General Troubleshooting Information

Before Troubleshooting

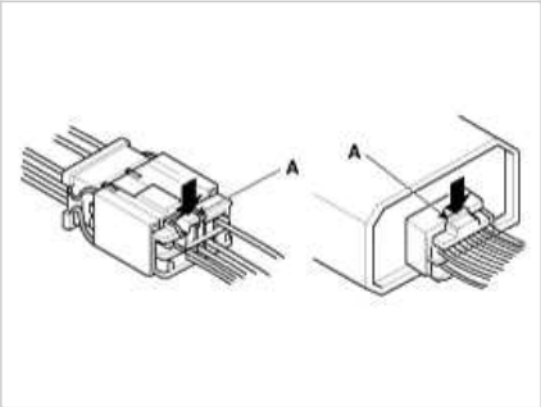
1. Check applicable fuses in the appropriate fuse/relay box.
2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tight connections.
   (Refer to the Engine Electrical System - Battery)

> **NOTICE**
>
> - Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
> - Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.

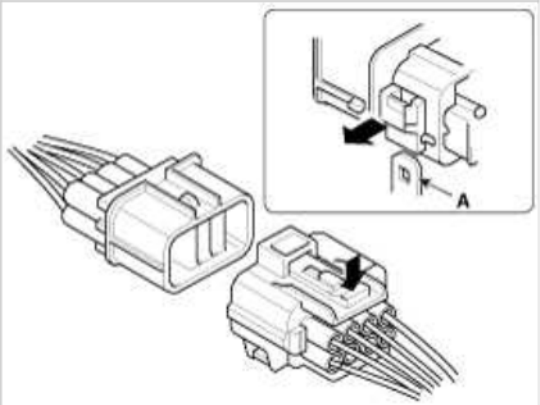
3. Check the alternator belt tension.

Handling Connectors

1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



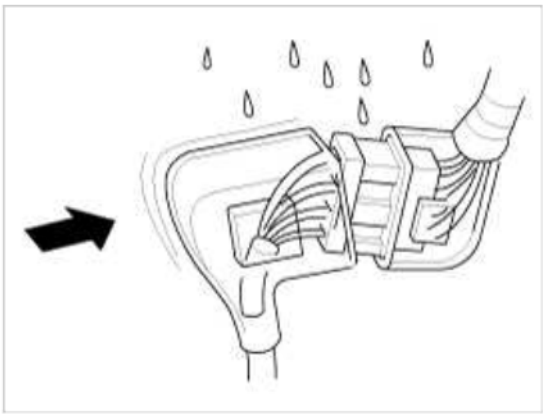
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another con This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector fro mount bracket (A).



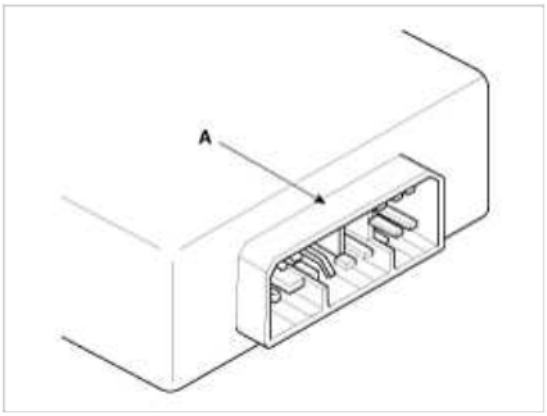
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.

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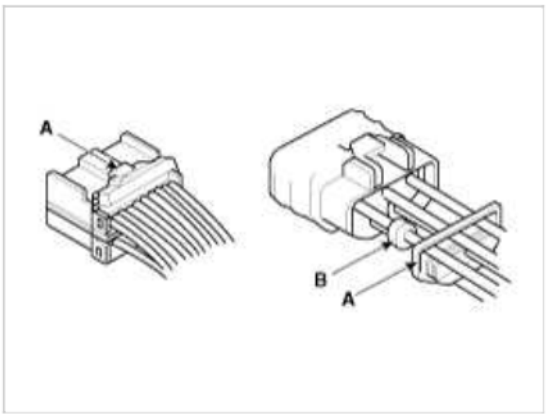
7. Always reinstall plastic covers.



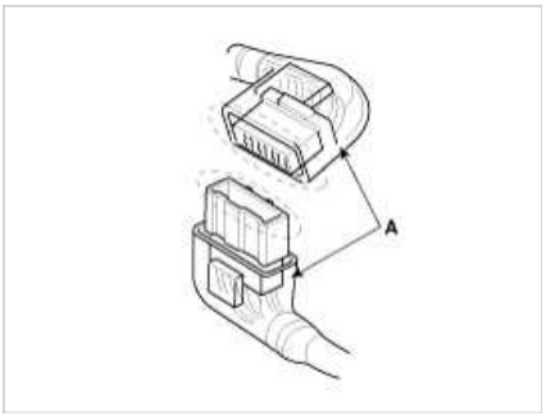
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



9. Check for loose retainer (A) and rubber seals (B).



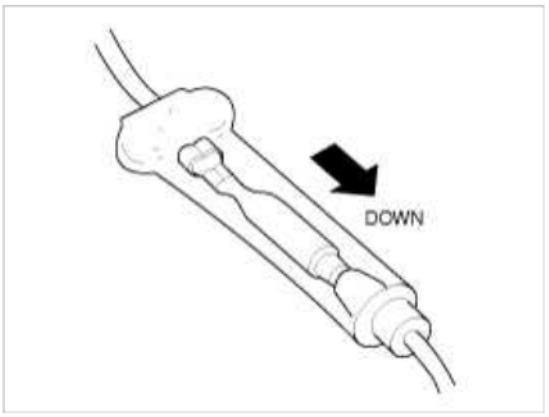
10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminat replace it.



11. Insert the connector all the way and make sure it is securely locked.

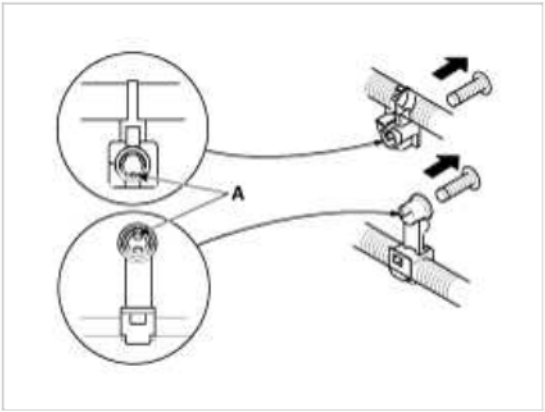
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12. Position wires so that the open end of the cover faces down.

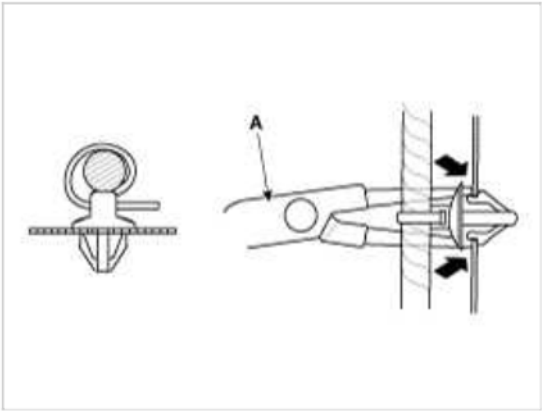


Handling Wires And Harnesses

1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



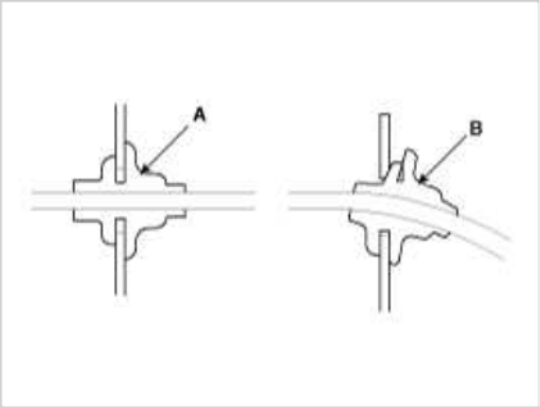
3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to releas clip.



4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and f exposed screws and bolts.

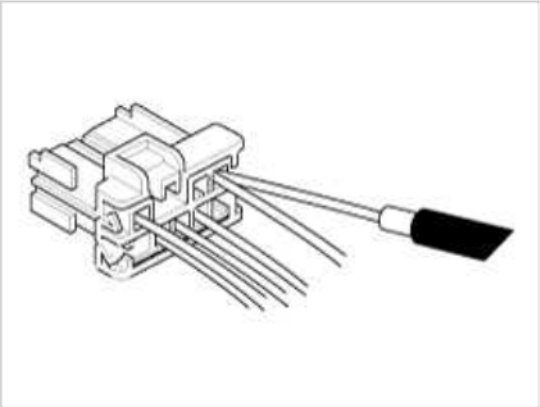
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6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).

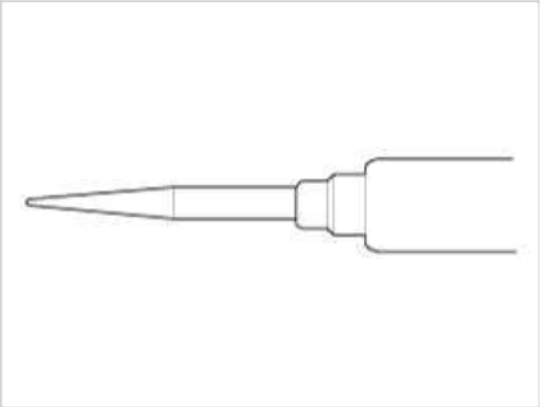


Testing And Repairs

1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.
3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the remover tool from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.
   Refer to the user's guide in the wiring repair kit (Pub No. : TRK 015.)



Five-step Troubleshooting

1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not b
   disassembly or testing until you have narrowed down the problem area.

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2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circu components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of t problem.
3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe procedures.
5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the prc was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the origin problem does not recur.

Battery Reset

Description

When reconnecting the battery cable after disconnecting, recharging battery after discharged or installing the memory located on the driver's side panel after removing, be sure to reset systems mentioned on the below table.
In addition, when replacing or reinstalling their fuses after removing, they should be reset according to the below table refer to the below table when servicing.

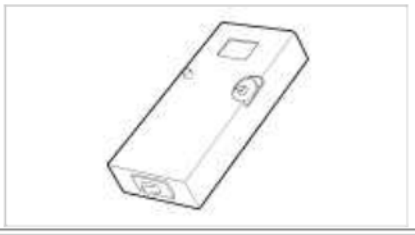
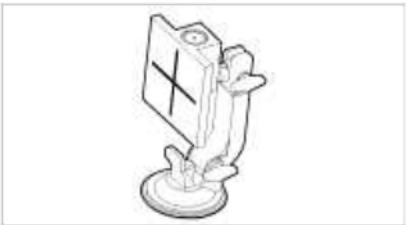
System	Resetting
Auto up/down window	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstall reset the Auto up/down window system according to the procedure below. 1) Turn the ignition switch to the ON position. 2) Pull up the power window switch in order that the window can close completely, and the pulling up the power switch for about 1 second.
Sunroof	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstall sunroof system must be reset according to the procedure below. 1) Turn the ignition switch to the ON position. 2) According to the position of the sunroof, do the following. - In case the sunroof is closed completely or tilted: Push the sunroof control lever upward until the sunroof tilts completely upward. - In case the sunroof is open: Push the sunroof control lever forward until the sunroof closes completely. Push the sunı control lever upward until the sunroof tilts completely upward. 3) Release the sunroof control lever. 4) Push the sunroof control lever upward until the sunroof has returned to the original tilt po after it is raised a little higher than the maximum tilt position. Then, release the lever. 5) Push the sunroof control lever upward until the sunroof operates as follows; TILT DOWN → SLIDE OPEN → SLIDE CLOSE Then, release the lever.
Trip computer	When the battery is disconnected and reconnected, the set functions of the trip computer be initialized. So, you need to explain this information to the customer.
	Whenever the battery terminals or related fuses are disconnected, you must reset the time. When the ignition switch is in the ACC or ON position, the clock buttons operate as follow

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Clock	HOUR : Pressing the “H” button will advance the time displayed by one hour. MINUTE : Pressing the “M” button will advance the time displayed by one minute.
Audio	When the battery is disconnected and reconnected, the customer's radio stations become initialized. So, you need to record the customer's radio stations prior to service, and after se set the customer's radio stations into the audio.

Body Electrical System

Special Service Tools

Tool (Number and Name)	Illustration	Application
RKE Battery Checker (09954-2P100)		Measuring the RKE battery voltage
Correction jig for LDWS (09890-3N100)		Correction of LDWS (Lane Departu Warning System)

Body Electrical System

Specifications

Audio

Item		Specification		
Model		RADIO/CD/MP3/SDARS (PA30A)	RADIO/VCD/MP3/SDARS (BA900)	HD RADIO/VCD/MP3/SI (BA950)
Power supply		DC 14.4V		
Rated output		Max 43W x 4	- (External amplifier)	Max 43W x 4
Impedance		4 ohm X 4	2 ohm	4 ohm
Tuning type		PLL SYNTHESIZED TUNING		
Antenna		80PF 75Ω		
Dark current		Max. 1.0mA (Head unit only)	Max. 3.0mA (Head unit only)	
Frequency range / Channel space	FM	87.5 ~ 107. MHz/ 200 KHz		
	AM	530 ~ 1710 KHz/ 10 KHz		

Speaker

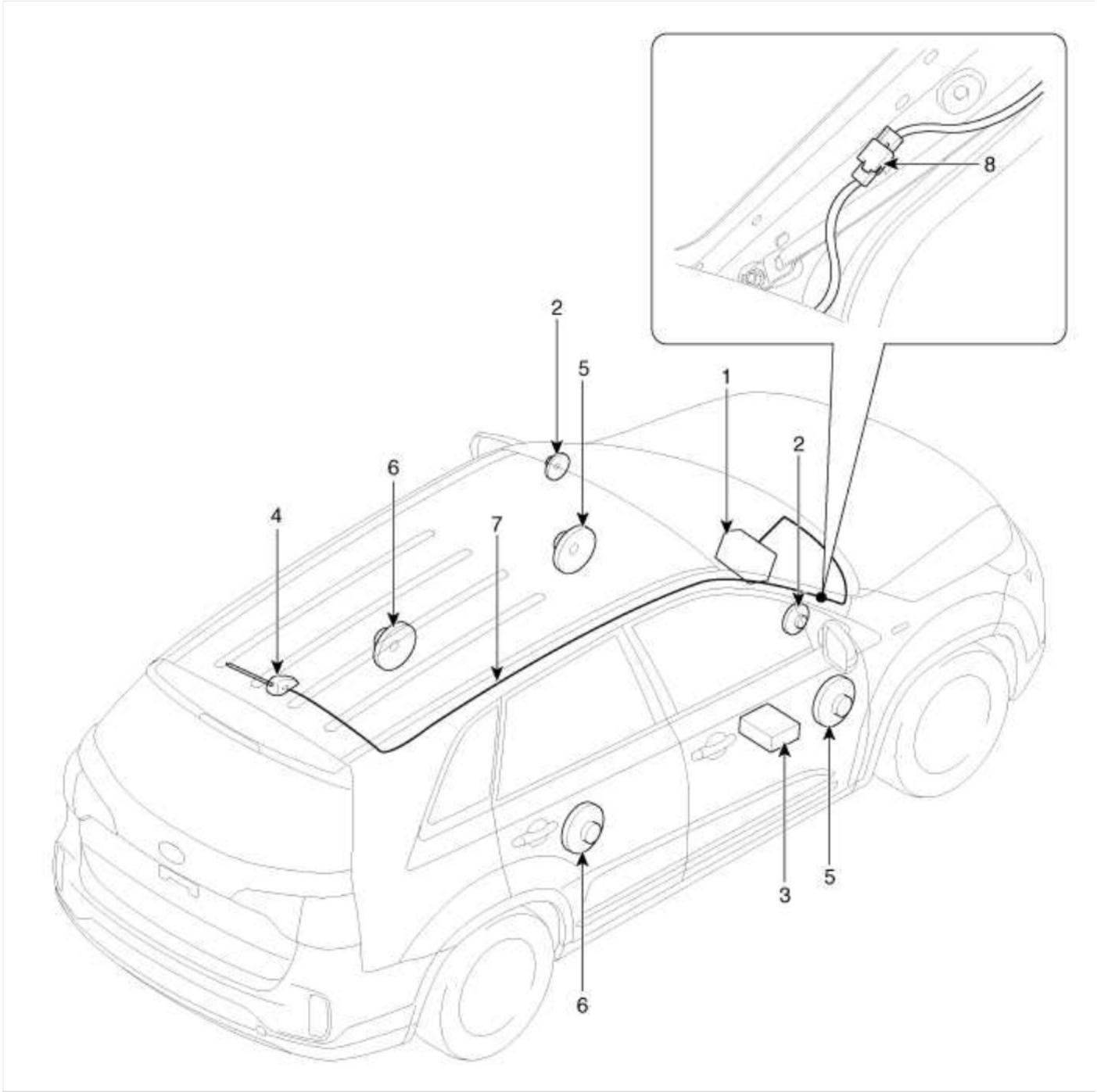
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Item		PA30A	BA900/BA950
Input Power (W or V)	Front	20W (Max 40W)	
	Rear	20W (Max 40W)	
	Front Center	-	20W (Max 40W)
	Front Tweeter	20W (Max 40W)	
	Surround	-	20W (Max 40W)
	Sub woofer	-	20W (Max 40W)
Speaker Impedance (Ω)	Front	4 ± 0.6	2 ± 0.3
	Rear	4 ± 0.6	2 ± 0.3
	Front Center	-	2 ± 0.3
	Front Tweeter	4 ± 0.6	3.2 ± 0.6
	Surround	-	2 ± 0.3
	Sub woofer	-	2 ± 0.3
Speaker Number		6	8

Body Electrical System

Component Location

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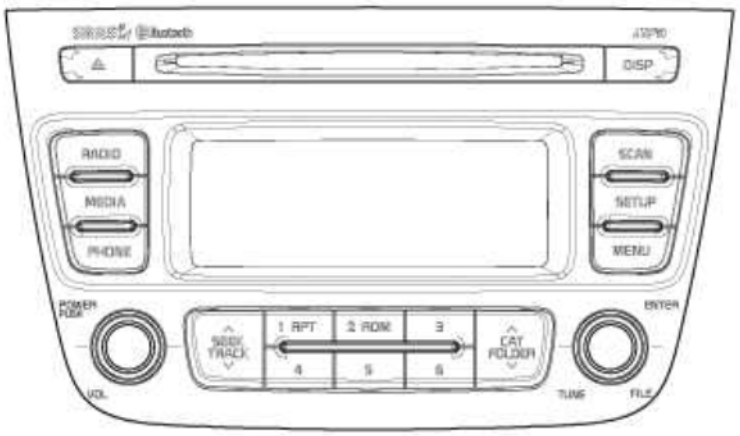
1. Audio unit 2. Tweeter speaker 3. External amplifier 4. Roof antenna (Radio + Siruis)	5. Front door speaker 6. Rear door speaker 7. Antenna feeder cable 8. Antenna cable connector

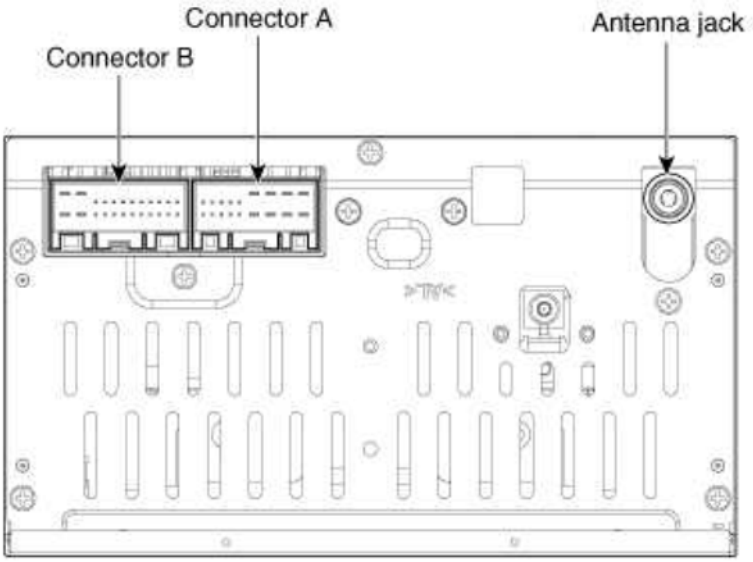
Body Electrical System

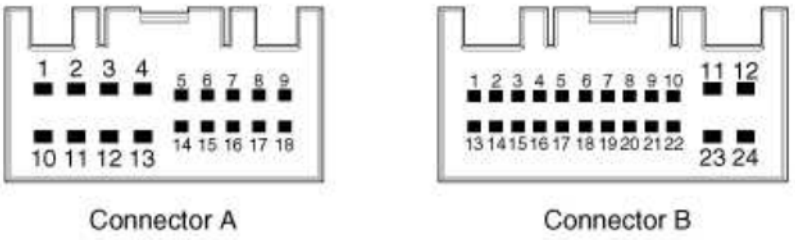
Components

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[RADIO/CD/MP3/SDARS(PA30A)]







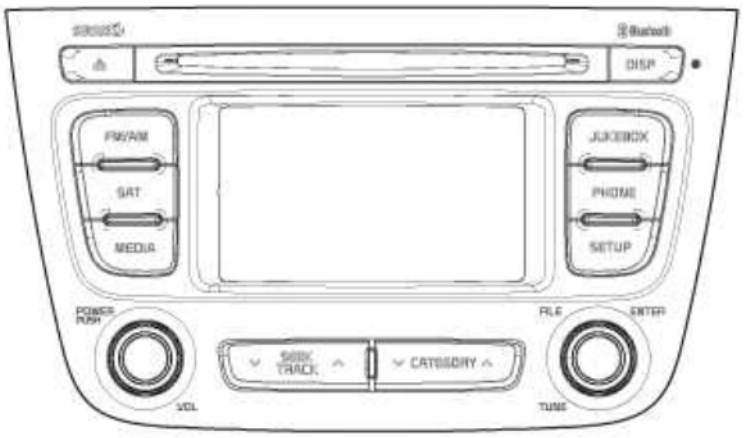
Connector Pin Information

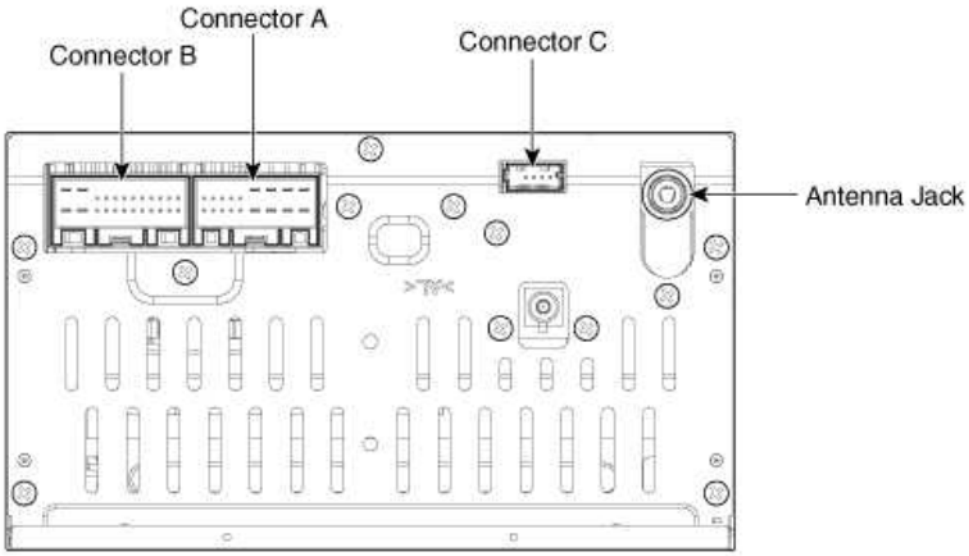
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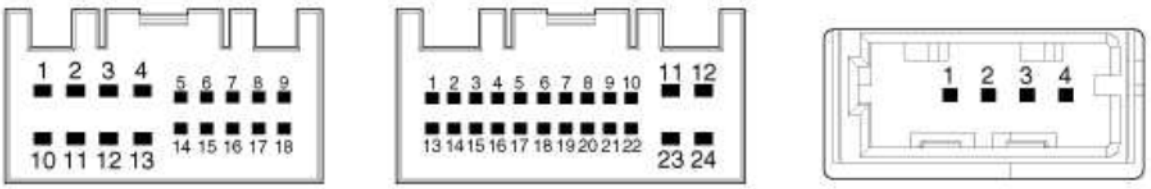
No	Connector A	Connector B
1	Rear left speaker (+)	CAN high
2	Front left speaker (+)	-
3	Front right speaker (+)	-
4	Rear right speaker (+)	Steering remote
5	-	-
6	-	USB D(+)
7	-	USB/iPod VDD
8	Illumination (+)	AUX R Input
9	Detent	AUX gorund
10	Rear left speaker (-)	MIC(+) (Bluetooth)
11	Front left speaker (-)	ACC
12	Front right speaker (-)	B(+)
13	Rear right speaker (-)	-
14	-	-
15	-	-
16	-	Vehicle speed
17	Illumination (-)	Remote GND
18	Remote antenna	USB D(-)
19		USB/iPod GND
20		AUX detect
21		AUX L Input
22		MIC(-) (Bluetooth)
23		-
24		Power GND

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[RADIO/VCD/MP3/SDARS(BA900/BA950)]







Connector A | Connector B | USB Connector

Connector Pin Information (Internal Amplifier Type (BA900))

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No	Connector A	Connector B	Connector C
1	Rear left speaker (+)	CAN high	USB ground
2	Front left speaker (+)	-	USB data (+)
3	Front right speaker (+)	-	USB data (-)
4	Rear right speaker (+)	Steering remote	USB 5V
5	-	Rear remote	
6	-	Camera video input	
7	Ignition	Camera battery (+)	
8	Illumination (+)	AUX R Input	
9	-	AUX gorund	
10	Rear left speaker (-)	MIC(+) (Bluetooth)	
11	Front left speaker (-)	ACC	
12	Front right speaker (-)	B(+)	
13	Rear right speaker (-)	CAN low	
14	-	-	
15	-	Auto light	
16	Door unlock	Vehicle speed	
17	Illumination (-)	Remote GND	
18	Remote antenna	Camera video ground	
19		Camera req.	
20		AUX detect	
21		AUX L Input	
22		MIC(-) (Bluetooth)	
23		Camera power ground	
24		Power GND	

Connector Pin Informatino (External Amplifier Type (BA950))

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No.	Connector A	Connector B	USB Connector
1	-	CAN high	USB/ iPod 5V
2	-	-	USB data (-)/ iPod Tx
3	-	-	USB data (+)/ iPod Rx
4	-	Steering remote	USB/ iPod ground
5	SPDIF GND	-	
6	SPDIF DN	Camera video input	
7	-	Camera battery (+)	
8	Illumination (+)	AUX R Input	
9	-	AUX gorund	
10	-	MIC(+) (Bluetooth)	
11	-	ACC	
12	-	B(+)	
13	-	CAN low	
14	-	-	
15	SPDIF DP	Auto light	
16	Door unlock	Vehicle speed	
17	Illumination (-)	Remote ground	
18	Remote antenna	Camera video ground	
19		Camera req.	
20		AUX detect	
21		AUX L Input	
22		MIC(-) (Bluetooth)	
23		Camera power ground	
24		Power GND	

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Body Electrical System

Removal

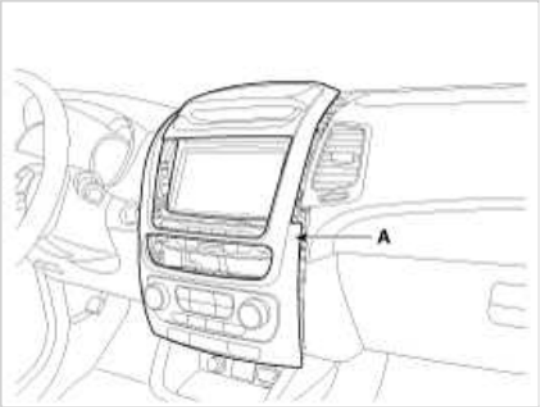
CAUTION

Put on gloves to protect your hands.

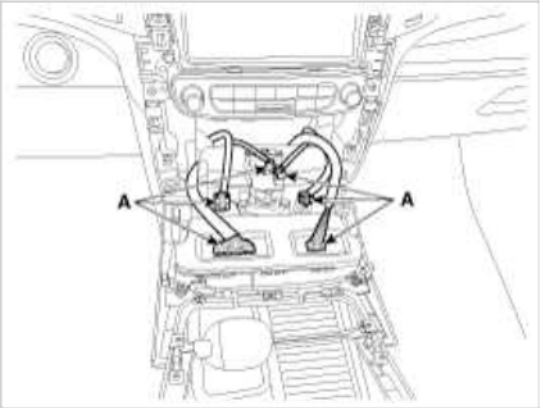
Information

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the relate parts, to prevent damage.
- Use a plastic panel removal tool to remove interior trim pieces to protect from marring the surface.
- Take care not to bend or scratch the trim and panels.

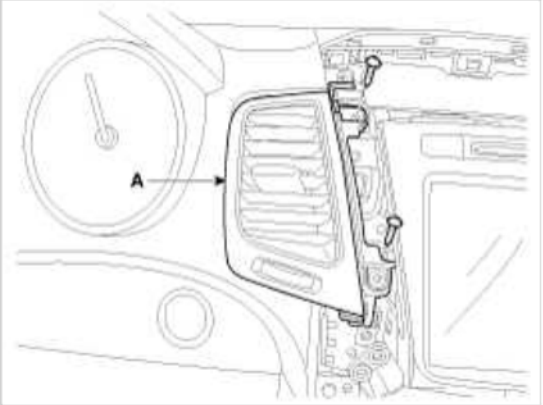
1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia panel (A).
   (Refer to Body - "Crash pad")

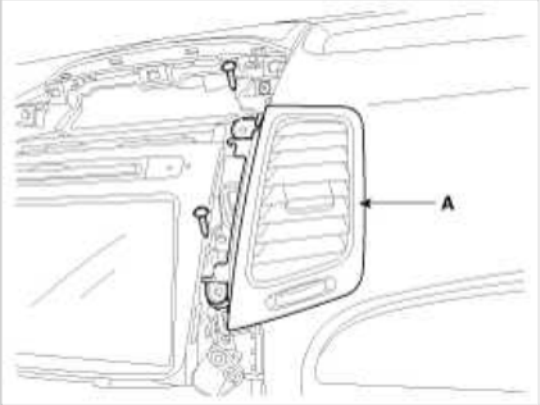


3. Disconnect the connectors and cables (A) from center fascia panel.



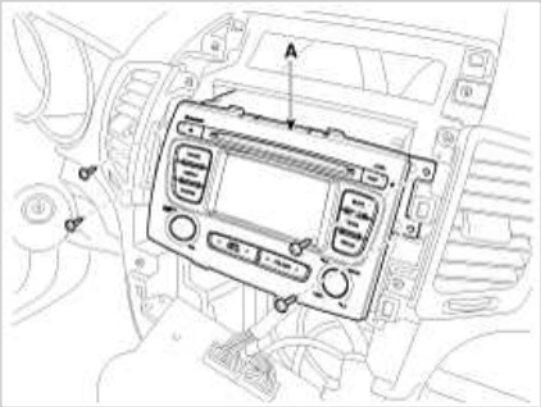
4. Remove the crash pad center air vent (A).



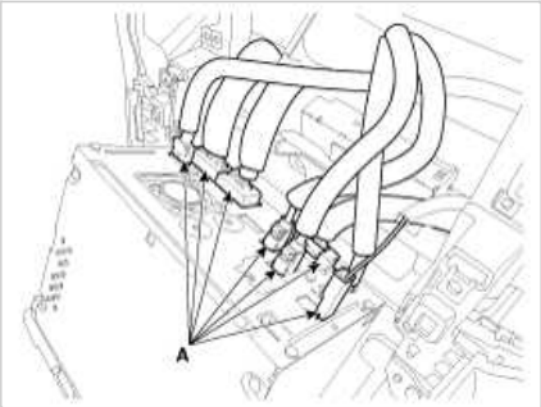


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5. Remove the audio head unit (A) from crash pad after loosening the screws (4EA).



6. Disconnect the connectors and cables (A) from head unit.



NOTICE

When the compact disc is not ejected, do not remove it forcibly.

Installation

1. Connect the audio unit connectors and cable.
2. Install the audio unit.
3. Install the center facia panel.
4. Connect the negative (-) battery terminal.

NOTICE

A. Make sure the connector are connected in properly.
B. Check the audio system.

Body Electrical System

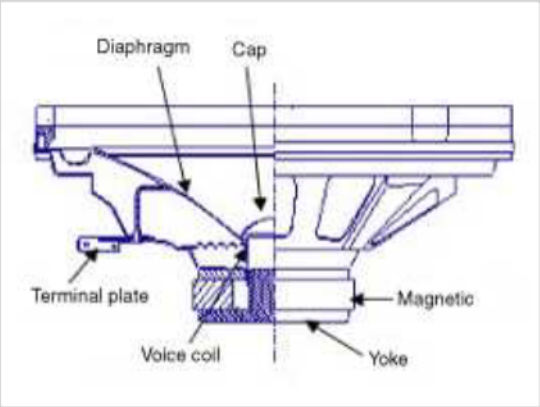
Inspection

1. Troubleshooting for Speaker

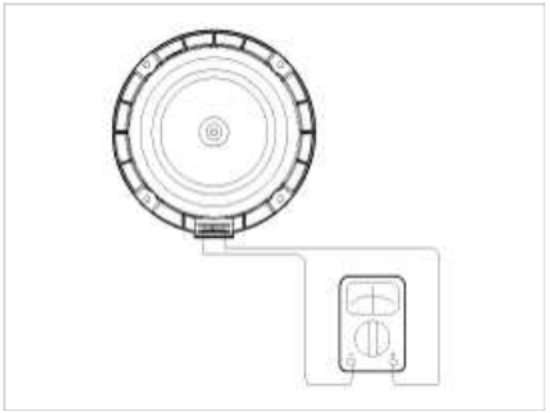
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(1) Basic inspection of speaker

Inspect the sound from speaker after verifying that the speaker mounting screws is removed and the wiring cc is connected precisely to remove vibration transmitted from body trims and surrounding parts.



(2) Case Troubleshooting

No.	Case	Inspection/Remedy
1	Trembling sound	1. Before replacing the speaker, inspect that the mounting screw is installed normally 2. After re-installing the speaker, verify that no trembling sound is heard. 3. When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1. Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2. In case of radio static, check if there is a noise from CD player. 3. When a noise is heard on turning radio and CD on, replace the speaker with new **NOTICE** In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.
3	Poor working	Inspection of the wiring connection between the battery and the speaker 1. Before replacing the speaker, inspect the wiring connection between the battery ai speaker is normal. 2. Check the supplying power to the speaker and the resistance, and then inspect the quality.  3. If the speaker works poorly, replace it with new one.

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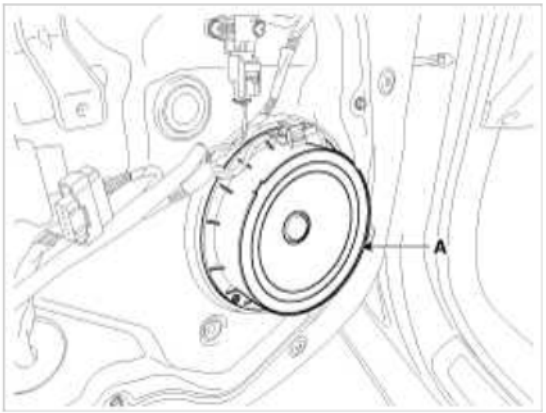
⚠ CAUTION

- During dealing of speaker
- Do not damage the speaker with impact as like a drop and a throw.
- Be careful not to cover water and oil over the speaker.
- Caution during dealing of speaker because the material of diaphragm is paper which is easy to be torn b impact and external force.
- When modifying audio system as customer pleases, this does electric damage to speaker.
- And, in this case the speakers are not covered by the manufacturer's warranty.

Replacement

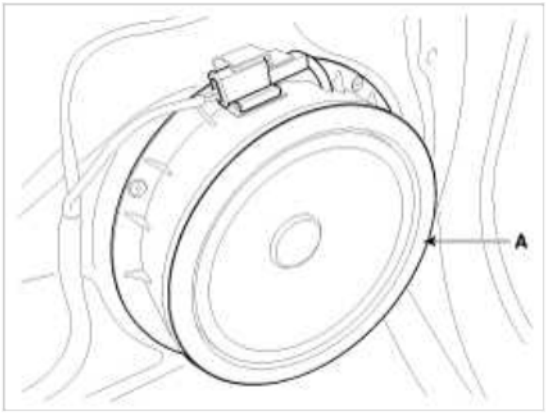
Front Speaker

1. Remove the front door trim.
   (Refer to Body - "Front door")
2. Remove the front speaker (A) after removing the mounting screws.



Rear Speaker

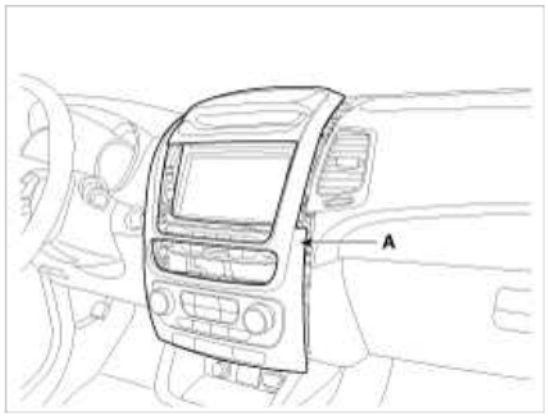
1. Remove the rear door trim.
   (Refer to Body - "Rear door")
2. Remove the rear speaker (A) after removing the mounting screws.



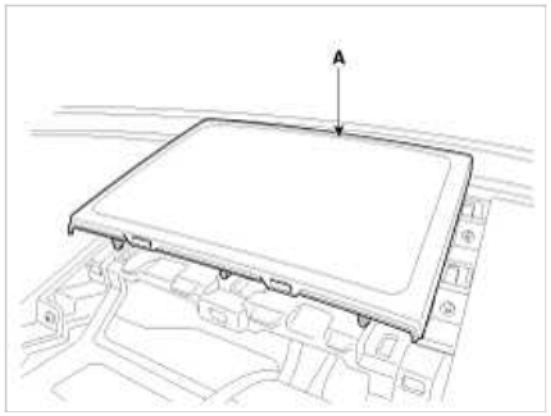
Crash Pad Center Speaker

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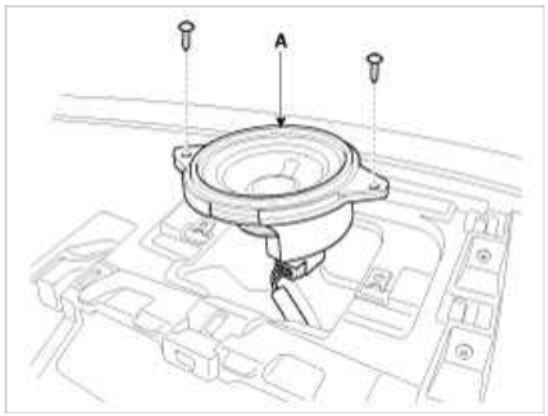
1. Remove the center fascia panel (A).



2. Remove the crash pad center speaker grill (A).

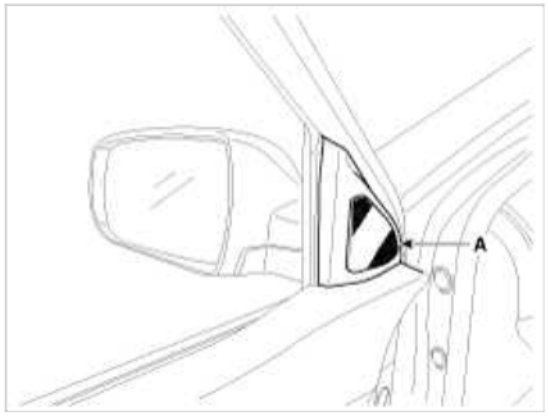


3. Remove the crash pad center speaker (A) after loosening the mounting screws (2EA).



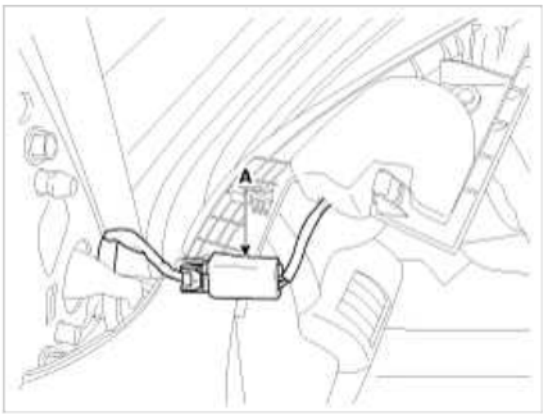
Tweeter Speaker (Front)

1. Remove the front door delta cover (A).
   (Refer to Body - "Front door")



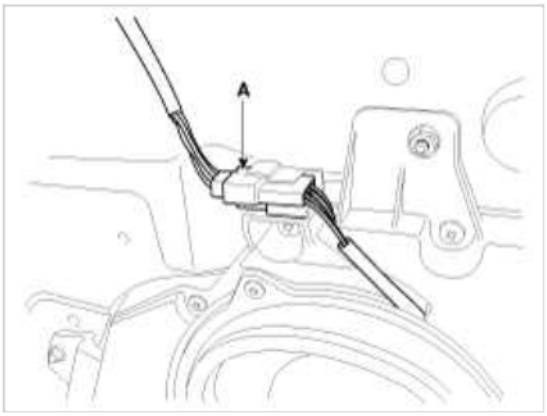
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2. Remove the tweeter speaker (A) after disconnecting the connector.

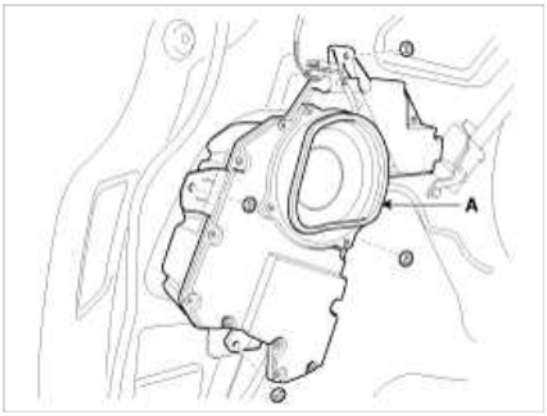


Woofer Speaker

1. Remove the left luggage side trim.
   (Refer to Body - "Interior trim")
2. Remove the woofer speaker connector (A).



3. Remove the woofer speaker (A) after removing 4 nuts.

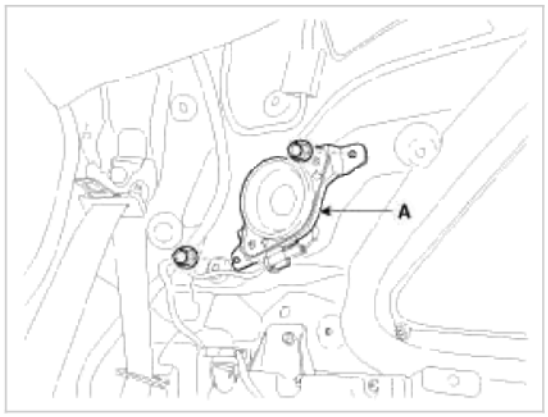


Surround speaker

1. Remove the luggage side trim.
   (Refer to Body - "Interior trim")
2. Remove the rear pillar trim.
   (Refer to Body - "Interior trim")

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3. Remove the surround speaker (A) after removing 2 nuts.



Installation

Front speaker

1. Install the speaker to the speaker mounting hole in the door in-panel.
2. Reconnect the speaker connector.

Rear speaker

1. Install the speaker to the speaker mounting hole in the door in-panel.
2. Reconnect the speaker connector.

Crash pad center speaker

1. Reconnect the connector to the center speaker.
2. Install the center speaker.
3. Install the crash pad center speaker grill.

Tweeter speaker (Front)

1. Install the front tweeter speaker to the front door delta cover.
2. Reconnect the connector and then install the delta cover.

Woofer speaker

1. Install the woofer speaker to the left quarter inner panel.
2. Reconnect the connector
3. Install the left luggage side trim.

Surround speaker

1. Install the surround speaker and connect the connector.
2. Install the rear pillar trim.
3. Install the luggage side trim.

NOTICE

- Make sure that the amplifier connectors are plugged in properly.
- Check the audio system.

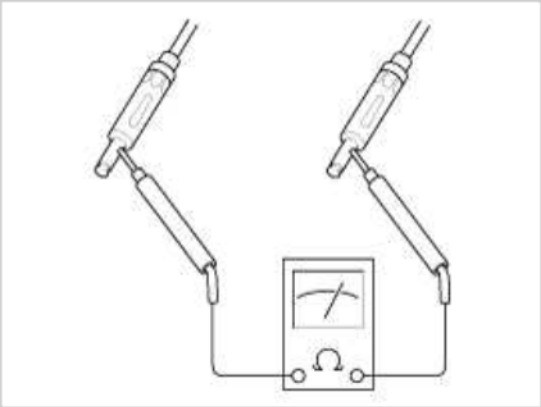
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Inspection

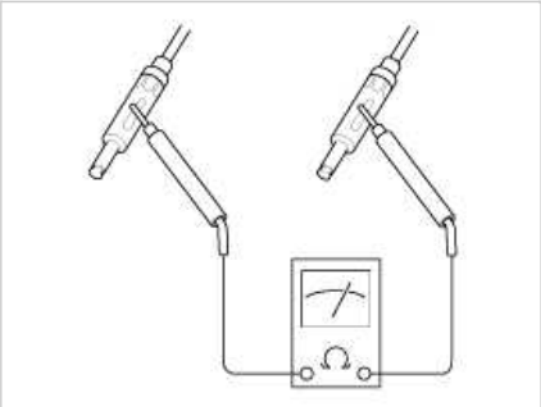
Antenna Cable

1. Remove the antenna jack from the audio unit and antenna.

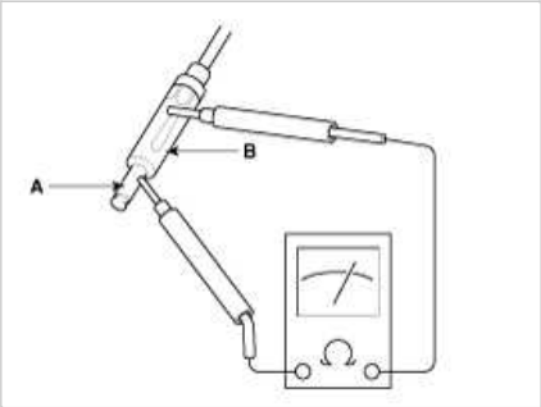
2. Check for continuity between the center poles of antenna cable.



3. Check for continuity between the outer poles of antenna cable. There should be continuity.



4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continu



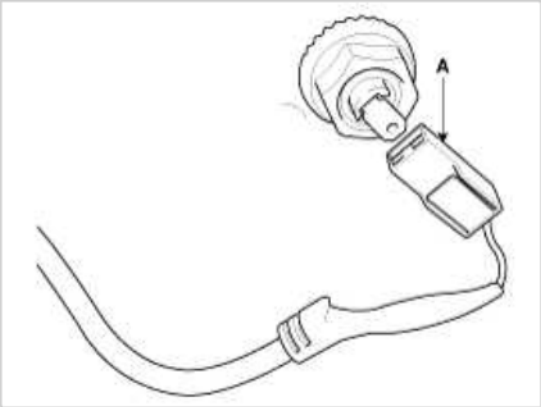
6. If there is continuity, replace the antenna cable.

Removal

1. Remove the rear roof trim.
   (Refer to Body - "Roof trim")

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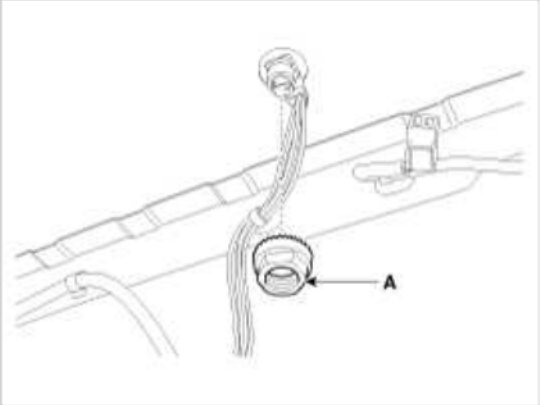
2. Disconnect the power cable (A).

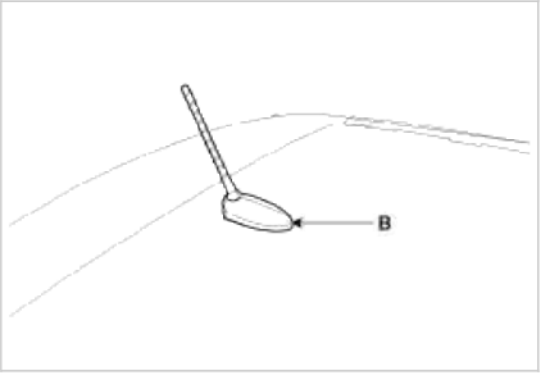


3. Disconnect the connectors (A) from the roof antenna.



4. Remove the roof antenna (B) after removing a nut (A).





Installation

1. Connect the roof antenna cables and connectors.

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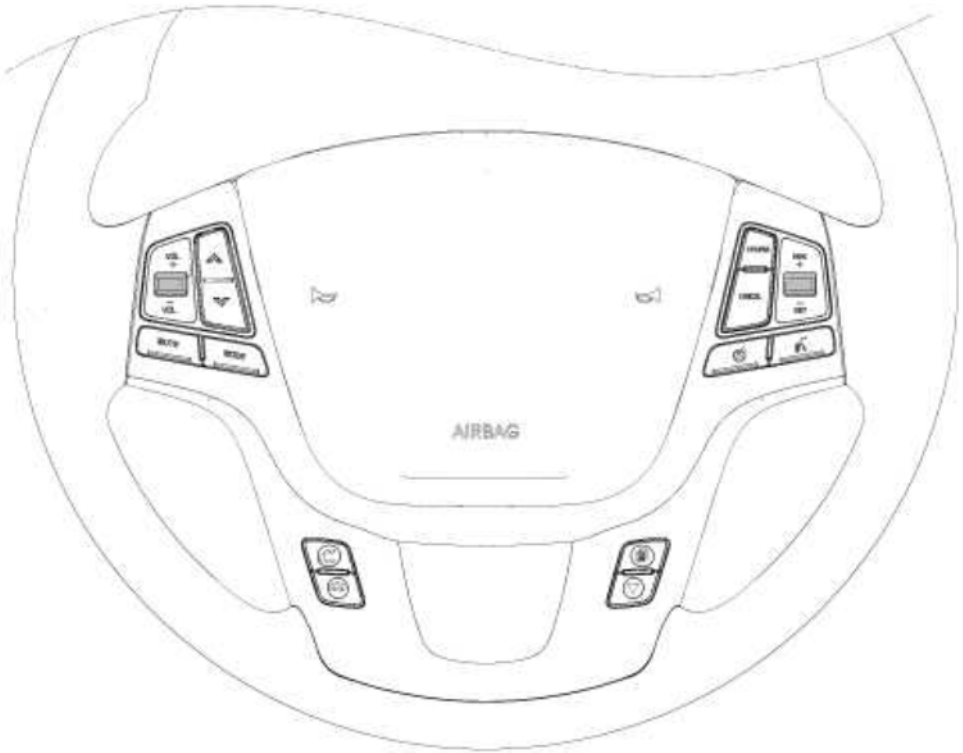
2. Install the rear roof trim.

NOTICE

- Make sure that the cables and connectors are plugged in properly.
- Check the audio system.

Body Electrical System

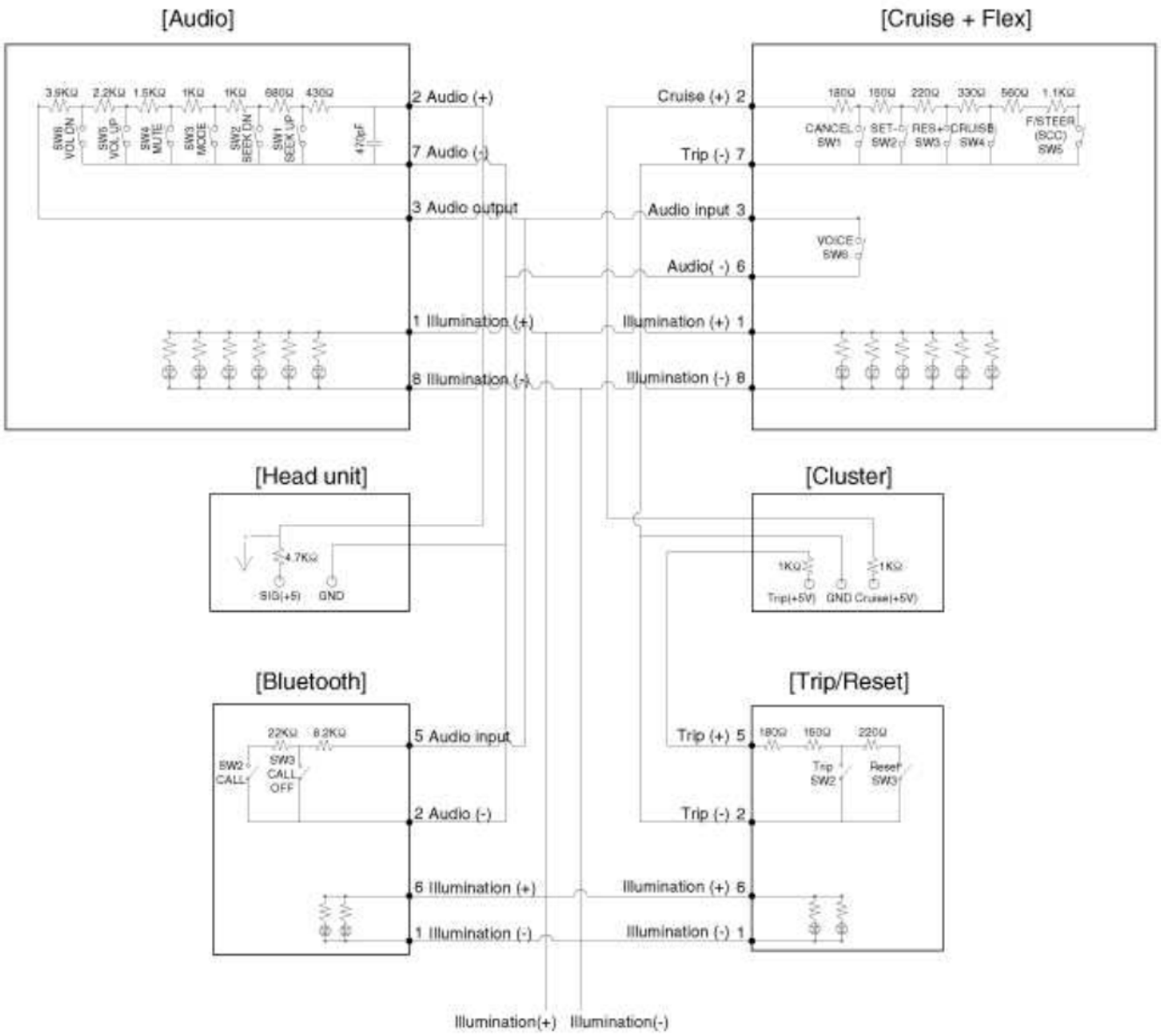
Components



Body Electrical System

Circuit Diagram

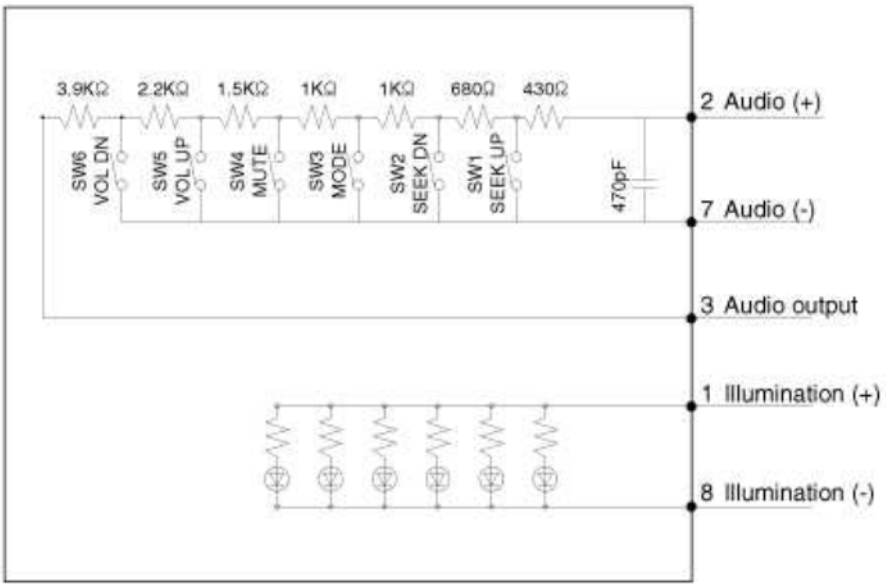
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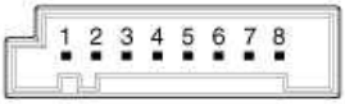


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[Audio]

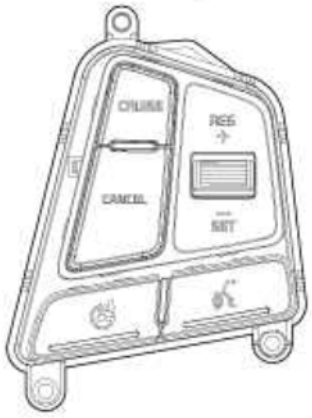


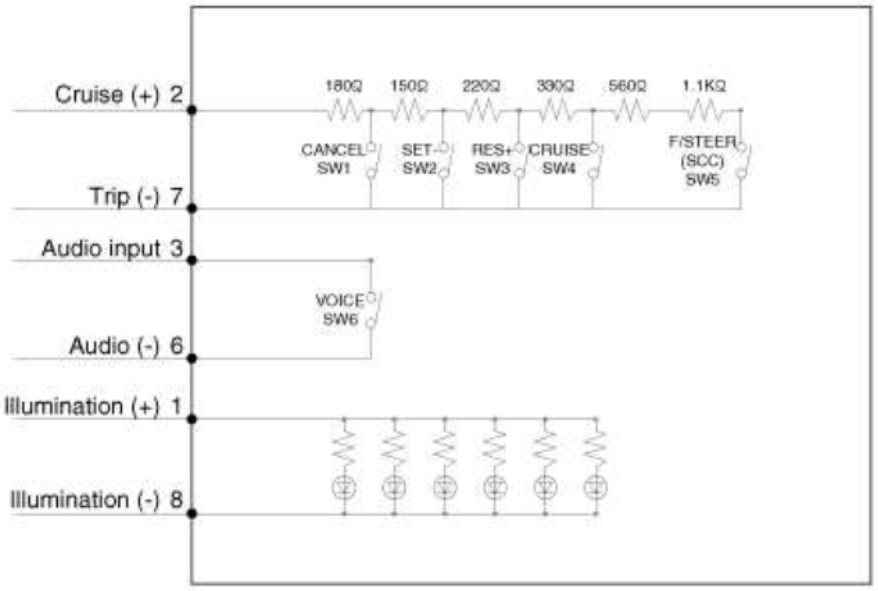


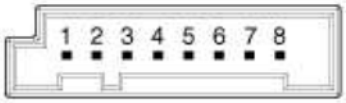
Connector	
	
Pin	**Description**
1	Illumination (+)
2	Audio (+)
3	Audio output
4	-
5	-
6	-
7	Audio (-)
8	Illumination (-)

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[Cruise + Voice + Flex]



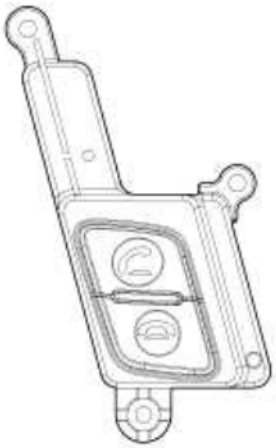


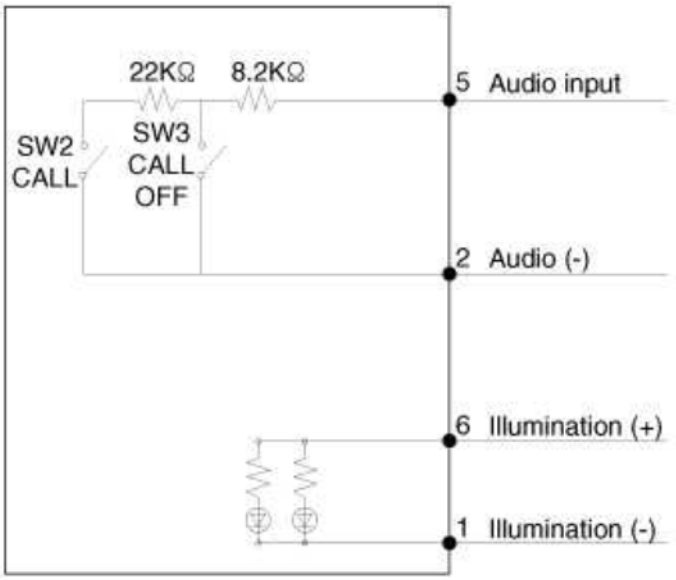
Connector


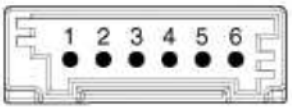
Pin	Description
1	Illumination (+)
2	Cruise (+)
3	Audio input
4	-
5	-
6	Audio (-)
7	Trip (-)
8	Illumination (-)

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[Bluetooth]



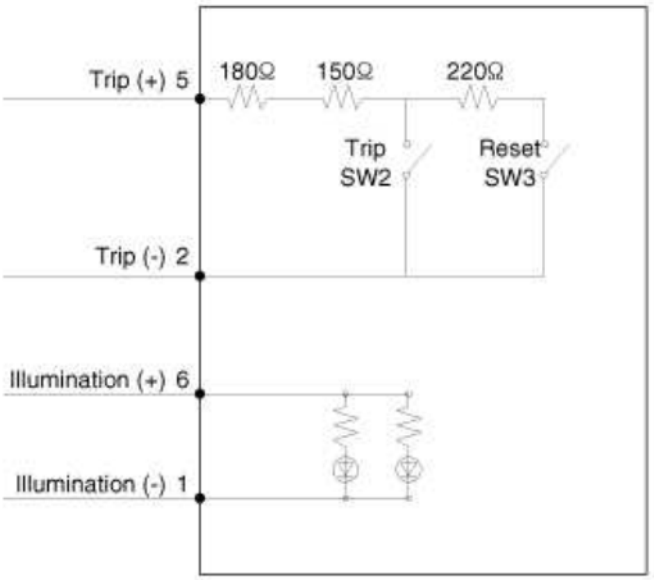


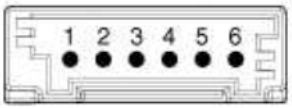
Connector	
	
Pin	**Description**
1	Illumination (-)
2	Audio (-)
3	-
4	-
5	Audio input
6	Illumination (+)

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[Trip + Reset]



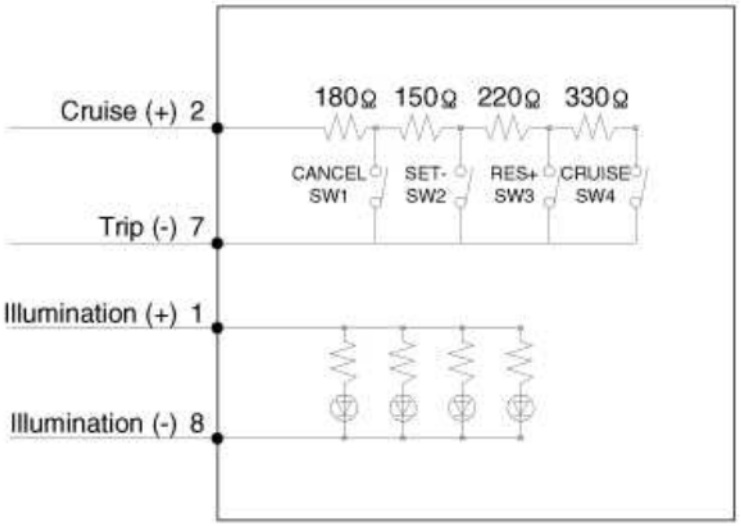


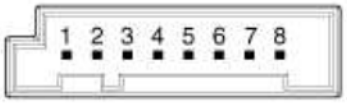
Connector	
	
Pin	**Description**
1	Illumination (-)
2	Trip (-)
3	-
4	-
5	Trip (+)
6	Illumination (+)

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[Cruise]



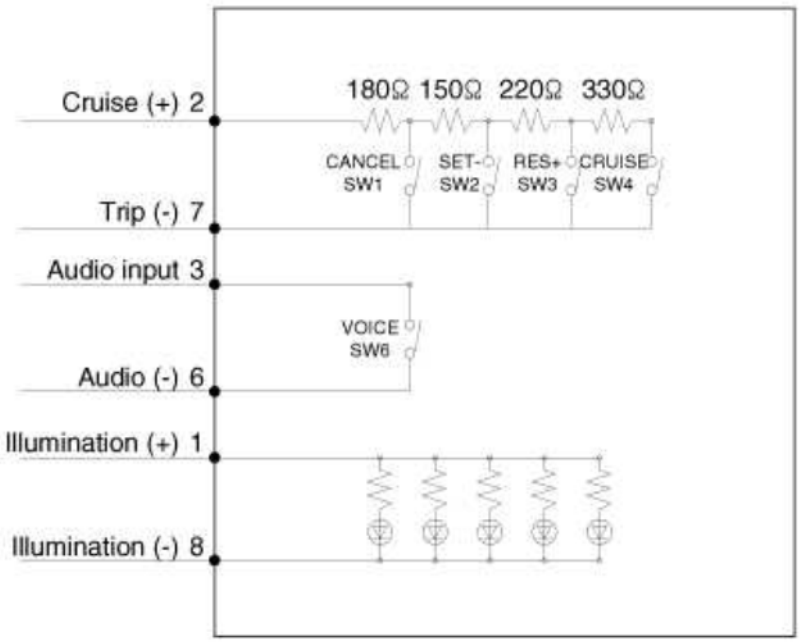


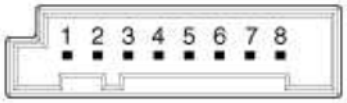
Connector	
	
Pin	**Description**
1	Illumination (+)
2	Cruise (+)
3	-
4	-
5	-
6	-
7	Trip (-)
8	Illumination (-)

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[Cruise + Voice]





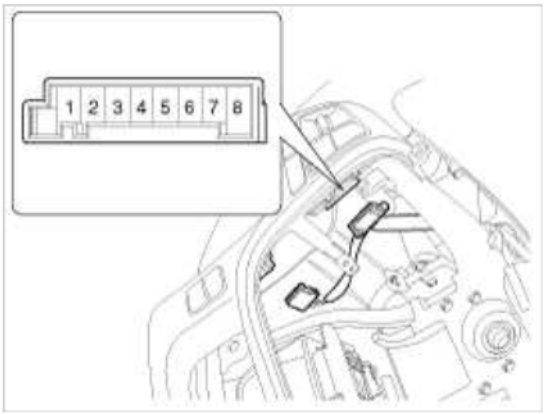
Connector


Pin	Description
1	Illumination(+)
2	Cruise (+)
3	Audio input
4	-
5	-
6	Audio (-)
7	Trip (-)
8	Illumination (-)

Body Electrical System

Inspection

1. Check for resistance between No.2 and No.7 terminals in each switch position.



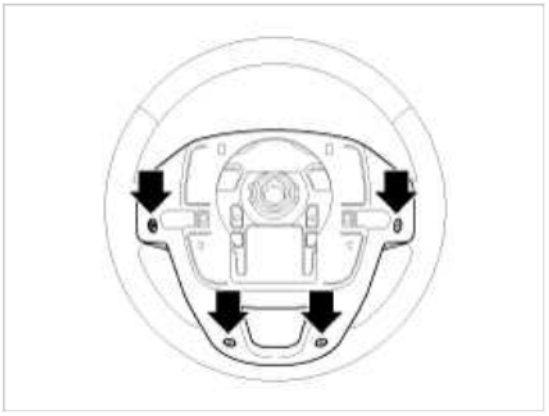
[Audio System]

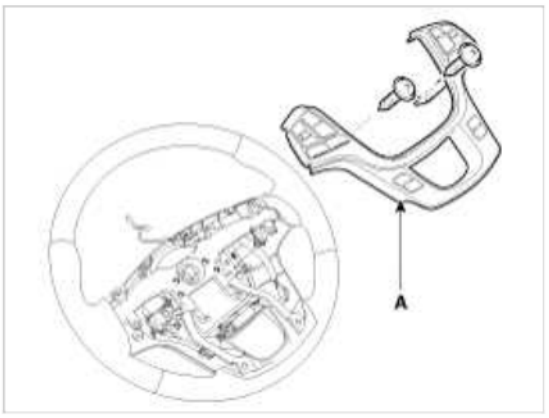
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Switch	Connector terminal	Resistance (±1%)
Volume Down	2-7	6.81 kΩ
Volume Up	2-7	4.61 kΩ
MUTE	2-7	3.11 kΩ
Mode	2-7	2.11 kΩ
Seek Down	2-7	1.1 kΩ
Seek Up	2-7	430 Ω

Removal

1. Remove the driver airbag module.
   (Refer to Restraint - "Airbag module")
2. Remove the steering wheel front cover (A) after loosening the screws.

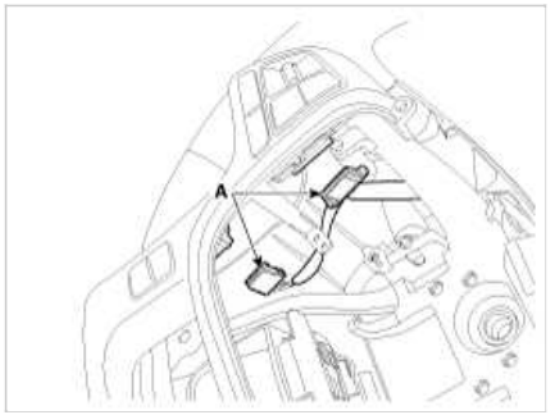




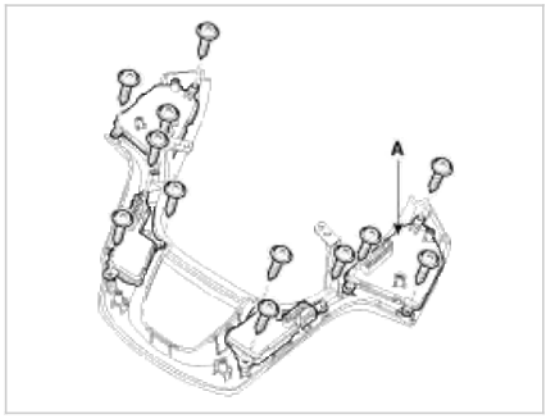
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3. Disconnect the audio remote control switch connector (A).





4. Remove the audio remote control switch (A).



Installation

1. Install the audio remote control switch on the steering wheel front cover.
2. Install the steering wheel front cover.
3. Reconnect the audio remote control switch connector and airbag connectors.

> **NOTICE**
> Make sure that the switch connector is plugged in properly.

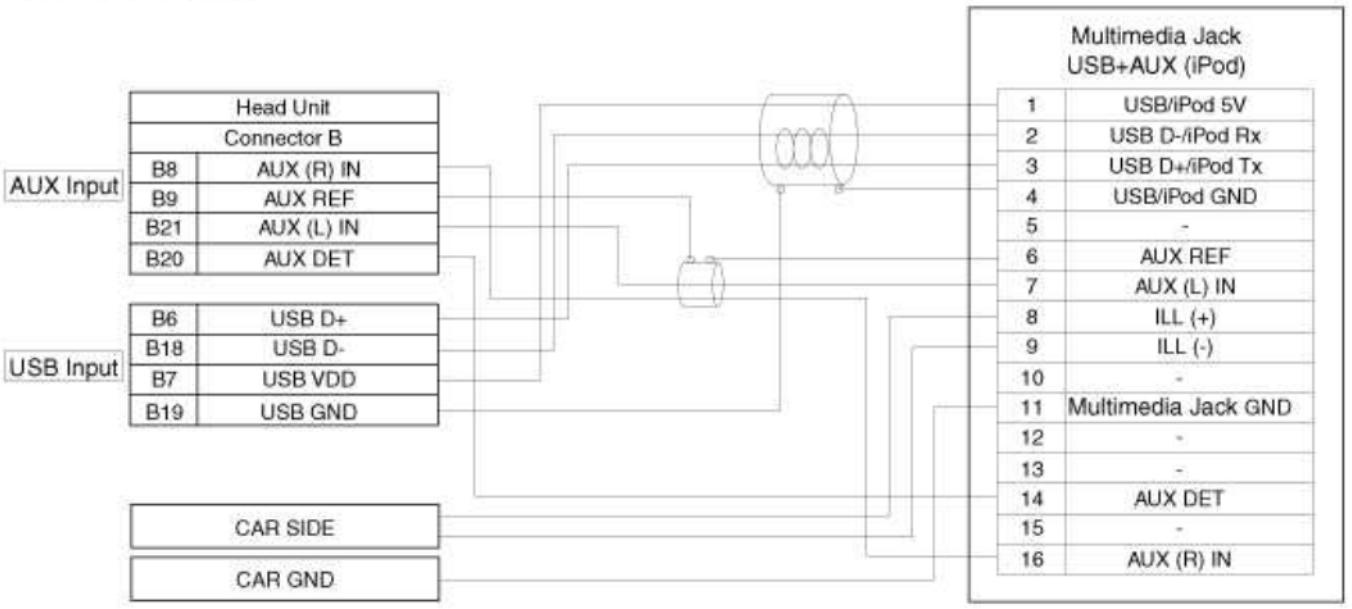
4. Install the driver airbag module.

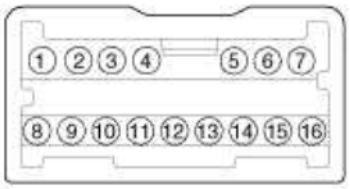
Body Electrical System

Circuit Diagram

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[AUX, USB, iPod Jack]



OUTPUT Connector	Pin No.	Description
	1	USB/iPod 5V
	2	USB D-/iPod Rx
	3	USB D+/iPod Tx
	4	USB/iPod GND
	5	-
	6	AUX REF
	7	AUX (L) IN
	8	ILL (+)
	9	ILL (-)
	10	-
	11	Multimedia Jack GND
	12	-
	13	-
	14	AUX DET
	15	-
	16	AUX (R) IN

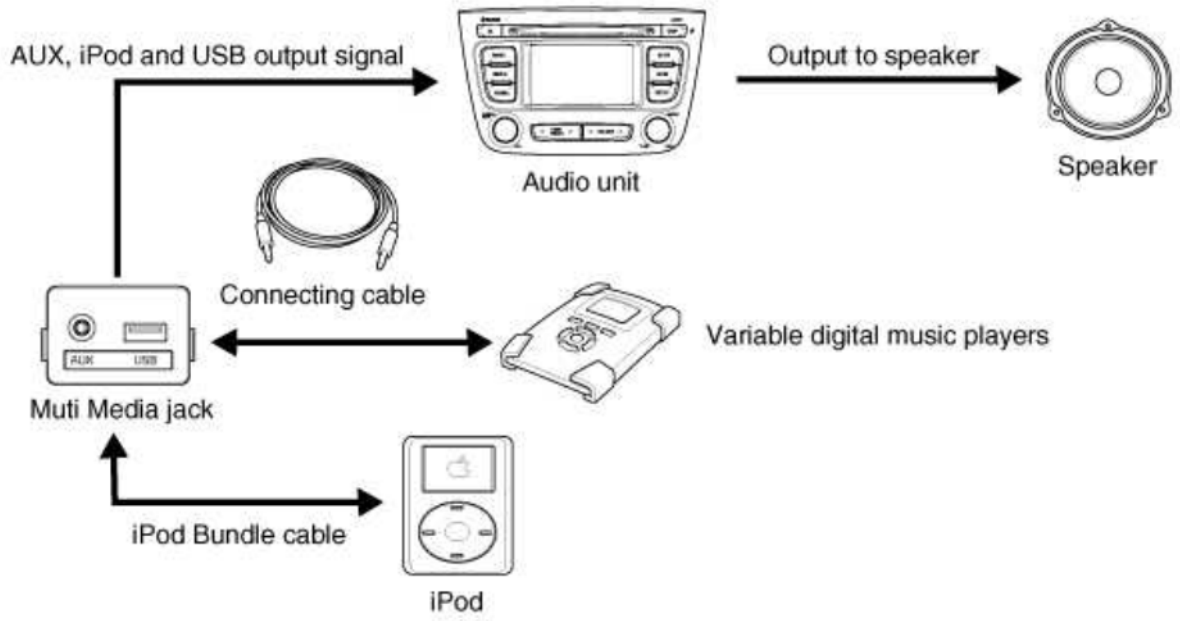
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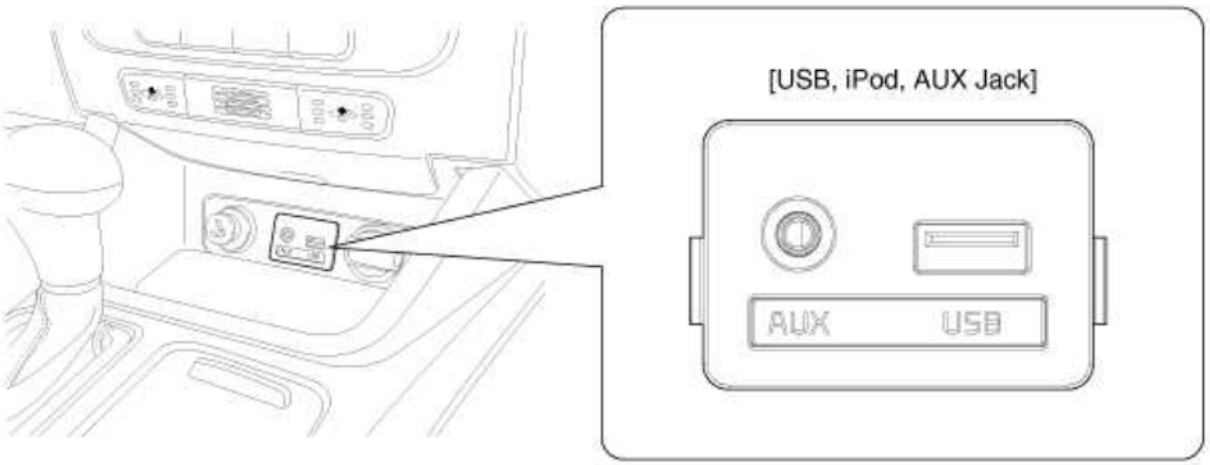
Body Electrical System

Description

The AUX, iPod and USB JACK on the center console is for customers who like to listen to external portable music like the MP3, iPod, earphone, USB memory stick, CD player and etc., through the vehicle's sound system when it is to this jack. The customer has this added option.

In case of distortions from media connected to the AUX source, the audio unit may not be defect but the output level used media does not match the specification of the AUX input.





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Removal

CAUTION

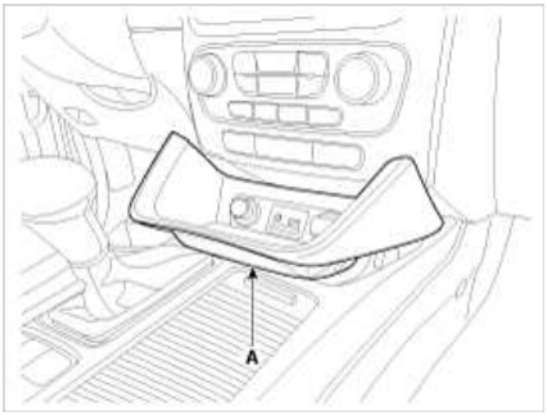
Put on gloves to protect your hands.

Information

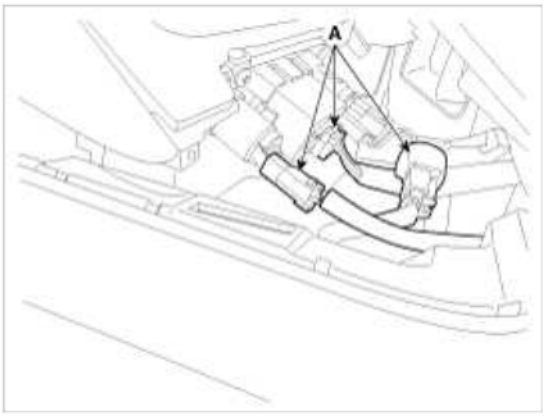
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the relate parts, to prevent damage.
- Use a plastic panel removal tool to remove interior trim pieces to protect from marring the surface.
- Take care not to bend or scratch the trim and panels.

1. Disconnect the negative (-) battery terminal.

2. Remove the floor console upper tray (A).
   (Refer to Body - "Console")



3. Disconnect the connectors and cables (A) from the floor console upper tray.



4. Remove the Multimedia Jack (A) after disengaging the hook.



Installation

1. Install the Multimedia jack.
2. Install the console upper cover.

Body Electrical System

Troubleshooting

Customer Complaint Analysis Check Sheet

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TROUBLE IN	☐ ALL ☐ AM ☐ FM ☐ CD ☐ MP3 ☐ CD changer ☐ AMP ☐ Others
TROUBLE OCCURS	☐ Always ☐ Engine start ☐ Engine Running ☐ Cold ☐ Warm ☐ Sometimes ☐ Most of the time ☐ Engine off
TYPE OF TROUBLE	☐ Will not play ☐ Weak ☐ Squealing noise ☐ Display/illumination poor ☐ CD skips & jumps ☐ CD will not eject or insert ☐ Others (Describe) :
OTHERS	▶ Customer complaint contents : ▶ Have you checked customer's defects :
* Using the customer complaint analysis check sheet for reference, ask the customer for as much detail as possible about the problem.	

There are six areas where a problem can occur: wiring harness, the radio, the CD player, and speaker. Troubleshooti enables you to confine the problem to a particular area.

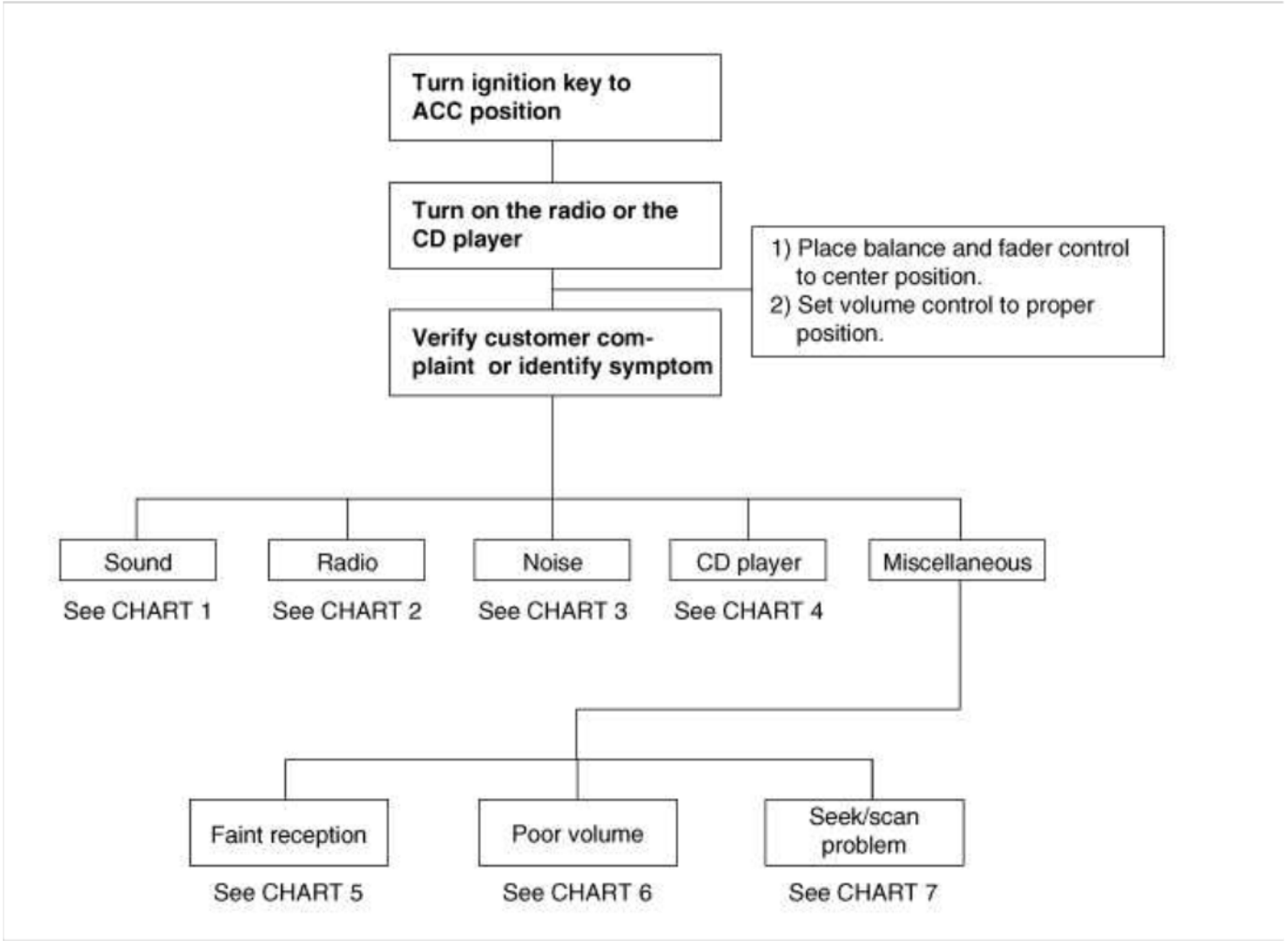
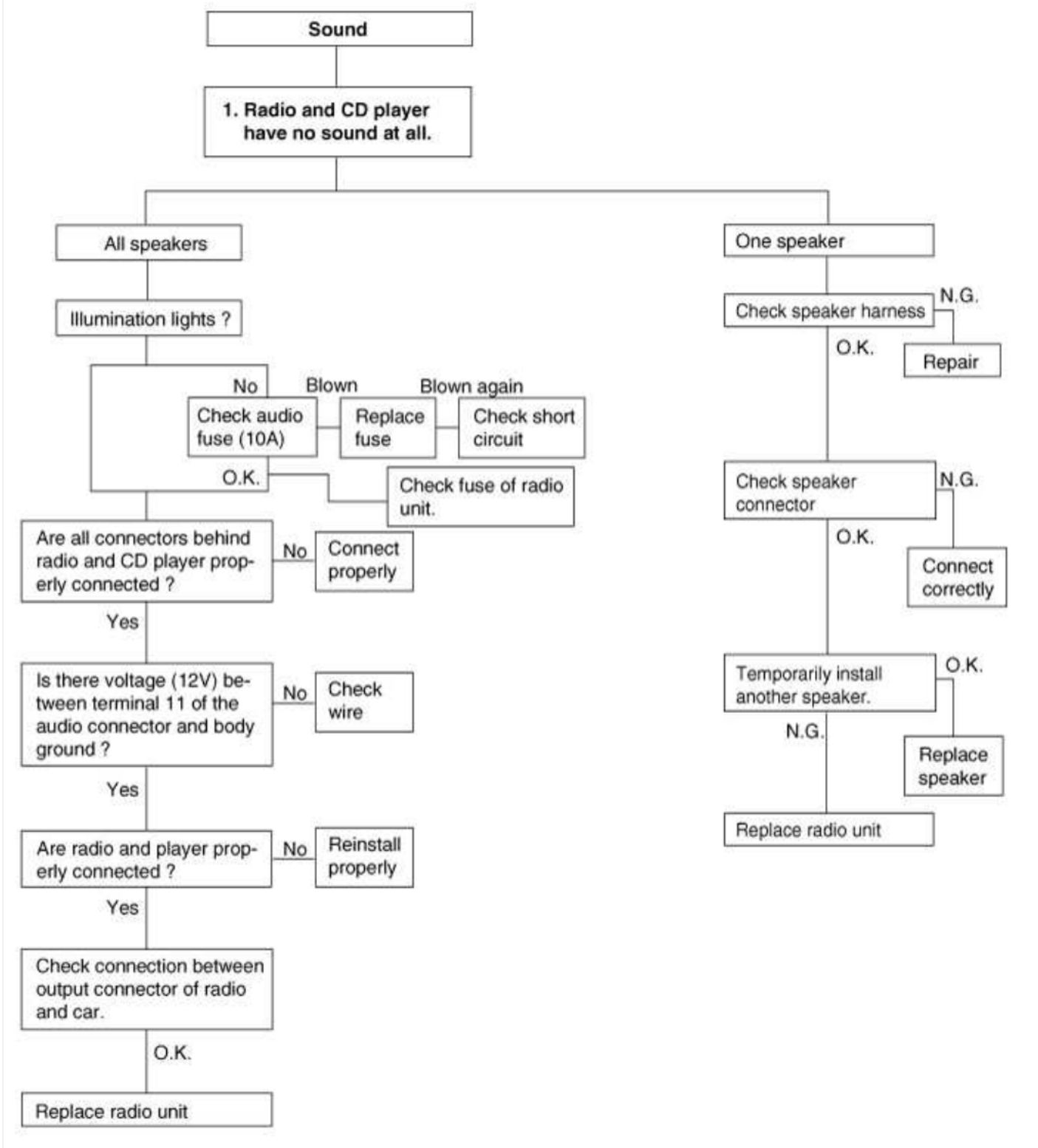


Chart 1

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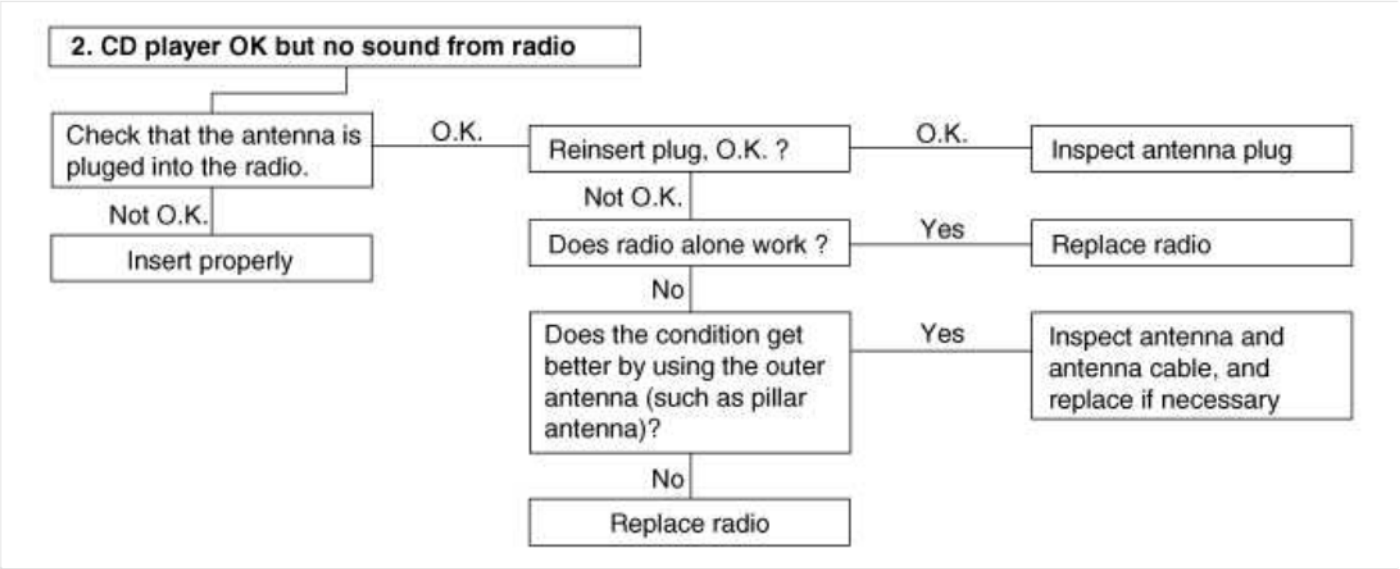


Chart 2

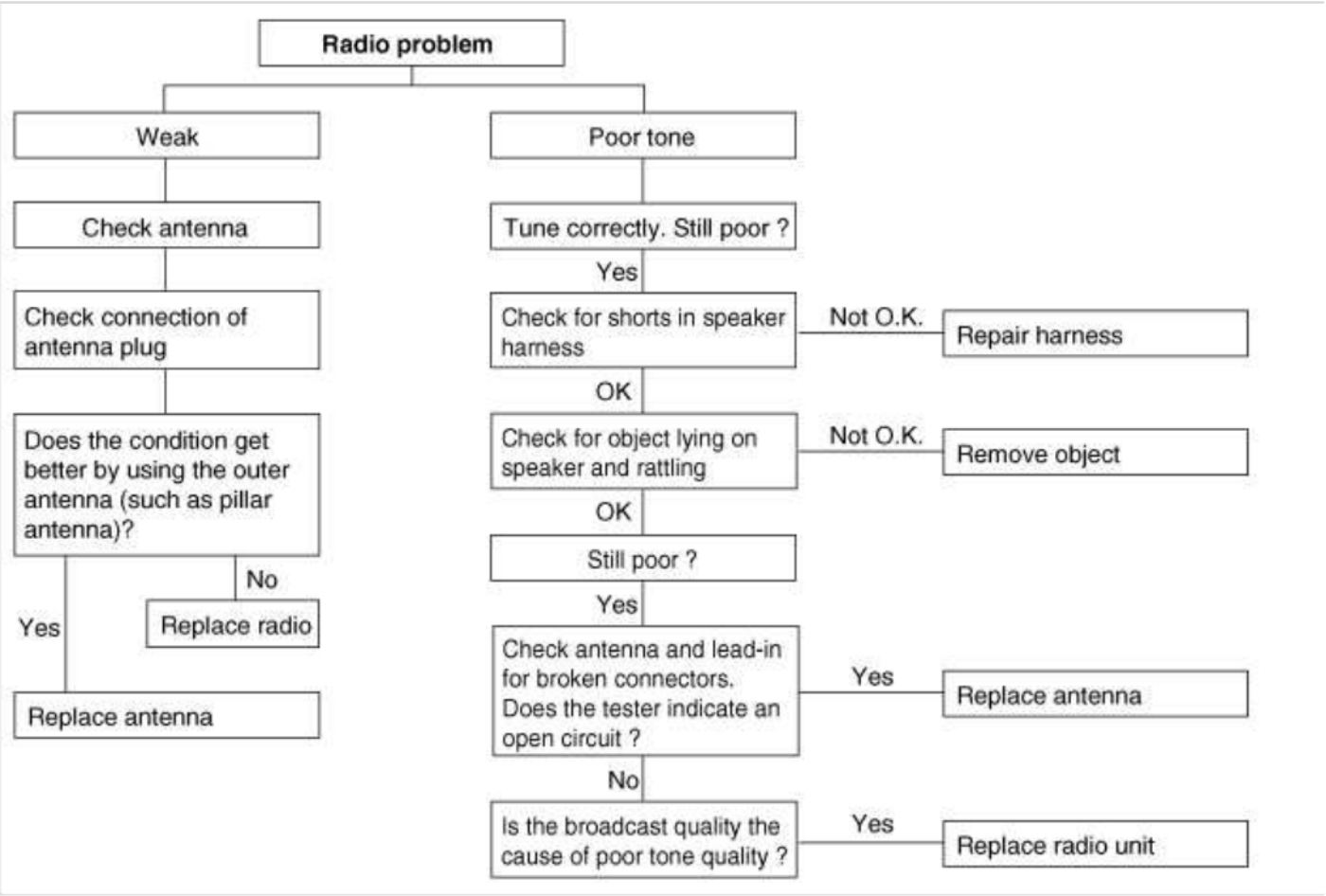


Chart 3

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1. RADIO

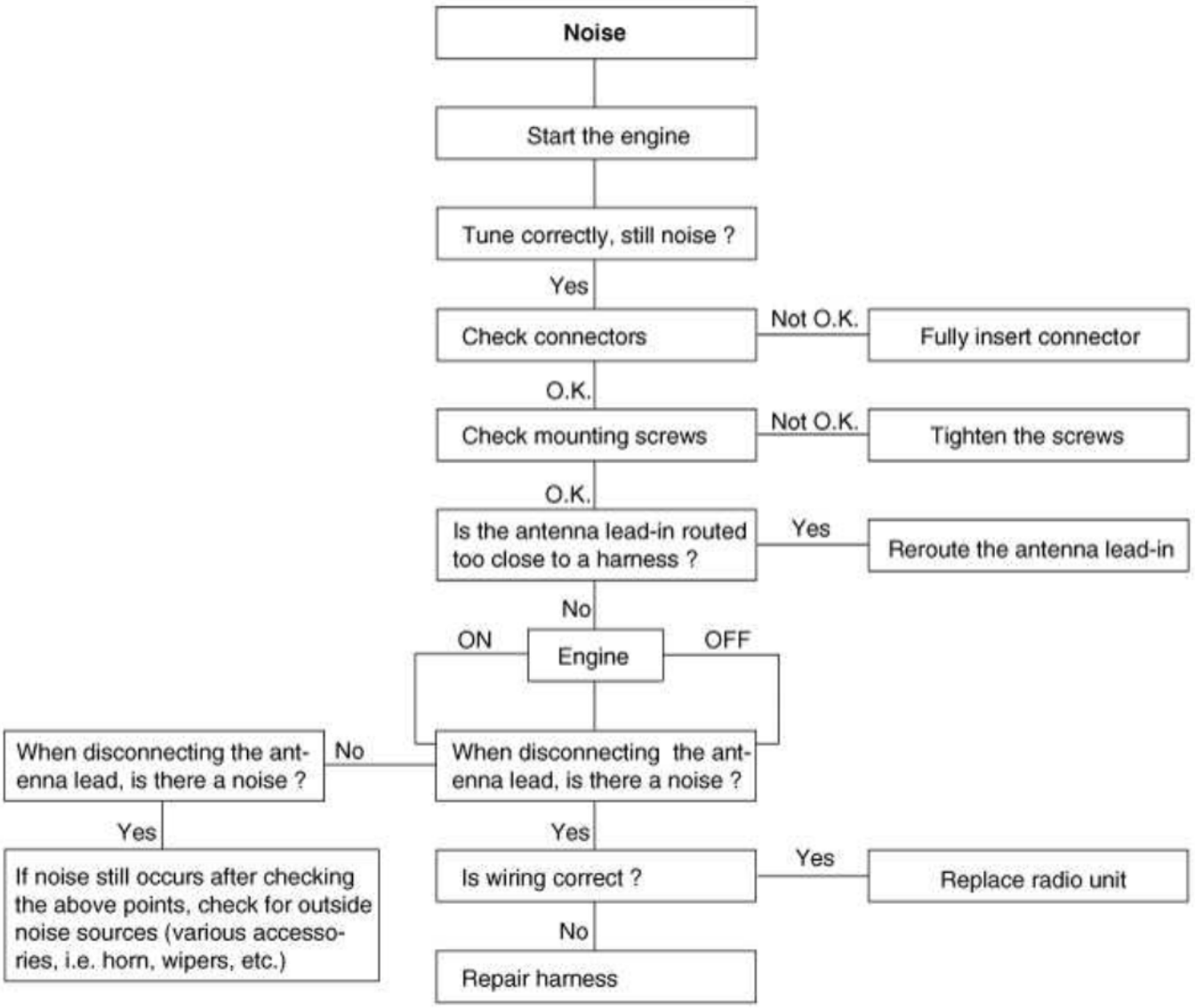
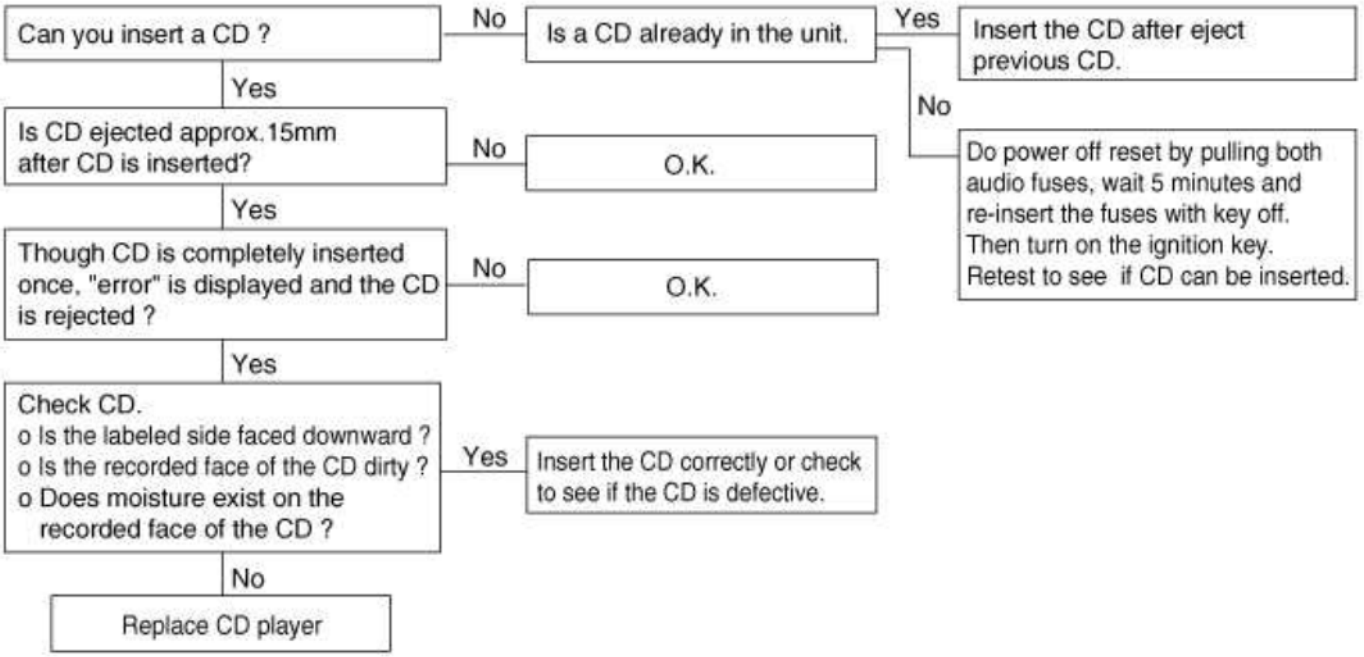


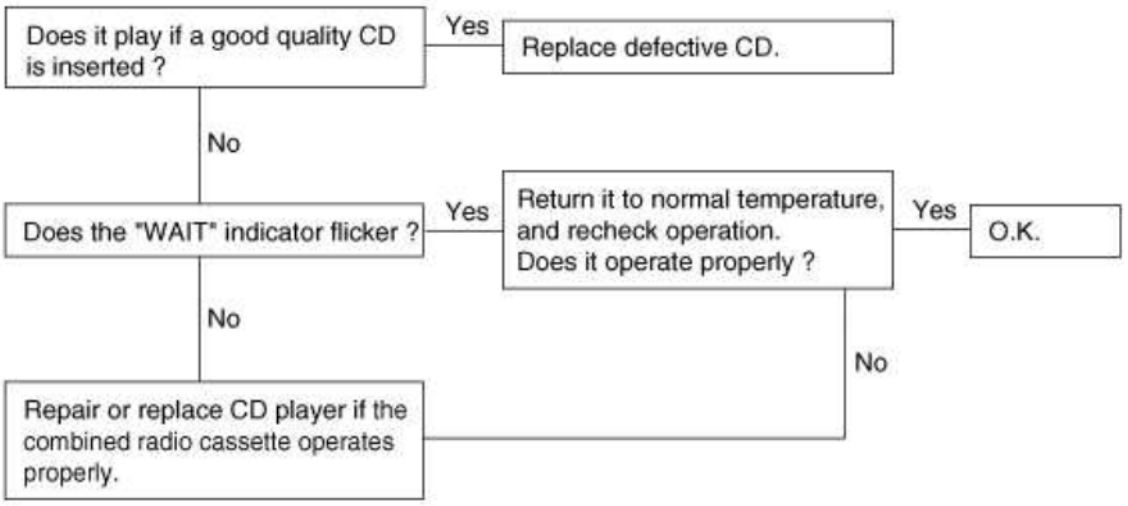
Chart 4

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1. CD WILL NOT BE ACCEPTED



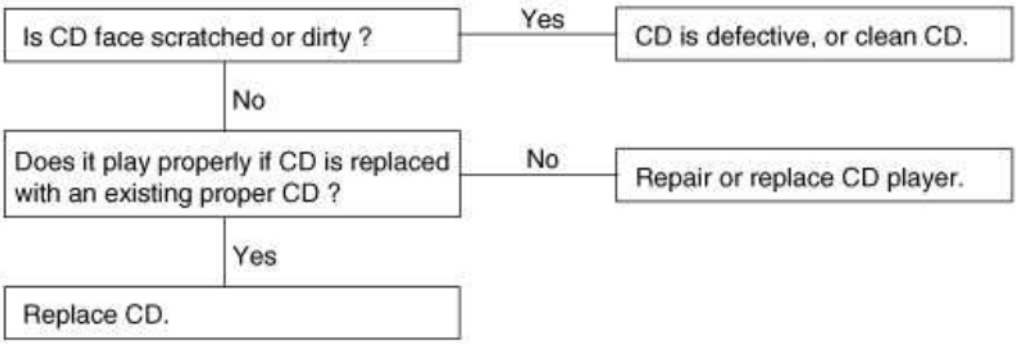
2. NO SOUND



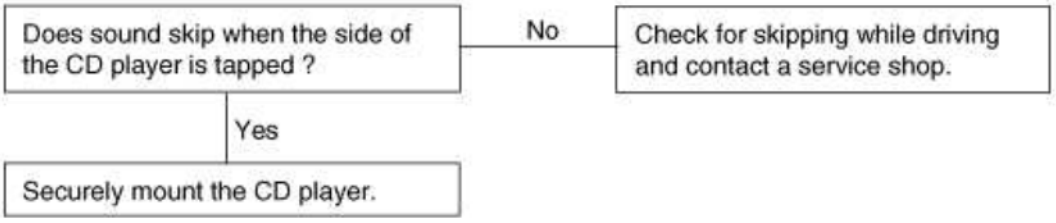
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3. CD SOUND SKIPS

1) Sound sometimes skips when parking.

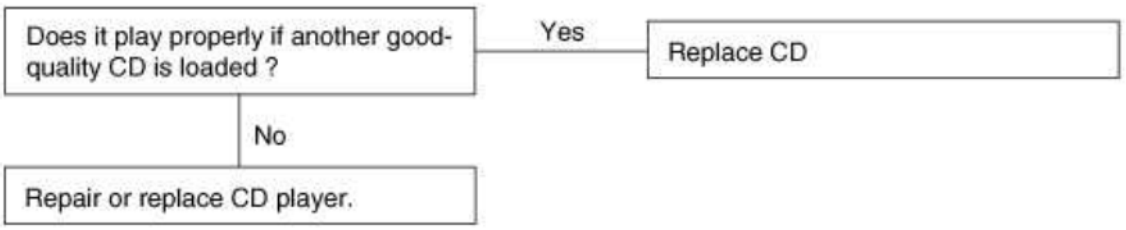


2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)

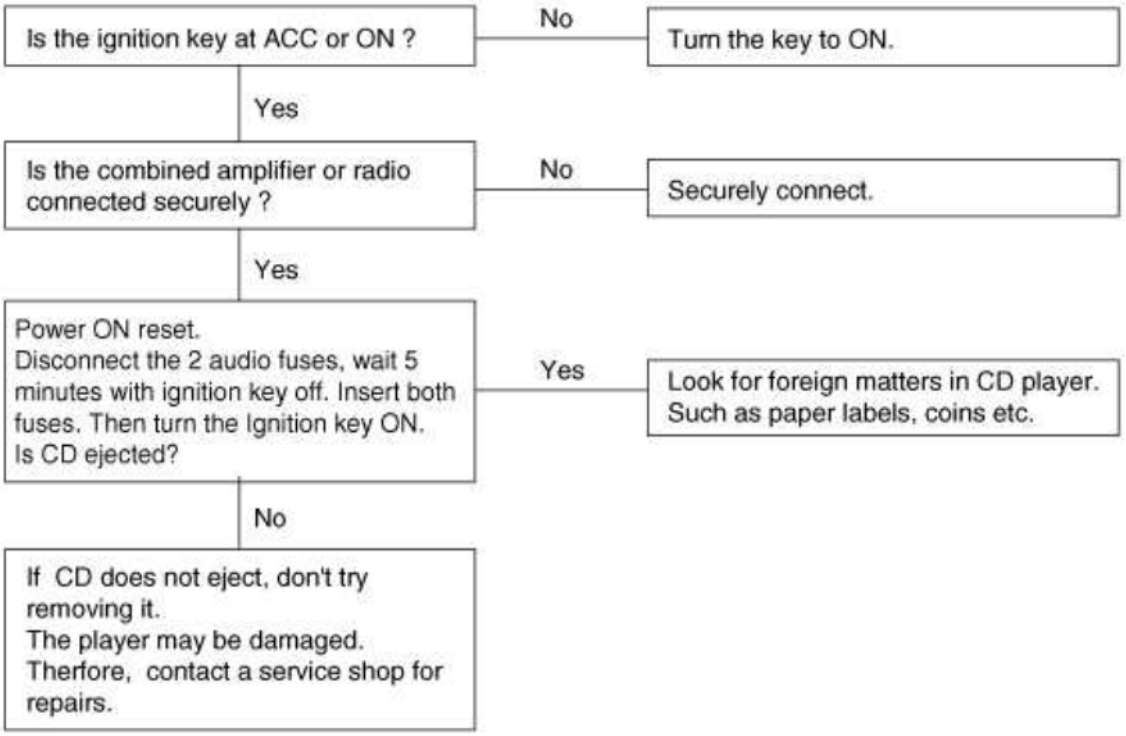


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4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

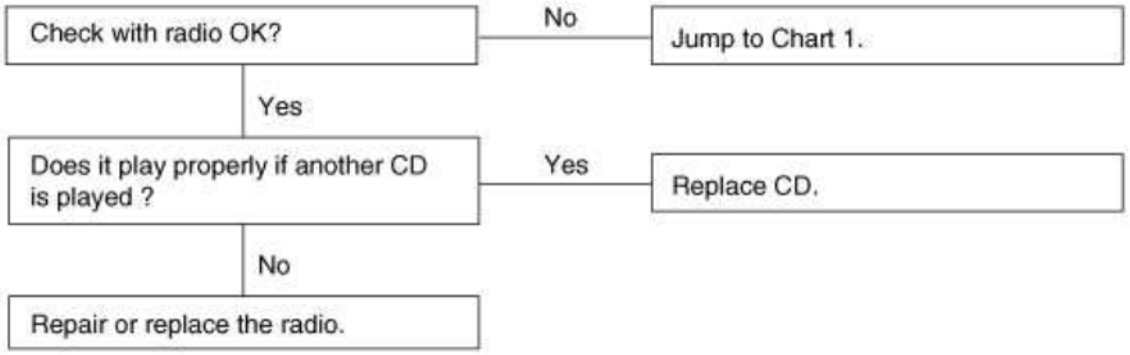


Chart 5

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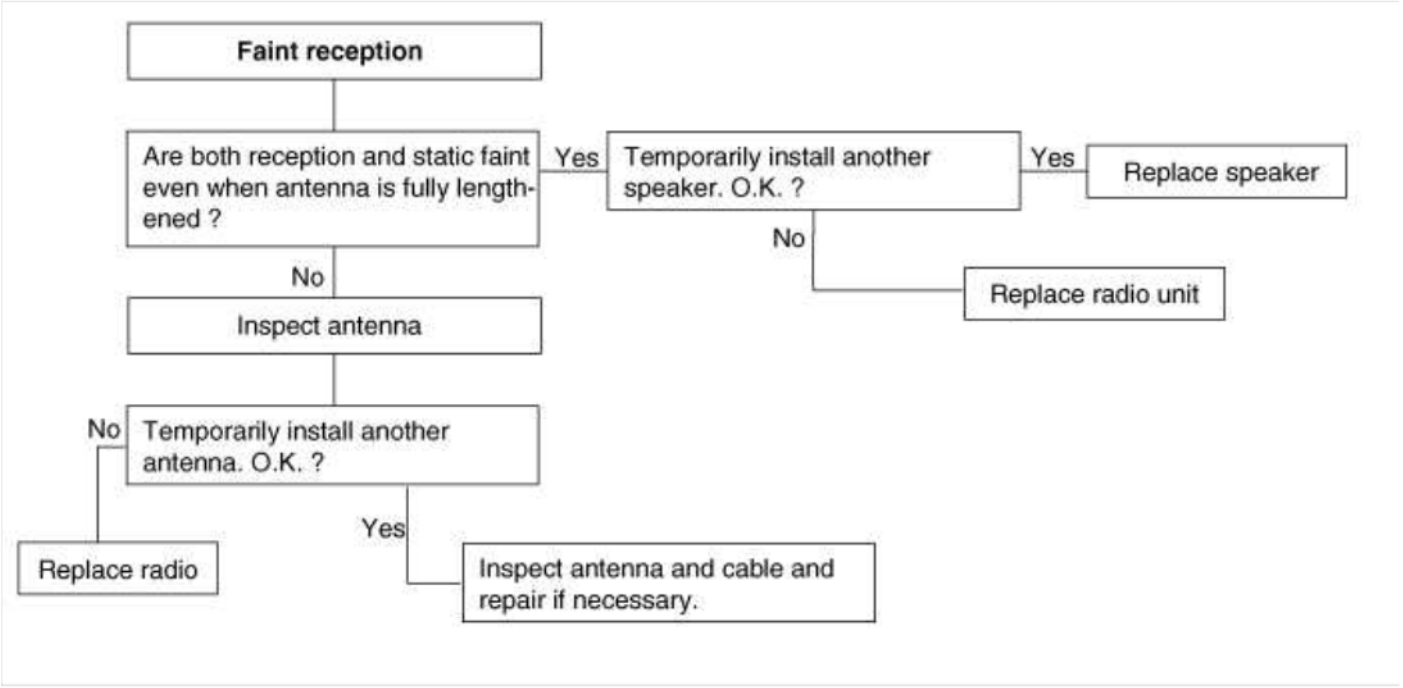


Chart 6

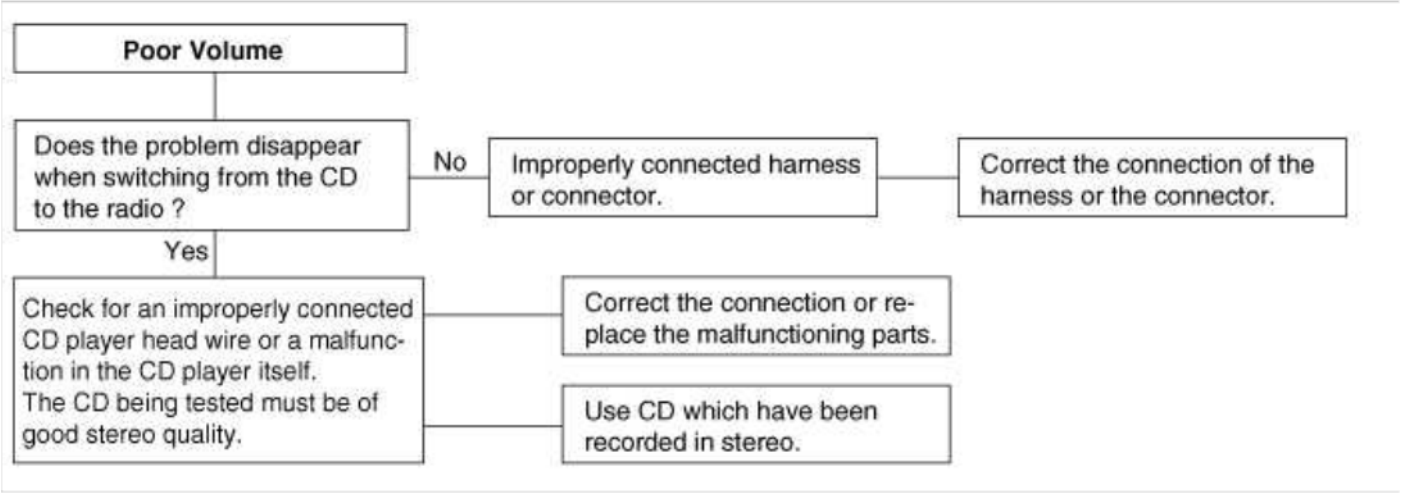
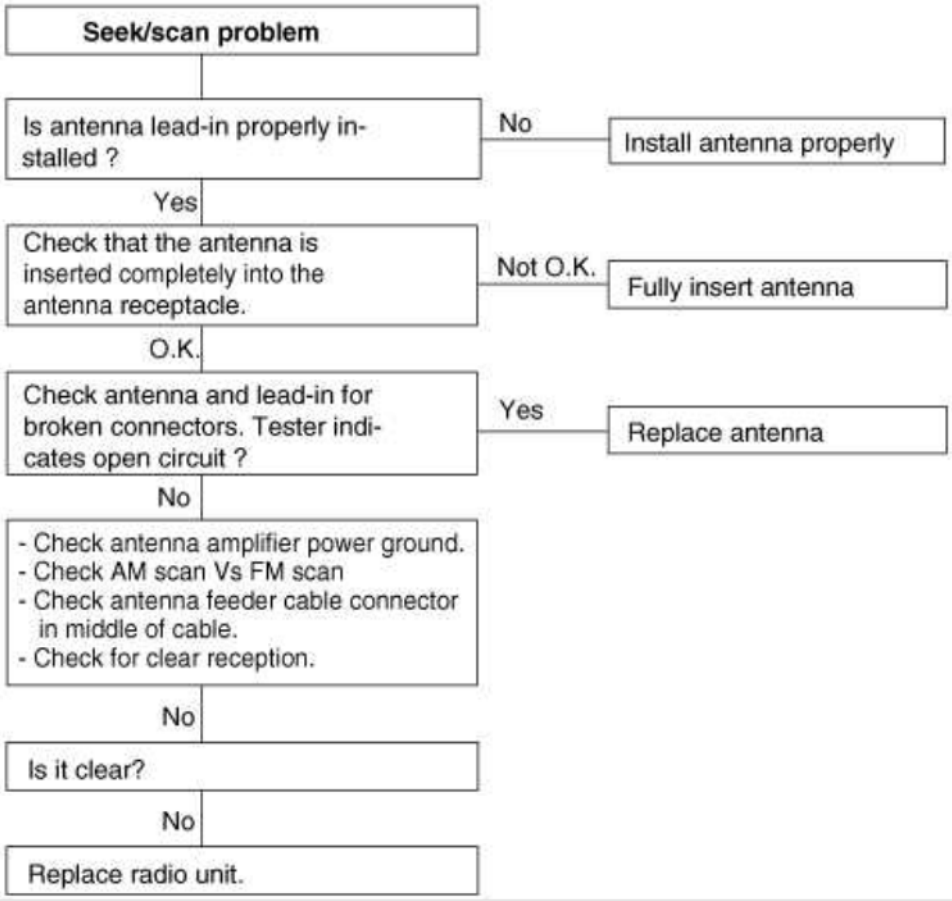


Chart 7

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Body Electrical System

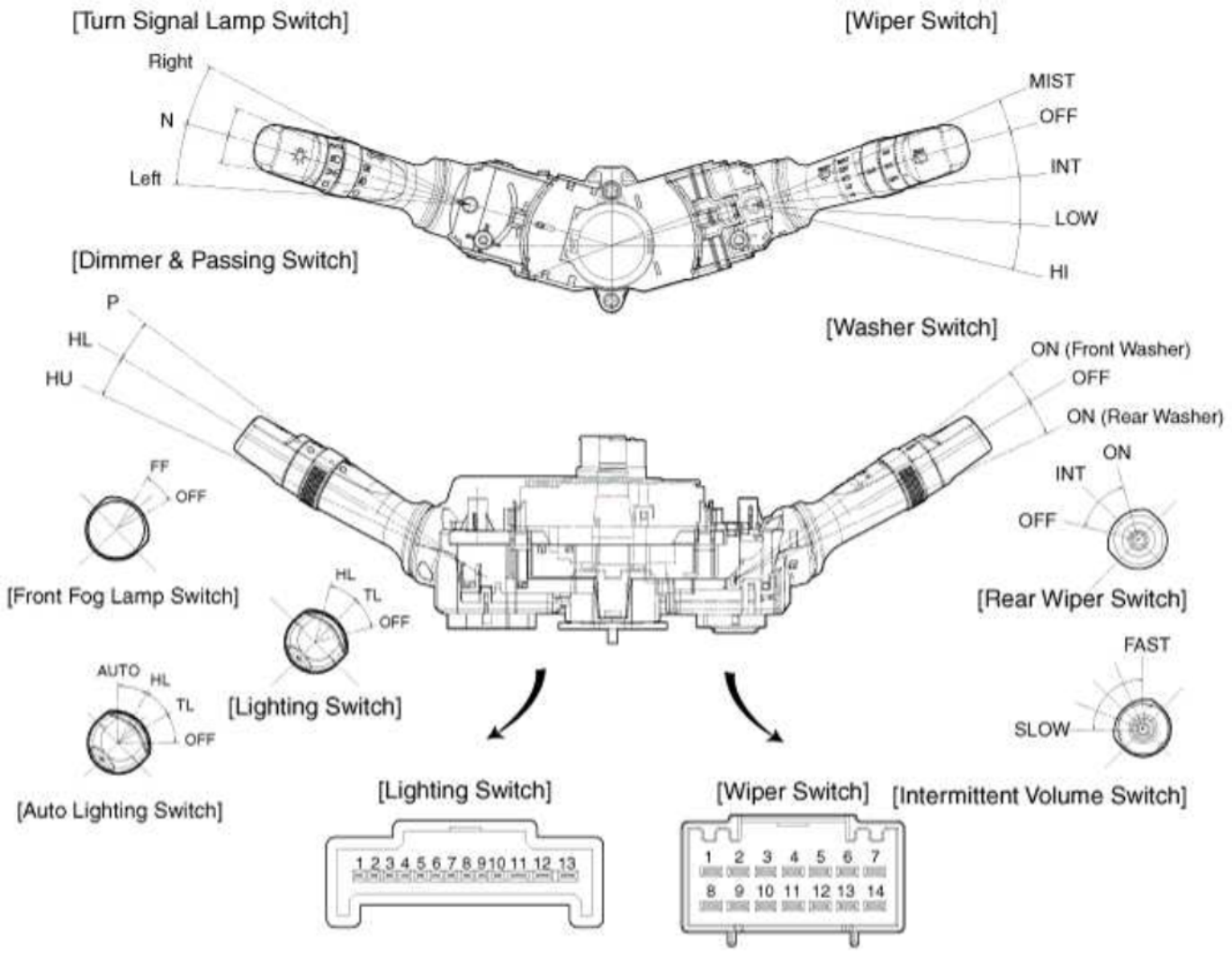
Specifications

Items		Specifications
Rated voltage		DC 12V
Operating temperature range		-22 ~ +176°F (-30°C ~ +80°C)
Rated load	Dimmer & passing switch	High : 1.0A (Relay load) Low : 1.0A (Relay load) Passing : 1.0A (Relay load)
	Lighting switch	Lighting : 1.0A (Relay load)
	Turn signal switch	6.6 ± 0.5A (Lamp load)
	Wiper & mist switch	Low, High : 4.0A (Motor load) Intermittent : 0.22 ± 0.05A (Relay load) Lock : Max. 28A (Motor load) Mist : 4.0A (Motor load) Washer : 4.0A (Motor load)
	Front fog lamp switch	1.0A (Relay load)
	Rear wiper & washer	Wiper : 0.2A (Relay load) Washer : 4.0A (Motor load)

Body Electrical System

Component

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Connector name	No	Description	Connector name	No	Description
Lighting (13 pin)	1	Lighting switch GND	Wiper & Washer (14 pin)	1	Mist switch
	2	Tail lamp switch		2	Wiper parking
	3	Auto light switch		3	Wiper low speed
	4	Head lamp switch		4	-
	5	Fog lamp switch base		5	Rear washer switch
	6	Front fog lamp switch		6	IGN2 (rear wiper & washer)
	7	-		7	Intermittent rear wiper switch
	8	Head lamp low		8	Intermittent wiper switch
	9	Head lamp high		9	Wiper high speed
	10	Dimmer switch base		10	IGN2 (front washer & wiper)
	11	Turn signal left		11	Washer switch
	12	Turn signal base		12	Intermittent volume base
	13	Turn signal right		13	Intermittent time
				14	Rear wiper switch

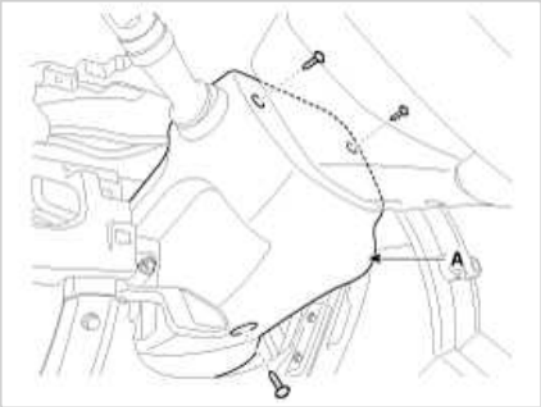
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Body Electrical System

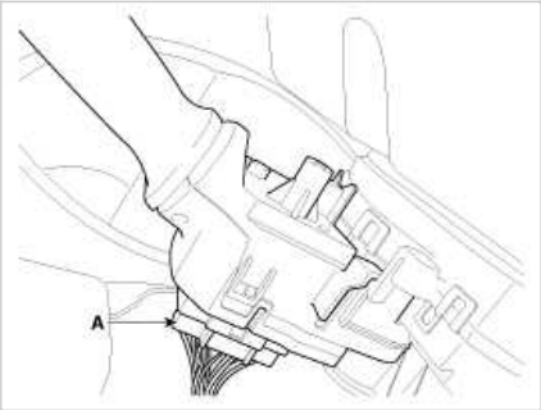
Removal

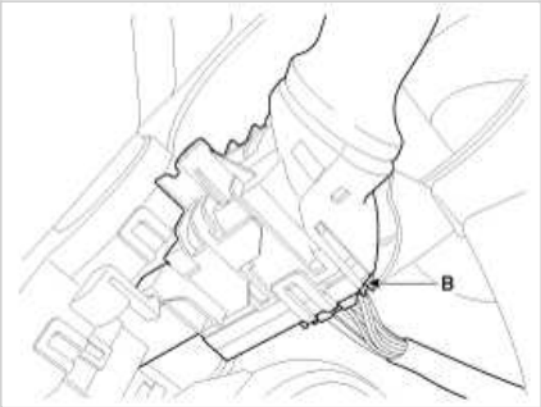
1. Disconnect the negative (-) battery terminal.

2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.



3. Disconnect the light switch connector (A) and the wiper switch connector (B).

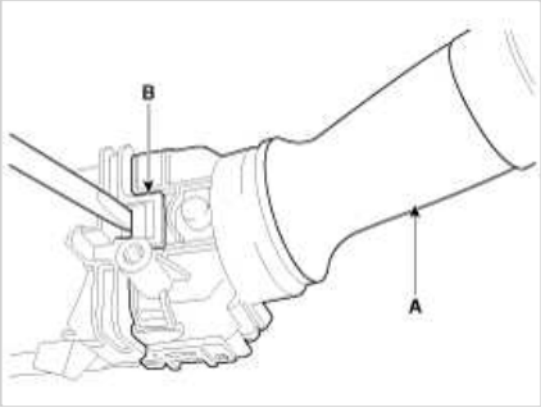




4. Remove the wiper switch (A) by pushing the lock pin (B).

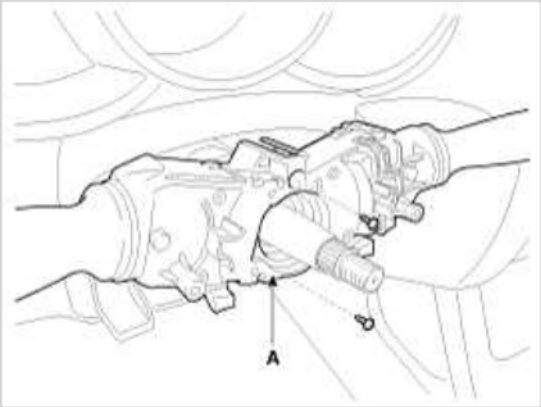
NOTICE

When removing the wiper & washer switch only, release the lock of wiper switch without removing the steering wheel.



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5. Remove the steering wheel.
   (Refer to Steering System - "Steering column and shaft")
6. Remove the clock spring.
   (Refer to Restraint - "Airbag module")
7. Loosen the screws from the multifunction switch assembly (A).



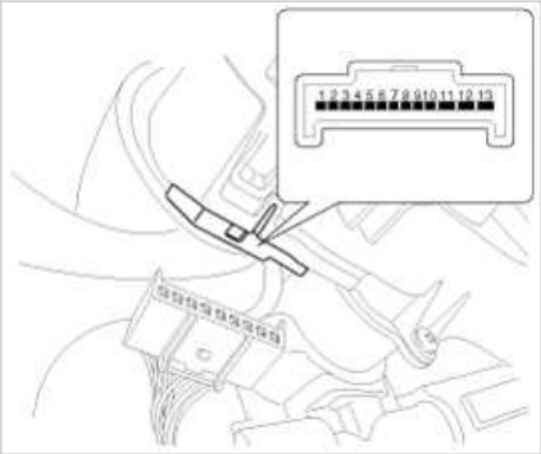
Installation

1. Install the multifunction switch.
2. Install the clock spring and steering wheel.
3. Install the steering column upper and lower shrouds.

Inspection

Lighting Switch Inspection

1. With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch



Lighting switch (Auto light)

Terminal / Position	2	4	3	1
OFF				
Tail Lamp	○			○
Head Lamp	○	○		○
Auto			○	○

Lighting Switch

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Terminal / Position	1	2	4
OFF			
Tail Lamp	○	○	
Head Lamp	○	○	○

Dimmer And Passing Switch

Terminal / Position	1	9	8	10
HU		○		○
HL			○	○
P	○	○		○

HU : Head lamp high beam
HL : Head lamp low beam
P : Head lamp passing switch

Turn Signal Switch

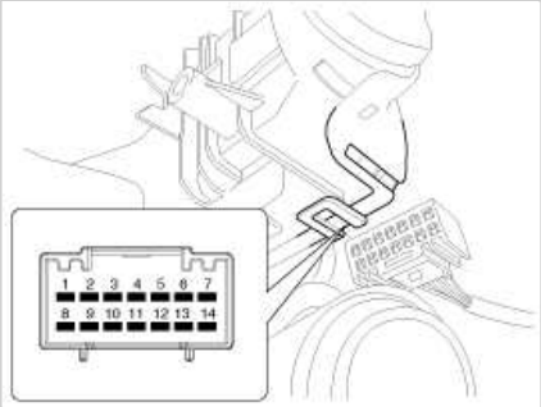
Hazard Switch / Turn Signal Switch \ Terminal		13	12	11
OFF	L		○	○
	N			
	R	○	○	

Front Fog Lamp

Terminal / Position	5	6
OFF		
ON	○	○

Wiper And Washer Switch Inspection

1. With the multi function switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multi-function switch.



Wiper Switch

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Position \ Terminal	3	9	2	8	10	1	12	13
MIST	○	—	○		○	○		
OFF	○	—	○					
INT	○	—	○	○	—		○	○
LOW	○	—	—	—	○			
HI		○	—	—	○			

Washer Switch

Position \ Terminal	10	11
OFF		
ON	○	○

Rear Wiper Switch

Position \ Terminal	6	14	7
INT	○		○
OFF			
ON	○	○	

Rear Washer Switch

Position \ Terminal	6	5
OFF		
ON	○	○

Inspection (With GDS)

1. Check IPM input/output specification of multifunction switch using the GDS. If the specification is abnormal, repl lamp or wiper switch.
2. If diagnosis is required on the multifunction switch, select model and "IPM".

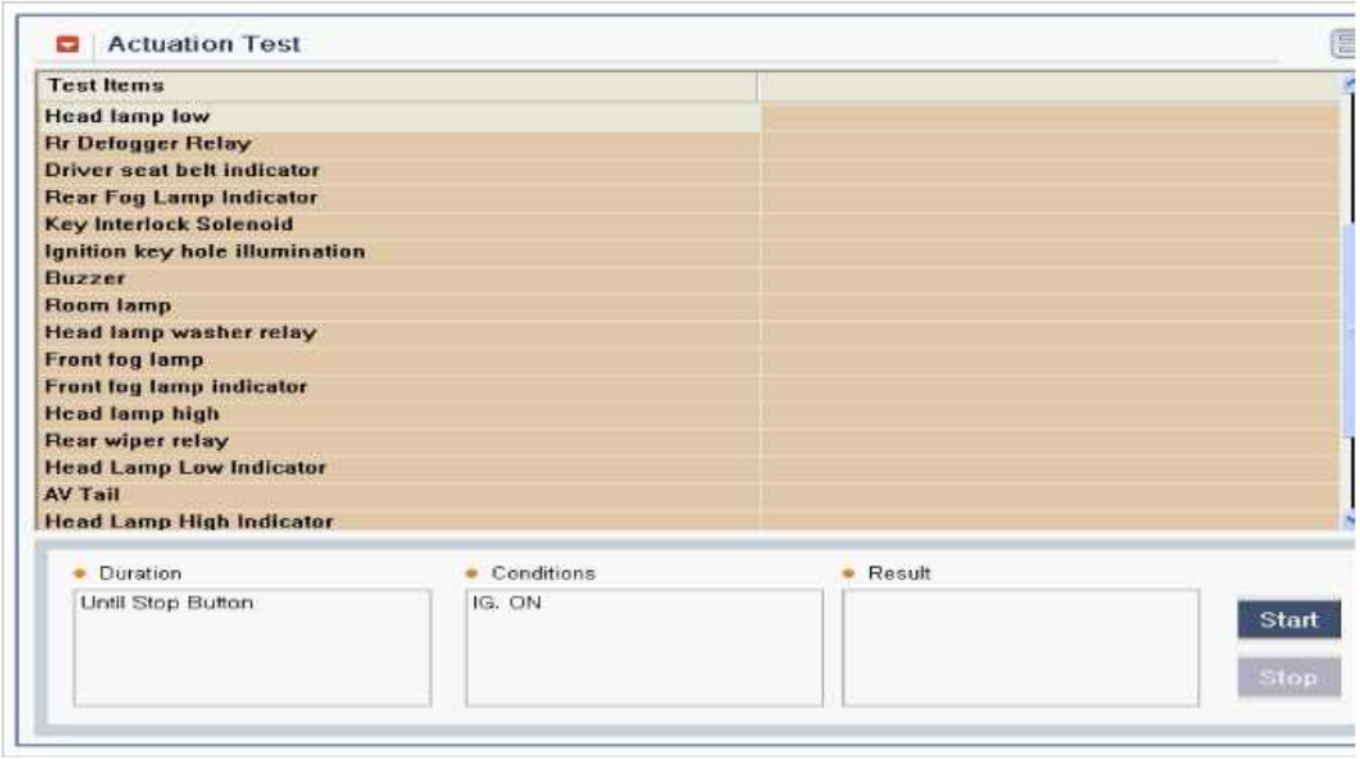


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3. Select "Current data" and check the input/output condition of "Multifunction switch".



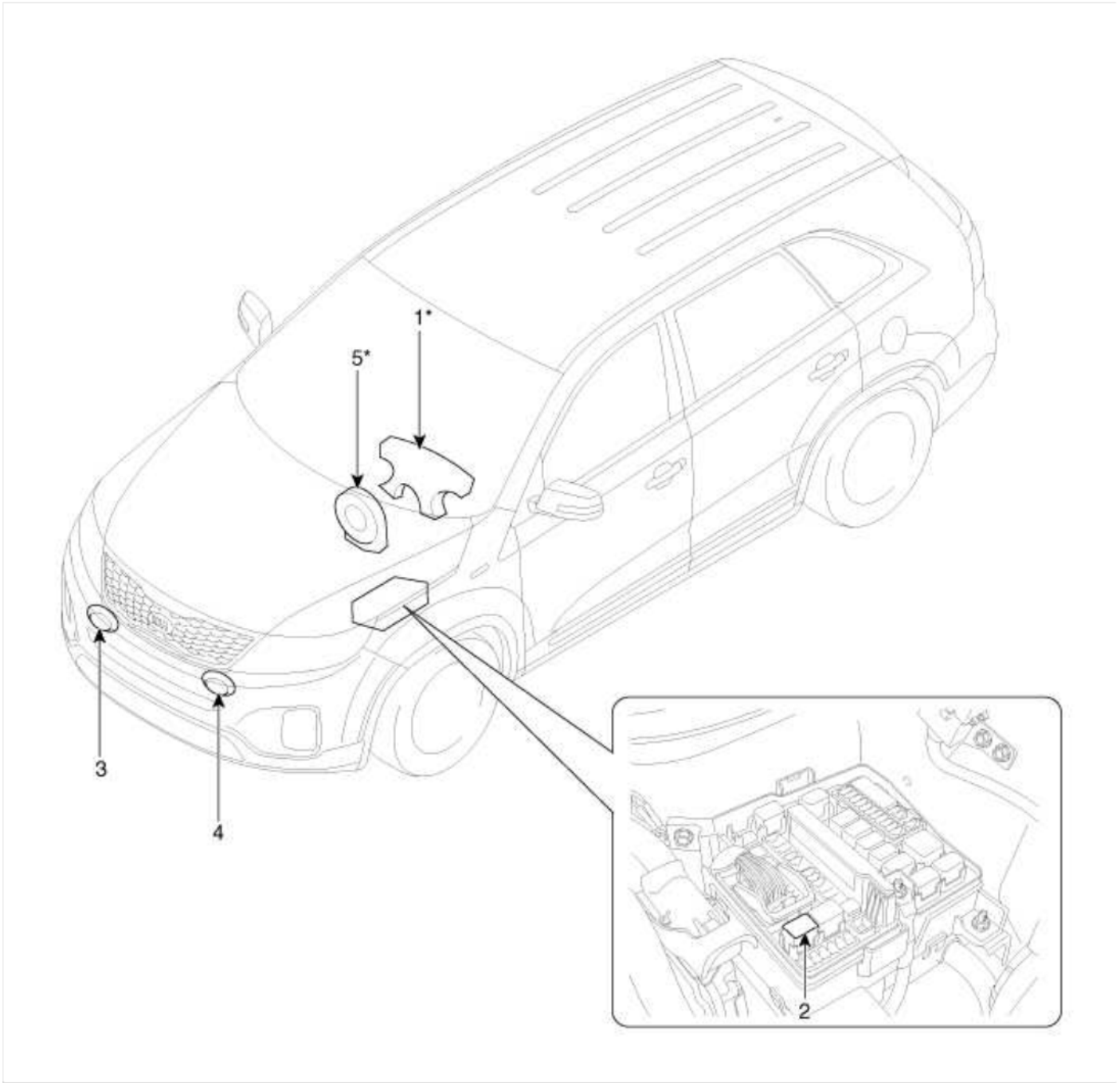
4. To perform test on "Multifunction switch" outputs, select "Actuation test".



Body Electrical System

Component Location

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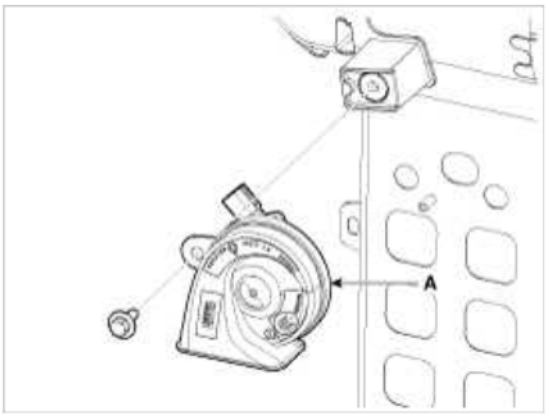
1. Horn switch 2. Horn relay (Engine room compartment) 3. Horn (Low pitch)	4. Horn (High pitch) 5. Clock spring

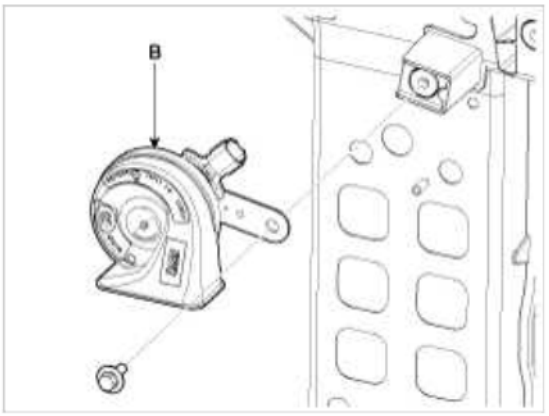
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Removal

1. Remove the head lamp.
   (Refer to "Lighting system")

2. Remove the bolts and disconnect the horn connectors, then remove the high pitch horn (A) and low pitch horn (B





Installation

1. Install the horns after connecting the horn connectors.
2. Install the head lamp.
   (Refer to "Lighting system")

Inspection

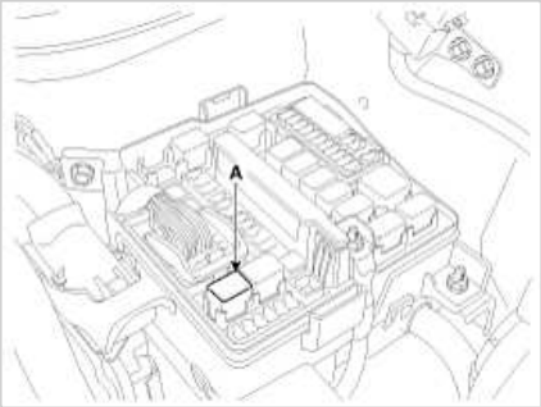
Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The horn should make a sound. If the horn fails to make a sound, replace it.

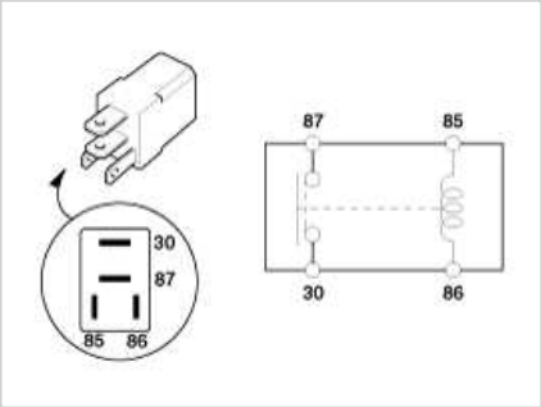
Horn Relay Inspection

1. Remove the horn relay (A) from the engine room relay box.
2. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to th
   No.85 and No.86 terminals.

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3. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



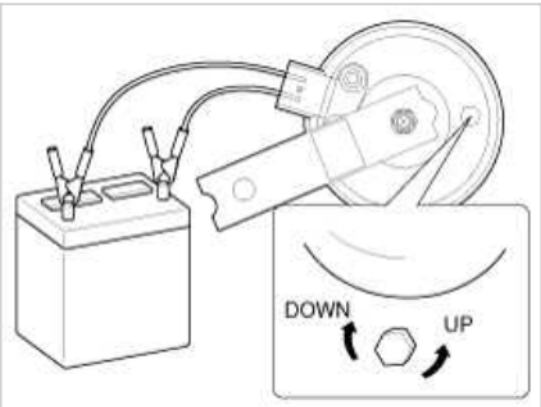


Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Adjustment

1. Operate the horn, and adjust the tone to a suitable level by turning the adjusting screw.

> **NOTICE**
>
> Horn adjustment screw is automatically sealed with silicon sealant.
> The shape and size of the applied sealant is variable and tails or dribbles are acceptable and not to be tampere with.



Body Electrical System

Specifications

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Item	Specification
Power source	DC 14.4V (-) ground
Frequency range / Channel space	FM : 87.5 ~ 107.9 MHz / 200 KHz AM : 530 ~ 1710 KHz / 10 KHz
Tuning type	PLL SYNTHESIZED TUNING
Impedance	2 ohm x 4
Antenna	80 pF 75 ohm
Dark current	MAX 4mA (Head unit only)
S/N	FM : MIN 40 dB AM : MIN 40 dB

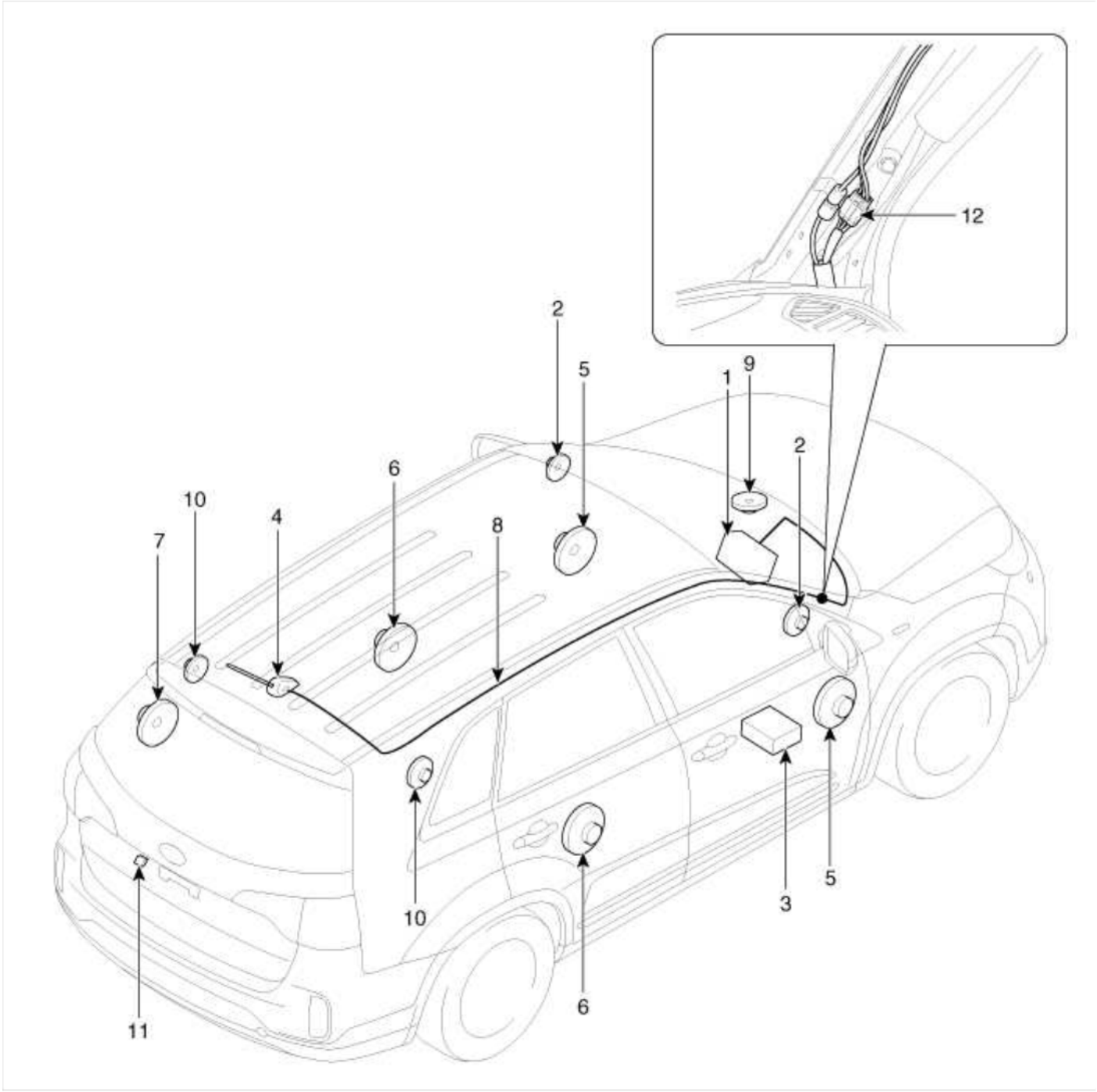
GPS

Item	Specification
Frequency	1.57542 GHz
Sensitivity level	- 144 dbm
Channel	12CH

Body Electrical System

Components Location

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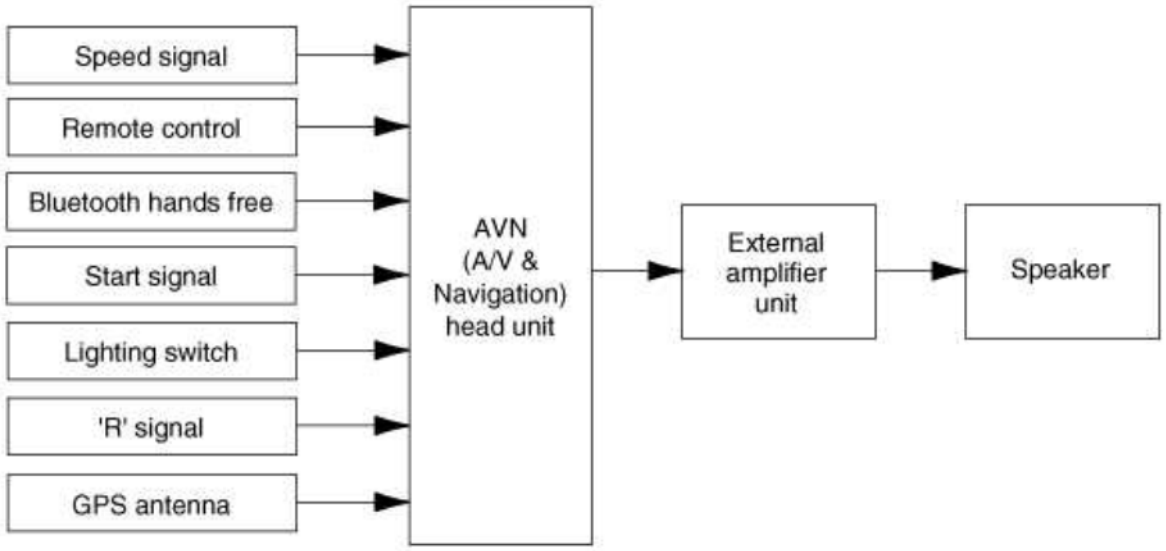


1. AVN (A/V & Navigation) head unit 2. Tweeter speaker 3. External amplifier 4. Roof antenna (Radio+Sirius+GPS) 5. Front door speaker 6. Rear door speaker	7. Subwoofer speaker 8. Antenna feeder cable 9. Center speaker 10. Surround speaker (Option) 11. Back view camera 12. Feeder cable joint connector

Body Electrical System

System Block Diagram

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Body Electrical System

Description

Limitations Of The Navigation system

GPS Signal Reception State

As the GPS satellite frequency is received/transmitted in straight lines, reception may not work if hiding devices are p or near the GPS antenna or when traveling through the following locations.

- Tunnels
- Basement parking structures
- Underneath an overpass
- Roads within forested areas
- Areas near high rise buildings
- Roads within canyons

Vehicle Position Display

1. If multipass errors occur due to reflections from buildings or related causes, the current position mark on the navig may differ from the actual position of the vehicle.
2. The position of the vehicle on the navigation may be different from the actual position if the vehicle is under the oc driving for a short period of time will vehicle through map matching or GPS information (several minutes may be necessary in certain cases).
   A. When driving on a Y-shaped road with a narrow angle, the current position may be displayed in the opposite direction.
   B. If the vehicle is loaded onto a car transport vehicle, the current position mark may be stalled on the last positio to loading.
   C. When driving on a spiral-shaped road.
   D. When driving in mountain regions with sharp turns or sudden brakes.
   E. When entering a road after having been in an underground parking structure, building parking structure, or turn with many rotations.
   F. When the tires have recently been replaced (Especially upon use of spare or studless tires)
   G. If the battery terminal is removed.
   H. When driving in city streets, the current position may be displayed on the opposite side or on an off-road posi
   I. When changing the zoom level from the maximum zoom in level to a different zoom level, the current position may be displayed on a different road.

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J. When driving in heavy traffic with frequent go · stops in traffic or intersections.
K. When driving under slippery conditions, such as heavy sand, snow, etc.
L. When driving with the tire chain in place.
M. When using a tire with an incorrect size specification.
N. When the tire pressure for the 4 tires are different.
O. When the replacement tire is a worn or used tire (Especially studless tires having passed a 2nd seasons, etc.)
P. When driving near high-rise buildings
Q. If a roof carrier has been installed
R. When driving under high speeds or having calculated a long-distance route.

Route Guidance
Suitable route guidance may not occur caused by search conditions or the driving position.

- Guidance to go straight may be given while driving on a straight road.
- Guidance may not be given even when having turned at an intersection.
- There are certain intersections in which guidance may not occur.
- A route guidance signaling entrance into a no enter zone may occur (No enter zone, road under construction, etc.
- Guidance may be given to a position removed from the actual destination if roads to reach the actual destination d exist or are too narrow.
- Faulty voice guidance may be given if the vehicle breaks from the designated route (ex : if a turn is made at an intersection while the navigation provided guidance to go straight).
- Map Data may be missing or incorrect causing route guidance to not be given.

Route Re-calculation
The following phenomena may occur after conducting route recalculation.

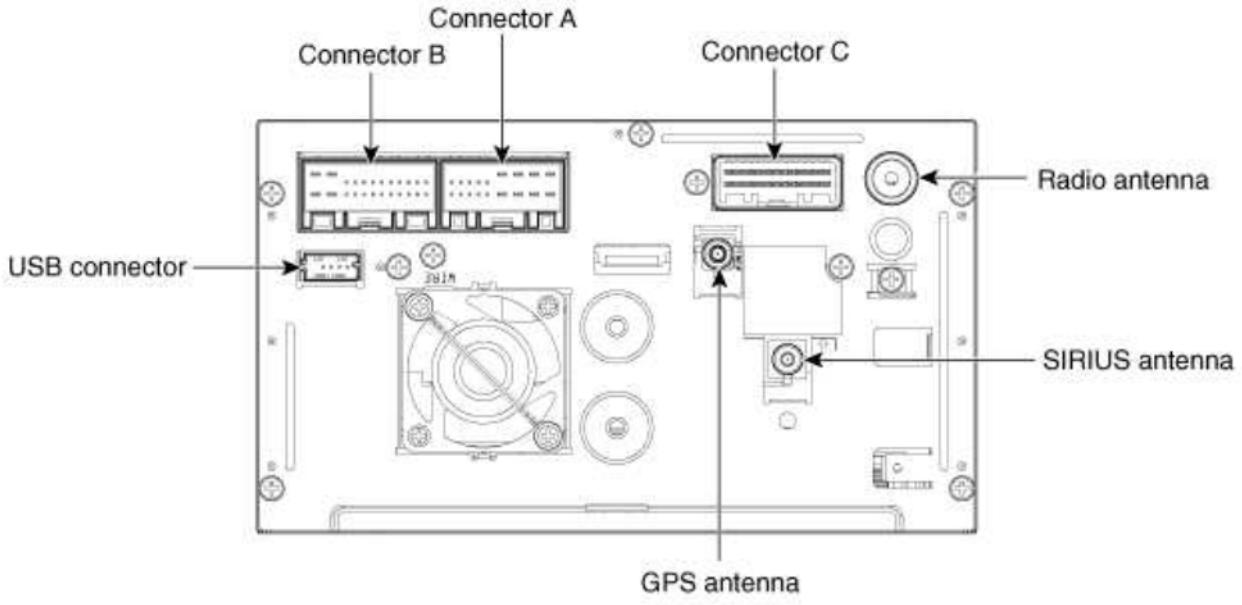
- Guidance may be given to a position differing from the current position when turning at an intersection.
- Route recalculation may take a longer period of time when driving under high speeds.
- A route guidance signaling for a U-Turn in a No U-Turn location may occur.
- A route guidance signaling entrance into a no enter zone may occur (No enter zone, road under construction, etc)
- Guidance may be given to a position removed from the actual destination do not exist or are too narrow.
- Faulty voice guidance may be given if the vehicle breaks from the designated route (ex : if a turn is made at an intersection while the navigation provided guidance to go straight)

Body Electrical System

Components

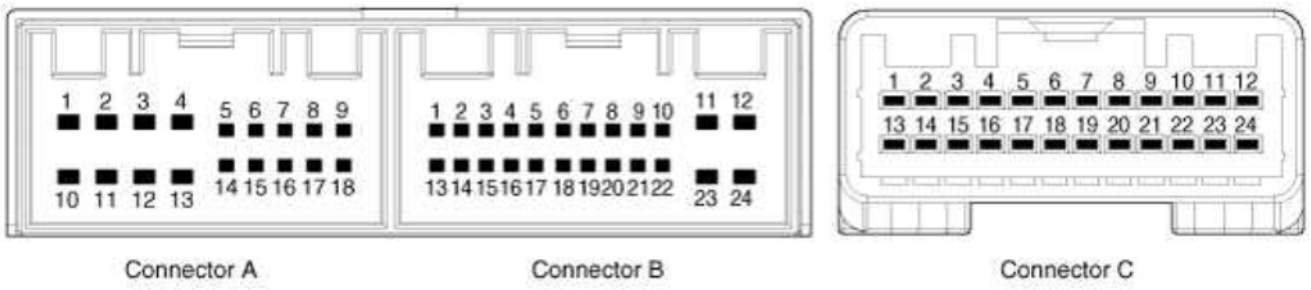
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AVN (A/V & Navigation) Head Unit Connector

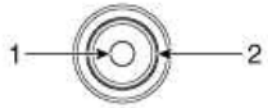
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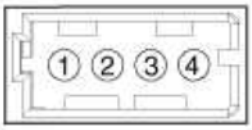


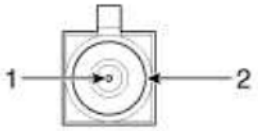
Connector Pin Information

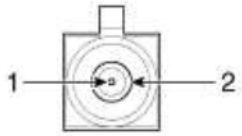
No.	Connector A	Connector B	Connector C
1	-	MM CAN High	-
2	Parking V VIDEO	Ground (Non TMU) / - (TMU)	-
3	Parking V GND	Parking (MT)	-
4	Rear camera shield ground	Steering wheel remocon	-
5	SPDIF ground	-	-
6	SPDIF (+)	-	-
7	ALT L	-	-
8	Illumination (+)	AUX right input	-
9	R position	AUX ground	-
10	-	MIC (+)	Fuel indicator
11	Rear camera power	ACC (+)	Door open
12	Navigation voice (-)	Battery (+)	-
13	Navigation voice (+)	MM CAN Low	-
14	-	Auto light	-
15	SPDIF (-)	P position (AT)	-
16	Door key unlock	Vehicle speed	-
17	Illumination (-)	Key ground	-
18	Antenna remocon power	-	-
19		-	-
20		AUX detect	-
21		AUX left input	-
22		MIC (-)	-
23		Power ground	Ground
24		Power ground	-

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Radio antenna	No.	Description	No.	Description
	1	FM/AM signal	2	Ground

USB connector	No.	Description	No.	Description
	1	USB ground	3	USB D (+)
	2	USB D (-)	4	USB VCC

GPS antenna	No.	Description	No.	Description
	1	GPS signal	2	Ground

SIRIUS antenna	No.	Description	No.	Description
	1	SIRIUS signal	2	Ground

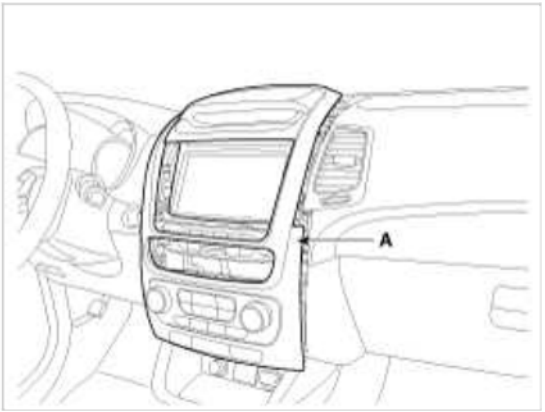
Body Electrical System

Removal

NOTICE

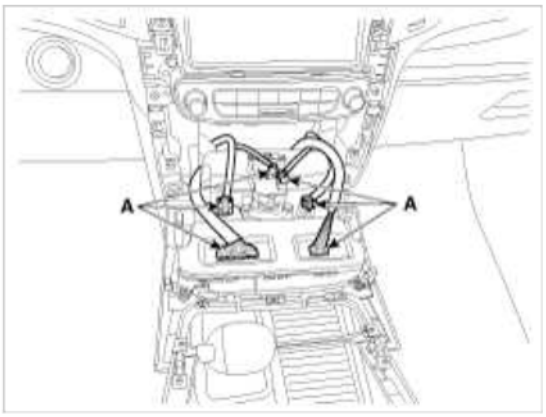
- Take care not to scratch the center fascia panel and related parts.
- Eject all the disc before removing the AVN head unit to prevent damaging the CD player's load mechanism.

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia panel (A).
   (Refer to Body - "Crash pad")

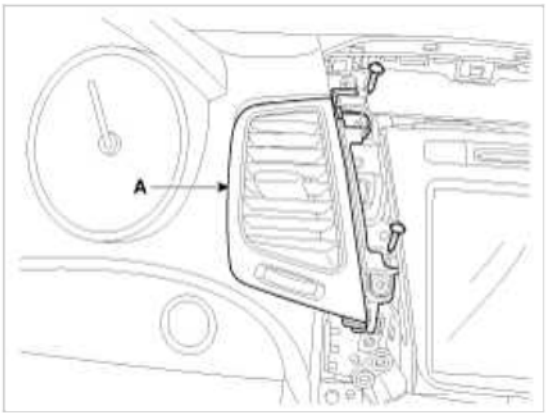


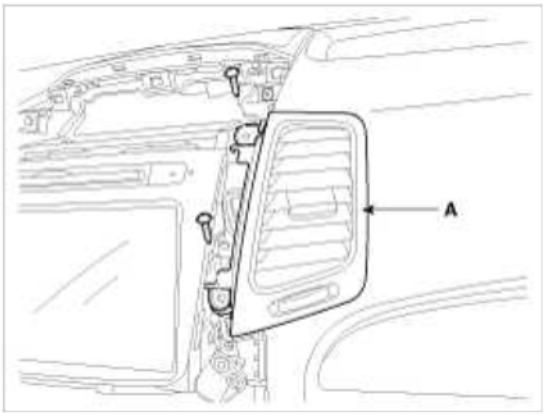
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3. Disconnect the connectors and cables (A) from center fascia panel.

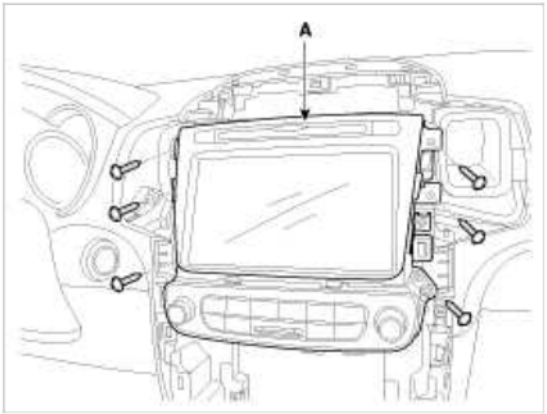


4. Remove the crash pad center air vent (A).



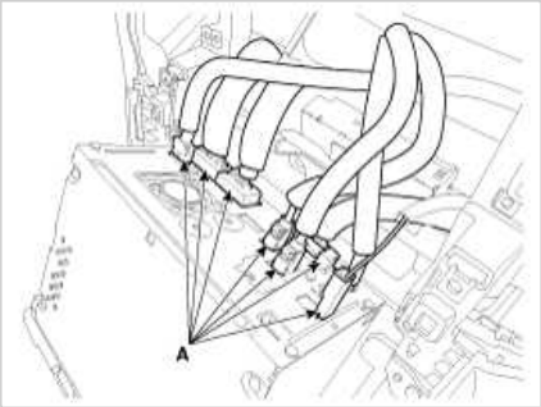


5. Remove the AVN head unit (A) after loosening the mounting screws.



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6. Remove the AVN head unit after disconnecting connectors and cables (A).



NOTICE

- If CD does not eject, don't try to remove it.
- The CD player may get damaged.
- Contact the nearest Hyundai Dealer for assistance.

Installation

1. Connect the AVN head unit connectors and cable.
2. Install the AVN head unit.
3. Install the center air vent duct and center fascia panel.
4. Connet the negative (-) battery terminal.

NOTICE

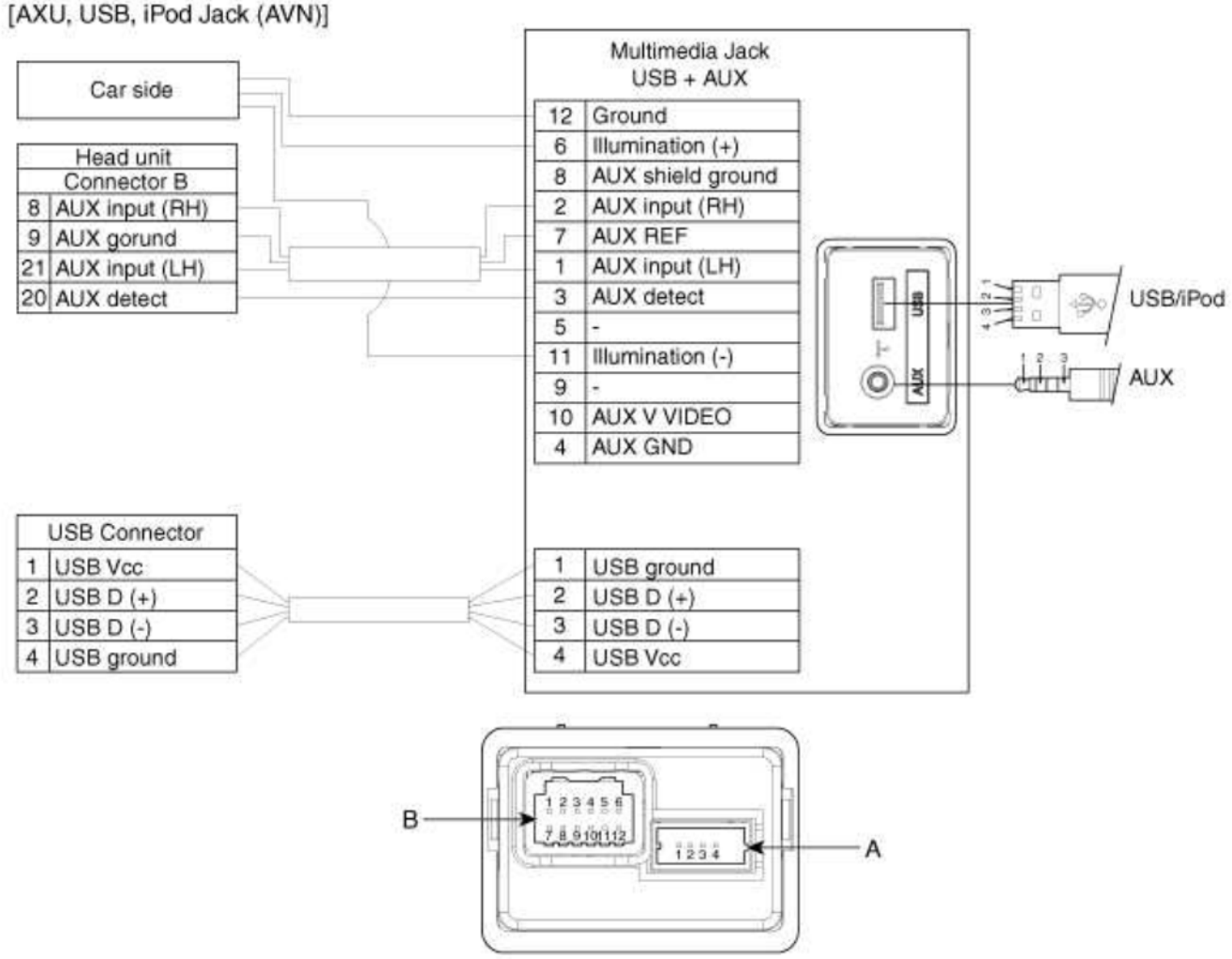
Make sure the AVN Head unit connectors are plugged in properly and the antenna cable is connected properly.

