

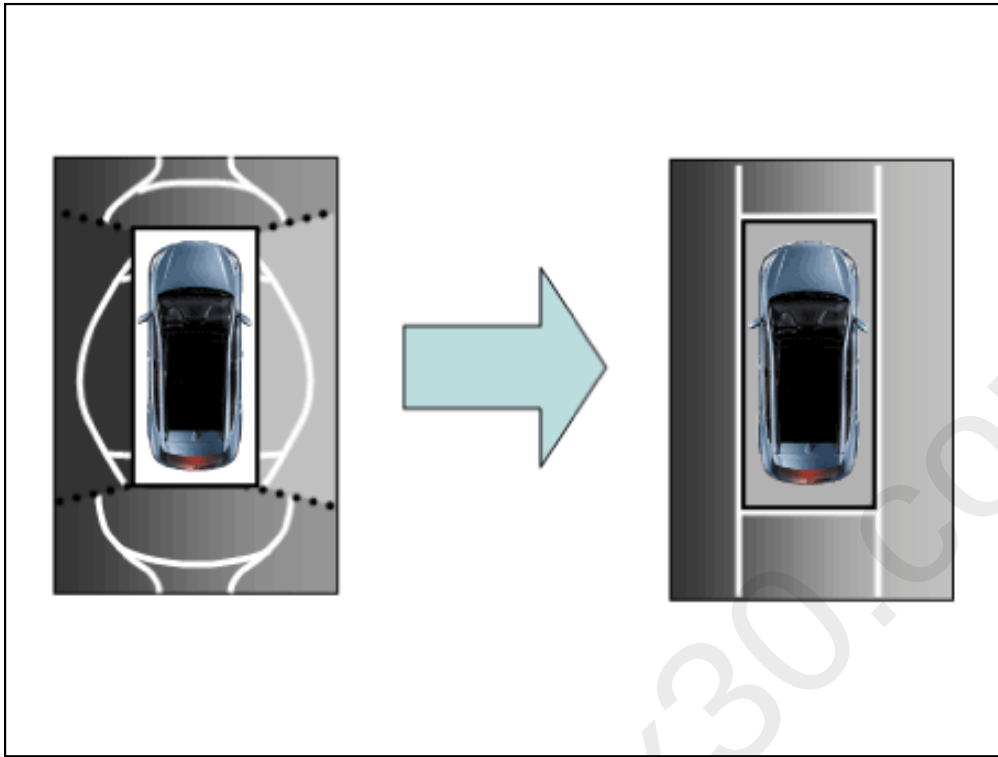
Description

Surround View Monitor (SVM) is the system that allows video monitoring of 360 degrees around the vehicle. The system includes 4 ultra optical camera mounted around the vehicle (front, both sides, rear).

The video from these cameras are applied with distortion compensation, time point conversion, and video merging technologies to provide sky-view image of the vehicle's surrounding area, as well as various other view modes.

The SVM System provides video feed of the vehicle's surrounding area while parking or during low speed driving to the driver to enhance safety and driver's convenience.

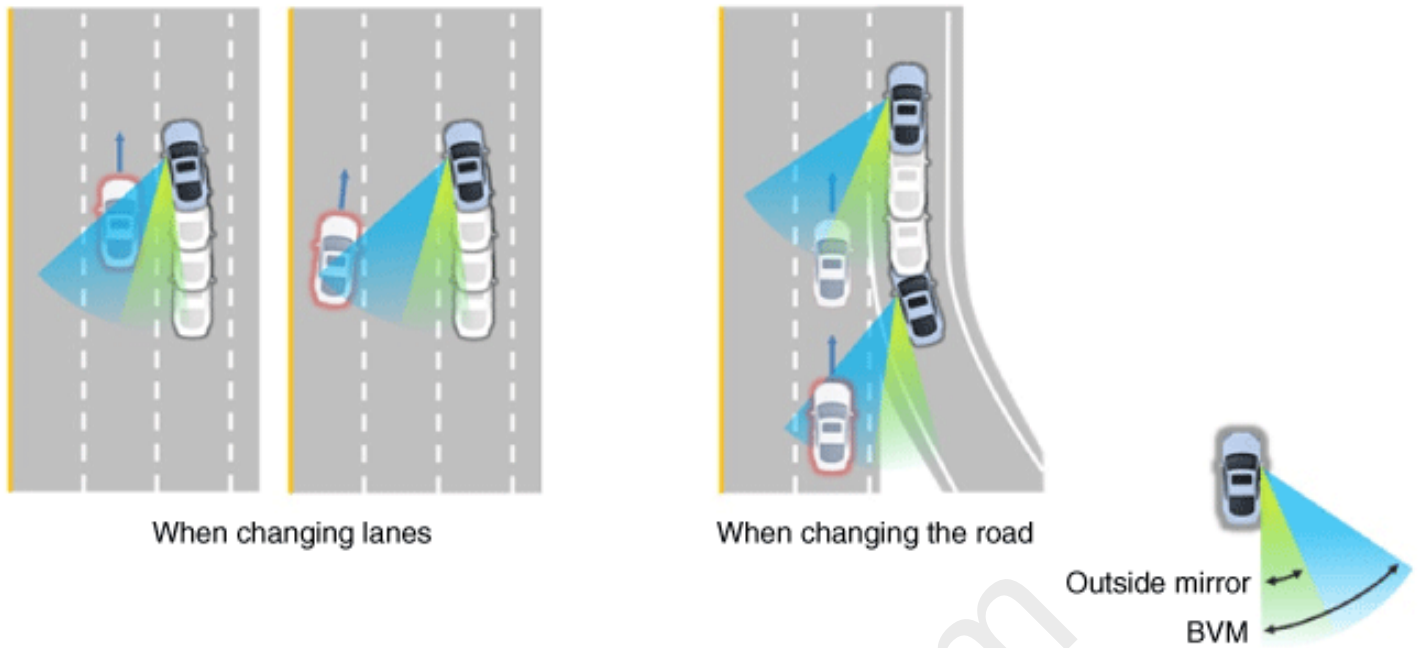
In addition, the system also displays video image of vehicle's surrounding area, and includes steering wheel synchronized guide line indication, front and rear object warning, and A/S (including In-Line) tolerance compensation features.



It's a system that displays the video, from ultra optical cameras mounted on 4 sides of the vehicle, on the Head Unit Screen. It shows 360 degrees sky-view image of the vehicle's surrounding area, as well as various other view modes. The SVM System provides video feed of the vehicle's surrounding area while the vehicle is parked or during low speed driving to the driver to enhance safety and driver's convenience.

Blind-spot View Monitor (BVM)

Blind-spot View Monitor (BVM) is a driving safety system that helps provide a more comprehensive views on areas which is not usually visible by the side mirrors when the vehicle tries to change the lane.



The BVM system provides a driver a more comprehensive view which is not usually visible by the side mirrors in certain situations like swithing drive lanes. The system helps to avoid any blind spot mishaps.

- The rear side view is displayed in the cluster screen when the turning lights are in operation as the turn signal light switch goes up and down by the driver.
- The SVM also provides an edited view of the left side/ right side without adding more cameras.
- It helps minimize the distraction of the driver by displaying the rear side view that is usually hard to see.



- The video will be played even though the side mirrors are folded. But it does not provide a proper view of the surroundings.
- The video quality may be lower than the SVM video as the size of the original image has to be adjusted to fit the cluster.
- The screen may temporarily fades out with changes in light conditions during daytime or with a sunrise or a sunset. Or when the car enters the tunnel.
- The view of the surrounding objects provided by the system may look far away than views that are obtained by the side mirrors.
- The brightness of the rear side video may change due to a mode switching delay of the SVM/BVM.

Major Features

1. Display Vehicles Surrounding in Video

The surrounding area video display function displays the 360 degrees video image captured through 4 cameras to the driver through the Head controller Screen while the vehicle is moving at low speed or going reverse. The SVM System displays total of 8 video modes for displaying surrounding video based on the vehicle driving state and the driver's selection.

2. Guide Line Indication & Steering Wheel Synchronized Feature

The Guide Line Indication & Steering Wheel Synchronized Feature is the function that assists the driver in parking by synchronizing the steering wheel with the rear view video display marked with a guide line to help anticipate the direction of the vehicle going reverse.

3. Front/Rear Object Warning (Obstacle Detection Feature)

The system receives obstacle warning signal from the PAS or SPAS sensors mounted on the front/rear of the vehicle and displays the obstacle location on the SVM Head Unit Screen.

4. Tolerance Compensation (including A/S)

Manual Tolerance Compensation Software is embedded in the SVM ECM to compensate the SVM deviation that may occur due to assembly line installation tolerance. You must first setup proper work environment in order to perform correct tolerance compensation.

SVM Mode Entry Conditions

The vehicle information is accessed regularly, even after entering SVM mode. When the conditions are met, conversion from front mode to rear mode is available, and vice versa.

When the mode is converted, the view displayed on the screen can be the initial view or the previous view depending on the conditions.

If the mode for conversion is the initial entry, the default view is selected based on the front or rear. If a continuous front-rear conversion mode occurs as forward and backward movement are repeated for parking, the previous view is recalled and displayed.

–Initial Entry: When the rear and front mode view in SVM mode is displayed on the screen for the first time

–Re-entry: When switching from SVM mode to another mode, without turning off SVM, and returning to the previous mode

(e.g. Rear → Front → Rear: Re-enter rear mode / Front → Rear → Front: Re-enter front mode)

Switch mode	Vehicle speed	Gear	SVM Switch	Display view
Rear → Front	below 15 kph	R Range or P Range excluded	ON	Initial Entry: Front view set in the initial view mode option
				Re-entry: The last view mode displayed in the previous front mode
Front → Rear	Irrelevant	Reverse Gear	Irrelevant	Initial Entry: Rear view set in the initial view mode option
				Re-entry: The last view mode displayed in the previous rear mode

SVM Mode Disengagement

If the conditions below are satisfied while in SVM mode, the SVM is turned OFF and no video is displayed.

OFF Mode	Vehicle speed	Gear	SVM Switch	Notes
Front mode	over 20 kph	R Range or P Range	OFF	If any of the three conditions are satisfied
Rear mode	Irrelevant	Except R gear	Irrelevant	If any of the two conditions are satisfied

SVM Options

Considering the user's convenience, the SVM provides three options for the user to select.

The window for changing options (parking guide settings) is displayed by the AVN. Only the changed options are forwarded to the SVM controller through M_CAN.

These three options are applied as soon as they have been selected by the user. Based on the conditions, the initial views displayed are as follows.

Option	Function	Default setting
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Guideline steering interlocking	Interlocks with steering to display the driving direction of the vehicle during parking.	Classification code
Close range warning indicator	Indicates front and rear obstacle detection	Classification code
Initial view mode setting	Default view displayed when entering SVM mode	Front + around view
		Rear + around view

Operations for Guideline Steering Interlocking Indications

The indication for the guideline steering interlocking trace uses the steering wheel angle value periodically received by the SVM controller through C-CAN.

