SORENTO(XM) > 2013 > G 3.5 DOHC > Body Electrical System

Body Electrical System > General Information > General Information

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 EE group - "Battery")

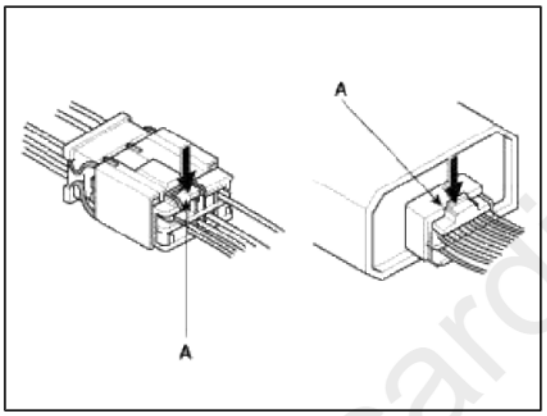
NOTE

- 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.

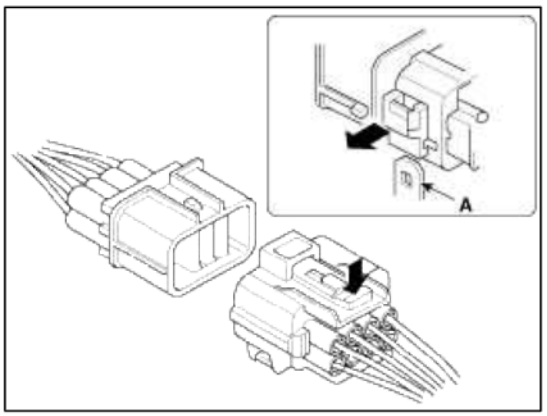
3. Check the alternator belt tension (D).

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).



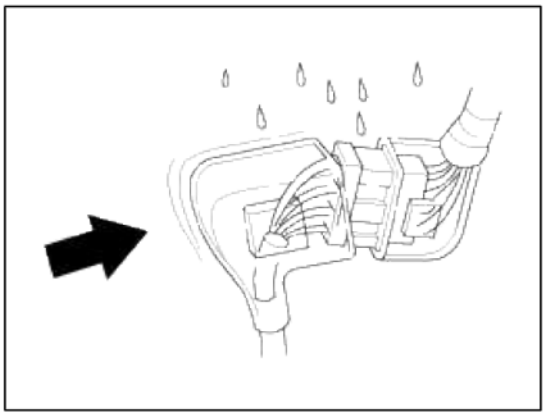
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



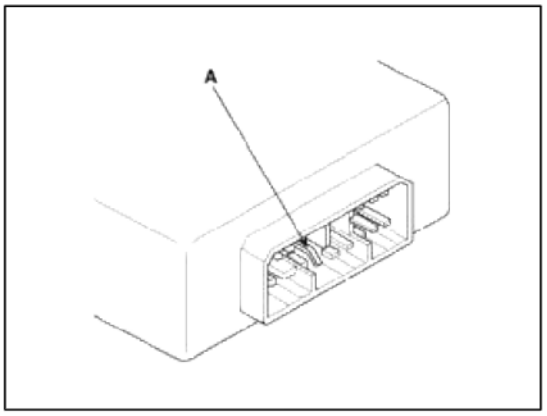
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.

cardiagn.com

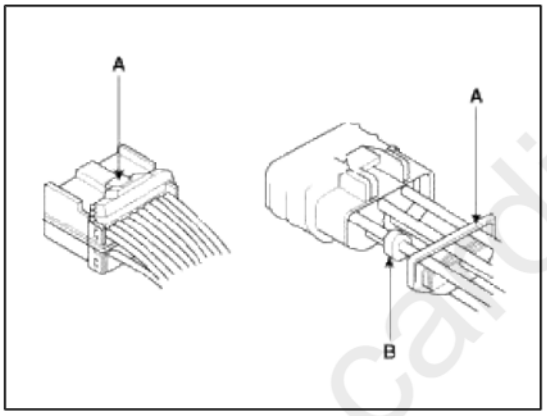
7. Always reinstall plastic covers.



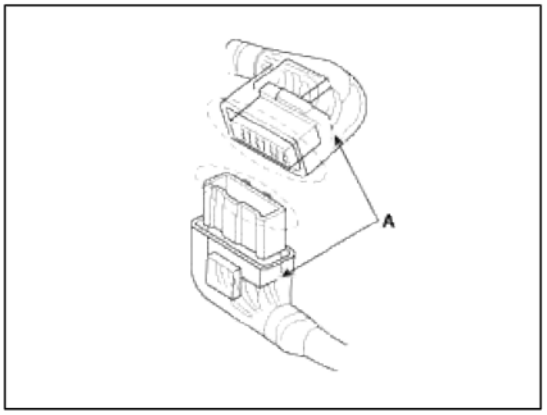
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



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



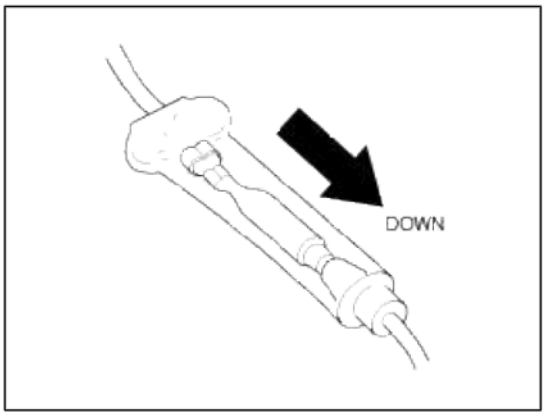
10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.



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

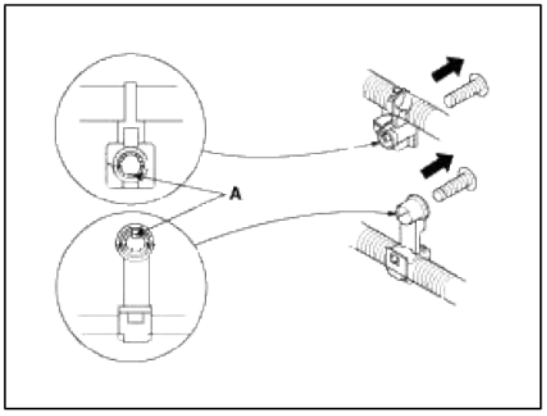
cardiagn.com

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

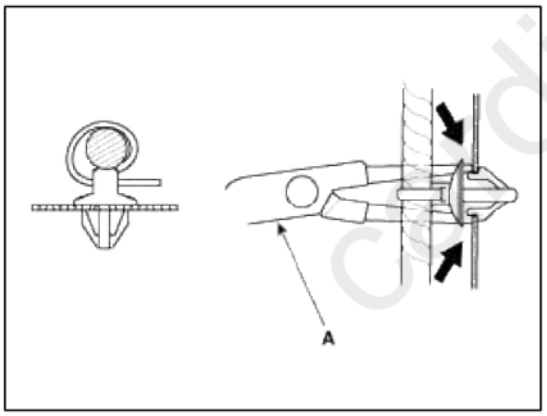


Handling Wires And Harnesses

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).



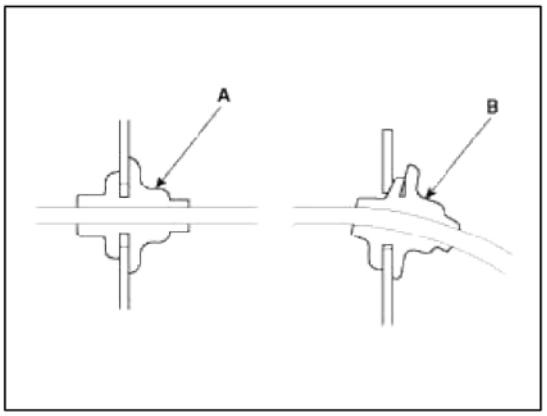
3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



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 from exposed screws and bolts.

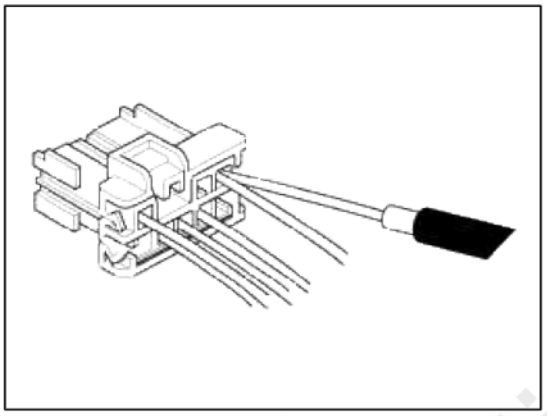
cardiagn.com

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

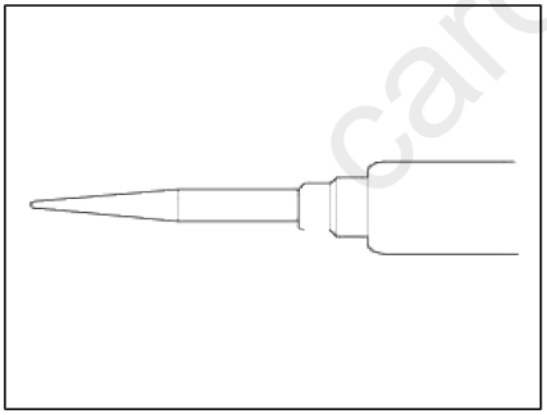


Testing And Repairs

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 begin disassembly or testing until you have narrowed down the problem area.
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 circuit 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 the problem.

cardiagn.com

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 key to 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 problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Battery Reset

Description

When reconnecting the battery cable after disconnecting, recharging battery after discharged or installing the memory fuse 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. Please 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 reinstalled, 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 then keep pulling up the power switch for about 1 second.
Panoramaroof	Whenever the battery is disconnected, discharged or the related fuse is replaced or reinstalled, the panoramaroof system must be reset according to the procedure below. 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. 5) Press and hold the CLOSE button once again until the sunroof do as follows. • Tilt → Slide Open → Slide Close Then, release the lever. 6) Reset procedure of panorama system is finished.
Trip computer	When the battery is disconnected and reconnected, the set functions of the trip computer become initialized. So, you need to explain this information to the customer.
Clock	Whenever the battery terminals or related fuses are disconnected, you must reset the time in audio head unit. (Refer to Audio owner's manual)
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 service, set the customer's radio stations into the audio.

Body Electrical System > Audio > Specifications

Specifications

Audio

Item		Specification	
Model		RADIO/CD/MP3	RADIO/CD/MP3/RSE
		PA710	PA765
SDARS (Option)		○ (PA710S)	○
Power supply		DC 14.4V	
Dark current		Max. 2.3mA (Head unit only)	
Antenna		80PF 75Ω	
Tuning type		PLL SYNTHESIZED TUNING	
Frequency range / Channel space	FM	87.5~107.9 MHz / 200KHz	
	AM	530~1710 KHz (10KHz)	

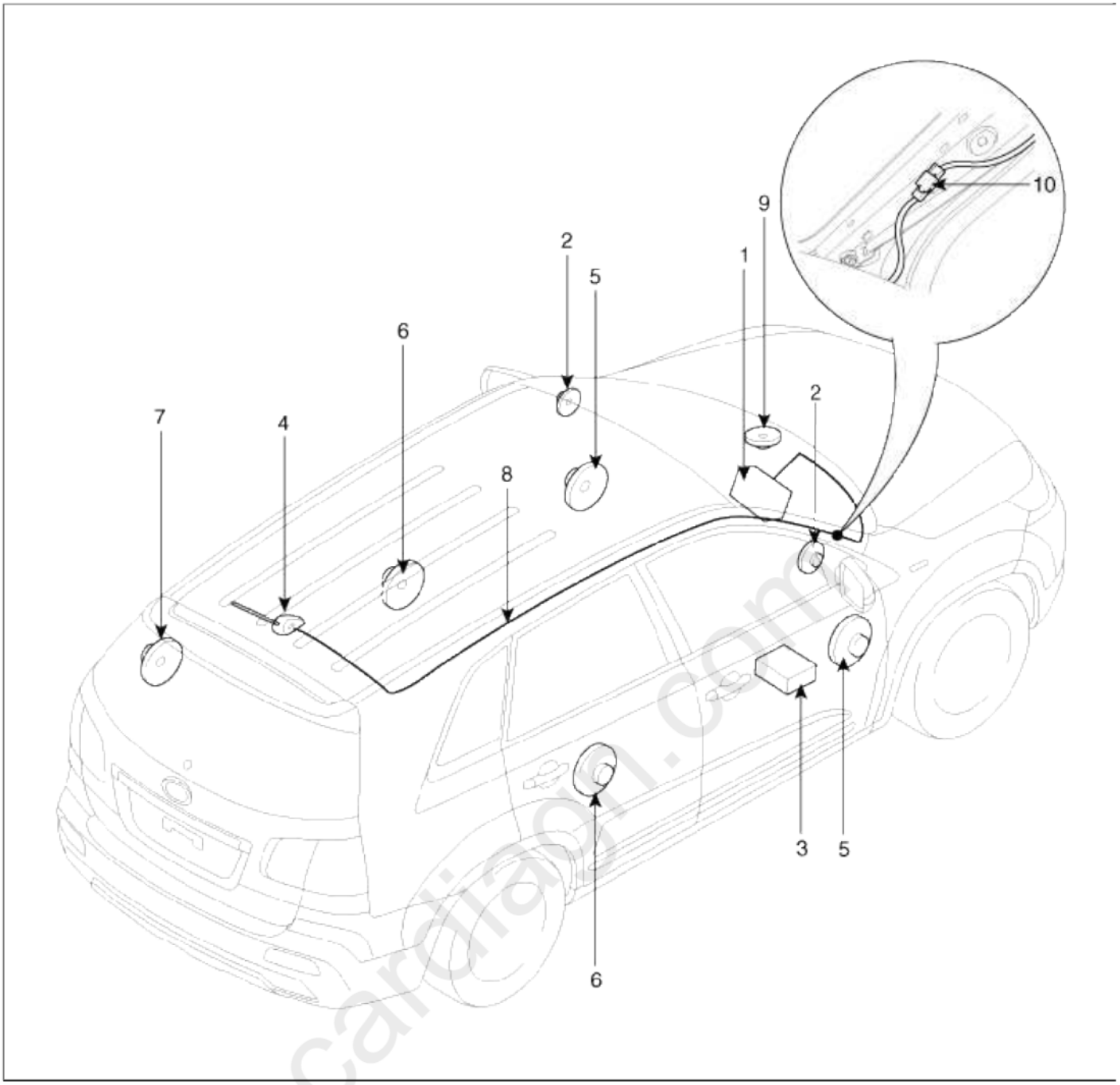
Speaker

Item		PA710	PA76
Input Power (W or V)	Front	Max 40W	
	Rear	Max 40W	
	Front Center	-	8 Vrms
	Front Tweeter	Max 25W	
	Sub woofer	-	MAX 40W
Speaker Impedance (Ω)	Front	2 ± 0.3	
	Rear	2 ± 0.3	
	Front Center	-	2.15 ± 0.25
	Front Tweeter	Min 3.2	
	Sub woofer	-	2 ± 0.3
Speaker Number		6	8

cardiagn.com

Body Electrical System > Audio > Components and Components Location

Component Location



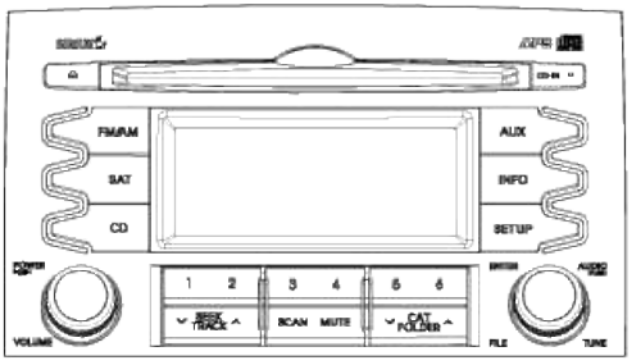
1. Audio unit 2. Tweeter speaker 3. External amp 4. Roof antenna (Radio+SDARS) 5. Front door speaker	6. Rear door speaker 7. Sub woofer speaker 8. Antenna feeder cable 9. Crash pad center speaker 10. Antenna cable connector

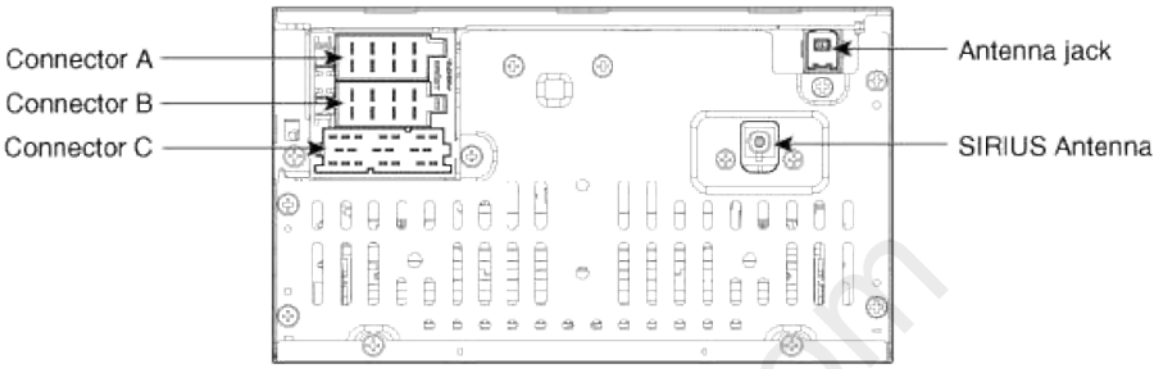
SDARS : Satellite Digital Audio Radio Service

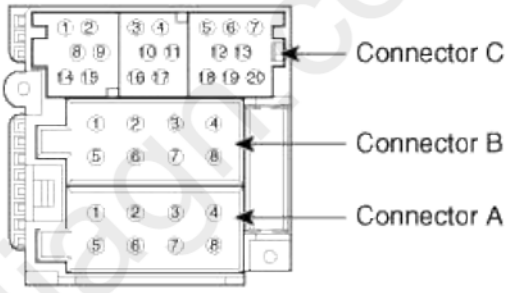
Body Electrical System > Audio > Audio Unit > Components and Components Location

Components

[RADIO/CD/MP3(PA710)]





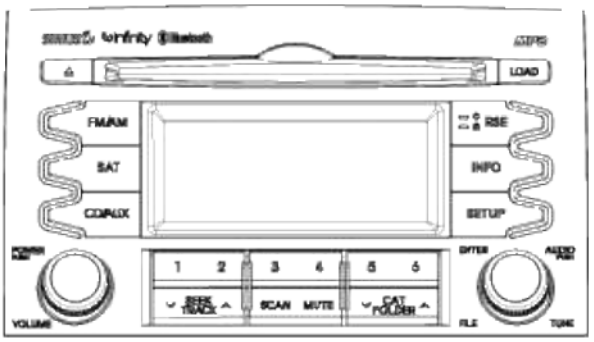


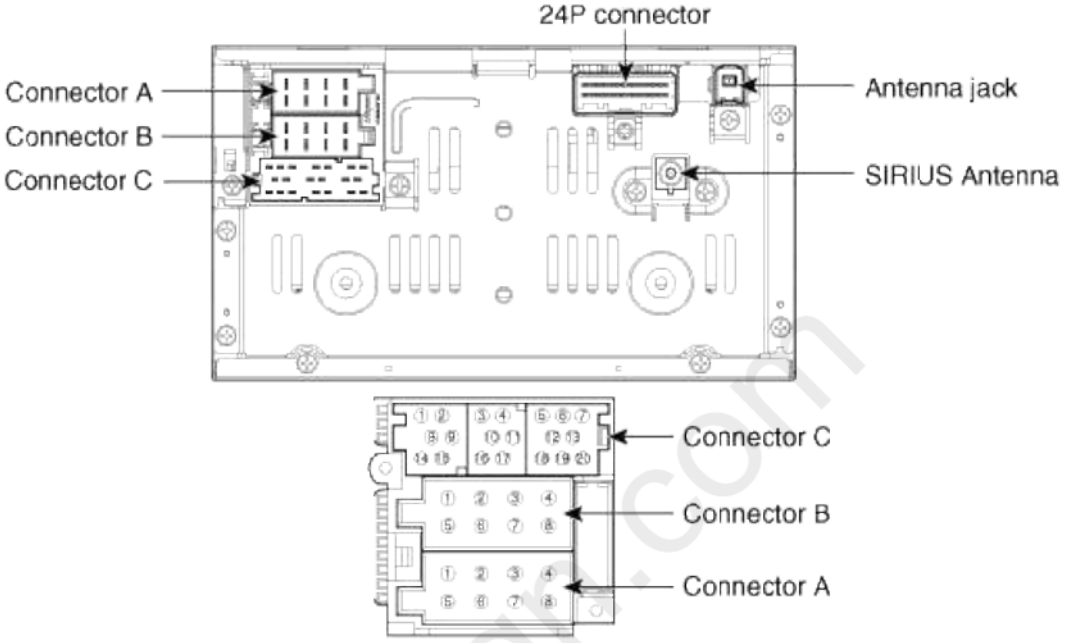
NO	Connector A	Connector B
1	Speed	Speaker RR (+)
2	Illumination (+)	Speaker FR (+)
3	Remote antenna	Speaker FL (+)
4	Battery (+)	Speaker RL (+)
5	-	Speaker RR (-)
6	ACC	Speaker FR (-)
7	Illumination (-)	Speaker FL (-)
8	GND	Speaker RL (-)

NO	Connector C	NO	Connector C
1	MIC (+)	11	Aux input detect
2	MIC (-)	12	USB D (+)
3	Aux input-R	13	USB iPod GND
4	Aux input-L	14	Tel mute
5	-	15	-
6	USB D (-)	16	S/Wheel remote
7	-	17	Remote GND
8	-	18	-
9	Detent	19	USB iPod VOD
10	Aux GND	20	-

cardiagn.com

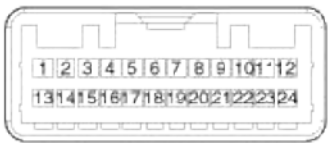
[RADIO/MP3/CDC(PA765)]





NO	Connector A	Connector B
1	Speed	LVDS GND
2	Illumination (+)	LVDS (-)
3	Remote antenna	-
4	Battery (+)	-
5	-	-
6	ACC	LVDS (+)
7	Illumination (-)	-
8	GND	-

NO	Connector C	NO	Connector C
1	MIC(+)	11	Aux Input Detect
2	MIC(-)	12	USB D(+)
3	Aux Input-R	13	USB iPod GND
4	Aux Input-L	14	Tel Mute
5	-	15	-
6	USB D(-)	16	S/Wheel Remote
7	CAN Low	17	Remote GND
8	-	18	-
9	Detent	19	USB iPod VOD
10	Aux GND	20	CAN High

24P connector	NO	Description	NO	Description	NO	Description
	1	-	9	RSE LIN GND	17	-
	2	-	10	-	18	-
	3	-	11	-	19	RSE L out (+)
	4	RSE R in (+)	12	-	20	RSE L out (-)
	5	RSE R in (-)	13	-	21	RSE L out GND
	6	RSE R in GND	14	-	22	RSE R out GND
	7	RSE L in (+)	15	-	23	RSE R out (+)
	8	RSE L in (-)	16	-	24	RSE R out (-)

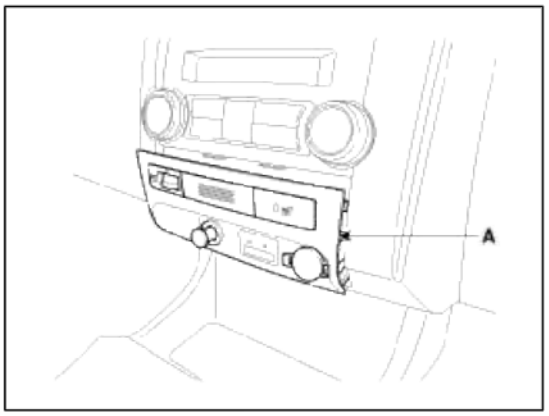
cardiagn.com

Body Electrical System > Audio > Audio Unit > Repair procedures

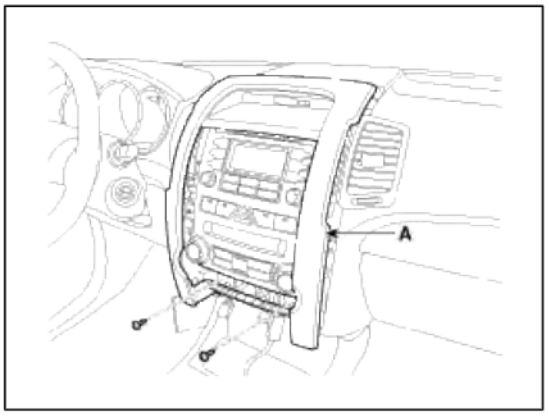
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the floor console upper cover
   (Refer to BD group - "Console")

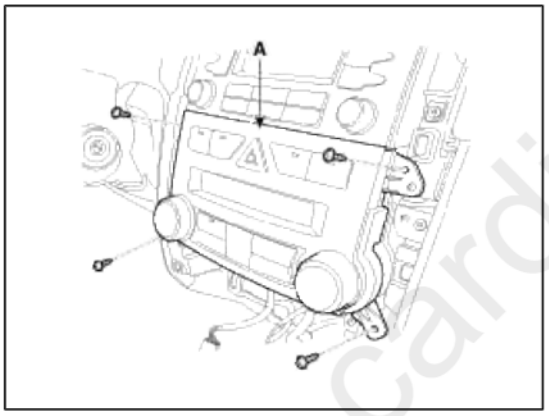
3. Remove the seat warmer switch module (A).



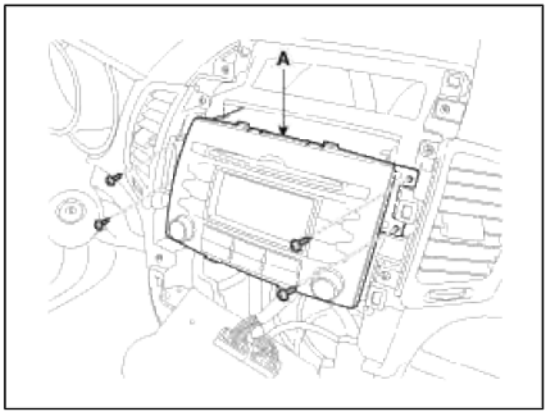
4. After removing the screws, remove the center fascia panel (A).



5. After removing the screws, remove the heater control module (A).

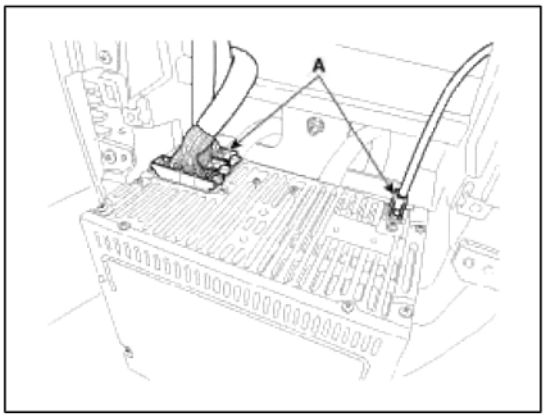


6. Remove the audio assembly (A) after loosening the mounting screws.



cardiagn.com

7. Disconnect the audio connectors and cable (A), then remove the audio unit



NOTE

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 heater control module.
4. Install the center facia panel.
5. Install the seat warmer switch module.
6. Install the floor console upper cover.
7. Connect the negative (-) battery terminal.

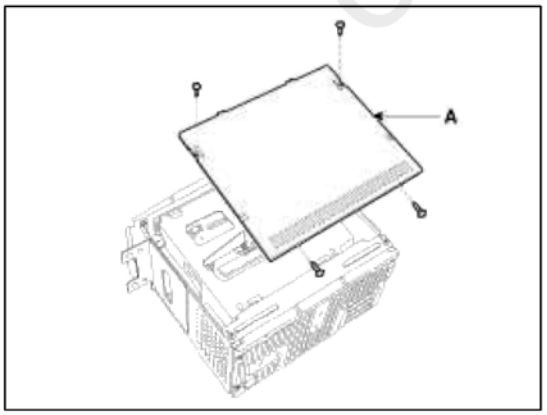
NOTE

A. Make sure the connector are connected in properly.

B. Check the audio system.

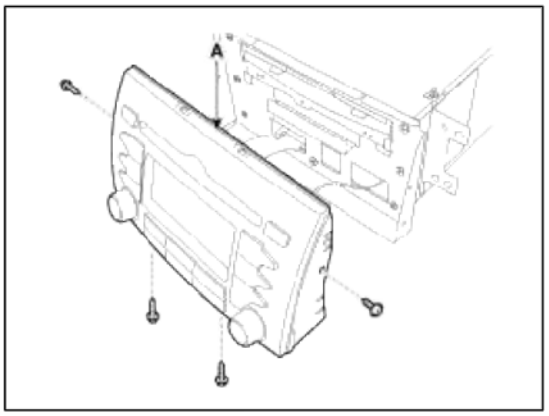
Disassembly

1. When removing the CD rom drive, remove the screws (4EA) on the head unit and, and then remove the top cover (A).

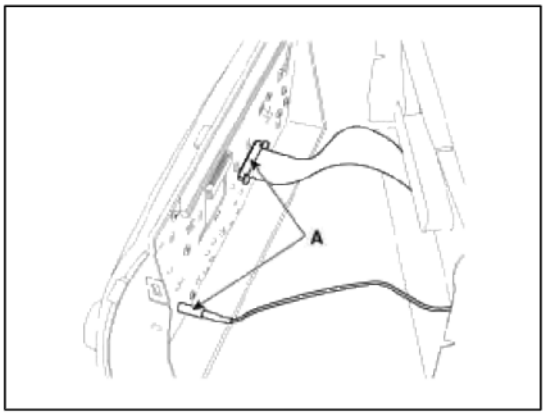


cardiagn.com

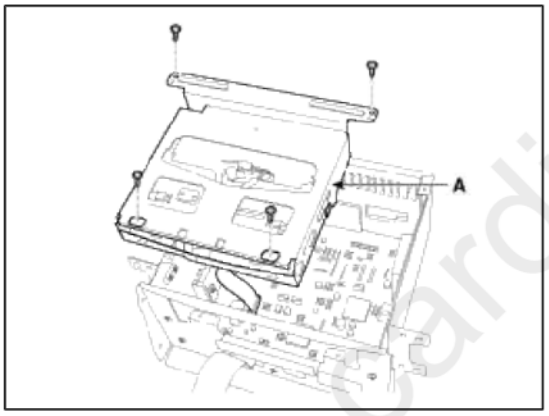
2. After removing the screws, remove the front cover (A).



3. Remove the connectors (A).



4. After loosening the screws (4EA), remove the CD rom drive (A).



cardiagn.com

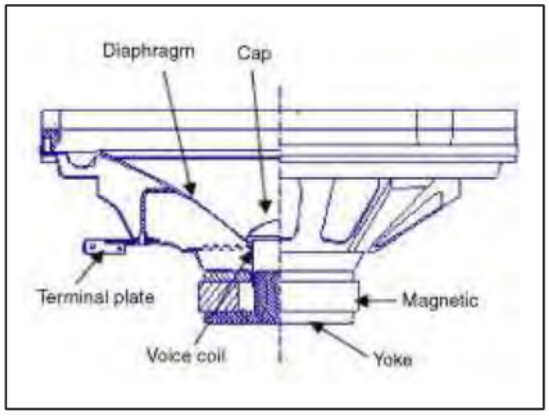
Body Electrical System > Audio > Speakers > Repair procedures

Inspection

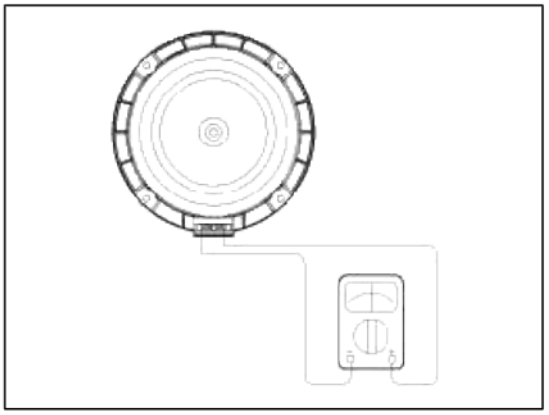
1. Troubleshooting for Speaker

(1) Basic inspection of speaker

Inspect the sound from speaker after verifying that the speaker mounting screws is removed and the wiring connector 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 one. NOTE 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 and connections in the speaker circuit. 2. Check the supplying power to the speaker and the resistance, and then inspect the sound quality.  3. If the speaker works poorly, replace it with new one.

cardiagn.com

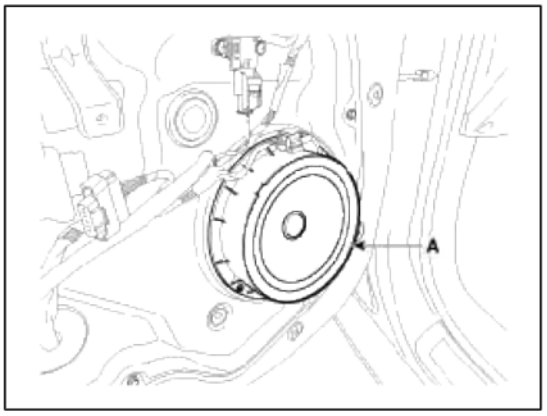
CAUTION

- During dealing of speaker
- Dropping or rough handling of the speaker can cause damage.
- 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 by 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.

Removal

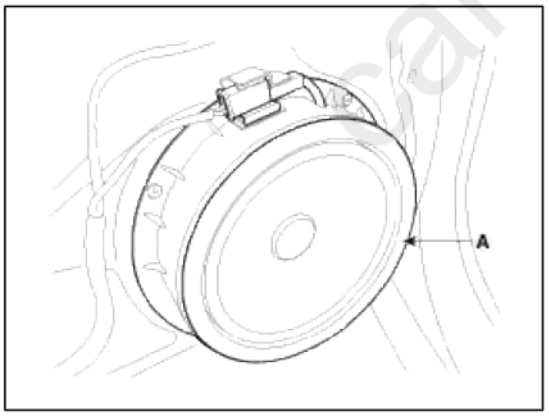
Front Speaker

1. Remove the front door trim.
   (Refer to BD group - "Front door")
2. Remove the front speaker (A) after drilling out the 4 rivets.



Rear Speaker

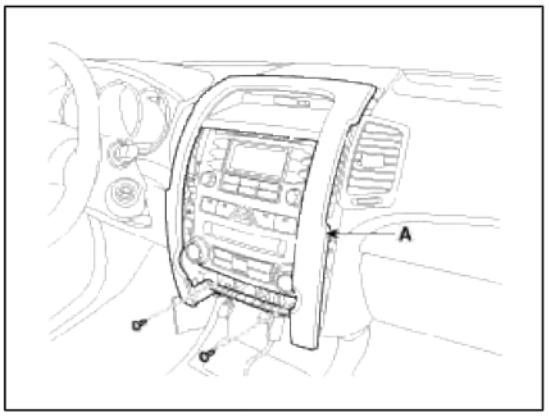
1. Remove the rear door trim.
   (Refer to BD group - "Rear door")
2. Remove the rear speaker (A) after removing 4 rivets.



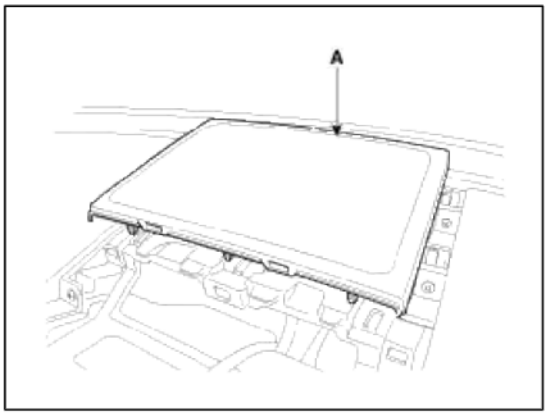
Crash Pad Center Speaker

cardiagn.com

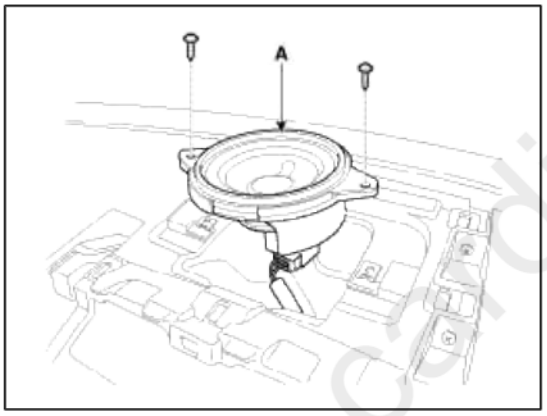
1. Remove the center fascia panel (A).



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

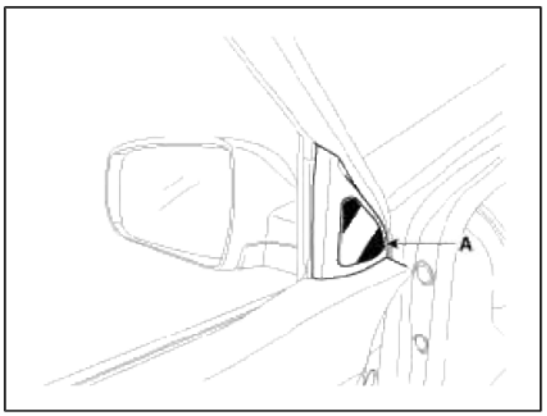


3. Remove the crash pad center speaker (A) after loosening the mounting screws (2EA).



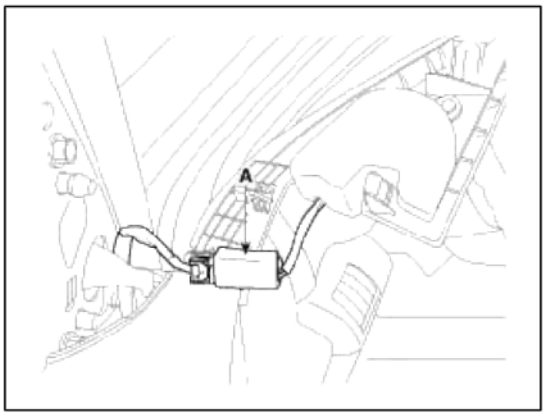
Tweeter Speaker (Front)

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



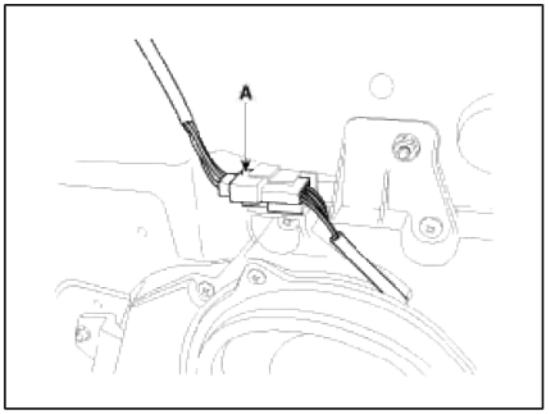
cardiagn.com

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

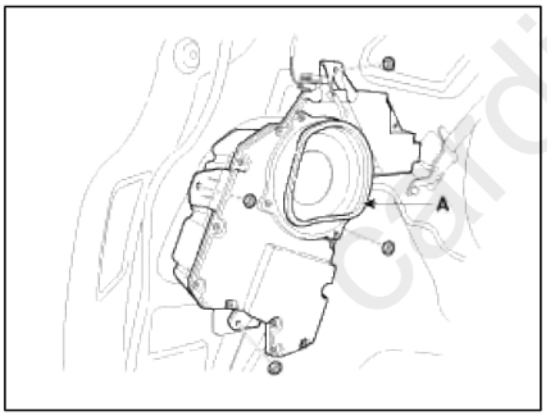


Woofer Speaker

1. Remove the left luggage side trim.
   (Refer to BD group – "Interior trim")
2. Remove the woofer speaker connector (A).



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

cardiagn.com

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.

NOTE

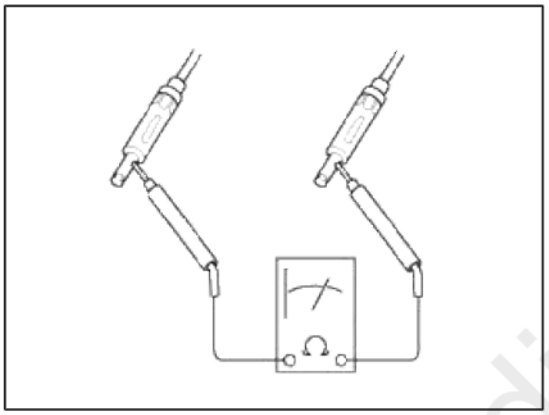
- Make sure that the amplifier connectors are plugged in properly.
- Check the audio system.

Body Electrical System > Audio > Antenna > Repair procedures

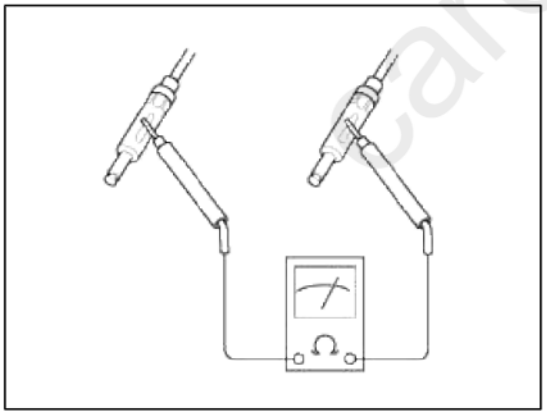
Inspection

Antenna Cable

1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



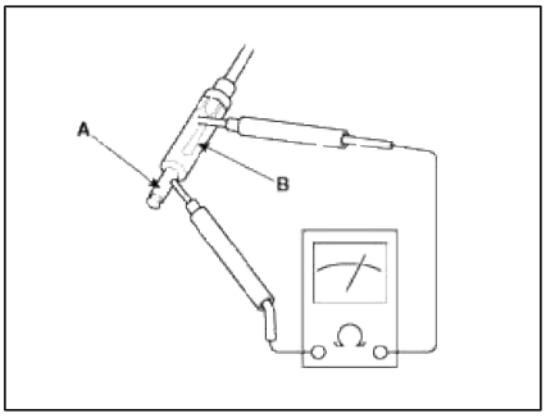
3. Check for continuity between the outer poles of antenna cable. There should be continuity.



4. If there is no continuity, replace the antenna cable.

cardiagn.com

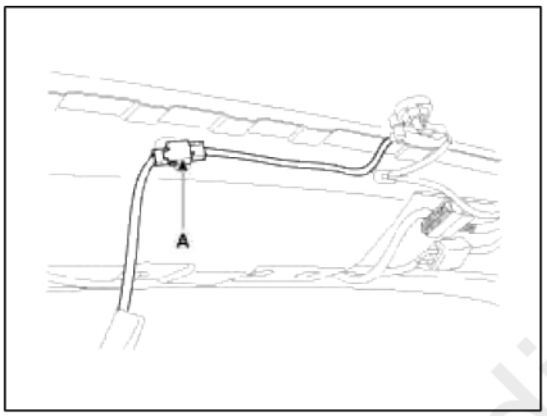
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.



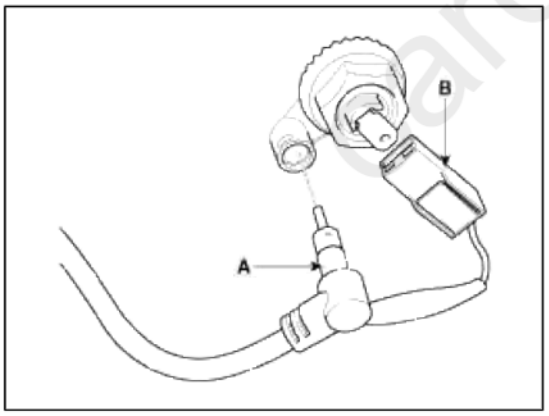
6. If there is continuity, replace the antenna cable.

Removal

1. Remove the rear roof trim.
   (Refer to BD group - "Roof trim")
2. Disconnect the roof antenna feeder cable and connector (A) from the roof antenna.

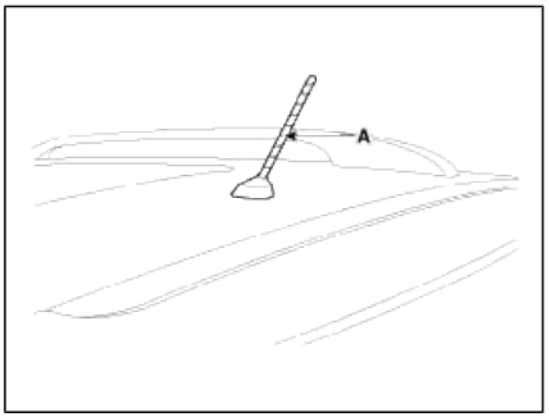


3. Disconnect the antenna jack (A) and power cable (B).



carjiagn.com

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



Installation

1. Connect the roof antenna cables and connectors.
2. Install the rear roof trim.

NOTE

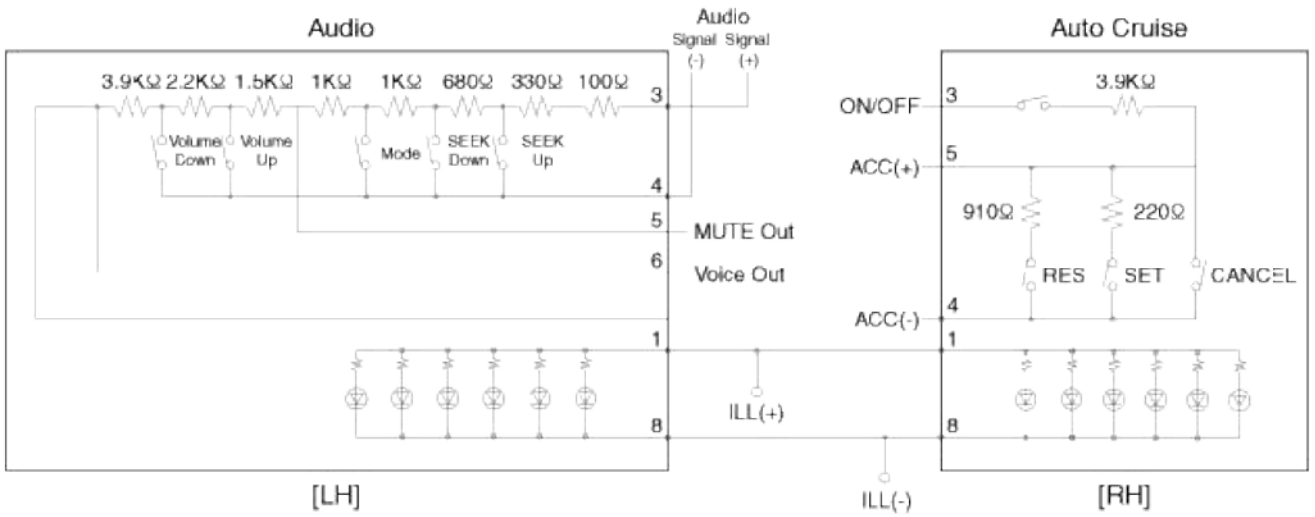
- Make sure that the cables and connectors are plugged in properly.
- Check the audio system.

Body Electrical System > Audio > Audio Remote Control > Schematic Diagrams

Circuit Diagram

cardiagn.com

[Audio + Auto Cruise]



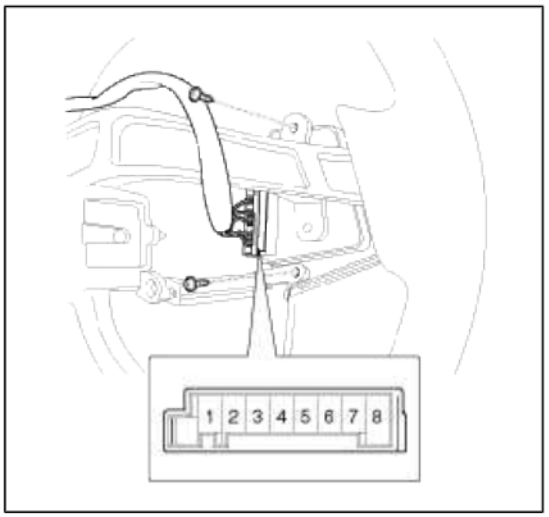
Connector (LH)		Connector (RH)	
1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8	
Pin	Description	Pin	Description
1	Illumination (+)	1	Illumination (+)
2	-	2	-
3	Audio 1 (+)	3	ACC ON/OFF
4	Audio 1 (-)	4	ACC (-)
5	MUTE OUT	5	ACC (+)
6	Voice OUT	6	-
7	-	7	-
8	Illumination (-)	8	Illumination (-)

carmanual.com

Body Electrical System > Audio > Audio Remote Control > Repair procedures

Inspection

1. Check for resistance between No.3 and No.4 terminals in each switch position.

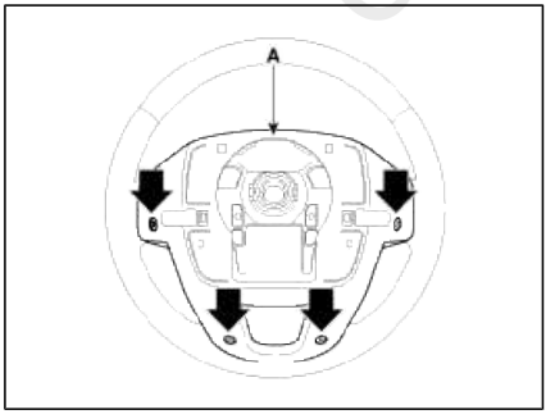


[Audio System]

Switch	Connector terminal	Resistance (±1%)
VOLUME DOWN	3-4	6.81 kΩ
VOLUME UP	3-4	4.61 kΩ
MUTE	3-4	3.11 kΩ
MODE	3-4	2.11 kΩ
SEEK DOWN	3-4	1.11 kΩ
SEEK UP	3-4	430 Ω

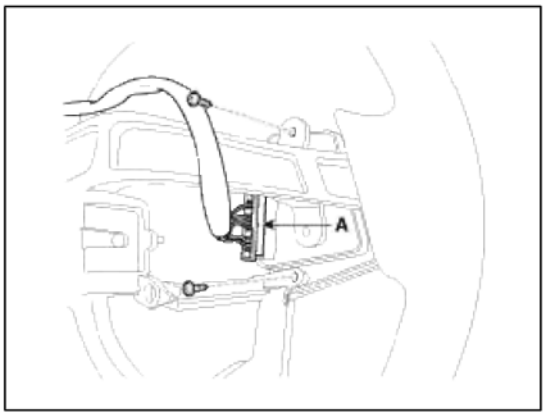
Removal

1. Remove the driver airbag module.
   (Refer to RT group - "Airbag module")
2. Remove the steering wheel.
   (Refer to ST group - "Steering column and shaft")
3. Remove the steering wheel cover (A) after removing the screws.

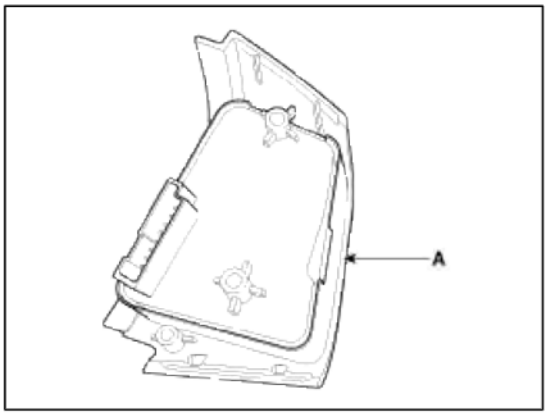


cardiagn.com

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



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



Installation

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

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

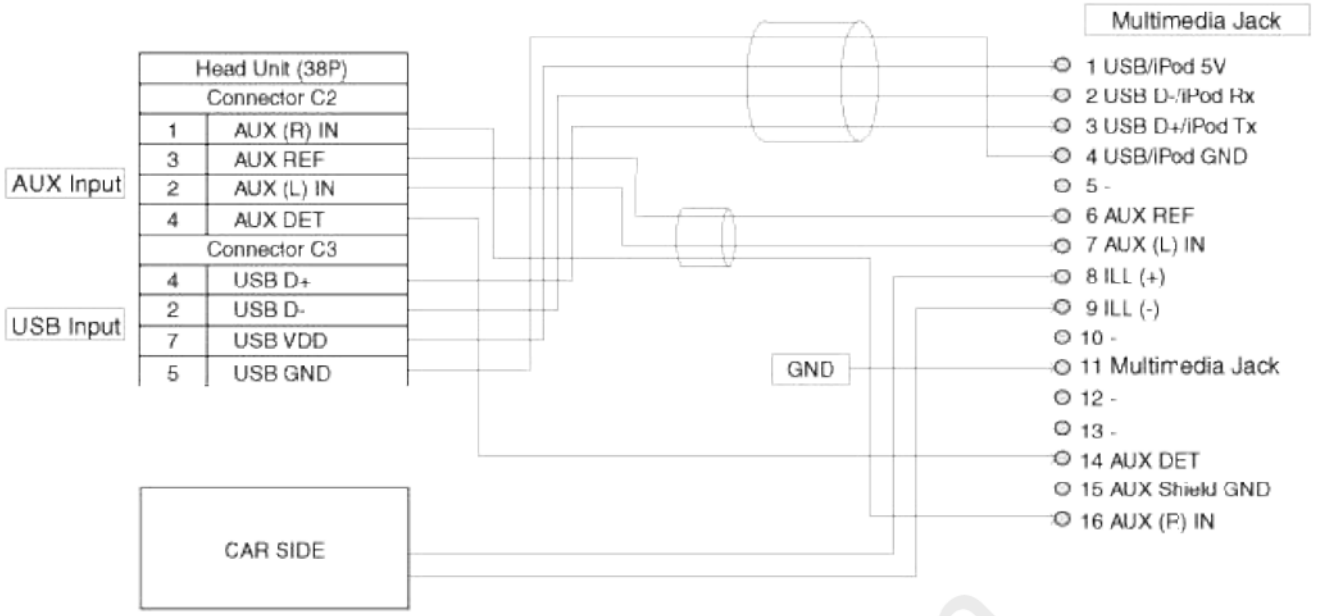
4. Install the driver airbag module.

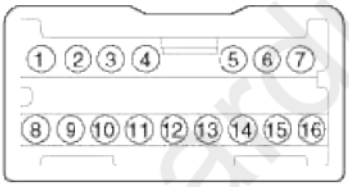
cardiagn.com

Body Electrical System > Audio > AUX(Auxiliary) Jack > Schematic Diagrams

Circuit Diagram

[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
	12	-
	13	-
	14	AUX DET
	15	AUX Shield GND
	16	AUX (R) IN

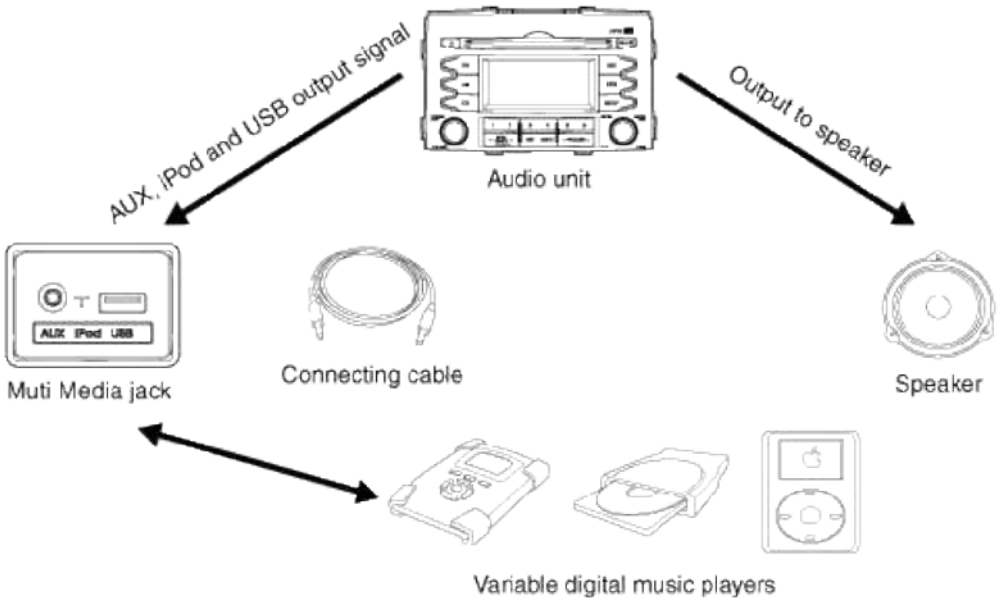
cardiagn.com

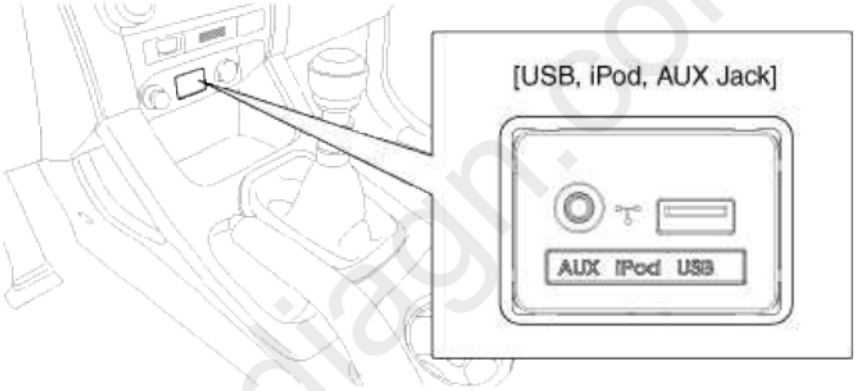
Body Electrical System > Audio > AUX(Auxiliary) Jack > Description and Operation

Description

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

If sound distortion occurs it may be due to a mismatch of specifications between units.



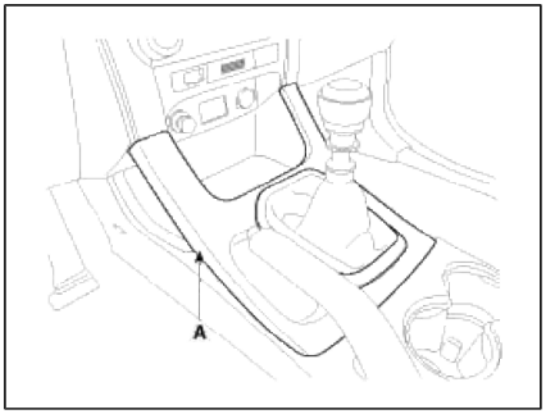


cardiagn.com

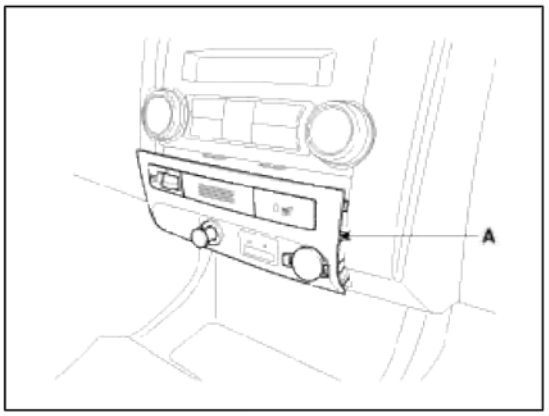
Body Electrical System > Audio > AUX(Auxiliary) Jack > Repair procedures

Removal

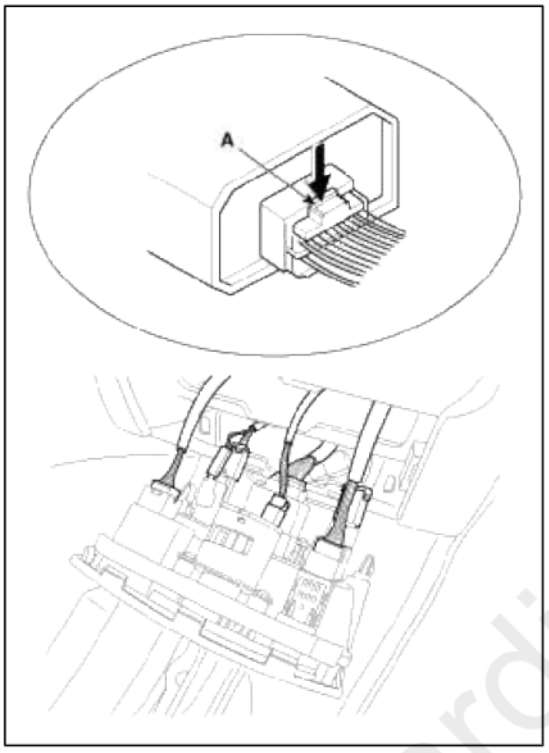
1. Remove the shift lever knob.
   (Refer to BD Group - "Console")
2. Remove the floor console upper cover (A).



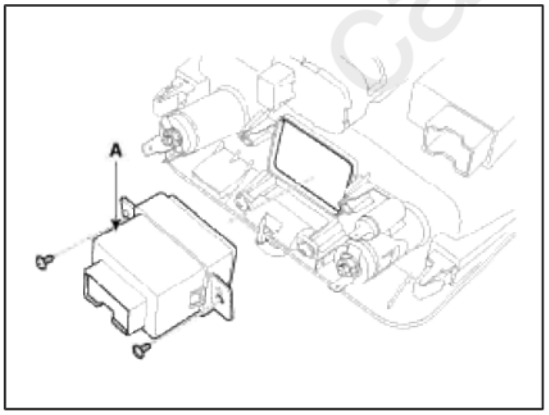
3. Remove the seat warmer switch module (A).



4. Disconnect the connectors (A) from the seat warmer switch module.



5. Remove the Multimedia Jack (A) from the seat warmer switch module after loosening the mounting screws.



Installation

1. Install the Multimedia jack.
2. Install the seat warmer switch module.
3. Install the console upper cover.

Body Electrical System > Audio > SIRIUS Radio > Description and Operation

cardiagn.com

Description

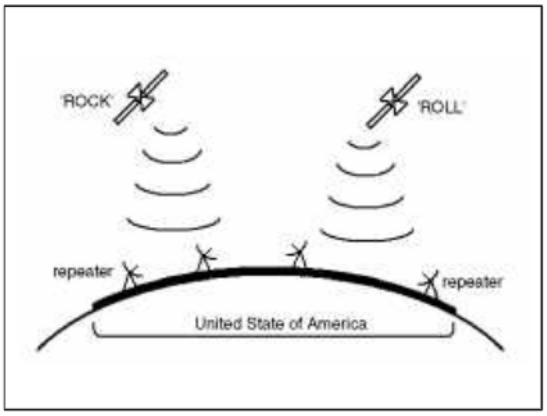
Introduction to SIRIUS radio

SIRIUS-Radio is a Satellite Based Radio Broadcast System that operates around 2.3 GHz from two 15,000 watts satellites; The service covers Continental US and Canada. But the service in Canada is not guaranteed.

Due to the limitations of satellite transmission, the signal is not able to penetrate buildings, so it cannot effectively cover dense urban areas. The terrestrial repeater network extends SDARS coverage and allows providers to reach the greatest number of subscribers and provide quality coverage. The repeaters receive the SIRIUS signal directly from the satellites and then re-transmit it to SIRIUS radios anywhere.

SIRIUS provides digitalized radio programs in terms of channels. Each channel is a program that the user can tune to. A category is a group of channels. Examples of categories are classical, news and sports.

SIRIUS is a paid service. That means users have to make a subscription to SIRIUS before they can enjoy the programs. However, SIRIUS does give some free-to-air channels. The users can listen to one of them without making any subscription.



SDARS : Satellite Digital Audio Radio Service

Function

Activation

In order to extend or reactivate your subscription to SIRIUS Satellite Radio, you will need to contact SIRIUS Customer Care at 888-539-7474.

Have your 12 digit SID (Sirius Identification Number)/ESN (Electronic Serial Number) ready.

To retrieve the SID/ESN, turn on the radio, press the [SAT] button and tune to channel zero.

Please note that the vehicle will need to be turned on, in Sirius mode, and have an unobstructed view of the sky in order for the radio to receive the activation signal.

1. SATELLITE RADIO Selection Button(SIRIUS Satellite Radio)

Press the [SAT] button to switch to SIRIUS Satellite Radio. It cycles through the different bands as noted below.

SAT1 → SAT2 → SAT3 → SAT1 →...

2. Channel Selection Button

- Press [TRACK] or [SEEK] button Press [TRACK] or [SEEK] button previous or next channel.
- Press [TRACK] or [SEEK] button for 0.8 or longer to continuously move to previous or next channel.
- If "CATEGORY" Icon is displayed at the top of the screen, channel up/down is done through the channels within current category.

3. Preset Selection Button

- Push [1]~[6] buttons less than 0.8 second to play the channel saved in each button.
- Hold down the preset button for 0.8 second or longer to save current channel. An audible beep will play to confirm the preset is stored.

4. SCAN Button

- When the button is pressed, it automatically scans the radio stations upwards.
- The SCAN feature steps through each channel, starting from the initial channel, for ten seconds.

cardiagn.com

- Press the [SCAN] button again to stop the scan feature and to listen to the currently selected channel.
- If "CATEGORY" Icon is displayed at the top of the screen, channel changing is done through the channels in current category.

5. TUNE Knob and ENTER Button

While listening to SIRIUS broadcast, rotate this knob to the right or left to search other channels while listening to current channels and push this knob to select what you want to listen to. (Turn to the right to search higher channels and left lower channels)

6. CAT/FOLDER Button

- Press [CAT] or [FOLDER] button to enter the Category List Mode, it displays cateogry items and highlights the category that currently tuned channel belongs to.
- On Category List Mode, press these buttons to navigate category list.
- Press [ENTER] Button to select the lowest channel in highlighted category.
- If channel is selected by selecting category CATEGORY Icon is displayed at the top of the screen.

7. INFO Selection Button

Displays the information of the channel currently played by in the order of Artist/ Song title → Category/Channel name → Composer(if available) → Artist/Song title → Category/Channel name →... (ART/TITLE Selection)
Displays the information of the channel currently played by in the order of Category/Channel name → Artist/Song title → Composer(if available) → Category/Channel name → Artist/Song title →... (CAT/CH Selection) (If there is no information of COMPOSER NAME, it returns to main display.)

8. SETUP Button

Press this button to adjust to the SCROLL, SDVC, SIRIUS and adjustment mode. If no action is taken for 5 seconds after pressing the button, it will return to the previous radio mode.(After entering SETUP mode, move between items using the left,right and PUSH functions of the TUNE button.)
The setup item changes from SCROLL → SDVC → SIRIUS → SCROLL →...

Body Electrical System > Audio > SIRIUS Radio > Troubleshooting

Troubleshooting

1. Antenna Error

If this message is displayed, the antenna or antenna cable is broken or unplugged. Please consult with your Kia dealership.

2. Acquiring Signal

If this message is displayed, it means that the antenna is covered and that the SIRIUS Satellite Radio signal is not available. Ensure the antenna is uncovered and has a clear view of the sky.

Body Electrical System > Audio > Troubleshooting

Troubleshooting

Customer Complaint Analysis Check Sheet

cardiagn.com

TROUBLE IN	☐ ALL ☐ AM ☐ FM ☐ Sirius ☐ 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. Troubleshooting enables you to confine the problem to a particular area.

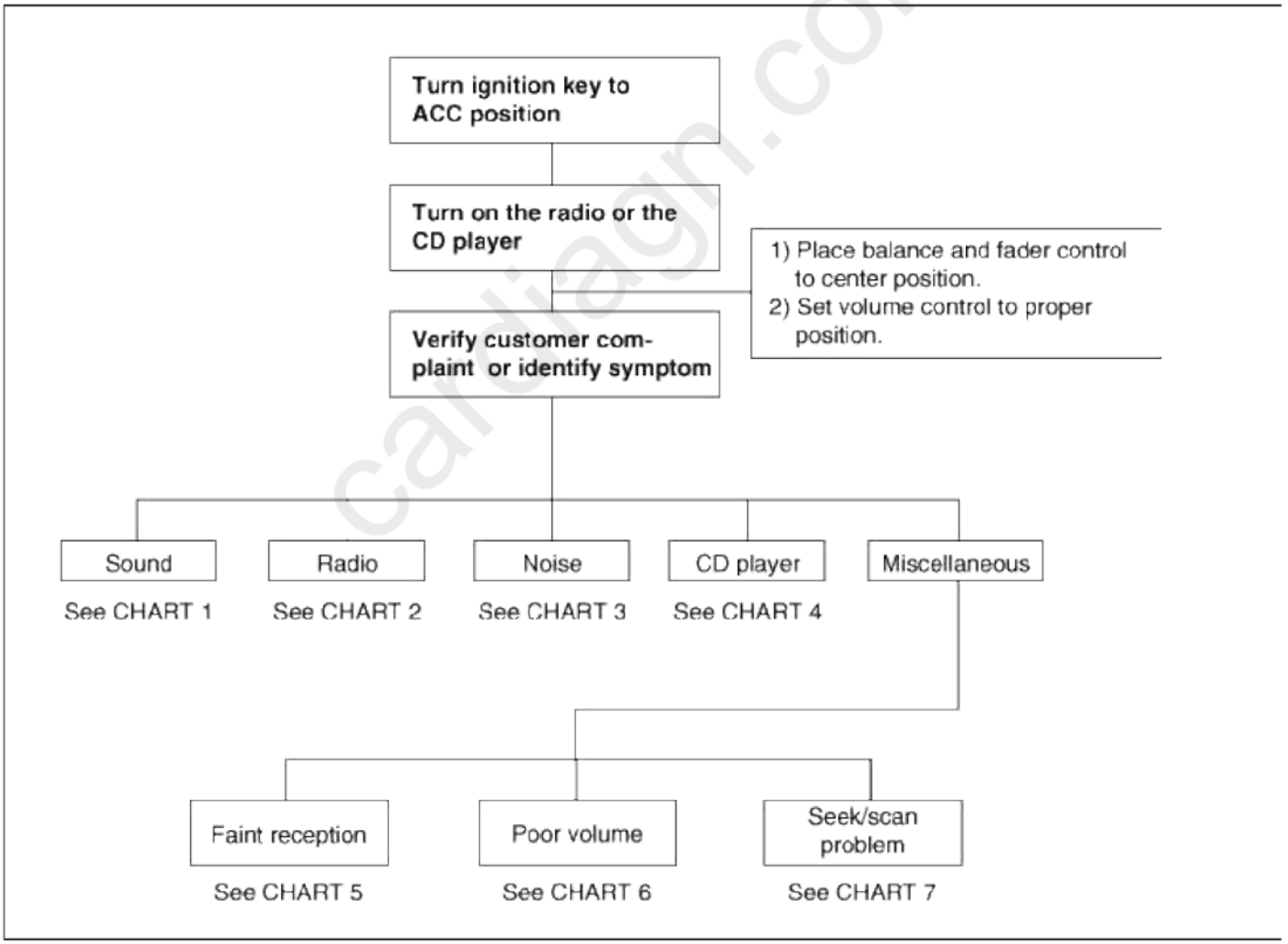
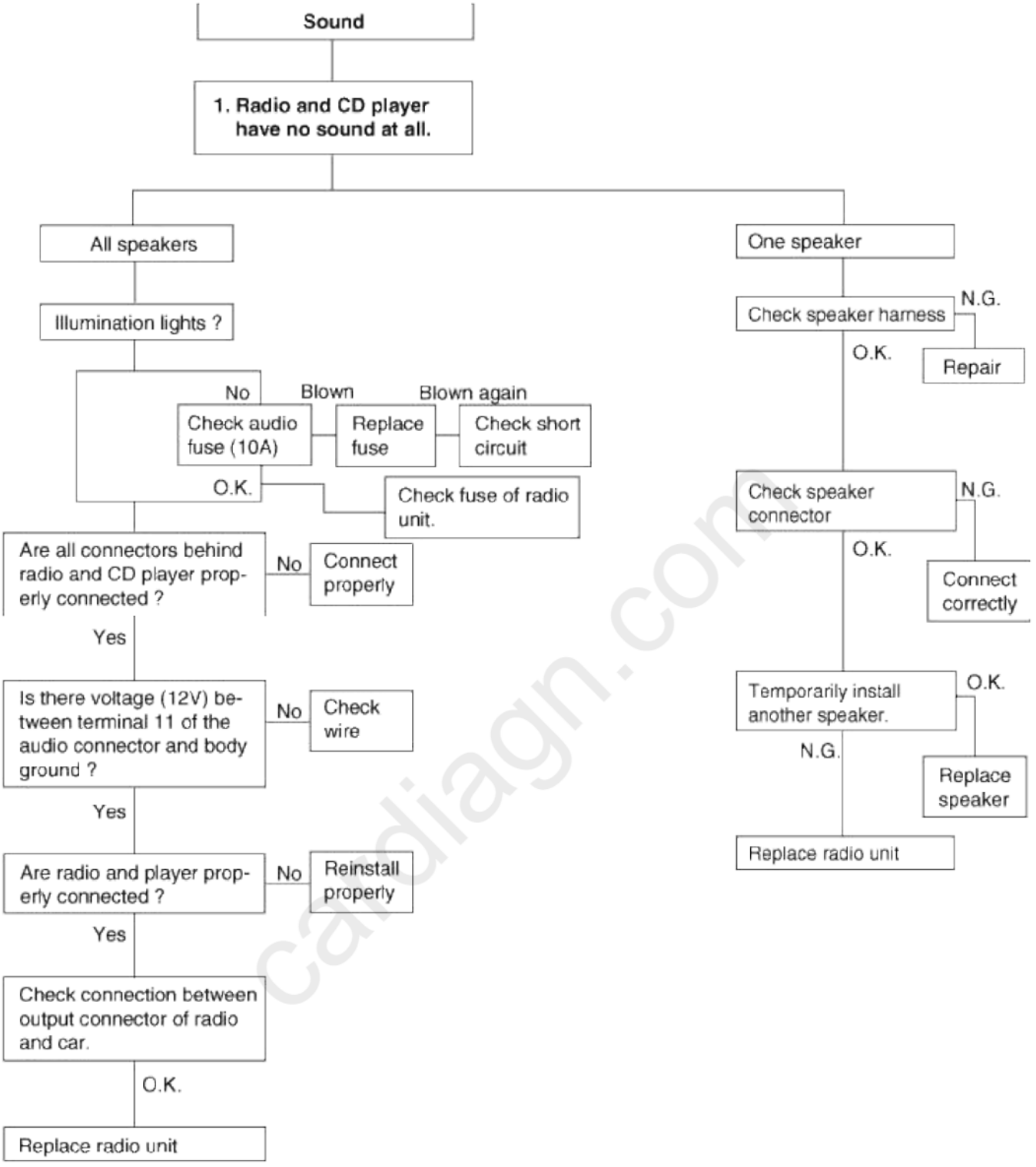


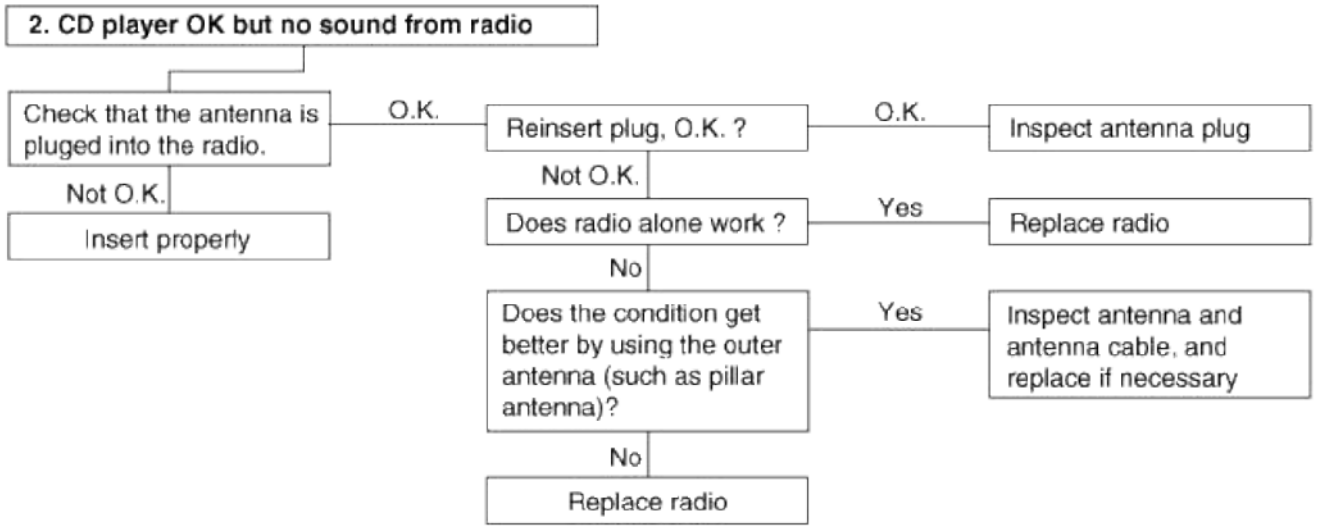
Chart 1

cardiagn.com

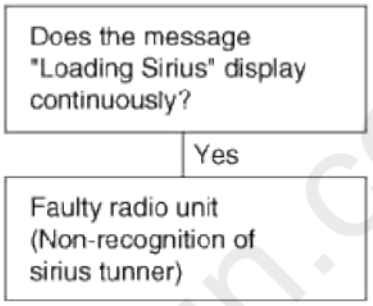
1. RADIO



cardiagn.com



2. Sirius



cardiagn.com

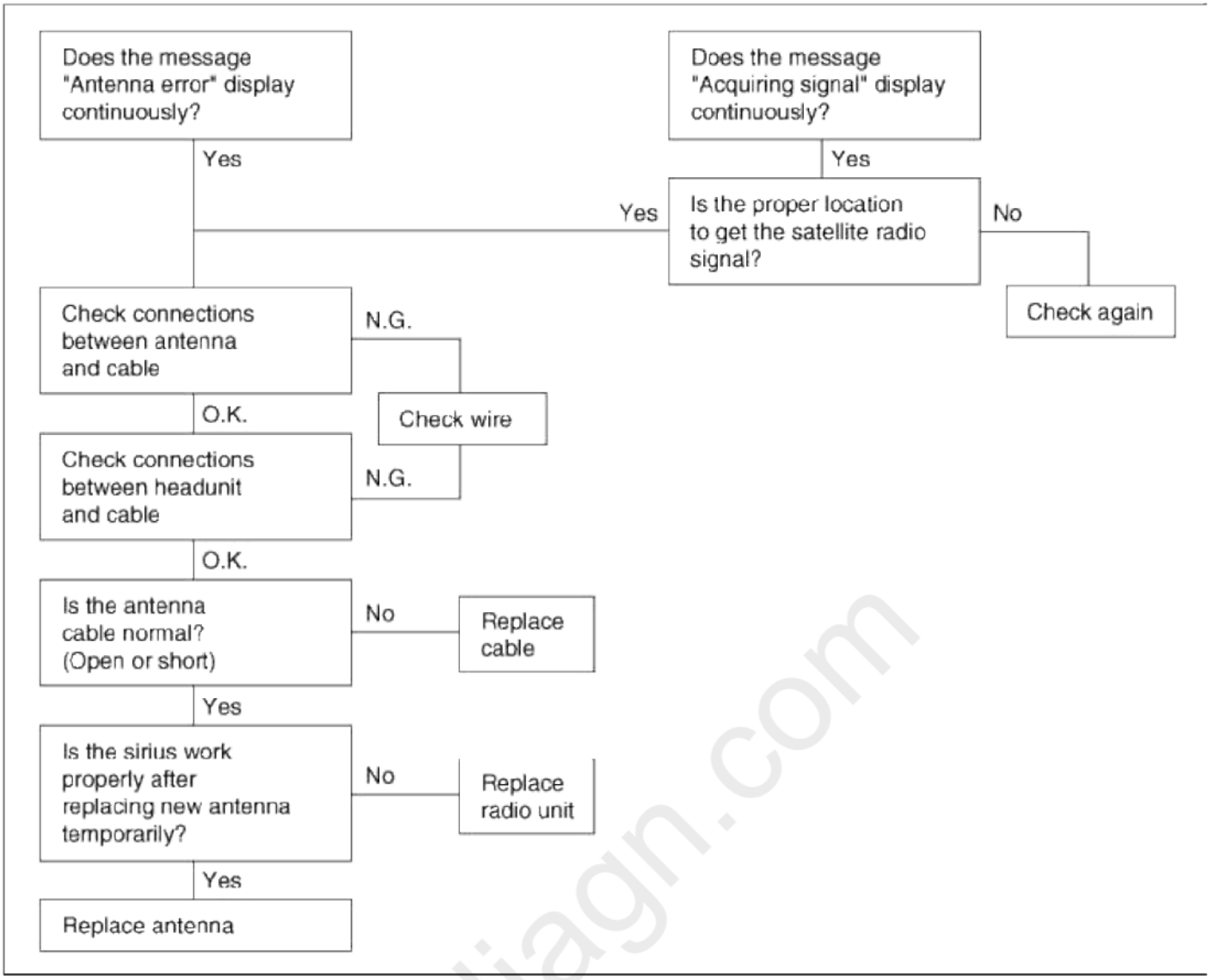


Chart 2

cardiagn.com

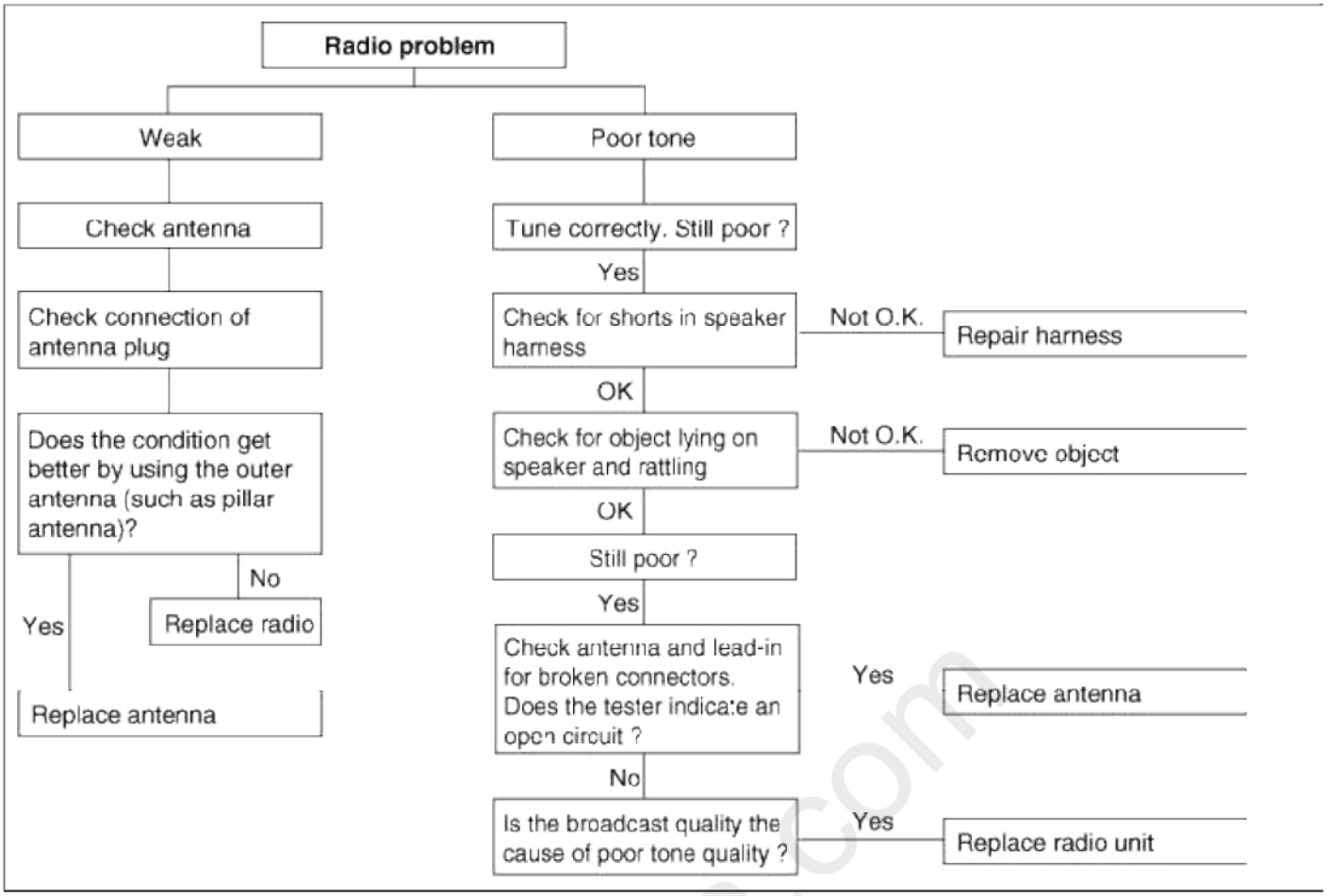
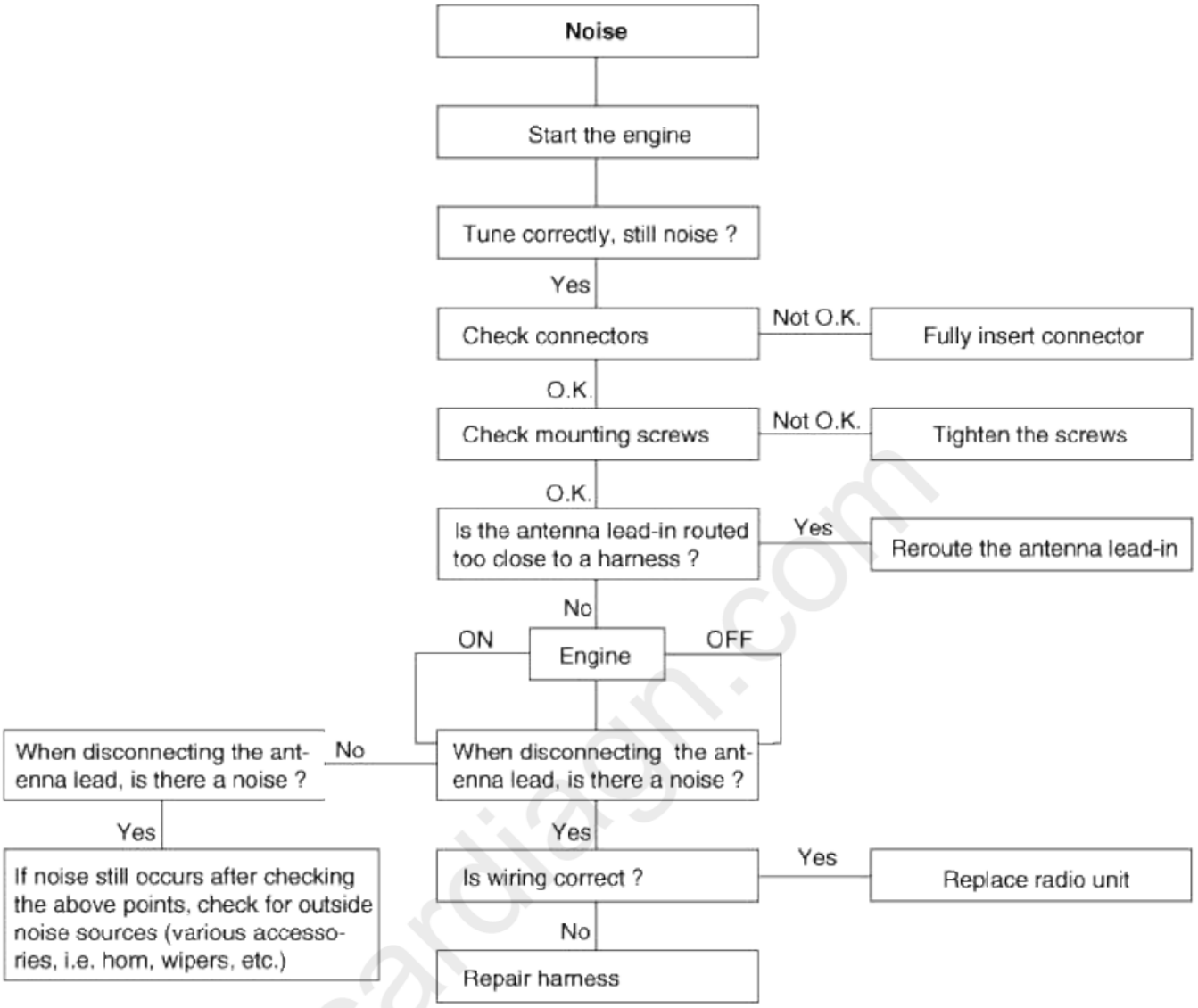


Chart 3

cardiagn.com

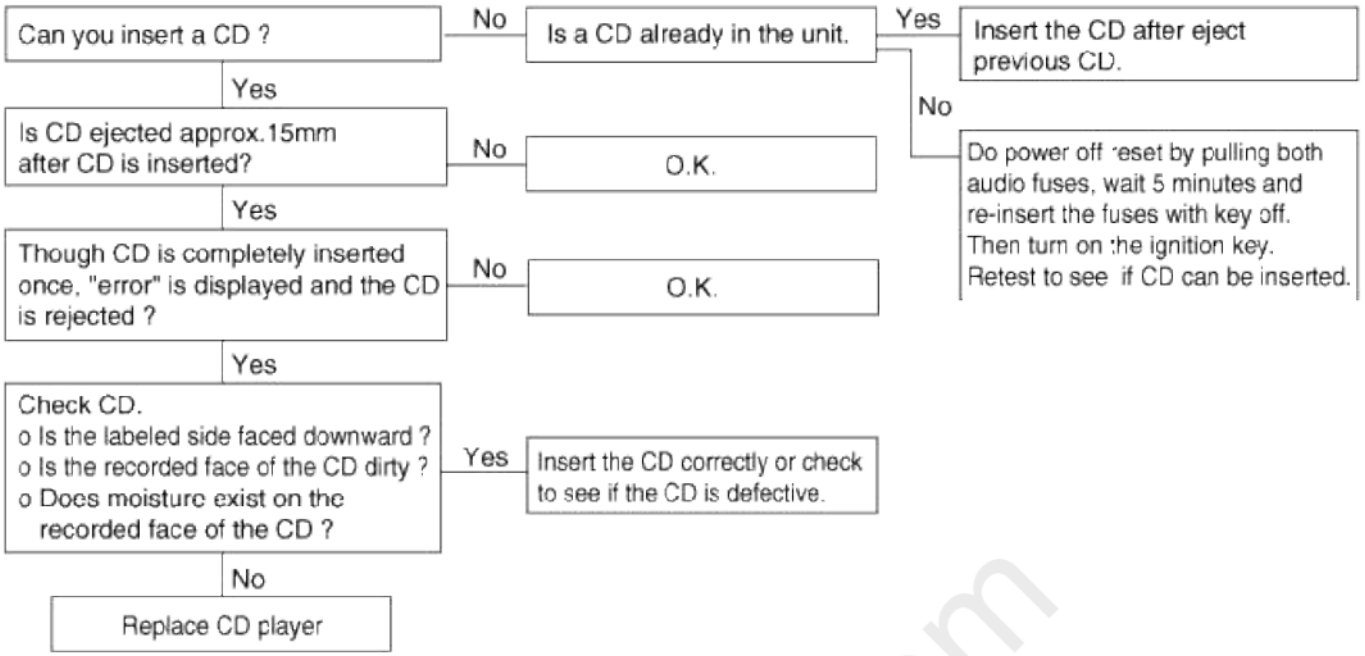
1. RADIO



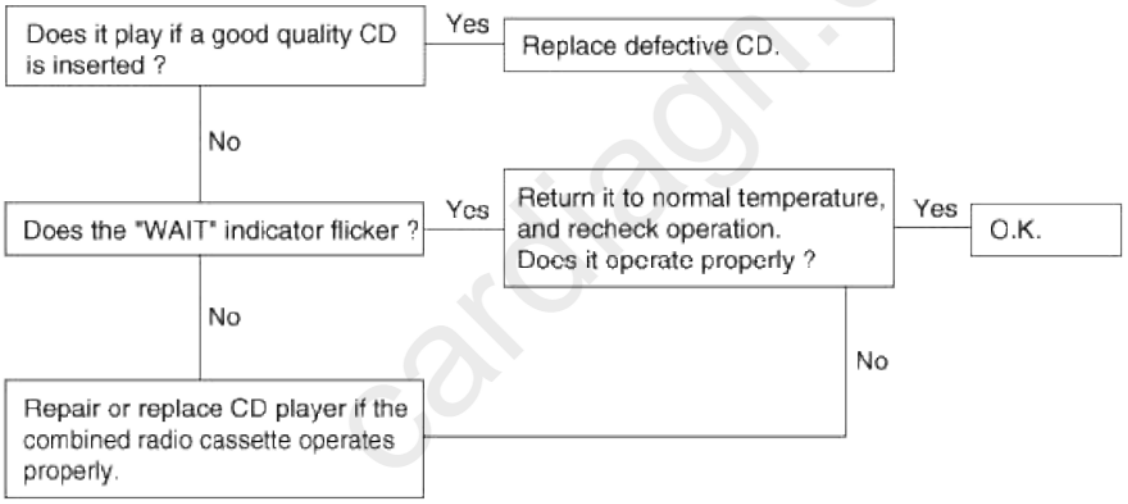
cardiagn.com

Chart 4

1. CD WILL NOT BE ACCEPTED



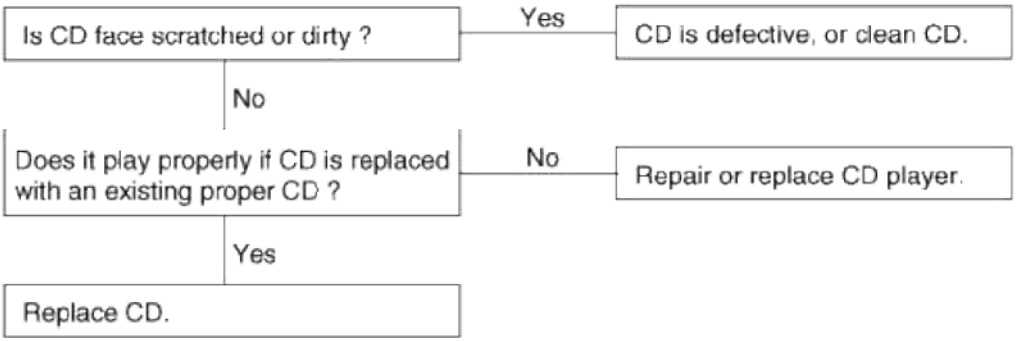
2. NO SOUND



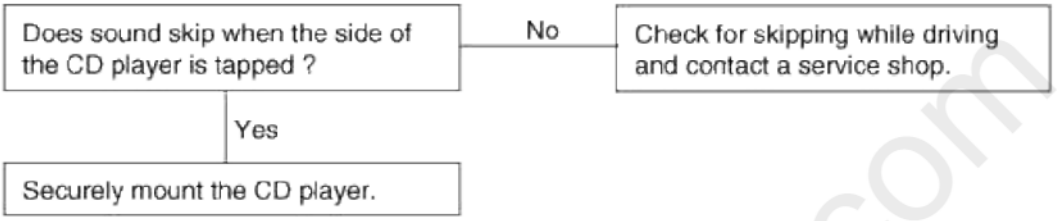
carmagn.com

3. CD SOUND SKIPS

1) Sound sometimes skips when parking.

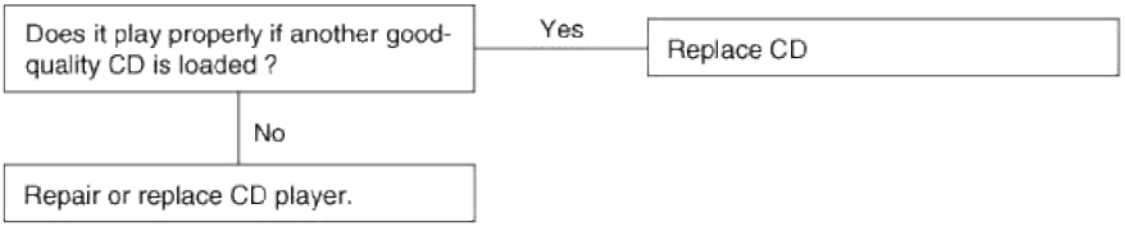


2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)

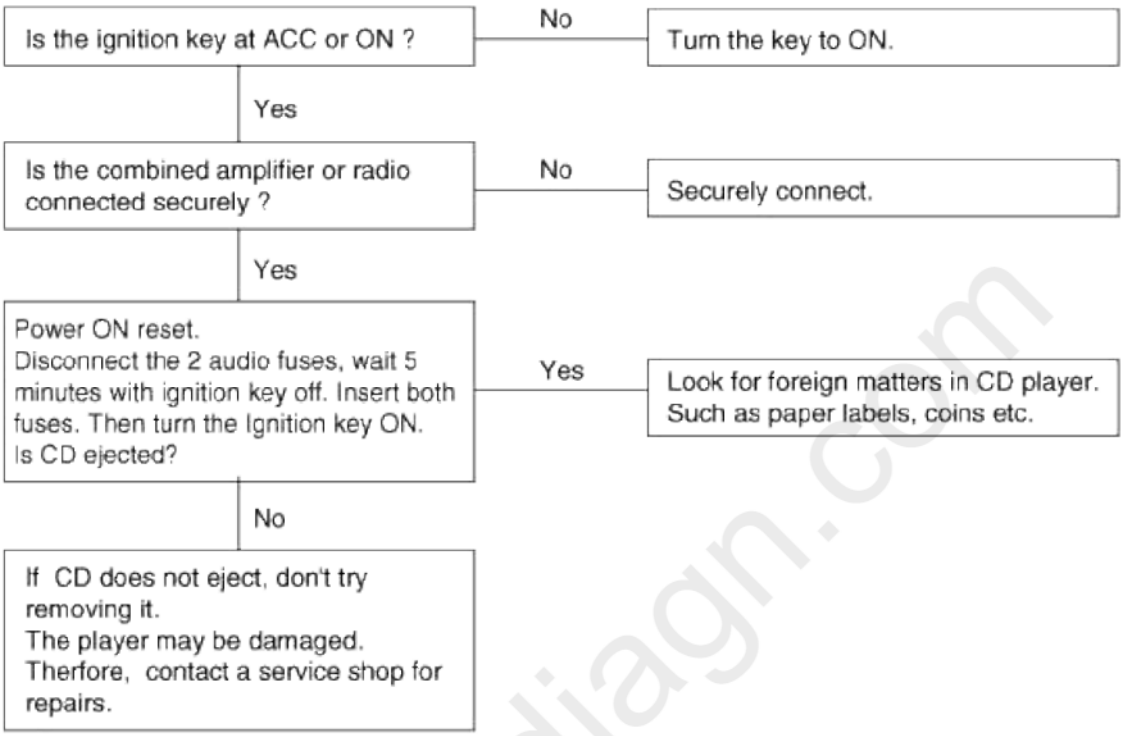


cardiagn.com

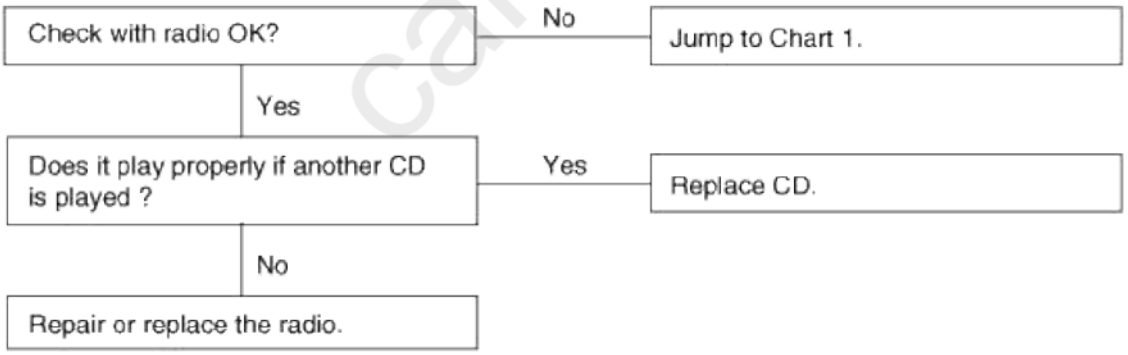
4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER



cardiagn.com

Chart 5

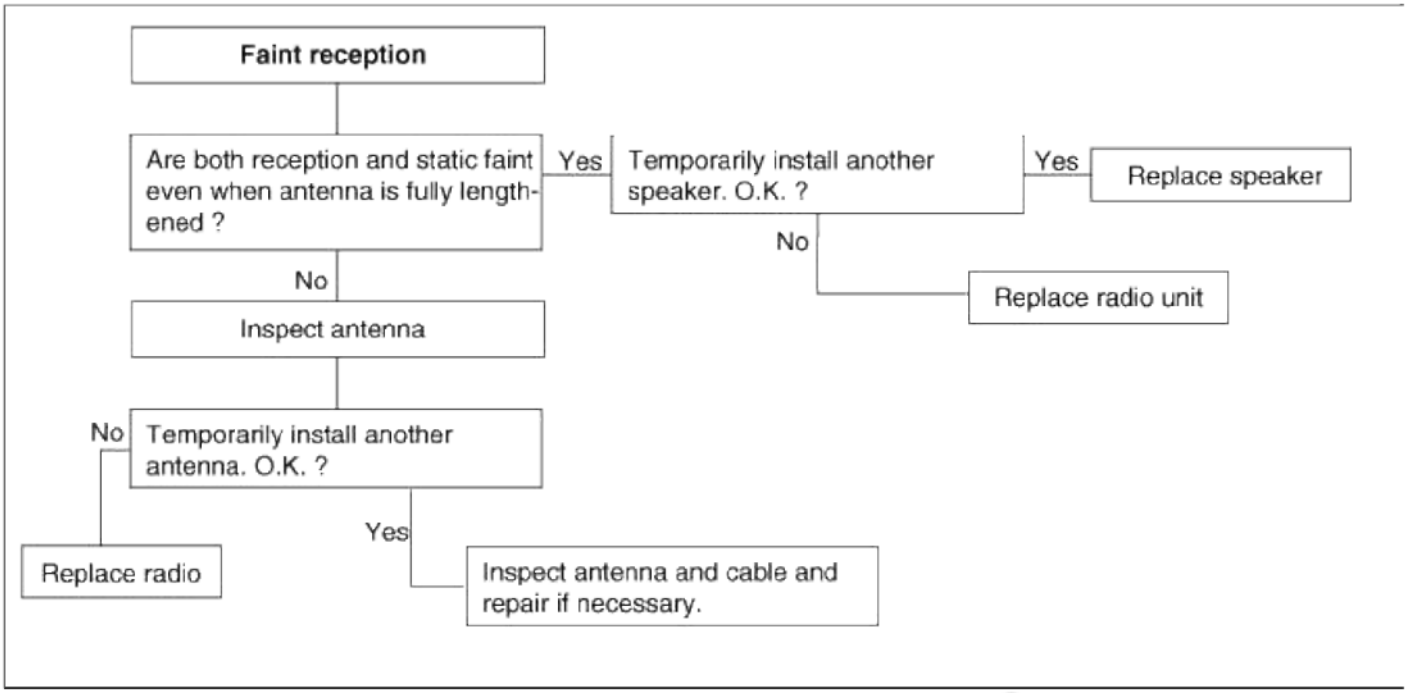


Chart 6

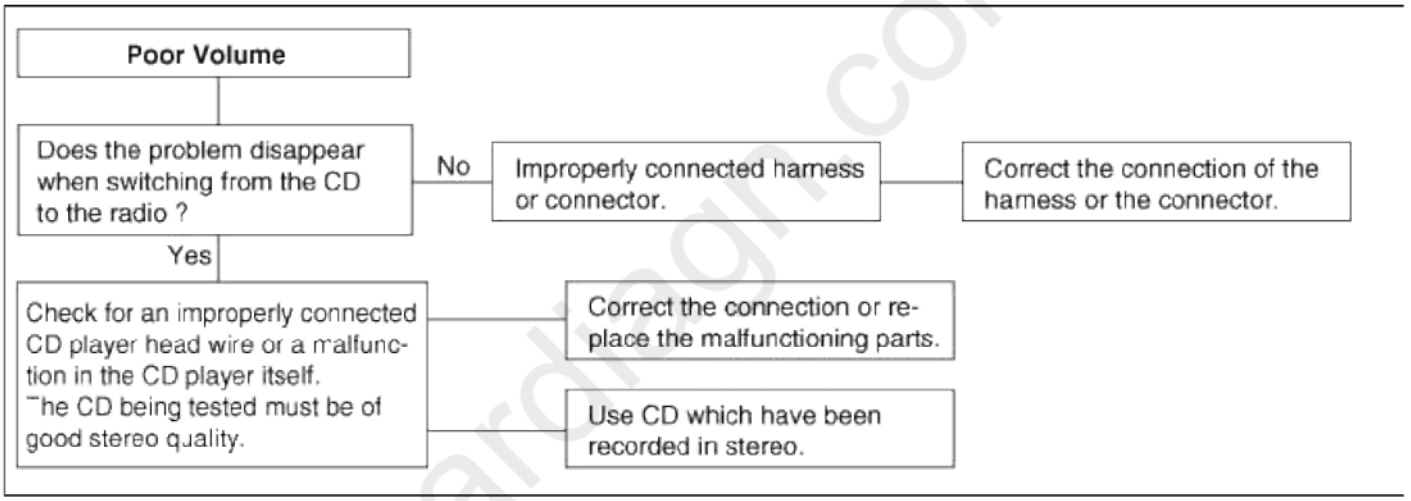
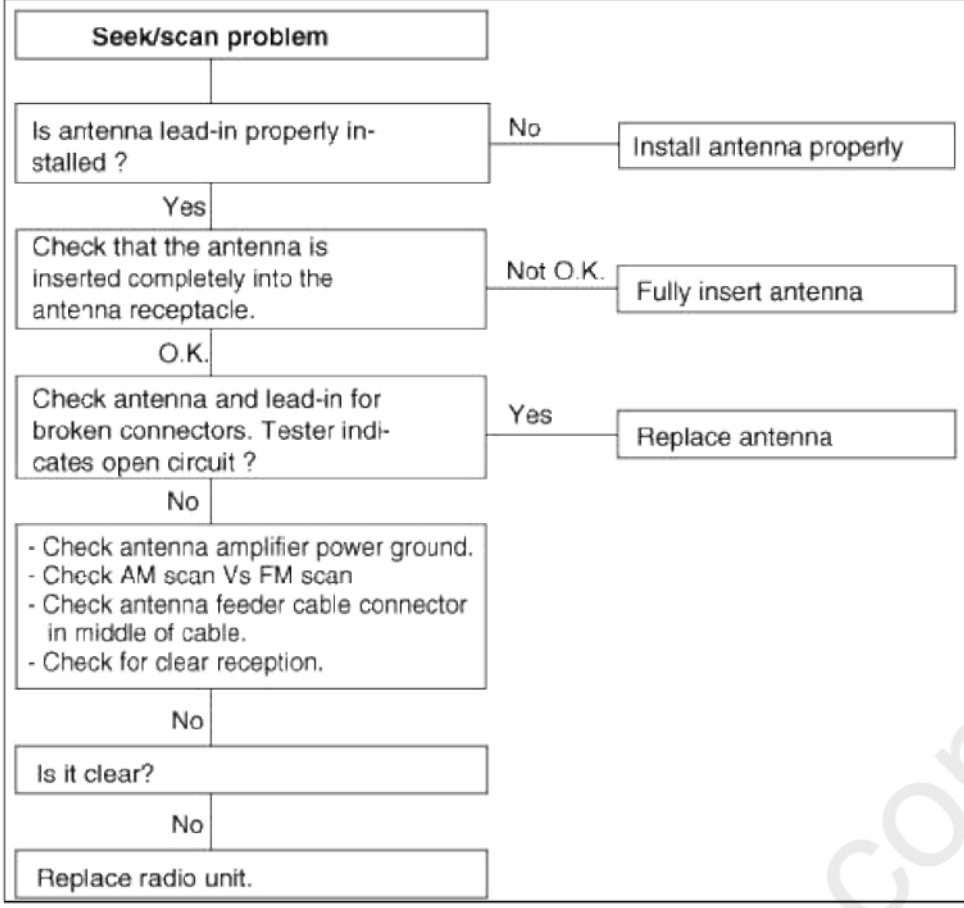


Chart 7

cardiagn.com



Body Electrical System > Multifunction switch > Specifications

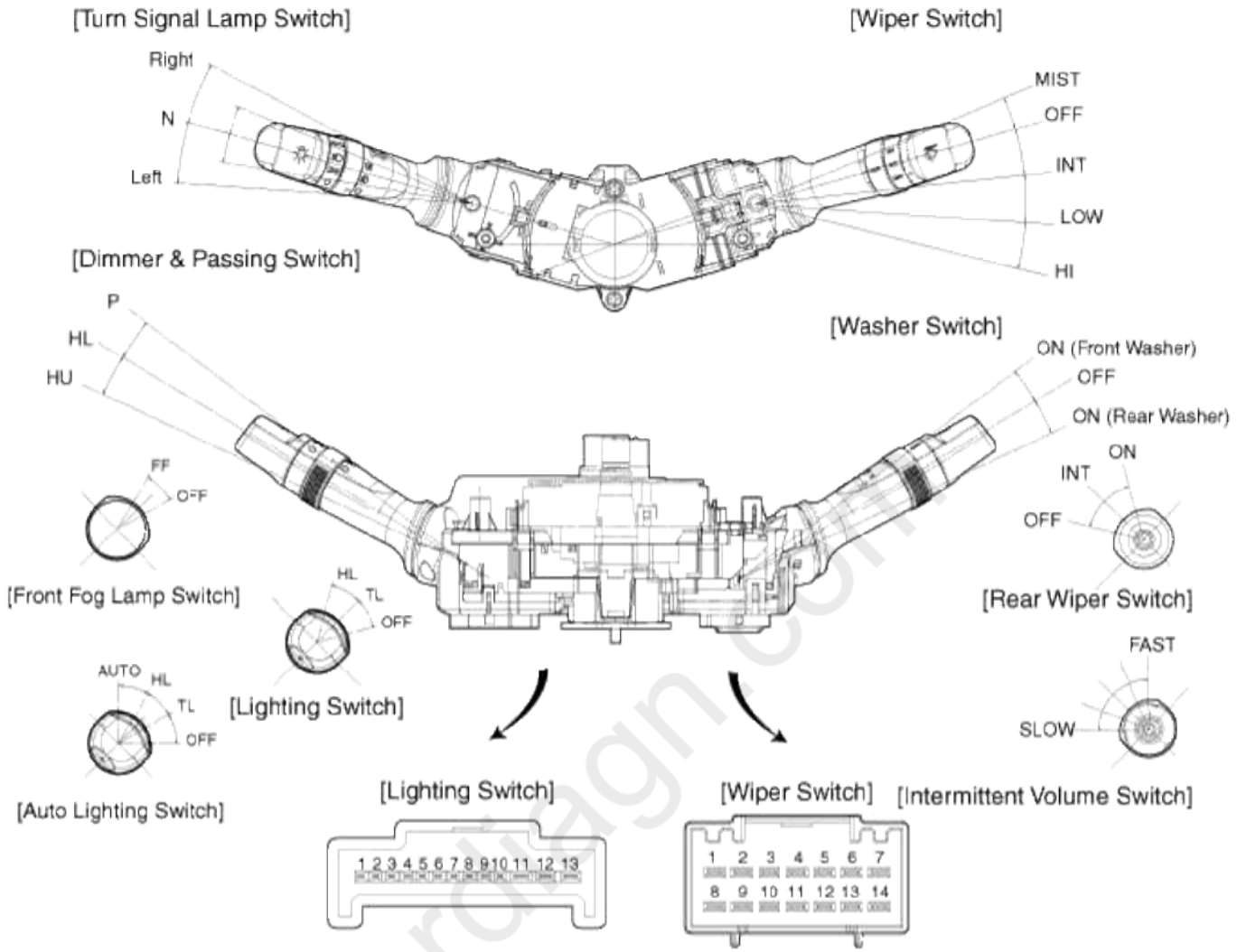
Specifications

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 & rear fog lamp switch	1.0A (Relay load)
	Rear wiper & washer	Wiper : 0.2A (Relay load) Washer : 4.0A (Motor load)

cardiagn.com

Body Electrical System > Multifunction switch > Components and Components Location

Component



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	-
	6	Front fog lamp switch		6	-
	7	-		7	-
	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

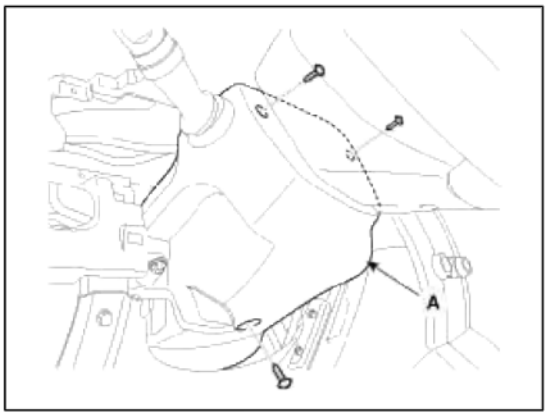
cardiagn.com

Body Electrical System > Multifunction switch > Repair procedures

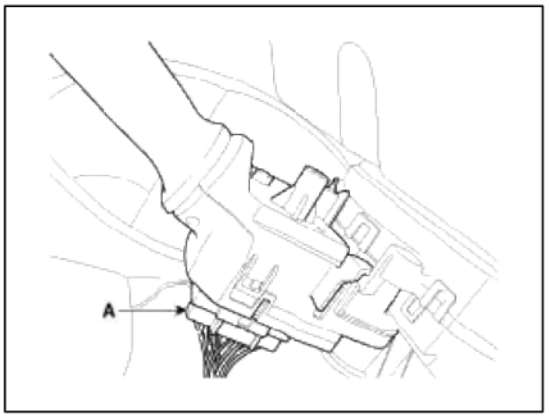
Removal

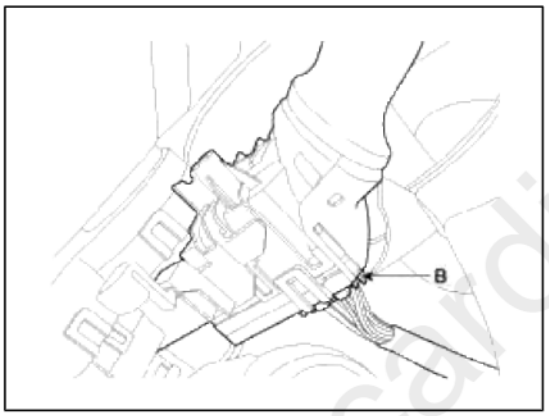
1. Disconnect the negative (-) battery terminal.

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).

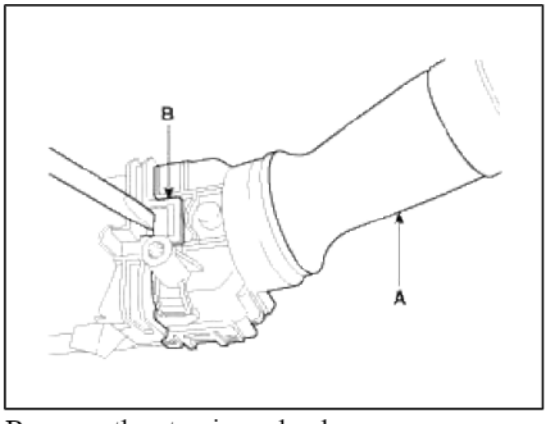




4. Remove the wiper switch (A) by pushing the lock pin (B).

NOTE

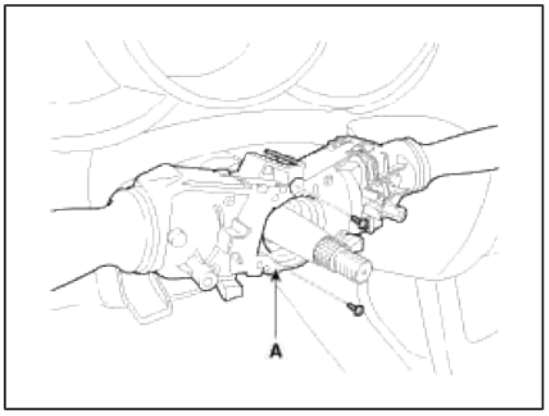
When removing the wiper & washer switch only, release the lock of wiper switch without removing the steering wheel.



5. Remove the steering wheel.
(Refer to ST group - "Steering column and shaft")

cardiagn.com

6. Remove the clock spring.
   (Refer to RT group - "Airbag module")
7. Loosen the screws from the multifunction switch assembly (A).



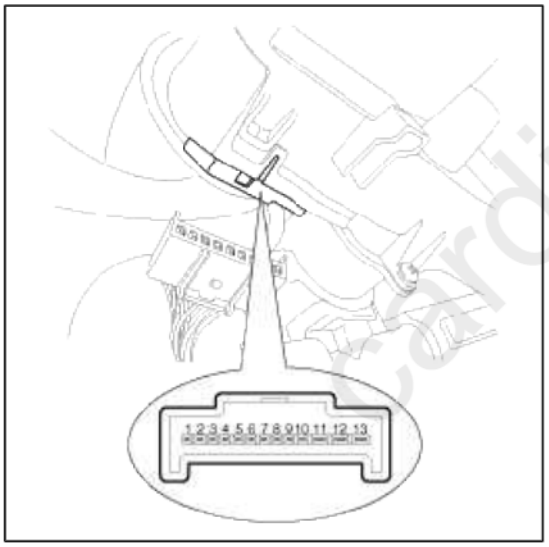
Installation

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

cardiagn.com

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

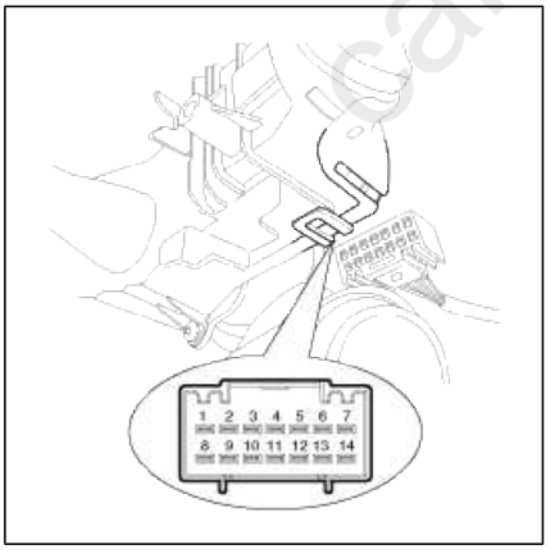
Hazard Switch / Turn Signal Switch / Terminal	13	12	11
OFF — L		○	○
OFF — N			
OFF — R	○	○	

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

carldiagn.com

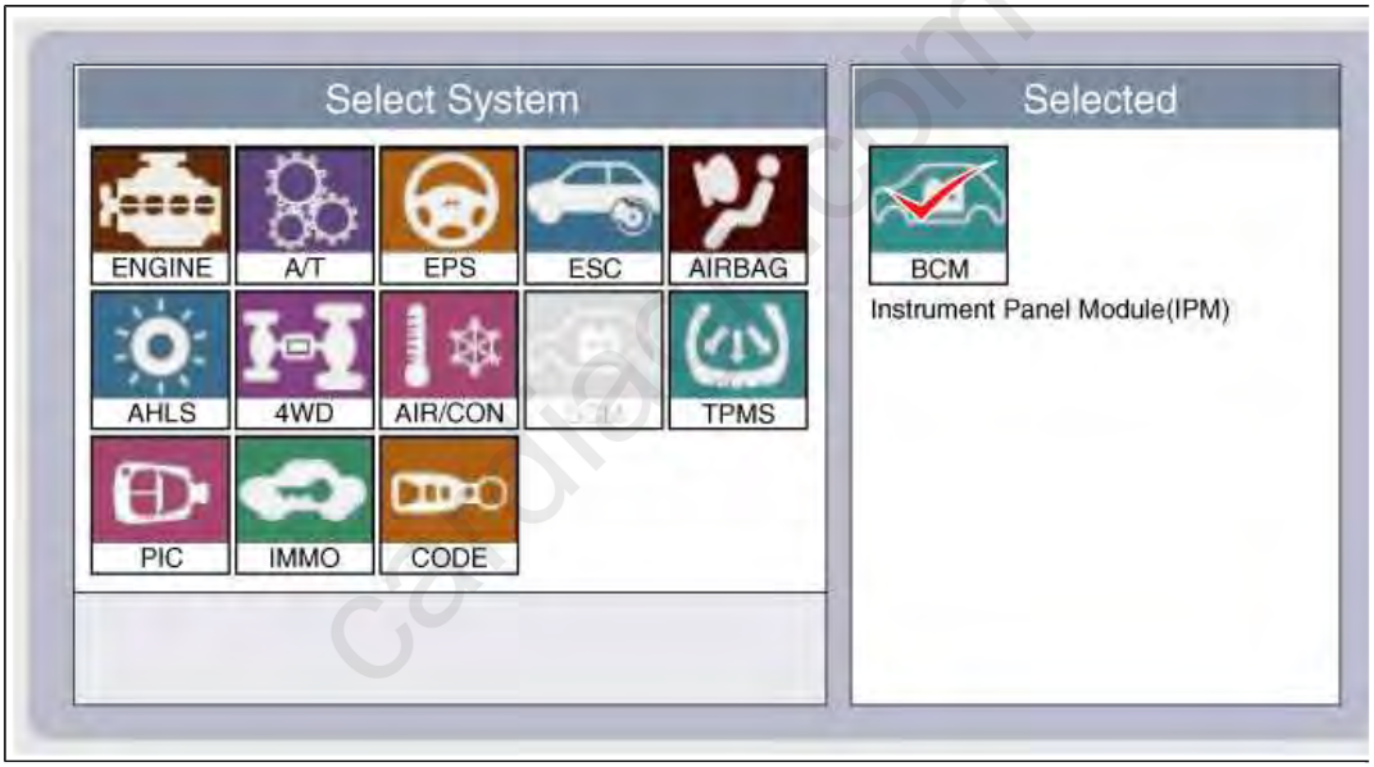
Position \ Terminal	3	9	2	8	10	1	12	13
MIST	○	—	○		○	○		
OFF	○	—	○					
INT	○	—	○	○	○		○	○
LOW	○	—	—	—	○			
HI		○	—	—	○			

Washer Switch

Position \ Terminal	10	11
OFF		
ON	○	○

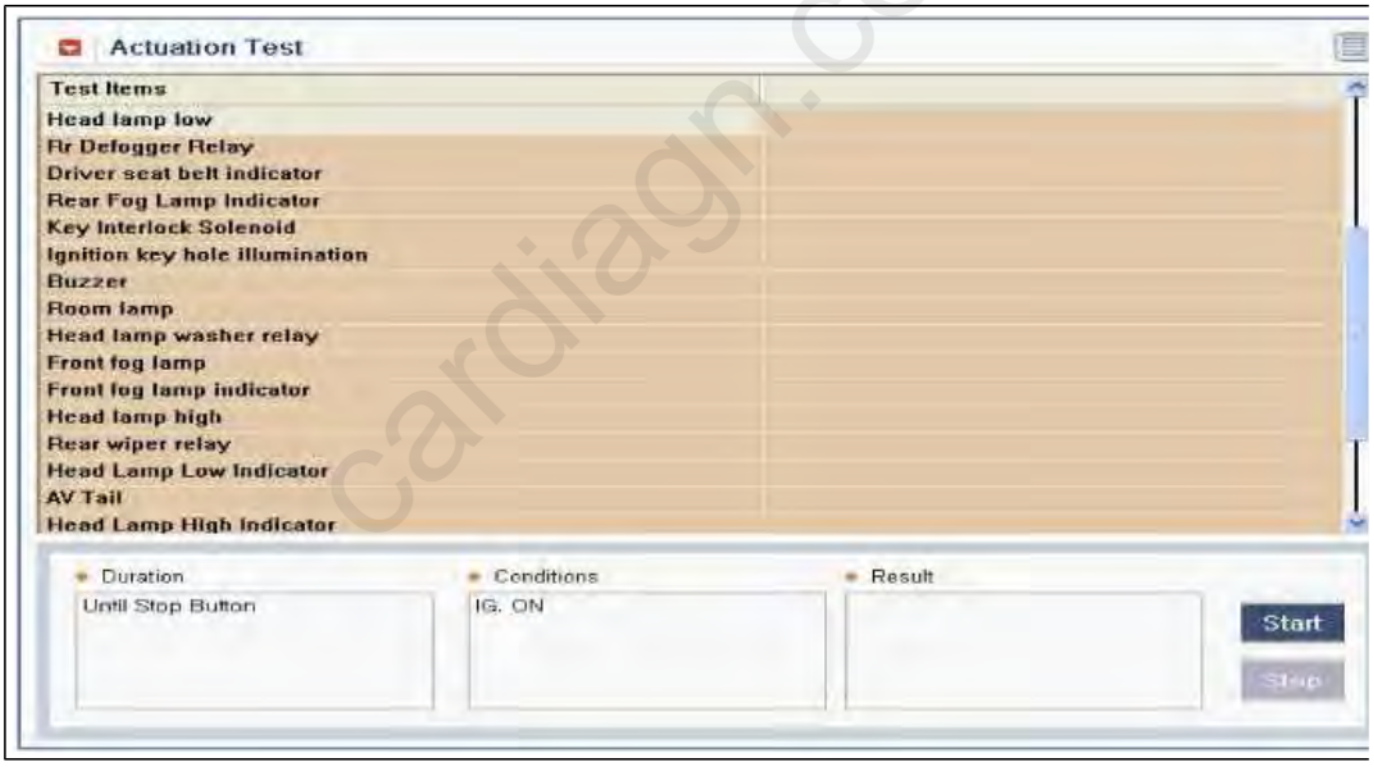
Inspection (With GDS)

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



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

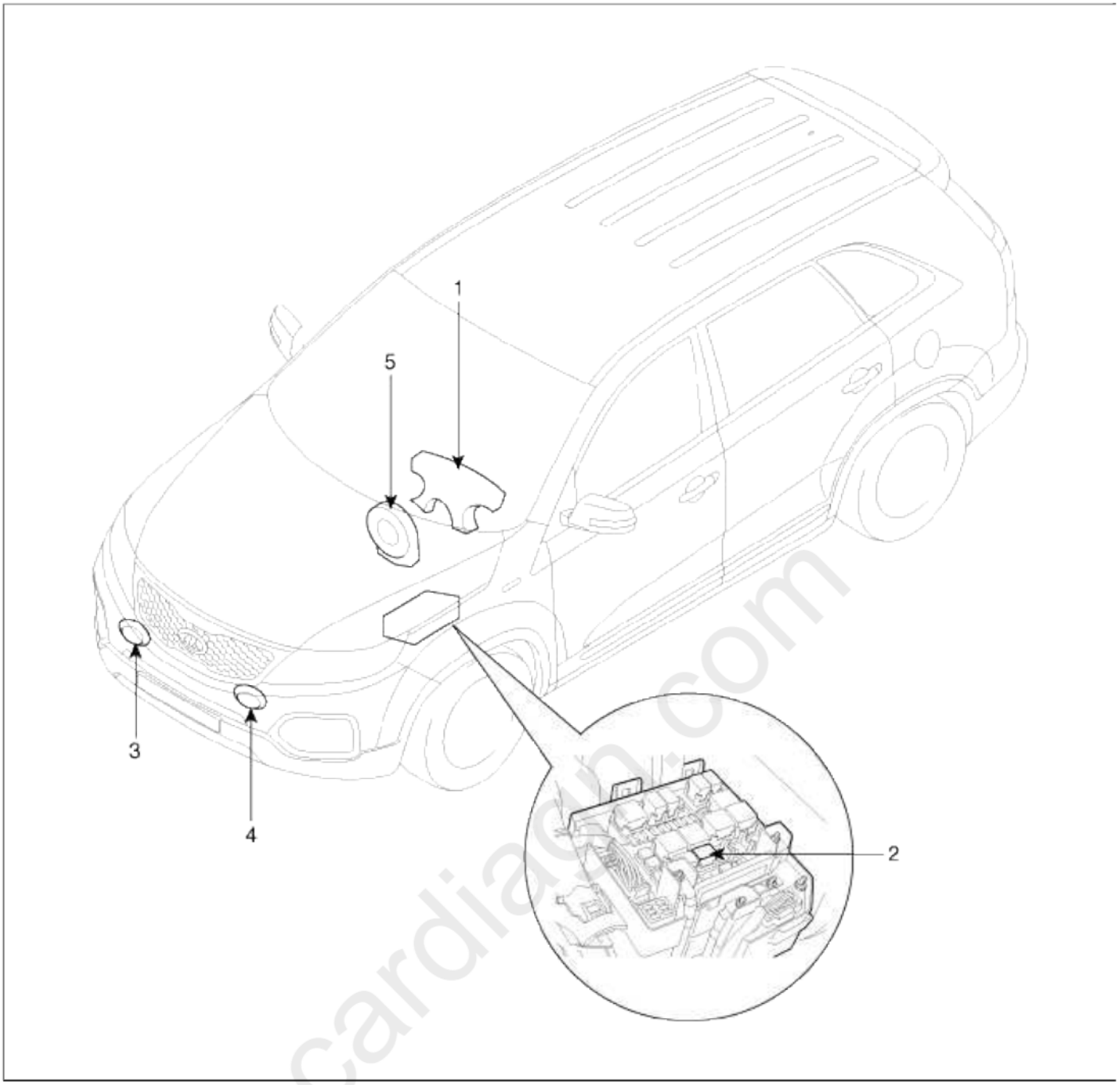
4. To perform test on "Multifunction switch" outputs, select "Actuation test".



cardiagn.com

Body Electrical System > Horn > Components and Components Location

Component Location



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

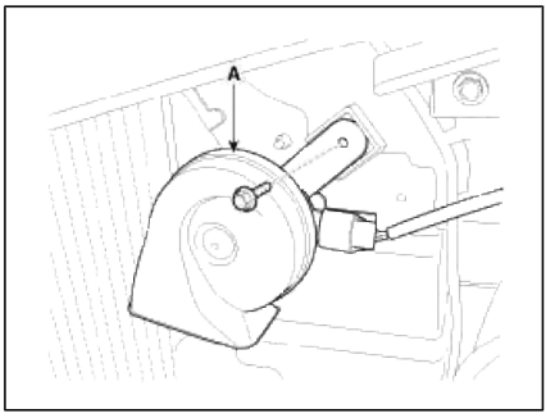
Body Electrical System > Horn > Repair procedures

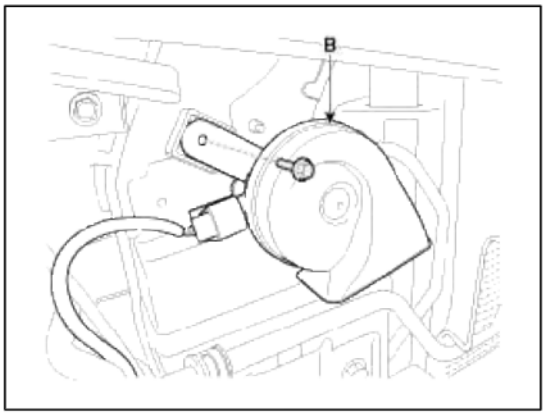
Removal

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

cardiagn.com

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

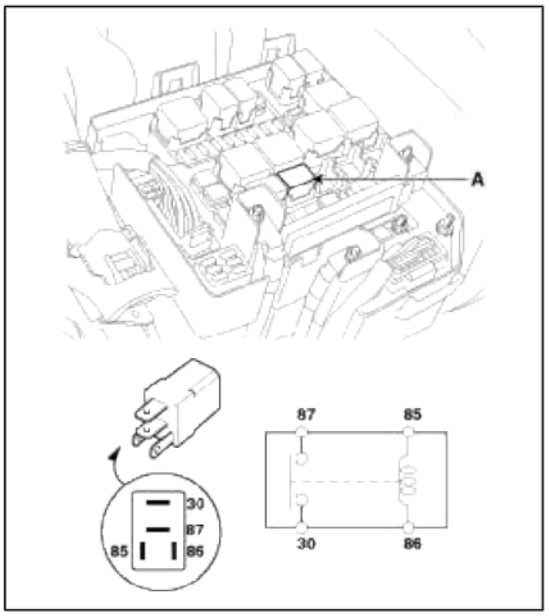
Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The horn should make a sound. If the horn fails to make a sound, replace it.