Body Electrical System

Circuit Diagram

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[AXU, USB, iPod Jack (AVN)]



Connector A	No.	Description
① ② ③ ④	1	USB ground
	2	USB D(+)
	3	USB D(-)
	4	USB Vcc

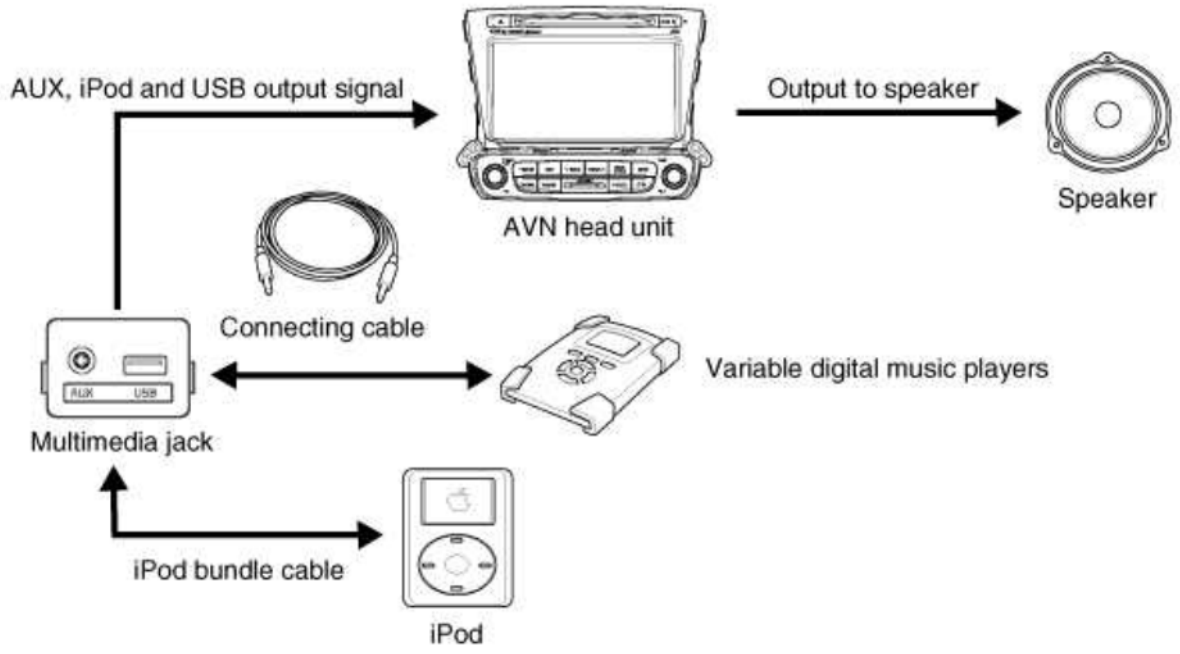
Connector B	No.	Description
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ 10 11 12	1	AUX input (LH)
	2	AUX input (RH)
	3	AUX detect
	4	AUX VIDEO
	5	-
	6	Illumination (+)
	7	AUX REF
	8	AUX Shield GND
	9	-
	10	AUX VIDEO GND
	11	Illumination (-)
	12	Ground

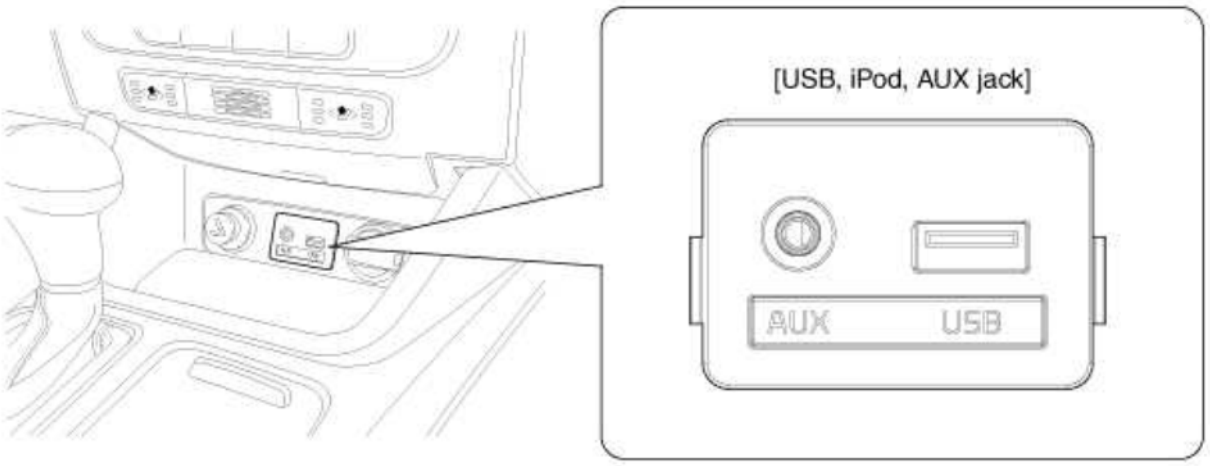
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Body Electrical System

Description

The multimedia jack on the console upper cover is for customers who like to listen to external portable music players MP3, iPod and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added op In case of distortions from media connected to the AUX source, the audio unit may not be defective but the output le the used media does not match the specification of the AUX input.





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Removal

CAUTION

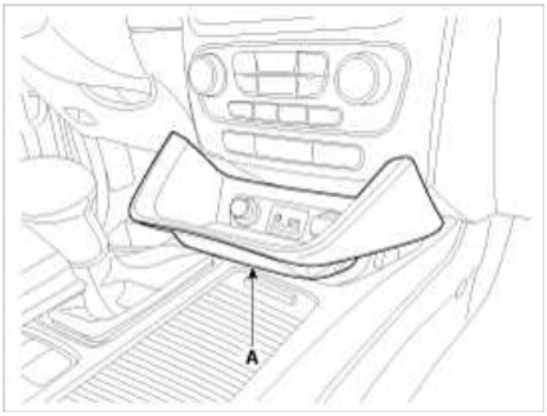
Put on gloves to protect your hands.

Information

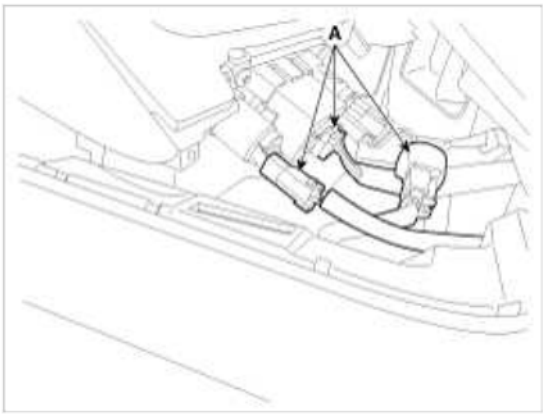
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the relate parts, to prevent damage.
- Use a plastic panel removal tool to remove interior trim pieces to protect from marring the surface.
- Take care not to bend or scratch the trim and panels.

1. Disconnect the negative (-) battery terminal.

2. Remove the floor console upper tray (A).
   (Refer to Body - "Console")



3. Disconnect the connectors and cables (A) from the floor console upper tray.



4. Remove the Multimedia Jack (A) after disengaging the hook.



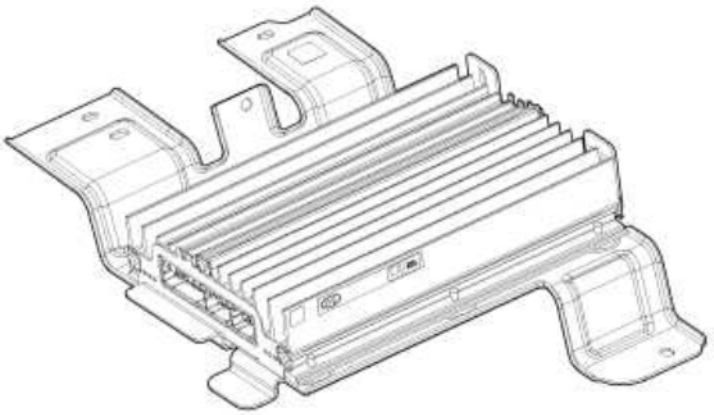
Installation

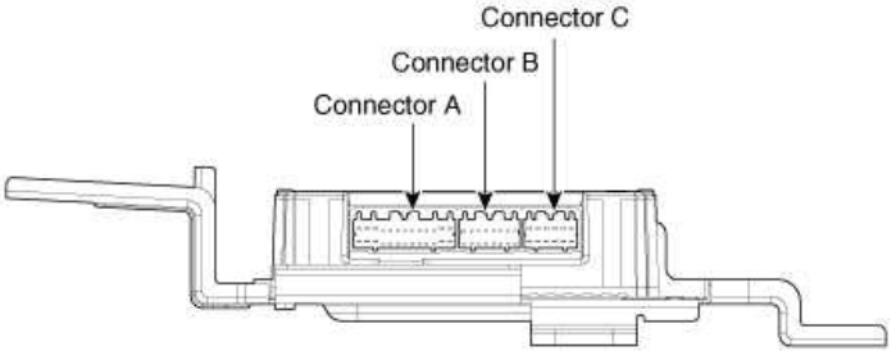
1. Install the Multimedia jack.
2. Install the console upper cover.

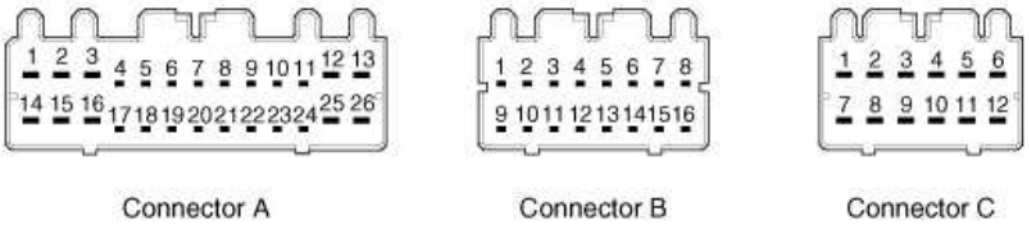
Body Electrical System

Components

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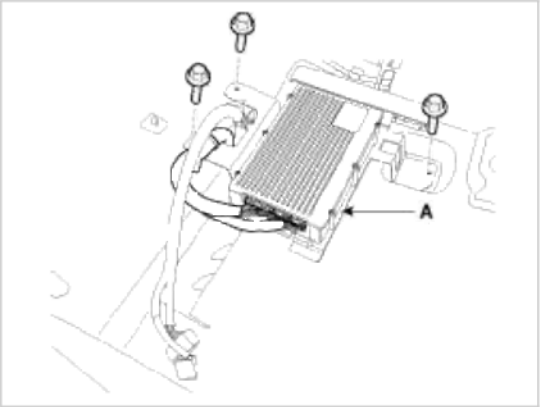
Connector Pin Information

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No.	Connector A (26 pin)	Connector B (16 pin)	Connector C (12 pin)
1	Battery +	Right surround speaker +	Rear right door +
2	Battery +	Left surround speaker +	Rear left door speaker +
3	Battery +	-	Front right tweeter speaker +
4	-	-	Front left tweeter speaker +
5	CAN +	-	Front right door speaker +
6	CAN -	-	Front left door speaker +
7	ACC	Front center speaker +	Rear right door speaker -
8	IGN 1	-	Rear left door speaker -
9	-	Right surround speaker -	Front right tweeter speaker -
10	-	Left surround speaker -	Front left tweeter speaker -
11	Navigation voice +	-	Front right door speaker -
12	Subwoofer 2 +	-	Front left door speaker -
13	Subwoofer 1 +	-	
14	Ground	-	
15	Ground	Front center speaker -	
16	Ground	-	
17	-		
18	SPDIF +		
19	SPDIF -		
20	SPDIF ground		
21	-		
22	-		
23	-		
24	Navigation voice -		
25	Subwoofer 2 -		
26	Subwoofer 1 -		

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1. Remove the passenger seat assembly.
   (Refer to Body - "Front Seat Assembly")
2. Remove the external amplifier (A) after disconnecting the connectors and loosening the mounting bolts (3EA).



Installation

External Amplifier

1. Install the external amplifier after connecting the connector.
2. Install the passenger seat assembly.

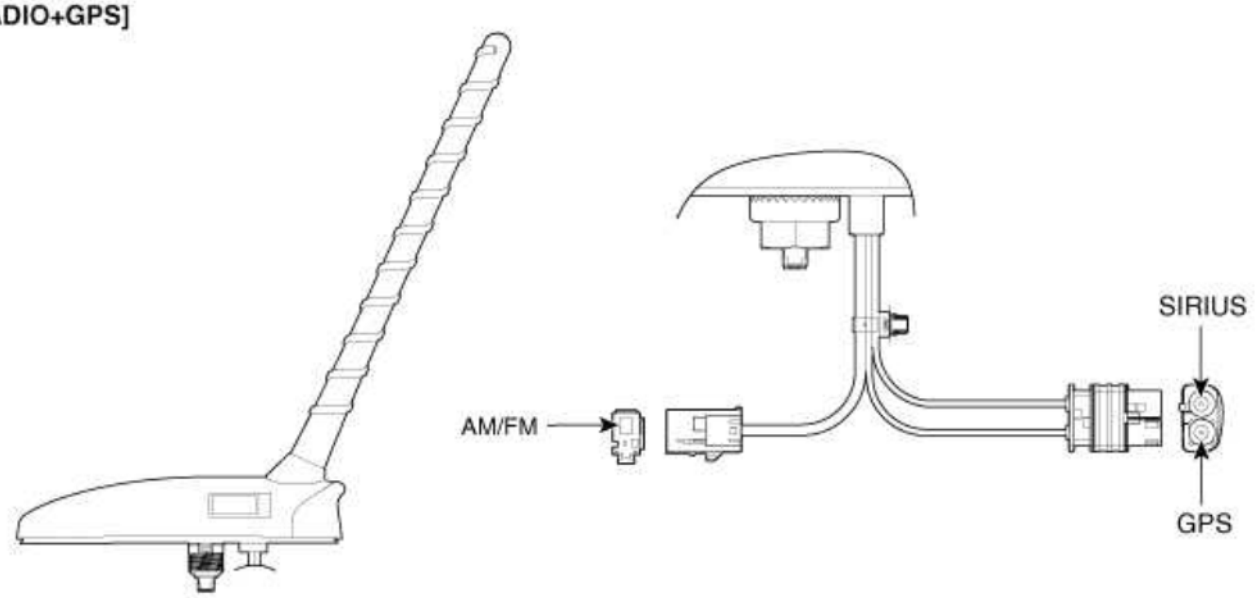
> **NOTICE**
>
> - Make sure the speaker and related connectors are plugged in properly.

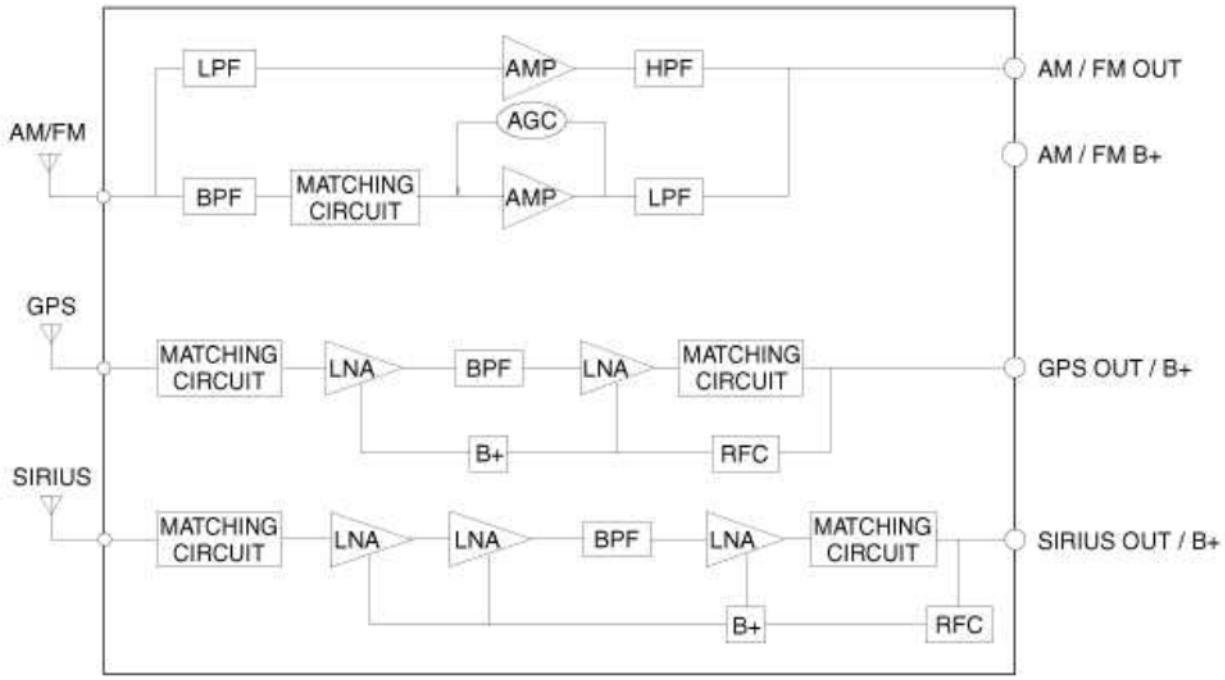
Body Electrical System

Components

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[RADIO+GPS]





※ LPF : Low Pass Filter
HPF : High Pass Filter
BPF : Band Pass Filter
LNA : Low Noise Amplifier
RFC : Radio Frequency Choke
AGC : Automatic Gain Control

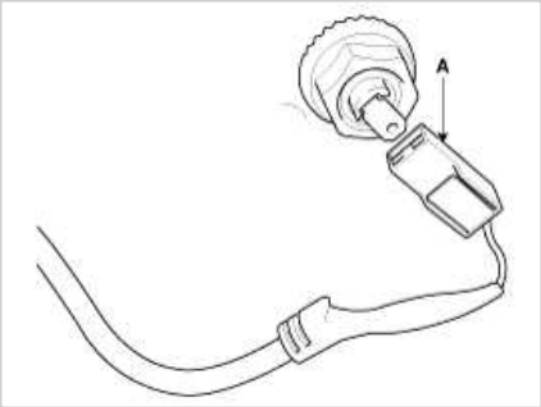
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Body Electrical System

Removal

1. Remove the rear roof trim.
   (Refer to Body - "Roof Trim Assembly")

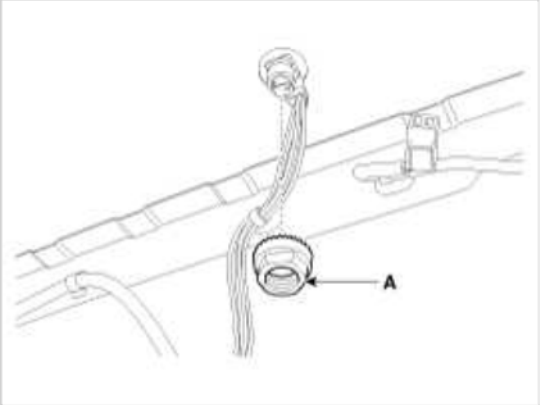
2. Disconnect the power cable (A).

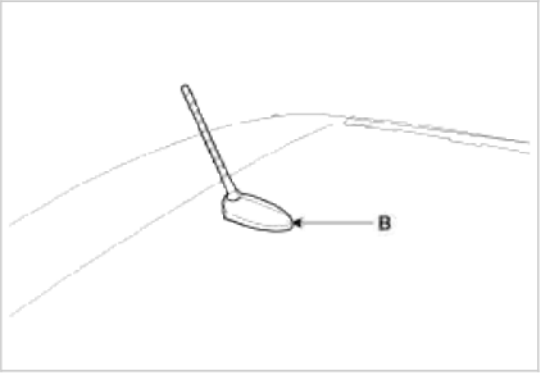


3. Disconnect the connectors (A) from the roof antenna.



4. Remove the roof antenna (B) after removing a nut (A).





Installation

1. Connect the roof antenna connectors.

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2. Install the rear roof trim.

NOTICE

- Make sure that the cables and connectors are plugged in properly.
- Check the audio system.

Body Electrical System

Troubleshooting Guide

Before Thinking The Product Has Malfunctioned

1. Errors which occur during the operation or installation of the device may be mistaken as a malfunction of the actua device.
2. If you are having problems with the divice, try the suggestions listed below.
3. If the problems persist, contact your point of purchase or the nearest service center.

Problem	Function
There are small red, blue, or green dots on the screen	Because the LCD is manufactured with technology requiring high point d a pixel deficiency or lighting may occur within 0.01% of total pixels.
The sound or image is not working	• Has the switch for the vehicle been turned to [ACC] or [ON]? • Has the SYSTEM been turned OFF?
The video is being displayed but sound is not working	• Has the volume been set to a low level? • Has the volume been set on mute?
When the power is turned on, the corners of the screen are dark	• The display looking somewhat darker after prolonged periods of use normal phenomenon with LCD panels. It is not a malfunction. • If the screen is very dark, contact your point of purchase or the neare service center.
Sound is working from only one speaker	• Is the position of FAL/BAL sound controls or volume adjusted to onl side?
Sound and video does not work in AUX mode	Is the audio and video connector jacks fully inserted into the AUX termi
The external device is not working	Is the external device connected with a standard connector cable?
The road is missing	Some map data may be missing or incorrect.
The road name is spoken incorrectly	The TTS(Text To Speech) engine speaks the street name based off of th phonetic spelling. This will continuously be update with the map datebase.

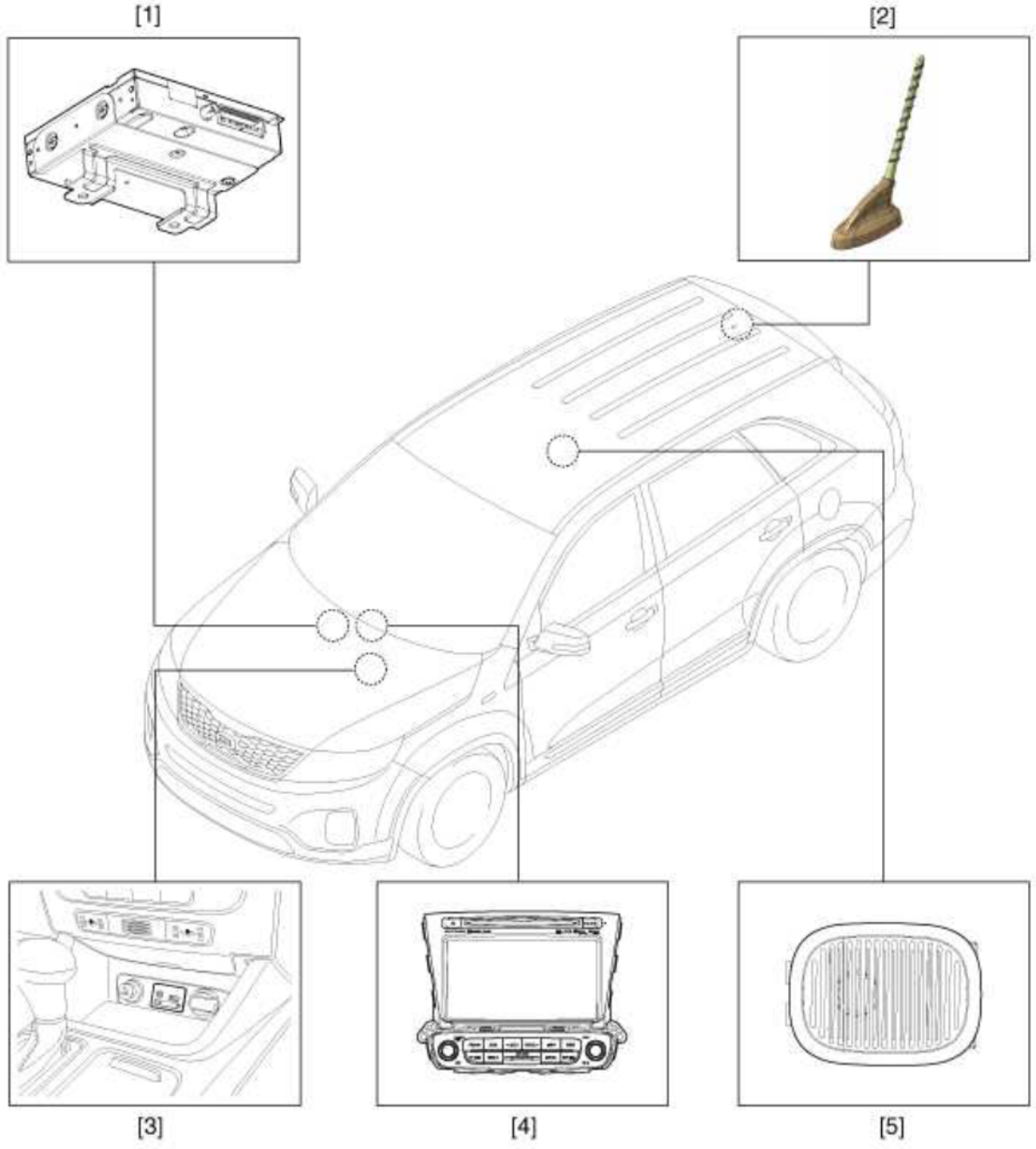
Troubleshooting

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Problem	Possible Cause	Solution
The power does not turn on.	The fuse is disconnected.	Replace with a suitable fuse. If the fuse is disconnecte please contact your point of purchase or service cente
	Device is not properly connected.	Check to see that the device has been properly conne
The CD does not play.	The DISC has not been inserted or has been inserted upside down.	Insert the disc properly so that the sides are facing the correct direction.
	The DISC has been contaminated.	Wipe dirt dirt and other foreign substances from the I
	The vehicle battery is low.	Charge the battery. If the problem persists, please cor your point of purchase or service center.
	A disc which is not supported by the device has been inserted.	Insert a disc which is supported for play by the device
The sound does not work.	• The volume level is set the lowest level. • The connector is not properly connected. • The device is currently fast-forwarding, rewinding, scanning, or playing in slow mode.	• Adjust the volume level. • Check the connection state. • The sound will not work when the device is fast-forwarding, rewinding, scanning, or playing in slow
The sound or video quality is low.	• The DISC is dirty or scrached. • Vibration is occuring from the position in which the conversion switch has been installed. • The color and tone quality of the image is low.	• Wipe off water or dirt from the DISC. Do not use which has been scrached. • The sound may be short-circuited and the image d if the device begins to vibrate. The device will retu normal operation once the vibration has stopped. • Aging of the video display and deterioration in performance may cause certain quality degradation
The USB does not work.	• USB memory is damaged. • USB memory has been contaminated. • A separately purchased USB HUB is being used. • A USB extension cable is being used. • A USB which is not a Metal Cover Type USB Memory is being used. • A HDD type, CF, SD Memory is being used. • There are no music files which can be played.	• Please use after formatting the USB into FAT 12/1 format. • Remove any foreign substances on the contact sur the USB memory and multimedia terminal. • Directly connect the USB memory with the multim terminal on the vehicle. • Directly connect the USB memory with the multim terminal on the vehicle. • Use a standard USB memory. • Use a standard USB memory. • Only MP3, WMA file formats are supported. Plea only the supported music file formats.
The iPod is not recognized even though it has been connected.	• There are no titles which can be played. • The iPod firmware version has not been properly updated. • The iPod device does not recognize downloads.	• Use iTunes to download and save MP3 files into t iPod. • Use iTunes to update the firmware version and rec the iPod with the device. • Reset the iPod and reconnect with the device.

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Components



1. Telematics unit (TMU) 2. Roof Antenna (GPS) 3. AUX jack	4. AVN head unit 5. Mic

Body Electrical System

Description

The Vehicle Information System is a Telematics service that ensures comfortable and enjoyable driving by providing s security, and vehicle diagnostic information, with the option of using your smartphone.

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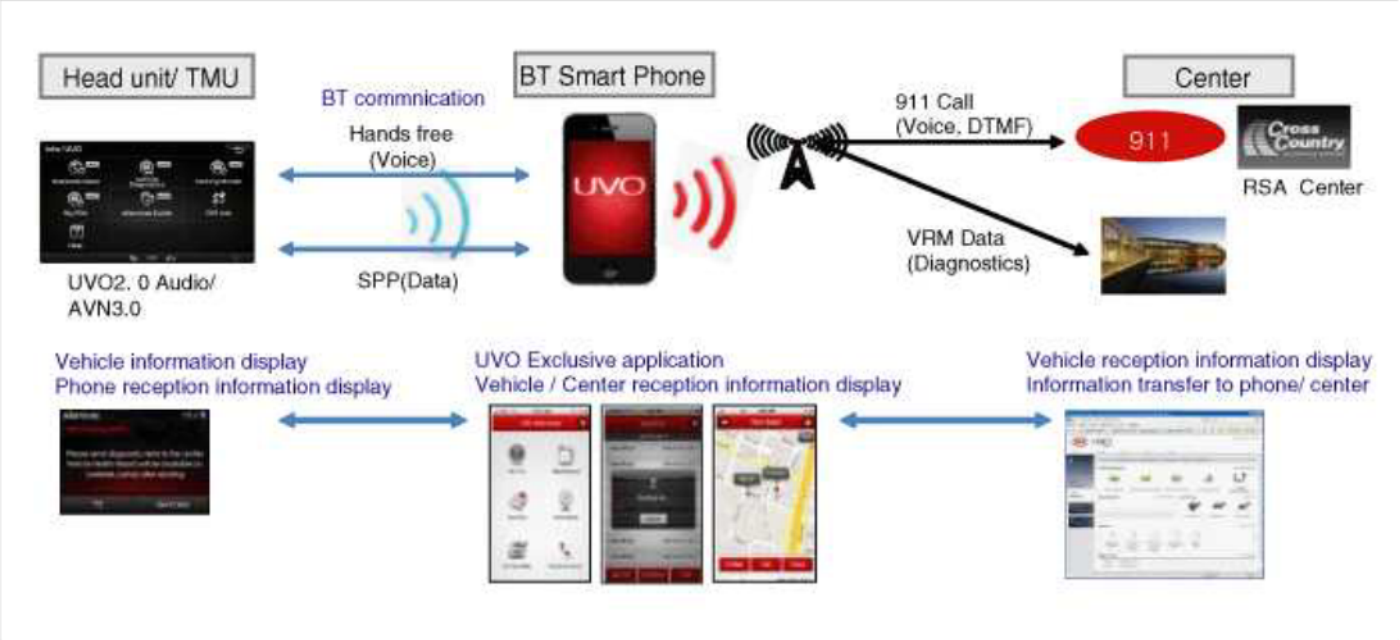
NOTICE

The term "Telematics" is a combination of telecommunication and informatics. The Telematics system uses an assorti communication devices mounted on the vehicle to analyze various vehicle and driving conditions and keep driving sa convenient.

Main Features

- The Telematics system's goals are safety, diagnostics, vehicle management, and driving support.
- eServices via smartphone apps
- Features bi-directional communication between UVO2.0/AVN3.0 devices and smartphones, and between smart and the call center. An audio/AVN head unit is provided and the system supports both smartphone-links and independent operation.

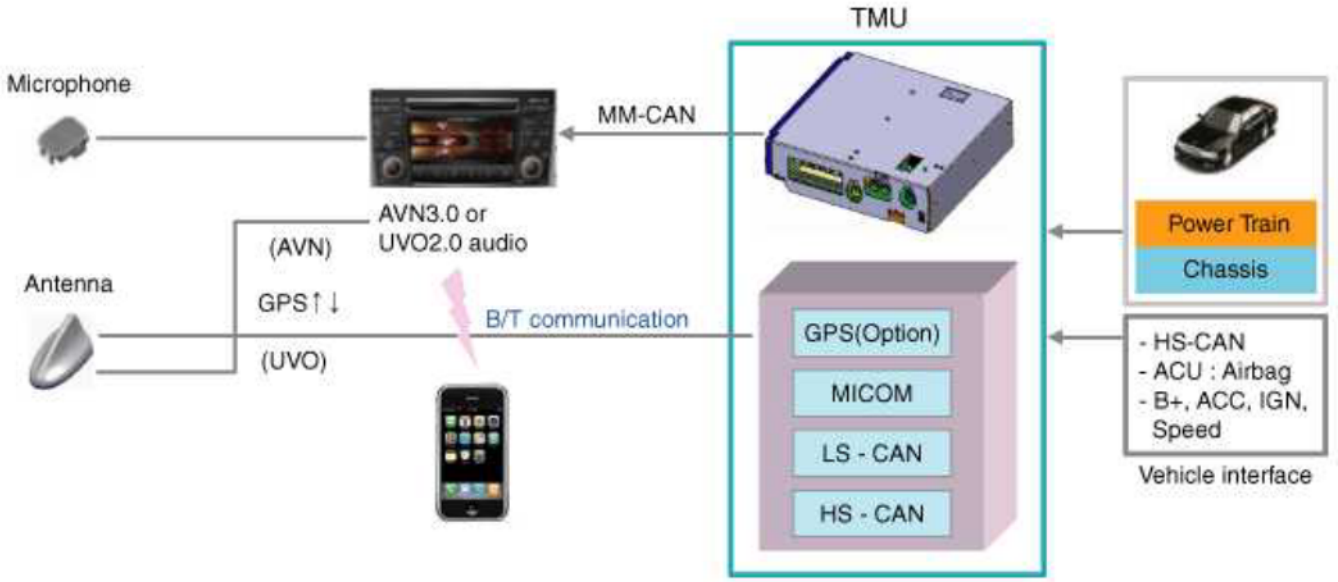
Block Diagram



SPP (Serial Port Protocol) : Protocol for the smartphone and data

Vehicle Components

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Service Lists

No.	Service Name	Description
1	Crash Notification Assist	The emergency call service automatically contacts the local emergency call cen when the airbag is deployed.
2	Roadside Assist	The emergency dispatch service automatically contacts the KMA customer cer when towing and/or fuel is needed.
3	Automatic Diagnostics	The system can automatically detect failures in PT controllers and provide tips troubleshooting.
4	Vehicle Diagnostics	The user can perform vehicle diagnostics at any time.
5	Scheduled Diagnostics	The system informs the user of regular inspection dates and sends the inspectio results to the service center.
6	eServices Guide	An automatic voice guide system provides information on various Telematics fu to the user.
7	My POIs	Send target destination information from your smartphone to the system. Your destinations are saved at www.myuvo.com.
8	Parking Minder	Use your smartphone to find where you parked.
9	MyUVO	Use your smartphone to check your driving patterns, vehicle diagnostic results, diagnostic history, and part replacement history on the mobile website.
10	Maintenance	Use your smartphone to manage your mileage-based part replacement schedul

TMU Dealer Engineering Mode

1. Function
   A. TMU Update : Update TMU unit using update file.
   B. TMU Factory Default : Clear TMU unit setting and TMU relative information.
      ; Registered phone info, Acitvation status, Reset password, 911 Setting default (default is "OFF"), Alert histor POI list, Service data, Diagnostic data, Driving information
   C. TMU Version Information : Check TMU version.

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2. Access Dealer Engineering Mode in Head Unit (Hidden Menu) (in the order as below)
   (1) Audio type
      A. Press SETUP key.



      B. Click the audio screen in order.
      ; Click ① position one time → Click ② position one time → Click ③ postion 5 times



> **Information**
> IF you click other position, you should go another screen and then try again.

      C. Enter Dealer Eng Mode and check TMU veresion.



      D. Press "TMU Update" or "Factory Defaults" button on head unit.



> **Information**
> - TMU bin file should be in USB ROOT. (file name : KMA_TMU_install.inf)
> (TMU bin file name should not be changed.)
> - TMU Update may take about 15 minutes.

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⚠ CAUTION

- Don't touch anthing during TMU Update.
- If fail to update, please update again.

(2) AVN type

A. Press Info/SETUP( ) key.



B. Press Info/UVO key.



C. Touch the AVN screen in order.

; Click ① position one time → Click ② position one time
→ Click ① position one time → Click ② position one time
→ Click ① position one time → Click ② position one time



ⓘ Information

IF you click other position, you should go another screen and then try again.

D. Enter Dealer Eng Mode and check TMU veresion.



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E. Press "TMU Update" or "Factory Defaults" button on head unit.



Information

- TMU bin file should be in USB ROOT.
- TMU Update may take about 15 minutes.

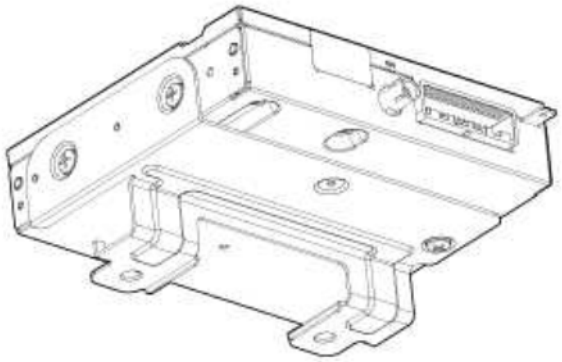
CAUTION

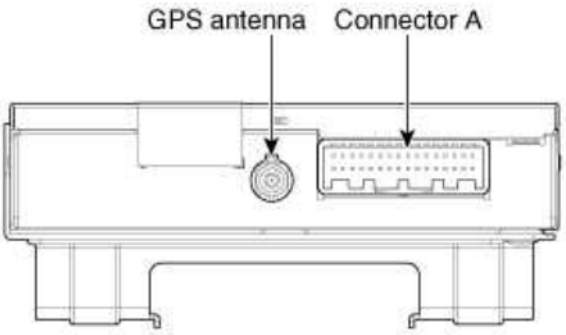
- Don't touch anthing during TMU Update.
- If fail to update, please update again.

Body Electrical System

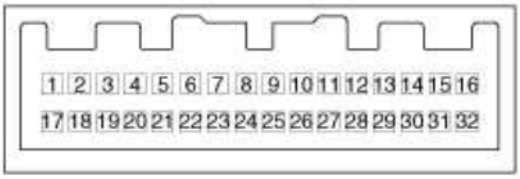
Component

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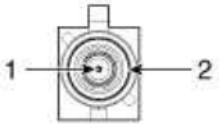


Connector A



No.	Description	No.	Description
1	Ground	17	-
2	Ground	18	V_battery 1
3	-	19	Ignition 1
4	-	20	ACC
5	-	21	Airbag
6	-	22	-
7	-	23	-
8	-	24	-
9	-	25	-
10	-	26	-
11	-	27	Speed
12	HSCAN -	28	-
13	HSCAN +	29	-
14	-	30	-
15	-	31	MMCAN -
16	-	32	MMCAN +

GPS antenna



No.	Description
1	Signal
2	Ground

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Connector Pin Specification

No.	Pin Name	Type	From	To	Description (Wiring Spec.)
1	GND	DC Ground	TMU	Battery	Connected to battery ground
2	GND	DC Ground	TMU	Battery	Connected to battery ground
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
8	-	-	-	-	-
9	-	-	-	-	-
10	-	-	-	-	-
11	-	-	-	-	-
12	HS CAN (-)	Data I/O	BUS	BUS	High Speed CAN bus low
13	HS CAN (+)	Data I/O	BUS	BUS	High Speed CAN bus high
14	-	-	-	-	-
15	-	-	-	-	-
16	-	-	-	-	-
17	-	-	-	-	-
18	V battery 1	DC Input	Battery	TMU	DC level input from battery Supply power to TMU
19	Ignition 1	Data Input	Junction Box	TMU	Vehicle Key mode status
20	ACC	Data Input	Junction Box	TMU	Vehicle Key mode status
21	Airbag	Data Input	ACU	TMU	Airbag status data from ACU
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	-	-	-
25	-	-	-	-	-
26	-	-	-	-	-
27	Speed	Data Input	-	TMU	GPS Calibration (UVO ONLY)
28	-	-	-	-	-
29	-	-	-	-	-
30	-	-	-	-	-
31	MM CAN (-)	Data I/O	BUS	BUS	Low Speed CAN bus low
32	MM CAN (+)	Data I/O	BUS	BUS	Low Speed CAN bus high

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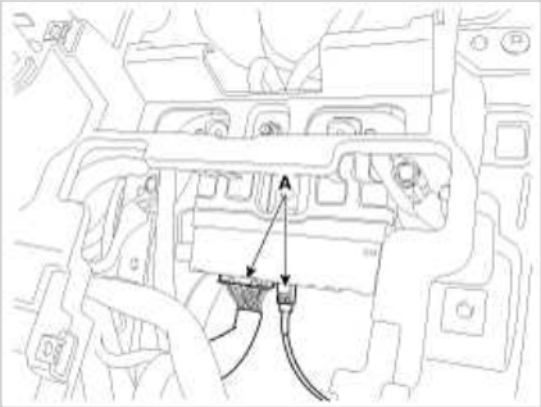
Body Electrical System

Removal

NOTICE

- Take care not to scratch the crash pad and related parts.

1. Disconnect the negative (-) battery terminal.
2. Remove the AVN head unit.
   (Refer to AVN System - "AVN Head Unit")
3. Disconnect the TMU unit and GPS connector (A).



Installation

1. Install the TMU unit.
2. Install the AVN head unit and center fascia panel.
3. Connect the negative (-) battery terminal.

Inspection

1. After replacing the TMU unit, access Dealer Engineering Mode in head unit.
   (Refer to MTS system - "TMU Dealer Engineering Mode")
2. Check the TMU version ("App S/W") from the head unit screen.

   [Audio type]



   [AVN type]



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3. Check the H/U Type from the head unit screen.

[Audio type]



[AVN type]



4. Check the Model from the head unit screen.

[Audio type]



[AVN type]



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Specifications

Smart Key Unit

Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-22°F ~ 167°F (-30°C ~ 75°C)
Dark current	Max. 5.0mA (When welcome light off)
Frequency	315 Mhz
Antenna type	FSK (Frequency Shift Keying)

Smart Key Fob

Items	Specification
Battery	Lithium battery 3V
Distance	30m
Battery life	More than 2 years **⚠WARNING** An inappropriately disposed battery can be harmful to the environment and human health. Dispose the battery according to your local law(s) or regulation.
Push buttons	4 (Door lock / unlock, Tailgate, Panic)
Frequency(Rx)	125 kHz
Frequency(Tx)	315 MHz
Numbers	2EA

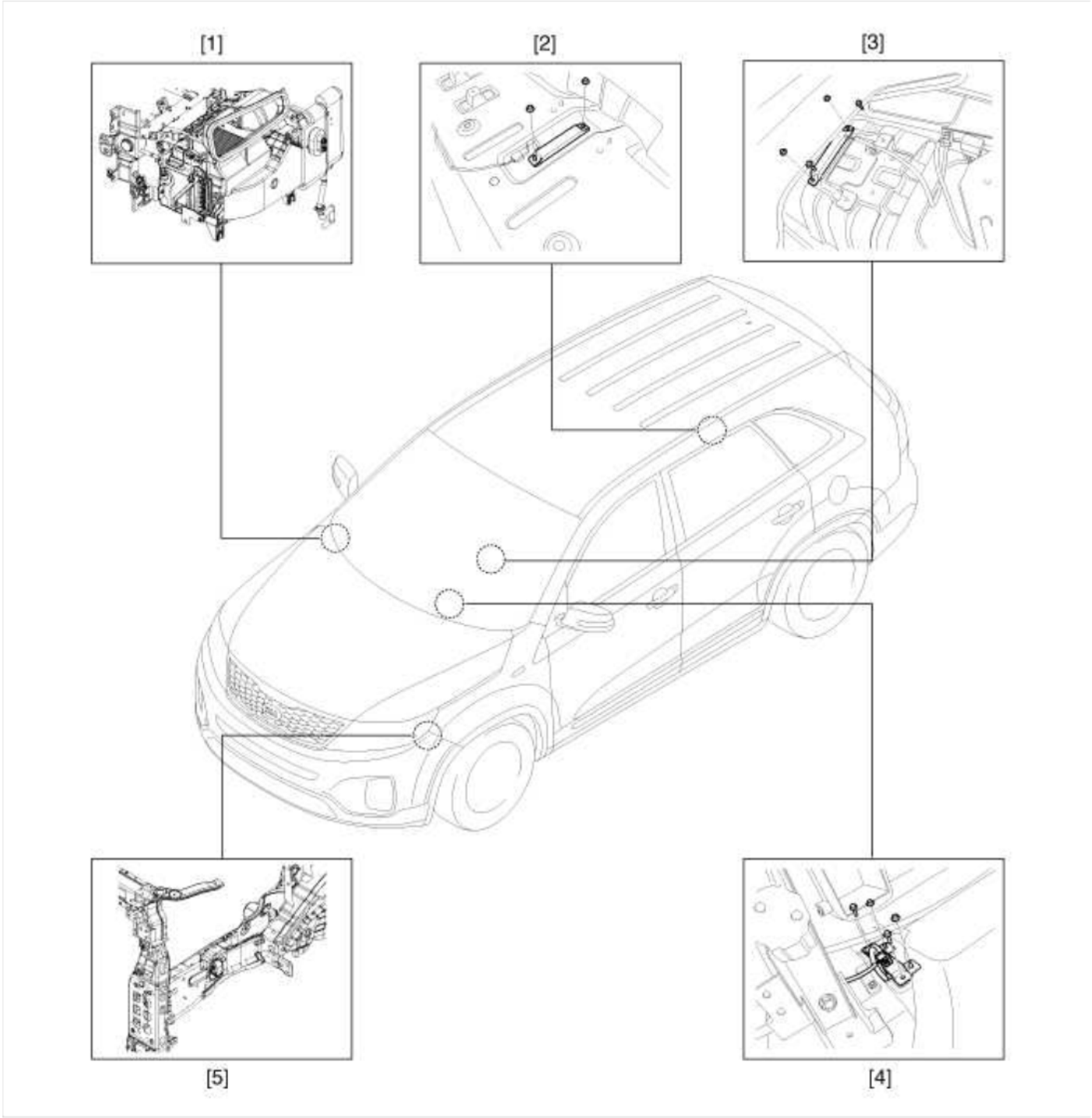
Antenna

Items	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-22°F ~ 167°F (-30°C ~ 75°C)
Frequency	125kHz
Numbers	Interior(3EA), Door(2EA), Bumper(1EA)

Body Electrical System

Component Location (1)

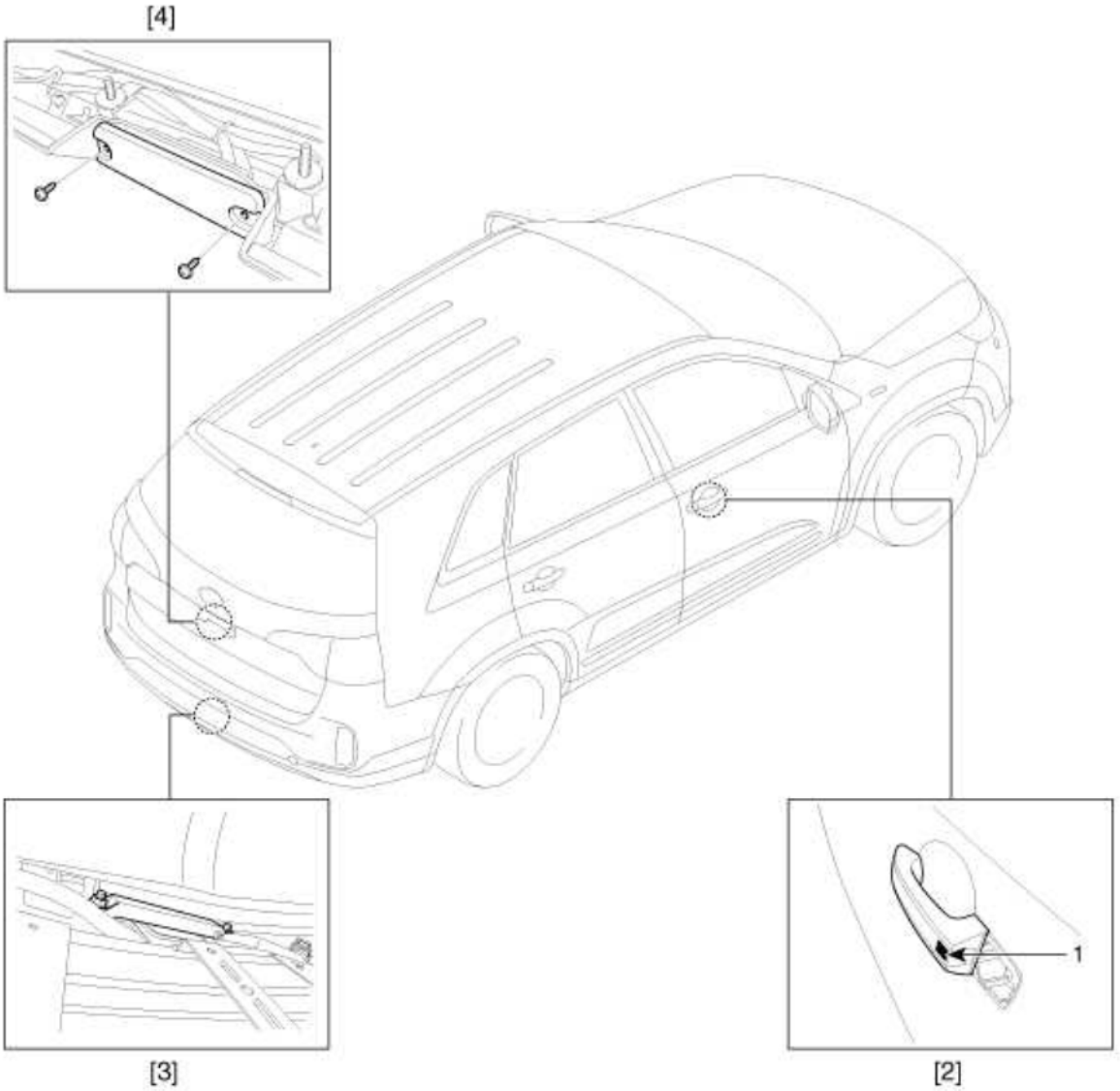
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1. Smart key unit 2. Interior antenna 3 3. Interior antenna 2	4. Interior antenna 1 5. Buzzer

Component Location (2)

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1. Door outside handle button 2. Door outside handle	3. Bumper antenna 4. Tailgate switch

Body Electrical System

Description

The SMART KEY system is a system that allows the user to access and operate a vehicle in a very convenient way. access the vehicle, no traditional key or remote control unit is needed.

The user carries a SMART KEY FOB which does not require any conscious actions by the user (e.g. operate a RKI button). The SMART KEY system is triggered by pressing a push button in the door handle.

After being triggered the vehicle sends out a request in a limited range. If the SMART KEY FOB receives this reque automatically sends a response to the vehicle. Then the system decides whether to perform a particular action (unlock locking…) or remain inactive.

Again, a communication between the vehicle and the SMART KEY FOB is needed before any actions will be perfor

The System offers the following features :

- Passive unlock via door driver side and passenger side
- Passive locking via door driver side and passenger side
- Passive start

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- Passive access trunk via the trunk lid switch at the trunk
- Passive locking via tailgate
- Max. 2 fobs can be handled by the system
- Immobilizer backup antenna driver integrated into SSB for TP authentication (i.e. limp home mode)
- Communication with engine management system
- Communication with SRX
- LF-RF communication

1. Passive unlock
   The system allows the user to access (unlock) the vehicle without performing any actions with the SMART KEY
   This feature could be different depending on platform as follows:
   A. Pressing Push button in door handle
2. Passive locking
   The system allows the user to lock the vehicle by pushing a button on door handle with the SMART KEY FOB.
3. Button start
   The system allows the user to switch the power modes (Off, Accessory, Ignition), as well as to start and stop the vehicle's engine without performing any actions with the SMART KEY FOB. See Button Engine Start system specification.
4. LIMP HOME Mode
   Additionally, the system offers so called "limp home mode", which is the user can operate all vehicle functions by the key into the SSB.

Smart Key ECU (SMK ECU)
The SMK ECU manages all functions related to "Passive Unlock", "Passive Lock" and "Passive Authorization for Er Start Operation".
It reads the inputs (Push button in door handle, Start Stop Button (SSB), PARK position Switch), controls the outpu exterior and interior antennas), and communicates via the CAN as well as a single line interface to further devices of t
For communication with the SMART KEY FOB, SMK ECU generates a request (challenge) as an encoded and mo 125 (or 134.2) kHz signal at the inductive antenna outputs and receives the SMART KEY FOB's response via the e RF receiver.
The main functional blocks of the SMK ECU are:

- Power supply
- Microcontroller with FLASH Memory
- Single Line Interface to EMS
- Input stage
- LF antenna amplifier/driver
- CAN communication with BCM

The LF antenna amplifier/driver generates a 125 (or 134.2) kHz sinusoidal carrier signal which is distributed to the di antennas.
Smart Key FOB
The system supports up to 2 SMART KEY FOBs.
The main functions of the SMART KEY FOB are:

- Passive functionality: receives LF-challenge and sends automatically RF response.
- Classic RKE function by action up to 4 push buttons.
- Transponder-functionality in case of a flat battery or a disturbed communication.

Antennas

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1. Emitting LF Antennas:
   Inductive antennas in and at the vehicle are used to transform the current, driven by the SMK ECU antenna drive
   125 (or 134.2) kHz magnetic field, which is the carrier for the SMART KEY challenge.
   Three antennas cover the vehicle's exterior: two antennas in the Door Handles (DS and PS) cover the area aroun
   doors; one antenna in the rear bumper covers the area around the trunk or tailgate.
   Up to three antennas cover the vehicle's interior and the trunk or tailgate interior: two in the passenger compartm
   one in the tailgate room or trunk.
2. Bidirectional Immobilizer Antenna (for Limp Home):
   The Immobilizer Backup Antenna is used for sending and receiving data: it emits a magnetic field (125 - 135 kHz
   challenge) and receives changes in the field strength (response of Transponder).

Door Handle

The front door handles of the two doors (driver door / passenger door) are equipped with emitting LF-antennas to er
125 (or 134.2) kHz signals. The front door handles are also equipped with a push button.

Push Button

The push button in door handle serves as a trigger to indicate the user's intent to unlock or lock the vehicle.
The push buttons are installed at front doors, integrated into the door handles.
Another button is installed at the trunk or tailgate lid.

Operation

Passive Functions

The system allows the user to access the vehicle without having to perform any actions (e.g. RKE button pressing) wi
SMART KEY FOB. It is sufficient that a valid SMART KEY FOB is located within a defined and limited range witl
to the vehicle. So the system is capable of detecting and authenticating a SMART KEY FOB in the ranges as specifi
below.

Operating Range

The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free s
range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the belov
picture.
The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free s
range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the belov
picture

Passive Access (Passive Entry)

Pressing one of the push buttons in the door handles when all doors locked indicates the operator's intent to access tl
vehicle and thus triggers the system for unlock

Passive Locking (Exit)

Pressing one of the push buttons in the door handles when one of the following condition is fulfilled:

- At least one door is unlocked and two_steps timer is not running or
- Two_steps timer is running and one of the push button except Front Left side is triggered

indicates the operator's intent to lock the vehicle and thus triggers the system for a lock.

Passive Open Tailgate

Pressing the Tailgate Lid Switch when tailgate is closed indicates the operator's intent to open the tailgate and thus tri
the system. Subsequently, the SMK ECU sends a LF-challenge to the SMART KEY FOB via the exterior bumper a
The SMART KEY FOB answers with a RF-response. If the received response matches the expected answer, SMK
sends a "tailgate open" message via the CAN network.

Smart Key Reminder 1

1. Preconditions:
   All terminals OFF & at least one door open & locking status is not locked checked by SMK periodically every 1
   as long as CAN/LIN active.

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2. Event:
   At least 1 door knob status changed from unlock to lock.
3. SMK actions:
   A. IF NO FOB-IN ACTIVE
      SMK performs a search for the fobs in the interior of the vehicle. The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication
   B. IF FOB-IN ACTIVE
      SMK sends request toward PDM to search valid TP
   If no fob or no TP has been found, no action is required.
   If any valid fob or valid TP has been found, SMK unlocks the vehicle by sending a CAN Key Reminder unlock r with the fob number.
   If any valid fob has been found, SMK unlocks the vehicle by sending a CAN/LIN Key Reminder unlock messag the fob number.

Smart Key Reminder 2

1. Preconditions:
   All terminals OFF & any door (including trunk) open & no FOB-IN & no locking status (checked by SMK perio every 100ms, as long as CAN/LIN active)
2. Vehicle action:
   Closing last door or trunk with knobs locked state, or with a locking in progress
3. SMK actions:
   Before elapsing 500ms after the closing if all doors are locked then:
   A. IF NO FOB-IN ACTIVE
      SMK performs a search for the fobs in the interior of the vehicle.
      The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication
   B. IF FOB-IN ACTIVE
      SMK sends request toward PDM to search valid TP
   If no fob has been found, no action is required.
   If any valid fob or valid TP has been found, SMK sends unlock command via CAN and activates ext. buzzer wa
   If any valid fob has been found, SMK sends unlock command via CAN/LIN and activates ext. buzzer warning.

Smart Key Door Lock Warning

Door Lock Warning 1

1. Preconditions:
   While (at least one door knob is unlocked) & (ACC ON or IGN ON) & (No FOB-IN) :
   A. (All doors are closed) & (trunk closed)
2. Event:
   A. User presses the push button in door handle or trunk
3. SMK actions:
   SMK performs a search for the fobs outside of the vehicle; the same LF-strategy has to be used as it is defined f "Scenario Access with I/O Distinction".

Door Lock Warning 2

1. Preconditions:
   Same as passive locking precondition but with at least one door open.
2. Event:
   User presses the door handle Push button .

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3. SMK actions:
   SMK performs a search for the fobs outside of the vehicle; the same LF-strategy has to be used as it is defined f
   "Scenario Access with I/O Distinction".
   If no fob has been found, no action is required.
   If the preconditions are no longer valid during buzzer active time (3 seconds), the SMK ECU stops the buzzer immediately.

Door Lock Warning 3

1. Preconditions:
   Same as passive locking precondition
2. User action:
   A. User presses the door handle Push button
3. SMK ECU actions:
   A. If ATWS(Anti Theft Warning System) is in DISARM status, SMK ECU performs a search for the fob inside vehicle (use "Door Lock Warning 3" scenario)

If no fob has been found, the passive locking is performed.
If any valid fob has been found, SMK ECU activates the external buzzer.
If the activity timer elapsed or ACC ON or IGN1 ON or NOT All door closed or FOB-IN, the SMK ECU stops tl buzzer immediately.
After searching of inside fob, SMK ECU also performs a search for fobs outside of the vehicle.
Smart Key Lamp Warning

1. SMK actions:
   As long as the preconditions are valid, the SMK ECU performs a periodical search for the fobs in the interior of t vehicle; the same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentica periodical means, the search is done every 3 seconds.
   If no fob has been found, the SMK ECU starts Key out indicator lamp activation as all preconditions are valid an perform another search 3 seconds later.

If any valid fob has been found, the SMK ECU stops the Key out indicator lamp and will (if one door is open) perfo another search 3 seconds later; if no door is open then it's only at the next When the preconditions are still valid, the resumes by opening of one door.
User Information Functions

ID OUT Warning

1. Preconditions:
   A. (ACC or IGN1) & (any door open or trunk open)
2. Event:
   The last opened door is closed
3. SMK action:
   SMK searches for a SMART KEY FOB in the interior.
   A. If no valid SMART KEY FOB is found, the SMK activates external buzzer and also sends ID OUT WNG v (exterior buzzer warning and internal buzzer warning).
   B. If a door is opened and closed again during terminals on and inside valid fob, SMK re-enables the authenticati stops the warning. If the terminal is in ACC, SMK shall turn on immobilizer lamp.

NOTICE

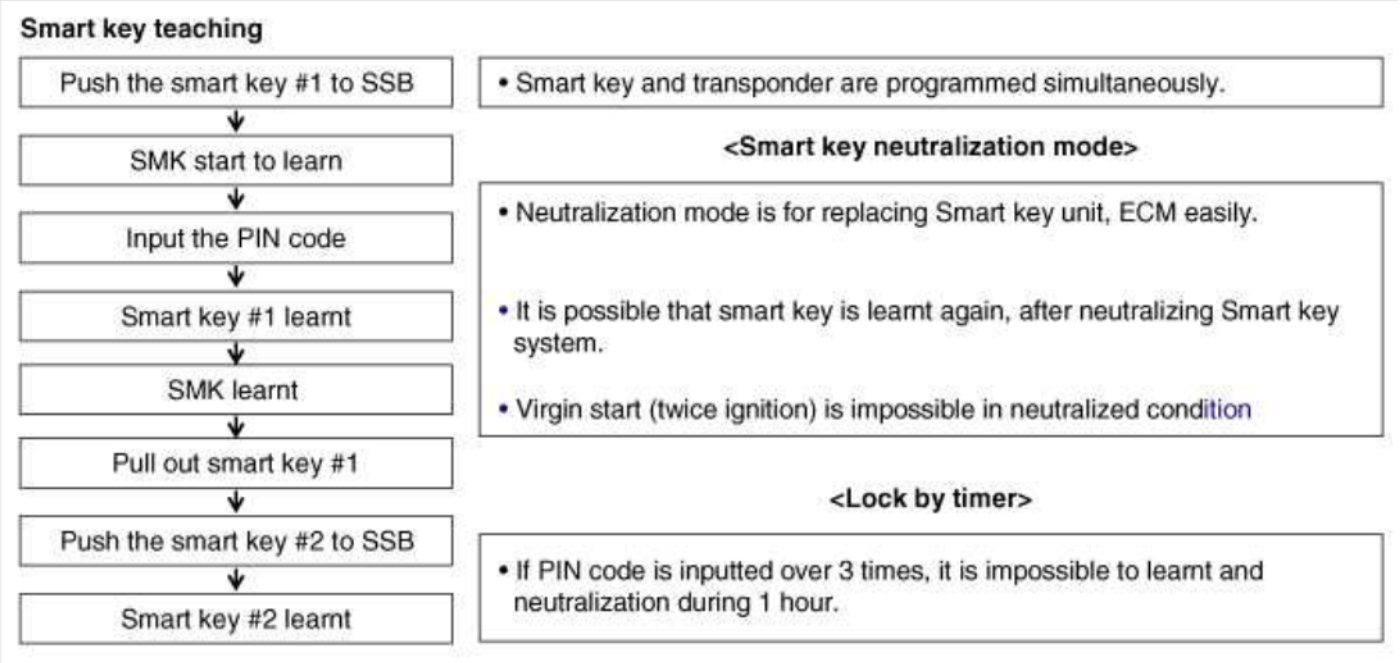
If there is a LF error (LF overheating or LF antenna failure), the system will have the same behavior as it is with no f found.

Immobilizer Lamp
Removing the PIF from the MSL and reinserting the PIF and pushing the MSL Knob will switch the lamp on again.
Fob Battery Low Voltage Detection

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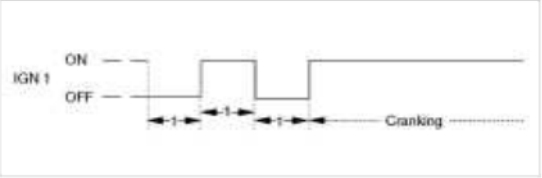
To detect fob low battery condition, certain battery voltage measurement and low voltage detection strategy are impl into fob. The measurement of the battery voltage will be done if fob button is pressed or if a LF measurement comma received.
If the fob has detected a low battery voltage, the LED will not be switched on at button press.
Learning Description
In this chapter, the learning procedure for SMK and FOBs is described.
For the learning of the SMK and FOBs, it's necessary to have a connection to the diagnostic tool.
Learning MODE
Whatever the mode, the learning procedures are managed by the SMK.
Prior to start learning service, Fob-In signal must be active and the vehicle secret code (called as PIN code) should b known.
Teaching MODE
This mode is used by the dealers in order to replace SMK and/or the set of keys, or to register additional keys for an system. That means the system already has been learnt with certain PIN Code. The PIN Code is fixed for the life tim vehicle, therefore the same PIN Code must be used in this mode. Otherwise learning will be failed
Teaching MODE Procedure Description (Step By Step)
Objective: Key teaching procedure at service station
Initial state:

- SMK replacement: SMK is not learnt and SMART FOB are already learnt with same PIN code
- Additional or new keys teaching: SMK is already learnt with same PIN code



Starting After Replacing (Virgin Start)
Starting is possible by following process after replacing new smart key unit, FOB key.

- It is for starting at virgin condition
- All related parts are virgin condition (Smart key, IPM, ECM)
- Press brake pedal in P or N range
- Push the start button once with virgin smart key.

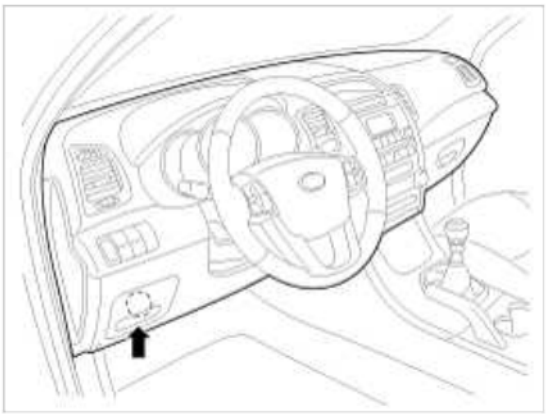


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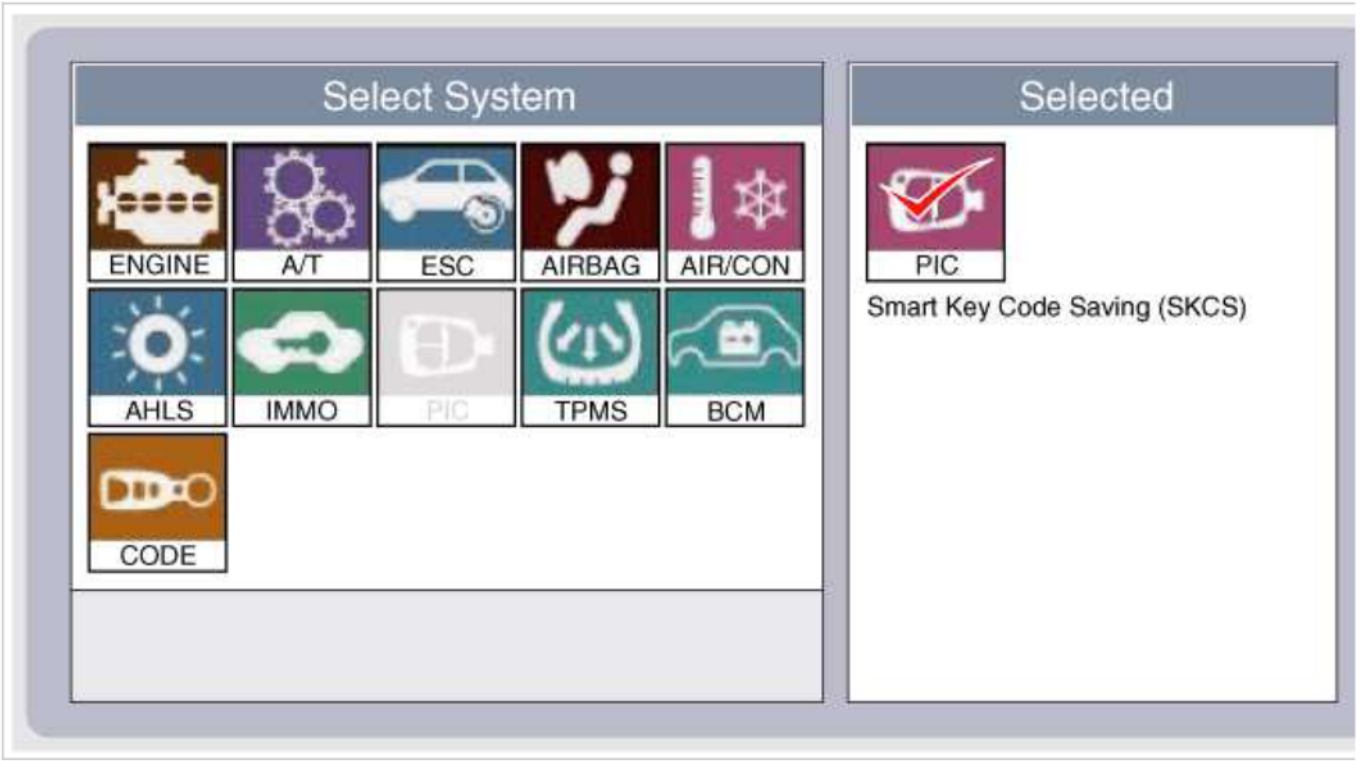
Smart Key

Smart Key Code Saving

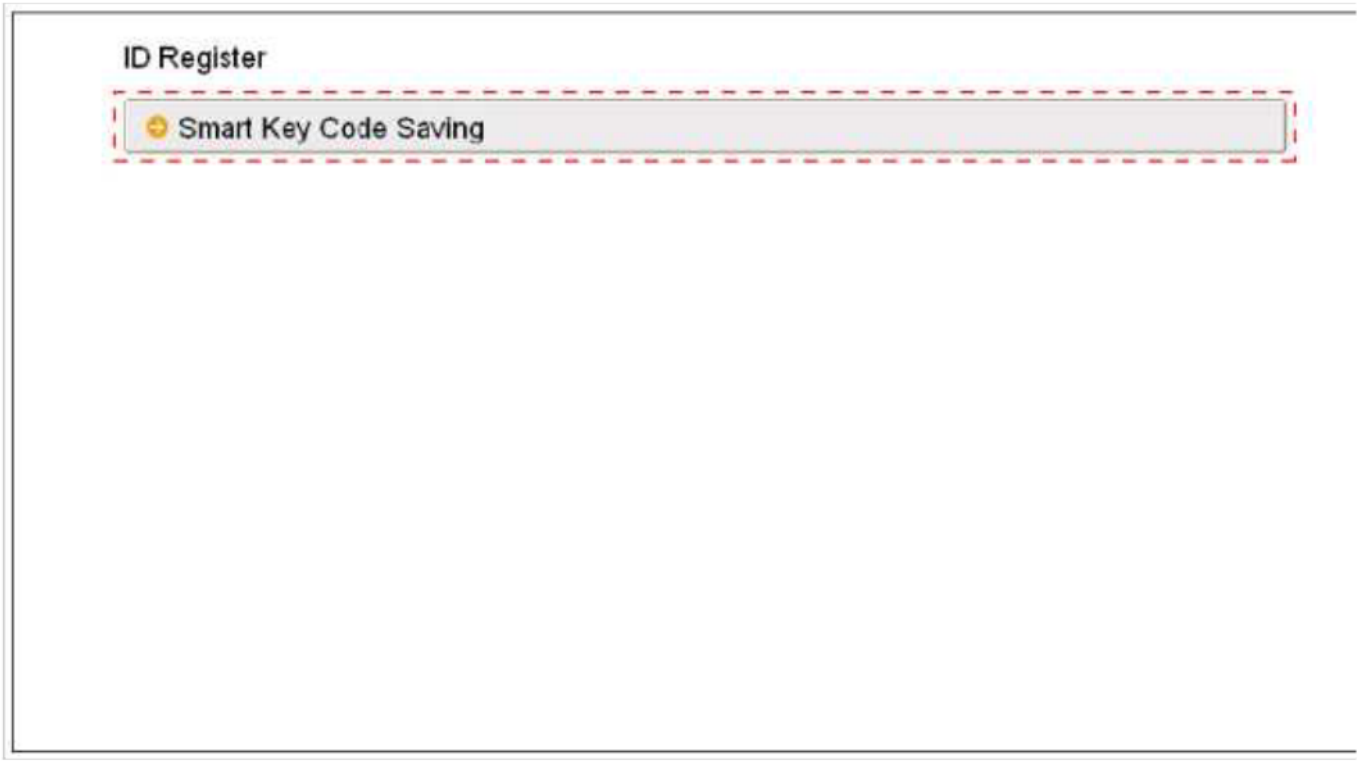
1. Connect the DLC cable of GDS to the data link connector (16 pins) in driver side crash pad lower panel, turn th on GDS.



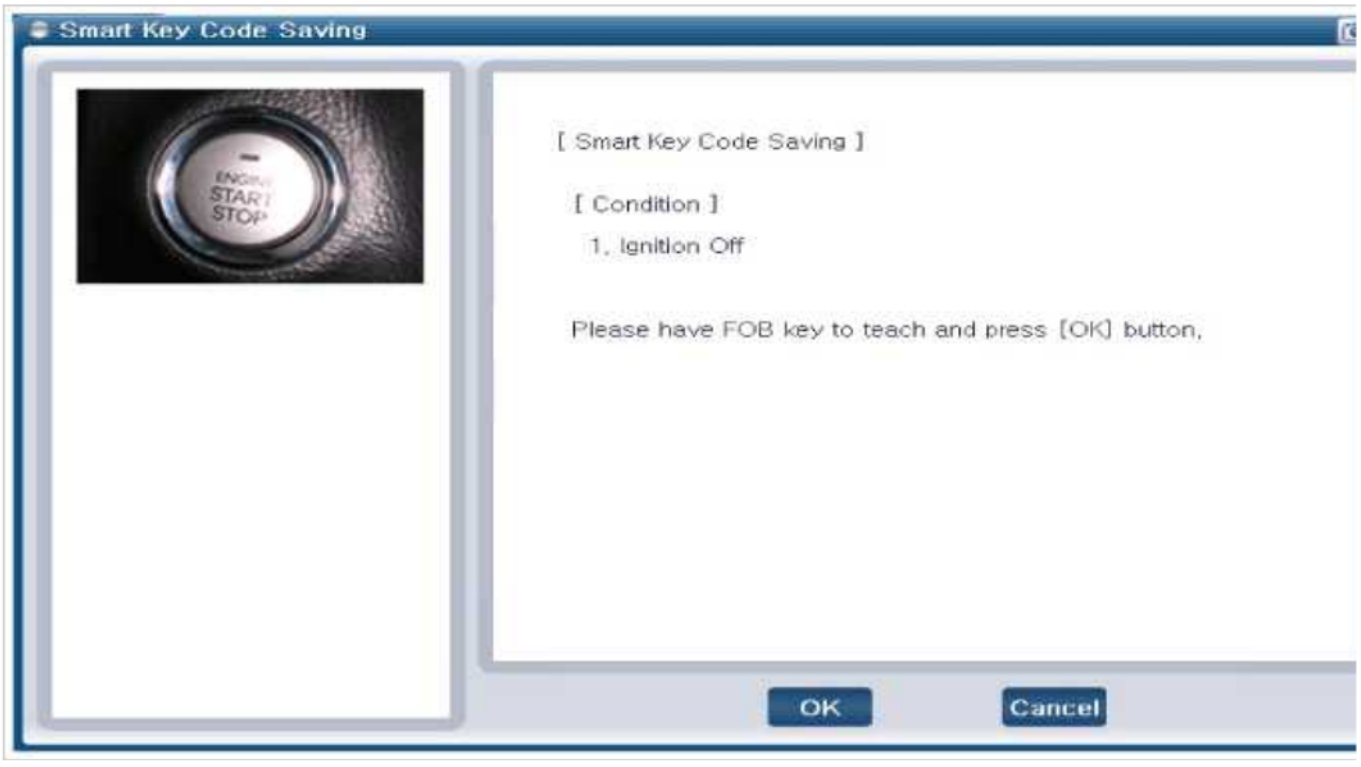
2. Select the vehicle model and then do "Smart key code saving".



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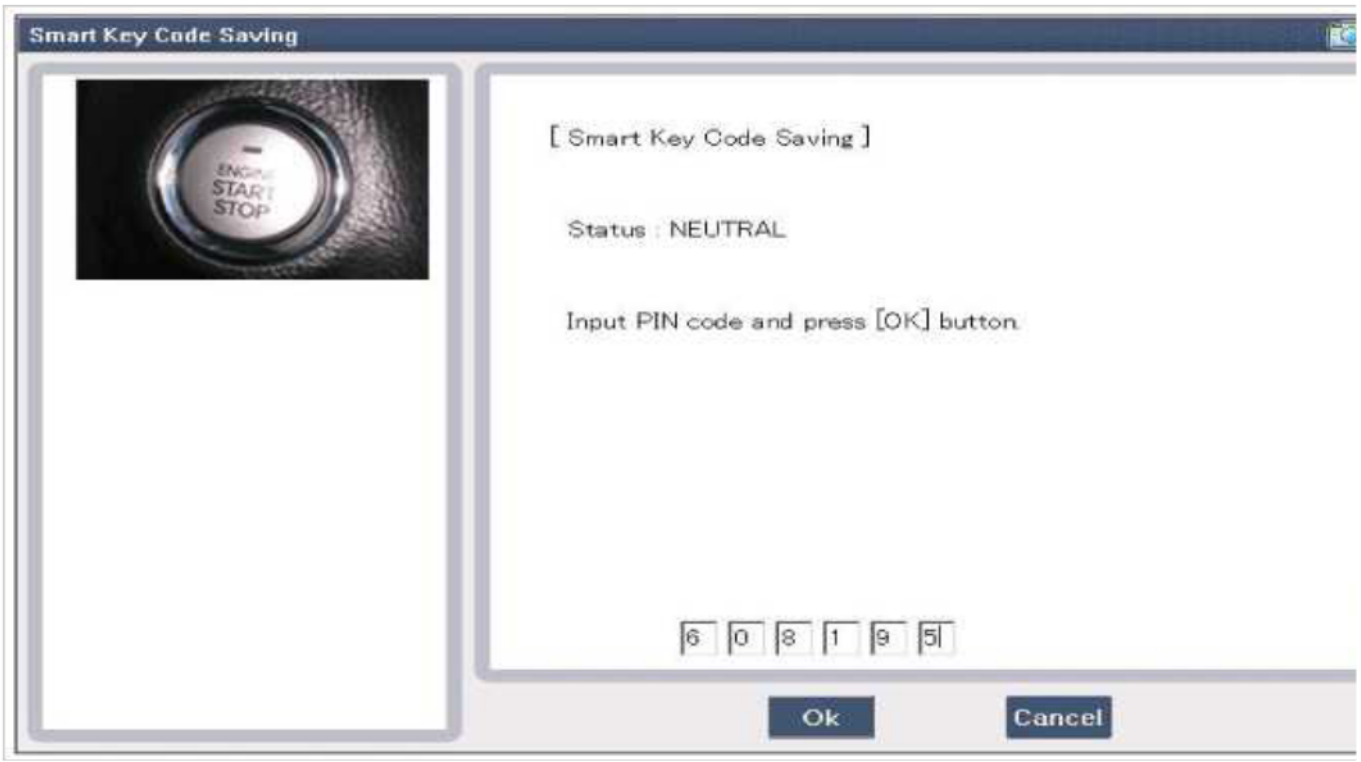
3. After selecting "Smart key teaching" menu, push "Enter" key, then the screen will be shown as below.

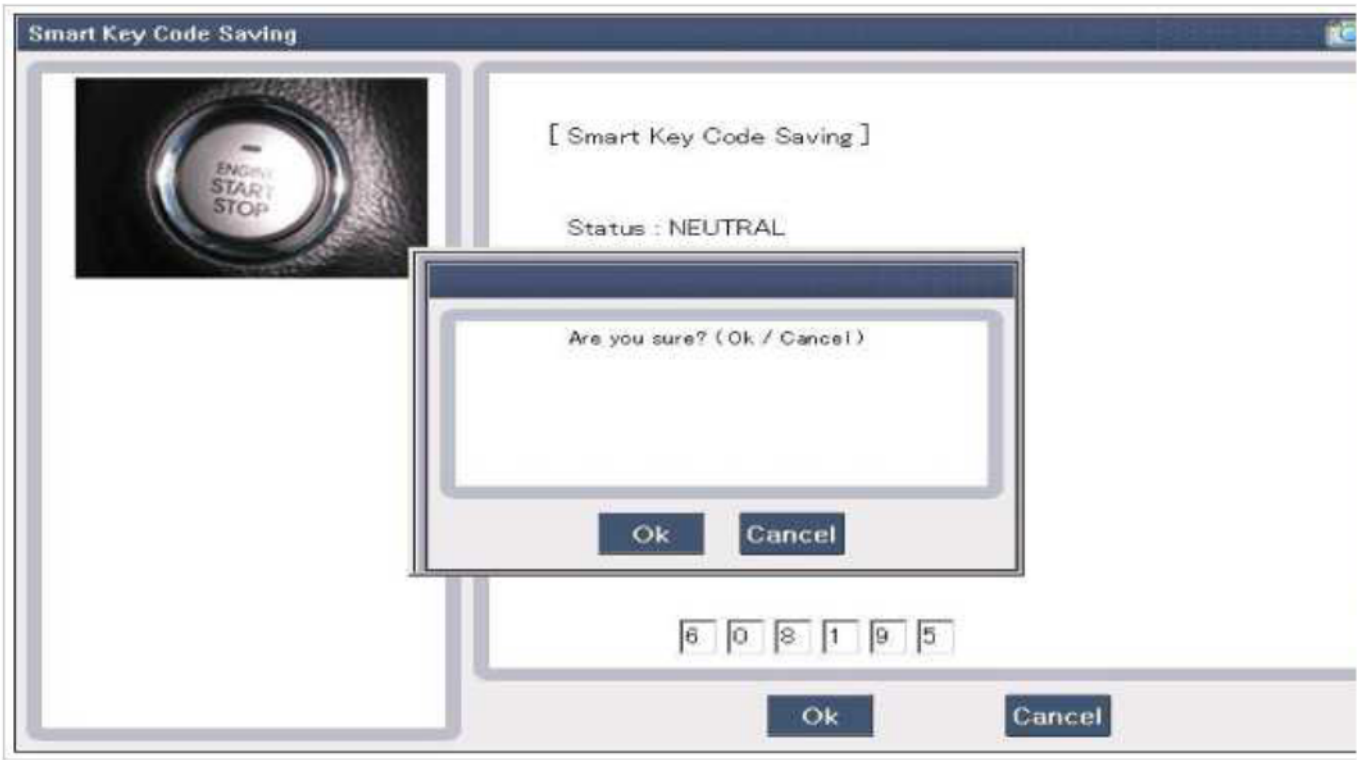


4. After having the teaching smart key, push "ENTER" key.

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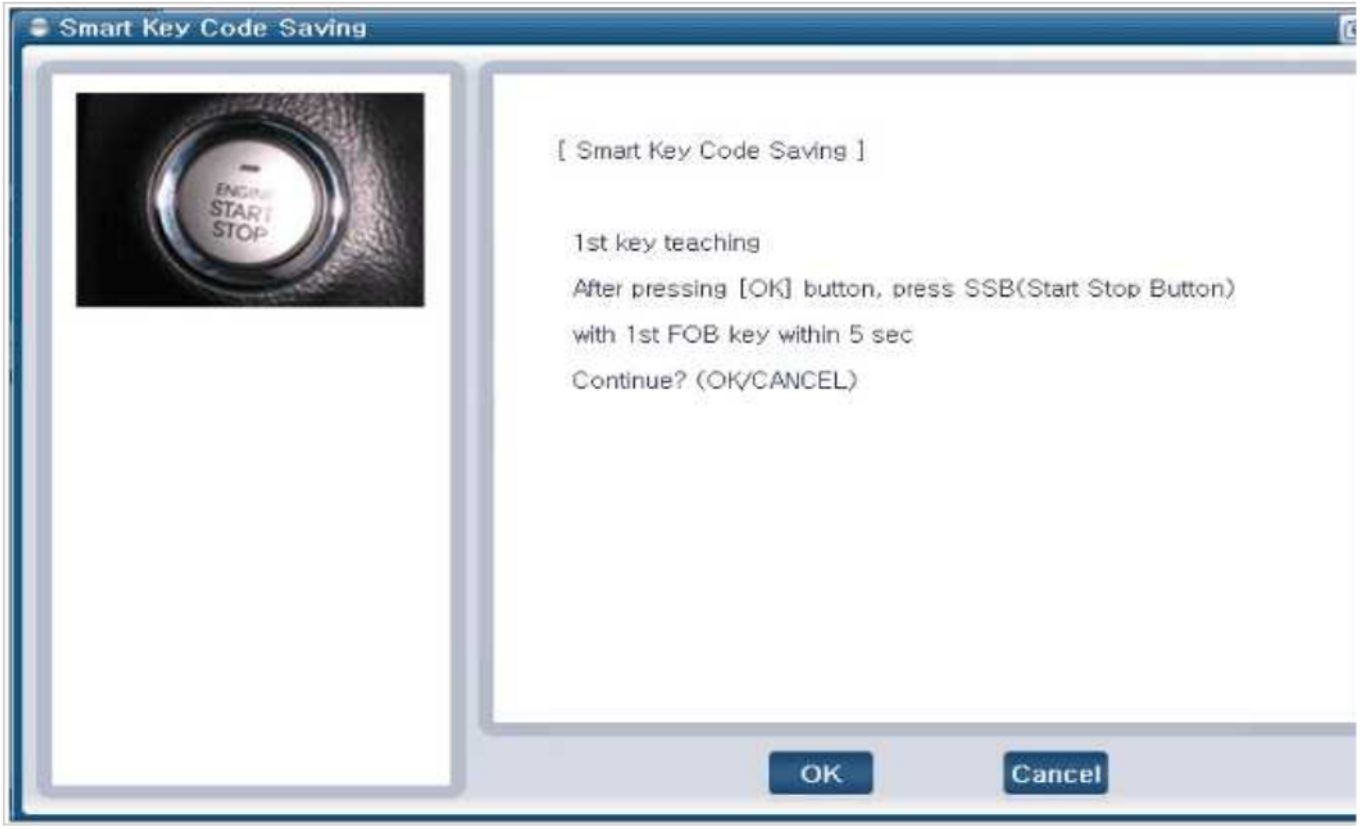
5. Input the "Pin code" for first key teaching.



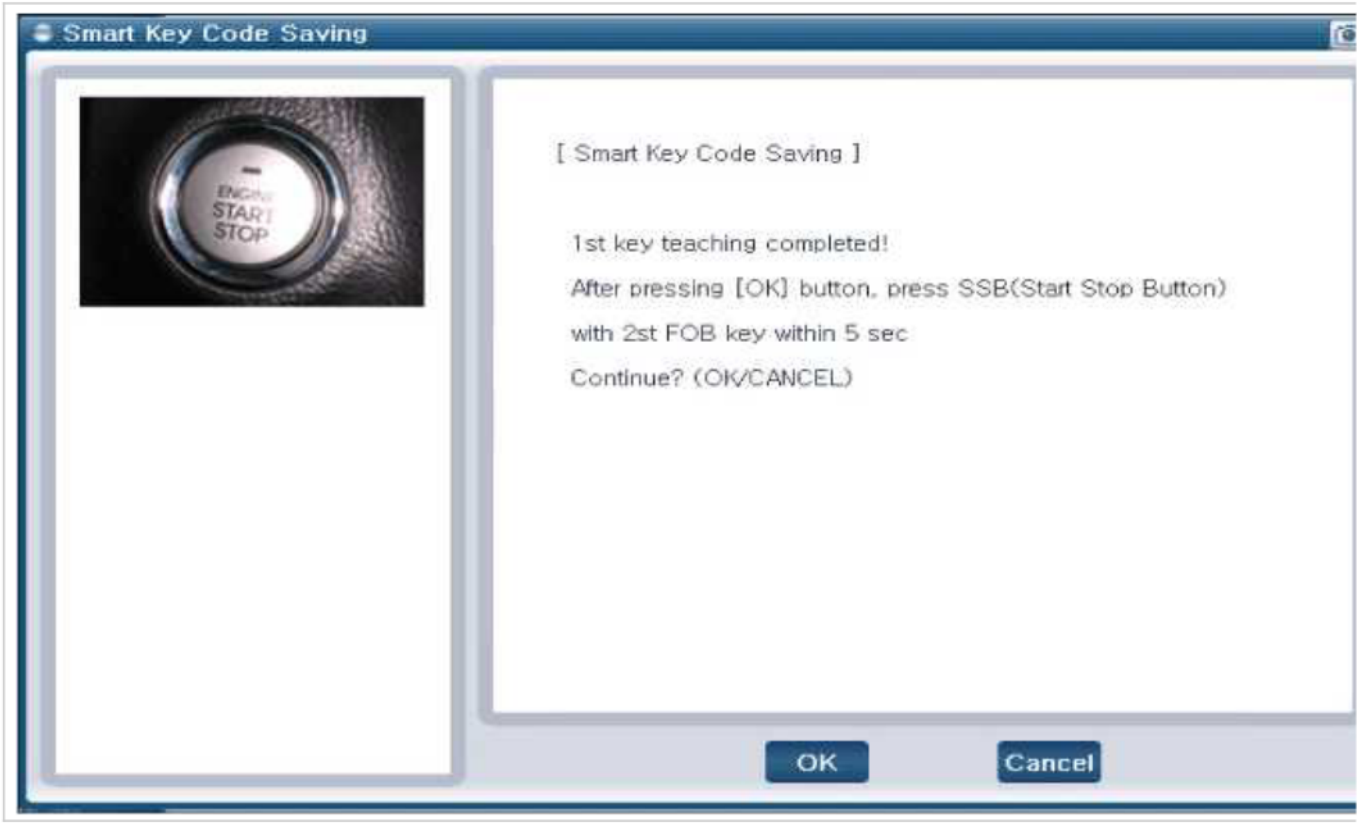


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6. Press the SSB with smart key within 5 sec after pressing "OK".

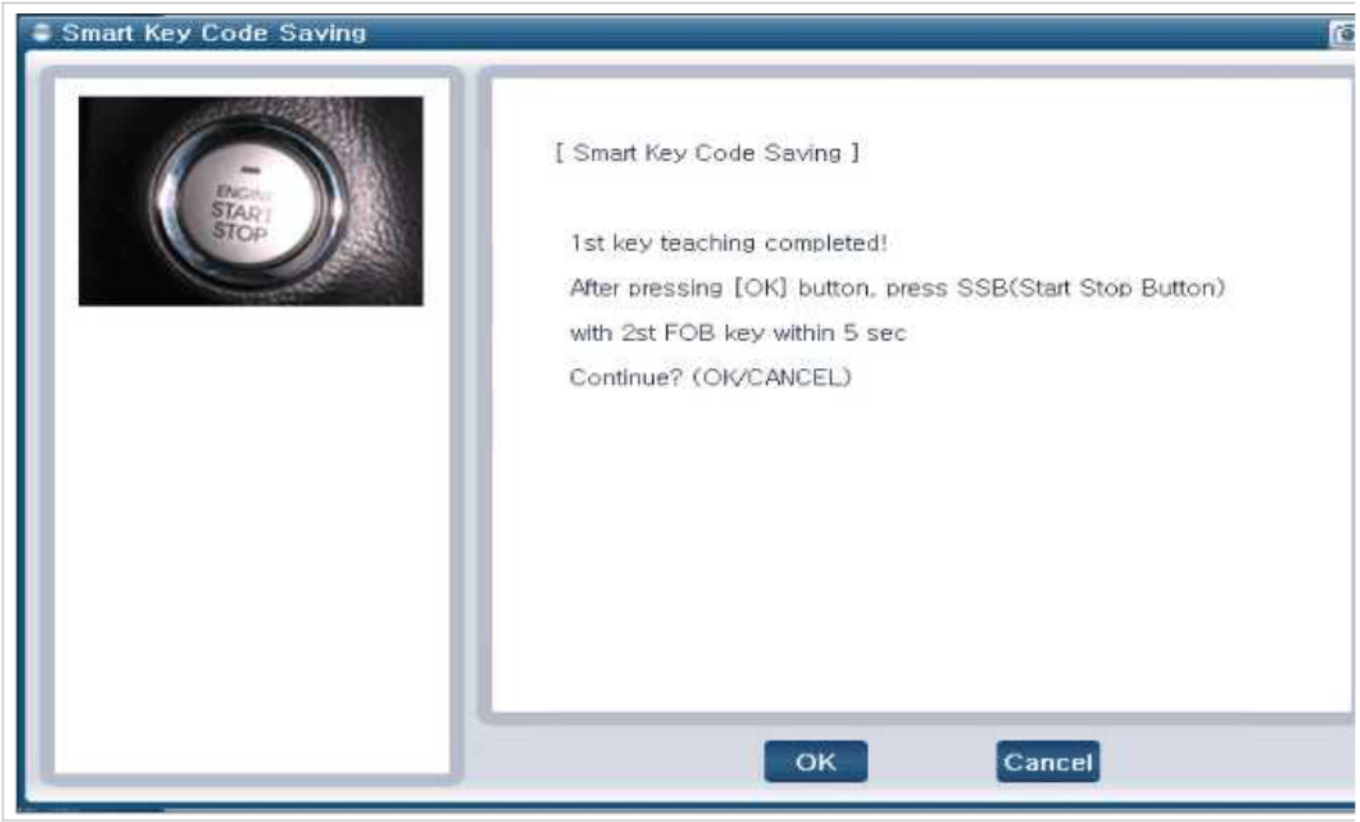


7. Confirm the message "First key teaching completed".

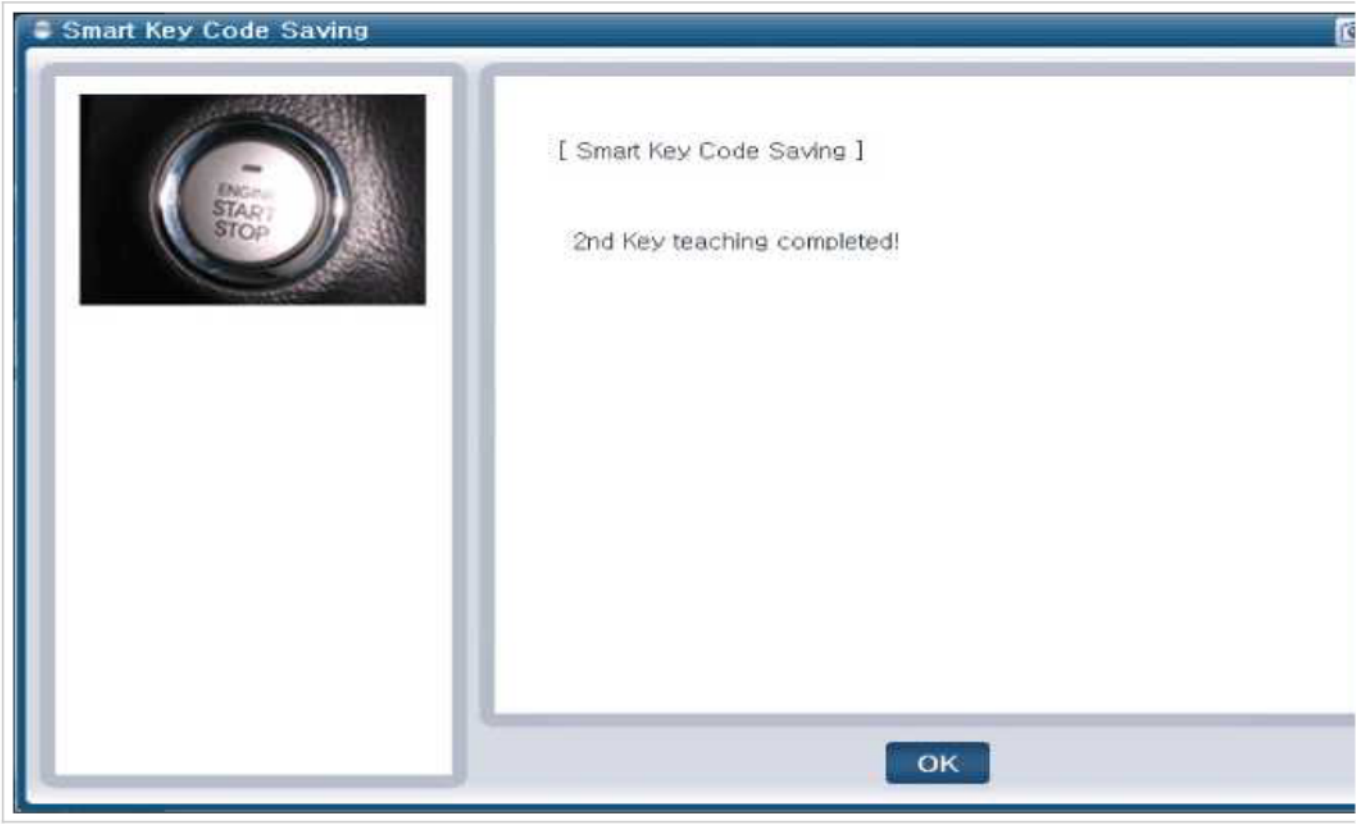


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8. Press the SSB with smart key within 5 sec after pressing "OK".

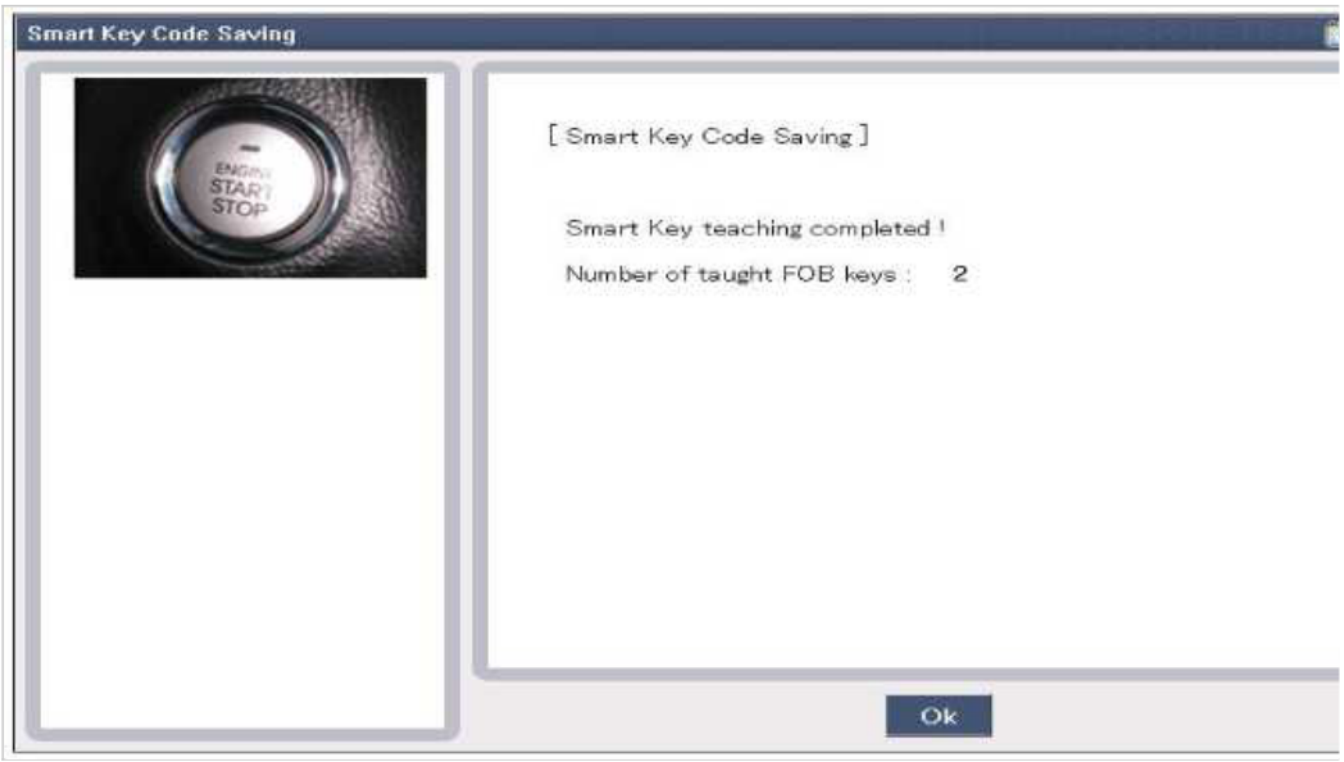


9. Confirm the message "Second key teaching completed".



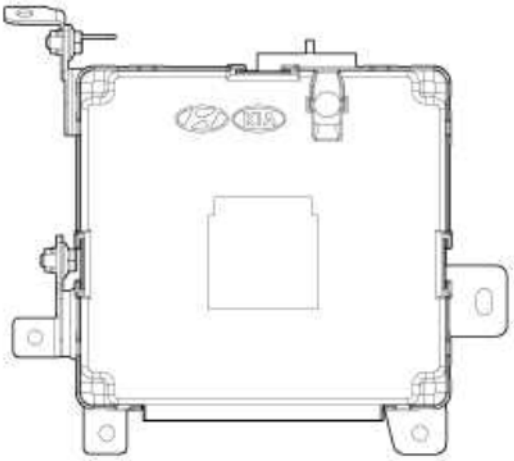
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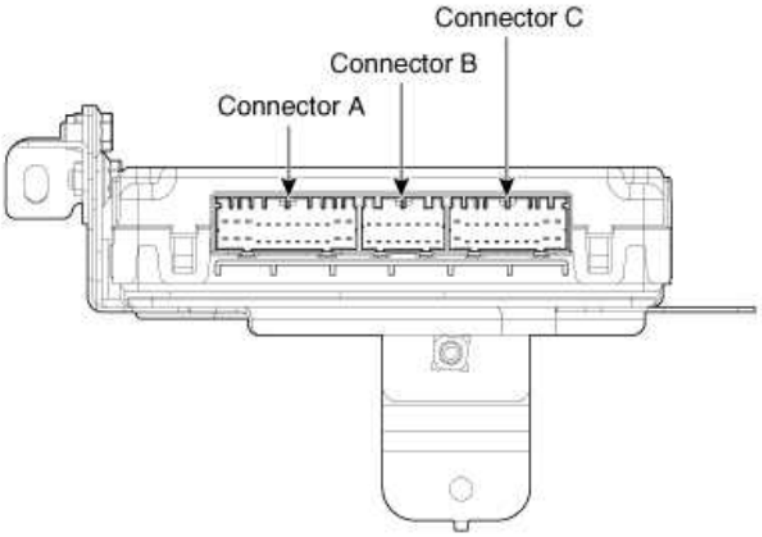
10. Then the screen will be shown as below when key teaching process is completed.

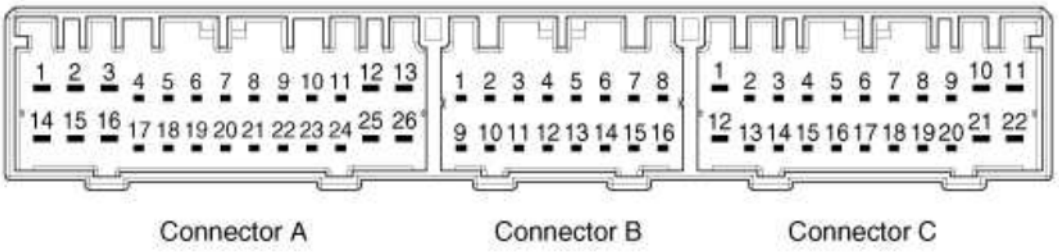


Components

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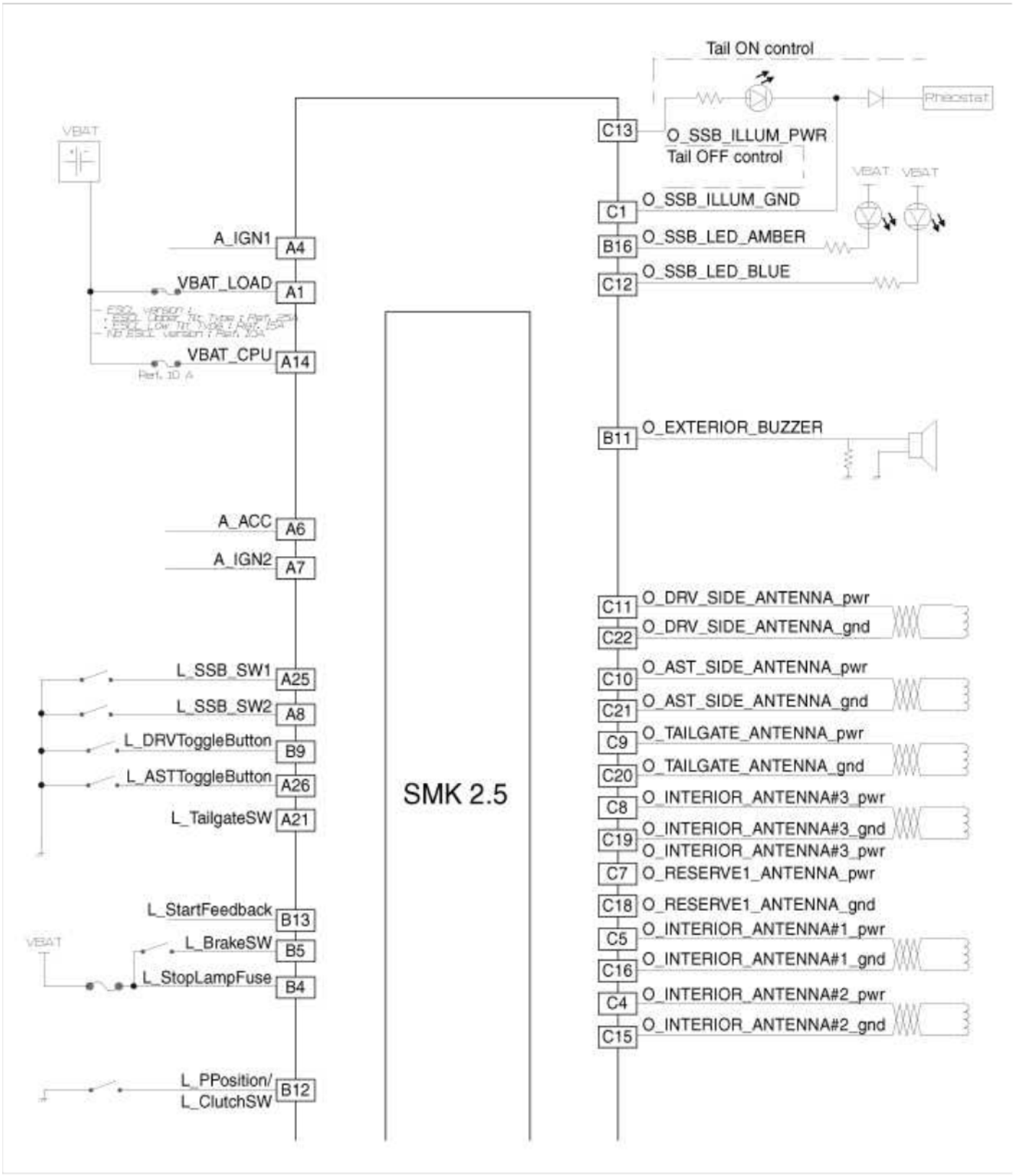


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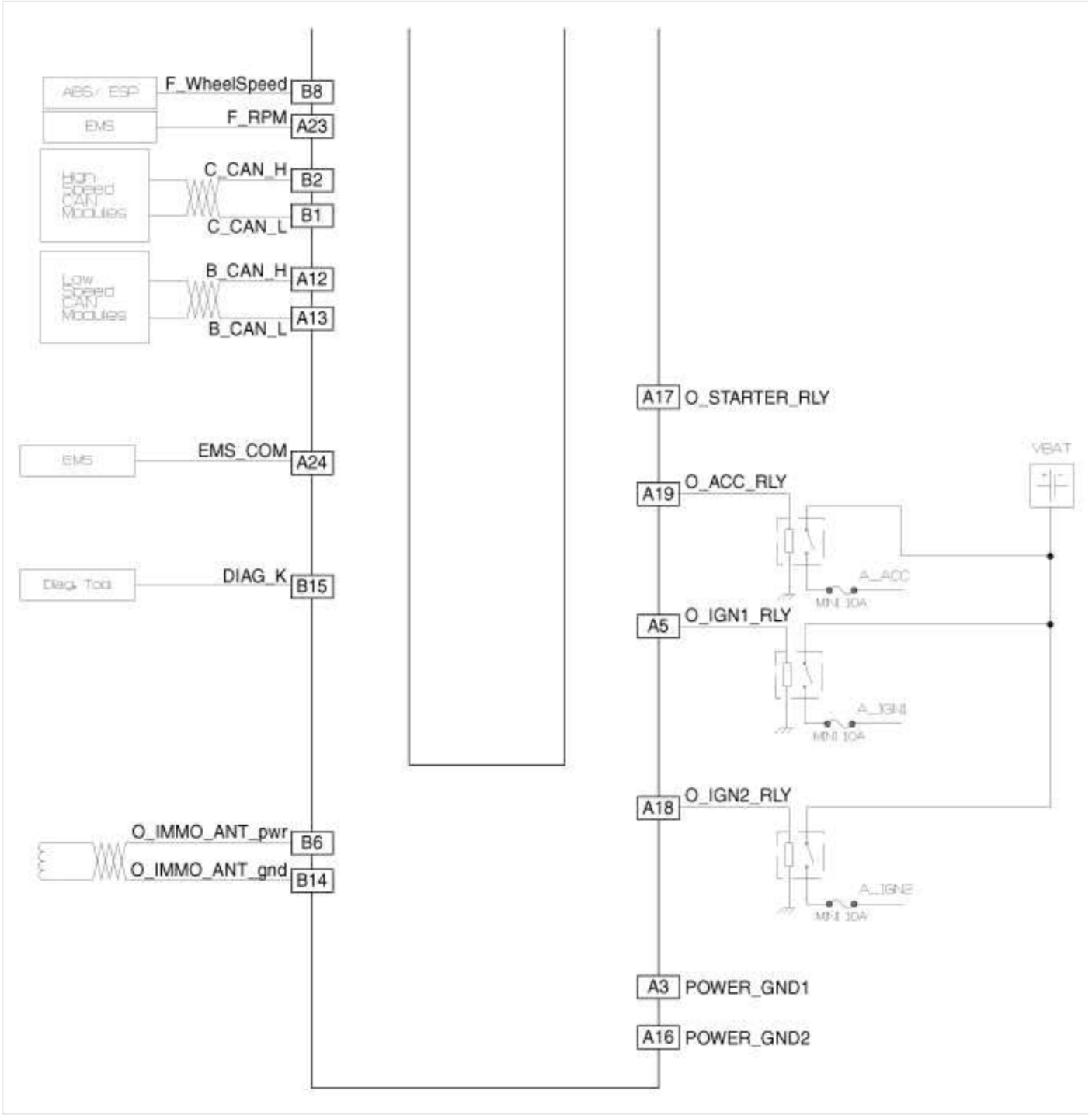
Connector Pin Information

No.	Connector A	Connector B	Connector C
1	V_BAT load	C_CAN Low	SSB illumination ground
2	-	C_CAN High	-
3	Power ground1	-	-
4	IGN1	Stop lamp fuse	Interior antenna #2 power
5	IGN1 relay	Brake switch	Interior antenna #1 power
6	ACC	Immobilizer antenna power	-
7	IGN2	-	-
8	SSB switch2	Wheel speed	Interior antenna #3 power
9	-	Driver toggle button	Bumper antenna power
10	-	-	Assistant side antenna power
11	-	External buzzer	Driver side antenna power
12	B_CAN High	P position/ Clutch switch	SSB LED IGN
13	B_CAN Low	Start feedback	SSB illumination power
14	V_BAT CPU	Immobilizer antenna ground	-
15	-	Diagnostic	Interior antenna #2 ground
16	Power ground2	SSB LED ACC	Interior antenna #1 ground
17	Starter relay		-
18	IGN2 relay		-
19	ACC relay		Interior antenna #3 ground
20	-		Bumper antenna ground
21	Tailgate lid switch		Assistant side antenna ground
22	-		Driver side antenna ground
23	RPM		
24	EMS COM		
25	SSB switch1		
26	Assistant toggle button		

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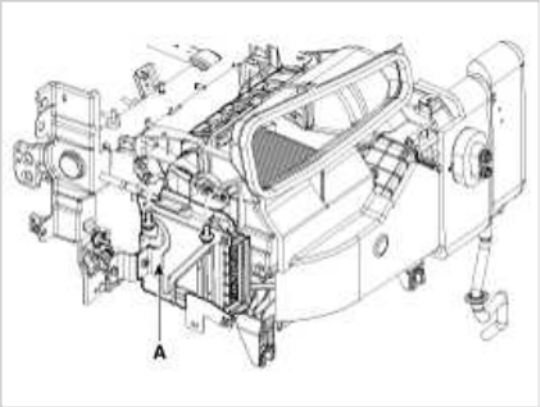
Body Electrical System

Removal

Smart Key Unit

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box housing (A).
   (Refer to Body - "Crash pad")

3. Remove the smart key unit (A) after removing the bolts and connectors.

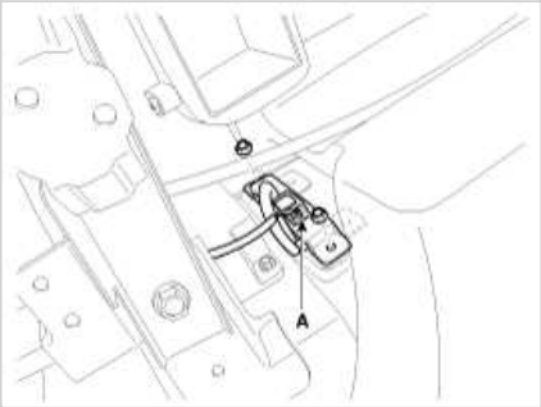


Interior 1 Antenna

1. Disconnect the negative (-) battery terminal.
2. Remove the console assembly (A).
   (Refer to Body - "Console")



3. After loosening the antenna bolts (2EA) and connector, remove the interior 1 antenna (A).

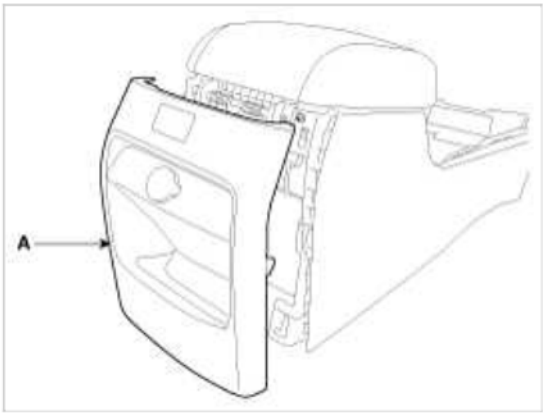


Interior 2 Antenna

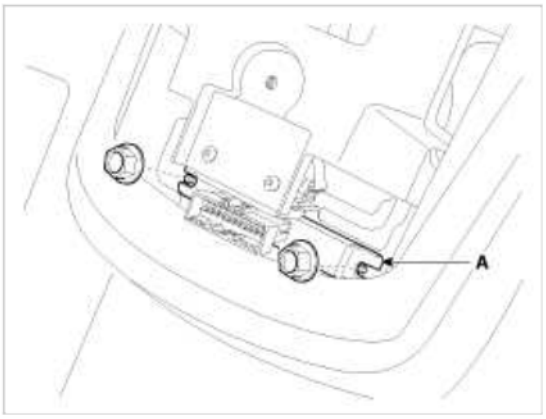
1. Disconnect the negative (-) battery terminal.

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2. Remove the floor console rear cover (A).
   (Refer to Body - "Console")

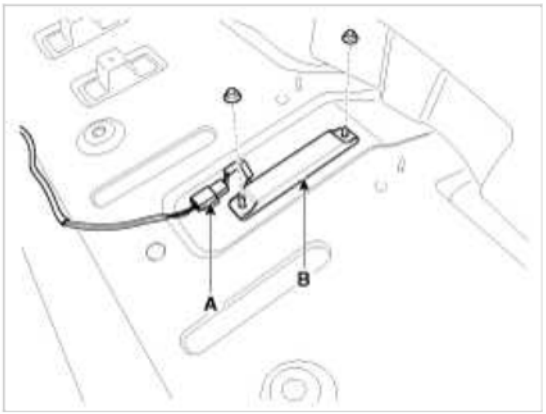


3. After loosening the antenna nuts (2EA) and connector, remove the interior 2 antenna (A).



Interior 3 Antenna

1. Disconnect the negative (-) battery terminal.
2. After loosening the mounting bolts, then remove the third seat assembly (A).
   (Refer to Body - "Rear seat")
3. After loosening the antenna nuts (2EA) and connector (A), remove the interior 3 antenna (B).

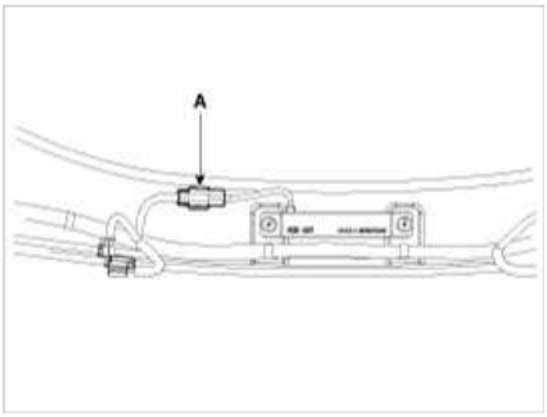


Exterior Bumper Antenna

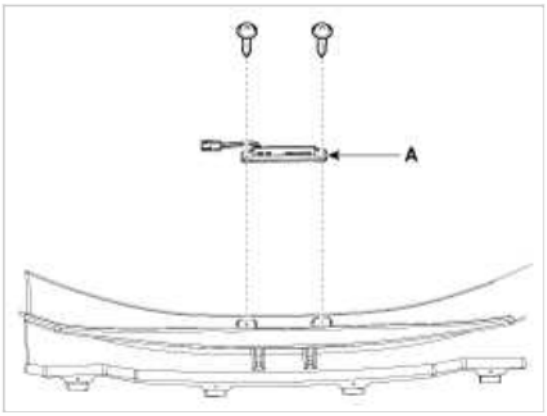
1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to Body - "Rear bumper")

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3. Disconnect the antenna connector (A) on the center of rear bumper.

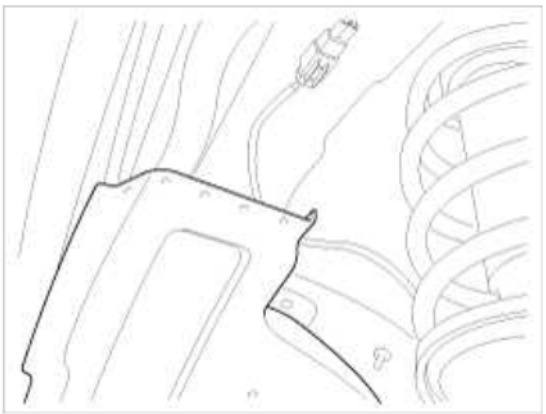


4. After loosening the screws (2EA), remove the exterior bumper antenna (A).

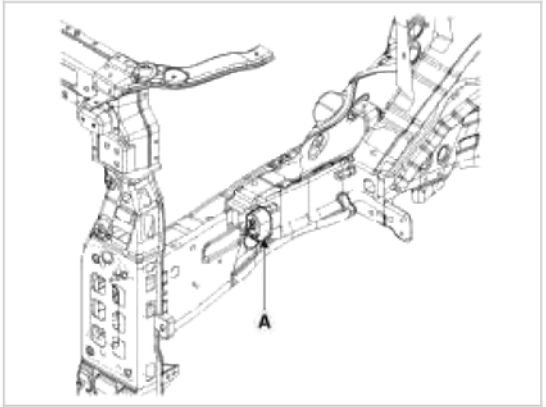


Buzzer

1. Disconnect the negative (-) battery terminal.
2. Remove the front left wheel guide.



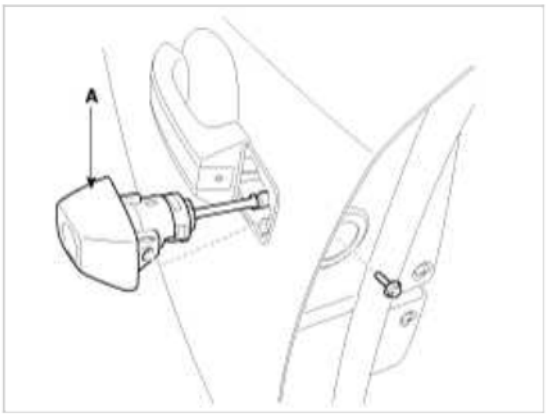
3. Disconnect the connectors, then remove the buzzer (A).



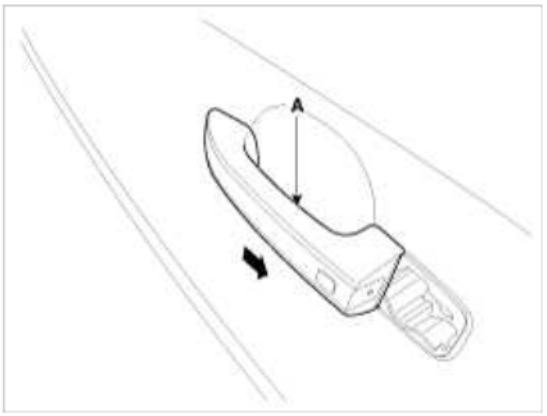
Door Outside Handle

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1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector after removing the door trim.
   (Refer to Body - "Front door")
3. After loosening the mounting bolt, then remove the key holder (A).

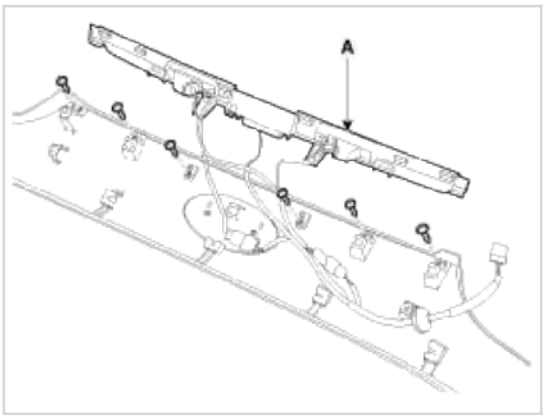


4. Remove the outside handle (A) by sliding it rearward.



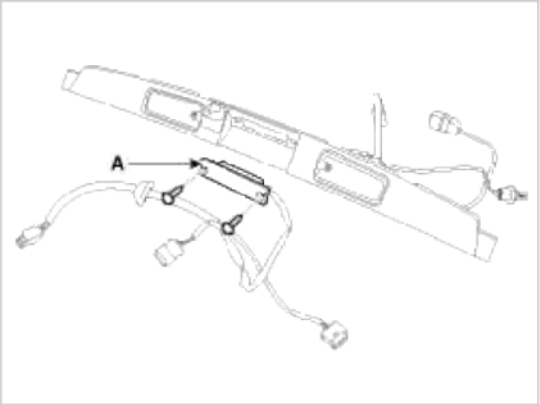
Tailgate Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate garnish.
   (Refer to Body - "Body side molding")
3. Remove the outside handle panel assembly (A) after removing the screws and connectors.



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4. Remove the outside handle (A) after removing the screws.



Inspection

Smart Key Unit

- Refer to BE group - inspection / self diagnosis with scan tool.

Smart Key Switch

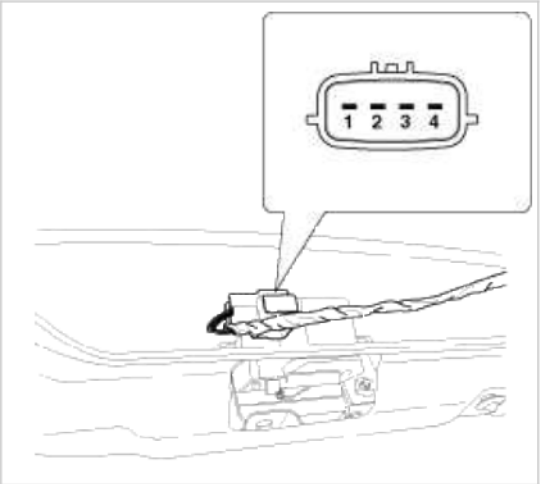
- Refer to BE group - inspection / self diagnosis with scan tool.

Antenna

- Refer to BE group - inspection / self diagnosis with scan tool.

Tailgate Switch

1. Check for continuity between the tailgate latch terminals.



2. If continuity is not specified, inspect the switch

Terminal / Position	1	2	3	4
Unlock			⊕	⊖
Lock				

Installation

Smart Key Unit

1. Install the smart key unit.
2. Install the smart key unit mounting bolt and nut, and then connect the connector.
3. Install the glove box.
4. Install the negative (-) battery terminal and check the smart key system.

Interior 1 Antenna

1. Install the interior 1 antenna.
2. Install the console assembly.

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3. Install the negative (-) battery terminal and check the smart key system.

Interior 2 Antenna

1. Install the interior 2 antenna.
2. Install the connector mounting bracket.
3. Install the console rear cover after connecting the connector.
4. Install the negative (-) battery terminal and check the smart key system.

Interior 3 Antenna

1. Install the interior 3 antenna.
2. Install the third seat assembly.
3. Install the negative (-) battery terminal and check the smart key system.

Exterior Bumper Antenna

1. Install the exterior bumper antenna.
2. Install the rear bumper.
3. Install the negative (-) battery terminal and check the smart key system.

Buzzer

1. Install the buzzer.
2. Install the front left wheel guide.
3. Install the negative (-) battery terminal and check the smart key system.

Door Outside Handle

1. Install the outside handle.
2. Install the door trim.
3. Install the negative (-) battery terminal and check the smart key system.

Tailgate Switch

1. Install the tailgate switch.
2. Install the tailgate garnish.
3. Install the tailgate trim.
4. Install the negative (-) battery terminal and check the smart key system.

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Body Electrical System

Inspection

Self Diagnosis With GDS

Smart key system defects can be quickly diagnosed with the GDS. GDS operates actuator quickly to monitor, input/(value and self diagnosis.

The following three features will be major problem in SMART KEY system.

1. Problem in SMART KEY unit input.
2. Problem in SMART KEY unit.
3. Problem in SMART KEY unit output.

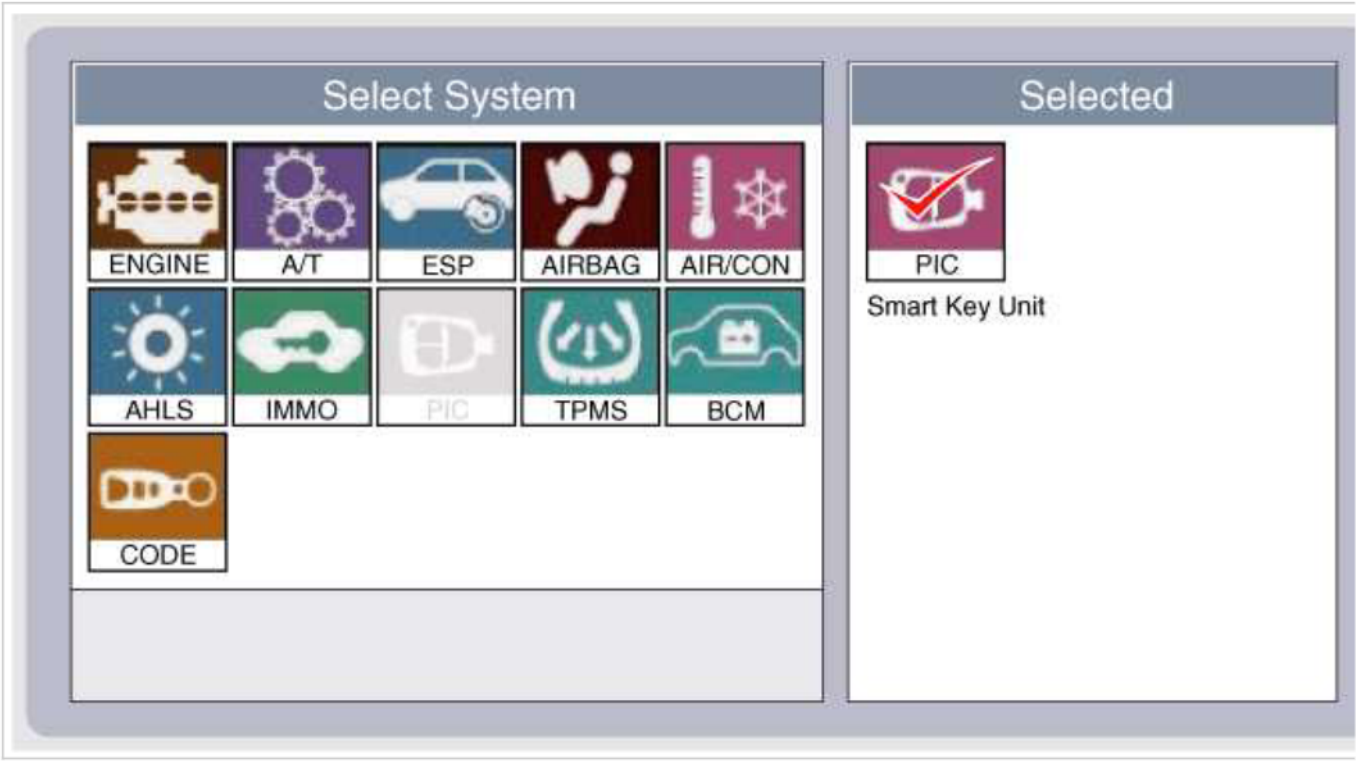
The following three diagnostic solutions will be the main solution process to a majority of concerns.

1. SMART KEY unit Input problem : switch diagnosis
2. SMART KEY unit problem : communication diagnosis
3. SMART KEY unit Output problem : antenna and switch output diagnosis

Switch Diagnosis

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel, turn the power on GD

2. Select the vehicle model and then SMART KEY system.



3. Select the "SMART KEY unit".
4. After IG ON, select the "Current data".



5. You can see the situation of each switch on scanner after connecting the "current data" process.

Display	Description
FL Toggle switch	ON : Push button is ON in the driver door handle.
FR Toggle switch	ON : Push button is ON in the assist door handle.
Tailgate open switch	ON : Trunk button is ON.
Gear P Position	ON : Shift lever is P position.
IGN 1	ON : IGN switch is IG position.
ACC	ON : IGN switch is ACC position.
External Buzzer	ON : Buzzer is ON.

Communication Diagnosis With GDS (Self Diagnosis)

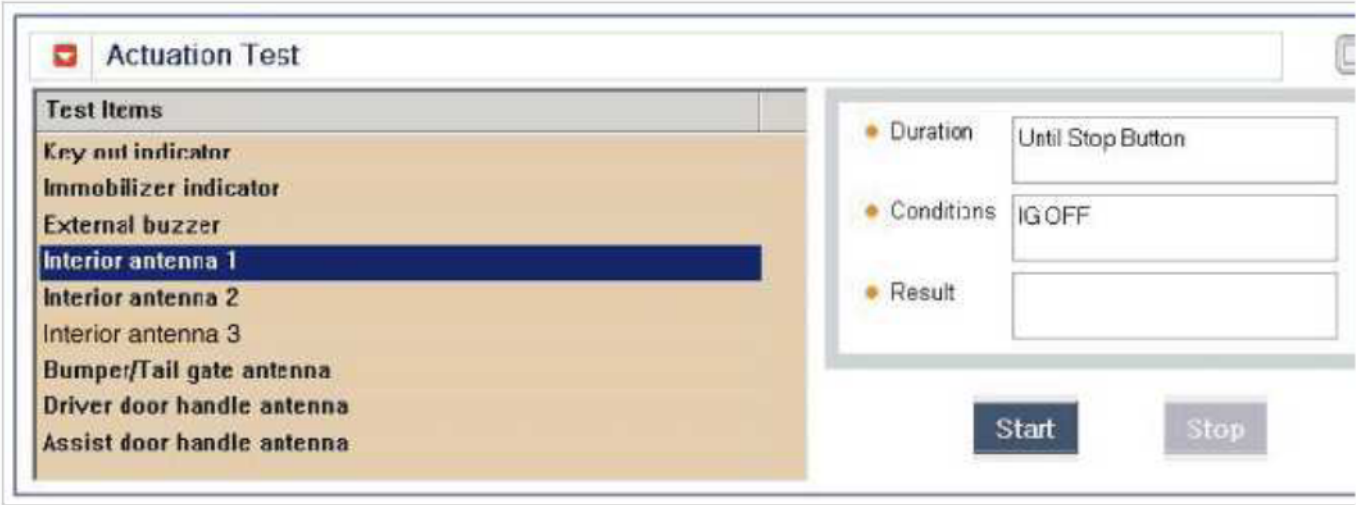
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1. Communication diagnosis checks that the each linked components operates normal.
2. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
3. After IG ON, select the "DTC".

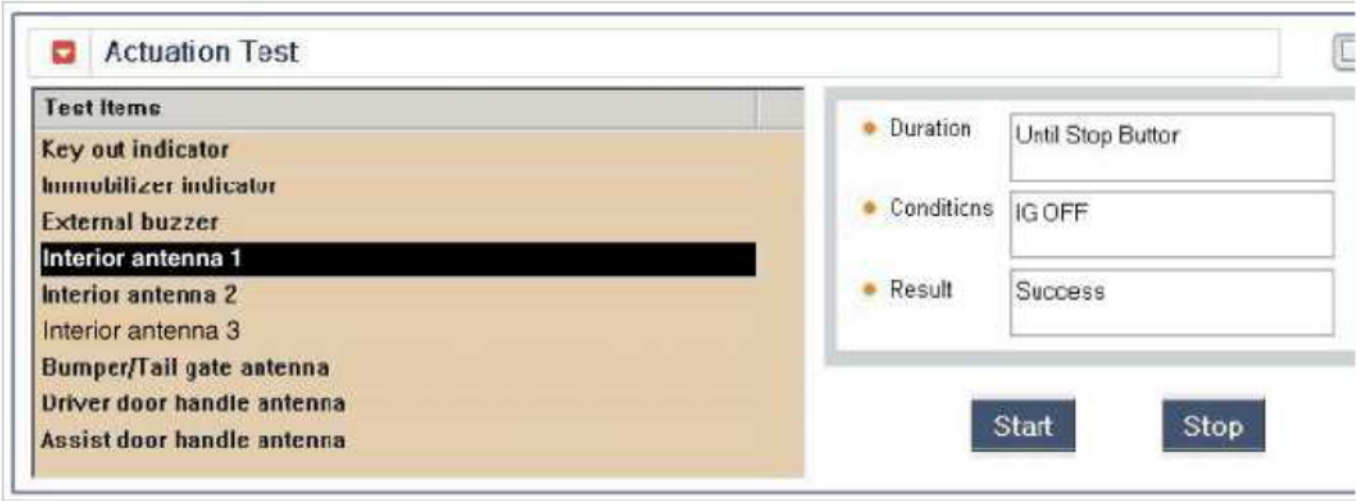


Antenna Actuation Diagnosis

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "ACTUATION TEST".



3. Set the smart key near the related antenna and operate it with a GDS.



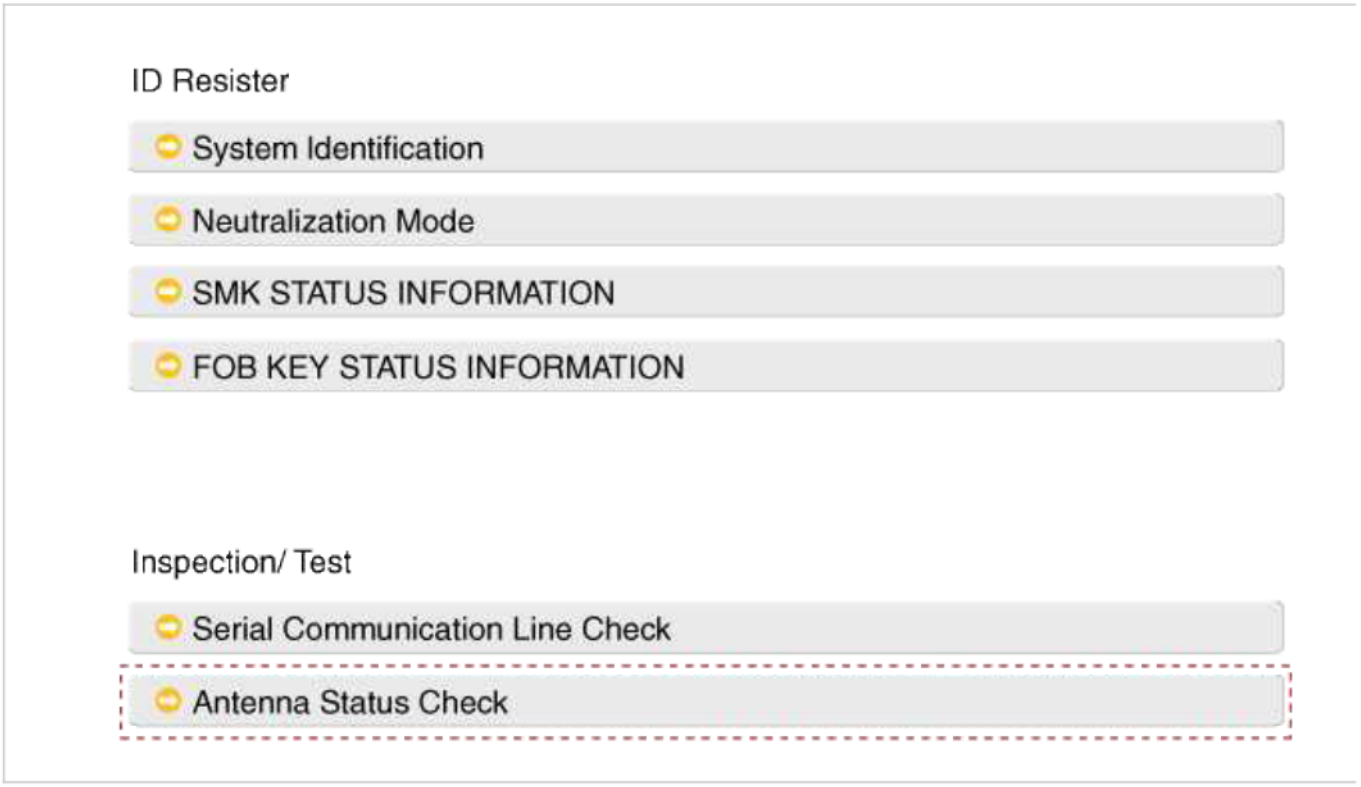
4. If the LED of smart key is blinking, the smart key is normal.
5. If the LED of smart key is not blinking, check the voltage of smart key battery.

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6. Antenna actuation
   A. INTERIOR Antenna 1
   B. INTERIOR Antenna 2
   C. INTERIOR Antenna 3
   D. BUMPER Antenna
   E. DRV_DR Antenna
   F. AST_DR Antenna

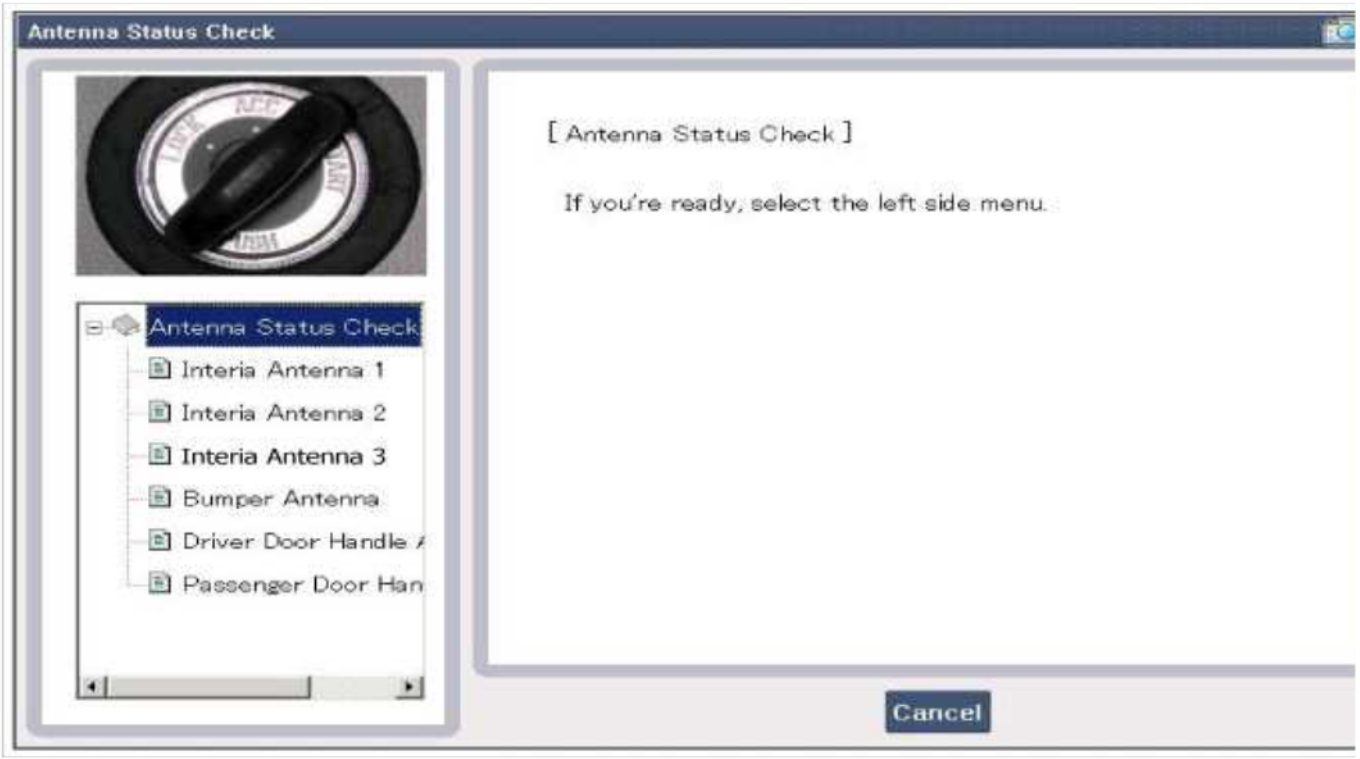
Antenna Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. Select the "Antenna Status Check".

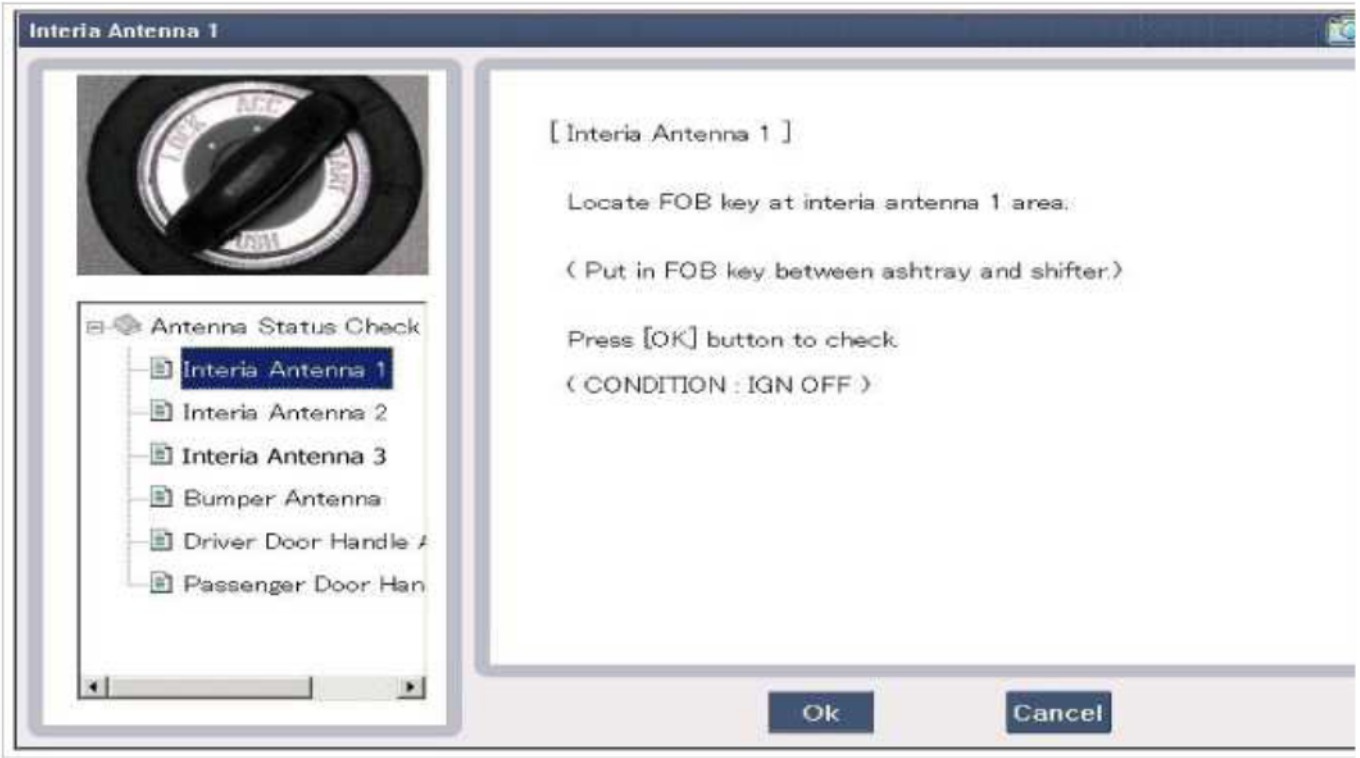


3. After IG ON, select the "Antenna Status Check".

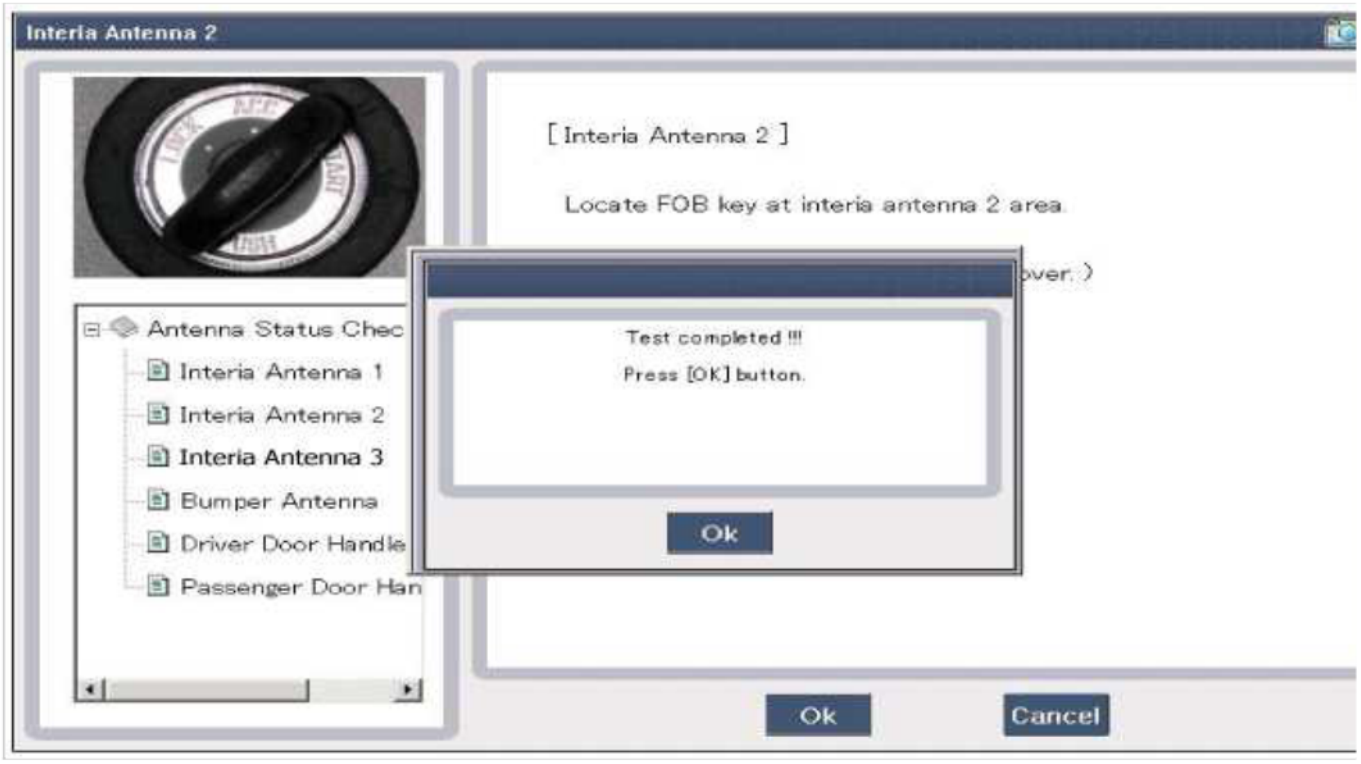
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4. Set the smart key near the related antenna and operate it with a GDS.



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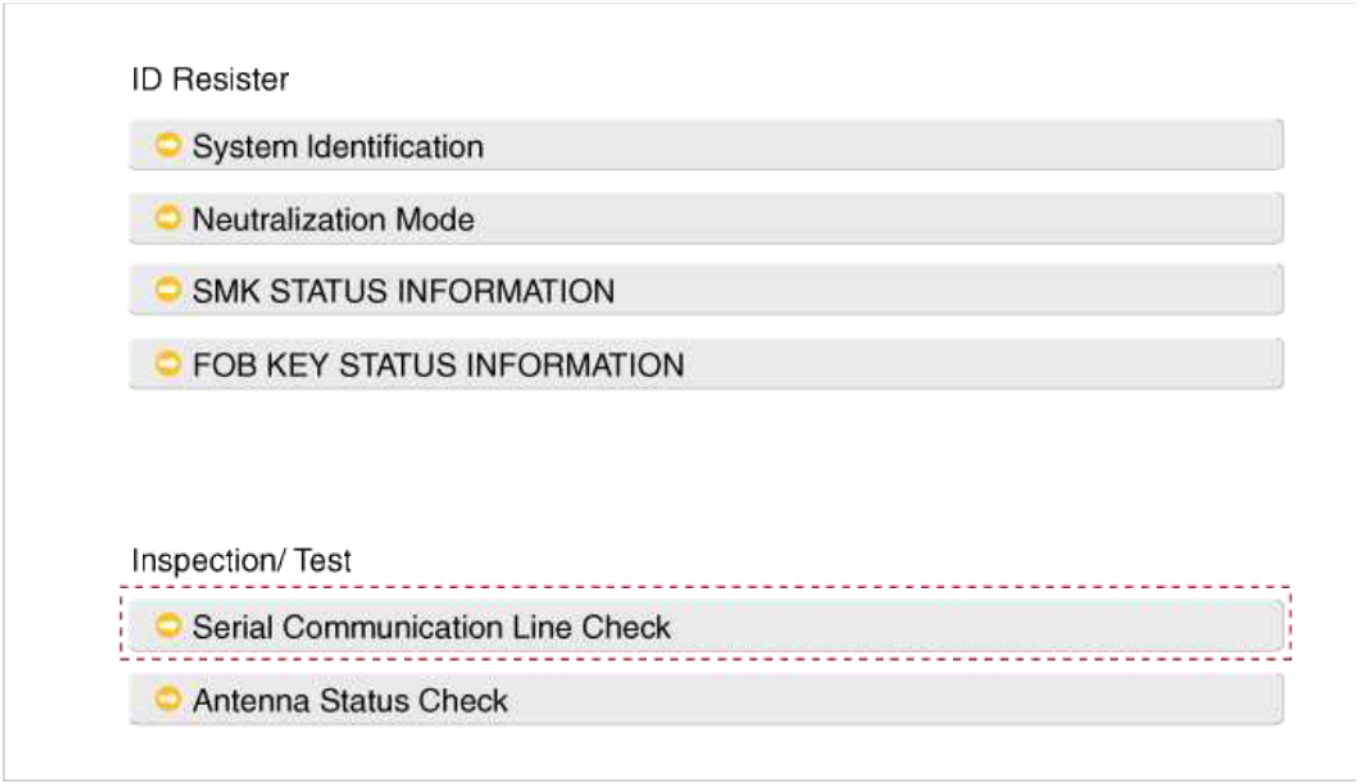


5. If the smart key runs normal , the related antenna, smart key(transmission, reception) and exterior receiver are no
6. Antenna status
   A. INTERIOR Antenna 1
   B. INTERIOR Antenna 2
   C. INTERIOR Antenna 3
   D. BUMPER Antenna
   E. DRV_DR Antenna
   F. AST_DR Antenna

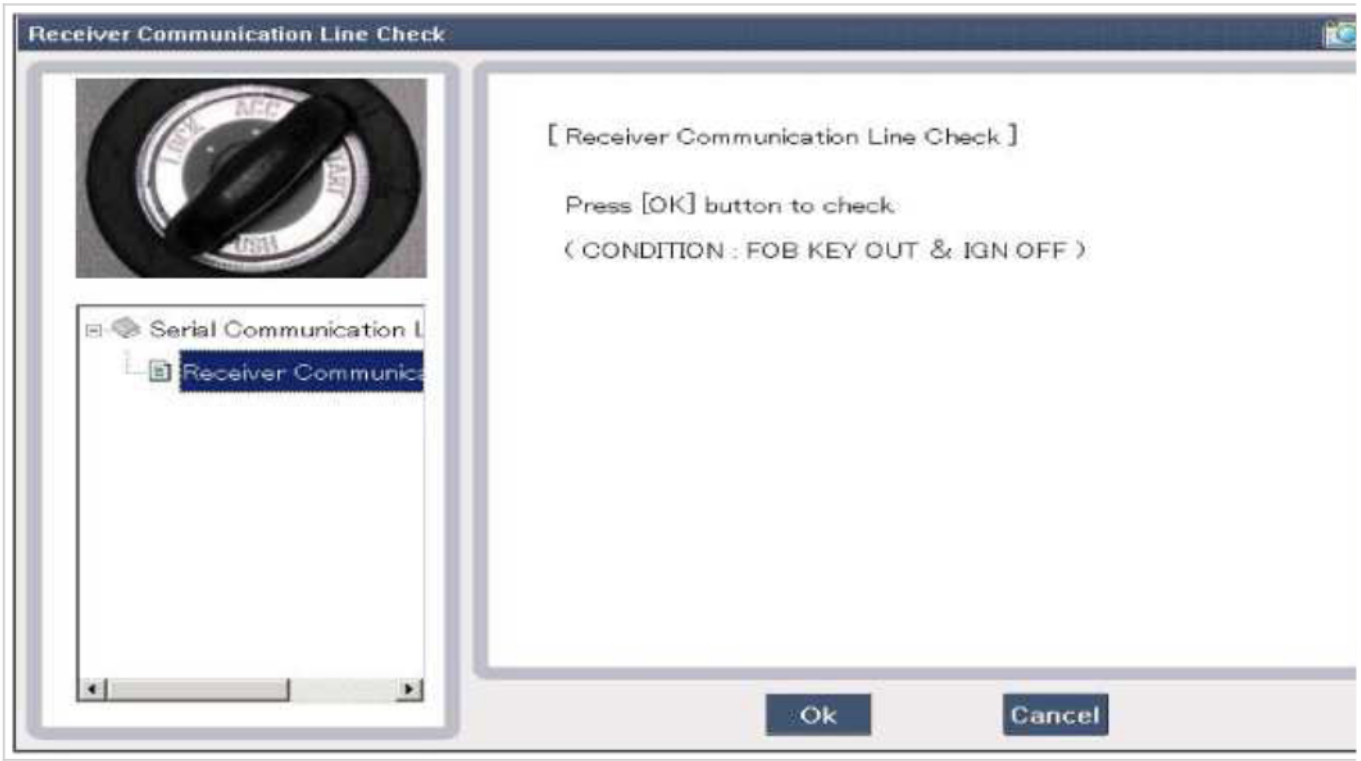
Serial Communication Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. Select the "Serial Communication Line Check".

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3. After IGN ON, select the "Receiver Communication Line Check".

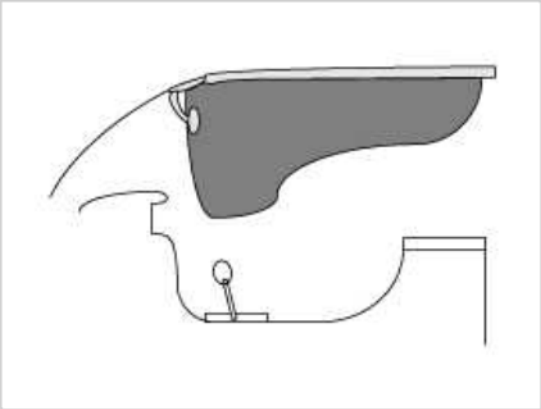


4. Check the serial communication line with a GDS.
5. If the smart key runs normal, the communication of smart key unit, exterior receiver and ESCL are normal.
6. If the smart key runs abnormal, check the following items.
   A. Disconnection or no response of the exterior receiver communication line.
   B. The exterior receiver communication line disconnection and ground connection.
   C. The ESCL disconnection or no response
   D. The ESCL disconnection and ground connection

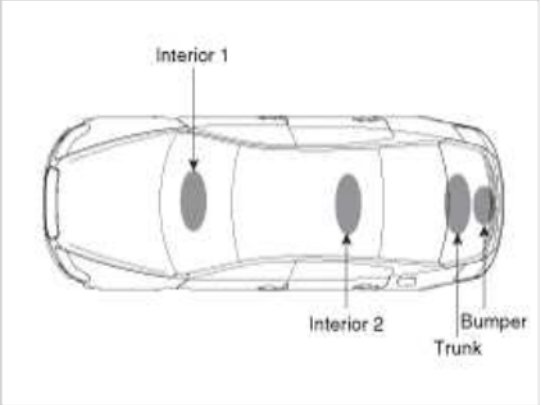
Interior Antenna Actuation Check

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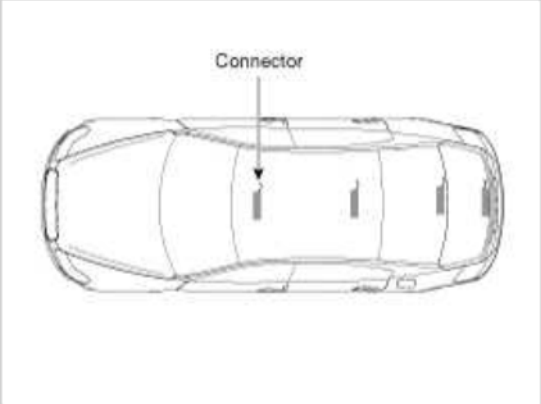
1. Set the smart key in the following shade area and check the IG ON.



2. If the ignition is ON, the antenna runs normal.
3. Check the interior antenna ignition mode.
4. Set the smart key in the following shade area and actuate the antenna. Check the LED of smart key is blinking.



5. If the LED of smart key is not blinking, check the antenna in shade area.

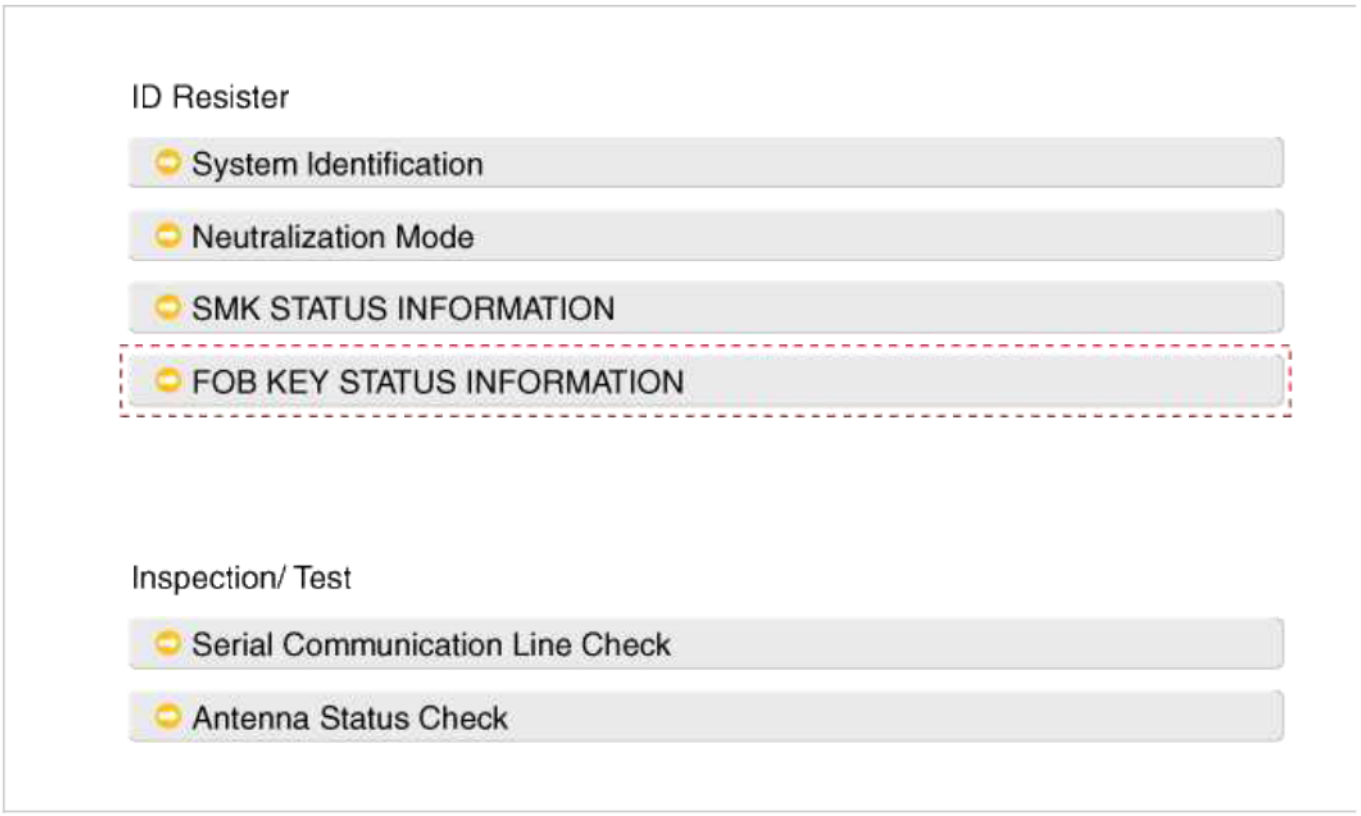


FOB Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

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2. After IGN ON, select the "FOB KEY STATUS INFO".



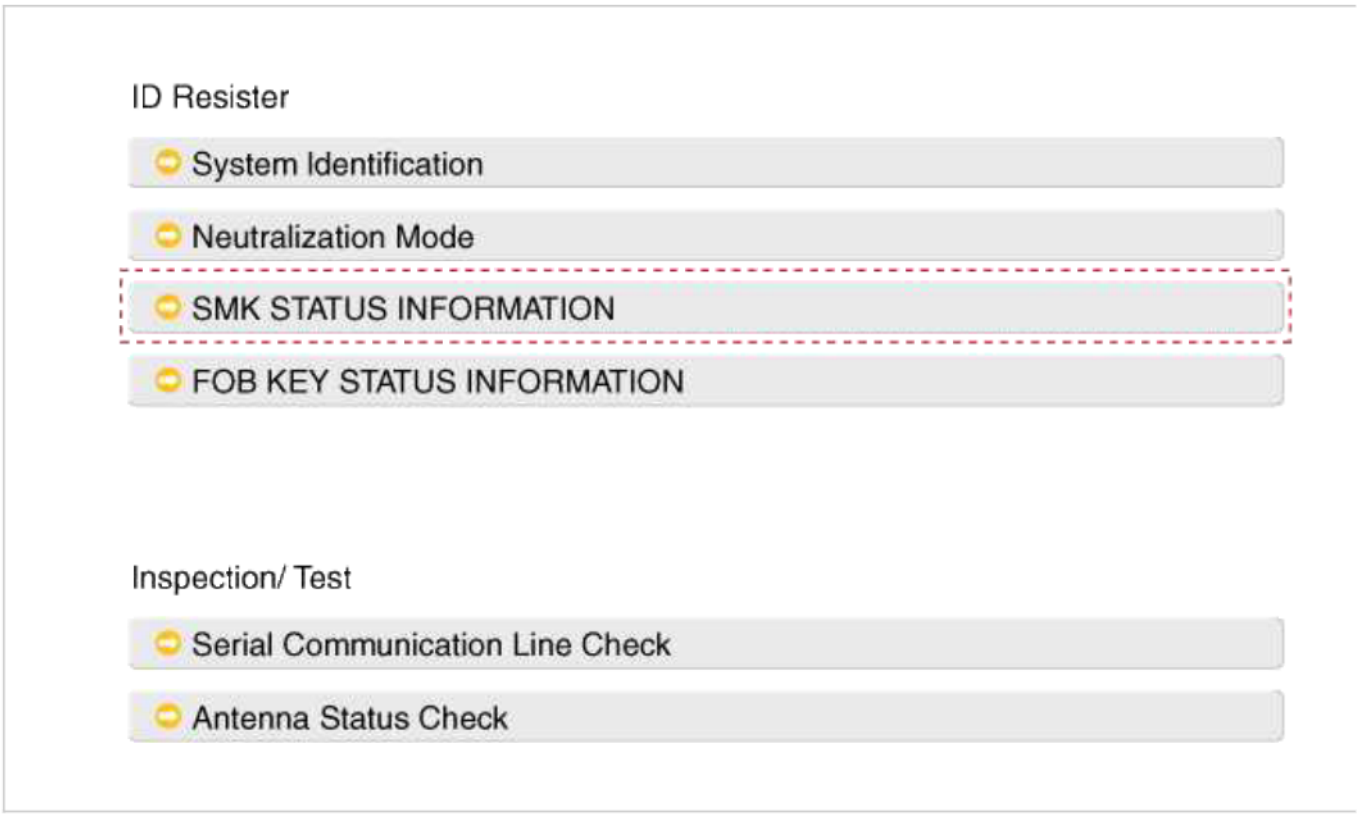


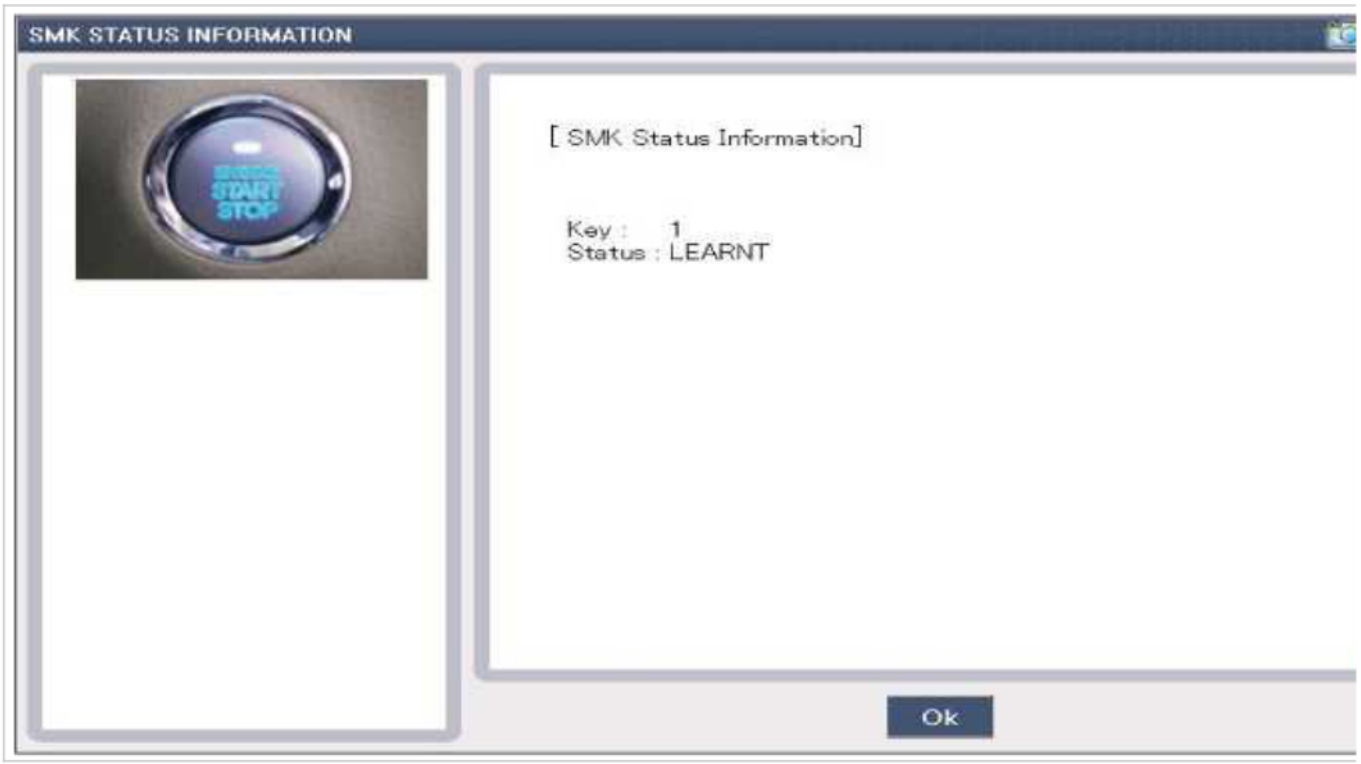
Smart Key Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.