A rear area that displays a 130 degree image of the rear mode (two-split mode) and a wide view are displayed with the expected car movement trace.

1. View modes for guideline steering interlocking indications

Mode	View	Notes
Rear	Rear wide view + Top view	
	Rear top view + Top view	
	Rear corner view + Top view	

2. Specifications for guideline steering interlocking trace lines

Number	Distance	Color
①	0.5 m	Red
②	1 m	Yellow
③	3 m	Yellow
④	Bumper left side end + 0.3 m	Yellow
⑤	Bumper right side end + 0.3 m	Yellow



3. Indications for neutral trace lines

If the steering angle is neutral, the neutral trace line is indicated in blue, which shows the expected movement trace of the car.
This line is displayed with the guideline steering interlocking trace line and is also a fixed line that is not interlocked with the steering angle operation.

SVM system input/output

4. Camera input

Category		Specification
Angle of view	Horizontal	192°
	Vertical	137°
Provided function		Original wide angle image is provided
		(No additional functions)
Applied position		Applied to front/rear/left/right cameras

5. SVM image display

The images received from the 4 cameras mounted on the vehicle go through the image distortion correction logic and the image merging process.H/UNIT displays these images together with other additional features such as the parking guidelines linked with steering wheel on the AVN screen.

6. Parking/view button

It is used as a control input signal to operate the front view mode function with the ignition switch ON.

7. Ignition input

SVM controller displays the image only in the IGN1 ON and limits the image display with the SVM OFF in the IGN1 OFF.

SVM controller uses the signal which is input to the IGN pin or B-CAN message routed from the IGPM (gateway) to C-CAN to judge the IGN1 ON/OFF.

8. Chassis CAN input (C_CAN)

SVM controller receives the vehicle state information through the C_CAN to determine the operation of SVM major functions.

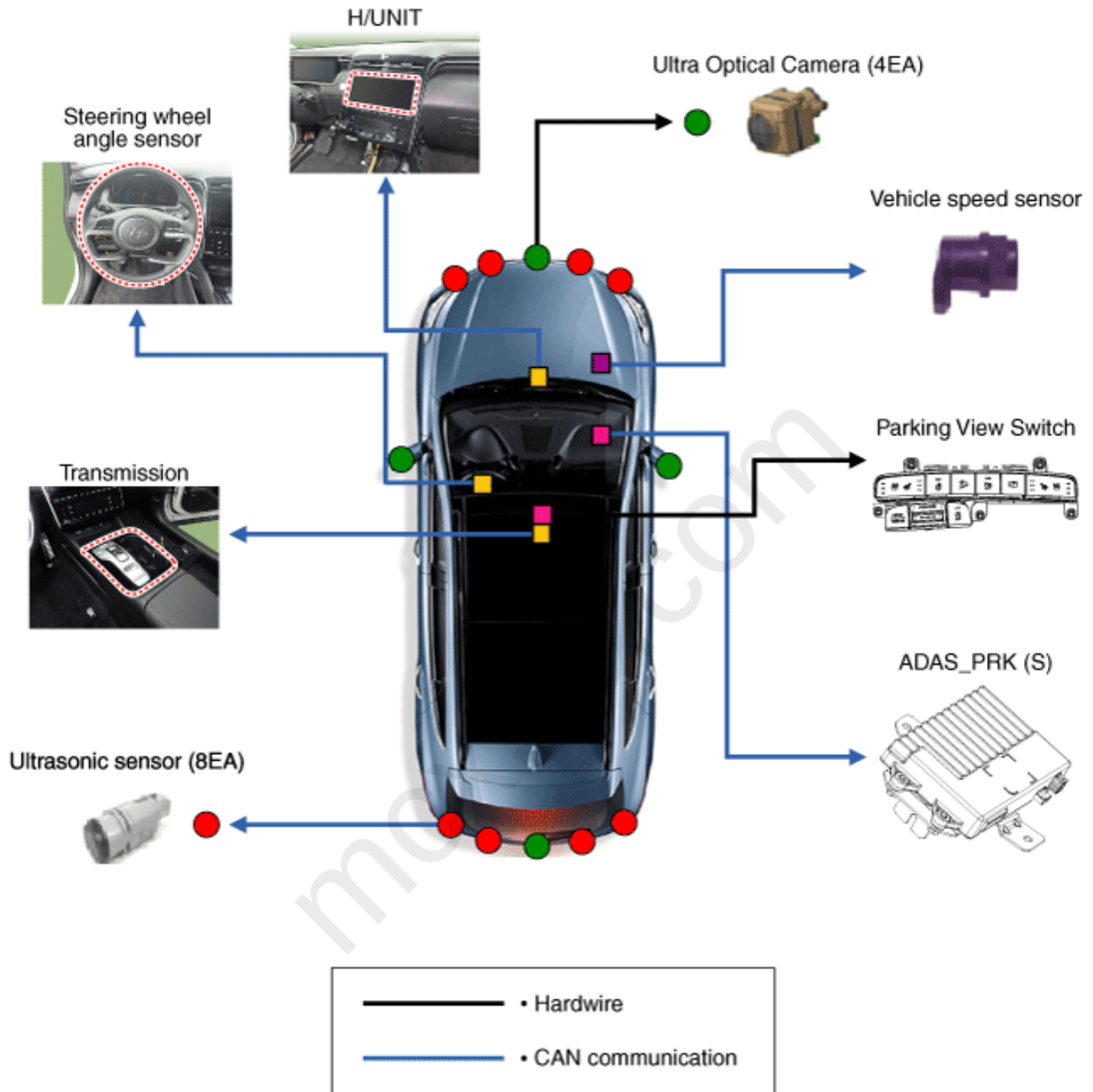
9. Multimedia CAN input/output

Relevant information is processed by receiving the M-CAN signal routed from the IGPM (gateway) to C-CAN.

The routed M-CAN signal communication aims to transmit and receive the below information.

mcx30.com

Components



Troubleshooting



- 1) After replacing controller, always check that the system operates properly.
- 2) If the failure persists after replacing the controller, do not replace the controller.

1. Inspection by DTC Code

Symptom	Probable Cause	Remedy
1. Single DTC code appearance	Loose connector relevant to a certain DTC code	1) Check connection status and reconnect the connector.
	Tolerance compensation not completed	1) DTC code appearance (B103000) 2) Perform tolerance compensation.
	Disconnected wiring	1) Inspect for conductivity of relevant area of DTC and wiring. - DTC code generated (B16B700/B16B800/B16B900/B16BA00/C161600/B162C00)
	Faulty wiring connector	1) Check for bent or damaged wiring connector pin. 2) DTC code generated (B16B700/B16B800/B16B900/B16BA00)
	Faulty controller connector	1) Check for bent or damaged controller connector pin. 2) DTC code generated (B16B700/B16B800/B16B900/B16BA00)
	Faulty controller single unit or camera	1) Check basic operation and DTC on Diagnostic tool. 2) DTC code generated (B16B700/B16B800/B16B900/B16BA00)
2. Multiple DTC	Loose SVM main connector	1) Check connection status and reconnect the connector.

codes appearance	Disconnected wiring	1) Camera power - In case of 6V or below, inspect relevant wiring. 2) ACC/IGN power - In case of 7.5V or below, inspect relevant wiring. 3) Parking/view button - In case of 1.75V or higher with the switch ON, inspect relevant wiring.
	Faulty wiring connector	1) Check for bent wiring connector pin or interference in neighboring parts. 2) DTC code generated (B16B700/B16B800/B16B900/B16BA00)
	Faulty controller connector	1) Check for bent controller connector or interference in neighboring parts. 2) DTC code generated (B16B700/B16B800/B16B900/B16BA00)
	Faulty controller single unit	1) If failure recurs after the items above are confirmed normal, replace SVM.

2. Inspection for Defect in SVM Performance (Image Output)

Symptom	Probable Cause	Remedy
1. No image output : Black screen, Blue screen, Green screen	Loose controller or SVM main connector	1) Check connection status and reconnect the connector.
	Disconnected controller or SVM wiring	1) Inspect for conductivity of ACC / IGN / V-OUT / M-CAN terminal wiring
	Faulty IPM (SJB)	1) Check power of ACC / IGN terminals : In case of 7.5V or below, inspect IPM (SJB)
	Faulty controller or SVM	1) If failure recurs after the items above are confirmed normal, replace controller or SVM camera.
	Loose main connector	1) Check connection status and reconnect the connector.
	Disconnected or short-circuited wiring	1) Inspect the wiring relevant to DTC appearance.

2. Abnormal image output : Noise on screen / lines / cracked display / unable to change display	Faulty tolerance compensation	1) If the SVM image display is cracked even though the camera display is normal, execute tolerance compensation again.
	Faulty camera	1) If both camera display and SVM image display are cracked, inspect the camera.
	Faulty IPM (SJB)	1) In case of DTC code (C161600) appearance, inspect IPM (SJB).
	Faulty console switch	1) Inspect parking/view button. - In case of 1.75V or higher with the switch ON, replace the switch.
	Faulty controller or SVM camera	1) If failure recurs after the items above are confirmed normal, replace controller or SVM camera.

3. Inspection for Faulty PAS Warning Display & Parking Guideline

Symptom	Probable Cause	Remedy
1. Faulty PAS warning display & faulty parking guideline	H/UNIT option information not configured	1) Check and modify AVN option configuration status.
	Loose main connector	1) Check connection status and reconnect the connector.
	Faulty IPM (SJB)	1) Check that Parking Assist System (PAS) and Steering wheel Angle Sensor (SAS) are normal. 2) Inspect IPM (SJB).
	Faulty controller or SVM	1) If failure recurs after the items above are confirmed normal, replace controller or SVM.