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 the No.85 and No.86 terminals.

cardiagn.com

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

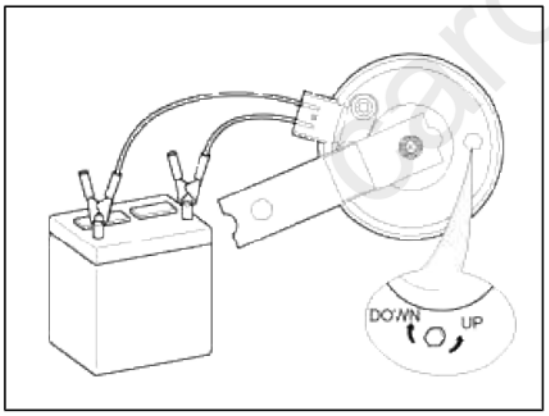


Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Adjustment

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

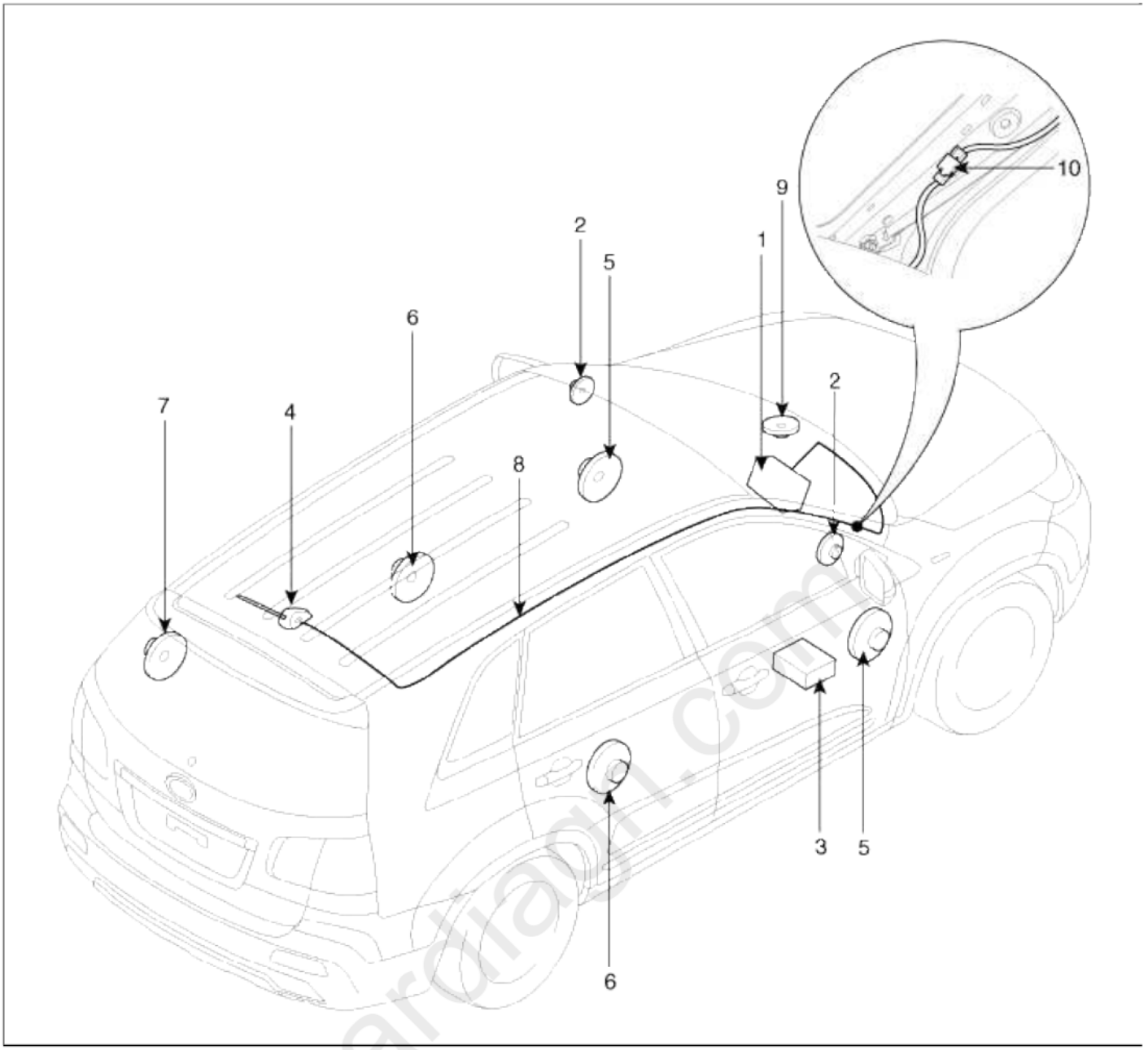
> NOTE
>
> Horn adjustment screw is automatically sealed with silicon sealant.
> The shape and size of the applied sealant is variable and tails or dribbles are acceptable and not to be tampered with.



Body Electrical System > Navigation > Components and Components Location

Component Location

carmanuals.com



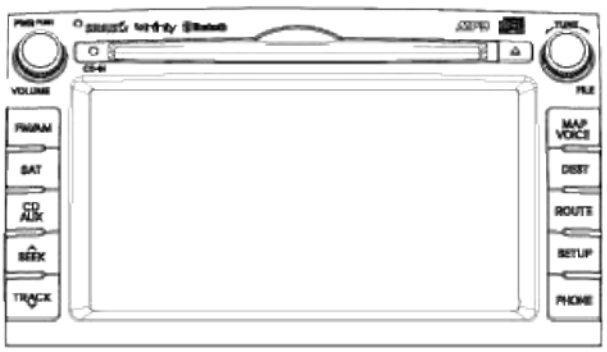
1. AVN head unit (AV & Navigation) 2. Tweeter speaker 3. External amp 4. Roof antenna (Radio+SDARS+GPS) 5.Front door speaker	6. Rear door speaker 7. Sub woofer speaker 8. Antenna feeder cable 9. Crash pad center speaker 10. Antenna cable connector

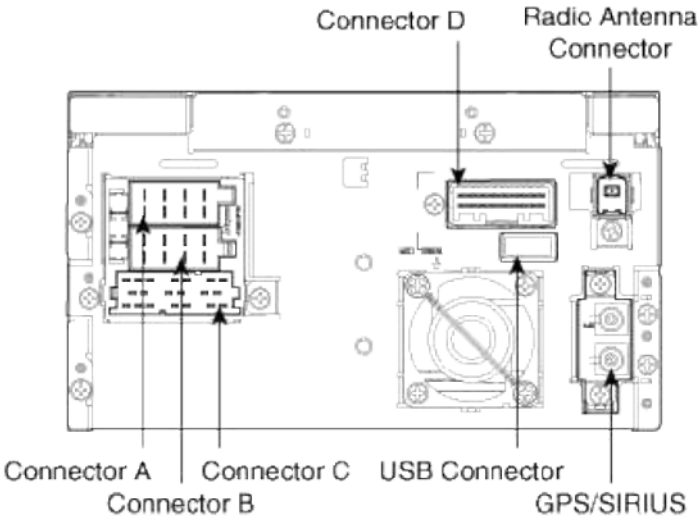
SDARS : Satellite Digital Audio Radio Service

Components

Head Unit

cardiagn.com

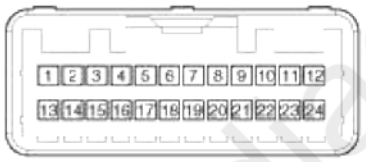




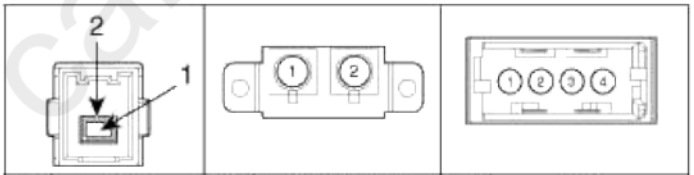
No	Connector A	Connector B
1	Speed signal	-
2	Illumination(+)	-
3	Remote ANT	-
4	Battery(+)	-
5	R	-
6	ACC	-
7	Illuminat on(-)	-
8	Power GND	-

No	Connector C	No	Connector C
1	MIC(+)	11	Aux Input Detect
2	MIC(-)	12	-
3	Aux Input-R	13	-
4	Aux Input-L	14	-
5	Aux V GND	15	Door Unlock
6	-	16	-
7		17	S/Wheel Remote
8	ALT L	18	Aux Video Input
9	Autolight	19	-
10	Aux GND	20	-

Connector D



No	Description	No	Description
1	SDIF Out(+)	13	Camera B(+)
2	SDIF Out(-)	14	Camera P GND
3	SDIF GND	15	Camera CVBS
4	-	16	Camera V GND
5	-	17	-
6	Navi Voice(+)	18	Navi Voice(-)
7	-	19	-
8	-	20	-
9	-	21	-
10	-	22	-
11	-	23	-
12	CAN High	24	CAN Low



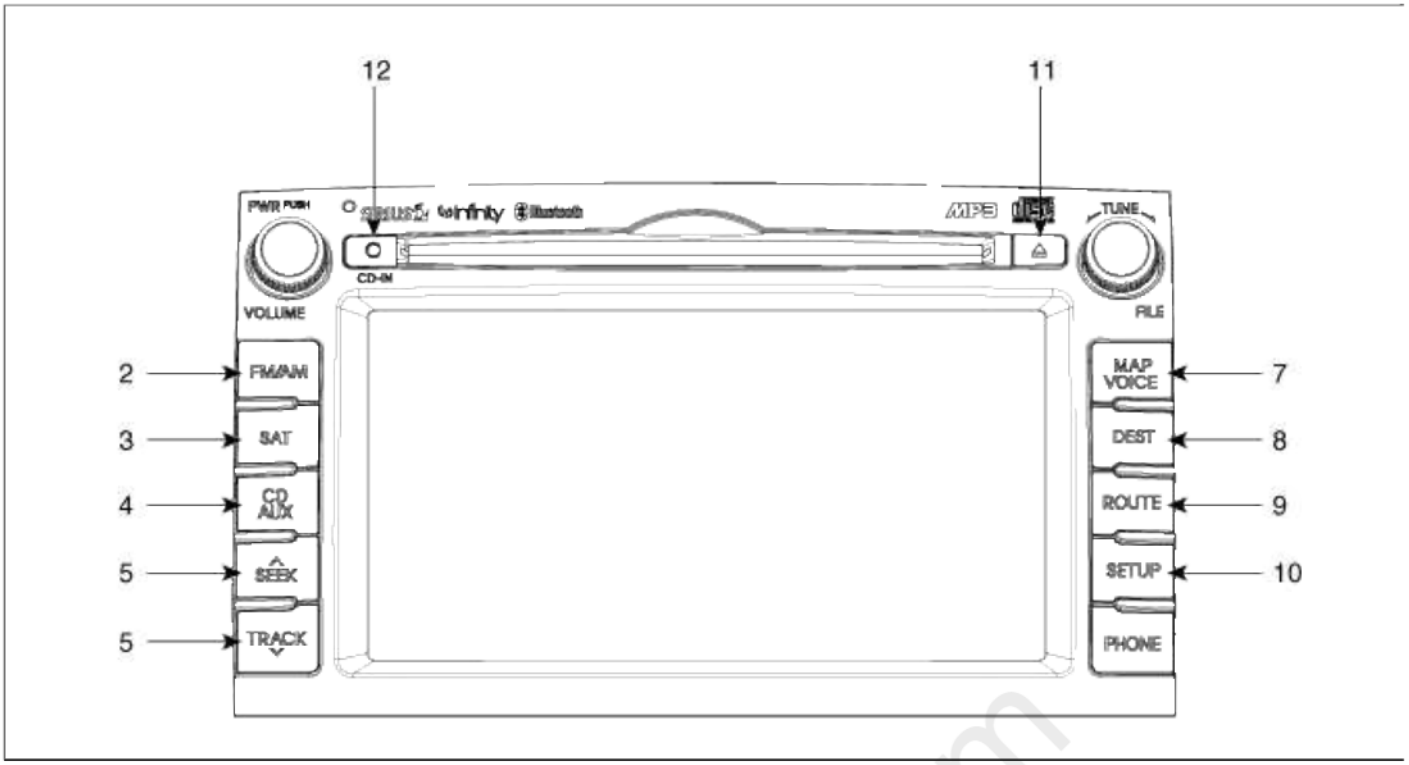
No	Radio	No	GPS/SRIUS	No	USB
1	Signal	1	SIRIUS Signal	1	USB GND
2	GND	2	GPS Signal	2	USB D(+)
				3	USB D(-)
				4	USB VCC

carallstore.com

Body Electrical System > Navigation > Description and Operation

Controls And Functions

Control Panel



1. Power / Volume control Knob
   A. Push knob (over 0.8 second) : Turns the power off.
   B. Push knob (under 0.8 second) : Each time the knob is pressed, the Audio is turned on and off.
   C. Turn knob : The range of volume adjustment is between 0 ~ 35.
2. FM/AM button
   Each press will change the bands in the following order : FM1 → FM2 → AM → FM1
3. SIRIUS button
   Each press will change the bands in the following order : SIRIUS1 → SIRIUS2 → SIRIUS3 → SIRIUS1
4. DISC/AUX button
   Each press will change the bands in the following order : DISC(CD, MP3) → (USB or iPod) →(AUX) →DISC(CD, MP3)
5. SEEK/TRACK Up/Down button
   A. Short key press (less than 0.8 second)
   - FM/AM Mode : Automatically searches for the previous or next broadcast frequencyand starts playing.
   - SAT Mode : Receives the previous or next channel.
   - CD Mode : Plays the previous or next track.
   - MP3, USB Mode : Plays the previous or next file.
   - iPod Mode : Plays the previous or next song.

   B. Long key press (over 0.8 second)
   - FM/AM Mode : Quickly moves through the frequencies while the button ispressed. Once released, automatically searches for broadcasts which can bereceived.
   - SAT Mode : Quickly moves to the previous or next channel.
   - CD Mode : REW/FF the current playing track.
   - MP3, USB Mode : REW/FF the current playing file.
   - iPod Mode : REW/FF the current playing song.

cardiagn.com

6. TUNE Knob
   A. FM/AM Mode : Turn the Knob to search for the desired frequency. Press theKnob to receive the selected frequency.
   B. SAT Mode : Turn the Knob to search for the desired channel. Press the Knobto receive the selected channel.
   C. CD Mode : Turn the knob to search for the desired track. Press the knob toplay the selected track.
   D. MP3, USB Mode : Turn the knob to search for the desired file. Press the knobto play the selected file.
   E. iPod Mode : Turn the knob to search for the desiredsong. Press the knob to play the selected song.
7. MAP VOICE button
   Displays the map screen for the current position.
8. DEST button
   Displays the Destination menu screen.
9. ROUTE button
   Displays the Route menu screen.
10. SET UP button
    Displays the Setup menu screen.
11. RESET button
    Resets the system - if software locks-up.

> NOTE
>
> If holding the power off knob pressed for 0.8 second does not shut down the system,carefully use a straightened paper clip at the access hole shown next to theright DISC indicator LED to reset the software. The system power will shut-off andrestart.

12. DISC insert indicator LED
    Displays that a DISC has been inserted.

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 placed on 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 navigation may differ from the actual position of the vehicle.

carjiagn.com

2. The position of the vehicle on the navigation may be different from the actual position in some of the following conditions. In some cases it may take several minutes to correct the position.
   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 position prior 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 turnable 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 position.
   I. When changing the zoom level from the maximum zoom in level to a different zoom level, the current position mark may be displayed on a different road.
   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 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).
- 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.

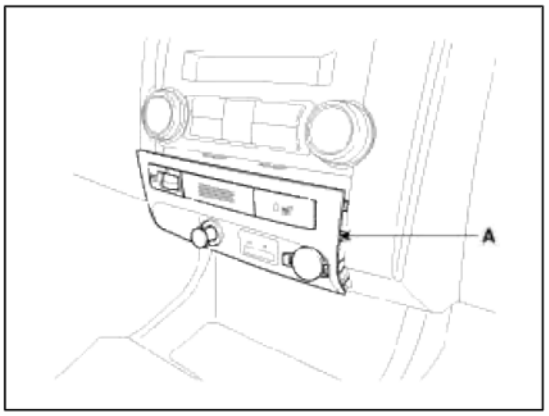
- Guidance may be given to a position differing from the current position when turning at an intersection.
- Route recalculation may take a longer period of time when driving under high speeds.
- A route guidance signaling for a U-Turn in a No U-Turn location may occur.
- A route guidance signaling entrance 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)

cardiagn.com

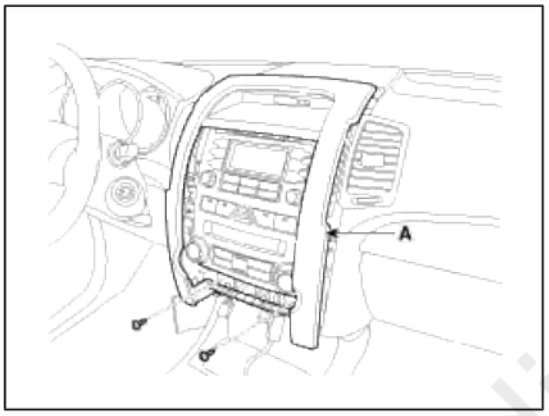
Body Electrical System > Navigation > Repair procedures

Removal

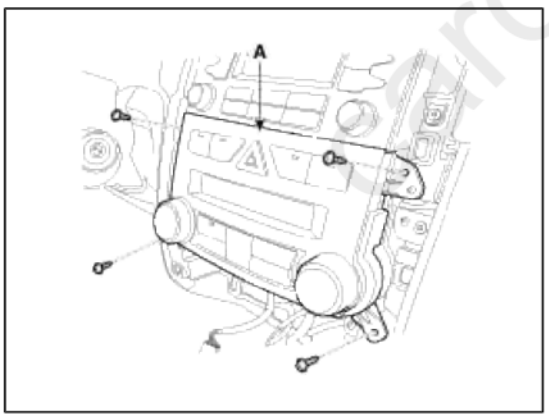
1. Disconnect the negative (-) battery terminal.
2. Remove the floor console upper cover
   (Refer to BD group - "Console")
3. Remove the seat warmer switch module (A).



4. After removing the screws, remove the center fascia panel (A).

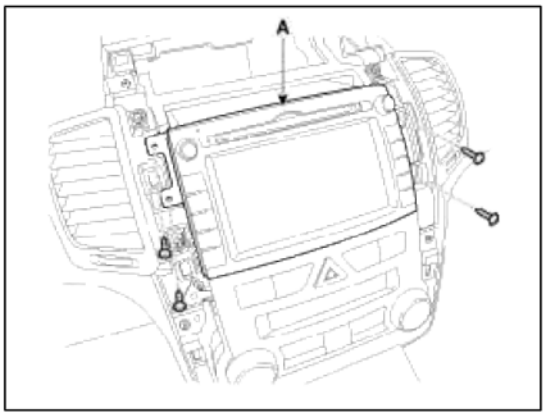


5. After removing the screws, remove the heater control module (A).

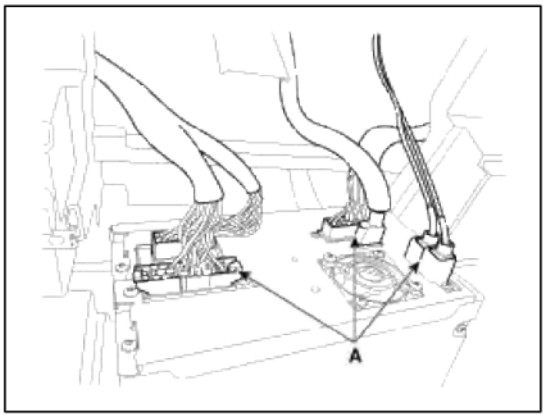


carodiagn.com

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



7. Disconnect the audio connectors and cable (A), then remove the AVN head unit



NOTE

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 heater control module.
4. Install the center facia panel.
5. Install the seat warmer switch module.
6. Install the floor console upper cover.
7. Connect the negative (-) battery terminal.

NOTE

A. Make sure the connector are connected in properly.

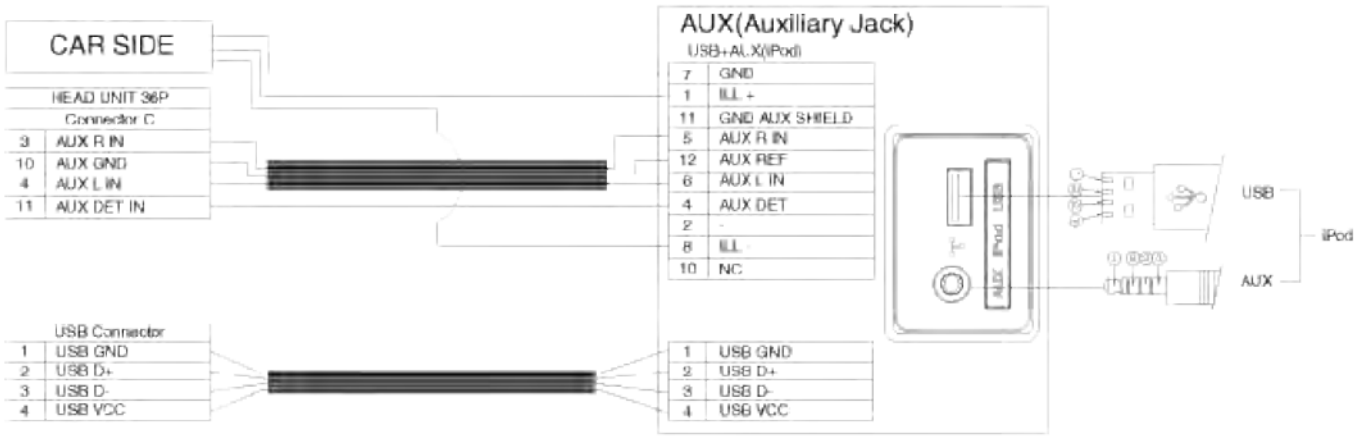
B. Check the audio system.

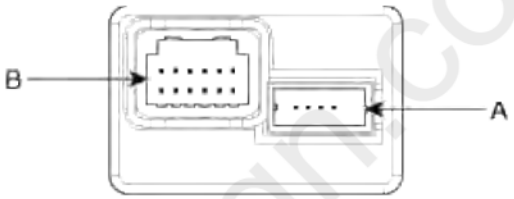
Body Electrical System > Navigation > AUX(Auxiliary) Jack > Schematic Diagrams

Circuit Diagram

cardiagn.com

[AUX, USB, iPod Jack]





Connector A	No.	USB Connector
1 2 3 4	1	USB VCC
	2	USB D (+)
	3	USB D (-)
	4	USB GND

Connector B	No.	AUX(iPod) Connector
1 2 3 4 5 6 7 8 9 10 11 12	1	AUX Input (L)
	2	AUX Input (R)
	3	AUX DET
	4	AUX Video
	5	-
	6	Illumination (+)
	7	AUX REF
	8	AUX Shield GND
	9	-
	10	AUX V GND
	11	Illumination (-)
	12	GND

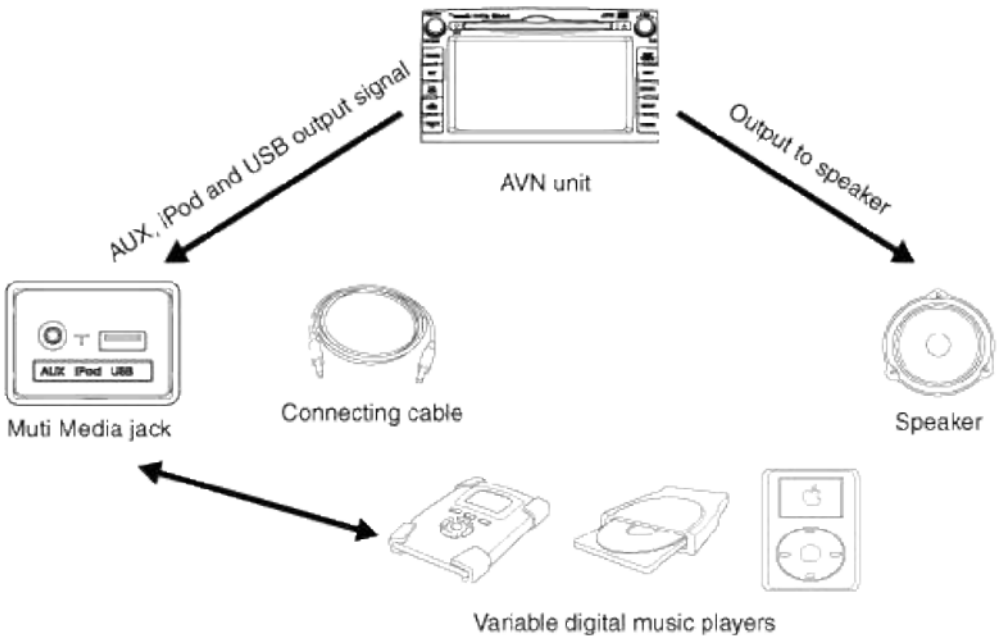
carmanuals.com

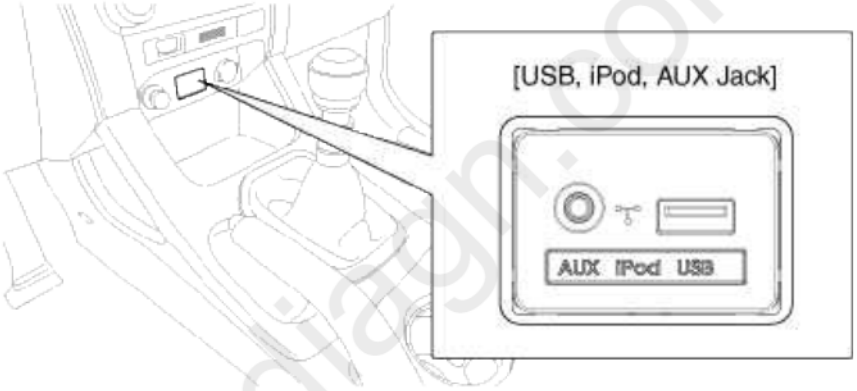
Body Electrical System > Navigation > AUX(Auxiliary) Jack > Description and Operation

Description

The AUX, iPod and USB JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPod, earphone, USB memory stick, CD player and etc., through the vehicle's sound system when it is linked 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 of the used media does not match the specification of the AUX input.



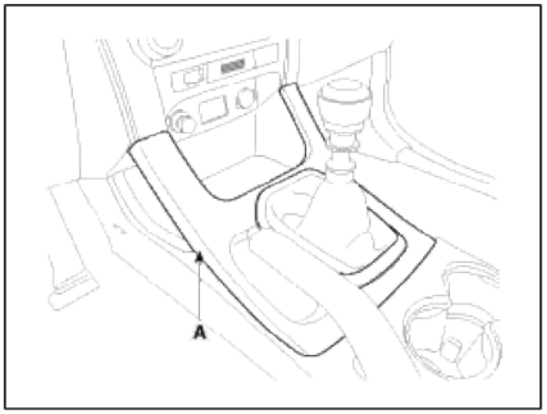


cardiagn.com

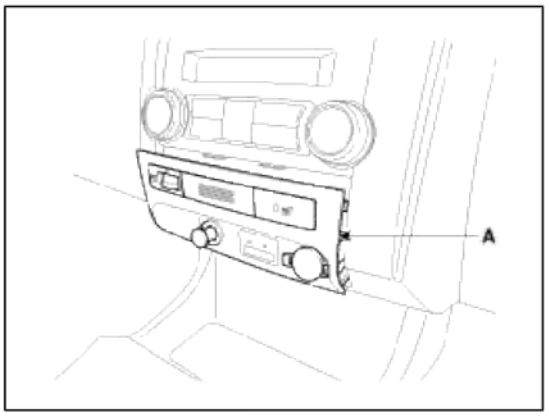
Body Electrical System > Navigation > AUX(Auxiliary) Jack > Repair procedures

Removal

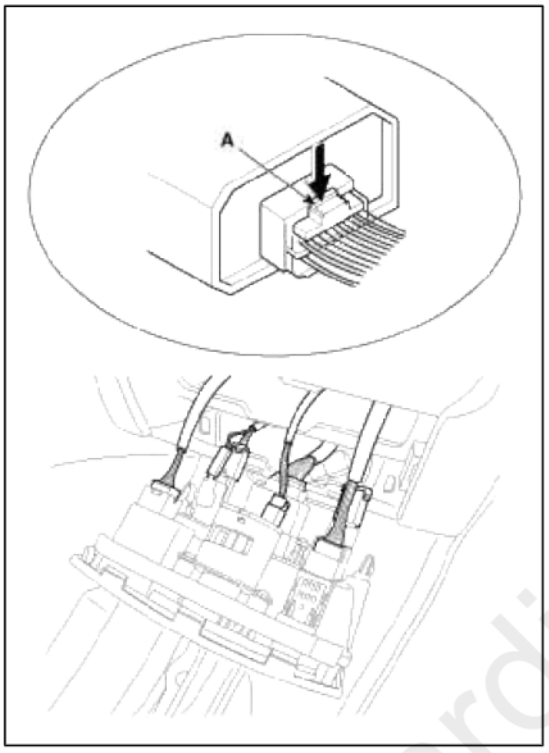
1. Remove the shift lever knob.
   (Refer to BD Group - "Console")
2. Remove the floor console upper cover (A).



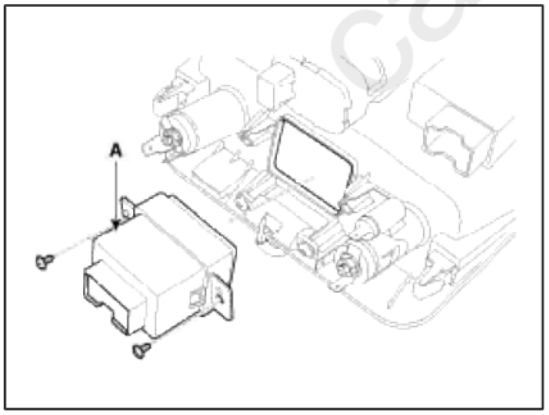
3. Remove the seat warmer switch module (A).



4. Disconnect the connectors (A) from the seat warmer switch module.



5. Remove the Multimedia Jack (A) from the seat warmer switch module after loosening the mounting screws.



Installation

1. Install the Multimedia jack.
2. Install the seat warmer switch module.
3. Install the console upper cover.

Body Electrical System > Navigation > Troubleshooting

cardiagn.com

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 actual 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 density, 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 is a normal phenomenon with LCD panels. It is not a malfunction. • If the screen is very dark, contact your point of purchase or the nearest service center.
Sound is working from only one speaker	• Is the position of FAL/BAL sound controls or volume adjusted to only one side?
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 the phonetic spelling. This will continuously be update with the map datebase.

Troubleshooting

Problem	Possible Cause	Solution
The power does not turn on.	The fuse is disconnected.	Replace with a suitable fuse. If the fuse is disconnected again, please contact your point of purchase or service center.
	Device is not properly connected.	Check to see that the device has been properly connected.
SIRIUS only goes through one category	The SIRIUS mode is in category.	Press the mode button to change to channel mode.
The DVD 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 clean dirt and other foreign substances from the DISC.
	The vehicle battery is low.	Charge the battery. If the problem persists, please contact your point of purchase or service center.

cardiagn.com

	A disc which is not supported by the device has been inserted.	Insert a disc which is supported for play by the device.
The video does not work.	The brightness level has been set to the lowest level.	Adjust the brightness to a highter level.
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 mode.
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 a disc which has been scrached. • The sound may be short-circuited and the image distorted if the device begins to vibrate. The device will return to normal operation once the vibration has stopped. • Aging of the video display and deterioration in performance may cause certain quality degradations.
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 12/16/32 format. • Remove any foreign substances on the contact surface of the USB memory and multimedia terminal. • Directly connect the USB memory with the multimedia terminal on the vehicle. • Directly connect the USB memory with the multimedia terminal on the vehicle. • Use a standard USB memory. • Use a standard USB memory. • Only MP3, WMA file formats are supported. Please use 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 the iPod. • Use iTunes to update the firmware version and reconnect the iPod with the device. • Reset the iPod and reconnect with the device.

Body Electrical System > Smart key System > Specifications

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)
Load	Max. 2mA

RF Receiver

Items	Specification
Frequency	315 Mhz
Antenna type	FSK (Frequency Shift Keying)

Smart Key Fob

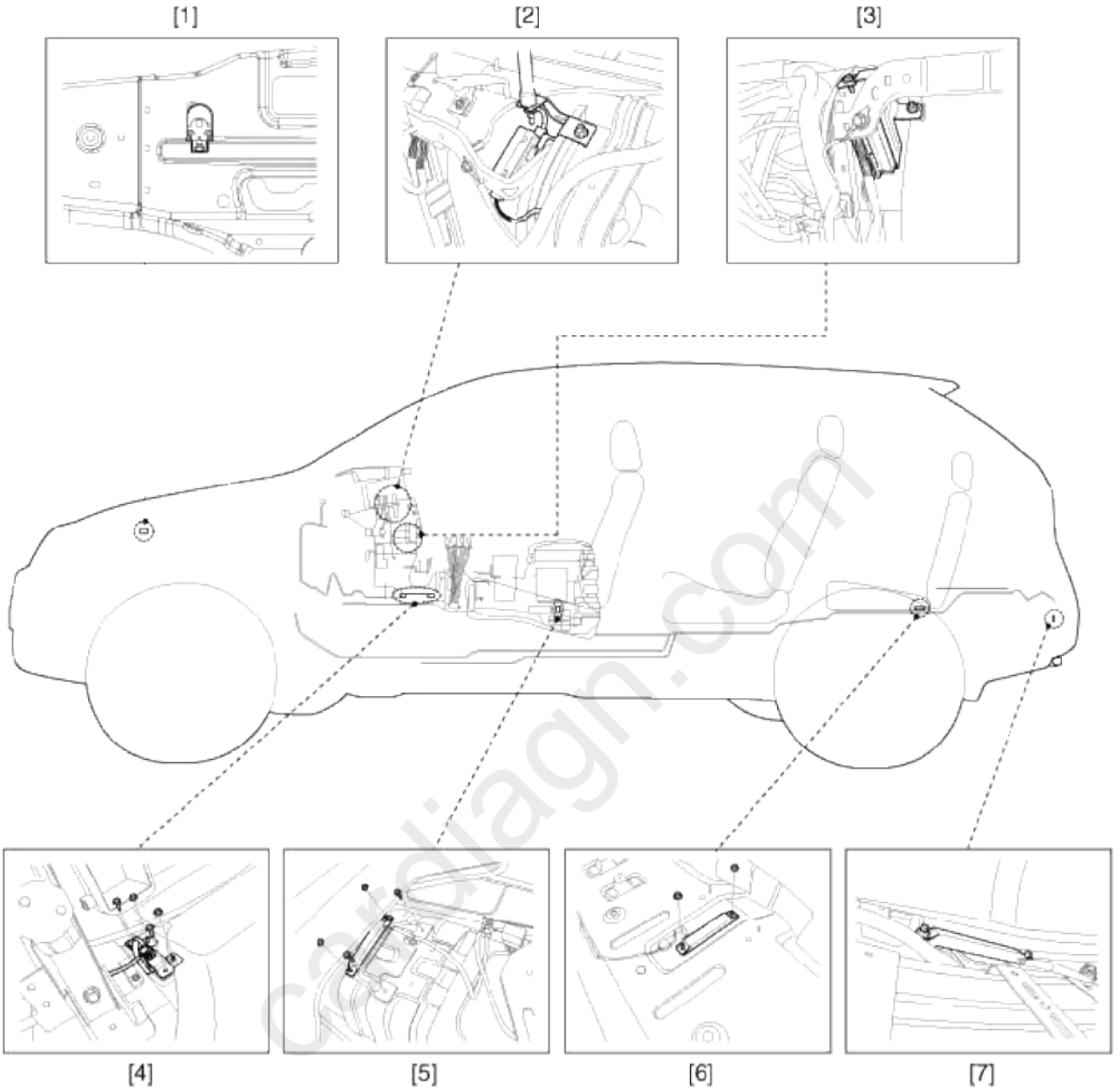
Items	Specification
Battery	Lithium battery 3V
Distance	30m
Battery life	More than 2 years WARNING An inappropriately disposed battery can be harmful to the environment and human health. Dispose the battery according to your local law(s) or regulation.
Push buttons	4 (Door lock / unlock, Tailgate, Panic)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

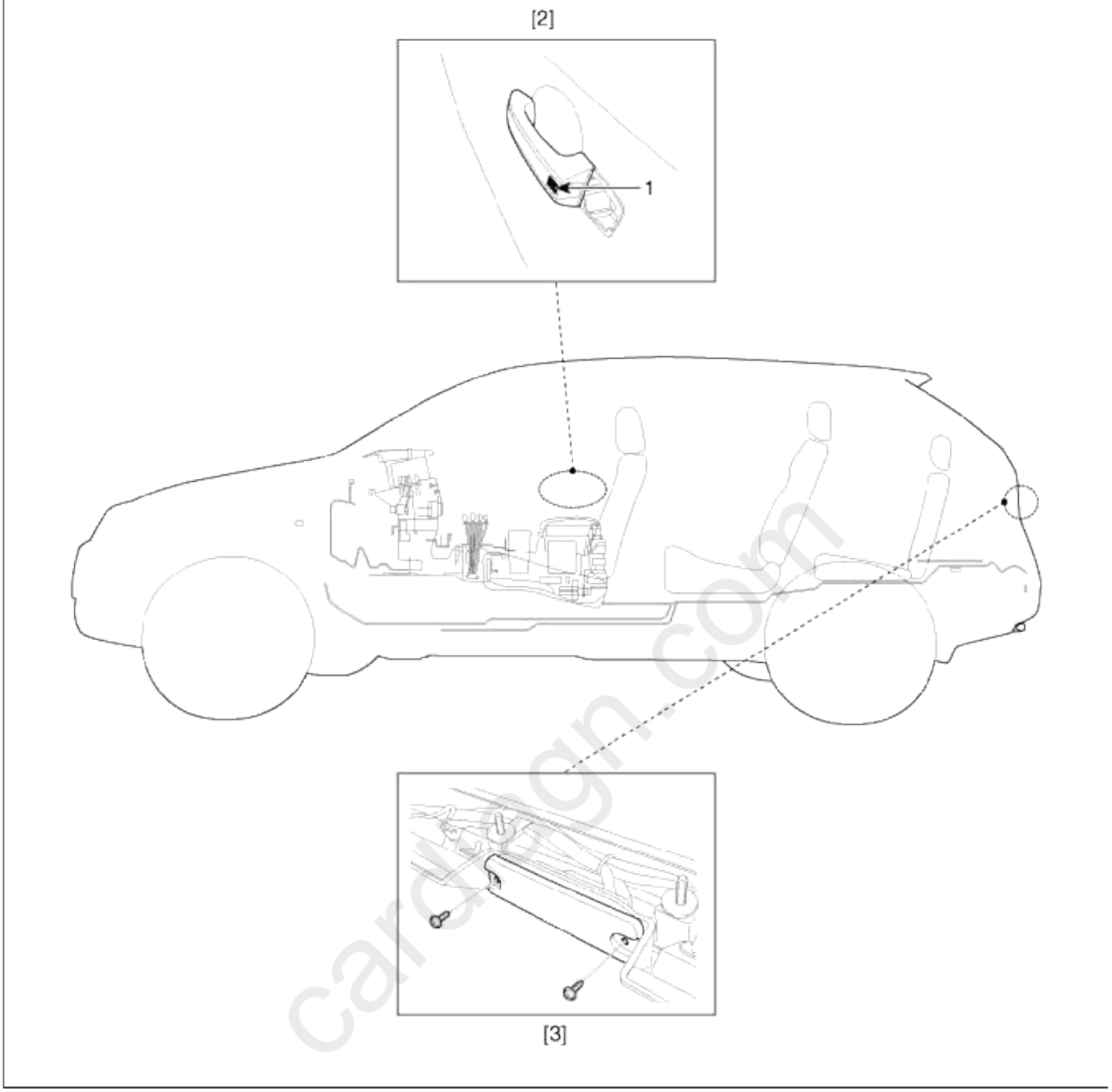
carmanualsonline.com

Component Location (1)



1. Buzzer 2. RF receiver 3. Smart key unit 4. Interior antenna 1	5. Interior antenna 2 6. Interior antenna 3 7. Bumper antenna

Component Location (2)



1. Door outside handle button 2. Door outside handle	3. Tailgate switch

Body Electrical System > Smart key System > Description and Operation

Description

The SMART KEY system is a system that allows the user to access and operate a vehicle in a very convenient way. To 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 RKE 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 request, it automatically sends a response to the vehicle. Then the system decides whether to perform a particular

action (unlocking, locking…) or remain inactive.
Again, a communication between the vehicle and the SMART KEY FOB is needed before any actions will be performed.
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
- Max. 2 fobs can be handled by the system
- Immobilizer backup antenna driver integrated into FOB-HOLDER 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 FOB. 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 inserting the key into the FOB HOLDER.

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

- Power supply
- Microcontroller with FLASH Memory
- Single Line Interface to SRX
- Single Line Interface to EMS
- Input stage
- LF antenna amplifier/driver
- CAN communication with BCM
- LIN communication with other unit (depending on platform)

The LF antenna amplifier/driver generates a 125 kHz sinusoidal carrier signal which is distributed to the different antennas.
Smart Key FOB

carjdiagn.com

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 6 push buttons.
- Transponder-functionality in case of a flat battery or a disturbed communication.
- LED for operation feedback and battery monitoring.

NOTE

The FOB's LED indicator may continue to light even with a low transmitter battery.
If the performance or range of the FOB is less than expected, check the transmitter battery.

Antennas

1. Emitting LF Antennas:
   Inductive antennas in and at the vehicle are used to transform the current, driven by the SMK ECU antenna driver, into a 125 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 around the doors; one antenna in the rear bumper covers the area around the tailgate.
   Two antennas cover the vehicle's exterior: two antennas in the Door Handles (DS and PS) cover the area around the doors.
   Up to three antennas cover the vehicle's interior and the tailgate interior: two in the passenger compartment and one in the tailgate.
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).
3. External Receiver
   The SMART KEY FOB's response is received via the external RF receiver, which is connected to the SMK ECU via a serial communication Line.
   The SMK ECU provides a connector pin for the serial communication Line.

Door Handle

The front door handles of the two doors (driver door / passenger door) are equipped with emitting LF-antennas to emit the 125 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.

Operation

Passive Functions

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

Operating Range

The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the below given picture.
The SMART KEY FOB receives and interprets a challenge sent from the vehicle via the exterior antennas in a free space range of min. 0.7m measured around the exterior antennas which are integrated in the door handles; refer to the below given 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 the vehicle and thus triggers the system for unlock

cardiagn.com

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 triggers the system. Subsequently, the SMK ECU sends a LF-challenge to the SMART KEY FOB via the exterior bumper antenna. The SMART KEY FOB answers with a RF-response. If the received response matches the expected answer, SMK ECU 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 100ms, as long as CAN/LIN active.
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 message with the fob number.
   If any valid fob has been found, SMK unlocks the vehicle by sending a CAN/LIN Key Reminder unlock message with the fob number.

Smart Key Reminder 2

1. Preconditions:
   All terminals OFF & any door (including tailgate) open & no FOB-IN & no locking status (checked by SMK periodically every 100ms, as long as CAN/LIN active)
2. Vehicle action:
   Closing last door or tailgate 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 warning.
   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) & (tailgate closed)

cardiagn.com

2. Event:
   A. User presses the push button in door handle or tailgate
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 for "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 .
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 for "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 of the 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 the 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 the vehicle; the same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication); 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 and will 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) perform another search 3 seconds later; if no door is open then it’s only at the next When the preconditions are still valid, the search resumes by opening of one door.

Failsafe Functions (Backup For Limp Home)

In case of a discharged battery of the SMART KEY FOB or disturbed transmission, the following functions are available:

- Unlocking / locking of doors or tailgate (or tailgate depending of the vehicle configuration): use of mechanical key

User Information Functions

ID OUT Warning

1. Preconditions:
   A. (ACC or IGN1) & (any door open or tailgate open)
2. Event:
   The last opened door is closed

cardiagn.com

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 via CAN (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 authentication and stops the warning. If the terminal is in ACC, SMK shall turn on immobilizer lamp.

NOTE

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

To detect fob low battery condition, certain battery voltage measurement and low voltage detection strategy are implemented into fob. The measurement of the battery voltage will be done if fob button is pressed or if a LF measurement command is 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, PDM and FOBs is described.

For the learning of the SMK, PDM 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 be known.

Teaching MODE

This mode is used by the dealers in order to replace SMK and/or PDM and/or the set of keys, or to register additional keys for an existing system. That means the system already has been learnt with certain PIN Code. The PIN Code is fixed for the life time of the 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, PDM and SMART FOB are already learnt with same PIN code
- PDM replacement: PDM is not learnt, SMK and SMART FOB are already learnt with same PIN code

cardiagn.com

- Additional or new keys teaching: SMK and PDM are already learnt with same PIN code

Smart key teaching

Insert smart key #1 to key holder
↓
SMK start to learn
↓
Input the PIN code
↓
PDM start to learn
↓
Smart key #1 learnt
↓
SMK/PDM learnt
↓
Pull out smart key #1
↓
Insert smart key #2 to holder
↓
Smart key #2 learnt

- Smart key and transponder are programmed simultaneously.

<Smart key neutralization mode>

- Neutralization mode is for replacing Smart key unit, PDM ECM easily.
- It is possible that smart key is learnt again, after neutralizing Smart key system.
- Virgin start (twice ignition) is impossible in neutralized condition

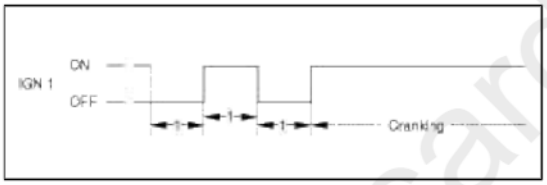
<Lock by timer>

- If PIN code is inputted over 3 times, it is impossible to learnt and neutralization during 1 hour.

Starting After Replacing (Virgin Start)

Starting is possible by following process after replacing new smart key unit , PDM, FOB key.

- It is for starting at virgin condition
- All related parts are virgin condition (Smart key, IPM, PDM, ECM)
- When virgin smart key is inserted in smart key holder, possible to start, IG ON and ACC position
- Press brake pedal in P or N range
- After inserting virgin smart key to holder, push start button once.



cardiagn.com

Body Electrical System > Smart key System > Repair procedures

Inspection

Self Diagnosis With Scan Tool

It will be able to diagnose defects of SMART KEY system with GDS quickly. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.

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

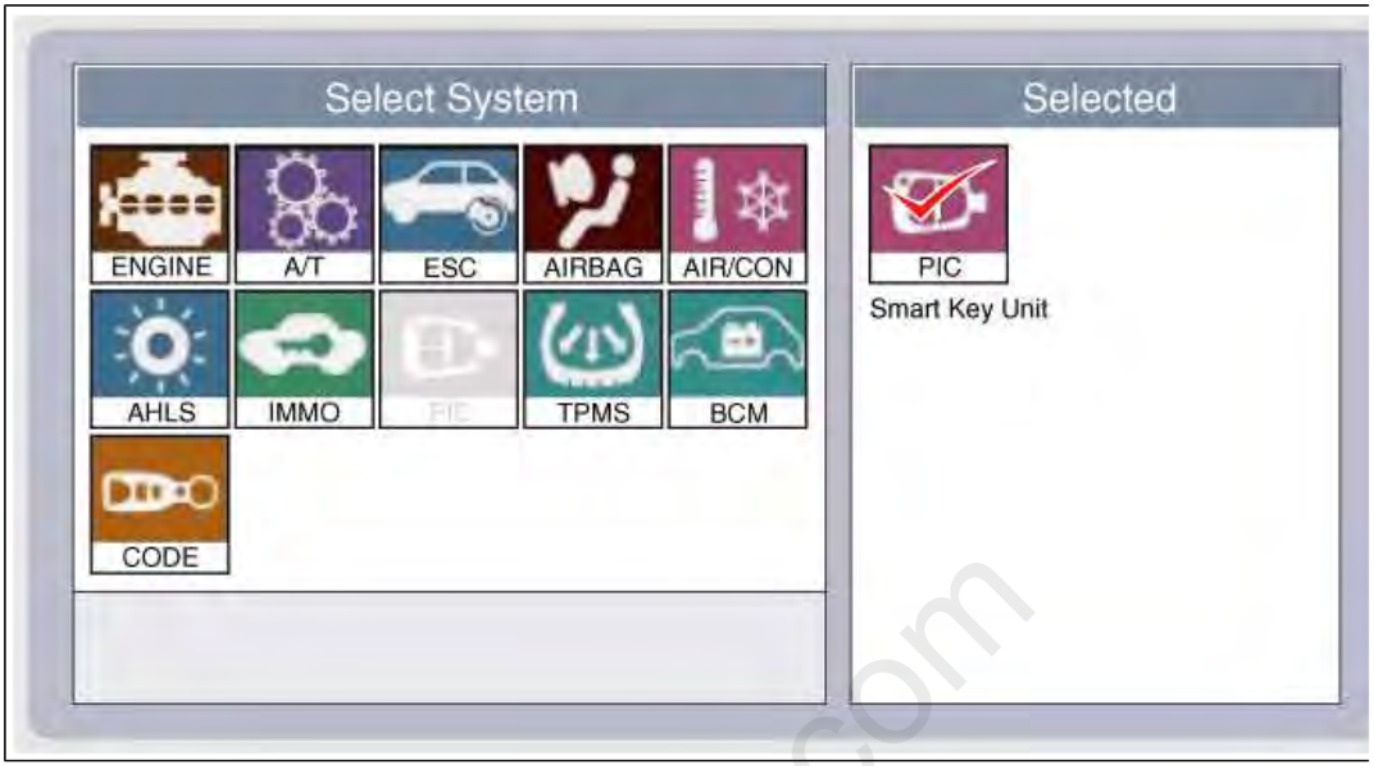
1. Problem in SMART KEY unit input.
2. Problem in SMART KEY unit.
3. Problem in SMART KEY unit output.

So the following three diagnosis operates will be the major problem solution process.

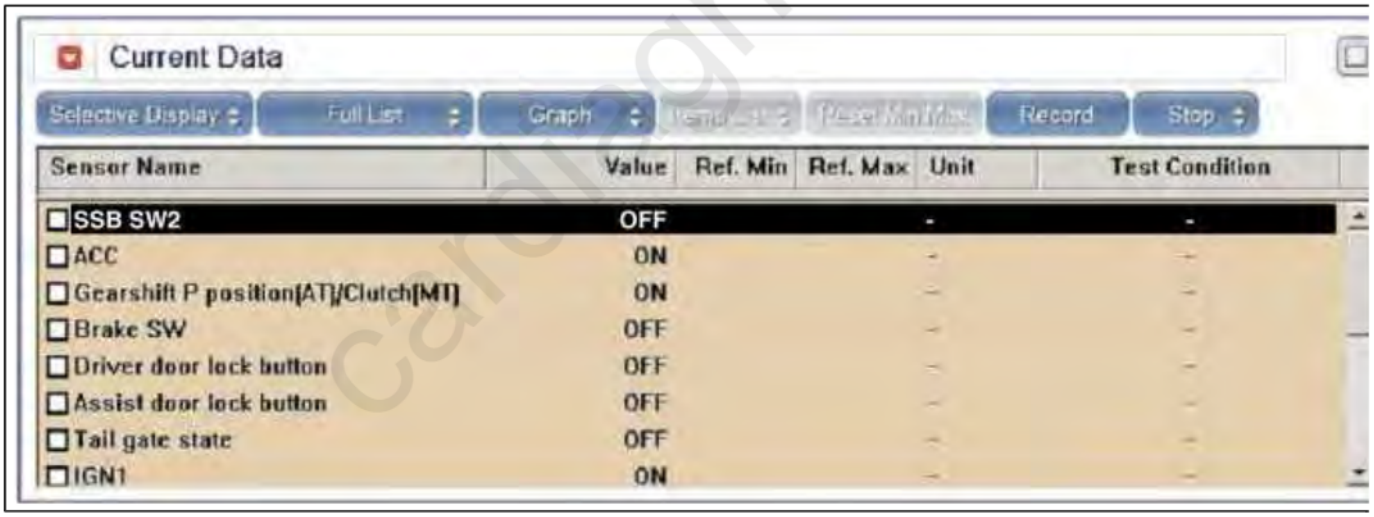
1. SMART KEY unit Input problem : switch diagnosis
2. SMART KEY unit problem : communication diagnosis
3. SMART KEY unit Output problem : antenna and switch output diagnosis

Switch Diagnosis

1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel, turn the power on GDS.
2. Select the vehicle model and then SMART KEY system.



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



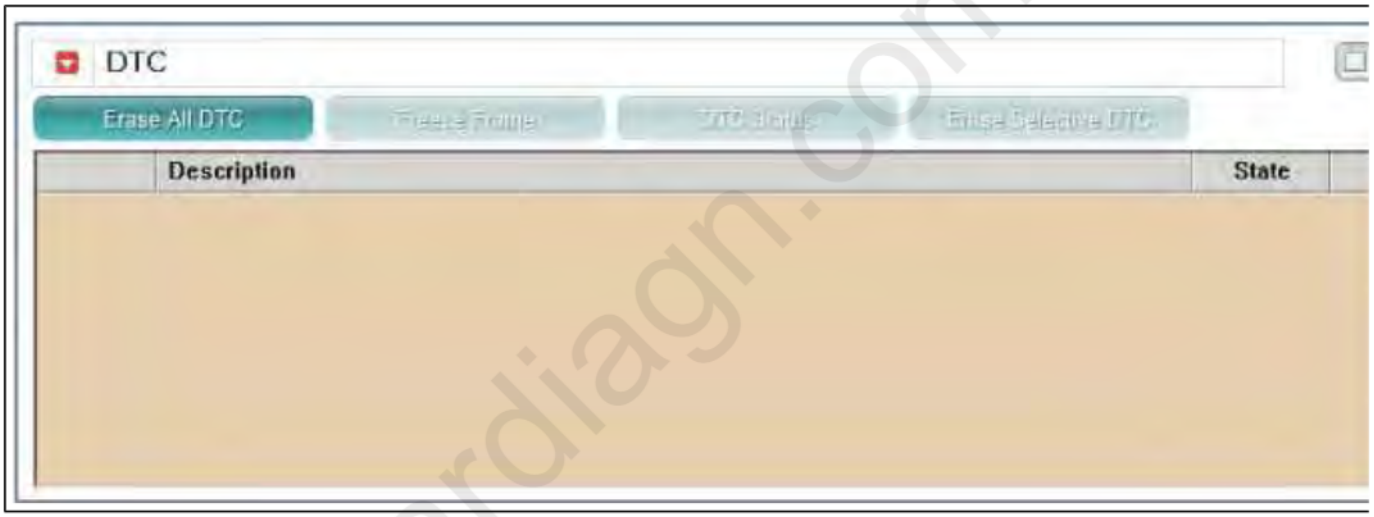
Cardiagn.com

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

Display	Description
FL Toggle SW	ON : Push button is ON in the driver door handle.
FR Toggle SW	ON : Push button is ON in the assist door handle.
Trunk SW	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.
Push Knob SW	ON : Push knob switch is ON.
External Buzzer	ON : Buzzer is ON.

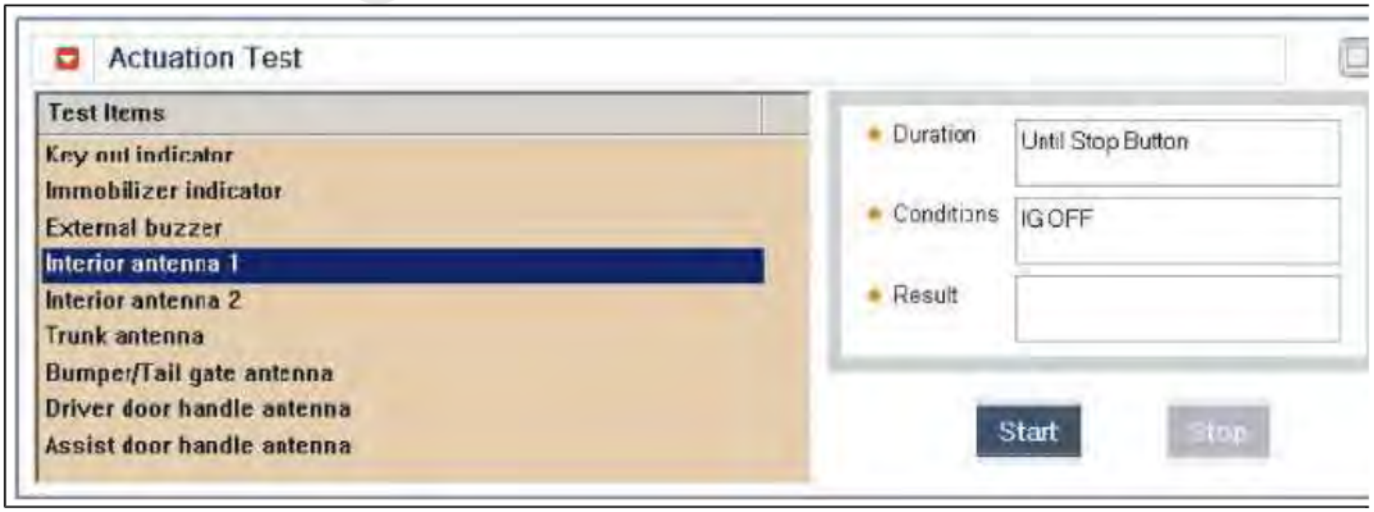
Communication Diagnosis With GDS (Self Diagnosis)

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".



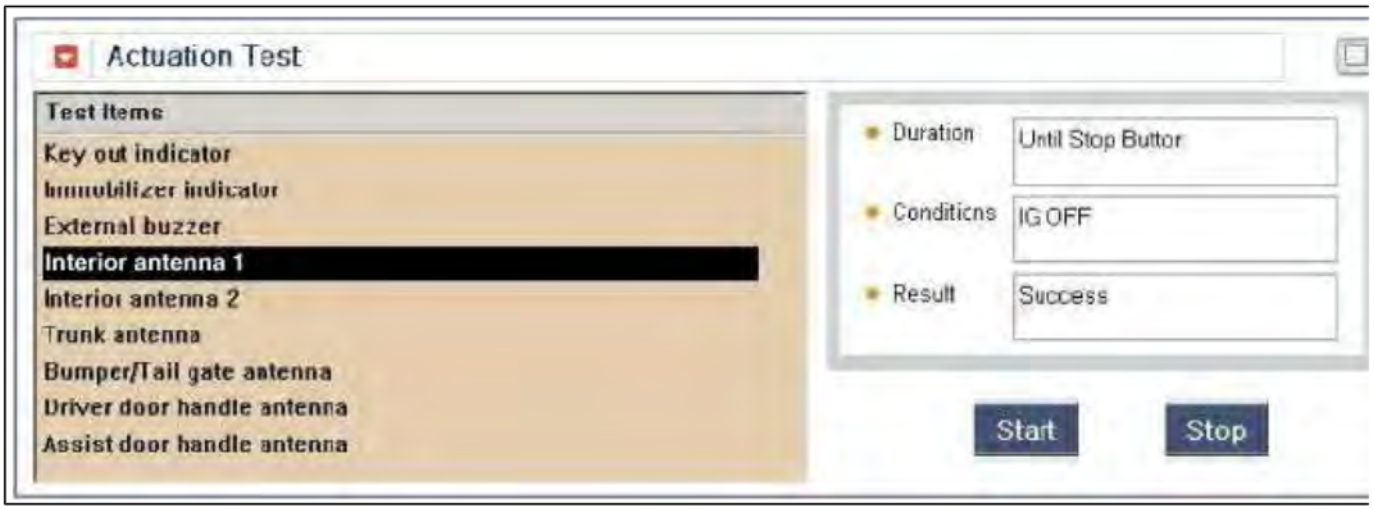
Antenna Actuation Diagnosis

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".



cardiagn.com

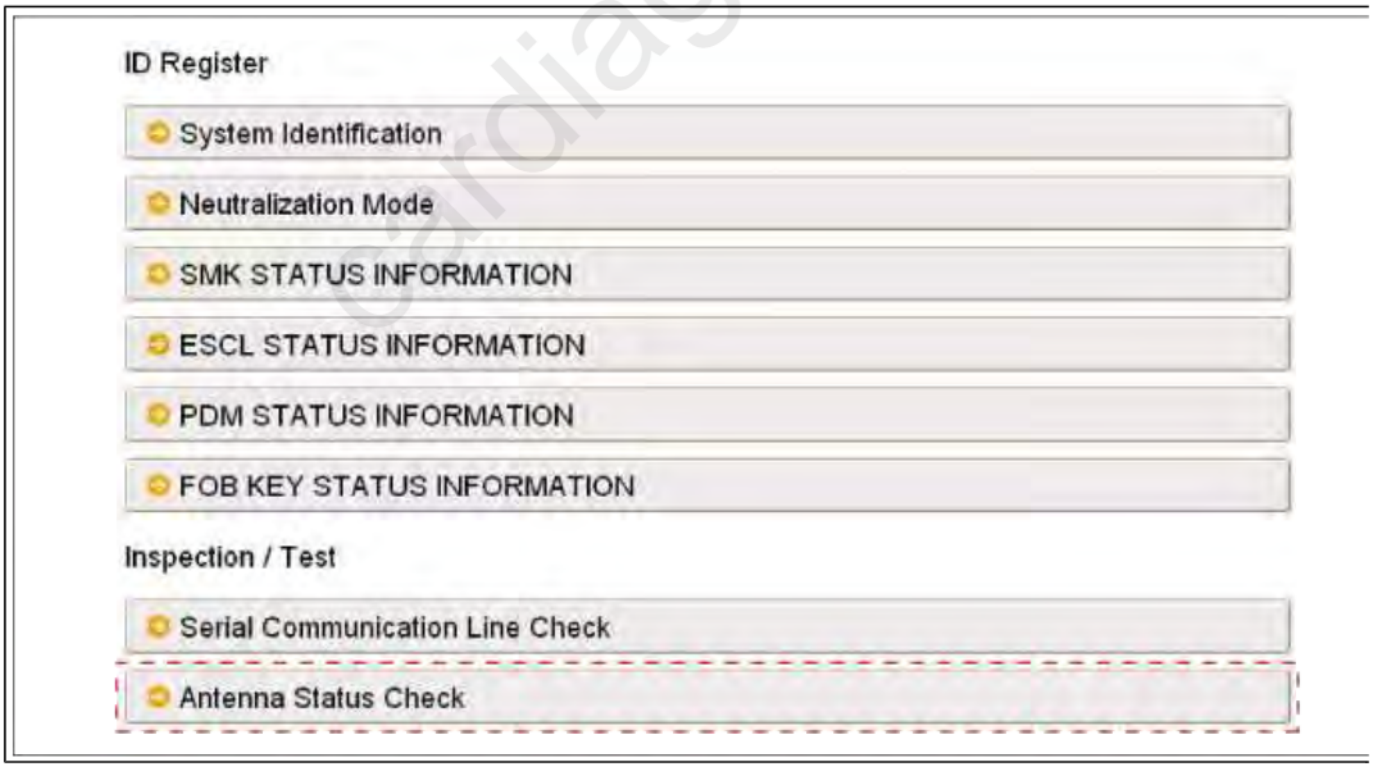
3. Set the smart key near the related antenna and operate it with a GDS.



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

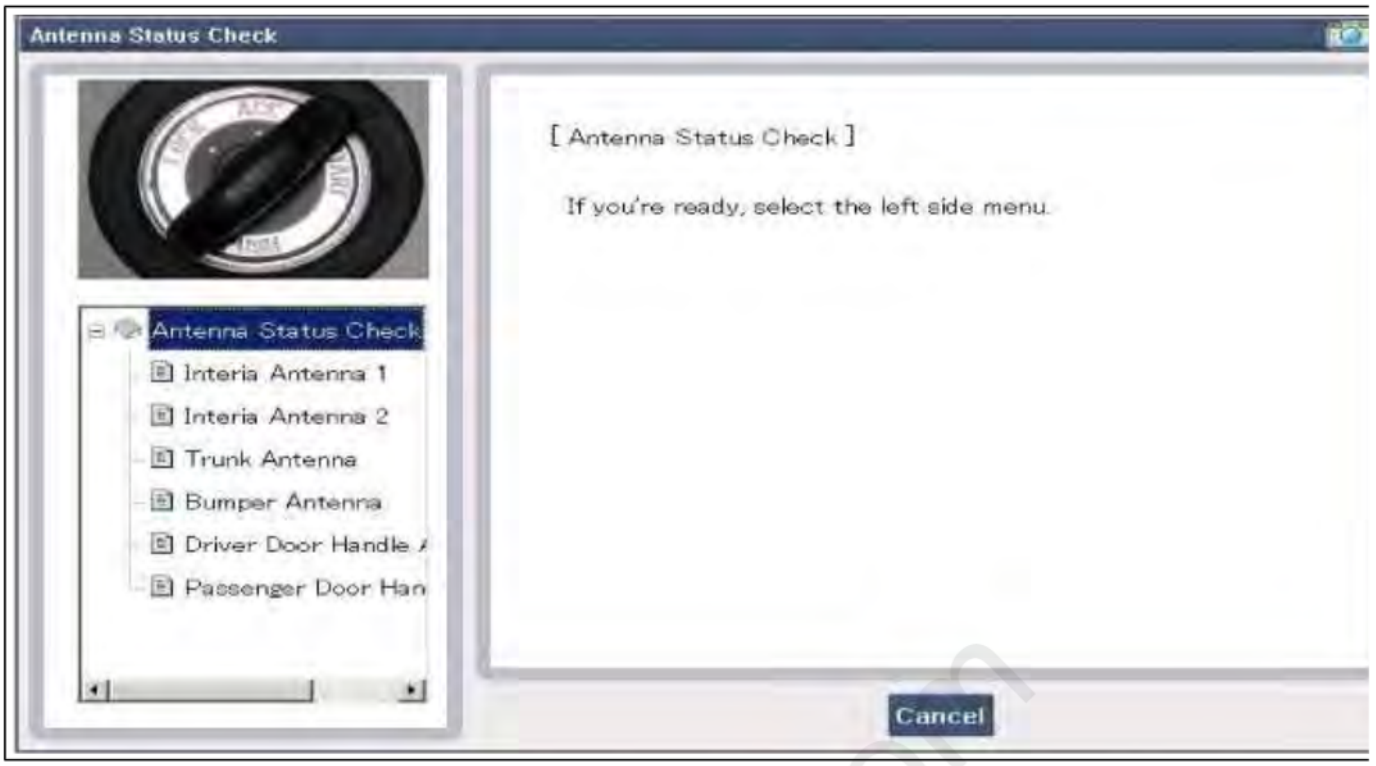
Antenna Status Check

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



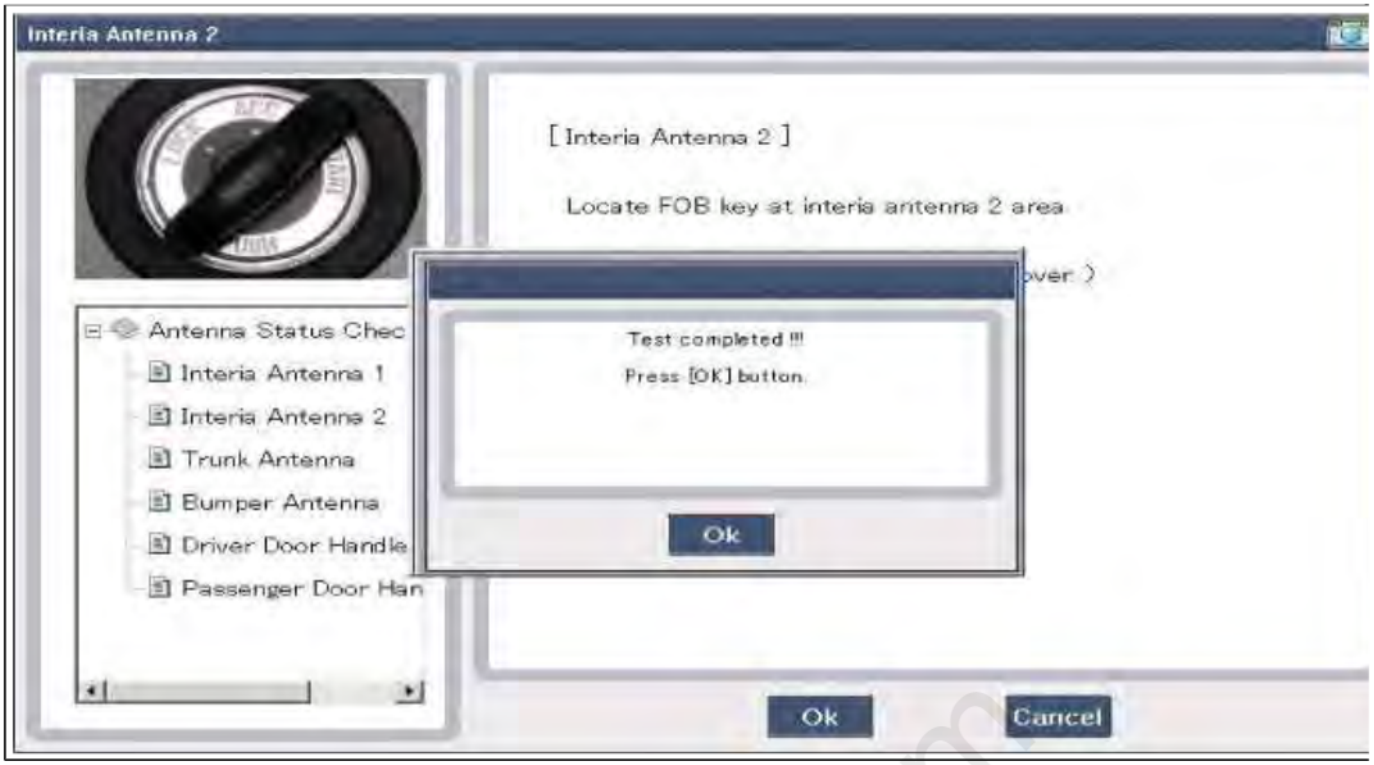
cardiagn.com

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



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

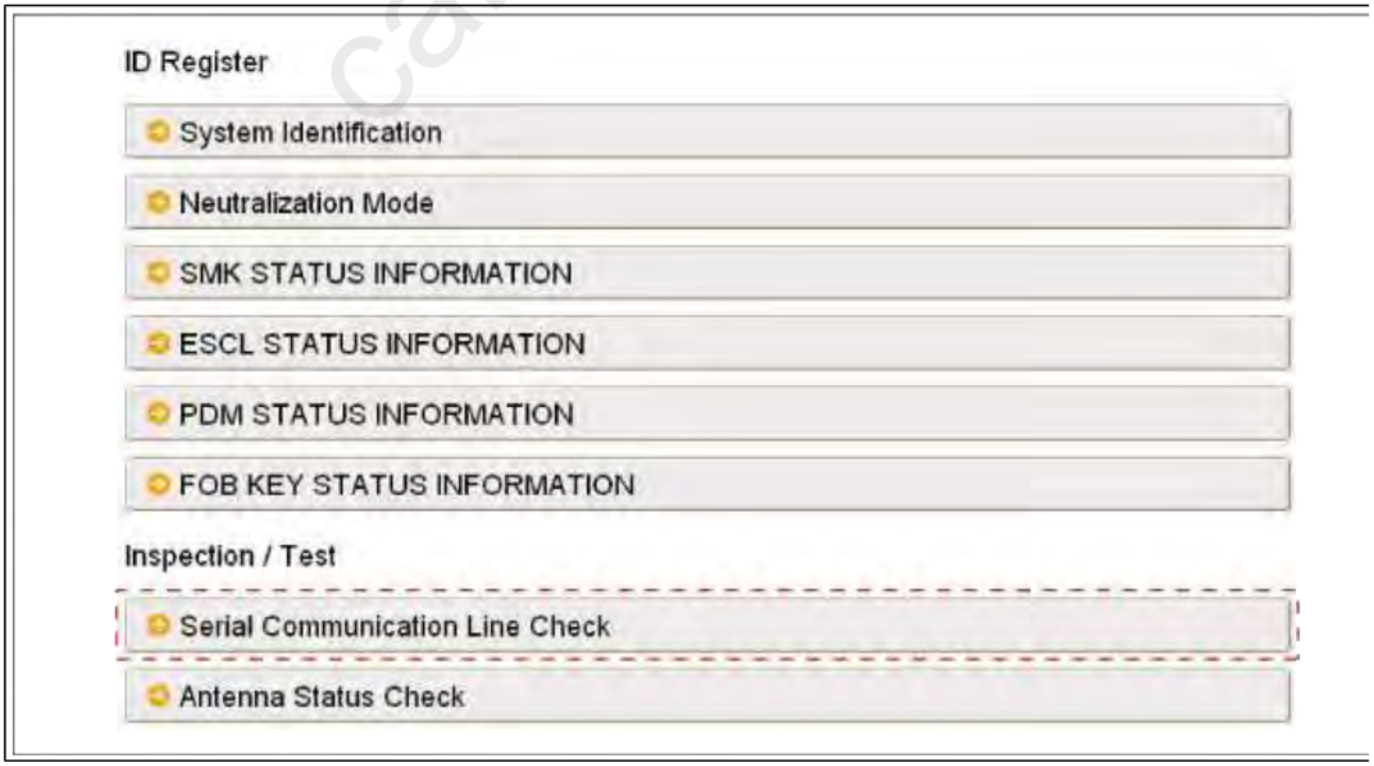
cardiagn.com



5. If the smart key runs normal , the related antenna, smart key(transmission, reception) and exterior receiver are normal.
6. Antenna status
   A. INTERIOR Antenna 1
   B. INTERIOR Antenna 2
   C. Trunk antenna
   D. BUMPER/ Trunk 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".



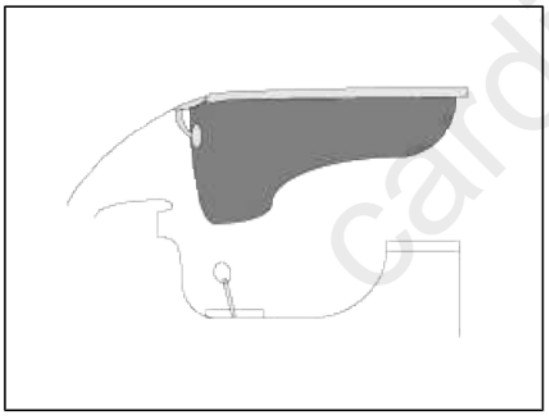
cardiagn.com

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

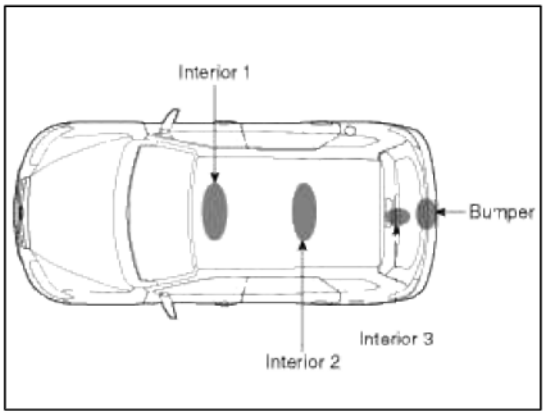
4. Check the serial communication line with a GDS.
5. If the smart key runs normal, the communication of smart key unit and exterior receiver are normal.
6. If the smart key runs abnormal, check the following items.
   A. Disconnection or no response of the exterior receiver communication line.
   B.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

Interior Antenna Actuation Check

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

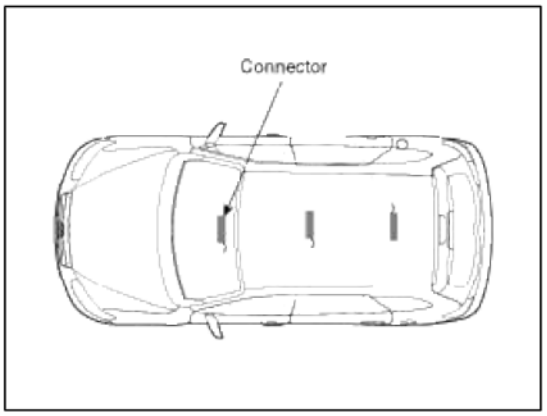


2. If the ignition is ON, the antenna runs normal.
3. Check the interior antenna ignition mode.
4. Set the smart key in the following shade area and actuate the antenna. Check the LED of smart key is blinking.



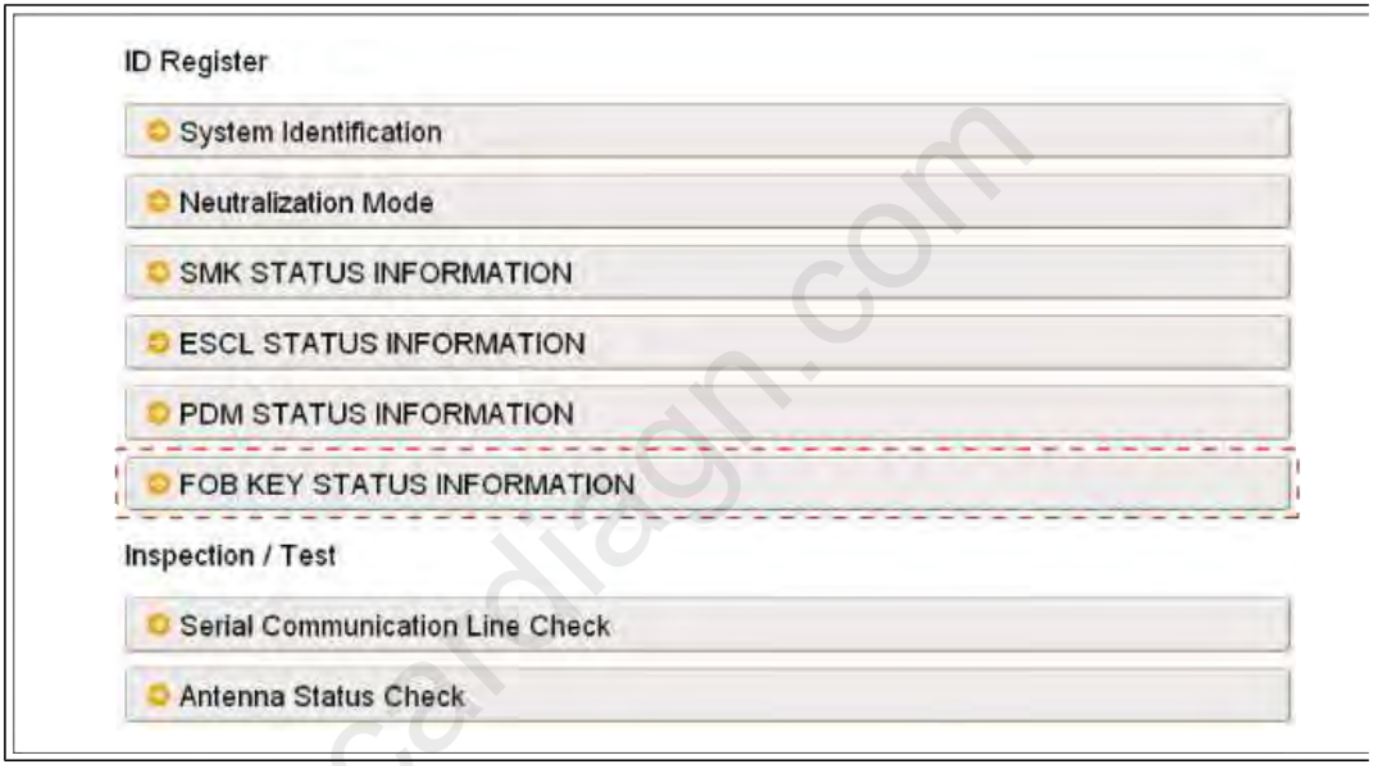
cardiagn.com

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



FOB Status Check

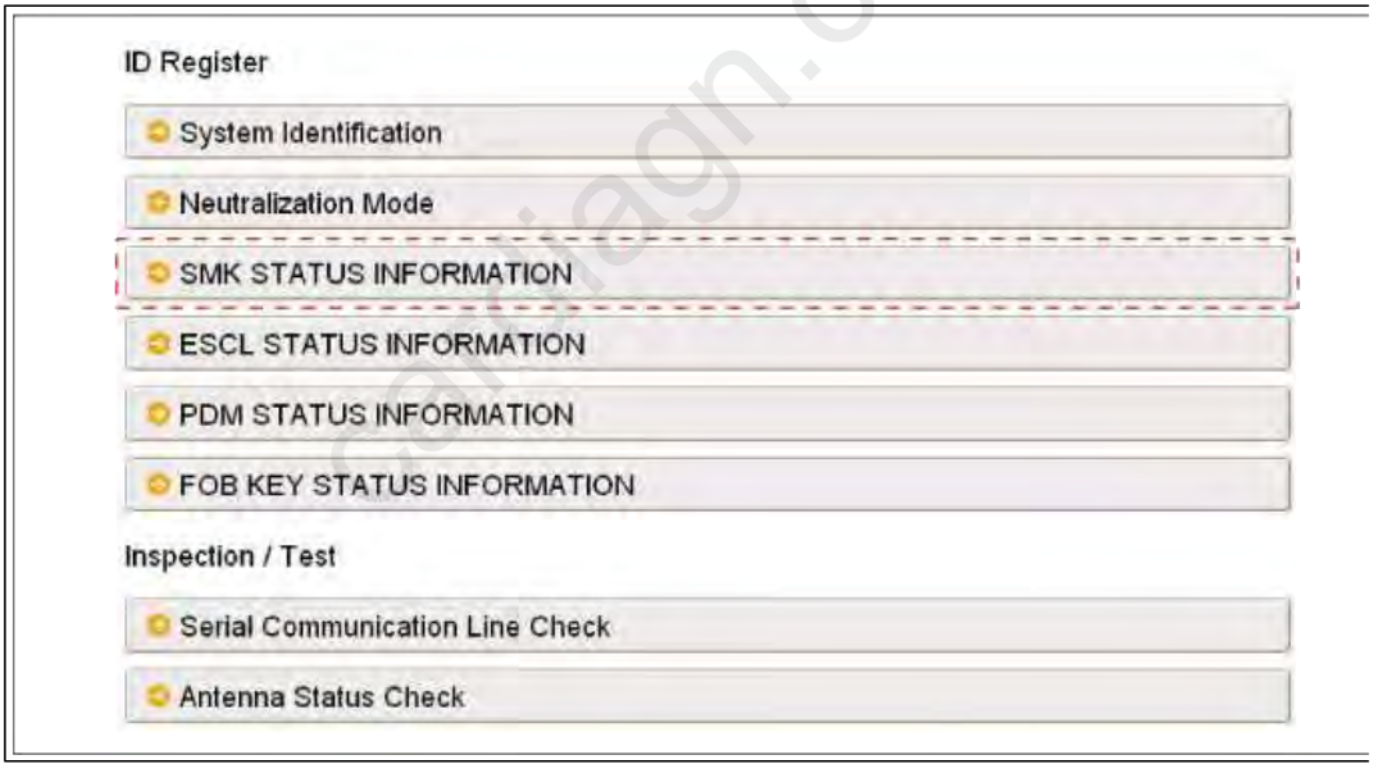
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "FOB KEY STATUS INFO".

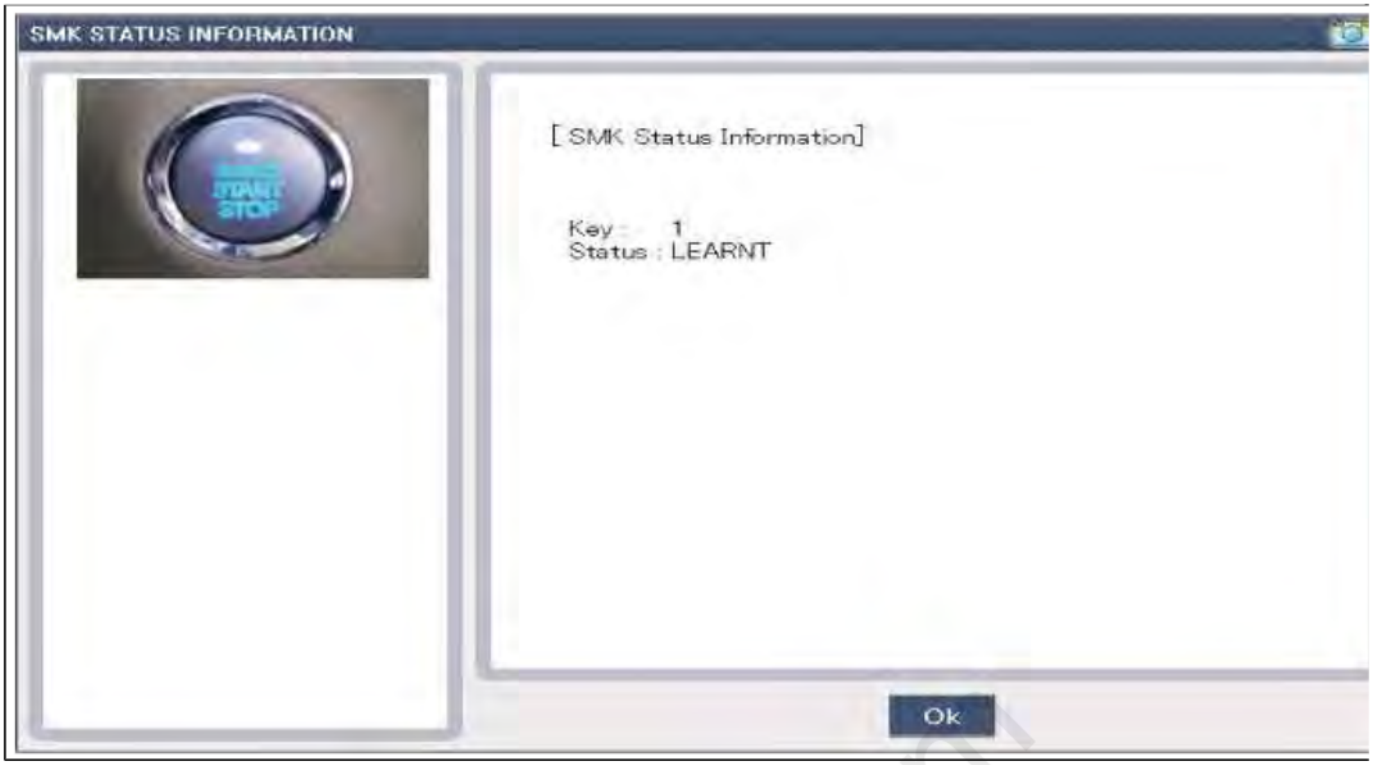


cardiagn.com

Smart Key Status Check

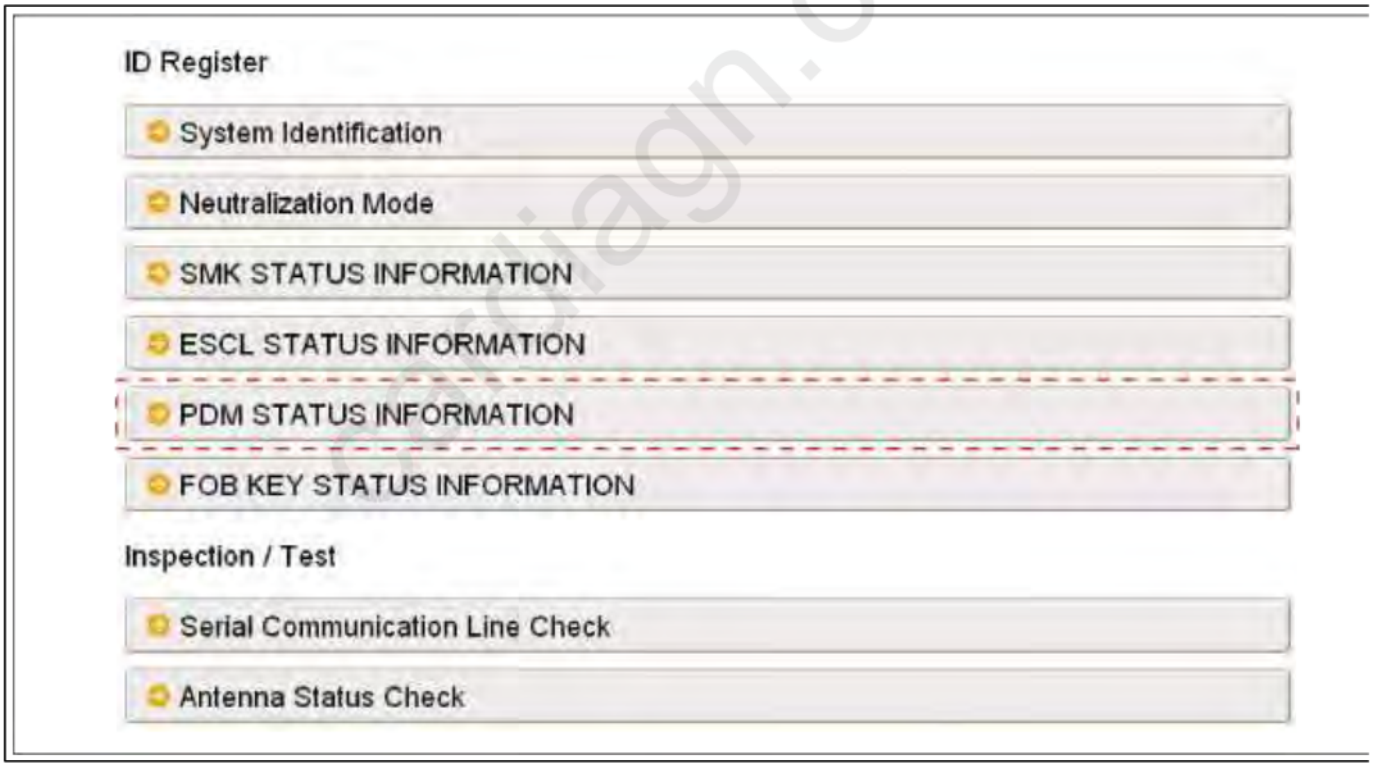
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "SMK STATUS INFO".





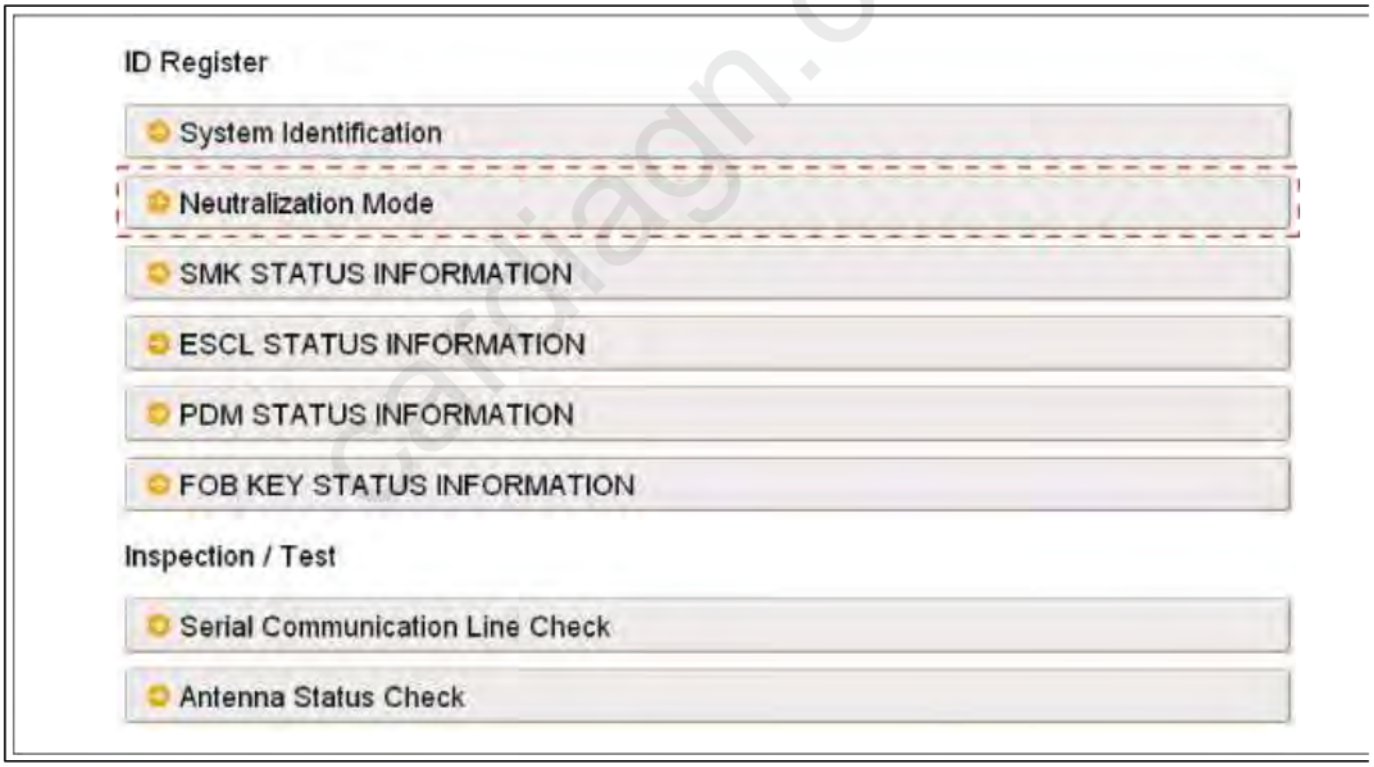
PDM Status Check

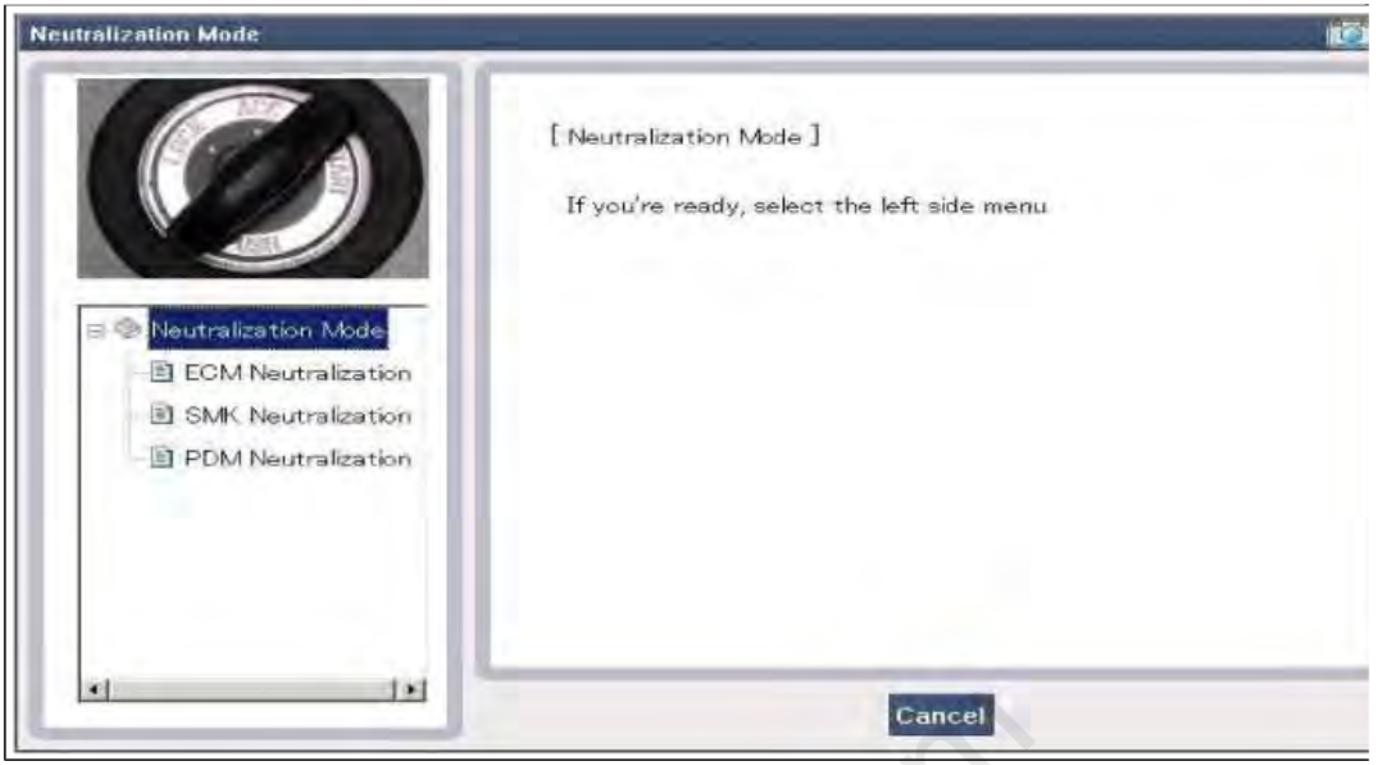
1. Connect the cable of GDS to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "PDM STATUS INFO".



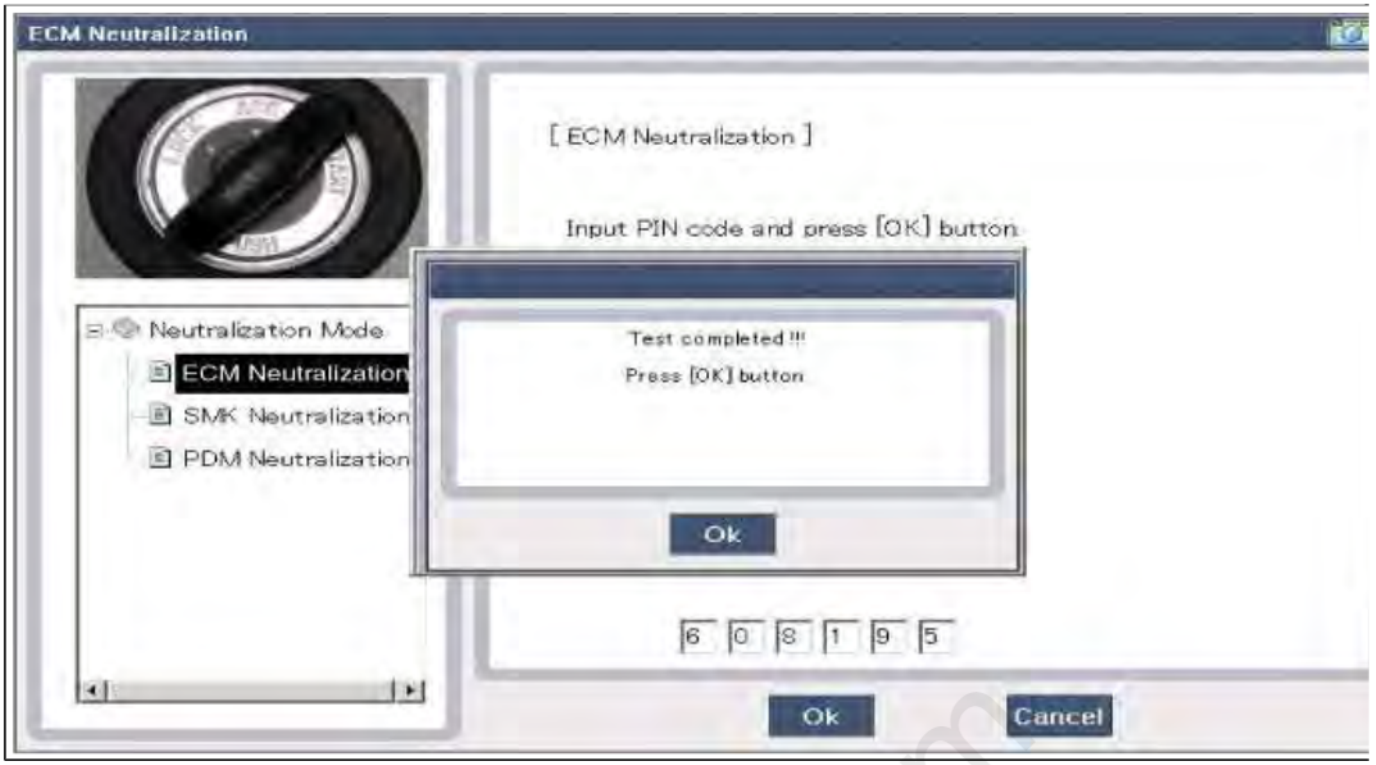
Neutralization Status Check

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

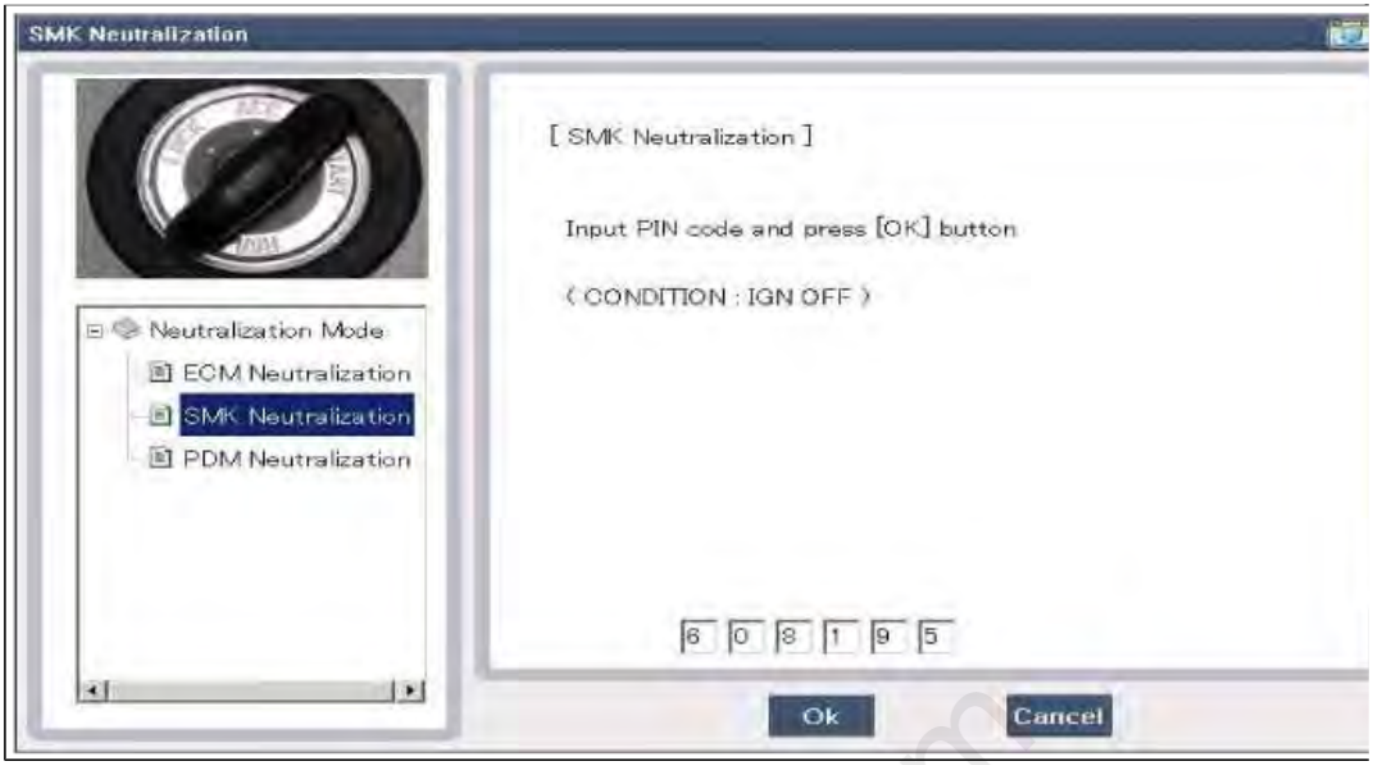


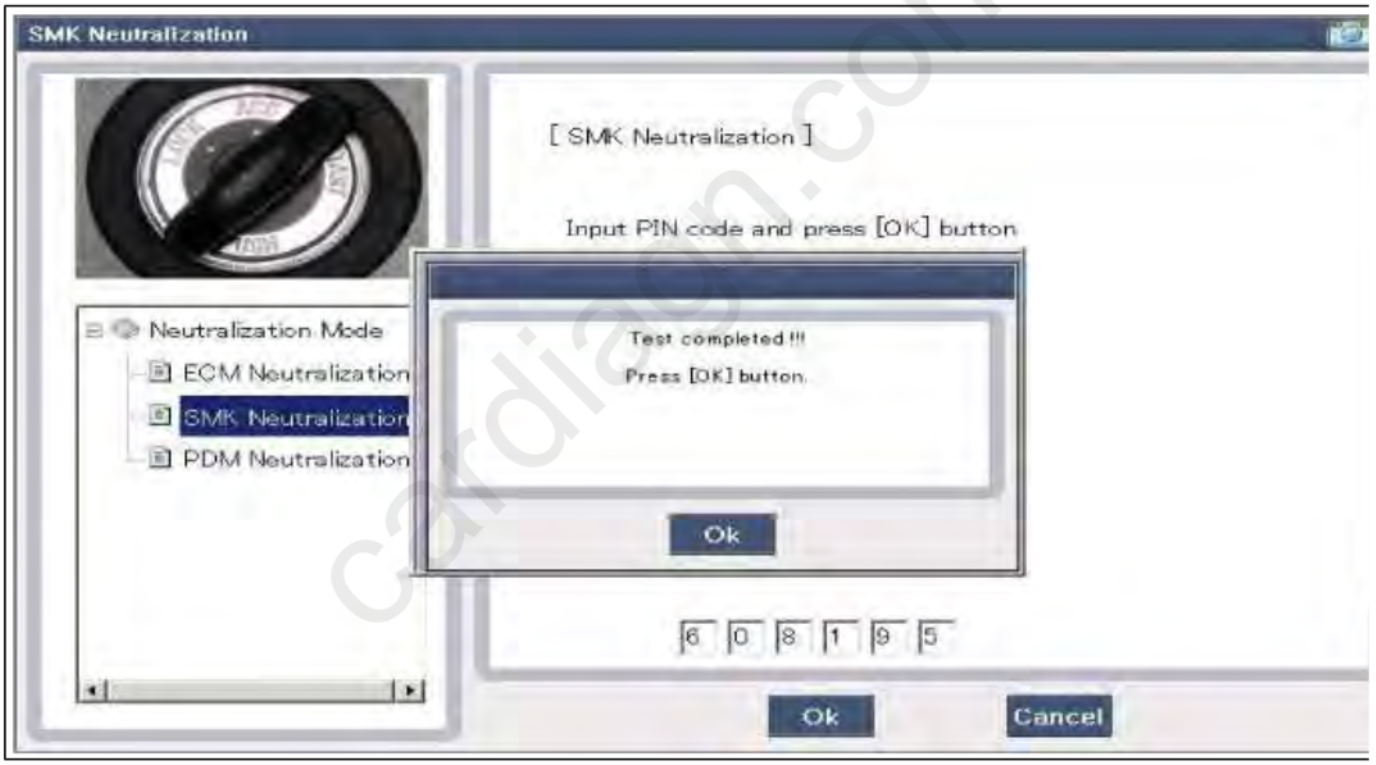


cardiagn.com

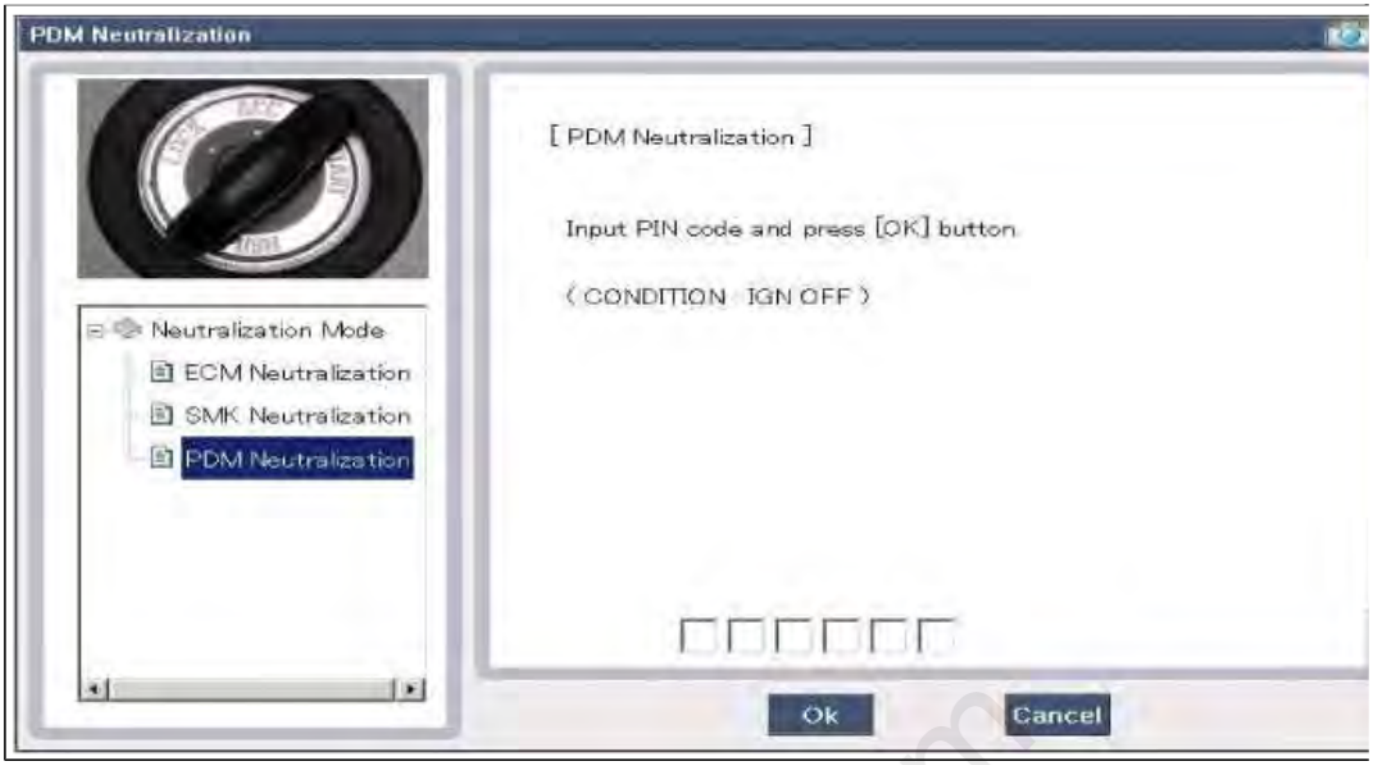


cardiagn.com

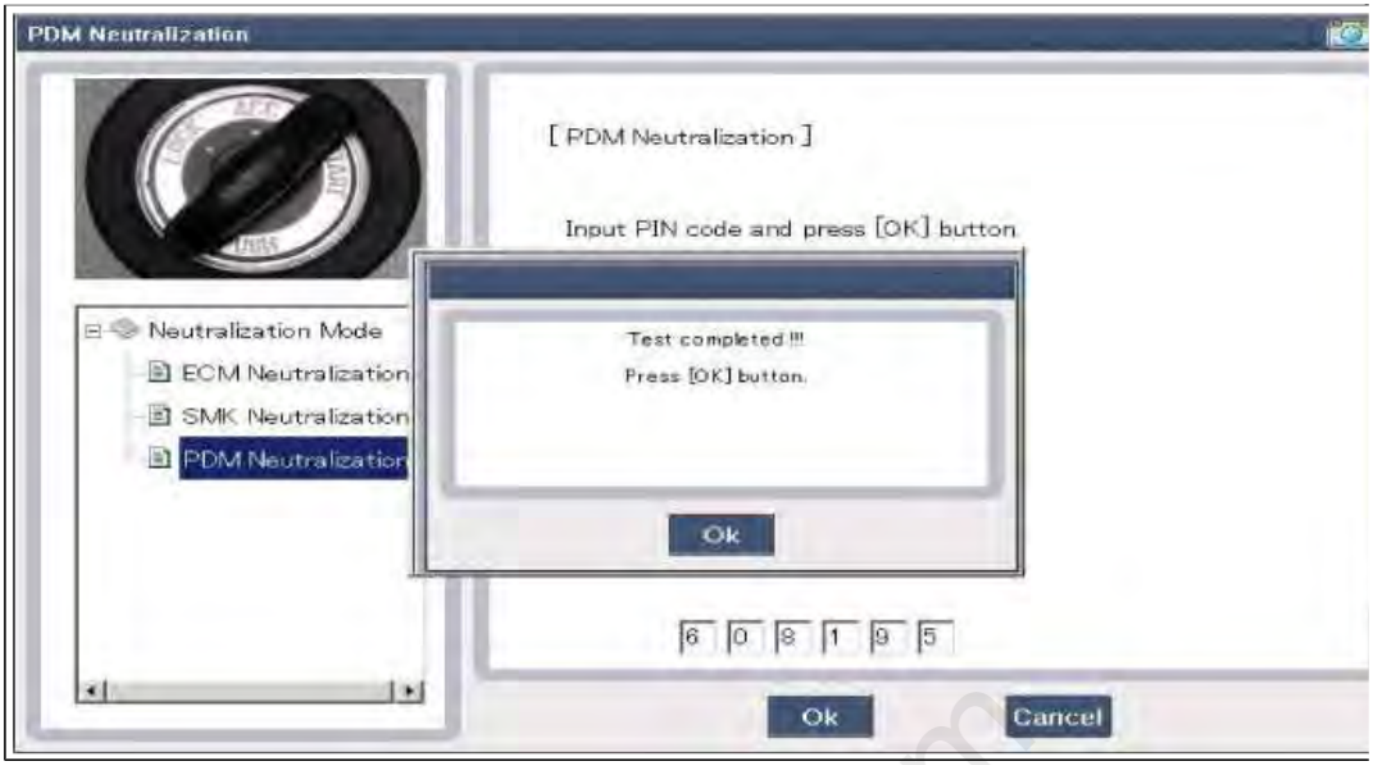




cardiagn.com



cardiagn.com



Input Switch List

No	Item name	Unit
1	SSB SW2	-
2	ACC	-
3	IGN1	-
4	Gear 'P' Position	-
5	Brake SW	-
6	FL Door Lock Button	-
7	FR Door Lock Button	-
8	Trunk Lid SW	-
9	Battery Voltage	-
10	Alternator Voltage	-
11	KEY out Indicator Lamp	-
12	Immobilizer Lamp	-
13	External Buzzer	-

Actuator List

cardiagn.com

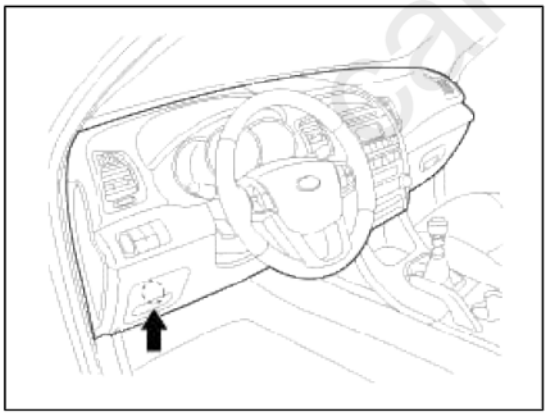
No.	Item name	Condition
1	**KEY out Indicator Lamp**	**Ignition switch ON Engine off**
2	Immo.indicator Lamp	Ignition switch ON Engine off
3	External Buzzer	Ignition switch ON Engine off
4	Interior Antenna 1 Active	Ignition switch ON Engine off
5	Interior Antenna 2 Active	Ignition switch ON Engine off
6	Interior Antenna 3 Active	Ignition switch ON Engine off
7	Bumper/trunk Antenna Active	Ignition switch ON Engine off
8	DRV_DR Antenna Active	Ignition switch ON Engine off
9	AST_DR Antenna Active	Ignition switch ON Engine off

Body Electrical System > Smart key System > Smart key > Repair procedures

Smart Key

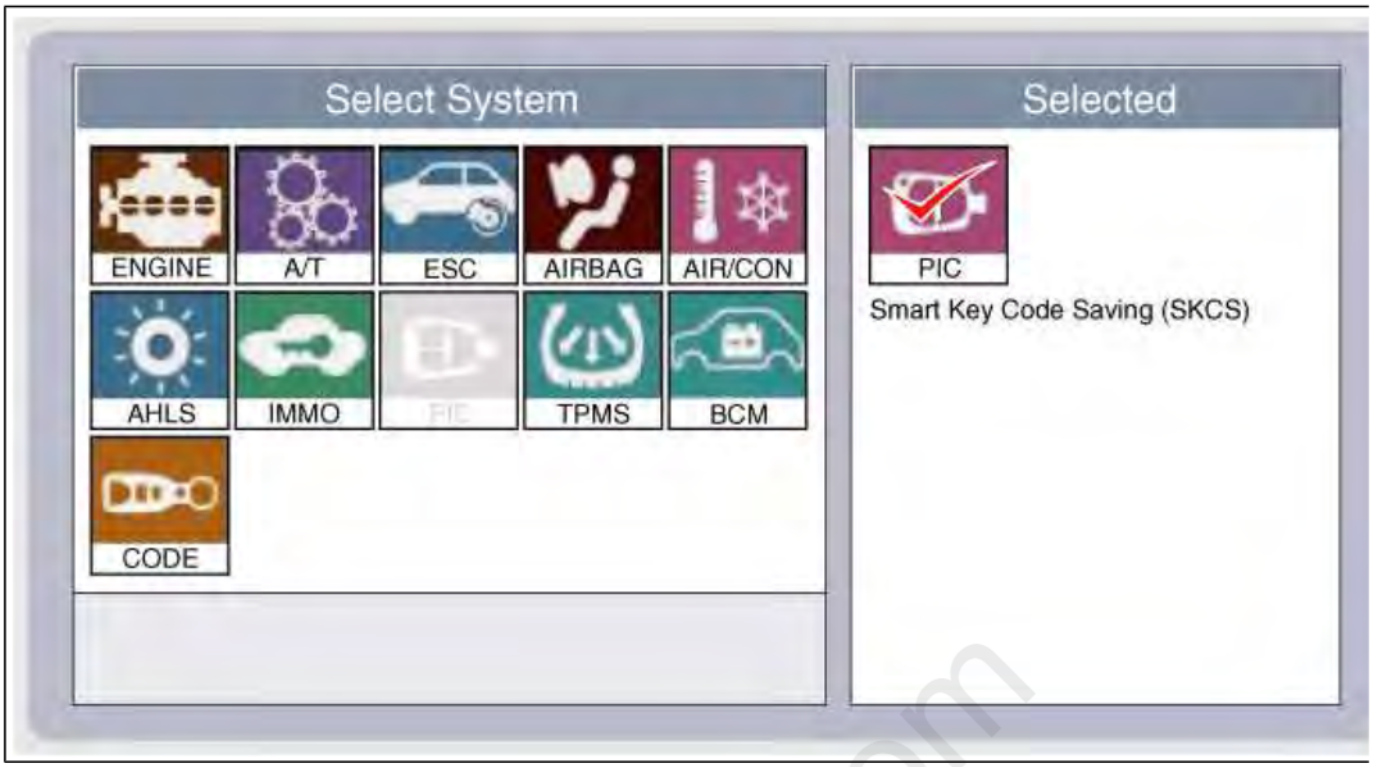
Smart Key Code Saving

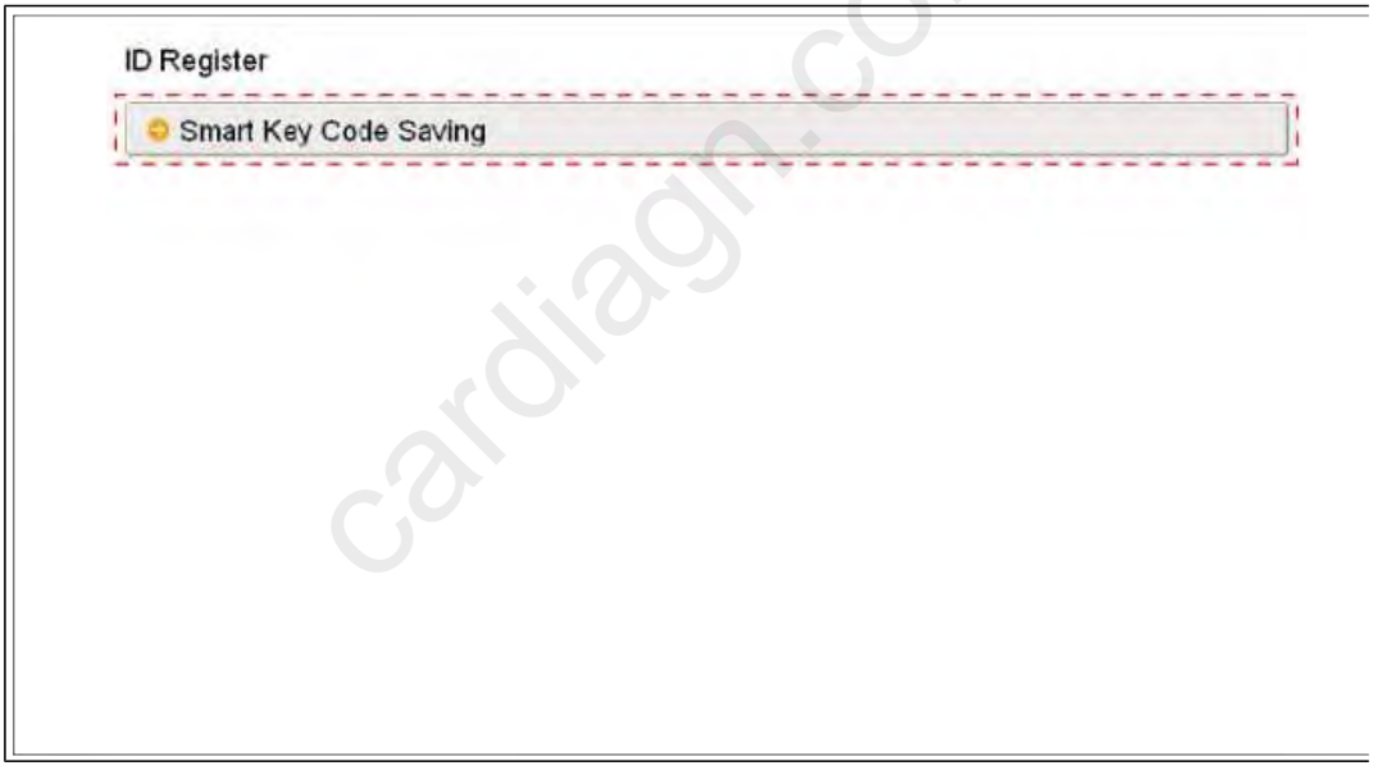
1. Connect the DLC cable of GDS to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on GDS.



cardiagn.com

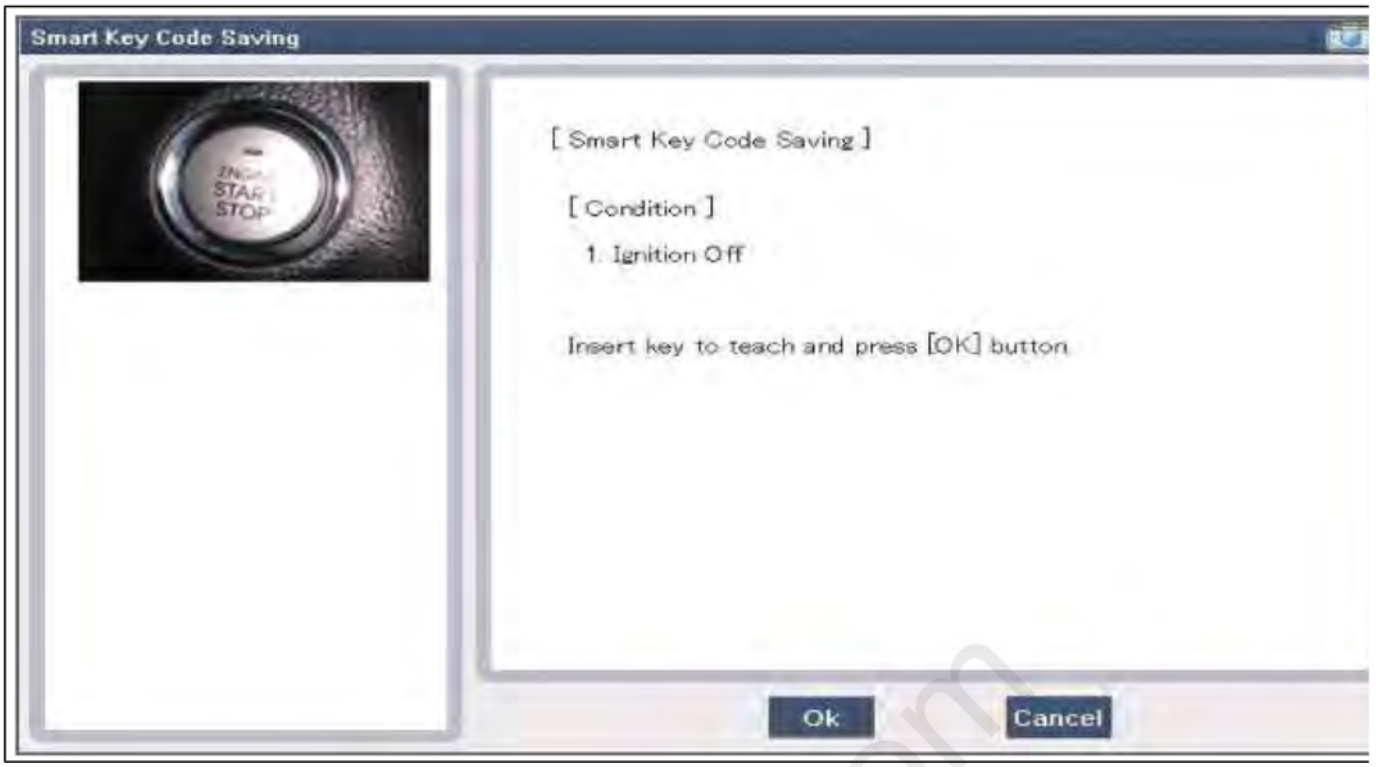
2. Select the vehicle model and then do "Smart key code saving".