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2. After IG ON, select the "SMK STATUS INFO".





Neutralization Status Check

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IGN ON, select the "Neutralization mode".

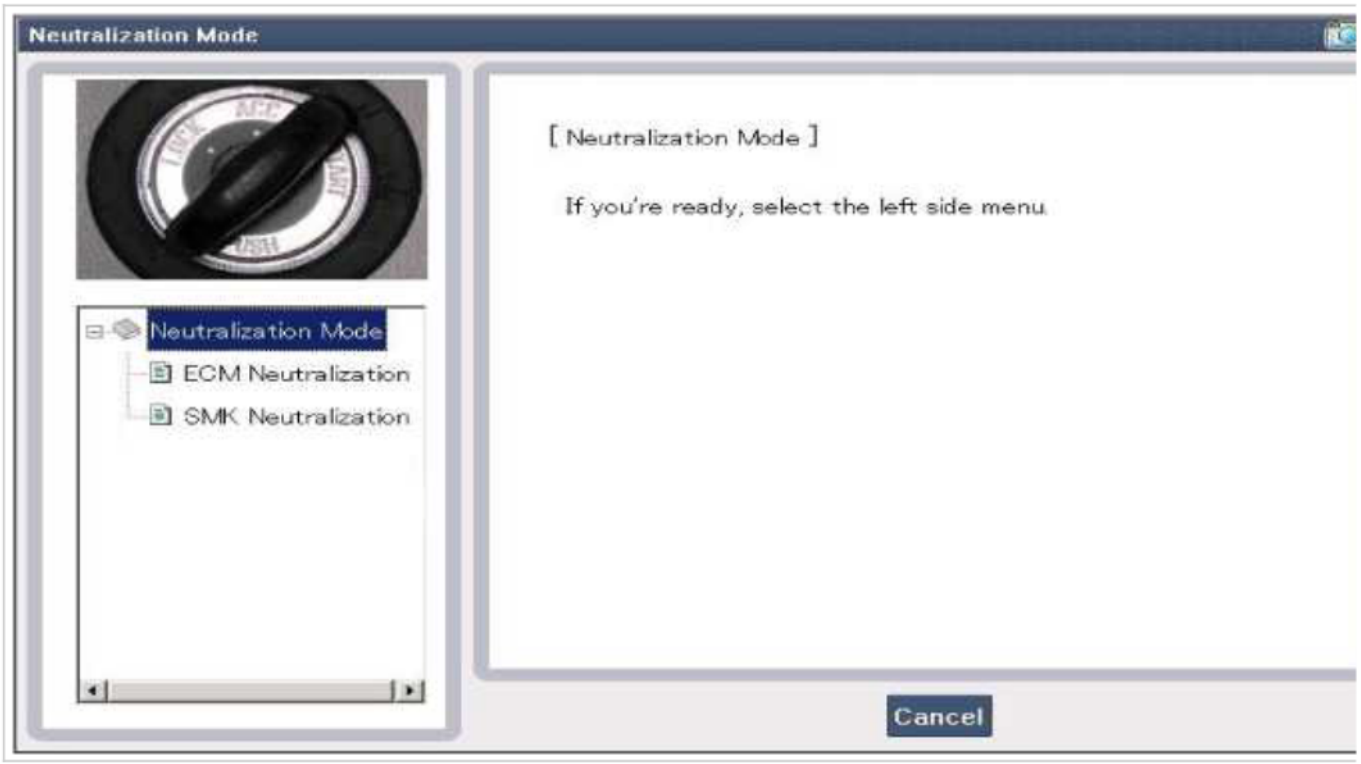
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ID Resister

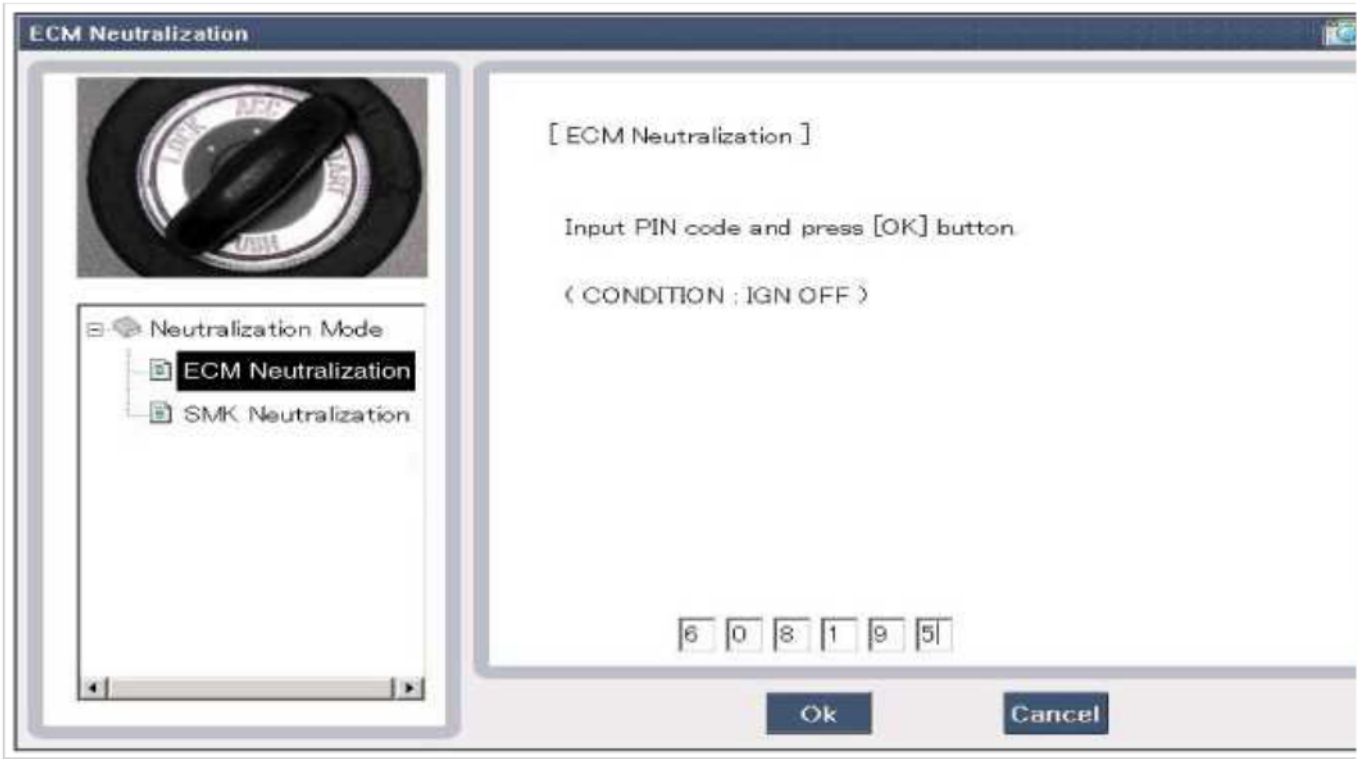
- System Identification
- Neutralization Mode
- SMK STATUS INFORMATION
- FOB KEY STATUS INFORMATION

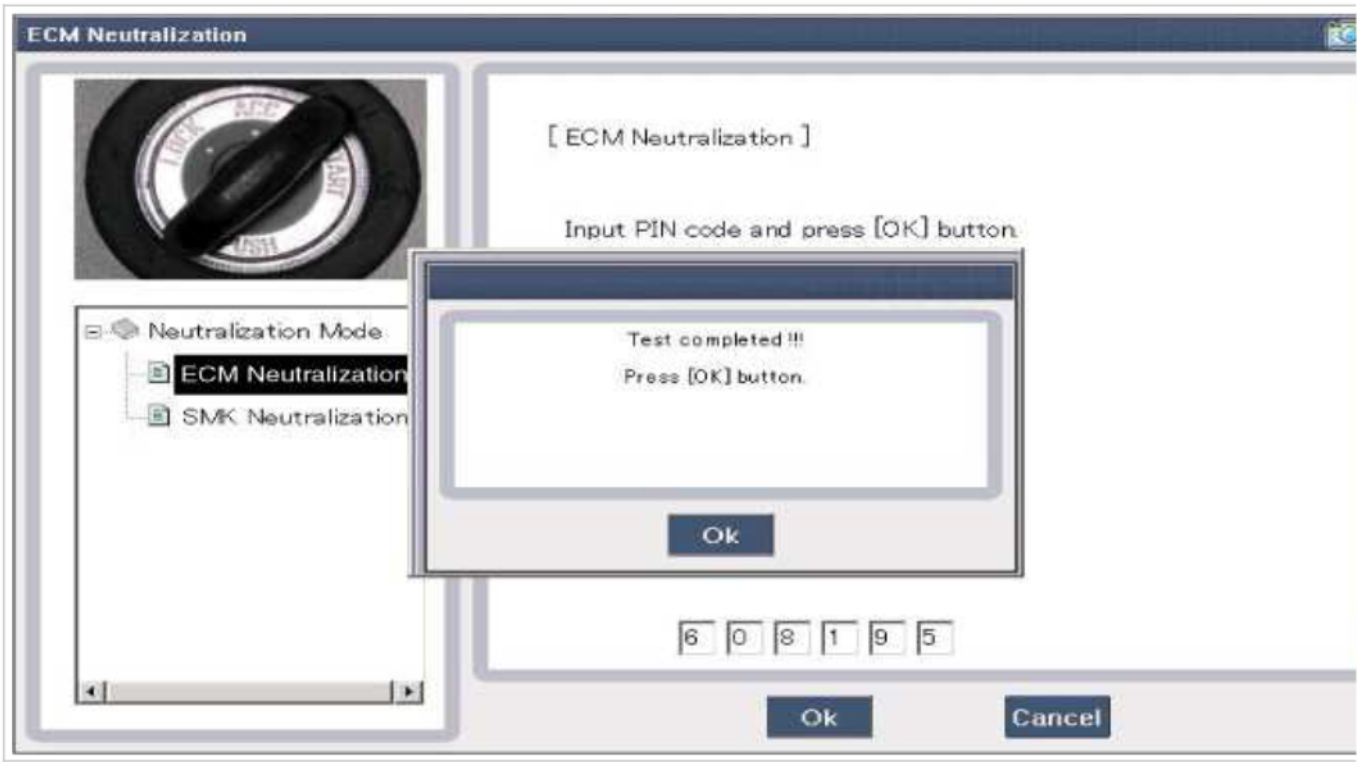
Inspection/ Test

- Serial Communication Line Check
- Antenna Status Check



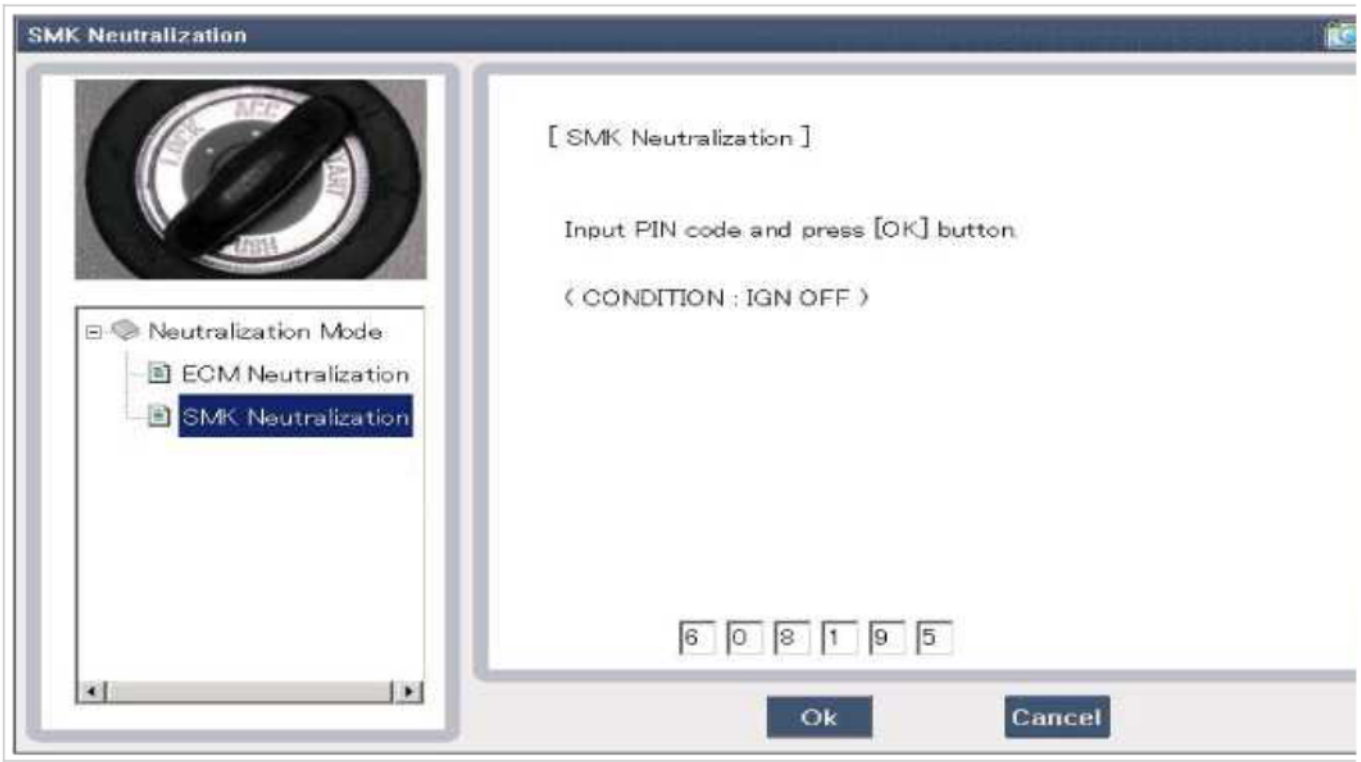
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Input Switch List

No	Item name	Unit
1	SSB switch2	-
2	ACC	-
3	IGN1	-
4	Gear 'P' Position	-
5	Brake switch	-
6	FL Door Lock Button	-
7	FR Door Lock Button	-
8	Trunk Lid switch	-
9	Battery Voltage	-
10	Alternator Voltage	-
11	KEY out Indicator Lamp	-
12	Immobilizer Lamp	-
13	External Buzzer	-

Actuator List

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No.	Item name	Condition
1	Immo. indicator Lamp	Ignition switch ON Engine off
2	External Buzzer	Ignition switch ON Engine off
3	Interior Antenna 1 Active	Ignition switch ON Engine off
4	Interior Antenna 2 Active	Ignition switch ON Engine off
5	Interior Antenna 3 Active	Ignition switch ON Engine off
6	Bumper Antenna Active	Ignition switch ON Engine off
7	DRV DR Antenna Active	Ignition switch ON Engine off
8	AST DR Antenna Active	Ignition switch ON Engine off

Body Electrical System

Specifications

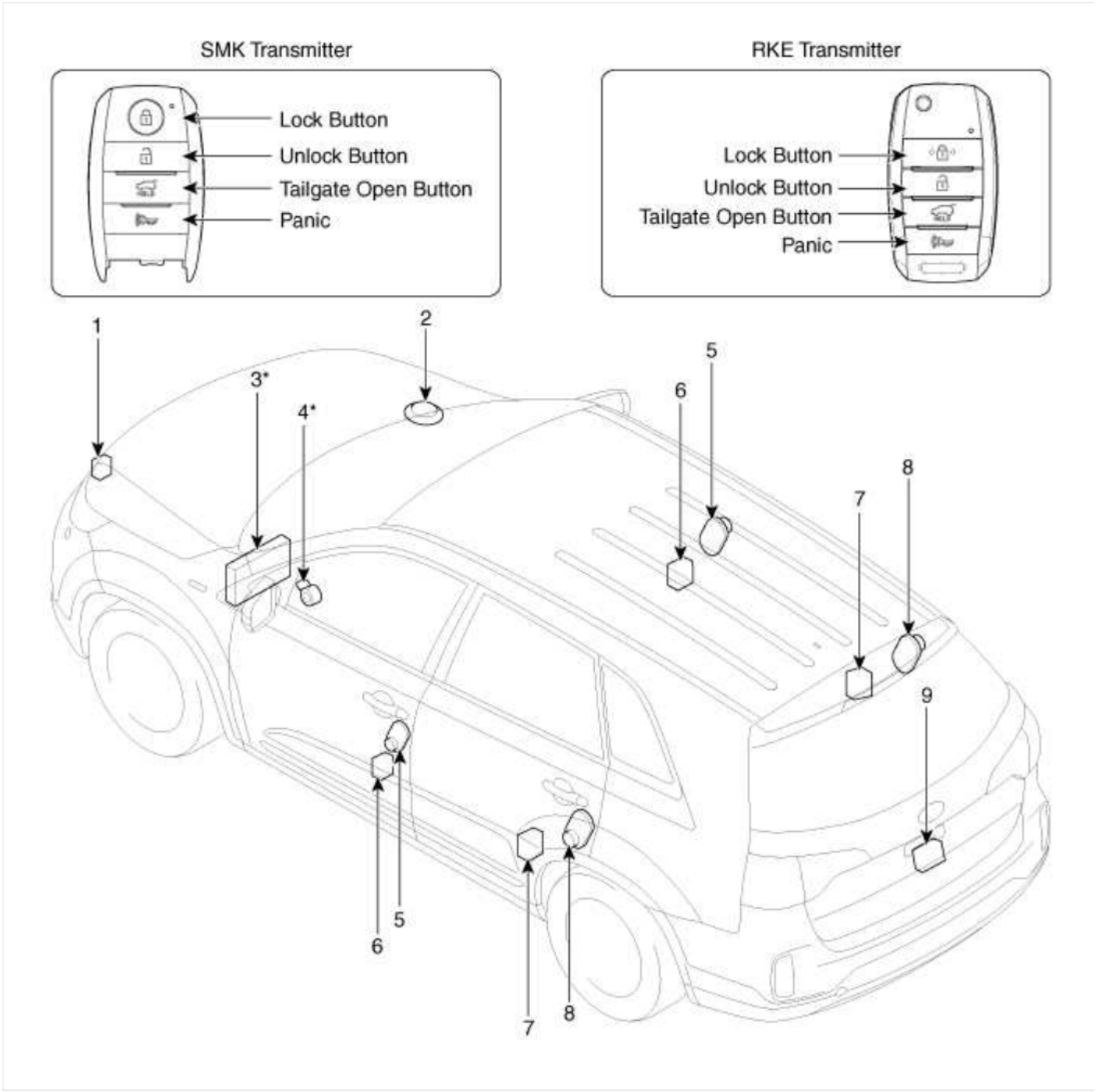
Item	Specification
Rated voltage	DC 3V
Temperature range	-4°F ~ 140°F (-20°C ~ +60°C)
RF Modulation method	FSK
LF Modulation method	ASK
Keyless entry transmitterPower source	Lithium 3V battery (1EA)
Transmissible distance	30m or more
Life of battery	2 years or more (at 20 times per day)
Button	4 (Door lock, Door unlock, Tailgate, Panic)
Transmission frequency	315 MHz

FSK : Frequency Shift Keying
ASK : Amplitude Shift Keying

Body Electrical System

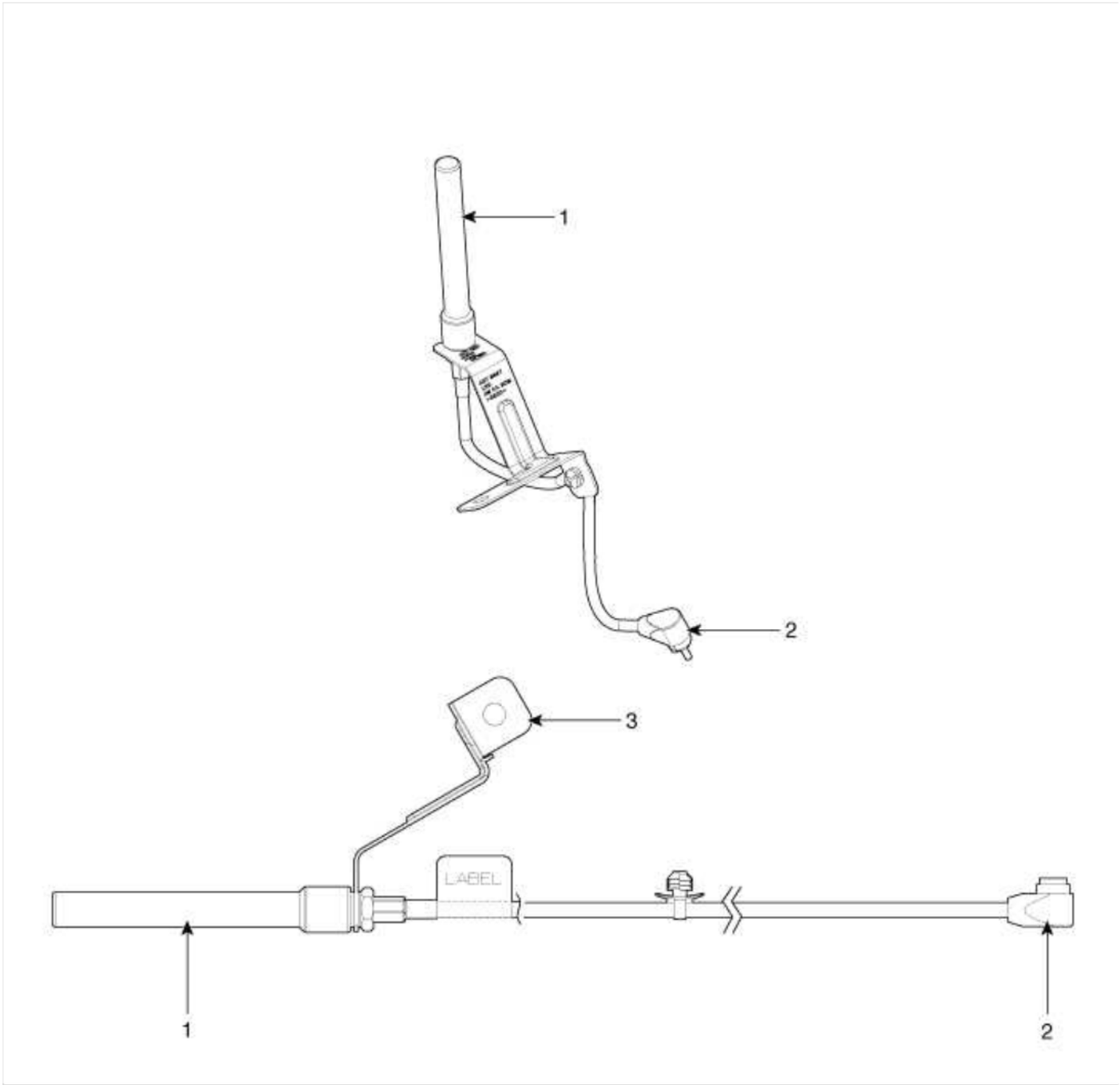
Component Location

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1. Hood switch 2. Burglar horn 3. IPM & RF receiver 4. Key warning switch 5. Front door switch	6. Front door lock actuator & switch 7. Rear door lock actuator & switch 8. Rear door switch 9. Tailgate lid switch

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1. Antenna 2. IPM connector	3. Antenna bracket

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Body Electrical System

Description

Burglar Alarm State [B/A State]

B/A State	Description
DISARM	1. In "DISARM" state, no vehicle start inhibition. So, when door, hood, or Tailgate i opened, there is no alarm sound and flashing. 2. If the battery is disconnected while the state is not "ARM/ARMWAIT/ALARM/REARM", B/A state is set to "DISARM" state.
ARMWAIT	1. In "ARMWAIT" state, when timer "30sec." is running, if this timer reaches "30sec transits to "ARM" state. 2. If the battery is disconnected while the state is "ARMWAIT", B/A state is set to "ARMWAIT" state and timer "30sec" is restarted.

[ARM WAIT Procedure]

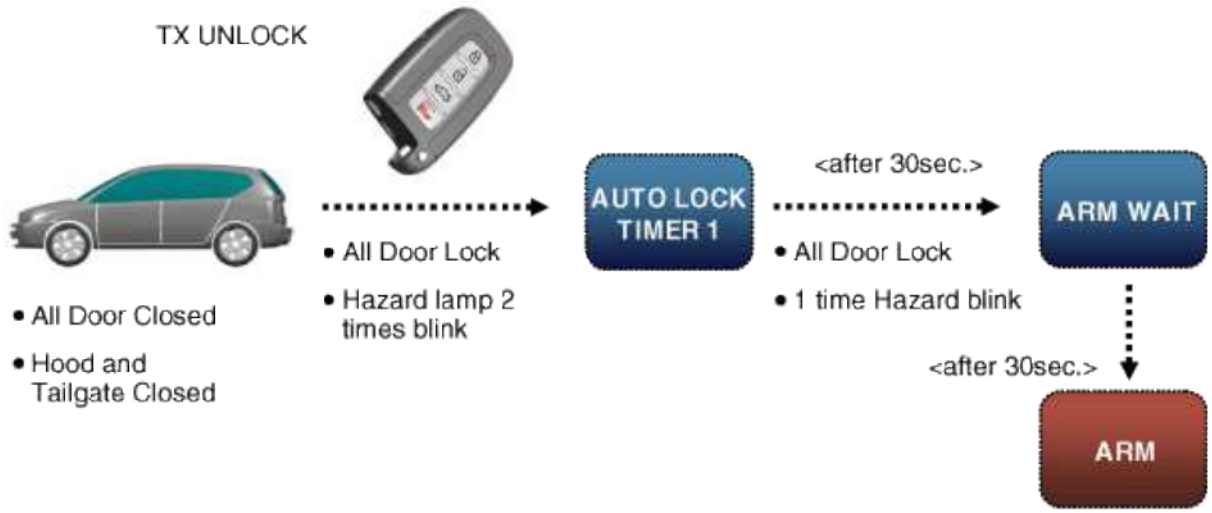


Remark: On Smart key system, it works the same way with passive lock

B/A State	Description
AUTO LOCK TIMER 1	1. In "AUTOLOCKTIMER1" state, timer "30sec."is running. If this timer expired, tl lock command is generated "Lock command". 2. When "Lock command" operated, All Door changed lock and closed then B/A s changes "AUTOLOCKTIMER1" to "ARMWAIT 3. In "AUTOLOCKTIMER1" state, Security Indicator keeps blinking. In "AUTOLOCKTIMER1" state, timer "30sec."is running. If this timer expired, the lock command is generated "Lock command". When "Lock command" operated Door changed lock and closed then B/A state changes "AUTOLOCKTIMER1" "ARMWAIT

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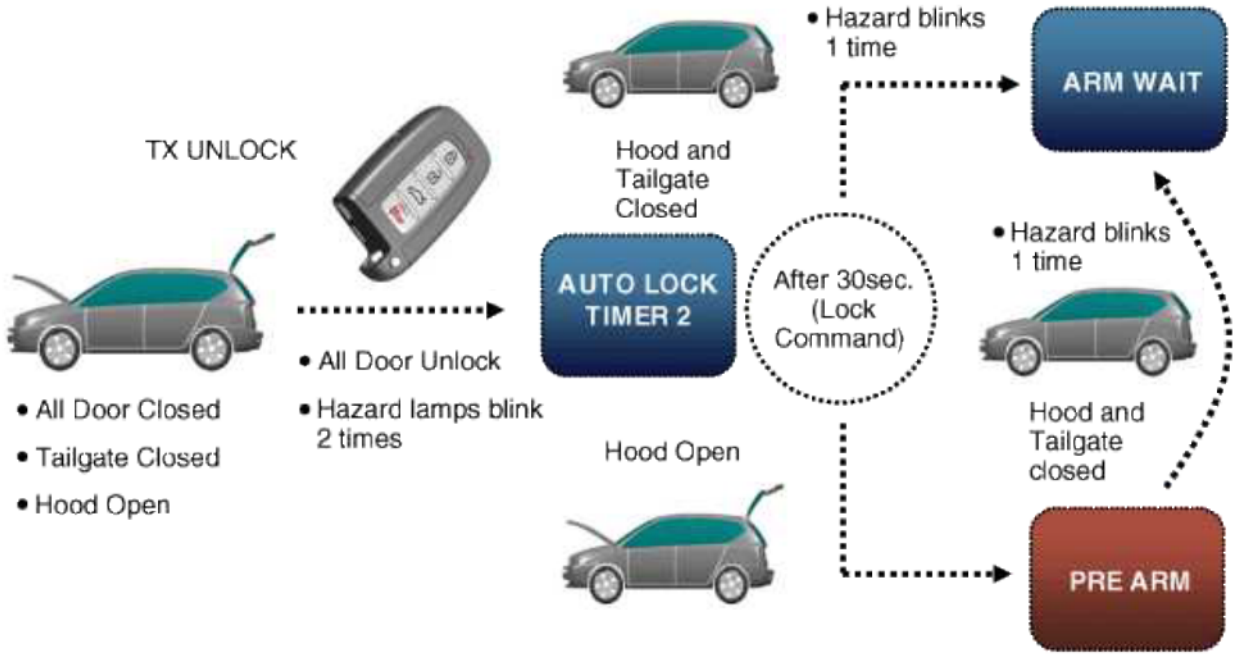
[AUTO LOCK TIMER 1 Procedure]



Remark: On Smart key system, it works the same way with passive unlock

B/A State	Description
AUTO LOCK TIMER 2	1. In "AUTOLOCKTIMER2" state, when timer "30sec."is running, if this timer expi auto lock command is generated "Lock command". 2. All doors are Locked, Hood is closed and Tailgate is closed when "Lock comma operated, then B/A state changes to"AUTOLOCKTIMER2" when "Lock Comn generated with Hood open. 3. When "Unlock command" operated on the condition of All Door closed and Hoc B/A state changes to "AUTOLOCKTIMER2".

[AUTO LOCK TIMER 2 Procedure]

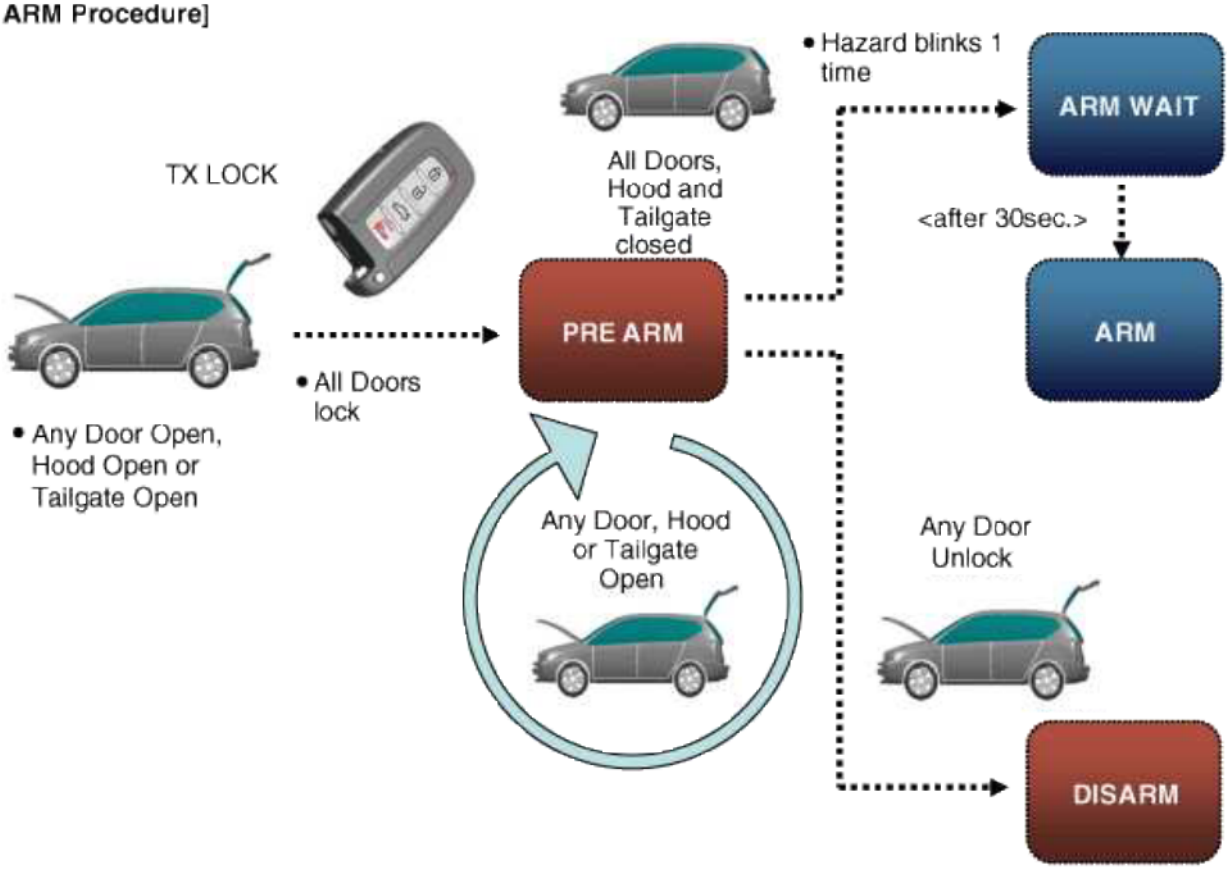


Remark: On Smart key system, it works the same way with passive unlock

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B/A State	Description
PRE ARM	1. The "PREARM" state is when user try to change to arm but pre-condition are not satisfied (door open, tailgate open, or hood open). 2. B/A state changes to “PREARM” when TX Lock command occurs with any doc Hood or Tailgate Open. 3. B/A state changes to “PREARM” when “30sec.” timer expired in“AUTOLOCKTIMER2”with Hood or Tailgate Open 4. The “PREAMR” state changes to “ARM” when all doors closed, All doors locke Hood and Tailgate closed. 5. The “PREAMR” state changes to “DISARM” when Any Door Unlock

[RPE ARM Procedure]

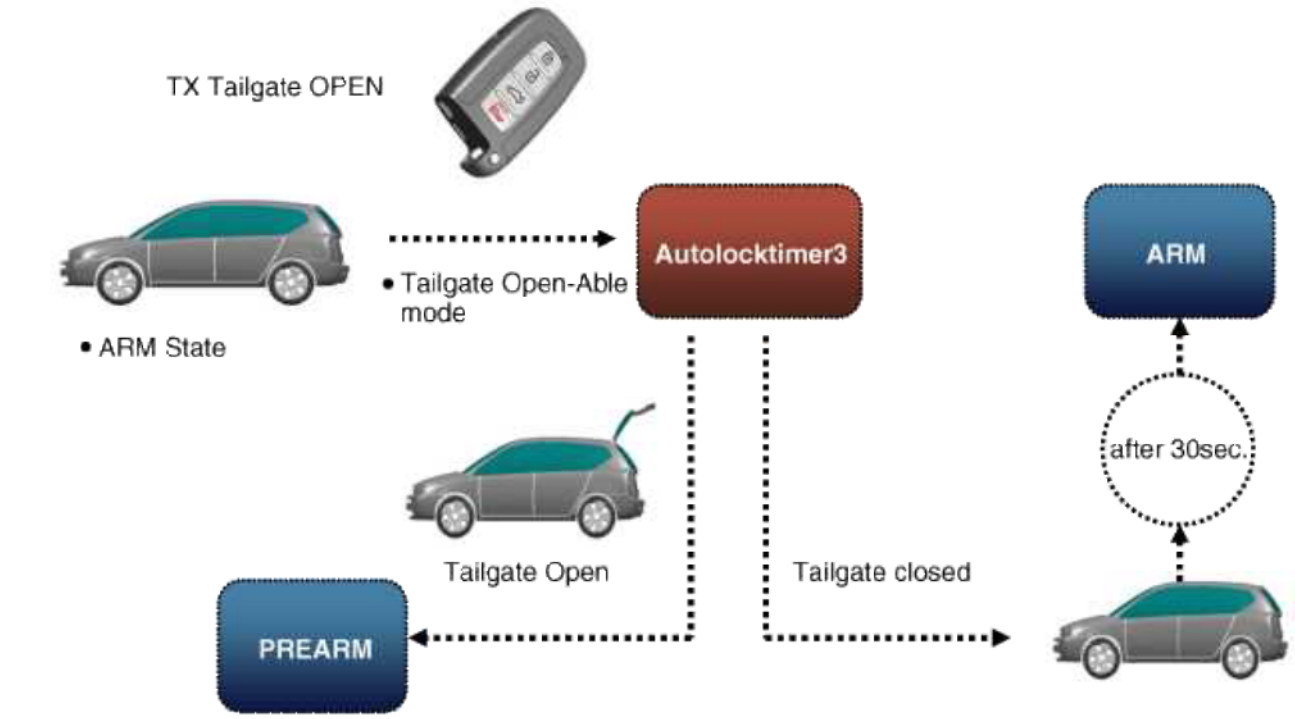


B/A State	Description
RE ARM	1. In "REARM" state, if the vehicle intrusion is detected, flashing and sound is restar again and state transits to "ALARM" state. 2. B/A state changes to “REARM” after the timer “27sec.” expires in “ALARM” sta All doors closed and lock.

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B/A State	Description
AUTOLOCK TIMER3	1. B/A state changes to “AUTOLockTIMER3”, when TX-Tailgate command opera 2. B/A state changes “AUTOLOCKTIMER3” to “ARMWAIT”, when the “30sec.” expires with all doors lock and closed. 3. B/A state changes “AUTOLOCKTIMER3” to “DISARM”, when any door oper 4. In "AUTOLOCKTIMER3" state, timer “30sec.“ timer is running. If this timer exp state transits to "PREARM" state with Tailgate Open.

[AUTOLOCKTIMER 3 Procedure]



Body Electrical System

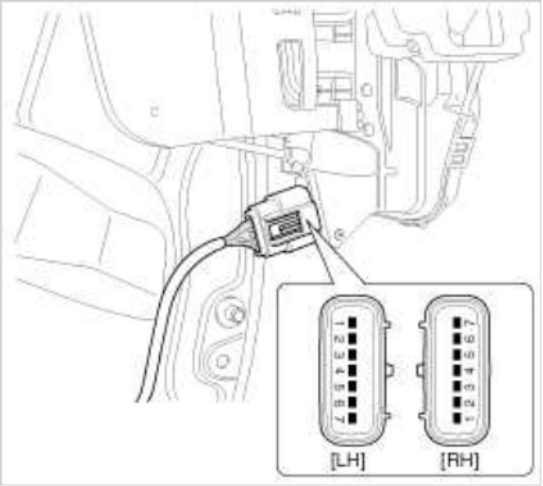
Inspection

Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to Body - "Front door")
2. Remove the front door module.
   (Refer to Body - "Front door")

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3. Disconnect the connectors from the actuator.

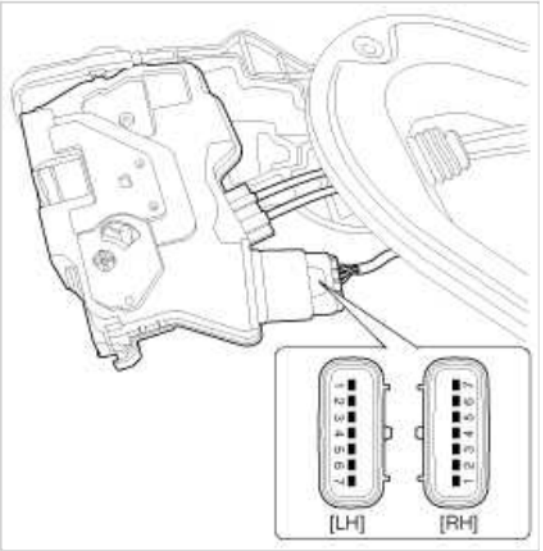


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the act apply battery voltage only momentarily.

Position \ Terminal		3	4
Front left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		**4**	**5**
Front right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Rear Door Lock Actuator

1. Remove the rear door trim.
   (Refer to Body - "Rear door")
2. Remove the rear door module.
   (Refer to Body - "Rear door")
3. Disconnect the connectors from the actuator.



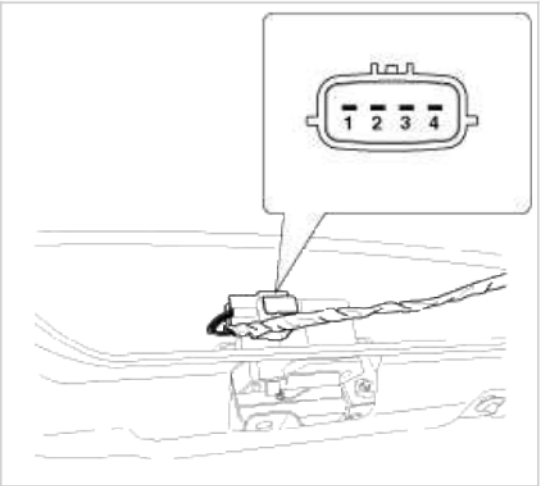
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4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the act apply battery voltage only momentarily.

Position \ Terminal		4	3
Rear left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		4	5
Rear right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim.
   (Refer to Body - "Tailgate")
2. Disconnect the 4P connector from the actuator.

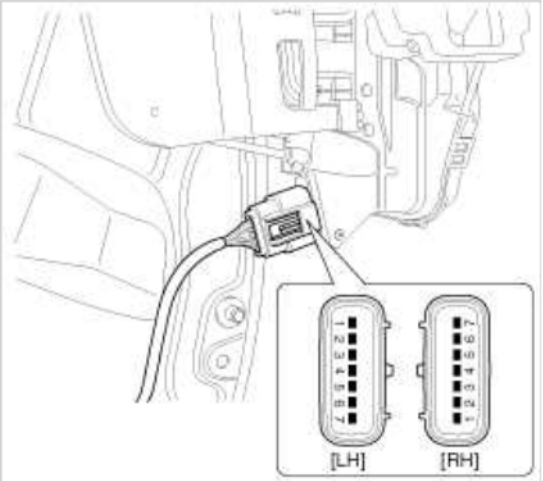


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the act apply battery voltage only momentarily.

Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

1. Remove the front door trim.
   (Refer to Body - "Front door")
2. Remove the front door module.
   (Refer to Body - "Front door")
3. Disconnect the connectors from the actuator.



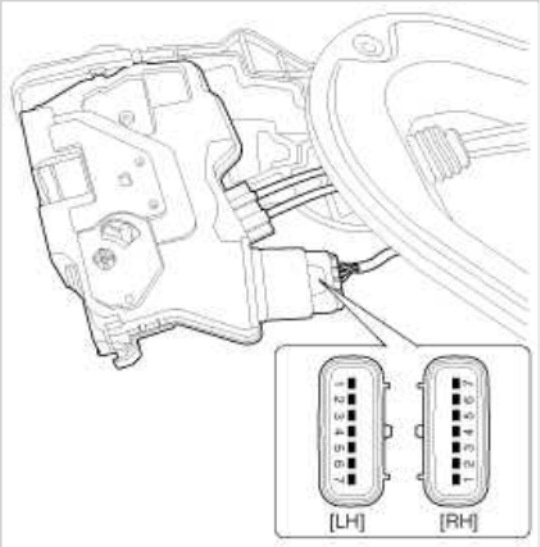
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4. Check for continuity between the terminals in each switch position when inserting the key into the door according table.

Position		Terminal 7	6	2	1
Front left	Lock	○			○
	Unlock		○	○	○
Front right	Lock	○			○
	Unlock		○	○	○

Rear Door Lock Switch

1. Remove the rear door trim.
   (Refer to Body - "Rear door")
2. Remove the rear door module.
   (Refer to Body - "Rear door")
3. Disconnect the connectors from the actuator.



4. Check for continuity between the terminals in each switch position according to the table.

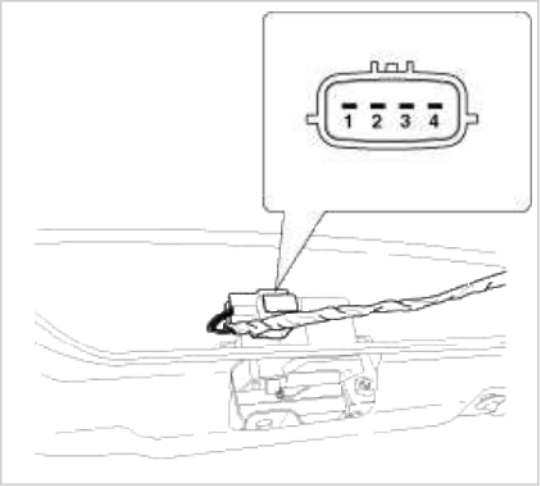
Position		Terminal	2	1
Central Door Lock	Rear Left	Lock		
		Unlock	○	○
Position		Terminal	6	7
Central Door Lock	Rear Right	Lock		
		Unlock	○	○

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to Body - "Tailgate")

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2. Disconnect the 4P connector from the actuator.

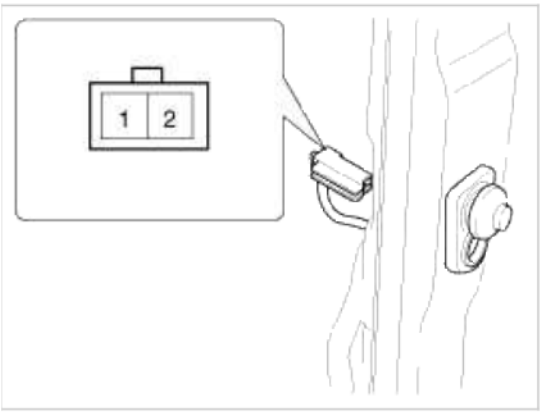


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2
Lock		
Unlock	○	○

Door Switch

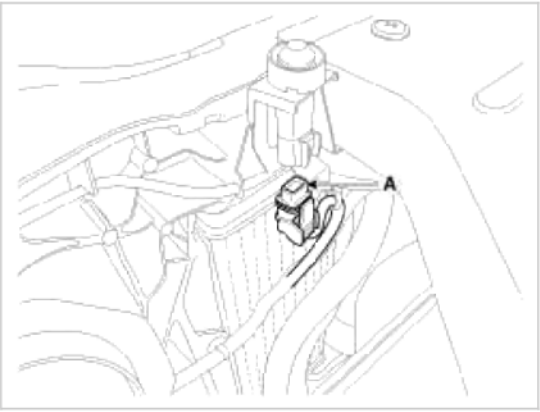
Remove the door switch and check for continuity between the terminals.



Position \ Terminal	1	2	GND
Free(Door open)	○	○	○
Push(Door close)			

Hood Switch

1. Disconnect the connector (A) and bolt from the hood switch.



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2. Check for continuity between the terminals and ground according to the table.

[2P Connector]

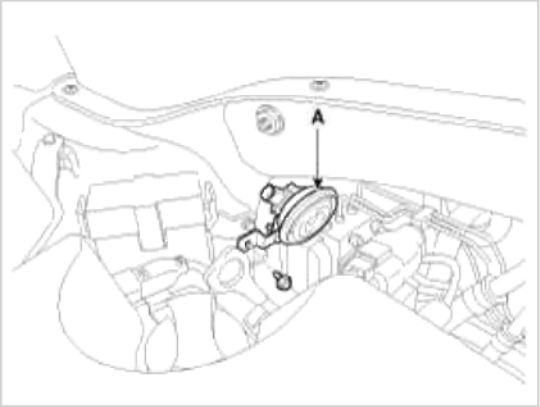
Position \ Terminal	1	2
Hood Open(Free)	○	○
Hood Close(Push)		

[1P Connector]

Position \ Terminal	1	GND
Hood Open(Free)	○	○
Hood Close(Push)		

Burglar Horn

1. Remove the burglar horn after removing a bolt and disconnect the 2P connector from the burglar horn.

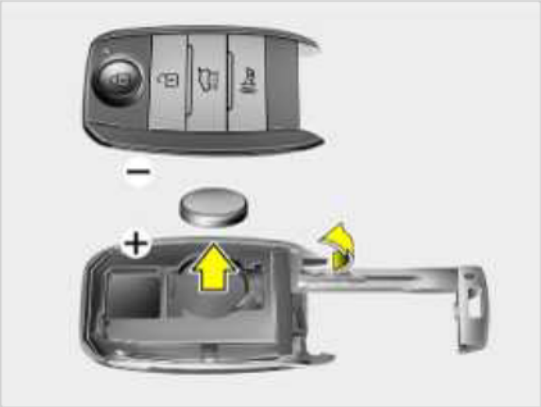


2. Test the burglar horn by connecting battery power to the terminal 1 and ground the terminal 2.
3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

Inspection

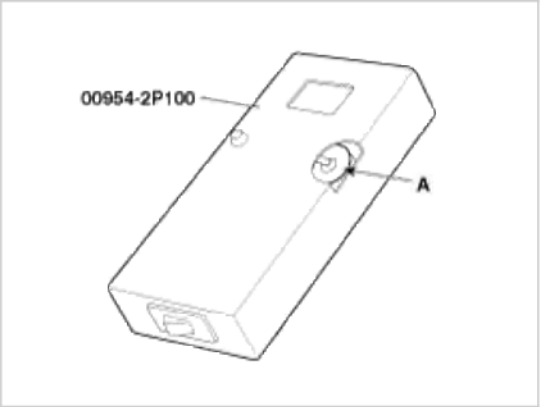
1. Check that the red light flickers when the door lock or unlock button is pressed on the transmitter.
2. Remove the battery (A) and check voltage if the red light doesn't flicker.

Standard voltage : 3V



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3. Insert the battery (A) into the tester (09954-2P100).

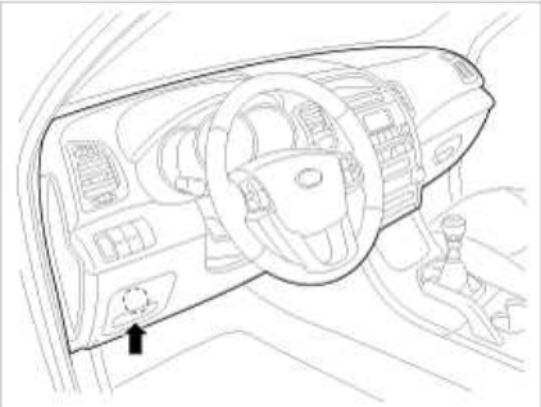


4. Push the test button and If "0.00" is displayed on screen, it means that the battery voltage is 2V or less.
5. If "L" is displayed on screen, it means that the battery is low power and it needs to replace.
6. To prevent the discharge of electricity, turn the tester power off.
7. Replace the transmitter battery with a new one, if voltage is low power then try to lock and unlock the doors with transmitter by pressing the lock or unlock button five or six times.
8. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitte then try to lock and unlock the doors.
9. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, replace the transmitte

> **WARNING**
> An inappropriately disposed battery can be harmful to the environment and human health.
> Dispose the battery according to your local law(s) or regulation.

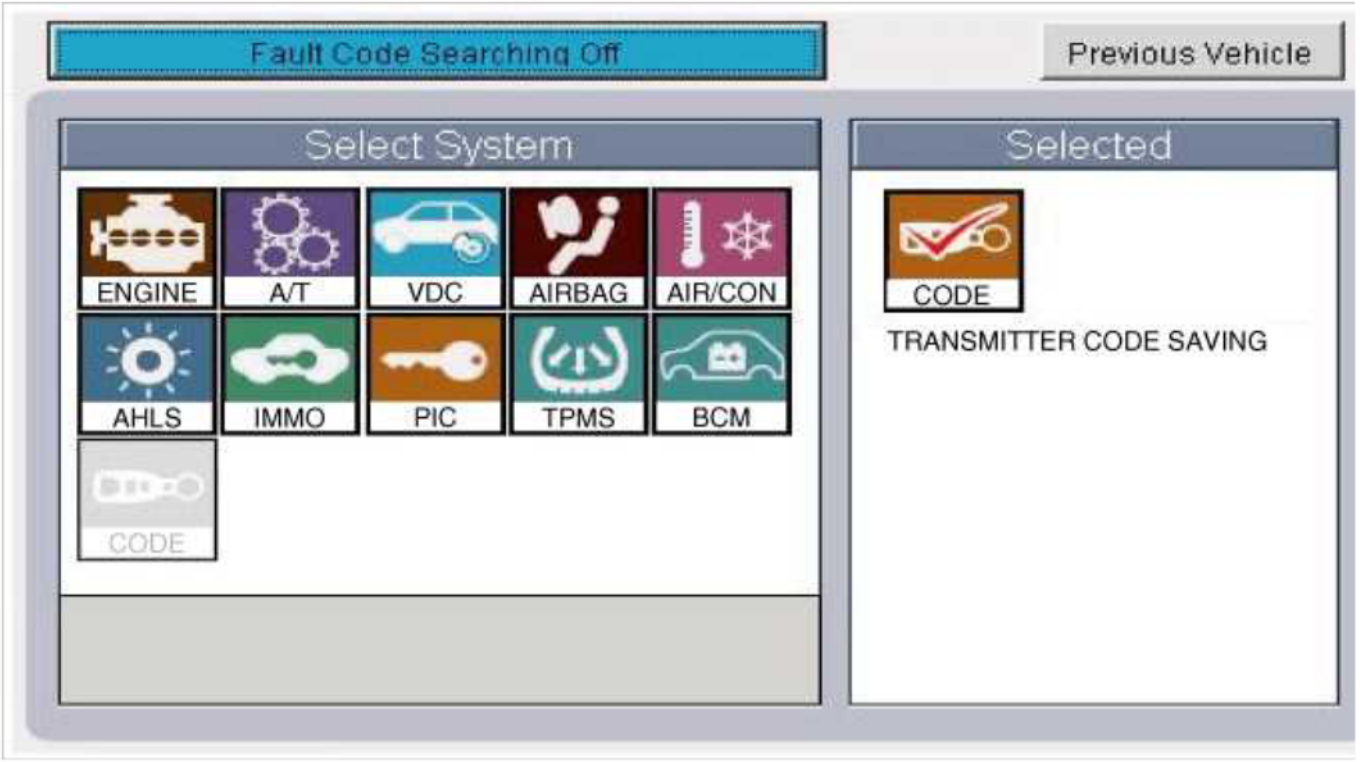
Transmitter Code Registration (Using GDS)

1. Connect the DLC cable of GDS to the data link connector (16 pins) in driver side crash pad lower panel, turn th on GDS.

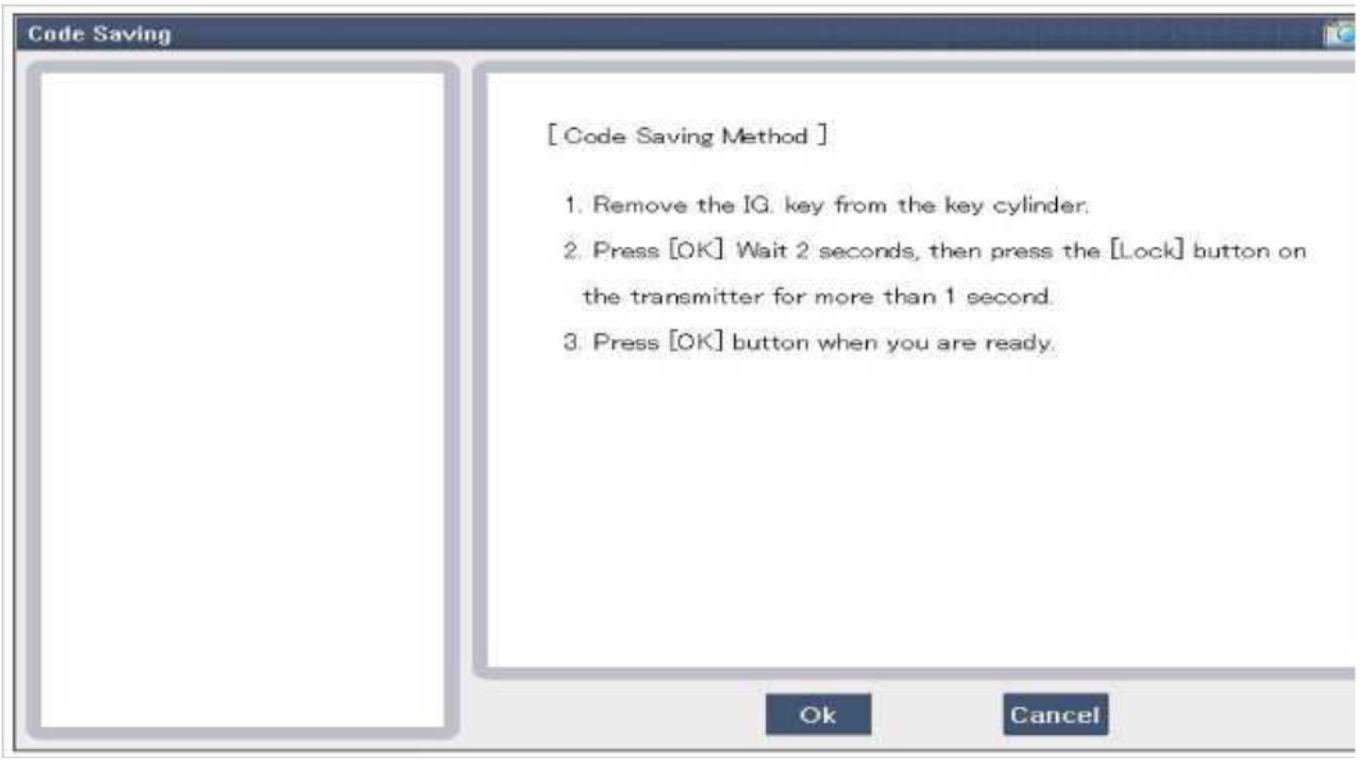


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2. Select the vehicle model and then do "CODE SAVING"

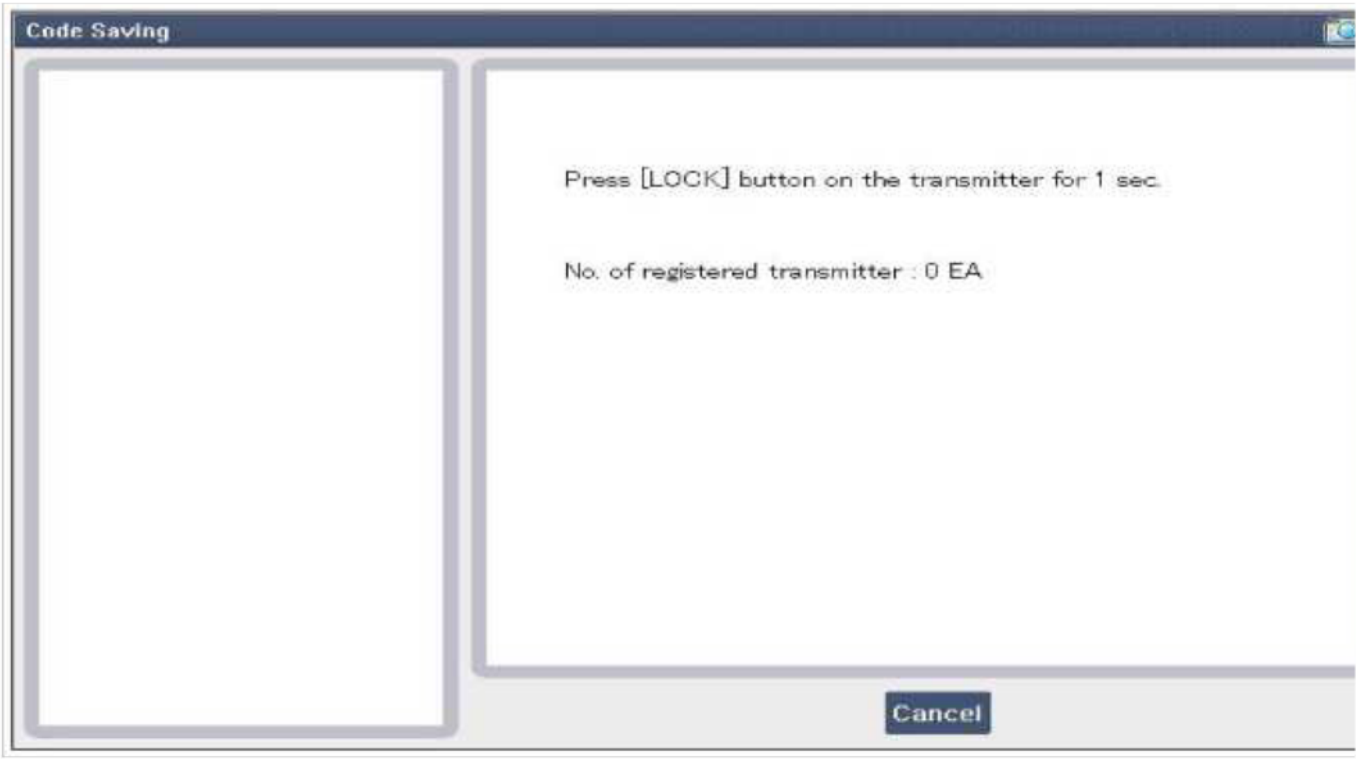


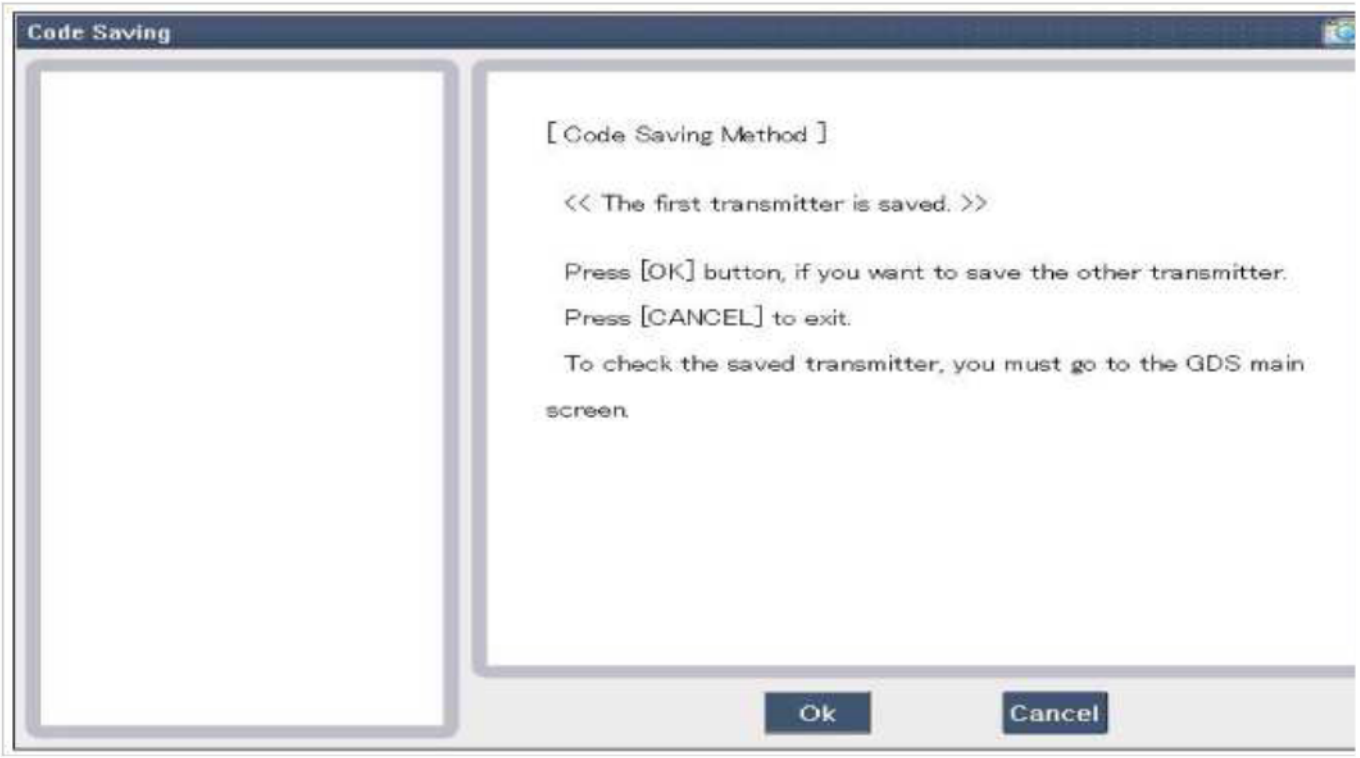
3. After selecting "CODE SAVING" menu, button "ENTER" key, then the screen will be shown as below.



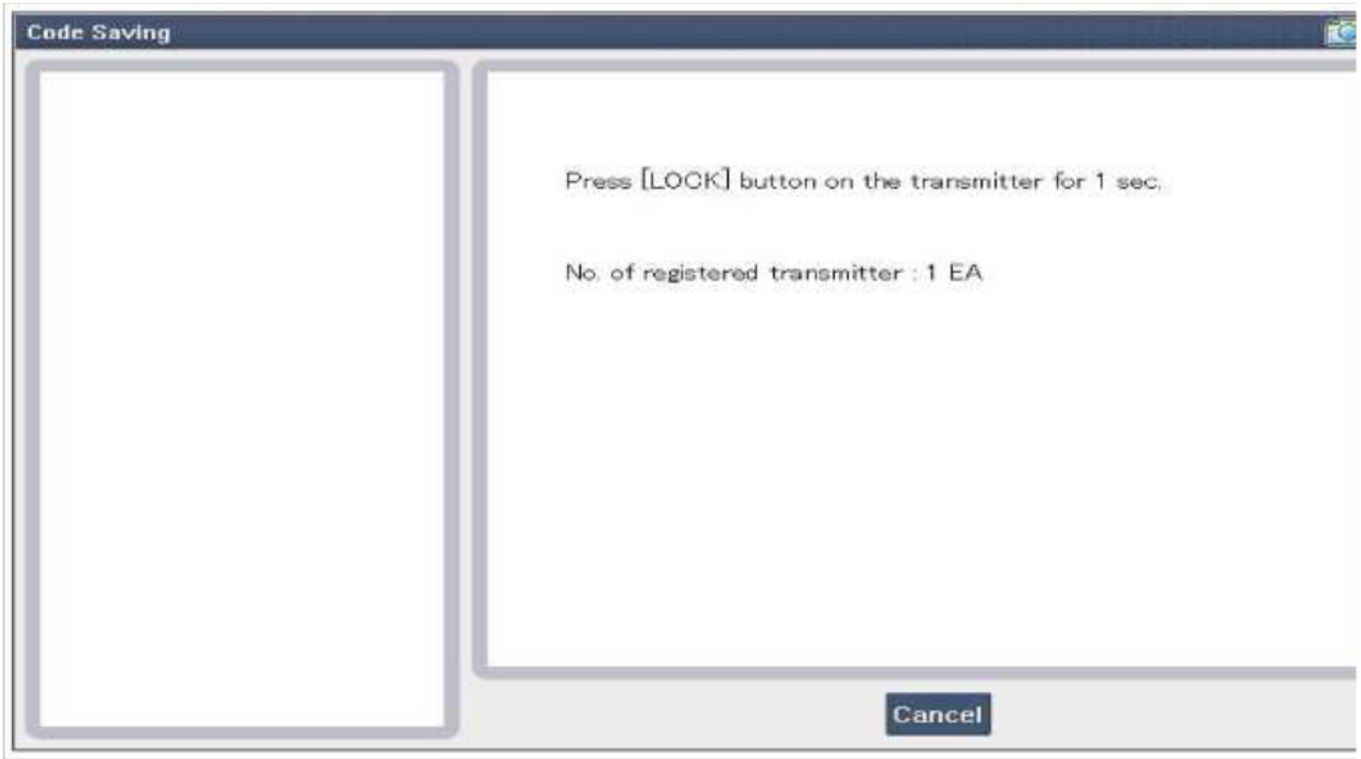
4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code savi
Follow steps 1 to 4 and then code saving is completed.

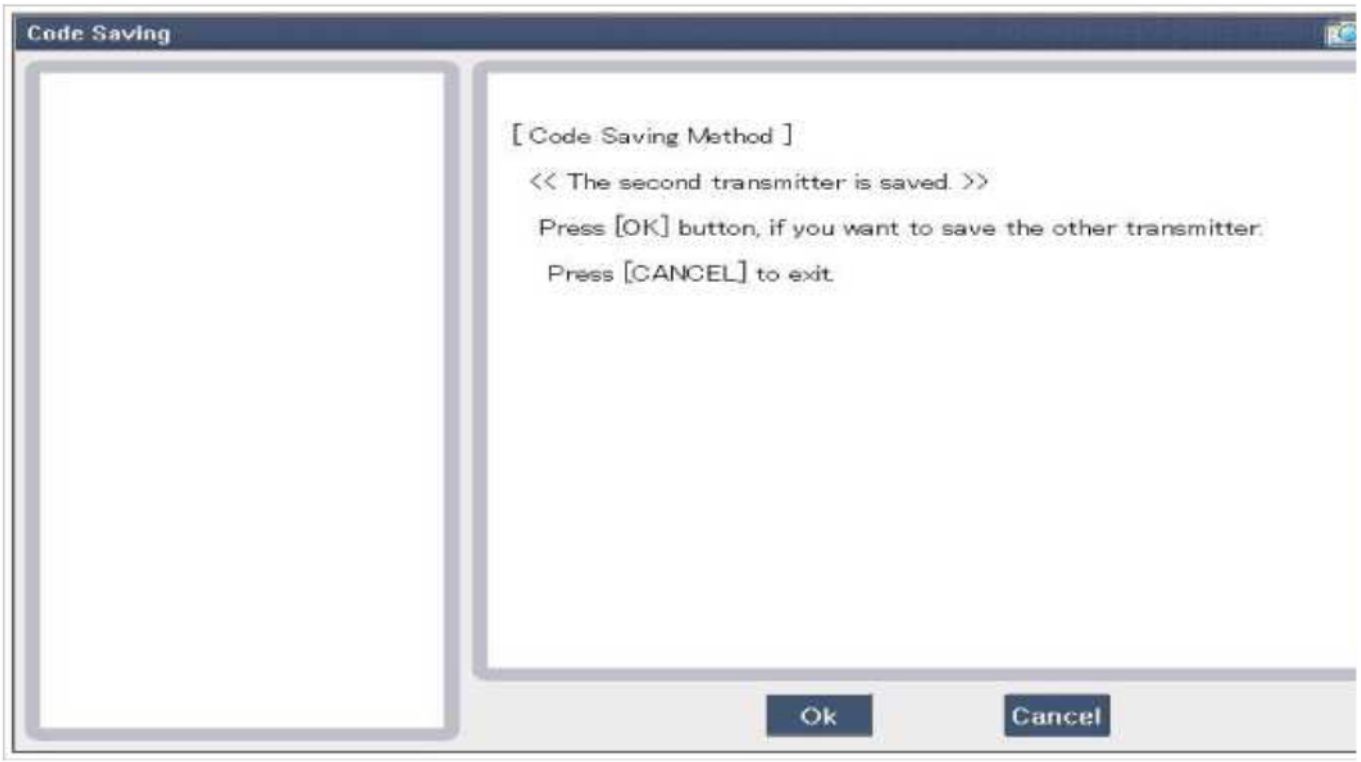
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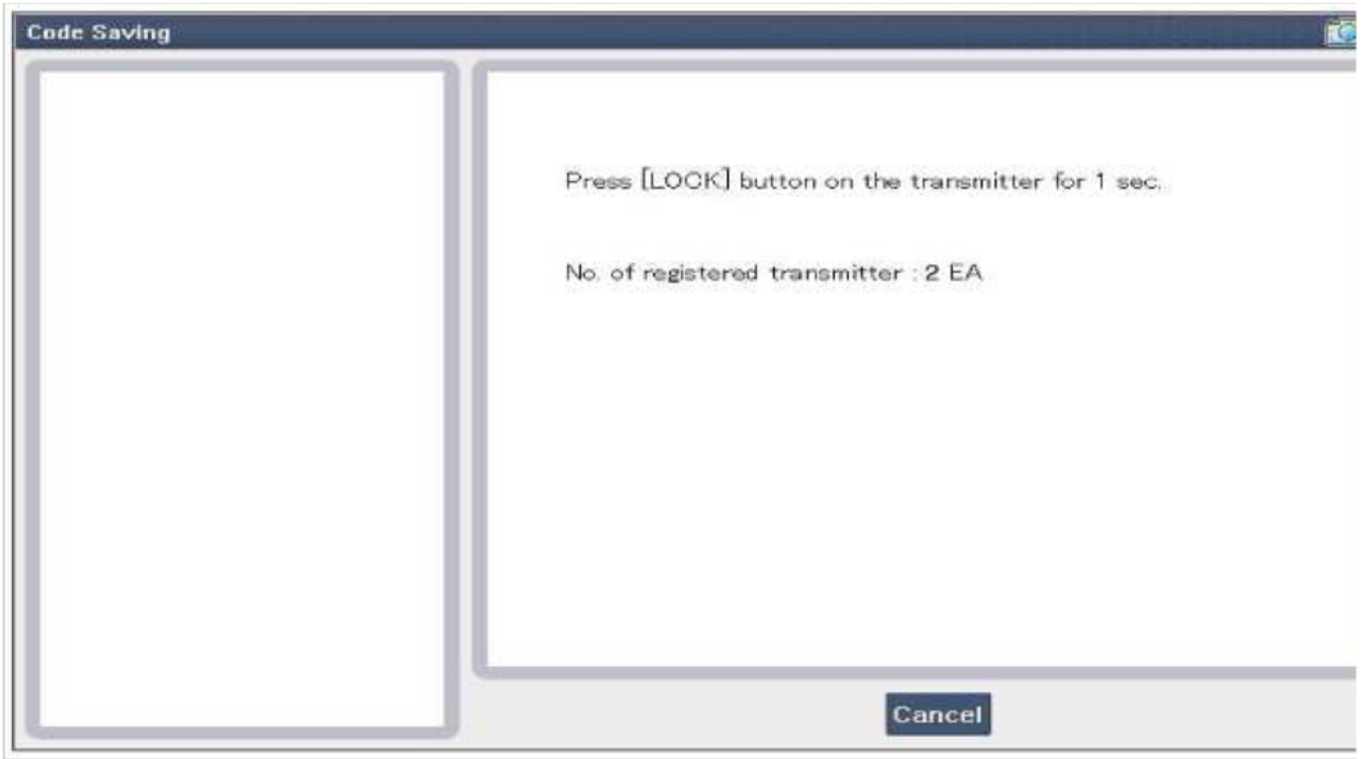


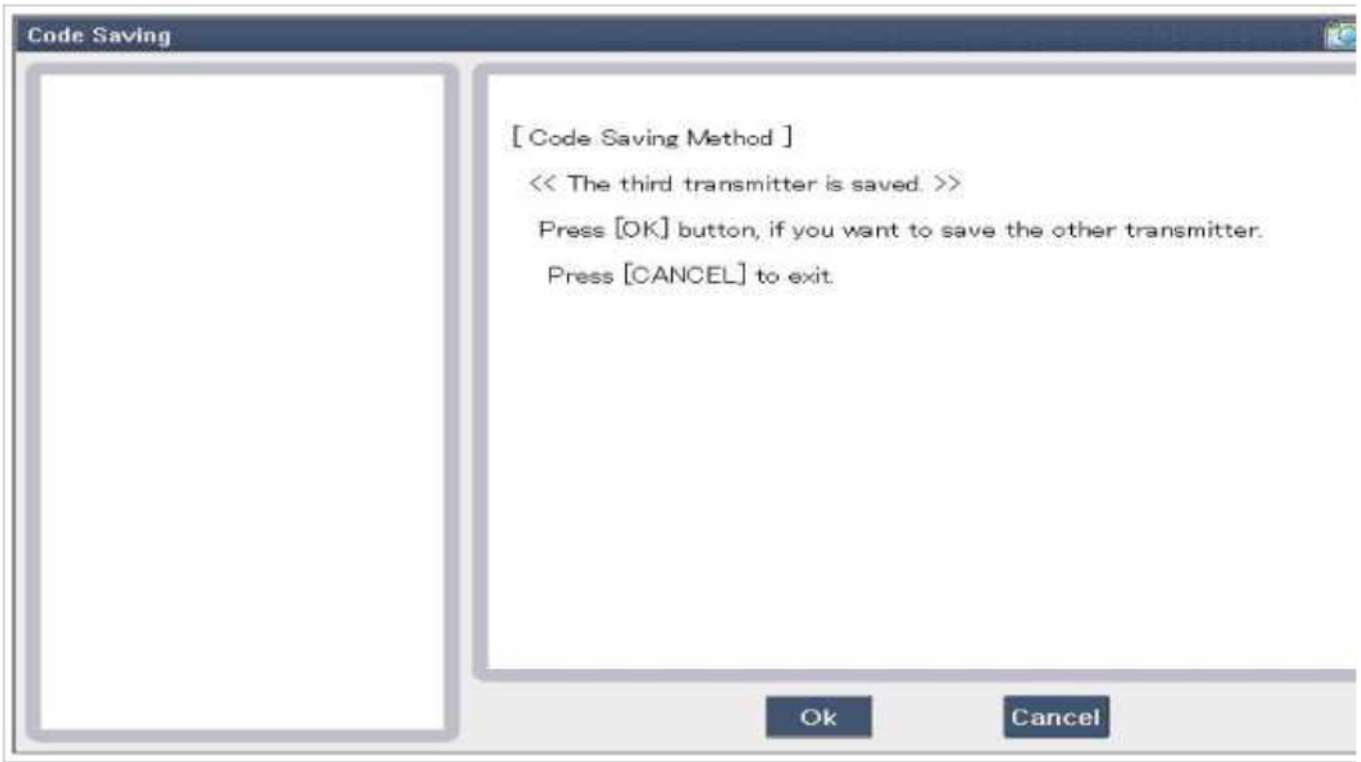
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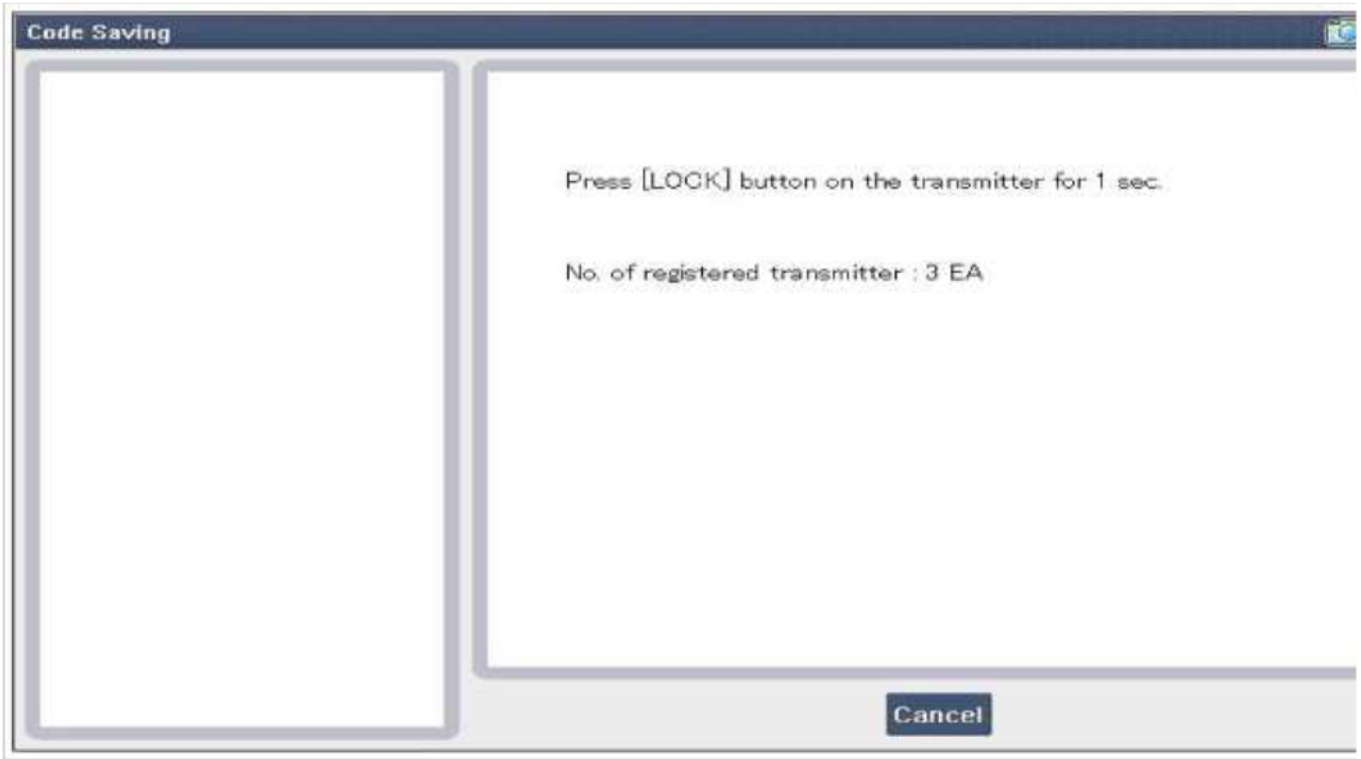


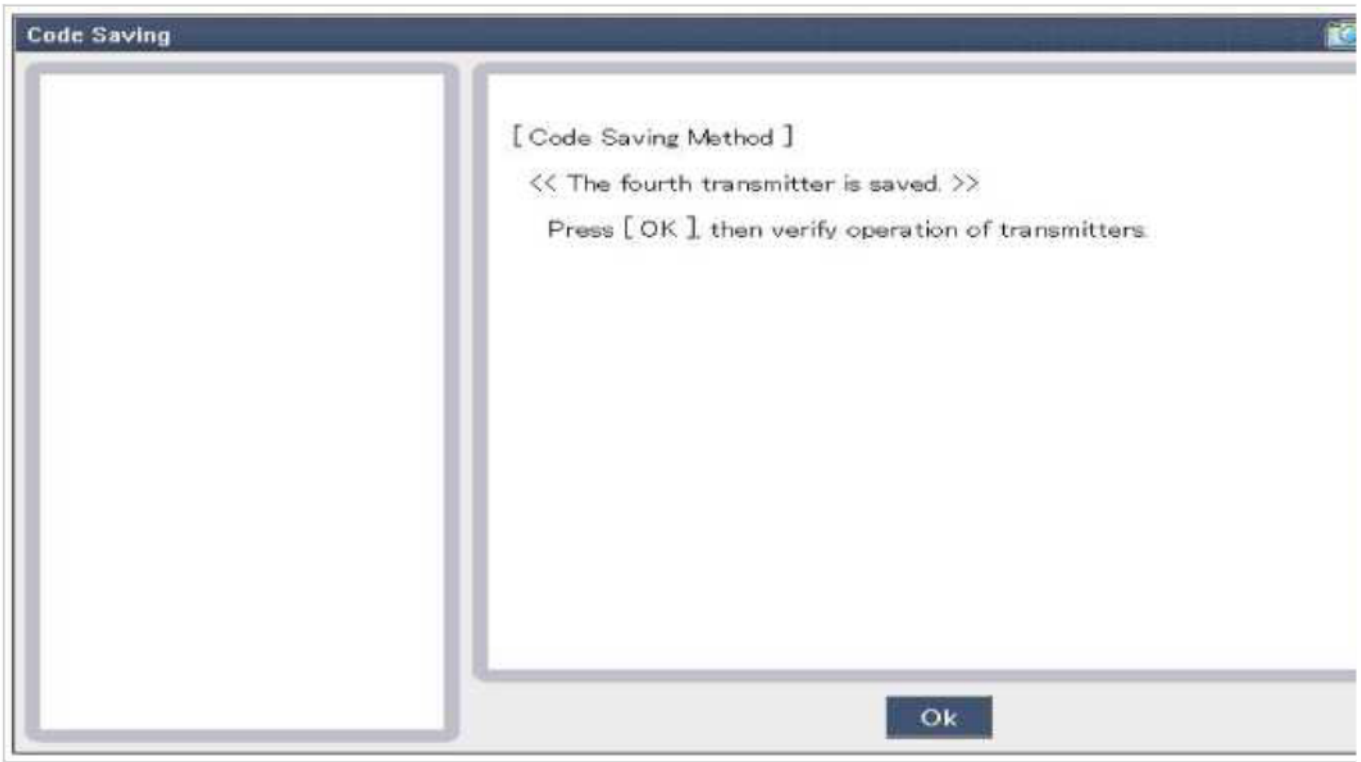
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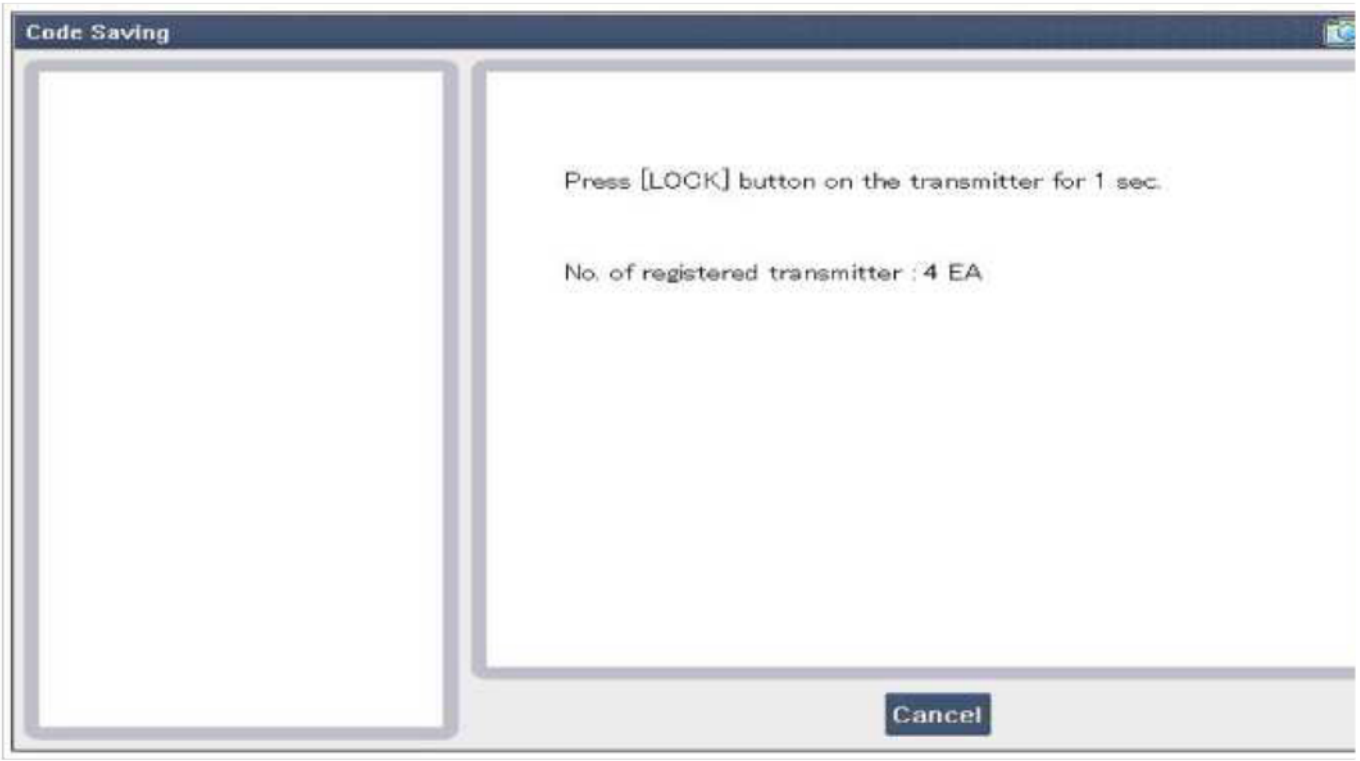


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Body Electrical System

Specifications

Items	Specifications
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-30°C ~ 75°C (-4°F ~ 158°F)
Insulation resistance	RKE specificaiton : 5.5 mA Smart key specificaiton : 3.0 mA LIN communication specificaiton : 3.3 mA

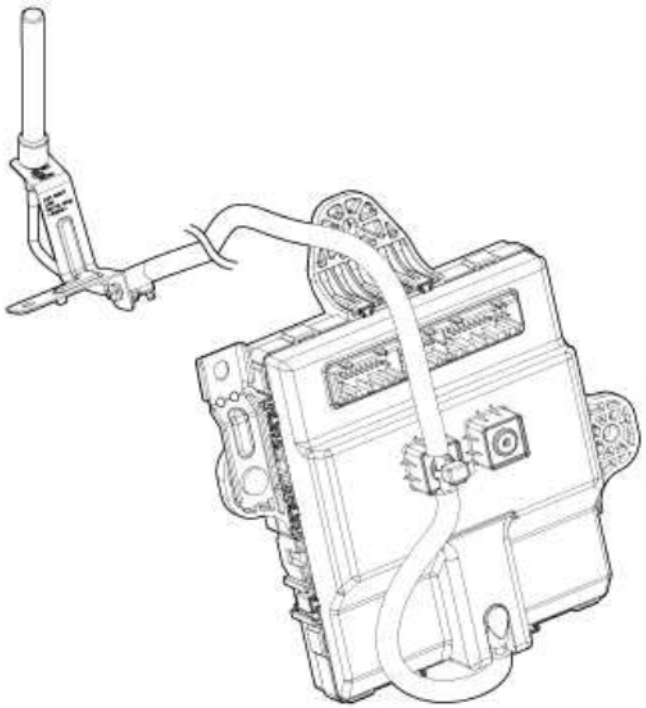
Abbreviation

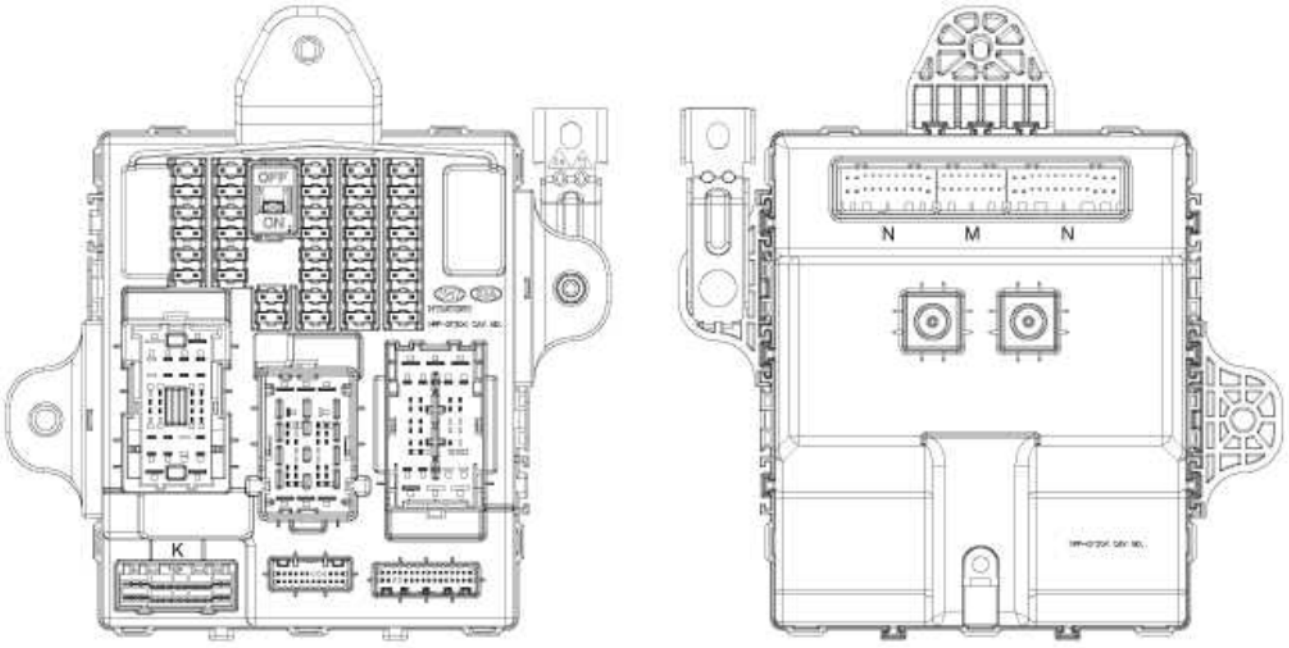
IPM : Intelligent intergrated Platform Module
DDM : Driver Door Module
ADM : Assist Door Module
IMS : Intergrated Memory System
SMK : Smart Key

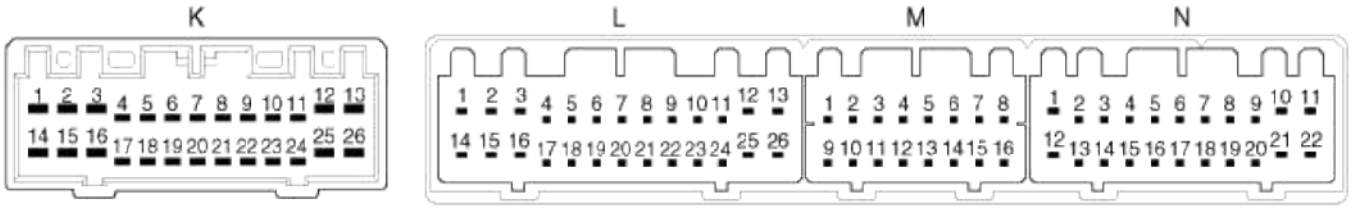
Body Electrical System

Components

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Outer Connector (L / M / N / K)

Connector	Pin No.	Description	Active	Remark

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K	1	IMS LIN		
	2	Master LIN		
	3	PAS LIN		
	4	Power window lock switch	Low	Input
	5	Power window unlock switch	Low	Input
	6	Driver door switch	Low	Input
	7	Assist door switch	Low	Input
	8	Rear left door switch	Low	Input
	9	Rear right door switch	Low	Input
	10	Driver door key lock switch	Low	Input
	11	Driver door key unlock switch	Low	Input
	12	Parking brake switch	Low	Input
	13	Tailgate outside handle switch	Low	Input
	14	-		
	15	-		
	16	-		
	17	Driver door actuator unlock switch	Low	Input
	18	Assist door actuator unlock switch	Low	Input
	19	Rear left door actuator unlock switch	Low	Input
	20	Rear right door actuator switch	Low	Input
	21	Driver seat belt switch	Low	Input
	22	Assist seat belt switch	Low	Input
	23	-		
	24	Tailgate open switch	Low	Input
	25	Hood switch	Low	Input
	26	Pocket lamp	High	Output
L	1	Room lamp	Low	Output
	2	Head lamp RH HID	Low	Output
	3	Key solenoid	Low	Output
	4	MTS Tx	Low	Output
	5	Rear left seat warmer relay	Low	Output
	6	Driver door unlock relay	Low	Output
	7	Head lamp washer	Low	Output
	8	Burglar alarm horn	Low	Output
	9	Key hole illumination	Low	Output
	10	RPAS buzzer	Low	Output
	11	PAS OFF indicator	High	Output
	12	Auto light power		Output
	13	Auto light sensor	AD	Input

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L	14	Sun roof Tx		Output
	15	-		
	16	Rear wiper relay	Low	Output
	17	Rear fog lamp relay	Low	Output
	18	Horn relay	Low	Output
	19	Rear right seat warmer relay	Low	Output
	20	Wiper low	Low	Output
	21	AV tail	Low	Output
	22	Tailgate latch	Low	Output
	23	Head lamp low control	Low	Output
	24	Assist seat belt indicator	Low	Output
	25	Rear fog lamp switch	Low	Input
	26	Auto ligth ground	GND	
M	1	Rear left seat warmer switch	Low	Input
	2	Rear right warmer switch	Low	Input
	3	C CAN low	Data	
	4	C CAN High	Data	
	5	B CAN high	Data	
	6	B CAN low	Data	
	7	K Line		
	8	MTS Rx		Input
	9	-		
	10	Hazard switch	Low	Input
	11	Key IN	Low	Input
	12	Tail switch		
	13	Crash unlock		Input
	14	R position	High	Input
	15	Auto light switch	Low	Input
	16	Head lamp low switch	Low	Input
	1	Wiper intermittent volume	AD	Input
	2	PTG option	Low	Input
	3	HID option	Low	Input
	4	MT option	Low	Input
	5	Head lamp high switch	Low	Input
	6	Front fog switch	Low	Input
	7	DRL option	Low	Input
	8	Defroster switch	Low	Input
	9	Brake fuild switch	High	Input
	10	Trunk lamp switch - LH	Low	Input

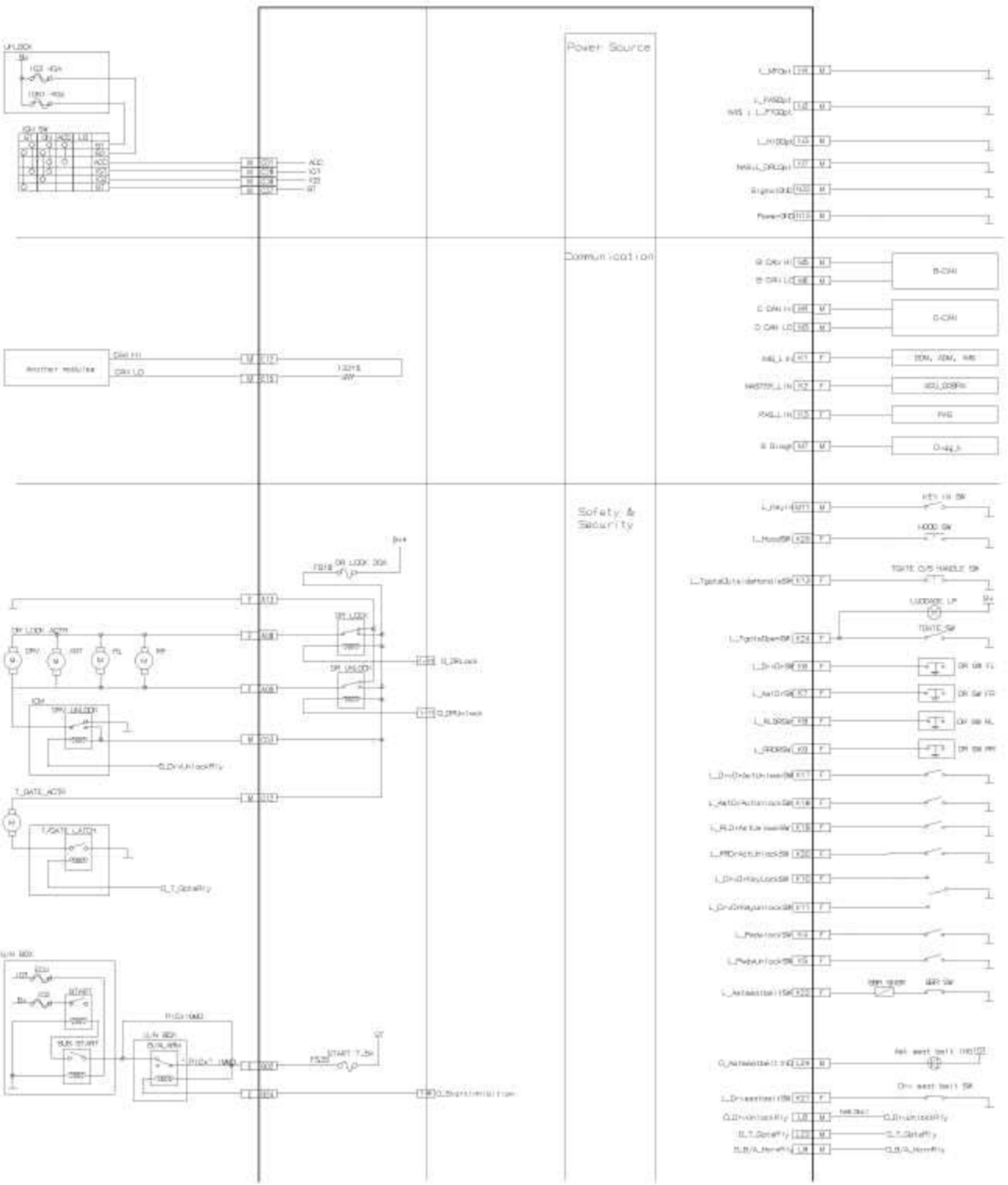
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N	11	Trunk lamp switch - RH	Low	Input
	12	Power ground	GND	
	13	Sun roof RX		Input
	14	P position	Low	Input
	15	PAS OFF switch	Low	Input
	16	Rear intermittent switch	High	Input
	17	Rear wiper switch	High	Input
	18	Wiper intermittent switch	High	Input
	19	Washer mist switch	High	Input
	20	Washer switch	High	Input
	21	Rear washer switch	High	Input
	22	Signal ground	GND	Input

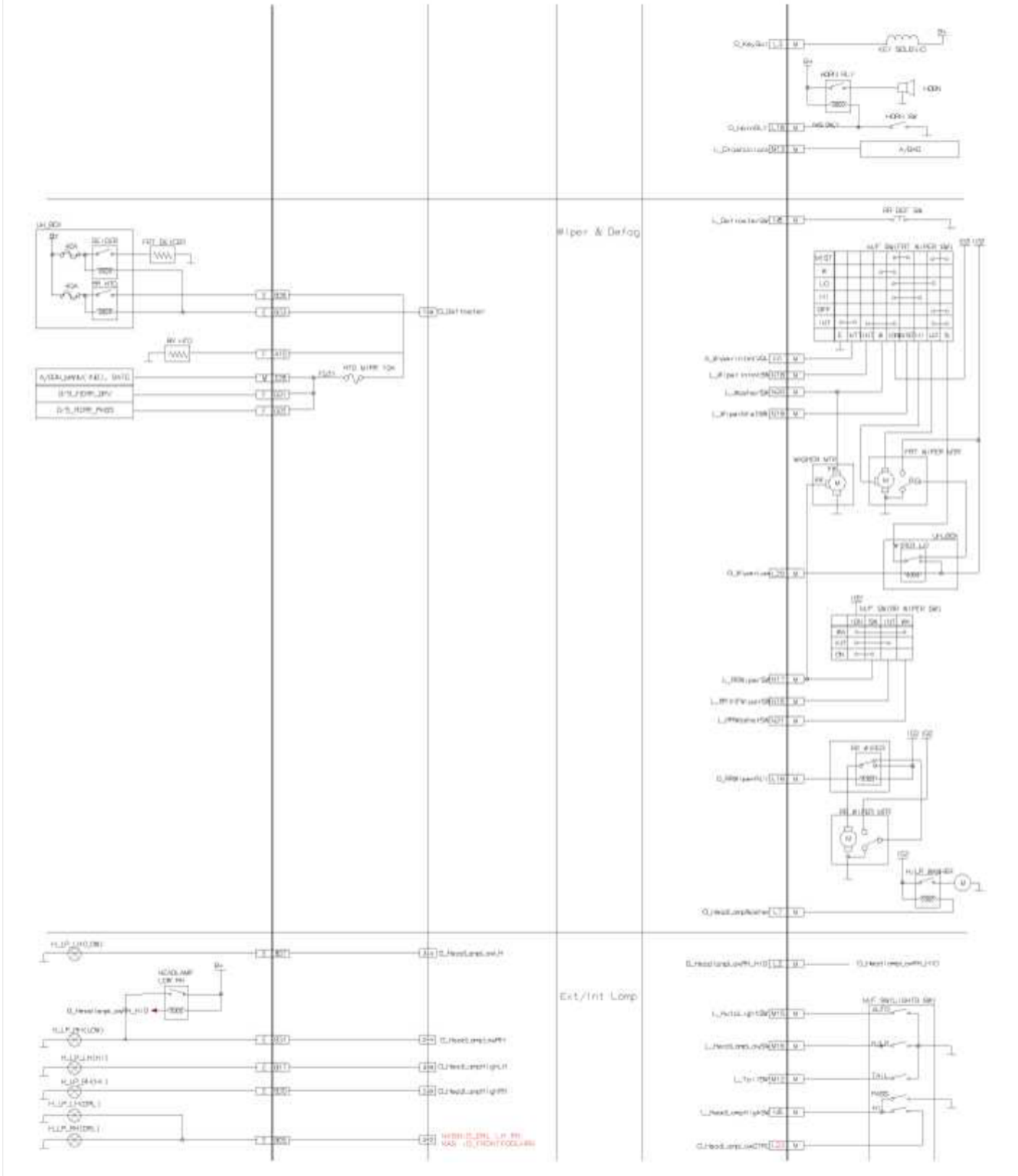
Body Electrical System

Circuit Diagram

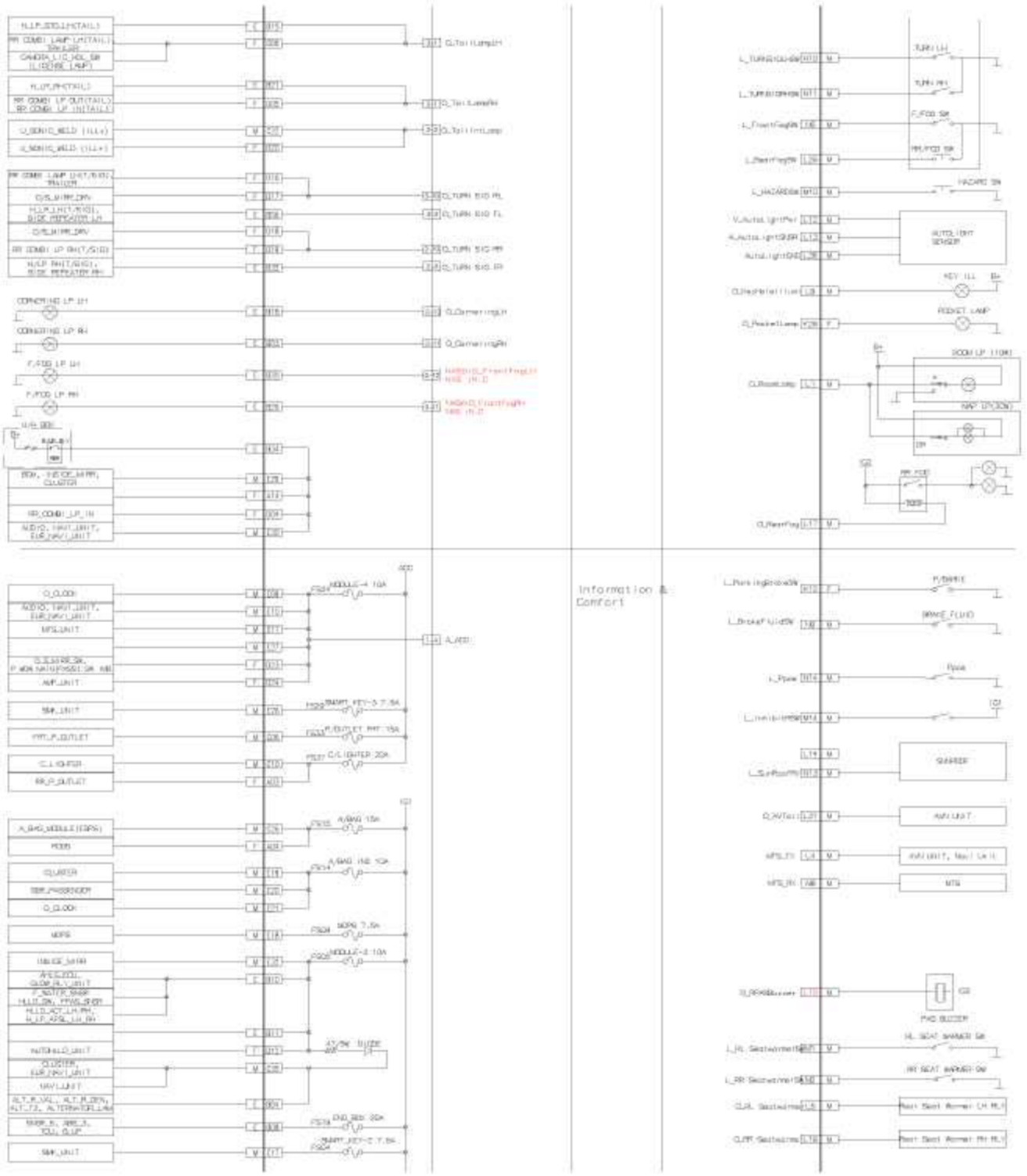
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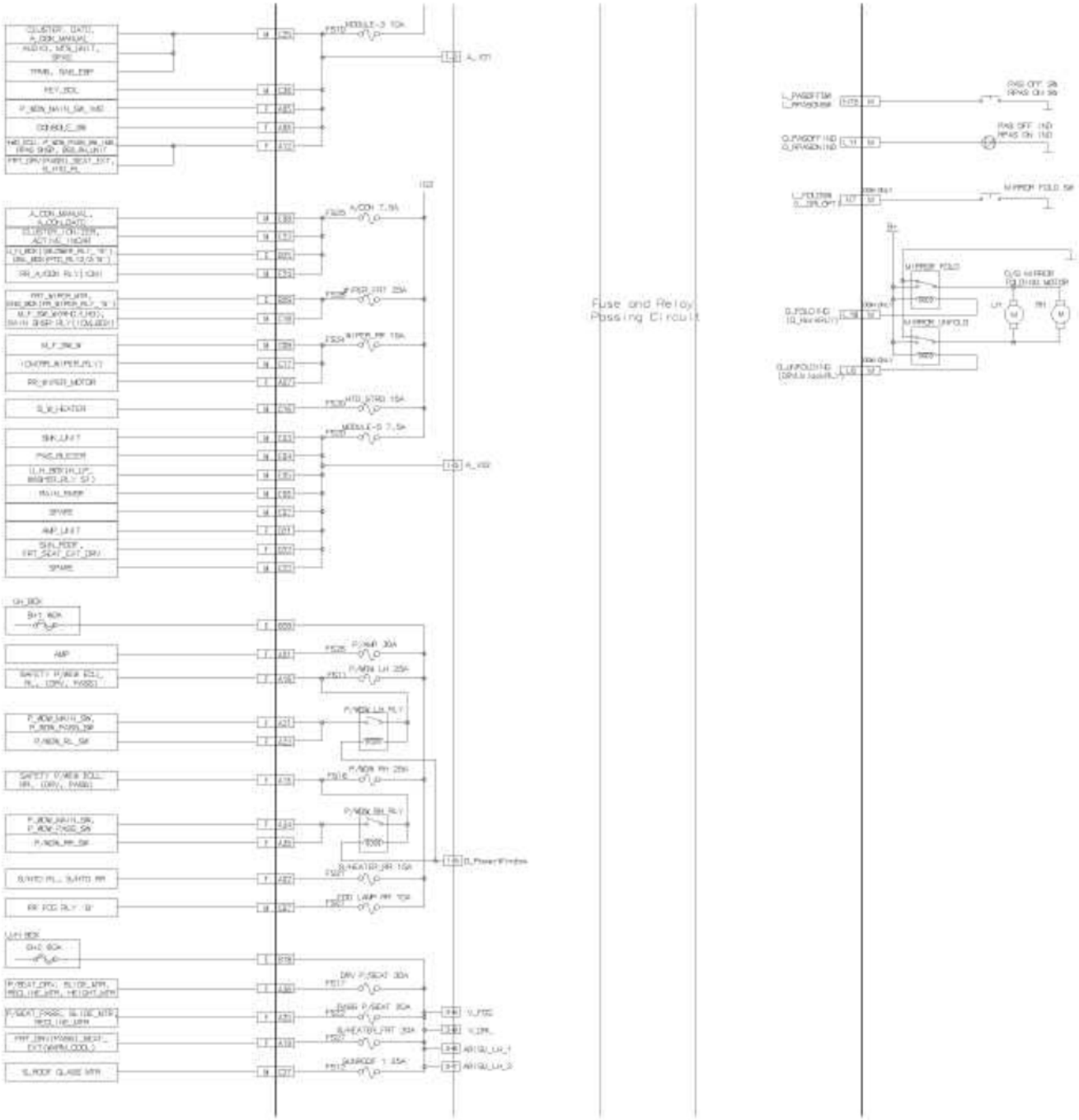
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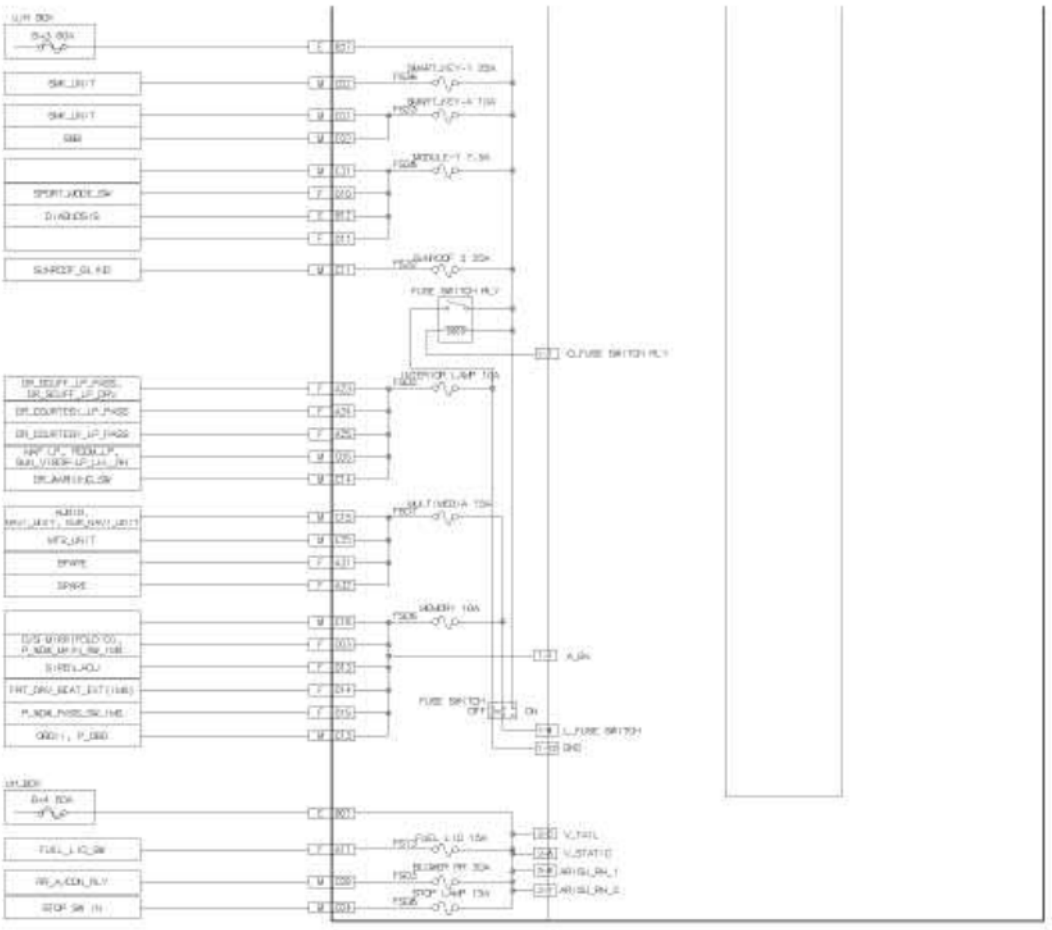
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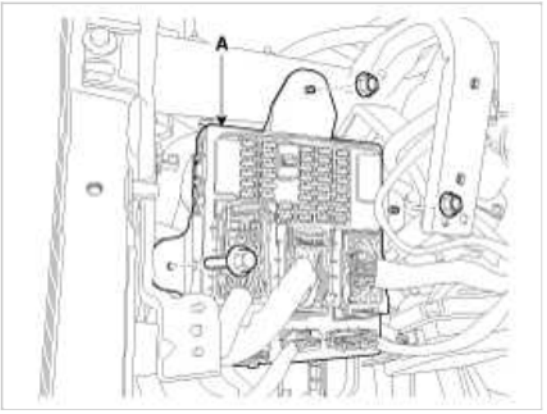


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Body Electrical System

Description

IPM (Intelligent intergrated Platform Module) receives various input switch signals ling time and alarm fuctions for fr washer interlocking wiper, fr intermittent wiper, mist wiper, rear washer interlocking wiper, rear wiper, tail lamp autocut, head lamp low/high, auto light, AV tail, DRL, front/rear fog lamp, IGN key hole illumination, decayed loom lamp, head lamp washer, manual HLLD , seat belt warning/reminder, key operated warning, over speed warning, parking start warning, SMK warning, rear defogger, front deicer, power window timer, rear seat warmer timer, central door lock/unlock, IGN key reminder, passive key reminder, dead lock, crash door unlock, auto door lock/unlock, anti-theft , tailgate release control.	

Function

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1. Wiper & Washer Control
   (1) Front Washer Interlocking Wiper Control
   If washer switch (WasherSW) is ON at the status of IGN2 ON, Wiper turn ON. If washer switch is OFF, w
   turn ON for 2.5~3.8 seconds and then turn OFF.
   (2) Front Wiper Intermittent Control
   If front wiper INT switch is ON at the status of IGN2 ON, wiper turn ON according to INT volume.
   (3) Front Wiper MIST Control
   If front wiper MIST switch is ON at the status of IGN2 ON, wiper turn ON continually.
   (4) Rear Washer Interlocking Rear Wiper Control
   If rear washer switch is ON at the status of IGN2 ON, Wiper turn ON. If rear washer switch is OFF, rear w
   turn ON for 2.5~3.8 seconds and then turn OFF.
   (5) Rear Wiper Control
   If rear wiper switch is ON at the status of IGN2 ON, rear wiper turn ON continually.
   (6) Rear Wiper Intermittent Control
   If rear wiper INT switch is ON at the status of IGN2 ON, rear wiper turn ON according to INT volume.

2. Warning
   (1) Seat Belt Reminder (Front)

<table>
<tr><th colspan="2">ConditionS</th><th colspan="2">Warning Pattern</th></tr>
<tr><td>Seat Blet</td><td>Vehicle Speed</td><td>Light-Blink</td><td>Chime-Sound</td></tr>
<tr><td colspan="2">Unbuckled</td><td colspan="2">6 seconds</td></tr>
<tr><td colspan="2">Bucked</td><td>6 seconds</td><td>None</td></tr>
<tr><td rowspan="3">Bucked → Unbuckled</td><td>Below 3 mph
(5 km/h)</td><td>6 seconds</td><td>None</td></tr>
<tr><td>3 mph
(5 km/h) ~
6 mph
(10 km/h)</td><td colspan="2">6 seconds</td></tr>
<tr><td>Above 6 mph
(10 km/h)</td><td colspan="2">6 seconds on/ 24 seconds off
(11 times)</td></tr>
<tr><td>Unbuckled</td><td>Above 6 mph
(10 km/h)
↓
Below 3 mph
(5 km/h)</td><td colspan="2">6 seconds
↓
Stop</td></tr>
</table>

   (2) Parking Brake Start Warning
   If the vehicle speed is over 5 km/h & parking brake switch ON & IGN ON, the parking brake waring sounc

3. Rear defogger
   (1) If rear defogger switch turns ON after Alt L is ON while IGN1 is ON, turn the defogger relay output ON for
   (2) If rear defogger switch turns ON again while defogger relay output is ON, turn the defogger relay output OF
   (3) Also turn defogger output OFF in case of Alt L OFF or IGN1 OFF while the defogger relay output is ON.

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4. Power Window Timer
   (1) Turn the safety and power window ECU output ON when turning IGN1 ON.
   (2) Turn safety power window ECU output OFF after keeping safety power window ECU output for 30sec whe IGN1 is OFF.
   (3) Turn safety power window ECU OFF immediately when opening the driver door or assist door within the co (2) above.

5. Exterior Lamp Control
   (1) Tail Lamp Auto Cut
   If the key out and driver door is opened while the key or ACC or IGN ON and tail lamp switch ON, turn the lamp relay OFF automatically.
   When turning tail lamp switch ON again from OFF after the automatic blackout, the tail lamp relay will be tu and Tail Lamp Auto Cut function will be cancelled.
   (2) Auto Light Control
   If the value of Auto Light Signal is input value of LIGHT ON at the status of IGN1 ON and the auto light swi ON, turn the light ON in 2.5sec ± 100msec.
   If the value of Auto Light Signal is LIGHT OFF and the auto light switch ON, turn the light OFF after 5sec.
   (3) Front Fog Lamp control
   Turn the front fog lamp ON when pressing the front fog lamp switch when Head Lamp Low ON.
   (4) Head lamp low control
   Turn the head lamp relay ON when turning the head lamp switch ON while IGN1 is ON.
   (5) Escort
   Turn the head lamp relay ON for 5 min. when turning the key OFF while the head lamp is ON.
   The head lamp relay ON for 15 sec when opening the driver door while the head lamp is ON for 5 min.
   The head lamp relay OFF immediately when pressing the door lock button twice with RKE(or FOB) while th lamp is ON.
   (6) Head Lamp Welcome Function
   The tail lamp ON for 15 sec when pressing the door lock button twice with RKE(or FOB) while all doors ar closed, locked, the key out and the head lamp switch (or auto light switch) is ON.
   If the lock/unlock with RKE(or FOB) or IGN1 & head lamp switch (or auto light switch) OFF while tail lam the head lamp is OFF.
   (7) Turn Signal Lamp Control
   Turn the turn sgnal lamp ON when turning the turn signal lamp switch ON and IGN2 ON.
   Triple turn signal operates when the turn signal switch OFF bofore signal lamp operating 3 times.
   (8) Hazard Lamp Control
   Turn the hrzard lamp ON when turning the hazard lamp switch ON.

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6. Interior Lamp Control
   (1) Room Lamp Control
   If 4 doors are closed & RKE(or FOB) unlocked or 4 doors are closed & KEY ON → OFF, turn the room l
   ON for 30 sec.
   If IGN key OFF and door is opend, turn the room lamp ON for 20 min.
   If IGN ON while the room lamp ON for 20 min, keep the room lamp ON.
   If the door is closed while the room lamp ON for 20 min, keep the room lamp ON for 30 sec.
   If the door is locked while the room lamp ON for 30 sec, the room lamp is decaying.

   (2) Room Lamp Auto Cut
   Romm lamp turn ON when the ACC and IGN ON.
   If ACC OFF, turn the room lamp ON for 20 min.
   If vehicle enter the ARMWAIT, the room lamp ON for 3 sec and OFF.

7. Door Lock/unlock Control
   (1) Central Reminder
   Turn the central door unlock ON when the lock inputed while the key OUT and door is opened.

   (2) IGN Key Reminder
   Turn the door unlock relay output ON when the knob is locked while the key IN and driver (or assist) door i
   opened.

   (3) Passive Reminder
   Turn the central door unlock ON when receiving the passive unlock signal.

   (4) Crash Door Unlock
   Keep the central unlock output for 5 sec when receiving the crash signal while the key IN or ACC ON or IC
   Crash door unlock function has priority to LOCK/UNLOCK control by other functions

   (5) Auto Door Lock By Vehicle Speed Change
   All door lock signal is output if vehicle speed is 15km/h when the IGN1 ON and Alt L ON.

   (6) Auto Door Lock By Shift Lever Change
   All door lock signal is output if shift lever is changed from P to R/N/D position while the IGN1 ON and all d
   closed.

   (7) Auto Door Unlock By Key In Condition
   All door unlock signal is output if the IGN KEY IN→OUT while the door knob is locked.

   (8) Auto Door Unlock By Shift Lever Change
   All door unlock signal is output if shift lever is changed from R/N/D to P position while the IGN1 ON and all
   are closed.

   (9) AVN Wakeup Function
   AVN wakeup signal is output if door unlock signal is inputed by RKE(or FOB) while the KEY OFF.

   (10) Tailgate Release
   Tailgate release relay is ON if tailgate open switch is ON while all door unlocked.

8. Anti-theft
   (1) If all door is locked with RKE(or FOB) and knob is locked while all door lock and key out, the vehicle enter
   ARMWAIT for 30 sec.

   (2) The vehicle enter the ARM after 30 sec from ARMWAIT mode.

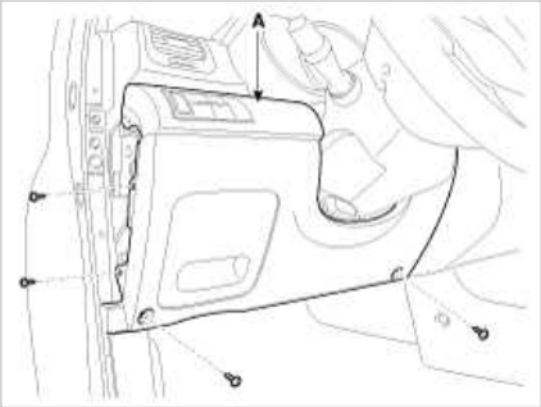
   (3) If the door or hood or tailgate is opened in ARM mode, the arlarm is ON for 27sec.

9. One Touch Triple Turn Signal
   Triple turn signal operates when the turn signal switch OFF bofore signal lamp operating 3 times.

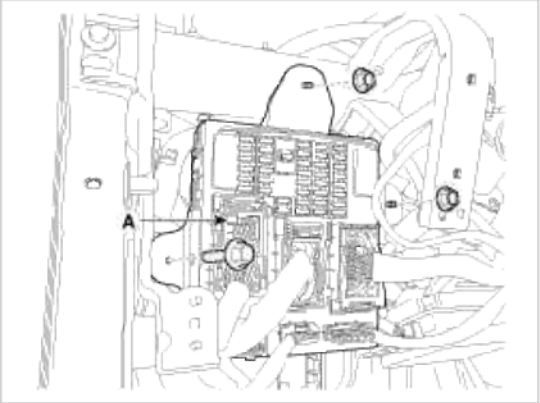
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Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A).
   (Refer to Body - "Crash pad")



3. Remove IPM(Intelligent intergrated Platform Module) connector (A), bolts and nut



4. Remove IPM after removing rear connectors.

Installation

1. Install IPM(Intelligent intergrated Platform Module).
2. Connect the IPM connector.
3. Install the crash pad lower panel.

Trouble Diagnostics When Using GDS

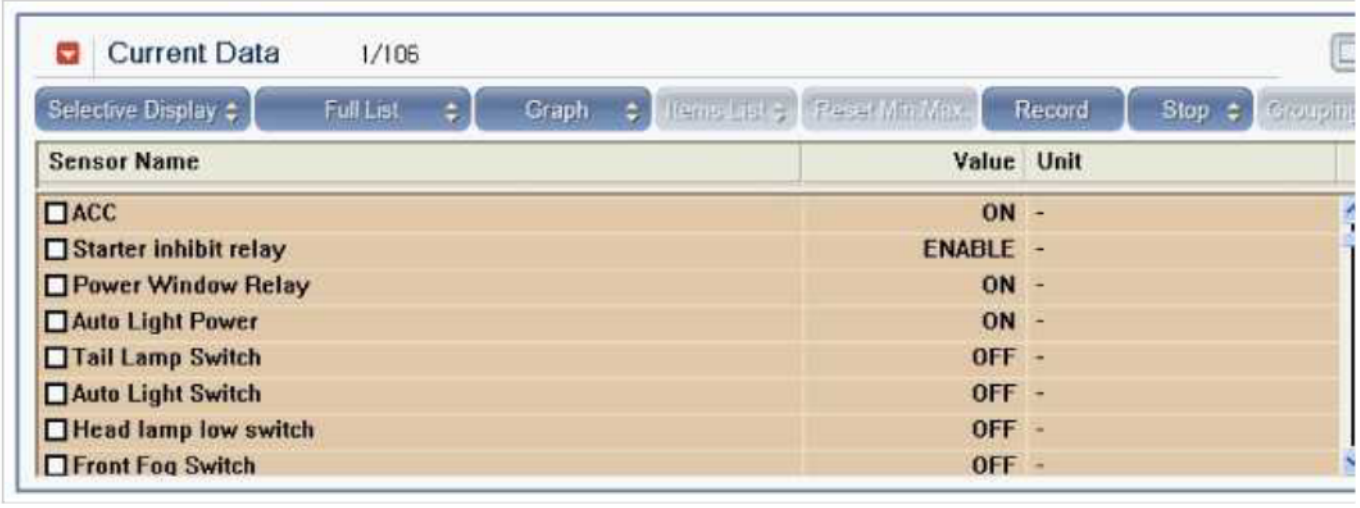
1. The IPM can be diagnosed by using the GDS. The BCM communicates with the GDS which then displays inputs outputs along with codes.

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2. To diagnose the IPM function, select the vehicle model and IPM.

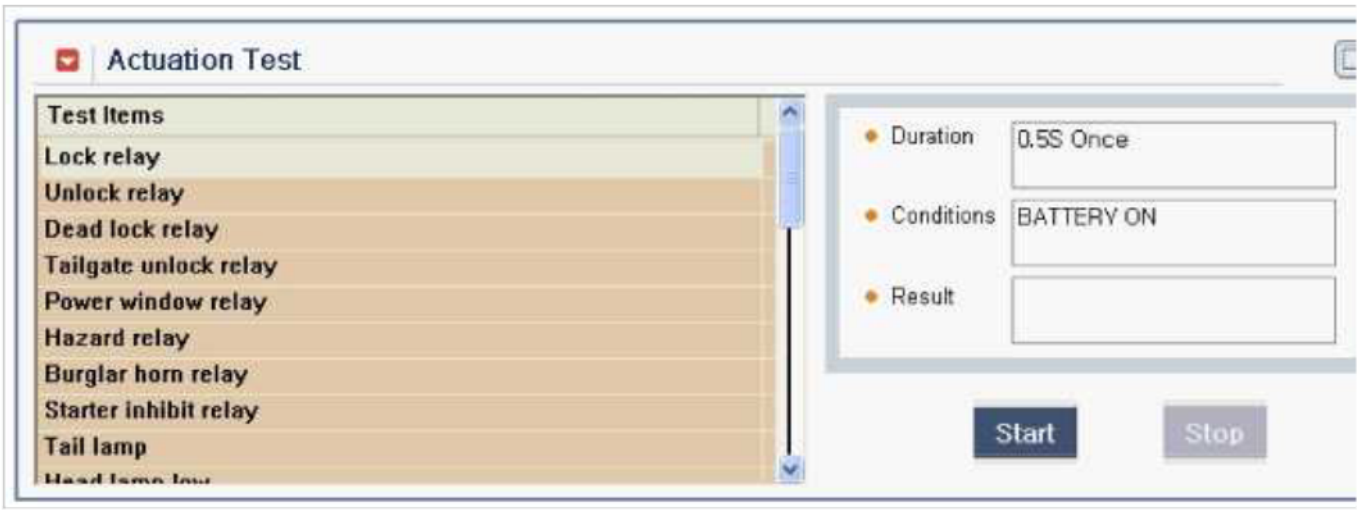


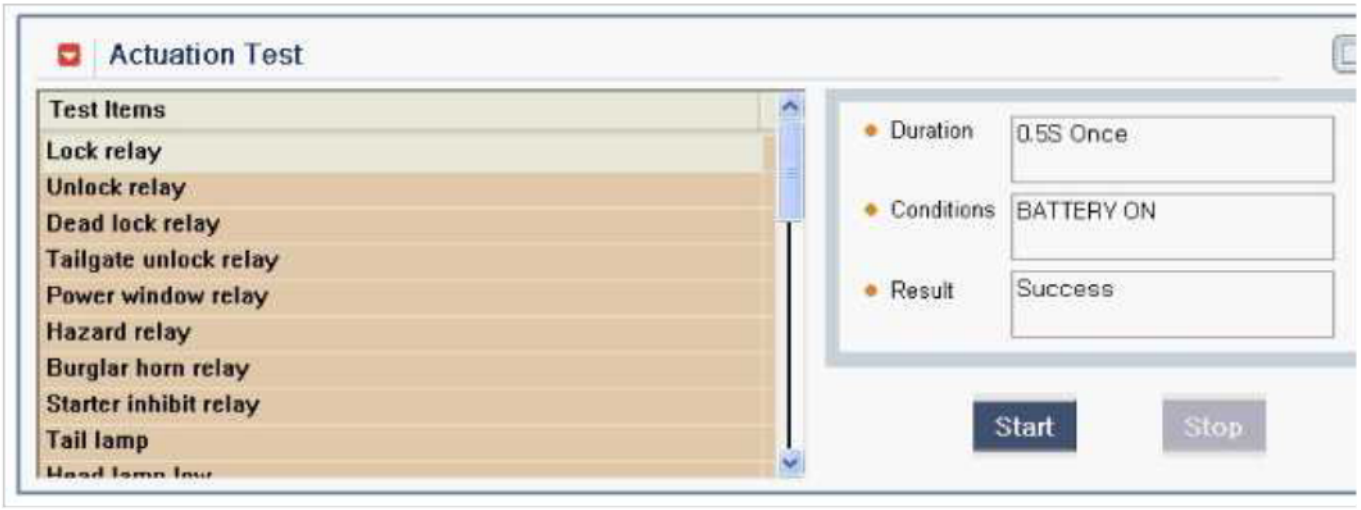
3. To consult the present input/out value of IPM, "Current DATA". It provides information of IPM input/output cond of power supply, turn signal/brake lamp, headlamp, door locks, outside mirror, wiper, auto-light and transmitters



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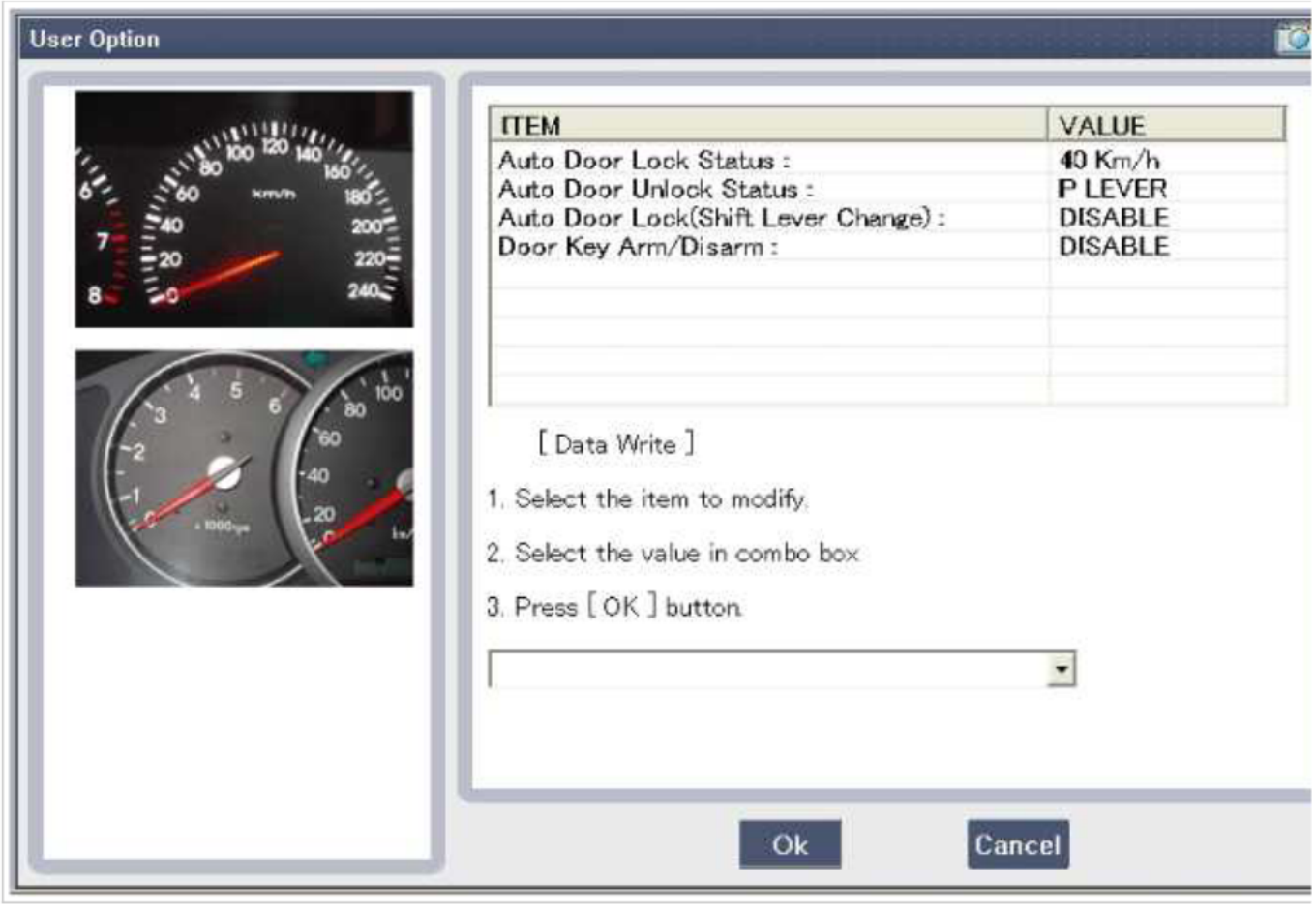
4. To perform functional test on IPM outputs, select "Actuation Test"





5. To change the "user option" on BCM, select the "User Option" menu and change the value as below.

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Specifications

Memory Power Seat Unit

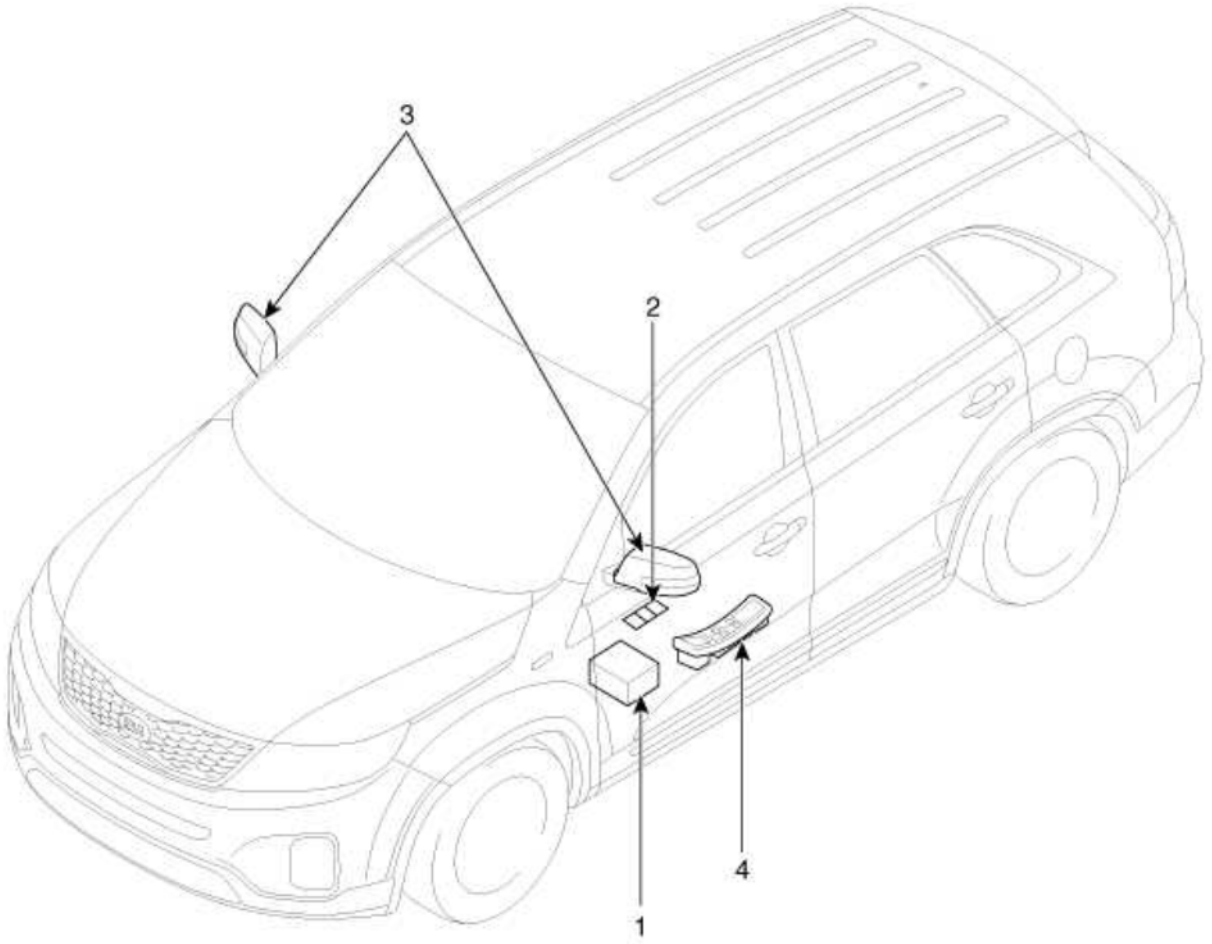
Item	Specification
Rating voltage	DC 12V
Operation voltage	DC 9V ~ 16V
Operation temperaure	-30°C ~ 80°C
Dark current	Max. 2mA

Memory Power Seat Switch

Item	Specification
Rating voltage	DC 5V
Type	Soft Feeling Tact type
category temperature range	-30°C ~ 80°C

Component Location

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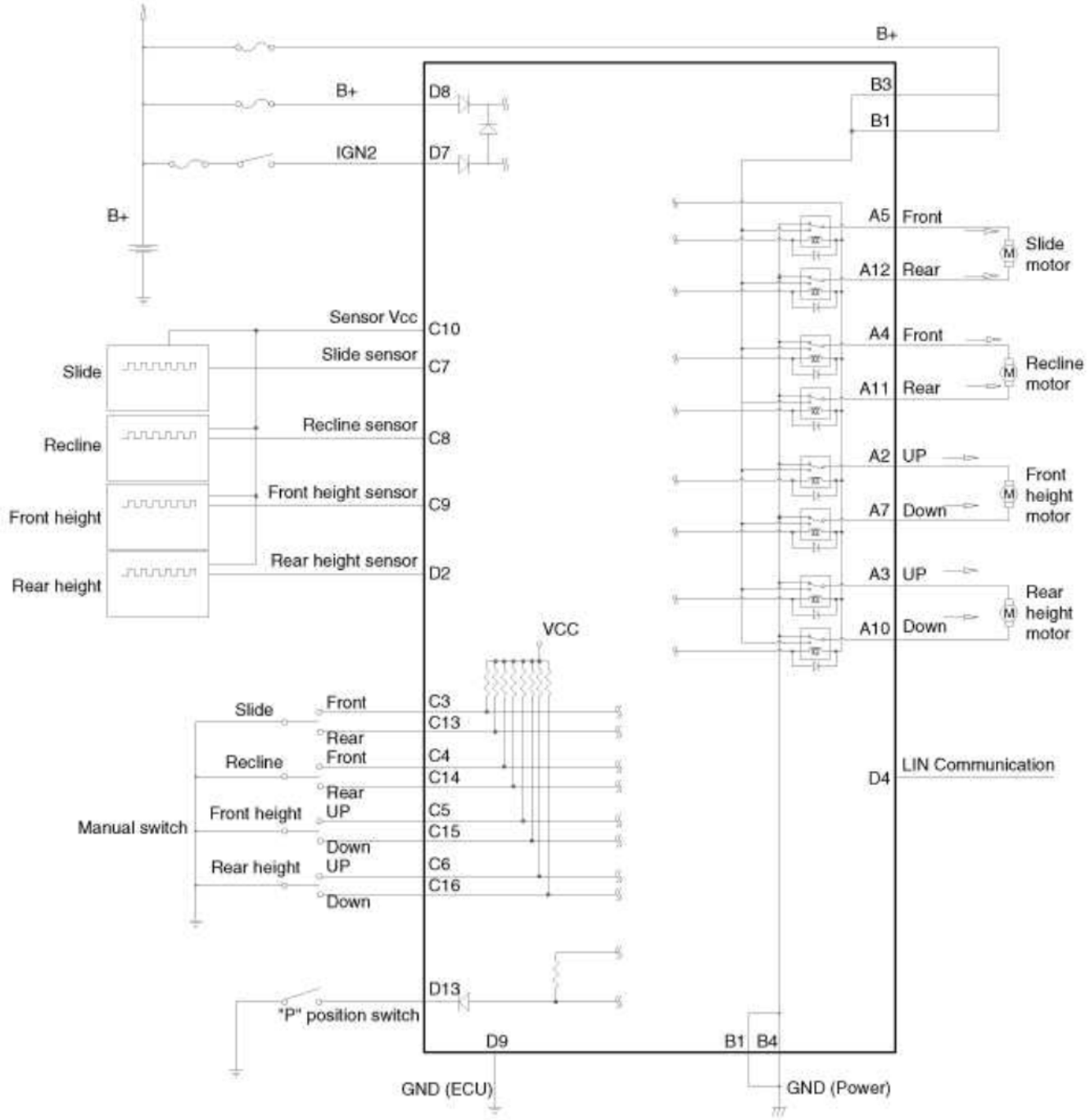


1. Seat Memory Unit (IMS) 2. IMS control switch	3. Outside mirror 4. IMS mirror control (Driver power window switch)

Body Electrical System

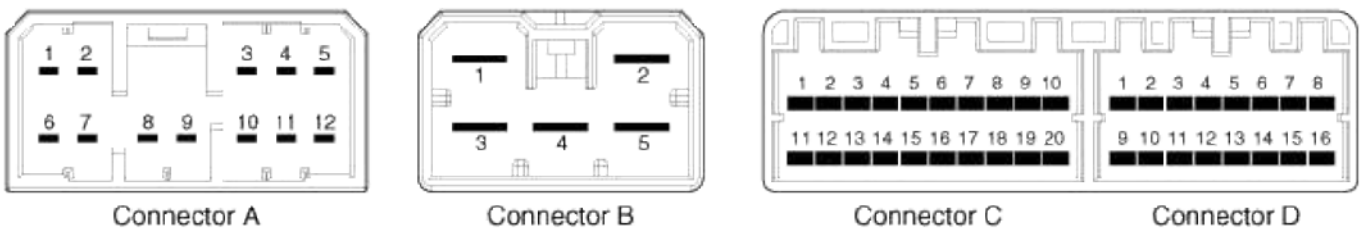
Circuit Diagram

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Input/Output Specification

Connector Pin Lay Out



IMS input/output pin information

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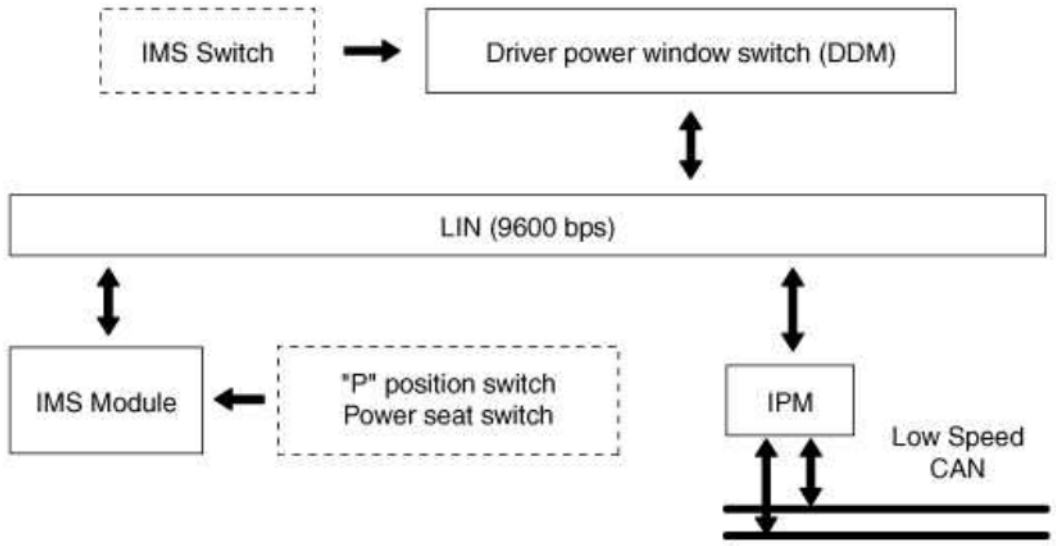
No	Signal Name	I/O	Contents	Remark
A1	-	-	-	
A2	FR height motor up	O	FR height motor up output	
A3	RR height motor up	O	RR height motor up output	
A4	Recline motor FR	O	Recline motor FR output	
A5	Slide motor FR	O	Slide motor FR output	
A6	-	-	-	
A7	FR height motor down	O	FR height motor down output	
A8	-	-	-	
A9	-	-	-	
A10	RR height motor down	O	RR height motor down output	
A11	Recline motor RR	O	Recline motor RR output	
A12	Slide motor RR	O	Slide motor RR output	
B1	GND (Power)	I	Power GND for operating motor	
B2	-	-	-	
B3	B+ (Power)	I	Power B+ for operating motor	
B4	GND (Power)	I	Power GND for operating motor	
B5	B+ (Power)	I	Power B+ for operating motor	
C1	-	-	-	
C2	-	-	-	
C3	Slide FR manual switch	I	Slide FR manual switch input	On : GND
C4	Recline FR manual switch	I	Recline FR manual switch input	On : GND
C5	FR height up manual switch	I	FR height up manual switch input	On : GND
C6	RR height up manual switch	I	RR height up manual switch input	On : GND
C7	Slide motor sensor	I	Slide motor sensor input	Pulse signal
C8	Recline motor sensor	I	Recline motor sensor input	Pulse signal
C9	FR height motor sensor	I	FR height motor sensor input	Pulse signal
C10	Sensor Vcc(Seat)	O	VCC for operating sensor	5V
C11	-	-	-	
C12	-	-	-	
C13	Slide RR manual switch	I	Slide RR manual switch input	ON : GND
C14	Recline RR manual switch	I	Recline RR manual switch input	ON : GND

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C15	FR height down manual switch	I	FR height down manual switch input	ON : GND
C16	RR height down manual switch	-	RR height down manual switch input	ON : GND
C17	-	-	-	
C18	-	-	-	
C19	-	-	-	
C20	-	-	-	
D1	-	-	-	
D2	RR height up sensor	I	RR height up motor sensor	Pulse signal
D3	-	-	-	
D4	LIN	I/O	LIN	
D5	-	-	-	
D7	IGN2	I	IGN2 input	BAT
D8	B+(ECU)	I	ECU power input	BAT
D9	GND(ECU)	I	ECU GND	
D10	-	-	-	
D11	-	-	-	
D12	-	-	-	
D13	"P" position	I	"P" position switch input	ON : GND
D14	-	-	-	
D15	-	-	-	
D16	-	-	-	

Communication System

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- IPM : Intelligent intergrated Platform Module
- LIN : Local Interconnect Network
- CAN : Controller Area Network

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Body Electrical System

Description

System Outline

An optimal seat position set by a driver can be memorized in Power seat unit by IMS SW, which enables restoration position set by the driver despite

Playing of this function during drive is banned for safety reasons, and it has emergency stop function of restoration and operation as well

Input Specification

1. IGN2
   IGN switch input is determined by Local switch "IGN2".
2. SEAT MANUAL switch : SEAT Input
   (1) SLIDE Front rear / rear right manual switch
   Operating SLIDE motor of Seat either backward or forward
   (2) Recline Front rear / rear right switch
   Operating recline motor of seat either backward or forward
   (3) Front rear height UP / DOWN manual switch
   Operating Front rear height motor of SEAT either upward or downward
   (4) Rear right height UP / DOWN manual switch
   Operating rear right height motor of SEAT either upward or downward
3. SEAT position Sensor (pulse Signal)
   Sensing movement amount of Slide, Recline, Front rear height, and Rear right height motor
4. "P" Position switch
   Sensing "P" position of SHIFT LEVER, not allowed for memory saving and easy access function by getting on a vehicle in the position other than "P."

5. Dr Door switch
   This signal is receiver for sensing state of dr door open state by BCM.
6. BCM KEY IN
   This signal is received for sensing state of KEY by BCM
7. Local KEY IN switch
   This signal is receiver for sensing state of KEY IN state by BCM.
8. Speed
   This signal is received for sensing vehicle speed by BCM
9. IMS switch
   (1) SET switch
      Allowing for saving the SEAT position set by driver
   (2) 1, 2 switch
      Saving and replaying the SEAT position set by driver
10. LIN Communication LINE

Transmitting communication signals between IMS switch and MEMORY P/SEAT (9600 bps)
CHATTERING Control in Input Signal

1. Input switch - 40ms delay
   SLIDE, RECLINE, Front rear height, rear right HEIGHT switch
   "P" Position switch, SPEED, KEY IN, LOCAL KEY IN switch, DR DOOR switch, IGN2 switch
2. IGN switch input is determined by Local switch "IGN2.

TIME Error

1. ±10%, for TIME without error indication
   ±50ms, for TIME not exceeding 500ms
2. Indicated time in each function does not include Time of controlling CHATTERING started from changing point c
   input.

Operation

Control Specification

1. MANUAL Operation
   (1) MANUAL Seat Operation SEAT is to be operated by MANUAL switch Input of SEAT. SLIDE, RECLIN
      Front rear height, and rear right height is available to operate manually with IGN2 ON regardless of ECU B+

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2. MEMORY Saving Operation

(1) Allowing for Memory Storage

This process is allowed in case that IGN2 switch = ON, "P" Position switch = ON and SPEED input is high than 3km/h).

1 BUZZER output is generated from IMS by receiving the DATA, "SET = 1."

(2) Memory Saving Operation

When MEM_1 or MEM_2 of transmitted LIN communication DATA receives the DATA ("1") by IMS swi generated from 1 or 2 switch control in memory storage permission mode above, 2 BUZZER outputs are ge and current seat position is stored. (IMS switch transmits storage command only if 1 or 2 switch input is gen within 5 seconds from SET switch OFF->ON, and the storage permission mode is cancelled if more than 5 s are elapsed.)

(3) Requirements for Memory Storage

MEMORY Storage is not allowed or cancelled in case that all of the following requirements are not met.

A. Ignition switch is ON

B. "P" Position switch is ON

C. Vehicle speed input received from BCM is high (less than 3Km/h)

D. Less than 5 seconds elapsed from SET switch OFF->ON (determined by IMS switch)

(4) Memory SET is to be available for memory storage notwithstanding the number of SET times. (However, ea MEMORY switch operation delivers 1 memory storage action only.)

(5) If MEMORY command is received during operating easy access function or reproducing memory, activation stopped, and current position is stored.

If the command is received during operating MANUAL switch of SEAT, it will be stored where the memory command is received.

Memory Reproduction

1. Reproducing Memory

When "1" is received by DATA PL_1 or PL_2 of LIN communication transmitted by IMS switch generated fro switch operation, 1 BUZZER output is generated and SEAT position is automatically controlled, moving back to is stored to be according to MEMORY.

2. Anti-Reproduction

Reproducing memory is not allowed if the following condition is not met.

IMS will reproduce memory, only if all of ① , ② and ③ are satisfied, and also either ④ or ⑤ is satisfied.

① "P" Position switch is ON

② Vehicle speed input received from BCM is high (less than 3Km/h)

③ MANUAL switch of SEAT is not operated.

④ 1 and 2 switch of IMS switch is ON in case that driver door is open or within 30 seconds from driver door clo

⑤ Ignition switch is ON

3. Stopping Memory Reproduction

Reproducing memory is stopped unless all of the following conditions are met.

A. "P" Position switch of LOCAL switch is positioned at PARKING

B. Vehicle speed input received from BCM is high (less than 3Km/h)

C. Target position of motor not reached

D. MANUAL switch of SEAT is not operated.

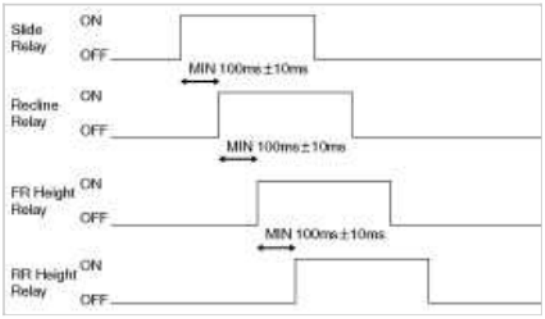
BUZZER output is operated for USER to understand reproduction by other UNIT, regardless that MANUA switch of SEAT is ON.

E. SET switch is not operated

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4. Other
   (1) If memory is not stored, Reproduction will not be activated by 1 or 2 switch and BUZZER Output is generat
   (2) The most recently received signal will be reproduced if other DATA (reproduction command) is received dur reproducing memory.
   (3) If Input of SEAT MANUAL switch is operated during reproducing seat position, the activation should be cor stopped.
   (4) If ERROR occurs during operating SEAT, memory of related motor will clear.

5. Motor Driving Control
   (1) To prevent inrush current from being duplicated during driving motor, automated control of driving motor will driving time for 100ms each, and the priority is as follows. SLIDE > RECLINE > Front rear height > rear rig height
   (2) Driving motor is executed in the following order, in case of reproduction process, and DELAY TIME among motor is as follows.



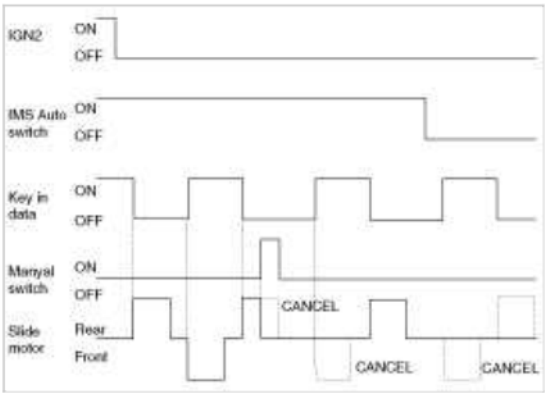
   TIME value of each continuous driving motor (excluding operation by MANUAL switch)
   SLIDE: 20 seconds, RECLINE: 35 seconds, Front rear height: 10 seconds, rear right height: 15 seconds
   (3) Motor Driving Control of Reverse Direction
   If motor driving requires being in reverse direction during operating easy access function or reproduction pro driving in current direction is immediately stopped, and driving in the reverse direction will be operated follow 100ms.
   (4) If distance difference between stored position on reproduction and current position is under the rated measur motor is not operating regardless of receiving reproduction DATA. * SLIDE, RECLINE, Front rear height, r right HEIGHT: 12EDGE (6PULSE)
   (5) Operation is stopped in reaching target position of motor, when operating easy access function or reproductic process.

Easy Access Function
(user option - default : Operating easy access function)

1. If Signal "BCM KEY IN" transmitted from BCM and signal "LOCAL KEY IN" in case that key is removed are changed from "LOW"(KEY IN) ->"HIGH" (KEY OFF), SEAT SLIDE is moved 75mm backward from KEY position.
2. Signal "BCM KEY IN" transmitted from BCM or signal "LOCAL KEY IN" is changed from "HIGH" (KEY C >"LOW" (KEY IN) by inserting KEY, it is moved to KEY OUT position.

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3. Prohibiting and Stopping easy access operation.The following requirements are determined and controlled by IM one of the following conditions is met during anti-operation or operation process, it is stopped.
   (1) "P"Position switch is not ON
   (If "P" Position switch is OFF during operating, the operation is completed.)
   (2) Vehicle data "SPEED" transmitted from BCM is LOW (More than 3km/h)
   (3) MANUAL switch of SEAT is in operation
   (4) Reproduction command is received during easy access operation
   (5) "AUTO_SET" DATA transmitted from IMS switch has " OFF" value.
   (If "AUTO_SET" is changed during operating, the operation is completed.)
   (6) SET message transmitted from IMS switch is "1" during easy access operation
4. If control is stopped during moving backward, the backward action is paused without moving further. When retur moves just as much the distance as it previously moved backwards.
5. MANUAL switch Input is operated during or after moving backward, it will move to KEY OUT position on eas operated by KEY IN.
6. Condition to Restore Memory of riding position in a vehicle
   (1) MANUAL switch is operated in the level above Key IN
   (2) Reproducing memory is in operation



LIMIT Setting

1. LIMIT position is randomly set as following since there is no SLIDE, RECLINE, rear right height, and Front rear LIMIT switch.
   (1) Control is immediately stopped, and the location in front of 6 pulse is set Driving LIMIT position, if more thar 6PULSE is not generated for 2 seconds during initial operation by MANUAL switch or by easy access funct inserting battery.
   (LIMIT position in reverse direction is the same as above.)
   However, LIMIT position for Front rear height and rear right height is set if more than 6PULSE is not genera a second.
   (2) If virtual LIMIT is set, MEMORY Reproduction is not operated off the LIMIT boundary for preventing mot damage by mechanical LOCK
   (3) If PULSE is correctly input away from the LIMIT boundary by MANUAL operation or by Easy access func with the previously set LIMIT applied, LIMIT position is renewed

Detecting and Controlling ERROR

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1. Detecting seat ERROR
   ERROR is controlled if the following situation occurs during easy access operation, reproduction process and ope
   MANUAL switch of each motor.
   (1) ERROR resulted from PULSE is not input

Direction / Item	Slide	Recline	Front Rear Height	Rear Right Height
ERROR Occurrence	Less than 6PULSE generated for 2 seconds		Less than 6PULSE generated for 1 second	
Precondition	LIMIT Setting Completed			

   Related motor output is stopped if ERROR is detected during reproduction and easy access operation
   Related motor output is stopped, if ERROR is found in MANUAL operation.

   (2) Sensor Vcc of Seat is detected as much as 40ms from less than 1V. => Return if Sensor Vcc of Seat is over
   If SEAT Sensor Vcc ERROR is detected during reproduction and easy access operation, all operating SEAT
   is stopped. (BUZZER output is not operated.)

2. ERROR Control
   If ERROR is detected as shown above, it is considered to be caused by broken HARNESS or Sensor malfunctic
   and is controlled as following.
   A. BUZZER output is operated during receiving storage and reproduction command regardless of ERROR occu
   B. Paused easy access operation and memory reproduction is available to be re-activated from operating MEM(
      command after motor malfunctioning is repaired, and it is as following.
      (When SLIDE motor is repaired from Sensor ERROR, Easy access function is available)
      SEAT: 6PULSE is correctly input from ERROR causing motor position Sensor by operating MANUAL switc
      in 2 seconds (SLIDE, RECLINE)/ 1 second(Front rear height, Rear right height).

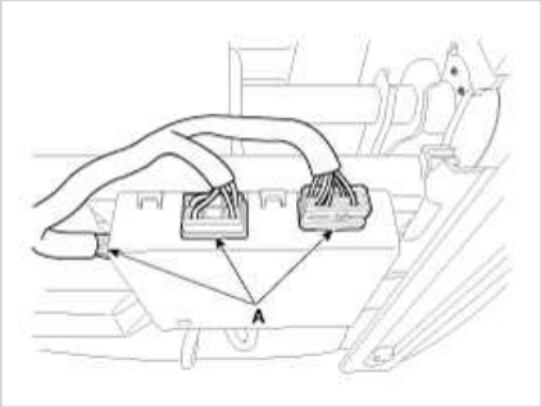
Determining Seat Position

Seat position is relatively determined rather than by absolute position.

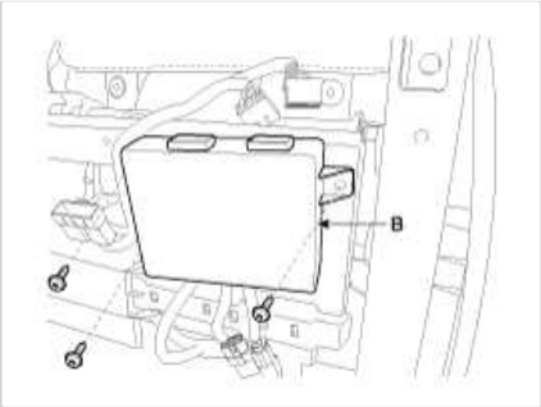
Body Electrical System

Removal

1. Remove the negative (-) battery terminal.
2. Remove the front seat assembly.
   (Refer to Body - "Front Seat")
3. Remove the IMS module (B) after disconnecting the connector (A) and loosening the screws (3EA).



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Installation

1. Install the IMS module after reconnecting the connector.
2. Install the driver seat.

NOTICE

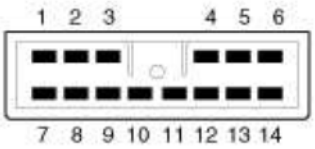
- Make sure the IMS module connectors and related connectors are plugged in properly.
- Check that IMS system operates normally.

Body Electrical System

Circuit Diagram

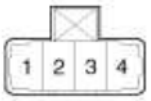
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Power seat control switch



Connector A

Lumber support switch



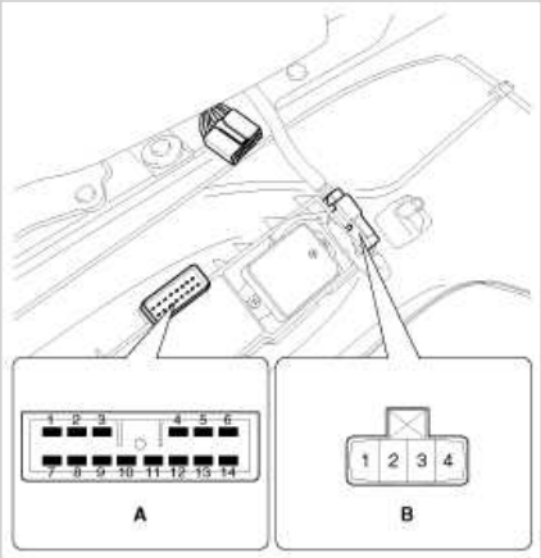
Connector B

Pin	Connector A	Connector B
1	Battery (+)	Battery (+)
2	Reclining motor (Backward)	GND
3	Reclining motor (Forward)	Lumber support motor (Backward)
4	Front sliding motor	Lumber support motor (Forward)
5	Front height motor (Down)	
6	Front height motor (Up)	
7	-	
8	-	
9	Rear height motor (Up)	
10	Rear height motor (Down)	
11	Rear sliding motor	
12	-	
13	-	
14	-	

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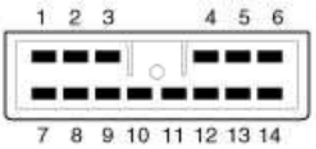
Inspection

1. With the power seat switch in each position, make sure that continuity exists between the terminals below. If conti not as specified, replace the power seat switch.



