TF card, select one photo and click "Delete" to delete the photo. If all photos are selected, click "Delete" to delete from the first photo, "Delete" icon will change to "-Cancel" icon, and click "Cancel" to stop deleting. Deleted photos cannot be recovered.

On photo list interface in TF card, click one photo, this photo will be displayed at left area of screen.

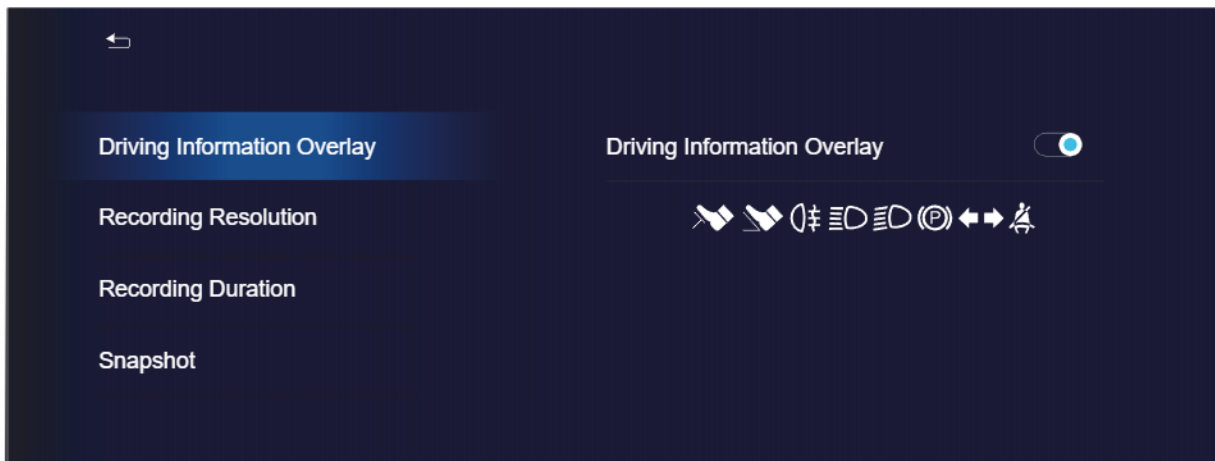
Time watermark and driving information (such as "driving information" setting is on during photo taking) can be displayed on the photo playback interface. Click ICON, the photos will be played automatically at speed of 3 s per photo from the current photo, ICON will change to , click will pause automatic play, ICON returns to .

Click "<" or ">" ICON, it will change to previous or next photo.

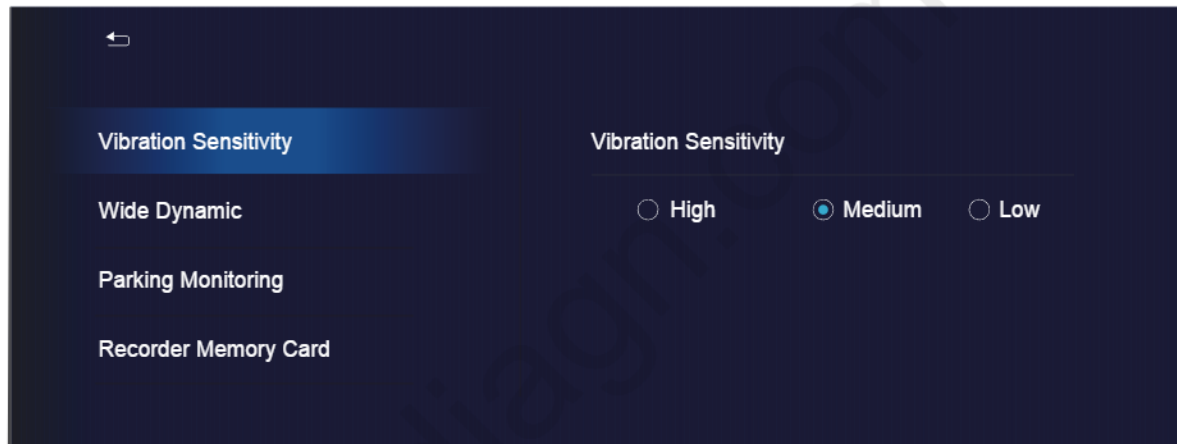
Click "Return" icon to exit photo playback and return to DVR main interface.

11) Setting

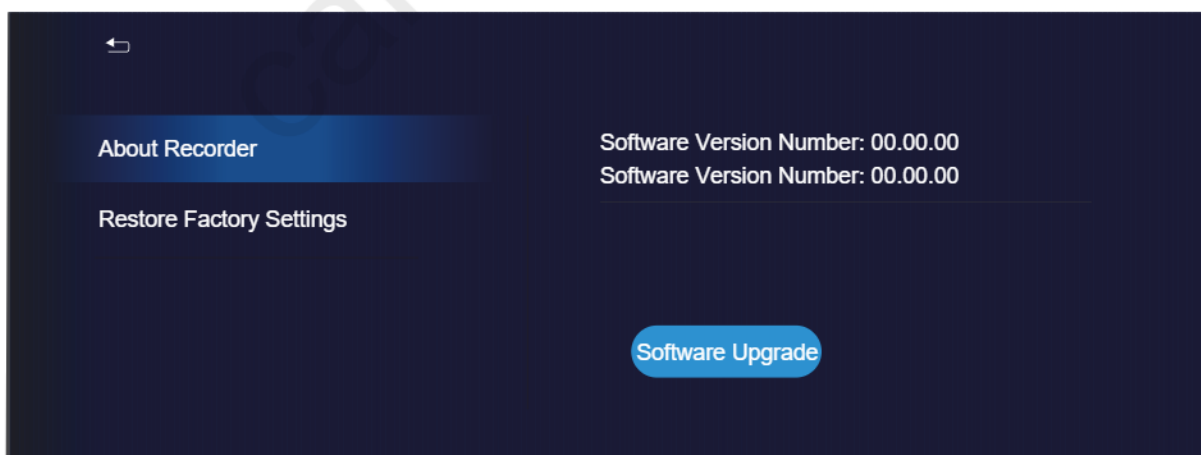
On the real-time preview interface, click setting ICON to enter setting menu interface of drive recorder, setting items of drive recorder contains the following:



U20246



U20248



U20252

Driving information overlay: ON (default) and OFF.

Resolution: 1080P (default) and 720P.

Video duration: 1 minute, 3 minutes (default) and 5 minutes.

Sound recording: ON, OFF (by default).