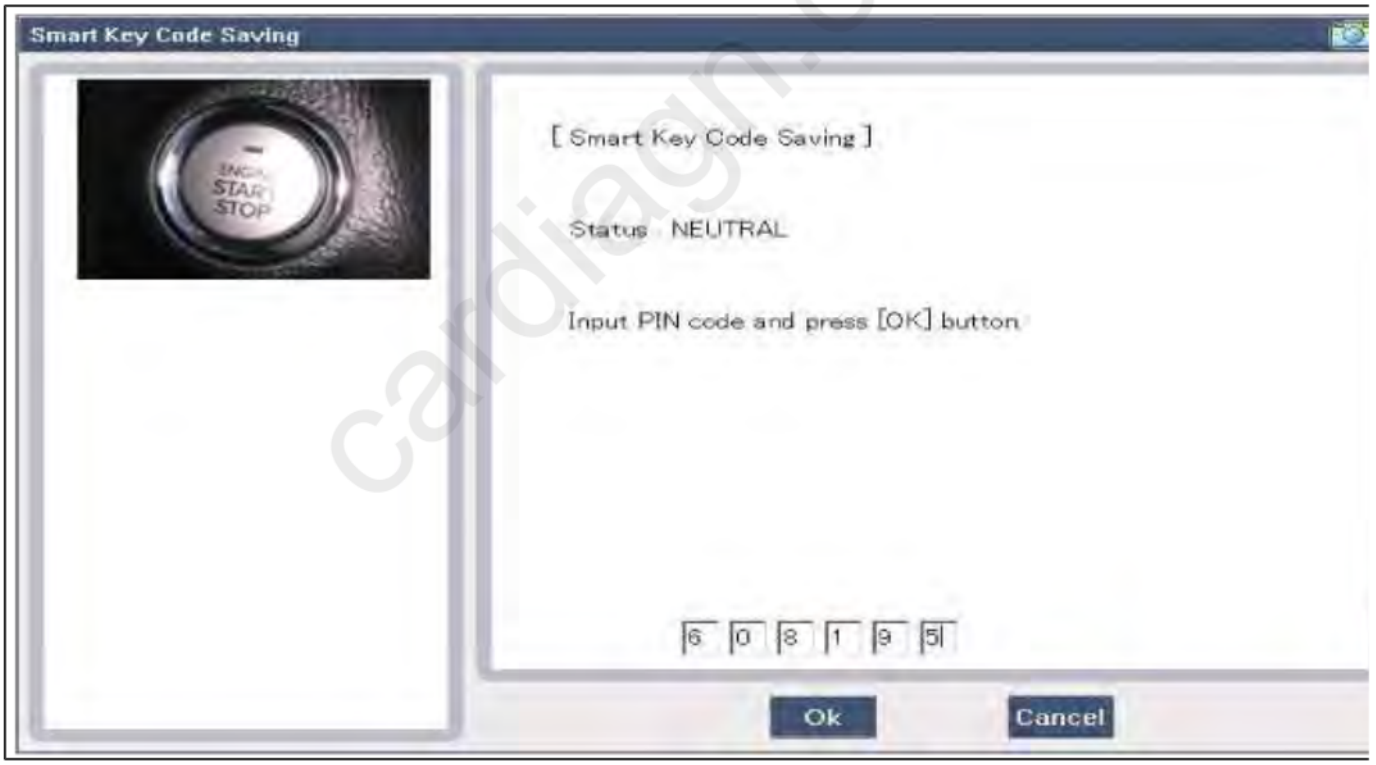


cardiagn.com

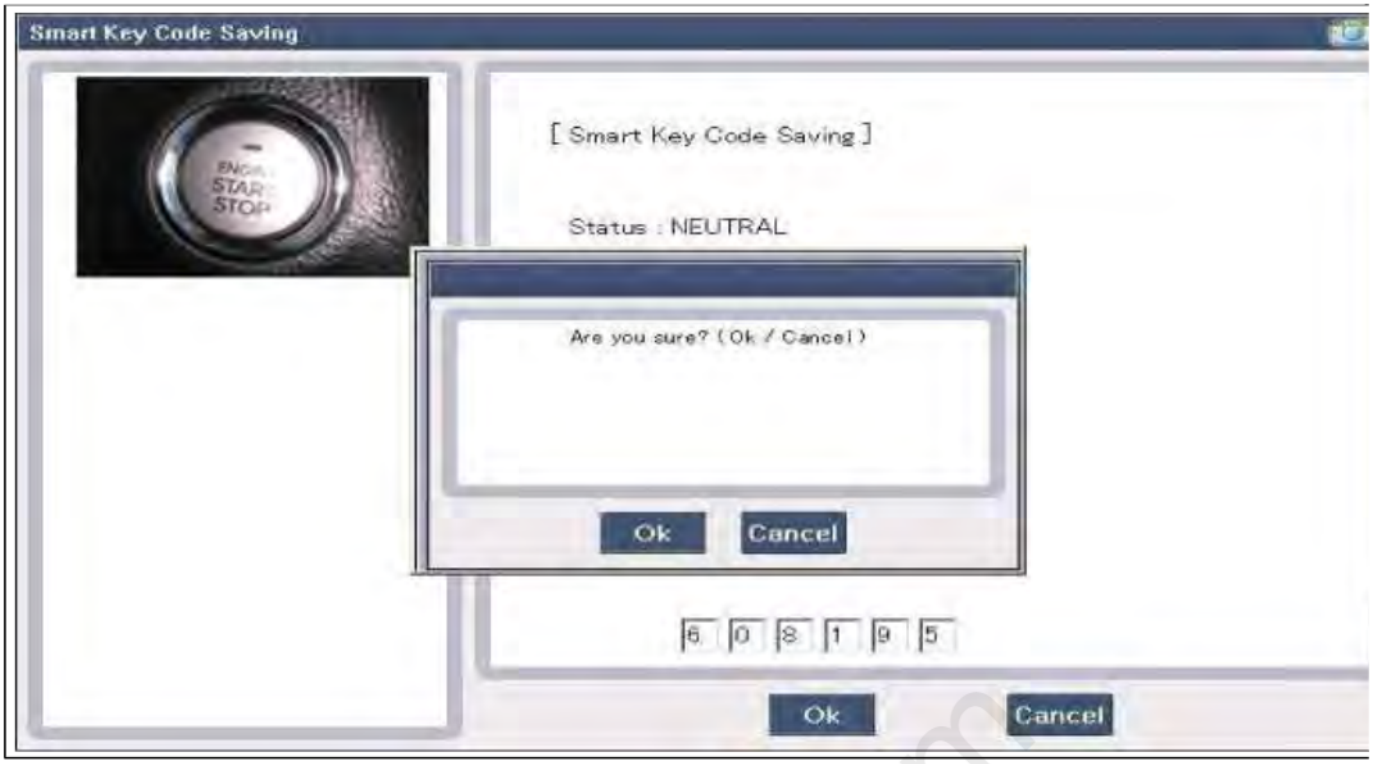
3. After selecting "Smart key teaching" menu, push "Enter" key, then the screen will be shown as below.



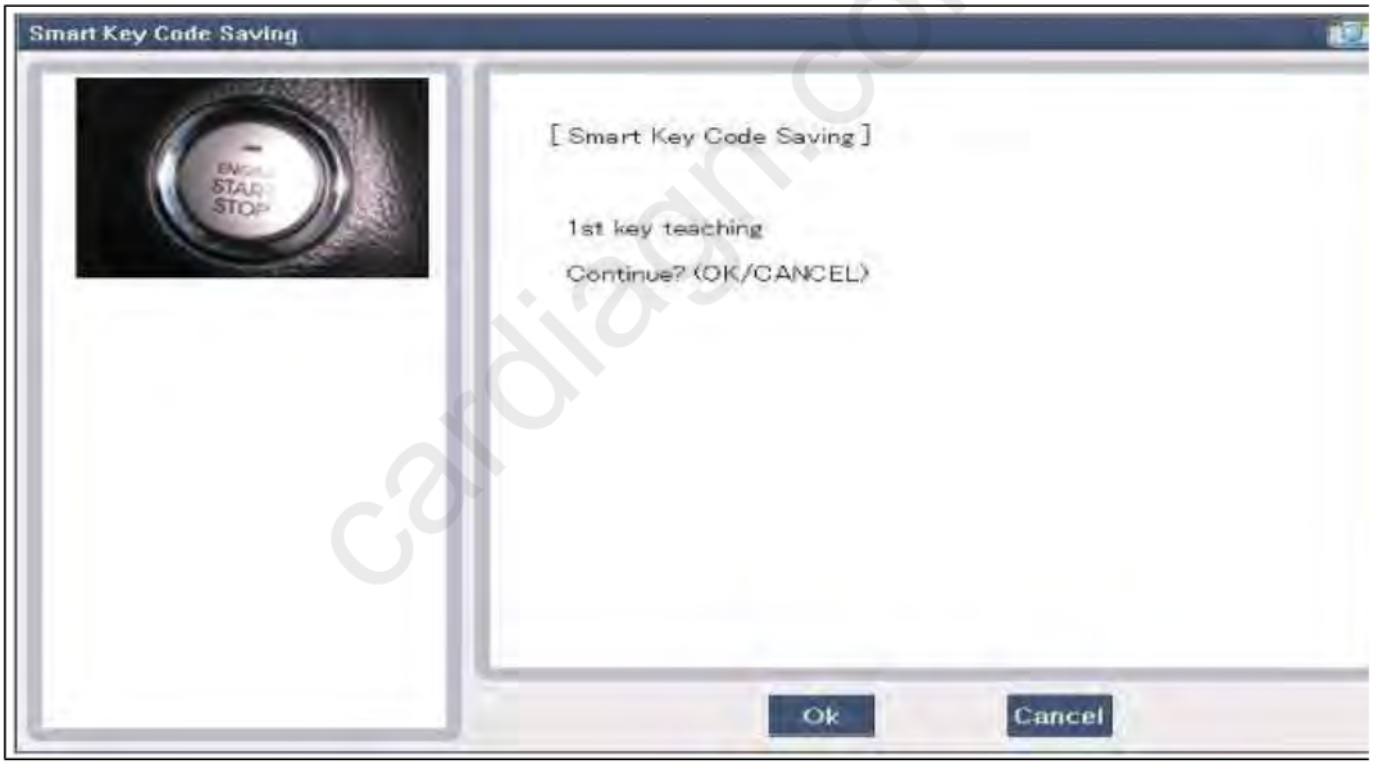
4. After inserting the teaching key, push "ENTER" key.
5. Input the "Pin code" for first key teaching.



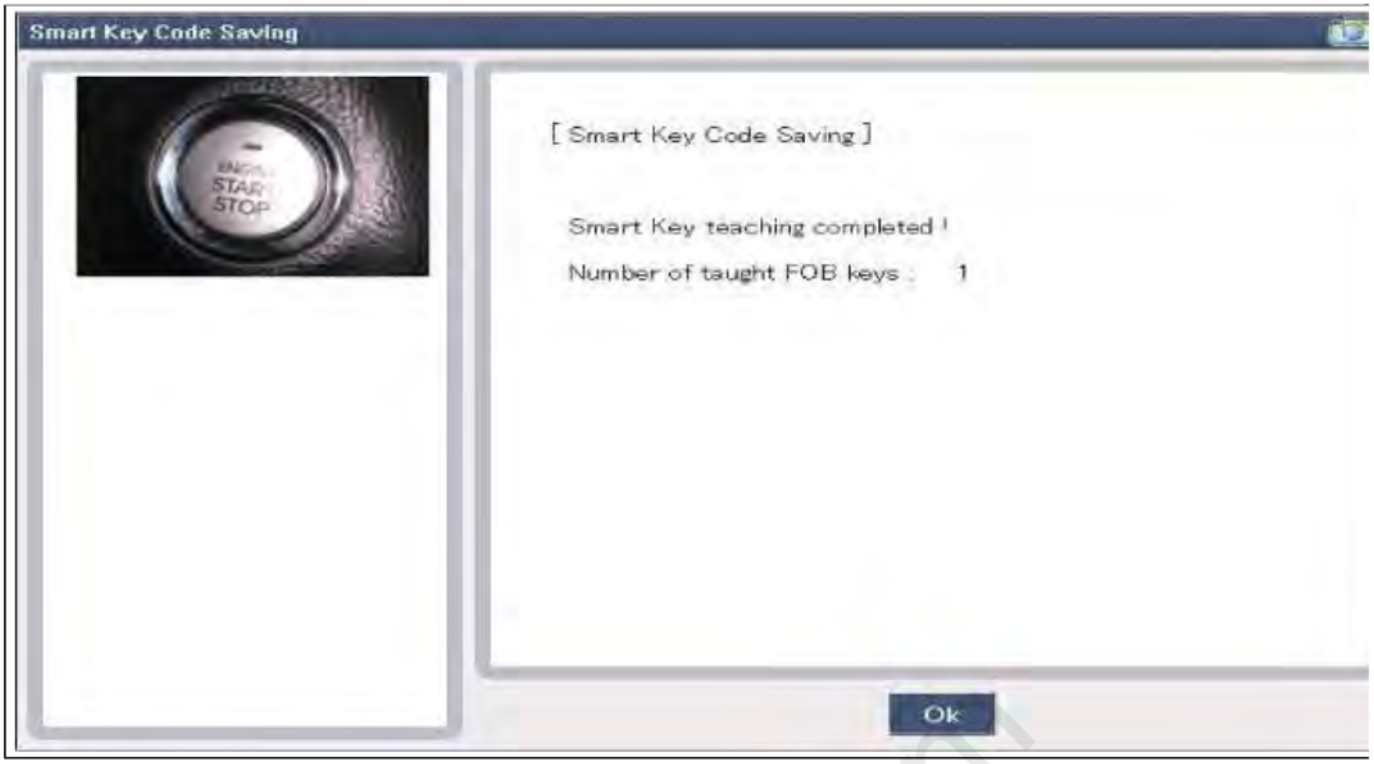
cardiagn.com



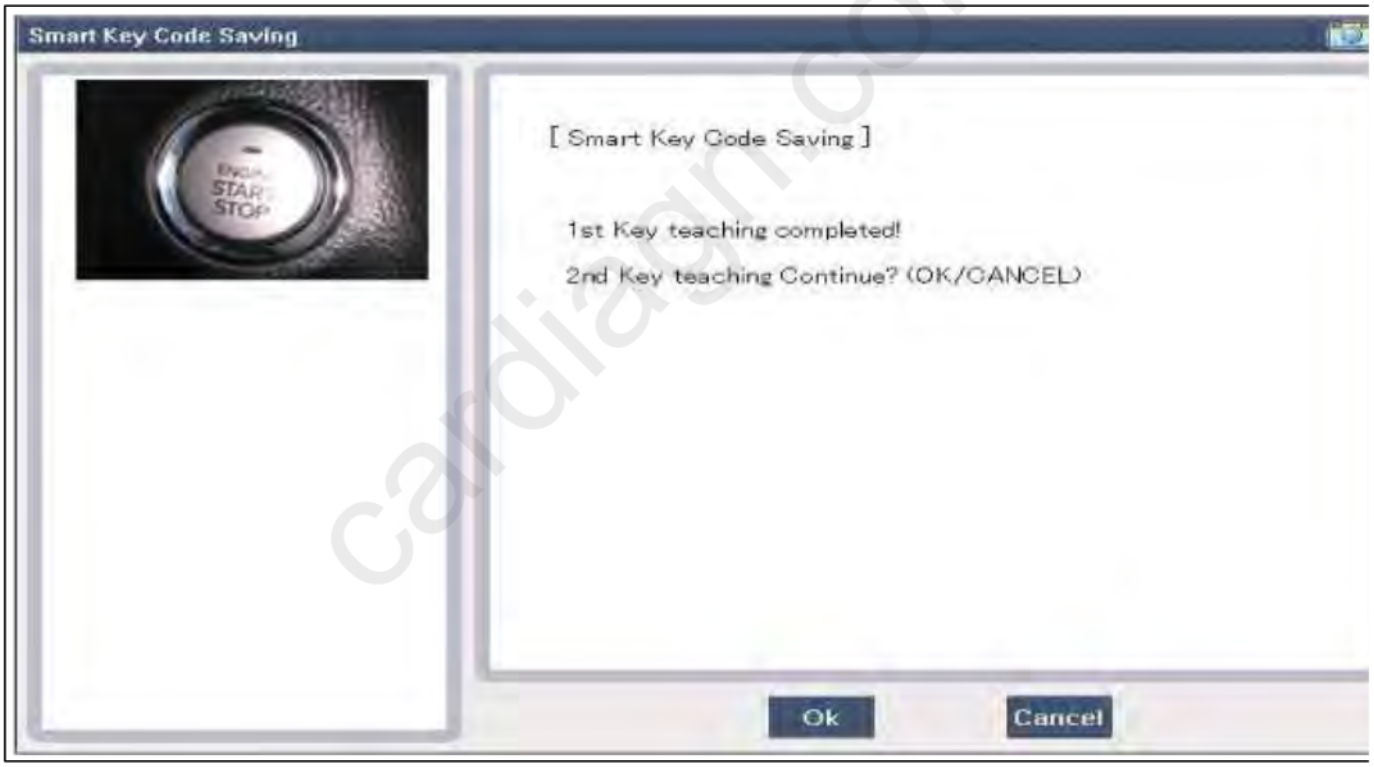
6. Confirm the message "First key teaching completed".



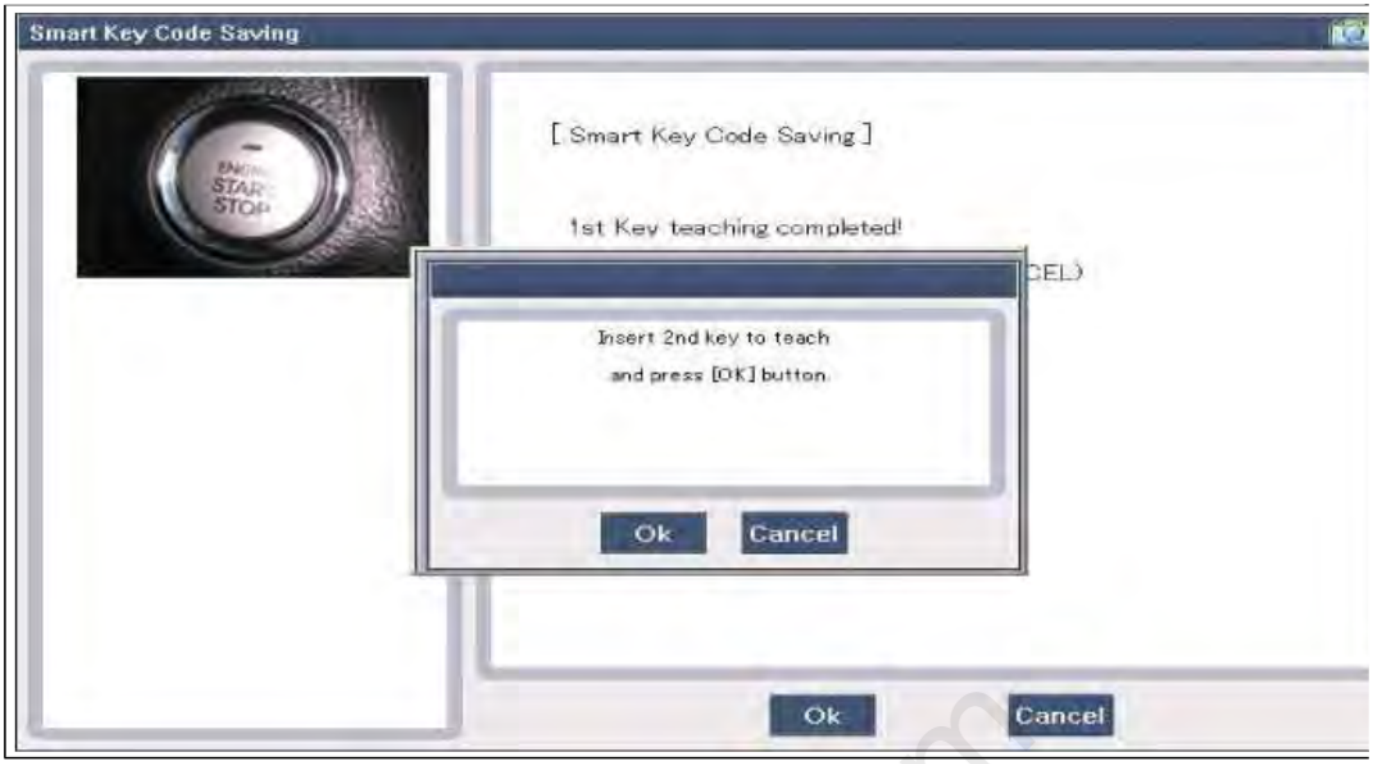
cardiagn.com



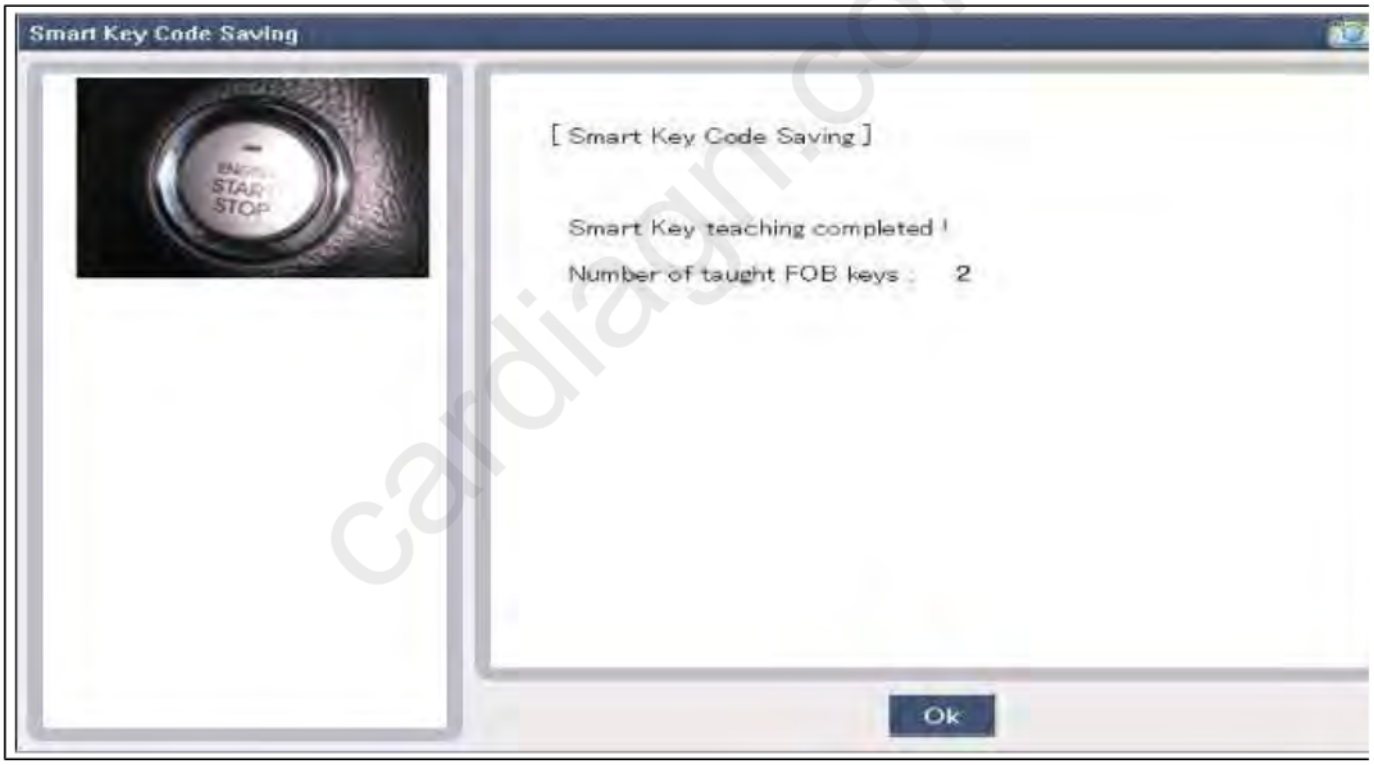
7. Input the "Pin code" for second key teaching.



cardiagn.com



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

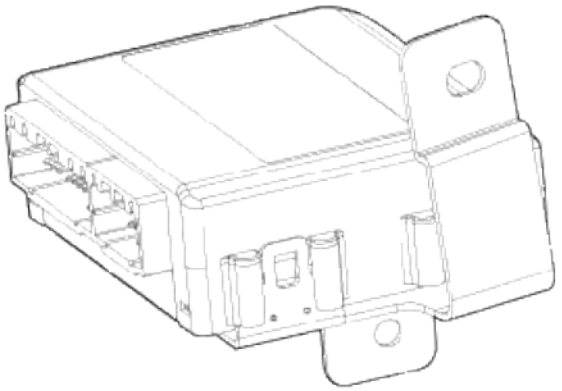


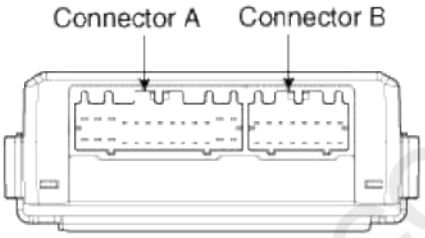
9. Then the screen will be shown as below when key teaching process is completed.

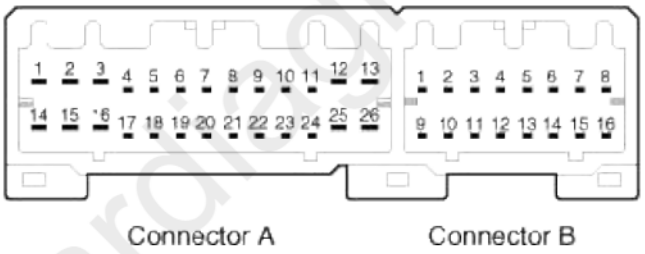
Body Electrical System > Smart key System > Smart key unit > Components and Components Location

Components

cardiagn.com







cardiagn.com

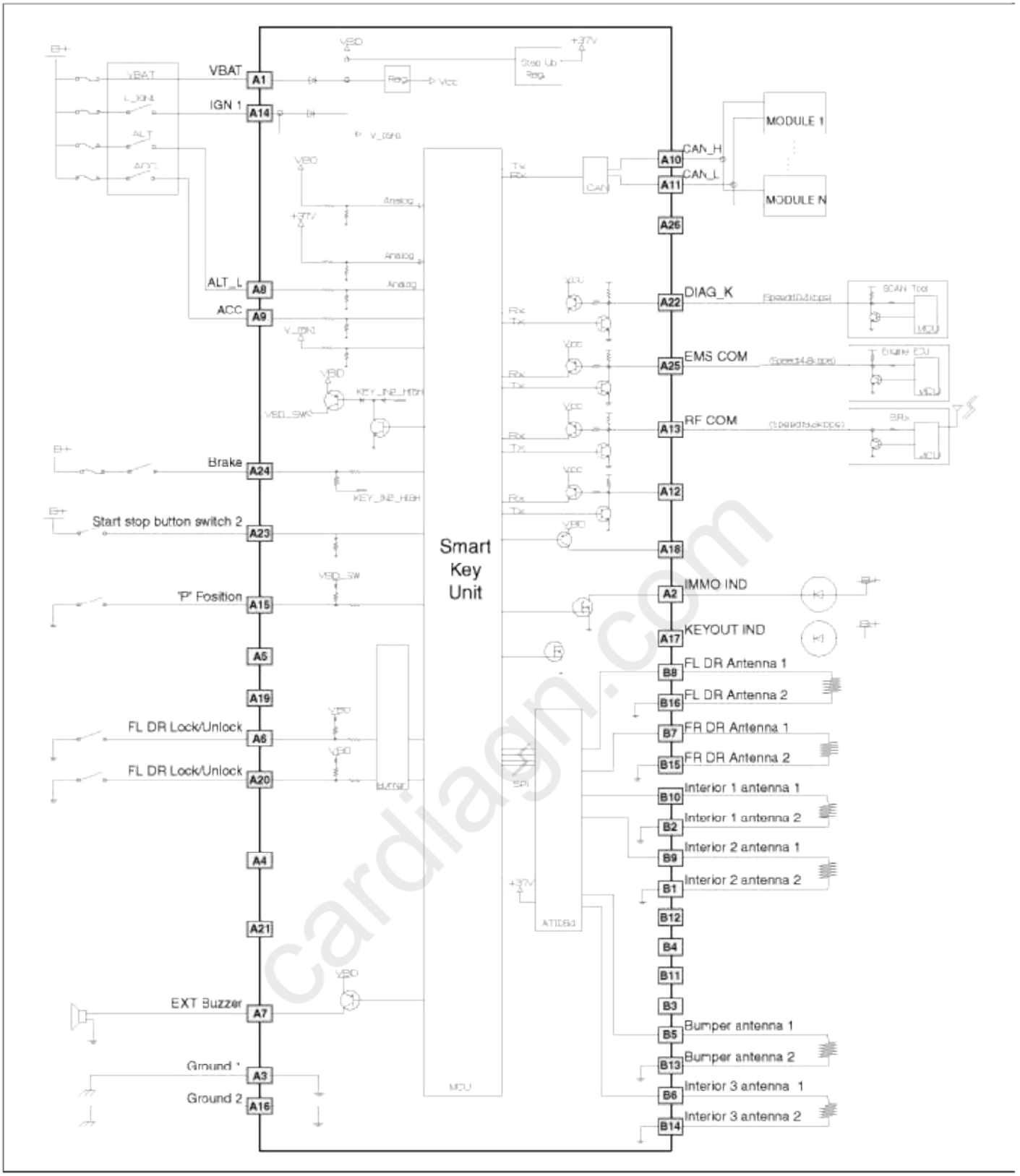
Connector Pin Information

No	Connector A (26 Pin)			No	Connector B (16 Pin)
1	BAT. Voltage	17	KEY OUT indicator	1	Interior 2 Antenna 2
2	IMMO indicator	18	-	2	Interior 1 Antenna 2
3	Ground 1	19	-	3	-
4	-	20	Front-right door Lock/Unlock	4	-
5	Tailgate switch	21	-	5	Interior 3 Antenna 1
6	Front-left door Lock/Unlock	22	DIAGNOSIS	6	Bumper Antenna 1
7	Exterior Buzzer	23	Start stop button switch	7	Front-right door Antenna 1
8	ALT 'L	24	Brake	8	Front-left door Antenna 1
9	ACC	25	EMScommunication	9	Interior 2 Antenna 1
10	CAN HIGH	26	-	10	Interior 1 Antenna 1
11	CAN LOW			11	-
12	-			12	-
13	RF communication			13	Interior 3 Antenna 2
14	IGN 1			14	Bumper Antenna 2
15	P position			15	Front-right door Antenna 2
16	Ground 2			16	Front-left door Antenna 2

Body Electrical System > Smart key System > Smart key unit > Schematic Diagrams

Circuit Diagtam

cardiagn.com



cardiagn.com

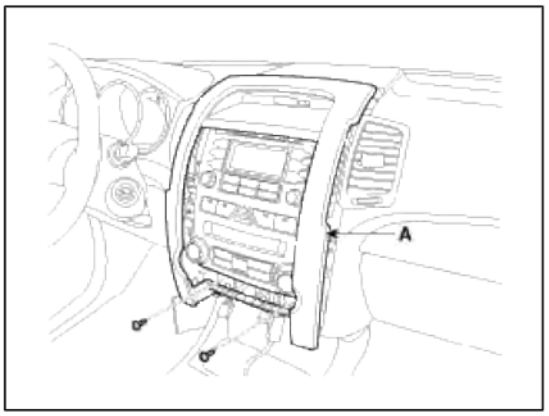
Body Electrical System > Smart key System > Smart key unit > Repair procedures

Removal

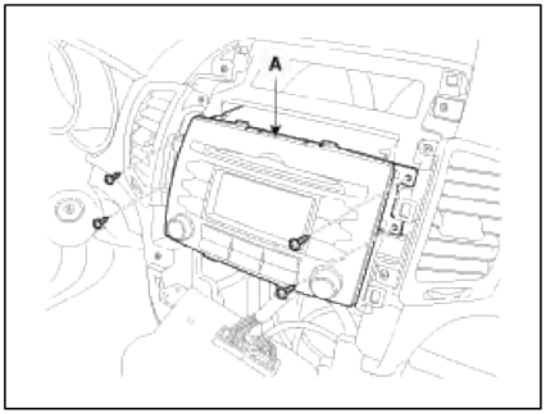
Smart Key Unit

1. Disconnect the negative (-) battery terminal.

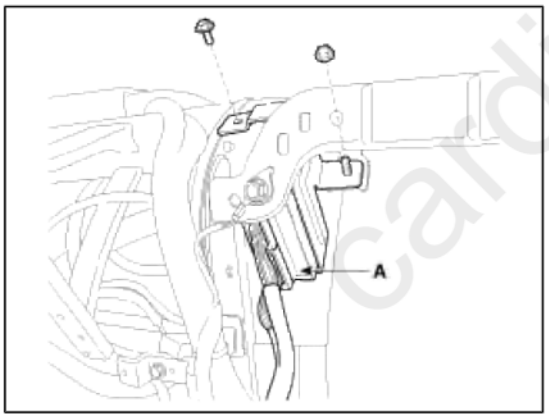
2. Remove the center fascia panel (A).
   (Refer to BD group - "Crash pad")



3. Remove the audio assembly (A) after loosening the mounting screws.
   (Refer to BD group - "Crash pad")



4. After disconnecting the smart key unit connector, loosen the smart key unit mounting bolt and nut, and remove the smart key unit (A).

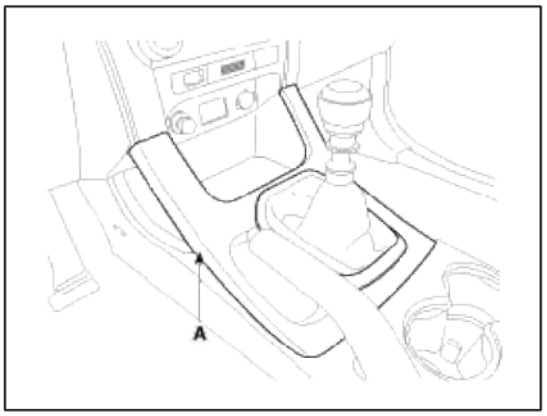


RF Receiver

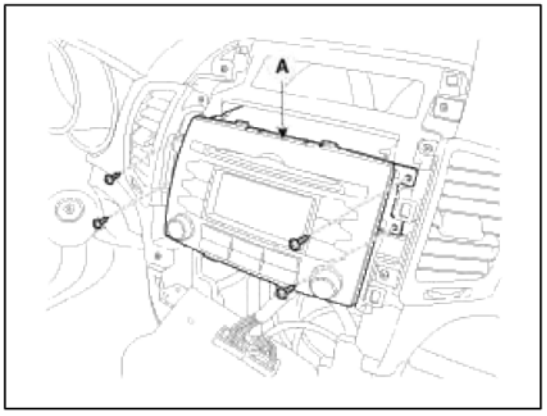
1. Disconnect the negative (-) battery terminal.

cardiagn.com

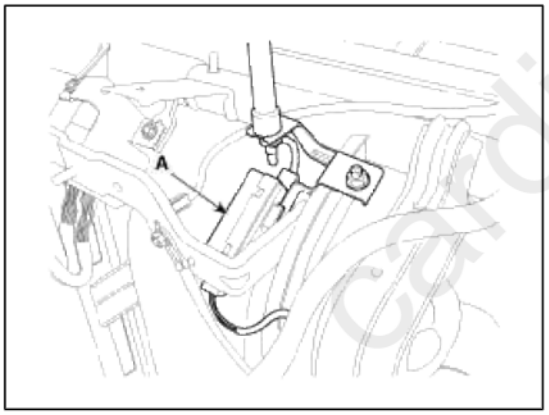
2. Remove the floor console upper cover (A).
   (Refer to BD group - "Console")



3. Remove the audio assembly (A).
   (Refer to BD group - "Crach pad")



4. After loosening the mounting nut (1EA), disconnect the connector and remove the receiver (A).

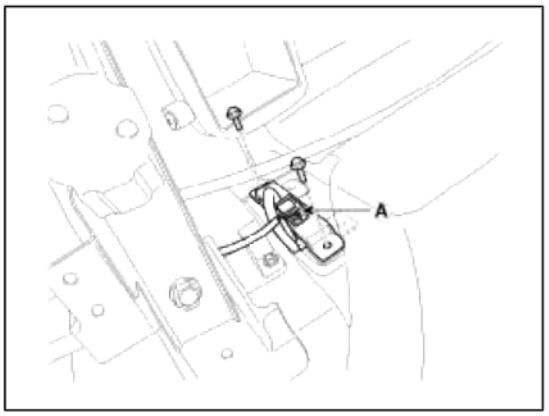


Interior 1 Antenna

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

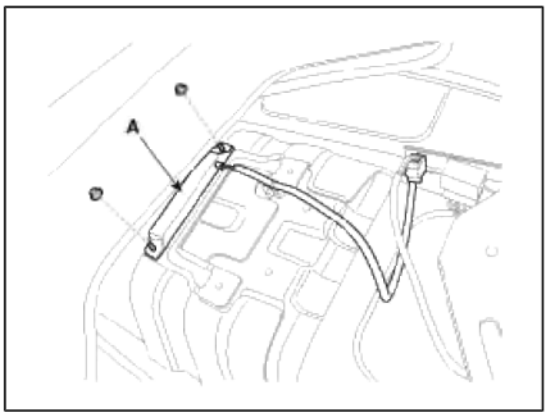
cardiagn.com

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



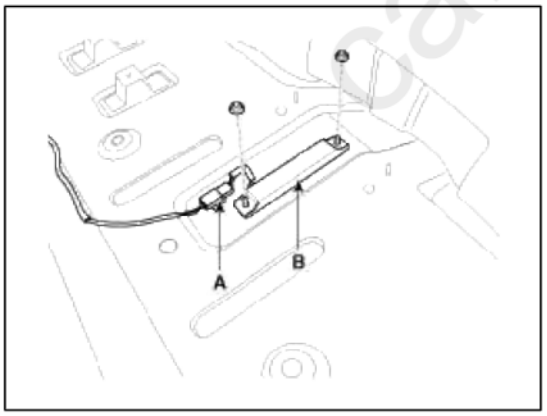
Interior 2 Antenna

1. Disconnect the negative (-) battery terminal.
2. Remove the console assembly.
   (Refer to BD group - "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 BD group - "Rear seat")
3. After loosening the antenna nuts (2EA) and connector (A), remove the interior 3 antenna (B).

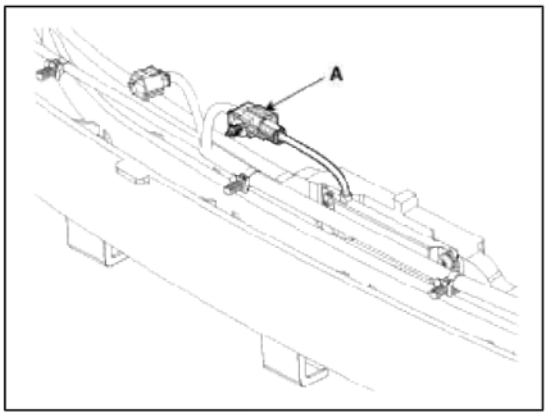


Exterior Bumper Antenna

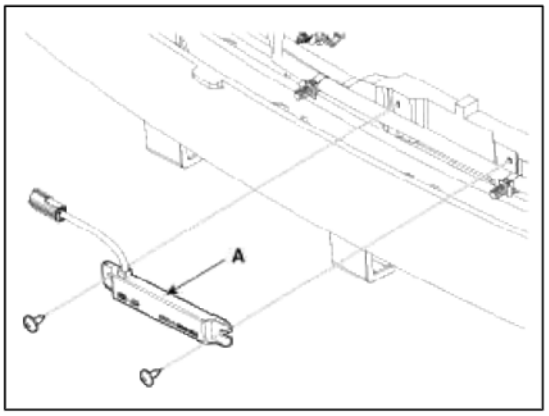
1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to BD group - "Rear bumper")

cardiagn.com

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

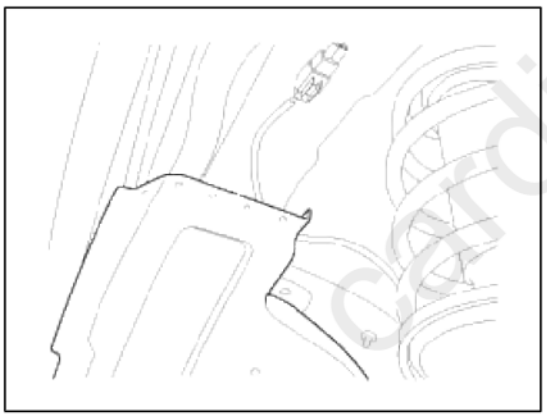


4. After loosening the nuts (2EA), remove the exterior bumper antenna (A).

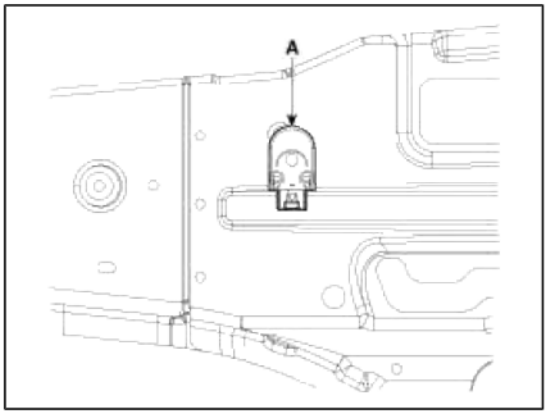


Buzzer

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



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

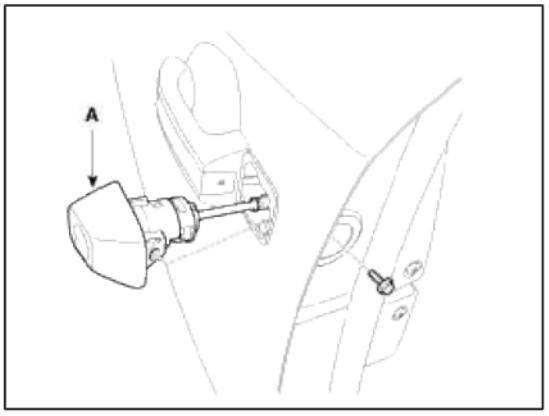


Door Outside Handle

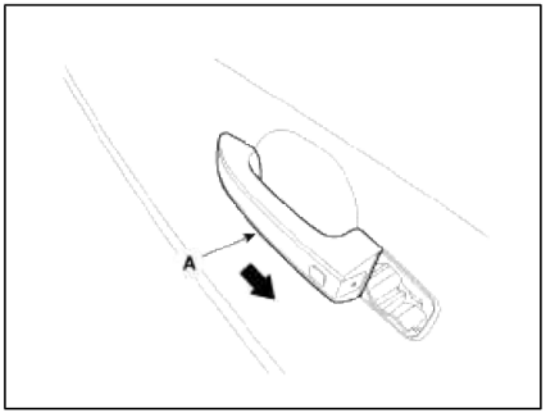
1. Disconnect the negative (-) battery terminal.

cardiagn.com

2. Disconnect the connector after removing the door trim.
   (Refer to BD group - "Front door")
3. After loosening the mounting bolt, then remove the key holder (A).

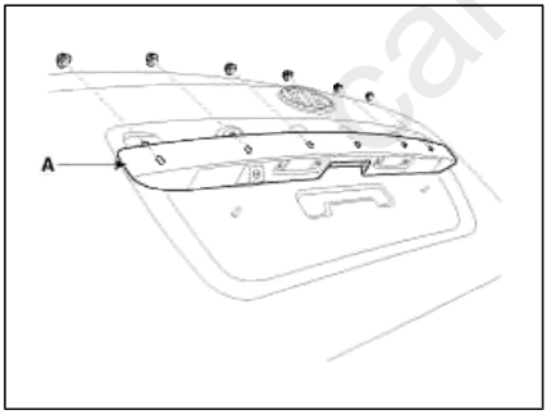


4. Remove the outside handle (A) by sliding it rearward.



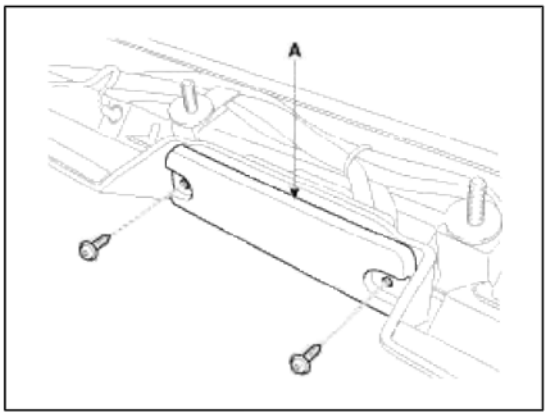
Tailgate Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.
   (Refer to BD group - "Tailgate trim")
3. Disconnect the connector. After loosening the remove tailgate garnish mounting nuts (6EA), then tailgate garnish (A).



cardiagn.com

4. Remove the outside handle (A) after loosening the outside handle mounting screws.



Inspection

Smart Key Unit

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

Smart Key Switch

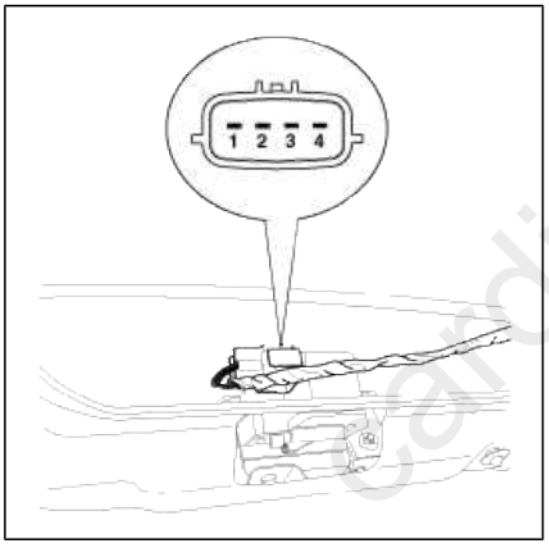
- Refer to BE group - inspection / self diagnosis with scan tool.

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 center fascia panel.
4. Install the glove box.
5. Install the negative (-) battery terminal and check the smart key system.

RF Receiver

1. Install the RF receiver.

cardiagn.com

2. Install the center fascia panel.
3. 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.
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 assembly.
4. Install the console rear cover after connecting the connector.
5. 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.

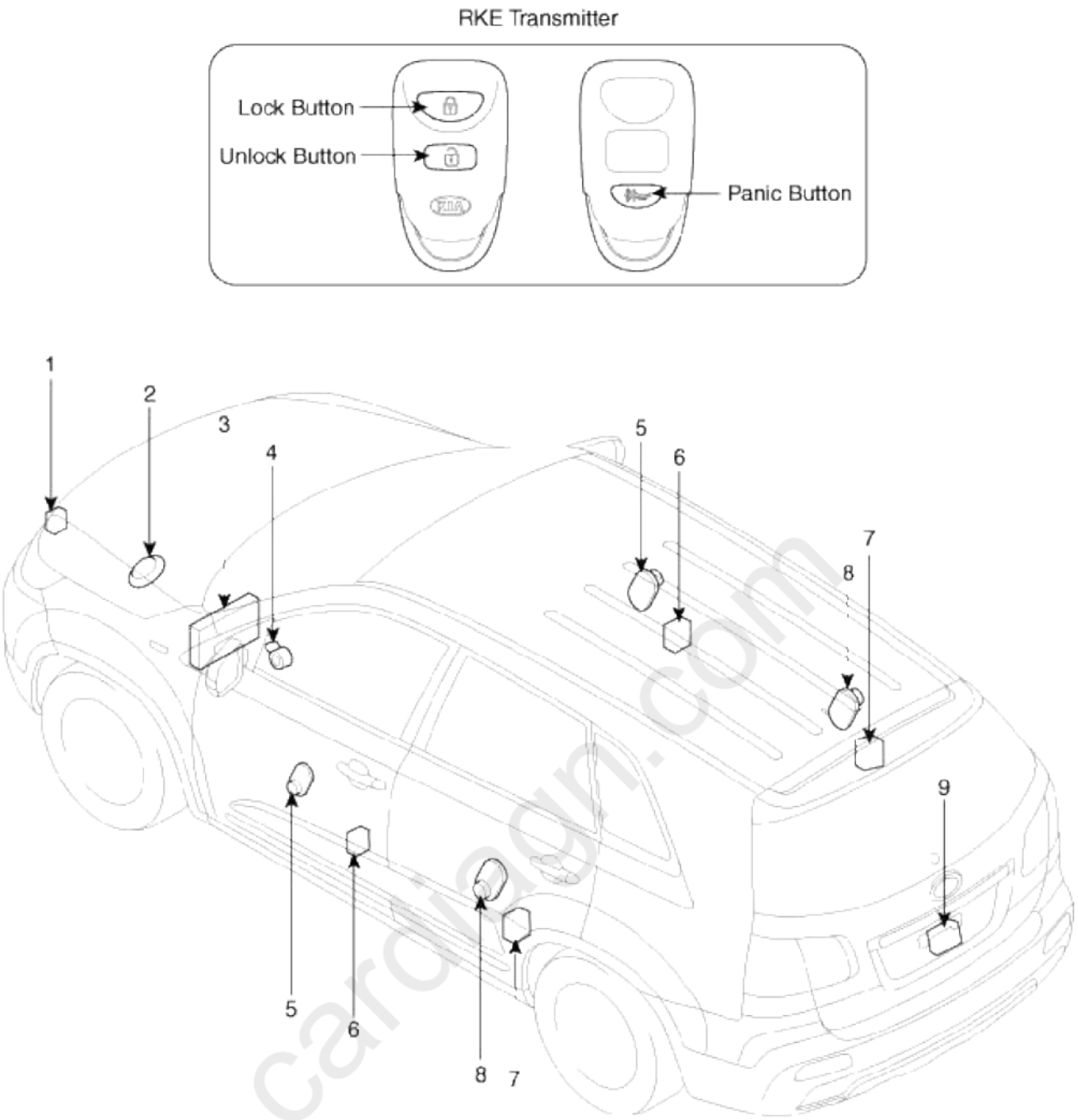
Tailgate Switch

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.

cardiagn.com

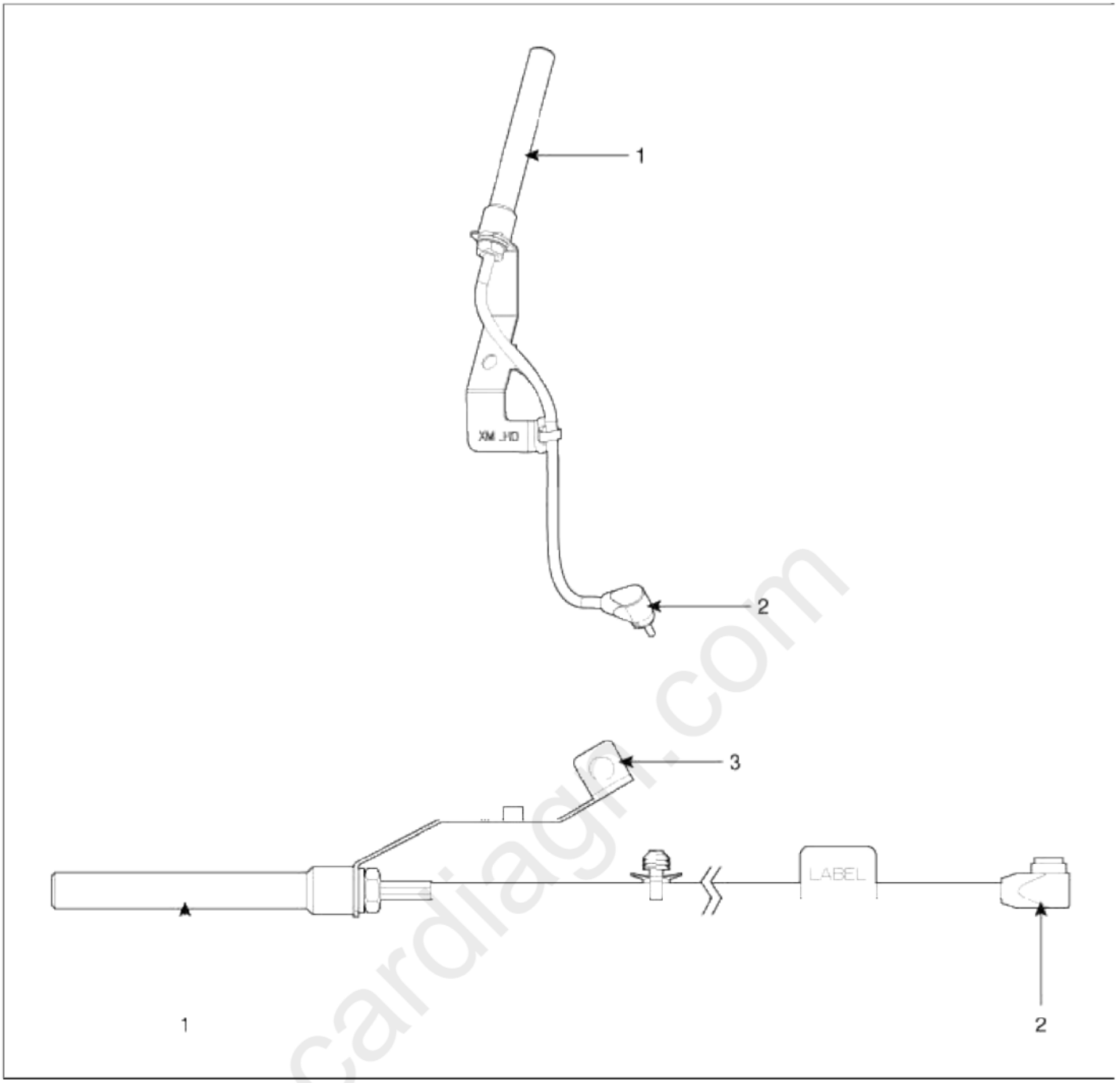
Body Electrical System > Keyless Entry And Burglar Alarm > Components and Components Location

Component Location



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

cardiagn.com



1. Antenna 2. IPM connector	3. Antenna bracket

Body Electrical System > Keyless Entry And Burglar Alarm > Description and Operation

Description

Keyless Entry System

The burglar alarm system is integrated with the keyless entry system. The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK button, all doors lock. When you push the UNLOCK button again, all doors unlock.

Function

Keyless Entry Function

DOOR LOCK / UNLOCK and Trunk operations are performed with remote controller

1. Keyless entry function is performed in a state that key in switch is eliminated from key cylinder.

cardiagn.com

2. LOCK / UNLOCK and trunk signals are received from the transmitter and DOOR LOCK / UNLOCK and Trunk signals are sent to the doors.
3. In case of the tailgate, the latch is operated when the button is pushed for 0.5s or more.

Transmitter(TX) Spec

1. Transmission Distance : 30m or more from outside of the car
2. Registration (Programming) procedure of the transmitter
   (1) In registration mode, it shall be possible to register up to Max 4EA.
   (2) During re-registration, new data is registered after deleting the previous TX DATA

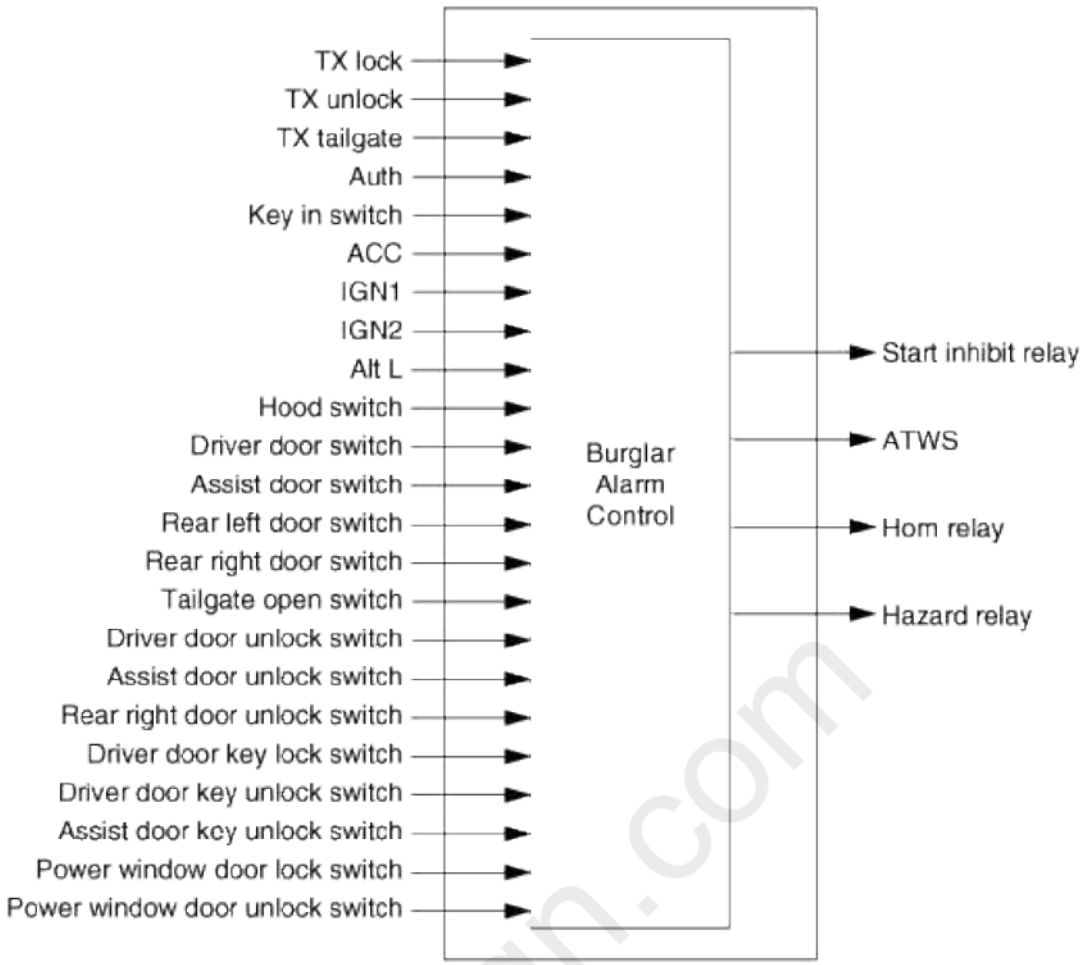
No.	Saved Code	Code to change	Changed Code
1	A	C	C (A is deleted)
2	A, B, C, D	E	E (A, B, C, D is deleted)
3	A, B	C, D, E	C, D, E
4	A, B	C, C, D	C

   (3) To perform the registration procedure use the GDS and go to "TRANSMITTER CODE REGISTRATION".
3. Transmitter signal & Receiver Spec
   (1) Transmission signal
      A. Transmit relevant transmission DATA (Transmission frame) twice by pushing TX switch.
      B. Only the LOCK signal is sent when pushing both TX LOCK and UNLOCK switchs at the same time.

Anti-theft function

1. Anti-theft control data flow

cardiagn.com



2. DISARM

State	Description
Initial Condition	ALARM
Transition Condition	Any door open or tailgate open switch ON, and TX unlock input 3 seconds elapsed under IGN key all ON state (excluding China) 3 seconds elapsed under IGN key all ON & AltL ON state (excluding China) door lock failed within 5 seconds from TX lock input lock by lock lock input failed (mechanical key enabled) lock unlock input (mechanical key enabled) TX tailgate or SMK passive tailgate input AUTH (SMK Specification only)
Action	DISARM state activated Horn relay, hazard relay, start Inhibit OFF 2 hazard relay inputs in 0.5 second cycle of ON/OFF (TX unlock input)

cardiagn.com

State	Description
Initial Condition	IGN key OUT and (Any door open or tailgate open switch ON) under DISARM activation
Transition Condition	TX unlock input AUTH (SMK Specification only)
Action	DISARM state maintained 2 hazard relay inputs in 0.5 second cycle of ON/OFF (TX unlock)

State	Description
Initial Condition	ARM WAIT
Transition Condition	Any door open or Hood switch open or tailgate open switch ON At least a door is unlocked keyIn or ACC ON lock unlock input (mechanical key enabled) AUTH (SMK specification only) SMK passive tailgate input
Action	DISARM state activated

State	Description
Initial Condition	Auto lock timer1
Transition Condition	Any door open or hood switch open or tailgate open switch ON key in or ACC ON lock by auto lock is failed lock by TX lock is failed lock by lock lock is failed (mechanical key enabled) AUTH (SMK speficiation only)
Action	DISARM state activated

State	Description
Initial Condition	Autolock timer2
Transition Condition	Any door open or tailgate open switch ON key in or ACC ON lock by auto lock is failed lock by TX lock is failed lock by lock lock is failed (mechanical key enabled) AUTH (SMK Speficiation only)
Action	DISARM state activated

cardiagn.com

State	Description
Initial Condition	ARM
Transition Condition	IGN key all ON (excluding China) lock unlock input (mechanical key enabled) AUTH (SMK Speficiation only)
Action	DISARM state activated

State	Description
Initial Condition	REARM
Transition Condition	30 seconds elapsed under IGN key all ON state (excluding China) 3 seconds elapsed under IGN key all ON & AltL ON (excluding China) lock by auto lock is failed lock by TX lock is failed (mechanical key enabled) lock by lock lock is failed (mechanical key enabled) TX tailgate unlock input AUTH (SMK Speficiation only)
Action	DISARM state activated Start inhibit OFF

State	Description
Initial Condition	PREARM
Transition Condition	TX unlock input with any door open or tailgate open switch ON KeyIn or ACC ON At least one of doors is unlocked with all entrances closed lock unlock input (mechanical key enabled) AUTH (SMK Speficiation only)
Action	DISARM state activated 2 hazard relay inputs in 0.5 second cycle of ON/OFF (TX unlock)

State	Description
Initial Condition	Auto lock timer3
Transition Condition	Any door open key in or ACC ON Hood switch open lock by TX lock is failed lock by lock lock is failed (mechanical key enabled) lock by lock unlock is failed (mechanical key enabled) AUTH (SMK Specification only)
Action	DISARM state activated

cardiagn.com

3. ARM

State	Description
Initial Condition	ARM
Transition Condition	TX lock Input
Action	ARM state maintained Hazard relay output for a second

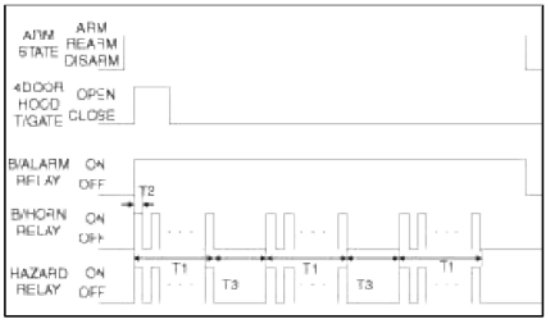
State	Description
Initial Condition	ARM WAIT
Transition Condition	After halting ARM WAIT TIMER
Action	ARM state activated

4. ALARM

State	Description
Initial Condition	ARM
Transition Condition	Any door open or hood switch open or tailgate open switch ON Or either of key in or ACC is ON (China)
Action	ALARM state activated Starting is prevented by turning ON start inhibit output Turn ON horn relay Alarm for 28 seconds (±2), and OFF for 10 seconds (±1sec) OFF in total of 3times Hazard relay output is operated as same with horn relay. (all region)

State	Description
Initial Condition	REARM
Transition Condition	Any door open or hood switch open or tailgate open switch ON
Action	ALARM state activated Turn ON horn relay Alarm for 28 seconds (±2), and OFF for 10 seconds (±1sec) OFF in total of 3times Hazard relay output is operated as same with horn relay. (all regions)

carmanual.com



T1 : 28sec ± 2, T2 : 0.5sec

T3 : 10sec ± 1, T4 : 1sec

5. ARM WAIT

State	Description
Initial Condition	ARM WAIT
Transition Condition	TX lock Input
Action	ARM WAIT state maintained 1 hazard relay output for a second

State	Description
Initial Condition	DISARM state and IGN key out and all entrances closed
Transition Condition	Successfully locked by TX lock Successfully locked by lock Input (mechanical key enabled) Tailgate open switch OFF and (Any door open → All door closed) with door locked or All door closed and (tailgate open switch ON→OFF) (mechanical key enabled)
Action	ARM WAIT state activated 1 Hazard relay output for a second (excluding Mechanical lock) Starting ARMWAIT TIMER

State	Description
Initial Condition	IGN key out and and all entrances closed with ALARM state activated
Transition Condition	Successfully locked by TX lock Successfully locked by mechanical lock Input (mechanical key enabled)
Action	ARM WAIT state activated Horn relay, start inhibit output OFF 1 Hazard relay output for a second (excluding mechanical lock) Starting ARMWAIT TIMER

carmagn.com

State	Description
Initial Condition	Auto lock timer1
Transition Condition	Successfully locked by Autolock Successfully locked by TX lock Successfully locked by mechanical lock Input (mechanical key enabled)
Action	ARM WAIT state activated 1 Hazard relay output for a second (excluding mechanical lock) Starting ARMWAIT TIMER

State	Description
Initial Condition	PREARM
Transition Condition	All entrances closed and all DOORS locked
Action	ARM WAIT state activated 1 Hazard relay output for a second (excluding mechanical lock) Starting ARMWAIT TIMER.

State	Description
Initial Condition	REARM
Transition Condition	Successfully locked by TX lock Successfully locked by mechanical lock Input (mechanical key enabled)
Action	ARM WAIT state activated 1 Hazard relay output for a second (excluding mechanical lock) Start inhibit OFF Starting ARMWAIT TIMER

Saett	Dsrpinecito
Initial Condition	Autolock timer3
Transition Condition	Successfully locked by TX lock Successfully locked by mechanical lock Input (mechanical key enabled)
Action	ARM WAIT state activated 1 Hazard relay output for a second (excluding mechanical lock) Starting ARMWAIT TIMER

6. REARM

State	Description
Initial Condition	ALARM
Transition Condition	All entrances closed and ALARM pattern completed
Action	REARM state activated

7. Auto-lock timer 1

carofign.com

State	Description
Initial Condition	ARM
Transition Condition	TX unlock Input
Action	Auto-lock timer1 state activated 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Starting autolock timer1

State	Description
Initial Condition	Auto-lock timer1
Transition Condition	Autolock timer1 completed TX unlock Input
Action	Auto-lock timer1 state maintained CASE1: Autolock timer1 completed → Attempting autolock CASE2: TX unock → 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Re-starting autolock timer1

State	Description
Initial Condition	ARM WAIT
Transition Condition	TX unlock Input
Action	Auto-lock timer1 state activated 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Starting Autolock timer1

State	Description
Initial Condition	DISARM state, IGN key out and all entrances closed
Transition Condition	TX unlock Input
Action	Auto-lock timer1 state activated 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Re-starting Autolock timer1

State	Description
Initial Condition	ALARM state and All entrances closed
Transition Condition	TX unlock Input
Action	Auto-lock timer1 state activated Horn relay, start inhibit output OFF 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Starting Autolock timer1

cardiagn.com

State	Description
Initial Condition	REARM
Transition Condition	TX unlock Input
Action	Auto-lock timer1 state activated start inhibit OFF 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Starting Autolock timer1

State	Description
Initial Condition	Autolock timer3
Transition Condition	TX unlock Input
Action	Autolock timer1 state activated 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Starting Autolock timer1

8. Auto-lock timer 2

State	Description
Initial Condition	Auto-lock timer2
Transition Condition	Autolock timer2 completed TX unlock Input
Action	Auto-lock timer2 Stated maintatined CASE1: Autolock timer2 completed → attempting Autolock CASE2: TX unlock Input → 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Re-starting Autolock timer2

State	Description
Initial Condition	DISARM state, IGN KEY OUT, (All door closed & tailgate open switch OFF), and hood switch open
Transition Condition	TX unlock Input
Action	Auto-lock timer2 state activated 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Re-starting Autolock timer2

State	Description
Initial Condition	ALARM state, (All door closed & tailgate open switch OFF) and Hood switch open
Transition Condition	TX unlock Input
Action	Auto-lock timer2 state activated Horn relay, start inhibit output OFF 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Re-starting Autolock timer2

cardiagn.com

State	Description
Initial Condition	PREARM State, (All door closed & tailgate open switch OFF) and hood switch open
Transition Condition	TX unlock Input
Action	Auto-lock timer2 state activated 2 Hazard relay outputs in 0.5 second cycle of ON/OFF Starting Autolock timer2

9. Auto-lock timer 3

State	Description
Initial Condition	ARM
Transition Condition	TX tailgate Input or SMK passive tailgate Input
Action	Autolock timer3 state activated START Autolock timer3 2 hazard relay outputs in 0.5 second cycle of ON/OFF

State	Description
Initial Condition	Autolock timer3
Transition Condition	TX tailgate Input
Action	Autolock timer3 state maintained Restart Autolock timer3

State	Description
Initial Condition	ARMWAIT
Transition Condition	TX tailgate Input
Action	Autolock timer3 state activated Start Autolock timer3 2 hazard relay outputs in 0.5 second cycle of ON/OFF

If hazard lamp output is not compatible with"Tailgate release function"on activating Autolock timer3 by TX tailgate in ARM and ARMWAIT, Hazard lamp output control by tailgate release function is the priority.

cardiagn.com

10. PREARM

State	Description
Initial Condition	Auto-lock timer2 state
Transition Condition	Successfully locked by Autolock Successfully locked by TX lock Successfully locked by mechanical lock Input (mechanical key enabled)
Action	PREARM state activated

State	Description
Initial Condition	DISARM state & IGN key out
Transition Condition	Sucessfully locked by TX lock, with any door open or hood switch open or tailgate open switch ON Sucessfully locked by mechanical lock Input with any door open or hood switch open or tailgate open switch ON.(mechanical key enabled) In hood switch open state (Mechanical Key Enabled), (Any door open → all doors closed) and tailgate open switch OFF with all doors locked or tailgate open switch ON → OFF with all doors closed.
Action	PREARM state activated

State	Description
Initial Condition	IGN key out and (Any door open or hood switch open or tailgate open switch ON) in ALARM state
Transition Condition	Sucessfully locked by TX lock Sucessfully locked by mechanical lock Input (mechanical key enabled)
Action	PREARM state activated Horn relay, hazard relay, start inhibit Ouput OFF

State	Description
Initial Condition	Auto-lock timer3
Transition Condition	Autolocktimer3 is expired Tailgate open switch ON
Action	PREARM state activated

carmanual.com

11. RESET

State	Description
Initial Condition	ALARM, REARM
Transition Condition	Battery removal and replacement
Action	Start inhibit ON, 3 horn relay Alarm outputs Starting from ALARM state

State	Description
Initial Condition	ARM
Transition Condition	Removing battery and replacing it
Action	Starting from ALARM State

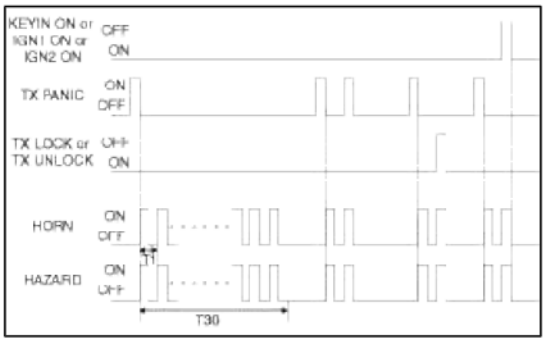
State	Description
Initial Condition	Excluding ARM, ALARM, REARM
Transition Condition	Removing battery and replacing it
Action	Starting from DISARM State

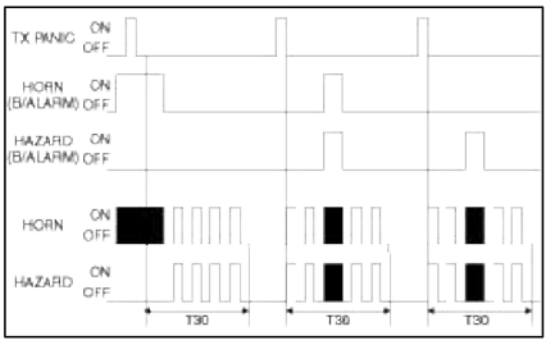
cardiagn.com

Panic Alarm function

1. Activated by inputting TX PANIC with KEY IN=OFF, ACC=OFF, IGN1=OFF, IGN2=OFF, and stopped in the following condition.
   A. TX LOCK
   B. TX UNLOCK
   C. PANIC (RKE PANIC=1 for SMK speficiction) input
   D. KEY IN=ON or IGN1=ON or IGN2=ON Input
   E. Driver door key unlock switch ON
   F. Driver door key LOCK switch ON
   G. Transponder AUTH = 1
   H. After completeing PANIC alarm activation
   I. ARM mode activation
2. PANIC alarm is activated regardless of B/ALARM mode, but halted in activating ARM mode. It is activated in alarm mode by B/ALARM.
3. Horn and Hazard operation by B/ALARM is prior to PANIC alarm.

4. Horn should be OFF for 10 seconds of pausing time during being alerted by B/ALARM.

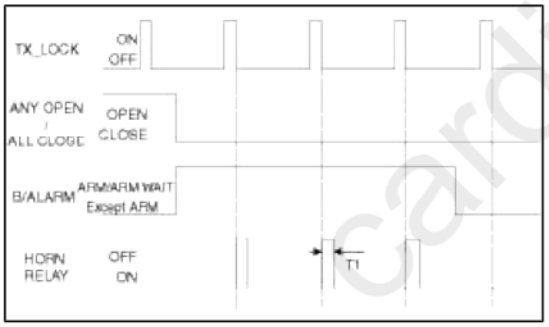




T1 : 1.5sec, T30 : 28sec ± 2, T2 : 0.5sec

Horn Answer Back function

1. HORN and B/HORN output is operated during HAZARD action, if ARM WAIT condition is maintained by TX LOCK within 4 seconds from ARM WAIT activation.
2. HORN and B/HORN output is operated during HAZARD action, if ARM is maintained by TX LOCK within 4 seconds from TX LOCK input.
3. If ARMWAIT or ARM mode is cancelled during T1, HORN and HAZARD ouput is not operated.
4. HORN and B/HORN and HAZARD output is operated regardless of receving other TX LOCK that is registered during T1 action.



T1 : 0.05 ± 0.01sec

Body Electrical System > Keyless Entry And Burglar Alarm > Repair procedures

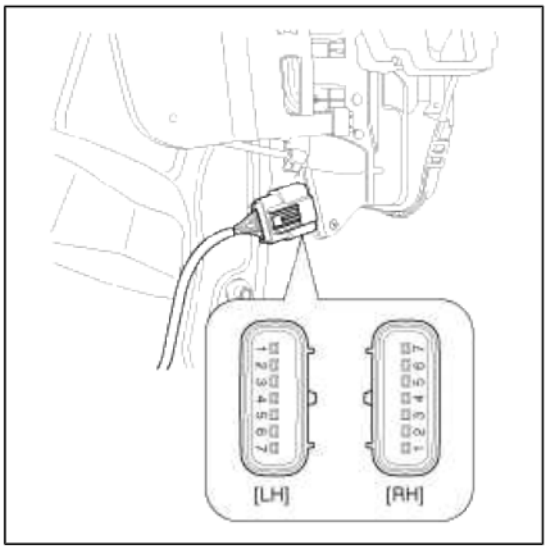
Inspection

Front Door Lock Actuator

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

cardiagn.com

3. Disconnect the connectors from the actuator.

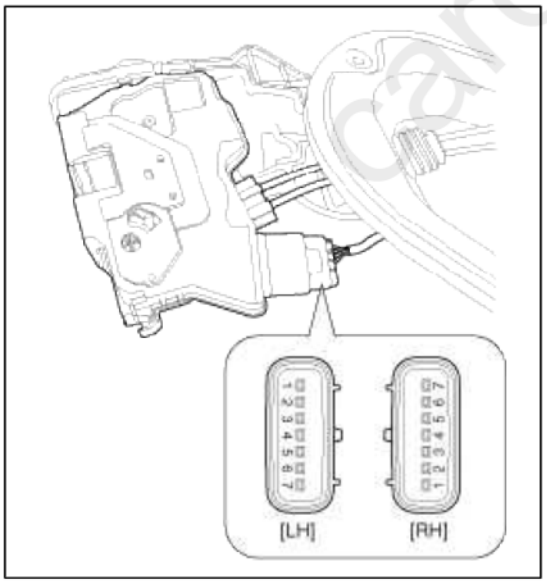


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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 BD group - "Rear door")
2. Remove the rear door module.
   (Refer to BD group - "Rear door")
3. Disconnect the connectors from the actuator.



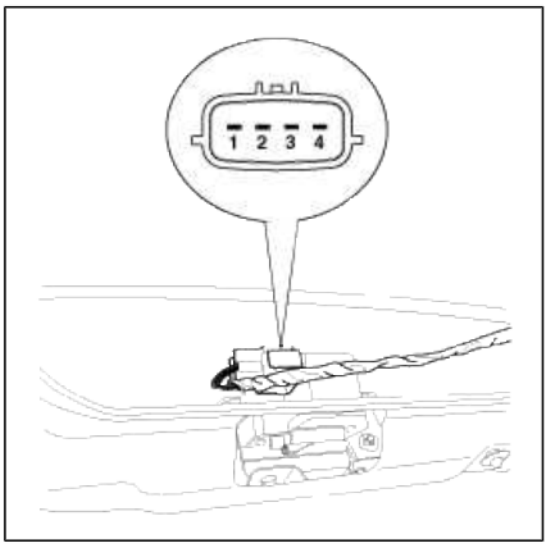
cardiagn.com

4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, 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 BD group - "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 actuator, apply battery voltage only momentarily.

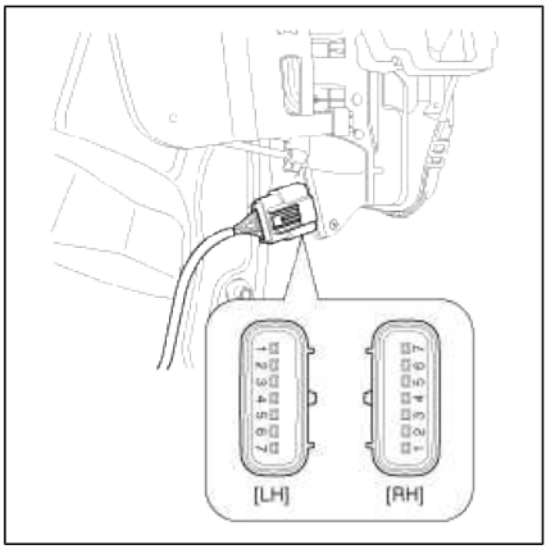
Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

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

cardiagn.com

3. Disconnect the connectors from the actuator.

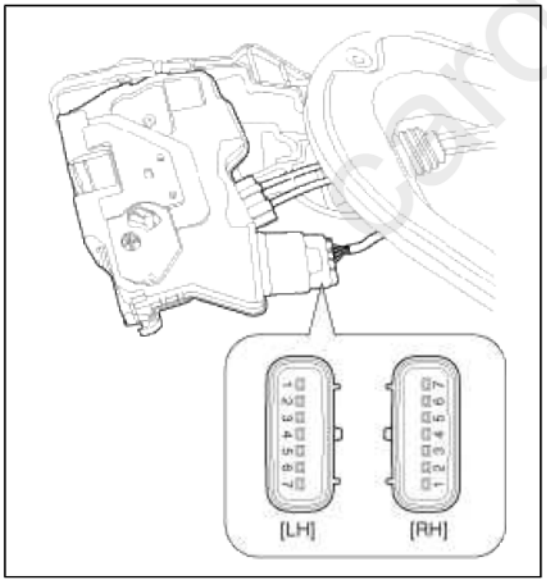


4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

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 BD group - "Rear door")
2. Remove the rear door module.
   (Refer to BD group - "Rear door")
3. Disconnect the connectors from the actuator.



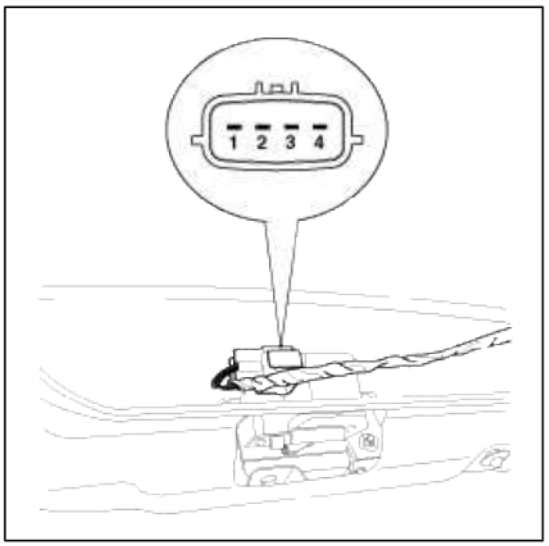
cardiagn.com

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 BD group - "Tailgate")
2. Disconnect the 4P connector from the actuator.

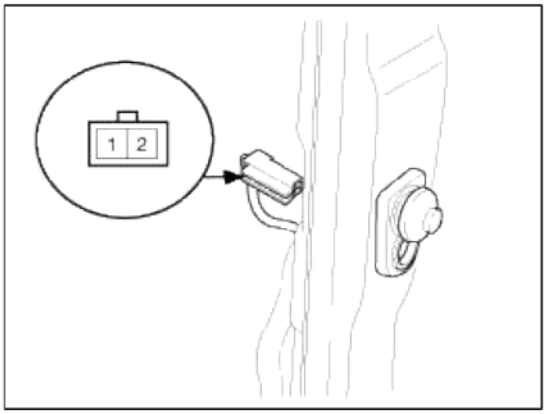


3. Check for continuity between the terminals in each switch position according to the table.

Position	Terminal	1	2
Lock			
Unlock		○——○	

Door Switch

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

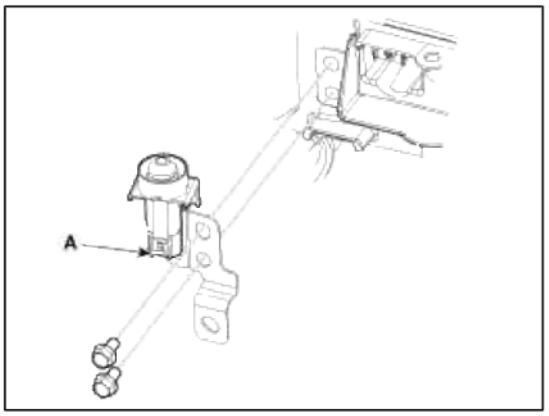


Position	Terminal	1	2	GND
Free(Door open)		○———	○———	○
Push(Door close)				

cardiagn.com

Hood Switch

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



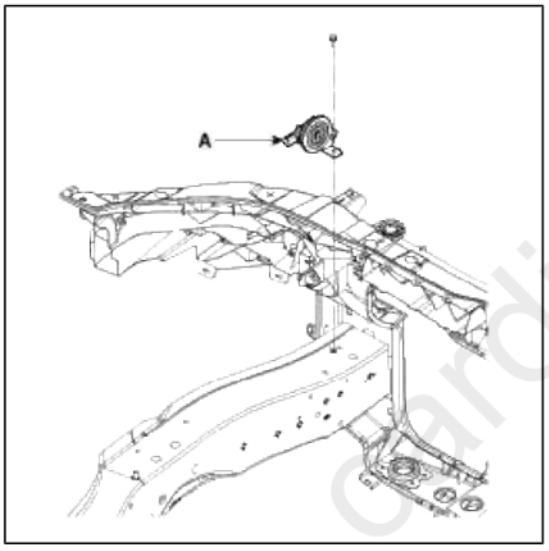
2. Check for continuity between the terminals and ground according to the table.

[2P Connector]

Terminal / Position	1	2
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 sound. If the burglar horn fails to sound replace it.

Body Electrical System > Keyless Entry And Burglar Alarm > Transmitter > Specifications

Specifications

cardiagn.com

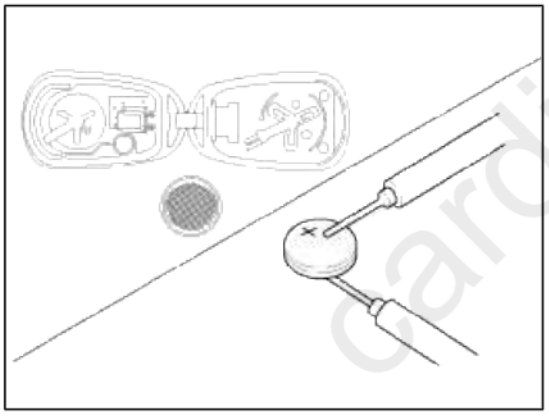
Item	Specification
Rated voltage	DC 3V
Temperature range	-4°F ~ 140°F (-20°C ~ +60°C)
RF Modulation method	FSK
LF Modulation method	ASK
Keyless entry transmitterPower source	Lithium 3V battery (1EA)
Transmissible distance	30m or more
Life of battery	2 years or more (at 20 times per day)
Button	3 (Door lock, Door unlock, Tailgate)
Transmission frequency	433.92 MHz

Body Electrical System > Keyless Entry And Burglar Alarm > Transmitter > Repair procedures

Inspection

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

Standard voltage : 3V



3. If the voltage is below 3V replace the transmitter battery with a new one. Then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
5. If the transmitter is fails, replace only the transmitter.

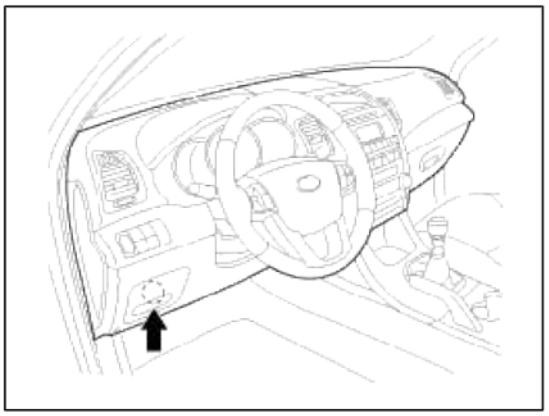
WARNING

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

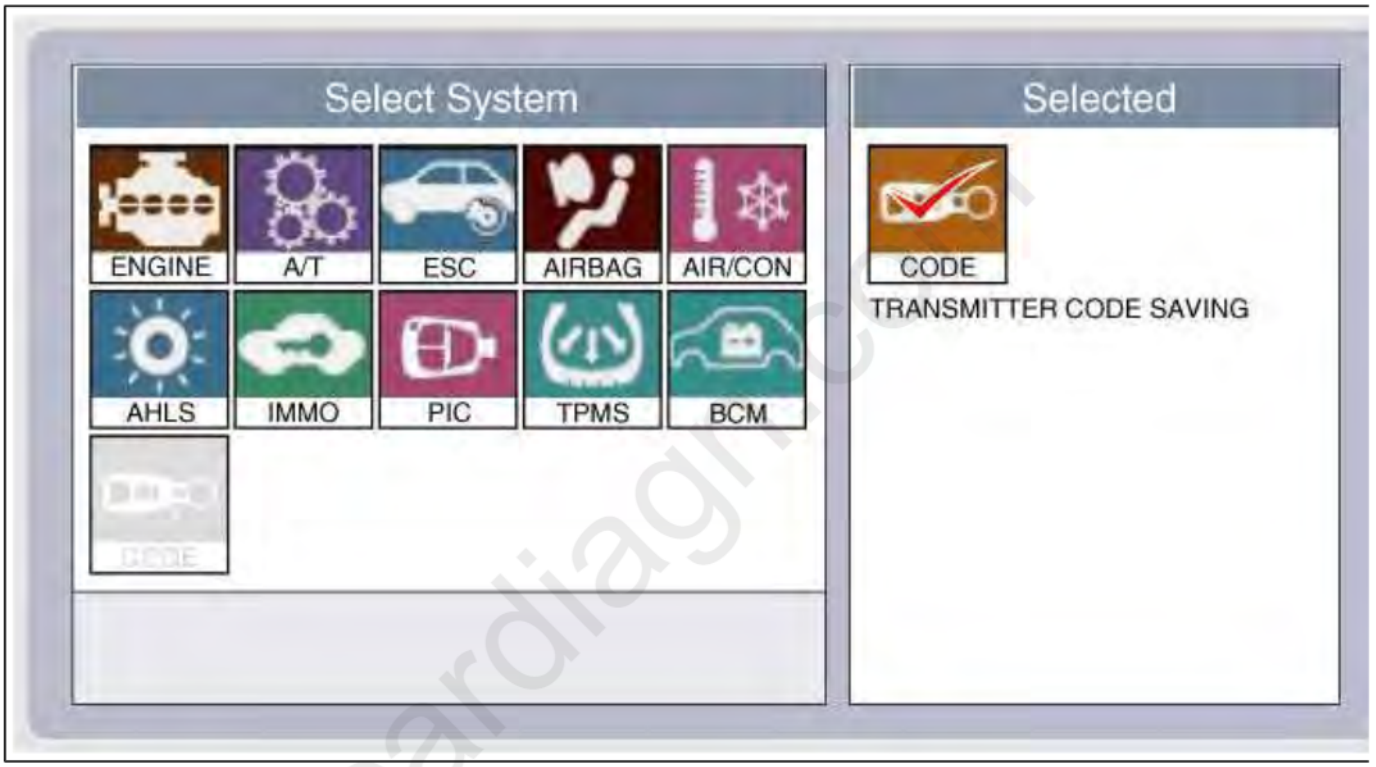
Transmitter Code Registration (Using GDS)

cardiagn.com

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

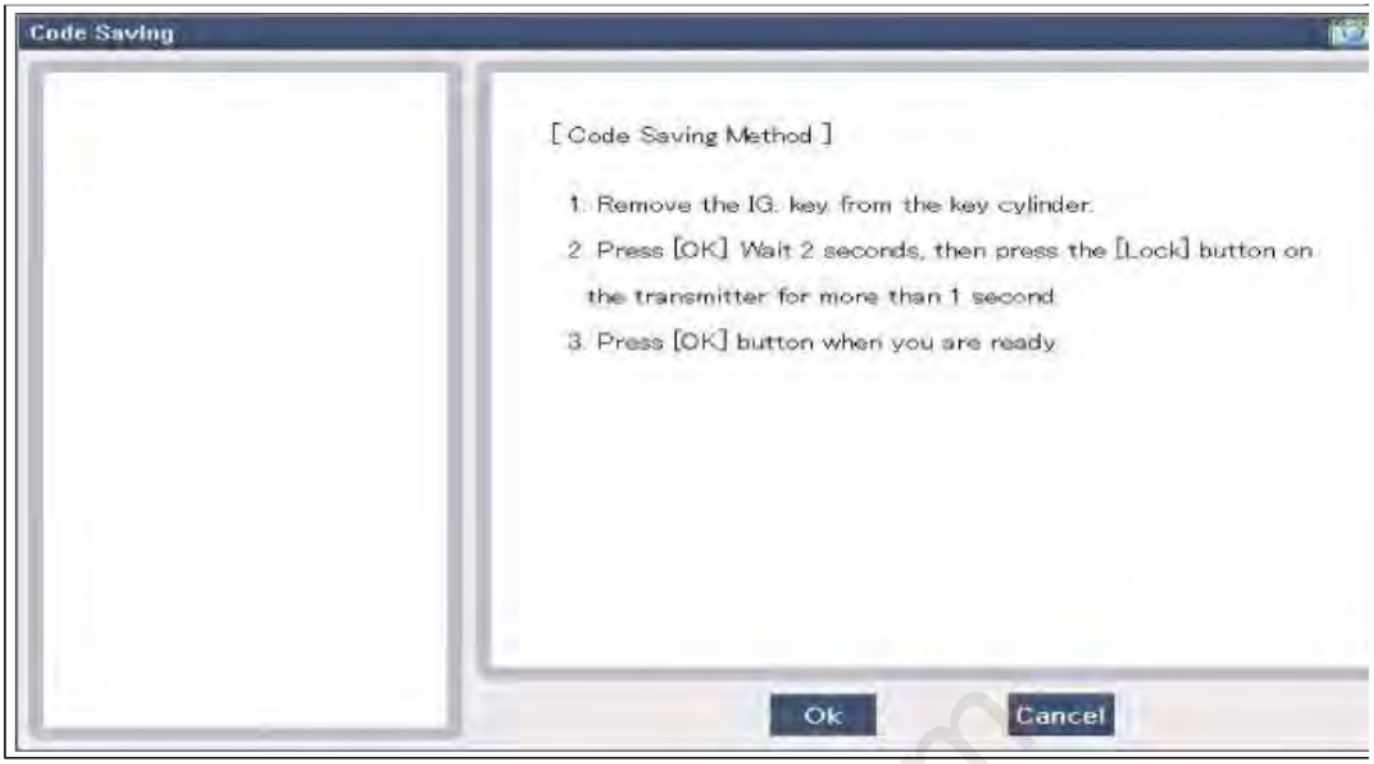


2. Select the vehicle model and then do "CODE SAVING"

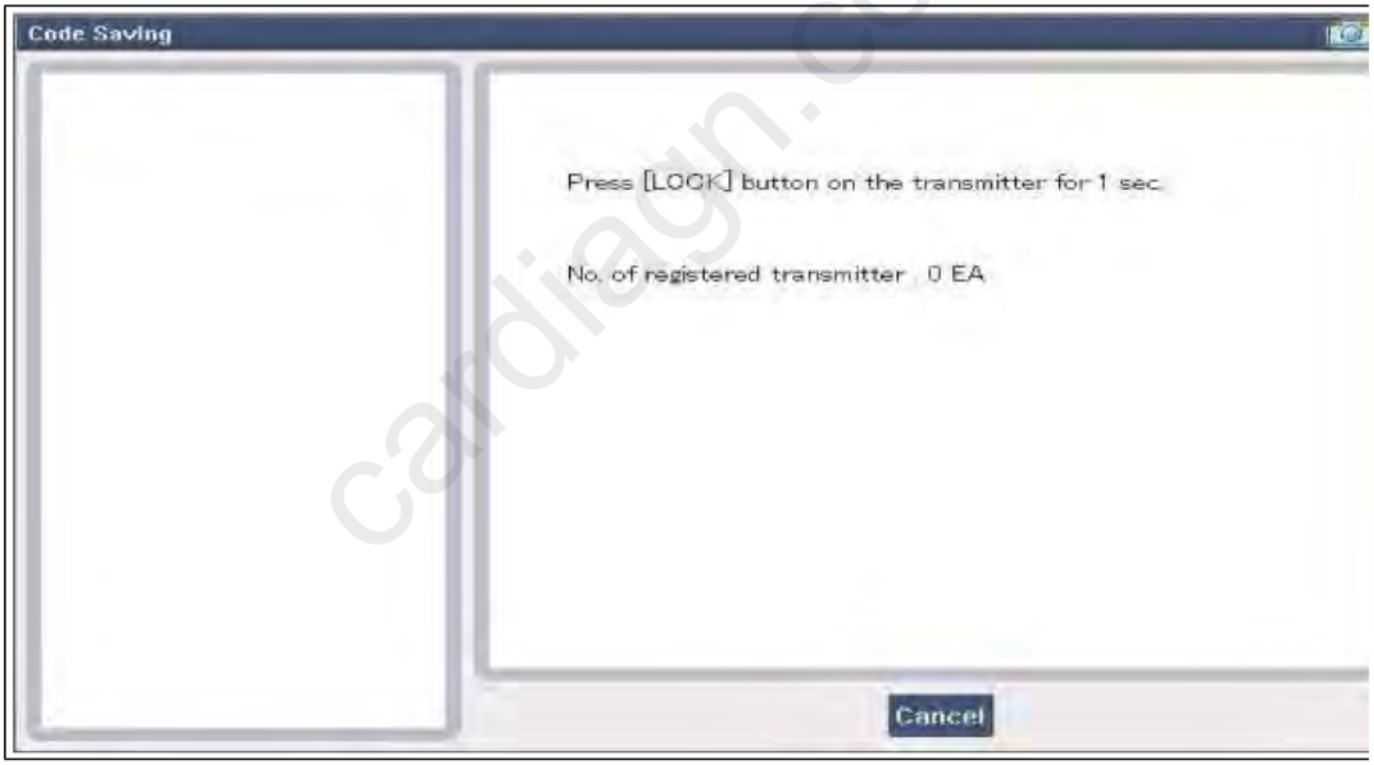


3. After selecting "CODE SAVING" menu, button "ENTER" key, then the screen will be shown as below.

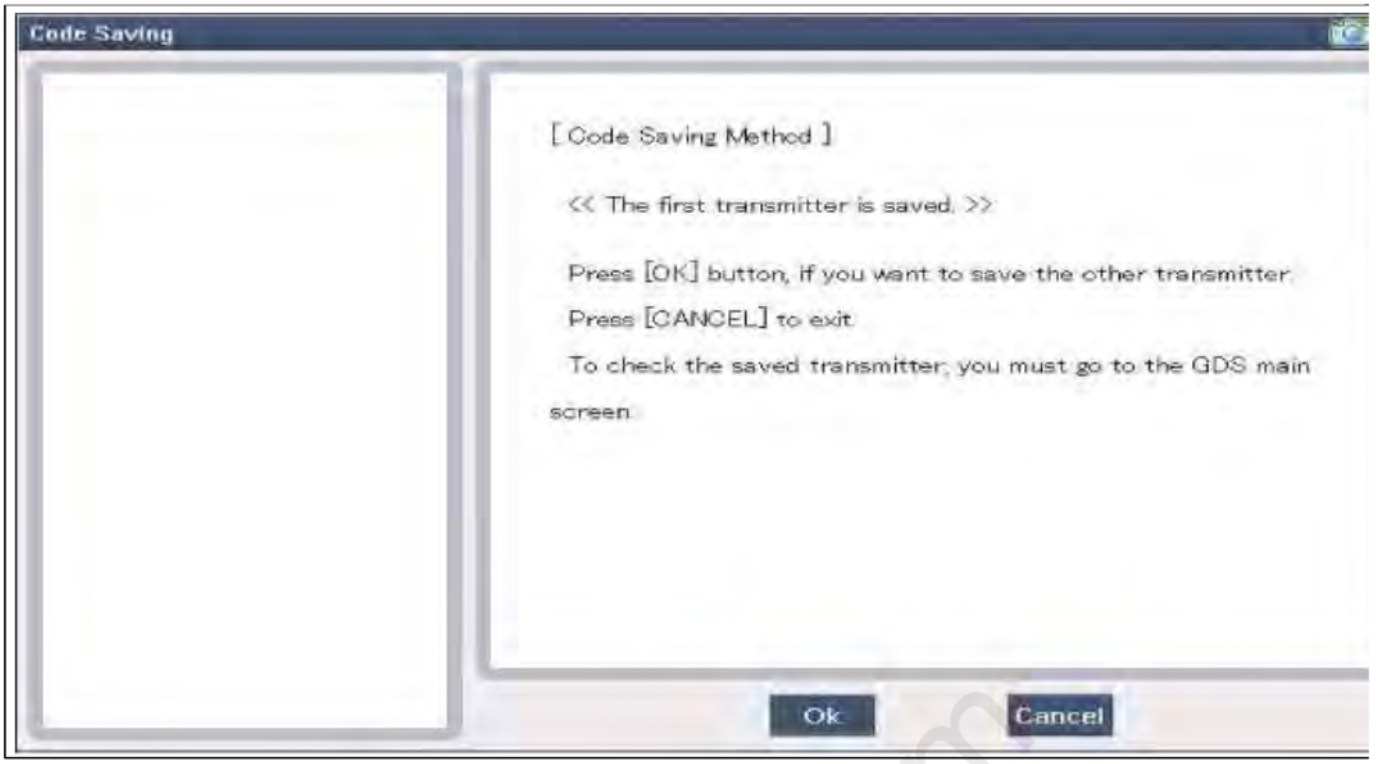
cardiagn.com

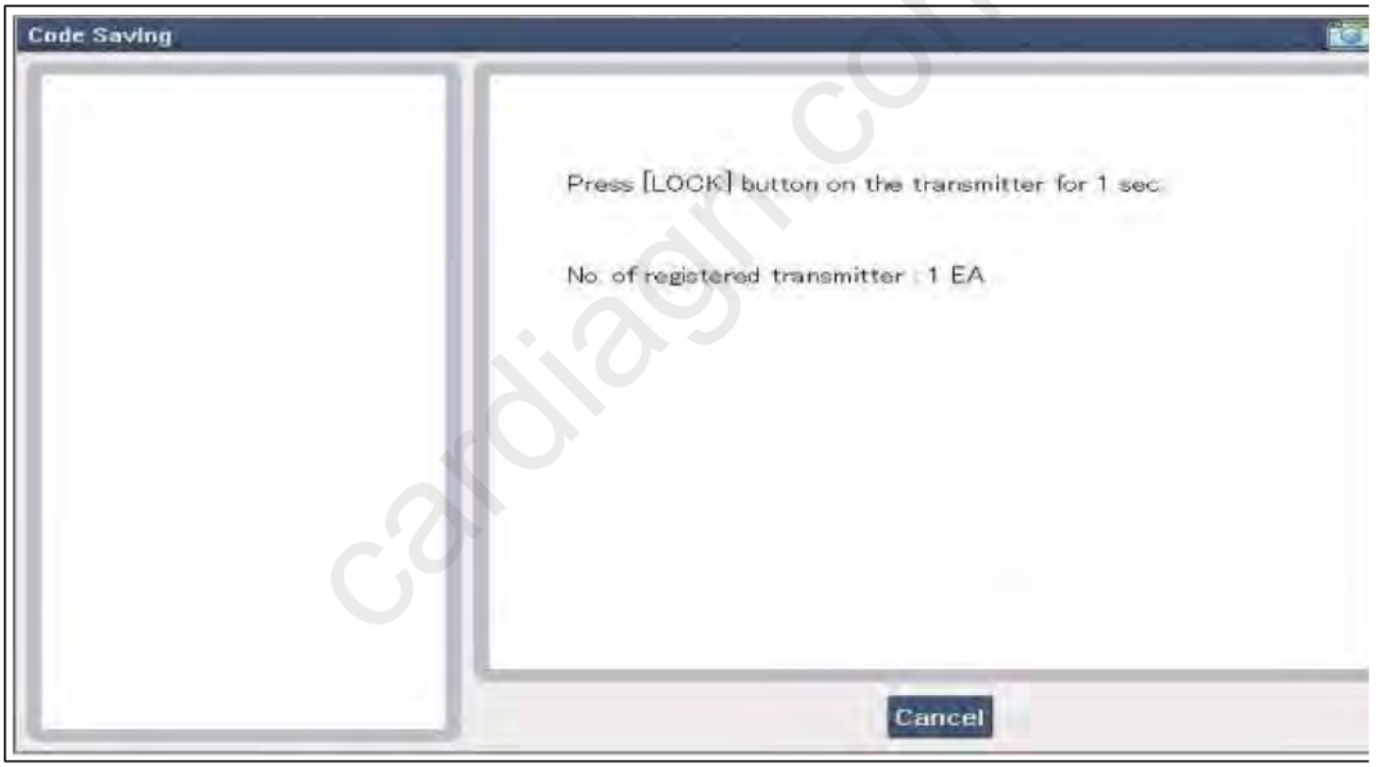


4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code savin
Follow steps 1 to 4 and then code saving is completed.

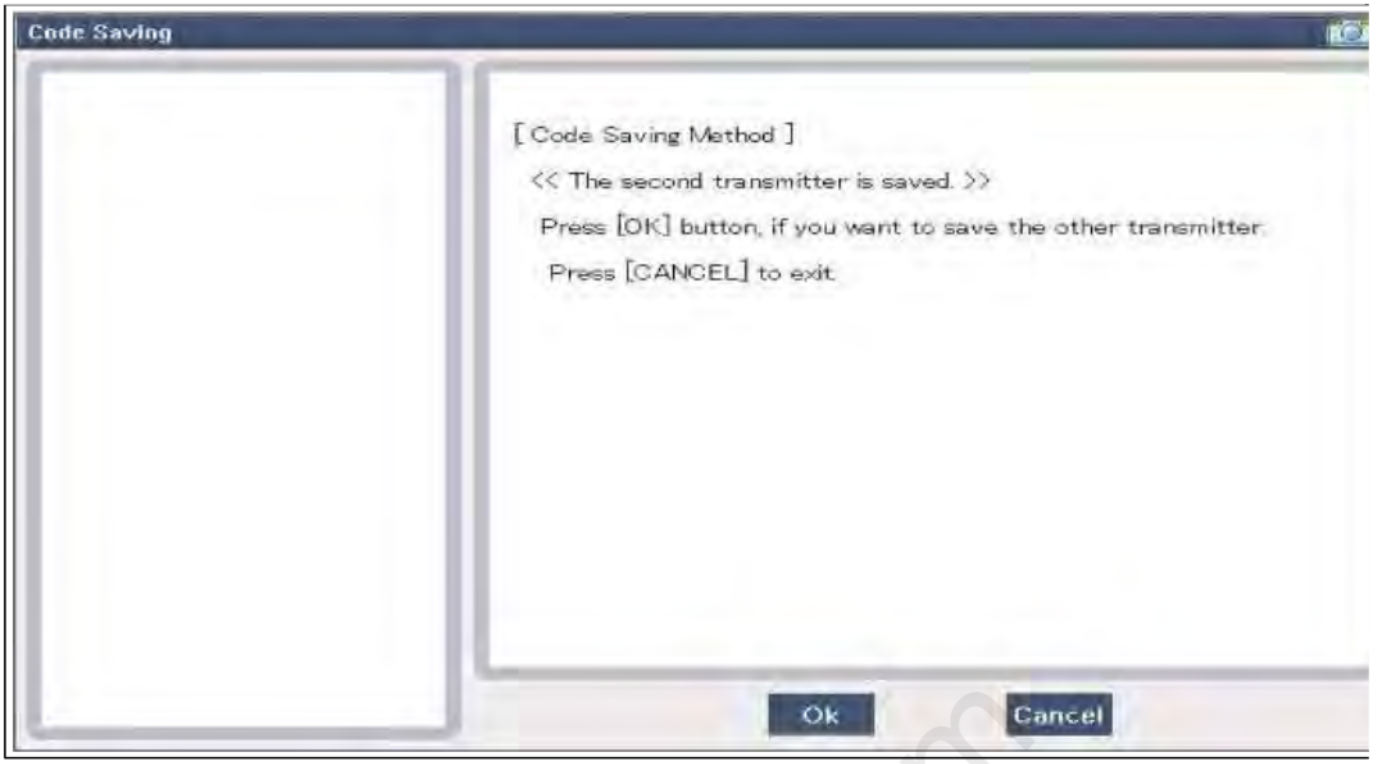


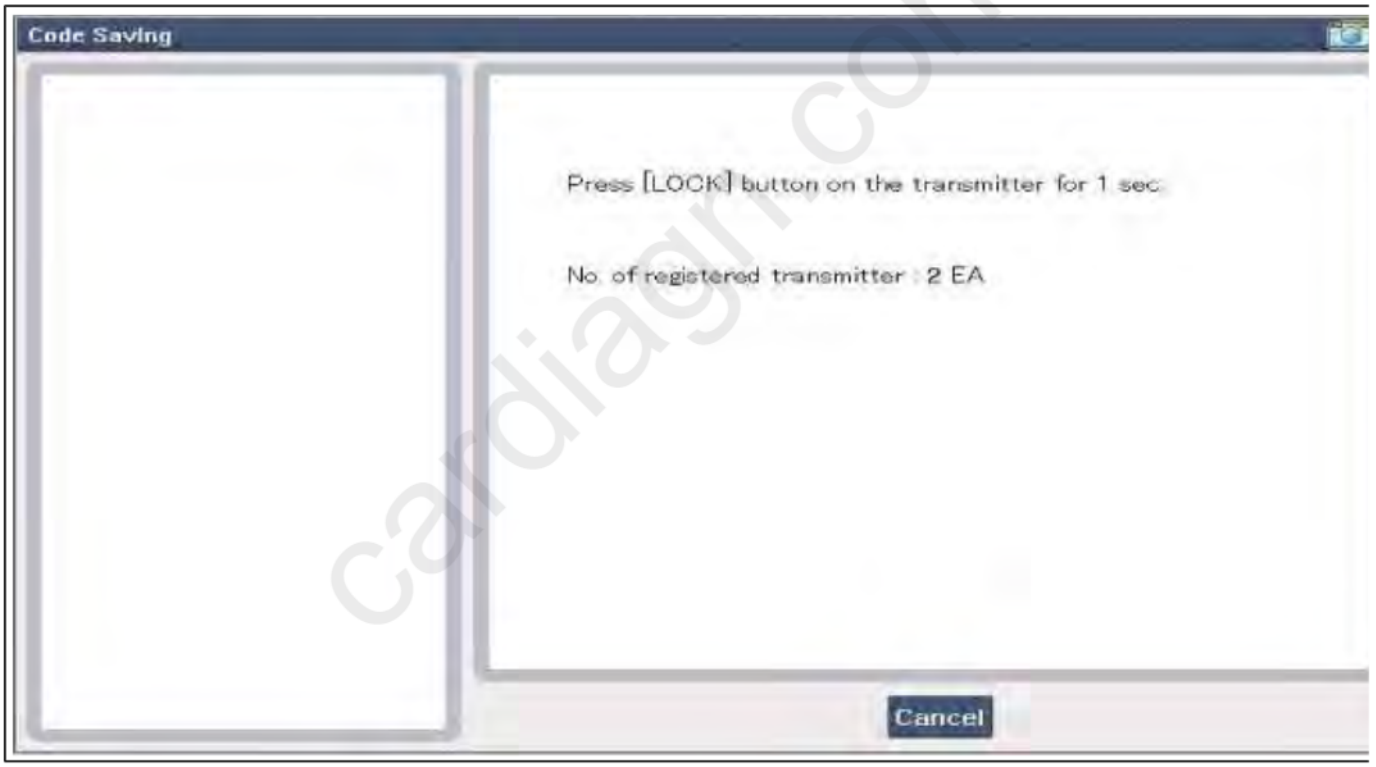
cardiagn.com



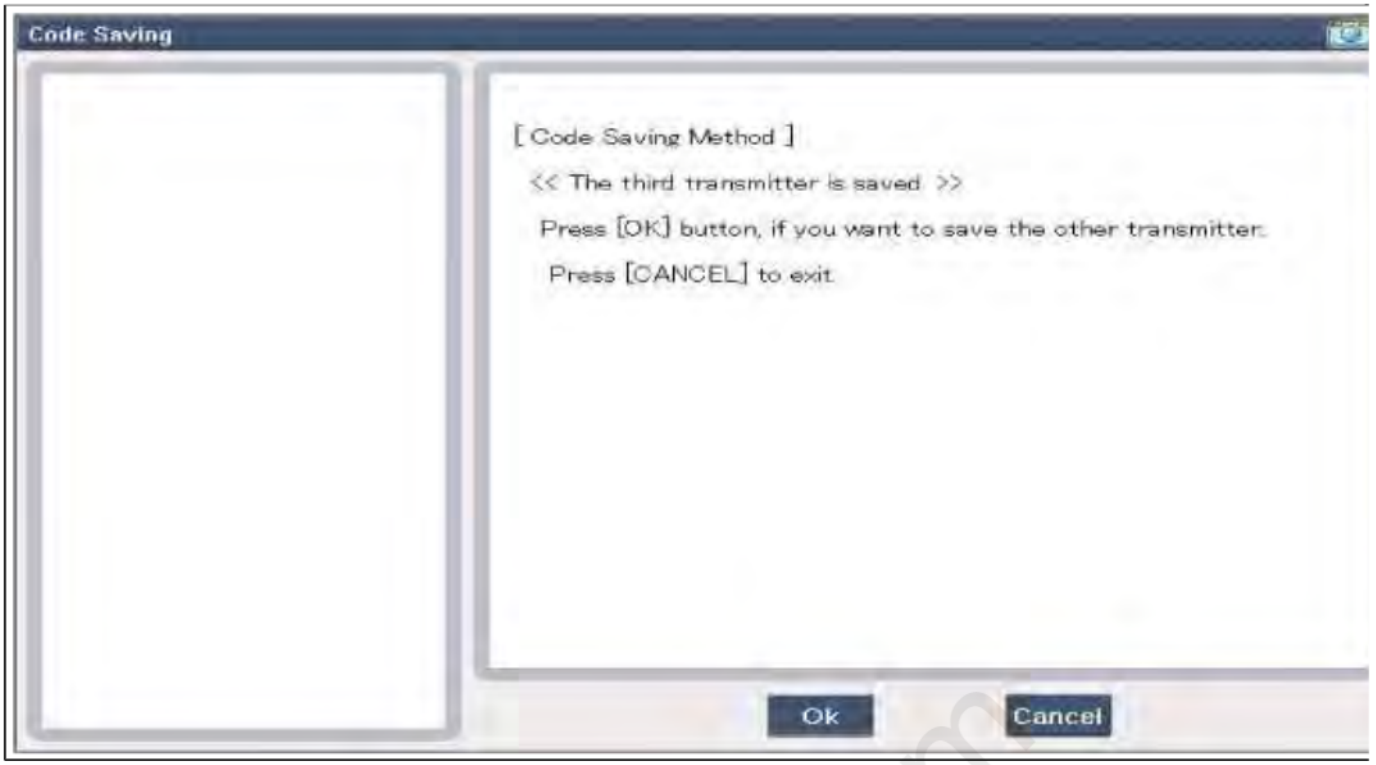


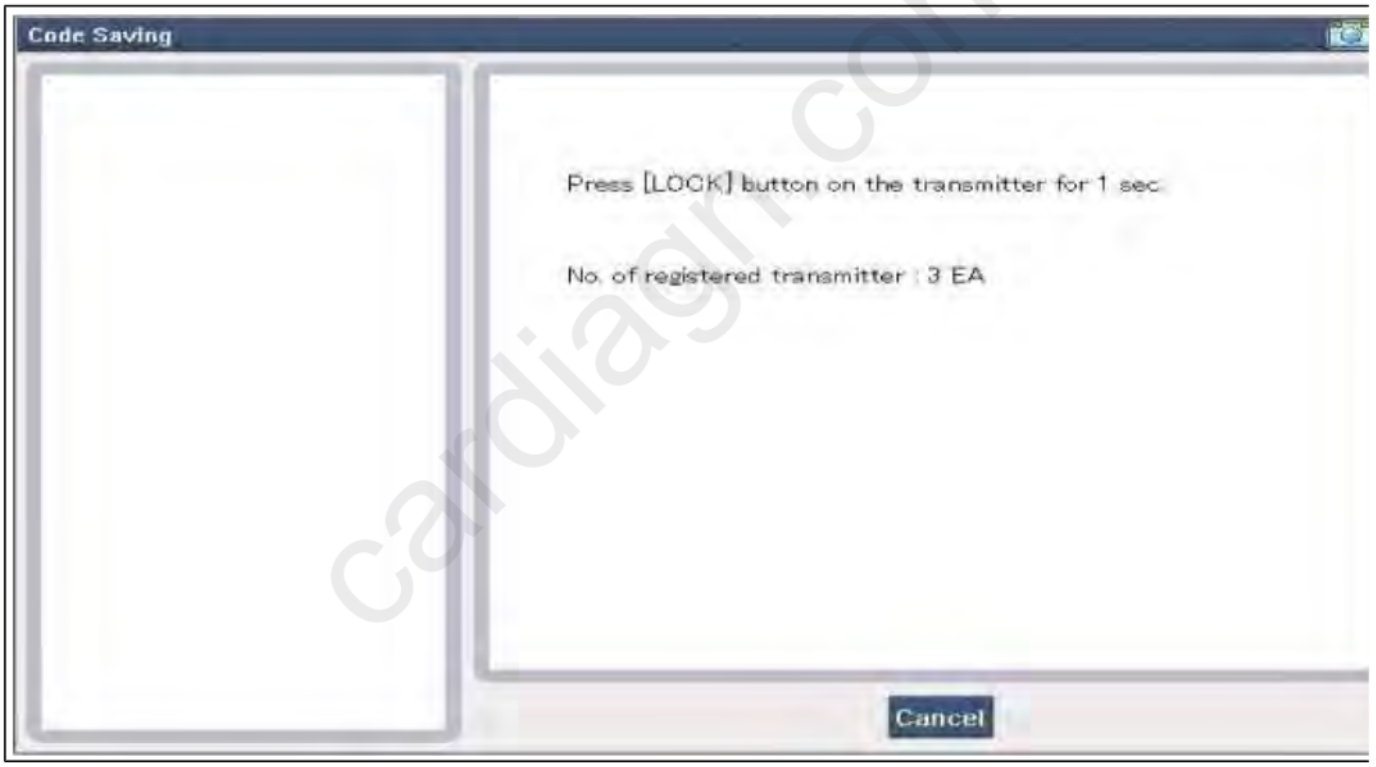
cardiagn.com





cardiagn.com





cardiagn.com

cardiagn.com

Body Electrical System > BCM (Body Control Module) > IPM (Intelligent intergrated Platform Module) > Specifications

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 : 4.5 mA Smart key specificaiton : 3.0 mA LIN communication specificaiton : 3.3 mA

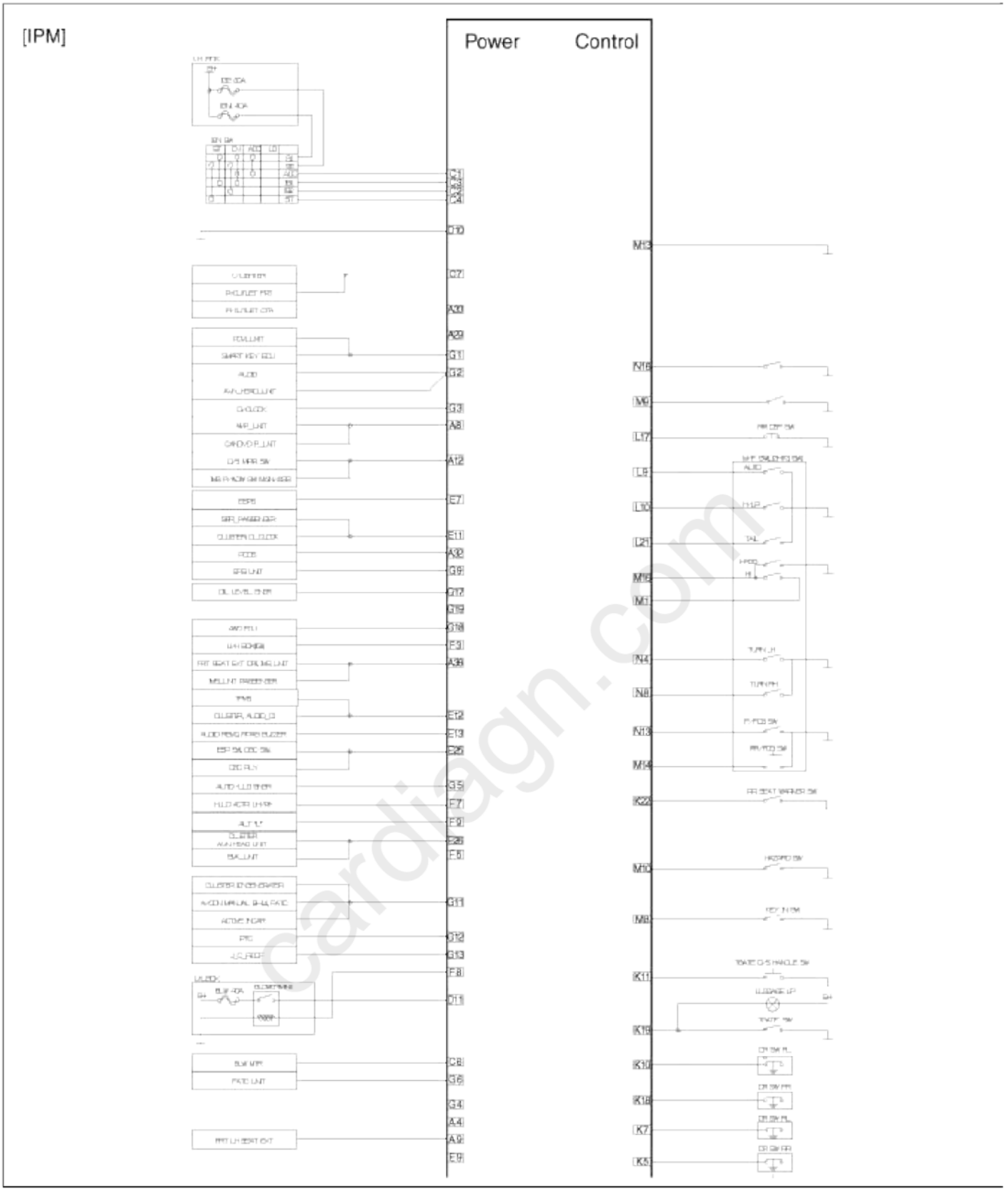
Abbreviation
IPM : Intelligent intergrated Platform Module
DDM : Driver Door Module
ADM : Assist Door Module
IMS : Intergrated Memory System
SMK : Smart Key
PDM : Power Distribution Module

Body Electrical System > BCM (Body Control Module) > IPM (Intelligent intergrated Platform Module) > Schematic Diagrams

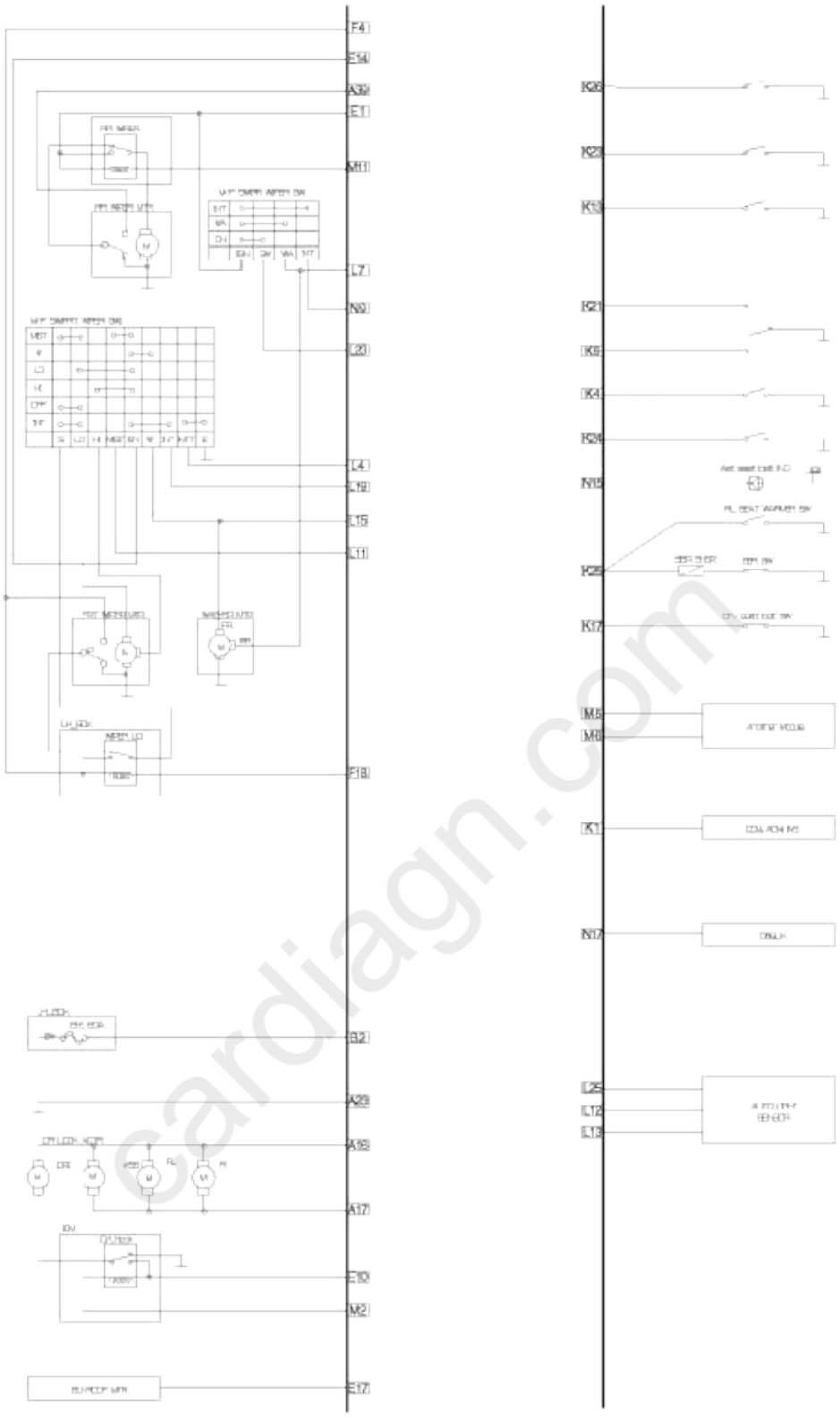
Circuit Diagram

cardiagn.com

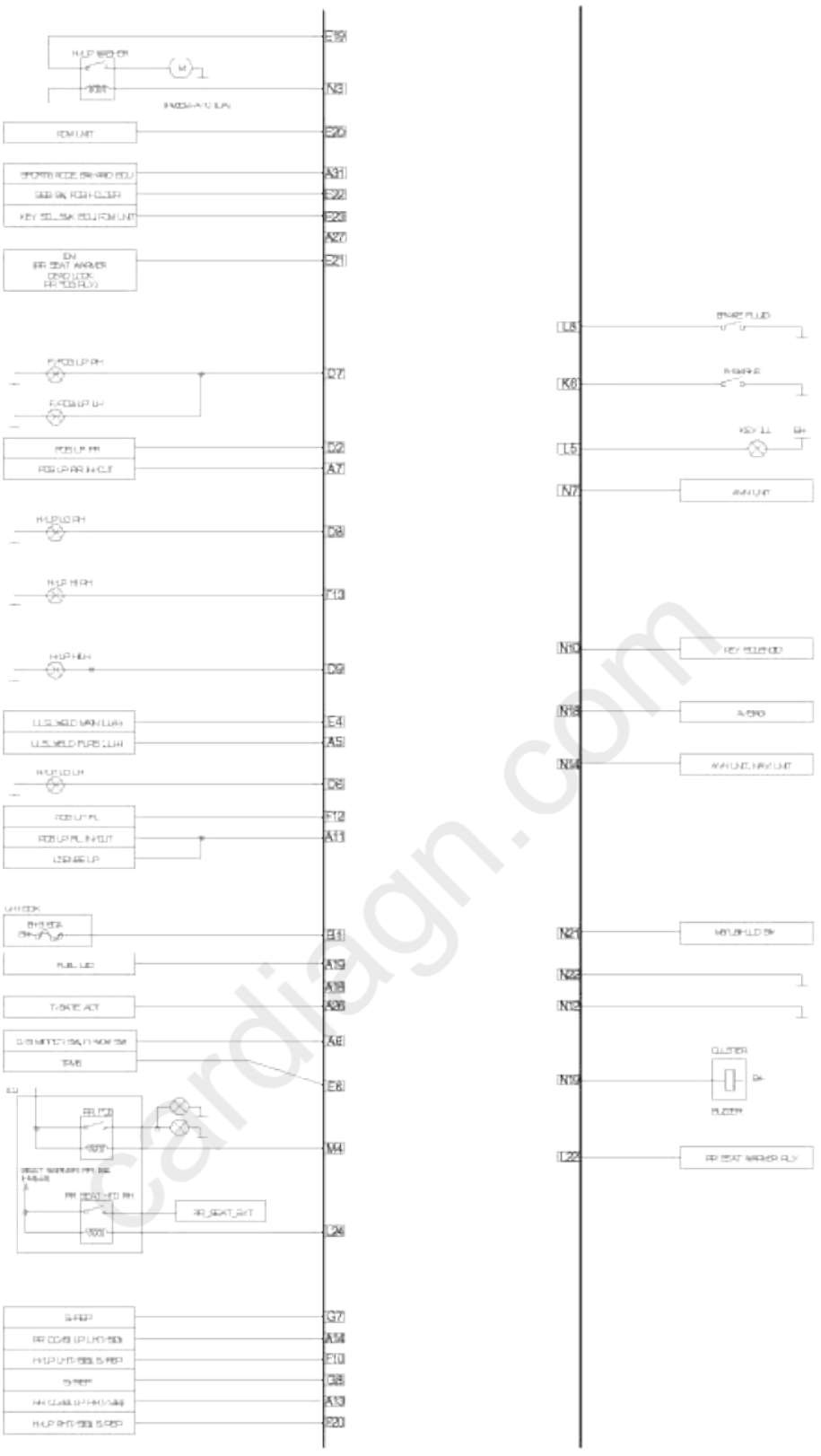
[IPM]



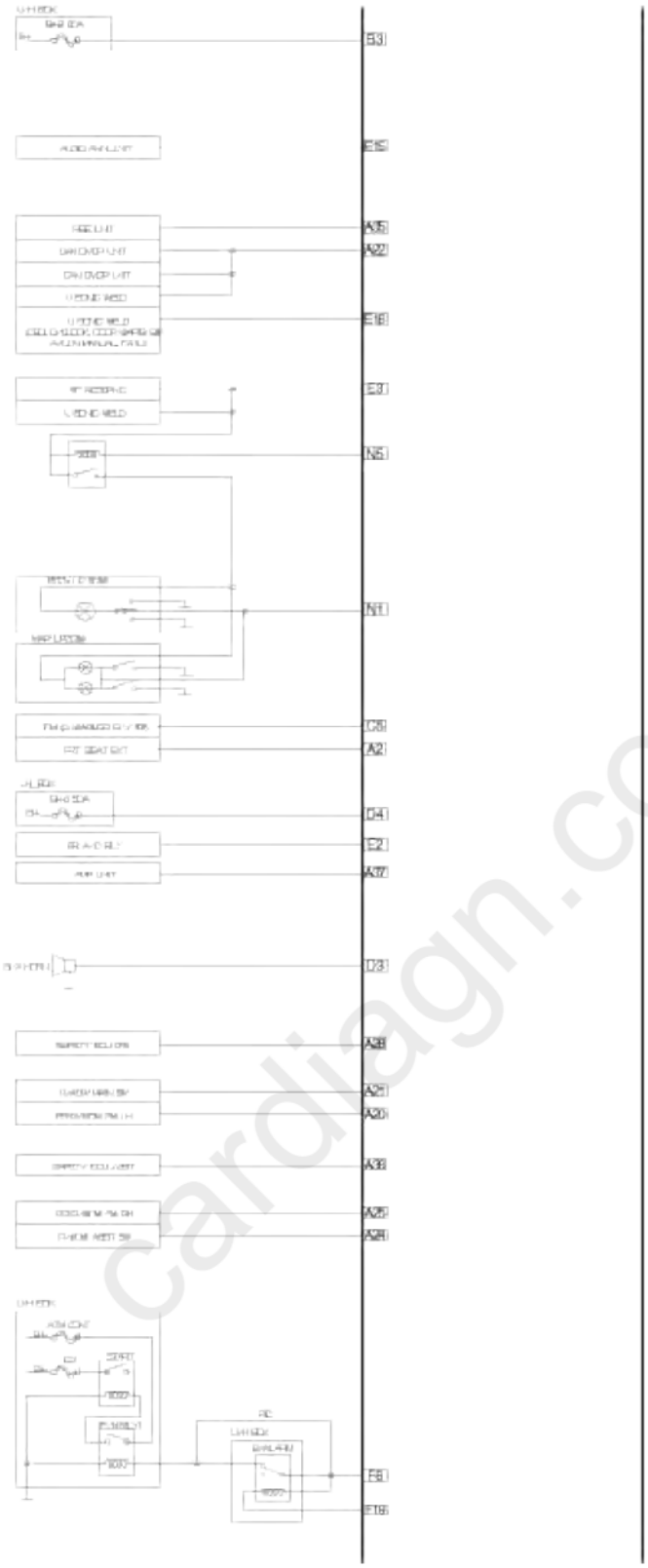
cardiagn.com



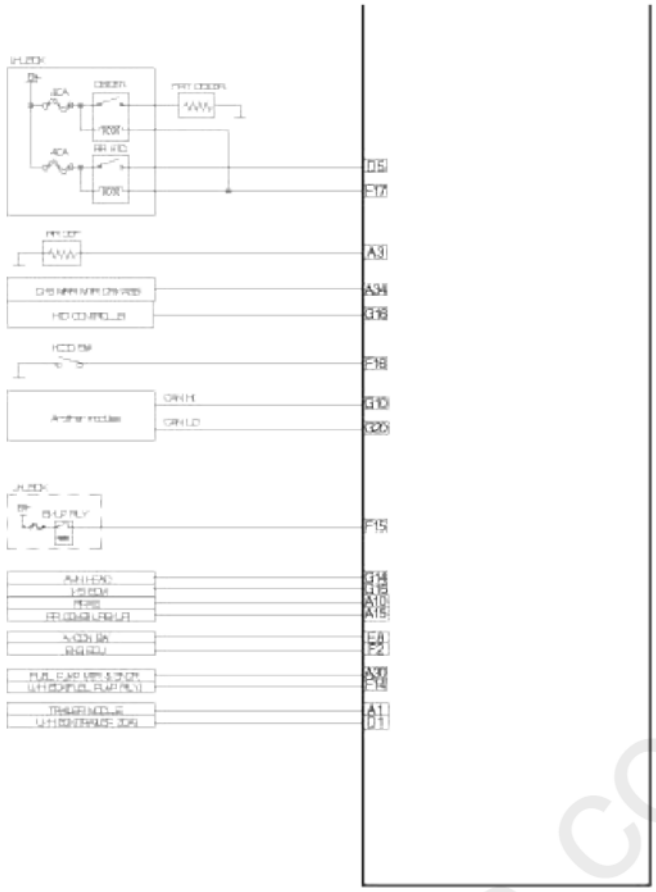
cardiagn.com



cardiagn.com

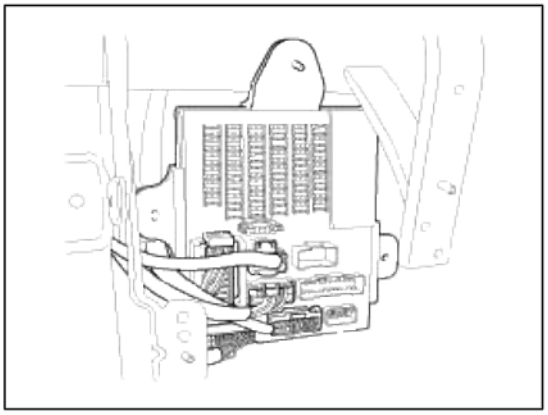


cardiagn.com



Body Electrical System > BCM (Body Control Module) > IPM (Intelligent intergrated Platform Module) > Description and Operation

Description

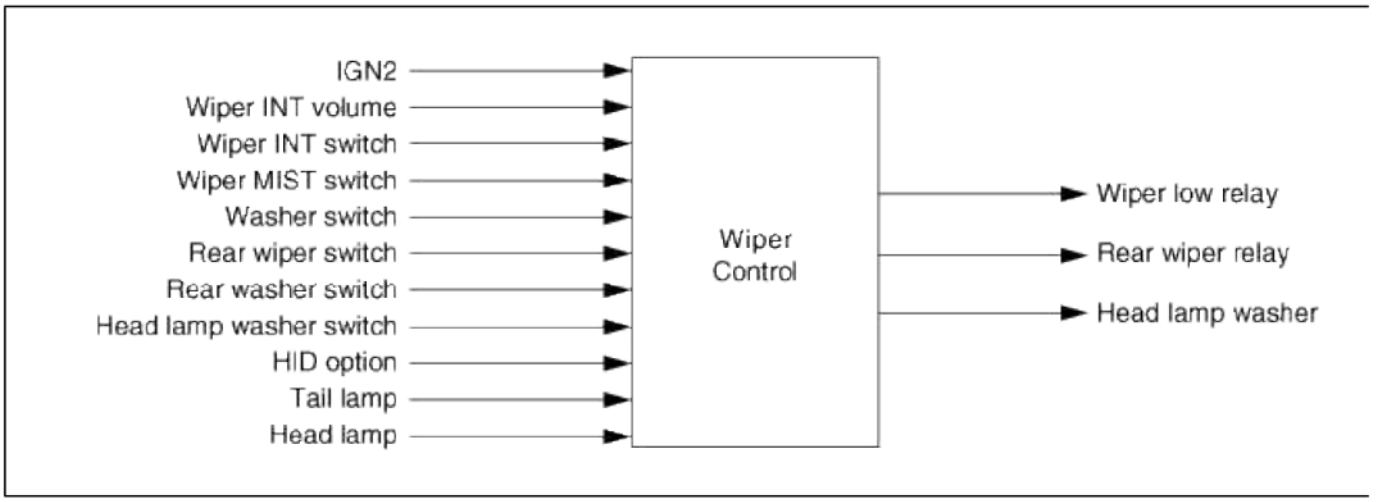
IPM (Intelligent intergrated Platform Module) receives various switch input signals and time/alarm fuctions for fr washer interlocking wiper, fr intermittent wiper, mist wiper, rear washer interlocking wiper, rear wiper, tail lamp autocut, head lamp low/high, auto light, AV tail, DRL, front/rear fog 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

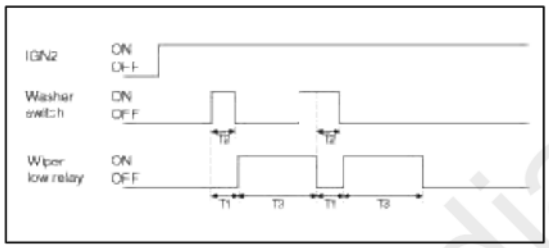
Wiper Control

cardiagn.com

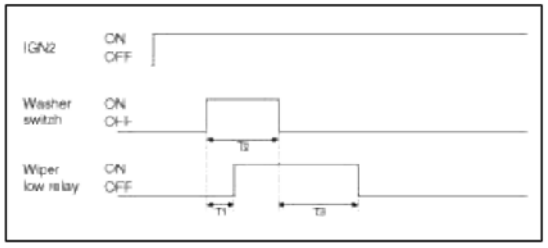
1. Wiper Data Flow



2. Wiper control priority
   1. Control of washer interlocking wiper
   2. MIST wiper control
   3. INT wiper control
3. Control of front washer Interlocking Wiper
   (1) Turn Washer switch ON in IGN2 ON and turn Wiper low relay ON after T1.
   If Washer switch is input in 0.06~0.2 second, turn OFF Wiper low relay output after T3.
   (2) However, Washer switch input during operating washer interlocking wiper is ignored, and received after operating washer interlocking wiper.



