General Information

General Troubleshooting Information

Before Troubleshooting

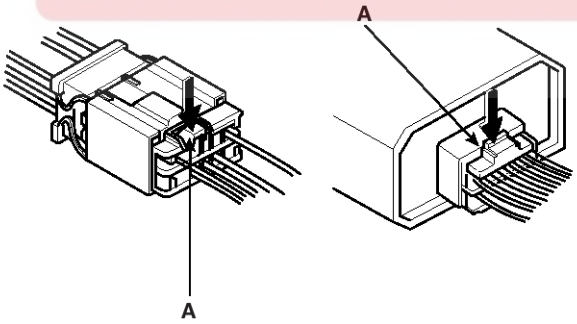
1. Check applicable fuses in the appropriate fuse/relay box.
2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tight connections.

   (Refer to the Engine Electrical System - Battery)

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

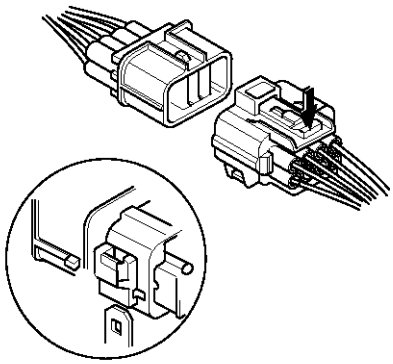
Handling Connectors

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



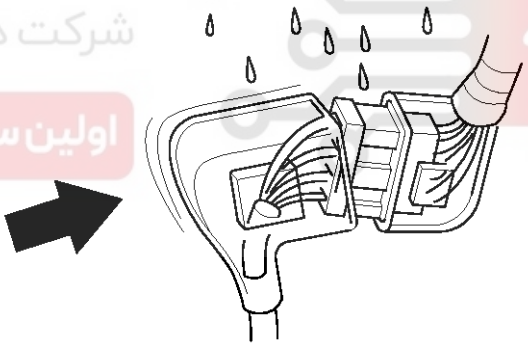
ETKD150A

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).



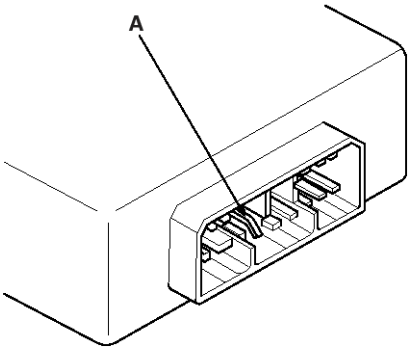
ETKD150B

6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



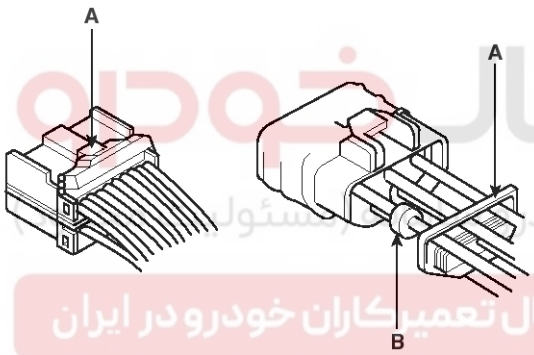
ETKD150C

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



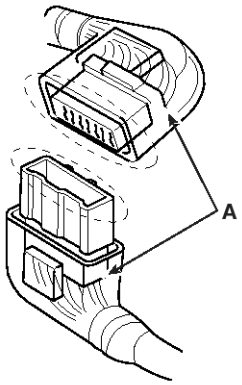
ETKD150D

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



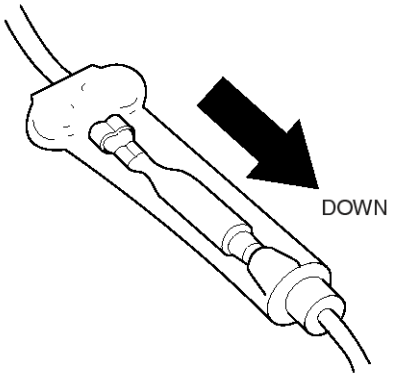
ETKD150E

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



ETKD150F

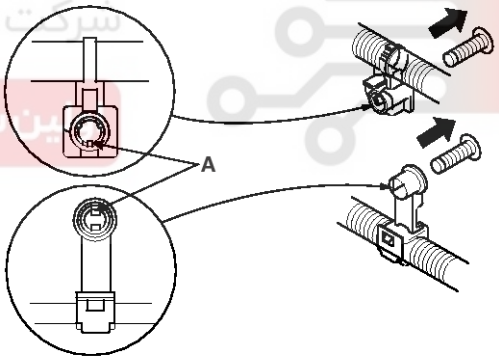
11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.



ETKD150G

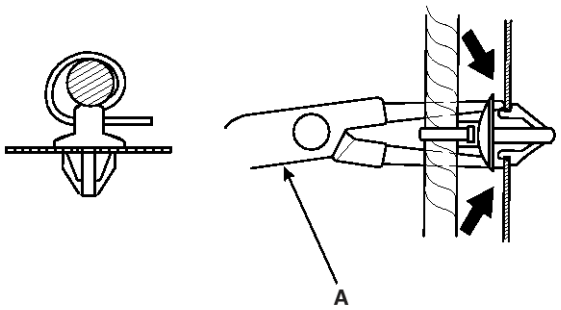
Handling Wires And Harnesses

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).



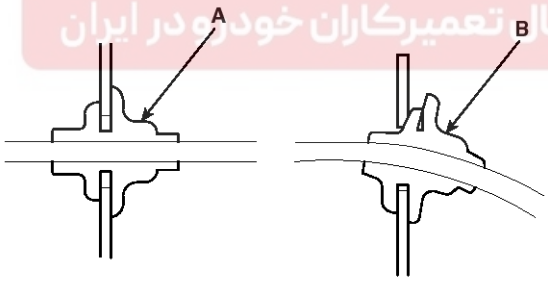
ETKD150H

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.



ETKD150I

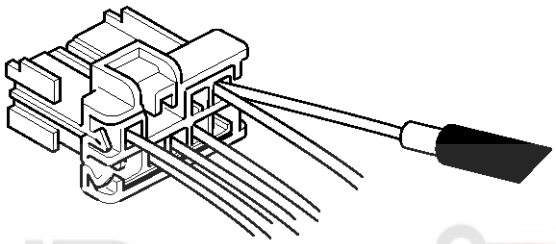
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).



ETKD150J

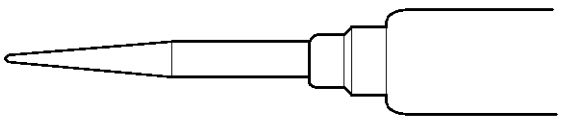
Testing And Repairs

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).



ETKD150K

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



ETKD150L

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.

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.

Audio

Specification

Item		Specification		
Model		Radio/MP3/CD (PA710)	Radio/MP3/CDC (PA760)	Radio/MP3/6CDC (PA760 RSE)
Power supply		DC 14.4V		
Rated output		Max 43W x 4 (Power IC)	3.2Vrms	
Antenna		80PF 75Ω		
Load Impedance		4 ohm X 4		
Tuning type		PLL synthesized type		
Other device		-	External Amplifier	External AmplifierRSE
Frequency range / Channel space	FM	87.5~108.0 MHz / 100KHz		
	AM	531~1602 KHz / 9KHz		

* RSE: Rear Seat Entertainment

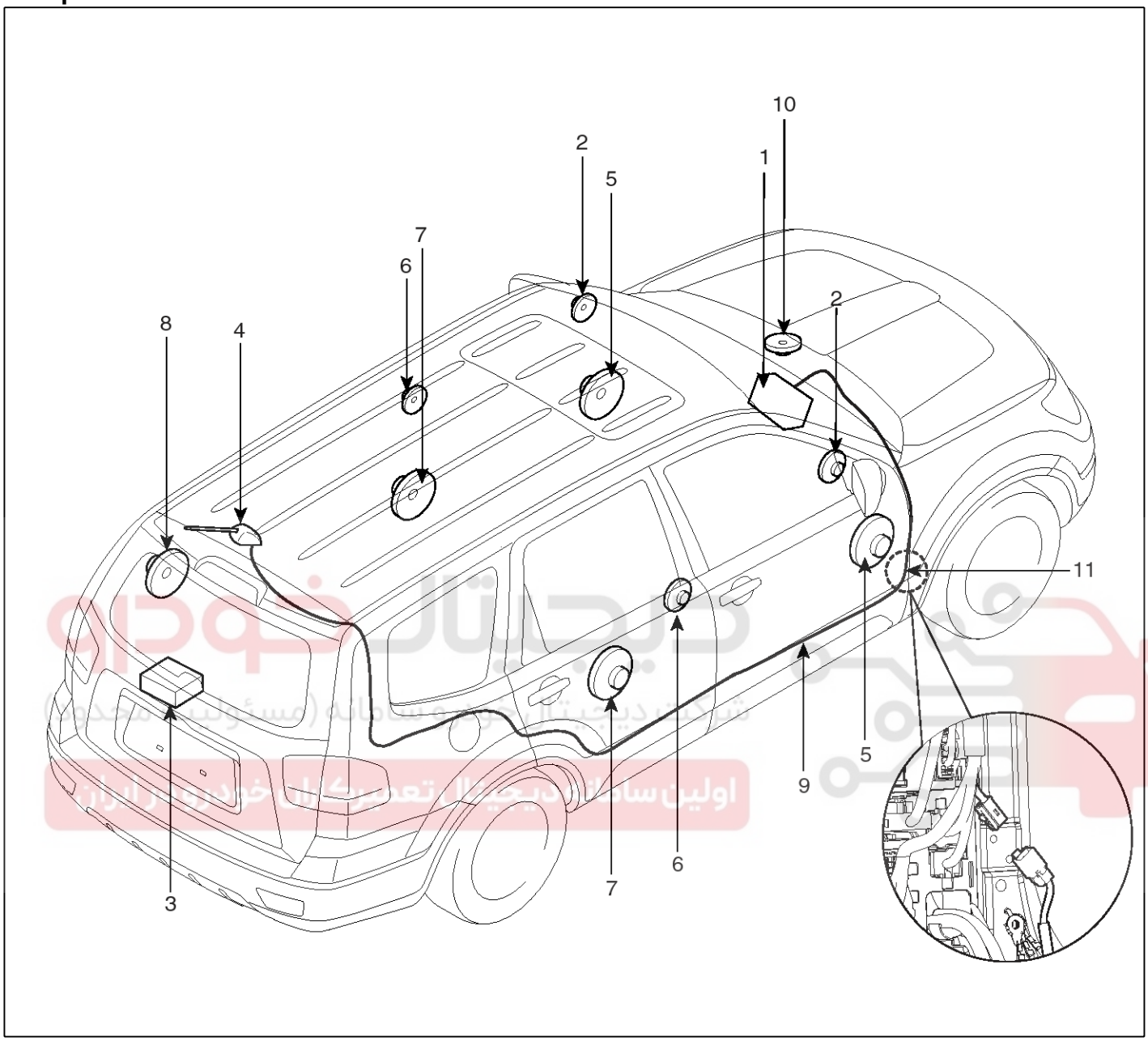
Speaker

Item		A200	A300	A350 RSE
Input Power (W)	Front	Max 40	8 Vrms	8 Vrms
	Rear	Max 40	8 Vrms	8 Vrms
	Front Center	-	8 Vrms	8 Vrms
	Front Tweeter	Max 40w	8 Vrms	8 Vrms
	Rear Tweeter	-	8 Vrms	8 Vrms
	Sub woofer	-	64	64
Speaker Impedance (Ω)	Front	4 ± 0.6	4 ± 0.6	4 ± 0.6
	Rear	4 ± 0.6	Min 1.6	Min 1.6
	Front Center	-	2.15 ± 0.25	2.15 ± 0.25
	Front Tweeter	4 ± 0.6	Min 3.6	Min 3.6
	Rear Tweeter	-	Min 3.6	Min 3.6
	Sub woofer	-	4.6 ± 0.5	4.6 ± 0.5
Speaker Number		6	10	10

Roof Antenna

Item	Specification
Operation voltage	DC 10.5V ~ 16.0V
Consumption current	MAX 150mA
Input/Output Impedance	75Ω

Component Location



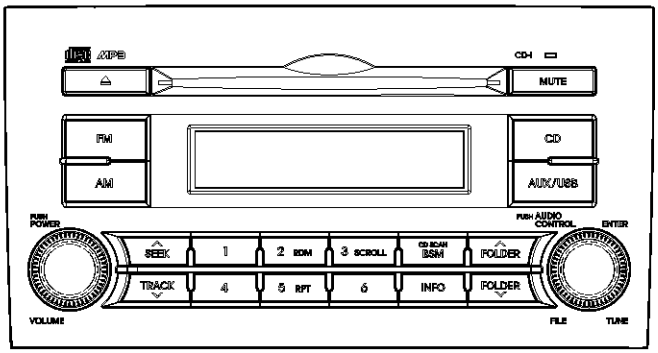
SHMBE9096L

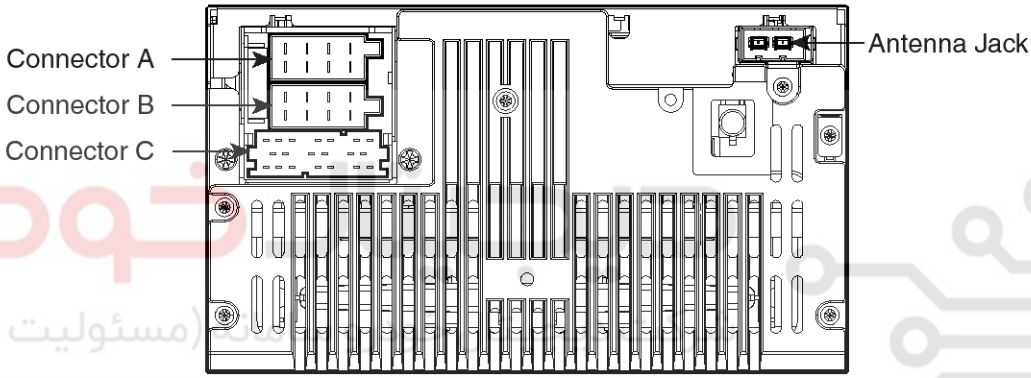
1. Audio head unit
2. Tweeter speaker
3. External amplifier
4. Roof antenna
5. Front door speaker
6. Rear tweeter speaker
7. Rear door speaker
8. Subwoofer speaker
9. Antenna feeder cable
10. Crash pad center speaker
11. Feeder cable joint connector

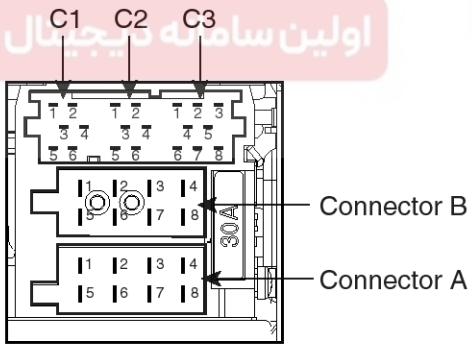
Audio Unit

Component Location

[RADIO/CD/MP3 (PA710)]



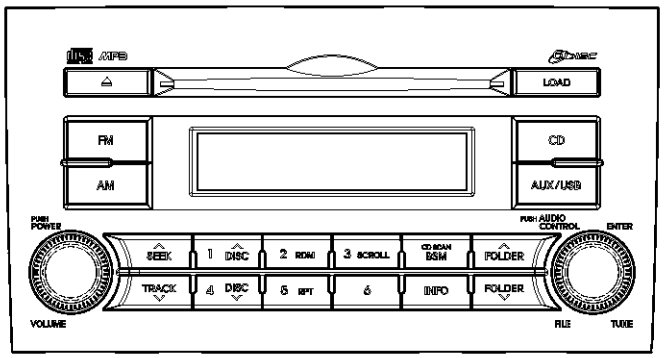


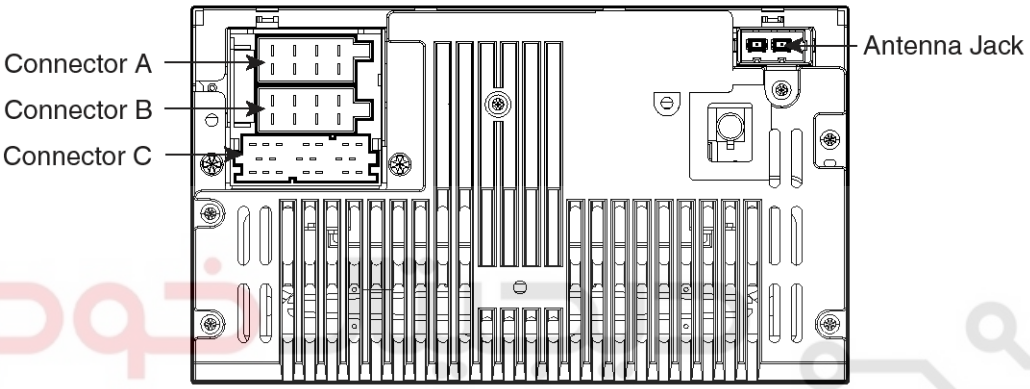


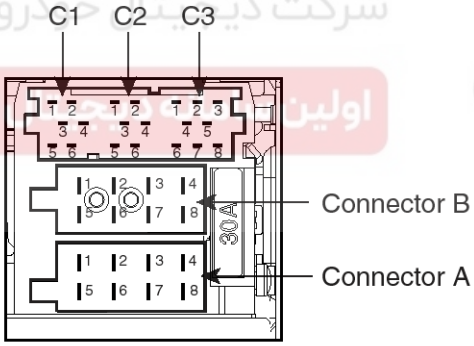
NO	Connector A	Connector B	Connector C1	Connector C2	Connector C3
1	Vehicle speed	Rear right speaker(+)	-	AUX input(R)	-
2	Illumination (+)	Front right speaker(+)	-	AUX input(L)	USB D-
3	Remote control antenna	Front left speaker(+)	-	AUX REF	-
4	Battery +	Rear left speaker(+)	-	AUX Detect	USB D+
5	-	Rear right speaker(-)	Tel mute	Remote control(+)	IPOD/USB GND
6	ACC	Front right speaker(-)	-	Remote Ground	-
7	Illumination (-)	Front left speaker(-)			USB/IPOD VDO
8	Ground(Power)	Rear left speaker(-)			-

SHMBE9097L

[RADIO/MP3/CDC (PA760)]



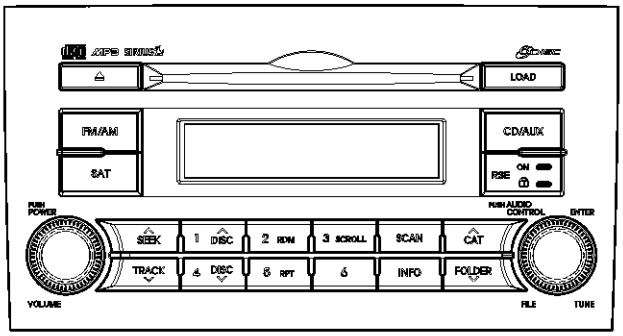


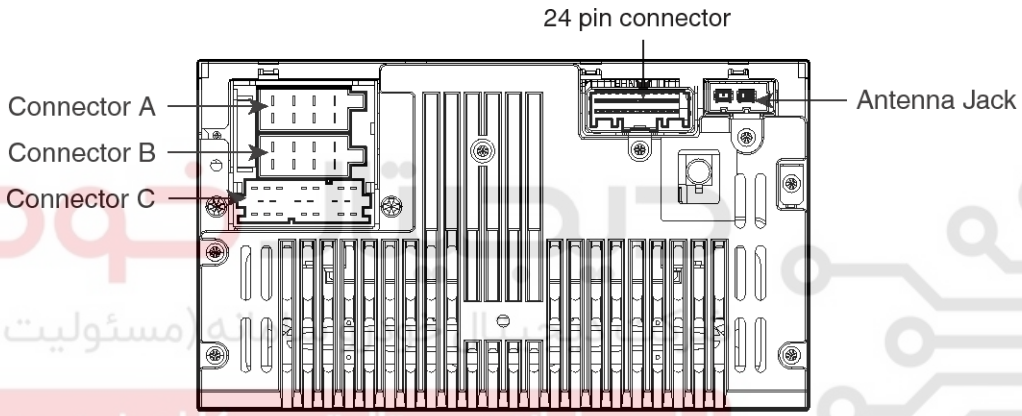


NO	Connector A	Connector B	Connector C1	Connector C2	Connector C3
1	-	Rear right speaker(+)	-	AUX input(R)	-
2	Illumination (+)	Front right speaker(+)	-	AUX input(L)	USB D-
3	Remote control antenna	Front left speaker(+)	External Amp. select	AUX REF	-
4	Battery +	Rear left speaker(+)	-	AUX Detect	USB D+
5	-	Rear right speaker(-)	Tel mute	Remote control(+)	IPOD/USB GND
6	ACC	Front right speaker(-)	-	Remote Ground	Amp. Remote
7	Illumination (-)	Front left speaker(-)			USB/IPOD VDO
8	Ground(Power)	Rear left speaker(-)			-

SHMBE9098L

[RADIO/MP3/CDC (PA760 RSE)]





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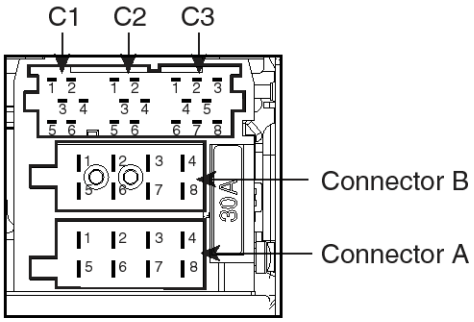
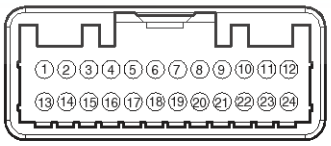
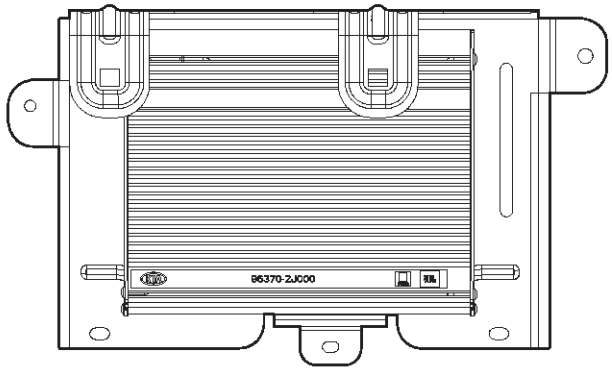


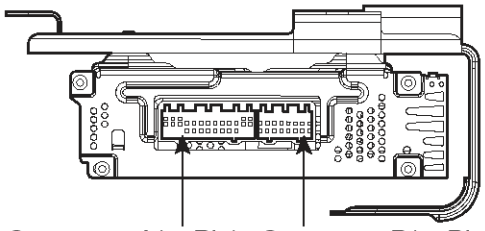
NO	Connector A	Connector B	Connector C1	Connector C2	Connector C3
1	-	Rear right speaker(+)	-	AUX input(R)	-
2	Illumination (+)	Front right speaker(+)	-	AUX input(L)	USB D-
3	Remote control antenna	Front left speaker(+)	External Amp. select	AUX REF	CAN Low
4	Battery +	Rear left speaker(+)	-	AUX Detect	USB D+
5	-	Rear right speaker(-)	Tel mute	Remote control(+)	IPOD/USB GND
6	ACC	Front right speaker(-)	-	Remote Ground	Amp. Remote
7	Illumination (-)	Front left speaker(-)			USB/IPOD VDO
8	Ground(Power)	Rear left speaker(-)			CAN High

Connector	Pin	Name	Pin	Name
24pin connector 	1	-	13	-
	2	-	14	-
	3	-	15	RSE output(GND)
	4	-	16	-
	5	-	17	RSE Left
	6	-	18	RSE Right
	7	-	19	RSE input(R)
	8	-	20	RSE input(GND)
	9	-	21	-
	10	-	22	RSE input(L)
	11	-	23	-
	12	-	24	-

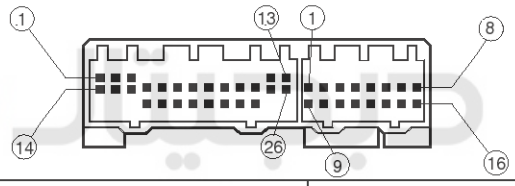
SHMBE9103N

[External Amplifier]





Connector A(26Pin) Connector B(16Pin)

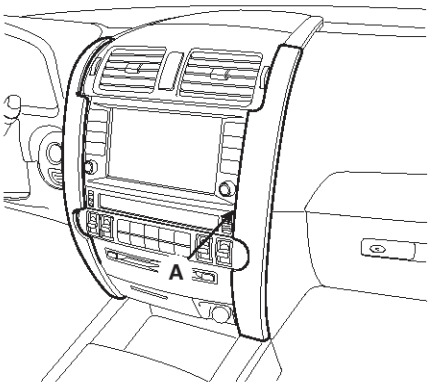


Pin	Connector A	Connector B
1	B+	-
2	B+	-
3	B+	-
4	Front Left input +	-
5	Front Right input +	Rear Door Left +(CH4)
6	Rear Left input +	Front Center + (CH3)
7	Rear Right input +	Front Right + (CH2)
8	On/Off	Front Left + (CH1)
9	-	-
10	Rear Door Right + (CH8)	-
11	-	-
12	SUB 2 + (CH6)	-
13	SUB 1 + (CH5)	Rear Door Left - (CH4)
14	GND	Front Center - (CH3)
15	GND	Front Right - (CH2)
16	GND	Front Left - (CH1)
17	Front Left input -	
18	Front Right input -	
19	Rear Left input -	
20	Rear Right input -	
21	Speed	
22	Mode EQ select	
23	Rear Door Right - (CH8)	
24	-	
25	SUB 2 - (CH6)	
26	SUB 1 - (CH5)	

SHMBE9104N

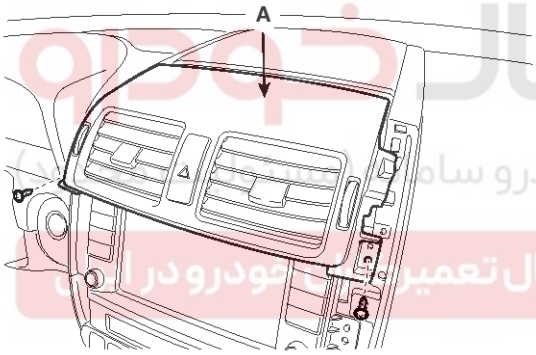
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia side garnish(A).



SHMBE8027D

3. Remove the center air vent(A) after loosening the screws.



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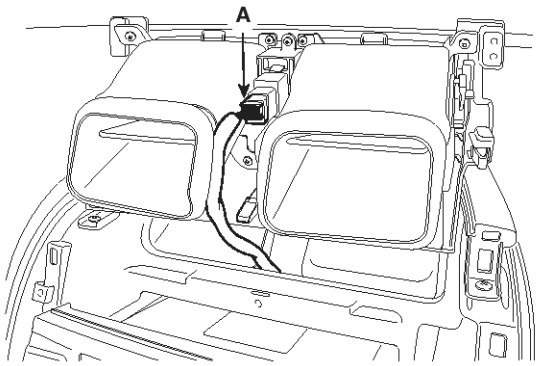
4. Disconnect the hazard lamp connector.

NOTICE

- *Be careful not to damage the connector when disconnecting the connector.*



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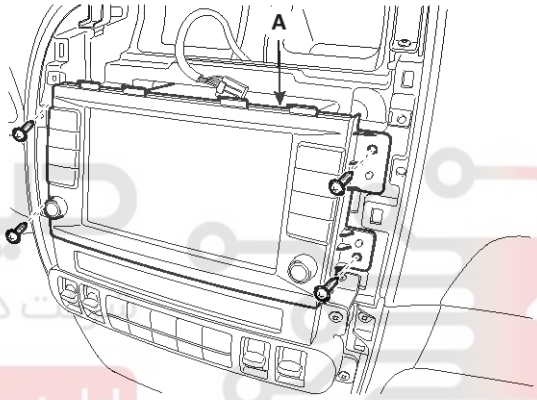
5. Remove the mounting screws then remove the audio head unit (A).



SHMBE8029D

6. Disconnect the connectors and antenna cable.

Installation

1. Reconnect the audio connector and antenna cable.
2. Install the audio head unit.
3. Reconnect the hazard lamp connector
4. Install the center air bent panel.
5. Install the center fascia side garnish.

NOTICE

- *Make sure the audio head unit connectors are plugged in properly, and the antenna cable is connected properly.*

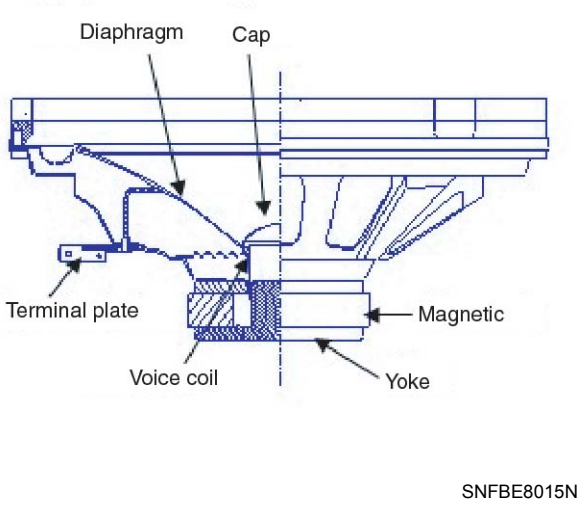
6. Check the audio system.

Speakers

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.



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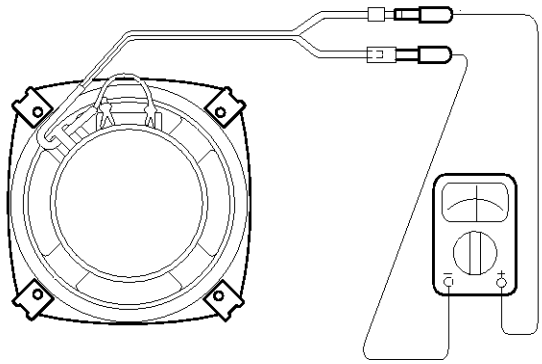
2) Case Troubleshooting

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. **NOTICE** *In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.*
3	Poor working	Inspection of the wiring connection between the battery and the speaker 1. Before replacing the speaker, inspect the wiring connection between the battery and the speaker is normal. 2. Check the supplying power to the speaker and the resistance, and then inspect the sound quality. ■ Specified impedance : 2 ~ 4Ω  3. If the speaker works poorly, replace it with new one.

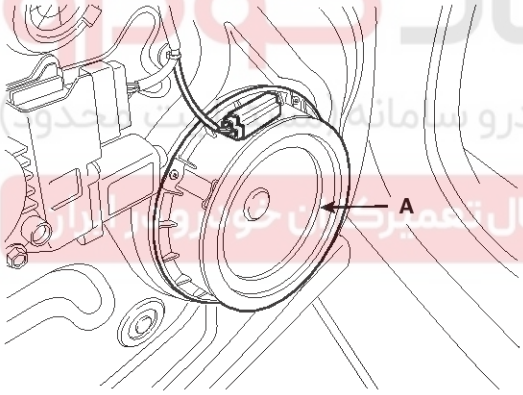
⚠CAUTION

- **During dealing of speaker**
- **Do not damage the speaker with impact as like a drop and a throw.**
- **Be careful not to cover water and oil over the speaker.**
- **Caution during dealing of speaker because the material of diaphragm is paper which is easy to be torn 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.**

Replacement

Front Speaker

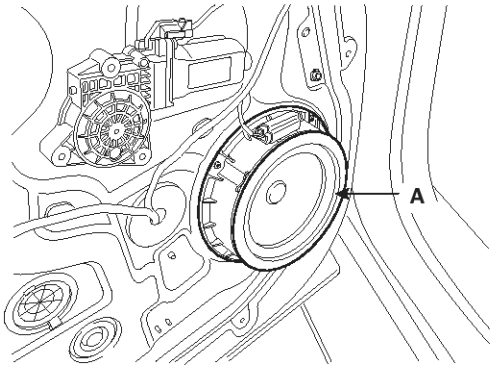
1. Remove the front door trim panel (Refer to the Body group - Front door).
2. Remove the front speaker (A) after removing 4 rivets.



SHMBE8032D

Rear Speaker

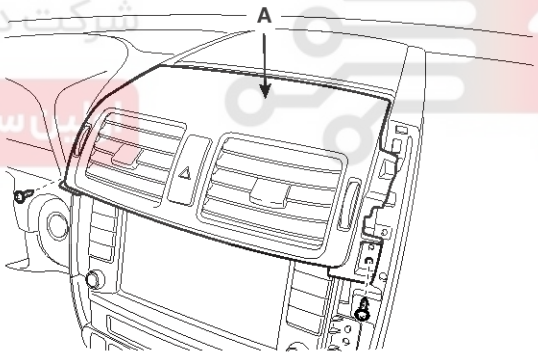
1. Remove the rear door trim panel (Refer to the Body group - Rear door).
2. Remove the rear speaker (A) after removing 4 rivets.



SHMBE8033D

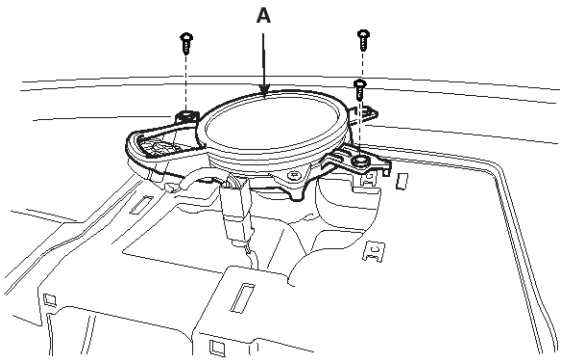
Crash pad center speaker

1. Remove the center fascia side garnish.
2. Remove the center air vent(A) after loosening the mounting screws.



SHMBE8030D

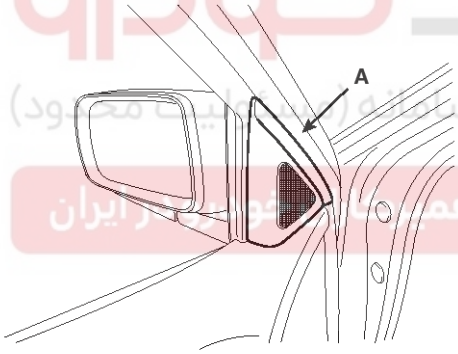
3. Remove the crash pad center speaker grill(A) after loosening the mounting screws(3EA).



SHMBE8036D

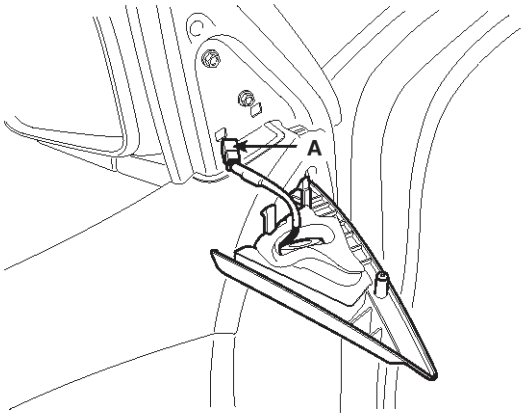
Tweeter Speaker(Front)

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



SHMBE8037D

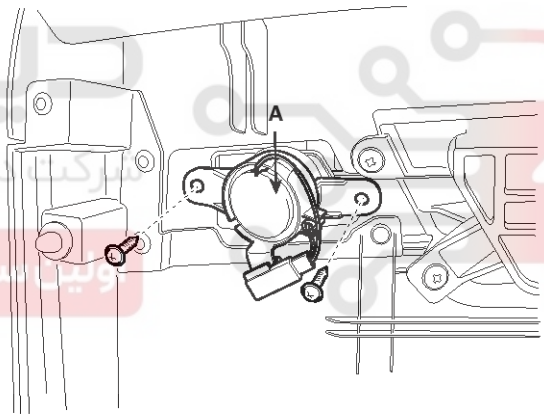
2. Remove the tweeter speaker (A) after disconnecting the connector.



SHMBE8038D

Tweeter speaker(Rear)

1. Remove the rear door trim and loosen the mounting screws(2EA).

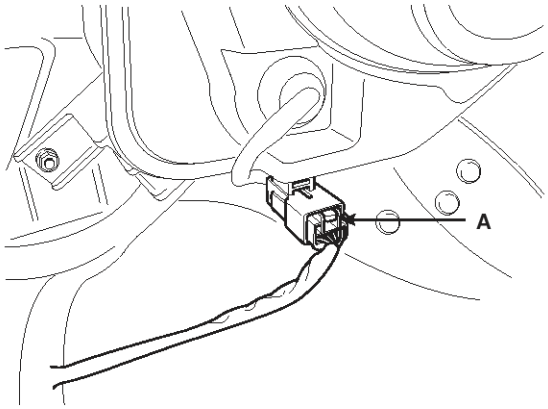


SHMBE8039D

2. Remove the rear tweeter speaker(A).

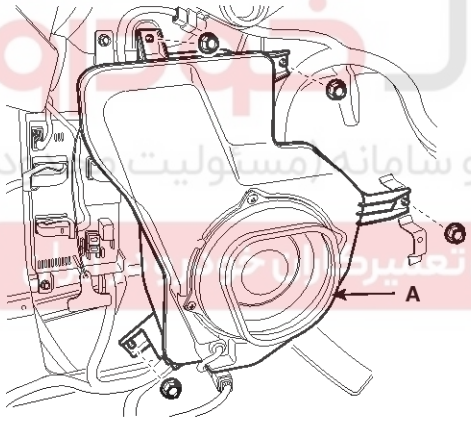
Woofer Speaker

1. Remove the rear side trim. (Refer to the Body group – Interior trim)
2. Remove the woofer speaker connector(A).



SHMBE8040D

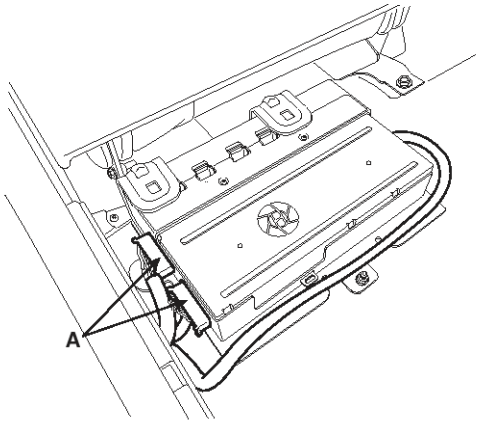
3. Remove the woofer speaker(A) after removing 4 nuts.



SHMBE8041D

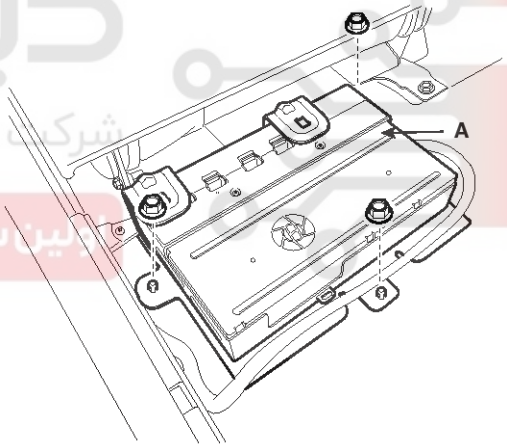
External Amplifier

1. Remove the rear floor panel.
   (Refer to the Body group – Interior trim)
2. Disconnect the external amplifier connector(A).



SHMBE8043D

3. Remove the external amplifier(A) after loosening the mounting nuts(3EA).



SHMBE8042D

Installation

Front speaker

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

Rear speaker

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

Crash pad center speaker

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

Tweeter speaker (Front)

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

Tweeter speaker (Rear)

1. Install the rear tweeter speaker to the rear door trim.
2. Reconnect the connector and then install the rear door trim.

Woofer speaker

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

External amplifier

1. Fold the 3rd seat back forward.
2. Reconnect the connector
3. Install the external amplifier on the floor panel.

NOTICE

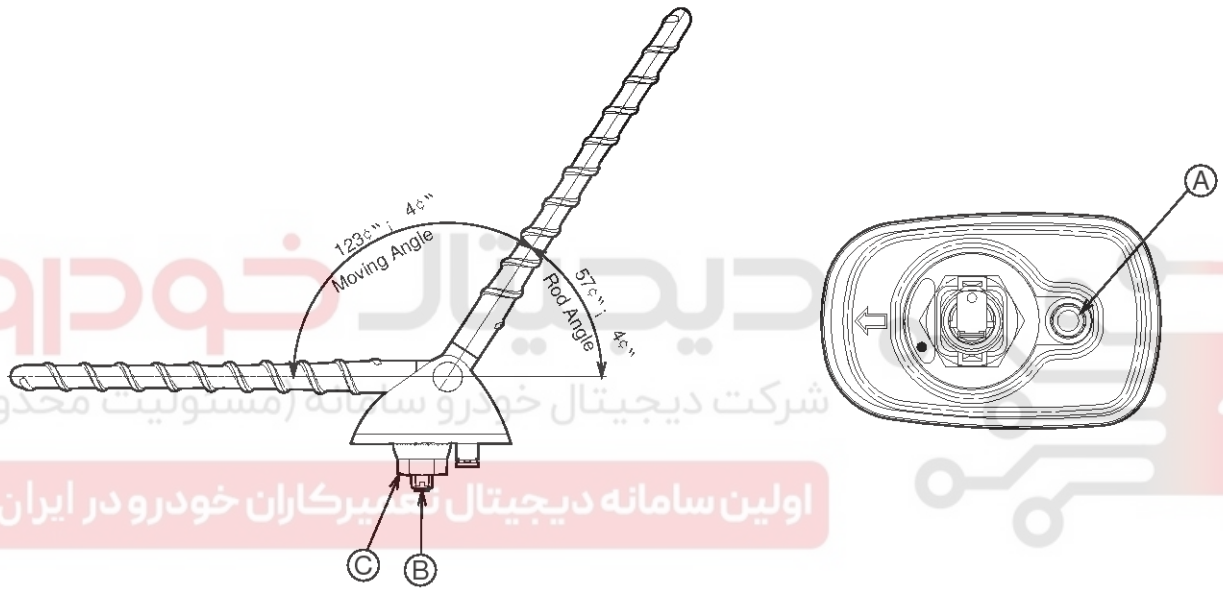
- *Make sure the speaker connectors are plugged in properly.*
- *Check the audio system.*

Antenna

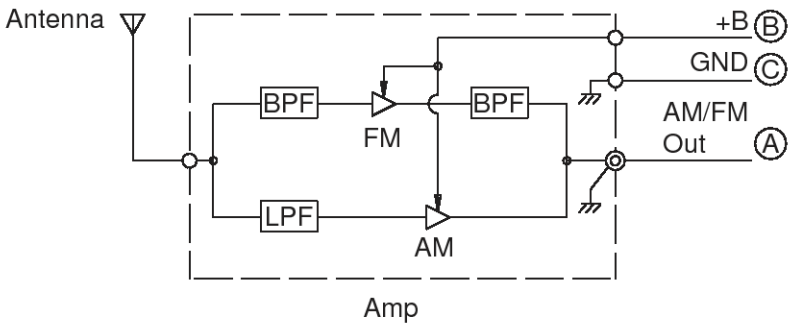
Specifications

Item	Specification
Storage temperature	-40˚F ~ 221˚F (-40˚C ~ 105˚C)
Operation temperature	-22˚C ~ 185˚C (-30˚C ~ 85˚C)
Operation voltage	DC 10.5 ~ 16.0V
Consumption current	MAX 150mA
Input/output impedance	75Ω

Component



[Circuit Diagram]

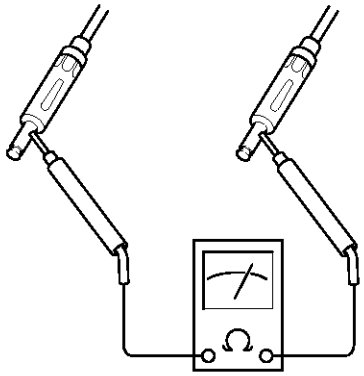


SHMBE9099L

Inspection

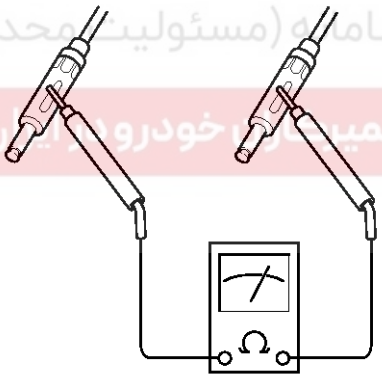
Antenna Cable

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



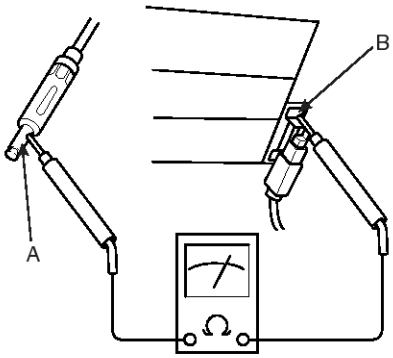
ATJF023C

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



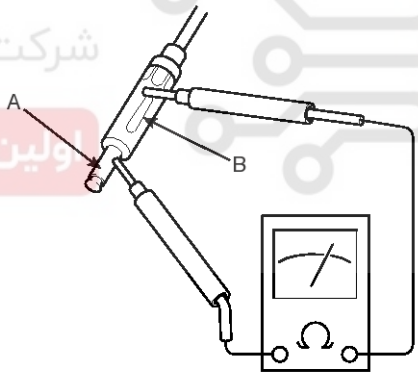
ATJF023D

4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole of antenna cable and terminal of glass antenna. There should be continuity.



ATJF023E

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

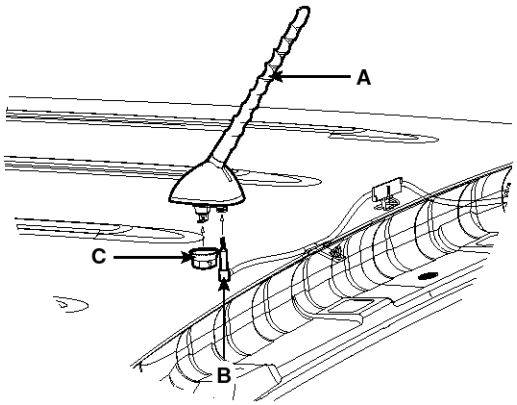


ATJF023F

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

Removal

1. Remove the rear roof trim (Refer to the Body group – Roof trim).
2. Disconnect the connector from the roof antenna.
3. Remove the roof antenna(A) after disconnecting the jack(B) and loosening the nut(C).



SHMBE9100L

Installation

1. Install the roof antenna to the roof panel.

Tightening torque (Nut)
4 ~ 8 N.m (0.4 ~ 0.8 Kg.m, 2.9 ~ 5.8 lb-ft)

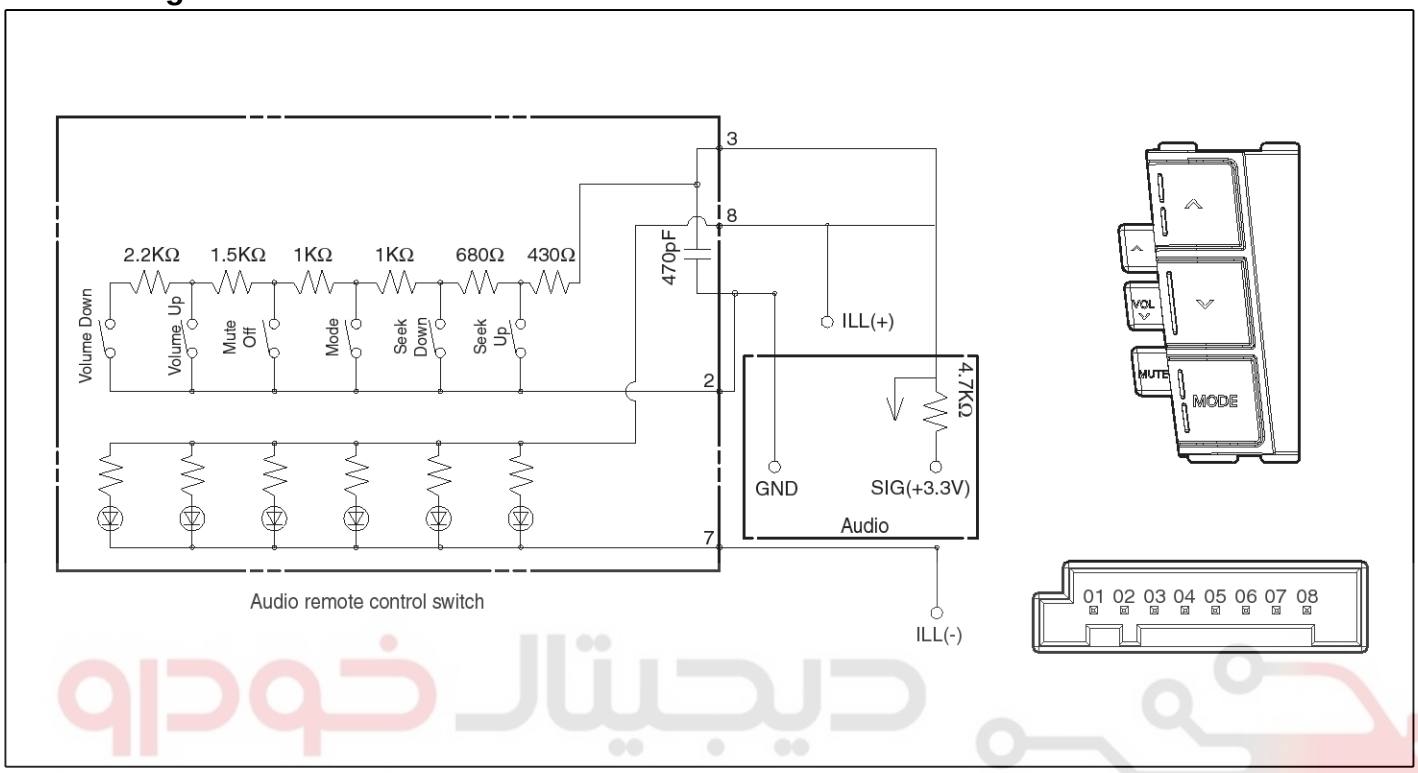
2. Reconnect the cable and connector to the roof antenna.
3. Install the rear roof trim.

NOTICE

- *Make sure the speaker connectors are plugged in properly.*
- *Check the audio system.*

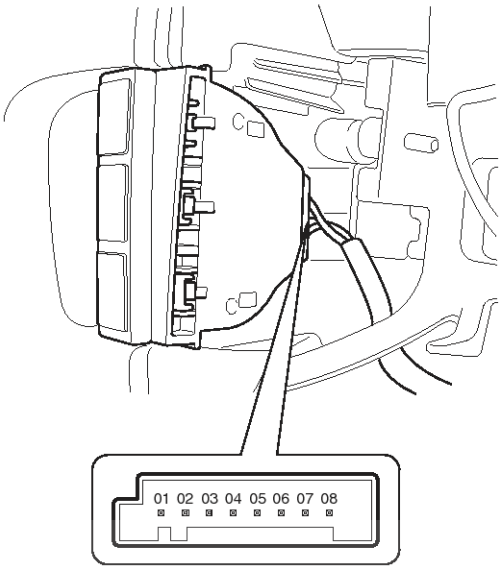
Audio Remote control

Circuit Diagram



Inspection

1. Check for resistance between No.2 and No.3 terminals in each switch position.

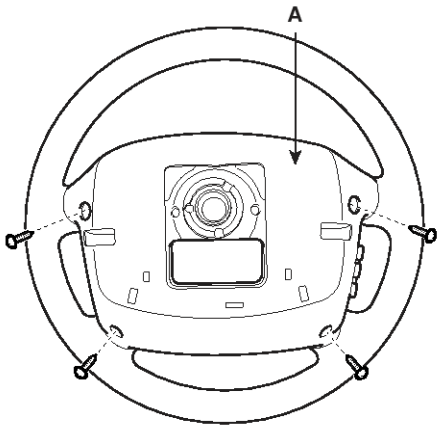


SHMBE8047D

Switch	Connector terminal	Resistance (±5%)
Volume Down	2 - 3	6.81 kΩ
Volume Up	2 – 3	4.61 kΩ
Mute Off	2 - 3	3.11 kΩ
Mode	2 - 3	2.11 kΩ
Seek Down	2 - 3	1.11 kΩ
Seek Up	2 - 3	430 Ω

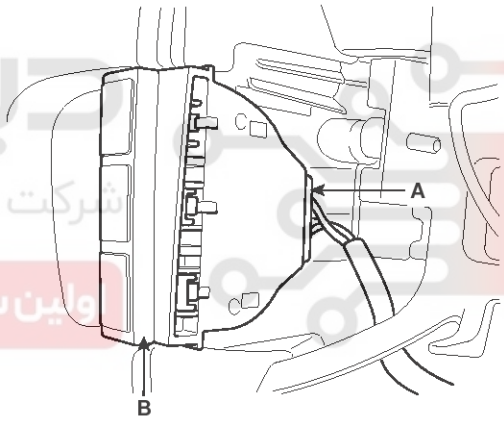
Removal

1. Remove the driver airbag module.
   (Refer to Restraint group – “Airbag Module”)
2. Remove the steering wheel.
   (Refer to Steering System – “Steering Column and Shaft”)
3. Remove the steering wheel cover (A) after loosening the screws (4EA).



SHMBE9379N

4. Remove the audio remote control switch(B) after disconnecting the connector(A).



SHMBE8049D

Installation

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

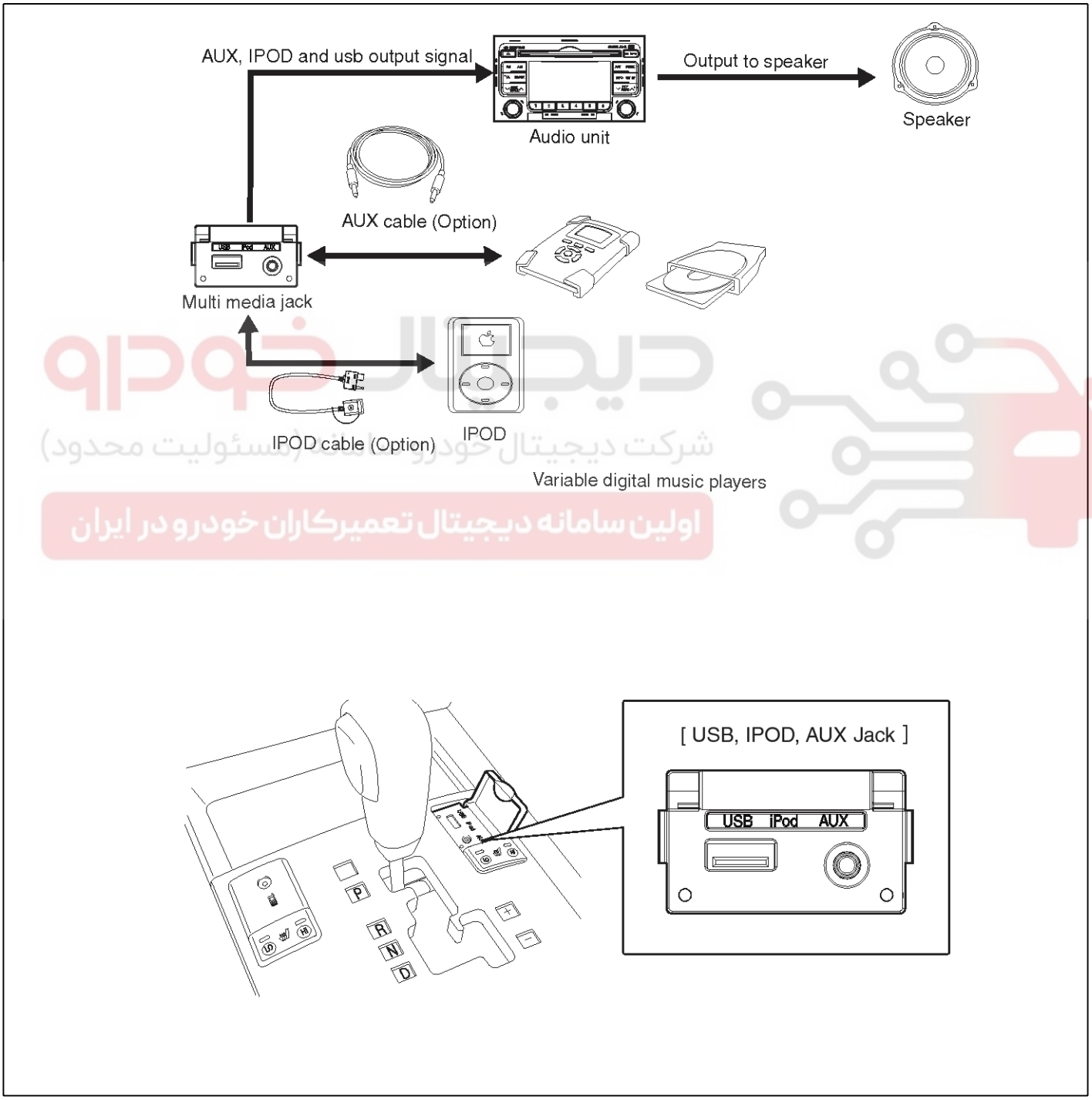
   NOTICE
   - *Make sure the speaker connectors are plugged in properly.*
4. Install the driver airbag module.

Multimedia jack

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, 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.

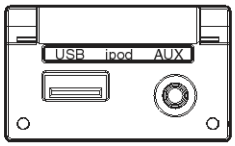
If audio distortion is present, check the volume settings on the device connected to Aux jack.



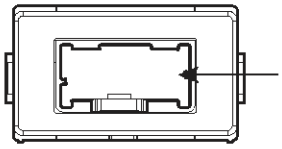
SHMBE9108N

Components

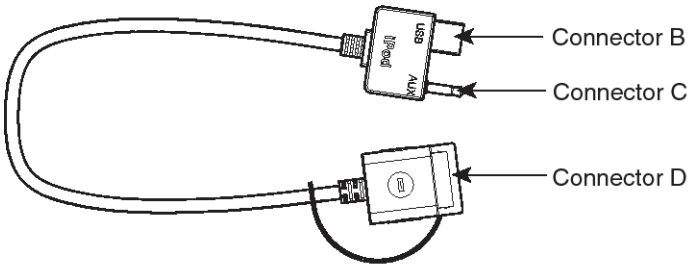
[AUX, USB, IPOD]

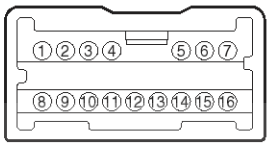
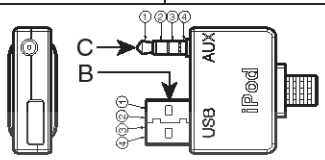
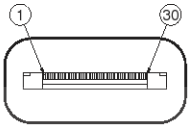


[Jack Connector]



[IPOD Cable]

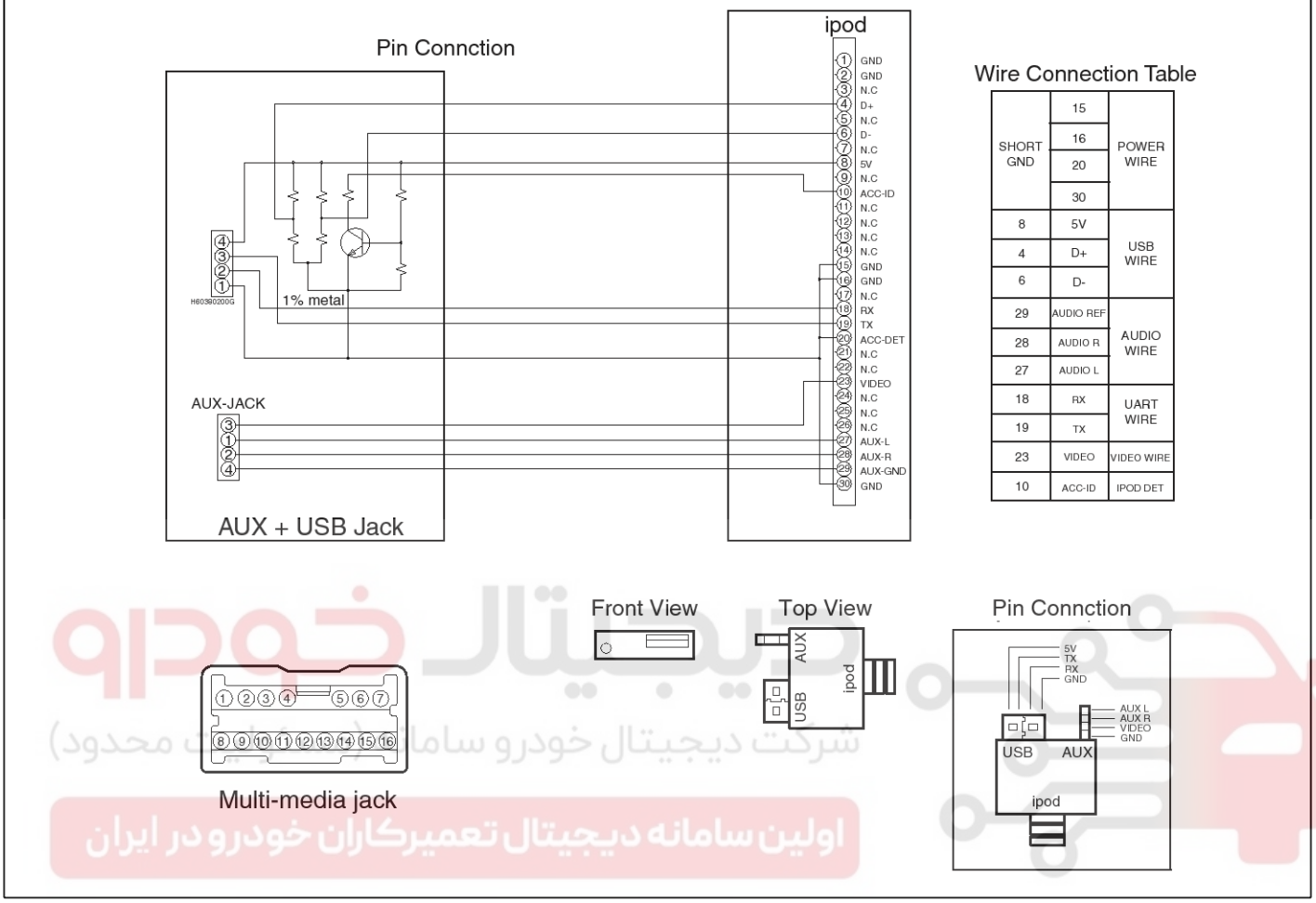


Name	Multi-media Jack Connector A (USB/AUX/IPOD)	USB Connector B	AUX Connector C	IPOD Connector D
Connector				
1	USB/IPOD 5V	USB/IPOD 5V	AUX1 L IN	-
2	USB D-/ IPOD TX	USB D-/IPOD TX	AUX1 R IN	-
3	USB D+/ IPOD RX	USB D+/ IPOD RX	Option/ Video	-
4	USB/ IPOD GND	USB/IPOD GND	AUX1 GND	D+
5	-			-
6	AUX1 REF			D-
7	AUX1 L IN			-
8	ILL+			5V
9	-			-
10	-			ACC ID
11	-			-
12	Video IN			-
13	Video GND			-
14	AUX DET			-
15	AUX shield GND			GND
16	AUX1 R IN			GND
17				-
18				RX
19				TX
20				GND
21				-
22				-
23				Video
24				-
25				-
26				-
27				AUX1 L IN
28				AUX1 R IN
29				Audio REF
30				Signal wire GND

SHMBE9109N

Circuit Diagram

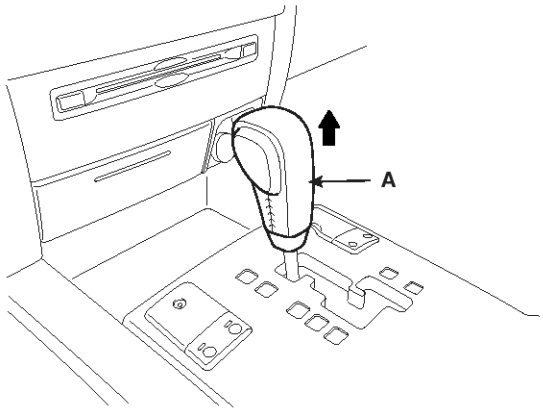
[Aux + USB + iPod] Multimedia jack



SHMBE9308N

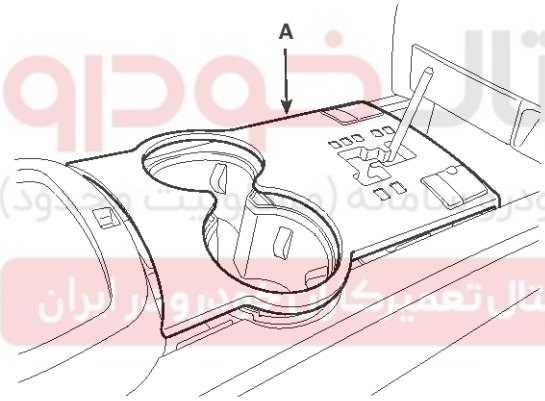
Removal

1. Remove the shift lever knob (A) pulling up.
   (Refer to Body Group - "Console")



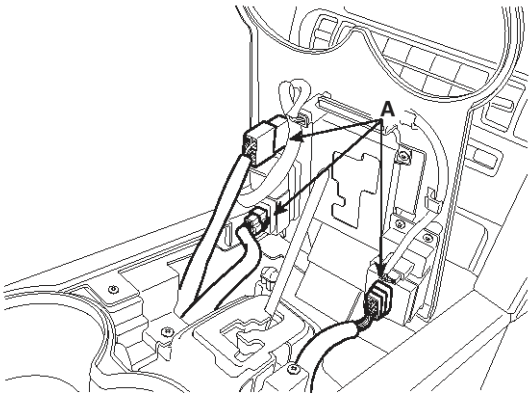
SHMBE8171D

2. Remove the console under cover (A).



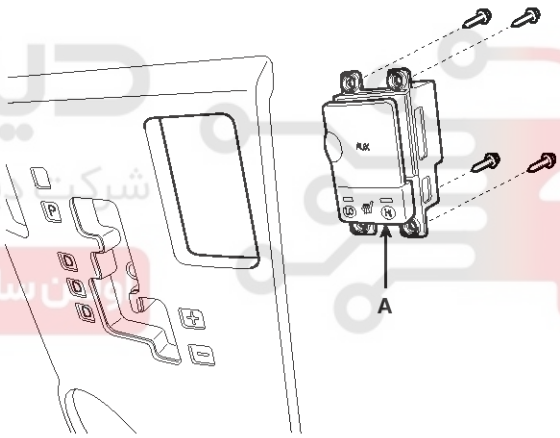
SHMBE8052D

3. Disconnect the connectors (A) from the console under cover.



SHMBE8053D

4. Remove the Multimedia Jack (A) from the console under cover after loosening the mounting screws(4EA).



SHMBE8054D

Installation

1. Install the Multimedia jack to the console under cover.
2. Reconnect the connector
3. Install the console under cover.

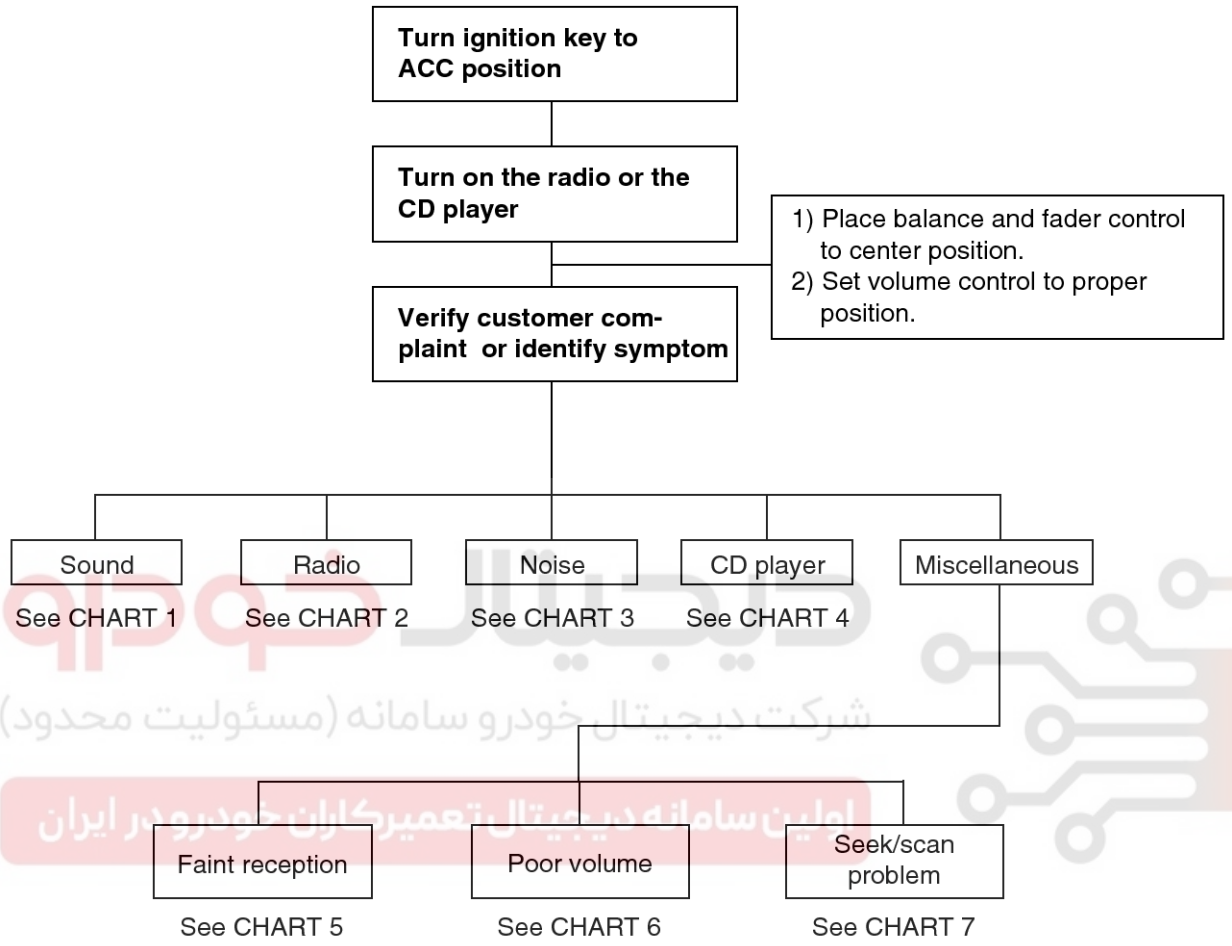
Troubleshooting

Customer Complaint Analysis Check Sheet

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

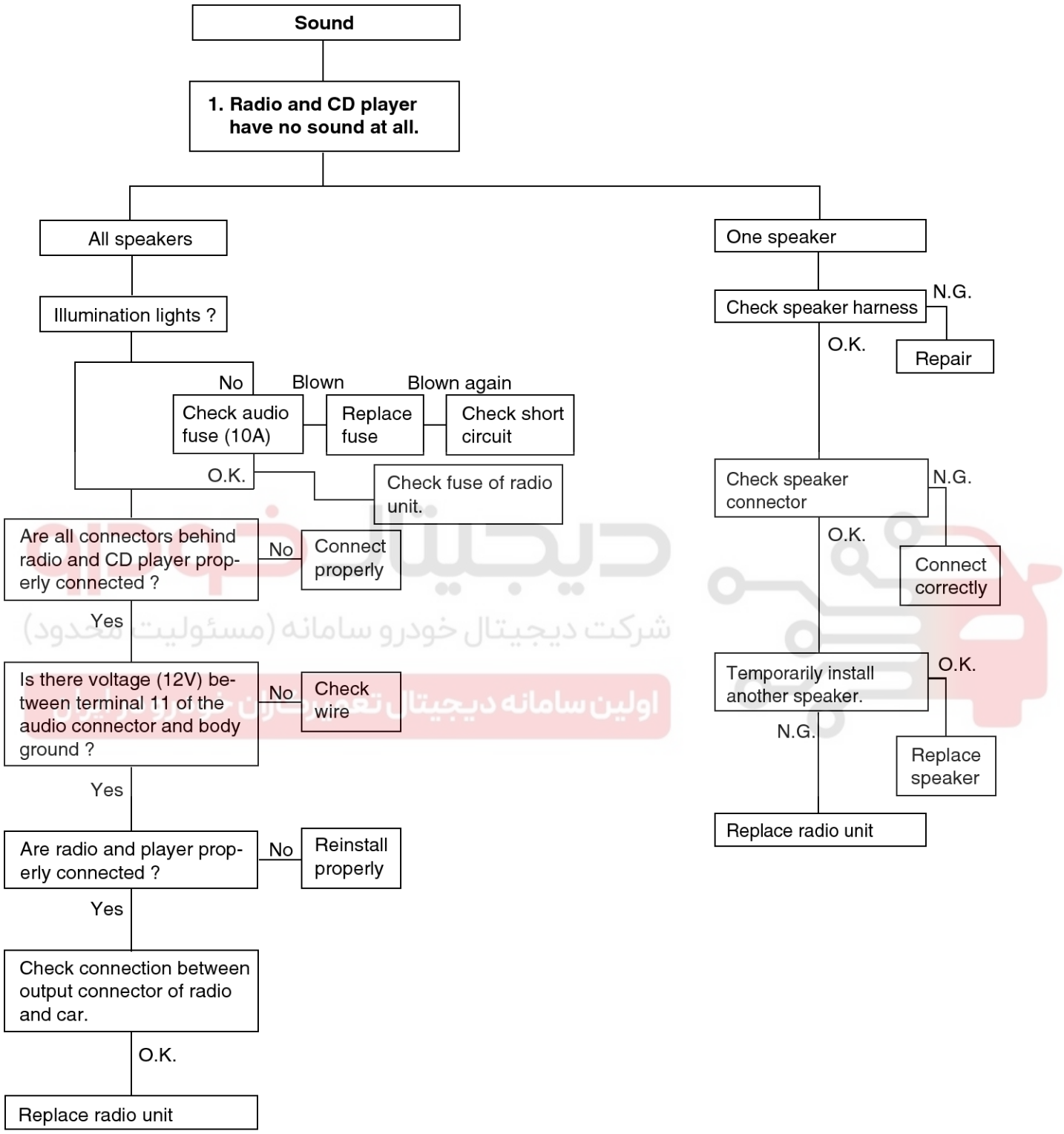
STGBE9041N

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.

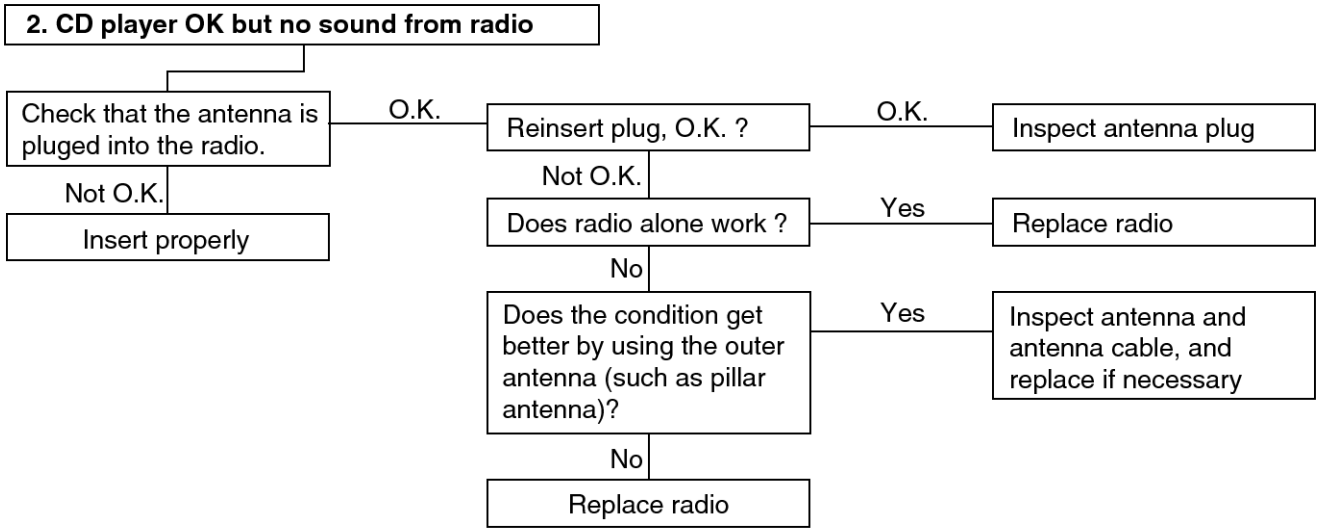


SENBE7047L

Chart 1

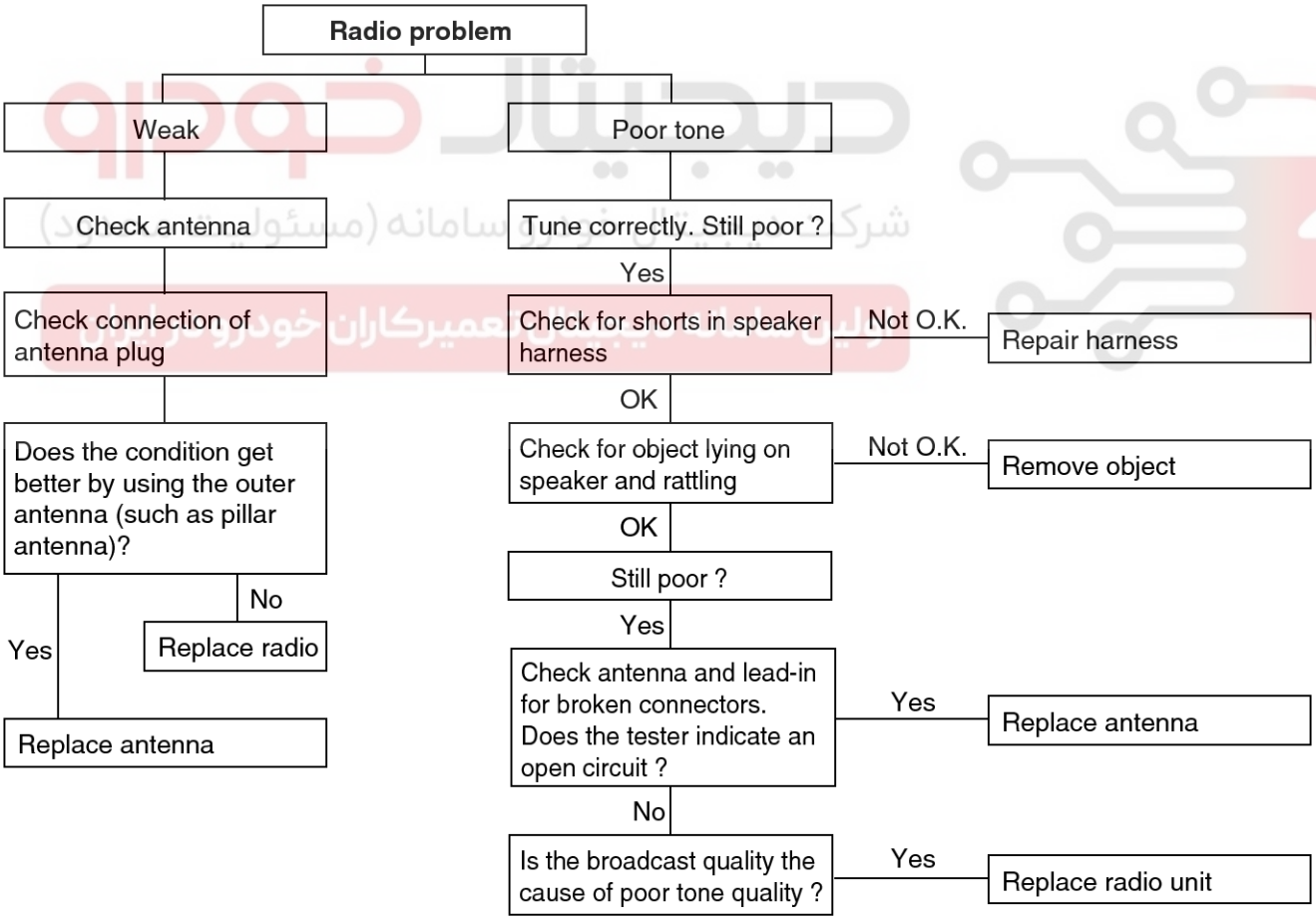


SENBE7048L



SHMBE9380N

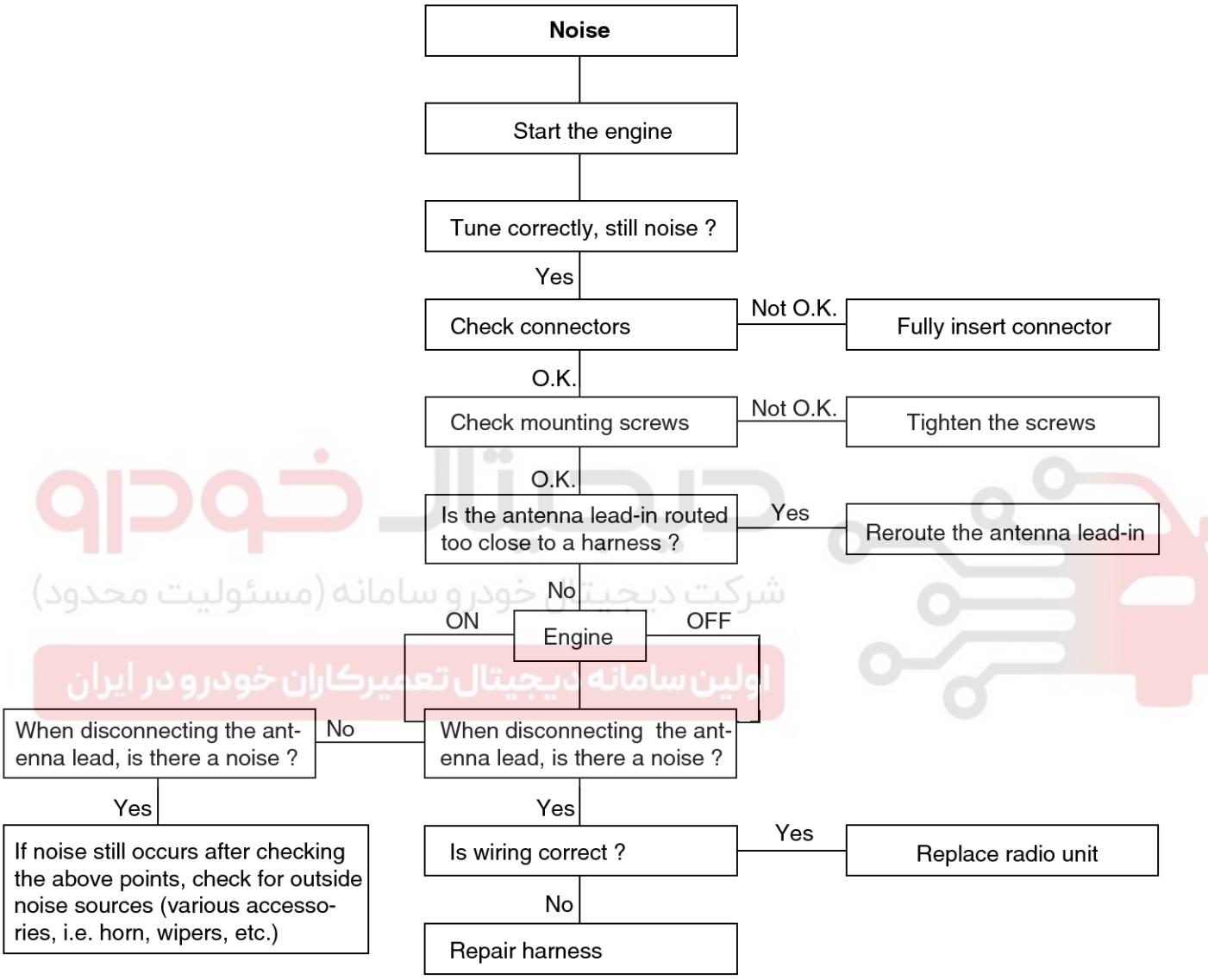
Chart 2



LTIF001D

Chart 3

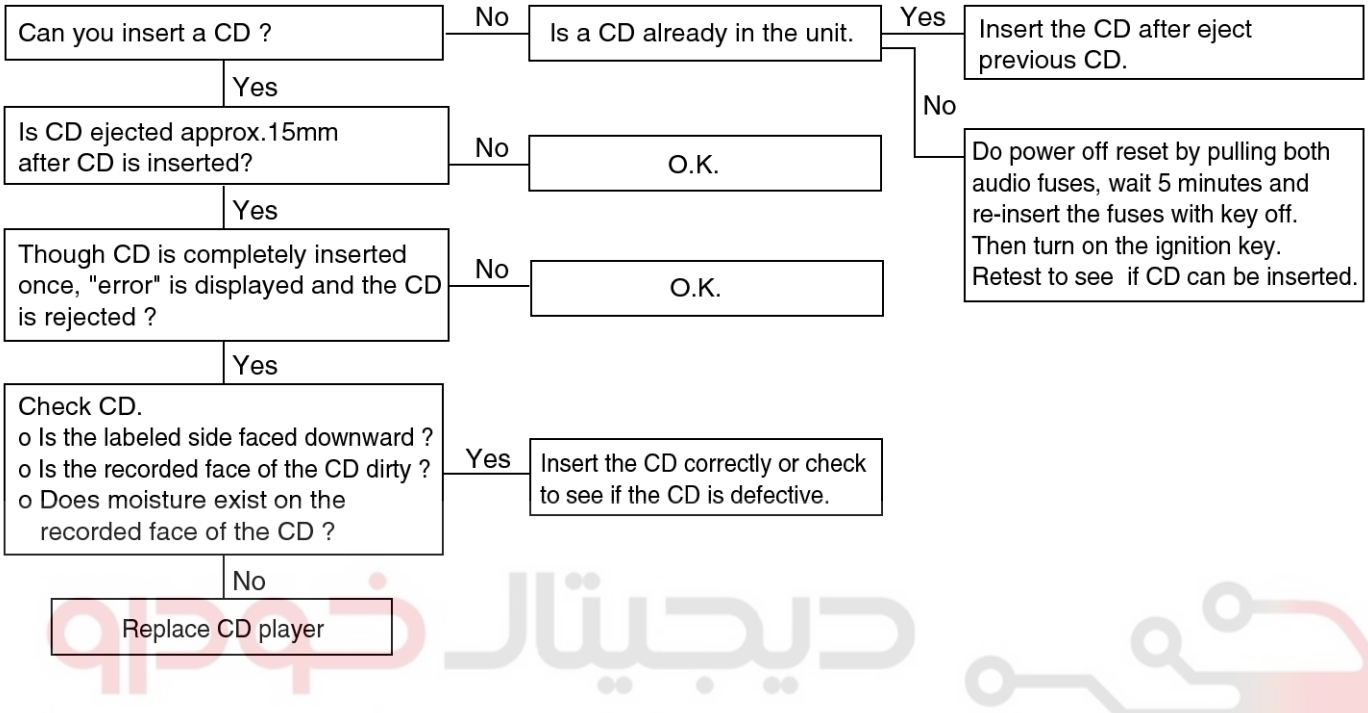
1. RADIO



LTIF001F

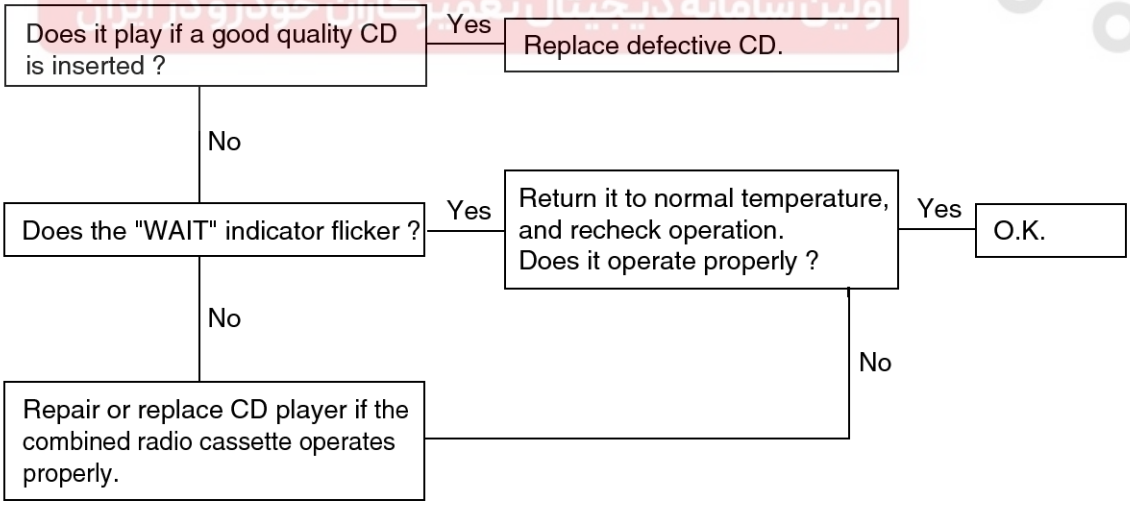
Chart 4

1. CD WILL NOT BE ACCEPTED



LTIF001H

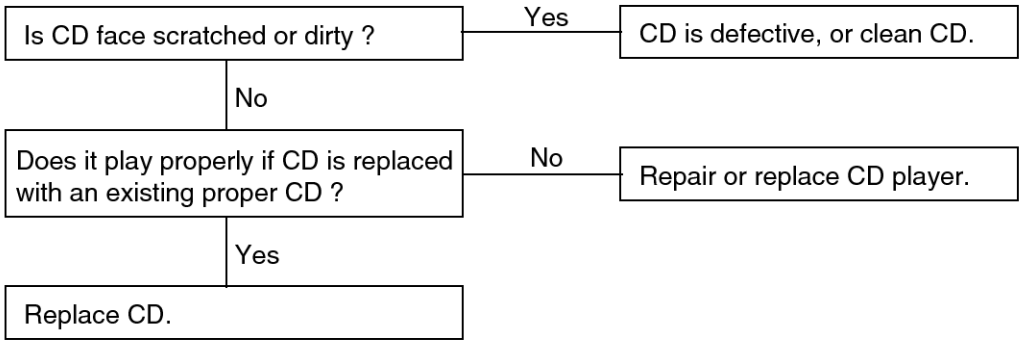
2. NO SOUND



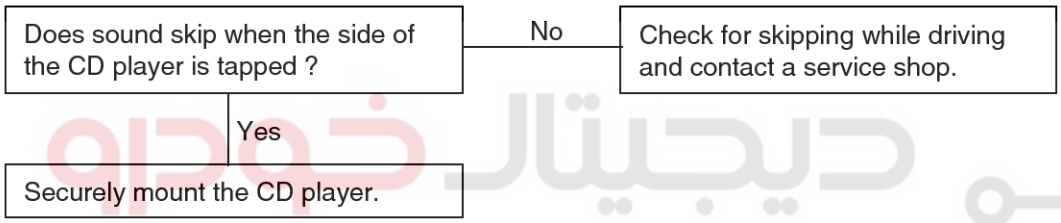
LTIF001I

3. CD SOUND SKIPS

1) Sound sometimes skips when parking.

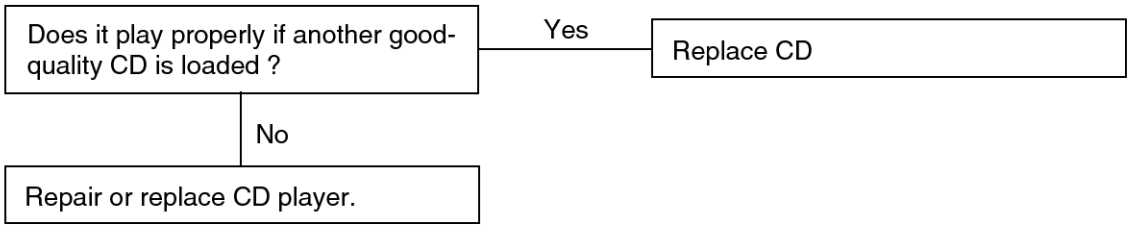


2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)

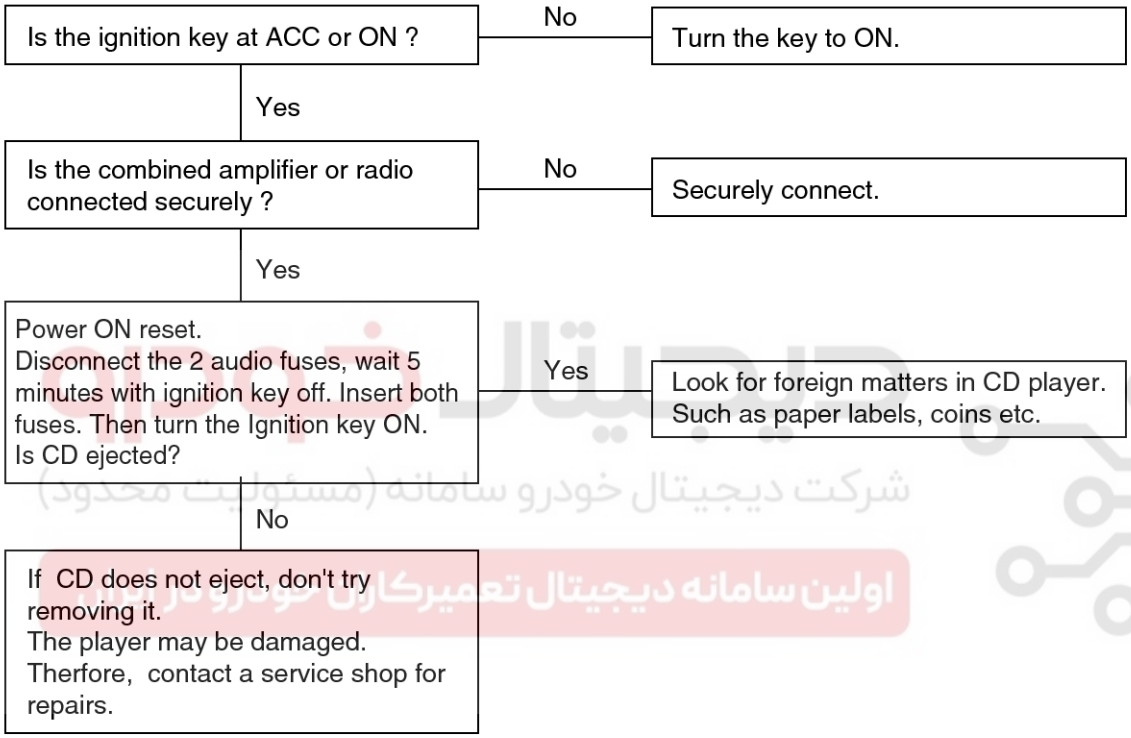


LTIF001J

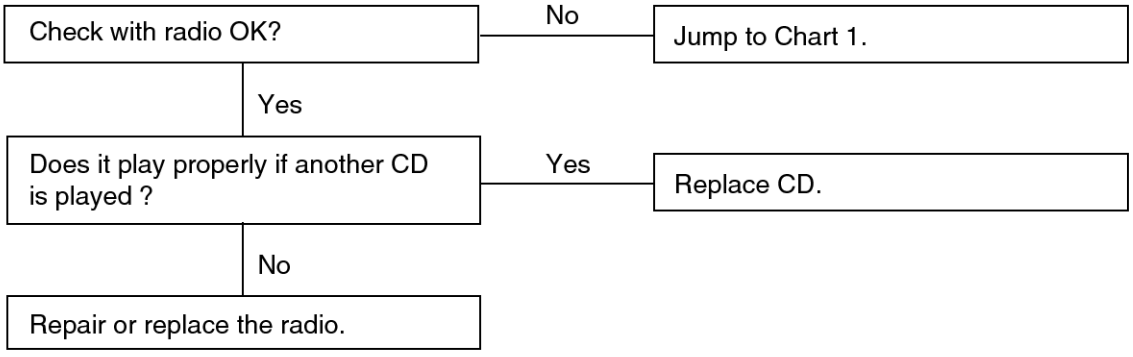
4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT

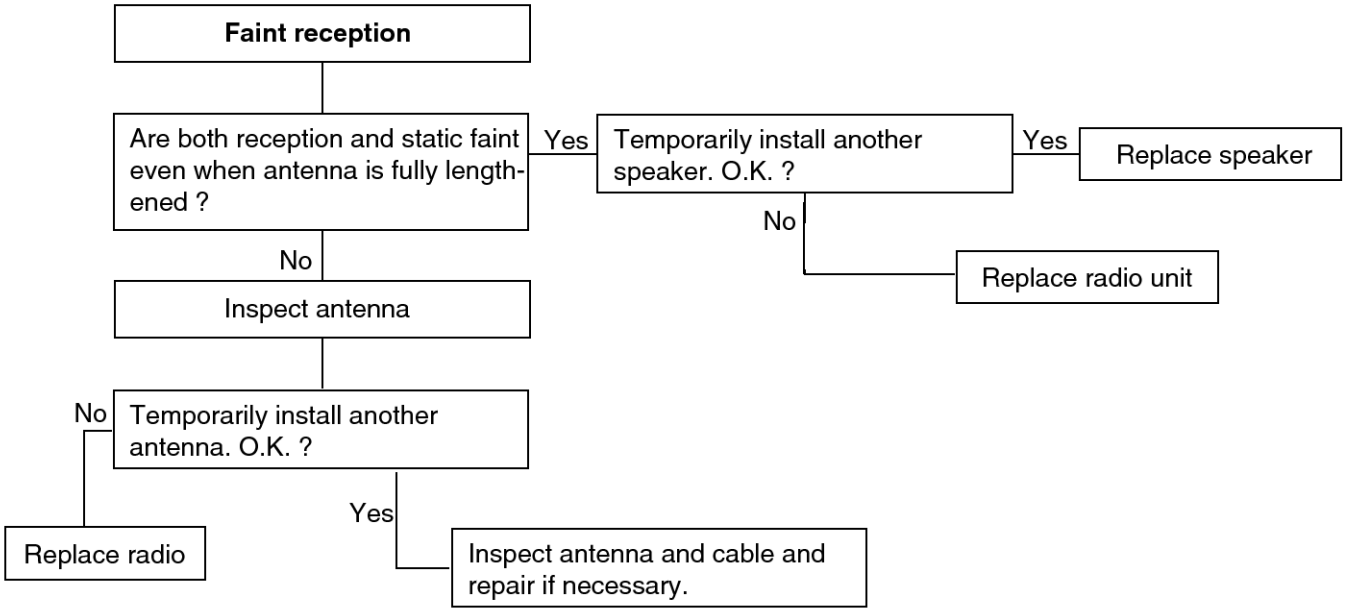


6. NO SOUND FROM ONE SPEAKER



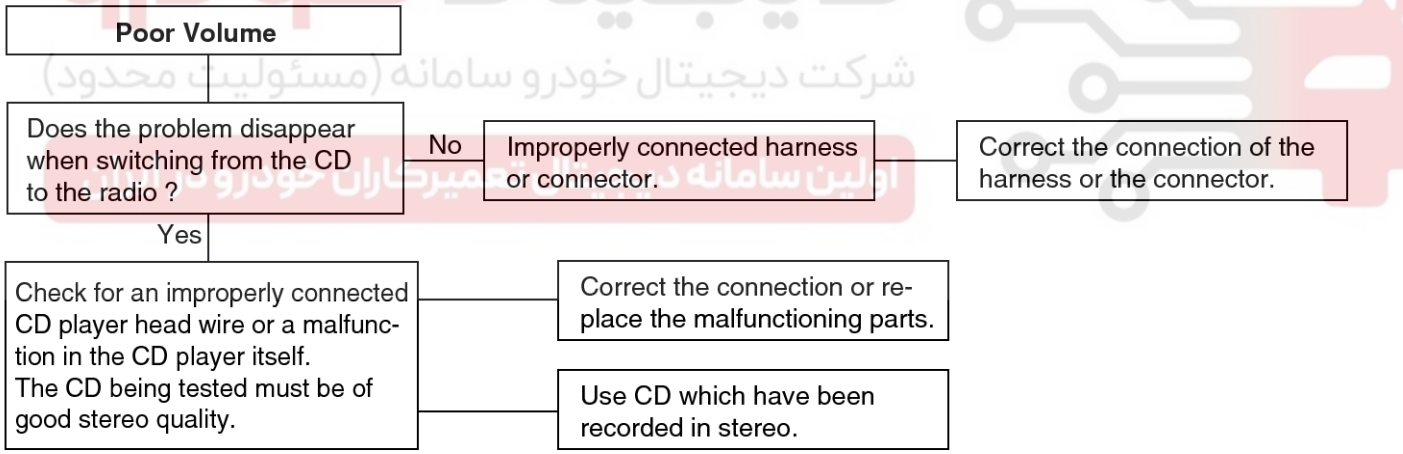
LTIF001K

Chart 5



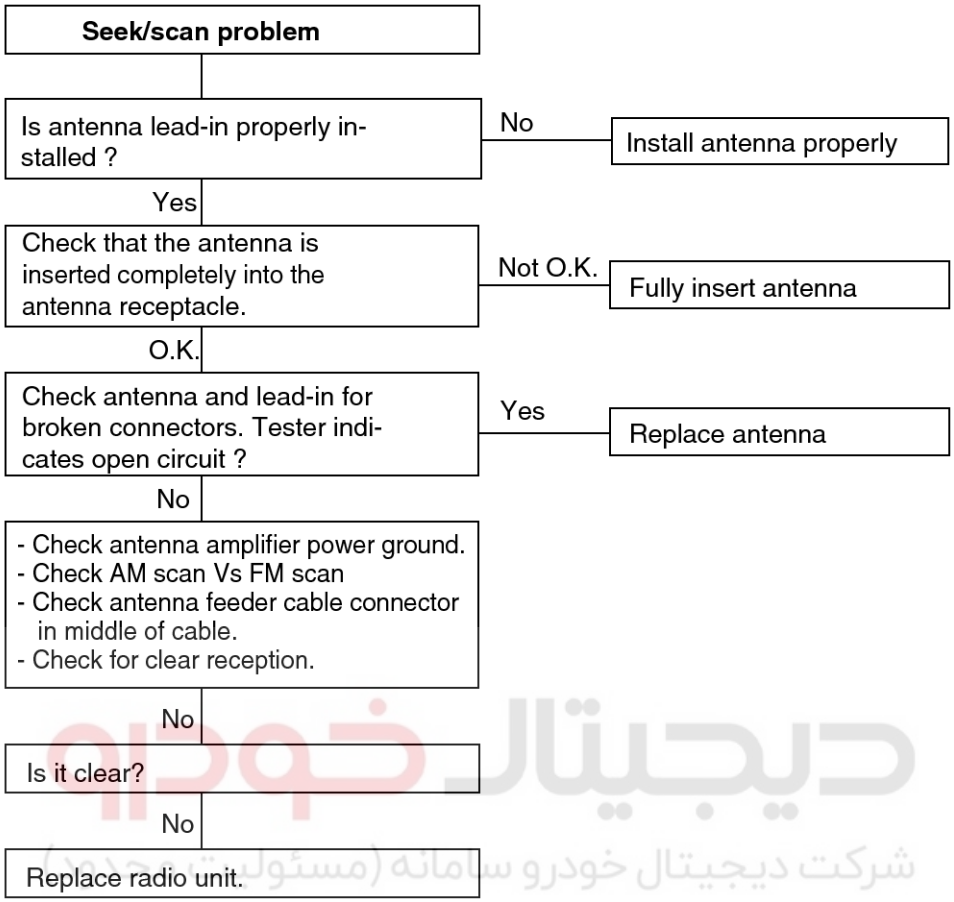
LTIF001L

Chart 6



SENBE7039L

Chart 7



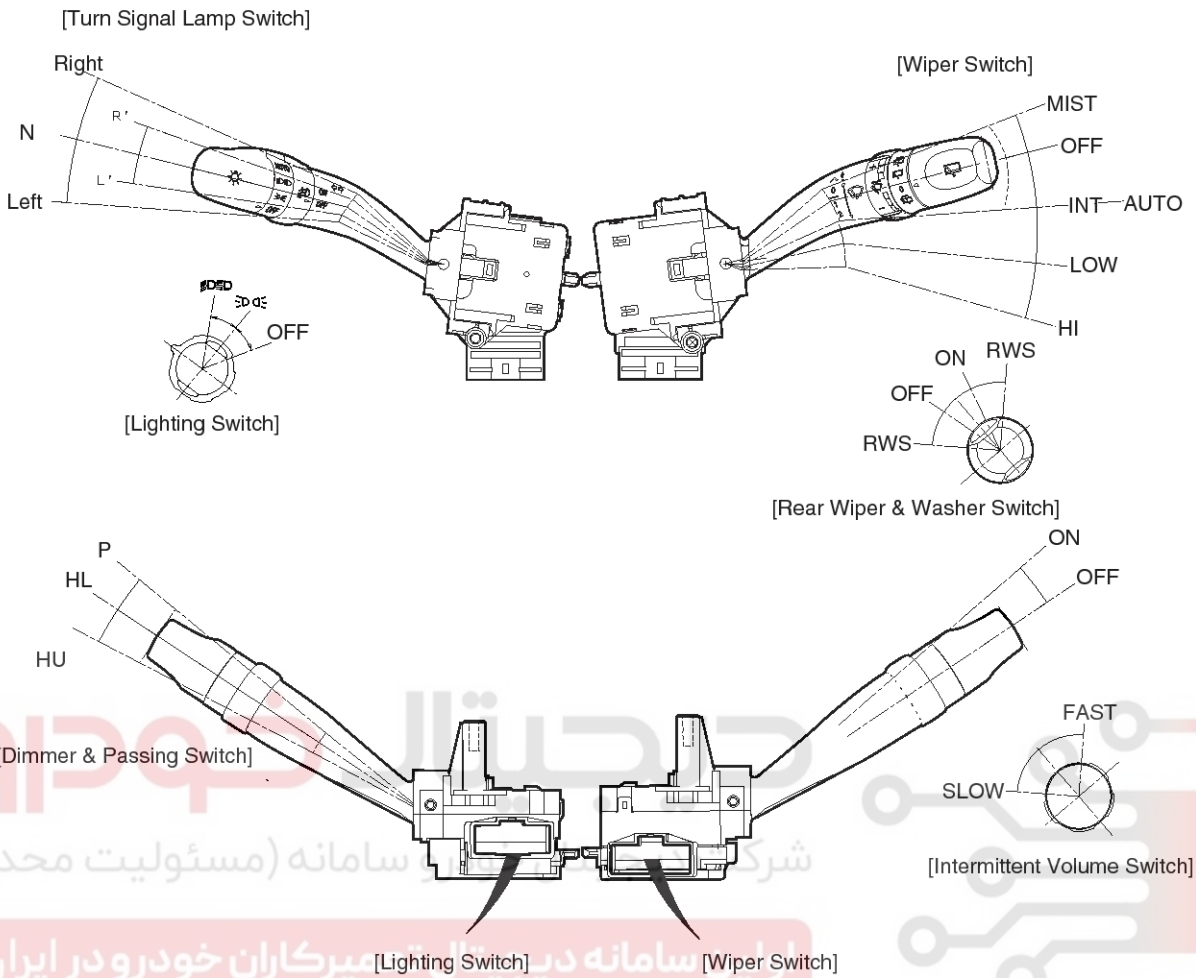
LTIF001N

Multifunction switch

Specifications

Items		Specifications
Rated voltage		DC 12V
Operating temperature range		-22 ~ +176°F (-30°C ~ +80°C)
Rated load	Dimmer & passing switch	High : 0.2A (Relay load) Low : 0.2A (Relay load) Passing : 2A (Relay load)
	Lighting switch	Lighting : 0.2A (Relay load)
	Turn signal switch	6.6 ± 0.5A (Lamp load)
	Wiper & mist switch	Low, High : 4.5A (Motor load) Intermittent : 6.0A (Relay load) Lock : Max. 28A (Motor load) Mist : 4.5A (Motor load) Washer: 4A(Motor load)
	Fog lamp switch	0.2A (Relay load)
	Rear wiper & washer	Wiper: 0.2A(Relay load) Washer: 4A(Motor load)

Component



1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

1	2	3	4	5	6	7
8	9	10	11	12	13	14

Connector Name	No	Description	Connector Name	No	Description
Lighting (18pins)	1	Head lamp passing switch	Wiper (14pins)	1	Wiper high speed
	2	Head lamp high beam		2	Wiper low speed
	3	-		3	Wiper parking
	4	-		4	Mist switch
	5	-		5	IGN(2)
	6	-		6	Intermittent wiper volume
	7	Turn signal lamp (RH)		7	Front washer switch
	8	Flash unit		8	-
	9	Turn signal lamp (LH)		9	Rear wiper & washer
	10	Head lamp low beam		10	Rear wiper
	11	Dimmer & passing ground		11	-
	12	Front fog lamp switch		12	Rear wiper ground
	13	Front fog lamp ground		13	Intermittent wiper volume(t)
	14	Tail lamp switch		14	IGN(2)
	15	Head lamp switch			
	16	Auto light			
	17	Lighting switch ground			
	18	-			

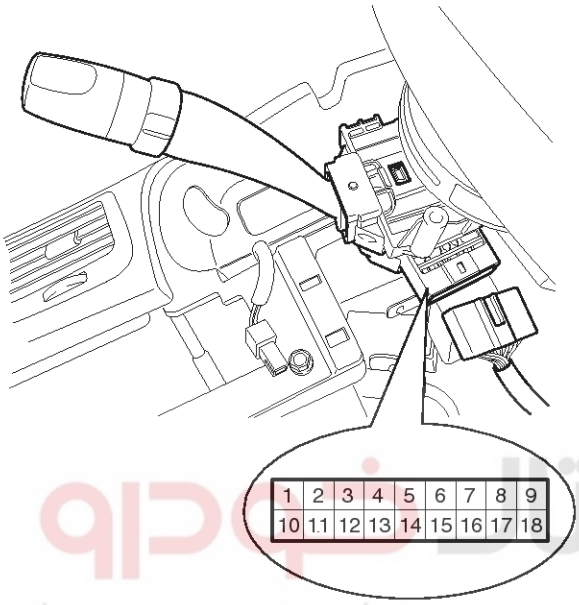
SHMBE9101L

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



SHMBE8059D

Lighting switch (Auto light)

Position \ Terminal	14	15	16	17
OFF				
I	○	—	—	○
II	○	○	—	○
Auto			○	○

SHMBE9309N

Lighting Switch

Position \ Terminal	14	15	16	17
OFF				
I	○	—	—	○
II	○	○	○	○

SHMBE9078N

Dimmer And Passing Switch

Position \ Terminal	1	2	10	11
HU		○	—	○
HL			○	○
P	○	○	—	○

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

SHMBE9079N

Turn Signal Switch

Hazard Switch	Turn Signal Switch \ Terminal	7	8	9
OFF	L		○	○
	N			
	R	○	○	

SHMBE9080N

Front Fog Lamp

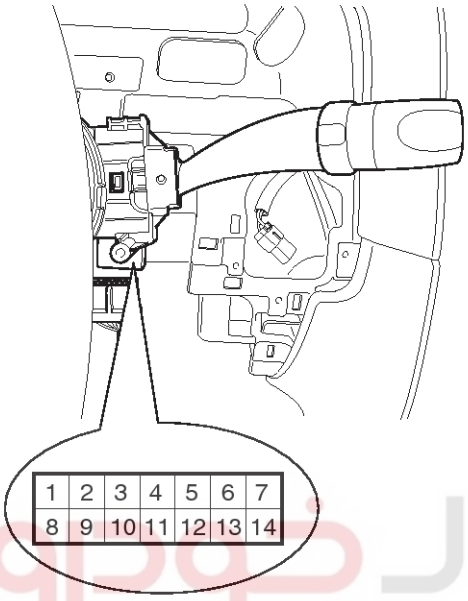
Position \ Terminal	12	13
OFF		
ON	○	○

SHMBE9081N

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.