Vibration sensitivity: High, Medium (default) and Low.

Wide dynamic: ON (default) and OFF.

Emergency recording overwriting: ON (default) and OFF.

Parking monitoring: ON and OFF (default).

Format: Select to format the memory card on the recorder.

Factory settings: Restore the factory default settings of recorder.

Firmware upgrade: When there is a correct upgrade file in TF card, click "Firmware upgrade" to update system firmware of recorder.

12) AR navigation video output

i. AR navigation video output

When DVR is turned on and central control navigation starts and successfully configures LVDS transmission pair (MAX96705), DVR turns on AR navigation video output. When DVR detects that ON signal is turned off, and after CAN network is turned off, DVR turns off AR navigation video output.

ii. AR navigation video requirement

DVR head unit intercepts camera center FOV (H) = 55° range video (resolution: 920*520), transmits it to central navigation head unit via LVDS, for AR navigation map analysis and processing; Output video frame rate requires 30 frames.

13) Status indication

Status indicator is located next to the TF card slot, indicator is red-blue indicator.

Blue indicator constant on indicates that device operates normally.

Blue indicator flashes slowly, that is, blue indicator flashes at a frequency of 0.5 HZ, indicating that the wifi connection is successful.

Red indicator constant on indicates that device failure or abnormal function, including abnormal TF card or low card speed, video stopping and machine fault.

Red indicator flashes slowly, that is, blue indicator flashes at a frequency of 0.5 HZ, indicating that video is abnormal or there is no TF card.

Alternating red and blue flashes indicate that the software is being upgraded.

(4) Electrical requirement

1) Steering wheel drive-by-wire

i. Drive-by-wire button definition

"Mode" button on steering wheel is the user-customizable button, which can be defined by the user as: sound source switching or drive recorder snapshot. If it is defined as drive recorder snapshot, you can perform drive recorder snapshot function by pressing Mode button. User can customize the snapshot in the setting interface of the drive recorder: Photo taking, short video and photo taking + short video (default).

(5) Interaction between DVR and central control

drive recorder function involves the interaction among central control IHU, central control APK and drive recorder.

Main functions of central control are:

- As a hot spot, central control needs to support DVR Wi-Fi access.
- It is necessary to provide CAN writing interface to send CAN data for central control APK.
- It is necessary to provide CAN data callback interface, notify APK when central control receives relevant CAN data.

Main functions implemented by APK:

- Interact with the DVR through Wi-Fi.
- Notify the DVR of some central control information (such as Wi-Fi SSID, etc.) through the CAN writing interface provided by the central control.
- Feedback the CAN information (such as TFC card status, etc.) received by the central control from DVR.

Main functions implemented by DVR:

- Basic functions of drive recorder.

- Report DVR status and other information through CAN.
- Respond APK by requirements sent from CAN (such as TF card status, etc.)

The CAN command interacting with DVR is an event message, and the time interval between two messages is not less than 20 ms. Like a CAN message which is composed of multiple frames, the sending interval of two frames is 20 ms.

The main protocols for CAN interaction between central console and DVR are as follows:

Command Type	Parameter Length	Sending Timing	Note
MAC Address	6 Byte	Sent when IHU is turned on, when there is a change, when DVR requests, and when IHU responds (when DVR is turned on)	For example: 00:23:DE:2C:34:DF, sending from start to end; parameter length (6 Byte) + 1 (1 Byte check digit) is the total data length.
Wi-Fi Name	64 Byte max	Sent when IHU is turned on, when there is a change, when DVR requests, when IHU responds, and when IHU turns on AP	Wi-Fi name is variable length. When the overall length of data is more than 6, it is necessary to send it by frame.
Wi-Fi Password	64 Byte max	Sent when IHU is turned on, when there is a change, when DVR requests, when IHU responds, and when IHU turns on AP	Wi-Fi name is variable length. When the overall length of data is more than 6, it is necessary to send it by frame.
Wi-Fi Connection	1 Byte	When DVR APK starts/exits	
UDP broadcast terminal number	2 Byte	When head unit APK starts, when DVR requests actively	Used for notifying APK to connect with DVR by DVR broadcasting
TF card status	1 Byte	DVR sends actively when TF status changes, DVR sends passively when APK requires actively (- when APK starts)	The status of card includes: TF card status is normal, no card is inserted (IHU display: memory card is not inserted into recorder), TF card is not formatted (IHU display: recorder memory card is not formatted), card is abnormal (IHU display: recorder memory card is abnormal)
DVR Status	1 Byte	DVR sends actively when DVR status changes, DVR sends passively when APK requires actively (- when central console starts)	Included status: DVR status is normal, DVR status is abnormal
Photo folder status	1 Byte	DVR sends actively when photo space is full, DVR sends passively when APK requires actively	Included status: Photo space is not full/Photo space is full (IHU display: photo folder of drive recorder is full)

Command Type	Parameter Length	Sending Timing	Note
Emergency video folder status	1 Byte	DVR sends actively when emergency video space is full, DVR sends passively when APK requires actively	Included status: Emergency video space is not full/Emergency video space is full (IHU display: emergency video folder of drive recorder is full)
DVR Requirement	1 Byte	When DVR needs to actively acquire the central console information	SSID information and others needs to be known when DVR starts
APK Requirement	1 Byte	When DVR needs to actively acquire the DVR status	APK requires actively. After DVR receives this requirement, TF status, DVR status, photo space status and emergency video space is sent by CAN

3 DIAGNOSIS & TESTING

3.1 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.

3.2 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.