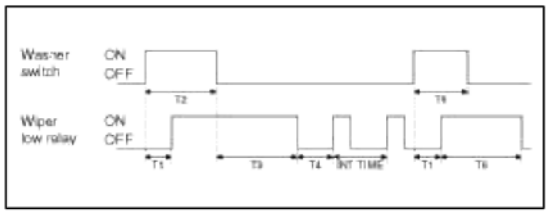
   T1 : 0.3±0.03sec, T2 : 0.06~0.2sec,
   T3 : 0.7±0.1sec
   T3=0 (if T2 is less than 0.06sec)
   (3) Turn Washer switch ON in IGN2 ON and trun ON Wiper low relay out after T1.
   If Washer switch Input takes more than 0.2 second, turn ON and OFF Wiper low relay within 2.5~3.8 seconds after turing Washer switch OFF.
   (4) However, Washer switch input is ignored during operating washer interlocking wiper, and received after operating washer interlocking wiper.



   T1 : 0.3±0.03sec, T2 : above 0.2sec,
   T3 : 2.5~3.8sec

cardiagn.com

(5) If Washer switch is ON for over 0.2 second in operation of INT wiper, turn ON washer interlocking wiper output after T1. If Washer switch is ON for less than 0.2 second, turn ON Wiper low relay Output once.

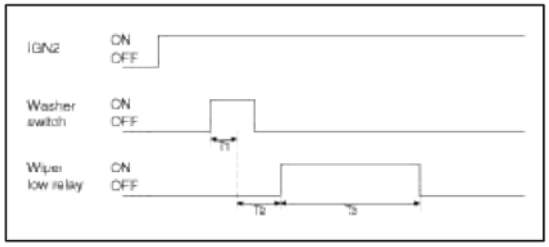


T1 : 0.3±0.03sec, T2: above 0.2 sec,
T3 : 2.5~3.8sec, T4 : INT TIME-0.7sec,
T5 : 0.06~0.2sec, T6 : 0.7±0.1sec

(6) When turing on (IGN1 ON & IGN2 OFF), Washer switch signal is ignored.

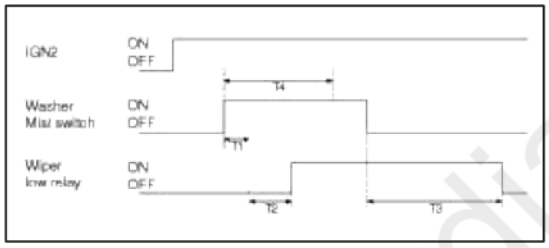
4. MIST wiper control

(1) When turning on Wiper Mist SW with L _IGN2 ON, turning ON O_WiperLowRLY output for 700ms.



T1 : Min 60ms, T2: Max 100ms, T3 : 700±100ms

(2) If Wiper Mist switch input lasts for over 700ms, maintain Wiper low relay ON. IF Wiper Mist switch is OFF, turn ON Wiper low relay output for 700ms from it is turned OFF.



T1 : Min 60ms, T2: Max 100ms,
T3 : 700±100ms, T4 : 700ms

5. INT wiper control

Intermittent time of intermittent wiper is controlled dependent on the following conditions.

(1) IGN2 switch ON.

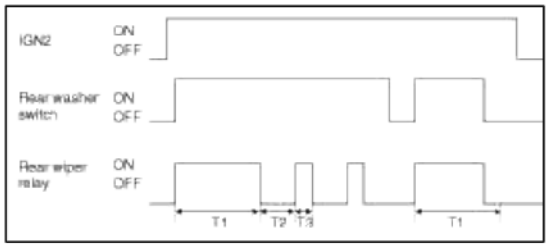
(2) Wiper switch INT.

(3) INTERMITTENT VOLUME level is used to set the intermittent time.

6. Rear wiper control

(1) Rear wiper realy is continuously operating when turing Rear wiper switch ON with IGN2 switch ON.

(2) Repeat ON mode for 0.7 second and OFF mode for 6 seconds.

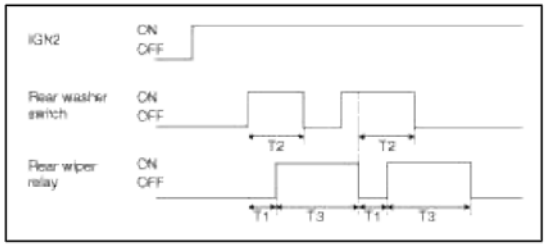


T1 : 6±0.6sec, T2 : 6±0.6sec, T3 : 0.7±0.1sec

cardiagn.com

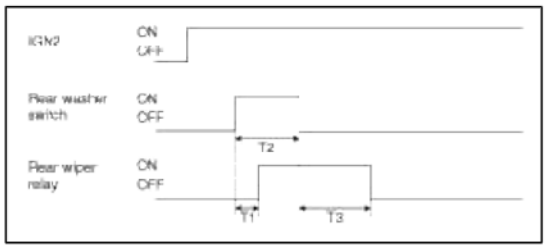
7. Control of rear washer interlocking rear wiper

(1) If Rear washer switch is ON with L_IGN2 SW ON, turn ON Rear wiper relay output after T1.
If Rear washer switch Input is carried on for 0.2~0.6 second, turn OFF Rear wiper relay after T3.
However, Rear washer switch input generated during oprating Rear wiper relay is ignored, and received following the operation of Rear wiper relay.



T1 : 0.3±0.1sec
T2 : 0.2~0.6sec
T3 : 0.7±0.1sec
If T2 is not more the 0.2sec, T3=0

(2) With Rear washer switch is ON with IGN2 switch ON, turn ON Rear wiper relay output after T1.
If Rear washer switch input is continued for more than 0.6, turn ON and OFF Rear wiper relay Output for 2.5~3.8 seconds after turning Rear washer switch OFF. However Rear washer switch Input during operating Rear wiper relay is ignored and received after the operation of Rear wiper relay.



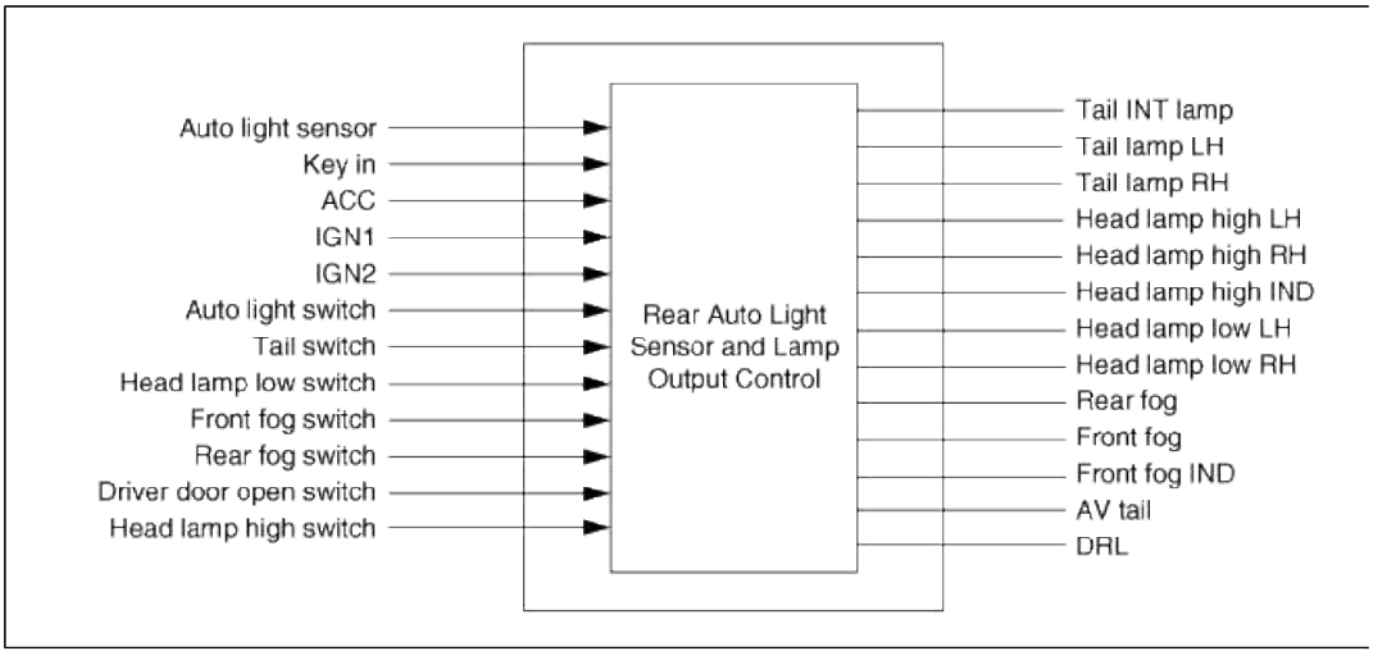
T1 : 0.3 ± 0.1sec, T2 : 0.6↑sec
T3 : 2.5~3.8sec(3sec)

(3) Rear washer switch Input is igonored during continuous operation of Rear wiper relay generated by Rear wiper switch.

(4) The function of Rear washer interlocking Rear wiper is primarily taken, in case that Rear washer switch Input is generated during intermittent operation of Rear wiper relay by Rear wiper switch.

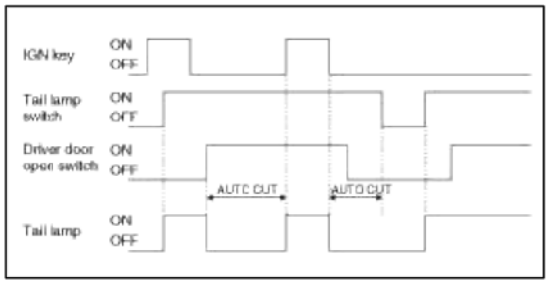
Lamp Control

1. Exterior lamp control data flow

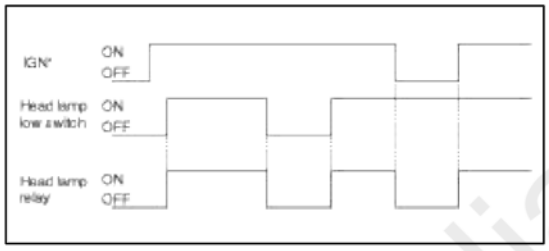


cardiagn.com

2. Tail lamp auto cut
   (1) IGN KEY is OUT when turning Tail lamp switch ON following IGN KEY ON and Tail lamp is automatically OFF (auto power off) when turning on ON Driver door open switch.
   (2) Tail lamp is automatically OFF (auto power off) when turning ON Driver door open switch with IGN KEY ON, and then IGN KEY OUT.
   (3) If turning Tail lamp switch ON and OFF in turns follwing auto power off, Tail lamp is ON and AUTO CUT function is disabled.
   (4) If IGN KEY is ON again after auto power off, Tail lamp is ON and AUTO CUT function is disabled.
   (5) AUTO CUT mode is maintained when changing BATTERY.



3. Head lamp low control
   (1) If turning Head lamp low switch ON with IGN1 ON, Head lamp low is ON.
   (2) If IGN1 is OFF or Head lamp low switch is OFF, Head lamp low is OFF.
   (3) If IPM does not work with IGN1 ON, Head lamp low Output should be automatically ON.



4. Head lamp low signal control
   (1) If Head lamp low output is ON by 'Head lamp low switch ON' or 'Auto light function', Head lamp low control output is ON.
   (2) If Head lamp low output is ON by 'DRL EUROPE function', Head lamp low control output is Off.
   (3) If Head lamp low output is turned ON → Off, Head lamp low control output is Off.

5. Head lamp high control
   Head lamp high Input and Head lamp Passing Input by M/F are controlled by single input of Head lamp high switch.
   A. Head lamp high Input
      Determined by Head lamp high Input when Head lamp high switch ON with Head lamp low control output ON by IPM, and IGN2 ON.
   B. Head lamp Passing Input
      Determined by Head lamp passing Input when Head lamp high switch ON with Head lamp Low control Output OFF and IGN2 ON.
   (1) If Head lamp high Input is ON with IGN2 ON, Head lamp high output is ON.
   (2) If Head lamp passing is ON with IGN2 ON, Head lamp high output is ON.

cardiagn.com

6. Auto light control

(1) Auto light function is not applicable for Europe DRL option (DRL option=GND).

(2) If Auto light power is less than 4V or more than 6V with IGN1 ON & IGN2 ON, it is considered to be malfunctioning. In this case, Head lamp LOW is ON with Auto light switch ON no matter what the value of Auto light sensor is. Filtering time of failing and recovering supply power takes 300msec each.

(3) If Auto light sensor value is adaptable with the condition of Auto light Control, turn light ON immediately.

(4) If Auto light sensor value is equal to the Input value of light ON with IGN1 ON & IGN2 ON, Auto light switch ON, and light OFF, turn light ON after T1: 2.5 ± 0.2sec.

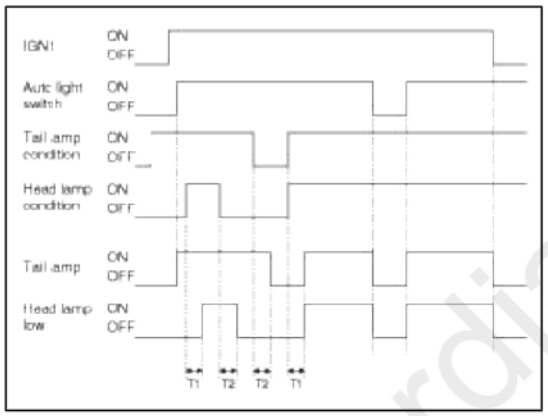
(5) If Auto light sensor value is equal to the Input value of light OFF with light ON, turn light OFF after T2: 2.5 ± 0.2sec.

(6) When turning OFF Auto light switch, immediately turn OFF light.

(7) Auto light sensor value for light ON is as following.

	TAIL LAMP	HEAD LAMP LOW
ON	2.7±0.05V	
OFF	4.3±0.05V	

(8) TIME CHART based on Filtering time and sensor value in each application region is as following.



T1 : 2.5±0.2s, T2: 2.5±0.2s

7. Tail interlocking AV control

(1) Tail Interlocking AV control fuction is not applied to Europe DRL option.

(2) If Auto light power is less than 4V or over 6V with ACC ON, it is considered to be malfunctioning. AV Tail Output should be OFF in malfunctioning.

(3) Power supply Filtering time of failing and recovering takes 300msec each.

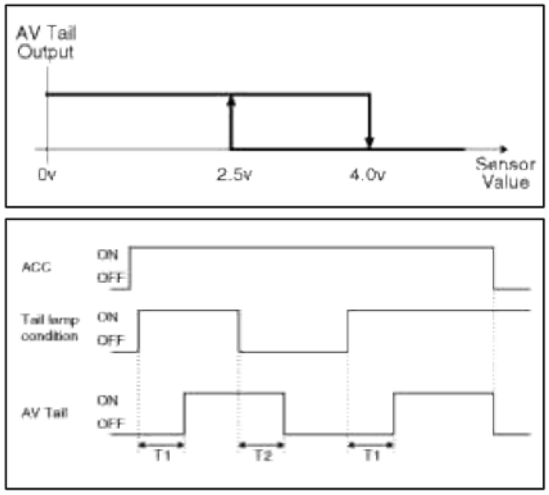
(4) If Auto light sensor value is equal to the input value of Tail lamp ON with ACC ON, turn ON AV Tail Output after 2.5 ± 0.2 sec.

(5) If Auto light sensor value is equal to the input value of Tail lamp OFF with AV Tail Output ON, turn OFF AV Tail output after 2.5 ± 0.2sec.

cardiagn.com

(6) Auto light sensor value of light ON is as follows.

	AV Tail
ON	2.7±0.05V
OFF	4.3±0.05V



T1 : 2.5±0.2s, T2: 2.5±0.2s

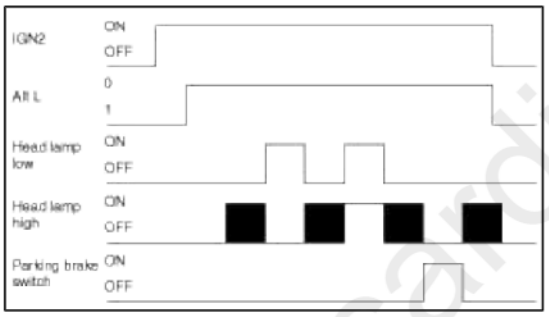
8. Day time running light

DRL (DAYTIME RUNNING LIGHT) option is categorized into 2 types, based on DRL option Input.

① NON-DRL OPTION: DRL option is not connected. (Switch Open)

② DRL OPTION: DRL option is connected for having ground. (Switch Short To GND)

DRL option is input on a regular basis, and to be based on availability of immediated function.



(1) If IGN2 & Alt L ON, DRL is functioning by controlling Head lamp high output with PWM.

(2) Head lamp high output is restricted to frequency: 80Hz / Duty 50% during operating DRL.

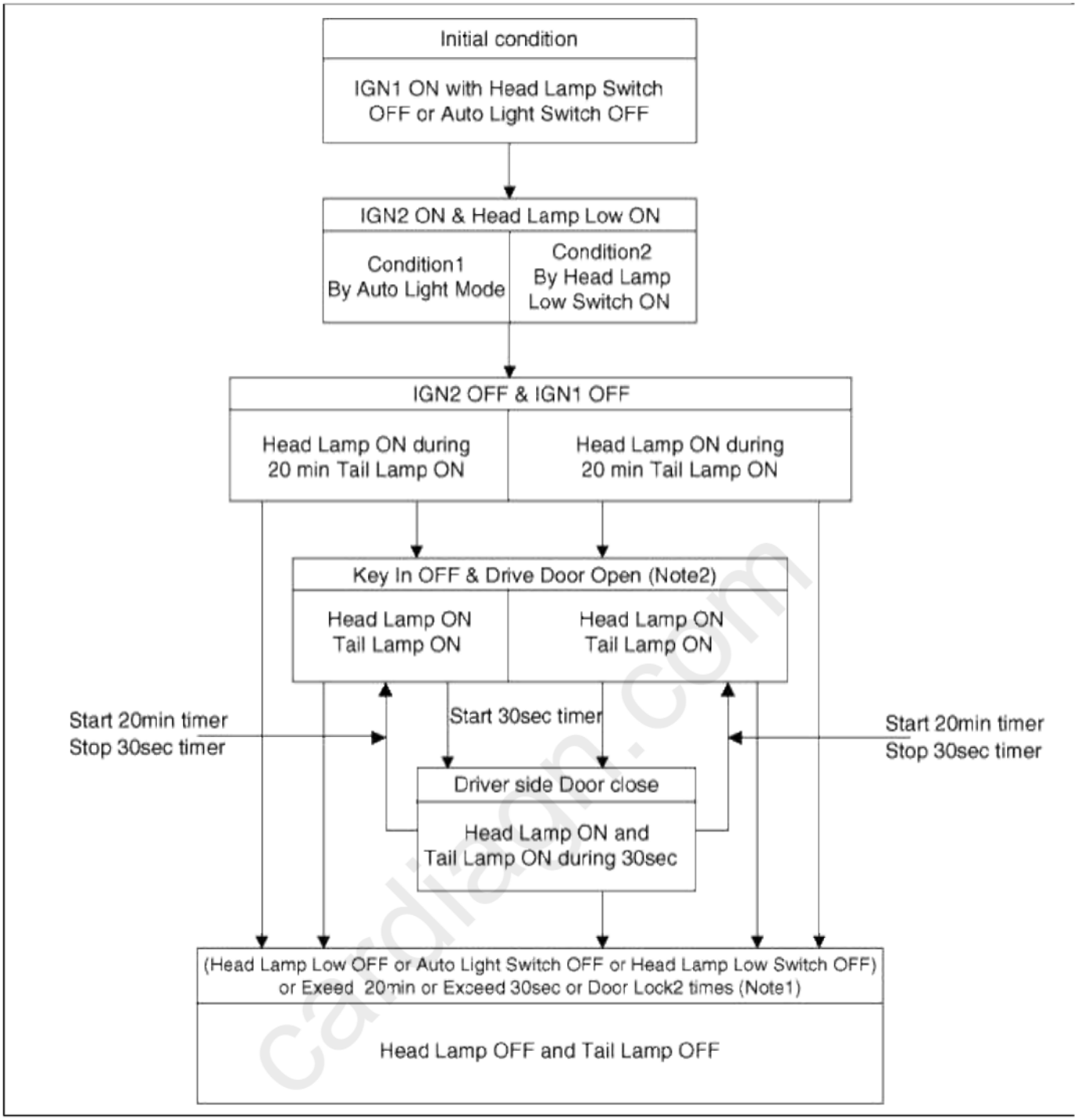
(3) If Head lamp low is ON with head lamp low switch ON or by functioning Auto light, the function of DRL is cancelled.

(4) If Head lamp high is ON by turning ON Head lamp high switch, the DRL function is cancelled.

(5) If Parking brake switch is ON (PARK), the DRL function is cancelled.

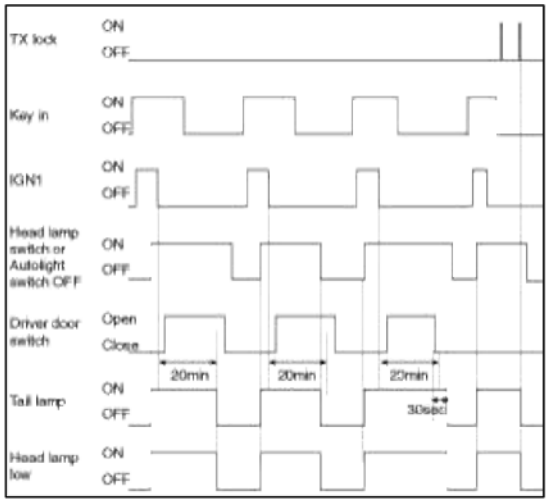
9. Escort function

cardiagn.com



(1) Door Lock 2 times : Tx Door Lock 2 times

(2) When Open the Driver door, former 2 times lock counter is cleared, and Start new 2 times lock counting durii active the Escort function(counting 30sec).
If Driver door is re-opened,re-start 20min counter and if Driver door is re-close, re-start 30sec counter.

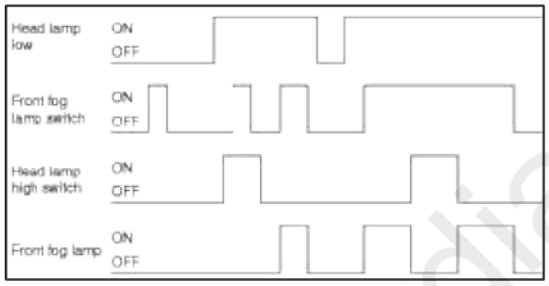


10. Front fog lamp

(1) If turning OFF front fog lamp switch with front fog lamp ON, turn OFF front fog lamp. (Front fog lamp switch is Lock type Switch)

(2) When turning IGN2 OFF with Front fog lamp ON, turn OFF Front fog lamp.

(3) When turning ON Head lamp high switch with Front fog lamp ON, turn off Front fog lamp. If turning Head lmap high siwtch off another time, turn on Front fog lamp.



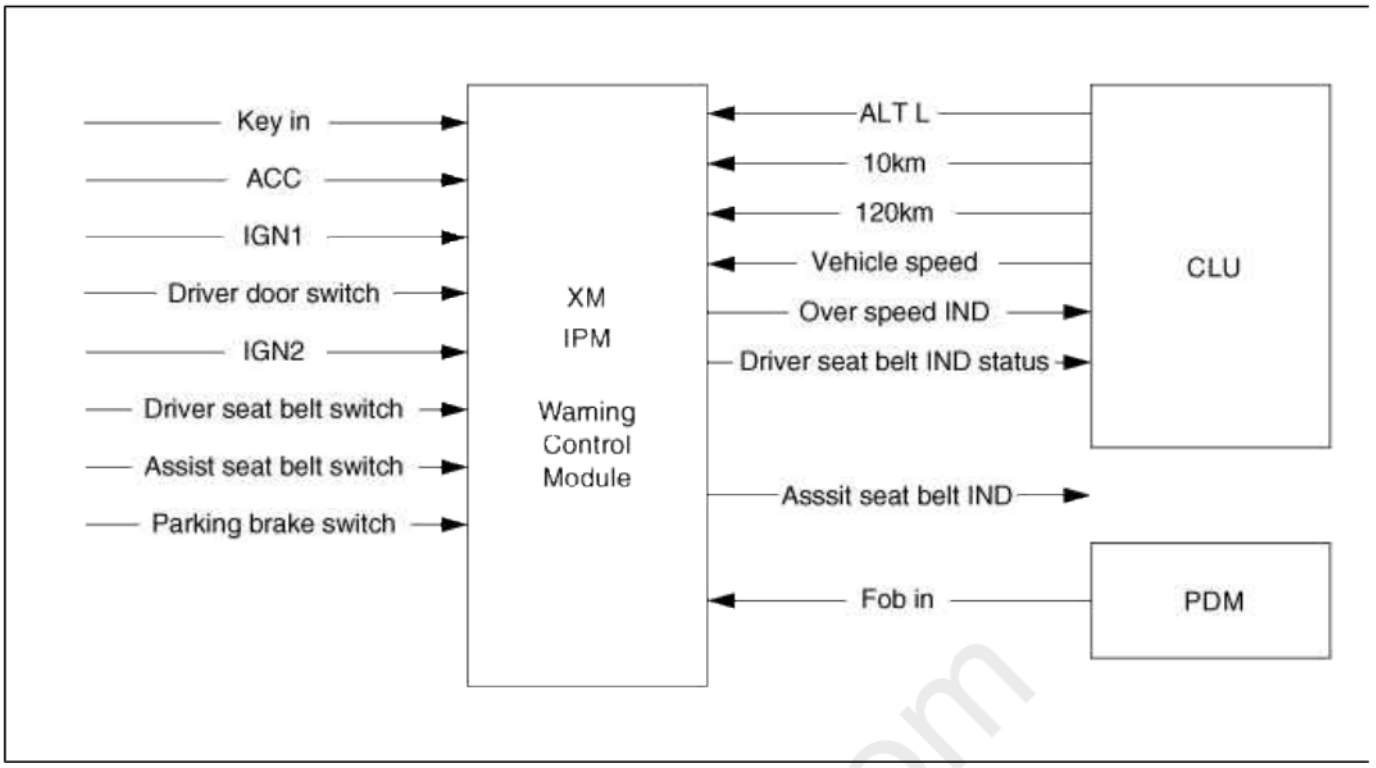
Warning Control

1. Priority

Priority	Internal Buzzer Warning	Logic	Load Control
1	Rear PAS Warning	IPM	IPM
2	Seat Belt Warning		
3	Over Speed Warning		
4	Key Operated Warning		
5	Parking Brake Warning		
6	Steering Column Not Locked Warning (SMK Option)	SMK	
7	ID Out Warning		
8	Steering Column Not Unlocked Warning (SMK Option)		
9	SSB Button Warning (SMK Option)		
10	Rheostat Detent Sound	CLU	

cardiagn.com

2. Warning control data flow



3. Seat belt reminder

* Terminology

① Bulb check 6s driver ind blinking: If IGN1=0→1, indicator is blinking.

② Bulb check 6s buzzer: If IGN1=0→1 with Unbelted, buzzer is warning.

③ Normal 6s driver ind blinking: If IGN1=1 with Belted→Unbelt, indicator is blinking.

④ Normal 6s buzzer: If IGN1=1 with Belted→Unbelted, buzzer is warning.

6s driver Indi blinking: Blinking for 6 seconds in 1 second cy

(1) From state IGN1 Off (Default State)

State	Description
Initial condition	**IGN1 OFF**
Event	Driver side seat belt is belted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking
	- The automaton state is changed to IGN1 ON DRIVER BELTED

State	Description
Initial condition	**IGN1 OFF**
Event	Driver side seat belt is unbelted and IGN1 ON
Action	- Start Bulb check 6 seconds driver indicator blinking
	- Start Bulb check 6 seconds buzzer warning
	- The automaton state is changed to IGN1 ON DRIVER UNBELTED

cardiag.com

(2) From state IGN1 On Driver Belted

State	Description
Initial condition	**IGN1 ON DRIVER BELTED**
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking
	- The automaton state is changed to IGN1 OFF

State	Description
Initial condition	**IGN1 ON DRIVER BELTED**
Event	Driver side seat belt is unbelted && Vehicle Speed < 5km/h
Action	- Start Normal 6 seconds driver indicator blinking
	- The automaton state is changed to IGN1 ON DRIVER UNBELTED

State	Description
Initial condition	**IGN1 ON DRIVER BELTED**
Event	Driver side seat belt is unbelted & Vehicle Speed ≥ 5km/h
Action	- Start Normal 6 seconds driver indicator blinking
	- Start Normal 6 seconds buzzer warning
	- The automaton state is changed to IGN1 ON DRIVER UNBELTED

(3) From state IGN1 On Driver Unbelted

State	Description
Initial condition	**IGN1 ON DRIVER UNBELTED**
Event	IGN1 OFF
Action	- Stop Bulb check 6 seconds driver indicator blinking
	- Stop Normal 6 seconds driver indicator blinking
	- The automaton state is changed to IGN1 OFF

State	Description
Initial condition	**IGN1 ON DRIVER UNBELTED**
Event	Driver side seat belt is belted
Action	- Stop Normal 6 seconds driver indicator blinking
	- Stop ALL 6 seconds buzzer warning
	- The automaton state is changed to IGN1 ON DRIVER BELTED

cardiagn.com

State	Description
Initial condition	**IGN1 ON DRIVER UNBELTED**
Event	Vehicle Speed ≥ 10km/h
Action	- Start buzzer and driver indicator Pattern (10 times (6sec ON/24sec OFF) + 6sec ON)
	- The automaton state is changed to **PATTERN**

(4) From State Pattern

State	Description
Initial condition	**PATTERN**
Event	IGN1 OFF
Action	- Stop Buzzer and driver indicator Pattern
	- Stop ALL 6s driver indicator blinking
	- Stop ALL 6s buzzer warning
	- The automaton state is changed to IGN1 OFF

State	Description
Initial condition	**PATTERN**
Event	Driver side seat belt is belted
Action	- Stop Buzzer and driver indicator Pattern
	- Stop Normal 6s driver indicator blinking
	- Stop ALL 6s buzzer warning
	- The automaton state is changed to IGN1 ON DRIVER BELTED

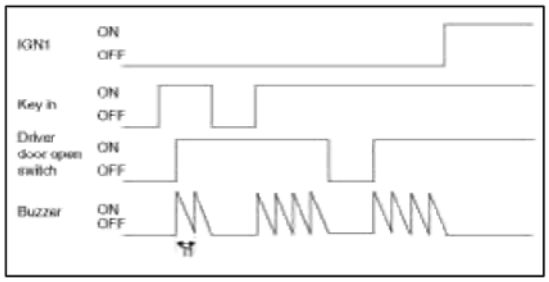
State	Description
Initial condition	**PATTERN**
Event	Vehicle Speed ≤ 5km/h
Action	- Stop Buzzer and driver indicator Pattern
	- if 6s buzzer period, after 6s warning stop Pattern
	- The automaton state is changed to IGN1 ON DRIVER UNBELTED

carmanuals.com

4. Key operated warning

(1) Buzzer is continuously ON in 0.6 second cycle, when key in & Driver door open switch is ON.

(2) Turn off the Buzzer if IGN1 switch is ON or Driver door open switch is OFF or KEY OFF during the output condition.



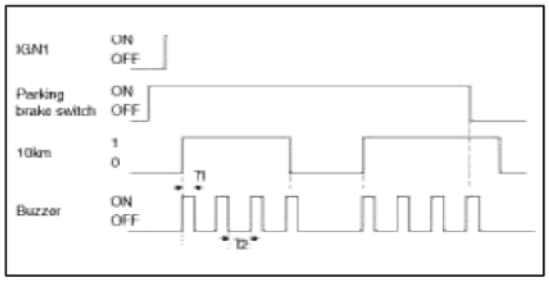
T1 : 0.6±0.1sec

5. Parking start warning

(1) If [10km = 1] with IGN1 ON and Parking brake switch ON , Buzzer output.

(2) If [10km = 1] with Parking brake switch ON, turn ON the Buzzer output.

(3) If IGN1 OFF, Parking brake switch OFF or [10km = OFF], turn OFF the Buzzer output.



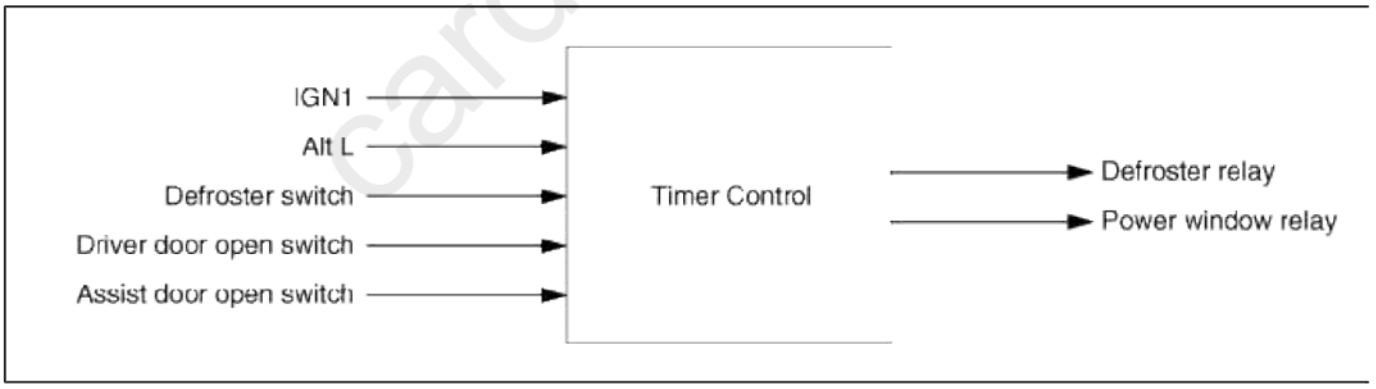
T1 : 0.3±0.1sec, T2 : 0.7±0.1sec

6. SMK warning

Refer to Smart key system in this group.

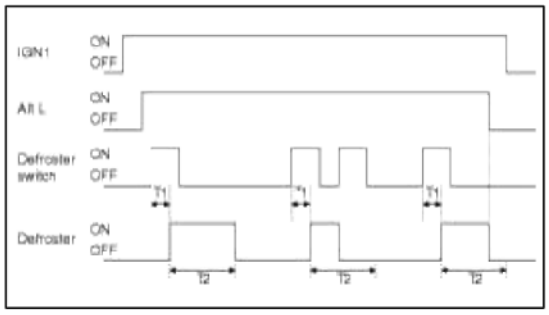
Timer Control

1. Timer Control data flow



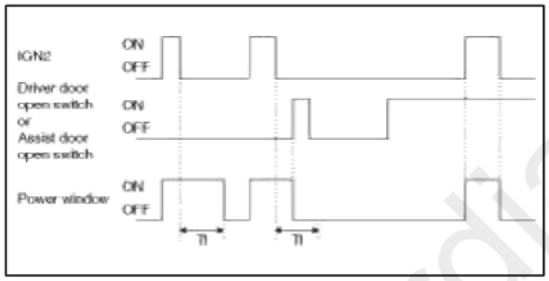
cardiagn.com

2. Defroster timer
   (1) If turning ON Alt L and then Defroster switch with IGN1 switch ON, turn ON Defroster for 20 minutes. (operated in ENGINE RUNNING Condition)
   (2) If Defroster switch is ON during Defroster ON, turn OFF Defroster.
   (3) If Alt L OFF or IGN1 OFF during Defroster ON, turn OFF Defroster.
   (4) Defroster is not activated with Alt L ON as well as Defroster switch being pushed simultanesouly.



T1 : 60±20msec, T2 : 20±1min

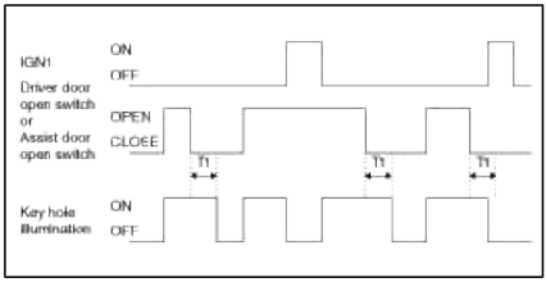
3. Power window timer
   (1) Turn ON Power window if IGN2 switch ON.
   (2) Power window output is maintained for 30 seconds and OFF if IGN2 switch is OFF.
   (3) The output is immediately OFF if Driver door open switch ON or Assist door open switch ON in the (2) above.
   (4) If IGN2 is OFF with Driver door open switch ON or Assist door open switch ON, Power window is OFF.



T1 : 30±1sec

IGN key hole Illuminationnation Control

1. If driver door open switch ON or assist door open switch ON with IGN1 OFF , turn ON key hole illumination.
2. In case of driver door open switch OFF or assist door open switch OFF with the condition (1) above, turn ON key hole illumination for 30 seconds, and then OFF the lighting.
3. Turn OFF key hole illumination on activating IGN1 switchin case of (1) and (2) above. However, key hole illumination light should be immediately OFF if ARM WAIT or ARM or ALARM or REARM activation.



T1 : 30±1sec

Decremental Room lamp Control

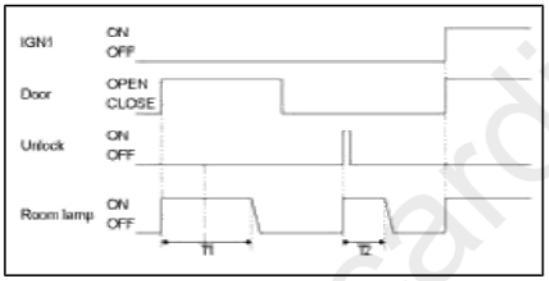
cardiagn.com

1. Room lamp OFF

State	Description
Initial Condition	Room lamp OFF and doorCLOSED
Transition Condition	TX UNLOCK Key out event
Action	Room lamp ON for 30s state activated Room lamp ON for 30 ± 3 seconds

State	Description
Initial Condition	Room lamp OFF
Transition Condition	Door OPEN for over 0.1 second with all doors CLOSED
Action	Room lamp ON for 20 min state activated Room lamp ON for 20 ± 1 minutes

State	Description
Initial Condition	Room lamp OFF and IGN1=OFF
Transition Condition	IGN1 = ON and door OPEN for over 0.1 seconed
Action	Room lamp ON state activated Room lamp ON



T1 : 20±1min, T2 : 30±3sec

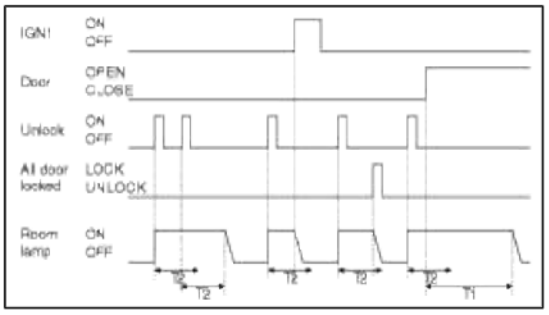
2. Room lamp ON for 30s

State	Description
Initial Condition	Room lamp ON for 30s and IGN1=OFF
Transition Condition	Door OPEN for over 0.1 second with all doors CLOSED
Action	Room lamp ON for 20min state activated Room lamp ON for 20 ± 1 minutes

State	Description
Initial Condition	Room lamp ON for 30s and IGN1=OFF
Transition Condition	TX UNLOCK Key out event
Action	Maintaining Room lamp ON for 30s Room lamp ON for 30 seconds

cardiagn.com

State	Description
Initial Condition	Room lamp ON for 30s and IGN1=OFF
Transition Condition	In case of IGN1=ON, after 30 seconds, on ARM being activated, or when all doors are LOCKED
Action	Room lamp DECAYING state activated Turning OFF Room lamp after diminishing the light for 2 ± 0.2 seconds



T1 : 20±1min, T2 : 30±3sec

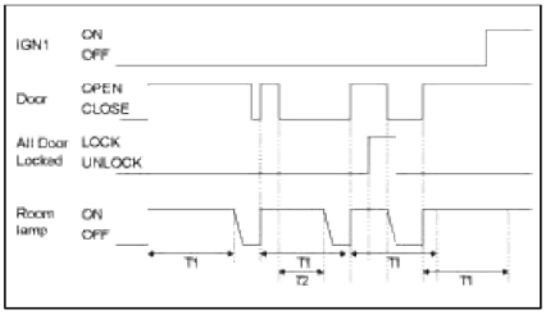
3. Room lamp ON for 20min

State	Description
Initial Condition	Room lamp ON for 20min and IGN1=OFF
Transition Condition	IGN1 = ON
Action	Room lamp ON state activated Room lamp ON

State	Description
Initial Condition	Room lamp ON for 20min and IGN1=OFF
Transition Condition	In case of doorCLOSE and when all doors are LOCKED, or after 20 minutes
Action	Room lamp DECAYING state activated Turning OFF Room lamp after diminishing the light for 2 ± 0.2 seconds

State	Description
Initial Condition	Room lamp ON for 20min and IGN1=OFF
Transition Condition	Door CLOSE
Action	Room lamp ON for 30s state activated Room lamp ON for 30 ± 3 seconds

cardiagn.com



T1 : 20±1min, T2 : 30±3sec

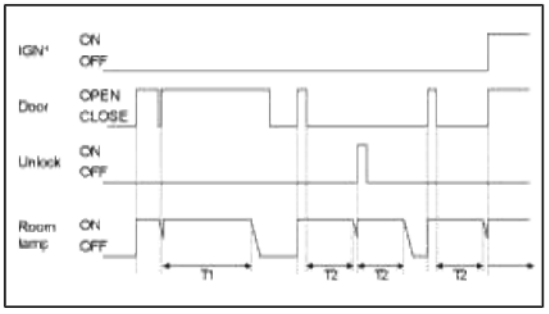
4. Room lamp decaying

State	Description
Initial Condition	Room lamp DECAYING and IGN1=OFF
Transition Condition	Door OPEN for over 0.1 second with all doors CLOSE
Action	Room lamp ON for 20min state activated Room lamp ON for 20 ± 1 minutes

State	Description
Initial Condition	Room lamp DECAYING and IGN1=OFF and door CLOSE
Transition Condition	TX UNLOCK Key out event
Action	Room lamp ON for 30s state activated Room lamp ON for 30 ± 3 seconds

State	Description
Initial Condition	Room lamp DECAYING
Transition Condition	After the lamp decaying
Action	Room lamp OFF state activated Room lamp OFF

State	Description
Initial Condition	Room lamp DECAYING
Transition Condition	IGN1 = ON and door OPEN for over 0.1 second
Action	Room lamp ON state activated Room lamp ON



T1 : 20±1min, T2 : 30±3sec

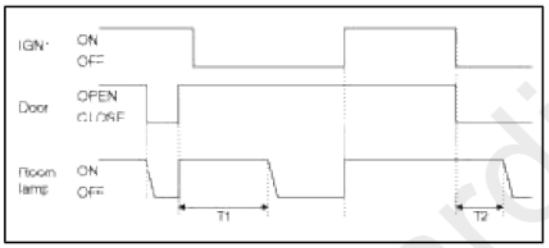
cardiagn.com

5. Room lamp ON

State	Description
Initial Condition	Room lamp ON and IGN1=ON and door OPEN
Transition Condition	Door CLOSE
Action	Room lamp DECAYING state activated Turning OFF Room lamp after diminishing the light for 2 ± 0.2 seconds

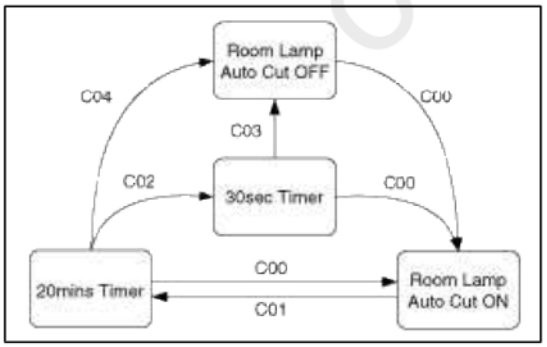
State	Description
Initial Condition	Room lamp ON and IGN1=ON and door OPEN
Transition Condition	IGN1=OFF
Action	Room lamp ON for 20min state activated Room lamp ON for 20 ± 1 minutes

State	Description
Initial Condition	Room lamp ON and IGN1=ON and door OPEN
Transition Condition	Door CLOSE and IGN1=OFF
Action	Room lamp ON for 30s state activated Room lamp ON for 30 ± 3 seconds



T1 : 20±1min, T2 : 30±3sec

6. Room lamp auto cut



(1) C00: If (ACC=ON or IGN1=ON or IGN2=ON) or (Burglar Alarm state = 1→0) then Room lamp auto cut = ON and 20mins timer stop and 3sec timer stop.

(2) C01: If (Key In = ON or KEY OFF) then start 20mins timer.

(3) C02: If (Burglar alarm = 0→1) then start 3sec timer.

(4) C03: If 3sec timer elapsed then room lamp auto cut = OFF.

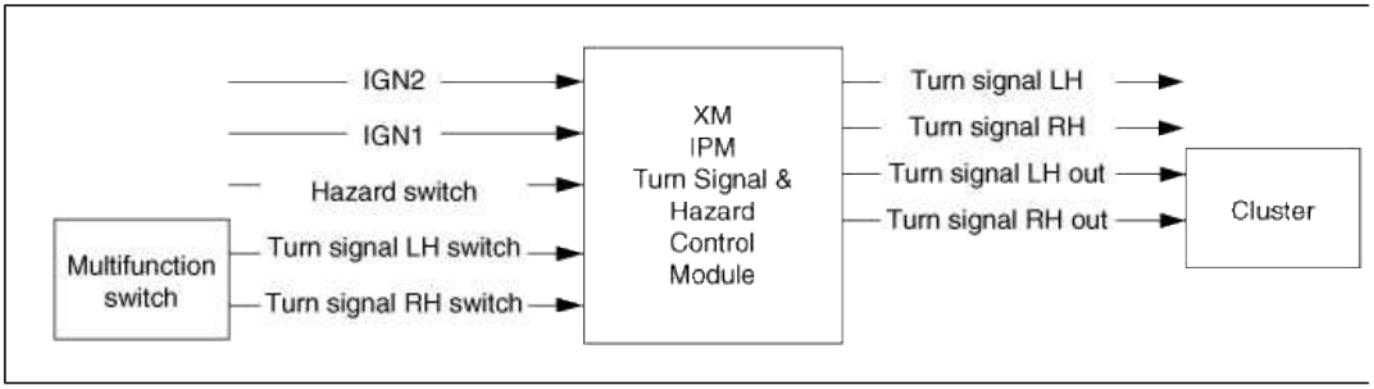
(5) C04: If 20mins timer elapsed then room lamp auto cut = OFF.

cardiagn.com

(6) C05: If (ACC=ON or IGN1=ON or IGN2=ON) or (Burglar Alarm state = 1→0) or (Any door close → open or Tailgate open switch=ON then room lamp auto cut = ON and 20mins timer stop and 3sec timer stop.

Turn signal and hazard Control

1. Turn signal and hazard control data flow



2. Flasher function priority

If conditions of activating flashing conflict with each other, functional priorities are as following:

1st : Arm / Disarm / Flashing (Burglar Alarm system) & Tailgate release Flashing

2nd : Burglar Alarm Flashing

3rd : Panic (including MTS) Flashing

4th : Hazard Flashing

5th : Turn Signal Flashing

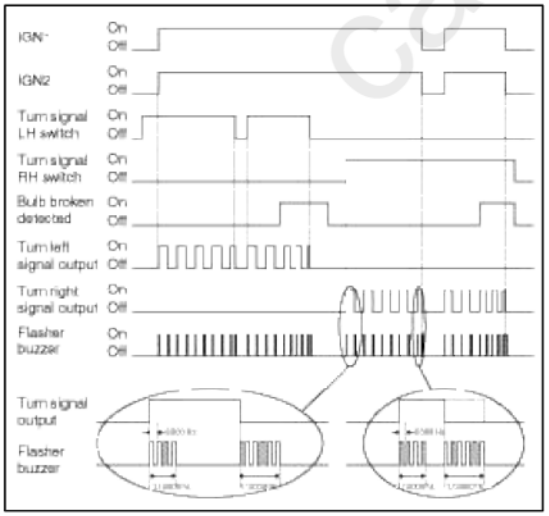
3. Turn Left/ Right signal flashing function

If the Left (or Right) turn switch is active and if IGN2 is On, the left (or Right) turn signal outputs are driven. The turn signal is active as long as both conditions ((Turn Signal LH switch or L_Turn Signal RH switch = On) and IGN2 = On) are true and is turned Off when one of these conditions is no longer detected.

If a failure is detected (Bulb/LED) outage or open load on the activated turn signal side, the flasher frequency is doubled.

This failure can be detected when IGN1 and IGN2 On (IGN1 = On and IGN2 = On).

While turn switch is ON and failure was detected, even if bulb (or LED) failure is no longer detected, keep the double blinking flashing and after next turn switch ON transition, only then, flasher is activated with normal blinking.



cardiagn.com

4. Lane change turn Left/ Right signal control function

The Flasher Lane-Change feature is initiated with a momentary activation of the turn switch. The turn signal will then flash 3 times.

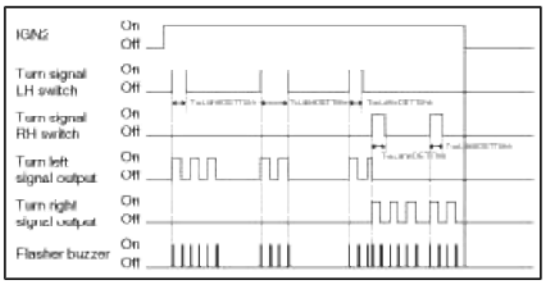
This lane-change feature operates under the following conditions:

A. Lane change mode enabled (Lane Enable = ON)

B. The Lane Change feature will not work without voltage on the Ignition 2 circuit.

C. The "bulb-fail" mode is not working and the flashing frequency is always normal blinking in lane change mode (85 ±10 period/min).

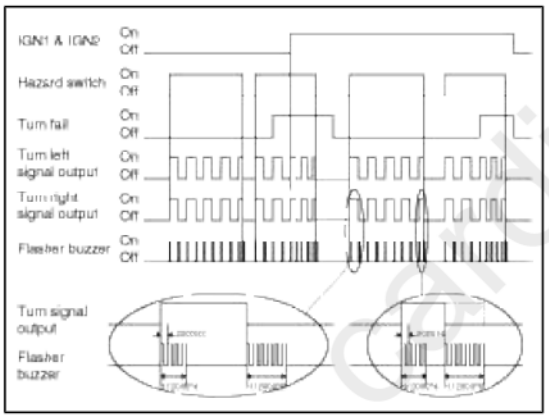
D. During the lane change mode operation, if the user moves the turn switch in the other direction, then lane change mode is finished and the other direction's flashing (normal or lane change flashing) will start depending on the switch detection time.



5. Hazard flashing function

Activating the hazard switch generates the hazard signal, regardless of the Ignition key position. The hazard signal is a permanent sequence. It goes off when the hazard switch is deactivated. The hazard drives both the Left and Right flashing sides.

Like the turn signal flashing, if bulb(or LED) failure is detected, flashing frequency is doubled. But it is ONly possible in IGN1 and IGN2 ON (IGN1 = ON and IGN2 = ON).



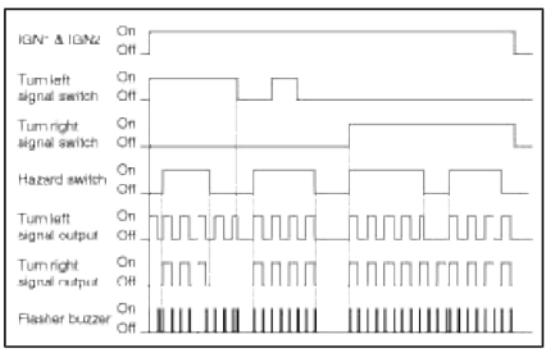
6. Turn signal and hazard priority

Hazard flashing has a higher priority than turn Left/Right control.

A. During hazard flashing, if turn Flashing is requested, keep the hazard operation.

B. During turn flashing, if hazard flashing is requested, interrupt the turn flashing and start hazard operation immediately.

C. During hazard operation if hazard and turn switch are On at the same time, if hazard switch is turned Off, turn flashing starts to operate but, does not discontinue the running period.



carmanuals.com

7. Double blinking detection condition

In case of activation of hazard the fault detection will be able to detect the failure only if 3 bulbs of Front or Rear are broken-down.

In case of turn signal activation when one of the front or rear is broken-down (Lamp failure), the turn signal blinks with double frequency. Lamp failure condition as below:

A. Flasher fault detection should be inhibited according to Battery voltage, i.e.: When the Vbat voltage is lower than flasher fault voltage detection(9V). This threshold for flasher fault detection should be configured as a calibration variable (EEPROM variable)

B. The fault detection is done while output for turn left/right or hazard is active and IGN1 ON and IGN2 ON (lane change is not included), once fault is detected, IPM keep the fault mode until flasher triggering condition is released (Turn right or left switch off/ IGN2 or hazard switch off)

Door Lock/unlock Control

1. Door lock/unlock priority

① Crash unlock

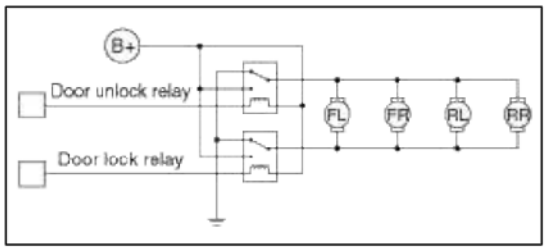
② Auto door lock/unlock (by shift lever change)

③ IGN key reminder unlock (passive key reminder)

④ Central door lock/unlock (2-Turn unlock)

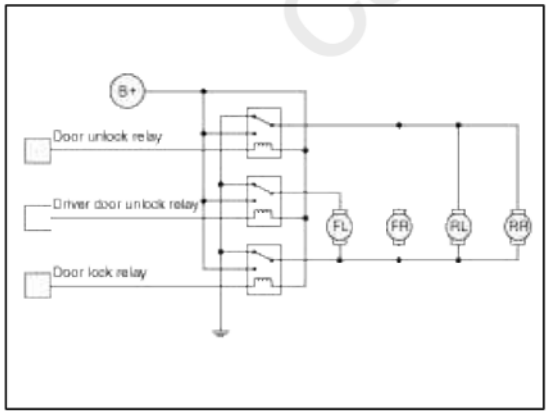
2. Door lock/unlock relay control

(1) NON 2-TURN UNLOCK



Mode	Door unlock relay	Driver door unlock relay / Dead lock relay	Door lock relay
Central Lock	OFF	NC	ON
Central Unlock	ON	NC	OFF

(2) 2-Turn Unlock Specification (North America)



Mode	Door unlock	Driver door unlock relay / Dead lock relay	Door lock relay
CENTRAL LOCK	OFF	OFF	ON
CENTRAL UNLOCK	ON	ON	OFF
DRIVER UNLOCK	OFF	ON	OFF

cardiagn.com

3. Determining key lock/unlock input

(1) Determine outside door key lock / unlock Input following ensuring that lock / unlock switch is mechanically interlocking with the function.

(2) Driver door key lock

A. Driver door unlock switch OFF being checked within 3 seconds from Driver door key lock switch = ON, on Driver door key lock switch input.

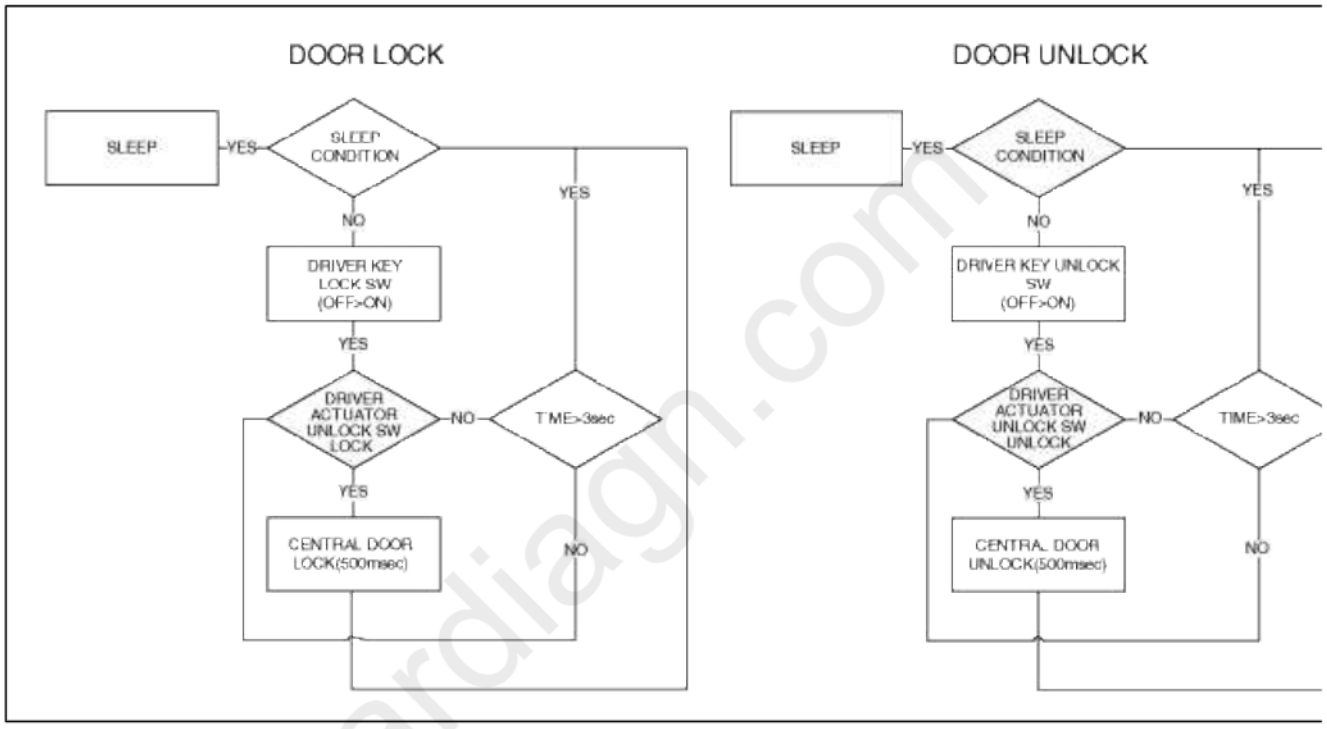
B. If Driver door unlock switch is ON for over 3 seconds, Driver door key lock switch input is ignored.

(3) Driver door key unlock

A. Driver door unlock switch OFF being checked within 3 seconds from Driver door key lock switch = ON, on Driver door key unlock switch input.

B. If Driver door unlock switch is ON for over 3 seconds, Driver door key unlock switch input is ignored.

(4) Driver door key lock switch input is ignored if key IN & IGN1 is ON.



4. Central door lock/unlock

(1) Lock commend condition

A. TX lock (SMK_passive_lock is inputting with all doors closed.)

B. Driver door key lock switch = ON (excluding key IN & IGN1 ON state.)

C. All door lock requirements are met based on AUTOlock_TIMER1 / AUTOlock_TIMER2

D. Power window lock switch = ON

(2) Unlock commend condition

A. TX unlock Input

B. Driver door keyunlockswitch= ON

C. Power window unlock switch= ON (excluding ARM state)

(3) Central lock output is ON for T1 (0.5sec) when inputting lock commend.

(4) Central unlock output is ON for T1 (0.5sec), when inputting unlock commend.

(5) Lock/unlock by SAFETY KNOB is not interlocking. (mechnical operation)

(6) No malfunctioning should be in the presence when changing Battery. (in key In switch ON state, also)

(7) No pressure lower than 60msec (driver door key lock switch / Driver door key unlock switch)

cardiagn.com

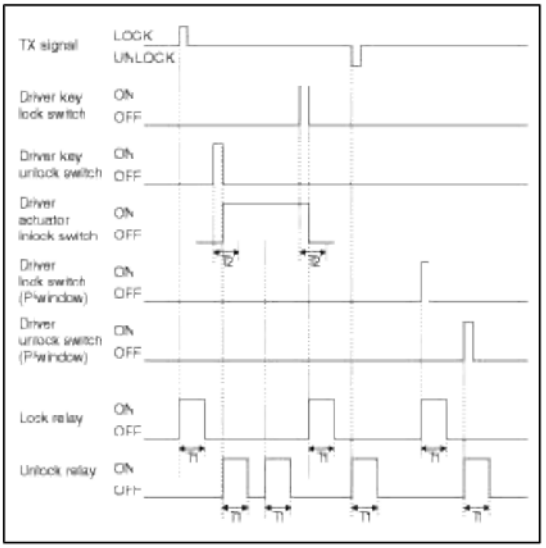
(8) Immediately turn OFF the output if reverse output is required during the output, and operate the reverse output after 100ms. However, in case that another output is required during the delay of 100ms, operate the most recently required output.

(9) If the condition of Central lock output and Central unlock output is simultaneously developed, lock output is prior to unlock output.

(10) Central lock / unlock output is consistently operated regardless of knob Input condition when inputting lock / unlock.

(11) When re-inputting lock (unlock) commend during lock (unlock) output by lock (unlock) commend, previous output is maintained.

(12) When the input is simultaneously operated by key / TX / driver door key lock switch, priority is to be TX > key > driver door key lock switch in order. (This condition is prior to (9) above.)



T1 : 0.5±0.1sec, T2 : Max 3sec

5. 2-TURN UNLOCK (NORTH AMERICA)

(1) If Driver door unlock switch is Unlocked within 3 seconds from Driver door key unlock switch is OFFON(Driver door unlock switch is mechanically Unlocked and IPM output is not operated), and Driver door key unlock switch is OFF → ON in T1, turn Door unlcok relay and Driver unlock relay Output for T2.

(2) If Driver door unlock switch is Unlocked within 3 seconds from Driver door key unlock switch is OFF → ON (Driver door unlock switch is mechanically Unlocked and IPM output is not operated), and TX UNLOCK signal is received within T1, turn ON Door unlcok relay and Driver unlock relay Output for T2.

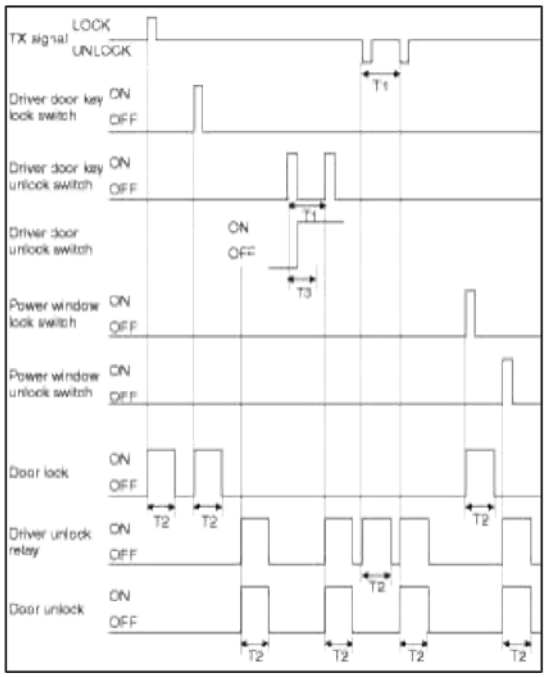
(3) Turn ON Driver unlock relay Output for T2 when receiving TX UNLOCK signal. However, if TX UNLOCK signal is received within T1, turn ON Door unlcok relay and Driver unlock relay Output for T2.

(4) If Driver door unlock switch is Unlocked within 3 seconds from Driver door key unlock switch is OFF→ON in T1 following the receipt of TX UNLOCK signal, (Driver door unlock switch is mechanically Unlocked and IPM output is not operated), turn ON Door unlcok relay and Driver unlock relay Output for T2.

(5) It is considered to be the same TX not with standing receiving different TX signal registered in T1.

carldagn.com

(6) Door lock relay, Door unlcok relay, and Driver unlock relay Output by Driver door unlock switch change is not operated.



T1 : 4±1 sec, T2 : 0.5 ± 0.1 sec T3 : Max 3sec

6. IGN key reminder

(1) This function is disabled in vehicle speed over 3km/h. (determined by 3km Signal)

(2) Unlock condition: ALL door Unlock is operated for 1 sec of the following is met.

A. Condition 1

1) IGN key ON & Driver's seat door = Open & Driver's seat door Unlock switch = LOCK

2) IGN key ON & Passenger seat door = Open & passenger seat door Unlock switch = LOCK

B. Condition 2

1) Driver's seat door is Open → Close within 0.5s from door Unlock switch is Unlocked → locked with IGN key ON.

2) Passenger seat door is Open → Close within 0.5s from door Unlock switch is Unlocked → Locked with IGN key ON

C. Condition 3

1) Driver's seat door unlock switch is unlocked → locked within 0.5s from Driver's seat door is Open → Close with IGN key ON.

2) Passenger seat door unlock switch is Unlocked → Locked within 0.5s from Passenger seat door is Open → Close with IGN key ON.

(3) Unlock retry condition: If Lock condition is maintained regardless of Unlock output for 1 second by condition 1, the maximum of 3 times (excluding the 1 second output) of Unlock output is operated. (1s cycle: 0.5s ON/OFF)

(4) DEAD LOCK Applied Region :

A. Dead Unlock output is operated for 0.5 second and then all door unlock signal output is ON for a second following the delay of 200msec , if Unlock condition (1) is met.

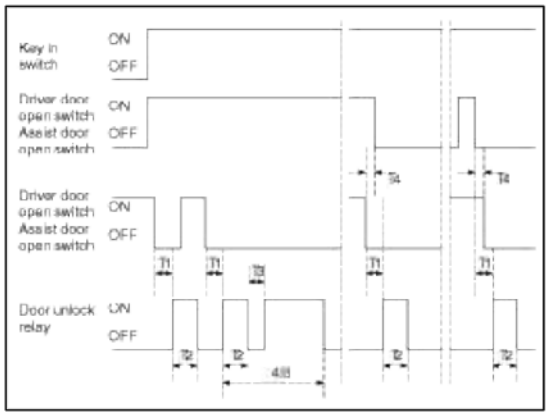
B. Dead Unlock ouput is operated for 0.5 second and the maximum of 3 times of 200msec all door unlock output is operated following the delay of 200msec, if unlock retry condition (2) is met. (1s cycle: 0.5s ON/OFF)

(5) If door is locked by power window lock switch with IGN key ON after driver door or assist door open, IGN key reminder function is performed.

cardiagn.com

(6) Unlock output is operated despite that unlock condition is not maintained for 0.5 s from the condition is met. However, it is not operated if IGN key is out after 0.5 sec from door lock switch is met with the condition by change from unlock → lock.

(7) Passenger seat action is prior to that of driver's seat if both confition is fulfilled at the same time.



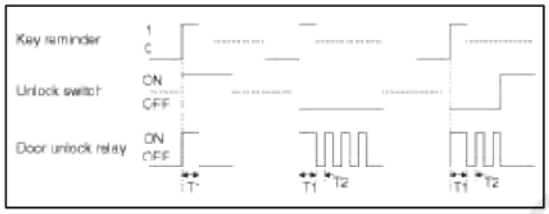
T1,T3 : 0.5±0.1sec, T2 : 1±0.1sec, T4 : 0.5sec or less

7. Passive key reminder unlock

(1) This function is disabled to be performed if vehicle speed is over 3km/h.

(2) Door unlock output is operated for 1s when receiving KEY REMIND(CAN) from SMK ECU.

(3) The maximum of 3 times of (excluding the 1s output) unlock output is operated if lock state is maintained regardless of unlock output for 1s by (2).



T1 : 1±0.1sec, T2 : 0.5±0.1sec

*UnlockSW ON : DRVDRUnlockSW is unlocked and ASTDRUnlockSW is unlocked
UnlockSW OFF : DRVDRUnlockSW is locked and ASTDRUnlockSW is locked

8. Crash door unlock

(1) Whenever crashInput signal[1] Input is ON with IGN1 = ON or IGN2 = ON , Unlock output is operated without exception.

(2) Unlock output is maintatined to the cycle not with standing IGN1 = OFF and IGN2 = OFF during Unlock output.

(3) Unlock output is operated for T3 when driver or assist, rear door Lock switch is Unlocked → Locked following unlock output.

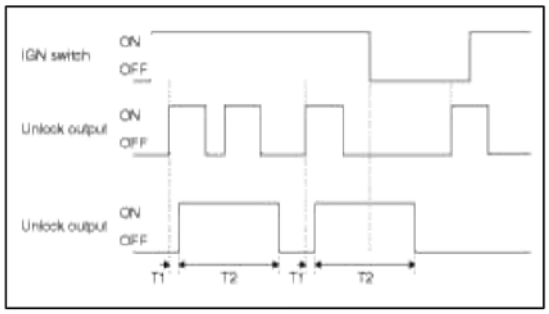
(4) Auto door lock function is not performed under the crash Unlock condition.

(5) Centrol door lock function is not performed during or after crash unlock output. However, centrol door lock function will be performed as usual if crash unlock function is reset following IGN OFF.

(6) Crash door unlock function is prior to Lock/Unlock control by other functions.

cardiagn.com

(7) Lock/unlock required by other functions is ignored during and after crash door unlock output. However, lock/unlock is controlled by other function if IGN1 switch = OFF & IGN2 switch = OFF.



T1 : 40msec, T2 : 5±0.5sec

9. Auto door lock

(1) Auto door lock is divided into non-activaton / 20km activation / 40km activation.

(2) Door lock relay output is ON by T1, when maintaining rated speed or more in (1) with A_IGN1 SW=ON. However, lock output is not operated if ALL doorS are failed or locked.

(3) If any of the door is in unlock condition after lock output in (2), the maximum of 3 times of lock output is operated (1s cycle). However, door changed from unlock→lock during the output is ignored.

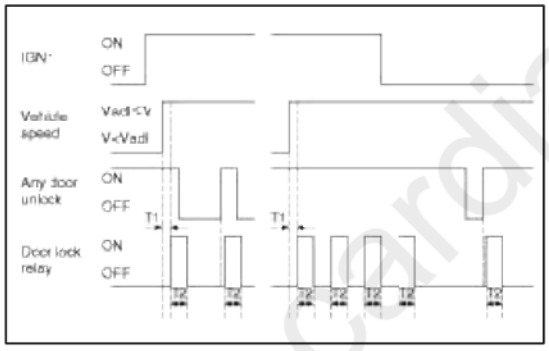
(4) The door is failed if it is unlocked after the 3 times output.

(5) 1 lock output is operated only if failed door is unlocked following the previous change. (unlock→lock)

(6) 1 lock output is operated only if locked door is unlocked after the lock output in (2). However, 1 lock output is operated on the door regardless of maintaining unlock condition following the lock output.

(7) Clear failed door when IGN1 switch is OFF.

(8) Auto door lock function is not performed under crash unlock condition.

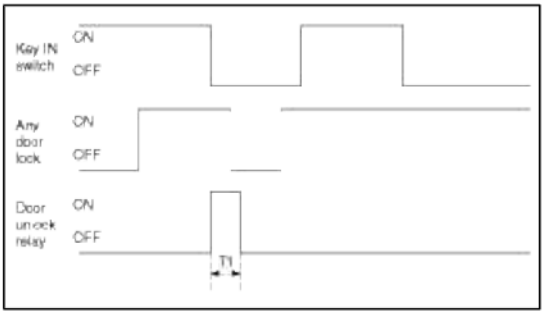


T1 : Max 1.5, T2 : 0.5±0.1sec

10. IGN key off unlock

(1) IGN key OFF unlock is divided into non-activaton/activation.

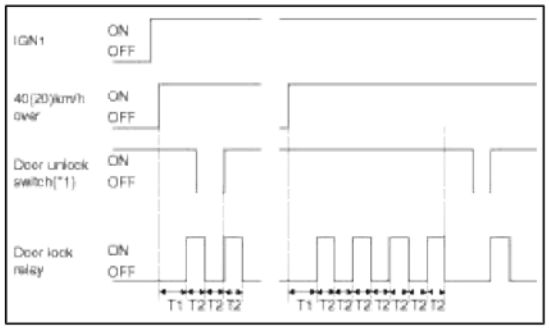
(2) All doors are unlocked if any of the door is locked during IGN1 switch OFF prior to key OFF.



T1 : 0.5±0.1sec

cardiagn.com

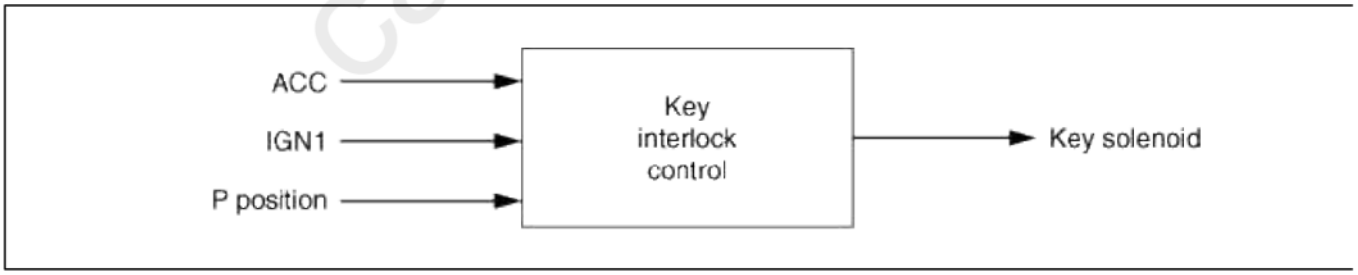
11. Auto door Lock by shift lever change (NORTH AMERICAT AT SPECIFICATION)
    (1) Activation of above funcation is in accordance with CALIBRAION PARAMETER TABLE.
    (2) Door Lock Output is operated when Inhibit P signal Input value is changed from 1 → 0 with All door close (including Tail Gate) and Any door unlock after 300msec from IGN1 is ON and Alt L is ON. However, the output is not operated with All door Lock or All door fail.
    (3) If any of the doors is Unlocked after Lock Output by above condition, the maximum of 3 times of Lock Output is operated. (1s cycle) However, DOOR UNLOCK→LOCK during the output is ignored.
    (4) The door is Failed if it is Unlocked after the 3 outputs.
    (5) 1 Lock Ouput is operated only if Failed door is Unlocked following the previous change. (UNLOCK→LOCK)
    1 Lock Output is operated only if Locked door is Unlocked after the Lock Output in (2). However, 1 Lock Ouput is operated on the door regardless of maintaining Unlock condition following the Lock Output.
    (6) Clear failed door when IGN1 switch is OFF.
    (7) Shift P interlocking Door Lock function is not performed under Crash Unlock function.



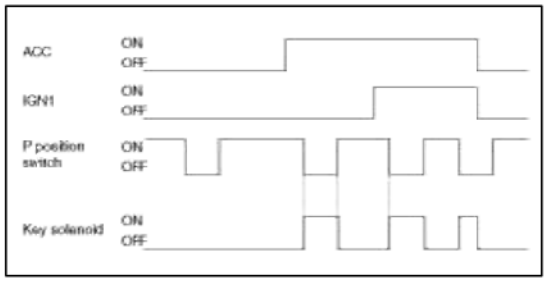
T1 : Max 1.5sec, T2 : 0.5 ± 0.1sec
*1 ON (UNLOCK) : DRIVERDRUnlock Switch I ASTDRUnlock Switch I RRDRUnlock Switch = UNLOCK
OFF (LOCK) : DRIVERDRUnlock Switch & ASTDRUnlock Switch & RRDRUnlock Switch = LOCK

12. Auto door Unlock by shift lever change (NORTH AMERICAT AT SPECIFICATION)
    (1) When any door lock & IGN1 ON & Alt L=ON, Inhibit P signal value change to 0 from 1 after 300msec, Central door unlock ouput.

13. Key interlock control

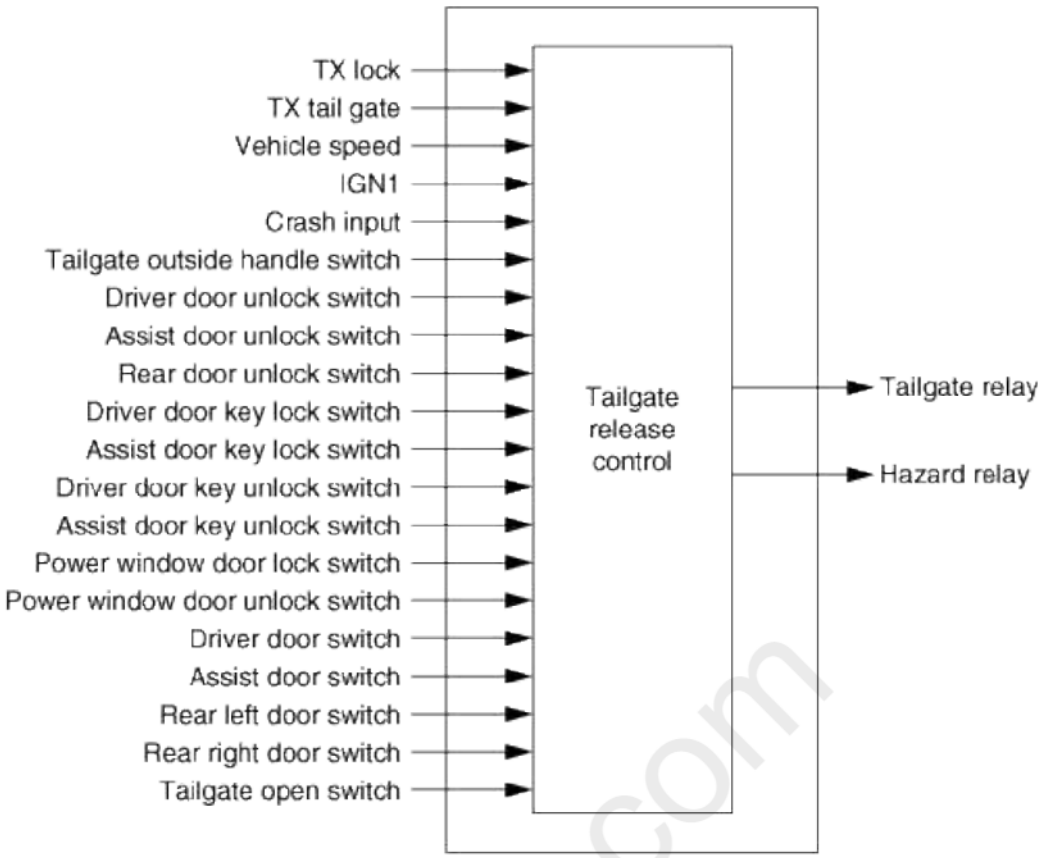


    (1) If P position switch Input is OFF with IGN1 ON or ACC ON, the condition is required to be made for key being tightly fixed by turning ON Key solenoid output.
    (2) Other than the above condition, key is to be removed by turning OFF Key solenoid output.



14. Tailgate release control

carDiagn.com



(1) Permission mode state

State	Description
Initial Condition	**Anti-permission mode state**
Event	All knob unlock
Action	**Changed to permission mode state**

State	Description
Initial Condition	**30s permission mode state**
Event	All knob unlock
Action	**Changed to permission mode state**

State	Description
Initial Condition	**permission mode state**
Event	1. TX tailgate 2. Tailgate outside handle switch ON with vehicle speed not exceeding 5k
Action	**Changed to permission mode state** 1. Hazard relay flashing for 2 times (tailgate unlock) 2. Tailgate relay 0.5secON (tailgate outside handle switch ON)

cardiagn.com

(2) 30sec permission mode state

State	Description
Initial Condition	**Anti-permission mode state**
Event	TX tailgate
Action	**30s permission mode state** Start tailgate timer Hazard relay flashing for 2 times

State	Description
Initial Condition	**30s permission mode state**
Event	1.TX tailgate 2 Tailgate outside handle switch ON with vehicle speed not exceeding 5kı
Action	**Changed to 30s permission mode state** 1. Restart tailgate timer & hazard relay flashing for 2 times (tailgate unlocl 2. Tailgate relay 0.5secON (tailgate outside handle switch ON)

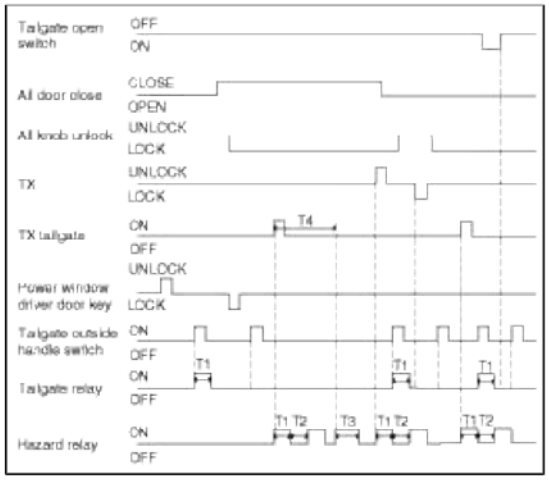
(3) Anti-permission mode state

State	Description
IiilCniinIiilCniin	**30s permission mode state**
Event	1. TX lock 2. Key lock 3. Power window door lcok switch ON 4. Auto door lock 5. Relock 6. Tailgate open switch ON → OFF 7. Tailgate timer is expired 8. ARM WAIT activated
Action	**Changed to Anti-permission mode state**

State	Description
Initial Condition	Permission mode state
Event	Any knob Lock
Action	Changed to anti-permission mode state

State	Description
Initial Condition	**Anti-permission mode state**
Event	Smart key passive tailgate Vehiclespeed ≤ 5km/h
Action	**Anti-permission mode state maintained** Tailgate relay 0.5sec ON

carmanual.com

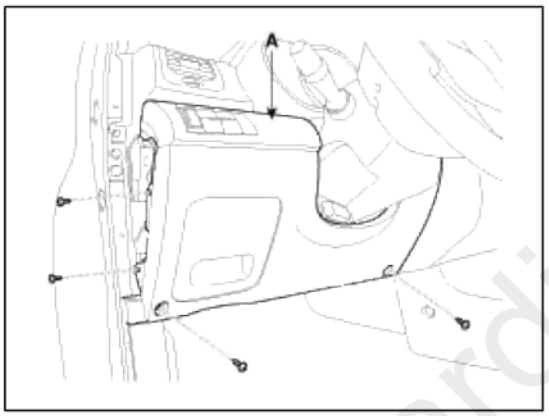


T1,T2 : 0.5±0.1sec, T3 : 1±0.2sec, T4 : 30±3sec

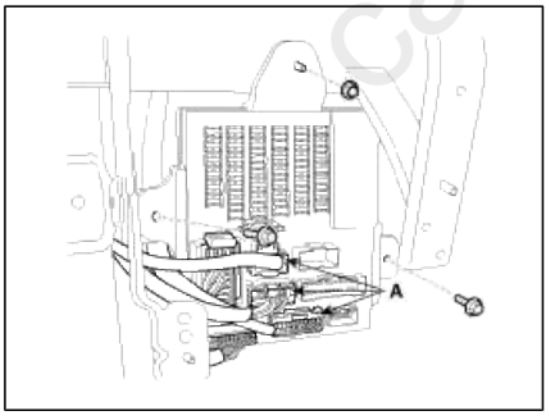
Body Electrical System > BCM (Body Control Module) > IPM (Intelligent intergrated Platform Module) > Repair procedures

Removal

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

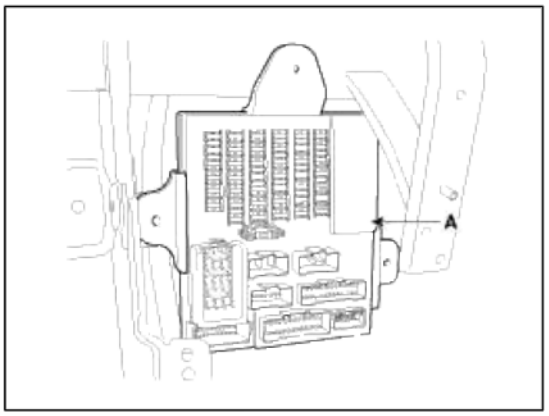


3. Remove IPM(Intelligent intergrated Platform Module) connector (A), bolts and nut



cardiagn.com

4. Remove IPM (A) after removing rear connectors.

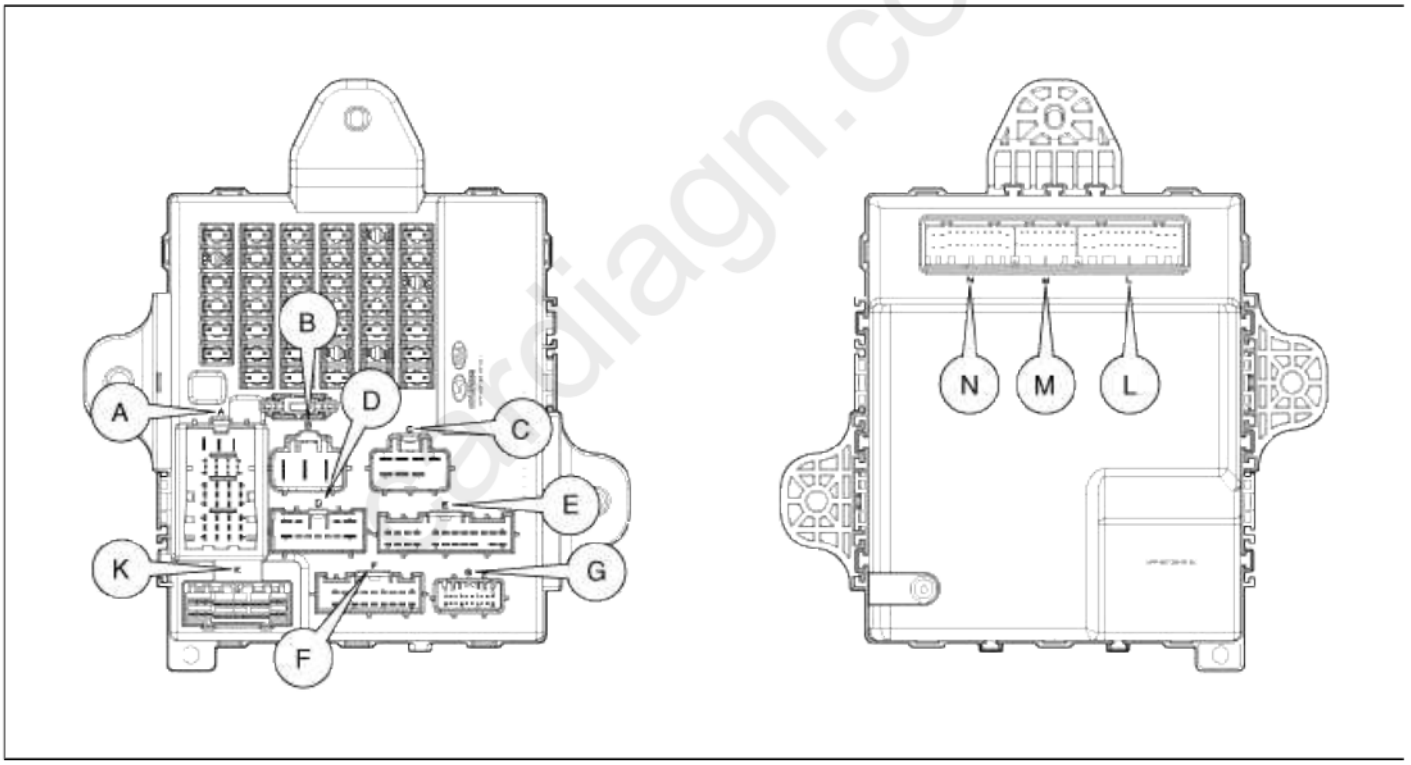


Installation

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

Inspection

IPM Connectors



Outer Connector (L / M / N / K)

CON.	PIN	Description	Active	Remark
	1			
	2			
	3			
	4	Wiper Intermittent Volume	AD	
	5	Key Illumination Lamp Output		

ardiagn.com

L	6	Rear Left Seatwarmer Switch Input		
	7	Rear Washer Switch Input	High	
	8			
	9	Auto Light Switch Input	Low	
	10	Head Lamp Low Switch Input	Low	
	11	Wiper Mist Switch Input	High	
	12	Auto Light Sensor Input	AD	
	13	Auto Light Sensor Ground	Ground	
	14			
	15	Washer Switch Input	High	
	16			
	17	Defroster Switch Input	Low	
	18	Rear Right Seatwarmer Switch Input		
	19	Wiper Intermittent Switch Input	High	
	20			
	21	Tail Lamp Switch Input	Low	
	22	Rear Left Seatwarmer Relay Output		
	23	Rear Wiper Switch Input	High	
	24	Rear Right Seatwarmer Relay Output		
	25	ALS Power Monitoring Input	High	
	26			
M	1	Head		
	2	Driver Door Unlock Relay Output	Low	Relay
	3			
	4	Rear Fog Relay Output	Low	Relay
	5	Can Network Communication Line(high)	Data	
	6	Can Network Communication Line(Low)	Data	
	7			
	8	Key In Switch Input	Low	
	9	Head Lamp Washer Switch Input	Low	
	10			
	11			
	12	Parking Brake Indicator	Low	
	13	Hid Option Switch Input	Low	
	14	Rear Fog Lamp Switch Input	Low	
	15			

cardiagn.com

	16	Head Lamp high Switch Input	Low	
N	1	Room Lamp Output	Low	PWM
	2			
	3	Head Lamp Washer Realy Output	Low	Relay
	4			
	5	Hazard Relay Output	Low	Relay
	6			
	7	AV Tail Signal Output	Low	
	8			
	9			
	10	Key Solenoid Output	Low	Solenoid
	11	Supply Power To Ips For Mhlld		
	12	Power Ground2	Ground	
	13	Front Fog Lamp Switch Input	Low	
	14	Tx Door Unlock State Signal Output	High	
	15	Assist Seat Belt Indicator Output	Low	LED
	16	P Position Switch Input	Low	
	17	Diagnostic Comm. Line K For Tester	Data	
	18	Crash Unlock Signal Input	Low	
	19	Buzzer Output	Low	
	20			
	21	Manual HLLD Power Output	High	
	22	Power Ground1	Low	Lamp
K	1			
	2	Stop Lamp LH/RH Output	High	
	3	Stop Lamp Power	Power	
	4	Power Window Lock Switch Input	Low	
	5	Rear Right Door Open Switch Input	Low	
	6		Low	
	7	Rear Left Door Open Switch Input		
	8	Parking Brake Switch Input	Low	
	9	Driver Door Key Unlock Switch Input	Low	
	10	Driver Door Open Switch Input	Low	
	11	Tail Gate Out Side Handle Signal Input	Low	
	12	IMS Relay Output	Low	Relay
	13	Rear Door Actuator Unlock Switch Input		

cardiagn.com

K	14			
	15			
	16			
	17	Seat Belt Switch Input	Low	
	18	Assist Door Open Switch Input	Low	
	19	Tail Gate Open Switch Input	Low	
	20	Rear Parking Assist System Switch Input	Pulse	
	21	Driver Door Key Lock Switch Input	Low	
	22	Rear Wiper Relay Output	Low	Relay
	23	Assist Door Actuator Unlock Switch Input	Low	
	24	Power Window Unlock Switch Input	Low	
	25	Assistant Seat Belt Switch Input	Low	
	26	Driver Door Actuator Unlock Switch Input	Low	

Inner Connector (A / B / C)

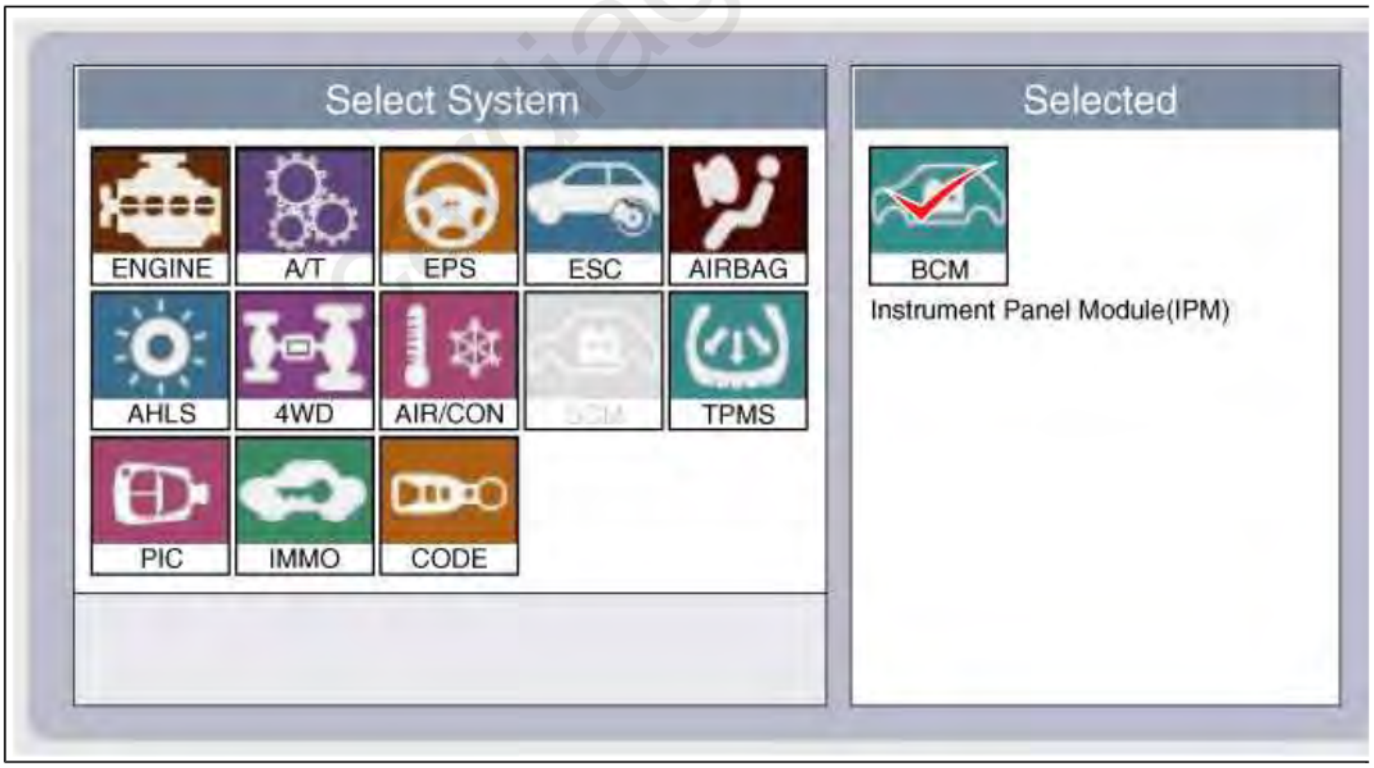
CON.	PIN	Description	Active	Remark
A	1	Head Lamp Low RH Output	High	PWM
	2	Head Lamp High RH Output	High	PWM
	3	Power (IPS2 & 3)	Power	
	4	Front Fog Lamp Output	High	PWM
	5	Tail Lamp RH Output	High	
	6	Power (IPS1 & 4)	Power	
	7	Tail Lamp LH Output	High	
	8	Head Lamp Low LH Output	High	PWM
	9	Power (IPS5 & 6)	Power	
	10	Head Lamp High LH Output	High	PWM
	11	Tail Interior Lamp Output	High	
	12	Power (IPS0 & 7)	Power	
B	1	Power Window Relay Output	Low	Relay
	2	Ignition2 Switch Input	High	
	3	Drl Option Switch Input	Low	
	4	Battery Monitoring Input	High	
	5	Accessory Switch Input	High	
	6			
	7			
	8	Burglar Alarm Horn Relay Output	Low	Relay
	9			

cardiagn.com

	10	Ignition1 Monitoring Input	High	
	11			
	12	Tail Gate Release Relay Output	Low	Relay
C	1			
	2	Door Unlock Relay Output	Low	Relay
	3	Door Lock Relay Output	Low	Relay
	4			
	5			
	6	Wiper Low Relay Output	Low	Relay
	7			
	8	Defroster Relay Output	Low	Relay
	9			
	10	Hood Open Switch Input	Low	
	11	Diagnostic Comm. Line K For Tester	Data	
	12	Start Inhibit Relay Output	Low	Relay

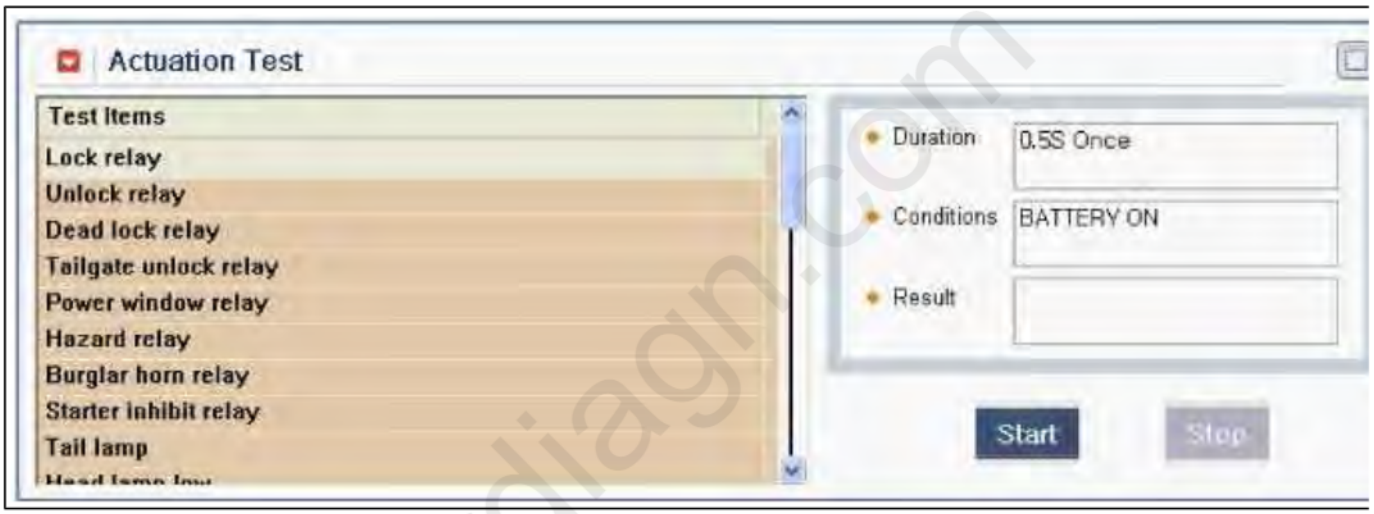
Trouble Diagnostics When Using GDS

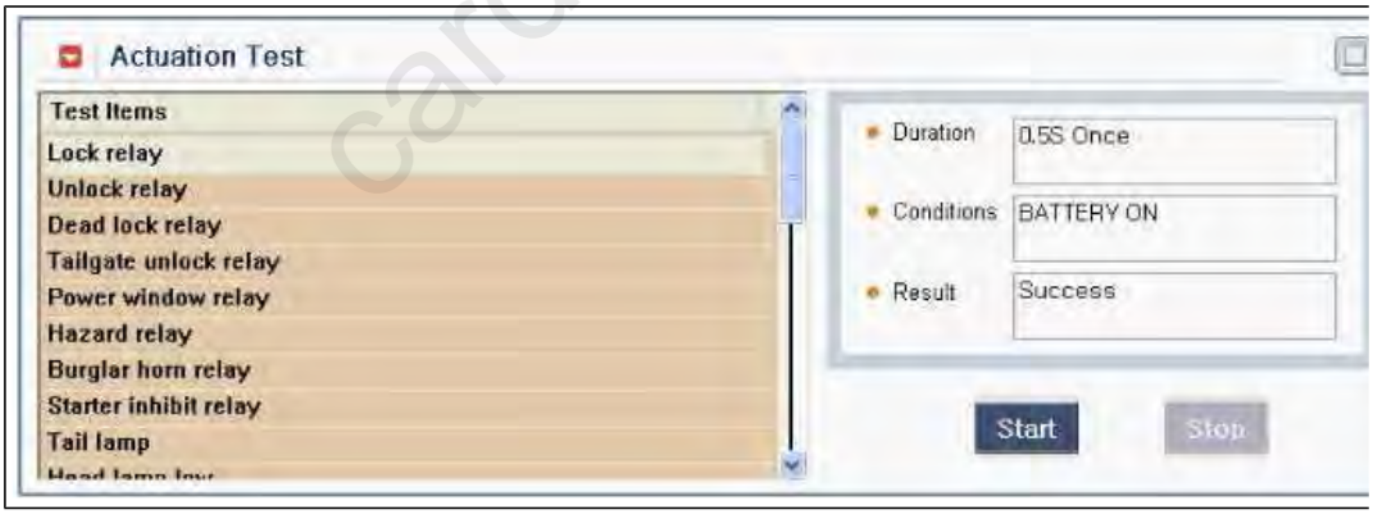
1. The IPM can be diagnosed by using the GDS. The BCM communicates with the GDS which then displays inputs and outputs along with codes.
2. To diagnose the IPM function, select the vehicle model and IPM.



3. To view the input/out value of IPM, use the GDS to check "Current DATA". It provides information of IPM input/output conditions of power supply, turn signal/brake lamp, headlamp, door locks, outside mirror, wiper, auto light and transmitters etc.

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

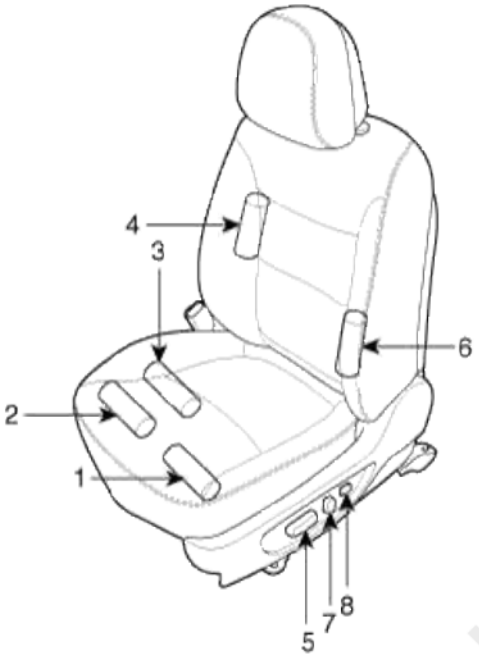




cardiagn.com

Body Electrical System > Seat Electrical > Components and Components Location

Component Location



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

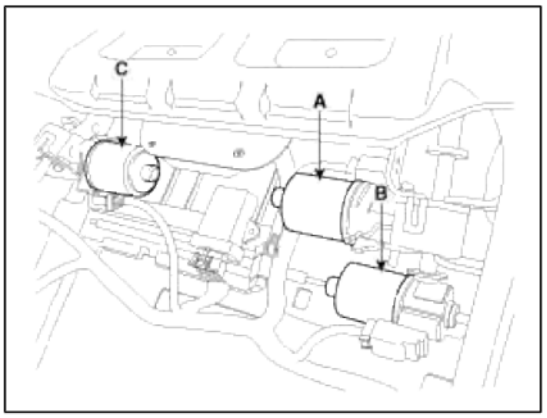
Body Electrical System > Seat Electrical > Power Seat Motor > Repair procedures

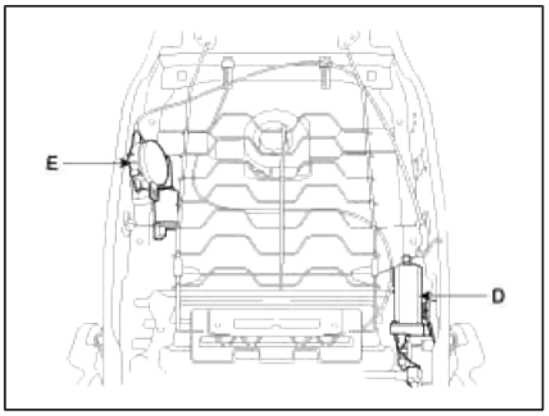
Inspection

Power Seat Motor

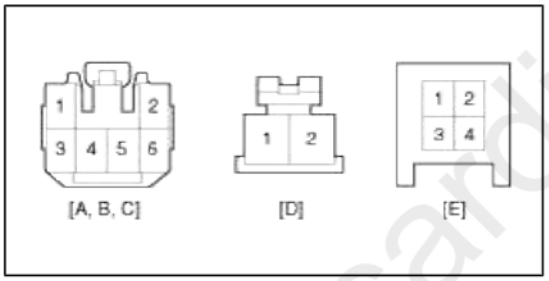
cardiagn.com

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





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.



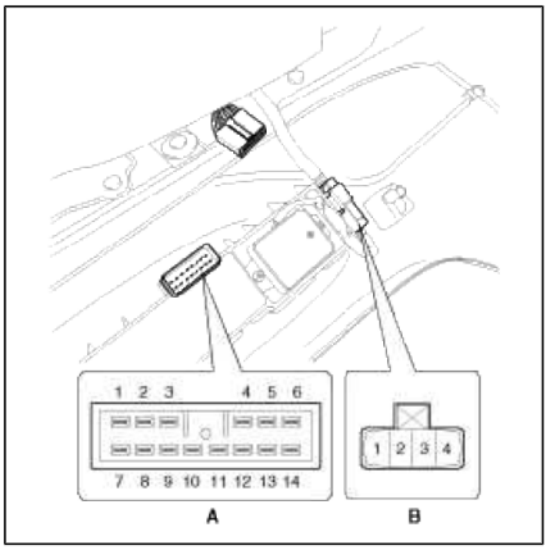
Position	Terminal	+	-
Front height motor A	Up	3	4
	Down	4	3
Slide motor B	Frontward	4	3
	Backward	3	4
Rear height motor C	Up	3	4
	Down	4	3
Lumbar support motor D	Forward	1	2
	Rearward	2	1
Reclining motor E	Forward	2	1
	Rearward	1	2

cardiagn.com

Body Electrical System > Seat Electrical > Power Seat Control Switch > Repair procedures

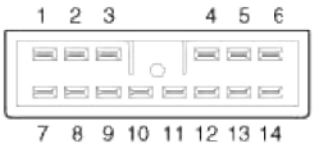
Inspection

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



Driver Power Seat Control Switch A

	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

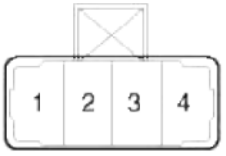


[Driver Power Seat Control Switch]

cardiagn.com

Driver Lumber Support Switch B

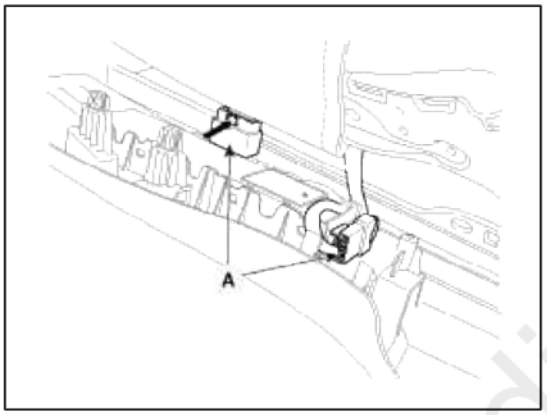
	Lumber Switch			Remarks
	Backward	N	Forward	
1	○		○	
2	○	○ ○	○	
3	○	○	○	
4	○	○		



[Lumber Switch]

Removal

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



Installation

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

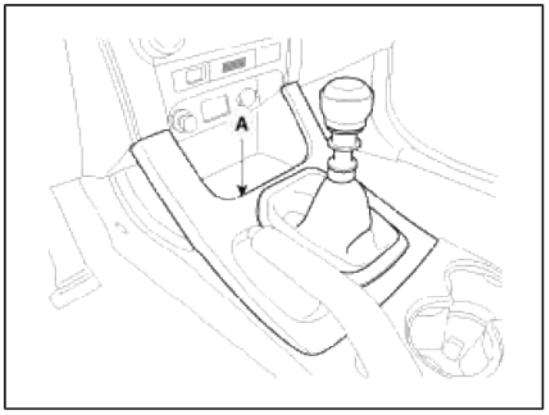
cardiagn.com

Body Electrical System > Seat Electrical > Seat Heater Switch > Repair procedures

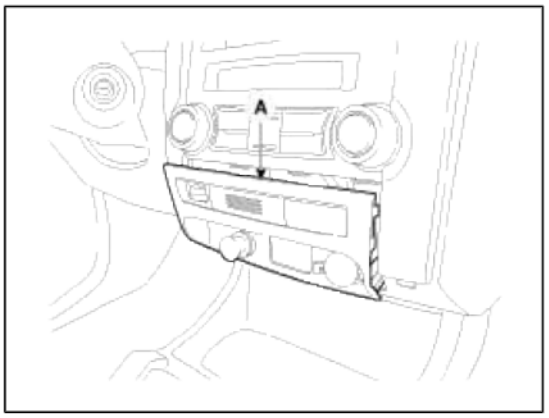
Inspection

Front Seat Heater Switch

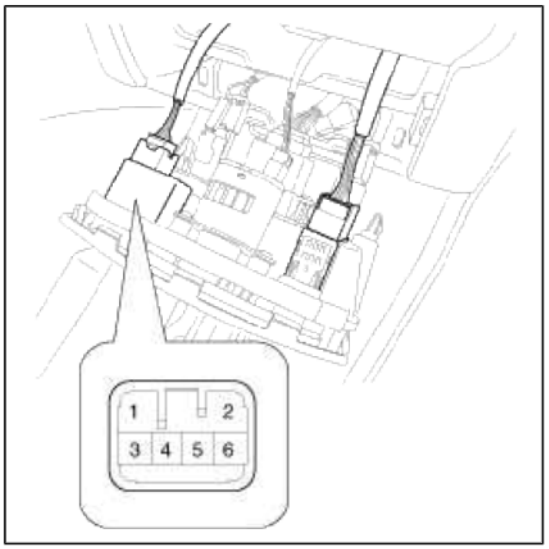
1. Disconnect the negative (-) battery terminal.
2. Remove the floor console upper cover (A).
   (Refer to BD group - "Console")



3. Remove the center fascia lower panel (A).



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



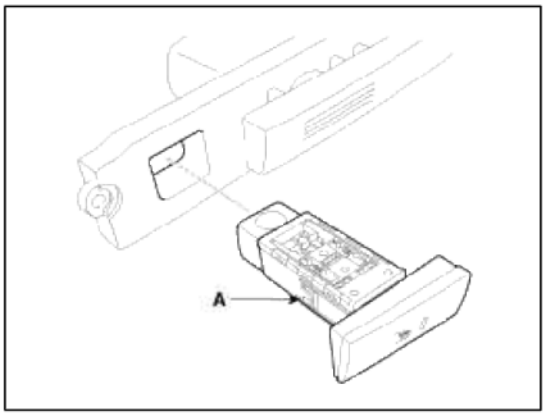
5. Check that continuity exists between the terminals after turning the driver and assist seat heater switch ON.

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

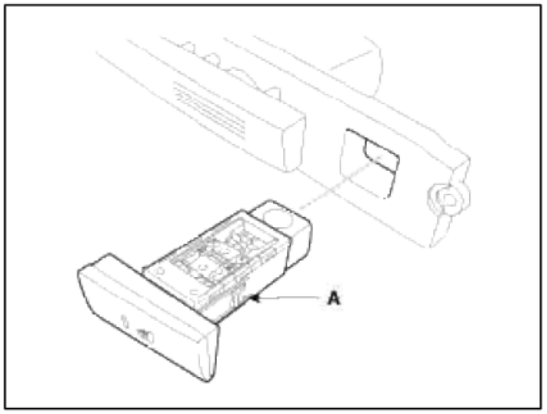
cardiagn.com

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

[Driver]



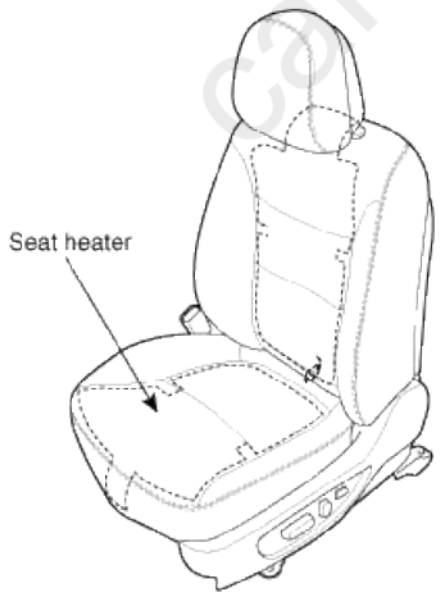
[Assist]

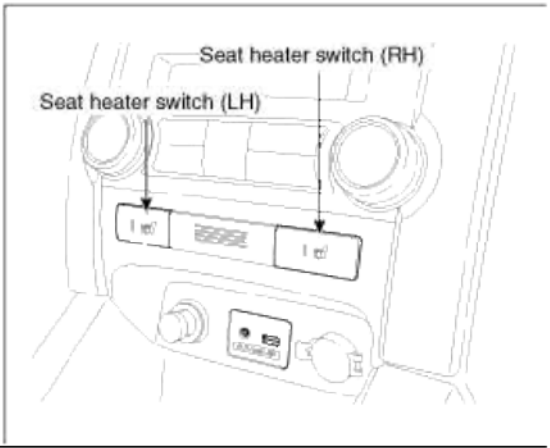


Body Electrical System > Seat Electrical > Seat Heater > Components and Components Location

Component Location

[Driver/Assist Seat]



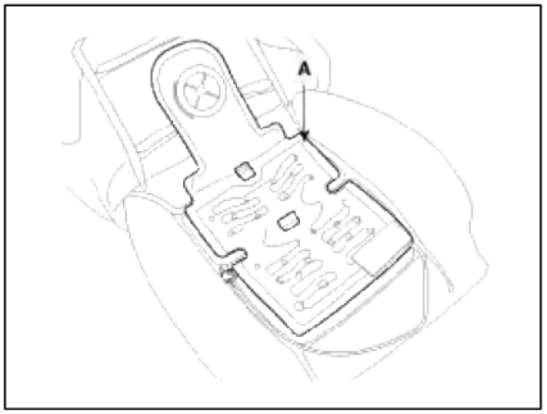


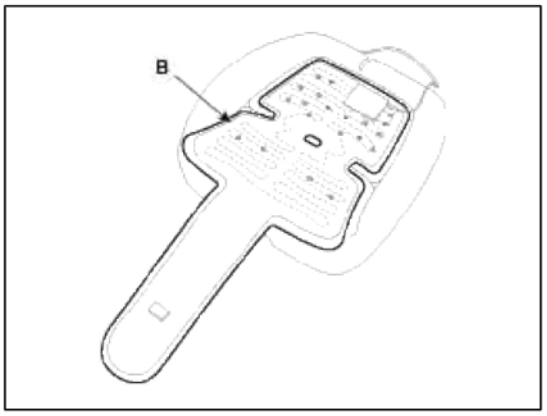
cardiagn.com

Body Electrical System > Seat Electrical > Seat Heater > Repair procedures

Removal

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





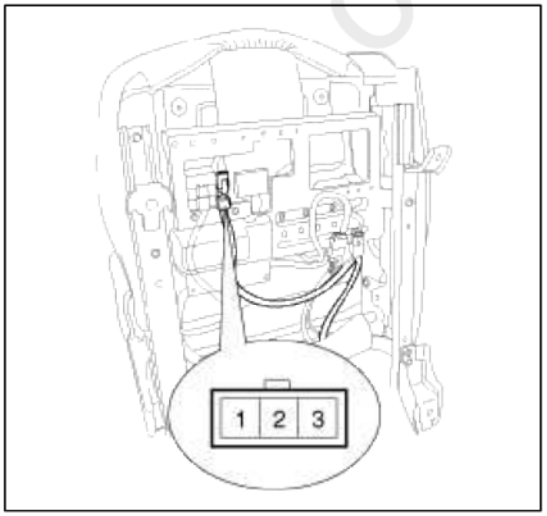
Installation

1. Install the driver / assist seat back and cushion heater.

Inspection

First Seat Heater

1. Check for continuity and measure the resistance between No.1 and NO.3 terminals.



cardiagn.com

Standard value
Cushion : 1.52Ω ± 10%
Back : 0.86Ω ± 10%
Set : 2.38Ω ± 10%

2. Operate the seat warmer after connecting the 3P connector, and then check the thermostat by measuring the temperature of seat surface.

Standard value
HI : 104 ± 3.6°F (40 ± 2°C) (Cushion),
114.8 ± 3.6°F (46 ± 2°C) (Back)

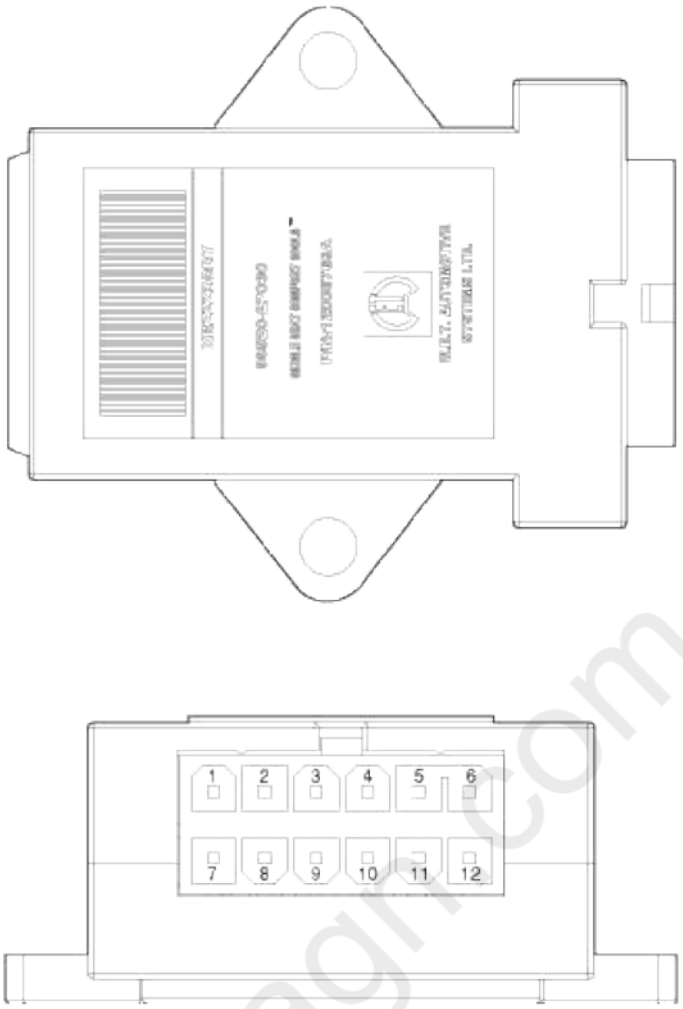
3. Check for continuity between the terminals after disconnecting the connector.

Terminal / Position	1	2	3
HIGH	⊕	⊖	⊖
LOW		⊕	⊖

Body Electrical System > Seat Electrical > Air Ventilation Seat Control Unit > Components and Components Location

Component Location

cardiagn.com



Pin	Description	Pin	Description
1	NTC sensor (+)	7	-
2	NTC sensor (-)	8	-
3	Battery	9	-
4	Switch input (+)	10	IGN
5	Seat heater	11	GND
6	Switch input (-)	12	Blower

※NTC sensor : Negative Thermal Coeffecient

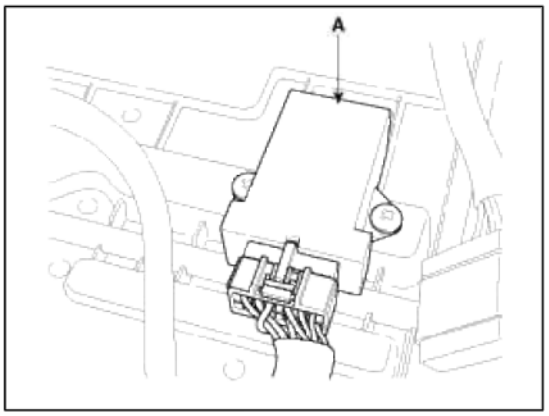
cardiagn.com

Body Electrical System > Seat Electrical > Air Ventilation Seat Control Unit > Repair procedures

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 > Seat Electrical > Air Ventilation Seat > Description and Operation

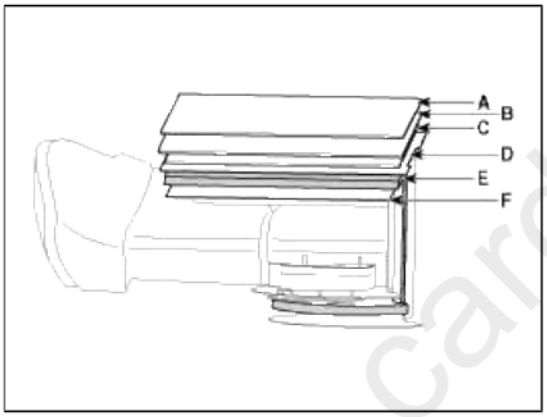
Description

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 into the 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.

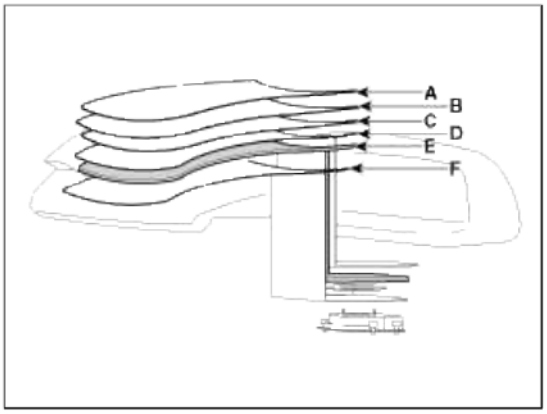
Seat Back Layers



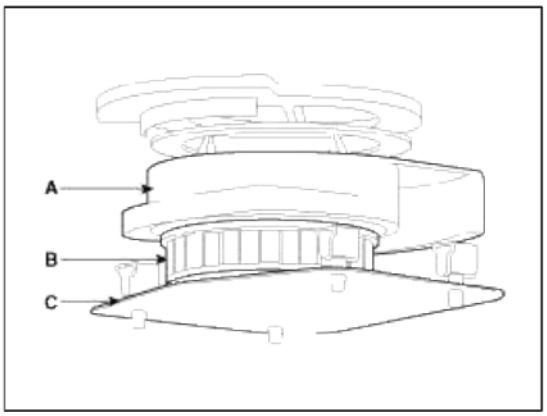
Item	Description
A	Leather
B	Pad
C	Seat Heater
D	Upper Layer
E	Air Ventilation Layer
F	Lower Layer

Seat Cushion Layers

cardiagn.com



Fan

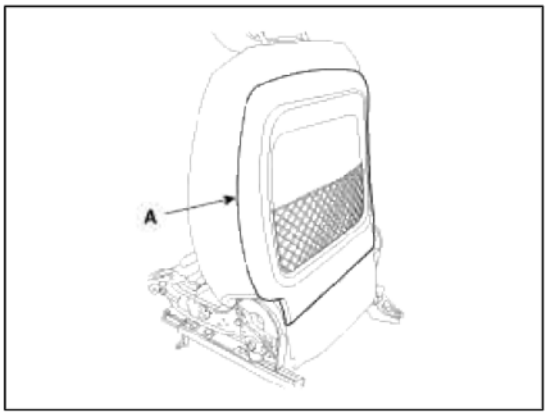


Item	Description
A	Fan Cover
B	Fan
C	Bracket

Body Electrical System > Seat Electrical > Air Ventilation Seat > Repair procedures

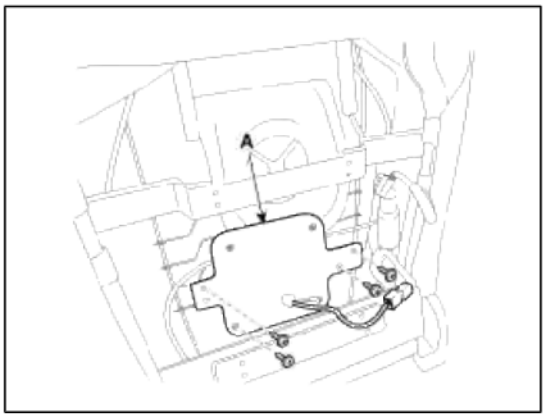
Removal

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

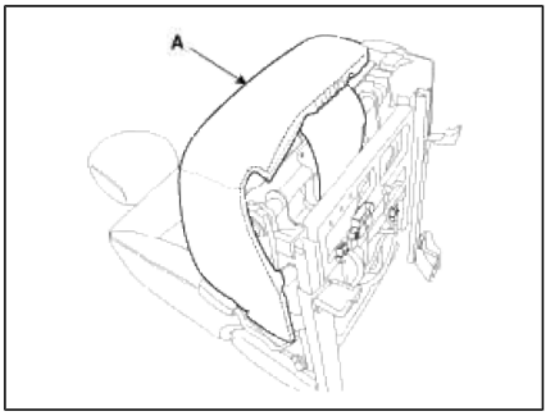


cardiagn.com

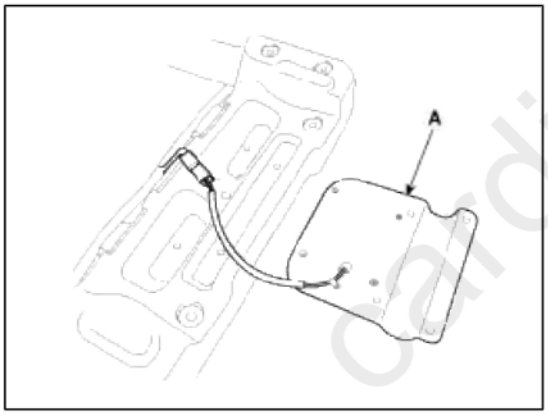
2. Remove the blower fan (A) after removing the screws from the seat back.