Driver Power Seat Control Switch A (IMS)

	Front Height Switch		Slide Switch		Reclining Switch		Rear Height Switch		PIN name
	Up	Down	Driver Seat				Up	Down	
			Forward	Backward	Forward	Backward			
1	○	○	○	○	○	○	○	○	⊖Battery
11				○					Rear slide motor
4			○						Front slide motor
3					○				Front reclining motor
2						○			Rear reclining motor
6	○								Front height motor up
5		○							Front height motor down
9							○		Rear height motor up
10								○	Rear height motor down

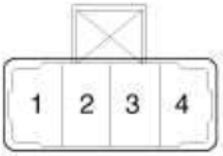


[Driver Power Seat Control Switch]

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Driver Lumber Support Switch B

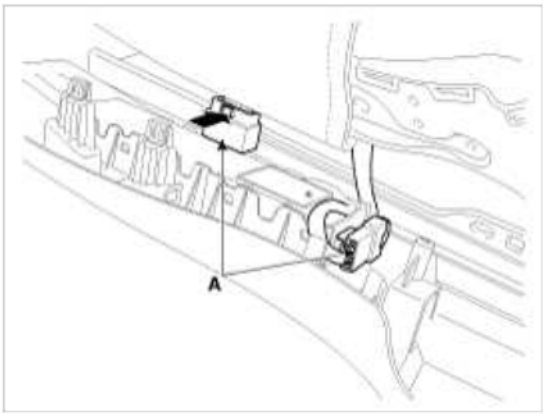
	Lumber Switch			Remarks
	Backward	N	Forward	
1	○		○	
2		○ ○		
3		○ ○	○	
4	○	○		



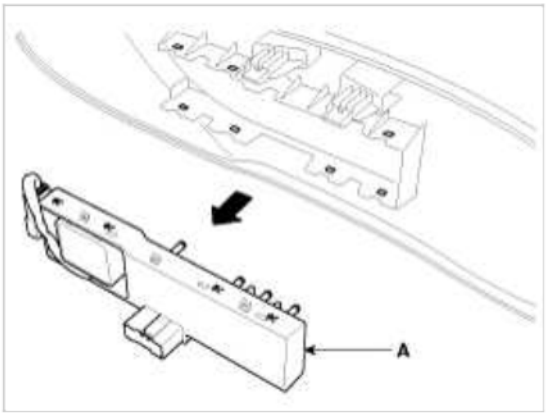
[Lumber Switch]

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the power seat control switch connectors (A).
   (Refer to Body - "Front seat")



3. Remove the power seat switch (A) after disengaging the hook holder.



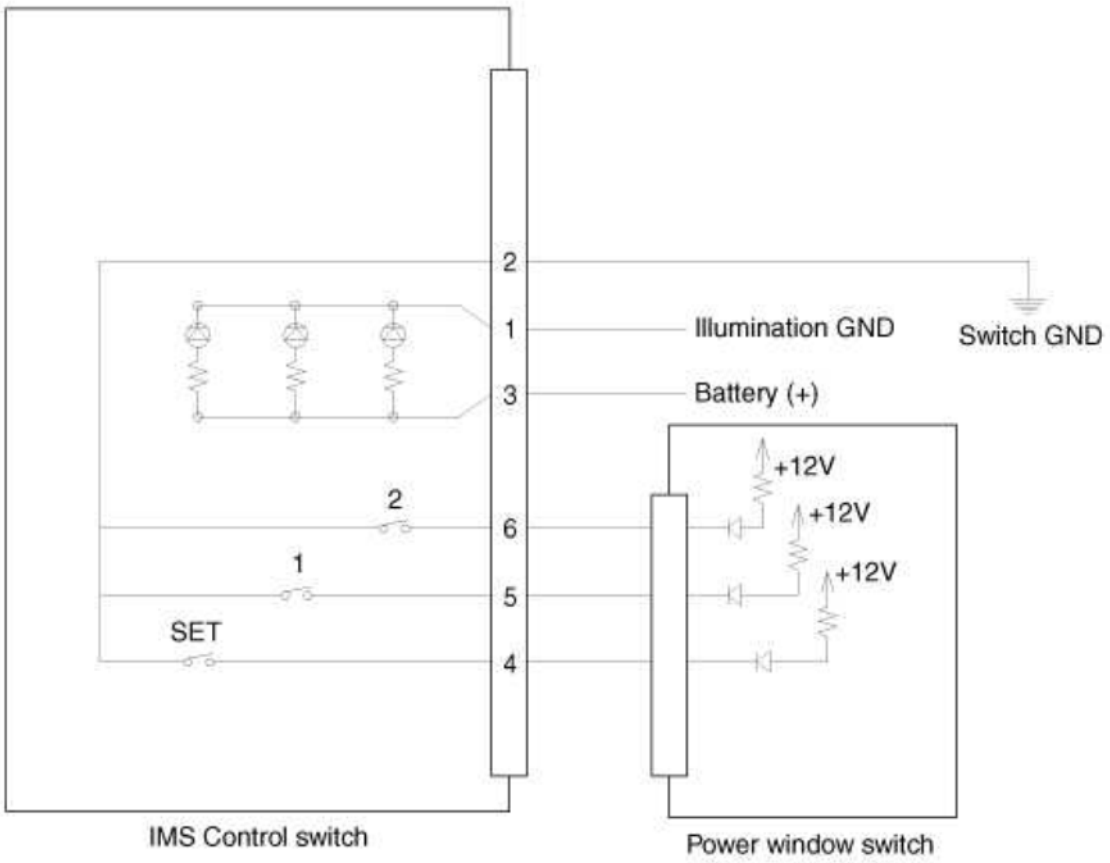
Installation

1. Install the power seat control switch after connecting the connector.

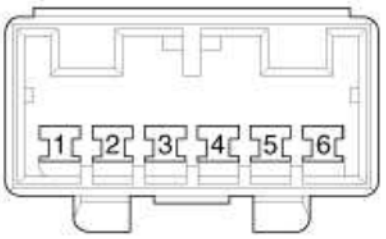
Body Electrical System

Circuit Diagram

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Pin	Description
1	Illumination GND
2	Switch GND
3	Battery (+)
4	SET switch
5	M1 switch
6	M2 switch



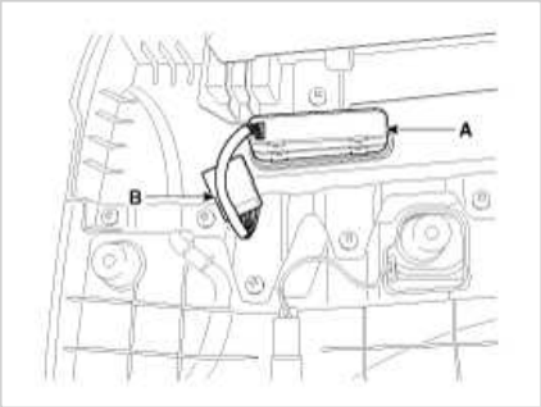
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Body Electrical System

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front Door")

3. Remove the IMS switch (A) after disconnecting the connector (B).



Installation

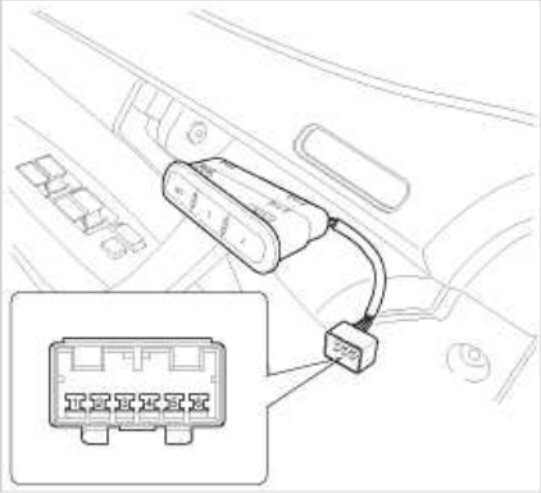
NOTICE

Make sure that the IMS control switch connectors and related connectors are plugged in properly.
Check the IMS control switch operates normally.

1. Connect the connectors and reassemble the IMS control switch.
2. Reassemble the front door trim.

Inspection

1. Disconnect the IMS control switch connector.

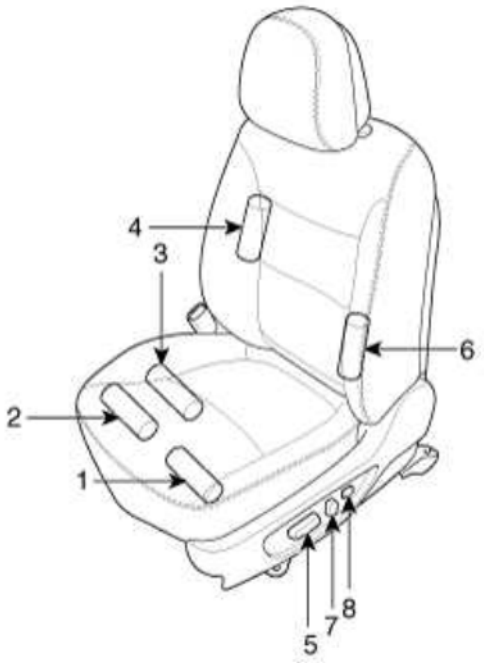


2. With the power IMS control switch in each position, make sure that continuity exists between the terminals below continuity is not as specified, replace the IMS control switch.

Terminal / Position	2	4	5	6
SET	○	○		
1	○		○	
2	○			○

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Component Location



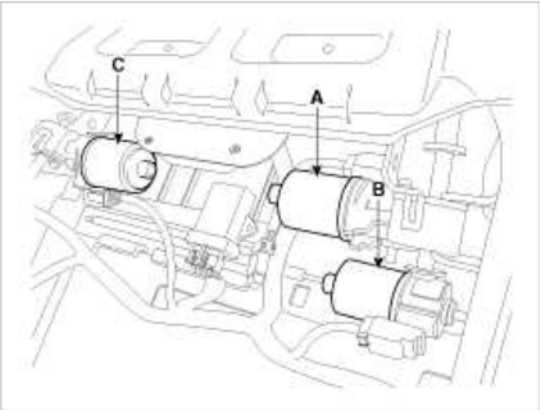
1. Slide motor 2. Front height motor 3. Rear height motor 4. Lumber support motor	5. Power seat switch 6. Reclining motor 7. Reclining switch 8. Lumber support switch

Body Electrical System

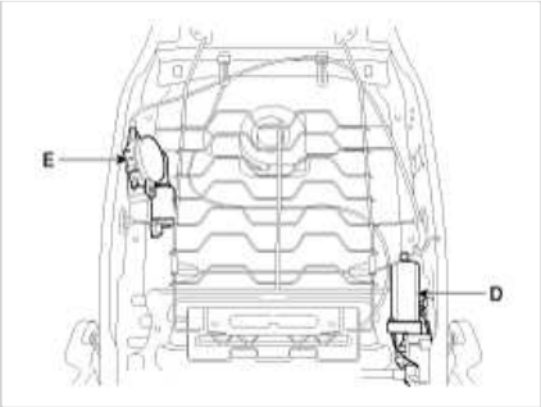
Inspection

Power Seat Motor

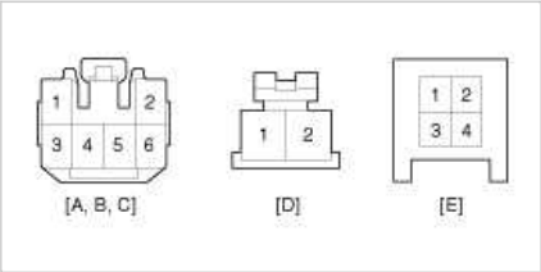
1. Disconnect the connectors for each motor.
   (Refer to Body - "Front seat")



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2. With the battery connected directly to the motor terminals, check if the motors run smoothly.
3. Reverse the connections and check that the motor turns in reverse.
4. If there is an abnormality, replace the motors.

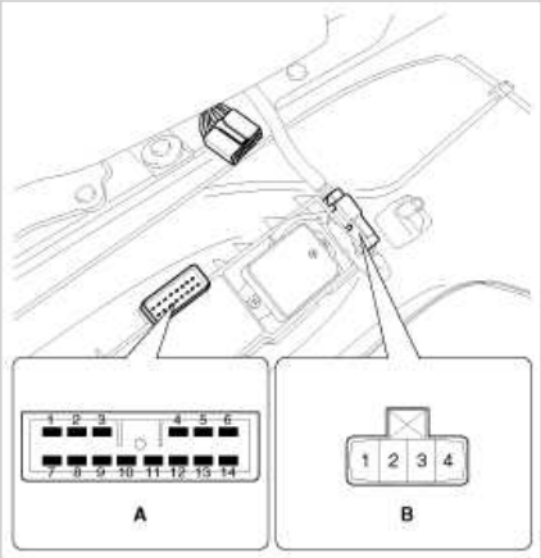


Position	Terminal	+	-
Front height motor A	Up	3	4
	Down	4	3
Slide motor B	Frontward	4	3
	Backward	3	4
Rear height motor C	Up	3	4
	Down	4	3
Lumber support motor D	Forward	1	2
	Rearward	2	1
Reclining motor E	Forward	2	1
	Rearward	1	2

Inspection

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1. With the power seat switch in each position, make sure that continuity exists between the terminals below. If conti not as specified, replace the power seat switch.



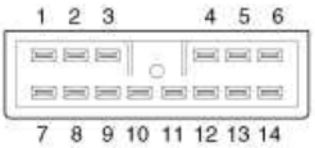
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Driver Power Seat Control Switch A [LHD]

	Front Height Switch			Slide Switch			Rear Height Switch			Reclining Switch			PIN name
	Up	Down	N		Assist Seat		Up	Down	N		Assist Seat		
			HEI	SEAT	Forward	Backward			HEI	REC	Forward	Backward	
1	○	○			○	○	○	○			○	○	Battery +
13				○	○								Front slide motor
5				○		○							Rear slide motor
11				○									GND (realy)
12				○									GND (realy)
3										○	○		Front reclining motor
8										○		○	Rear reclining motor
7										○			GND (realy)
2										○			GND (realy)
14	○		○										Front height motor up
6		○	○										Front height motor down
4			○						○				GND
10							○		○				Rear height motor up
9								○	○				Rear height motor down

Driver Power Seat Control Switch A [RHD]

	Front Height Switch			Slide Switch			Rear Height Switch			Reclining Switch			PIN name
	Up	Down	N		Assist Seat		Up	Down	N		Assist Seat		
			HEI	SEAT	Forward	Backward			HEI	REC	Forward	Backward	
1	○	○			○	○	○	○			○	○	Battery +
13				○	○								Front slide motor
12				○		○							Rear slide motor
6				○									GND (realy)
14				○									GND (realy)
8										○	○		Front reclining motor
3										○		○	Rear reclining motor
7										○			GND (realy)
2										○			GND (realy)
11	○		○										Front height motor up
5		○	○										Front height motor down
4			○						○				GND
9							○		○				Rear height motor up
10								○	○				Rear height motor down

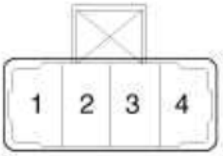


[Driver Power Seat Control Switch]

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Driver Lumber Support Switch B

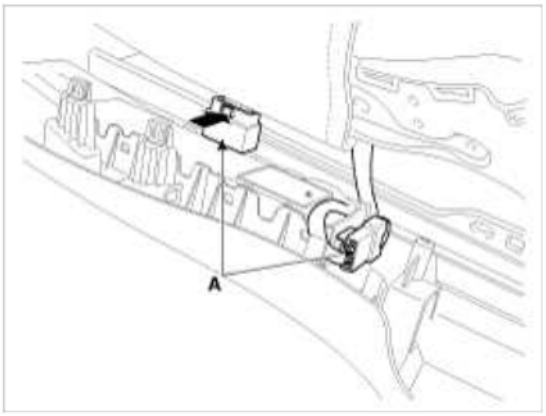
	Lumber Switch			Remarks
	Backward	N	Forward	
1	○		○	
2		○ ○		
3		○	○	
4	○	○		



[Lumber Switch]

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the power seat control switch (A).
   (Refer to Body - "Front seat")



Installation

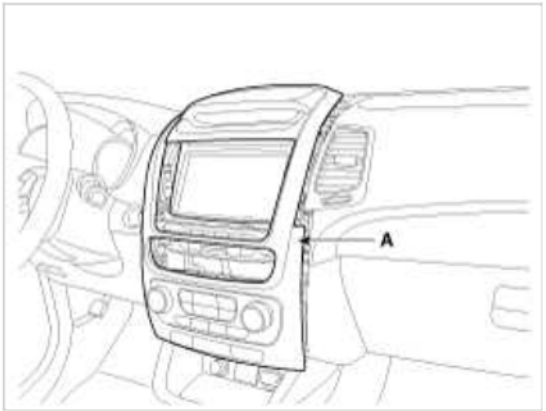
1. Install the power seat control switch after connecting the connector.

Body Electrical System

Inspection

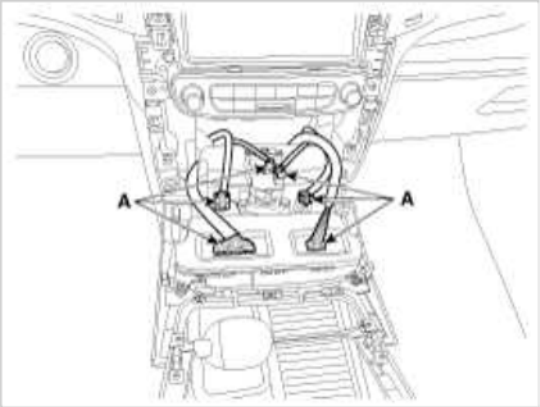
Front Seat Heater Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia panel (A).
   (Refer to Body - "Crash pad")

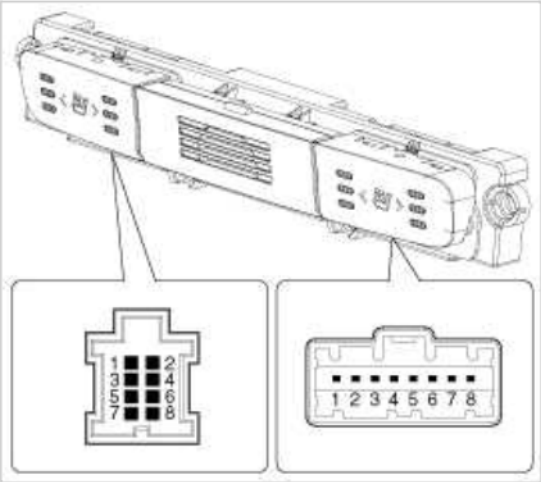


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3. Disconnect the connectors and cables (A) from center fascia panel.



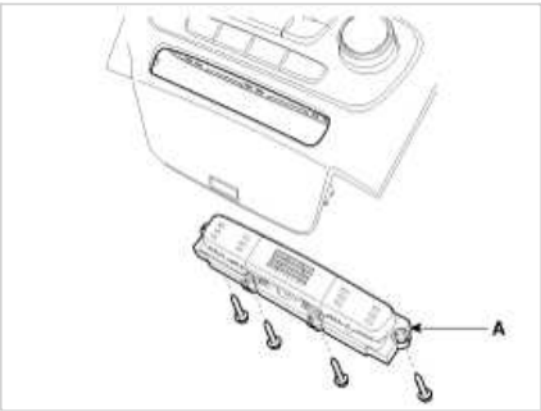
4. Remove the driver and assist seat heater switch connector.



5. Check that continuity exists between the terminals after turning the driver seat heater switch ON.

Terminal / Position	Inspection	Remarks
6		Illumination (-)
7		Illumination (+)
8		Switch signal
1		Battery (+)

6. If the switch fails to operate, replace the driver and assist seat heater switch (A).

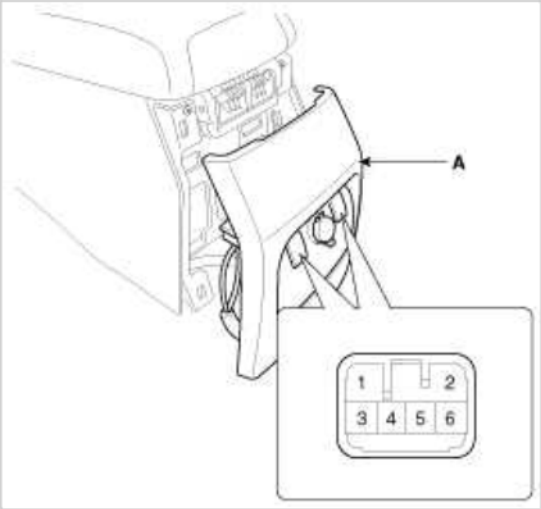


2nd Seat Heater Switch

1. Disconnect the negative (-) battery terminal.

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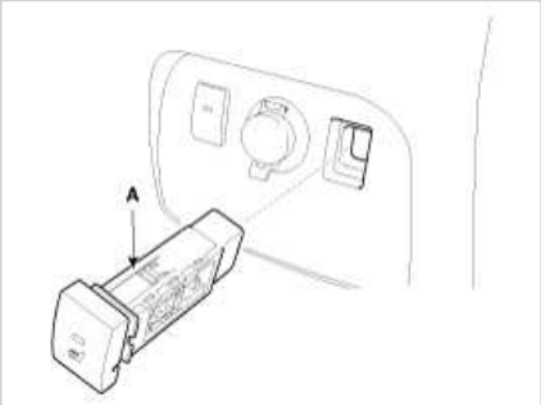
2. Remove the floor console rear cover (A).
(Refer to Body - "Console")



3. Turn 2nd seat heater switch ON and check that continuity exists between the terminals.

Position \ Terminal	ON	OFF	Remarks
5			Illumination(-)
3			Illumination(+)
2			
4			
1			
6			

4. Replace the 2nd seat heater switch.



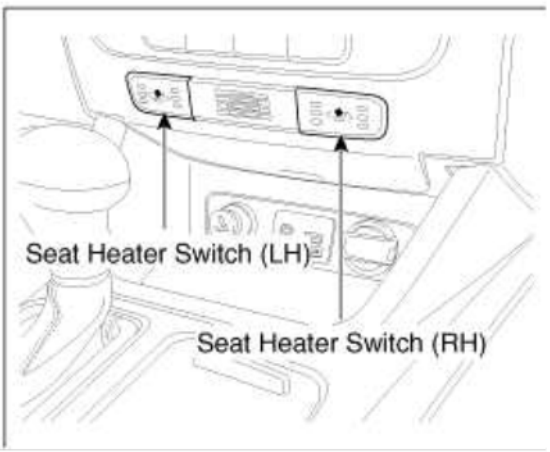
Body Electrical System

Component Location

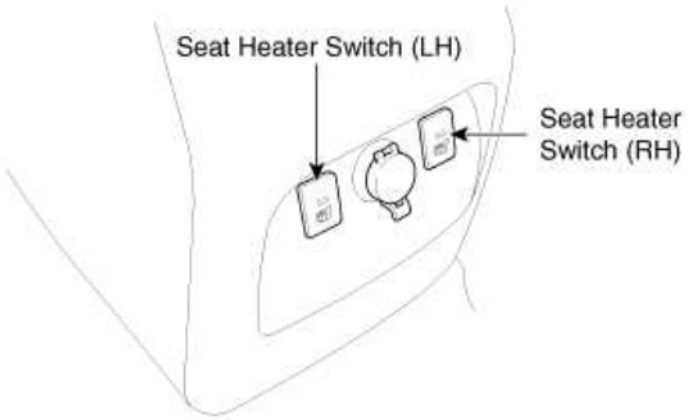
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[Driver/Assist Seat]





[Rear Seat]



[Rear Seat Heater (LH)]



[Rear Seat Heater (RH)]

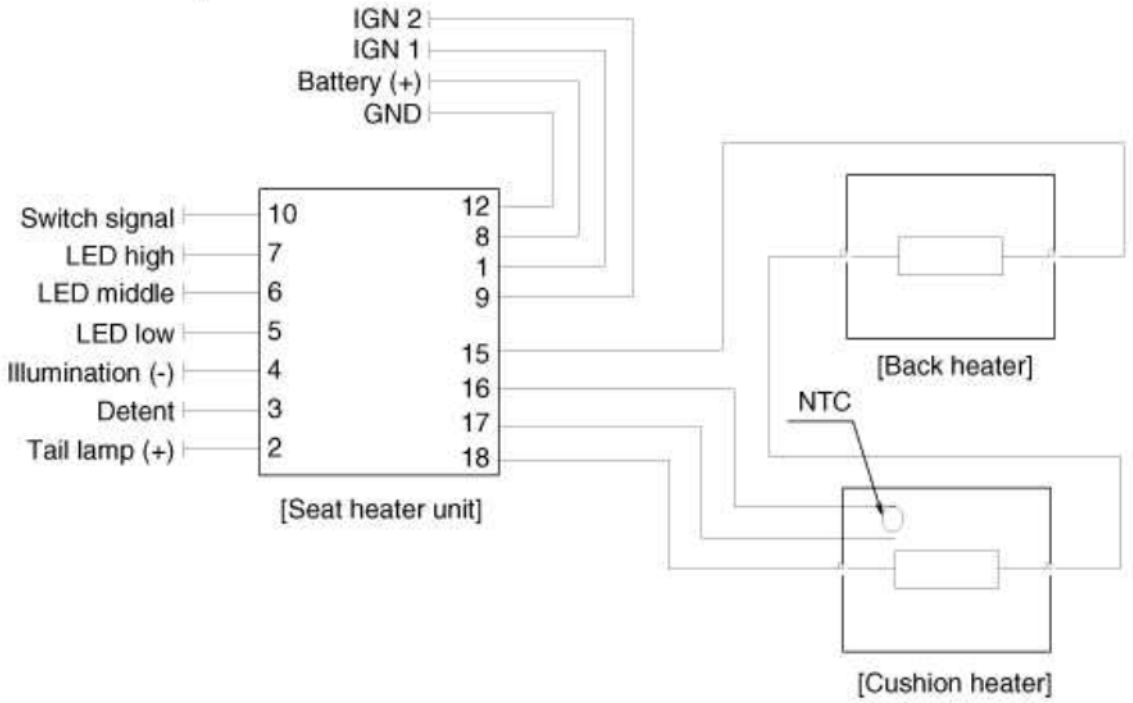


Body Electrical System

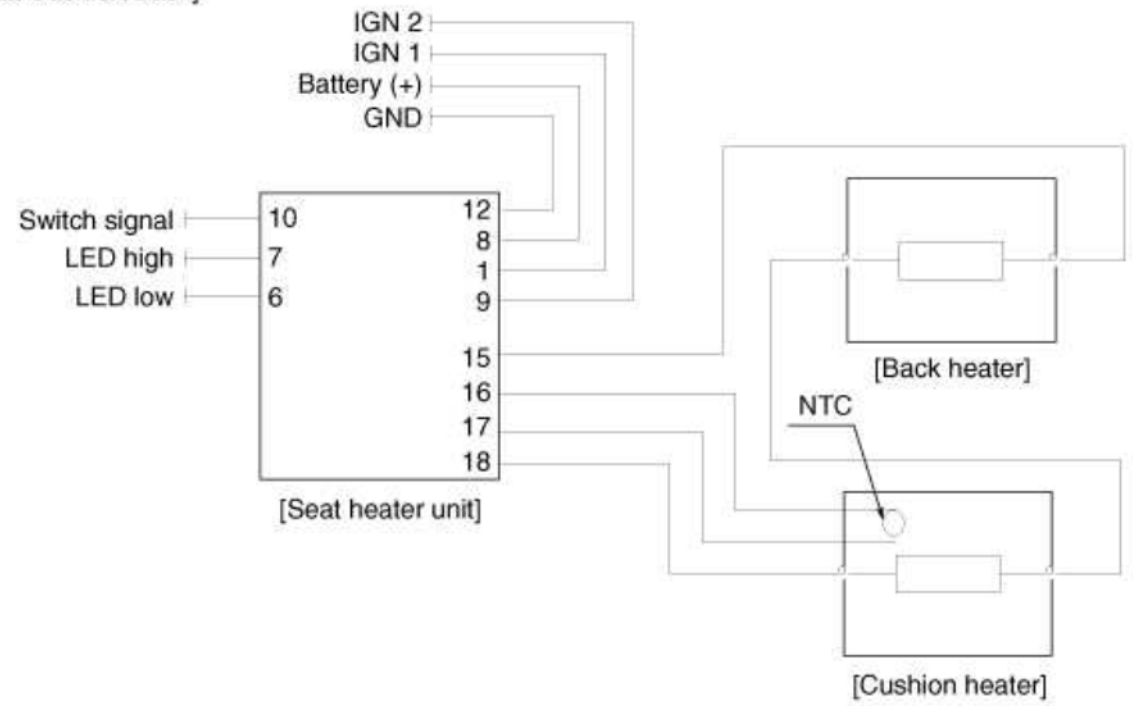
Circuit Diagram

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[Front Seat Cushion/Back]

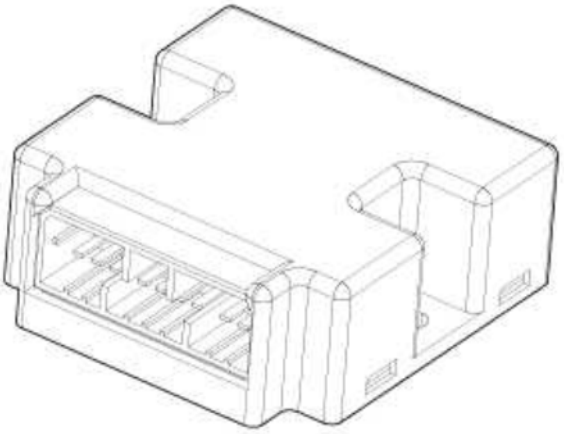


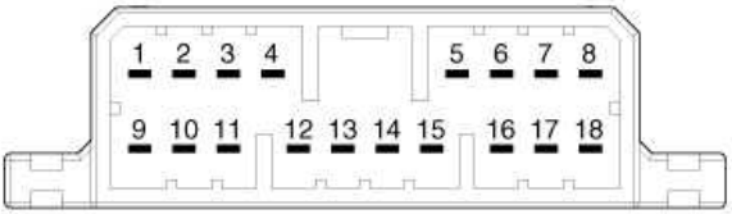
[Rear Seat Cushion/Back]



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[Seat Heater Unit]

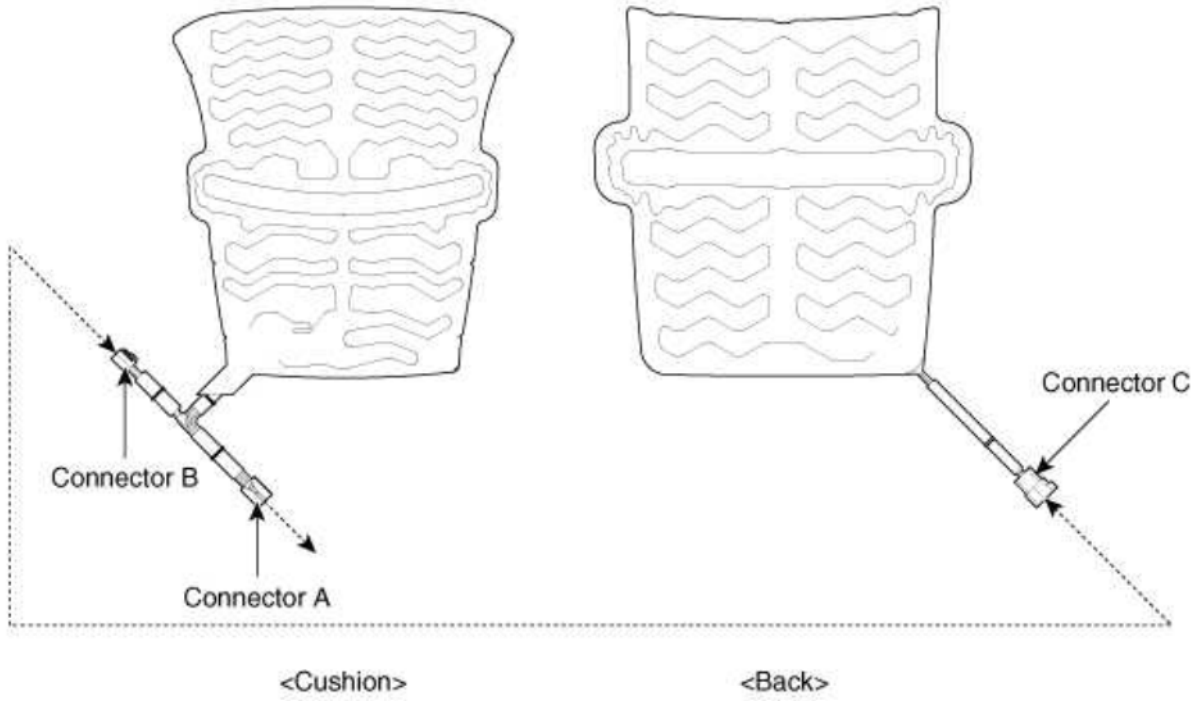


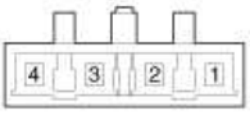


No.	Description	No.	Description
1	IGN 1	10	Switch signal
2	Tail lamp(+)	11	-
3	Detent	12	Battery(+)
4	Illumination(-)	13	-
5	LED low	14	-
6	LED middle	15	Heater(+)
7	LED high	16	NTC(+)
8	GND	17	NTC(-)
9	IGN 2	18	Heater(-)

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[Front Seat Heater]



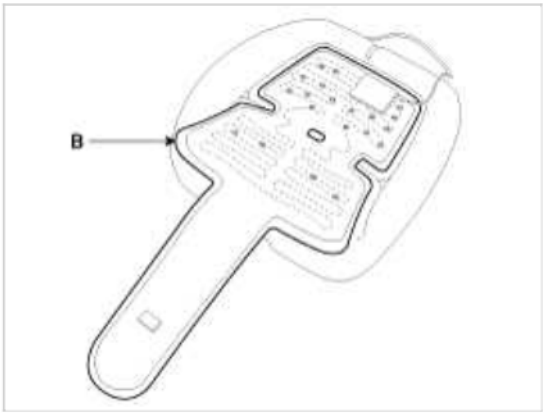
Description	Connector A	Connector B	Connector C
Shape			
1	Heater (+)	Heater (+)	Heater (+)
2	NTC (+)	Heater (-)	Heater (-)
3	NTC (-)		
4	Heater (-)		

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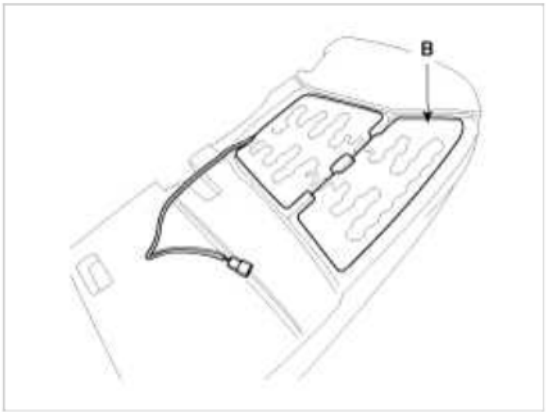
Removal

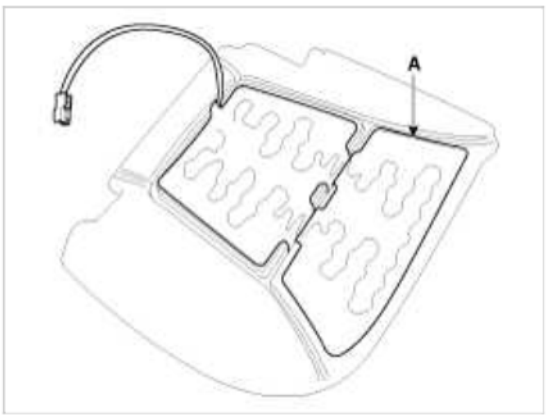
1. Remove the driver / assist seat back heater (A) and cushion heater (B).
   (Refer to Body - "Front seat")





2. Remove the rear seat LH heater (A) and RH heater (B).
   (Refer to Body - "Rear seat")





Installation

1. Install the driver / assist seat heater.
   (Refer to Body - "Front seat")

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2. Install the rear seat LH heater and RH heater.
(Refer to Body - "Rear seat")

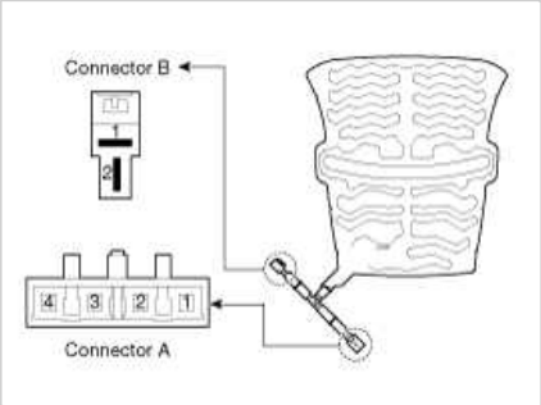
Inspection

Front seat

1. Operate the seat warmer after connecting the connector, and then check the thermostat by measuring the tempera seat surface.

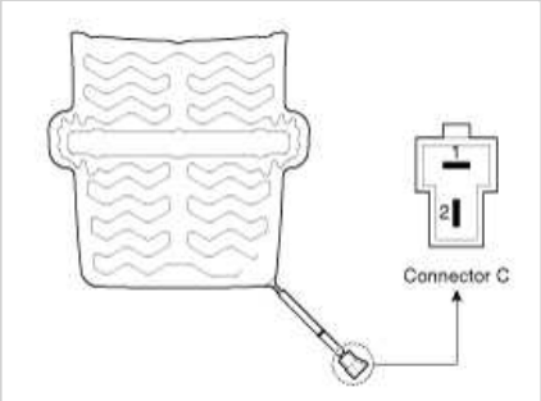
Position	Cushion	Back
1 step	36 ± 2°C (97 ± 3.6°F)	40 ± 2°C (104 ± 3.6°F)
2 step	39 ± 2°C (102 ± 3.6°F)	45 ± 2°C (113 ± 3.6°F)
3 step	42 ± 2°C (108 ± 3.6°F)	50 ± 2°C (122 ± 3.6°F)

2. Disconnect the connectors to check for continuity and measure the resistance between terminals.
3. Measure the resistance between A1 and B1 terminals of seat cushion.



Standard value
Seat cushion resistance : 1.39Ω ± 10%

4. Measure the resistance between C1 and C2 terminals of seat back.



Standard value
Seat back resistance : 0.89Ω ± 10%

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5. To measure the resistance of seat back and cushion, connect the B and C connectors.
   Measure the resistance between A1 and C1 terminals of seat.

Standard value
Seat set resistance : 2.3Ω ± 10%

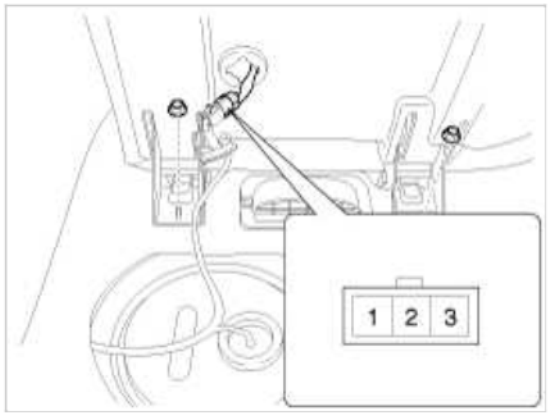
Rear seat

1. Operate the seat warmer after connecting the connector, and then check the thermostat by measuring the tempera seat surface.

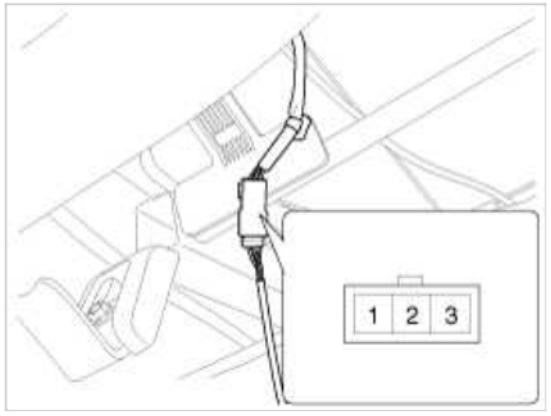
Standard value
Seat cushion temperature : 40 ± 2°C (104 ± 3.6°F)

2. Measure the resistance between 1 and 3 terminals of seat cushion.

[Rear RH seat]



[Rear LH seat]



Standard value
Seat cushion resistance : 4.5Ω ± 10%

Body Electrical System

Description

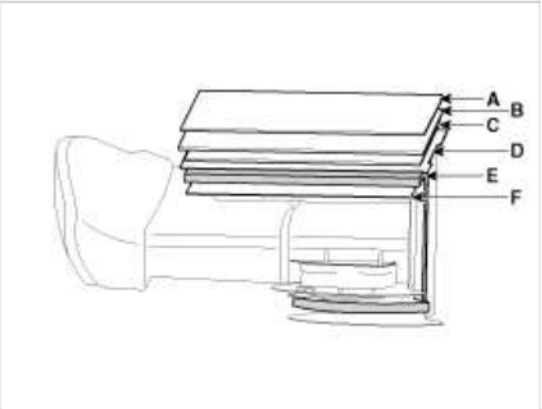
Air ventilation seat

It blows the indoor air through the blower fan installed at the seat cushion and back lower part, and supplies the air in seat cushion and the seat back through the duct.

It sends a indoor air to the seat surface through the air ventilation layer between upper and lower layer.

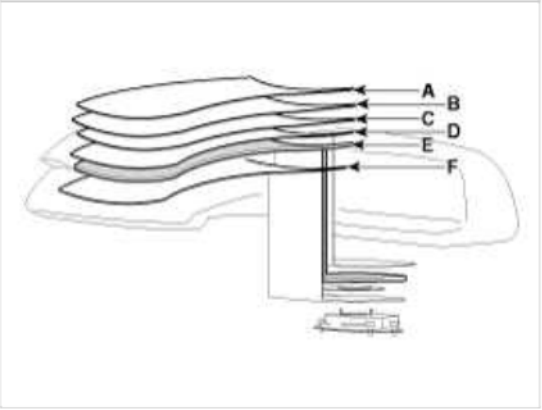
Seat Back Layers

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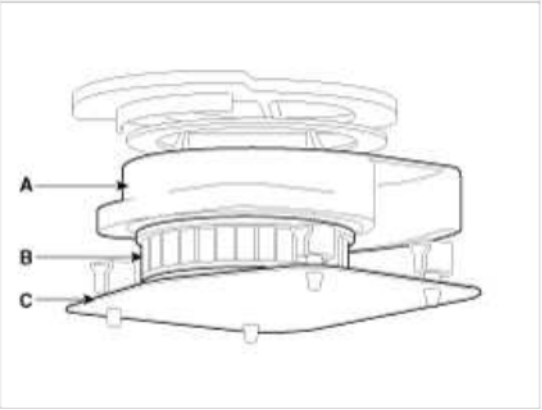


Item	Description
A	Leather
B	Pad
C	Seat Heater
D	Upper Layer
E	Air Ventilation Layer
F	Lower Layer

Seat Cushion Layers



Fan

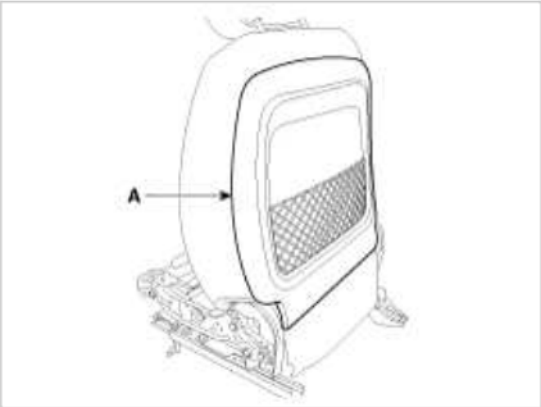


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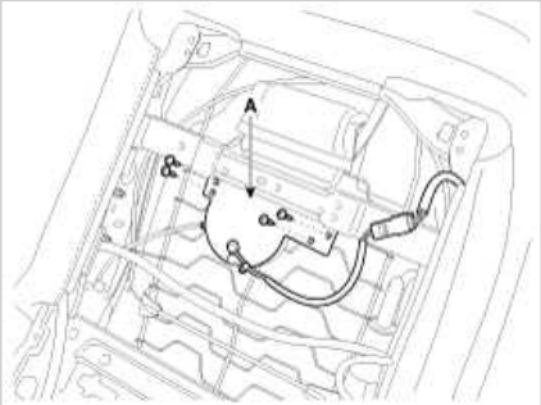
Item	Description
A	Fan Cover
B	Fan
C	Bracket

Removal

1. Remove the seat back cover (A).
   (Refer to Body - "Front seat")



2. Remove the blower fan (A) after removing the screws from the seat back.

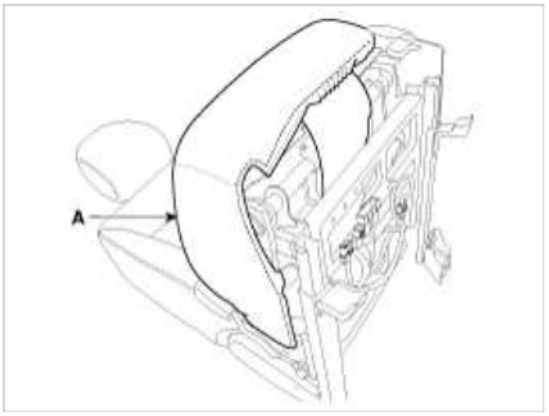


3. Remove the air duct (A) after disengaging the hook.

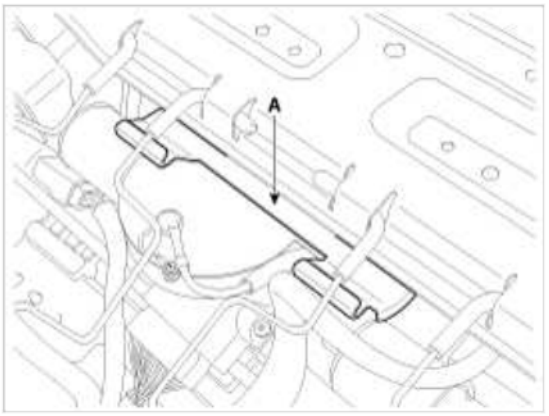


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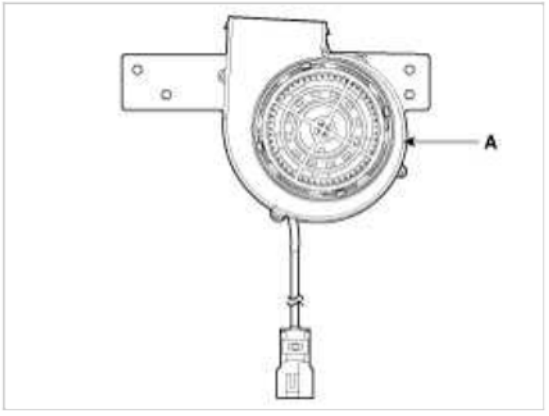
4. Remove the seat cushion (A).
   (Refer to Body - "Front seat")



5. Remove the blower fan (A) after removing the screws and disengaging hook.



6. Disconnect the connecter and remove the blower (A).



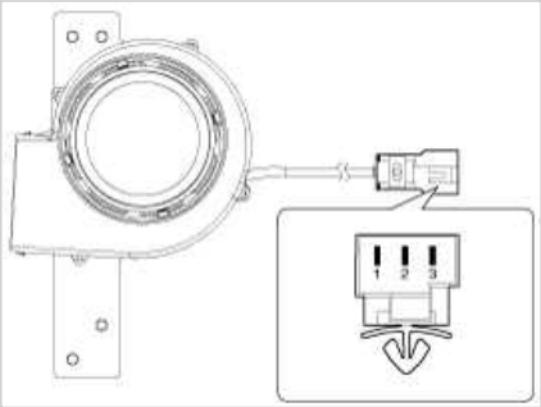
Installation

1. Install the blower fan.
2. Install the seat back and cushion.

Inspection

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1. Attach the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 3. Check that the fan motor operates.



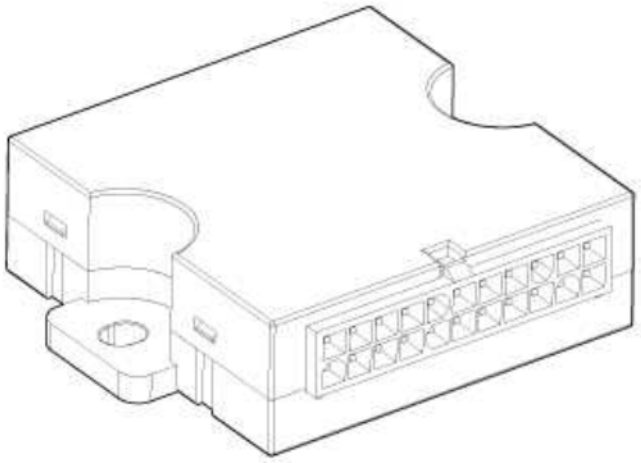
Pin	Description
1	12V
2	RPM control
3	GND

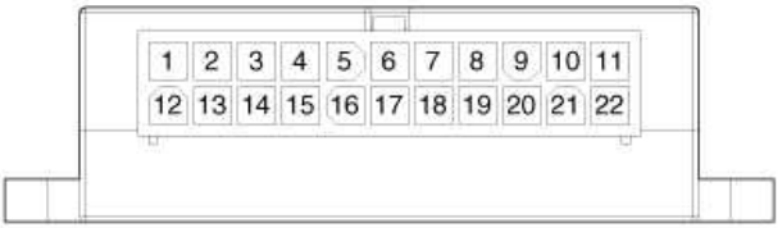
2. If the fan motor fails to operate, replace it.

Body Electrical System

Component Location

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Pin No.	Description	Pin No.	Description
1	Battery	12	Battery
2	Detent	13	Tail lamp
3	Cushion heater	14	IGN2
4	Switch (Ventilation)	15	Switch (Heater)
5	LED (Ventilation 3)	16	Illumination (-)
6	Back heater	17	LED (Heater 2)
7	LED (Ventilation 1)	18	LED (Heater 3)
8	LED (Ventilation 2)	19	LED (Heater 1)
9	NTC (+)	20	GND
10	Blower power	21	Blower 2
11	IGN1	22	Blower 1

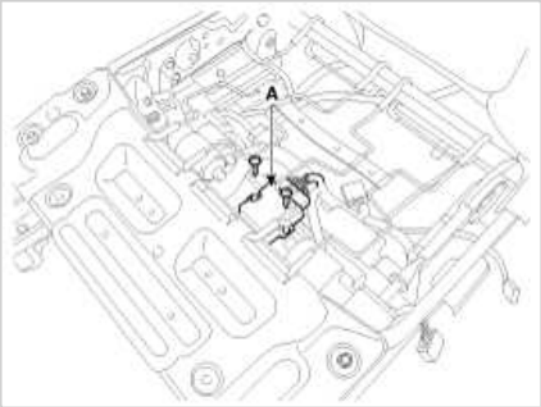
※NTC sensor : Negative Thermal Coeffecient

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Removal

1. Disconnect the negative (-) battery terminal.

2. Remove the air ventilation seat control unit (A) after loosening screws.

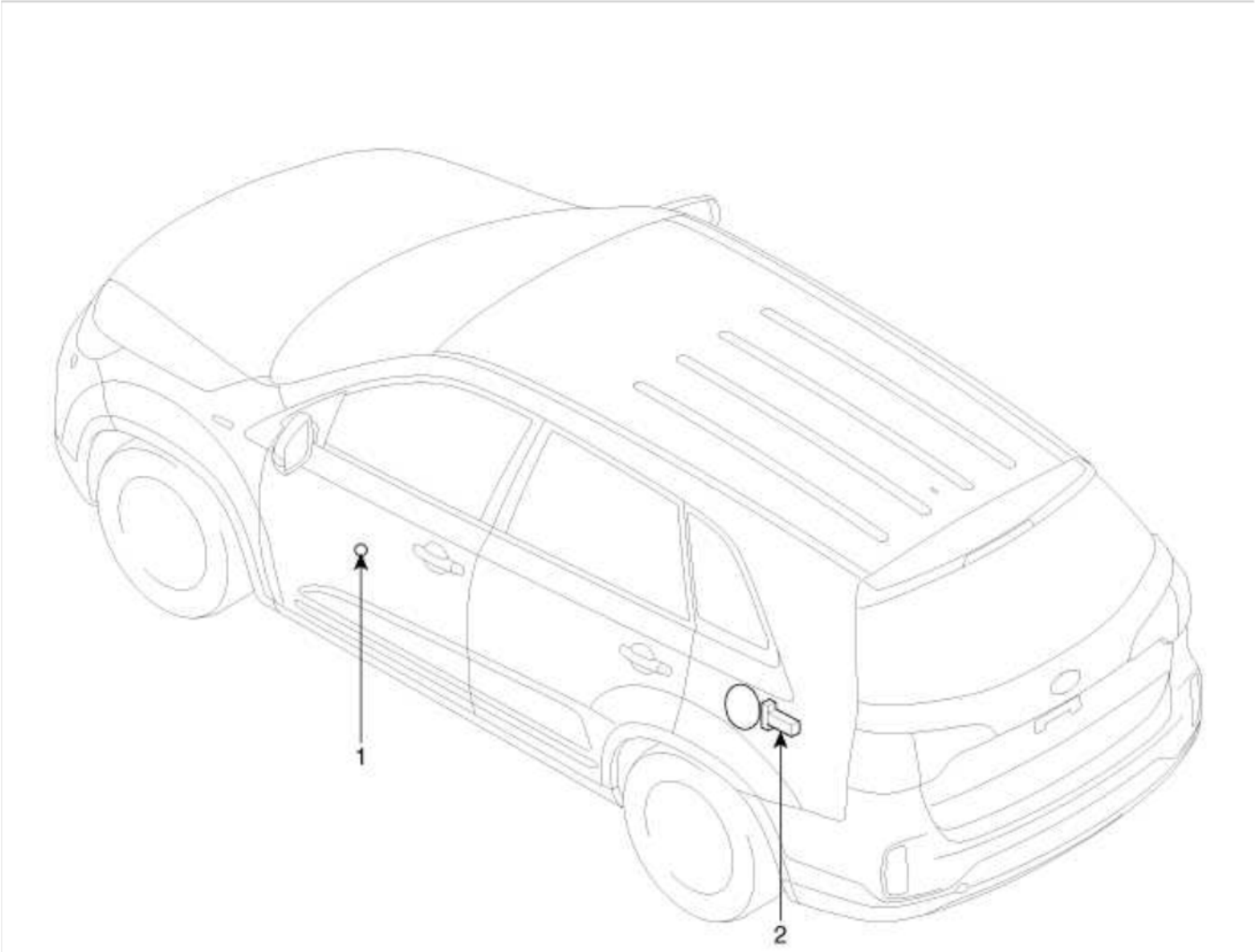


Installation

1. Install the air ventilation seat control unit and connector.

Body Electrical System

Component Location

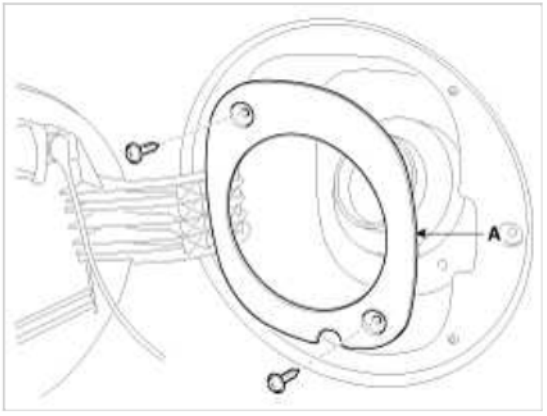


1. Fuel filler door open switch	2. Fuel filler door release actuator

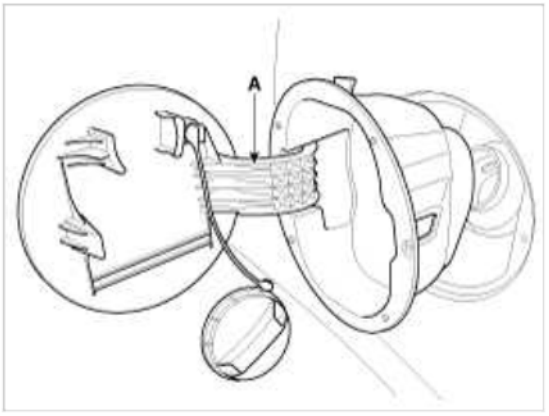
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Inspection

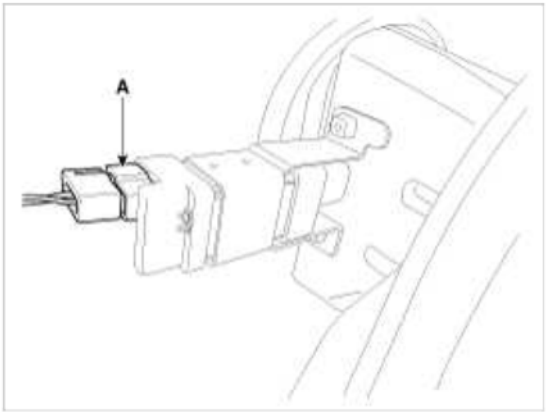
1. Remove the fuel filler cover (A) after loosening screws (2EA).



2. Remove the fuel filler door module (A).

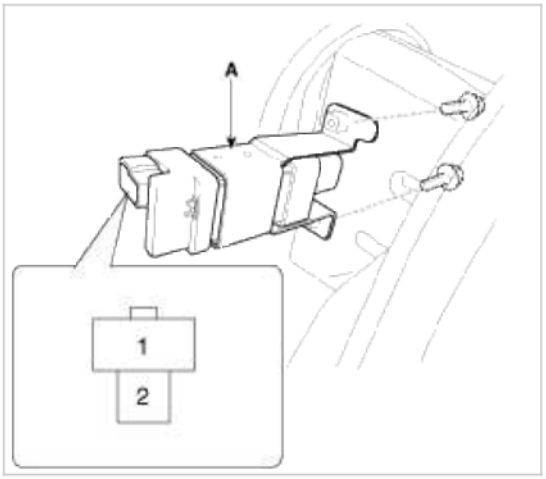


3. Remove the rear 3rd seats.
   (Refer to Body - "Rear seats")
4. Remove the luggage side trim.
   (Refer to Body - "Interior trim")
5. Disconnect the fuel filler door release actuator connector (A).



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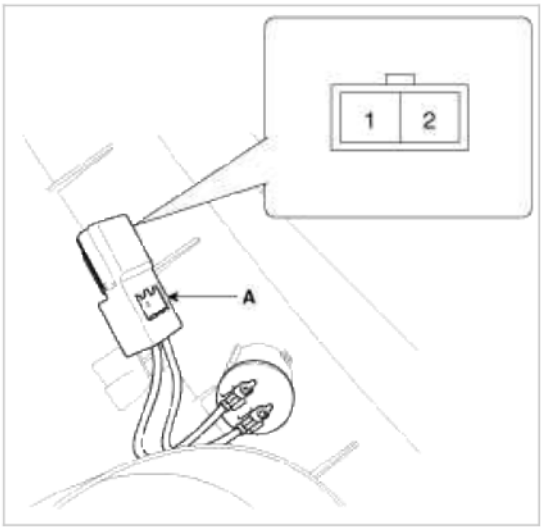
6. Check for continuity between terminal No. 1 and No. 2. If there is no continuity, replace the fuel filler door releas actuator (A).



Body Electrical System

Inspection

1. Remove the front door trim panel.
   (Refer to Body - "Front door")
2. Disconnect the switch connector (A) from wiring.



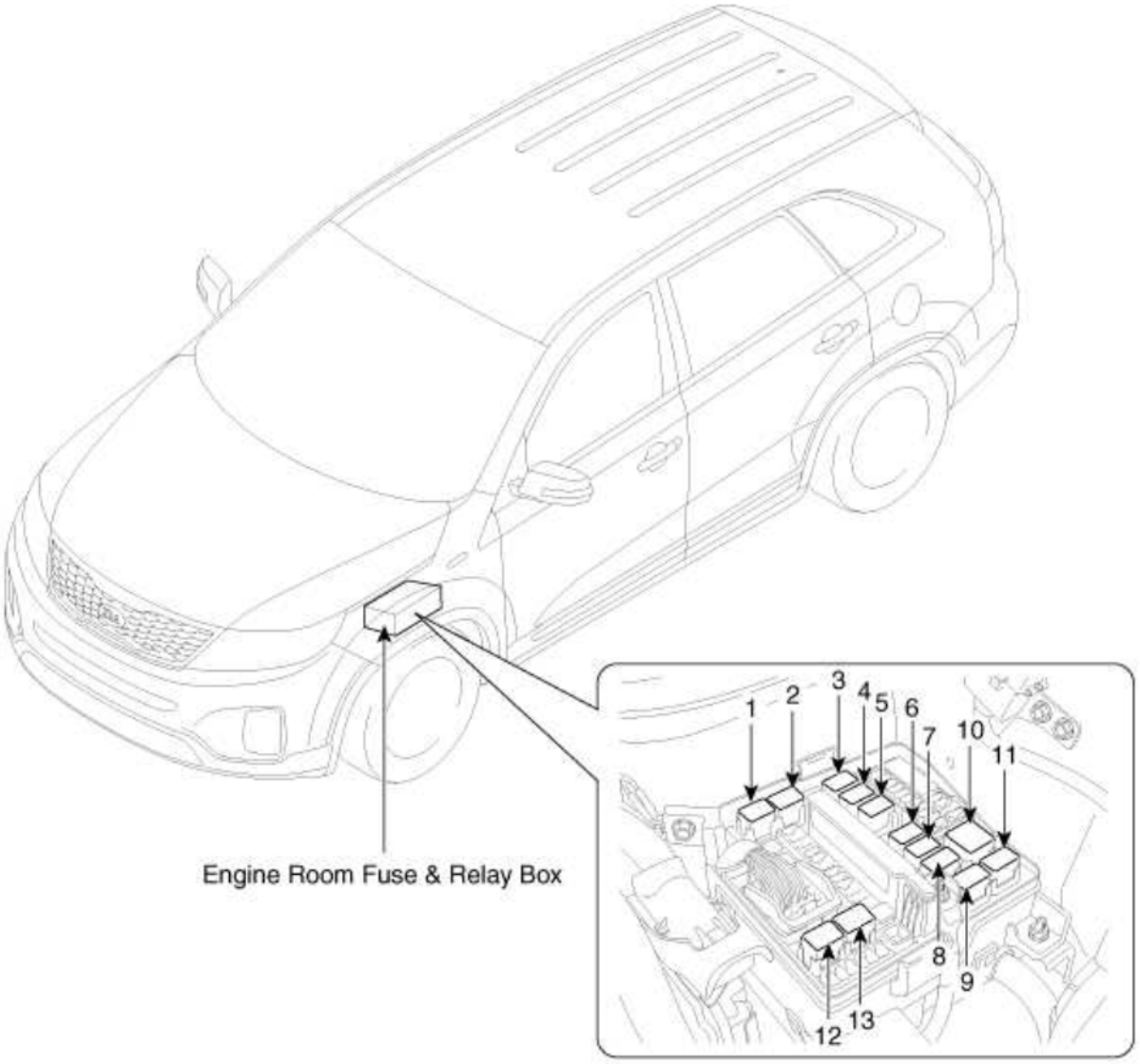
3. Check the switch for continuity between the No. 1 and No. 2 terminals. If the continuity is not as specified, repla switch.

Body Electrical System

Component Location

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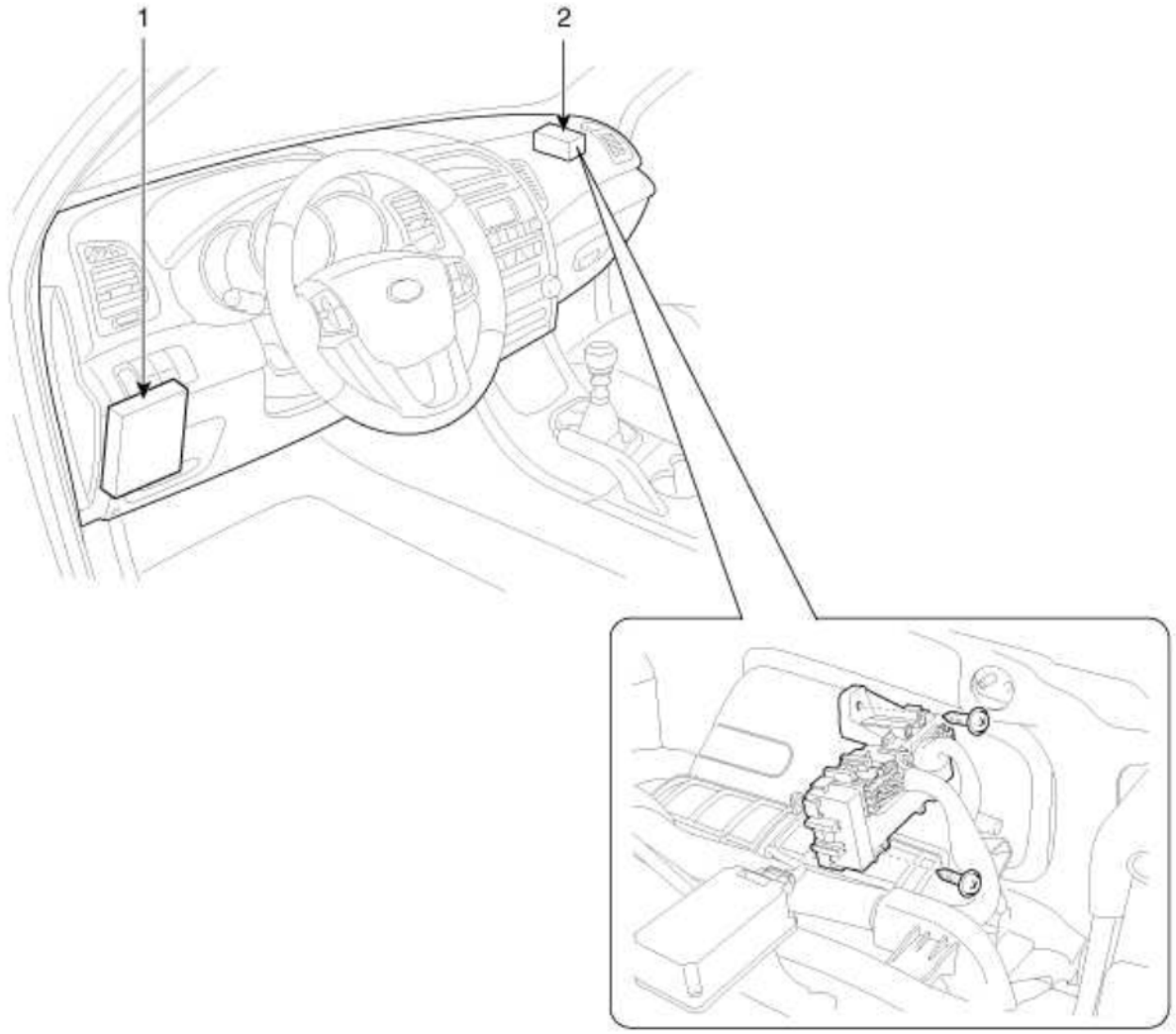
[Engine Room Relay Box]



1. Start relay #2 (W/O immo./smart key) / ACC relay (With smart key)	5. Wiper relay (low)	10. Cooling fan relay
2. Start relay #1	6. Burglar alarm horn relay	11. Rear glass defogger relay
3. Windshield deicer relay	7. Head lamp RH relay	12. Horn relay
4. Power outlet relay	8. IGN 1 relay	13. Blower relay
	9. IGN 2 relay	

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[Passenger Compartment Relay]

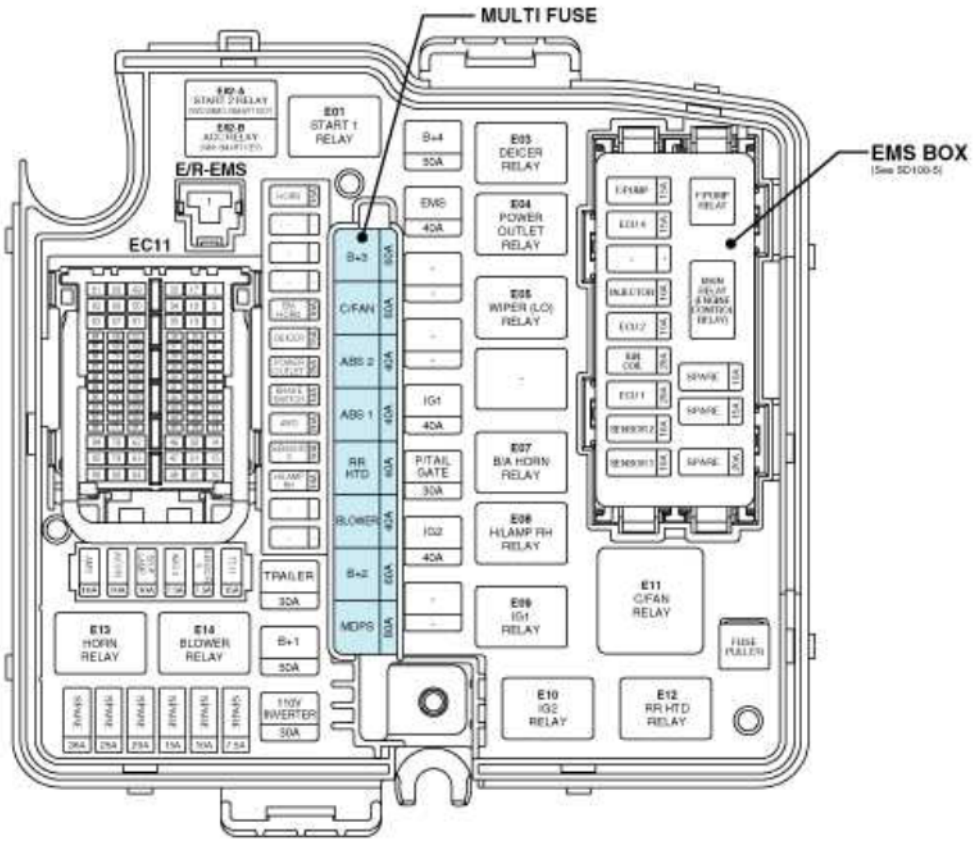


1. IPM
2. Rear wiper relay, Rear blower relay, Rear seat warmer LH relay, Rear seat warmer RH relay, Two turn unlock re
Tailgate latch relay (Built-in ICM relay box)

Body Electrical System

Component Location

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Relay NO.	Relay Name	Type
E01	START 1 RELAY	ISO MICRO
E02-A	START 2 RELAY (W/O IMMO./Smart Key)	ISO MICRO
E02-B	ACC RELAY (With Smart Key)	ISO MICRO
E03	DEICER RELAY	ISO MICRO
E04	POWER OUTLET RELAY	ISO MICRO
E05	WIPER (LO) RELAY	ISO MICRO
E07	B/A HORN RELAY	ISO MICRO
E08	H/LAMP RH RELAY	ISO MICRO
E09	IG1 RELAY	ISO MICRO
E10	IG2 RELAY	ISO MICRO
E11	C/FAN RELAY	ISO MINI
E12	RR HTD RELAY	ISO MICRO
E13	HORN RELAY	ISO MICRO
E14	BLOWER RELAY	ISO MICRO

※USE THE DESIGNATED FUSE AND RELAY ONLY

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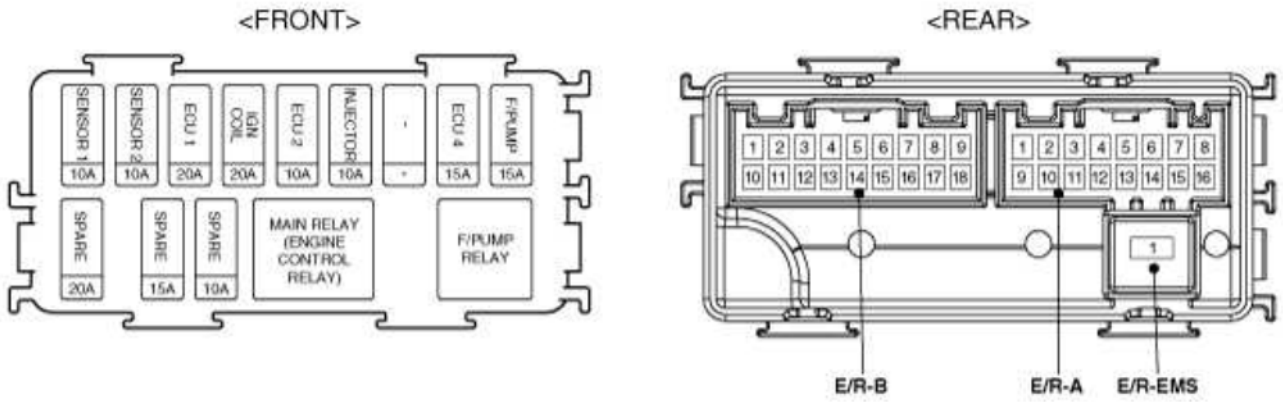
Circuit (E/R Fuse & Relay Box)

Fuse Name		(A)	Circuit Protected
MULTI FUSE	MDPS	80A	MDPS Unit
	B+2	60A	Smart Junction Box (IPS 1, ARISU LH, Fuse - SUNROOF 1, DRV P/SEAT, PASS P/SEAT, S/HEATER FRT)
	BLOWER	40A	Blower Relay
	RR HTD	40A	RR HTD Relay
	ABS 1	40A	ESC Module, Multipurpose Check Connector
	ABS 2	40A	ESC Module, Multipurpose Check Connector
	C/FAN	60A	C/FAN Relay
	B+3	60A	Smart Junction Box (Leak Current Autocut Device : Leak Current Autocut Relay, Fuse Switch, Fuse - INTERIOR LAMP, MEMORY, MULTIMEDIA) Smart Junction Box (Fuse - MODULE 1, SMART KEY 1, SMART KEY 4, SUNROOF 2)
FUSE	B+4	50A	Smart Junction Box (IPS 3, ARISU RH, Fuse - BLOWER RR, STOP LAMP, F/LID, DR LOCK)
	EMS	40A	EMS Box (Engine Control Relay, Fuse - ECU 4, F/PUMP)
	IG1	40A	Ignition Switch (W/O Smart Key), ACC Relay (With Smart Key), IG1 Relay (With Smart Key)
	P/TAIL GATE	30A	Power Tail Gate Module
	IG2	40A	Ignition Switch (W/O Smart Key), Start 1 Relay, IG2 Relay (With Smart Key)
	TRAILER	30A	Trailer Power Outlet
	B+1	50A	Smart Junction Box (Fuse - S/HEATER RR, P/WDW LH, P/WDW RH, AMP)
	AC INVERTER	30A	AC Inverter Module
	HORN	15A	Horn Relay
	B/A HORN	10A	B/A Horn Relay
	DEICER	15A	Deicer Relay
	POWER OUTLET	25A	Power Outlet Relay
	BRAKE SWITCH	10A	Stop Lamp Switch, Smart Key Control Module
	4WD	20A	4WD ECM
	SENSOR 3	10A	Battery Sensor
	H/LAMP RH	10A	H/Lamp RH Relay
	AMS	10A	PCM
	A/CON	10A	A/C Control Module (Auto)
	B/UP LAMP	10A	M/T - Back-Up Lamp Switch A/T - Rear Combination Lamp (In) LH/RH, Electro Chromic Mirror, Audio, A/V & Navigation Head Unit
	ABS 3	7.5A	ESC Module, Multipurpose Check Connector
	SENSOR 5	7.5A	PCM
	TCU	15A	G4KJ : Fuse - B/UP LAMP (M/T), Transaxle Range Switch (A/T) G6DH : IDB (Injector Driver Box), Transaxle Range Switch

※ USE THE DESIGNATED FUSE AND RELAY ONLY

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EMS BOX



Circuit

Fuse Name	(A)	Circuit Protected
F/PUMP	15A	F/Pump Relay
ECU 4	15A	G4KJ : PCM G6DH : PCM, IDB (Injector Driver Box)
INJECTOR	10A	G4KJ : Immobilizer Module, F/Pump Relay G6DH : PCM, F/Pump Relay
ECU 2	10A	G6DH : IDB (Injector Driver Box)
IGN COIL	20A	G4KJ : Condenser, Ignition Coil #1/#2/#3/#4 G6DH : Condenser #1/#2, Ignition Coil #1/#2/#3/#4/#5/#6
ECU 1	20A	G4KJ : PCM
SENSOR 2	10A	G4KJ : Canister Close Valve, E/R Fuse & Relay Box (C/Fan Relay) G6DH : Canister Close Valve, Oil Control Valve #1/2 (Exhaust), Oil Control Valve #1/2 (Intake), Purge Control Solenoid Valve, PCM, Immobilizer Module E/R Fuse & Relay Box (C/Fan Relay), Variable Intake Manifold Valve #1/2
SENSOR 1	10A	G4KJ : Oxygen Sensor (Up/Down), Purge Control Solenoid Valve, Camshaft Position Sensor #1/#2 Variable Intake Solenoid Valve, Crankshaft Position Sensor, Oil Control Valve #1/#2 G6DH : PCM, Oxygen Sensor #1/#2/#3/#4

※ USE THE DESIGNATED FUSE AND RELAY ONLY

Inspection

1. Disconnect the negative (-) battery terminal.
2. Pull out the relay from the engine compartment relay box.

Power Relay (Type A)

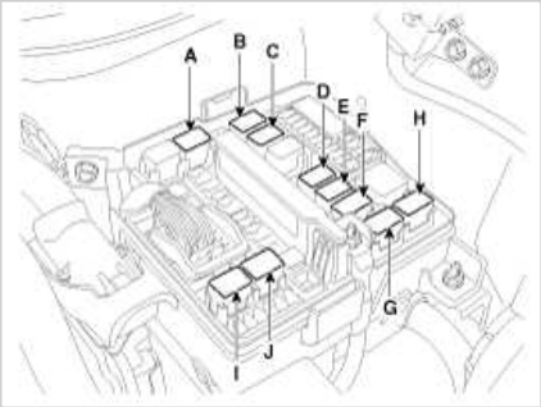
Check for continuity between the terminals.

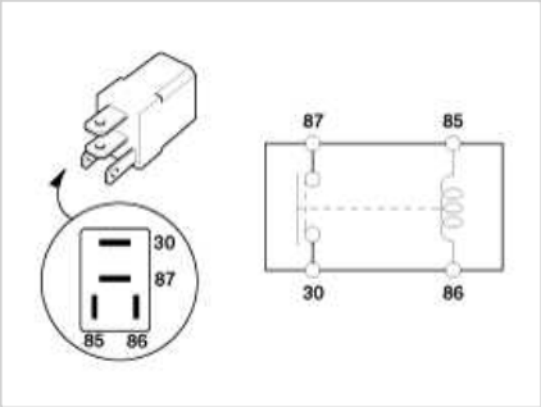
A : Start relay #1
B : Windshield deicer relay
C : Power outlet relay
D : Burglar alarm horn relay
E : Head lamp RH relay
F : IGN 1 relay
G : IGN 2 relay
H : Rear glass defogger relay
I : Horn relay
J : Blower relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to th No.85 and No.86 terminals.

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2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.





Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

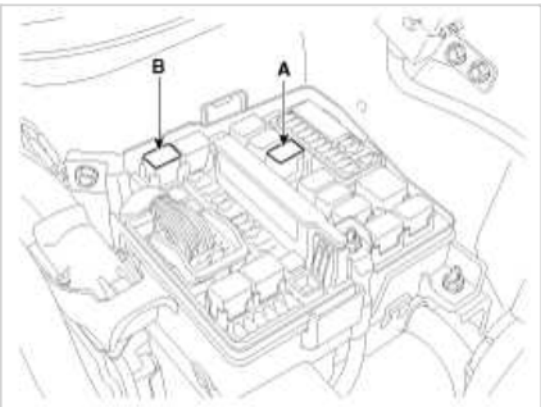
Power Relay (Type B)

Check for continuity between the terminals.

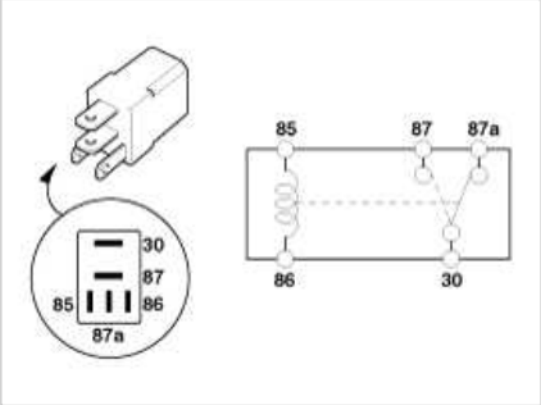
A : Wiper relay (Low)

B : Start relay #2 (W/O immo./smart key)/ ACC relay (With smart key)

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to th No.85 and No.86 terminals.
2. There should be continuity between the No.30 and No.87a terminals when power is disconnected.
3. There should be no continuity between the No.30 and No.87 termianls when power is disconnected.



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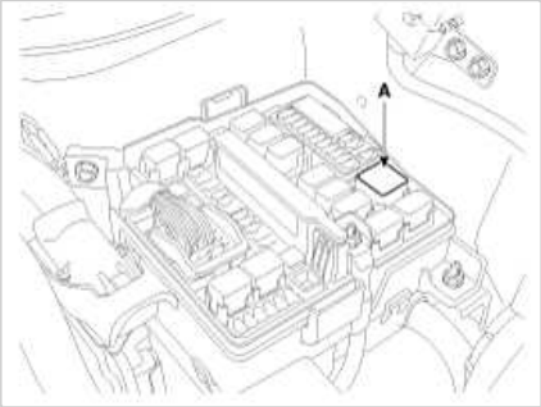
Terminal / Power	85	86	30	87	87a
Disconnected			○		○
Connected	⊖	⊕	○	○	

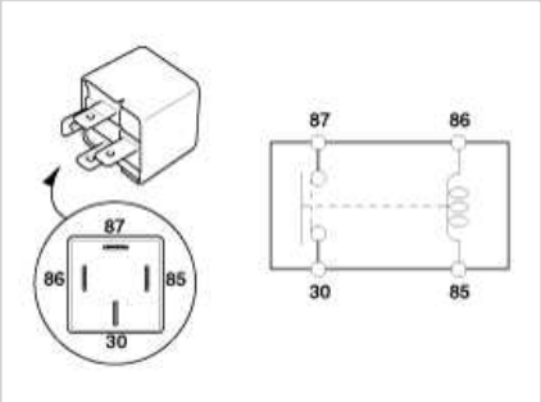
Power Relay (Type C)

Check for continuity between the terminals.

A : Condenser pan relay #1

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to th No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.





Terminal / Power	86	85	87	30
Disconnected	○	○		
Connected	⊖	⊕	○	○

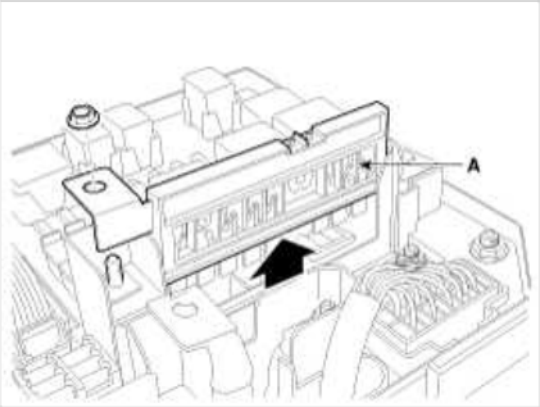
Fuse

1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?

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3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew fi
   completely eliminate the problem before installing a new fuse.

Multi Fuse

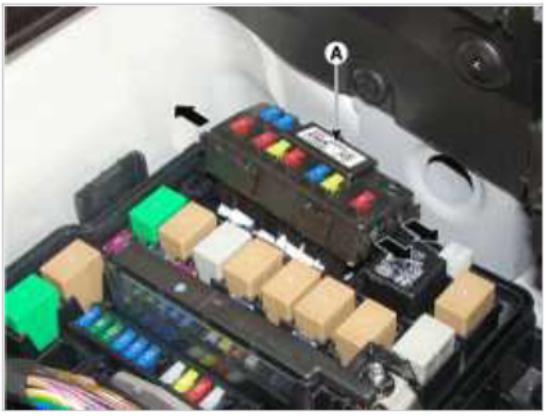


NOTICE

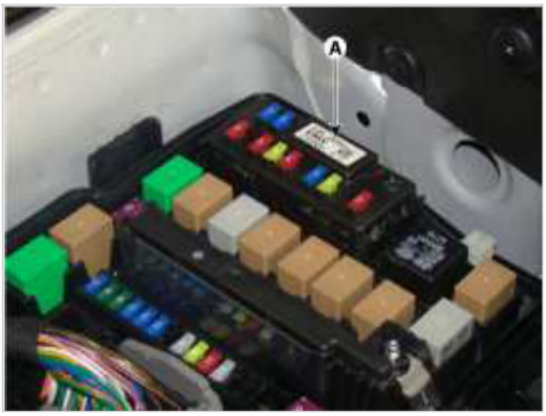
- Multi fuse is needed to replace in the mass when it damaged only one fuse.
- When replace the multi fuse, refer to the "Engine compartment - component location" diagram exactly.
- Use the multi fuse capacities for each circuit correctly.

Replacement of EMS block

1. Disconnect the negative(-) battery terminal.
2. Push 3 hooks in the engine room relay box out to the arrow direction and put up the EMS box assembly (A).



3. Disconnect the connector and remove the EMS box assembly (A).

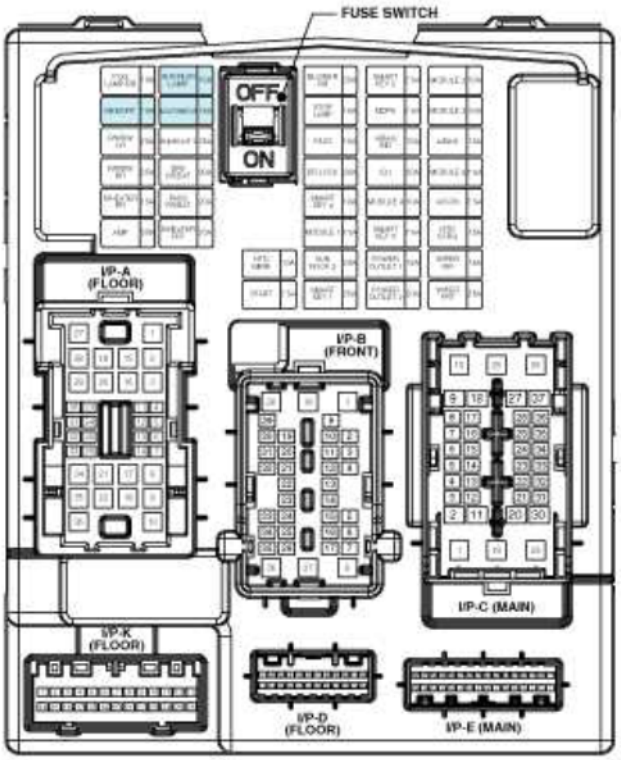


Body Electrical System

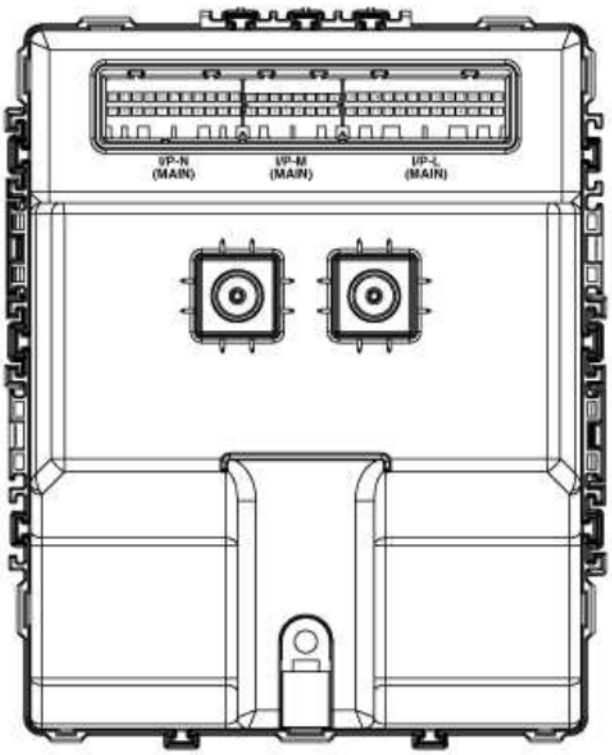
Component Location

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<FRONT>



<REAR>



※ USE THE DESIGNATED FUSE AND RELAY ONLY

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Circuit (Smart Junction Box)

Fuse Name	(A)	Circuit Protected
FOG LAMP RR	10A	Not used
INTERIOR LAMP	10A	Cargo Lamp, Vanity Lamp LH/RH, Overhead Console Lamp Room Lamp, Rear Personal Lamp LH/RH, Driver/Passenger Door Scuff Lamp Ignition Key I.L. & Door Warning Switch
BLOWER RR	20A	ICM Relay Box (Rear Blower Relay)
SMART KEY 2	7.5A	Smart Key Control Module
MODULE 2	10A	Stop Lamp Switch, Alternator,Head Lamp Leveling Device Actuator LH/RH Auto Head Lamp Leveling Device Module, Instrument Cluster (ALT 'L') A/V & Navigation Head Unit
MEMORY	10A	Tire Pressure Monitoring Module, Electro Chromic Mirror Instrument Cluster (B+), Data Link Connector, Clock, A/C Control Module Front CCS Switch LH/RH, Seat Warmer Switch LH/RH Driver IMS Module, Power Window Main Switch Passenger Power Window Switch, Power Outside Mirror Switch
MULTIMEDIA	15A	Audio, A/V & Navigation Head Unit, MTS Module
STOP LAMP	15A	Stop Signal Electronic Module
MDPS	7.5A	MDPS Unit
MODULE 3	10A	Instrument Cluster (IG), A/C Control Module, 4WD ECM ESC Off Switch, Tire Pressure Monitoring Module Audio, A/V & Navigation Head Unit, ATM Lever Indicator Power Window Main Switch, Passenger Power Window Switch MTS Module, Blind Spot Detection Radar LH/RH Rear Parking Assist Sensor LH/RH, Rear Parking Assist Sensor LH/RH (Center) Driver/Passenger CCS Control Module, IPS Control Module Driver/Passenger Seat Warmer Module
PWDW LH	25A	Power Window LH Relay, Driver Safety Power Window Module Power Window Main Switch, Rear Power Window Switch LH
SUNROOF 1	25A	Sunroof Motor & Master Control Unit
F/LID	15A	Fuel Filler Door Switch
A/BAG IND	10A	Instrument Cluster (IND.), Clock
A/BAG	15A	SRS Control Module (IG), Passenger Occupant Detection Sensor
PWDW RH	25A	Power Window RH Relay, Passenger Power Window Switch Power Window Main Switch Rear Power Window Switch RH
DRV P/SEAT	30A	Driver IMS Module, Driver Seat Manual Switch Driver Lumbar Support Switch
DR LOCK	20A	Door Lock/Unlock Relay ICM Relay Box (Tail Gate Latch Relay, Two Turn Unlock Relay)

Fuse Name	(A)	Circuit Protected
IG1	20A	E/R Fuse & Relay Box (Fuse - TCU, SENSOR 5, ABS 3)
MODULE 5	7.5A	Electro Chromic Mirror, Smart Key Control Module, Driver IMS Module Rear Parking Assist Buzzer, IPS Control Module, AC Inverter Switch Sunroof Motor & Master Control Unit, Driver/Passenger CCS Control Module Driver/Passenger Seat Warmer Module, AC Inverter Module
S/HEATER RR	15A	ICM Relay Box (Rear Seat Warmer Relay LH/RH)
PASS P/SEAT	20A	Passenger Seat Manual Switch
SMART KEY 4	10A	Start/Stop Button Switch, Smart Key Control Module
MODULE 4	10A	Audio, A/V & Navigation Head Unit, MTS Module AMP, Clock, Power Outside Mirror Switch Power Window Main Switch, IPS Control Module Passenger Power Window Switch, E/R Fuse & Relay Box (Power Outlet Relay)
A/CON	7.5A	ICM Relay Box (Rear Blower Relay) E/R Fuse & Relay Box (Blower Relay), A/C Control Module Inoar Temperature Sensor
AMP	30A	AMP
S/HEATER FRT	20A	Driver/Passenger CCS Control Module Driver/Passenger Seat Warmer Module
MODULE 1	7.5A	Sport Mode Switch (Shift Lock Solenoid), Key Solenoid
SMART KEY 3	7.5A	Smart Key Control Module
HTD STRG	15A	Clock Spring (Steering Wheel Heater)
HTD MIRR	10A	A/C Control Module, Driver/Passenger Power Outside Mirror
SUNROOF 2	25A	Sunroof Roller Blind Motor & Slave Control Unit
P/OUTLET 1	15A	Not used
WIPER RR	15A	ICM Relay Box (Rear Wiper Relay), Rear Wiper Motor Multifunction Switch (Wiper)
START	7.5A	W/O IMMO - E/R Fuse & Relay Box (Start 2 Relay) With IMMO - Transaxle Range Switch, E/R Fuse & Relay Box (Start 1 Relay)
SMART KEY 1	25A	Smart Key Control Module
P/OUTLET 2	20A	Driver Power Outlet, Luggage Power Outlet
WIPER FRT	25A	Multifunction Switch (Wiper) E/R Fuse & Relay Box (Wiper (LO) Relay) Front Wiper Motor

※ USE THE DESIGNATED FUSE AND RELAY ONLY

Inspection

Fuse

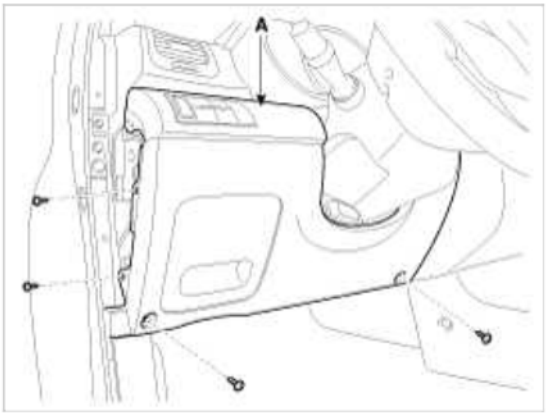
1. Be sure there is no play in the fuse holders, and that the fuses are held securely.
2. Are the fuse capacities for each circuit correct?
3. Are there any blown fuses?
   If a fuse is to be replaced, be sure to use a new fuse of the same capacity. Always determine why the fuse blew fi
   completely eliminate the problem before installing a new fuse.

Removal

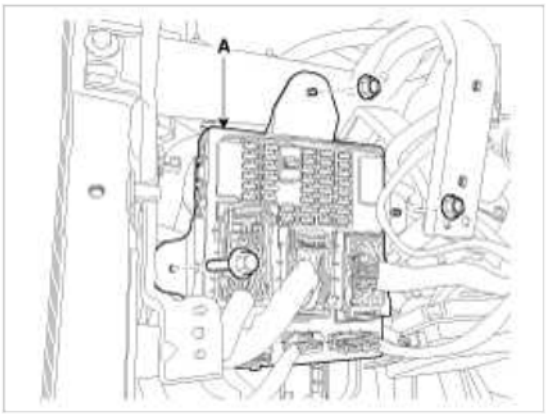
1. Disconnect the negative (-) battery terminal.

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2. Remove the crash pad lower panel (A).
   (Refer to Body - "Crash pad")



3. Remove IPM(Intelligent intergrated Platform Module) connector (A), bolts and nut.



4. Remove IPM after removing rear connectors.

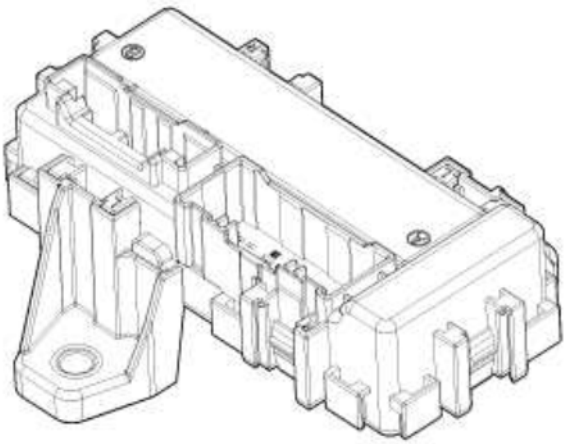
Installation

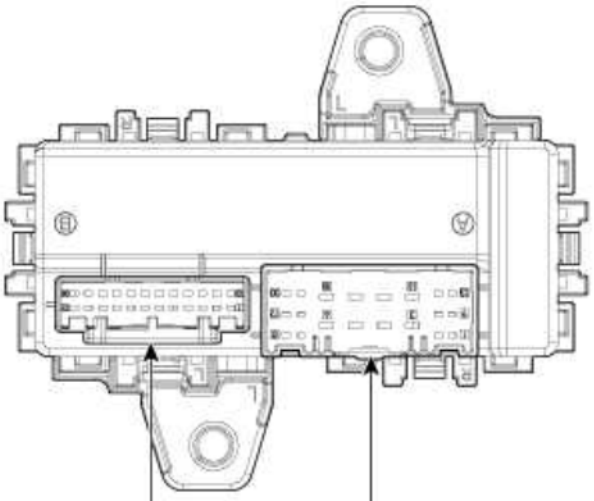
1. Install IPM(Intelligent intergrated Platform Module).
2. Connect the IPM connector.
3. Install the crash pad lower panel.

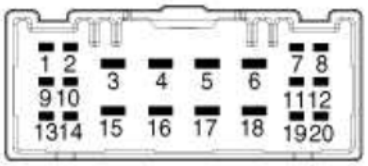
Body Electrical System

Component

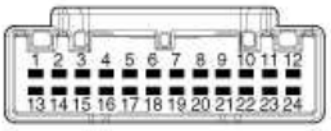
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Connector A



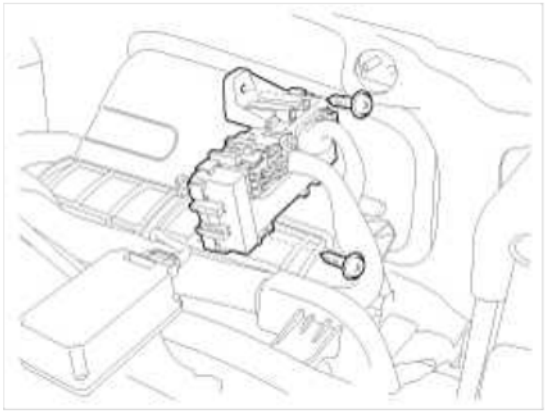
Connector B

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Body Electrical System

Description

The ICM relay is united with rear wiper relay, rear blower relay, rear seat warmer relay (LH/RH), two turn unlock re tailgate latch relay which installed inside the lower crash pad.



Inspection

Rear Wiper Motor relay

Check for continuity between the terminals.

1. There should be continuity between the No.1 and No.3 terminals when power and ground are connected to the I and No.10 in the ICM-A.

Tailgate Actuator Relay

Check for continuity between the terminals.

1. There should be continuity between the No.16 and No.15 terminals when power and ground are connected to th No.13 and No.14 in the ICM-A.

Folding Relay

Check for continuity between the terminals.

1. There should be continuity between the No.8 and No.20 terminals when power and ground are connected to the and No.12 in the ICM-A.

Unfolding Relay

Check for continuity between the terminals.

1. There should be continuity between the No.19 and No.7 terminals when power and ground are connected to the and No.11 in the ICM-B.

Door Unlock Actuator Relay

Check for continuity between the terminals.

1. There should be continuity between the No.12 and No.22 terminals when power and ground are connected to th No.21 and No.22 in the ICM-B.

Rear Blower Motor Relay

Check for continuity between the terminals.

1. There should be continuity between the No.17 and No.4 terminals int the ICM-A when power and ground are connected to the No.2 and No.1 in the ICM-B.

Rear Seat Warmer Relay (LH)

Check for continuity between the terminals.

1. There should be continuity between the No.20 and No.16 terminals when power and ground are connected to th No.17 and No.6 in the ICM-B.

Rear Seat Warmer Relay (RH)

Check for continuity between the terminals.

1. There should be continuity between the No.15 and No.13 terminals when power and ground are connected to th and No.9 in the ICM-B.

Front Wiper Motor Relay

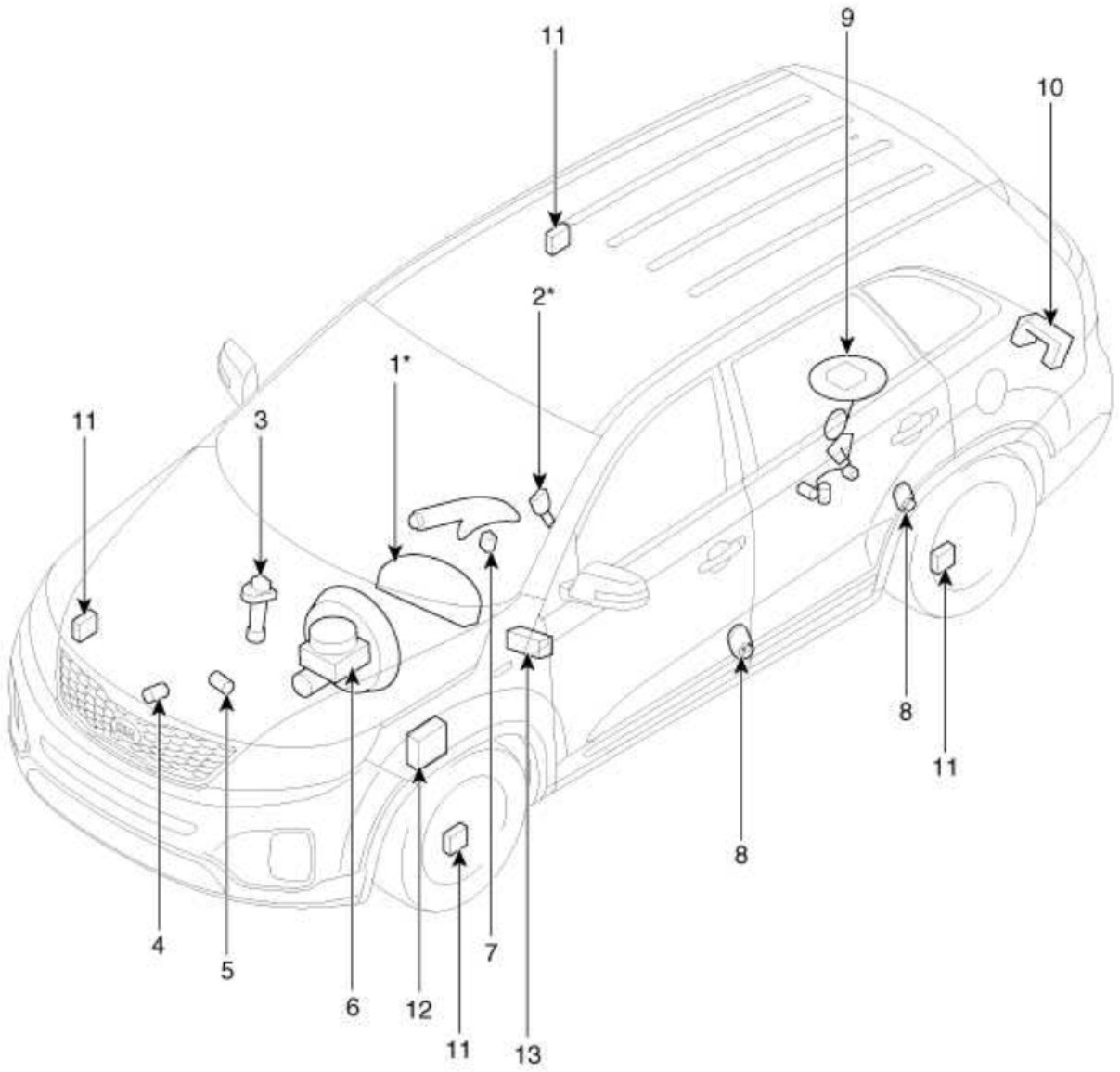
Check for continuity between the terminals.

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1. There should be continuity between the No.6 and No.18 terminals in the ICM-A when power and ground are co to the No.4 and No.3 in the ICM-B.

Body Electrical System

Component Location



1. Cluster assembly 2. Seat belt switch 3. Vehicle speed sensor 4. Engine coolant temperature sender 5. Oil pressure switch 6. Brake fluid level warning switch 7. Parking brake switch	8. Door switch 9. Fuel gauge sender 10. Tailgate switch 11. Wheel speed sensor 12. ABS ECU 13. Active ECO switch

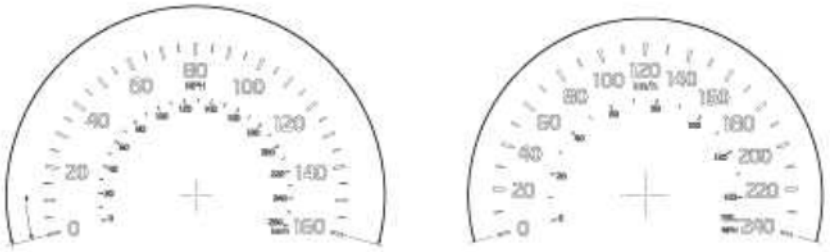
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Components

[General]

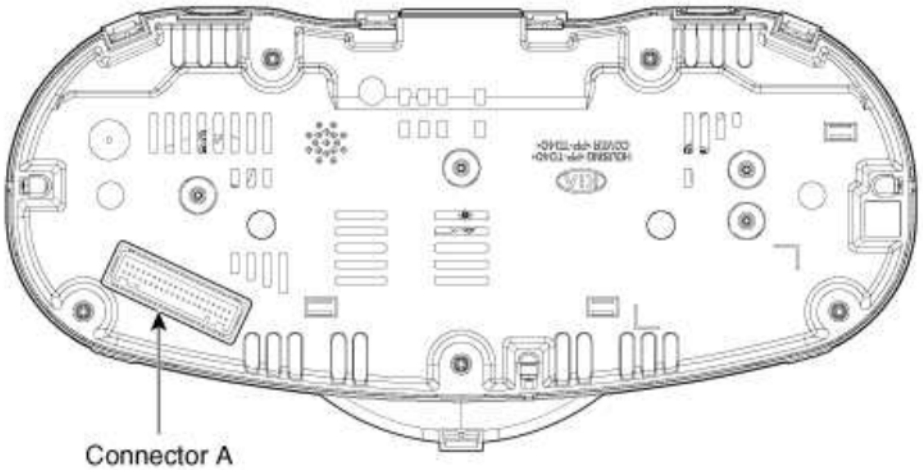
[Front]





[MPH] [KPH]

[Rear]

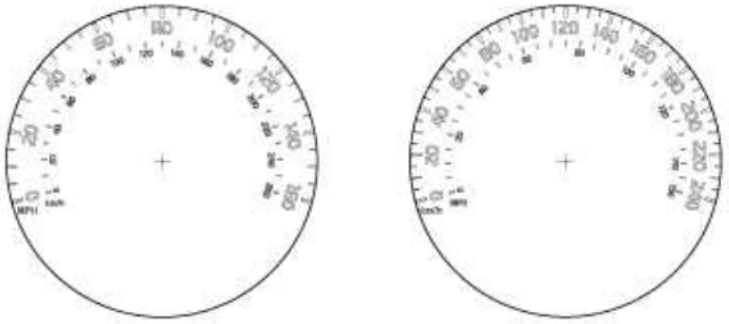


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[Supervision]

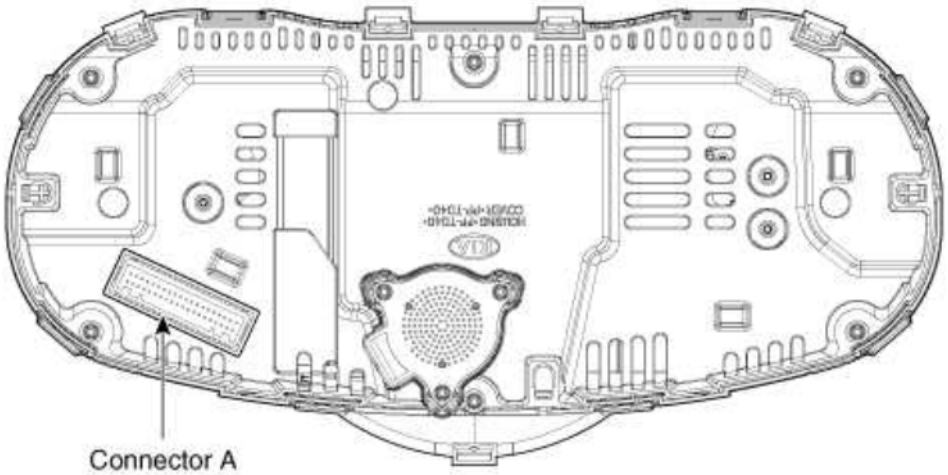
[Front]

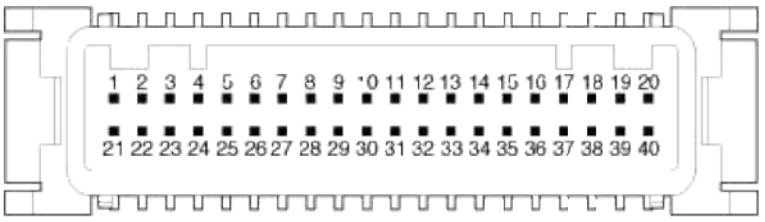




[MPH] [KPH]

[Rear]





Connector A

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Connector Pin Information

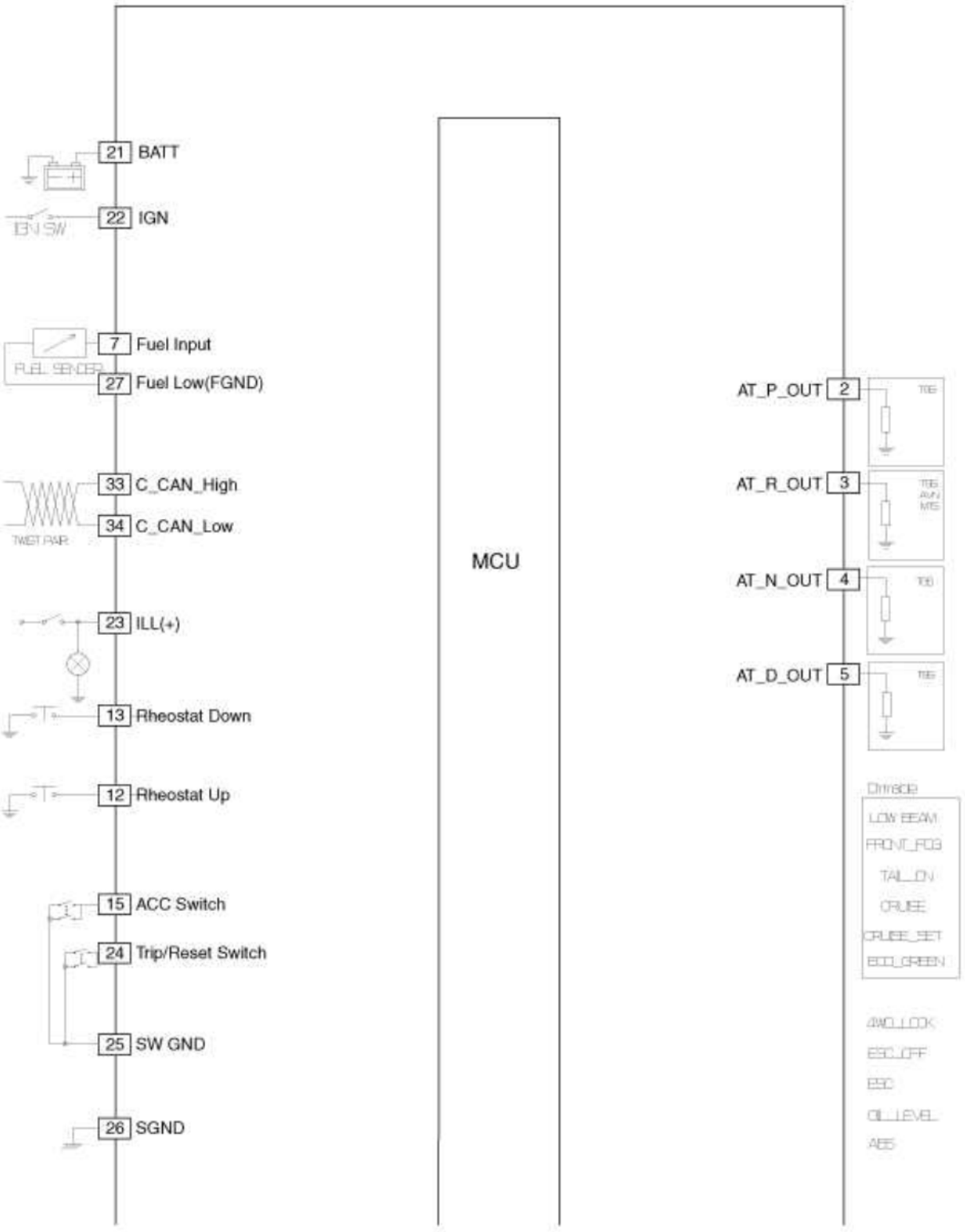
Pin No.	Description	Pin No.	Description
1	Airbag supply	21	Battery
2	P (AT)	22	IGN 1
3	R (AT)	23	Illumination (+)
4	N (AT)	24	Trip/Reset switch (Trip (+))
5	D (AT)	25	Switch GND (Trip (-))
6	Detent output	26	Signal GND
7	Fuel input	27	Fuel low
8	-	28	Fuel warning
9	Water separator sensor input	29	-
10	-	30	-
11	Washer input	31	4P output
12	Rheostat up	32	-
13	Rheostat down	33	C CAN high
14	Steering heat	34	C CAN low
15	Cruise (+) switch	35	-
16	Active ECO	36	M CAN high (Supervision)
17	Oil pressure	37	M CAN low (Supervision)
18	Alternator	38	-
19	Oil level	39	Rheostat output
20	Immobilizer	40	Rheostat ground

Body Electrical System

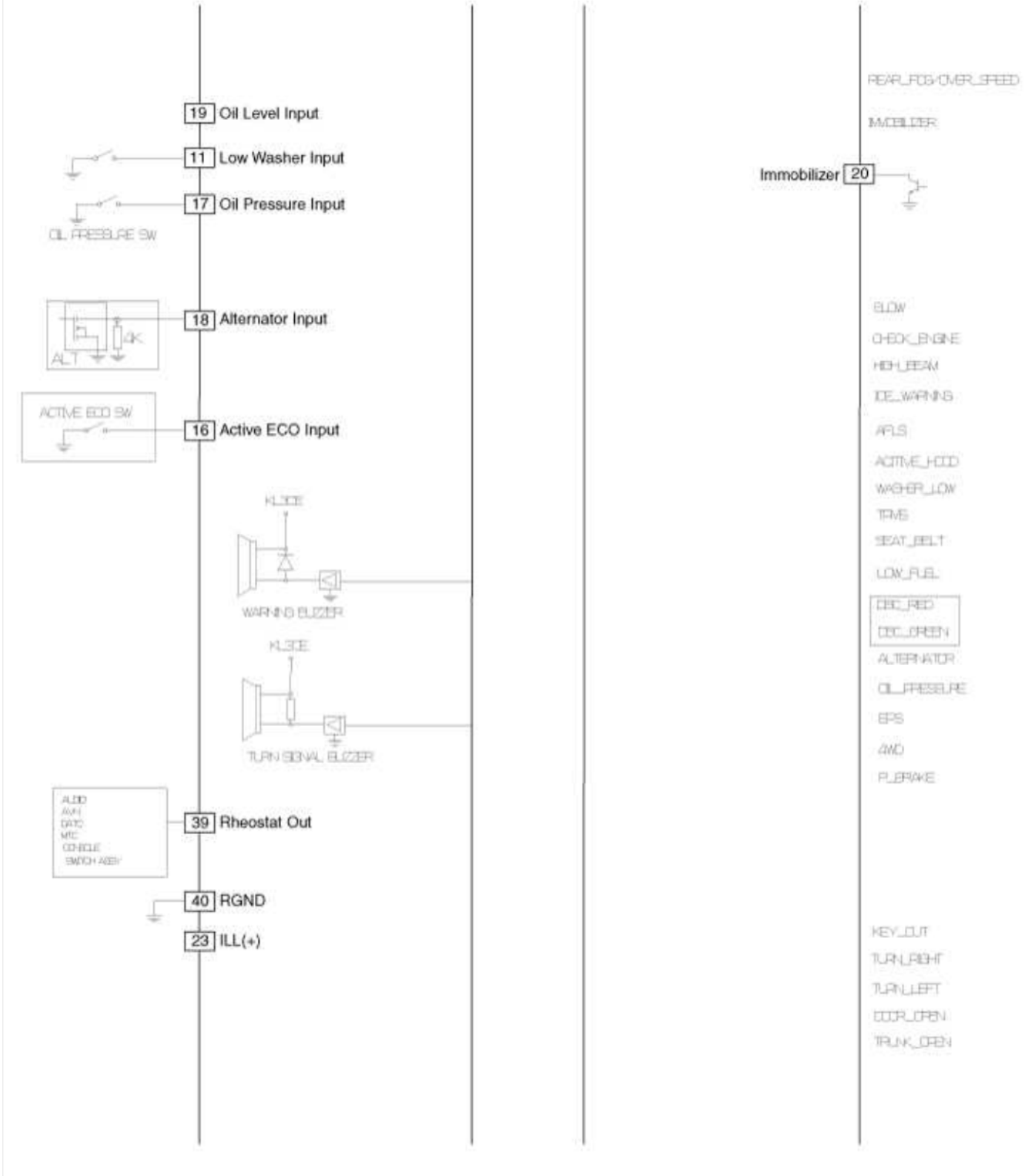
Circuit Diagram

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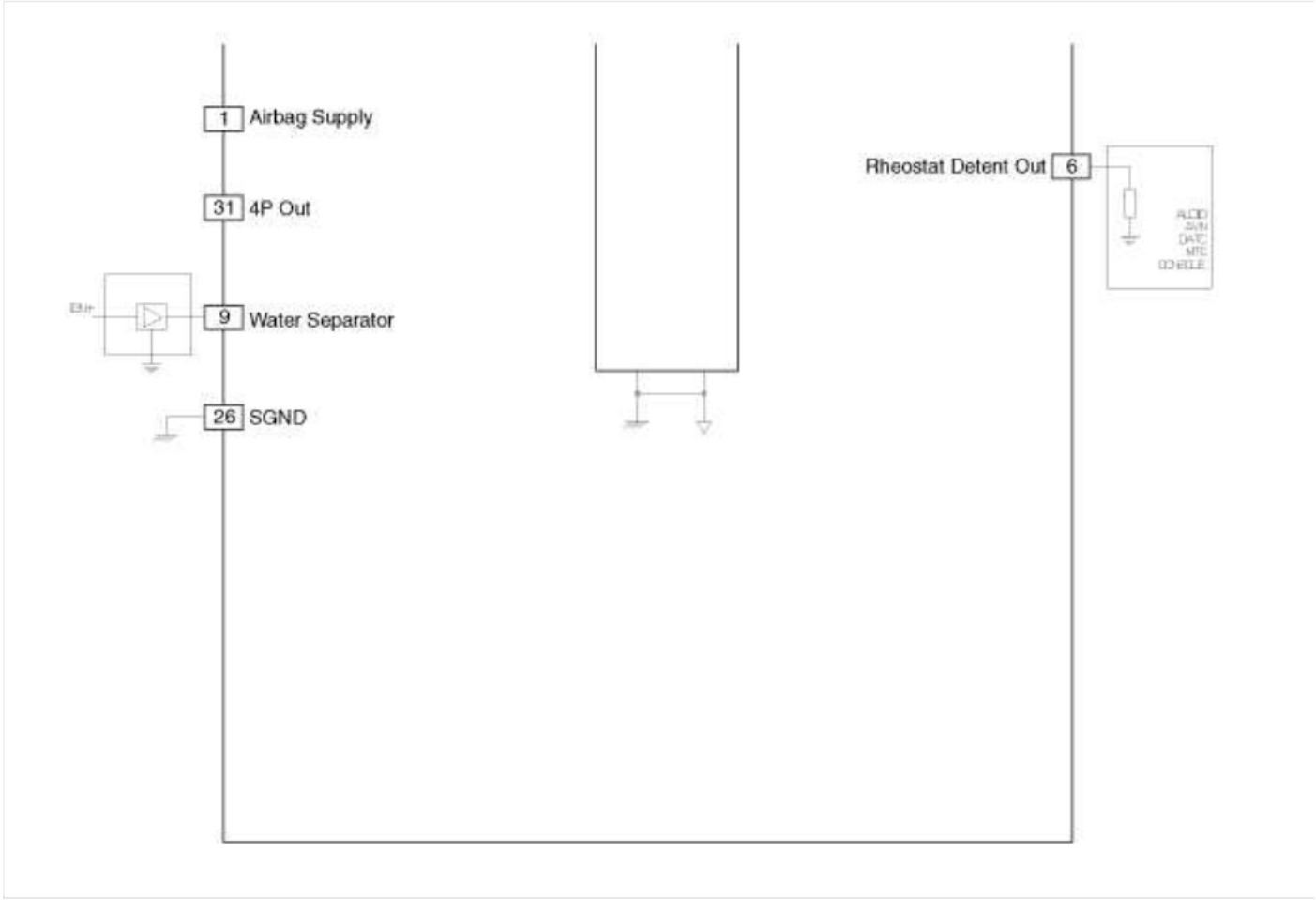
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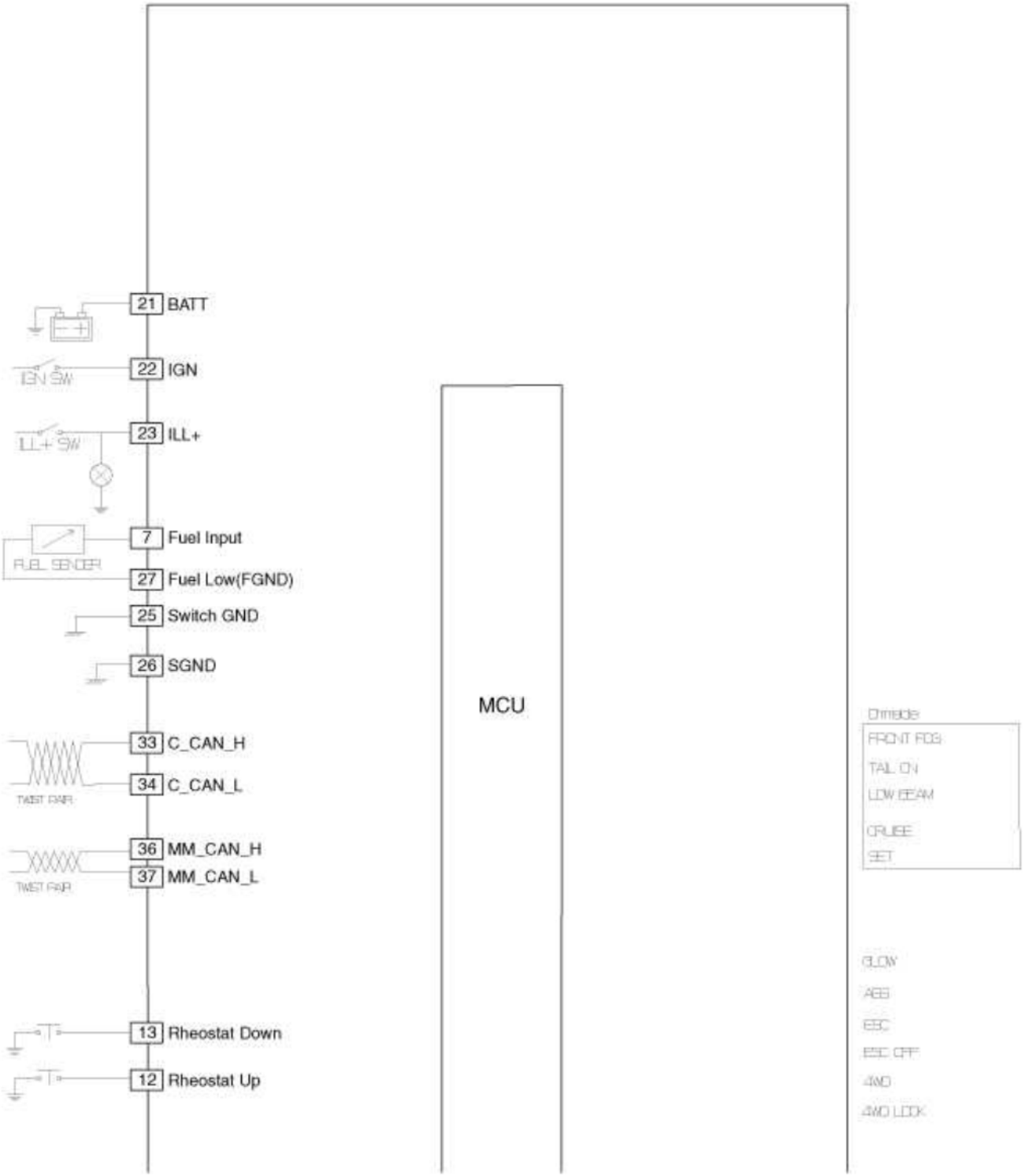


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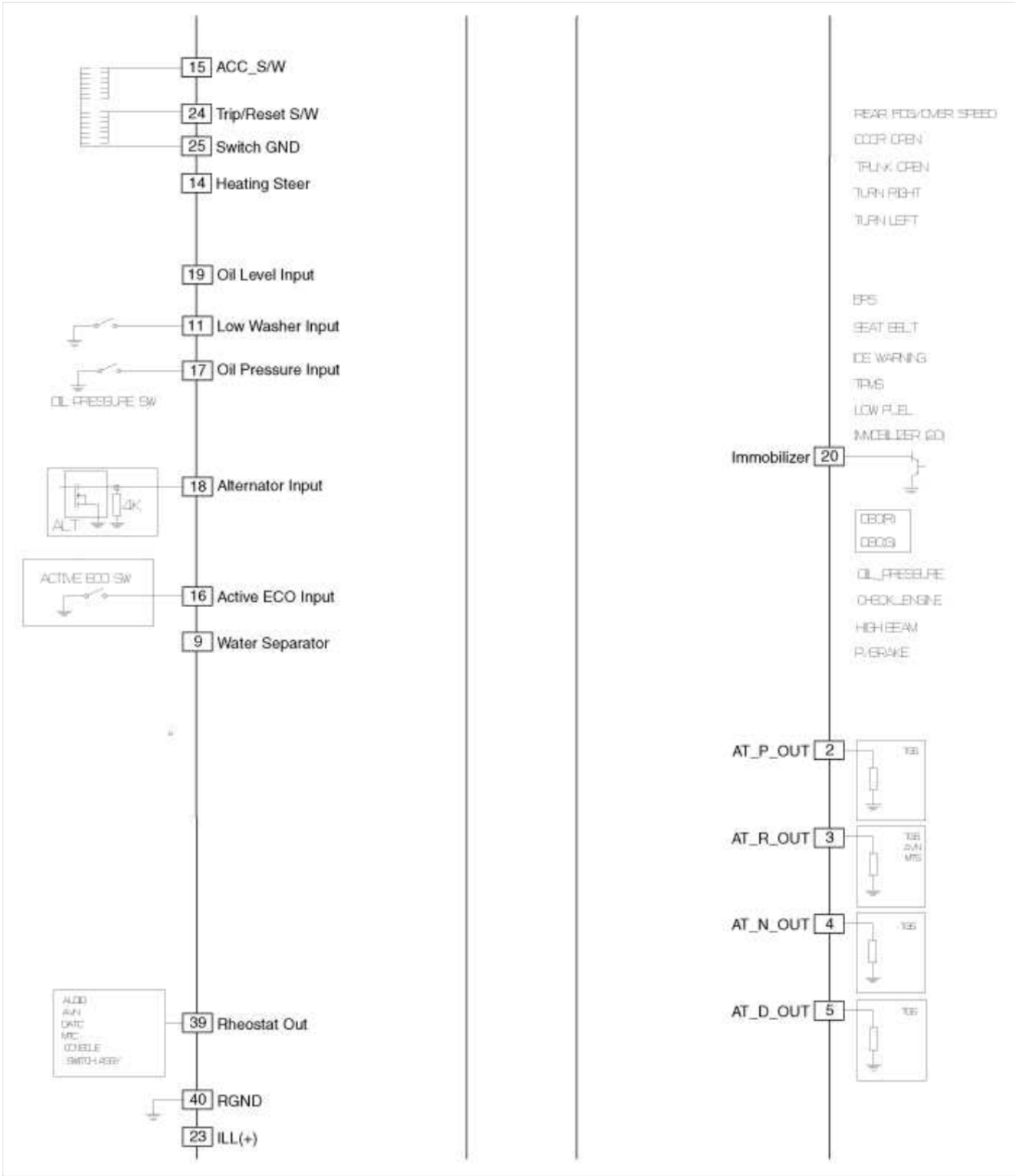


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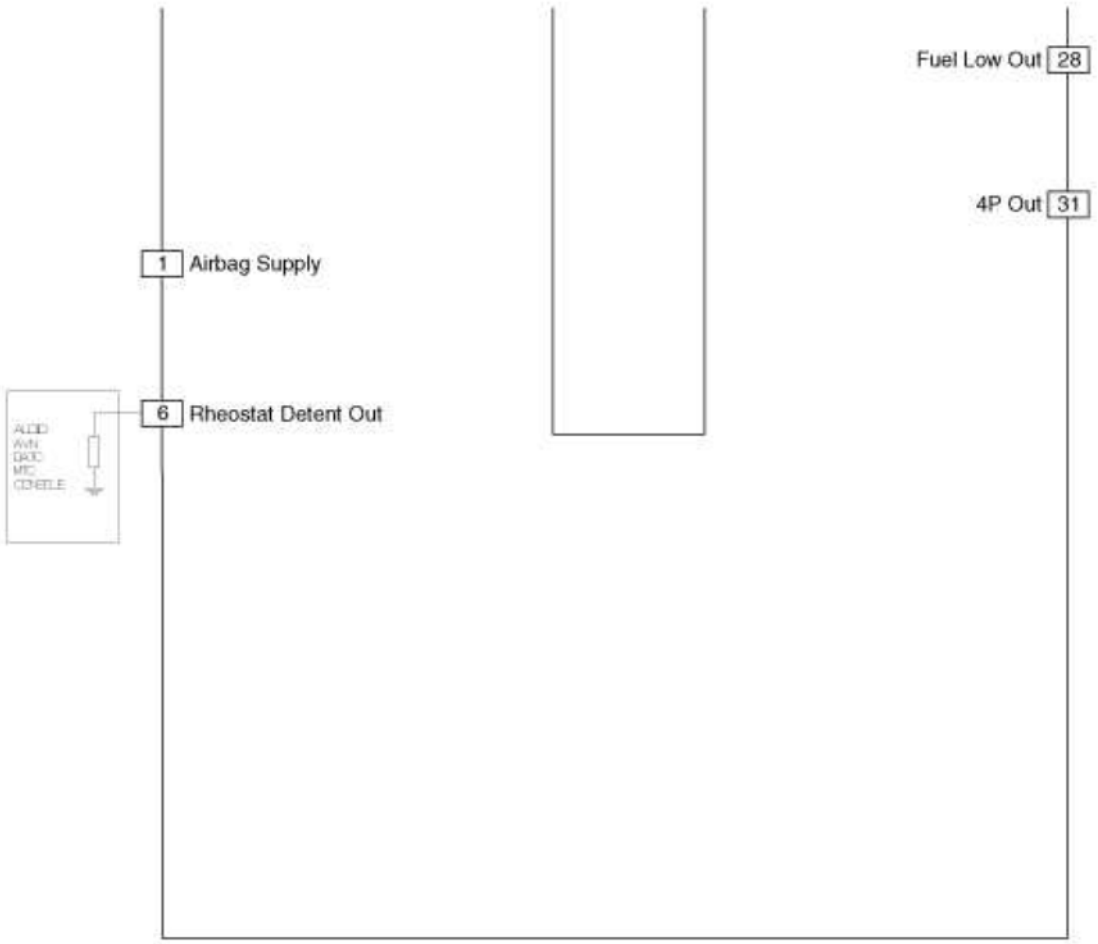
[Supervision]



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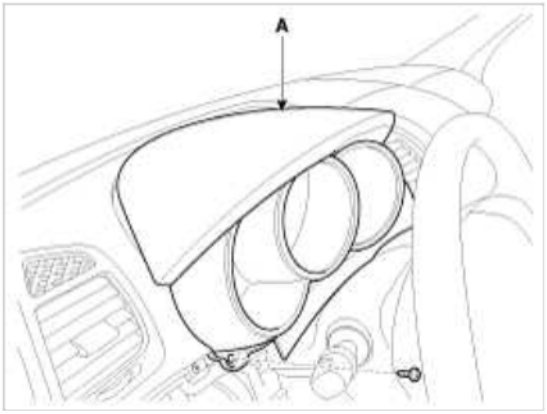
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Body Electrical System

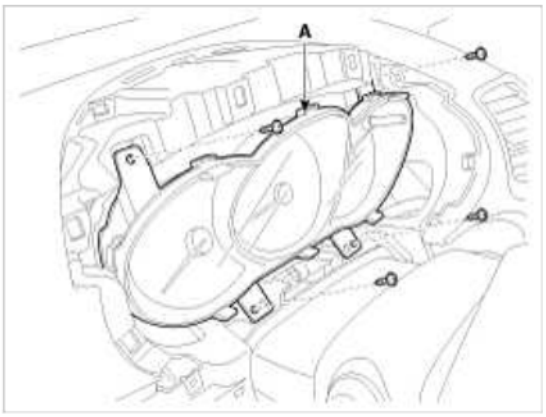
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster fascia panel (A).
   (Refer to Body - "Crash pad")

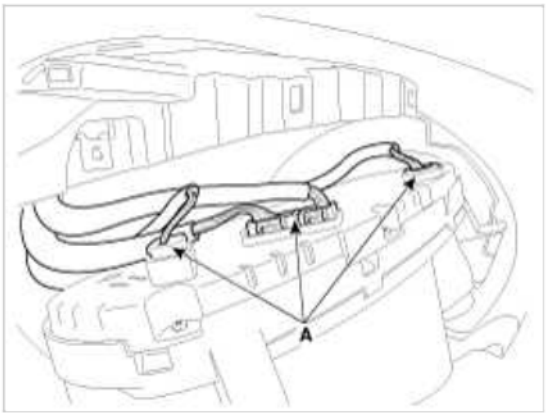


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3. Remove the cluster fascia (A) from the housing after removing 4 screws.



4. Disconnect the cluster fascia connecters (A) and then remove the cluster.



Installation

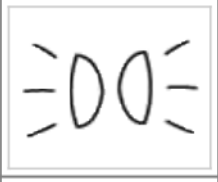
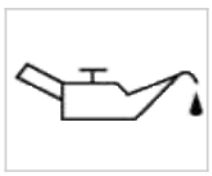
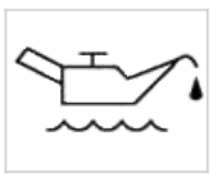
1. Connect the cluster connector.
2. Install the cluster assembly.
3. Install the cluster facia panel.

Inspection

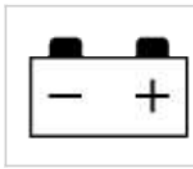
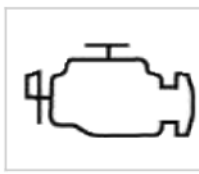
1. Check the suspected area as below table when the warning light is error.

NO	Warning light	Description	Communication	Signal (Unit/Sensor)	Suspected Area
1		Turn signal -LH	C-CAN	IPM	1. CAN line faulty
2		Turn signal -RH	C-CAN		
3		Cruise	C-CAN	SCC EMS	1. CAN line faulty

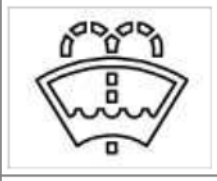
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4		SET	C-CAN	EMS	1. CAN line faulty
5		Front fog	C-CAN	IPM	1. CAN line faulty
6		Tail lamp ON	C-CAN	BCM	1. CAN line faulty
7		Head lamp low beam	C-CAN	IPM	1. CAN line faulty
8		ECO	Hardwire		
9		Head lamp high beam	C-CAN	BCM	1. CAN line faulty
10		Seat belt	C-CAN	BCM	1. CAN line faulty
11		Air bag	C-CAN	ACU	1. CAN line faulty
12		Oil pressure	Hardwire	Oil pressure sensor	1. Wiring faulty
13		Oil level	C-CAN	EMS	1. CAN line faulty

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14		Battery charge	Hardwire (Digital)	Battery sensor	1. Wiring faulty
15		Parking brake	C-CAN	IPM ABS	1. CAN line faulty
16		Door open	C-CAN	BCM	1. CAN line faulty
17		Water separator	Hardwire (Digital)	Fuel water separator sensor	1. Wiring faulty
18		Key out	C-CAN	SMK	1. CAN line faulty
19		DBC	C-CAN	TCS	1. CAN line faulty
20		Check engine	C-CAN	EMS	1. CAN line faulty
21		Glow	C-CAN	EMS	1. CAN line faulty
22		VDC(ESC)	C-CAN	TCS	1. CAN line faulty
23		VDC OFF (ESC OFF)	C-CAN	TCS	1. CAN line faulty

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24		ABS	C-CAN	ABS TCS	1. CAN line faulty
25		Trunk open	C-CAN	IPM	1. CAN line faulty
26		Immobilizer	C-CAN	SMK	1. CAN line faulty
27		Low fuel	Hardwire (Analogue)	Fuel sender	1. Fuel sender faulty 2. Wiring faulty
28		Washer low	Hardwire (Digital)	Washer fluid level sensor	1. Wiring faulty
29		TPMS(TREAD)	C-CAN	TPMS	1. CAN line faulty
30		4WD	C-CAN	4WD	1. CAN line faulty
31		4WD Lock	C-CAN	4WD	1. CAN line faulty
32		EPS	C-CAN	MDPS	1. CAN line faulty
33		LDWS	C-CAN	LDWS	1. CAN line faulty

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2. Check the suspected area as below table when the gauge is error.

NO	Description	Communication	Signal (Unit/Sensor)	Suspected Area
1	Speedometer	C-CAN	TCU	1. CAN line faulty
3	Tachometer	C-CAN	EMS	1. CAN line faulty
4	Coolant temperature	C-CAN	EMS	1. CAN line faulty
5	Fuel level	Hardwire	Fuel sender	1. Fuel sender faulty 2. Wiring faulty
6	Shift indicator	C-CAN	TCU	1. CAN line faulty

3. Check the specified value of cluster connector in specified condition.

NO	Description	Input/ Output	Communication	Value	Specified conditions
A1	Airbag supply	Input	Hardwire	9~16	IGN Switch ON
A2	P output	Output	Hardwire	6 ~ 15	IGN ON & shift the lever in P
A3	R Output	Output	Hardwire	6 ~ 15	IGN ON & shift the lever in R
A4	N Output	Output	Hardwire	6 ~ 15	IGN ON & shift the lever in N
A5	D Output	Output	Hardwire	6 ~ 15	IGN ON & shift the lever in D
A6	Rheostat Detent	Output	Hardwire	6 ~ 15	IGN ON & rheostat up to max pos
A7	Fuel	Input	Hardwire	~1.3	Gauge is FULL
				7.68~	Gauge is EMPTY
A8	-				
A9	Water separator sensor	Input	Hardwire	~ 2.7	IGN switch ON, Warning lamp turn
A10	-				
A11	Washer fluid	Input	Hardwire	~ 2.7	IGN ON & warning lamp turn C
A12	Rheostat up switch	Input	Hardwire	~ 2.7	IGN switch ON, Illumination U
A13	Rheostat down switch	Input	Hardwire	~ 2.7	IGN switch ON, Illumination DO
A14	Heated steering wheel	Input	Hardwire	5 ~	Heated steering wheel switch O
A15	Cruise (+) switch	Input	Hardwire	Analog switch input power	IGN switch ON & control the analog
A16	Active ECO	Input	Hardwire	~ 2.7	IGN switch ON, ACTIVE ECO sv ON, warning lamp ON
A17	Oil pressure	Input	Hardwire	~ 2.7	IGN switch ON, warning lamp C
A18	Alternator	Input	Hardwire	~ 2.7	IGN switch ON, warning lamp C
A19	Oil level	Input	Hardwire	~ 2.7	IGN switch ON, warning lamp C
A20	Immobilizer	Input	Hardwire	~ 1	IGN switch ON, warning lamp C
A21	Battery	Input	Hardwire	9~16	Always

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A22	IGN1	Input	Hardwire	9~16	IGN switch ON
A23	ILL+	Input	Hardwire	9~16	Tail lamp switch ON
A24	Trip/Reset switch (Trip (+))	Input	Hardwire	Analog switch input power	IGN switch ON & control the analog
A25	Switch GND	Input	Hardwire	~1V	Always
A26	Signal GND	Input	Hardwire	~1V	Always
A27	Fuel low	Input	Hardwire	~1V	Always
A28	Fuel warning	Output	Hardwire	~1.2V	IGN switch ON, warning lamp (
A29	-				
A30	-				
A31	4P_OUT	Output	Hardwire	~1.2V	IGN switch ON, vehicle speed o 1KM/H
A32	-				
A33	C CAN high	Input	Hardwire	-	
A34	C CAN low	Input	Hardwire	-	
A35	-				
A36	MM CAN high	Input	Hardwire	-	
A37	MM CAN low	Input	Hardwire	-	
A38	-				
A39	Rheostat output	Output	Hardwire	~1.5V	IGN ON & tail lamp turn ON
A40	Rheostat ground	Input	Hardwire	~1V	Always

4. Communication information with another units.

Transmission	Reception	Communication	Remarks
Cluster	BCM	C-CAN	Fuel supply signal Instantaneous fuel consumption LFW lamp ON signal Vehicle setting Illumination setting
Cluster	EMS	C-CAN	Active ECO mode
Cluster	MDPS	C-CAN	Flex steering switch
Cluster	ACU	C-CAN	Air bag
ACU	Cluster	CAN	Air bag warning control
BCM	Cluster	CAN	Hood warning
DATC	Cluster	CAN	Outside temperature
EHPS	Cluster	CAN	Warning message control
EMS	Cluster	CAN	Tachometer control Temperature gauge control Engine warning simbol, CRUISE, SET warning control

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ESC	Cluster	CAN	
BCM	Cluster	CAN	Vehicle setting control Warning and buzzer indicate, PAS control
LCA	Cluster	CAN	BSD warning message indicate
LDWS	Cluster	CAN	LDWS warning lamp, message indicate HBA(High Beam Assist) warning lamp control
SAS	Cluster	CAN	Steering angle indicate
SMK	Cluster	CAN	Smart key indicate
TCS	Cluster	CAN	ESC OFF switch information SCC control the brake lamp and indicate
TCU	Cluster	CAN	Shift lever information (AT)
TPMS	Cluster	CAN	TPMS information

5. The other information about the cluster
   (1) USM (User Setting Mode)
      A. USM is set using the steering wheel remote control button.
      B. IMS seat, IMS steering, auto door lock/unlock, head lamp escort, welcome light, welcome sound and trip signal lamp are controled.
   (2) USM setting procedure
      A. Send the USM value to the BCM
      B. BCM send the setting value to the each module through CAN.
      C. Each modules send the setting complete value to BCM.
      D. BCM send the final setting value to cluster through CAN.

Body Electrical System

Troubleshooting

Symptom	Possible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	CAN line faulty	Check the EMS
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	CAN line faulty	Check the EMS
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary

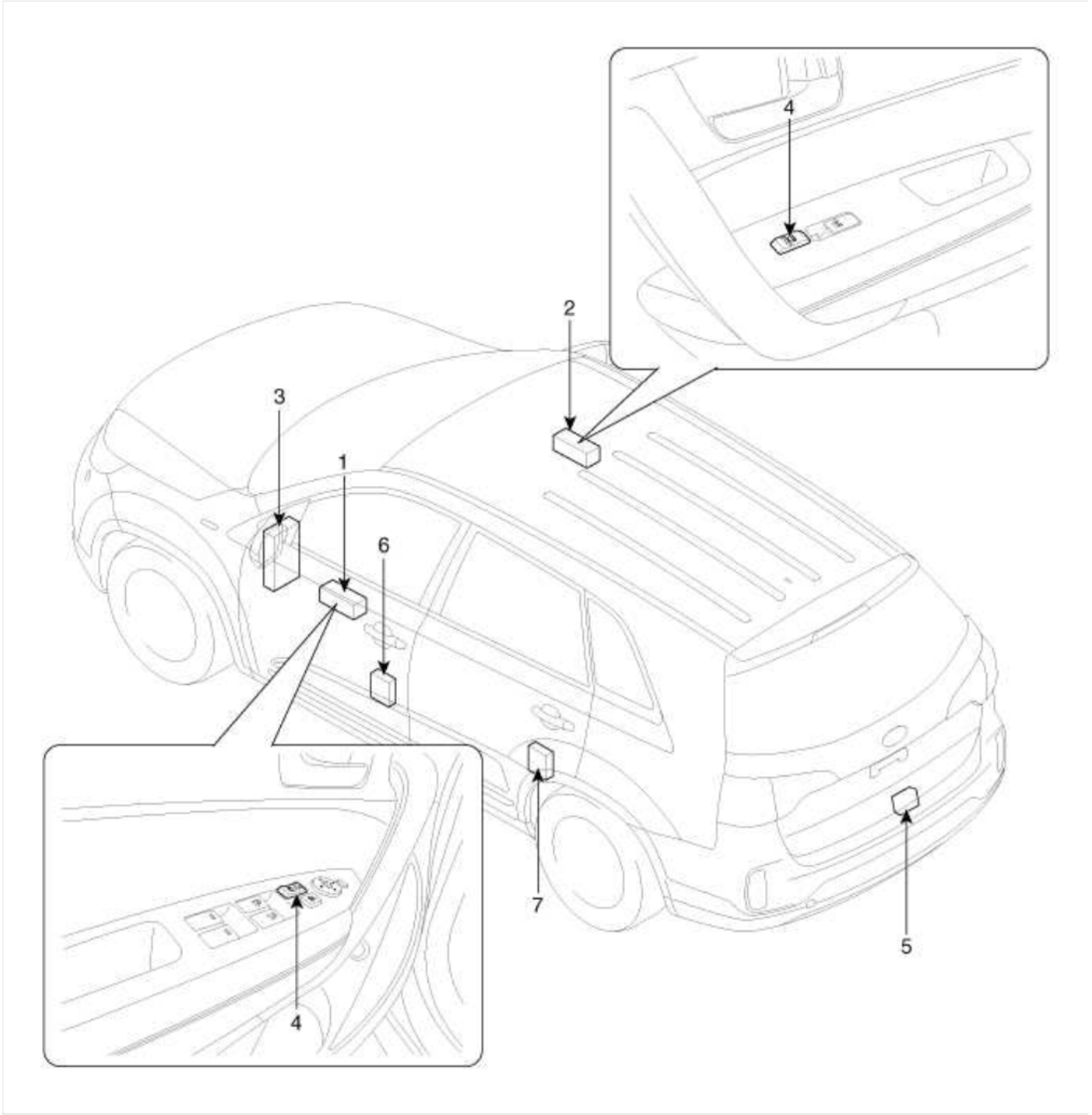
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Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
	CAN line faulty	Check the EMS
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Open door warning lamp and tailgate warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Speedometer and odometer does not operate	CAN line faulty	Check the ABS ECU
	Wheel speed sensor faulty	Check the wheel speed sensor

Body Electrical System

Component Location

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1. Driver power window main switch 2. Passenger window switch 3. IPM (Intalligent intergrated Platform Module) 4. Door lock switch	5. Tailgate lock actuator & switch 6. Front door lock actuator & switch 7. Rear door lock actuator & switch

Body Electrical System

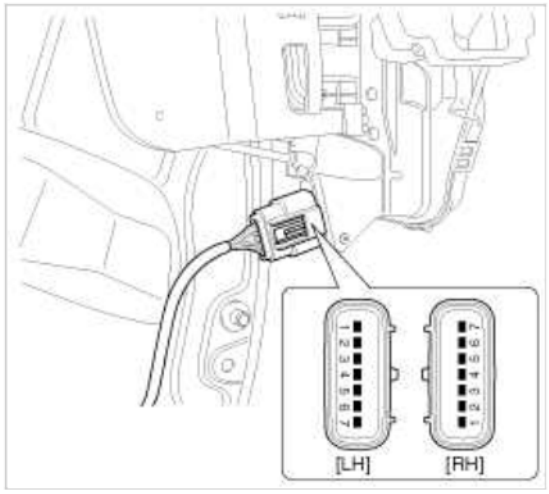
Inspection

Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to Body - "Front door")

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2. Remove the front door module.
   (Refer to Body - "Front door")
3. Disconnect the connectors from the actuator.

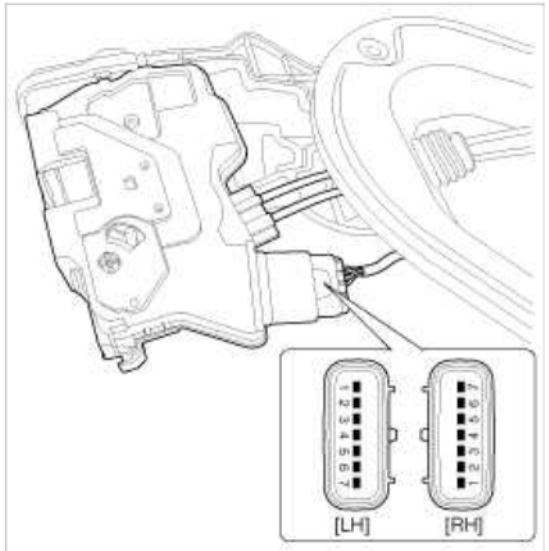


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the act
   apply battery voltage only momentarily.

Position \ Terminal		3	4
Front left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		**4**	**5**
Front right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Rear Door Lock Actuator

1. Remove the rear door trim.
   (Refer to Body - "Rear door")
2. Remove the rear door module.
   (Refer to Body - "Rear door")
3. Disconnect the connectors from the actuator.



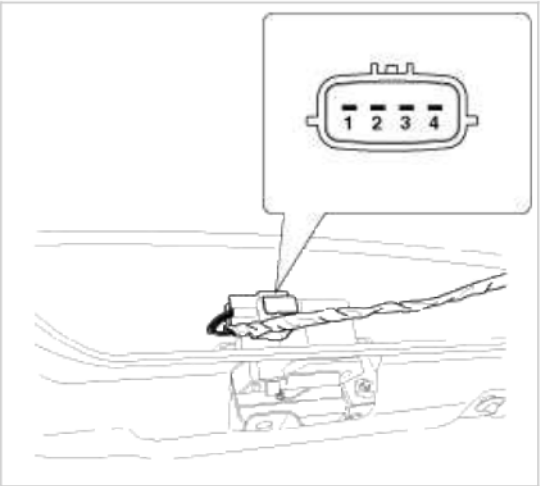
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4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the act apply battery voltage only momentarily.

Position \ Terminal		4	3
Rear left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		4	5
Rear right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim.
   (Refer to Body - "Tailgate")
2. Disconnect the 4P connector from the actuator.

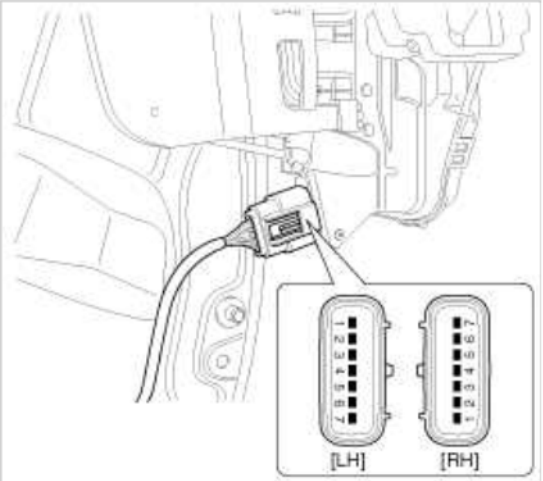


3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the act apply battery voltage only momentarily.

Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

1. Remove the front door trim.
   (Refer to Body - "Front door")
2. Remove the front door module.
   (Refer to Body - "Front door")
3. Disconnect the connectors from the actuator.



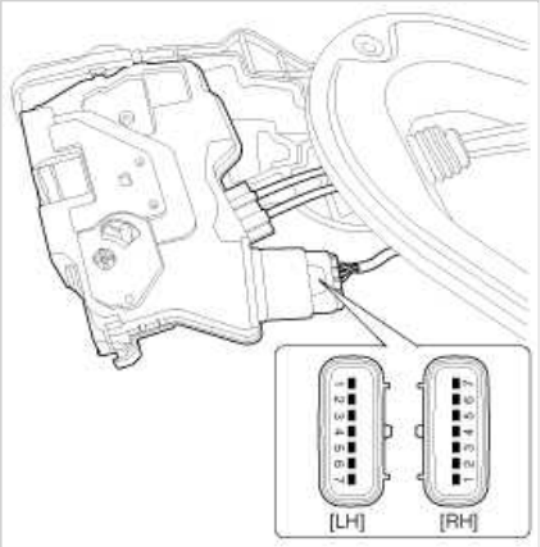
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4. Check for continuity between the terminals in each switch position when inserting the key into the door according table.

Position		Terminal 7	6	2	1
Front left	Lock	○			○
	Unlock		○	○	○
Front right	Lock	○			○
	Unlock		○	○	○

Rear Door Lock Switch

1. Remove the rear door trim.
   (Refer to Body - "Rear door")
2. Remove the rear door module.
   (Refer to Body - "Rear door")
3. Disconnect the connectors from the actuator.



4. Check for continuity between the terminals in each switch position according to the table.

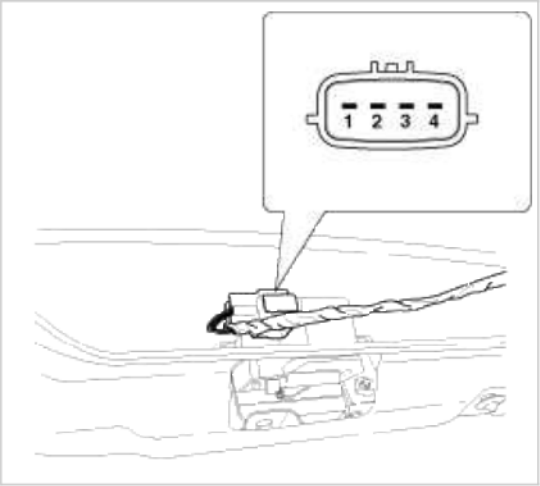
Position		Terminal	2	1
Central Door Lock	Rear Left	Lock		
		Unlock	○	○
Position		Terminal	6	7
Central Door Lock	Rear Right	Lock		
		Unlock	○	○

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to Body - "Tailgate")

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2. Disconnect the 4P connector from the actuator.



3. Check for continuity between the terminals in each switch position according to the table.

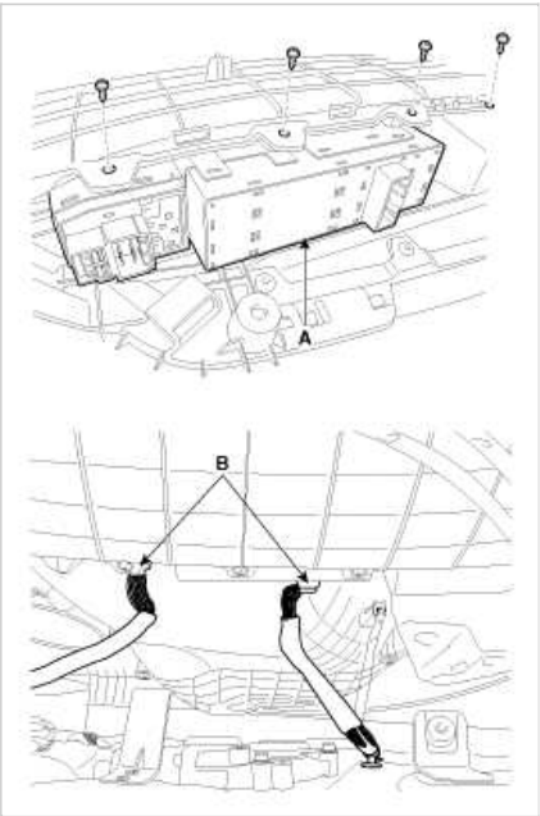
Position \ Terminal	1	2
Lock		
Unlock	○	○

Body Electrical System

Removal

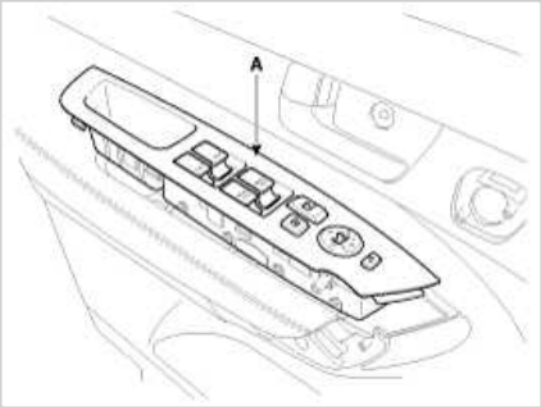
Driver Power Window Main Switch

1. Disconnect the negative battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front door")
3. Remve the screws(Inside:4EA, outside:1EA) from power window switch assembly (A) and connectors (B).



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4. Remove the power window switch assembly (A) from front door trim.

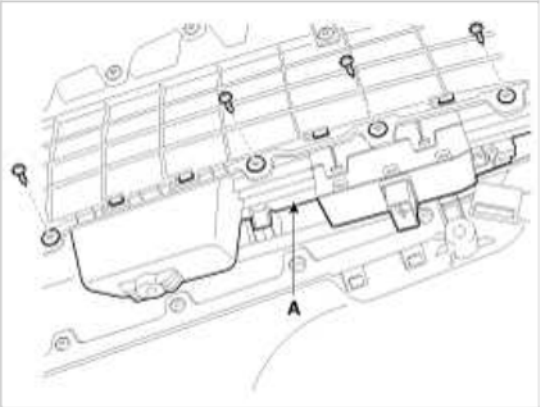


NOTICE

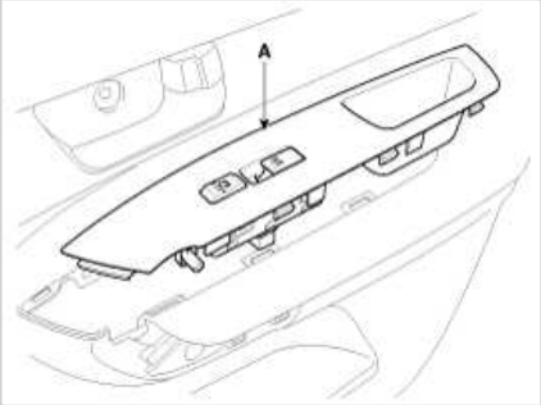
Be careful not to damage the hook when removing the switch module.

Passenger window switch

1. Disconnect the negative battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front door")
3. Remove the passenger window switch assembly (A) from front door trim.



4. Remove the passenger window switch assembly (A) from front door trim.



NOTICE

Be careful not to damage the hook when removing the switch module.

Installation

Driver Power Window Main Switch

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1. Install the driver power window switch assembly and connectors.
2. Install the front door trim.

Passenger Window Switch

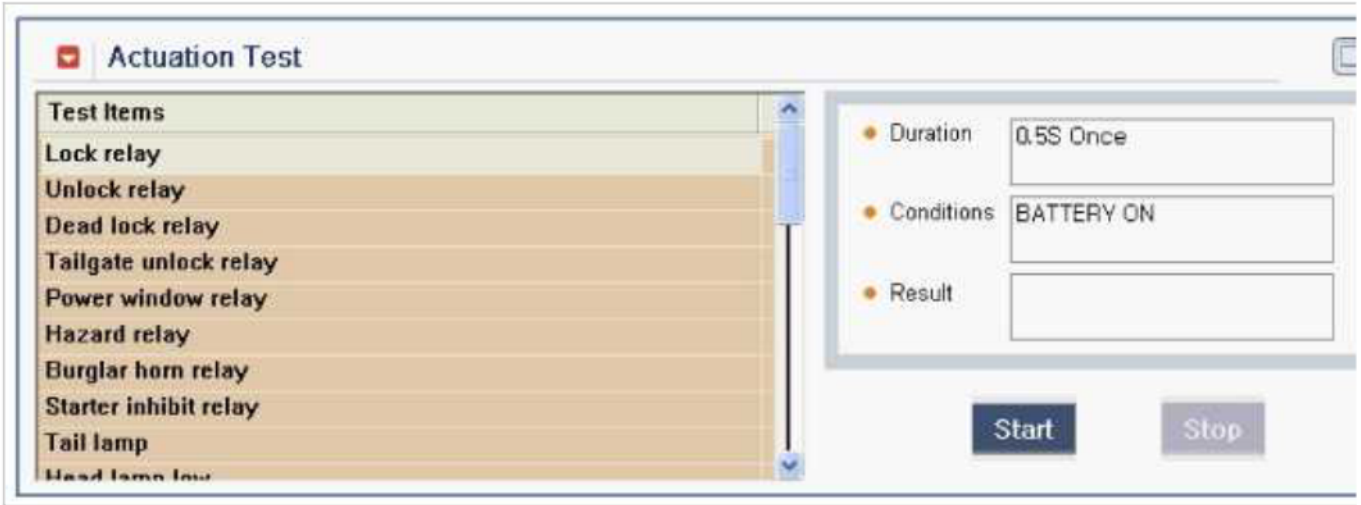
1. Install the passenger power window switch assembly and connectors.
2. Install the front door trim.

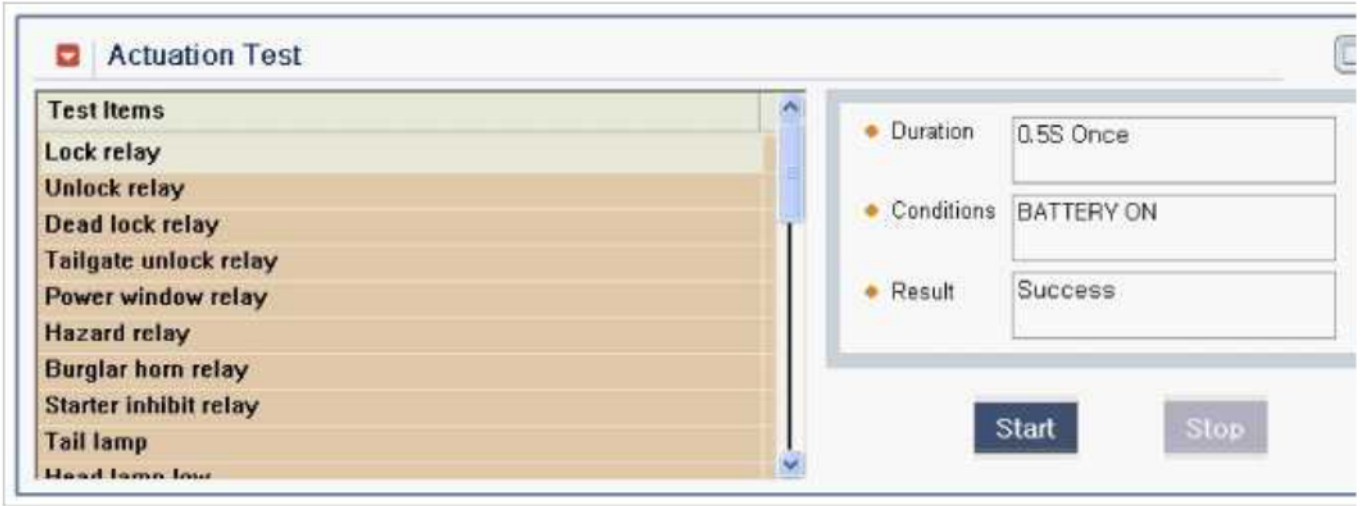
Diagnosis With GDS

1. It will be able to diagnose defects of door lock with GDS quickly. GDS can operates actuator forcefully, input/ou value monitoring and self diagnosis.
2. Select "Current data", if you will check current data of power door lock system. It provides input/output status of



3. If you will check the power door lock operation forcefully, select "Actuation test".



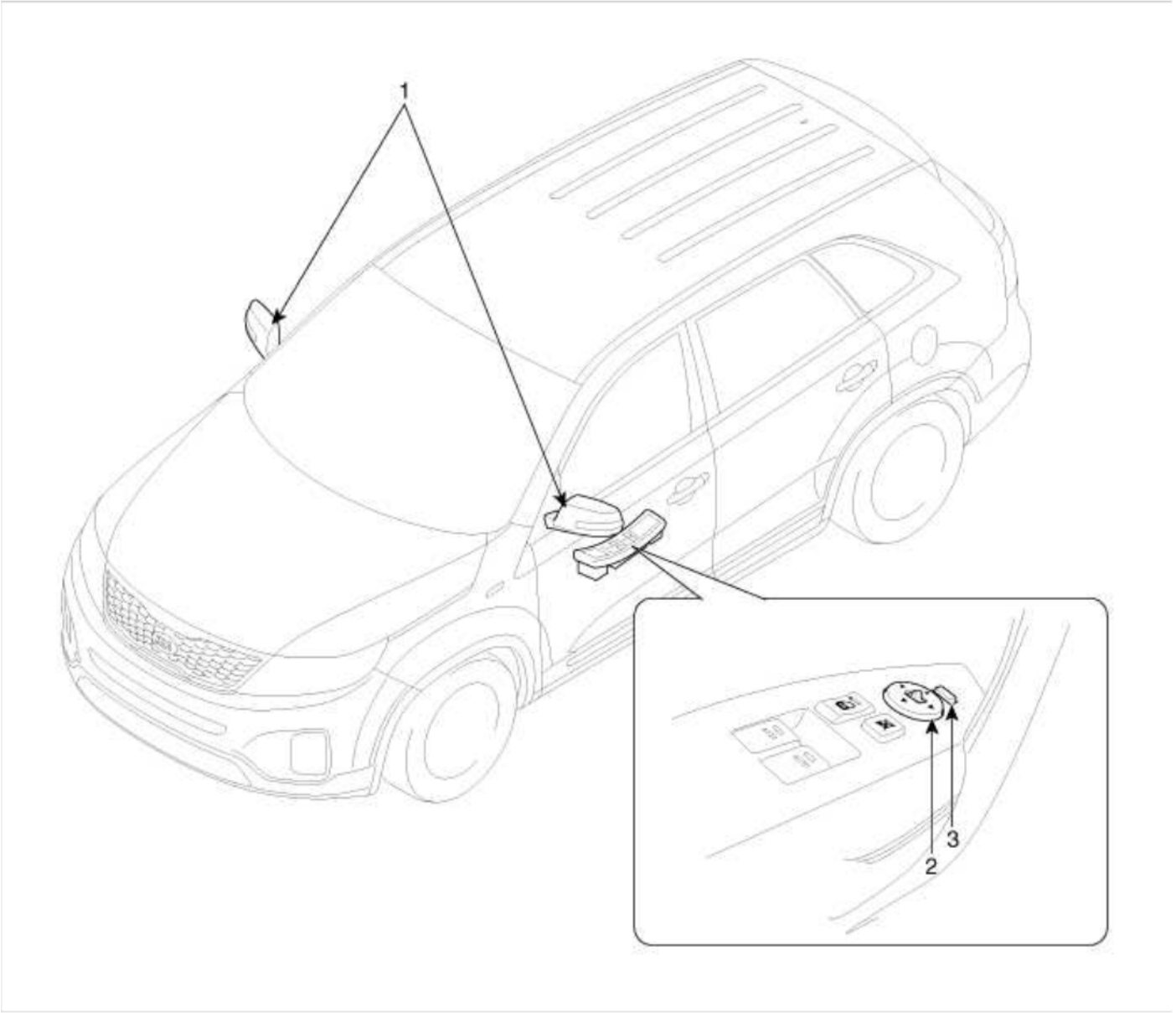


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4. To check the DTC of the door lock, select "Diagnostic trouble codes".