Inspection

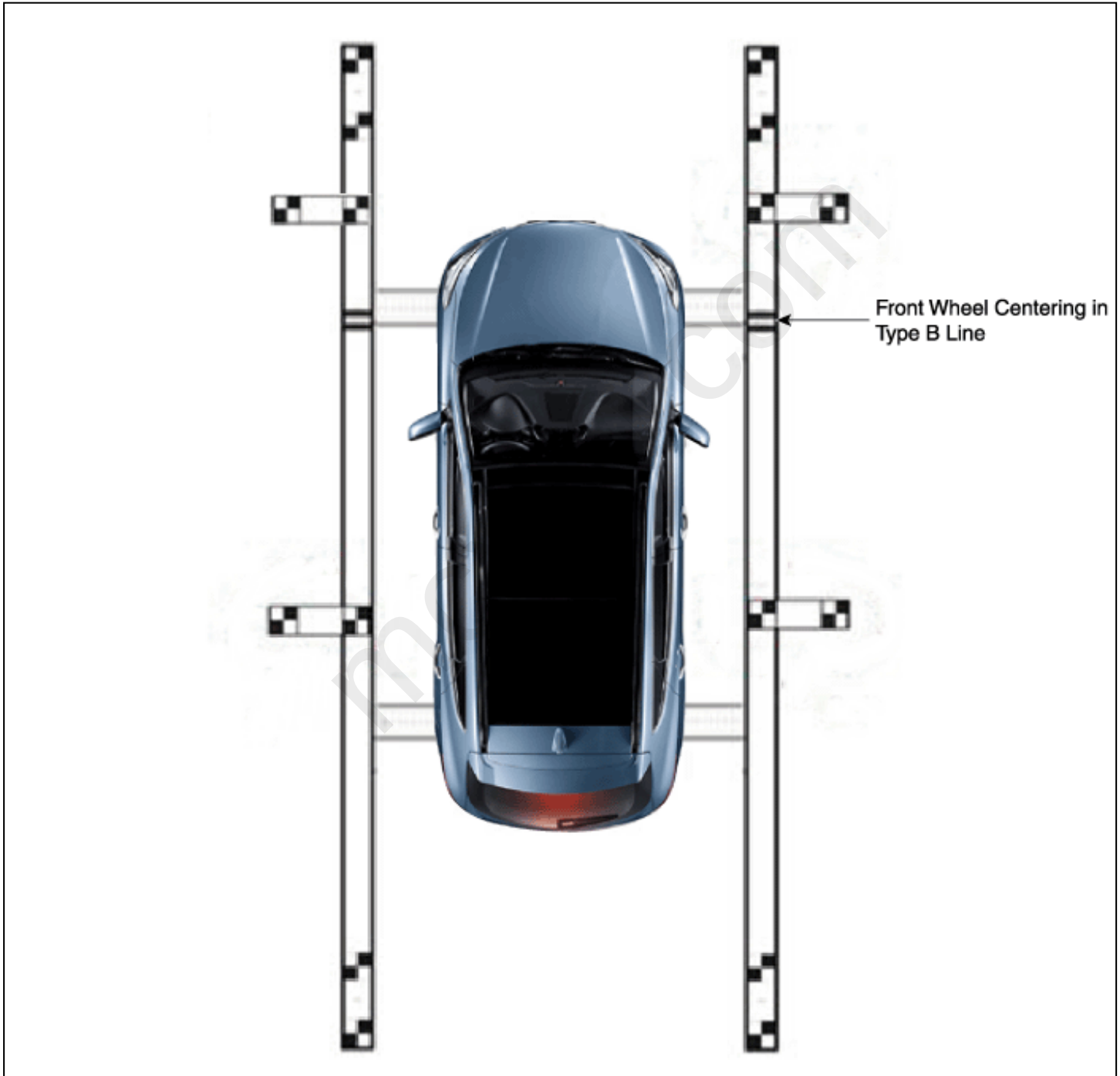
Tolerance Compensation

Tolerance compensation compensates for the error margins of surround view video that occur due to the installation tolerance when the four cameras that comprise the SVM system are installed.

You must carry out tolerance compensation if you do any of the following.

- Remove and install a wide camera.
- Conduct a body task that causes the focus of the wide camera to change, such as a trunk task.
- Replace the door mirror that has a wide camera.
- Replace the SVM Controller.

Tolerance Compensation Environments





There are two types of tolerance compensation [manual tolerance compensation] and [automatic tolerance compensation].

The service center with the SVM exclusive workshop performs [automatic tolerance compensation].

The maintenance environment lacking an SVM exclusive workshop performs [manual tolerance compensation].

The Procedure of Manual Tolerance Compensation

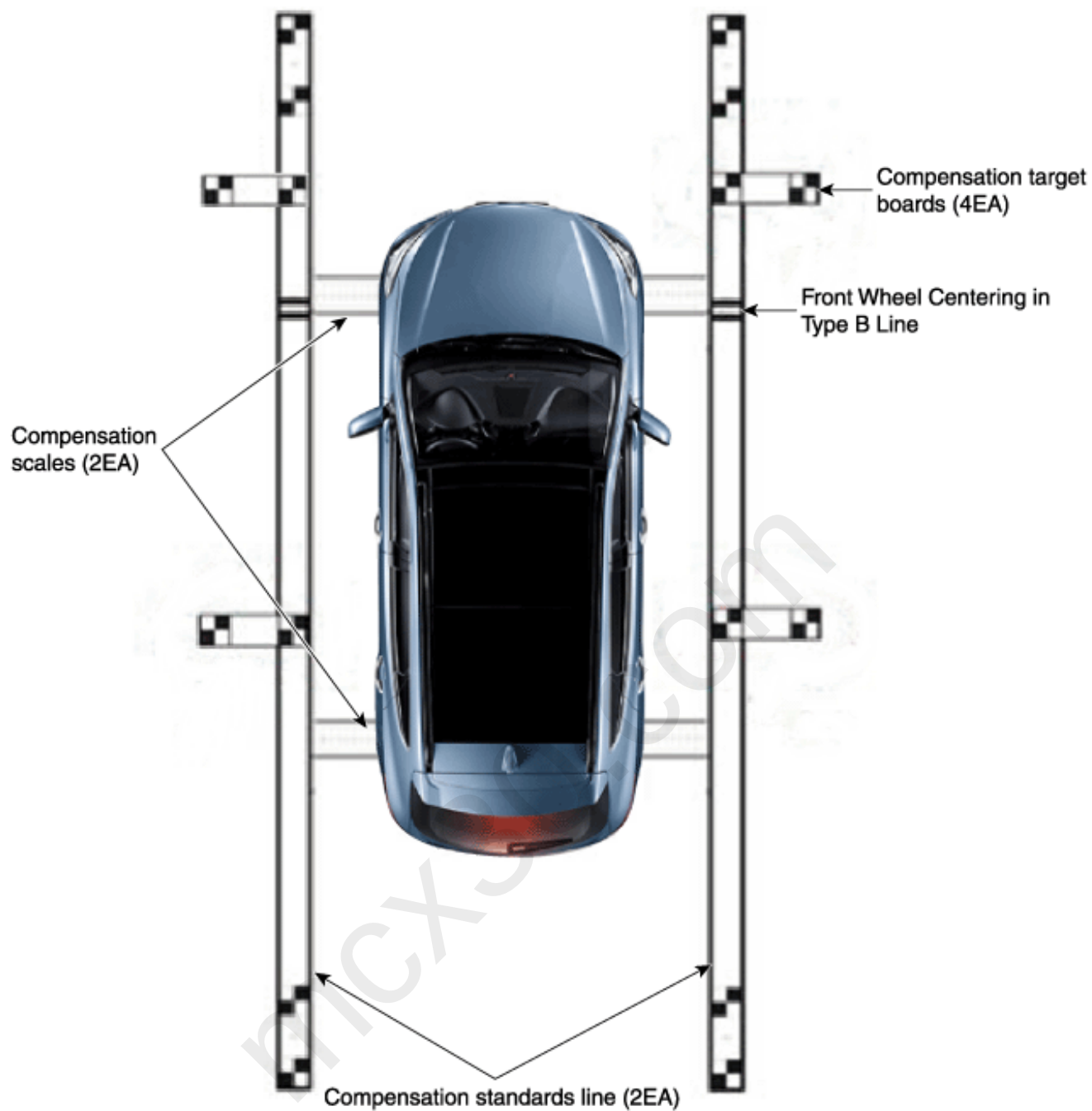
1. Advanced preparations will be made according to the following.
 - Confirm that the car hood, trunk and door are closed.
 - The door is closed after getting in on the passenger side.
 - Unfold the side mirror if it is folded in.
 - Put the gear into neutral.
 - In the preparation stage ahead of time an exhaust inhaler should not be installed as it can block the view of the rear camera.
 - Also, the exhaust from the exhaust pipe can create a smokescreen blocking rear footage, therefore after using a fan to clear the exhaust the compensation work should be performed while in IGN (ignition).
 - The foot brake or electro-mechanical parking brake should be engaged to prevent the car from moving.
2. The following processes will be performed to confirm whether or not the SVM ECU and camera are working properly before engaging tolerance compensation mode.
 - Confirm that the initially set up video is showing up. (front view footage while the gear is in neutral + top view footage)
 - Confirm that footage from the front, back, left and right is showing up properly.
 - When the footage appears properly, the tolerance compensation mode will be engaged, and when footage is not showing up clearly or does not show up at all the part will have to be replaced.
3. Install around the vehicle by referring to the guide that was provided along with the compensation scales (2), compensation standard line boards (2), and compensation target boards (4).



When centering the wheels on the compensation standards line board, the A-type and B-type must be centered separately.

Caution should be taken because the center location of the white and black compensation plate consist of standard coordinates the accuracy(distance / right-angles) are very important.

- The front and rear / left and right centering should be maintained within a deviation of 3cm.
- When centering the vehicle the rotation deviation should be maintained within 1 degree on the side.



4. Keep the IG on while the car is stopped, confirm the location of the gear stick is on 'N' and engage the parking brake on a flat area.
5. Perform the work with the parking/view switch in the vehicle set to 'ON.'
6. Perform SVM Calibration according to GDS diagnostics display.



Fault Code Searching



ECU Upgrade



DTC Analysis



Data Analysis



**Actuation
Test**



**Flight
Record**



S/W Management



Multi Data Analysis



**Recorded
Data**



**Digital Before
Service**



Measurement



OBD-II



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7. Proceed with the AVM calibration according to the GDS screen.

S/W Management

■ AVM Calibration

● [AVM Calibration]

This function is to calibrate the image tolerance in AVM system when AVM control unit or the cameras(front, rear, left, right) on the vehicle is replaced.

●[Condition]

1. Check engine hood/trunk/doors closed and outside mirrors unfolded.
2. Engine stop, IG ON, Gear position 'N', Parking Brake ON.
3. AVM system button 'ON'.
4. Install the AVM calibration target. (Refer to Shop Manual)

If this function is not performed when AVM control unit is replaced, AVM switch lamp will blink and DTC(B103000 : No Camera Tolerance Correction) will be set.

Click **OK** to proceed to next step.

OK

Cancel



Do not touch any system buttons while performing this function.

S/W Management

■ AVM Calibration

● [AVM Calibration Information]

1. Overlap the blinking cross box(+) on AVN monitor of vehicle to calibration coordinates of calibration target by using ►, ►► and press **[OK]** button.
2. Overlap the other cross boxes to calibration coordinates of calibration target with same method and press **[OK]** button, then press **[Update AVM]** button to proceed to next camera.
3. With same method as front camera, perform the calibration procedure in order of rear → left → right camera.
4. Monitor the AVM update process with monitor after press **[Update AVM]** button when last camera calibration procedure is complete.
5. Check the proper image displaying on monitor.