SHMBE8065D

Wiper Switch

Terminal / Position	1	2	3	4	5	6	14	13
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

SHMBE9082N

Washer Switch

Terminal / Position	7	5
OFF		
ON	○	○

SHMBE9083N

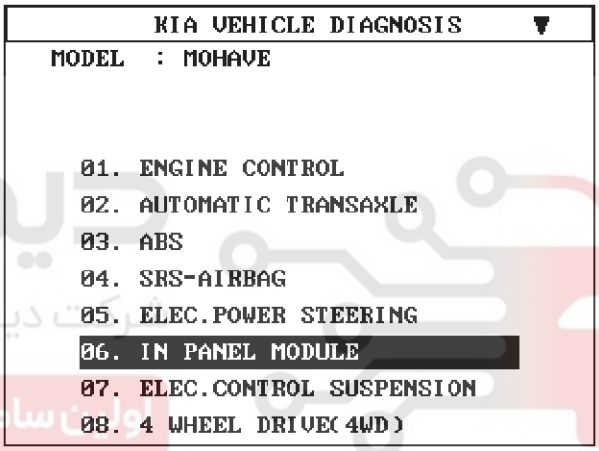
Rear Wiper & Washer Switch

Terminal / Position	12	10	9
Washer	○		○
OFF			
ON	○	○	

SHMBE9084N

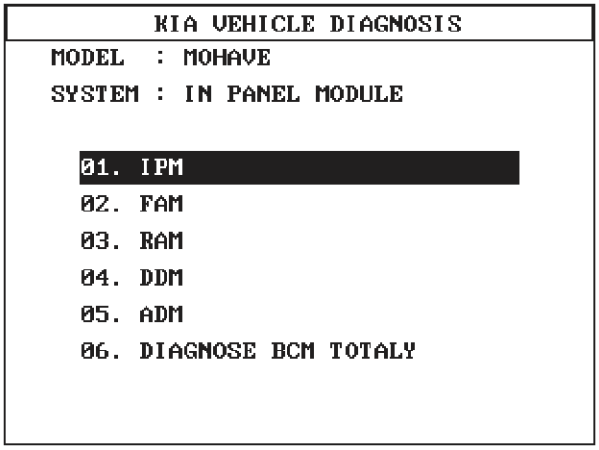
Inspection (With Scan Tool)

1. It will be able to diagnose defects of multifunction switch with scan tool quickly. Scan tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select model and menu.



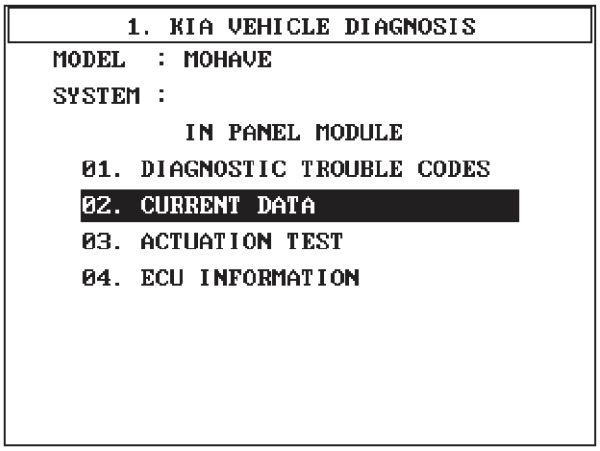
SHMBE9102L

3. Select “In-panel module(IPM).



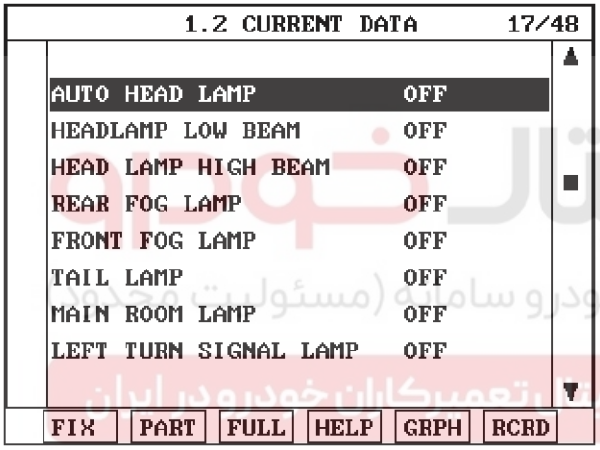
SHMBE9103L

4. Select "Current data".



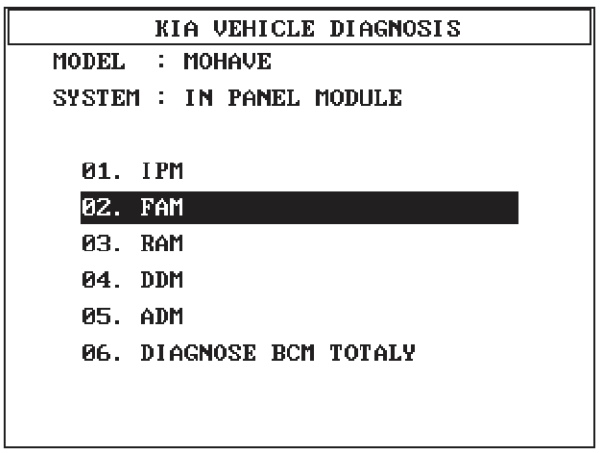
SHMBE9104L

5. Check the input/output status of multifunction switch.



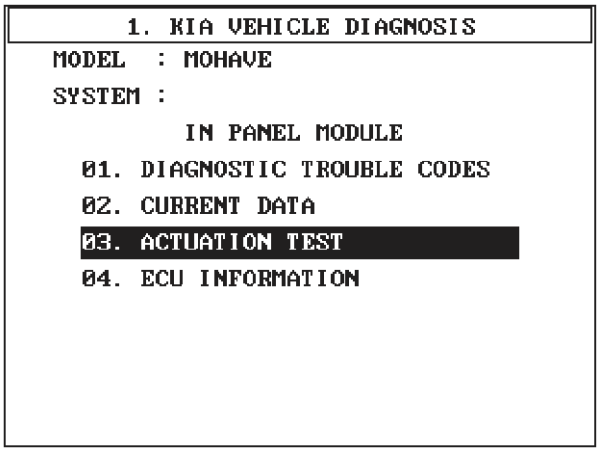
SHMBE9088N

6. Select “Front Area Module(FAM)” or “Rear Area Module(RAM)”.

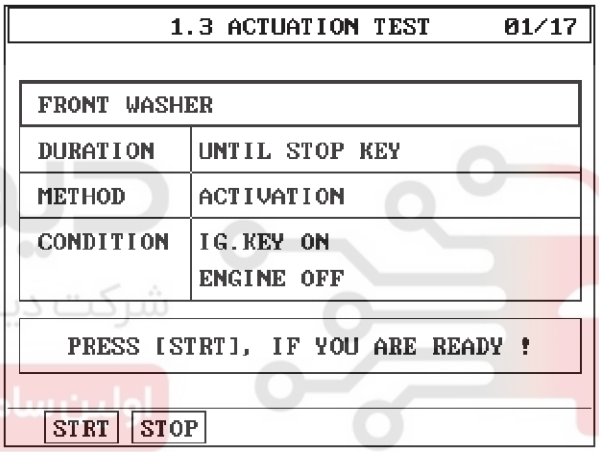


SHMBE9105L

7. If you will check multifunction switch input data operation forcefully, select "Actuation test".



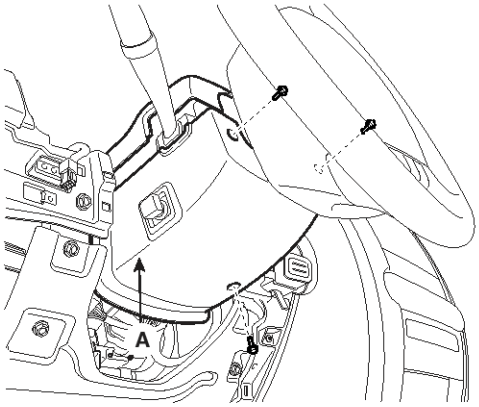
SHMBE9106L



SHMBE9091N

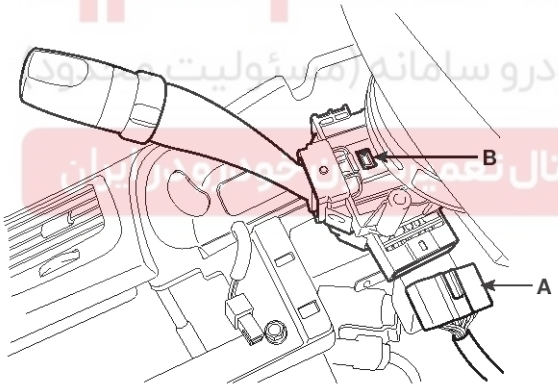
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws.
   (Refer to ST group - Steering column and shaft).



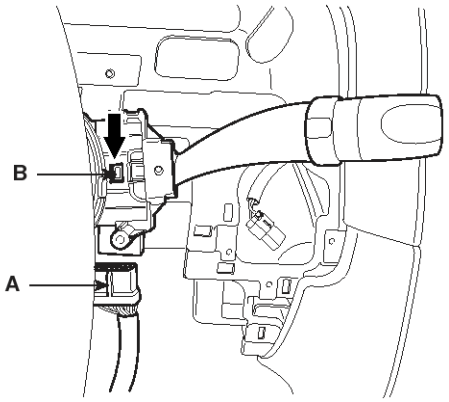
SHMBE8056D

3. Remove the lighting switch (A) by pushing the lock pin (B) after disconnecting the connector.



SHMB18031D

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



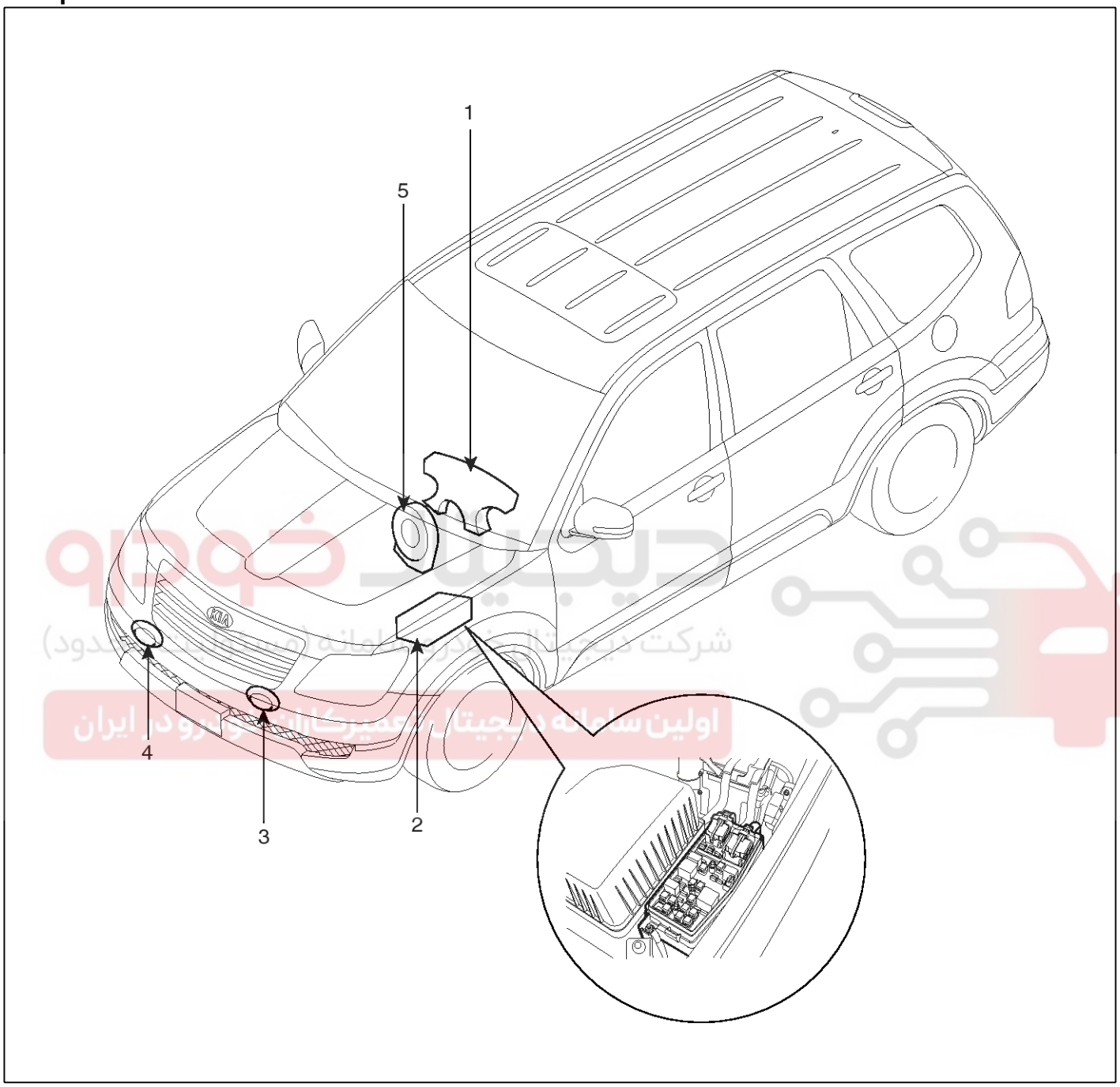
SHMBE8058D

Installation

1. Install the wiper switch after connecting the connector.
2. Install the lighting switch after connecting the connector.
3. Install the steering column upper and lower shrouds.

Horn

Component Location

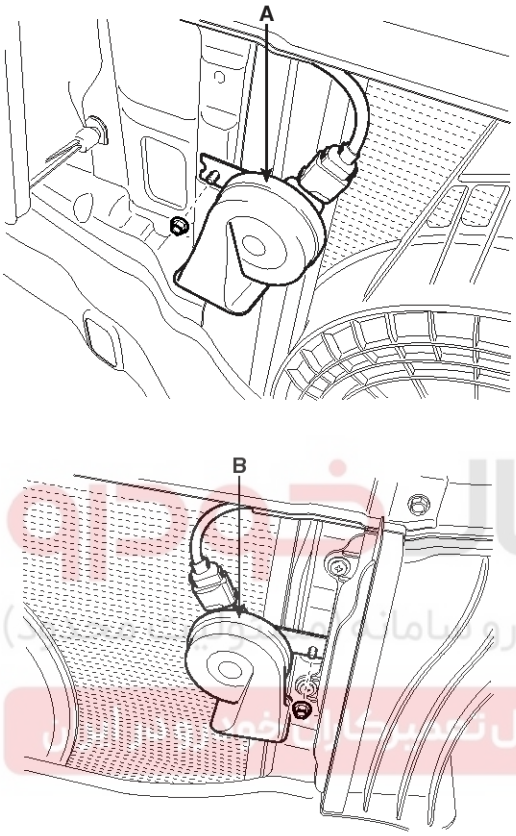


SHMBE8070D

1. Horn switch
2. Relay box (Built in FAM)
3. Horn (Low pitch)
4. Horn (High pitch)
5. Clock spring

Removal

1. Remove the front bumper. (Refer to the Body group - front bumper).
2. Remove the bolt and disconnect the horn connector, then remove the high pitch horn (A) and low pitch horn (B).



SHMBE8071D

Installation

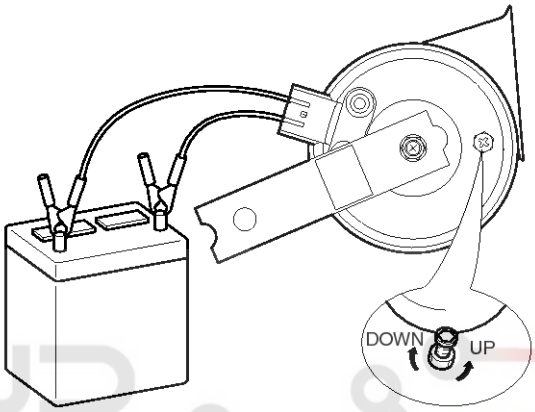
1. Install the horn after connecting the horn connector.
2. Install the front bumper.
   (Refer to the Body group - Front bumper).

Adjustment

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

NOTICE

After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



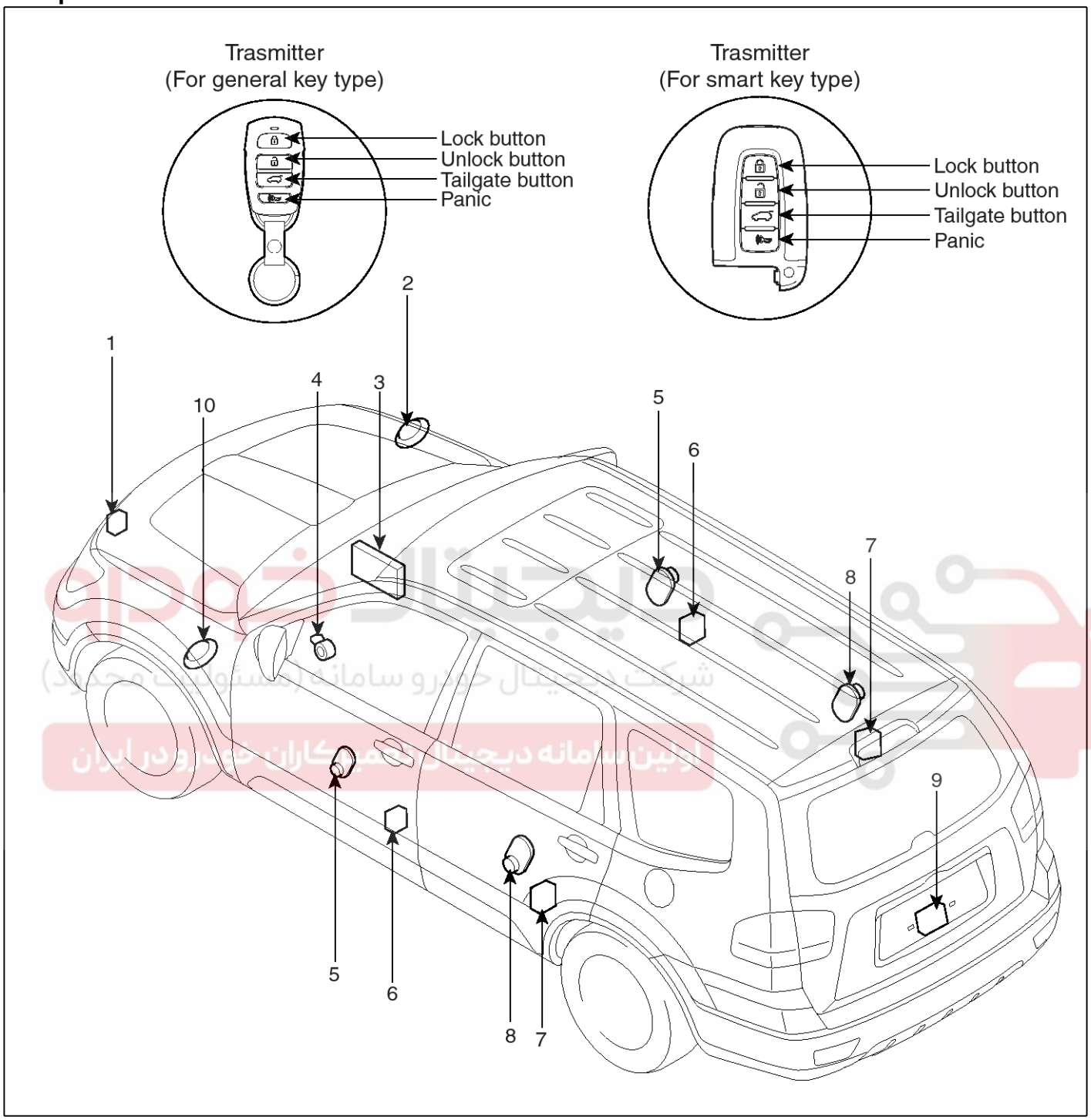
SCMBE6064D

Keyless Entry And Burglar Alarm

Specifications

Items		Specifications
Power source		DC 3V
Operating temperature	General key	-4˚F ~ 140˚F (-20˚C ~ +60˚C)
	Smart key	14˚F ~ 140˚F (-10˚C ~ +60˚C)
Transmission frequency		315MHz (China)
		433MHz (General and Middle east)
Indicator		LED
Button number		4 (China) / 3 (General and Middle east)
Button		Lock
		Unlock
		Panic
		Tailgate unlock (for China)
Life time of battery	General key	2 year (10 times / day)
	Smart key	2 year (Active 20 times / day + Passive 10 times / day)

Component Location



SHMBE9055L

1. Hood switch
2. Burglar alarm horn
3. RF receiver
4. Key warning switch
5. Front door switch
6. Front door lock actuator and switch
7. Rear door lock actuator and switch
8. Rear door switch
9. Power latch assembly switch
10. Door lock/ unlock buzzer

Remote Keyless Entry System

The aim of this function is to receive the key fob signal and decode it. There are 4 different data included in the radio frequency frame sent by the RKE to the IPM module:

- Central door lock
- Central door unlock
- Panic function
- Tailgate unlock (for China)

Each vehicle can have at most 2 associated key. The key is physically separated from the key itself (separate device).

Description

The RF signal from the key is received by a special IPM daughter board. This signal (RKE signal) is transmitted to the micro controller where the RKE function is in charge of decoding it.

Lock/Unlock with key

When the key Lock (respectively Unlock) button is pressed, a Lock command (respectively Unlock) is issued for all doors by IPM.

In the following description “all doors” means driver door, assist door, left rear door, right rear door and tailgate.

Central lock/unlock with key is independent of door lock status.

In all cases, when IPM issues lock/unlock command, it does not check monitoring switches to make sure command was successful.

Remote Keyless Entry Panic

When the key fob panic button is pressed, the siren and also the horn depending on the country are switched on and the hazard lamps are activated.

Function

IPM

Description
RKE function does not work when any of the car keys is inserted in the ignition key cylinder.

Lock / Unlock

Description
Lock /Unlock with key Lock /unlock with key is independent from door lock status, Door Lock control is sent with lock value even if door lock status is already locked
Lock /Unlock with key fob If there is no door, tailgate or key insert before and within 30seconds after RKE unlock (except RKE Tailgate Unlock), all doors lock themselves using standard lock procedure (All lock sent from IPM for 500ms then no action). Answer back is like that for a Lock with key fob.
Lock /Unlock with key fob If IPM receives a new RKE unlock while 30 s lock timer is already started, 30’s timer is restarted.

Lock

Description
Lock with key fob: When receiving key fob signal lock, IPM immediately issues Door lock control CAN signal with value all lock for 0.5 s for locking all doors.

Unlock

Description
Unlock with key fob: When receiving key fob signal unlock, IPM immediately issues door lock control CAN signal with value all unlock for 0.5 s for locking all doors.

Multiple Lock / Unlock within 500 ms

Description
Multiple lock/unlock within 500 ms 2 consecutive RKE LOCK signals:door lock control CAN signal is sent with value all lock for 0.5 s upon reception of the first signal. The 2nd signal has no action on door lock control.
Multiple lock/unlock within 500 ms RKE lock followed by UNLOCK signal: Door Lock control CAN signal is sent with value all lock upon reception of the first signal. When 2nd signal is received, door lock control is set to no actionfor 100 ms and then all unlock is sent for 500 ms.
Multiple lock/unlock within 500 ms 2 consecutive RKE unlock signals: Door lock control CAN signal is sent with value all unlock for 0.5 s upon reception of the first signal. The 2nd signal has no action on Door Lock control.
Multiple lock/unlock within 500 ms RKE unlock followed by LOCK signal:door lock control CAN signal is sent with value all unlock upon reception of the first signal. When 2nd signal is received, door lock control is set to no action for 100 ms and then all lockis sent for 500 ms.

Description
RKE Lock/Unlock and RKE Tailgate Unlock within 500 ms Within 500 ms of a RKE Lock/Unlock, a RKE Tailgate unlock is not taken into account, there is no action.

Panic

Description
RKE Panic Function for Korea and General When the RKE panic signal is received, the following actions occur: Turn indicators are flashed at a 1Hz frequency (0.5s On/0.5s Off) for 27 s using Turn Indicator control CAN signal. The Siren is activated at a 1Hz frequency (0.5s On/0.5s Off) for 27 s usingsiren drive output(command sent by the IPM to FAM by CAN signal Sirencontrol, and relay drive located on the FAM).
RKE Panic Function Cancel Panic is cancelled (turn indicators and siren management) if one of the buttons of the keyfob (Lock, unlock, tailgate unlock, Panic) is pushed or ignition key is inserted or if the system enters in ALARM mode while panic is activated.

Tailgate Unlock

Description
RKE Tailgate unlock When receiving key fob signal tailgate unlock, IPM immediately issues Door Lock control CAN signal with value tailgate unlock for 0.5 s for unlocking the tailgate
Multiple RKE Tailgate Unlock within 500 ms Within 500 ms of a RKE tailgate unlock, a new RKE tailgate unlock is not taken into account, there is no action.
RKE Tailgate Unlock and RKE Lock within 500 ms When a RKE Tailgate unlock occurs, IPM sends the CAN signal door lock control with the value tailgate unlock. Within 5 00 ms of this occurrence, if a RKE Lock occurs, IPM sends the CAN signal door lock control with the value no action for 100 ms and then with the value all lock for 500 ms.
RKE Tailgate Unlock and RKE Unlock within 500 ms When a RKE Tailgate Unlock occurs, IPM sends the CAN signal Door Lock control with the value tailgate unlock. Within 500 ms of this occurrence, if a RKE Unlock occurs, IPM sends the CAN signal Door Lock control with the value no actio-n for 100 ms and then with the value all unlock for 500 ms.

Description
The RKE function is always ready to receive an RKE signal even when the IPM is in sleep mode.

Description
Sleep Mode: IPM does not enter SLEEP MODE* while the unlock 30s timer is running.

Burglar Alarm system

Alarm

Description

The Burglar Alarm function purpose is to prevent intrusion in the vehicle when it has been locked. Burglar Alarm system is armed after all doors have been closed and locked (by key fob or driver/assist door key cylinder) and key is not inserted in ignition key cylinder.

Once it is armed the system considers an attack as any entrance (doors, hood and tailgate) opened.

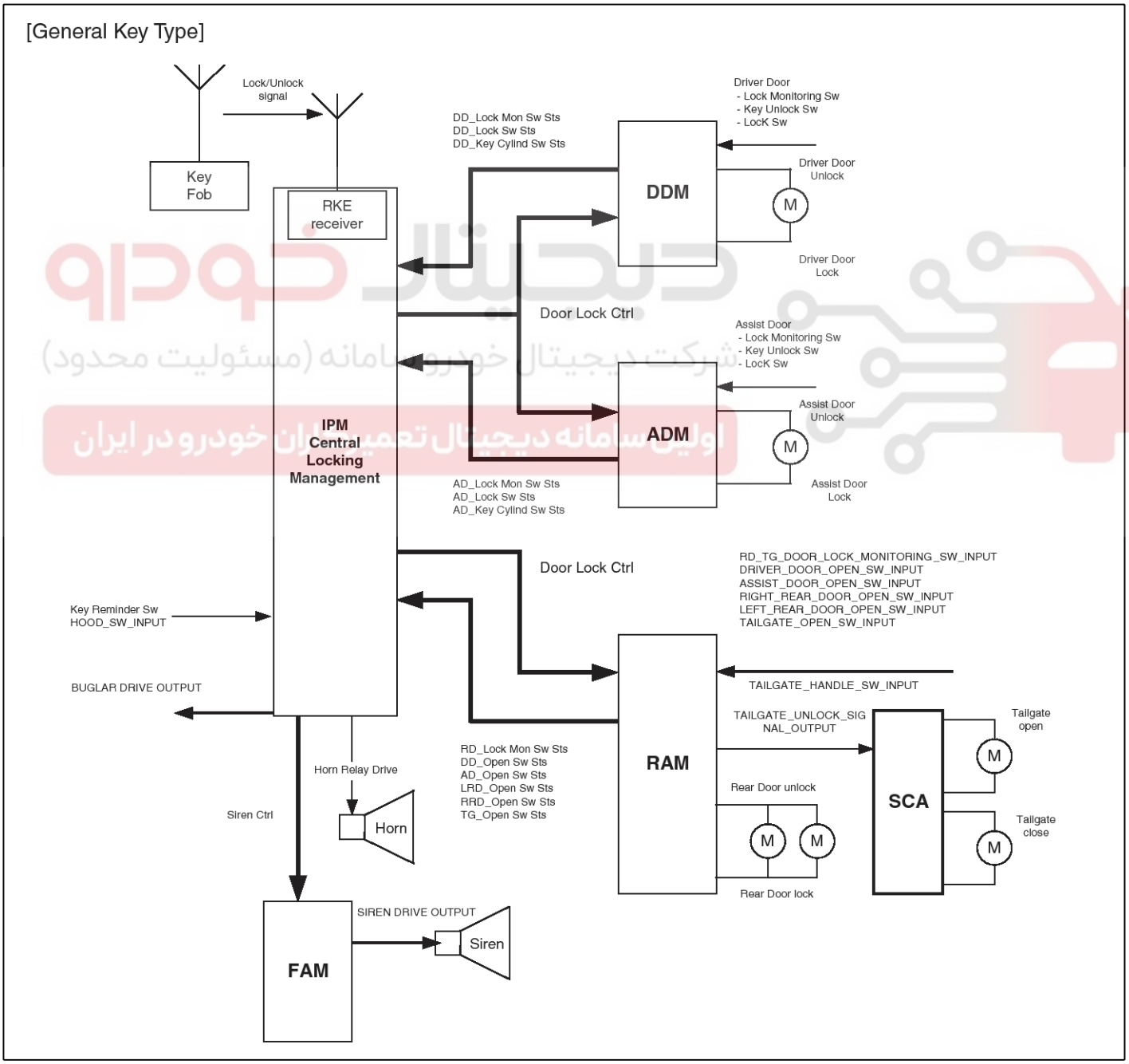
For the rest of this document the following terms are used:

All doors: Driver door, Assist door, LH Rear door, RH Rear door, Tailgate

Mech. Key: Driver door key cylinder lock/unlock, Assist door key cylinder key lock/unlock

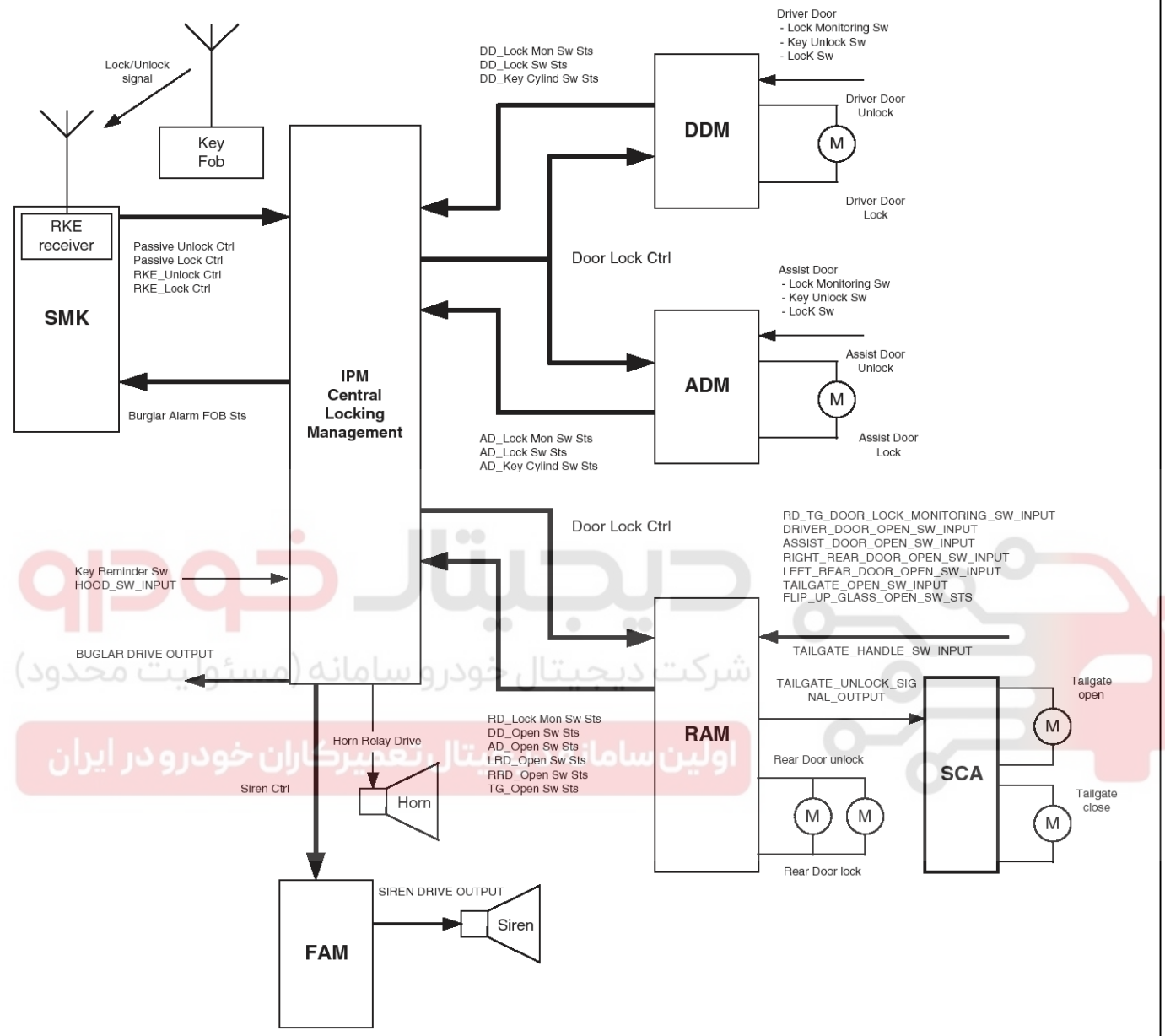
Entrance: All doors and hood

Functional Diagram



SHMBE9340N

[Smart Key Type]



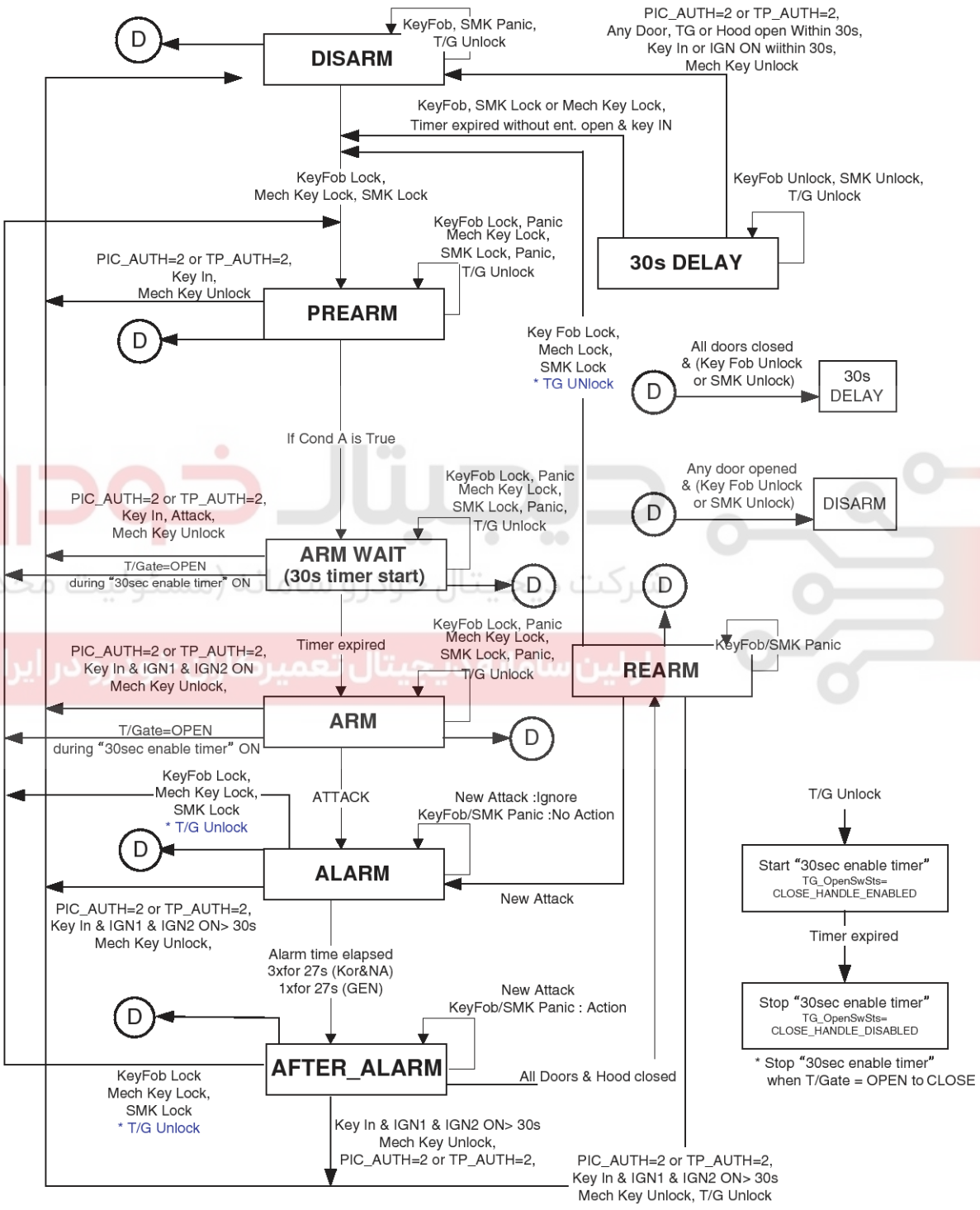
SHMBE9381N

Function

IPM

Description

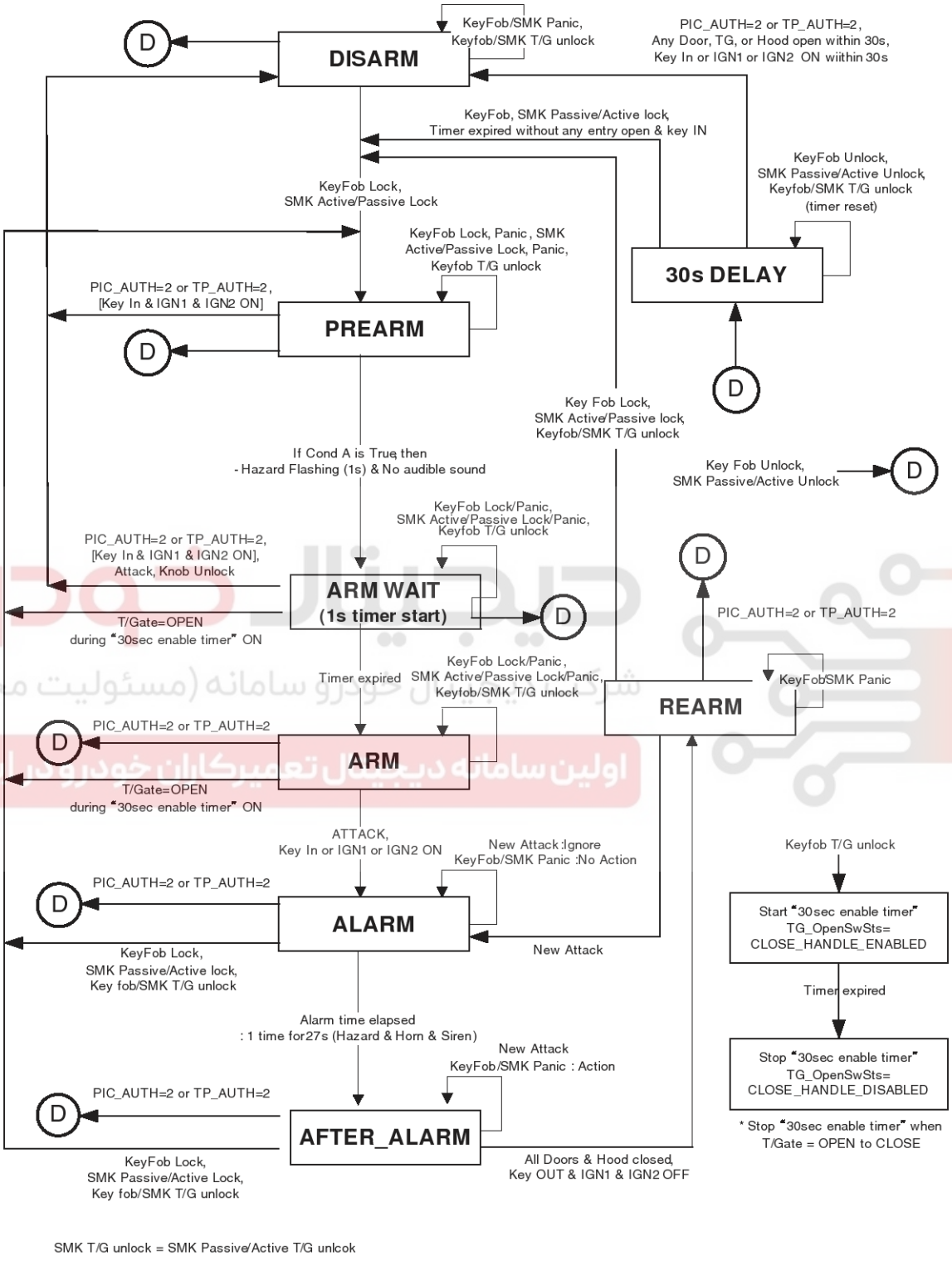
Burglar Alarm State machine



SHMBE9058L

* Waiting for RAM synchronization (tailgate closed handle disabled → closed handle enabled transition) during 3 sec, s-ee corresponding requirement for more details.

Burglar Alarm State machine for China



SHMBE9059L

* Waiting for RAM synchronization (tailgate closed handle disabled -> closed handle enabled transition) during 3 sec, s-ee corresponding requirement for more details.
SMK Lock/Unlock includes Active and Passive Lock/Unlock.
Tailgate unlock includes Key fob tailgate unlock, SMK Active tailgate unlock and SMK Passive tailgate unlock.

Description
Condition A for RKE equipped vehicle - All doors are closed: Driver door open switch status, assist door open switch status, rear door open switch status and tailgate open switch status are set to closed - Door lock status for all doors is lock: Driver door open switch status, assist door open switch status, rear door open switch status are set to locked, tailgate open switch status to closed handle disabled - Hood is closed: hood switch input to off - Key is not inserted: Ignition key reminder switch input is not inserted - Ignition switch status is OFF
Condition A for SMK equipped vehicle - All doors are closed: Driver door open switch status, assist door open switch status, rear door open switch status, tailgate open switch status are set to CLOSED - Door lock status for all doors are lock: Driver door lock monitor switch status, assist door lock monitor switch status, rear door lock monitor switch status are set to locked, tailgate open switch status to closed handle disabled - Hood is closed: Hood switch input to off - Ignition switch status is OFF
Attack description The system is under attack when any doors, hood or tailgate is open: Driver door open switch status, assist door open switch status, rear door open switch status, tailgate open switch status is issued with open value or hood switch input to on

Description
Expiration of the timer Tailgate unlock, answer back When IPM receives the CAN signal tailgate open switch status with the value close handle disabled following a tailgate unlock and the system goes from PREARM to ARM_WAIT state, only in this case the answer back is like that of RKE lock.

Description
3 sec timer when Tailgate unlock in ALARM, AFTER_ALARM or REARM states A 3 sec timer is started when the Tailgate unlock is detected under ALARM, AFTER_ALARM or REARM condition. During this timeout, if the tailgate state changes from closed handle disable to closed handle enable, the system goes immediately to PREARM state. If 3 sec timer is elapsed and the tailgate is still in closed handle disable state, the system goes to PREARM state. The 3 sec timeout is aborted when leaving the current alarm state due to valid leave condition (any door opened, key unlock…)

Description
DISARM mode with Mech. Key unlock If Mech. Key unlock signal is received in any mode, the system immediately goes into DISARM state.
DISARM mode with PIC Authentication If PIC authentication signal is received in any mode with value FOB authorized, the system immediately goes into DISARM state.
DISARM mode with Transport Authentication If transport authentication signal is received in any mode with value transport authorized, the system immediately goes into DISARM state.
DISARM mode with Ignition key from ARM for RKE equipment only If ignition key reminder switch input is inserted & IGN 1 & IGN 2 are turned ON in ARM then the system immediately goes into DISARM state.

DISARM mode with Ignition key from ARM for SMK equipment only If IGN 1 & IGN 2 are turned ON in ARM then the system immediately goes into DISARM state.
DISARM mode with Ignition key from 30s DELAY for RKE equipment If ignition key reminder switch input is inserted or ACC or IGN1 or IGN2 are turned ON in 30s DELAY then the system immediately goes into DISARM state.
DISARM mode with Ignition key from 30s DELAY for SMK equipment If ACC or IGN1 or IGN 2 is turned ON in 30s DELAY then the system immediately goes into DISARM state.

Description
PREARM mode entry The system enters in PREARM mode in these cases : - Lock by the RKE - Lock by SMK Active or Passive - Lock by Mech. Key - Auto-lock following a Lock (RKE or SMK) with 30s no action
PREARM mode exit In the PREARM mode, if the opened doors are closed, i.e., the vehicle condition is compliant with the Condition A, then the system enters into ARM_WAIT mode

Description
ARM WAIT mode timer 30sec timer starts as soon as entering to ARM WAIT mode
ARM WAIT mode delay time The delay time between the locking of door lock actuator and the entering time into ARM_WAIT mode is 0.6 second.
ARM WAIT mode with Key lock The system enters ARM_WAIT mode after the locking with key fob or Mech. Key.
ARM WAIT mode with SMK lock The system enters ARM_WAIT mode after the active or passive locking with SMK.
ARM WAIT mode exit for RKE equipped vehicle If one of the following conditions happens during 30sec timer is ongoing, DISARM mode is immediately entered: - Any entrance open (Driver, Assist, Rear Left/Right doors, Tailgate and Hood) - Key In - Attack - Mech. Key unlock - Fob authorized or TP authorized

Description
30 sec Delay mode entry for RKE equipment If key fob unlock signal is received in any mode when all doors (including driver, assist, rear doors, tailgate and hood) are closed, the system goes into 30s delay mode. In this state, if one of the following conditions happens within 30 second after receiving key fob unlock signal then the system goes to DISARM state. One of any entrance is open Ignition key reminder switch input is inserted If no entrance is opened within 30 second after receiving the signal, then the system automatically issues the lock pulse and goes to the ARM_WAIT state. Answer back is needed for this case either.

30 sec Delay mode entry for SMK equipment
If key fob unlock signal or SMK active/passive unlock (when equipped) is received in any mode when all doors (including driver, assist, rear doors, tailgate, flip up and hood) are closed, the system goes into 30s delay mode. In this state, if one of the following conditions happens within 30 second after receiving key fob unlock signal then the system goes to DISARM state.
One of any entrance is open
Ignition switch state ACC or IGN1 or IGN2 at ON
If no entrance is opened within 30 second after receiving the signal, then the system automatically issues the lock pulse and goes to the ARM_WAIT state. Answer back is needed for this case either.

Description

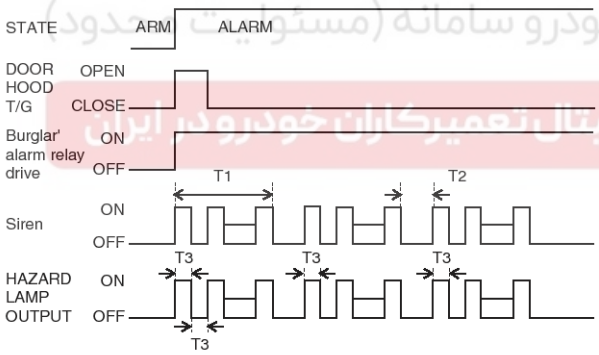
30 sec Delay mode exit to ARM
If none of the above conditions happens within 30 second after receiving key fob signal, then the system automatically issues the lock pulse and goes to the ARM_WAIT state. Answer back is needed for this case either.

30 sec Delay mode reset
If another unlock key fob signal during the 30s delay, the timer of 30s is reset.

Description

ARM mode entry
If 30second timer is elapsed without any from the ARM_WAIT mode, then system goes to ARM mode.

Key fob, SMK Active/Passive Tailgate Unlock in ARM mode
If TG unlock is received in ARM mode, Tailgate handle is enabled during 30s, if tailgate or flip up is open during this timer then the system goes to PREARM mode



SHMBE9060L

T1 : 27 sec (-0, + 3 sec)

T2 : 10 sec (-0, + 3 sec)

T3 : 0.5 ± 0.1 sec

Description

ALARM mode
If one or more of entrances are opened in the ARM or REARM state, then burglar drive output is turned ON in order to inhibit the start condition and Turn Indicator control signal is sent with hazard value and Siren control is sent with ON during 27 sec only once.

Description

ALARM mode synchronization
Siren control and Turn Indicator control are synchronized to get the same output period.

Door close during ALARM Even though all the doors are closed during alarm, alarm continues to operate for the remaining time.
New attack, AFTER_ALARM When there is a new attack (with one of the entrance still open) in the vehicle after completing the alarm output, alarm is not started again.
New attack during ALARM answer back If there is a new attack during the alarm operating, this new attack is not taken into account Siren control and Turn Indicator control outputs continue to operate by the remaining time. Burglar alarm relay drive output is also maintained on as long as the system is in ALARM condition.
Key fob Unlock during ALARM In case of receiving Key Fob UNLOCK signal during ALARM, if all doors (including driver, assist, rear doors, tailgate and hood) are closed the system goes directly into the 30sec delay state with following behavior. - Unlock output is turned on for 0.5 second - Hazard & Siren output for alarm function are turned OFF - Burglar alarm relay drive output is turned OFF
Key Fob Lock during Alarm In case of receiving Key Fob lock during ALARM (with one of the doors opened), the ALARM stops functioning and the system goes to PREARM state - LOCK output is turned ON for 0.5 second - Hazard & Siren output for alarm function are stopped immediately - Burglar alarm relay drive output is turned OFF - The system stay at the PREARM state, and if the vehicle condition meets the ARM entering condition, then the system goes to ARM_WAIT state from the PREARM state
Key fob, SMK Active/Passive Tailgate Unlock during Alarm If tailgate unlock is received during ALARM, the system goes to PREARM mode : during 3 sec timeout, immediately if tailgate open switch status closed handle disabled → closed handle enabled transition detected after 3 sec timeout if the tailgate open switch status is still closed handle disabled

Description
AFTER_ALARM mode, time elapsed If ALARM cycle is elapsed, the system goes into AFTER_ALARM state.
AFTER_ALARM mode answer back During AFTER_ALARM state, Burglar drive output maintains ON Siren and hazard lamp output are stopped.
AFTER_ALARM mode, door opened again If another door is newly opened during AFTER_ALARM state and other door are still open, then burglar alarm relay drive output maintains ON but no Siren output & hazard output in this case.
AFTER_ALARM mode exit with Key fob If tailgate unlock is received during AFTER_ALARM, the system goes to PREARM mode: - During 3 sec timeout, immediately if tailgate open switch status closed handle disabled → closed handle enabled transition detected - After 3 sec timeout, if the tailgate open switch status is still closed handle disabled

AFTER_ALARM mode exit with Key fob, SMK Active/Passive Tailgate Unlock
If tailgate UNLOCK is received during AFTER_ALARM, the system goes to PREARM mode:
- During 3 sec timeout, immediately if tailgate open switch status closed handle disbled → closed handle enabled transition detected
- After 3 sec timeout, if the tailgate open switch status is still closed handle disabled

Description
REARM mode entry If all entrances are closed during AFTER_ALARM state, the system goes into REARM state.
REARM mode to ALARM If there is the new attack during REARM mode, the system goes to ALARM mode.
REARM mode exit with Key fob, SMK active/passive tailgate unlock If Tailgate UNLOCK is received during REARM, the system goes to PREARM mode: during 3 sec timeout, immediately if tailgate open switch status closed handle disabled → closed handle enabled transition detected after 3 sec timeout, if the tailgate open switch status is still closed handle disabled

Description
Battery removal in ARM If disconnecting and then connecting again battery (Battery feed to bcm to off then on again) at ARM condition, ARM condition continues.
Battery removal after ALARM If disconnecting and then connecting again battery (Battery feed to bcm to off then on again) after completion of ALARM, alarm function is activated again.
Battery removal in ALARM If disconnecting and then connecting again battery (Battery feed to bcm to off then on again) during alarm, alarm is reset and activated again.
Battery removal in ARM_WAIT If disconnecting and then connecting again battery (Battery feed to bcm to off then on again) during ARM_WAIT, they system goes to DISARM mode.

Description
ALARM and PANIC ALARM has higher priority than PANIC function.
RKE PANIC and AFTER_ALARM mode If RKE PANIC signal is received, AFTER_ALARM mode is maintained and PANIC function is activated.
SMK PANIC and AFTER_ALARM mode If SMK PANIC signal is received, AFTER_ALARM mode is maintained and PANIC function is activated.

Description
Authentication not authorized with SMK If IPM receives the CAN signal PIC authentication with the value PIC not authorized or TP authentication with the value TP not authorized then IPM does nothing.

Description
Error Cases In case of CAN failure, value invalid or undefined of lock monitoring sw, Open sw CAN signals, doors (except tailgate) are considered open and unlocked. In DISARM alarm state, in case of CAN failure, value INVALID or undefined of CAN signal tailgate open switch status, the default value used is closed handle disabled. In other alarm state, the default value used is open. This means that in case of problem with RAM/ADM/DDM, the vehicle will not enter in ARM state. If the vehicle is already in ARM state when the problem happens, the system will go in ALARM state.
Invalid values from SMK passive In case of CAN failure, value invalid or undefined of both CAN signals Detected FOB1 and Detected FOB2 or CAN signal driver door Passive switch status SwSts, AD_PassiveSwSts, TG_PassiveSwSts, PassiveUnlockCtrl, PassiveLockCtrl, IPM considers that the corresponding function is inactive (DetectedFOB1, DetectedFOB2 = NOT_DETECTED, DD_PassiveSwSts, AD_PassiveSwSts, TG_PassiveSwSts = OFF, PassiveUnlockCtrl, PassiveLockCtrl = NO_ACTION). Burglar alarm keeps its current state.
INVALID values from SMK active In case of CAN failure, value INVALID or undefined of both CAN signals DetectedFOB1 and DetectedFOB2 or CAN signal RKE_LockCtrl, RKE_UnlockCtrl, RKE_TailGateCtrl, SMK_PanicCtrlIPM considers that the corresponding function is inactive (values OFF). Burglar alarm keeps its current state.

FAM

Description
Turning on Siren When receiving CAN message Siren control with ON value, siren drive output is set to ON
Turning off Siren When receiving CAN message Siren control with OFF value, siren drive output is set to OFF

RKE Learning System

Description

This is the procedure for the RKE key learning and synchronization for HM Program.

The IPM and the RF keys are delivered by separated logistic flow and are not linked when they are delivered to the assembly plant.

The learning of the keys must be done in two steps:

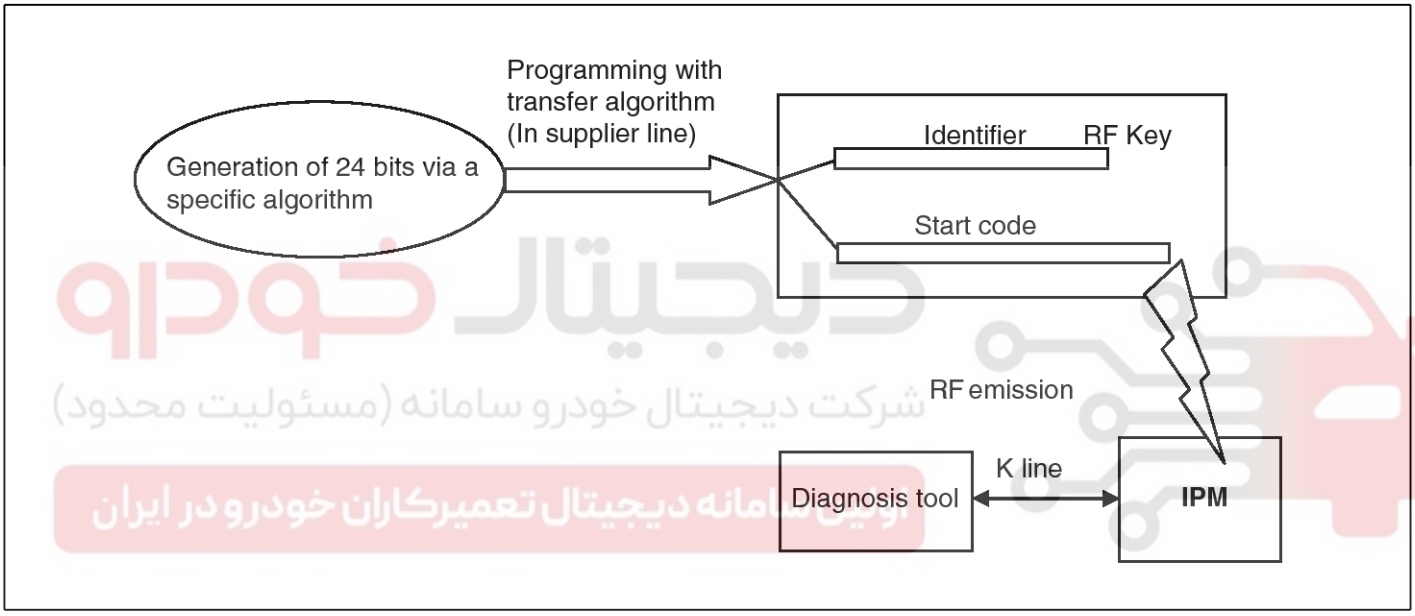
- First by learning Fix Code of the Key.
- Second by synchronizing Rolling Code between IPM and key, by the first frame received outside the learning procedure.

The RF transmitter (inside the key) is programmed in supplier line on the base of a 24 bits serialized number, which determines the Identifier and Start code value, insuring that all codes are different.

The learning procedure uses the RF frame emission to transmit the RF code data from the key, and a diagnosis tool to control the procedure (Hi-Scan - using the K line).

This learning can be done on Customer dealers or in the garages.

Functional Diagram



SHMBE9061L

IPM

Description
Key Learning procedure, key reminder switch status Key learning procedure is possible only if ignition key is not inserted.
Key Learning procedure condition The RF transmitter (inside the key) is programmed in supplier line on the base of a 24 bits serialized number, which determines the Identifier and Start code value, insuring that all codes are different. The learning procedure uses the RF frame emission to transmit the RF code data from the key, and a diagnosis tool to control the procedure
Key learning procedure, disabled commands During the learning procedure, all commands (locking, unlocking, etc) by RKE are disabled

Description

Key Learning procedure description

Step	Operator action	RF transmitter reaction	IPM reaction
1	Connection of the diagnosis tool to the K line of the vehicle		
2	Sending of diagnosis frame « RF learning start »		IPM switches in learning mode and disables all the keys(feedback information on the tool's screen)
3	Sending of diagnosis frame « learning of one key »		IPM is now waiting for a RF frame to learn the key data (feedback information on the tool's screen)
4	Short push on the LOCK or UNLOCK button of the key to be learnt	Transmission of a RF frame	First Key learning (within the same learning cycle) a - Write to Eeprom, ID and Rolling Code (any previous value is overwritten) b - Erase (all related bytes set to 0xFF) ID/Rolling code of all other keys c - Trigger the buzzer sound for one time after successful completion these steps. (Notification of diagnostic layer is done for each processed key)
5	Learning of the 2nd, 3rd and 4th keys (if any)	Transmission of a RF frame	Second Key learning (within the same learning cycle) a: - If new Key is different from Learnt Key #1: Write to Eeprom, ID and Rolling Code (any previous value is overwritten) - If new Key is identical to Learnt Key #1: Exit learning session. b: Trigger the buzzer sound for one time after successful completion these steps c: Exit the learning session (at application software layer) when the maximum number of key to be learnt is

Description

Key Learning procedure timer
RF Key code saving (Key teaching) is allowed while a "10s Learning Procedure Timer" is running.
This timer is:
Started at reception of the "learning routine start" CAN command
Restarted at each learnt key (i.e. successfully stored in eeprom)
Stopped at any exit reason of the learning process: Maximum number of keys learnt, exit on error case, reception of "learning routine stop"

Example : Learning Process Results for Four Key fobs

NO.	Current key fob	Learning key fob	Changed key fob
1	None(Virgin)	A, B, C, D	A, B, C, D
2	A, B, C, D	E	E (Delete 'A', 'B', 'C', 'D')

3	A, B, C, D	C, D, E, F	C, D, E, F
4	A, B, C, D	FAIL	A, B, C, D

Description
Key learning procedure cancel Before first key learning or during first key learning, it is always possible to cancel the learning procedure.
Key learning procedure cancel methods Cancellation can be done using 4 methods: Sending a specific diagnosis frame « Cancel RF learning » Sending standard diagnosis frame « End of diagnosis session » Waiting a time-out of 15 minutes without sending diagnosis frame « Learning of one key » Hardware reset of IPM (Power cut-off)
Key learning procedure cancel, restore configuration After the first key learning, cancel in learning procedure will not restore the previous learning configuration, IPM keeps first learnt key data and status.
Key learning procedure end, already learnt key The learning procedure finishes if there is an attempt of key learning with a key that has already been learnt in the current learning procedure.
Key learning procedure end, max key already learnt Finish the learning procedure after the learning of a number of keys equal to the maximum number (maximum number of RKE is 4)

RKE Synchronization

Description

Once the learning procedure is finished, the operator has to push RF key button of each learnt key to check keys are operational; a door locking/unlocking action is done as feedback.

This first reception and processing of a rolling code data after the learning procedure is the first synchronization (between key and IPM, from a rolling code point of view).

NOTICE

A key is said “active” (learnt), when it has been learnt by way of a learning procedure.

A key is said “synchronized” (operational), when it has been synchronized after the learning procedure

(i.e. validated by a locking/unlocking action with Scan tool connected)

IPM

Description
Key synchronization procedure There is no time limit between the learning procedure and the synchronization procedure.

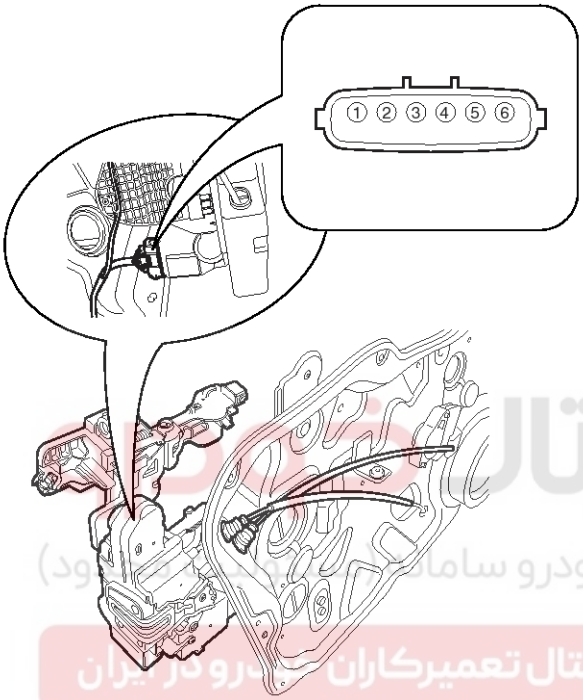
Key synchronization procedure description

Step	Operator action	RF transmitter reaction	IPM reaction
Synch.	Push on one of the RF key button	Emission of a « normal » frame	Synchronization:RF frame reception and processingIdentifier comparisonCalculation and memorization of the rolling codeCentral Locking feedback actionFeedback information on the tool’s screenSynchronization is done

Inspection

Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Remove the front door module.
   (Refer to the Body group - Front door)
3. Disconnect the connectors (6P) from the actuator.



SHMBE8215D

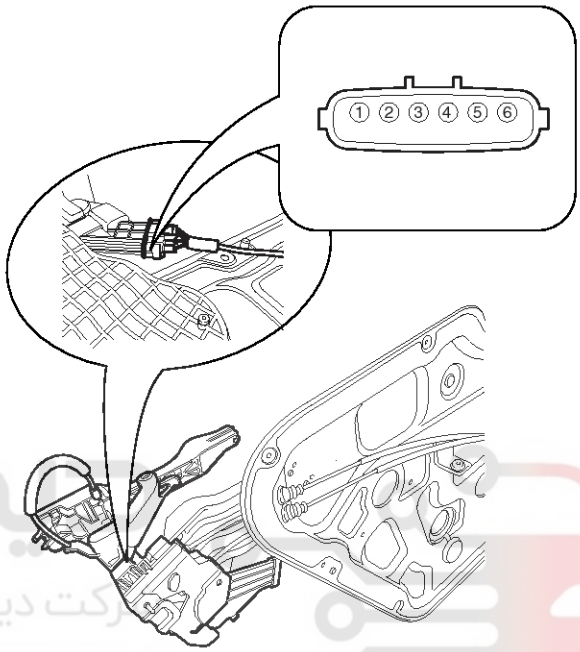
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	6
Front Left	Lock	⊕	⊖
	Unlock	⊖	⊕
Position \ Terminal		2	1
Front Right	Lock	⊖	⊕
	Unlock	⊕	⊖

SHMBE9063L

Rear Door Lock Actuator

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



SHMBE8115D

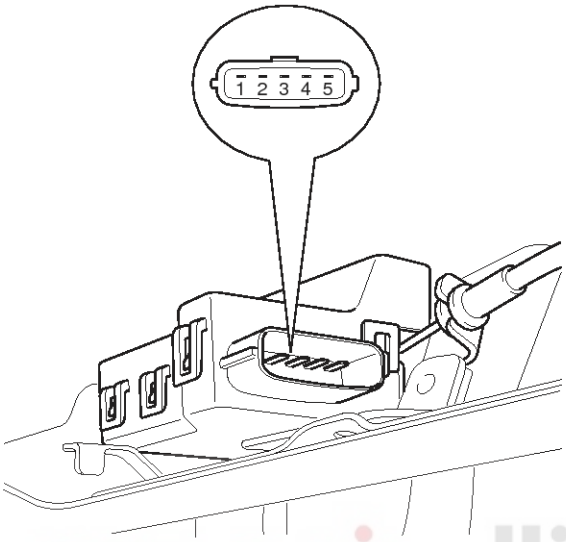
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	6
Rear Left	Lock	⊕	⊖
	Unlock	⊖	⊕
Position \ Terminal		2	1
Rear Right	Lock	⊖	⊕
	Unlock	⊕	⊖

SHMBE9064L

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim.
   (Refer to the Body group - tailgate)
2. Disconnect the connector from the tailgate latch.



SHMBE8123D

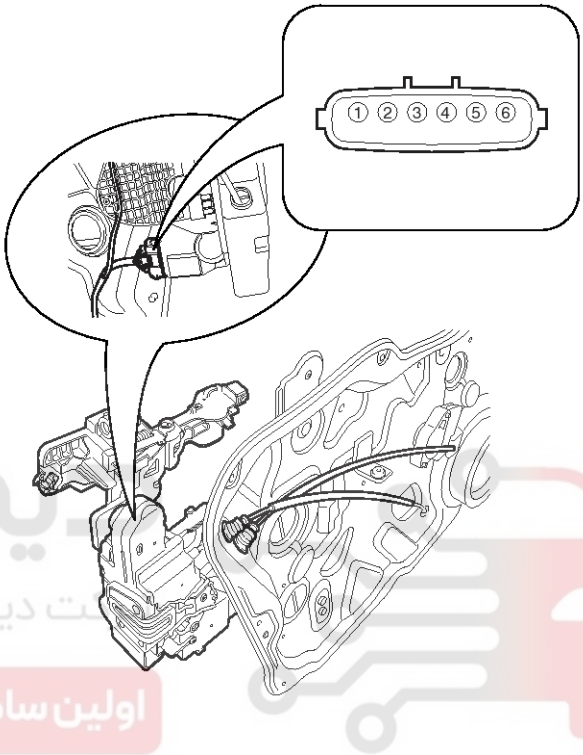
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Terminal / Position	5	4	3
Unlock	○	○	
		○	○
1st Lock	○	○	
Complete Lock		○	○

SHMBE9054L

Front Door Lock Switch

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



SHMBE8215D

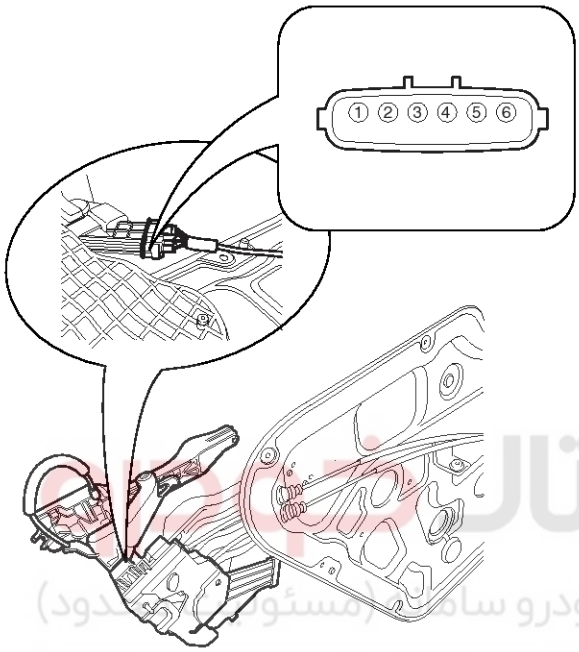
4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

Terminal / Position		2	3	4	1
Front Left	Unlock		○	○	○
	Lock	○	○		
Terminal / Position		**3**	**4**	**5**	**6**
Front Right	Unlock	○	○		○
	Lock		○	○	

SHMBE9065L

Rear Door Lock Switch

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



SHMBE8115D

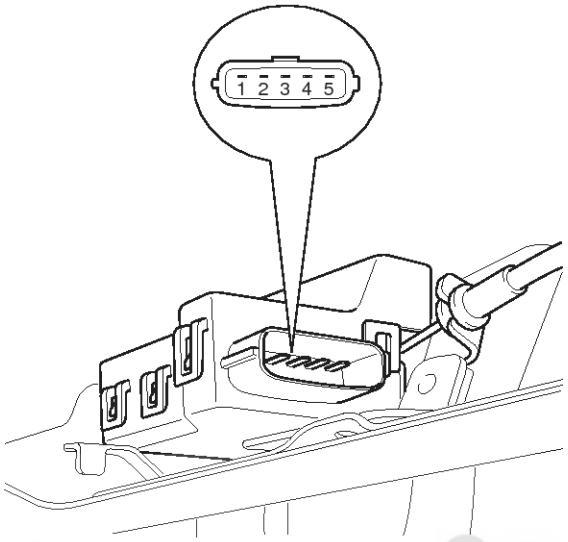
4. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	3
Rear Left	Unlock	○——○	
Position \ Terminal		4	6
Rear Right	Unlock	○——○	

SHMBE9066L

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to the Body group - Tailgate)
2. Disconnect the connector from the tailgate latch.



SHMBE8123D

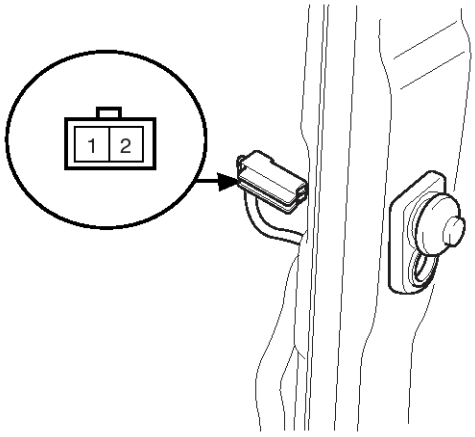
3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	5	4	3
Unlock	○——○	○——○	
1st Lock	○——○	○——○	
Complete Lock		○——○	

SHMBE9054L

Door Switch

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



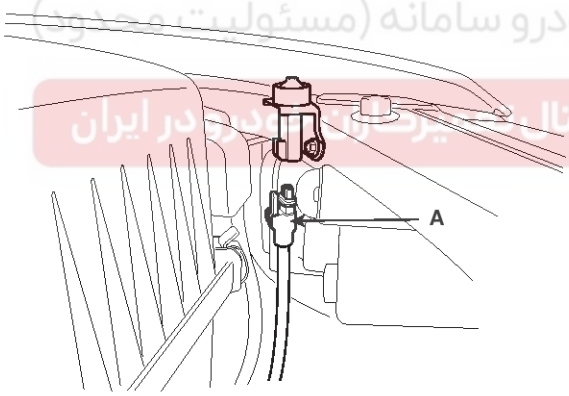
SHMBE8125D

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

SHMBE9067L

Hood Switch

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



SHMBE8127D

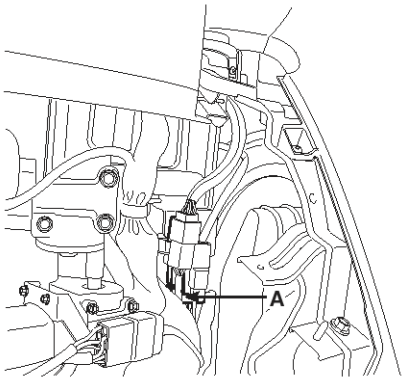
2. Check for continuity between the terminals and ground according to the table.

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

SHMBE9068L

Key Warning Switch

1. Remove the crash pad lower panel.
   (Refer to Body group-Crash pad)
2. Disconnect the connector from the key warning switch(A).



SHMBE9338N

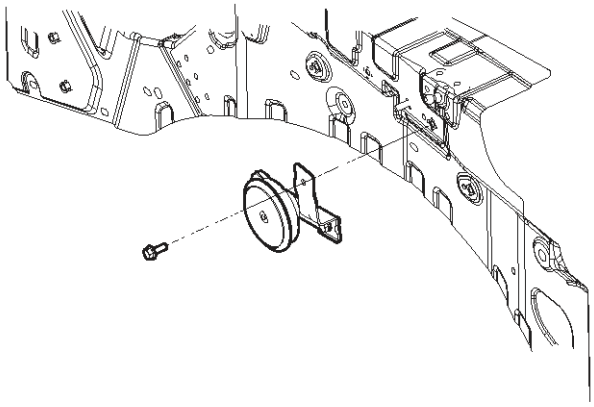
3. Check for continuity between the terminals in each position according to the table.

Key position \ Terminal	5	6
Insert	○	○
Removal		

SHMBE9070L

Burglar Alarm Horn

1. After loosening the mounting bolt(1EA) and disconnecting the horn connector, remove the burglar alarm horn.



SHMBE8128D

2. Check the continuity between the burglar alarm horn terminals when power is disconnected.

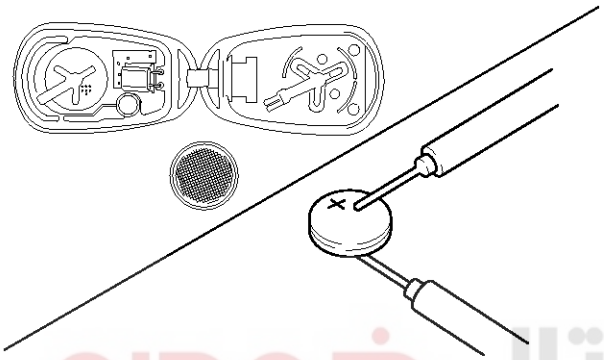
Transmitter

Specification

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

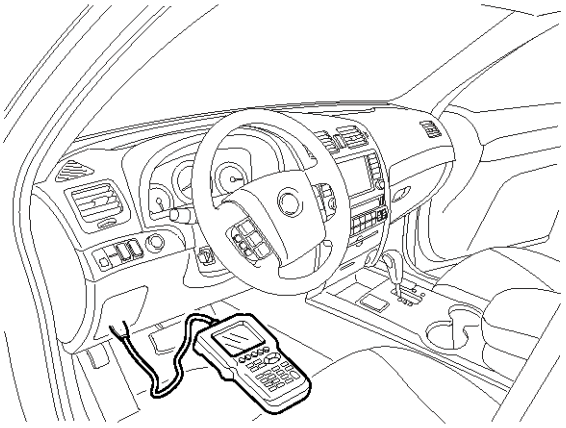


ATLG029A

3. Replace the transmitter battery with a new one, if voltage is below 3V 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 failure, replace only the transmitter (A).

Transmitter Code Registration

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



SHMBE9310N

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

1. KIA VEHICLE DIAGNOSIS

MODEL : ALL

02. ENGINE
03. AUTOMATIC TRANSAXLE
04. ANTI-LOCK BRAKE SYSTEM

:
:
:

07. CODE SAVING

SHMBE9112L

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

TRANSMITTER CODE SAVE

REMOVE THE IG. KEY FROM THE KEY CYLINDER. CONNECT THE DLC CABLE AND 16 PIN CONNECTOR OF THE VEHICLE.

PRESS [ENTER], IF YOU ARE READY!

ETRF065M

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

TRANSMITTER CODE SAVE

1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON OR [UNLOCK] BUTTON FOR 1 SECOND.

* NO. OF CODED KEY : 0 EA

ETRF065N

TRANSMITTER CODE SAVE

1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON OR [UNLOCK] BUTTON FOR 1 SECOND.

1ST. TRANSMITTER SAVE SUCCESS!

IF YOU WANT TO SAVE THE 2ND KEY PRESS [YES], OR NOT PRESS [NO]

* NO. OF CODED KEY : 1 EA

ETRF065O

TRANSMITTER CODE SAVE

2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON OR [UNLOCK] BUTTON FOR 1 SECOND.

* NO. OF CODED KEY : 1 EA

ETRF065P

TRANSMITTER CODE SAVE

2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON OR [UNLOCK] BUTTON FOR 1 SECOND.

2ND. TRANSMITTER SAVE SUCCESS!

CODE SAVING IS COMPLETED!
IF YOU STOP, PRESS [ESC] KEY!!!

* NO. OF CODED KEY : 2 EA

ETRF065Q

BCM (Body Control Module)

Specifications

Item	Specification
Rated voltage	DC 12V
Operating voltage	DC 9 ~ 16V
Operating temperature	-22°F ~ 167°F (-30°C ~ 75°C)
Parasitic draw	19mA (Total)
	IPM / FAM / RAM : 8mA DDM / ADM : 4mA IMS / SCM : 4mA SMK / PDM : 3mA

※ Abbreviation

IPM : Instrument Panel Module)

FAM : Front Area Module

RAM : Rear Area Module

DDM : Driver Door Module

ADM : Assist Door Module

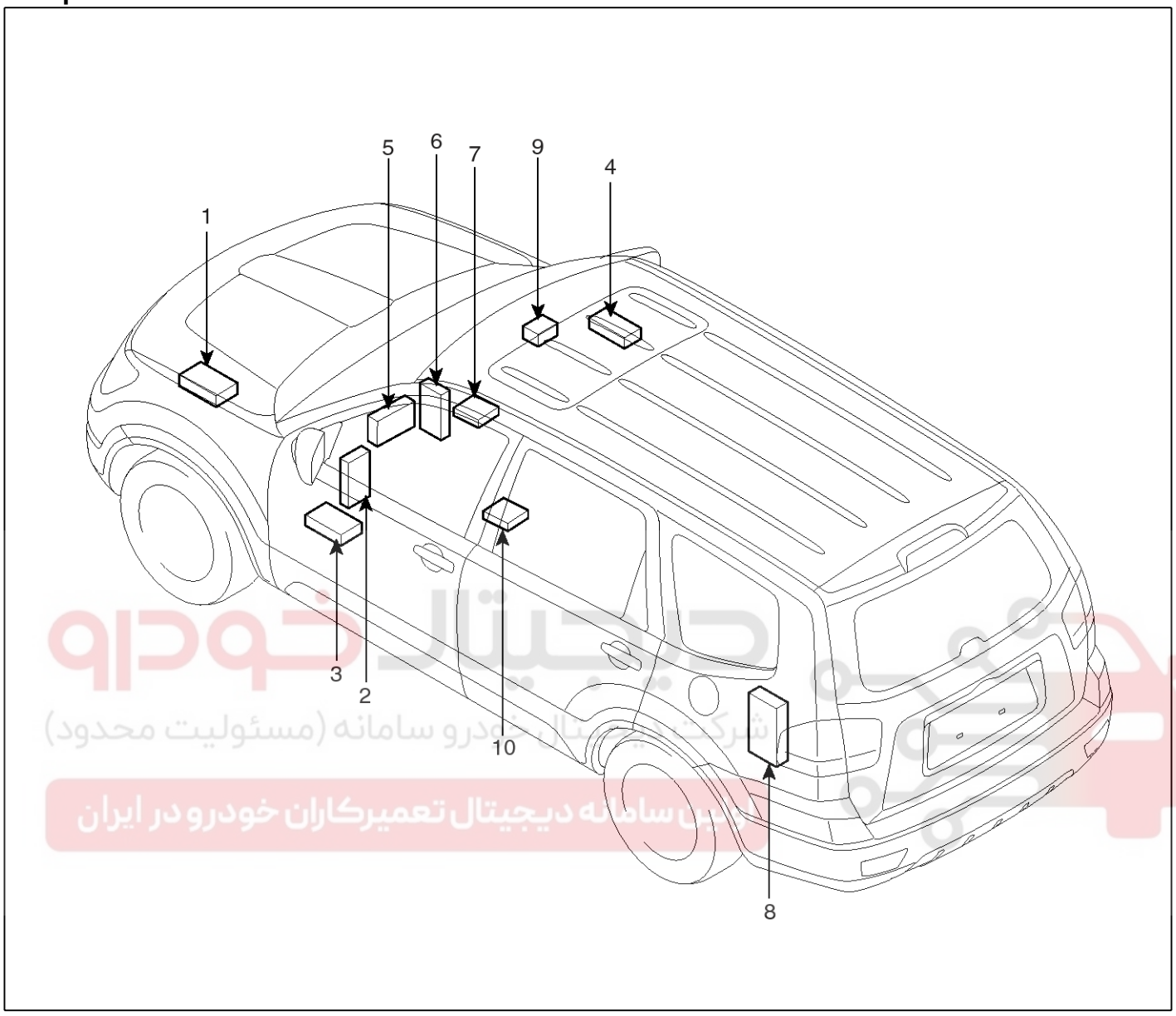
IMS : Integrated Memory System

SCM : Steering Control Module

SMK : Smart Key

PDM : Power Distribution Module

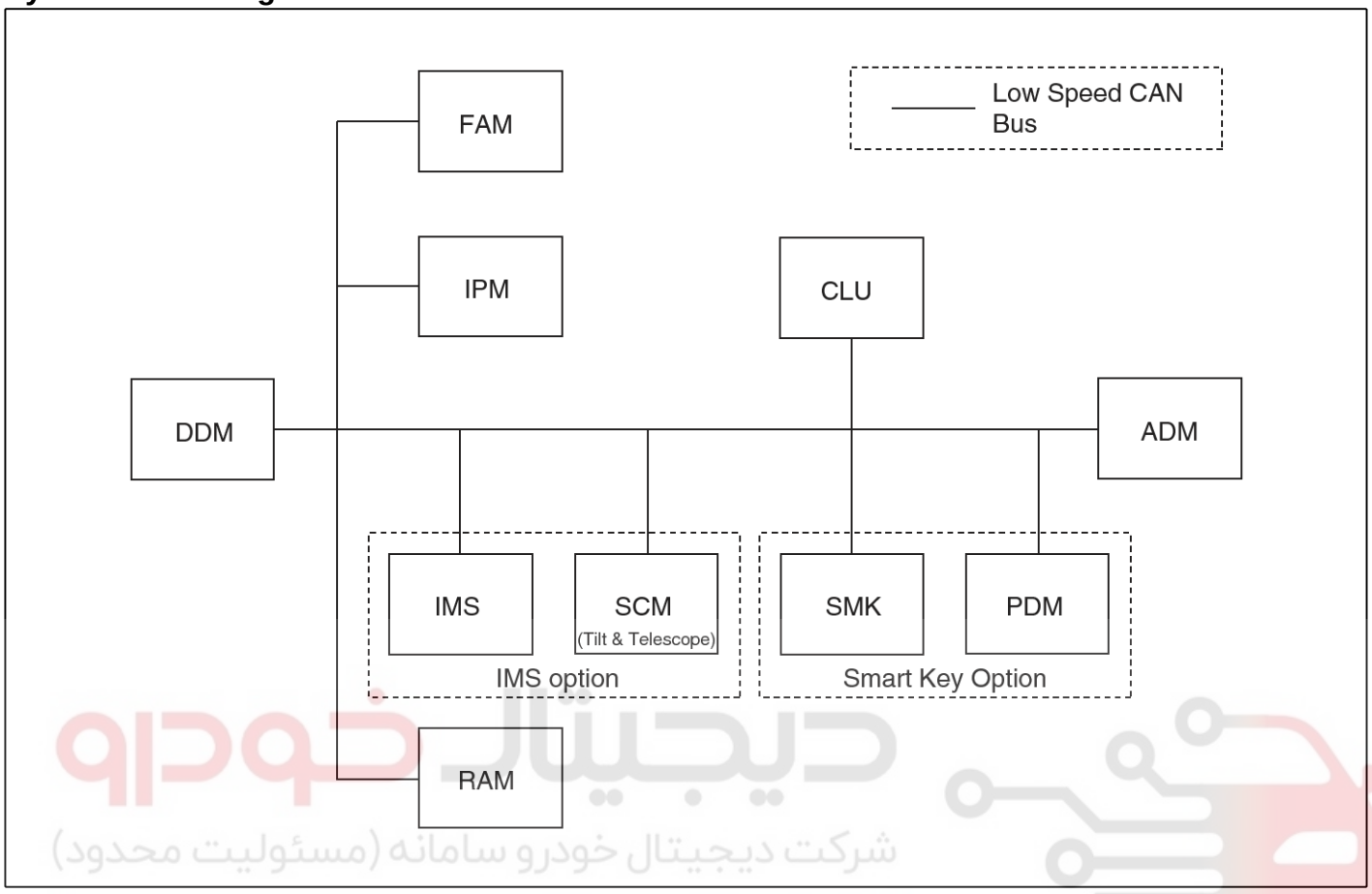
Component location



SHMBE9071L

1. FAM (Front Area Module)
2. IPM (Instrument Panel Module)
3. DDM (Driver Door Module)
4. ADM (Assist Door Module)
5. CLU (Cluster)
6. PDM (Power Distribution Module)
7. Smart key (SMK)
8. RAM (Rear Area Module)
9. SCM (Steering Column Module)
10. IMS (Integrated Memory System)

System block diagram



Operation

Engine and Ignition Key Control

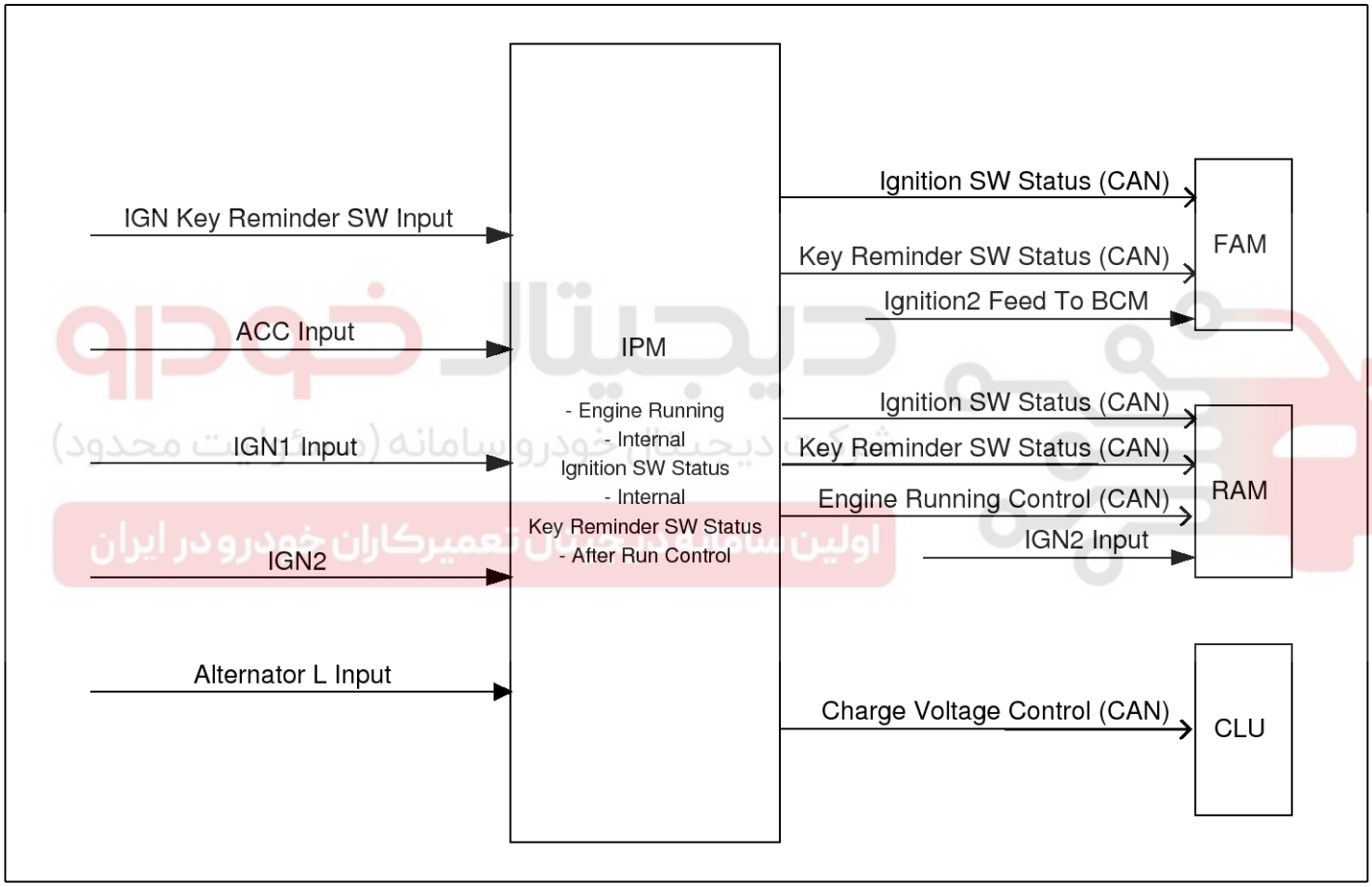
Description

This function managed by the IPM, controls :

- Ignition key position in the key cylinder (off, acc, run , start)
- Ignition key reminder status (inserted or not)
- Engine running status
- Charging voltage

The data are transmitted on the CAN.

Functional Diagram



SHMBE9012N

Exterior Lighting

Light MF switch (Multi - Function Light switch)

Description

The MF Light switch is used to manage the park lamps, the tail lamps and the headlamps low beam.

The park lamps, the tail lamps and the headlamps low beam status are determined by:

- The light MF switch:

  1) The MF light switch has 4 positions: OFF, Park and Tail, Headlamps Low Beam, Auto light

  2) It is connected to the IPM with 3 wires: Park and Tail lamp Sw, Headlamp Sw, Auto light Sw
- The Auto light function
- The Battery Saver function

The Auto light function is active when the MF Light sw is in Auto light position and depends on the ignition key position.

Based on the Auto light sensor values corresponding to the exterior brightness level, it automatically manages the lighting of the park lamps, the tail lamps and the headlamps low beam. Depending on the country, these lamps are controlled either separately or together.

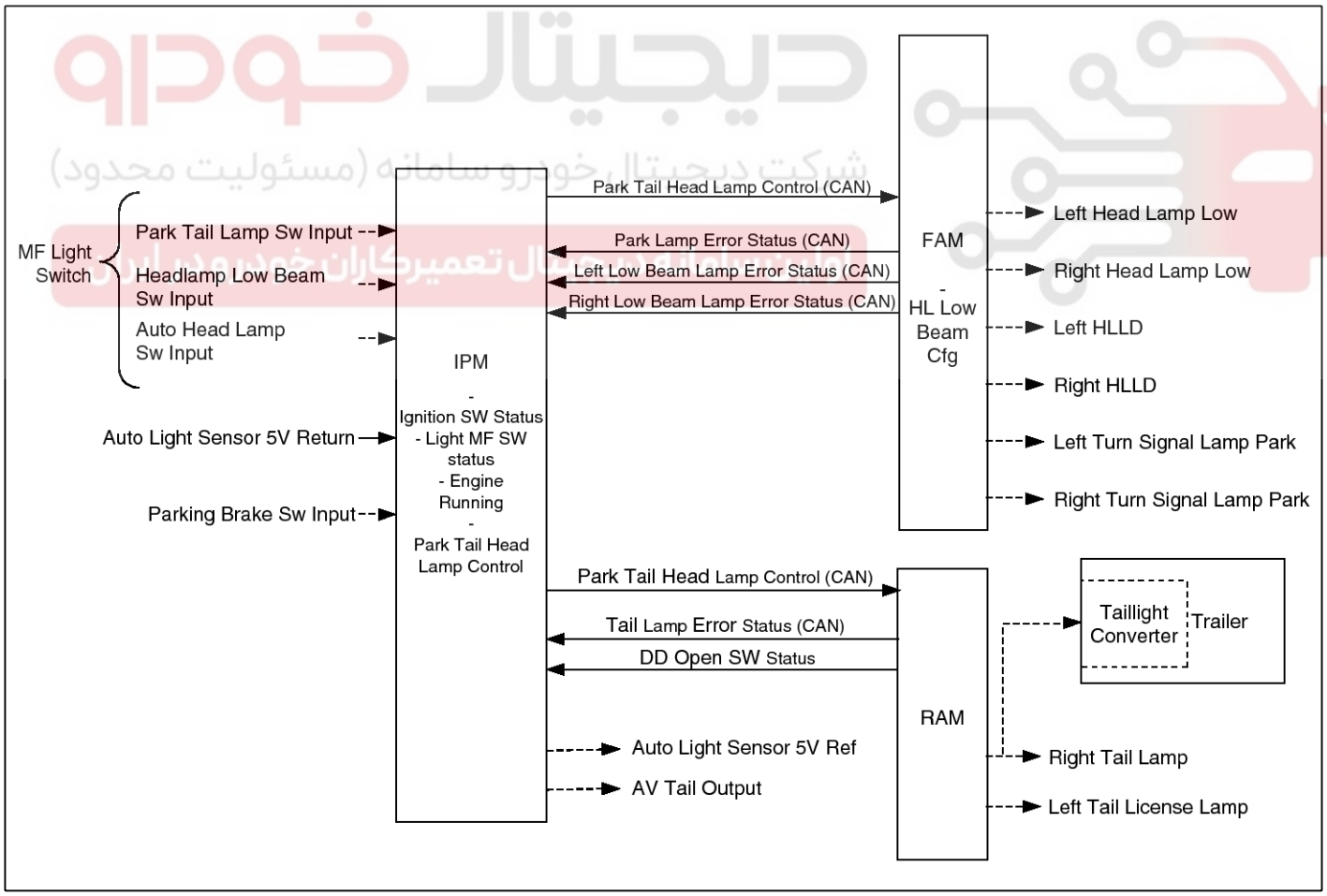
The IPM manages the control logic of the functions, and sends the command to the RAM and the FAM that drive the lamps.

The FAM drives the turn signal park lamps and the side marker lamps. All these lamps are controlled simultaneously. The FAM also drives the headlamps low beam and the HLLD, both in same time.

The RAM drives the tail lamps. Moreover, when the tail lamps are switched on, the license plate lamps are also lighted on.

For each of the park lamps, the tail lamps and the headlamps low beam, a status message is sent by FAM or RAM to the IPM and to CLU to indicate if one lamp is in error.

Functional Diagram



SHMBE9073L

IPM

The light MF switch is connected to the IPM and is used to command the park lamps, tail lamps and the headlamps low beam.

Description

MF Light sw status definition:

Park Tail Lamp SW Input	Headlamp Low Beam SW Input	Auto Headlamp SW Input	MF Light sw status
Off	Off	Off	Off
On	Off	Off	Park Tail
On	On	Off	Low Beam
On	On	On	Low Beam
Off	Off	On	Auto

The Auto light Sensor signal status value is defined thanks to the Auto light sensor value (input “Auto light sensor 5V return”).

Description

Auto light Sensor signal Sts definition:

N°	Autolight Sensor 5V Return	Previous Value Of Auto Light Sensor 5V Return	Auto Light Sensor Signal Sts
1	> 3.47V	< 3.47V	Off
2	< 1.77V	> 1.77V	HL On

NOTICE

These values can be calibrated on the real vehicle depending on the customer’s request. Thes calibrated values are prior to the specification.

RAM

The RAM drives the tail lamps.

Description

Tail lamps truth table:

The tail lamps are controlled depending on the Park Tail Head Lamp control value.

Park Tail Head Lamp	Right Tail Lamp Left Tail License Lamp
Off	Off
Park Tail On	On
Park Low Tail On	On

FAM

The FAM drives either the side marker lamps or the turn signal park lamps.

The lamps are controlled simultaneously.

Description

Park lamps truth table:

The park lamps are controlled depending on the Park Tail Head Lamp control value.

Park Tail Head Lamp	Left Turn Signal Lamp Park Right Turn Signal Lamp Park
Off	Off
Park Tail On	On
Park Low Tail On	On

The FAM also drives the Headlamps low beam and the HLLD, both simultaneously.

Description

Headlamps low beam truth table:

The Headlamps low beams are controlled depending on the Park Tail Head Lamp Control value.

Park Tail Head Lamp	Left Head Lamp Low Right Head Lamp Low
Off	Off
Park Tail On	Off
Park Low Tail On	On

Description

HLLD control:

The left and right HLLD are following the same control logic and the same requirements as the headlamps low beam.

The module drives left HLLD and right HLLD.

Head Lamps High Beam

Description

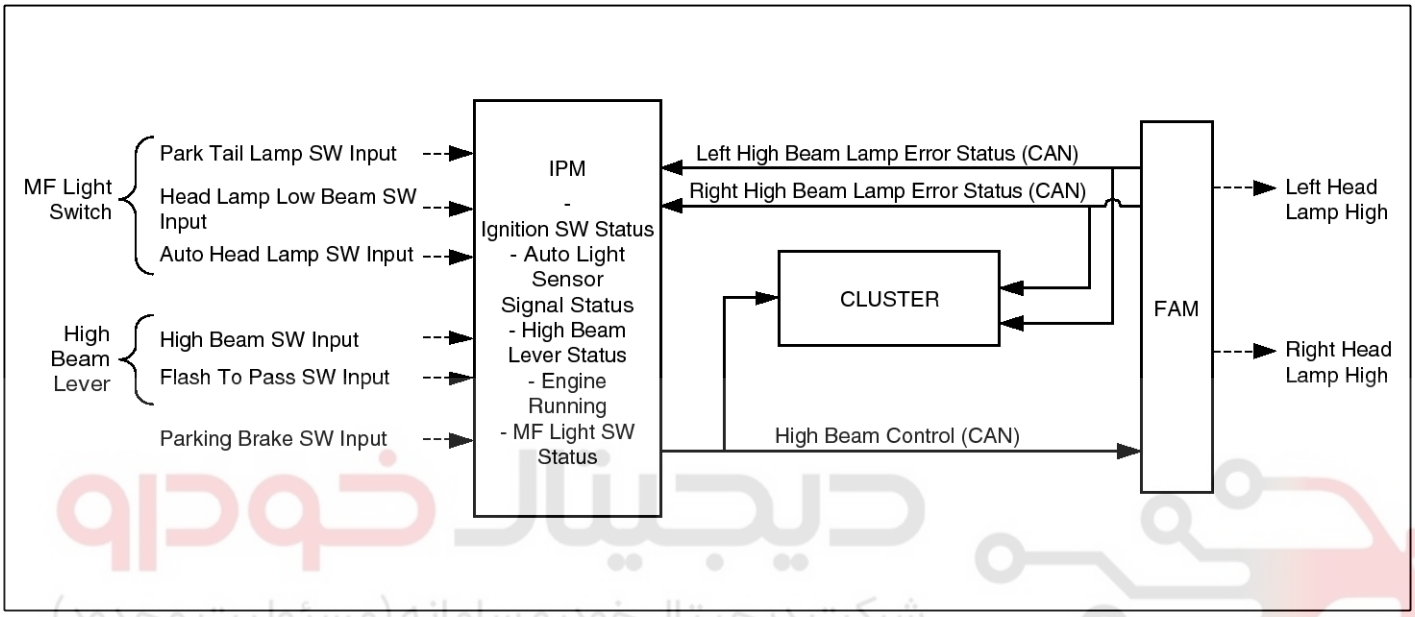
The following functions activate the Headlamps High Beam:

- The High Beam switch,
- The Flash To Pass switch,

The IPM manages the control logic of the functions, and sends the command to the FAM that drives the headlamps high beam lamps. CLU has a backlight indicator for the Headlamps High Beam.

A status message coming from the Left and Right Head lamps High Beam is sent by FAM to the IPM and to CLU to indicate if one lamp is in error.

Functional Diagram



SHMBE9074L

IPM

The high beam lever (High Beam sw and Flash To Pass sw) is connected to the IPM and is used to command the headlamps high beam.

The IPM manages the control logic of all the functions concerned with the headlamps high beam. The command of those lamps is sent to the FAM thanks to the CAN signal High Beam control.

Description

High beam lever in High Beam position:

In this lever position, the headlamps high beam is lighted ON when the ignition key position is RUN and if the headlamps low beam is also activated.

N°	High Beam	Flash To Pass	Ignition SW Status	Engine Running	Park Brake	MF Light SW Status	High Beam Control
1	On	Off	Run	Running	Off	Off	DRL On (*)
2						Park Tail	DRL On (*)
3						Other Cases	Off
4			Run	x	x	Low Beam	High On
5			Run	x	x	Auto	High On
6			Other Cases				Off

x : Not applicable

High beam lever in Flash To Pass position:

Description

In this lever position, the headlamps high beam control logic only depends on the ignition key position.

N°	High Beam	Flash To Pass	Ignition SW Status	Engine Running	Park Brake SW	MF Light SW Status	High Beam Control
1	On	On	Off	x	x	x	High On
2			ACC	x	x	x	High On
3			Run	x	x	x	High On
4			Start	x	x	x	Off

x : Not applicable

FAM

The FAM drives the headlamps high beam depending on the High Beam Ctrl:

Description

Truth table for the Headlamps high beam:

High Beam Control	Left Head Lamp Highright Head Lamp High
Off	Off
High On	On
DRL On	On DRL

Backup Lamps

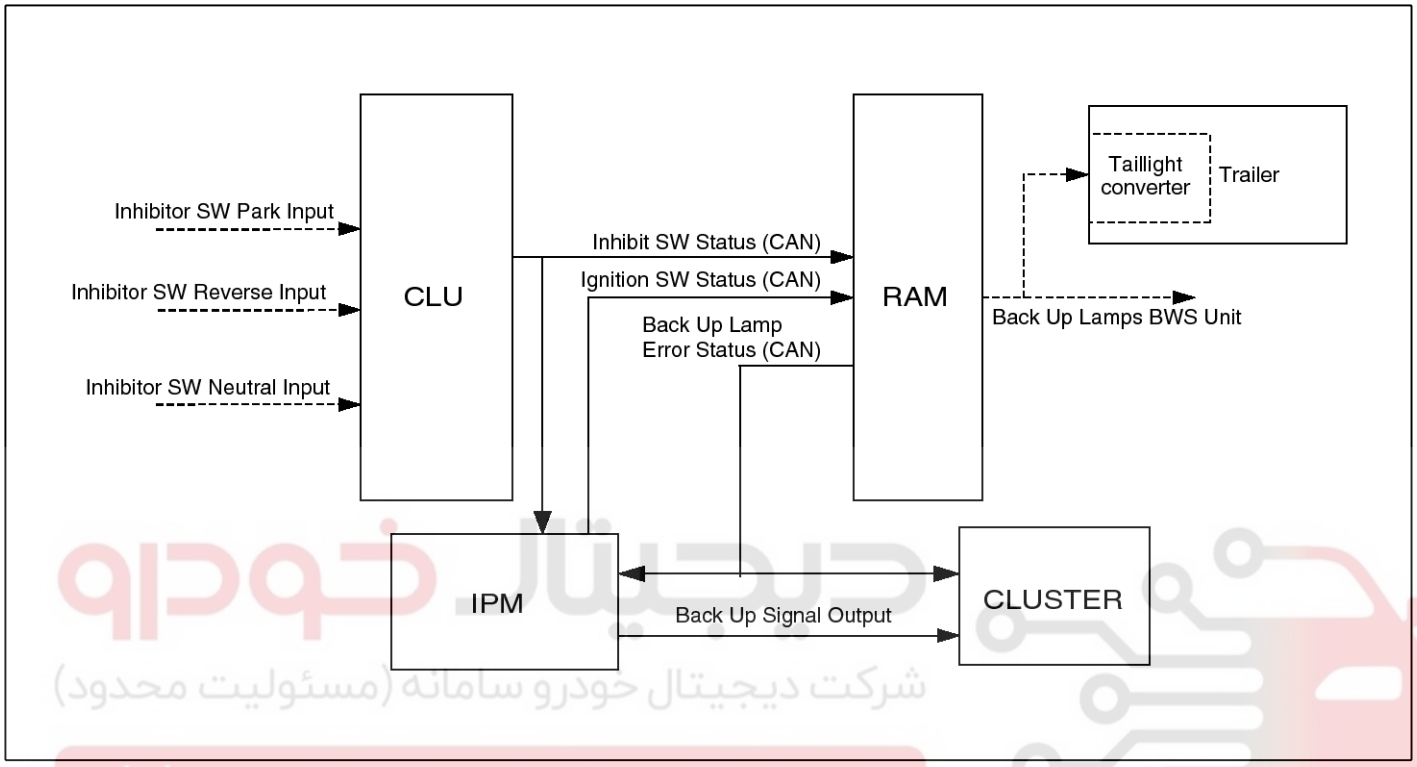
Description

The backup lamps function switches on the backup lamps to indicate that the vehicle is in the reverse gear, it also switches on the backup signal output for cluster.

The CLU module sends the reverse gear status to the IPM and the RAM. The IPM drives the backup signal output for cluster and the RAM drives the backup lamps.