3.3 Ground Inspection

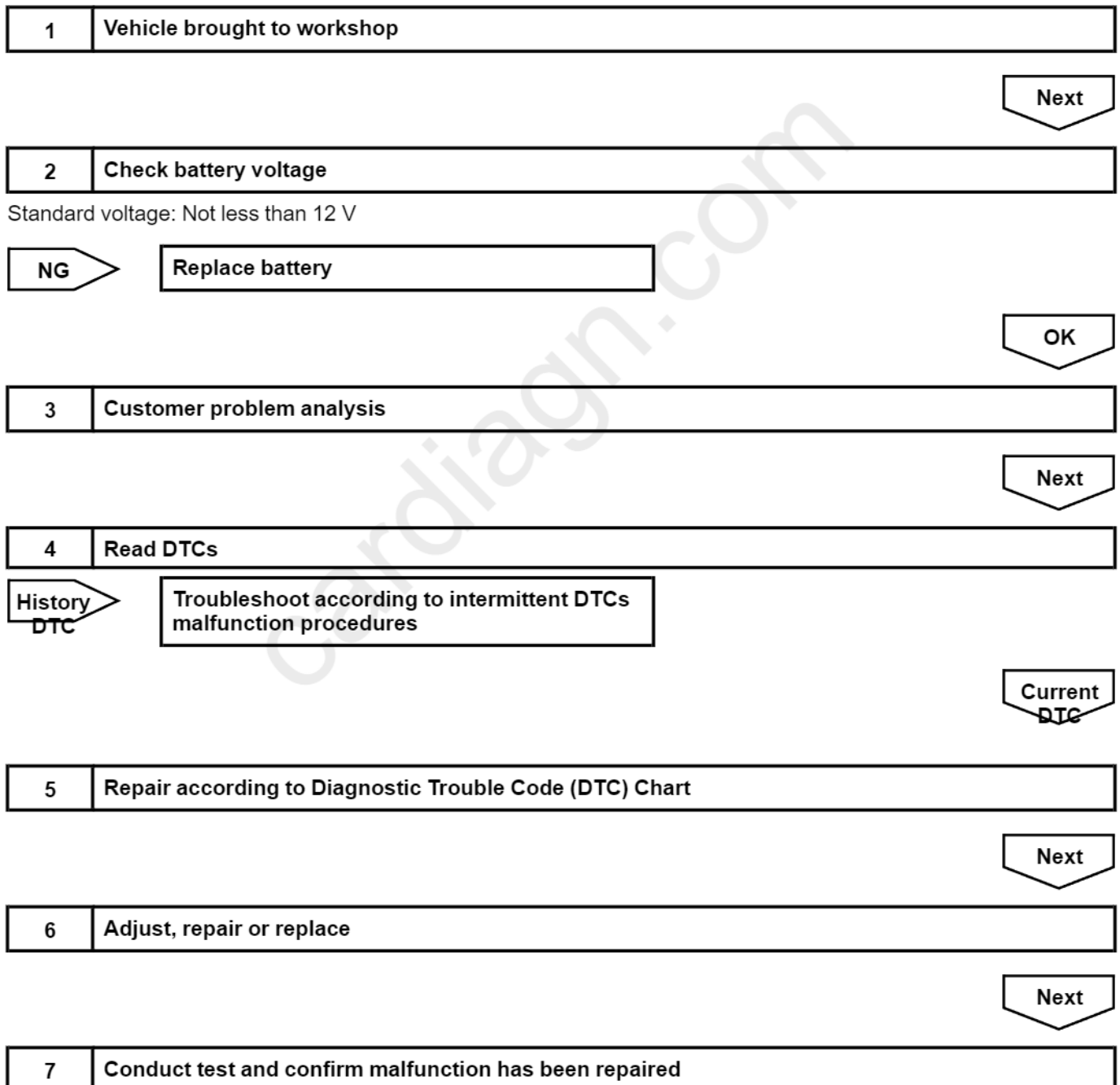
Ground points are very important to the proper operation of circuits. Ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) may increase load resistance. This situation

may change the way in which a circuit operates. Circuits are very sensitive to proper grounding. A loose or corroded ground can seriously affect the control circuit. Check the ground points as follows:

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

3.4 Diagnosis Procedure

Use following procedures to troubleshoot the inside rear view mirror system.



Next

End

3.5 Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition	Detection Condition	Possible Cause	Maintenance Advice
B1B5000	Image Sensor Failure - Abnormal Image Acquisition	Abnormal image acquisition	1. Accidental failure; 2. Sensor failure.	1. Reset module and clear DTC; 2. Replace module for testing.
B1B5100	DSP Failure	DSP failure	1. Accidental failure; 2. Module internal fault.	
B1B5200	WIFI Failure - WIFI Module Abnormal	WIFI module abnormal	1. Accidental failure; 2. Module internal fault.	1. Reset module and clear DTC; 2. Replace module for testing.
B1B5300	G-sensor Fault - Abnormal Collision Sensing	Abnormal collision sensing	1. Accidental failure; 2. Module internal fault.	1. Reset module and clear DTC; 2. Replace module for testing.
B1B544A	Abnormal Memory Card - Low Write Speed of Memory Card, Serious Fragmentation of Memory Card, Memory Card Damage	Low write speed of memory card, serious fragmentation of memory card, memory card damage	1. Accidental failure; 2. The memory card is abnormal.	1. Reset module and clear DTC; 2. Replace a new memory card with a correct format for testing; 3. Replace module for testing

3.6 DTC Diagnosis Procedure

DTC	B1B5000	Image Sensor Failure - Abnormal Image Acquisition
DTC	B1B5100	DSP Failure

■ 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 intermittent fault

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

- Wait 120 seconds, ignition switch is turned on and off again;
- Clear DTC again.

OK

If DTC still exists, replace module hardware.

NG

2 Check camera

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

- (a) Check camera for obstruction or damage.

NG

Check, repair and replace module assembly.

OK

3 Check related wire harness and connector

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Disconnect the DVR module assembly connector B-219.
- (c) Check if related wire harnesses are worn, pinched or broken.
- (d) Check if related connector terminals are loose, broken, bent or corrosive.
- (e) According to the table below, use a digital multimeter to check for continuity between DVR module assembly connectors B-219 (1, 2) and I-034 (1, 2).

Multimeter Connection	Specified Condition
B-219 (1, 2) - I-034 (1, 2)	$\leq 1 \Omega$
B-219 (1, 2) - I-034 (1, 2)	$\leq 1 \Omega$

NG

Check and repair wire harness and connector.

OK

4 Check controller module

NG

Check and repair or replace controller

OK

Go back to step 1 and recheck.

DTC	B1B5200	WIFI Failure - WIFI Module Abnormal
DTC	B1B5300	G-sensor Fault - Abnormal Collision Sensing

■ 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 intermittent fault

- (a) Wait 120 seconds, ignition switch is turned on and off again;
 (b) Clear DTC again.

OK

If DTC still exists, replace module hardware.

NG**2 Check controller module****NG**

Check and repair or replace controller.

OK

Go back to step 1 and recheck.

DTC**B1B544A****Abnormal Memory Card - Low Write Speed of Memory Card, Serious Fragmentation of Memory Card, Memory Card Damage****■ 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 intermittent fault

- (a) Wait 120 seconds, ignition switch is turned on and off again;
 (b) Clear DTC again.

OK

If DTC still exists, replace module hardware.

NG**2 Check memory card**

- (a) Check memory card for contamination or damage.