※ You can re-do the calibration procedure with **[Reset]** button.



Reset

Update AVM

Close



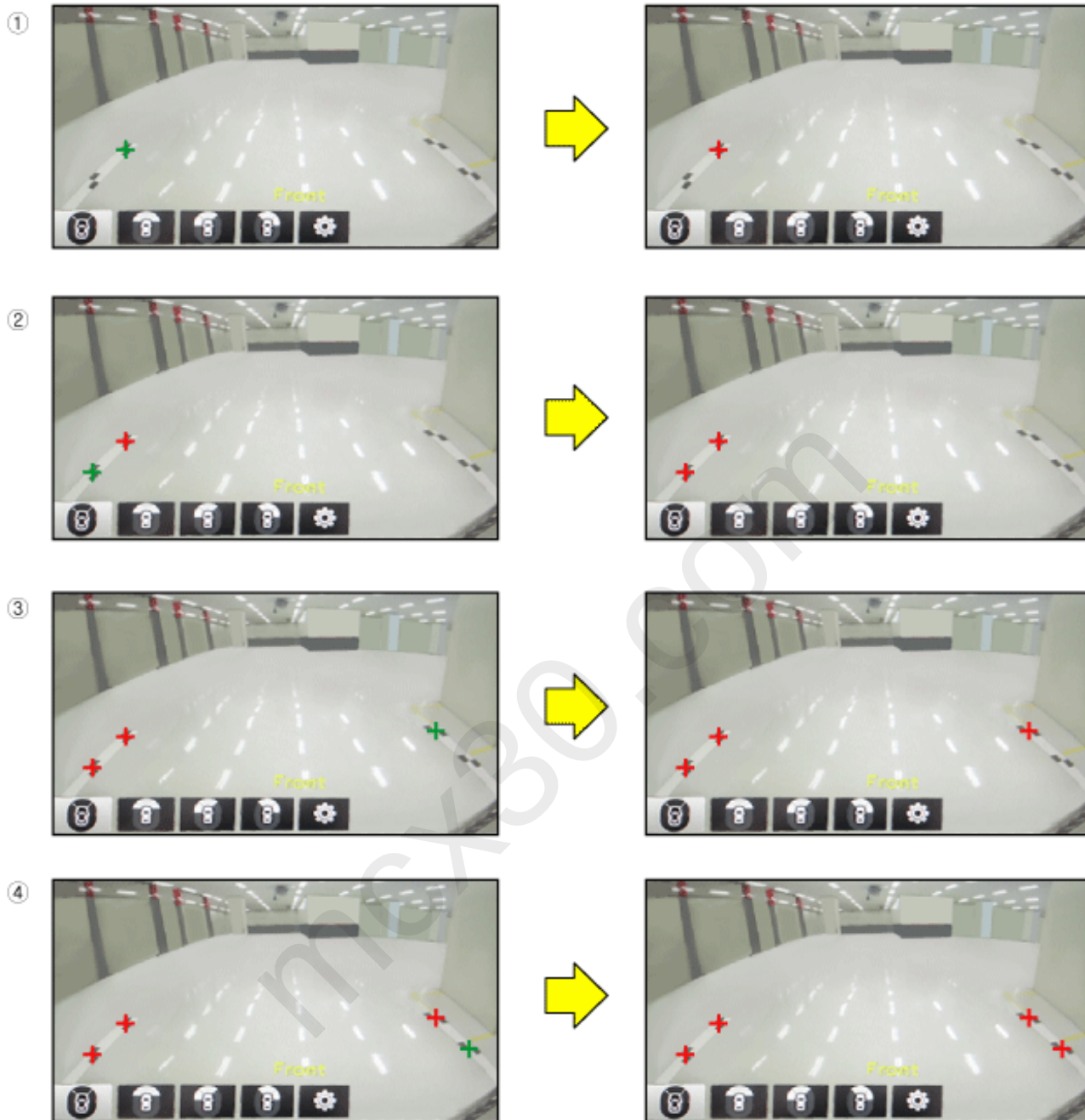
Do not touch any system buttons while performing this function.



- Before matching the calibration point : "+" blinks in green color.
- When you click [OK] after matching the calibration point : "+" turns on in red color.
- After matching 4 forward correction points, click [OK] button and click [Update AVM] button to move to the next camera calibration.

- Perform the calibration in the order of front -> rear -> left -> right camera.

Monitor calibration procedure : ① Front → ② Rear → ③ Left → ④ Right

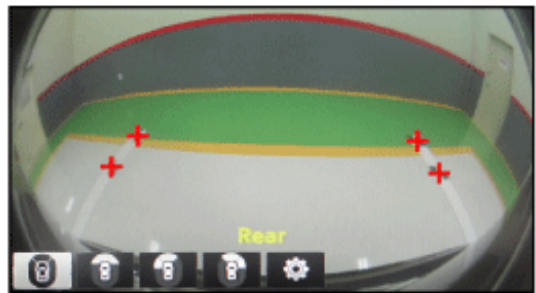


Monitor calibration procedure : Front → Rear → Left → Right

<Front>



<Rear>



<Right>



<Left>

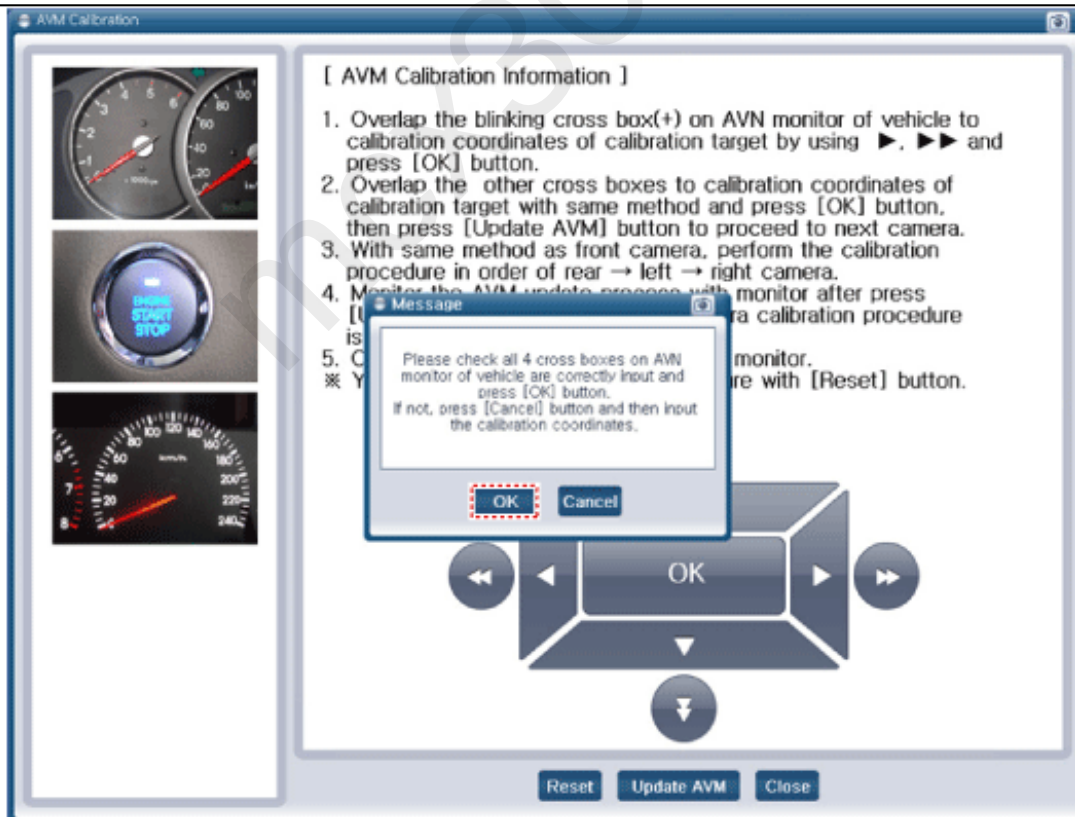


8. After checking the vehicle and calibration line on the AVN monitor screen to see if the calibration has been performed properly, press the [OK] button.
When calibration has not been performed properly, press the [Cancel] button to match the calibration points again.

[AVN Monitor]

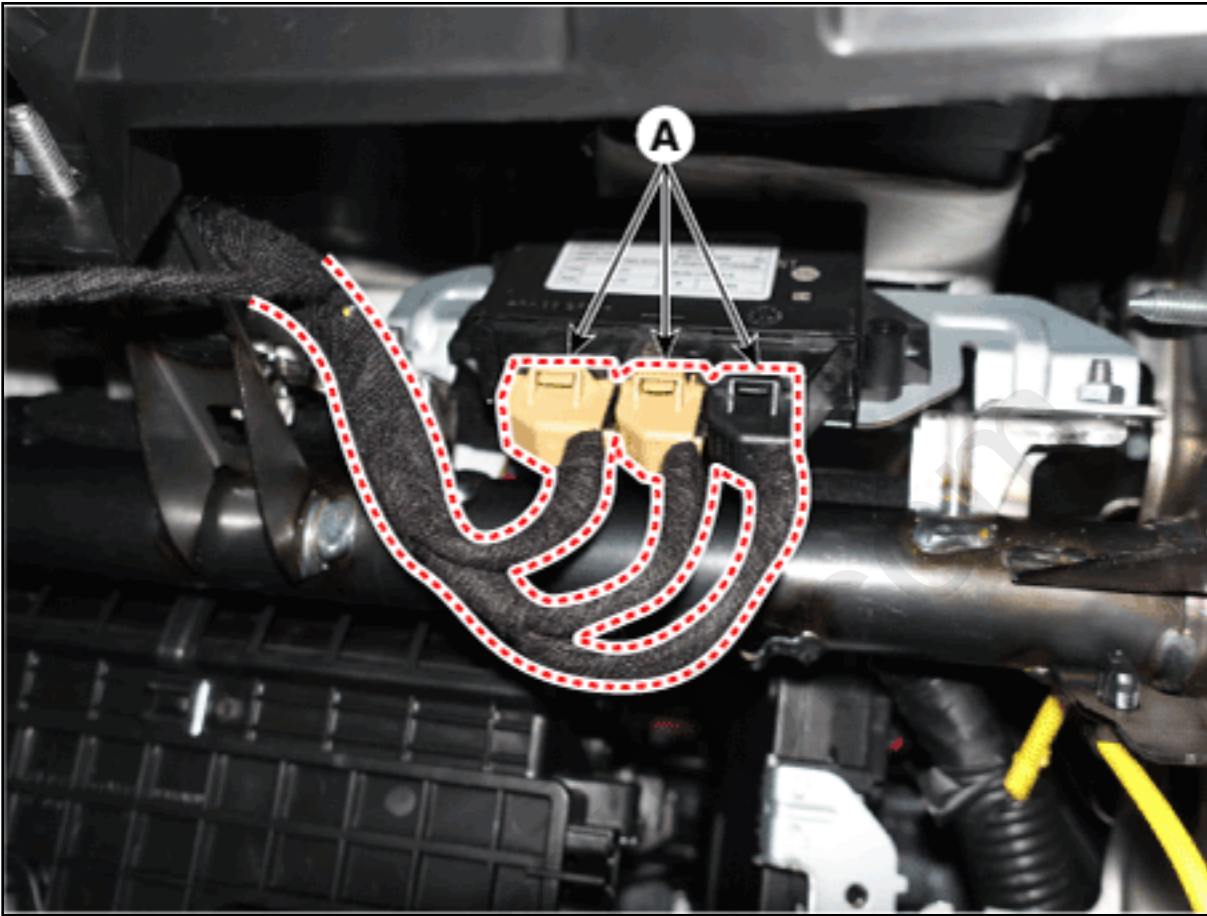


[GDS Screen]