A status message is sent by RAM to the IPM and to CLU to indicate if one lamp is in error.

Functional Diagram



Front Fog Lamps

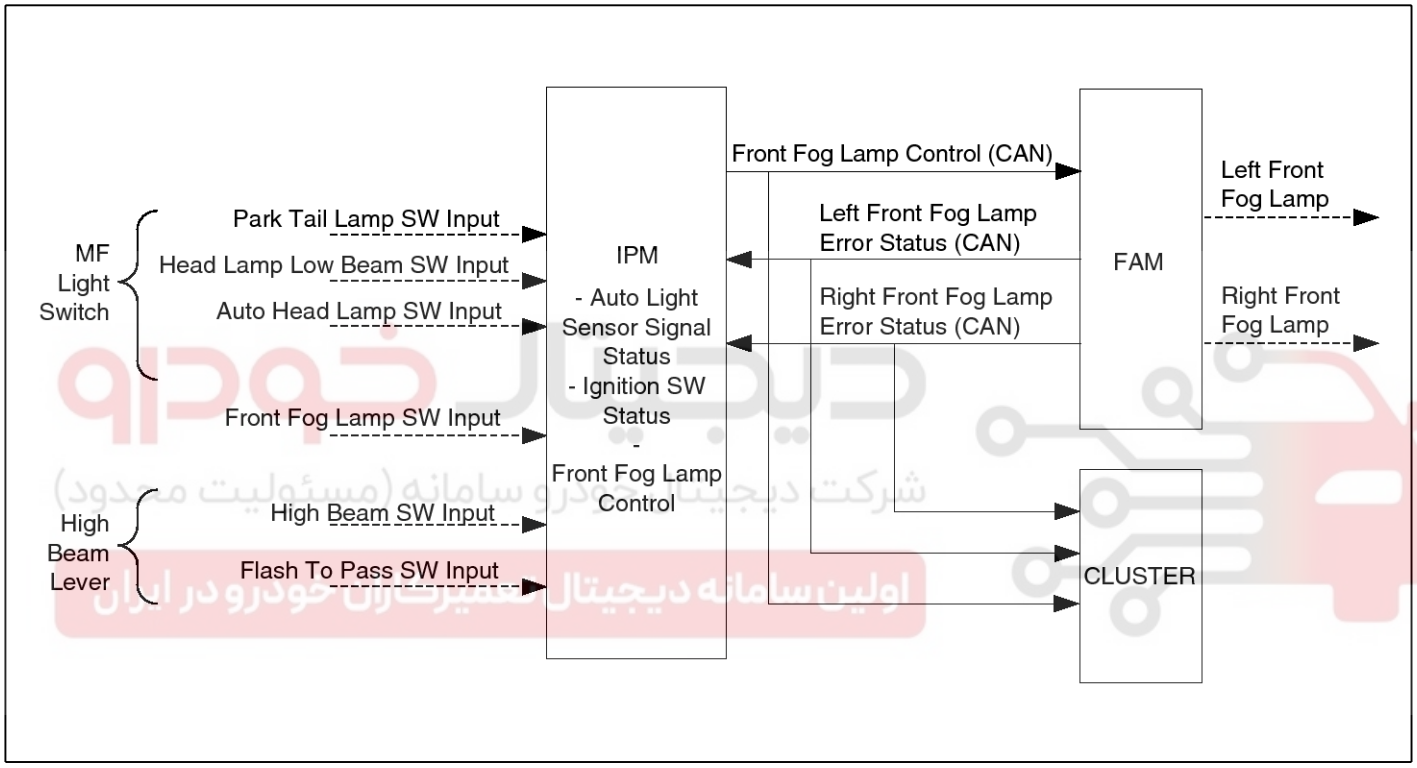
Description

The front fog lamps are activated thanks to a switch connected to the IPM.

The IPM manages the control logic of the front fog function, and sends the command to the FAM that drives the front fog lamps.

A status message coming from the left and right front fog lamps is sent by FAM to the IPM to indicate if one lamp is in error or not.

Functional Diagram



SHMBE9017N

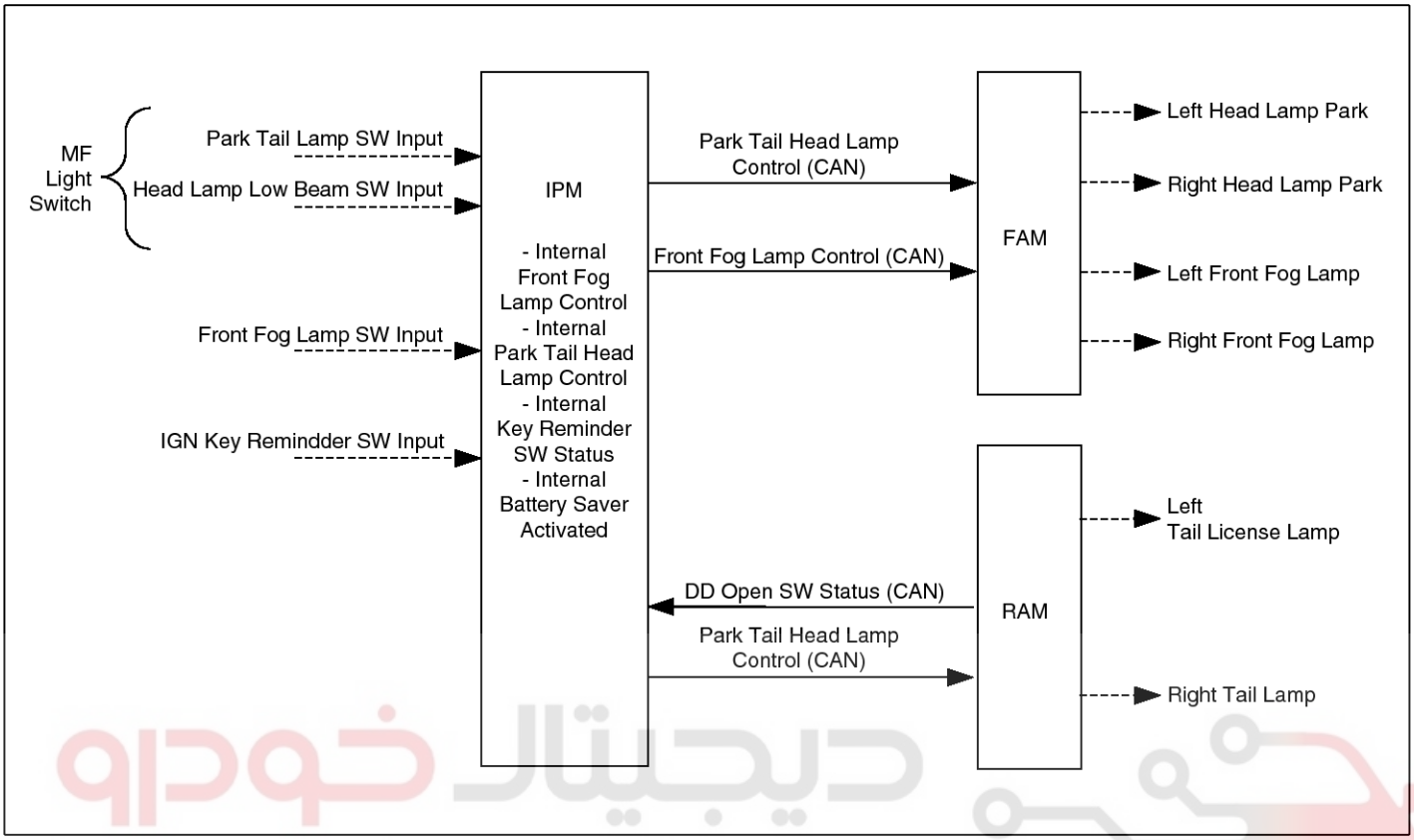
Battery Saver

Description

The Battery Saver function provides an automatic shut off to the Park and Tail lamps (with the license plate lamps and the Side marker lamps) and to the Front fog lamps to save the power of the Battery.

The IPM manages the control logic of the function, and sends the command to the FAM and the RAM that drives the lamps.

Functional Diagram



SHMBE9077L

IPM

The following requirements describe the conditions to activate and to deactivate the battery save function.

Description

Working conditions for the battery Saver function for RKE equipped vehicle only:

The Battery Saver function is activated when Key Reminder Sw Sts is not inserted and the driver door is open (1). In this case, Battery Saver Activated is ON.

(1) Driver door open switch status is OPEN

Working conditions for the battery Saver function for SMK equipped vehicle:

The Battery Saver function is activated when Ignition Sw status is at OFF state and the driver door is open (1). In this case, Battery Saver Activated is ON.

(1) Driver door open switch status is OPEN

Battery Saver deactivation: key inserted for RKE equipped vehicle only

The battery saver function is deactivated when Key Reminder Sw Sts is inserted (Battery Saver Activated is OFF).

Battery Saver deactivation: for SMK equipped vehicle

The battery saver function is deactivated when a transition from OFF to ACC or IGN1 or ING2 for Ignition Sw Sts is detected (Battery Saver Activated is OFF).

Battery Saver activated: action of Driver door open switch status is OPEN

The battery saver is not deactivated when Driver door open switch status value changes.

Description

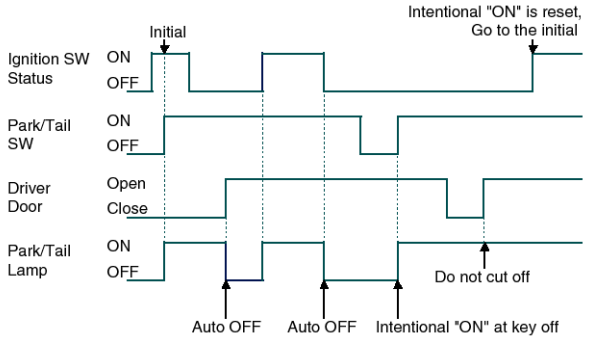
Battery Saver deactivation: intentional “park and tail ON”

When the light MF is switched OFF and then set to 'Park and Tail lamps' or 'Headlamps low beam' positions (intentional “park and tail ON”), the Battery Saver function is deactivated.

In this case, Battery Saver Activated is OFF.

Battery Saver deactivation: reset of the intentional “park and tail ON” for SMK equipped vehicle only

When the light MF is switched OFF then set to 'Park and Tail lamps' or 'Headlamps low beam' positions (intentional “park and tail ON”), the Battery Saver function is deactivated (Battery Saver Activated is OFF) while the Ignition Sw Sts is at OFF position.



SHMBE9078L

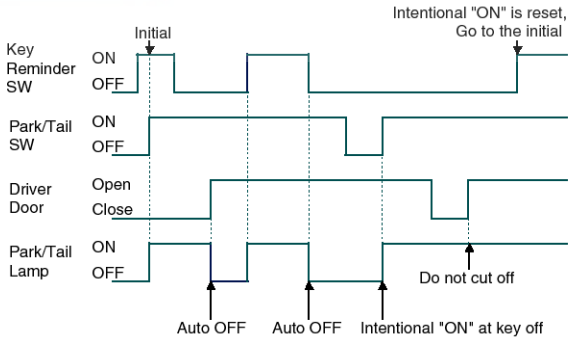
This time sequence diagram is true with an intentional “park and tail ON” due to ‘Head Lamp low beam’ switching sequence ON-> OFF-> ON : Park/Tail lamps are switched to ON.

Time sequence diagram for battery saver function

Battery Saver deactivation: reset of the intentional “park and tail ON” for RKE equipped vehicle

Description

When the light MF is switched OFF then set to 'Park and Tail lamps' or 'Headlamps low beam' positions (intentional “park and tail ON”), the Battery Saver function is deactivated (Battery Saver Activated is OFF) while the Key Reminder Sw Sts is not inserted.



SHMBE9019N

This time sequence diagram is true with an intentional “park and tail ON” due to ‘Head Lamp low beam’ switching sequence ON-> OFF-> ON : Park/Tail lamps are switched to ON.

Time sequence diagram for battery saver function

Turn Signal and Side Repeater Lamps

FAM

Description

The turn signal lamps status is determined by:

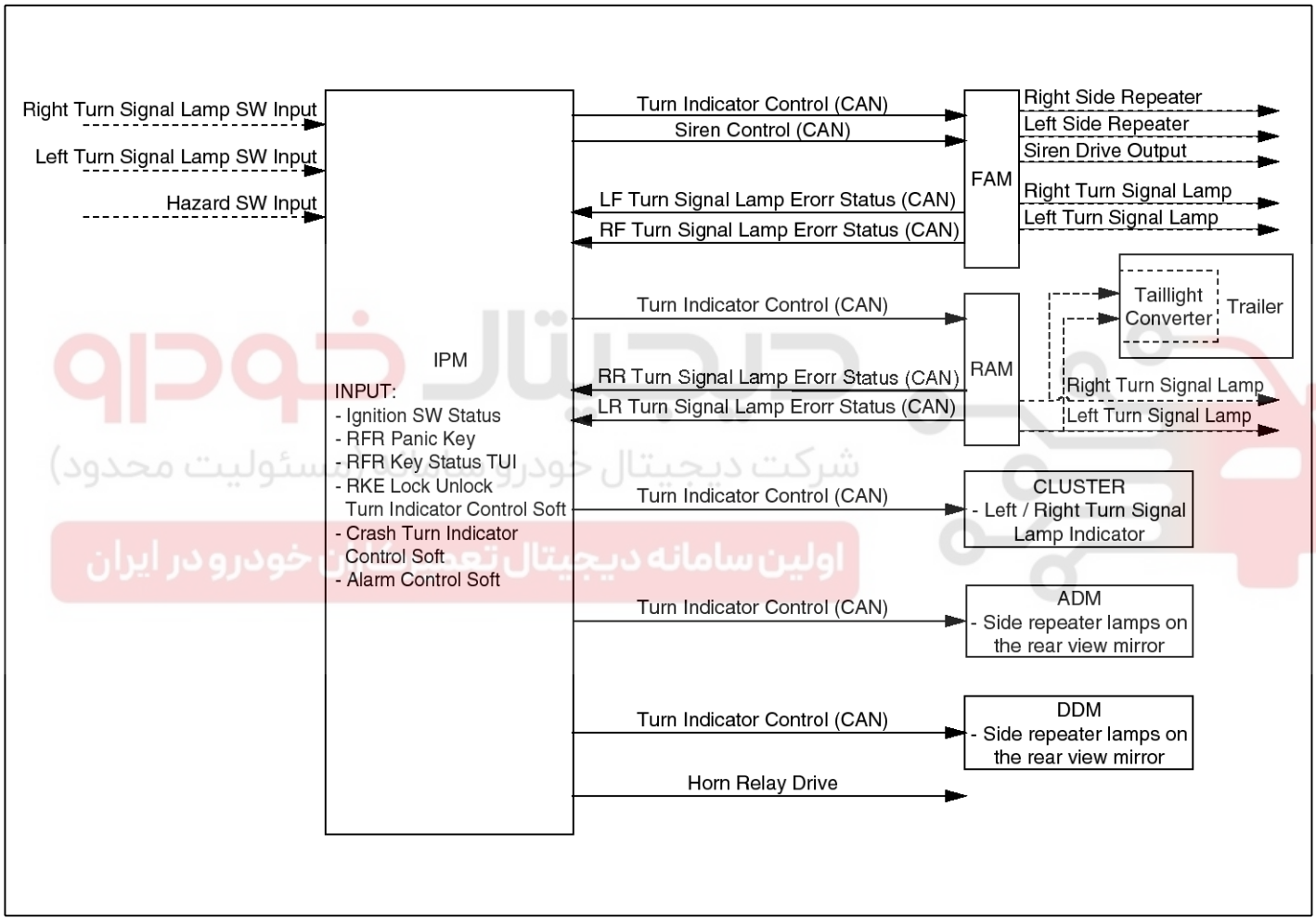
- The left and right turn signal switches
- The hazard switch
- The crash unlock activation
- The RKE lock, unlock, tailgate unlock and panic signals
- The alarm activation

A sound relay connected to the Cluster manages the “tick” sound during the turn signal lamps activation.

The cluster has two backlight indicators: one for the left Turn Signal lamps and one for the right Turn Signal lamps.

The IPM manages the control logic of the function, and sends the command to the FAM and the RAM that drives the turn signal lamps. The same CAN signal is used for the front and the rear turn signal activation.

Functional Diagram



SHMBE9079L

IPM

The IPM manages the control logic of the turn signal function. The command of the turn signal lamps is sent to the FAM and the RAM thanks to the CAN signal Turn Indicator Ctrl.

Description

Crash unlock mode:

When a crash unlock occurs, the CAN message Turn Indicator Ctrl is sent with the sequence values all on / all off at the frequency 80 (+/-5) cycles per minute (duty 50% +/-5%).

Crash unlock sequence stop:

The crash unlock flashing sequence stops when the ignition key is OFF.

Description

Hazard mode: working conditions

The Hazard lamps sequence is activated when the hazard SW input is ON in any position of Ignition Sw.

Description

Hazard mode: definition

When the Hazard lamps are activated by the Hazard button, Turn Indicator Ctrl is sent with the sequence values ALL ON / ALL OFF at the frequency (80 +/- 5) cycles per minute (duty 50% +/-5%).

Stop of the hazard mode:

The Hazard lamps sequence is stopped when the hazard SW input is off or when a higher priority sequence occurs.

The priorities between the different modes are:

Description

Priorities between the turn signal commands:

The priorities between the different commands of the turn signal lamps from the upper to the lower priority are as following:

1st: Hazard lamps ordered by the Hazard switch

2nd: Hazard lamps ordered by the Crash Unlock activation

3rd: Alarm flashing sequence

4th: RKE panic signal flashing sequence

5th: RKE lock / unlock signal flashing sequence

6th: Left or Right Turn signal lamps ordered by the turn lever switch

Interior Lighting

Room Lamps

Description

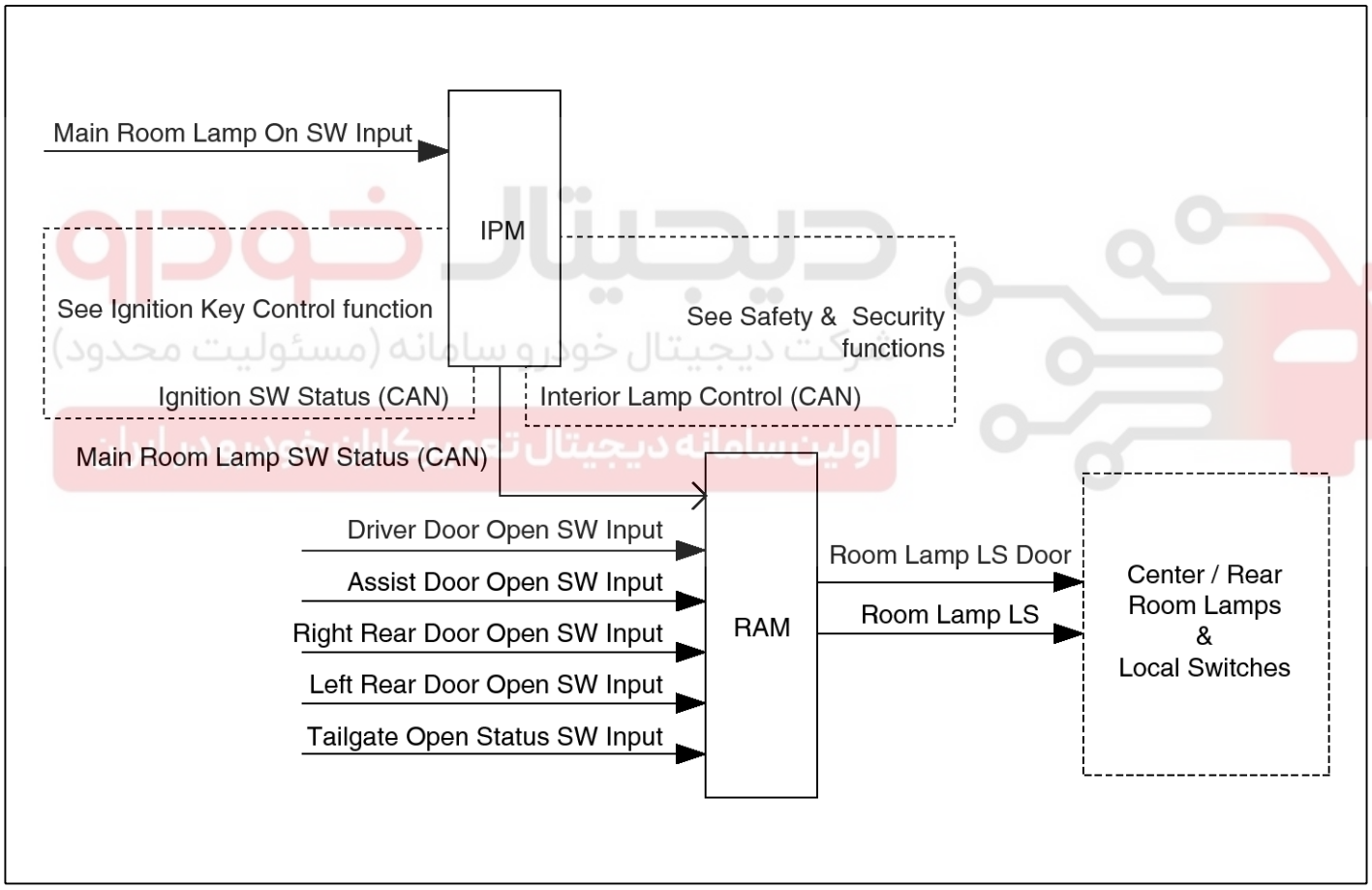
The vehicle is equipped with Room Lamps located on the front and rear interior roof.

The lamps low sides are driven by the RAM, and the control logic depends on:

- Front and rear doors status (RAM input)
- Tailgate status
- Lock/unlock interior lamp control information depending on RKE/SMK for vehicles not equipped with
- Burglar Alarm (signal sent from IPM to RAM)
- Lock/unlock interior lamp control information depending on Burglar Alarm state for vehicles equipped with Burglar Alarm (signals sent from IPM to RAM)
- The ignition key position (managed by the IPM and signal transmitted to the RAM).
- The Main Room Lamp switch (variation dependent equipment), which is a common control for the interior light.

Local 3-state switches (ON, OFF and DOOR positions) directly wired to the lamps can also be used to manually force the Room Lamp behavior. The RAM has no feedback of the local switches positions. No diagnostic (problem detection) is done on the Room Lamps.

Functional Diagram



SHMBE9027N

Luggage Lamps

Description

The vehicle is equipped with a Luggage Lamp of which the low side is driven by the RAM, and the control logic depends on:

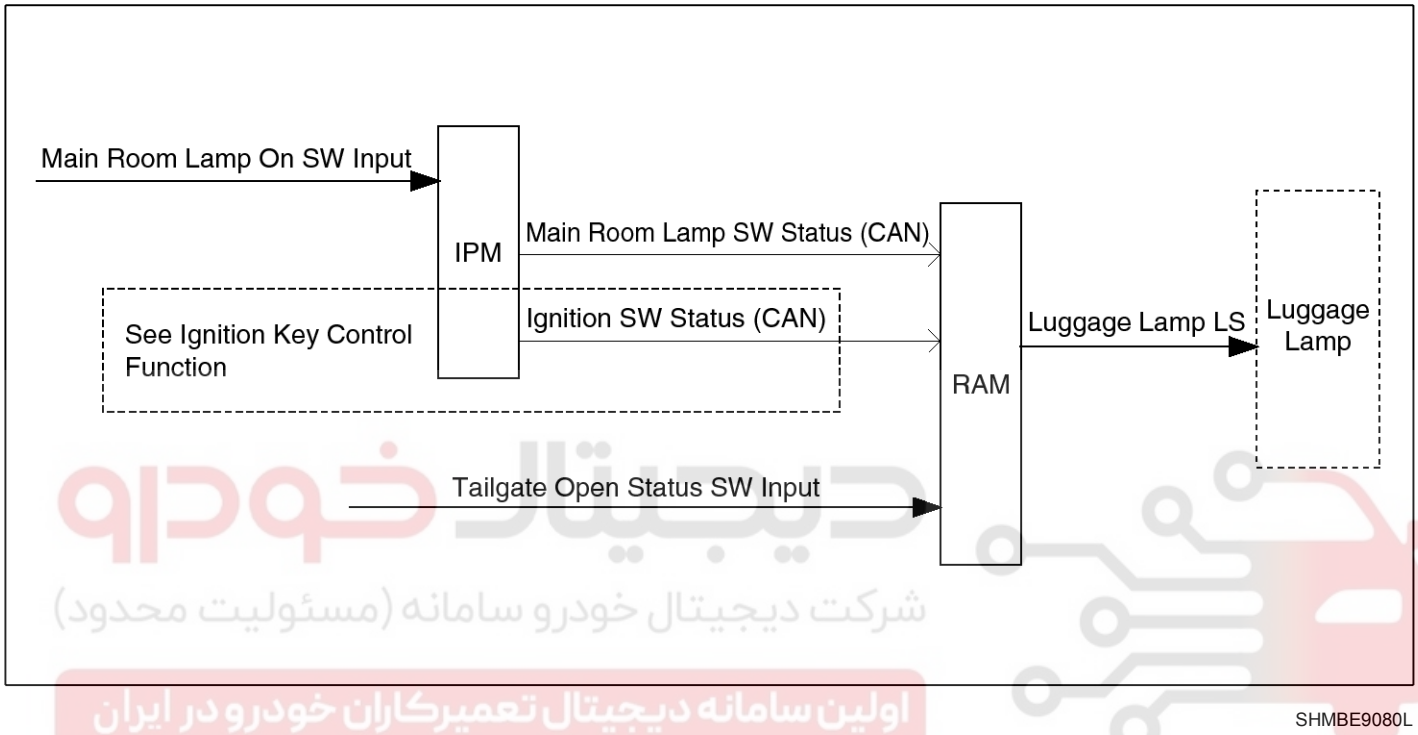
Tailgate status (RAM input)

The ignition key position (managed by the IPM and signal transmitted to the RAM).

The Main Room Lamp switch (variation dependent equipment), which is a common control for the interior light.

No diagnostic (problem detection) is done on the Luggage Lamps.

Functional Diagram



Key Hole Illumination

Description

This function provides an illumination of the ignition key cylinder to help the driver inserting the key.

The key cylinder illumination depends on:

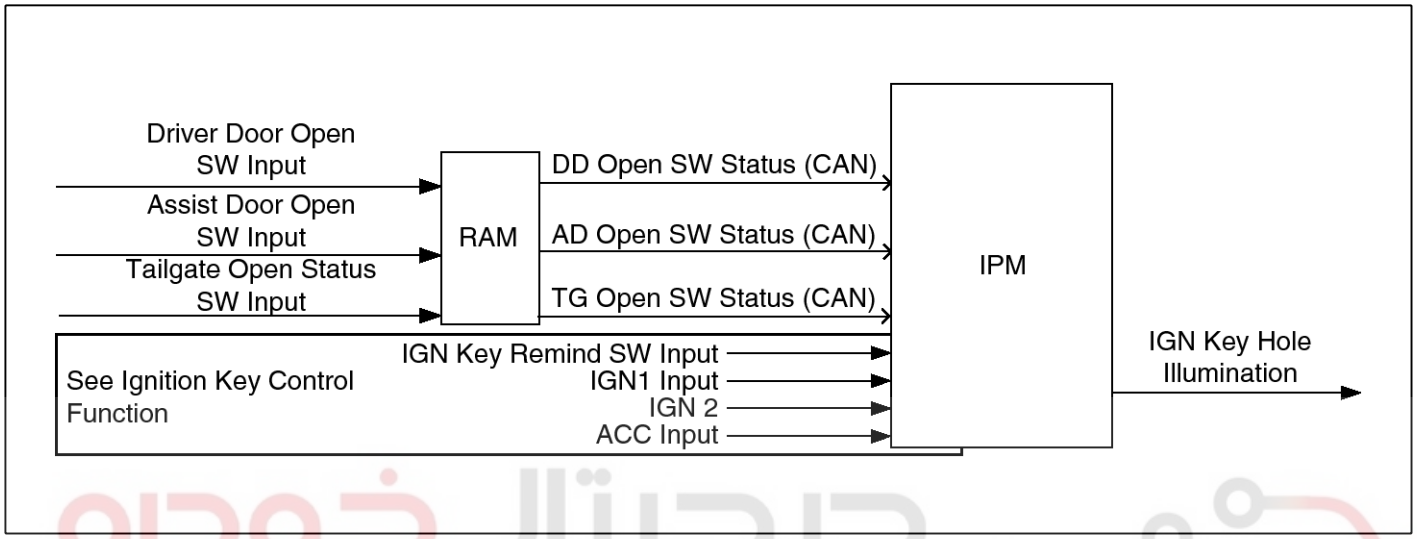
The driver and assist door status (open or close) provided by the RAM,

The ignition key position (off, acc, run, start) managed by the IPM,

Ignition key reminder (inserted or not) managed by the IPM,

The Burglar Alarm state managed by the IPM (depending on vehicle variation),

Functional Diagram



SHMBE9032N

IPM

Description

The keyhole illumination is switched on when receiving Driver door open switch status or Assist door open switch status CAN signals with open value.

The keyhole illumination is switched off 30s after Driver door open switch status or Assist door open switch status CAN signals were received with value close.

When the ignition key switch status is RUN or start, the keyhole illumination is off.

When the ignition key is in off or ACC position, and if any transition from closed to open is detected on the Driver or Assist door, then the key hole illumination is switched ON for 20minute and then off.

When the Driver or Assist door is open, and the ignition key position changes from run/start to off/ACC, then the keyhole illumination is switched ON for 20minute and then off.

Description

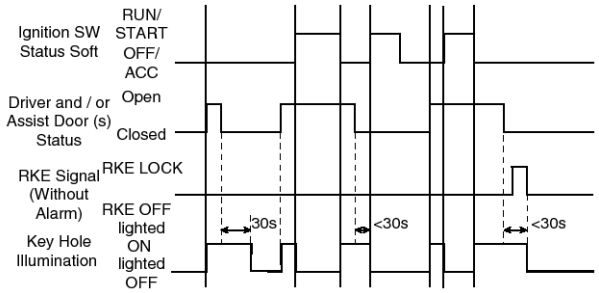
When the system enters arm wait mode by Remote Key or Mechanical cylinder lock switches, the key hole illumination is switched off immediately.

Description

If the keyhole is illuminated, and both the Driver and the Assist doors status changed to closed, then a 30-second timer is started.

The keyhole illumination is maintained on while this 30-second timer is running.

While running, this 30-second timer is restarted on reception of a Driver or the Assist doors status transition.



SHMBE9033N

View Enhancement

Front Wiper and Washer

Description

The vehicle is equipped with a Front Wiper and Washer, locally controlled (manual operation) by a MF switch.

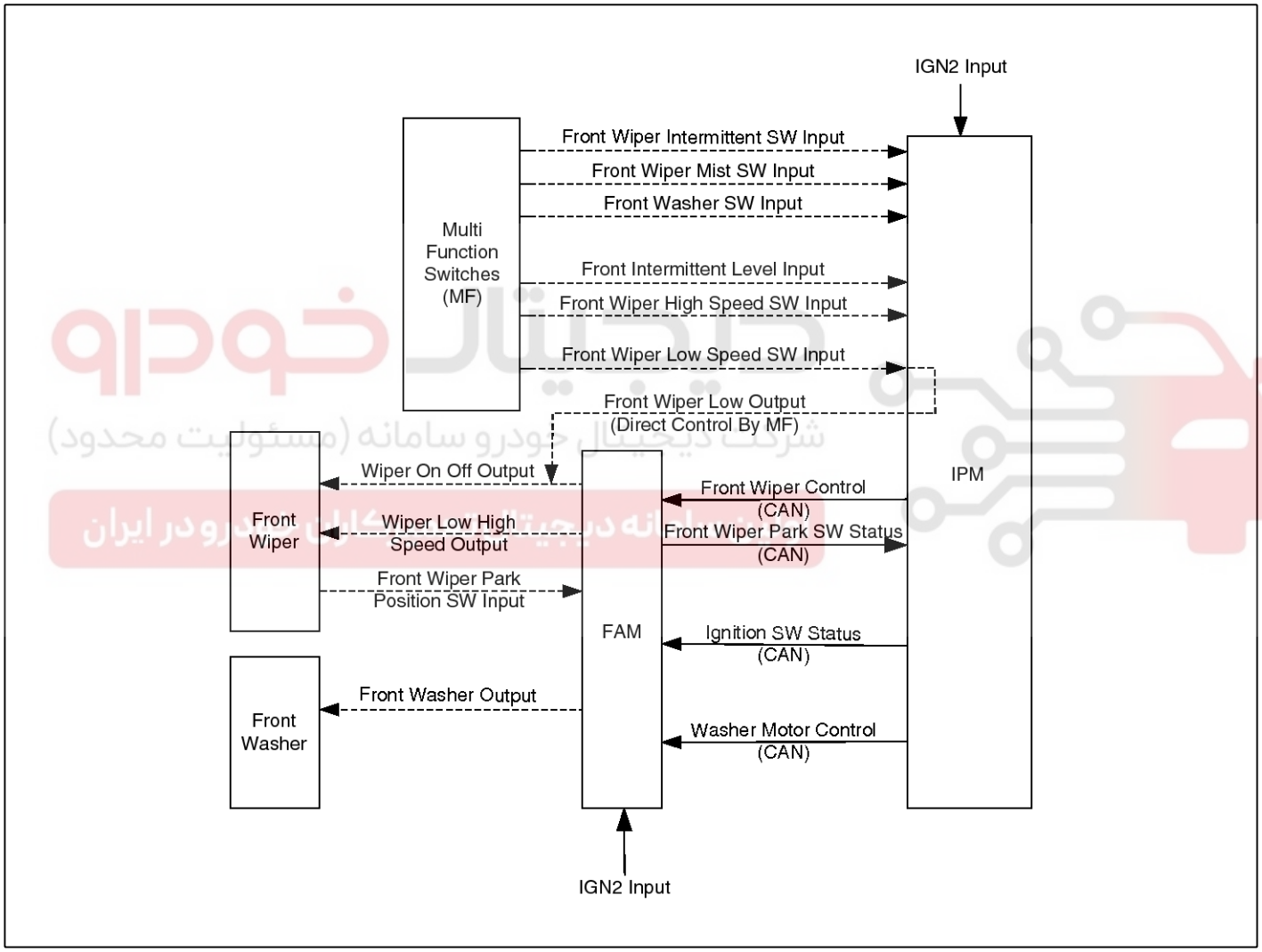
This functionality is directly accessible to the driver. It consists in the possibility to activate or deactivate the wiper of the front windshield. When the driver decides to activate the front wiper, he has to choose between several modes of operation using the MF switch:

- Continuous low speed;
- Continuous high speed;
- Auto (intermittent) mode (5 levels)

Another switch is used for the front washer. It consists in activating the front washer pump, which is located under hood. The washer activation has a consequence on the activation of the front wiper in order to clean the windshield.

The driver can also be informed of the low level of washer fluid by an indication on the cluster display

Functional Diagram



SHMBE9081L

IPM

Description

Interaction with Ignition Key position:

Front wiper and washer functions are active when the ignition key is in run position.

Else, Front wiper Ctrl and Washer Motor Ctrl are sent with off value.

Front wiper activation

Description

Front wiper activation modes:

- Off mode: no wiper;
- Low speed: the front wiper runs continuously with low speed;
- High speed: the front wiper runs continuously with high speed
- Mist: the front wiper runs continuously with low speed until the Mist button is released, then, the wiper stops at the next park position

Description

Front wiper activation modes:

- Intermittent / Auto modes

  If a rain sensor is present in the vehicle, it uses the intermittent level to adjust the rain sensor sensitivity. With the rain sensor the front wiper can operate in the following modes:

Continuous high speed

Continuous low speed

Intermittent low speed (speed is set by rain sensor)

See rain sensor requirements for more information

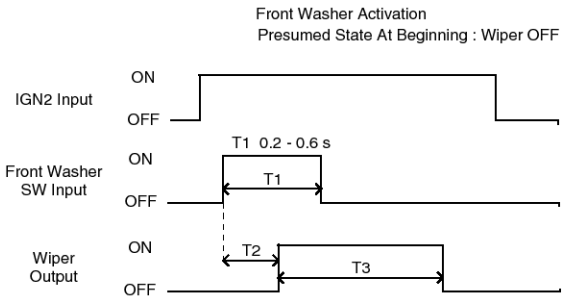
Description

Washer activation logic with inactive front wiper:

When the front wiper is not active and if the washer signal is active for more than 200 ms and less than 600 ms, the following sequence is started:

T2 second (0.3 second) after the washer is switched on, the front wiper signal is switched on with the current level speed

T3 second (700 ms) the front wiper signal is switched off



SHMBE9037N

T2 = 0.3 s.

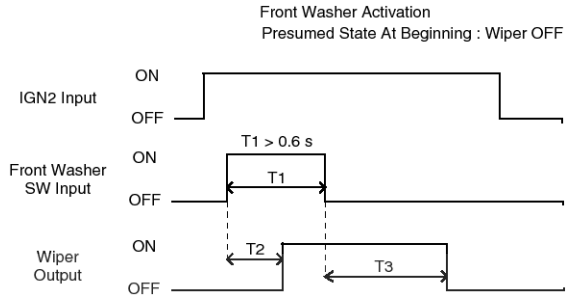
T3 : 0.7 s.

Washer activation logic with inactive front wiper:

When the front wiper is not active and if the washer signal is active for more than T1=0.6 seconds, the following sequence is started:

T2 second (0.3 second) after the washer is switched on, the front wiper signal is switched on with the current level speed

T3 second (2.7 ~ 3.3 seconds) after the washer is switched off, the front wiper signal is switched off



SHMBE9038N

T2 = 0.3 s.

T3 : 2.7 ~ 3.3 s.

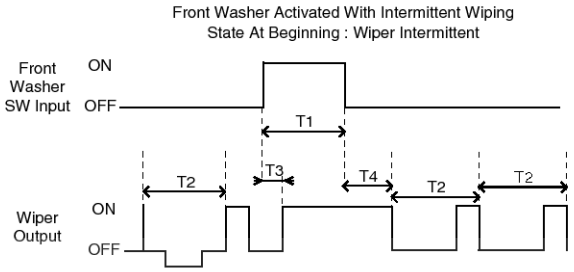
Description

Washer activation logic with active front wiper:

When the front wiper is active, the current speed of the front wiper is kept during 0.3 sec of the washer signal and after T3 seconds (wiper activation due to washer) the front wiper returns to the wiping speed requested by the switch or the rain sensor. Depending on the mode of wiper that is active, the wiping action linked to the washer has to be stopped or not.

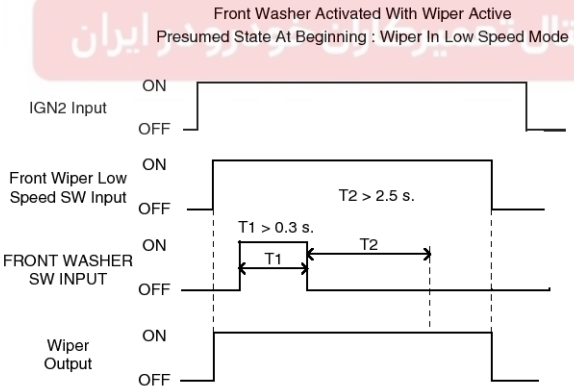
Here are the following wiper modes and the actions:

Wiper mode before the washer is switched ON (with or without rain sensor)	Wiper Speed During Washing
Off	Low
Intermittent	Low
Low Speed	Low
High Speed	High



SHMBE9039N

T1 > 60 ms, T2 : period of intermittence, T3 : 0.3 sec, T4 : 2.5 ~ 3.8 sec



SHMBE9040N

FAM

Interaction with ignition key position & park switch

Description

Interaction with Ignition key position:

Front wiper and washer functions are active when the ignition key is in run position.

In the start state, all the wiper and washer outputs are halted (in order to have the maximum power for the start of engine).

In the off and ACC states, the front wiper and washer are not activated.

Interaction with Ignition Key position:

If the ignition key leaves the run position while wiper operation, the wiper stops at the current position and will move to the park position the next time ignition key is run.

Start / stop of wiping:

When Front Wiper Ctrl CAN signal is received with:

LOW value, the output Front Wiper on/off is set to on and the output Front Wiper low/high is set to low

HIGH value, the output Front Wiper on/off is set to on and the output Front Wiper Low/High is set to high

off value, the output Front Wiper on/off is set to off

Interaction with the park switch:

When the Front Wiper Ctrl CAN signal has off value and the front wiper is not parked, if the IGN2_INPUT signal goes to on, then the output signal Front Wiper on/off is set to on and Front Wiper Low/High is not changed.

Interaction with the park switch:

When the IGN2 input signal is already on, if the Front Wiper Ctrl CAN signal has OFF value and the front wiper becomes not parked, then the output Front Wiper on/off signal is not changed.

Rear Wiper and Washer

Description

The vehicle is equipped with a Rear Wiper and Washer, locally controlled (manual operation) by a Rear MF switch (RMS) connected to the IPM module. This functionality is directly accessible to the driver. It consists in the possibility to activate or deactivate the wiper of the rear glass. When the driver decides to activate the rear wiper, he has to choose between several modes of operation using the rear MF switch (RMS):

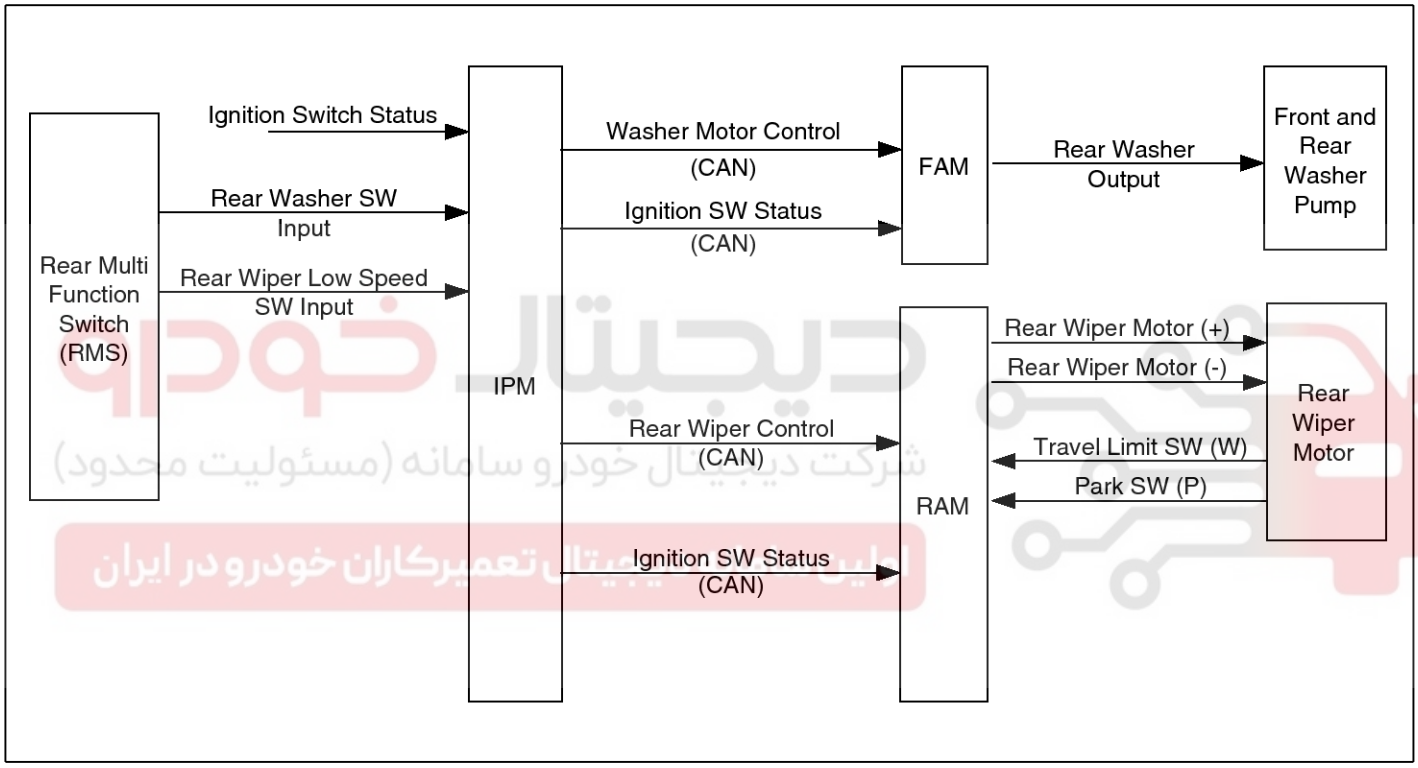
- Continuous low speed
- Rear washer switch

The rear wiper uses a bi-directional motor with integrated logic for rotation sense change, the RAM module manages the wiping period (intermittent or low speed) and park operation.

Another switch is also used for the rear washer. It consists in activating the front washer pump, located under hood and connected to the FAM module. The rear washer activation has a consequence on the activation of the rear wiper in order to clean the rear glass.

The driver can be informed of the low level of washer fluid by an indication on the cluster panel.

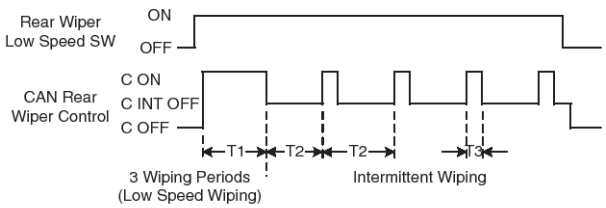
Functional Diagram



SHMBE9082L

Rear wiper activation logic :

If the Rear Wiper Low Speed Sw is ON, then the CAN signal Rear Wiper Ctrl is sent with following logic:



SHMBE9042N

+/-10% T1 = 6.2 sec, T2 = 6 sec, T3 = 700 ms

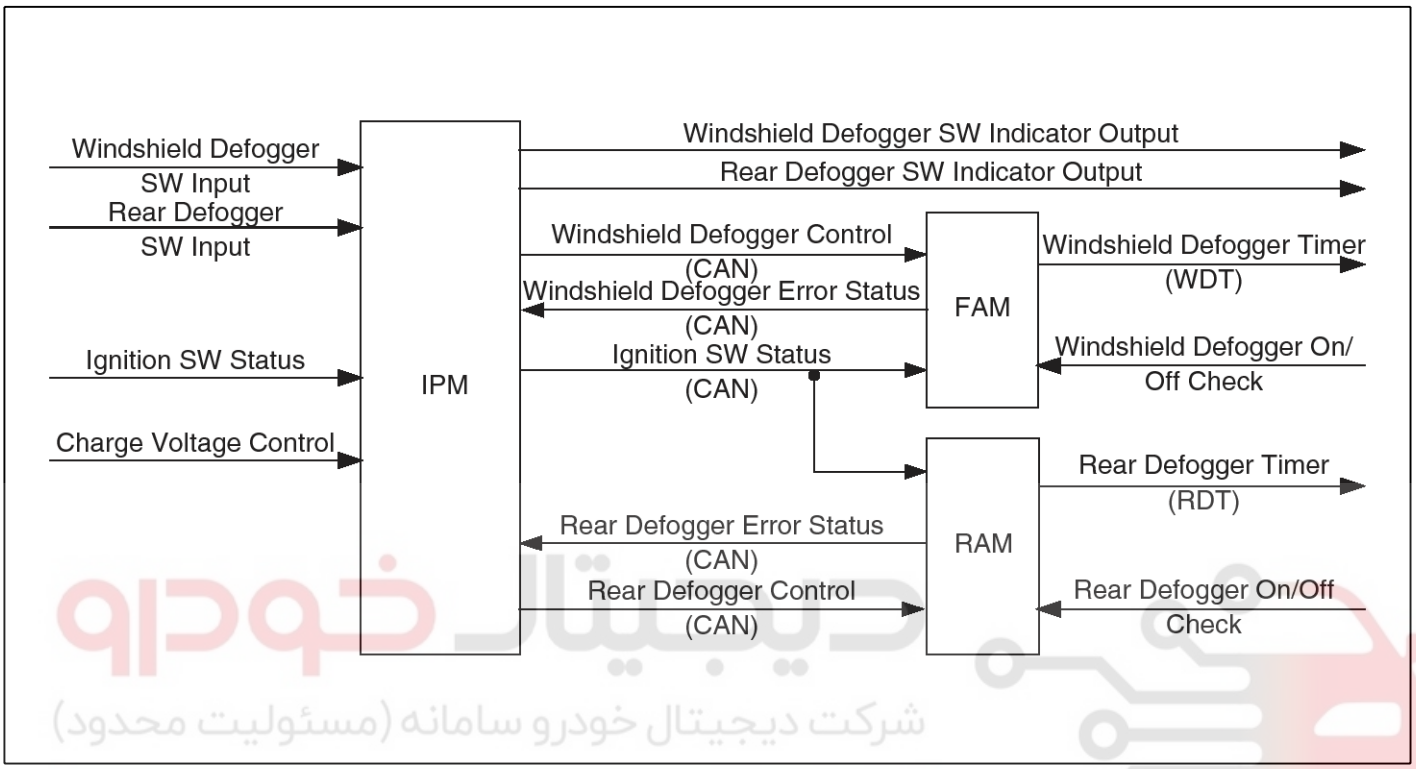
Defogger

Description

The vehicle is equipped with a Defogger function, locally controlled (manual operation) by a windshield and rear defogger switches.

This function controls the heating defogger grids on windshield, rear glass, and rear view mirrors (managed by DDM and ADM).

Functional Diagram



SHMBE9043N

NOTICE

The defogger of rear view mirrors managed by DDM and ADM modules is not shown on this diagram,

as it uses the same Rear Defogger control CAN signal as the RAM module.

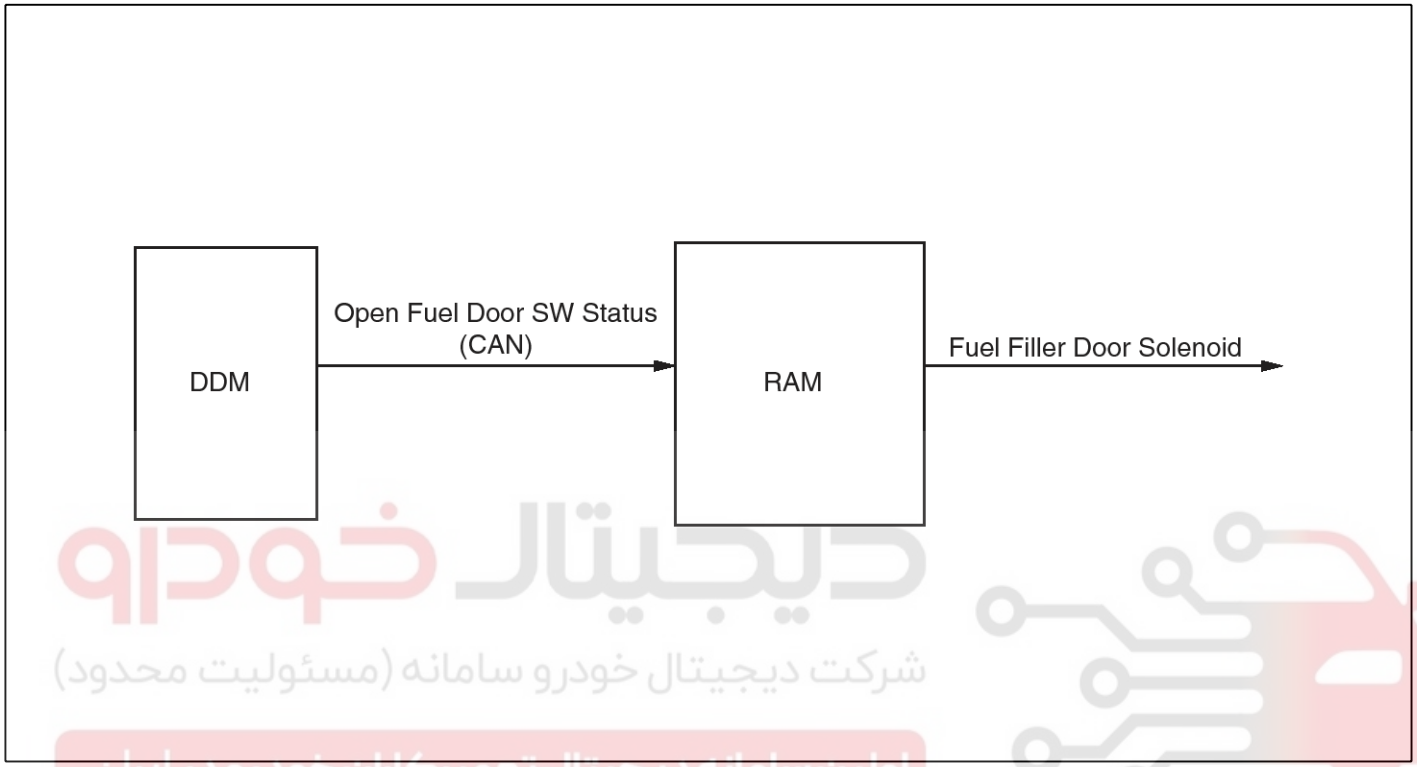
Comfort Function

Open Fuel Filler Door

Description

Open Fuel Door switch on DDM drives the solenoid for the Fuel Filler Door opening.

Functional Diagram



SHMBE9045N

RAM

Description

Fuel filler door solenoid definition:

In case of closed → open transition of Open Fuel Door Sw Sts, Fuel filler door solenoid output is set to on while pushing the switch (Max. 10sec) then off.

During or after this pulse, in case of open → closed transition of Open Fuel Door Sw Sts, there is no influence on the Fuel filler door solenoid output.

Time between 2 pulse commands:

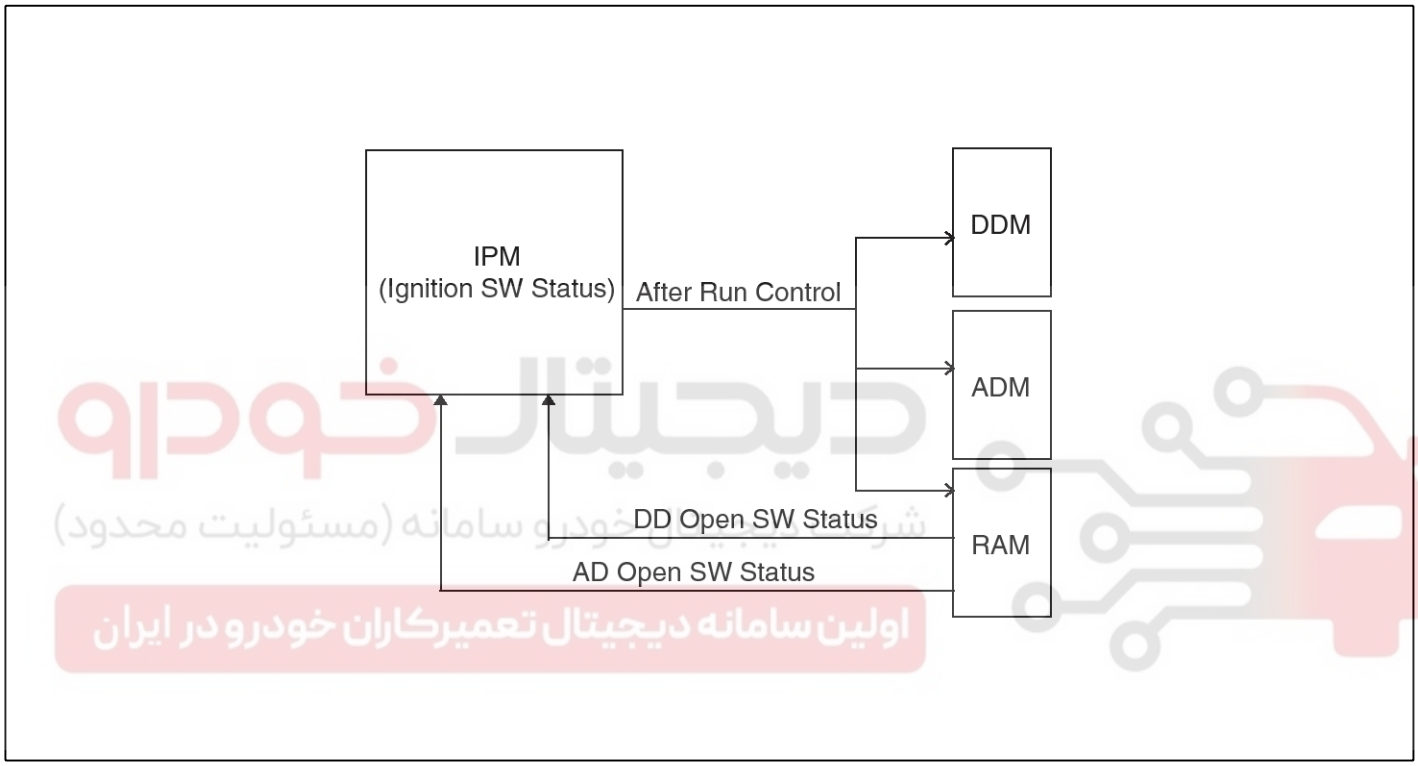
A new CAN signal Open Fuel Door Sw Sts is received with open value within 1.5s after first message will not be taken into account.

Power Window Timer

Description

This function defines the conditions for allowing use of power windows after that the ignition key has been removed from the key cylinder.

Functional Diagram



SHMBE9046N

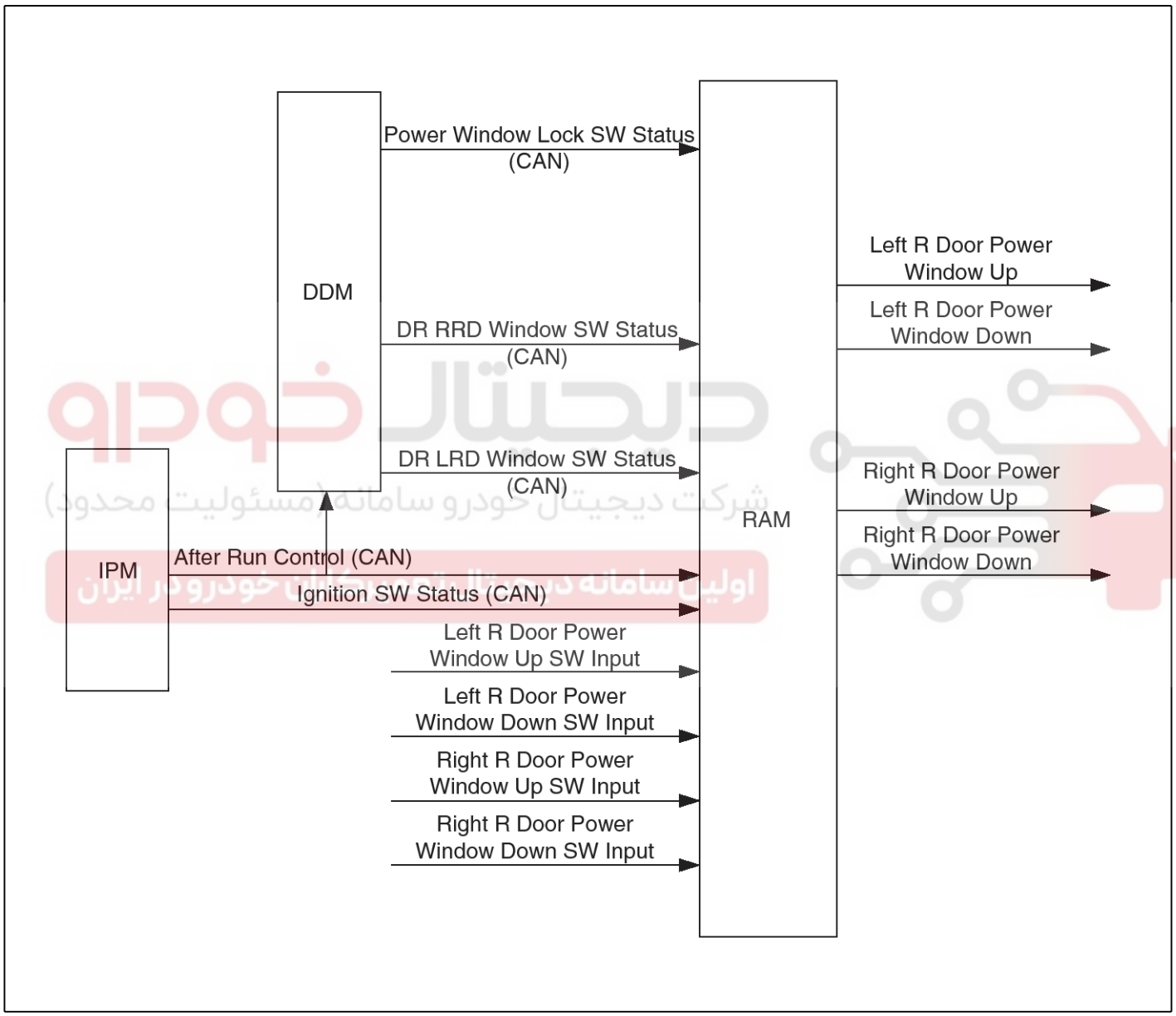
Rear Doors Power Windows

Description

Each rear door is equipped with a power window.

The RAM module manages power window motors and switches, but controls neither the window position nor the motor current. RAM does not implement any stall mechanism detection.

Functional Diagram



SHMBE9047N

RAM

Description

Rear doors window control:

When a power window switch is pressed, the corresponding motor output is ON until the switch is released and no more than 10+/- 1sec

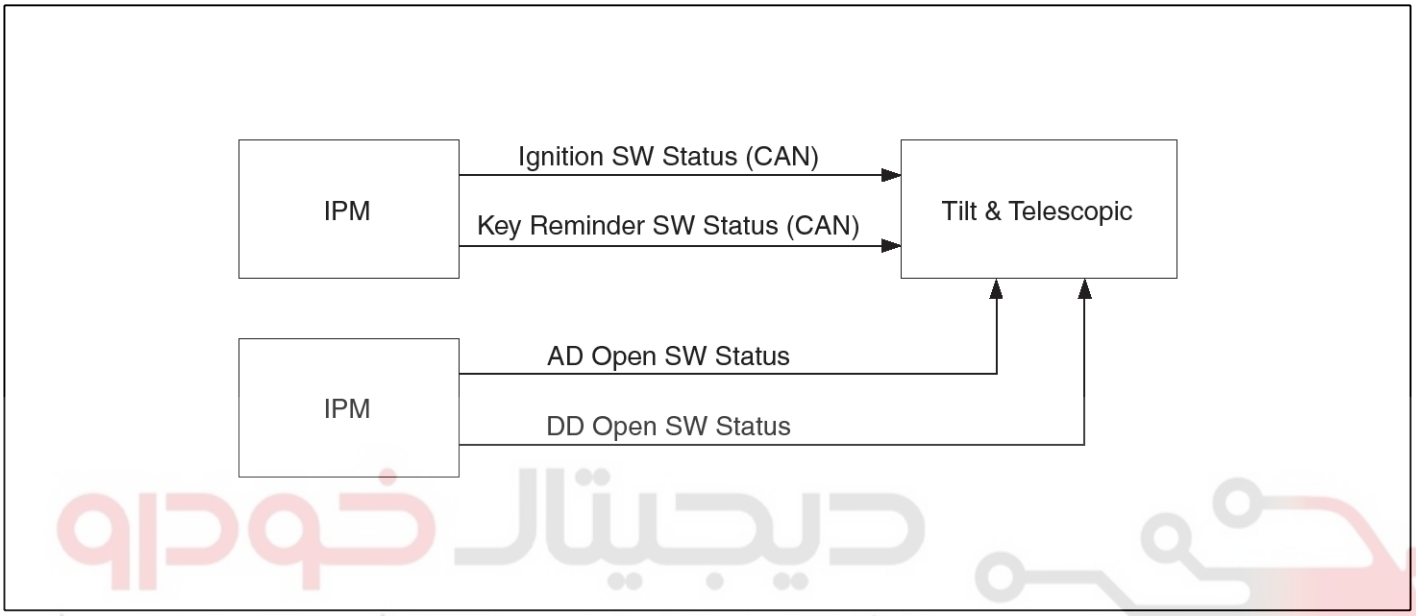
Tilt and Telescopic

Description

Tilt and Telescopic function provides a motorized steering wheel position adjustment. This equipment comes with the IMS option.

The Tilt &Telescopic CAN unit uses the ignition key position managed by the IPM.

Functional Diagram



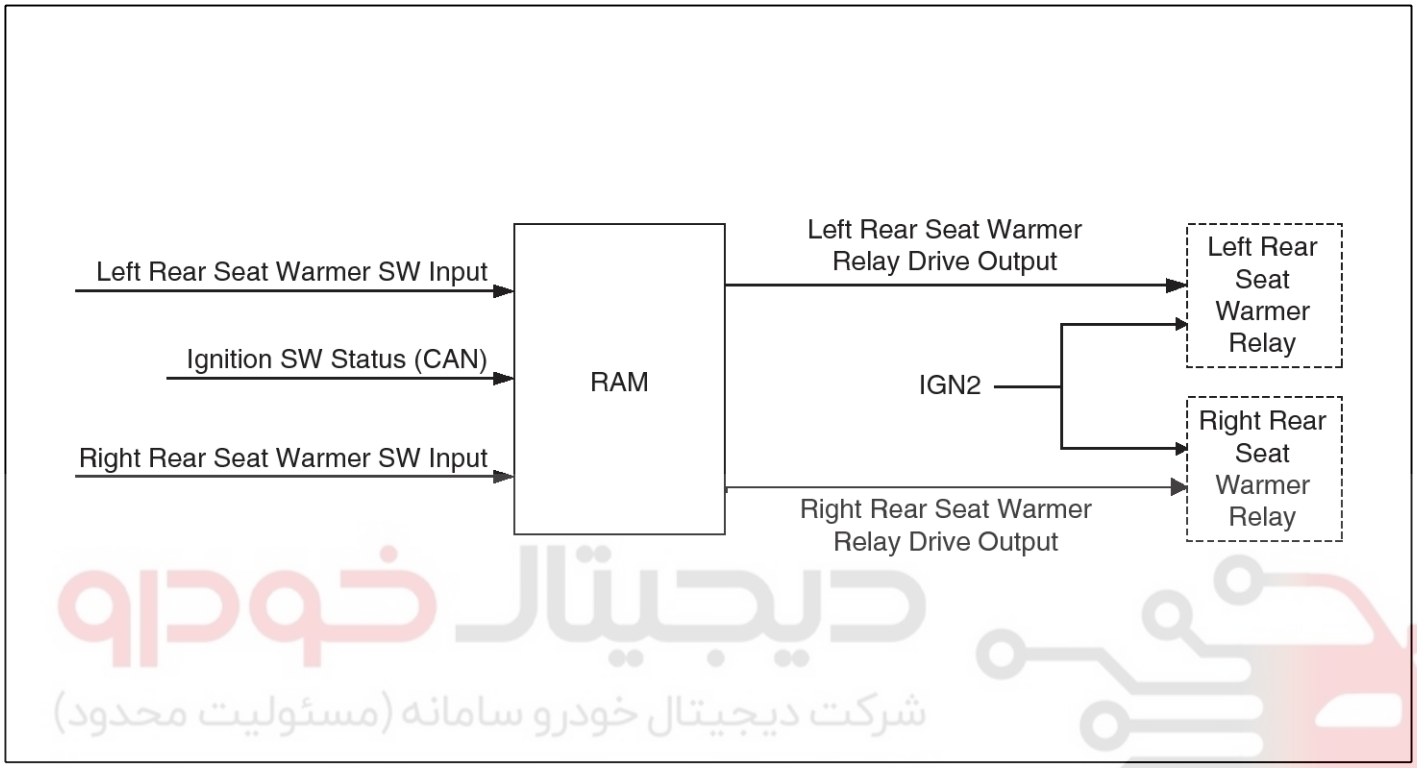
SHMBE9048N

Rear Seat Warmer

Description

IGN2 switch and the RH/LH seat warmer switches control the Rear Seat Warmer relays.

Functional Diagram



SHMBE9049N

RAM

Description

Left and right rear seat warmers working condition:

The left and right rear seat warmers can be activated only if ignition key is in RUN position (Ignition Sw Sts CAN signal is received with RUN value). When the rear seat warmers (left/right) are activated and the ignition key leaves the RUN position, the rear seat warmers are stopped.

Left rear seat warmer operation:

At each OFF → ON transition detected on left rear seat warmer switch input, the left rear seat warmer relay drive output signal toggles its state.

Right rear seat warmer operation:

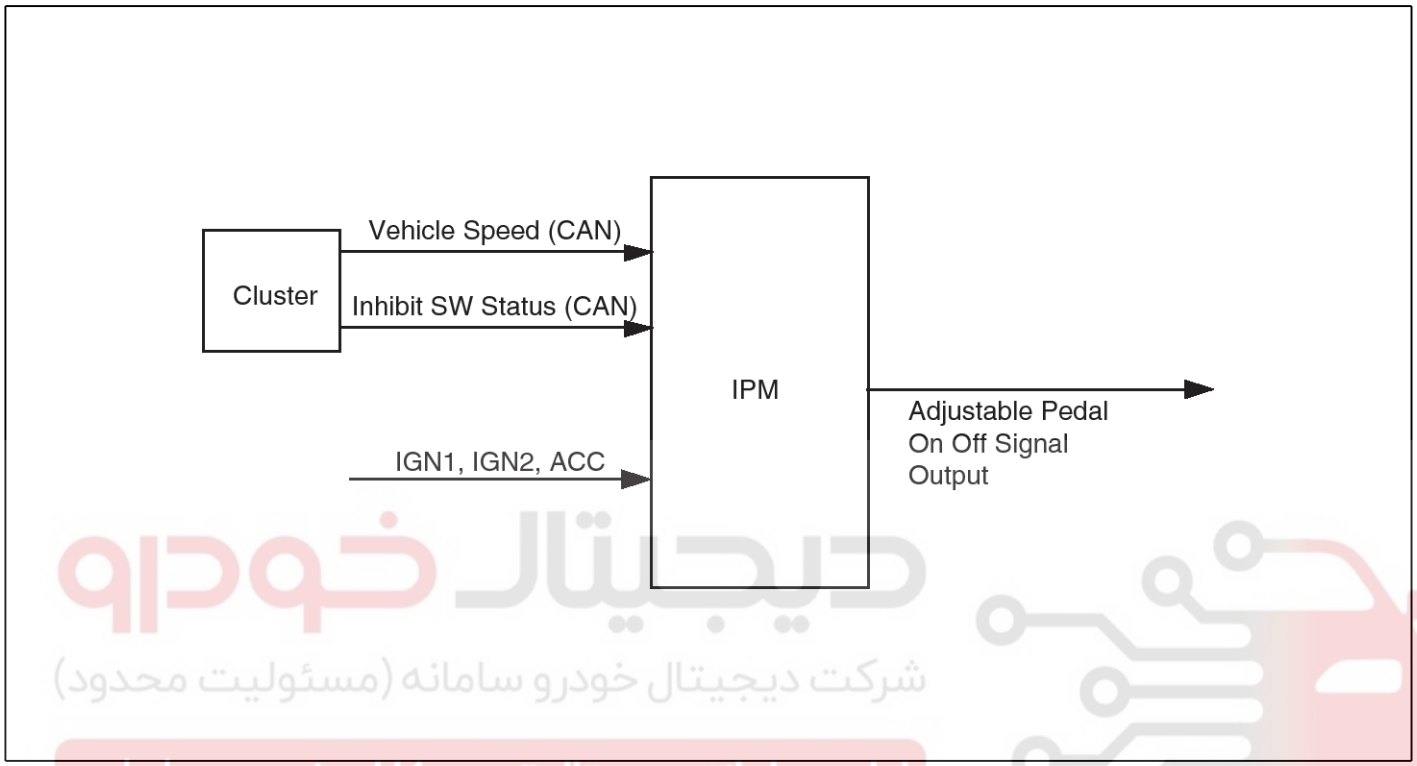
At each off → on transition detected on right rear seat warmer switch input, the right rear seat warmer relay drive output signal toggles its state.

Adjustable pedal

Description

Adjust Pedal allows to activate Adjustable Pedal feature; IPM needs to control the power source (by relay coil control) of the adjustable Pedal switch unit.

Functional Diagram



SHMBE9050N

IPM

Description

Adjustable Pedal

N°	Inhibit SW Status	Vehicle Speed	Ignition SW Status	Adjustable Pedal On Off Signal Output
1	P	0 kph	Run	On
2	x	x	Off, Acc	On
3	P	1-254 kph	Run, Start	Off
4	Not P	x	Run, Start	Off

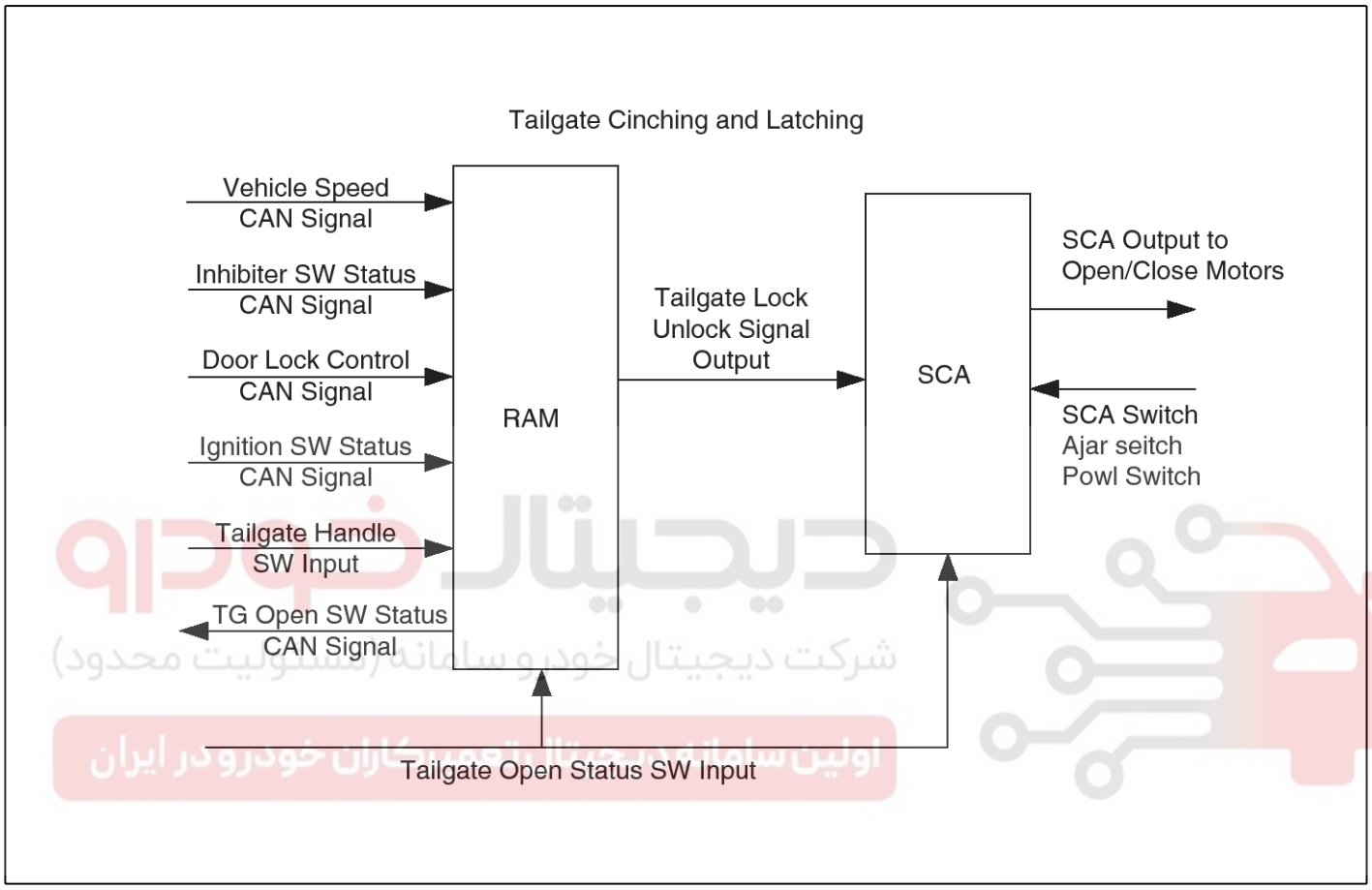
x = any value

Tailgate Cinching and latching

Description

This function provides assistance in tailgate latching and cinching. The RAM sends a command to external module, connected to latching and cinching motors.

Functional Diagram



SHMBE9051N

RAM

Description

Tailgate cinching and latching 30 s enable timer (1):

The tailgate cinching and latching function is enabled for 30 sec after receiving the Door Lock Ctrl CAN signal with tailgate unlock value. During this delay, the tailgate can be opened if the Inhibit Sw Sts CAN signal is received with P or N values and if the vehicle speed is ≤ 5 km/h.

During the 30 sec Cinch & Latch Timer delay:

If the tailgate close → open transition is detected during this 30 sec delay, the timer is stopped and the function becomes disabled immediately.

After this 30 sec Cinch & Latch Timer delay:

After this 30 sec delay, if no action is detected on the tailgate handle switch, the cinching and latching function is disabled (any action on tailgate handle switch is ignored).

1) This timer is not started when the vehicle state is unlocked, i.e. after successful completion of the key reminder unlock sequence or if the previous value of Door Lock Ctrl was : all unlock, rear door and tailgate unlock, rear door, tailgate and driver door unlock, rear door, tailgate and assist door unlock.

Description

Cinching and latching function initial state after the cold reset:

After the cold reset the initial state of tailgate cinching and latching function (enabled / disabled) depends on the rear doors lock monitoring switch state:

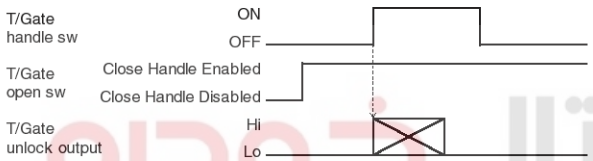
R RD Lock Monitoring SW Input	L RD Lock Monitoring SW Input	Tailgate cinching and latching function state
On	Off	Enabled (1)
Off	On	
On	On	
Off	Off	Disabled

(1) Only if the Inhibit Sw Sts CAN signal is received with P or N values and if the vehicle speed is ≤ 5 km/h

Description

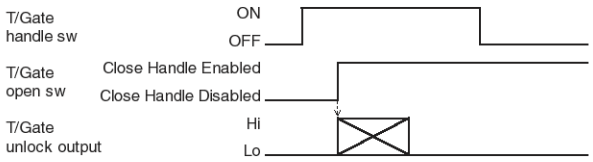
Tailgate unlock logic for latch pulse generation:

→ Case 1



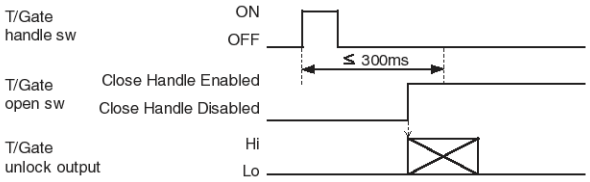
SHMBE9052N

→ Case 2



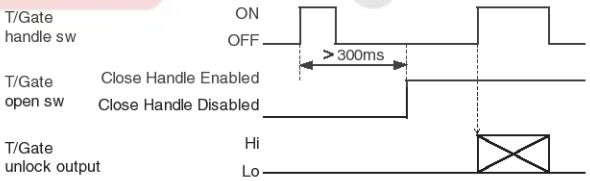
SHMBE9053N

→ Case 3



SHMBE9054N

→ Case 4



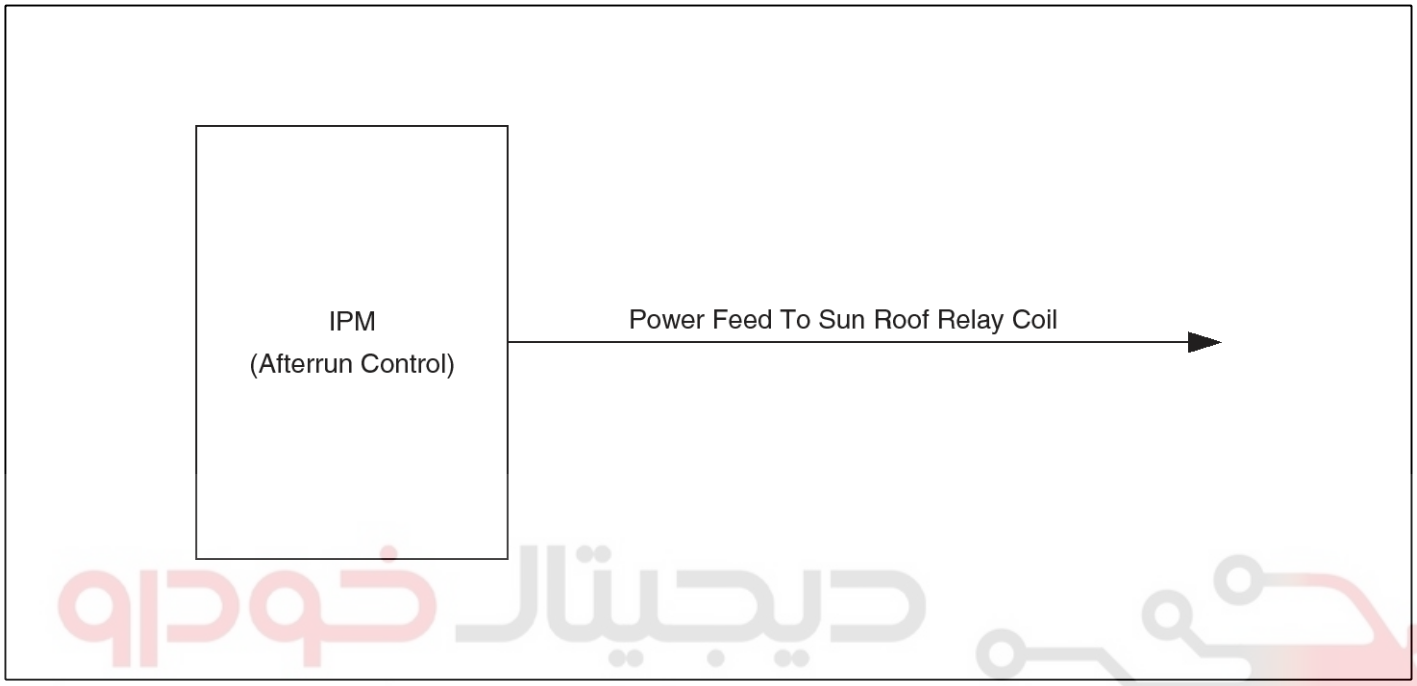
SHMBE9055N

Power Feed To Sun Roof Relay Coil

Description

This function controlled by the IPM defines the condition for switching on or off power feed to Sun Roof Relay Coil.

Functional Diagram



SHMBE9076N

Driver Information

Cluster Indicators and Chime Control

Description

The cluster indicators, managed by the cluster module, show the state of activated functions or warn the driver if a problem occurs. Some visual cluster indications are associated with a chime warning.

The IPM, FAM or RAM sends on the CAN the status of several switches and sensors. The cluster module receives the status of several switches and sensors from the CAN and activates the corresponding indicators.

The following table gives a list of existing cluster indicators and associated chime warnings:

Cluster Indicator	Associated Chime Warning	Description
Oil Pressure	-	This function warns the driver if the oil pressure becomes low. The FAM receives on a digital input the status of oil pressure switch and sends it on the CAN
Sediment Fuel Filter*	-	This function indicates that the fuel filter needs to be replaced. The FAM receives on a digital input the status of the fuel filter and sends it on the CAN
Brake Fluid	-	This function warns the driver if the brake fluid level becomes low. The FAM receives on a digital input the status of the brake fluid sensor and sends it on the CAN
Washer Fluid	-	This function warns the driver if the washer fluid level becomes low. The FAM receives on a digital input the status of the washer fluid sensor and sends it on the CAN
Seat Belt	Seat Belt Warning	This function warns the driver if the seat belt is not attached. The IPM receives on a digital input the status of seat belt switch and sends it on the CAN.The IPM activates also an associated chime warning.
Park Brake	Park Brake Warning	This function indicates that the park brake is activated. The IPM sends the parking brake warning on the CAN . This signal is based on following information: The status of the parking brake switch. The vehicle speed The brake fluid status. The IPM activates also an associated chime warning.
Charging Voltage	-	This function signals the low charging voltage level. The IPM receives on analog input the voltage of alternator L and sends a warning when the voltage is low on the CAN
Turn Indicators	-	This function signals that one of turn indicators is activated. The cluster module uses the Turn Indicator Ctrl CAN signal generated by IPM
High Beam	-	This function signals that the high beam lamps are activated. The cluster module uses the High Beam Ctrl CAN signal generated by IPM
Front Fog	-	This function signals that the front fog lamps are activated. The cluster module uses the Front Fog Lamp Ctrl CAN signal generated by IPM

Door Open	Doors open Warning	There are 4 individual door open indicators on the CL-U, such as driver door open switch indicator, passenger door open indicator, rear left door open indicator and rear right door open. The RAM receives on digital inputs the status of door open switch and sends it on the CAN. The IPM activates an associated chime warning.
Tailgate Open	Tailgate open Warning	This function indicates that the tailgate is opened. The RAM receives on digital inputs the status of tailgate open switch and sends it on the CAN. The IPM activates an associated chime warning.

The chime control function provides also the several chime warnings that are not associated with the cluster visual indications.

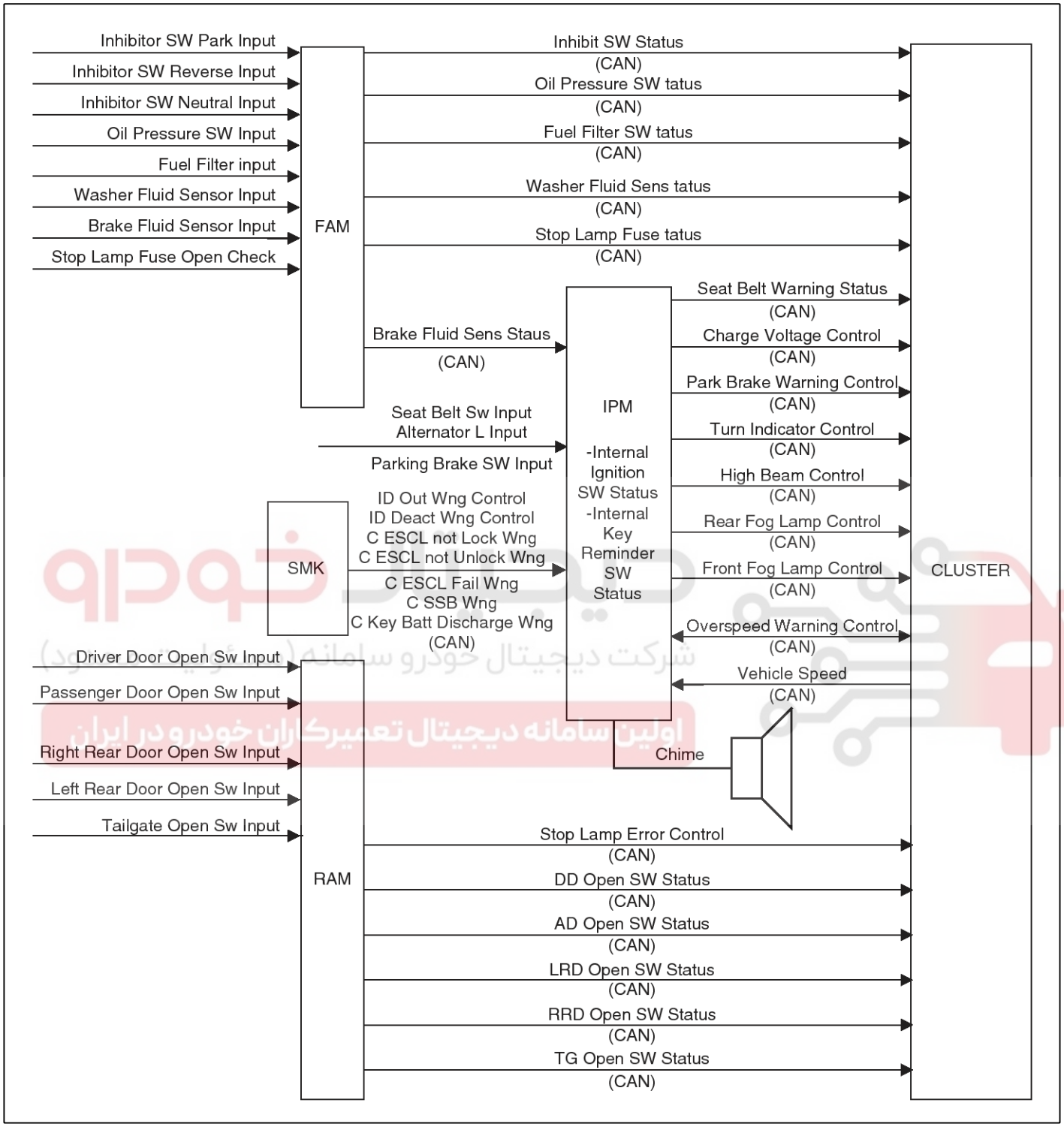
The following table gives a list of these warnings:

Chime Warning	Description
Over Speed Warning	The IPM receives the over speed warning by the CAN
Key Reminder Warning	This warning is based on the following information:The status of ignition key, from digital input. The status of the driver door, from CAN
Light Warning	This warning is based on the following information: The status of the driver door, from CAN . The light state of park and tail lamps, from digital inputs (MF switch)

All following SMK warnings are activated by IPM when receiving CAN signals from the SMK ECU.

SMK Chime warning	Description
ID Out Warning	Activated when a valid fob is not inside the vehicle, all doors are closed and ignition not off
Deactivation of IDs warning	Activated when a valid fob is inside the vehicle and alarm is in arm state
Escl not locked warning	Activated when all terminals are off and the Escl is not locked with a lock command
Escl not unlocked warning	Activated when all terminals are off and the Escl is not unlocked with an unlock command
Escl ecu fail warning	Activated when all terminals are off and a Escl failure is detected
SSB button warning	Activated when all terminals are off and a SSB failure is detected
Key battery discharging warning	Activated if key battery is low

Functional Diagram



SHMBE9083L

Seat Belt Warning

Description

Seat Belt Warning Chime and Indicator synchronization:

When the Seat Belt Warning Chime is activated, the Seat Belt Indicator is blinking simultaneously.

Description

Seat Belt Warning indicator :

The seat belt warning indicator (Seat Belt Warning Sts) can be lighted only when the ignition switch is in run or start position

Seat Belt Warning indicator :

If the Ignition Sw Sts is RUN or START when the Seat Belt Sw Input is fastened, the seat belt warning indicator (Seat Belt Warning Sts) is blinking for 6 seconds at 50% duty in 1.0 second

Seat Belt Warning indicator :

When Seat Belt Sw Input is not fastened, the seat belt warning indicator (Seat Belt Warning Sts) is blinking for 6 seconds at 50% duty in 1.0 second.

Seat Belt Warning indicator :

If the Seat Belt Sw Input is fastened during the 6 seconds, the seat belt warning indicator (Seat Belt Warning Sts) is blinking till the end of the 6 seconds

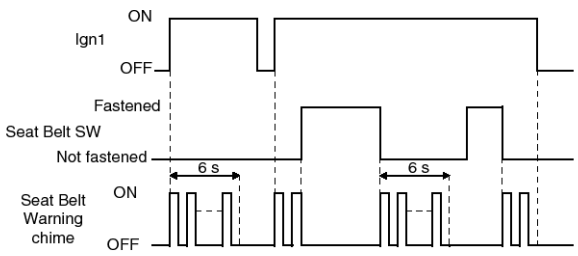
Seat Belt Warning chime :

The seat belt chime warning can be activated only when the ignition switch is in run or start position

Seat Belt Warning chime :

The chime is activated during 6 second when the seat belt is not fastened.

The chime will stop immediately if the seat belt is fastened during the 6 seconds of the chime.



SHMBE9084L

Safety and Security

Central Lock/Unlock

Description

Central locking/unlocking logic is controlled by IPM. Locking/Unlocking inputs are located in ADM, DDM (Lock/Unlock switch, door knobs, door key cylinder) and in IPM (RKE receiver).

Locking/Unlocking actuators are located in ADM for assist door, DDM for driver door and RAM for rear doors and tailgate.

There are 5 ways of operating central lock/unlock:

- With Key fob
- With Smart key ECU (when equipped)
- With Door Lock/Unlock switches located on ADM/DDM (assist/driver door trim).
- With Door Key Cylinder Lock/Unlock switches located on assist/driver door.
- Treatment for those switches depends on the country.

RAM/ADM/DDM Input Control

Except for RKE, all inputs for controlling lock/unlock actions are located on ADM, DDM or RAM.

ADM/DDM/RAM controls those inputs and manages the configuration according to the country. IPM controls central lock/unlock process.

If a lock/unlock command is issued by ADM/DDM to IPM through CAN, IPM does not check the command validity according to the country.

Door Lock Monitoring Switches

Door Lock Monitoring Switches are equipped on all vehicles. ADM/DDM send Assist door Lock Monitor Switch status/Driver door lock monitor switch status to IPM with value locked when the corresponding Door Monitoring Switch indicates a locked door and unlocked otherwise.

RAM sends rear right door Lock Monitor switch status/rear left door lock monitor switch status to IPM with “Locked” value when the right/left rear doors are locked, otherwise witH “Unlocked” value.

Concerning Tailgate Open Switch status is closed handle disabled when it is closed and locked and closed handle enabled when it is closed and unlocked

Door Key Cylinder

When Assist/Driver Door Key Cylinder request lock/unlock, ADM/DDM send assist door Key Cylinder Sw Sts/ Driver door Key Cylinder Sw Sts CAN signal with value lock/unlock.

Door Lock Switches

When Assist/Driver Door Lock Switch request lock, ADM/DDM send Assist door lock switch status /Driver door lock switch status CAN signal with value lock.

When Assist/Driver Door Lock Switch request unlock, ADM/DDM send Assist door lock switch status /Driver door lock switch status CAN signal with value unlock.

ADM/DDM Actuators Control

ADM and DDM control lock/unlock motors.

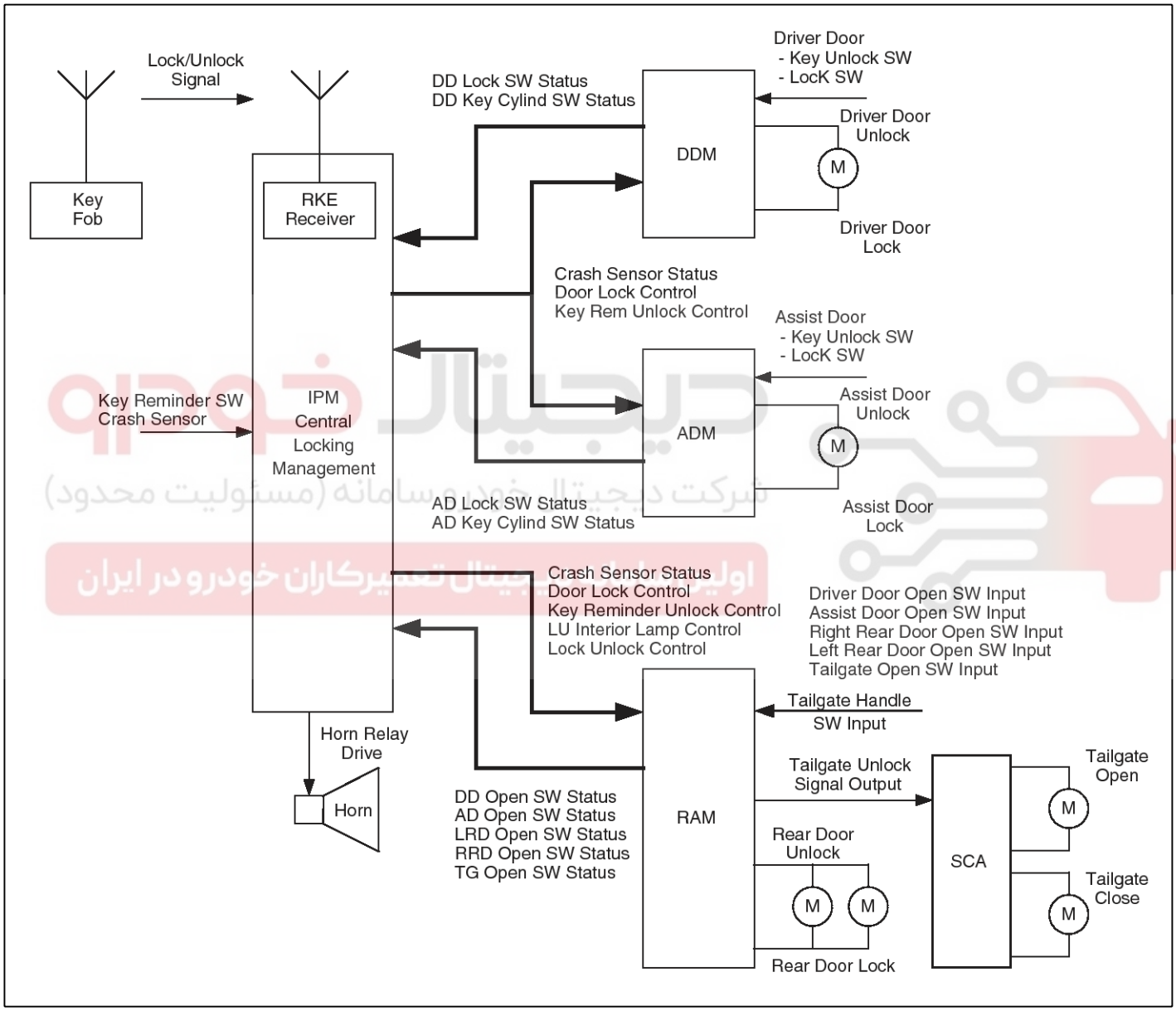
DDM

LOCK/UNLOCK is performed when DDM receives Door Lock Ctrl CAN signal from IPM

ADM

LOCK/UNLOCK is performed when ADM receives Door Lock Ctrl CAN signal from IPM

Main Functional Diagram



SHMBE9060N

Lock/Unlock With Door Lock Switch

Description

Lock/unlock with Door Lock Switch does not depend on Ignition Key position.

IPM

Description

Working conditions

For vehicle not equipped with burglar alarm :

All following requirements are applicable.

For vehicle equipped with burglar alarm :

In ARM alarm state, there is no action on door lock switch. So, all following requirements are applicable in alarm state disarm, prearm, 30sec delay, arm wait, alarm, after alarm and rearm.

Lock

Description

Locking process

Upon a transition of Assist door lock switch status or Driver door lock switch status CAN signal from any value to lock value, IPM issues Door Lock Ctrl CAN signal with value lock all for 500 ms.

Unlock

Description

Unlocking process

Upon a transition of Assist door lock switch status or Driver door lock switch status CAN signal from any value to unlock value, IPM issues Door Lock Ctrl CAN signal with value unlock all for 500 ms.

Unlocking process

When Assist door lock switch status and Driver door lock switch status CAN signal state change at the same moment, IPM uses Driver door lock switch status state for lock/unlock operation

This locking/unlocking process doesn't depend on the Driver Door Open Switch status, Assist Door Open Switch status, Rear Doors Open Switch status Tailgate Open Switch Status.

This locking/unlocking process doesn't activate or deactivate hazard lamps, horn or interior lamps.

Description

Fast lock / unlock

If IPM receives door lock/unlock command again while lock/unlock pulse (500ms) is ongoing, lock/unlock pulse is stopped immediately and new lock/unlock pulse is sent after 100ms time delay.

Lock/Unlock With Door Key Cylinder

Description

When a lock/unlock command is requested using Assist/Driver door key cylinder, ADM/DDM modules deal with this request according to §0 and use CAN signal to issue the command to IPM, then IPM issues central lock/unlock when Assist/driver door lock monitoring switches is locked/unlocked.

When IPM issues lock/unlock command, it does not check monitoring switches to make sure command was successful.

Key Off Unlock

Description

When the key is withdrawn from Ignition Key Cylinder if any door is locked, the IPM issues a command to unlock only locked doors.

Key Reminder Unlock

Description

The purpose of this function is to avoid locking the doors when the key is inserted in the Ignition Key Cylinder and the vehicle speed is lower than 3 km/h.

IPM

Description

Requirements for SMK only

There is no insertion of ignition key with SMK equipment, all following requirements are applicable for SMK equipment with these changes :

"key is inserted" must be replaced by CAN signal Key Reminder Sw Sts is set to value inserted

"key is not inserted, key is removed" must be replaced by CAN signal Key Reminder Sw Sts is set to value not inserted

If a SMK reminder unlock is on going, a Key reminder unlock is not taken into account.

Description

Key reminder unlock working condition

The key reminder function is active when key is inserted in the ignition key.

Description

Key reminder unlock for driver door lock change

When ignition key is inserted into the ignition key cylinder, driver door is open and driver door lock monitoring sw status changes from unlocked to locked, then Key Reminder Unlock Ctrl signal is sent with value DD long unlock (consisting in 1s +/-0.1s long driver door unlock)

Key reminder unlock, no interruption

The long unlock cannot be interrupted by any action (key removed, door closed…)

Description

Key reminder unlock, second unlock

If driver or assist door remains locked after the 1s long unlock and if driver or assist door is still OPEN And key is still inserted, then Key Reminder Unlock Ctrl signal is sent with values no value/short unlock at a rate of 0.5s/0.5s three times.

Key reminder unlock, interruption

The short unlock sequence is interrupted (after the current unlock has ended) if DD/AD Lock Monitoing Sw Sts is set to unlock, key is withdrawn from key cylinder or DD/AD Open Sw Sts is set to closed

Description

Key reminder unlock, door closing

When closing driver/assist door within 0.5 second after locking this door, Key Reminder Unlock Ctrl signal with long unlock value is sent

Key reminder unlock, door locking

When locking driver/assist door within 0.5 second after closing this door, Key Reminder Unlock Ctrl signal with long unlock value is sent

Description

Key reminder unlock, driver door opened when locked

If driver door is close to open when key reminder switch is IN and driver's door locked, then issue short unlock pulse for 0.5 sec.

Key reminder unlock, assist door opened when locked

If assist door is close to open when key reminder switch is IN and assist's door locked, then issue short unlock pulse for 0.5 sec.

Description

Key reminder unlock, key removed

When ignition key is removed within 0.5 second after pressing driver/assist door lock switch, key reminder function is cancelled (Key Reminder Unlock Ctrl at no action) and central door lock is issued.

Description

Key reminder unlock pattern

After issuing 4 successive unlock output, the reset condition for "Key reminder unlock function" is as follow :

Door open switch is Open to Close (In this case, issue one time unlock pulse for 0.5sec and then go to initial)

Key reminder switch is IN to OUT (No unlock output and go to initial mode)

Knob switch is Lock to Unlock (No unlock output and go to initial mode)

Description

Key reminder unlock while inserting key

When inserting a key into ignition key cylinder with door opened and locked, only LONG_UNLOCK unlock is issued (no short unlock).

RAM

Description

Key Reminder Unlock

When CAN signal Key Reminder Unlock Ctrl is received with Short Unlock,

Door Unlock is sent with value ON during 0.5s to right and left rear doors

Key Reminder Unlock

When CAN signal Key Reminder Unlock Ctrl is received with Long Unlock,

Door Unlock is sent with value ON during 1s to Tailgate, right and left rear doors

Key Reminder Unlock Priority

CAN signal Key Reminder Unlock Ctrl long or short unlock have higher priority than Door Lock Ctrl lock or unlock command

Description

Key reminder unlock, tailgate unlock

When CAN signal Key Reminder Unlock Ctrl is received with Short Unlock or Long Unlock and if tailgate is closed, tailgate Open Sw Sts is set to Closed Handle Enabled

Crash Unlock

Description

In case of crash of the vehicle, all doors must be unlocked as fast as possible.

IPM

Activation & Deactivation

Description

Crash Unlock Function Activation

The crash unlock function is activated after 100 ms delay after the ignition switch state is changed from off or ACC to RUN or START position (Ign1 active).

Crash Unlock Function

In case of crash, the time between the "Crash Sensor From Air Bag Unit" signal activation sent by the sensor and the unlock motors activation (driver door, assist door, Right/Left rear door and tailgate unlock) to unlock the doors must be less than 40 ms.

Crash Unlock Function Deactivation

The crash unlock function is deactivated when the ignition switch state is changed from run or start to ACC or off position.

There are two steps in deactivation:

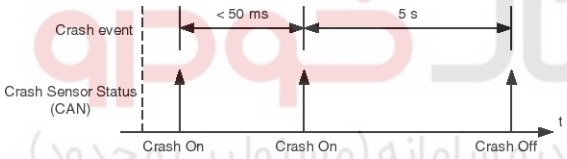
- crash sensor deactivation in ignition switch ACC or OFF position
- turn indicators deactivation in ignition switch OFF position (sending also the Crash Sensor Sts CAN signal with off value)

Crash Unlock Function

Description

Crash Unlock Function (initial unlock output)

When the vehicle crashes, the airbag unit activates the “Crash Sensor From Air Bag Unit” signal. IPM detects this signal change, filters it and sends the CAN signal Crash Sensor Sts with the following logic:



SHMBE9061N

Crash Unlock Function

After this initial unlock output, a 100 ms long pause (Crash Sensor Sts =off) is done and then if any door is still locked, CAN signal Crash Sensor Sts = ON is sent again for 5 s.

Crash Unlock Function

This unlock action is done one more time if doors are still locked after 2 unlock attempts. After 3 attempts, if any door is still locked, IPM stops trying to unlock and Crash Sensor Sts CAN signal is set to off.

Crash Unlock Function

Once a crash has occurred, Door Lock Ctrl cannot be set to lock doors until crash is cancelled (ignition switch status turned off). Only unlock is authorised.

After Crash Unlock

When all doors are unlocked by crash unlock function, if any door becomes locked, the IPM sends the CAN signal Crash Sensor Sts = ON again for 5sec then off

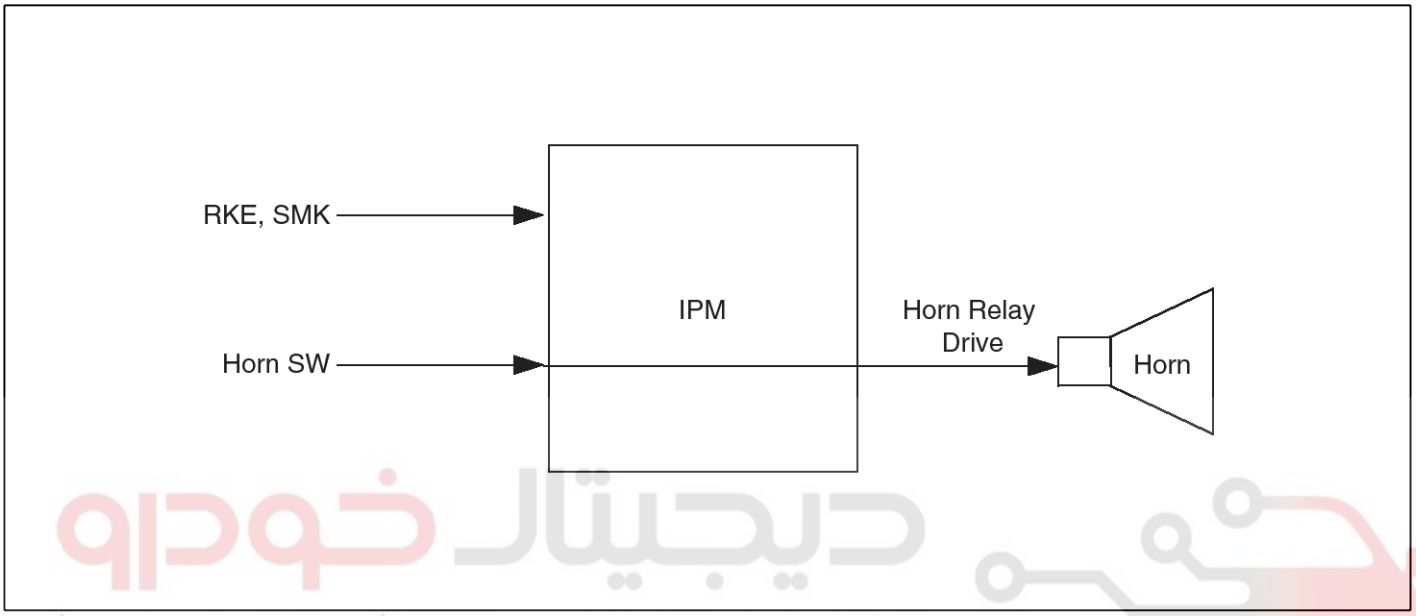
Horn

Description

The different ways of activation of the horn are:

The driver is directly activating the horn manually. Since the horn stalk switch is directly wired to the horn relay, the software does not manage this command.