NG

Check, repair and replace memory card with correct format for testing.

OK**3 Check controller module****NG**

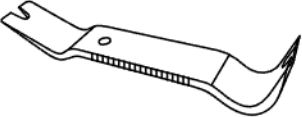
Check and repair or replace controller.

OK

Go back to step 1 and recheck.

4 ON-VEHICLE SERVICE

4.1 Tool

Tool Name	Tool Drawing
Interior Crow Plate	 S00020

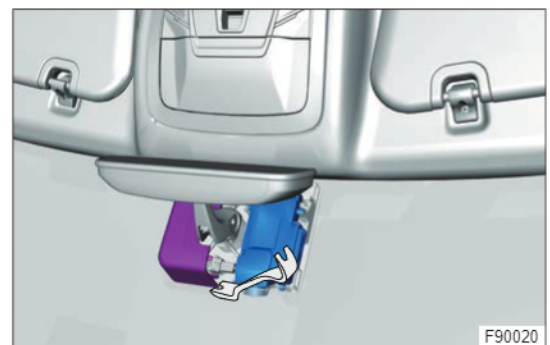
4.2 Replacement of Drive Recorder

■ Removal

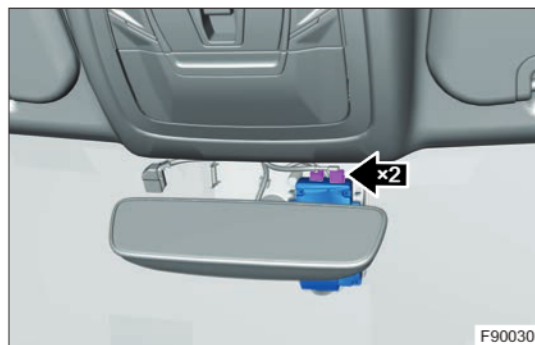
- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Using an interior crow plate, pry off and remove the inside rear view mirror right protective cover.



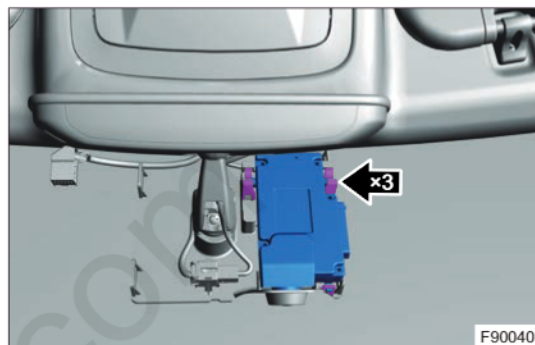
- (4) Using an interior crow plate, pry off the inside rear view mirror left protective cover.



- (5) Remove the drive recorder connector



- (6) Remove the fixing columns on both sides of drive recorder along the upward direction of bracket base, and take out the lens of drive recorder and front end pin, and finally remove drive recorder.



■ Installation

- (1) Align lens and front end pins of drive recorder with the corresponding holes on the base of multi-function bracket and insert them.
- (2) When front end pins of drive recorder is inserted in place, the fixed columns on left and right sides of drive recorder are just at upper end of bracket base. Press down the fixed columns on left and right sides along the direction of bracket base, and assemble them to the corresponding structure of base. After drive recorder is assembled, insert connectors of drive recorder respectively.
- (3) Pull off protective film on drive recorder lens.
- (4) Install the inside rear view mirror left protective cover.
- (5) Install the inside rear view mirror right protective cover.

.1 Precautions

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

- (1) Be sure to wear necessary safety equipment to prevent accidents, when removing outside rear view mirror assembly.
- (2) Operate carefully to prevent components from being damaged, when removing outside rear view mirror assembly.
- (3) DO NOT scratch interior and body paint when removing outside rear view mirror assembly.
- (4) Avoid breaking claw, when removing outside rear view mirror lens assembly.
- (5) Make sure the lens can move smoothly, flexibly and reliably after installing outside rear view mirror lens assembly.

1 System Overview

1.1 System Description

This vehicle is equipped with power outside rear view mirror assembly and inside rear view mirror assembly. Power outside rear view mirror assembly: Driver can control the rotation of outside rear view mirror internal motor by operating the outside rear view mirror adjustment switch in vehicle, thus adjusting the mirror surface to a required visual angle and folding mirror. Outside rear view mirror adjustment switch: Located on front left door protector. With ENGINE START STOP switch ON, press the outside rear view mirror adjustment switch to "L" or "R" position to select left or right outside rear view mirror assembly, and then press the up or down and left or right button of outside rear view mirror adjustment switch to a required visual angle. Manual glare-resistant inside rear view mirror assembly: It is necessary to adjust inside rear view mirror to desired direction with hands. When driving at night, to reduce glare, adjust the inside rear view mirror assembly to required angle by pulling glare-resistant rod backward. Automatic glare-resistant inside rear view mirror assembly (if equipped): It is composed of a special mirror, two photosensitive diodes and an electronic controller. The electronic controller receives the front and back light signals from the photosensitive diodes. If light shines on the inside rear view mirror, for example if the light behind is brighter than that in front, the electronic controller will output a voltage to the conductive layer. The voltage on conductive layer will change the color of electrochemical layer on mirror surface. The higher the voltage is, the darker the color of electrochemical layer is. At this time, even if a strong light shines on the rear view mirror, a dark light will be reflected on the driver's eyes through the glare-resistant inside rear view mirror, which will not be glaring. The electrochemical layer on mirror surface will change continuously and automatically according to the incident intensity of light behind, thus preventing glare. When reversing the vehicle, the glare-resistant function of glare-resistant inside rear view mirror will be released.

1.2 System Components Diagram



U20010

1	Left Outside Rear View Mirror Assembly	3	Inside Rear View Mirror Assembly
2	Rear View Mirror Folding Switch	4	Right Outside Rear View Mirror Assembly

1.3 System Schematic

Operation of rear view mirror

- The up and down, left and right movement of outside rear view mirror is signaled by front left window switch and adjusted and controlled by door control module.
- The defrosting of outside rear view mirror starts with the defrost request signal received by BCM via CAN (defroster operating time: 20 minutes timing ends, defrosting stops) and then the heating signal is transmitted to the rear view mirror heating relay to perform heating.

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
Outside rear view mirror cannot operate	Fuse
	Outside rear view mirror adjustment switch
	Outside rear view mirror assembly
	Wire harness or connector
Outside rear view mirror intermittent malfunction	Ground
	Wire harness or connector
Rear view mirror defroster cannot operate	Wire harness or connector
	Rear defroster switch
	Outside rear view mirror assembly
	BCM is damaged

2.2 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.