Body Electrical System

Component Location

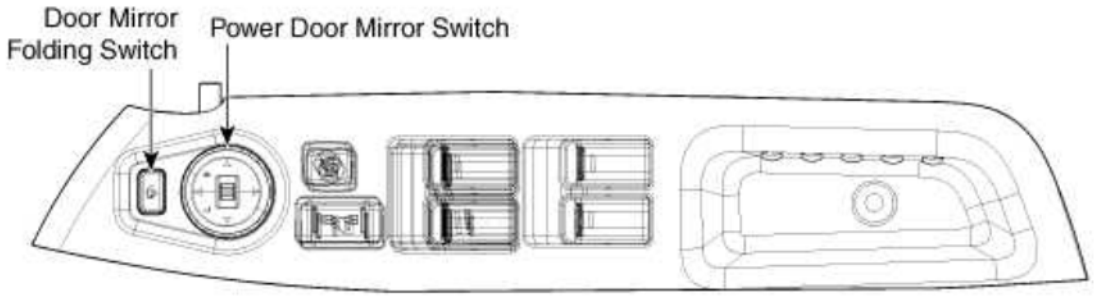


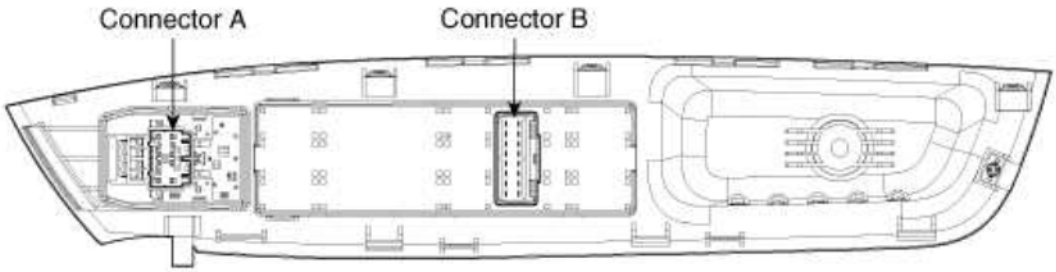
1. Power door mirror 2. Power door mirror	3. Power folding mirror switch

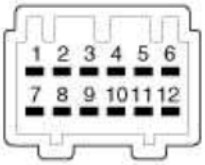
Body Electrical System

Circuit Diagram

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Pin	Connector A	Connector B
1	Assist door mirror motor (horizontal)	Driver window switch down
2	-	Door unlock
3	Assist door mirror motor (vertical)	Rear left window switch down
4	Driver door mirror motor (vertical)	Battery (+) L
5	-	Battery (+) R
6	Driver door mirror motor (horizontal)	Rear left window switch up
7	ACC	Rear right window switch down
8	Mirror folding motor 1	Rear right window switch up
9	Mirror folding motor 2	Driver window switch up
10	GND	Door lock
11	Battery (mirror folding)	Illumination
12	Common	Driver switch Auto
13		-
14		Assist window switch down
15		GND
16		Assist window switch up

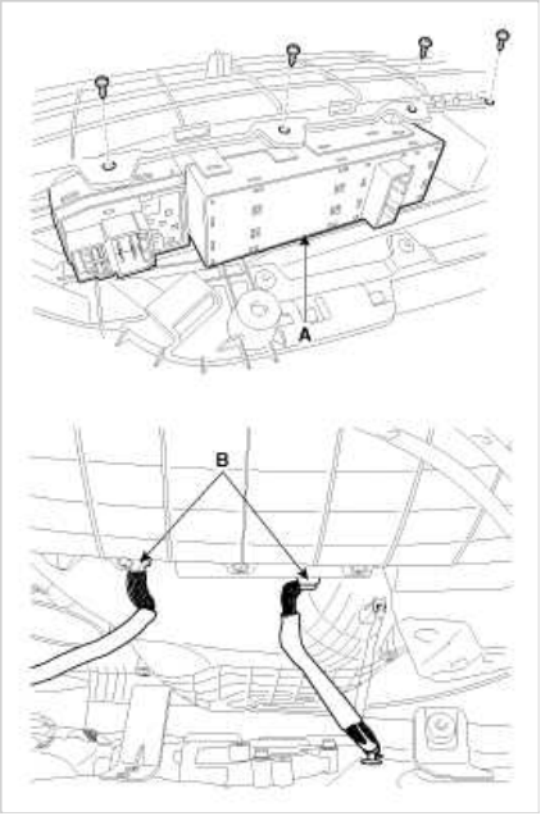
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Removal

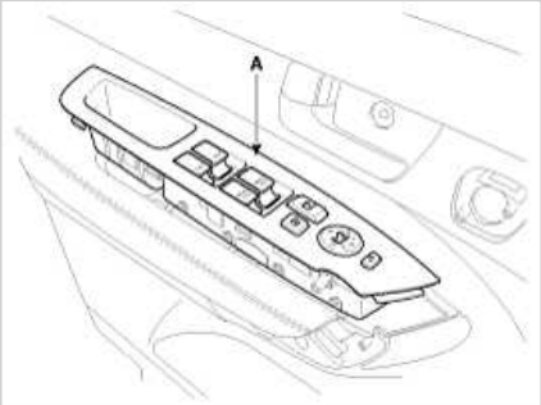
Driver Door Mirror Switch

1. Disconnect the negative battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front door")

3. Remve the screws(Inside:4EA, outside:1EA) from door module (A) and connectors (B).



4. Remove the driver door module (A) from front door trim.



NOTICE

Be careful not to damage the hook when removing the switch module.

Installation

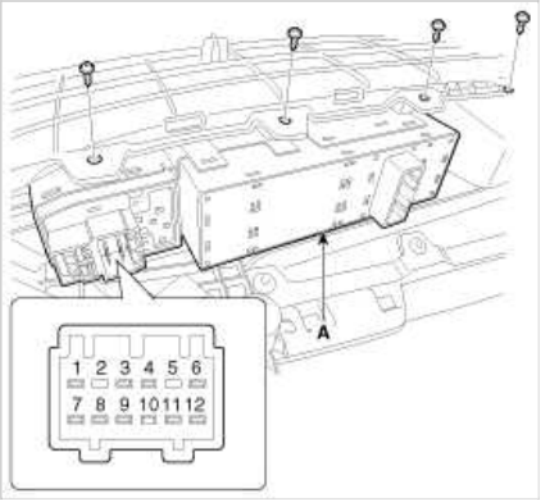
Driver Door Mirror Switch

1. Install the driver door module and connectors.
2. Install the front door trim.

Inspection

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1. Remove the front door trim and power door mirror switch module (A).
   (Refer to Body - "Front door")



2. Check for the continuity between terminals of power door mirror switch according to the table.

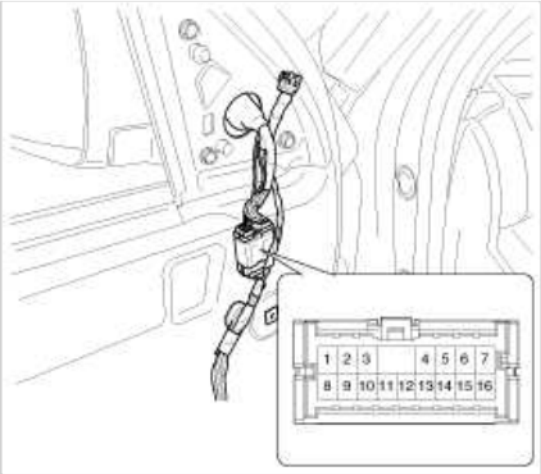
Item	Terminal / Direction	4	6	3	1	12	7	10
Left	UP	○	○			○	○	
	DOWN	○	○			○	○	
	OFF	○	○			○		○
	LEFT	○				○	○	○
	RIGHT		○			○	○	○
Right	UP			○	○		○	
	DOWN			○	○		○	
	OFF			○	○	○		○
	LEFT			○		○	○	○
	RIGHT			○		○	○	○

Terminal / Direction	10	11	9	8
Folding	○		○	
Unfolding	○		○	

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Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the driver door module.
   (Refer to Body - "Front door")
3. Disconnect the connector from the mirror.
4. Verify that the mirror operates properly as shown in the table.



Position \ Terminal		5	7	6	B+	GND
LH	UP	○	○	○	○	
	DOWN		○	○	○	○
	OFF	○	○		○	
	RIGHT	○		○	○	○
	LEFT		○	○	○	○
RH	UP	○	○	○	○	○
	DOWN		○	○	○	○
	OFF	○	○		○	
	RIGHT	○		○	○	○
	LEFT		○	○	○	○

Mirror Heater

Position \ Terminal	13	14
Heater	○	○

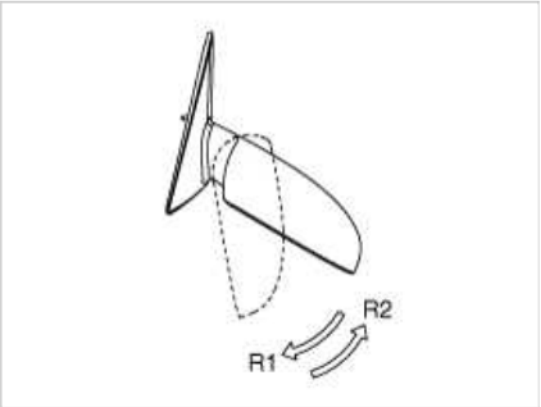
Turn Signal Lamp

Position \ Terminal	1	2
Side repeater	⊕	⊖

BSD Warning Lamp

Position \ Terminal	3	12
BSD Warning	⊕	⊖

Mirror Folding

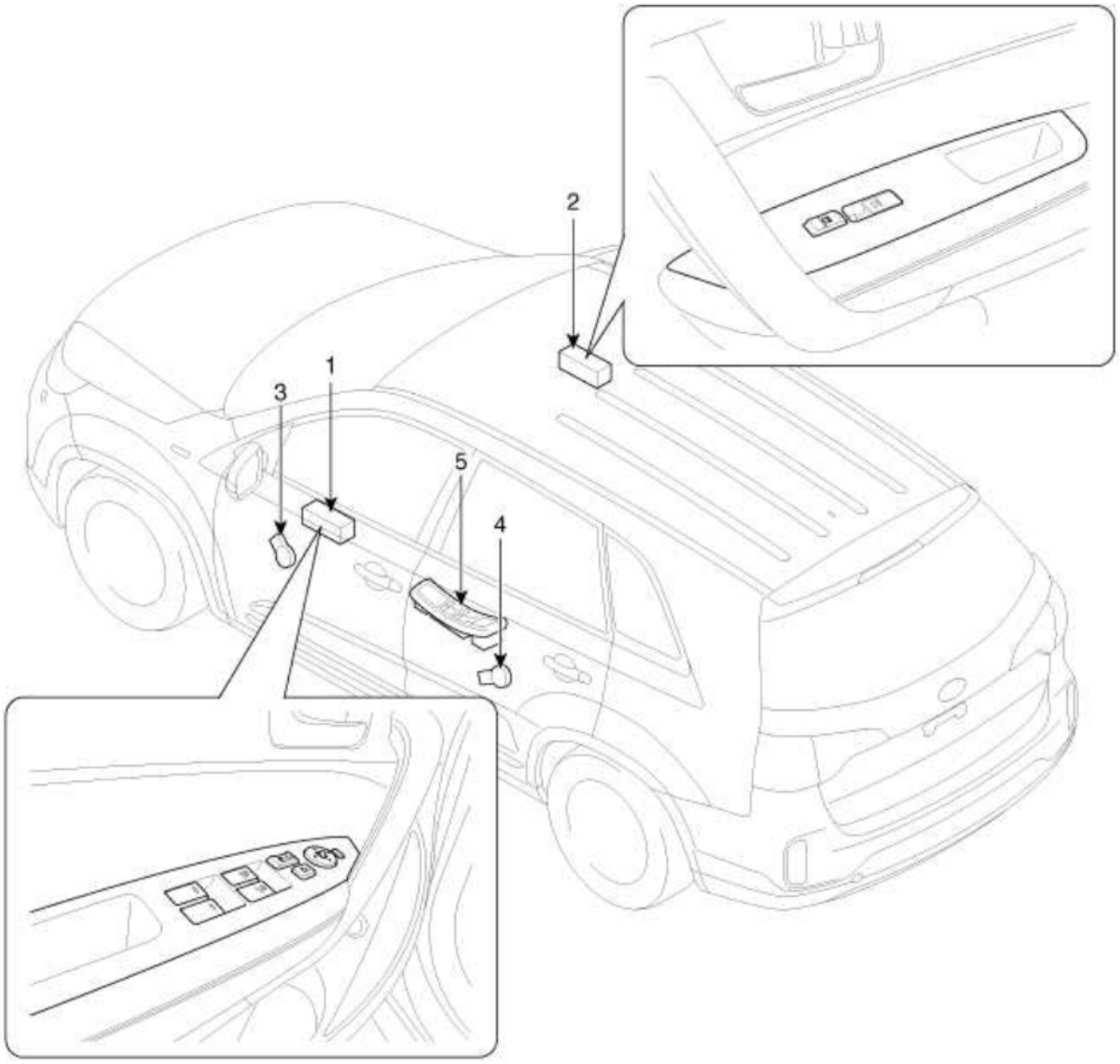


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Terminal / Position	B (+)	GND	16	15
R1	○		○	
		○		○
R2	○			○
		○	○	

Body Electrical System

Component Location



1. Driver power window main switch 2. Passenger window switch 3. Front window motor	4. Rear window motor 5. Rear window switch

Body Electrical System

Operation

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Function Of Safety Power Window

When all door (Front, Rear) power window auto-up switch is operated, safety function is activated.

1. Safety function condition
   When detect the force of 100N during the window rising, window is reversed.
2. Length of window reversing (except holding the auto-up switch)
   A. When detect the jamming during the 4mm ~ 250mm from top of the door.
      → Window is reversed until 300mm from top of the door.



   B. When detect the jamming over the 250mm from top of the door.
      → Window is reversed until 50mm from jamming position.
      → Window is reversed 50mm or bottom position in case of 50mm reversing distance.



   C. When detect the jamming over 300mm from top of the door.
      → Window stops at reverse point.
3. Length of window reversing (holding the auto-up switch)
   A. When detect the jamming during holding the auto-up switch.
      → Window is reversed until 25mm from jamming position.
   B. Auto-up function is not available during the 5 seconds from above condition.
      → When holding the auto-up switch, window is operated as a manual-up function. (Safety function is not activ
   C. When detect the jamming during holding the auto-up switch again.
      → Window is reversed until 25mm from jamming position.

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D. When holding the auto-up switch after 5 seconds from above condition.
→ Window is reverse until 25mm from jamming position.



4. Safety function is not available area
Safety function is not available during the 4mm from top of the door.

Normalization (Teaching)
After power on reset or error detection, the motor has to be nomalized at the fully closed position.
How to be nomalized:

- Move the window upwards into the fully closed position. As the window reaches the fully closed position, hold th power window switch in auto for T≥2 seconds.
If the block is reconized, the system state turns to normalized.

Recall And Storing The Normalization (teaching) Information
ECU records the normalization information into the specified location in Flash ROM. (as long as Flash ROM page is

- Stroing conditions : Entering to sleep mode after valid switch input. Entering to low voltage(7.5V) after valid swit
- Recall conditions : Engine=ON or Power ON reset

Denormalization (Memory reset)
Under conditions below, ECU turns to denormalized status. After demormalization, auto up and safety function shall operated. In order to make these function active again, ECU should go through the mormalization process.

- Denormalization conditions :

1. Continuous 15 times reverses
2. Power off during motor operation
3. Driver side door opened and window glass is at the bottom (hard stop position) with IGN on, IGN off → within IGN on → Press Manual Down switch 3 times within 5 sec → De-normalization

Door and Glass status	IGN status	Input time	IGN status	Switch input status			Switch input times	Norma sta
				Re-input time	IGN status	Switch input		
Driver side door opened, Window glass is bottom with IGN on (Hard stop)	IGN Off	T≤2 sec	IGN On	T≤5 sec	IGN On	Press and release Manual down switch	3 times	D normal

Window Position Control
To detect the window position and direction of motor rotation, hall sensors are employed. ECU recognizes the fully c position of the window and sets this relative window position value as "0". When the window goes downwards, base information from the hall sensor, the relative position value increments. On the contrary, when the window goes upwa decrements.
Thermal Protection
Thermal protection by software module is implemented to prevent from destruction of motor during overload conditic

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Motor temperature is estimated by integrating squared motor current as an estimate for heating power integral. When estimated motor temperature exceeds EEPROM programmable upper limit, motor is deactivated for fixed delay time value = 30 sec.)
Thermal shutdown during a window operation will not interrupt the operation due to safety reasons.
Operation Time Limiter
Maximal operation time of power window motor is limited to 15 sec (EEPROM programmable).

Inspection

Front Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front door")
3. Disconnect the connector from the motor.
   (A : Safety, B : Standard)



4. Connect the terminal No. 2 and No. 3 to battery voltage (12V) and check that the motor operates smoothly whe connecting the terminals below.

[SAFETY]

Position \ Terminal		1	4(GND)	6
Left	UP	○	○	
	DOWN		○	○
Right	UP	○	○	
	DOWN		○	○

5. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, rep motor.

[STANDARD]

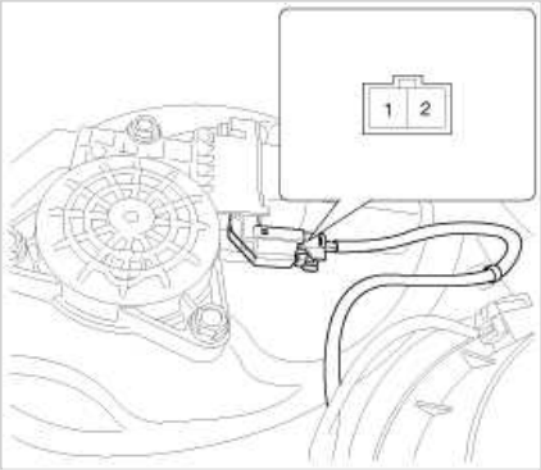
Position \ Terminal			1	2
Left	UP	Clockwise	⊕	⊖
	DOWN	Counter-clockwise	⊖	⊕
Right	DOWN	Clockwise	⊕	⊖
	UP	Counter-clockwise	⊖	⊕

Rear Power Window Motor

1. Remove (-) negative battery terminal.

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2. Remove the rear door trim.
   (Refer to Body - "Rear door")
3. Disconnect the connector from the motor.



4. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, rep motor.

Position		Terminal	1	2
Left	UP	Clockwise	⊕	⊖
	DOWN	Counter-clockwise	⊖	⊕
Right	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖

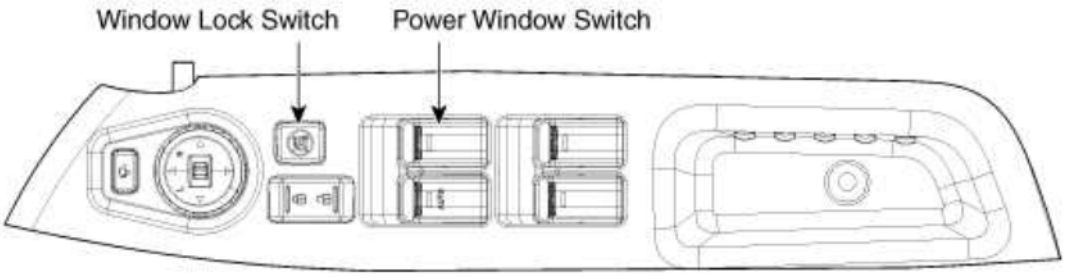
Body Electrical System

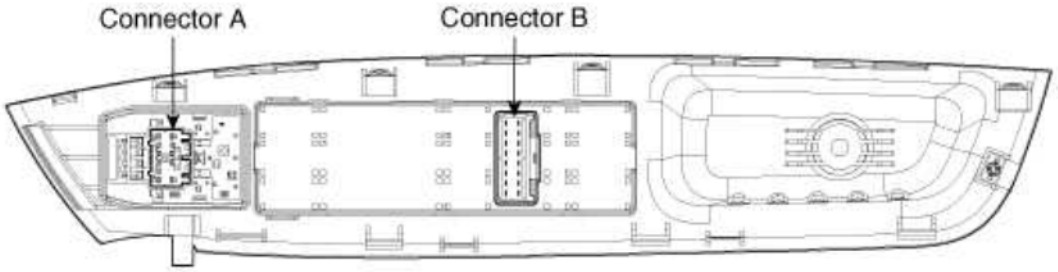
Components

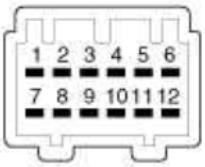
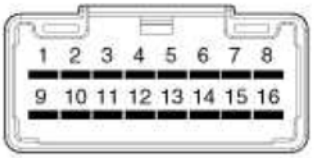
Power Window Main Switch

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[General]

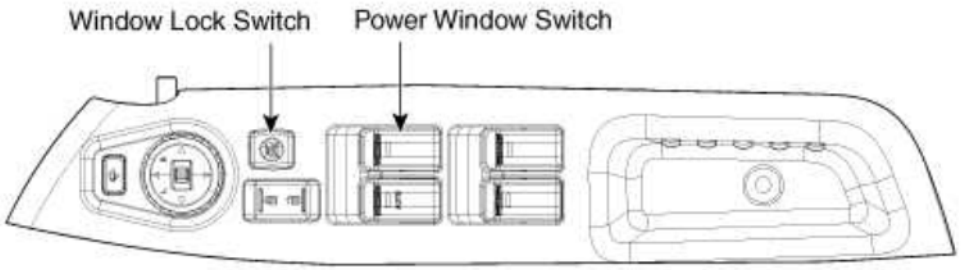


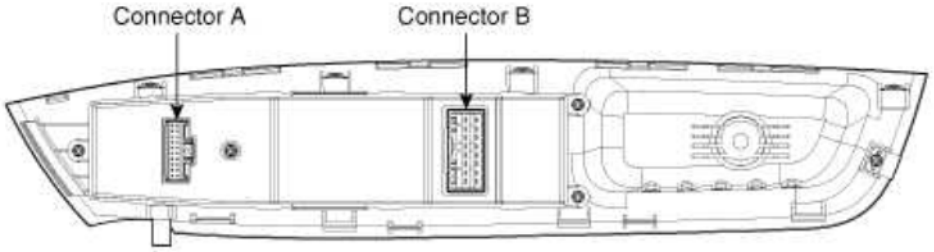


		
Pin	Connector A	Connector B
1	Assist door mirror motor (horizontal)	Driver window switch down
2	-	Door unlock
3	Assist door mirror motor (vertical)	Rear left window switch down
4	Driver door mirror motor (vertical)	Battery (+) L
5	-	Battery (+) R
6	Driver door mirror motor (horizontal)	Rear left window switch up
7	ACC	Rear right window switch down
8	Mirror folding motor 1	Rear right window switch up
9	Mirror folding motor 2	Driver window switch up
10	GND	Door lock
11	Battery (mirror folding)	Illumination
12	Common	Driver switch Auto
13		-
14		Assist window switch down
15		GND
16		Assist window switch up

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[IMS]



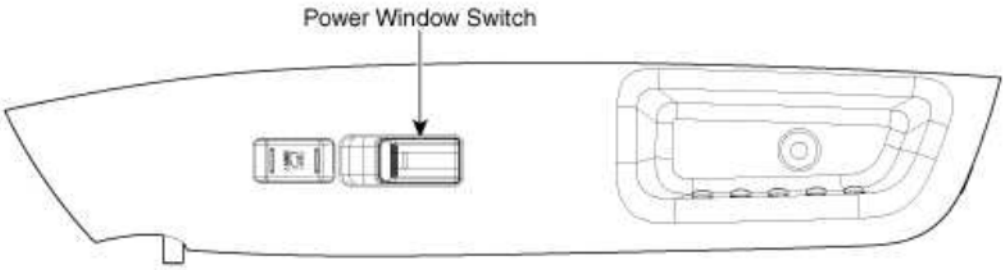


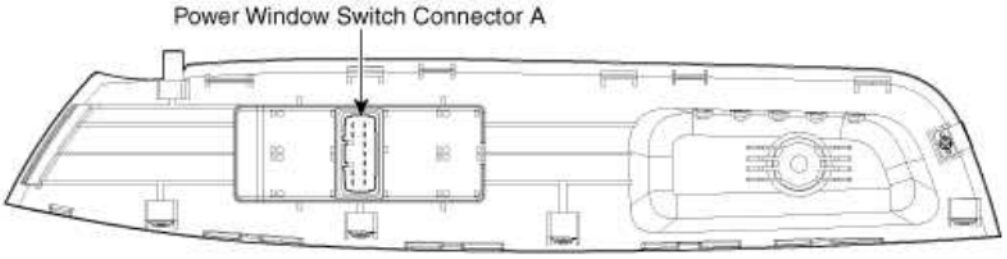
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
No.	**Connector A**	**Connector B**
1	Door unlock	Mirror switch left
2	LIN	Mirror switch right
3	-	Ground (Signal)
4	Driver window switch down	IGN 1 (Back up)
5	Driver window switch up	Battery (+) (Safety ECU)
6	IMS SET	Mirror switch up
7	IMS 1	Mirror switch down
8	IMS 2	Tail
9	-	Battery (+) (Power)
10	Driver window switch auto	Window lock
11	Door lock	-
12	Rear right window switch up	ACC
13	Rear right window switch down	Battery (+) (Mirror)
14	Rear left window switch up	Mirror folding
15	Rear left window switch down	Mirror unfolding
16	Vertical mirror sensor	Ground (Power)
17	Horizontal mirror sensor	
18	-	
19	Vertical mirror sensor (+)	
20	Vertical mirror sensor (-)	

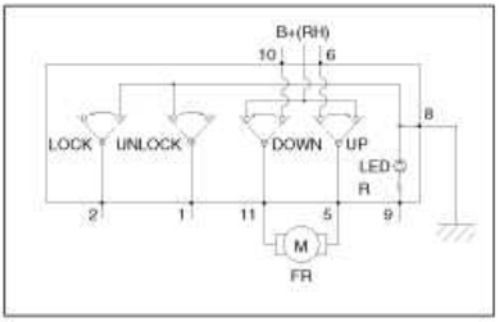
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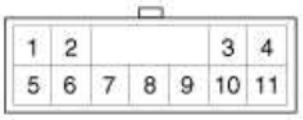
Passenger Power Window Switch

[General]





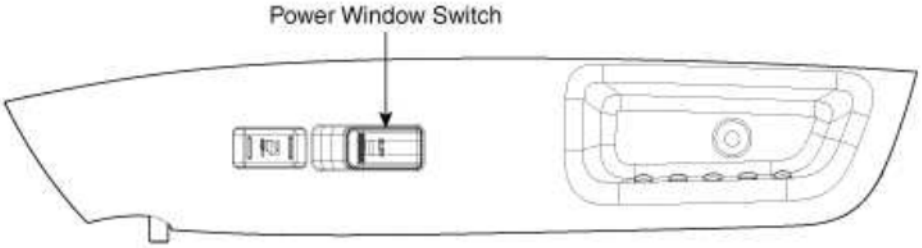


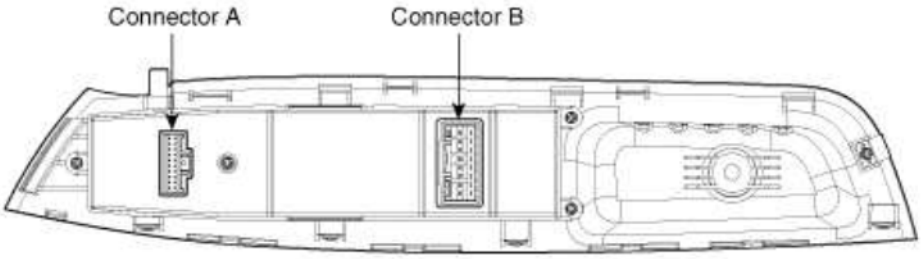


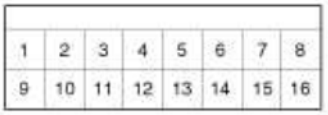
No.	Connector A
1	Door unlock
2	Door lock
3	-
4	Battery (+) Auto
5	Power window motor up
6	Power window switch up
7	-
8	GND
9	Tail lamp
10	Power window switch down
11	Power window motor down

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[IMS]



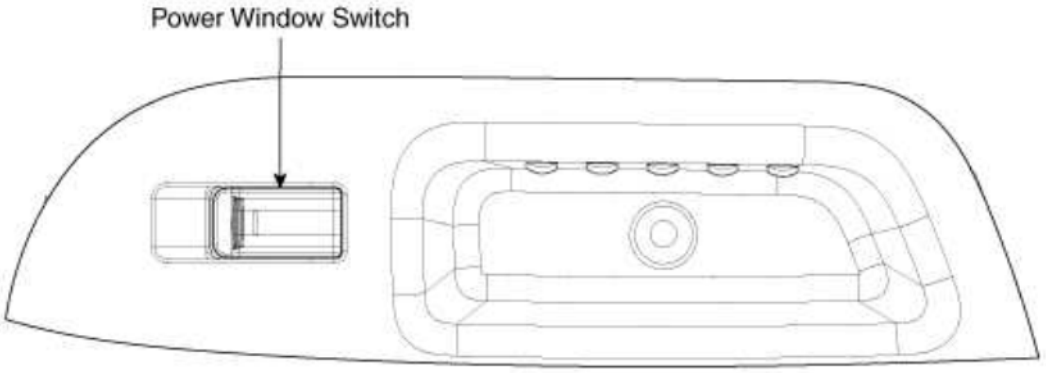


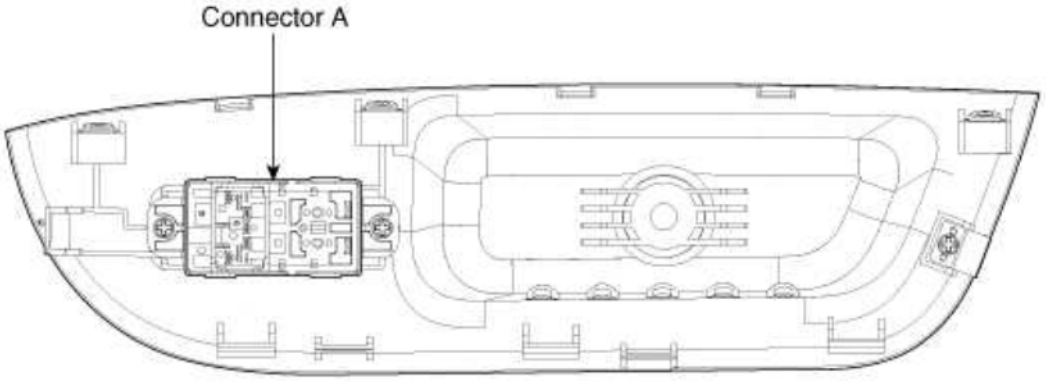
		
No.	**Connector A**	**Connector B**
1	-	Mirror switch left
2	-	Mirror switch right
3	-	Ground (Signal)
4	-	IGN 1 (Back up)
5	-	Battery (+) (Safety ECU)
6	-	Mirror switch up
7	-	Mirror switch down
8	-	Tail
9	-	Battery (+) (Power)
10	-	Window lock
11	-	-
12	-	-
13	-	Battery (+) (Mirror)
14	Horizontal mirror sensor	Assist window switch up
15	Vertical mirror sensor	Assist window switch down
16	Vertical mirror sensor (+)	Ground (Power)
17	Vertical mirror sensor (-)	
18	Door unlock	
19	Door lock	
20	LIN	

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Rear Power Window Switch

[General]

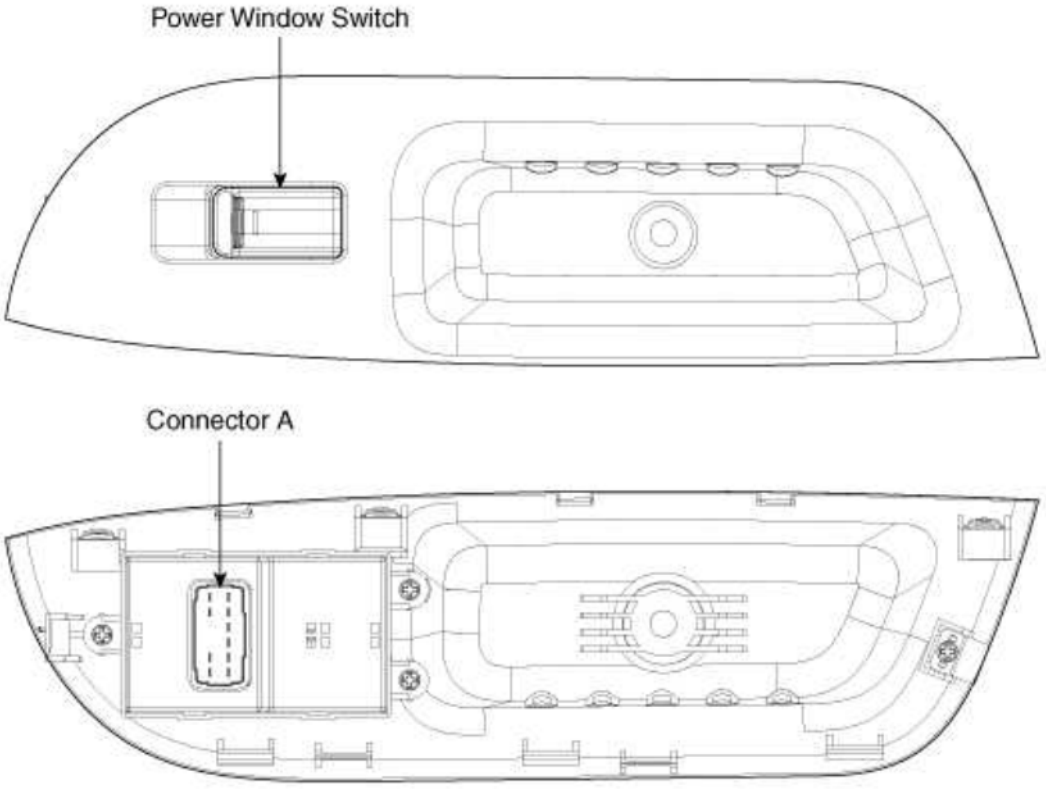


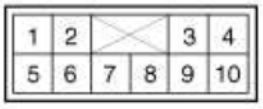


	1 2 3 4 5 6 7 8
No.	**Connector A**
1	Power window motor up
2	-
3	Power window motor down
4	Power window switch up
5	Tail lamp
6	Battery (+)
7	GND
8	Power window switch down

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[IMS]



	
No.	**Connector A**
1	Power window motor down
2	Ground
3	Power window motor up
4	Power
5	Power window switch down
6	Lock
7	Tail
8	-
9	-
10	Power window switch up

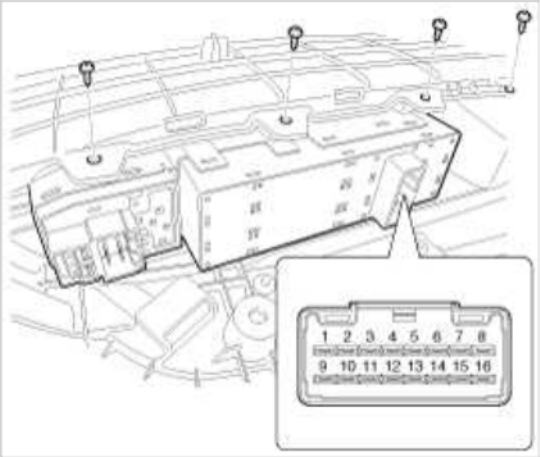
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Inspection

Main Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch.
   (Refer to Body - "Front door")

3. Check for continuity between the terminals in each switch position according to the table. If the continuity conditic normal, replace the switch.



Position \ Terminal	11	13	4
Lock		○	○
Unlock	○	○	

[Driver Auto Up/Down]

Position \ Terminal	Front left				Front right			
	15	9	1	12	5	16	14	15
UP	○	○			○	○	○	○
OFF						○	○	○
DOWN	○		○		○		○	○

Position \ Terminal	Rear left				Rear right			
	4	6	3	15	5	8	7	15
UP	○	○	○	○	○	○	○	○
OFF		○	○	○		○	○	○
DOWN	○	○		○	○	○		○

Position \ Terminal	Front left			
	15	9	1	12
AUTO UP	○	○		○
AUTO DOWN	○		○	○

[Driver & Assist Auto Up/Down]

Position \ Terminal	Front left				Front right			
	15	9	1	12	15	16	14	13
UP	○	○			○	○		
AUTO UP	○	○		○	○	○		○
OFF								
DOWN	○		○		○		○	
AUTO DOWN	○		○	○	○		○	○

Position \ Terminal	Rear left				Rear right			
	4	6	3	15	5	8	7	15
UP	○	○	○	○	○	○	○	○
OFF		○	○	○		○	○	○
DOWN	○	○		○	○	○		○

[Auto Down Only]

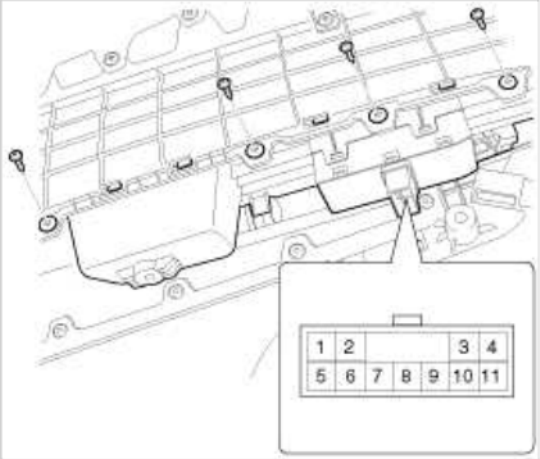
Position \ Terminal	Front left				Front right			
	15	9	1	12	5	16	14	15
UP	○	○			○	○	○	○
OFF						○	○	○
DOWN	○		○		○		○	○
AUTO DOWN	○		○	○				

Position \ Terminal	Rear left				Rear right			
	4	6	3	15	5	8	7	15
UP	○	○	○	○	○	○	○	○
OFF		○	○	○		○	○	○
DOWN	○	○		○	○	○		○

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Passenger Power Window Switch Inspection

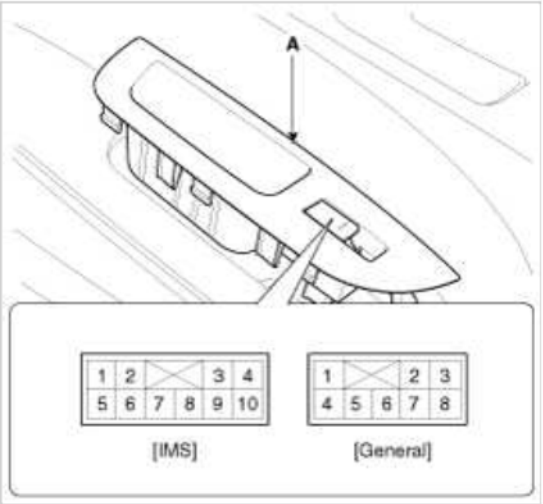
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch.
   (Refer to Body - "Front door")
3. Check for continuity between the terminals in each switch position according to the table. If the continuity conditic normal, replace the switch.



Terminal / Position	4	5	6	10	11
UP	○	○		○	○
OFF		○	○	○	○
DOWN	○	○	○		○

Rear Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim.
   (Refer to Body - "Rear door")
3. Remove the rear power window switch module (A).

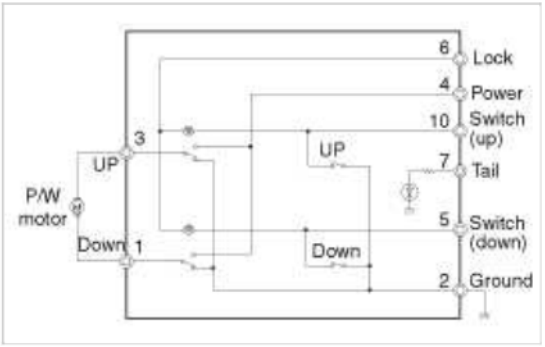


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4. Check for continuity between the terminals in each switch position according to the table. If the continuity conditic normal, replace the switch.

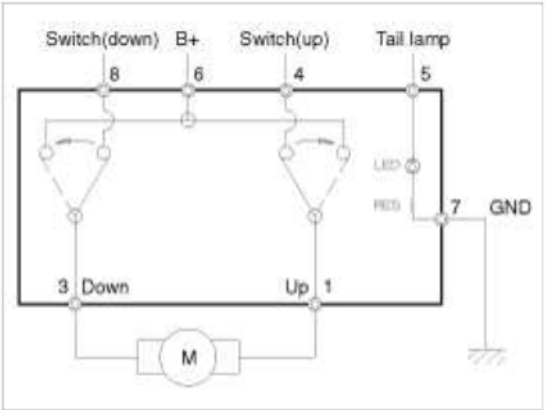
[IMS]

Terminal / Position	10	5	2 (GND)
UP	○	—	○
OFF			
DOWN		○	○



[General]

Terminal / Position	6	4	8	3	1
UP	○		○	○	○
OFF		○	○		○
DOWN	○	○		○	○

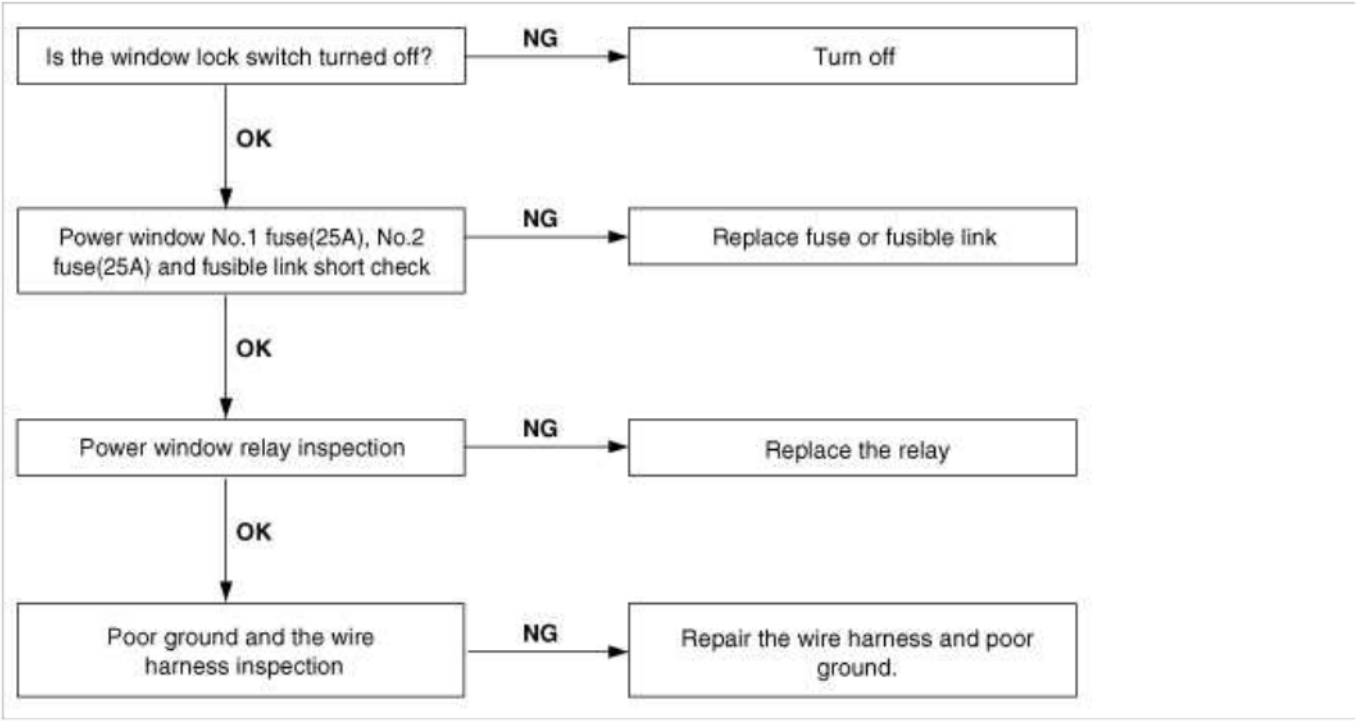


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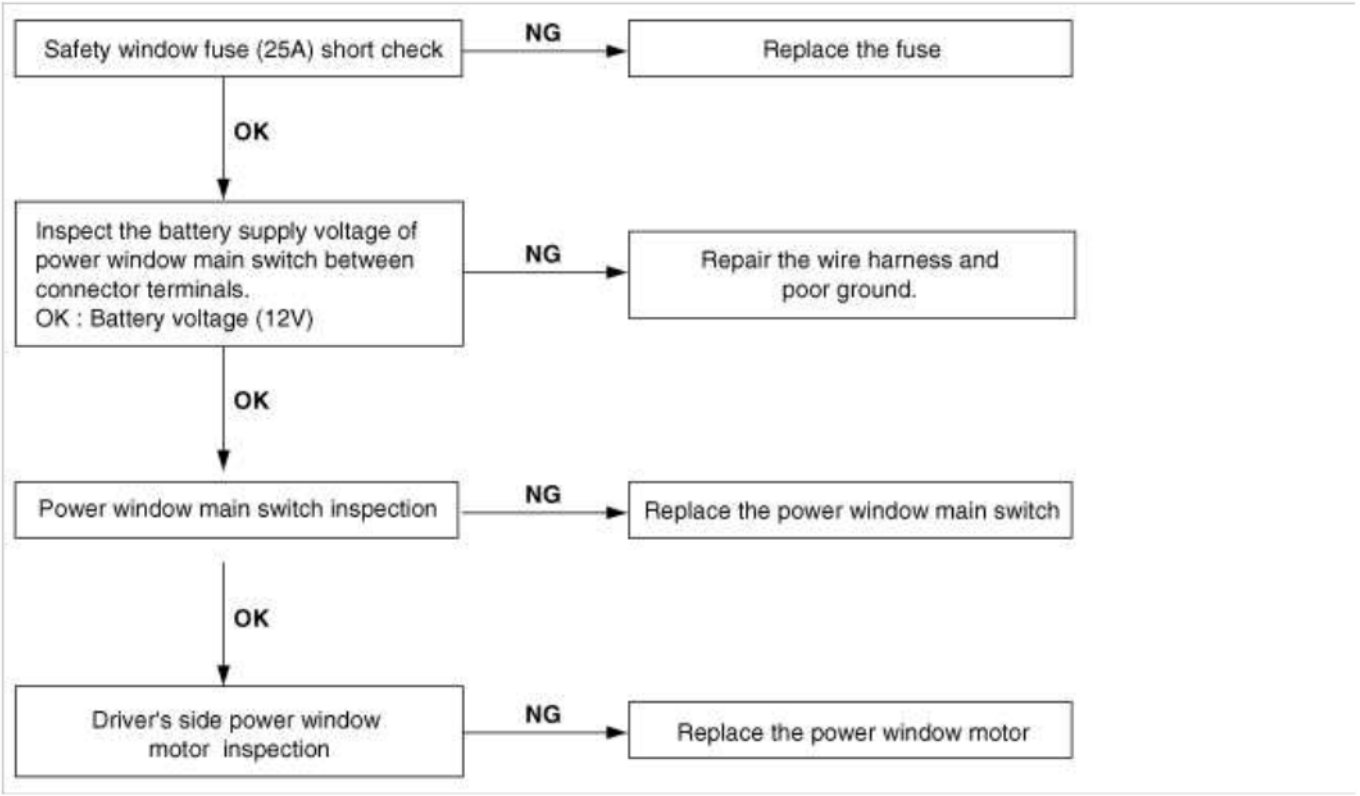
Body Electrical System

Troubleshooting

1. No windows operate from the main switch on the driver's door.

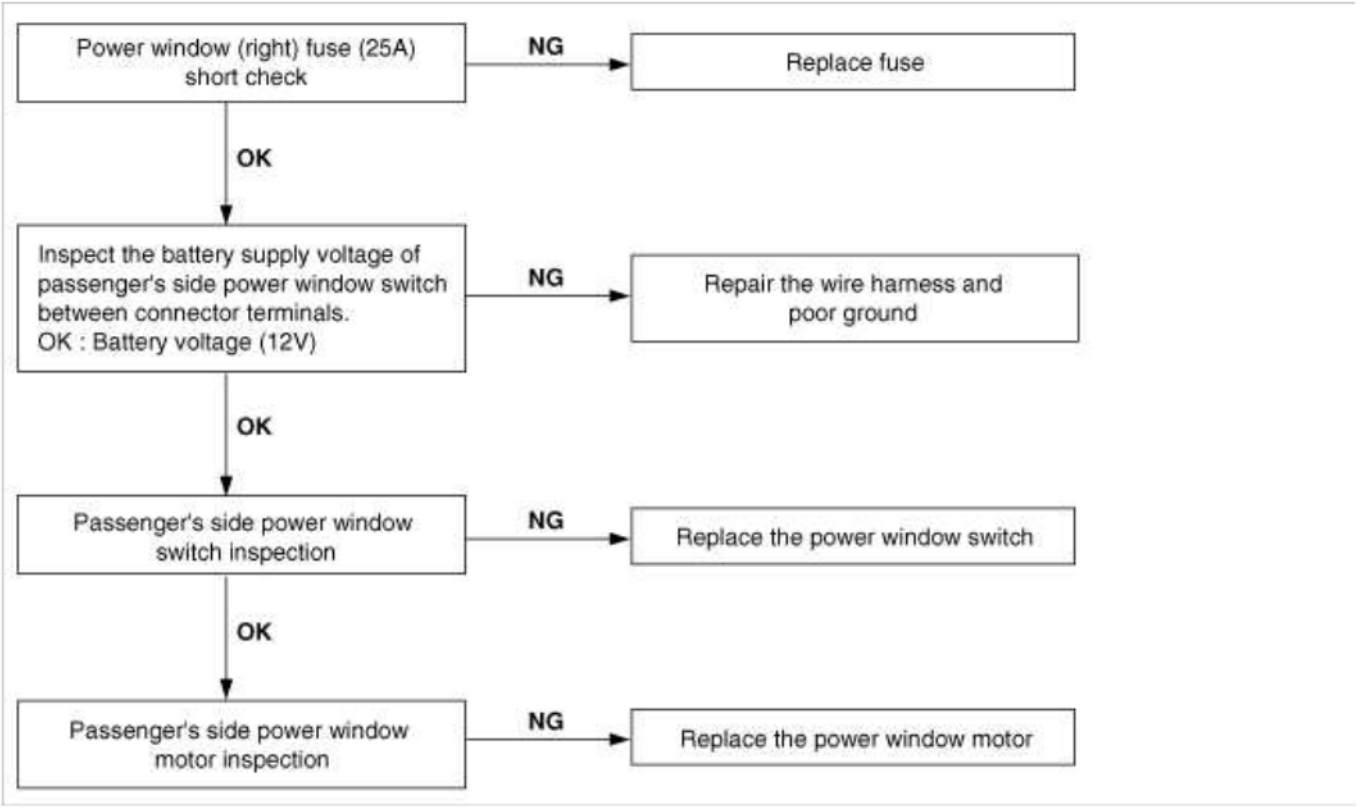


2. Driver's side window does not operate.



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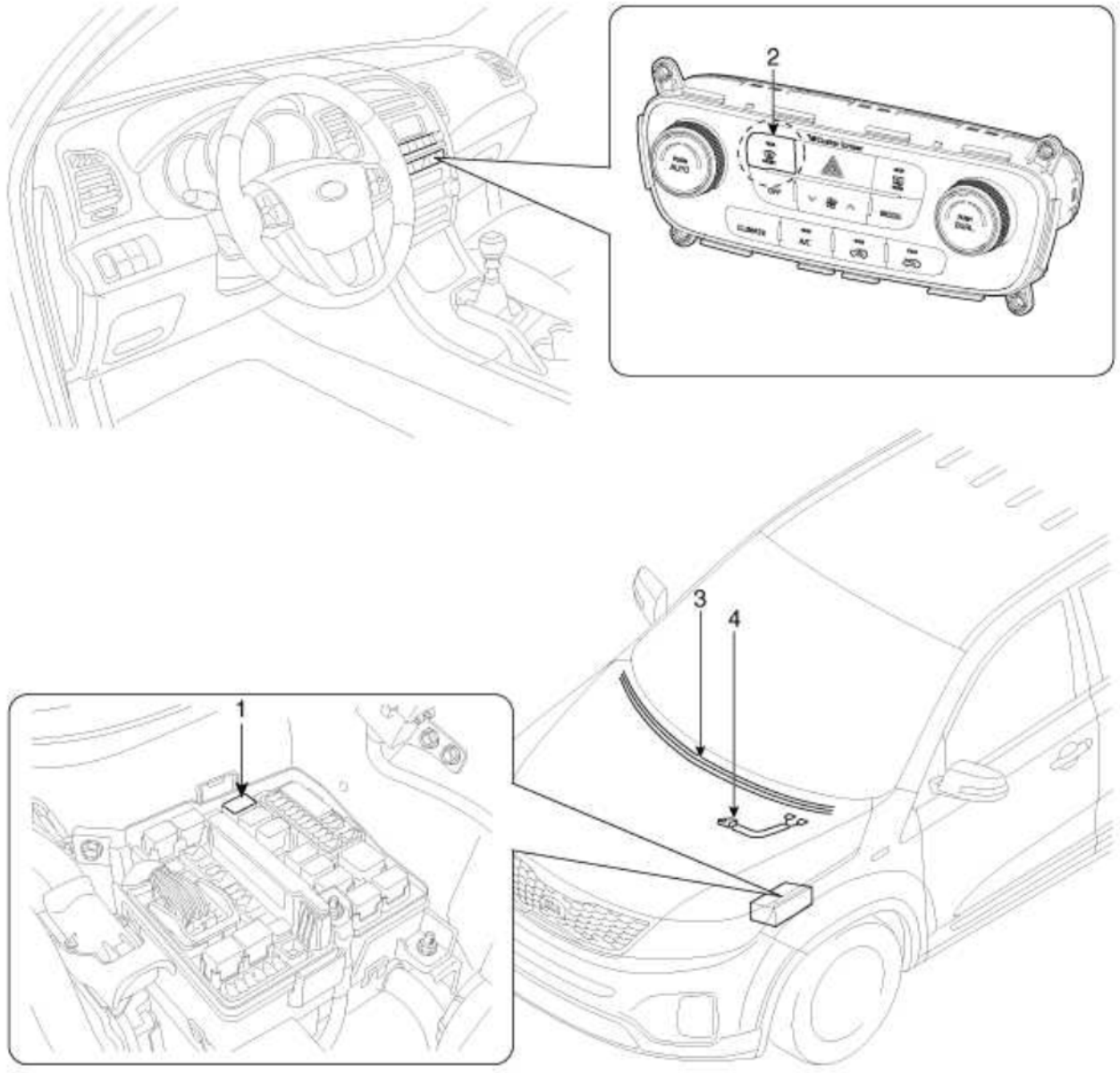
3. Passenger's side window does not operate.



Body Electrical System

Component Location

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1. Windshield deicer relay 2. Windshield deicer switch	3. Windshield deicer 4. Deicer connector

Body Electrical System

Description

Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the low of windshield, switch and relay. Body control module receives an input signal from the deicer switch, then controls rel Since the generator "L" is switched ON, if the deicer switch is ON, then deicer output is ON for 20 minutes.

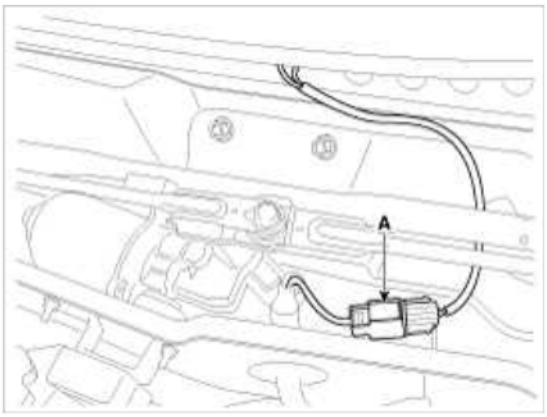
Body Electrical System

Inspection

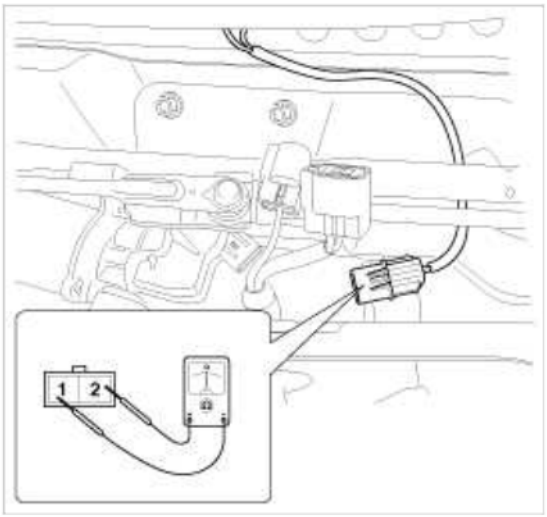
1. Remove the cowl top cover.
   (Refer to the wiper)

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2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.

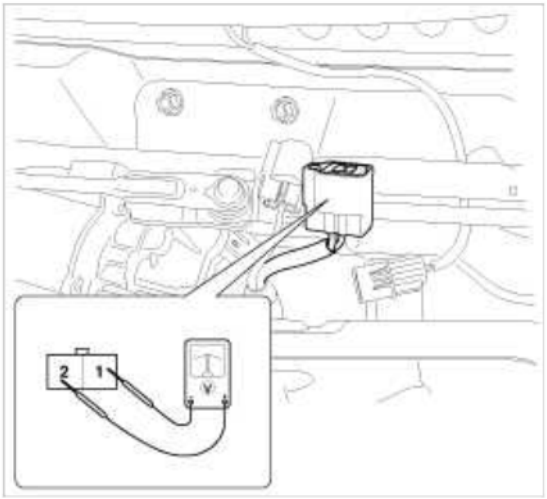


3. Check for continuity between the terminals of deicer lines.



4. Turn the ignition switch ON and the windshield deicer switch ON, then measure the voltage between the terminal harness side deicer connector.

OK : approx. Battery voltage (12V)



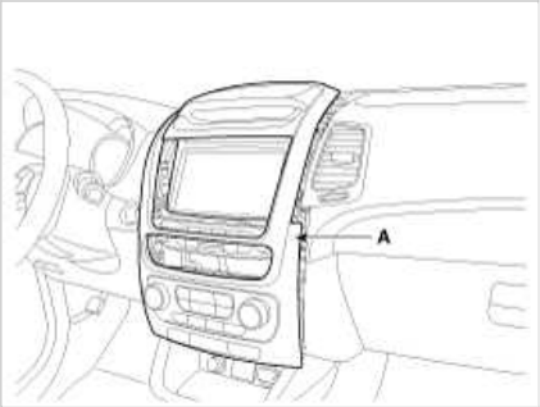
Body Electrical System

Removal

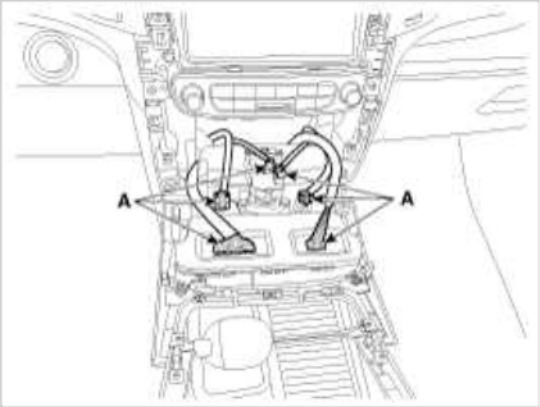
1. Disconnect the negative (-) battery terminal.

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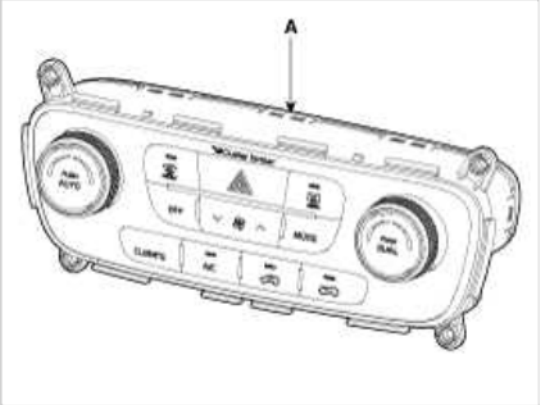
2. Remove the center fascia panel (A).
   (Refer to Body - "Crash pad")



3. Disconnect the connectors and cables (A) from center fascia panel.



4. Remove the heater control unit (A) with the windshield deicer switch.



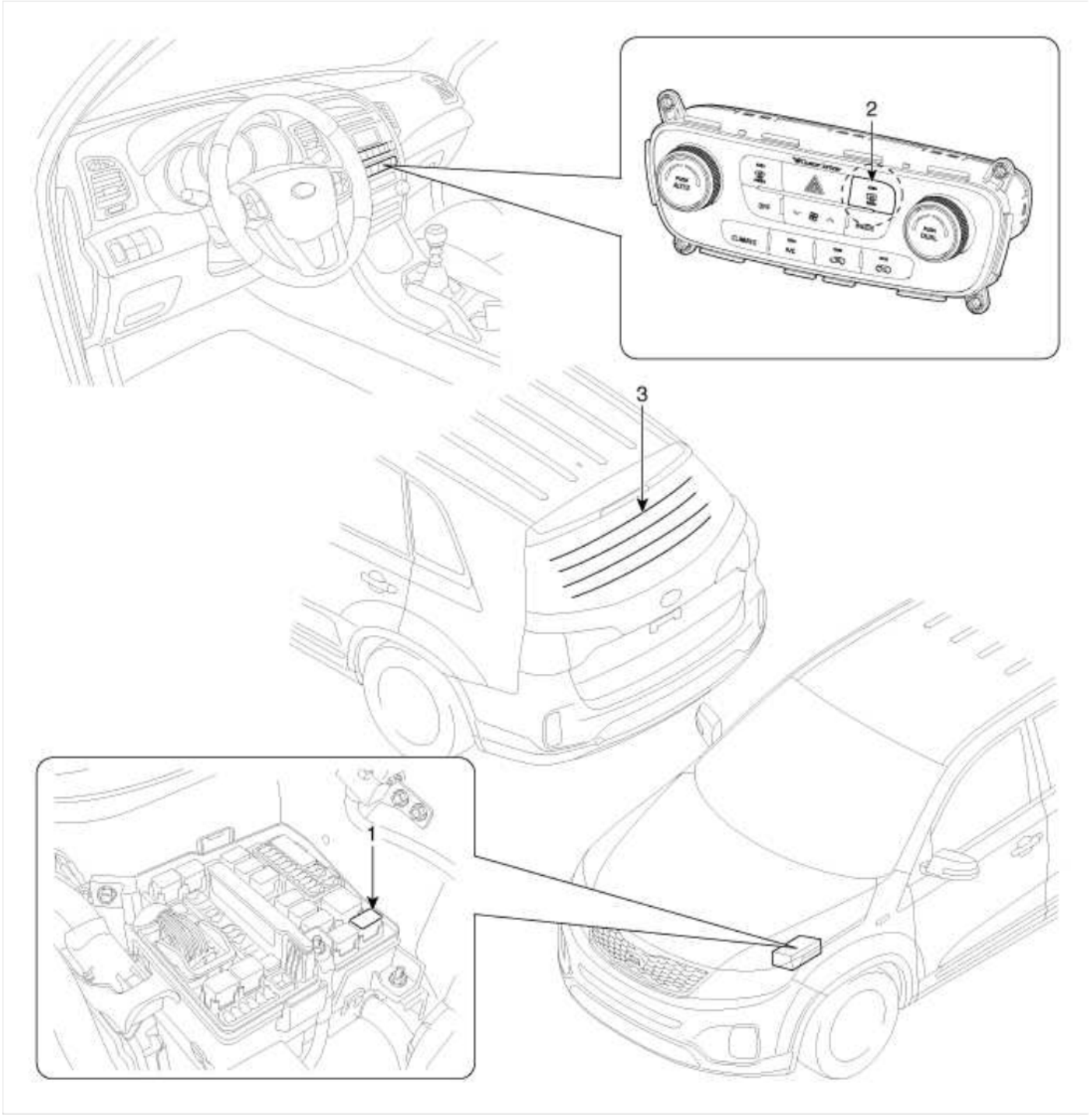
Installation

1. Install the heater control unit.
2. Install the center fascia panel.

Body Electrical System

Component Location

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1. Rear glass defogger relay 2. Rear glass defogger switch	3. Rear glass defogger

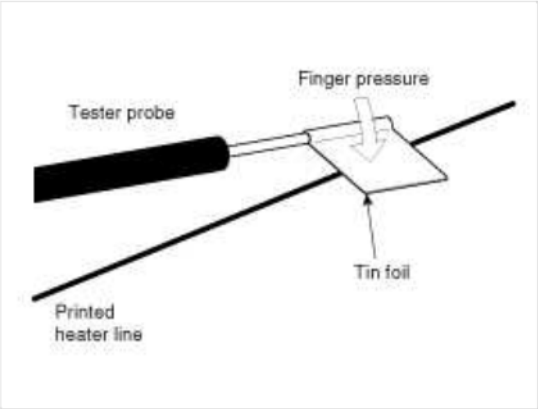
Body Electrical System

Inspection

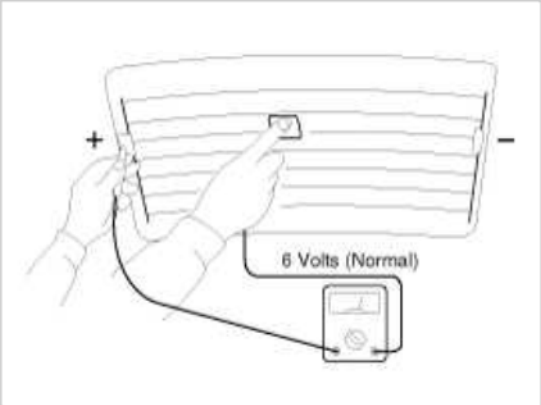
⚠ CAUTION

Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on foil, moving the tin foil along the grid line to check for open circuits.

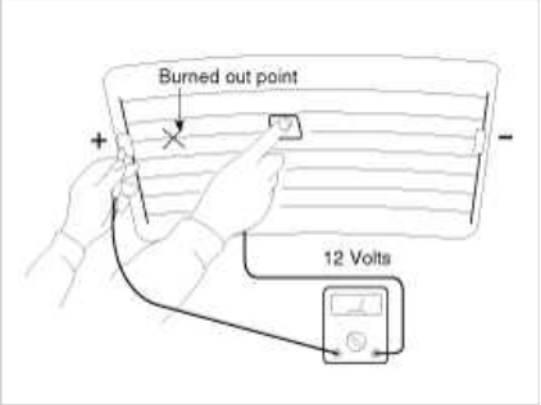
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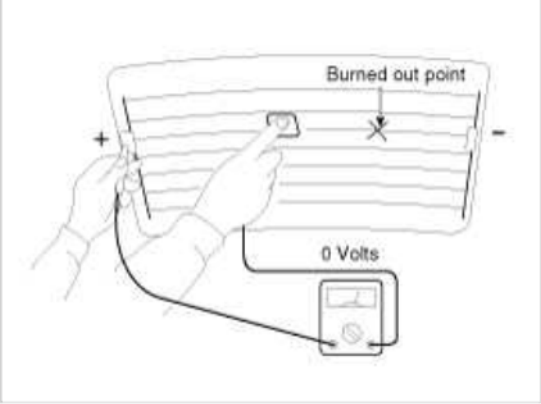
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center poi voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfa



2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.

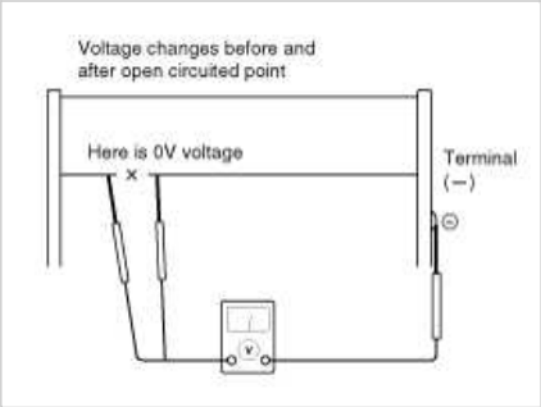


3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.

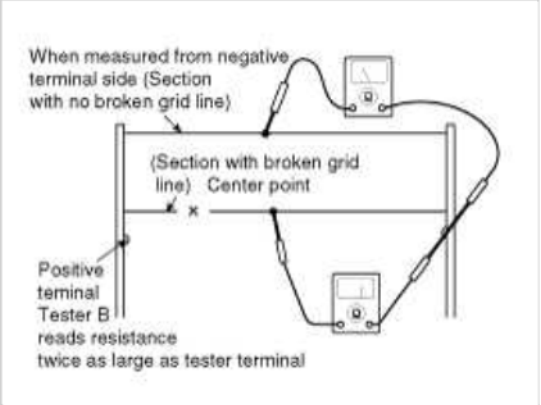


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4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to fi point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit



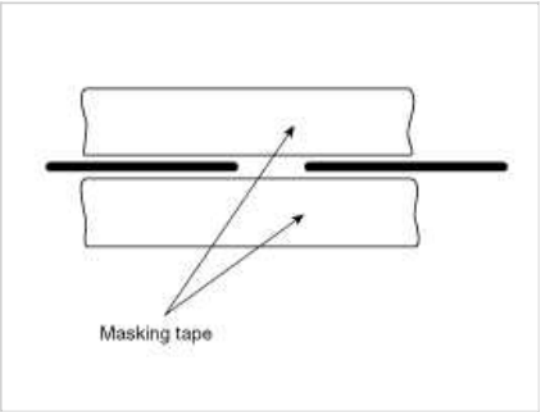
5. Use an ohmmeter to measure the resistance of each heater line between a terminal and the center of a grid line, ar between the same terminal and the center of one adjacent heater line. The section with a broken heater line will ha resistance twice as that in other sections. In the affected section, move the test lead to a position where the resista sharply changes.



Repair Of Broken Heater Line

Prepare the following items :

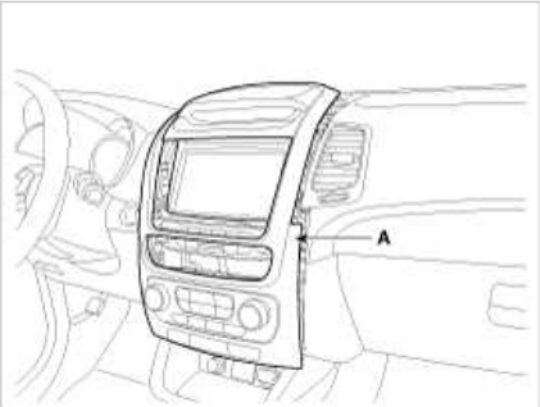
1. Conductive paint.
2. Paint thinner.
3. Masking tape.
4. Silicone remover.
5. Using a thin brush :
   Wipe the glass adjacent to the broken heater line, clean with silicone remover and attach the masking tape as sho
   Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes ap
   Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away exc
   deposits with a knife after the paint has completely dried. (Allow 24 hours).



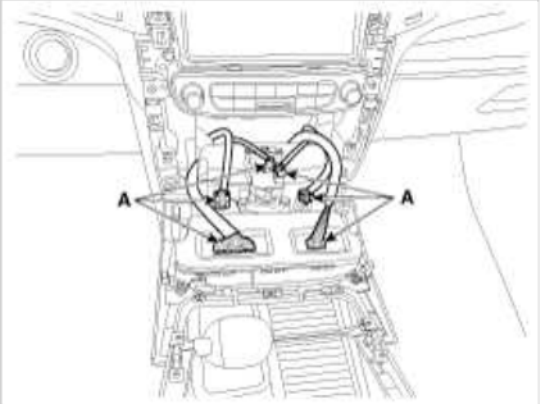
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Removal

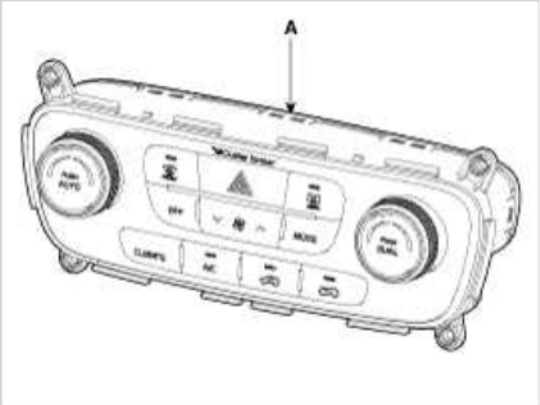
1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia panel (A).
   (Refer to Body - "Crash pad")



3. Disconnect the connectors and cables (A) from center fascia panel.



4. Remove the heater control unit (A) with the rear glass defogger switch.



Installation

1. Install the heater control unit.
2. Install the center fascia panel.

Inspection

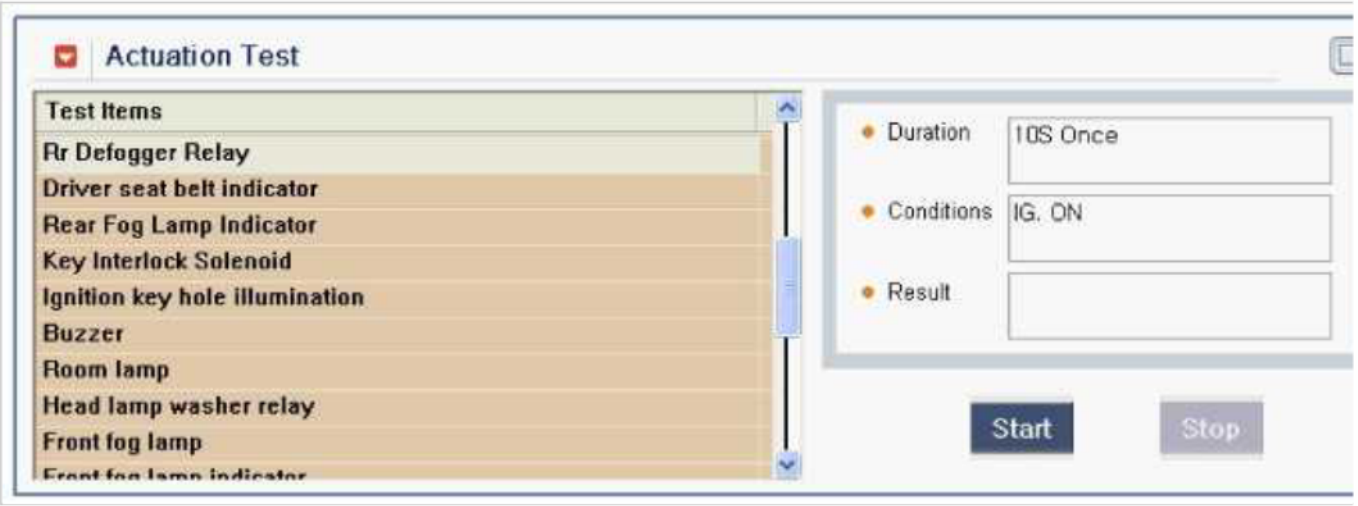
1. It will be able to diagnose defects of rear glass defogger with GDS quickly. GDS can operates actuator forcefully input/output value monitoring and self diagnosis.

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2. Select "Current data", if you will check current data of rear glass defogger system. It provides input/output status glass defogger.



3. If you will check the rear glass defogger operation forcefully, select "Actuation test".

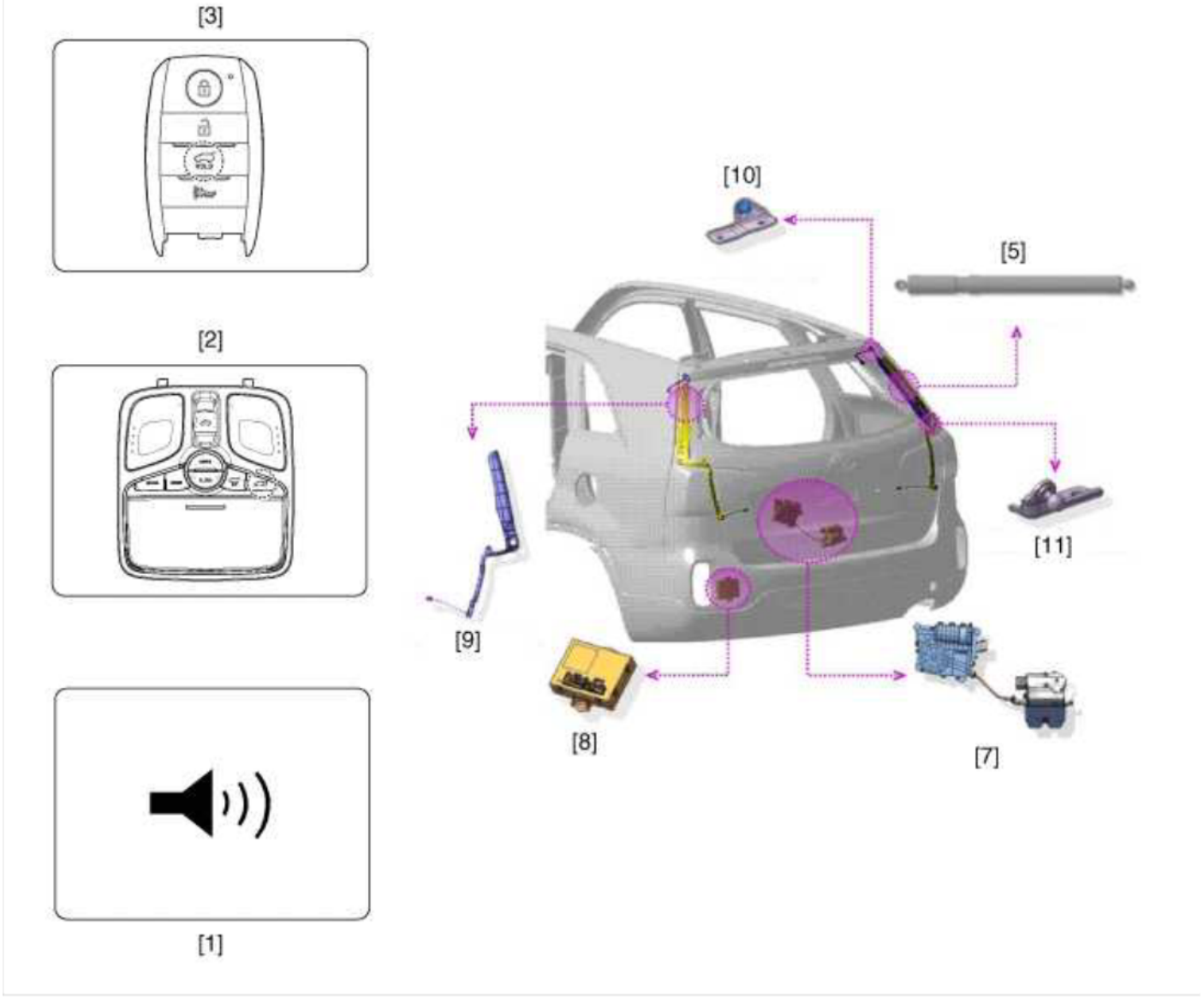


4. To check the DTC of the rear glass defogger, select "Diagnostic trouble codes"

Body Electrical System

Component Location (1)

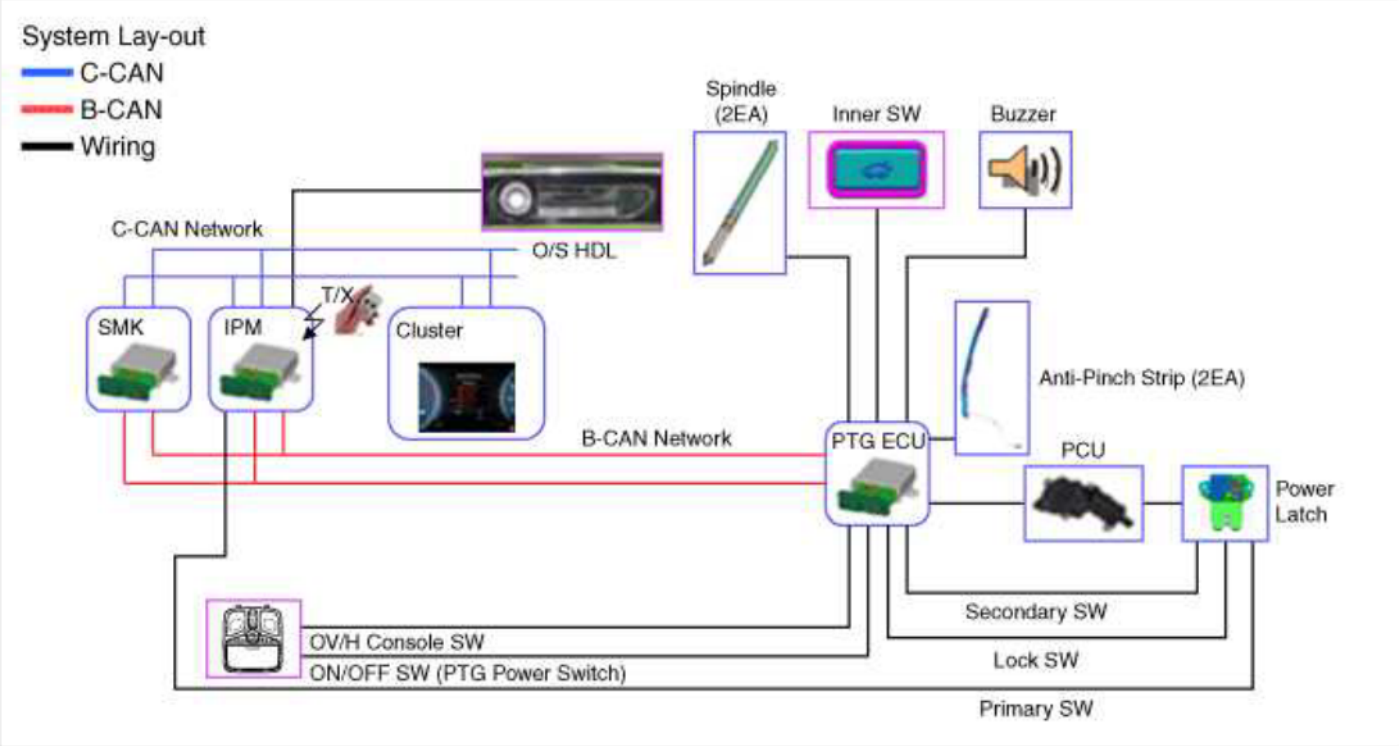
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1. Buzzer 2. Console S/W 3. RKE 4. Anti Pinch Strip 5. Spindle Drive	6. Tailgate Trim Switch 7. Power Latch 8. PTG Control Module 9. Anti Pinch Strip 10. Body Side Bracket 11. Lifter Side Bracket

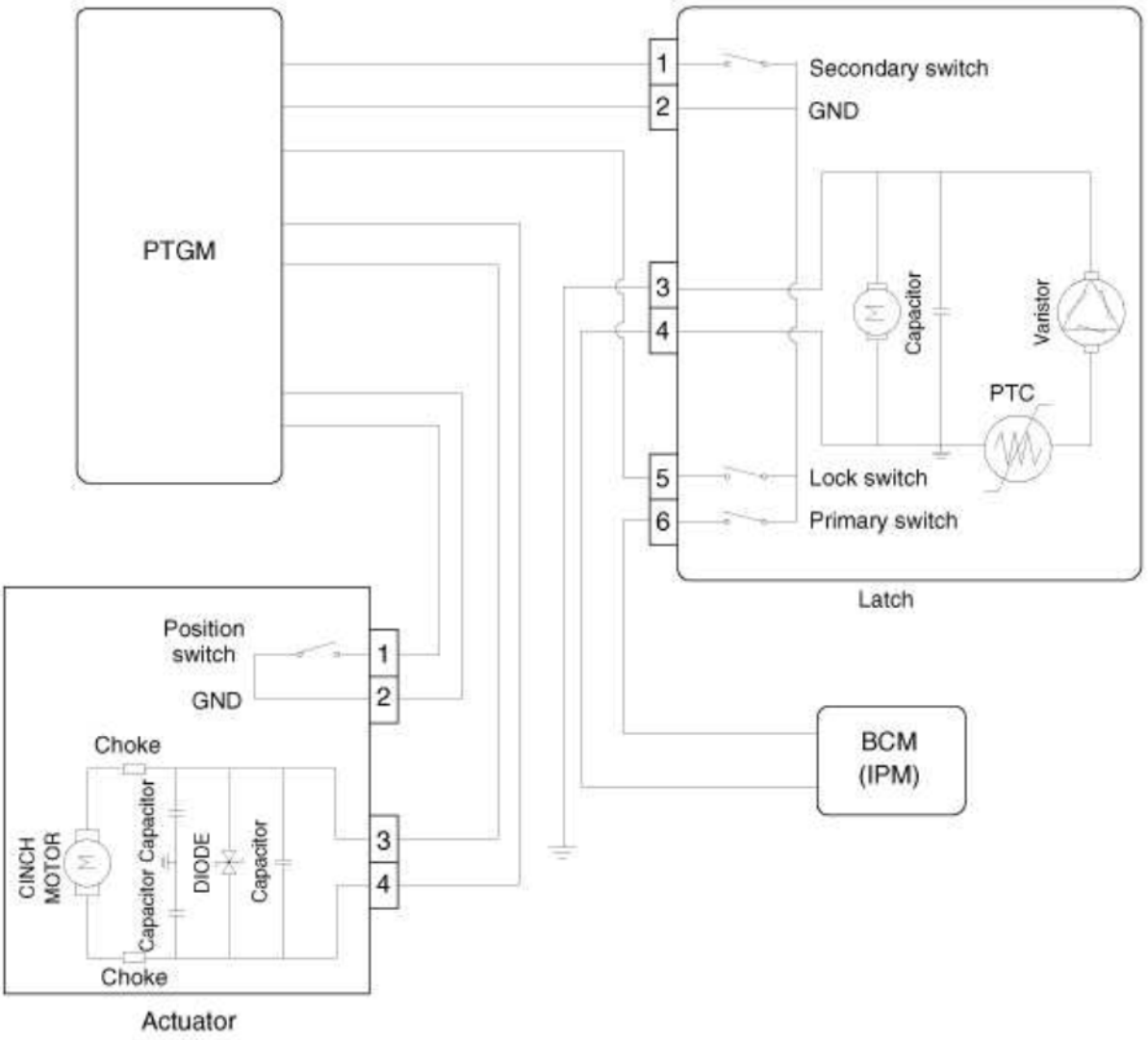
Component Location (2)

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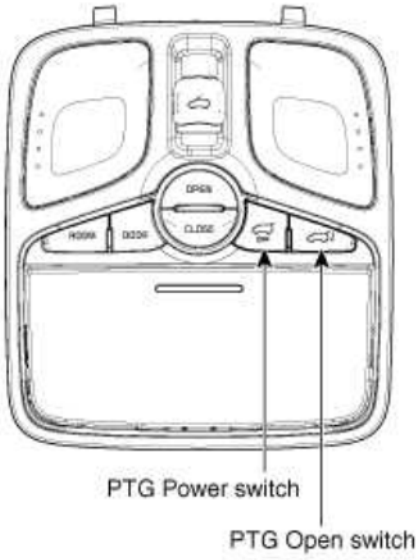


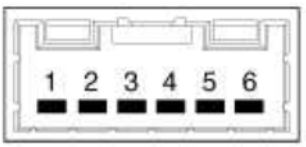
Block Diagram

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Connector A	
	
No.	**Description**
1	Battery (+)
2	PTG Power switch
3	Room (+)
4	Door (-)
5	PTG Open switch
6	Ground

Terminal / Position	PTG Power switch		PTG Open switch		Remark
	ON(Free)	OFF(Push)	ON(Push)	OFF(Free)	
6		○	○		GND
2		○			PTG Power switch
5			○		PTG Open switch

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Body Electrical System

Description

Power tailgate is an electro-mechanical system designed to provide power opening and closing of the tailgate through push of a button of a remote key (fob), console switch, inner switch or an outside handle switch of the tailgate.
The power tailgate will reverse direction of travel if resistance to movement is detected while the tailgate is being ope closed.

Tailgate Position And Direction

The PTG system will measure the Tailgate position via an integrated hall sensor inside the Spindle drive unit motor.
The moving direction of tailgate will be detected by analyzing the direction of the drive unit motor.
The hall sensor pulse counting (position detection) is active during power and manual operation mode.

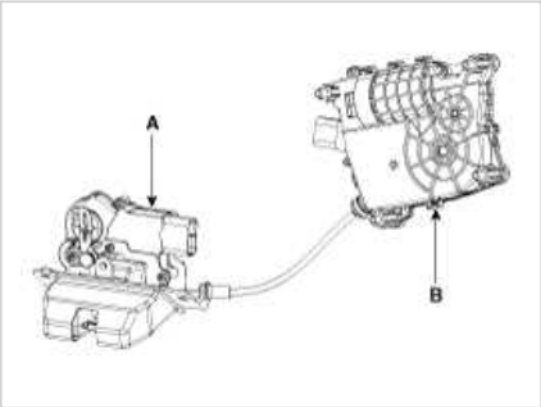
System Components

1. PTG Unit



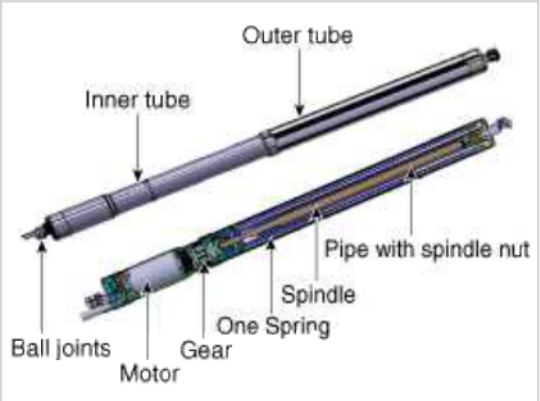
PTG unit is located in rear left luggage side trim.
PTG drive unit drive the two actuators (Spindles) by measuring the driving motors.
Anti pinch strips (ATS) does not contain any hall sensor. PTG controls the anti trap function by resistance analysis
ATS.

2. PTG Latch Assembly



PTG latch assembly is consist of Power Latch (A) and Power Closeing Unit (B).
Power latch is located in the lower part of tail gate panel.

3. PTG Spindle



PTG spindle open and close the tailgate by driving the motor.

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4. Anti-Pinch Strip



During power closing or cinching, the PTG system shall reverse to full open if an anti-pinch strip signal is received However, the anti-pinch strips will not work when the Tailgate is idle in the full closed, full open, or stopped posit

5. SMK (Smart key)

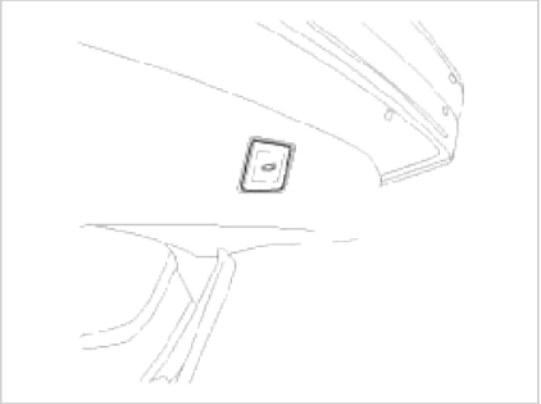


Push the power tailgate open of the SMK more than 0.5s to open the power tailgate. Power Open operation sha reversed when an additional Open/Close signal is received during power opening.

6. Interrior Swtich



7. Tailgate inner switch



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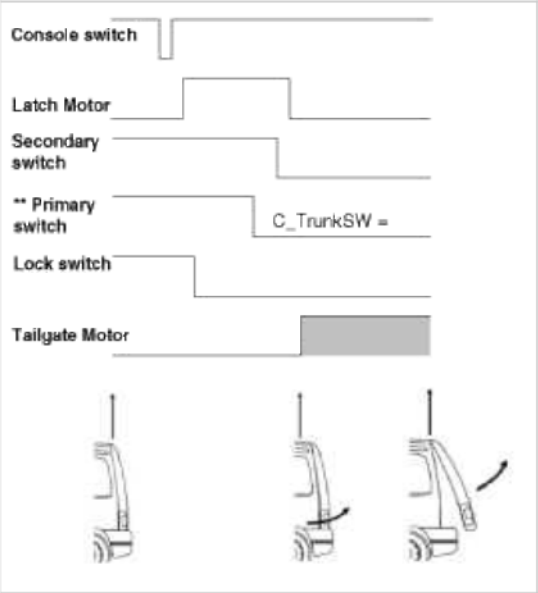
8. Tailgate buzzer



When a power operation cannot be performed as requested or if the Tailgate operation was requested via Interio or RKE/SMK.

Operation

Power Tailgate Opening



** - Primary switch signal received by PTGM via CAN bus (sent by IPM)

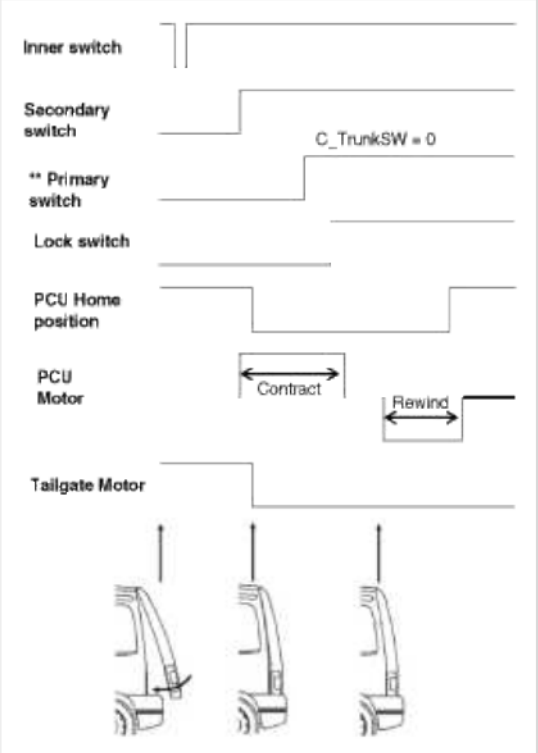
PTGM Opening procedure:

1. Opening can be triggered after a signal is received from, driver-console switch, outside handle switch, remote Ke (FOB)
2. The latch will be released (by IPM) by actuation of latch motor.
3. On latch release, the tailgate latch pops out of the striker.
4. PTG module controls the tailgate motor in order to open the tailgate.
5. Opening angle of the tailgate is calculated by counting the input pulse signals from Hall sensor.

> **NOTICE**
>
> When the motor movement is restricted, the PTGM stops the tailgate motor movement due to obstacle detection.

Power Tailgate Closing

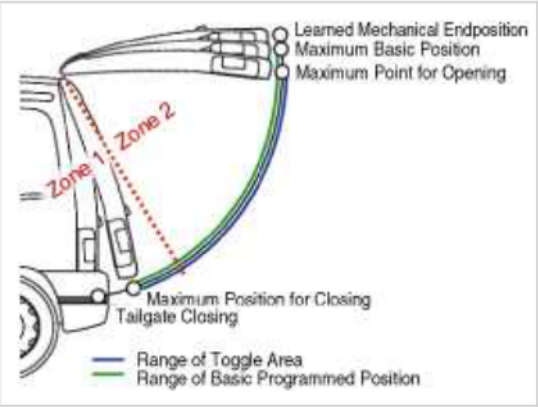
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PTGM Closing procedure:

1. Closing can be triggered after receiving a signal from, console (driver) switch, ouside handle switch, remote key (inner switch
2. PTG module controls the tailgate motor in order to close the tailgate
3. Closing angle of the tailgate is calculated by counting the input pulse signlas from hall sensor
4. The tailgate latch engages with the striker and the latch is locked mechanically (Latch unlock → Latch lock)
5. PTGM stops the tailgate motor operation after detecting the tailgate latch's secondary signal
6. On detecting the latch's secondary signal, the power close unit (PCU) starts the contract (cinch) operation and st after the latch lock signal is detected
7. After contract operation is stopped, PCU is rewound until the PCU home position is reached
8. The tailgate is completely closed and latch is fully locked

Learned/Calculated/Programmed positions



1. Maximum Point for Opening
   Above this position a start in opening direction could make the tailgate move beyond the Maximum Basic Positio overload the mechanical system (hinges).
   Therefore the start of an opening action above this point is disabled.
   Anyway the tailgate moves beyond this point, if it has been started at a lower position.

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2. Learned Mechanical End Position
   This is the mechanical block position while opening and is considered to be 100% opening. During the first tailgat opening this position is learned.
   After learning, the tailgate will not move beyond the Maximum Basic Position, which is defined by the Learned Mechanical Position – Security Distance.
   All positions are defined by parameters in the ECU or programmed by the user (Basic Programmed Position)

Programming the max. T/gate opening (Garage Position)

1. The customizable Programmed Basic Position is set equal to the Maximum Basic Position after the Learned Mecl End Position is learned.
   A. The customer can change the Programmed Basic Position to any new position between the Maximum Point F Closing and the Maximum Basic Position.
   B. If the customer wants to set a new Programmed Basic Position below the actual Programmed Basic Position, to move the tailgate electrically or manually to the new position and has to push the Inner Switch for e.g. 3 sec (time can be modified by parameter)
   C. If the customer wants to set a new Programmed Basic Position above the actual Programmed Basic Position l to move the tailgate manually to the new position and has to push the Inner Switch for 5 seconds (time can be modified by parameter)
   D. If the user tries to program a tailgate position above the Maximum Basic Position, the ECU will set the Progra Basic Position to the Maximum Basic Position.

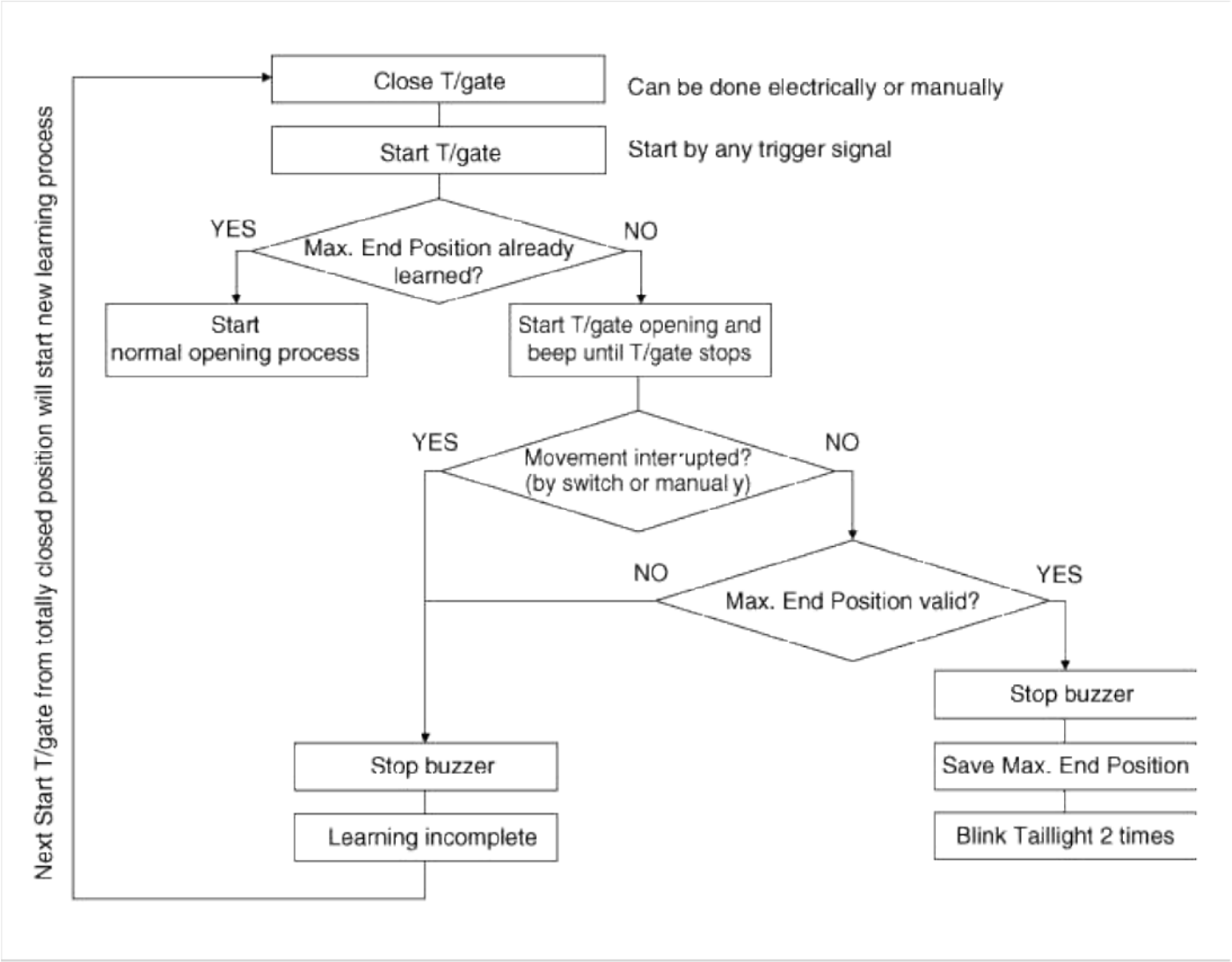
System Parameterization

Due to mechanical tolerances and adjustments in vehicle production and assembly the power operated tailgate needs calibration of the maximum movement range before proper operation can be ensured.

The tailgate's maximum movement range is represented by the number of Hall-pulses received by the ECU from the actuators' speed / position sensors during a tailgate movement from the fully closed position (closure unit in fully latch position) to the upper end position limited by mechanical constraints (e.g. upper bump stops, spindle length or similar

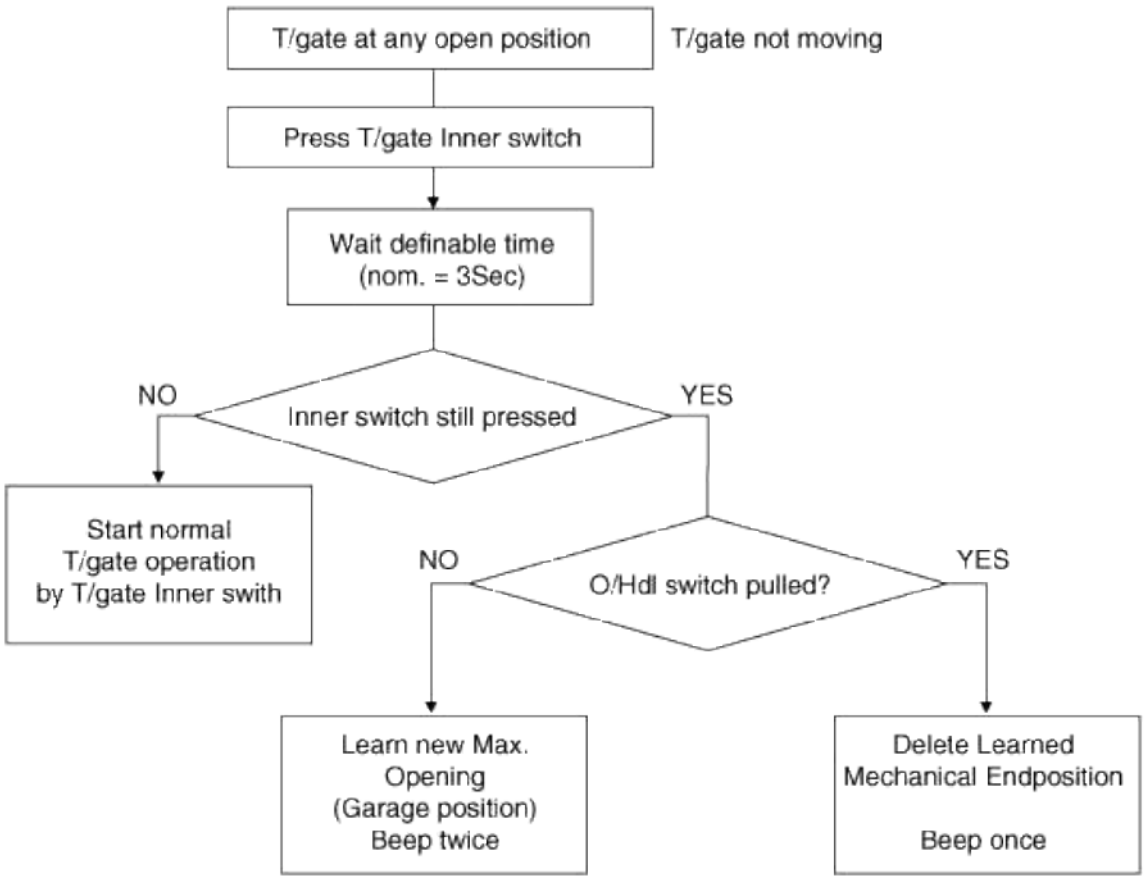
Calibration Mode

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Manual De-calibration Mode

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System Initialization

System initialization is necessary to identify the Tailgate closed (0-Position) position.

After a Battery Power-on reset, an initialization process must be executed to find the full open and full closed Tailgate position. After successful initialization for Tailgate closed position and learning of the Tailgate full open position the no Tailgate open and close operation can be ensured.

Procedure: Refer to "Calibration Mode".

Buzzer operation is defined in the following chart

	BUZZER	LAMP *)	Remark
T/gate start	2 times	2 times	When T/gate is triggered by Remote Contol or T/ Console Switch
T/gate start	n.a.	n.a.	When T/gate is triggered by T/gate Inner Switch c T/gate Outer Handle Switch
T/gate stop	n.a.	n.a.	
System error	3 Times	-	PCU/Tailgate antiplay active, 0ver-/undervoltage condition, Endposition-/position error, spindle err CAN error, Latch closed when Tailgate open
T/gate not closed	10 times	10 times	Latch Lock Switch not present
During Calibration run	Continuous ON-OFF beeping	n.a.	Activate buzzer but not C_PTHazard
Max. End Position learned	n.a.	2 times	Buzzer confirms learning finished
Max. End Position deleted	1 time	n.a.	Buzzer confirms “position deleted”
Car is moving with open T/gate	10 times	n.a.	T/gate open AND Speed >3km/h

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Garage Position saved	2 times	n.a.	Buzzer confirms “New Garage Position”

*) Lamp will be synchronized by sending C_PTHazard simultaneously to Buzzer signal

Troubleshooting

Diagnosis And Testing - Power Tailgate System

The power Tailgate system is a complex system containing many components. In order to perform conclusive testing, receive outputs the power Tailgate control module must be checked.

The most reliable, efficient, and accurate means to diagnose the power Tailgate system requires the use of a GDS. Th can be used to observe current switch status recorded in the power Tailgate control module to help the technician dia an inoperative switch.

Before any testing of the power Tailgate system is attempted, the battery should be fully charged, all power Tailgate s inhibitors read and understood (Refer to power Tailgate system description for list).

Following are quick reference diagnostic tables to help when diagnosing and testing the power Tailgate system.

CONDITION	POSSIBLE CAUSES	CORRECTION
Tailgate opens unexpectedly	Accidental activation or Failure of open/close command switch	Check for shorted or defective switch
	Failure of latch assembly	Check wiring connections
		Check for trouble codes, replace latch if necessary
	Failure of Power Tailgate or Body Control module	Disconnect then reconnect battery or fus reset module, function tailgate, if no funct exists check for loose wire connections, Body Diagnostic Manual for detailed pro
Tailgate will not power open or close	Not in Park or false indication	Check switch status with SCAN tool
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
	Blown fuse	Check for blown fuse
	Gas strut failure	Check condition of tailgate gas struts
	BCM or tailgate control module critical fault codes	Check code status with SCAN tool
	Failure of latch assembly	Check wire connections and for blown fi
		Check for foreign matter preventing the operation of latch assembly
Tailgate will not power open or close	Failure of motor assembly	Test motor assembly
	Binding or sticking of components	Establish location of binding and replace necessary components
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to wiring diagrams
Power loss during Tailgate	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics. to wiring diagrams
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery

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operation	Failure of Power Tailgate or Body Control Module	Check for diagnostic trouble codes with tool
	Failure of motor assembly	Test motor assembly
No power latching in primary and/or secondary positions	Failure of latch assembly	Check wire connections and for blown fu
		Check for diagnostic trouble codes and c with SCAN tool
		Troubleshoot using Body Diagnostic Mar Replace latch assembly, if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
	Failure of Power Tailgate or Body Control Module	Check for diagnostic trouble codes with tool
	Tail Gate seal force too high	Inspect seals for damage, mis-assembly, matter or other possible obstruction
	Failure of motor assembly	Test motor assembly
Latch will not release from primary position	Not in Park or false indication	Check switch status with SCAN tool
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
	Blown fuse	Check fuse and replace if required
	Failure of latch assembly	Check switch status with scan tool
		Check for foreign matter or damaged components preventing the operation of l assembly
		Troubleshoot using body diagnostic manu Replace latch assembly, if necessary
	Failure of outside handle connection	Check handle of brainplate.
	Failure of Power Tailgate or Body Control Module	Check for diagnostic trouble codes and c with scan tool
	Binding or sticking of components	Establish location of binding and replace necessary components
Key fob or overhead console switch does not power operate tailgate	Blown Fuse	Check fuse and replace
	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
Does Not Power Unlatch	Failure of latch assembly	Check for foreign matter preventing the operation of latch assembly
		Check for diagnostic trouble codes and c with scan tool
		Check pawl and/or ratchet switch with S tool
		Troubleshoot using body diagnostic manu
	Failure of Power Tailgate Module	Troubleshoot using body diagnostic manu
	Failure of Body Control Module (BCM)	Troubleshoot using body diagnostic manu
		Replace BCM if necessary

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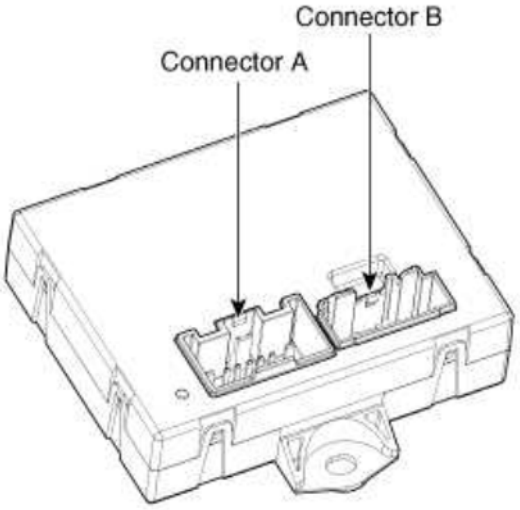
Does Not Power Unlatch	Failure of key fob	Reprogram key fob
		Replace key fob if necessary
	Failure of Power Tailgate Module	Check for diagnostic trouble codes with tool, see Body Diagnostic Manual for detailed pro
	Failure of tailgate motor assembly	Check for foreign matter preventing the operation of motor assembly
		Check wire connections
		Motor clutch does not engage, replace as
		Full open switch inoperative, replace swit necessary
		Troubleshoot using Body Diagnostic Mar Replace motor, if necessary
Tailgate does not stay open	Failure of tailgate gas struts	Replace gas struts
		Check for broken attachments
High inside/outside opening effort	Failure of tailgate gas spindle	Replace gas spindle
		Check for broken attachments
	Drive unit jammed or did not disengage	Troubleshoot using Body Diagnostic Mar Replace components, if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
Tailgate continues to cinch closed	Failure of latch assembly	Check wire connections and for blown fu Check switches with SCAN tool
Tail gate continues to power close	Failure of latch assembly	Check wire connections
		Check for foreign matter
		Troubleshoot using Body Diagnostic Mar
	Control Module	Check for diagnostic trouble codes with tool
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to wiring diagrams
Tailgate continues to power open	Failure of PTGM or BCM	Check for diagnostic trouble codes and c see Body Diagnostic Manual for detailed procedures
	Failure of motor assembly	Check for continuous drive condition
	Wiring problems (system or vehicle)	Troubleshoot using electrical schematics Refer to Wiring Diagrams
Tailgate opens very slowly	Battery voltage at PTGM is too low	Check for proper voltage at the PTGM Charge battery
	Failure of tailgate gas struts	Replace gas struts, if necessary
	Binding or sticking of components	Establish location of binding and replace necessary components
	Grade of vehicle too steep for power operation	Operate tailgate manually

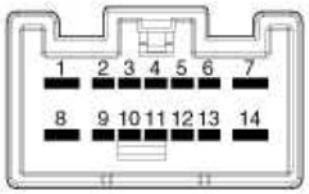
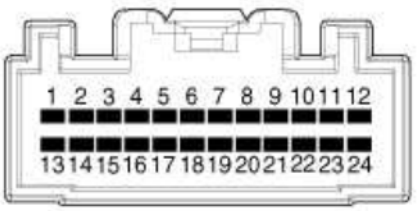
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	Failure of tailgate motor assembly	Replace motor assembly, if necessary
Squeaks, Noises and rattles	Foreign material in tail gate compartment	Remove foreign material
	Worn/Loose components	Check and tighten loose components

Body Electrical System

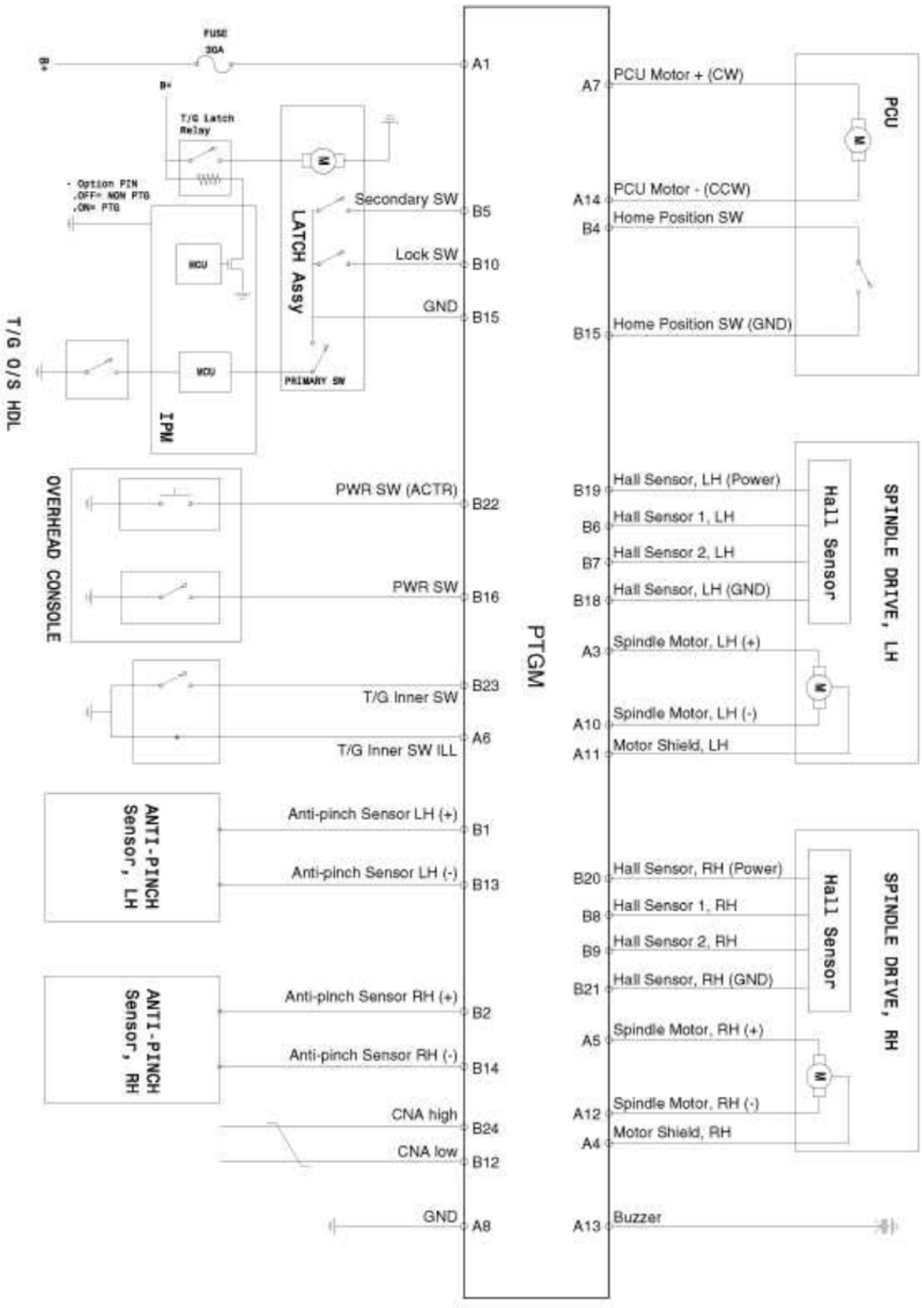
Circuit Diagram



Connector A		Connector B			
					
No.	**Description**	**No.**	**Description**	**No.**	**Description**
1	Power supply	1	Anti-Pinch strip 1 (LH)	13	Anti-Pinch strip 1 GND (LH)
2	-	2	Anti-Pinch strip 2 (RH)	14	Anti-Pinch strip 2 GND (RH)
3	Spindle motor left (+)	3	-	15	GND (PCU home switch)
4	Noise shield GND (RH)	4	PCU home position switch	16	ON/OFF switch
5	Spindle motor right (+)	5	Latch secondary switch	17	-
6	Tailgate switch illumination	6	Hall sensor left 1	18	Hall GND left
7	PCU cinching (+)	7	Hall sensor left 2	19	Hall power left
8	GND (Power1)	8	Hall sensor right 1	20	Hall power right
9	-	9	Hall sensor right 2	21	Hall GND right
10	Spindle motor left (-)	10	Latch lock switch	22	Tailgate console switch
11	Noise shield GND (LH)	11	-	23	Tailgate inner switch
12	Spindle motor right (-)	12	CAN Low	24	CAN High
13	Buzzer				
14	PCU cinching (-)				

Block Diagram

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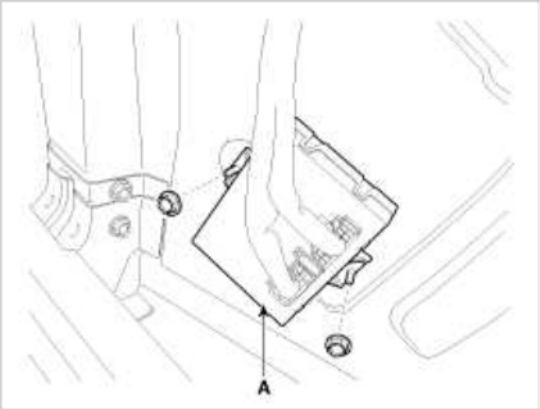


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Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear left luggage side trim.
   (Refer to Body - "Interior Trim")

3. Remove the power tailgate unit (A) connectors after loosening mounting nuts (2EA).



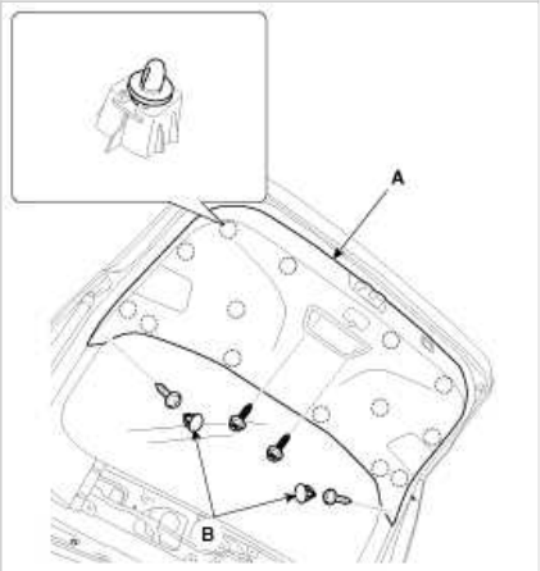
Installation

1. Install the power tailgate unit.
2. Install the rear left luggage side trim.
3. Connect the negative (-) battery terminal.

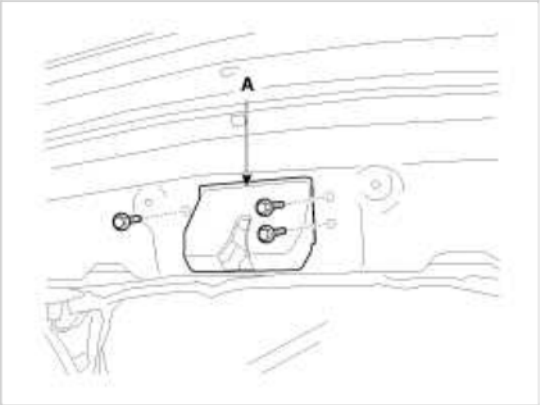
Body Electrical System

Removal

1. Disconnect the negative (-) battery terminal.
2. After loosening the mounting screws, then remove the tailgate trim (A).
   (Refer to the Body - "Tailgate")

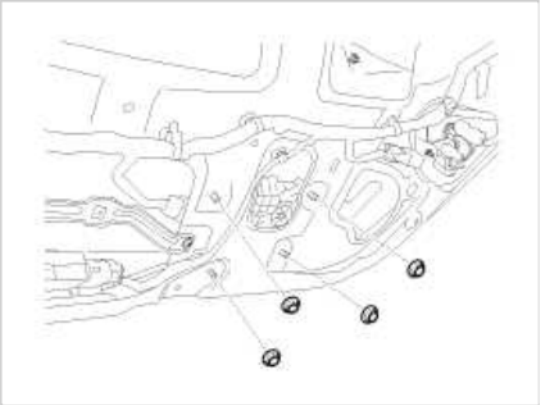


3. Remove the tail gate latch assembly (A) after loosening the mounting bolts.

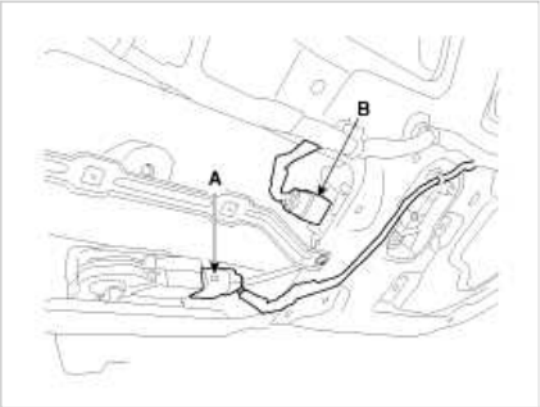


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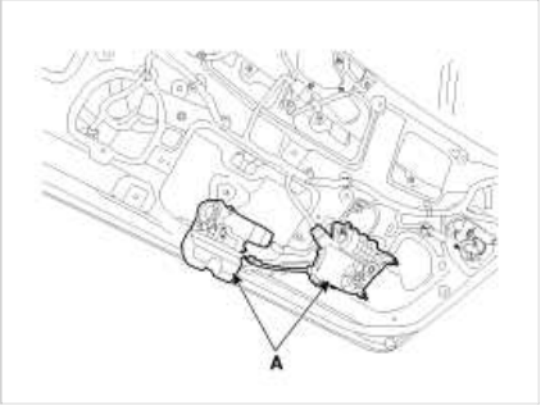
4. Loosen the PCU (Power Closing Unit) mounting nuts.



5. Disconnect the power tailgate latch connector (A) and PCU connector (B).



6. Remove the power tailgate latch & PCU assembly (A).



Installation

1. Install the power tailgate latch & PCU assembly.
2. Install the tailgate trim.
3. Connect the negative (-) battery terminal.

Inspection

Power Tailgate Inspection With GDS

1. Check the power Tailgate module input/output value by using the GDS. If the operation of power Tailgate module abnormal, replace power trunk drive unit.
2. To check the DTC of the power trunk module, select "PTM"

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3. Select "Input/output monitoring".

Current Data

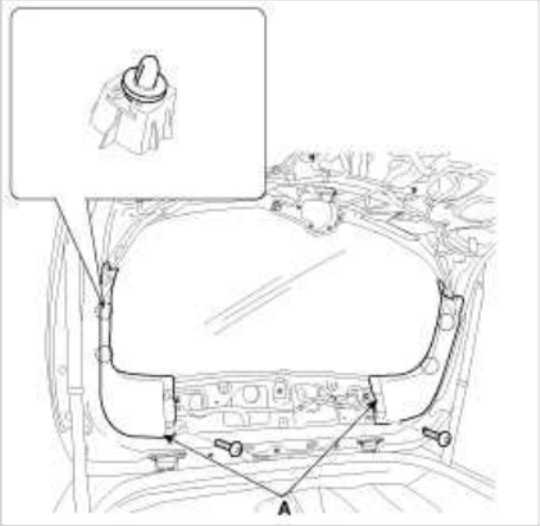
Selective Display | Full List | Graph | Items List | Reset Min Max | Record | Stop | Grouping | VSS

Sensor Name	Value	Unit
Power Tailgate	ON	-
Battery Voltage	12.2	V
Driver Motor Operating Current - LH	0.08	A
Cinching Motor Cinching Current	0.00	A
Tailgate Position	95.2	%
Hall Sensor Operation status LH	0	RPM
ECU Temperature	18	°C
Driver Motor Operating Current -RH	0.24	A
Hall Sensor Operation status RH	0	RPM
LED On/Off	ON	-
Tailgate Inner Switch	PRESSED	-
Tailgate Interior Switch (Console Switch)	NOT PRESS	-
PCU Home Position Switch Status	OFF	-
Latch Lock Switch	ON	-
Latch Primary Switch Status	ON	-
Latch Secondary Switch Status	ON	-
Cinching Motor Command Status	OFF	-
Tailgate Command Status	Not Moving	-
Buzzer State	Inactive	-
Hazard Lamp	Inactive	-
Tailgate Master Switch (Tailgate On/Off Switch)	ON	-
Unknown Tail Gate Position Flag	KNOWN	-
Battery Power Voltage In Range	IN RANGE	-

Body Electrical System

Removal

1. Disconnect the negative (-) battery terminal.
2. After loosening the mounting screws, then remove the tailgate side trim (A).
   (Refer to Body - "Tailgate")



3. Remove the anti-pinch strip sensor connector.

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4. Remove the anti-pinch strip (A) after removing the clips (5EA).



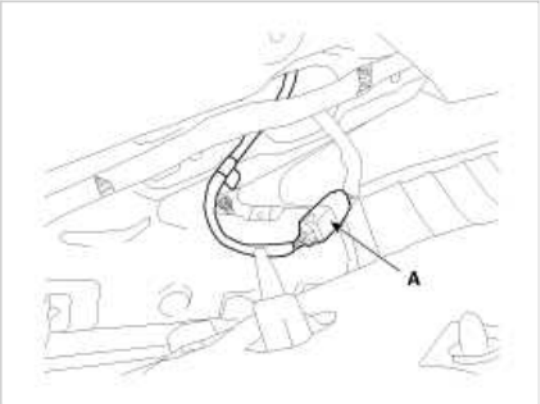
Installation

1. Install the tailgate anti-pinch strip.
2. Install the tailgate side trim.
3. Connect the negative (-) battery terminal.

Body Electrical System

Removal

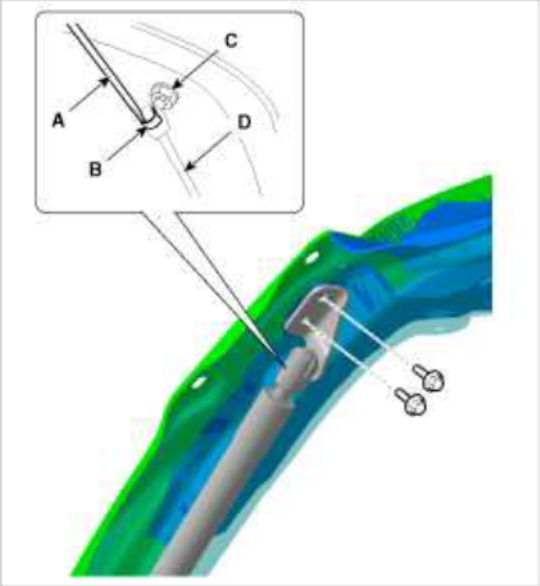
1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim and Luggage side trim.
   (Refer to the Body - "Tailgate")
3. Disconnect the power PTG spindle connector (A).



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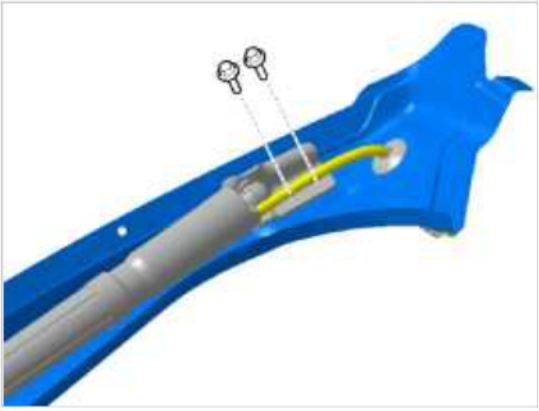
4. Using a screwdriver (A), lift up slightly the socket clips (B) of both ends on the lifer (D), and then remove the PTG spindle from the bracket (C).

> **⚠ CAUTION**
> Take care not to be closed the tail gate, when removing the lift.



5. If it is necessary, remove the nuts and replace the PTG spindle bracket (A).

Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0 lb-ft)



Installation

1. Connect the PTG spindle, bracket and connector.

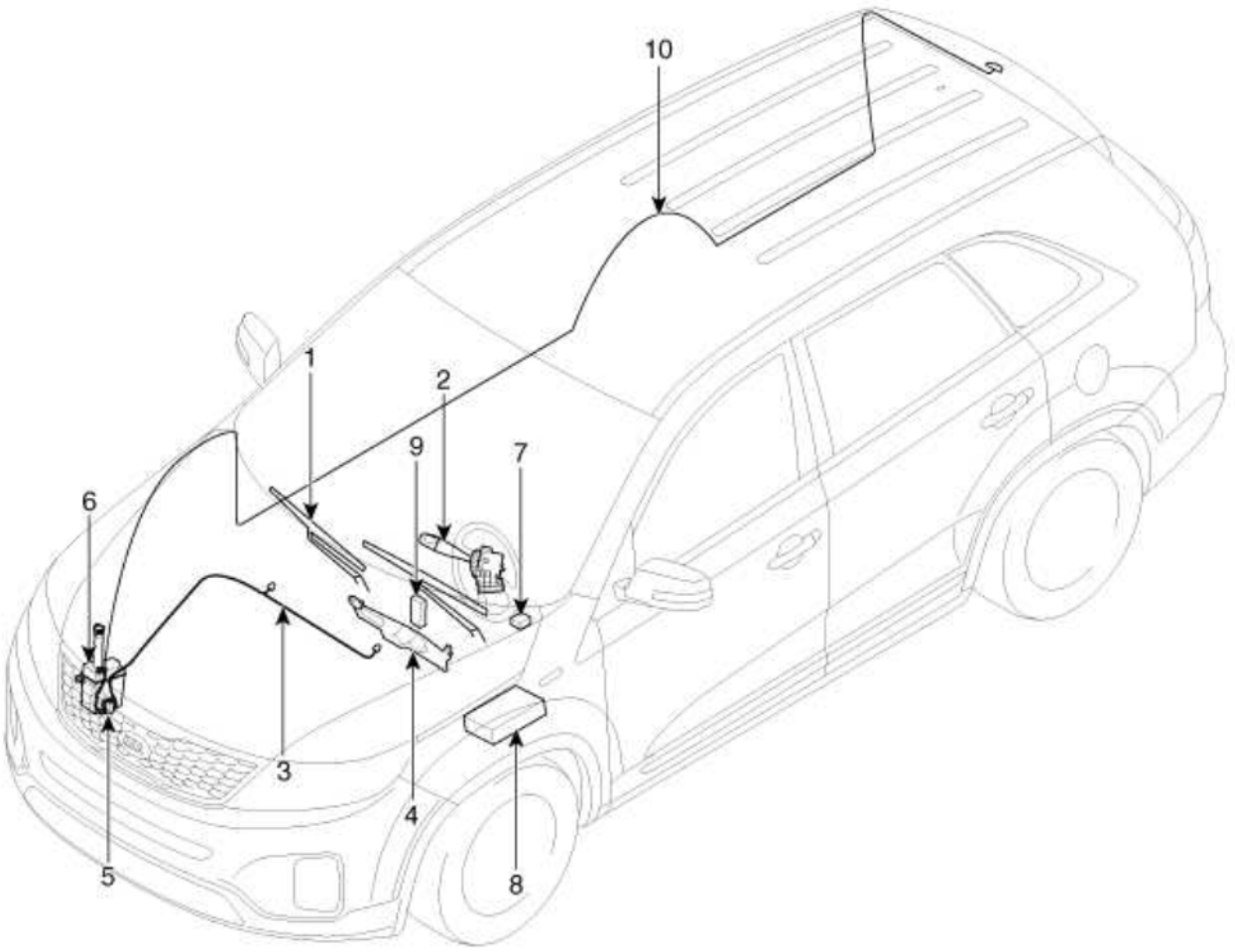
Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0 lb-ft)

2. Install the tailgate trim and Luggage side trim.
3. Connect the negative (-) battery terminal.

Body Electrical System

Component Location

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1. Windshield wiper arm & blade	6. Washer reservoir
2. Wiper & washer switch	7. Head lamp washer switch (Crash pad side garnish)
3. Windshield washer hose	8. Front wiper relay (Engine room relay box)
4. Windshield wiper motor & linkage	9. Rear wiper relay (ICM relay box)
5. Washer motor	10. Rear washer hose & nozzle

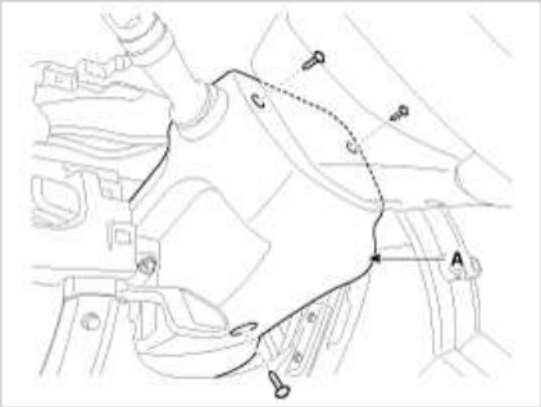
Body Electrical System

Removal

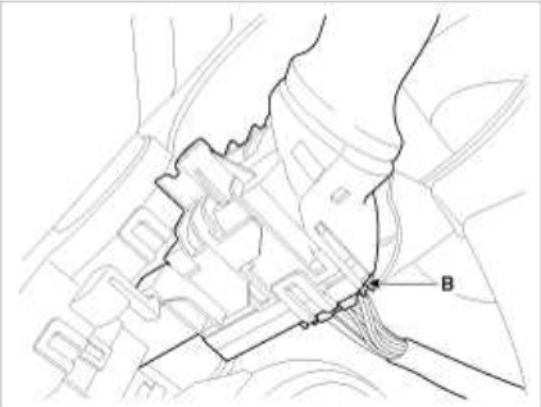
1. Disconnect the negative (-) battery terminal.

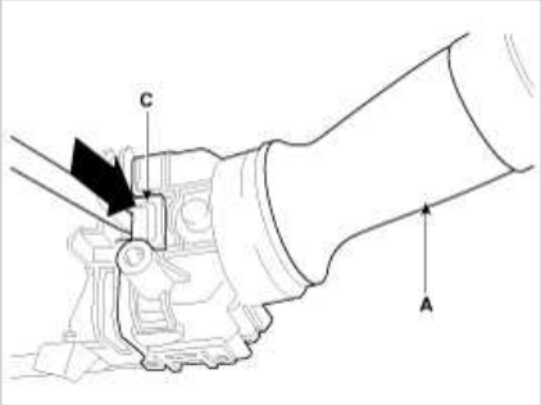
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2. Remove the steering column upper and lower shrouds (A) after loosening 3 screws.



3. Remove the wiper switch (A) with pushing the lock pin (C) after disconnecting the connector (B).





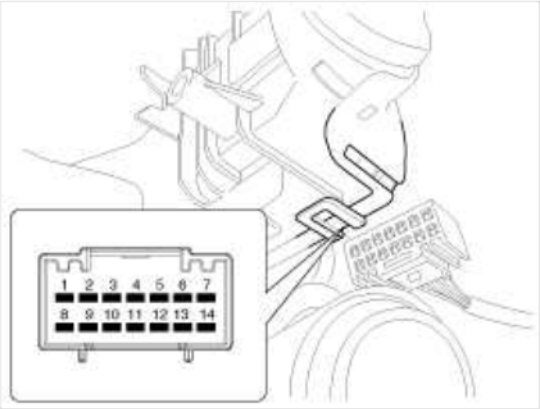
Installation

1. Install the windshield wiper switch.
2. Connect the wiper switch connector.
3. Install the steering column upper and lower shrouds.

Inspection

Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, wiper and wiper switch.

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Wiper Switch

Terminal / Position	3	9	2	8	10	1	12	13
MIST	○		○		○	○		
OFF	○		○					
INT	○		○		○		○	○
LOW	○				○			
HI		○			○			

Washer Switch

Terminal / Position	10	11
OFF		
ON	○	○

Rear Wiper Switch

Terminal / Position	6	14	7
INT	○		○
OFF			
ON	○	○	

Rear Washer Switch

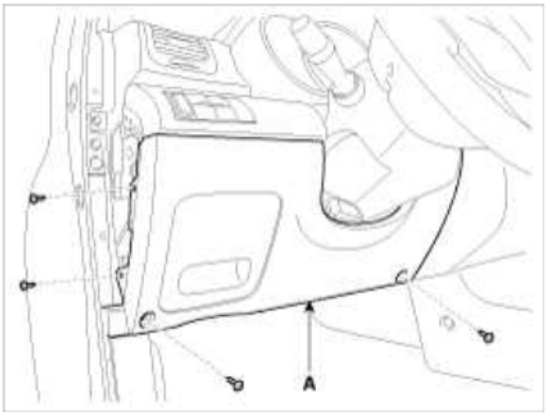
Terminal / Position	6	5
OFF		
ON	○	○

Head Lamp Washer Switch

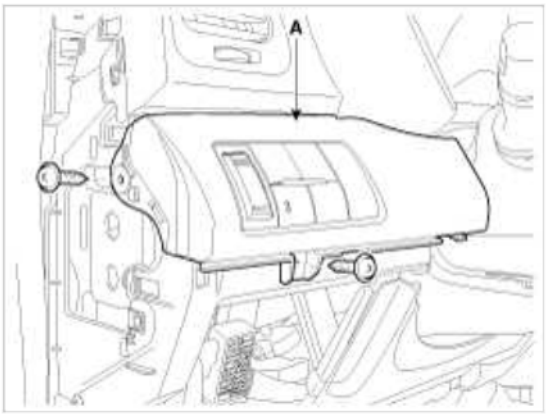
1. Disconnect the negative(-) battery terminal.

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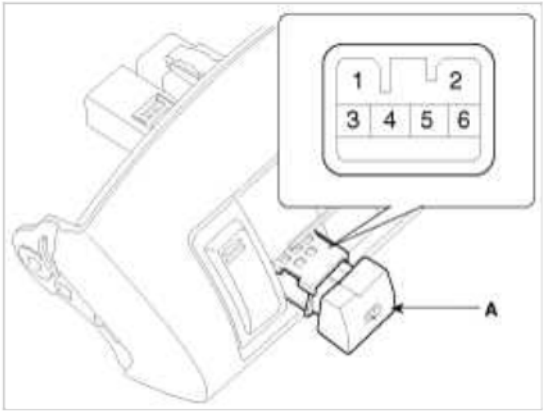
2. Remove the crash pad lower panel (A).
   (Refer to Body - "Crash pad")



3. Remove the side garnish (A) after loosening the screws.



4. Remove the head lamp washer switch (A).



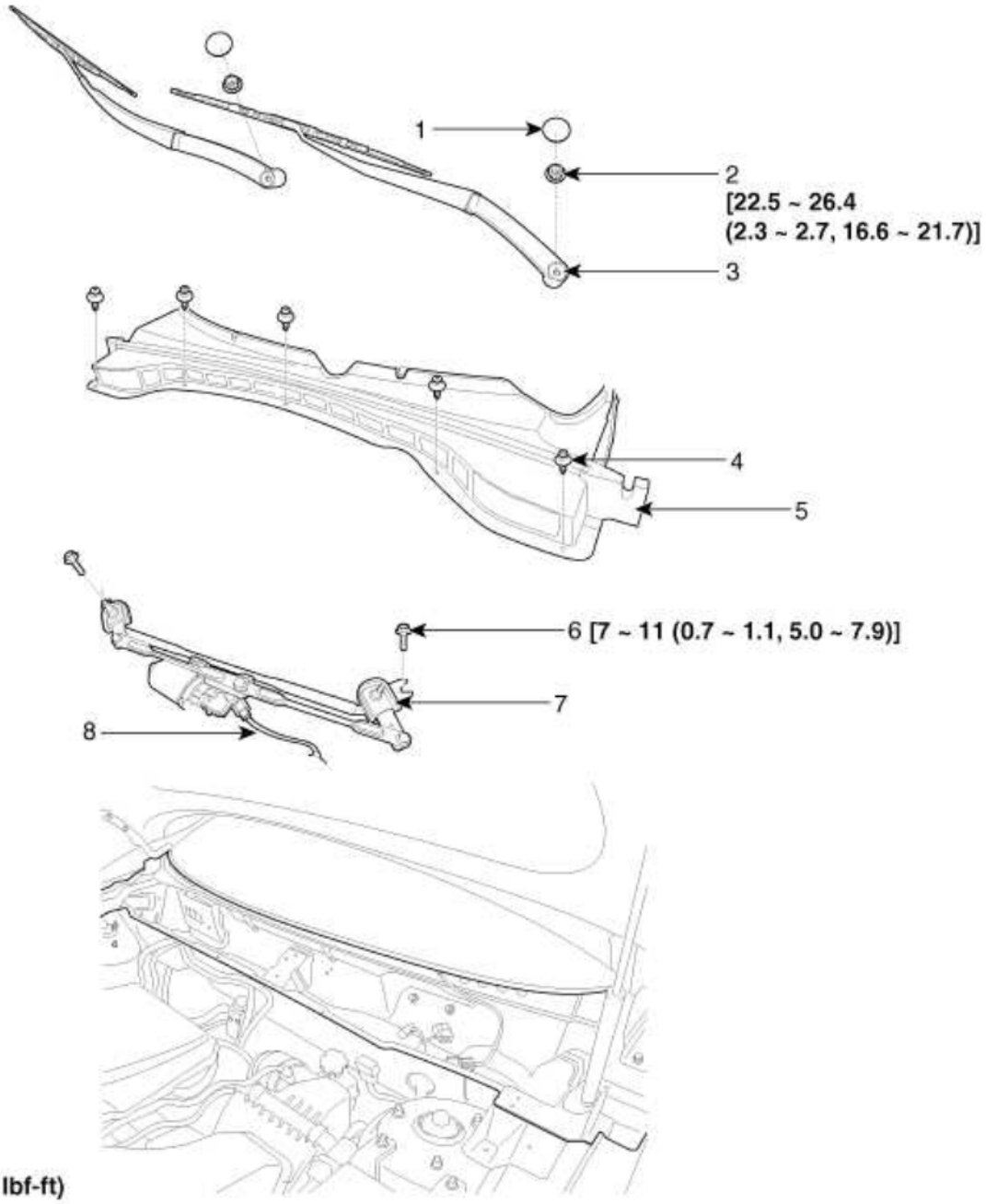
5. Make sure that the continuity exists between the terminals as below. If it is not normal condition, replace the head washer switch

Position / Terminal	ON	OFF	Remarks
1			
4			
6			Illumination +
2			Illumination -

Body Electrical System

Component Location

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Torque : N.m (kgf.m, lbf-ft)

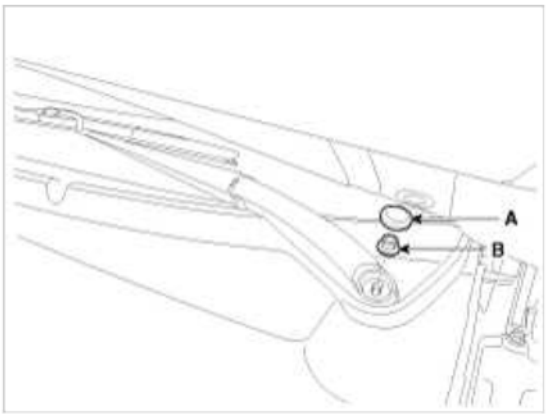
1. Cap 2. Nut 3. Wiper arm & blade 4. Retainer	5. Cowl top cover 6. Bolt 7. Wiper motor & linkage assembly 8. Wiper motor connector

Body Electrical System

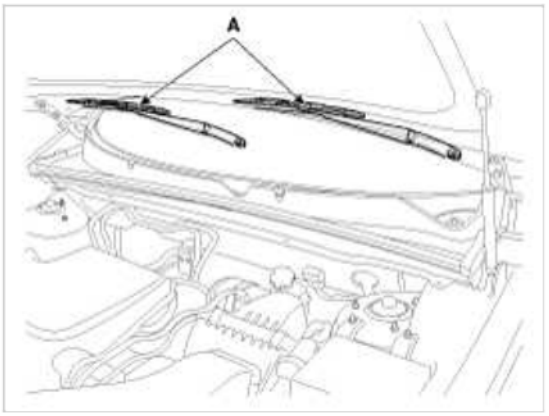
Removal

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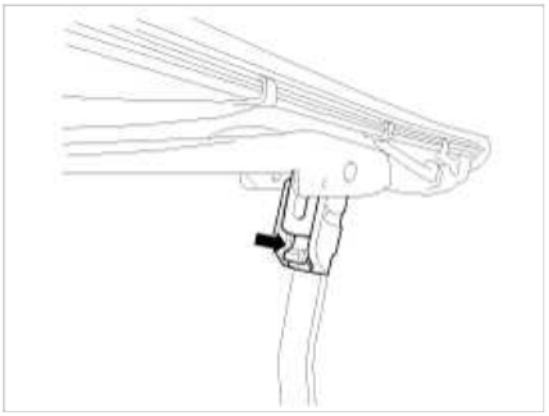
1. Remove the windshield wiper arm and blade after removing a nut (B) and wiper cap (A).



2. Remove the windshield wiper arm and blade (A) after removing a nut.

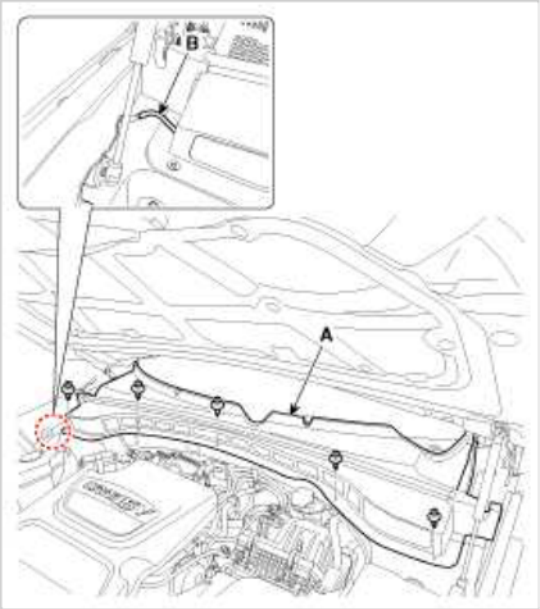


3. If necessary, release the wiper blade fixing clip by pulling up and remove the wiper blade from the inside radius of arm.

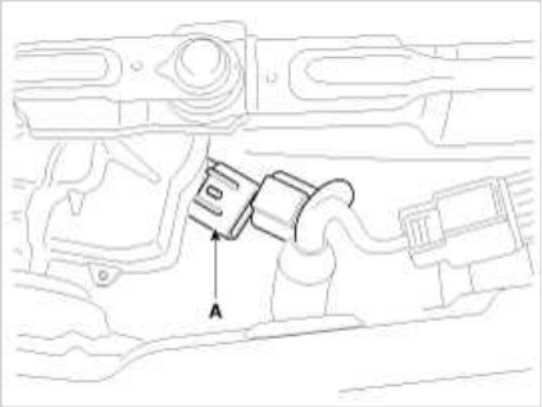


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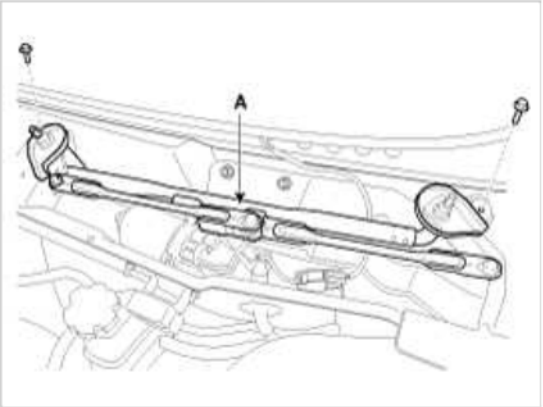
4. Remove the weather strip and the cowl top cover (A) after removing retainers.



5. Disconnect the wiper motor connector (A) from the wiper motor & linkage assembly.

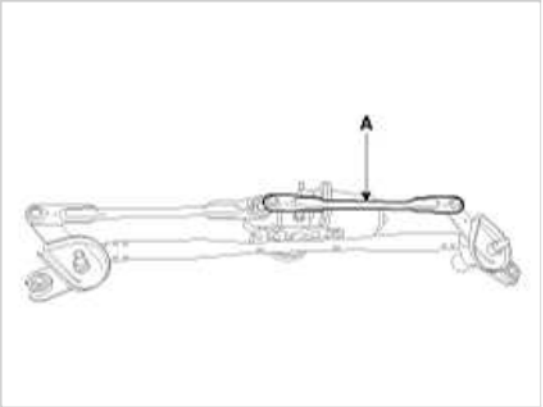


6. Remove the windshield wiper motor and linkage assembly (A) after removing 2 bolts.



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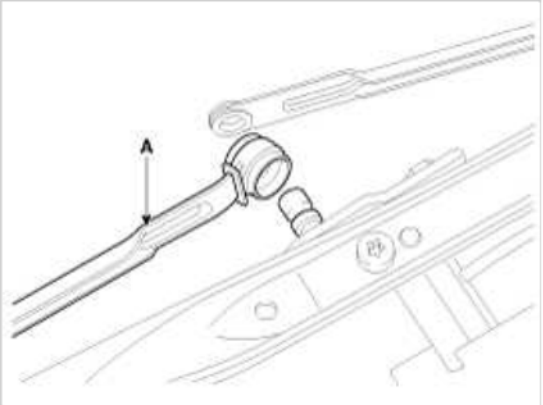
7. Hold the wiper motor crank arm and remove the upper linkage (A) from the wiper motor crank arm.



⚠ CAUTION

Before remve the wiper motor and linkage assembly, make sure that the linkage is stoped at auto stop position
To install the wiper motor crank arm exactly, check that the linkage is aligned with the crank arm in straight line and the angle of each linkages.
Be careful not to bend the linkage.

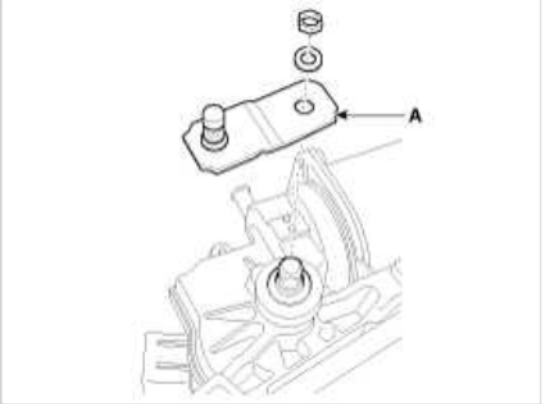
8. Remove the lower linkage (A) from the wiper motor crank arm.



⚠ CAUTION

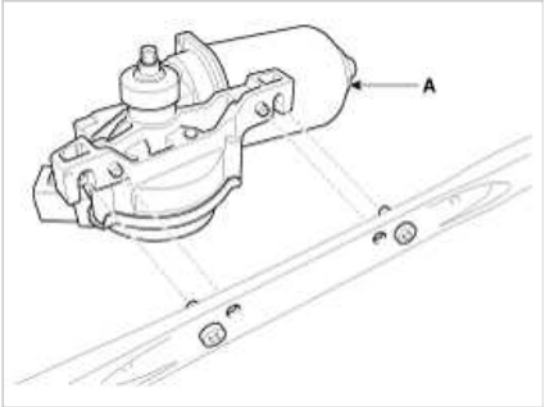
To install the wiper motor crank arm exactly, check that the linkage is aligned with the crank arm in straight line and the angle of each linkages.
Be careful not to bend the linkage.

9. Remove the crank arm (A) after loosening a nut.



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10. Remove the wiper motor (A) after loosening the screws.



Installation

1. Install the wiper motor.
2. Install the crank arm.

Torque :
12.7-17.6Nm (1.3-1.8, kgf.m, 9.4-13.0 lbf.ft)

⚠ CAUTION
To install the wiper motor crank arm, make sure that the linkage is aligned with the crank arm in straight line an set the angle of each linkages exactly.

3. Install the lower and upper linkage to the wiper motor crank arm.

⚠ CAUTION
To install the wiper motor crank arm, make sure that the linkage is aligned with the crank arm in straight line an set the angle of each linkages exactly.
Be careful not to bend the linkage.

4. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

Torque :
7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

5. Install the cowl top cover.
6. Install the windshield wiper arm and blade.

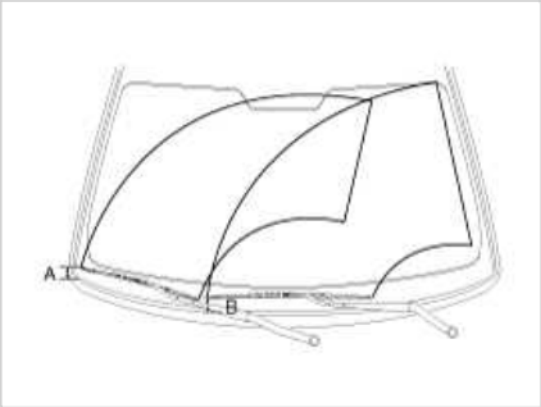
Torque :
22.5~26.4 Nm (2.3~2.7 kgf.m, 16.6~21.7 lbf.ft)

NOTICE
- The windshield wiper motor must be cycled to make sure that it is in the park position. If necessary, adjust the wiper arm and blade.

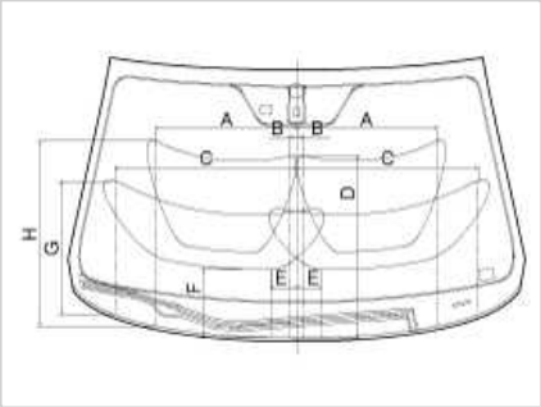
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7. Install the wiper arm and blade to the specified position.

Specified position	A	B
Distance [in (mm)]	1.37 ± 0.2 (25±5)	1.17±0.2 (30±5)



8. Set the cowl top cover on the specified spray position.



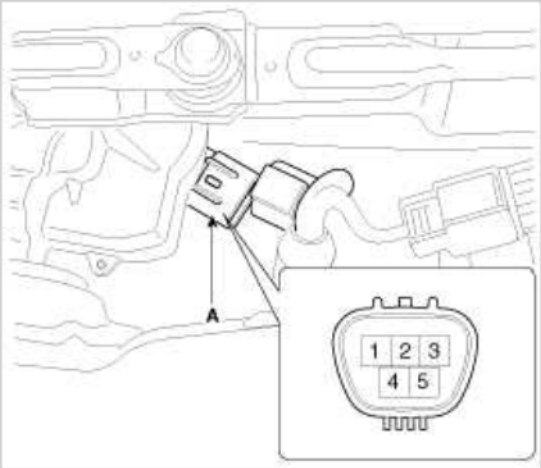
Specified position	Distance (in)	Distance (mm)
A	18.2	463.0
B	0.9	24.0
C	23.5	598.0
D	23.4	595.0
E	3.2	82.0
F	8.7	223.0
G	17.1	436.5
H	23.8	606.0

Inspection

Speed Operation Check

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1. Remove the connector (A) from the wiper motor.



2. Attach the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 5.
3. Check that the motor operates at low or high speed as below table.

Terminal / Position	3	2	1	4
OFF	○			○
LOW		○		○
HIGH		○	○	

⚠ CAUTION

Common sources of contamination are insects, tree sap, and hot wax treatments used by some commercial car washes. If the blades are not wiping properly, clean both the window and the blades with a good cleaner or mi detergent, and rinse thotoughlly with clean water.

Inspection

Front and Rear Washer Motor

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

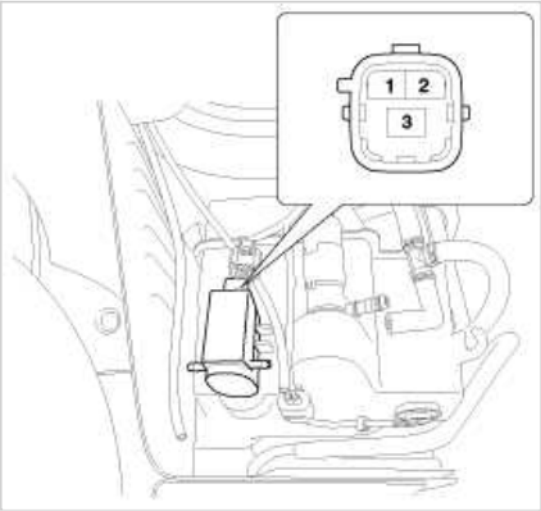
NOTICE

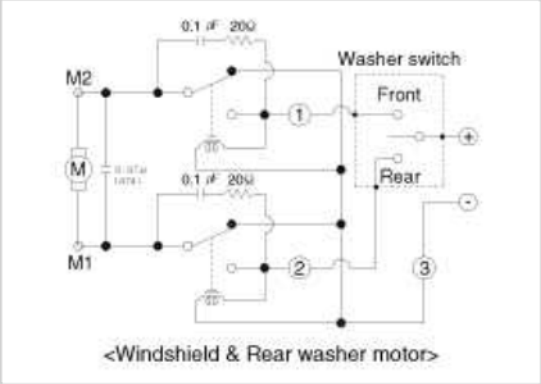
Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.

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4. If they are abnormal, replace the washer motor.
   [Front & Rear washer]
   1. Windshield washer (+)
   2. Ground
   3. Rear washer (+)





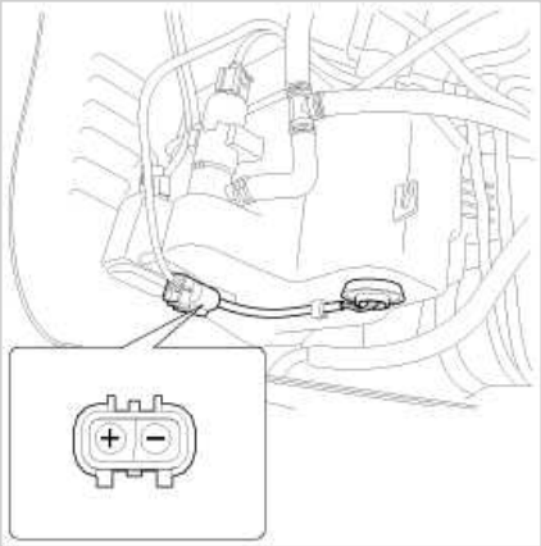
<Windshield & Rear washer motor>

Washer Fluid Level Sensor Switch

1. Disconnect the negative(-) battery terminal.
2. Drain the washer fluid less than 650 cc.
3. Check for continuity between the No. 1 and No.2 terminal in each float position.
   There should be continuity when the float is down.
   There should be no continuity when the float is up.

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4. If the continuity is not as specified, replace the washer fluid level switch



Terminal / Position	1	2
Over 650cc		
Under 650cc	○	○

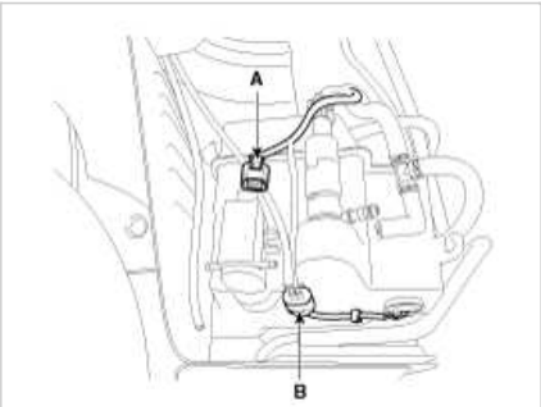
(Tolerance : -50cc ~ +100cc)

Removal

⚠ CAUTION

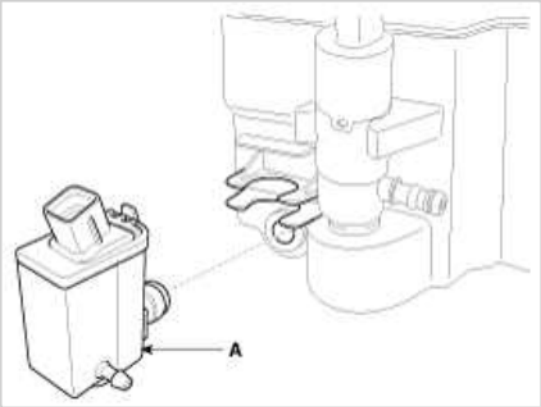
- When servicing the washer pump, be careful not to damage the washer pump seal.
- Do not operate the washer pump before filling the washer reservoir.
  Failure to do so could result in premature pump failure.

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
   (Refer to Body - "Front bumper")
3. Remove the washer hose and disconnect the washer motor connector (A) and washer fluid level sensor connecto

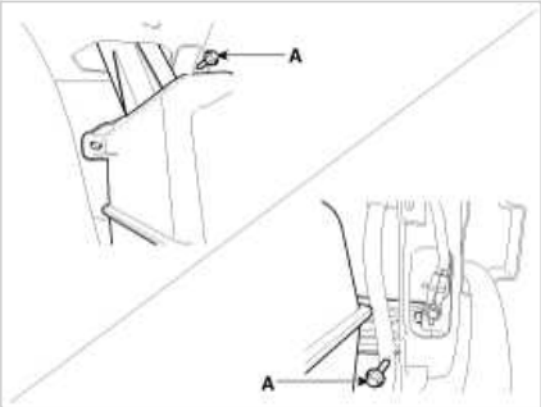


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4. Remove the washer motor (A).



5. Remove the washer reservoir after removing bolts (A).



Installation

1. Reassemble the washer reservoir.

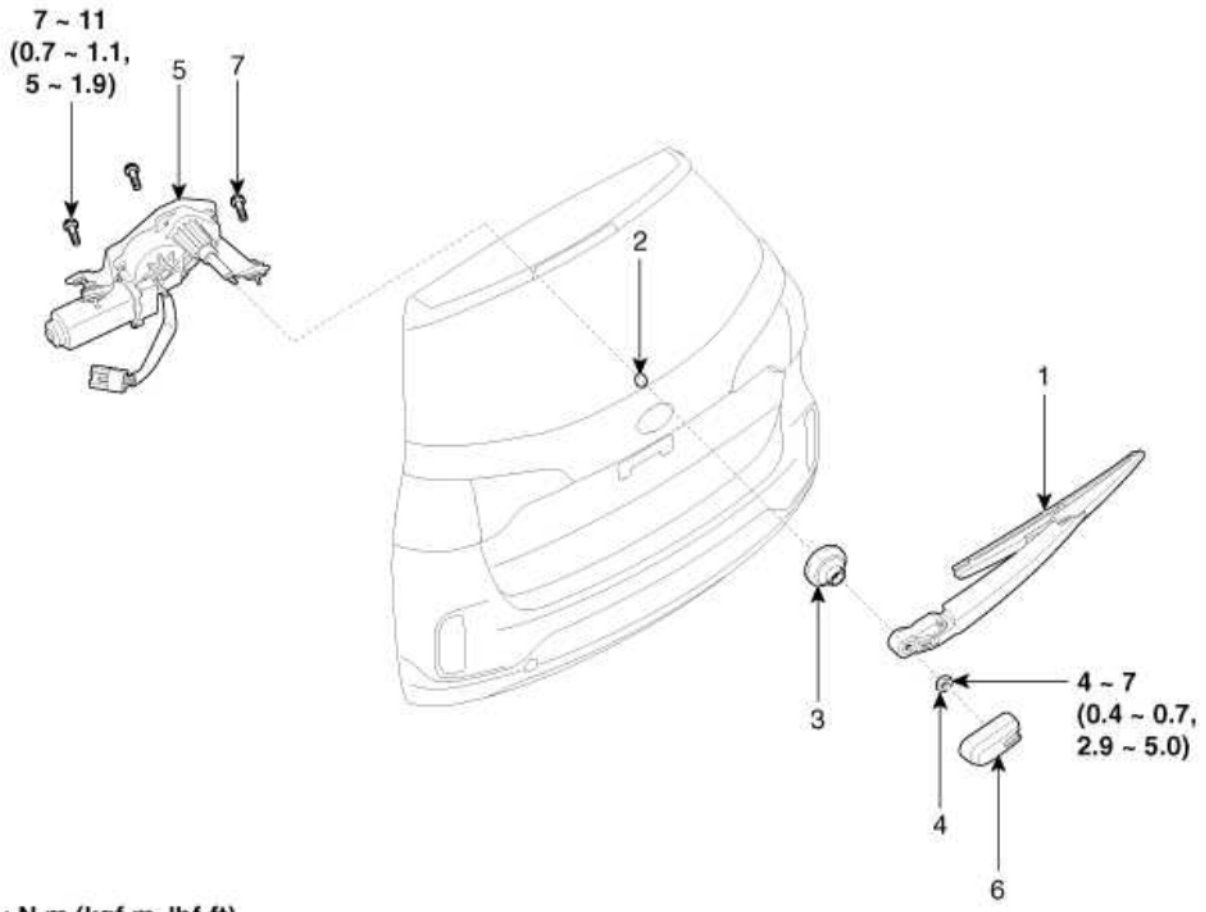
> **NOTICE**
>
> Before installing the pump motor, check the filter for foreign material or contamination. if necessary, clean the fi into the pump motor.

2. Connect the washer motor connector and washer hose.
3. Install the washer motor.
4. Reassemble the front bumper cover.