Functional Diagram



SHMBE9113L

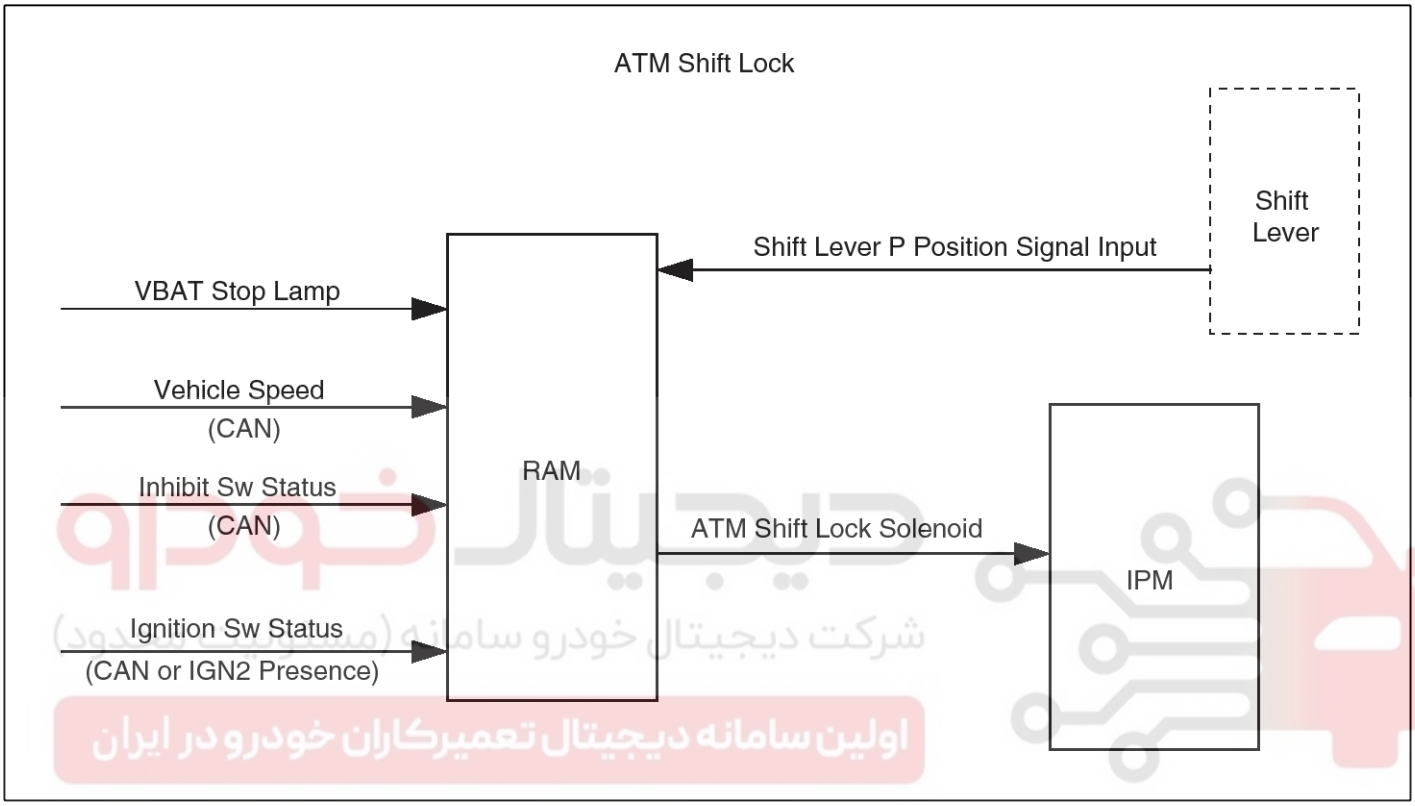
ATM Shift Lock

Description

The purpose of this function is to prevent gear change from <P> to others if no pressure is applied on brake pedal.

ATM stands for Automatic Transmission

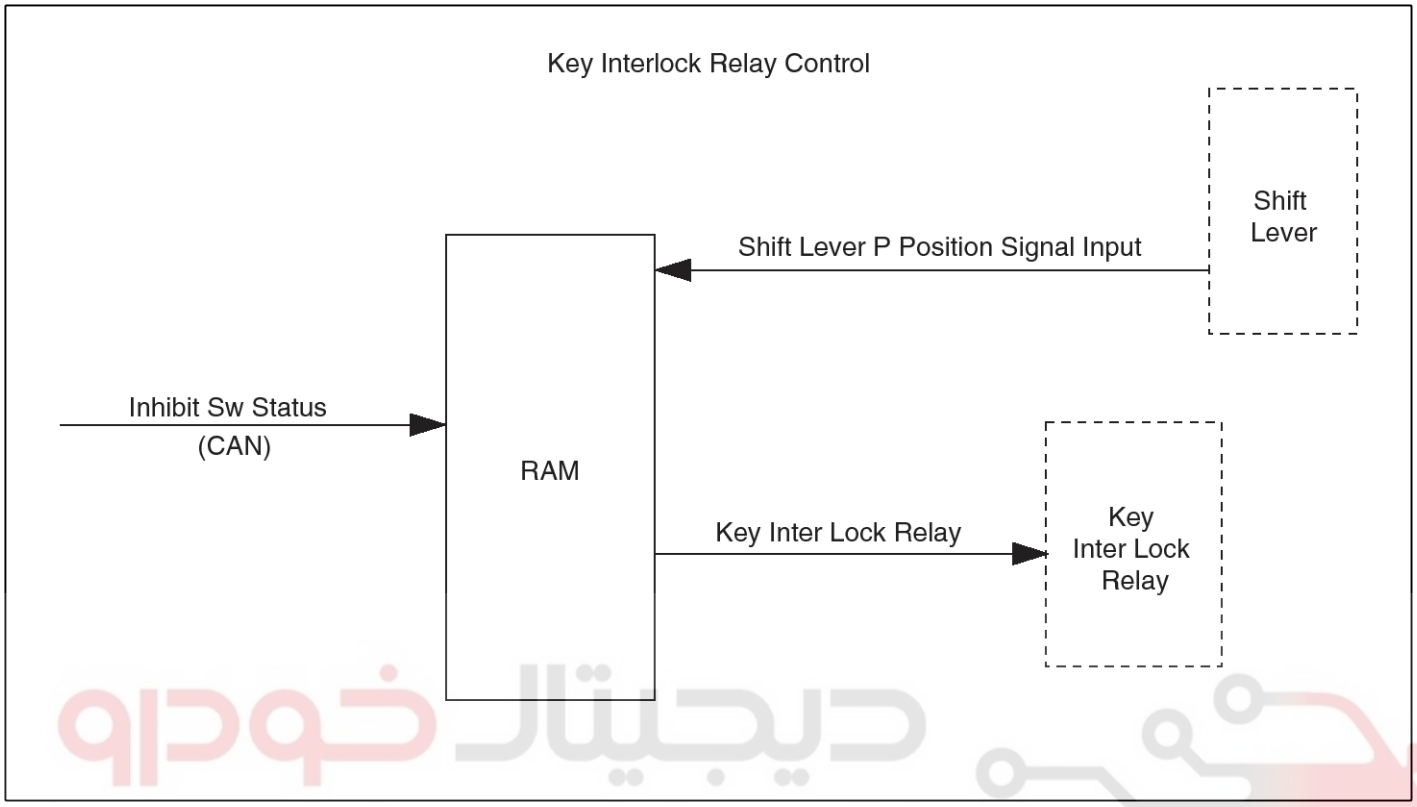
Functional Diagram



SHMBE9063N

Key Interlock Relay Control

Functional Diagram



SHMBE9064N

Answers back

Description

Answers back give a visual and/or sound feedback to user's action. These actions are linked to lock / unlock action and the alarm status (if equipped). Visual feedback is realized with the hazard turn indicators and the interior lighting, sound feedback with the horn sound.

IPM

Here are the different answers back with their description.

Description

Horn answer back sequence description

Horn lock sequence : Horn Relay Drive is set to ON for 50ms to activate the horn

Description

SMK sound answer back sequence description (with SMK system equipped)

SMK sound lock sequence : IPM sends the CAN signal Chirp Sound Ctrl with the value ON for 500ms then OFF

Description

Hazard answer back sequence description

Hazard lock sequence : IPM sends the CAN signal Turn Indicator Ctrl with the value all on for 1s to switch on hazard lamps then all off

Hazard unlock sequence : IPM sends the CAN signal Turn Indicator Ctrl with the sequence value all on / all off during 2s to blink the hazard lamps at 1Hz frequency (duty 50%) then all off

Description

Interior lighting answer back sequence description

Interior lighting lock sequence : IPM sends the CAN signal Interior Lamp Ctrl with the value lock for 500ms then off

Interior lighting unlock sequence : IPM sends the CAN signal Interior Lamp Ctrl with the value unlock for 500ms then OFF

BCM (Body Control Module) BE-113

Low Power Mode

Full Low Power Mode

Description

In normal mode, all modules and the CAN network are powered and running. All module functions are available; communication through the bus is possible as well as communication with the SCAN tool.

Low power mode is a state in which the modules try to lower their power consumption as much as possible in order to save energy. Low power mode can also be called “sleep mode”. In this mode, CAN bus communication is not available and the ignition key position is OFF (Acc = OFF Ign1 = OFF and Ign2 = OFF). In low power mode the normal features of the modules are not available. The modules have to switch to normal mode in order to perform their functions. Thus, in low power mode, the modules periodically monitor changes on a given set of inputs in order to detect a user request and then enter normal mode. Those monitored inputs are called “Wake Up” inputs.

Full low power is the lowest power consumption state in which all the modules inputs and outputs as well as the modules themselves are in their lowest power consumption state. This implies that none of the equipments controlled by the modules are active, i.e., they do not consume energy. For example, in full low power mode, keyhole illumination must be off. All power consumption measurements in low power mode are made in full low power mode.

Low power mode is entered to save energy when the car is not running. This implies that low power mode can only be entered when ignition key is in OFF position. In low power mode, the software is not running, hence all the modules features must be in a stable inactive state for low power mode to be entered. The exact conditions for allowing a module to enter low power mode depending on each function are described in requirements.

In order to enter low power mode, the K line transceiver must be powered down. This means that low power mode cannot be entered while the SCAN tool is connected.

Sequence for entering low power mode for one module is as follows:

Check that all the module functions are in a state where they can enter low power mode.

If all the module functions are in a state where they can enter low power mode for 10s, the module sends a CAN message informing that it is ready to enter low power mode.

When all the modules on the network are ready to enter low power mode, the IPM sends a CAN message authorizing the CAN to be shut down.

Once the CAN network is in low power mode, each module enters low power mode.

This process can be interrupted at any time to go back to normal mode when a wake up event is detected.

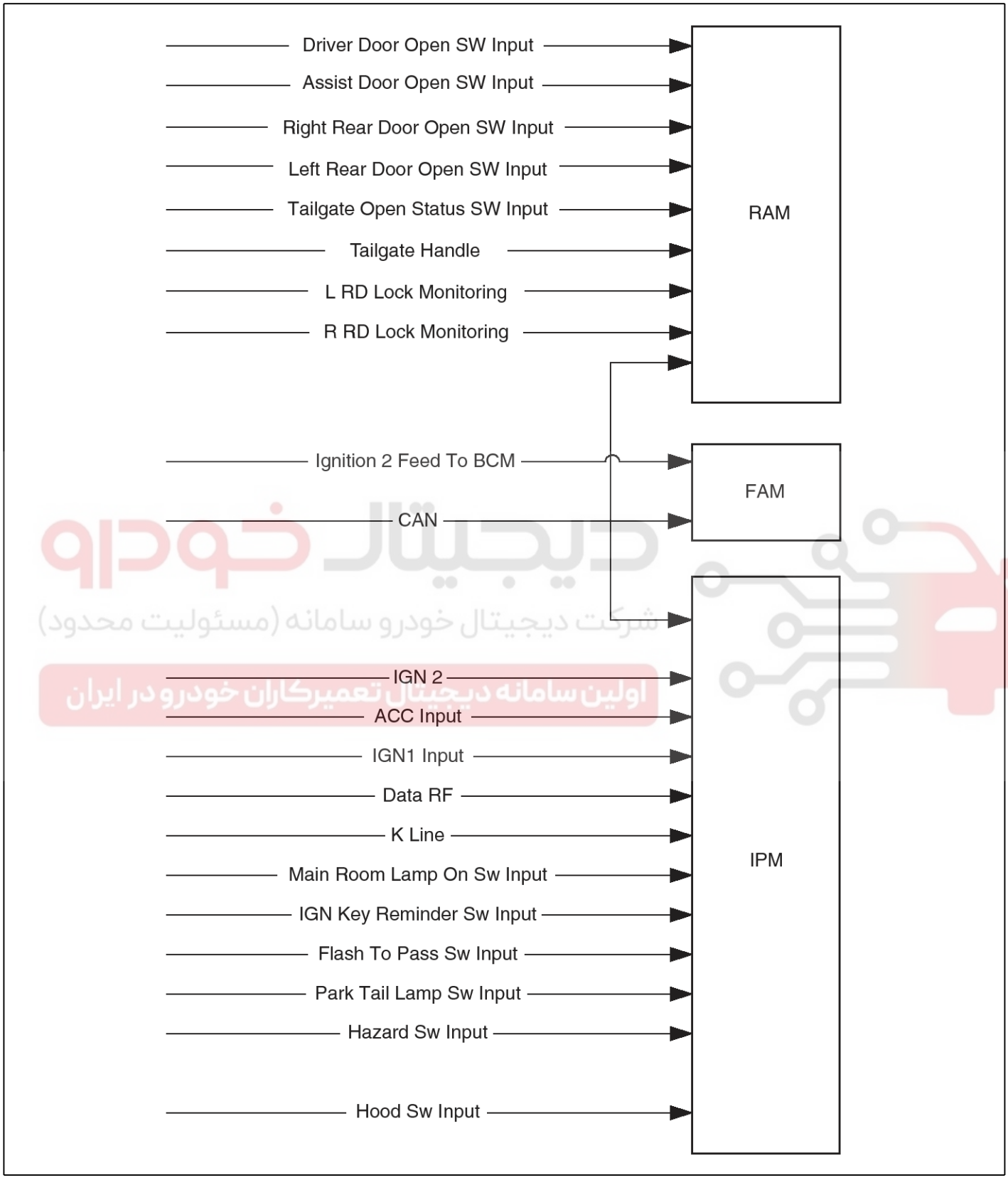
The transition process from normal to low power mode is the same whether full low power or intermediate low power mode is being entered.

Normal mode has to be entered from low power mode when changes on one or several inputs create a condition where one of the modules features must be activated. Since the modules cannot process the inputs in low power mode, they must enter normal mode to process the inputs and activate the requested feature.

In low power mode, the inputs that have an effect on the features active when ignition key position is OFF are monitored periodically in order to detect a valid “wake up” condition. Those inputs are called “wake up” inputs. They include several switches, Ign2, Ign1, Acc but also K line and CAN messages and a valid RKE signal.

In order to avoid false transitions to normal mode due to noise, wake up inputs are debounced before transition from low power to normal mode takes place.

Functional Diagram



SHMBE9085L

Intermediate Low Power Mode

Description

Intermediate low power is a state in which the modules lower their power consumption as much as possible. In this mode, one or several components connected to the modules are active. The modules reduce their power consumption but cannot achieve full low power mode because of those external components that need to be maintained in powered state.

Safe and Rescue Mode

Safe mode

Description

There are 2 safe modes:

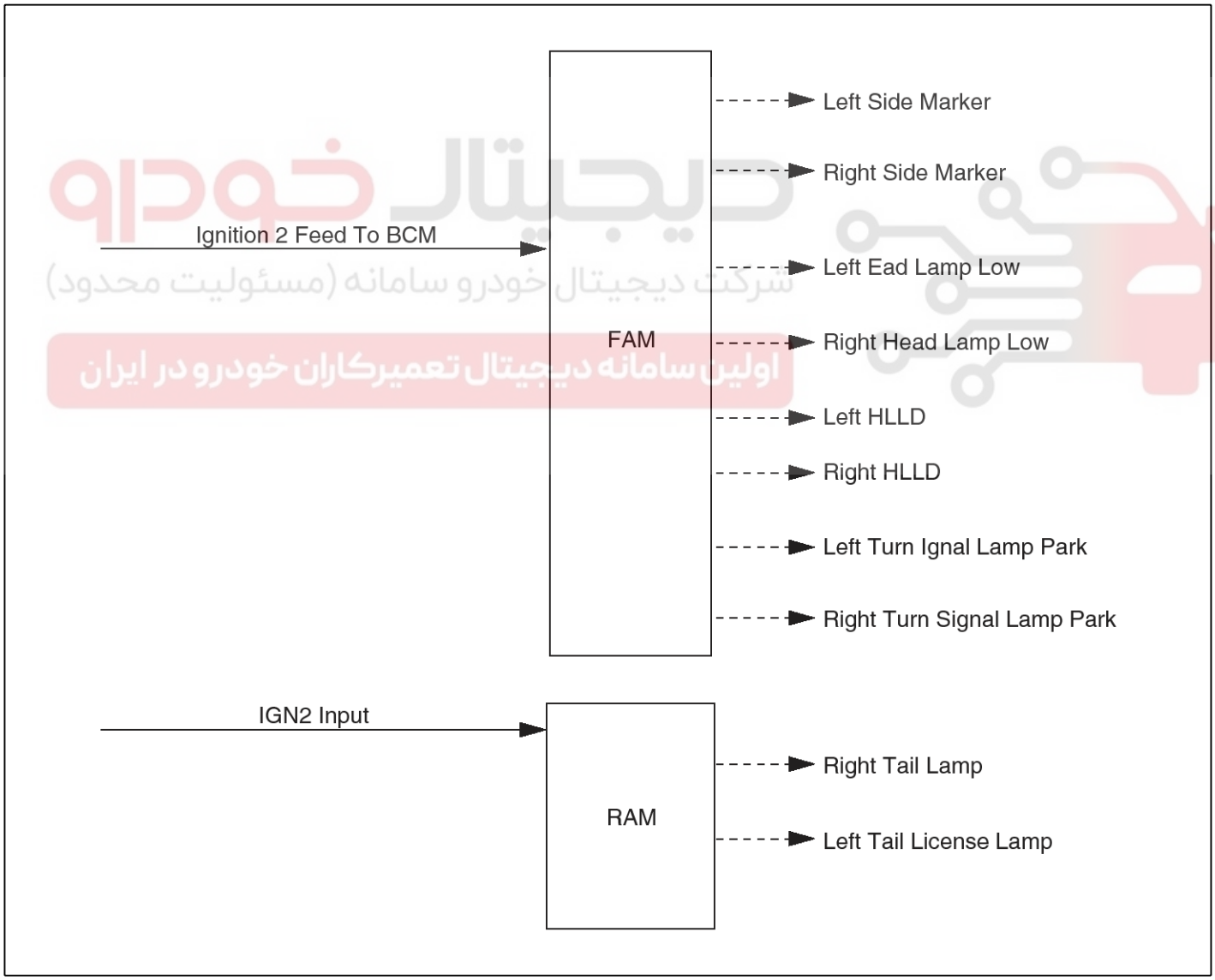
- Software safe mode;
- Hardware safe mode.

The software safe mode is a transition state entered as soon as one of the CAN signals monitored is lost. It is built in such a manner that the current state of the lighting on the low beams and tail lamps is kept. The rest of the functions follow their own default behavior.

This transition state is mainly used to avoid going back and forth between the normal mode and the rescue mode in case of sporadic trouble on a signal. This will avoid having the low beams and tail lamps being turned on/off for small periods.

The hardware safe mode consists in maintaining the state of the low beam if the exterior lighting was active before entering the safe mode.

Functional Diagram



SHMBE9066N

Rescue mode

Description

The goal of this mode is to be able to cope with failures that may happen on some of the most critical functionalities (for the driver security) of the system.

There are 2 rescue modes:

- The hardware rescue mode;
- The software rescue mode.

The software rescue mode consists in activating some safety functions when IGN2 input = ON:

Switch on the low beams (FAM), park lamps (FAM), tail lamps (RAM) and cluster backlighting (IPM);

Unlock of all the doors when the rescue mode is entered with IGN2 input = ON

All other functions (apart from head lamp low beams, tail lamps and front wipers) will try to behave as specified and will enter their own default mode if it is not possible.

Front wipers do not need to be turned on by software in rescue mode because wipers can be turned on by manually setting the MF switch to low speed. The FAM software must keep the same state as before entering the rescue mode.

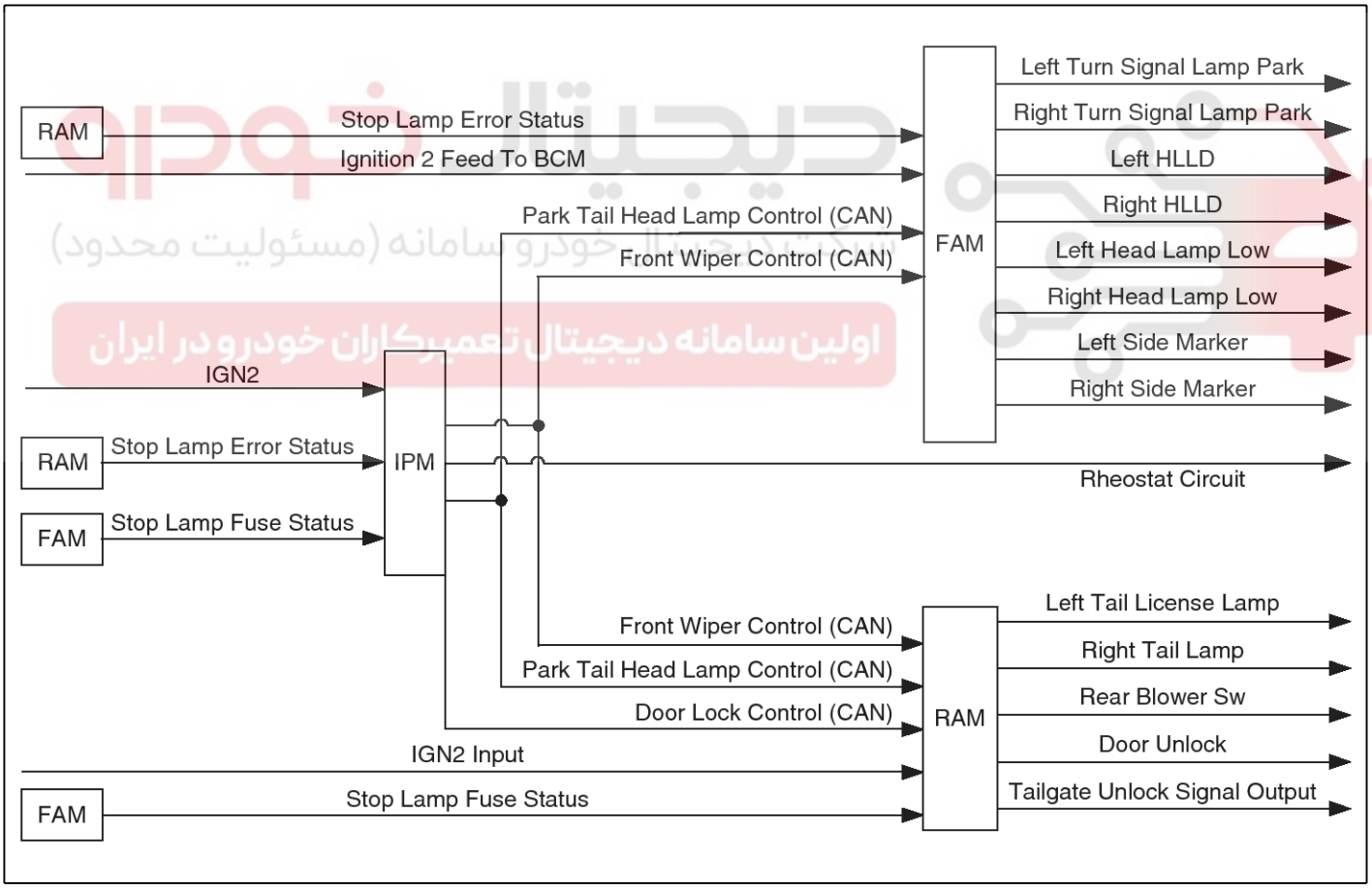
When IGN2 input = OFF, low beams, park/tail lamps and cluster backlighting are turned off.

The hardware rescue mode will switch on the low beams and the tail lamps. The front wipers are not taken into account due to the direct wiring of the stalk switch (low speed position).

The boards are designed to allow this hardware rescue mode to ensure their own integrity.

Note that none of the modules powered by IPM, RAM or FAM are kept powered in rescue mode.

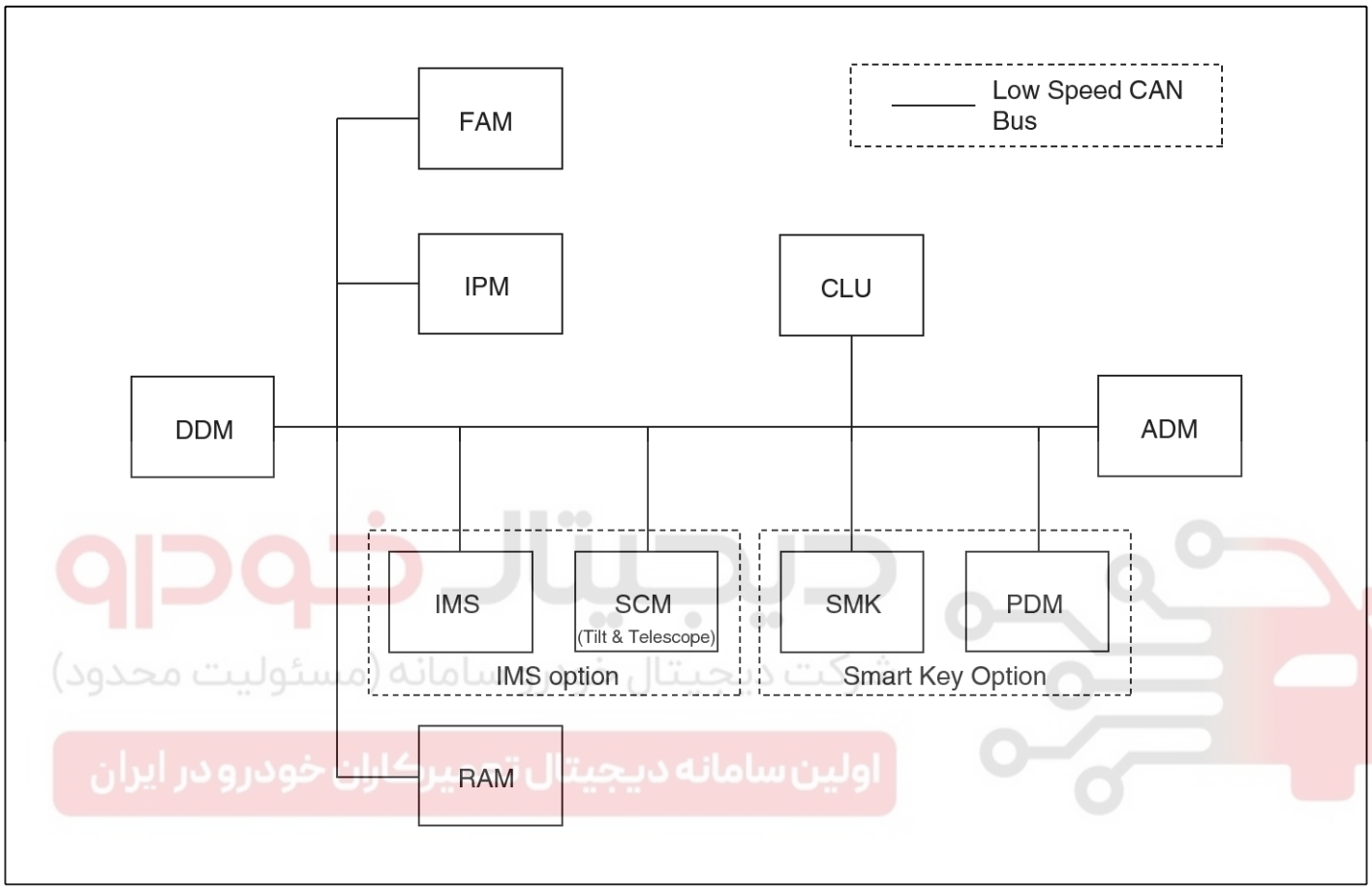
Functional Diagram



SHMBE9067N

Inspection

1. The body network system consists of several Modules that communicates via a CAN bus. The diagnostic tester is not directly connected to the CAN bus, but utilizes a one-wire communication line (K-line) that connects to a gateway in the IPM ECU.
2. The IPM communicates with the diagnostic tester directly. But other units operate self diagnostic, input/output monitoring and actuator operation via the IPM using the CAN communication.



SHMBE9072L

Input Monitoring

IPM (Instrument Panel Module)

No.	Input switch	Unit
1	IPM Node Availability	PRESENT/NOT PRESENT
2	FAM Node Availability	PRESENT/NOT PRESENT
3	RAM Node Availability	PRESENT/NOT PRESENT
4	DDM Node Availability	PRESENT/NOT PRESENT
5	ADM Node Availability	PRESENT/NOT PRESENT
6	IMS Node Availability	PRESENT/NOT PRESENT
7	CLU Node Availability	PRESENT/NOT PRESENT
8	SCM Node Availability	PRESENT/NOT PRESENT
9	SMK Node Availability	PRESENT/NOT PRESENT

10	PDM Node Availability	PRESENT/NOT PRESENT
11	IPM Node Failure	FAILURE/ O.K
12	FAM Node Failure	FAILURE/ O.K
13	RAM Node Failure	FAILURE/ O.K
14	DDM Node Failure	FAILURE/ O.K
15	ADM Node Failure	FAILURE/ O.K
16	IMS Node Failure	FAILURE/ O.K
17	CLU Node Failure	FAILURE/ O.K
18	SMK Node Failure	FAILURE/ O.K
20	PDM Node Failure	FAILURE/ O.K
21	Auto Head lamp	ON/OFF
22	Headlamp low beam	ON/OFF
23	Headlamp high beam	ON/OFF
24	Rear fog lamp	ON/OFF
25	Front fog lamp	ON/OFF
26	Park tail lamp	ON/OFF
27	Main room lamp	ON/OFF
28	Left turn signal	ON/OFF
29	Right turn signal	ON/OFF
30	Front wiper low speed switch(from multi function switch)	ON/OFF
31	Front wiper high speed switch(from multi function switch)	ON/OFF
32	Rear wiper low speed switch	ON/OFF
33	Rear wiper intermittent switch	ON/OFF
34	Front wiper intermittent switch	ON/OFF
35	Front washer	ON/OFF
36	Rear washer	ON/OFF
37	Windshield defogger	ON/OFF
38	Rear defogger	ON/OFF
39	Parking brake	ON/OFF
40	Hazard lamp switch	ON/OFF
41	Seat-belt	ON/OFF
42	Front headlamp washer switch	ON/OFF
43	Front wiper mist switch	ON/OFF
44	Headlamp high beam passing switch	ON/OFF
45	Ignition key reminder	INSERTED/NOT INSERTED
46	Crash sensor input from airbag unit	ON/OFF

47	IGN1	ON/OFF
48	IGN2	ON/OFF
49	ACC	ON/OFF
50	Hood Open switch	OPEN/CLOSED

FAM (Front Area Module)

No.	Input switch	Unit
1	Inhibitor Switch Neutral	ON/OFF
2	Inhibitor Switch Park	ON/OFF
3	Inhibitor Switch Reverse	ON/OFF
4	Brake Fluid Sensor State	OK/LOW
5	Washer Fluid Sensor State	OK/LOW
6	Fuel Filter State	OK/NG
7	Oil Pressure Switch State	OK/LOW
8	IGN2	ON/OFF
9	Front Wiper Park Switch State	Park/Out of park
10	Windshield defogger operation check	OK/NG

RAM (Rear Area Module)

No.	Input switch	Unit
1	Shift lever “P” position switch	ON/OFF
2	Passenger Door Open Switch	ON/OFF
3	Driver Door Open Switch	OPEN/CLOSE
4	Tailgate Door Open Switch	OPEN/CLOSE
5	RRD Open Switch	OPEN/CLOSE
6	RLD Open Switch	OPEN/CLOSE
7	RRD Power Window Up Switch	ON/OFF
8	RRD Power Window Down Switch	ON/OFF
9	RLD Power Window Up Switch	ON/OFF
10	RLD Power Window Down Switch	ON/OFF
11	RLD Lock Monitoring Switch	Lock/Unlock
12	RRD Lock Monitoring Switch	Lock/Unlock
13	IGN2	ON/OFF
14	Rear Wiper Park Switch	Park/Out of park
15	Rear defogger operation check input	ON/NG

DDM (Driver door module)

No.	Input switch	Unit
1	Door Lock Monitoring Switch	LOCK/UNLOCK

2	Door Lock Switch	ON/OFF
3	Door Unlock Switch	ON/OFF
4	Key Cylinder Door Lock Switch	ON/OFF
5	Key Cylinder Door Unlock Switch	ON/OFF
6	Fuel Filler Door Open Switch	ON/OFF
7	OSRVM(Outside Rearview Mirror) Select Switch	RH/LH/OFF
8	OSRVM direction Select Switch	RIGHT/LEFT/DOWN/UP/OFF
9	OSRVM Folding/Unfolding Switch	Folding/Unfolding
10	IGN 2 Switch	ON/OFF
11	Window Lock Switch	ON/OFF
12	Front Left Window Up Switch	ON/OFF
13	Front Left Window Down Switch	ON/OFF
14	Front Left Window Auto Up Switch	ON/OFF
15	Front Left Window Auto Down Switch	ON/OFF
16	Front Right Window Up Switch	ON/OFF
17	Front Right Window Down Switch	ON/OFF
18	Front Right Window Auto Up Switch	ON/OFF
19	Front Right Window Auto Down Switch	ON/OFF
20	Rear Right Window Up Switch	ON/OFF
21	Rear Right Window Down Switch	ON/OFF
22	Rear Left Window Up Switch	ON/OFF
23	Rear Left Window Down Switch	ON/OFF

ADM (Assist door module)

No.	Input switch	Unit
1	Door Lock Monitoring Switch	ON/OFF
2	Door Lock Switch	ON/OFF
3	Door Unlock Switch	ON/OFF
4	Key Cylinder Door Lock Switch	ON/OFF
5	Key Cylinder Door Unlock Switch	ON/OFF
6	IGN2 Switch	ON/OFF
7	Front Right Window Up Switch	ON/OFF
8	Front Right Window Down Switch	ON/OFF
9	Front Right Window Auto Up Switch	ON/OFF
10	Front Right Window Auto Down Switch	ON/OFF

Self-diagnosis

IPM DTC List

No.	DTC Code	DTC	Possible cause
1	B1102	Battery Voltage Low	Vbat < 9V
2	B1581	Ignition Switch Error	IG sw input is not coherent for more than 2s
2	B1588	FR Wiper/washer MF SW	MF switch status is not coherent for more than 2s
3	B1589	RR Wiper/washer MF SW	
4	B1590	Light MF SW Error	MF switch status is not coherent for more than 2s
5	B1591	Turn Signal MF SW Error	
6	B1602	CAN Bus Physical Bus F-ailure	Physical error indicated by network management
7	B1605	DDM COMM. Lost & bus Failure	DDM is missing in system configuration information reported from n-etwork management.
8	B1606	ADM COMM. Lost & bus Failure	ADM is missing in system configuration information reported from n-etwork management.
9	B1607	IMS COMM. Lost & bus F-ailure	IMS is missing in system configuration information reported from net-work management.
10	B1608	Lost Communication With SCM, Bus Failure	SCM is missing in system configuration information reported form n-etwork management.
11	B1609	Lost communication with SMK, bus failure	SMK is missing in system configuration information reported from n-etwork management
12	B1611	FAM COMM. Lost & bus Failure	FAM is missing in system configuration information reported from n-etwork management.
13	B1612	RAM COMM. Lost & bus Failure	RAM is missing in system configuration information reported from n-etwork management.
14	B1613	CLU COMM. Lost & bus F-ailure	CLU is missing in system configuration information reported from ne-twork management.
15	B1624	EEPROM Failure	Failed attempt to read or write EEPROM
16	B1627	EEPROM Corruption	Data in EEPROM is not coherent
17	B1628	Module CONF. Conflict	Hardware and software configuration are not coherent
18	B1646	S/W Rescue Mode	Module enters rescue mode
19	B1681	Lost communication with PDM, bus failure	PDM is missing in system configuration information reported from n-etwork management.

FAM DTC List

No.	DTC Code	DTC	Possible cause
1	B1624	EEPROM Failure	Failed attempt to read or write EEPROM
2	B1627	EEPROM Corruption	Data in EEPROM is not coherent
3	B1646	S/W Rescue Mode	As soon as the module enters rescue mode
4	B2119	Windshield Defog Relay Fail	Windshield defog relay failure

5	B2535	Right T/signal Lamp Short To Gnd	Right turn signal lamp circuit short to ground error
6	B2537	Right T/signal Lamp Open	Right turn signal lamp circuit open error
7	B2539	Left T/signal Lamp Short To Gnd	Left turn signal lamp circuit short to ground error
8	B2541	Left T/signal Lamp Open	Left turn signal lamp circuit open error
9	B2543	Right H/lamp High Short To Gnd	Right headlamp high circuit short to ground error
10	B2545	Right H/lamp High Open	Right headlamp high circuit open error
11	B2547	Left H/lamp High Short To Gnd	Left headlamp high circuit short to ground error
12	B2549	Left H/lamp High Open	Left headlamp high circuit open error
13	B2551	Right H/lamp Low Short T-o Gnd	Right headlamp low circuit short to ground error
14	B2553	Right H/lamp Low Open	Right headlamp low circuit open error
15	B2555	Left H/lamp Low Short To Gnd	Left headlamp low circuit short to ground error
16	B2557	Left H/lamp Low Open	Left headlamp low circuit open error
17	B2559	Fr Fog Lamp Short To Gn-d	Right front fog lamp circuit short to ground error
18	B2561	FR Fog Lamp Open	Right front fog lamp circuit open error
19	B2563	FL Fog Lamp Short To G-nd	Left front fog lamp circuit short to ground error
20	B2565	FL Fog Lamp Open	Left front fog lamp circuit open error
21	B2571	Right P/lamp Short To Gn-d	Right parking lamp circuit short to ground error
22	B2573	Right P/lamp Open	Right parking lamp circuit open error
23	B2575	Left P/lamp Short To Gnd	Left parking lamp circuit short to ground error
24	B2577	Left P/lamp Open	Left parking lamp circuit open error

RAM DTC List

No.	DTC Code	DTC	Possible cause
1	B1624	EEPROM Failure	Failed attempt to read or write EEPROM
2	B1627	EEPROM Corruption	Data in EEPROM is not coherent
3	B1646	S/W Rescue Mode	As soon as the module enters rescue mode
4	B2115	Rear Defog Relay Fail	Command active and check entry not active
5	B2441	RR Wiper P. POS. Detect Fail	Command active and park position does not change during 5s
6	B2535	Right T/signal Lamp Short To Gnd	Right turn signal lamp circuit short to ground error

7	B2537	Right T/signal Lamp Open	Right turn signal lamp circuit open error
8	B2539	Left T/signal Lamp Short To Gnd	Left turn signal lamp circuit short to ground error
9	B2541	Left T/signal Lamp Open	Left turn signal lamp circuit open error
10	B2579	RR Tail Marker Lamp Short To Gnd	Right tail license side marker lamp circuit short to ground error
11	B2581	RR Tail Marker Lamp Open	Right tail license side marker lamp circuit open error
12	B2583	RL Tail Marker Lamp Short To Gnd	Left tail license side marker lamp circuit short to ground error
13	B2585	RL Tail Marker Lamp Open	Left tail license side marker lamp circuit open error
14	B2587	Back Up Lamp Short To Gnd	Back up lamps for Back Up Warning System unit circuit short to ground error
15	B2589	Back Up Lamp Open	Back up lamps for Back Up Warning System unit circuit open error
16	B2599	RR Blower SW ILLU. Short To Gnd	Rear blower switch illumination short to ground

DDM DTC List

No.	DTC Code	DTC	Possible cause
1	B1603	CAN Bus error	CAN communication error
2	B1910	Left OSM horizontal motor or sensor error	Right OSM horizontal motor circuit open error
3	B1911	Left OSM vertical motor or sensor error	Right OSM horizontal motor circuit open error
4	B1952	OSRVM defogger error	Left OSM deicer circuit open error
5	B2330	Driver door lock actuator error	Assist door lock actuator circuit open error
6	B2331	Driver door unlock actuator error	Assist door unlock actuator circuit open error
7	B2529	Drive door courtesy lamp error	Driver door courtesy lamp circuit open error

ADM DTC List

No.	DTC Code	DTC	Possible cause
1	B1603	CAN Bus error	CAN communication error
2	B1912	Right OSM horizontal motor or sensor error	Right OSM horizontal motor circuit open error
3	B1913	Right OSM vertical motor or sensor error	Right OSM horizontal motor circuit open error
4	B1952	OSRVM defogger error	Right OSM deicer circuit open error

5	B2332	Assist door unlock actuator error	Assist door lock actuator circuit open error
6	B2333	Assist door unlock actuator error	Assist door unlock actuator circuit open error
7	B2533	Assist door courtesy lamp error	Assist door courtesy lamp circuit open error

IMS DTC List

No.	DTC Code	DTC	Possible cause
1	B1954	Slide motor or sensor error	Lost Communication With Slide motor sensor output for more than 2 s
2	B1955	Recline motor or sensor error	Lost Communication With Recline motor sensor output for more than 2 s
3	B1956	Front height motor or sensor error	Lost Communication With Front right motor sensor output for more than 1 s
4	B1957	Rear height motor or sensor error	Lost Communication With Rear right motor sensor output for more than 1 s

SCM DTC List

No.	DTC Code	DTC	Possible cause
1	B1959	Tilt motor or sensor errer	-
2	B1960	Tele motor or sensor error	-

Driving Actuator

IPM ACTUATOR LIST

No.	Description	Value	Control
1	Windshield Defog Switch Indicator Output	ON/OFF	Continuously ON
2	Rear Defog Switch Indicator Output	ON/OFF	Continuously ON
3	Rear Fog Lamp Switch Indicator Output	ON/OFF	Continuously ON
4	Back Up Signal Output	ON/OFF	Continuously ON
5	Micro Burglar Relay Drive Output	ON/OFF	Continuously ON
6	Ignition Key Hole Illumination	ON/OFF	Continuously ON
7	Adjustable Pedal On Off Signal Output	ON/OFF	Continuously ON
8	Power Feed To Sunroof Relay Coil	ON/OFF	Continuously ON
9	Horn Relay Drive	ON/OFF	0.5 sec ON then OFF
10	Sound Mute Signal Output	ON/OFF	Continuously ON
11	Panel Lights Trip Computer Output	ON/OFF	Continuously ON
12	Burglar Alarm Indicator	ON/OFF	Continuously ON
13	AV Tail Output	ON/OFF	Continuously ON
14	Chime	ON/OFF	Continuously ON with 0.6 sec period

BCM (Body Control Module) BE-125

FAM ACTUATOR LIST

No.	Description	Value	Control
1	Front Washer	ON/OFF	1 sec ON then OFF (once)
2	Rear Washer	ON/OFF	2 sec ON then OFF (once)
3	Right Headlamp High	ON/OFF	Continuously ON
4	Right Headlamp Low	ON/OFF	Continuously ON
5	Right Lamp Park	ON/OFF	Continuously ON
6	Right Fog Lamp	ON/OFF	Continuously ON
7	Right Turn Signal	ON/OFF	Continuously ON with (80 +/ - 5) cycles per minute, Duty: 50%
8	Left Headlamp High	ON/OFF	Continuously ON
9	Left Headlamp Low	ON/OFF	Continuously ON
10	Left Lamp Park	ON/OFF	Continuously ON
11	Left Fog Lamp	ON/OFF	Continuously ON
12	Left Turn Signal	ON/OFF	Continuously ON with (80 +/ - 5) cycles per minute, Duty: 50%
13	IGN2 Control	ON/OFF	Continuously ON
14	Headlamp washer	ON/OFF	Continuously ON
15	Windshield Defog Timer	ON/OFF	Continuously ON
16	Wiper On Off	ON/OFF	Continuously ON
17	Wiper Low speed	ON/OFF	3 wiping with LOW speed
18	Wiper High speed	ON/OFF	3 wiping with HIGH speed
19	Burglar Alarm horn	ON/OFF	Continuously ON with 60 cycles per minute, Duty:50%

RAM ACTUATOR LIST

No.	Description	Value	Control
1	Room Lamp LS	ON/OFF	Continuously ON
2	Room Lamp LS Door	ON/OFF	Continuously ON
3	Luggage Lamp LS	ON/OFF	Continuously ON
8	RRD Power Window Up	ON/OFF	3 sec ON then OFF (once)
9	RRD Power Window Down	ON/OFF	3 sec ON then OFF (once)
10	RLD Power Window Up	ON/OFF	3 sec ON then OFF (once)
11	RLD Power Window Down	ON/OFF	3 sec ON then OFF (once)
12	RR Seat Warmer switch	ON/OFF	Continuously ON
13	RL Seat Warmer switch	ON/OFF	Continuously ON
14	ATM shift lock solenoid	ON/OFF	Continuously ON

15	Key interlock solenoid	ON/OFF	Continuously ON
16	Tailgate unlock signal	ON/OFF	Continuously ON
17	Rear Defogger	ON/OFF	Continuously ON
18	Rear Fog Lamps	ON/OFF	Continuously ON
19	Right Turn Signal Lamp	ON/OFF	Continuously ON with (80 +/ - 5) cycles per minute, Duty: 50%
20	Left Turn Signal Lamp	ON/OFF	Continuously ON with (80 +/ - 5) cycles per minute, Duty: 50%
21	Back Up Lamp Back Up Warning System Unit	ON/OFF	Continuously ON
22	Left/Right Tail License Side Marker	ON/OFF	Continuously ON
23	Door Lock	ON/OFF	0.5 sec ON then OFF (once)
24	Door Unlock	ON/OFF	0.5 sec ON then OFF (once)
25	Rear Wiper Motor	ON/OFF	5 sec ON then OFF (once)
26	Rear Monitor illumination	ON/OFF	Continuously ON
27	Fuel Filler Door Solenoid	ON/OFF	0.5 sec ON then OFF (once)
28	Map Lamp LS	ON/OFF	Continuously ON

DDM ACTUATOR LIST

No.	Description	Value	Control
1	Door Courtesy Lamp	ON/OFF	Continuously ON
2	Door Lock Out	ON/OFF	0.5 sec ON then OFF (once)
3	Door Unlock Out	ON/OFF	0.5 sec ON then OFF (once)
4	OSRVM Up	ON/OFF	3 sec ON then OFF (once)
5	OSRVM Down	ON/OFF	3 sec ON then OFF (once)
6	OSRVM Left	ON/OFF	3 sec ON then OFF (once)
7	OSRVM Right	ON/OFF	3 sec ON then OFF (once)
8	OSRVM Defogger	ON/OFF	Continuously ON
9	Power Window up Out	ON/OFF	3 sec ON then OFF (once)
10	Power Window Down Out	ON/OFF	3 sec ON then OFF (once)
11	Illumination Out	ON/OFF	Continuously ON
12	OSRVM Folding	ON/OFF	Continuously ON
13	OSRVM Unfolding	ON/OFF	Continuously ON
14	OSRVM Turn signal lamp	ON/OFF	Continuously ON

ADM ACTUATOR LIST

No.	Description	Value	Control
1	Door Courtesy Lamp	ON/OFF	Continuously ON
2	Door Lock Out	ON/OFF	0.5 sec ON then OFF (once)
3	Door Unlock Out	ON/OFF	0.5 sec ON then OFF (once)
4	OSRVM Up	ON/OFF	3 sec ON then OFF (once)
5	OSRVM Down	ON/OFF	3 sec ON then OFF (once)
6	OSRVM Left	ON/OFF	3 sec ON then OFF (once)
7	OSRVM Right	ON/OFF	3 sec ON then OFF (once)
8	OSRVM Defogger	ON/OFF	Continuously ON
9	Power Window up Out	ON/OFF	3 sec ON then OFF (once)
10	Power Window Down Out	ON/OFF	3 sec ON then OFF (once)
11	Illumination Out	ON/OFF	Continuously ON
12	OSRVM Folding	ON/OFF	Continuously ON
13	OSRVM Unfolding	ON/OFF	Continuously ON
14	OSRVM Turn signal lamp	ON/OFF	Continuously ON

IMS Actuator List

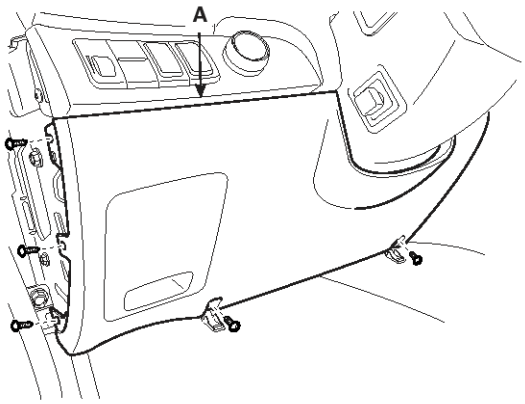
No.	Description	Value	Control
1	Power Seat Slide Forward Motor	ON/OFF	Continuously ON
2	Power Seat Slide Backward Motor	ON/OFF	Continuously ON
3	Power Seat FR Height Up Motor	ON/OFF	Continuously ON
4	Power Seat FR Height Down Motor	ON/OFF	Continuously ON
5	Power Seat RR Height Up Motor	ON/OFF	Continuously ON
6	Power Seat RR Height Down Motor	ON/OFF	Continuously ON
7	Power Seat Recline Forward Motor	ON/OFF	Continuously ON
8	Power Seat Recline Backward Motor	ON/OFF	Continuously ON

SCM Actuator List

No.	Description	Value	Control
1	Steering Column Tilt Up Motor	ON/OFF	Continuously ON
2	Steering Column Tilt Down Motor	ON/OFF	Continuously ON
3	Steering Column Telescopic Forward Motor	ON/OFF	Continuously ON
4	Steering Column Telescopic Backward Motor	ON/OFF	Continuously ON

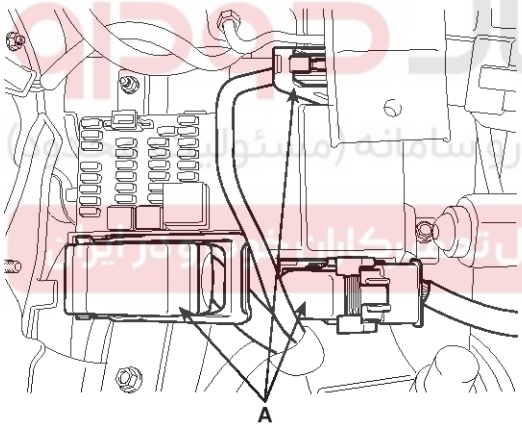
Removal

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



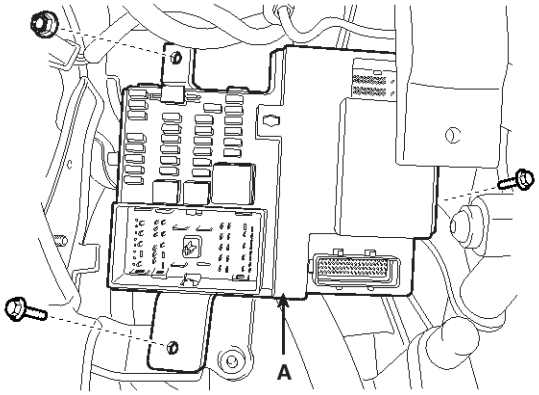
SHMBE8132D

3. Remove IPM(Instrument Panel Module) connector(A)



SHMBE8133D

4. Remove IPM(Instrument Panel Module) after loosening mounting bolts(3EA).



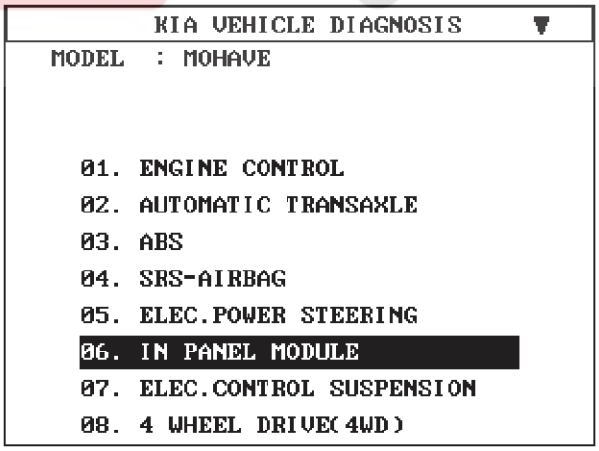
SHMBE8134D

Installation

1. Install IPM(instrument Panel Module)
2. Connect the IPM connector
3. Install the crash pad lower panel

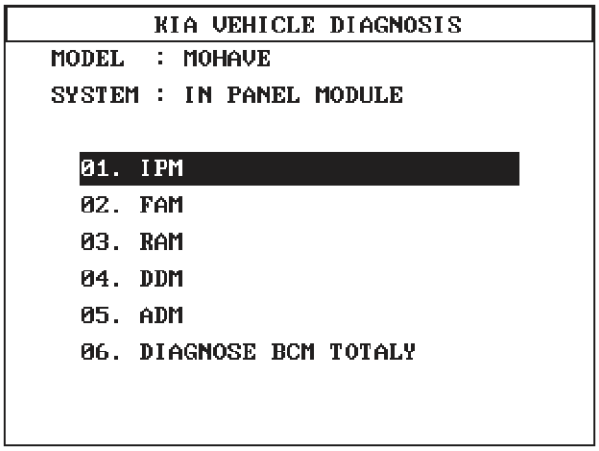
Trouble Diagnostics When Using Diagnosis Tool

1. The diagnosis tool supports quick diagnosis of supported body electrical systems through input/output monitoring and actuation testing.
2. To diagnose the IPM function, select the menu of model and In-panel module(IPM).



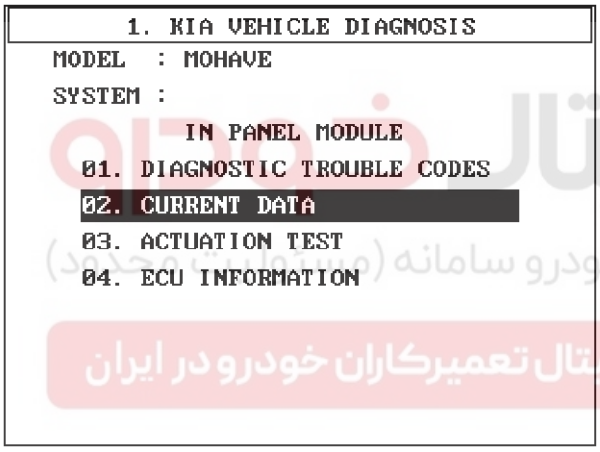
SHMBE9102L

3. Select the module menu to diagnose.

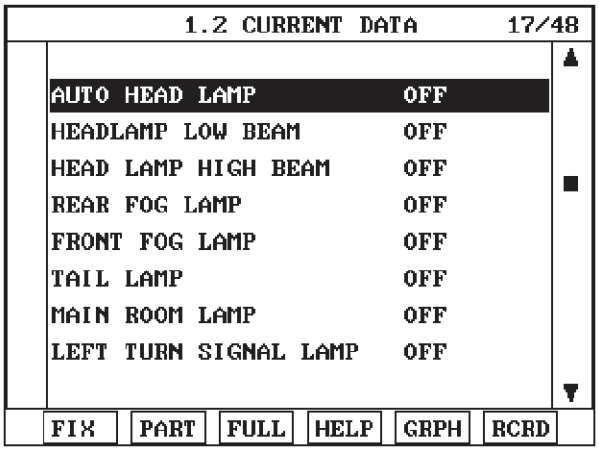


SHMBE9103L

4. The CURRENT DATA function is used to monitor input/output conditions.

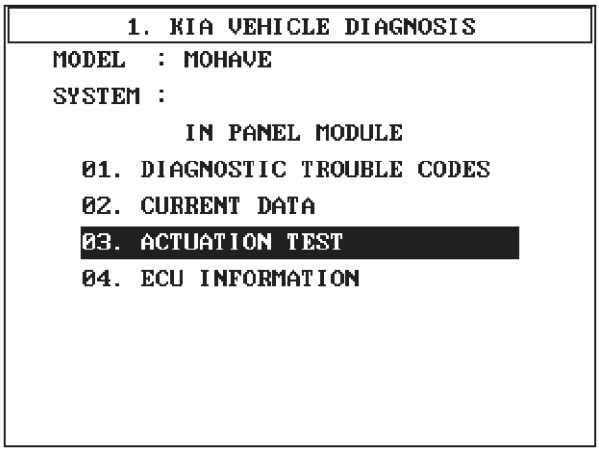


SHMBE9104L

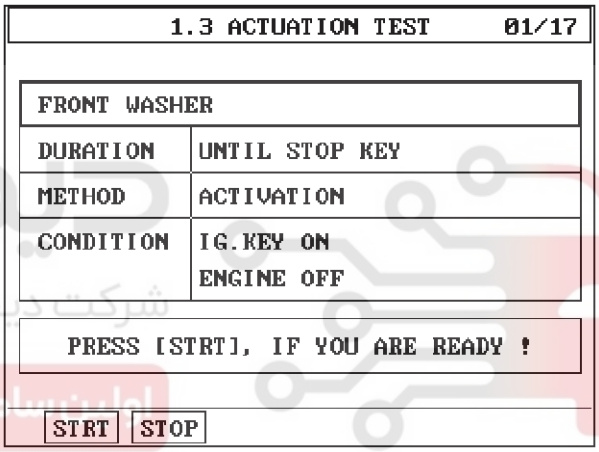


SHMBE9088N

5. Use the ACTUATION TEST mode to force output devices to operate for testing purposes.

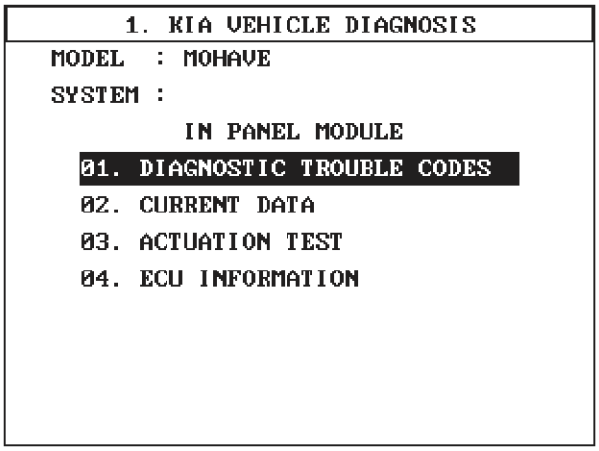


SHMBE9106L



SHMBE9091N

6. Use the "DIAGNOSTIC TROUBLE CODES" mode.



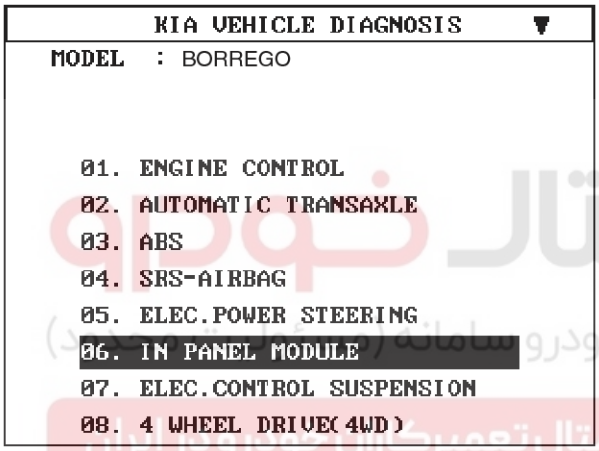
SHMBE9114L

User Option Mode

The BCM offers 3 items user option mode for a user convenience (AUTO DOOR UNLOCK, AUTO DOOR LOCK, IMS & SCM CONFIGURATION)

- It is able to set up the enable or disable of AUTO DOOR LOCK function or AUTO DOOR LOCK operation when using it.
- It is able to set up the enable or disable of AUTO DOOR UNLOCK function or AUTO DOOR UNLOCK operation when using it.
- It is able to set up the enable or disable of IMS & SCM configuration.

1. Select the model and press ENTER.
2. Select option "In-panel module (IPM)" and press ENTER.



SHMBE9085N

3. Select option "USER OPTION" and press ENTER.
4. Select option "AUTO DOOR LOCK STATUS by using the direction button(▲ / ▼).
5. Select the parameter by using the direction button(◀ / ▶) and press ENTER to save it.

   (Disable / 20km/h / 40km/h / P → R)
6. Select option "Auto door unlock" by using the direction button(▲ / ▼).
7. Select the parameter by using the direction button(◀ / ▶) and press ENTER to save it.

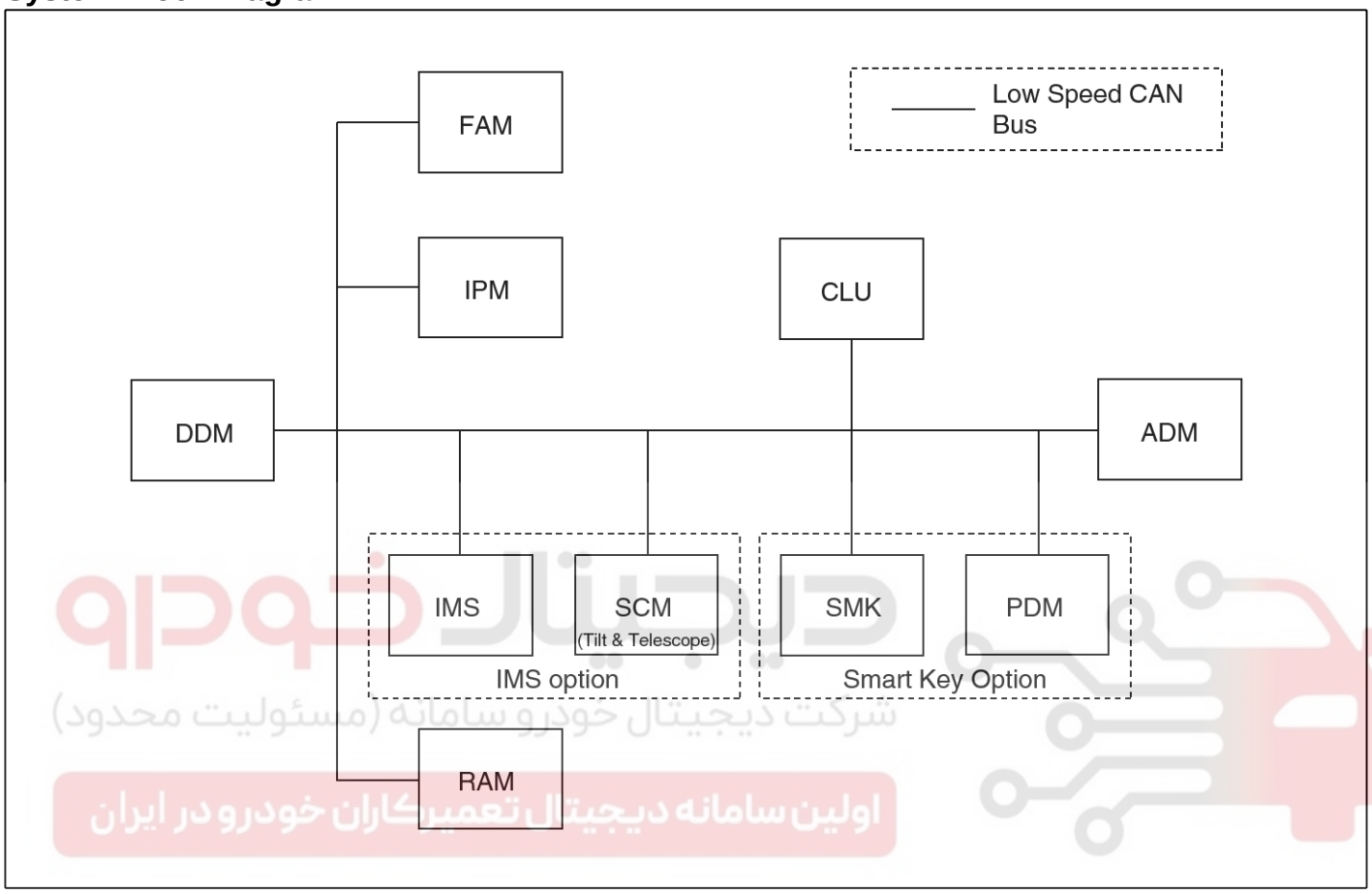
   (Disable / KEY OFF / R → P / D. D. UNLOCK)
8. Select option "IMS & SCM configuration" by using the direction button(▲ / ▼).
9. Select the parameter by using the direction button(◀ / ▶) and press ENTER to save it.

   (Disable all / Enable SCM / Disable all)

Body network system

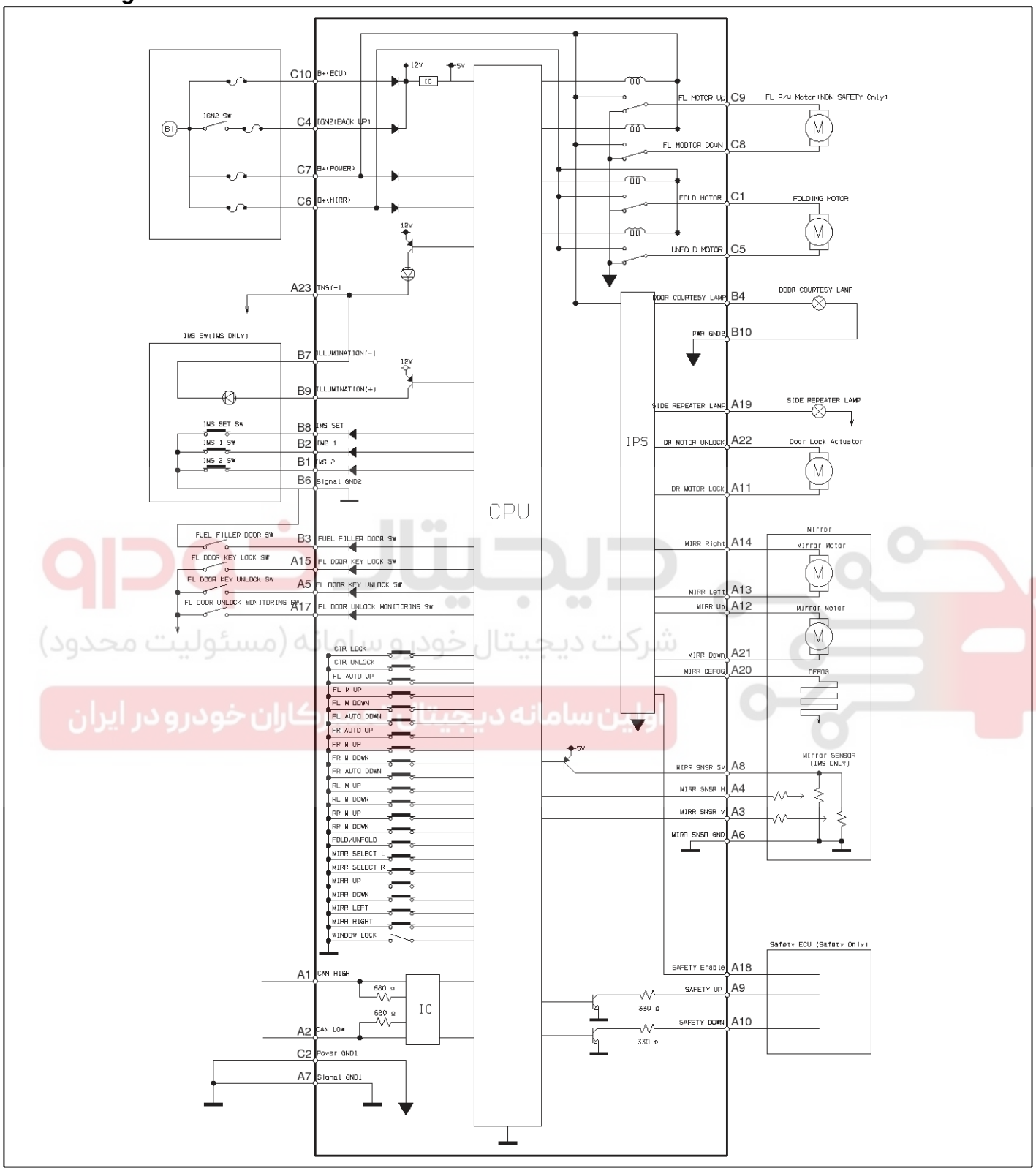
Driver Door Module (DDM)

System Block Diagram



SHMBE9072L

Circuit Diagram



SHMBE9279N

※ Connector pin information

- Refer to the power window switch - "component"

Description

The driver door module(DDM) is a part of a Controller Area Network (CAN), and performs CAN communication with the FAM, IPM, RAM, ADM, IMS and SCM. Driver controls driver side power window switch button located inside of the driver side door to operate power window, mirror, door lock and unlock.

1. Two manual operations (up and down) for four p/windows. However, on the driver's seat the auto up/down operation must be possible.
2. Manually operating the mirror position by the manual switch (Up, Down, Right, and Left)
3. Saving and replacing the mirror position by RKE → For 2 persons
4. Out side mirror auto reverse operation
5. Out side mirror fold/unfold power control
6. Central door lock/unlock function
7. Door courtesy lamp control
8. Out side mirror defog control
9. Illumination control
10. Outside mirror turn signal lamp control.

Control Function

Power Window

Power Window Control

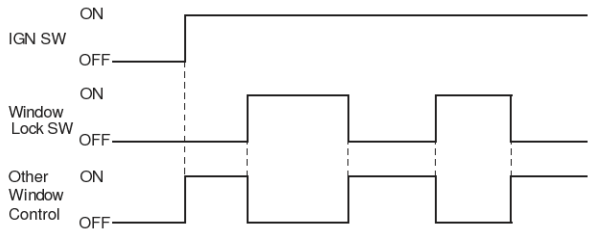
1. According to the input at DR as window manual up/down, RL window manual up/down, RR window manual up/down Switch of the SW ASSY P/WDW main, the inputted signal will be sent out (ADM, RAM) through CAN Communication. Simultaneously, DDM will send out manual up/down, auto up/down signal.

   (message : AD Window Motor Ctrl, RLD Window Sw Sts, RRD Window Sw Sts)
2. Driver Door Window control :
   - Safety spec. : According to the input of Driver Door Window Auto, up/down SW, output Manual up/down, AUTO UP/DOWN signal to Safety window module.
   - Down Only spec. : According to the input of Driver Door Window Auto, up/down SW, Operate by the input of Driver Door Window auto, up/down SW.
     - If the motor operation lasts over 10sec ±1sec from Manual up/down SW input, output of the motor will be OFF.
     - Current sensing method adopted Stop current : 13 ± 1A, delay time : 0.5sec ± 0.2sec

Power Window Lock

Under the condition, power window lock SW of SW ASSY P/WDW main(DDM) is "ON", Instruction from power window lock is sent out through can message, there by power window operation is controlled only from the driver's door and prohibited from any other doors.

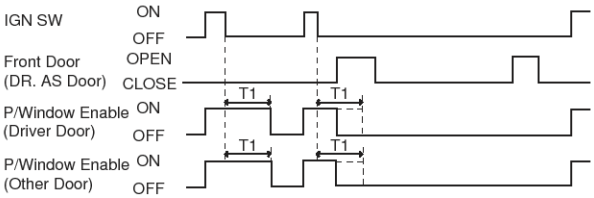
(Message: Power Window Lock Sw Sts = LOCK)



SHMBE9280N

Power Window Timer Function

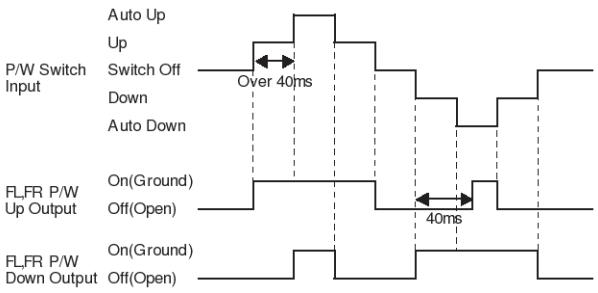
1. It is a message from IPM. (Message : After run Ctrl).
2. Under the condition "IGN ON -> IGN OFF", Power Window SW Control Function lasts for "30 sec". But, it immediately terminates to OFF when front door is opened.



SHMBE9281N

Safety Power Window

1. Drive door and assist door apply to, In condition of IGN2 On or After Run Ctrl (CAN) On Door door is controlled by DDM, assist door is controlled by CAN message (message :AD Window Ctrl)
2. P/WDW main SW (DDM) control signal of down, auto up, auto down.



SHMBE9282N

Power Window control

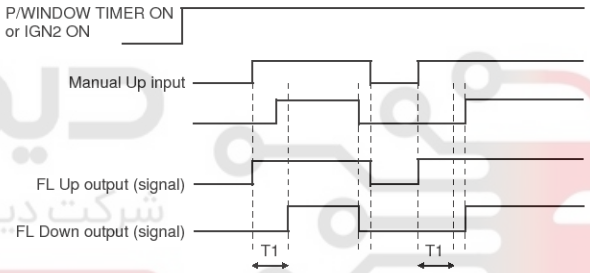
1. P/Window enable signal on condition
   - P/Window timer(from IPM) ON or IGN2 (DDM itself) ON

   (When satisfied with one of two condition)
2. up/down control signal
   - P/WDW timer(from IPM) ON or IGN2 (DDM itself) ON

SWITCH state	UP SIG	DOWN SIG	P/WINDOW ENABLE SIG
State(OFF)	Off	Off	On
Manual Up	On	Off	On
Manual Down	Off	On	On
Manual Up → Auto Up	On (maintenance)	Off → On	On
Manual Down → Auto Down	Off -> On	On (maintenance)	On
Off → Auto Up	On	Off(40ms) → On	On
Manual Down → Auto Up			
Auto Down → Auto Up			
Off → Auto Down	Off(40ms) → On	On	On

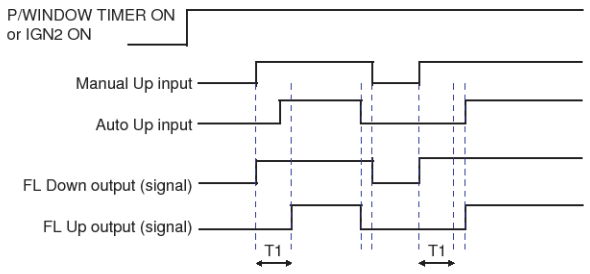
* P/WINDOW TIMER(FROM IPM) OFF & IGN2(DDM ITSELF) OFF, independently of Switch's state UP SIGNAL and DOWN SIGNAL are OFF state preservation

1) Auto/Manual Up Output(Signal) Operation Time Chart(T1:40mS ± 10mS)



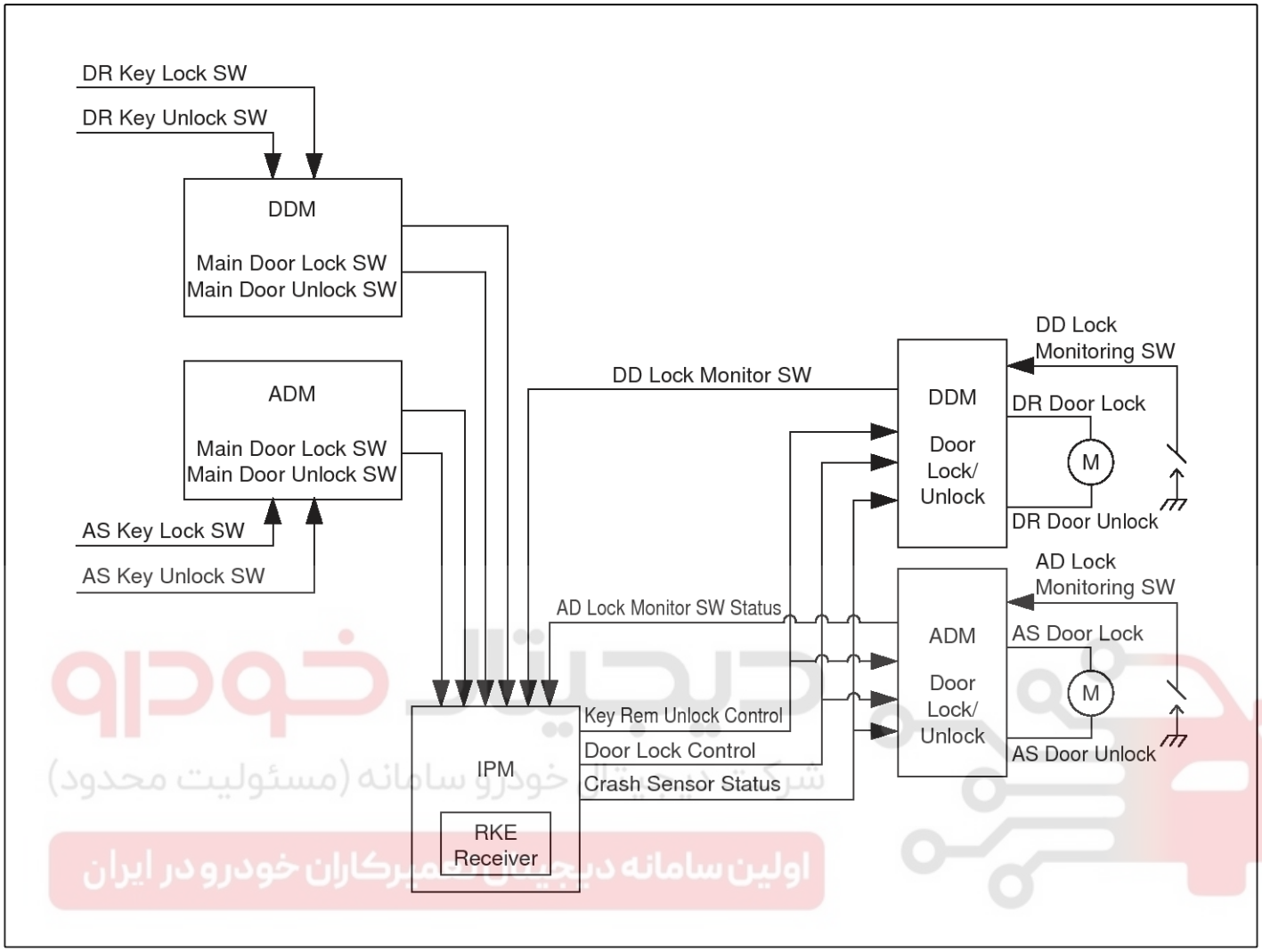
SHMBE9283N

2) Auto/Manual Down Output(Signal) Operation Time Chart(T1:40mS ± 10mS)



SHMBE9284N

Door Lock/Unlock (controlled by IPM)

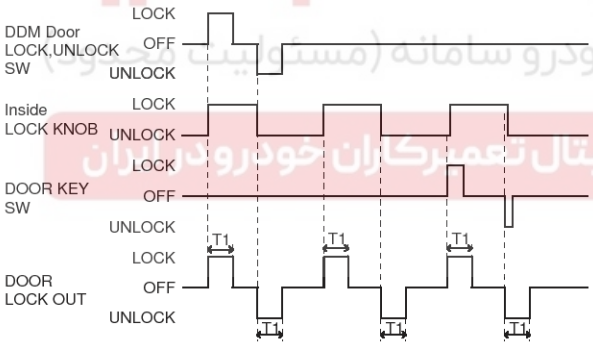


SHMBE9115L

1. Lock/unlock controlled by can message from IPM (message : Door Lock Ctrl , Key Remember Unlock Ctrl, Crash Sensor Sts)
2. If Door Lock monitoring switch is "Lock" or "Unlock", DD Lock monitor SW Sts message is sent to "Locked" or "Unlocked".
3. Lock changes to unlock or unlock changes to lock, there will be delay time for 100ms.(controlled by IPM)

Item			Action
Driver Door	Key Cylinder	Lock	All Door Lock
		Unlock	All Door Unlock
	Knob	Lock	No Action
		Unlock	No Action
	Main SW (P/WDW SW)	Lock	All Door Lock
		Unlock	All Door Unlock
Assist Door	Key Cylinder	Lock	All Door Lock
		Unlock	All Door Unlock
	Knob	Lock	No Action
		Unlock	No Action
	Main SW (P/WDW SW)	Lock	All Door Lock
		Unlock	All Door Unlock
RKE		Lock	All Door Lock
		Unlock	All Door Unlock

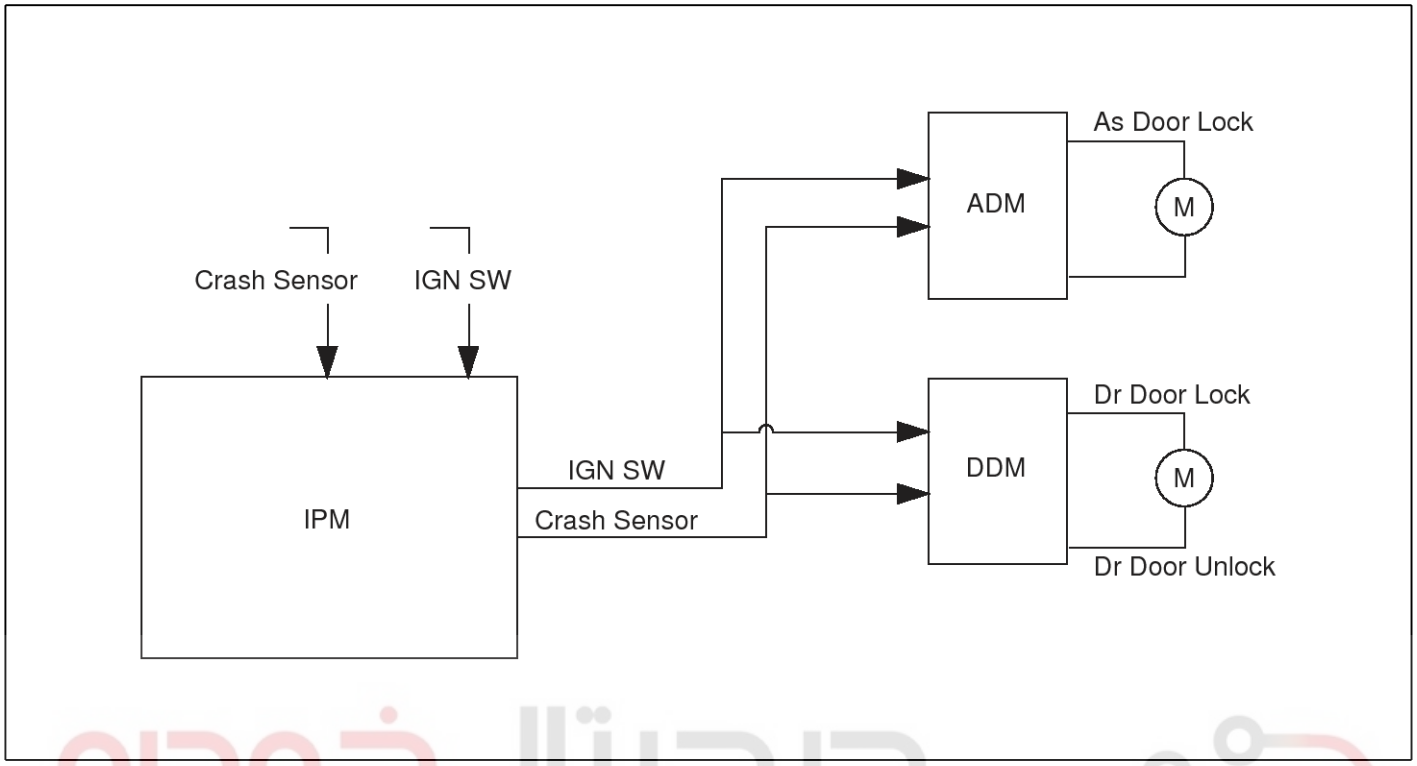
Central Door Lock/Unlock



SHMBE9286N

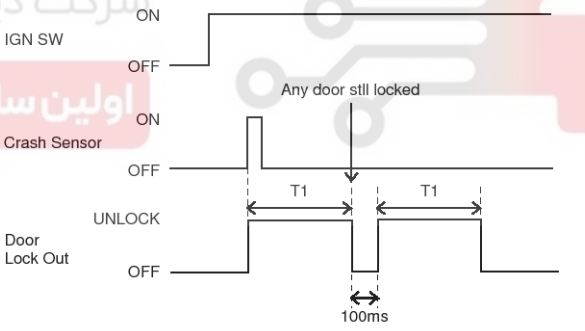
1. If Central door lock/unlock Sw is "on", driver door lock Sw Sts message is sent to lock/unlock.
2. If Key cylinder lock switch is "on", driver door key cylinder Sw Sts message is sent to lock.
3. If Key cylinder unlock switch is "on", driver door key cylinder Sw Sts message is sent to unlock.
4. If door lock Ctrl message from IPM is "driver door lock, driver door and assist door lock, rear door, tailgate and driver door lock, lock all", door lock actuator is locked for O.5sec.
5. If door lock Ctrl message from IPM is "driver door unlock, driver door and assist door unlock, rear door, tailgate and driver door unlock, unlock all", or lock actuator is unlocked for O.5sec.

Crash Unlock (controlled by DDM)



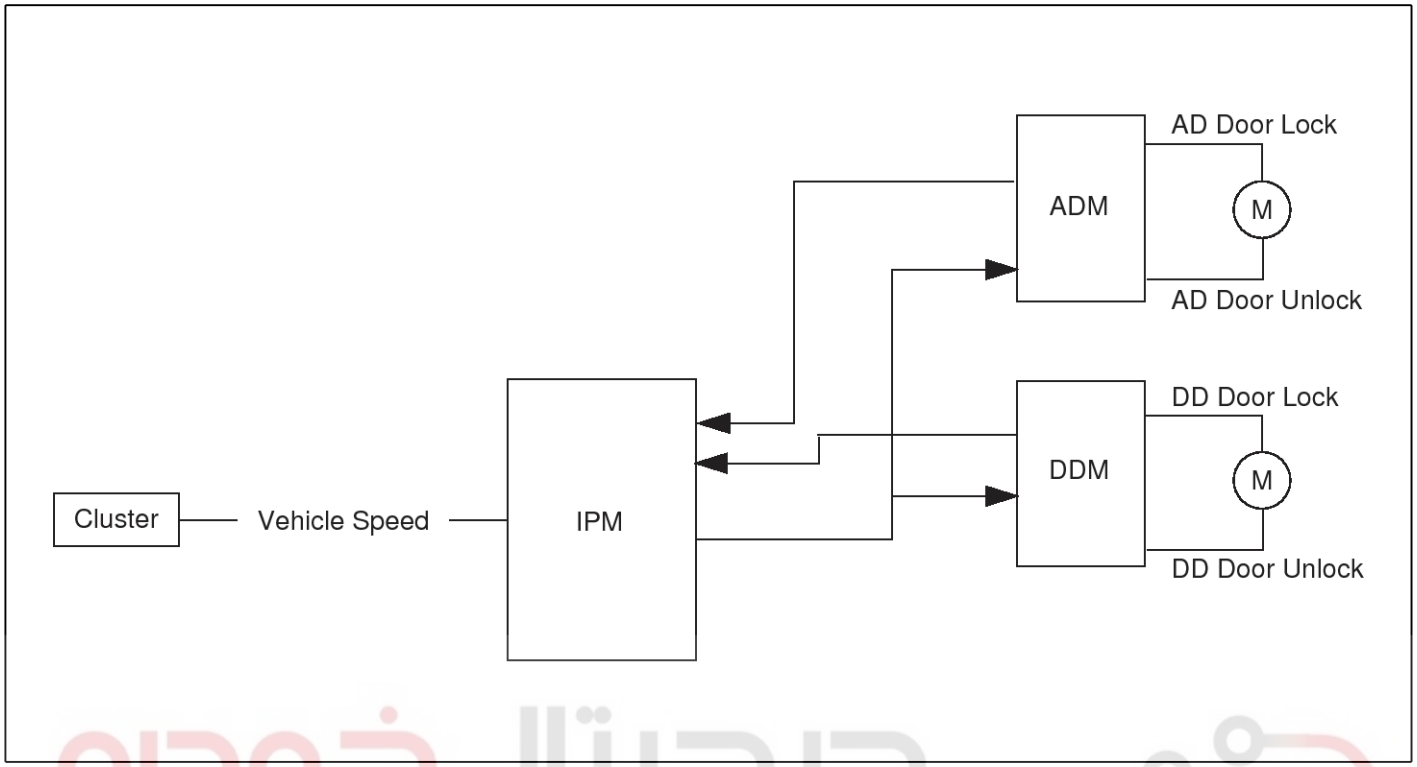
SHMBE9287N

1. Under the condition "IGN ON", if Crash Sensor Sts message from IPM is ON, Door UNLOCK makes output.(5 ± 0.5sec)
2. Remained action goes on irrespective of OFF signal of Crash Sensor Sts message.
3. Door Lock can't make output until IGN is OFF during or after Crash Action.
4. After Crash UNLOCK, Driver Door Key Cylinder Sw Sts and Driver Door Lock Sw Sts data are not sent to LOCK though key cylinder lock Sw and main door lock Sw is on until IGN is "OFF".
5. Unlock action is done again after 100ms if any door is still locked after Crash UNLOCK.
6. If Crash Sensor Sts message is sent on door, unlock action will be generated until IGN is “OFF”



SHMBE9288N

Auto Door Lock



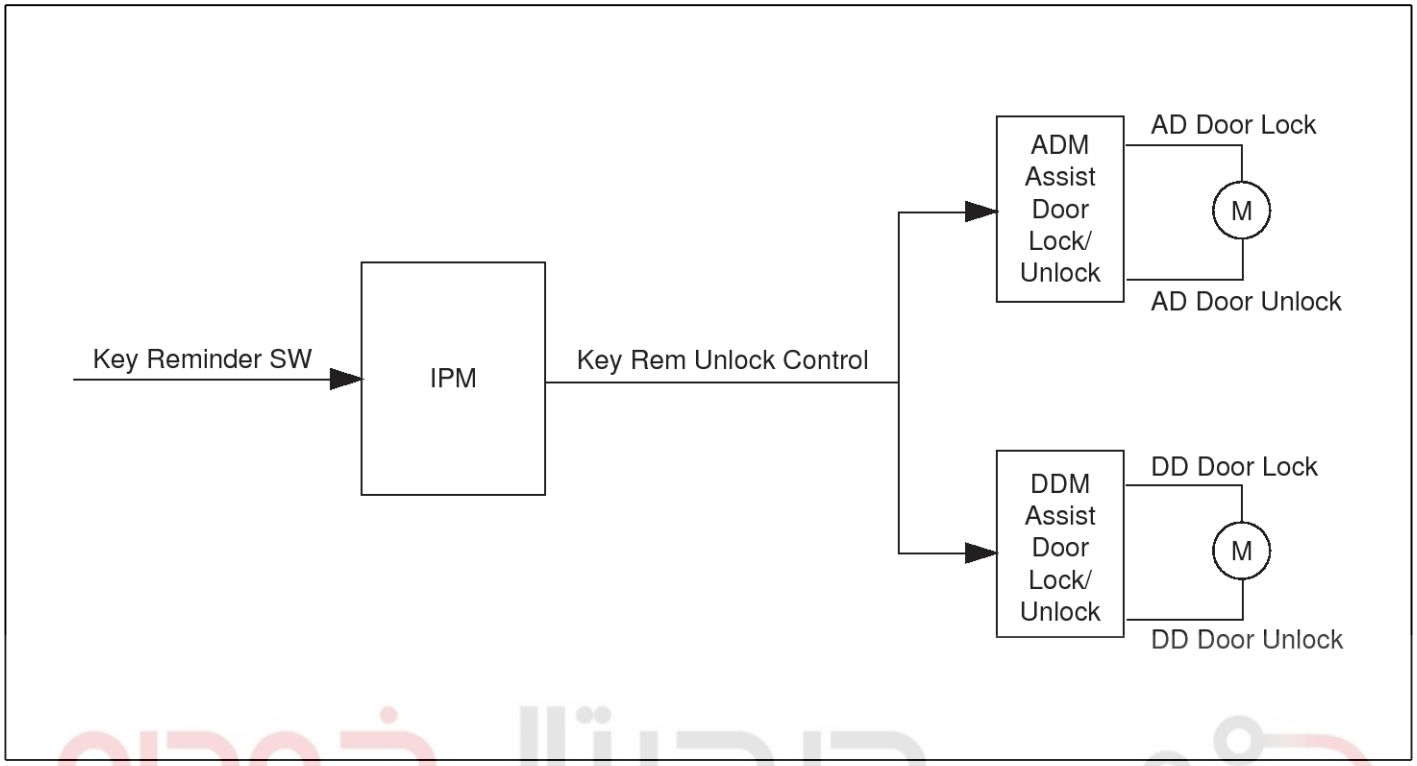
SHMBE9289N

1. If the vehicle is under any condition of the followings, all doors is locked.
   If message from IPM is (Door Lock Ctrl = LOCK_ALL), it will be locked for 0.5sec.
   - Speed of the vehicle is over 40Km/h
   - Condition of Shift Lever (P → except P)

Key Off Unlock

1. Apply when Auto Door Lock function exists
2. If the vehicle is under any condition of the followings, all doors will be unlocked.
   If message from IPM is (Door Lock Ctrl = UNLOCK_ALL), it will be unlocked for 0.5sec.
   - Key off
   - Condition of Shift Lever (Except P→ P)
   - If drive door is on "UNLOCK"

Key Reminder Unlock



SHMBE9290N

- If door is locked by using door lock knob after opening door while IGN Key is inserted to Key Cylinder, Unlock output will be for 1sec (IPM sends Key Remember Unlock Ctrl message to Long Unlock) and there will be a series of three outputs every 0.5sec if door condition is "Lock".

  (IPM sends Key Remember Unlock message to Short Unlock)
- If condition is unlocked during a series of three outputs, output will be stopped.

RKE Lock/Unlock

1. LOCK/UNLOCK by Key fob is run by Door Lock Ctrl message from IPM.
2. Operation in DDM is identical with Central Door Lock/Unlock.

Priority of Door Lock/Unlock

1. If the priority is the low, it'll be ignored.
2. Priority is same under any condition.

   1st Crash unlock

   2nd Auto door lock (Auto door unlock)

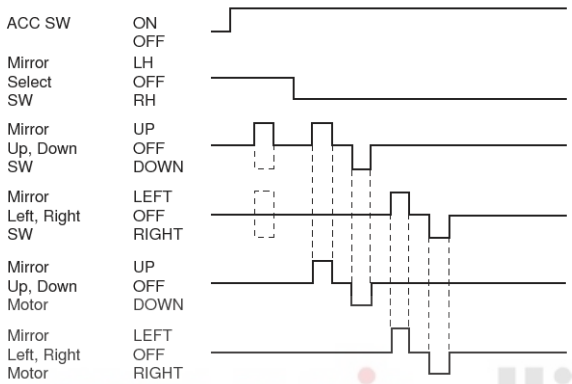
   3rd Key reminder unlock

   4th Central door lock/unlock
3. If there is equal output command during output Priority order same Door lock/unlock, input ignore. if there is contrast output command during output Priority order same Door lock/unlock, input ignore and present output immediately discontinue and executes output that is inputted after 100 ms(except CRASH UNLOCK, Without waiting TIME 100 ms immediately action enforcement)
4. If there is a signal which has priority over existing action, it will be stopped Immediately and the signal makes its own action.
5. When was new output condition after existing output completion, send output after wait 100 ms by standard existing output completion point of time.(except CRASH UNLOCK, Without waiting TIME 100 ms immediately action enforcement)

Outside Mirror

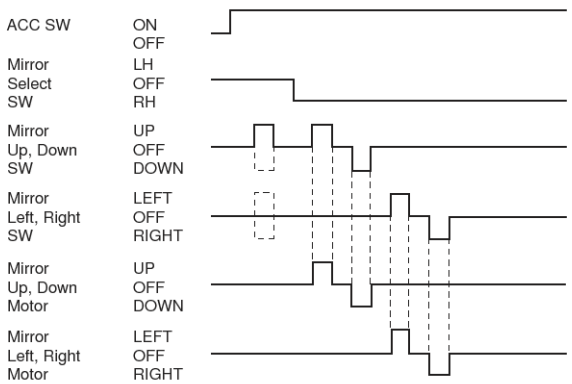
Manual Control

1. Manual Control for O/S Mirror LH
   - At the ACC or RUN ON state, if the mirror select switch in the SW ASSY P/WDW MAIN is the LH state and the mirror direction switches (UP, DOWN, LEFT, and RIGHT) are operated, then the mirror motor shall be driven to control the mirror to the desired direction.



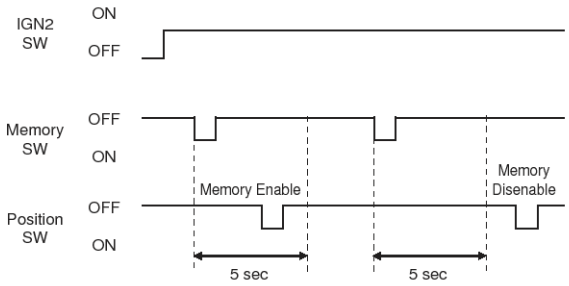
SHMBE9292N

2. Manual Control for O/S Mirror RH
   - At the ACC or RUN ON state, if the mirror select switch in the SW ASSY P/WDW MAIN is the RH state and the mirror direction switches (UP, DOWN, LEFT, and RIGHT) are operated, then the driving signal shall be sent to the SW ASSY P/WDW MAIN through the CAN.



SHMBE9292N

Memory Operation By Memory Switch



SHMBE9294N

1. If the position switch (POS1 or POS2) within 5 seconds after the memory switch (‘SET’ SW) is pushed at the ON state of the IGN2 (the switch module shall send the state signal through can), the present mirror position shall be memorized. (The 5-second duration from the ON state of the memory switch is the memory allowance period so that the allowance state shall be released if the 5 second duration is passed. That is, if the position switch (POS1 or POS2) is ON during the memory allowance period, and then the present position shall be memorized.) Except, when the mirror manual switch at the LH is operated, the mirror position at RH shall not be memorized.
2. Inhibiting and releasing of saving mode may be carried out when any of following conditions is satisfied:
   - -If 5 seconds is elapsed after the memory switch is turned on
   - -If the ignition 2 is turned off
   - -When saving is completed
   - - If "Ignition Sw Sts" of the CAN communication data sent by the IPM is not "Run"
   - - If "Inhibit Sw Sts" of the CAN communication data sent by the CLU is not "P"
   - - If "Vehicle Speed" of the CAN communication data sent by the CLU is over "3Km/h
3. If the battery is removed, the memory must be cleared. (only position data)

Replacing the Outside Mirror action by the Memory Switch

1. In IGN On (IGN State = On) or Driver door opened or during 30 seconds after Driver door open to close when IGN Off Condition (It used IMS Main signal), if user press the position button, Outside Mirror is play to memorized position
2. The position switch (position1 and position2) that has not been saved yet cannot perform replacing.
3. If the user presses a position switch (position1 or position2) during replacing operation, the recently pressed switch will be prior to the other.
4. Replacing Prohibition Conditions
   - If the mirror switch on the LH side is pressed
   - If "position switch states" of the CAN communication data sent by the IMS is not "ON"
   - If "Vehicle Speed" of the CAN communication data sent by the cluster is "3Km/h" or more

Auto Reverse Function

No.	Operation	Power	Select Switch	Shift Lever	Mirror Position		Manipulation	Result
					L	R		
1	Basic Operation	IGN	LH	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L: Auto reverse to position (A - 5˚) MIR R: Auto reverse to position (B - 5˚)
2		IGN	RH	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L: Auto reverse to position (A - 5˚) MIR R: Auto reverse to position (B - 5˚)
3		IGN	N	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L: No change MIR R: No change
4	Returning after Basic Operation	IGN	LH	R	Result of No. 1	Result of No. 1	Changing the shift lever from "R" to "P"	MIR L: Return to position (A) MIR R: Return to position (B)
5		IGN	RH	R	Result of No. 2	Result of No. 2	Changing the shift lever from "R" to "P"	MIR L: Return to position (A) MIR R: Return to position (B)
6	Mirror Switch Manipulation During Auto Reverse	IGN	LH	P -> R	No.1 is being performed.	No. 1 is being performed.	Mirror switch manipulation	MIR L: Operating by the mirror switch MIR R: Auto reverse to position (B - 5˚)
7		IGN	RH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Mirror switch manipulation	MIR L: Auto reverse to position (A - 5˚) MIR R: Operating by the mirror switch

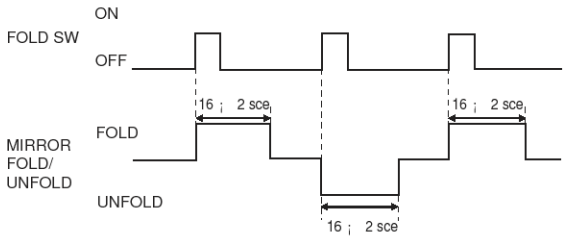
No.	Operation	Power	Select Switch	Shift Lever	Mirror Position		Manipulation	Result
					L	R		
8	Select Switch Change During Auto Reverse	IGN	LH	R -> P	No. 4 is being performed.	No. 4 is being performed.	Mirror switch manipulation	MIR L: Operating by the mirror switch MIR R: Return to position (B)
9		IGN	RH	R -> P	No. 5 is being performed.	No. 5 is being performed.	Mirror switch manipulation	MIR L: Return to position (A) MIR R: Operating by the mirror switch
10		IGN	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing the select switch into N	MIR L: Return to position (A) after 500ms MIR R: Return to position (B) after 500ms
11		IGN	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing the select switch from LH to N (within 500ms) and to RH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
12		IGN	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing the select switch from LH to N (after 500ms) and to RH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
13	Select Switch Change During Auto Reverse	IGN	RH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Changing the select switch into N	MIR L: Return to position (A) after 500ms MIR R: Return to position (B) after 500ms
14		IGN	RH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Changing the select switch from RH to N and to LH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
15		IGN	N	P -> R	Position A	Position B	Changing the select switch from N to LH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
16		IGN	N	P -> R	Position A	Position B	Changing the select switch from N to RH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)

No.	Operation	Power	Select Switch	Shift Lever	Mirror Position		Manipulation	Result
					L	R		
17	Ignition Turning Off During Auto Reverse	IGN->ACC or B+	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
18		IGN->ACC or B+	LH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
19	Ignition Turning Off After Auto Reverse	IGN->ACC or B+	LH	P -> R	No. 1 is completed.	No. 1 is completed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
20		IGN->ACC or B+	RH	P -> R	No. 2 is completed.	No. 2 is completed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
21	Ignition Off During Returning to the Original Position	IGN->ACC or B+	LH	P	No. 4 is being performed.	No. 4 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
22		IGN->ACC or B+	RH	P	No. 5 is being performed.	No. 5 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
23	Ignition Turning Off During Returning to the Original Position by Ignition Turning Off	ACC or B+-> IGN	LH	P	No. 21 is being performed.	No. 21 is being performed.	Changing from IGN to ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
24		ACC or B+-> IGN	LH	R	No. 17 is being performed.	No. 17 is being performed.	Changing from ACC or B+ into IGN	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
25		ACC or B+-> IGN	RH	P	No. 22 is being performed.	No. 22 is being performed.	Changing from ACC or B+ into IGN	MIR L: Return to position (A) MIR R: Return to position (B)
26		ACC or B+-> IGN	RH	R	No. 18 is being performed.	No. 18 is being performed.	Changing from ACC or B+ into IGN	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
27	If the position switch is pressed during the returning operation and replacing is prohibited, returning will be made. Also, if replacing conditions are satisfied, replacing will be made.							
28	if the current position of Outside mirror is out of the visual area , the mirror is not operated outside mirror down .							
29	When "R" changes from 0 to 1, the mirror operates after 350msec ± 50msec.							

No.	Operation	Power	Select Switch	Shift Lever	Mirror Position		Manipulation	Result
					L	R		
30	All condition except 'Inhibit SW = R'. ('P', 'D' '2', 'L') is the same							

Fold/Unfold

1. If the Fold switch in the SW ASSY P/WDW main is operated on B+ condition
2. Assist O/S Mirror control for CAN message (message : OSRVM Fold Ctrl)
3. In condition of The first, fold button realize “FOLD”



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Outside Mirror Defogger

1. IN condition of IGN=RUN and ALT_L=ON, if Rear Defogger SW is “ON”, send on Rear Defogger Ctrl message of IPM, DDM/ADM turn on the O/S Mirror Defog.
2. If Rear Defogger SW is “off”, send on Rear Defogger Ctrl message of IPM, DDM/ADM turn off the O/S Mirror Defog.
3. The priority order is CAN message.

Other Functions

IMS Memory SW

1. Saving and reminder operation Of the following conditions is satisfied
   - If "Ignition Sw Sts" of the CAN communication data sent by the IPM is "Run"
   - If "Inhibit Sw Sts" of the CAN communication data sent by the CLU is "P"
   - If "Vehicle Speed" of the CAN communication data sent by the CLU is under "3Km/h
2. Push on the set sw, it transmits IMS Memory Commend message with the SET.
3. Push on the POSITION1/2 SW within 5 seconds after push on the set sw, it transmits IMS Memory Commend message of MEMORY1 or MEMORY2.
4. Push on the POSITION1/2 SW after 5 seconds after push on the set sw, it transmits IMS Memory Commend message of RETURN1 or RETURN 2.
5. when not operating set, memory, return, it transmits IMS Memory Commend message of passive
6. In condition of OFF or ACC (during drive door open or for 30 seconds after drive door close),

   Push on the position sw 1/2, it transmits IMS Memory Commend message of RETUEN1 or RETUEN 2.
7. Above 10 seconds Push on the set sw constantly, it transmits after changing IMS Auto SW message.
   - Initial price of IMS Auto SW transmits on
   - Condition of SW is ON, When SET SW is on for more than 10 seconds, CAN message is sent in Off.
   - Condition of SW is Off, When SET SW is on for more than 10 seconds, CAN message is sent in ON
   - When IMS SET SW continues for more than 10 seconds, IMS Auto Can message moves by ON->OFF or OFF->ON order in the time it'll be for 10 seconds.

     (IMS Memory Commend transmits SET)
   - When IMS1, IMS2 S/W was held in the IMS SET S/W ON state.

     When it's within 5 seconds from the time when IMS SETS/W was held, IMS Memory Command sends

     Set -> Memory1, 2. After 5 seconds IMS Memory Command sends return 1, 2
   - When IMS1, 2 S/W was held at the same time, IMS Memory Command sends Passive.

Illumination

1. When sending Park Tail Head Lamp Ctrl Message by off or DRL ON in IPM, ILLUMINATION output is turned off.
2. When sending Park Tail Head Lamp Ctrl Message by PARK TAIL ON or PARK LOW TAIL ON in IPM, ILLUMINATION output is turned on.

Courtesy Lamp

1. When a driver's seat door opens, DDM sends Driver Door Courtesy Lamp Ctrl Message on by RAM, and turns on Courtesy lamp.
2. When a driver's seat gate is closed, Driver Door Courtesy Lamp Ctrl Message is sent in OFF_DECAY, and, DDM Courtesy lamp, it's exposed to light (2 ± 0.2, sec).
3. When a driver's seat gate is closed, Driver Door Courtesy Lamp Ctrl Message will be sent in OFF_DECAY, and when Message ON during exposure to light forwards DDM Courtesy lamp, Courtesy lamp is turned on immediately.
4. IGN 'RUN' during exposure to light be, and when closing door in the IGN 'RUN' state, please send by Driver Door Courtesy Lamp Ctrl Message off. and turns off Courtesy lamp immediately
5. When 20 minutes pass in the state which opened, a driver's seat door sends Driver Door Courtesy Lamp Ctrl Message off by Key reminder SW OFF, and DDM will turn off Courtesy lamp immediately.
6. When being exposed to light, when the resolution is exposed to light beyond 32step, you aren't supposed to shake.

Fuel Filler Door

Fuel filler door open SW, if it's on, Open Fuel Door Sw Sts message is sent in OPEN.

Side Repeater Lamp

When Turn indicator message is being forwarded to on, Side Repeater Lamp On.

Power Consumption

1. All subordinate's output is off, and SW related to WAKE - UP is by the state that everything is off. When SC Message in CAN IPM forwards everything to S (Sleep) in the off state, enters SLEEP MODE.
2. WAKE-UP related SW is same as the bottom.
3. The above 2) when effective input also occurs in SW of whole one item, WAKE-UP will be immediately.
4. When sending WAKE-UP Message from other MODULE, WAKE-UP will be immediately.
5. It's done within 2 mA of blackout kinds.