2.3 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.

2.4 Ground Inspection

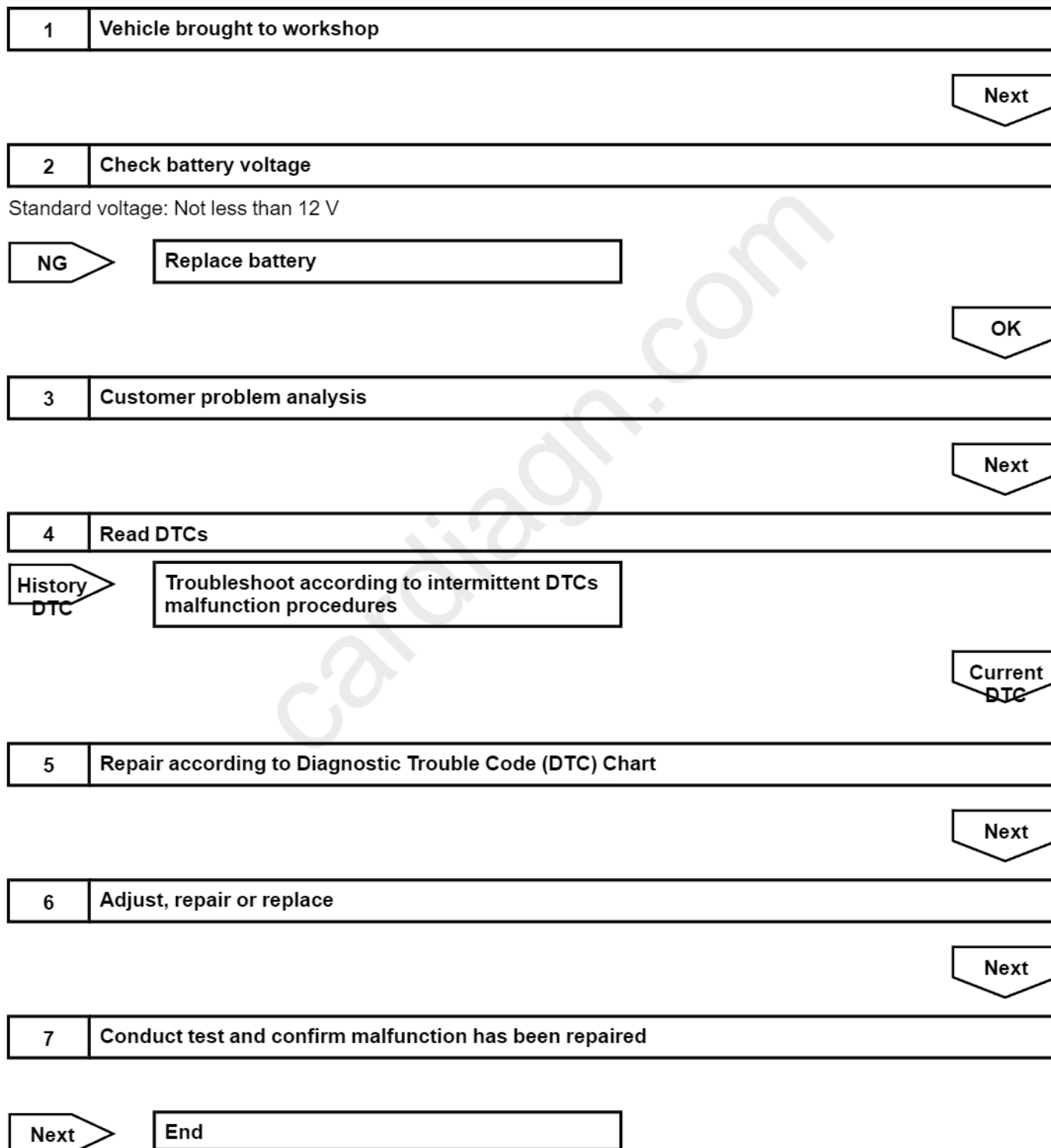
Ground points are very important to the proper operation of circuits. Ground points are often exposed to moisture, dirt and other corrosive environments. Corrosion (rust) may increase load resistance. This situation may change the way in which a circuit operates. Circuits are very sensitive to proper 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.

2.5 Diagnosis Procedure

Use following procedures to troubleshoot the inside rear view mirror system.



2.6 Diagnostic Trouble Code (DTC) Chart

DTC	DTC Definition
B104111	Outside Rear View Mirror Folding Relay Circuit Short to Power Supply
B104113	Outside Rear View Mirror Folding Relay Circuit Open
B105112	Outside Rear View Mirror Defroster Relay Circuit Short to Power Supply
B105011	Rear Defroster Relay Circuit Open or Short to Ground
B105012	Rear Defroster Relay Circuit Short to Power Supply

2.7 DTC Diagnosis Procedure

DTC	B104111	Outside Rear View Mirror Folding Relay Circuit Short to Power Supply
DTC	DTC Definition	Possible Cause
B104111	Outside Rear View Mirror Folding Relay Circuit Short to Power Supply	• Check wire harness connector • Outside rear view mirror • Check BCM

■ 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 for short to power supply in wire harness and connector
---	---

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

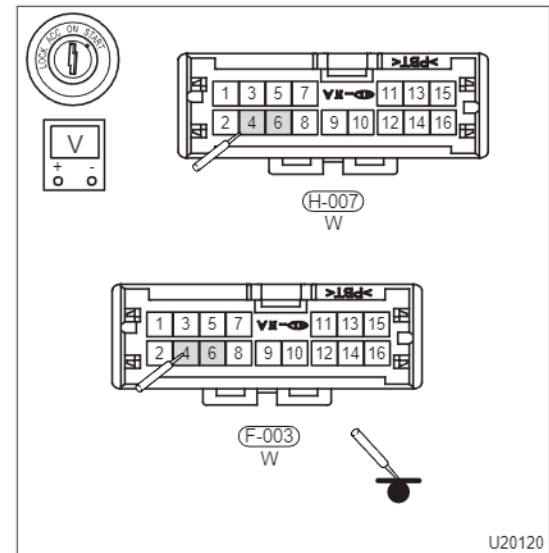
- Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- Disconnect the connectors H-007 and F-003.
- Connect the negative battery cable, and turn ENGINE START STOP switch to ON.
- Using voltage band of digital multimeter, check for voltage between H-007 (4) - ground, H-007 (6) - ground, F-003 (4) - ground and F-003 (6) - ground separately.