Body Electrical System

Component Location

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Torque : N.m (kgf.m, lbf-ft)

1. Rear wiper arm & blade 2. Tailgate glass hole 3. Grommet 4. Rear wiper arm nut	5. Rear wiper motor assembly 6. Head cap 7. Rear wiper motor bolt

Body Electrical System

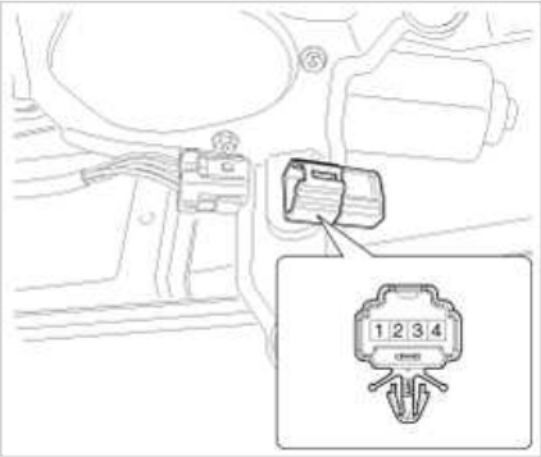
Inspection

Rear Wiper Motor

1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 3 and 4 respectively.

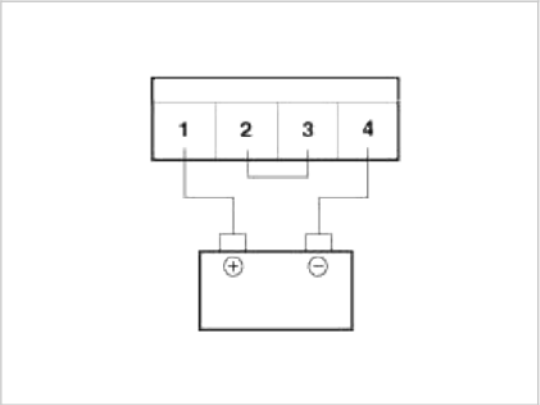
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3. Check that the motor operates normally. Replace the motor if it operates abnormally.
   1. IGN +
   2. Parking
   3. Switch
   4. Ground



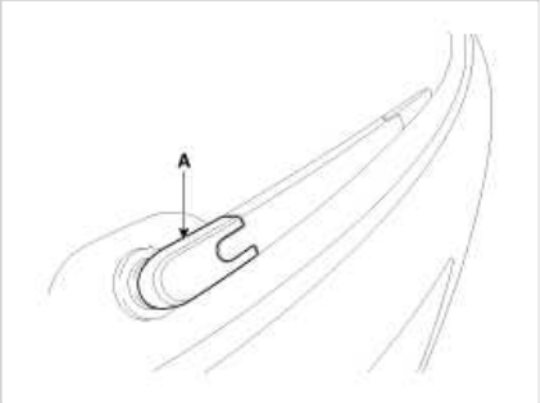
Automatic Stop Operation Check

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 3.
3. Connect terminals 2 and 3.
4. Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 4.
5. Check that the motor stops running at the off position.



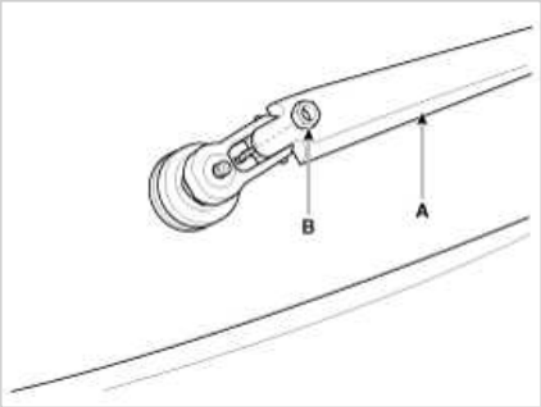
Removal

1. Detach the rear wiper cap (A).

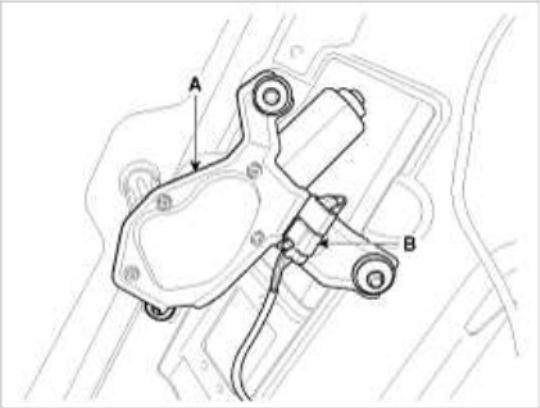


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2. Remove the rear wiper arm & blade (A) after removing rear wiper HEX nut (B).



3. Open the tailgate then remove the tailgate trim.
   (Refer to Body - "Tailgate")
4. Disconnect the rear wiper motor connector (B) then remove the rear wiper motor (A) after loosening bolts (3EA)



Installation

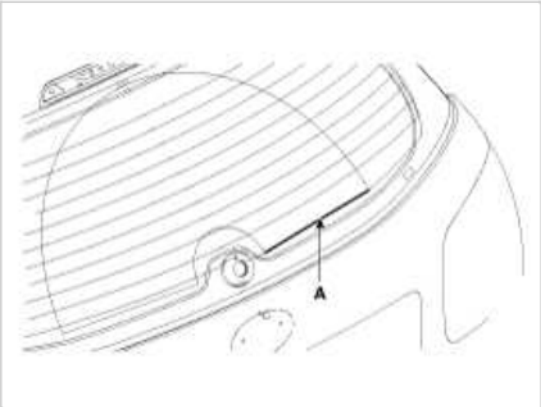
1. Install the rear wiper motor assembly.

Tightening torque Nut :
7 ~ 11 N.m (0.7 ~ 1.1 kgf.m, 5 ~ 7.9 lbf-ft)

2. Install the tailgate trim.
3. Install the rear wiper arm and rear wiper cap.

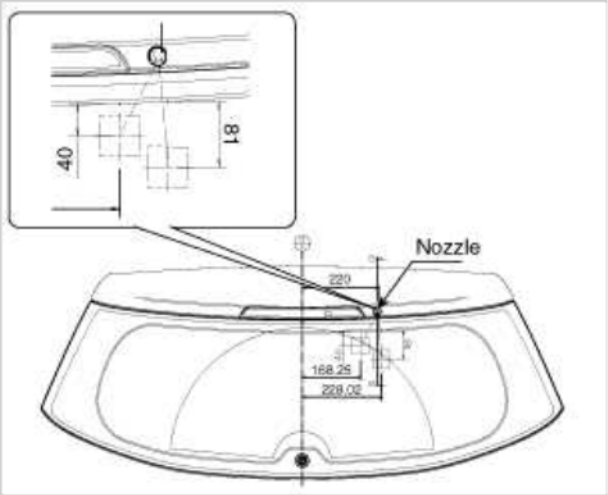
Tightening torque Nut(B) :
4 ~ 7 N.m (0.4 ~ 0.7 kgf.m, 2.9 ~ 5.0 lbf-ft)

4. Install the rear wiper arm and blade to align with black rear defogger line (A).



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5. Set the rear washer nozzle on the specified spray position.

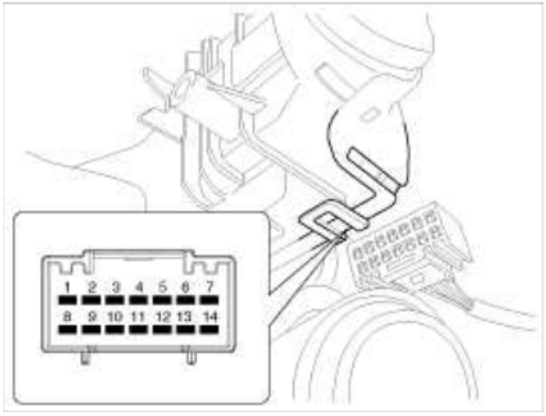


Specified position	Distance (in)	Distance (mm)
A	1.57	40
B	3.18	81
C	8.66	220
D	6.61	168
E	8.97	228

Body Electrical System

Inspection

Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, wiper and wiper switch.



Rear Wiper Switch

Terminal / Position	6	14	7
INT	○	—	○
OFF			
ON	○	○	

Rear Washer Switch

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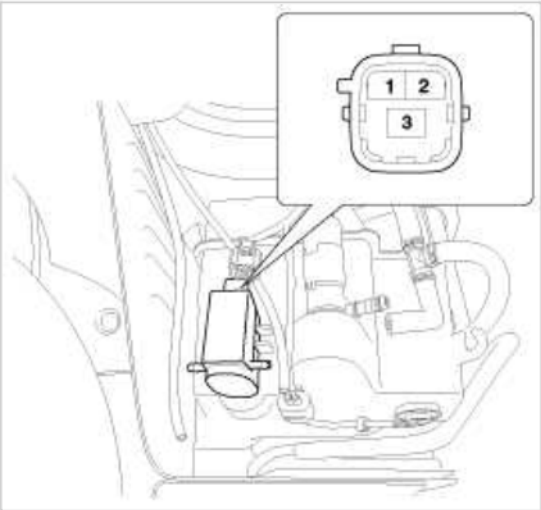
Terminal / Position	6	5
OFF		
ON	○	○

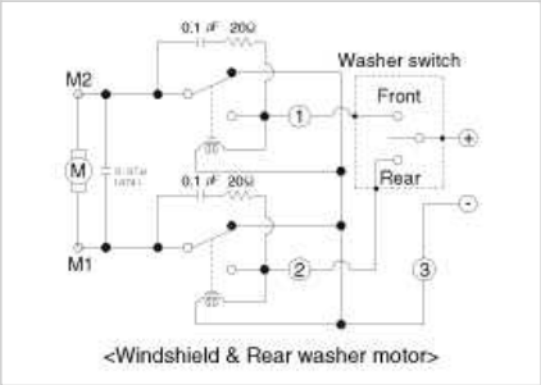
Inspection

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

> **NOTICE**
>
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Remove the front bumper cover.
   (Refer to Body - "Front bumper")
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 2 respectively to see that the washer moto and water is pumped.
4. Check that the motor operates normally.
   Replace the motor if it operates abnormally.
   [Front & Rear washer]
   1. Windshield washer (+)
   2. Ground
   3. Rear washer (+)





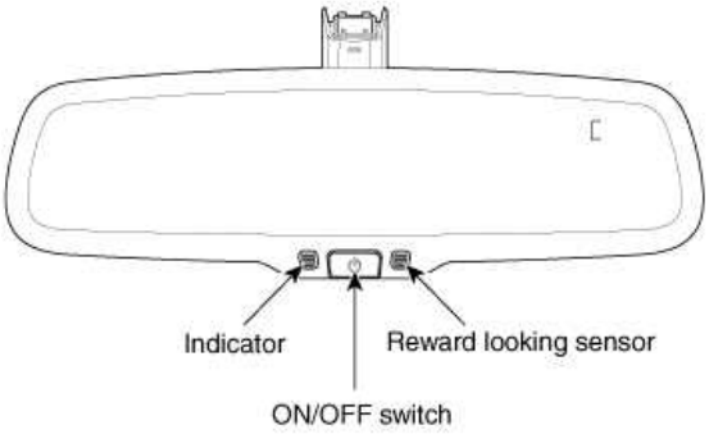
<Windshield & Rear washer motor>

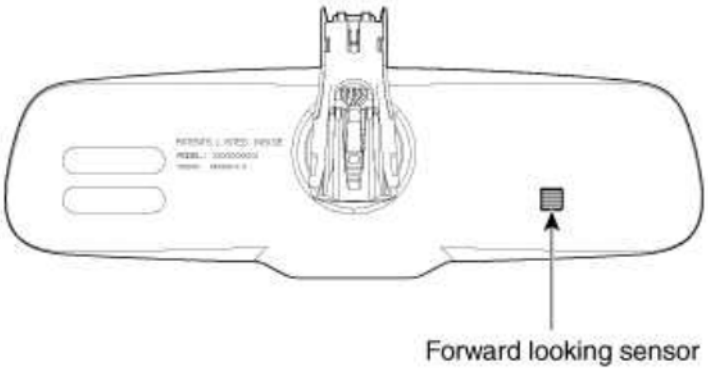
Body Electrical System

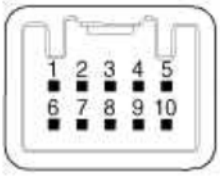
Components

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[COMPASS]

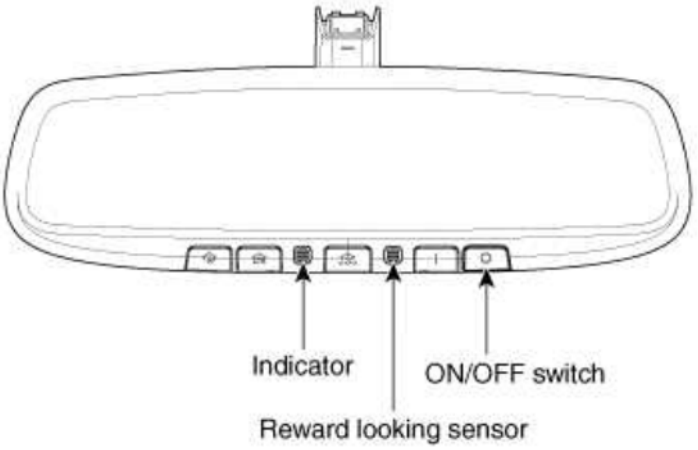


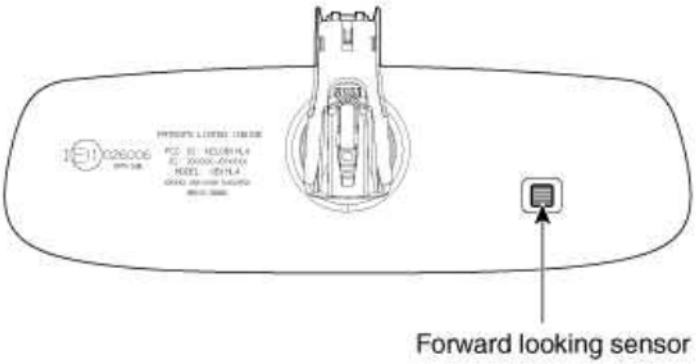


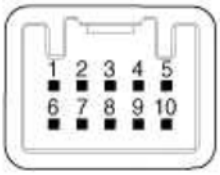
Connector	No.	Description	No.	Description
	1	-	6	-
	2	-	7	-
	3	-	8	GND
	4	-	9	Reverse signal
	5	-	10	IGN (+)

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[HOMELINK]





Connector	No.	Description	No.	Description
	1	-	6	Battery (+)
	2	-	7	-
	3	-	8	Ground
	4	-	9	Reverse signal
	5	-	10	IGN (+)

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Body Electrical System

Description

The ECM (Electro Chromatic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night order the user not to be dazzled by the light. The forward facing sensor detects brightness of the surroundings, while t rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of ' But, when the reverse gear is engaged, it stops functioning.

1. The forward facing sensor sees if the brightness of the surroundings is low enough for the mirror to operate its fun
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.

3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer d the mirror stops functioning.
   1. LED indicator
   2. ON/OFF Switch
   3. Rearward looking sensor
   4. Forward facing sensor



Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicl traveling behind you. The auto-dimming function can be controlled by the Dimming ON/OFF Button :

1. Pressing and holding the Feature Control button for more than 3 but less than 6 seconds turns the auto-dimming fi OFF which is indicated by the green Status Indicator LED turning off.
2. Pressing and holding the Feature Control button again for more than 3 but less than 6 seconds turns the auto-dimr function ON which is indicated by the green Status Indicator LED turning on.

> **NOTICE**
> The mirror defaults to the "ON" position each time the vehicle is started.

Body Electrical System

Inspection

Check it by the procedure below to see if the function of the ECM is normal.

1. Turn the ignition key to the "ON" position.
2. Cover the forward facing sensor.
3. Head a light to the rearward looking sensor.
4. The ECM should be darkened as soon as the rearward looking sensor detects the light.

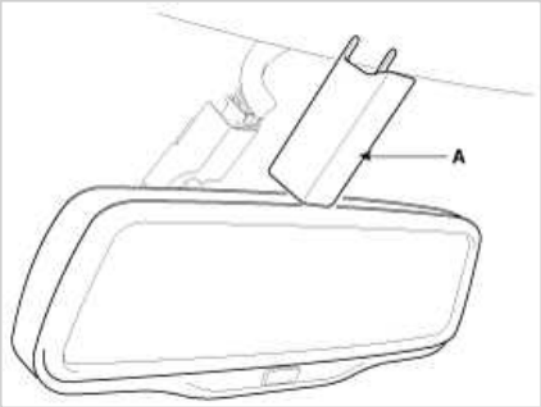
> **NOTICE**
> If this test is performed in daytime, the ECM may be darkened as soon as the forward facing sensor is covered.

5. When the reverse gear is engaged, the ECM should not be darkened.
   When heading lights to both the forward facing and rearward looking sensors, the ECM should not be darkened.

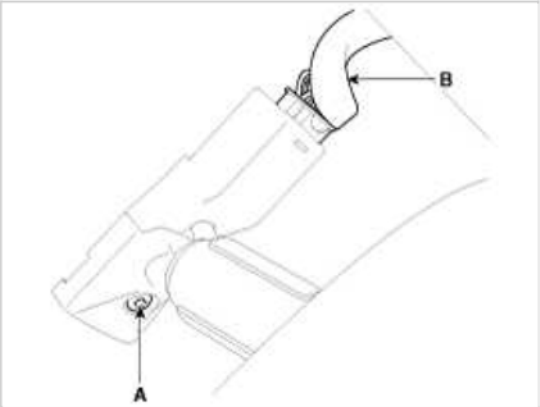
Removal

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1. Remove the mirror wiring cover (A).

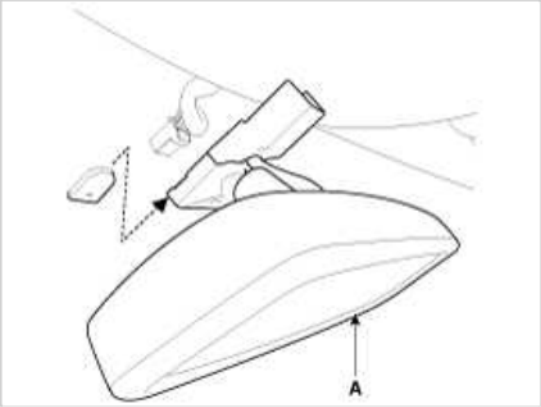


2. Remove the mirror mounting screw (A) and connector (B).



3. Remove the mirror (A) pulling up in the arrow direction.

> **NOTICE**
> Make sure not to damage the mounting bracket when removing the mirror.



Installation

1. Install the mirror making sure the mounting bracket not to be damaged.
2. Install the mirror wiring cover after reconnecting the connector and tightening the screw.

Body Electrical System

Function

1. Push the A button lower of the rear view mirror to turn on the function of the compass mirror so that displays a si direction on the small board in the upper-right side of the mirror.
2. Push the A button again to turn off its function.

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Calibration Procedure

If the compass has been calibrated or set to variance zone number incorrectly, or you are driving in specific places (tu parking lot in building, underground parking lot, near transformer substation, etc.), the below conditions may occur.

- The display read "C".
- The compass headings become inaccurate.
- The compass heading is not changed.
- Some compass headings are not displayed.
- The compass headings are inaccurate in long distance driving.

This compass automatically calibrates itself while the vehicle is driven as your route takes you in complete circles.
If the vehicle's compass headings become inaccurate continuously, the compass should be manually calibrated as follc

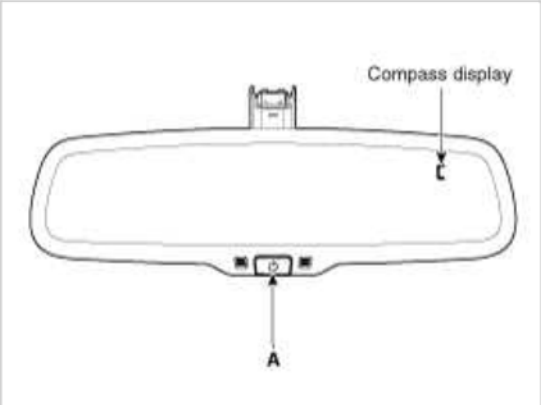
1. Move the vehicle from the large steel structure or electric power supply cable.
2. Turn on the compass by pressing the A button.
3. Check the zone number by pressing the A button for more than 4 seconds until the current zone number appears display.
   To re-calibrate, hold the A button for 3 seconds until C is displayed. If the zone number is different for your coun the correct zone number referring to "Setting the compass zone" and do the "calibration procedure" again.
4. Drive your vehicle in at least 2 circles at less than 5 miles per hour (8 km/h) until the compass heading appears. Dı a circle in right-handed direction and opposite direction is possible and if possible, stops the wiper operation.
5. If the vehicle's compass headings become inaccurate as before, do the following procedure again.

> **NOTICE**
> If new vehicle is first driven or if the battery has been disconnected, do the calibration procedure as above.

Setting The Compass Zone

This compass must be set to compensate for the variation between true north and magnetic north. To set variation:

1. Find your current location and variance zone number on the zone map.
2. Press the A button for more than 4 seconds. The current zone number will appear in the display.
3. Release and press the A button until the new zone number appears in the display. After you stop pressing the butt the display will show a compass direction within a few seconds.



Zone Map

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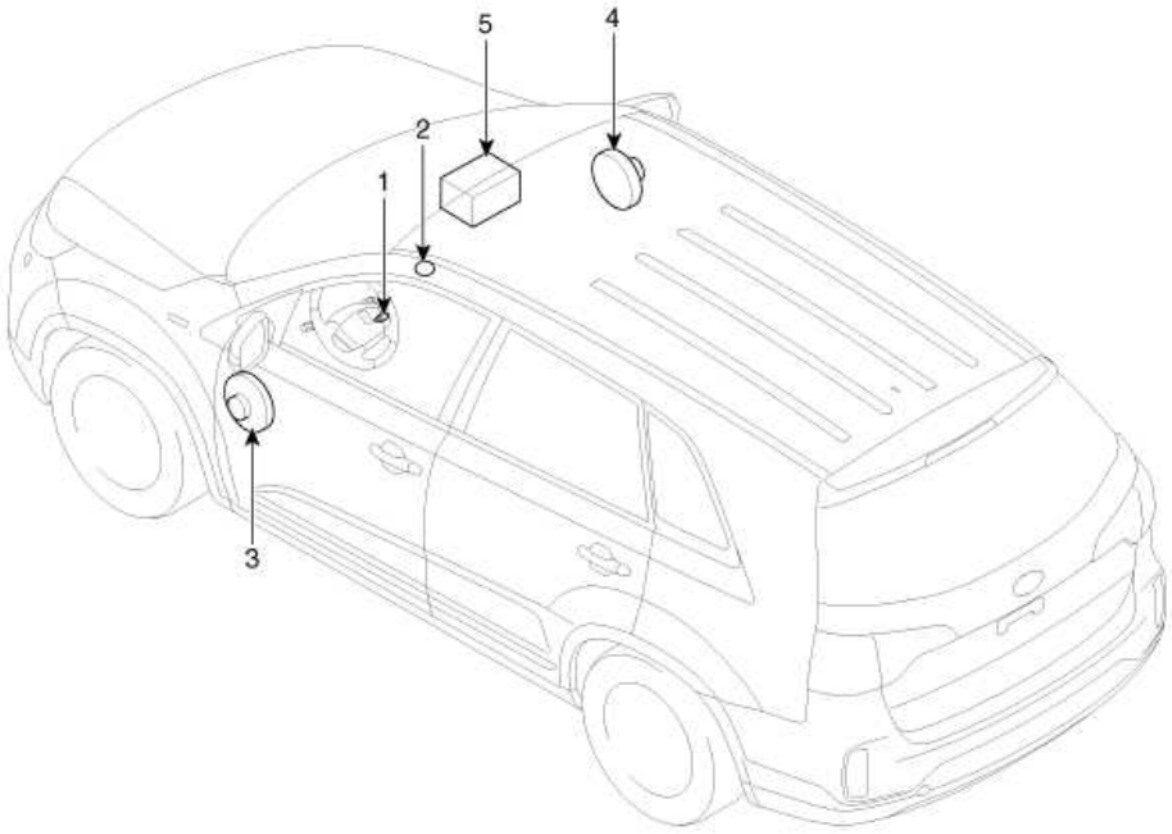
⚠ WARNING

1. Do not install the ski rack, antenna, etc. which are attached to the vehicle by means of a magnet. They affect the operation of the compass.
2. If the compass deviates from the correct indication soon after repeated adjustment, have the compass checked a authorized dealer.
3. The compass may not indicate the correct compass point in tunnels or while driving up or down a steep hill. (The compass returns to the correct compass point when the vehicle moves to an area where the geomagnetism is stab

Body Electrical System

Components

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1. Hands free call switch 2. Mic 3. Front left speaker	4. Front right speaker 5. Audio head unit (hands free control)

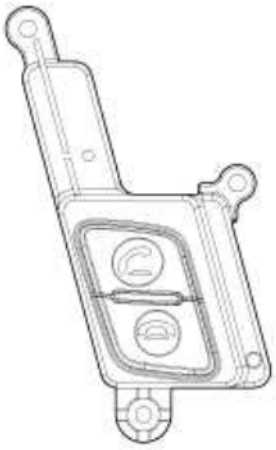
There is no hands free jack. This system supports Bluetooth(wireless system).

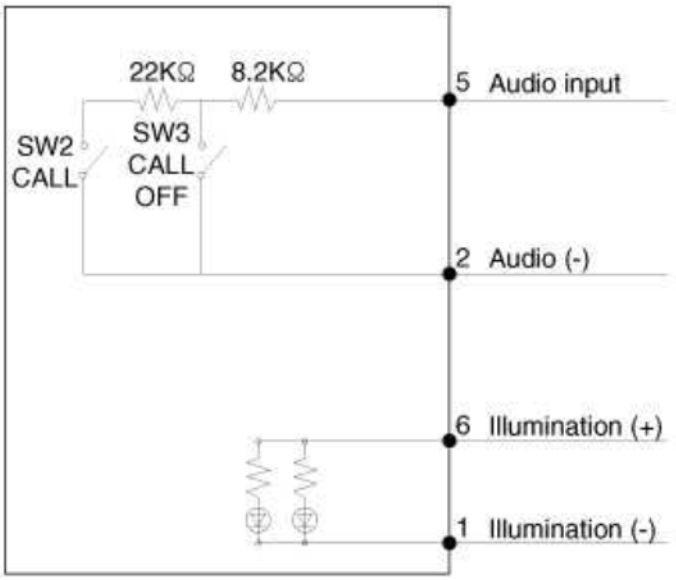
Body Electrical System

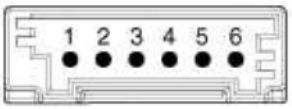
Component Location

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[Bluetooth]



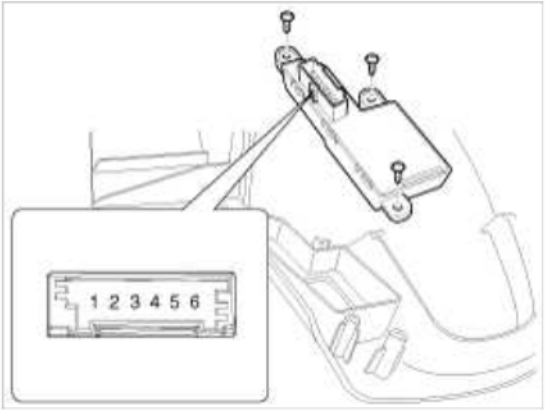


Connector	
	
Pin	**Description**
1	Illumination (-)
2	Audio (-)
3	-
4	-
5	Audio input
6	Illumination (+)

Body Electrical System

Inspection

1. Check the handsfree remote control switch for resistance between No.2 and No.5 terminals in each switch positi



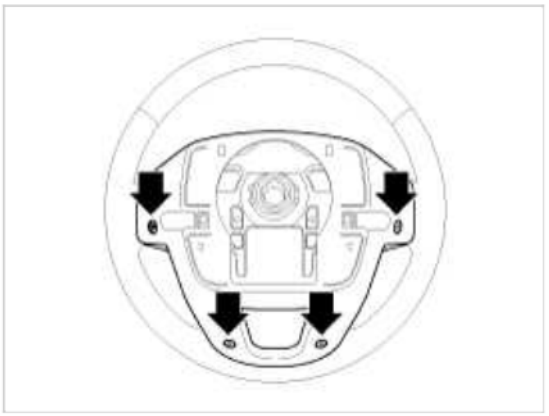
[Call + Hang Up]

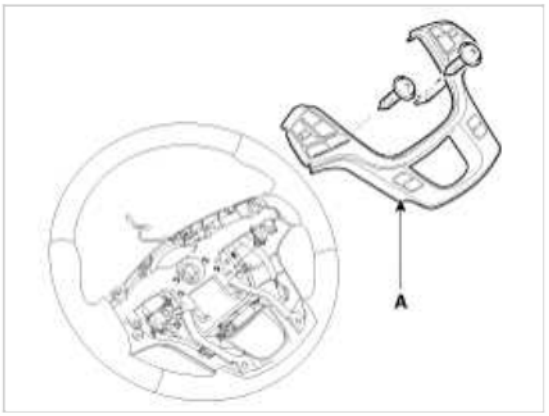
Switch	Connector terminal	Resistance (±5%)	Output voltage (±0.16V)
Call	2 - 5 (Right)	30.2 kΩ ±5%	2.96V
Hang up	2 - 5 (Right)	8.2 kΩ ±5%	2.64V

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Removal

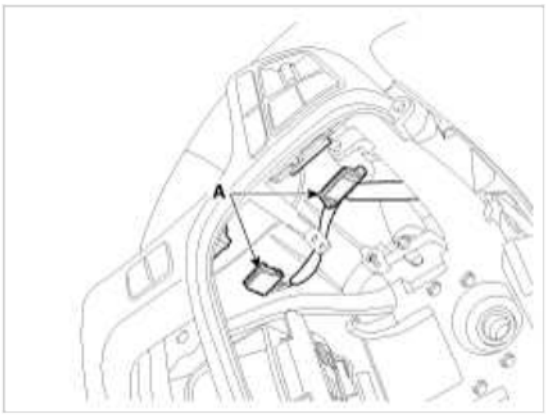
1. Remove the driver airbag module.
   (Refer to Restraint - "Airbag module")
2. Remove the steering wheel front cover (A) after loosening the screws.





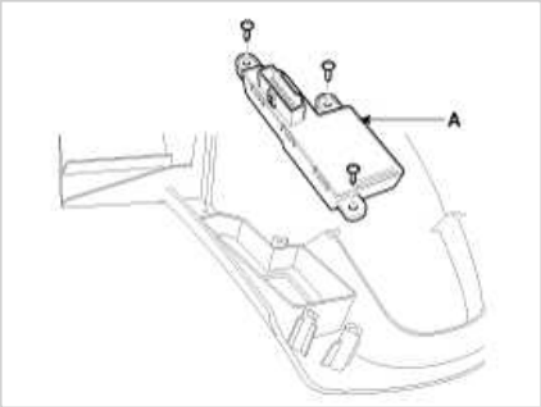
3. Disconnect the audio remote control switch connector (A).





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4. Remove the handsfree remote switch (A) after loosening the screws.



Installation

1. Install the handsfree remote switch to the steering wheel front cover.
2. Install the steering wheel front cover.
3. Reconnect the handsfree remote control switch connector and airbag connectors.

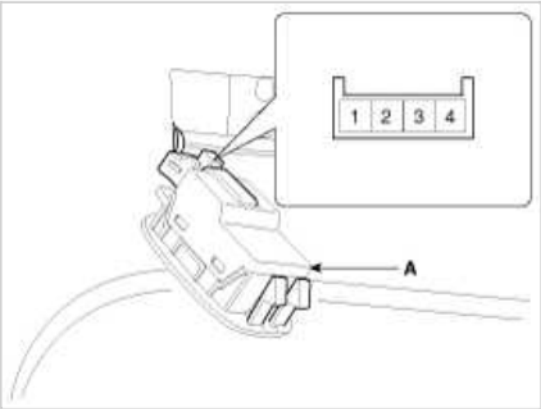
> **NOTICE**
> Make sure that the switch connector is plugged in properly.

4. Install the driver airbag module.

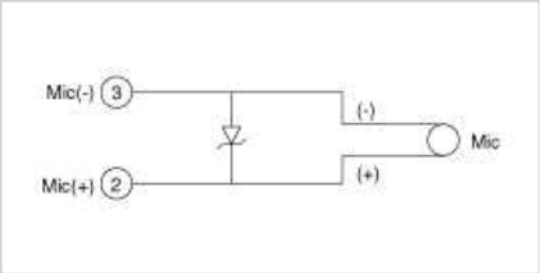
Body Electrical System

Inspection

1. Disconnect the negative(-) battery terminal.
2. Remove the hands free mic (A) after disengaging the hook from roof top.



3. Check the continuity of Mic between terminals.



Body Electrical System

Troubleshooting

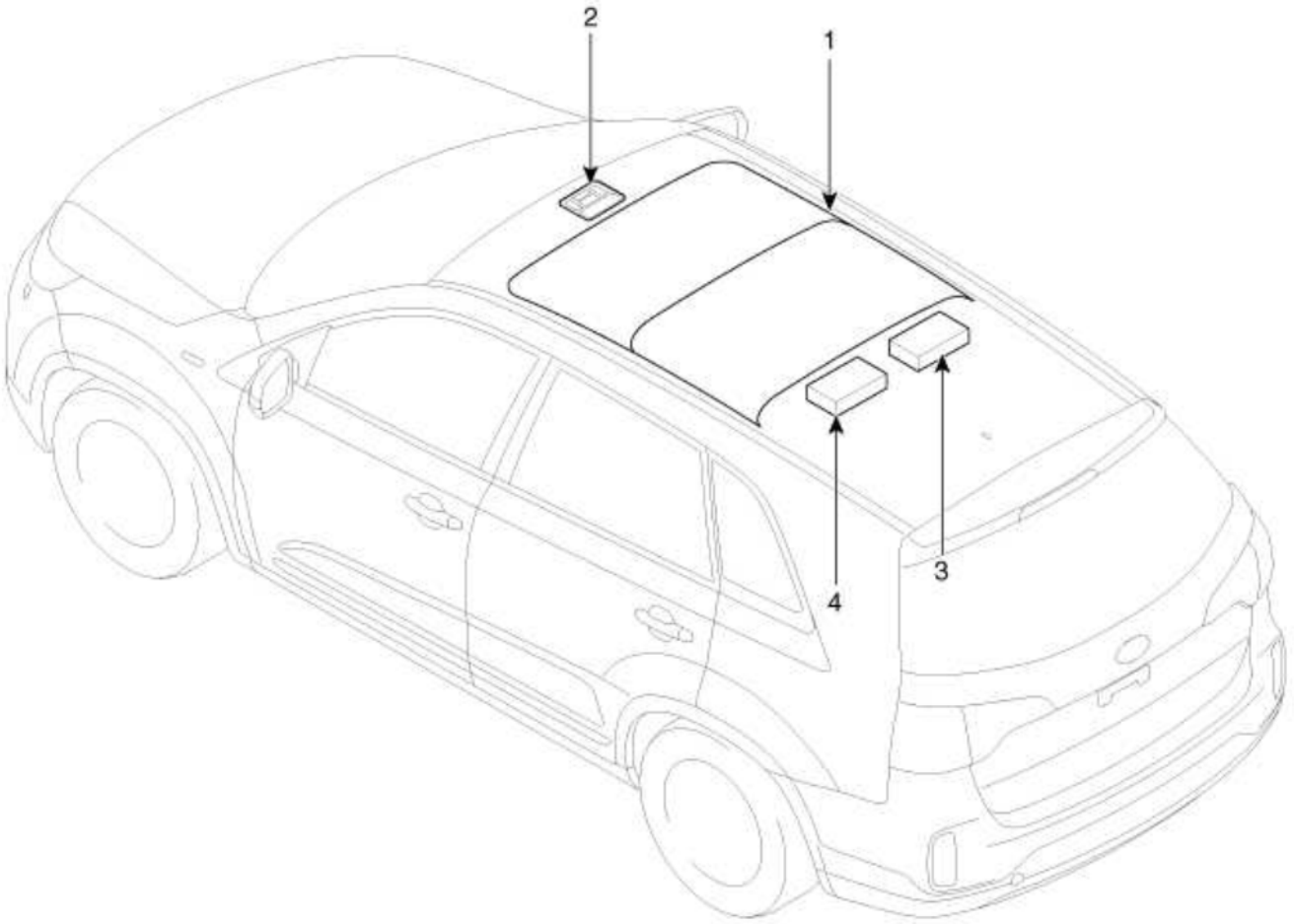
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Problem	Possible cause	Solution
Not pairing	Bluetooth device of Car is not discoverable mode	Enter Bluetooth pairing (searching) mode
	User's phone is Bluetooth off mode	User's phone set Bluetooth on
	Making an attempt pairing others bluetooth system	Check Bluetooth device name and addre word) to attempt paring Ex) 000B24FFF123
	Pass key error	Input the passkey displayed on the audio into the phone.
	5 phones have already been registered.	Delete paired phone list
	Bluetooth system cannot communicate with the phone.	Refer to IOP sheet IOP : Inter-operability
Not connection	User's phone or Bluetooth device of Car dose not register Bluetooth device to connect	Retry pairing
	Bluetooth system cannot communicate with the phone.	Waiting 1minute then Retry connection o power off/on. Refer to IOP sheet
Not redial	User phone system issue	Push the 2 times Send button
Not accept call	User phone system issue	Refer to IOP sheet
Not dialing	User's phone playing other menu (internet, mp3, game, etc..)	Stop other menu then set normal mode
	Bluetooth system cannot communicate with the phone	Refer to IOP sheet

Body Electrical System

Component Location

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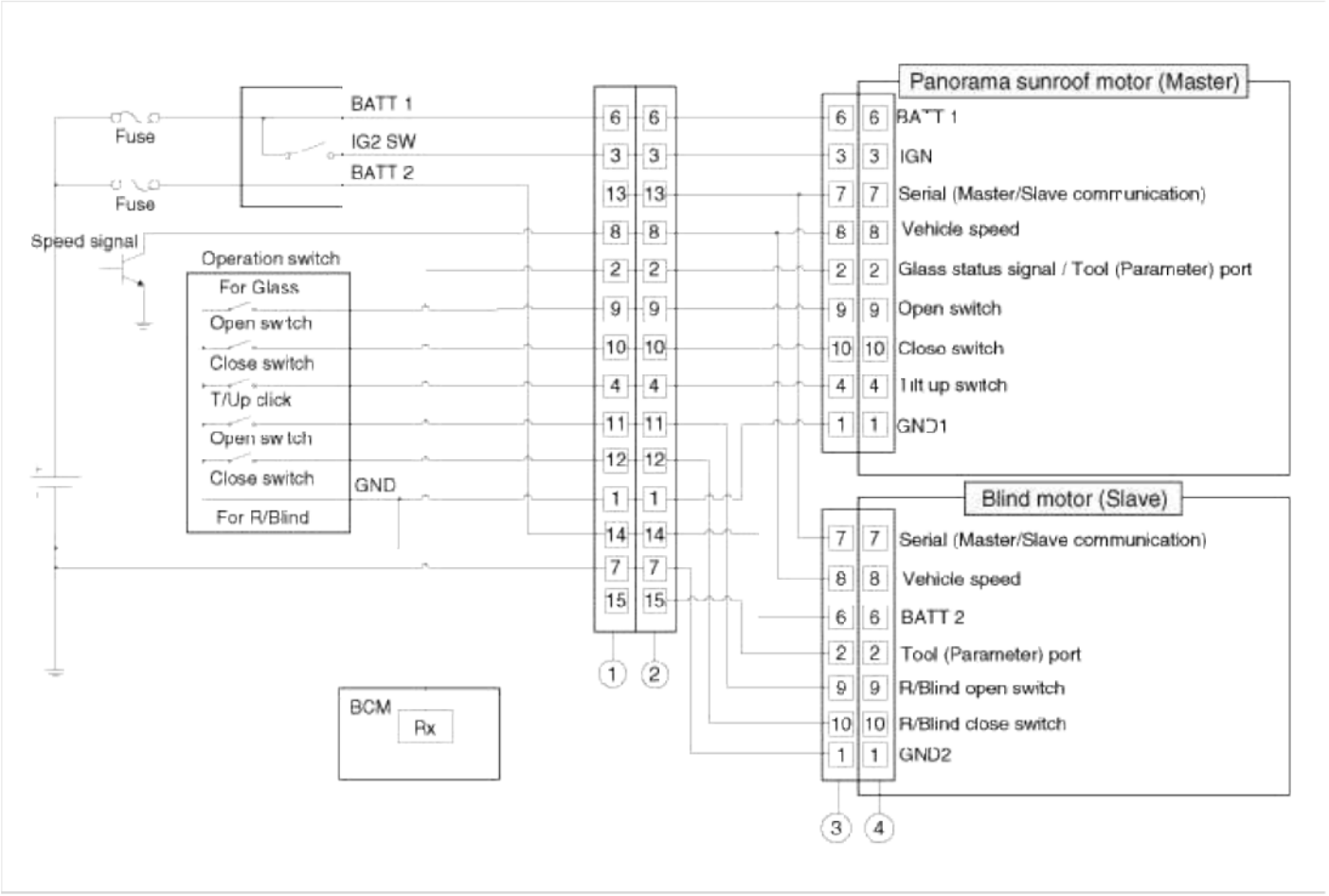


1. Panorama sunroof (Panorama) 2. Panorama sunroof switch	3. Panorama sunroof motor & controller (Master) 4. Roller blind motor & controller (Slave)

Body Electrical System

Circuit Diagram

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Connector Pin Information

No.	Wire harness connector	Panorama motor	Blind motor
			
1	Ground 1	Ground 1	Ground 2
2	Glass status signal / Tool fot glass	Glass status signal/ Tool (Parameter)	Tool (Parameter)
3	IGN 2	IGN 2	-
4	Tilu up switch	Tilu up switch	-
5	-	-	-
6	Battery 1	Battery 1	Battery 2
7	Ground 2	Serial	Serial
8	Vehicle speed signal	Vehicle speed signal	Vehicle speed signal
9	Glass open switch	Glass open switch	Blind open switch
10	Glass close switch	Glass close switch	Blind close switch
11	Blind open switch		
12	Serial		

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13	Blind close switch
14	Battery 2
15	Blind tool
16	-

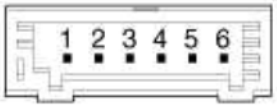
Components

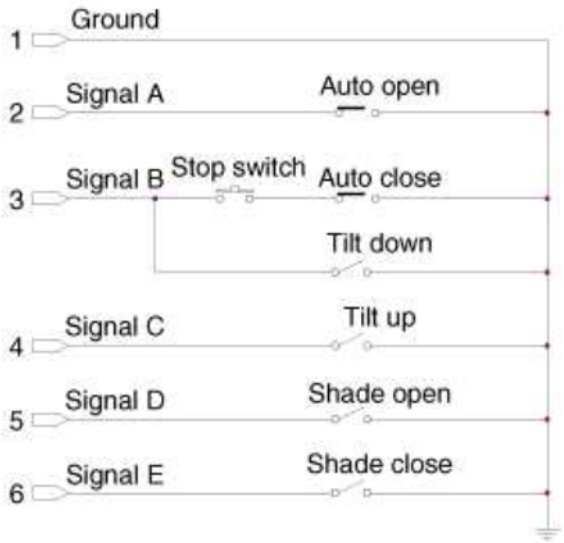
[Sunroof]



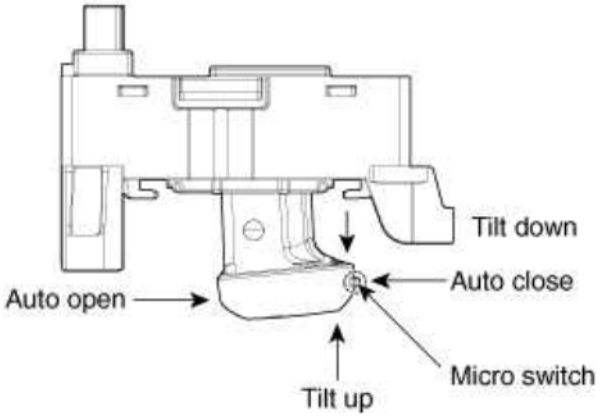
[Sunroof + PTG]



Connector A	No.	Description	No.	Description
	1	Ground	4	Signal C
	2	Signal A	5	Signal D
	3	Signal B	6	Signal E



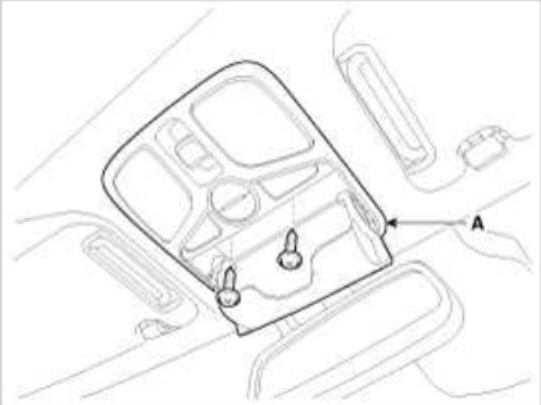
Panorama sunroof & blind signal logic						
	Auto open	Auto close	Tilt down	Tilt up	Blind open	Blind close
Signal A	●					
Signal B		●	●			
Signal C				●		
Signal D					●	
Signal E						●



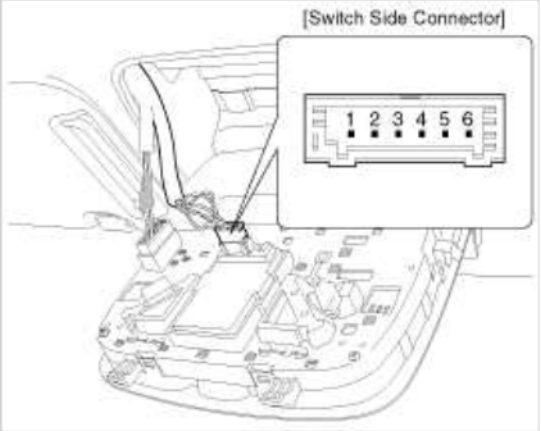
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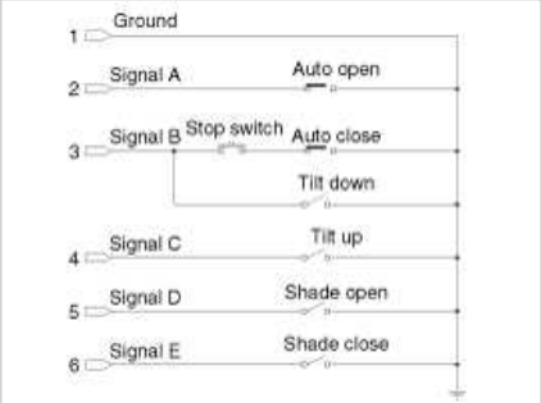
Inspection

1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console Disconnect the switch connector (6P) and Map lamp connector (6P), and then remove the overhead console lam



3. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.





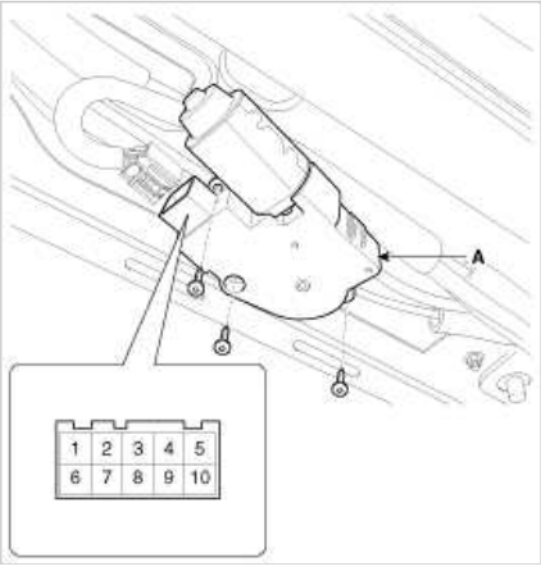
Terminal / Position	1	2	3	4	5	6
Auto open	○	○				
Auto close/ Tilt down	○		○			
Tilt up	○			○		
Blind open	○				○	
Blind close	○					○

Body Electrical System

Inspection

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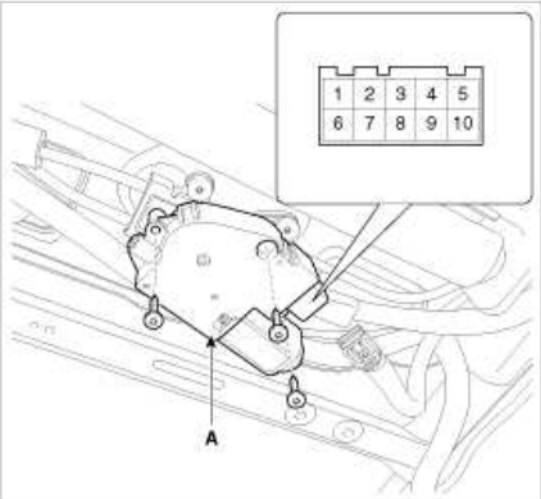
1. Close the panorama sunroof glass and blind completely (Full close position).
2. Disconnect the negative (-) battery terminal.
3. Remove the roof trim assembly.
   (Refer to Body - "Roof Trim")
4. Remove the panorama sunroof glass motor (A) after loosening the screws and disconnecting the connector.



5. Check the wiring connector of the panorama sunroof glass motor as below table.

Terminal	Test condition	Test : Desired result
3 - GND	IG2 ON	Check for voltage to ground : There should be battery voltage
1 - GND	Under all conditions	Check for continuity to ground : There should be continuity.
6 - GND	Under all conditions	Check for voltage to ground : There should be battery voltage.

6. Remove the blind motor (A) after loosening the screws and disconnecting the connector.



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7. Check the wiring connector of the blind motor as below table.

Terminal	Test condition	Test : Desired result
1 - GND	Under all conditions	Check for continuity to ground : There should be continuity.
6 - GND	Under all conditions	Check for voltage to ground : There should be battery voltage.

8. Connect the panorama sunroof glass and blind motor and each connectors.

> **NOTICE**
> Be careful not to reinstall the motors on the panorama sunroof.

9. Connect the negative (-) battery terminal.
10. Start the vehicle engine.
11. Check the motor's operation by pressing the panorama sunroof switch.

Terminal	Operation Test
Auto open switch	Both the glass and blind motors operate
Auto close switch	Both the glass and blind motors operate
Auto tilt up switch	Both the glass and blind motors operate
Blind open switch	The blind motor operates
Blind close switch	The blind motor operates

12. Pless the auto close switch after checking the motor's operation.
13. Install the panorama sunroof glass motor and blind motor. And then perform the resetting procedure of the panc sunroof.

> **NOTICE**
> Use only the auto close switch.

Replacement

Resetting The Panoramaroof

Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the panorar you have to reset your panoramaroof system as follows :

1. Turn the ignition key to the ON position and then close the panoramaroof completely.
2. Release the panoramaroof control lever.
3. Press and hold the CLOSE button for more than 10 seconds until the sunroof has moved slightly.
4. Release the panoramaroof control lever.

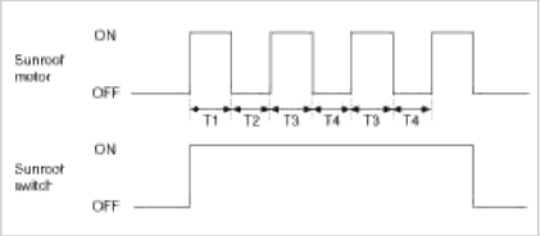
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5. Press and hold the CLOSE button once again within 5 seconds until the panorama sunroof do as follows ;
   A. Blind open and glass open → Glass close → Blind close
      Then release the lever.
6. Reset procedure of panorama system is finished.

Protecting The Overheated Motor

In order to protect the overheated panoramaroof motor by continuous motor operation, the panoramaroof ECU cont Run-time and Cool-time of motor as followings;

1. The panoramaroof ECU detects the Run- time of motor
2. Motor can be operated continuously for the 1st Run-time(120 ± 10sec.).
3. Motor which is operated continuously stops operating after the 1st Run-time(120 ± 10sec.).
4. And then Motor is not operated for the 1st Cool-time(18 ± 2sec.).
5. Motor is operated for the 2nd Run-time(10 ± 2sec.) at the continued motor operation after 1st Cool-time(18 ± 2
6. Motor which is operated continuously stops operating after the 2nd Run-time(10 ± 2sec.)
7. Motor is not operated for the 2nd Cool-time(18 ± 2sec.).
8. Motor repeats the 2nd Run-time and 2nd Cool-time at the continued motor operation.
   A. In case that motor is not operated continuously, the Run-time which is limited for protecting the overheated m increased.
   B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, disch or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

Body Electrical System

Replacement

1. Refer to the inspection procedure in the panorama sunroof motor.
   (Refer to the "Panorama Sunroof Motor")

Body Electrical System

Specifications

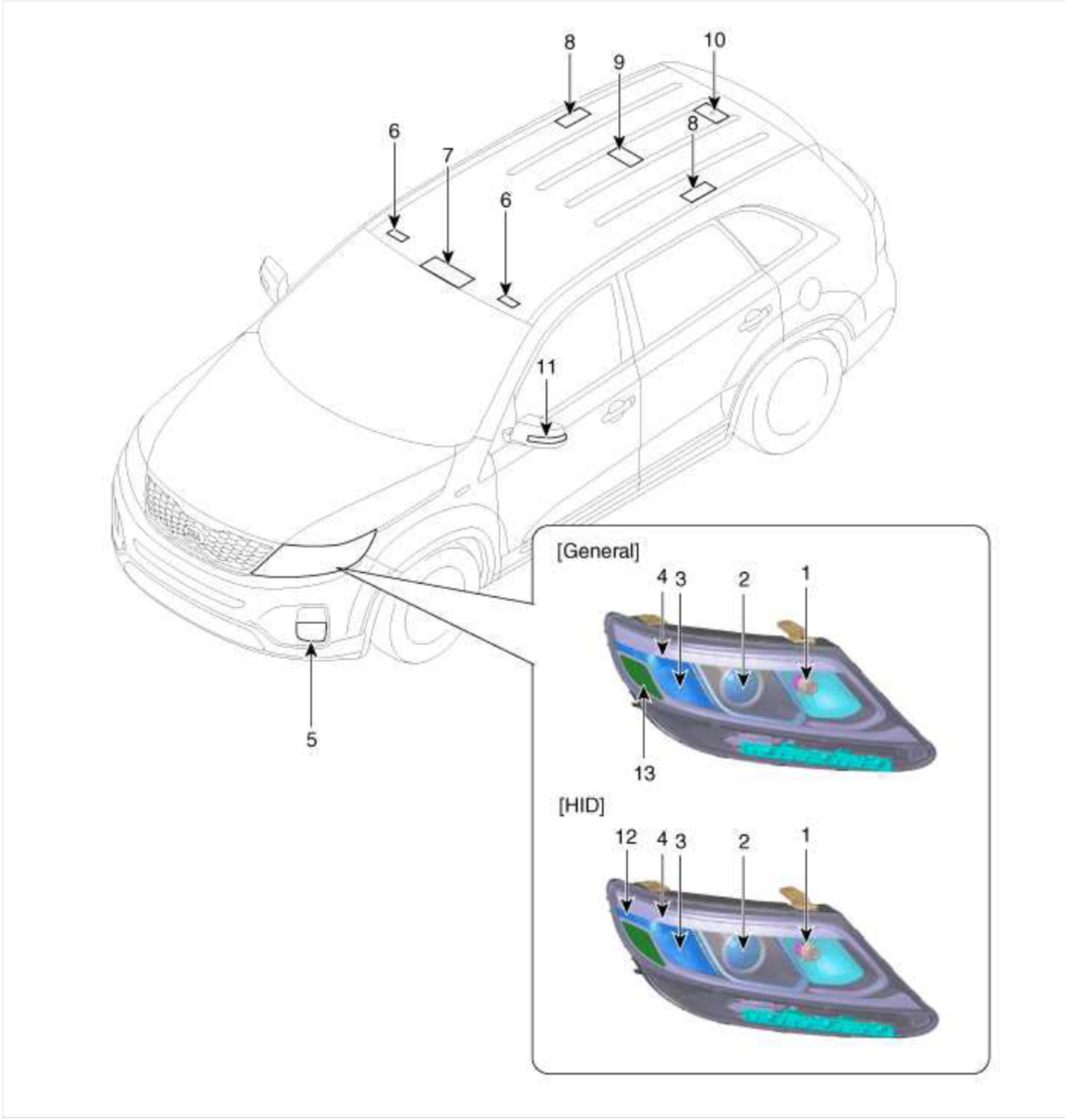
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Items			Wattage (W)	Type
Front	Standard	Head lamp (Low)	55	H7LL
	HID		35	D3S
	Head lamp (High)		55	H7LL
	Turn signal lamp		28	PY28/8W
	Position lamp		LED	LED
	Fog lamp		27	GE881
	Side repeater (Outside mirror)		LED	LED
Rear	Standard	Stop/Tail (Outside)	27/8	P27 / 8W
		Tail (Inside)	8	P27 / 8W
	Option	Stop lamp	LED	LED
		Tail lamp	LED	LED
	Turn signal lamp		27	PY27W
	Back up lamp		18	W18W
	Standard	Side marker	5	W5W
	Option		LED	LED
	High mounting stop lamp		LED	LED
	License plate lamp		5	FESTOON
Room	Map lamp		10	W10W
	Room lamp		10	FESTOON
	Personal lamp		8	FESTOON
	Vanity lamp		5	FESTOON
	Glove box lamp		5	FESTOON
	Door lamp		5	FESTOON
	Cargo lamp		10	FESTOON

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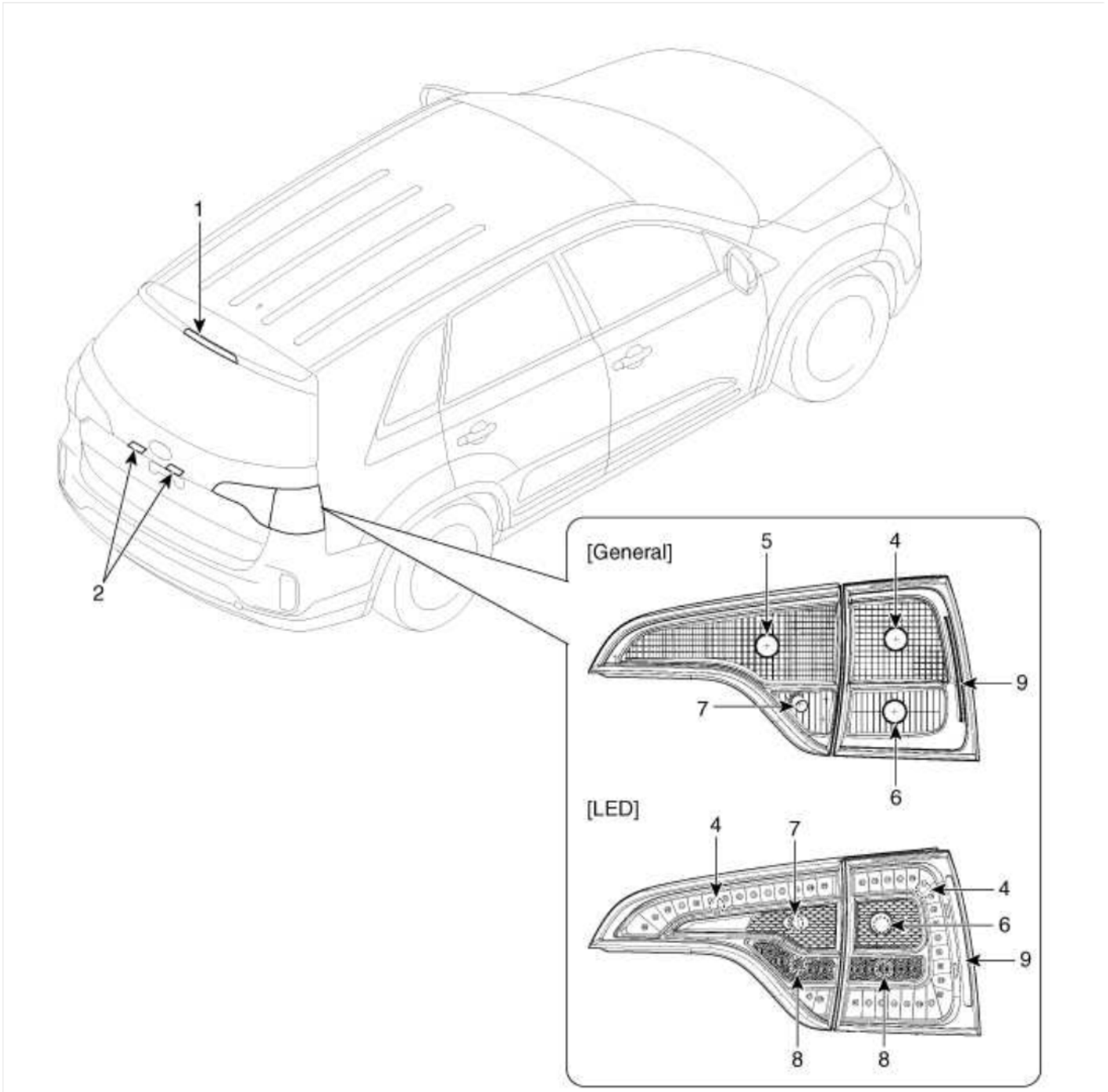
Body Electrical System

Component Location



1. Head lamp (High)	5. Front fog lamp	9. Room lamp
2. Head lamp (Low)	6. Vanity lamp	10. Cargo lamp
3. Front turn signal lamp	7. Overhead console lamp	11. Side repeater (Outside mirror)
4. Position lamp/ DRL	8. Room lamp (Sunroof)	12. Side marker

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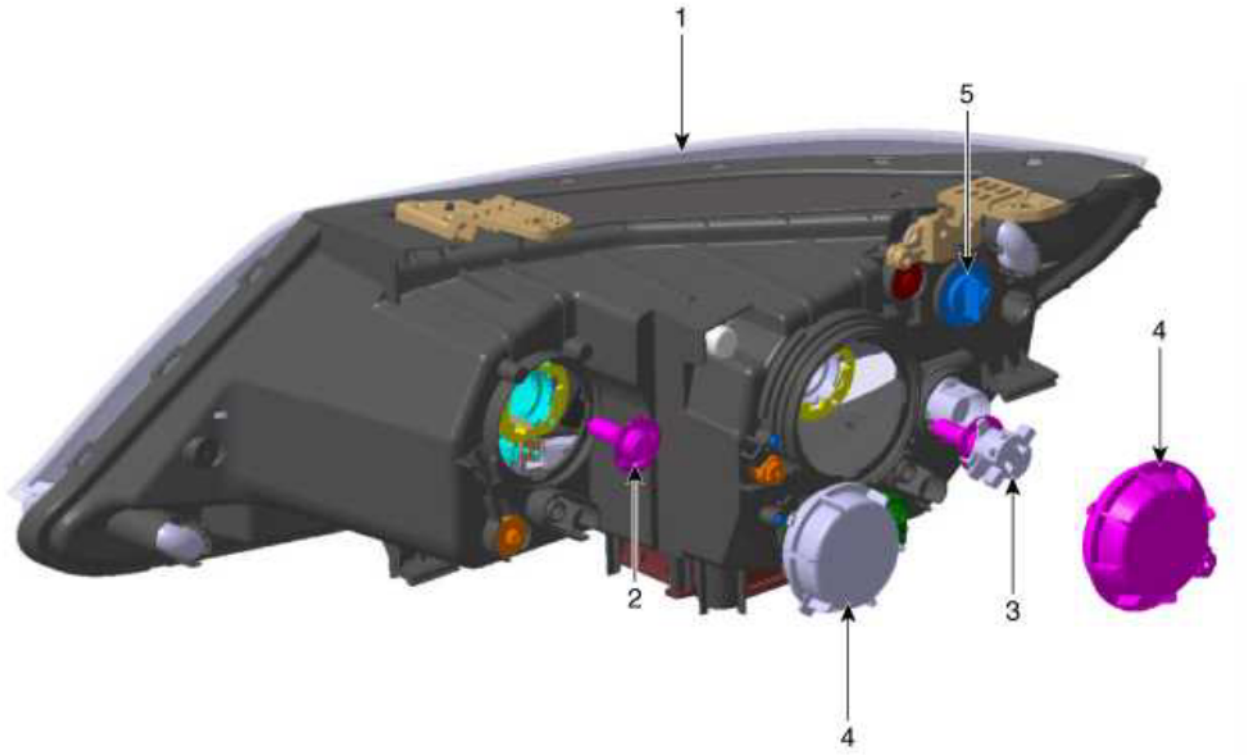
1. High mounting stop lamp 2. License plate lamp 3. Tail/ stop lamp 4. Tail lamp	5. Rear turn signal lamp 6. Back up lamp 7. Stop lamp 8. Side marker

Body Electrical System

Component (1)

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[General]

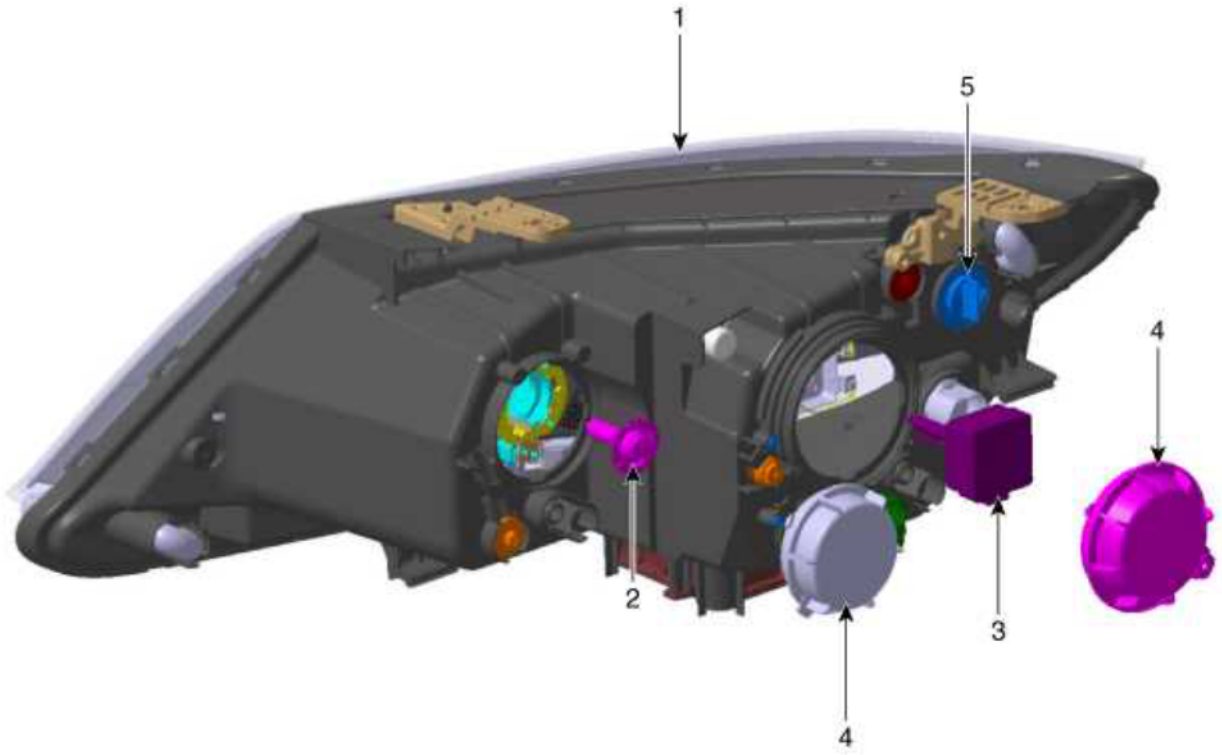


1. Head lamp assembly 2. Head lamp high beam bulb 3. Head lamp low beam bulb	4. Dust cap 5. Turn signal lamp socket & bulb

Component (2)

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[HID]



1. Head lamp assembly 2. Head lamp high beam bulb 3. Head lamp low beam bulb (HID & ignitor)	4. Dust cap 5. Turn signal lamp socket & bulb

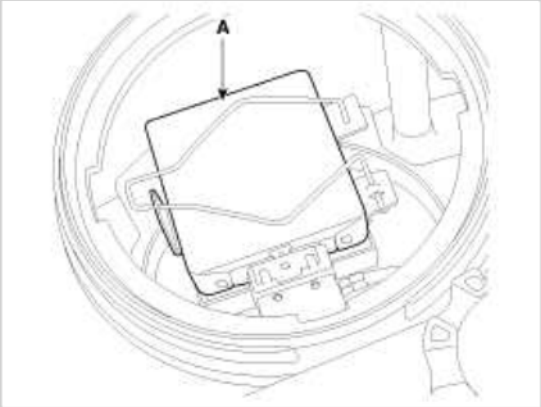
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HID Head Lamp

1. Bulb
   (1) Elements
   Xenon gas: Xenon gas activates the initial reaction for rapid illuminating.
   Molybdenum electrode: anode arcing
   Metal halide salts: color composing component
   (2) Lightening principle
   When Xenon gas and metal halide salt will discharge the molybdenum anode in a capsule, it emits light.

2. Ignitor

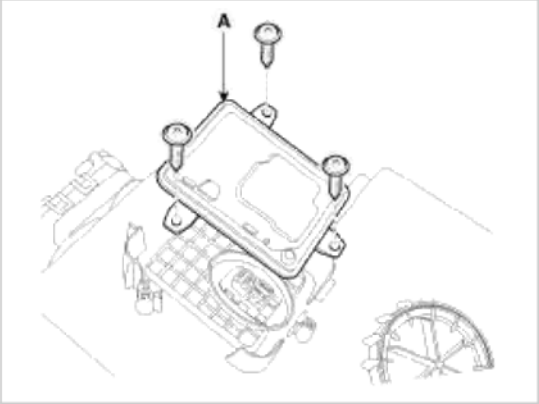
Ignitor (A) is an electromagnetic transformer that receives current from ballast and boost voltage to light on the arc source in any environment.



3. Ballast

(1) Ballast (A) delivers an instant high voltage pulse to the ignitor electrode, to initialize discharge in the source.

(2) Ballast supplies the stable power to the bulb and the ignitor during initialization and normal state of arc.



4. Stability

(1) Durable for vibration as there is no filament.

(2) Does not operate if polarity are changed.

(3) Doesn't operate if the input voltage is not in the range of 10-16V.

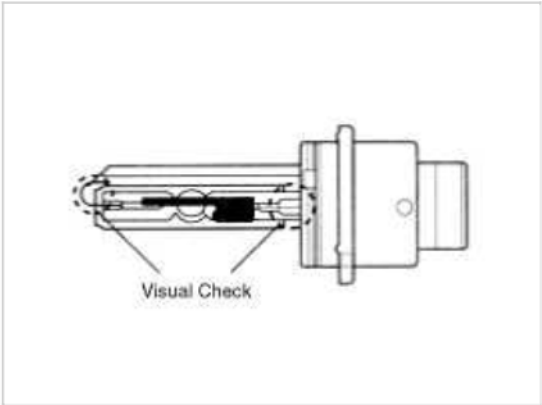
(4) Doesn't operate if the circuit is short.

(5) Doesn't operate if the bulb burnt out.

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Inspection

1. Check-points upon head lamp failure (HID)
   (1) Check the battery voltage. (Low beam will be on when the battery voltage above 9V.)
   (2) Check the fuse and relay.
   (3) Check the polarity of ballast. (If the polarity are changed, low beam doesn't lighten)
   (4) Check the bulb connector securely.
   (5) Visually bulb checking (no filament): damaged glass, damaged for upper parts and lower parts of glass tube.
   (6) After (1)~(5), replace the ballast and the ignitor. (ballast assembly).



2. Service procedure and warning (HID)

No.	Item	Service procedures	Warning	Remar
1	Replacement of lamp assembly	1. Disconnect the power connector from the lamp. 2. Remove and replace the lamp assembly. 3. Connect the power connector.	• Disconnect the head lamp power connector to avoid high voltage.	• Other descriptio same as th halogen bu
2	Replacement of the Bulb	1. Disconnect the power connector from the lamp. (head lamp, turn signal, head lamp leveling device) 2. Remove the lamp assembly. 3. Remove the ballast and dust cover. 4. Remove the bulb socket and replace the bulb. 5. Installation is the reverse of removal.	• Disconnect the head lamp power connector to avoid high voltage. • Be careful not to damage the bulb and use genuine bulbs only. • Do not apply excessive force and fit it correctly.	
		1. Disconnect the power connector from the lamp. 2. Remove the lamp and then the		

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3	Replacement of the Ballast (with built-in ignitor)	ballast and the dust cover. 3. Remove the head lamp leveling device and then the bulb socket. 4. Connect the bulb socket on the replacement ballast and install the leveling device. 5. Installation is the reverse of removal.	• Disconnect the head lamp power connector to avoid high voltage.	• Replace tl ballast onl install the lamp. • Replace tl assembly the ballast
4	Others	1. Power supply should be according to the rated capacity. 2. Use the rated fuse and wire. 3. Bulb socket shall be free from moisture or dirt. 4. Do not apply the ballast severe shock, water, or extreme	• All parts should be serviced only at specified service centers.	• HID lamp not be inst on other c (Dangerou may occu

⚠ CAUTION

HID lamp shall not be used on other cars.(Fire may occur.)
Fire may occur when HID lamp initially lights due to the fact that arc-discharge generates high voltage (max. 30,000V) and high current (12-13A), and are different from the halogen lamp specification.

Characteristic

1. Durable for vibration as there is no filament.
2. HID lamp had a more long life than halogen lamp.
3. Does not operate if polarity is changed.
4. Operating input voltage : 9-16V

Removal

⚠ CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have l turned off.

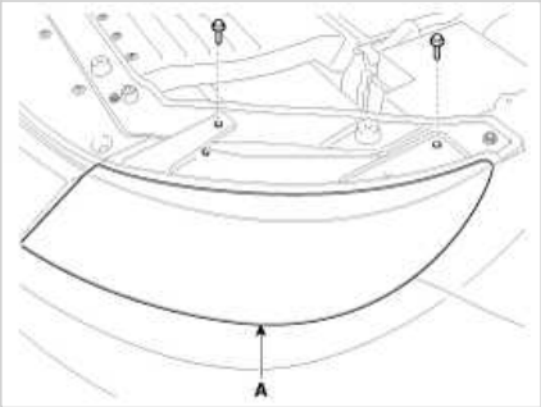
NOTICE

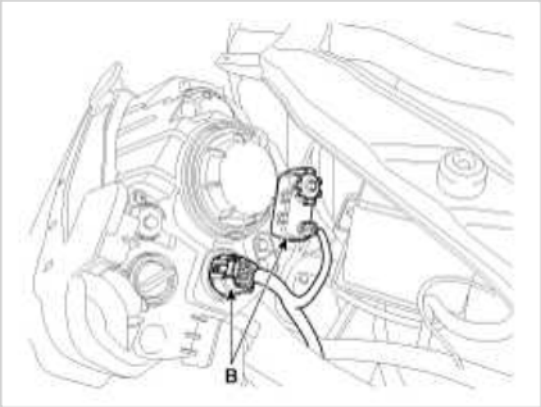
The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.
Removing bulb for an extended period of time may affect headlamp bulb performance.
Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.
Never turn on the head lamps with the bulb removed from the headlamp assembly.

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
   (Refer to Body - "Front Bumper")

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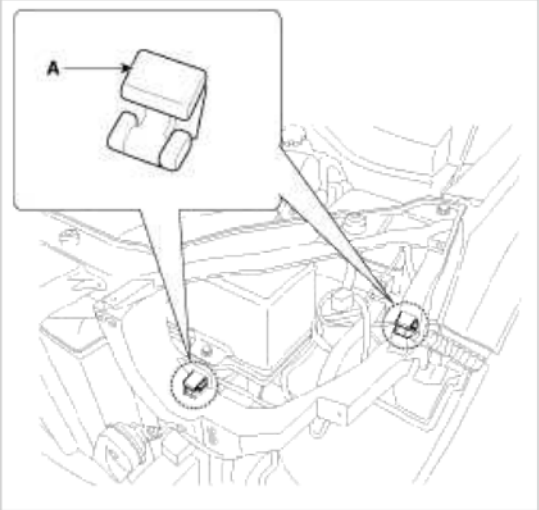
3. Loosen the mounting bolts (2EA) of head lamp. Remove the head lamp assembly (A) after disconnecting the lamp connectors (B).





NOTICE

Take care that retaining clip (A) is not to be damaged.



Installation

1. Install the head lamp bulbs.
2. Reassemble the head lamp bulb covers.
3. Reassemble the head lamp assembly after connecting the lamp connector.

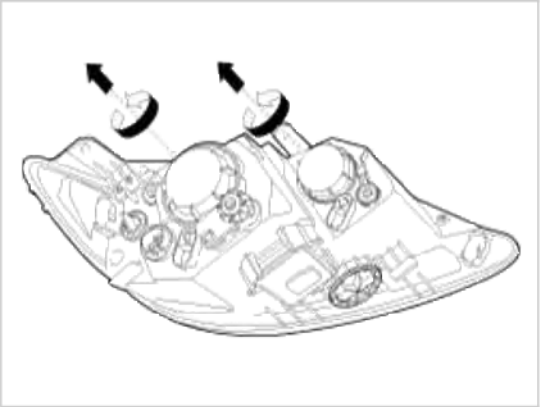
Replacement

Bulb (HID)

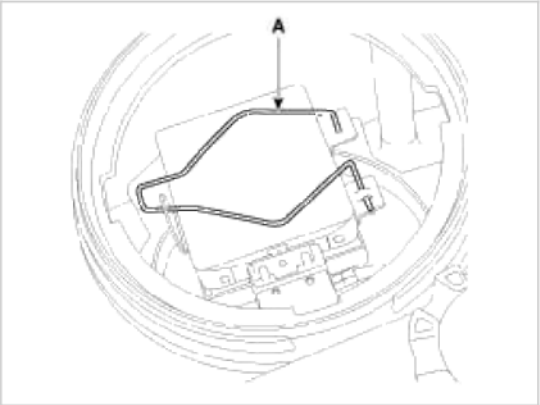
1. Turn the head lamp switch off.
2. Disconnect the power connector from the lamp.
3. Remove the lamp assembly.

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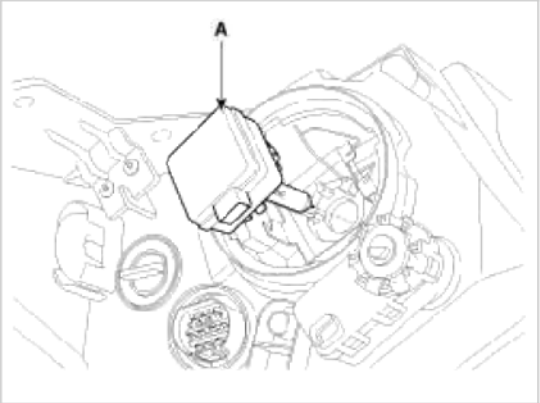
4. Remove the dust cover.



5. Remove the ignitor clip (A) from the lamp assembly.



6. Disconnect the ignitor connector.
7. Remove the ignitor and bulb (A).



8. Installation is the reverse of removal.

⚠ CAUTION

Turn the head lamp switch off to avoid high voltage
Be careful not to damage the bulb and use genuine bulbs only

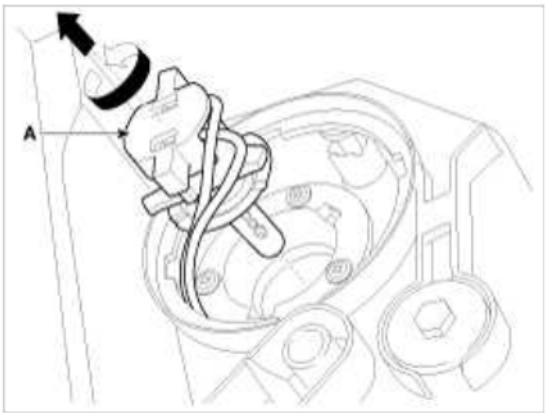
- Do not apply excessive force and fit it correctly.
- Confirm the bulb locking

Bulb (high/low)

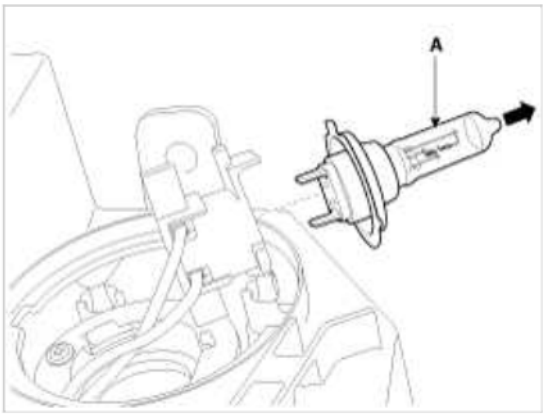
1. Turn the head lamp switch off.
2. Disconnect the power connector from the lamp.
3. Remove the lamp assembly

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4. Remove the dust cover.
5. Turn the bulb socket (A) counterclockwise and then remove it.



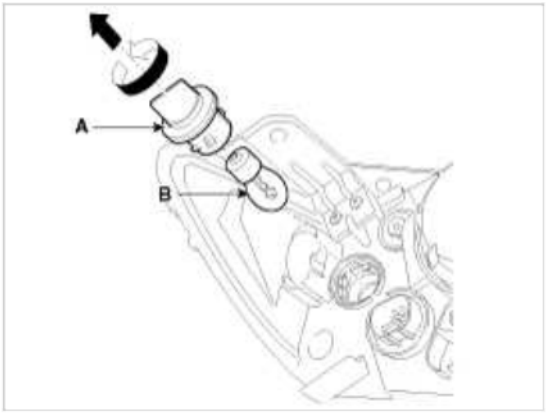
6. Remove the bulb (A) from socket.



7. Installation is the reverse of removal.

Turn signal lamp

1. Turn the head lamp switch off.
2. Remove the lamp assembly
3. Turn the bulb socket (A) counterclockwise and then remove the turn signal lamp bulb (B).

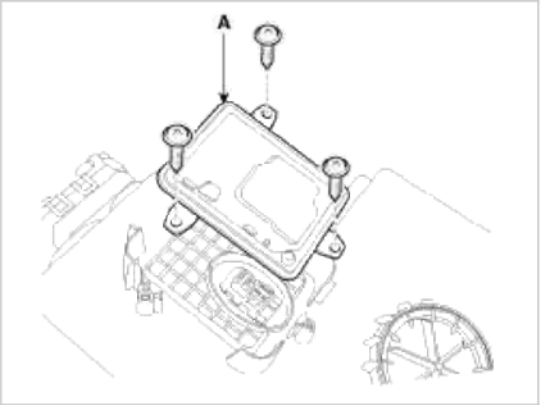


Ballast

1. Turn the head lamp switch off.
2. Disconnect the power connector from the lamp.
3. Remove the head lamp assembly.

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4. Remove the ballast (A) after loosening the screws (4EA).



5. Installation is the reverse of removal.

NOTICE

- Turn the head lamp switch off to avoid high voltage.

⚠ CAUTION

- HID lamp shall not be used on other cars.(Fire may occur.)
- Fire may occur when HID lamp initially lights due to the fact that arc-discharge generates high voltage (max 20,000V) and high current (12-13A), and are different from the halogen lamp specification.
- Install the dust cover after confirming the locking state between bulb and bulb holder.
- When testing the HID head lamp, turn the power on or off with switch between power supply and lamp because of high voltage.
- Do not operate the head lamp switch with the bulb not installed, because it generates spark momently.

Adjustment

Head Lamp Aiming Instructions

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

NOTICE

If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust s meet those requirements.

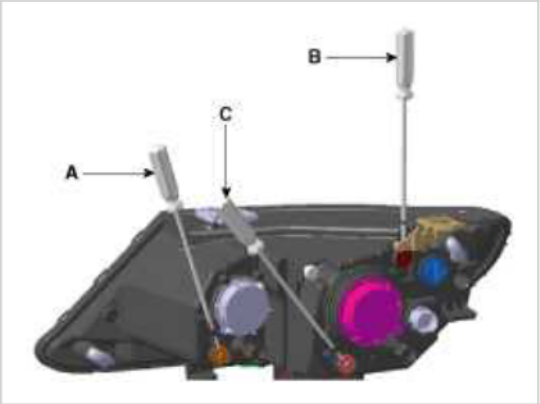
Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed follows :

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal l passing through center of head lamps) on the screen.

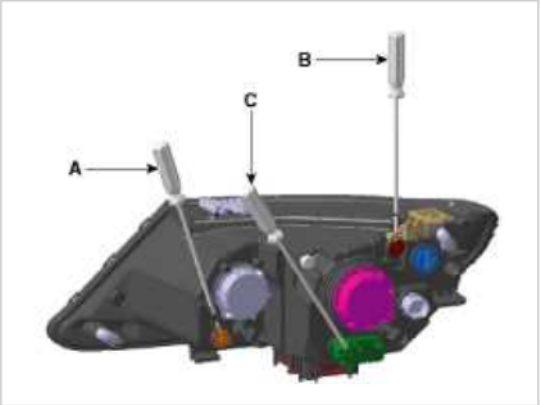
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4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the vertic
   A : High - Vertical
   B : Low - Horizontal
   C : Low - Vertical

   [General type]



   [HID type]



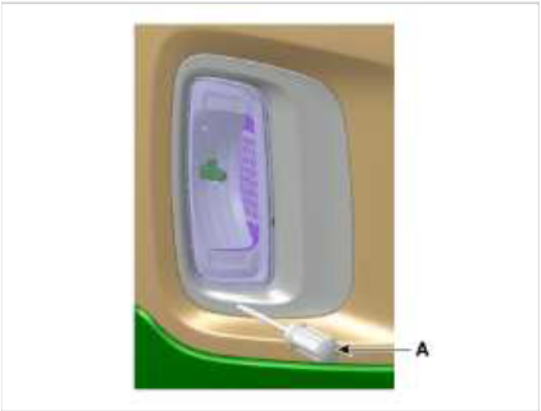
Front Fog Lamp Aiming

The front fog lamps should be aimed as the same manner of the head lamps aiming.

With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).

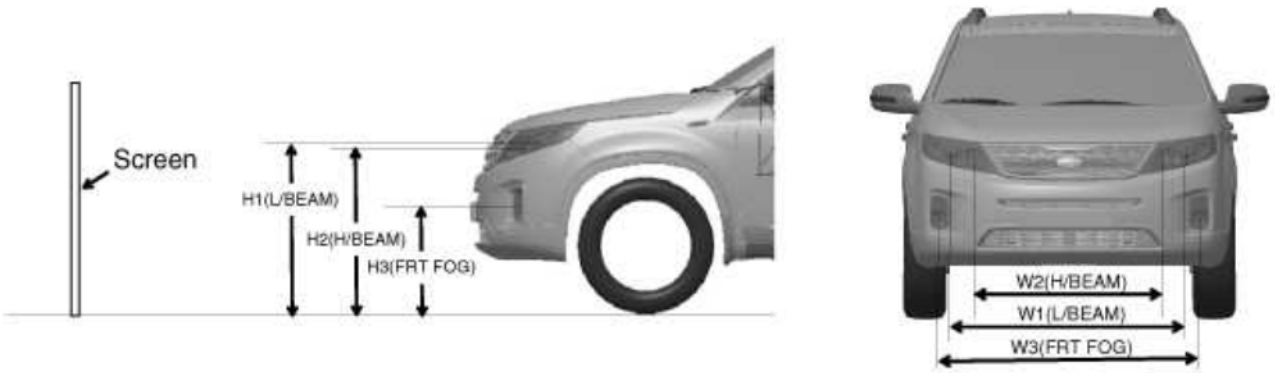
NOTICE

- When aiming the front fog lamp, the fog lamp can be adjusted in front of vehicle without removing the front bump
- The adjusting aiming hole is located at the bottom of the fog lamp.



Head Lamp And Fog Lamp Aiming Point

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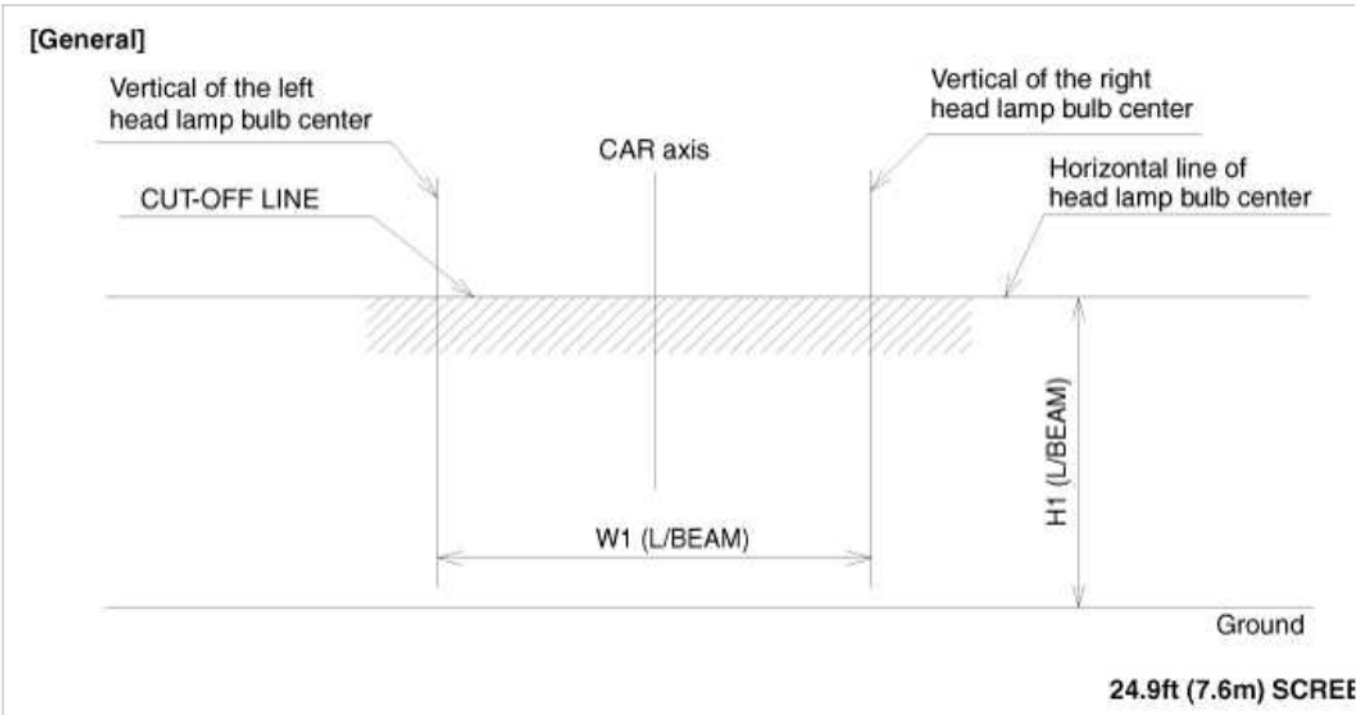


H1 : Height between the head lamp bulb center and ground (Low beam)
H2 : Height between the head lamp bulb center and ground (High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low beam)
W2 : Distance between the two head lamp bulbs centers (High beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

Unit : in(mm)

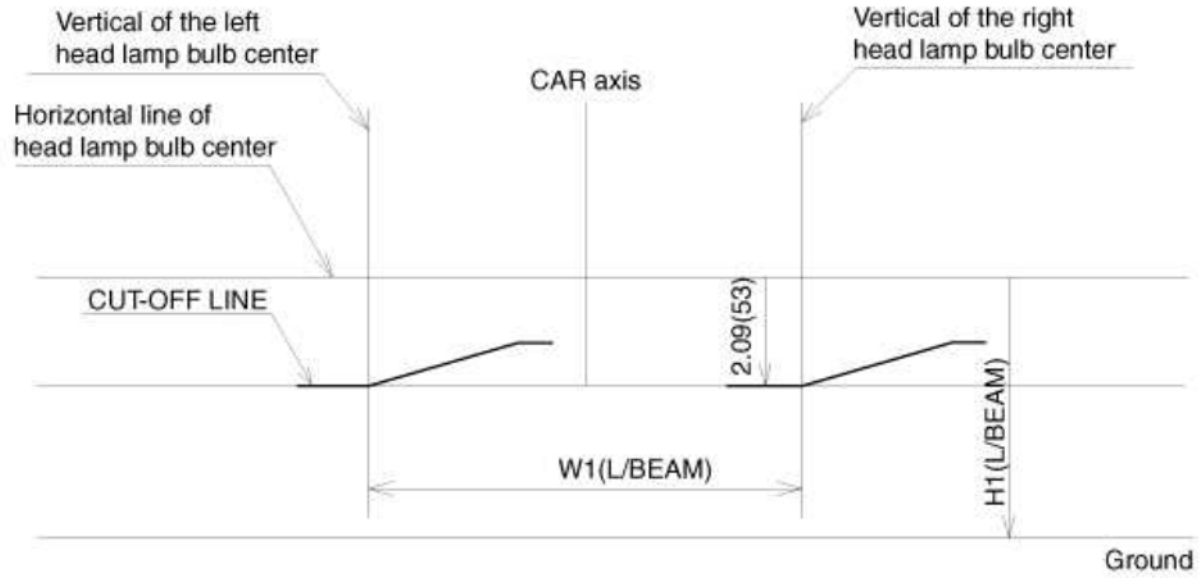
Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	35.3(898)	34.6(880)	20.5(521)	51.7(1,312)	42.7(1,084)	57.8(1,467)	Refer to aiming condition
With driver	35.0(890)	34.3(872)	20.2(513)				

1. Turn the low beam on with driver seated in the vehicle.
   The cut-off line should be projected in the allowable range shown in the picture.
   In case of equipping with the manual leveling device, set the leveling device switch on the "O" position.
   In case of equipping with the auto leveling device, set the initialization by using the diagnostic tool before aiming.



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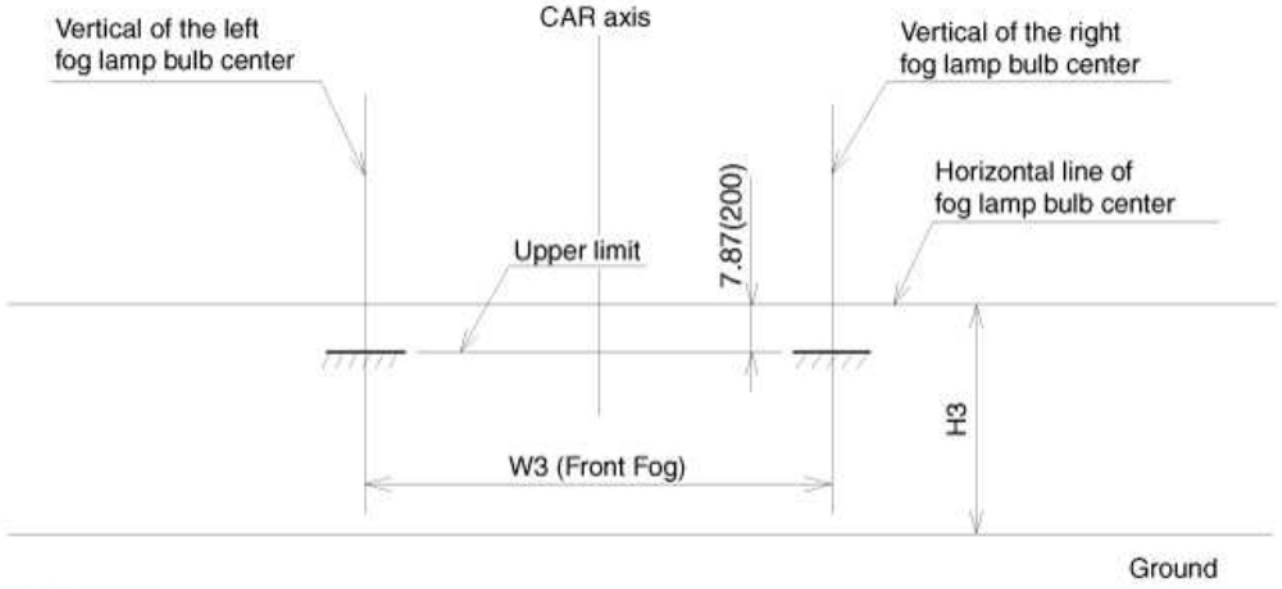
[HID]



Unit : in.(mm)

24.9ft (7.6m) SCREE

2. Turn the front fog lamp on with driver seated in the vehicle.
   The cut-off line should be projected in the allowable range shown in the picture.



L : 9.84 ft (3m)
Unit : in.(mm)

Body Electrical System

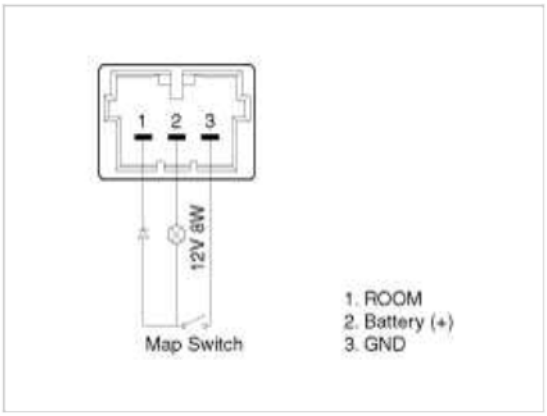
Inspection

1. Remove the room lamp assembly then check for continuity between terminals.

   [Sunroof]

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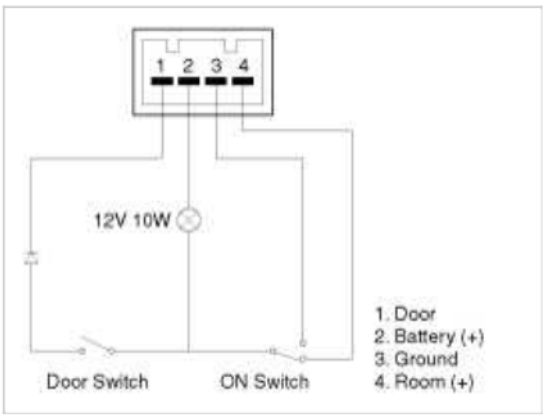




Position \ Terminal	1	2	3
OFF			
Map Switch ON	○	○	○

[General]





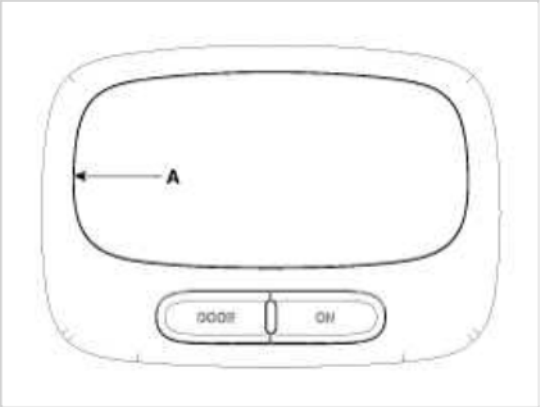
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Terminal / Position	1	2
DOOR	○	○
OFF		

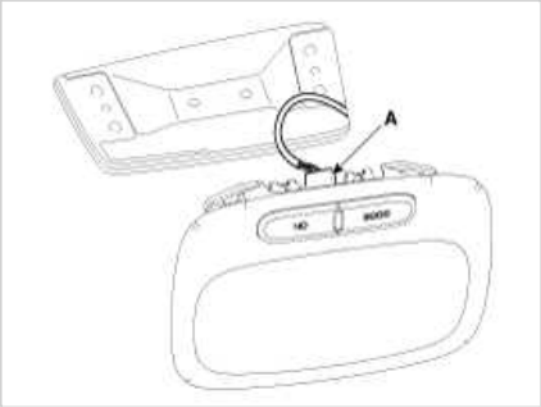
Removal

[General]

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then replace the bulb.

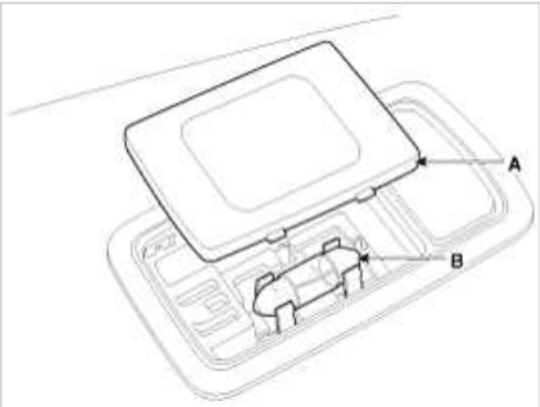


3. Loosen the fixing screw (2EA) and disconnect the 4P connector. And then remove the room lamp assembly (A).



[Sunroof]

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then replace the bulb (B).

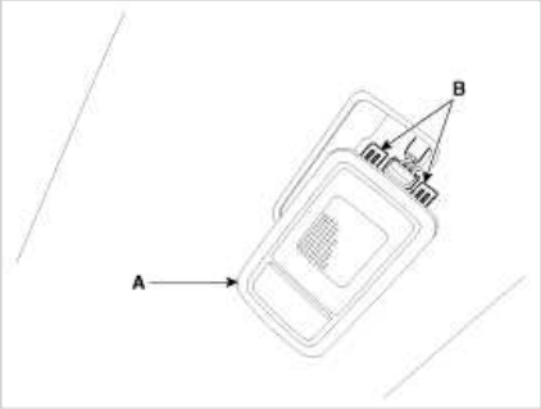


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3. If it is necessary to replace the lamp assembly, remove the room lamp (A).

NOTICE

Becareful not to damage the fixing clip (B) when disengaging the lamp assembly.

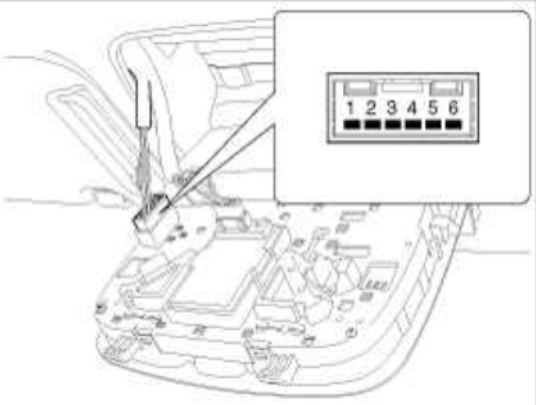


Installation

1. Install the room lamp assembly after connecting the lamp connector.
2. Install the lamp lens after assembling the bulb.

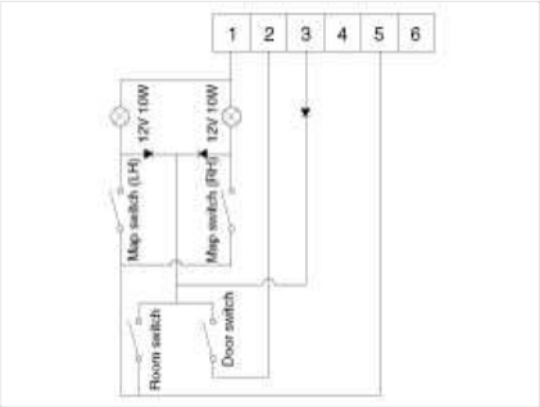
Inspection

Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as s replace the map lamp switch.



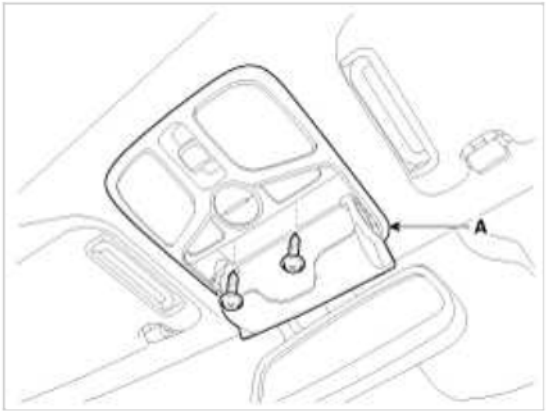
Item / Position / Terminal	Map lamp switch			
	Left		Right	
	ON	OFF	ON	OFF
1	●		●	
5	●		●	

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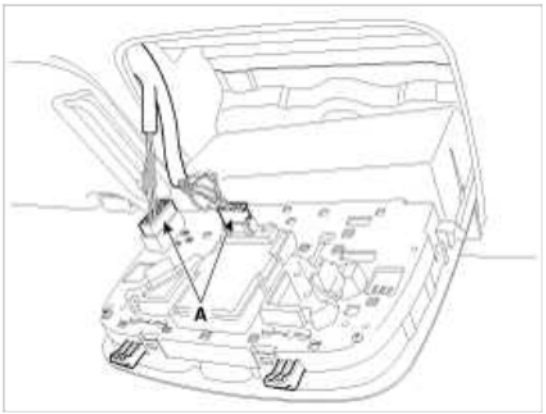


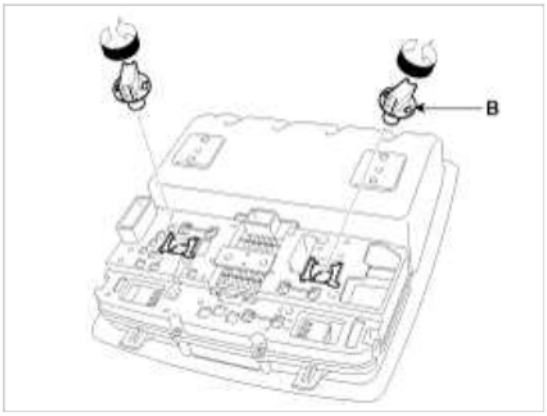
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the mounting screws (2EA).
   And then remove the overhead console (A).



3. Remove the overhead console lamp (B) from the head lining after disconnecting the sunroof switch connector and lamp switch connector (A).





4. If the bulb only should be replaced, replace the bulb after removing the lens.

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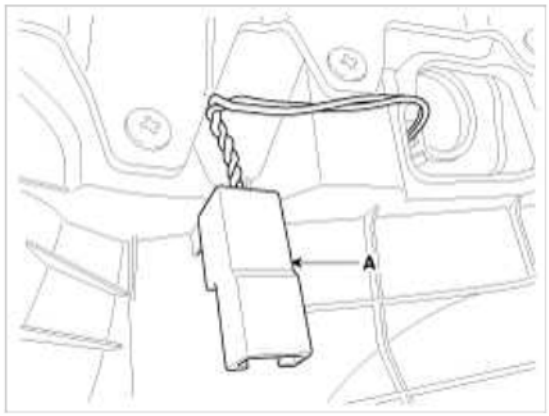
Installation

1. Install the overhead console lamp after connecting the sunroof switch connector and lamp connector.
2. Install the lens after tightening 2 screws.

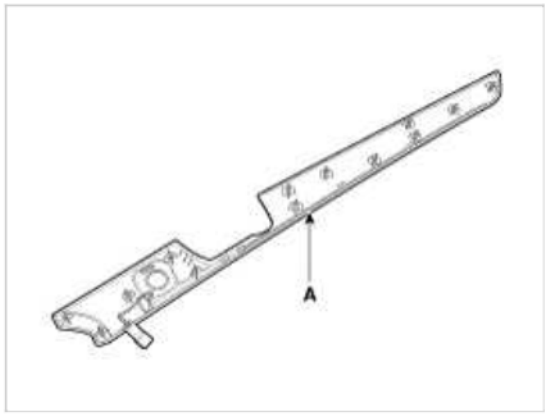
Body Electrical System

Removal

1. Disconnect the negative battery terminal.
2. Remove the front door trim.
   (Refer to Body - "Front door")
3. Disconnect the door mood lamp connector (A).



4. Remove the door mood lamp (A) after loosening the screws.



Installation

1. Install the door mood lamp and connector.
2. Install the front door trim.
3. Connect the negative battery terminal.

Body Electrical System

Removal

CAUTION

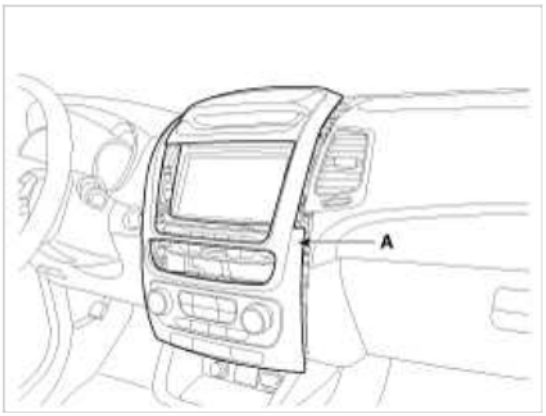
- Put on gloves to protect your hands.

Information

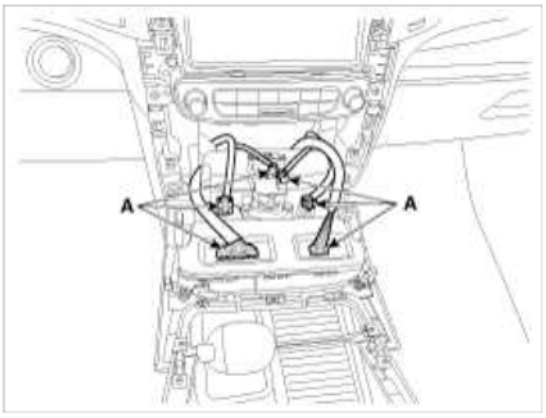
- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the relate parts, to prevent damage.
- Use a plastic panel removal tool to remove interior trim pieces to protect from marring the surface.
- Take care not to bend or scratch the trim and panels.

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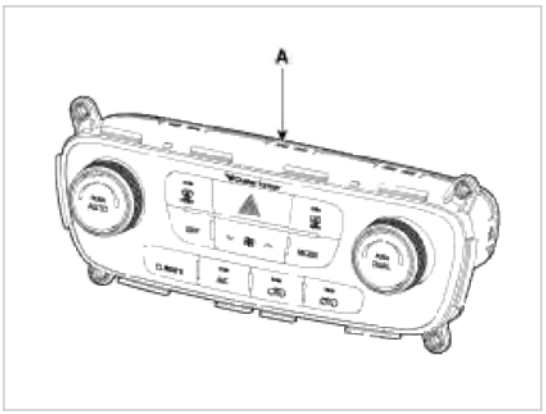
1. Disconnect the negative (-) battery terminal.
2. Using a screwdriver or remover, remove the center fascia panel (A).



3. Remove the heater control unit connectors (A).



4. Remove the heater control unit (A) with hazard switch.
(Refer to HA group - "Heater & A/C Control Unit")



Installation

1. Install the heater control unit to the center fascia panel.
2. Install the center fascia panel.

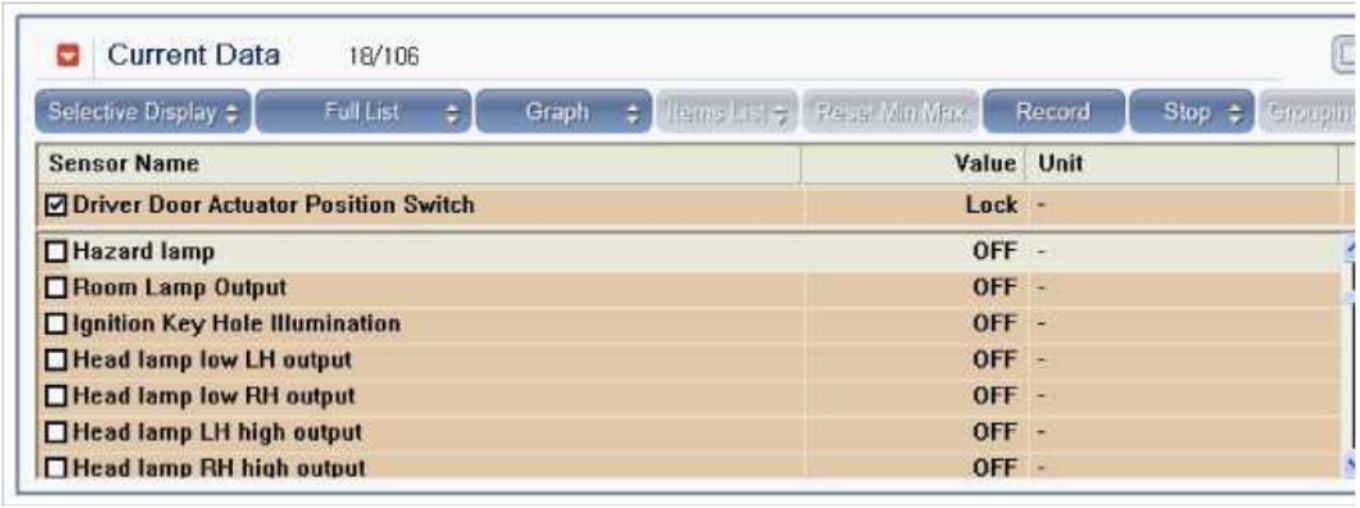
Inspection

Diagnosis With GDS

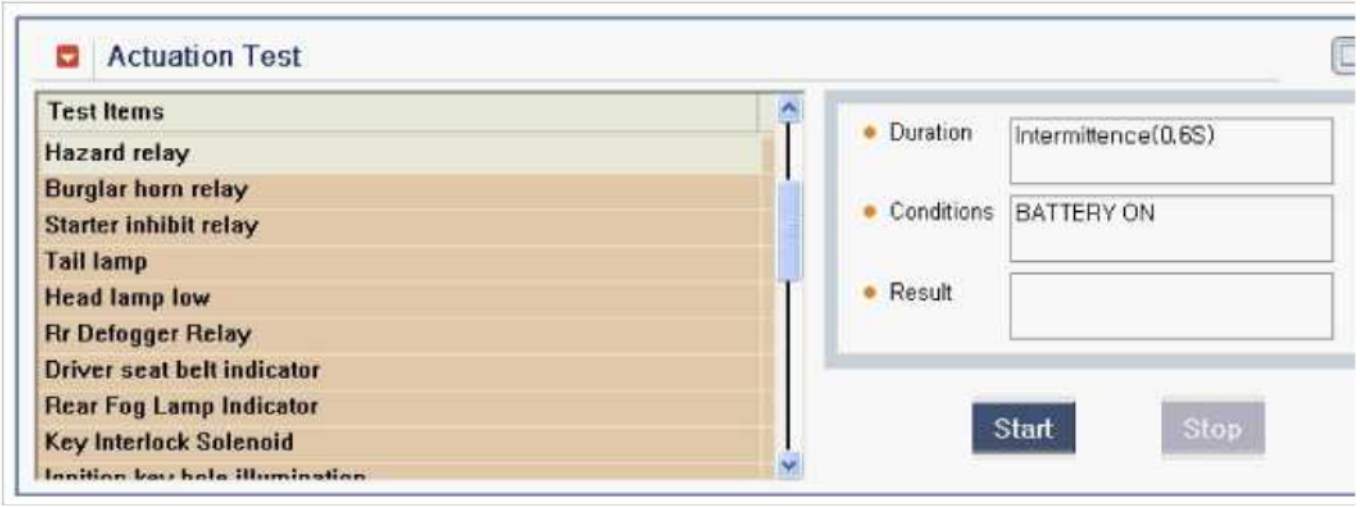
1. It will be able to diagnose defects of IPM with GDS quickly. GDS can operates actuator forcefully, input/output v monitoring and self diagnosis.

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2. Select "Current data", if you will check current data of hazard switch.



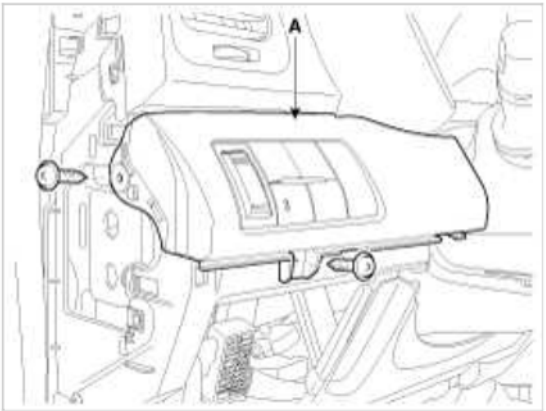
3. If you will check the hazard switch operation forcefully, select "Actuation test".



Body Electrical System

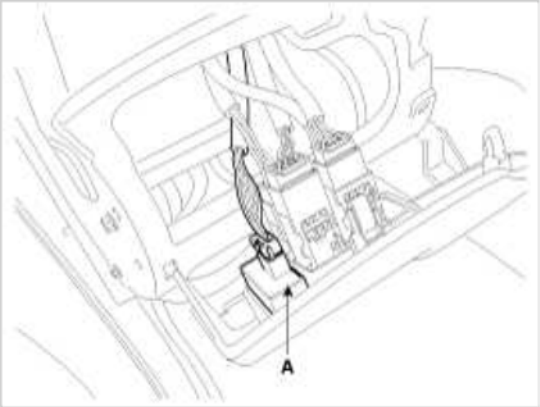
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover.
3. Remove the lower crash pad switch assembly (A) after loosening the screws.

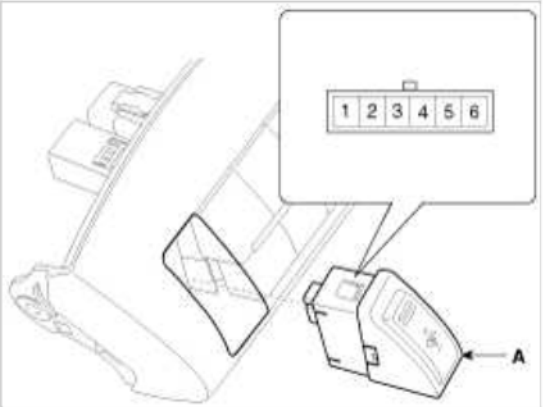


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4. Remove the rheostat switch connector (A).



5. Remove the rheostat switch (A) from lower crash pad switch assembly.



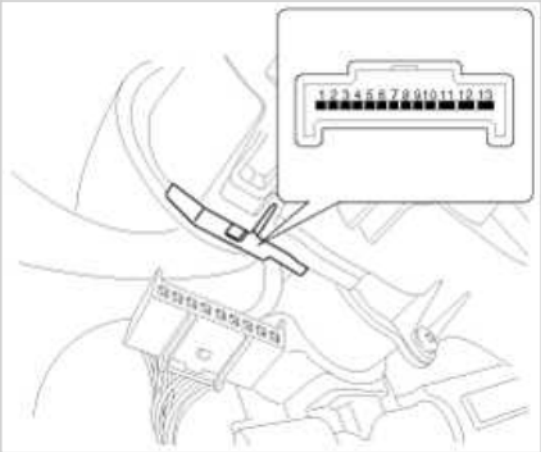
6. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickerii the rheostat is turned, it can be assumed that the rheostat is normal.

Terminal / Position	UP(+)	DOWN(-)	Description
1		○	Down
2	○	○	GND
5	○		Up
3	○		Illumination (-)
4	○ ~~~		Illumination (+)

Inspection

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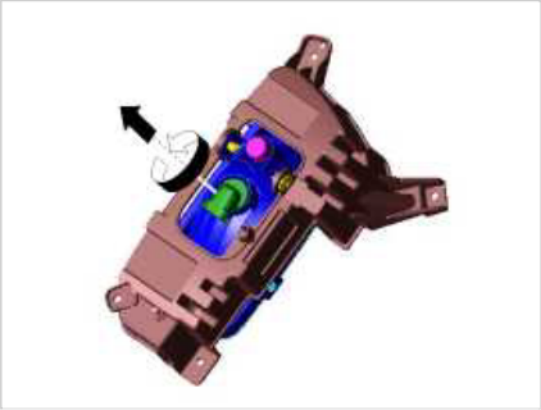
1. With the fog lamp switch in each position, make sure that continuity exists between the terminals below. If continu not as specified, replace the multifunction switch.



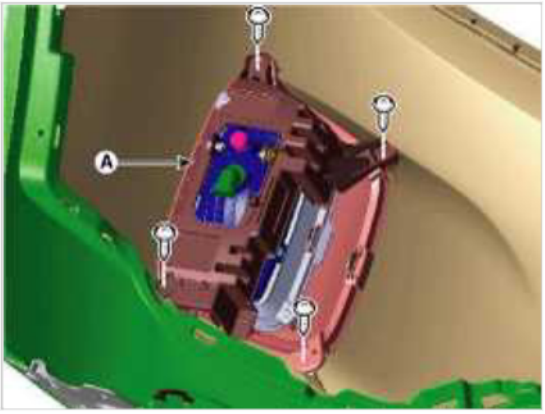
Terminal / Position	5	6
ON	○	○
OFF		

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front tire wheel guard.
   (Refer to Body - "Front bumper")
3. Turn the bulb socket counterclockwise and then remove the fog lamp bulb.



4. If it is necessary to replace the lamp assembly, remove the fog lamp (A) after loosening the screws.



Installation

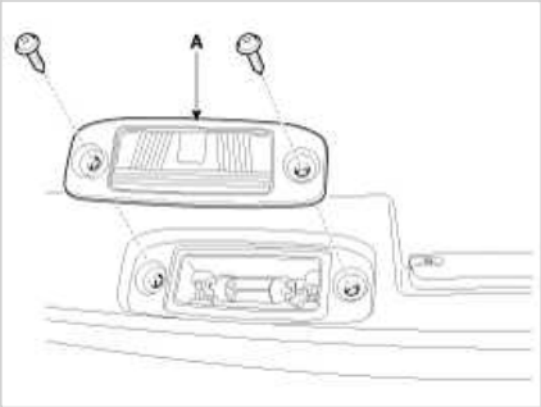
1. Install the front fog lamp bulb.
2. Connect the fog lamp connector.

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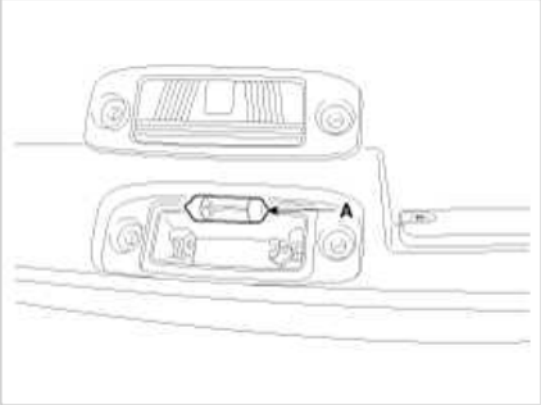
3. Install the front tire wheel guard.

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens (A) from the panel after loosening a screw.



3. Replace the bulb (A).



Installation

1. Install the bulb.
2. Install the license lamp lens.

Body Electrical System

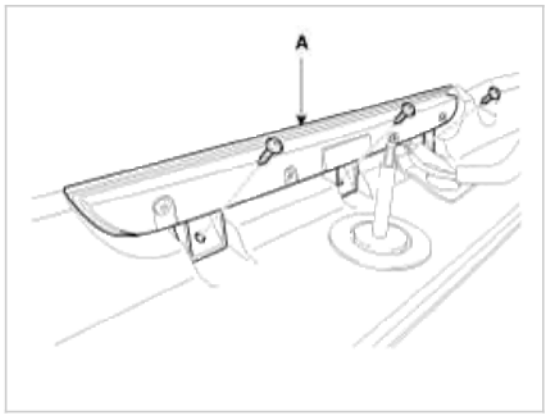
Removal

High Mounted Stop Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.
   (Refer to Body - "Body Side Moldings")

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3. Remove the high mounted stop lamp assembly after removing nuts (3EA).



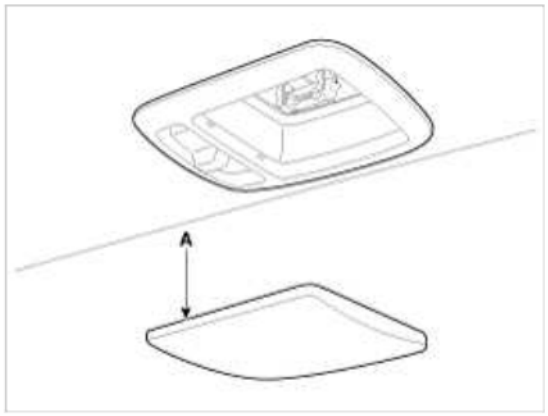
Installation

1. Install the high mounted stop lamp.
2. Install the tailgate trim.

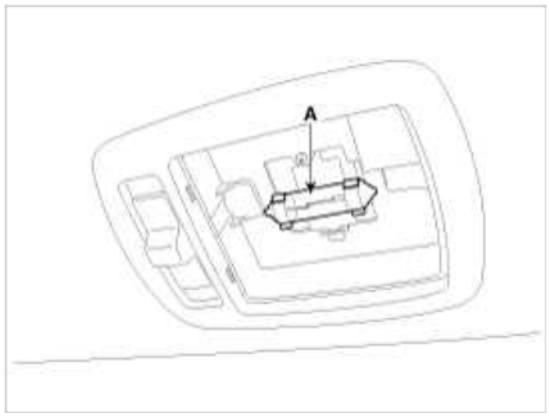
Body Electrical System

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the cargo lamp lens (A) with a flat-tip screwdriver.

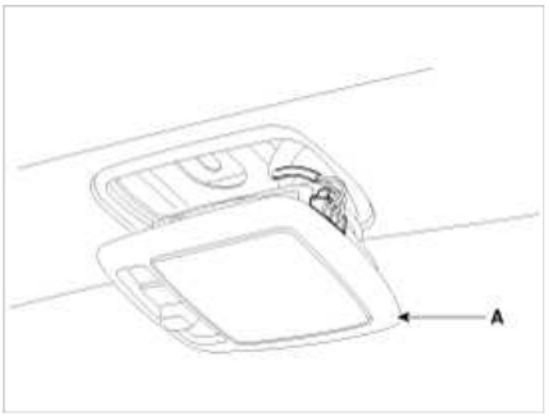


3. Remove the cargo lamp bulb (A).



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4. Remove the cargo lamp assembly (A) after disconnecting the connector.



Installation

1. Replace the lamp bulb.
2. Install the cargo lamp assembly after connecting the lamp connector.

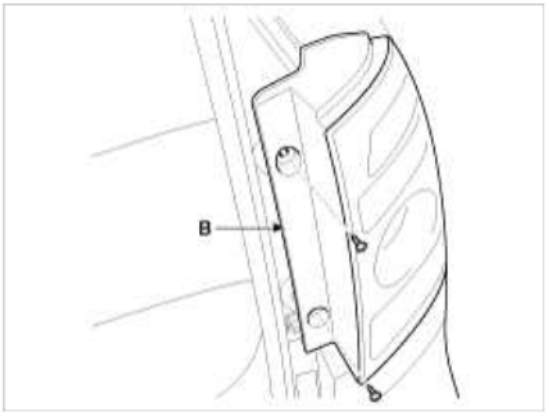
Body Electrical System

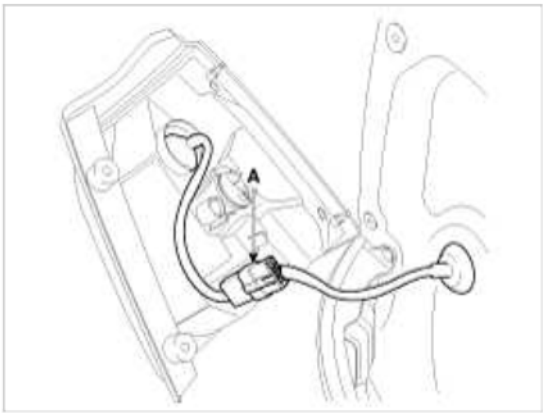
Removal

1. Disconnect the negative (-) battery terminal.

   [Outside]

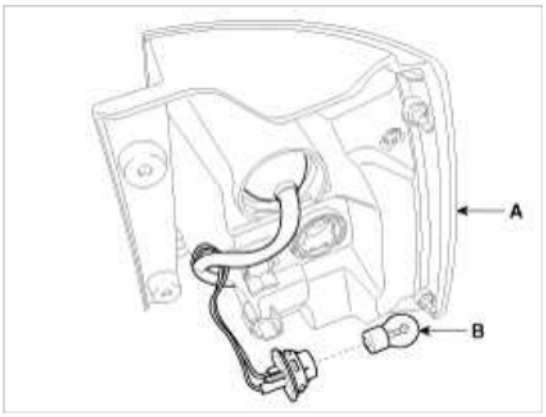
2. Loose the screws (2EA) holding the rear combination lamp then disconnect the connector (A) then remove the ou rear combination lamp (B).





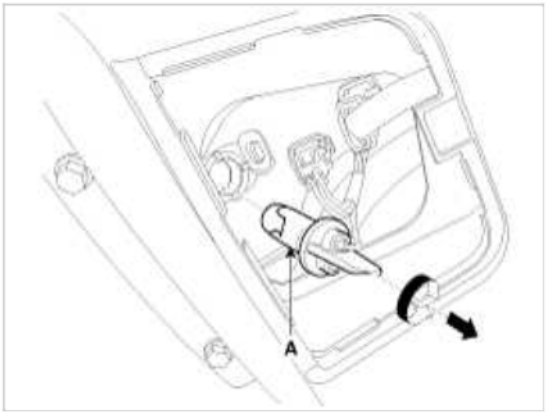
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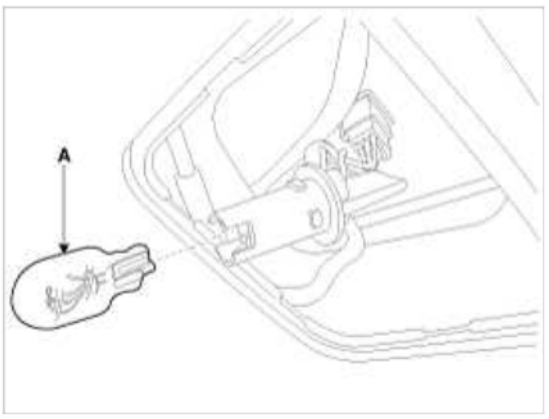
3. Replace the bulbs (B) after removing the rear combination lamp assembly (A).



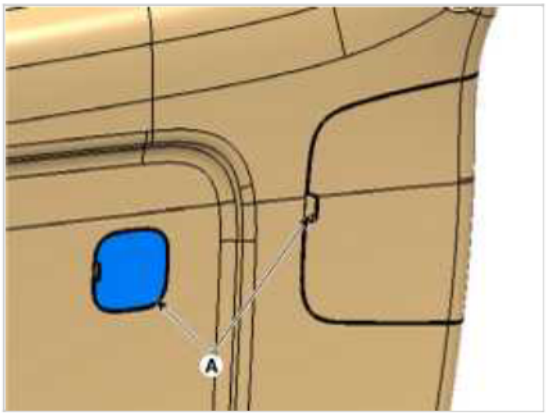
[Inside]

4. If the bulbs should be only replaced without removing lamp assembly, replace the bulbs after removing the rear combination lamp cover inside trunk.



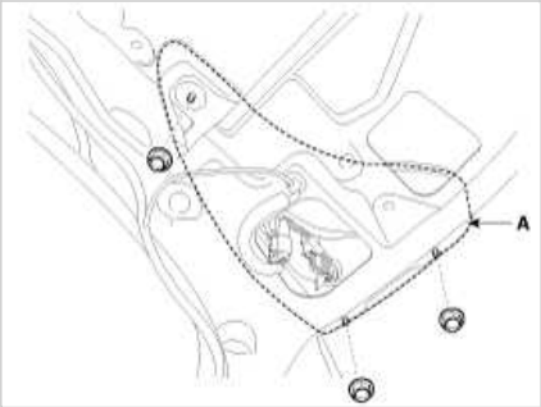


5. Remove the tail gate service covers (A) when removing the inside rear combination lamp assembly.

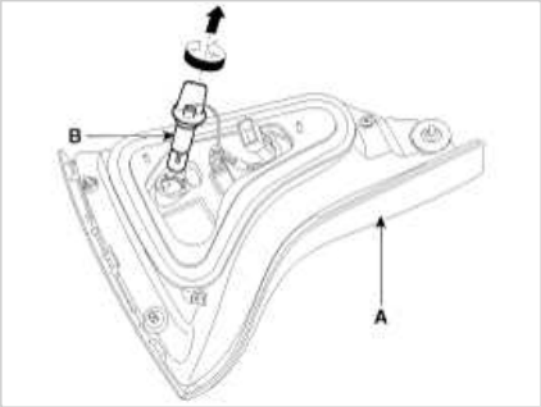


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6. Disconnect the lamp cover on tailgate. Remove the lamp assembly (A) after loosening nuts (3EA) and disconnect connector.



7. Remove the tailgate combination lamp assembly (A) and then replace the bulbs (B).



8. If the bulbs should be only replaced without removing lamp assembly, replace the bulbs after removing the tailgate cover inside trunk.

Installation

1. Install the tailgate combination lamp assembly after replacing the bulb.
2. Install the lamp cover to the tailgate after connecting the lamp connector.
3. Install the rear combination lamp assembly after replacing the bulbs and connecting the lamp connector.

Body Electrical System

Troubleshooting

Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Ignition fuse (LOW:10A, HIGH:20A) blown	Check for short and re fuse
	Head lamp fuse (15A) blown	Check for short and re fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not	Bulb burned out	Replace bulb

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light	Tail lamp fuse (10A) blown	Check for short and re fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (15A) blown	Check for short and re fuse
	Stop lamp switch faulty	Adjust or replace switc
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switc
Instrument lamps do not light (Tail lamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and re fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (15A) blown	Check for short and re fuse
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and re fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and re fuse
	Room lamp switch faulty	Check switch

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	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (15A) blown	Check for short and re fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Rear fog lamp fuse (15A) blown	Check for short and replace fuse	
Rear fog lamp fuse (15A) blown	Check for short and replace fuse	
Rear fog lamp switch faulty	Check switch	
Rear fog lamp relay faulty	Check relay	
Wiring or ground faulty	Repair if necessary	
Map lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and re fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Trunk room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and re fuse
	Trunk room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System

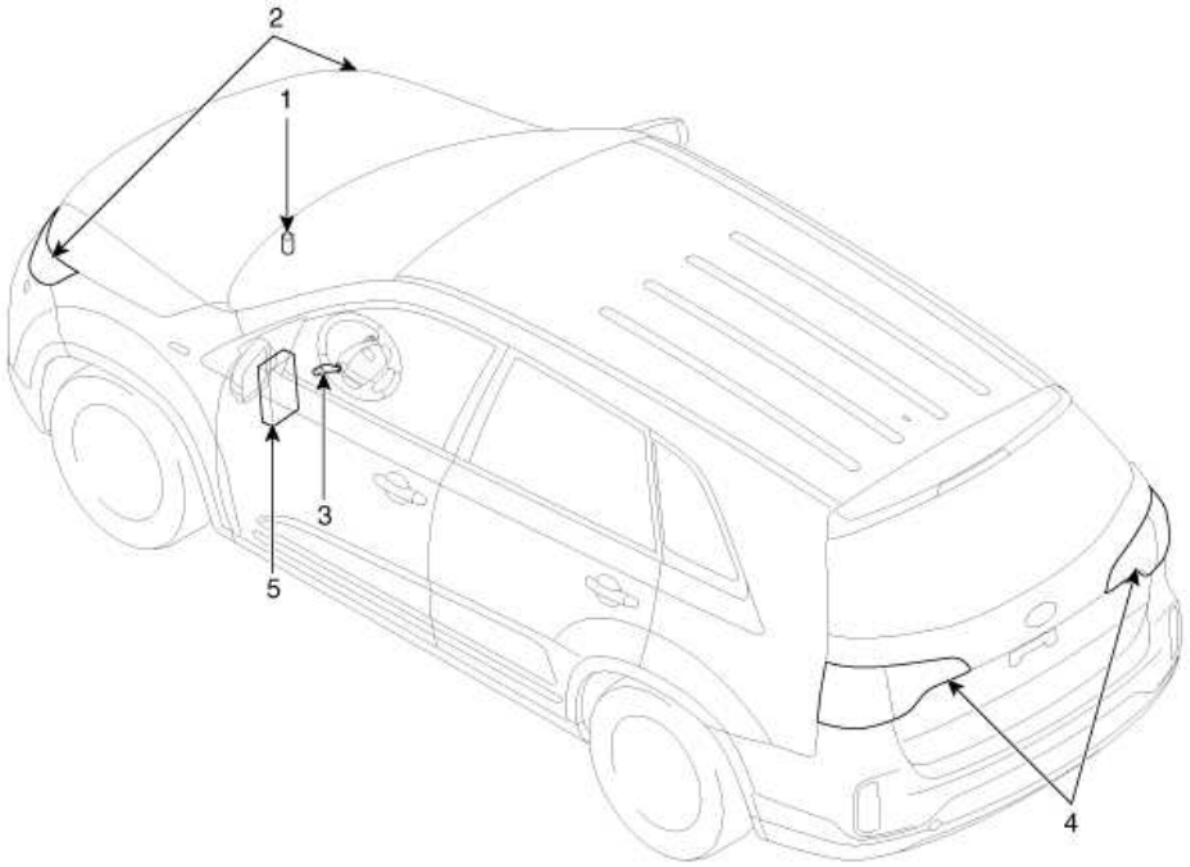
Specifications

Items		Specifications
Rated voltage		5V
Load		Max. 1mA
Detection illuminations	Tail lamp	ON : 2.7 ± 0.05 (V) OFF : 4.3 ± 0.05 (V)
	Head lamp	

Body Electrical System

Component Location

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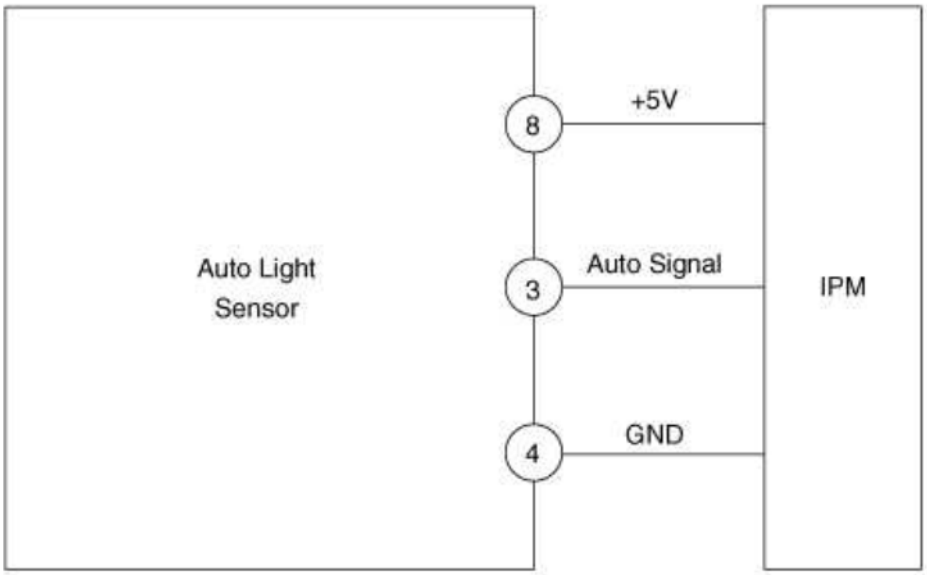


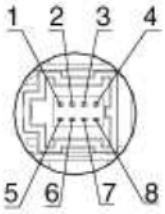
1. Auto light sensor 2. Head lamps 3. Lighting switch (Auto)	4. Tail lamps 5. IPM (Intelligent intergrated Platform Module)

Body Electrical System

Circuit Diagram

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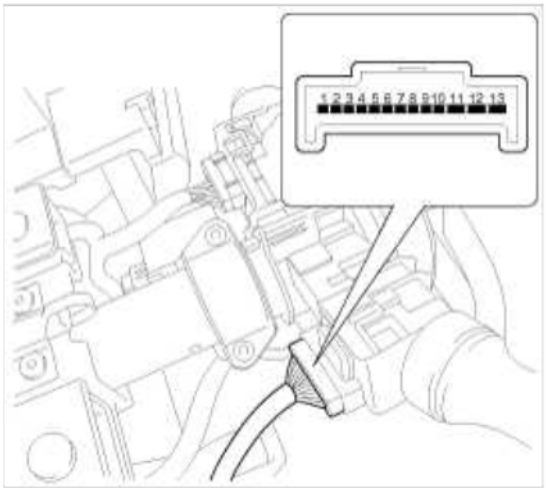
[Auto Light Unit Side Connector]

3. Signal (Autolight)
4. GND
8. Vcc (+5V)



Inspection

Operate the auto light switch, then check for continuity between terminals of multi-function switch connector.



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Position \ Terminal	1	4	3	2
OFF				
I	○			○
II	○	○		○
AUTO			○	○

Inspection

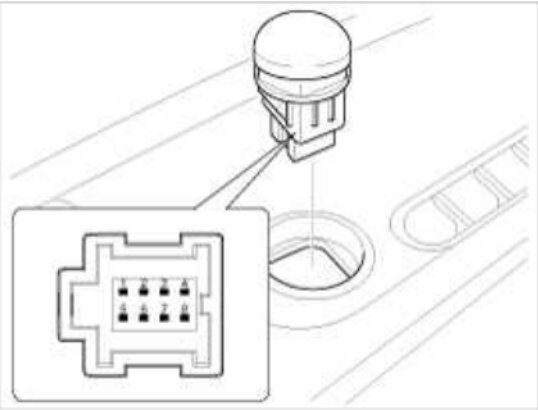
In the state of IGN1 ON, when multi function switch module detects auto light switch on, tail lamp relay output and h lamp low relay output are controlled according to auto light sensor's input.

The auto light control doesn't work if the pin sunlight supply (5V regulated power from Ignition 1 power to sunlight se in short circuit with the ground.

If IGN1 ON, The IPM monitors the range of this supply and raises up a failure as soon as the supply's voltage is out range. Then this failure occurs and as long as this is present, the head lamp must be turned on without taking care abo sunlight level provided by the sensor.

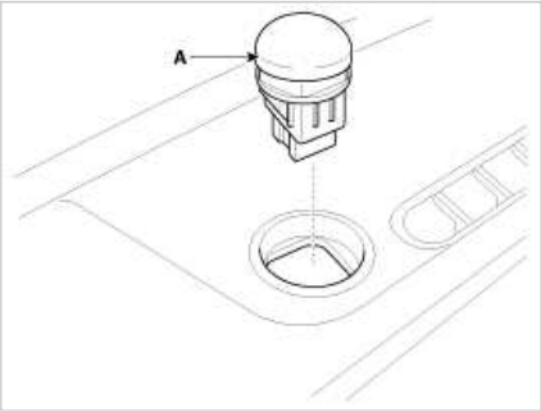
This is designed to prevent any head lamp cut off when the failure occurs during the night.

	Tail lamp	**Head lamp**
ON	2.7 ± 0.05V	
OFF	4.3 ± 0.05V	



Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the photo & auto light sensor (A) from crash pad upper side by using screw (-) driver.



3. Remove the auto light connector.

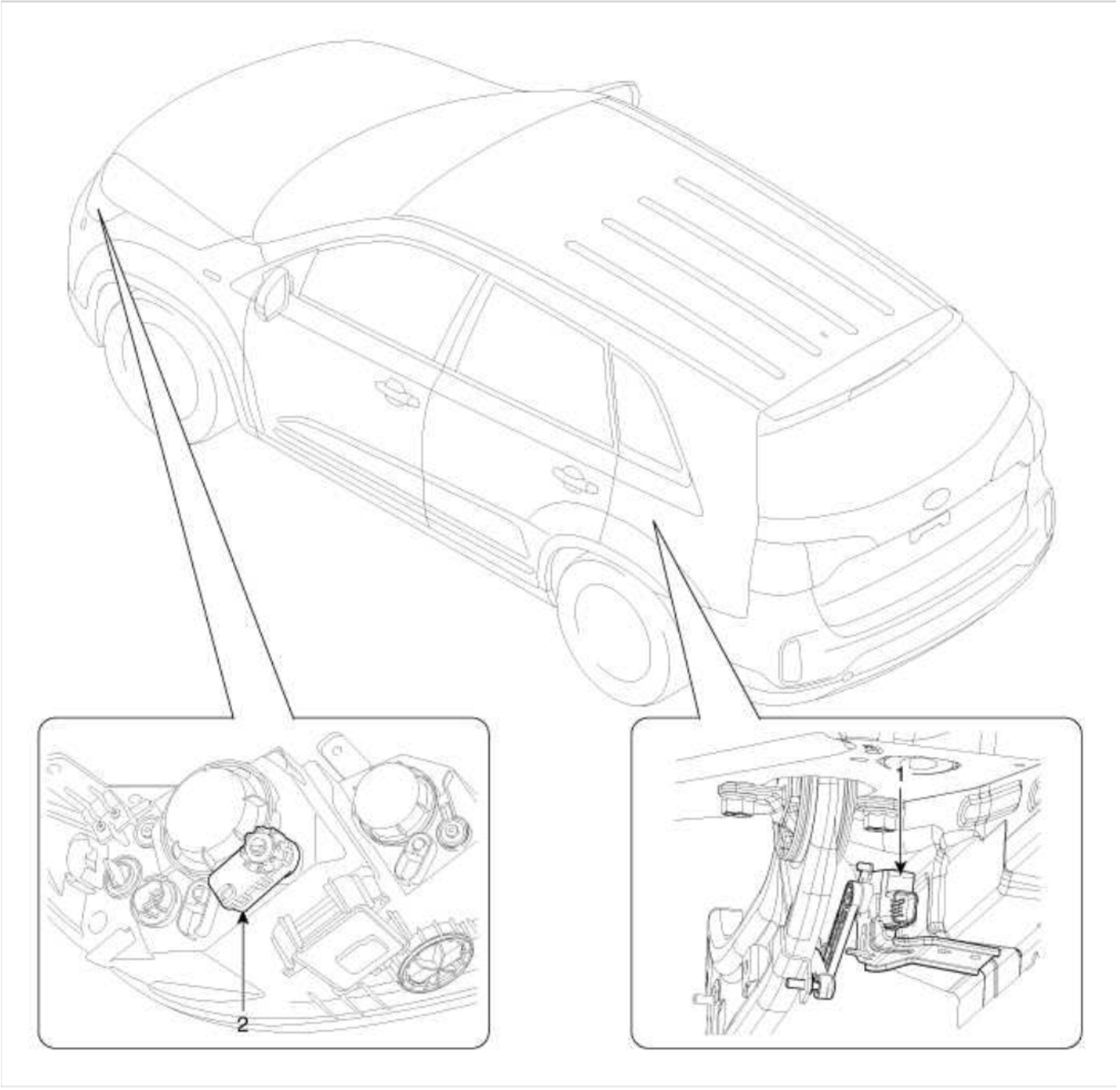
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Installation

1. Reconnect the auto light connector.
2. Install the auto light sensor.

Body Electrical System

Component Location

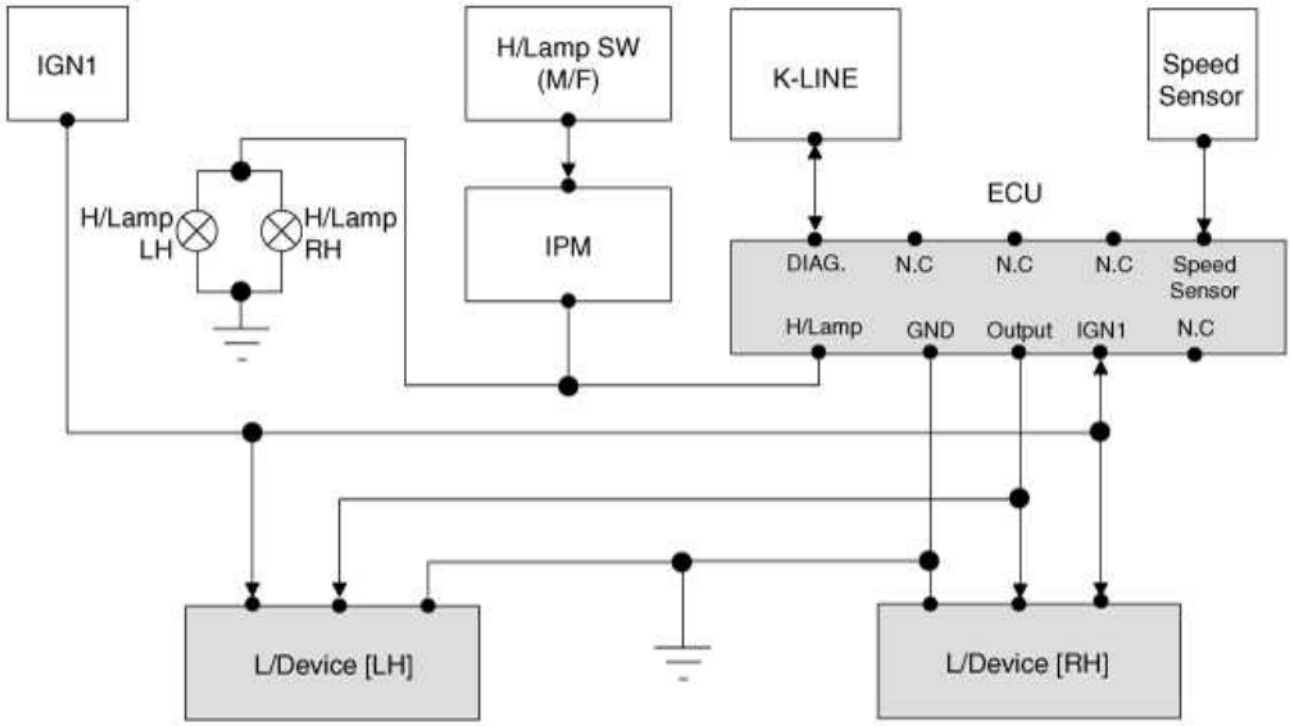


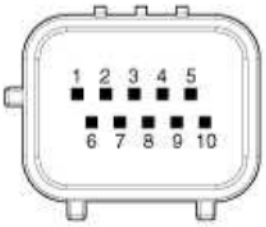
1. Head lamp leveling sensor & unit	2. Head lamp leveling actuator

Body Electrical System

Circuit Diagram

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Connector	Pin	Descritption	Remarks
	1	GND	Head lamp leveling sensor (unit) GND
	2	-	
	3	-	
	4	Diagnostic	K line
	5	Power	Head lamp leveling sensor (unit) power
	6	Vehicle speed	Vehicle speed signal
	7	Head lamp	Head lamp ON/OFF signal
	8	Signal output	Head lamp leveling sensor (unit) signal
	9	-	
	10	-	

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Description

According to driving environment and loading state of vehicle, head lamp lighting direction is changed to keep the driv visibility range and to protect the driver's vision from glare, aiming at safety driving.

Sensor mounting on the rear center arm drives the actuator mounting on the head lamp since sensing the input signal fc the vehicle's statical changes.

Head lamp beam is automatically operated by chassis tilt.

Purpose of AHLS(Auto Headlamp Leveling System)

- Compensation of headlamp visual range for changes in vehicle load.
- Preventing oncoming traffic being blinded by excessive glare.
- Meeting regulation

Operation

Operating Procedure

1. Suspension angle change resulted from vehicle's load change.
2. Height sensor signal change
3. Calculation of HLLD signal by AHLS ECU algorithm.
4. Sending a proper signal to HLLD (head lamp levelling device) and driving actuator.
5. Actuation of HLLD and compensation of headlamp beam range.

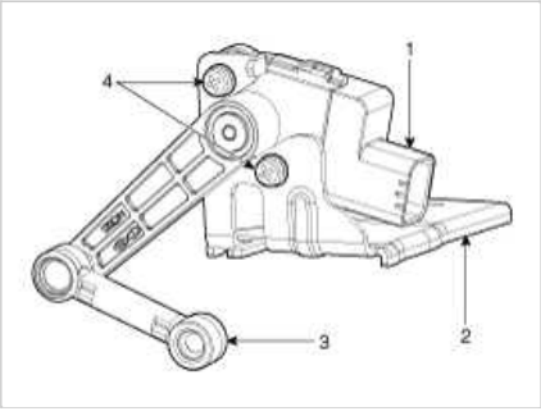
Operating Condition

- IGN1 ON & Head lamp low bean ON
- Sensor angle changed over 1° and keeping 10~12seconds with vehicle standing.
- Sensor angle changed over 1° and keeping 10~12seconds and when vehicle runs over 20km/h with constant spe
- Leveling control is off after controlling HLLD for few seconds.
- To eliminate mechanical tolerance, the lamp position is always reached from the lower side.

System characteristics

1. Height sensor & unit

No.	Components
1	Height sensor
2	Sensor mounting bracket
3	Link
4	Mounting screw



A. Using a Micro-processor, percept the operation lever's mechanical angle change or speed signal.
B. As an actuator control device of inner control program, mounting on the rear center arm.

Body Electrical System

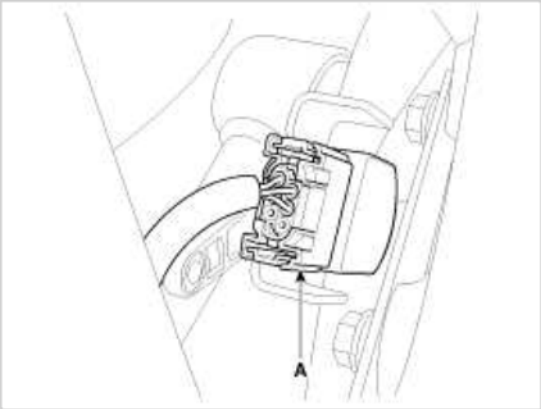
Removal

Height Sensor & Unit

1. Disconnect the negative(-) battery terminal.

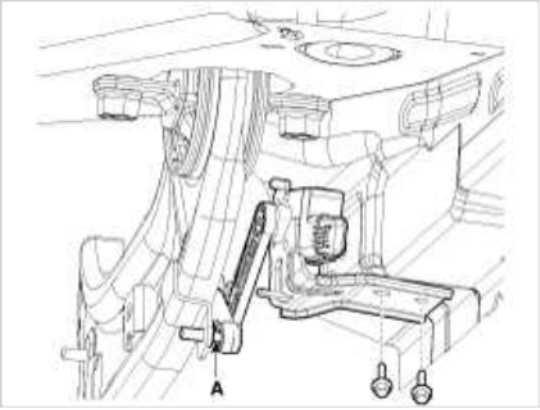
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2. Remove the height sensor connector (A).



3. Loosen the mounting bolts (2EA) from height sensor bracket after removing the linkage (A).

Torque :
3 ~ 5 N.m (0.3 ~ 0.5 kgf.m, 2.21 ~ 3.68 lbf-ft)



4. Remove the height sensor.

Installation

Height Sensor & Unit

1. Install the height sensor.
2. Connect the connector.

Inspection with GDS

Initialization and diagnosis sequence by using GDS equipment.
Below content summarize the procedure for A/S using GDS.

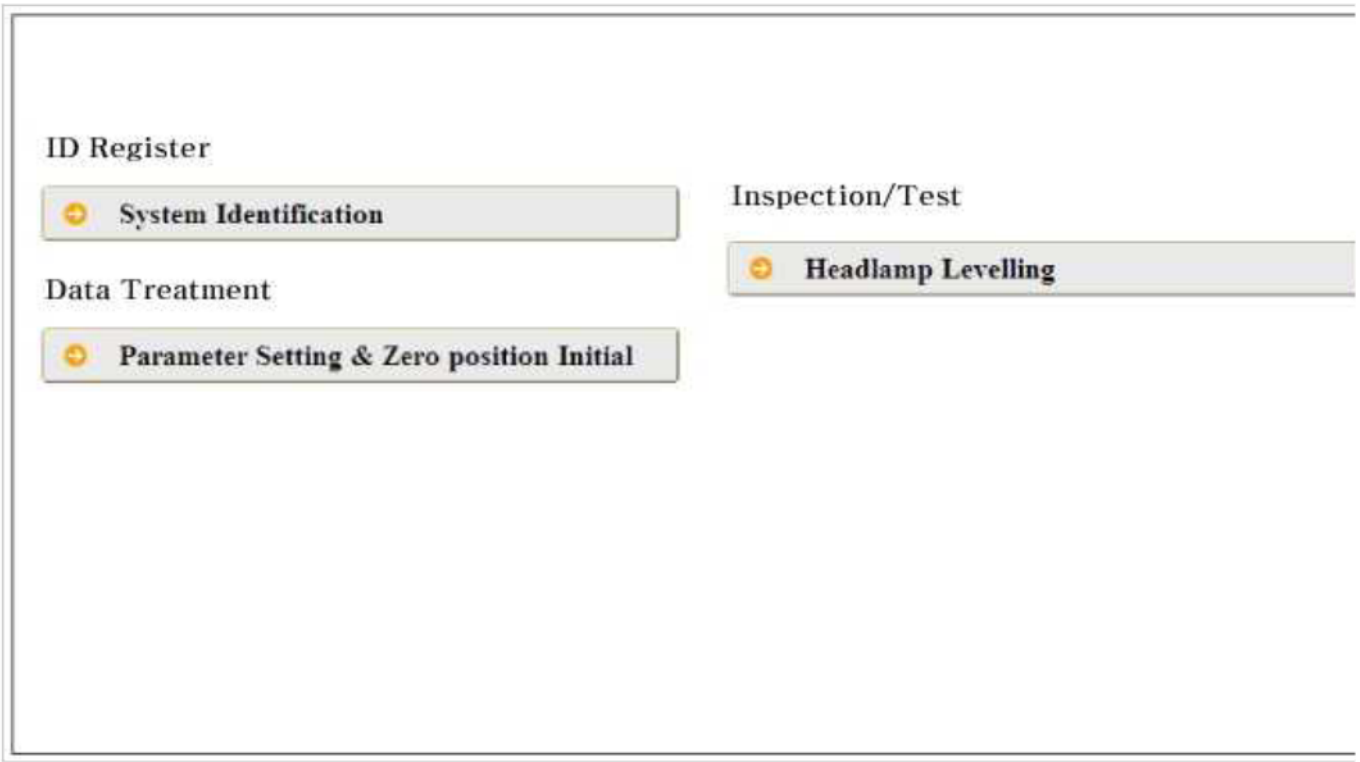
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No.	Procedure
1	Locate vehicle to flat plane
2	Tire check
3	IGN1 ON
4	Head lamp Low Beam ON
5	Connection with diagnostic tool
6	Initial command by diagnostic tool
7	Clear DTC Code
8	IGN1 OFF → ON
9	Re- Connection with diagnostic tool
10	Checking of HLLD output value as 15% and DTC Code
11	HLLD actuating by diagnostic tool command
12	Head lamp mechanical Initial Aiming

NOTICE

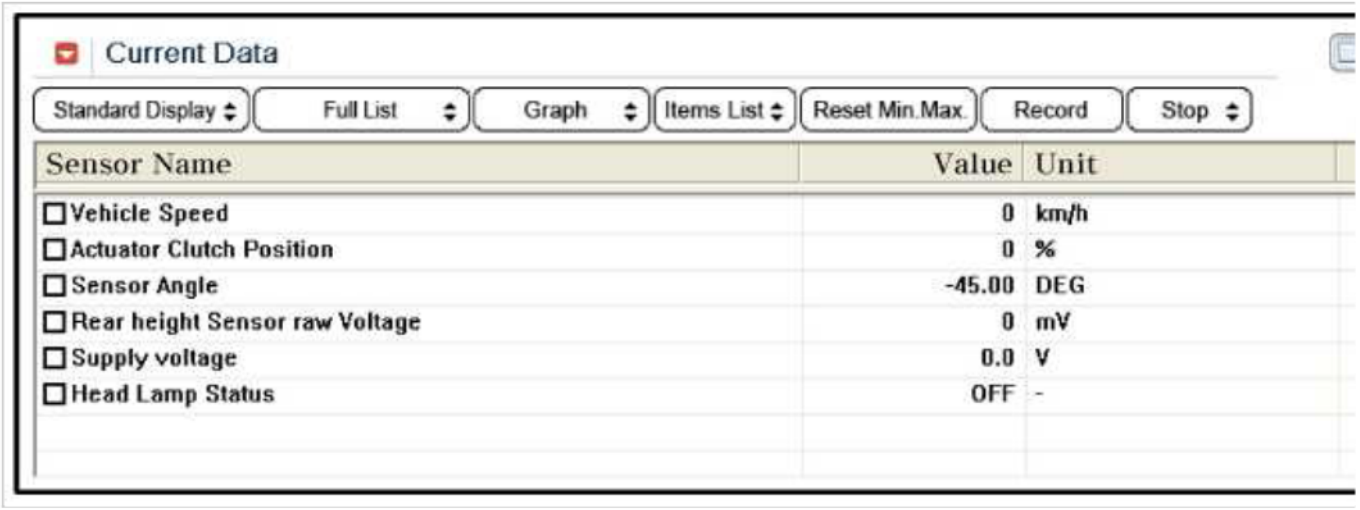
1. There's no loads in vehicle and vehicle should be on flat plane.
2. Should check of HLLD output value(15% for XM car) after initial setting.
3. Should do first electrical initial setting by diagnostic tool and then mechanical aiming afterward.

1. Select the vehicle model and "Head lamp leveling".

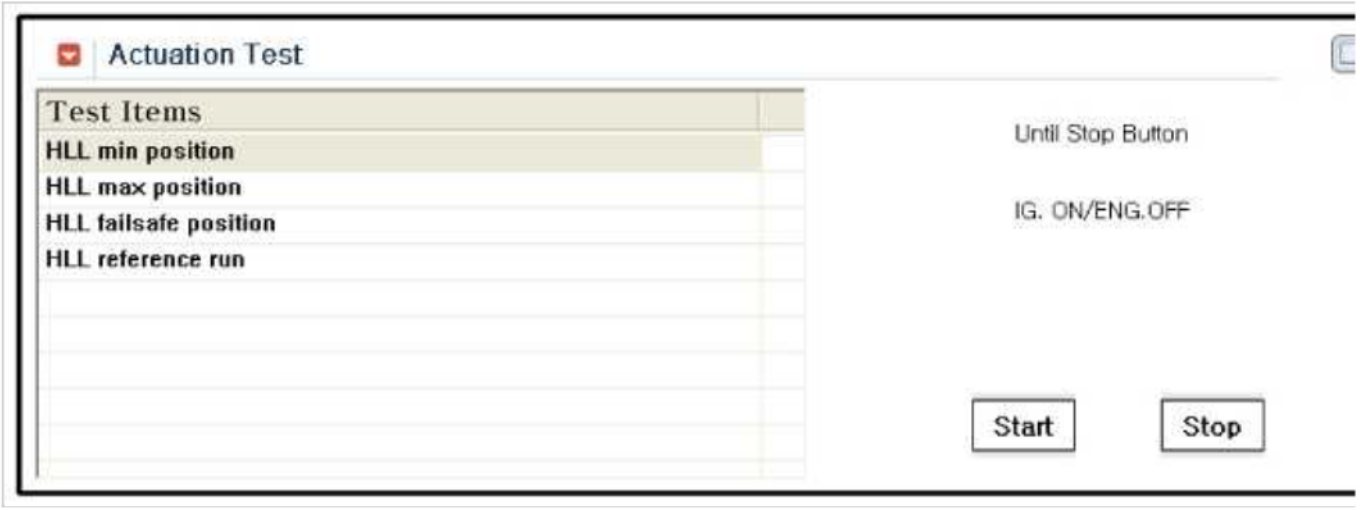


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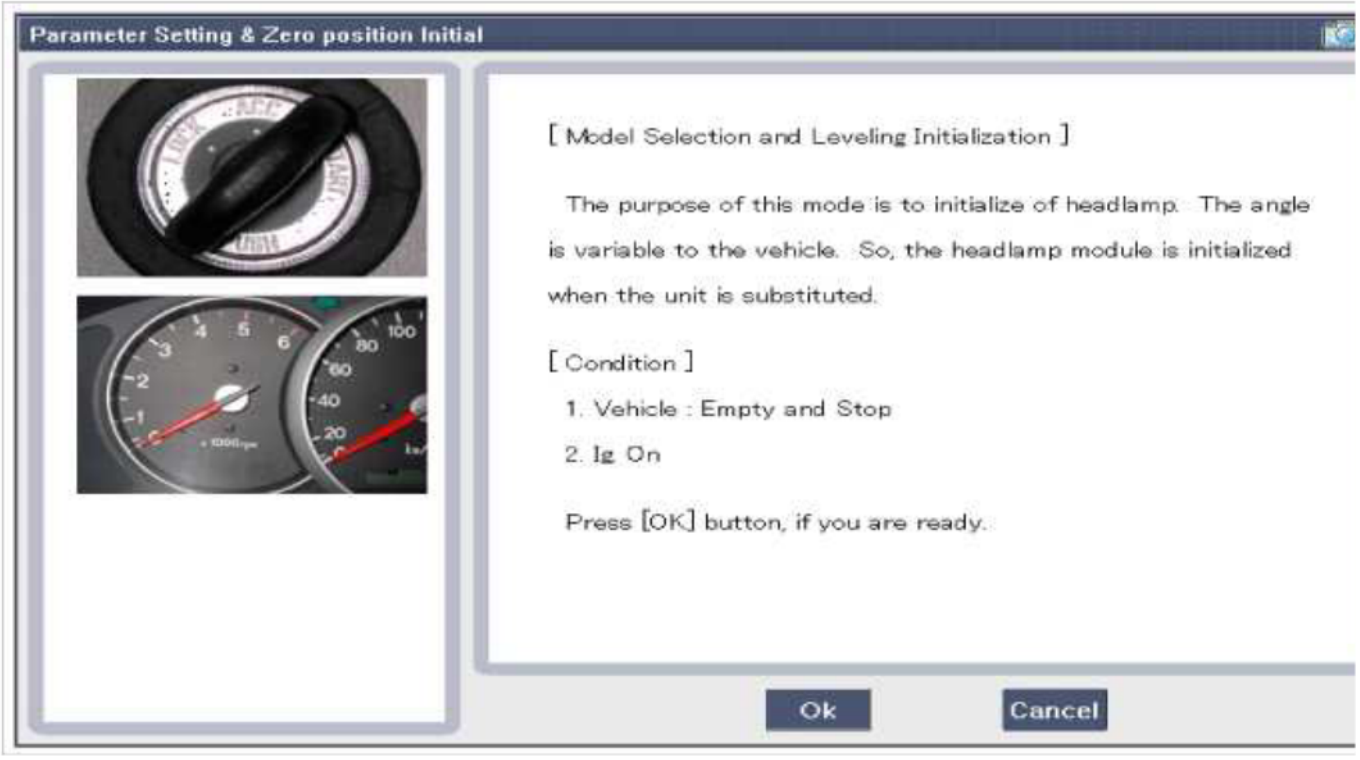
2. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.