P/WDW Main SW Wake Up Signal Check (Sleep Prohibition)

Signal	Input
IGN2	On
Fold SW	On
Door Key Lock SW	On
Door Key Unlock SW	On
Central Door Lock SW	On
Central Door Unlock SW	On
Lock Monitoring SW	State(Lock→Unlock, Unlock→Lock)
Fuel Filler Door Open sw	On
IMS Set	State(Off→On, On→Off)
IMS 1	State(Off→On, On→Off)
IMS 2	State(Off→On, On→Off)

※ IMS SET, IMS 1,IMS 2 SW will be WAKE UP by change of state. But The SW state is on, WAKE UP continues only in case of, and WAKE UP will be off in case of, and the SW state will enter in the SLEEP

Rescue Mode

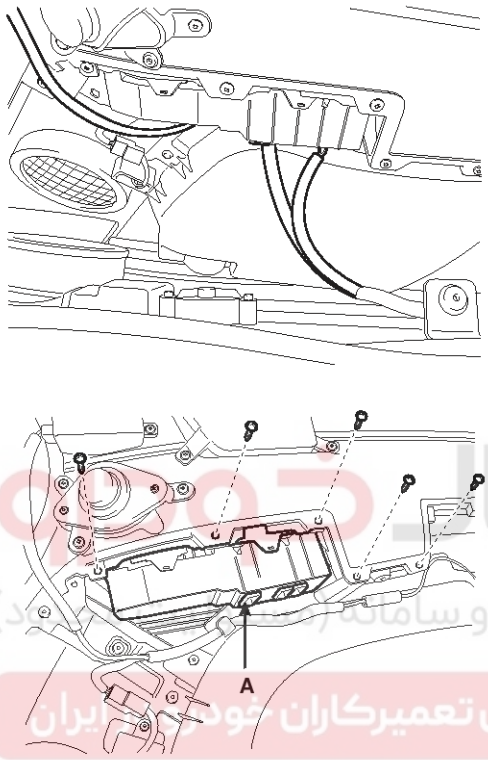
1. The condition to enter RESCUE MODE seems to be the next.
   - Ignition Sw Sts Message is RUN or IGN SW ON and Ignition Sw Sts Message is by RUN or IGN SW ON.
   - One of whole Park Tail Head Lamp Ctrl, Front Wiper Ctrl Message is sent in INVALID or, when CAN Line for IPM is error.
   - Driver Door Courtesy Lamp Ctrl Message is sent in INVALID or when CAN Line for RAM is error.
2. When entering RESCUE MODE, It moves as the next.
   - Door Unlock it's on for 0.5 seconds.
   - OSRVM Defogger, It's on for 20 minutes.
   - Illumination is much on.
   - The another function is identical with NORMAL MODE movement.
3. When Inhibit Sw Sts message is OFF/ACC or IGN SW is off and CAN Line abnormality from IPM, FAM, RAM is not, Park Tail Head Lamp Ctrl, Front Wiper Ctrl, Driver Door Courtesy Lamp Ctrl Message isn't INVALID, released in RESCUE MODE.

Power window Main SW Input Filtering Time

Switch Signal Name	Filtering Time(ms)
Central Door Lock SW	50 ~ 52
Central Door Unlock SW	50 ~ 52
Window Lock SW	50 ~ 52
FL/FR/RL/RR Power Window SW	50 ~ 52
Mirror Up/down/left/right S/W	50 ~ 52
Mirror Fold S/W	50 ~ 52

Removal

1. Disconnect the negative battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - Front door)
3. Remove the door module (A) mounting screws (5EA) after disconnecting the connector (3EA) from the module.



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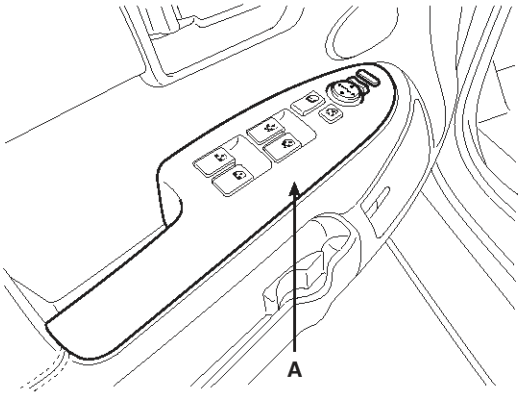
4. Remove the front door module (DDM) (A) from the front door trim panel.



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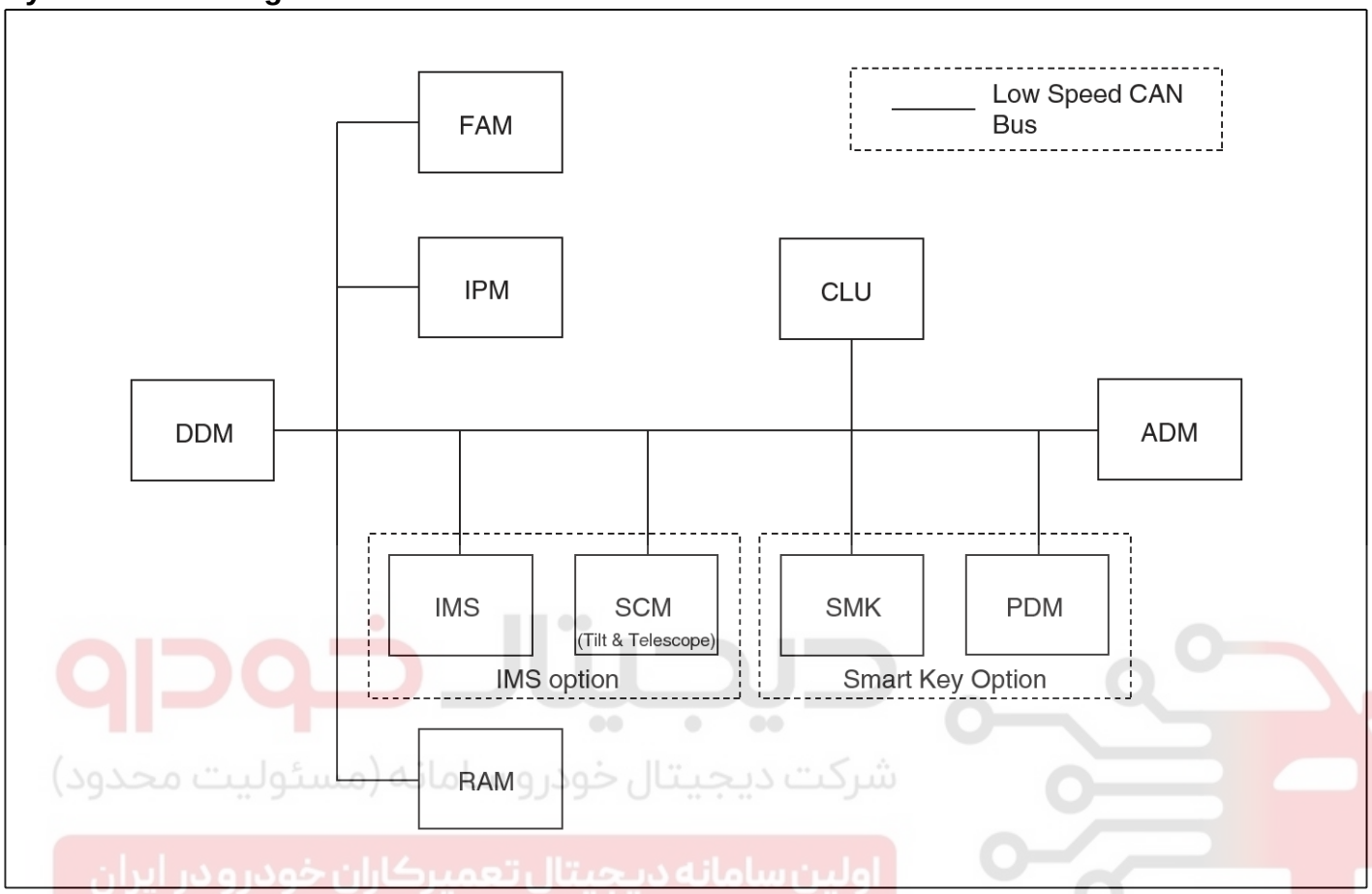
Installation

1. Install the front door module to the front door trim panel.
2. Reconnect the door module connector
3. Install the front door trim panel.

Assist Door Module (ADM)

System Block Diagram



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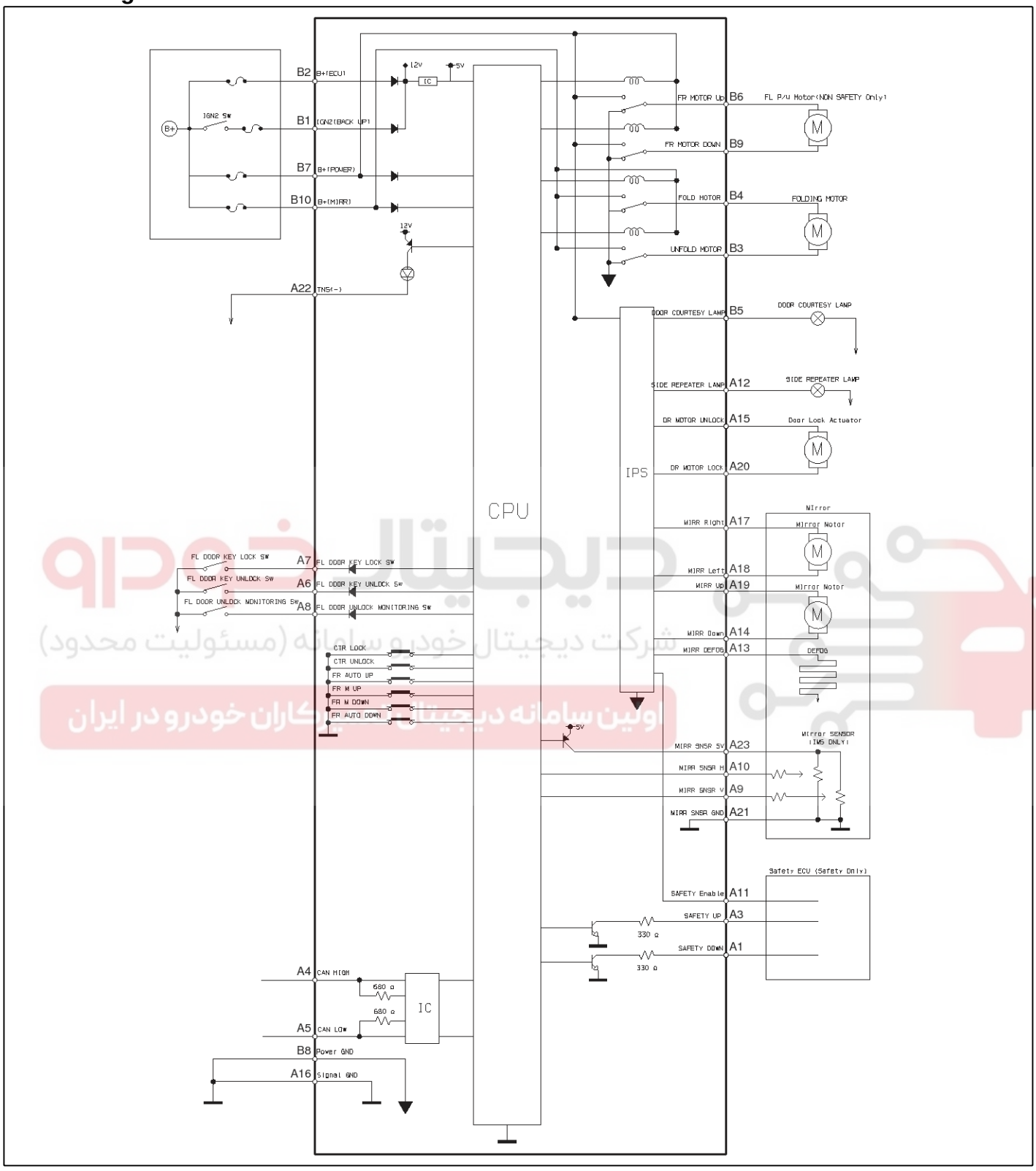
Circuit Diagram



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※ Connector pin information

- Refer to the power window switch - "component"

Description

The Assist door module (ADM) is a part of a Controller Area Network (CAN), and performs CAN communication with the FAM, IPM, RAM, DDM, IMS and SCM. Assist controls driver side power window switch button located inside of the driver side door to operate power window, mirror, door lock and unlock.

1. Two manual operations (up and down) for four p/windows. However, on the assists seat the auto up/down operation must be possible.
2. Manually operating the mirror position by the manual switch (Up, Down, Right, and Left)
3. Saving and replacing the mirror position by RKE → For 2 persons
4. Outside mirror auto reverse operation
5. Outside mirror fold/unfold power control
6. Central door lock/unlock function
7. Door courtesy lamp control
8. Outside mirror defog control
9. Illumination control
10. Outside mirror turn signal lamp control.

Control Function

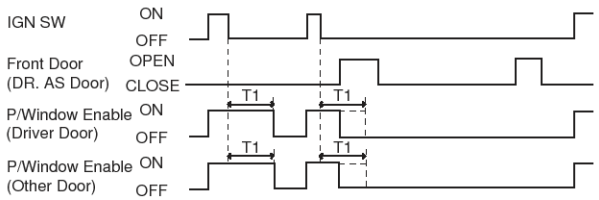
Power Window

Power Window Control

1. Window Motor UP/DOWN is output by forwarded in Assist window Motor Ctrl Message UP/DOWN from DDM.
2. Window Motor UP/DOWN is output by Assist Window UP/DOWN sw in ADM.
3. In case of Power Window Lock Sw Sts Message is ON, Forwarded from ADM, Motor output turns off
4. When being different driver Window Motor Ctrl Message forwarded from ADM and data of assist window sw, don't move.
5. When about 10sec ± 1 moves all the while more than, Motor turns off Motor output from Manual UP/DOWN sw input starting point .

Power Window Timer Function

1. It is a message from IPM. (Message : After run Ctrl) .
2. Under the condition "IGN ON -> IGN OFF", Power Window SW Control Function lasts for "30 sec". But, it immediately terminates to OFF when front door is opened.



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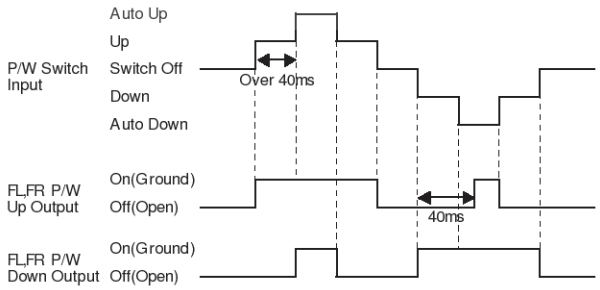
Safety Power Window

1. Drive door and assist door apply to, In condition of IGN2 On or After Run Ctrl (CAN) On Door door is controlled by DDM, assist door is controlled by CAN message (message :Assist door Window Ctrl)
2. P/WDW main SW (DDM) control signal of down, auto up, auto down.



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Power Window Control

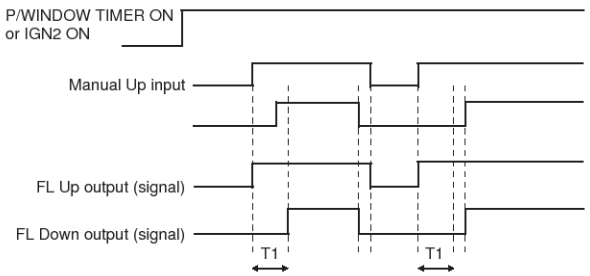
1. P/Window enable signal on condition
   - P/window timer(from IPM) ON or IGN2 (ADM itself) ON

     (When satisfied with one of two condition)
2. Up/down control signal
   - P/WDW Timer(from IPM) ON or IGN2 (ADM itself) ON

SWITCH state	UP SIG	DOWN SIG	P/WINDOW ENABLE SIG
State(Off)	Off	Off	On
Manual Up	On	Off	On
Manual Down	Off	On	On
Manual Up → Auto Up	On (maintenance)	OFF → On	On
Manual Down → Auto Down	Off → On	On (maintenance)	On
Off → Auto Up	On	Off(40ms) → On	On
Manual Down → Auto Up			
Auto Down → Auto Up			
Off → Auto Down	Off(40ms) → On	On	On

* P/Window timer (from IPM) OFF & IGN2 (DDM ITSELF) OFF, independently of Switch's state Up Signal And down signal are OFF state preservation

1) Auto/Manual Up Output(Signal) Operation Time Chart(T1:40mS±10mS)



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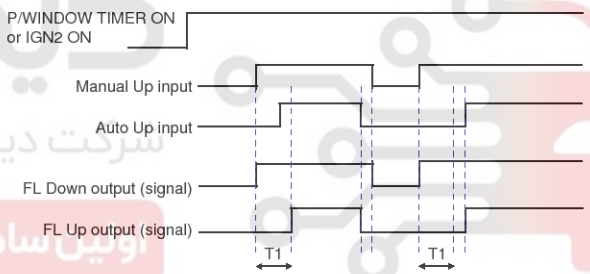
2) Auto/Manual Down Output(Signal) Operation Time Chart(T1:40mS±10mS)



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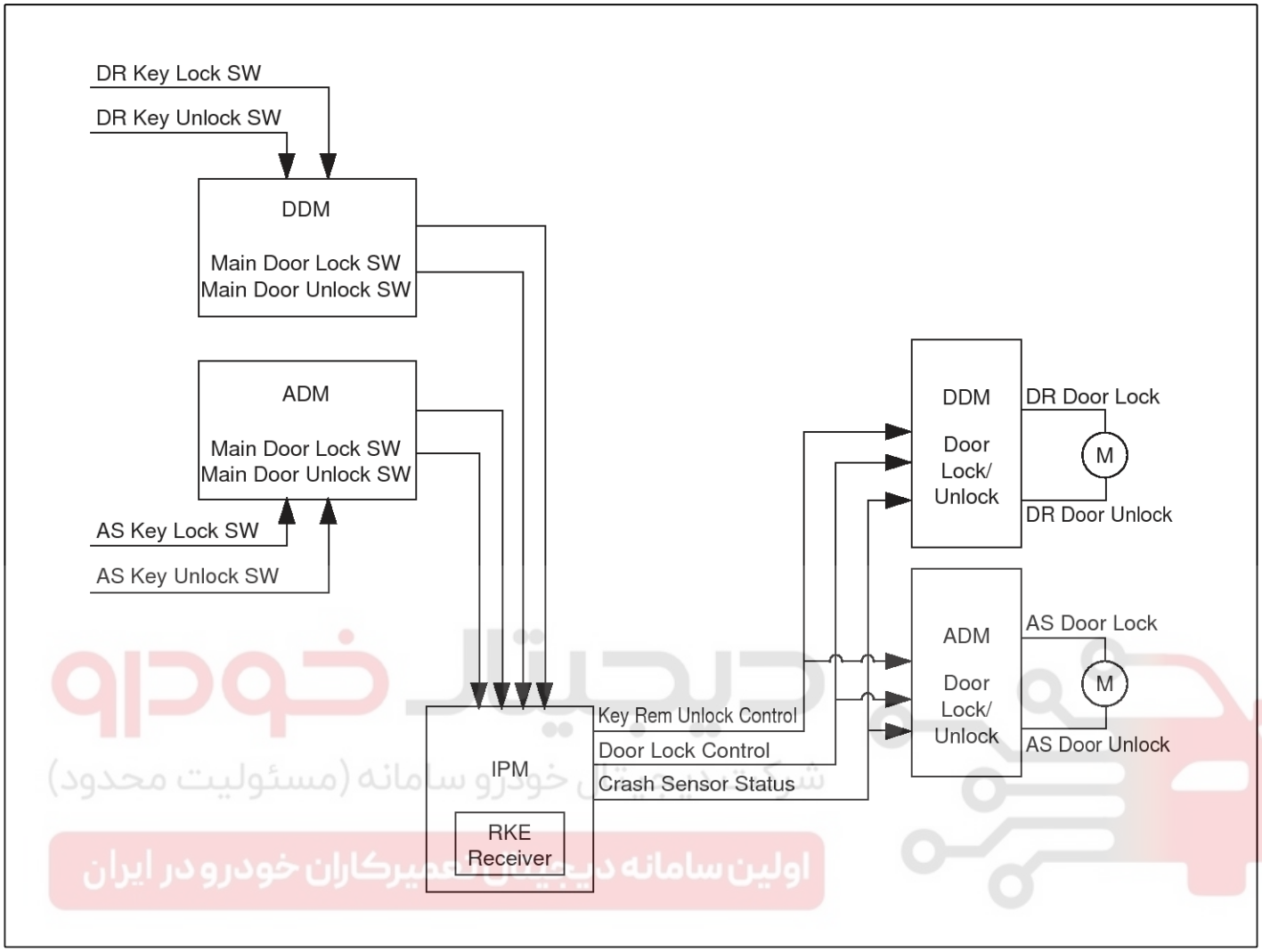
Door Lock/Unlock (Controlled by IPM)

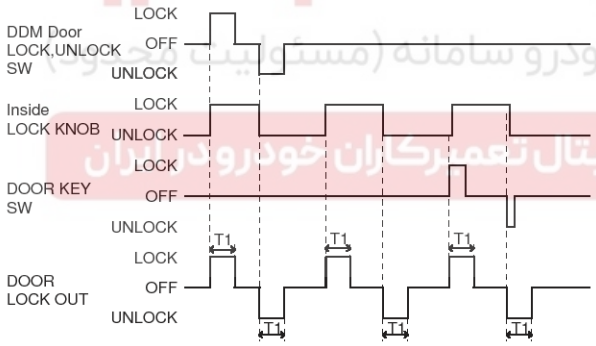


SHMBE9285N

1. Lock/unlock controlled by can message from IPM (message : Door Lock Ctrl , Key Remember Unlock Ctrl, Crash Sensor Sts)
2. If Door lock monitoring switch is "lock" or "unlock", Assist door Lock Monitor Sw Sts message is sent to "LOCKED" or "UNLOCKED"
3. Lock changes to unlock or unlock changes to lock, there will be delay time for 100ms.(controlled by IPM)

Item			Action
Driver Door	Key Cylinder	Lock	All Door Lock
		Unlock	All Door Unlock
	Knob	Lock	No Action
		Unlock	No Action
	Main SW (P/WDW SW)	Lock	All Door Lock
		Unlock	All Door Unlock
Assist Door	Key Cylinder	Lock	All Door Lock
		Unlock	All Door Unlock
	Knob	Lock	No Action
		Unlock	No Action
	Main SW (P/WDW SW)	Lock	All Door Lock
		Unlock	All Door Unlock
RKE		Lock	All Door Lock
		Unlock	All Door Unlock

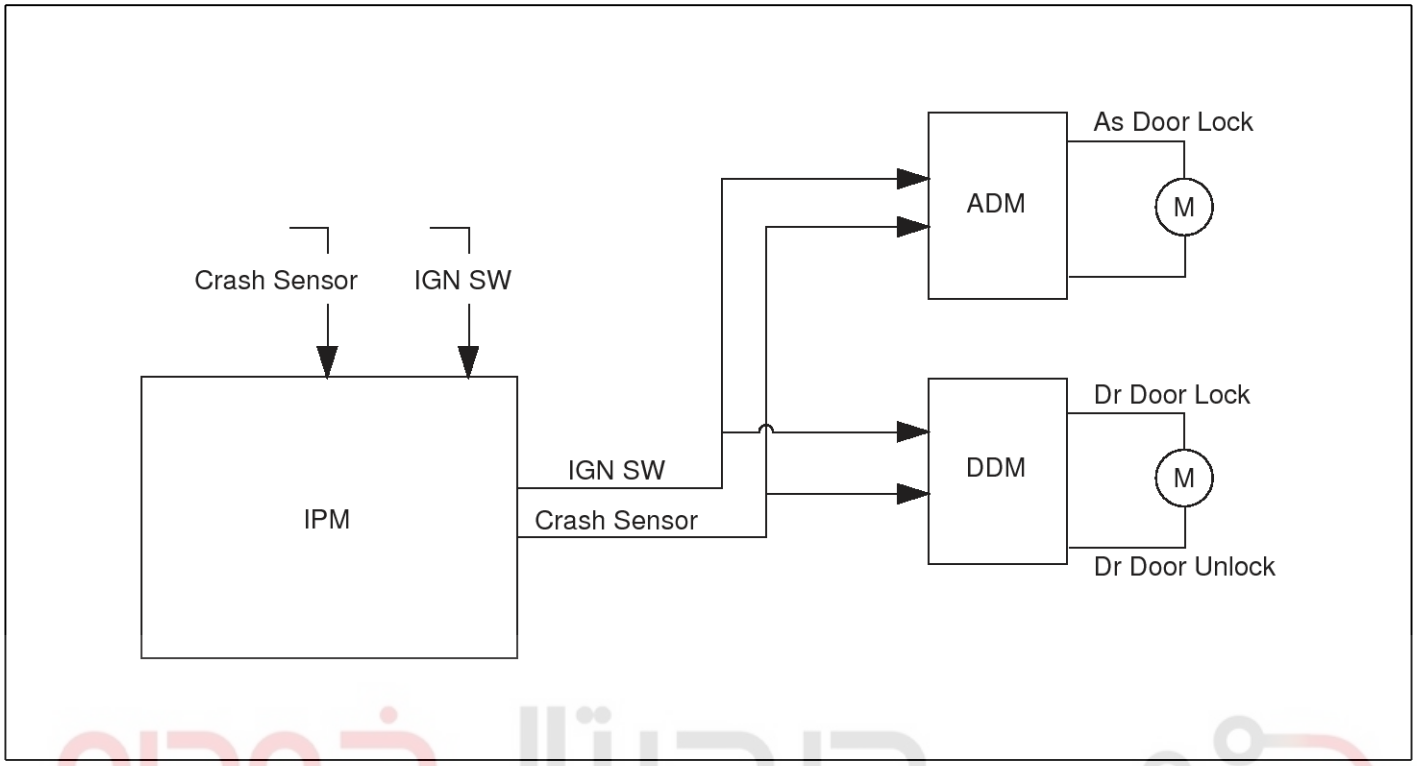
Central Door Lock/Unlock



SHMBE9286N

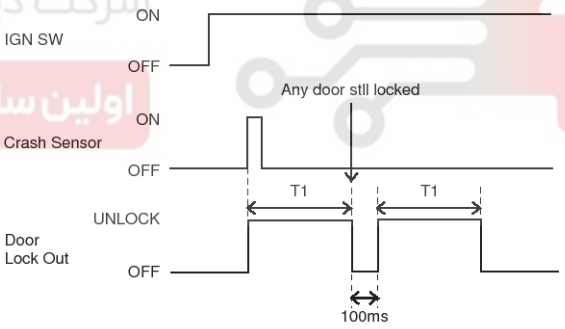
1. If Central door lock/unlock SW is "ON", Assist Door Lock Sw Sts message is sent to LOCK/UNLOCK.
2. If Key cylinder lock switch is "ON", Assist Door Key Cylinder Sw Sts message is sent to LOCK.
3. If Key cylinder unlock switch is "ON", Driver Door Key Cylinder Sw Sts message is sent to UNLOCK.
4. If Door Lock Ctrl message from IPM is "Assist LOCK, Driver Door and Assist Door LOCK, Rear Door, Tailgate and Assist Door LOCK, LOCK ALL", Door Lock Actuator is locked for O.5sec.
5. If Door Lock Ctrl message from IPM is "Assist Door UNLOCK, Driver Door and Assist Door UNLOCK, Rear Door, Tailgate and Assist Door UNLOCK, UNLOCK ALL", or Lock Actuator is unlocked for O.5sec.

Crash Unlock (Controlled by ADM)



SHMBE9287N

1. Under the condition "IGN ON", if Crash Sensor Sts message from IPM is ON, Door UNLOCK makes output.(5 ± 0.5sec)
2. Remaining action goes on irrespective of OFF signal of Crash Sensor Sts message.
3. Door Lock can't make output until IGN is OFF during or after Crash Action.
4. After Crash UNLOCK, Assist Door Key Cylinder Sw Sts and Assist Door Lock Sw Sts data are not sent to LOCK though key cylinder lock Sw and main door lock Sw is on until IGN is "OFF".
5. Unlock action is done again after 100ms if any door is still locked after Crash UNLOCK.
6. If Crash Sensor Sts message is sent on door, unlock action will be generated until IGN is “OFF”



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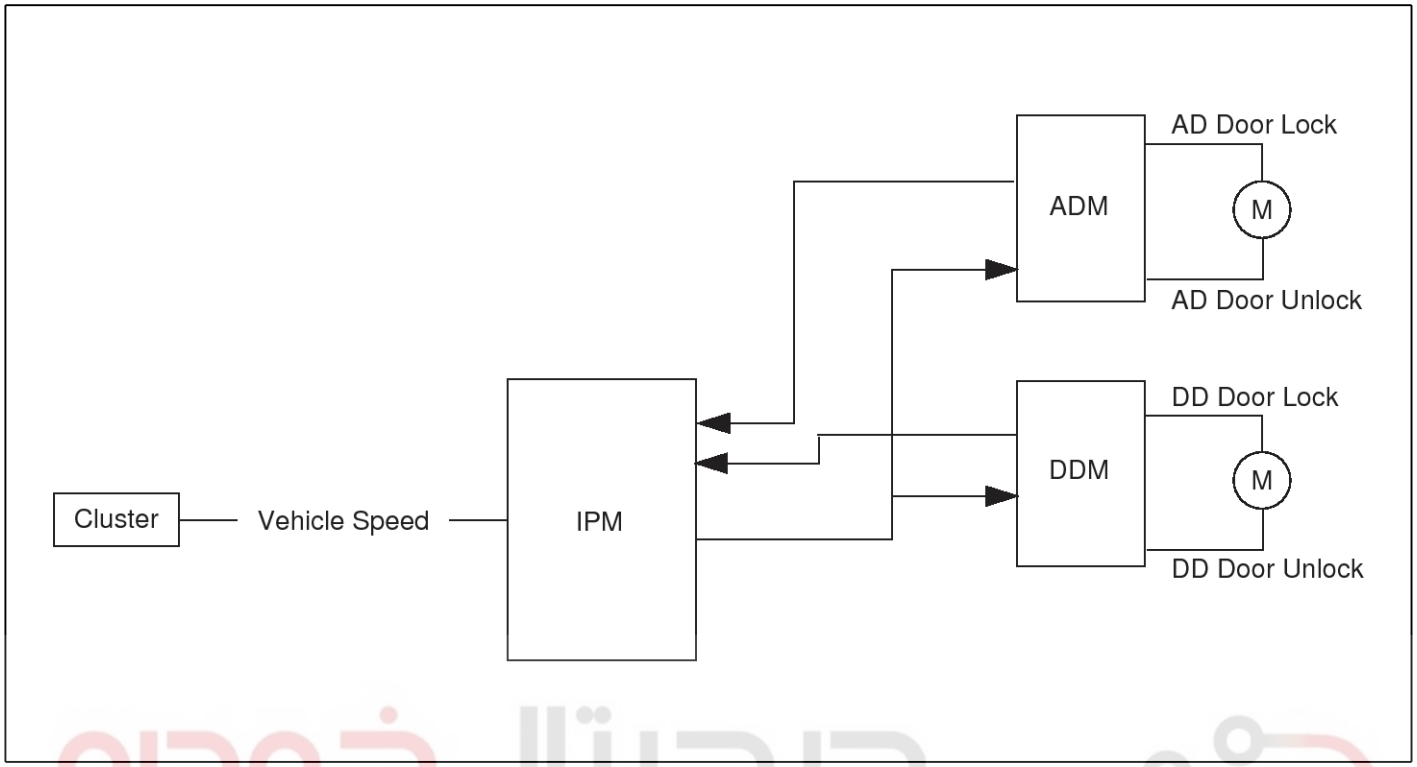
Auto Door Lock



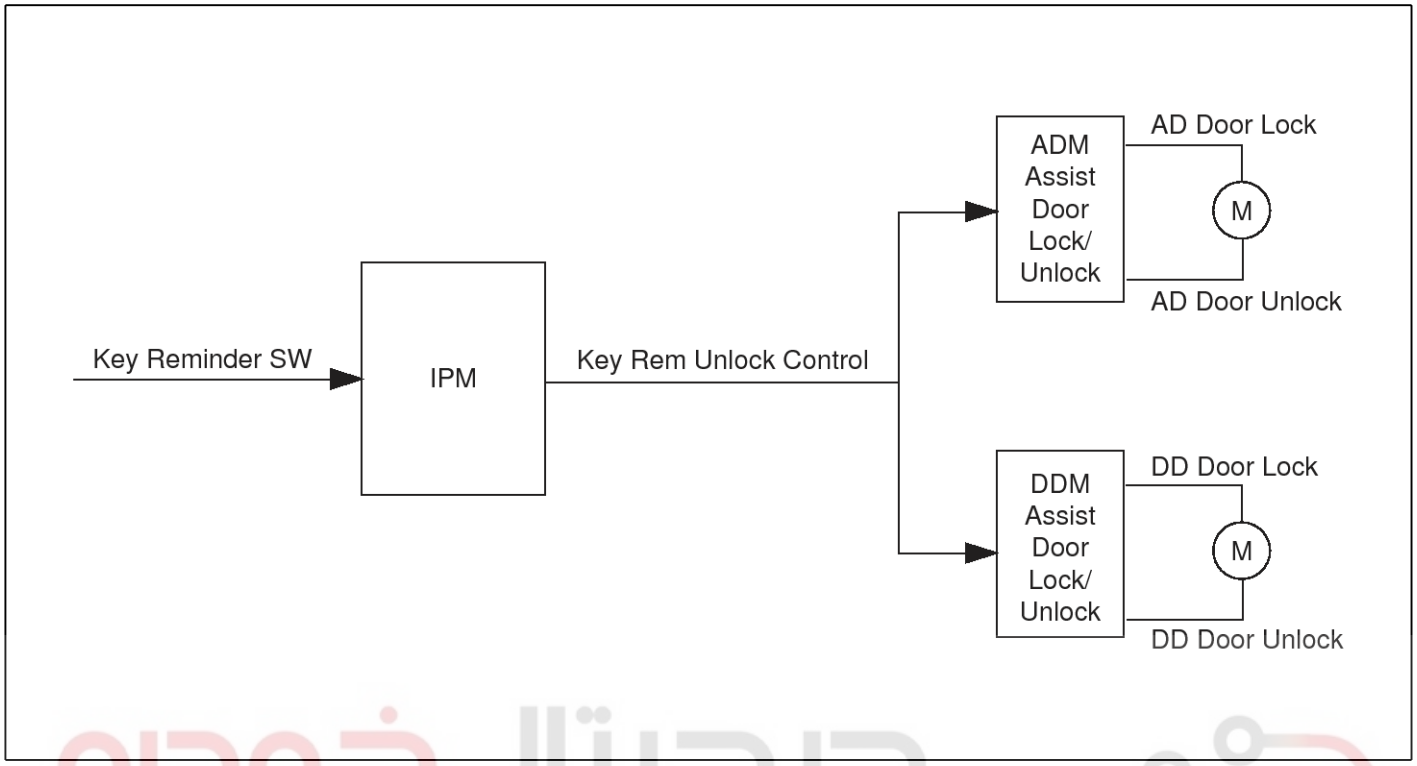
SHMBE9289N

1. If the vehicle is under any condition of the followings, all doors is locked.
   If message from IPM is (Door Lock Ctrl = LOCK_ALL), it will be locked for 0.5sec.
   - Speed of the vehicle is over 40Km/h
   - Condition of Shift Lever (P → except P)

Key Off Unlock

1. Apply when Auto Door Lock function exists
2. If the vehicle is under any condition of the followings, all doors will be unlocked.
   If message from IPM is (Door Lock Ctrl = UNLOCK_ALL), it will be unlocked for 0.5sec.
   - Key off
   - Condition of Shift Lever (Except P→ P)
   - If drive door is on "UNLOCK"

Key Reminder Unlock



SHMBE9290N

- If door is locked by using door lock knob after opening door while IGN Key is inserted to Key Cylinder, Unlock output will be for 1sec (IPM sends Key Remember Unlock Ctrl message to Long Unlock) and there will be a series of three outputs every 0.5sec if door condition is "Lock".

  (IPM sends Key Remember Unlock message to Short Unlock)
- If condition is unlocked during a series of three outputs, output will be stopped.

RKE Lock/Unlock

1. LOCK/UNLOCK by Key fob is run by Door Lock Ctrl message from IPM.
2. Operation in ADM is identical with Central Door Lock/Unlock.

Priority of Door Lock/Unlock

1. If the priority is low, it'll be ignored.
2. Priority is same under any condition.

   1st Crash Unlock

   2nd Auto Door Lock (Auto Door Unlock)

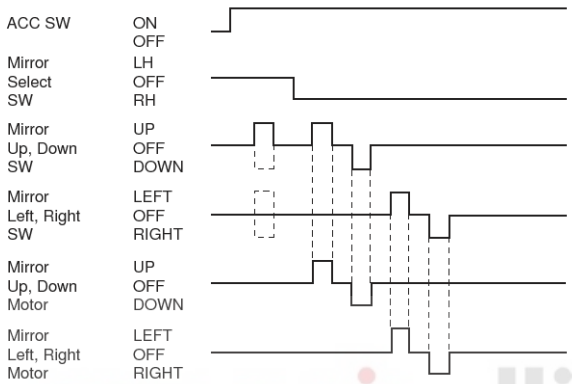
   3rd Key Reminder Unlock

   4th Central Door Lock/Unlock
3. If there is equal output command during output Priority order same Door lock/unlock, input is ignore. if there is contrast output command during output Priority order same Door lock/unlock, input is ignore and present output immediately discontinue and executes output that is inputted after 100 ms(except CRASH UNLOCK, Without waiting TIME 100 ms immediately action enforcement)
4. If there is a signal which has priority over existing action, it will be stopped Immediately and the signal makes its own action.
5. When was new output condition after existing output completion, send output after wait 100 ms by standard existing output completion point of time.(except CRASH UNLOCK, Without waiting TIME 100 ms immediately action enforcement)

Outside Mirror

Manual Control

1. Manual Control for O/S Mirror RH
   - At the ACC or RUN ON state, if the mirror select switch in the SW ASSY P/WDW MAIN is the RH state and the mirror direction switches (UP, DOWN, LEFT, and RIGHT) are operated, then the mirror motor shall be driven to control the mirror to the desired direction. (Controlled by ADM)



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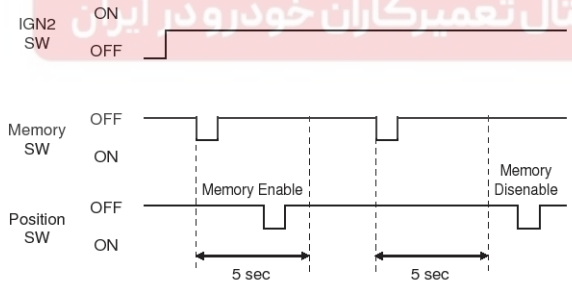
Memory Operation By Memory Switch



SHMBE9294N

1. When IMS Memory Commend Message is forwarded to MEMORY1 or MEMORY2 from DDM, the location of present MIRROR is memorized.

   The thing you don't do MIRROR memorization of at the time of MIRROR MANUAL SW movement.

2. Inhibiting and releasing of saving mode may be carried out when any of following conditions is satisfied:
   - If 5 seconds is elapsed after the memory switch is turned on
   - If the ignition 2 is turned off
   - When saving is completed
   - If "Ignition Sw Sts" of the CAN communication data sent by the IPM is not "Run"
   - If "Inhibit Sw Sts" of the CAN communication data sent by the CLU is not "P"
   - If "Vehicle Speed" of the CAN communication data sent by the CLU is over "3Km/h
3. If the battery is removed, the memory must be cleared.

Replacing the Outside Mirror action by the Memory Switch

1. In IGN On (IGN State = On) or Driver door opened or during 30 seconds after Driver door open to close when IGN Off Condition (It used IMS Main signal), if user press the position button, Outside Mirror is play to memorized position
2. The position switch (position1 and position2) that has not been saved yet cannot perform replacing.
3. If the user presses a position switch (position1 or position2) during replacing operation, the recently pressed switch will be prior to the other.
4. Replacing Prohibition Conditions
   - If the mirror switch on the LH side is pressed
   - If "position switch states" of the CAN communication data sent by the IMS is not "ON"
   - If "Vehicle Speed" of the CAN communication data sent by the cluster is "3Km/h" or more

Auto Reverse Function

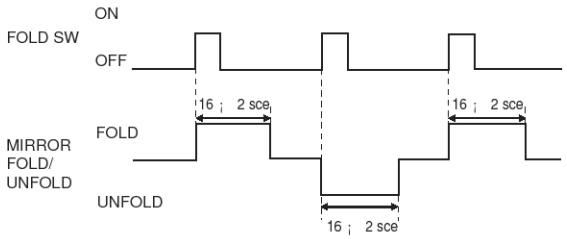
No.	Operation	Power	Select Switch	Shift Lever	Mirror Position		Manipulation	Result
					L	R		
1	Basic Operation	IGN	LH	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L: Auto reverse to position (A - 5˚) MIR R: Auto reverse to position (B - 5˚)
2		IGN	RH	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L: Auto reverse to position (A - 5˚) MIR R: Auto reverse to position (B - 5˚)
3		IGN	N	P	Position A	Position B	Changing the shift lever from "P" to "R"	MIR L: No change MIR R: No change
4	Returning after Basic Operation	IGN	LH	R	Result of No. 1	Result of No. 1	Changing the shift lever from "R" to "P"	MIR L: Return to position (A) MIR R: Return to position (B)
5		IGN	RH	R	Result of No. 2	Result of No. 2	Changing the shift lever from "R" to "P"	MIR L: Return to position (A) MIR R: Return to position (B)
6	Mirror Switch Manipulation During Auto Reverse	IGN	LH	P -> R	No.1 is being performed.	No. 1 is being performed.	Mirror switch manipulation	MIR L: Operating by the mirror switch MIR R: Auto reverse to position (B - 5˚)
7		IGN	RH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Mirror switch manipulation	MIR L: Auto reverse to position (A - 5˚) MIR R: Operating by the mirror switch
8	Select Switch Change During Auto Reverse	IGN	LH	R -> P	No. 4 is being performed.	No. 4 is being performed.	Mirror switch manipulation	MIR L: Operating by the mirror switch MIR R: Return to position (B)
9		IGN	RH	R -> P	No. 5 is being performed.	No. 5 is being performed.	Mirror switch manipulation	MIR L: Return to position (A) MIR R: Operating by the mirror switch

No.	Operation	Power	Select Switch	Shift Lever	Mirror Position		Manipulation	Result
					L	R		
10	Select Switch Change During Auto Reverse	IGN	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing the select switch into N	MIR L: Return to position (A) after 500ms MIR R: Return to position (B) after 500ms
11		IGN	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing the select switch from LH to N (within 500ms) and to RH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
12		IGN	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing the select switch from LH to N (after 500ms) and to RH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
13		IGN	RH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Changing the select switch into N	MIR L: Return to position (A) after 500ms MIR R: Return to position (B) after 500ms
14		IGN	RH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Changing the select switch from RH to N and to LH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
15		IGN	N	P -> R	Position A	Position B	Changing the select switch from N to LH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
16		IGN	N	P -> R	Position A	Position B	Changing the select switch from N to RH	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
17	Ignition Turning Off During Auto Reverse	IGN->ACC or B+	LH	P -> R	No. 1 is being performed.	No. 1 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
18		IGN->ACC or B+	LH	P -> R	No. 2 is being performed.	No. 2 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)

No.	Operation	Power	Select Switch	Shift Lever	Mirror Position		Manipulation	Result
					L	R		
19	Ignition Turning Off After Auto Reverse	IGN->ACC or B+	LH	P -> R	No. 1 is completed.	No. 1 is completed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
20		IGN->ACC or B+	RH	P -> R	No. 2 is completed.	No. 2 is completed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
21	Ignition Off During Returning to the Original Position	IGN->ACC or B+	LH	P	No. 4 is being performed.	No. 4 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
22		IGN->ACC or B+	RH	P	No. 5 is being performed.	No. 5 is being performed.	Changing from IGN into ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
23	Ignition Turning Off During Returning to the Original Position by Ignition Turning Off	ACC or B +-> IGN	LH	P	No. 21 is being performed.	No. 21 is being performed.	Changing from IGN to ACC or B+	MIR L: Return to position (A) MIR R: Return to position (B)
24		ACC or B +-> IGN	LH	R	No. 17 is being performed.	No. 17 is being performed.	Changing from ACC or B+ into IGN	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
25		ACC or B +-> IGN	RH	P	No. 22 is being performed.	No. 22 is being performed.	Changing from ACC or B+ into IGN	MIR L: Return to position (A) MIR R: Return to position (B)
26		ACC or B +-> IGN	RH	R	No. 18 is being performed.	No. 18 is being performed.	Changing from ACC or B+ into IGN	MIR L: Auto reverse to position (A-5˚) MIR R: Auto reverse to position (B-5˚)
27	If the position switch is pressed during the returning operation and replacing is prohibited, returning will be made. Also, if replacing conditions are satisfied, replacing will be made.							
28	if the current position of Outside mirror is out of the visual area , the mirror is not operated outside mirror down .							
29	When "R" changes from 0 to 1, the mirror operates after 350msec ± 50msec.							
30	All condition except 'Inhibit SW = R'. ('P', 'D' '2', 'L') is the same							

Fold/Unfold

1. If the Fold switch in the SW ASSY P/WDW MAIN is operated on B+ condition
2. Assist O/S Mirror control for CAN message (message : OSRVM Fold Ctrl)
3. In condition of The first, FOLD BUTTON realize “FOLD”



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Outside Mirror Defogger

1. IN condition of IGN=RUN and ALT_L=ON, if Rear Defogger SW is “ON”, send on Rear Defogger Ctrl message of IPM, DDM/ADM turn on the O/S Mirror Defog.
2. If Rear Defogger SW is “off”, send on Rear Defogger Ctrl message of IPM, DDM/ADM turn off the O/S Mirror Defog.
3. The priority order is CAN MESSAGE.

Other Functions

Illumination

1. When sending Park Tail Head Lamp Ctrl Message by off or DRL ON in IPM, ILLUMINATION output is turned off.
2. When sending Park Tail Head Lamp Ctrl Message by PARK TAIL ON or PARK LOW TAIL ON in IPM, ILLUMINATION output is turned on.

Courtesy Lamp

1. When a driver's seat door opens, ADM sends Assist Door Courtesy Lamp Ctrl Message on by RAM, and turns on Courtesy lamp.
2. When an assist’s seat gate is closed, Assist Door Courtesy Lamp Ctrl Message is sent in OFF_DECAY, and, ADM Courtesy lamp, it's exposed to light (2 ± 0.2, sec).
3. When an assist's seat gate is closed, Assist Door Courtesy Lamp Ctrl Message will be sent in OFF_DECAY, and when Message ON during exposure to light forwards ADM Courtesy lamp, Courtesy lamp is turned on immediately.
4. IGN 'RUN' during exposure to light be, and when closing door in the IGN 'RUN' state, please send by Assist Door Courtesy Lamp Ctrl Message off. and turns off Courtesy lamp immediately
5. When 20 minutes pass in the state which opened, an assist's seat door sends Assist Door Courtesy Lamp Ctrl Message off by Key reminder SW OFF, and ADM will turn off Courtesy lamp immediately.
6. When being exposed to light, when the resolution is exposed to light beyond 32step, you aren't supposed to shake.

Side Repeater Lamp

When Turn indicator message is being forwarded to on, Side Repeater Lamp On.

Power Consumption

1. All subordinate's output is off, and SW related to WAKE - UP is by the state that everything is off. When SC Message in CAN IPM forwards everything to S (Sleep) in the off state, enters SLEEP MODE.
2. WAKE-UP related SW is same as the bottom.
3. The above 2) when effective input also occurs in SW of whole one item, WAKE-UP will be immediately.
4. When sending WAKE-UP Message from other MODULE, WAKE-UP will be immediately.
5. It's done within 2 mA of blackout kinds.

P/WDW Assist SW Wake Up Signal Check (Sleep Prohibition)

Signal	Input
Door Key Lock SW	On
Door Key Unlock SW	On
Central Door Lock SW	On
Central Door Unlock SW	On
Lock Monitoring SW	State(Lock → Unlock, Unlock → Lock)

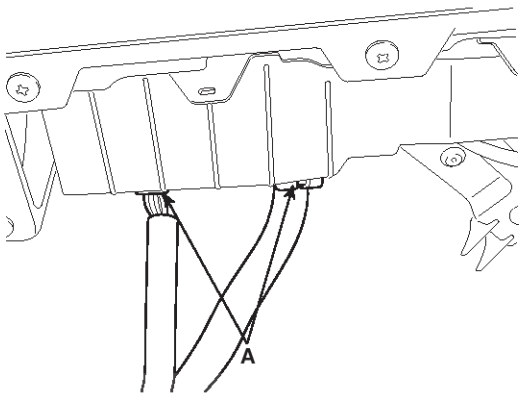
Rescue Mode

1. The condition to enter RESCUE MODE follows.
   - Ignition Sw Sts Message is RUN or IGN SW ON and Ignition Sw Sts Message is by RUN or IGN SW ON.
   - One of whole Park Tail Head Lamp Ctrl, Front Wiper Ctrl Message is sent in INVALID or, when CAN Line for IPM is error.
   - Assist Door Courtesy Lamp Ctrl Message is sent in INVALID or when CAN Line for RAM is error.
2. When entering RESCUE MODE, It moves as the next.
   - Door Unlock it's on for 0.5 seconds.
   - OSRVM Defogger, It's on for 20 minutes.
   - Illumination is much on.
   - The another function is identical with NORMAL MODE movement.
3. When Inhibit Sw Sts message is OFF/ACC or IGN SW is off and CAN Line abnormality from IPM, FAM, RAM is not, Park Tail Head Lamp Ctrl, Front Wiper Ctrl, Assist Door Courtesy Lamp Ctrl Message isn't INVALID, released in RESCUE MODE.

Switch Signal Name	Filtering Time(ms)
Central Door Lock SW	50 ~ 52
Central Door Unlock SW	50 ~ 52

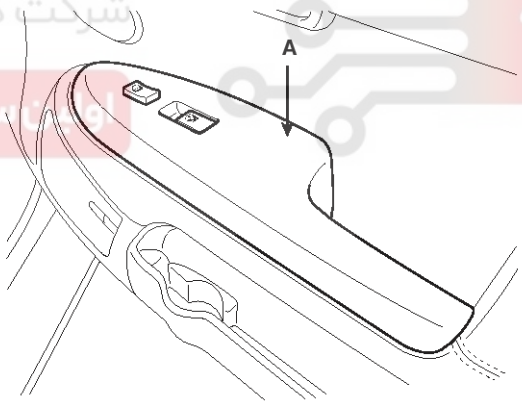
Removal

1. Disconnect the negative battery terminal.
2. Remove the front assist door trim panel. (Refer to the Body group - Front door)
3. Remove the assist door module (A) mounting screws (5EA) after disconnecting the connector (3EA) from the module.



SHMBE8143D

4. Remove the front door module (ADM) (A) from the front assist door trim panel.



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Installation

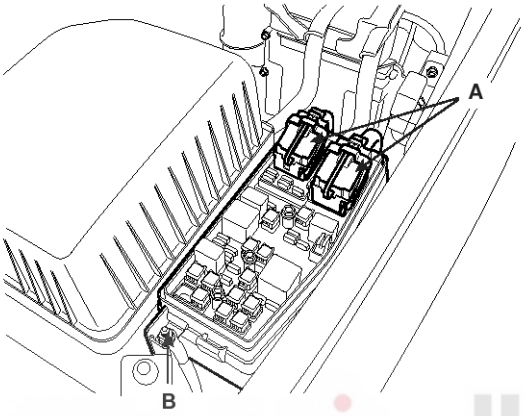
1. Install the front assist door module to the front door trim panel.
2. Reconnect the assist door module connector
3. Install the front assist door trim panel.

Front Area Module(FAM)

Replacement

FAM (Front Area Module)

1. Disconnect the negative (-) battery terminal.
2. Remove the FAM cover of engine room.
3. Remove the FAM connectors (2EA) (A) and battery terminal nut (1EA) (B).



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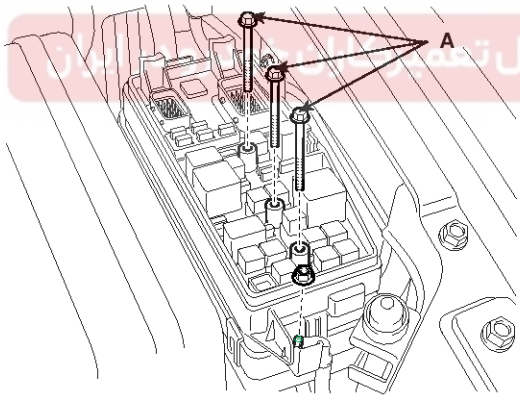
4. Remove FAM mounting bolts (3EA) (A) and remove the FAM mounting clips.



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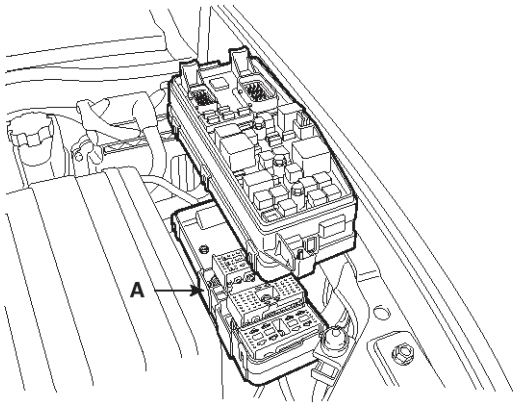
5. Remove the FAM from splash shield (A).



SHMBE8135D

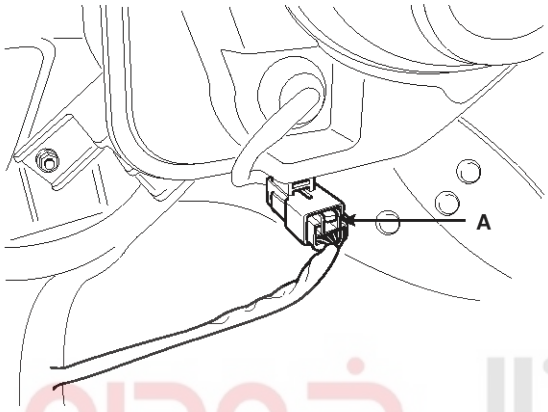
6. Disconnect the connector from splash shield.
7. Installation is the reverse of removal.

Rear Area Module(RAM)

Replacement

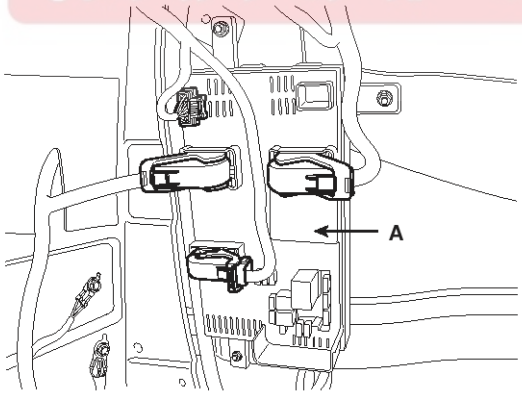
RAM (Rear Area Module)

1. Disconnect the nagative(-) battery Terminal.
2. Remove the rear left luggage side trim.
   (Refer the body group - "Interior trim")
3. Remove the woofer after disconnecting the connector (A) and loosening the mounting nuts (4EA).



SHMBE8040D

4. Remove the RAM (A) after disconnecting the connectors (4EA) and loosening the mounting bolts (3EA).



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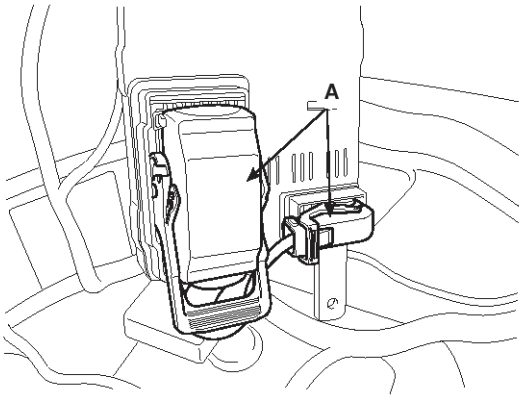
5. Disconnect the back side connector (A) of RAM.



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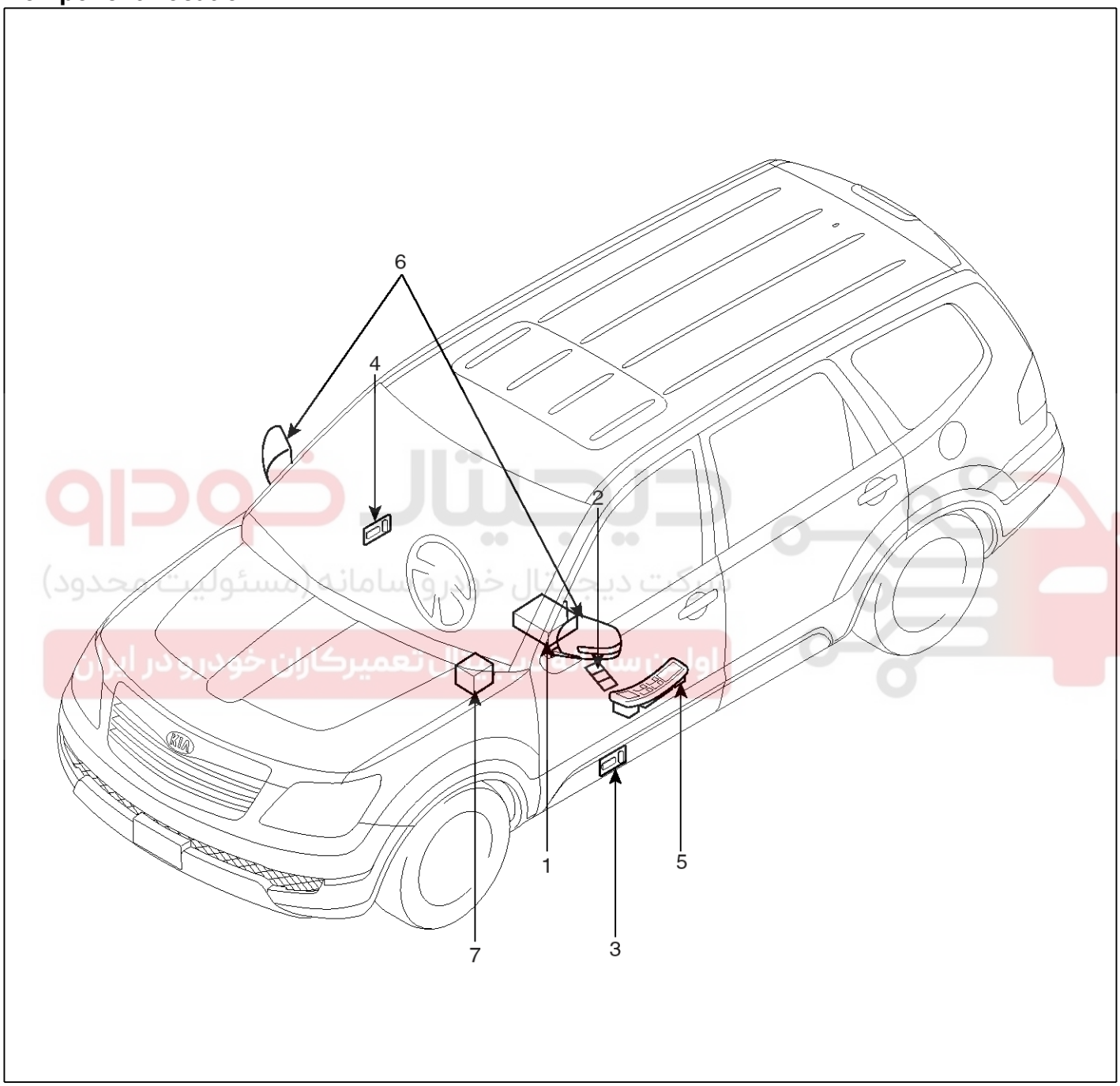
6. Installation is the reverse of removal procedures.

IMS (Integrated Memory System)

IMS (Integrated Memory System) module

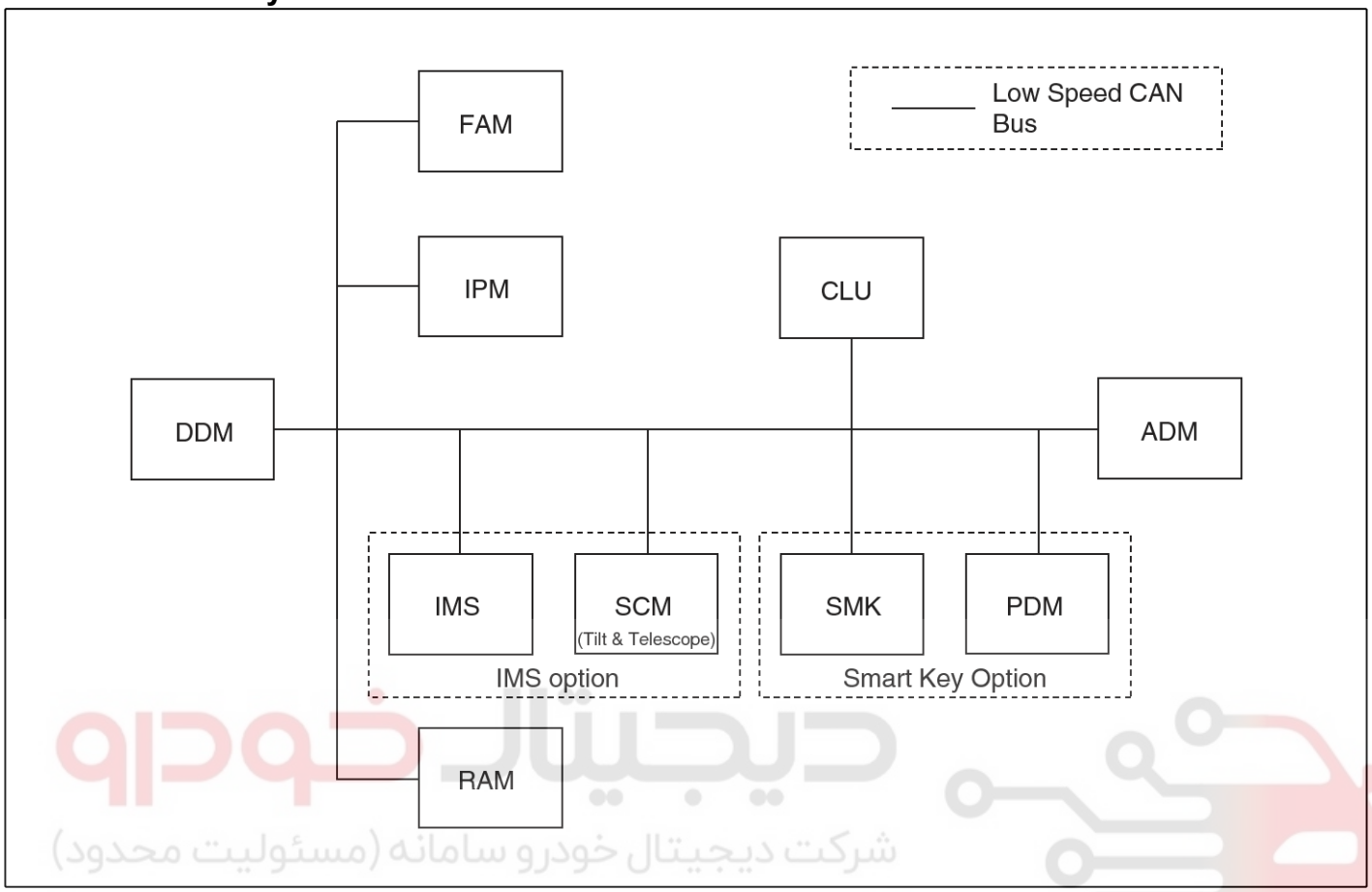
Component Location



SHMBE8145D

1.Seat Memory Unit
2.IMS control switch
3.IMS driver power seat control
4.IMS assist power seat control
5.IMS mirror control(Driver power window switch)
6.Outside mirror
7.SCM(Tilt-telescopic module)
8.Steering column control switch

Communication System



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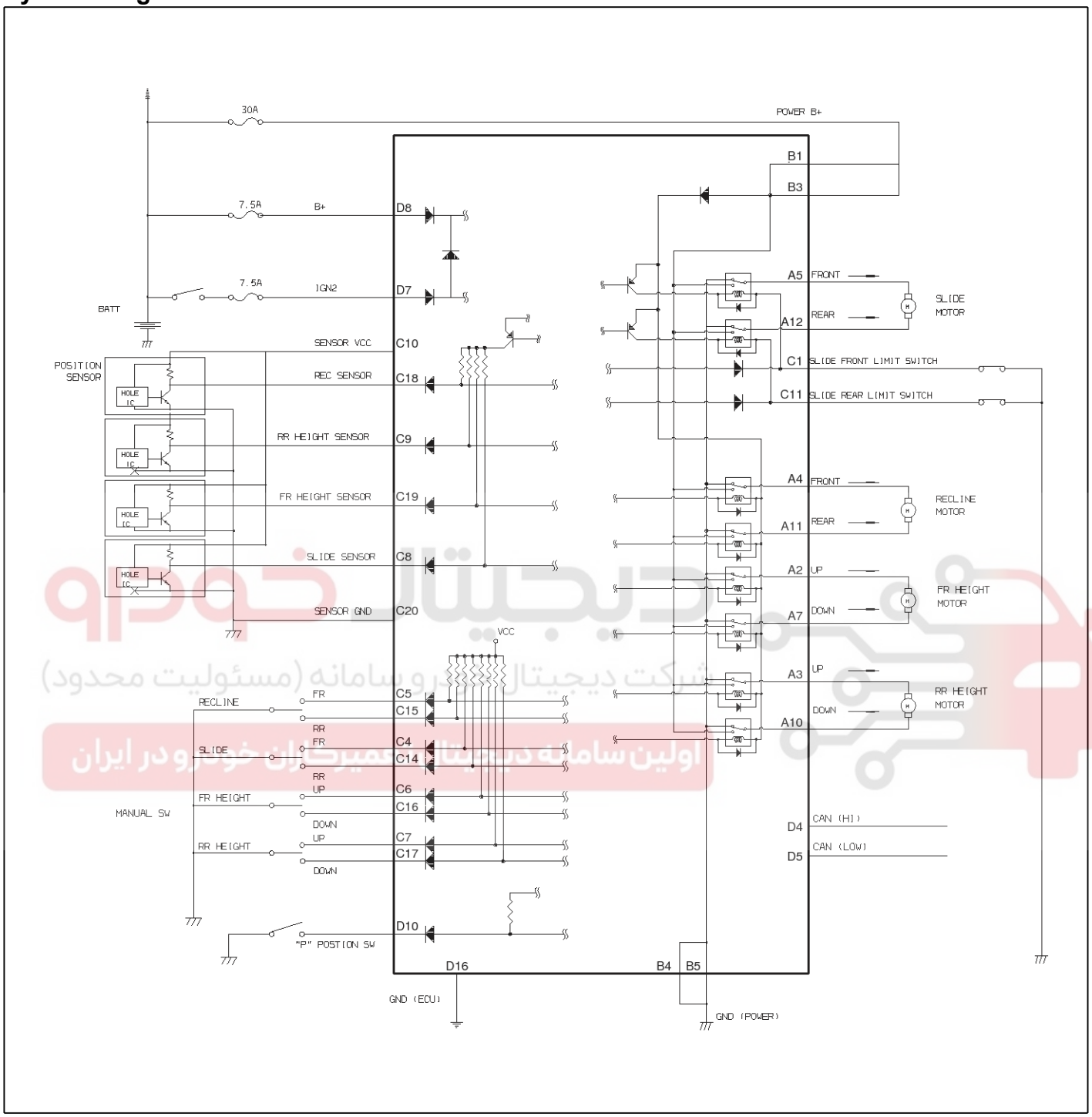
System Diagram



SHMBE9296N

Description

system outline

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

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

Input Specification

1. IGN2

   IGN is judged by local SW “IGN2”and CAN data “Ignition sw Sts”

2. Seat manual SW: Seat Input

   1) Slide FR / RR manual SW

      SW that moves slide motor of a seat forward or backward

   2) Recline FR / RR SW

      SW that moves recline motor of a seat forward or backward

   3) FR height up / down manual SW

      SW that moves front height motor of a seat upward or downward

   4) RR height up / down manual SW

      SW that moves rear height motor of a seat upward or downward

3. Seat position sensor (pulse signal)

   - A sensor to sense the movement of slide, recline, FR height and RR height motor.

4. “P” position SW

   This SW detects parking state of transmission.

   Get-on/off gearing and memory storage are not allowed in positions other than “P”. (AT only)

   (“P” position SW is used because INH “P” detection is not possible when IGN is off)

   “P” Position SW is used in case that CAN is time out

5. IMS SW: It Is transmitted to IMS with CAN communication after DDM input

   1) SET SW

      SW that sets the position of seat by a driver at memory allowed state

   2) MEM 1, MEM 2 SW

      SW that memorizes and plays the position of seat set by a driver

6. CAN communication line (CAN Hi, CAN Low)

   IMS communicates IPM, FAM, DDM, ADM, RAM, CLU, SCM, SMK and PDM through CAN BUS

   (At the speed of 50kbps)

7. Limit SW

   SW that prevents restriction of seat and its contact point is normal close type.

Functional specification

1. Output time

   Buzzer output: 0.1 sec. On, 0.4 sec. off

2. Output condition

   *When it is allowed Memory mode (memory SW on): once

   *When Memory storage mode is completed (Position SW on): twice

   *When Memory mode is played (Position SW on): once

   *When Easy Access operation is set (IMS Auto Sw ON): twice

   *When Easy Access operation is canceled (IMS Auto Sw OFF) : once

   *When error occurs due to sensor failure: 10 times

The conduct of input signal chattering

1. 40ms objects : input SW

   * Slide, recline, FR height, RR height manual SW

   * ”P” position SW

   * Slide FR/RR limit SW

   * Recline FR/RR limit SW

2. IGN is judged by local SW “IGN2” and CAN data “Ignition Sw Sts”

Function

Manual operation

1. Manual operation of seat

   Seat manual SW manipulation enables seat operation by the input of manual SW.

   Manual operation is always possible for slide, recline, front height and rear height even though ECU B+ is off as long as IGN2 is on.

Memory storage operation

1. Memory permission operation

   If CAN BUS data “IMS Memory Commend” transmitted from DDM according to Memory SW is SET, it enters Memory permission mode, and if IMS receives “IMS Memory Commend SET”, IMS outputs buzzer once.

2. Memory operation

   If CAN BUS data “IMS Memory Commend” transmitted from DDM according to handling position SW is MEMORY1 or MEMORY2, IMS outputs buzzer twice and memorize the current seat positions

   (DDM transmits Memory order only when position SW input happens within 5 sec from Memory SW off->on, and passage of 5 sec in Memory permission mode will cancel the mode.)

3. Memory conditions

   Failure to meet any one of the following conditions will trigger ban or cancellation of Memory permission. (DDM determines if the following conditions are met or not, and only if all four conditions are met, it transmits Memory permission order (“IMS Memory Commend”: “SET “) and Memory order (“IMS Memory Commend”:“Memory1” or “Memory2”).

   ① CAN BUS data “Ignition sw Sts” transmitted from IPM is “RUN”.

   ② CAN BUS data “Inhibitor Sw Sts” transmitted from CLU is “P”.

   ③ CAN BUS data “Vehicle Speed” transmitted from CLU is “3km/h” or below.

   ④ Below 5 sec. After Memory SW on-> off.

4. Memory set does not have a limit in terms of the number of inputs

   (Storage by Memory SW manipulation once is limited to once)

5. If Memory order is received during Get-on gearing or play operation, halt auto control and remember the current position while remembering the position where Memory order is received if it is received during operation by manual SW for seat.

Memory play operation

1. Play operation

   If CAN BUS data (IMS Memory Commend) transmitted from DDM by position SW manipulation is “RETURN 1” or “RETURN 2”, Output a buzzer once and automatically put seat back to a remembered position,

2. Halt conditions

   DDM will transmit CAN BUS data to generate Memory play order only in case that two conditions of ①② (in the following 5) items are met and one condition of ③, ④ items is met.

   ① CAN BUS data “Inhibitor Sw Sts” transmitted from CLU is “P”.

   ② CAN BUS data “Vehicle Speed” transmitted from CLU is “3km/h” or below

   ③ In case that the MEM1/MEM2 SW of IMS SW is ON, if driver door open or in 30 seconds after driver door close

   ④ CAN BUS data “Ignition Sw Sts” transmitted from IPM is “RUN

   ⑤ No manual SW manipulation for seat (determined by IMS)

3. Halt conditions (determined by IMS)

   Failure to meet any one of the following during play operation will halt the operation

   ① CAN BUS data “Inhibitor Sw Sts” transmitted from CLU is “P”.

   ② CAN BUS data “Vehicle Speed” transmitted from CLU is “3km/h” or below

   ③ The limit sw of moving direction. is ON during operation

   ④ In case that target position of motor (±6 EDGE) is not arrived

   ⑤ No manual SW manipulation for seat

   However, buzzer output will still take place in order to inform the user of play operation of other units when play order is received even though manual SW for seat is on.

4. Others

① Play operation not recorded in the MEM1/2 will not be conducted and there will be no buzzer output

② If other data is received during Play operation, the most recent play signal will take precedence

③ If engine is started(if “Ignition Sw Sts” is “START”) during Play operation, halt Play operation, and resume it toward target position 100ms after “Ignition Sw Sts” is returned to “RUN”.

However, if the START state lasts over 5 sec., it will not resume even after returning to RUN

④ If Play order is received during engine start(if “Ignition Sw Sts” is “START”), Play operation is inhibited.

⑤ If input from manual SW during Play operation occurs. halt all Play operations of seat.

⑥ If an error occurs during manual operation of seat, do not delete Memory.

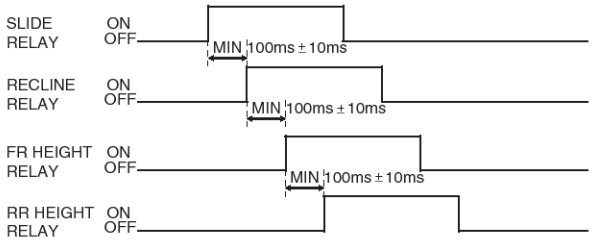
5. Operation control

① Prioritization of operations

Motor starting is delayed for 100ms respectively in case of auto control to prevent rush current from overlap when motors are running, and it follows the following order.

SLIDE > RECLINE > FR HEIGHT > RR HEIGHT

② Memory play is conducted in the following order, and delay time for each motor is as follows.



SHMBE9297N

Continuous cooperation TIMER value for each motor (Except operations by manual SW)

Slide: 20 sec., recline: 35 sec., front height: 10 sec., rear height: 15 sec

③ Control when turning to the opposite direction

When motor has to be run in a reverse direction during Easy access function gearing or play operation, stop the operation immediately, wait for 100ms and then try operation to the reverse direction.

④ If the difference between memorized position and the current one is below specified value, motor will not run even though play data is received.

* Slide, recline, front height, rear height: 12 EDGE (6PULSE)

* Slide, recline, FR height, RR height: 12EDGE (6PULSE)

⑤ Operation will stop upon reaching Motor’s target point when conducting Easy access function gearing or play operation.

Easy access function gearing operation

1. Easy access function gearing operation is allowed only when CAN DATA (IMS Auto Sw) transmitted from DDM is ON
2. If “SET SWITCH” pushes over 10 sec, it will enable Easy access function gearing operation to set or cancel

   (when Get-on gearing operation is set, output buzzer twice, / when Get-off gearing operation cancel, output buzzer once),
3. Get-off gearing operation is set in case that CAN DATA (IMS SCM Cfg) transmitted from IPM is “1”

   (0: Not Equipped, 1: Equipped ALL ON, 2: Equipped SCM ON, 3: Equipped ALL OFF)
4. If a key is removed and CAN BUS data “Key Reminder Sw Sts” transmitted from IPM changes from “on” to “off”, the seat slide will move 50mm backward based on the key out point.

   If slide rear limit becomes off in the middle of backward operation, get-off gearing will not be conducted.
5. If the key is inserted and CAN BUS data “Key Reminder Sw Sts” transmitted from IPM change from “on” to “off”, slide motor will move to the position of key out
6. Conditions to ban or halt Easy access function gearing operation

   The following conditions will be identified and processed by IMS, and if any one of the following conditions is met, Easy access function gearing operation will be prevented or halted

① When “P” position SW is not on.

② When “Vehicle Speed” in CAN BUS data transmitted from CLU is “3km/h” or faster

③ When seat is under manual SW operation

④ When play operation is received during get-on gearing operation

⑤ When CAN data (IMS Auto Sw) transmitted from DDM is off

(Operation is completed in case that CAN data (IMS Auto Sw) changes form “ON” to “OFF” during operation)

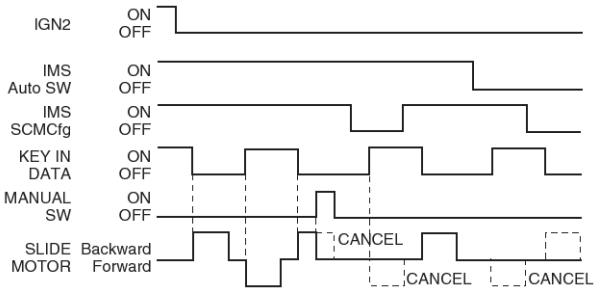
7. When control is halted in the middle of backward operation, the remaining operation will not be completed, and when returning, it will return just as much as it retreated
8. It will move to key out point in case of Get-on gearing by key in despite manual SW input during or after backward operation
9. Renewal condition of get-on gearing operation

① When CAN data (Ignition Sw Sts) changes from “RUN” to OFF and when CAN data (Key Reminder Sw Sts) changes from “ON" to “OFF”, Unit Remember position of “IGN = OFF“ and “KEY OUT “

② When manual SW is operated during KEY IN

③ When play operation is accomplishing

④ When pulse difference between previously memorized position and current position is beyond 6 pulse.



SHMBE9298N

Setting limit

1. SLIDE, RECLINE

   Limit SW is installed on both front/rear of the slide and the recline, and motor is not allowed to run under Limit SW off during manual SW operation, memory playing/Easy access function gearing operation.

2. RR HEIGHT, FR HEIGHT

   Since there is no Limit SW, set an arbitrary limit position as the following

   ① Immediately stop control and set its position to the limit position of its proceeding direction if input of over 6 pulses in 2 sec. is not fed during memory playing after attaching battery (Setting Limit on the opposite is the same).

   ② Once a certain limit is set, memory playing that goes beyond set range is not allowed to run to prevent motor damage by mechanical lock

   ③ Renew limit position if pulses are fed normally beyond its limit position Already set by manual operation

Detecting error or handling error

1. Detecting error for seat

   Unit judges motor to be error if the following conditions occur during manual SW operation,Easy access function gearing operation or memory playing.

   ① Error when pulse is not fed

Item	Slide	Recline	Fr height	Rr height
Error condition	Below 6 pulses in 2 sec.		Below 6 pulses in 1 sec	
Prerequisite	FR/RR Limit SW On		Limit setting complete	

   * Stop the related motor if an error is detected during playing or Easy access function gearing operation.

   * Stop the corresponding motor if an error is detected during manual operation (Excluding slide motor).

   ② If seat sensor Vcc below 1V is detected by 40ms,

   => Return if seat sensor Vcc is 4V or more.

   * Stop all seat motors running if seat sensor Vcc error is detected during playing or Easy access function gearing operation. (No buzzer output)

2. Handling error

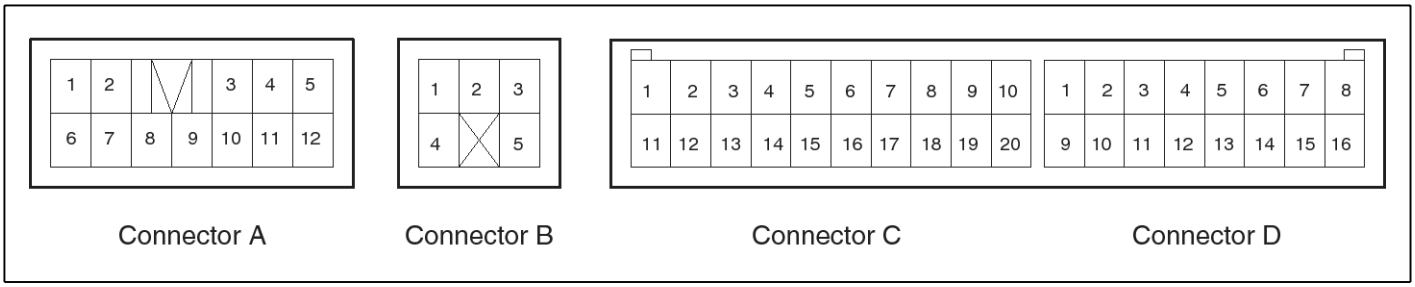
   If errors in the above are discovered, regard them as harness disconnection or sensor failure, and conduct the following measures.

   - Stop auto control (play or Easy access function gearing operation) if it is under auto control and set off buzzer 10 times (however, have motors other than the one with an error operate normally).
   - Set off alarm again in case of recurrence of error after restoration of a motor with an error.
   - Complete alarm 10 times though it comes back to normal during error alarm.
   - Stop alarm if receiving memory recall or play order, and set off buzzer in the corresponding function.
   - Manual operation control is allowed even for a motor with errors.
   - Set off buzzer if memory or play order is received even during error.
   - The timing to lift auto control suspension is when repair for the failing motor is completed, and the criteria for the completion point are as follows:

     Seat: if signal input is normal with over 6 pulses within a sec. from position sensor of a motor with an error caused by manual SW

Input/Output Specification

Connector Pin Lay Out



SHMBE9299N

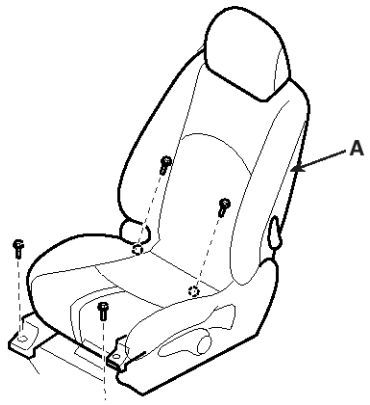
IMS input/output pin information

No	Signal Name	I/O	Contents	Remark
A1	-	-	-	
A2	FR Height Motor Up	O	FR Height Motor Up Output	
A3	RR Height Motor Up	O	RR Height Motor Up Output	
A4	Recline Motor FR	O	Recline Motor FR Output	
A5	Slide Motor FR	O	Slide Motor FR Output	
A6	-	-	-	
A7	FR Height Motor Down	O	FR Height Motor Down Output	
A8	-	-	-	
A9	-	-	-	
A10	RR Height Motor Down	O	RR Height Motor Down Output	
A11	Recline Motor RR	O	Recline Motor RR Output	
A12	Slide Motor RR	O	Slide Motor RR Output	
B1	GND(Power)	I	Power B+ For Operating Motor	
B2	-	-	-	
B3	B+(Power)	I	Power B+ For Operating Motor	
B4	GND(Power)	I	Power GND for Operating Motor	
B5	B+(Power)	I	Power GND for Operating Motor	
C1	Slide FR Limit SW	I	Slide FR Limit SW Input	Normal Close
C2	Recline FR Limit SW	I	Recline FR Limit SW Input	Normal Close
C3	-	-	-	
C4	Slide FR Manual SW	I	Slide FR Manual SW Input	On : GND
C5	Recline Fr Manual SW	I	Recline FR Manual SW Input	On : GND
C6	FR Height Up Manual SW	I	FR Height Up Manual SW Input	On : GND
C7	RR Heigth Up Manual SW	I	RR Height Up Manual SW Input	On : GND
C8	Slide Motor Sensor	I	Slide Motor Sensor Input	Pulse Signal
C9	RR Height Motor Sensor	I	RR Height Motor Sensor Input	Pulse Signal

C10	Sensor Vcc(Seat)	O	VCC For Operating Sensor	
C11	Slide RR Limit SW	I	Slide RR Limit SW Input	Normal Close
C12	Recline RR Limit SW	I	Recline RR LIMIT SW Input	Normal Close
C13	-	-	-	
C14	Slide RR Manual SW	I	Slide RR Manual SW Input	ON : GND
C15	Recline RR Manual SW	I	Recline RR Manual SW Input	ON : GND
C16	FR Height Down Manual SW	-	FR Height Down Manual Sw Input	ON : GND
C17	RR Height Down Manual SW	-	RR Height Down Manual Sw Input	ON : GND
C18	Recline Motor Sensor	I	Recline Motor Sensor Input	PULSE SIGNAL
C19	FR Height Motor Sensor	I	FR Height Motor Sensor Input	PULSE SIGNAL
C20	Sensor GND(Seat)	O	GND For Operating Sensor	
D1	-	-	-	
D2	-	-	-	
D3	-	-	-	
D4	CAN (Hi)	I/O	CAN Bus Line	
D5	CAN (Low)	I/O	CAN Bus Line	
D6	-	-	-	
D7	IGN2	I	IGN2 Input	BAT
D8	B+(ECU)	I	ECU Power Input	BAT
D9	-	-	-	
D10	“P” Position SW	I	“P” Position SW Input	On : GND
D11	-	-		
D12	-	-		
D13	-	-		
D14	GND(ECU)	I	ECU GND	
D15	-	-		
D16	-	-		

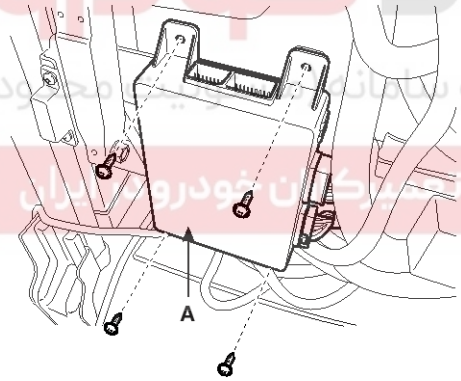
Removal

1. Remove the negative (-) battery terminal.
2. Remove the driver seat (A) in the car.
   (Refer to the Body group - Front seat)



SHMBE8150D

3. Remove the IMS module (A) after loosening 4 screws in the bottom of seat.



SHMBE8152D

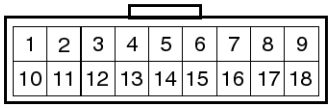
Installation

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

IMS Power Seat Control

Circuit diagram

Power seat control switch connector



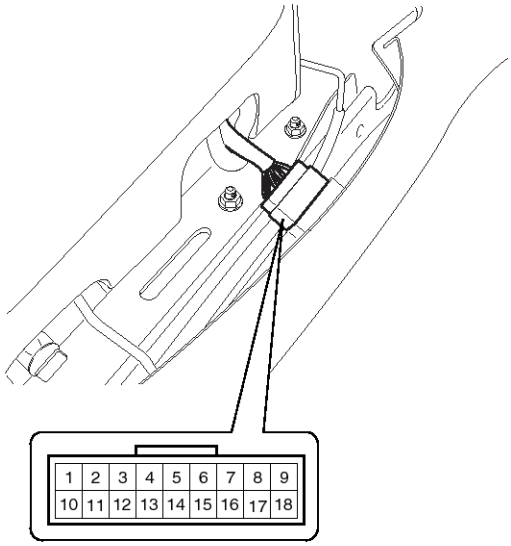
Connector A

Pin No.	Connector name
1	Battery +
2	Front recline motor
3	Front recline limit
4	Rear slide seat limit
5	Rear slide seat motor
6	Front slide seat motor
7	Front slide seat limit
8	Front height up motor
9	Front height up limit
10	-
11	Rear recline limit
12	Rear recline motor
13	Rear height up limit
14	Rear height up motor
15	Rear height down motor
16	Rear height down limit
17	Front height down motor
18	Front height down limit

SHMBE9300N

Inspection

1. Remove the seat control switch.



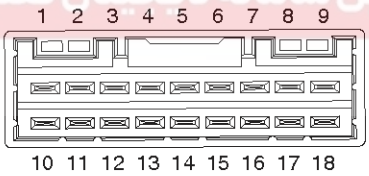
SHMBE9312N

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

Driver power seat control switch

Driver power seat control switch

	Front height control switch			Slide control switch			Rear height control switch			Recline control switch			Remark
	LH		N		LH		LH		N		LH		
	UP	DOWN	HEI	SEAT(LH)	F	R	UP	DOWN	HEI	REC	F	R	
1	●	●			●	●	●	●			●	●	⊕
5				●	●	●							SEAT MTR
6				●	●	●							SEAT MTR
4				●		●							SEAT LIMIT
7				●	●								SEAT LIMIT
2										●	●	●	REC MTR
12										●	●	●	REC MTR
3										●	●		REC LIMIT
11										●		●	REC LIMIT
8	●		●										HEI (FR) UP MTR
17	●	●	●										HEI (FR) DOWN MTR
9	●		●										HEI (FR) LIMIT ⊖
18		●		●									HEI (FR) LIMIT ⊖
14							●	●	●				HEI (RR) UP MTR ⊖
15							●	●	●				HEI (RR) DOWN MTR ⊖
13							●		●				HEI (RR) LIMIT ⊖
16								●	●				HEI (RR) LIMIT ⊖

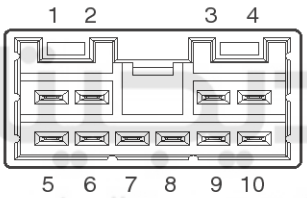


SHMBE9301N

Assist power seat control switch

Assist power seat control switch

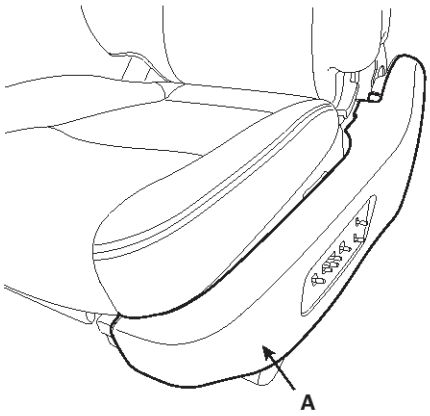
	Slide control			Recline control			Remark
	Right		Neutral		Right		
			Slide	Recline control			
	Froward	Reward	RH		Froward	Reward	
5	○	○			○	○	+
1	○	○	○				Slide motor
2	○	○	○				Slide motor
3				○	○	○	Recline control motor
4				○	○	○	Recline control motor
10				○		○	Recline control limit
6	○		○				Slide limit
7		○	○				Slide limit
9				○	○		Recline control limit



SHMBE9302N

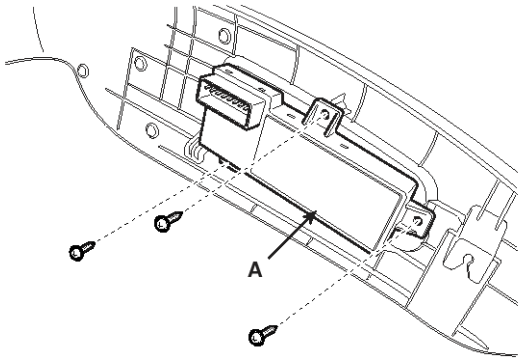
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the seat front cover (A).
   (Refer to the Body group-front seat)



SHMBE8154D

3. Loosen the power seat control switch (A) mounting screws (3EA) and disconnect the connector.



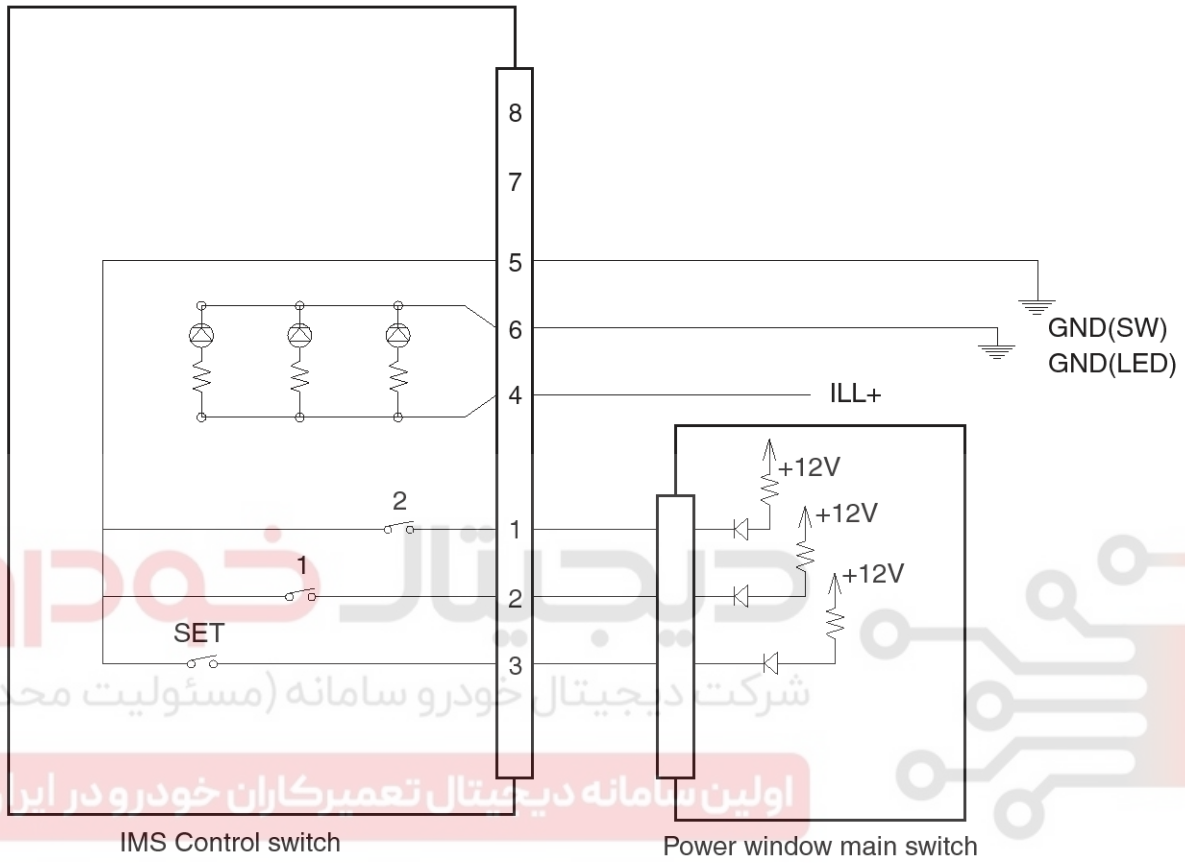
SHMBE8155D

Installation

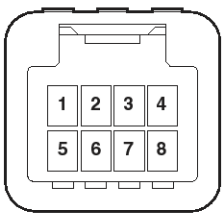
1. Connect the connectors and reassemble the power seat control switch.
2. Reassemble the front seat cover.

IMS Control Switch

Circuit diagram



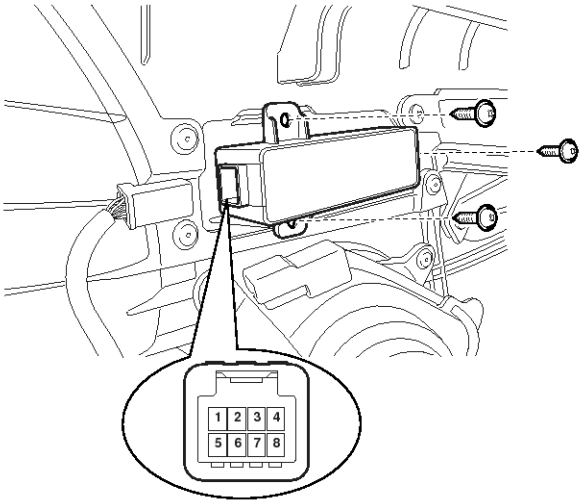
Pin No.	Name
1	M2 switch
2	M1 switch
3	SET switch
4	Illumination (+)
5	Ground (SW)
6	Illumination (-)
7	-
8	-



SHMBE9303N

Inspection

1. Disconnect the IMS control switch connector.



SHMBE8159D

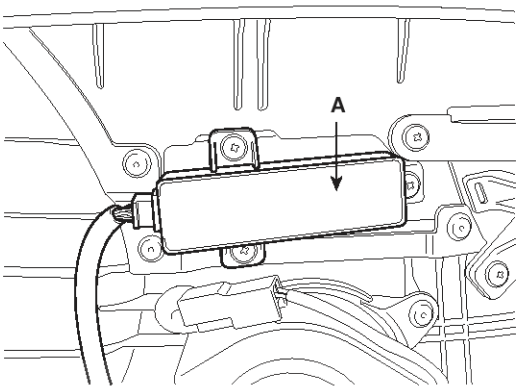
2. With the power IMS control switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the IMS control switch.

Terminal / Position	5	3	2	1
SET	○	○		
1	○		○	
2	○			○

SHMBE9304N

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel.
   (Refer to the Body group-front door)
3. After removing the mounting screws (3EA) and switch connector, then remove the IMS control switch (A) from the front door trim panel.



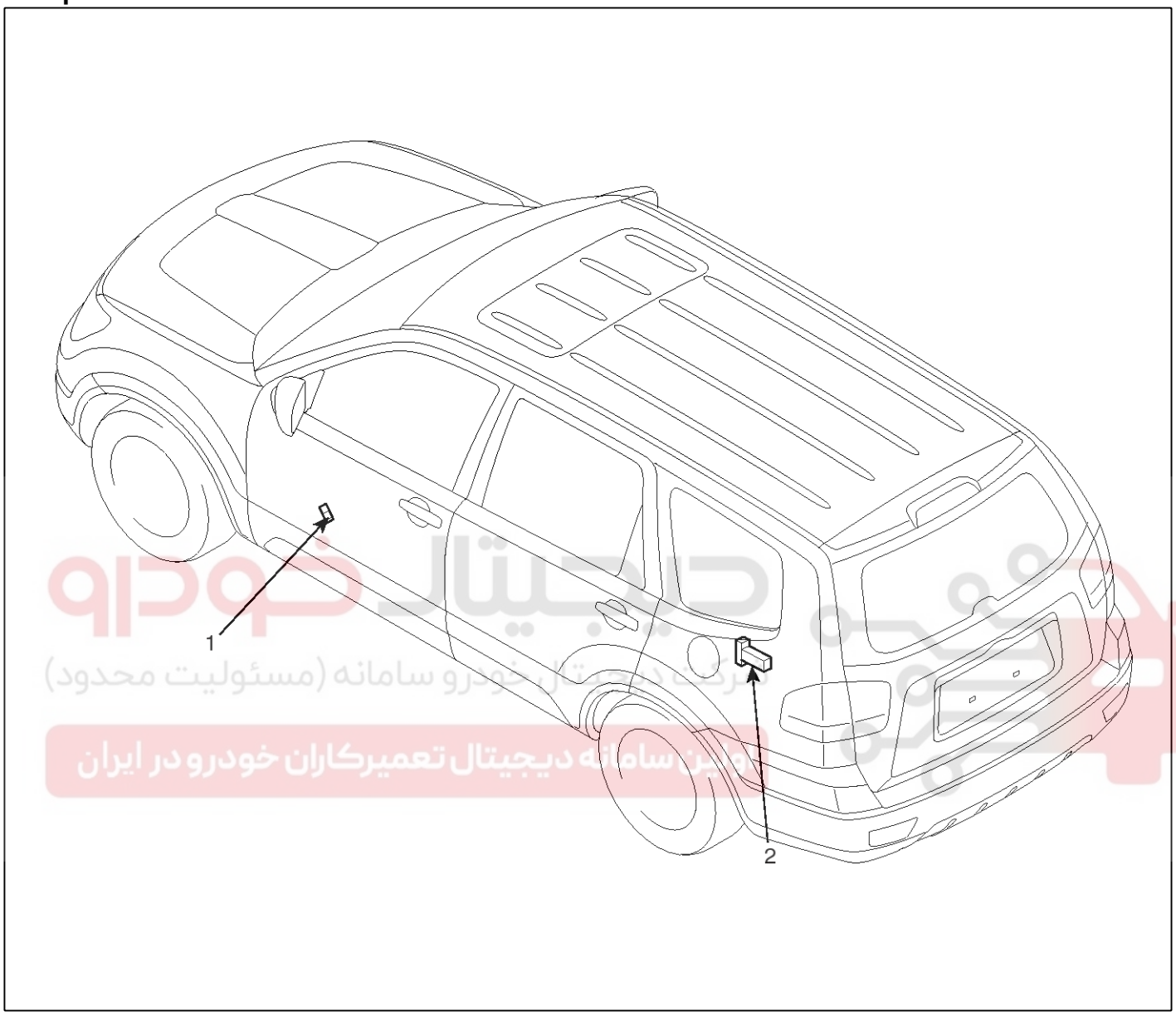
SHMBE8158D

Installation

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

Fuel Filler Door

Component Location



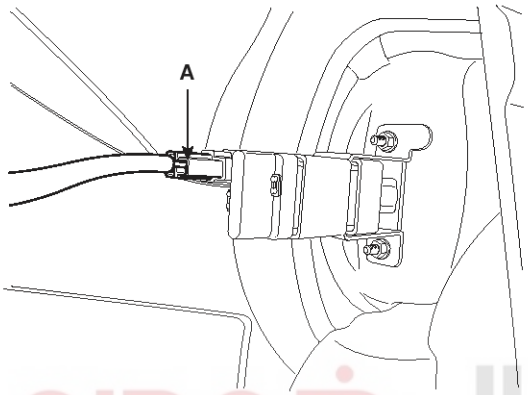
SHMBE8161D

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

Fuel Filler Door Release Actuator

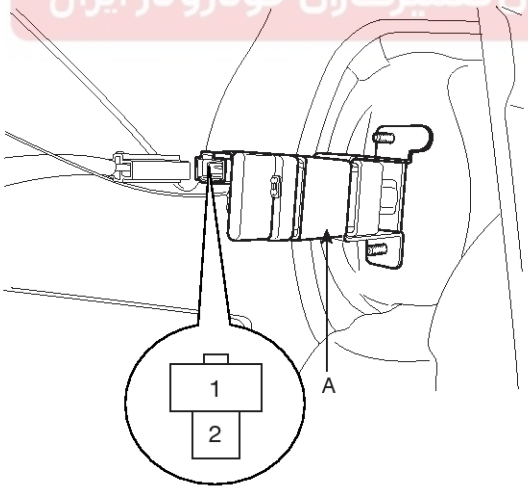
Inspection

1. Remove the rear 3rd seats. (Refer to the Body group - rear seats)
2. Remove the luggage side trim. (Refer to the Body group - interior trim)
3. Disconnect the fuel filler door release actuator connector (A).