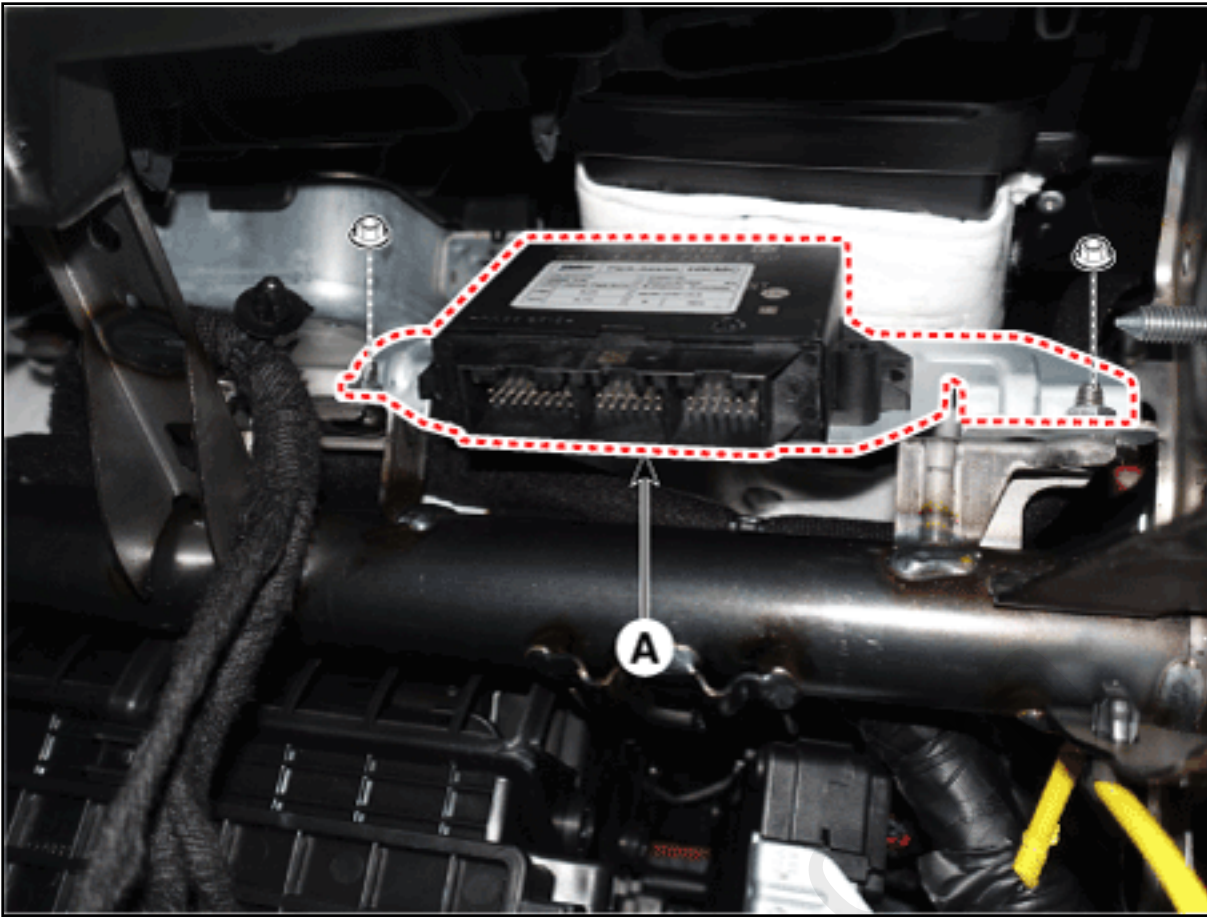


Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad center panel.
(Refer to Body - "Crash Pad Center Panel")
3. Disconnect the SVM unit connector (A).



4. Loosen the mounting nuts and remove the SVM Unit (A).



Installation

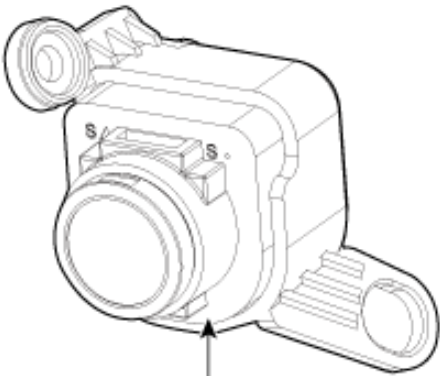
1. Install the SVM unit.
2. Install the crash pad center panel.
3. Connect the negative (-) battery terminal.

Components

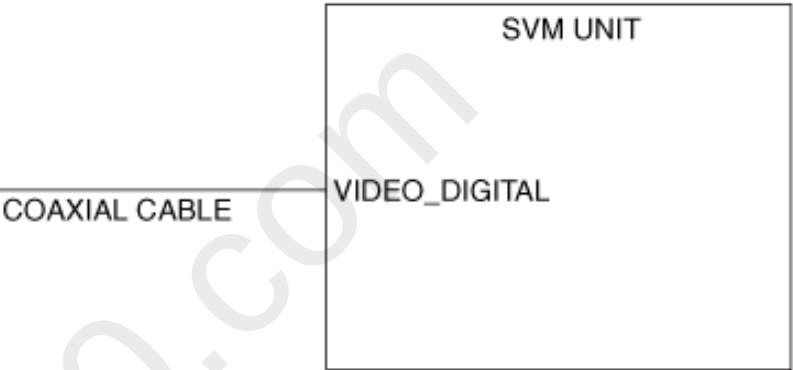
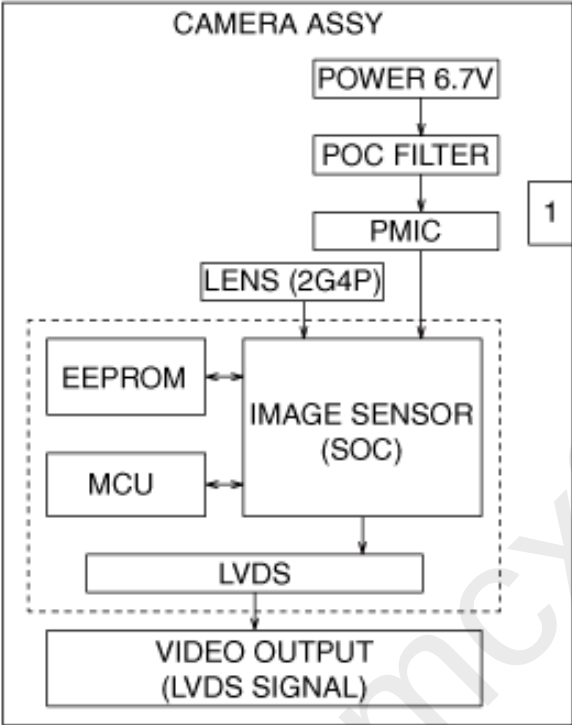
[Ultra Optical Camera - RH/LH]



Ultra optical camera [LH]

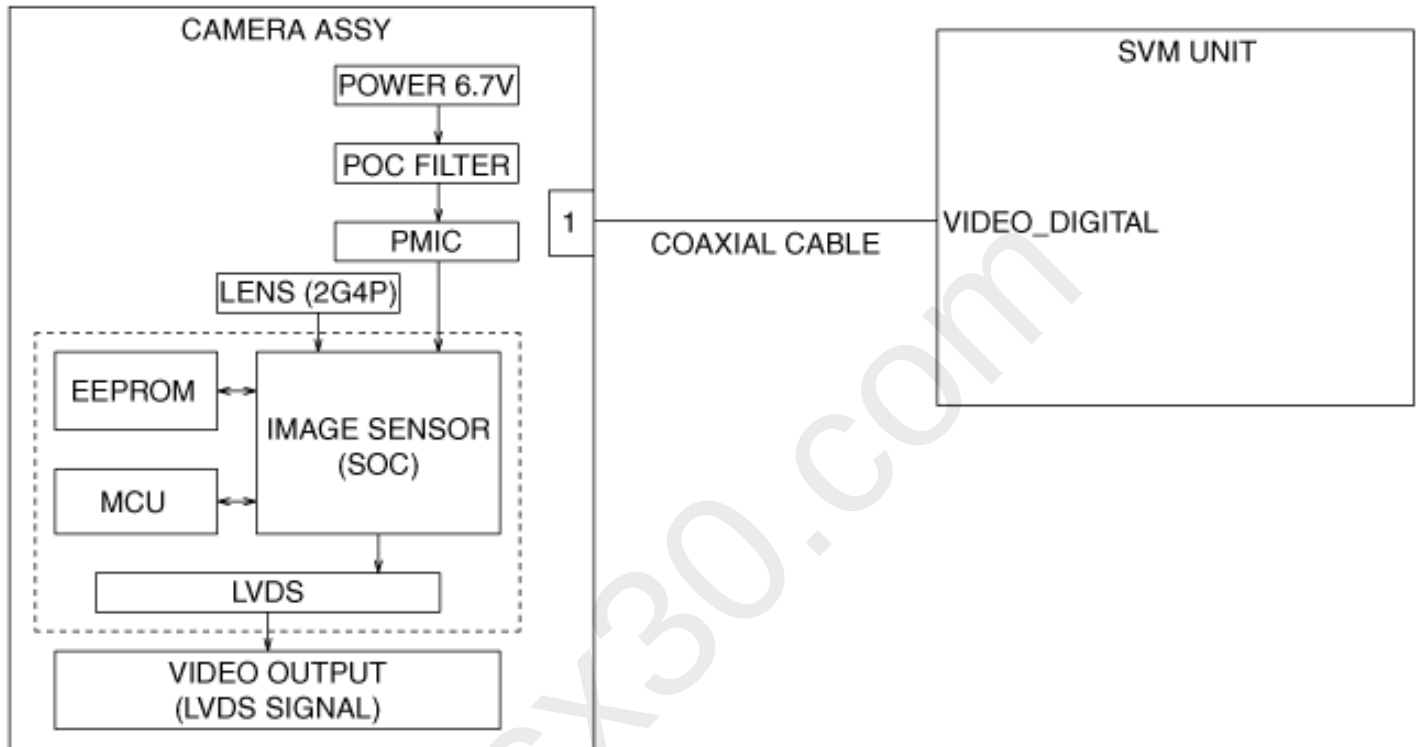
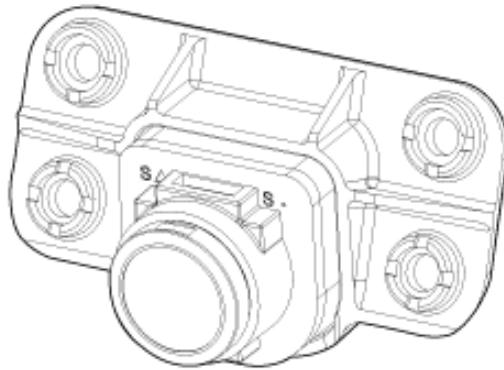