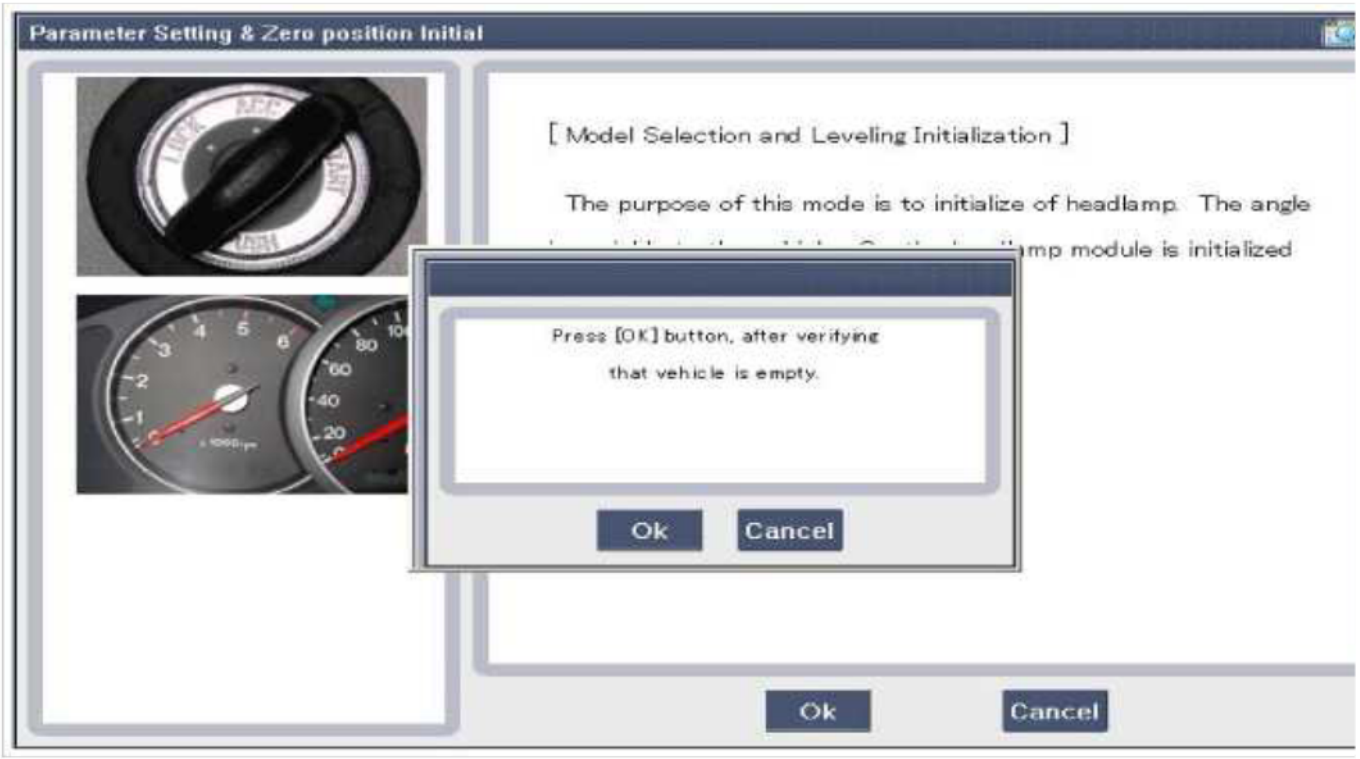
3. To perform functional test on AHLS outputs, select "Actuation Test".



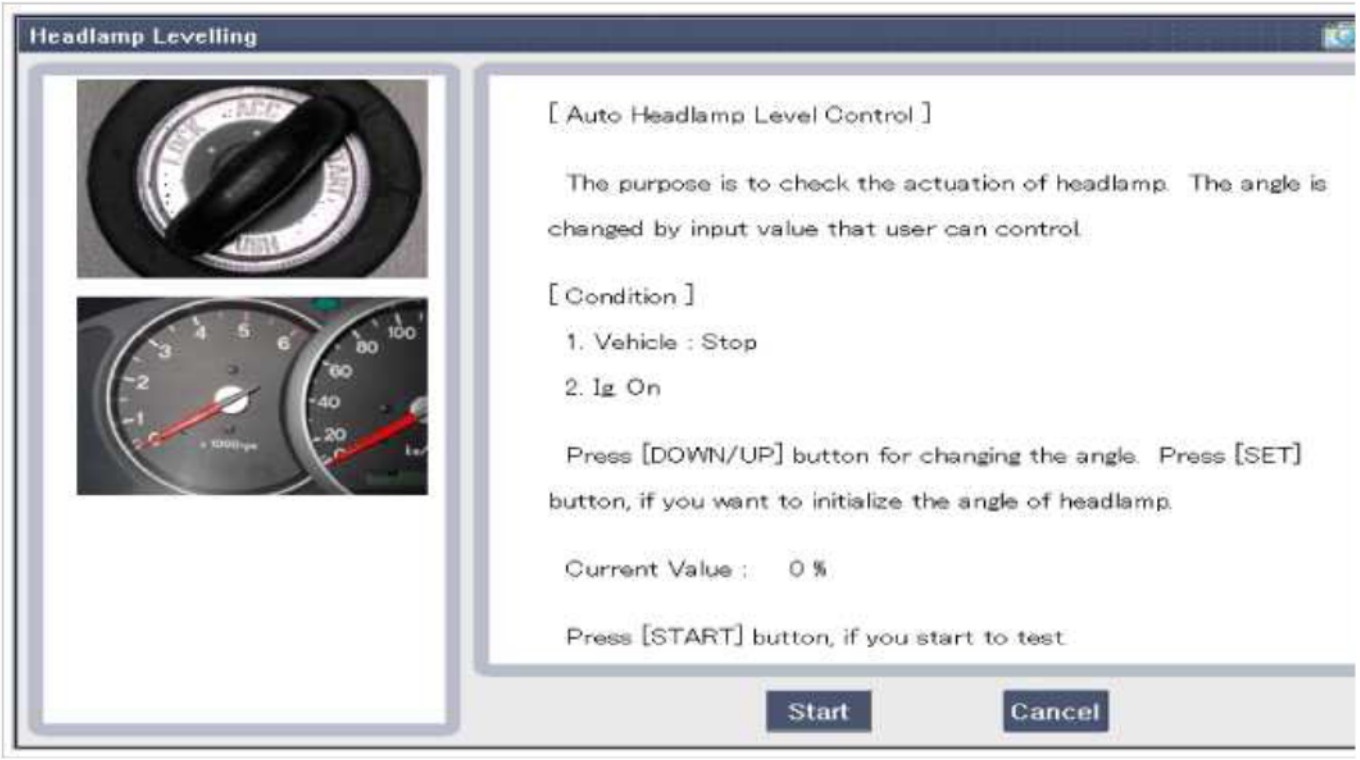
4. Select " Parameter setting & Zero position Initial".



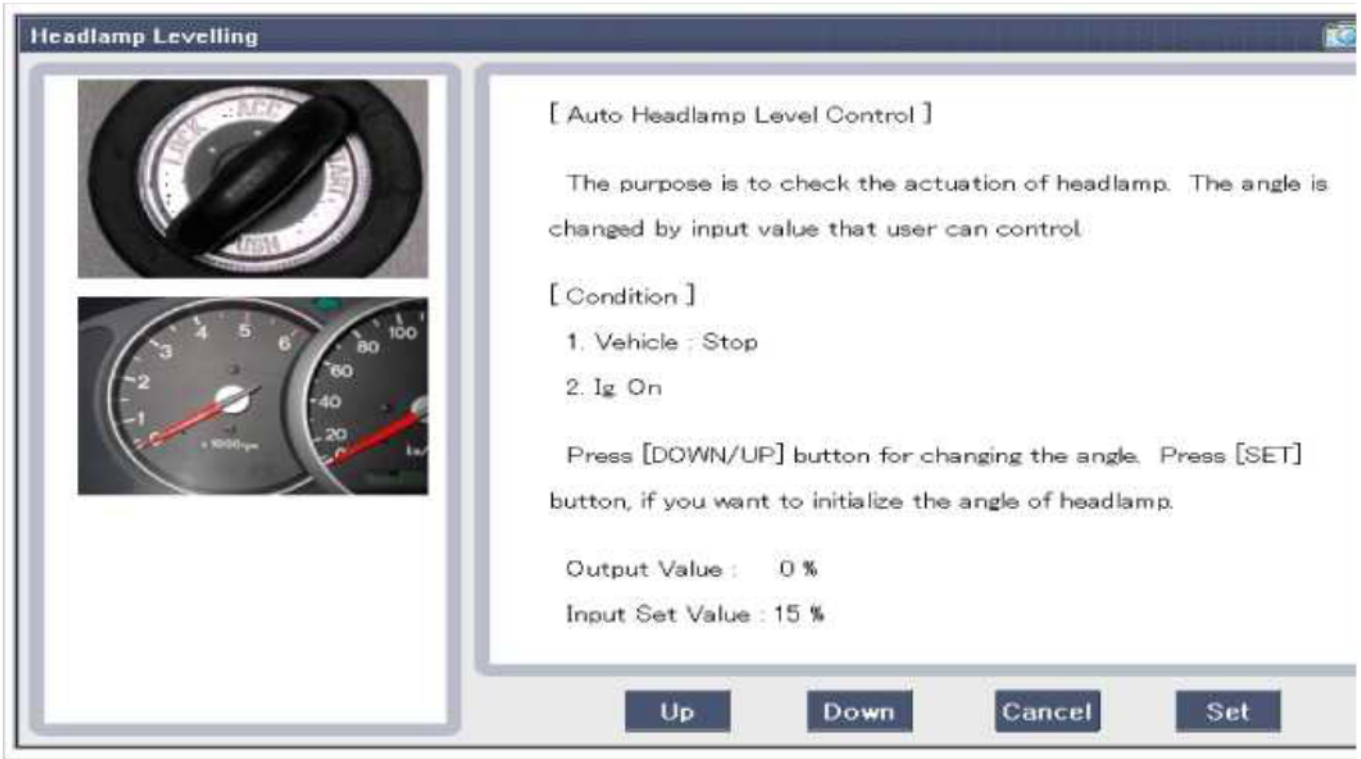
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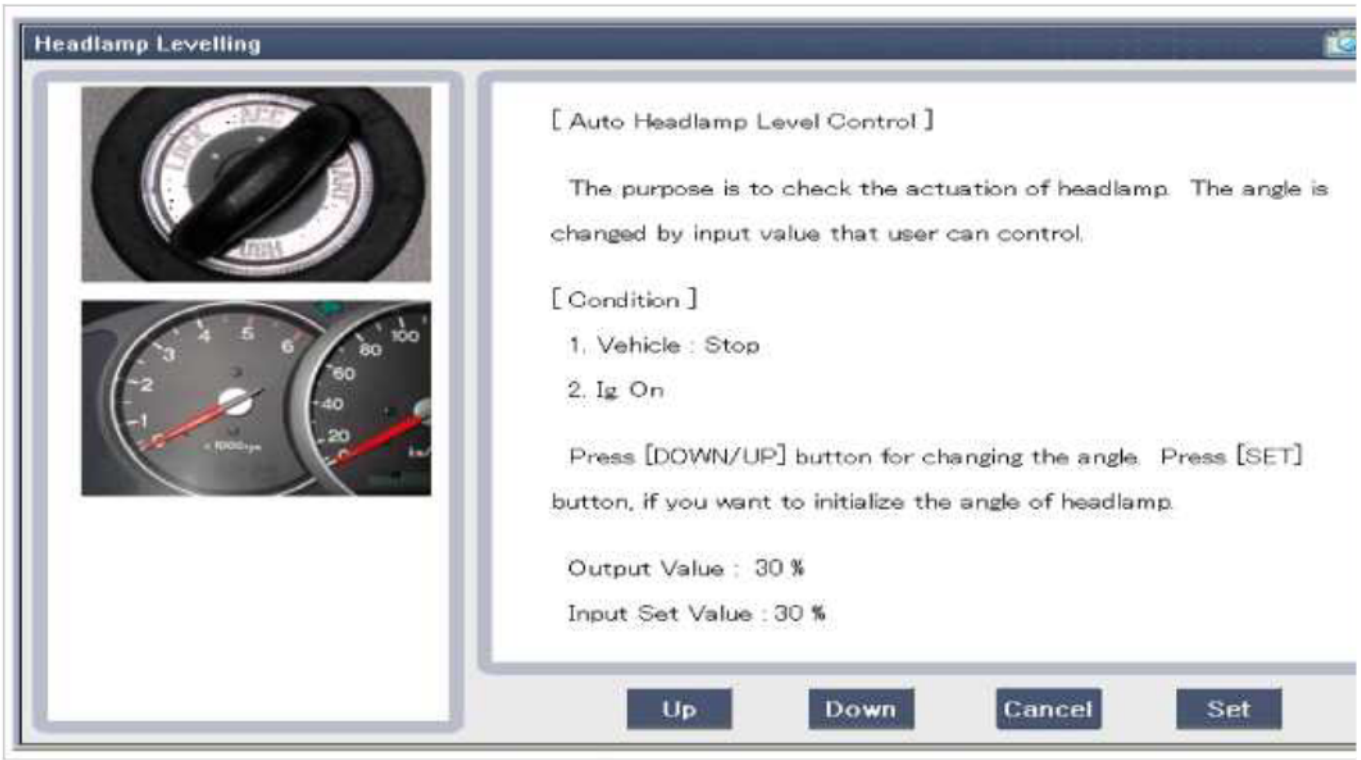


5. Confirm that AHLS operate forcefully in "Head lamp leveling" menu.



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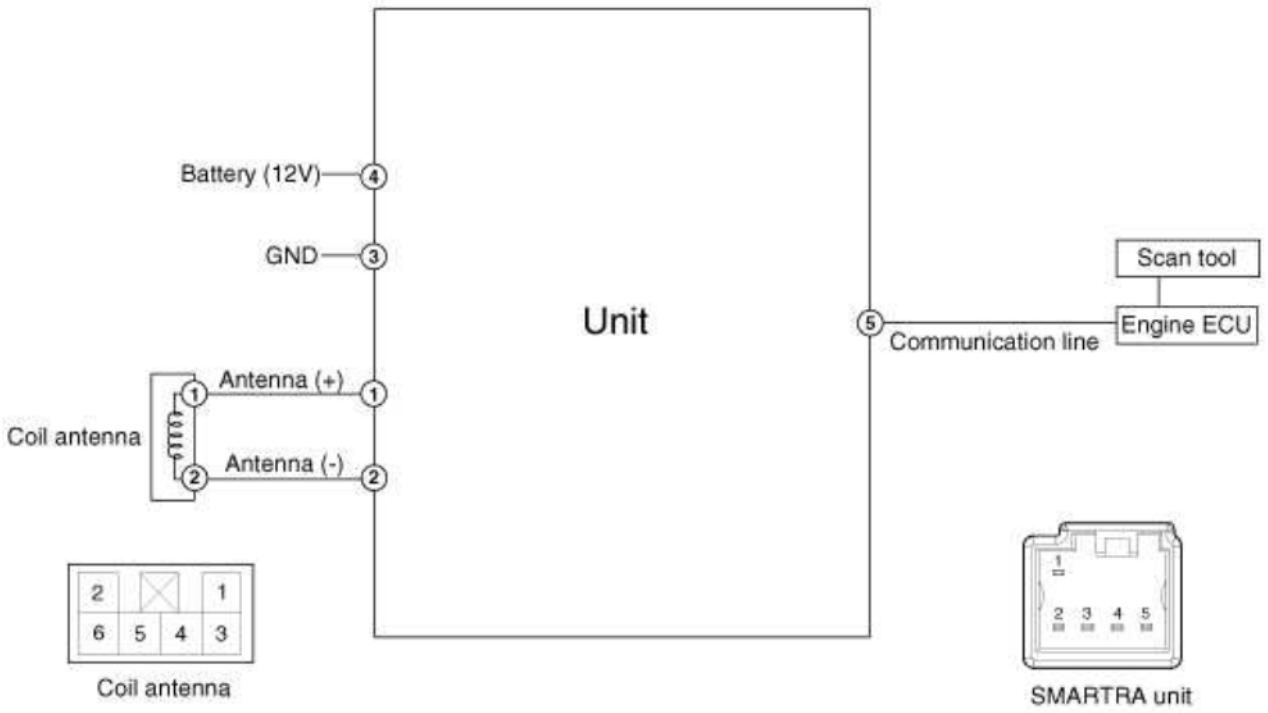


6. To check the DTC of the head lamp leveling system, select "Diagnostic trouble codes"

Body Electrical System

Circuit Diagram

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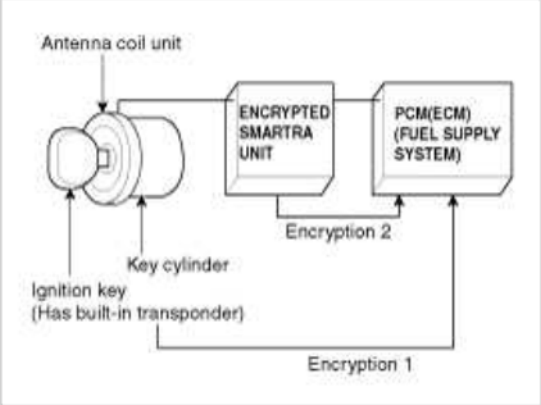
Body Electrical System

Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently availa theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. Encrypted SMARTRA type immobilizer
   A. The SMARTRA system consists of a passive challenge - response (mutual authentication)transponder located ignition key, an antenna coil, an encoded SMARTRA unit, an indicator light and the PCM(ECM).
   B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit tc the SMARTRA.
   C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit PCM(ECM).
   D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicat in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by the transponder.
   E. If the wrong key has been used and the code was not received or recognized by the PCM(ECM) the indicato will continue blinking for about five seconds until the ignition switch is turned OFF.
   F. If it is necessary to rewrite the PCM(ECM) to learn a new key, the dealer needs the customer's vehicle, all its and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting longer start the engine.
   G. The immobilizer system can store up to eight key codes.
   H. If the customer has lost his key, and cannot start the engine, contact Hyundai motor service station.

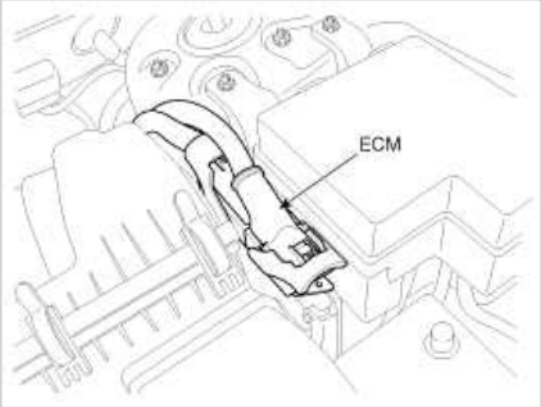
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Components Operations

PCM (Power Train Control Module)

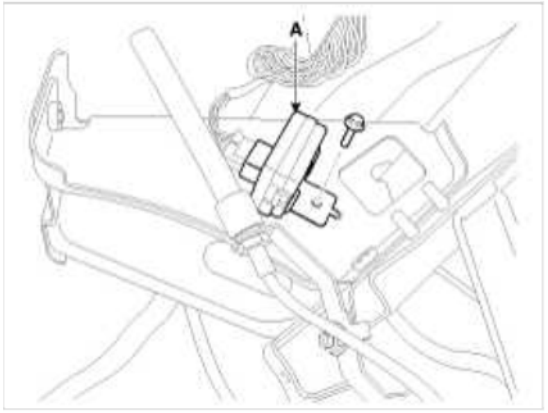
1. The PCM(ECM)(A) carries out a check of the ignition key using a special encryption algorithm, which is progran into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be st The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM).
   ERN (Encrypted Randorn Number) value between EMS and encrypted smartra unit is checked and the validity c coded key is decided by EMS.



ENCRYPTED SMARTRA unit(A)

The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communicat on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communicatio SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is tran to the transponder by the antenna.

The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. T device is only an advanced interface, which converts the RF data flow of the transponder into serial communication t PCM(ECM) and vice versa.



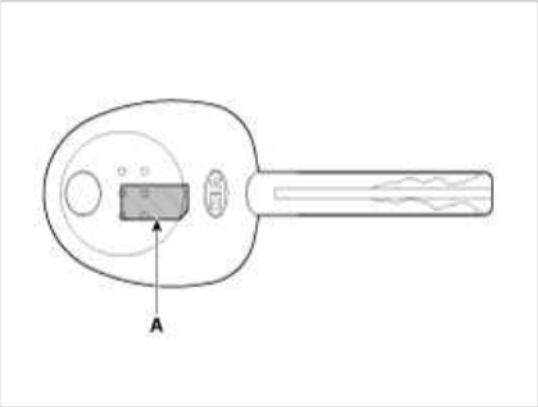
TRANSPONDER (Built-in keys)

The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will

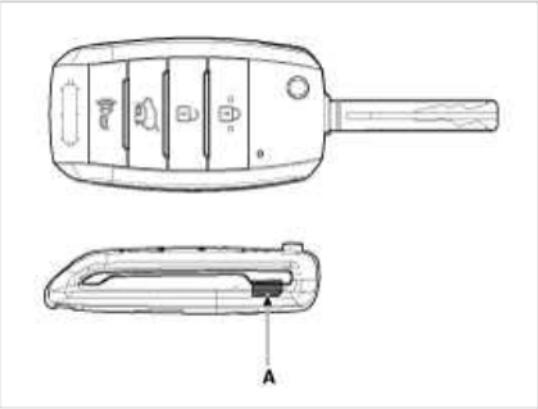
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programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.

[Key Type]



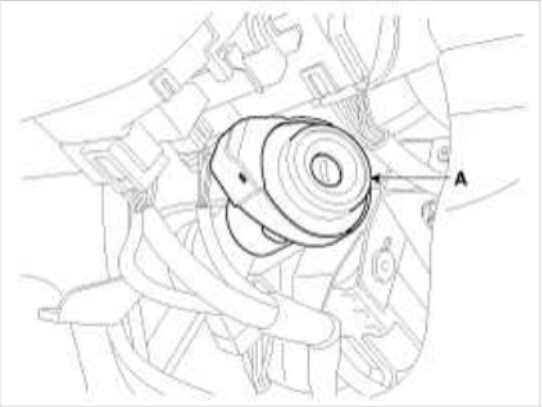
[Folding Key Type]



Antenna coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.
  It is located directly in front of the steering handle lock.



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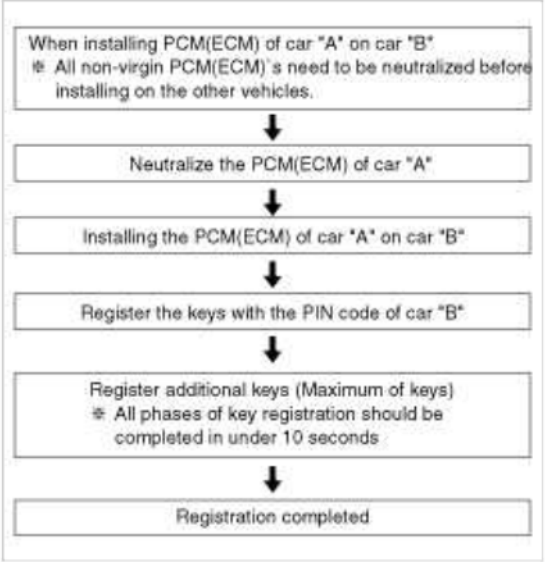
Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	PCM(ECM)	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, PCM(ECM)	YES
SMARTRA unit does not work	SMARTRA unit	YES

Replacement Of Ecm And Smartra

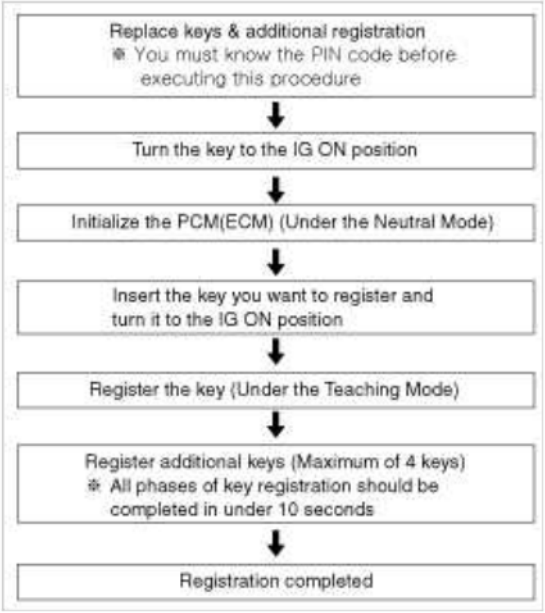
In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught t new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one anc smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))



2. Things to remember before a replacement (Keys & Additional registration)



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NOTICE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.
   (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
   Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

Neutralizing Of ECM

The PCM(ECM) can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin tran are requested.

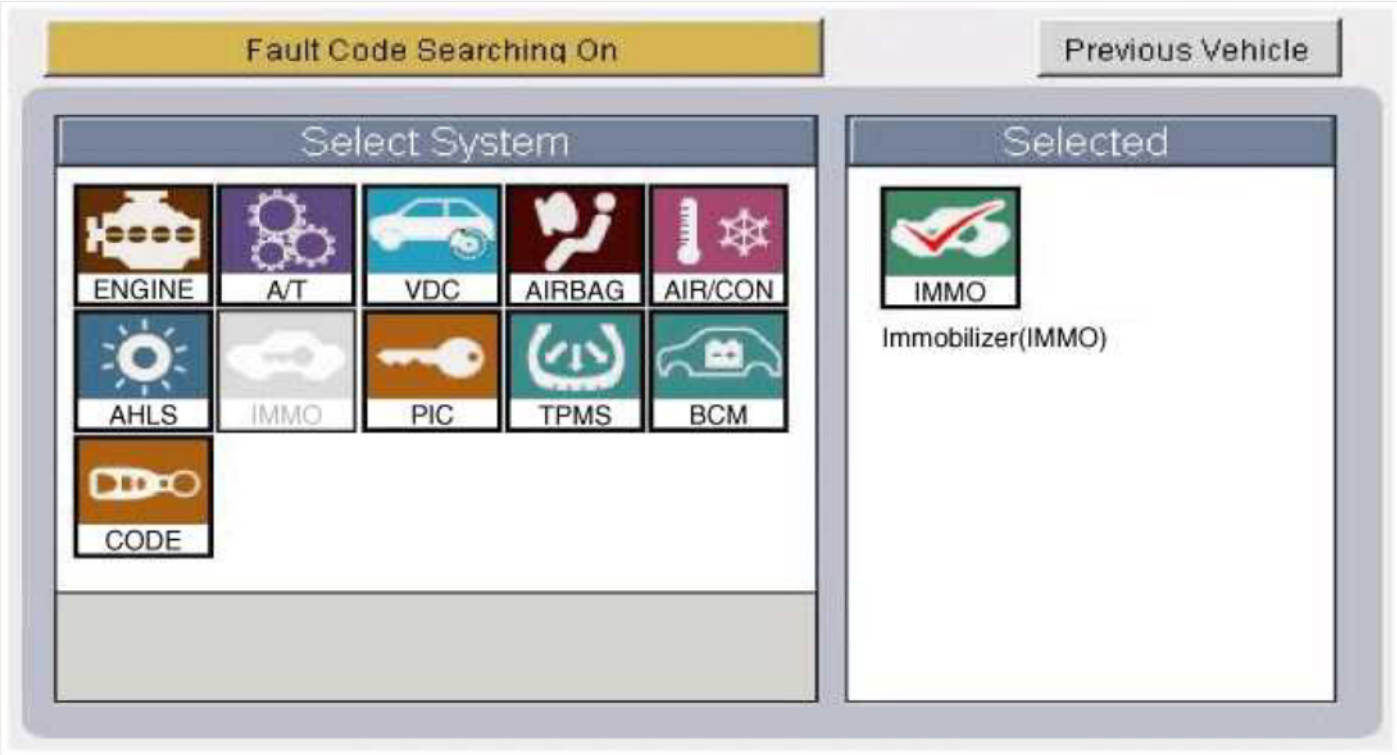
This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach (Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner. If vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. A connecting the battery the timer starts again for one hour.

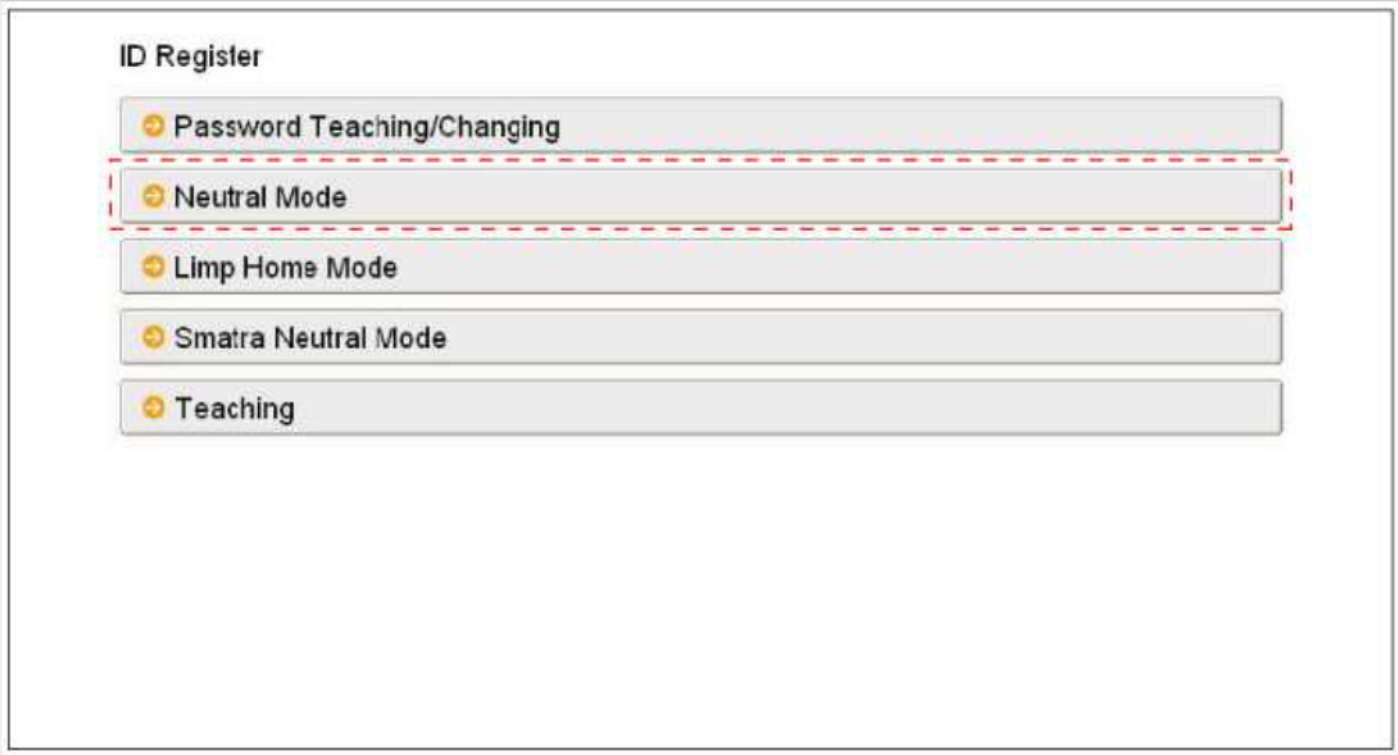
NOTICE

- Neutralizing setting condition
  - In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) & user password (4) deletion.
    : Locking of ECM (except key teaching permission)
- Neutralizing meaning:
  - PIN Code(6) & User P/Word(4) deletion
  - Locking of EMS(except Key Learning permission)

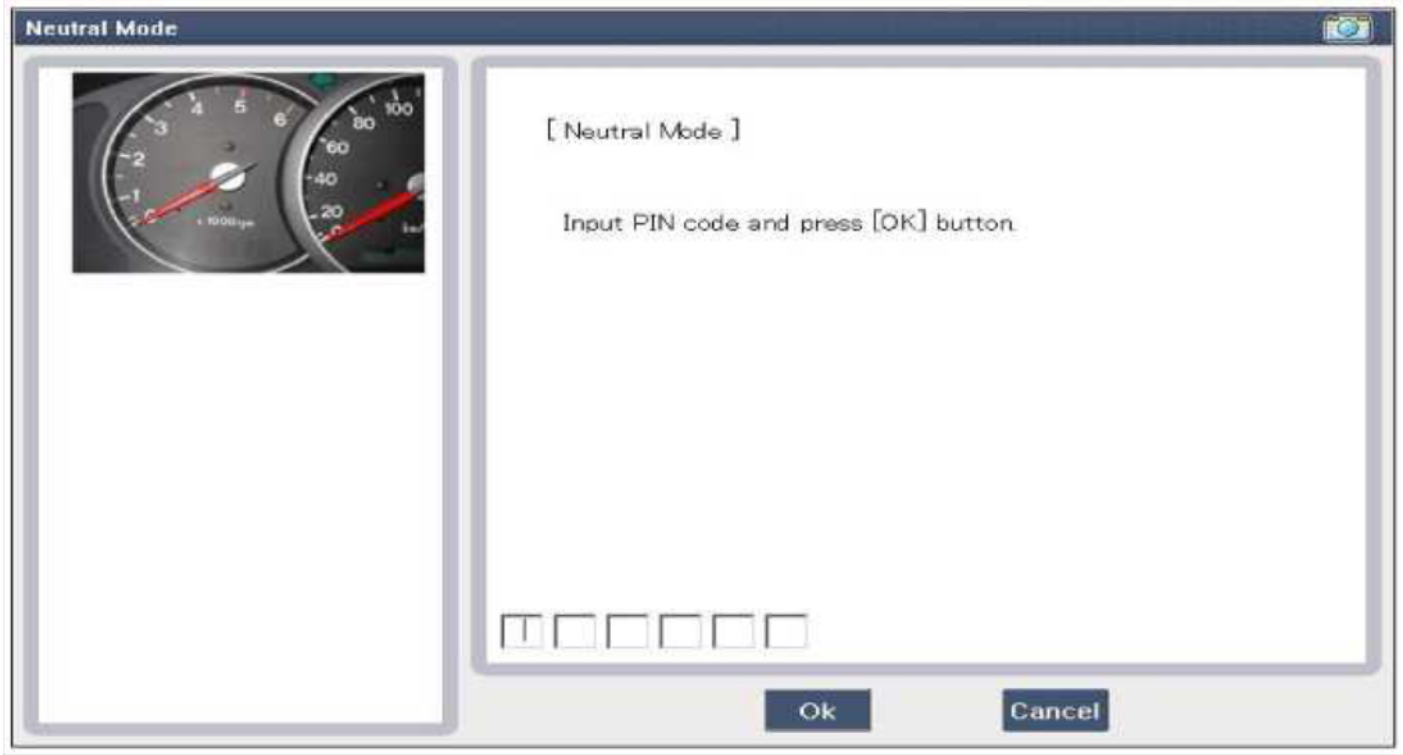
Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No

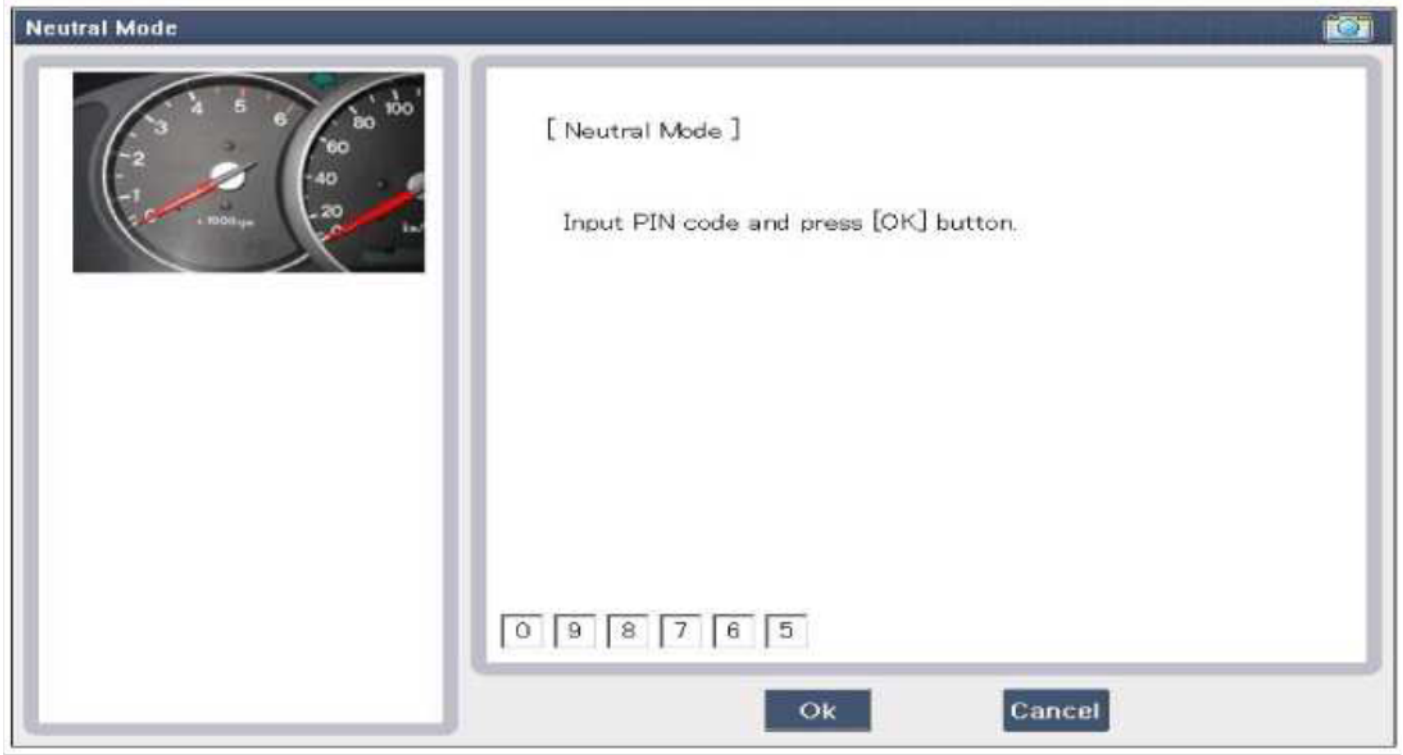
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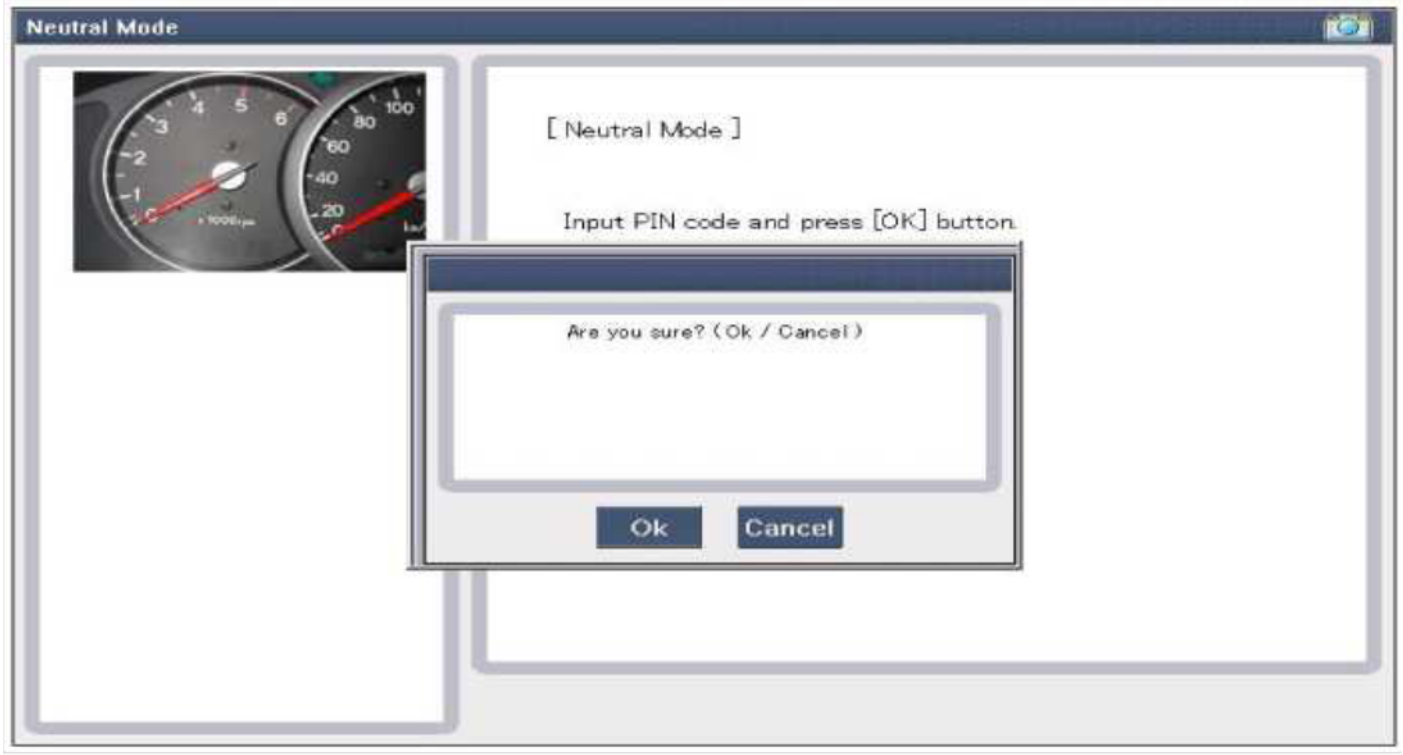


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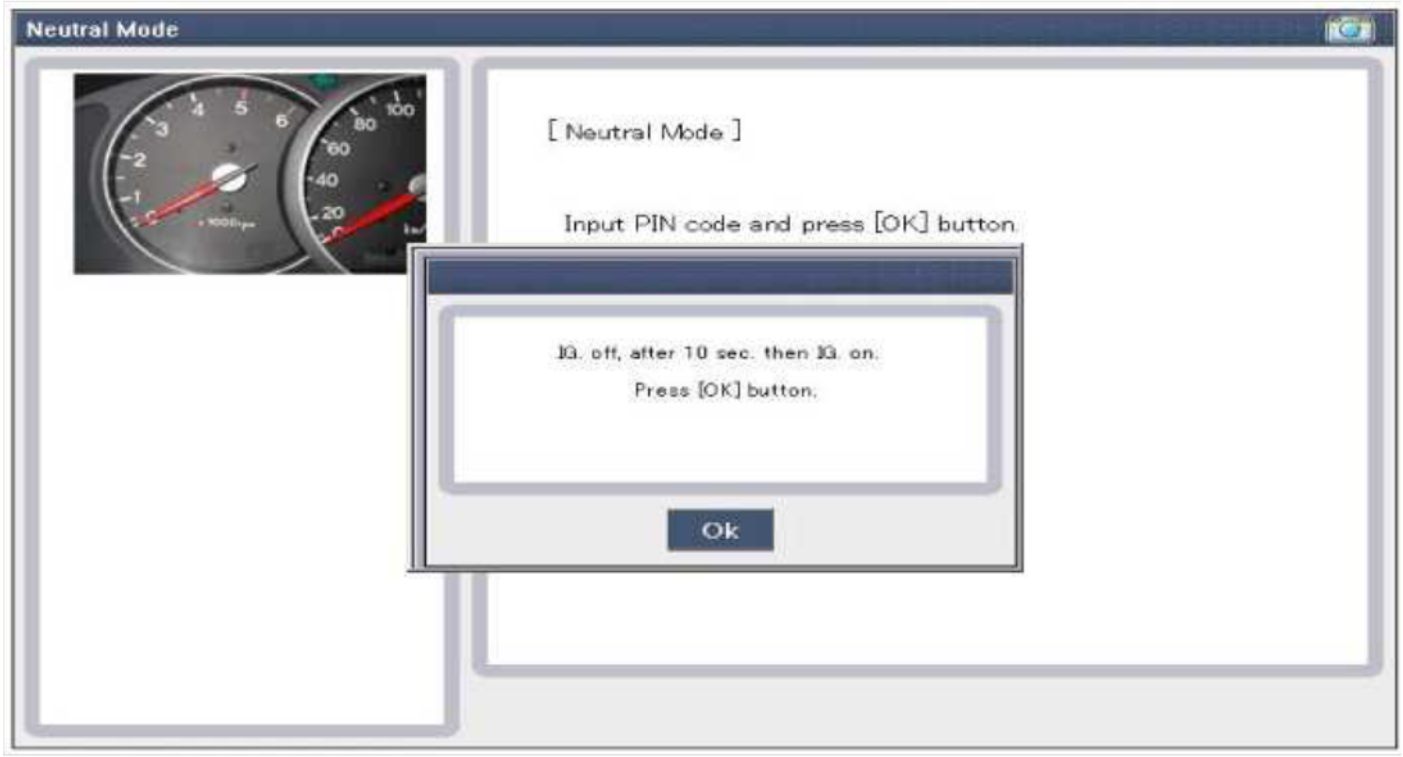


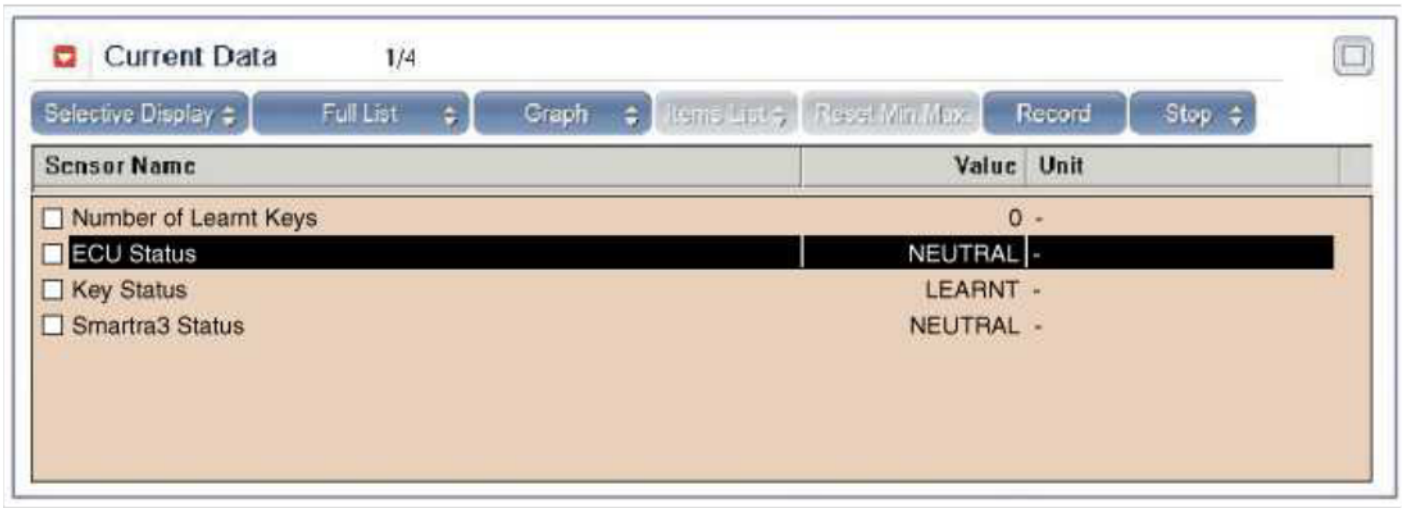
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Neutralizing Of SMARTRA

The EMS can be set to the status "neutral" by tester

Ignition key (regardless of key status) is inserted and after IGN ON. If receiving the correct vehicle password from C SMARTRA can be neutralized. The neutralization of SMARTRA is possible if DPN is same as the value inputted by In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice igr In case of changing the vehicle password, new virgin transponder must be only used. And in case of virgin key, after I the key of vehicle password, it can be used.

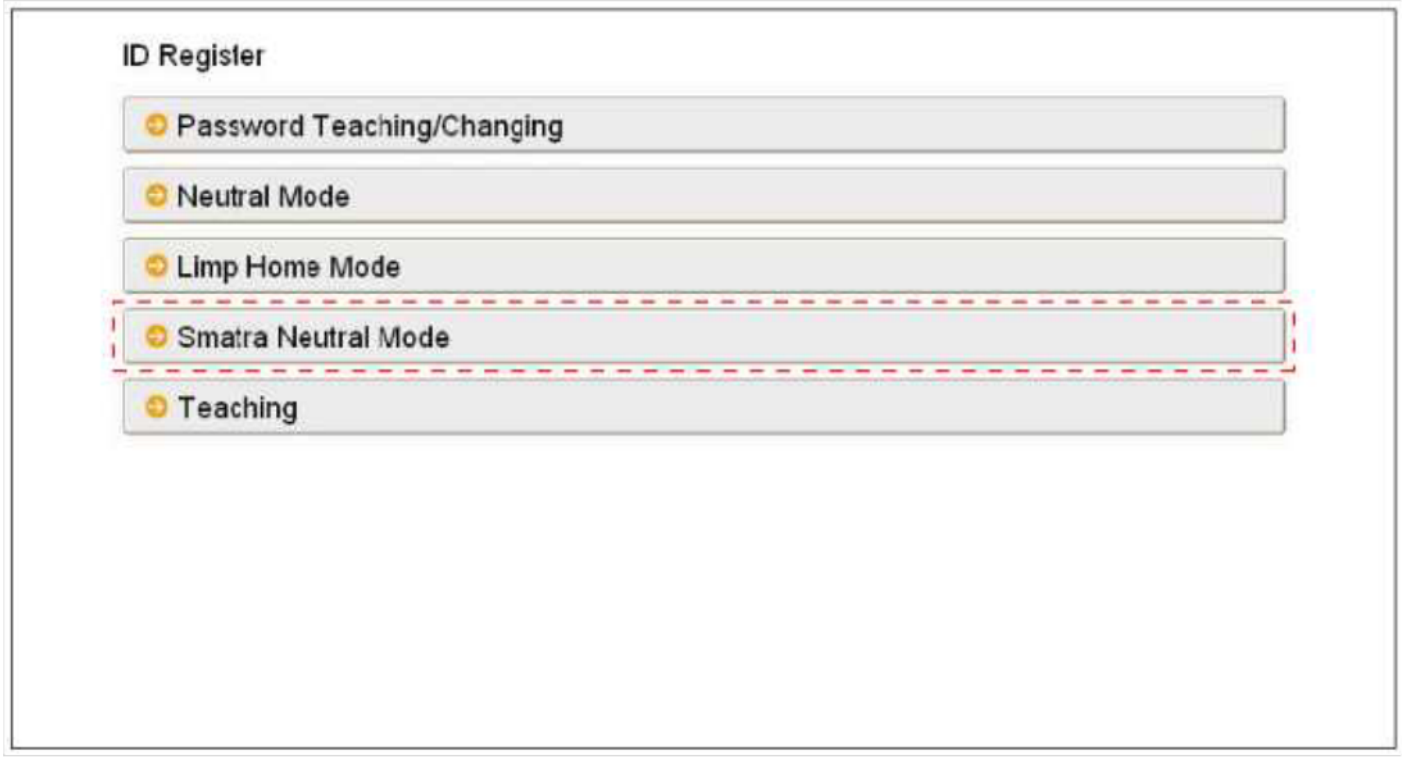
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA v the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this tim connecting the battery the timer starts again for one hour.

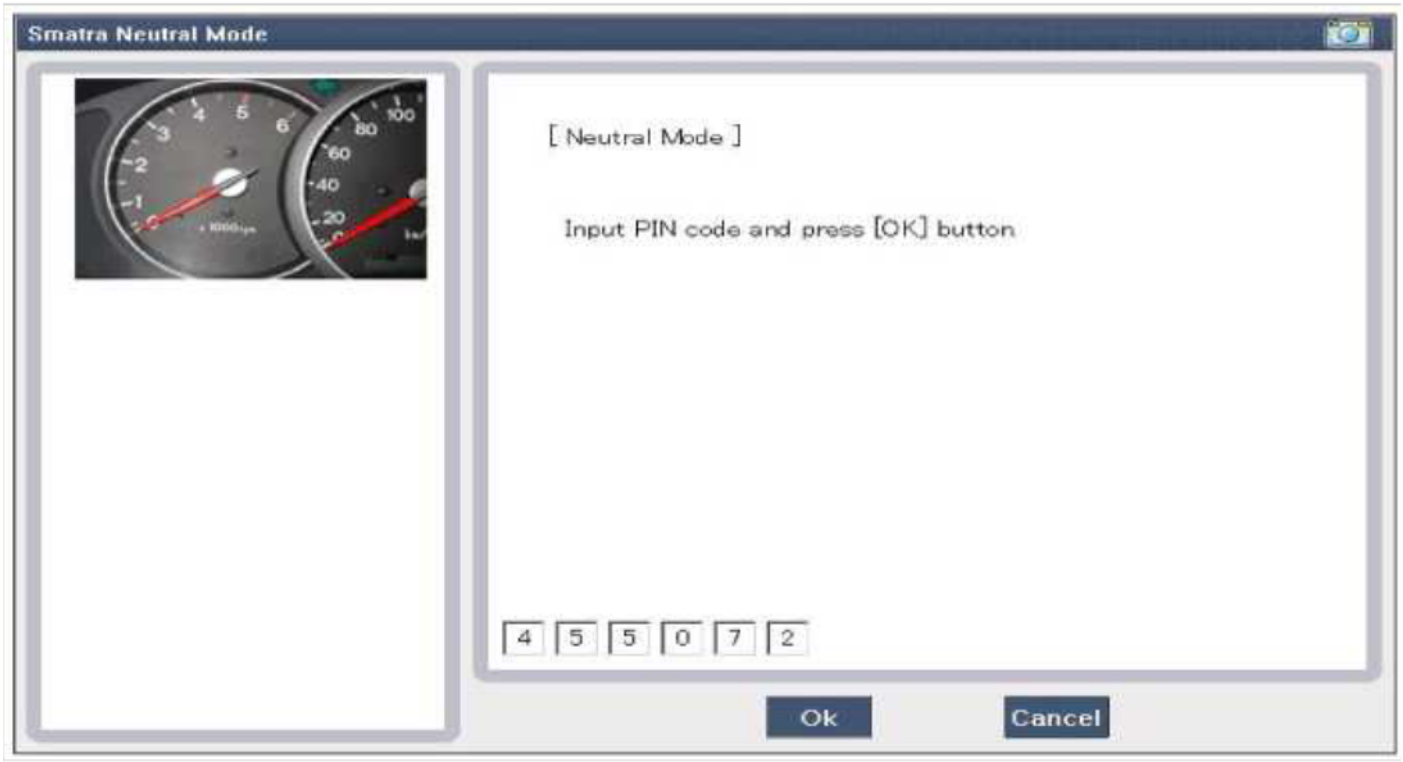
NOTICE

- Neutralizing Setting condition :
  - In case of "SMARTRA status", "Learnt"
  - Input correct Pin code by tester
- Neutralizing meaning :
  - Vehicle password(DPN Code) & SEK Code deletion.
  - Permission of New DPN Learning.

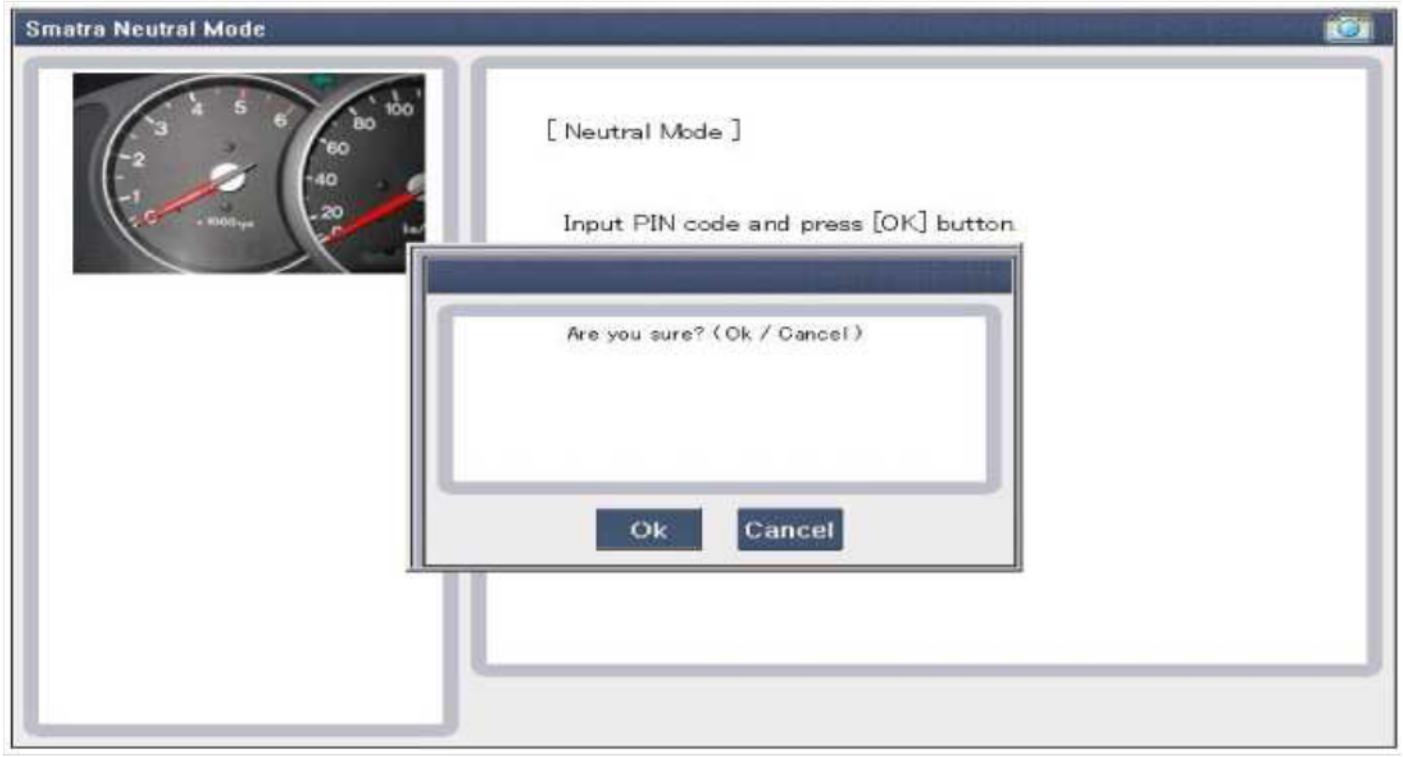
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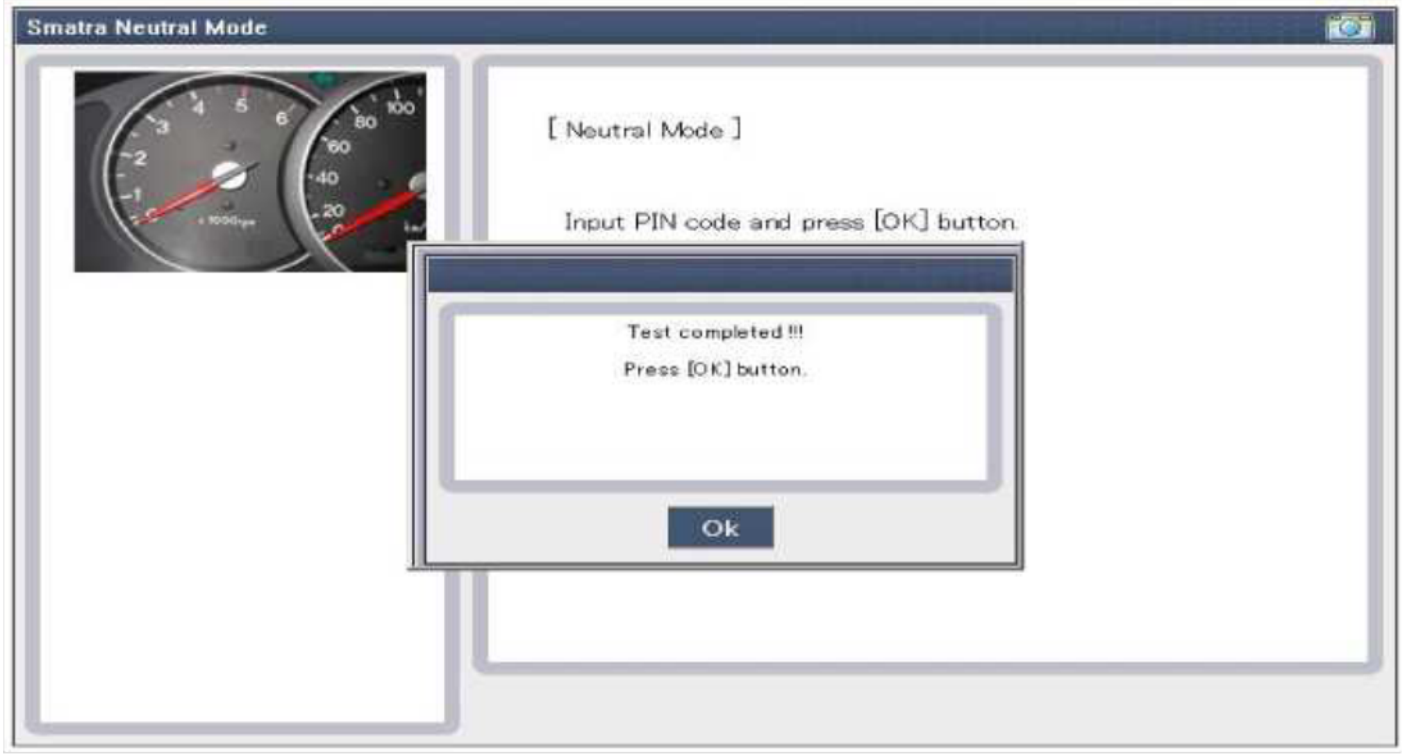
Function / SMARTRA	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS learnt)	No	Yes	No



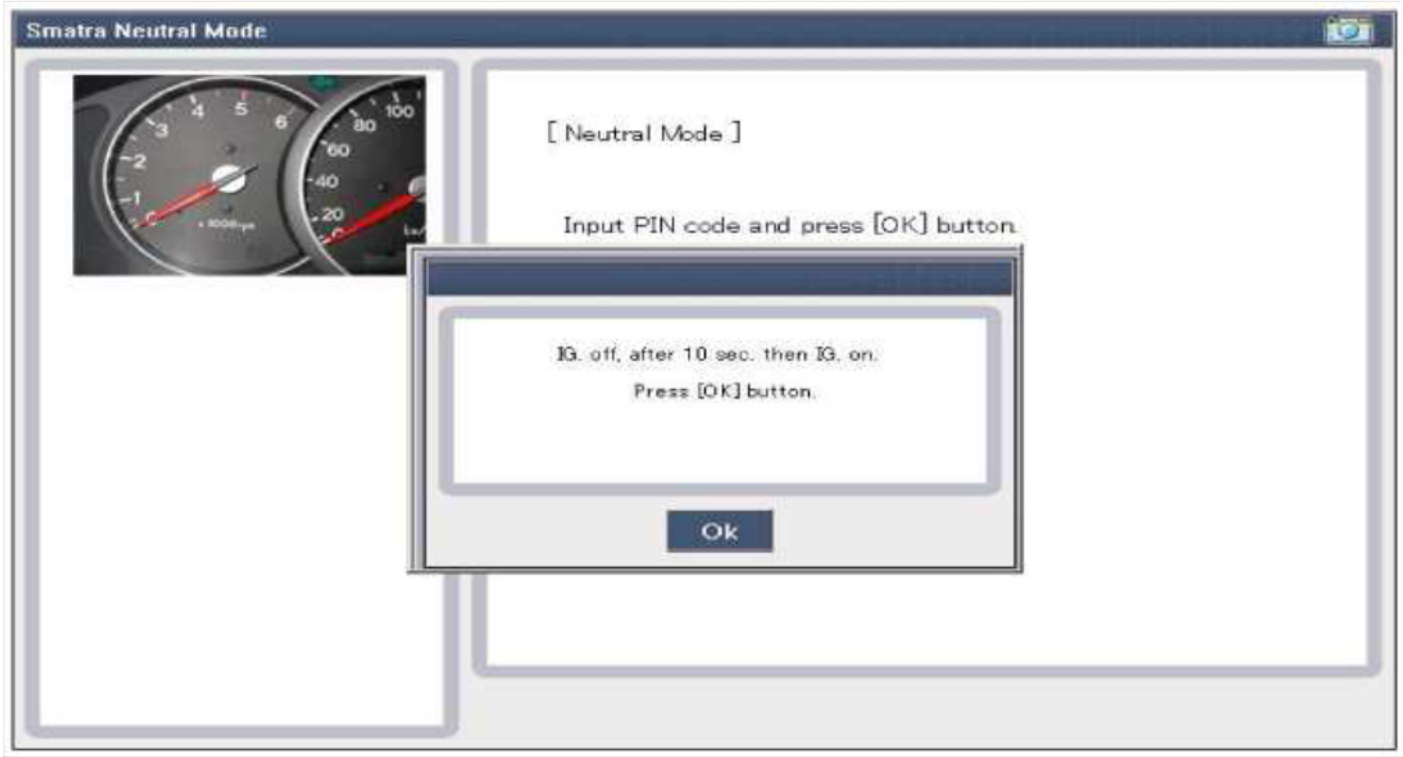


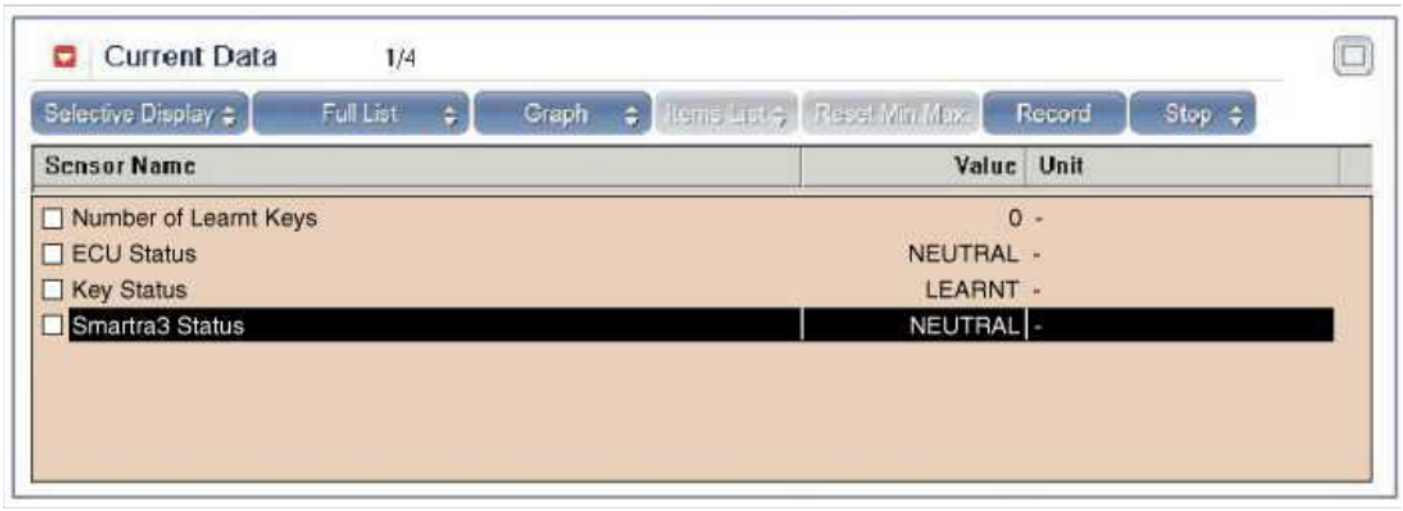
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Teaching Procedures

1. Key Teaching Procedure

   Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehi owner.

   The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. Tl "virgin" PCM(ECM) stores the vehicle specific data and the key teaching can be started. The "learnt" PCM(ECM compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can p If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the re of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation reconnecting the battery, the timer starts again for one hour.

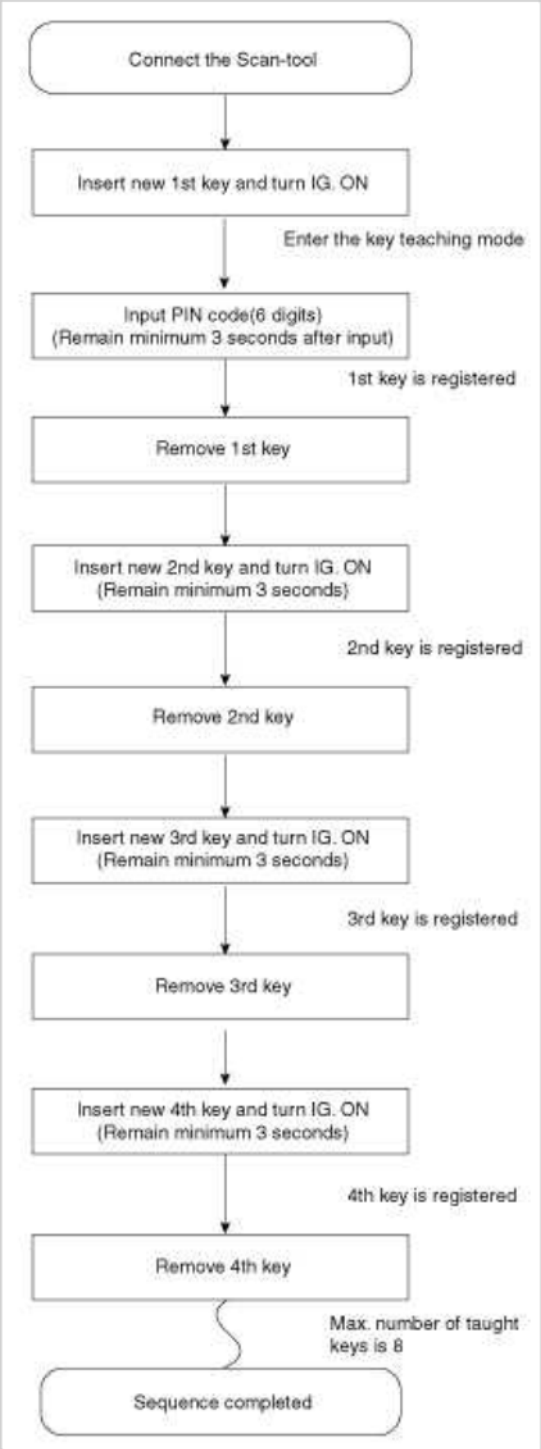
   The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

   If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognize the PCM(ECM). This rejects the key and a message is sent to the tester.

The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If th PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be in The maximum number of taught keys is 8
If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific code is stored.
If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stopp a specific fault code will be stored at PCM(ECM).

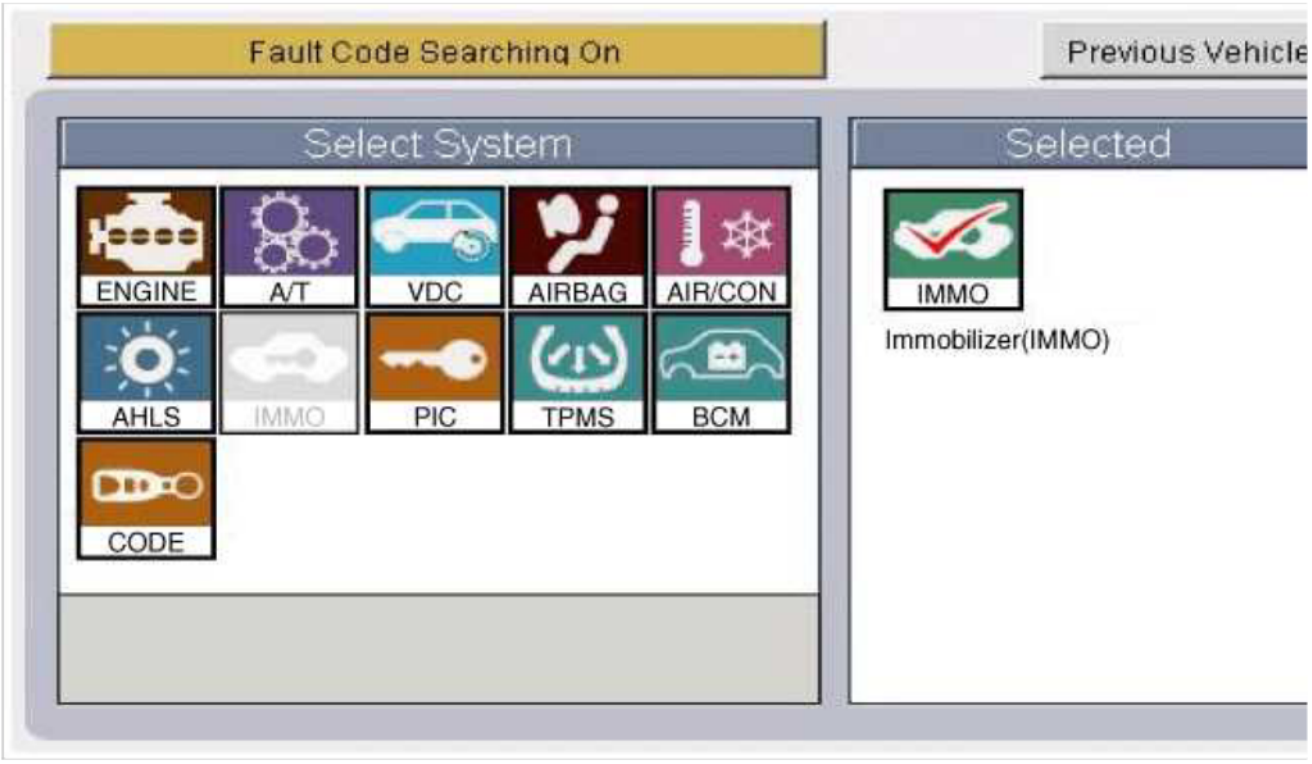
NOTICE

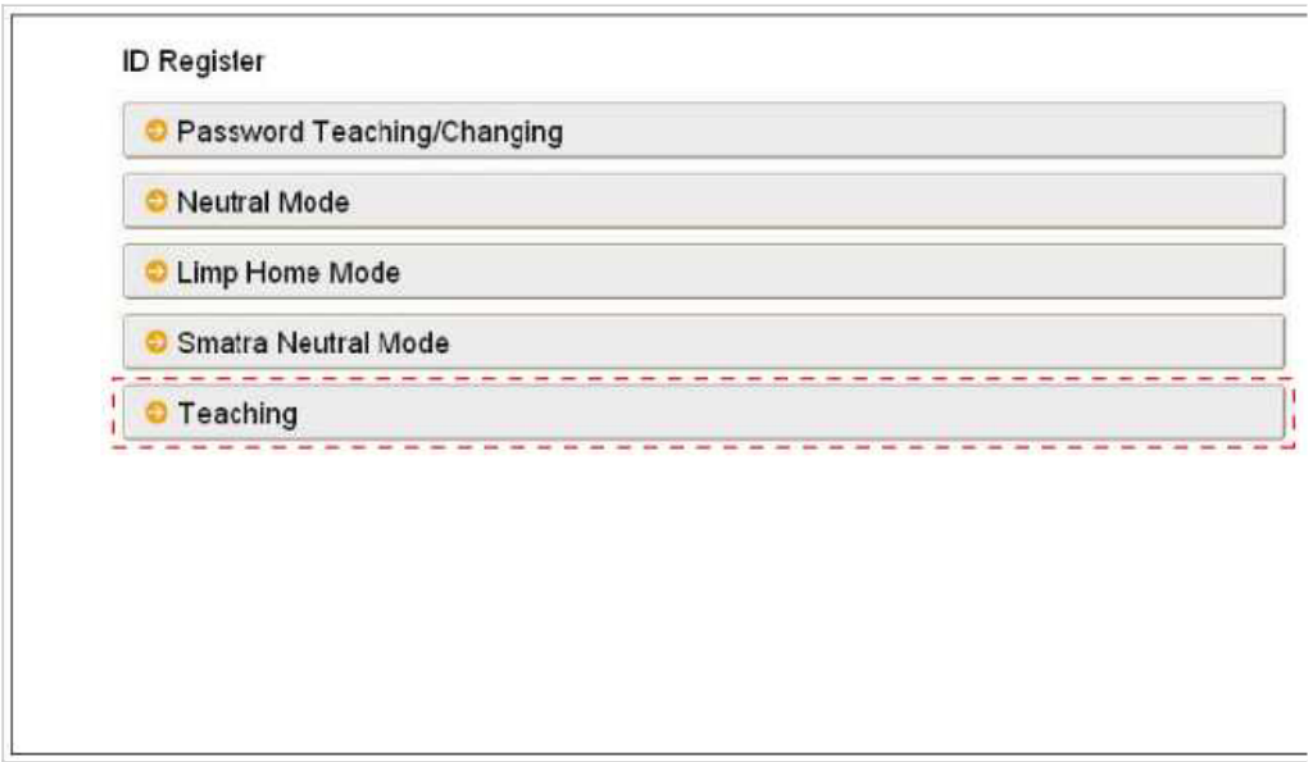
When teaching the 1st key, Smartra regists at the same time.



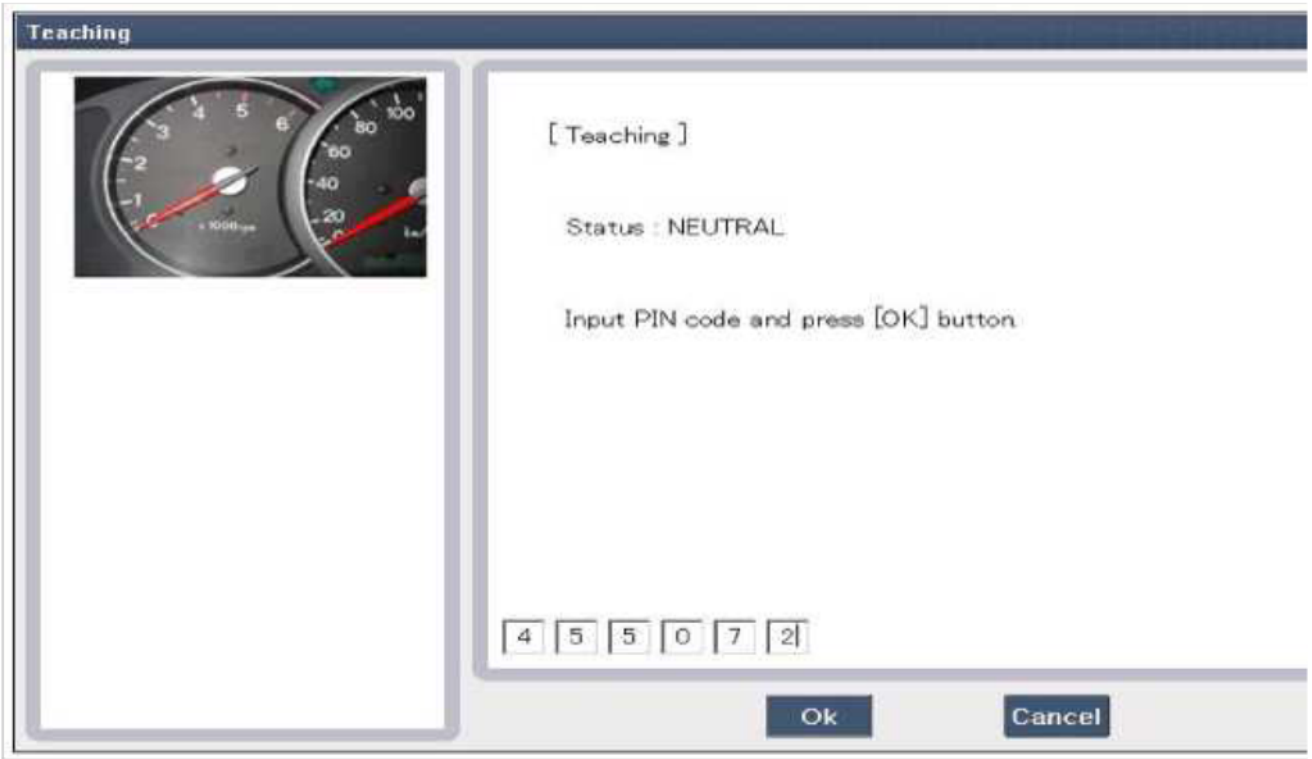
(1) PCM(ECM) learnt status.

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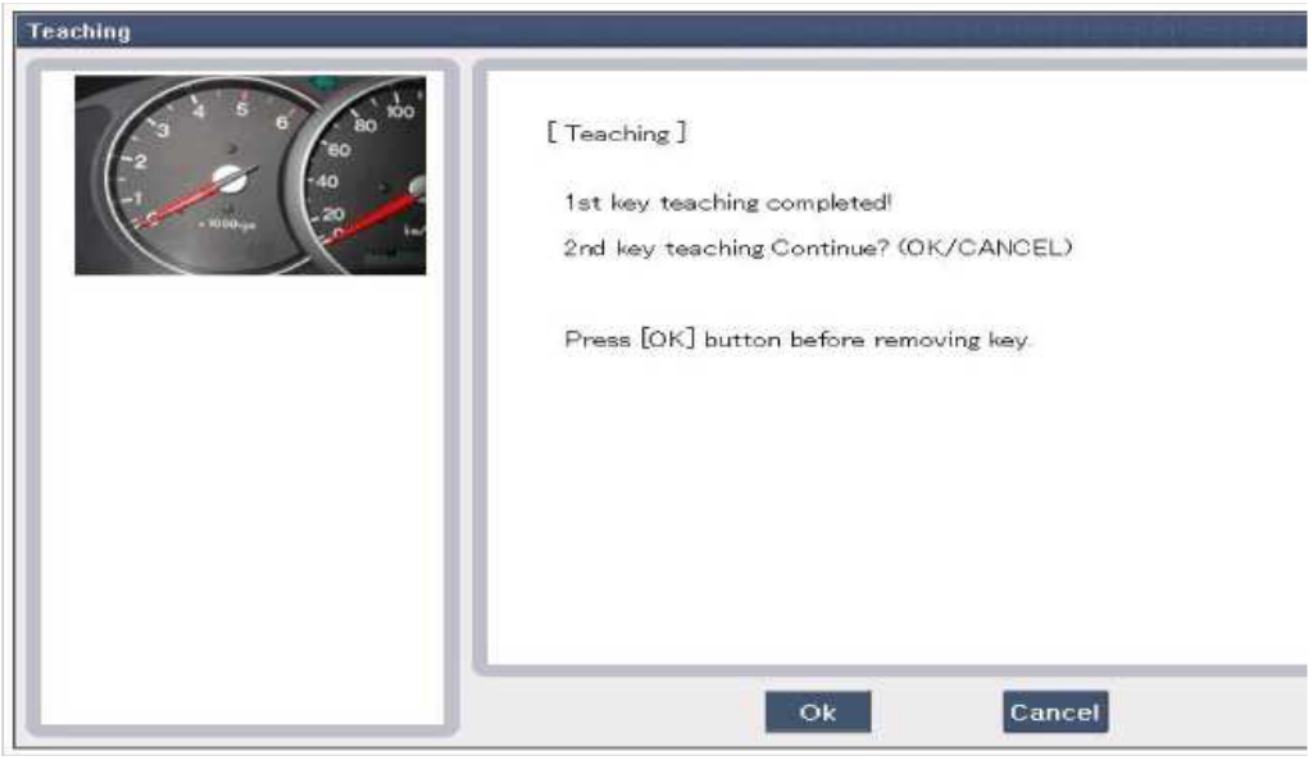


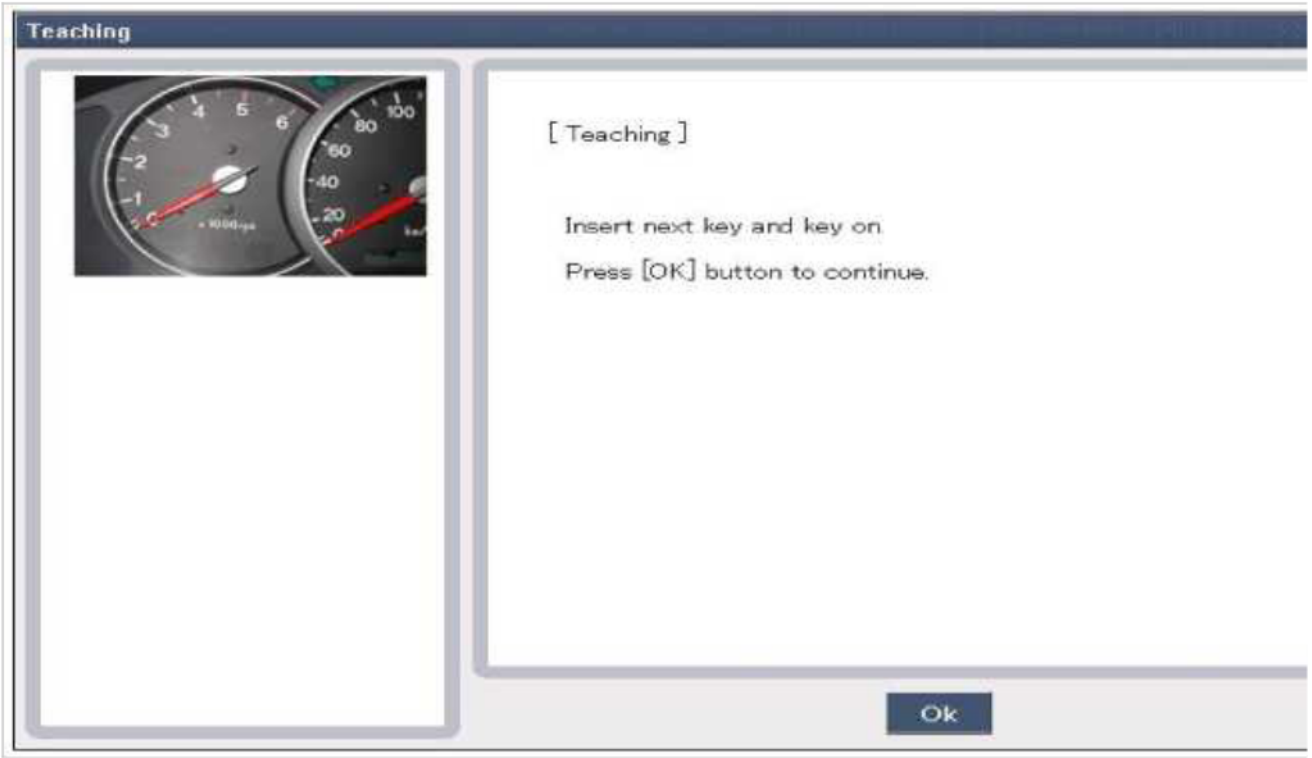
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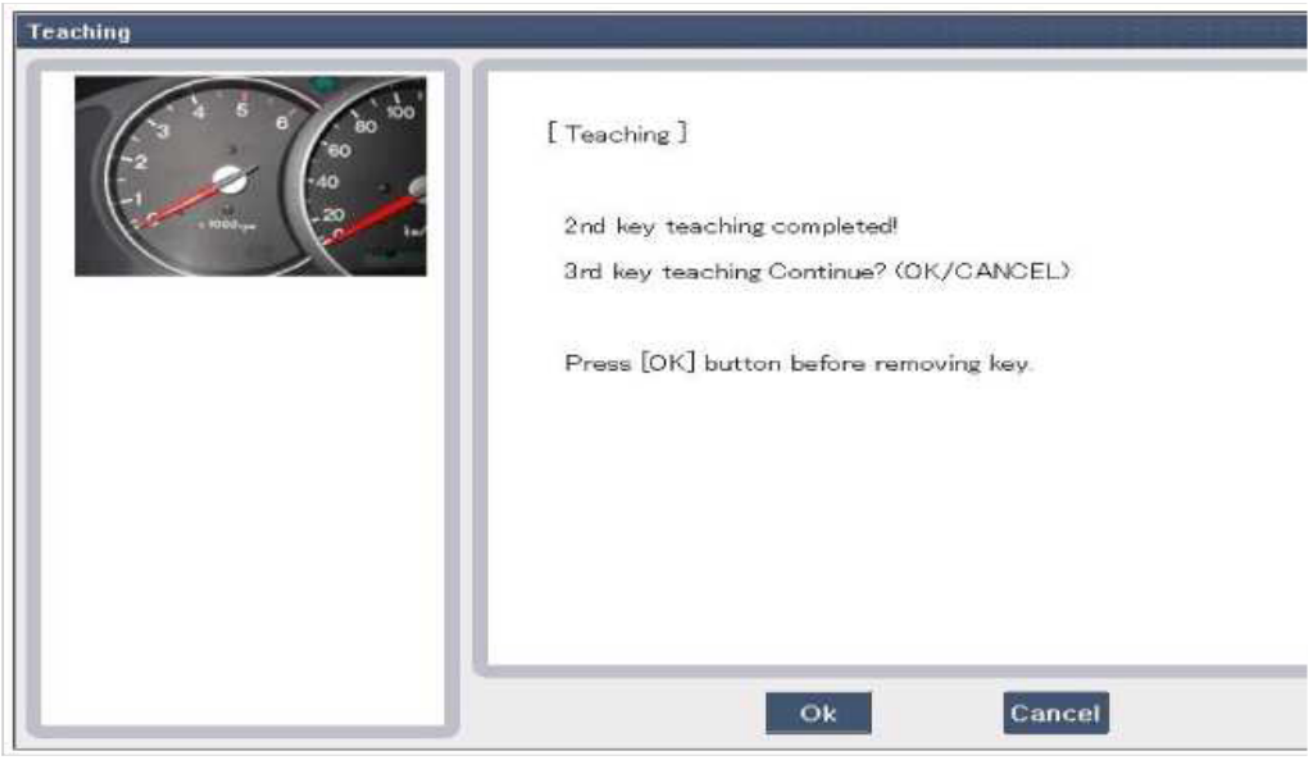


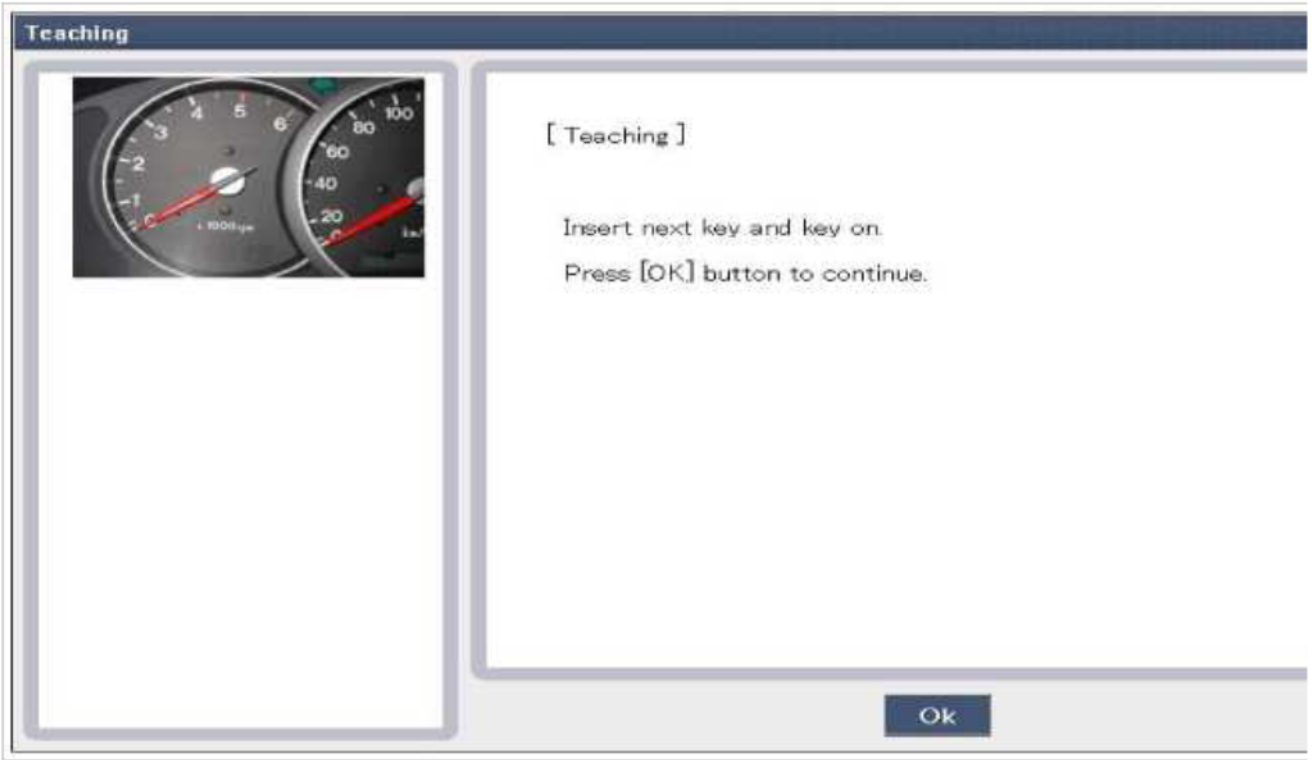
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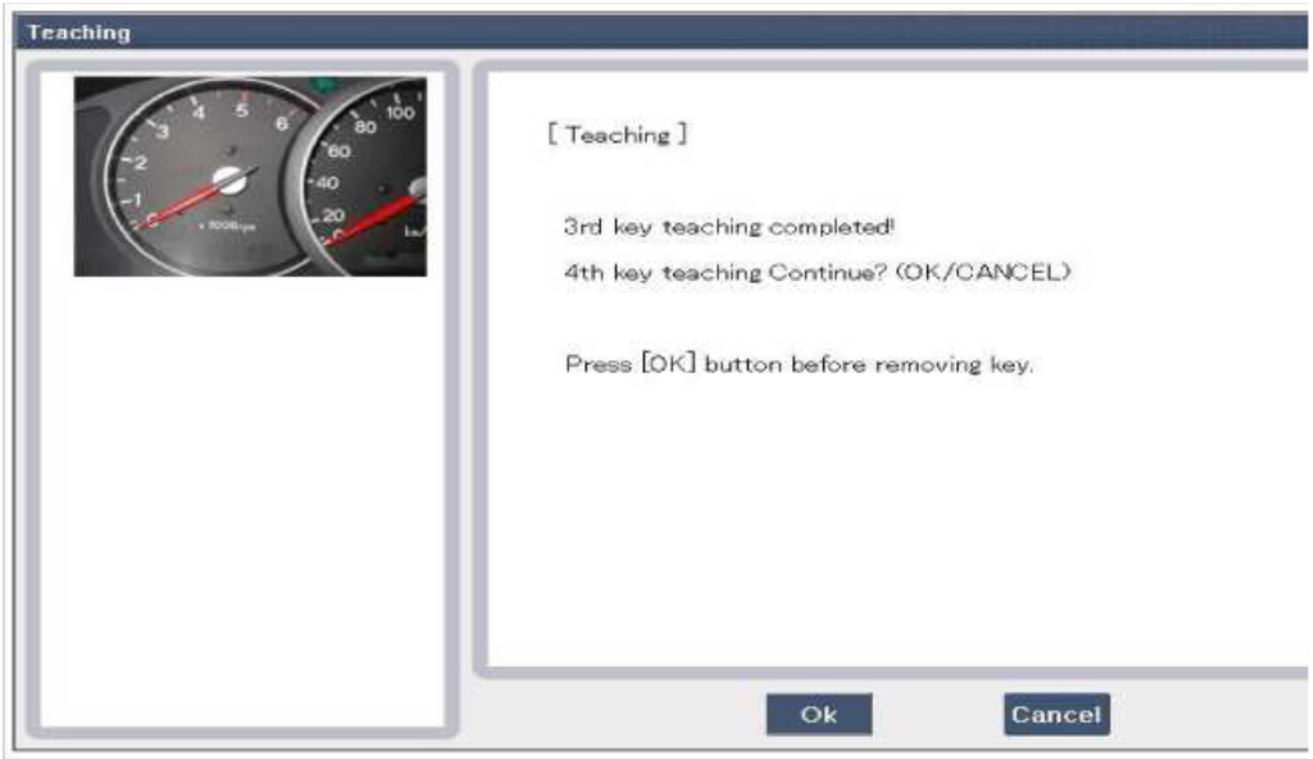


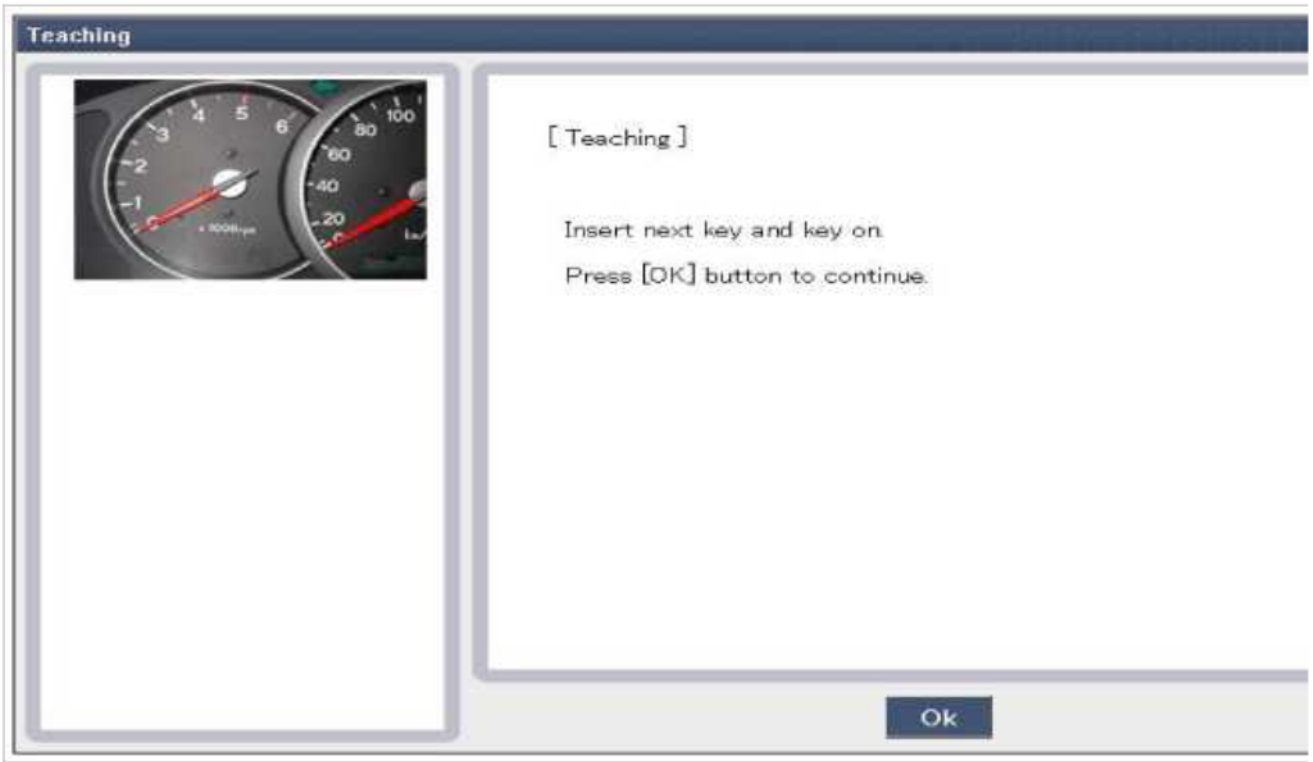
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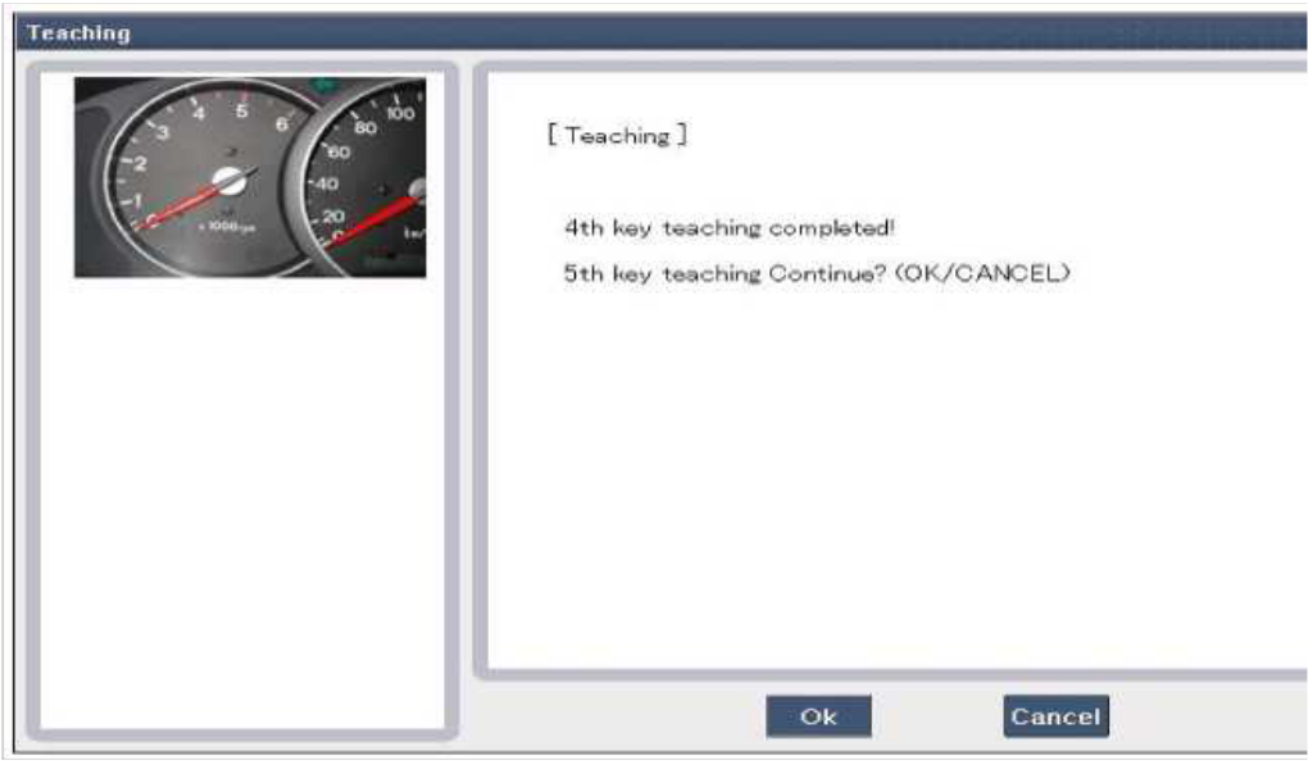


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(2) PCM(ECM) virgin status.

After replacing new "PCM(ECM)" scan tool displays that PCM(ECM) is virgin status in Key Teaching mode "VIRGIN" status means that PCM(ECM) has not matched any PIN code before.

Password Teaching/changing

1. User Password Teaching Procedure

The user password for limp home is taught at the service station. The owner of the vehicle can select a number wi digits.

The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to PCM(ECM), the status of the password is "virgin" No limp home function is possible.

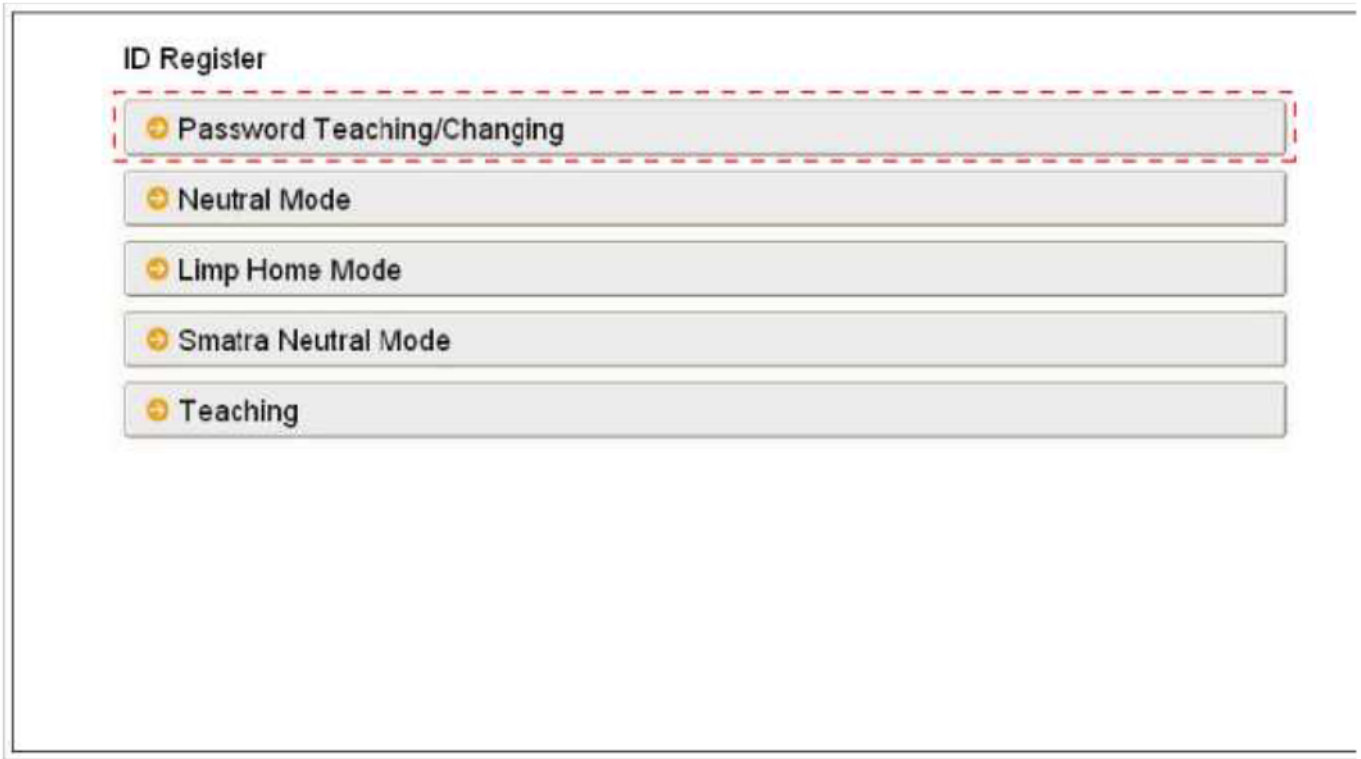
The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

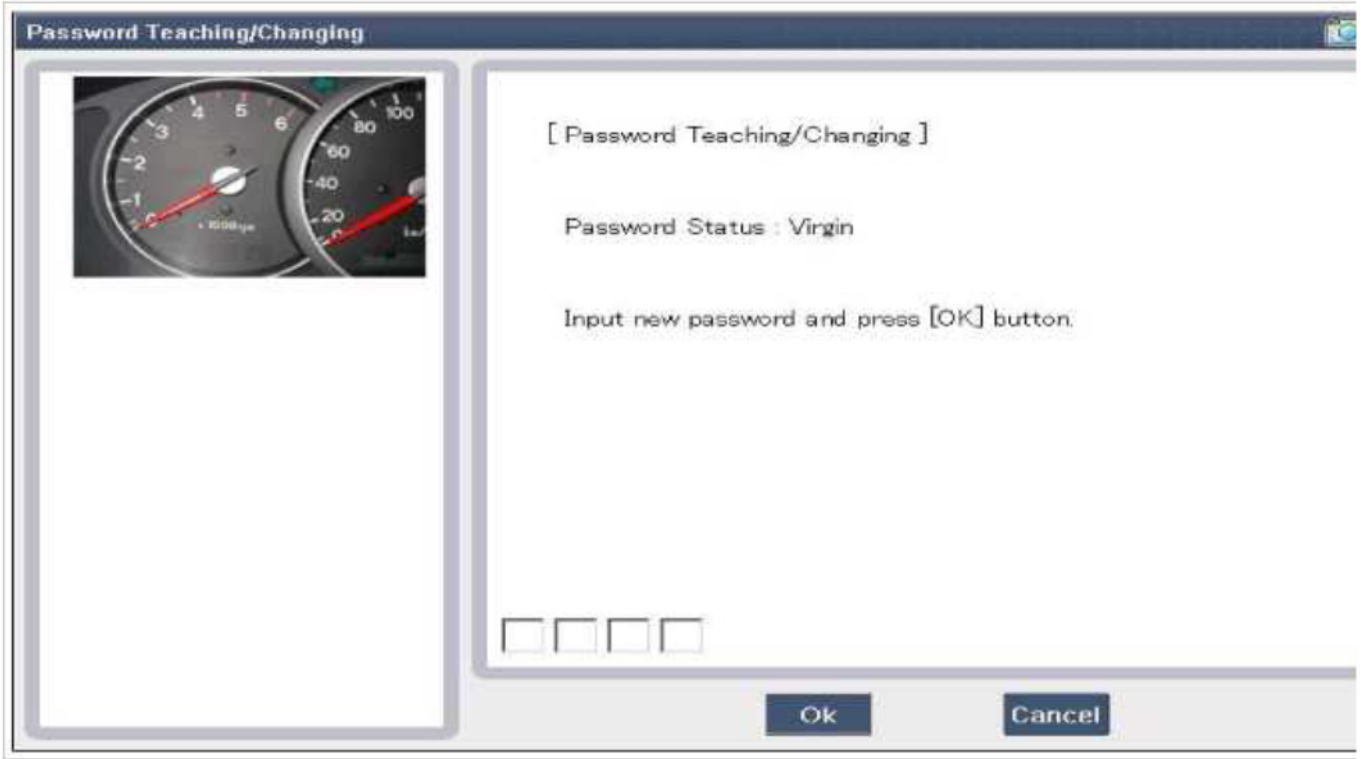
The learnt user password can also be changed. This can be done if the user password status is "learnt" and the te sends authorization of access, either the old user password or the vehicle specific data. After correct authorizatio PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be vali the next limp home mode.

If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuou intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be r by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one ho

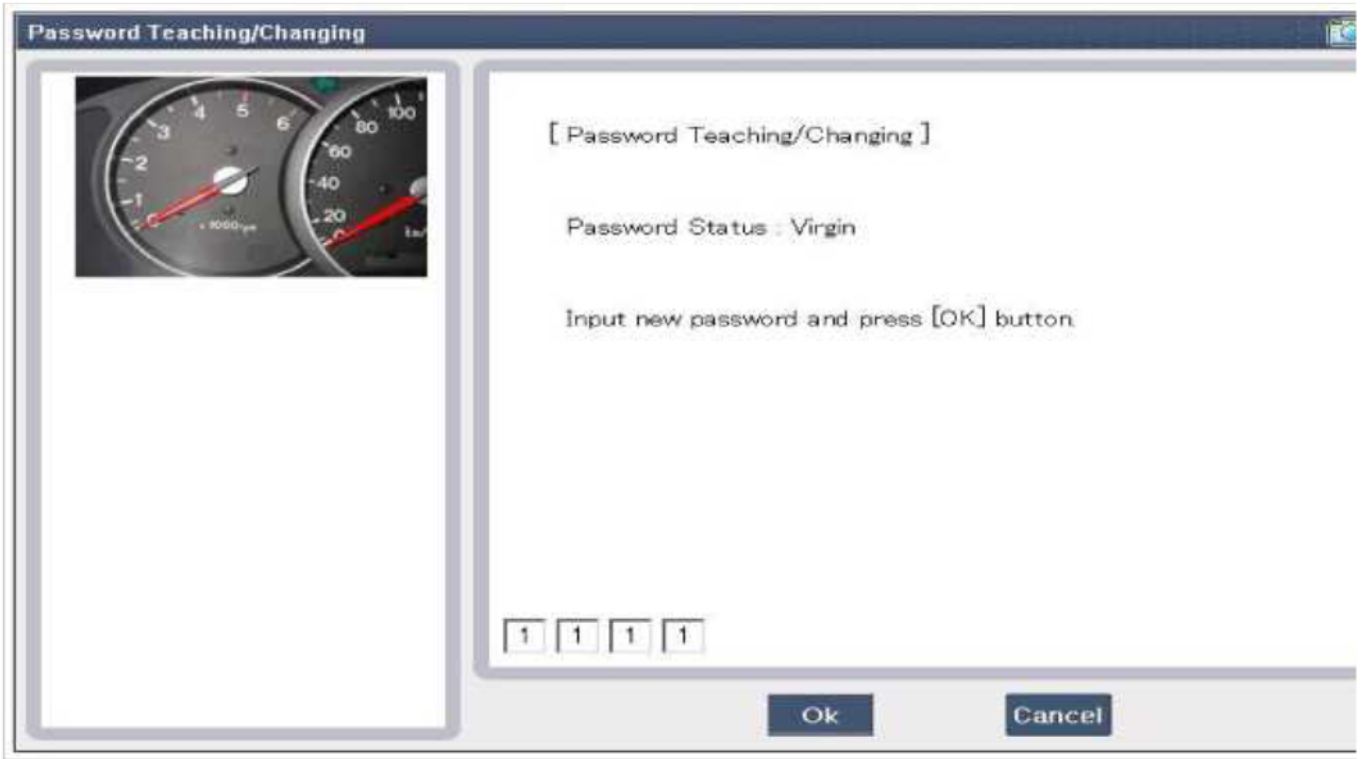
2. User password teaching

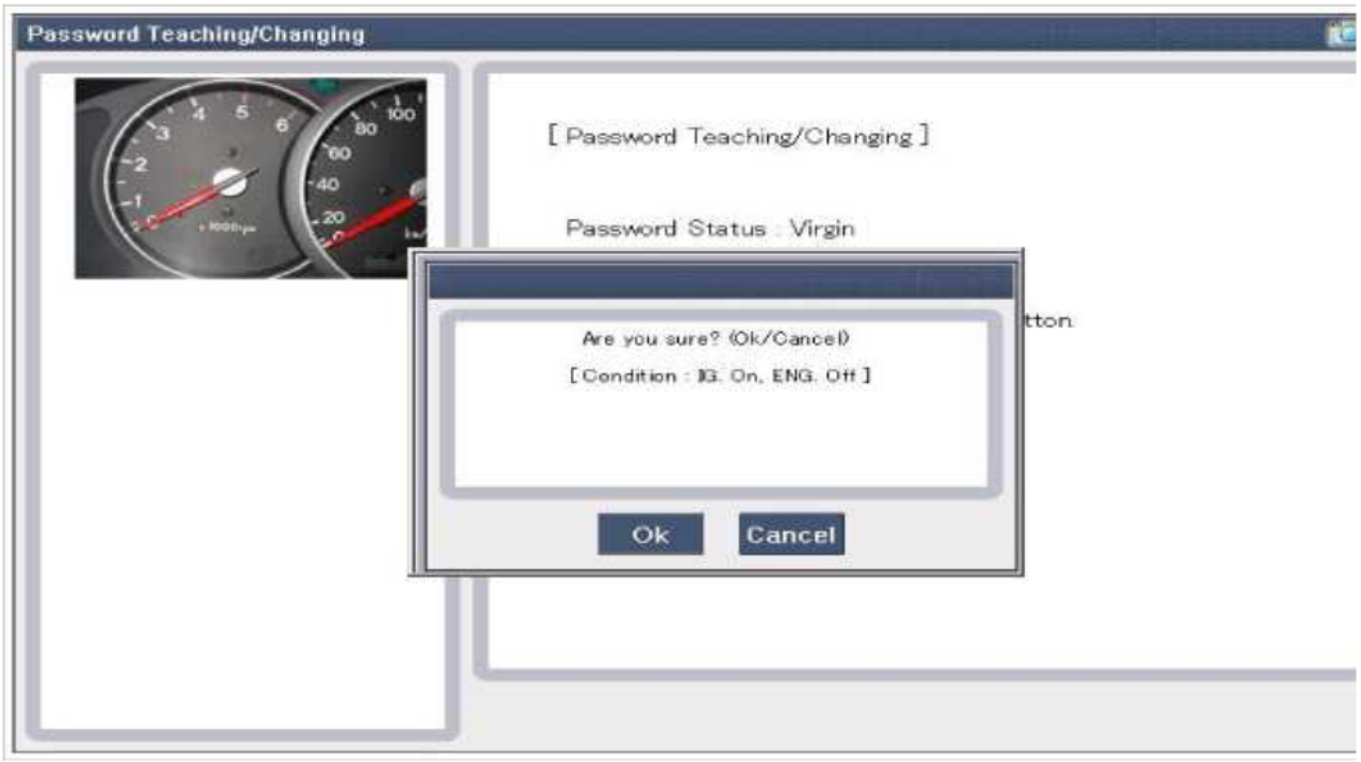
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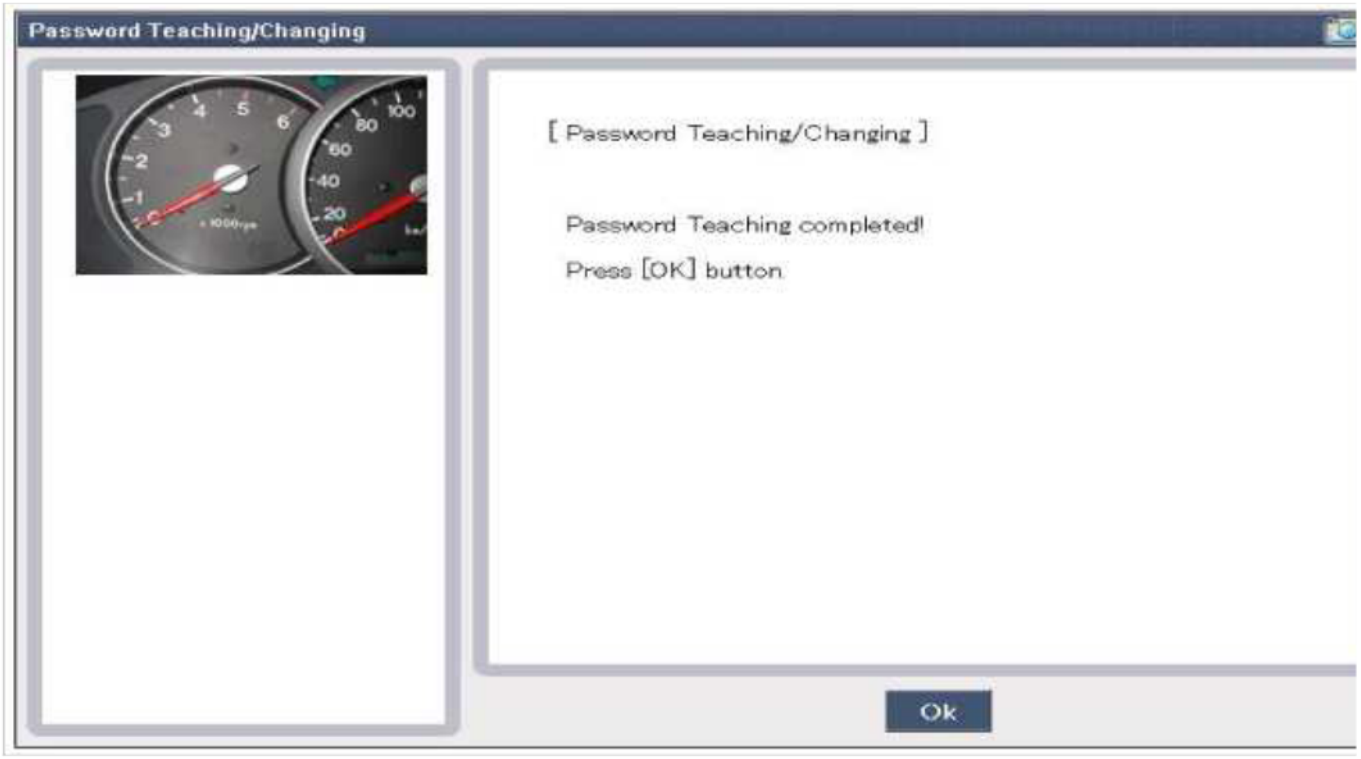


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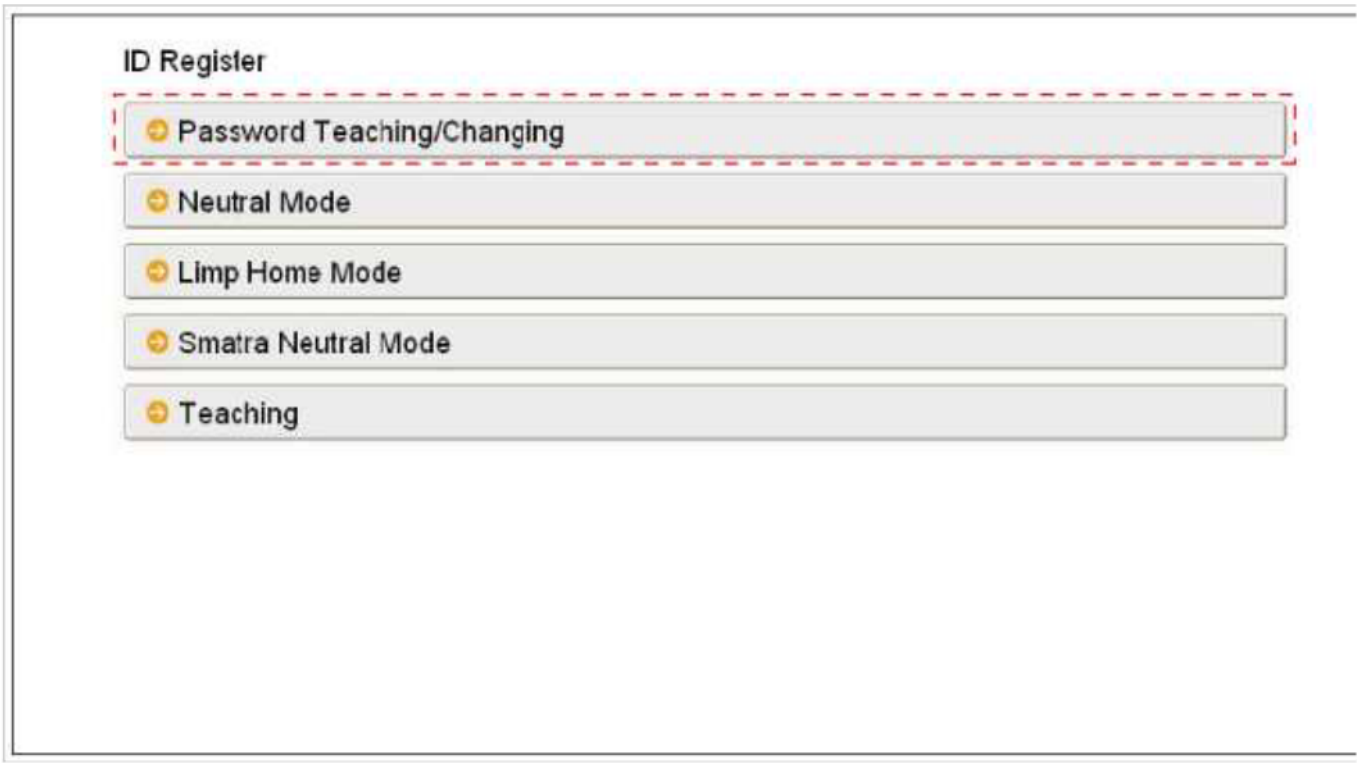


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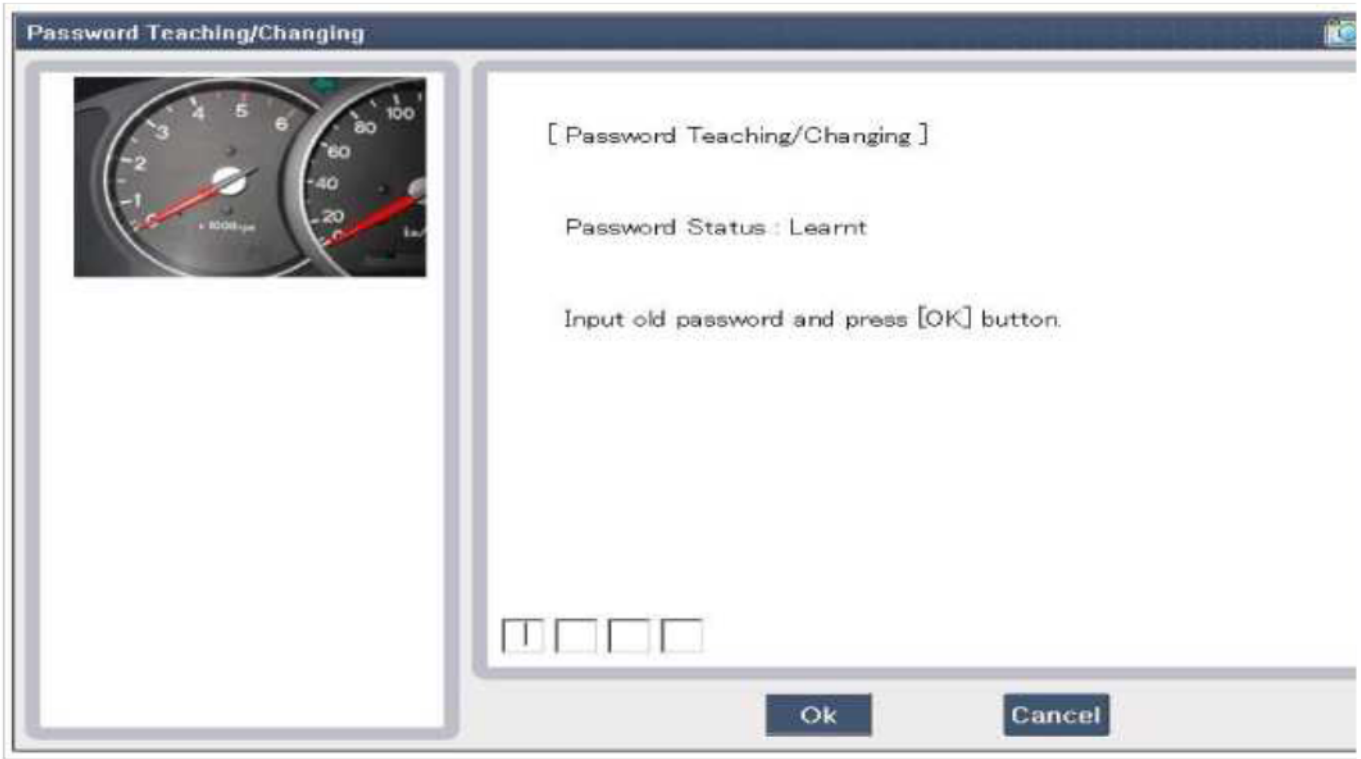


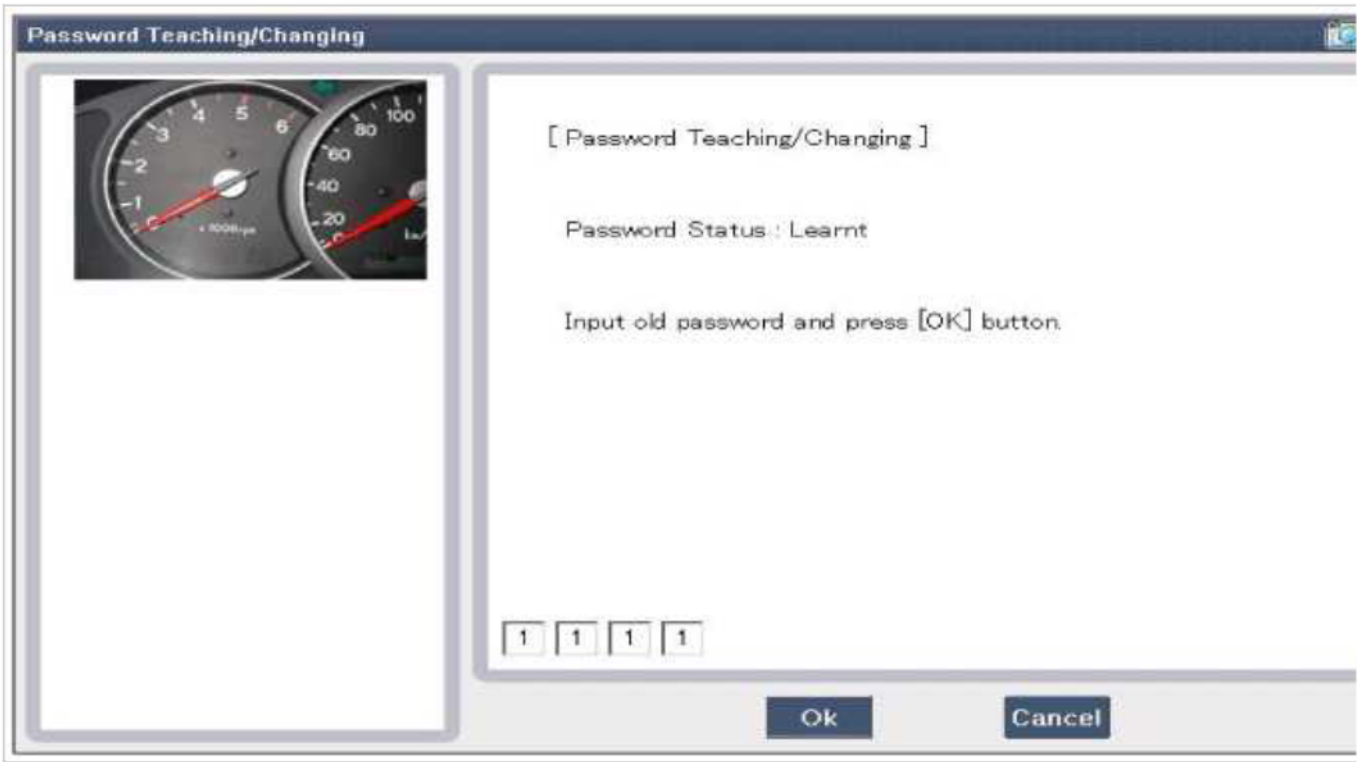
In case of putting wrong password, retry from first step after 10 seconds.

3. User password changing

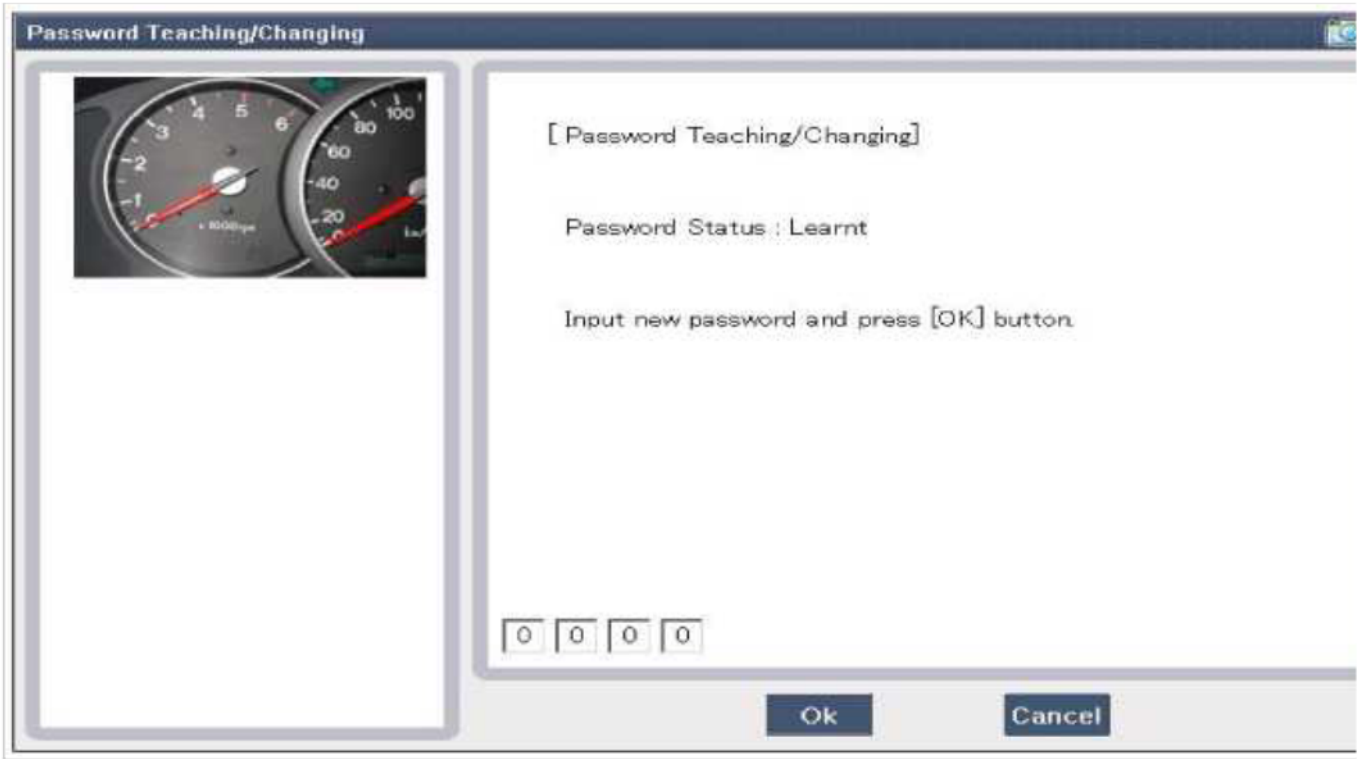


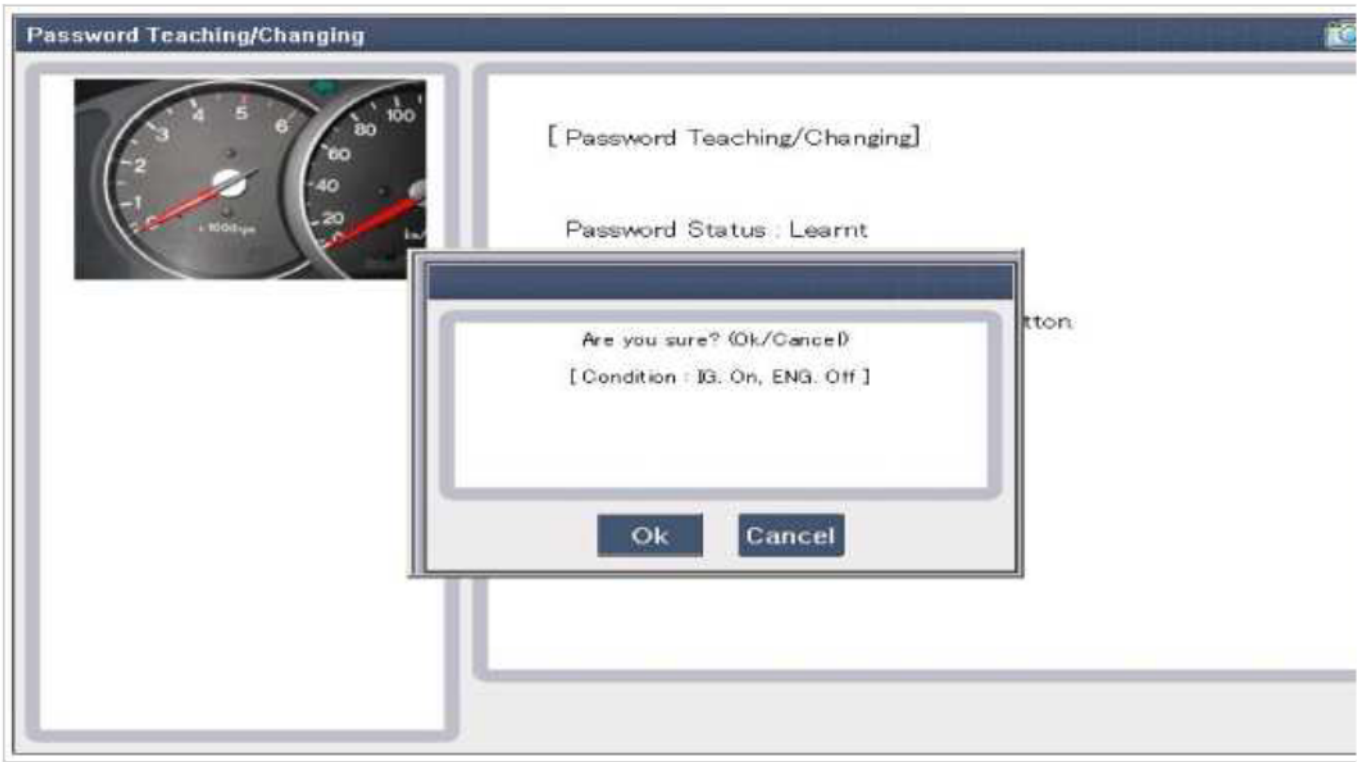
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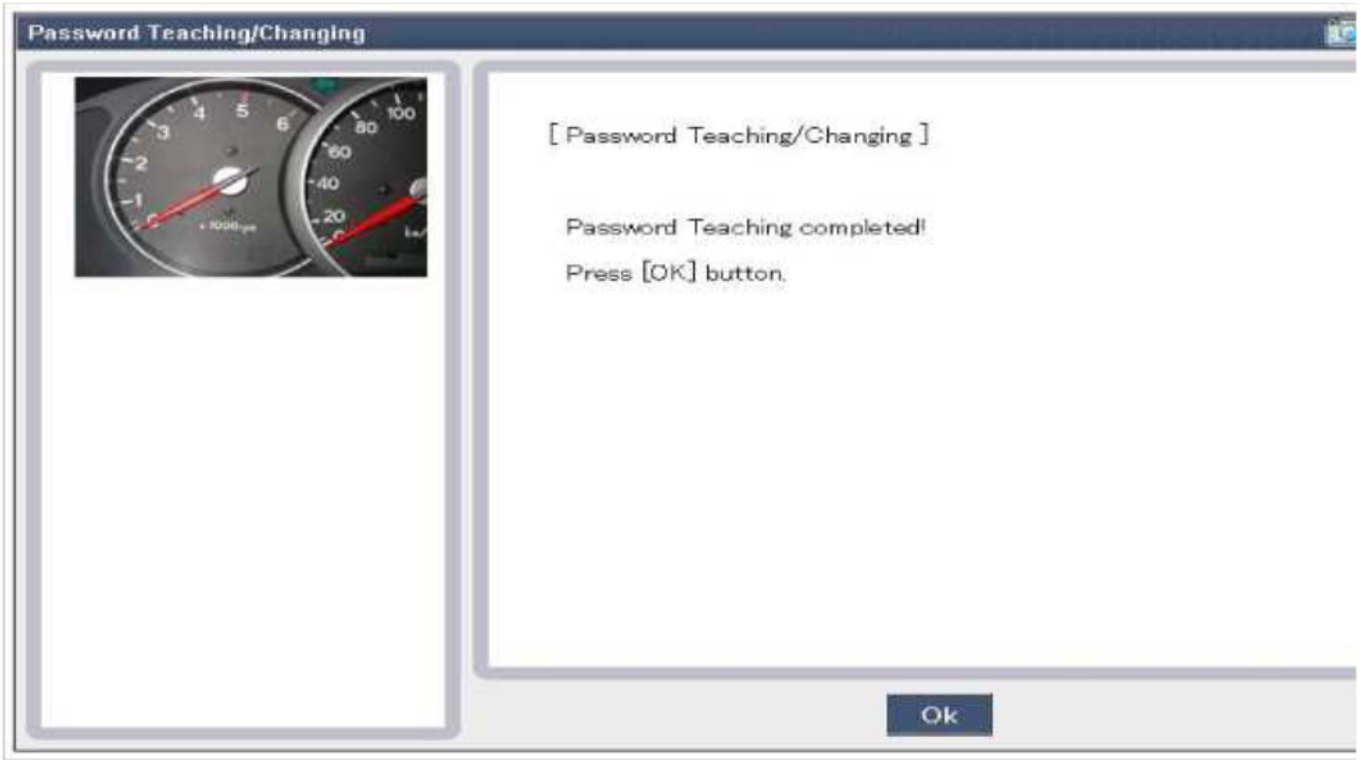


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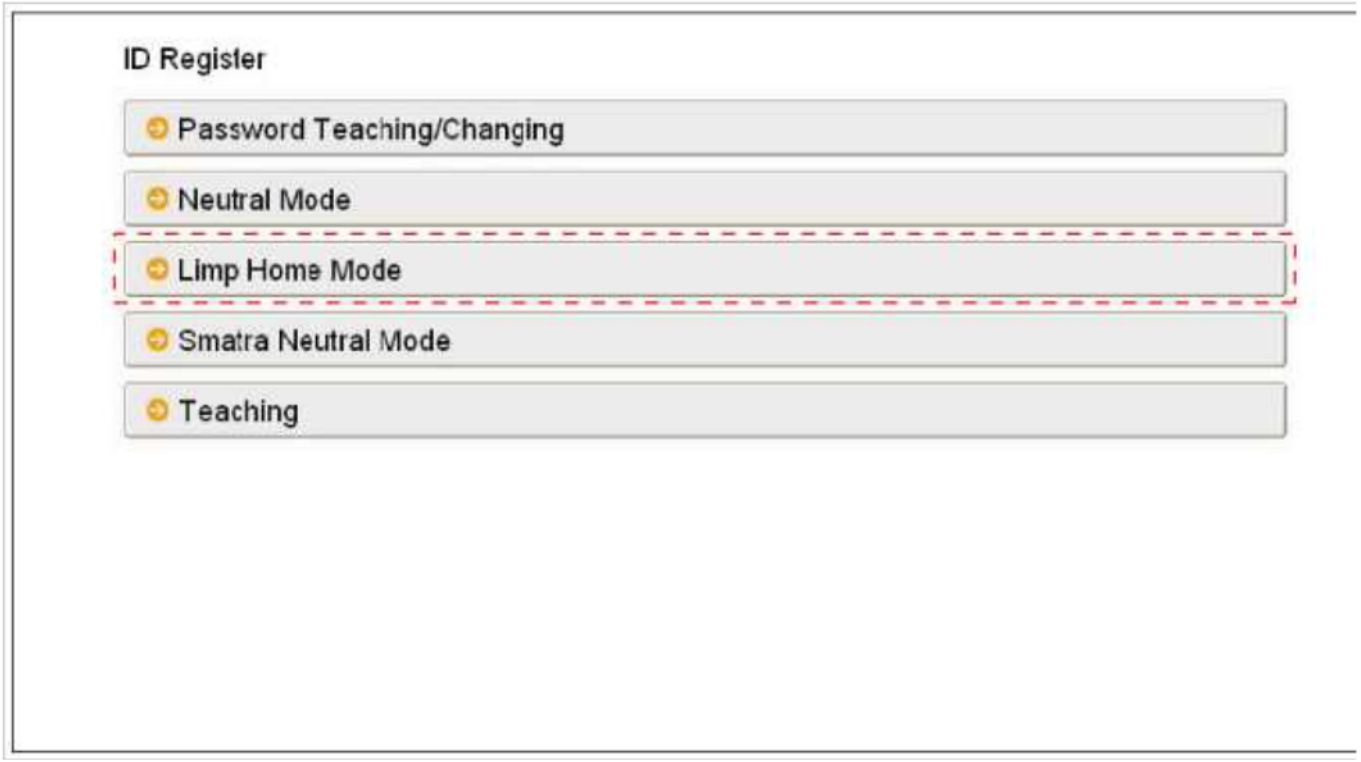


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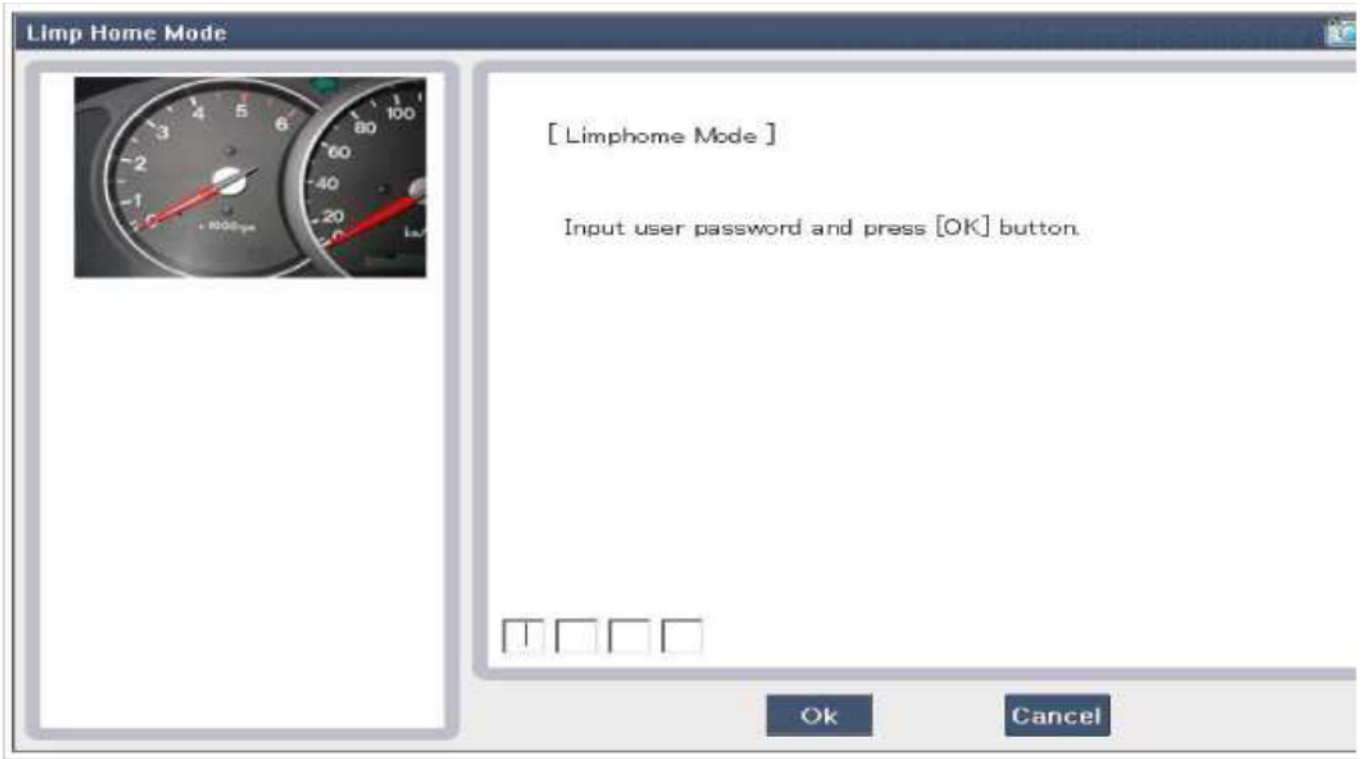


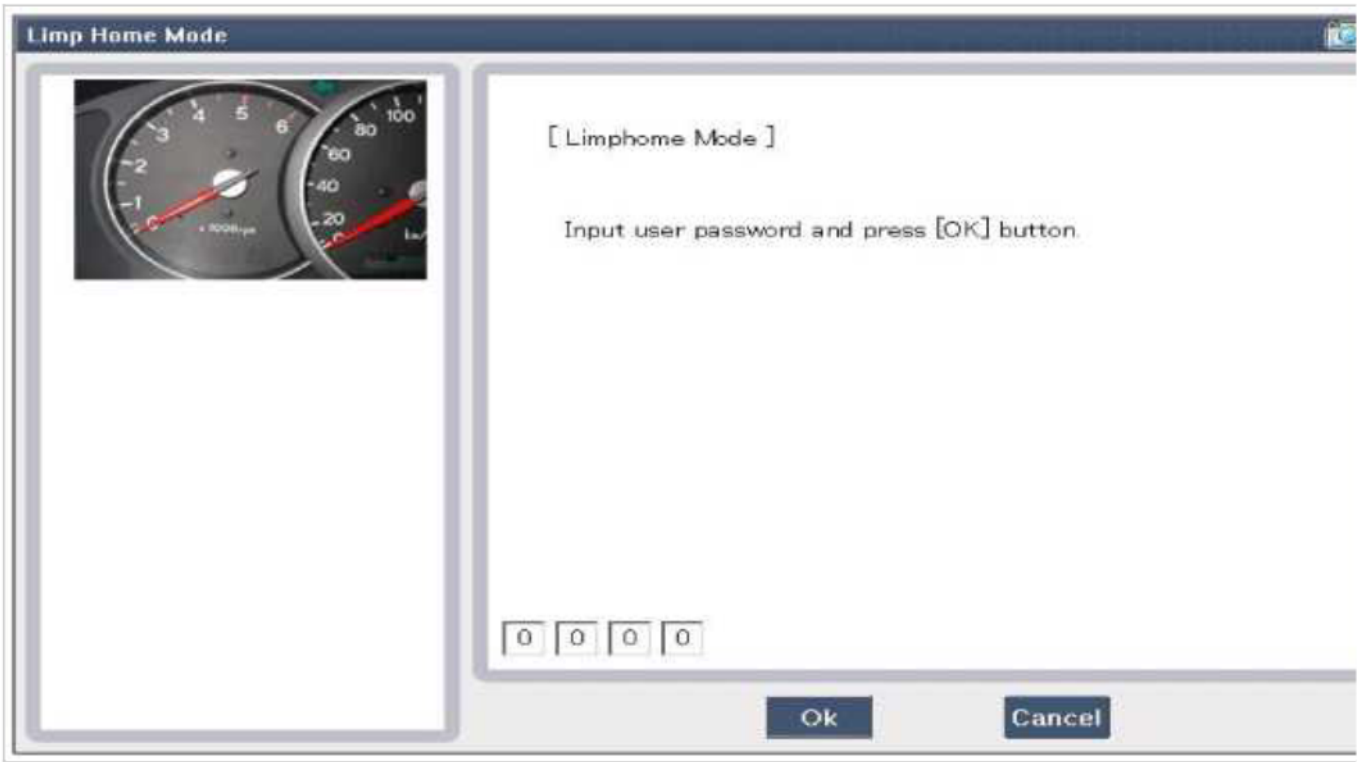
Limp Home Function

1. Limp Home By Tester
   If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home fun
   the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) be
   This password can be selected by the vehicle owner and is programmed at the service station.
   The user password can be sent to the PCM(ECM) via the special tester menu.
   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is corr
   PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. Afte
   time has elapsed, engine start is not possible.
   If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnect
   battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer sta
   again for one hour.

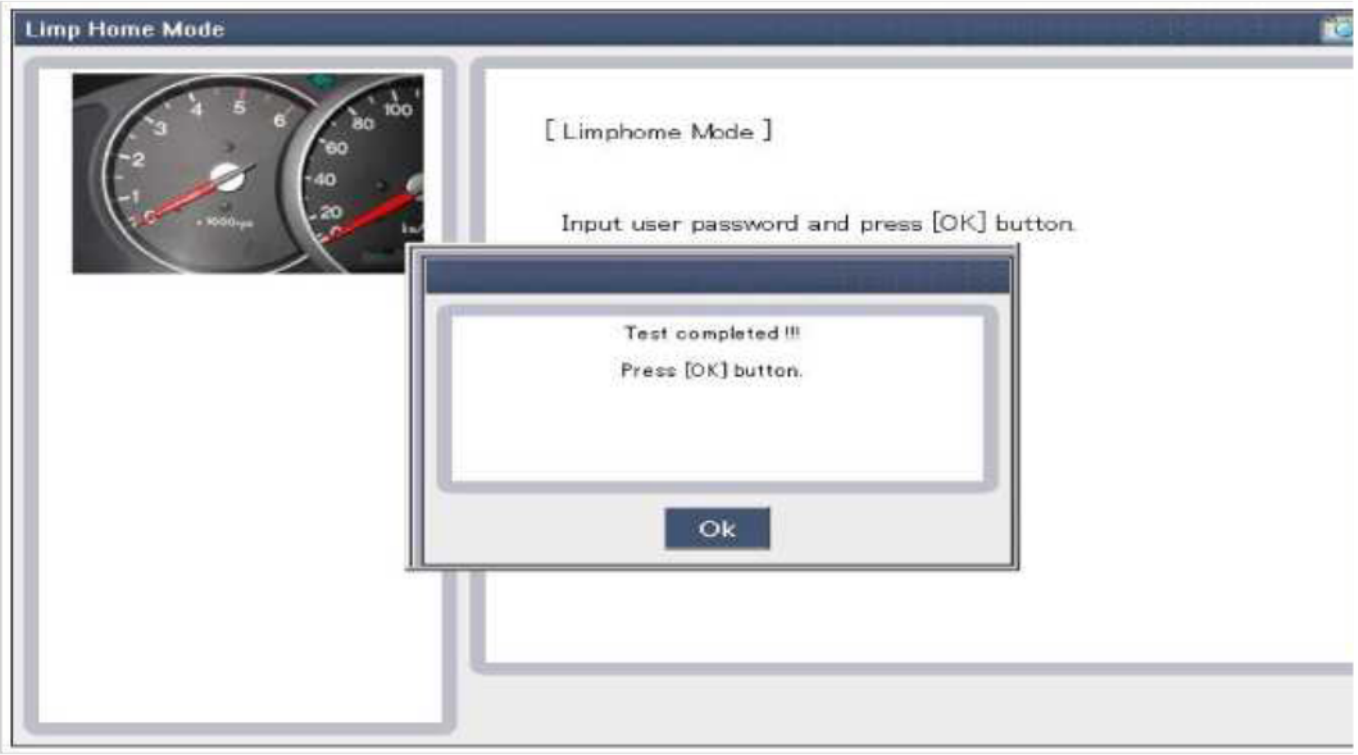


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2. Limp Home By Ignition Key

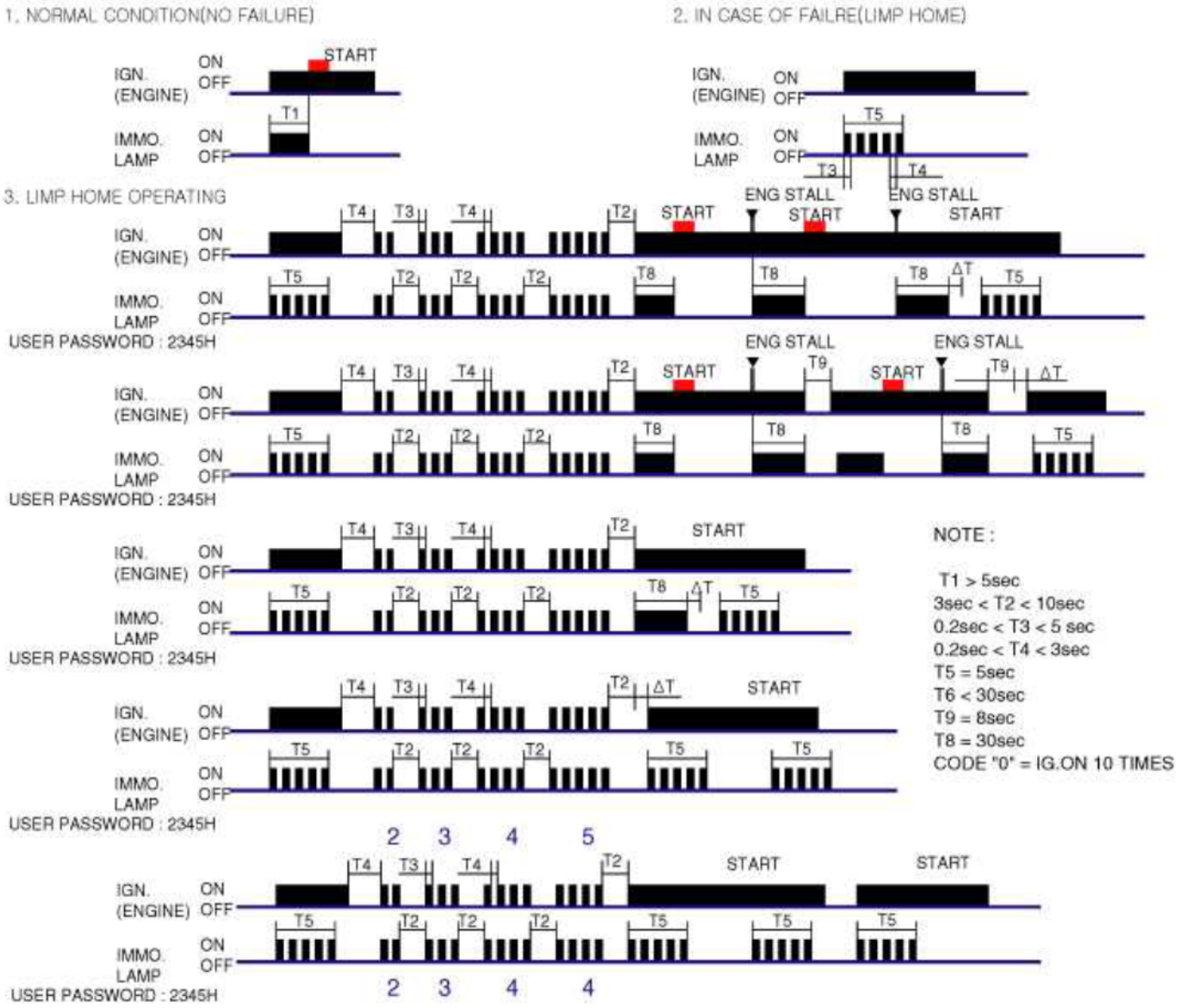
The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is corr PCM(ECM) will be unlocked for a period of time (30 sec.).

The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new pa has been input, the timer (30 sec.) will start again.

After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the password is requested again.

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Body Electrical System

Diagnosis Of Immobilizer Faults

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function.

The following table shows the assignment of immobilizer related faults to each type:

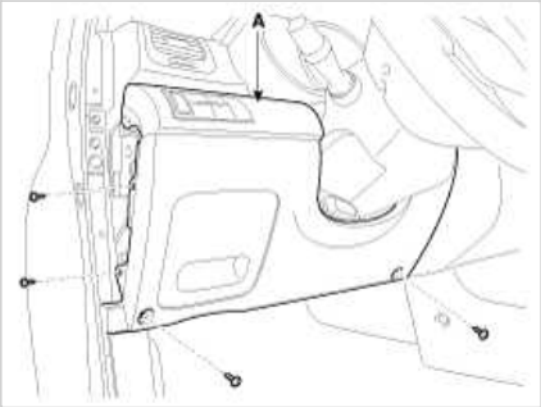
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Immobilizer Related Faults	Fault types	Diagnostic cod
PCM(ECM) fault	1. Non-Immobilizer-EMS connected to an Immobilizer	P1610
Transponder key fault	1. Transponder not in password mode 2. Transponder transport data has been changed.	P1674 (Transponder status
Transponder key fault	1. Transponder programming error	P1675 (Transponder prograı error)
SMARTRA fault	1. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA messag
SMARTRA fault	1. Virgin SMARTRA at learnt EMS 2. Neutral SMARTRA at learnt EMS 3. Incorrect the Authentication of EMS and SMARTRA 4. Locking of SMARTRA	P169A (SMARTRA Authent fail)
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error 3. Communication line error (Open/Short etc.) 4. Invalid message from SMARTRA to PCM(ECM)	P1690 (SMARTRA no resp
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil err
Immobilizer indicator lamp fault	1. Immobilizer indicator lamp error (Cluster)	P1692 (Immobilizer lamp e
Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil)	P1693 (Transponder no res error/invalid respo
PCM(ECM) fault	1. Request from PCM(ECM) is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (PCM(ECM) messag
PCM(ECM) internal permanent memory (EEPROM) fault	1. PCM(ECM) internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (PCM(ECM) memor
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fa
Hi-Scan fault	1. Hi-Scan message error	P1697
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (32 times)	P1699 (Twice IG ON over

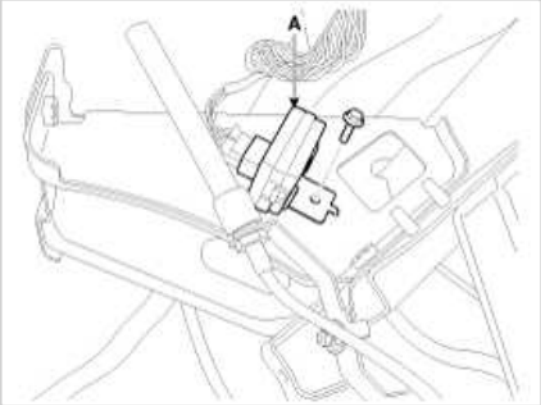
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Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A).
   (Refer to Body - "Crash pad")



3. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening a l



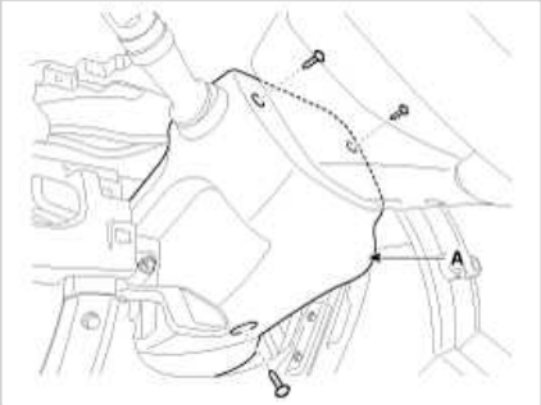
Installation

1. Install the immobilizer control unit after connecting the unit connector.
2. Install the crash pad lower panel.

Body Electrical System

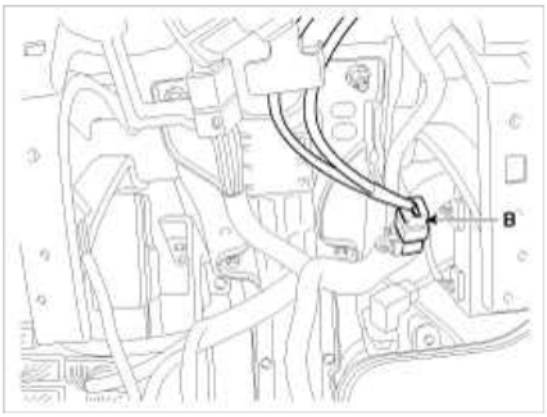
Removal

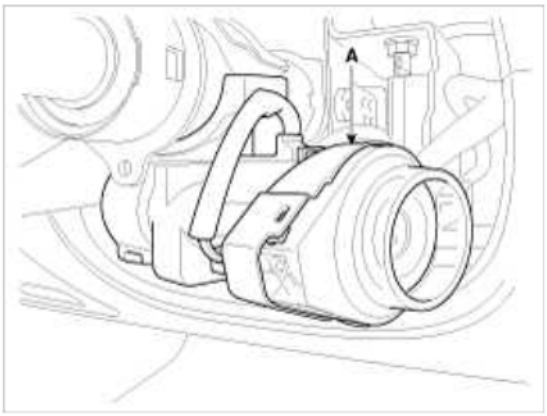
1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A).



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3. Disconnect the 6P connector (B) of the coil antenna and then remove the coil antenna (A) after loosening the scre





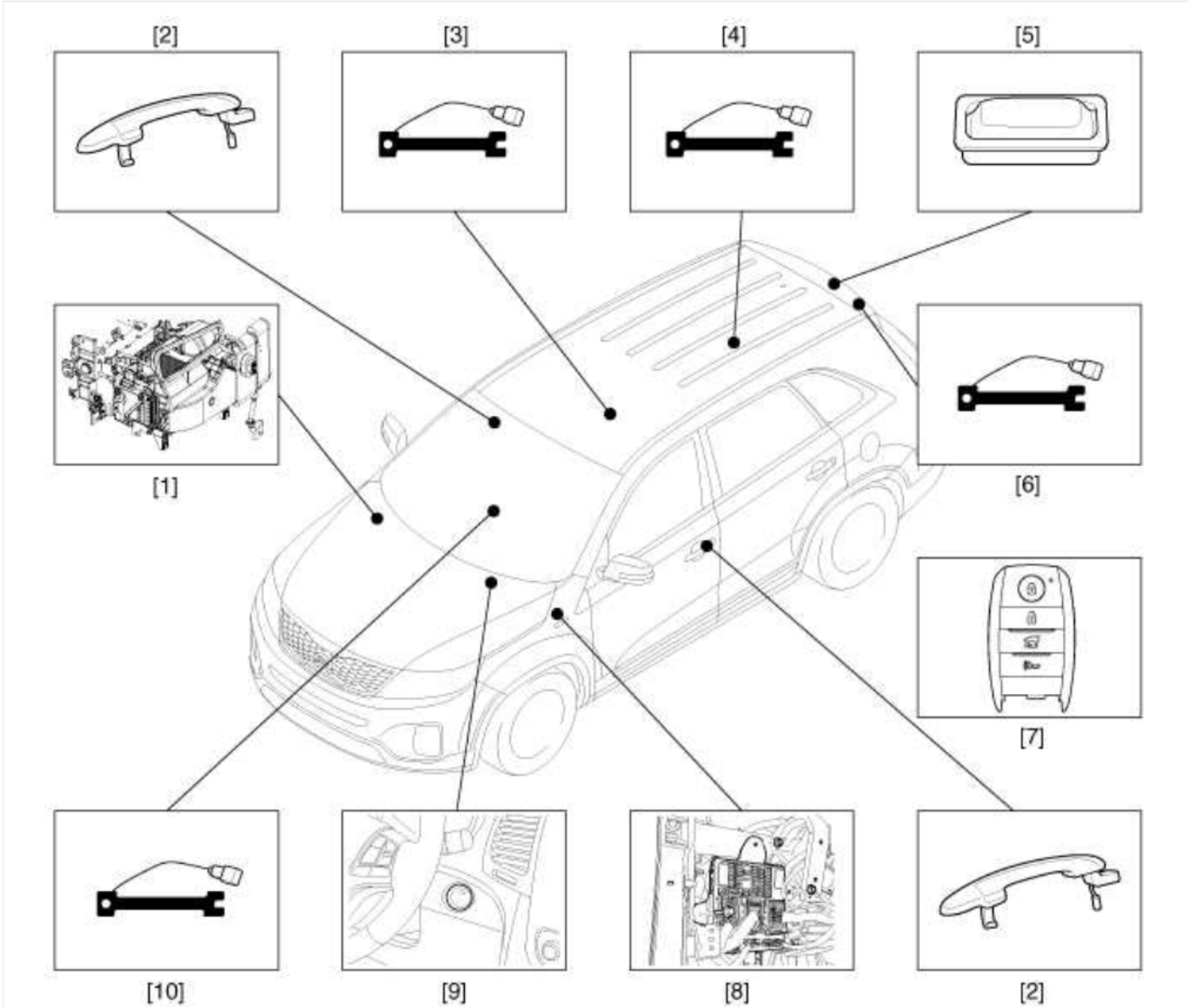
Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the steering column upper and lower shrouds.