3. Remove the seat cushion (A).
(Refer to BD group - "Front seat")



4. Remove the blower fan (A) after removing the rivets from the seat cushion.



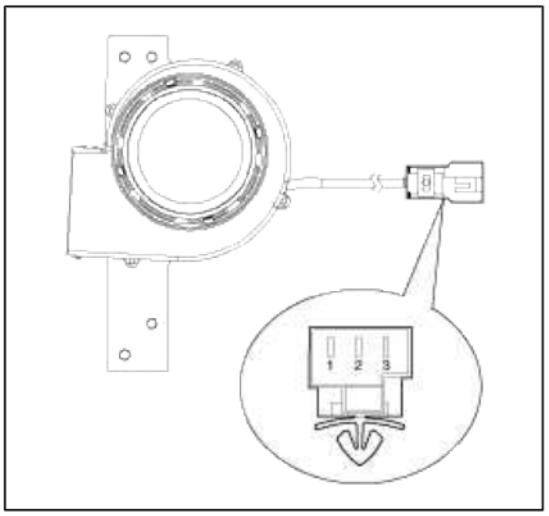
Installation

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

Inspection

cardiagn.com

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



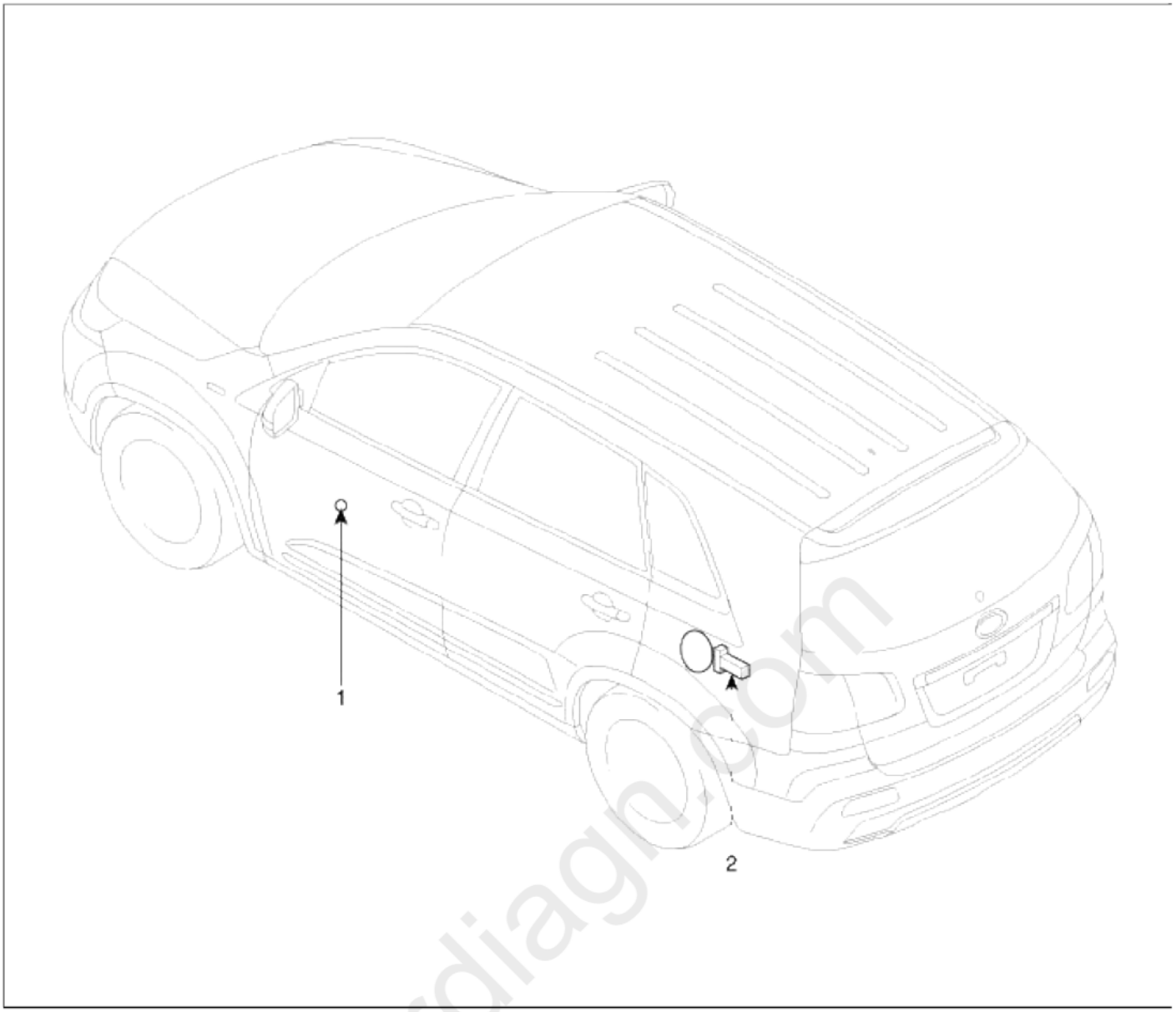
Pin	Description
1	12V
2	RPM control
3	GND

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

Body Electrical System > Fuel Filler Door > Components and Components Location

Component Location

cardiagn.com



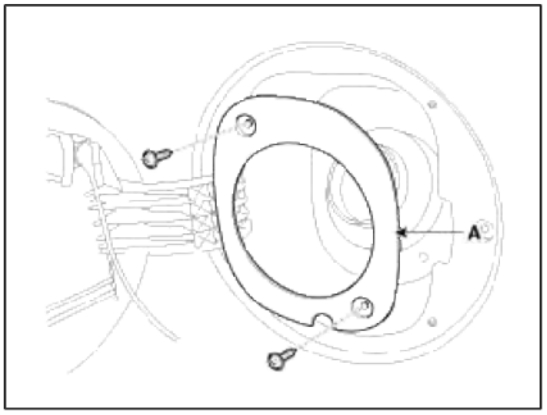
1. Fuel filler door open switch	2. Fuel filler door release actuator

cardiagn.com

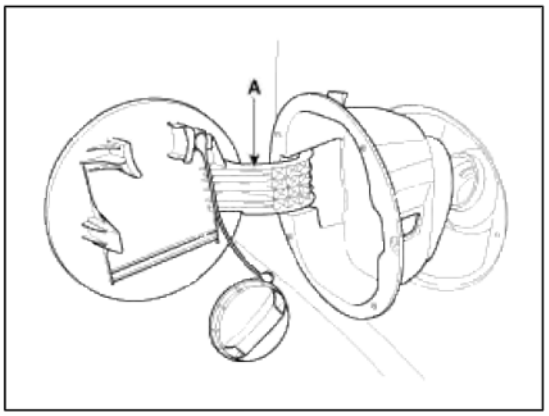
Body Electrical System > Fuel Filler Door > Fuel Filler Door Release Actuator > Repair procedures

Inspection

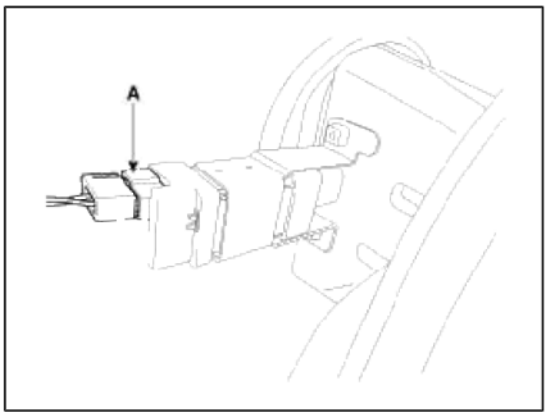
1. Remove the fuel filler cover (A) after loosening screws (2EA).



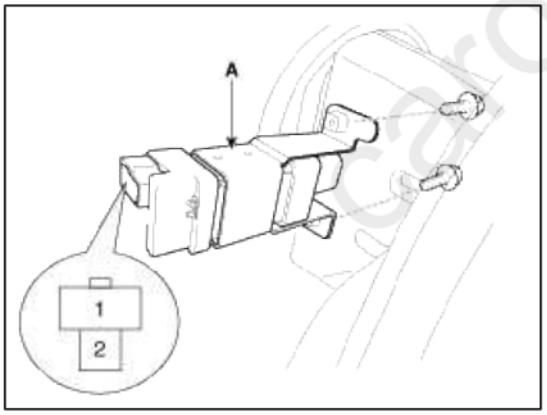
2. Remove the fuel filler door module (A).



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



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



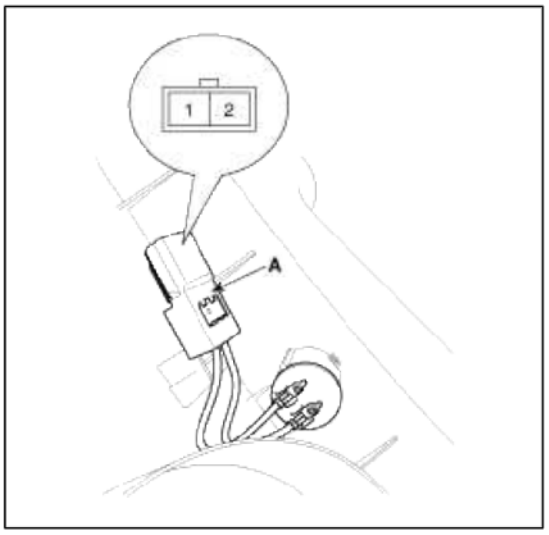
cardiagn.com

Body Electrical System > Fuel Filler Door > Fuel Filler Door Open Switch > Repair procedures

Inspection

1. Remove the front door trim panel.
   (Refer to BD group - "Front door")

2. Disconnect the switch connector (A) from wiring.



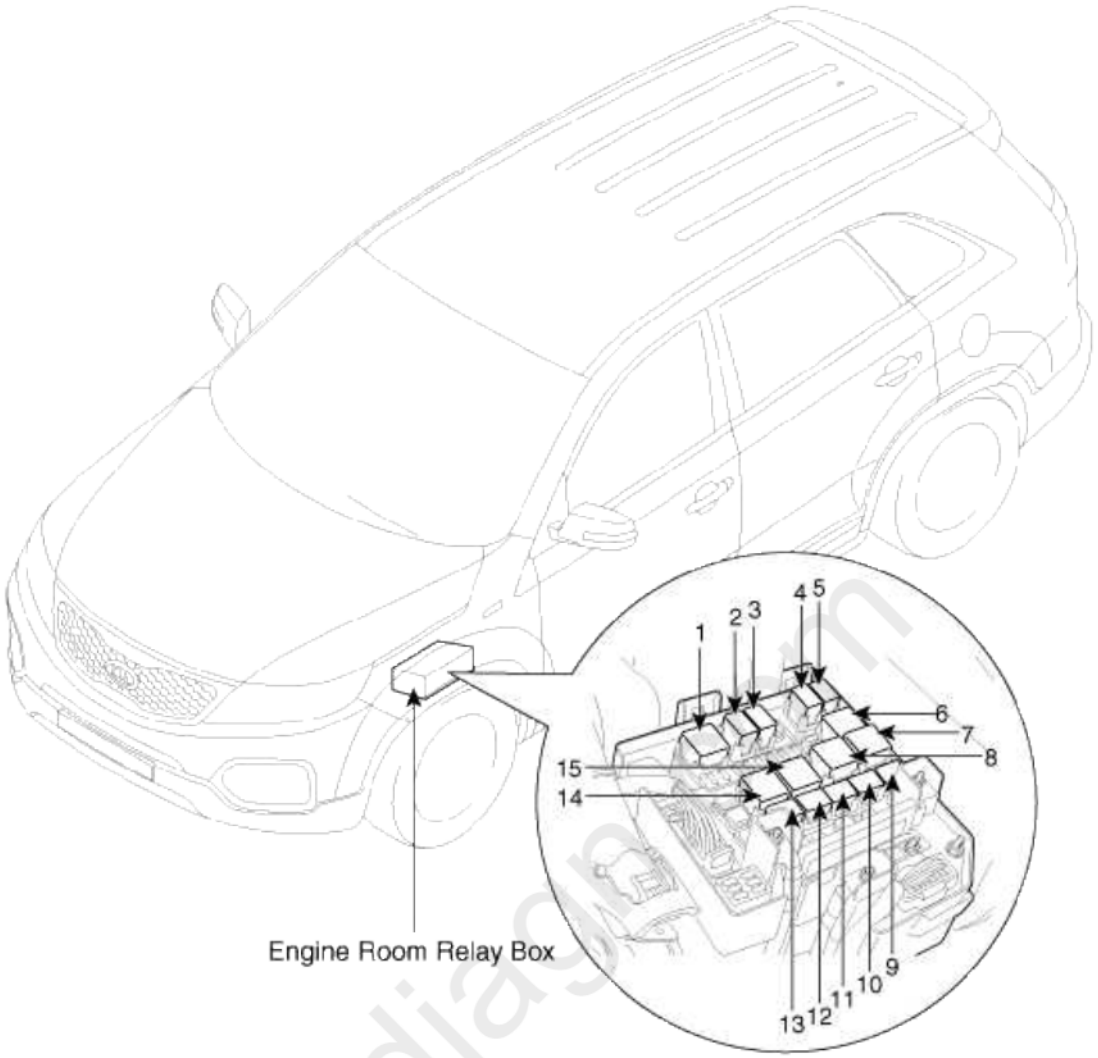
3. Check the switch for continuity between the No. 1 and No. 2 terminals. If the continuity is not as specified, replace the switch.

Body Electrical System > Fuses And Relays > Components and Components Location

Component Location

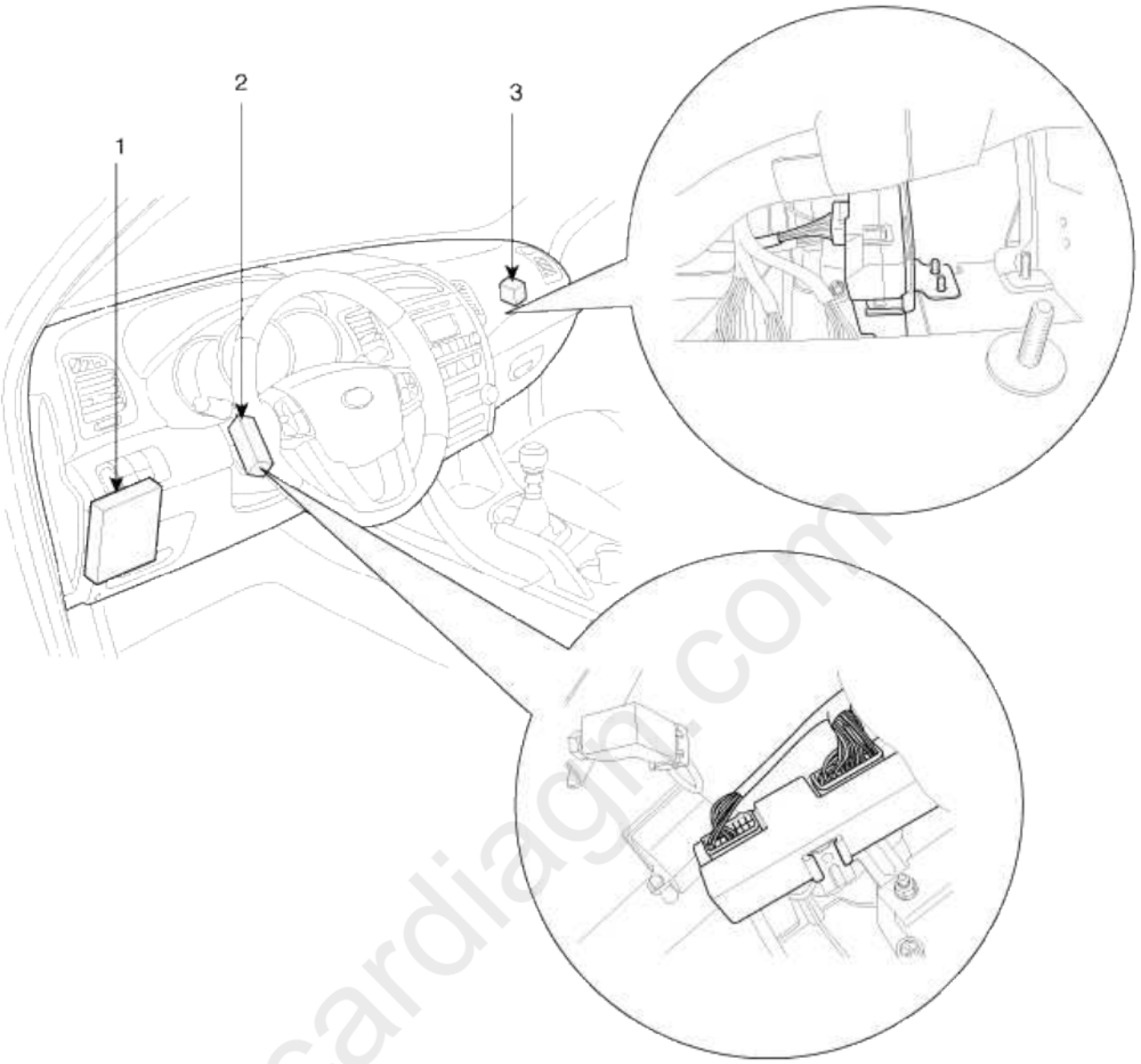
cardiagn.com

[Engine Room Relay Box]



1. Main relay	9. Back up lamp relay
2. Fuel pump relay	10. Sub start relay
3. A/C relay	11. Buglar alarm relay
4. Wiper relay (Low)	12. Horn relay
5. Wiper relay (High)	13. Windshied deicer relay
6. Blower relay	14. Condenser fan relay #1
7. Rear glass defogger relay	15. Start relay #1
8. Condenser fan relay #2	

[Passenger Compartment Relay]

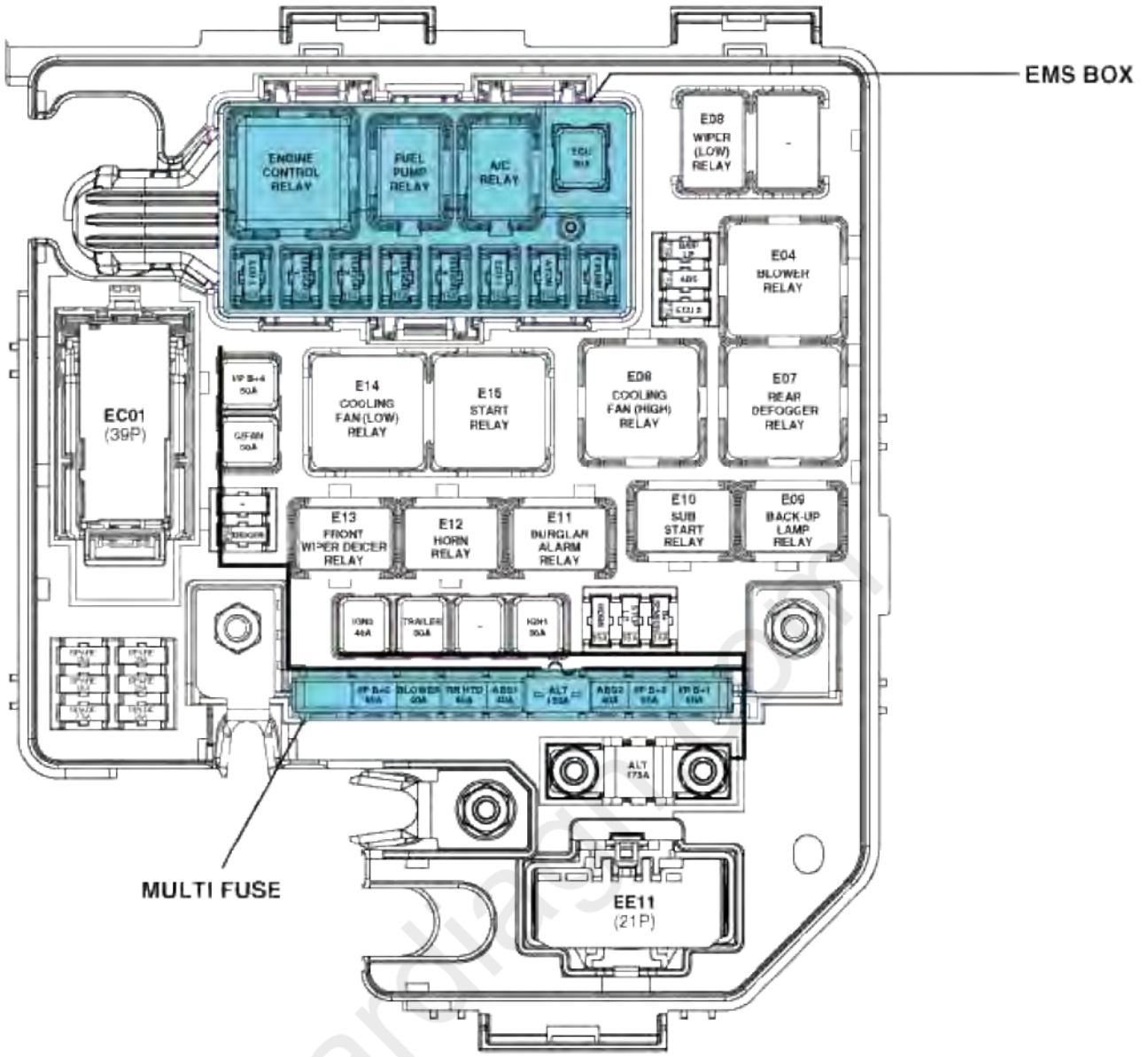


cardiagn.com

1. IPM
2. Rear wiper relay, Seat heater relay, Head lamp washer relay, Rear A/C relay (Built-in ICM relay box)
3. ACC relay, IG1 relay, IG2 relay (Built-in PDM relay box)

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Components and Components Location

Component Location

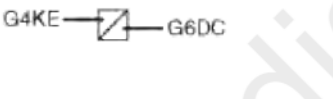


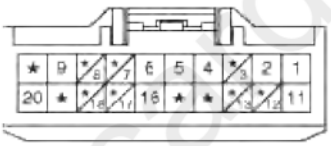
※USE THE DESIGNATED FUSE AND RELAY ONLY

- Relay Type

NO.	RELAY NAME	TYPE
E01	START RELAY	PLUG MICRO
E02	BURGLAR ALARM RELAY	PLUG MICRO
E03	SUB START RELAY	PLUG MICRO
E04	BLOWER RELAY	PLUG MICRO
E05	COOLING FAN (LOW) RELAY	PLUG MICRO
E06	COOLING FAN (HIGH) RELAY	PLUG MINI
E07	BACK-UP LAMP RELAY	PLUG MINI
E08	WIPER (LOW) RELAY	PLUG MINI
E10	HORN RELAY	PLUG MINI
E11	REAR DEFOGGER RELAY	PLUG MINI
E12	FRONT WIPER DEICER RELAY	PLUG MICRO
EMS BOX	ENGINE CONTROL RELAY	PLUG MINI
	FUEL PUMP RELAY	PLUG MICRO
	A/C RELAY	PLUG MICRO

- EMS BOX





E/R-CHGA(G4KE)
E/R-CLGA(G6DC)

E/R-CHGK(G4KE)
E/R-CLGK(G6DC)

cardiagn.com

CIRCUIT

Fuse Name		(A)	Circuit Protected
ALT		175A	Alternator
MULTI FUSE	I/P B+2	60A	IPM (Fuse - S/HTR FRT, P/SEAT, Power Connector - MODULE, ROOM LP DOOR LP)
	BLOWER	40A	Blower Relay
	RR HTD	40A	Rear Defogger Relay
	ABS 1	40A	ESC Control Module, Multipurpose Check Connector
	ALT	150A	-
	ABS 2	40A	ESC Control Module, Multipurpose Check Connector
	I/P B+3	60A	IPM (Fuse - HAZARD, TPMS, F/LID)
	I/P B+1	60A	IPM (Fuse - DR LOCK, SUNROOF, 4WD, PDM, SMART KEY)
FUSE	IGN 2	40A	Start Relay, W/O Smart Key Ignition Switch, With Smart Key PDM Relay Box (IGN2 Relay)
	TRAILER	30A	Trailer Power Outlet
	IGN 1	30A	W/O Smart Key - Ignition Switch, With Smart Key - PDM Relay Box (IGN1 Relay)
	HORN	15A	Horn Relay
	STOP LP	15A	Stop Lamp Switch, ICM Relay Box (DBC Relay)
	B+ SENSOR	15A	Battery Sensor
	DEICER	15A	Front Wiper Deicer Relay
	C/FAN	50A	Cooling Fan Relay Low/High
	I/P B+4	50A	IPM (Fuse - P/WDW LH, P/WDW RH, B/A HORN, A/CON REAR, AMP)
	ECU 2	7.5A	Sub Start Relay, PCM, Transaxle Range Switch, Alternator (G6DC)
	ABS	7.5A	ESC Control Module, Multipurpose Check Connector, Stop Lamp Switch (G4KF)
	B/UP LP	7.5A	Back-Up Lamp Relay (A/T), Back-Up Lamp Switch (M/T)
EMS BOX	ECU	30A	Engine Control Relay
	ECU 3	20A	G4KE - Ignition Coil #1/2/3/4, Condenser
			G6DC - Ignition Coil #1/2/3/4/5/6, Condenser #1/2
	SENSOR 1	10A	G4KE - Variable Intake Manifold Valve, Crankshaft Position Sensor, Immobilizer Module, Camshaft Position Sensor #1/2, Oil Control Valve #1/2, Canister Purge Control Solenoid Valve, Canister Close Valve, Cooling Fan (Low) Relay
			G6DC - Variable Intake Manifold Valve #1/2, Immobilizer Module, Canister Purge Control Solenoid Valve, Oil Control Valve #1/2 (Exhaust), Oil Control Valve #1/2 (Intake), Canister Close Valve
	SENSOR 2	10A	G6DC - Cooling Fan (Low) Relay, Stop Lamp Switch
	SENSOR 3	10A	G4KE - Injector #1/2/3/4, A/C Relay
			G6DC - PCM, Injector #1/2/3/4/5/6, A/C Relay
	SENSOR 4	15A	G4KE - Oxygen Sensor Up/Down, Fuel Pump Relay
			G6DC - PCM, Oxygen Sensor #1/2/3/4, Fuel Pump Relay, Variable Charge Motion Actuator
	ECU 1	15A	PCM
	A/CON	10A	A/C Relay
	F/PUMP	15A	Fuel Pump Relay

※USE THE DESIGNATED FUSE AND RELAY ONLY

cardiagn.com

Body Electrical System > Fuses And Relays > Relay Box (Engine Compartment) > Repair procedures

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 : Fuel pump relay

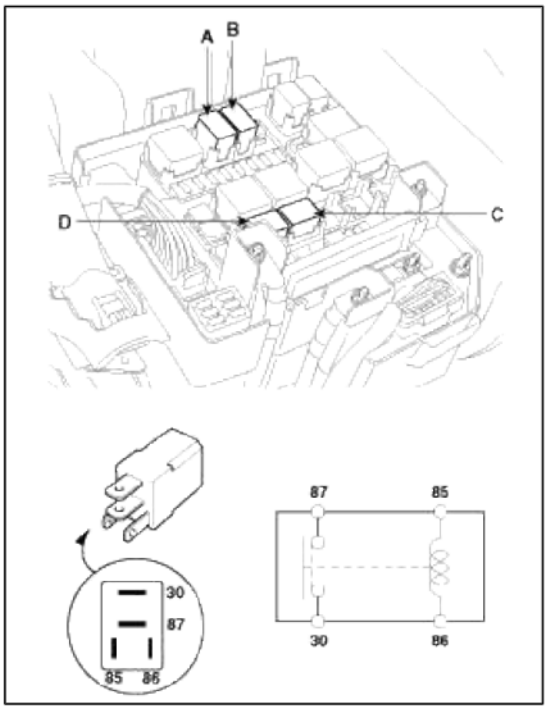
B : A/C relay

C : Horn relay

D : Windshied deicer relay

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

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



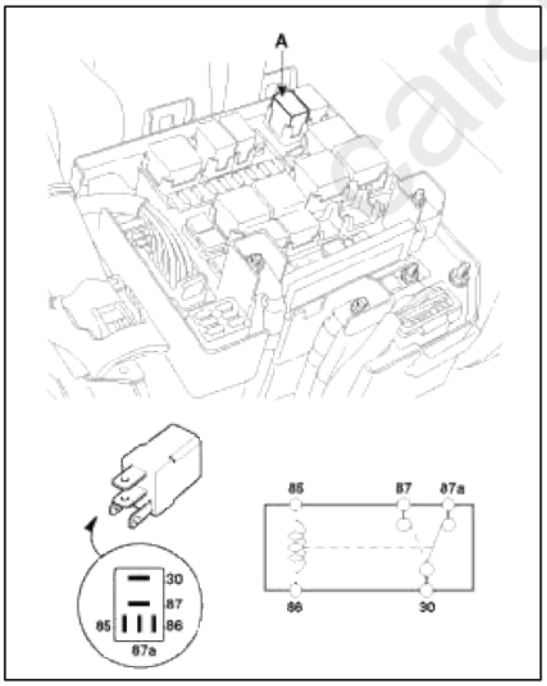
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Power Relay (Type B)

Check for continuity between the terminals.

A : Wiper relay (Low)

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



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

cardiagn.com

Power Relay (Type C)

Check for continuity between the terminals.

A : Condenser pan relay #1

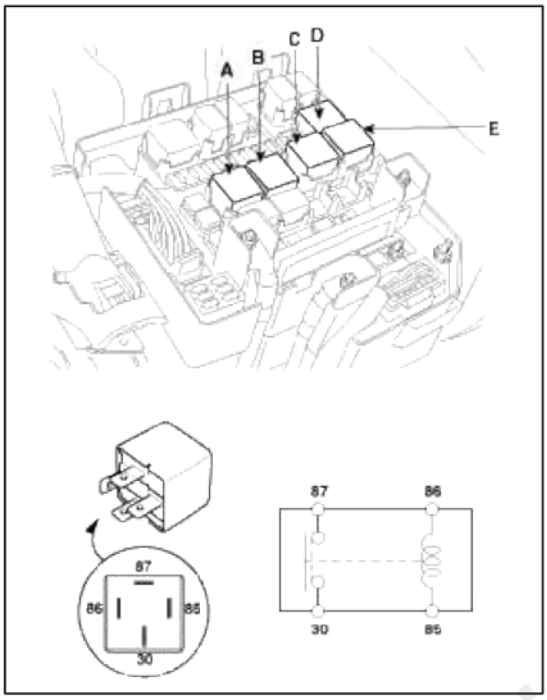
B : Start #1 relay

C : Condenser pan relay #2

D : Blower relay

E : Rear glass defogger relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the 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	⊖	⊕	○	○

Power Relay (Type D)

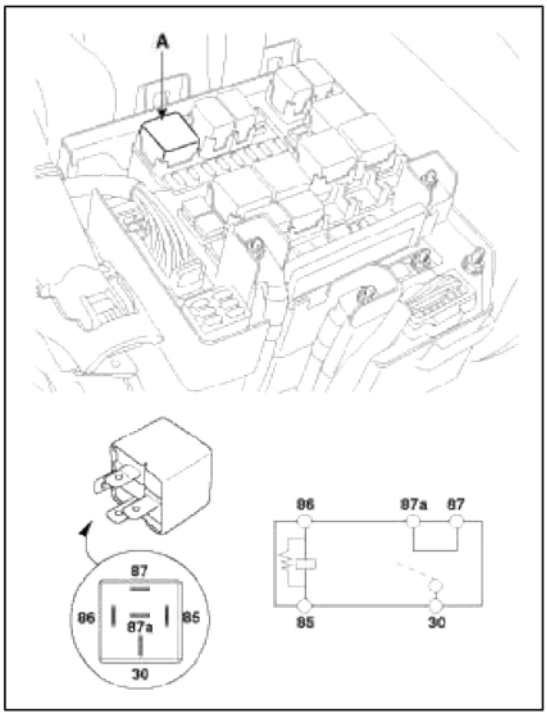
Check for continuity between the terminals.

A : Main relay

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

cardiagn.com

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



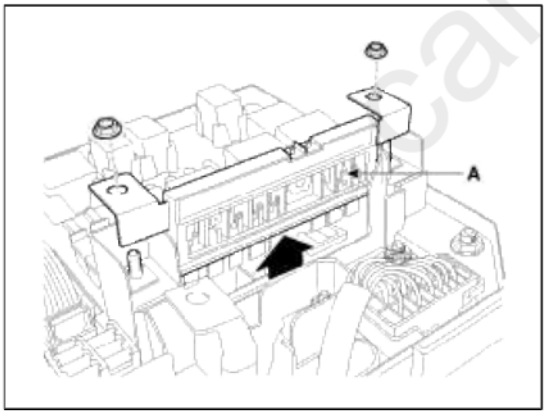
Terminal / Power	86	85	87	87a	30
Disconnected	○—○				
Connected	⊖—⊕		○—○		○

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?
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 first and completely eliminate the problem before installing a new fuse.

Multi Fuse



NOTE

- 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.

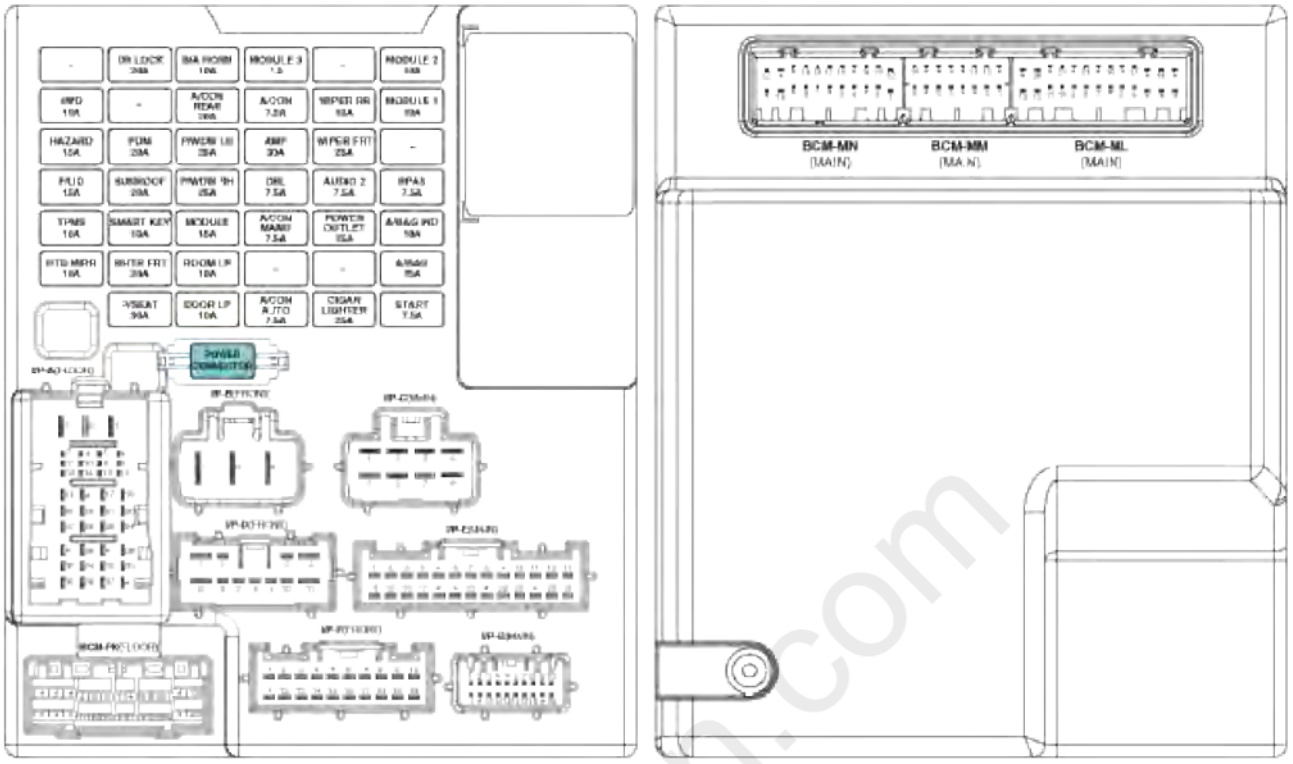
Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Components and Components Location

cardiagn.com

Component Location

< FRONT >

< REAR >



※ USE THE DESIGNATED FUSE ONLY

cardiagn.com

CIRCUIT

FUSE	(A)	Circuit Protected
MODULE 2	10A	Instrument Cluster (IND./MICOM), Tire Pressure Monitoring Module Audio, Multifunction Switch (Remocon), Rear Parking Assist Buzzer ICM Relay Box (DRC Relay), ESC Off Switch, DRC Switch Steering Angle Sensor, Alternator, Smart Key Control Module A/V & Navigation Head Unit, Rear Monitor, IPM (BCM IG1)
MODULE 1	10A	Smart Key Control Module, Rear Parking Assist Control Module E/R Fuse & Relay Box (Fuse - B/UP LP, ABS, ECU 2), PDM, 4WD ECM
RPAS	7.5A	Rear Parking Assist Switch
AIR BAG IND	10A	Instrument Cluster (IND.), PODS Module, Digital Clock
AIR BAG	15A	SRS Control Module
START	7.5A	E/R Fuse & Relay Box (Relay - Start, Sub Start, Burglar Alarm), PDM
WIPER RR	15A	ICM Relay Box (Rear Wiper Relay), Rear Wiper Motor Rear Wiper Switch, Rear Washer Switch
WIPER FRT	25A	E/R Fuse & Relay Box (Wiper (Low) Relay), Front Wiper Motor Multifunction Switch (Wiper)
AUDIO 2	7.5A	AMP, Power Outside Mirror Switch, Smart Key Control Module, PDM Audio, A/V & Navigation Head Unit, Digital Clock, IPM (BCM ACC) DVD Player Can, Rear Monitor
POWER OUTLET	15A	Rear Power Outlet
CIGAR LIGHTER	25A	Driver/Passenger Power Outlet
MODULE 3	7.5A	Not Used
A/CON	7.5A	Front A/C Control Module, Active Incar Sensor, Cluster Ionizer, PDM ICM Relay Box (Front Seat Warmer Relay, Rear A/C Relay) E/R Fuse & Relay Box (Blower Relay), Sunroof Motor Electro Chromic Mirror, IPM (BCM IG2)
AMP	30A	AMP
DRL	7.5A	Ground (GE01)
A/CON MANU	7.5A	PCM, Front Blower Resistor, Front A/C Control Module
A/CON AUTO	7.5A	Front A/C Control Module

FUSE	(A)	Circuit Protected
B/A HORN	10A	Burglar Alarm Horn Relay
A/CON REAR	20A	ICM Relay Box (Rear A/C Relay)
P/WDW LH	25A	Driver Power Window Relay, Power Window Main Switch Rear Power Window Switch LH, Driver Safety Power Window Module
P/WDW RH	25A	Passenger Power Window Relay, Power Window Main Switch Passenger Power Window Switch, Rear Power Window Switch RH
MODULE	15A	Audio, A/V & Navigation Head Unit, RF Receiver, IPM (BCM B+) Rear Monitor
ROOM LP	10A	Instrument Cluster (IND.), Digital Clock, Front A/C Control Module Data Link Connector, Door Warning Switch, Personal Room Lamp Room Lamp Auto Cut Relay, Overhead Console (MAP Lamp) Room Lamp, Cargo Lamp, Driver/Passenger Vanity Lamp Electro Chromic Mirror
DOOR LP	10A	Driver/Passenger Door Scuff Lamp, DVD Player Can
DR LOCK	20A	Door Lock/Unlock Relay, ICM Relay Box (Two Turn Unlock Relay) Driver/Passenger Door Lock Actuator, Rear Door Lock Actuator LH/RH
PDM	20A	PDM
SUNROOF	20A	Sunroof Motor
SMART KEY	10A	PDM, Smart Key Control Module, Start Stop Button Switch FOB Holder, Key Solenoid
S/HTR FRT	20A	ICM Relay Box (Front Seat Warmer Relay)
P/SEAT	30A	Driver Power Seat Switch, Driver Lumbar Support Switch
4WD	10A	4WD ECM, Sport Mode Switch
HAZARD	15A	IPM (Flasher Unit)
FUID	15A	Tail Gate Relay, Tail Gate Actuator, Fuel Filler Door Switch
TPMS	10A	Tire Pressure Monitoring Module
HTD MIRR	10A	Driver/Passenger Power Outside Mirror, Front A/C Control Module
POWER CONNECTOR		FUSE - MODULE, ROOM LP, DOOR LP

※ USE THE DESIGNATED FUSE ONLY

cardiagn.com

Body Electrical System > Fuses And Relays > Relay Box (Passenger Compartment) > Repair procedures

Inspection

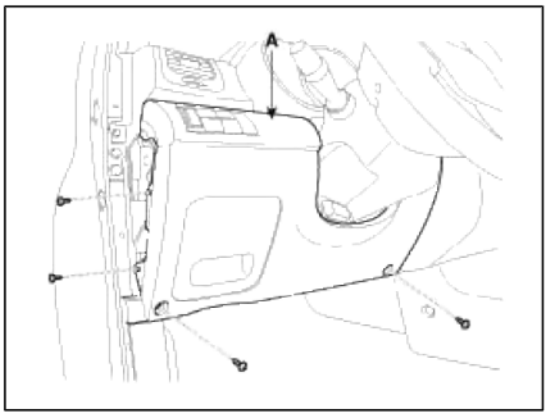
Fuse

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 first and completely eliminate the problem before installing a new fuse.

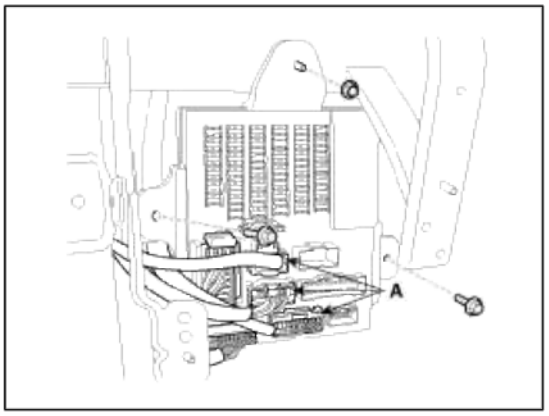
Removal

1. Disconnect the negative (-) battery terminal.

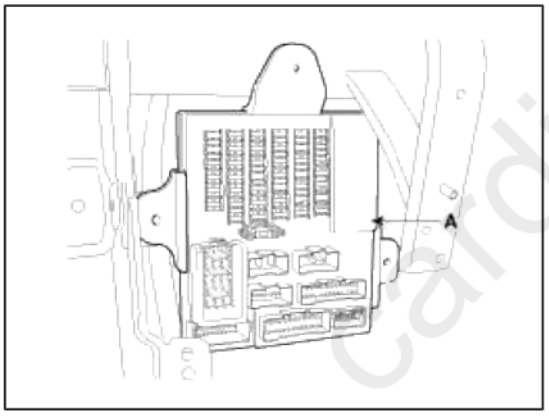
2. Remove the crash pad lower panel (A).
   (Refer to BD group - "Crash pad")



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



4. Remove IPM (A) after removing rear connectors.



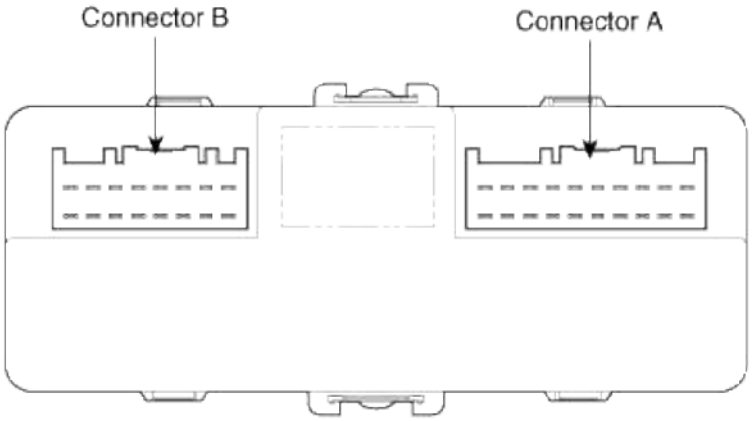
Installation

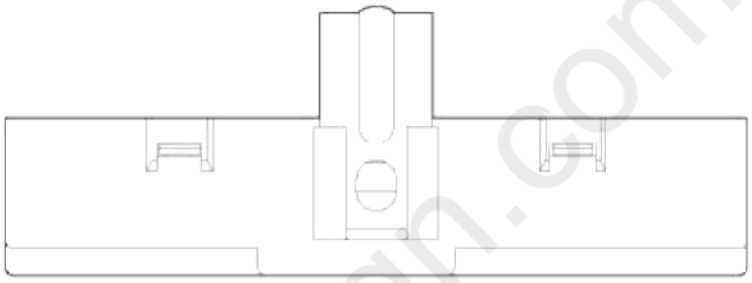
1. Install IPM(Intelligent intergrated Platform Module).
2. Connect the IPM connector.
3. Install the crash pad lower panel.

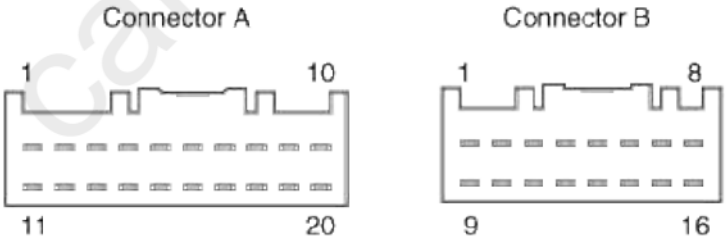
Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Components and Components Location

Component

cardiagn.com





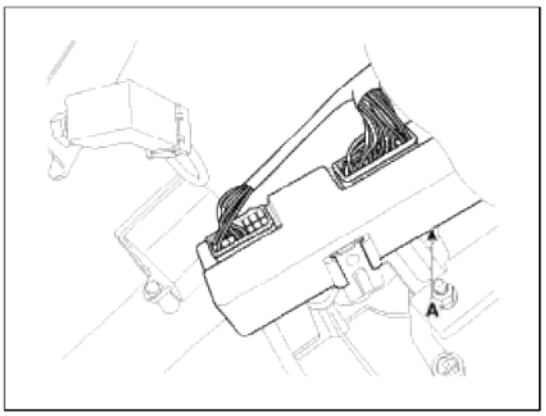


cardiagn.com

Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Description and Operation

Description

The ICM relay is united with rear wiper relay, seat heater relay(front/rear), head lamp washer relay and rear A/C relay which installed inside the lower crash pad.



Body Electrical System > Fuses And Relays > ICM (Integrated Circuit Module) Relay Box > Repair procedures

Inspection

Rear Wiper Relay

Check for continuity between the terminals.

1. There should be continuity between the No.11 in the A and No.12 in the A terminals when power and ground are connected to the No.2 in the A and No.11 terminals in the A terminals.
2. There should be no continuity between the No.11 in the A and No.12 terminals in the A terminals when power is disconnected.

Seat Heater Relay (Front seat)

Check for continuity between the terminals.

1. There should be continuity between the No.19 in the A and No.20 in the A terminals when power and ground are connected to the No.9 in the A and No.10 terminals in the A terminals.
2. There should be no continuity between the No.19 in the A and No.20 terminals in the A terminals when power is disconnected.

Rear A/C Relay

Check for continuity between the terminals.

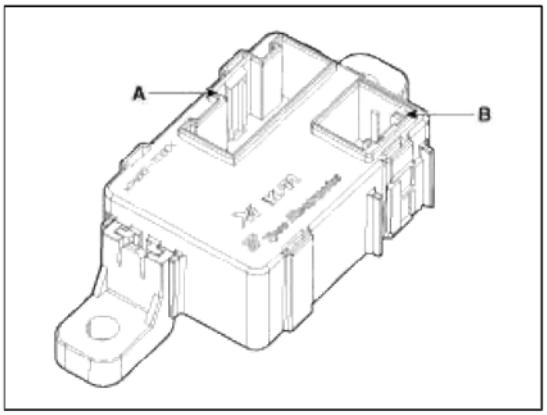
1. There should be continuity between the No.12 in the B and No.13 in the B terminals when power and ground are connected to the No.10 in the A and No.2 terminals in the B terminals.
2. There should be no continuity between the No.10 in the A and No.3 in the B terminals when power is disconnected.

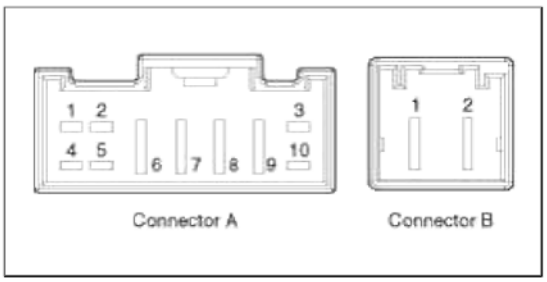
cardiagn.com

Body Electrical System > Fuses And Relays > PDM Relay Box > Description and Operation

Description

The PDM relay is united with IG1, IG2 and ACC relays and installed beside the assist instrument panel.

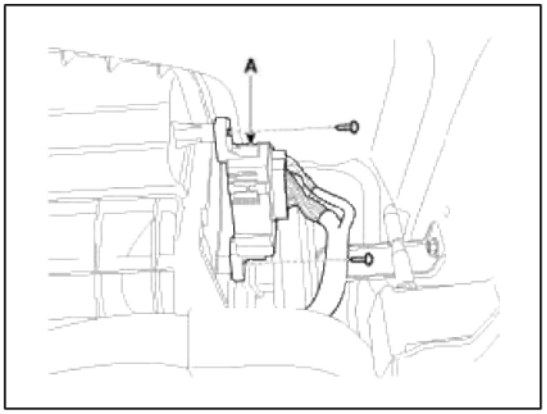




Body Electrical System > Fuses And Relays > PDM Relay Box > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the glove box housing.
   (Refer to BD group - "Crash pad")
3. Remove the PDM relay box (A) after loosening the screws (2EA) and desconnecting the connector.



IG2 Relay

Check for continuity between the terminals.

1. There should be continuity between the No.1 in the B and No.2 in the B terminals when power and ground are connected to the No.3 in the A and No.4 terminals in the B terminals.
2. There should be no continuity between the No.1 in the B and No.2 terminals in the B terminals when power is disconnected.

IG1 Relay

Check for continuity between the terminals.

1. There should be continuity between the No.7 in the A and No.8 in the A terminals when power and ground are connected to the No.3 in the A and No.10 terminals in the A terminals.
2. There should be no continuity between the No.7 in the A and No.8 terminals in the A terminals when power is disconnected.

ACC Relays

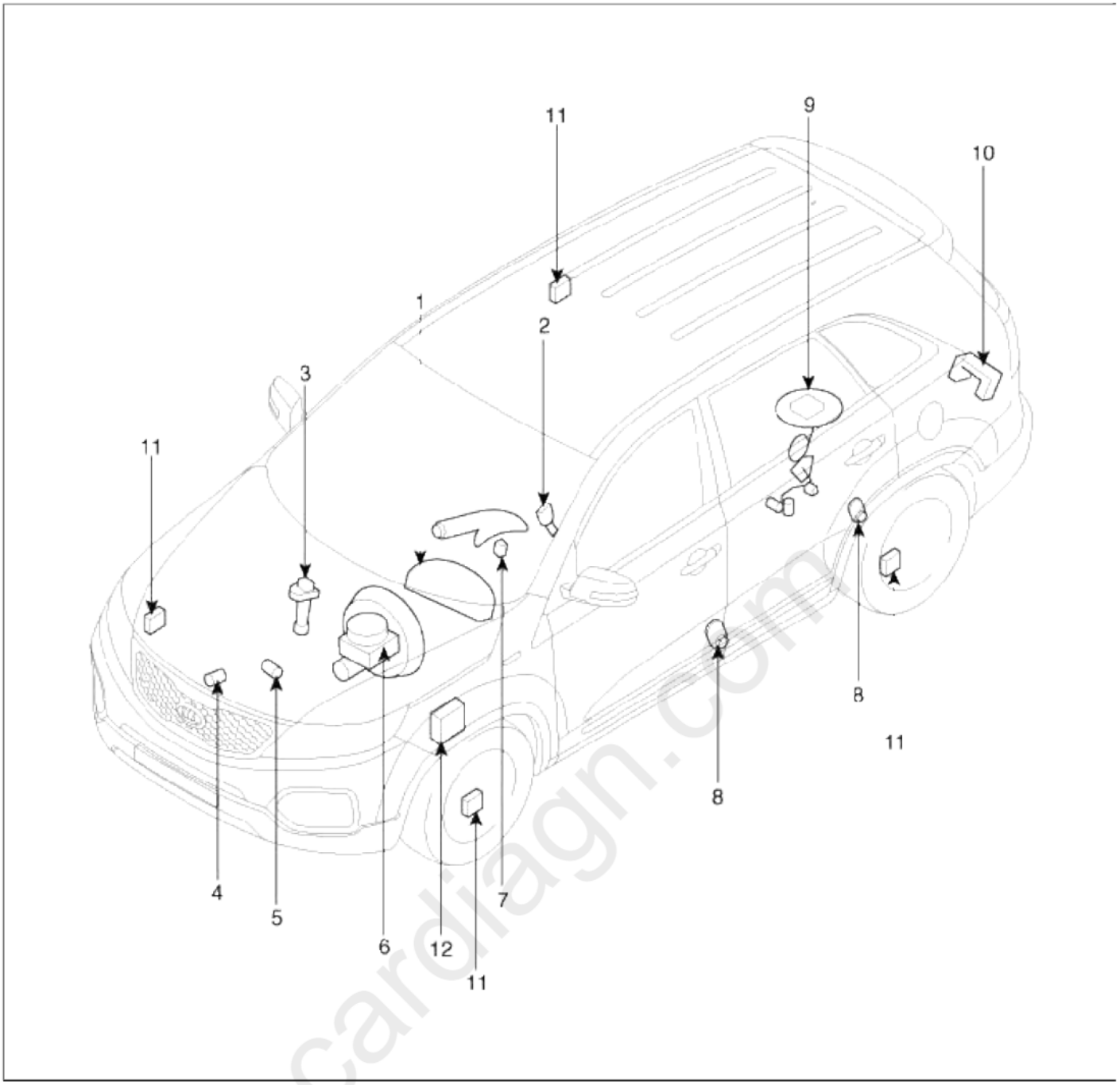
Check for continuity between the terminals.

1. There should be continuity between the No.7 in the A and No.6 in the A terminals when power and ground are connected to the No.1 in the A and No.3 terminals in the A terminals.
2. There should be no continuity between the No.7 in the A and No.6 terminals in the A terminals when power is disconnected.

Body Electrical System > Indicators And Gauges > Components and Components Location

Component Location

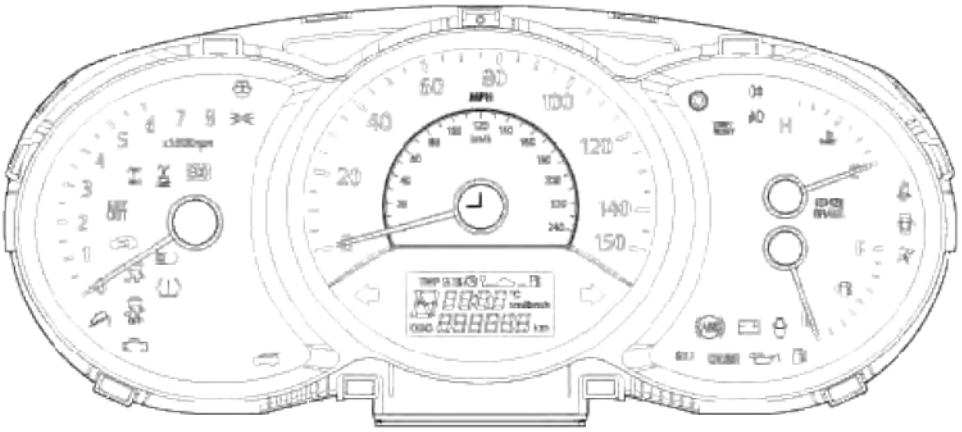
carmagn.com

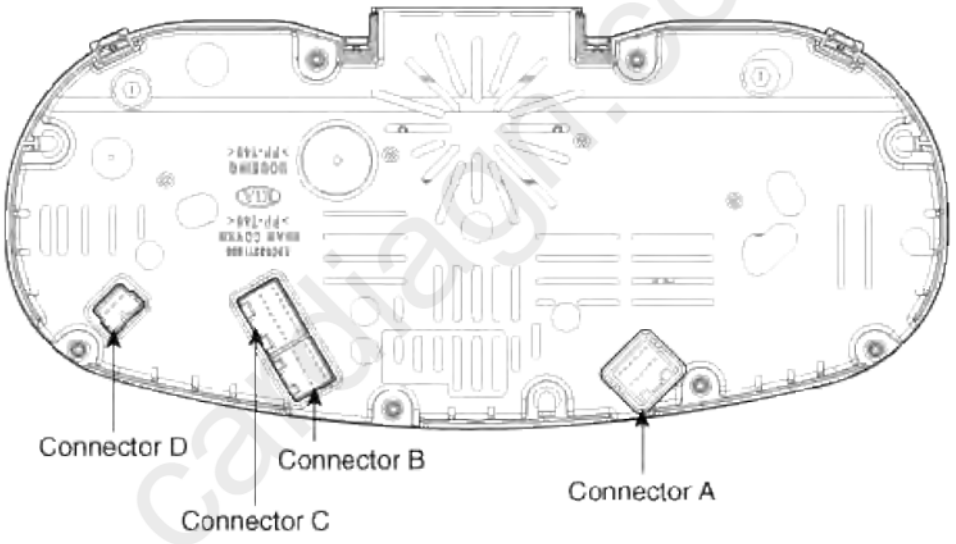


1. Cluster assembly 2. Seat belt switch 3. Vehicle speed sensor 4. Engine coolant temperature sender 5. Oil pressure switch 6. Brake fluid level warning switch	7. Parking brake switch 8. Door switch 9. Fuel gauge sender 10. Tailgate switch 11. Wheel speed sensor 12. ABS ECU

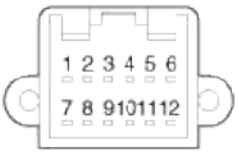
Body Electrical System > Indicators And Gauges > Instrument Cluster > Components and Components Location

Components

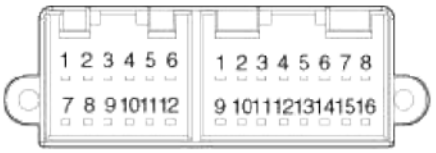




carbiagi.com



Connector A



Connector B Connector C

Pin	Connector A	Connector B	Connector C
1	C-CAN low	Fuel input	-
2	C-CAN high	Check engine	Power GND
3	-	Oil pressure	Rheo down button
4	Active ECO input	-	4P out
5	Rheo up button	Immobilizer	-
6	Illumination +	-	-
7	Alternator input	Battery	Buzzer input
8	Washer low	IGN1	Fuel low
9	Airbag supply	-	-
10	Airbag input	-	-
11	B CAN high	-	Oil level
12	B CAN low	-	-
13			DAT input
14			Rheo detent out
15			Water separator
16			Signal GND

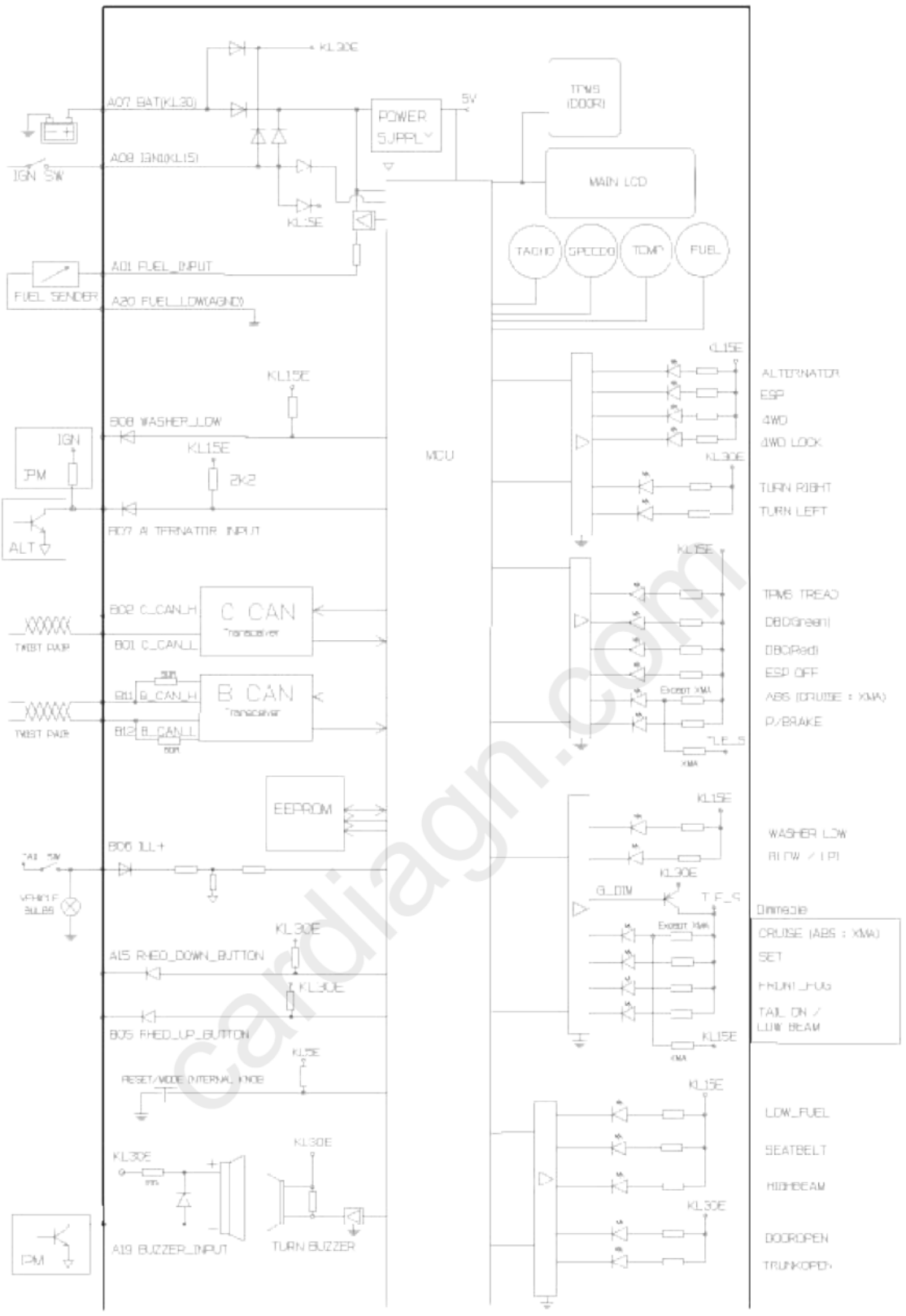
Connector D

Pin	Connector D
1	Rheostat GND
2	-
3	Rheostat out

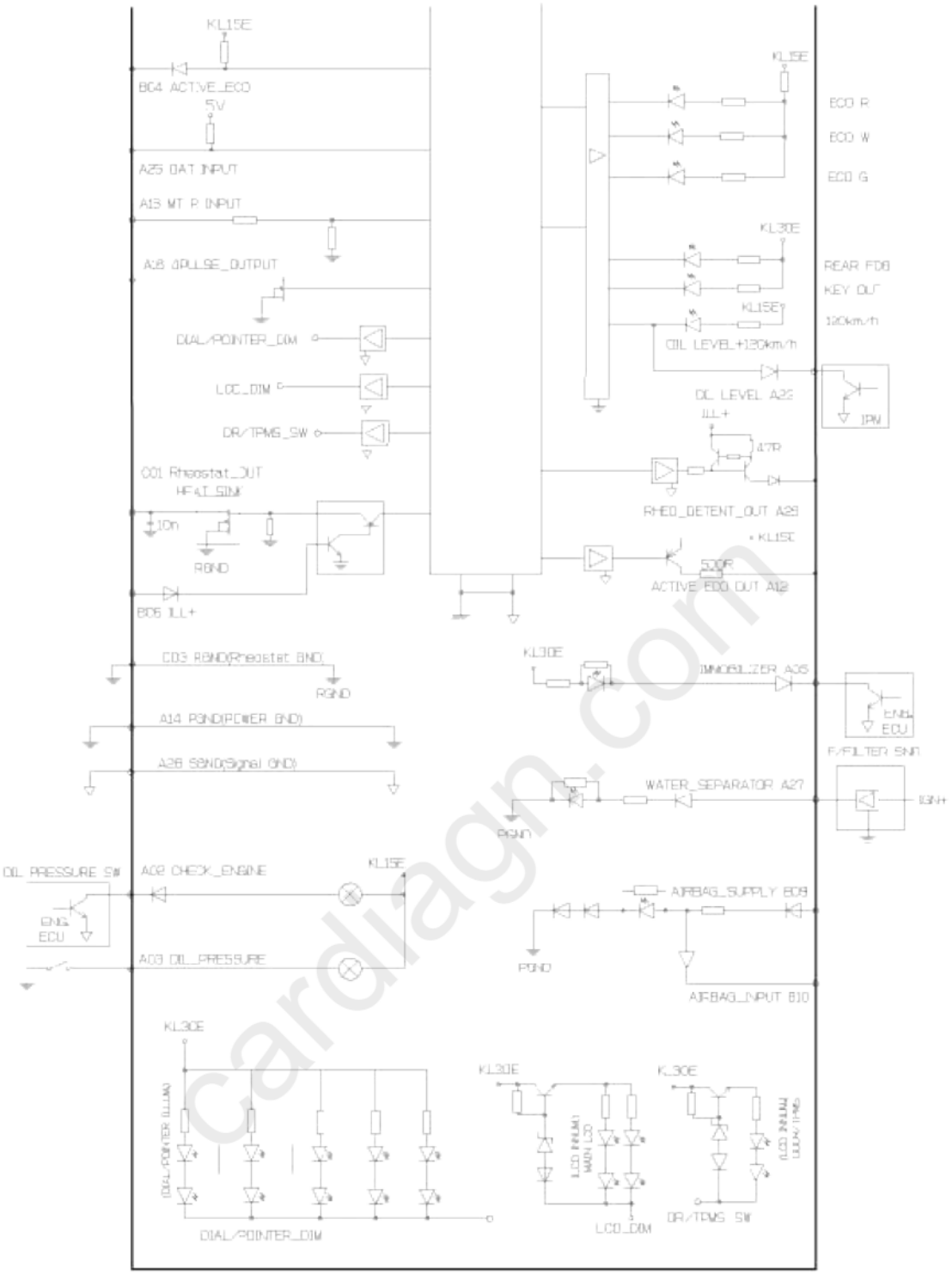
cardiagn.com

Body Electrical System > Indicators And Gauges > Instrument Cluster > Schematic Diagrams

Circuit Diagram



cardiagn.com



cardiagn.com

Body Electrical System > Indicators And Gauges > Instrument Cluster > Description and Operation

Description

ECO driving system

This system is designed to encourage eco-driving by providing real-time feedback to the driver.

The ECO indicator light assists you to drive in the most economical way.

The green indicator comes on when you drive with high fuel efficiency.

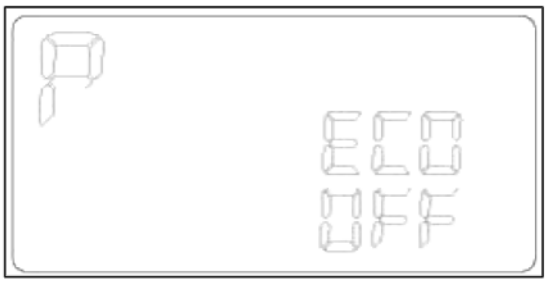
The fuel efficiency depends on driver's driving habit and road condition.

The system stops operation when the transaxle is in the P,R,N position or sports mode, or instantaneous fuel consumption mode is selected.

ECO indicator ON/OFF

1. ECO indicator light is always OFF when driver select the "ECO OFF" mode pushing the "Trip" button.
   A. Set the main LCD display to "ECO ON" pushing "Trip" button as below picture.

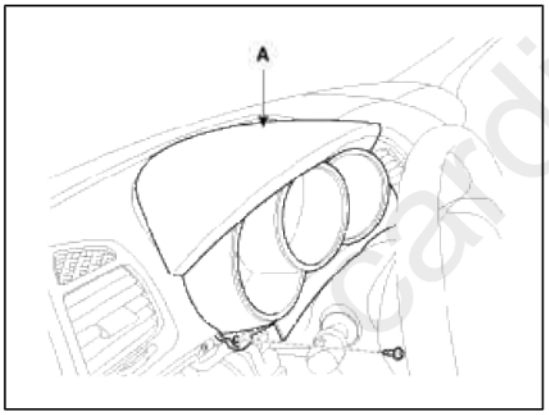
   B. And then set the "ECO OFF" pushing "Trip" button more than 1 second as below picture.
   In this option, ECO indicator light does not operate any trip mode.



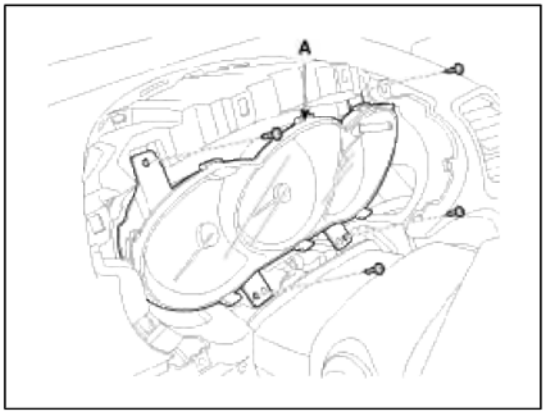
Body Electrical System > Indicators And Gauges > Instrument Cluster > Repair procedures

Removal

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

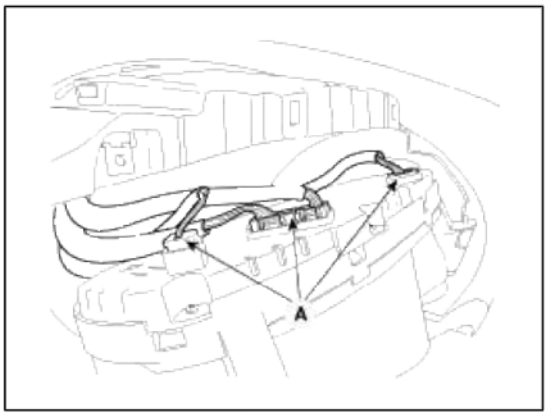


3. Remove the cluster fascia (A) from the housing after removing 4 screws.



cardiagn.com

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



Installation

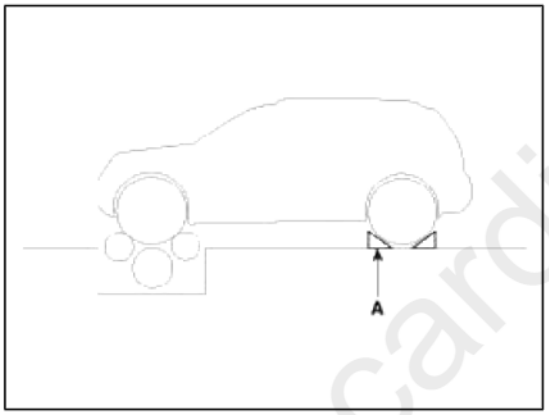
1. Connect the cluster connector.
2. Install the cluster assembly.
3. Install the cluster facia panel.

Inspection

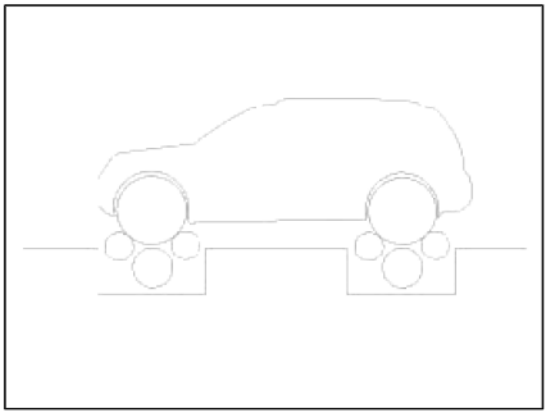
Speedometer

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks (A) as appropriate.

[2WD]



[4WD]



cardiagn.com

3. Check if the speedometer indicator range is within the standard values.

CAUTION

Do not operate the clutch suddenly or increase/ decrease speed rapidly while testing.

NOTE

Tire wear and tire over or under inflation will increase the indication error.

[Canada]

Velocity (km/h)	20	40	60	80	100	120
Tolerance (km/h)	0 +3.0	0 +3.0	0 +3.0	+1.0 +4.0	+2.0 +5.0	+3.0 +6.0
Velocity (km/h)	140	160	180	200	220	240
Tolerance (km/h)	+4.0 +7.0	+5.0 +8.0	+5.5 +9.0	+6.0 +10.0	+6.5 +10.5	+7.0 +11.0

[USA]

Velocity (MPH)	10	20	40	60	80
Tolerance (MPH)	0 +2.0	0 +2.0	0 +2.0	+1.0 +3.0	+2.0 +4.0
Velocity (MPH)	100	120	140	150	
Tolerance (MPH)	+3.0 +6.0	+3.0 +6.0	+4.0 +7.0	+4.0 +7.0	

Tachometer

1. Connect the scan tool to the diagnostic link connector or install a tachometer.

cardiagn.com

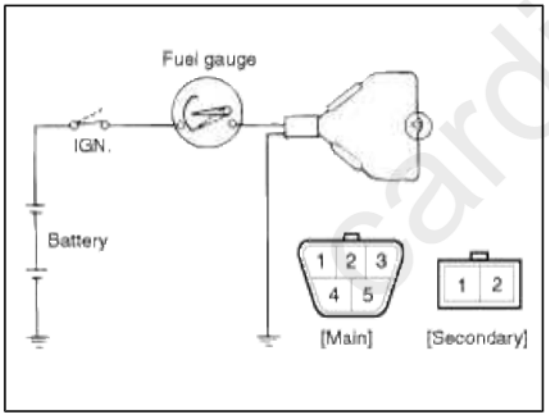
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

> **CAUTION**
>
> 1) Reversing the connections of the tachometer will damage the transistor and diodes inside.
> 2) When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution (rpm)	Tolerance (rpm)
	Max 8000rpm
	Gasoline
1,000	±100
2,000	±125
3,000	±150
4,000	±170
5,000	±200
6,000	±240
7,000	±260
8,000	±260

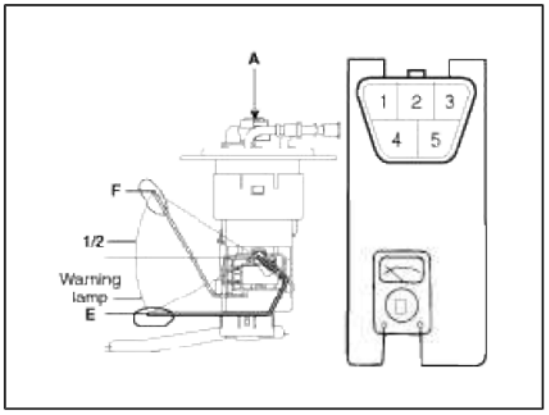
Fuel Gauge

1. Disconnect the fuel sender connector from the fuel sender.
2. Connect a 3.4 wattages, 12V test bulb to terminals 1 and 3 on the wire harness side connector.
3. Turn the ignition switch to the ON, and then check that the bulb lights up and the fuel gauge needle moves to full.



Fuel Gauge Sender

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level. (Secondary : terminals 1 and 2)



2. Also check that the resistance changes smoothly when the float is moved from "E" to "F".

[Main Fuel Sender]

Position	Resistance (Ω)
Sender(E)	93.3 ± 2Ω
Warning lamp	73.9 ± 2Ω
1/2	6.3 ± 2Ω
Sender (F)	6.3 ± 2Ω

[Secondary Fuel Sender]

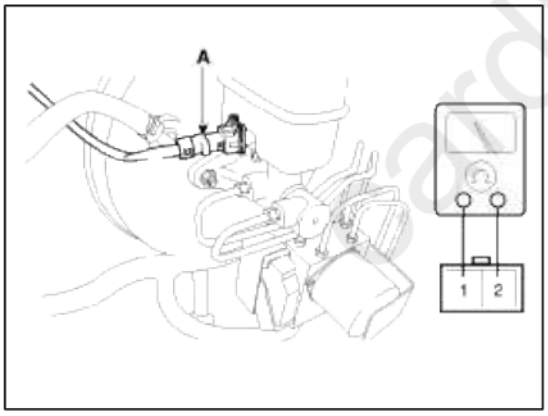
Position	Resistance (Ω)
Sender(E)	100 ± 2Ω
5/8	77.5 ± 2Ω
7/8	34.1 ± 2Ω
Sender (F)	6.7 ± 2Ω

3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

> CAUTION
>
> After completing this test, wipe the sender dry and reinstall it in the fuel tank.

Brake Fluid Level Warning Switch

1. Remove the connector (A) from the switch located at the brake fluid reservoir.
2. Verify that continuity exists between switch terminals 1 and 2 while pressing the switch (float) down with a rod.



Brake Fluid Level Warning Lamp

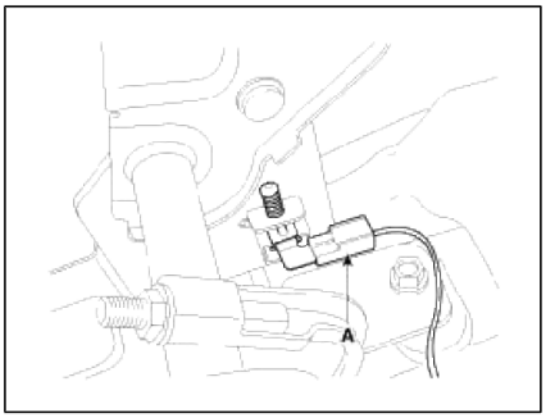
1. Ignition "ON".
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

Parking Brake Switch

The parking brake switch is a pull type. It is located at the side of the parking brake lever.

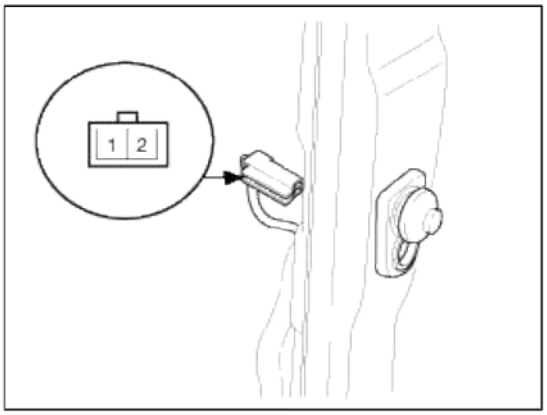
1. Check that there is continuity between the terminal and switch body with the switch (A) ON.

2. Check that there is no continuity between the terminal and switch body with the switch OFF.
   If continuity is not as specified, replace the switch or inspect its ground connection.



Door Switch

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

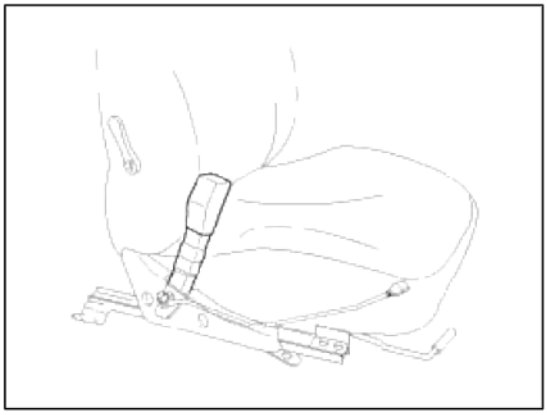


Terminal / Position	1	2	GND
Free(Door open)	○	○	○
Push(Door close)			

Seat Belt Switch

1. Remove the connector from the switch.
2. Check for continuity between terminals.

Seat belt condition	Continuity
Fastened	Non-conductive (∞Ω)
Not fastened	Conductive (Ω)



Seat Belt Warning Lamp

cardiagn.com

With the ignition switch turned ON, verify that the lamp glows.

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

Body Electrical System > Indicators And Gauges > Troubleshooting

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
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	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
	Bulb burned out	Replace bulb
	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
	Bulb burned out	Replace bulb

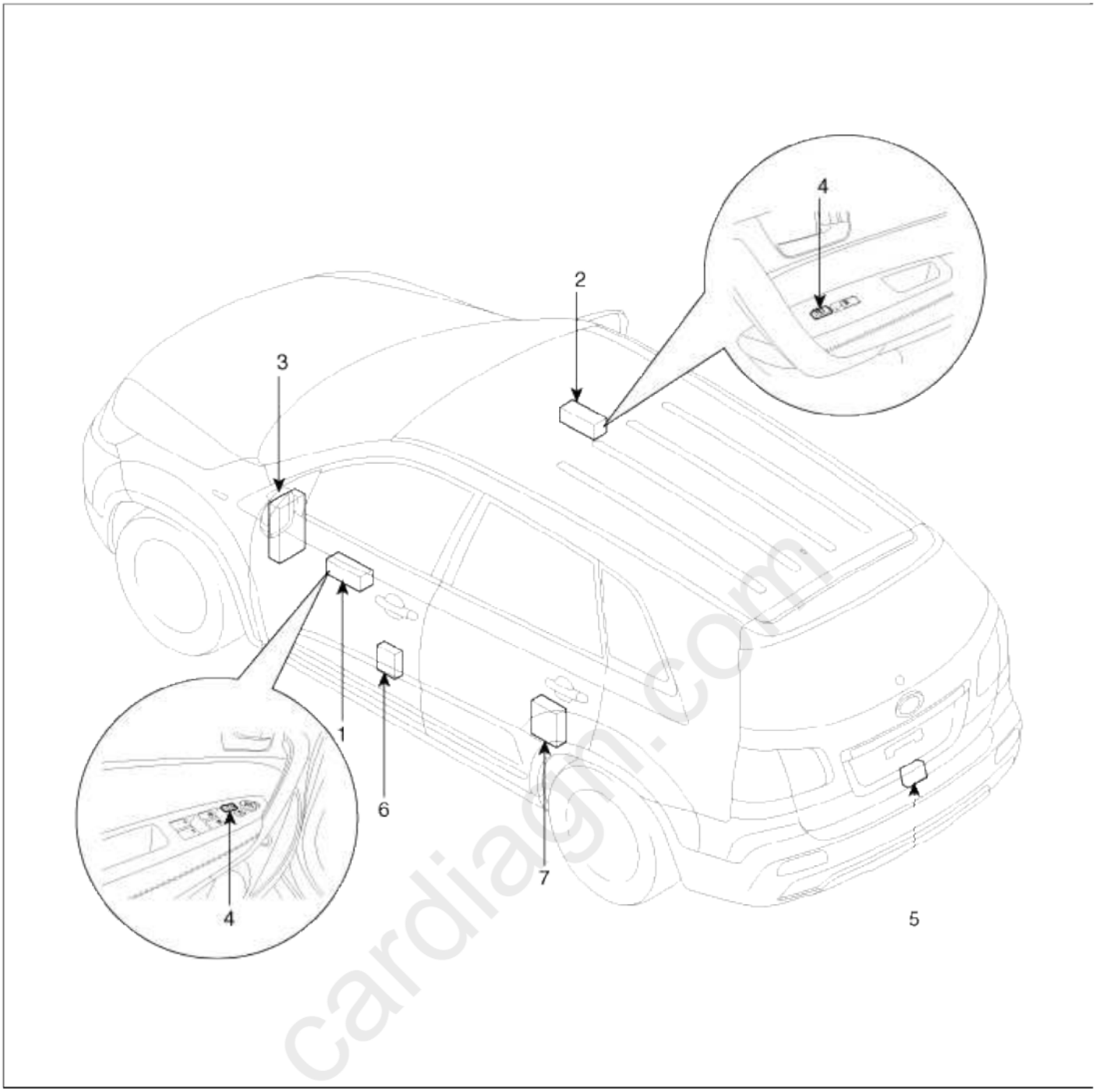
cardiagn.com

	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
	Bulb burned out	Replace bulb
	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
	Bulb burned out	Replace bulb
	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 > Power Door Locks > Components and Components Location

Component Location

cardiagn.com



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

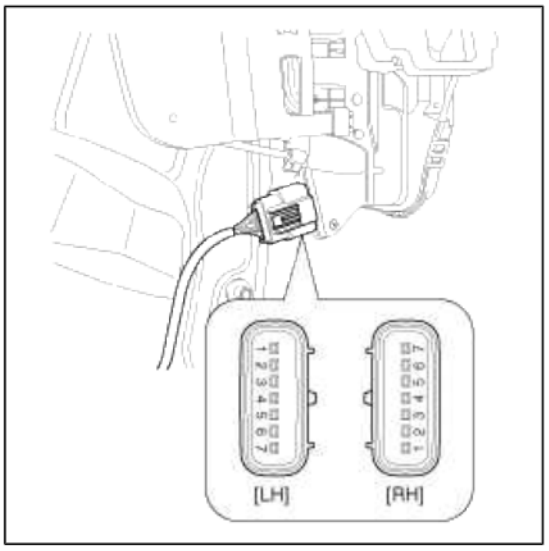
Body Electrical System > Power Door Locks > Power Door Lock Actuators > Repair procedures

Inspection

Front Door Lock Actuator

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

3. Disconnect the connectors from the actuator.

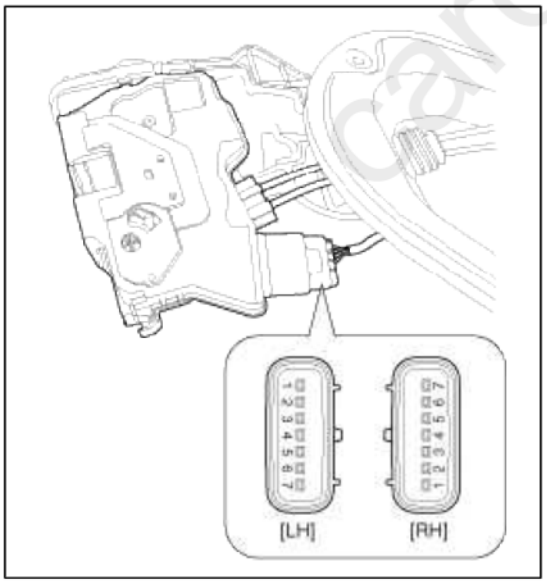


4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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 BD group - "Rear door")
2. Remove the rear door module.
   (Refer to BD group - "Rear door")
3. Disconnect the connectors from the actuator.



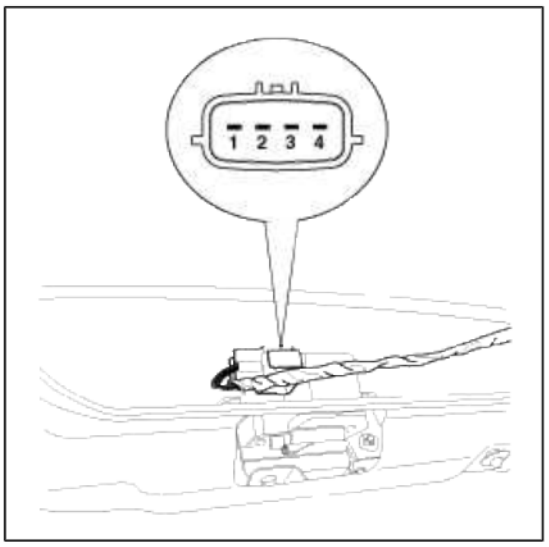
cardiagn.com

4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, 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 BD group - "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 actuator, apply battery voltage only momentarily.

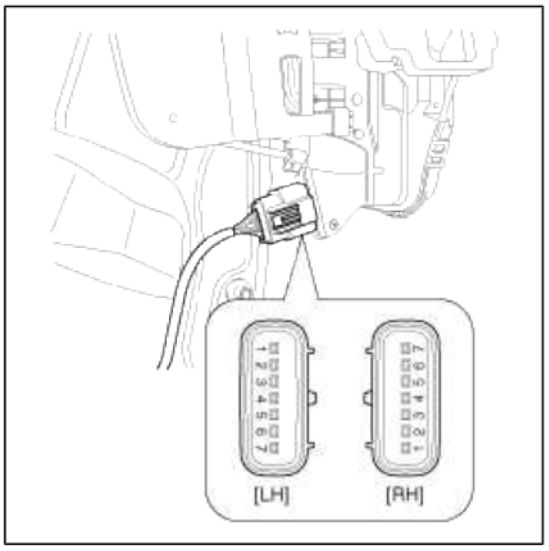
Position \ Terminal	3	4
Unlock	⊕	⊖

Front Door Lock Switch

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

cardiagn.com

3. Disconnect the connectors from the actuator.

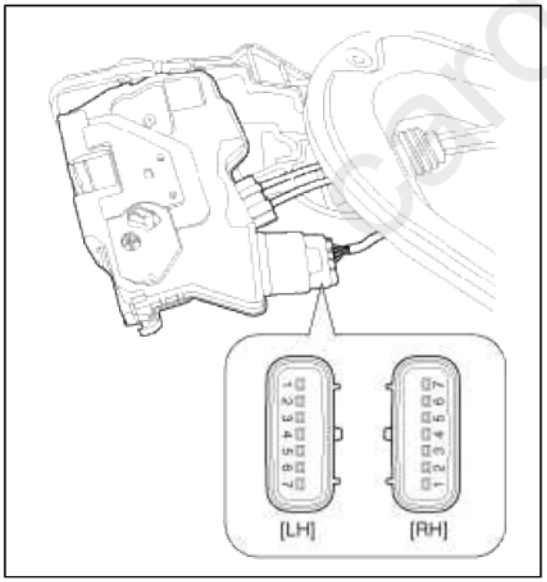


4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

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 BD group - "Rear door")
2. Remove the rear door module.
   (Refer to BD group - "Rear door")
3. Disconnect the connectors from the actuator.



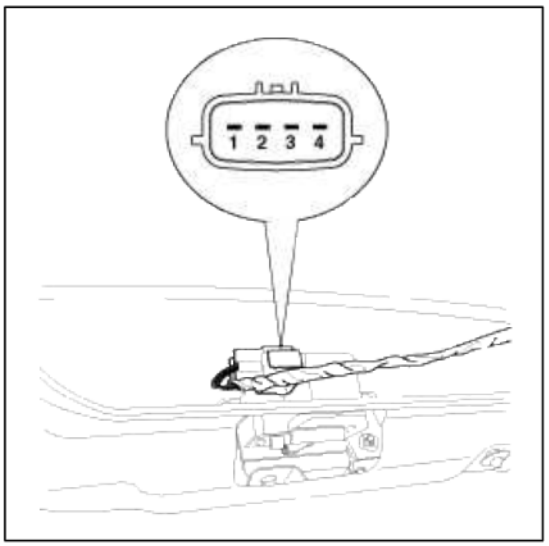
cardiagn.com

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 BD group - "Tailgate")
2. Disconnect the 4P connector from the actuator.

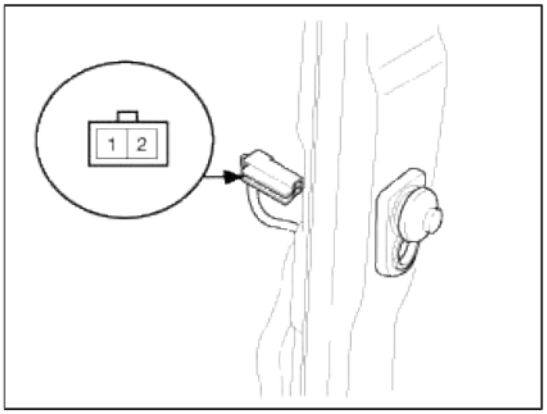


3. Check for continuity between the terminals in each switch position according to the table.

Position	Terminal	1	2
Lock			
Unlock		○——○	

Door Switch

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

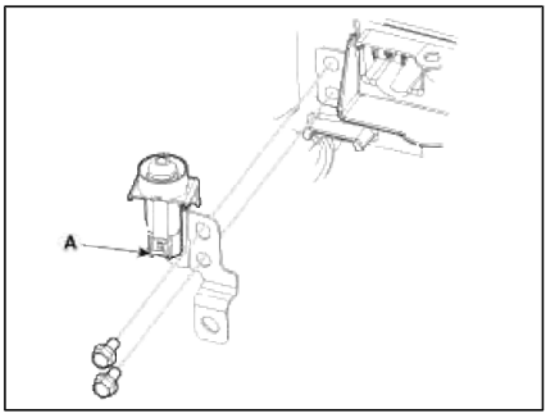


Position	Terminal	1	2	GND
Free(Door open)		○——○——○		
Push(Door close)				

cardiagn.com

Hood Switch

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



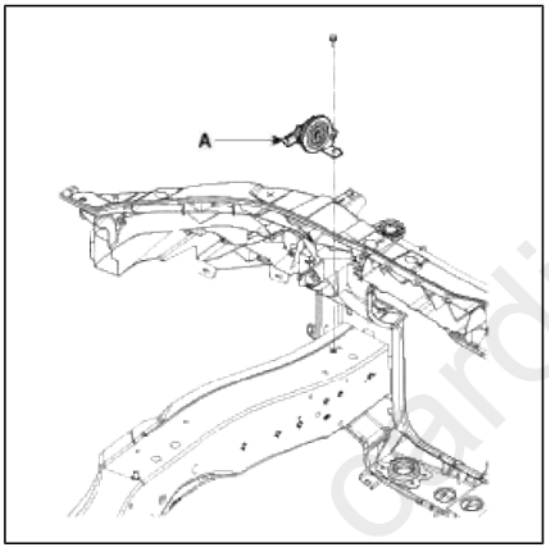
2. Check for continuity between the terminals and ground according to the table.

[2P Connector]

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

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 sound replace it.

Body Electrical System > Power Door Locks > Power Door Lock Switch > Repair procedures

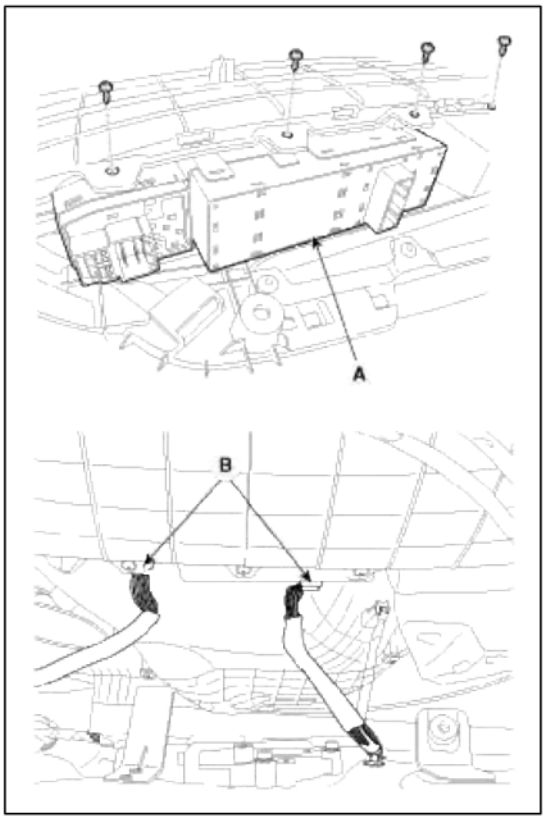
Removal

Driver Power Window Main Switch

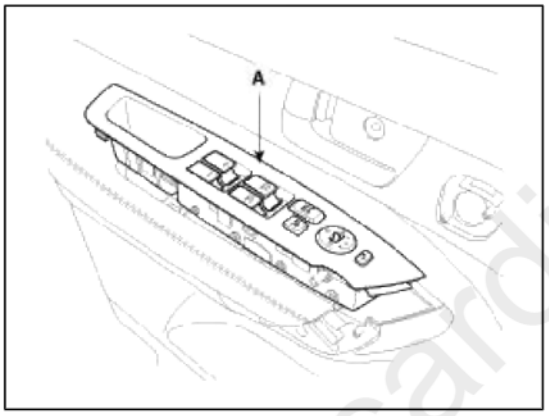
1. Disconnect the negative battery terminal.
2. Remove the front door trim.
   (Refer to BD group - "Front door")

cardiagn.com

3. Remve the screws (Inside:4EA, outside:1EA) from power window switch assembly (A) and connectors (B).



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



NOTE

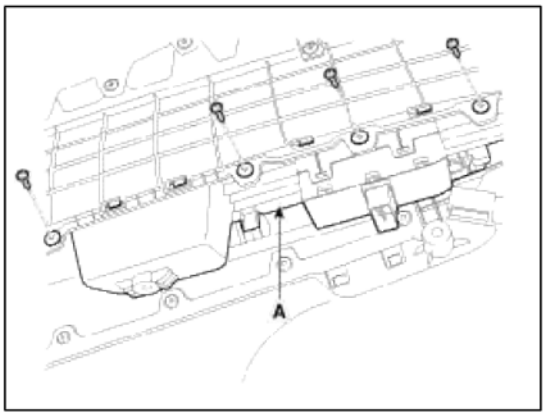
Be careful not to damage the hook when removing the switch module.

Passenger Window Switch

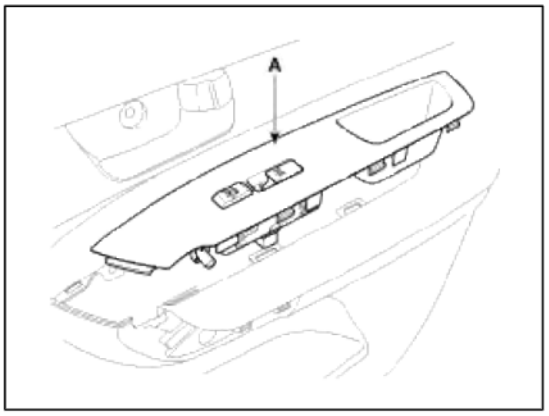
1. Disconnect the negative battery terminal.
2. Remove the front door trim.
   (Refer to BD group - "Front door")

cardiagn.com

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



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



NOTE

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

Installation

Driver Power Window Main Switch

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

Passenger Window Switch

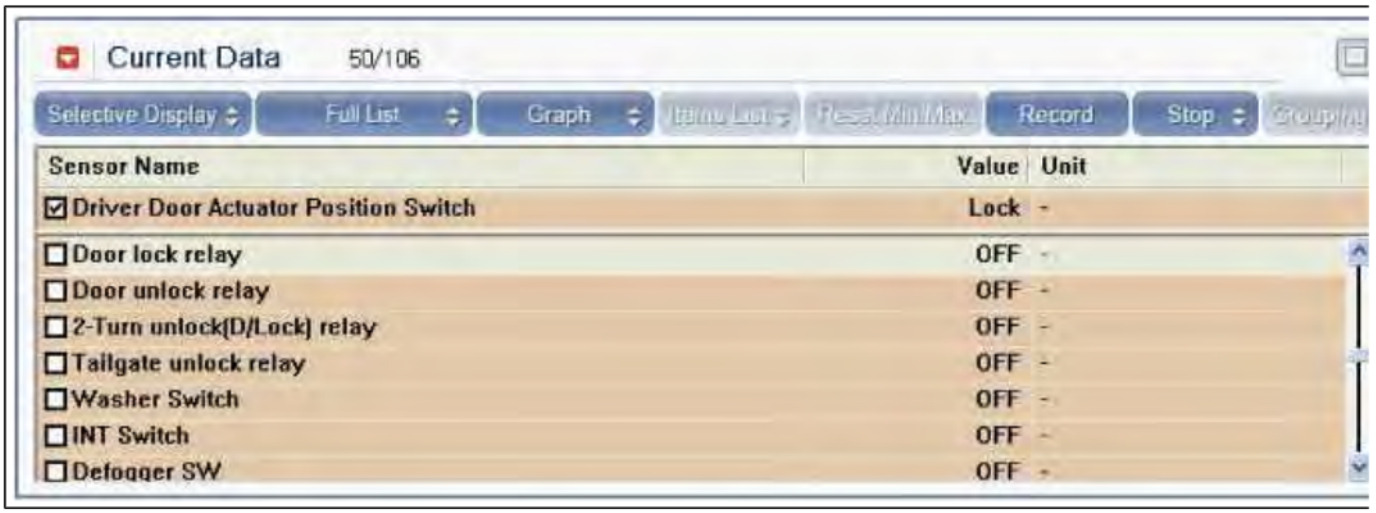
1. Install the passenger power window switch assembly and connectors.
2. Install the front door trim.

Diagnosis With GDS

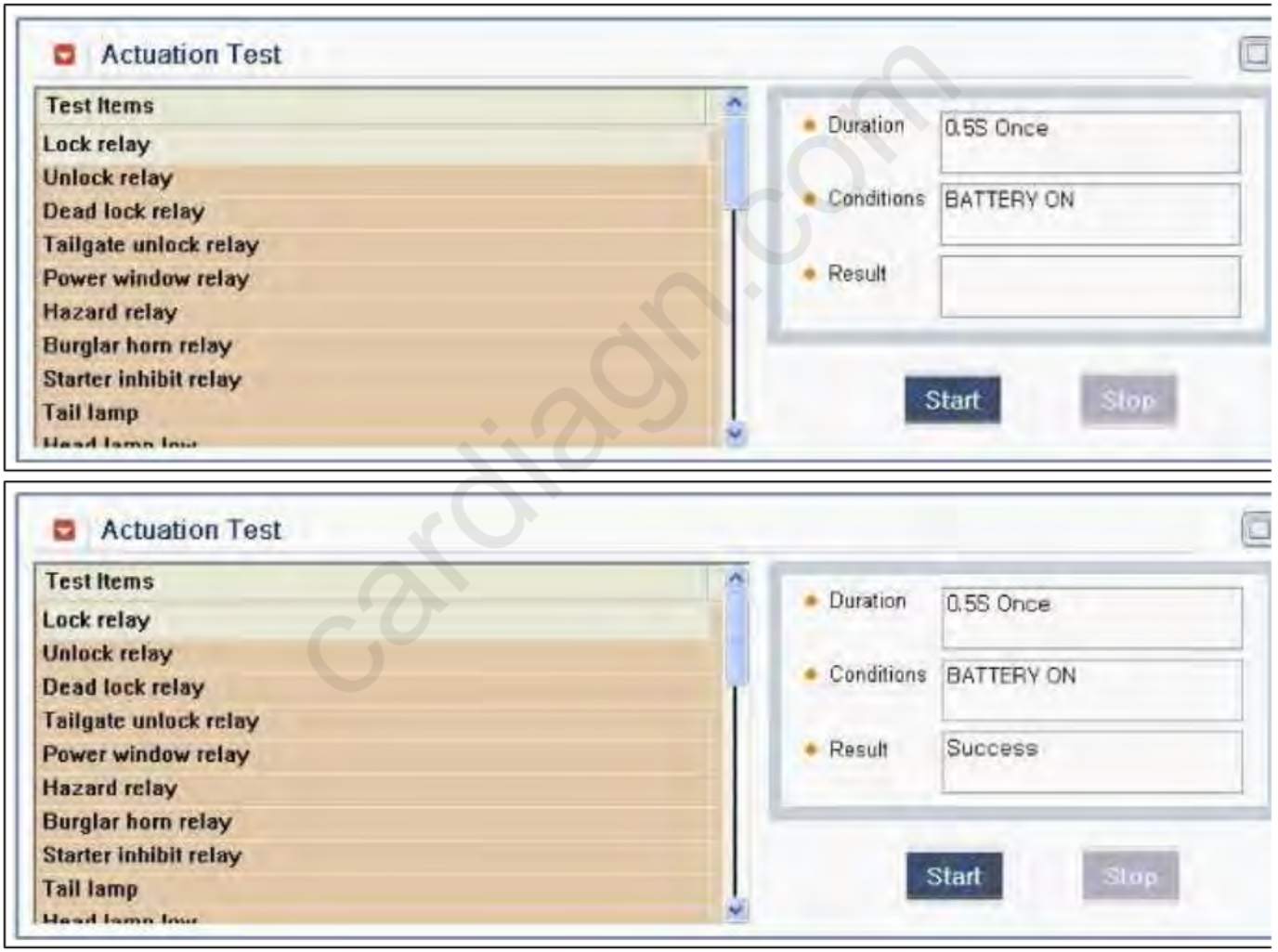
1. It will be able to diagnose defects of door lock with GDS quickly. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.

cardiagn.com

2. Select "Current data", if you will check current data of power door lock system. It provides input/output status of IPM.



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

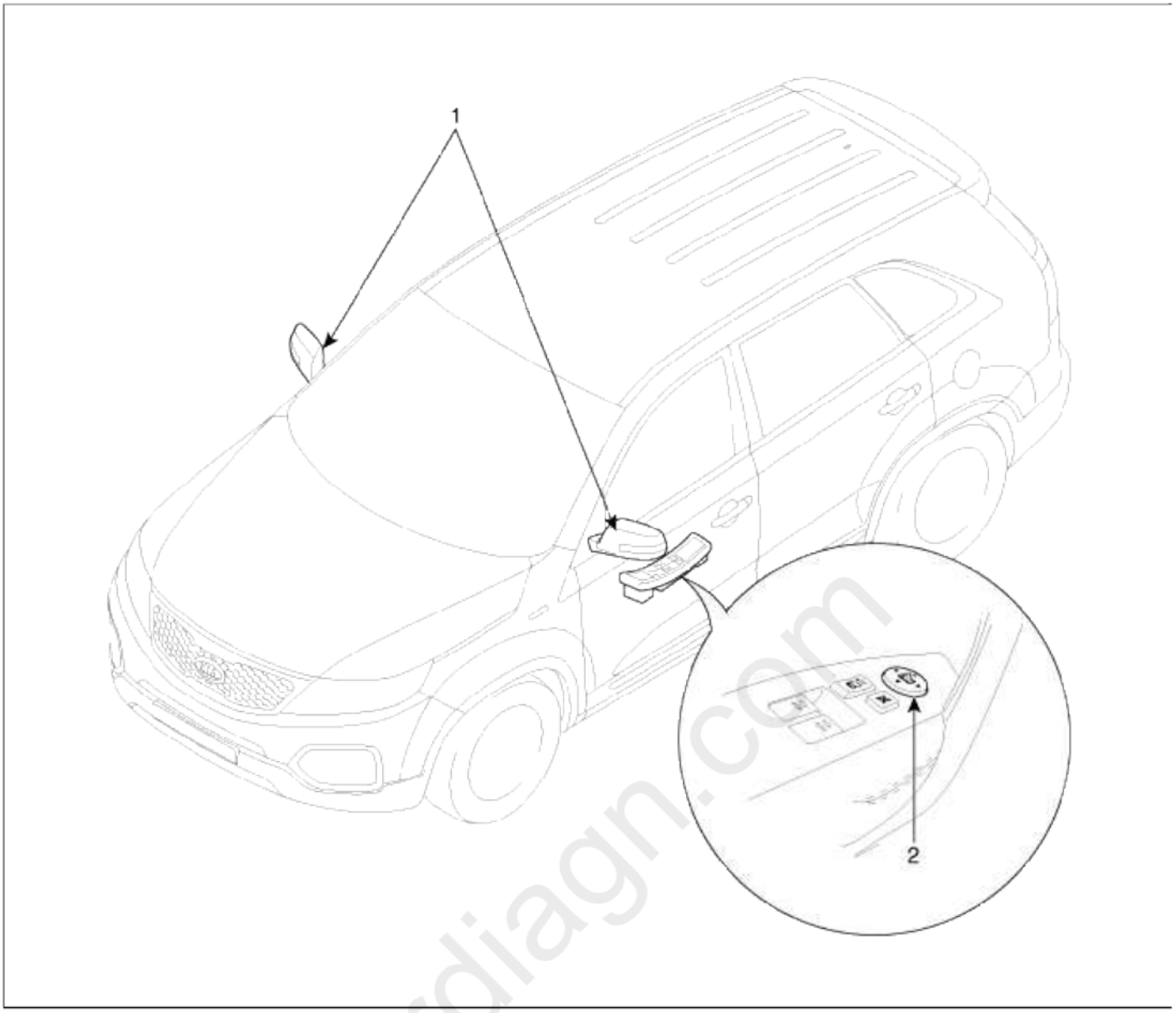


4. To check the DTC of the door lock, select "Diagnostic trouble codes".

Body Electrical System > Power Door Mirrors > Components and Components Location

Component Location

cardiagn.com

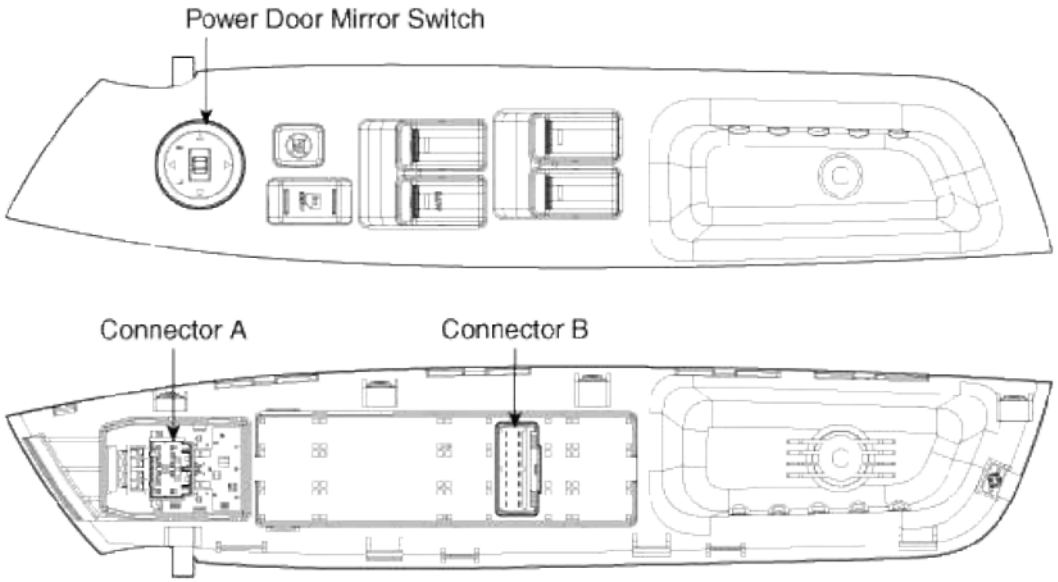


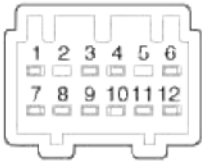
1. Power door mirror	2. Power door mirror switch

cardiagn.com

Body Electrical System > Power Door Mirrors > Power Door Mirror Switch > Schematic Diagrams

Circuit Diagram



		
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	-	Rear right window switch up
9	-	Driver window switch up
10	GND	Door lock
11	Battery (mirror folding)	Illumination
12	Common	Driver switch Auto
13		Assist switch Auto
14		Assist window switch down
15		GND
16		Assist window switch up

cardiagn.com

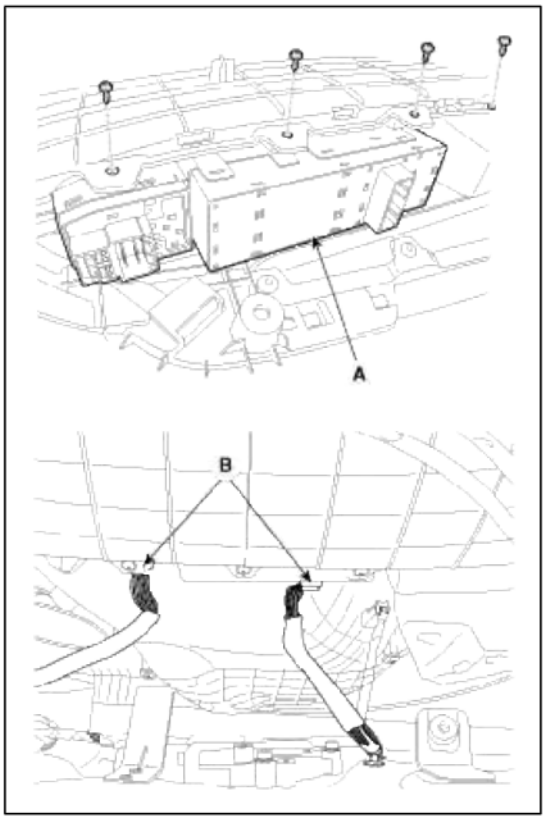
Body Electrical System > Power Door Mirrors > Power Door Mirror Switch > Repair procedures

Removal

Driver Door Mirror Switch

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

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



NOTE

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

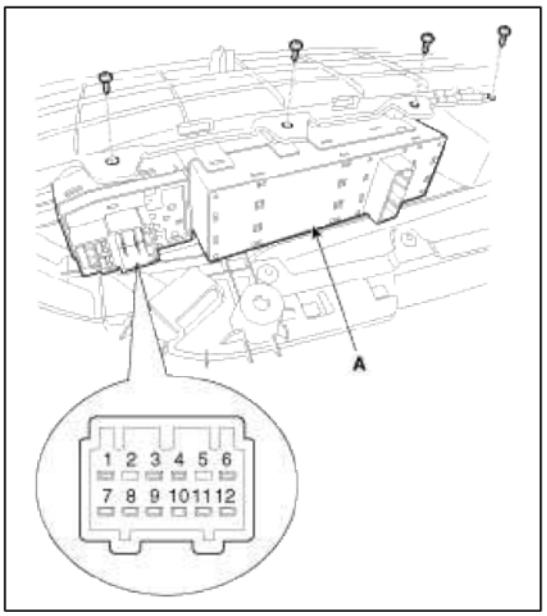
Installation

Driver Door Mirror Switch

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

Inspection

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



cardiagn.com

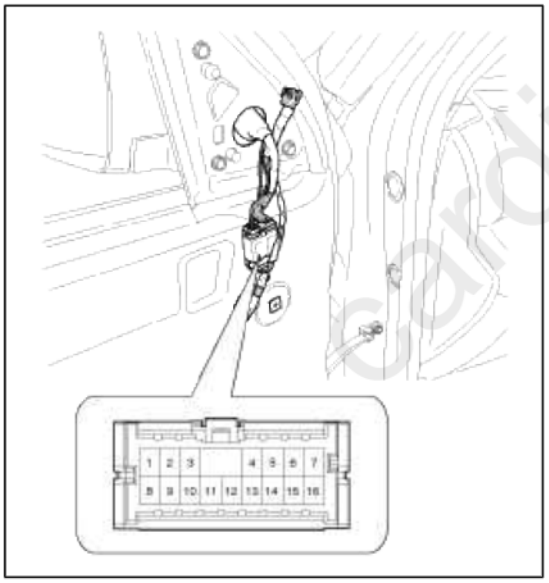
2. Check for the continuity between terminals of power door mirror switch according to the table.

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

Body Electrical System > Power Door Mirrors > Power Door Mirror Actuator > Repair procedures

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the driver door module.
   (Refer to BD group - "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		○	○	○	○

cardiagn.com

Mirror Heater

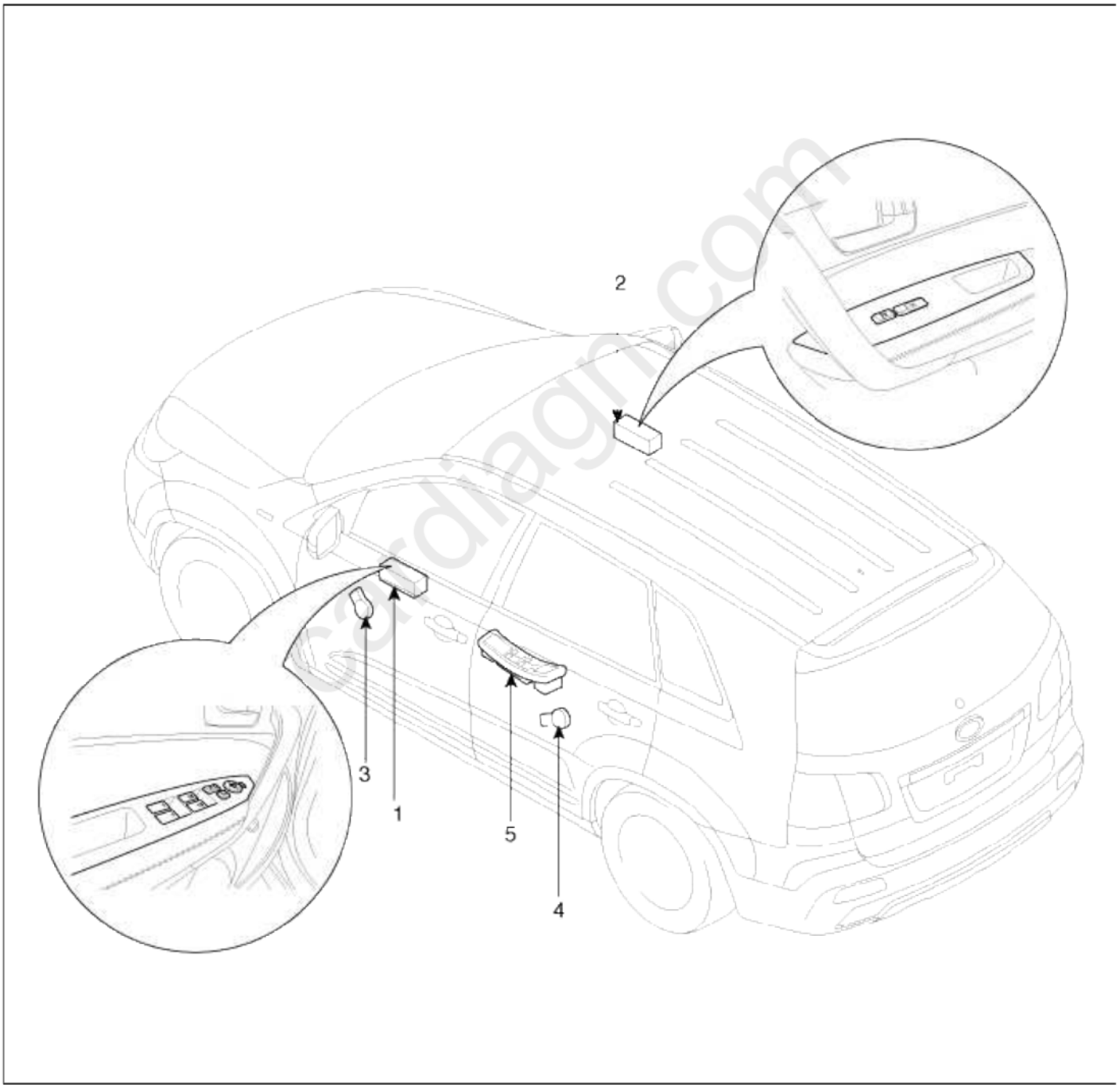
Position \ Terminal	13	14
Heater	○———	———○

Turn Signal Lamp

Position \ Terminal	1	2
Side repeater	⊕	⊖

Body Electrical System > Power Windows > Components and Components Location

Component Location



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

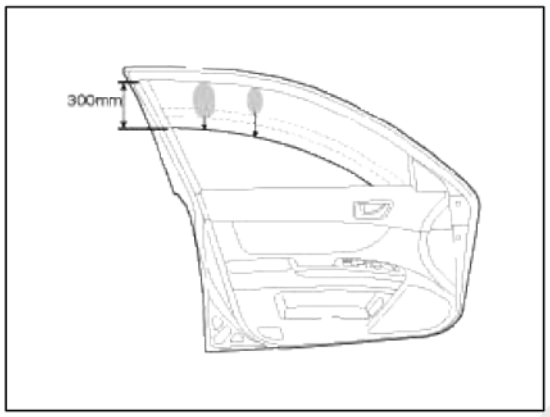
Body Electrical System > Power Windows > Description and Operation

Operation

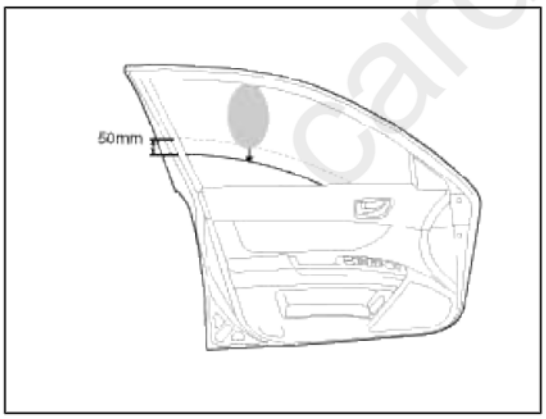
Function Of Safety Power Window

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.



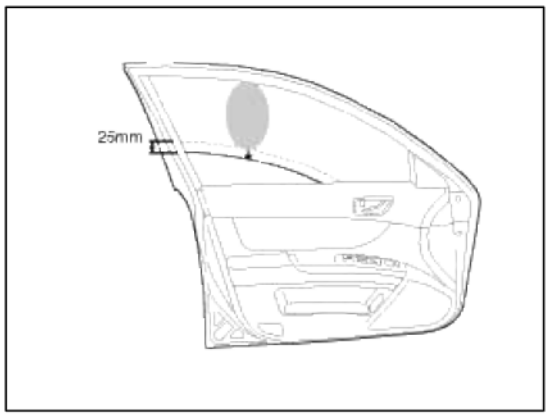
   B. When detect the jamming over the 250mm from top of the door.
      → Window is reversed until 50mm from jamming position.
      → Window is reversed 50mm or bottom position in case of 50mm reversing distance.



   C. When detect the jamming over 300mm from top of the door.
      → Window stops at reverse point.

carmagn.com

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 activated.)
   C. When detect the jamming during holding the auto-up switch again.
      → Window is reversed until 25mm from jamming position.
   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 the 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 valid)

- Stroing conditions : Entering to sleep mode after valid switch input. Entering to low voltage(7.5V) after valid switch input.
- 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 not be 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 2 sec, IGN on → Press Manual Down switch 3 times within 5 sec → De-normalization

carmagn.com

Door and Glass status	IGN status	Input time	IGN status	Switch input status			Switch input times	Normalization status
				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	De-normalization

Window Position Control

To detect the window position and direction of motor rotation, hall sensors are employed. ECU recognizes the fully closed position of the window and sets this relative window position value as "0". When the window goes downwards, based on the information from the hall sensor, the relative position value increments. On the contrary, when the window goes upwards, it decrements.

Thermal Protection

Thermal protection by software module is implemented to prevent from destruction of motor during overload condition. 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 (default value = 30 sec.)

Thermal shutdown during a window operation will not interrupt the operation due to safety reasons.

Operation Time Limiter

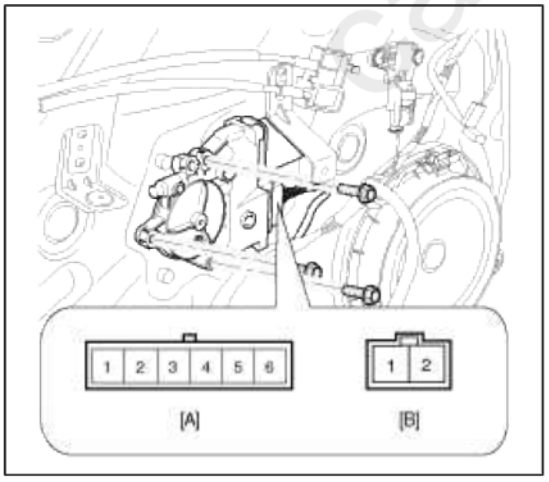
Maximal operation time of power window motor is limited to 15 sec (EEPROM programmable).

Body Electrical System > Power Windows > Power Window Motor > Repair procedures

Inspection

Front Power Window Motor

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



cardiagn.com

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

[Standard]

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

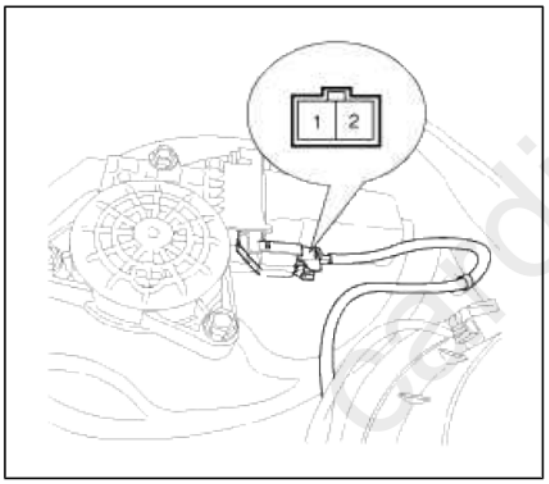
5. Connect the terminal No. 2 and No. 3 to battery voltage (12V) and check that the motor operates smoothly when connecting the terminals below.

[Safety]

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

Rear Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the rear door trim.
   (Refer to BD group - "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, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

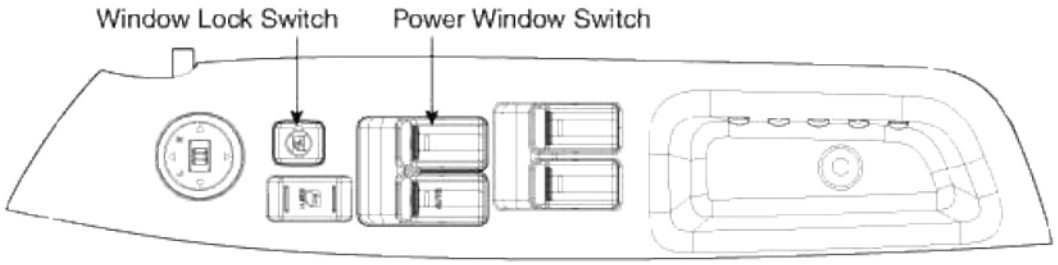
Position		Terminal	1	2
Left	UP	Clockwise	⊕	⊖
	DOWN	Counter-clockwise	⊖	⊕
Right	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖

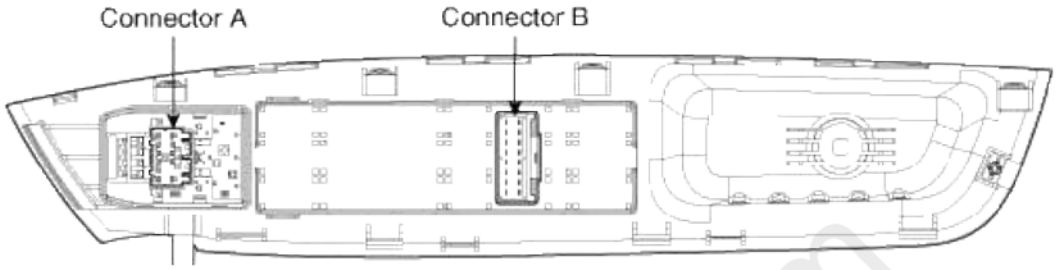
Body Electrical System > Power Windows > Power Window Switch > Components and Components Location

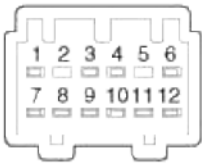
Components

cardiagn.com

Power Window Main Switch



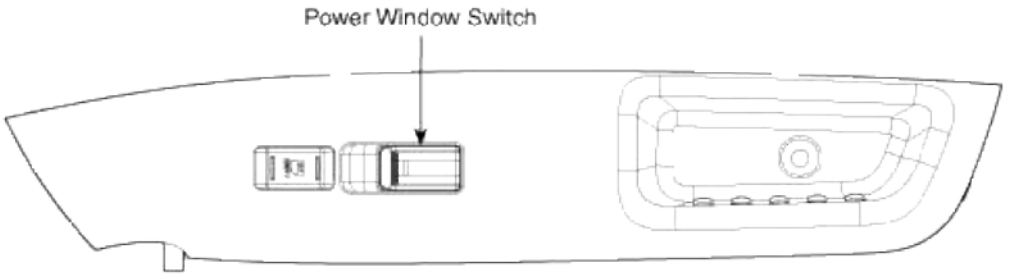


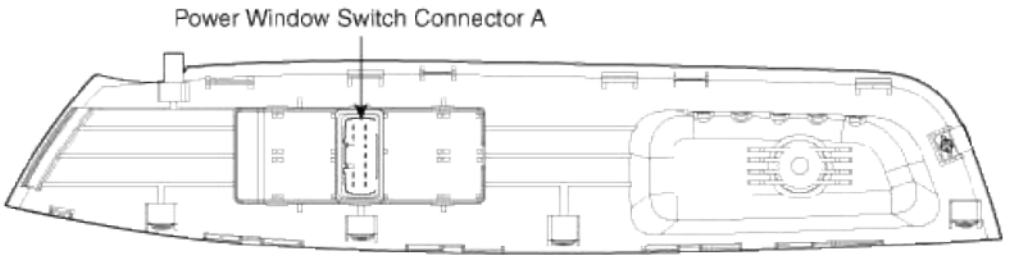


Pin	Connector A	Connector B
1	Assist door mirror motor (horizontal)	Driver window switch down
2	-	Door unlock
3	Assist door mirror motor (vertical)	Rear left window switch down
4	Driver door mirror motor (vertical)	Battery (+) L
5	-	Battery (+) R
6	Driver door mirror motor (horizontal)	Rear left window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

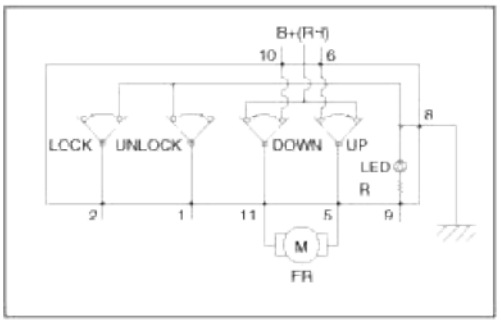
carmanuals.com

Assist Power Window Switch

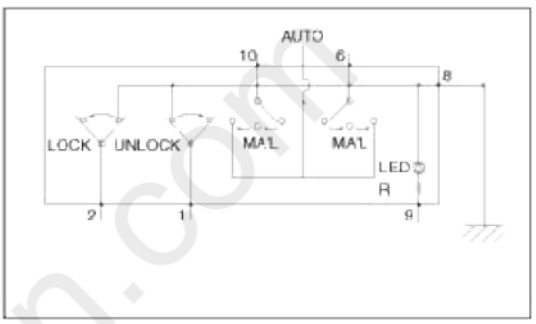


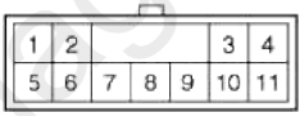


[Standard]



[Safety]

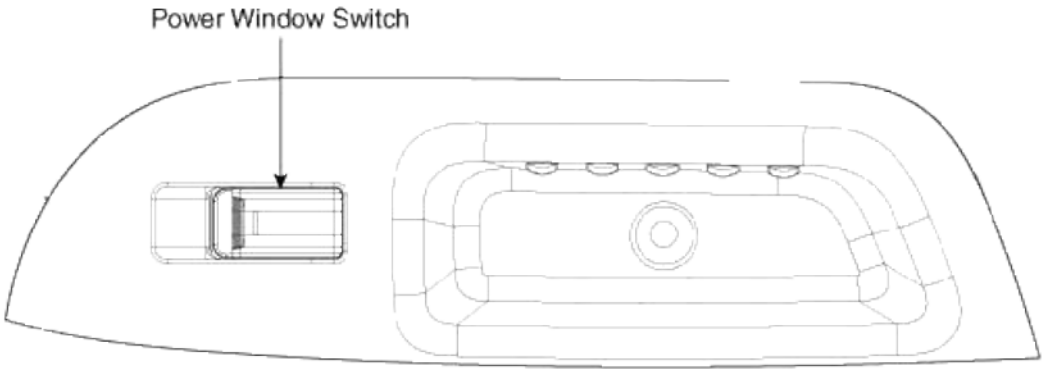


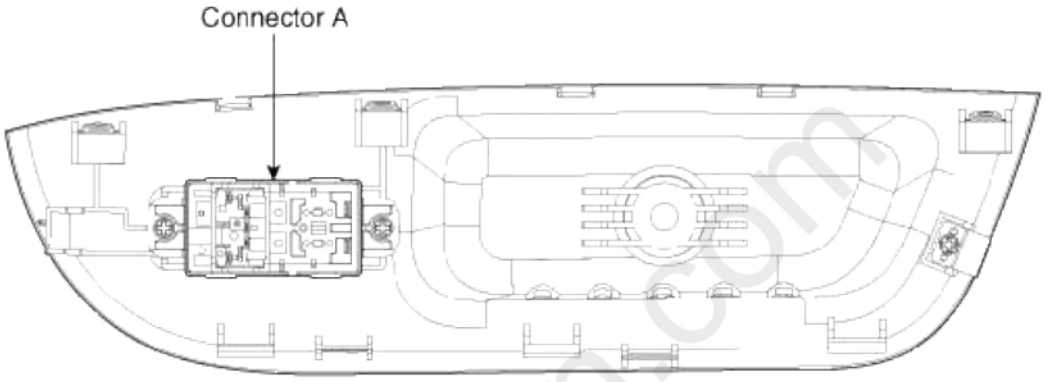


Pin	Connector A
1	Door unlock
2	Door lock
3	-
4	Battery (+) Auto
5	Power window motor up
6	Power window switch up
7	-
8	GND
9	Tail lamp
10	Power window switch down
11	Power window motor down

cardiagn.com

Rear Power Window Switch





Pin	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

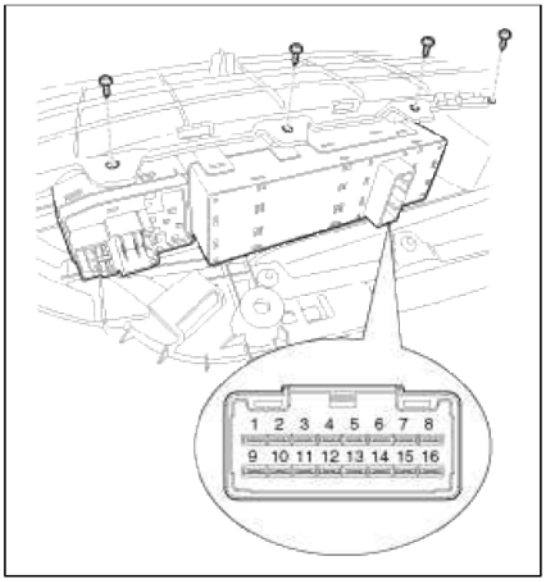
cardiagn.com

Body Electrical System > Power Windows > Power Window Switch > Repair procedures

Inspection

Main Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch.
   (Refer to BD group - "Front door")
3. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.