Ultra optical camera [RH]



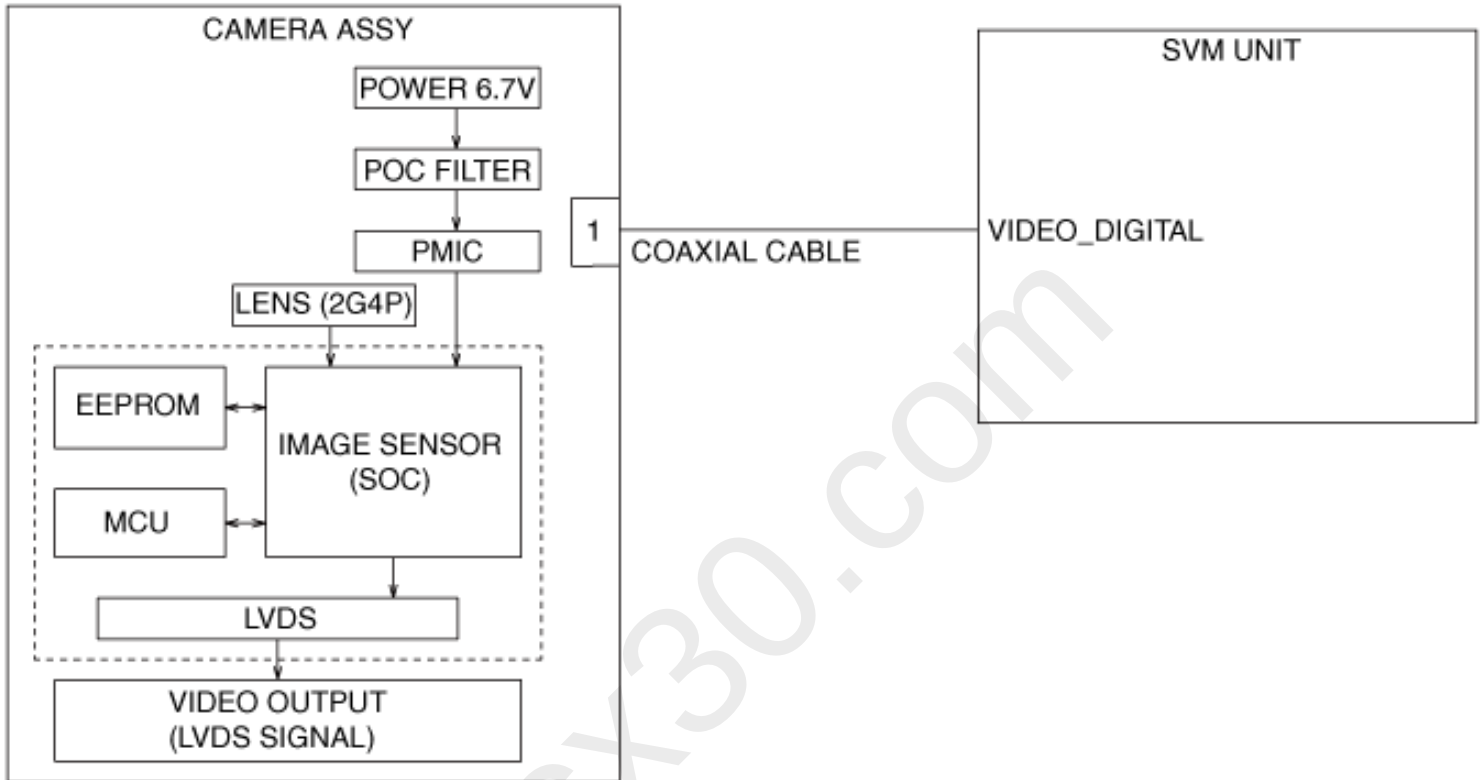
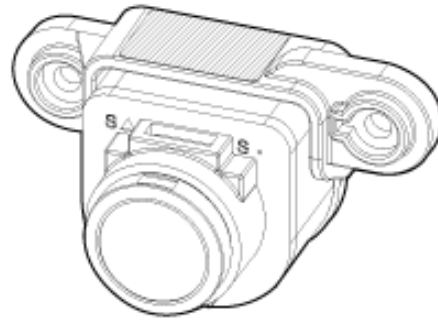
Connector	Pin NO	Description
	1	Digital Video

[Ultra Optical Camera - Front]



Connector	Pin NO	Description
	1	Digital Video

[Ultra Optical Camera - Rear]



Connector	Pin NO	Description
	1	Digital Video

Removal



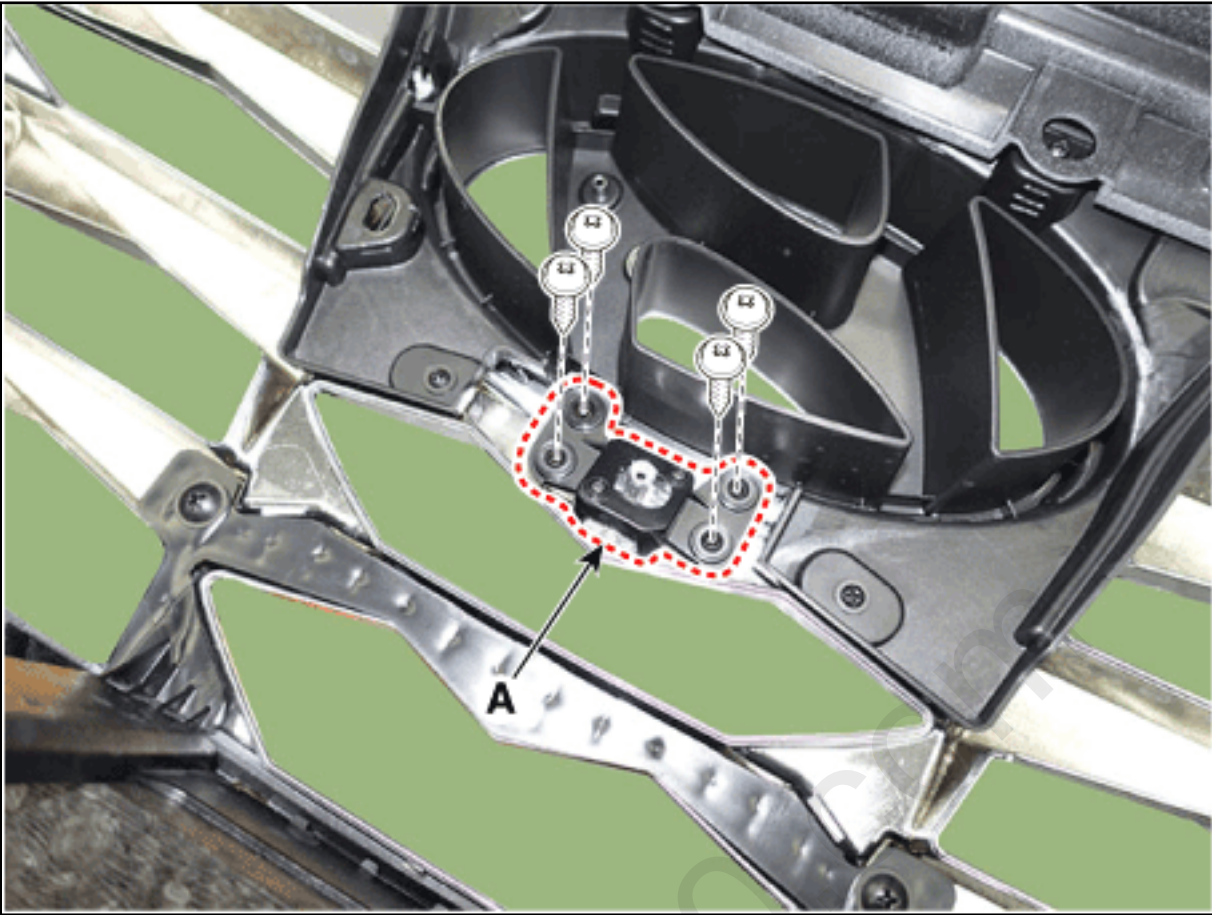
- In case of bad quality or poor focus, be sure to check the camera lense surface condition and foreign materials.

SVM Front Camera

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper assembly.
(Refer to Body - "Front Bumper Assembly")
3. Disconnect the SVM front camera connector (A).