SHMBE8162D

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

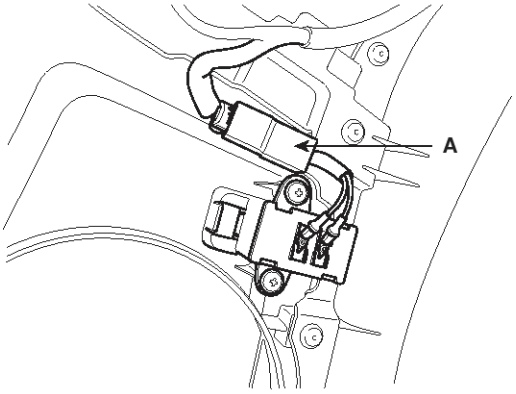


SHMBE8163D

Fuel Filler Door Open Switch

Inspection

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

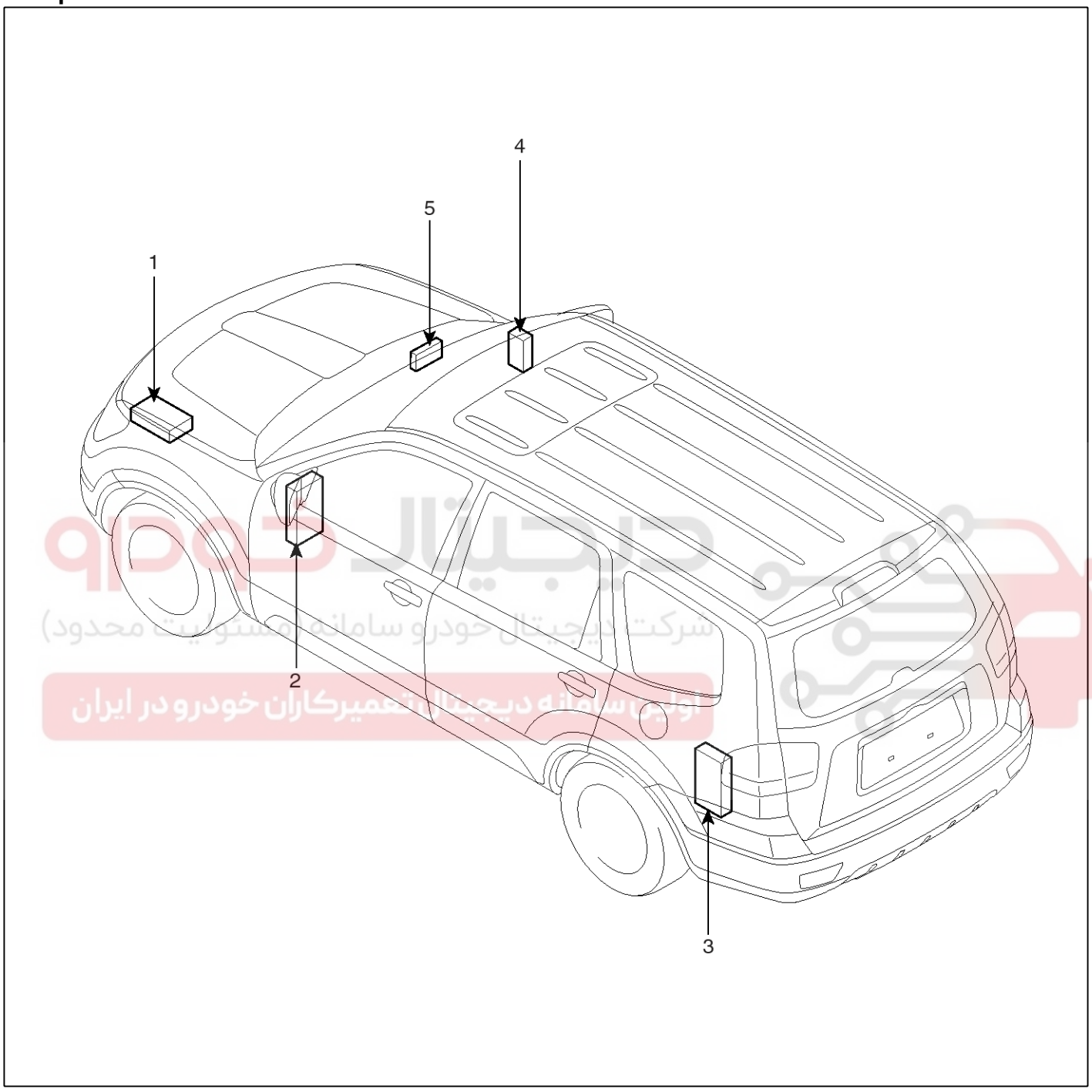


SHMBE8164D

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

Fuses And Relays

Component Location



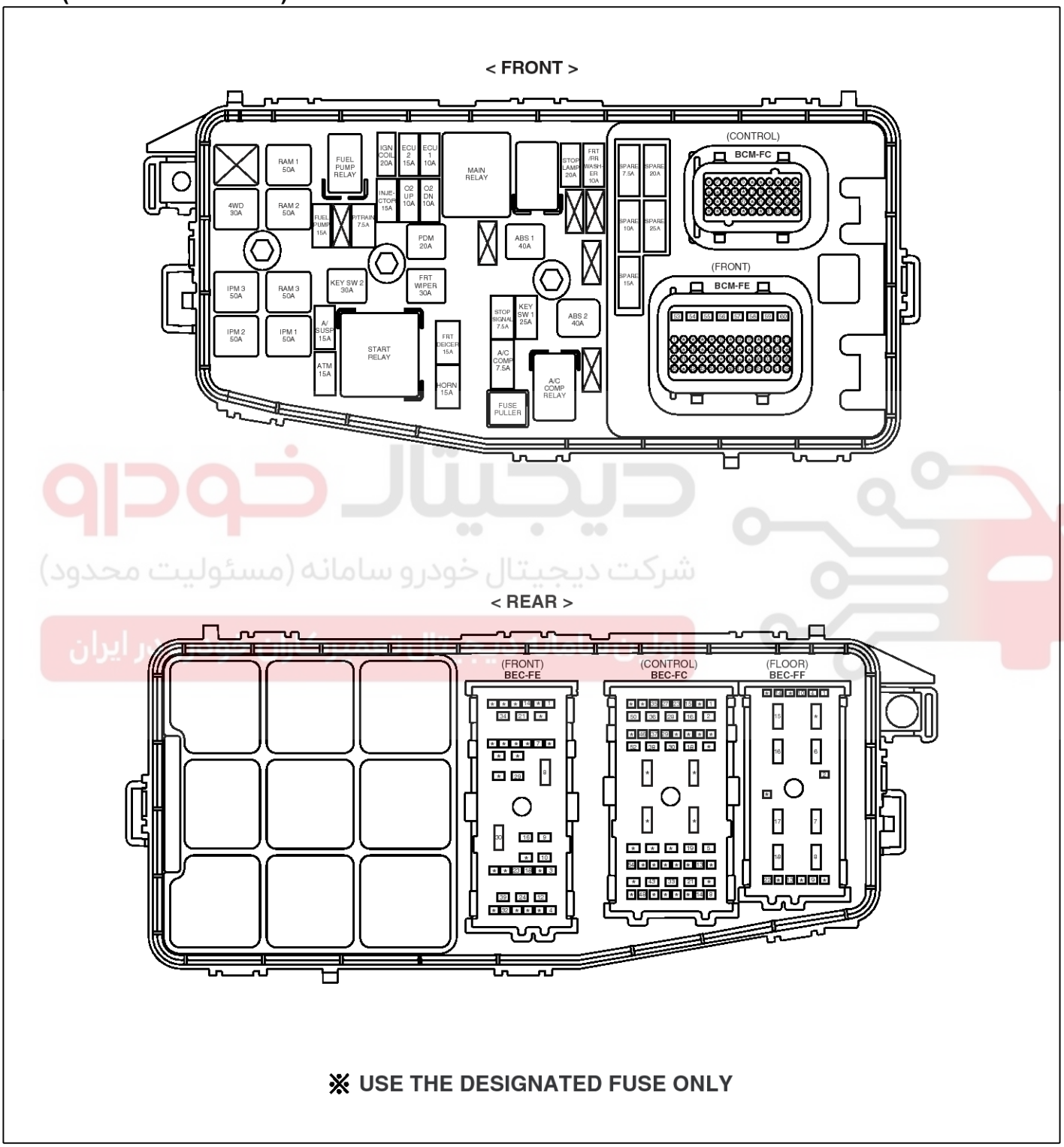
SHMBE9116L

1. Front area module (FAM)
2. In-Panel module (IPM)
3. Rear area module (RAM)
4. Power distribution module (PDM)

Fuse & Relay Box (Engine Compartment)

Components

FAM (Front Area Module)



SHMBE9134L

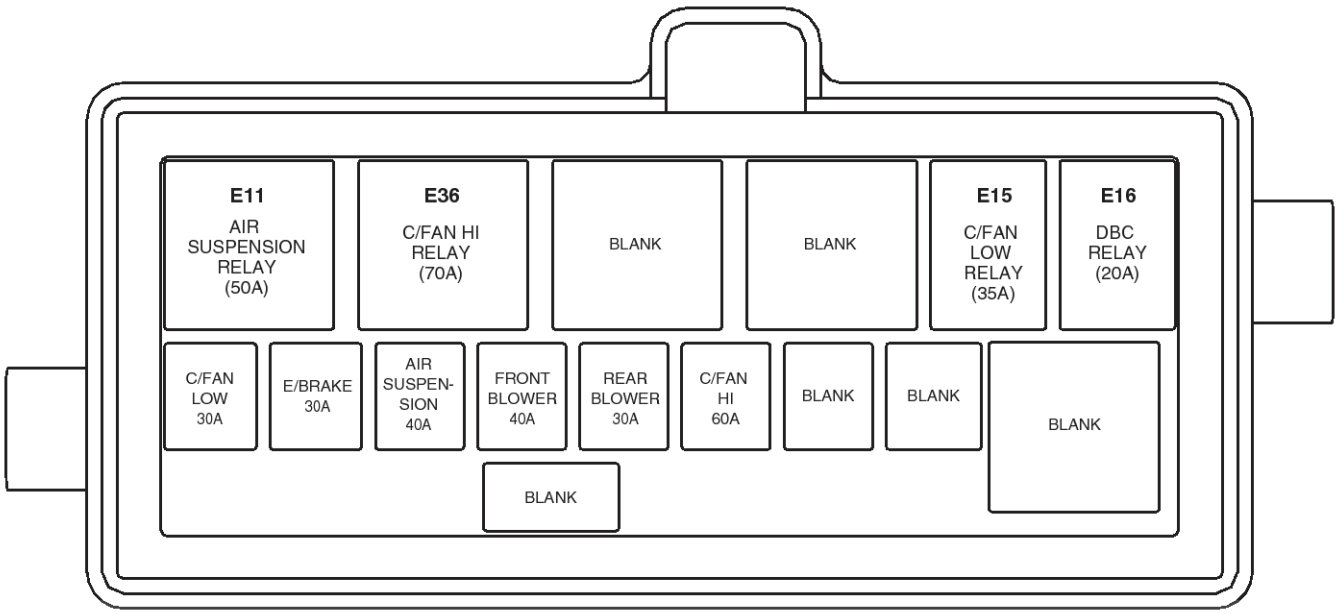
CIRCUIT

Description		(A)	Circuit Protected
FUSE	FRT/RR WASHER	10A	Front/Rear Washer Motor Relay, Washer Motor
	STOP LAMP	20A	Stop Lamp Switch, DBC Relay
	KEY SW 1	25A	Ignition Switch, PDM Relay Box(IG1 Relay , ACC Relay)
	STOP SIGNAL	7.5A	ABS Control Module, ESP Control Module, ECM, Smart Key Control Module
	A/C COMP	7.5A	A/C Comp Relay
	FRT DEICER	15A	Front Deicer Relay
	HORN	15A	Horn Relay
	ECU 1	10A	ECM, Mass Air Flow Sensor, Immobilizer Module, A/C Comp Relay
	O_2 DN	10A	Oxygen Sensor #3,#4
	ECU 2	15A	Oil Control Valve, ECM, Variable Intake Manifold Valve, Purge Control Solenoid Valve
	O_2 UP	10A	Oxygen Sensor #1,#2
	IGN COIL	20A	Ignition Coil #1~6, Condenser #1,#2
	INJECTOR	15A	ECM, Injector #1~#6
	P/TRAIN	7.5A	ECM, Main Relay, Relay Box(Burglar Horn Relay)
	FUEL PUMP	15A	Fuel Pump Relay
	A/SUSP	15A	Air Suspension Control Module
	ATM	15A	TCM
FUSIBLE LINK	ABS 2	40A	ABS Control Module, ESP Control Module
	ABS 1	40A	ABS Control Module, ESP Control Module
	PDM	20A	PDM
	FRT WIPER	30A	Front Wiper ON Relay, Front Wiper HI/LO Relay
	KEY SW 2	30A	Start Relay #1, Ignition Switch, PDM Relay Box(IG2 Relay)
	RAM 1	50A	RAM(CTR P/OUT FUSE 15A, RR P/OUT FUSE 15A, FUEL DR FUSE 15A, RR P/WIN-LH FUSE 20A, RR P/WIN-RH FUSE 20A, LUGGAGE FUSE 7.5A)
	RAM 2	50A	RAM(RR DEFOG FUSE 25A, T/G POWER LATCH FUSIBLE LINK 30A, DOOR LOCK FUSE 15A, RR WIPER FUSE 15A)
	RAM 3	50A	RAM(AMP FUSIBLE LIMK 30A)
	IPM 1	50A	IPM(ILLUMI FUSE7.5A, DDM FUSIBLE LINK 30A, FRT S/WARMER FUSE 20A, OBD-II FUSE 7.5A, SUNROOF FUSE 25A, KEY LOCK FUSE 7.5A)
	IPM 2	50A	IPM(ADM FUSIBLE LINK 30A, F/PWR OUTLET FUSE 15A, PEDAL FUSE 15A, S/TILT & TELE FUSE 20A)
	IPM 3	50A	IPM(MEMORY FUSE 7.5A, DRIVER P/SEAT FUSE 30A, PASS P/SEAT FUSE 20A, RR S/WARMER FUSE 20A, ROOM FUSE 7.5A, AUDIO FUSE 15A)
	4WD	30A	4WD ECM

※ USE THE DESIGNATED FUSE ONLY

SHMBE9135L

Sub Box (Engine Room)



FUSIBLE LINK	(A)	Circuit Protected
C/FAN LOW	30A	C/Fan Low Relay
E/BRAKE	30A	(Not Used)
AIR SUSPENSION	40A	Air Suspension Relay
FRONT BLOWER	40A	Front Blower Relay
REAR BLOWER	30A	Rear Blower Relay
C/FAN HI	60A	C/Fan Hi Relay

※ USE THE DESIGNATED FUSE ONLY

SHMBE9136L

Inspection

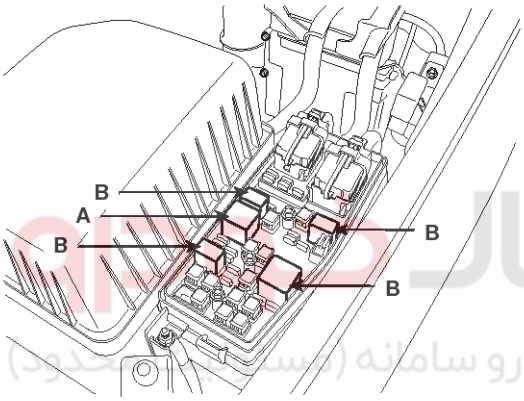
Fuse

1. Ensure that relays are security installed.
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.

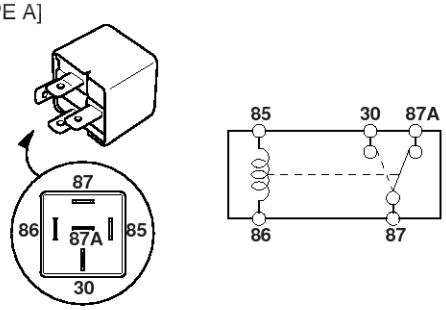
Relay

1. Be sure that the relays are held the each module securely.
2. Are the relay types for each circuit correct?



SHMBE9313N

[TYPE A]

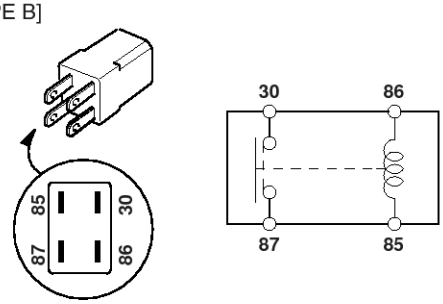


SHMBE9096N

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

SHMBE9097N

[TYPE B]



SHMBE9098N

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

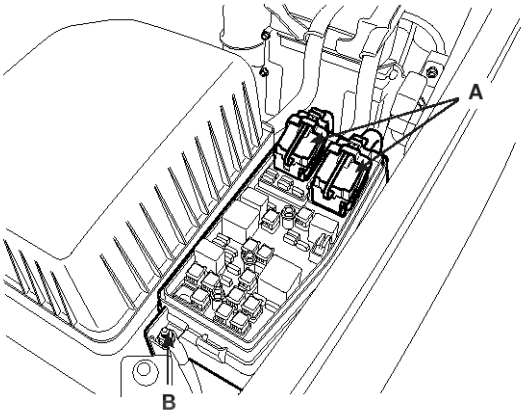
SHMBE9093N

3. If a relay-operated system does not operate properly, verify the condition of the relay and replace the relay (if inoperative) before continuing with additional troubleshooting.

Replacement

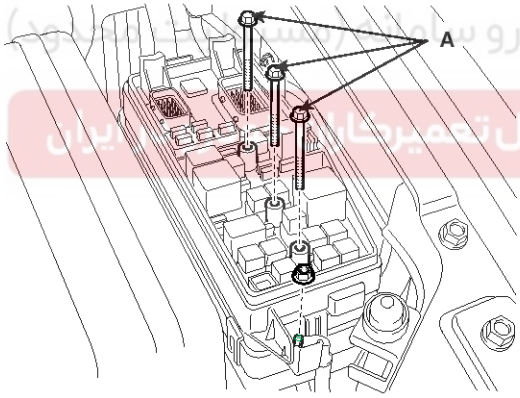
FAM (Front Area Module)

1. Disconnect the negative (-) battery terminal.
2. Remove the FAM cover of engine room.
3. Remove the FAM connectors (2EA) (A) and battery terminal nut (1EA) (B).



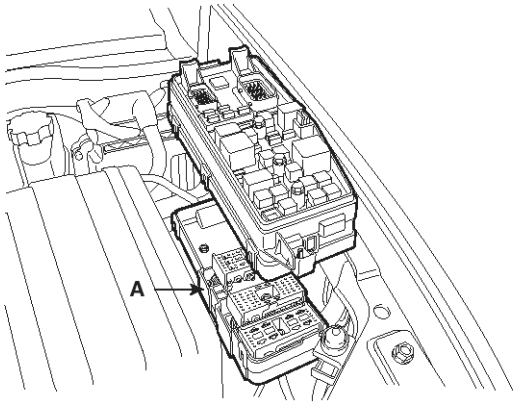
SHMBE8136D

4. Remove FAM mounting bolts (3EA) (A) and remove the FAM mounting clips.



SHMBE8137D

5. Remove the FAM from splash shield (A).



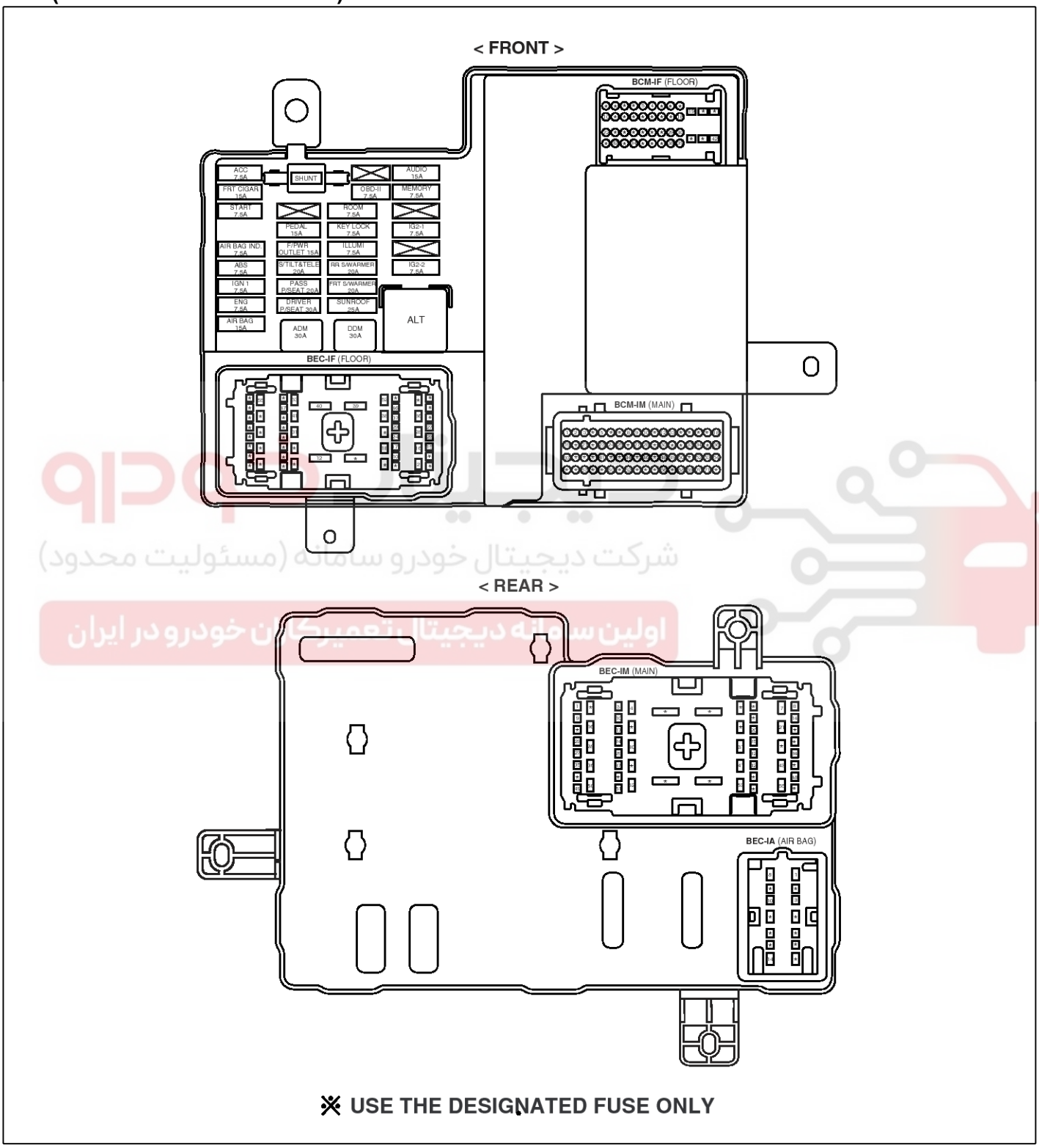
SHMBE8135D

6. Disconnect the connector from splash shield.
7. Installation is the reverse of removal.

Fuse & Relay Box (Passenger Compartment)

Components

IPM (Instrument Panel Module)



SHMBE9137L

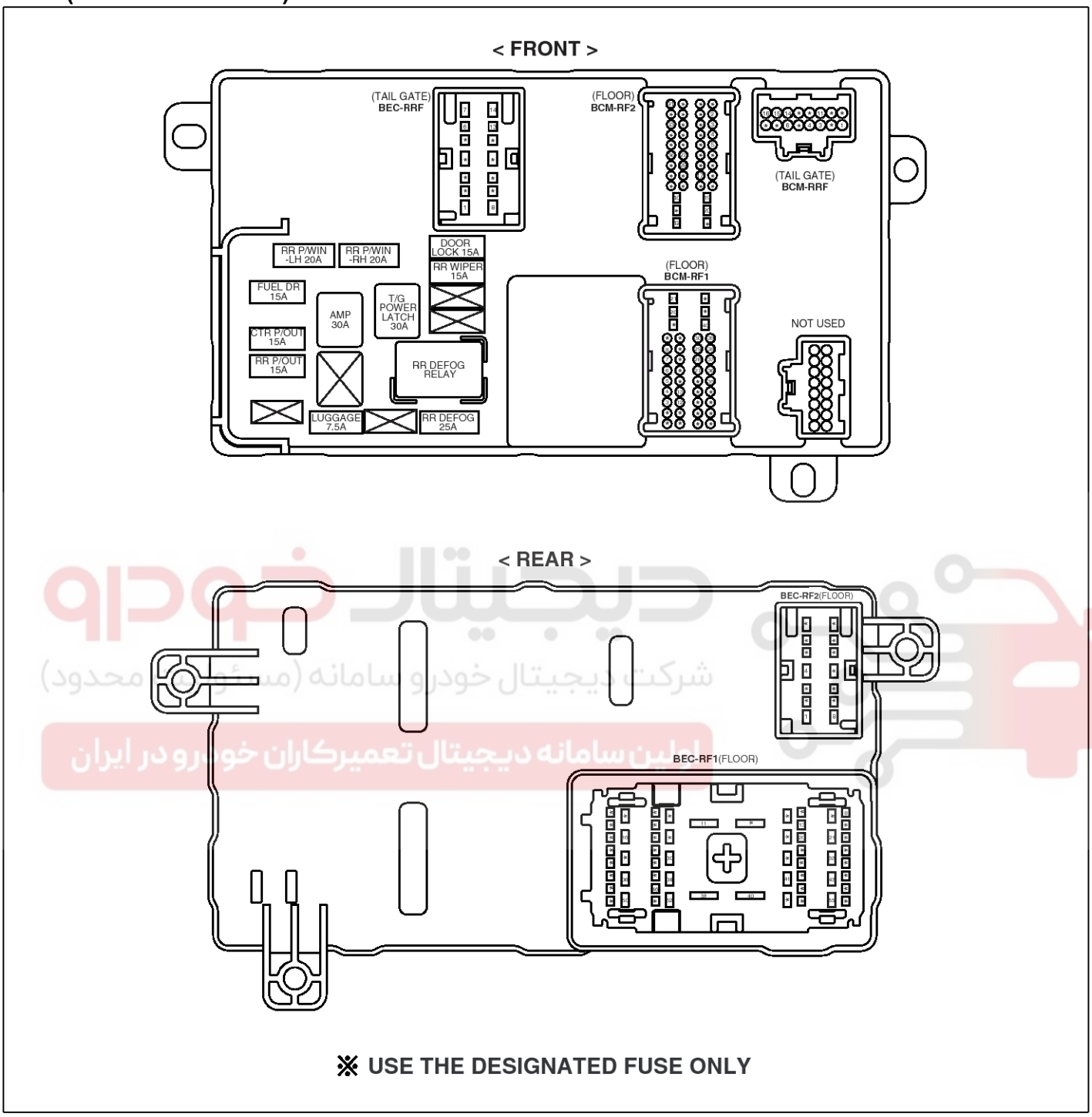
CIRCUIT

Description		(A)	Circuit Protected
FUSE	AUDIO	15A	Audio, Rear Monitor
	MEMORY	7.5A	Front A/C Control Module, Rear A/C Control Module, Instrument Cluster(IND.), RF Receiver, FAM, RAM, Driver Door Module, Assistant Door Module, Tilt & Telescopic Module, IMS Control Module
	S/TILT & TELE	20A	Tilt & Telescopic Module
	IG2-1	7.5A	Front A/C Control Module, Incar Temperature Sensor, PDM, Multifunction Switch(Wiper/Washer), Driver/Passenger Seat Warmer Module, Front Blower Relay, Electro Chromic Mirror, Rear Blower Relay
	IG2-2	7.5A	Rear A/C Control Module, Driver Door Module, FAM, Assistant Door Module, IMS Control Module, Tilt & Telescopic Module
	OBD-II	7.5A	Start Stop Button Switch, Data Link Connector, PDM, Multipurpose Check Connector, Smart Key Control Module, Fob Holder
	ROOM	7.5A	Electro Chromic Mirror, Map Lamp, Vanity Lamp Switch LH/RH, Front/Rear A/C Control Module, Center Room Lamp, Rear Room Lamp
	KEY LOCK	7.5A	Sport Mode Switch
	ILLUMI	7.5A	IPM
	RR S/WARMER	20A	Rear Seat Warmer Relay
	FRT S/WARMER	20A	Driver Seat Warmer Module, Passenger Seat Warmer Module
	SUNROOF	25A	Sunroof Module
	PEDAL	15A	Adjustable Pedal Relay
	F/PWR OUTLET	15A	Front Power Outlet
	PASS P/SEAT	20A	Passenger Power Seat Switch
	DRIVER P/SEAT	30A	Driver Power Seat Switch, Lumbar Support Switch, IMS Control Module
	ACC	7.5A	Audio, Front A/C Control Module, Smart Key Control Module, PDM
	FRT CIGAR	15A	Cigarette Lighter
	START	7.5A	Burglar Alarm Relay, Start Relay
	AIR BAG IND.	7.5A	Instrument Cluster(Air Bag IND.)
	ABS	7.5A	ABS Control Module, ESP Control Module, DBC Relay, Steering Angle Sensor, Crash Pad Switch LH
	IGN 1	7.5A	PDM, Rheostat, Instrument Cluster(MICOM), Smart Key Control Module, Multifunction Switch(Cruise Remocon), Air Suspension Control Module, Generator, Rear Parking Assist Control Module, Rear Parking Assist Buzzer
	ENG	7.5A	Multipurpose Check Connector, ECM, TCM, Front Wiper Motor, 4WD ECM, Stop Lamp Switch
	AIR BAG	15A	SRS Control Module
FUSIBLE LINK	DDM	30A	Driver Door Module, Driver Safety Power Window Motor
	ADM	30A	Assistant Door Module, Passenger Safety Power Window Motor

※ USE THE DESIGNATED FUSE ONLY

SHMBE9138L

RAM (Rear Area Module)



SHMBE9139L

CIRCUIT

Description		(A)	Circuit Protected
FUSE	DOOR LOCK	15A	Rear Door Lock Actuator LH/RH, Rear Door Lock/Unlock Relay
	RR WIPER	15A	Rear Wiper Motor Relay (+), Rear Wiper Motor
	RR DEFOG	25A	RR Defog Relay, Rear Defogger (+)
	RR P/WIN-RH	20A	Rear Power Window Relay RH(UP/DN), Rear Power Window Motor RH
	LUGGAGE	7.5A	Luggage Lamp
	RR P/WIN-LH	20A	Rear Power Window Relay LH(UP/DN), Rear Power Window Motor LH
	FUEL DR	15A	Fuel Door Relay, Fuel Filler Door Actuator
	CTR P/OUT	15A	Console Power Outlet
	RR P/OUT	15A	Rear Power Outlet
FUSIBLE LINK	T/G POWER LATCH	30A	Tail Gate Control Module
	AMP	30A	AMP

※ USE THE DESIGNATED FUSE ONLY

SHMBE9140L

Inspection

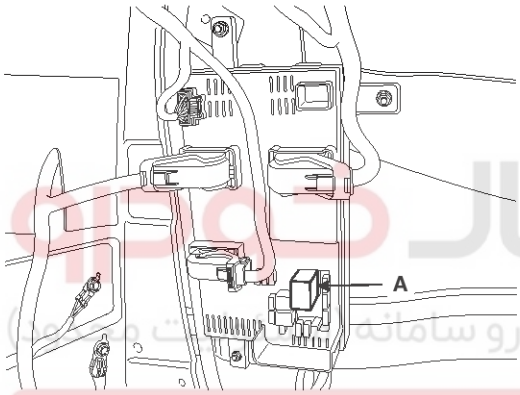
Fuse

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.

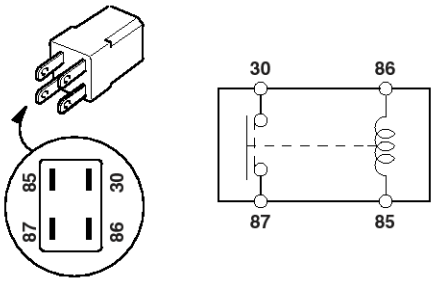
Relay (Rear Defogger)

1. Be sure that the relay (A) are held the each module securely.
2. Are the relay types for each circuit correct?



SHMBE8179D

3. If system of some relay is not operate accurately, replace with a new one and check the system.



SHMBE8180D

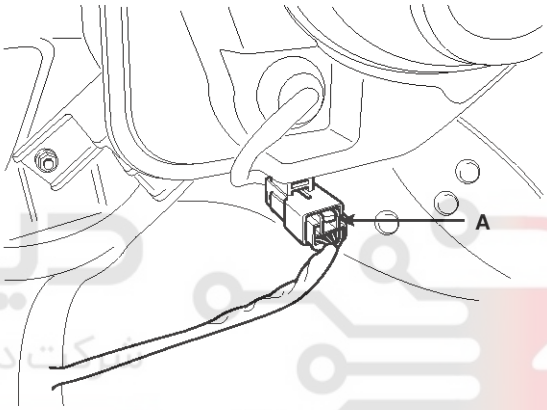
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

SHMBE9093N

RAM (Rear Area Module)

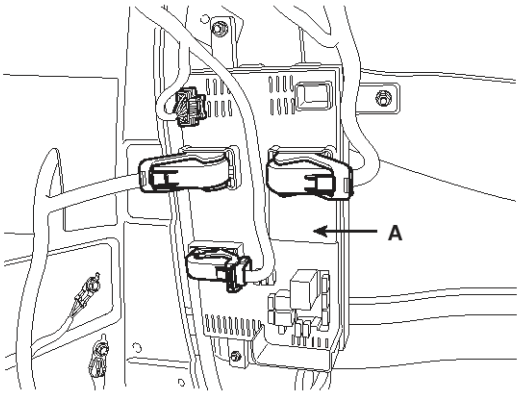
1. Disconnect the nagative(-) battery Terminal.
2. Remove the rear left luggage side trim.

   (Refer the body group - "Interior trim")
3. Remove the woofer after disconnecting the connector (A) and loosening the mounting nuts (4EA).



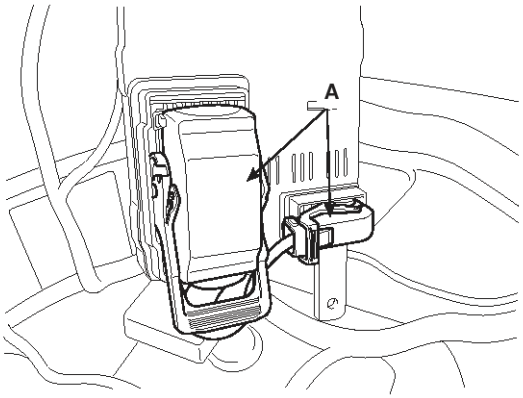
SHMBE8040D

4. Remove the RAM (A) after disconnecting the connectors (4EA) and loosening the mounting bolts (3EA).



SHMBE8140D

5. Disconnect the back side connector (A) of RAM.



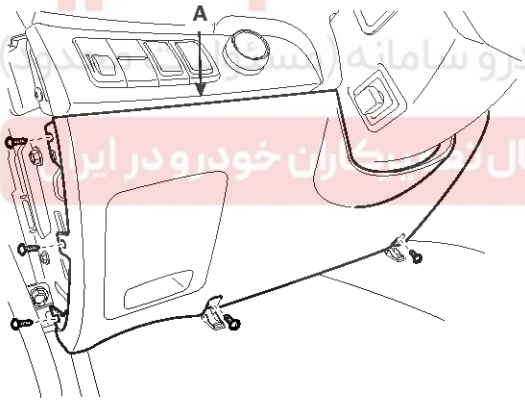
SHMBE8139D

6. Installation is the reverse of removal procedures.

Replacement

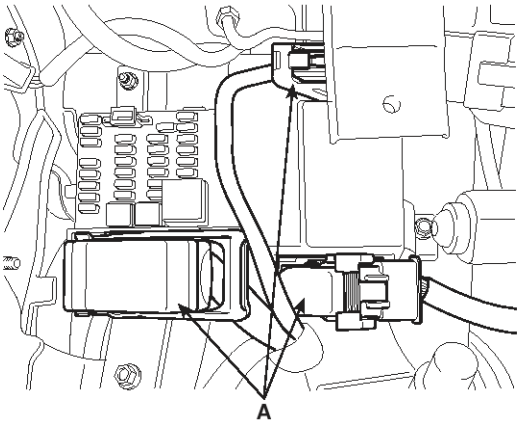
IPM (Instrument Panel Module)

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



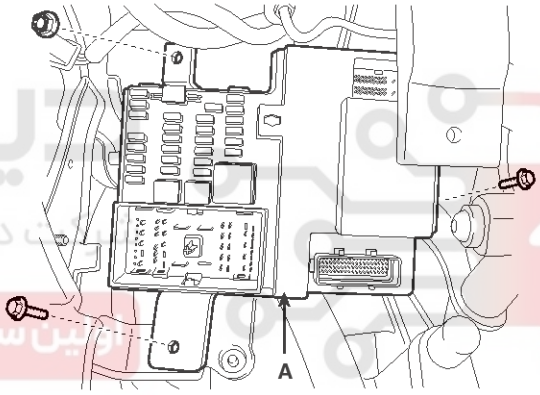
SHMBE8132D

3. Disconnect the IPM connectors (A) and the receiver antenna cable.



SHMBE8133D

4. Remove IPM mounting nuts (3EA) and IPM (A).



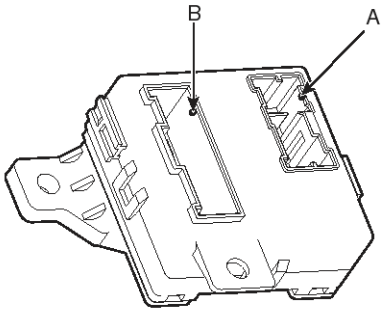
SHMBE8134D

5. Disconnect the back side connector of IPM.
6. Installation is the reverse of removal procedures.

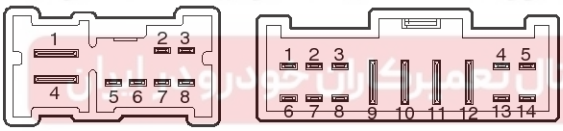
PDM (Power Distribution Module) Relay Box

Description

The PDM (Power Distribution Module) relay is united with many kinds of relays (IG1, IG2, ACC, Sub start) and installed under the in-panel module. (PDM is only available for start button type)



SHMBE8181D



[Connector A] [Connector B]

LTKG201E

Inspection

IG2 Relay

Check for continuity between the terminals.

1. There should be continuity between the No.1 in the A and No.10 in the B terminals when power and ground are connected to the No.7 in the A and No.13 terminals in the B terminals.
2. There should be no continuity between the No.1 in the A and No.10 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.4 in the A and No.12 in the B terminals when power and ground are connected to the No.2 in the A and No.14 terminals in the B terminals.
2. There should be no continuity between the No.4 in the A and No.12 in the B terminals when power is disconnected.

ACC Relays

Check for continuity between the terminals.

1. There should be continuity between the No.9 and No.3 terminals when power and ground are connected to the No.7 and No.8 terminals in the B.
2. There should be no continuity between the No.9 and No.3 terminals when power is disconnected.

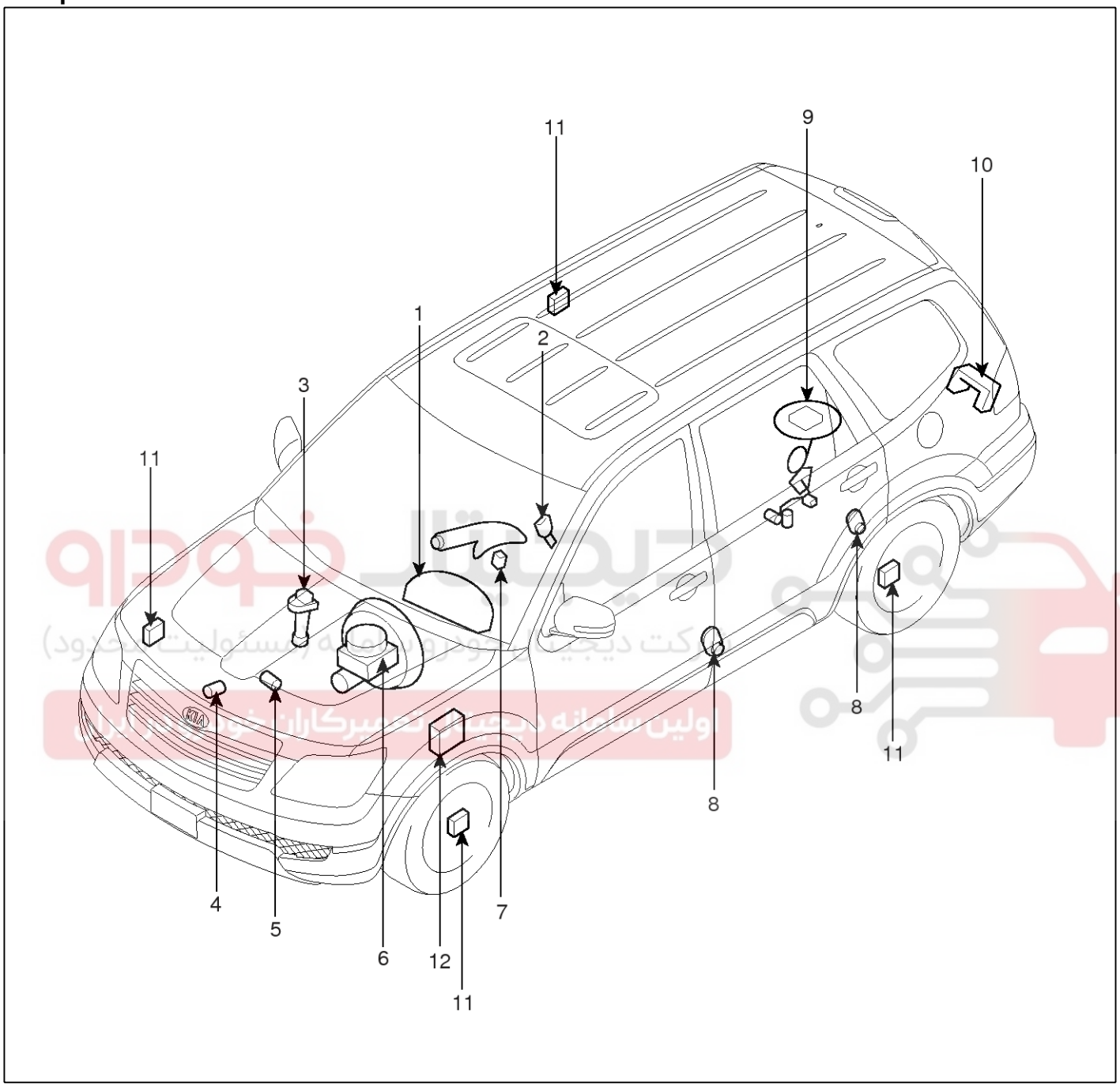
Sub Start Relay

Check for continuity between the terminals.

1. There should be continuity between the No.2 and No.3 terminals when power and ground are connected to the No.4 and No.5 terminals in the B.
2. There should be no continuity between the No.2 and No.3 terminals when power is disconnected.

Indicators And Gauges

Component Location



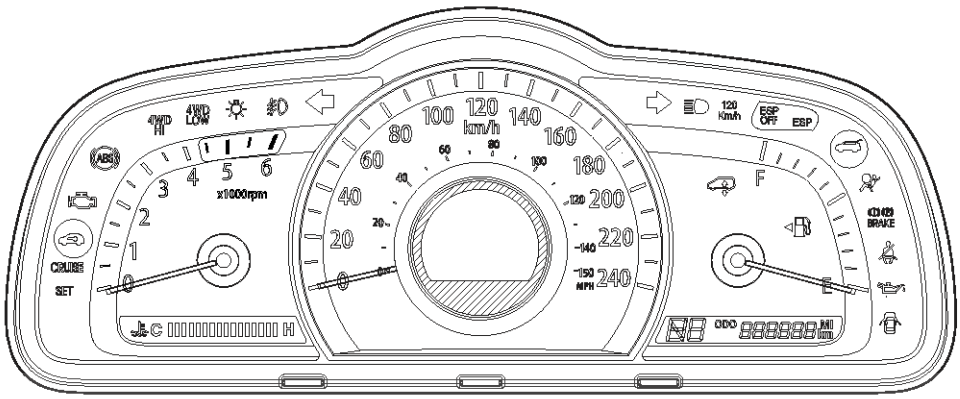
SHMBE8197D

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

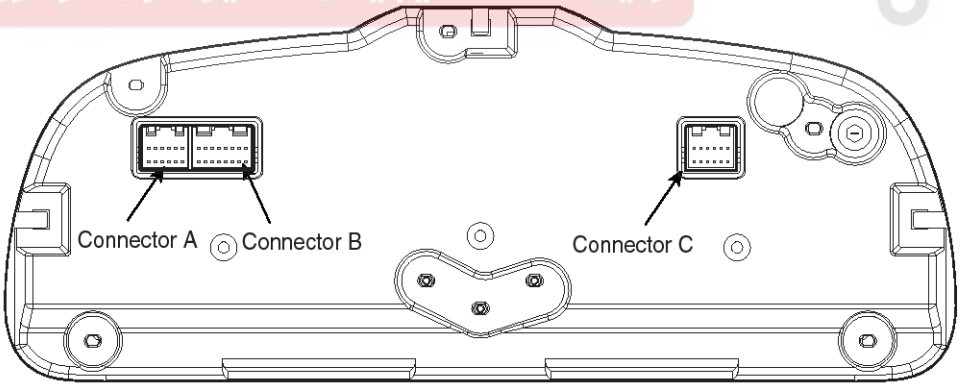
Instrument Cluster

Components

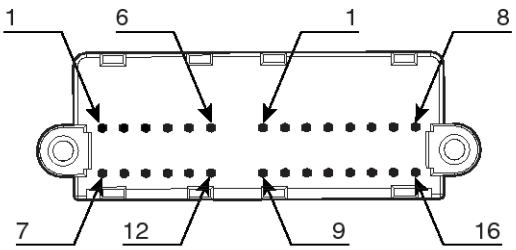
[Front]

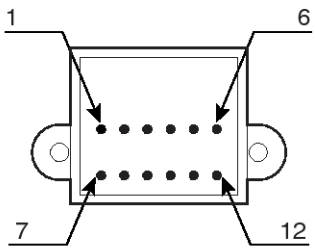


[Rear]



SHMBE9117L





Pin No.	Connector A	Connector B	Connector C
1	Airbag +	-	Fuel input
2	Airbag input	4P OUT	Ground
3	Mode SW	-	-
4	Reset SW	Immobilizer	-
5	-	C CAN LOW	-
6	-	C CAN HIGH	CHECK Engine
7	P	B CAN HIGH	Battery
8	R	B CAN LOW	Ground
9	N	-	IGN1
10	D	-	Diagnosis
11	-	-	-
12	-	-	-
13		Illumination +	
14		Illumination -	
15		Ground	
16		-	

SHMBE9118L

Inspection

Speedometer

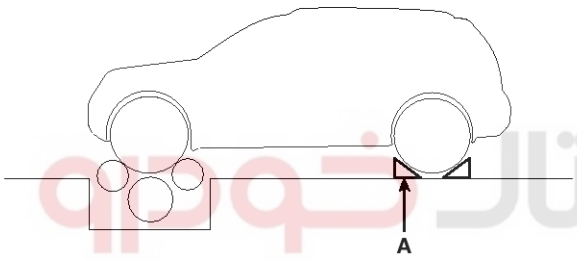
1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.
3. Check if the speedometer indicator range is within the standard values.

⚠CAUTION

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

NOTICE

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



SHMBE9112N

[MPH]

Velocity (MPH)	10	20	40	60
Tolerance (MPH)	+2.2 0	+2.4 +0.1	+2.6 +0.1	+2.9 +0.2
Velocity (MPH)	80	100	120	140
Tolerance (MPH)	+3.5 +0.2	+4.4 +0.3	+5.3 +0.4	+6.2 +0.4

[Km/h]

Velocity (Km/h)	20	40	60	80	100	120
Tolerance (Km/h)	+3.5 +0.0	+3.6 +0.1	+3.8 +0.2	+4.1 +0.3	+4.5 +0.4	+5.3 +0.5
Velocity (Km/h)	140	160	180	200	220	
Tolerance (Km/h)	+6.2 +0.6	+7.0 +0.6	+7.9 +0.8	+8.8 +0.8	+9.7 +0.9	

Tachometer

1. Connect the scan tool to the diagnostic link connector or install a tachometer.
2. With the engine started, compare the readings of the tester with that of the tachometer. Replace the tachometer if the tolerance is exceeded.

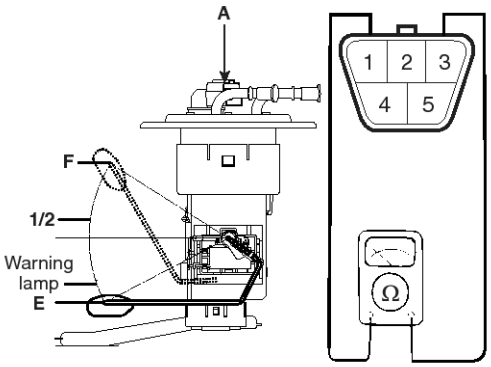
⚠CAUTION

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

Revolution (rpm)	1,000	2,000	3,000	4,000
Tolerance (rpm)	±120	±140	±170	±170
Tolerance (rpm)	5,000	6,000	7,000	8,000
Revolution (rpm)	±200	±240	±260	-

Fuel Gauge Sender

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



SHMBE9113N

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

Position	Resistance(Ω)
Sender (E)	180 ± 2Ω
Warning lamp	160 ± 2Ω
1/2	54.5 ± 2Ω
Sender (F)	12 ± 2Ω

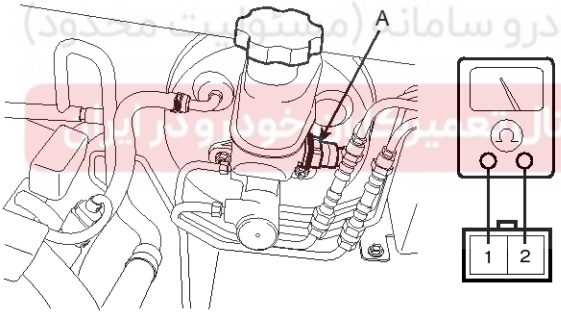
⚠CAUTION

If the height resistance is not within specifications, replace the fuel sender as an assembly.

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.



SHMB18029D

Brake Fluid Level Warning Lamp

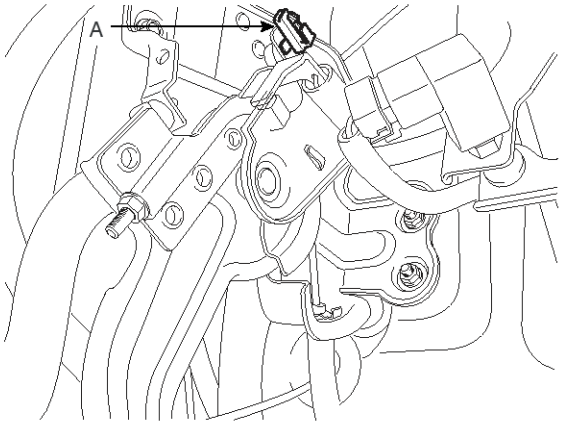
1. Ignition "ON"
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

Parking Brake Switch

The parking brake switch is a push type. It is located at the side of the brake pedal.

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.

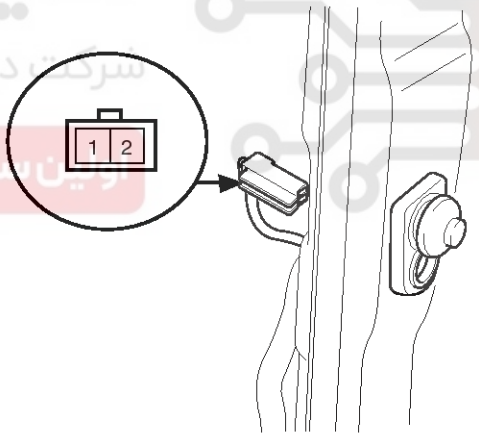
If continuity is not as specified, replace the switch or inspect its ground connection.



SHMB18030D

Door Switch

Remove the door switch and check for continuity between the terminals. If continuity is not as specified, replace the door switch.



SHMBE8125D

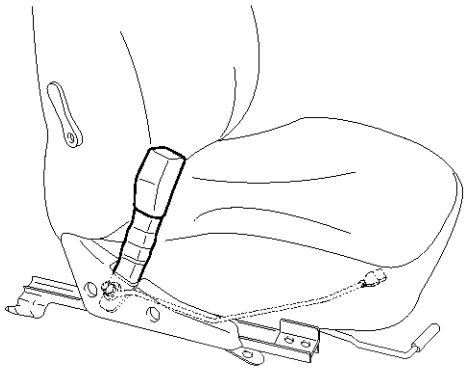
Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

ETQF180D

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 (0 Ω)



V5BE060Q

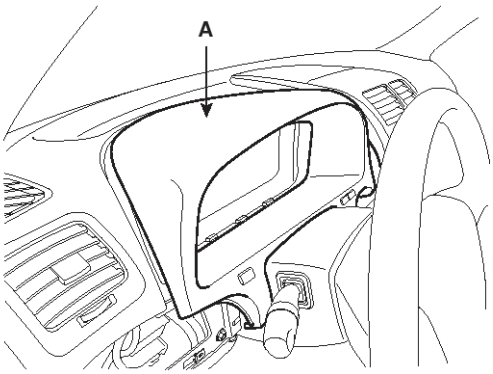
Seat Belt Warning Lamp

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

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

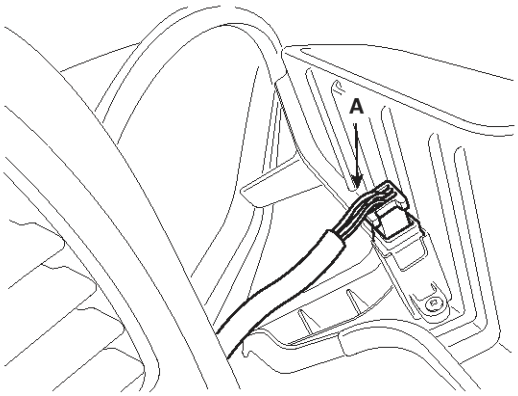
Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster fascia panel (A).



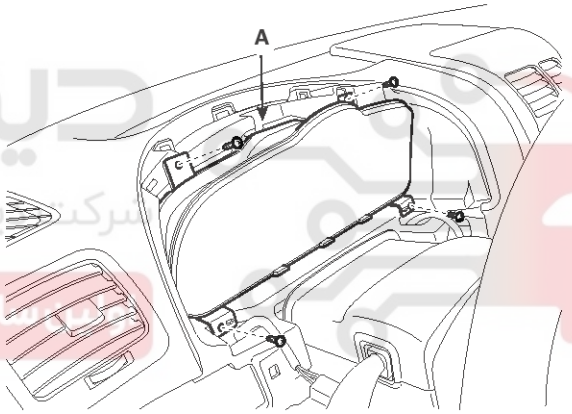
SHMBE8200D

3. Disconnect the trip switch and head lamp washer switch connectors and reset switch connector (A).



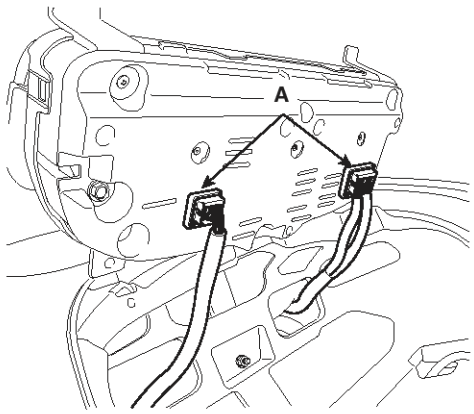
SHMBE8201D

4. Pull out the cluster (A) from the housing after removing 4 screws.



SHMBE8202D

5. Disconnect the cluster connecter (A) and then remove the cluster.



SHMBE8203D

Installation

1. Install the cluster to the housing after reconnecting the connectors.
2. Install the cluster fascia panel after reconnecting the conectors.

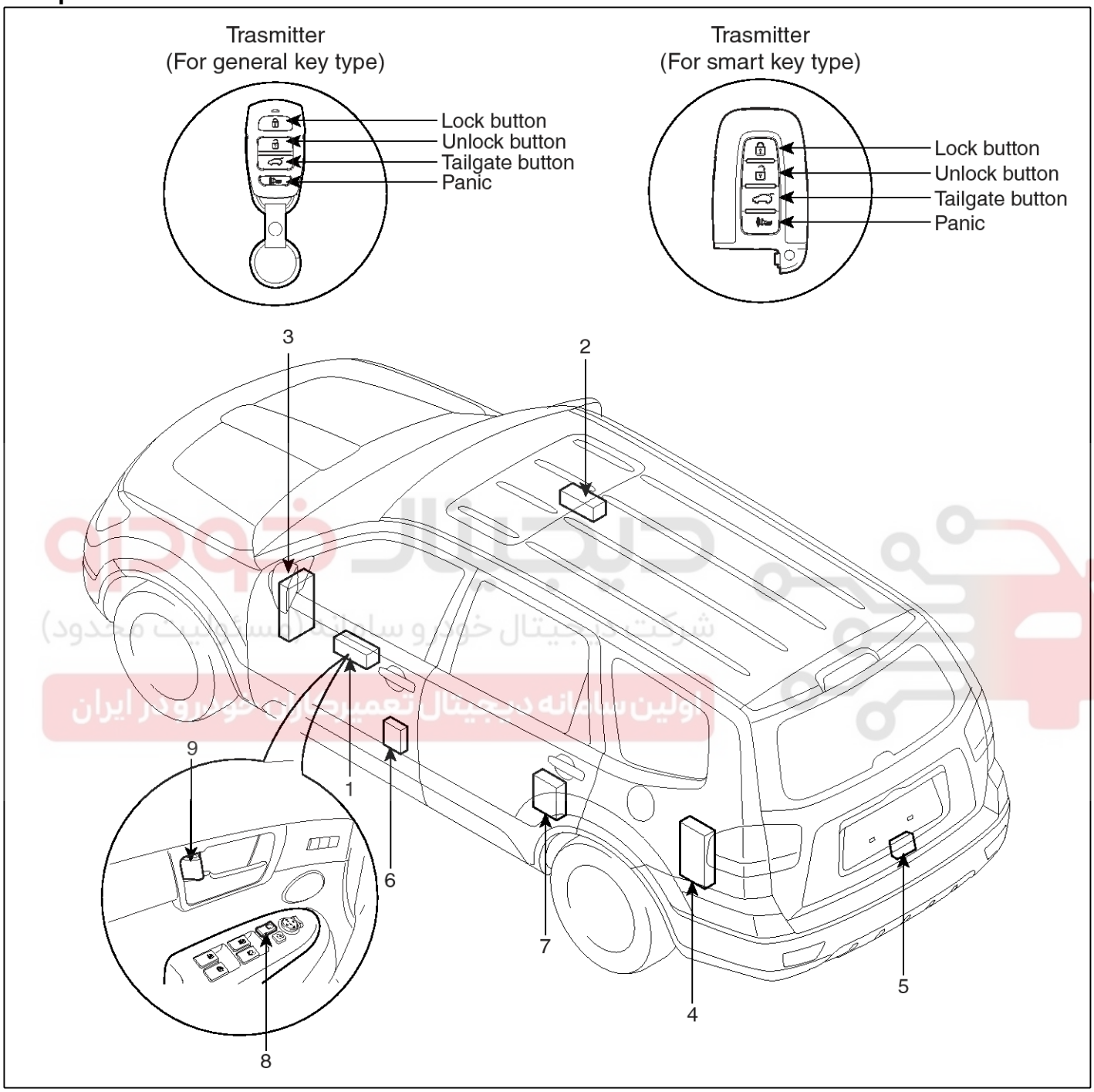
Troubleshooting

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
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Symptom	Possible cause	Remedy
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

Power Door Locks

Component Location



SHMBE9162N

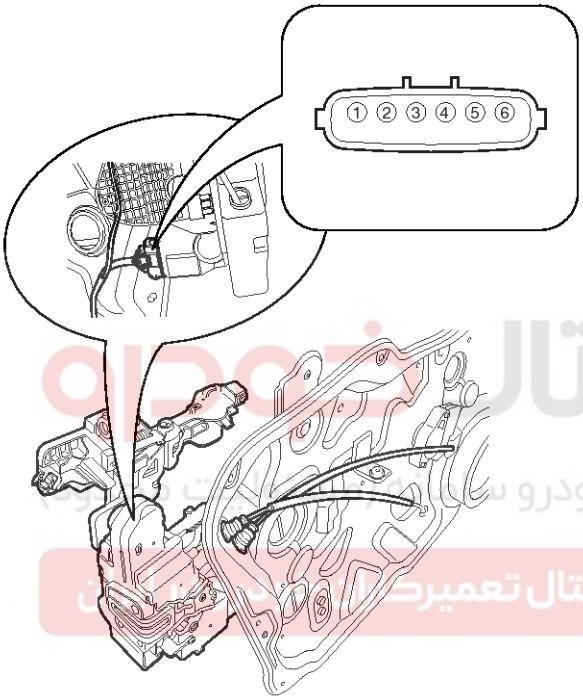
1. DDM (Driver Door Module)
2. ADM (Assist Door Module)
3. IPM (In-Panel Module)
4. RAM (Rear Area Module)
5. Tailgate lock actuator
6. Front door lock actuator
7. Rear door lock actuator
8. Door lock switch
9. Door lock knob

Power Door Lock Actuators

Inspection

Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Remove the front door module.
   (Refer to the Body group - Front door)
3. Disconnect the 6P connectors from the actuator.



SHMBE8215D

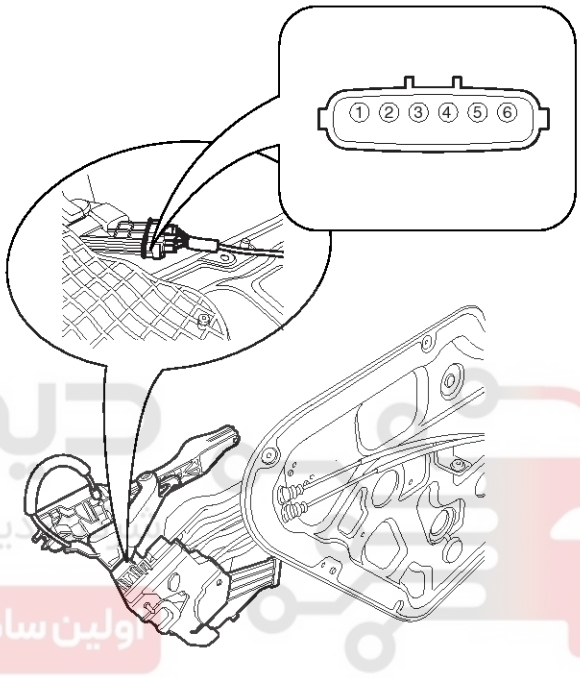
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	6
Front left	Lock	⊕	⊖
	Unlock	⊖	⊕
Position \ Terminal		2	1
Front right	Lock	⊖	⊕
	Unlock	⊕	⊖

SHMBE9163N

Rear Door Lock Actuator

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



SHMBE8115D

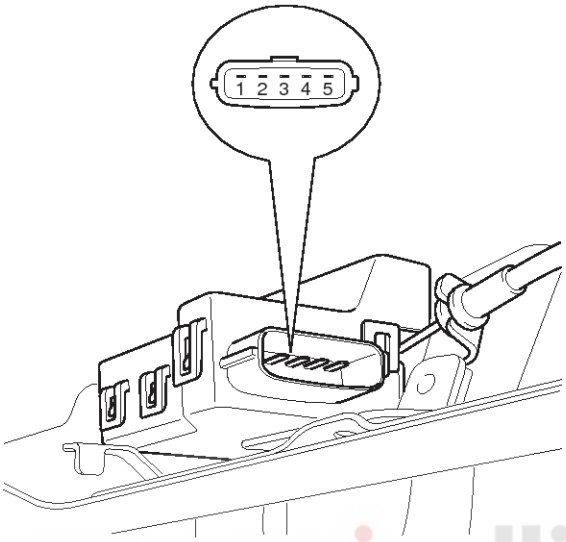
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal		5	6
Front left	Lock	⊕	⊖
	Unlock	⊖	⊕
Position \ Terminal		2	1
Front right	Lock	⊖	⊕
	Unlock	⊕	⊖

SHMBE9163N

Tailgate Lock Actuator

1. Remove the tailgate trim.
   (Refer to the Body group - tailgate)
2. Disconnect the 5P connector from the tailgate latch.



SHMBE8123D

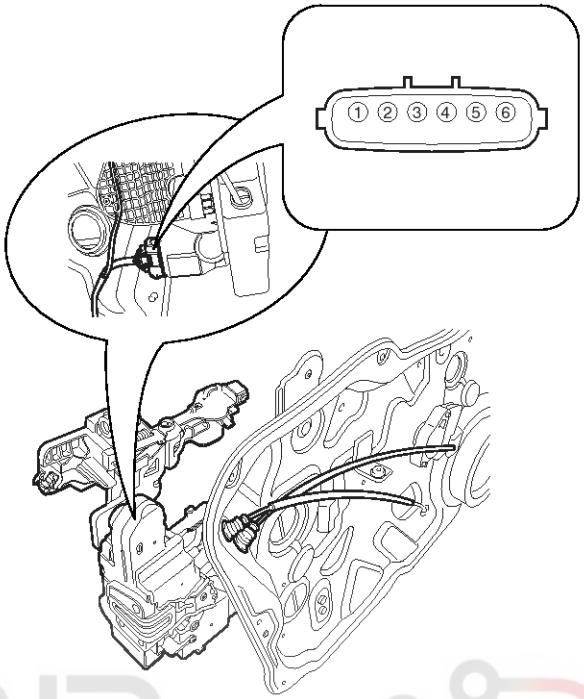
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	5	4	3
Unlock	○	○	
		○	○
1st Lock	○	○	
Complete Lock		○	○

SHMBE9164N

Front Door Lock Switch

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



SHMBE8215D

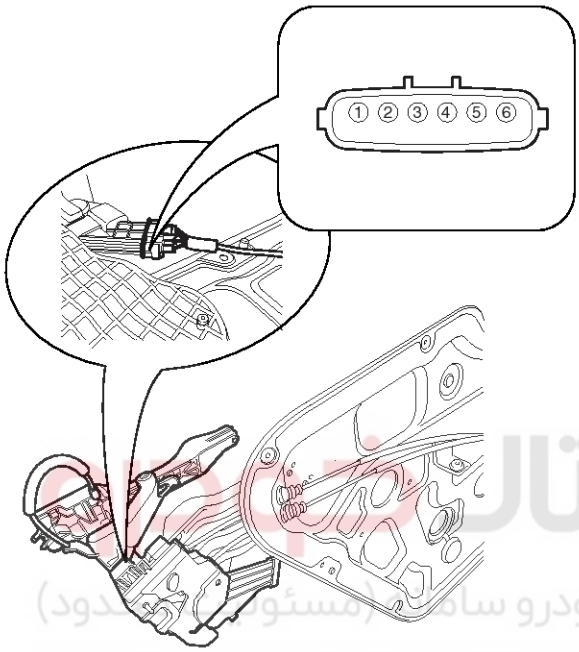
4. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

Position \ Terminal		2	3	4	1
Front Left	Unlock		○	○	○
	Lock	○	○		
Position \ Terminal		**3**	**4**	**5**	**6**
Front Right	Unlock	○	○		○
	Lock		○	○	

SHMBE9065L

Rear Door Lock Switch

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



SHMBE8115D

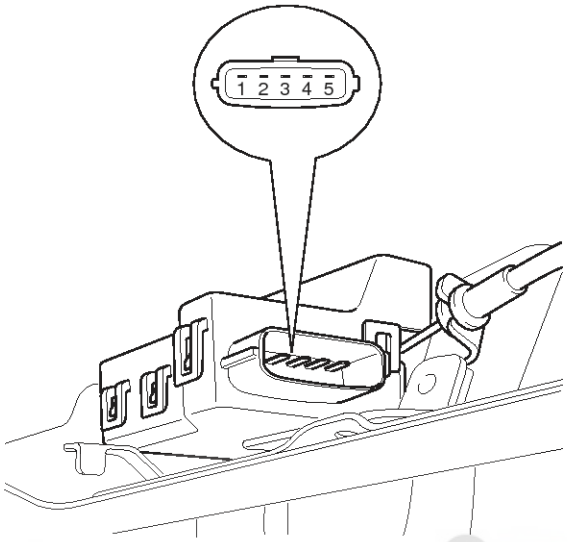
4. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal		1	3
Rear Left	Unlock	○——	——○
Position \ Terminal		4	6
Rear Right	Unlock	○——	——○

SHMBE9066L

Tailgate Switch

1. Remove the tailgate trim.
   (Refer to the Body group - Tailgate)
2. Disconnect the connector from the tailgate latch.



SHMBE8123D

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

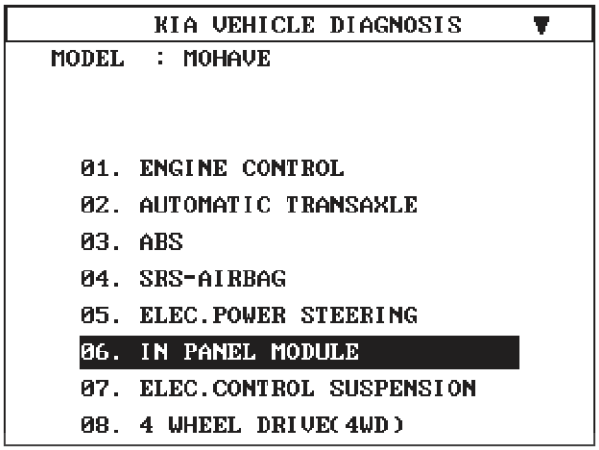
Position \ Terminal	5	4	3
Unlock	○——	○——	——○
1st Lock	○——	○——	
Complete Lock		○——	——○

SHMBE9054L

Power Door Lock Switch

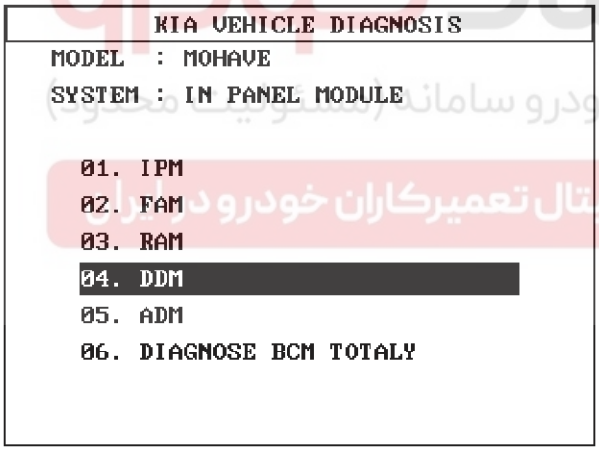
Inspection

1. The DDM inputs can be checked using the scan tool.
2. To check the Input Value of door lock switch, select option "In-panel module (IPM)".



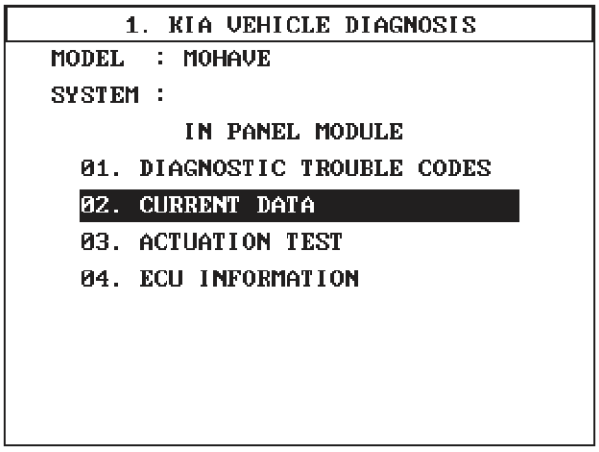
SHMBE9102L

3. Select option "Driver Door Module (DDM)".

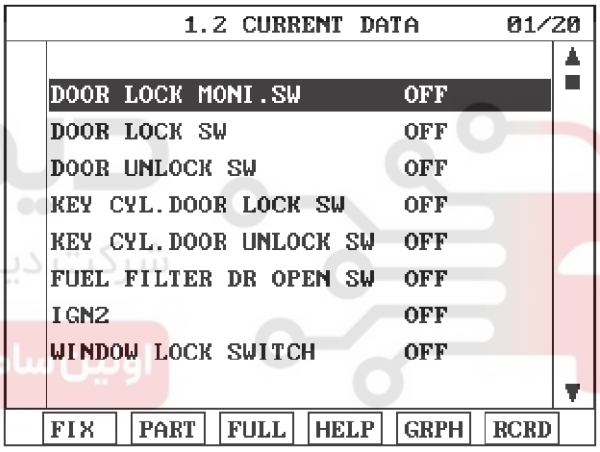


SHMBE9109L

4. Select option "Current Data".

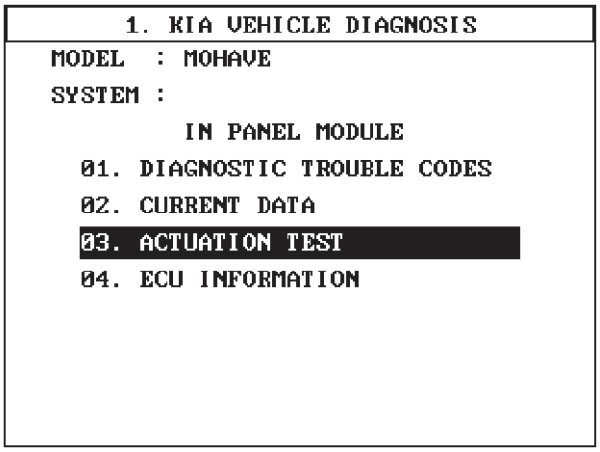


SHMBE9110L

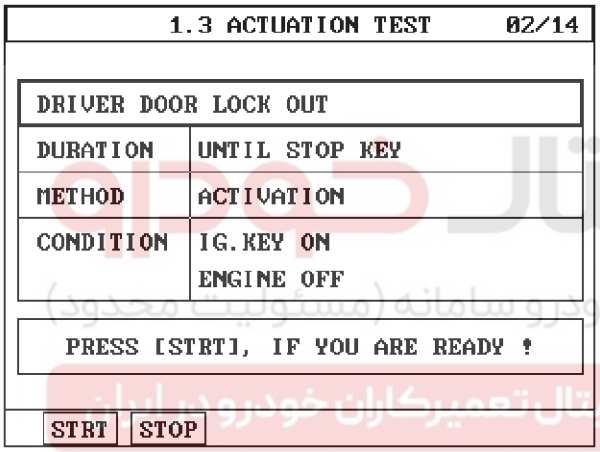


SHMBE9328N

5. To check the Input Value of door lock switch in force mode, select option "Actuation Test".



SHMBE9107L

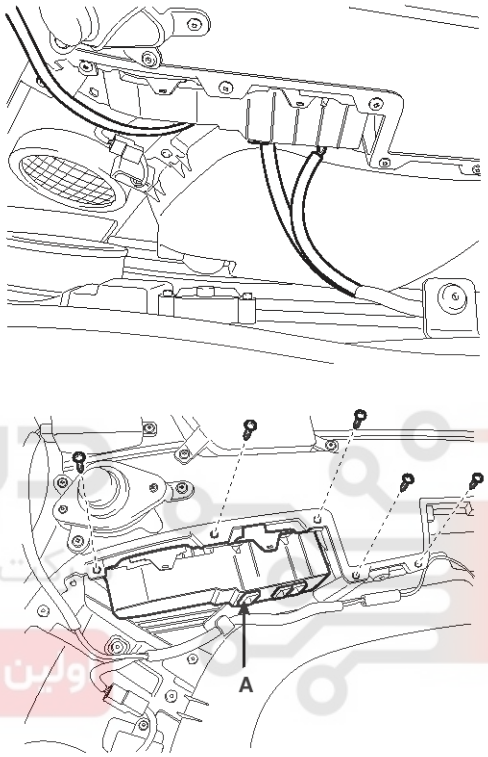


SHMBE9169N

Replacement

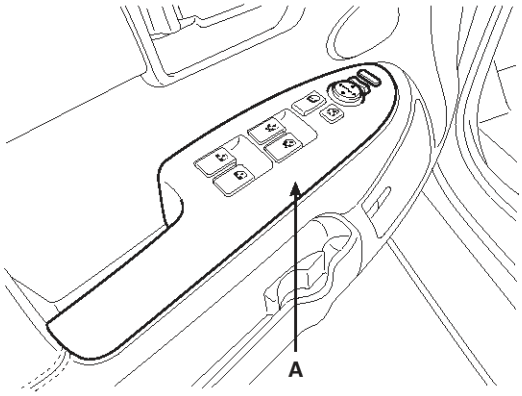
DDM (Drive Door Module)

1. Disconnect the negative battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - Front door)
3. Remove the door module (A) mounting screws (5EA) after disconnecting the connector (3EA) from the module.



SHMBE8141D

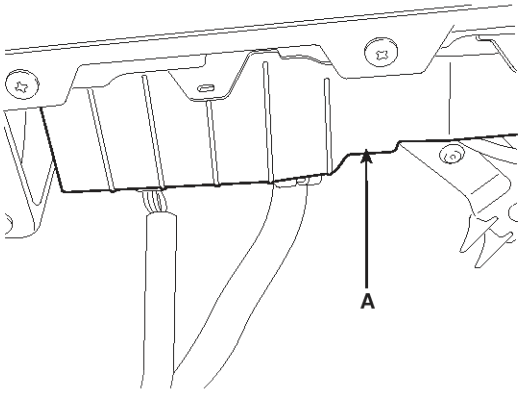
4. Remove the front door modules (DDM) (A) from the front door trim panel.



SHMBE8142D

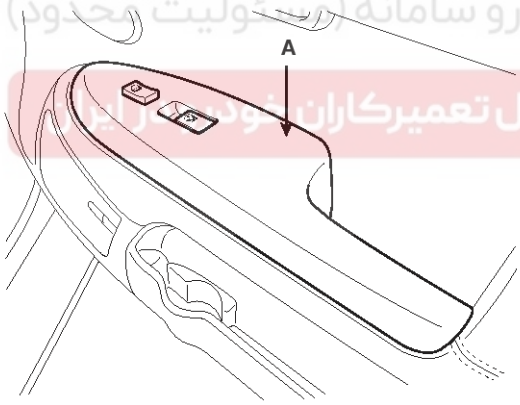
ADM (Assist Door Module)

1. Disconnect the negative(-) battery terminal.
2. Remove the front door trim panel. (Refer to the body group - "Front door")
3. Remove the door module (A) mounting screws (5EA) after disconnecting the connector (3EA) from the module.



SHMB18033D

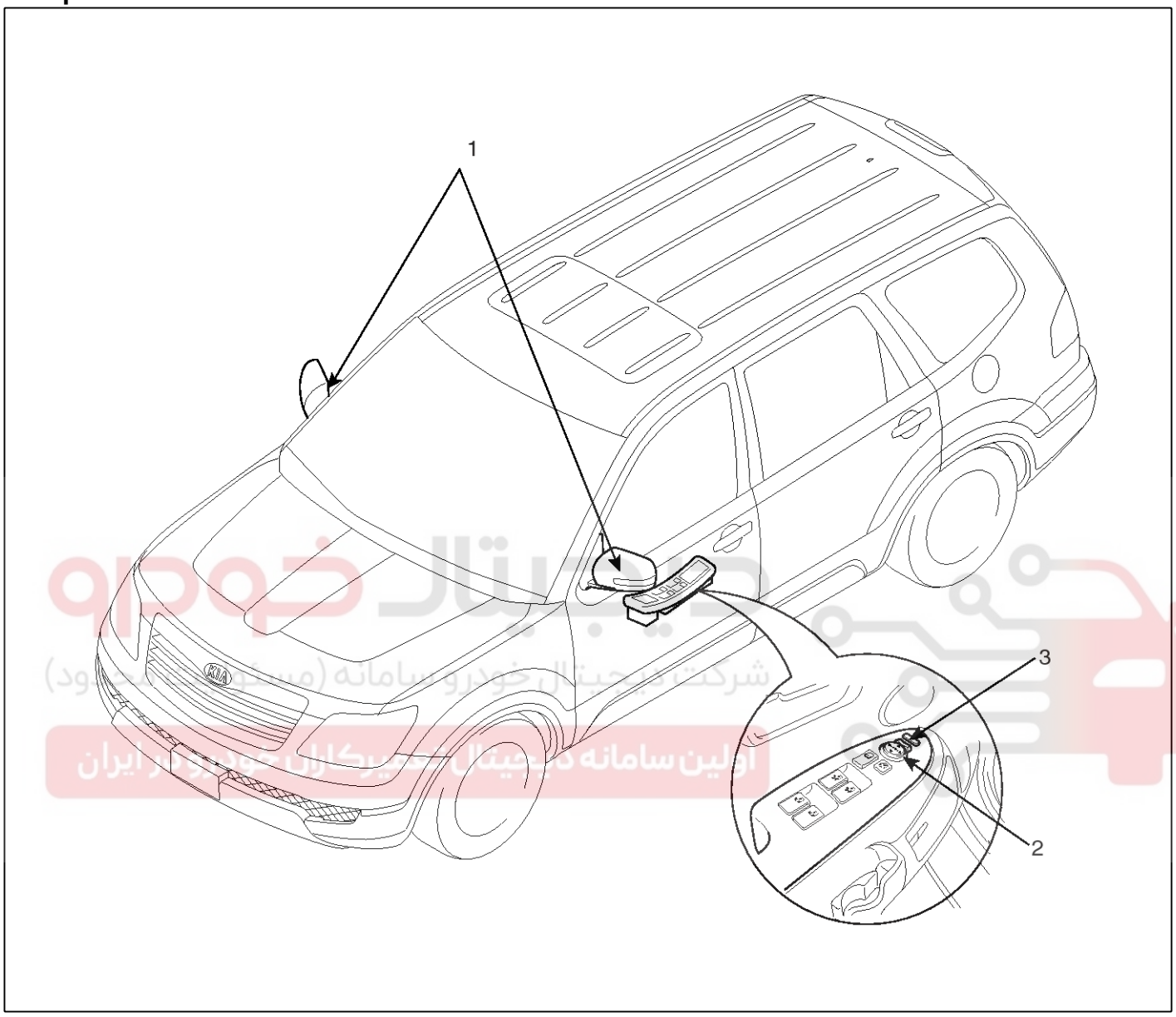
4. Remove the front door modules (ADM) (A) from the front door trim panel.



SHMBE8144D

Power Door Mirrors

Component Location

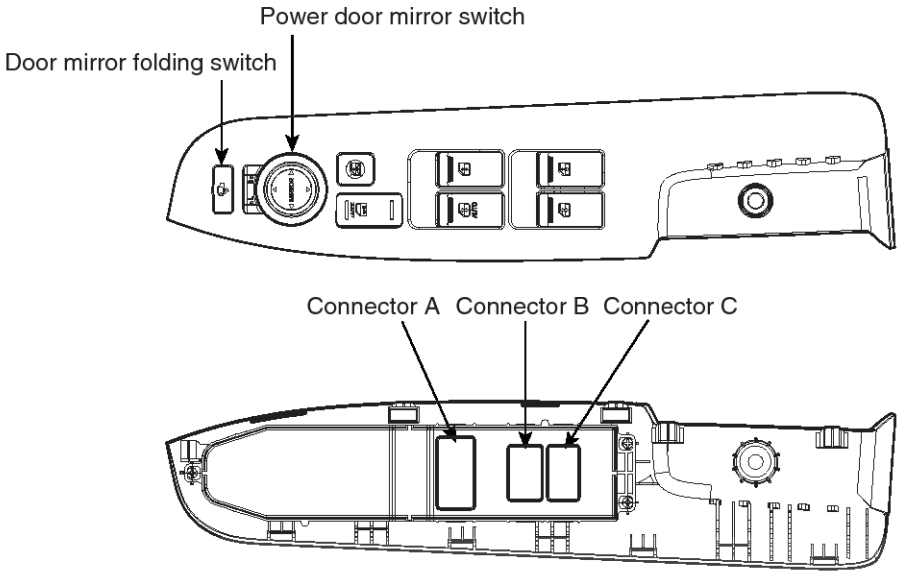


SHMBE8205D

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

Power Door Mirror Switch

Circuit Diagram



Connector A												
1	2	3	4	5			6	7	8	9	10	
11	12	13	14	15	16	17	18	19	20	21	22	23

Connector B					
1	2			3	4
5	6	7	8	9	10

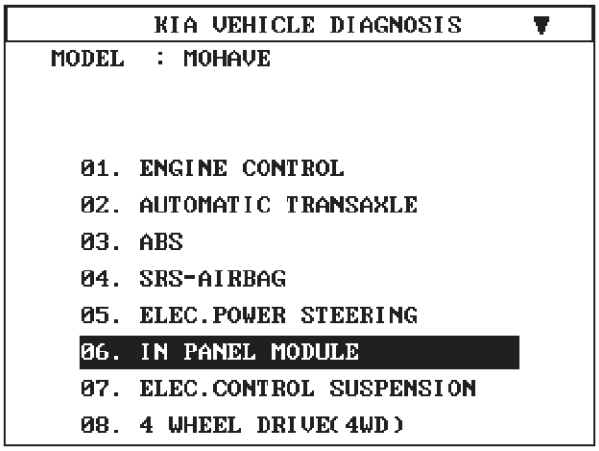
Connector C					
1	2			3	4
5	6	7	8	9	10

Pin No.	Connector A	Connector B	Connector C
1	CAN high	IMS 2	Fold motor
2	CAN low	IMS 1	-
3	Mirror sensor V	Fuel filler door switch	-
4	Mirror sensor H	Door courtesy lamp	IGN2
5	Front door unlock switch	-	Unfold motor
6	Mirror sensor ground	Signal ground	Power ground1
7	Signal ground	Illumination -	Battery
8	Mirror sensor 5V	IMS set	Front motor down
9	-	Illumination +	Front motor up
10	-	Power ground 2	Battery(Micro)
11	Door motor lock		
12	Mirror up		
13	Mirror left		
14	Mirror right		
15	Front door key lock switch		
16	-		
17	Front unlock monitoring SW		
18	-		
19	Side repeater lamp		
20	Mirror heater		
21	Mirror down		
22	Door motor unlock		
23	Motor(-)		

SHMBE9086L

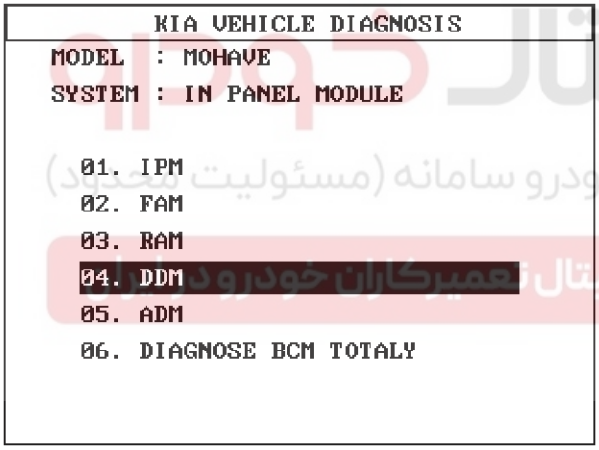
Inspection

1. The DDM inputs can be checked using the scan tool.
2. To check the input value of door mirror switch, select option "In-panel module (IPM)".



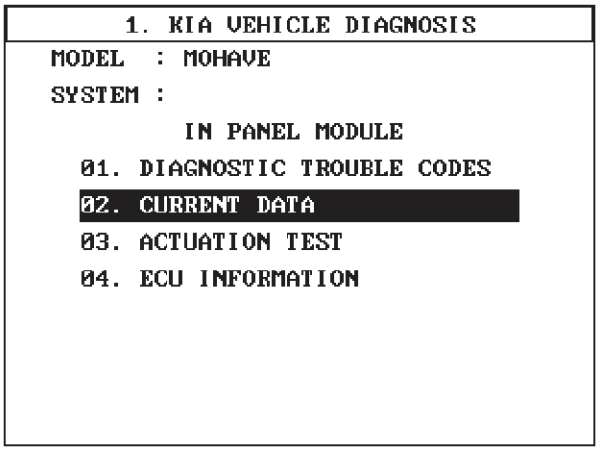
SHMBE9102L

3. Select option "Driver Door Module (DDM)".

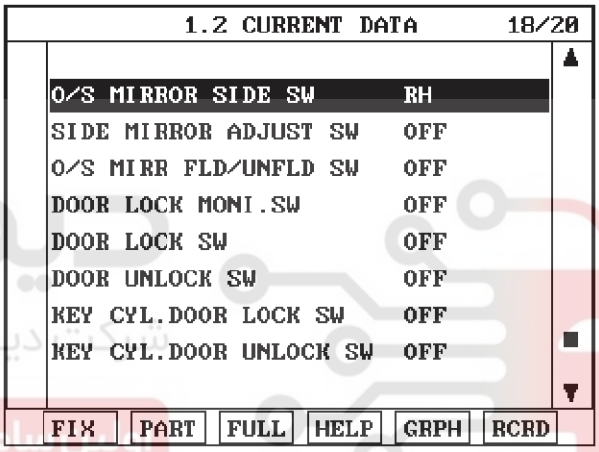


SHMBE9109L

4. Select option "Current Data".

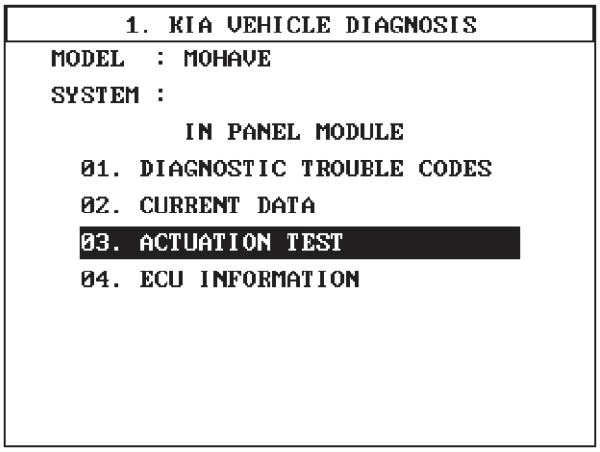


SHMBE9110L

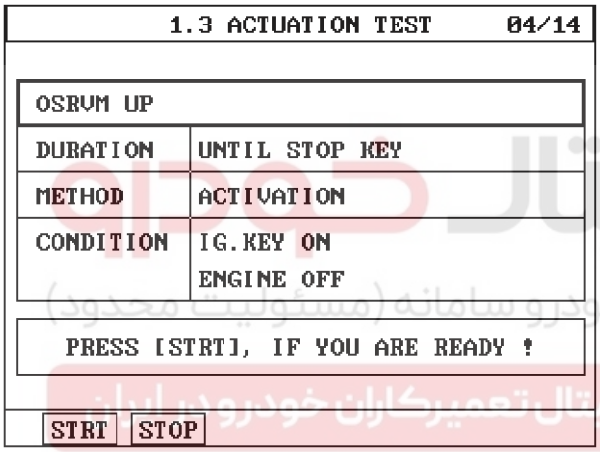


SHMBE9329N

5. To check the input value of door mirror switch in force mode, select option "Actuation Test".



SHMBE9107L

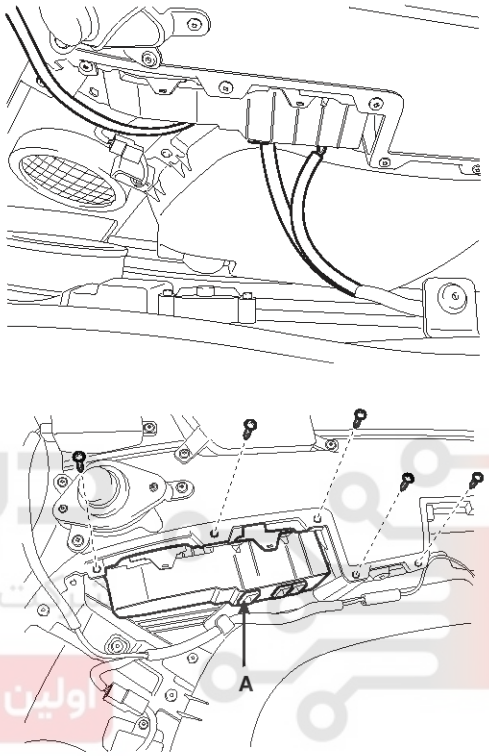


SHMBE9330N

Removal

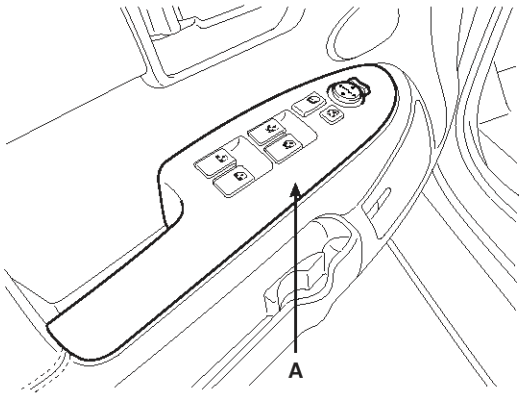
Driver Door Mirror Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel.
   (Refer to the Body group - front door)
3. Disconnect the module (A) connectors (3EA) and loosen the mounting screws. (5EA)



SHMBE8141D

4. Remove the DDM (A) from the front door trim panel.

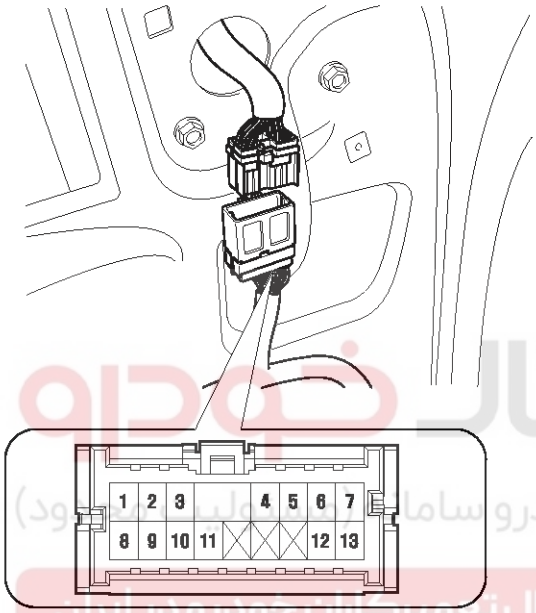


SHMBE9314N

Power Door Mirror Actuator

Inspection

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



SHMBE8207D

Position \ Terminal		B+	GND	7	6	4	5
LH	UP	○	○	○			
	DOWN	○	○		○	○	○
	OFF		○	○	○	○	○
	RIGHT	○	○	○		○	○
	LEFT	○	○	○	○		○
RH	UP	○	○		○	○	○
	DOWN	○	○	○		○	○
	OFF		○	○	○	○	○
	RIGHT	○	○	○	○		○
	LEFT	○	○	○	○	○	

SHMBE9115N

Mirror heater

Position \ Terminal	2	3
Heater	○	○

SHMBE9116N

IMS

Position \ Terminal	11	10
Mirror memory	⊕	⊖

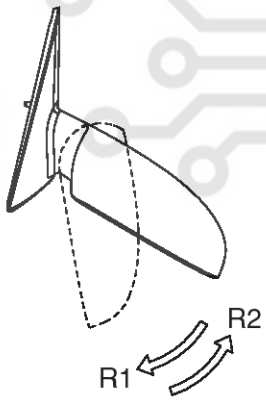
SHMBE9117N

Turn signal Lamp (Side repeater)

Position \ Terminal	1	3
Side repeater	⊕	⊖

SHMBE9118N

Mirror Folding



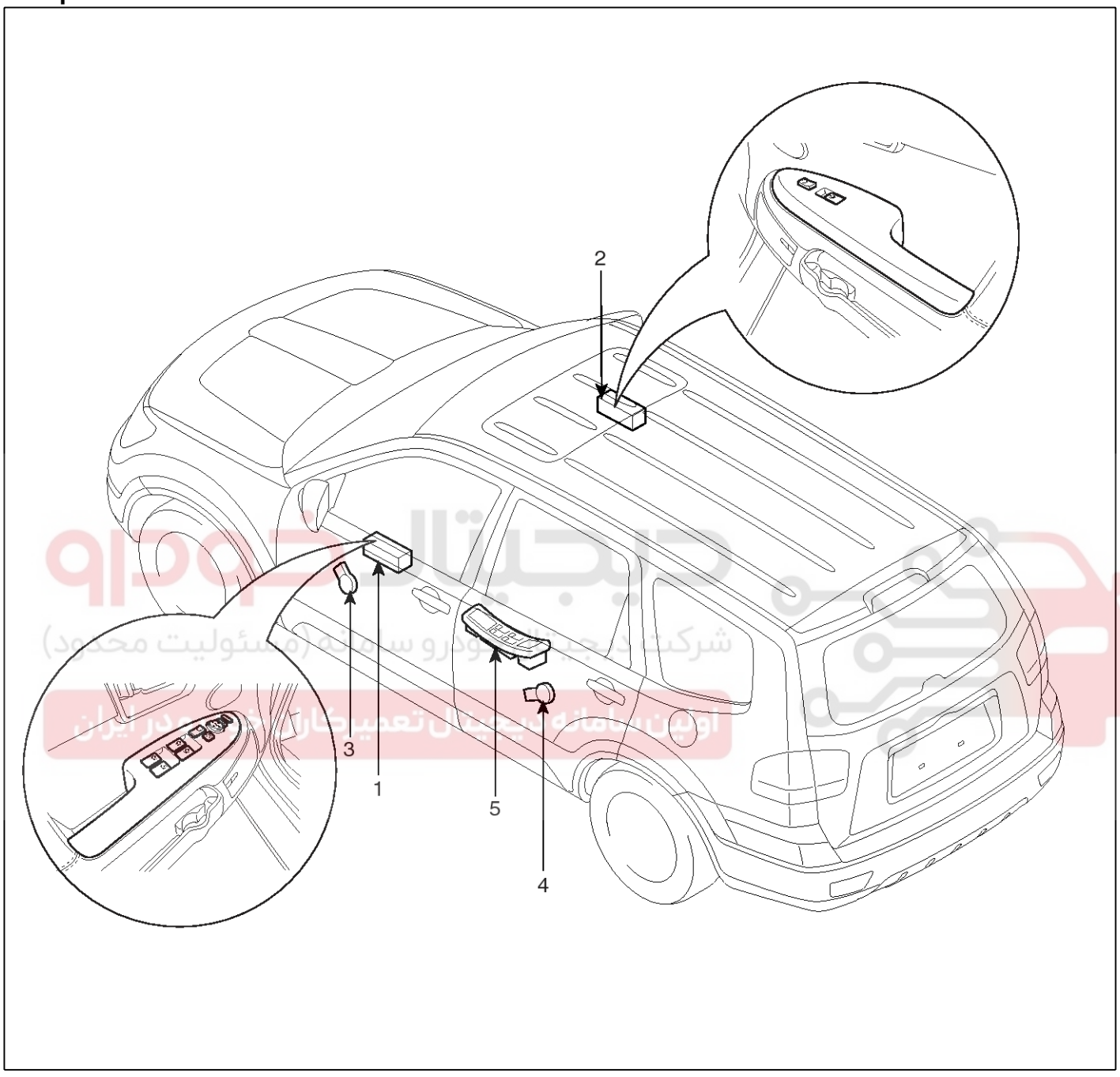
ETJA055B

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

SHMBE9119L

Power Windows

Component Location



SHMBE8230D

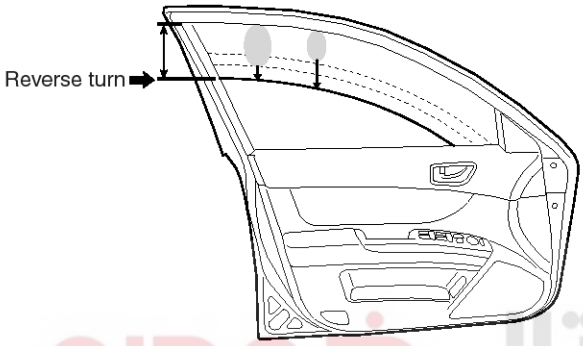
1. DDM (Driver door module)
2. ADM (Assist door module)
3. Front window motor
4. Rear window motor
5. Rear window switch

Power Window Motor

Function Of Safety Power Window

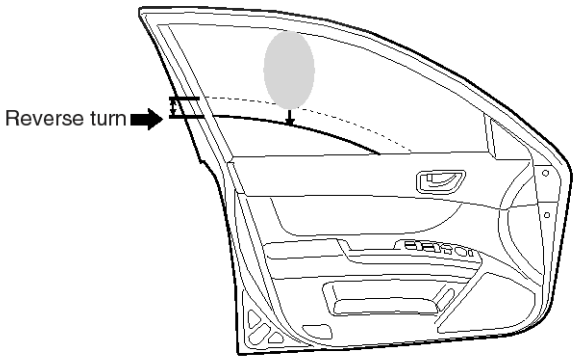
When driver door power window auto-up switch is operated, safety function is activated.

1. When a force of 100N is detected during window UP mode and the window is positioned between 4-250mm from the top of the door, the window will automatically reverse travel to a distance of 300mm from the top of the door.



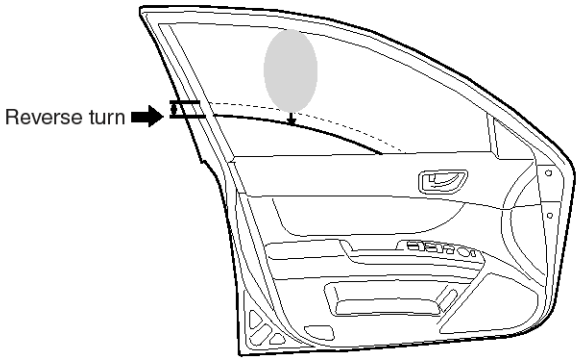
BTLG320B

- When an obstruction is detected, and the window is positioned over 250mm from the top of the door, the window will automatically reverse travel to a distance of 20mm from the detection point.



BTLG320C

2. When the auto-up switch is held in the UP position, and an obstruction is detected, the window will automatically reverse travel to a distance of 25mm from the detection point.



BTLG320D

3. The safety power window function is not available if the window is within 4mm from the top of the door.

System Initialization And Fail-safe Mode

1. The safety power windows require initialization if battery power is removed from the system for more than 5 minutes, or if components are replaced. Ensure that the window is not obstructed, and then rise the window by holding the AUTO-UP switch. Continue to hold the AUTO-UP switch for 1 second after the window is completely closed. Release the switch and verify proper operation.
2. Initializing of fail safe mode

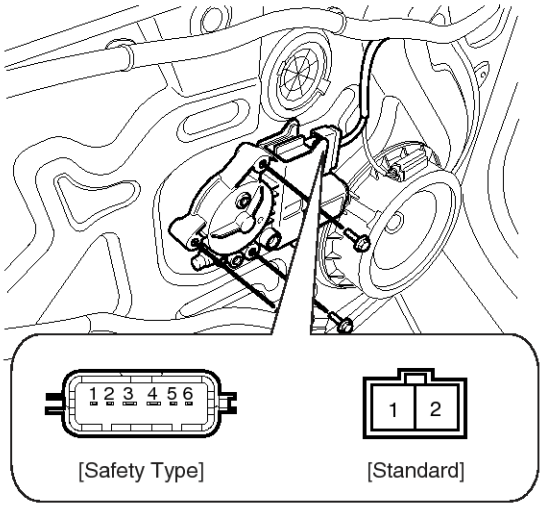
   If the power window system is in fail-safe mode, the auto-up function is not available; the window will rise 20mm each time the switch is placed into the AUTO-UP position.

Inspection

Front Power Window Motor

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

3. Disconnect the motor connector from the motor.



SHMBE9124N

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	⊕	⊖

SHMBE9320N

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.

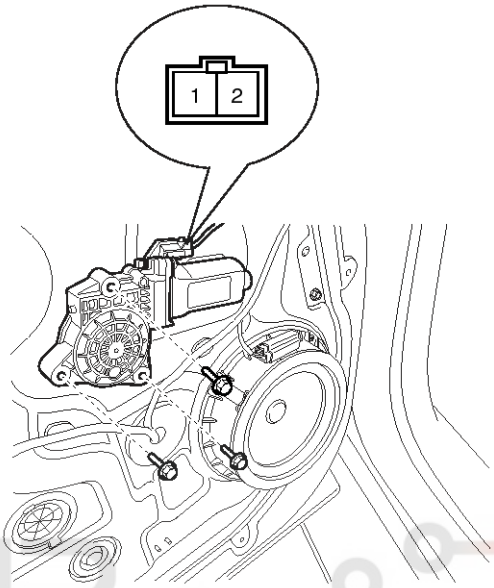
[Safety]

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

SHMBE9315N

Rear Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the rear door trim. (Refer to the Body group-rear door)
3. Disconnect the motor connector from the motor.



SHMBE9120L

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.

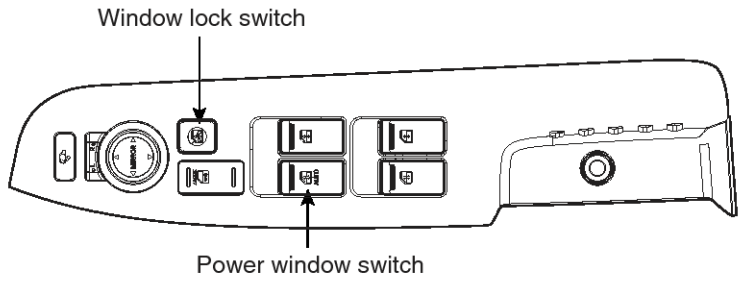
Position \ Terminal			1	2
Left	UP	Clockwise	⊕	⊖
	DOWN	Counter-Clockwise	⊖	⊕
Right	DOWN	Clockwise	⊖	⊕
	UP	Counter-Clockwise	⊕	⊖

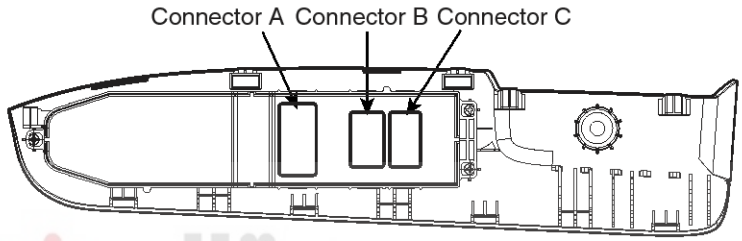
SHMBE9125N

Power Window Switch

Components

Driver Power Window Switch

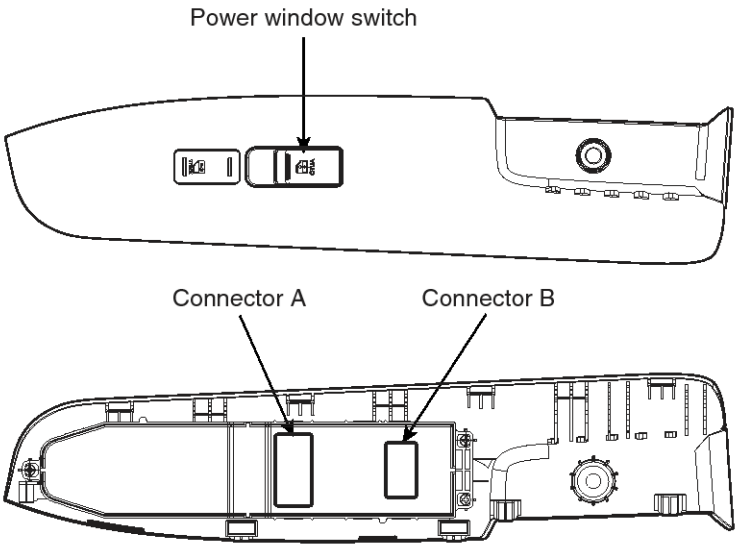




Connector			
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
Pin No.	Connector A	Connector B	Connector C
1	CAN high	IMS 2	Fold motor
2	CAN low	IMS 1	-
3	Mirror sensor V	Fuel filler door switch	-
4	Mirror sensor H	Door courtesy lamp	IGN2
5	Front door unlock switch	-	Unfold motor
6	Mirror sensor ground	Signal ground	Power ground1
7	Signal ground	Illumination -	battery
8	Mirror sensor 5V	IMS set	Front motor down
9	Safety up	Illumination +	Front motor up
10	Safety down	Power ground 2	Battery(Micro)
11	Door motor lock		
12	Mirror up		
13	Mirror left		
14	Mirror right		
15	Front door key lock switch		
16	-		
17	Front unlock monitoring SW		
18	Safety enable		
19	Side repeater lamp		
20	Mirror heater		
21	Mirror down		
22	Door motor unlock		
23	Motor(-)		

SHMBE9127N

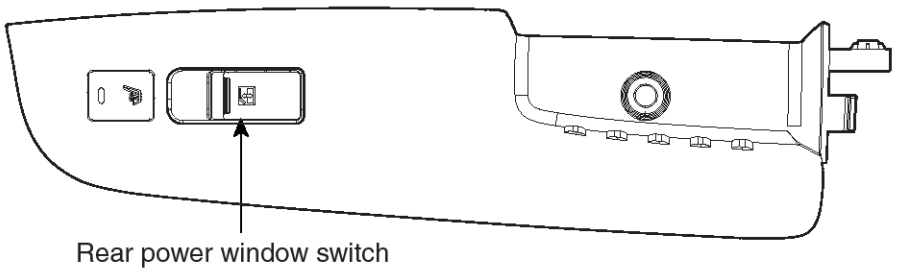
Assist Power Window Switch

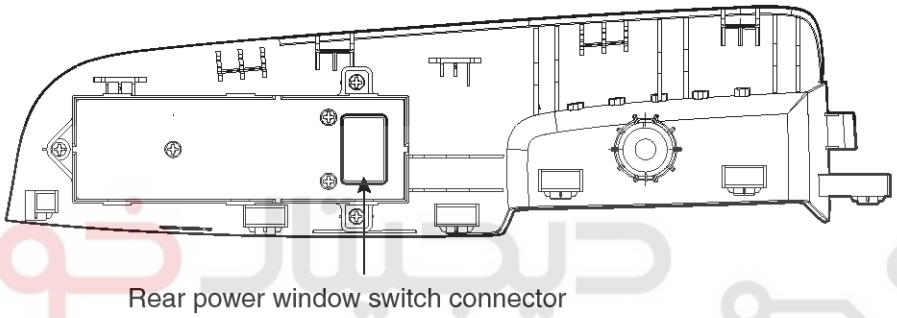


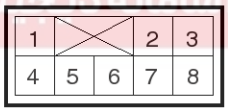
Connector	1 2 3 4 5 6 7 8 9 10 / 11 12 13 14 15 16 17 18 19 20 21 22 23	1 2 3 4 / 5 6 7 8 9 10
Pin No.	Connector A	Connector B
1	Safety down	IGN2
2	-	battery
3	Safety up	Unfold motor
4	CAN high	Fold motor
5	CAN low	Door courtesy lamp
6	Front door key unlock switch	-
7	Front door key lock switch	battery
8	Front unlock monitoring SW	Power ground
9	Mirror sensor V	Front motor down
10	Mirror sensor H	Front motor up
11	Safety enable	
12	Side repeater lamp	
13	Mirror heater	
14	Mirror down	
15	Door motor unlock	
16	Signal ground	
17	Mirror right	
18	Mirror left	
19	Mirror up	
20	Door motor lock	
21	Mirror sensor ground	
22	Motor(-)	
23	Mirror sensor 5V	

SHMBE9128N

Rear Power Window Switch







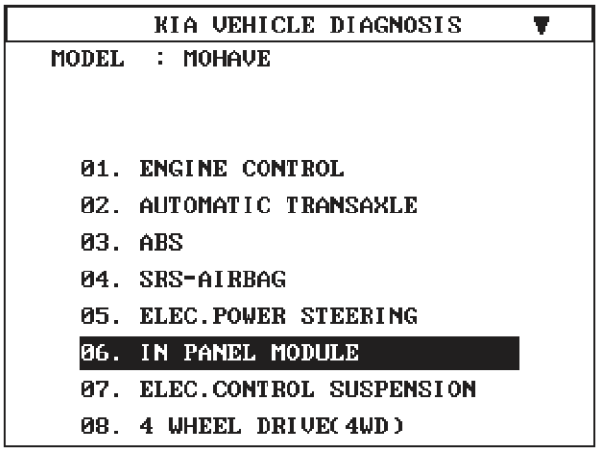
No	Name
1	Power window up switch
2	Power window down switch
3	Rear seat heater switch
4	Indicator
5	Indicator ground
6	Motor(+)
7	Motor(-)
8	Ground

SHMBE9129N

Inspection

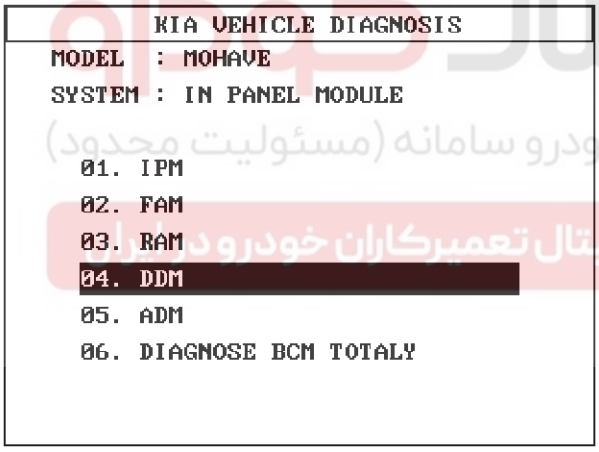
Driver Power Window Switch

1. When checking the power window switch operation, select a vehicle type and "In-panel module (IPM)" menu.



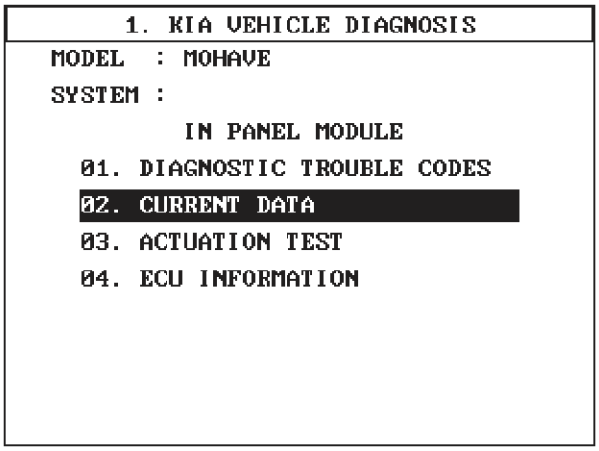
SHMBE9102L

2. Select "Driver Door Module(DDM)".

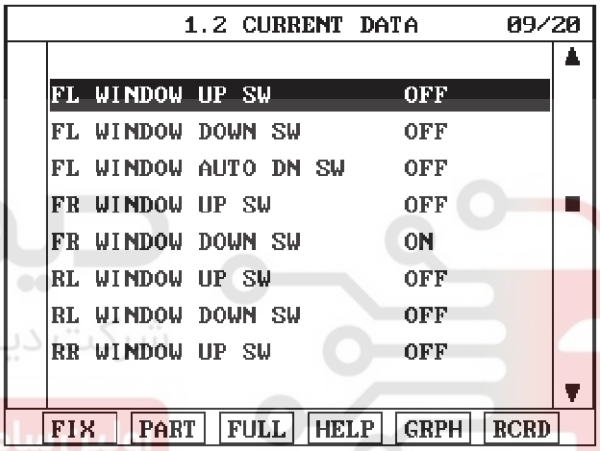


SHMBE9109L

3. Select option "Current Data".

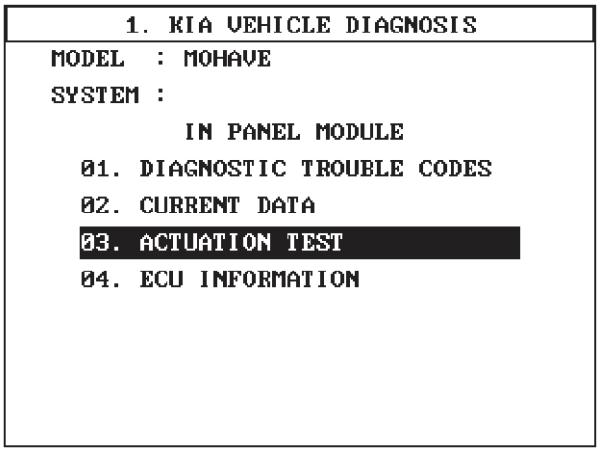


SHMBE9110L

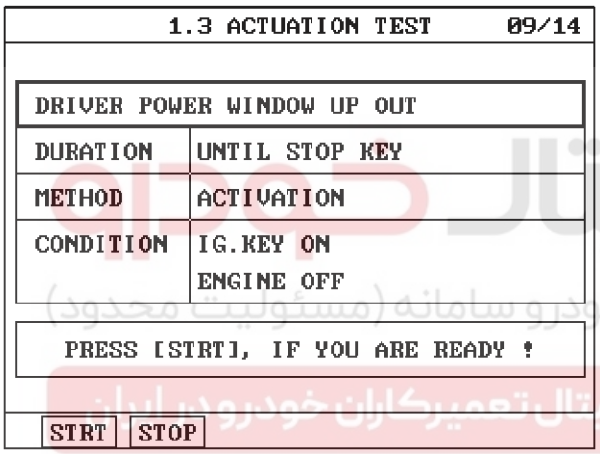


SHMBE9331N

4. To check the input value of power window switch in force mode, select option "Actuation Test".



SHMBE9107L

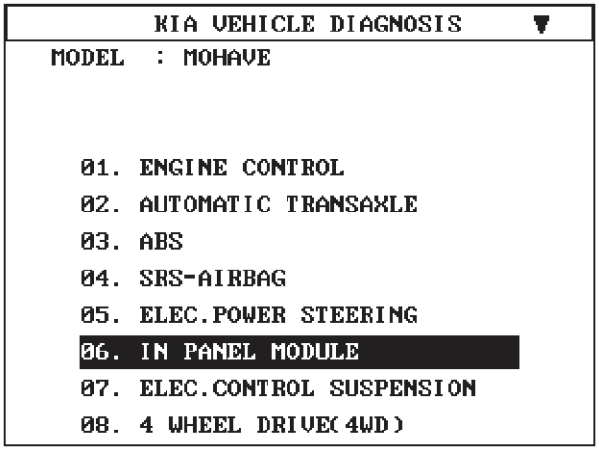


SHMBE9134N

※ Above voltage and numerical value may be different from the real value.