Terminal / Position	11	13	4
Lock		○—○	○—○
Unlock	○—○	○—○	

[Driver Auto Up/Down]

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

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

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

[Driver & Assist Auto Up/Down]

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

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

[Auto Down Only]

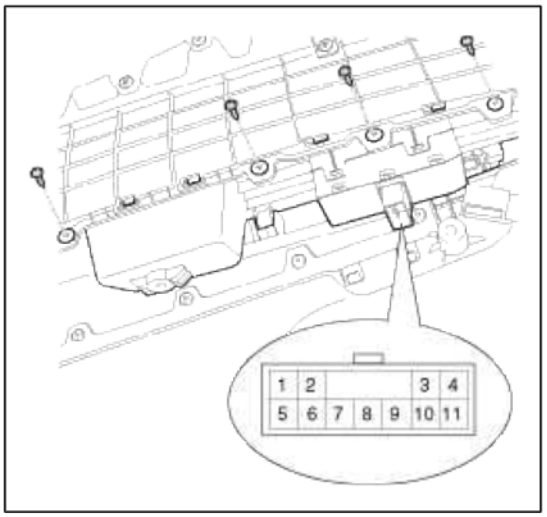
Terminal / Position	Front left				Front right			
	15	9	1	12	5	16	14	15
UP	○—○				○—○		○—○	
OFF						○—○	○—○	
DOWN	○—○		○—○		○—○		○—○	
AUTO DOWN	○—○		○—○	○—○				

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

cardiagn.com

Passenger Power Window Switch Inspection

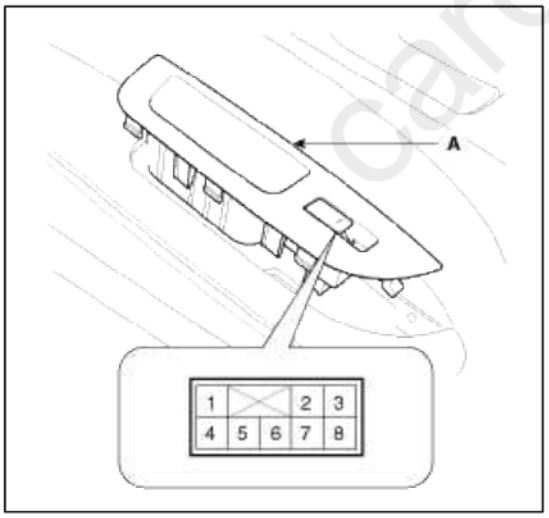
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch.
   (Refer to BD group - "Front door")
3. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.



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

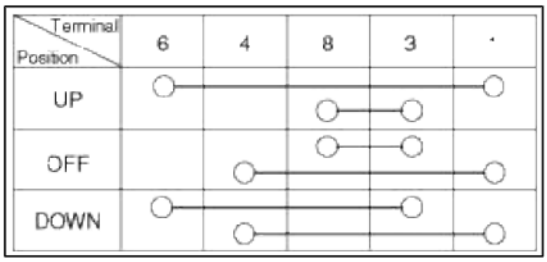
Rear Power Window Switch Inspection

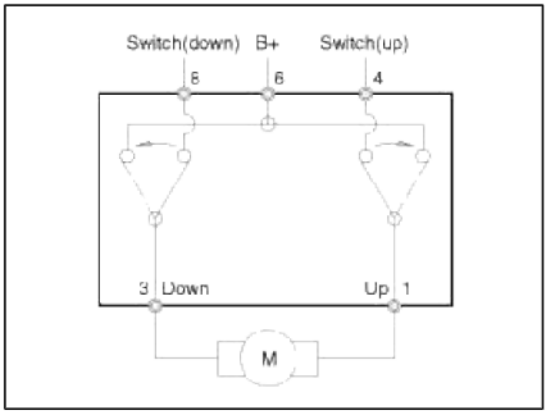
1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim.
   (Refer to BD group - "Rear door")
3. Remove the rear power window switch module (A).



cardiagn.com

4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

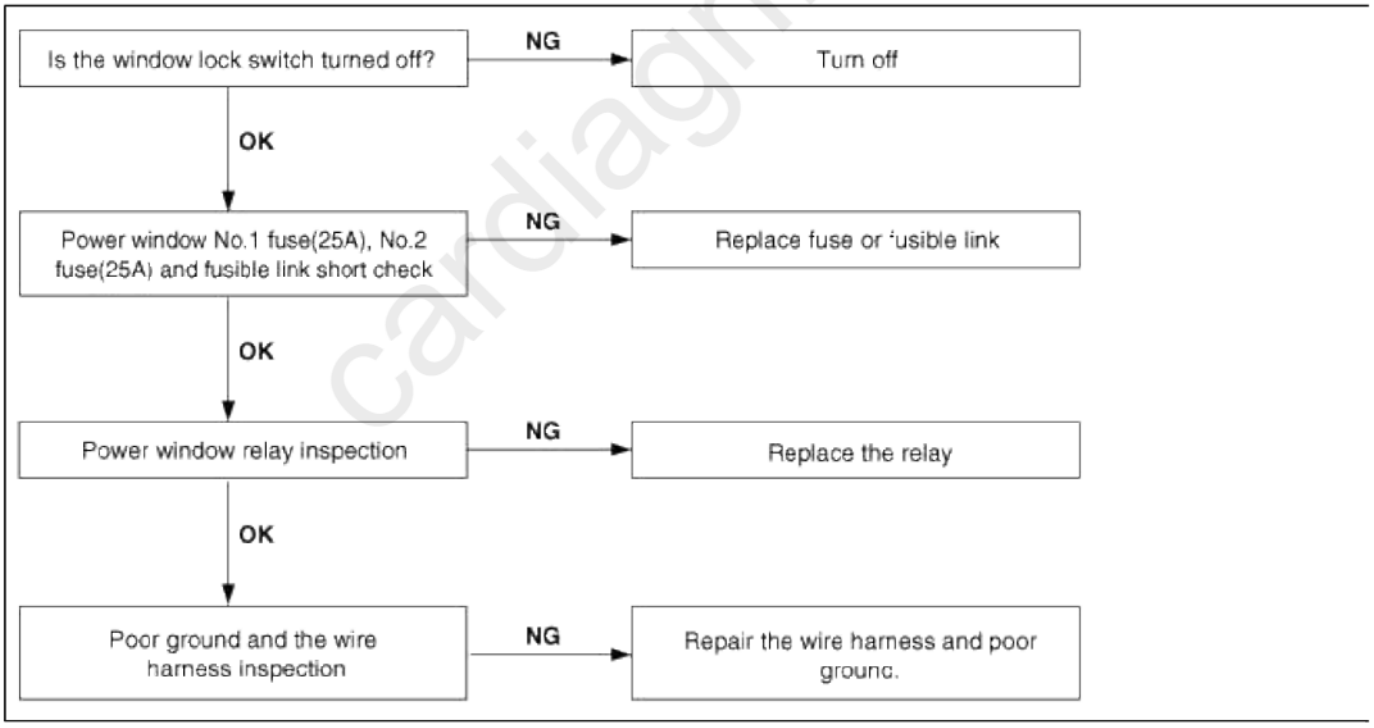




Body Electrical System > Power Windows > Troubleshooting

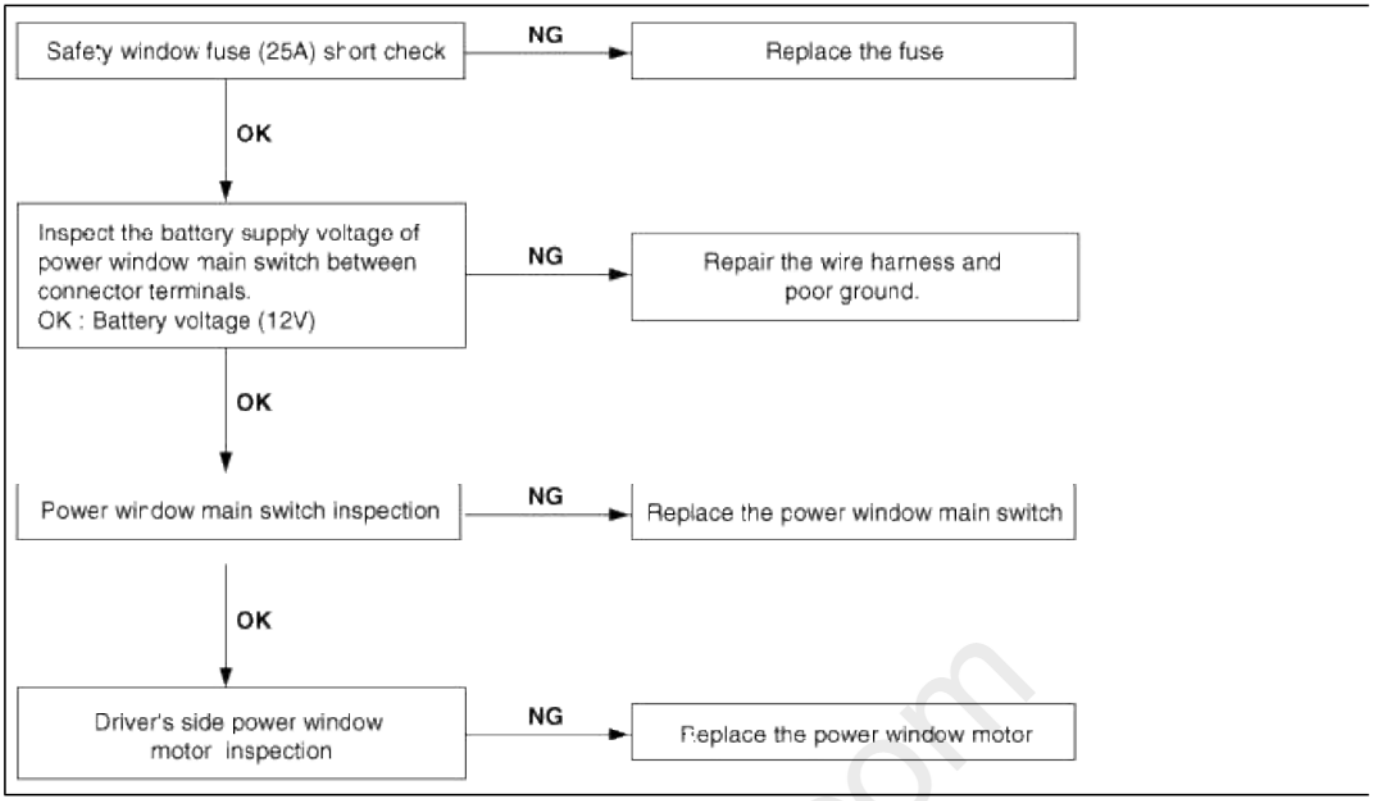
Troubleshooting

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

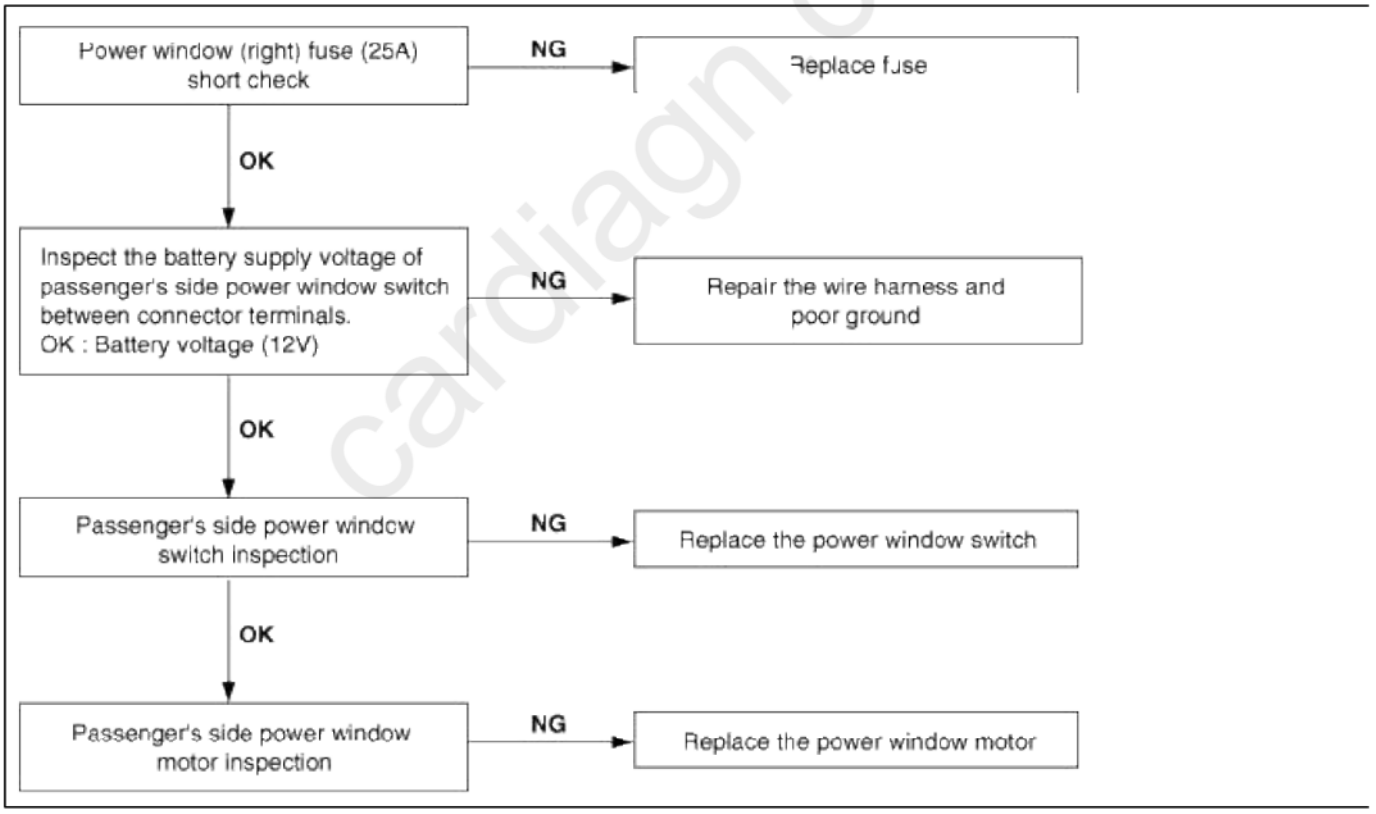


cardiagn.com

2. Driver's side window does not operate.



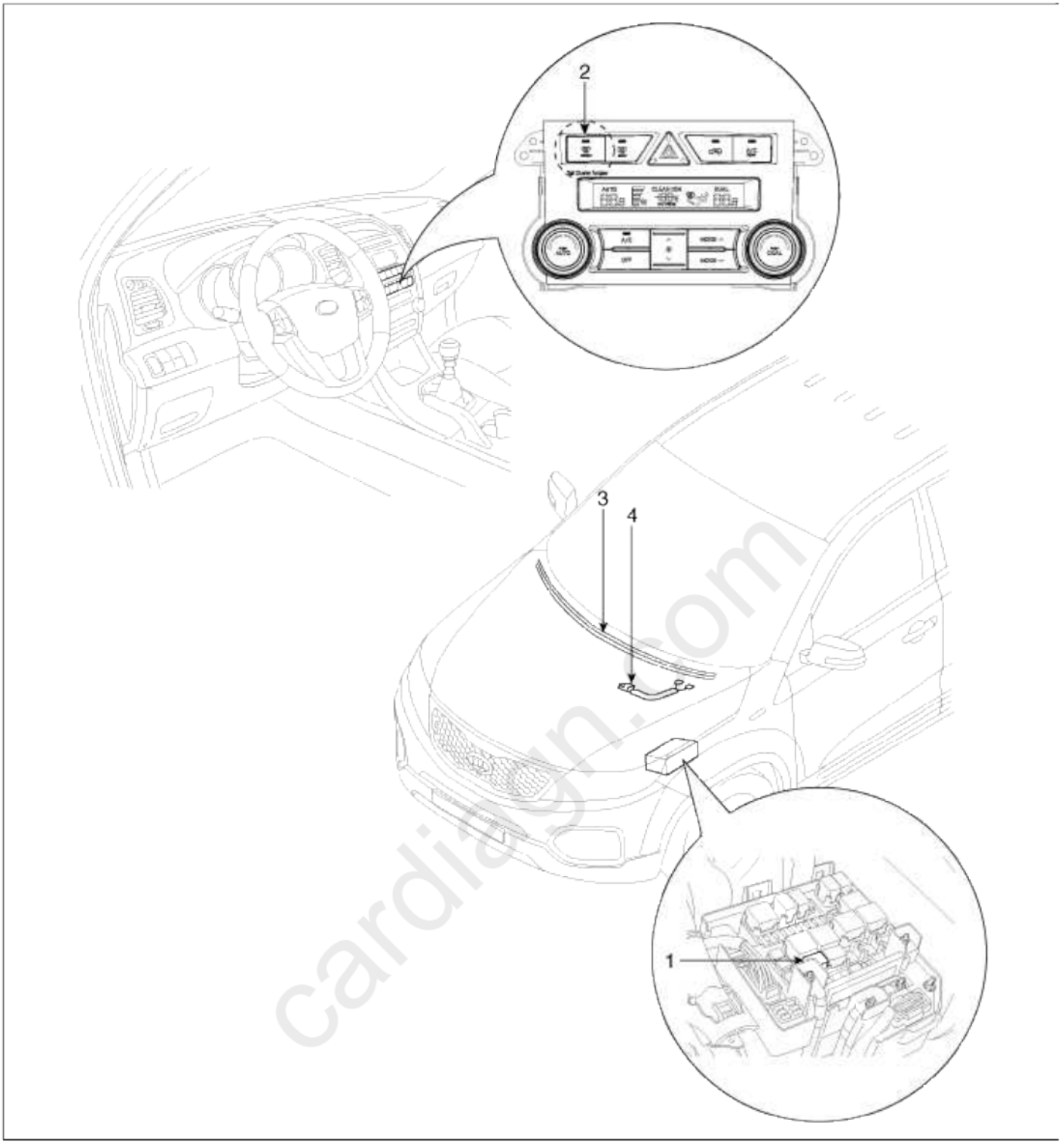
3. Passenger's side window does not operate.



cardiagn.com

Body Electrical System > Windshield Deicer > Components and Components Location

Component Location



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

Body Electrical System > Windshield Deicer > Description and Operation

Description

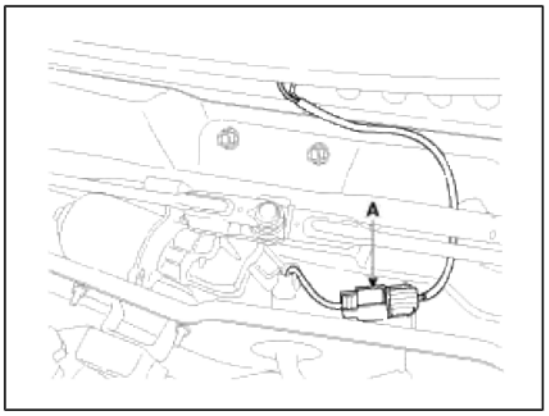
Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the lower part of windshield, switch and relay. Body control module receives an input signal from the deicer switch, then controls relay.

When the deicer switch is switched ON, and the engine is running with generator output, the deicer will go ON for a maximum of 20 minutes.

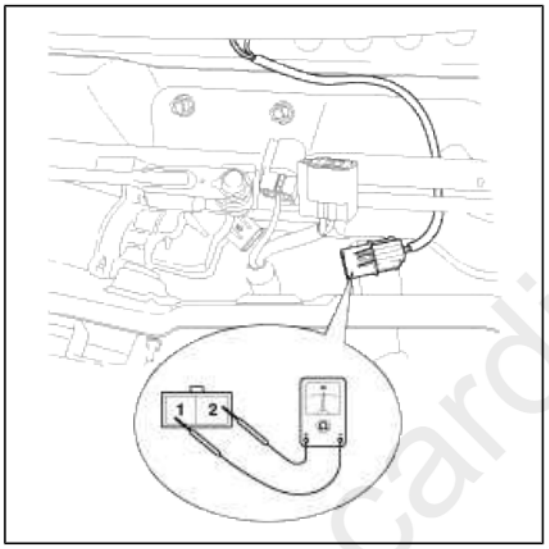
Body Electrical System > Windshield Deicer > Windshield Deicer > Repair procedures

Inspection

1. Remove the cowl top cover.
   (Refer to the wiper)
2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.



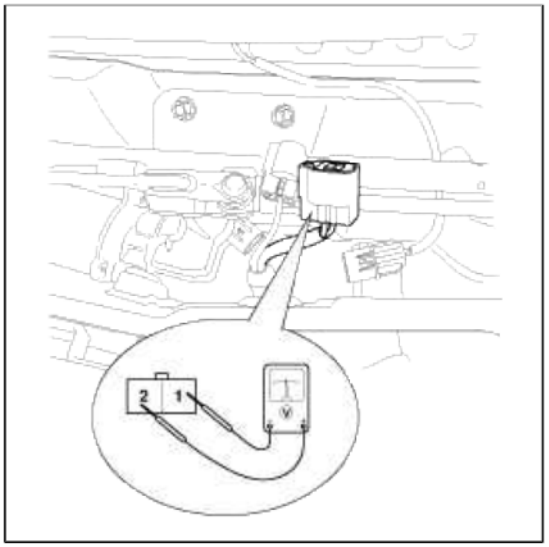
3. Check for continuity between the terminals of deicer lines.



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

OK : approx. Battery voltage (12V)

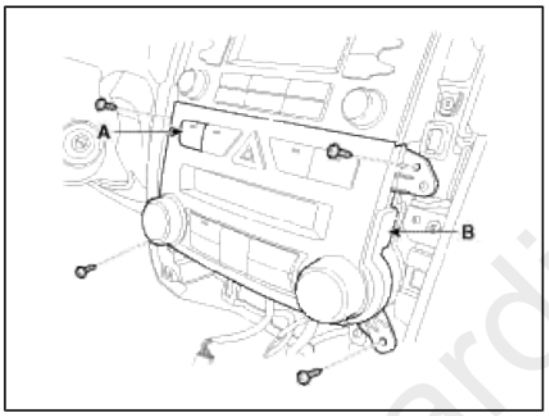
cardiagn.com



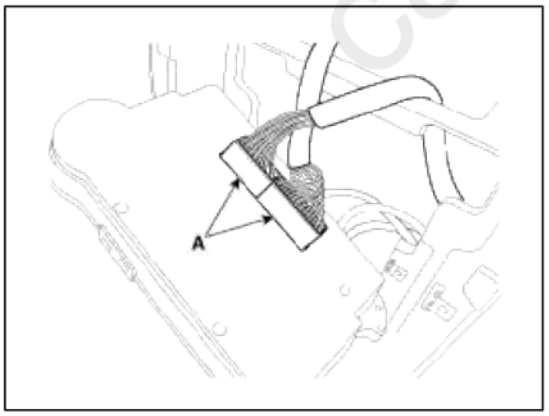
Body Electrical System > Windshield Deicer > Windshield Deicer Switch > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front seat heater switch module.
   (Refer to the Audio)
3. Remove the heater control unit (B) with windshield deicer switch (A).



4. Remove the heater control unit connector (A).



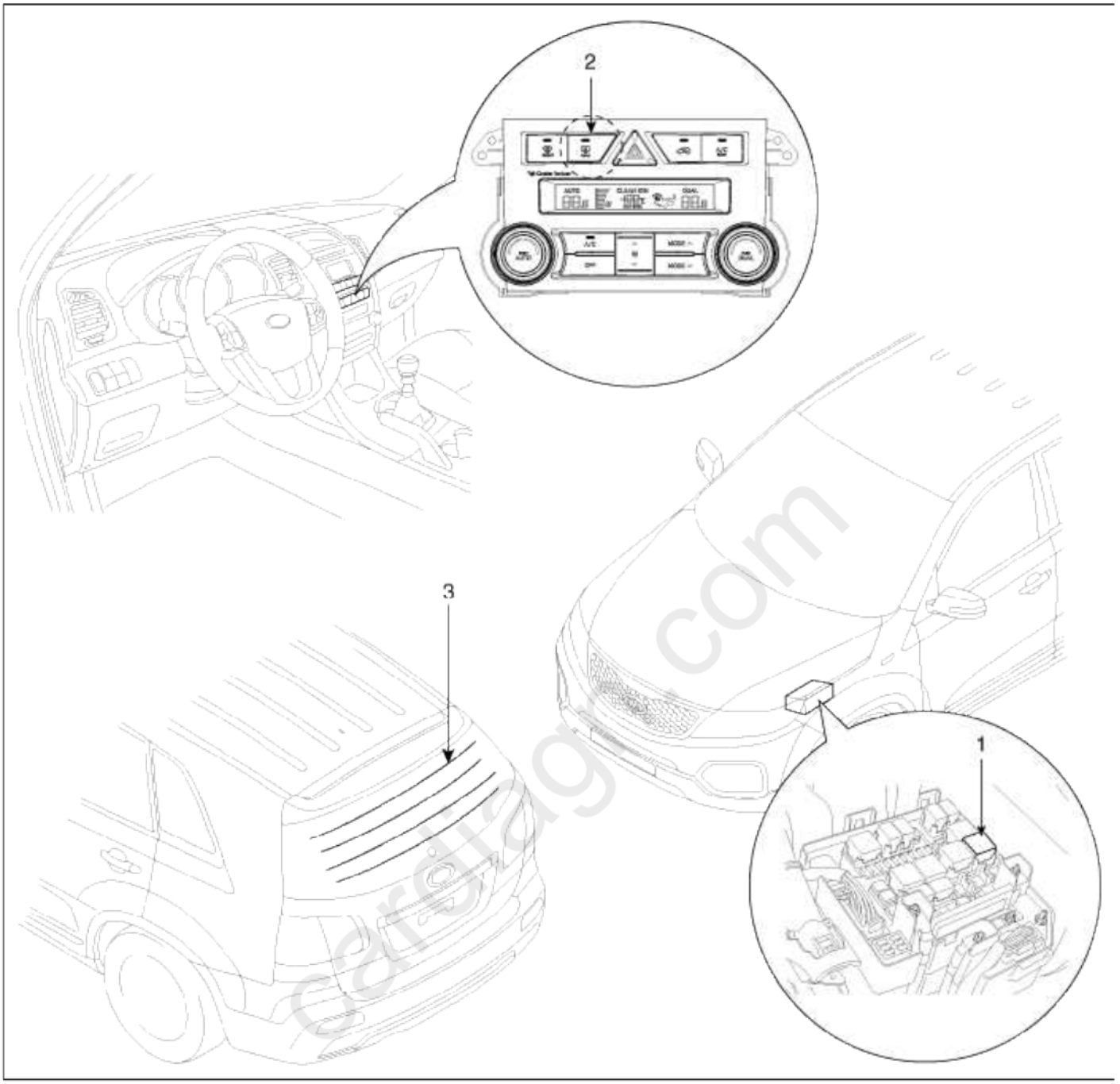
Installation

1. Install the heater control unit.
2. Install the seat heater switch module.

Body Electrical System > Rear Glass Defogger > Components and Components Location

cardiagn.com

Component Location



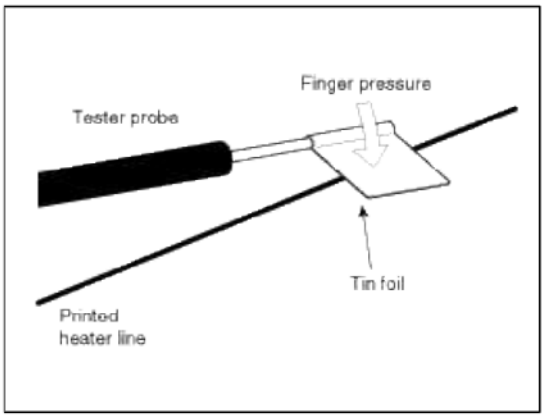
1. Rear glass defogger relay 2. Rear glass defogger switch	3. Rear glass defogger

Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Printed Heater > Repair procedures

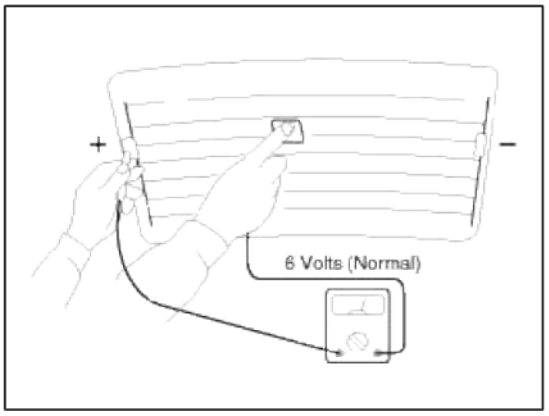
Inspection

CAUTION

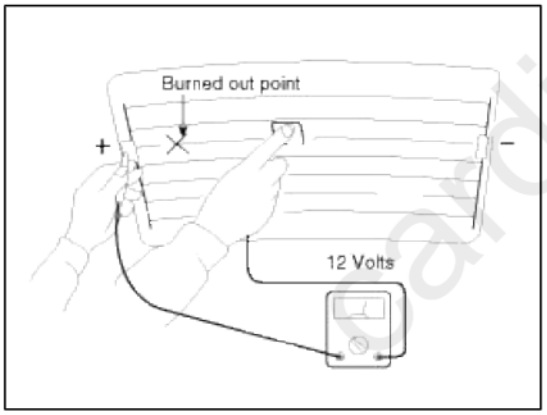
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



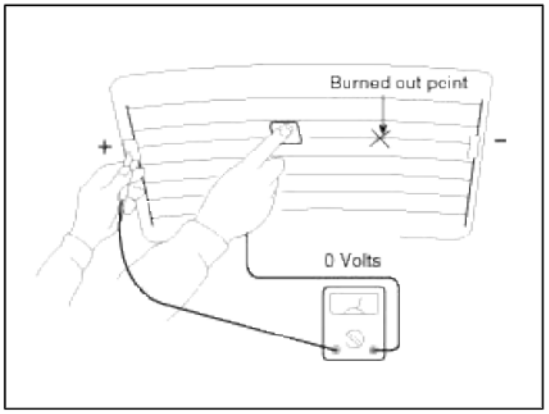
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



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

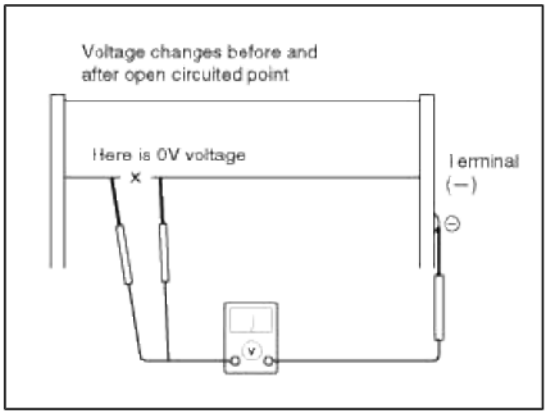


3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.

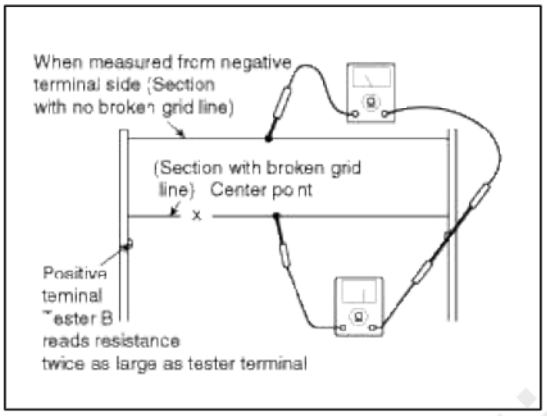


carldiagn.com

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



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

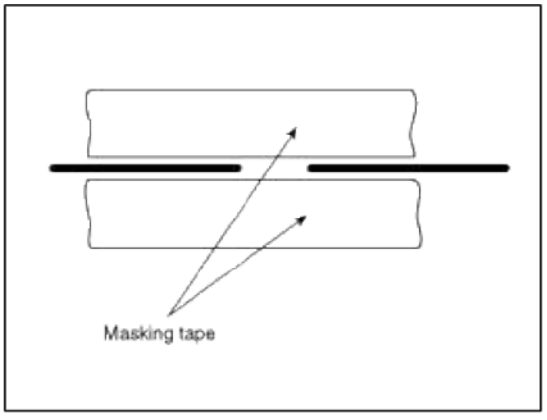


Repair Of Broken Heater Line

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 shown. Shake the conductive paint container well, and apply three coats with a brush at intervals of about 15 minutes apart. Remove the tape and allow sufficient time for drying before applying power. For a better finish, scrape away excess deposits with a knife after the paint has completely dried. (Allow 24 hours).

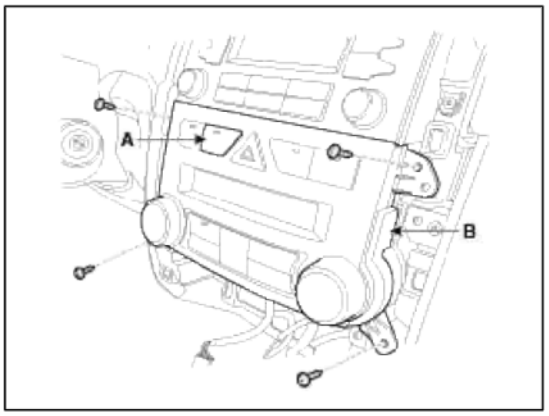


cardiagn.com

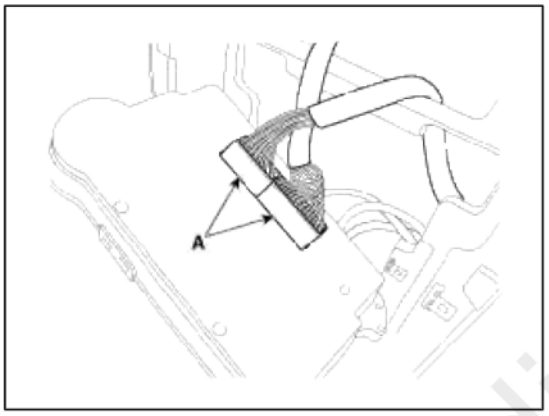
Body Electrical System > Rear Glass Defogger > Rear Glass Defogger Switch > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front seat heater switch module.
   (Refer to the Audio)
3. Remove the heater control unit (B) with rear glass defogger switch (A).



4. Remove the heater control unit connector (A).



Installation

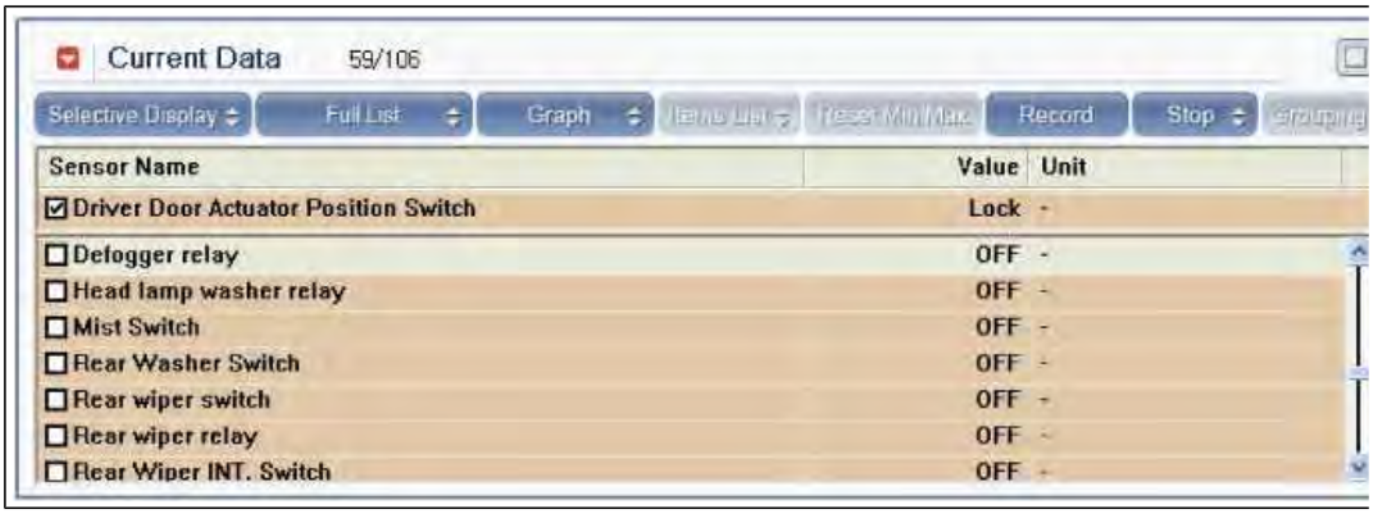
1. Install the heater control unit.
2. Install the seat heater switch module.

Inspection

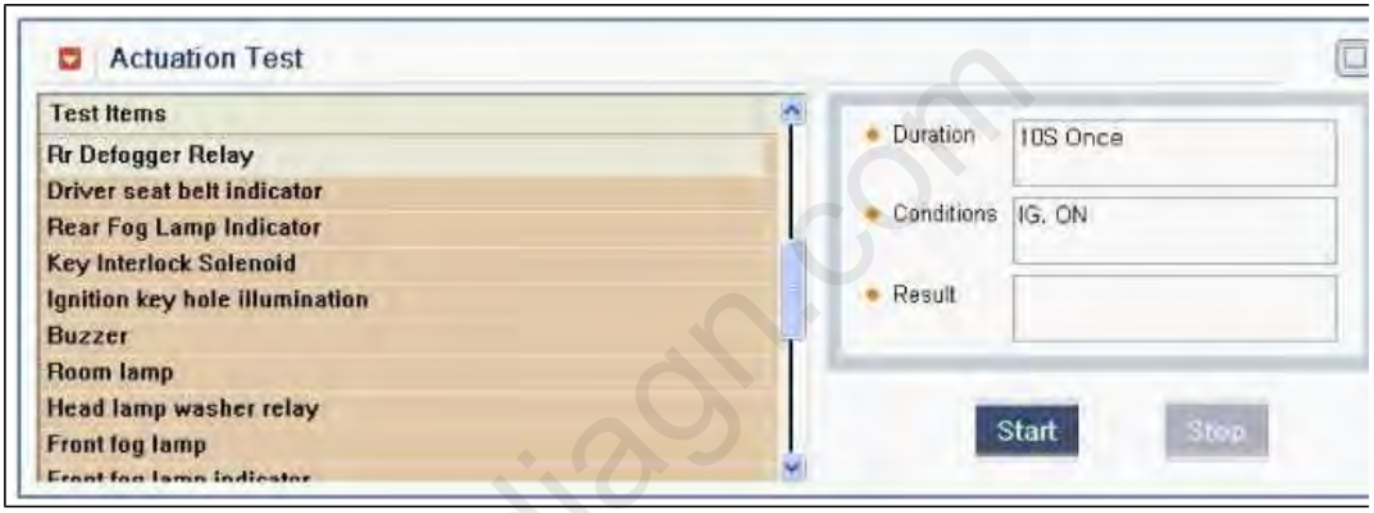
1. It will be able to diagnose defects of rear glass defogger with GDS quickly. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.

cardiagn.com

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



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

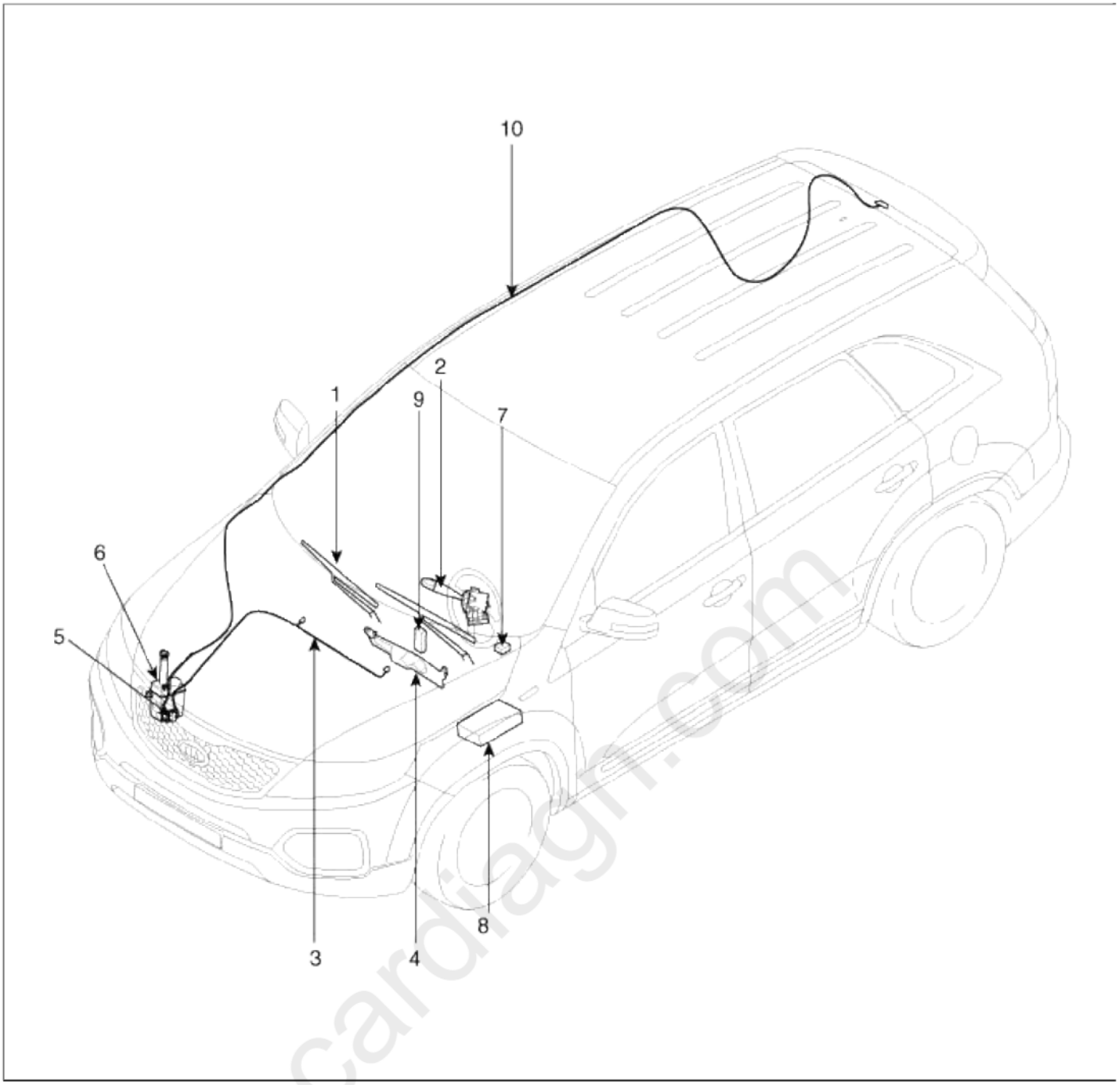


4. To check the DTC of the rear glass defogger, select "Diagnostic trouble codes"

Body Electrical System > Windshield Wiper/Washer > Components and Components Location

Component Location

cardiagn.com



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

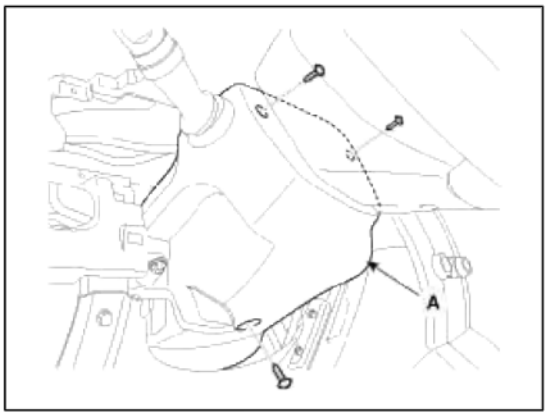
Body Electrical System > Windshield Wiper/Washer > Windshield Wiper-Washer Switch > Repair procedures

Removal

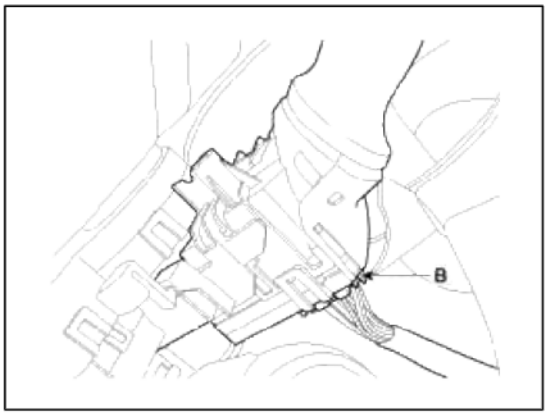
1. Disconnect the negative (-) battery terminal.

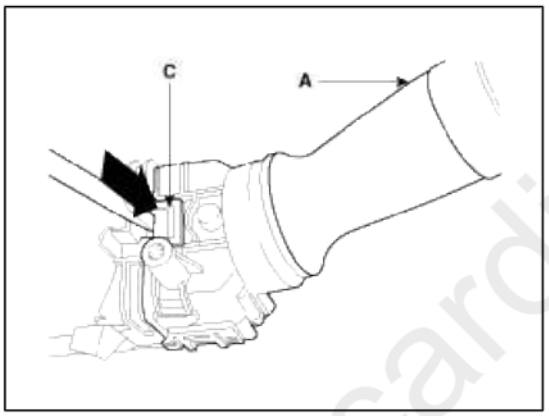
cardiagn.com

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).





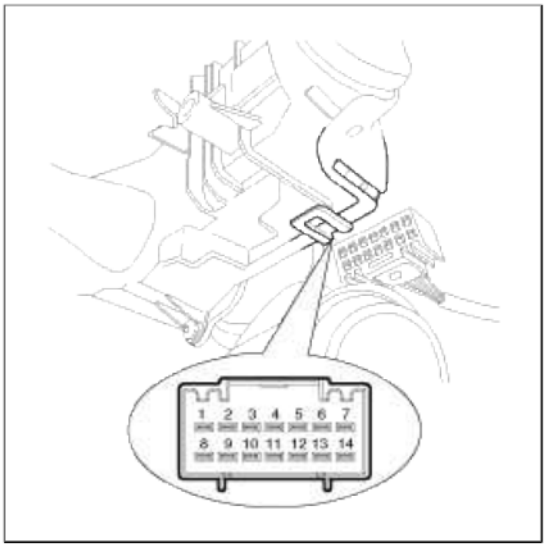
cardiagn.com

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, replace wiper and wiper switch.



Wiper Switch

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

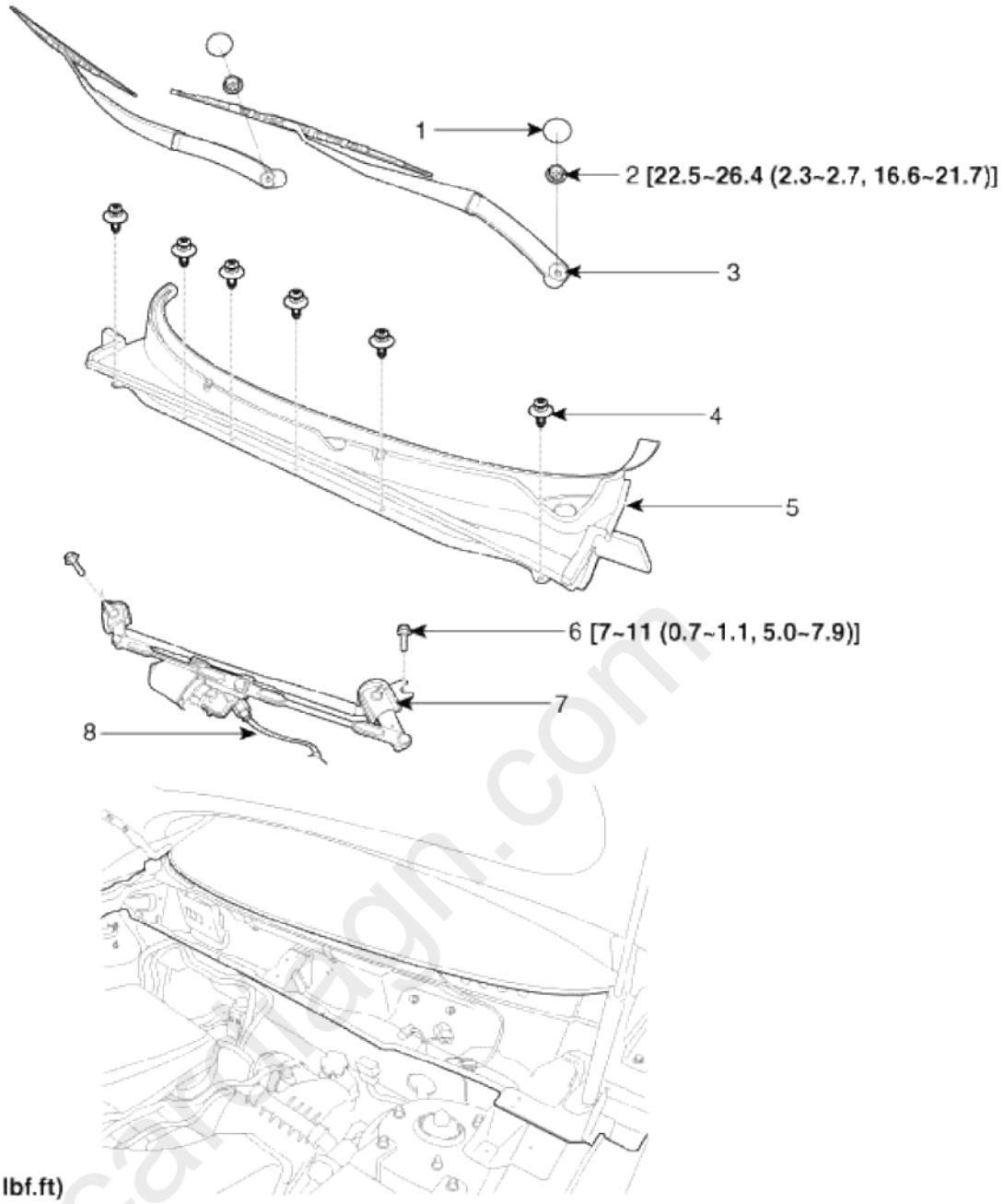
Washer Switch

Terminal / Position	10	11
OFF		
ON	○	○

Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Components and Components Location

Component Location

cardiagn.com

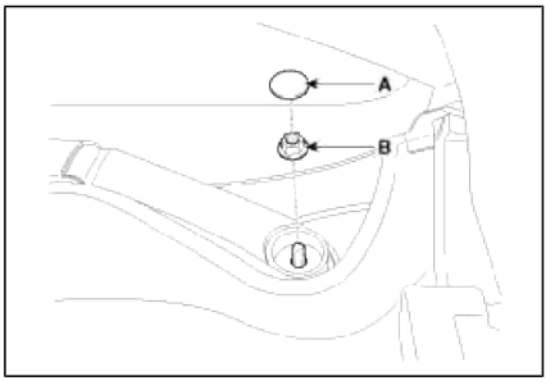


1. Cap 2. Nut 3. Wiper arm & blade 4. Retainer	5. Cowl top cover 6. Bolt 7. Wiper motor & linkage assembly 8. Wiper motor connector

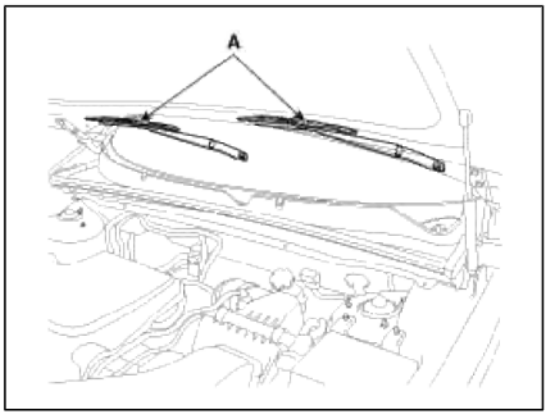
Body Electrical System > Windshield Wiper/Washer > Front Wiper Motor > Repair procedures

Removal

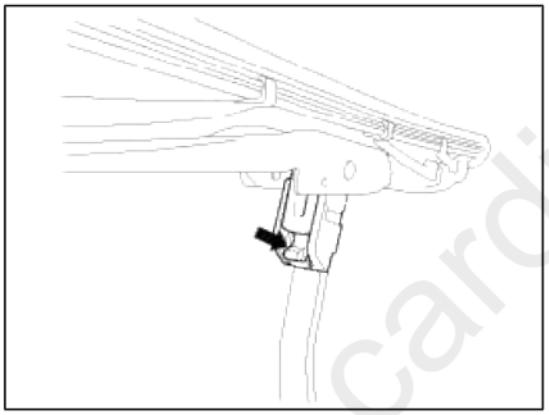
1. Remove the windshield wiper arm and blade after removing a nut (B) and wiper cap (A).



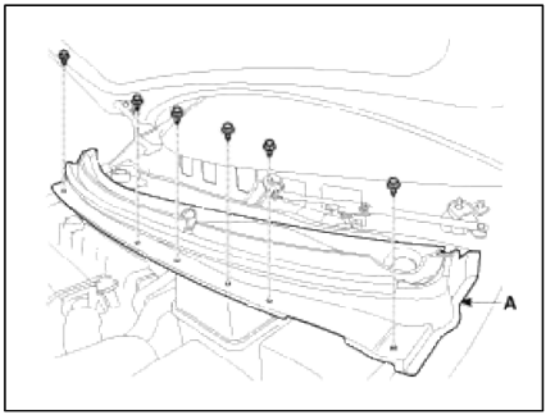
2. Remove the windshield wiper arm and blade (A) after removing a nut.



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

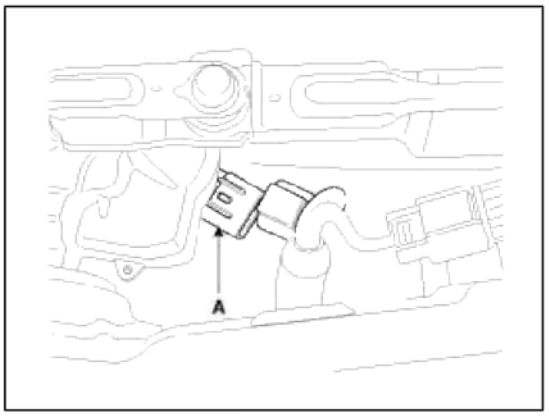


4. Remove the weather strip and the cowl top cover (A) after removing retainers.

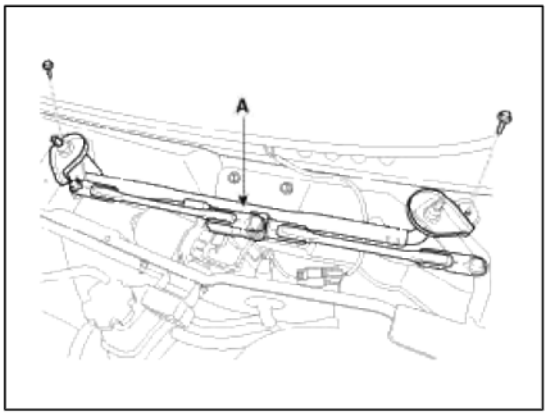


cardiagn.com

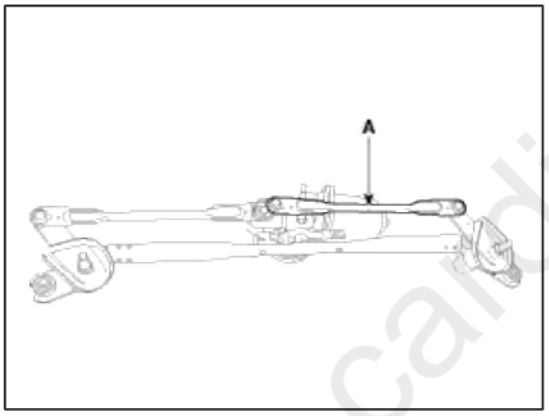
5. Disconnect the wiper motor connector (A) from the wiper motor & linkage assembly.



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



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

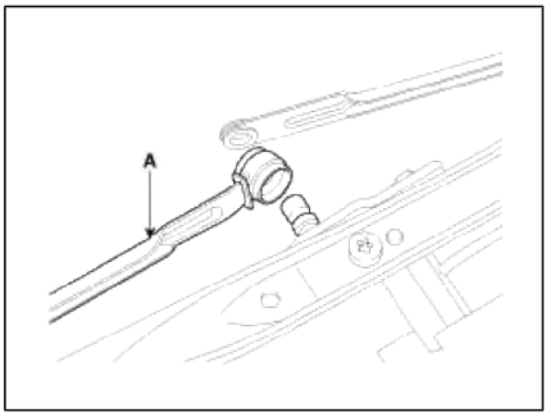


cardiagn.com

CAUTION

Before removing 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.

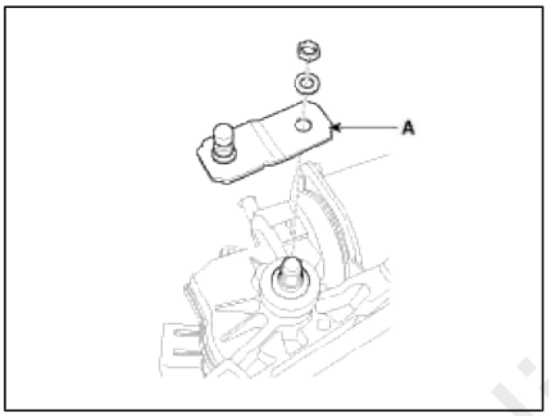
8. Remove the lower linkage (A) from the wiper motor crank arm.



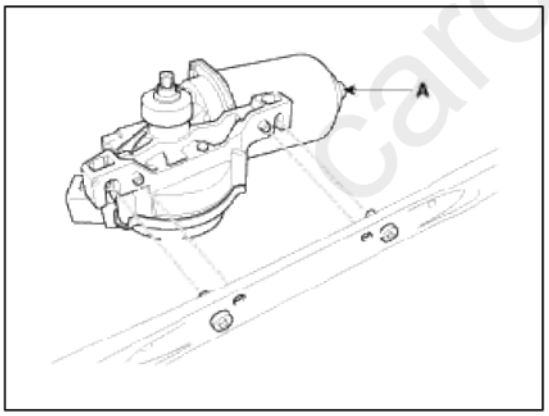
CAUTION

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.



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



Installation

1. Install the wiper motor.

cardiagn.com

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 and 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 and 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.

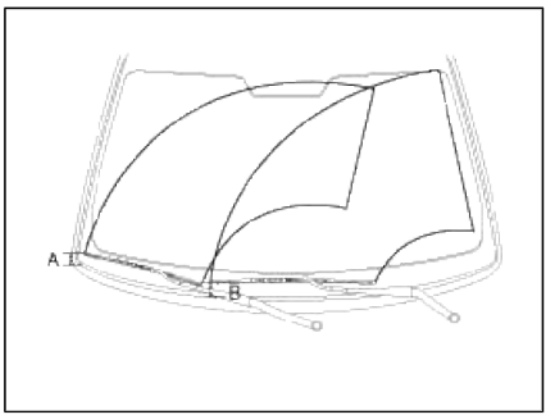
Torque :
22.5~26.4 Nm (2.3~2.7 kgf.m, 16.6~21.7 lbf.ft)

NOTE

- 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.

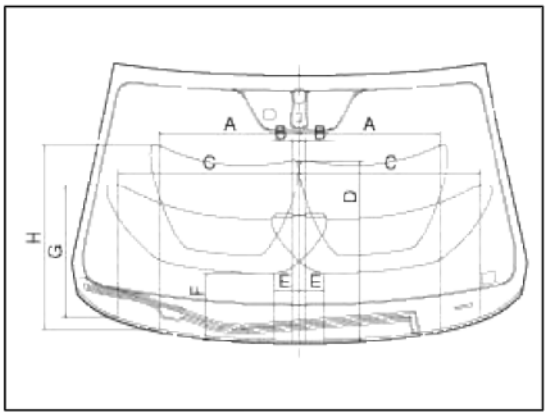
7. Install the wiper arm and blade to the specified position.

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



cardiagn.com

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

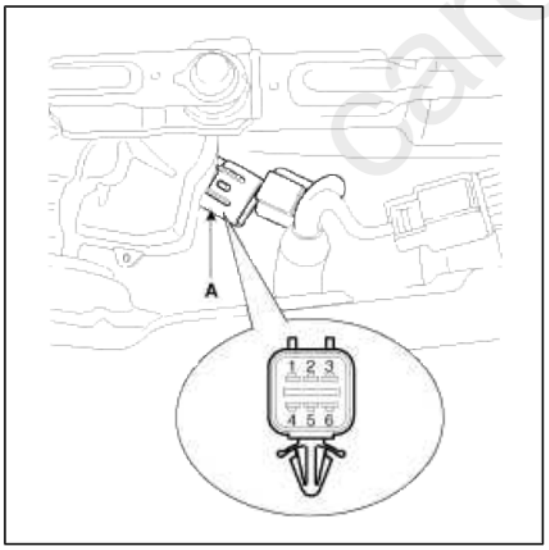


Specified position	Distance (in)	Distance (mm)
A	18.2	463.0
B	0.9	24.0
C	23.5	598.0
D	23.4	595.0
E	3.2	82.0
F	8.7	223.0
G	17.1	436.5
H	23.8	606.0

Inspection

Speed Operation Check

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.

cardiagn.com

3. Check that the motor operates at low or high speed as below table.

Termina / Position	3	2	4	6
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 mild detergent, and rinse thoroughly with clean water.

Body Electrical System > Windshield Wiper/Washer > Front Washer Motor > Repair procedures

Inspection

Front and Rear Washer Motor

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

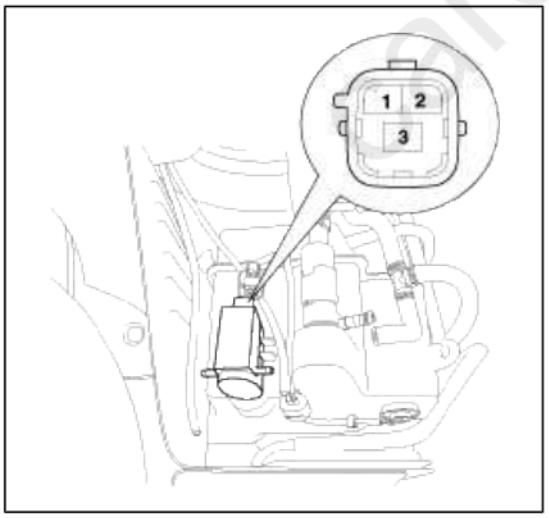
NOTE

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

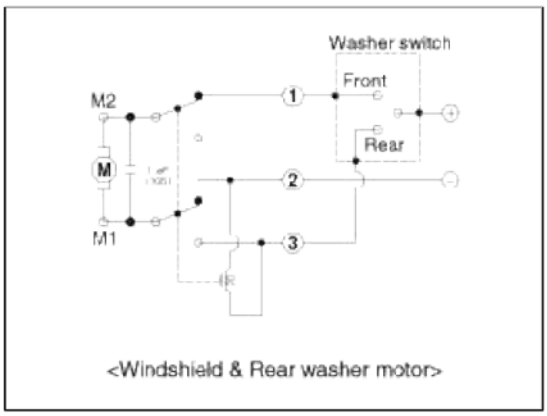
2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.

[Front & Rear washer]

1. Windshield washer (+)
2. Ground
3. Rear washer (+)



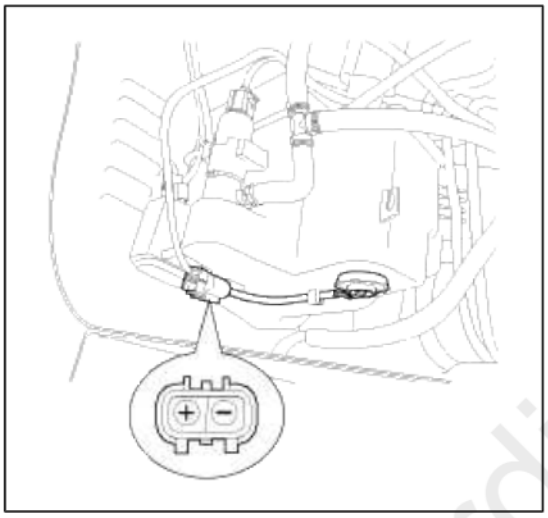
cardiagn.com



<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.
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

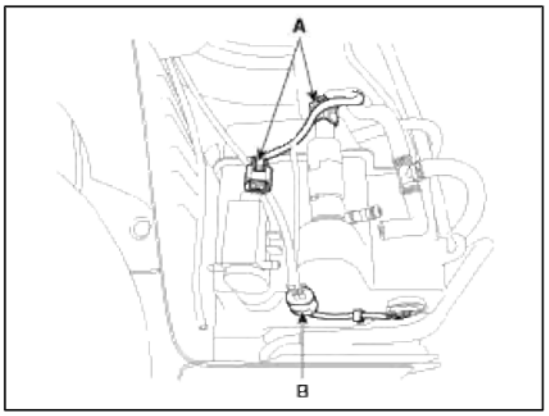
CAUTION

- 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.

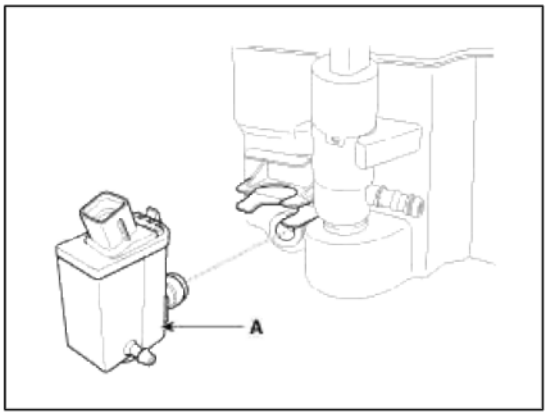
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
   (Refer to BD group - "Front bumper")

cardiagn.com

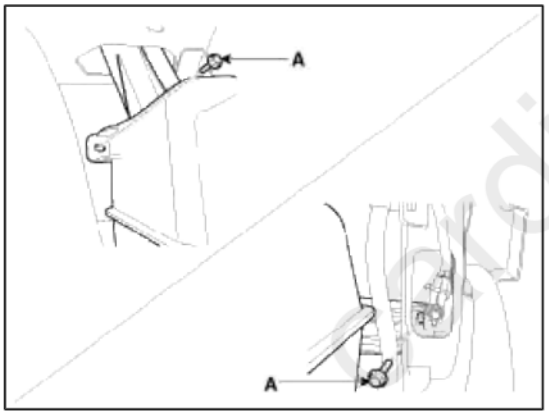
3. Remove the washer hose and disconnect the washer motor connector (A) and washer fluid level sensor connector (B).



4. Remove the washer motor (A).



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



Installation

1. Reassemble the washer reservoir.

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

2. Connect the washer motor connector and washer hose.
3. Install the washer reservoir.

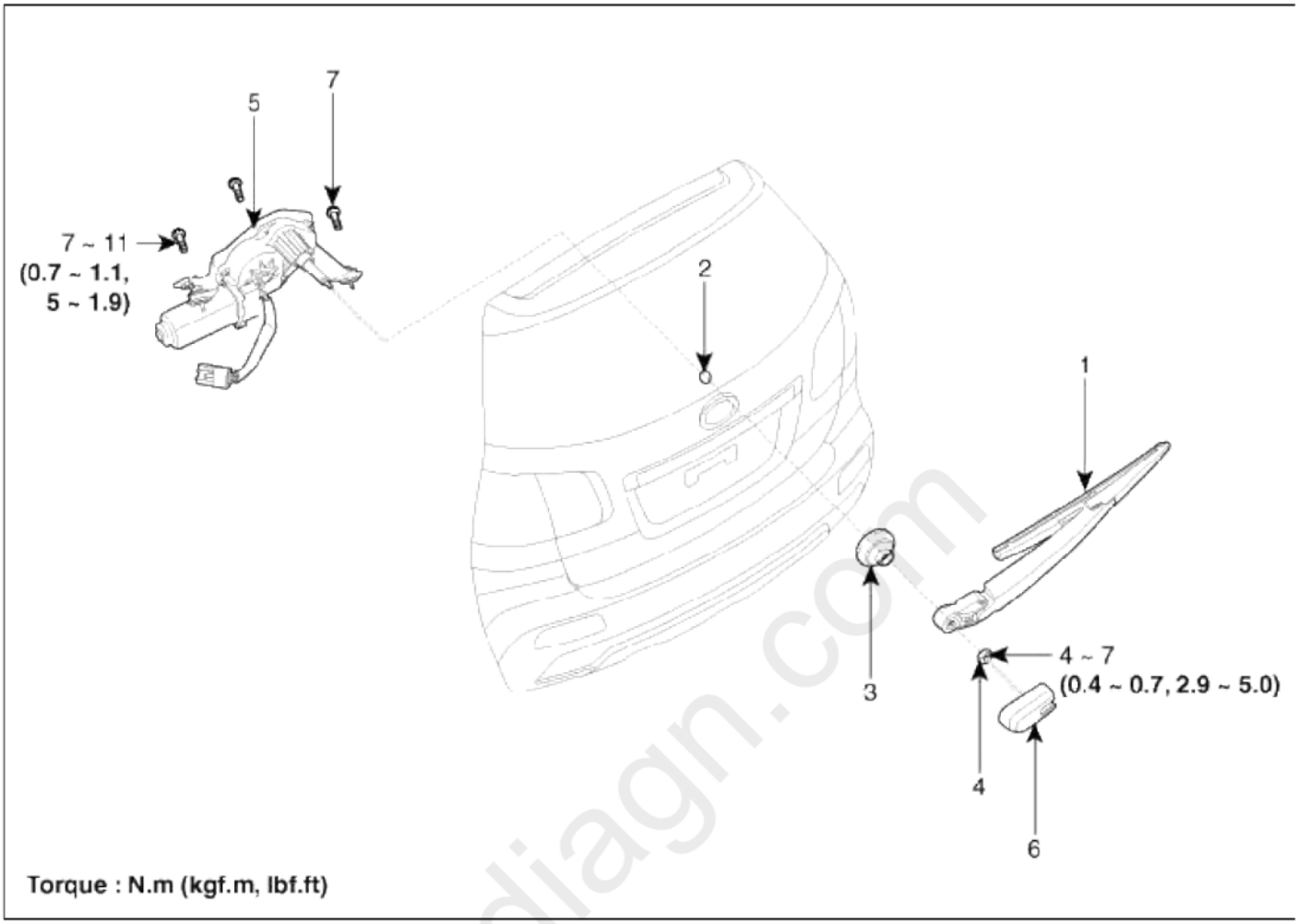
Tightening torque (Bolt)
3 ~ 5 Nm (0.3 ~ 0.5 kgf.m, 2.2 ~4.2 lbf.ft)

4. Reassemble the front bumper cover.

2cardiagn.com

Body Electrical System > Rear Wiper/Washer > Components and Components Location

Component Location



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

cardiagn.com

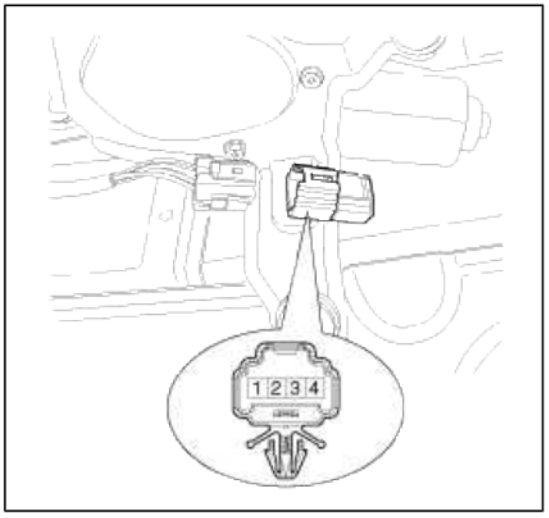
Body Electrical System > Rear Wiper/Washer > Rear Wiper Motor > Repair procedures

Inspection

Rear Wiper Motor

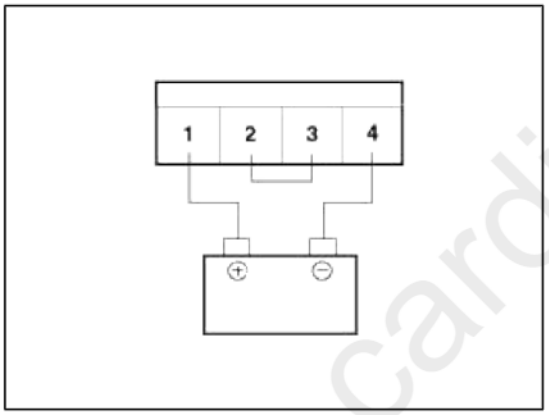
1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 3 and 4 respectively.

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



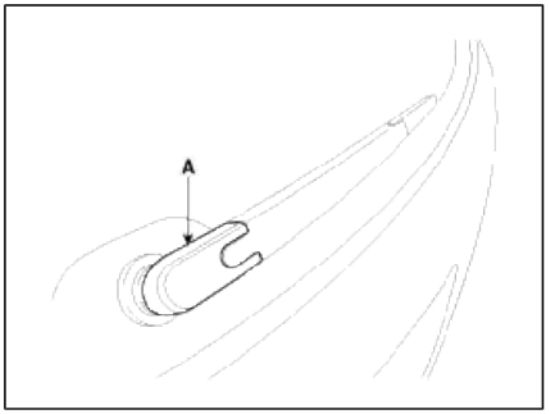
Automatic Stop Operation Check

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.



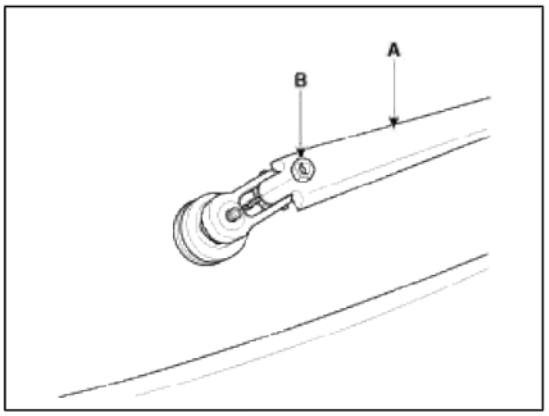
Removal

1. Detach the rear wiper cap (A).

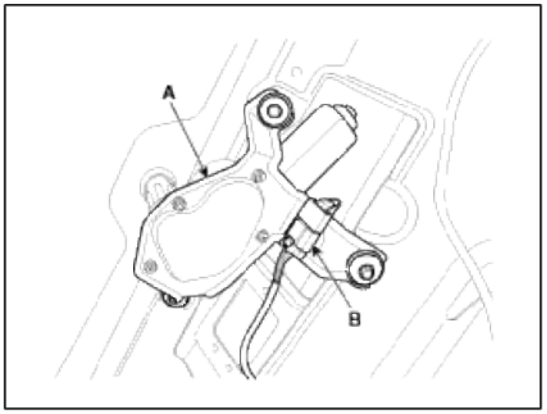


cardiagn.com

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 BD group - "Tailgate")
4. Disconnect the rear wiper motor connector (B) then remove the rear wiper motor (A) after loosening bolts (3EA).



Installation

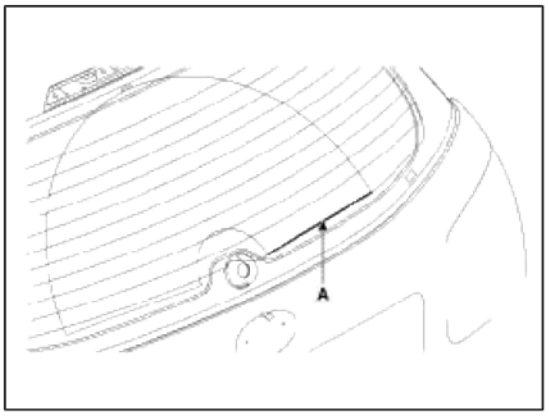
1. Install the rear wiper motor assembly.

Tightening torque Nut :
7~11 Nm (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.

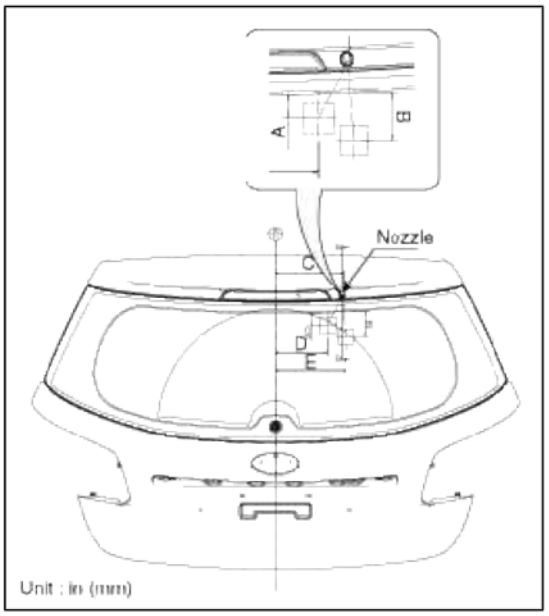
Tightening torque Nut (B) :
4~7 Nm (0.4~0.7 kgf.m, 2.9~5.0 lbf.ft)

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



cardiagn.com

5. Set the rear washer nozzle on the specified spray position.

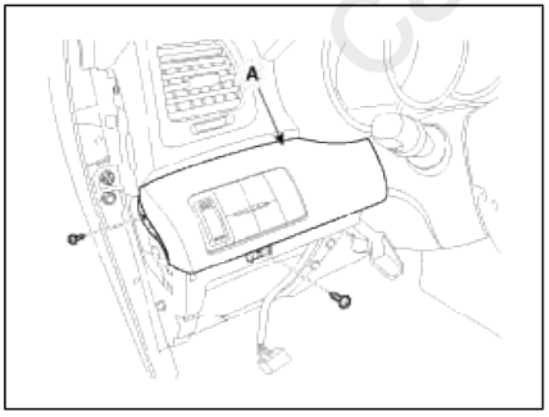


Specified position	Distance (in)	Distance (mm)
A	1.57	40
B	3.18	81
C	8.66	220
D	6.61	168
E	8.97	228

Body Electrical System > Rear Wiper/Washer > Rear Washer Switch > Repair procedures

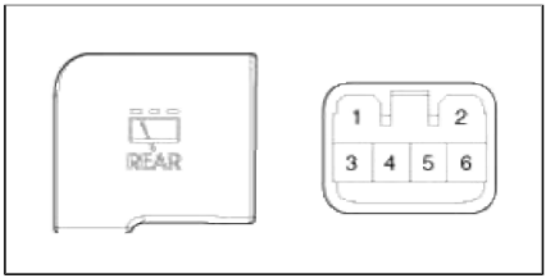
Inspection

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.



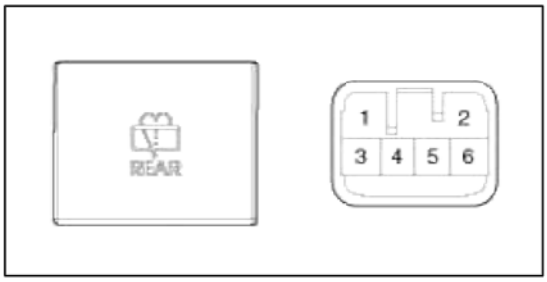
Rear Wiper Switch

cardiagn.com



Position / Terminal	ON	OFF	Remark
2			Illumination (-)
6			Illumination (+)
4			
1			

Rear Washer Switch



Position / Terminal	ON	OFF	Remark
2			Illumination (-)
6			Illumination (+)
4			
1			

Body Electrical System > Rear Wiper/Washer > Rear Washer Motor > Repair procedures

Inspection

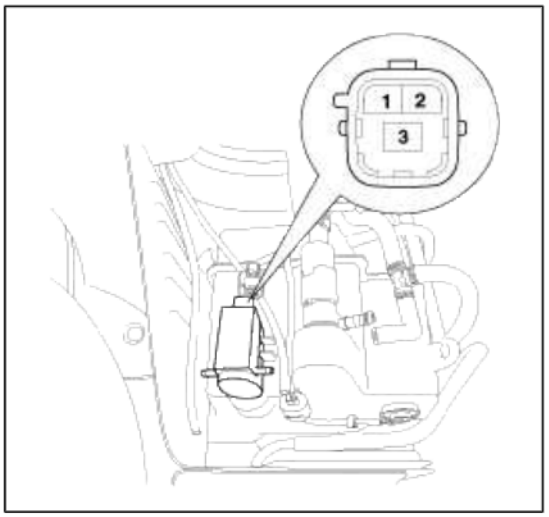
1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

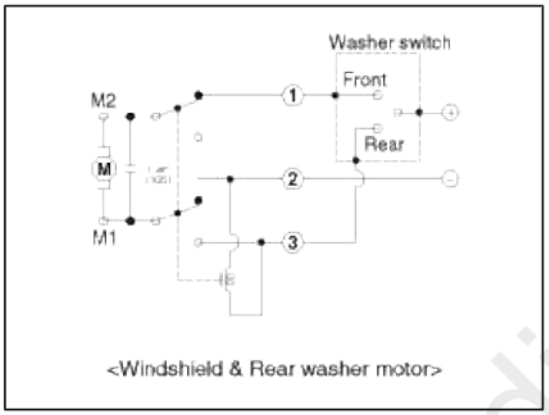
> NOTE
>
> Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Remove the front bumper cover.
   (Refer to BD group - "Front bumper")
3. Connect positive (+) and negative (-) battery cables to terminals 3 and 2 respectively to see that the washer motor runs and water is pumped.

cardiagn.com

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 (+)



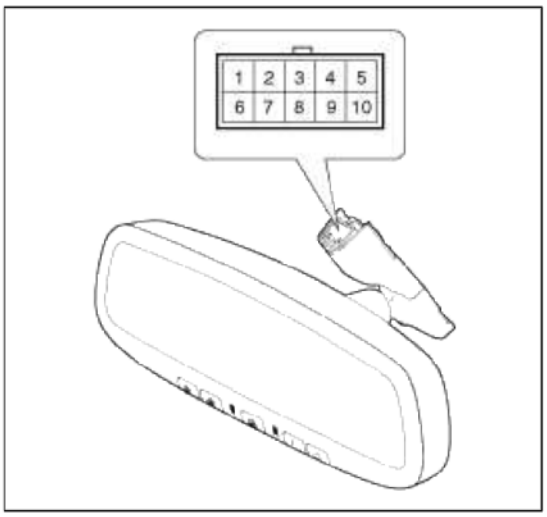


<Windshield & Rear washer motor>

Body Electrical System > Electro chromic Inside Rear View Mirror > Description and Operation

Description

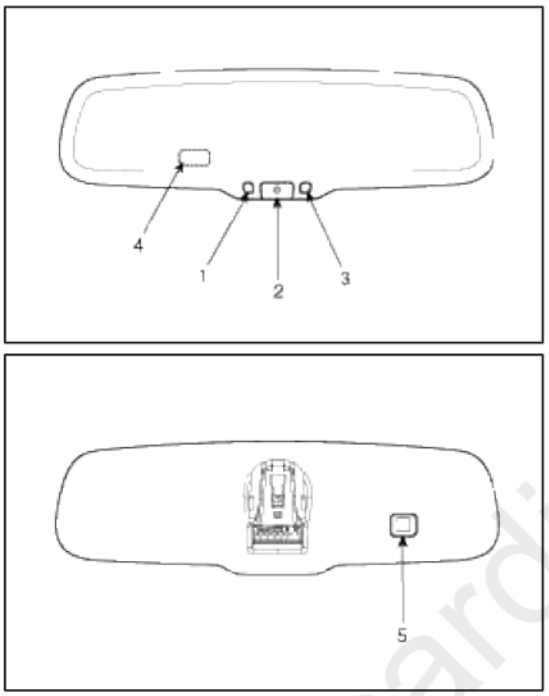
The ECM (Electro Chromatic inside rear view Mirror) is intended dim the reflecting light in the rear view mirror. The forward facing sensor detects brightness of the surroundings, while the rearward looking sensor is for the light from the rear. The strength of the light in the rear sensor is used by the mirror to adjust the shading. It ranges from 7 to 85%. When the reverse gear is engaged, it stops functioning.



cardiagn.com

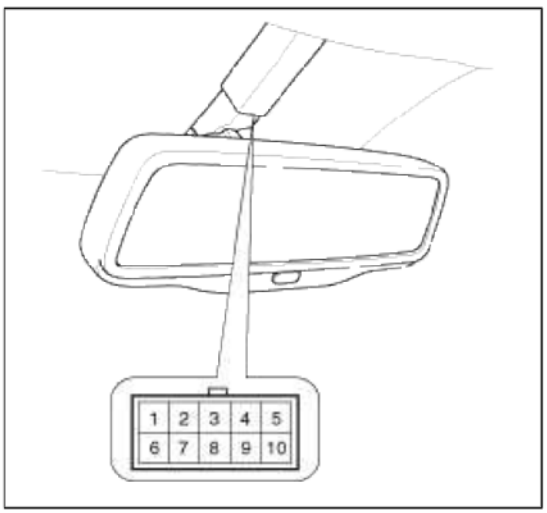
Pin	Description
6	Battery(+)
8	Mirror GND
9	Reverse signal
10	IGN power (+12V)

1. The forward facing sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
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 detected, the mirror stops functioning.
   (1. Status indicator LED, 2. Buttom, 3. Rear indicator, 4. Front light sensor, 5. Front light sensor)



Reverse Display Room Mirror

Description

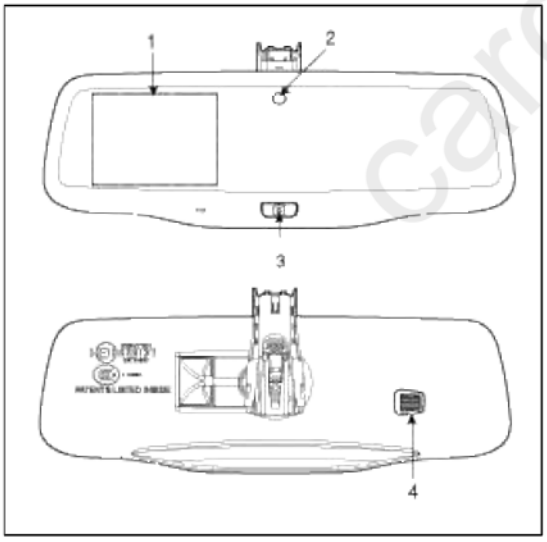


cardiagn.com

Pin	Description
1	Camera power (-)
2	-
3	Camera power (+)
4	Video signal (-)
5	Video signal (+)
6	-
7	-
8	Mirror GND
9	Reverse signal
10	IGN power (+12V)

The rear view camera system, located on the tailgate, provides a video image (which appears in the rear view mirror) of the area behind the vehicle. It adds assistance to the driver while reversing or reverse parking the vehicle. To use the back view camera system, place the transmission in R (Reverse); an image will display on the left portion of the rear view mirror. The area displayed on the screen may vary according to the vehicle orientation and/or road condition.

1. Rear camera display
2. Rearward looking sensor
3. Power button
4. Forward facing sensor



Use the side mirrors and back view mirror to get better coverage on both sides and rear of the vehicle. When shifting out of reverse and into any other gear, the image will remain on for a few seconds before it shuts off to assist in parking or trailer hookup.

The camera lens for the back view camera system is located on the tailgate, near the tailgate handle. Keep the lens clean so the video image remains clear and undistorted. Clean the lens with a soft, lint-free cloth and non-abrasive cleaner.

cardiagn.com

NOTE

If the back view camera system image is not clear or seems distorted, it may be covered with water droplets, snow, mud or any other substance. If this occurs, clean the camera lens before using the reverse camera system.

WARNING

The back view camera system is a reverse aid supplement device that still requires the driver to use it in conjunction with the back view mirror and the side mirrors for maximum coverage.

WARNING

Objects that are close to either corner of the bumper or under the bumper, might not be seen on the screen due to the limited coverage of the back view camera system.

WARNING

Backup as slow as possible since higher speeds might limit your reaction time to stop the vehicle.

WARNING

Do not use the back view camera system with the tailgate open.

If the back end of the vehicle is hit or damaged, then check with your authorized dealer to have your rear video system checked for proper coverage and operation.

Nighttime and dark area use

At night time or in dark areas, the back view camera system relies on the reverse lamp lighting to produce an image. Therefore it is necessary that both reverse lamps are operating in order to get a clear image in the dark. If either of the lamps are not operating, stop using the back view camera system, at least in the dark, until the lamp(s) are replaced and functioning.

Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicles 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 function 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-dimming function ON which is indicated by the green Status Indicator LED turning on.

NOTE

The mirror defaults to the "ON" position each time the vehicle is started.

Body Electrical System > Electro chromic Inside Rear View Mirror > Repair procedures

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.

NOTE

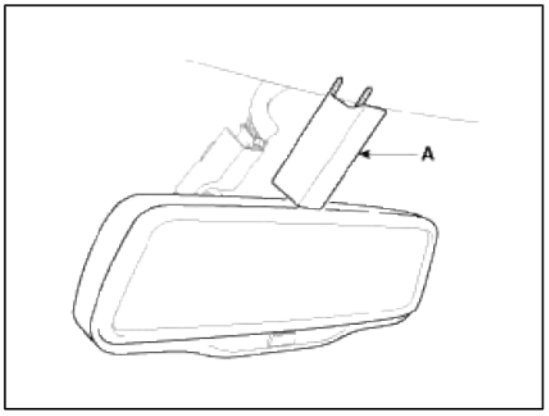
If this test is performed in daytime, the ECM may be darkened as soon as the forward facing sensor is covered.

cardiagn.com

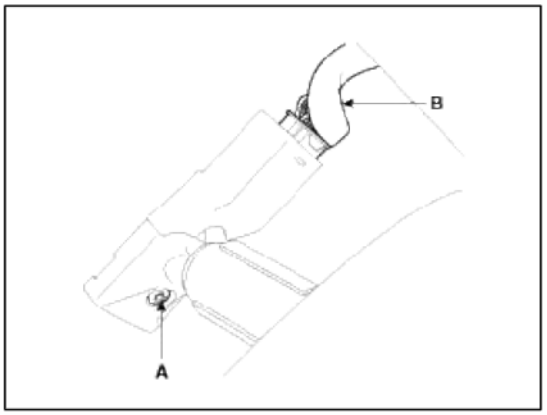
5. When the reverse gear is engaged, the ECM should not be darkened.
   When heading lights to both the forward facing and rearward looking sensors, the ECM should not be darkened.

Removal

1. Remove the mirror wiring cover (A).



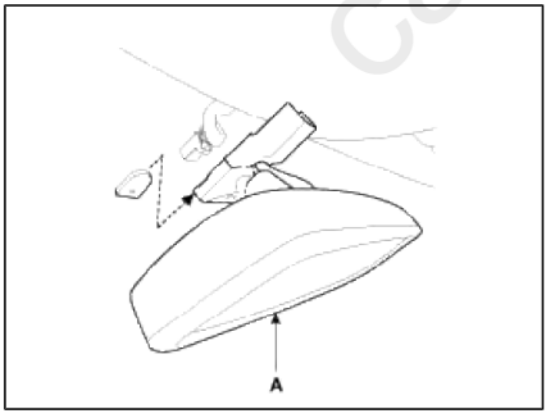
2. Remove the mirror mounting screw (A) and connector (B).



3. Remove the mirror (A) pulling up in the arrow direction.

NOTE

Make sure not to damage the mounting bracket when removing the mirror.



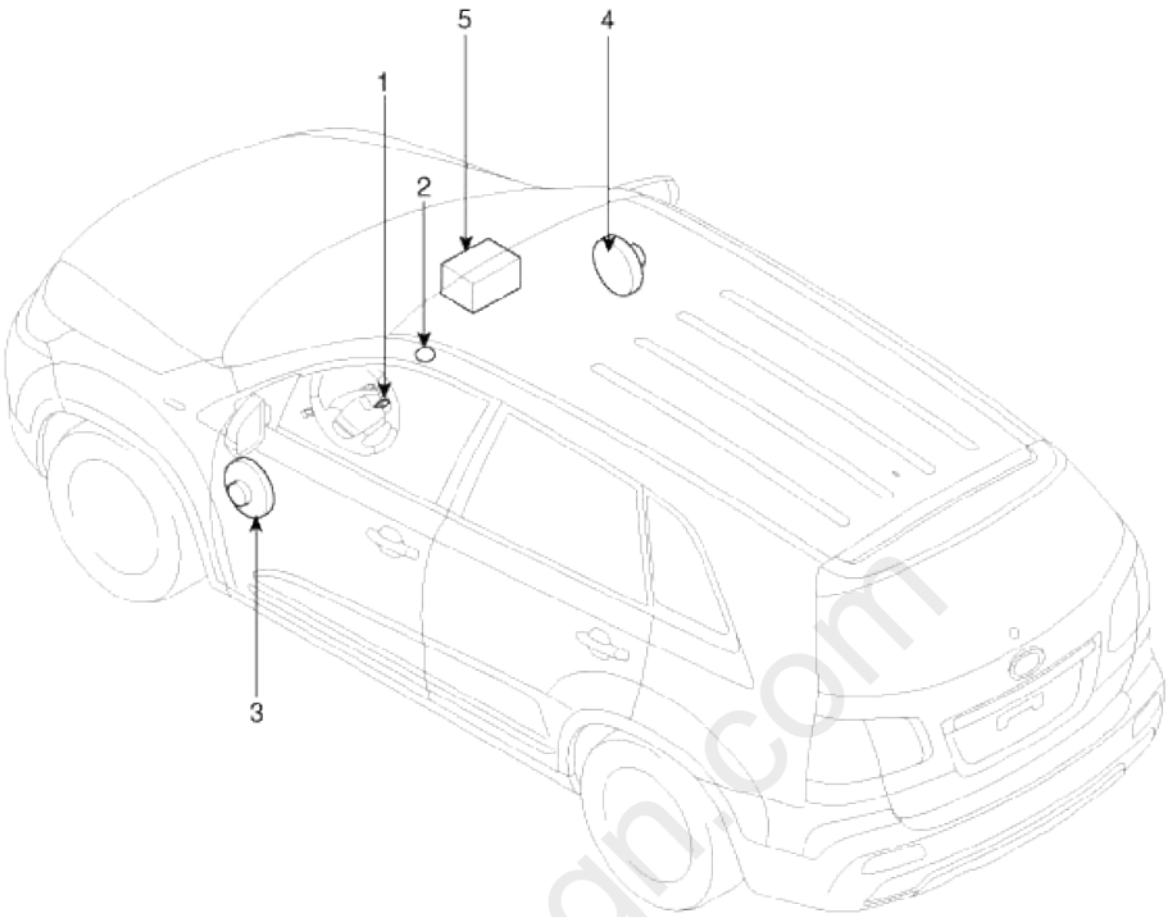
Installation

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 > Hands Free System > Components and Components Location

Components

cardiagn.com



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 > Hands Free System > Description and Operation

Function

Bluetooth Audio System

Bluetooth

You can use a Bluetooth device in your car to make a hands-free phone call or to stream music onto your in-car speakers (via this Head Unit). This Head Unit supports HFP, A2DP and AVRCP connection.

Advanced Audio Distribution Profile (A2DP)

This profile defines how high quality audio(stereo or mono) can be streamed from one device to another over a Bluetooth connection. For example: music streamed from a mobile phone to a wireless headset or caraudio.

Audio/Video Remote Control Profile (AVRCP)

This profile is designed to provide a standard interface to control TVs, Hi-fi equipment,etc. to allow a single remote control (or other device) to control all of the A/V equipment to which a user has access. It may be used inconcert with A2DP or VDP.

cardiagn.com

Hands-Free Profile (HFP)

This is commonly used to allow car handsfree kits to communicate with mobile phones in the car.

Notes for mobile phones

Some functions (e.g. starting of speech recognition) are not supported by all mobile phones. We cannot guarantee that all functions described will be supported by all mobile phones with Bluetooth.

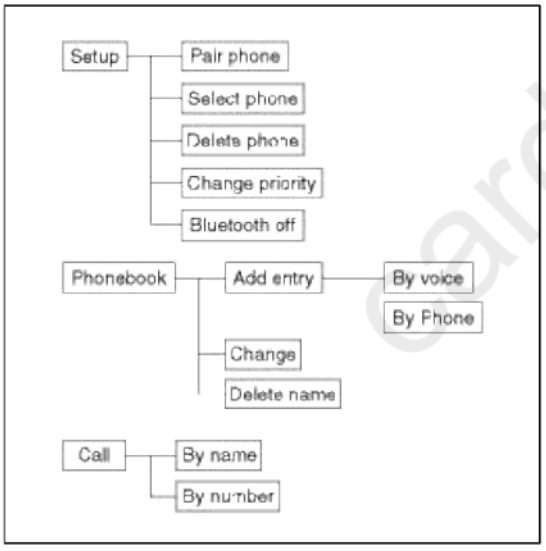
New device

This function allows you to add a new phone to the Head Units Bluetooth Device List. Maximum of 5 devices can be added to the list. If the list is full, the oldest device will be replaced by the newly added Bluetooth device, based on last pairing date.

Voice Recognition Activation

- The voice recognition engine containedin the Bluetooth System can be activatedin the following conditions :
  - Button Activation
  The voice recognition system will beactive when the button is pressed and after the sound of a Beep.
  - Active Listening
  The voice recognition system will beactive for a period of time when the Voice Recognition system has askedfor a customer response.
- The system can recognize single digits from zero to nine while number greaterthan ten will not be recognized.
- If the command is not recognized, the system will announce "Pardon" or Noinput voice signal from microphone. (Noresponse)
- The system shall cancel voice recogntionmode in following cases : When pressing the button and saying cancel following the beep. When not making a call and pressing the button. When voice recognition has failed 3 consecutive times.
- At any time if you say "help", the system will announce what commands are available.

Menu tree

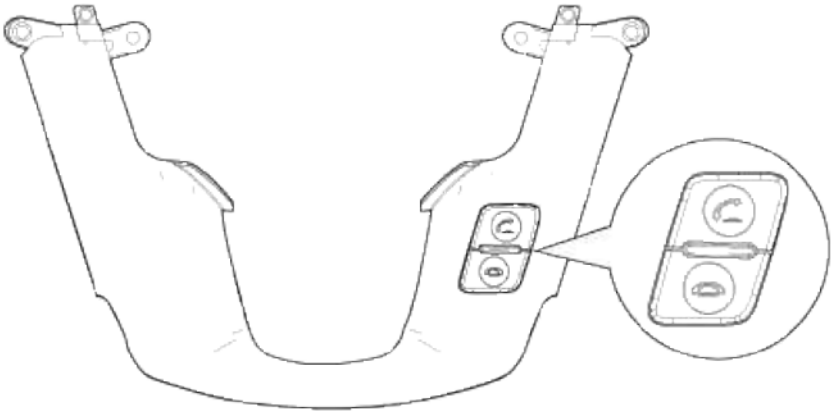


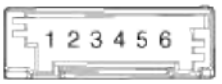
cardiagn.com

Body Electrical System > Hands Free System > Hands Free Switch > Components and Components Location

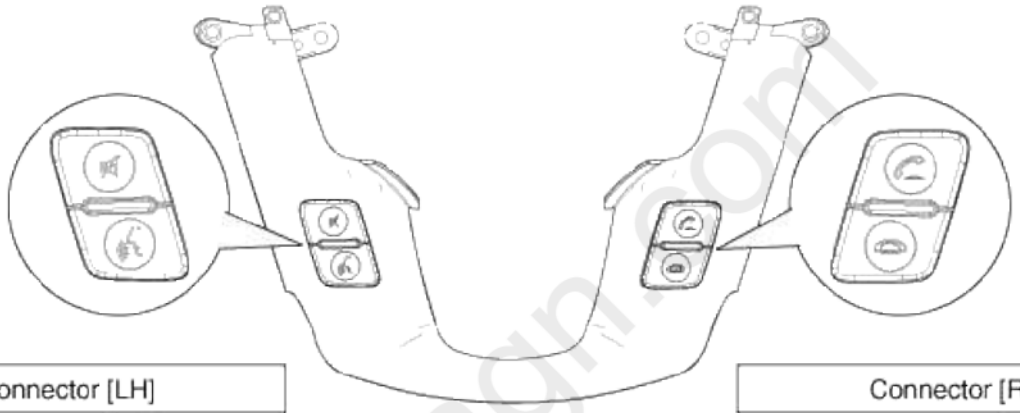
Component Location

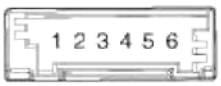
[Bluetooth]

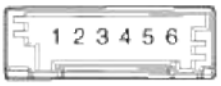


Connector [RH]	
	
No.	Hands free
1	Illumination (-)
2	-
3	Audio (-)
4	B/T input
5	Illumination (+)
6	-

[Bluetooth + Voice Recongnition]



Connector [LH]	
	
No.	Voice recongnition
1	Audio (-)
2	Illumination (+)
3	Voice input
4	Illumination (-)
5	Mute
6	-

Connector [RH]	
	
No.	Hands free
1	Illumination (-)
2	-
3	Audio (-)
4	B/T input
5	Illumination (+)
6	-

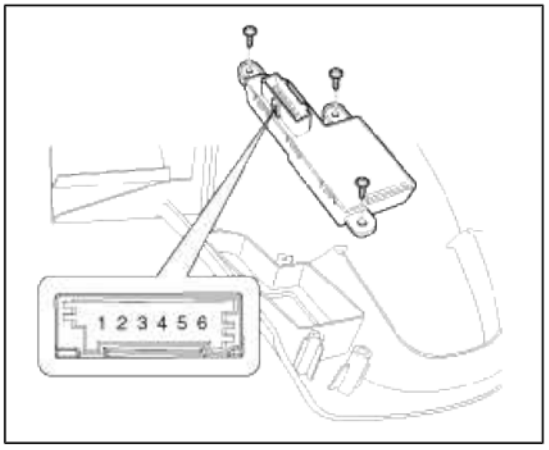
cardiagn.com

Body Electrical System > Hands Free System > Hands Free Switch > Repair procedures

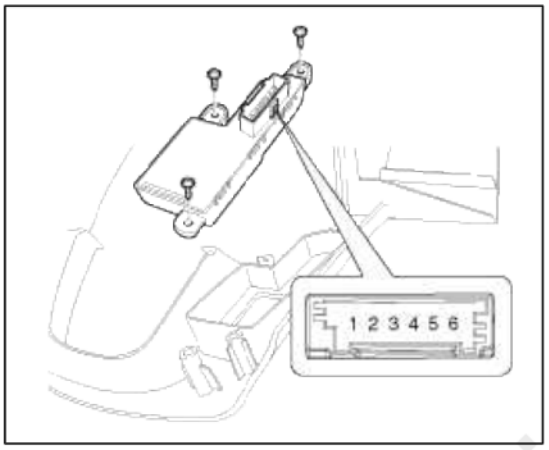
Inspection

1. Check the handsfree remote control switch for resistance between No.3 and No.4 terminals in each switch position.

[Call + Hang Up]



[Voice]



[Call + Hang Up]

Switch	Connector terminal	Resistance (±5%)	Output voltage (±0.16V)
Call	3 - 4 (Right)	40.91 kΩ	2.96V
Hang up	3 - 4 (Right)	18.91 kΩ	2.64V

[Voice]

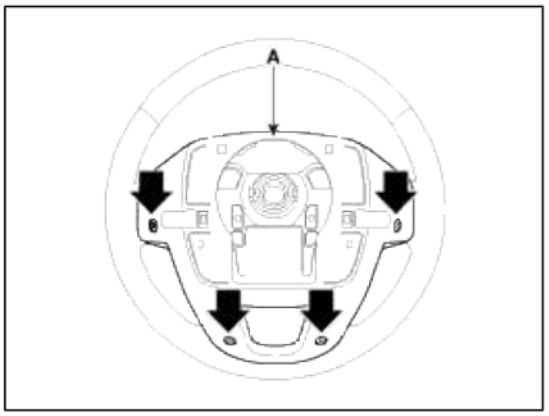
Switch	Connector terminal	Resistance (±5%)	Output voltage (±0.22V)
Voice	1 - 3 (Left)	10.71 kΩ	2.29V

Removal

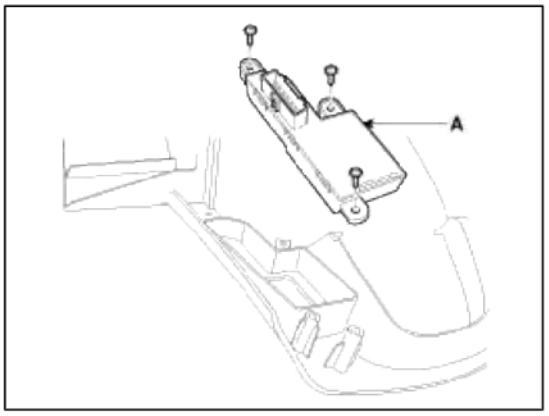
1. Remove the driver airbag module.
   (Refer to the RT group - "Airbag module")
2. Remove the steering wheel.
   (Refer to the ST group - "Steering column and shaft")

cardiagn.com

3. Remove the steering wheel rear cover (A) after loosening the screws.



4. Remove the handsfree remote switch (A) after loosening the screws.



Installation

1. Install the handsfree remote switch to the steering wheel bezel.
2. Install the steering wheel and bezel.
3. Reconnect the handsfree remote control switch connector and airbag connectors.

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

4. Install the driver airbag module.

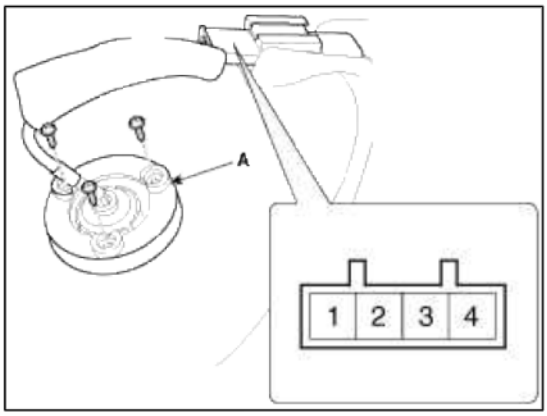
Body Electrical System > Hands Free System > Hands Free Mic > Repair procedures

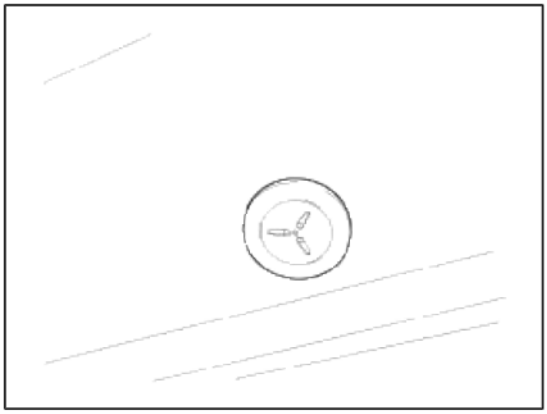
Inspection

1. Disconnect the negative(-) battery terminal.
2. Remove the roof trim.
   (Refer to the BD group - "Roof trim")

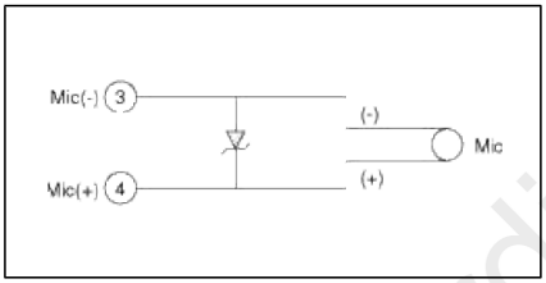
cardiagn.com

3. Remove the hands free mic (A) after loosening the connector and screws (3EA) from loof top.





4. Check the continuity of Mic between terminals.



Body Electrical System > Hands Free System > Troubleshooting

Troubleshooting

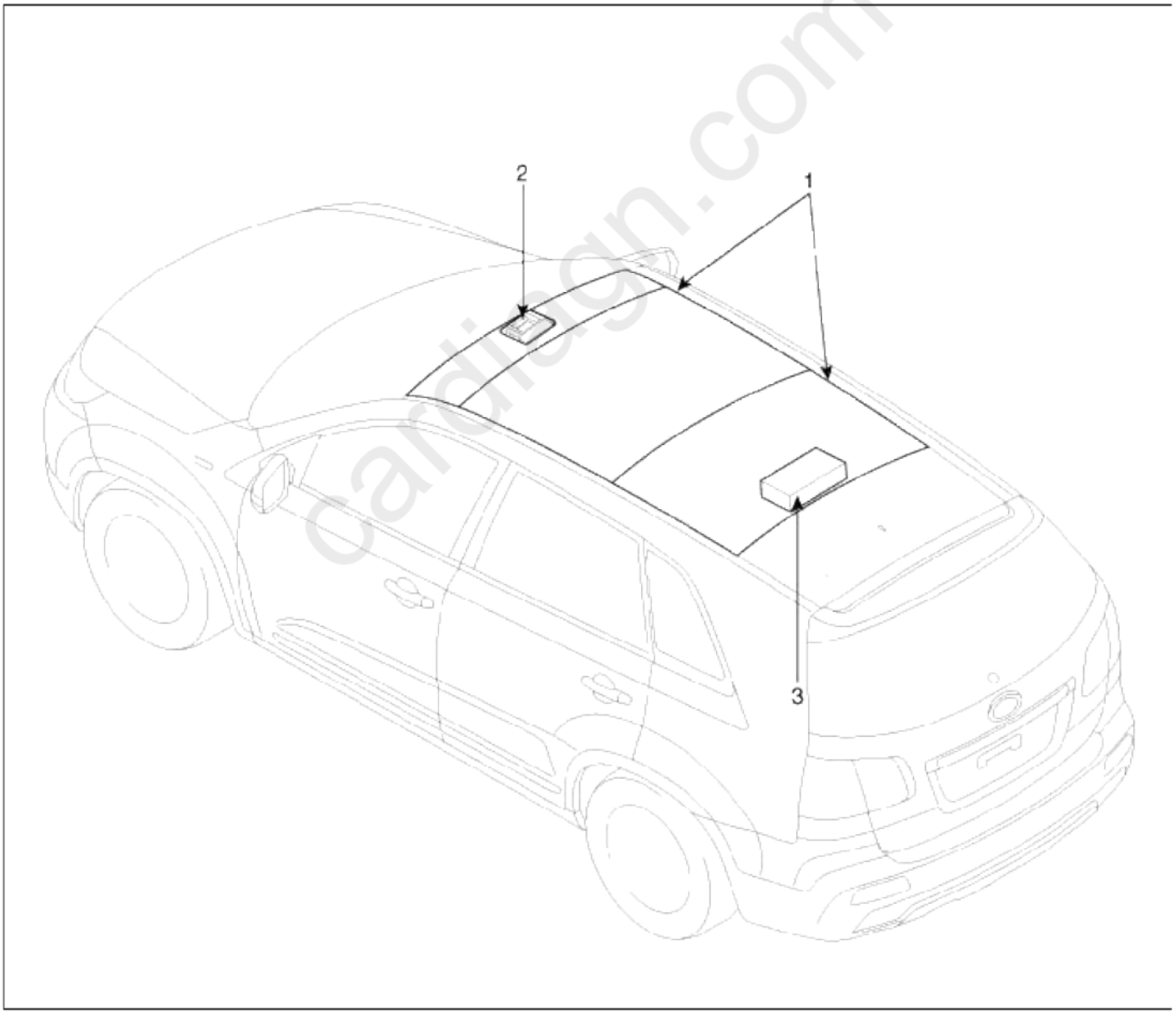
Problem	Possible cause	Solution
Not pairing	Bluetooth device of Car is not discoverable mode	Enter Bluetooth pairing (searching) mode
	User's phone is Bluetooth off mode	User's phone set Bluetooth on
	Making an attempt pairing others bluetooth system	Check Bluetooth device name and address (12 word) to attempt paring Ex) 000B24FFF123
	Pass key error	Input the passkey displayed on the audio screen 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	Retry pairing

cardiagn.com

	Bluetooth device to connect	
	Bluetooth system cannot communicate with the phone.	Waiting 1minute then Retry connection or phone 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 > Panoramaroof > Components and Components Location

Component Location

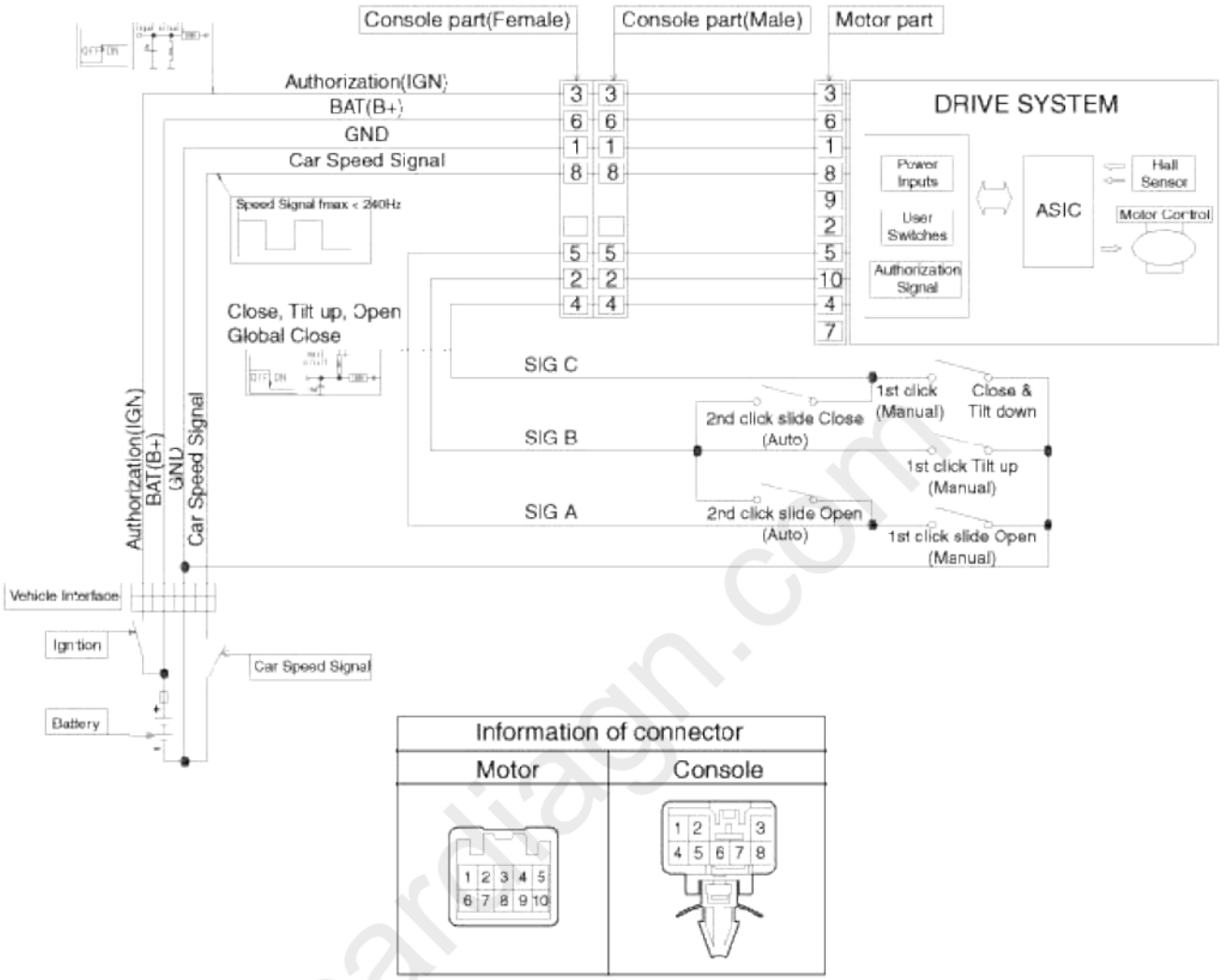


1. Panoramaroof 2. Panoramaroof switch	3. Panoramaroof motor & controller

cardiagn.com

Body Electrical System > Panoramaroof > Schematic Diagrams

Circuit Diagram



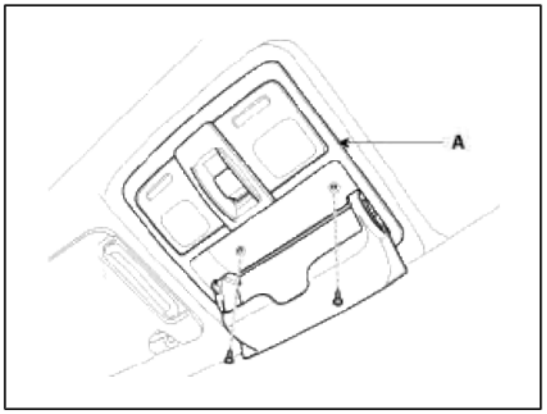
Information of connector		
No	Motor	Console
1	GND	GND
2	-	SIG B
3	IG2	IG2
4	SIG C	SIG C
5	SIG A	SIG A
6	B+	B+
7	-	-
8	Car speed	Car speed
9	-	-
10	SIG B	-

Logic table				
Function		SIG A	SIG B	SIG C
Slide open	MANUAL	ON	OFF	OFF
	AUTO	ON	ON	OFF
Slide close	MANUAL	OFF	OFF	ON
	AUTO	OFF	ON	ON
Tilt up	MANUAL	OFF	ON	OFF
Tilt down	MANUAL	OFF	OFF	ON

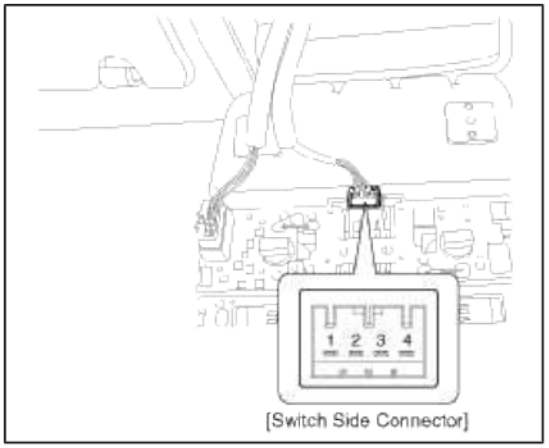
Body Electrical System > Panoramaroof > Panoramaroof Switch > Repair procedures

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 (4P) and Map lamp connector (6P), and then remove the overhead console lamp (A).



3. Check for continuity between the terminals. If the continuity is not as specified, replace the panoramaroof switch.



Terminal / Position	4	1	2	3
Manual OPEN	○			○
Auto OPEN	○		○	○
Manual CLOSE, Manual tilt DOWN		○		○
Auto CLOSE		○	○	○
Manual tilt UP			○	○

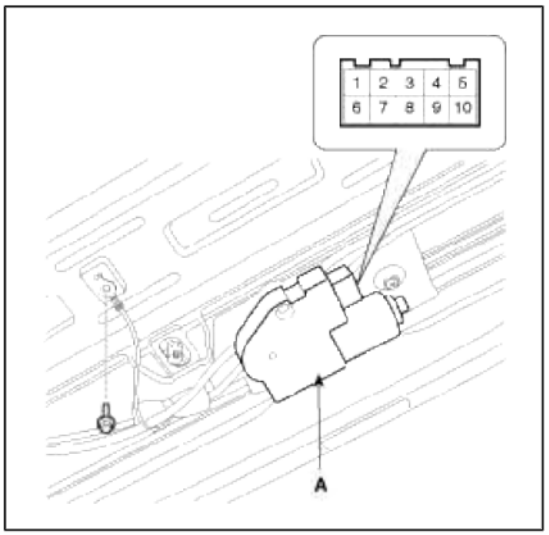
cardiagn.com

Body Electrical System > Panoramaroof > Panoramaroof Motor > Repair procedures

Replacement

1. Disconnect the negative (-) battery terminal.

2. Remove the overhead console then remove the panoramaroof motor mounting screws (3EA). And then remove the panoramaroof motor (A) after disconnecting the connector (10 Pin).



3. Ground the terminals as below table, and check that the panoramaroof unit operates as below table.

Position \ Terminal	6	4	5	10
Manual OPEN	⊕		⊖	
Auto OPEN	⊕		⊖	⊖
Manual CLOSE, Manual tilt DOWN	⊕	⊖		
Auto CLOSE	⊕	⊖		⊖
Manual tilt UP	⊕			⊖

4. Make these input tests at the motor connector of panoramaroof harness
if any test indicates a problem, find and correct the cause, then recheck the system.
If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test : Desired result
3	IG2 ON	Check for voltage to ground : There should be battery voltage
1	Under all conditions	Check for continuity to ground : There should be continuity.
6	Under all conditions	Check for voltage to ground : There should be battery voltage.

5. Make these input tests at the console connector of panoramaroof harness
if any test indicates a problem, find and correct the cause, then recheck the system.
If all the input tests prove OK, the sunroof motor must be faulty; replace it.

Terminal	Test condition	Test : Desired result
3	IG2 ON	Check for voltage to ground :
		There should be battery voltage
1	Under all conditions	Check for continuity to ground :
		There should be continuity.
2	Under all conditions	Check for voltage to ground :
		There should be battery voltage.

cardiagn.com

Resetting The Panoramaroof

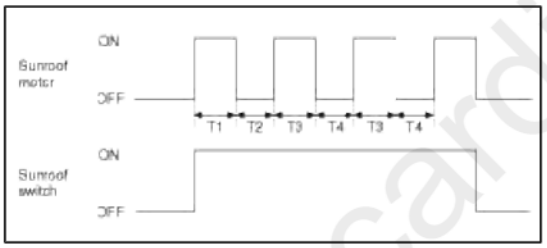
Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the panoramaroof, you have to reset your panoramaroof system as follows :

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.
5. Press and hold the CLOSE button once again until the sunroof do as follows;
   A. Tilt → Slide Open → Slide 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 controls the 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 ± 2sec.)
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 motor is increased.
   B. The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

Body Electrical System > Lighting System > Specifications

Specifications

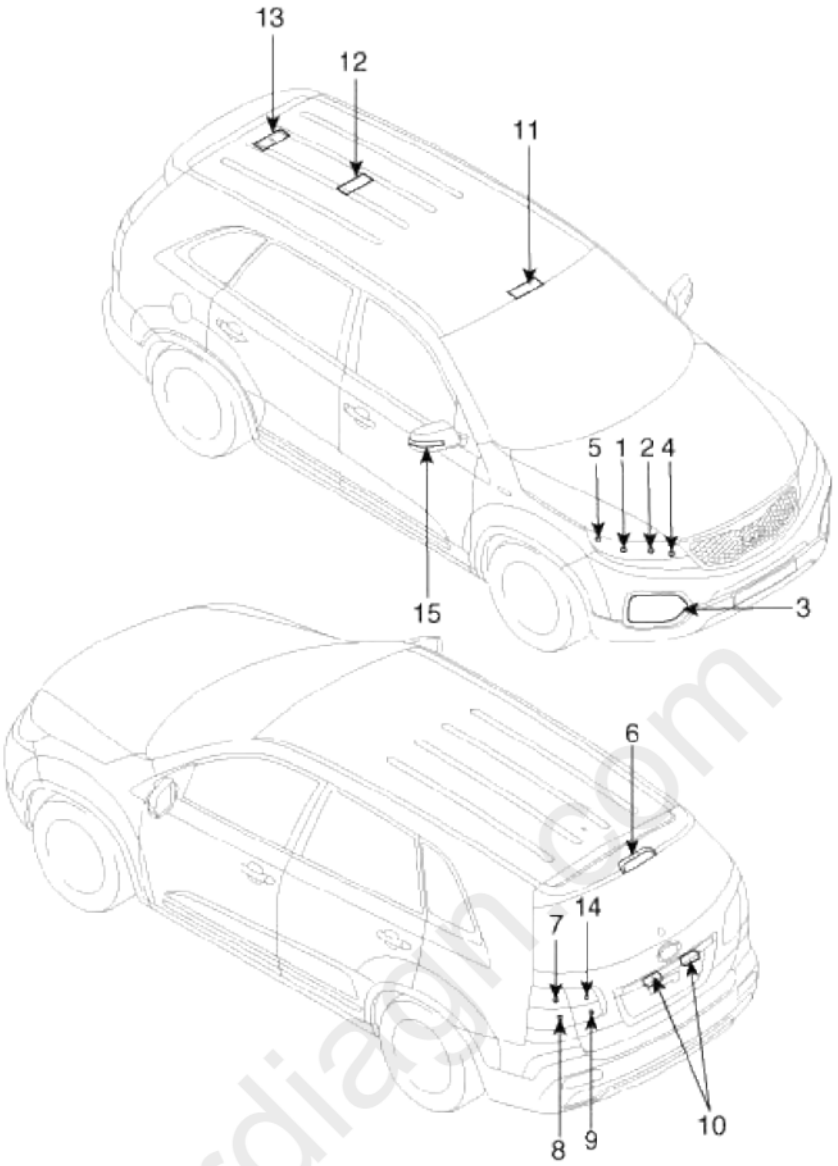
cardiagn.com

Items		Bulb Wattage (W)
Front	Head lamp (High)	55
	Head lamp (Low)	55
	Front turn signal lamp	28
	Front position lamp	8
	Front fog lamp	27
	Turn signal lamp (Door mirror)	LED
Rear	Rear stop/tail lamp	28/8
	Rear stop/tail lamp (LED Option)	LED
	Back up lamp	16
	Rear turn signal lamp	27
	License plate lamp	5
	High mounted stop lamp	LED
Room	Room lamp (Standard/RSE)	10
	Room lamp (Panoramaroof)	8
	Overhead console lamp	6 x 2
	Luggage room lamp	10
	Door mood lamp	LED

Body Electrical System > Lighting System > Components and Components Location

Component Location

cardiagn.com

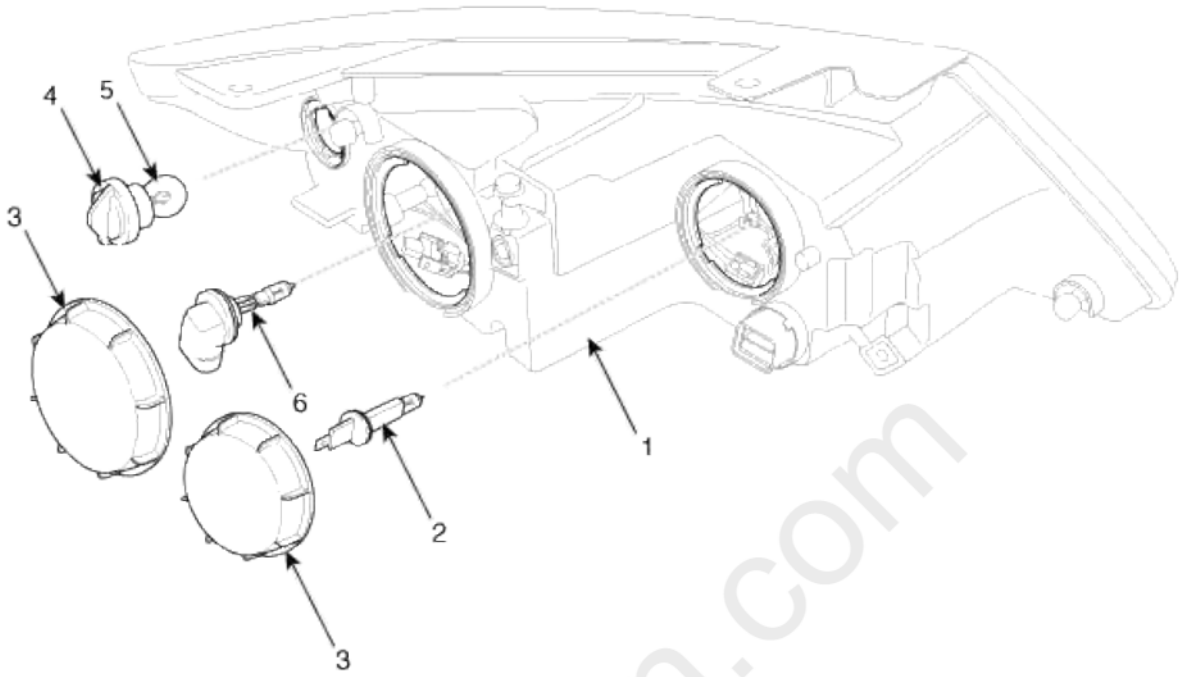


1. Head lamp (Low)	9. Back up lamp
2. Head lamp (High)	10. License plate lamp
3. Front fog lamp	11. Overhead console lamp
4. Position lamp/ Turn signal lamp	12. Room lamp
5. Front turn signal lamp	13. Luggage room lamp
6. High mounting stop lamp	14. Tail lamp (Bulb), Tail lamp/ Stop lamp (LED)
7. Tail/ stop lamp	
8. Rear turn signal lamp	15. Turn signal lamp (Door mirror)

Body Electrical System > Lighting System > Head Lamps > Components and Components Location

Component

cardiagn.com



1. Head lamp assembly lens and housing 2. Head lamp high beam bulb 3. Dust cover	4. Bulb socket 5. Turn signal lamp/ Tail lamp bulb 6. Head lamp low bean bulb

cardiagn.com

Body Electrical System > Lighting System > Head Lamps > Repair procedures

Removal

CAUTION

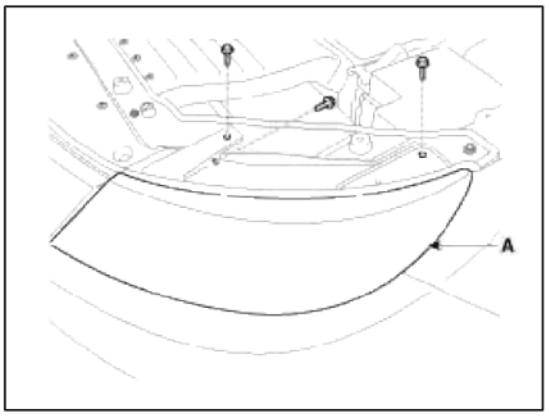
Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

NOTE

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.