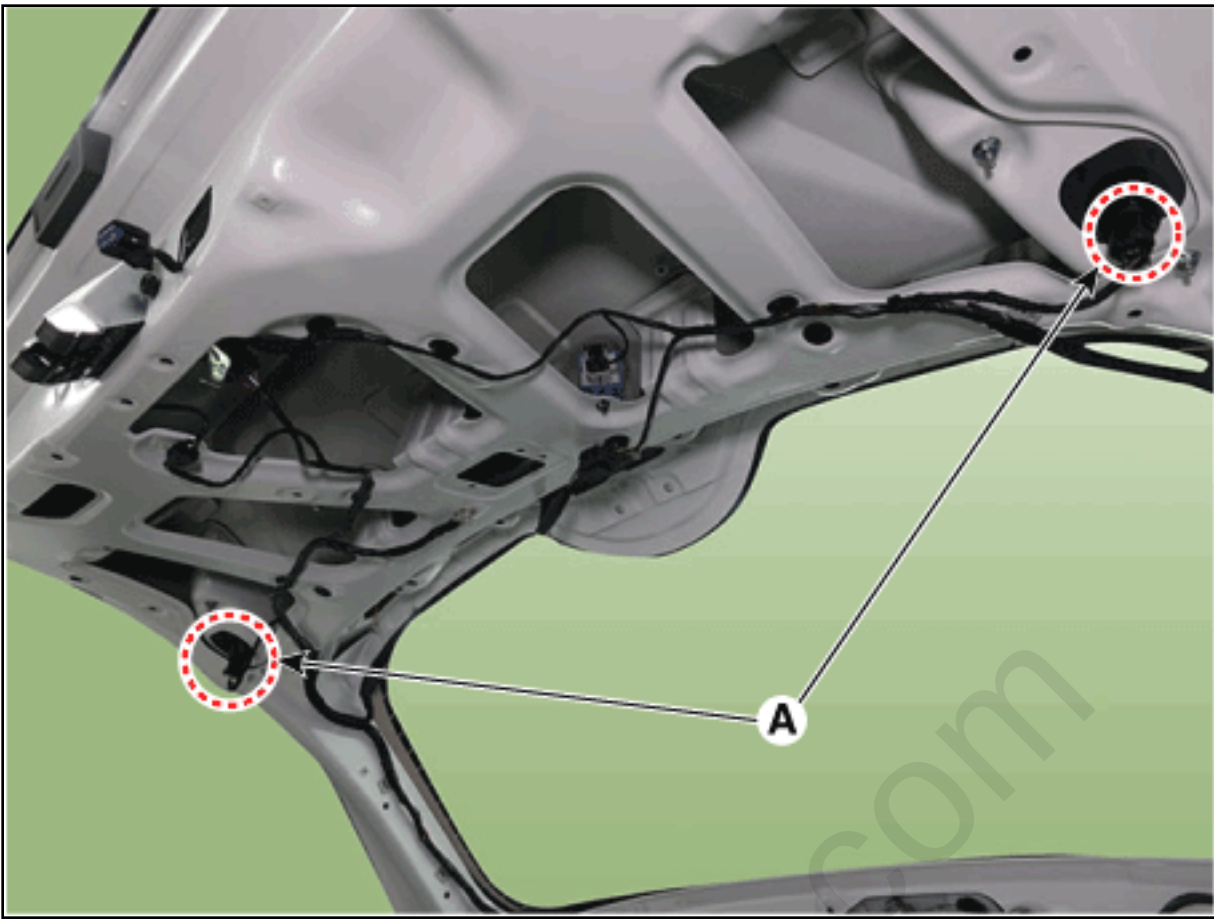


4. Loosen the mounting screws and remove the SVM front camera (A)



SVM Rear Camera

1. Disconnect the negative (-) battery terminal.
2. Remove the tail gate back panel molding.
(Refer to Body - "Tail Gate Back Panel Molding")
3. Disconnect the rear inside combination lamp connector (A).



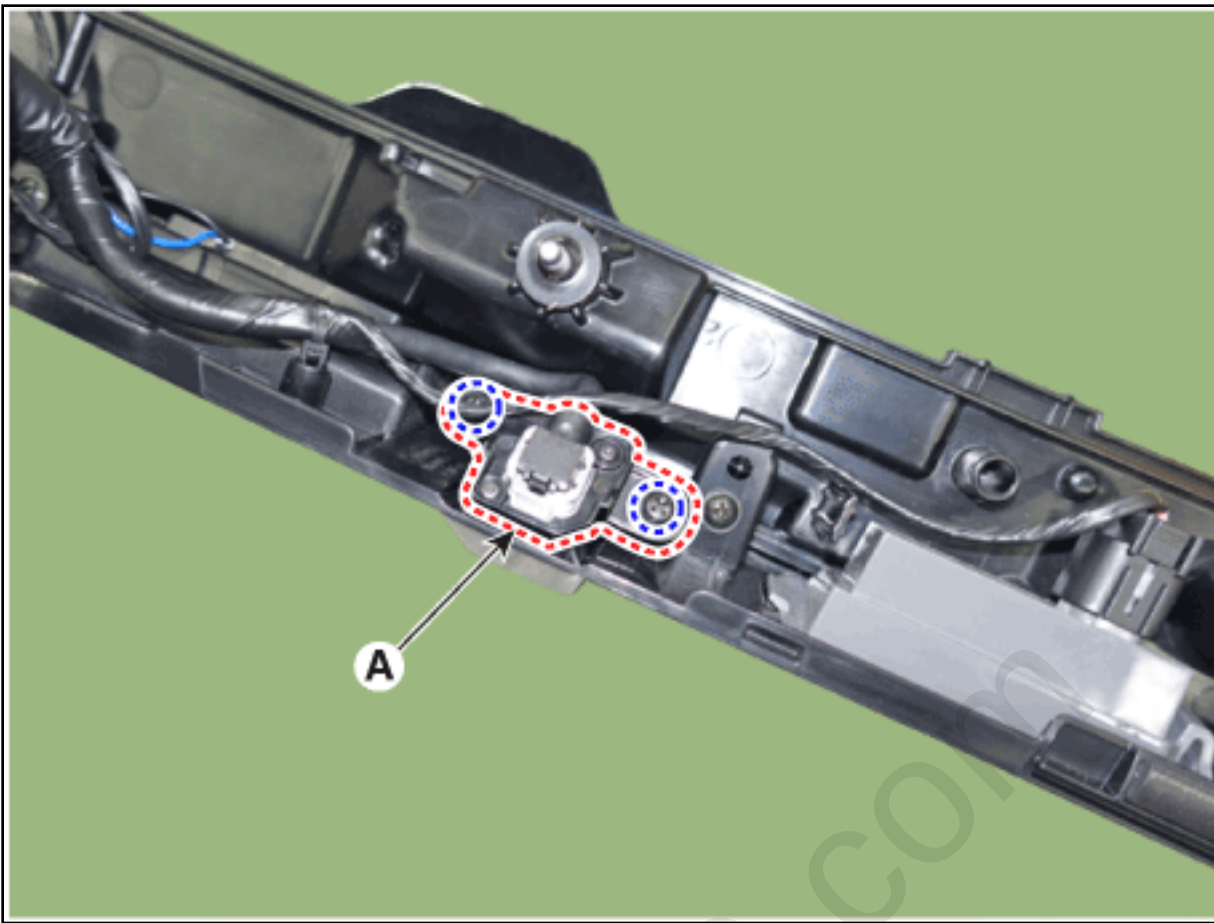
4. Disconnect the rear view camera connector (A).



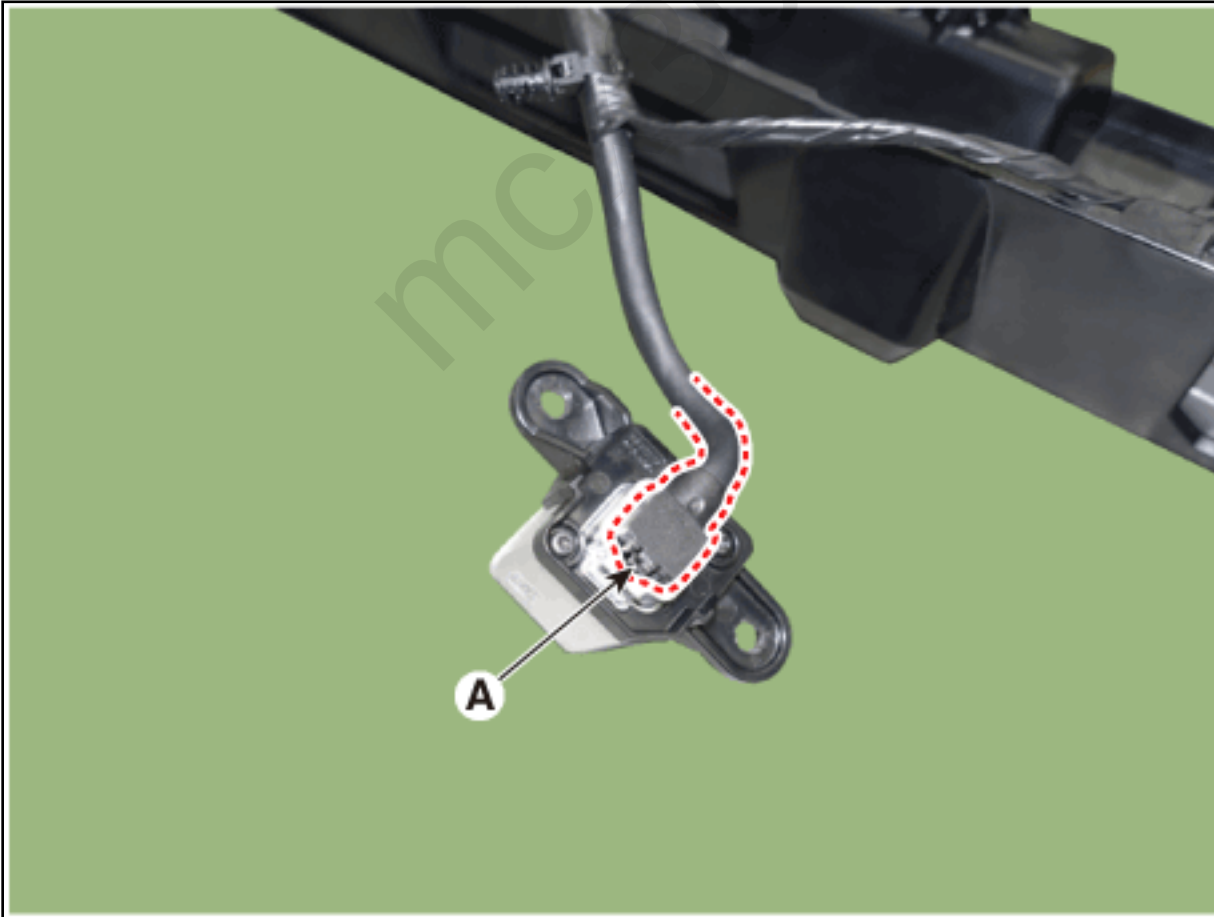
5. Loosen the mounting nuts and remove the rear inside combination lamp (A).