Body Electrical System

Component Location

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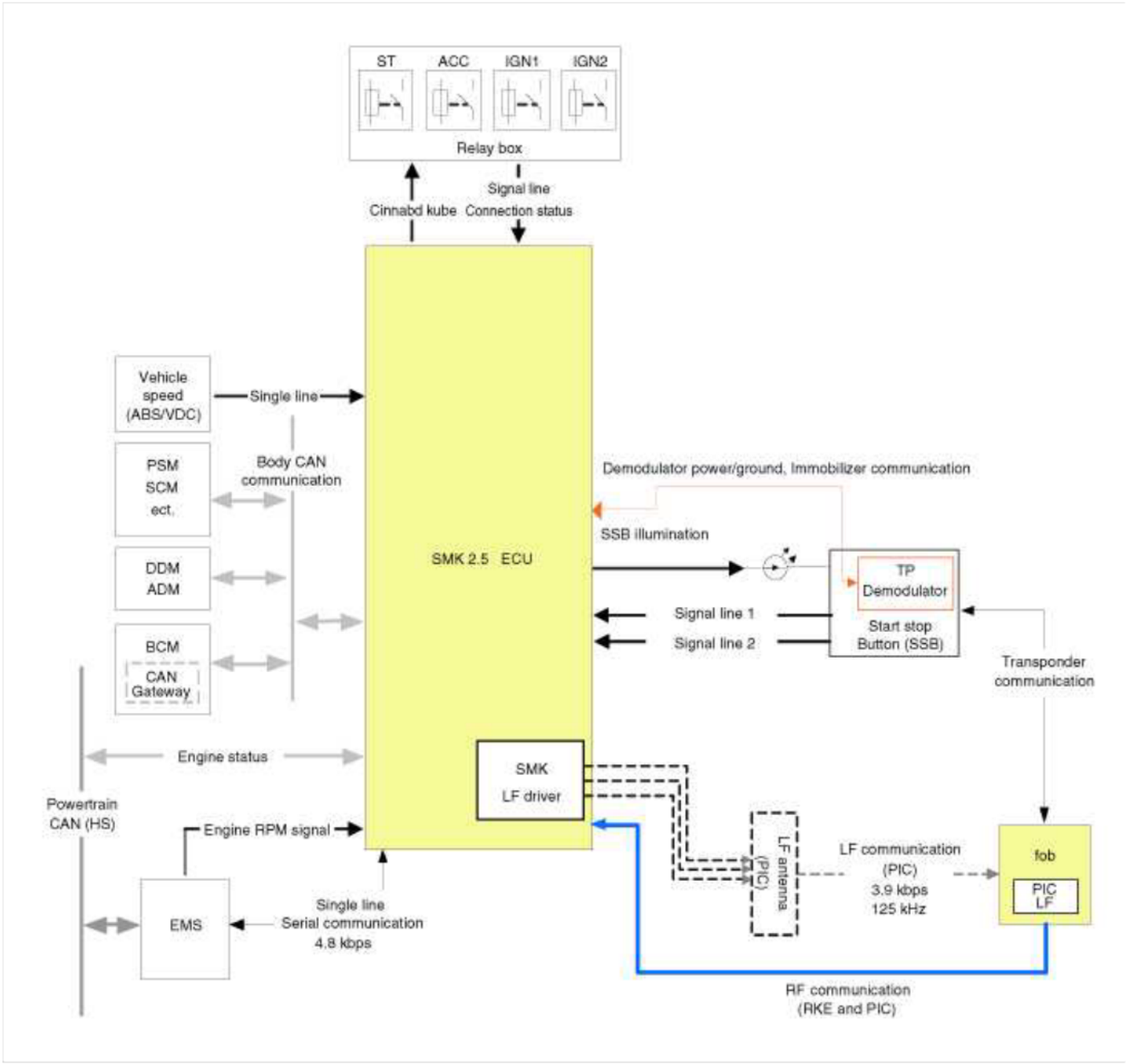


1. Smart key unit 2. Door handle & door antenna 3. Interior antenna 2 4. Interior antenna 3 5. Tailgate switch	6. Bumper antenna 7. FOB key 8. IPM (Intelligent intergrated Platform Module) 9. Start Stop Button (SSB) 10. Interior antenna 1

Body Electrical System

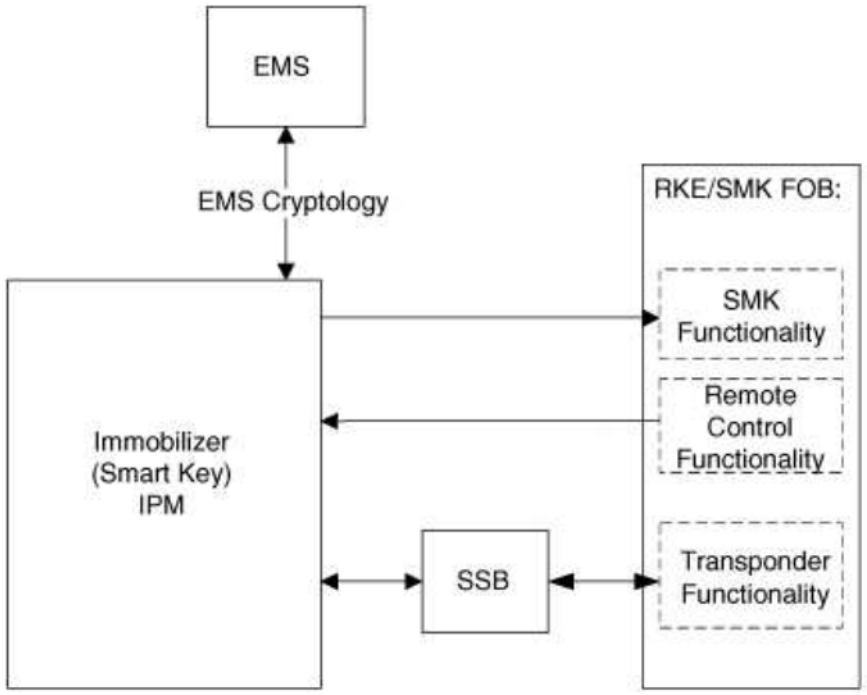
Circuit Diagram (1)

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Circuit Diagram (2)

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Body Electrical System

Description

System Overview

The System offers the following features:

- Human machine interface through a 1-stage button, for terminal switching and engine start.
- Control of external relays for ACC / IGN1 / IGN2 terminal switching and STARTER, without use of mechanical switch.
- Indication of vehicle status through LED or explicit messages on display.
- Immobilizer function by LF transponder communication between fob and fob holder.
- Redundant architecture for high system dependability .
- Interface with Low Speed CAN vehicle communication network.
- Interface with LIN vehicle communication network depending on platform .

The RKE and SMART KEY functions are not considered part of this Button Engine Start system and are specified in separated system.

System Main Function

- Switching of ACC / IGN1 / IGN2 terminals.
- Control of the STARTER relay BAT line (high side) based on communication with EMS ECU.
- Management of the Immobilizer function.
- Management of BES warning function.

Button Engine Start System

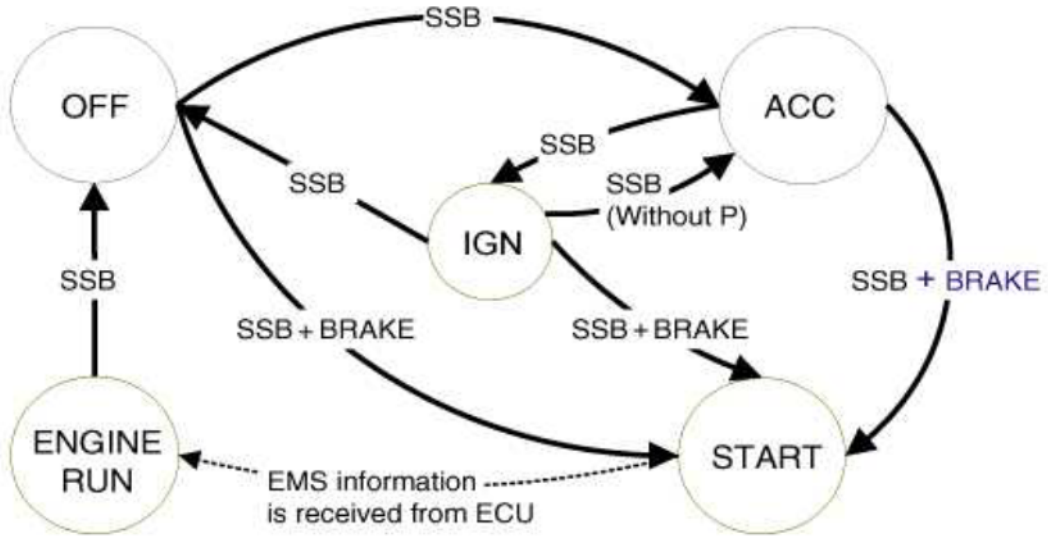
The Button Start System allows the driver to operate the vehicle by simply pressing a button (called as SSB) instead of a standard mechanical key.

If the driver press the SSB while prerequisites on brakes, fob authentication and transmission status are satisfied, the System will proceed with the locking/unlocking of the steering column, the control of the terminal, and the cranking of engine.

The driver can release the SSB as soon as this sequence initiated. After positive response from immobilizer interrogat system will activate the starter motor and communicate with the EMS to check the engine running status for starter re

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The driver will be able to stop the engine by a short push on the SSB if the vehicle is already in standstill. Emergency stop will be possible by a long press of the SSB or 3 consecutive presses in case the vehicle is in ENGINE RUNNI
If the conditions for engine cranking are not satisfied while a push on the SSB is detected and a valid fob authenticate system will unlock the steering column and switch the terminals to IGN. Another push on the SSB will be necessary t the engine.
In case of a vehicle equipped with SMART KEY system, fob authentication will not require any action from the drive limp home start or in case of vehicle without SMART KEY, the driver will have to insert the fob into the fob holder.



- Control Ignition and engine ON/OFF by Sending signal to IPM.
- Display status by LED Lamp ON/OFF. (Amber or Reddish orange)

Indicator ON/OFF Condition At Ignition Key Off Condition

No.	Character lamp	Conditions
1	Indicator Lamp ON	Door open, Tail lamp ON, ACC, IG ON
2	Indicator Lamp 30sec ON → Lamp OFF	Door close, Tail lamp OFF, IG OFF
3	Indicator Lamp OFF	Remote LOCK, Passive LOCK
4	Rheostat at tail lamp ON (Illumination lamp)	

Indicator ON/OFF Condition According To Ignition Key's Position

No.	Ignition conditions	Start Button LED status
1	IG OFF	LED OFF
2	IG ACC	Amber color LED ON
3	IG ON (Engine OFF)	Reddish orange color LED ON
4	Cranking	Maintain LED status before cranking
5	Engine running	LED OFF

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Smart Key Unit



The SMK manages all function related to:

- "Start Stop Button (SSB) monitoring",
- "Immobilizer communication" (with Engine Management System unit for immobilizer release),
- "Authentication server" (Validity of Transponder and in case of Smart Key option Passive Fob authentication),
- "System consistency monitoring",
- "System diagnosis",
- Control of display message / warning buzzer .

The unit behaves as Master role in the whole system.
In case of SMART KEY application, for example “Passive Access”, “Passive Locking” and “Passive Authorization a integrated for Terminal switching Operations”.
It collects information about vehicle status from other modules (vehicle speed, alarm status, driver door open...), read inputs (e.g. SSB, Capacitive Sensor / Lock Button, PARK position Switch), controls the outputs (e.g. exterior and in antennas), and communicates with others devices via the CAN network as well as a single line interfaces.
The diagnosis and learning of the components of the BES System are also handled by the SMK.
The SMK manages the functions related to the "terminal control" by activating external relays for ACC, IGN1 and IG This unit is also responsible for the control of the STARTER relay.
The SMK is also controlling the illumination of the SSB as well as the "system status indicator", which consists of 2 L different color. The illumination of the fob holder is also managed by the SMK.
The SMK reads the inputs (Engine fob in, vehicle speed, relays contact status), controls the outputs (Engine relay out drivers), and communicates with others devices via the CAN.
The internal architecture of the SMK is defined in a way that the control of the terminal is secured even in case of failu one of the two microcontrollers, system inconsistency or interruption of communication on the CAN network.
In case, failure of one of the two controllers, the remaining controller shall disable the starter relay. The IGN1 and IG terminals relays shall be maintained in the state memorized before the failure and the driver shall be able to switch tho terminals off by pressing the SSB with EMERGENCY_STOP pressing sequence. However, engine restart will not b allowed. The state of the ACC relay will depend on the type of failure.
The main functions of the SMK are:

- Control of Terminal relays
- Monitoring of the Vehicle speed received from sensor or ABS/ESP ECU.
- Control of SSB LEDs (illumination, clamp state).
- Control of the base station located in SSB through direct serial interface.
- System consistency monitoring to diagnose SMK failure and to switch to relevant limp home mode.
- Providing vehicle speed information
- Start Stop Button (SSB) monitoring

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- Starter power control

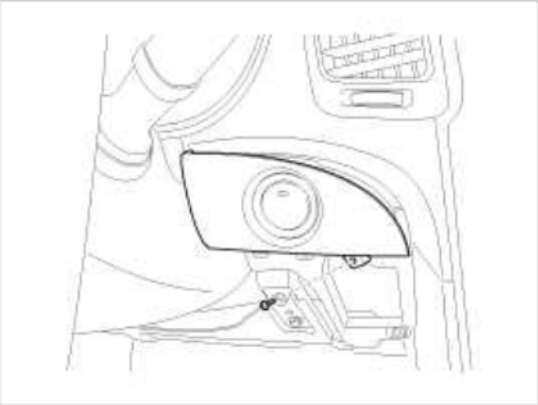
Start/Stop Button (SSB)

A single stage push button is used for the driver to operate the vehicle. Pressing this button allows:

- To activate the power modes ‘Off’, ’Accessory’, ‘Ignition’ and 'Start' by switching the corresponding terminals
- To start the engine
- To stop the engine

The contact will be insured by a micro-switch and a backlighting is provided to highlight the marking of the button wh necessary.

Two (2) LED colors are located in the center of the button to display of the status of the system. Another illumination also integrated into the SSB for the lighting of the "Engine Start/Stop" characters.



BES(Button Engine Start) System State Chart

System STATES in LEARNT MODE

In learnt mode, the BES System can be set in 6 different sates, depending on the status of the terminals and Engine st

System State	Terminal Status	Engine status
1. OFF - Locked	OFF	Stopped
2. OFF - Unlocked	OFF	Stopped
3. ACC	ACC	Stopped
4. IGN	IGN1, IGN2, ACC	Stopped
5. Start	IGN1, Start	Cranking
6. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

Referring to the terminals, the system states described in the table above are same as those one found in a system ba mechanical ignition switch.

The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition [OFF] to [START] without going through [ACC] and [IGN] states.

System STATES IN VIRGIN MODE

The BES System can be set in 5 different states (OFF LOCKED is not available in virgin mode), depending on the st the terminals and Engine status :

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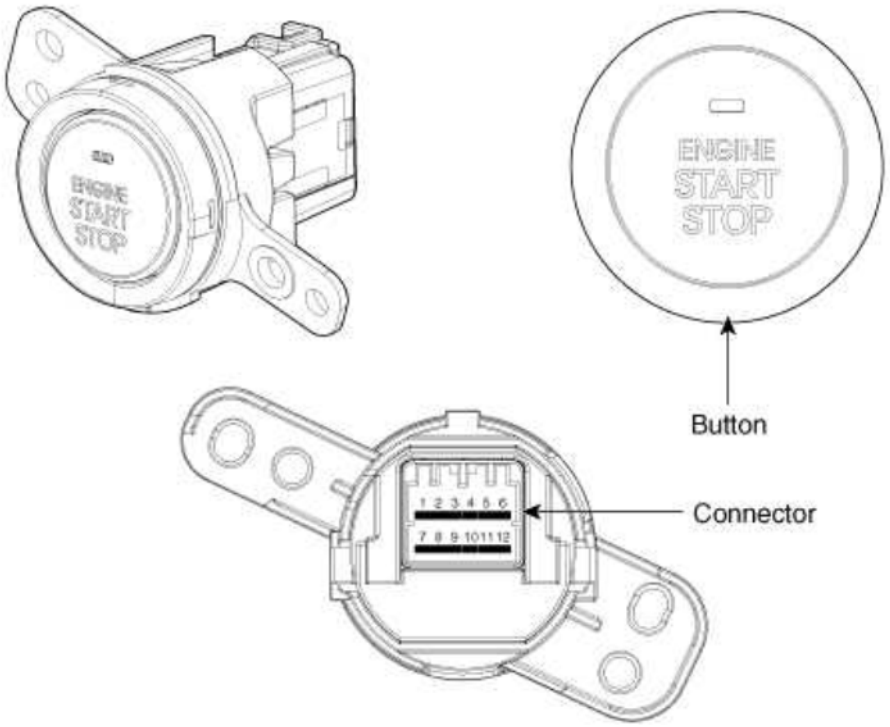
System State	Terminal Status	Engine status
1. OFF - UNLOCKED	OFF	Stopped
2. ACC	ACC	Stopped
3. IGN	IGN1, IGN2, ACC	Stopped
4. Start	IGN1, START with special pattern of activation	Cranking
5. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

Referring to the terminals, the system states described in the table above are same as those one found in a system bas mechanical ignition switch.
The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition [OFF] to [START] without going through [ACC] and [IGN] states.

Body Electrical System

Component

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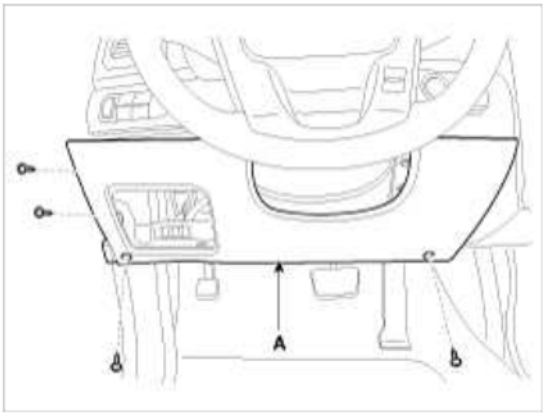
Connector (10 pins)	1 2 3 4 5 6 7 8 9 10 11 12		
Pin No.	**Description**	**Pin No.**	**Description**
1	SSB(Start Stop Button) switch1 (output)	7	SSB switch2 (output)
2	Battery LED	8	SSB LED
3	SSB LED (Amber)	9	SSB LED (Reddish orange)
4	SSB LED GND	10	Rheostat
5	SSB LED power	11	-
6	Immobilizer power	12	Immobilizer GND

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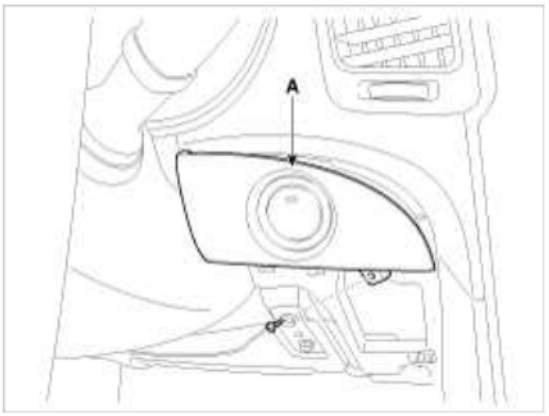
Removal

1. Disconnect the negative(-) battery terminal.

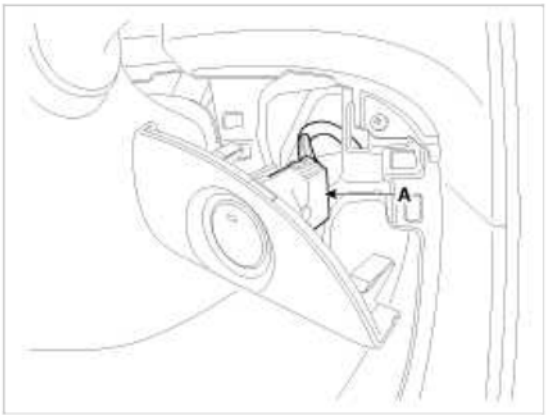
2. Remove the crash pad lower panel (A).
(Refer to Body - "Crash pad")



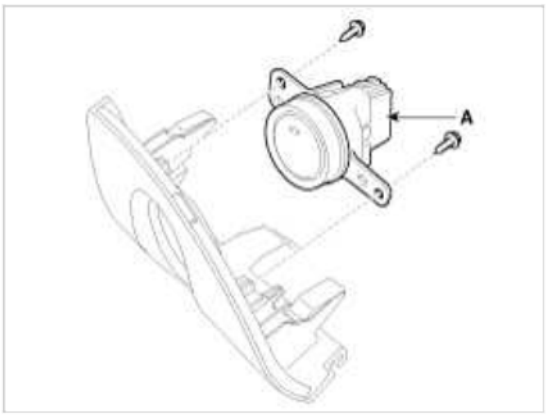
3. Remove the start/stop button cover (A) after loosening the mounting screw.



4. Disconnect the connector (A).



5. Remove the start/stop button (A) after loosening the mounting screws.



Installation

1. Install the start/stop button.

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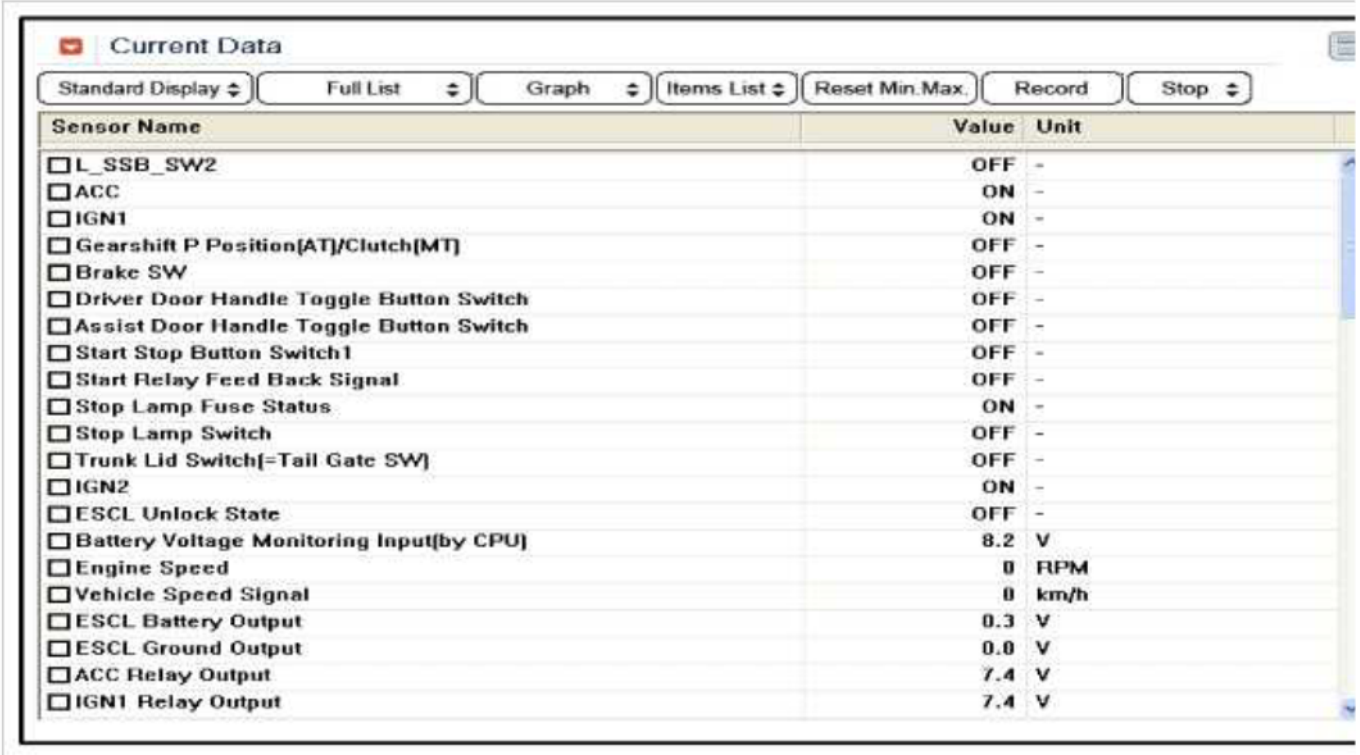
2. Install the start/stop button cover.
3. Install the crash pad lower panel.

Inspection

1. It will be able to diagnose defects of Smart key with GDS quickly. GDS can operates actuator forcefully, input/ou value monitoring and self diagnosis.
2. Select model and "Smart key system(Button start)" menu.



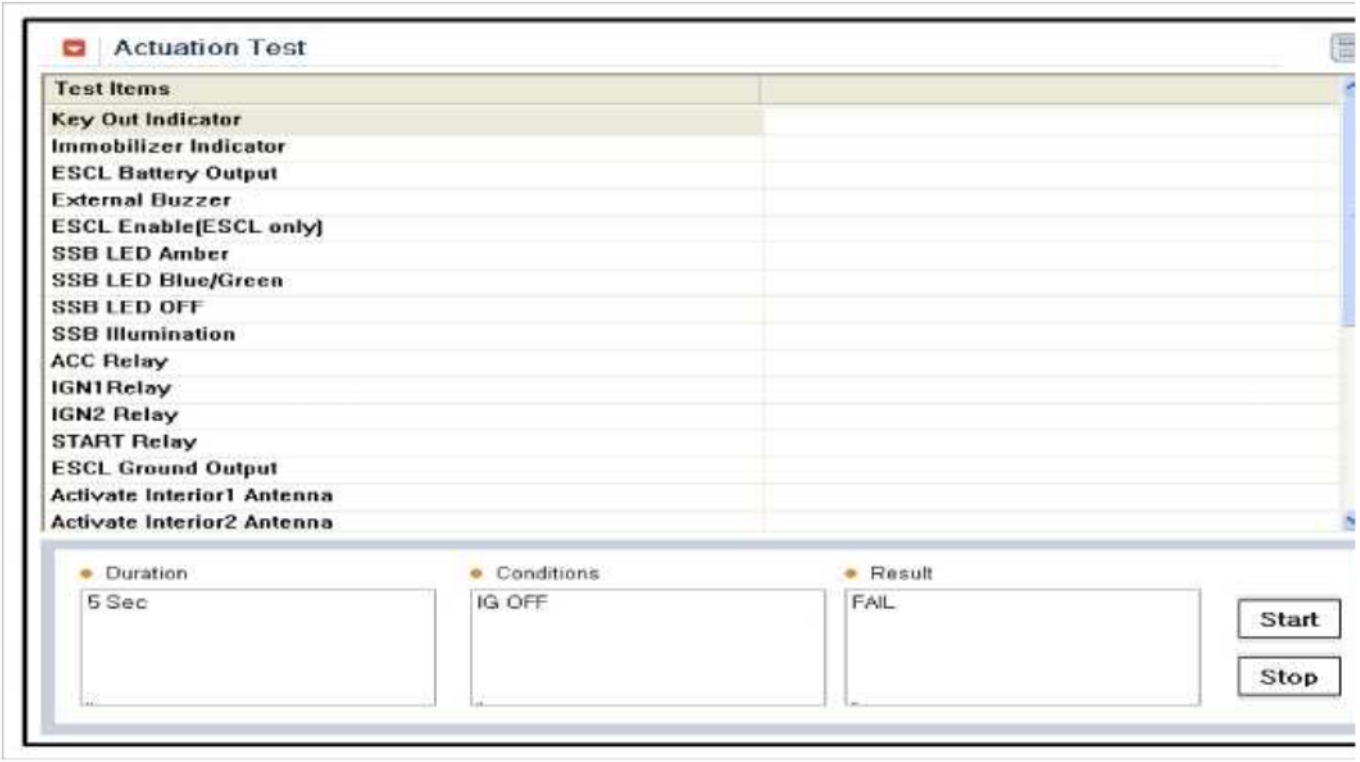
3. Select "Current Data", if you want to check current data of smart key system.
It provides the input/output status of each module.



Sensor Name	Value	Unit
L_SSB_SW2	OFF	-
ACC	ON	-
IGN1	ON	-
Gearshift P Position(AT)/Clutch(MT)	OFF	-
Brake SW	OFF	-
Driver Door Handle Toggle Button Switch	OFF	-
Assist Door Handle Toggle Button Switch	OFF	-
Start Stop Button Switch1	OFF	-
Start Relay Feed Back Signal	OFF	-
Stop Lamp Fuse Status	ON	-
Stop Lamp Switch	OFF	-
Trunk Lid Switch(=Tail Gate SW)	OFF	-
IGN2	ON	-
ESCL Unlock State	OFF	-
Battery Voltage Monitoring Input(by CPU)	8.2	V
Engine Speed	0	RPM
Vehicle Speed Signal	0	km/h
ESCL Battery Output	0.3	V
ESCL Ground Output	0.0	V
ACC Relay Output	7.4	V
IGN1 Relay Output	7.4	V

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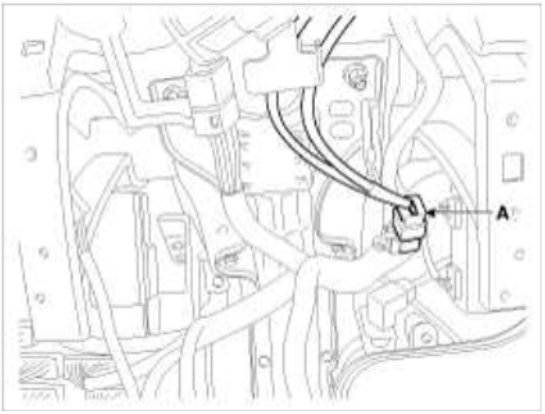
4. If you want to check smart key system operation forcefully, select "Actuation test".

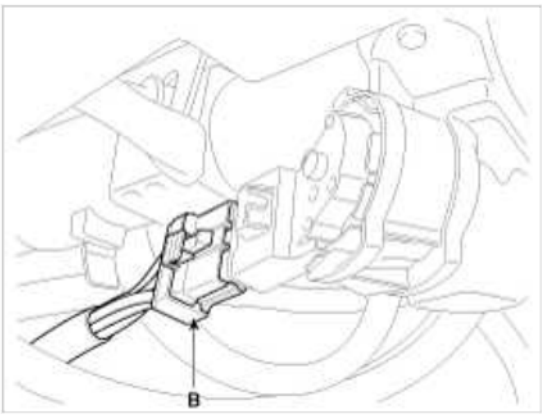


Body Electrical System

Inspection

1. Disconnect the ignition switch connector (B) and key warning switch connector (A) from under the steering colun





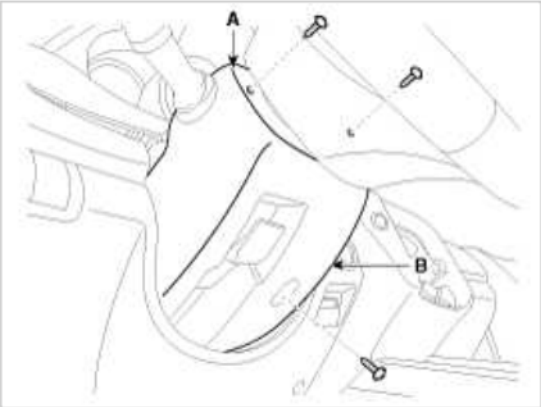
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

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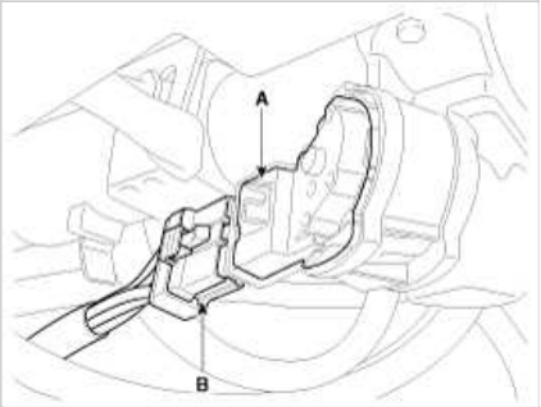
Terminal / Position	Key	Ignition Switch (B) 2	4	6	5	3	1	Steering Travel	Travel	Key Warning Switch (A) 5	6	Key Hole Illumination(A) 3	4
Lock	Removal							Lock					
	Insert							Lock	Unlock				
ACC		○	○					Unlock					
ON		○	○	○	○	○				○	○		
Start		○		○	○	○	○						

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds.
   (Refer to Steering System - "Steering column")

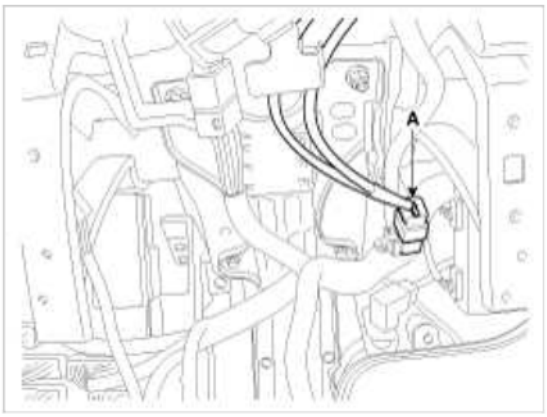


3. Remove the crash pad lower panel.
   (Refer to Body - "Crash pad")
4. Remove the ignition switch (A) after disconnecting the 6P connector (A).

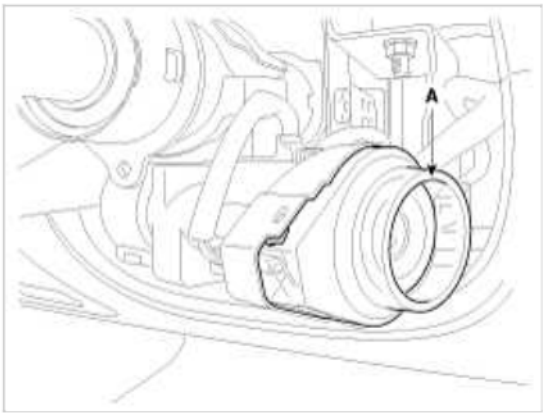


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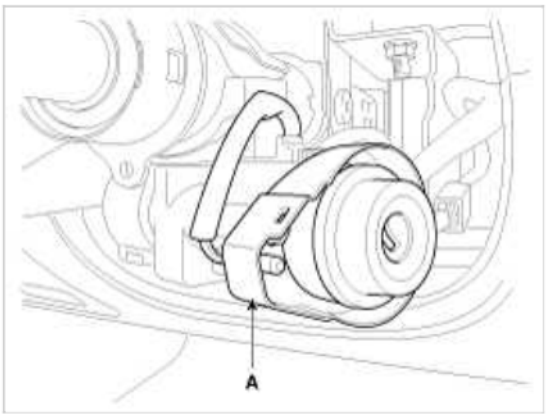
5. Remove the key warning and immobilizer connector (A).



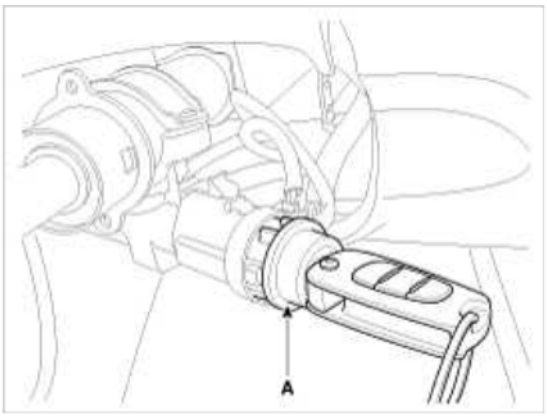
6. Remove the key illumination lens (A).



7. Remove the key illumination bulb and cover (A).



8. If it is necessary to remove the key lock cylinder (A), remove the key lock cylinder with key ACC.



Installation

1. Install the key lock cylinder.
2. Install the illumination bulb, lens and cover.

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3. Install the key warning and immobilizer connector.
4. Install the ignition switch.
5. Install the steering column shrouds and crash pad lower panel.

Body Electrical System

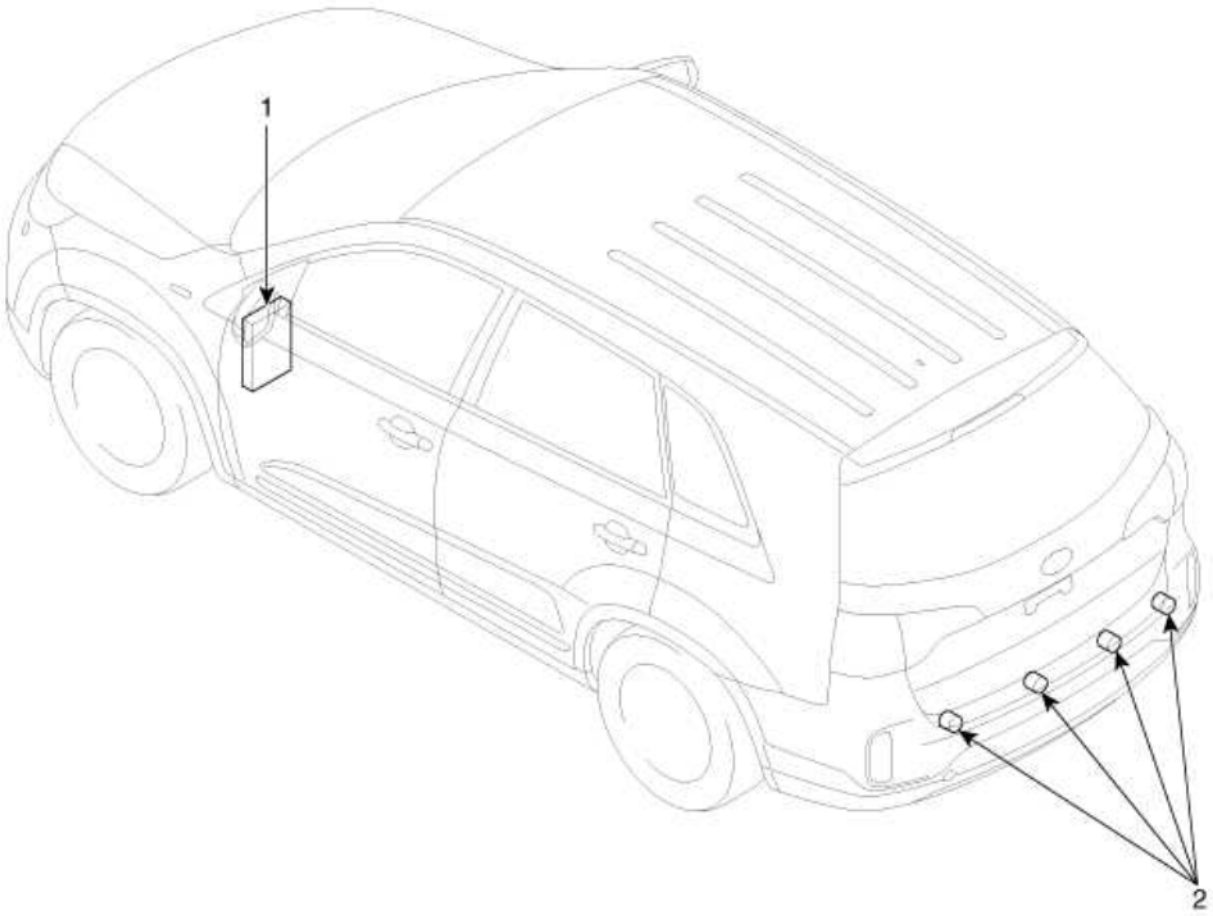
Specification

Item		Specification
Ultrasonic sensor	Voltage rating	DC 12 V
	Detecting range	30 cm ~ 120 cm
	Operation voltage	DC 9 ~ 16 V
	Operation current	MAX 300 mA
	Operation temperature	-30°C ~ +80°C (-22°C ~ +176°C)
	Operation frequency	48 ± 5 KHz
	Number of sensors	4 (Left side, Left center, Right center, Right side)

Body Electrical System

Component Location

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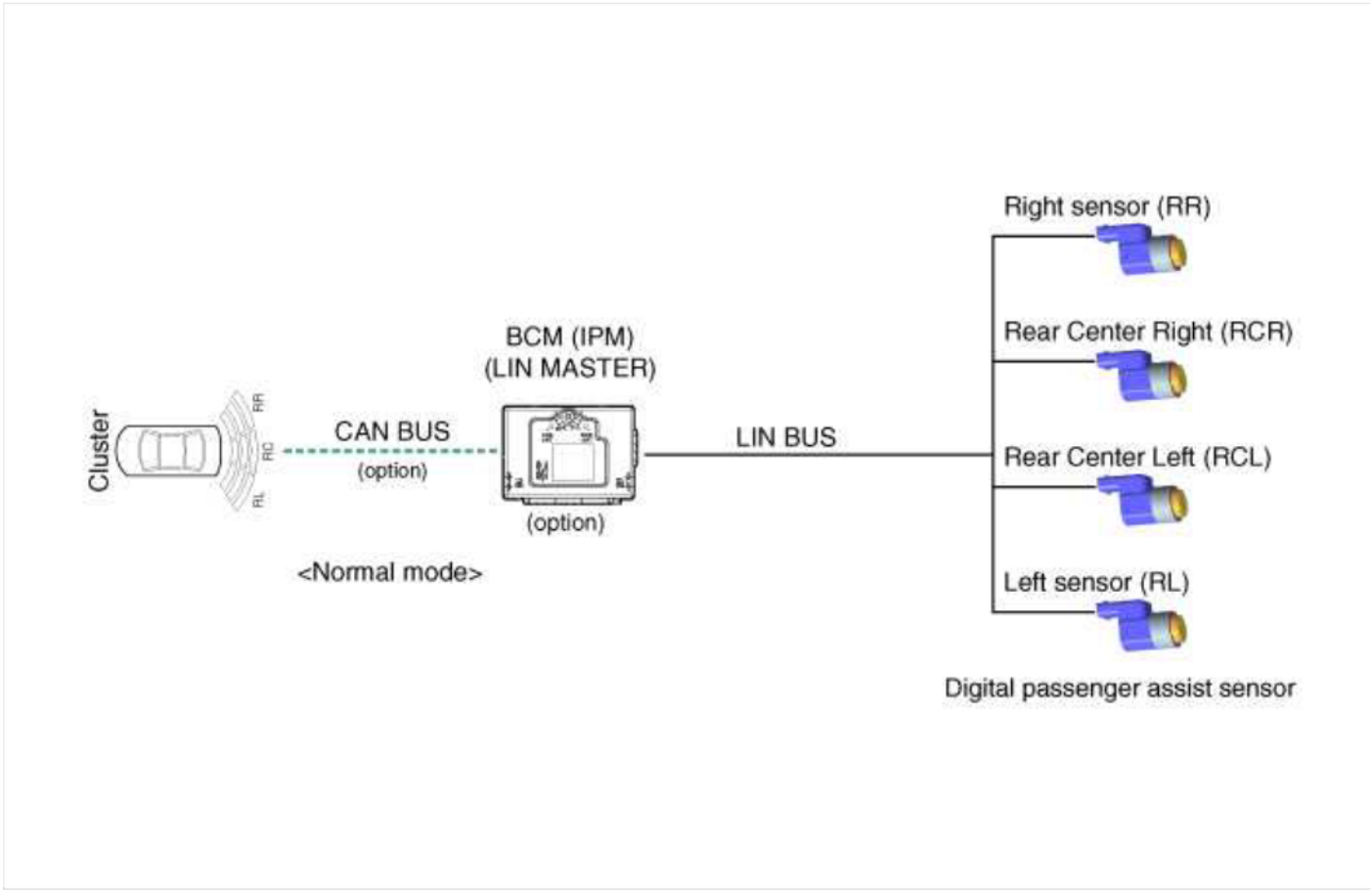
1. IPM (Intelligent intergrated Platfrom Moduel)	2. Ultrasonic sensor

Body Electrical System

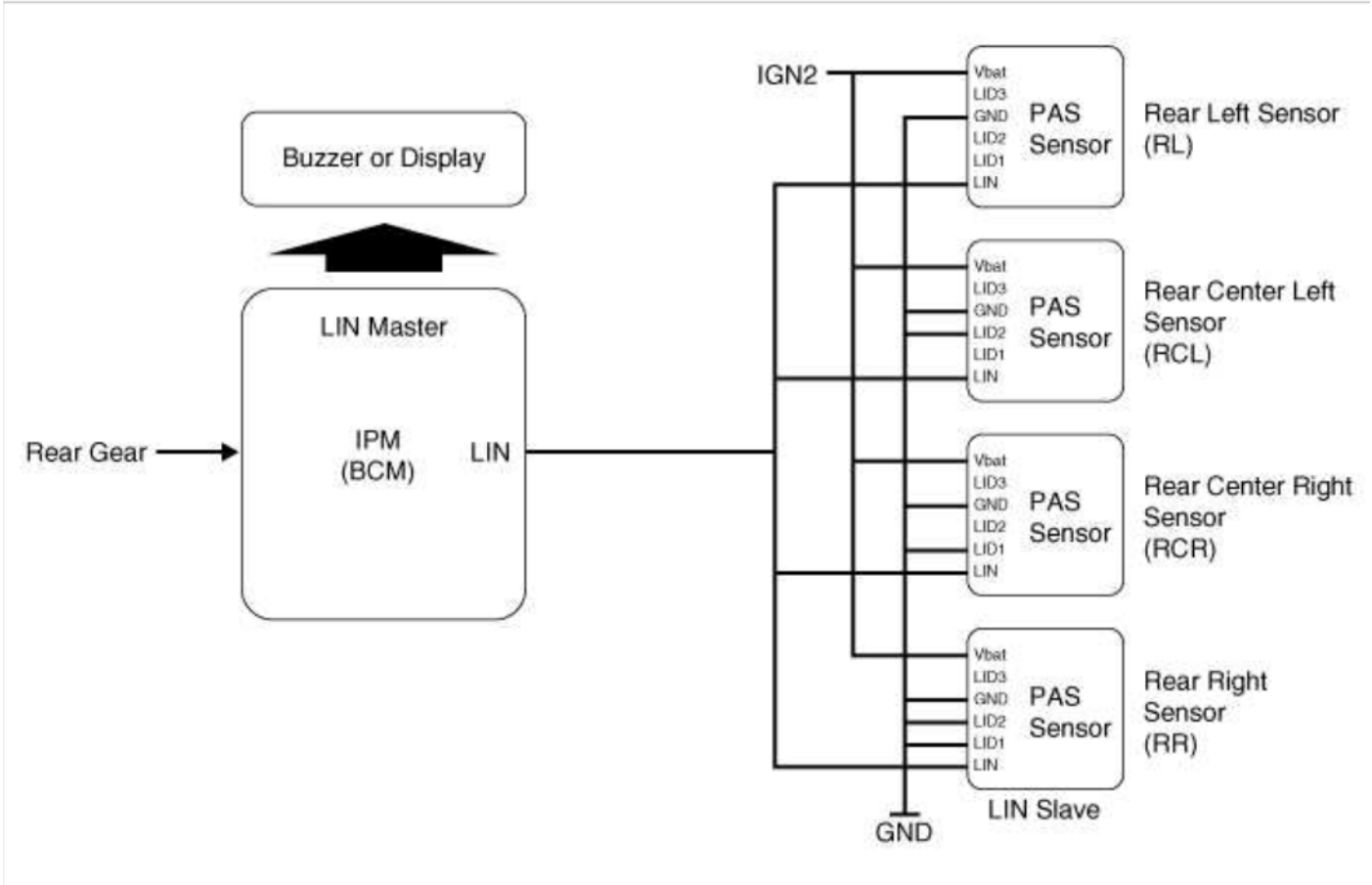
System Overview

RPAS (Rear Parking Assist System) is an electronic driving aid that warns the driver to be cautious while parking or i speed environments. The sensor uses ultrasonic waves to detect objects within proximity of the vehicle.
RPAS consists of four sensors which are detecting the obstacles and transmit the result separated into three warning l the first, second and third to IPM(BCM) by Lin communication. IPM(BCM) decides the alarm level by the transmitt communication message from the slave sensors, then operate the buzzer or transmits the data for display.

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System Block Diagram



System Operation Specification.

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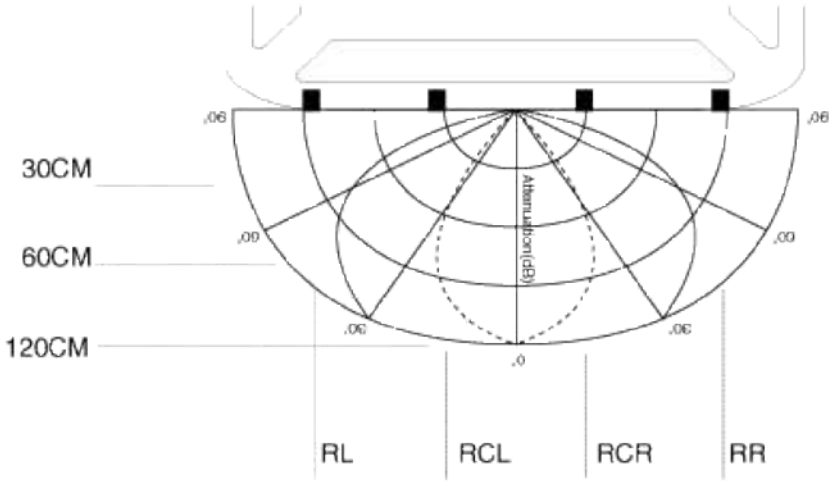
1. INIT mode
   (1) System initializing time is 500ms after IGN1+ R Gear.
   (2) RPAS recognizes LID and sets the sensor ID up during initialization.
   (3) RPAS activates each sensor and then executes the diagnosis after finishing initialization of BCM
   (4) R-PAS Starting buzzer" is normally worked, when sensor does not send an error message and after finishing diagnosis.
   (5) If any failure is received from the any sensors, R-PAS Starting Buzzer" does not work but the failure alarm is operated for a moment.
   If you have display option, warning sign is also shown on it.
   (6) Buzzer for sensor failure is operated once, but display is shown continuously until it is repaired completely.

2. NORMAL Mode
   (1) Lin communication starts and keeps the routine after IGN1 ON+R gear
   (2) BCM send a message once to each sensor for operating request to check the initial status of the system and f sensors response at a time. At this time, if there is no problem, the alarm starts after 500ms of R gear shifting 300ms intervals.
   (3) After initialization, normal mode starts 100ms later after finishing alarm output.
   (4) Alarm for obstacles is divided into 3 levels.
   The first and second are intermittent sound, and the third alarms continuously
   (5) The efficient vehicle speed of RPAS operation is under 10Km/h.
   (6) Refer to 'Digital PAS Project LIN communication' for the more detailed communication specification.

Sensing Area

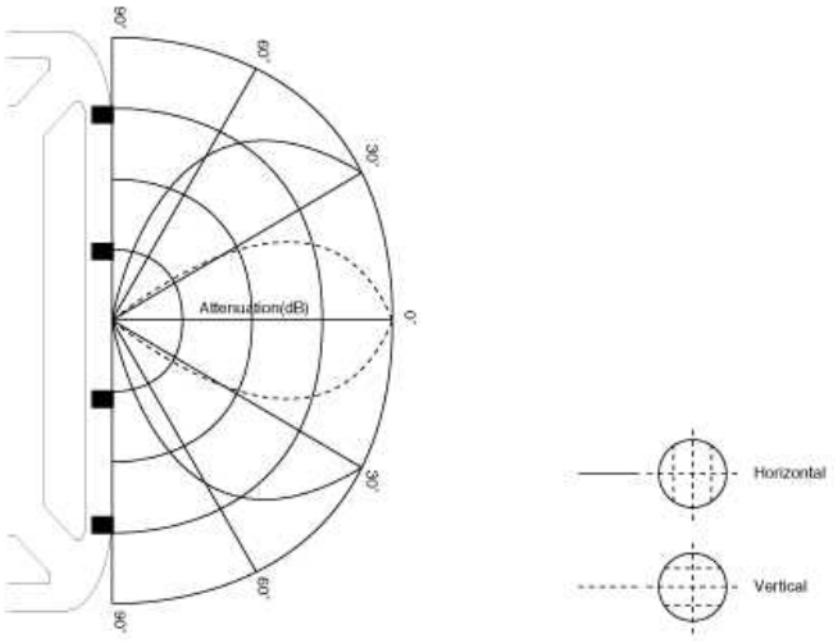
1. Measurement condition – PVC pole (diameter 75mm, length 3m), normal temperature
2. Distance range detected objects (Measured directly in front of sensor)
   61cm(24.0in) ~ 120cm(47.2in) : ± 15cm(5.9in)
   31cm(12.2in) ~ 60cm(23.6in): ± 15cm(5.9in)
   Less than 30cm(11.8in) : ± 10cm(3.9in)

Horizontal Sensing Area



Vertical Sensing Area

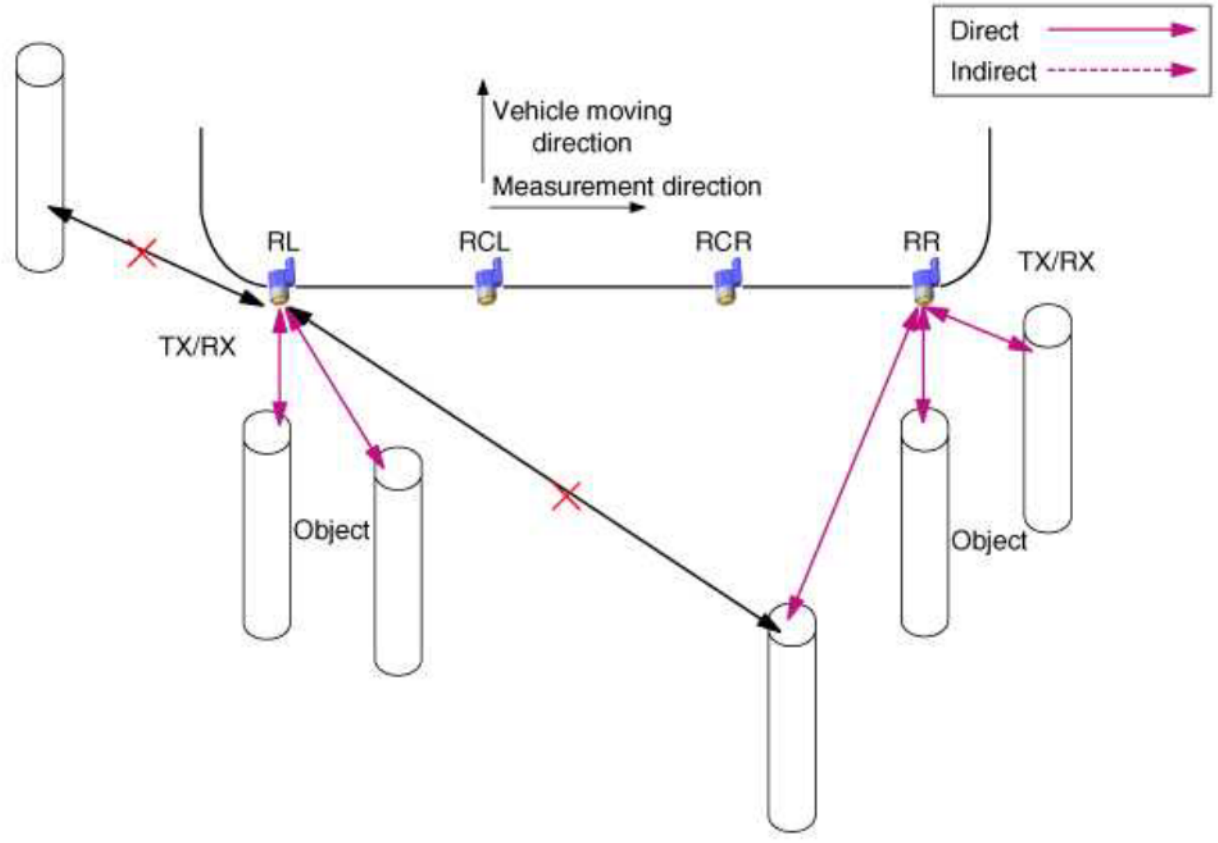
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Distance Measurement

Direct Measurement

Transmission and Reception are executed with one sensor
(RL, RCL, RCR, RR each sensor execution)

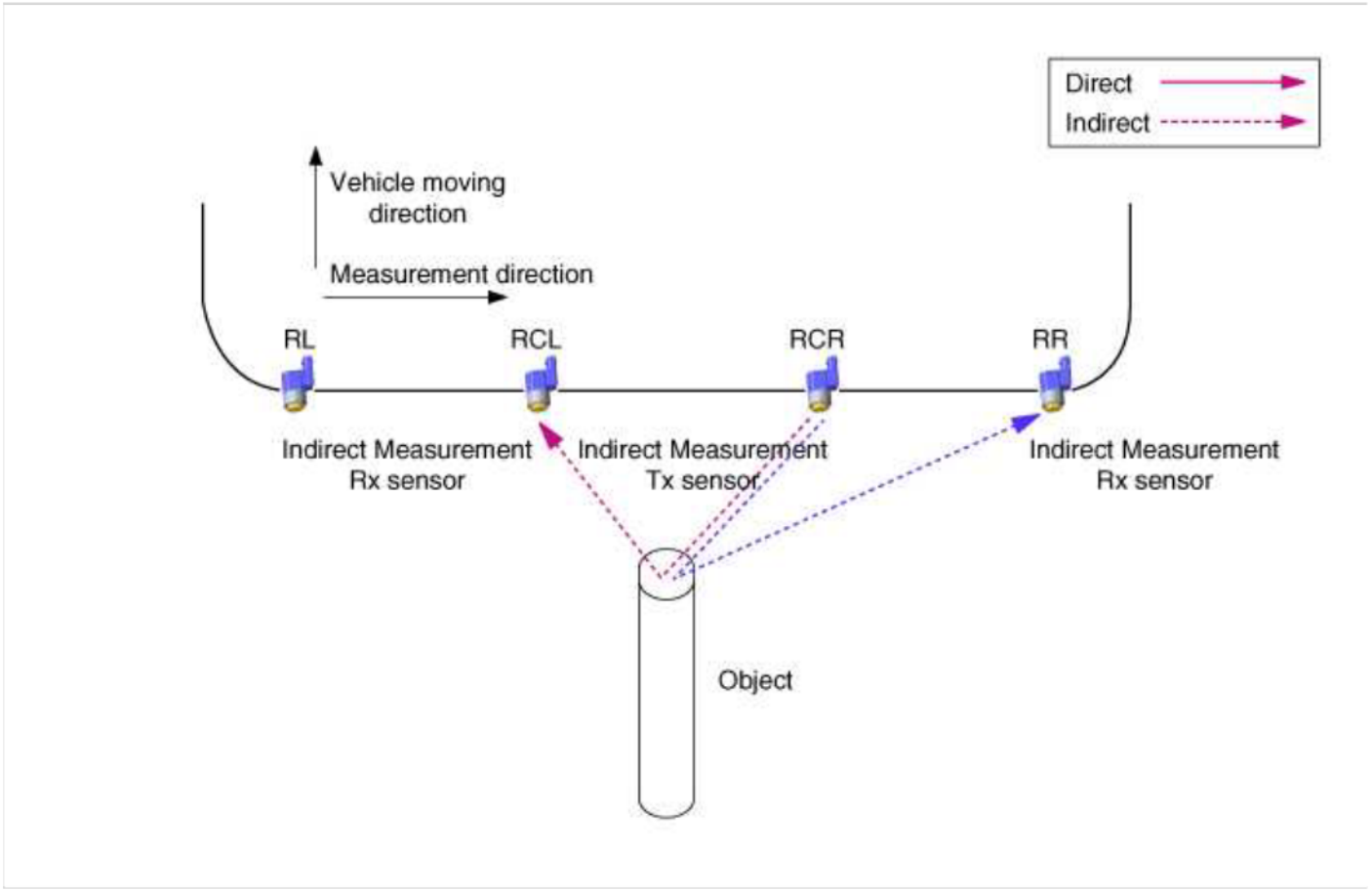


Indirect Measurement

(RCL → RL, RCL → RCR, RCR → RCL, RCR → RR Execution in order)

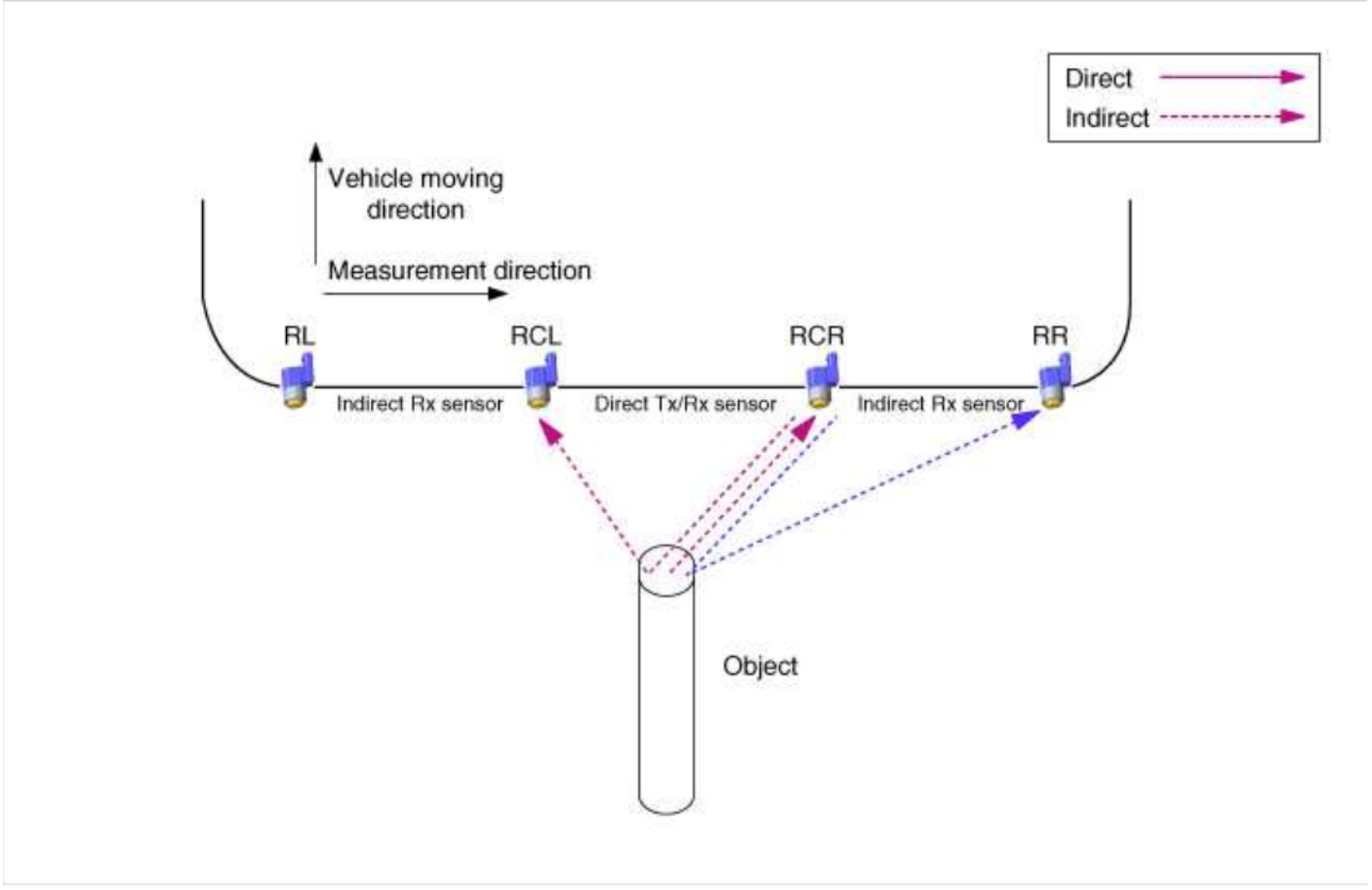
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With two or three sensors, one of them sends the transmission and the others get the reception.



Direct and Indirect Measurement at once

With two or three sensors, the one sensor performs both transmission and reception, and the others perform only rec



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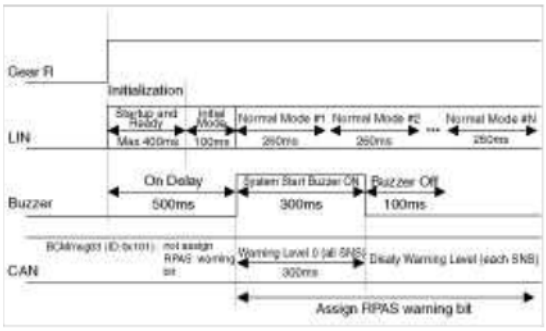
RPAS alarm system

When the RPAS sensor detects the object, warning is operated by audible alarm device as like buzzer. RPAS sensor data to BCM with LIN communication and BCM implements audible warning for each RPAS SENSOR by priority. performs a role of gateway only when it sends visible alarm device such as Cluster.

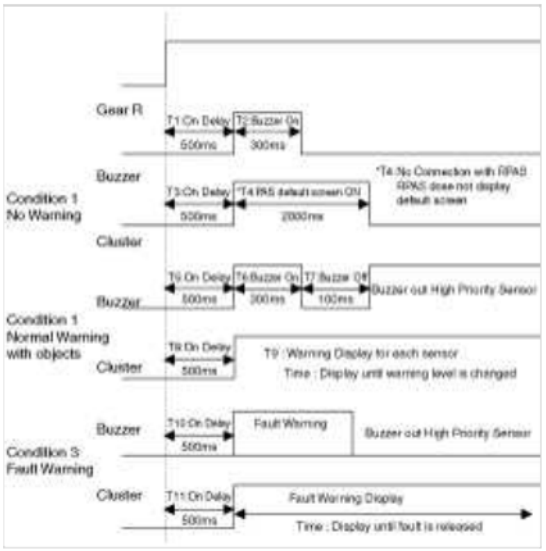
- Sensor buzzer/display information processing method of BCM In case of RL/RR sensor information, the BCM ha each sensor information directly about Display and buzzer output function. Buzzer output of CL/CR sensor, BCM handles center combination information by priority both sensor.

System Operation Spec

When the system has the power (after IGN ON and R gear), MICOM checks every sensor channel. In case it finds a error, it sounds 300ms buzzer 500ms afterward. But it finds any error even a sensor, it sounds buzzer corresponding t sensor instead of initial starting alarm. Function for normal mode entrance is as below

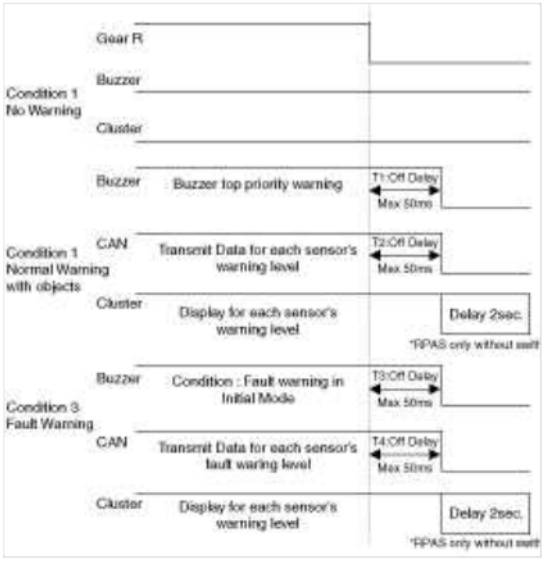


With R Gear, system function is as below



With R gear releasing, system function is as below

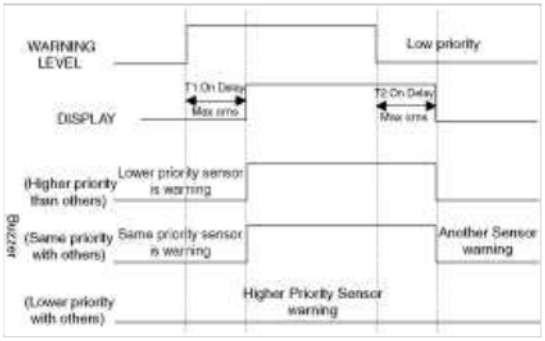
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acceptable error range on waveform ±10%

Alarm Output Specification classified by distance between sensors

Condition logic according to priority of alarm level is as below. (the identical sensor)



*α value definition

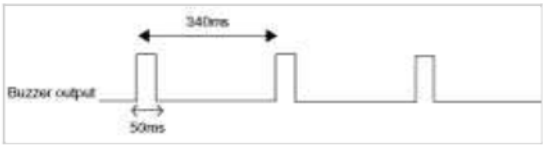
1. low priority sensor off : α = 0ms
2. low priority sensor is 1st warning level : α < 340ms
3. low priority sensor is 2nd warning level : α < 170ms

*β value definition

1. low priority sensor is 1st warning level : β = 1700ms
2. low priority sensor is 2nd warning level : β = 1700ms
3. low priority sensor is 3rd warning level : β = 700ms

Alarm control by sensing distance is as below

1. First warning area (61cm ~ 120cm / 24 ~ 47.2 in)



2. Second warning area (31cm ~ 60cm / 12.2 ~ 23.6 in)



3. Third warning area (less than 30cm / 11.8 in)



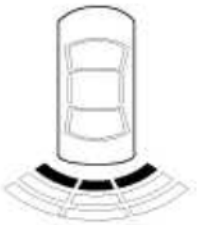
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Visible Alarm Indicator Specification

When the gear is applied to R, cluster lights the indicator as below figure.

When the system finds an object, it lights indicator immediately. During sensing an object, if there is no object, it lights indicator that is no alarm status for two seconds and then turns out afterward detecting an object.

(But when it turns third step alarm to No alarm status, it lights third step alarm for two second and turns out.)

Alarm level	No alarm	First step alarm (Lighting)	Second step alarm (Lighting)	Third step alarm (Flickering)
Indicator display				

- It shows only the detecting position of obstacles.
- In third level alarm, indicator flickers at intervals of a second.
- In normal alarm level display, RCR/RCL indicator is combinated by priority.

Communication Standard

This section defines the communication between RPAS and BCM.

RPAS send a detecting result of object and sensor diagnosis result to BCM according to this document, and BCM ta role to alarm.

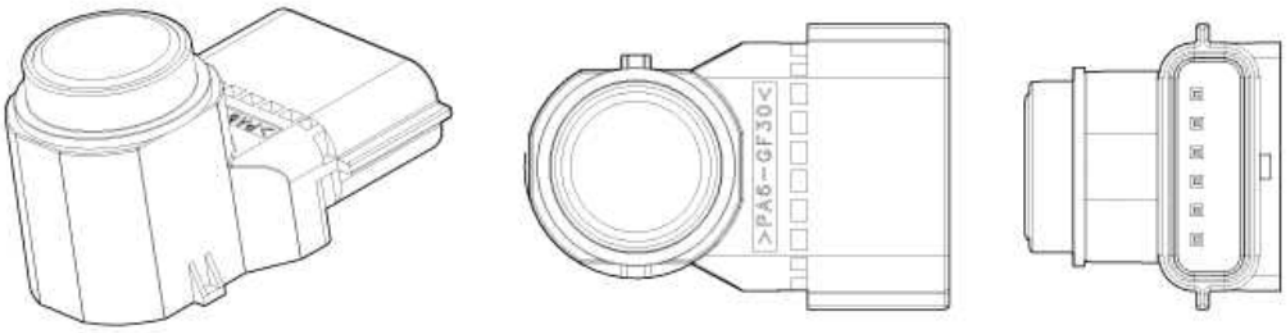
Indicator shows the transmitted position and alarm data, in alarm case, it finds the nearest DATA and alarms the near DATA first.

(Ex. In case, RL is first step alarm and RR is third step, RR alarm has priority.)

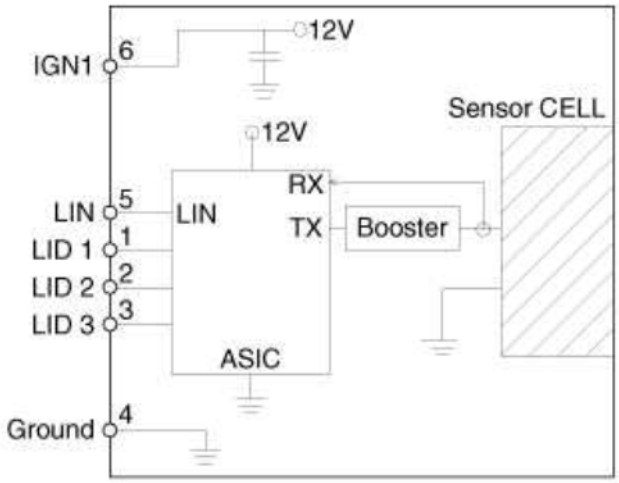
Body Electrical System

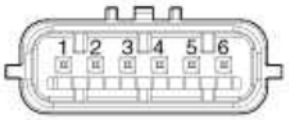
Component

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Circuit diagram





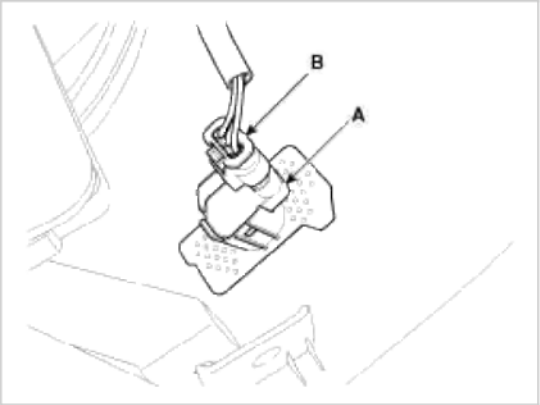
NO	Description
1	LID 1
2	LID 2
3	LID 3
4	Ground
5	LIN
6	IGN1

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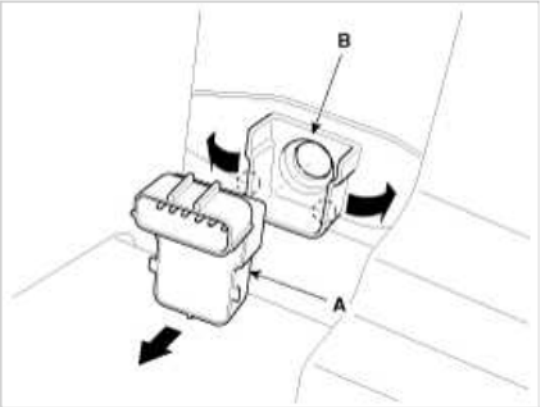
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper cover.
   (Refer to Body - "Rear Bumper Cover")

3. Disconnect the connector (B) from the parking assist sensor (A).



4. Pull out the sensor (A) by opening the sensor holder (B) out.



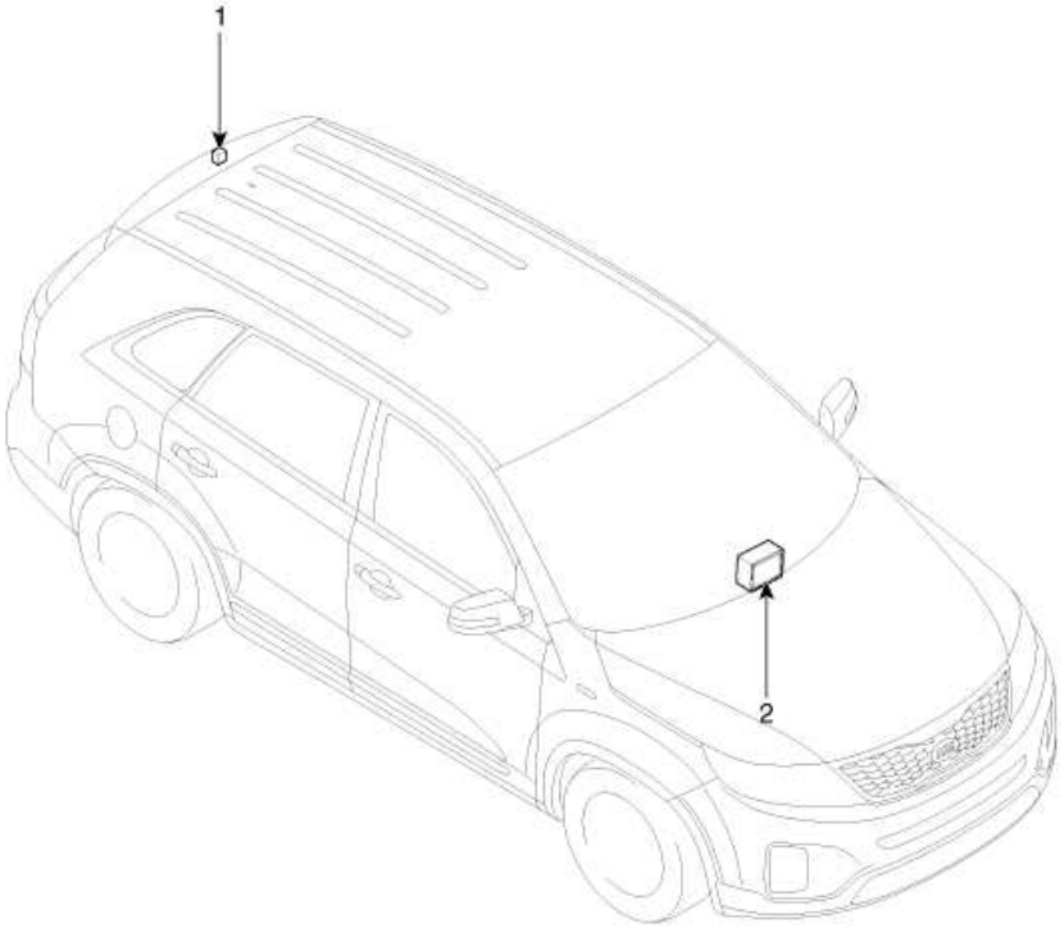
Installation

1. Install the rear ultra sensor after connecting the connector.
2. Install the rear bumper cover.
3. Connect the negative (-) battery terminal.

Body Electrical System

Component Location

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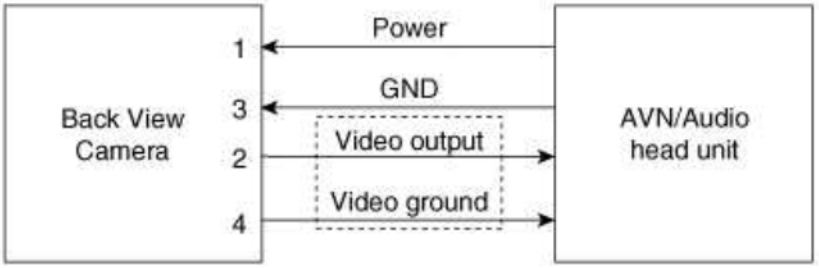


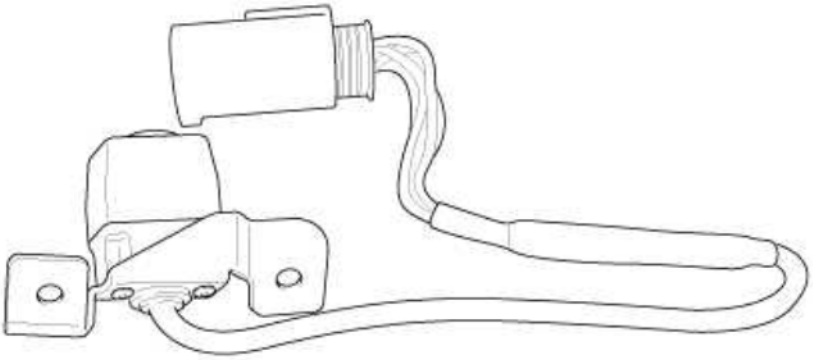
1. Back view camera	2. AVN/Audio head unit

Body Electrical System

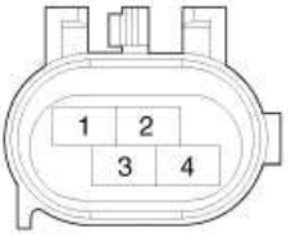
Circuit Diagram

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Back View Camera Connector



No.	Description
1	Power
2	Video output
3	Ground
4	Video ground

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Description

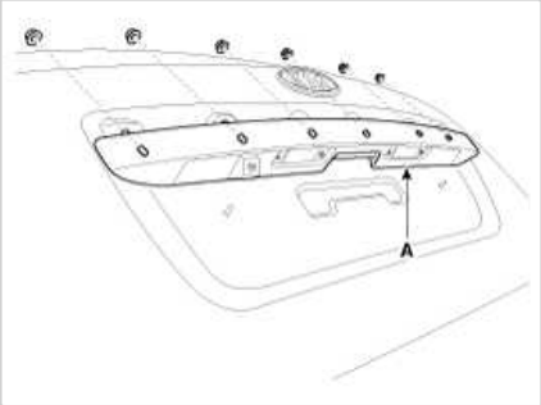
Back view camera will activate when the backup light is ON with the ignition switch ON and the shift lever in the R p
This system is a supplemental system that shows behind the vehicle through the AVN or Audio head unit while backi

WARNING

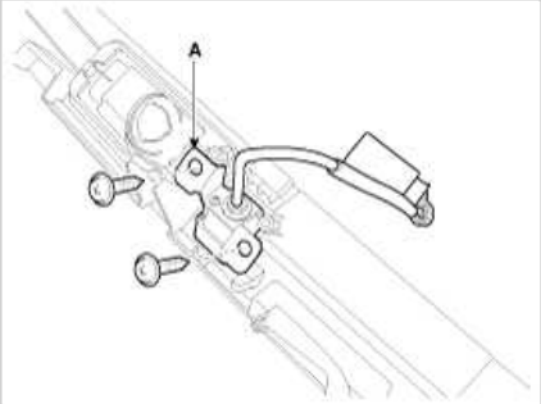
This system is a supplementary function only. It is the responsibility of the driver or always check the inside/ outside rearview mirror and the area behind the vehicle before and while backing up because there is a dead zone that can't through the camera.

Removal

1. Remove the tailgate trim in the trunk after removing the screws and clips.
   (Refer to Body - "Tailgate")
2. Remove the tailgate garnish (A) after disconnecting the connector.



3. Remove the back view camera (A) after removing the screws (2EA).



Installation

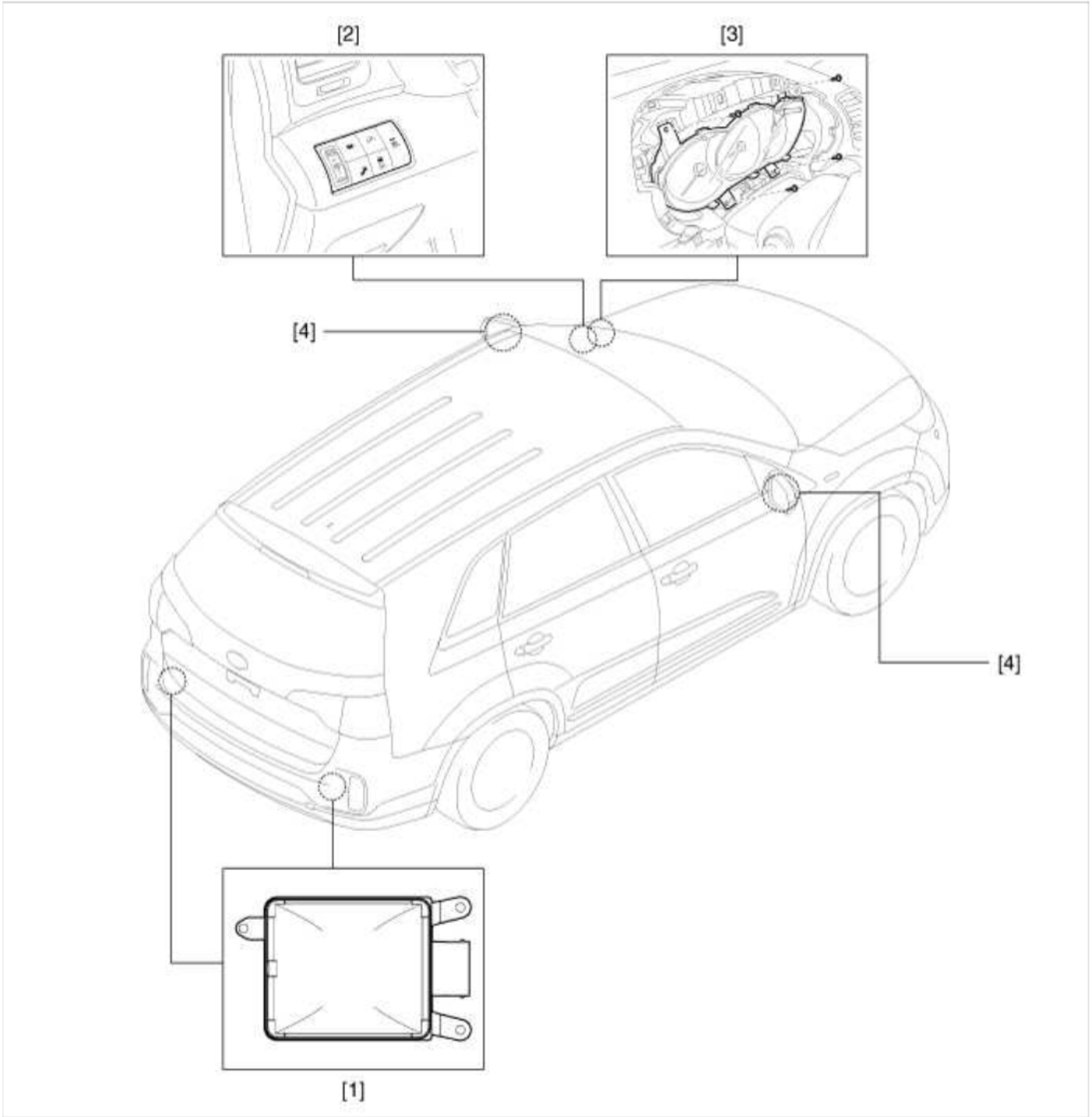
1. Install the back view camera.
2. Install the tailgate garnish and trim.

Specifications

Items	Specification
Rated voltage	DC 12V
Operating voltage	9V ~ 16V
Operating speed	30 /h ~ 250 /h
Sensible distance	70m (Sedan)
Curvature radius	Start : More than 170m Stop : Less than 150m
Frequency	24 GHz
Numbers	2EA (Master 1EA, Slave 1EA)

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Components



1. Blind Spot Detection (BSD) Unit 2. BSD switch	3. Speaker (Built in the cluster) 4. BSD warning lamp (Built in the outside mirror)

Body Electrical System

Description

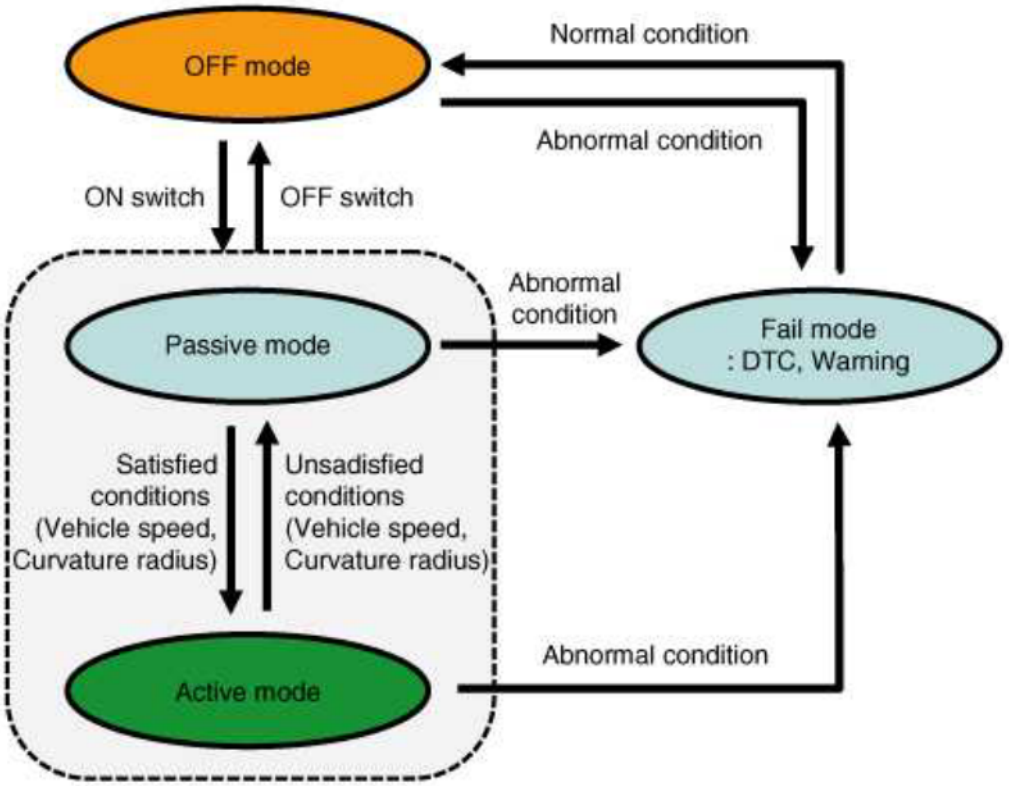
BSD is a system that uses two magnetic wave radar sensors attached on the rear bumper to measure the distance fro following vehicles and provides the sensing and (visual and auditory) alarm of any vehicle coming into the blind spot.

- Blind Spot Detection (BSD) : Senses other high-speed access vehicles in the blind spot and then displays a BSD lamp on the side mirror for the driver.
  Warning lamp and alarm is ON when driver turns on the turn signal lamp to enter the lane where another vehicle i

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- Lane Change Assist (LCA) : Senses other vehicles in the blind spot and then displays a BSD warning lamp on th mirror for the driver.
  Warning lamp and alarm is ON when driver turns on the turn signal lamp without recognizing any sudden approac vehicle from that direction.

System Operating Mode

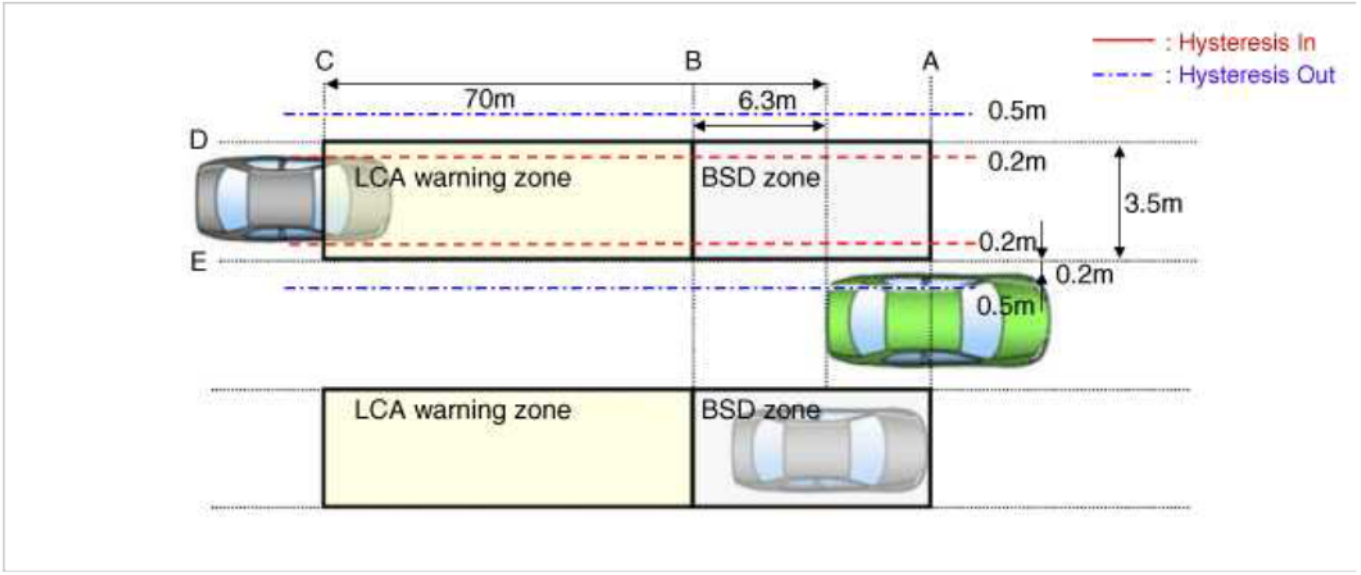


1. When starting the engine with the switch off, OFF mode is on.
2. When pressing ON switch in OFF mode, Passive mode is on.
3. If starting the engine with the switch ON, Passive mode is on.
   When IGN is ON, the switch is in the initial state : The last position is kept.
   A. If IGN OFF → ON with the switch ON, the switch is ON.
   B. If IGN OFF → ON with the switch OFF, the switch is OFF.
4. If you start the engine with BSD switch ON, or if you turn on BSD with BSD switch OFF, the warning lamp of tl mirror flickers for 2 to 3 seconds.
   This is to inform the driver that the BSD system is ready. (provided that if the system is in Fail mode, there is no flickering.)
5. If the activation conditions (speed and curvature radius) are met while driving, Active mode is on (warning issued
6. If the activation conditions (speed and curvature radius) are not met while driving, Passive mode is on (warning removed).
7. If BSD & LCA operation fails in any mode, Fail mode is on.
8. If BSD & LCA operation operates normally in Fail mode, OFF mode is on.
9. If pressing OFF switch while BSD & LCA function is operating (Active/Passive), OFF mode is on.

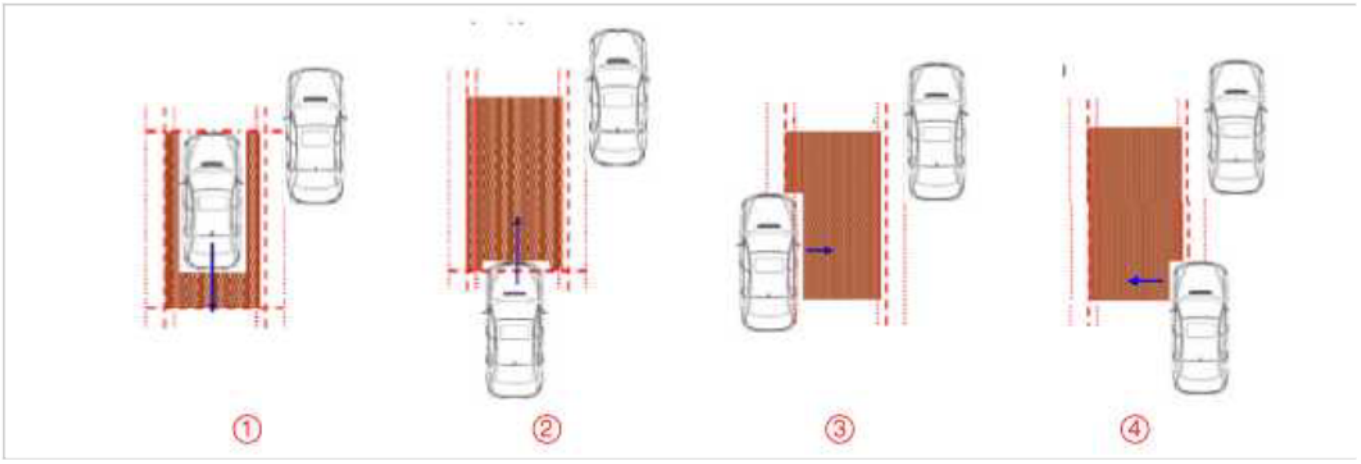
Warning Condition

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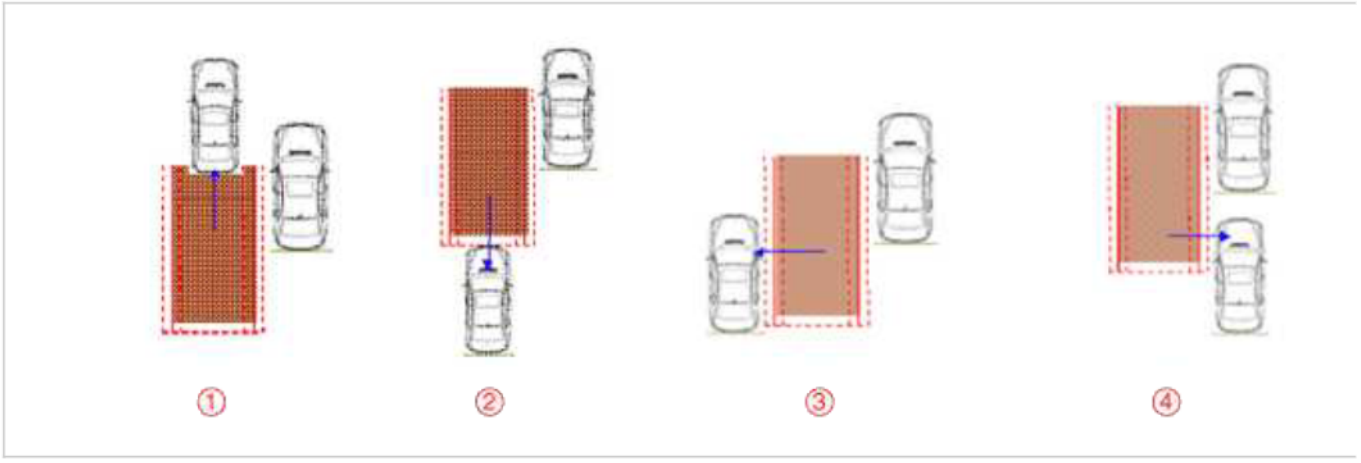
1. Warning zone



2. Conditions for BSD warning ON
   ① The entire body of the target vehicle is located behind the line A.
   ② Any part of the target vehicle pass the line B.
   ③ Any part of the target vehicle passes the line D and Hysteresis In.
   ④ The entire part of the target vehicle passes the line D and Hysteresis In.

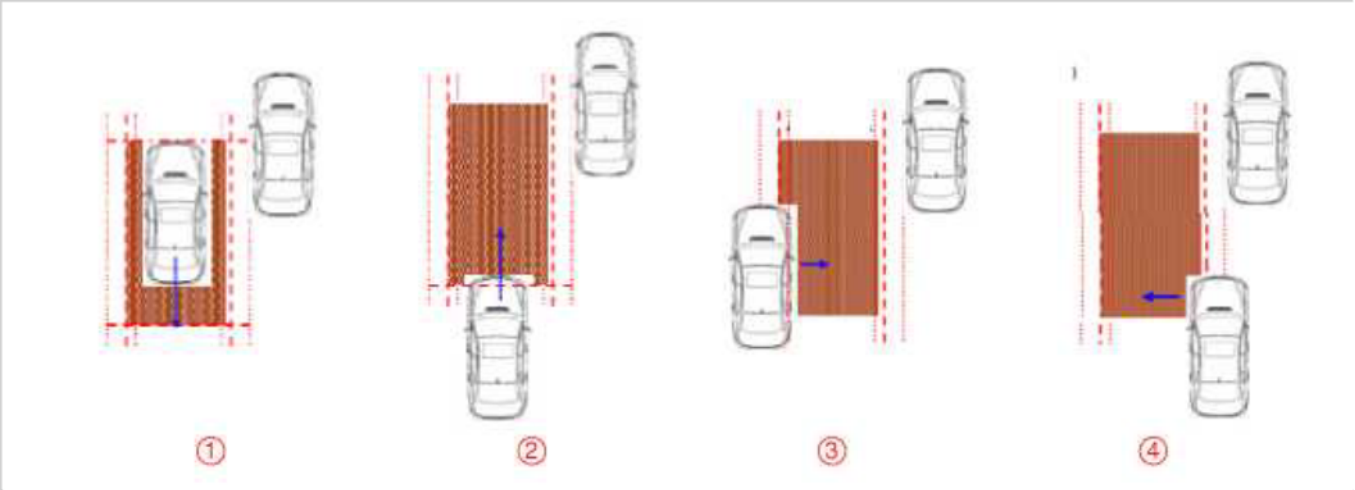


3. Conditions for BSD warning OFF
   ① The entire body of the target vehicle moves before the line A.
   ② The entire body of the target vehicle moves behind the line B.
   ③ The entire body of the target vehicle passes the line D and Hysteresis Out.
   ④ The entire part of the target vehicle passes the line E and Hysteresis Out.

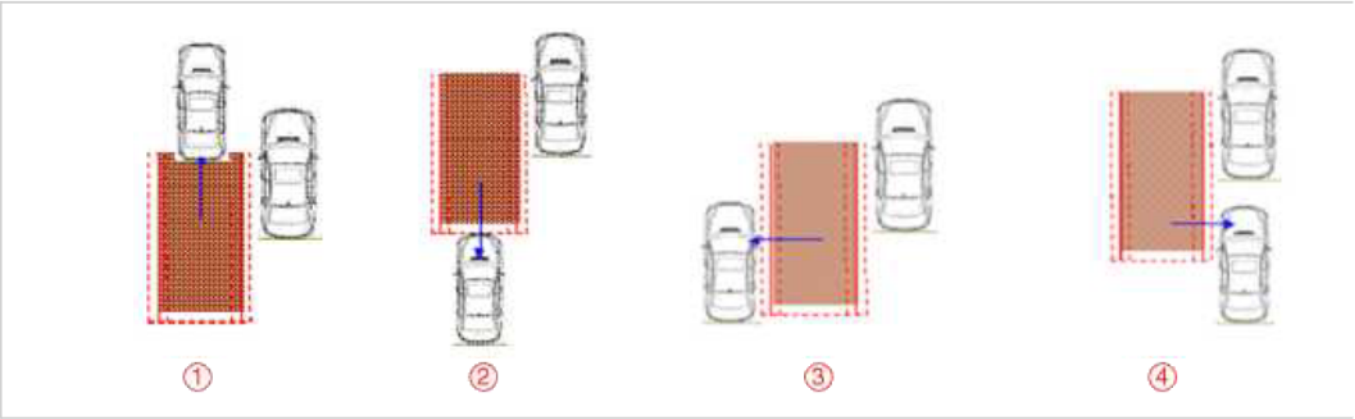


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4. Conditions for LCA warning ON
   ① The entire body of the target vehicle is located behind the line B.
   ② Any part of the target vehicle pass the line C.
   ③ Any part of the target vehicle passes the line D and Hysteresis In.
   ④ The entire part of the target vehicle passes the line E and Hysteresis In.
   ⑤ In the all above condition, TTC(Time to Collision) is not less than 4.5 sec.



5. Conditions for LCA warning OFF
   ① The entire body of the target vehicle is located before the line B.
   ② The entire body of the target vehicle pass the line C.
   ③ The entire body of the target vehicle passes the line D and Hysteresis Out.
   ④ The entire body of the target vehicle passes the line E and Hysteresis Out.
   ⑤ In the all above condition, TTC(Time to Collision) is not more than 4.5 sec.



6. Sensor activation conditions
   ① BSD & LCA switch (indicated by the switch LED) is on.
   ② Vehicle Speed: 30 km/h or faster
   ③ Curvature radius: 170m or more
   ④ Relative car speed: -10 ~ 250 /h
   ("-" means overtaking the preceding vehicle)

7. Sensor deactivation conditions
   ① BSD & LCA switch (indicated by the switch LED) is off.
   ② Vehicle Speed: 28 km/h or slower
   ③ Curvature radius: 150m or less
   ④ Relative car speed: All except -10 ~ 250 /h
   ("-" means overtaking the preceding vehicle)

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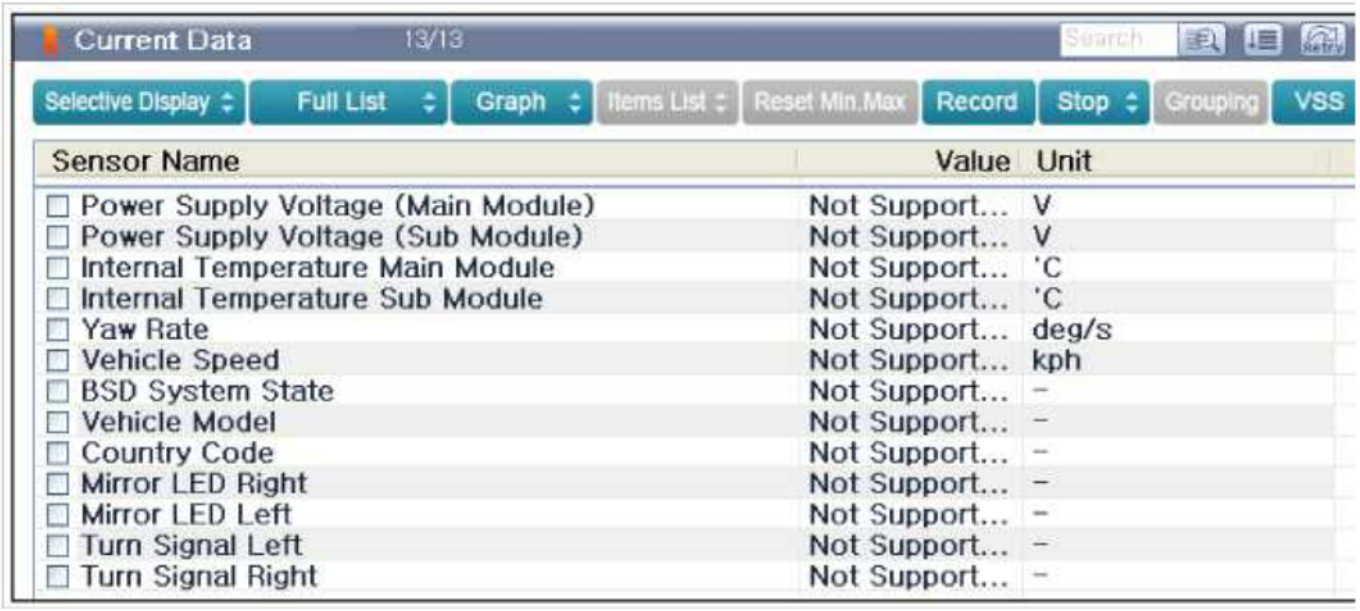
8. System control prohibition
   ① The radar is covered by debris: System conditions - Blockage message is outputted

> **Information**
> If the sensor on the rear bumper is contaminated by snow, mud or stickers, its detecting performance may be lowered.

   ② The radar installation is damaged by an outside shock: Send the error code
   ③ BSD & LCA system fails: Send the error code
   ④ The radar is overheated: System conditions - Over Temperature message is outputted.

Diagnosis With GDS

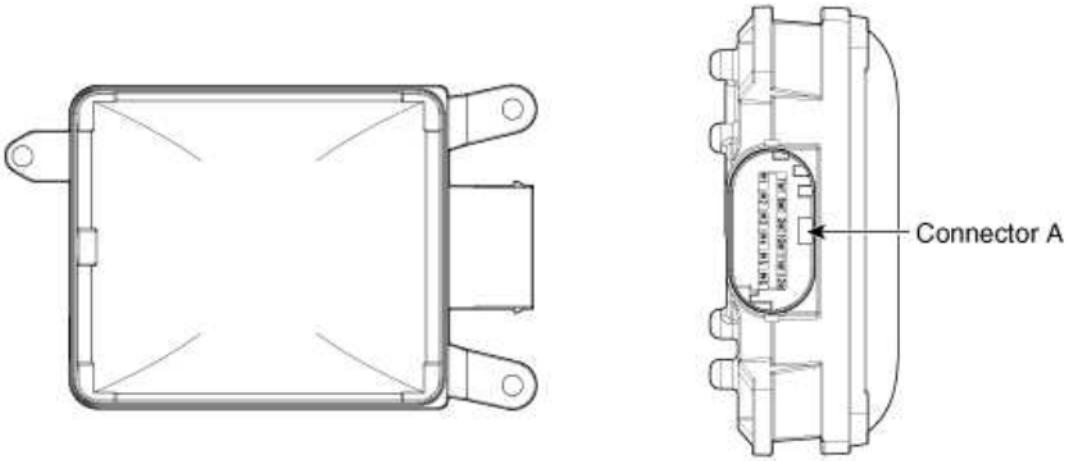
1. BSD system defects can be quickly diagnosed with the GDS. GDS operates actuator quickly to monitor, input/ou value and self diagnosis.
2. Connect the cable of GDS to the data link connector in driver side crash pad lower panel, turn the power on GD
3. Select the vehicle model and then BSD system.
4. Select "Input/output monitoring", if you want to check current data of BSD system.

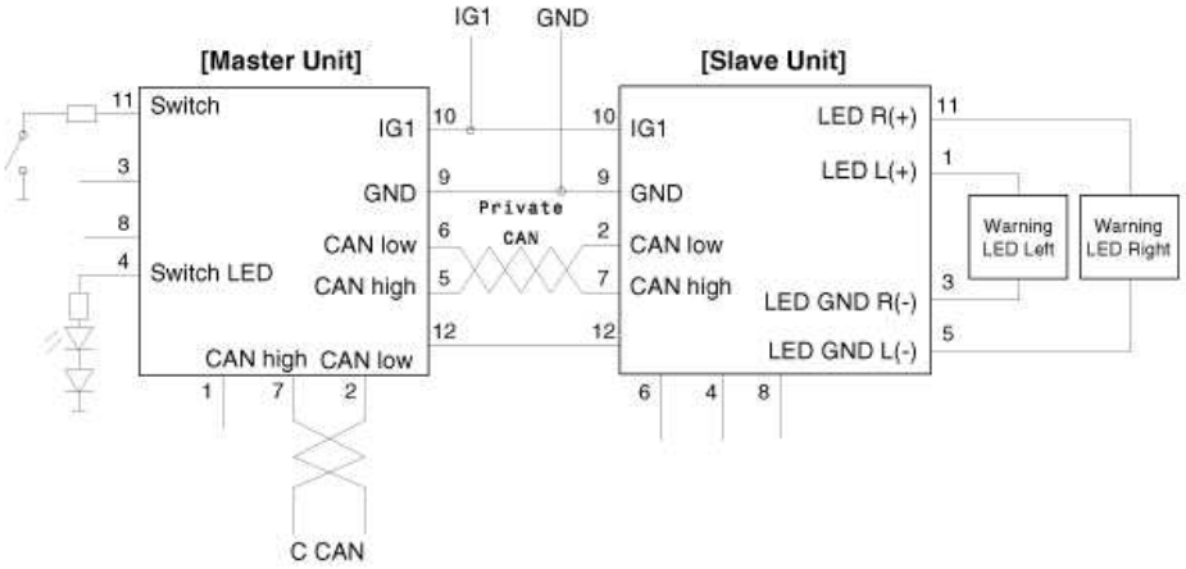


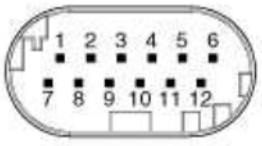
5. If you want to check each module operation forcefully, select "Actuation test".



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[Connector A]

Pin No.	Description	Pin No.	Description
1	-	1	BSD warning LED power (LH)
2	C CAN low	2	Private CAN low
3	-	3	BSD warning LED GND (LH)
4	LED switch	4	-
5	Private CAN High	5	BSD warning LED GND (RH)
6	Private CAN Low	6	-
7	C CAN high	7	Private CAN high
8	-	8	-
9	GND	9	GND
10	IG1	10	IGN1
11	Switch	11	BSD warning LED power (RH)
12	-	12	-

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Body Electrical System

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to Body - "Rear Bumper")

3. Remove the BSD unit (A) after loosening the mounting screws.



NOTICE

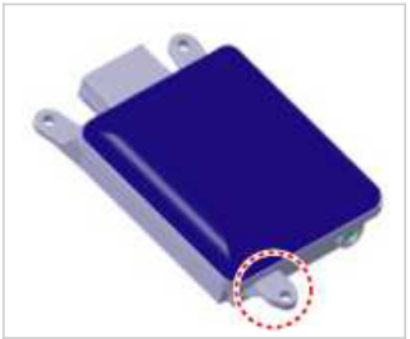
Take care not to separate the bracket from rear bumper when removing the BSD sensor.

Installation

1. Install the BSD units to the rear bumper.
2. Install the rear bumper.
3. Connect the negative (-) battery terminal.

NOTICE

Take care not to confuse left side (master) and right side (slave) unit when installing.

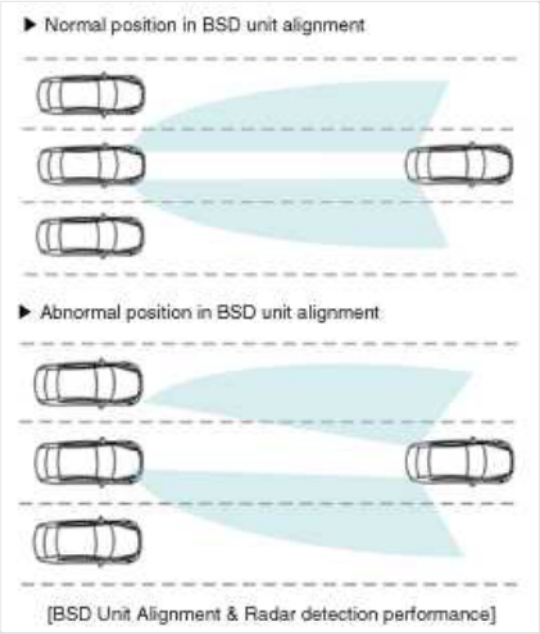
Item	Left (Master)	Right (slave)
Shape		
Remarks	Check the mounting screw hole shape	

Inspection

BSD Unit Alignment

To sense the cars exactly in the next lane with the radar, the direction of the sensor and the direction of the vehicle ha align.
This is BSD unit alignment. If this alignment is not performed as below illustration, the degradation of detection perfor and the cause of false alarms.
The rear bumper accident vehicle and after replacing the BSD unit vehicle have to do this align especially.

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1. The rear bumper accident vehicle and after replacing the BSD unit vehicle have to do BSD unit alignment using G
2. Select the "BSD EOL coding" procedure.



3. Complete the alignment procedure according to GDS screen message.

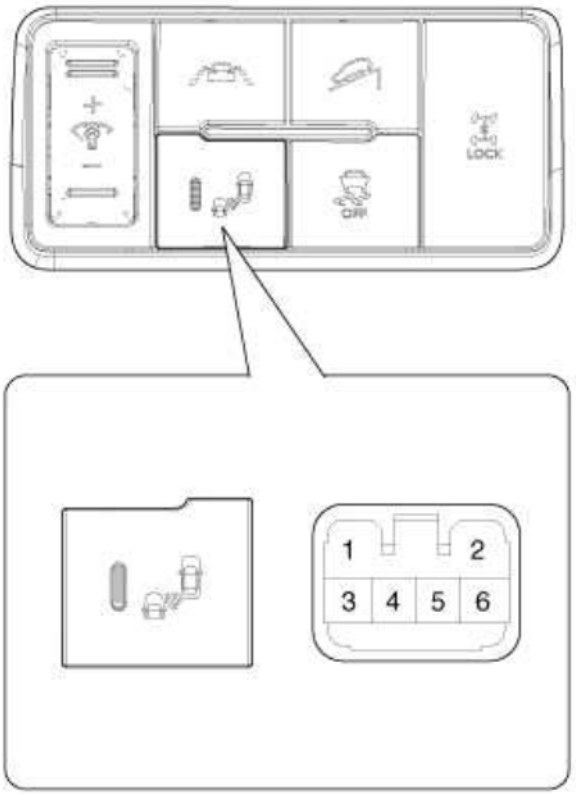


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Circuit Diagram

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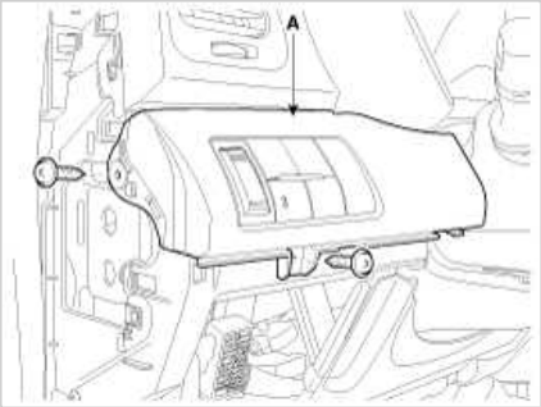
Terminal / Position	ON(PUSH)	OFF(FREE)	Remarks
1			BSD unit (input)
6			GND
3			BSD unit (output) / IND
2			Illumination(-)
4			Illumination(+)

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Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body - "Crash Pad")

3. Remove the crash pad side switch assembly (A) after loosening the mounting screws.

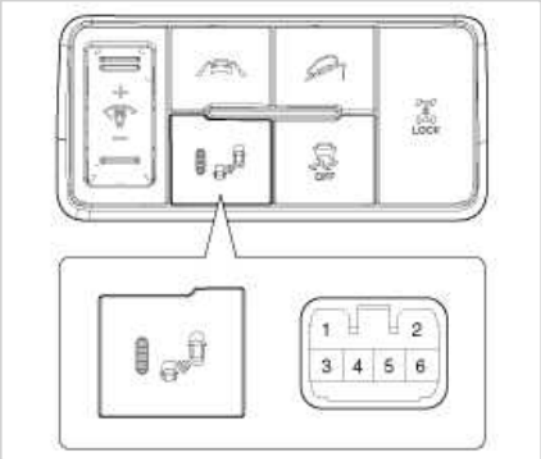


Installation

1. Install the crash pad side switch assembly after connecting the connector.
2. Install the crash pad lower panel.

Inspection

1. Disconnect the BSD switch connector.



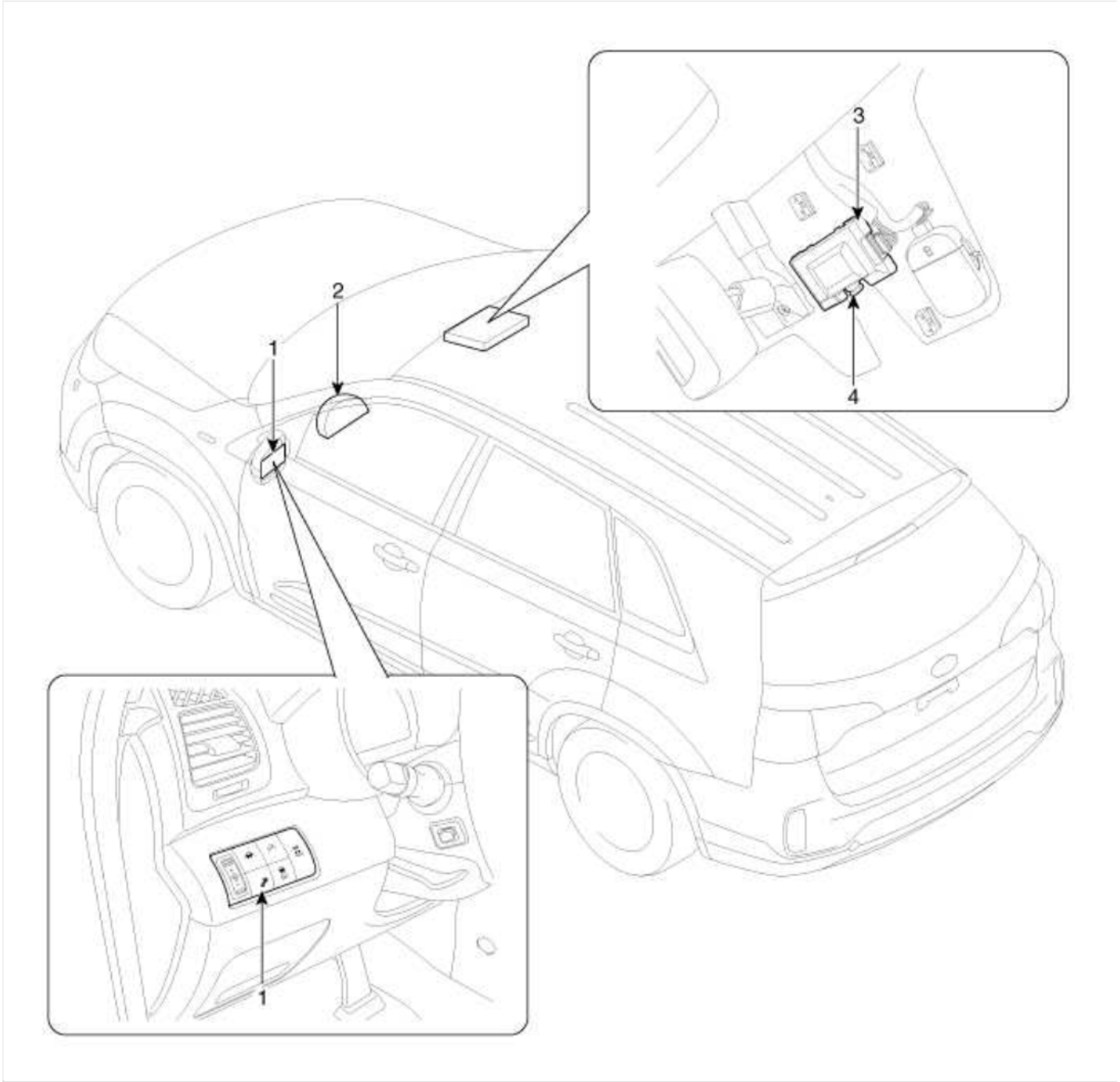
2. Operate the BSD switch, then check for continuity between terminals of BSD switch connector.

Terminal / Position	ON(PUSH)	OFF(FREE)	Remarks
1			BSD unit (input)
6			GND
3			BSD unit (output)/IND
2			Illumination(-)
4			Illumination(+)

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Body Electrical System

Components



1. LDWS ON/OFF switch 2. Instrument cluster	3. LDWS unit 4. Camera

Body Electrical System

Description

System Operation

Typically, lane departure warning is activated at a speed over 60 km, but suppressed in case of unintentional lane dep when driver do not operate turn signal.

System Operation Conditions

1. User Conditions
   (1) When unintended lane departure is occured, warnings are generated.
   (2) When driver operates a turn signal for lane departure, no warnings are generated.
   (3) When driver operates wiper, no warnings are generated according to operating coditions (Wiper High)

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2. Vehicle Conditions
   (1) When the accelerated velocity of vehicle exceeds certain speed, LDW system is activated.
   (2) When a turn signal is not used. LDW system activates.
   (3) LDWS system is not activated when wipe motor speed is more than 45 RPM, even if the vehicle is equipped rain sensor.

3. Lane Conditions
   (1) lanes are visible and recognizable , LDWS can be on normal operation mode.
   (2) Operate on all roads, including highways, country roads and urban freeways at a speed of 60 km/h and from 5.0 meters of lane width.
   (3) Lane material: asphalt roads, concreat roads
   (4) Lane color: White, Yellow, Blue,
   (5) Temporary lane marker for repairing road
   (6) lanes are visible and recognizable, LDWS can be on normal operation mode independent of season or time,
   (7) Operate under partially visible lane markers such as and regardless of inclement weather, including rain and w roads, and time limit
   (8) Be performed in a curve of radius 250 meters

Lane Departure Warning
This lane Departure Warning Algorithm is for HKMC whole vehicle that will apply to LDWS

1. Lane departure warning start speed: 60KPH
   (1) Warning Start Speed: 60KPH
   (2) Warning Stop Speed: 55KPH

   To prevent repetation of system warning on and off according to vehicle speed variation, This specification establi warning stop speed as 55 KPH for hystheresis characteristic.

2. Lane Recognition Standard Speed : 40KPH
   (1) Lane recognition start speed : 40KPH
   Lane recognition is started at 40KPH less than warning start speed to minimize recognition time after vehicle i into lane.
   (2) Lane recognition stop speed: 35KPH
   Lane recognition stop speed is setted 35KPH with hysteresis to avoid repetition of lane recognition on and of
   (3) Cluster can not display lane recognition even if lane detected, cluster display lane recognition when operation is more than 60KPH.

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3. Warning Method

(1) Warning Device

Cluster, Buzzer

(2) Cluster Display Symbols

		
Lane not detected	Lane detected and warning system engaged	Right side deviation
		
Left side deviation	System OFF/ System fail	

Display symbol and period vary according to vehicle's LCD and alarm.
(It is possible to adjust blinking period.)

Lane Type

LDW System can recognize a full lane, a dotted lane, Bott's Dot and yellow Retroreflective on a road.
In case of double lane, LDW System can recognize the lane on the inside. This is a standard about a dotted lane.

Recognition of Double Lane

In case of double lane, LDW System can recognize the lane on the inside.

Determination of Lane Departure

Lane Departure is determined according to vehicle speed, lane width and color.
LDW System set lane recognition error limits under 8cm.

1. Lane width (L)
   If Lane width is 2.7 ~ 5.2m(Including North America standard) then departure warning is activated. Also Lane w
   less than 2.8m then departure warning is deactivated.
2. Line painted width (p)
   Line painted width is refered to 16cm (the minimum 10cm, the maximum 55cm). LDWS can distinguish left,right l
   color. If it is technically possible, LDWS can distinguish kind of lane such as solid and dot.
3. Vehicle Width (W)
   Vehicle width is defined by kind of vehicle. Vehicle width is stored in internal memory and can be written by In-li
   using WriteDataByLocalIdentifier command or vehicle project code

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4. Lane Departure Warning Standard of Left Yellow Lane (Central Lane)
   A. condition 1 : Gap between yellow lane and a median strip is 25cm.
      → In case of road limit speed less than 80KPH, The distance between central lane and lane designs 25cm
   B. condition 2 : Yellow line width is 16cm as same line painted width.
   1) Central lane Departure Warning
      Central lane departure warning is activated when Vehicle's tire reachs to lane.
   2) Cancellation of Central lane Departure Warning
      When the vechicle departs the lane toward opposite lane more than 40% of the lane width, the warnings are deactivated.
5. Left,Right normal Lane (Blue, White, Right Yellow)
   Condition : Lane width standard is a 16cm.
   A. 1st Lane Departure Warning
      The departure alarm of the general lane when the wheel of the vehicle reaches to the lane, does in standard.
   B. Cancellation of lane departure warning
      When the vechicle departs the lane toward opposite lane more than 40% of the lane width, the warnings are s
6. The case of recognizing one of two lines (lane)
   The case of recognizing one of two lane, system provide departure warning using one line.

Lane Departure Warning Deactivation

1. Turn signal is actived
   A. Depart from lane after turn signal is activate
      If vehicle departs from lane after turn signal is activated, the departure warning of turn sigal direction is not act
      If vehicle departs from opposite line of turn signal direction, Departure warning is activated. Warning alarm is activated while turn signal is activated. If turn signal is deactivated during lane departure after turn signal activa system can issue warning after 2sec when it can recognize lane.
      If turn signal is deactivated after lane departure during turn signal activated, Warning signal can be generated a second.
   B. Turn signal is activated after lane departure
      Alarm is immediately deactivated when driver operates turn signal during lane departure.
      Alarm can be activated again after 2 second when turn signal is deactivated.
2. When Wiper operation signal is given, the condition of deactivation
   When driver operate wiper switch, LDWS do not excute lane departure warning.
3. Tracking on a curve under 250m radius
   When measured curve radius which is derived from lane recognition and Yaw Rate is under 250m,
   LDWS do not warn lane departure. LDWS can recognize if a road curvature condition is under 250m (R >= 25(

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4. Lane is unrecognizable
   A. During the warning, lane becomes unrecognizable
      - In lane departure alarm, the case where one lane becomes unrecognizable: Alarm is activated using previously measured lane width, a hue and a curvataure.
      - In lane departure alarm, the case where both lanes become unrecognizable: Lane departure Warning is immedi stopped and LDWS signal that lanes are unrecognizable to warn its condition to driver.
   B. A line is unrecognizable
      During vehicle is tracking the lane, if a line is not recognizable, LDWS can excute lane dwparture warning usin previous lane width which is measured from previous image processing. LDWS normally refer the color of lin previous recognition result, but if there are any changes of system operation and power on/off, when system ca determine the color of the lane, system can excute lane departure warning algorithm refer lane color to white. V system line unrecognized state is maintained, System status is changed to line unrecognized state.
   C. Both lanes are unrecognizable
      LDWS signal the status of unrecognizable lane. If there are none of additional indicator, system do not indicat recognition status.

> **⚠ CAUTION**
>
> LDWS is capable of recognizing continuing lines as lanes and has limited lane recognition capabilities when it comes to sharp-bending roads.
> In addition, the system may not function properly under the following circumstances:
> - No or faded lane markings (failed lane detection).
> - Low visibility due to foul weather conditions.
> - Low light or sudden change in exterior light conditions.
> - Sharp bends of the road (curvature radius of less than 250m).
> - Sidewalks and other dividing structures along the edge of the lane.
> - Dirty windshield (low camera visibility).

Camera Calibration

1. Necessity
   Once installed to the vehicle, LDWS needs to be calibrated to achieve accurate lane marking recognition.
   Specifically, the system needs to be calibrated to correct any difference between the ideal road coordinates and t actual road coordinates.
   A. When replacing the lane departure warning system unit.
   B. When repairing the roof panel of chassis by vehicle crash.
   C. When repairing the LDWS unit mounting bracket
   D. The system need to be calibrated to corect any vehicle crash.

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2. Schedule

Calibrate after LDWS replacement and as necessary.

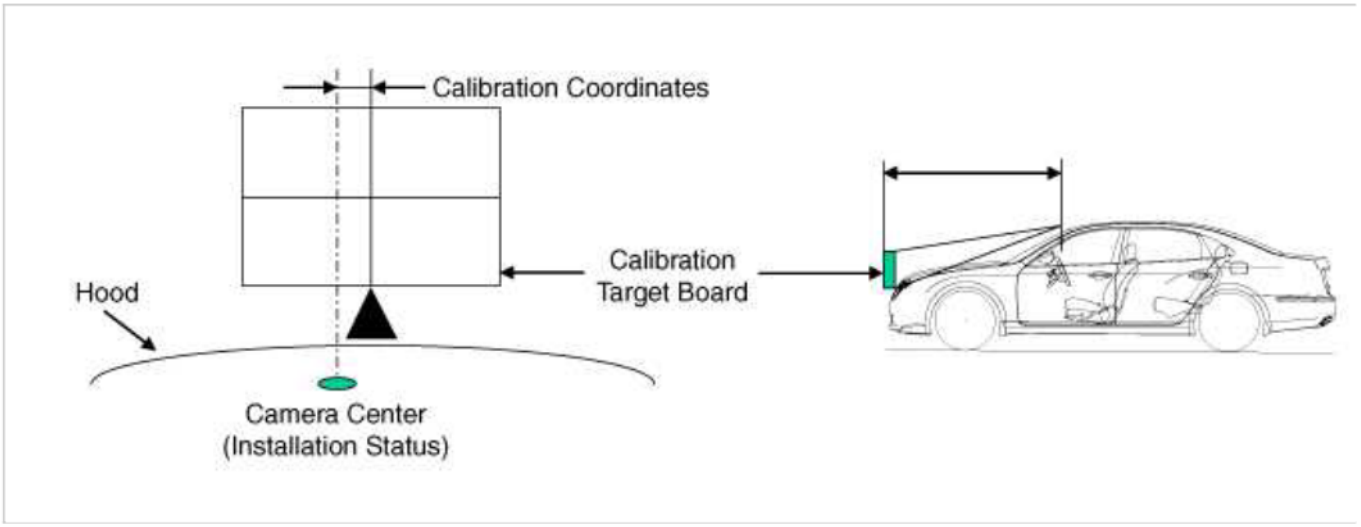
A. **Condition :** There should be an error between ideal road coordinates and actual road coordinates after install LDWS unit.

B. **Object :** Calibrate an error in LDWS unit to improve coordinates accuracy.

C. **Procedure :** Operate the calibration procedure using the GDS and calibration target jig.

D. **Environment :** Vehicle on an even surface and align the center of target jig to down the degree of scattering.

E. **Calibration process :** Refer to bellow "Calibration procedures"

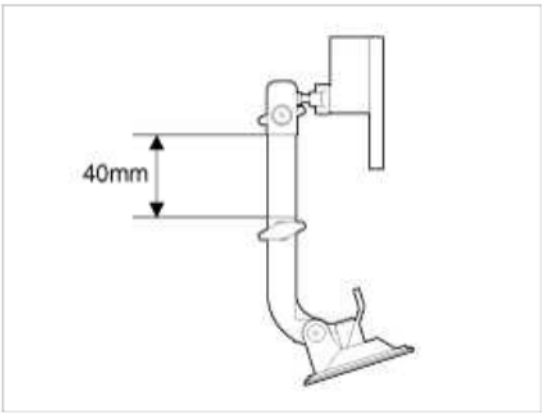


Calibration Procedures

NOTICE

Check LDWS lens vision field and if the lens is dirty make it clean.

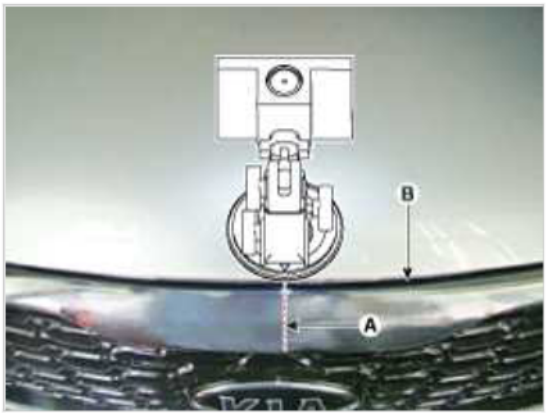
1. Install the calibration target jig (09890-3N100) on the hood.



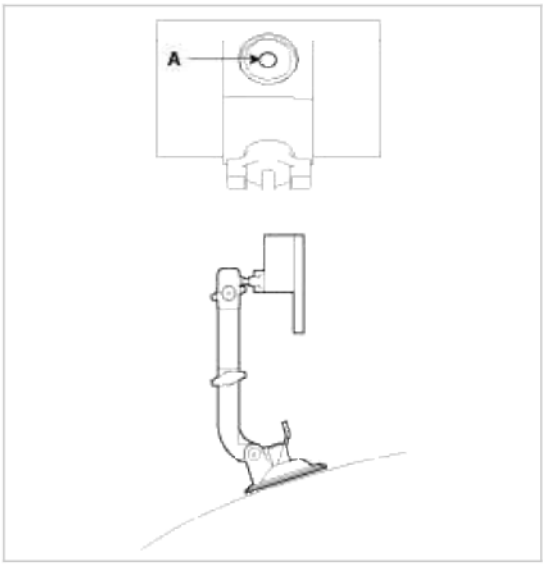
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2. Install the target jig at the end of the hood (B) after aligning the center (A) of the target jig and emblem.

Tolerance : 0.19 in (5mm)



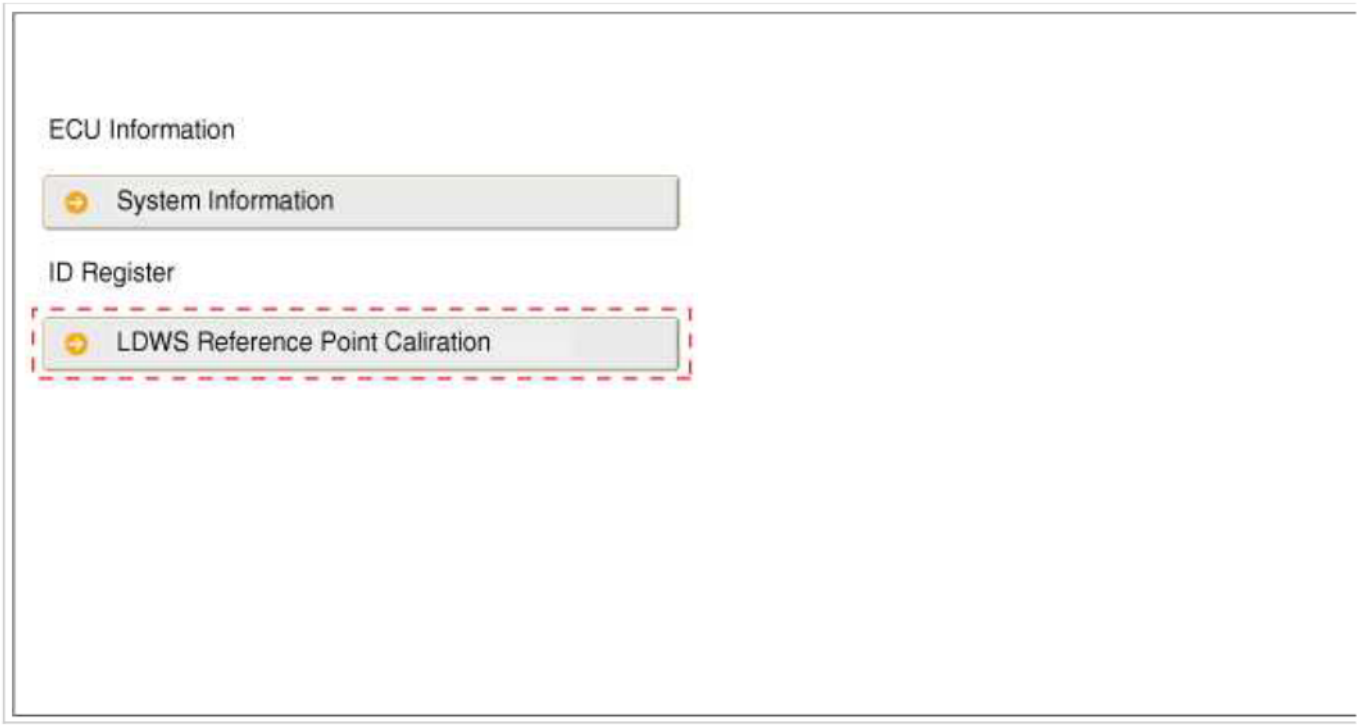
3. Adjust the top of target jig to center a drop of air (A) in circle by bending the target board.
(To adjust the target vertically)

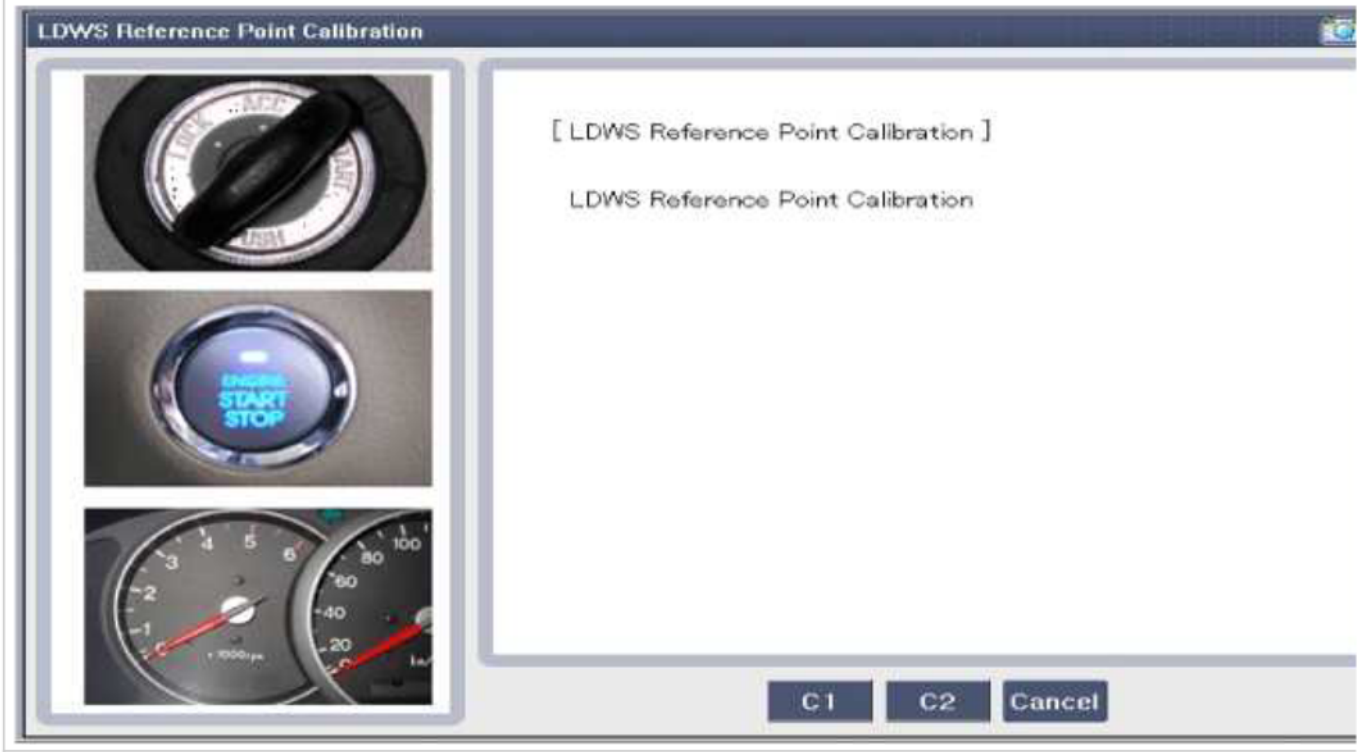


4. Connect GDS to the vehicle to calibrate LDWS unit.
5. Select model and LDWS system.
6. Select calibration.
7. Operate calibration automatically.
8. Select "LDWS Reference Point Calibration" and complete calibration procedures.

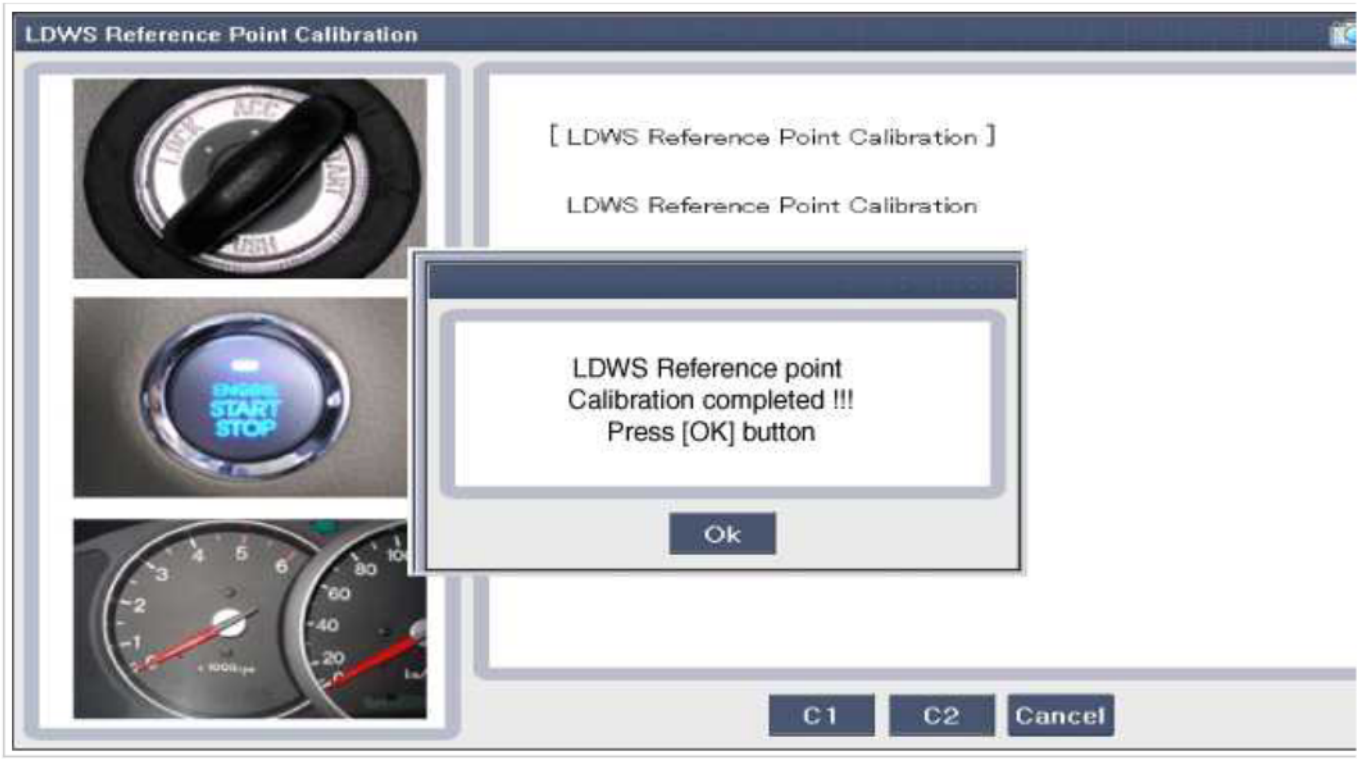
Coordinates allowance ranges
X : 123 ~ 143
Y : 179 ~ 199

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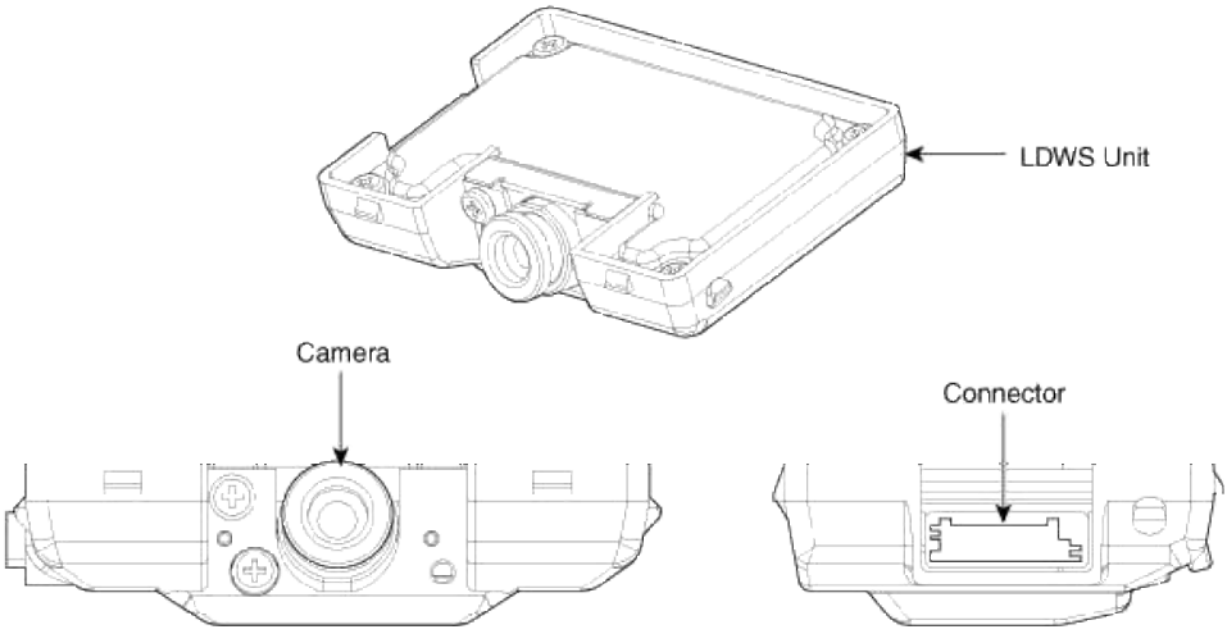
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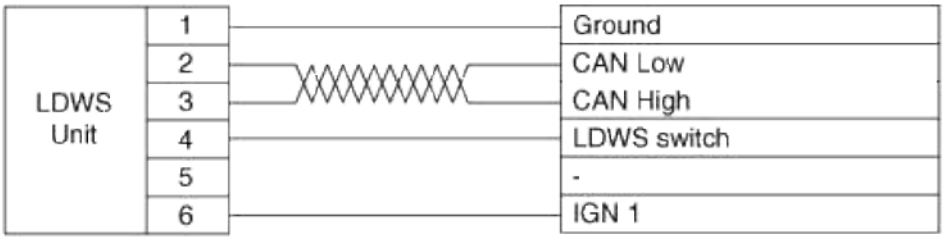


Body Electrical System

Components

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Connector



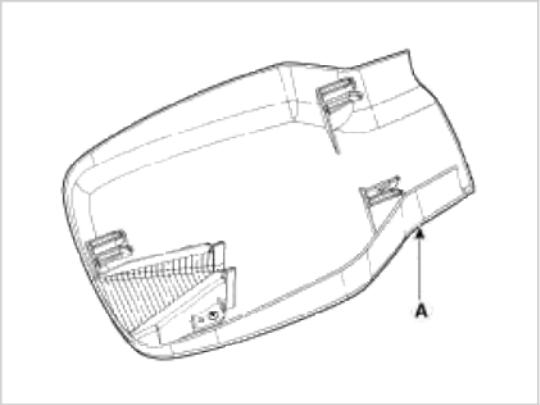
No.	Description
1	Ground
2	CAN Low
3	CAN High
4	LDWS switch
5	-
6	IGN 1

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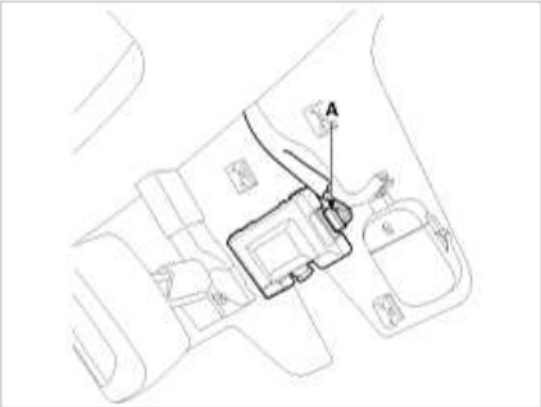
Removal

1. Disconnect the negative (-) battery terminal.

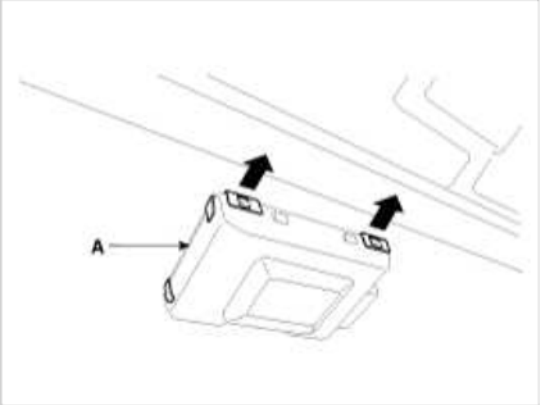
2. Remove the LDWS unit cover (A).



3. Remove the LDWS unit connector (A).

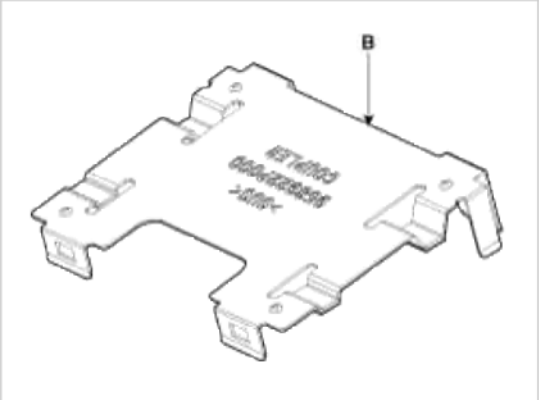


4. Remove the LDWS unit (A) after widening the mounting clips.



⚠ CAUTION

Be careful not to warp the coupler (B) when removing the LDWS unit (A).



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Installation

1. Install the LDWS unit.
2. Install the LDWS unit cover.
3. Check LDWS system operation.

Specification

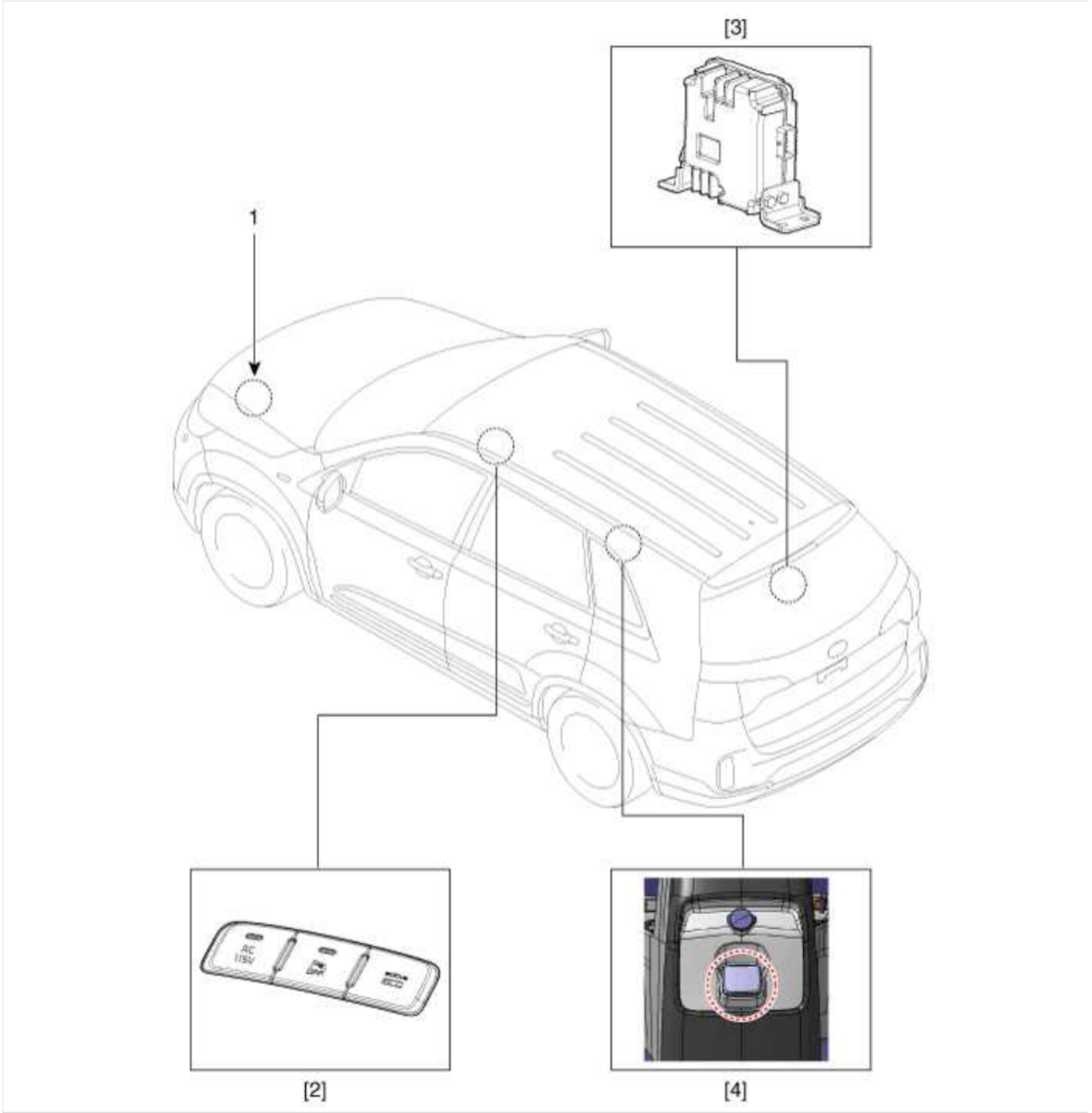
Item	Specification
Rated Voltage	DC 12.0V
Operating voltage	DC 10.7 ~ 15V
Operating temperature	-30 ~ 75°C (-22 ~ 167°F)
Output voltage	AC 103.5 ~ 126.5V (r.m.s)
Output frequency	60 ± 6Hz
Rated power	150W (-30 ~ 45°C / -22 ~ 113°F)
Current spec.	Full load input current : Max. 15A Key OFF current : Max 1

r.m.s : root mean square value
The A/C inverter initially operates with 12.5V and stops its operation when the voltage drops below 10.7V

Body Electrical System

Component Location

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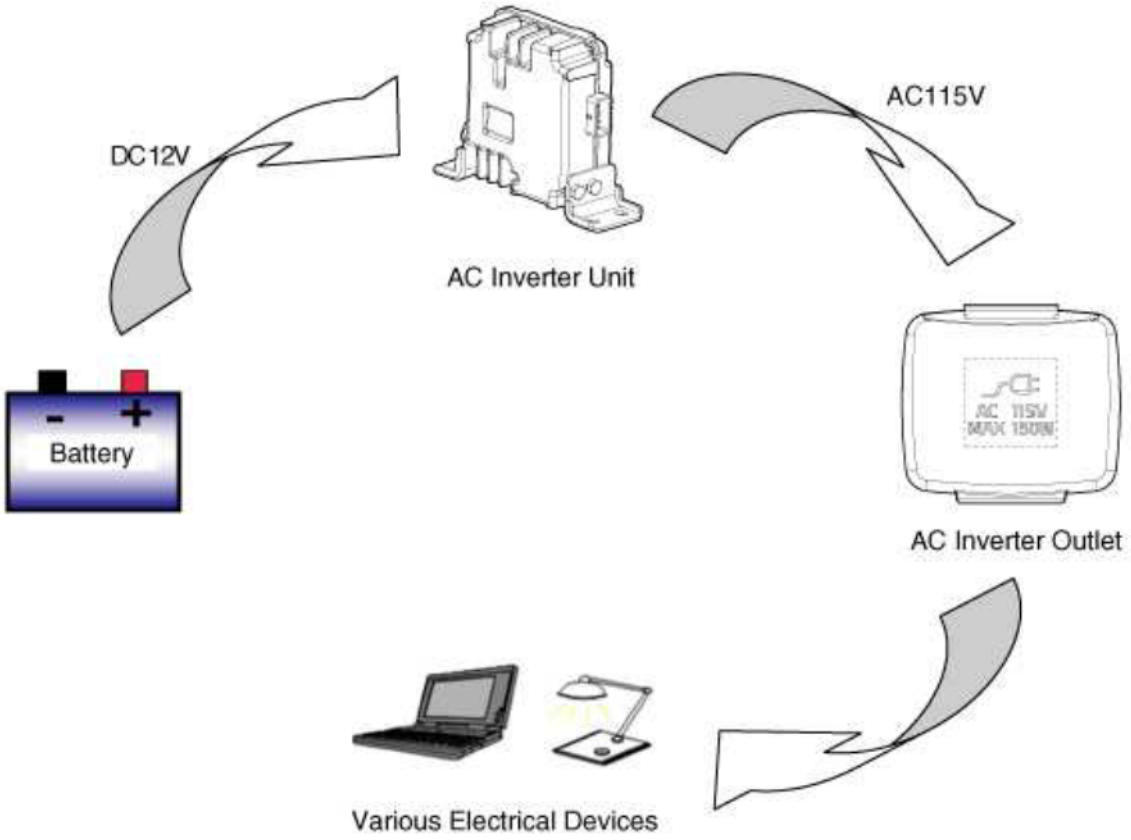
1. Battery 2. AC inverter switch	3. AC inverter unit 4. AC inverter outlet

Body Electrical System

Description

An inverter is a device that transforms the DC voltage from the battery into an AC voltage (115 V). The inverter can various electrical devices that consume 150 W or less, including mobile phone or notebook rechargers, audio system TVs.

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Inverter system Protection Function

Item	Condition	LED Stat
Undervoltage protection	Shuts down for safety at voltages lower than 11.3 V ± 0.3 V.	LED flicker
	Resumes operation at 12.2 V ± 0.3 V.	LED lighti
Overvoltage protection	Shuts down for safety at voltages higher than 15.5 V ± 0.3 V.	LED flicker
	Resumes operation at 15.3 V ± 0.3 V.	LED lighti
Overheat protection	Shuts down for safety if temperatures exceed 105°C ± 10°C.	LED flicker
	Resumes operation at 95°C ± 10°C.	LED lighti
Overcurrent protection	Turns OFF when overcurrent above a set point is detected.	LED lighti
	The inverter stops for 20 seconds before its restarts.	LED flicker (20 second
	Turns OFF when overcurrent is detected 3 times (turn the AC inverter switch ON again to turn on the inverter).	
short circuit protection	The inverter shuts down for safety if there is a short circuit between the AC1 and AC 2 outputs during operation.	LED OF
undervoltage/overvoltage shutdown protection	Shuts down at voltages lower than 10.7 V ± 0.3 V.	LED OF
	Shuts down at voltages lower than 16.5 V ± 0.3 V.	LED OF

WARNING

- DO NOT touch or insert any foreign substance into the AC inverter. Be aware of the potential risk of electric sh fire.

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⚠ CAUTION

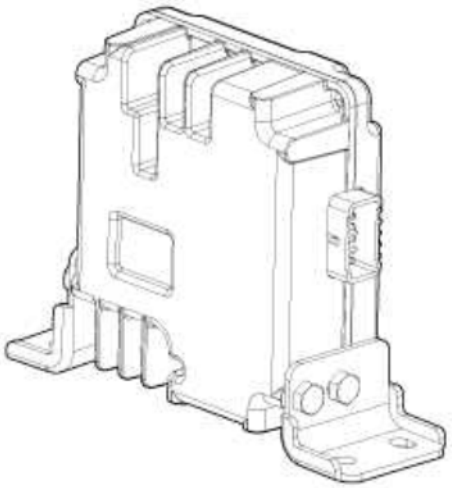
- Only use the AC inverter when the engine is running. Always disconnect the inverter when not in use.
- Using the AC inverter when the engine is off or leaving an electric device plugged in for a long time may drain the battery of the vehicle.
- DO NOT use any electric devices that consume more than 115 V (150 W) of power.
- Connecting an electrical device that generates excessive levels of electromagnetic noise to the AC inverter may c abnormal sounds in the audio equipment or a malfunction in the vehicle's electronic devices.
- Connecting a faulty electronic device to the AC inverter may damage the inverter or the electric system of the vel

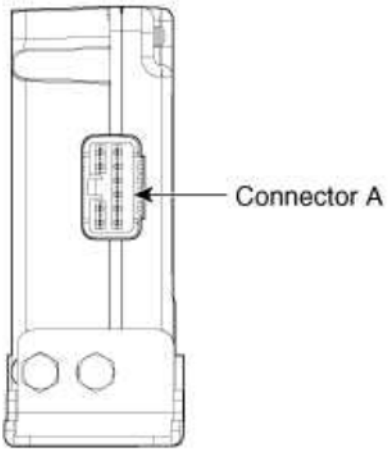
NOTICE

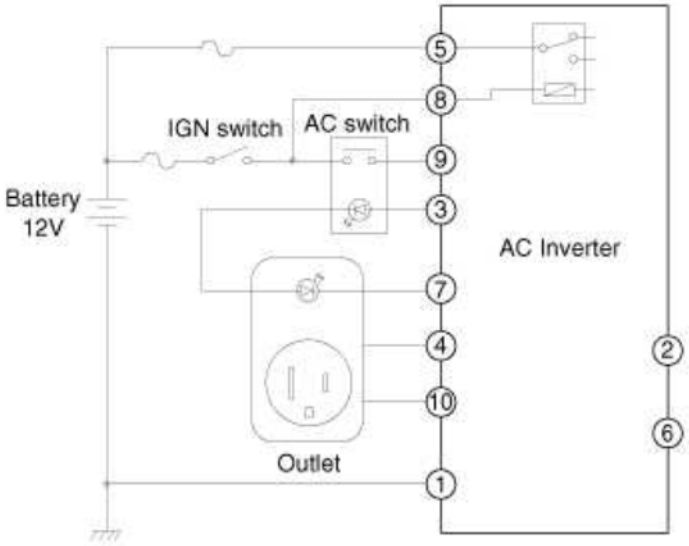
- The LED indicator blinks if the AC inverter input voltage falls below 11.3 V. The inverter shuts off if the voltage f below 10.7 V.
  Inspect the battery and recharging system.

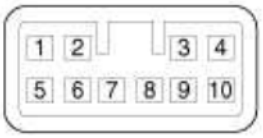
Components

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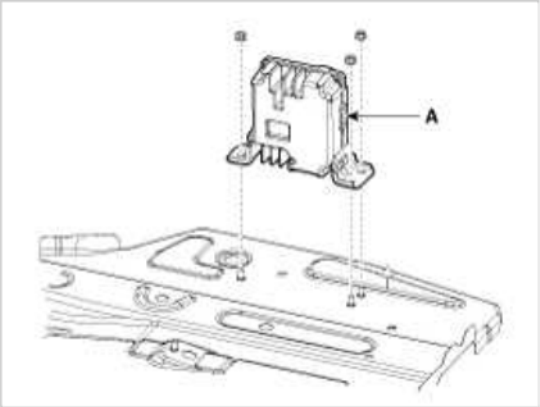
Connector A	No.	Description	No.	Description
	1	Ground	6	-
	2	-	7	LED (-)
	3	LED (+)	8	IGN2
	4	AC1	9	AC switch
	5	Battery (+)	10	AC2

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Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the right luggage side trim.
   (Refer to Body - "Luggage Side Trim")
3. Disconnect the connector from the AC inverter unit.

4. Remove the AC inverter unit (A) after loosening the mounting nuts (3EA).



Installation

1. Install the AC inverter unit.
2. Install the luggage side trim.
3. Connect the negative (-) battery terminal.

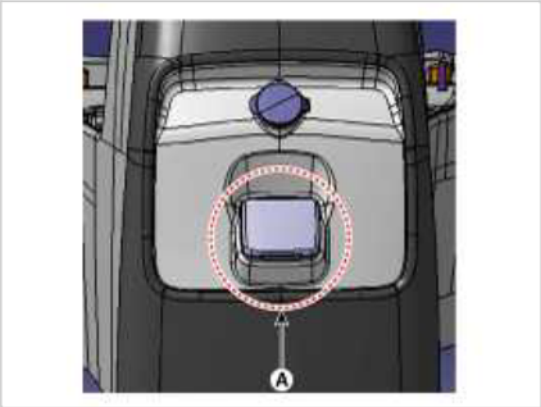
WARNING

- Before starting repair work, turn off the engine and AC inverter.
- You may get electrocuted if you work with the AC inverter on.
- You may get electrocuted if you work on the AC inverter with you hands wet.

Body Electrical System

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear console cover.
   (Refer to Body - "Console")
3. Remove the power outlet switch (A) from the rear console cover.



Installation

1. Install the power outlet switch.
2. Install the rear console cover.
3. Connect the negative (-) battery terminal.

Body Electrical System

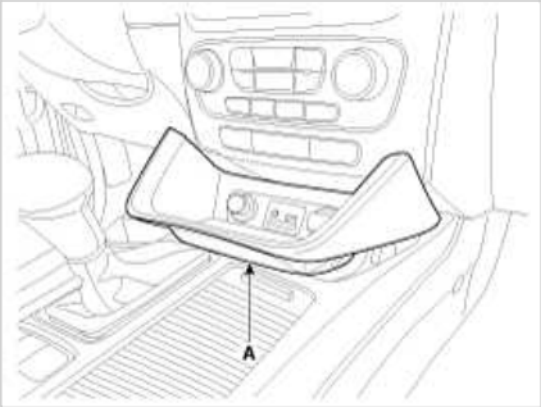
Removal

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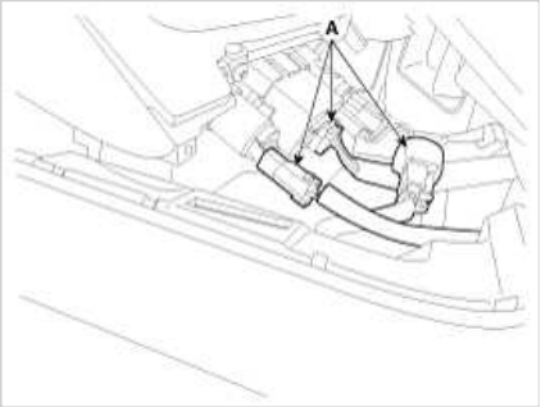
NOTICE

- Pry the trim off using a plastic trim tool and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

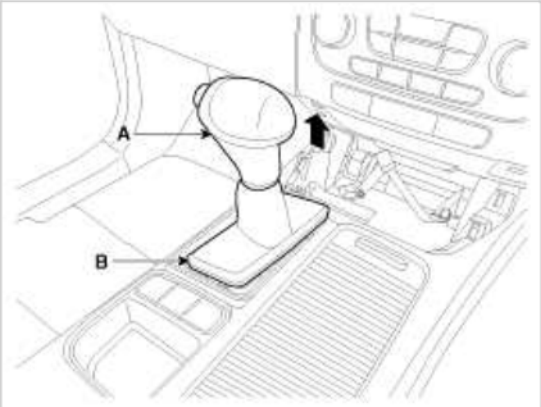
1. Disconnect the negative (-) battery terminal.
2. Using a screwdriver or remover, remove the floor console upper tray (A).



3. Disconnect the connectors (A).

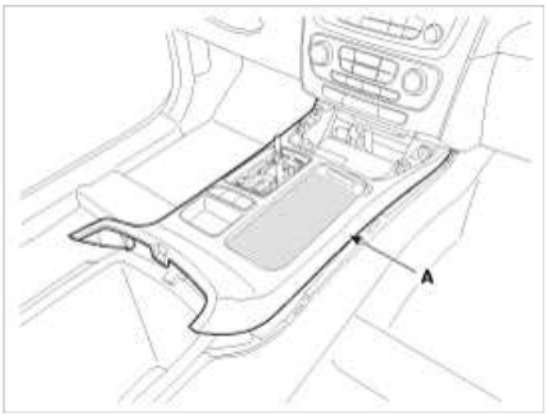


4. Remove the gear boots (B) and gear knob (A).

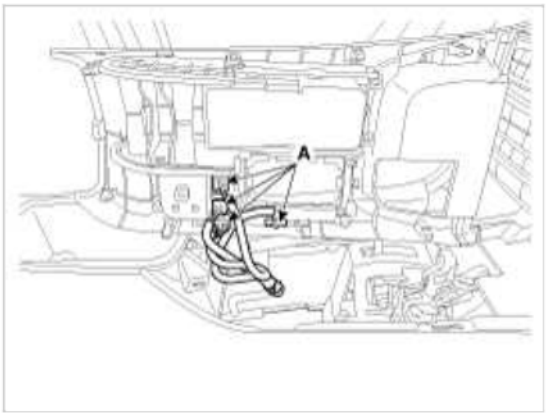


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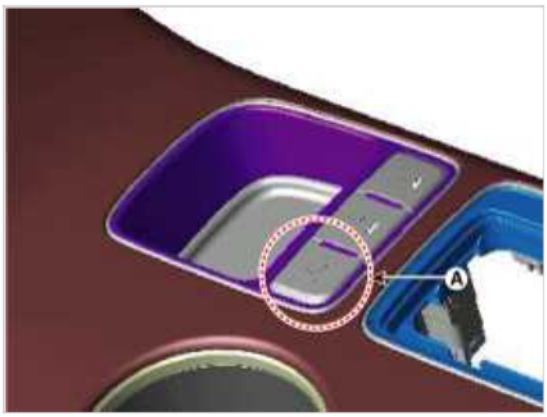
5. Using a screwdriver or remover, remove the console upper cover (A).



6. Disconnect the connectors (A).



7. Remove the AC switch (A) from the console upper cover.



Installation

1. Install the AC switch.
2. Install the console upper cover and console upper tray.
3. Connect the negative (-) battery terminal.

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