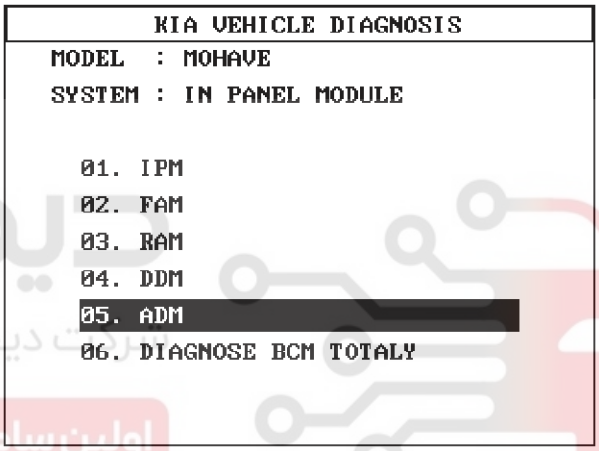
Assist Power Window Switch

1. When checking the assist power window switch, select a vehicle type and "In-panel module (IPM)" menu.



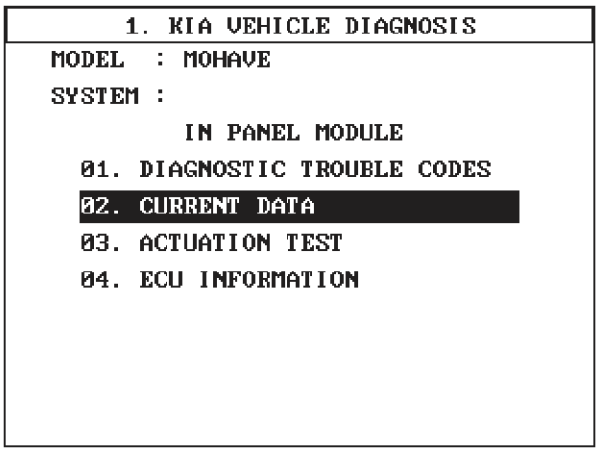
SHMBE9102L

2. Select "Assist Door Module(ADM)".

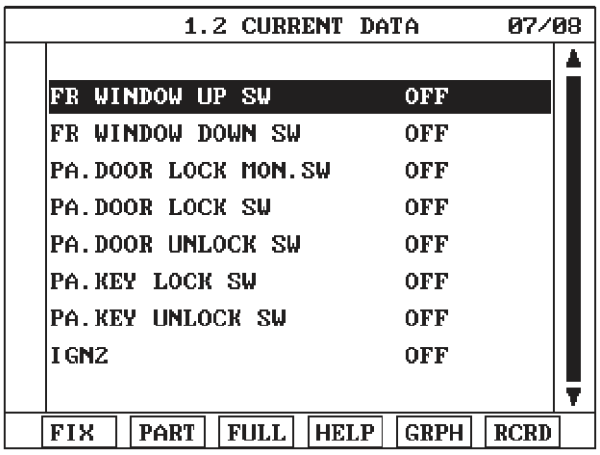


SHMBE9108L

3. Select option "Current Data".

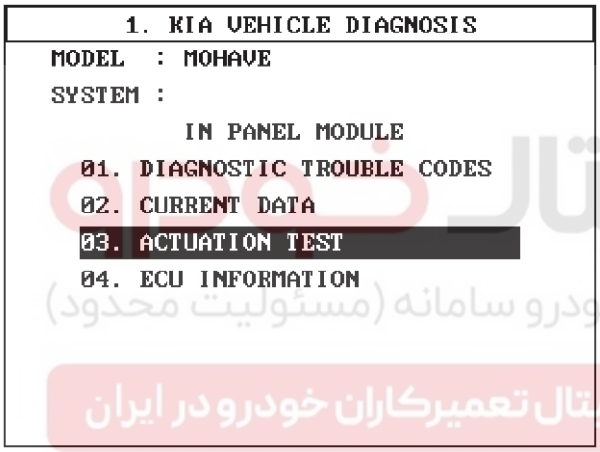


SHMBE9110L

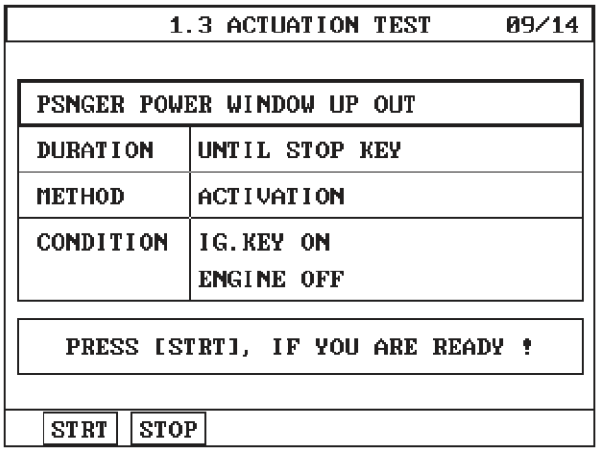


SHMBE9332N

4. To check the input value of power window switch in force mode, select option "Actuation Test".



SHMBE9107L



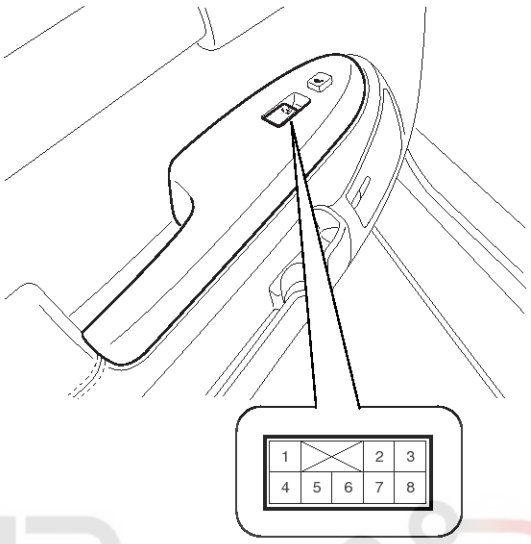
SHMBE9333N

※ Above voltage and numerical value may be different from the real value.

5. Change the anti pinch strip sensor, if there is no change from OFF to ON during operation.

Rear Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim. (Refer to the Body group - rear door)
3. Disconnect the connector from the switch.



SHMBE8238D

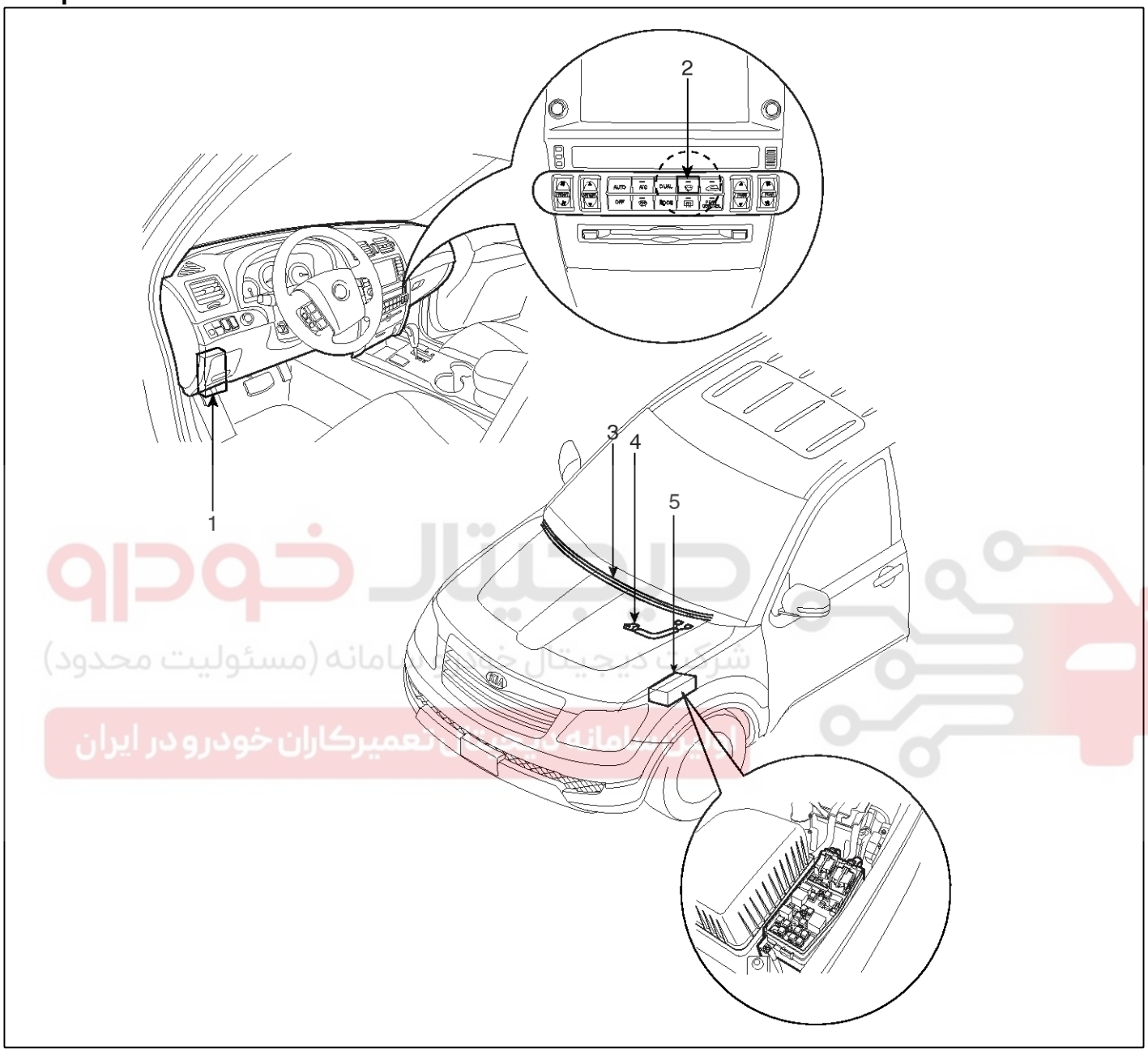
4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

Terminal / Position	1	2	GND
UP	○		○
OFF			
DOWN		○	○

SHMBE9139N

Windshield Deicer

Component Location



SHMBE9121L

1. IPM (Windshield deicer control)
2. Windshield deicer switch
3. Windshield deicer
4. Deicer connector
5. Windshield deicer relay (Built in FAM)

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. Instrument panel module receives an input signal from the deicer switch, and then controls relay.

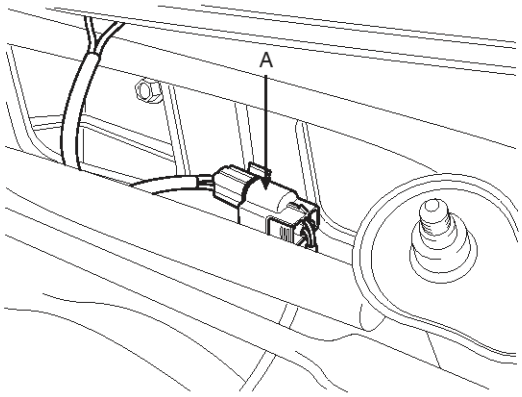
Operating condition is the same that of rear window defogger system.

Since the generator "L" is switched ON, if the deicer switch is ON, then deicer output is ON for 20 minutes.

Windshield Deicer

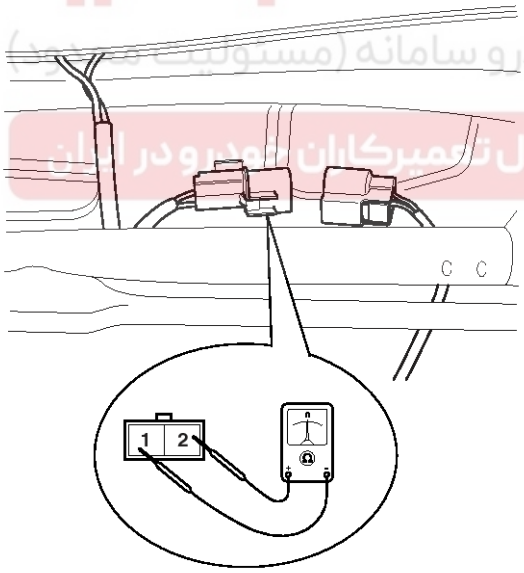
Inspection

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



SHMBE8241D

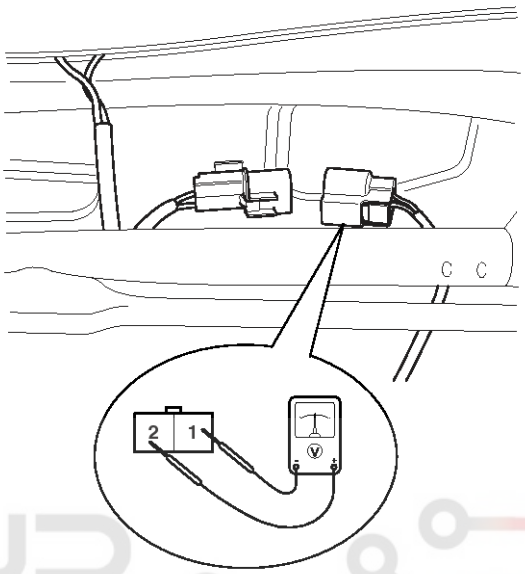
3. Check for continuity between the terminals of deicer lines.



SHMBE8242D

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

O K : approx. Battery voltage (12V)



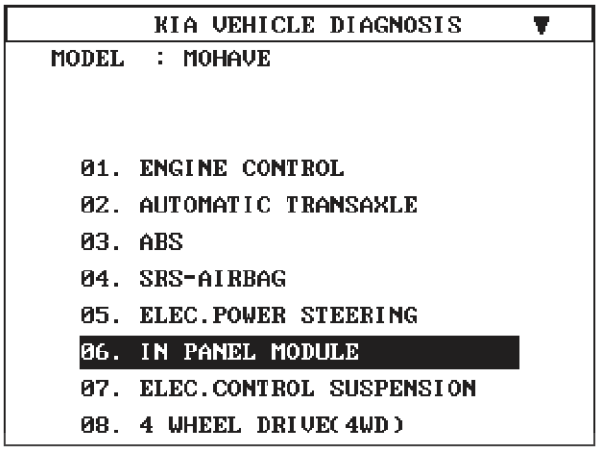
SHMBE8243D

Windshield Deicer Switch

Inspection

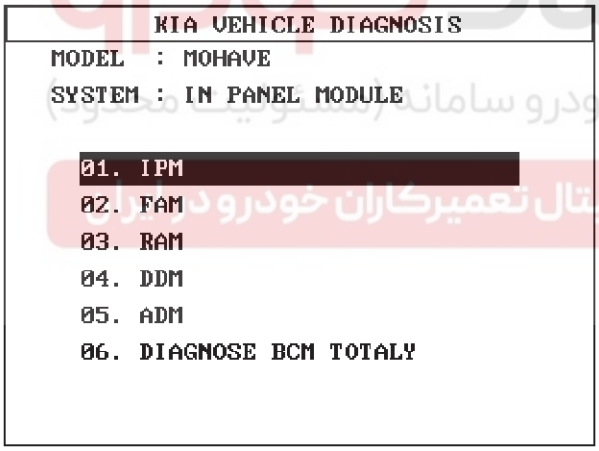
Windshield Deicer Switch

1. When checking the operation, select a vehicle type and menu.



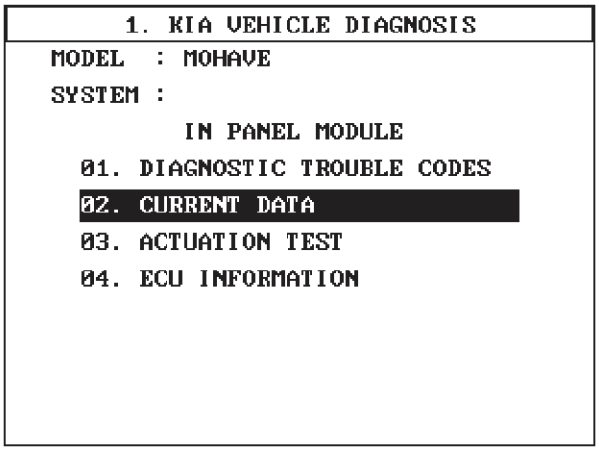
SHMBE9102L

2. Select "Instrument panel module (IPM)".

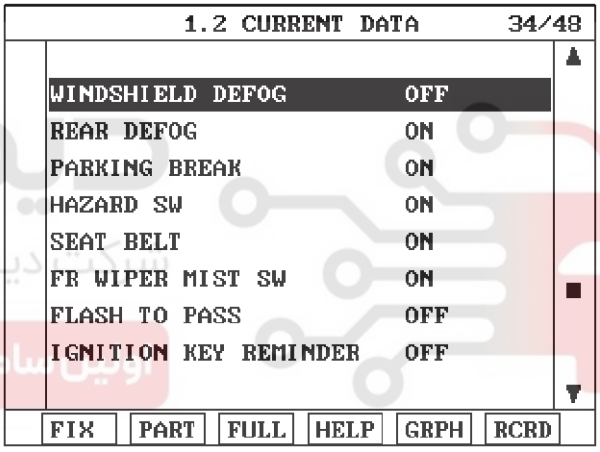


SHMBE9103L

3. Select option "Current Data".

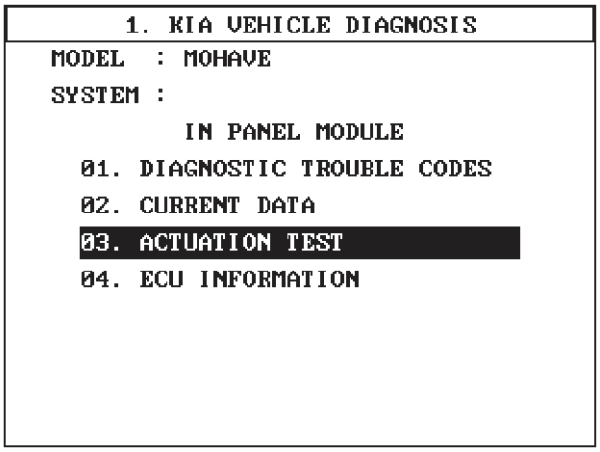


SHMBE9110L

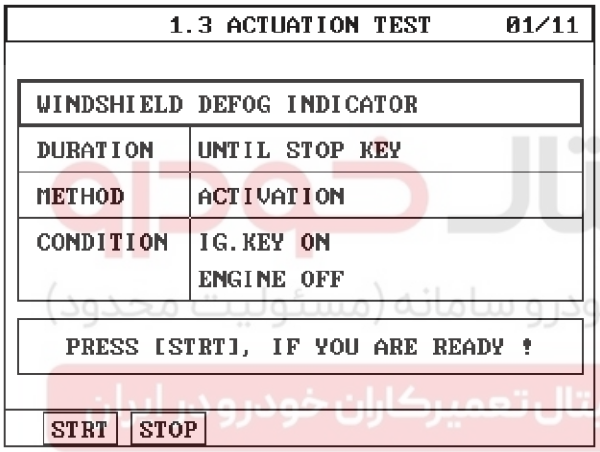


SHMBE9143N

4. To check the input value of windshield deicer switch in force mode, select option "Actuation Test".



SHMBE9107L

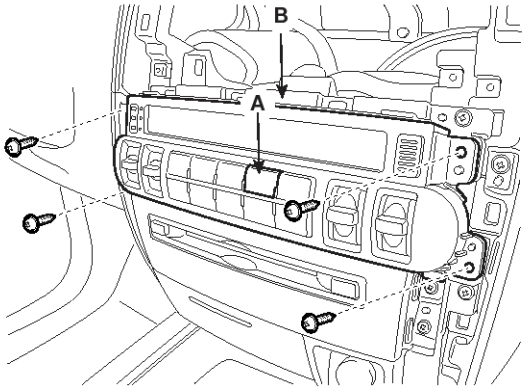


SHMBE9145N

※ Above voltage and numerical value may be different from the real value.

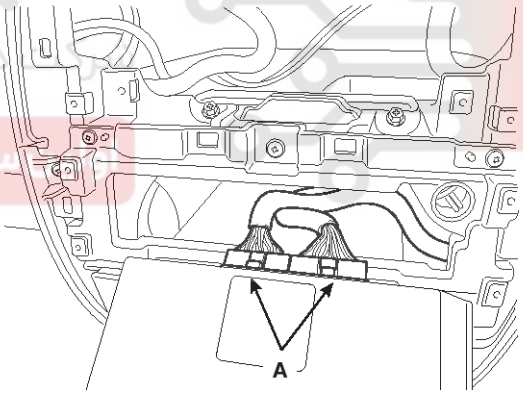
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the audio head unit.
   (Refer to Audio system - Removal/Installation)
3. Remove the heater control unit (B) including windshield deicer switch (A).



SHMB18034D

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



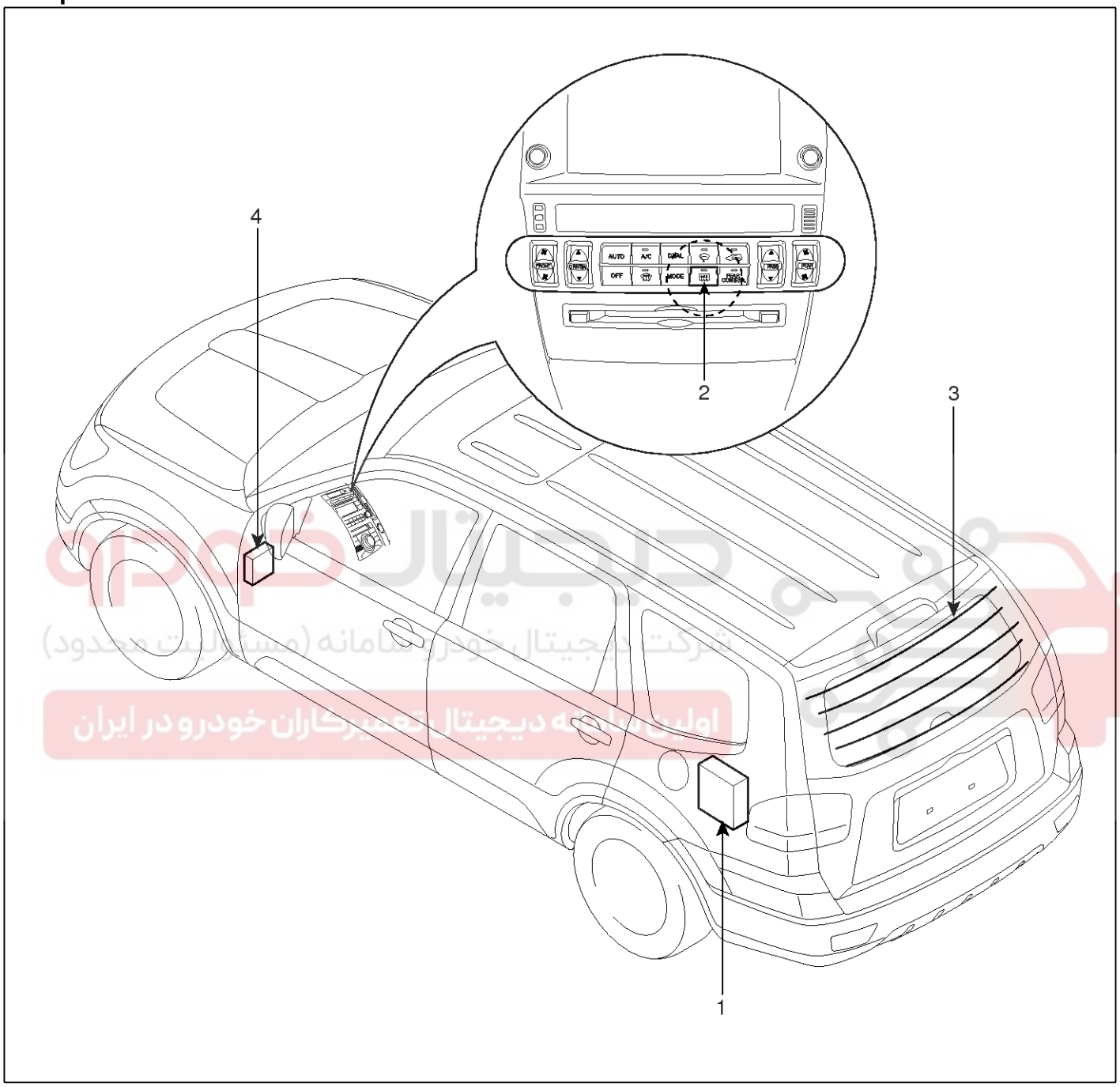
SHMBE8245D

Installation

1. Install the heater control unit.
2. Install the audio head unit.

Rear Glass Defogger

Component Location



SHMBE8246D

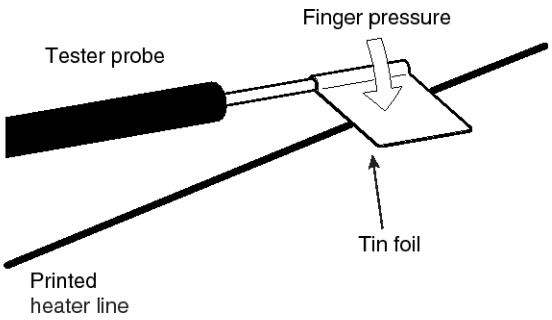
1. Rear window defogger relay (Built in RAM)
2. Rear window defogger switch (Included in A/C control switch)
3. Rear window defogger
4. IPM (Rear window defogger switch control)

Rear Glass Defogger Printed Heater

Inspection

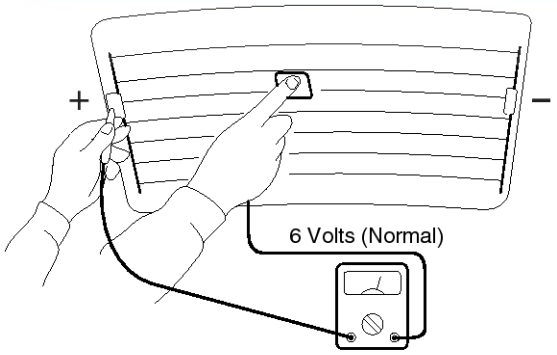
⚠CAUTION

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.



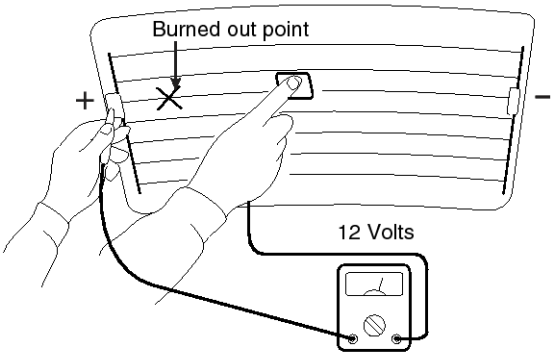
ETA9165A

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.



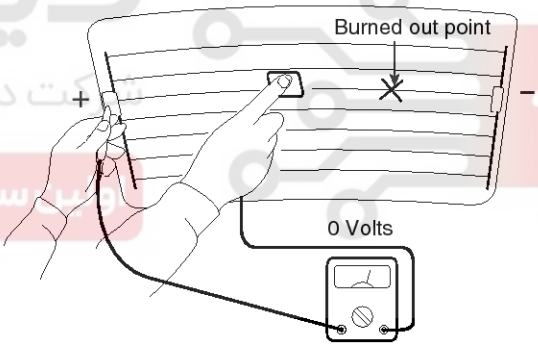
ETA9165B

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



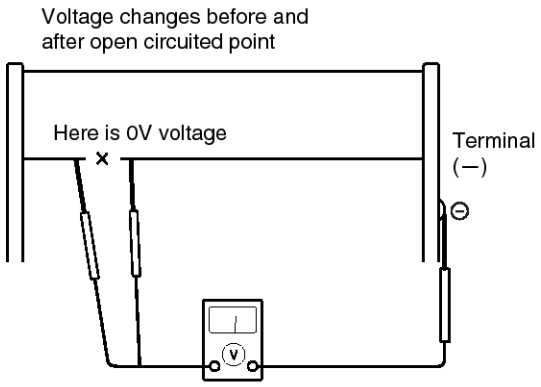
ETA9165C

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



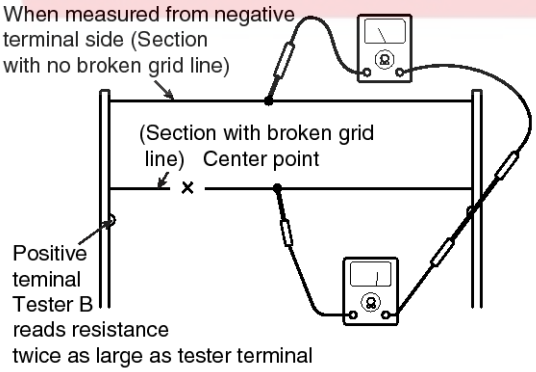
ETA9165D

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.



ETA9165E

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 as that in other sections. In the affected section, move the test lead to a position where the resistance sharply changes.



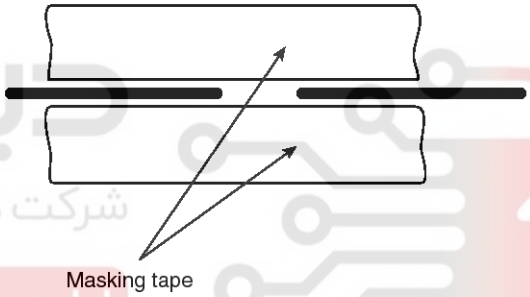
ETA9165F

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).



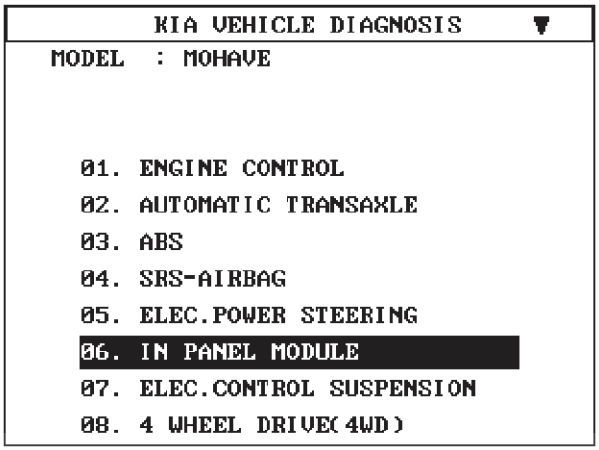
ETA9165G

Rear Glass Defogger Switch

Inspection

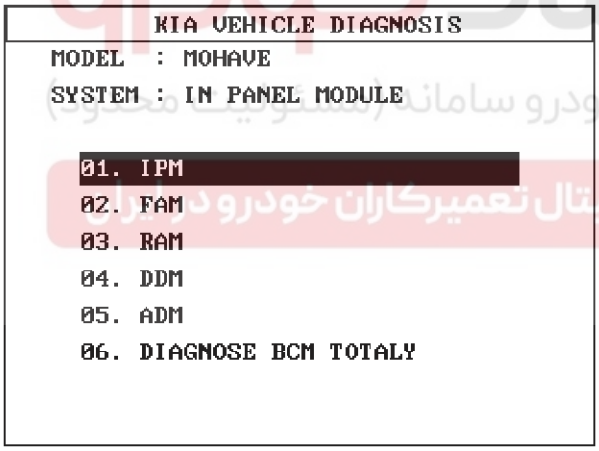
Rear Window Defogger Switch

1. When checking the rear window defogger switch operation, select a vehicle type and menu.



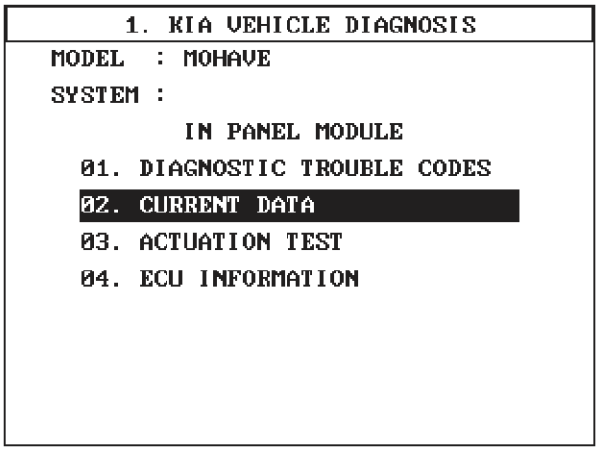
SHMBE9102L

2. Select "Instrument panel module (IPM)".

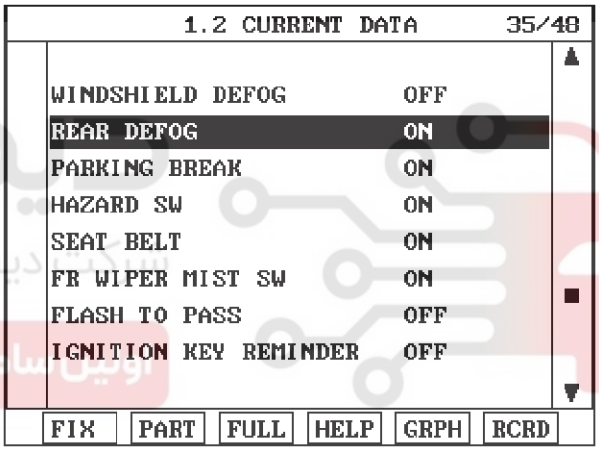


SHMBE9103L

3. Select option "Current Data".

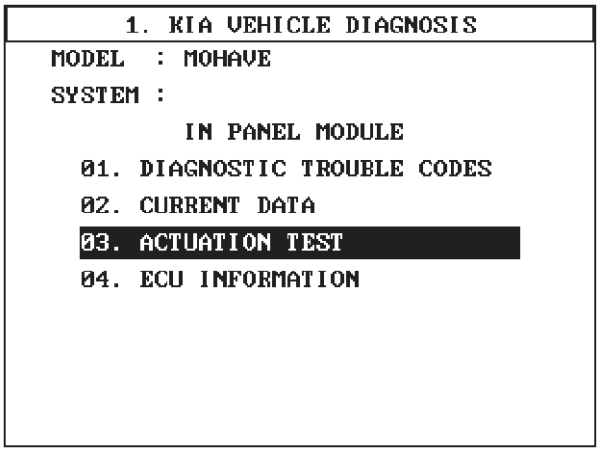


SHMBE9110L

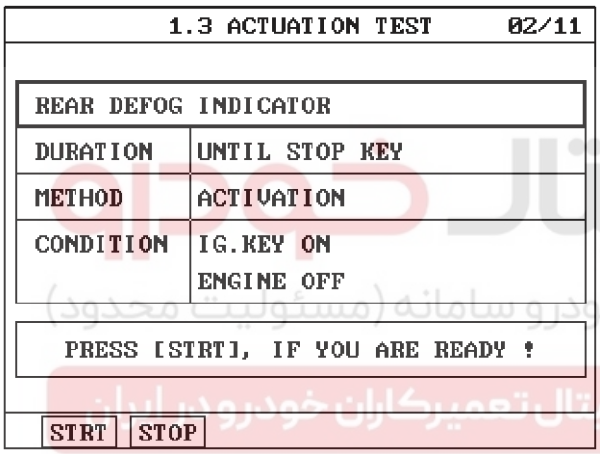


SHMBE9149N

4. To check the input value of rear window defogger switch in force mode, select option "Actuation Test".



SHMBE9107L

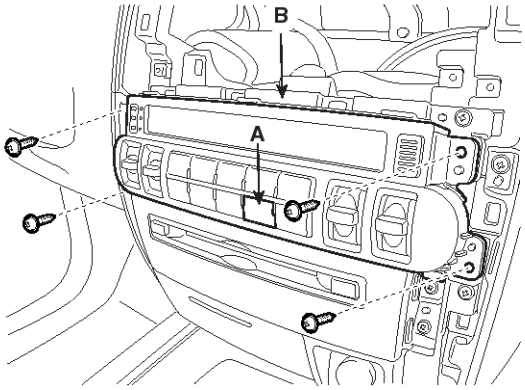


SHMBE9151N

※ Above voltage and numerical value may be different from the real value.

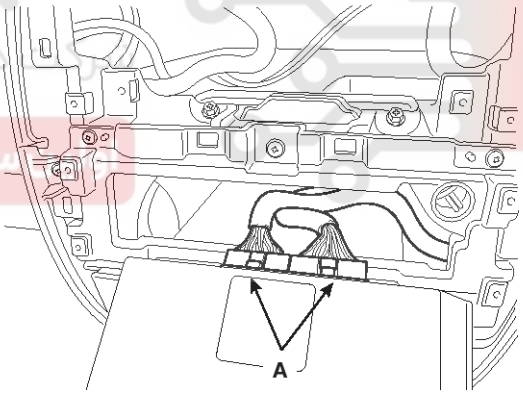
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the audio head unit.
   (Refer to the audio system - Removal/Installation)
3. Remove the heater control unit (B) including the rear window defogger switch (A).



SHMBE8244D

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



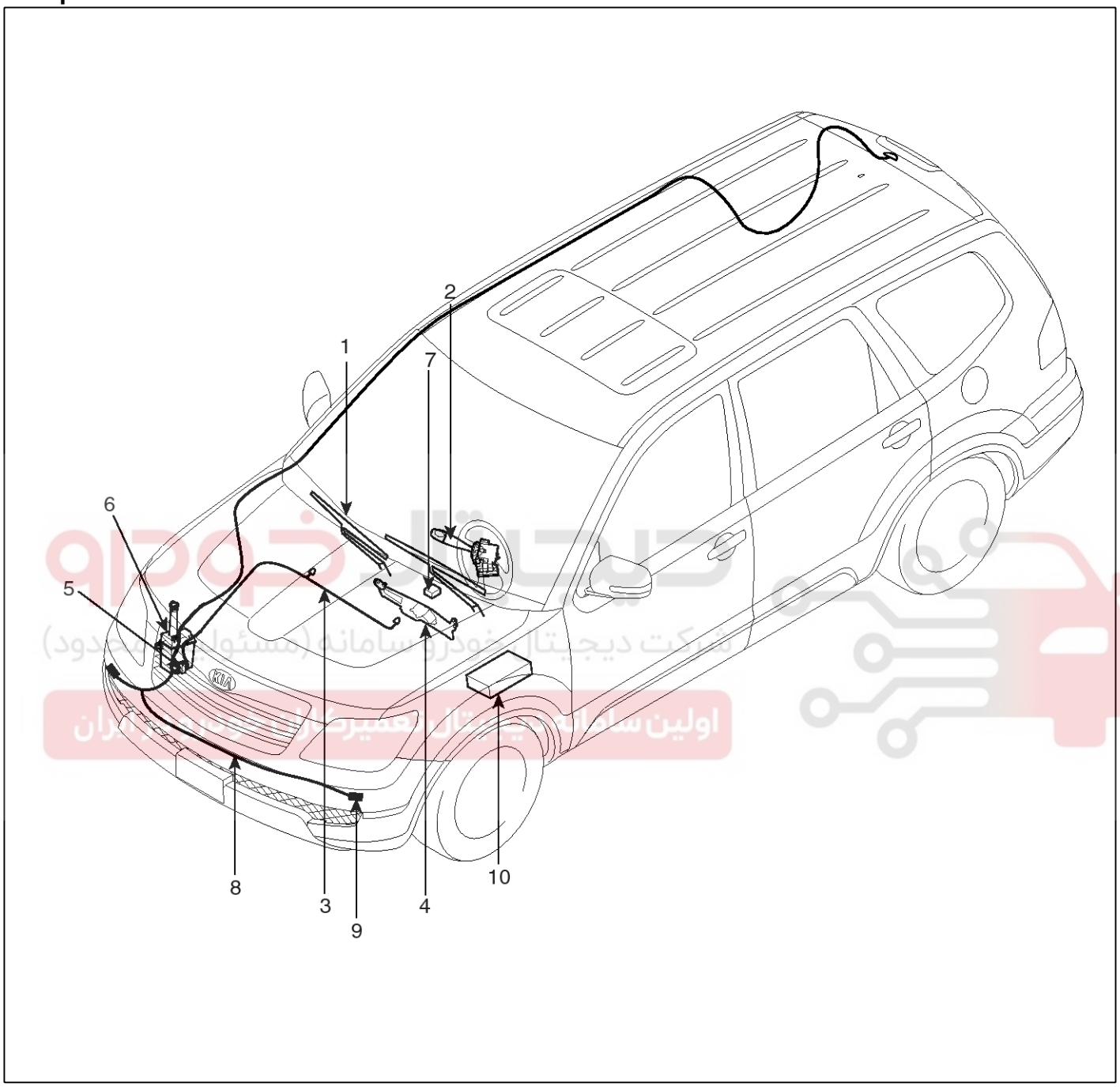
SHMBE8245D

Installation

1. Install the heater control unit.
2. Install the audio head unit.

Windshield Wiper/Washer

Component Location



SHMBE8247D

1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield wiper motor & linkage
5. Washer motor
6. Washer reservoir
7. Head lamp washer switch (Cluster fascia panel)
8. Head lamp washer hose
9. Head lamp washer nozzle
10. FAM (Front wiper relay, front / rear washer relay)

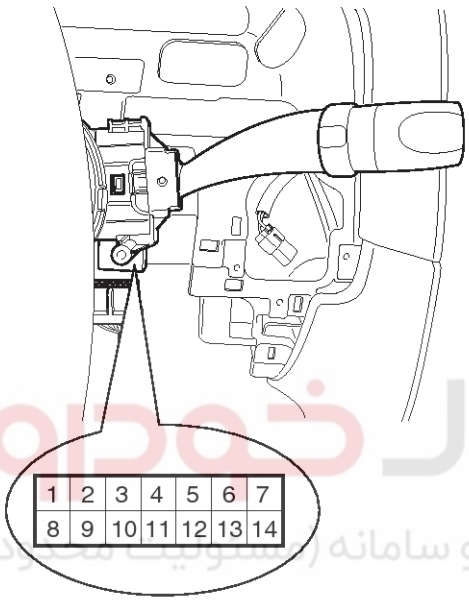
Windshield Wiper-Washer Switch

Inspection

Wiper And Washer Switch

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.



SHMBE8065D

Wiper Switch

Terminal / Position	1	2	3	4	5	6	14	13
MIST				○	○			
OFF		○	○					
INT		○	○		○	○	○	○
LOW		○			○			
HI	○				○			

SHMBE9082N

Washer Switch

Terminal / Position	7	5
OFF		
ON	○	○

SHMBE9083N

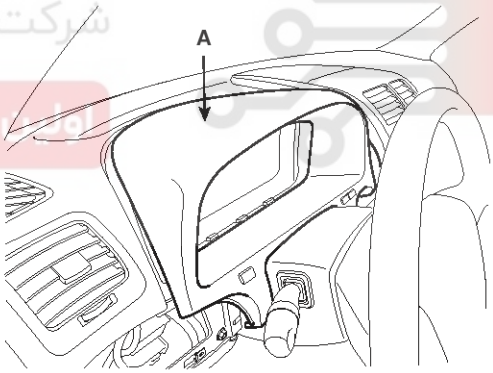
Rear Wiper & Washer Switch

Terminal / Position	12	10	9
Washer	○		○
OFF			
ON	○	○	

SHMBE9084N

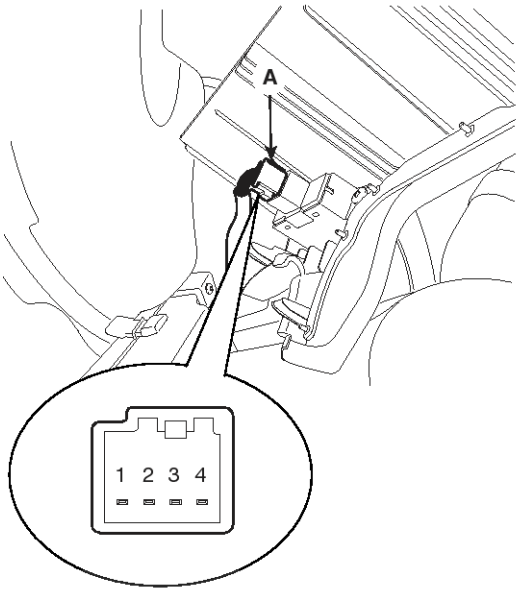
Head Lamp Washer Switch

1. Disconnect the negative(-) battery terminal.
2. Remove the cluster fascia panel (A).



SHMBE8248D

3. Disconnect the head lamp washer switch connector (A).



SHMBE8249D

4. Make sure that the continuity exists between the terminals below.

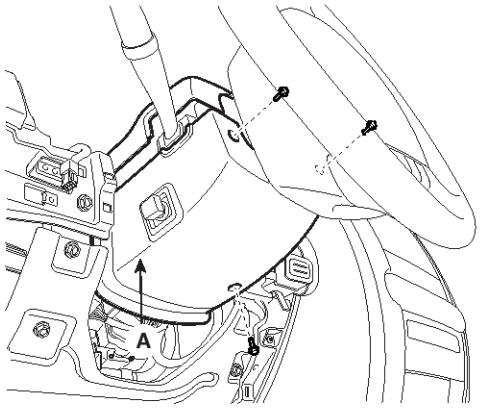
   If continuity is not as specified, replace the head lamp washer switch.

Terminal / Position	ON	OFF	Remark
2			5V
3			GND
1			ILL. (+)
4			ILL. (-)

SHMBE9132L

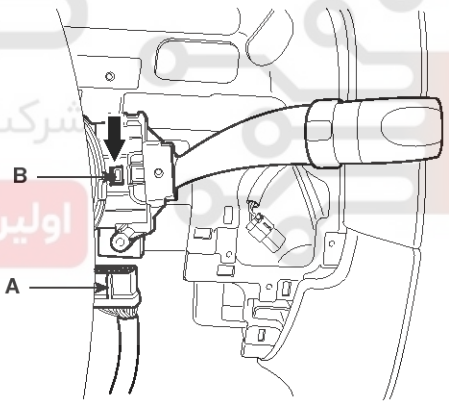
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws and connector.



SHMBE8056D

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



SHMBE8058D

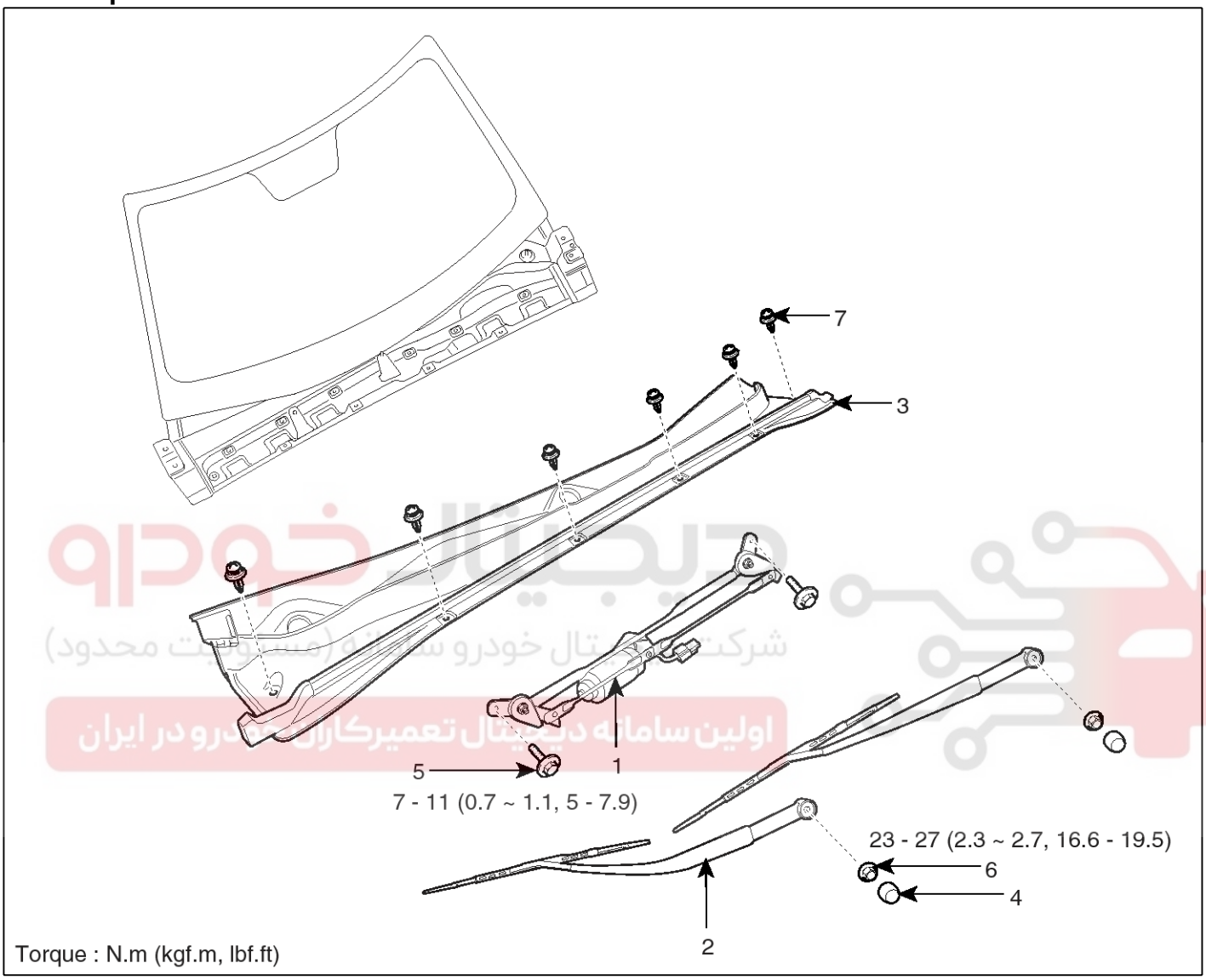
Installation

1. Connect the connectors and reassemble the wiper switch assembly.
2. Reassemble the steering column upper and lower shrouds.

Front Wiper Motor

Component

Front wiper motor

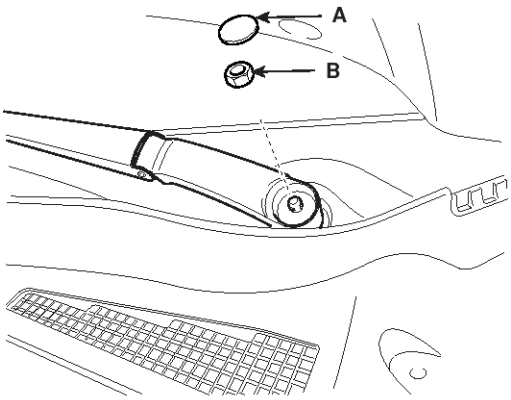


SHMBE9173N

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

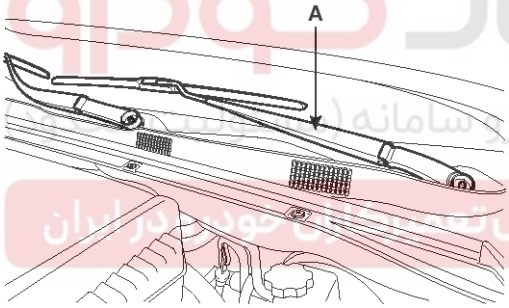
Removal

1. Remove the wiper arm nut (B) after removing the wiper cap (A).



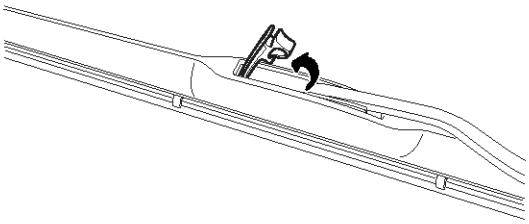
SHMBE8251D

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



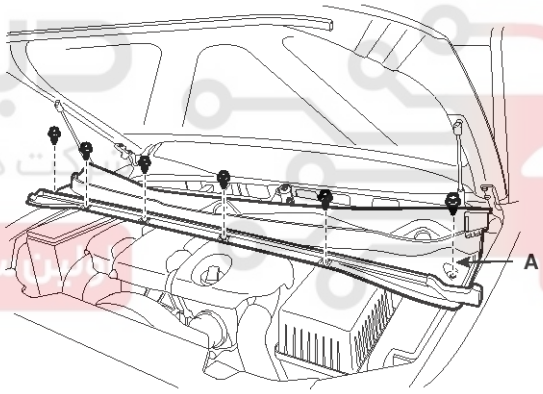
SHMBE9174N

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



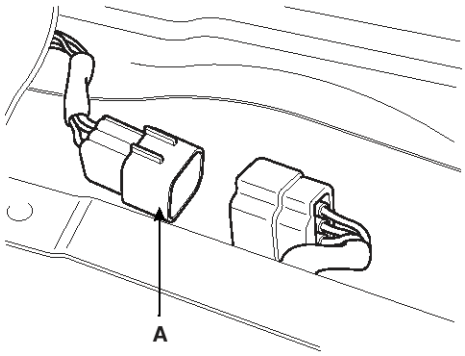
SHMBE9179N

4. Remove the weather strip and the cowl top cover (A) after removing rivets (6EA).



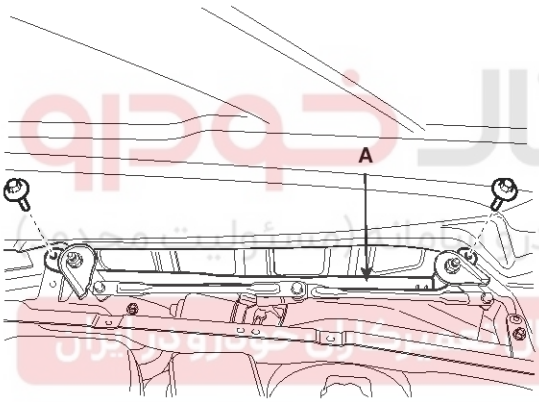
SHMBE8253D

5. Disconnect the wiper motor connector (A).



SHMBE8255D

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



SHMBE8256D

Installation

1. Reassemble the wiper motor & linkage assembly and connect the connector.

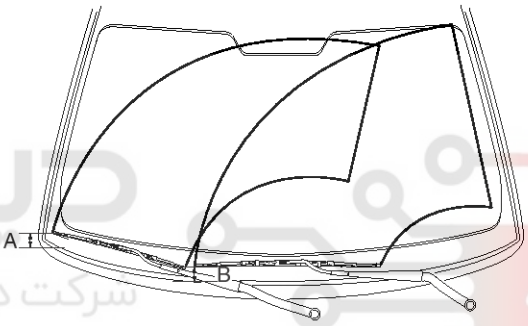
Torque: 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

2. Reassemble the cowl top cover.
3. Reassemble the windshield wiper arm and blade.

Torque: 23~27 Nm (2.3~2.7 kgf.m, 16.6~19.5 lbf.ft)

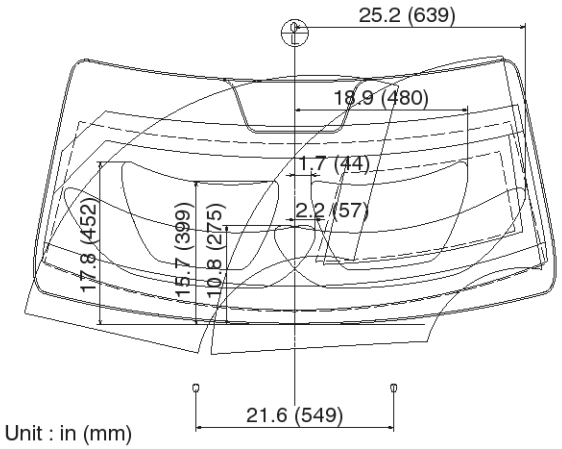
4. Install the wiper arm and blade to the specified position.

Specified Position	A	B
Distance [in(mm)]	1.38 ± 0.2 (35 ± 5)	1.38 ± 0.2 (35 ± 5)



ATGE362C

5. Set the washer nozzle on the specified spray position.



SHMBE9175N

Front Washer Motor

Inspection

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

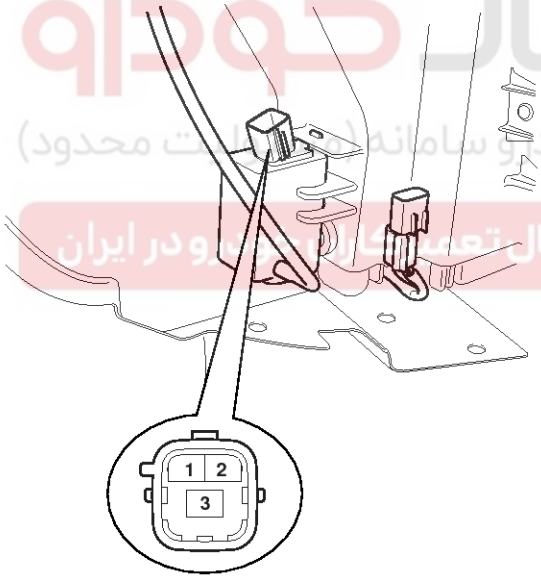
   NOTICE

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

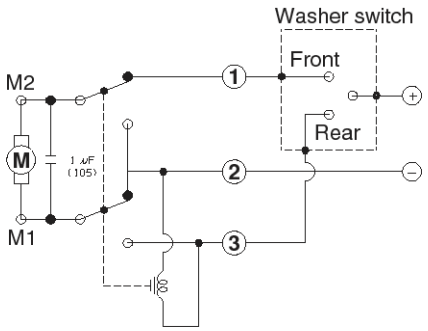
2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.

   [Front & Rear washer]

   1. Windshield washer (+)
   2. Ground
   3. Rear washer (+)



SHMBE9176N



<Windshield & Rear washer motor>

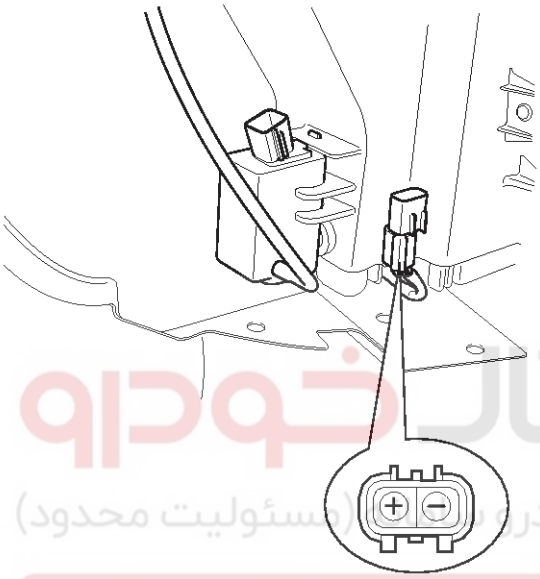
SHMBE9177N

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



SHMBE8262D

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

(Tolerance : -50cc ~ +100cc)

SHMBE9178N

Removal

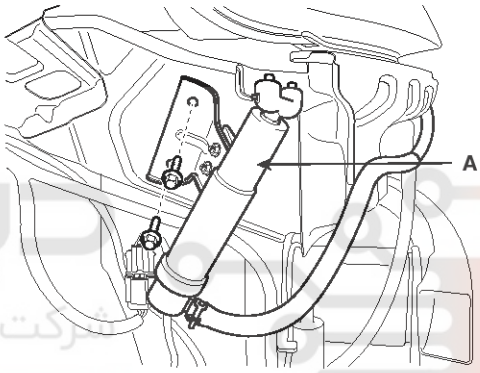
⚠CAUTION

- **When servicing the washer pump, be careful not to damage the washer pump seal.**
- **Do not operate the washer pump before filling the washer reservoir.**

  Failure to do so could result in premature pump failure.

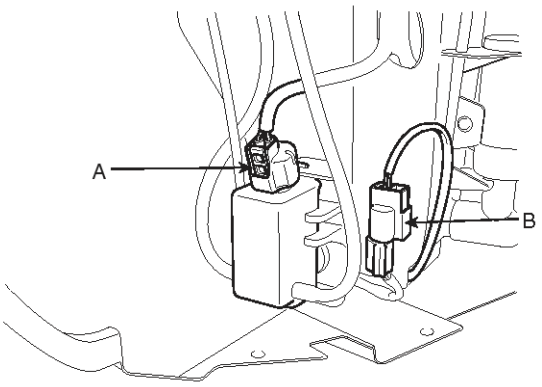
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.

   (Refer to Body group - Front bumper)
3. Remove the head lamp washer nozzle (A) after loosening bolts.



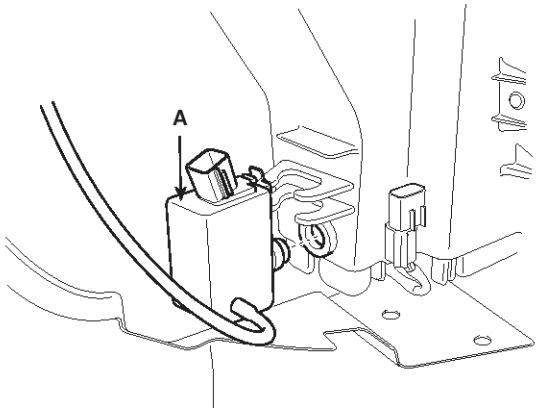
SHMBE8265D

4. Remove the washer hose and disconnect the washer motor connector (A) and washer fluid level sensor connector (B).



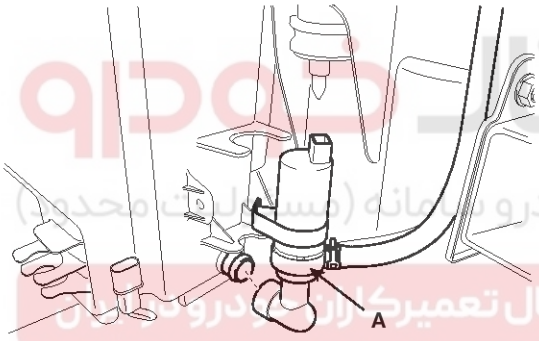
SHMBE8266D

5. Remove the washer motor (A).



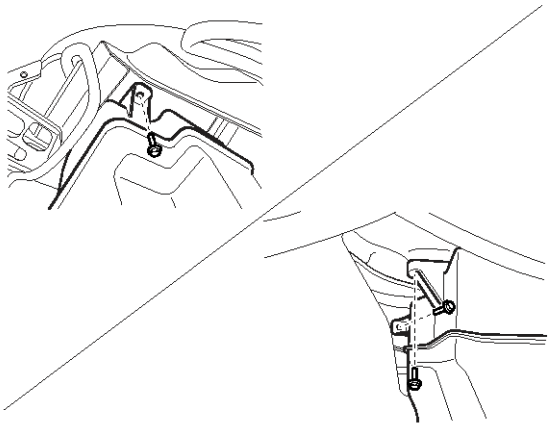
SHMBE8267D

6. Remove the head lamp washer pump (A) after disconnecting the connector.



SHMBE8269D

7. Remove the washer reservoir after removing 3 bolts.



SHMBE8268D

Installation

1. Reassemble the washer reservoir.

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

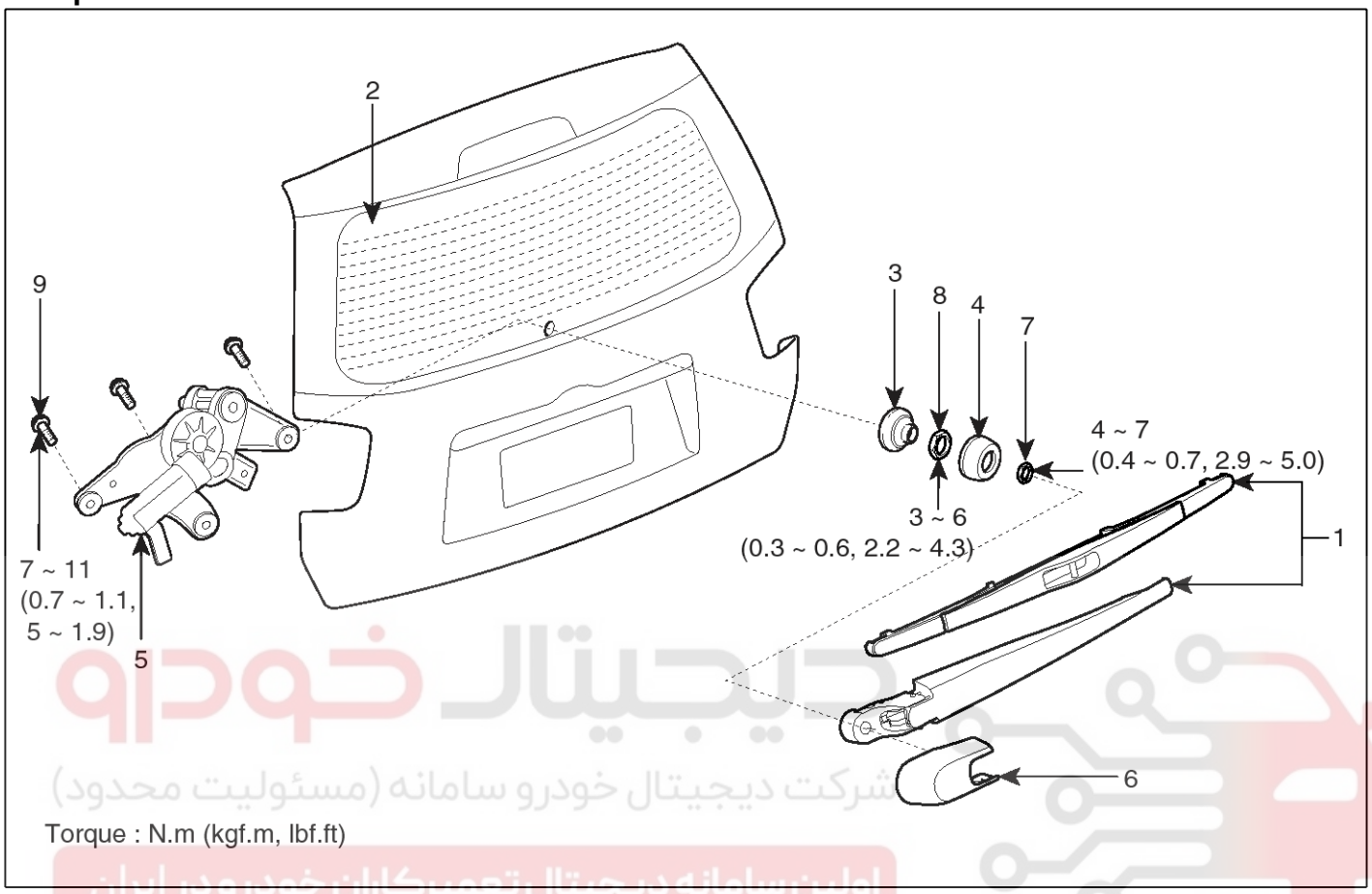
2. Connect the washer motor connector and washer hose.
3. Install the head lamp washer motor.
4. Install the head lamp washer nozzle.

Tightening torque (Bolt)
3 ~ 5 Nm (0.3 ~ 0.5 kgf.m, 2.2 ~4.2 lbf.ft)

5. Reassemble the front bumper cover.

Rear Wiper/Washer

Component Location



SHMBE9180N

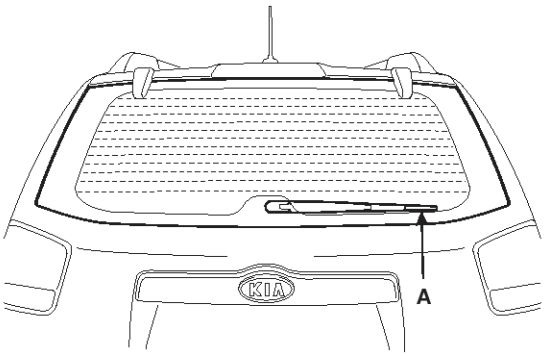
1. Rear wiper arm & blade
2. Tailgate glass
3. Cap & Pad
4. Outside cover
5. Rear wiper motor assembly
6. Head cap
7. Washer nut
8. HEX nut
9. Washer bolt

Rear Wiper Motor

Inspection

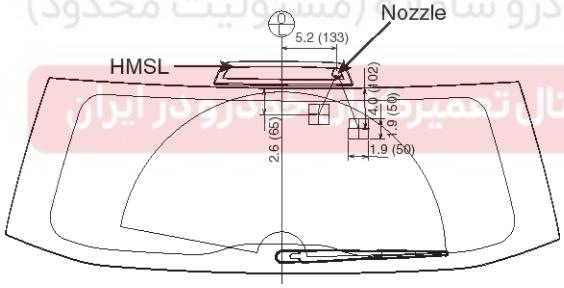
Rear Wiper And Nozzle

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



SHMBE8283D

2. Set the rear washer nozzle on the specified spray position.

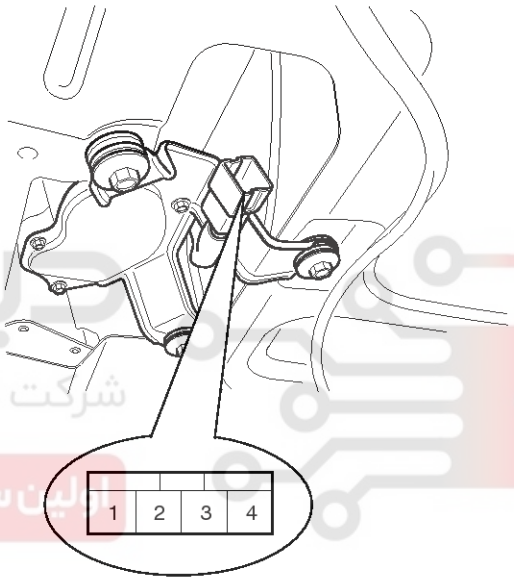


Unit : in (mm)

SHMBE9181N

Rear Wiper Motor

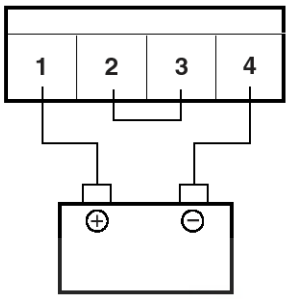
1. Remove the 4P connector from the rear wiper motor.
2. Connect battery positive (+) and negative (-) cables to terminals 3 and 4 respectively.
3. Check that the motor operates normally. Replace the motor if it operates abnormally.
   1. IGN +
   2. Parking
   3. Switch
   4. Ground



SHMBE8274D

Automatic Stop Operation Check

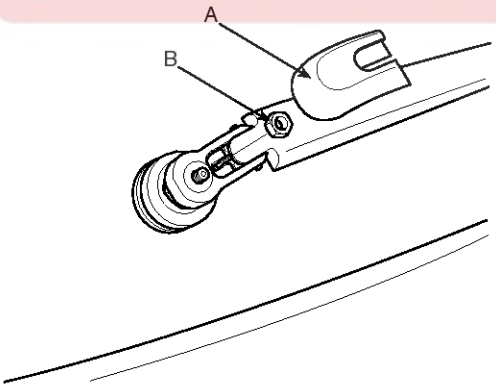
1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 3.
3. Connect terminals 2 and 3.
4. Connect the positive (+) lead from the battery to terminal 1 and the negative (-) lead to terminal 4.
5. Check that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



ATGE381F

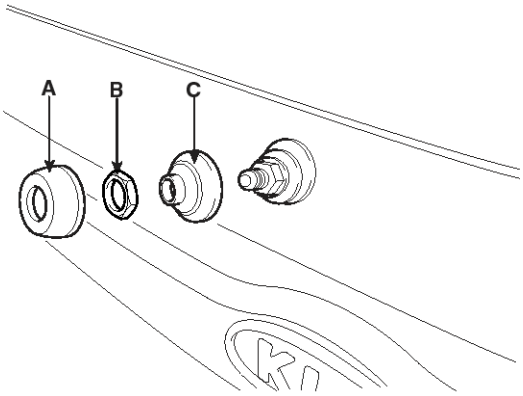
Removal

1. Detach the wiper cap, then remove the rear wiper arm (A) after removing a nut (B).



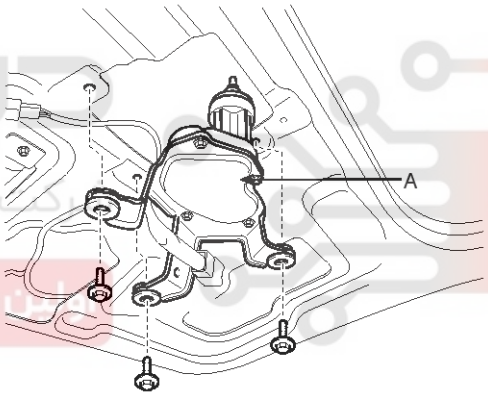
SHMBE8275D

2. Remove the rear wiper cap & pad (C) after removing rear wiper cover (A) and a HEX nut (B).



SHMBE8276D

3. Open the tailgate glass then remove the tailgate trim.
4. Disconnect the rear wiper motor connector then remove the rear wiper motor (A) after removing bolts (3EA).



SHMBE8282D

Installation

1. Reassemble the rear wiper motor assembly.

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

2. Reassemble the tailgate trim.
3. Reassemble the HEX nut and the rear wiper cap & pad.

Tightening torque Nut (A) :
3~6 Nm (0.3~0.6 kgf.m, 2.2~4.3 lbf.ft)

4. Reassemble the rear wiper arm and rear wiper cap.

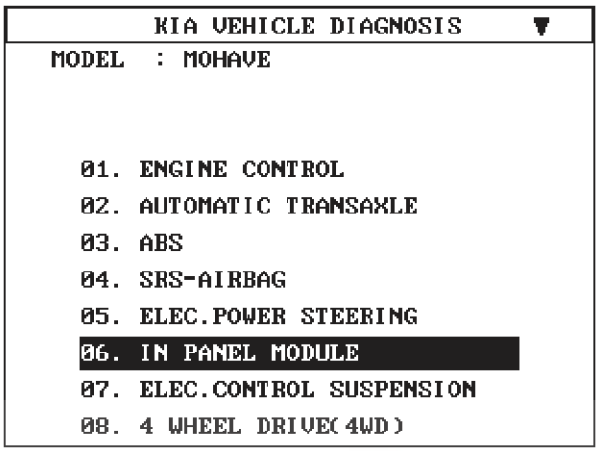
Tightening torque Nut(B) :
4~7 Nm (0.4~0.7 kgf.m, 2.9~5.0 lbf.ft)

5. Reassemble the rear wiper arm and blade.

Rear Washer Switch

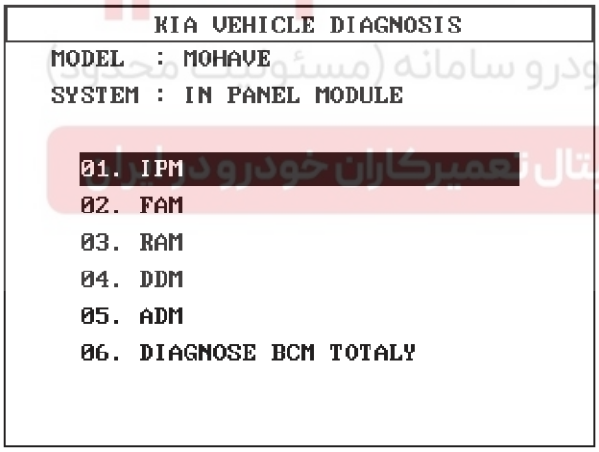
Inspection

1. Check BCM input/output value of each position of rear washer switch when you inspect the module whether faulty or not.
2. Select model and menu.



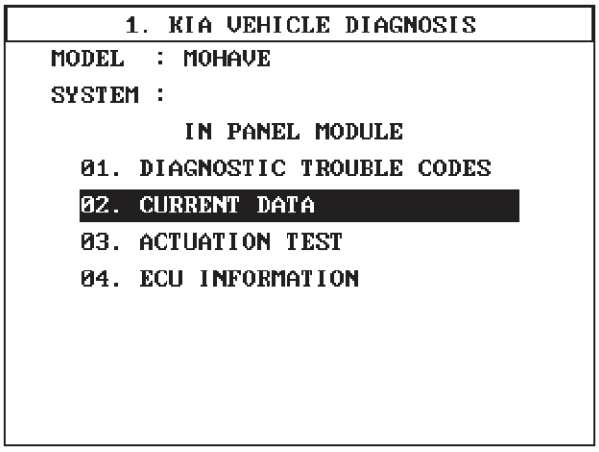
SHMBE9102L

3. Select "Instrument Panel Module (IPM)"



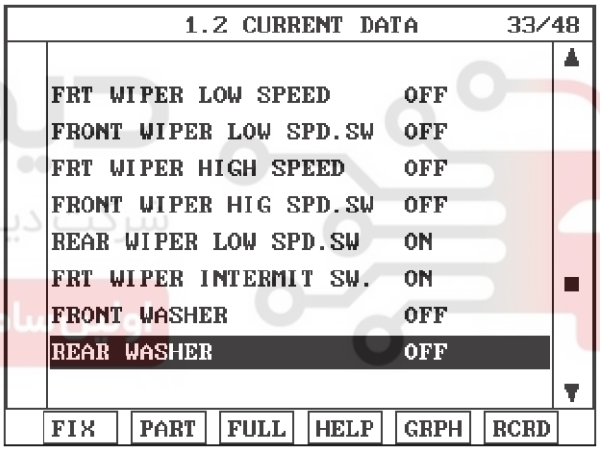
SHMBE9103L

4. Select "Current Data".



SHMBE9110L

5. Check input/output value of rear washer.



SHMBE9334N

Rear Washer Motor

Inspection

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

   NOTICE

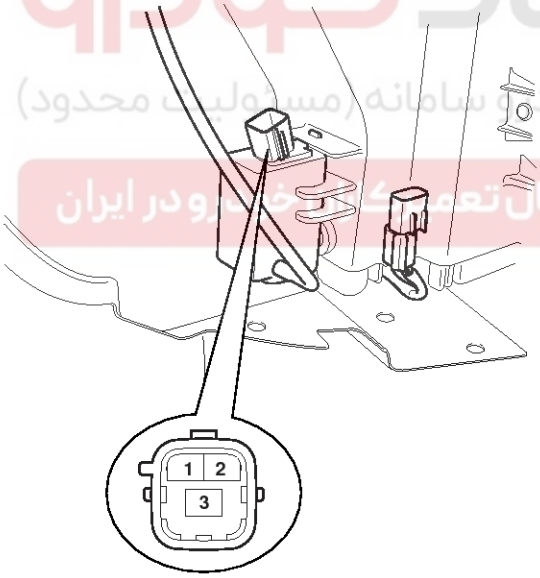
   Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

2. Remove the front bumper cover. (Refer to the Body 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.
4. Check that the motor operates normally.

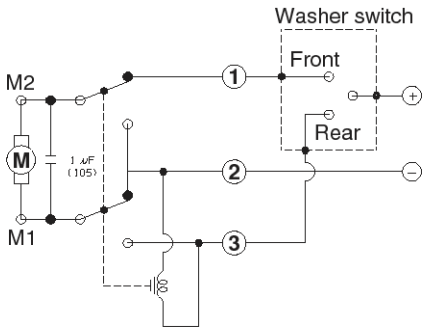
   Replace the motor if it operates abnormally.

   [Front & Rear washer]

   1. Windshield washer (+)
   2. Ground
   3. Rear washer (+)



SHMBE9176N



<Windshield & Rear washer motor>

SHMBE9177N

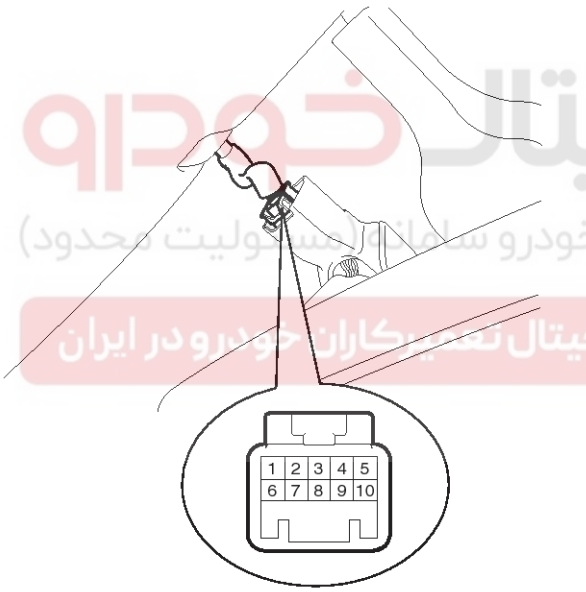
Electro chromic Inside Rear View Mirror

Description

The ECM (Electro Chromatic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night, in order the user not to be dazzled by the light. The forward facing sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 7~85%. But, when the reverse gear is engaged, it stops functioning.

Terminal No. :

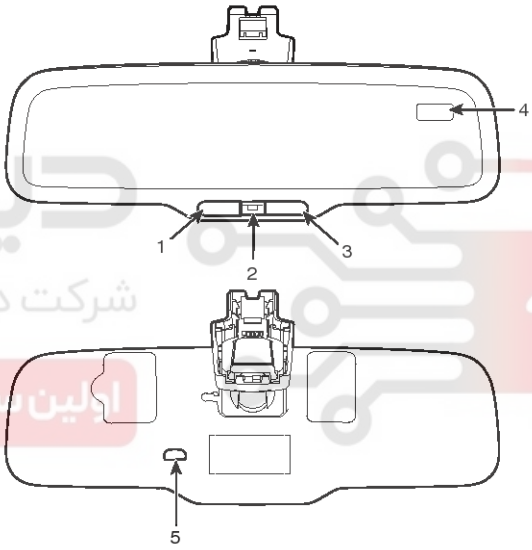
1. IGN (12V)
2. Reverse signal
3. Ground
4. ECM (+)
9. ECM (-)



SHMBE8284D

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. Mirror button
2. Rearward looking sensor
3. Compass button
4. Direction indicator
5. Front looking sensor



SHMBE8488D

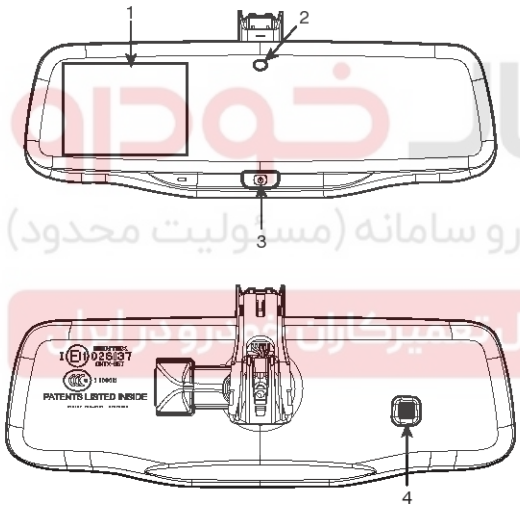
Reverse Display Room Mirror

Description

The back 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 sensor
3. Power button
4. Forward sensor



SHMBE8965D

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.

NOTICE

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.

NOTICE

The mirror defaults to the "ON" position each time the vehicle is started.

Inspection

Check it by the procedure below to see if the function of the ECM is normal.

1. Turn the ignition key to the "ON" position.
2. Cover the forward facing sensor.
3. Head a light to the rearward looking sensor.
4. The ECM should be darkened as soon as the rearward looking sensor detects the light.

NOTICE

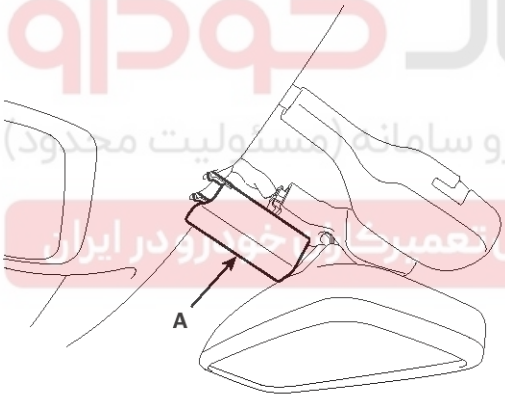
If this test is performed in daytime, the ECM may be darkened as soon as the forward facing sensor is covered.

5. When the reverse gear is engaged, the ECM should not be darkened.

   When heading lights to both the forward facing and rearward looking sensors, the ECM should not be darkened.

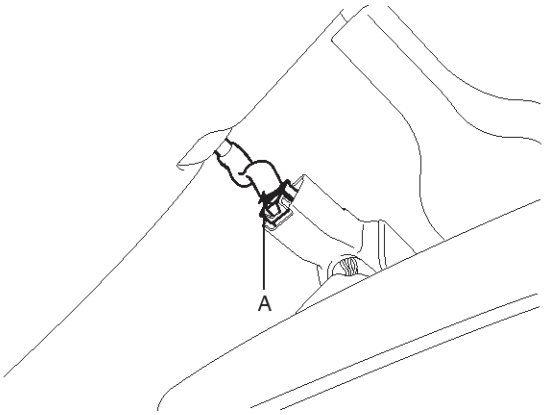
Removal

1. Remove the mirror wiring cover (A).



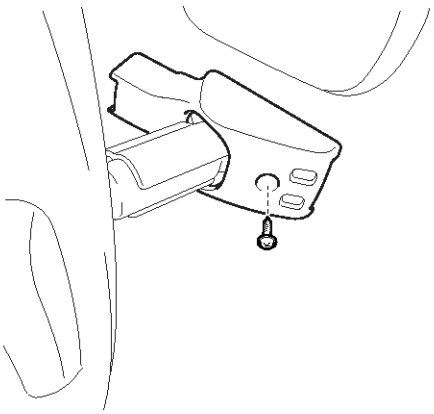
SHMBE8286D

2. Disconnect the mirror connector (A).



SHMBE8285D

3. Remove the mirror mounting screw.

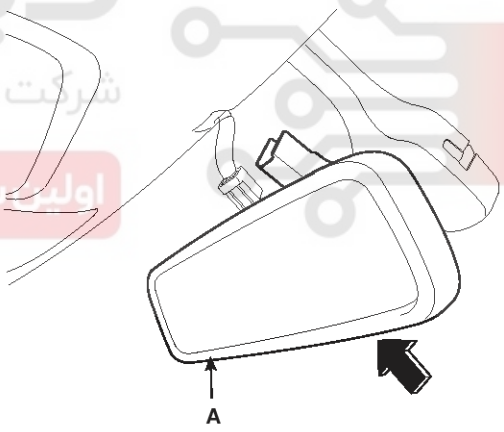


SHMBE8287D

4. Remove the mirror (A) pulling up in the arrow direction.

NOTICE

Make sure not to damage the mounting bracket when removing the mirror.



SHMBE8288D

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.

Compass Mirror

Description

The compass feature is designed to be integrated into an electro chromatic interior rearview mirror.

The mirror assembly shall display a compass heading.

The compass mirror then take the sensor information to determine static field strengths and rotating field information to determine an accurate compass heading.

Specification

Item	Standard value
Rate voltage	DC 12V
Operating voltage range	DC9 ~ 16V
Operating temperature range	-30 ~ +65°C
Direction display	8
Renewal time	2 sec.

Switch Point Accuracy

The compass module shall, while compensating for the vehicle magnetic fields, until the Earth's varying magnetic fields to determine direction.

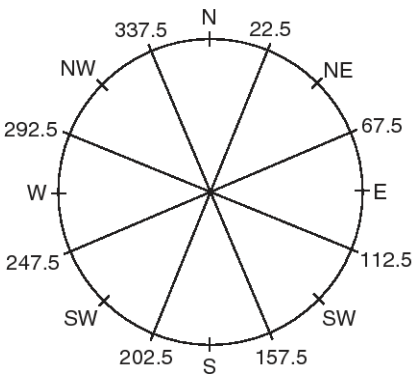
[Switch points]

Switch point	Heading ± 10°
N - NE	22.5
NE - E	67.5
E - SE	112.5
SE - S	157.5
S - SW	202.5
SW - W	247.5
W - NW	292.5
NW - N	337.5

NOTICE

There should be hysteretic at each switch point.

Switch points between the 8 cardinal directions, these switch points are ± 10°



ETQF241F

Compass display interval

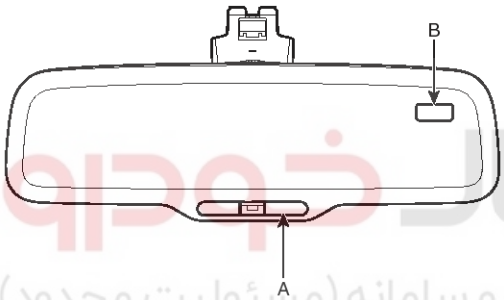
Compass display should be updated at every two seconds.

Function

The compass can be turned ON and OFF and will remember the last state when the ignition is cycled. To turn the display feature ON/OFF :

1. Press and release the feature control button (A) to turn the display feature OFF.
2. Press and release the feature control button (A) again to turn the display back ON.

   Additional options can be set with press and hold sequences of the feature control button (A) and are detailed below.



SHMBE9089L

There is a difference between magnetic north and true north. The compass in the mirror can compensate for this difference when it knows the magnetic zone in which it is operating. This is set either by the dealer or by the user.

Adjustment

Calibration procedure

If the display shows "C", calibrate the compass.

1. Driving the vehicle in a circle at less than 8km/h 3 times or until the compass heading appears.
2. Driving in a circle in right-handed direction and opposite direction are possible, and if the calibration is completed, the compass heading will appear.
3. Keep driving in a circle until a compass heading appears.

To adjust the Zone setting :

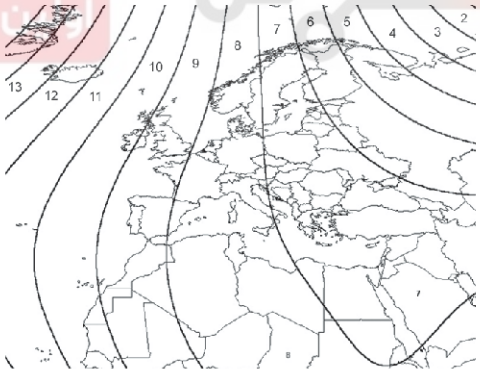
1. Determine the desired zone number based upon your current location on the zone maps.
2. Press and hold the Feature Control button for more than 6 but less than 9 seconds, the current zone number will appear on the display (B).
3. Pressing and holding the feature control button (A) again will cause the numbers to increment (Note: they will repeat …13, 14, 15, 1, 2,..). Releasing the button when the desired zone number appears on the display will set the new zone.
4. Within about 5 seconds the compass will start displaying a compass heading again.

To re-calibrate the compass :

There are some conditions that can cause changes to the vehicle magnets. Items such as installing a ski rack or a antenna or even some body repair work on the vehicle can cause changes to the vehicle's magnetic field. In these situations, the compass will need to be re-calibrated to quickly correct for these changes.

1. Press and hold the feature control button (A) for more than 9 seconds. When the compass memory is cleared, a "C" will appear in the display (B).
2. To calibrate the compass, drive the vehicle is 2 complete circles at less than 8 KPH (5 MPH).

Zone Map



EUROPE

SHMBE9090L

Seat Electrical

Component Location

SHMBE9154N

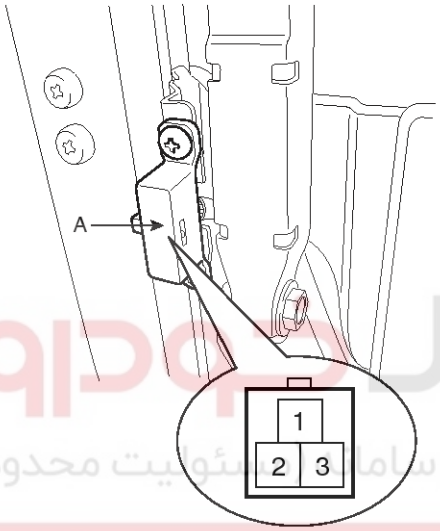
1. Slide motor
2. Front height motor
3. Rear height motor
4. Reclining motor
5. Power seat switch
6. Reclining switch

Power Seat Motor

Inspection

Slide Motor Limit Switch

1. Disconnect the limit switch (A) and operate the limit switch.
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If there is an abnormality, replace the limit switch.



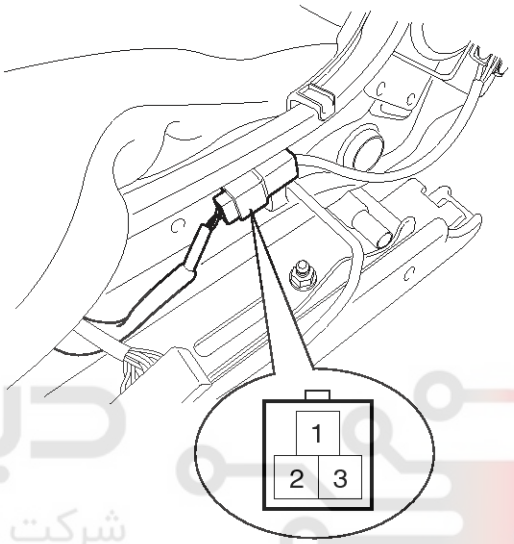
SHMBE8290D

Position \ Terminal	1	2	3
Forward	○		○
Backward	○	○	

SHMBE9316N

Reclining Motor Limit Switch

1. Disconnect the limit switch and operate the limit switch.
2. Check for continuity between the terminals.
3. Make sure that the seat operation is normal in the reverse after the maximum operation.
4. If there is an abnormality, replace the limit switch.



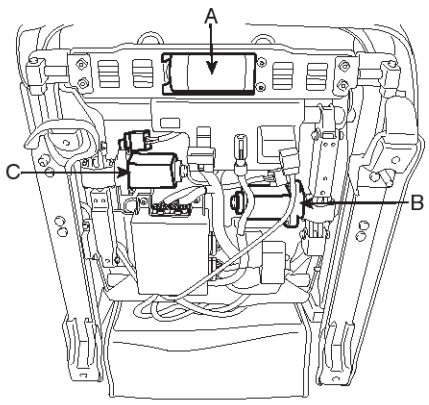
SHMBE8291D

Position \ Terminal	1	2	3
Forward	○		○
Backward	○	○	

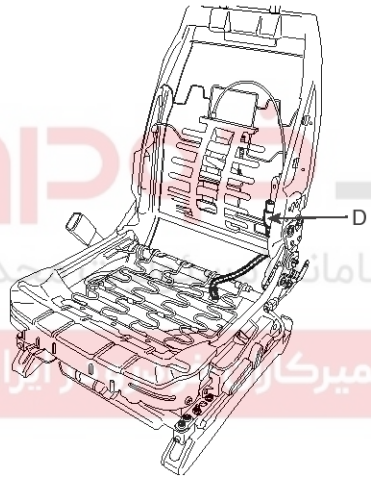
SHMBE9316N

Power Seat Motor

1. Disconnect the connectors for each motor.

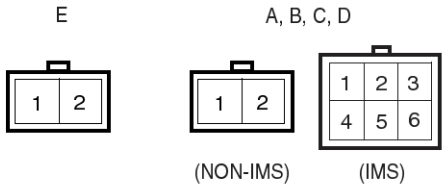


SHMBE8292D



SHMBE9156N

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.



SCMBE6397L

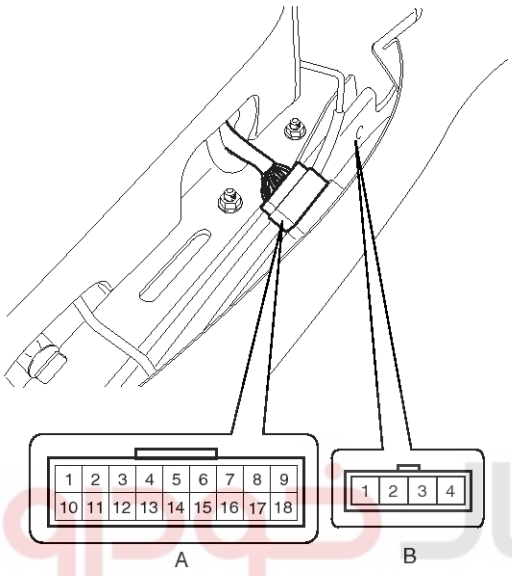
Position \ Terminal		1(2)	2(5)
Slide motor A	Frontward	⊕	⊖
	Backward	⊖	⊕
Front height motor B	UP	⊖	⊕
	DOWN	⊕	⊖
Rear height motor C	UP	⊕	⊖
	DOWN	⊖	⊕
Reclining motor D	Forward	⊖	⊕
	Rearward	⊕	⊖

SHMBE9157N

Power Seat Control Switch

Inspection

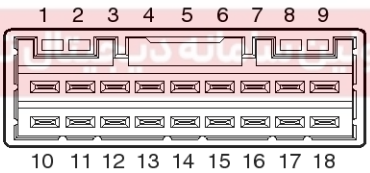
1. With the power seat switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the power seat switch.



SHMBE8294D

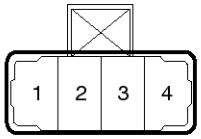
Power seat switch connector A

	Front height switch			Slide switch			Rear height switch			Reclining switch			PIN NAME
	Up	N	Down	Front	N	Rear	Up	N	Down	Front	N	Rear	
1	○		○	○		○	○		○	○		○	B+
5				○	○	○							Rear slide motor
6				○		○							Front slide motor
4					○	○							Rear slide limit
7				○	○								Front slide limit
2										○	○	○	Front recline motor
10										○	○	○	Rear recline motor
3										○	○		Front recline limit
11											○	○	Rear recline limit
8	○	○	○										Front height motor (UP)
17	○	○	○										Rear height motor (DOWN)
9	○	○											Front height limit(UP)
18		○	○										Front height limit(DOWN)
14							○	○	○				Rear height motor(UP)
15							○	○	○				Rear height motor(DOWN)
13							○	○					Rear height limit(UP)
16								○	○				Rear height limit(DOWN)



Driver lumber support connector B

	Driver lumber support control switch		
	Front	N	Rear
1	○		○
2		○ ○	
3		○	○
4	○	○	



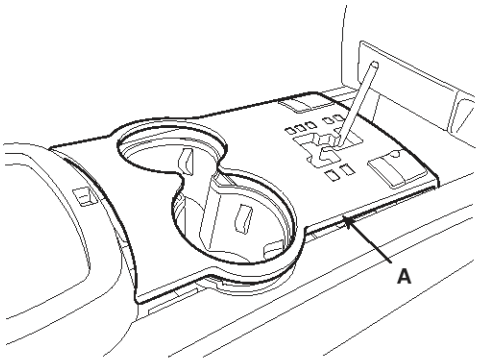
SHMBE0005N

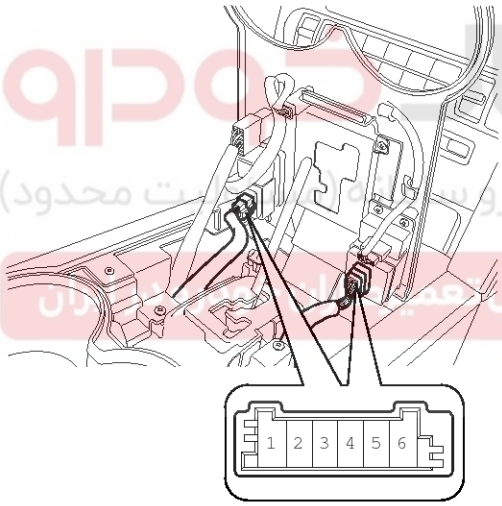
Seat Heater Switch

Inspection

Front Seat Heater Switch

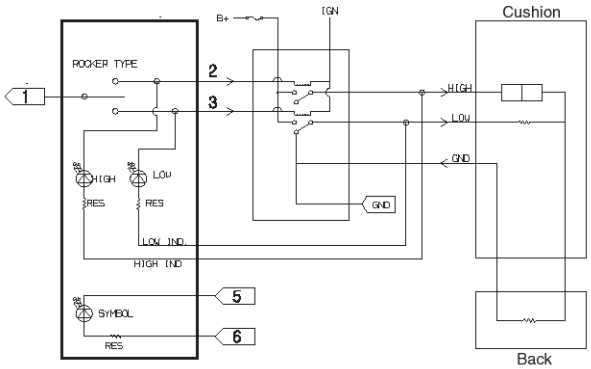
1. Disconnect the negative (-) battery terminal.
2. Remove the seat heater switch from the floor console (A) with scraper.





SHMBE8300D

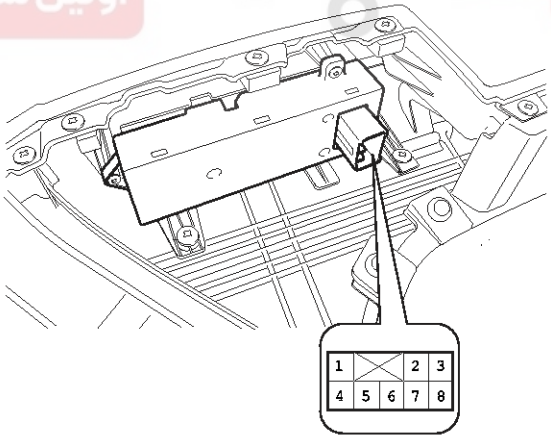
3. Check that continuity exists between the terminals.
   Terminal No : 1. Ground, 2. High signal switch
   3. Low signal switch, 5. Illumination (-),
   6. Illumination (+)



SHMBE9203N

2nd Seat Heater Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim. (Refer to Body group - "Rear door")
3. Turn 2nd seat heater switch ON and check that continuity exists between the terminals.



SHMBE8302D

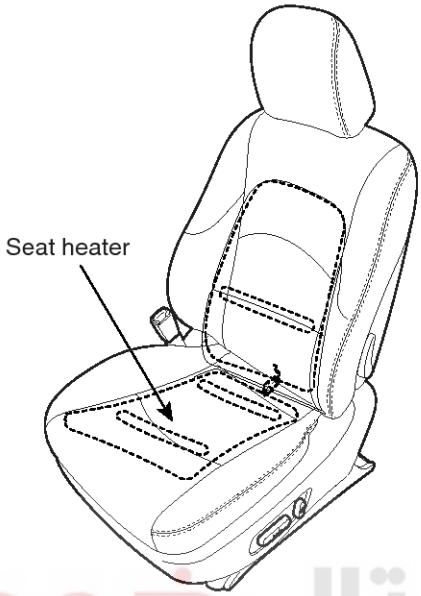
Position \ Terminal	3	GND	4	5
ON	○	○	○	○
OFF				

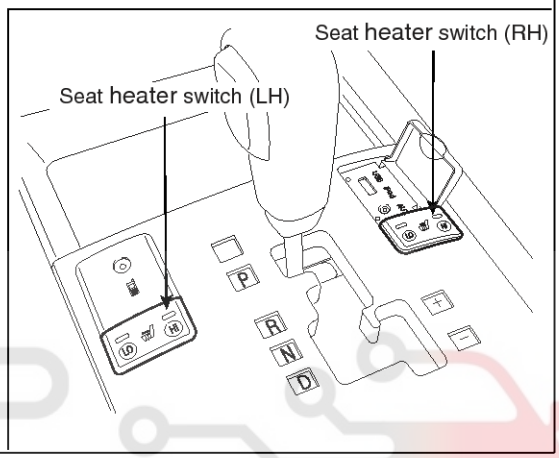
SHMBE9204N

Seat Heater

Component Location

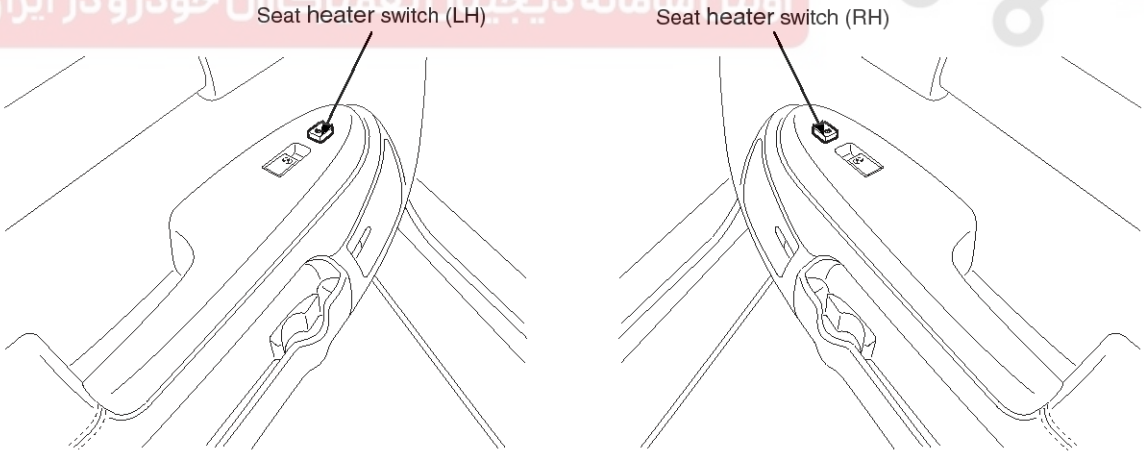
[Driver/Assist Seat]





SHMBE9200N

[2nd seat]

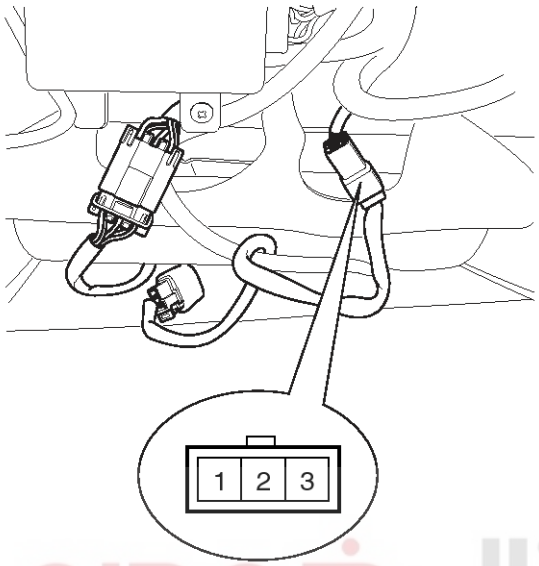


SHMBE9201N

Inspection

First Seat Heater

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



SHMBE8304D

Standard value

Cushion : 4.5Ω ± 10%, Back : 3.96Ω ± 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 : 107.6 ± 35.6°F (42 ± 2°C) (Cushion),
125.6 ± 35.6°F (52 ± 2°C) (Back)

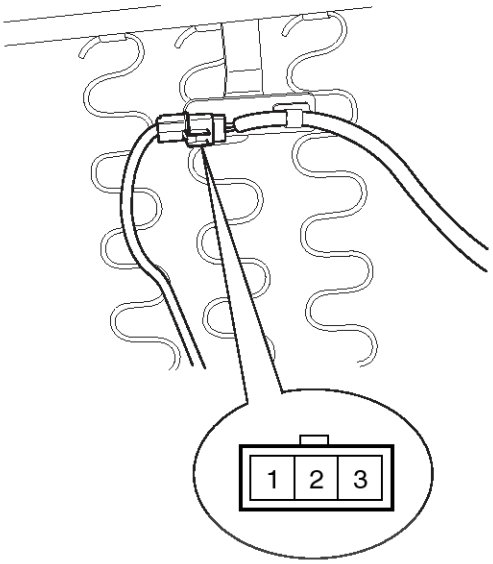
3. Check for continuity between the terminals after disconnecting the connector.