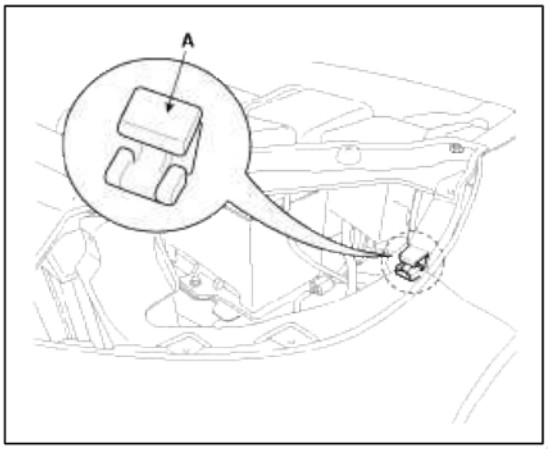
1. Disconnect the negative (-) battery terminal.

2. Loosen the mounting bolts (3EA) of head lamp. Remove the head lamp assembly (A) after disconnecting the lamp connectors.



NOTE

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.

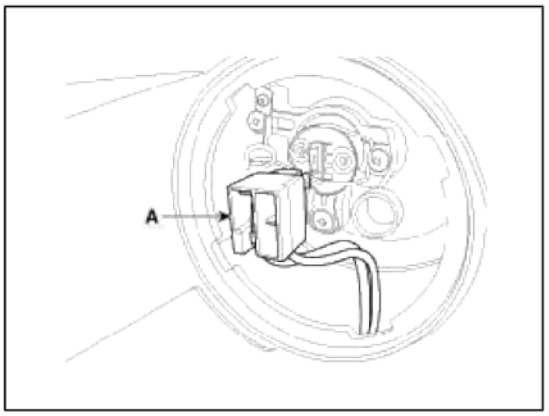
Replacement

Bulb (high)

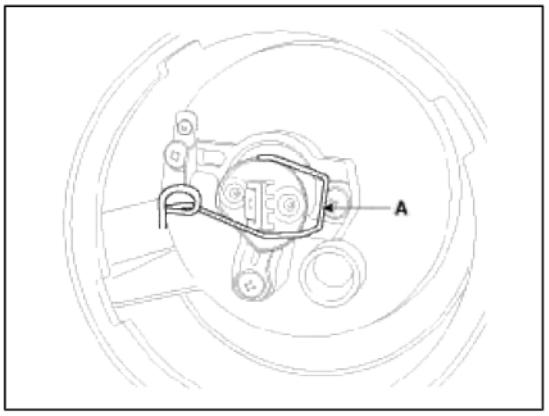
1. Turn the head lamp switch off.
2. Disconnect the power connector from the lamp.
3. Remove the lamp assembly.
4. Remove the dust cover.

cardiagn.com

5. Remove the connector (A) from the bulb.



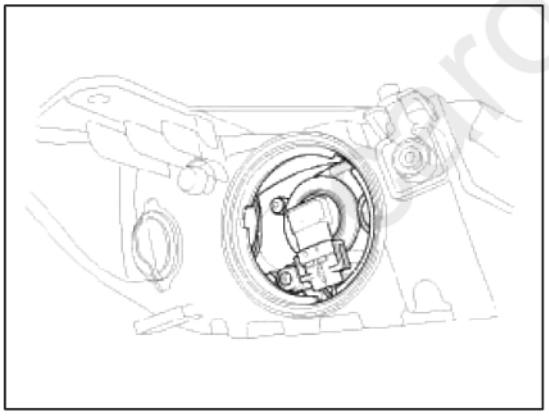
6. Remove the bulb clip (A) and bulb from the lamp assembly.



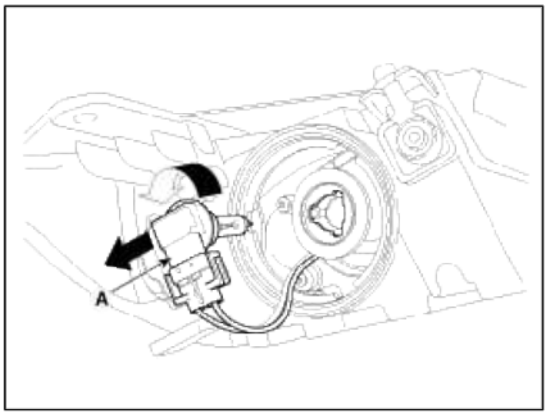
7. Installation is the reverse of removal.

Bulb (low)

1. Turn the head lamp switch off.
2. Disconnect the power connector from the lamp.
3. Remove the lamp assembly
4. Remove the dust cover.

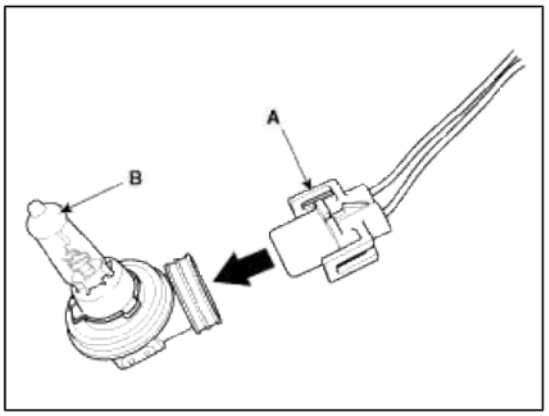


5. Remove the head lamp low bulb (A) by turning in the counterclockswise direction.



ordiagn.com

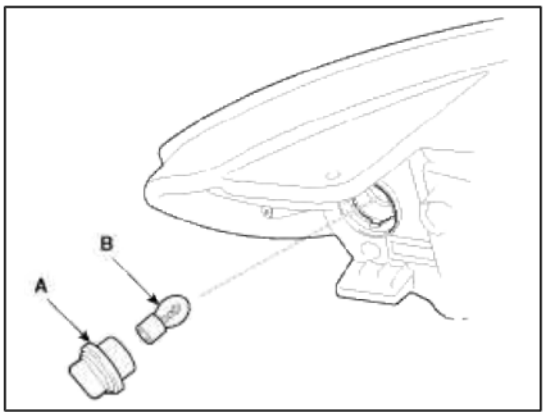
6. Remove the bulb soket (A) and bulb (B).



7. Installation is the reverse of removal.

Turn signal lamp

1. Turn the head lamp switch off.
2. Remove the lamp assembly
3. Remove the bulb socket (A) and bulb (B) from the lamp assembly.



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.

NOTE

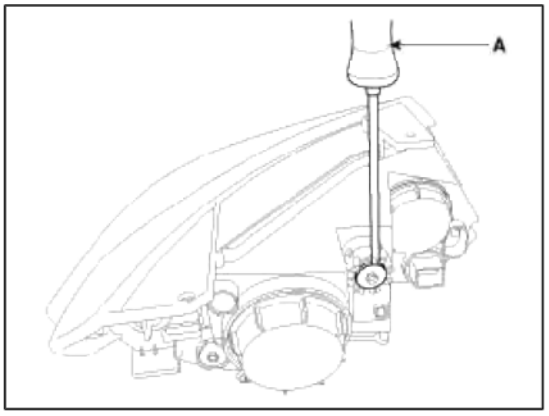
If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust so as to meet those requirements.

Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
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 line passing through center of head lamps) on the screen.

cardiagn.com

4. With the head lamp and battery in normal condition, aim the head lamps so the brightest portion falls on the vertical lines.
   Make vertical (A) adjustments to the lower beam using the adjusting wheel.

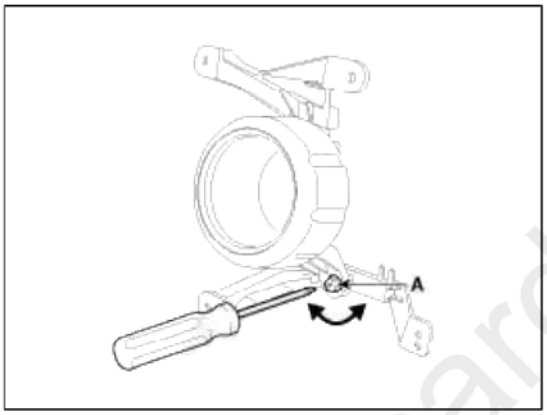


Front Fog Lamp Aiming

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).

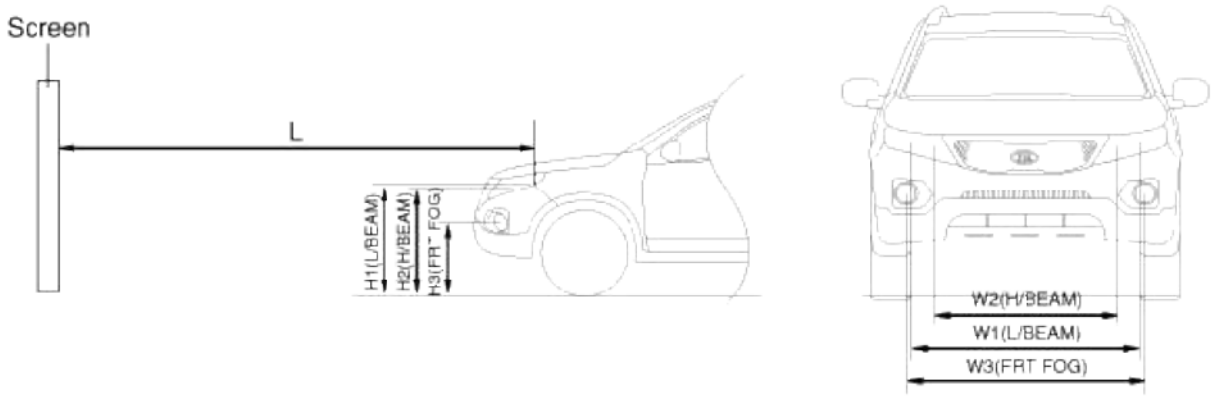
NOTE

- When aiming the front fog lamp, the fog lamp can be adjusted in front of vehicle without removing the front bumper.
- The adjusting gear is located inside the radiator grill.



Head Lamp And Fog Lamp Aiming Point

cardiagn.com

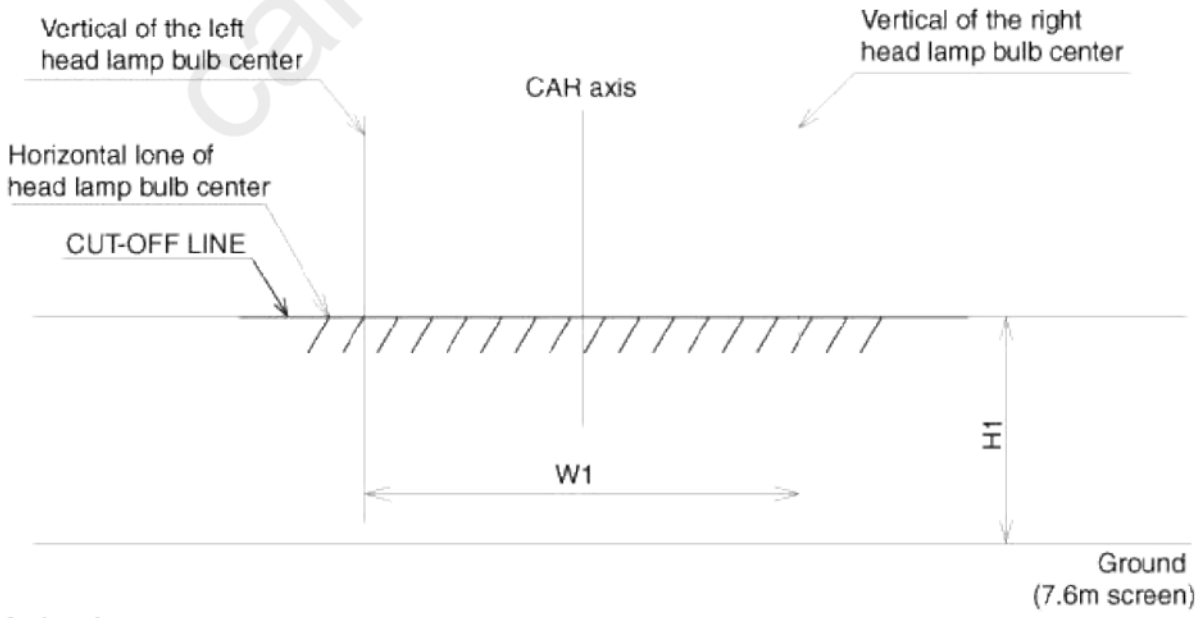


H1 : Height between the head lamp bulb center and ground (Low beam)
H2 : Height between the head lamp bulb center and ground (High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low beam)
W2 : Distance between the two head lamp bulbs 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	36.4(927)	35.4(901)	24.0(611)	53.7(1,366)	43.2(1,098)	56.2(1,428)	118(3,000)
With driver	36.2(920)	35.2(895)	23.7(604)				

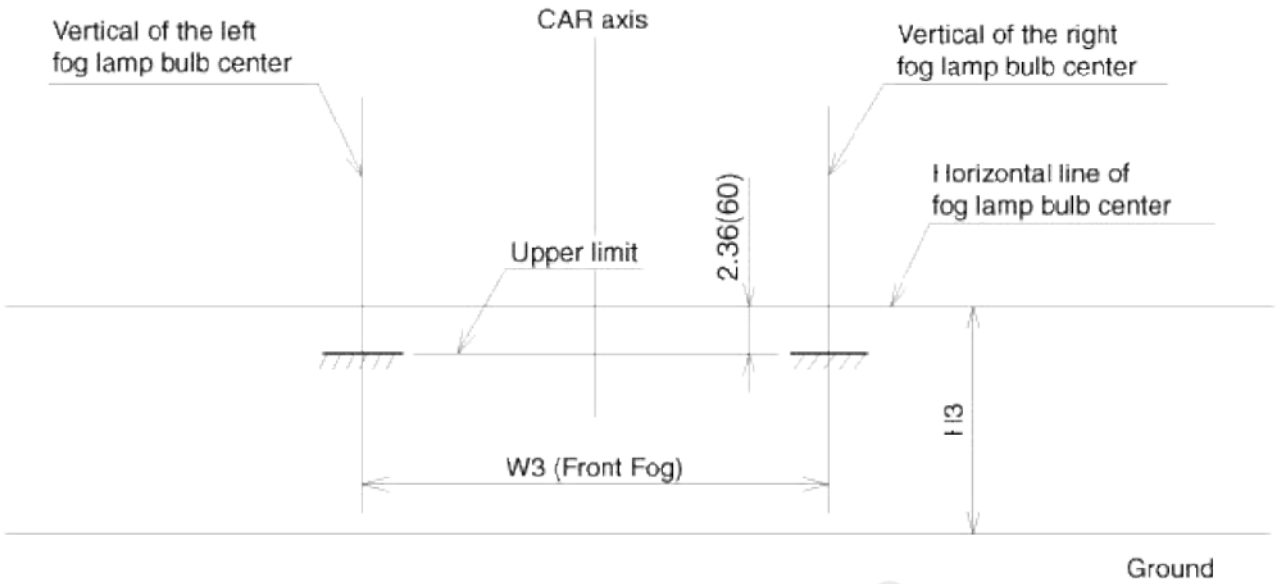
1. General Type (VOR)
   A. Turn the low beam on without driver aboard.
   B. The cut-off line should be projected in the allowable range (shaded region) shown in the picture.
   C. If head lamp leveling device is equipped, adjust the head lamp leveling device switch with 0 positions.



Unit : in.(mm)

cardiagn.com

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.

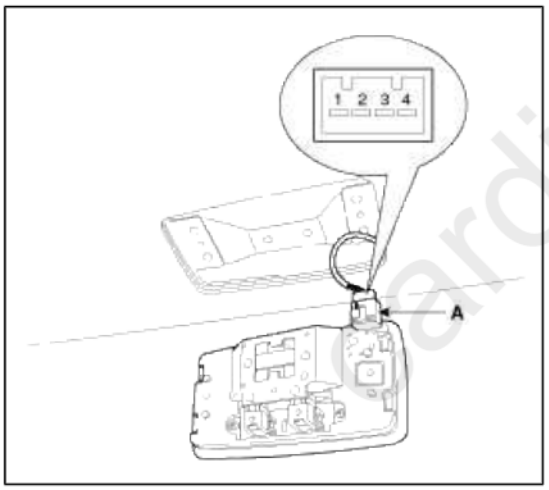


L : 118 in (3000mm)
Unit : in.(mm)

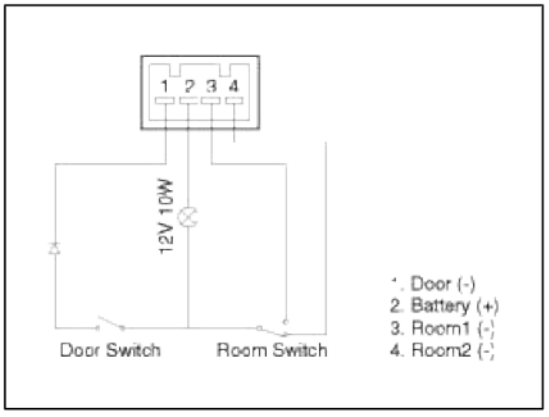
Body Electrical System > Lighting System > Room Lamp > Repair procedures

Inspection

1. Remove the room lamp assembly then check for continuity between terminals.



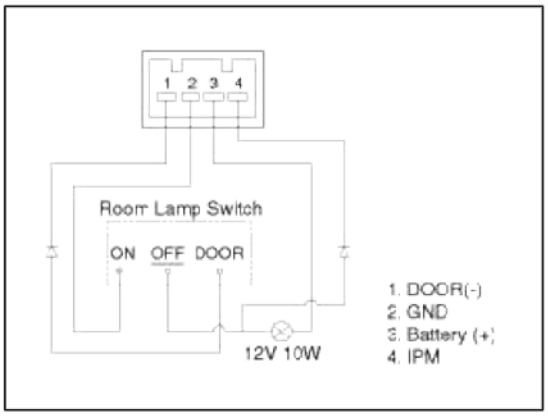
[RSE]



cardiagn.com

Terminal / Position	1	2	3	4
DOOR				
ON				
OFF				

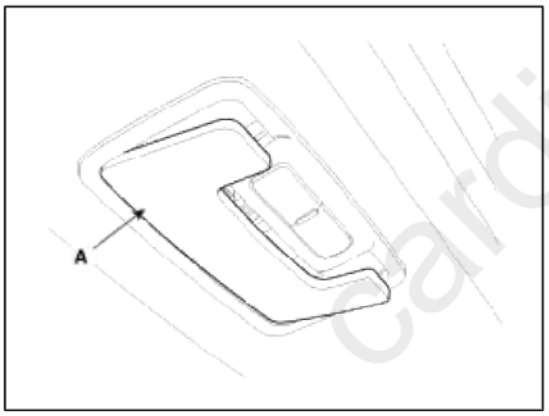
[General]



Terminal / Position	1	2	3	4
DOOR				
ON				
OFF				

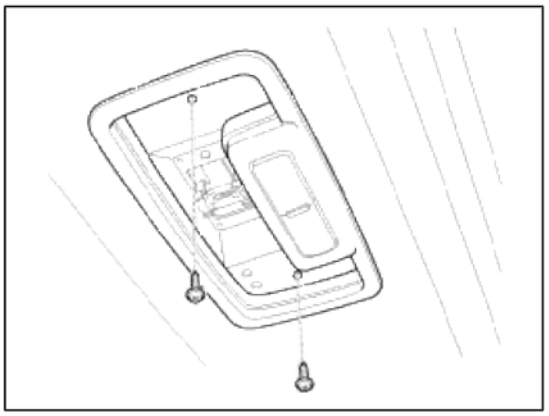
Removal

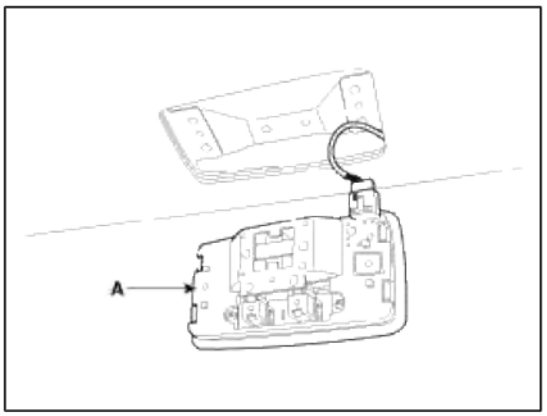
1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver then replace the bulb.



cardiagn.com

3. Loosen the fixing screw (2EA) and disconnect the 4P connector. And then remove the room lamp assembly (A).





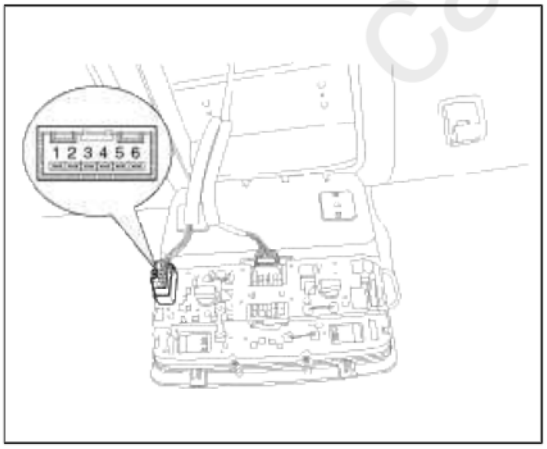
Installation

1. Install the room lamp assembly after connecting the lamp connector.
2. Install the lamp lens after assembling the bulb.

Body Electrical System > Lighting System > Overhead Console Lamp > Repair procedures

Inspection

Remove the overhead console lamp assembly then check for continuity between terminals. If the continuity is not as specified, replace the map lamp switch.

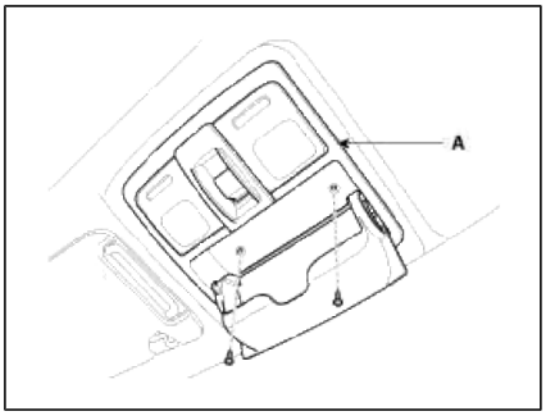


cardiagn.com

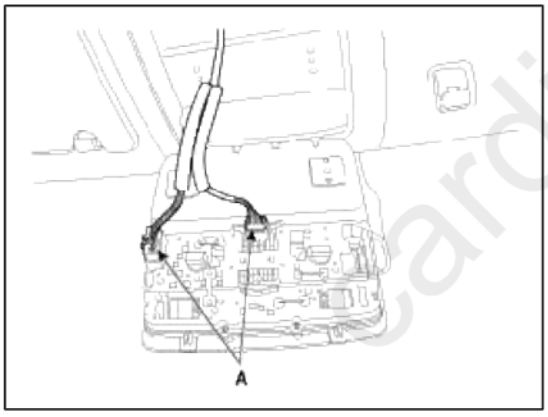
Item / Position / Terminal	Map lamp switch			
	Left		Right	
	ON	OFF	ON	OFF
1	○		○	
	⊕		⊕	
5	○		○	

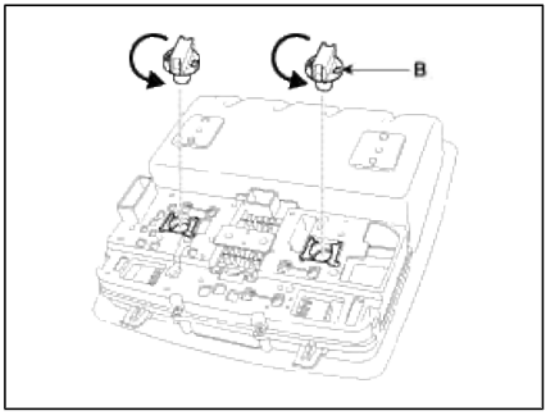
Removal

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 map lamp switch connector (A).





4. If the bulb only should be replaced, replace the bulb after removing the lens.

Installation

1. Install the overhead console lamp after connecting the sunroof switch connector and lamp connector.

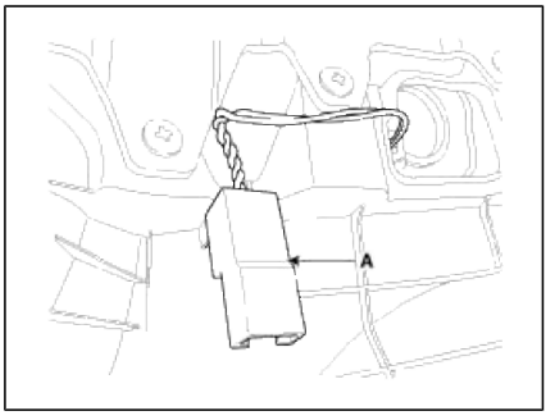
cardiagn.com

2. Install the lens after tightening 2 screws.

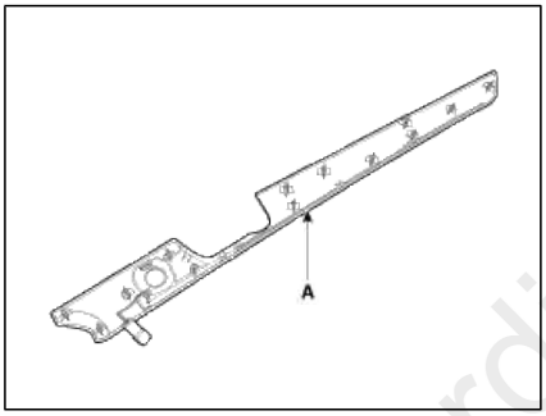
Body Electrical System > Lighting System > Door Mood Lamp > Repair procedures

Removal

1. Disconnect the negative battery terminal.
2. Remove the front door trim.
   (Refer to BD group - "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.

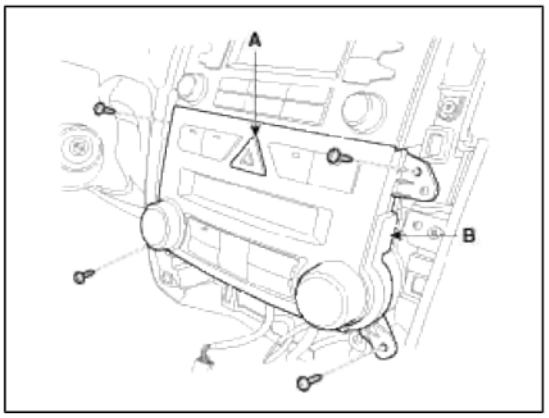
Body Electrical System > Lighting System > Hazard Lamp Switch > Repair procedures

Removal

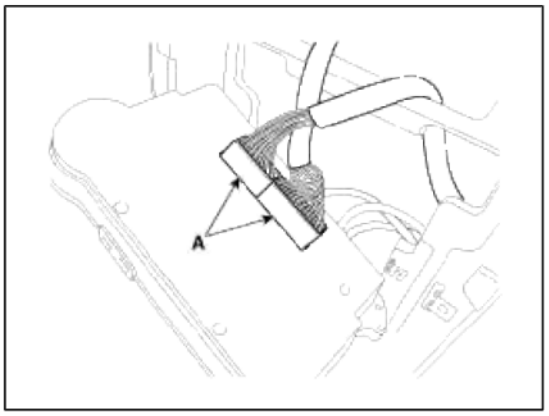
1. Disconnect the negative (-) battery terminal.
2. Remove the front seat heater switch module.
   (Refer to BD group - "Crash pad")

cardiagn.com

3. Remove the heater control unit (B) with hazard switch (A).



4. Remove the heater control unit connector (A).



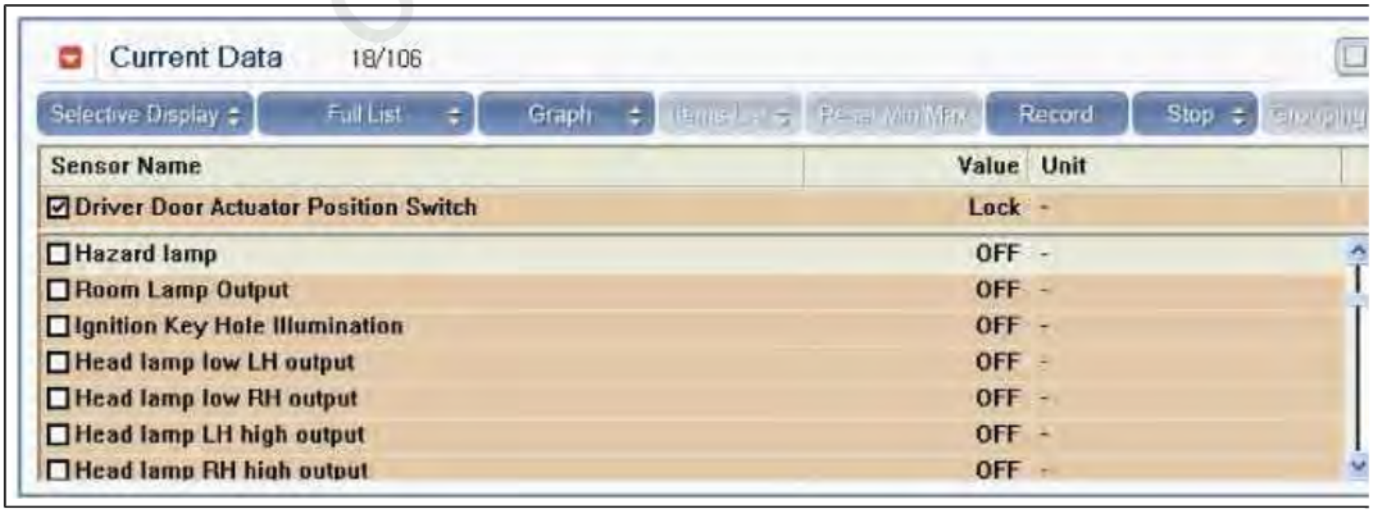
Installation

1. Install the heater control unit.
2. Install the seat heater switch module.

Inspection

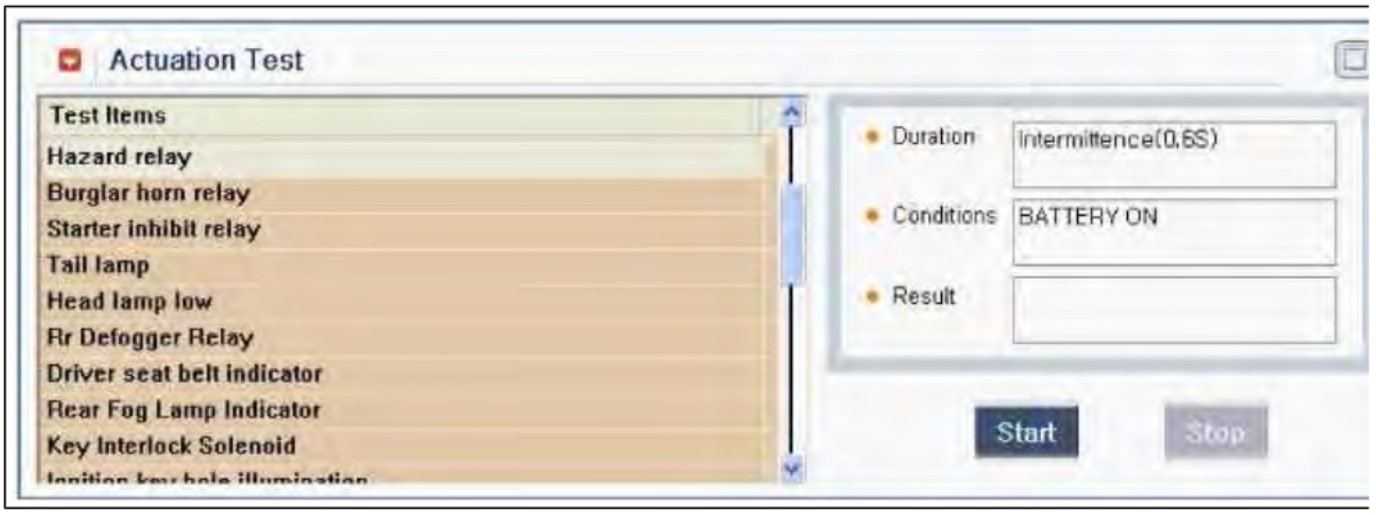
Diagnosis With GDS

1. It will be able to diagnose defects of IPM with GDS quickly. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select "Current data", if you will check current data of hazard switch.



cardiagn.com

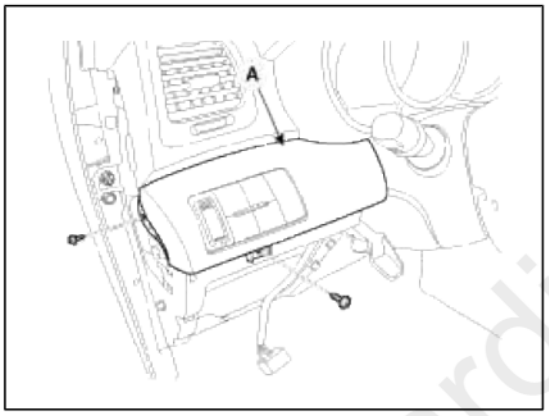
3. If you will check the hazard switch operation forcefully, select "Actuation test".



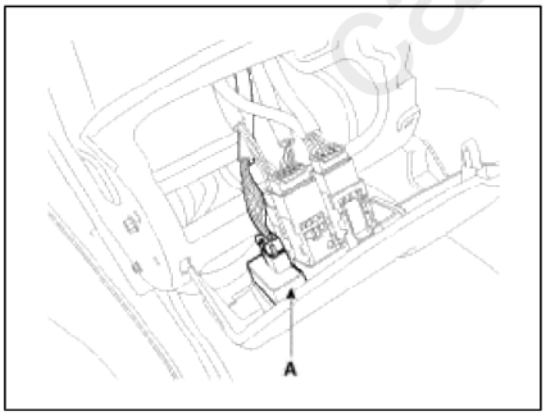
Body Electrical System > Lighting System > Rheostat > Repair procedures

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.

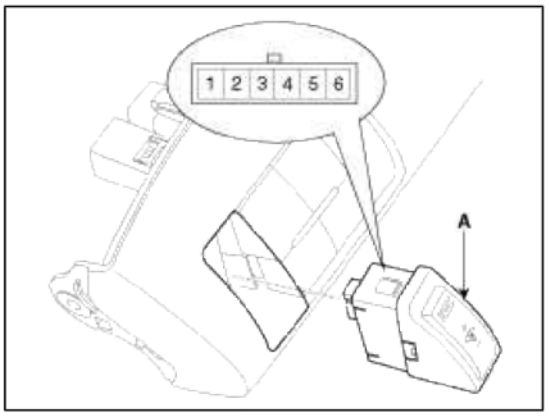


4. Remove the rheostat switch connector (A).



cardiagn.com

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 flickering when the rheostat is turned, it can be assumed that the rheostat is normal.

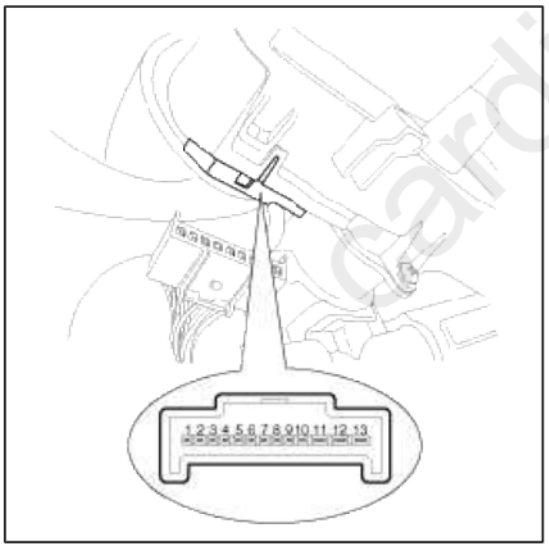
Terminal / Position	UP(+)	DOWN(-)	Description
1		○	Down
2	○	○	GND
5	○		Up
3	○		Illumination (-)
4	○		Illumination (+)

Body Electrical System > Lighting System > Front Fog Lamps > Repair procedures

Inspection

Front Fog Lamp Switch

1. With the fog lamp switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the multifunction switch.



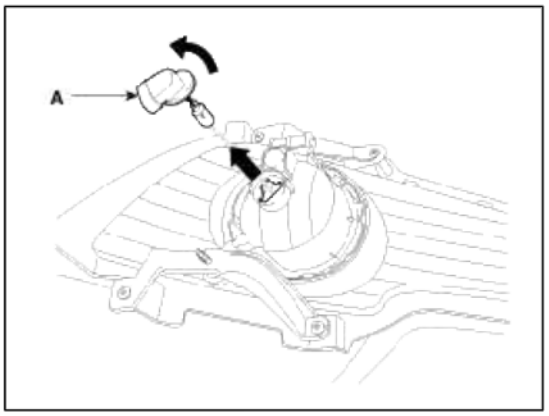
Terminal / Position	5	6
ON	○	○
OFF		

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer to BD group - "Front bumper")

cardiagn.com

3. Remove the front fog lamp (A) by turning in the counter clock-wise direction after disconnecting the connector.



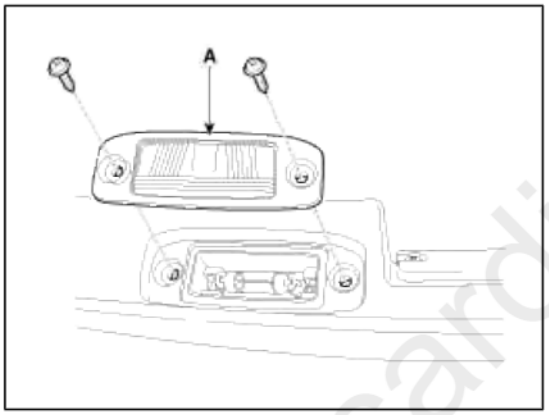
Installation

1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front bumper.

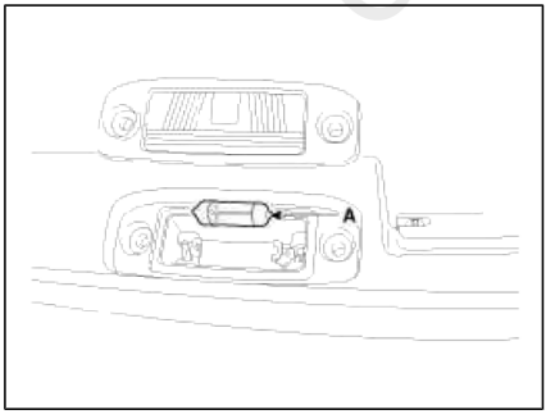
Body Electrical System > Lighting System > License Lamps > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens (A) from the panel after loosening a screw (2EA).



3. Replace the bulb (A).



Installation

1. Install the bulb.
2. Install the license lamp lens.

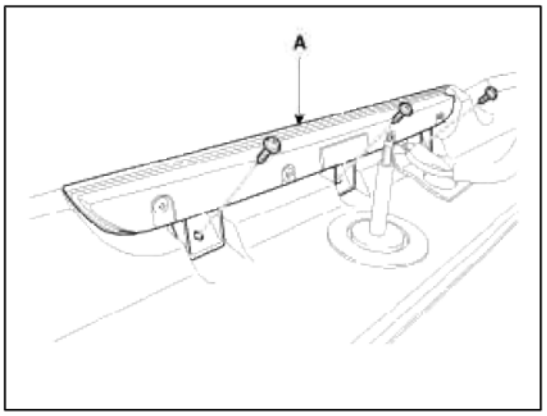
Body Electrical System > Lighting System > High Mounted stop lamp > Repair procedures

cardiagn.com

Removal

High Mounted Stop Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim.
   (Refer to BD group - "Tailgate")
3. Remove the high mounted stop lamp assembly after removing nuts (3EA).



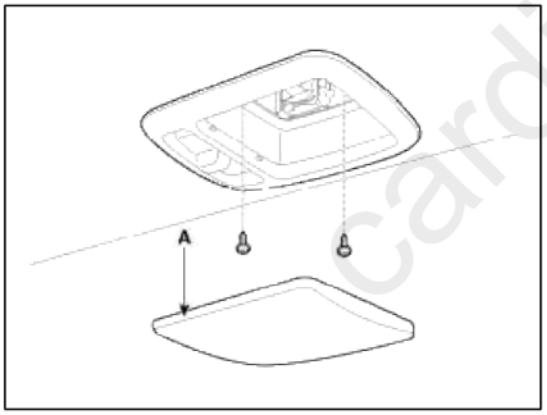
Installation

1. Install the high mounted stop lamp.
2. Install the tailgate trim.

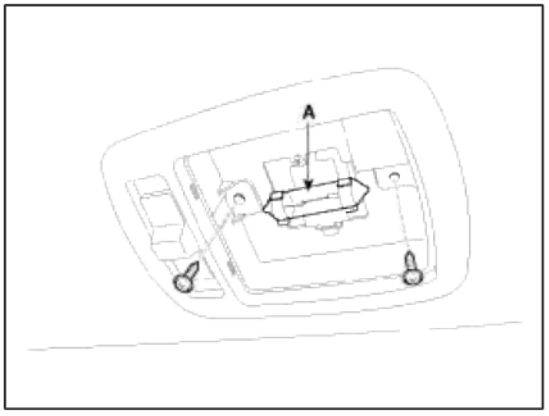
Body Electrical System > Lighting System > Luggage Room Lamp > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the luggage room lamp lens (A) with a flat-tip screwdriver after loosening the screws (2EA).

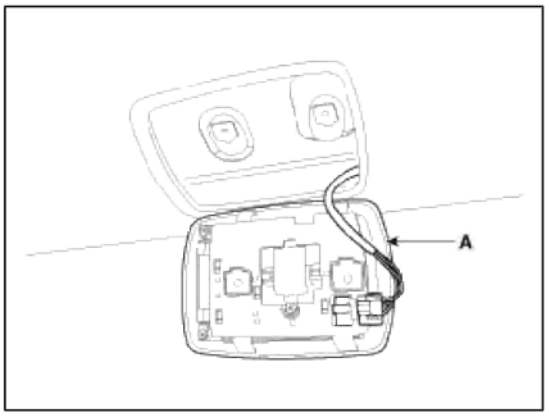


3. Remove the luggage room lamp bulb (A).



cardiagn.com

4. Remove the luggage room lamp assembly (A) after disconnecting the connector.



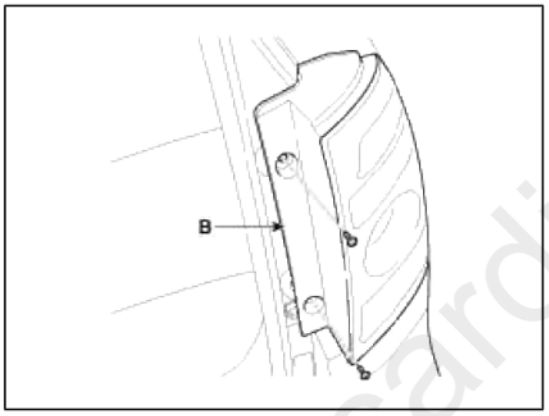
Installation

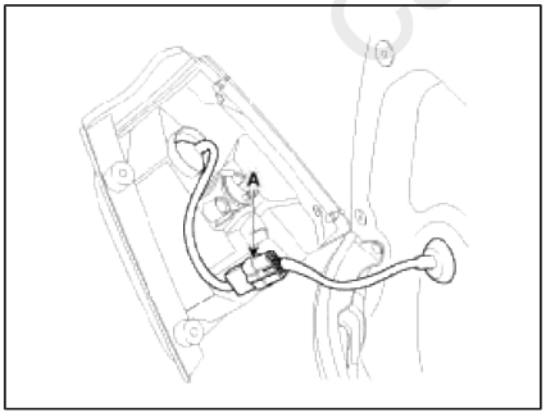
1. Replace the lamp bulb.
2. Install the luggage room lamp assembly after connecting the lamp connector.

Body Electrical System > Lighting System > Rear combination lamp > Repair procedures

Removal

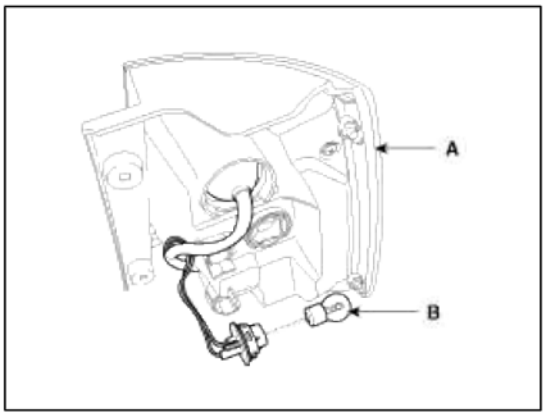
1. Disconnect the negative (-) battery terminal.
2. Loose the screws (2EA) holding the rear combination lamp then disconnect the connector (A) then remove the outside rear combination lamp (B).



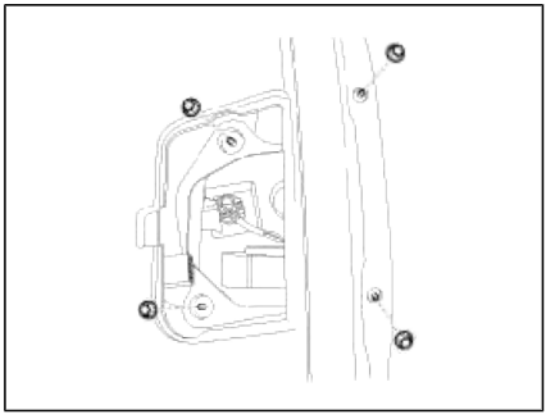


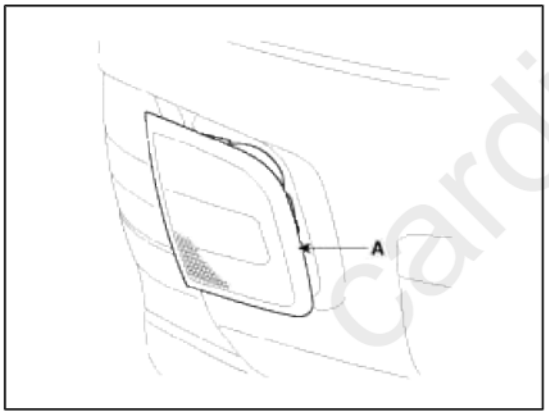
cardiagn.com

3. Replace the bulbs (B) after removing the rear combination lamp assembly (A).

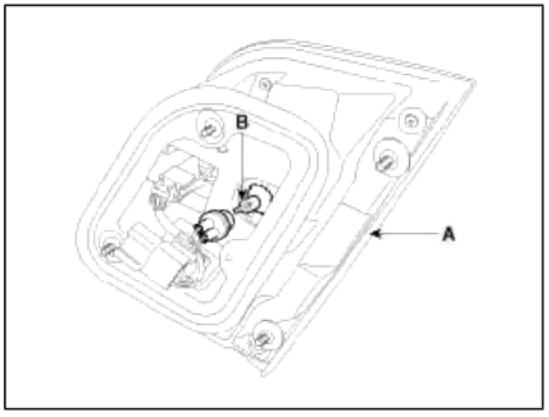


4. If the bulbs should be only replaced without removing lamp assembly, replace the bulbs after removing the rear combination lamp cover inside trunk.
5. Disconnect the lamp cover on tailgate. Remove the lamp assembly (A) after loosening nuts (4EA) and disconnecting the connector.





6. Remove the tailgate combination lamp assembly (A) and then replace the bulbs (B).



7. If the bulbs should be only replaced without removing lamp assembly, replace the bulbs after removing the tailgate lamp cover inside trunk.

cardiagn.com

Installation

1. Install the tailgate combination lamp assembly after assembling the bulb.
2. Install the lamp cover to the tailgate after connecting the lamp connector.
3. Install the rear combination lamp assembly after assembling the bulbs and connecting the lamp connector.

Body Electrical System > Lighting System > Troubleshooting

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 replace fuse
	Head lamp fuse (15A) blown	Check for short and replace 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 light	Bulb burned out	Replace bulb
	Tail lamp fuse (10A) blown	Check for short and replace 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 replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
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 replace fuse
	Flasher unit faulty	Check flasher unit

carmanualsonline.com

	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 replace 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 replace 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 replace fuse
	Room lamp switch faulty	Check switch
	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 replace 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 replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

carmanuals.com

Trunk room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Trunk room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Body Electrical System > Auto Lighting Control System > Specifications

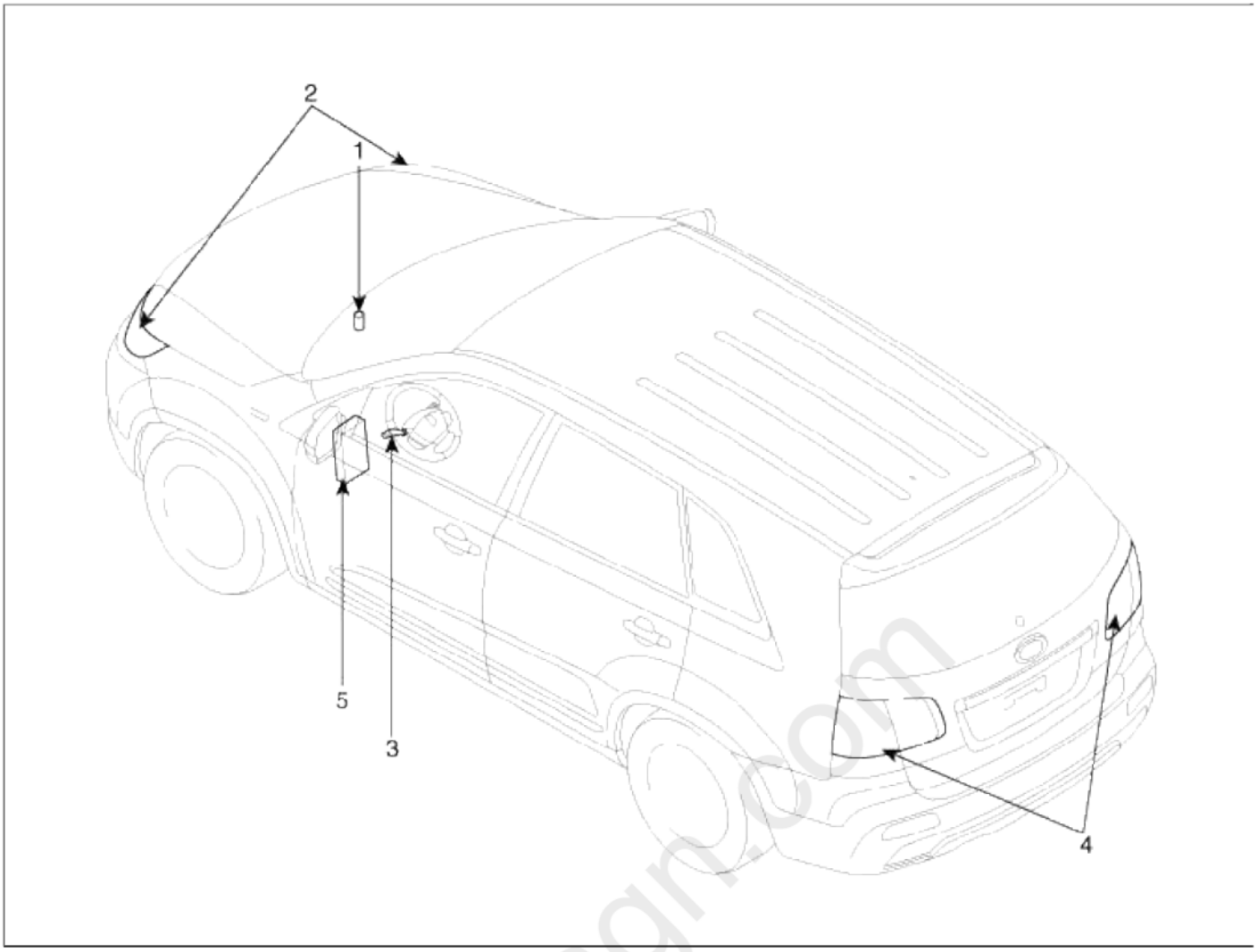
Specifications

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	ON : 2.7 ± 0.05 (V) OFF : 4.3 ± 0.05 (V)

Body Electrical System > Auto Lighting Control System > Components and Components Location

Component Location

cardiagn.com

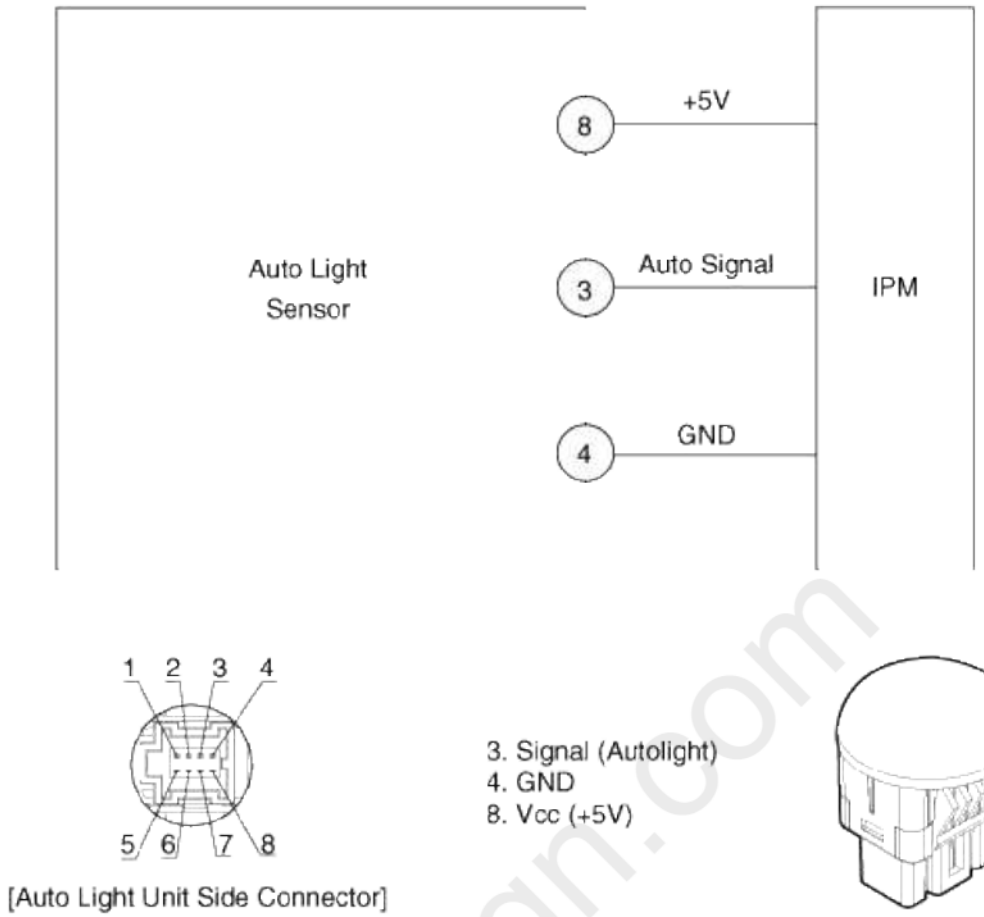


1. Auto light sensor 2. Head lamps 3. Lighting switch (Auto)	4. Tail lamps 5. IPM (Intelligent intergrated Platform Module)

Body Electrical System > Auto Lighting Control System > Schematic Diagrams

Circuit Diagram

carmanuals.com



Body Electrical System > Auto Lighting Control System > Auto Light Switch > Repair procedures

Inspection

Operate the auto light switch, then check for continuity between terminals of multi-function switch connector.

cardiagn.com

Position \ Terminal	1	4	3	2
OFF				
I	○			○
II	○	○		○
AUTO			○	○

Body Electrical System > Auto Lighting Control System > Auto Light Sensor > Repair procedures

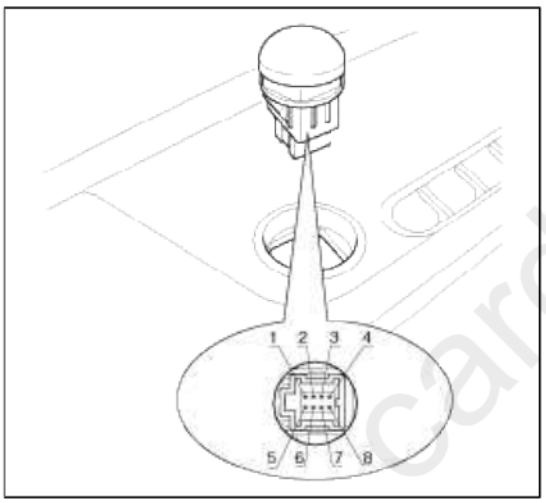
Inspection

In the state of IGN1 ON, when the multi function switch module detects auto light switch on, tail lamp relay output and head lamp low relay output are controlled according to auto light sensor's input.

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 of range. Then this failure occurs and as long as this is present, the head lamp must be turned on without taking care about the sunlight level provided by the sensor.

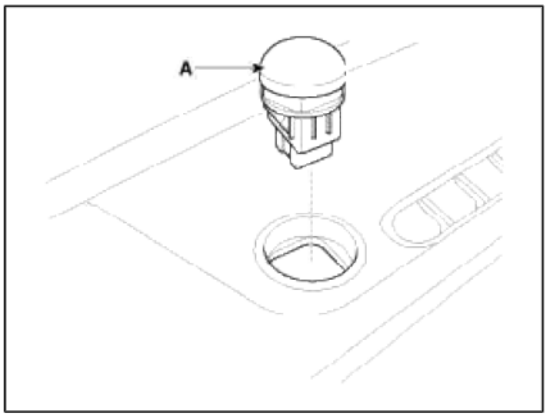
This is designed to prevent any head lamp cut off when the failure occurs during the night.

	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.



cardiagn.com

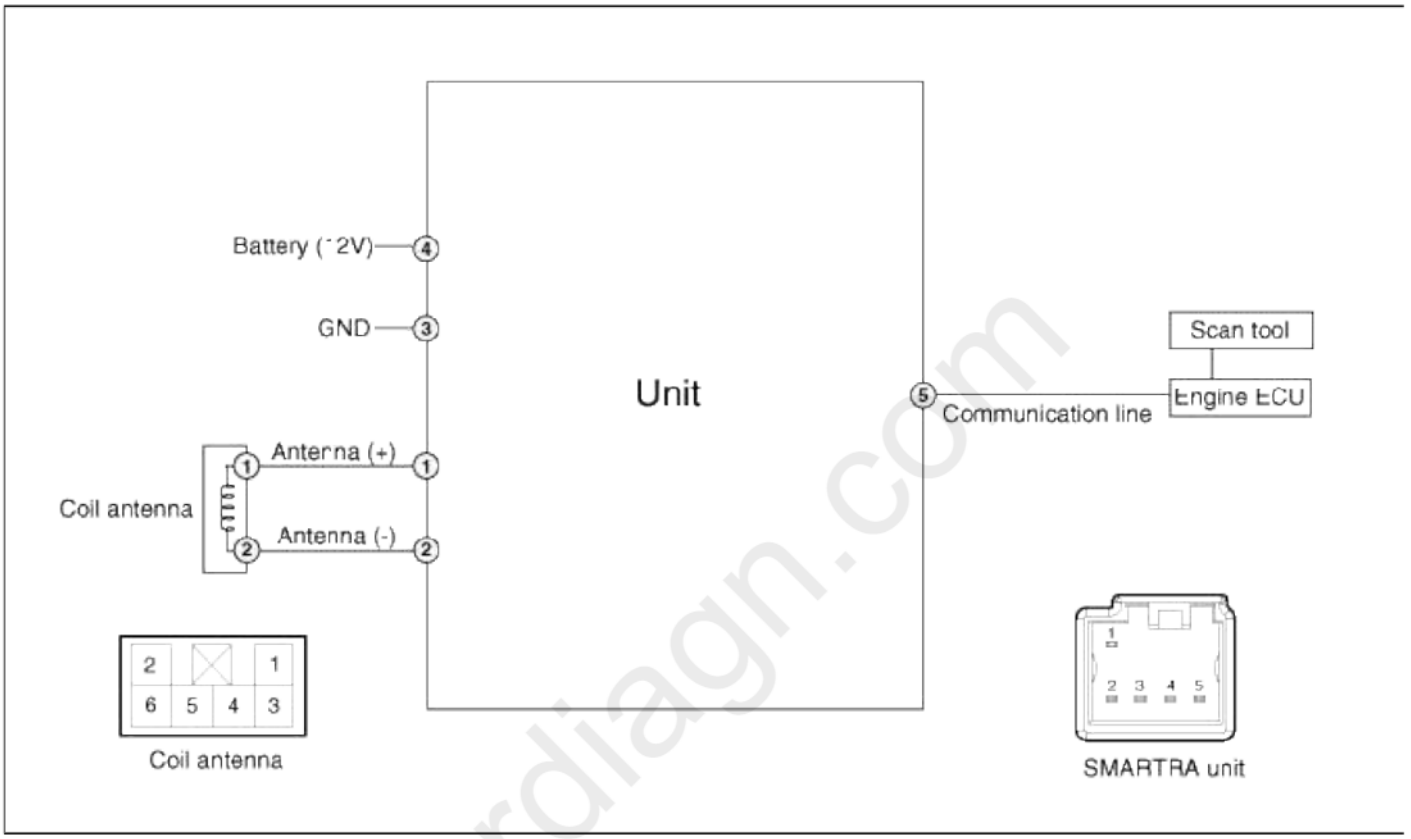
3. Remove the auto light connector.

Installation

1. Reconnect the auto light connector.
2. Install the auto light sensor.

Body Electrical System > Immobilizer System > Schematic Diagrams

Circuit Diagram



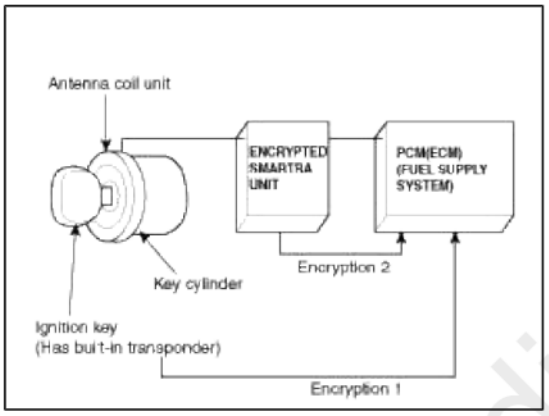
cardiagn.com

Body Electrical System > Immobilizer System > Description and Operation

Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

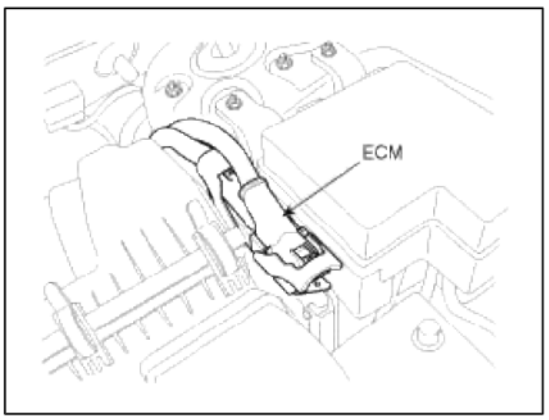
1. Encrypted SMARTRA type immobilizer
   A. The SMARTRA system consists of a passive challenge - response (mutual authentication)transponder located in the ignition key, an antenna coil, an encoded SMARTRA unit, an indicator light and the PCM(ECM).
   B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control 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 to the PCM(ECM).
   D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicator light 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 indicator light 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 keys and the GDS unit. Any key that is not learned during rewriting will no 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 Kia motor service station.



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 programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. 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 of coded key is decided by EMS.

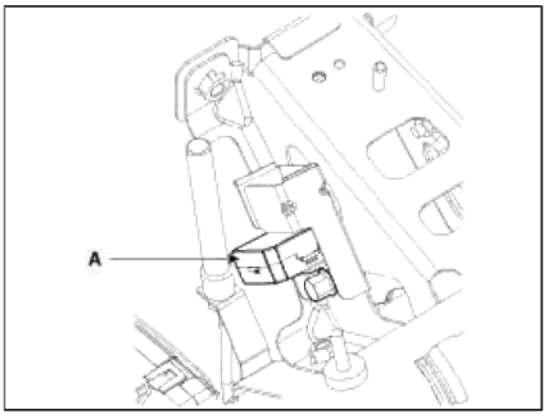


ENCRYPTED SMARTRA unit (A)

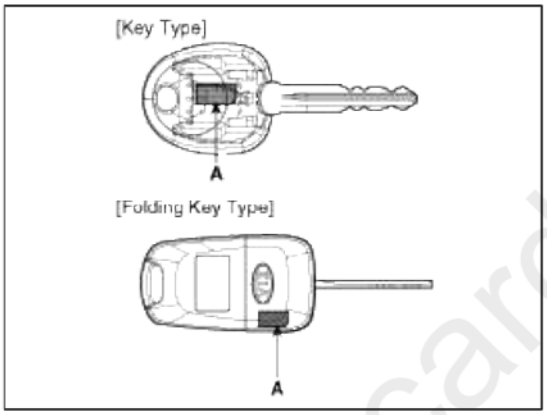
The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad

cardiagn.com

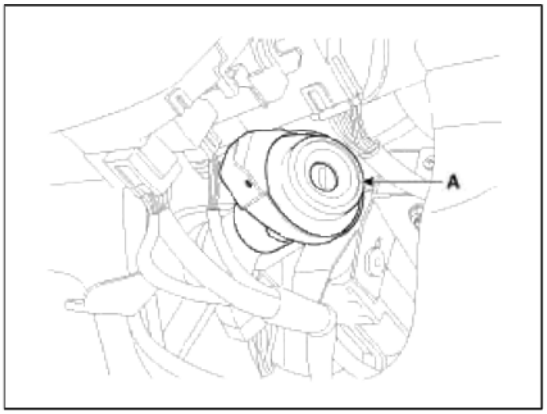
close to center cross bar.
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.
The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the 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 be 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.



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.



cardiagn.com

Body Electrical System > Immobilizer System > Repair procedures

Replacement

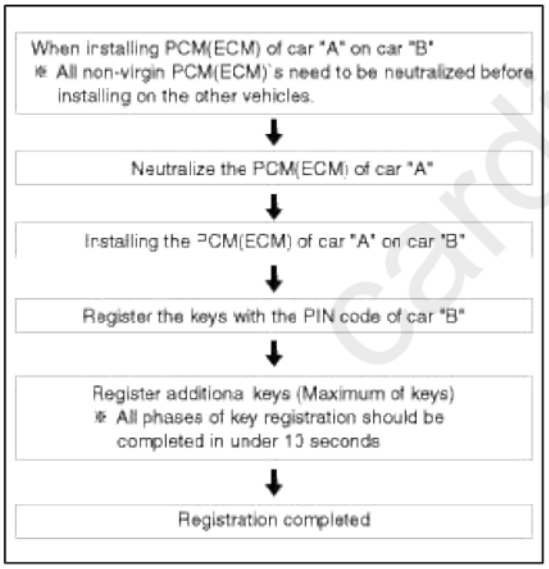
Problems And Replacement Parts:

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

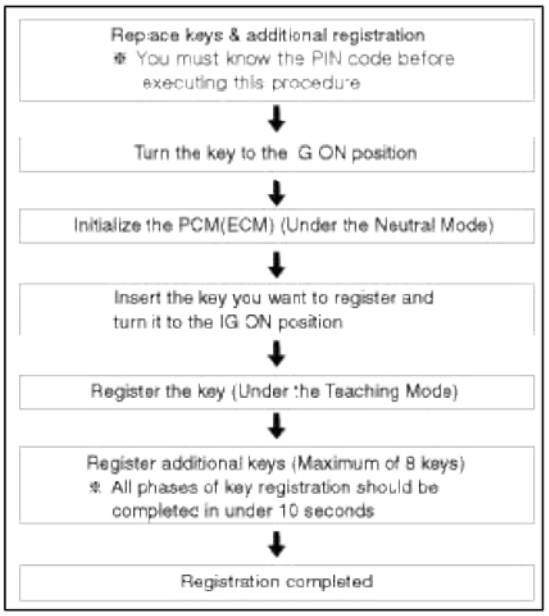
In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.
In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))



cardiagn.com

2. Things to remember before a replacement (Keys & Additional registration)



NOTE

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 the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).

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 transponder are requested.

This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys.

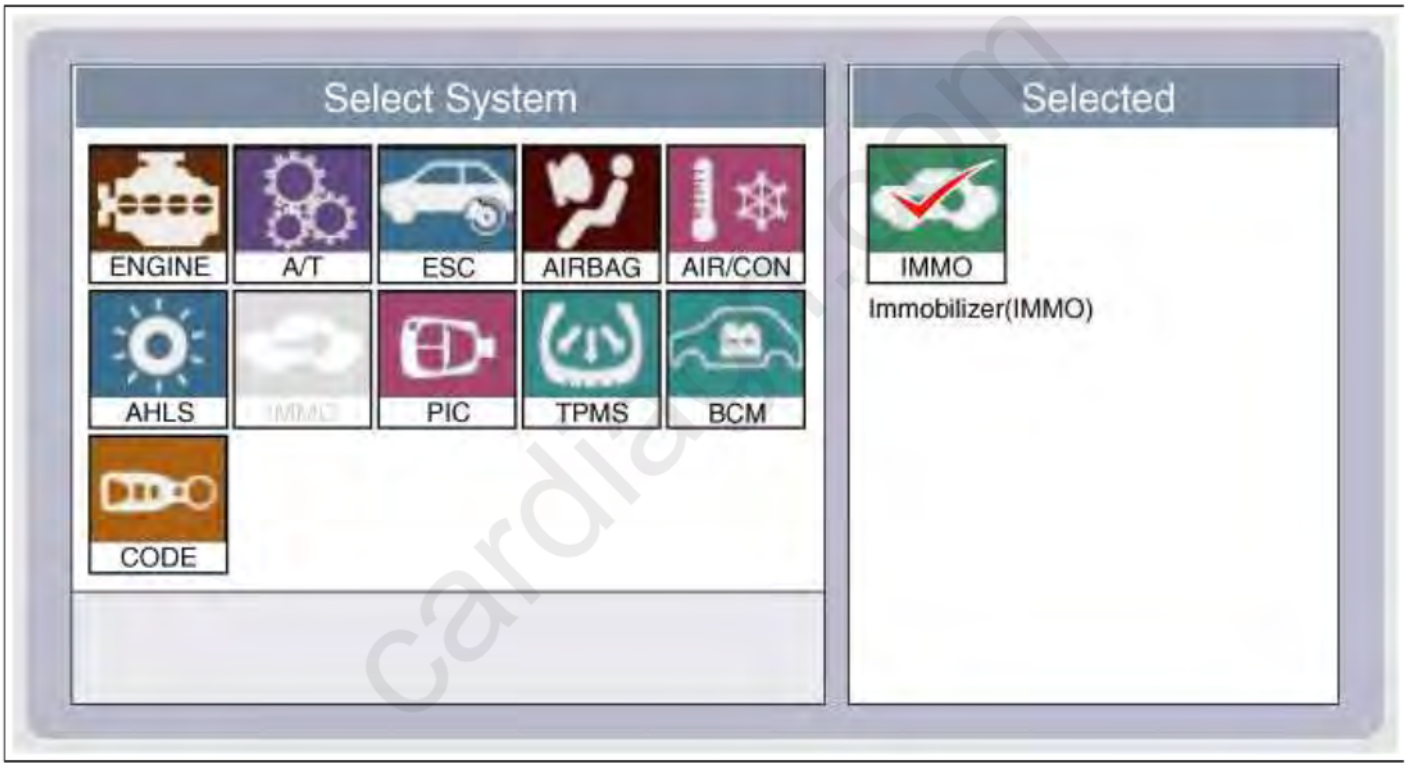
(Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner.

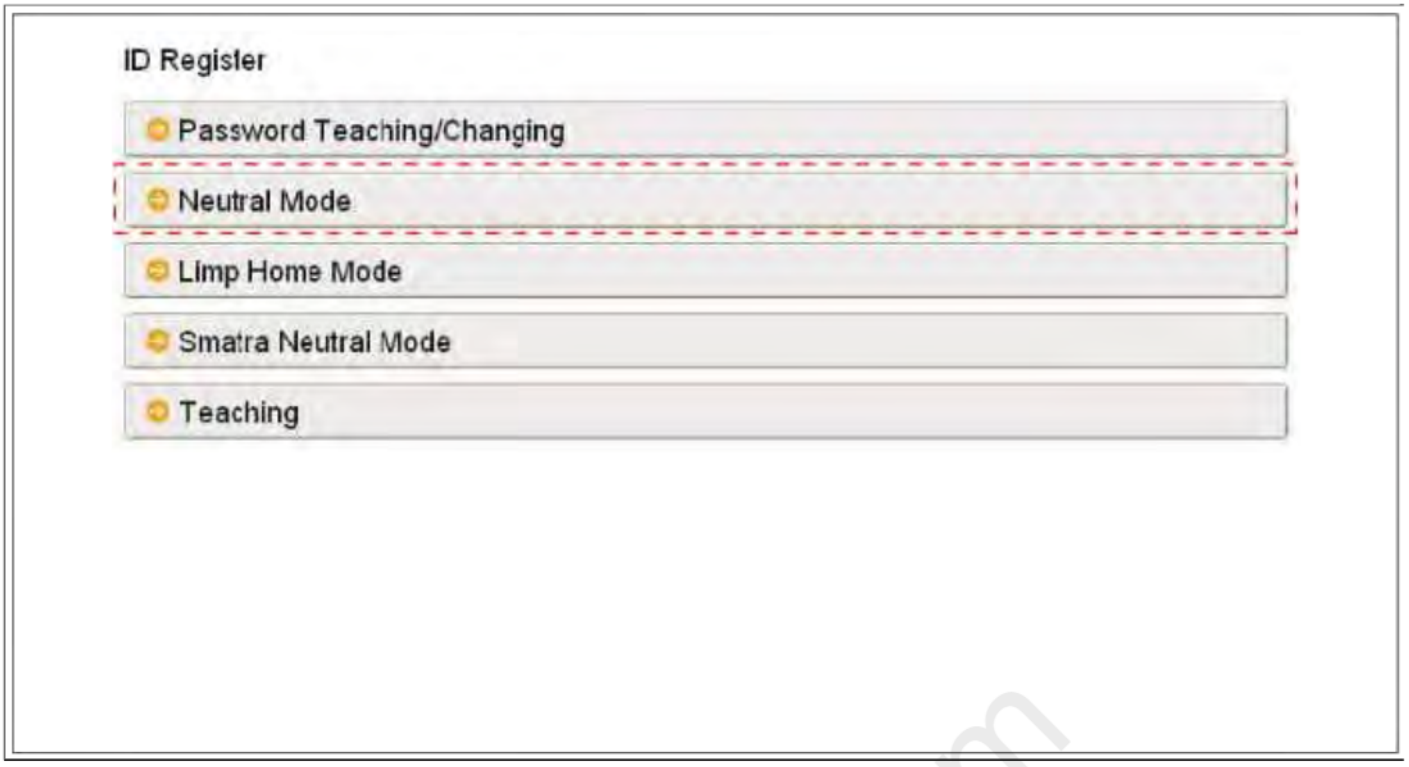
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

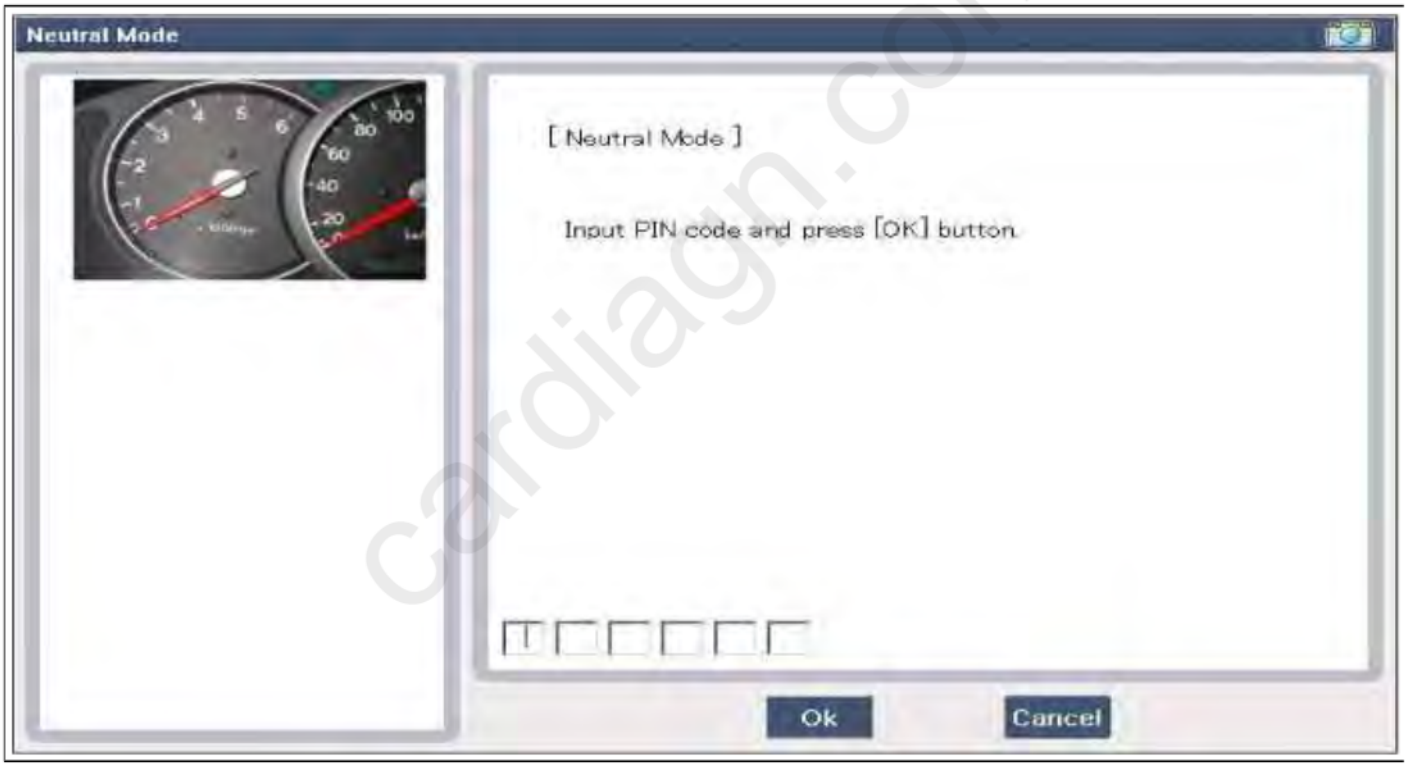
NOTE

- 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)

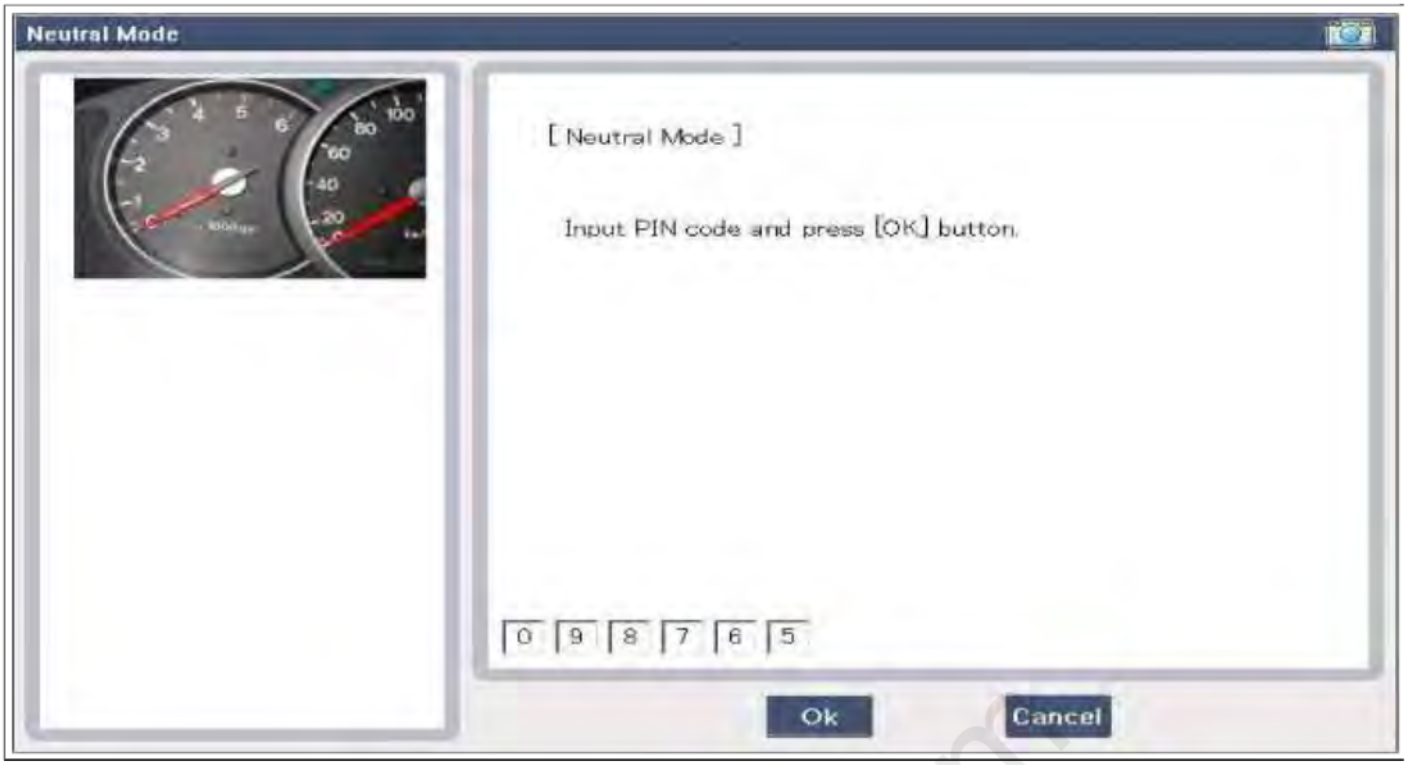
Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No







cardiagn.com



cardiagn.com

cardiagn.com

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 GST, SMARTRA can be neutralized. The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST.

In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".

In case of changing the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning 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 will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

NOTE

- 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.

Function / SMARTRA	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS learnt)	No	Yes	No

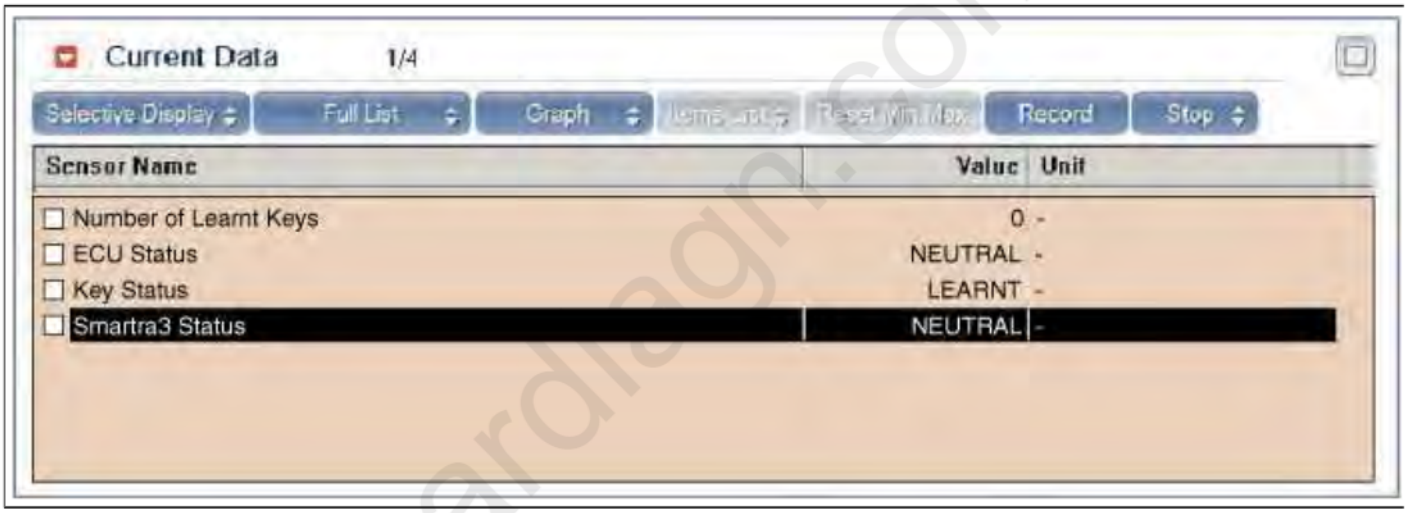
cardiagn.com

ID Register

- Password Teaching/Changing
- Neutral Mode
- Limp Home Mode
- Smatra Neutral Mode
- Teaching

cardiagn.com

cardiagn.com



cardiagn.com

Teaching Procedures

1. Key Teaching Procedure

Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehic owner.

The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. Th "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 pr 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.

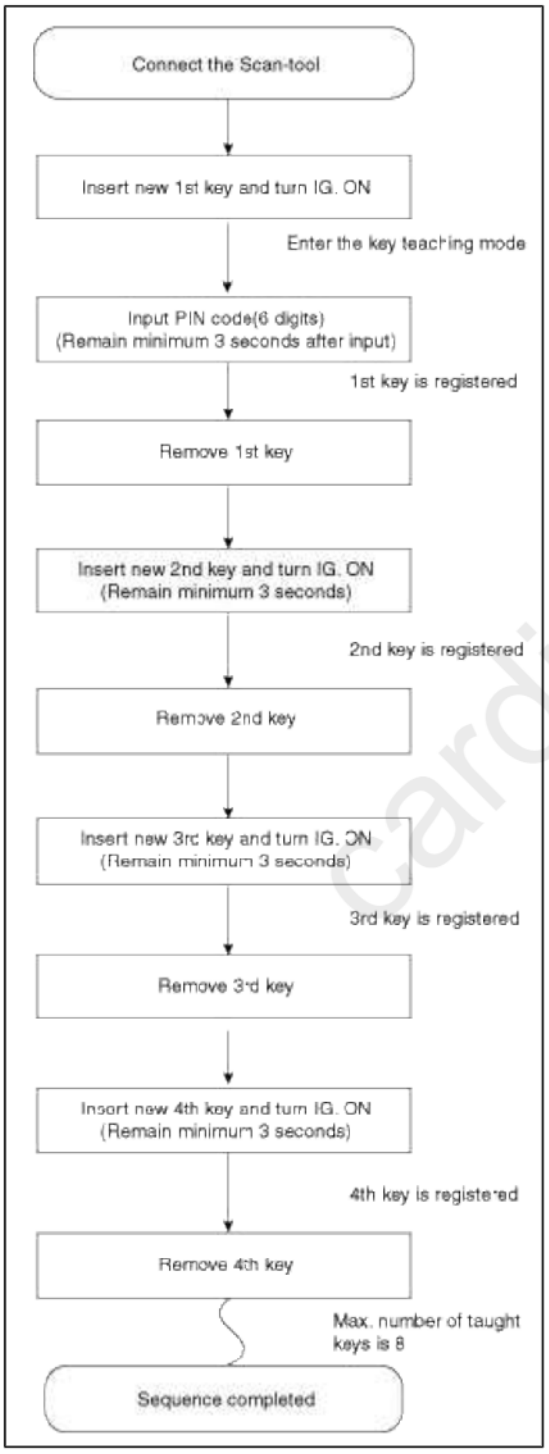
If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and t EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder)

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 c invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be inv
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 stoppe a specific fault code will be stored at PCM(ECM).

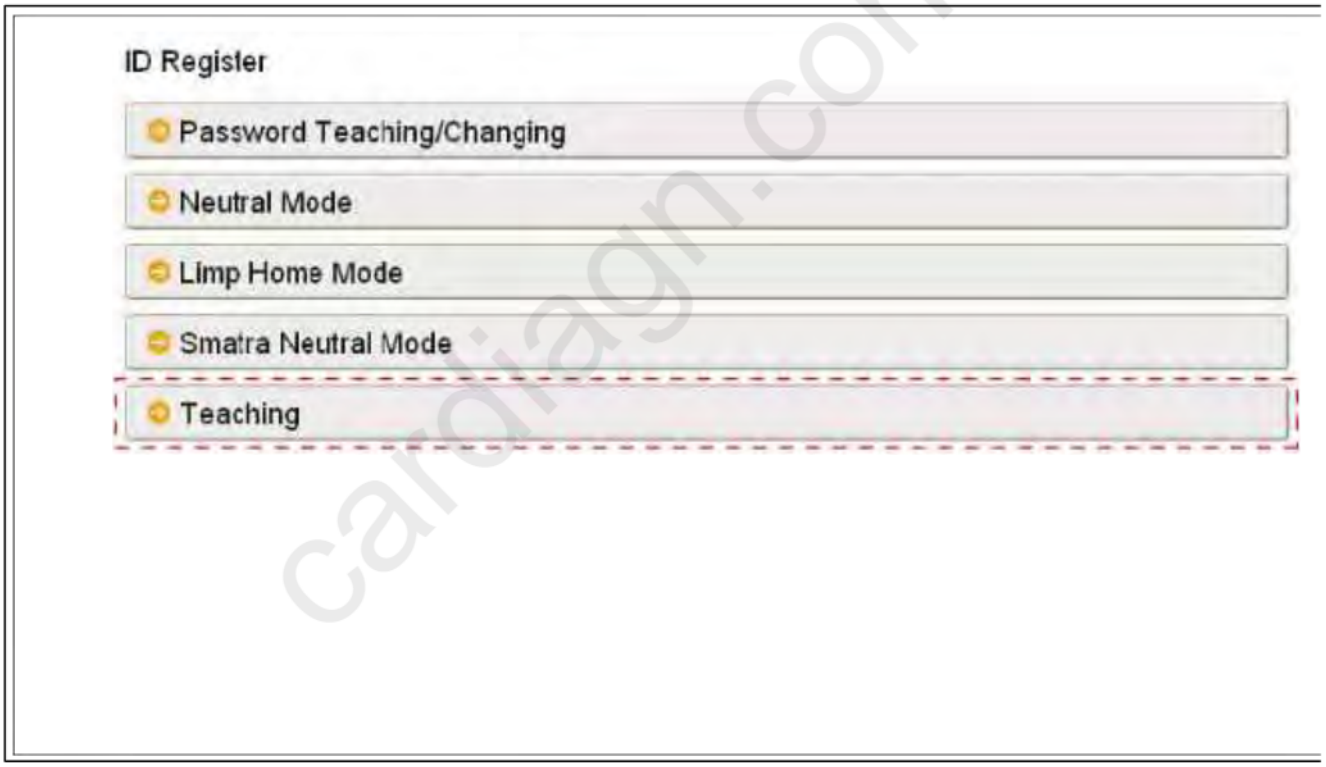
NOTE

When teaching the 1st key, Smartra regists at the same time.

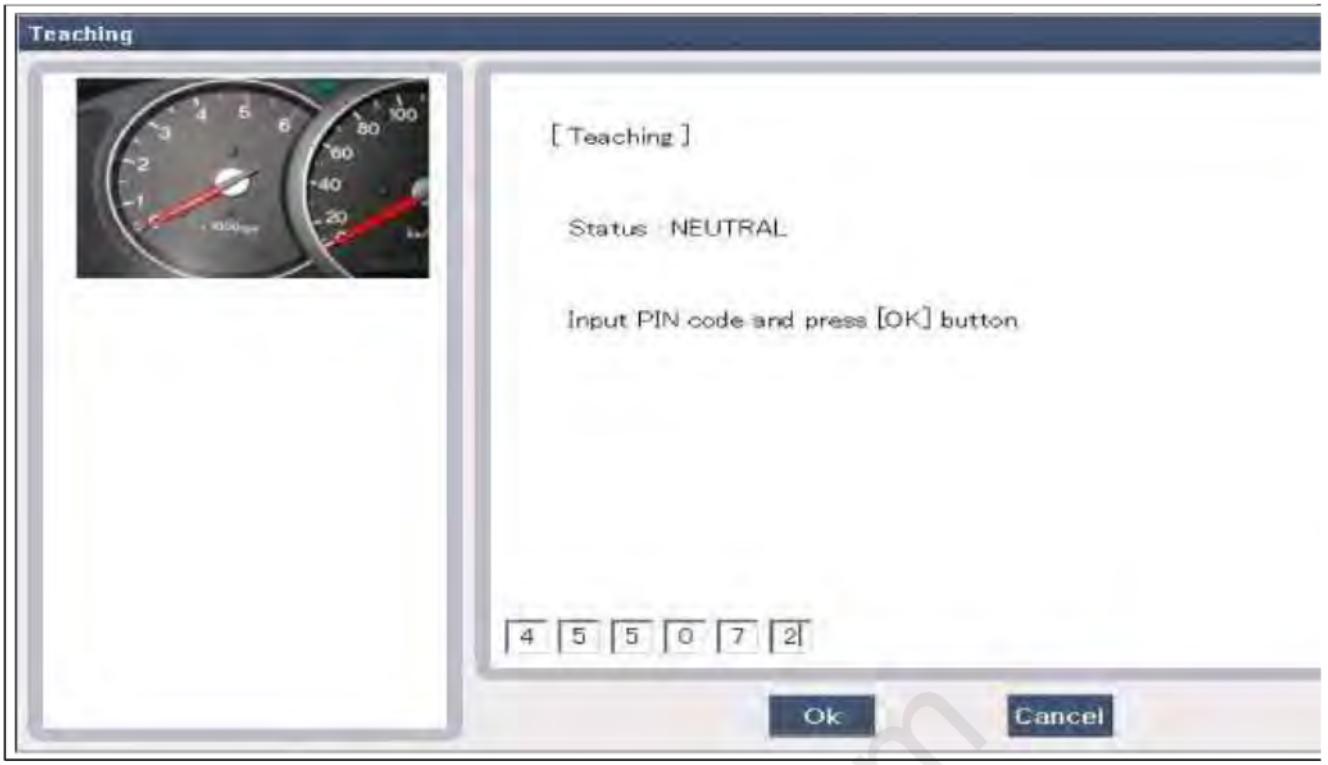


(1) PCM(ECM) learnt status.

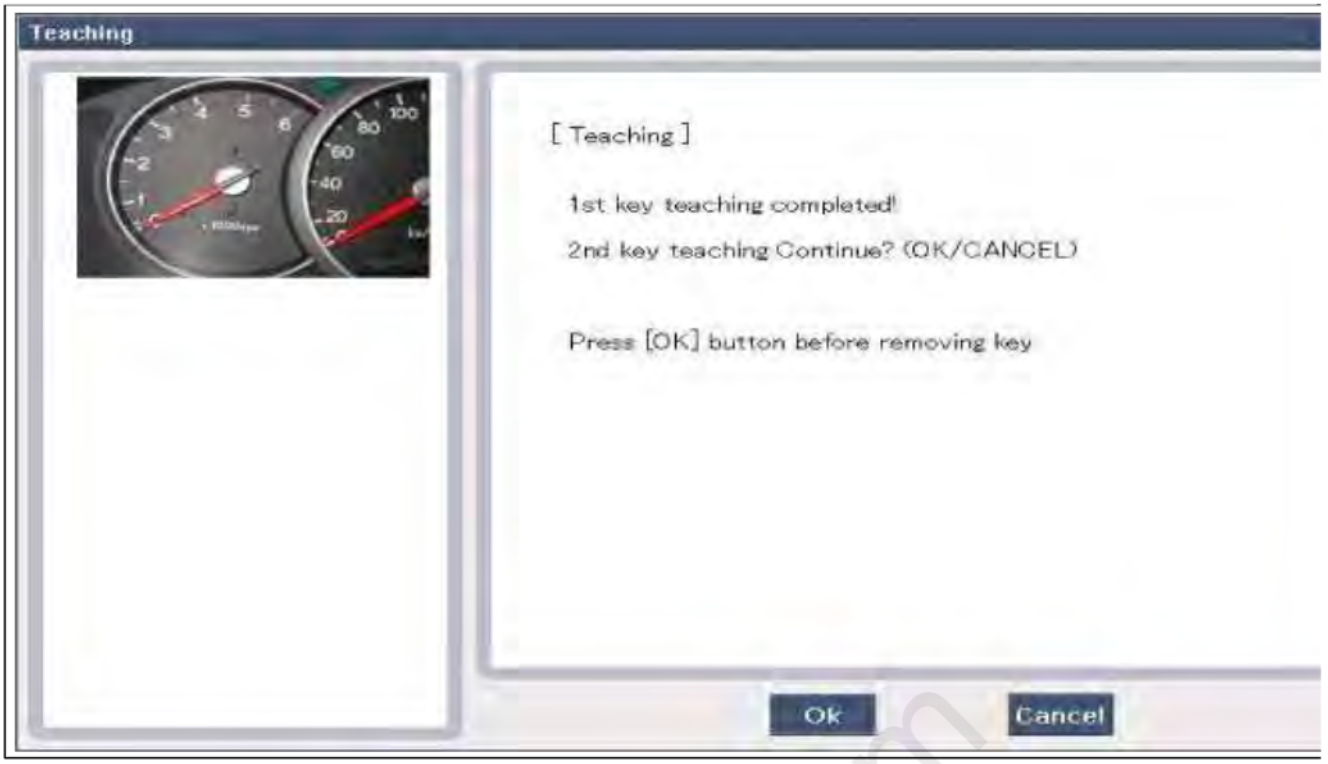
cardiagn.com



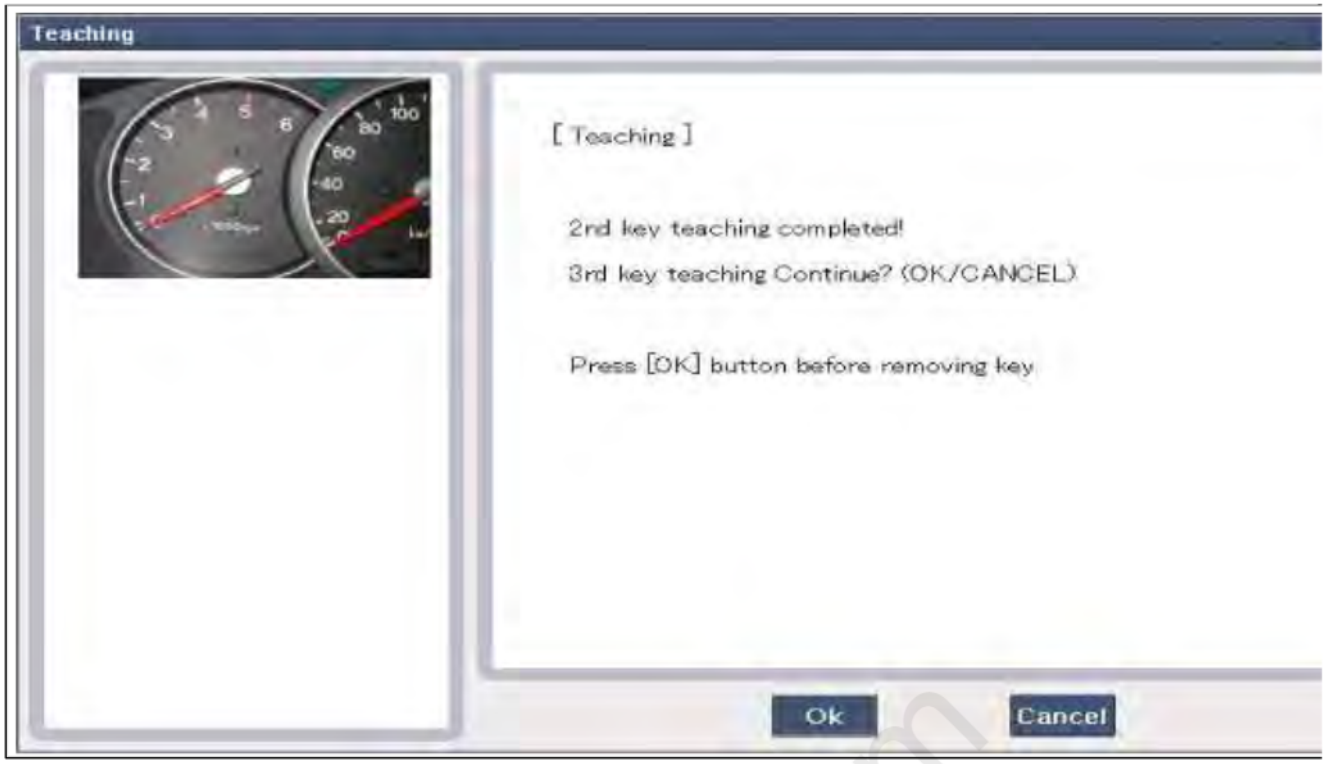
cardiagn.com



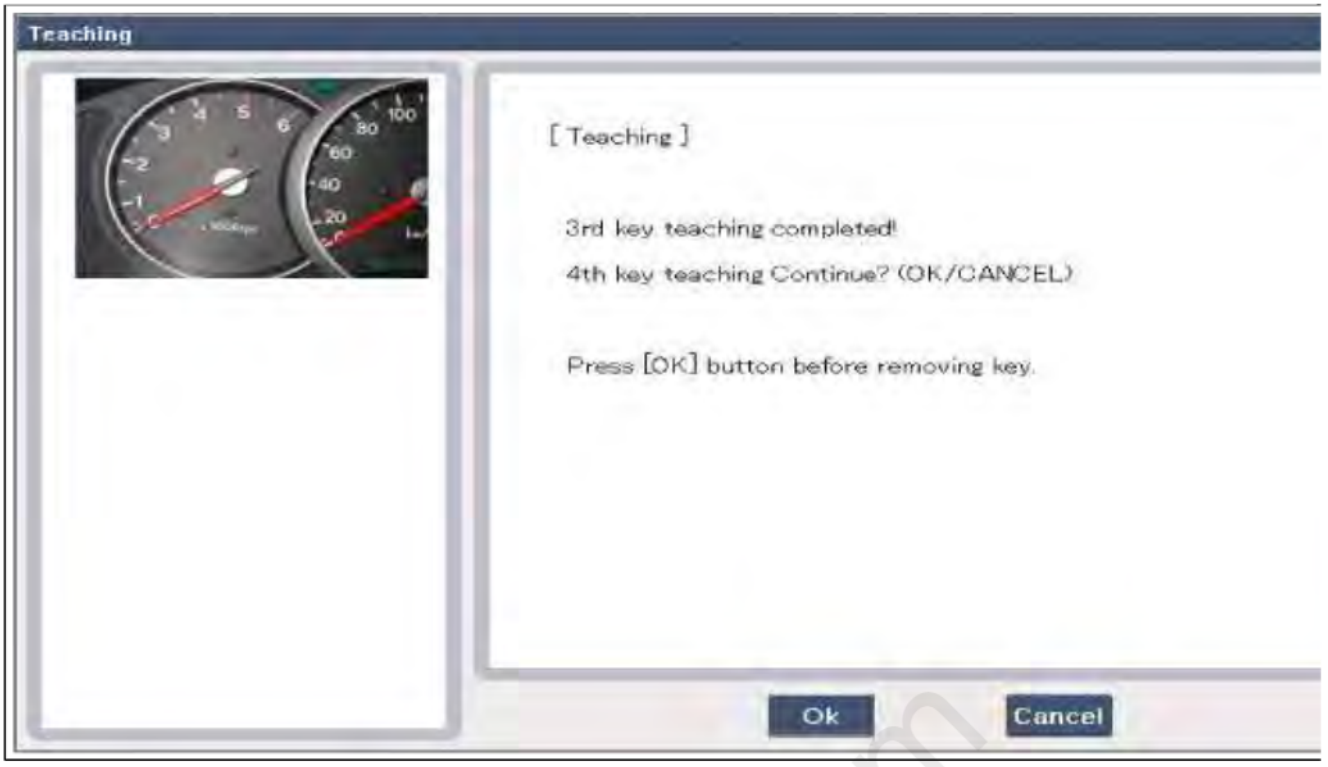
cardiagn.com

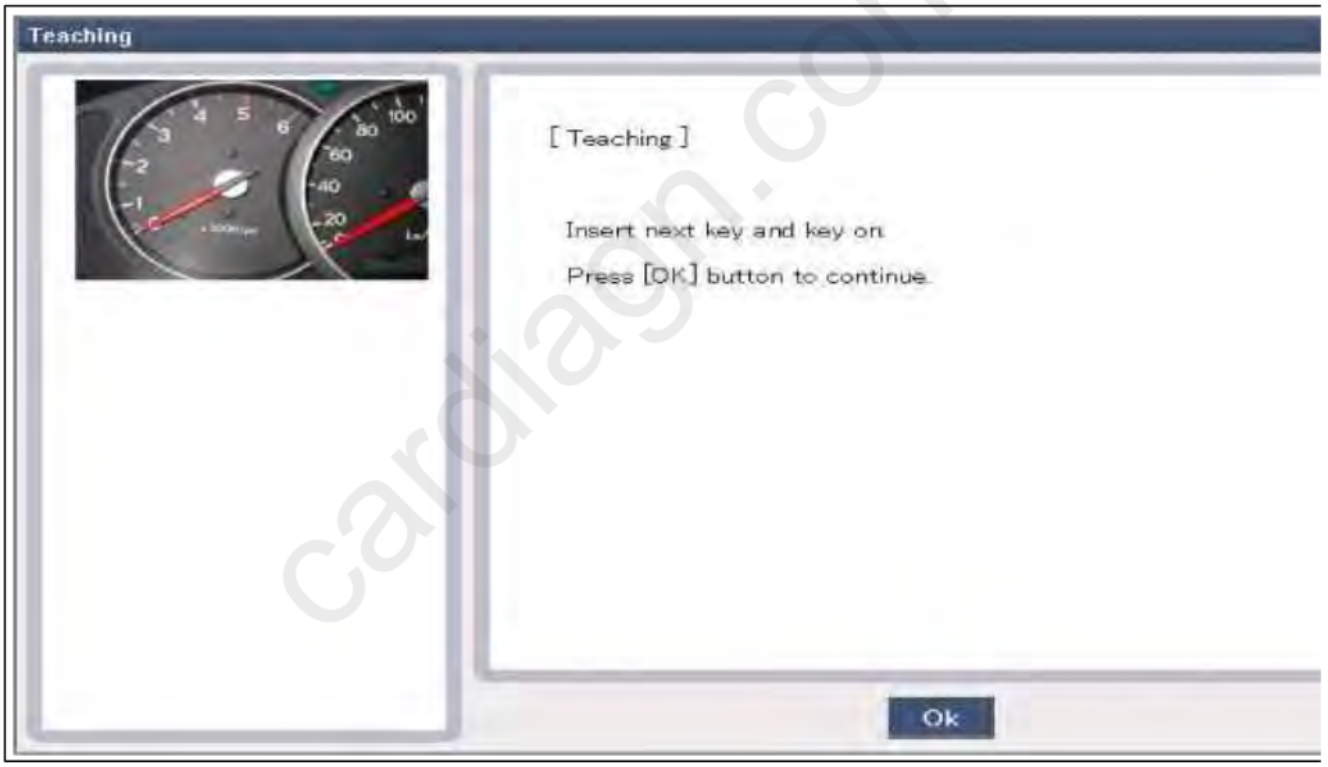


cardiagn.com

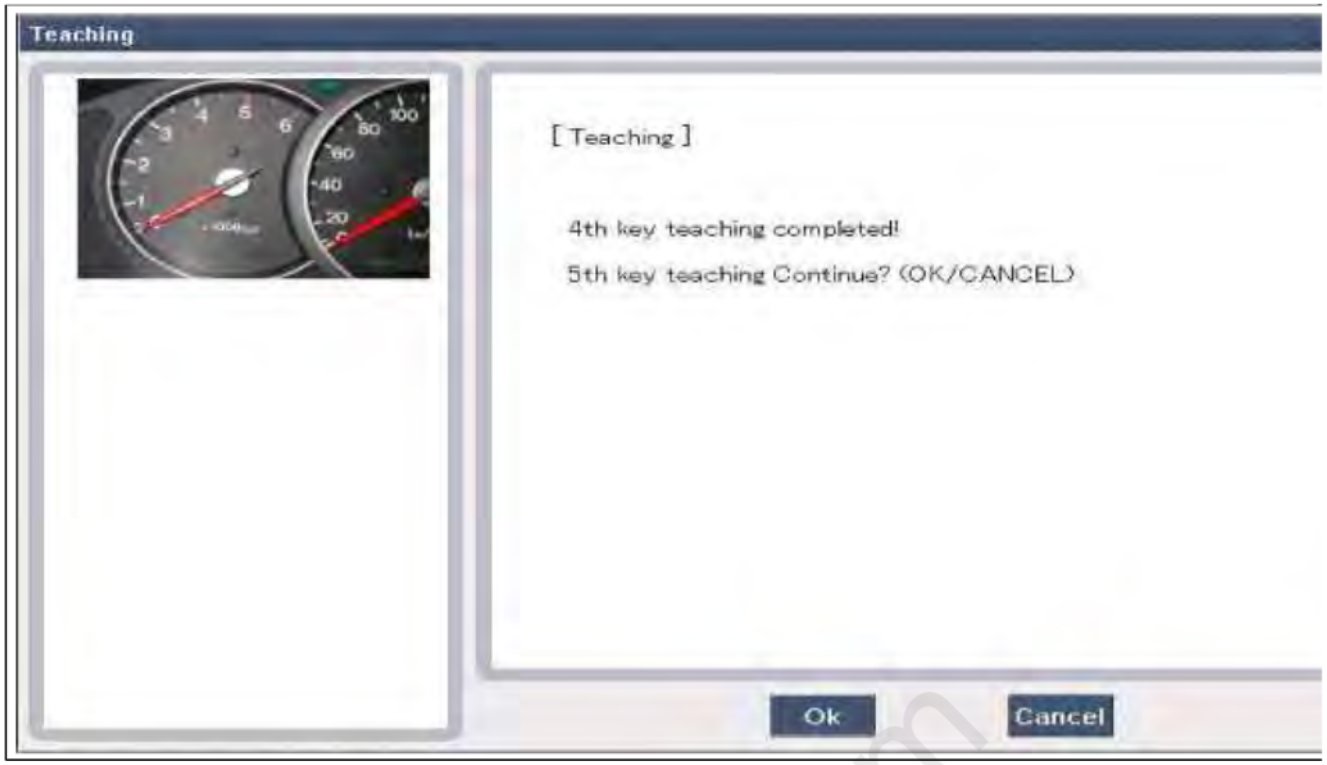


cardiagn.com





cardiagn.com



(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 with four digits.

The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to an 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 tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

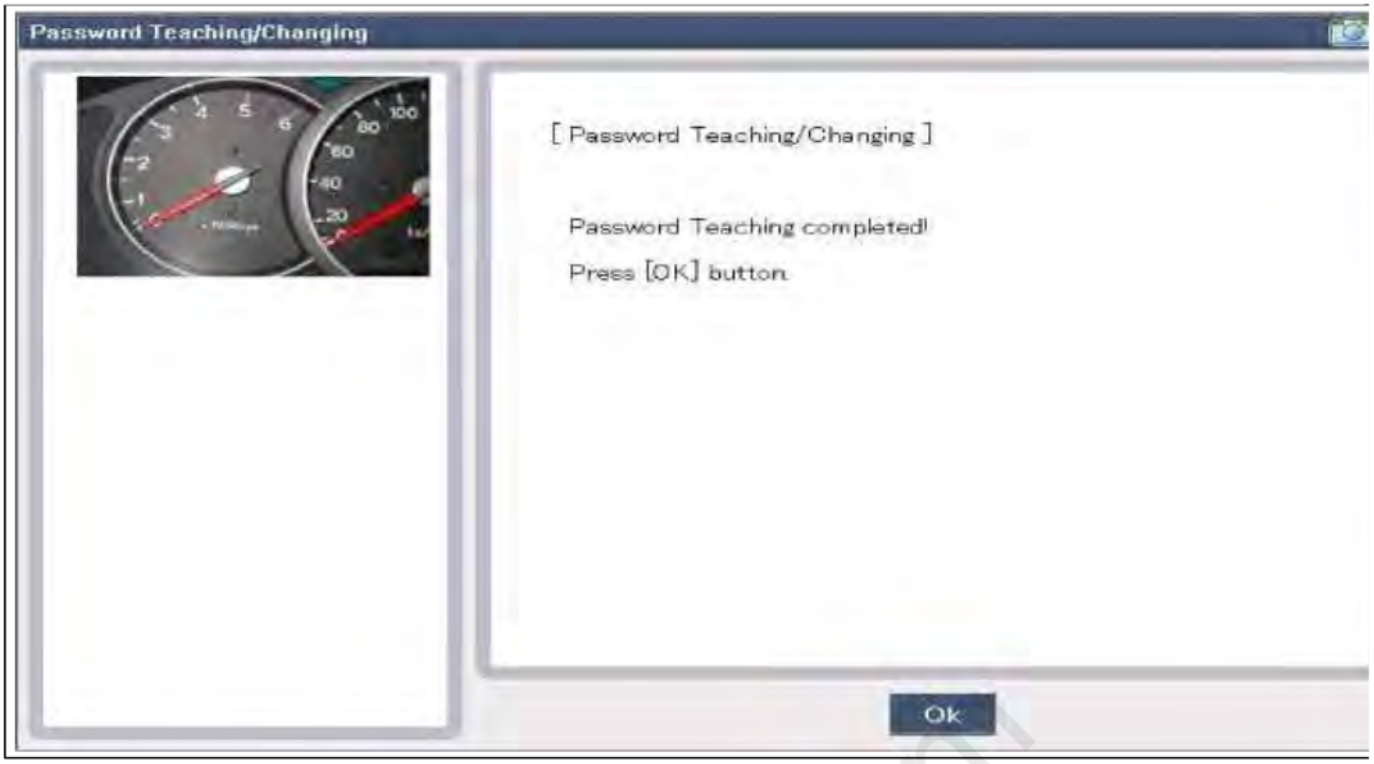
2. User password teaching

ID Register

- Password Teaching/Changing
- Neutral Mode
- Limp Home Mode
- Smatra Neutral Mode
- Teaching

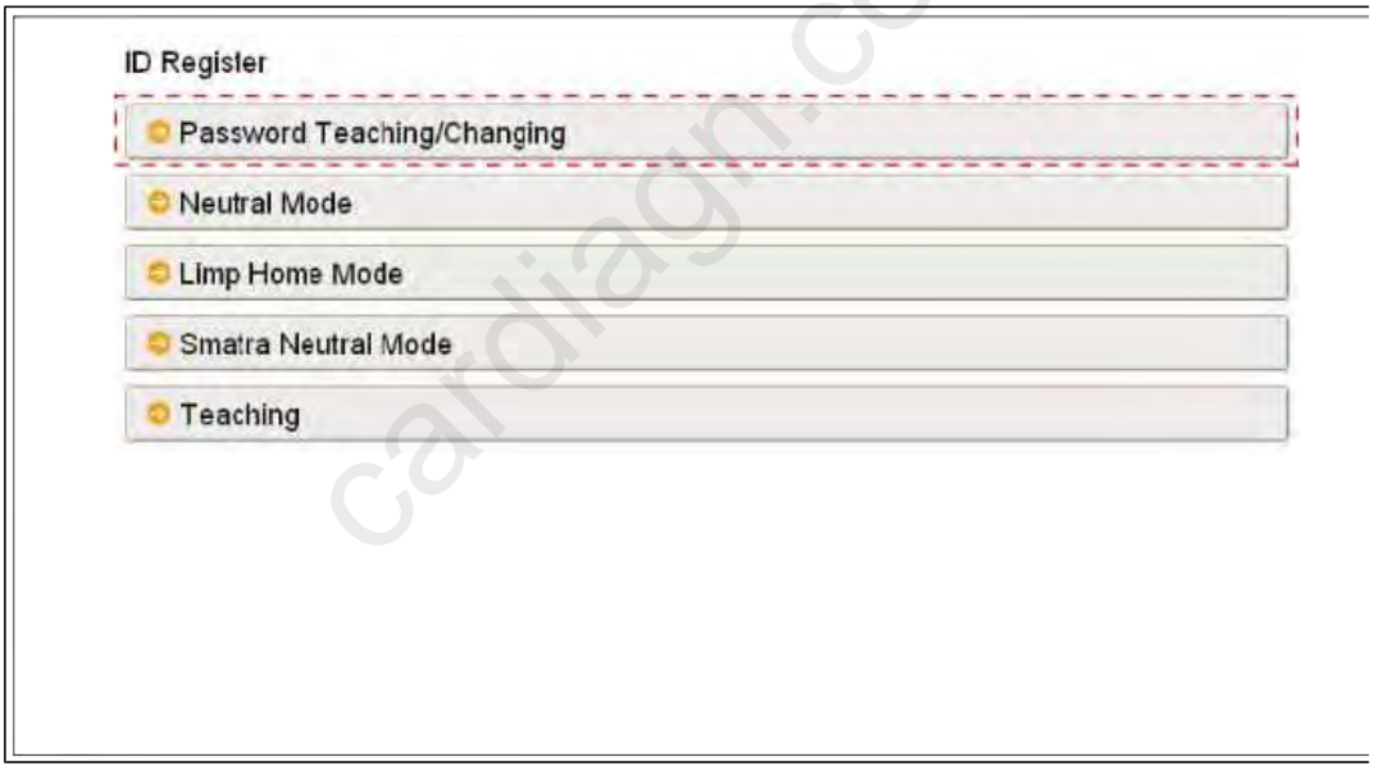
cardiagn.com

cardiagn.com



In case of putting wrong password, retry from first step after 10 seconds.

3. User password changing



cardiagn.com

cardiagn.com

cardiagn.com

Limp Home Function

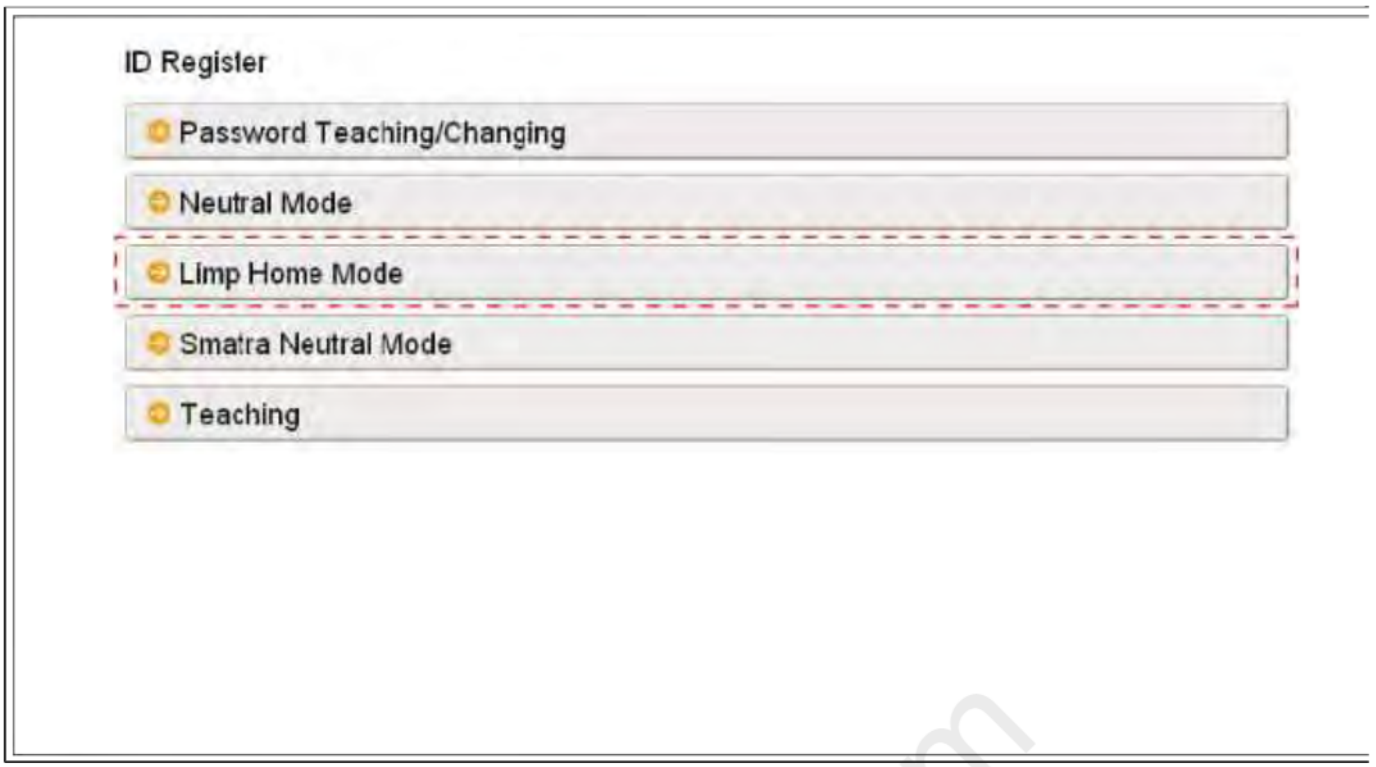
1. Limp Home By Tester

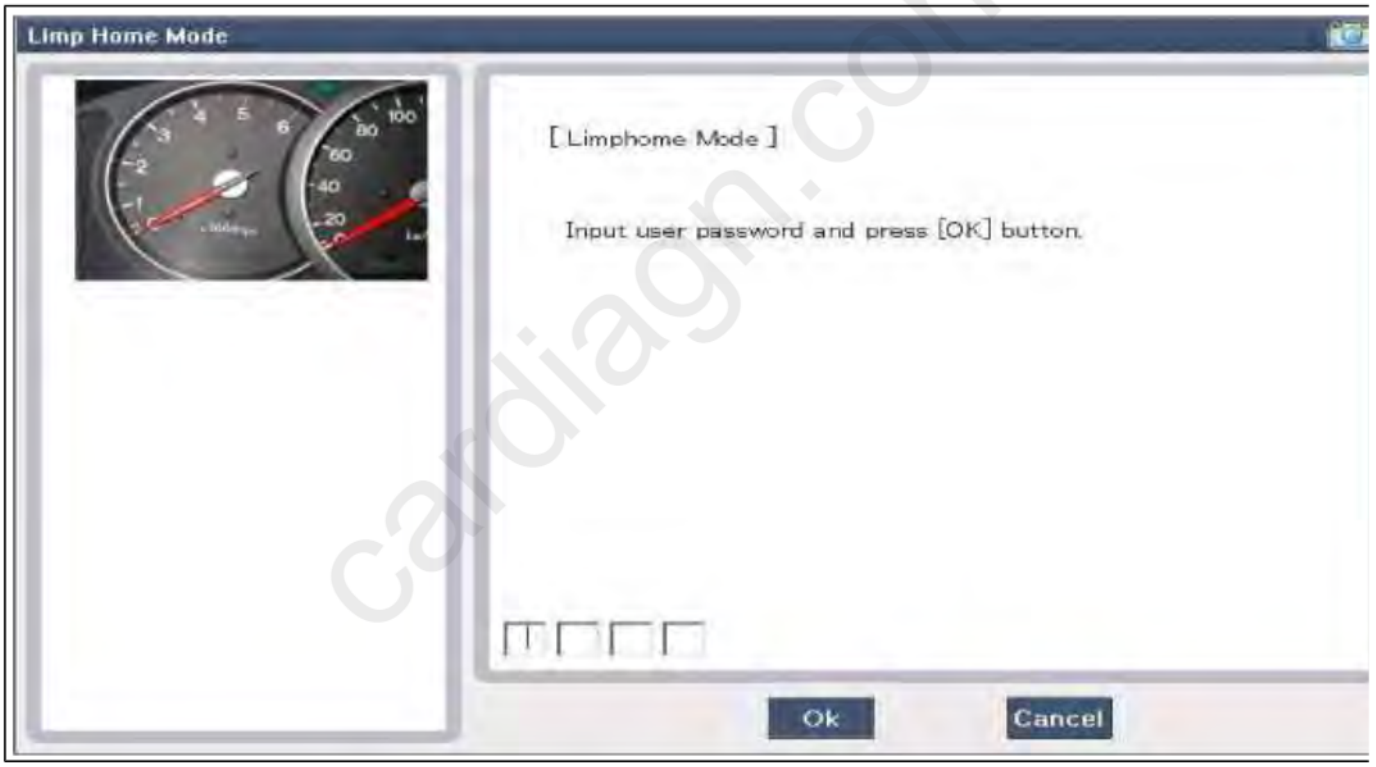
If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service statio 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 corre the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.

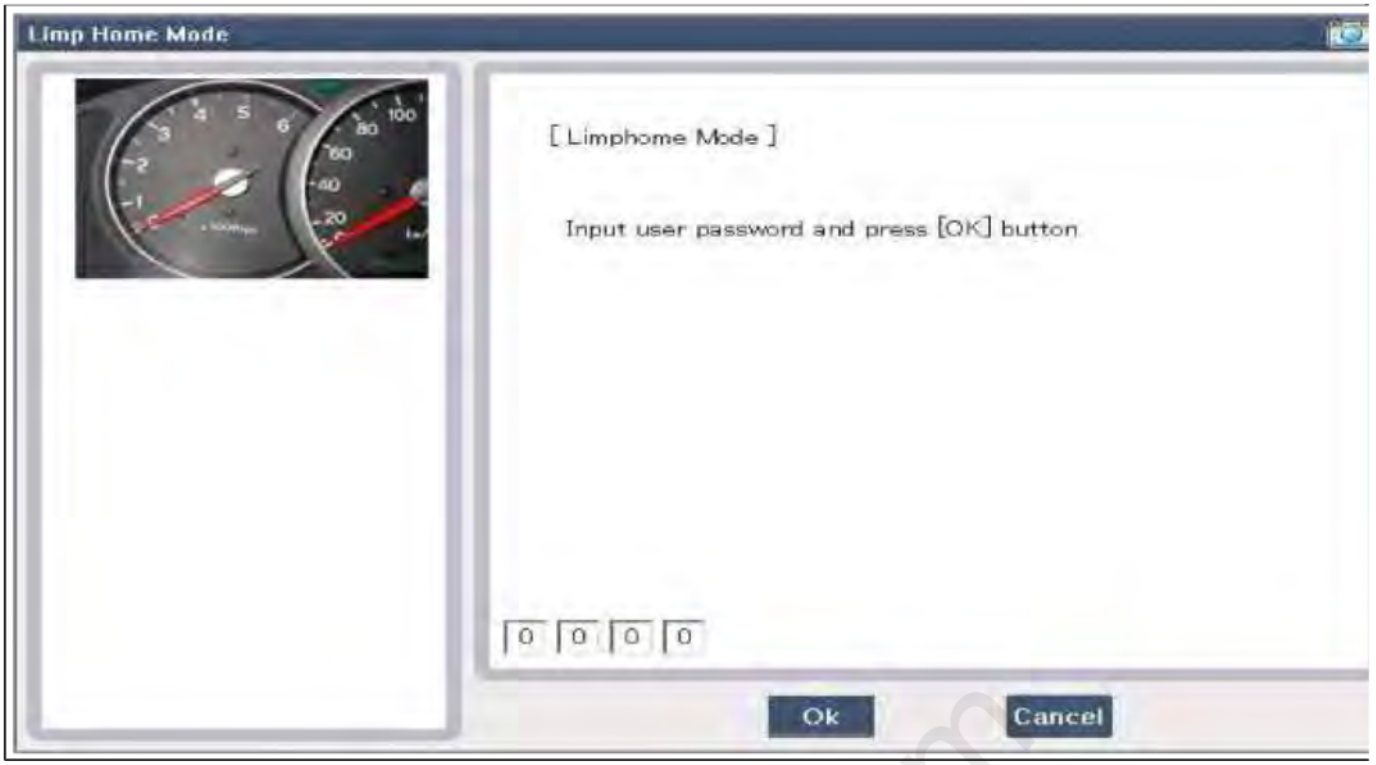
If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnecti the battery or any other action cannot reduce this time. After connecting the battery to the PCM(ECM), the timer starts again for one hour.

cardiagn.com





cardiagn.com



2. Limp Home By Ignition Key

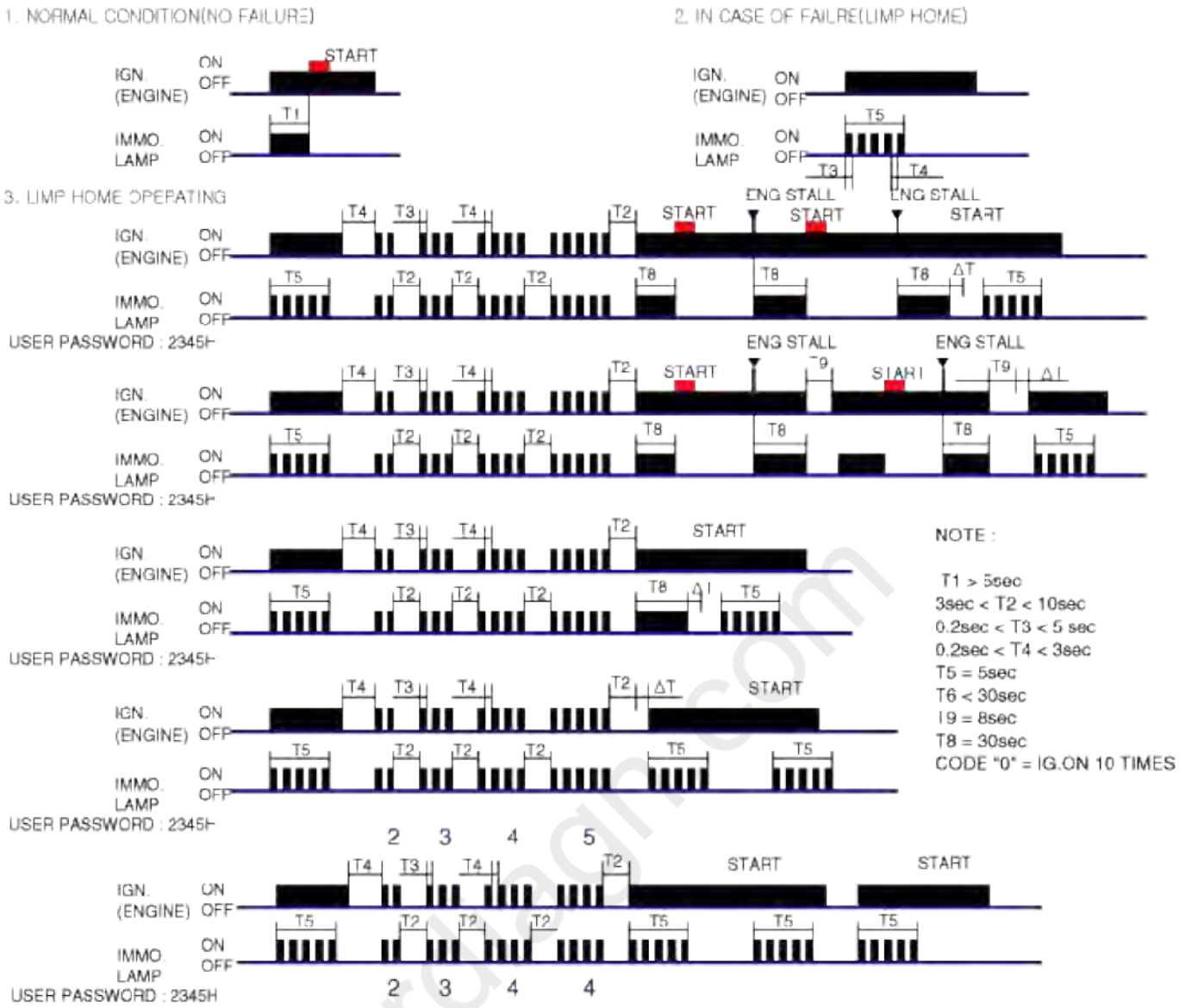
The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the 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 password 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 user password is requested again.