6. Loosen the mounting screws and remove the rear view camera (A).



7. Disconnect the rear view camera connector (A).

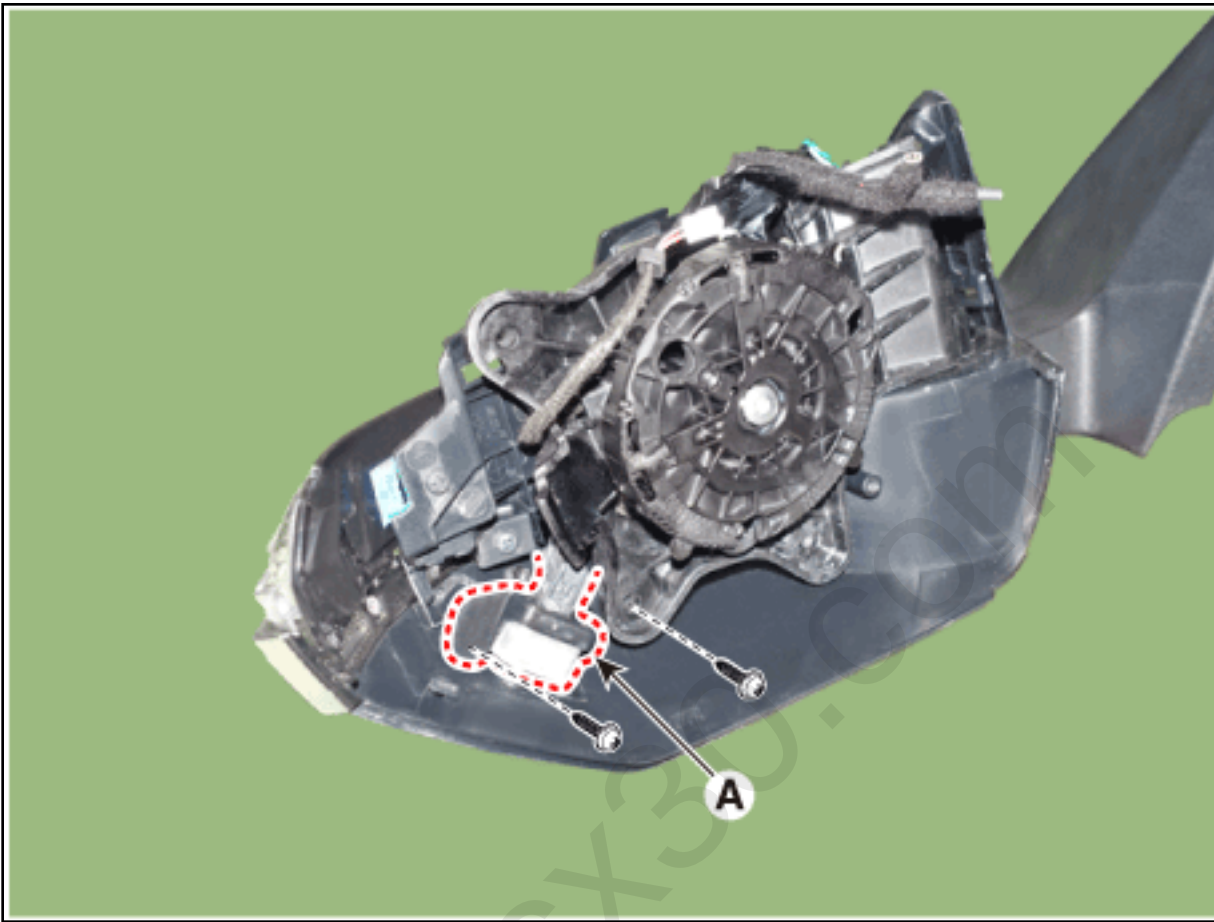


SVM Left/ Right Camera

1. Disconnect the negative (-) battery terminal.
2. Remove the outside mirror cover.

(Refer to Body Electrical System - "Power Door Mirror Actuator")

3. Loosen the mounting screws and remove the SVM left/right camera (A).



Installation

SVM Front Camera

1. Install the svm front camera.
2. Install the front bumper assembly.

SVM Rear Camera

1. Install the svm rear camera.
2. Install the tail gate back panel molding.

SVM Left/ Right Camera

1. Install the svm left/right camera.
2. Install the door mirror.

Removal

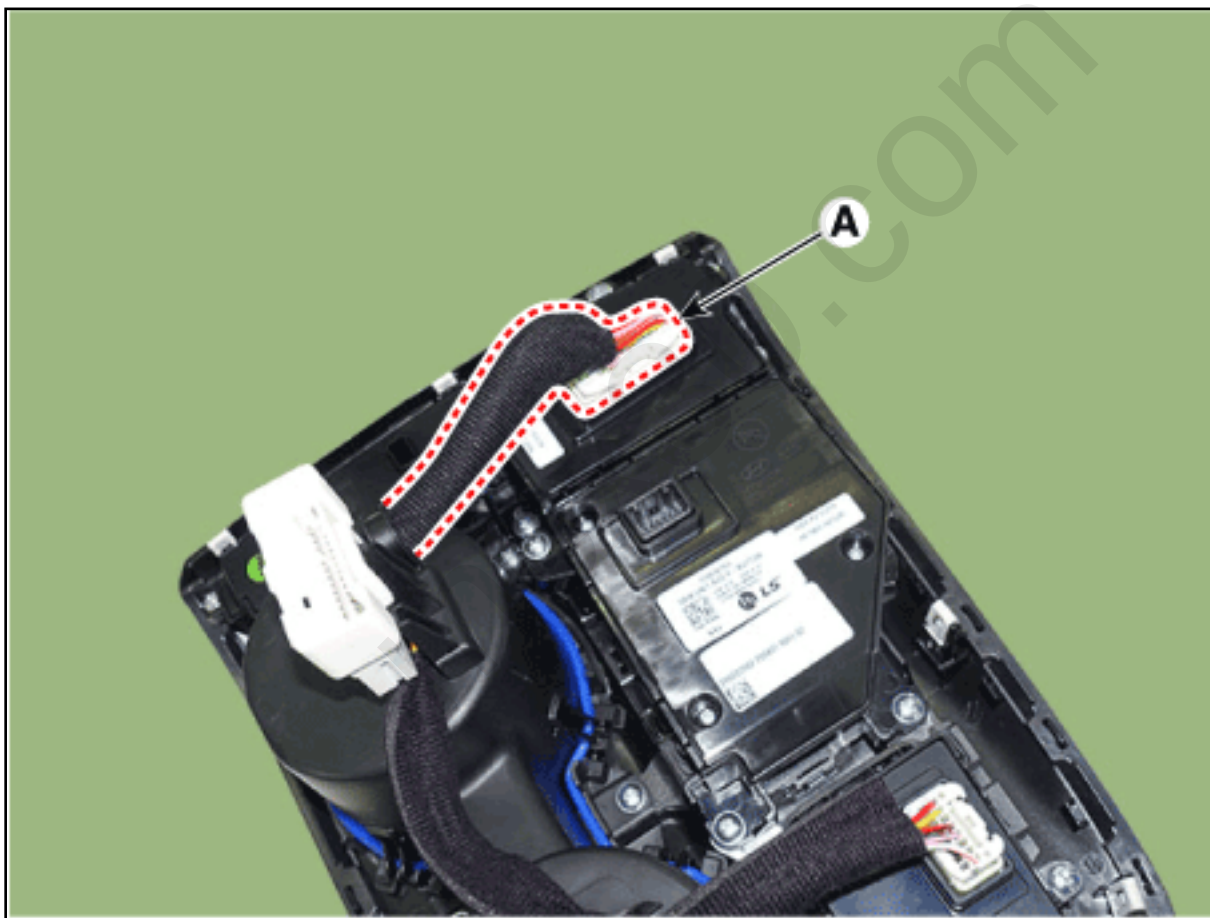


- When removing with a flat-tip screwdriver or remover, wrap protective tape around the tools to prevent damage to components.
- Put on gloves to prevent hand injuries.

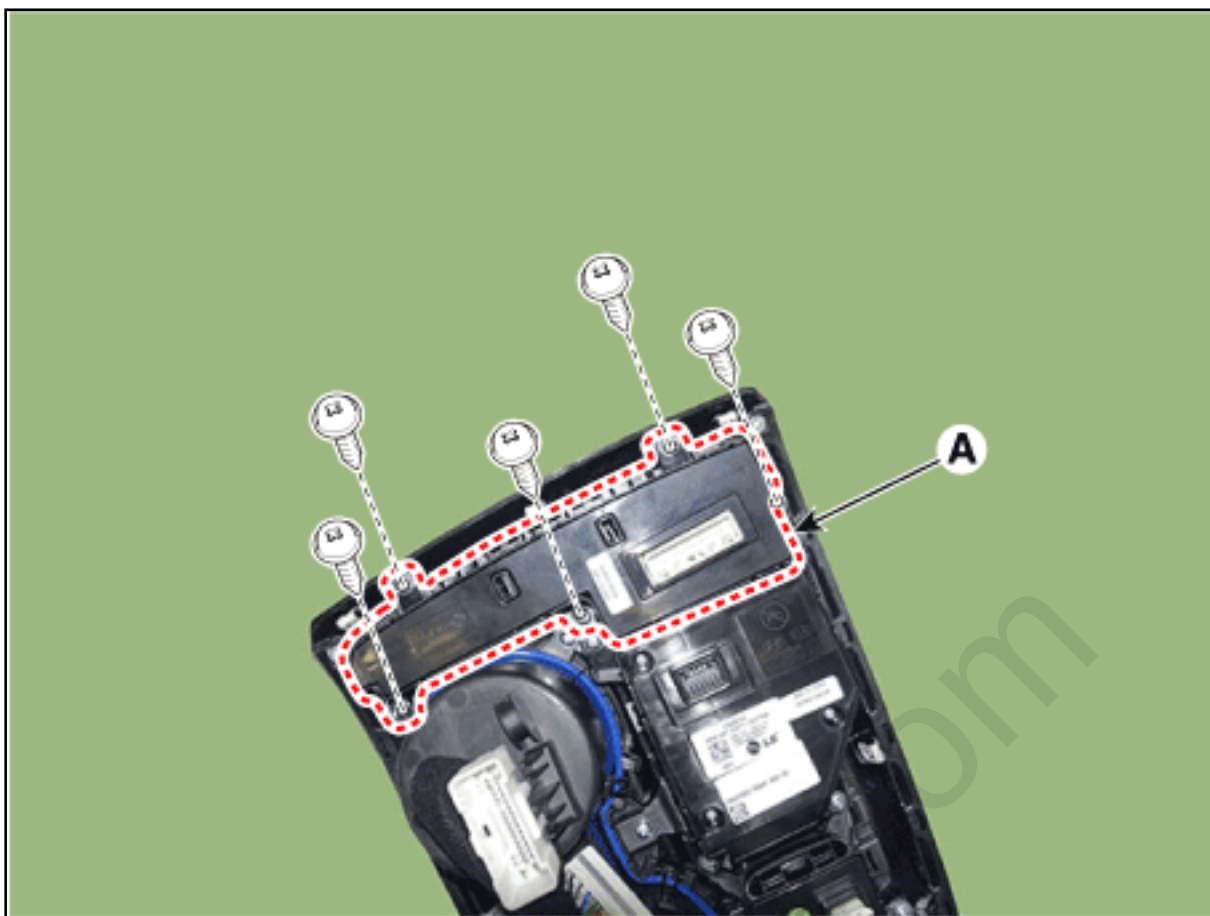


- Take care not to bend or scratch the trim and panels.

1. Disconnect the negative (-) battery terminal.
2. Remove the console upper cover.
(Refer to Body - "Floor Console Assembly")
3. Disconnect the SVM switch connector (A).



4. Loosen the mounting screws and remove parking/view switch (A)



Installation

1. Install the parking/view switch.
2. Install the console upper cover.
3. Connect the negative (-) battery terminal.