Multimeter Connection	Condition	Specified Condition
H-007 (4) - Ground	ENGINE START STOP switch "ON"	0 V
H-007 (6) - Ground	ENGINE START STOP switch "ON"	0 V
F-003 (4) - Ground	ENGINE START STOP switch "ON"	0 V
F-003 (6) - Ground	ENGINE START STOP switch "ON"	0 V

NG

Repair or replace faulty wire harness or connector

OK



2

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 malfunction information and confirm malfunction has been repaired.

NG

Replace BCM module

OK

System operates normally

DTC	B104113	Outside Rear View Mirror Folding Relay Circuit Open
DTC	DTC Definition	Possible Cause
B104113	Outside Rear View Mirror Folding Relay Circuit Open	- Check wire harness connector - Outside rear view mirror - Check BCM

■ 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 wire harness and connector for open

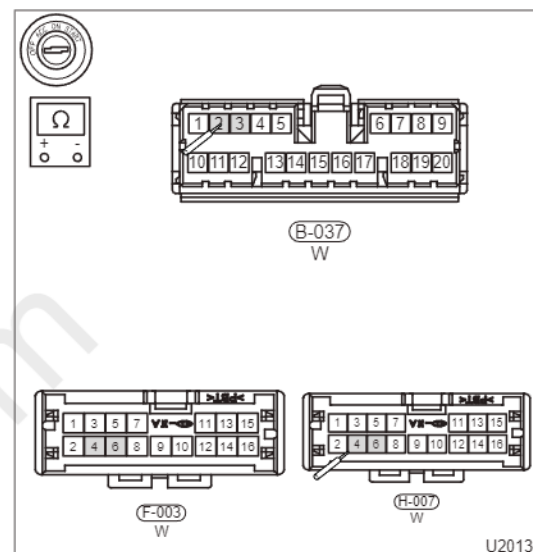
- Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- Disconnect the connectors B-037, H-007 and F-003.
- Connect the negative battery cable, and turn ENGINE START STOP switch to ON.
- Using voltage band of digital multimeter, check for voltage between B-037 (3) - H-007 (6), B- 037 (3) - F-003 (6), B-037 (2) - H-007 (4) and B-037 (2) - F-003 (4) separately.

Multimeter Connection	Condition	Specified Condition
B-037 (3) - H- 007 (6)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$
B-037(3) - F-003(6)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$
B-037 (2) - H- 007 (4)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$
B-037(2) - F-003(4)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$

NG

Repair or replace faulty wire harness or connector

OK


2 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 malfunction information and confirm malfunction has been repaired.

NG

Replace BCM module

OK

System operates normally

DTC	B105012	Rear Defroster Relay Circuit Short to Power Supply
DTC	B105112	Outside Rear View Mirror Defroster Relay Circuit Short to Power Supply

DTC	DTC Definition	Possible Cause
B105012	Rear Defroster Relay Circuit Short to Power Supply	- Relay - Wire harness or connector - BCM module
B105112	Outside Rear View Mirror Defroster Relay Circuit Short to Power Supply	

■ 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 relay

- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Using ohm band of digital multimeter, check relay (RRLY11) (RRLY12).

Multimeter Connection	Condition	Specified Condition
87#-30#	When battery voltage is not applied to 86#-85#	∞
87#-30#	When battery voltage is applied to 86#-85#	$\leq 1 \Omega$
30#-87#	When battery voltage is not applied to 1#-2#	∞
30#-87#	When battery voltage is applied to 1#-2#	$\leq 1 \Omega$

NG

Replace relay

OK

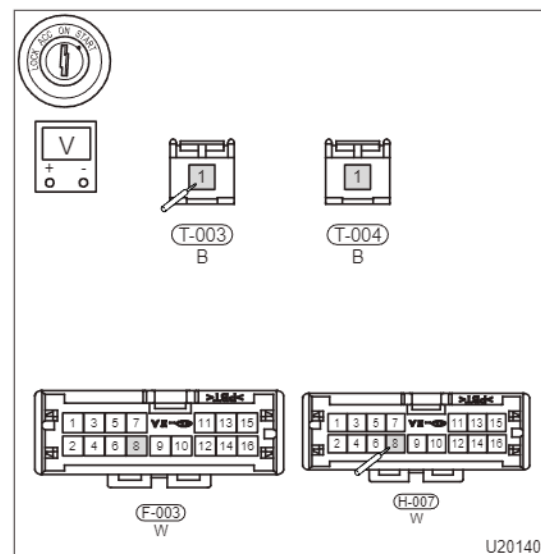
2 Check for short to power supply in wire harness and connector

- Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- Disconnect the connectors H-007, F-003, T-003 and T-004.
- Connect the negative battery cable, and turn ENGINE START STOP switch to ON.
- Using voltage band of digital multimeter, check for voltage between H-007 (8) - ground, F-003 (8) - ground, T-003 (1) - ground, and T-004 (1) - ground separately.

Multimeter Connection	Condition	Specified Condition
H-007 (8) - Ground	ENGINE START STOP switch "ON"	0 V
F-003 (8) - Ground	ENGINE START STOP switch "ON"	0 V
T-003 (1) - Ground	ENGINE START STOP switch "ON"	0 V
T-004 (1) - Ground	ENGINE START STOP switch "ON"	0 V

NG

Repair or replace faulty wire harness or 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 malfunction information and confirm malfunction has been repaired.

NG

Replace BCM module

OK

System operates normally

DTC	B105011	Rear Defroster Relay Circuit Open or Short to Ground
DTC	DTC Definition	Possible Cause
B105011	Rear Defroster Relay Circuit Open or Short to Ground	- Relay - Wire harness or connector - BCM 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 Check relay

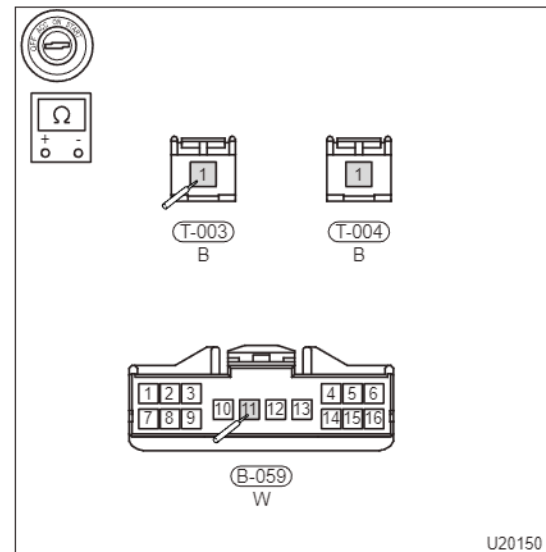
- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Using ohm band of digital multimeter, check relay (RRLY12).