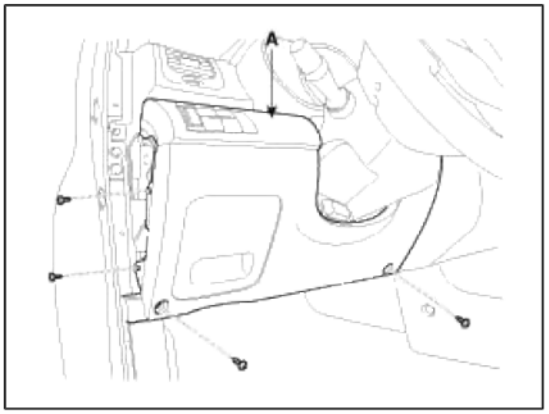
cardiagn.com



Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

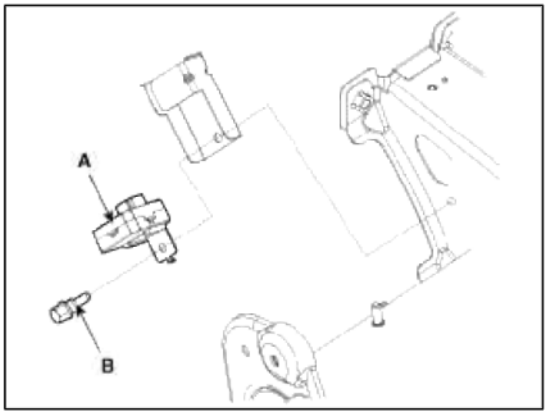
Removal

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

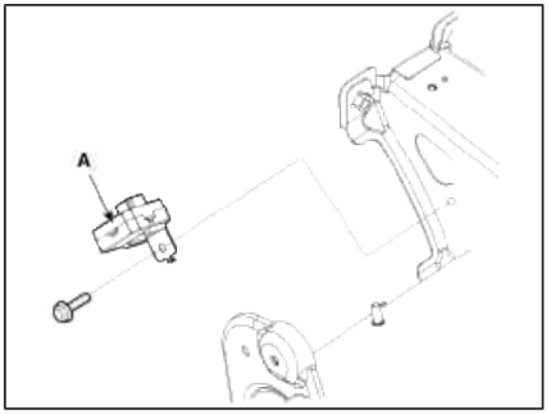


3. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening a shear bolt (B).

[Canada]



[USA]



NOTE

Remove the shear bolt
1) Using a center punch, mark the center of the shear bolt.
2) Drill a hole in the shear bolt using a drill.
3) Remove the drilled shear bolt.
4) Be careful not to damage the immobilizer unit when removing the shear bolt.

Installation

1. Install the immobilizer control unit after connecting the unit connector.

NOTE

Tighten the shear bolt until the hex head twist off.

2. Install the crash pad lower panel.

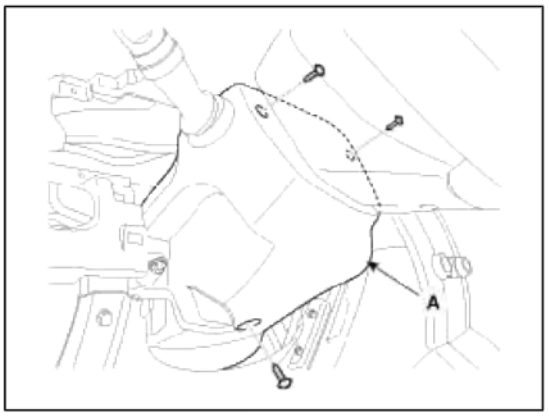
Body Electrical System > Immobilizer System > Antenna Coil > Repair procedures

Removal

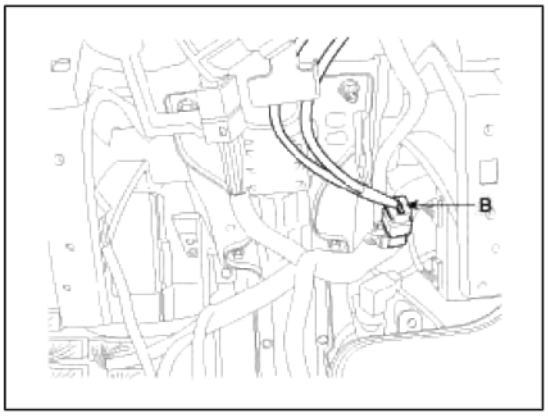
1. Disconnect the negative (-) battery terminal.

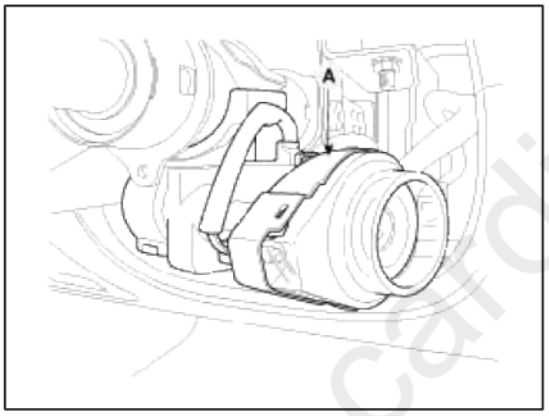
cardiagn.com

2. Remove the steering column upper and lower shrouds (A).



3. Disconnect the 6P connector (B) of the coil antenna and then remove the coil antenna (A) after loosening the screw.





Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the steering column upper and lower shrouds.

Body Electrical System > Immobilizer System > Troubleshooting

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:

Immobilizer Related Faults	Fault types	Diagnostic codes
PCM(ECM) fault	1. Non-Immobilizer-EMS connected to an Immobilizer	P1610

cardiagn.com

Transponder key fault	1. Transponder not in password mode 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programming error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA message error)
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 Authentication 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 response)
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil error)
Immobilizer indicator lamp fault	1. Immobilizer indicator lamp error (Cluster)	P1692 (Immobilizer lamp error)
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 response error/invalid response)
PCM(ECM) fault	1. Request from PCM(ECM) is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (PCM(ECM) message error)
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) memory error)
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt" Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fail)
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 trial)

cardiagn.com

Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Specifications

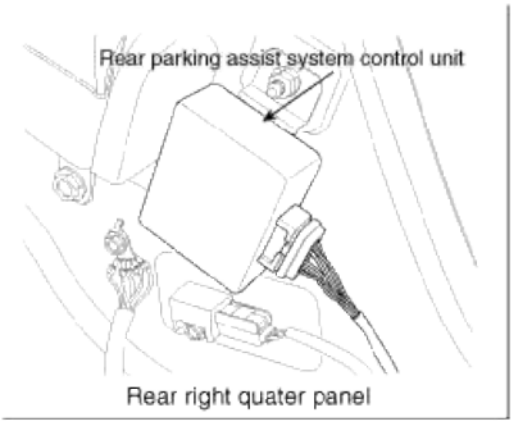
Specifications

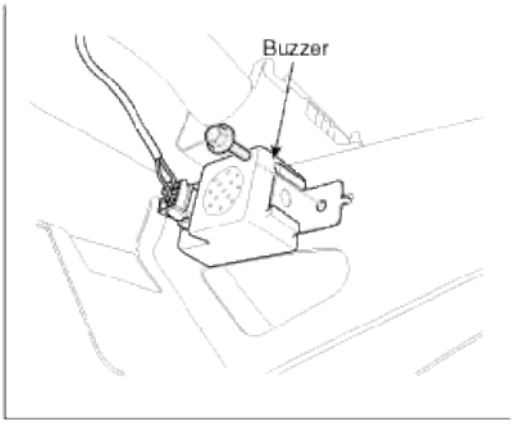
Item		Specification
Rear parking assist system control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-22°F ~ + 167°F (-30°C ~ + 75°C)
	Operation current	MAX 500 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8 V
	Detecting range	15.7 ~ 47.2 in (400 ~ 1200 mm)
	Operation voltage	DC 7 ~ 9 V
	Operation current	MAX 20 mA
	Operation temperature	-22°F ~ + 167°F (-30°C ~ + 75°C)
	Beam width	Horizontal : 100±5°(70cm), Vertical : 60±5°(50cm)
	Number of sensors	4 (Right, Center-left, Center-right, Left)
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-22°F ~ + 176°F (-30°C ~ + 80°C)
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.0±0.5 KHz
		Sound level : MIN 70 dB (DC 13V /m)

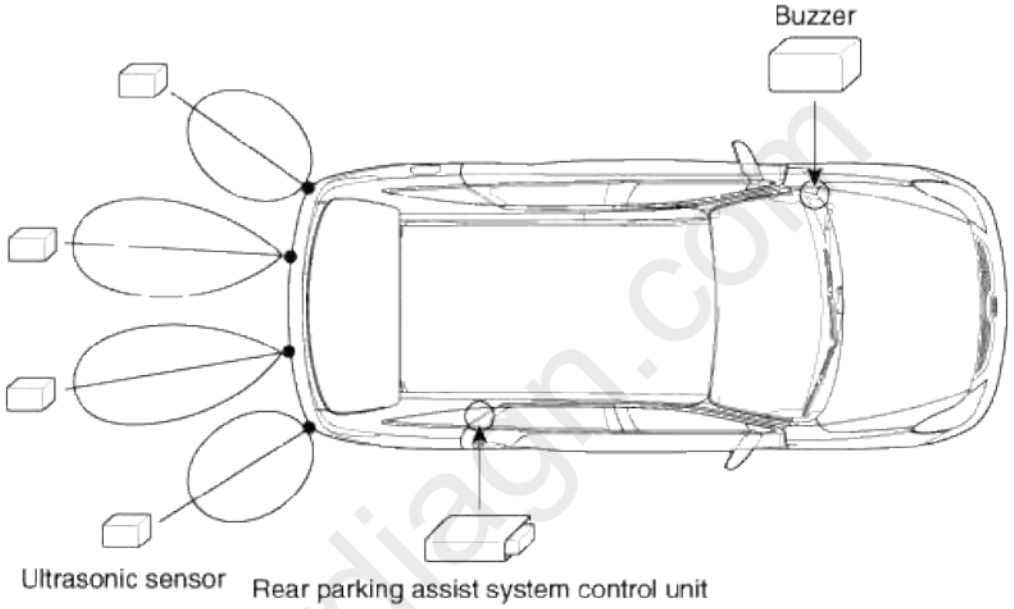
cardiagn.com

Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Components and Components Location

Component Location



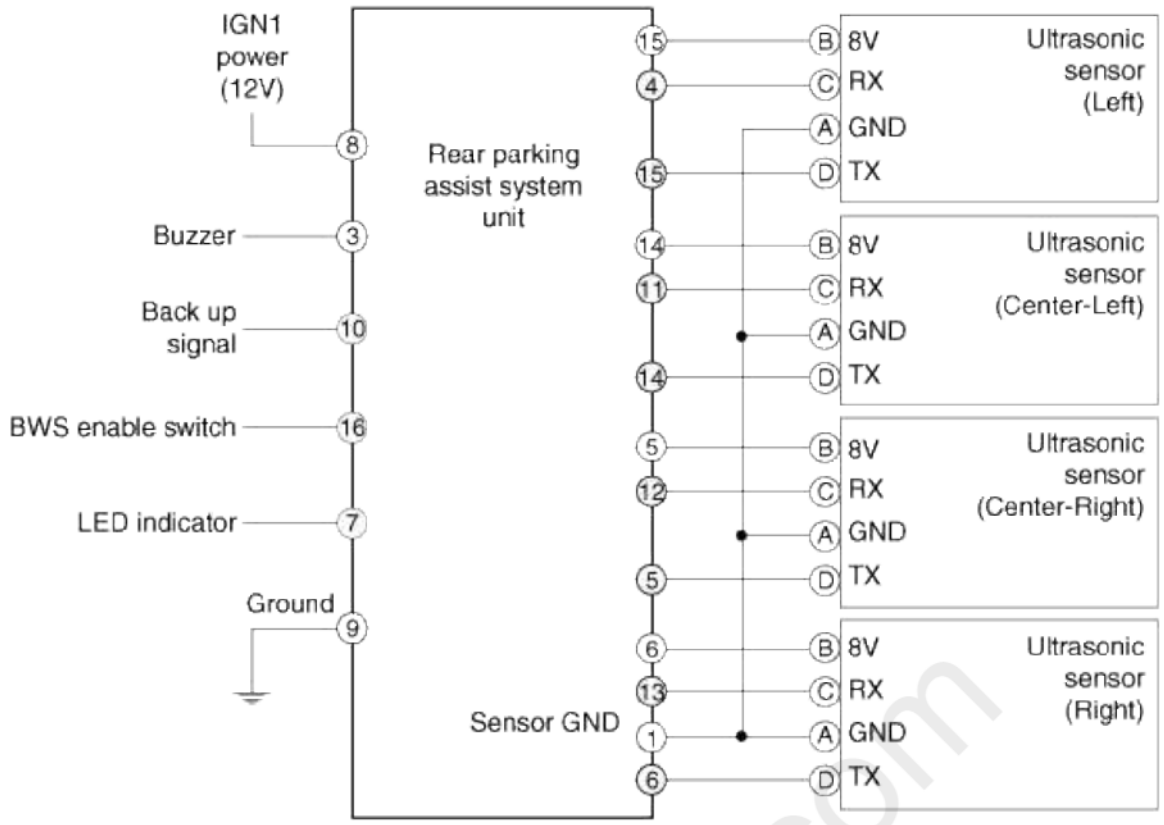




- First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm
- Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm
- Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm

Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Schematic Diagrams

Circuit Diagram



(Rear parking assist system control unit connector)

(Ultrasonic sensor connector)

Pin configuration

Pin No.	Specification	Pin No.	Specification
1	Sensor GND	9	GND
2	Sensor +8V	10	Back up signal
3	Buzzer	11	RX (Center-Left sensor)
4	RX (Left sensor)	12	RX (Center-Right sensor)
5	TX (Center-Right sensor)	13	RX (Right sensor)
6	TX (Right sensor)	14	TX (Center-Left sensor)
7	LED indicator	15	TX (Left sensor)
8	IGN1 power (12V)	16	BWS enble switch

Pin No.	Specification
A	GND
B	8V
C	RX
D	TX

cardiagn.com

Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Description and Operation

Description

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, back warning system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third

alarm).

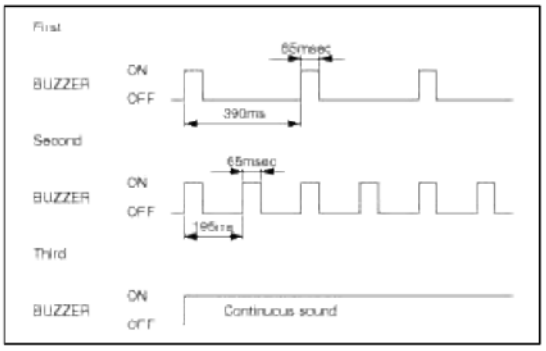
Alarm Range

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.

First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm

Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm

Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm



NOTE

1. Time tolerance of the above waveform : Time ± 10%
2. At nearer distance than 40cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 10km/h or less.
   For moving target, maximum operation speed shall be target approach speed of 10km/h.
4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. False alarm, or failure of the alarm to trigger may occur in the following conditions.
   - Irregular road surface, gravel road, reversing toward grass.
   - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
   - When a wireless transmitter is used near to the sensor.
   - Dirt on the sensor.
   - Sequential alarm may not occur due to the reversing speed or the target shape.

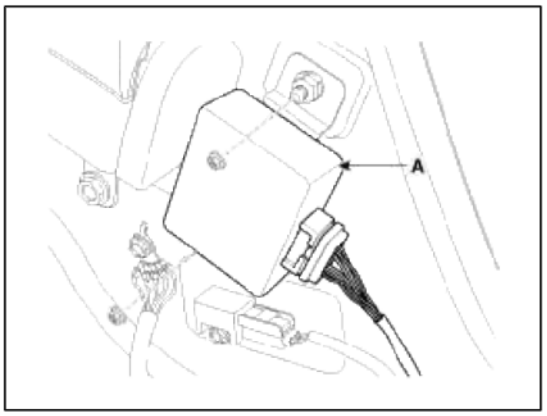
Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Repair procedures

Removal

1. Remove the rear left quarter trim of the trunk.
   (Refer to BD group - "Interior trim")

cardiagn.com

2. Loosen the mounting nuts and remove the rear parking assist system control module unit (A) from the quarter panel.



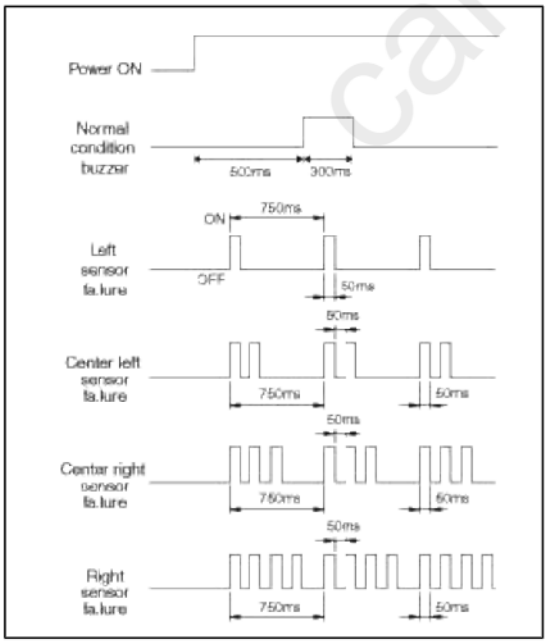
Installation

1. Reassemble the rear parking assist system control module.
2. Reassemble the rear left quarter trim.

Body Electrical System > Rear Parking Assist System > Rear Parking Assist System Control Unit > Troubleshooting

Diagnosis

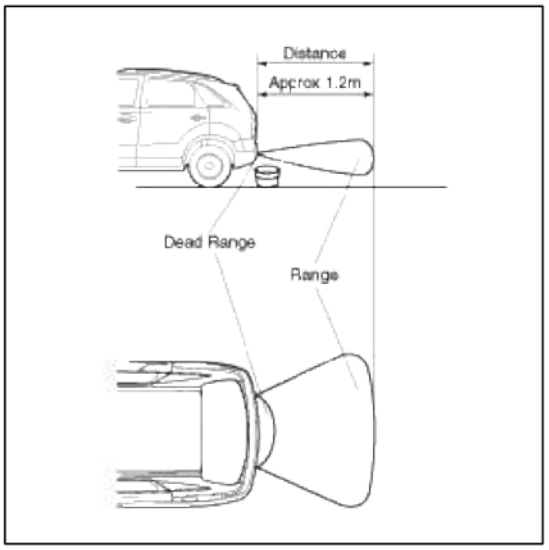
1. Operate with ignition switch on and shift the lever to position "R"
2. Then it checks the system condition.
   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.8 seconds from power approval. In case of system failure, then it indicates the failed point as follows.
   A. Left sensor failure : beep-beep-beep
   B. Center sensor failure : beep beep-beep beep-beep beep
   C. Right sensor failure: beep beep beep-beep beep beep-beep beep beep
3. Alarm is generated 3 times sequentially.
4. Effective operation range is 10km/h or less for the vehicle speed.



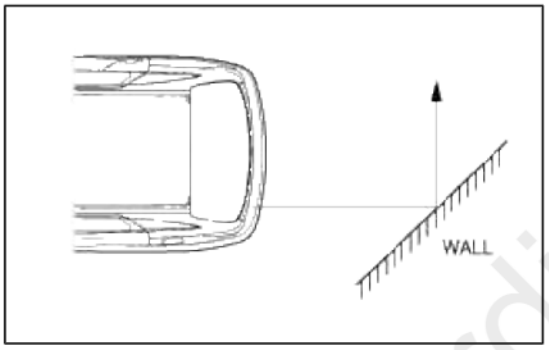
Warning

1. Range detected by back sensors is limited.
   Watch back before reversing

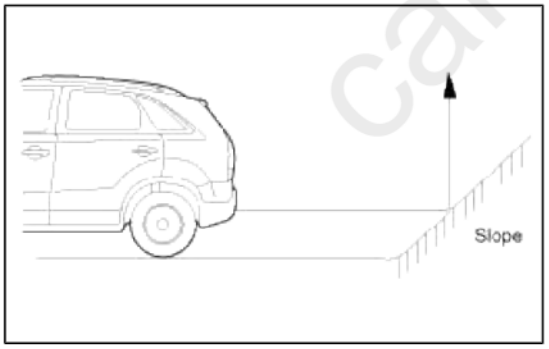
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
   (1) Needles, ropes, rods, or other thin objects.
   (2) Cotton, snow and other material absorbing ultrasonic wave
   (for example, fire extinguisher device covered with snow)



4. Reversing toward the sloped walls.



5. Reversing toward the sloped terrain.



6. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Always visually check the area behind the vehicle before backing up.
   The sensors cannot discriminate between materials.

cardiagn.com

7. Sensors may not operate correctly in the below conditions.
   Ensure sensors are clean from mud or dirt
   (1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water. Do not wipe or scrape sensor with a rod or a hard object.
   (2) If the sensor is frozen, alarm may not operate until sensor thaws.
   (3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
   (4) When heavy cargo is loaded in rear cargo area, it changes the vehicle balance, which reduces the detection range.
   (5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
   (6) Under heavy rain.
   (7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite the absence of a barrier)
   (8) If radio antenna is installed at the rear.
   (9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.
   (10) Vehicle balance is changed due to the replacement of the rear spring.
   (11) The unit will operate normally when the vehicle speed is 5km/h or less.
   Above this speed, the unit may not operate normally
8. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.
9. Be careful not to apply shock during sensor installation on the transmission or reception unit.
10. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not to change the transmission and reception unit wiring.
    Tagging the transmission side and reception side, it may cause malfunction.
11. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.
12. Be careful that excessive heat or sharp objects shall not touch ultrasonic sensor surface.
    Do not cover the sensor opening or press the sensor.

cardiagn.com

Body Electrical System > Rear Parking Assist System > Ultrasonic Sensor > Description and Operation

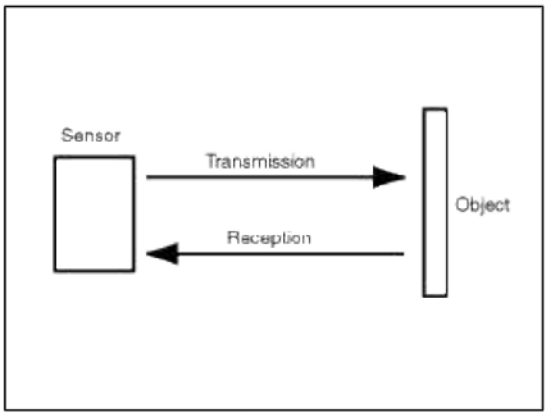
Operation

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

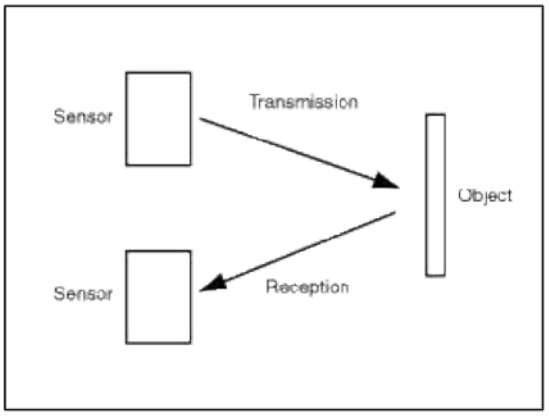
Distance detection type

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



Measurement principle

Back warning system (BWS) is a complementary device for reversing. BWS detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

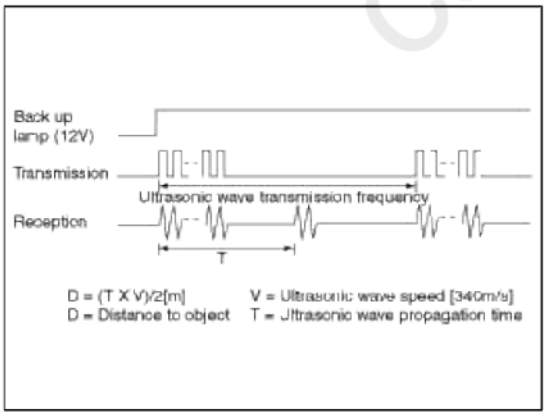
The propagation speed formula of ultrasonic wave in air is following :

v=331.5 + 0.6t (m/s)

v=ultrasonic wave propagation speed

t=ambient temperature

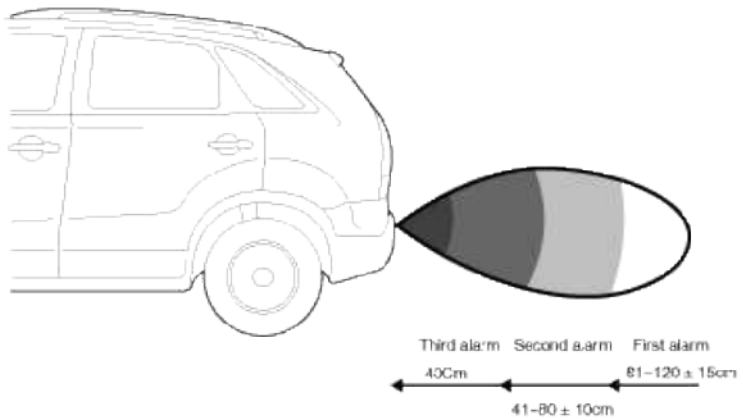
The basic principle of distance measurement using ultrasonic wave is :



Sensor detection range

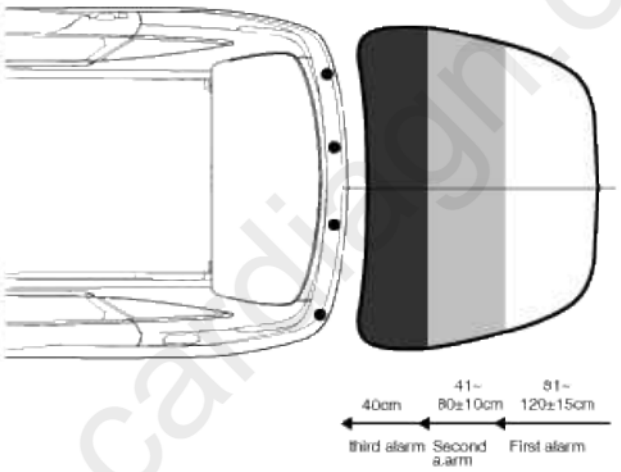
cardiagn.com

[Vertical Range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10Cm
2. Detection tolerance
   At 40cm :45° ± 15°
   At 80cm : 30° ± 15°
   At 120cm : 20° ± 15°
3. At nearer distance than 40cm detection may occur.
4. Measurement condition : Room temperature (20℃), 140mm diameter, 1m length rod.

[Horizontal Range]



1. Distance tolerance(Messured at the front of sensor)
   81~120cm : ±15cm
   41~80cm : ±10cm
   40cm : ±10cm
2. Detection tolerance
   At 80cm : 90° ± 20°
   At 120cm : 10° ± 20°
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20℃), 140mm diameter 1m length rod.

cardiagn.com

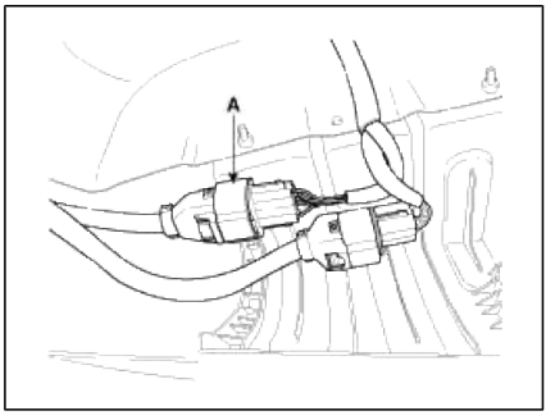
NOTE

1. 14cm (Diameter) plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
   - Sharp object or thin object like rope.
   - Cotton, sponge, snow or other materials absorbing sonic wave.
   - Smaller objects than 14cm (Diameter), 1m length.

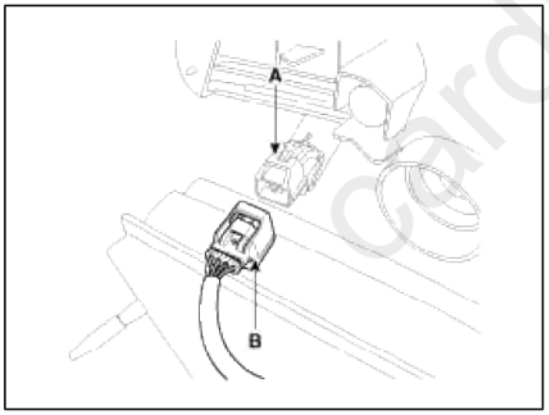
Body Electrical System > Rear Parking Assist System > Ultrasonic Sensor > Repair procedures

Removal

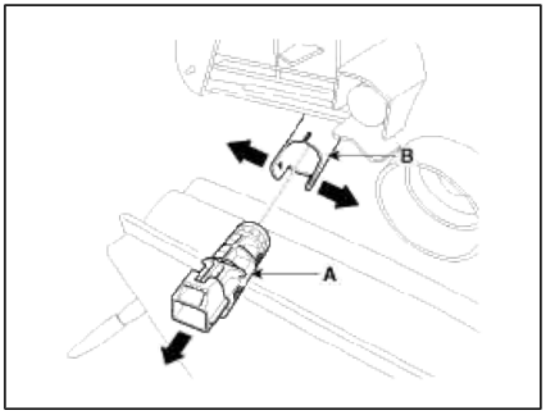
1. Remove the rear bumper.
   (Refer to BD group - "Rear bumper")
2. Disconnect the wiring harness connector (A) from the rear bumper.



3. Disconnect the sensor (A) connector (B) inside the rear bumper.



4. Pull out the sensor (A) by opening the sensor holder (B) out.



cardiagn.com

Installation

1. Connect the connector, and then reassemble the sensor.
2. Install rear bumper.

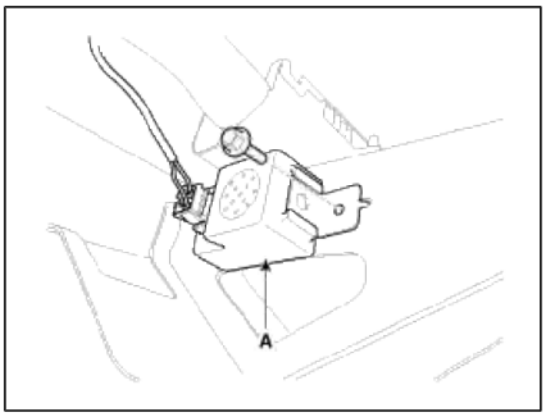
Body Electrical System > Rear Parking Assist System > Buzzer > Repair procedures

Inspection

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

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to BD group - "Crash pad")
3. Remove the buzzer (A) after loosening the bolt and disconnecting the 2P connector.



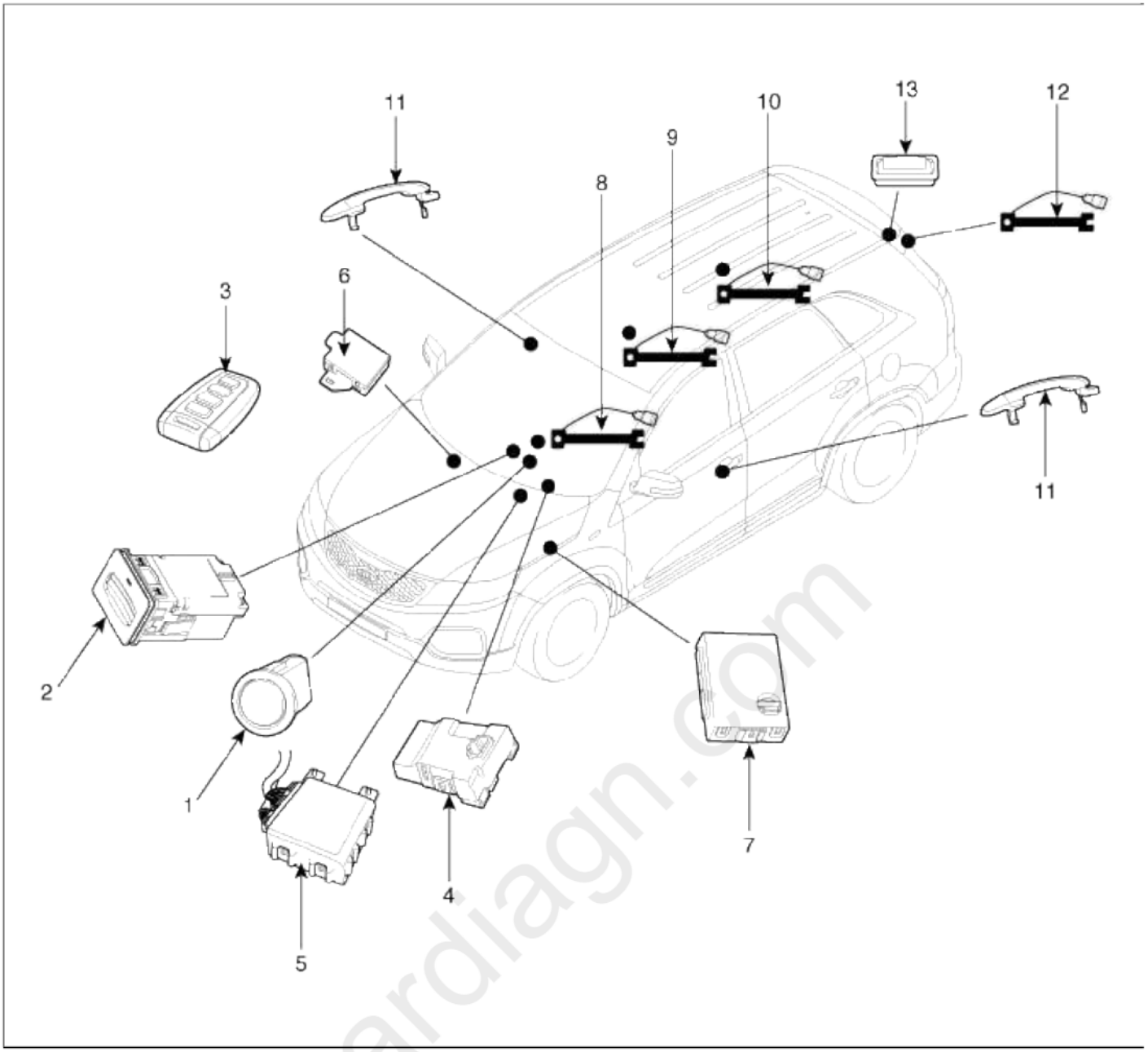
Installation

1. Connect the connector, and then install the buzzer.
2. Install the crash pad lower panel.

Body Electrical System > Button Engine Start System > Components and Components Location

Component Location

cardiagn.com

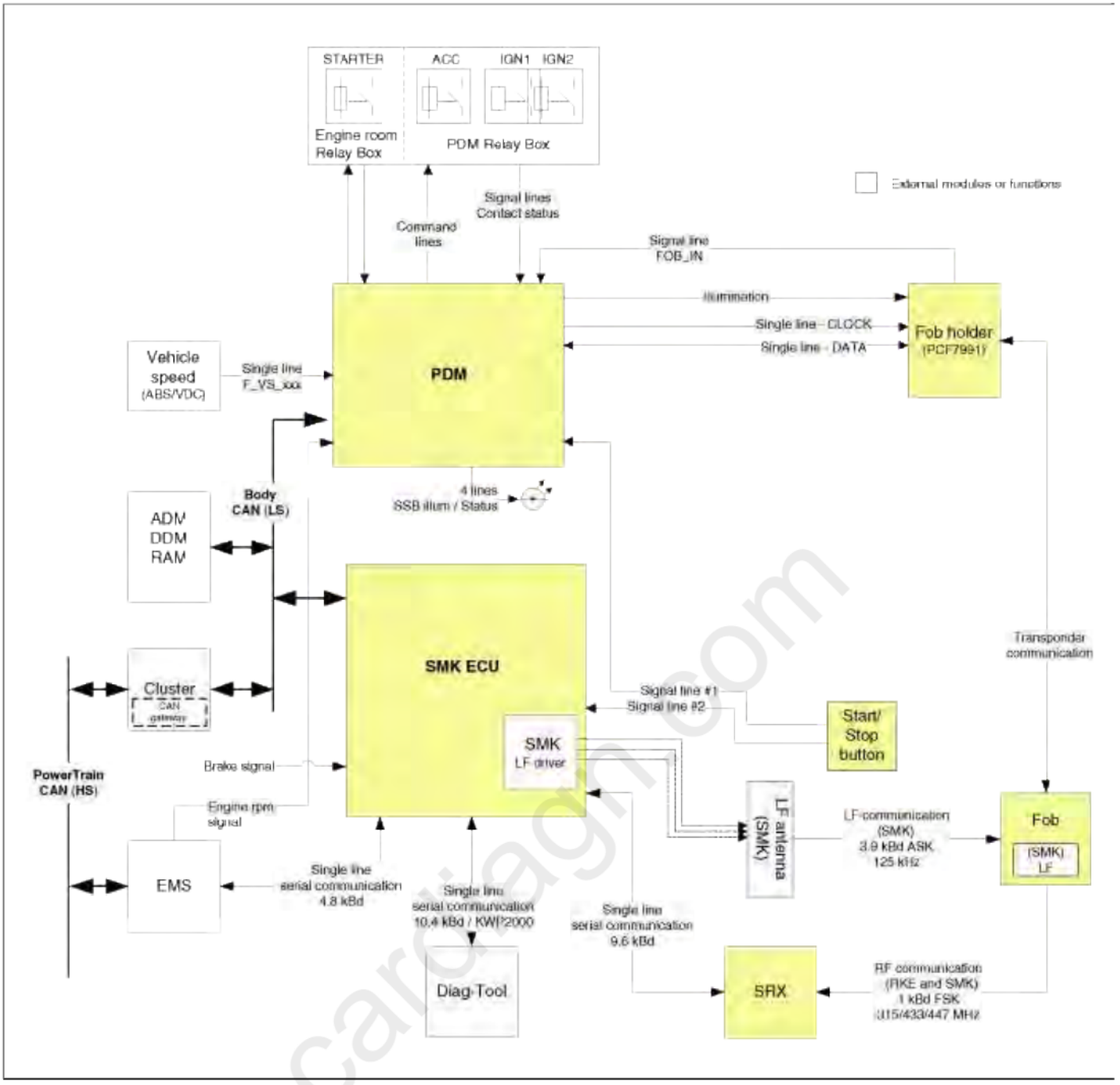


1. Start Stop Button (SSB) 2. FOB key holder 3. FOB key 4. PDM (Power Distribution Module) 5. Smart key unit 6. RF receiver 7. IPM (Intelligent intergrated Platform Module)	8. Interior antenna 1 9. Interior antenna 2 10. Interior antenna 3 11. Door handle & door antenna 12. Bumper antenna 13. Tailgate switch

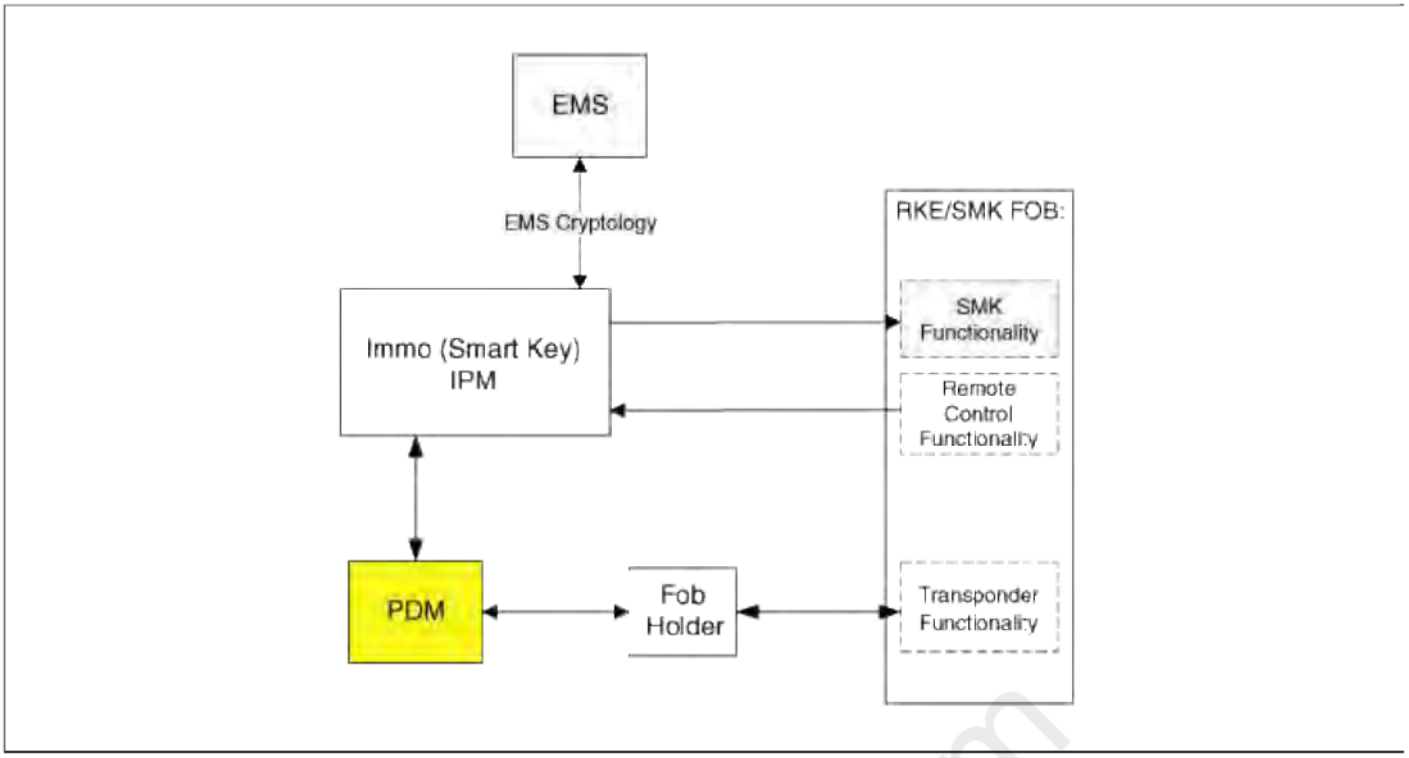
Body Electrical System > Button Engine Start System > Schematic Diagrams

Circuit Diagram (1)

cardiagn.com



Circuit Diagram (2)



Body Electrical System > Button Engine Start System > Description and Operation

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 ignition 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 using a standard mechanical key.

If the driver press the SSB while prerequisites on brakes, fob authentication and transmission status are satisfied, the BES System will proceed with the locking/unlocking of the steering column, the control of the terminal, and the cranking of the engine.

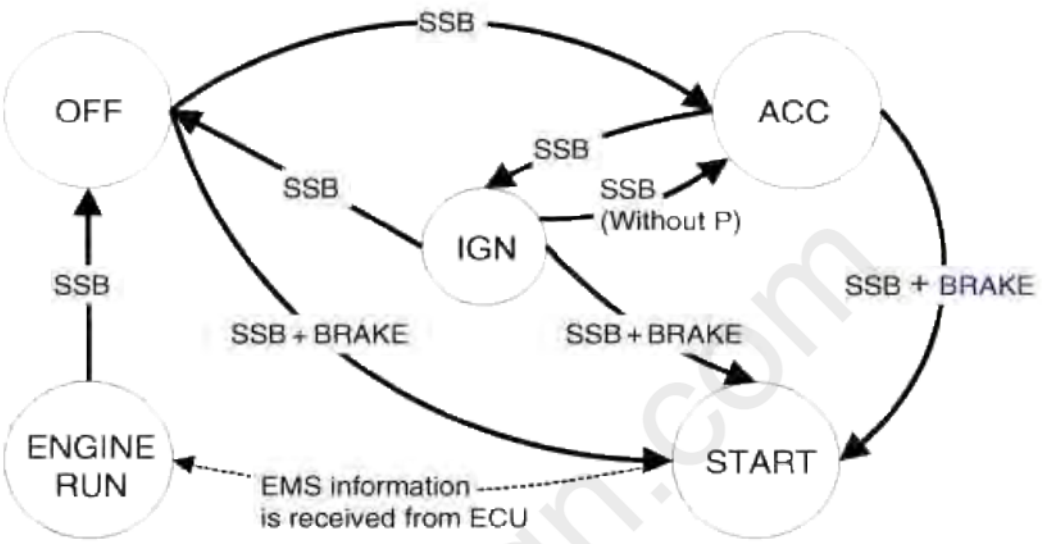
The driver can release the SSB as soon as this sequence initiated. After positive response from immobilizer interrogation, the system will activate the starter motor and communicate with the EMS to check the engine running status for starter release.

cardiagn.com

The driver will be able to stop the engine by a short push on the SSB if the vehicle is already in standstill. Emergency engine stop will be possible by a long press of the SSB or 3 consecutive presses in case the vehicle is in ENGINE RUNNING.

If the conditions for engine cranking are not satisfied while a push on the SSB is detected and a valid fob authenticated, the system will unlock the steering column and switch the terminals to IGN. Another push on the SSB will be necessary to start the engine.

In case of a vehicle equipped with SMART KEY system, fob authentication will not require any action from the driver. For 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 and PDM.
- Display status by LED Lamp ON/OFF. (Amber or Green)

Indicator ON/OFF Condition At Ignition Key Off Condition

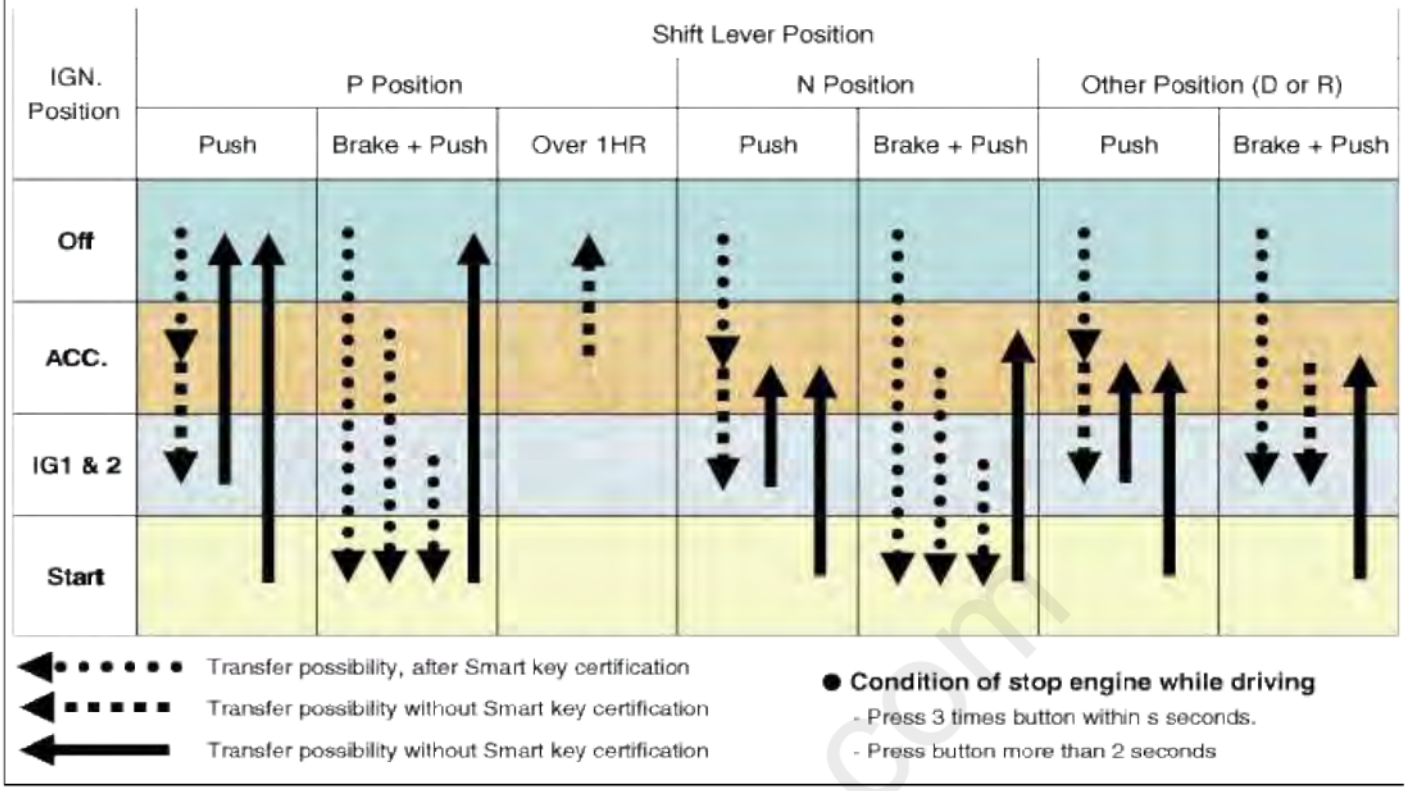
No.	Character lamp	Conditions
1	Indicator Lamp ON	Door open, Tail lamp ON, ACC, IG ON
2	Indicator Lamp 30sec ON → Lamp OFF	Door close, Tail lamp OFF, IG OFF
3	Indicator Lamp OFF	Remote LOCK, Passive LOCK
4	Rheostat at tail lamp ON (Illumination lamp)	

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)	Green color LED ON
4	Cranking	Maintain LED status before cranking
5	Engine running	LED OFF

cardiagn.com

The shift of Ignition Position



Wireless Communication

Electromagnetic waves are used to exchange information between the vehicle and the FOB. Two types of RKE Key can supplement the BES system:

- Non-PIC RKE
- SMART KEY FOB

Currently the BES system comprises with SMART KEY FOB always.

The transmitter, receiver and antennas required for the communication between the fob and the vehicle will differ depending on functionalities and regional areas.

The RKE and SMART KEY functions are in separated documents. Refer to Smart key system for more detailed information about SMART KEY function.

Smart Key

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 are integrated for Terminal switching Operations”.

It collects information about vehicle status from other modules (vehicle speed, alarm status, driver door open...), reads the inputs (e.g. SSB, Capacitive Sensor / Lock Button, PARK position Switch), controls the outputs (e.g. exterior and interior 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.

PDM (Power Distribution Module)

cardiagn.com

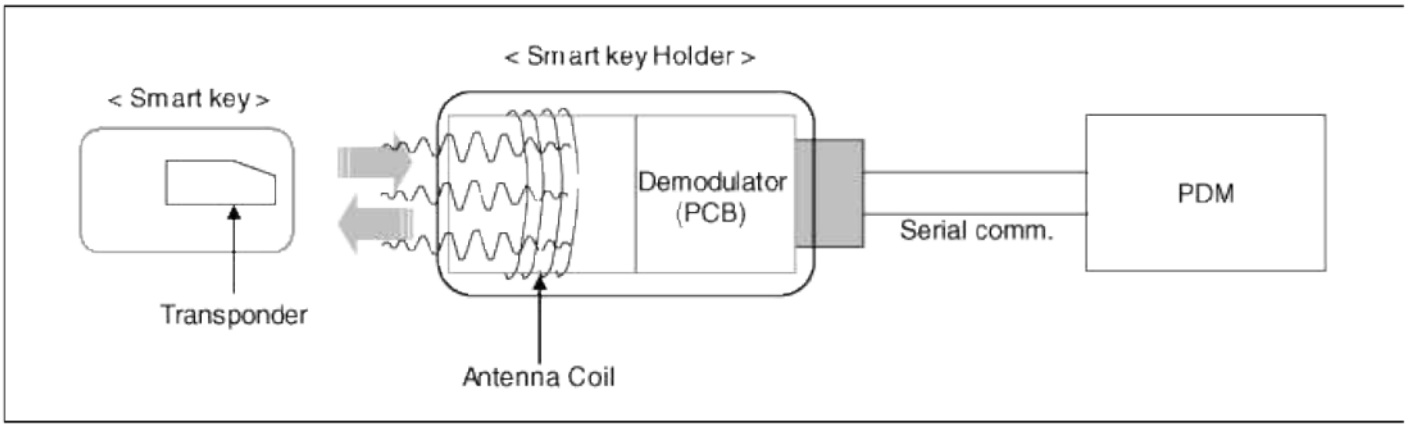
The PDM manages the functions related to the "terminal control" by activating external relays for ACC, IGN1 and IGN2. This unit is also responsible for the control of the STARTER relay.
The PDM is also controlling the illumination of the SSB as well as the "system status indicator", which consists of 2 LEDs of different color. The illumination of the fob holder is also managed by the PDM.
The PDM reads the inputs (Engine fob in, vehicle speed, relays contact status), controls the outputs (Engine relay output drivers), and communicates with others devices via the CAN.
The internal architecture of the PDM is defined in a way that the control of the terminal is secured even in case of failure of 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 IGN2 terminals relays shall be maintained in the state memorized before the failure and the driver shall be able to switch those IGN terminals off by pressing the SSB with EMERGENCY_STOP pressing sequence. However, engine restart will not be allowed. The state of the ACC relay will depend on the type of failure.
The PDM is diagnosed through theSMK MUT service, using the CAN network.
The main functions of the PDM are:

- Control of Terminal relays
- Monitoring of the Vehicle speed received from sensor or ABS/VDC ECU.
- Control of SSB LEDs (illumination, clamp state) and FOB HOLDER illumination.
- Control of the base station located in fob holder 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
- Starter power control

Fob Holder
This unit is used for transponder authentication. In case of a vehicle equipped with Smart key, this transponder authentication is necessary in case of failure of the passive fob authentication (Engine loss of RF or LF link with the fob).
The Fob holder module integrates a slot where to insert the fob. The fob is maintained in position with a push-push mechanical locking (not electrically driven) and a signal (FOB IN) is sent back to the PDM as soon as its insertion is detected.
The power supply of the fob holder is active only if a communication is initiated by the PDM.
The insertion of the fob into the holder and the communication with the transponder should be possible regardless of the insertion direction of fob to the holder (buttons facing up or bottom).
A lighting device is also integrated for illumination of the Fob Holder and it is driven directly by the PDM,
The main functions of the Fob holder are:

- Transponder base station
- Fob mechanical lock
- Illumination

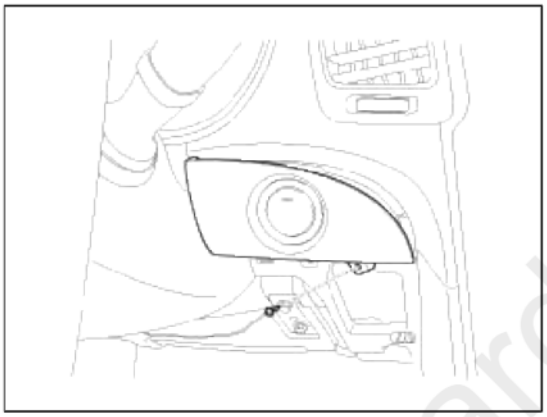
Transponder



External Receiver(SRX)
The data transmitted by the RKE or Smart key Fob is received by an external RF receiver called as SRX. This receiver will be same as that one for the SMK applications, with respect to electronics, housing, connector and software.
This receiver is connected to the SMK via a serial communication line.
Terminal And Starter Relays
Relays will be used to switch the terminals ACC / IGN1 / IGN2. Those normally-open relays will be driven by the PDM and located either in the passenger or engine compartment depending on the vehicle architecture.
Only one relay coil is connected to the terminal outputs of the PDM.
Those relays should integrate a resistor connected in parallel to the coil in order to reduce the transients during commutation.
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 whenever necessary.
Two (2) LED colors are located in the center of the button to display of the status of the system. Another illumination LED is also integrated into the SSB for the lighting of the "Engine Start/Stop" characters.



Bes 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 status:

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 based on a mechanical ignition switch.

cardiagn.com

The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition from [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 status of the terminals and Engine status:

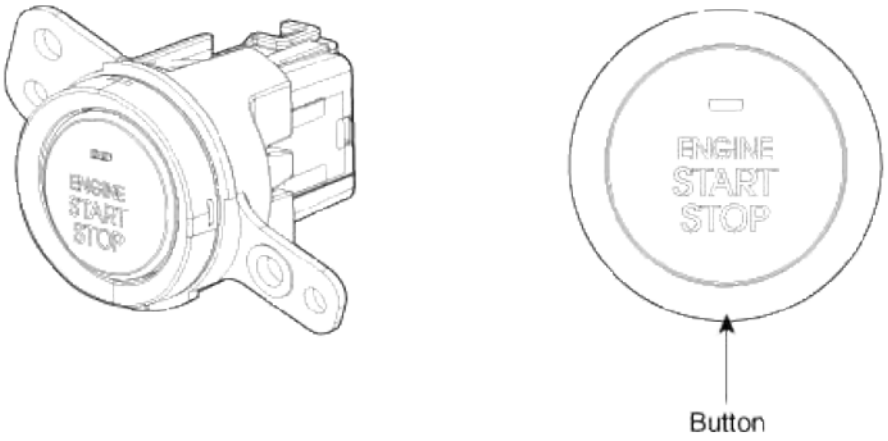
System State	Terminal Status	Engine status
1. OFF - UNLOCKED	OFF	Stopped
2. ACC	ACC	Stopped
3. IGN	IGN1, IGN2, ACC	Stopped
4. Start	IGN1, START with special pattern of activation see Chap 6.2.1 for details	Cranking
5. IGN - Engine	IGN1, IGN2, ACC	Running (means "self-running")

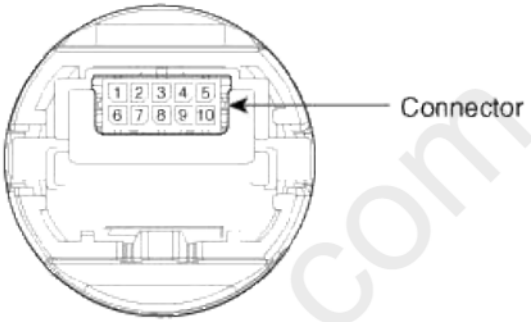
Referring to the terminals, the system states described in the table above are same as those one found in a system based on a mechanical ignition switch. The one of distinction with Mechanical-Ignition-Switch based system is that the BES system allows specific transition from [OFF] to [START] without going through [ACC] and [IGN] states.

Body Electrical System > Button Engine Start System > Start/Stop Button > Components and Components Location

Component

cardiagn.com





Connector (10 pins)			
Pin No.	Description	Pin No.	Description
1	Start Stop button switch1(PDM)	6	Battery
2	Battery illumination	7	Start Stop button switch2 (SMK)
3	Start Stop button LED (PDM)	8	Start Stop button LED (PDM)
4	PDM Driver P start stop button illumination	9	Rheostat
5	Start stop button illumination power (PDM)	10	-

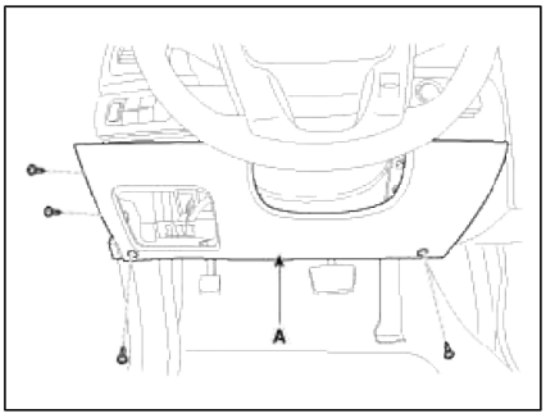
carjdiagn.com

Body Electrical System > Button Engine Start System > Start/Stop Button > Repair procedures

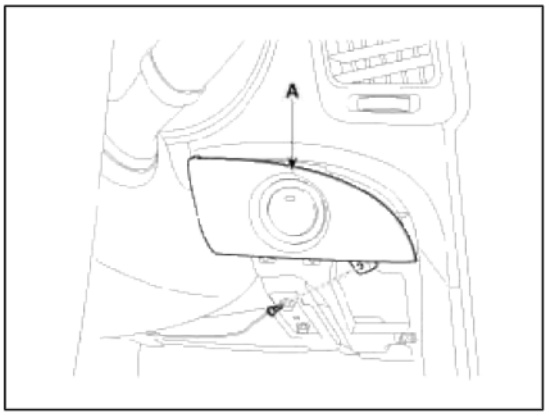
Removal

1. Disconnect the negative(-) battery terminal.

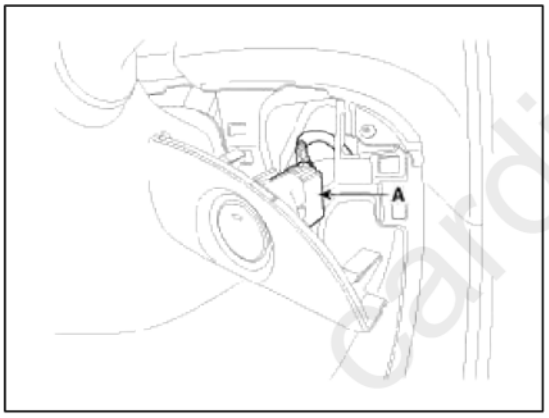
2. Remove the crash pad lower panel (A).
   (Refer to BD group - "Crash pad")



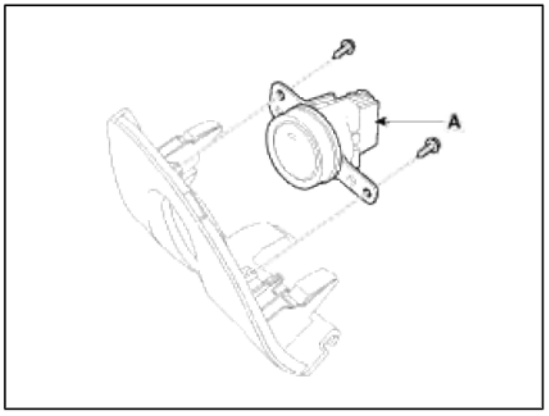
3. Remove the start/stop button cover (A) after loosening the mounting screw.



4. Disconnect the connector (A).



5. Remove the start/stop button (A) after loosening the mounting screws.



Installation

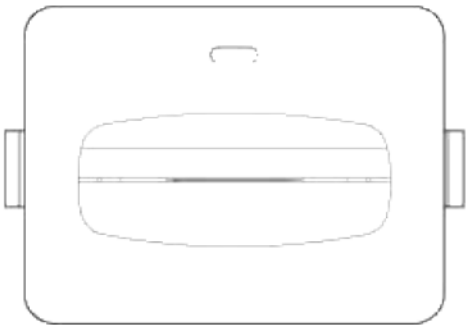
1. Install the start/stop button.
2. Install the start/stop button cover.

cardiagn.com

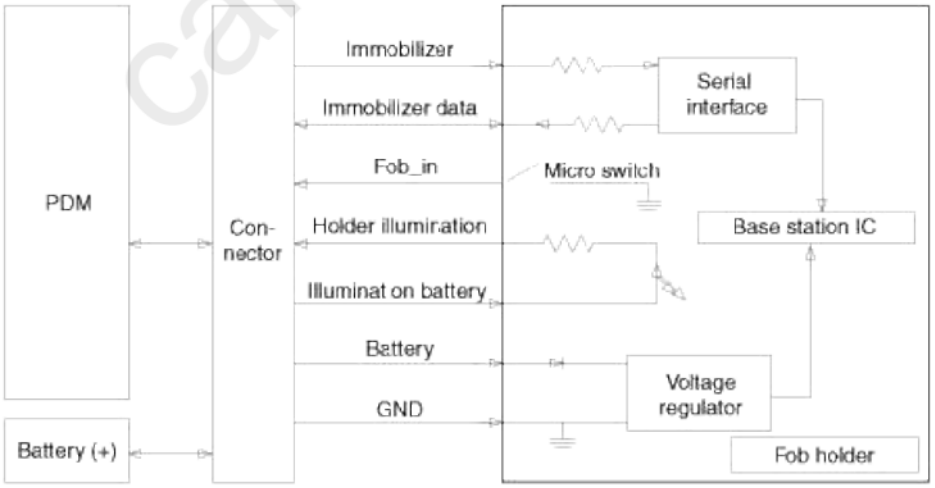
3. Install the crash pad lower panel.

Body Electrical System > Button Engine Start System > Fob Holder > Components and Components Location

Component



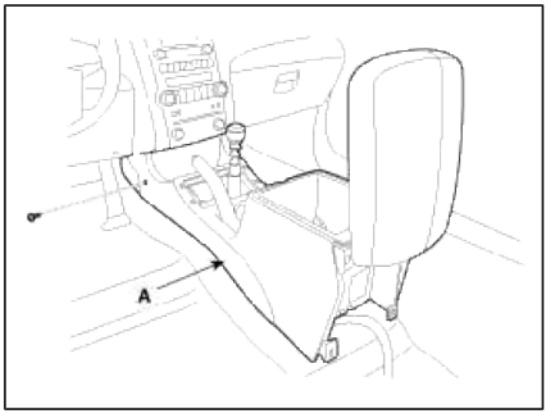
Connector (10 pins)			
Pin No.	Description	Pin No.	Description
1	-	6	Battery
2	Immobilizer clock	7	Immobilizer data
3	Holder illumination(PDM)	8	Illumination battery
4	-	9	Fob in (PDM)
5	GND	10	-



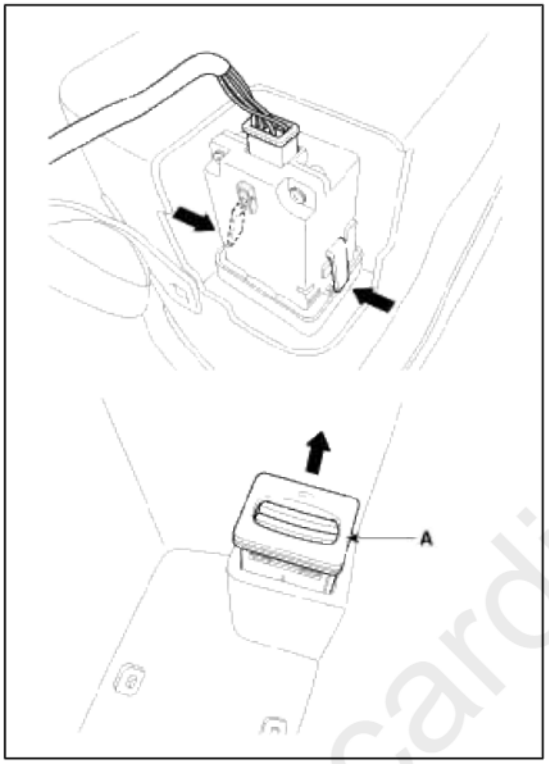
Body Electrical System > Button Engine Start System > Fob Holder > Repair procedures

Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the floor console (A).
   (Refer to BD group - "Console")



3. Disconnect the connector, then remove the fob holder assembly (A) after releasing the hook.



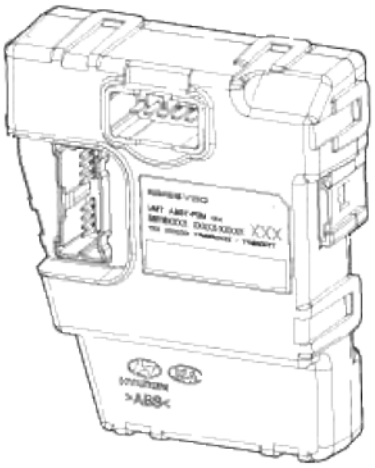
Installation

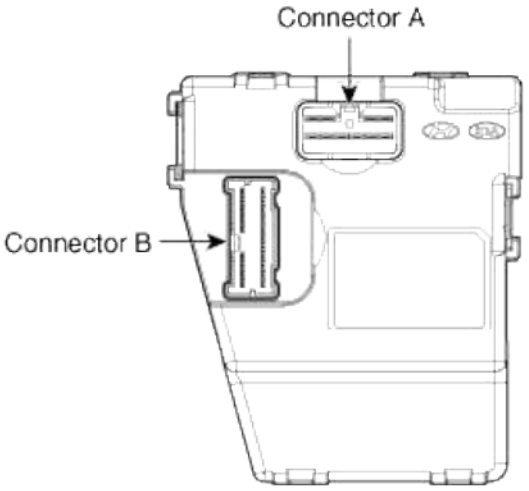
1. Install the fob holder assembly.
2. Install the floor console.
3. Install the negative(-) battery terminal.

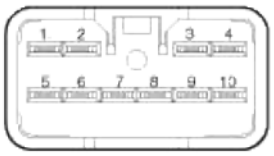
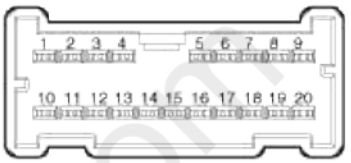
Body Electrical System > Button Engine Start System > PDM(Power Distribution Module) > Components and Components Location

Component

cardiagn.com

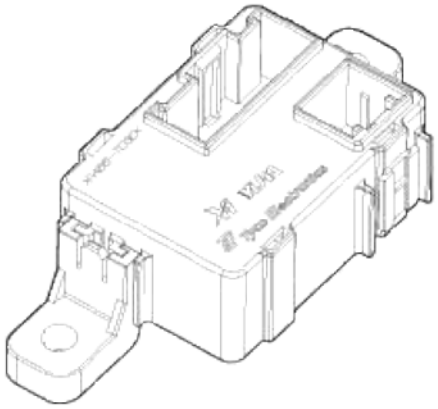


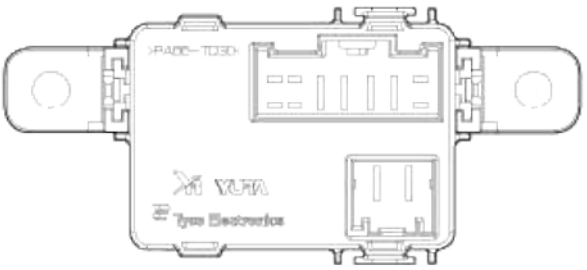


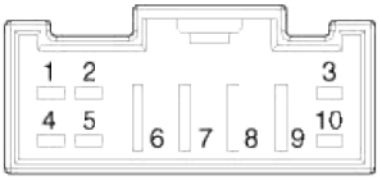
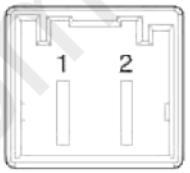
		
Pin No.	Connector A (10 pin)	Connector B (20 pin)
1	Power ground 1	IGN2
2	Power ground 2	Immobilizer clock
3	-	Immobilizer data
4	ESCL battery	ACC
5	ESCL ground	-
6	Starter relay	SSB switch1
7	IGN1 relay	SSB illumination ground
8	IGN2 relay	SSB LED green
9	ACC relay	IGN1
10	Battery load	CAN L
11		CAN H
12		Fob in
13		ESCL unlock
14		Vehicle speed/ ABS
15		Start feedback
16		RPM
17		SSB LED amber
18		SSB illumination power
19		Holder illumination
20		CPU battery

carsfaqn.com

PDM(Power Distribution Module) Relay Box



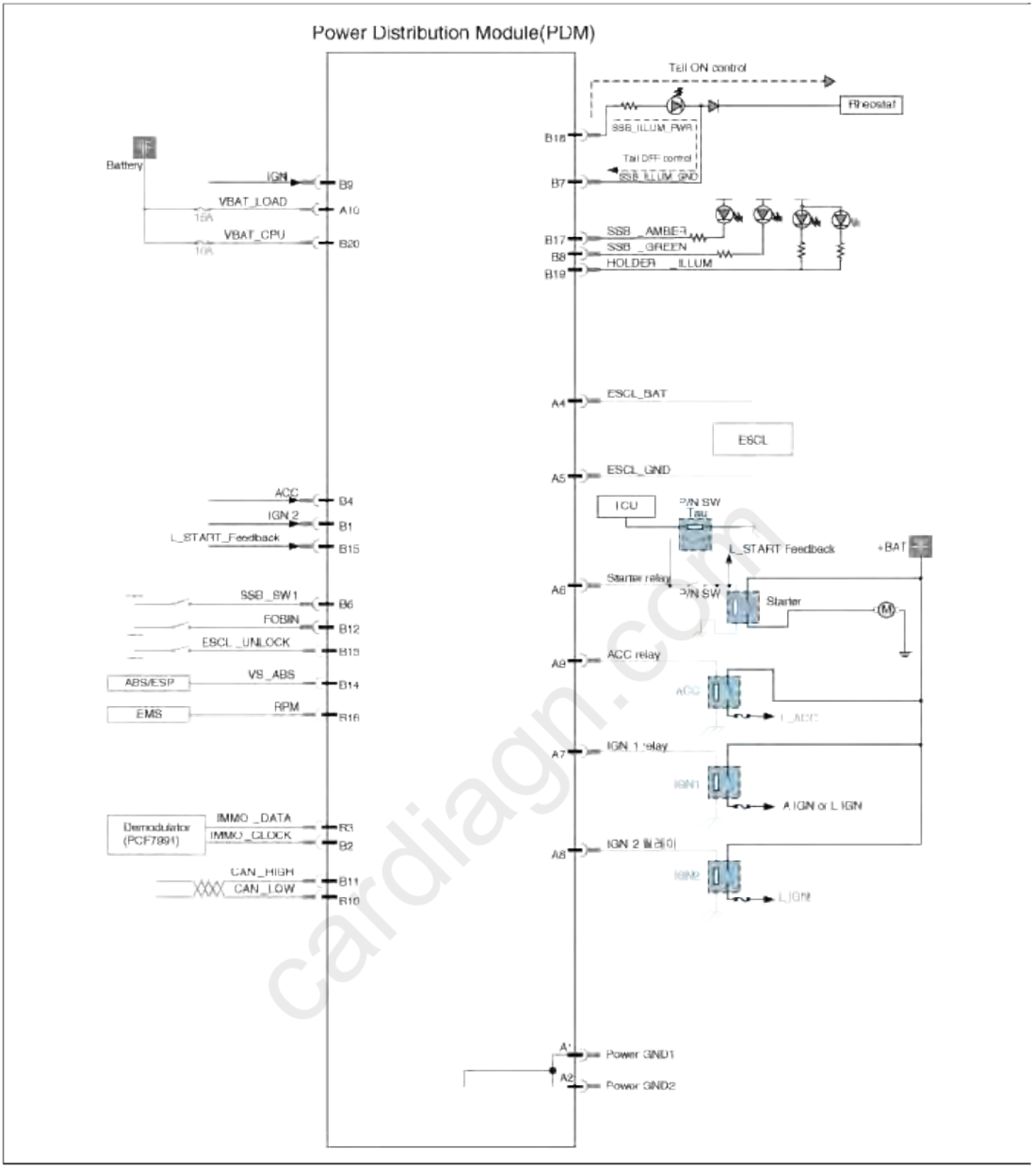


Connector		
Pin No.	Connector A (10 pin)	Connector B (20 pin)
1	PDM	IGN-2
2	-	Battery (IGN-2)
3	Ground	
4	PDM	
5	-	
6	ACC	
7	Battery (IGN-1)	
8	IGN-1	
9	-	
10	PDM	

cardiagn.com

Body Electrical System > Button Engine Start System > PDM(Power Distribution Module) > Schematic Diagrams

System circuit diagram



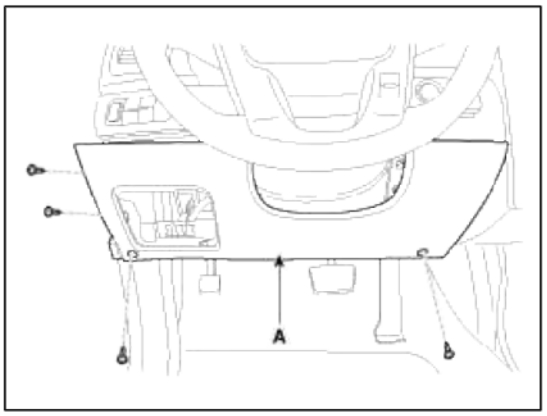
Body Electrical System > Button Engine Start System > PDM(Power Distribution Module) > Repair procedures

Removal

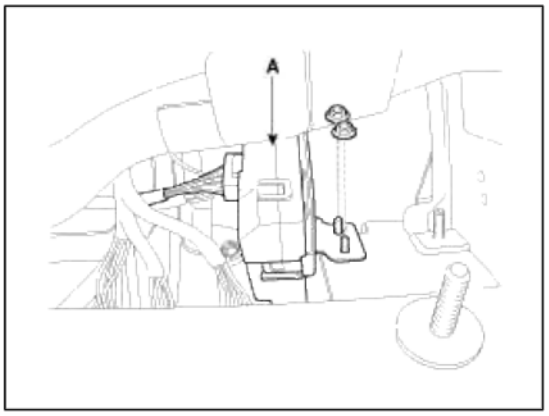
PDM(Power Distribution Module)

1. Disconnect the negative(-) battery terminal.

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

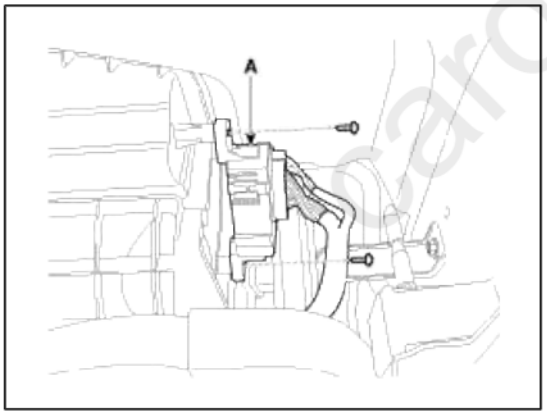


3. Remove the power distribution module (A) after loosening nuts (2EA).



PDM(Power Distribution Module) Relay

1. Remove the negative(-) battery terminal.
2. Remove the glove box housing.
   (Refer to BD group - "Crash pad")
3. After removing the screws (2EA) and connector, remove PDM relay box (A).



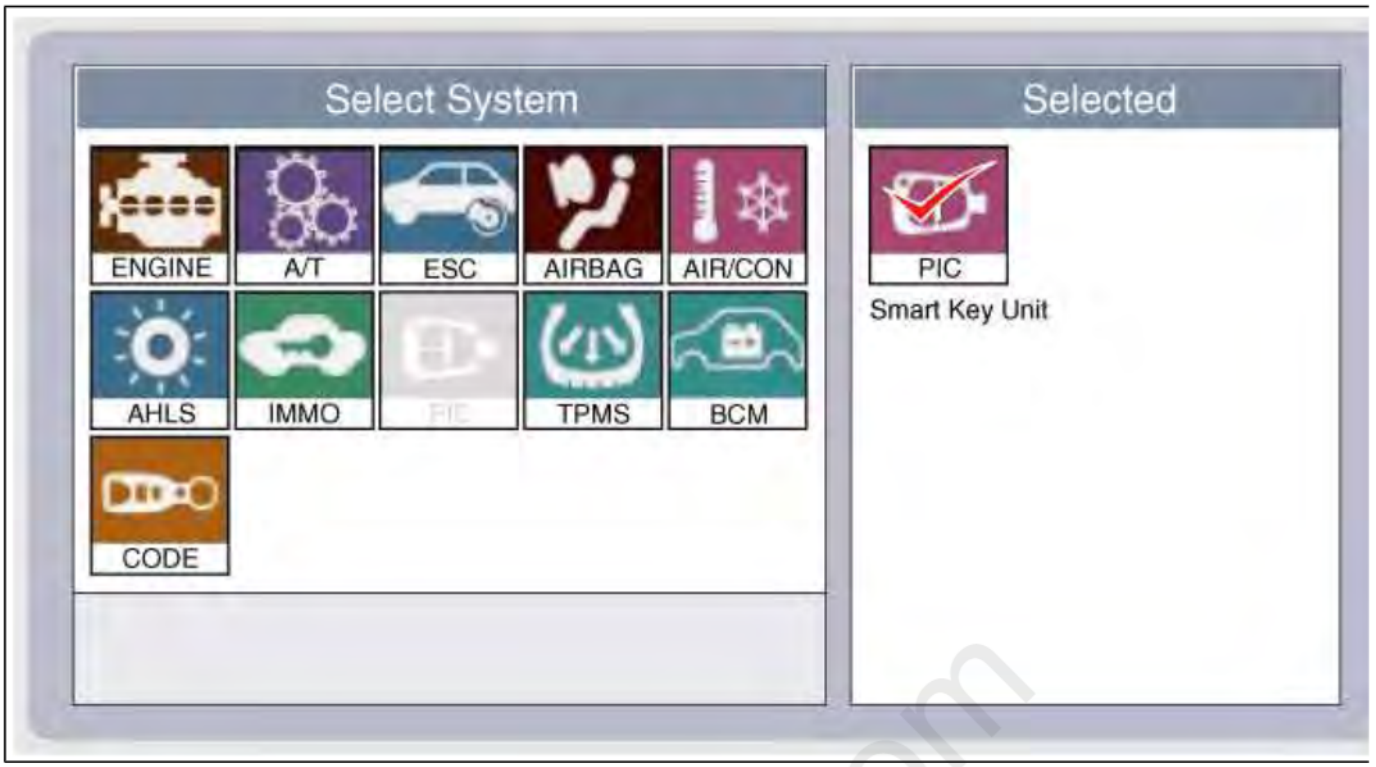
Inspection

PDM Diagnosis With GDS

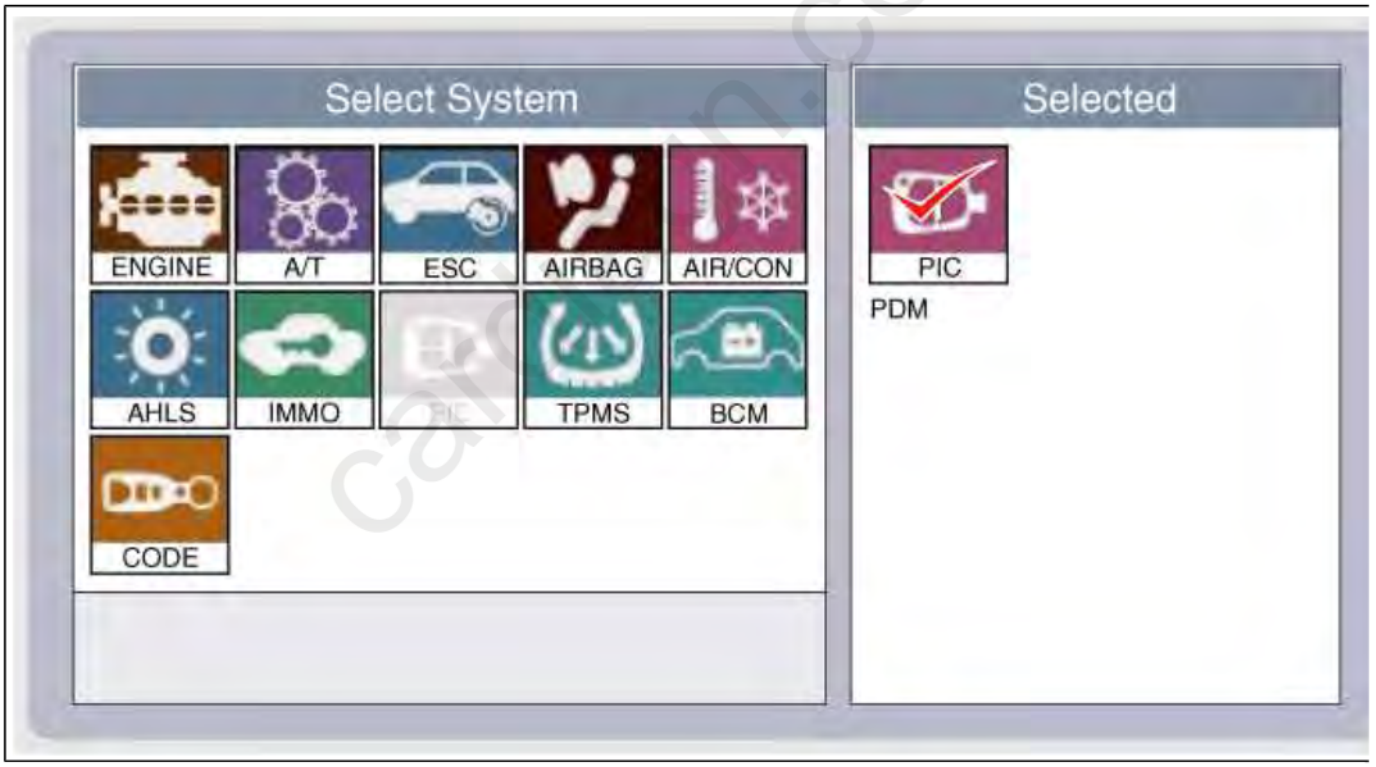
1. It will be able to diagnose defects of Smart key with GDS quickly. GDS can operates actuator forcefully, input/output value monitoring and self diagnosis.

cardiagn.com

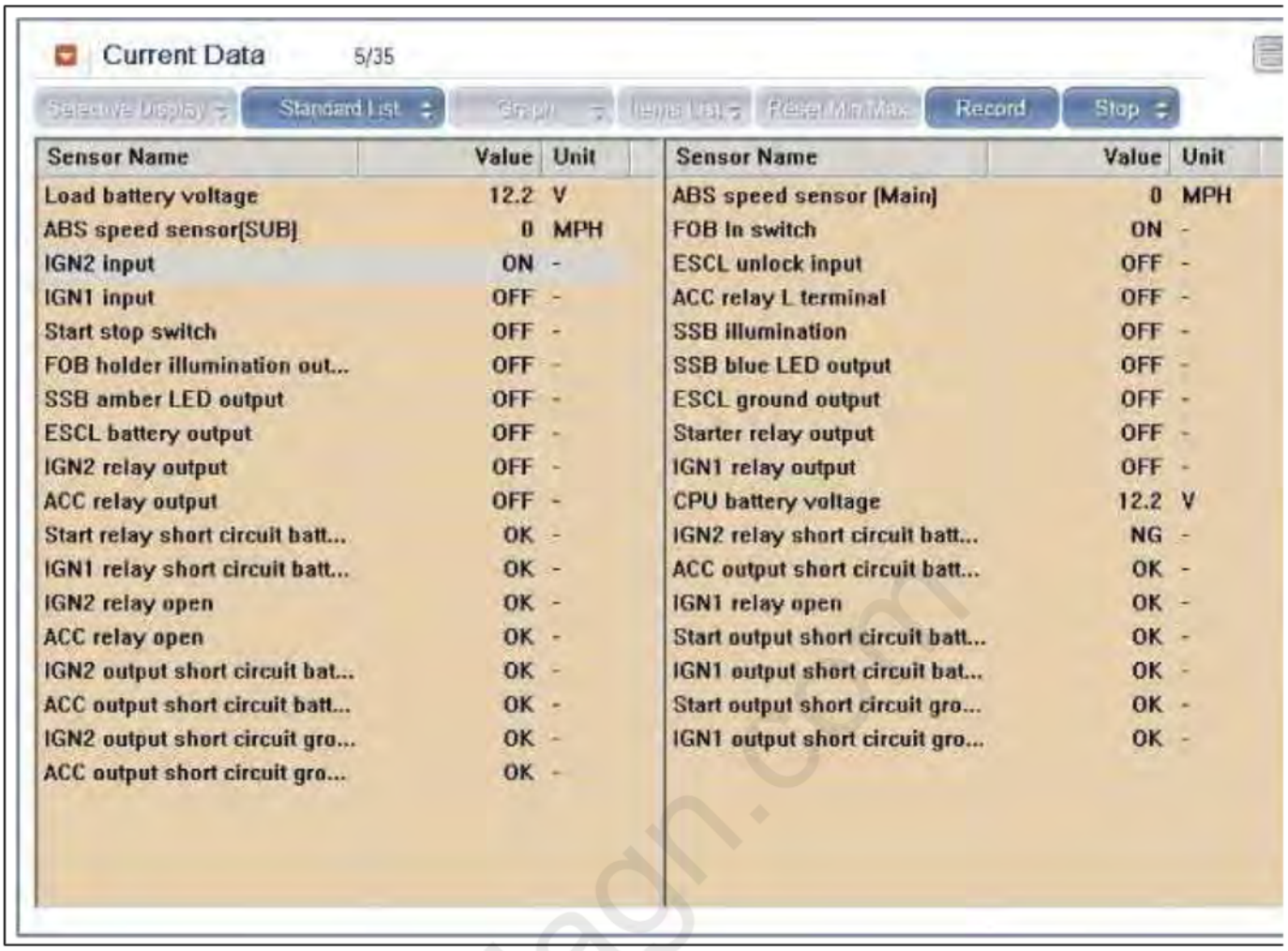
2. Select model and "Smart key system(Button start)" menu if you want to check PDM.



3. Select "PDM" in the manu.



4. Select "Current Data", if you want to check current data of PDM.
   It provides the input/output status of each module.



5. If you want to check PDM data operation forcefully, select "Actuation test".

Installation

PDM(Power Distribution Module)

1. Install the power distribution module.
2. Install the main crash pad.
3. Install the crash pad lower panel.
4. Install the negative(-) battery terminal.

PDM(Power Distribution Module) Relay

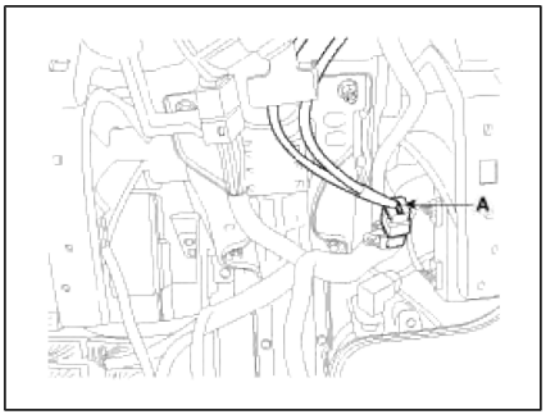
1. Install the power distribution module relay box.

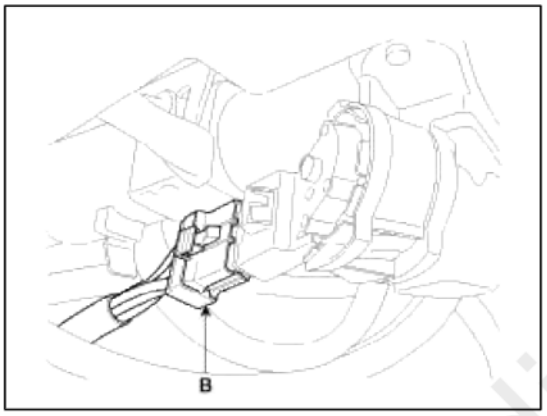
2. Install the glove box housing.
3. Install the negative(-) battery terminal.

Body Electrical System > Ignition Switch Assembly > Repair procedures

Inspection

1. Disconnect the ignition switch connector (B) and key warning switch connector (A) from under the steering column.





2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

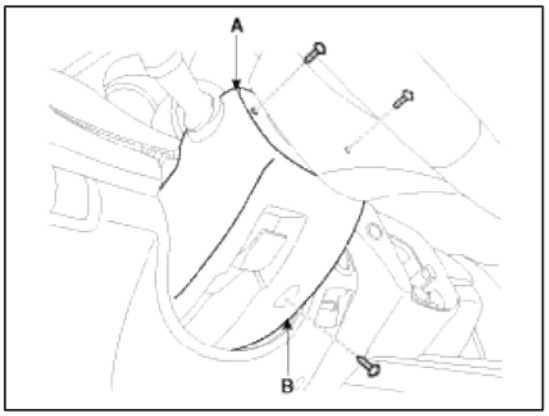
TERMINAL / POSITION / KEY		IGNITION SWITCH (B)						STEERING		KEY WARNING SWITCH (A)		KEY HOLE ILLUMINATION(A)	
		2	4	6	5	3	1	TRAVEL	TRAVEL	5	6	3	4
LOCK	REMOVAL							LOCK					
	INSERT							LOCK	UNLOCK				
ACC		○—○						UNLOCK		○—○			
ON		○—○	○—○		○—○								
START		○—○		○—○	○—○	○—○	○—○						

Removal

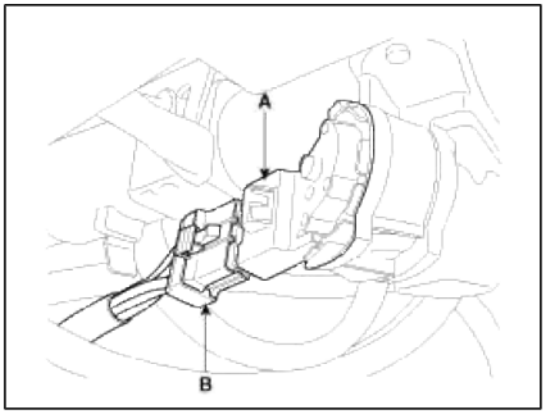
1. Disconnect the negative (-) battery terminal.

cardiagn.com

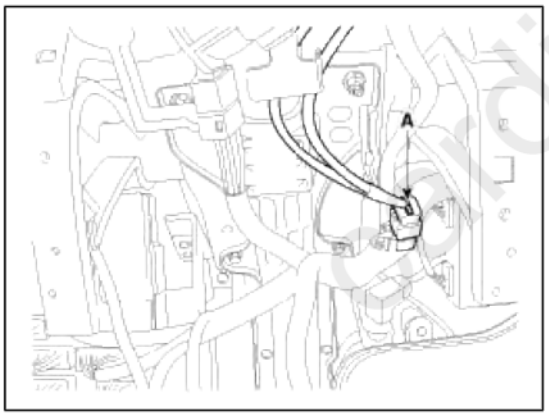
2. Remove the steering column upper and lower shrouds.
   (Refer to ST group - "Steering column")



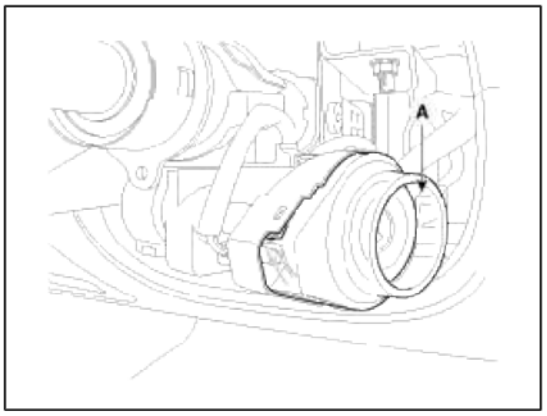
3. Remove the crash pad lower panel.
   (Refer to BD group - "Crash pad")
4. Remove the ignition switch (A) after disconnecting the 6P connector (A).



5. Remove the key warning and immobilizer connector (A).

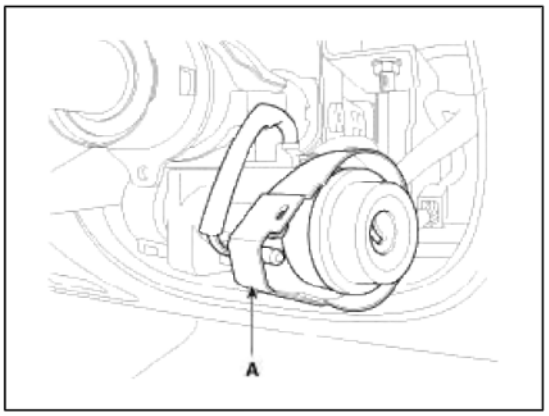


6. Remove the key illumination lens (A).

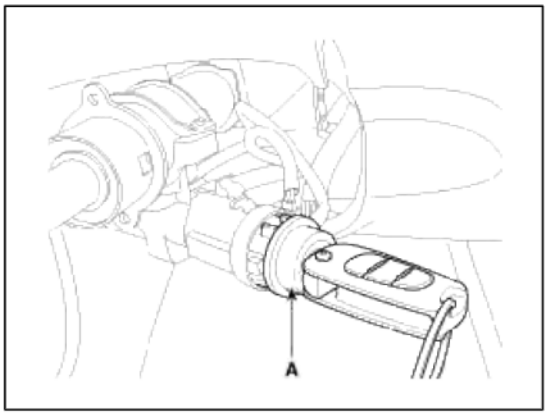


cardiagn.com

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.



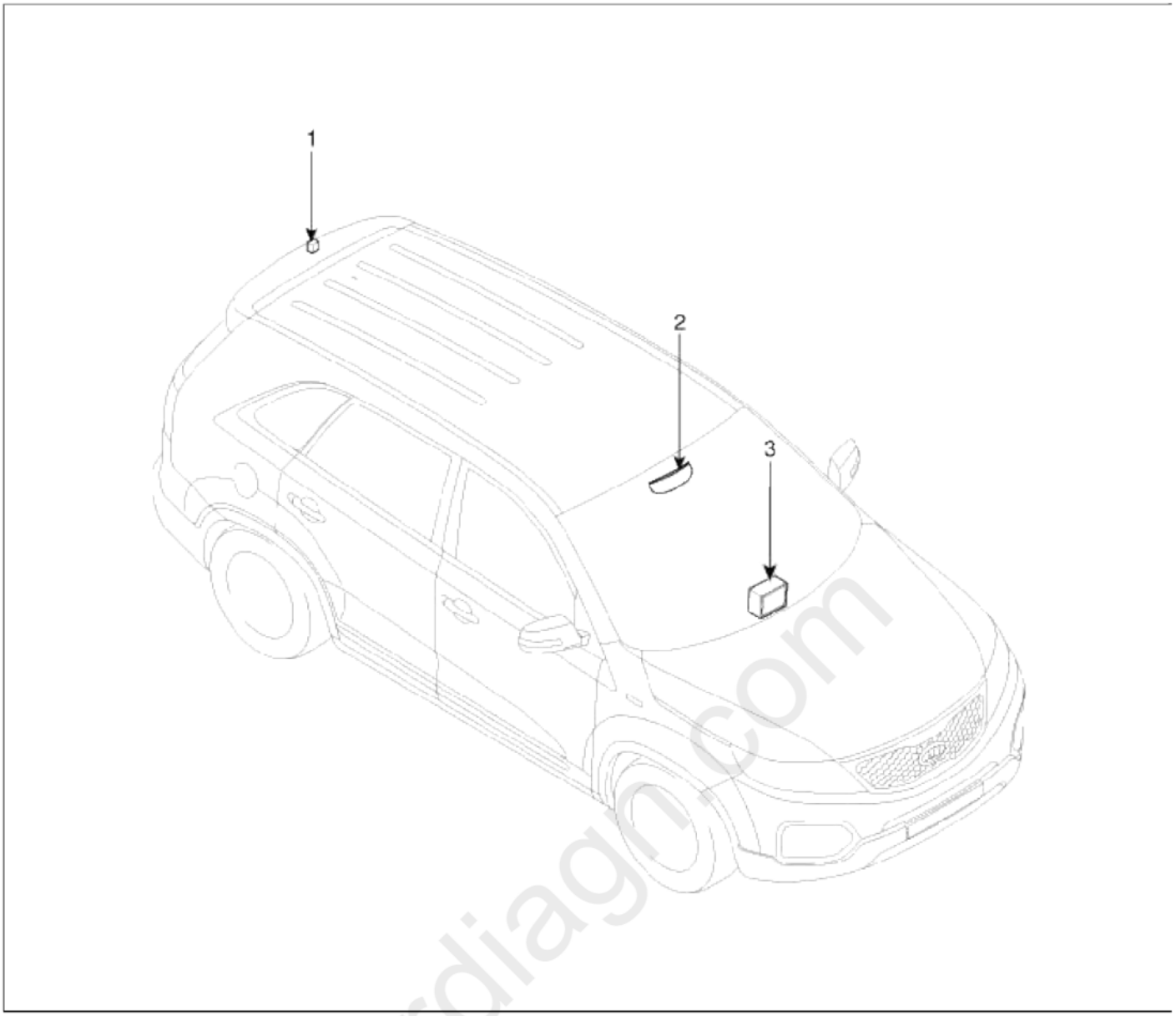
Installation

1. Install the key lock cylinder.
2. Install the illumination bulb, lens and cover.
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 > Back View Camera System > Components and Components Location

Component Location

cardiagn.com

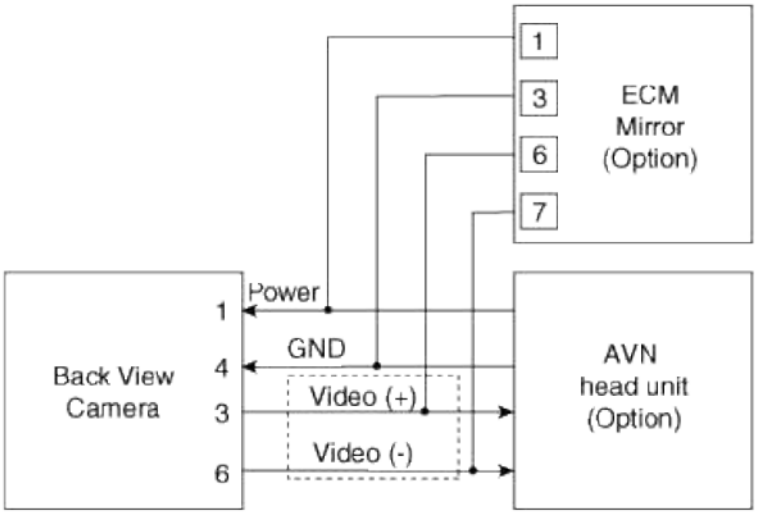


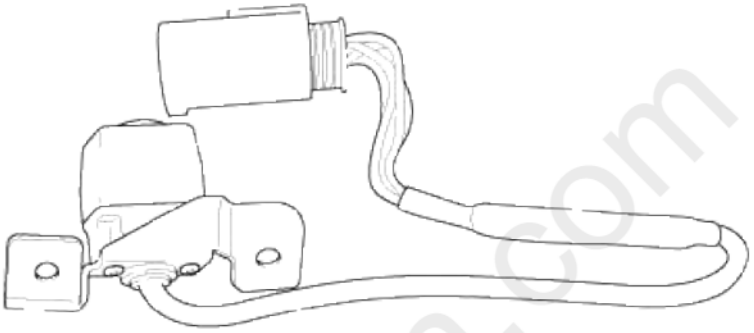
1. Back view camera 2. ECM mirror	3. AVN head unit

cardiag0.com

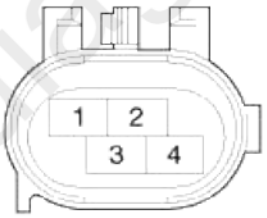
Body Electrical System > Back View Camera System > Schematic Diagrams

Circuit Diagram





Back View Camera Connector



Pin No.	Description
1	Power
2	Ground
3	Video (+)
4	Video (-)

cardiagn.com

Body Electrical System > Back View Camera System > Description and Operation

Description

Back view camera will activate when the backup light is ON with the ignition switch ON and the shift lever in the R position.

This system is a supplemental system that shows behind the vehicle through the ECM (Reverse Display Room Mirror) mirror while backing-up.

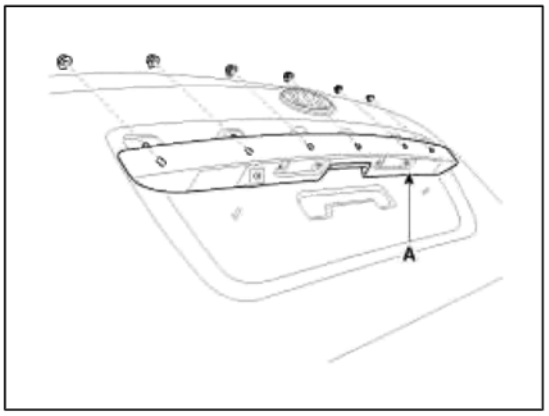
WARNING

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 see through the camera.

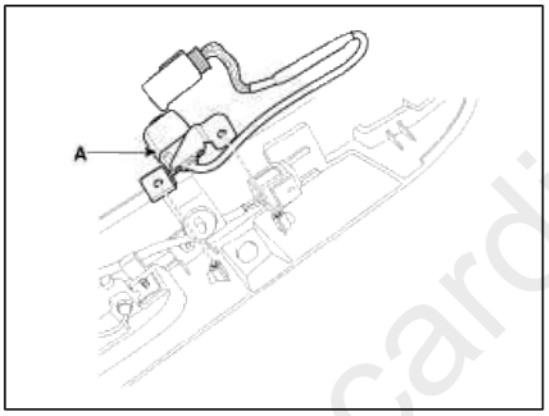
Body Electrical System > Back View Camera System > Repair procedures

Removal

1. Remove the tailgate trim in the trunk after removing the screws and clips.
   (Refer to BD group - "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.

Body Electrical System > RSE(Rear Seat Entertainment) System > Specifications

Specifications

Back Light Part

Characteristic Item		Specification
Power supply	Set part	DC 14.4V Negative ground
	LCD part	DC +3.3V
	Back light part	DC +9V ~ +16V
Dark current		Max. 2mA

cardiagn.com

Temperature range

Section	Item	Condition
LCD section	Normal operation temperature	-22°F ~ 185°F (-30°C ~ 85°C)
	Storage temperature	-40°F ~ 185°F (-40°C ~ 85°C)
Set section	Pannel & buttons	-40°F ~ 185°F (-40°C ~ 85°C)
	Storage temperature	

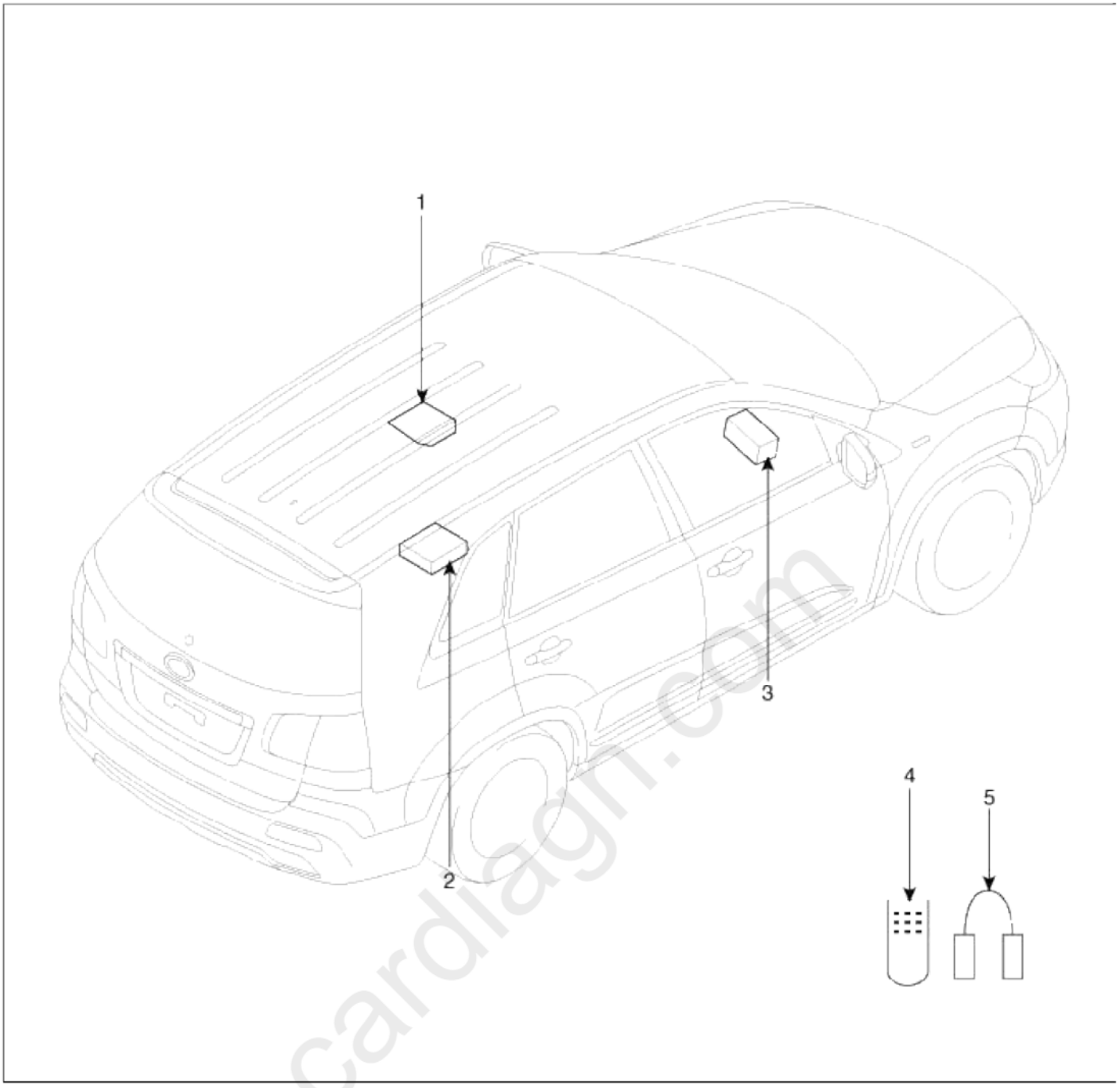
LCD display specification

LCD display		Specification
Viewing angle	Up/Down	60° / 50°
	Left/Right	70° / 70°
Display format		800(H) x RGB x 480(V)
		BGR vertical stripes
Active area		6.95 x 3.9 in (176.64 x 99.36 mm)
Screen size		Diagonal 202.7 mm (8.0 inch)
RGB configration		Digital RGB signal
Color		262,144 colors

Body Electrical System > RSE(Rear Seat Entertainment) System > Components and Components Location

Component Location

cardiagn.com



1. RSE LCD monitor & keyboard 2. RSE control unit (DVD) 3. Audio head unit	4. Remote controller 5. Headphone

Body Electrical System > RSE(Rear Seat Entertainment) System > Description and Operation

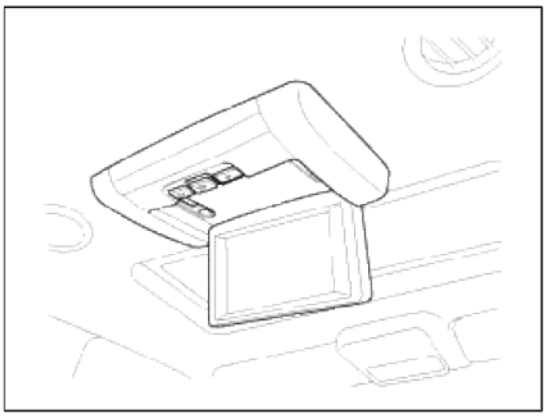
Description

RSE System

The RSE system contains the following components: DVD player, Roof Mount 8-inch WVGA LCD monitor with IR transceiver, IR remote controller, and IR headphone. The RSE system is designed to be functional with Audio H/U. The entire system is awake and operational whenever the vehicle is in either Ignition or Accessory power modes. The RSE system communicates with one of the Head Unites via CAN Serial Data Bus, The main control circuit of the RSE system resides in the DVD player module which communicates with the Roof Mount Display Module.

cardiagn.com

In the Audio Head Unit system, the H/U audio signal can be passed to RSE system. The RSE has the ability to pass certain pre-defined controls to the Head Unit via remote controller through CAN bus.
For Radio H/U, only the RSE system can be sent its audio signal to this head unit. Head unit doesn't send audio signal to RSE system. RSE and H/U system can be controlled by each other via CAN Serial Date Bus.
The entire RSE system including the LCD monitor Display and DVD mechanism is controlled by a ON/OFF swtich located at the Roof Mount Display Module. While in its ON state, the RSE system is set up to accept the commands from functional buttons located on the Roof Mount Display Module or from the IR Remote Controller.
There is a position-sensing switch located inside LCD Module to turn ON or OFF the LCD monitor power when its position is at 25 +/- 10 degrees from the closed and latched position. The RSE system has IR emitters to transmit a single channel stereo audio signal of the playing state to a matched IR wireless headphone.



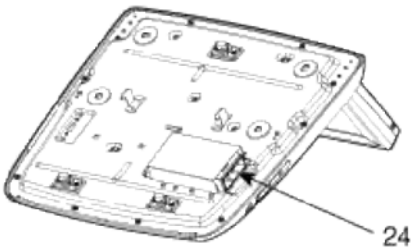
LCD Monitor Protective Operation
The monitor display has a built-in thermal sensor to sense the inside temperature of the monitor display package. This senor output is fed to a processor which will activate protective measure when the monitor operating temperature is rising close to the maximum allowable operating temperature limit of +76 ± 5°C.
DVD Mechanism Performance
The DVD player is a single player.
The player is only capable of reading the bottom side of a disc. When inserting single sided disc the label should be up.
Wireless Headphone
When the RSE is ON, its audio signal is transmitted from the IR transmitter located in the LCD monitor and is received and played back through the IR Headphones. The wireless headphone volume can be adjusted via the rotary volume on the headphones. The IR headphone is a single channel design.

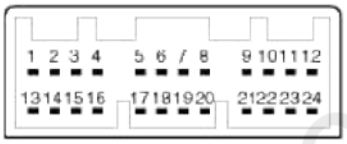
cardiagn.com

Body Electrical System > RSE(Rear Seat Entertainment) System > RSE LCD Monitor > Components and Components Location

Component Location

RSE LCD Monitor





Pin No.	Name
1	Rear (R) (+)
2	Rear input (L) (+)
3	CAN High
4	Shield GND
5	CVBS
6	-
7	-
8	Auto light
9	Illumination (+)
10	ACC
11	B+
12	B+
13	Rear input (R) (-)
14	Rear input (L) (-)
15	CAN Low
16	-
17	Video GND
18	-
19	-
20	-
21	Illumination (-)
22	Alt L
23	MGND
24	MGND

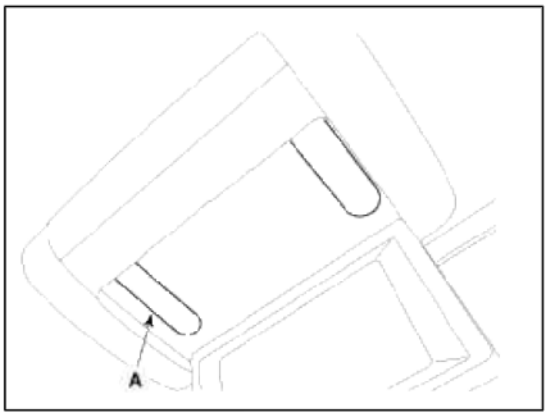
cardiagn.com

Body Electrical System > RSE(Rear Seat Entertainment) System > RSE LCD Monitor > Repair procedures

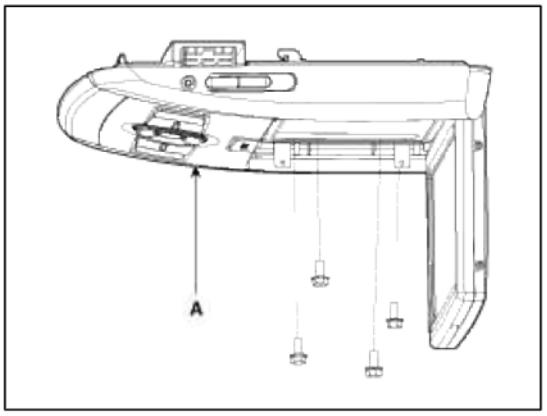
Removal

1. Disconnect the negative(-) battery terminal.

2. Remove the monitor hole cover (A).



3. Remove the RSE LCD monitor assembly (A) after loosening 4 bolts on the roof panel or roof rail.



4. Disconnect the connector(24P) from RSE LCD monitor.

Installation

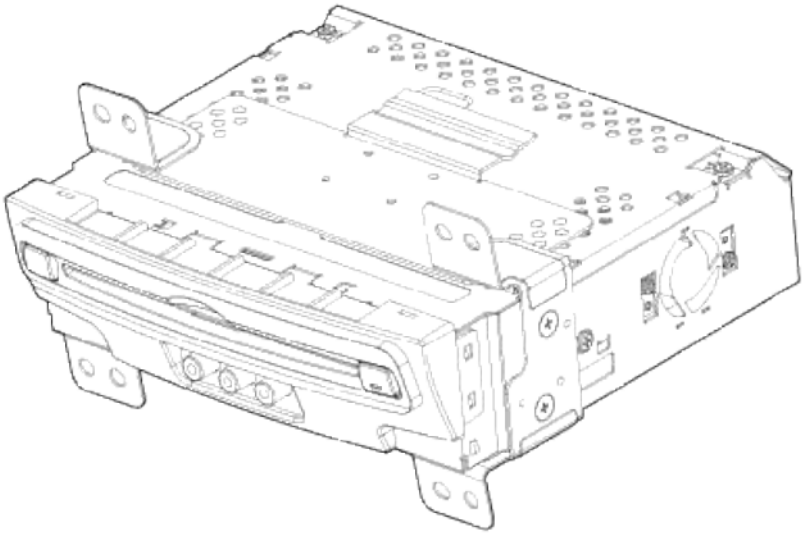
1. Connect the monitor connector on the RSE monitor assembly until a click sound is heard.
2. Install the RSE LCD monitor assembly on the roof panel.
3. Fix the monitor on the sunroof bracket by clips (3EA) and then tighten the bolts (4EA).
4. Push the RSE hole cover on the monitor assembly until a click sound is heard.

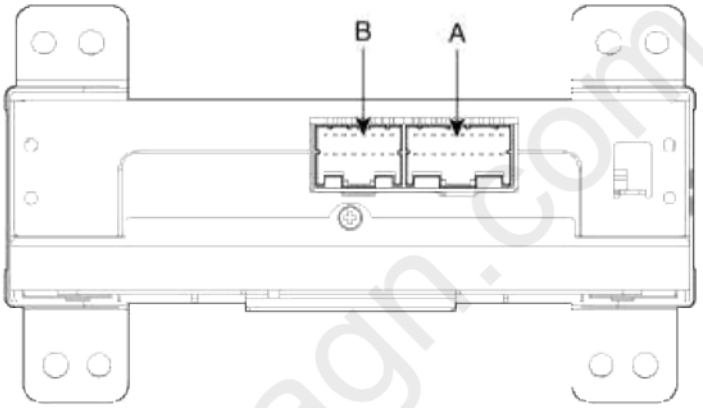
Body Electrical System > RSE(Rear Seat Entertainment) System > RSE Control Unit (DVD) > Components and Components Location

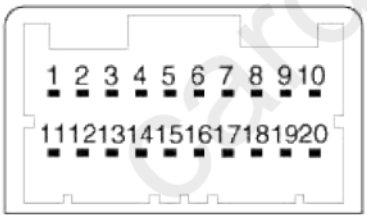
Component Location

RSE Control Unit (DVD)

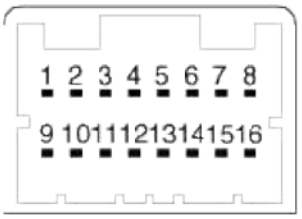
cardiagn.com







Connector A



Connector B

carldiagn.com

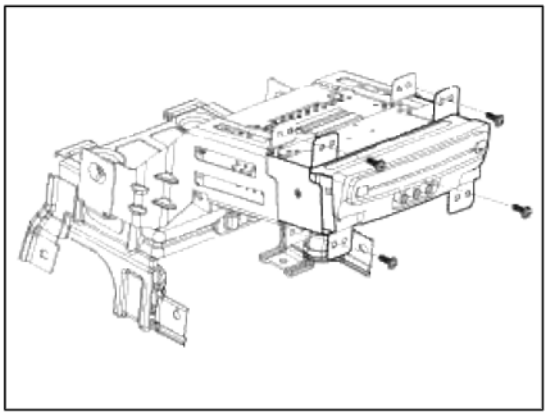
Pin No.	Connector A	Connector B
1	-	V GND
2	-	Shield GND
3	Front input (L) (-)	CAN high
4	Front output (R) (-)	-
5	Front output (L) (-)	ACC
6	Rear out (L) (-)	Illumination (+)
7	Rear out (R) (+)	Battery (+)
8	-	Battery (+)
9	-	Rear out CVBS
10	-	-
11	Front input (R) (+)	CAN low
12	Front input (R) (-)	-
13	Front input (L) (+)	-
14	Front output (R) (+)	Illumination (-)
15	Front output (L) (+)	M GND
16	Rear out (L) (+)	M GND
17	Rear out (R) (-)	
18	-	
19	-	
20	-	

cardiagn.com

Body Electrical System > RSE(Rear Seat Entertainment) System > RSE Control Unit (DVD) > Repair procedures

Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the console rear panel. (Refer to Body group - "Console").
3. Remove the RSE control unit (A) from the console after loosening screws.



4. Disconnect the RSE control unit connector.

Installation

1. Install RSE control unit (DVD) on the rear console bracket.
2. Install the console rear panel.

Body Electrical System > RSE(Rear Seat Entertainment) System > Troubleshooting

Troubleshooting

Symptom	Suspected area	Repairment
Pressing power switch does not turn on system	RSE monitor power source circuit	R-1
	RSE monitor and DVDP module	R-2
Panel switch does not function	RSE monitor keyboard pcb ass'y	R-1
	Radio receiver power source circuit	R-1
No sound can be heard from wireless headphone or wireless earphone	Wireless headphone	R-4 R-5
	Check the wiring between monitor and DVDP	R-11
Disc cannot be inserted or is ejected right after insertion	RSE monitor power source circuit	R-1
Disc cannot be ejected.	DVDP power source circuit	R-1
Illumination for RSE does not come on whth light control switch on.	Illumination circuit	R-11
	RSE monitor power source circuit	R-1
Display does not dim with light control switch turned on	Illumination circuit	R-11
Power does not turn off	RSE monitor	R-1
AUX connection error	DVDP	R-2
	Check the AUX jack connector	R-1

R-1 : Replace the RSE monitor

1. Check the same problems after replaceing the RSE monitor

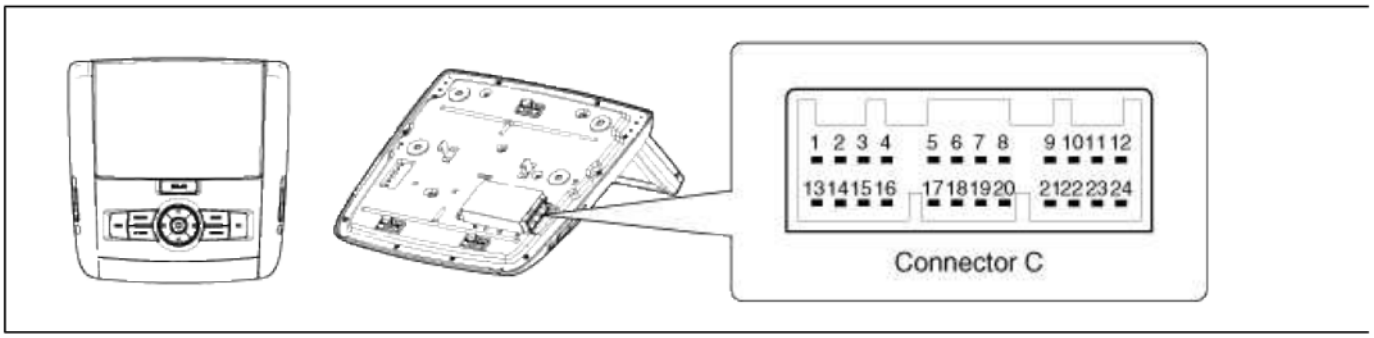
OK	If RSE is normal operating, replace the RSE monitor
NG	Check the vehicle wiring. (Refer to removal procedure. R-2)

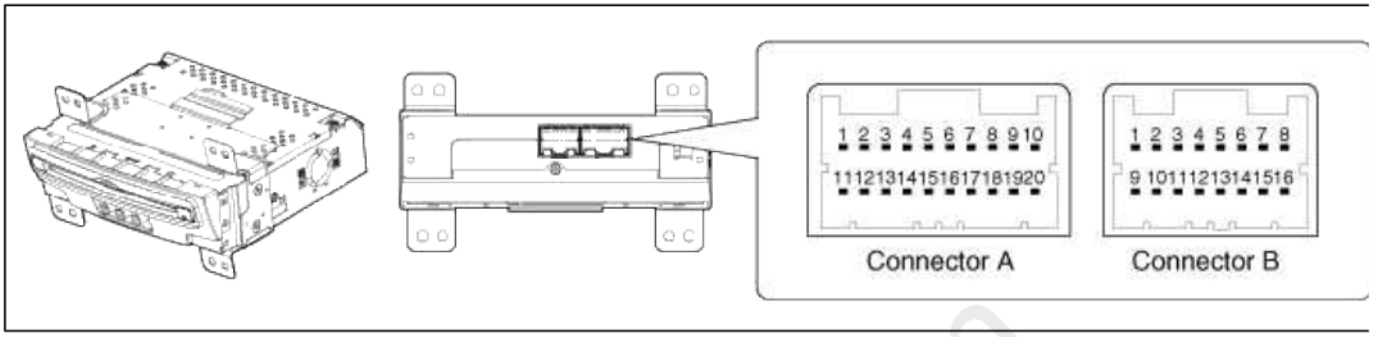
R-2 : Check the power connection of monitor and DVDP.

1. Remove the monitor and DVDP.

cardiagn.com

2. Check the specified condition of terminal.





OK	**Tester Connection**	**Condition**	**Specified Condition**
	CON-C10 ↔ GND	Always	9~16 V
	CON-C11/C12 ↔ GND	Always	9~16 V
	CON-C23/C24 ↔ GND	Always	Below 1Ω
NG	Check again after repairing or replacing the Cable harness or Connector.		

OK	**Tester Connection**	**Condition**	**Specified Condition**
	CON-B5 ↔ GND	Always	9~16 V
	CON-B7/B8 ↔ GND	Always	9~16 V
	CON-B15/B16 ↔ GND	Always	Below 1Ω
NG	Check again after repairing or replacing the Cable harness or Connector.		

R-3 : Replace the wireless headphone

1. Check the same problems after replaceing the wireless headphone

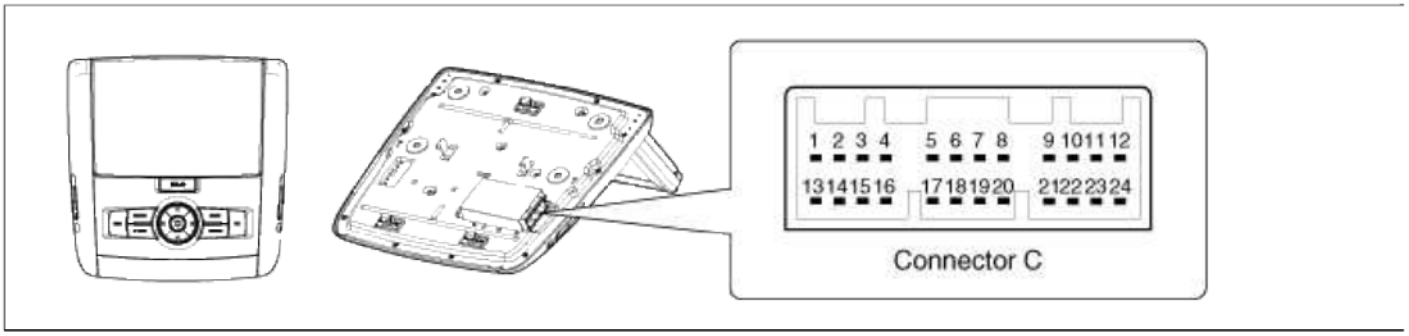
OK	If RSE is normal operating, replace the wireless headphone

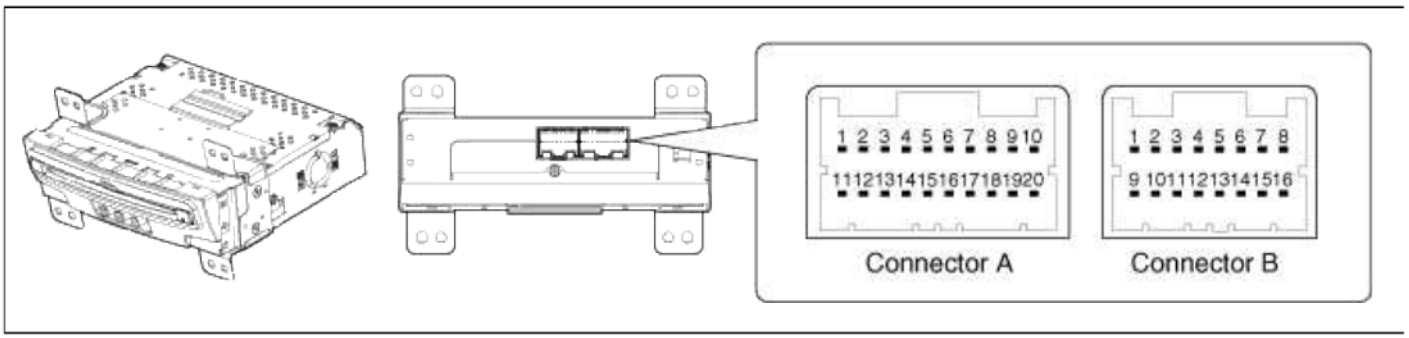
R-4 : Check the wireless headphone

1. Check the wireless headphone power button.
2. Check the volume button.

R-5 : Check again after replacing the Monitor and DVDP

carliagn.com





OK	Remove the Monitor and DVDP

NG	Go to step 1

1. Check the input signal of Illumination (+)

Tester Connection	Condition	Specified Condition
CON-C9 ↔ GND	Always	9~16 V

Tester Connection	Condition	Specified Condition
CON-B6 ↔ GND	Always	9~16 V

NG	Check the vehicle wiring

OK	Go to step 2

cardiagn.com

2. Check the illumination (-) input signal using the oscilloscope

Tester Connection	Condition	Specified Condition
CON-C21 ↔ GND	Always	Check the PWM waveform

Tester Connection	Condition	Specified Condition
CON-B14 ↔ GND	Always	Check the PWM waveform

NG	Check the vehicle wiring and cluster PWM output.

OK	Go to step 3

3. Check the vehicle illumination control unit (Refer to the "Rheostat").

cardiagn.com