Multimeter Connection	Condition	Specified Condition
87#-30#	When battery voltage is not applied to 1#-2#	∞
87#-30#	When battery voltage is applied to 1#-2#	$\leq 1 \Omega$

NG**Replace relay****OK****2 Check wire harness and connector for open**

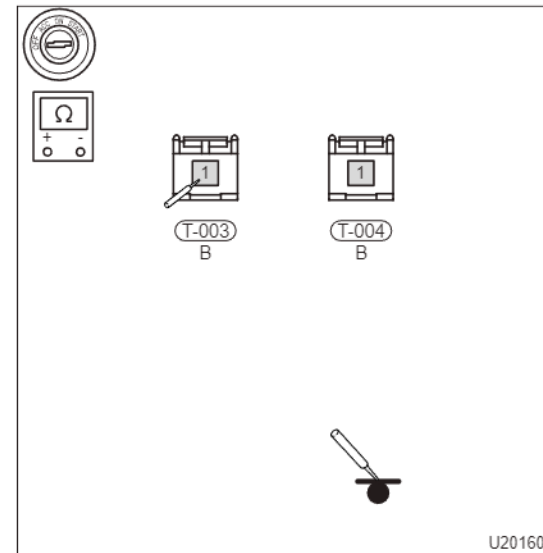
- (a) Turn ENGINE START STOP switch to OFF, disconnect the negative battery cable.
- (b) Disconnect the connectors B-059, T-003 and T-004.
- (c) Connect the negative battery cable, and turn ENGINE START STOP switch to ON.
- (d) Using voltage band of digital multimeter, check for continuity between B-059 (11) - T-003 (1) and B-059 (11) - T-004 (1) separately.

Multimeter Connection	Condition	Specified Condition
B-059 (11) - T-003 (1)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$
B-059 (11) - T-004 (1)	ENGINE START STOP switch "OFF"	$\leq 1 \Omega$

NG**Repair or replace faulty wire harness or 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 connectors T-003 and T-004.
- (c) Using voltage band of digital multimeter, check for continuity between T-003 (1) - ground and T-004 (1) - ground separately.

Multimeter Connection	Condition	Specified Condition
T-003 (1) - Ground	ENGINE START STOP switch "OFF"	∞
T-004 (1) - Ground	ENGINE START STOP switch "OFF"	∞



NG

Repair or replace faulty wire harness or connector

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 malfunction information and confirm malfunction has been repaired.

NG

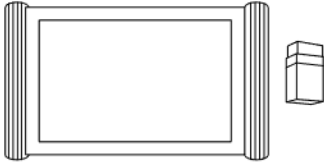
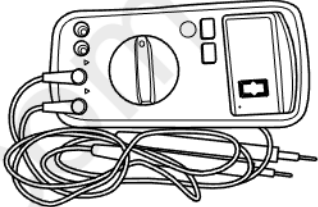
Replace BCM module

OK

System operates normally

3 ON-VEHICLE SERVICE

3.1 Tools

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

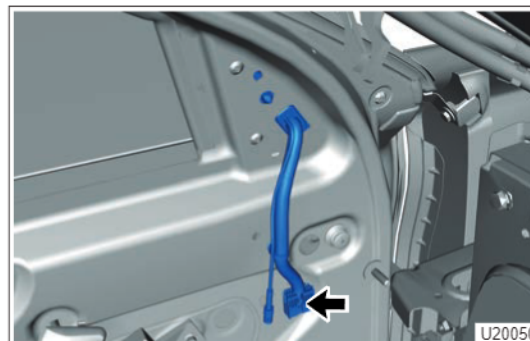
3.2 Replacement of Outside Rear View Mirror Assembly

■ Removal

Hint
• Use same procedures for right and left sides. • Procedures listed below are for left side.
Warning
• Be sure to wear necessary safety equipment to prevent accidents, when removing outside rear view mirror assembly. • Operate carefully to prevent components from being damaged, when removing outside rear view mirror assembly. • DO NOT scratch interior and body paint when removing outside rear view mirror assembly.

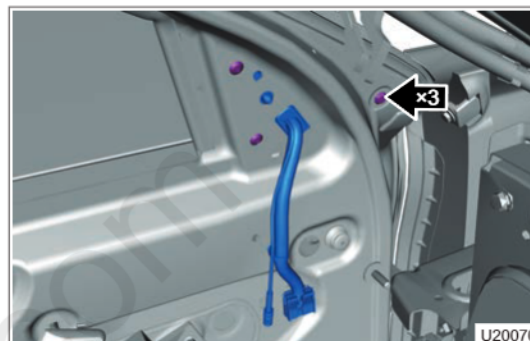
- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Remove the front left door inner protector assembly.

- (4) Disconnect the left outside rear view mirror assembly connector.



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

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



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

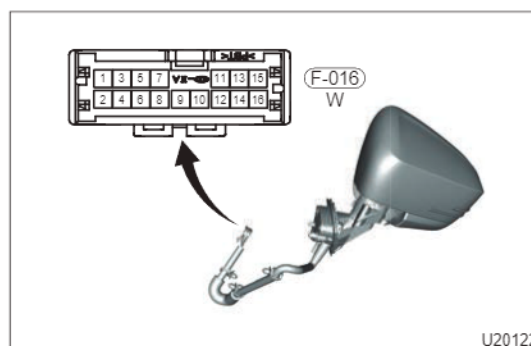
■ Inspection

Caution

When performing electrical equipment diagnosis and test, always refer to circuit diagram for related circuit and component information.

- (1) Apply battery voltage to terminals of outside rear view mirror assembly connector and check operation of outside rear view mirror assembly according to table below.

Multimeter Connection	Specified Condition
Battery positive (+) → Terminal 11 Battery negative (-) → Terminal 12	UP
Battery positive (+) → Terminal 12 Battery negative (-) → Terminal 11	DOWN
Battery positive (+) → Terminal 10 Battery negative (-) → Terminal 11	LEFT
Battery positive (+) → Terminal 11 Battery negative (-) → Terminal 10	RIGHT



■ 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 (if equipped).

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

3.3 Replacement of Outside Rear View Mirror Lens Assembly

■ Removal

Hint

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

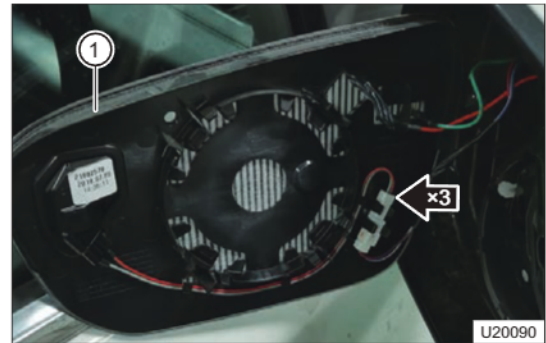
Warning

- Be sure to wear necessary safety equipment to prevent accidents, when removing outside rear view mirror assembly.
- Avoid breaking claw, when removing outside rear view mirror lens assembly.
- Avoid damaging lens due to dropping when removing outside rear view mirror lens assembly.
- **DO NOT** scratch body paint when removing outside rear view mirror lens assembly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Press the outside rear view mirror surface to tilt it.
- (4) Apply protective tape around exterior frame of outside rear view mirror.
- (5) Using an interior crow plate, pry off the claws of outside rear view mirror lens assembly.



- (6) Disconnect the connector from rear view mirror lens assembly, and remove the left outside rear view mirror lens assembly (1) (if equipped with rear view mirror heater).



■ Installation

Caution

- Make sure the lens can move smoothly, flexibly and reliably after installing outside rear view mirror lens assembly.

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

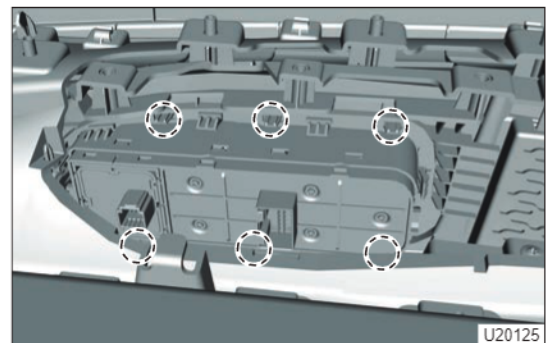
3.4 Replacement of Outside Rear View Mirror Adjustment Switch

■ Removal

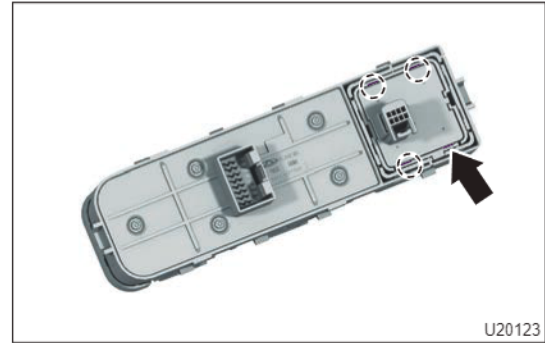
Warning

- Be sure to wear necessary safety equipment to prevent accidents, when removing outside rear view mirror adjustment switch.
- DO NOT scratch instrument panel assembly when removing outside rear view mirror adjustment switch.

- (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) Using an interior crow plate, pry off claws from power glass regulator switch and remove the power glass regulator switch.



- (5) Using an interior crow plate, pry off claws from outside rear view mirror adjustment switch and remove the outside rear view mirror adjustment switch.



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■ Installation

Caution

- Operate carefully to prevent damage to other components when installing outside rear view mirror adjustment switch.
- Install connectors in place, when installing outside rear view mirror adjustment switch.
- Check that switch can operate normally after installing outside rear view mirror adjustment switch.

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

3.5 Replacement of Inside Rear View Mirror Assembly

■ Removal

Warning

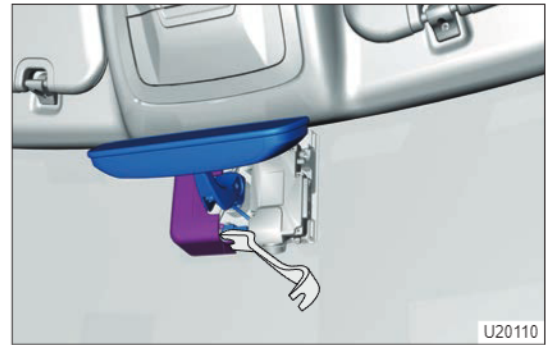
- Appropriate force should be applied when removing inside rear view mirror assembly. Be careful not to operate roughly.
- Try to prevent front windshield assembly from being scratched when removing inside rear view mirror assembly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch
- (2) Disconnect the negative battery cable
- (3) Using an interior crow plate, pry off and remove the inside rear view mirror right protective cover.

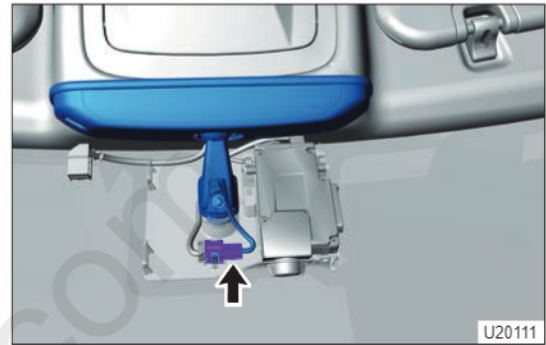


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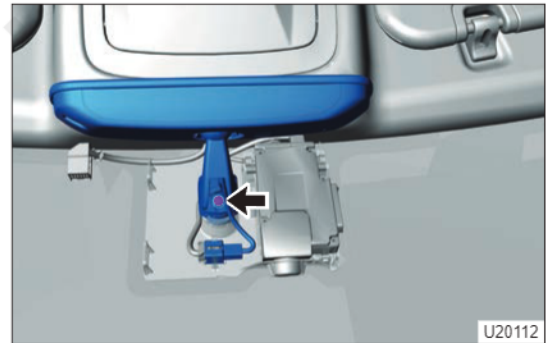
- (4) Using an interior crow plate, pry off the inside rear view mirror left protective cover.



- (5) Disconnect the inside rear view mirror wire harness connector.



- (6) Remove screws from inside rear view mirror base and remove inside rear view mirror assembly.



■ Installation

Caution

- Before installation, check if there is any obvious appearance defects (such as scratches, material missing, damage, etc.) and select the qualified parts.
- The inside rear view mirror should be within the normal range required by view and the lens assembly should be matched with lens base assembly firmly without any looseness.

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