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

SCMBE6384L

2nd Seat Heater

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



SHMBE8305D

Standard value

Cushion : 4.36Ω ± 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

Cushion : 104 ± 35.6°F (40 ± 2°C)

Air Ventilation Seat

Description

Using the blows power of FAN on seat, remove the moisture, sweat and warmth from occupants and surface of seats.

It inhales the indoor air through the blower installed at the seat cushion lower part, and supplies the air into the seat cushion and the seat back through the duct.

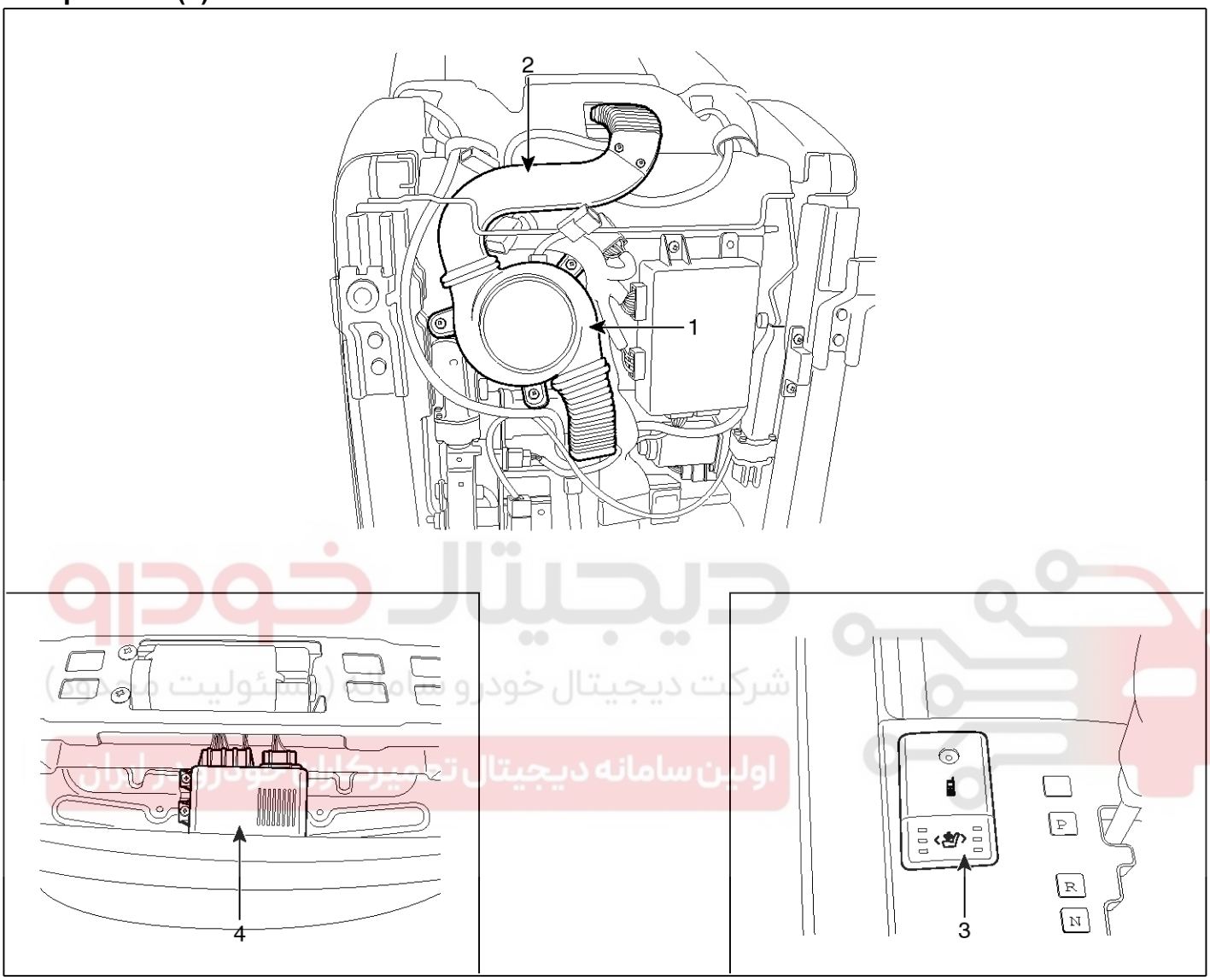
It sends a slight air throughout the seat surface through the air channel set up at seat cushion and seat back.

NOTICE

1. *Make sure not to spoil drink or water on the seat when equipping with ventilation system seat*
2. *Because of inhaling the slight air, it is difficult to feel the air strength by the sense of touch.*

Ventilation Seat ECU

Components (1)

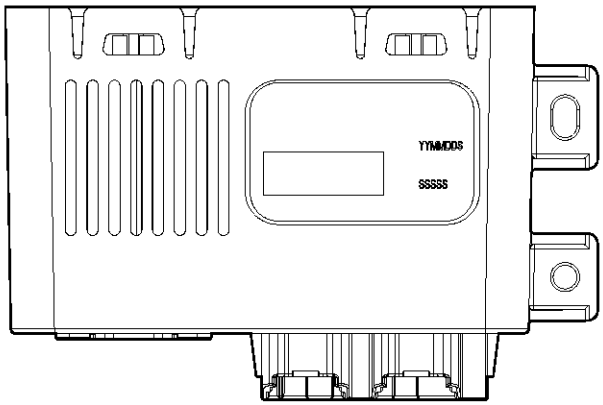


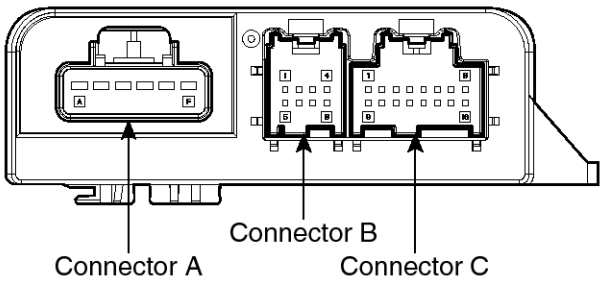
SHMBE9008D

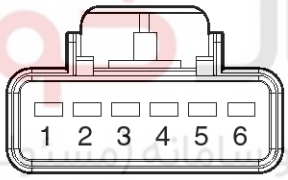
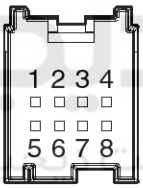
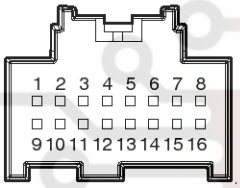
1. Ventilation blower
2. Ventilation duct
3. Ventilation seat switch
4. Ventilation seat ECU

Components (2)

[Ventilation Seat ECU]



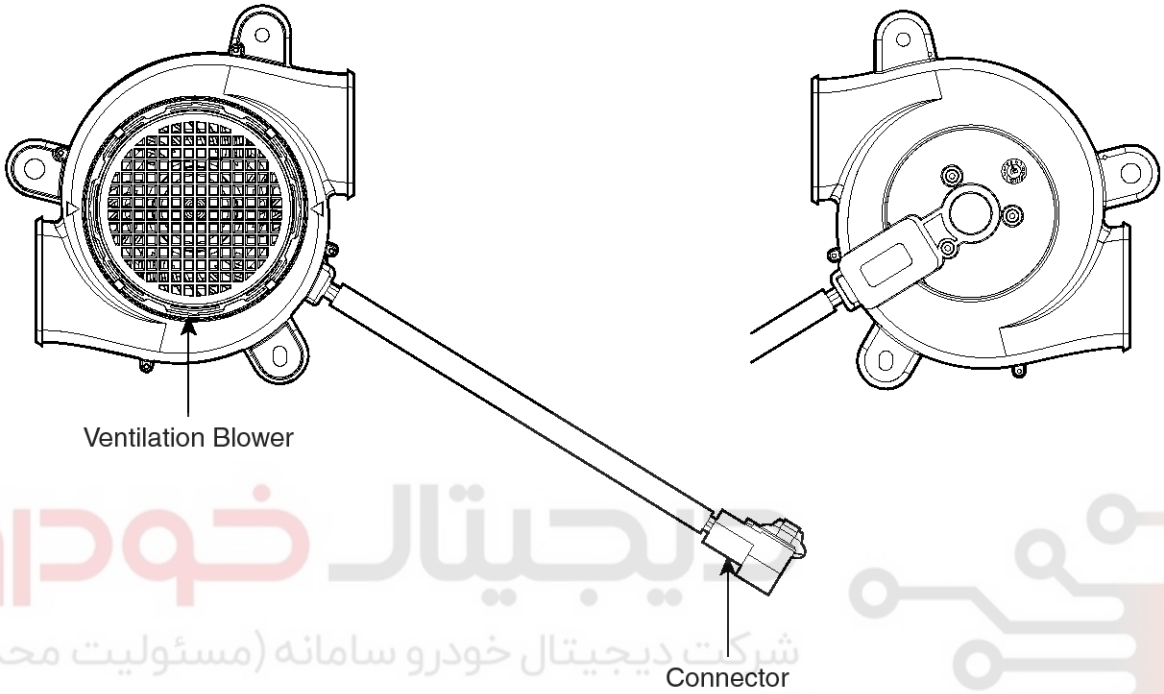


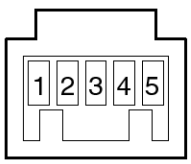
Connector			
Pin	Connector A	Connector B	Connector C
1	Heat mat	Heat switch input	Heat mid indicator
2	-	Cool switch input	Cool high indicator
3	Cushion heat mat	-	Cool low indicator
4	Back heat mat	-	Blower motor speed control
5	Battery	IGN	-
6	Ground	ALT L	Blower (-)
7		ISO 9141 Communication	Blower (+)
8		-	Mode
9			Heat high indicator
10			Heat low indicator
11			Cool mid indicator
12			-
13			Cushion sensor return
14			Cushion sensor
15			-
16			-

SHMBE0001L

Components (3)

[Ventilation Blower]



Connector	Pin	Description
	1	-
	2	12V
	3	RPM Control
	4	Ground
	5	-

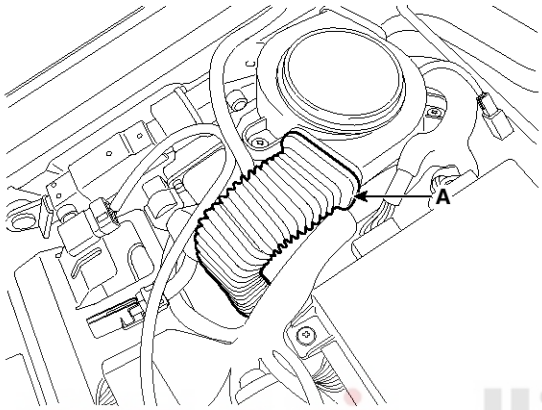
SHMBE0002L

Removal

Ventilation blower

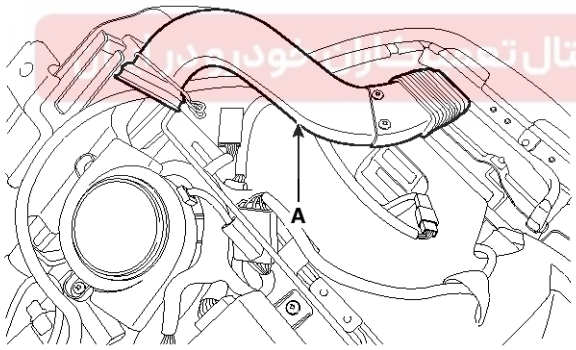
1. Remove the front seat assembly.
   (Refer to BD group - "Front Seat")
2. Remove the seat back cover.
3. Remove the ventilation seat duct (A) after removing fixing clips.

[Cushion]



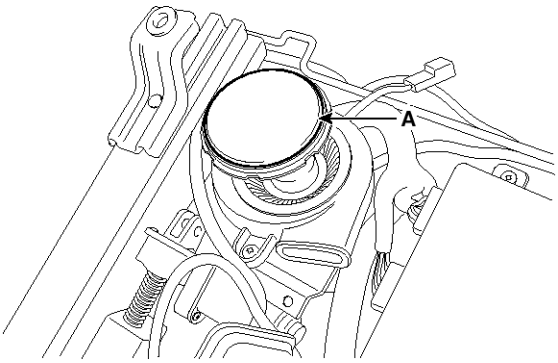
SHMBE9013D

[Back]



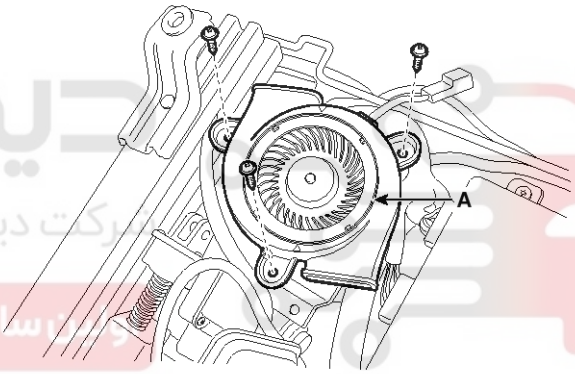
SHMBE9014D

4. Remove the ventilation blower filter.



SHMBE9012D

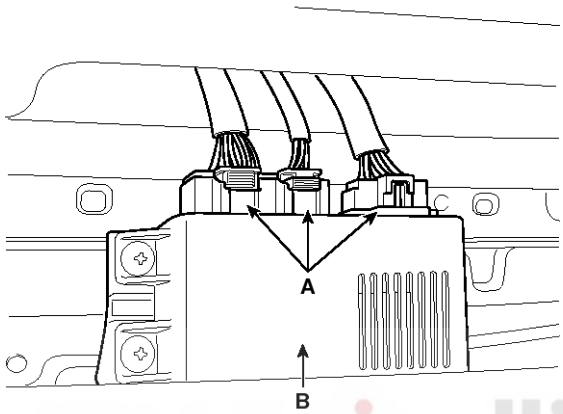
5. Remove the ventilation blower (A) after loosening the screws.



SHMBE9011D

Ventilation seat ECU

1. To remove the air ventilation seat ECU easily, please lift up the seat height to maximum position before remove the seat assembly.
2. Remove the front seat assembly.
   (Refer to BD group - "Front Seat")
3. Remove the ventilation seat ECU (B) after loosening the screws and connectors (A).



SHMBE9016D

Installation

Ventilation Blower

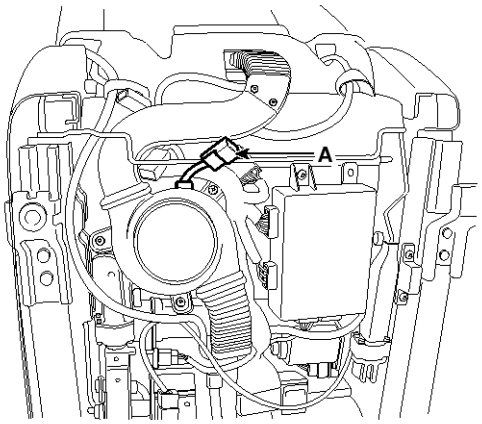
1. Install the connectors and climate blower.
2. Install the blower duct (back,cushion).
3. Install the seat back cover.
4. Install the seat assembly.

Ventilation Seat ECU

1. Install the ventilation seat ECU.
2. Install the front seat assembly.

Inspection

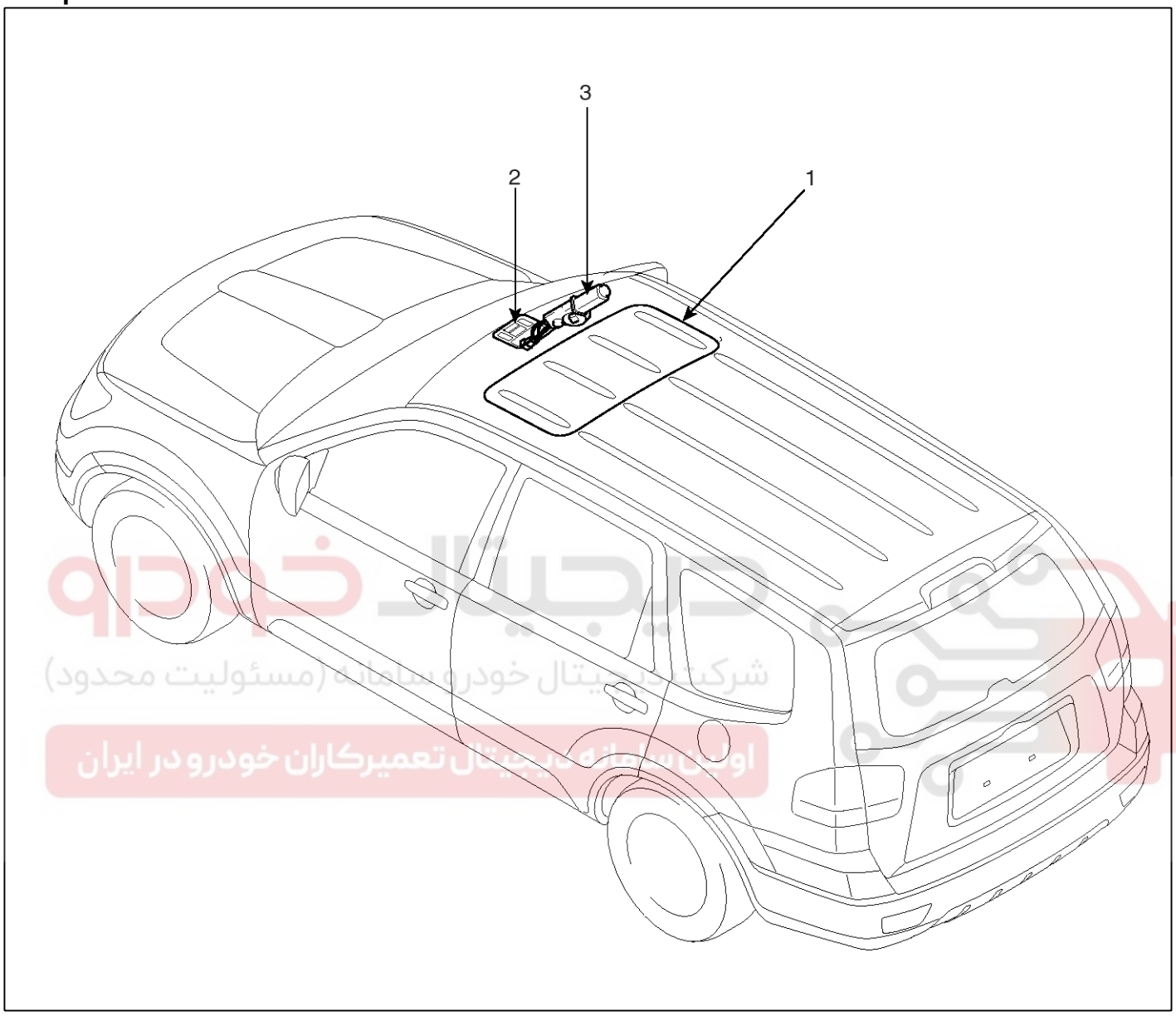
1. If the fan is abnormal after checking the connector (A), replace the ventilation blower.



SHMBE9015D

Sun Roof

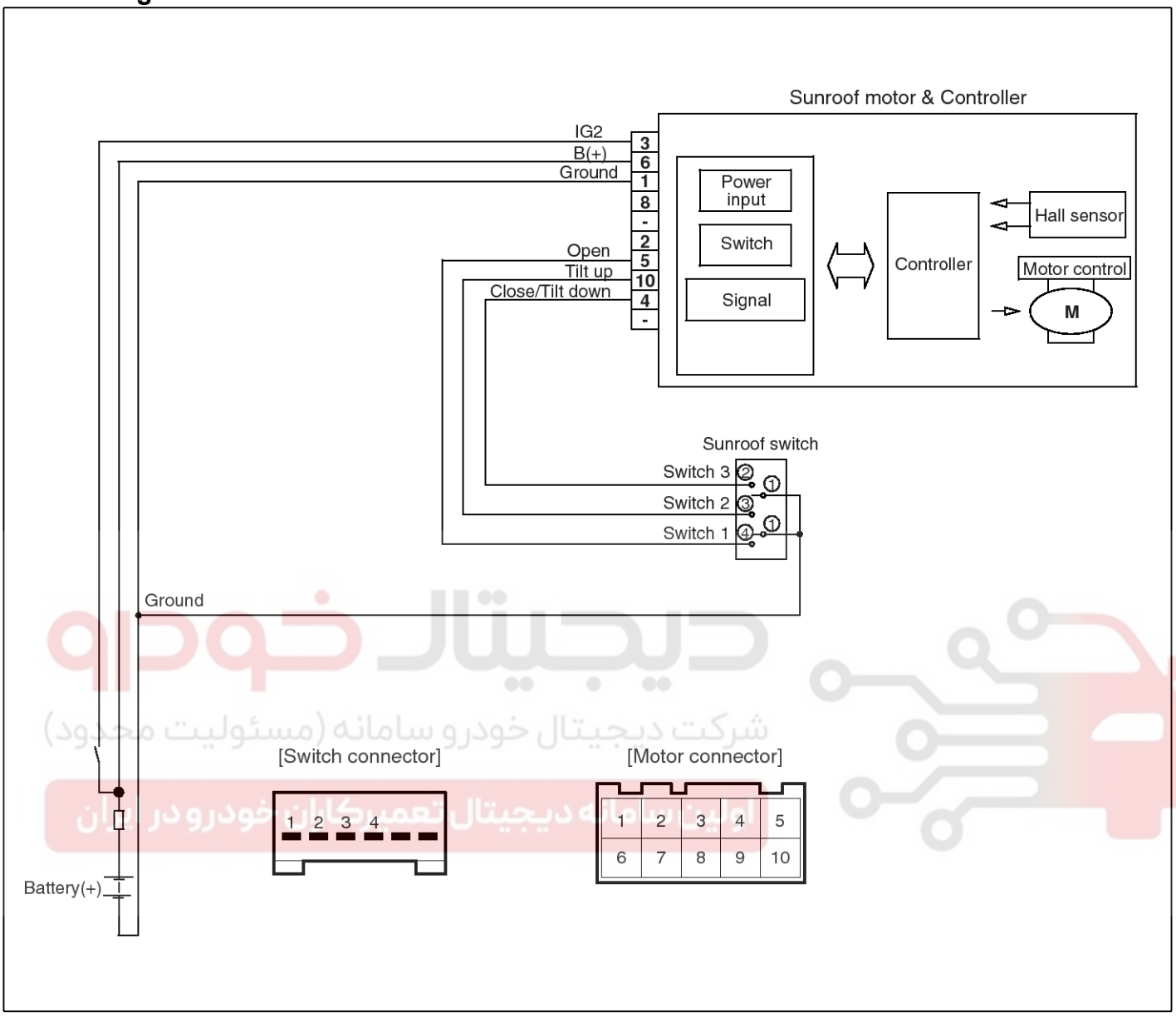
Component Location



SHMBE8321D

1. Sunroof
2. Sunroof switch
3. Sunroof motor & controller

Circuit Diagram

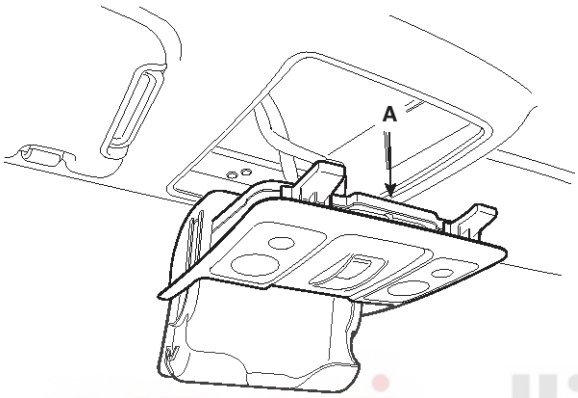


SHMBE9205N

Sunroof Switch

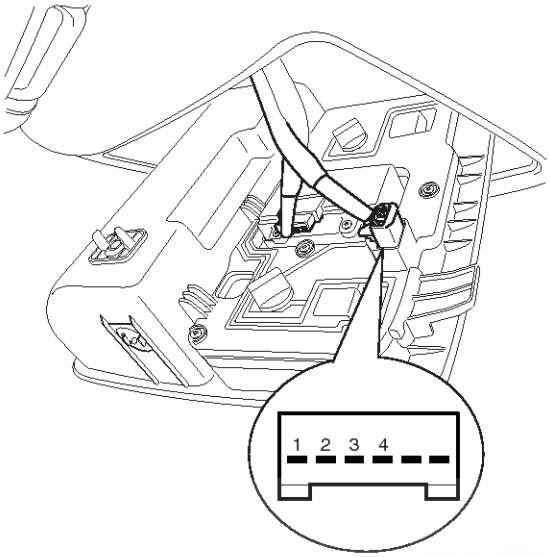
Inspection

1. Disconnect the negative (-) battery terminal.
2. Open the sunglass case cover from the overhead console then remove the 2 screws holding the overhead console. Disconnect the switch connector (6P) and Map lamp connector (2P), and then remove the overhead console lamp (A).



SHMBE8323D

3. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch.



[Switch side connector]

SHMBE9207N

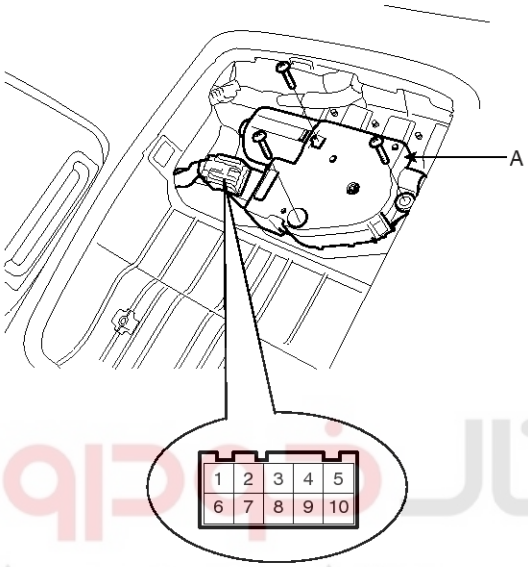
Position \ Terminal	1	4	3	2
Manual OPEN	○			○
Auto OPEN	○		○	○
Manual CLOSE, Manual tilt DOWN	○		○	
Auto CLOSE	○	○	○	
Manual tilt UP	○	○		
Auto tilt UP	○	○		○

SHMBE9206N

Sunroof Motor

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console then remove the sun roof motor mounting screws (3EA). And then remove the sunroof motor (A) after disconnecting the connector (10 Pin).



SENBE7425D

3. Ground the terminals as below table, and check that the sunroof unit operates as below table.

Position \ Terminal	3	4	5	10
Manual OPEN	⊕		⊖	
Auto OPEN	⊕		⊖	⊖
Manual CLOSE, Manual tilt DOWN	⊕			⊖
Auto CLOSE	⊕	⊖		⊖
Manual tilt UP	⊕	⊖		
Auto tilt UP	⊕	⊖	⊖	

SHMBE9208N

4. Make these input tests at the connector

   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.

Resetting The Sunroof

Whenever the vehicle battery is disconnected or discharged, or you use the emergency handle to operate the sunroof, you have to reset your sunroof system as follows :

1. Turn the ignition key to the ON position.
2. According to the position of the sunroof, do as follows.
   1) In case that the sunroof has closed completely or been tilted :

      Press the TILT button until the sunroof has tilted upward completely.
   2) In case that the sunroof has slide-opened :

      Press and hold the CLOSE button for more than 5 seconds until the sunroof has closed completely.

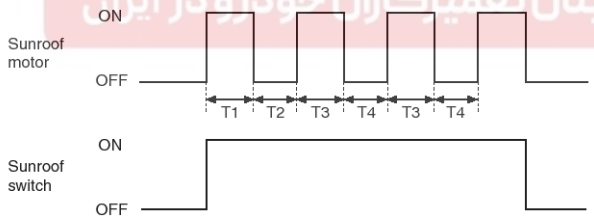
      Press the TILT button until the sunroof has tilted upward completely.
3. Release the TILT button.
4. Press and hold the TILT button once again until the sunroof has returned to the original position of TILT after it is raised a little higher than the maximum TILT position.

   When this is complete, the sunroof system is reset.

Protecting The Overheated Motor

In order to protect the overheated sunroof motor by continuous motor operation, the sunroof ECU controls the Run-time and Cool-time of motor as followings;

1. The Sunroof 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.
   - In case that motor is not operated continuously, the Run-time which is limited for protecting the overheated motor is increased.
   - The Run-Time of motor is initialized to "0" if the battery or fuse is reconnected after being disconnected, discharged or blown.



SHDBE6476L

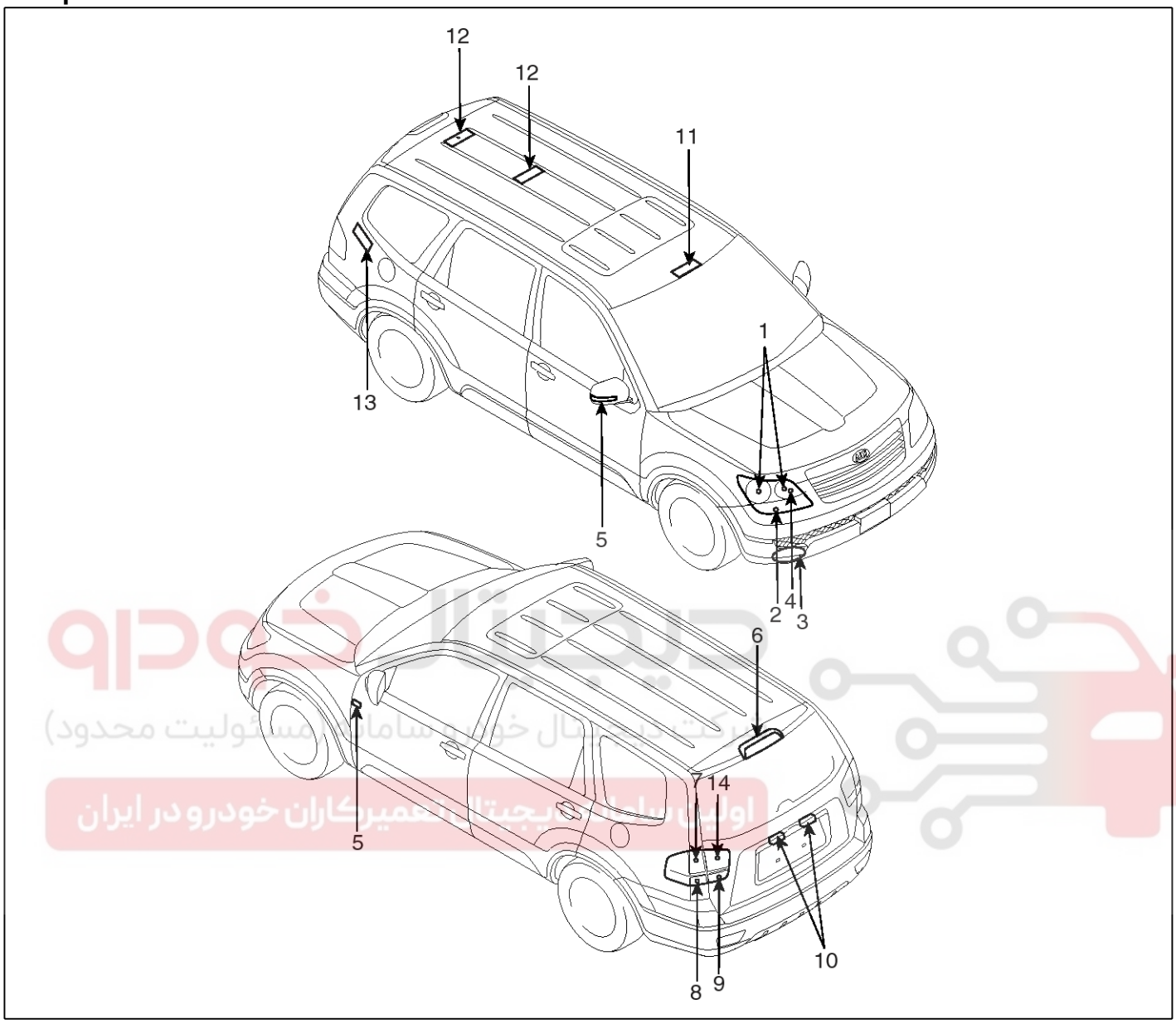
T1 : 120 ± 10 sec., T2 : 18 ± 2 sec.,
T3 : 10 ± 2 sec., T4 : 18 ± 2 sec.

Lighting System

Specification

Items			Bulb Wattage (W)
Front	Head lamp (High)		55
	Head lamp (Low)	Standard	55
		HID	35
	Front turn signal lamp		28
	Front position lamp		8
	Front fog lamp		27
	Side marker		5
Rear	Rear stop/tail lamp (Outside)		27/8 or LED
	Back up lamp		16
	Rear turn signal lamp		27
	License plate lamp		5
	Side repeater lamp		LED
	High mounted stop lamp		LED
Room	Room lamp (Center/Head lining)		10 x 2
	Overhead console lamp		6 x 2
	Trunk room lamp (Cargo lamp)		5

Component Location

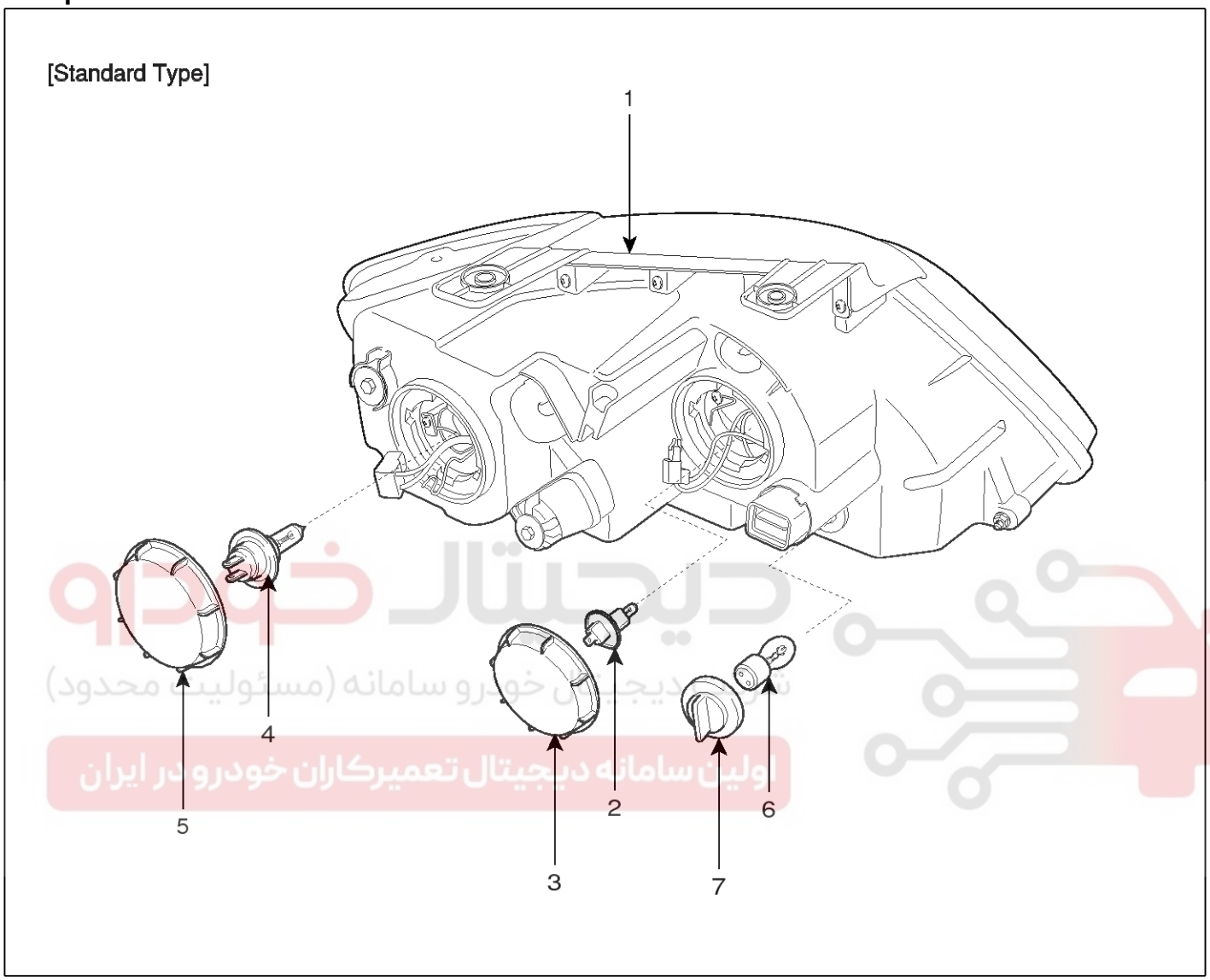


SHMBE9188N

1. Head lamp (High/Low)
2. Front turn signal lamp
3. Front fog lamp
4. Position lamp
5. Side marker
6. High mounting stop lamp
7. Tail/stop lamp
8. Rear turn signal lamp
9. Back up lamp
10. License plate lamp
11. Overhead console lamp
12. Room lamp
13. Trunk room lamp
14. Tail lamp

Head Lamps

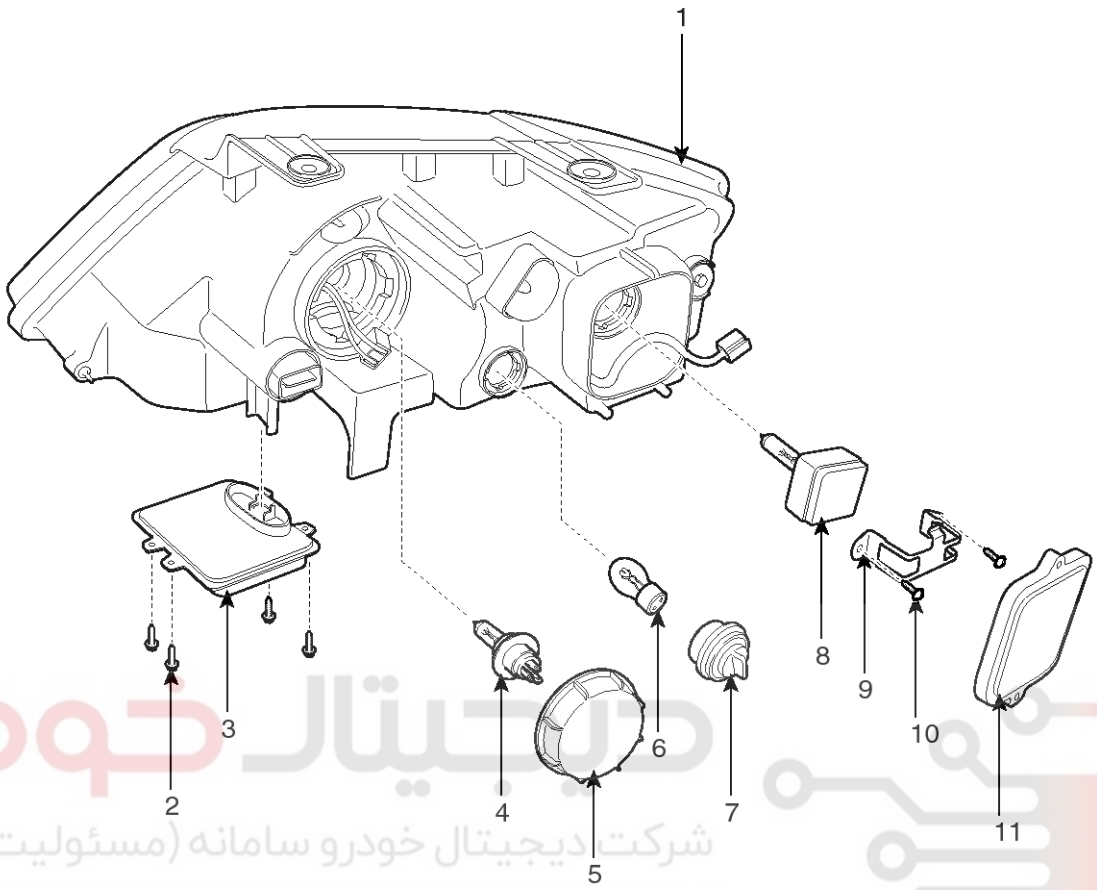
Component



SHMBE9122L

1. Head lamp assembly lens and housing
2. Head lamp low beam bulb
3. Cap
4. Head lamp high beam bulb
5. Cap
6. Turn signal lamp/Tail lamp bulb
7. Cap

[HID Type]



SHMBE9123L

1. Head lamp assembly lens & housing
2. Screws
3. Ballast
4. Head lamp high beam bulb
5. Cap
6. Turn signal lamp/Tail lamp bulb
7. Cap
8. Head lamp low beam bulb (HID) & ignitor
9. Bracket
10. Screws
11. Dust cover

HID Head Lamp

1. Bulb
   1) Elements

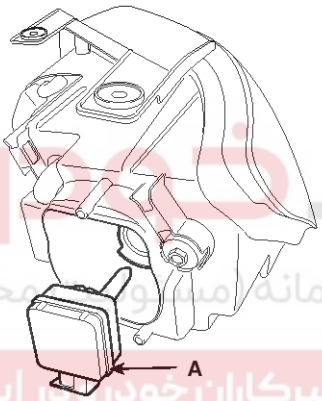
      Xenon gas: Xenon gas activates the initial reaction for rapid illuminating.

      Molybdenum electrode: anode arcing

      Metal halide salts: color composing component
   2) Lightening principle

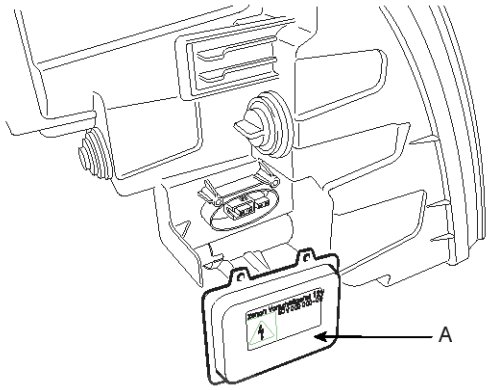
      When Xenon gas and metal halide salt will discharge the molybdenum anode in a capsule, it emits light.
2. Ignitor

   Ignitor (A) is an electromagnetic transformer that receives current from ballast and boost voltage to light on the arc light source in any environment.



SHMBE8326D

3. Ballast
   1) Ballast (A) delivers an instant high voltage pulse to the ignitor electrode, to initialize discharge in the source.
   2) Ballast supplies the stable power to the bulb and the ignitor during initialization and normal state of arc.

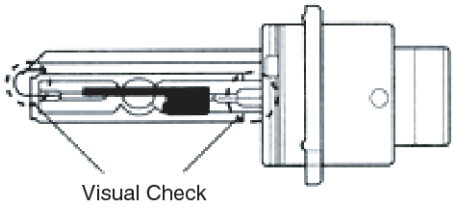


SHMBE8327D

4. Stability
   1) Durable for vibration as there is no filament.
   2) Does not operate if polarity are changed.
   3) Doesn't operate if the input voltage is not in the range of 10-16V.
   4) Doesn't operate if the circuit is short.
   5) Doesn't operate if the bulb burnt out.

Inspection

1. Check-points upon head lamp failure (HID)
   1) Check the battery voltage. (Low beam will be on when the battery voltage above 9V.)
   2) Check the fuse and relay.
   3) Check the polarity of ballast. (If the polarity are changed, low beam doesn't lighten)
   4) Check the bulb connector securely.
   5) Visually bulb checking (no filament): damaged glass, damaged for upper parts and lower parts of glass tube.
   6) After (1)~(5), replace the ballast and the ignitor. (ballast assembly).



SHMBE9124L

2. Service procedure and warning (HID)

No.	Item	Service procedures	Warning	Remarks
1	Replacement of lamp assembly	1. Disconnect the power connector from the lamp. 2. Remove and replace the lamp assembly. 3. Connect the power connector.	• Disconnect the head lamp power connector to avoid high voltage.	• Other description is the same as the halogen bulbs.
2	Replacement of the Bulb	1. Disconnect the power connector from the lamp. (head lamp, turn signal, head lamp leveling device) 2. Remove the lamp assembly. 3. Remove the ballast and dust cover. 4. Remove the bulb socket and replace the bulb. 5. Installation is the reverse of removal.	• Disconnect the head lamp power connector to avoid high voltage. • Be careful not to damage the bulb and use genuine bulbs only. • Do not apply excessive force and fit it correctly.	
3	Replacement of the Ballast (with built-in ignitor)	1. Disconnect the power connector from the lamp. 2. Remove the lamp and then the ballast and the dust cover. 3. Remove the head lamp leveling device and then the bulb socket. 4. Connect the bulb socket on the replacement ballast and install the leveling device. 5. Installation is the reverse of removal.	• Disconnect the head lamp power connector to avoid high voltage.	• Replace the ballast only and install the used lamp. • Replace the sub assembly except the ballast.

4	Others	1. Power supply should be according to the rated capacity. 2. Use the rated fuse and wire. 3. Bulb socket shall be free from moisture or dirt. 4. Do not apply the ballast severe shock, water, or extreme	• All parts should be serviced only at specified service centers.	• HID lamp should not be installed on other cars (Dangerous, fire may occur.)

⚠CAUTION

HID lamp shall not be used on other cars.(Fire may occur.)

Fire may occur when HID lamp initially lights due to the fact that arc-discharge generates high voltage (max. 30,000V) and high current (12-13A), and are different from the halogen lamp specification.

Characteristic

1. Durable for vibration as there is no filament.
2. HID lamp had a more long life than halogen lamp.
3. Does not operate if polarity is changed.
4. Operating input voltage : 9-16V

Removal

⚠CAUTION

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

NOTICE

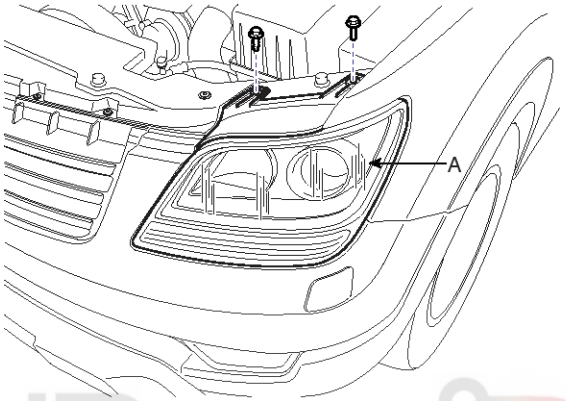
The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.

Removing bulb for an extended period of time may affect headlamp bulb performance.

Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.

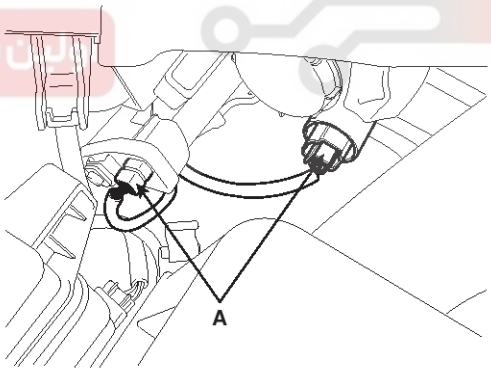
Never turn on the head lamps with the bulb removed from the headlamp assembly.

1. Disconnect the negative (-) battery terminal.
2. Loosen the mounting bolts (2EA) of head lamp assembly (A).



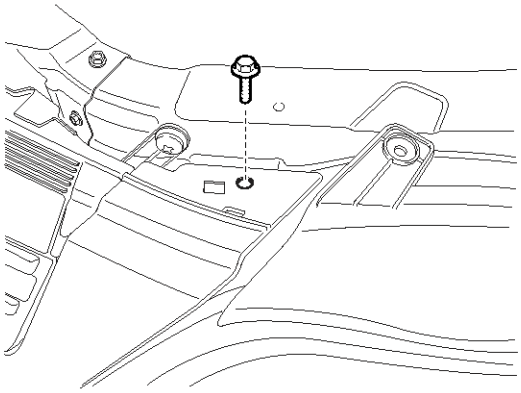
SHMBE8328D

3. Disconnect the head lamp connectors(A).



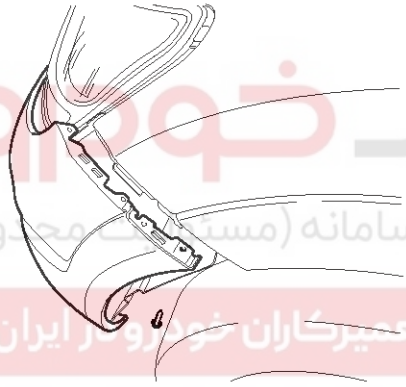
SHMBE9190N

4. Loosen the front bumper upper support bracket bolt.



SHMBE8339D

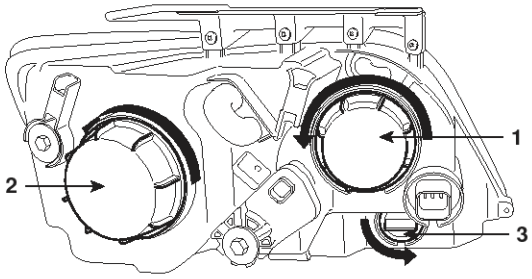
5. Loosen the bumper mounting screw from the side spacer.



SHMBE9191N

6. Remove the head lamp bulb after removing the head lamp assembly.

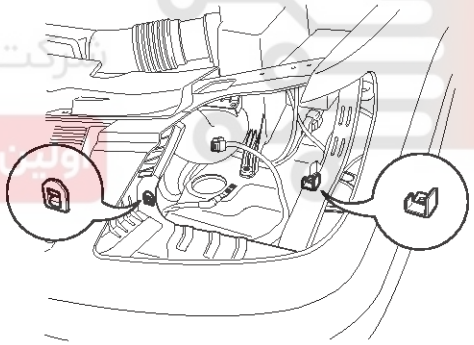
   (1. Head lamp low beam, 2. Head lamp high beam, 3. Turn signal lamp)



SHMBE9192N

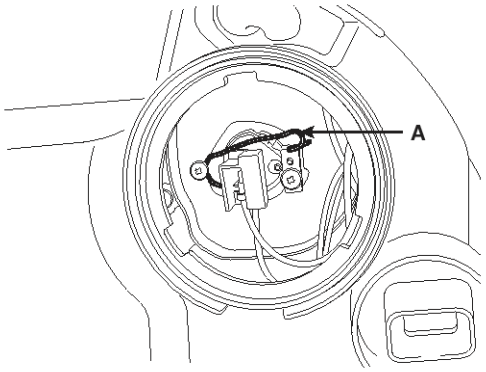
NOTICE

Take care that retaining clip (A) is not to be damaged.



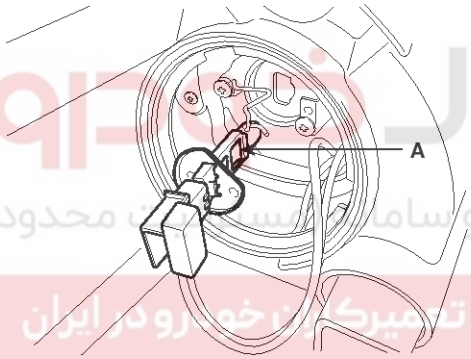
SHMBE9193N

7. Release the lock of the set spring (A) to remove the head lamp high beam bulb.



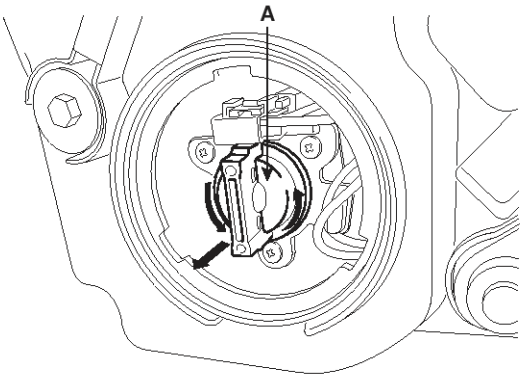
SHMBE9194N

8. Remove the head lamp high beam bulb(A).



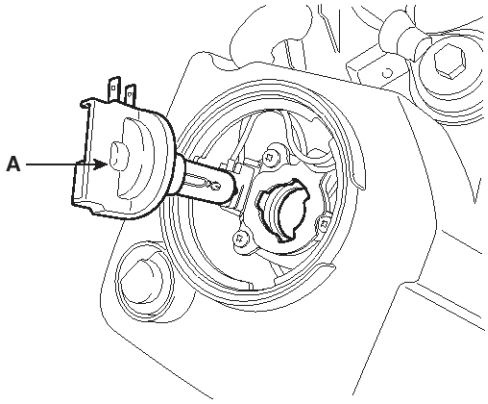
SHMBE9195N

9. Remove the head lamp low beam cap(A) by turning in the counter clock-wise direction.



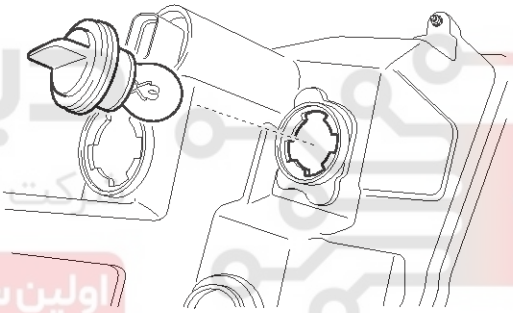
SHMBE9196N

10. Remove the head lamp low beam bulb(A).



SHMBE9197N

11. Remove the turn signal lamp bulb(A) by turning in the counter clock-wise direction.



SHMBE9198N

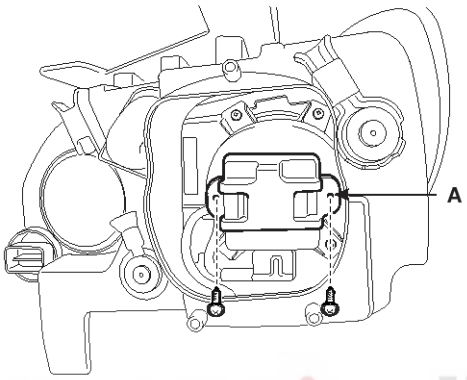
Installation

1. Install the head lamp bulbs.
2. Reassemble the head lamp bulb caps.
3. Reassemble the head assembly after connecting the lamp connector.
4. Reassemble the front bumper upper support bracket bolts.

Replacement

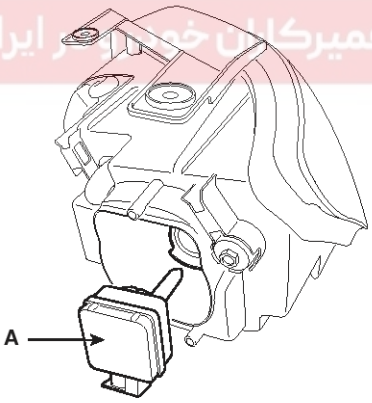
Bulb (HID)

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 after loosening the screws (3EA).
5. Remove the bracket (A) from the lamp assembly.



SHMBE8342D

6. Disconnect the ignitor connector.
7. Remove the ignitor and bulb (A).



SHMBE8343D

8. Installation is the reverse of removal.

⚠CAUTION

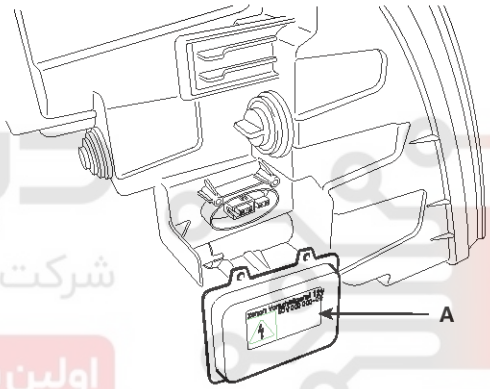
Turn the head lamp switch off to avoid high voltage

Be careful not to damage the bulb and use genuine bulbs only

- **Do not apply excessive force and fit it correctly.**
- **Confirm the bulb locking**

Ballast

1. Turn the head lamp switch off.
2. Disconnect the power connector from the lamp.
3. Remove the head lamp assembly.
4. Remove the ballast (A) after loosening the screws (4EA).



SHMBE8344D

5. Installation is the reverse of removal.

NOTICE

- *Turn the head lamp switch off to avoid high voltage.*

CAUTION

- **HID lamp shall not be used on other cars.(Fire may occur.)**
- **Fire may occur when HID lamp initially lights due to the fact that arc-discharge generates high voltage (max. 20,000V) and high current (12-13A), and are different from the halogen lamp specification.**
- **Install the dust cover after confirming the locking state between bulb and bulb holder.**
- **When testing the HID head lamp, turn the power on or off with switch between power supply and lamp because of high voltage.**
- **Do not operate the head lamp switch with the bulb not installed, because it generates spark momently.**

Adjustment

Head Lamp Aiming Instructions

The head lamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacturer's instructions.

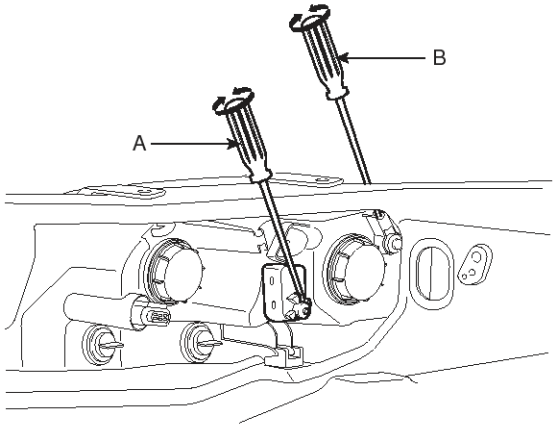
NOTICE

If there are any regulations pertinent to the aiming of head lamps in the area where the vehicle is to be used, adjust 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.
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) and horizontal (B) adjustments to the lower beam using the adjusting wheel.



SHMBE9127L

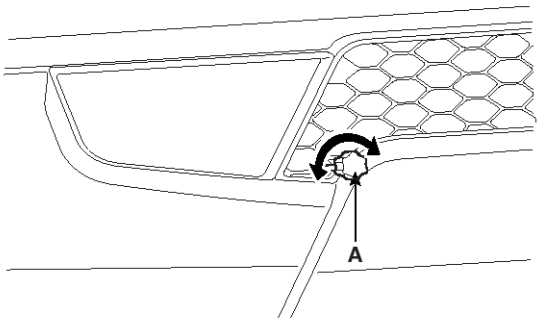
Front Fog Lamp Aiming

The front fog lamps should be aimed as the same manner of the head lamps aiming.

With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).

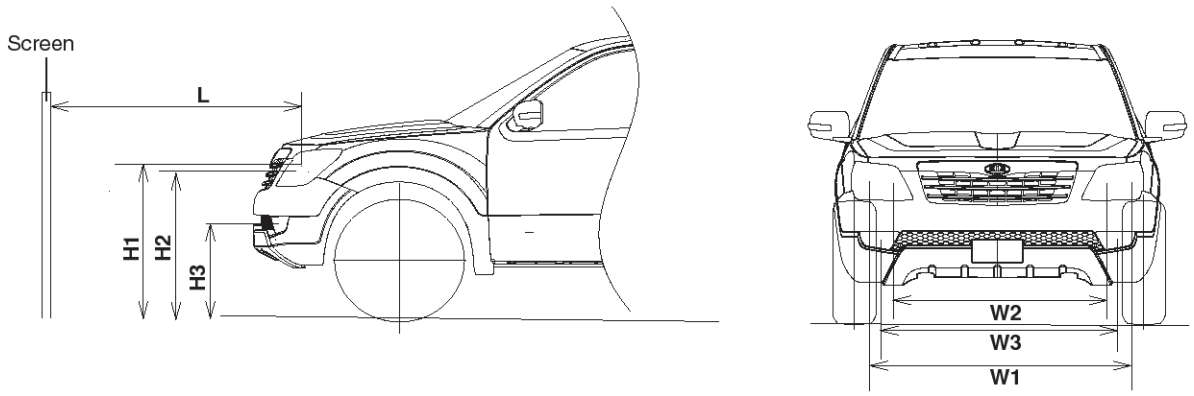
NOTICE

- *When aiming the front fog lamp, the fog lamp can be adjusted in front of vehicle without removing the front bumper.*
- *The adjusting gear is located inside the radiator grill.*



SHMBE8349D

Head Lamp And Fog Lamp Aiming Point



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

SHMBE9199N

Unit : in (mm)

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	36.7(931)	36.2(920)	22.1(562)	58.9(1,498)	49.2(1,250)	55.5(1,410)	118(3,000)
With driver	36.5(926)	35.9(914)	21.9(556)				

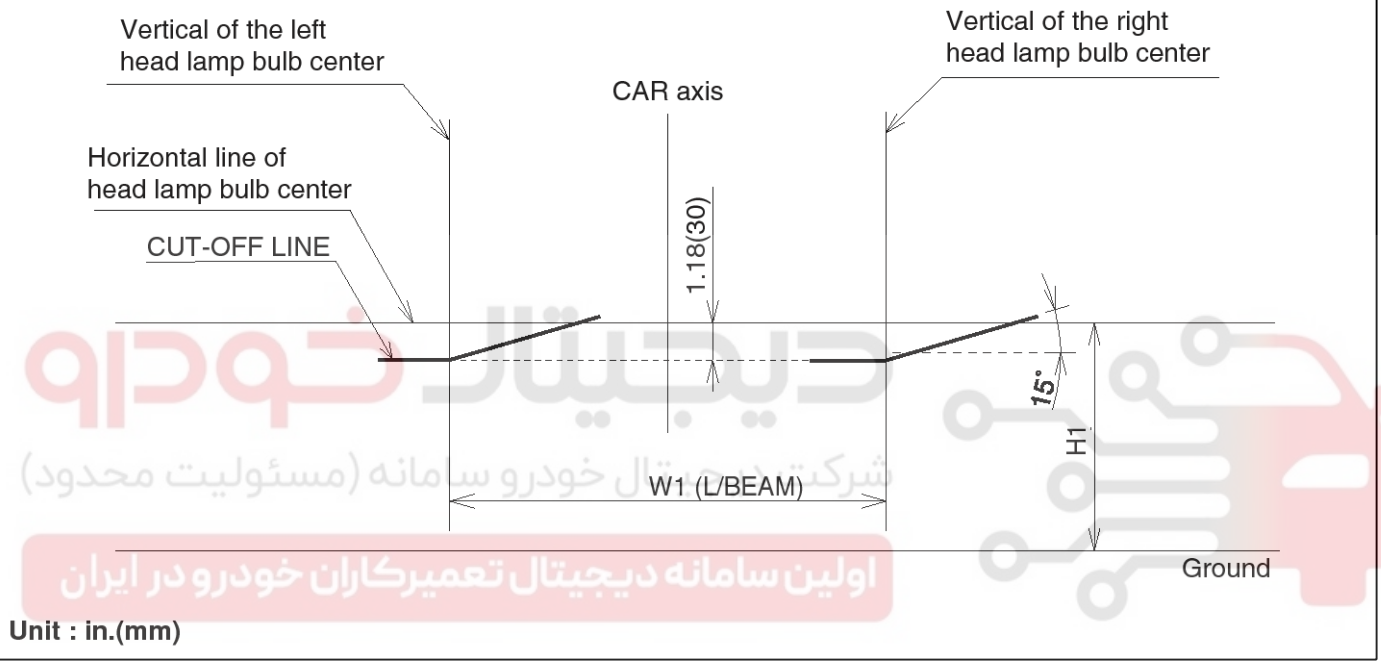
SHMBE9209N

1. Turn the low beam on with driver seated in the vehicle.

   The cut-off line should be projected in the allowable range shown in the picture.

   In case of equipping with the manual leveling device, set the leveling device switch on the "O" position.

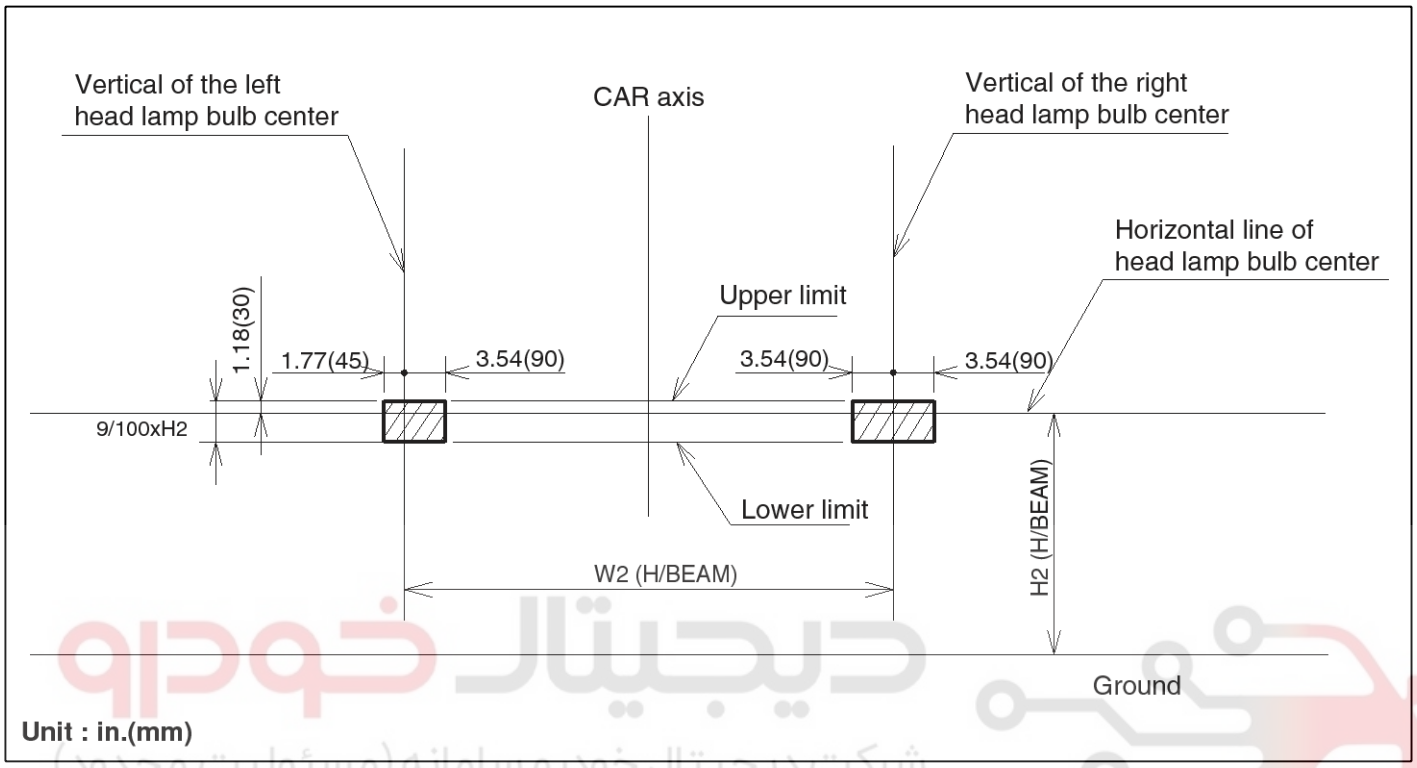
   In case of equipping with the auto leveling device, set the initialization by using the diagnostic tool before aiming.



SBHBE9471L

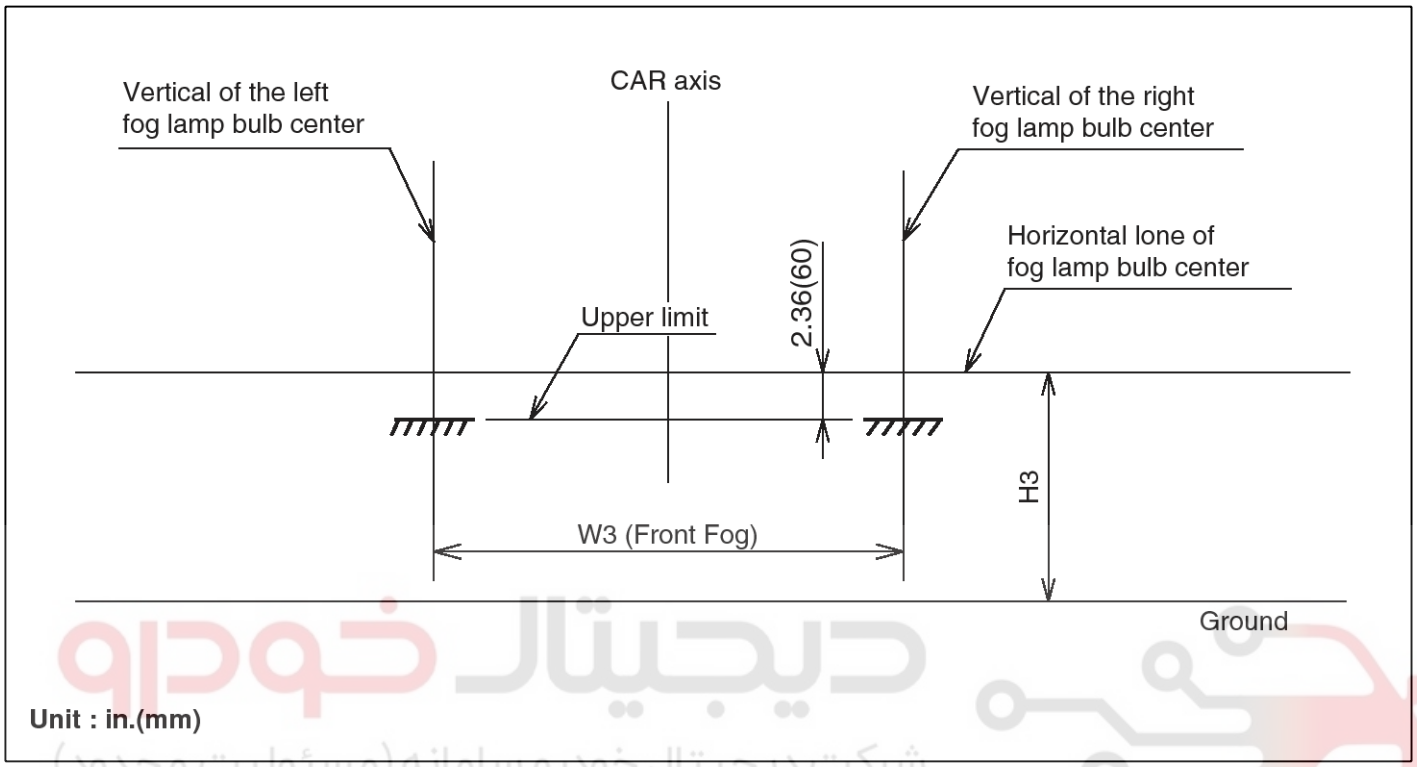
2. Turn the high beam on with driver seated in the vehicle.

   The hot zone should be projected in the allowable range shown in the picture.



3. 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.



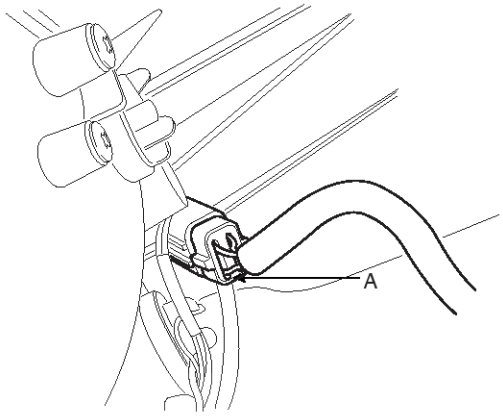
Unit : in.(mm)

SHMBE9126L

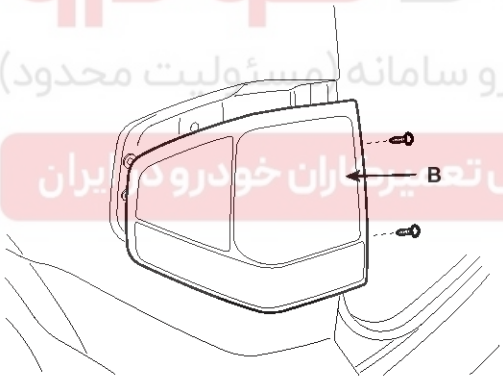
Rear Combination Lamp

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).

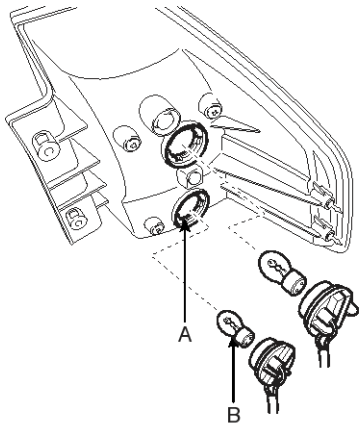


SHMBE8353D



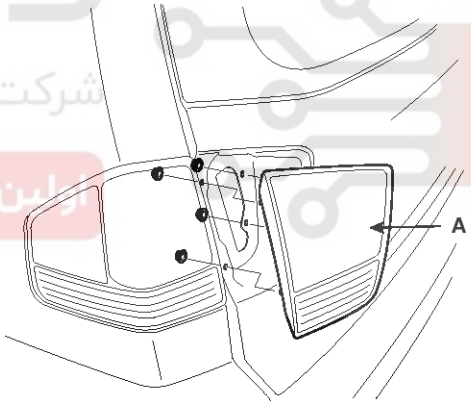
SHMBE8352D

3. Replace the bulbs (B) after removing the rear combination lamp assembly(A).



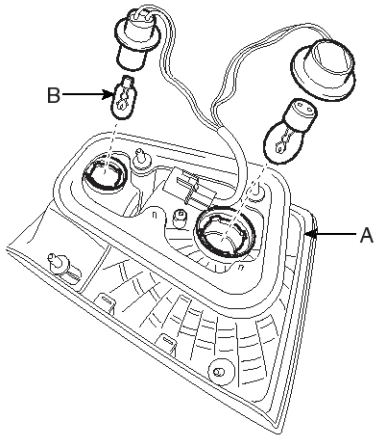
SHMBE8354D

4. Disconnect the lamp cover on tailgate. Remove the lamp assembly (A) after loosening nuts (4EA) and disconnecting the connector.



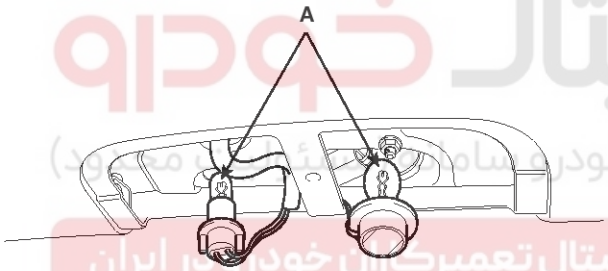
SHMBE8355D

5. Remove the tailgate combination lamp assembly (A) and then replace the bulbs(B).



SHMBE8356D

6. If the bulbs (A) should be only replaced without removing lamp assembly, replace the bulbs after removing the tailgate lamp cover inside trunk.



SHMBE8357D

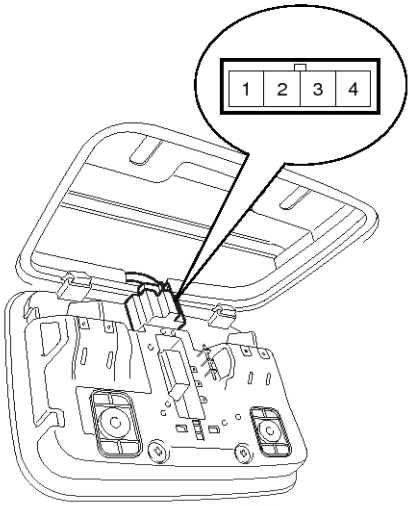
Installation

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.

Room Lamp

Inspection

1. Remove the room lamp assembly then check for continuity between terminals.



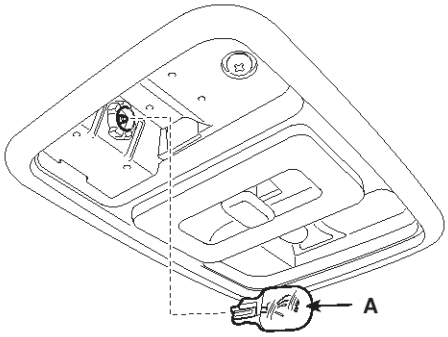
SHMBE9212N

Position \ Terminal	1	2	3	4
ON	●		●	●
DOOR	●		●	
OFF				

SHMBE9213N

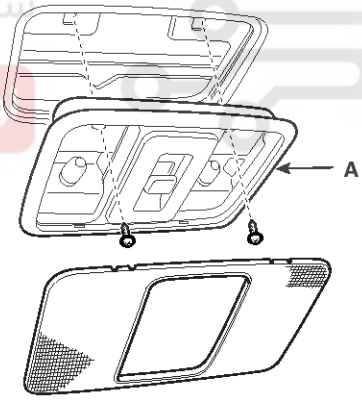
Removal

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens from the room lamp with a flat-tip screwdriver then replace the bulb (A).



SHMBE8358D

3. Loosen the fixing screw (2EA) and disconnect the 4P connector. And then remove the room lamp assembly (A).



SHMBE8359D

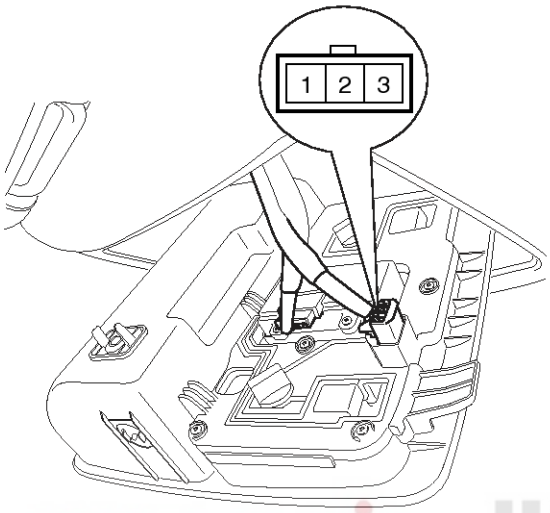
Installation

1. Install the room lamp assembly after connecting the lamp connector.
2. Install the lamp lens after assembling the bulb.

Overhead Console Lamp

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.



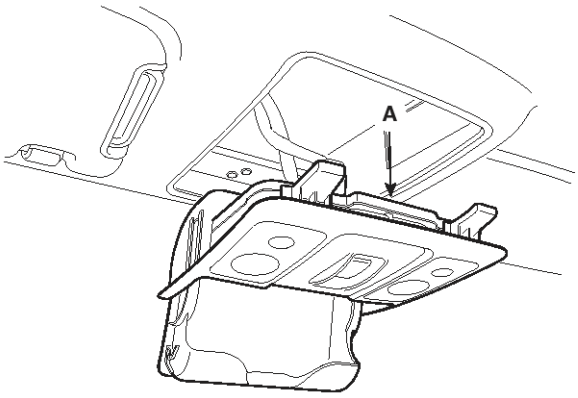
SHMBE8365D

Position \ Terminal	1	2	3
ON	○	○	○
DOOR		○	○
OFF			

SHMBE9214N

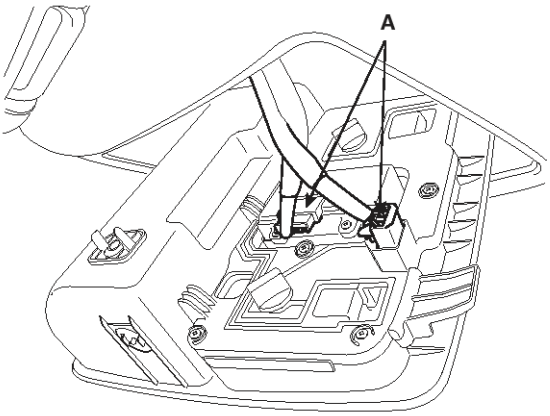
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the mounting 2 screws.
   And then remove the overhead console (A).

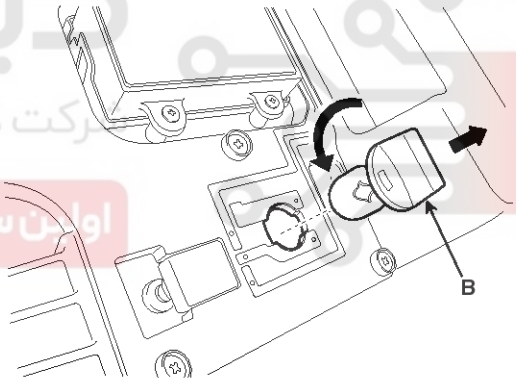


SHMBE8362D

3. Remove the overhead console lamp (B) from the head lining after disconnecting the sunroof switch connector and map lamp switch connector (A).



SHMBE8363D



SHMBE8364D

4. If the bulb only should be replaced, replace the bulb after removing the lens.

Installation

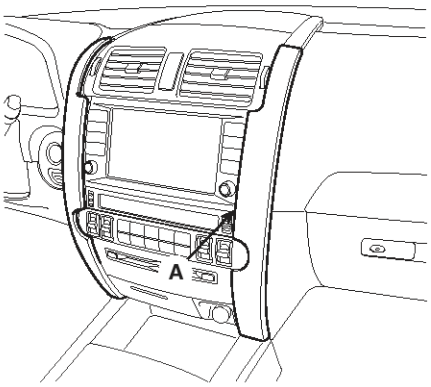
1. Install the overhead console lamp after connecting the sunroof switch connector and lamp connector.
2. Install the lens after tightening 2 screws.

Hazard Lamp Switch

Inspection

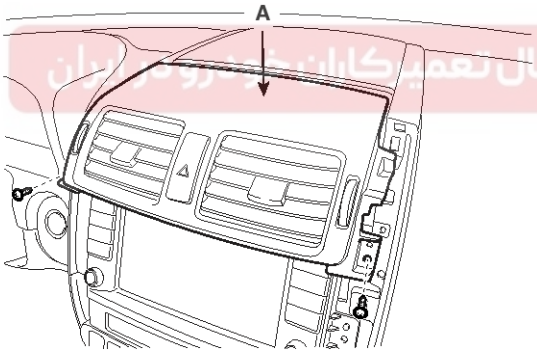
Hazard Lamp Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia side garnish (A).
   (Refer to body group - Crash pad)



SHMBE8367D

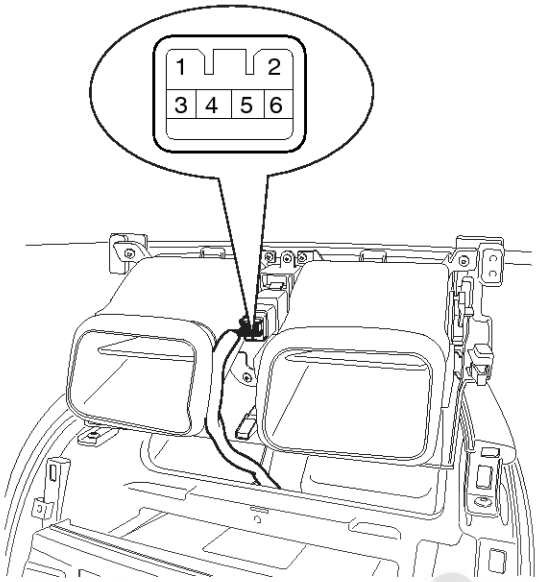
3. Remove the air vent panel (A) after loosening the screws.



SHMBE8368D

4. Disconnect the hazard lamp connector.

5. Operate the switch and check for continuity between terminals with an ohmmeter.



SHMBE8369D

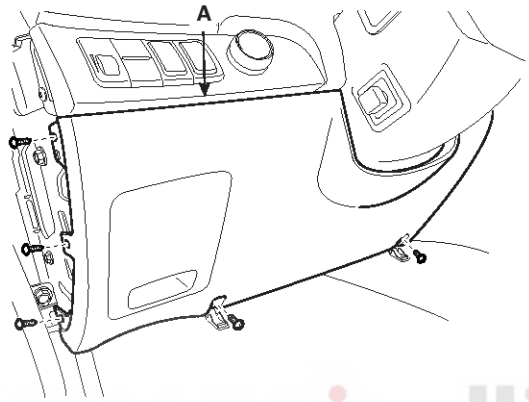
Terminal \ Position	ON (Push)	OFF	Remark
3			
4			
2			ILL(+)
5			ILL(-)

SHMBE9216N

Rheostat

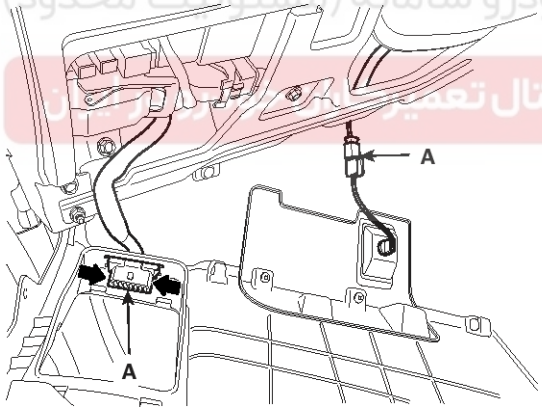
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover.
3. Remove the crash pad lower panel (A) after loosening the mounting screws.
   (Refer to Body group - "Crash pad")



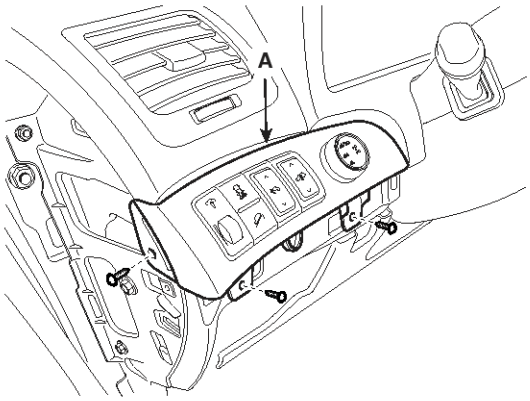
SHMBE8371D

4. Disconnect the connectors (A).



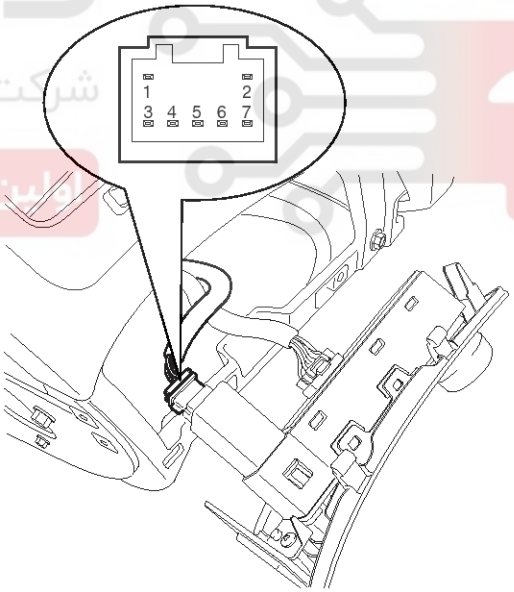
SHMBE8372D

5. Remove the lower crash pad switch assembly (A) by using a suitable trim removal tool after loosening the screws.



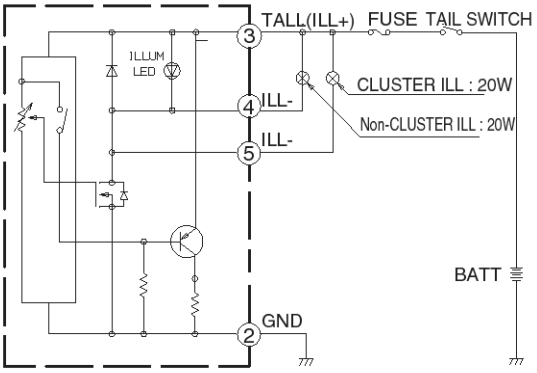
SHMBE8374D

6. Remove the rheostat from lower crash pad switch assembly.



SHMBE8373D

7. 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.



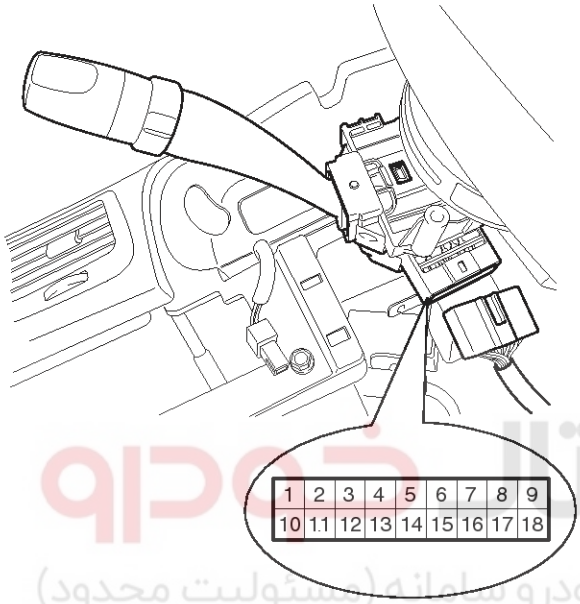
SHMBE9217N

Front Fog Lamps

Inspection

Front Fog Lamp Relay

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.



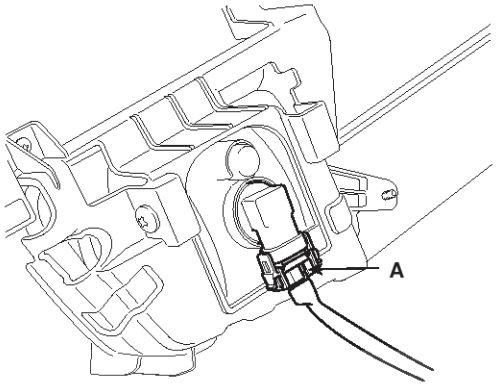
SHMBE8490D

Terminal / Position	12	13
ON		
OFF	○	○

SHMBE9218N

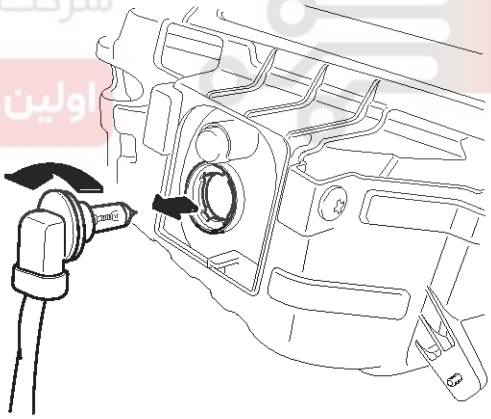
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer to Body group - "Front bumper")
3. Disconnect the fog lamp connector (A).



SHMBE8376D

4. Remove the front fog lamp by turning in the counter clock-wise direction.



SHMBE8377D

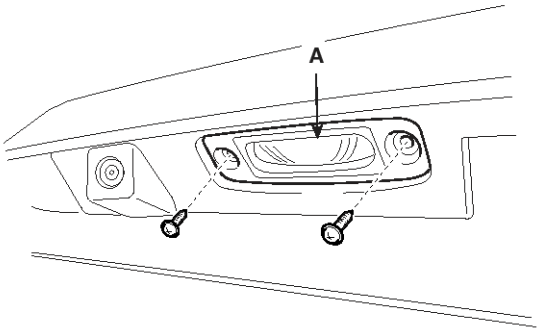
Installation

1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front bumper.

License Lamps

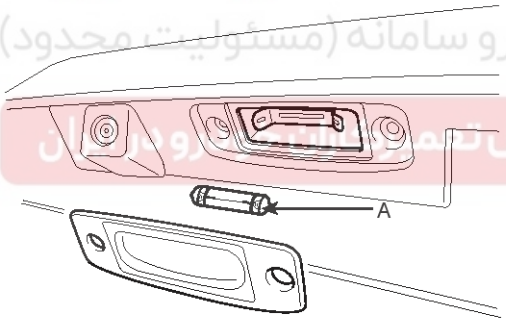
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens (A) from the panel after loosening a screw (2EA).



SHMBE8378D

3. Replace the bulb (A).



SHMBE8379D

Installation

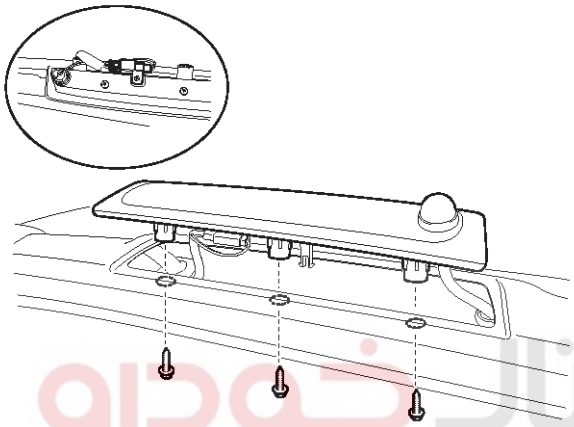
1. Install the bulb.
2. Install the license lamp lens.

High Mounted stop lamp

Removal

High Mounted Stop Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the tailgate trim. (Refer to the Body group - Tailgate).
3. Remove the high mounted stop lamp assembly after removing nuts (3EA).



SHMBE8380D

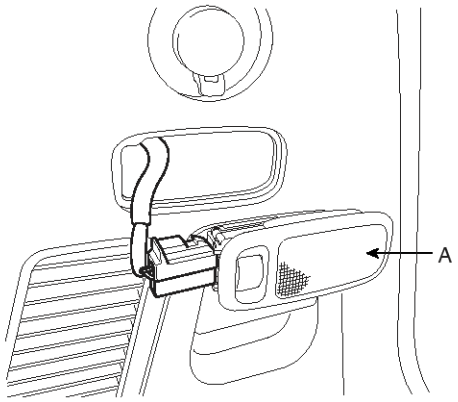
Installation

1. Install the high mounted stop lamp.
2. Install the tailgate trim.

Luggage Room Lamp

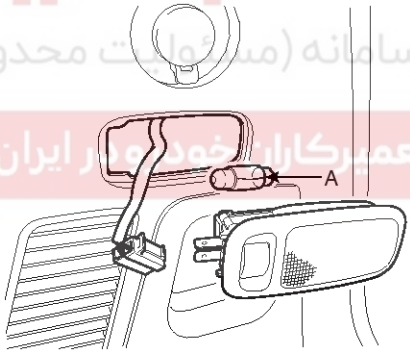
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the luggage room lamp lens(A) with a flat-tip screwdriver after disconnecting the connector.



SHMBE8382D

3. Remove the luggage room lamp bulb (A).



SHMBE8383D

Installation

1. Replace the lamp lens.
2. Install the luggage room lamp assembly after connecting the lamp connector.

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
	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

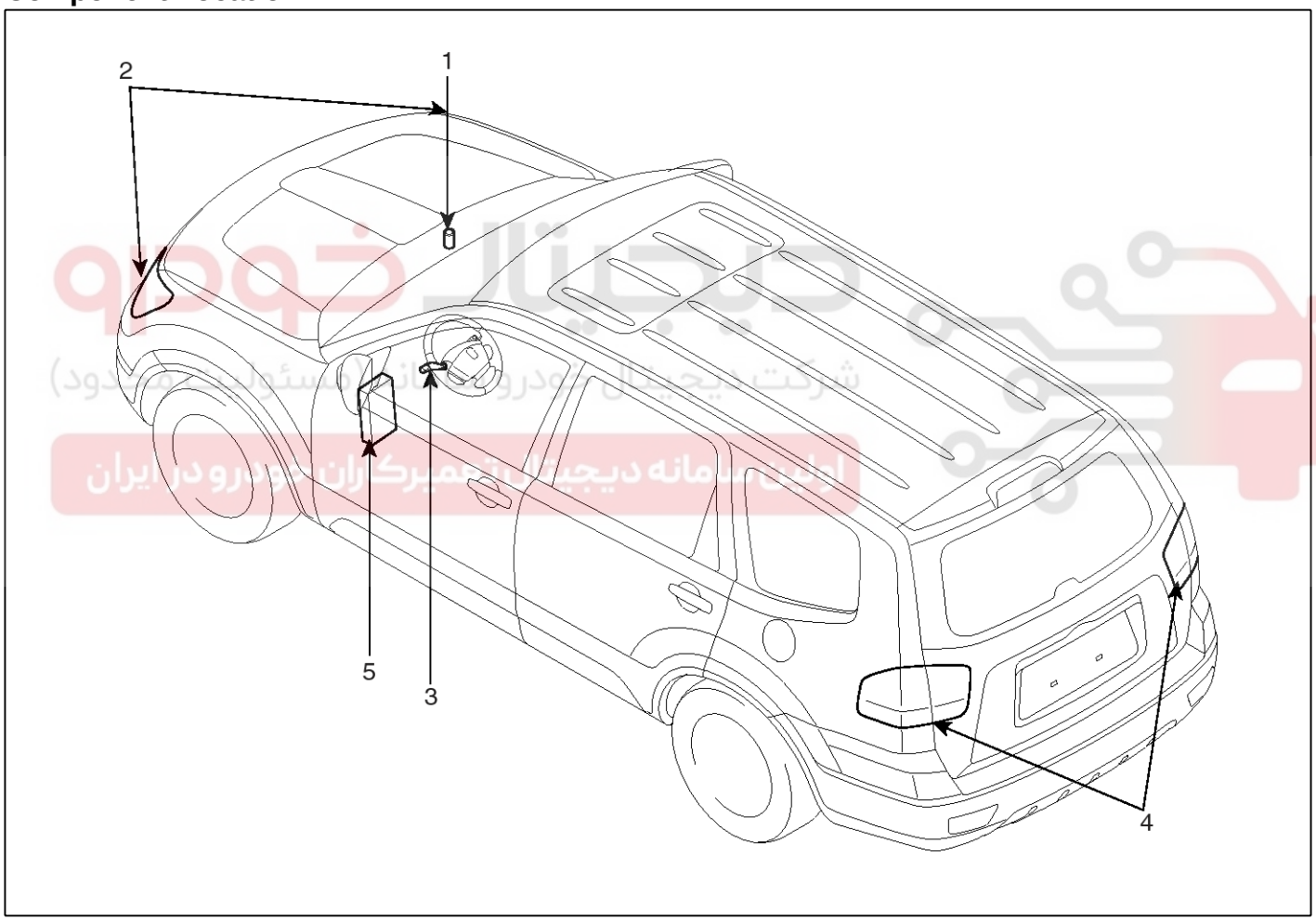
Symptom	Possible cause	Remedy
Flasher rate too slow or too fast	Lamps' wattages are smaller or larger than specified	Replace lamps
	Flasher unit faulty	Check flasher unit
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp 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
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

Auto Lighting Control System

Specifications

Item			Specifications
Rated voltage			5V
Load			Max. 1mA
Detection illuminations	Tail lamp	ON	Below 24 ± 5.2 Lux, Below 1.77 ± 0.08V
		OFF	Over 48 ± 10.5 Lux, Over 3.47 ± 0.1V
	Head lamp	ON	Below 6 ± 1.4 Lux, Below 0.63 ± 0.06V
		OFF	Over 12 ± 2.7 Lux, Over 1.02 ± 0.06V

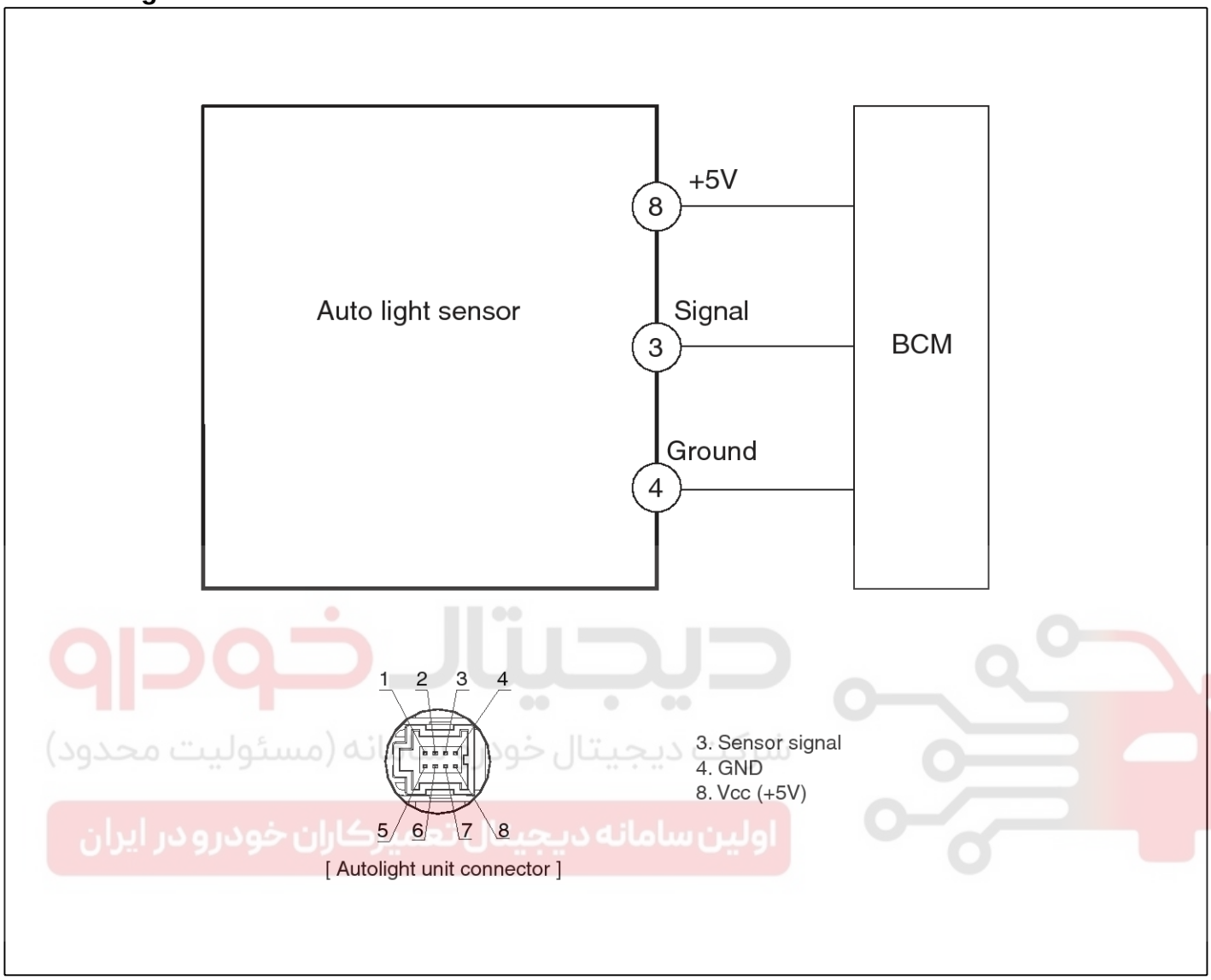
Component Location



SHMBE8384D

1. Auto light sensor unit
2. Head lamps
3. Lighting switch (Auto)
4. Tail lamps
5. IPM (Instrument Panel Module)

Circuit Diagram



SHMBE9210N

Description

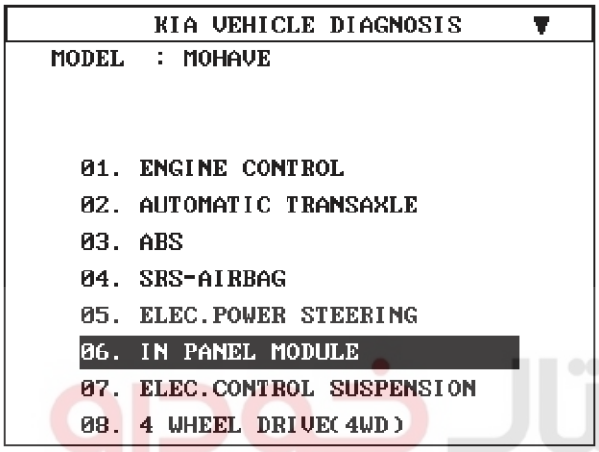
The auto light control system operates by using the auto light switch.

If you set the multi-function switch to "AUTO" position, the tail lamp and head lamp will be turned automatically on or off according to external illumination.

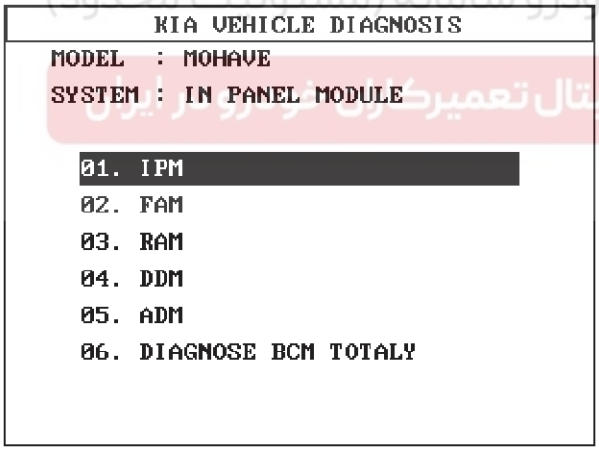
Auto Light Switch

Inspection

1. Multifunction switch operates head lamps and wiper by communicating with IPM through CAN communication.
2. Check IPM input/output value of each position of multifunction switch when you inspect the module whether faulty or not.
3. Select model and IPM menu.

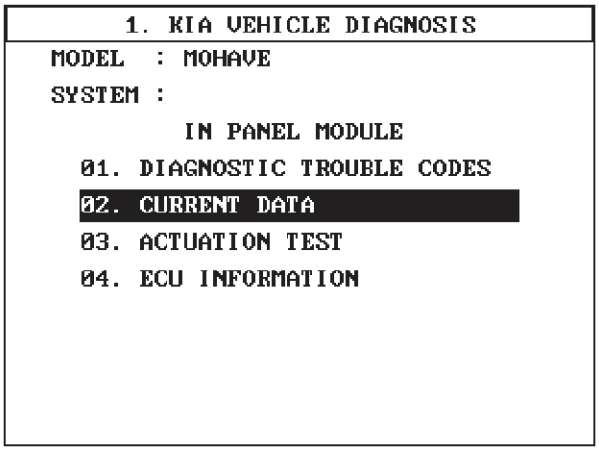


SHMBE9102L



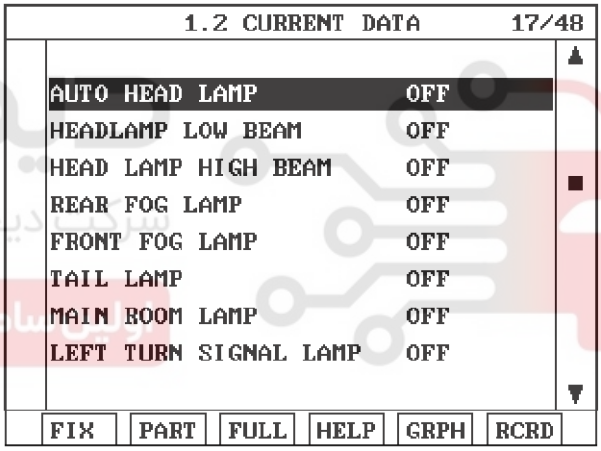
SHMBE9103L

4. Select "Current data". Check auto light value.



SHMBE9110L

5. Check input/output value of auto light.



SHMBE9221N

Auto Light Sensor

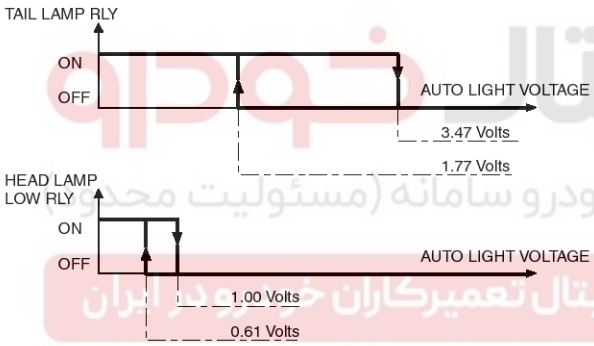
Inspection

In the state of IGN1 ON, when 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.

The auto light control doesn't work if the pin sunlight supply (5V regulated power from Ignition 1 power to sunlight sensor) is in short circuit with the ground.

If IGN1 ON, The BCM 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.

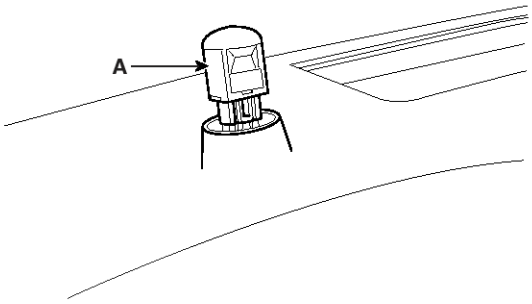


ETBF145K

	Tail lamp	Head lamp
ON	1.77 ± 0.08[V]	0.63 ± 0.06[V]
OFF	3.47 ± 0.10[V]	1.02 ± 0.06[V]

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad.
   (Refer to Body Group - "Crash pad")
3. Remove the Photo & auto light sensor (A) from defrost nozzle.



SHMBE9030D

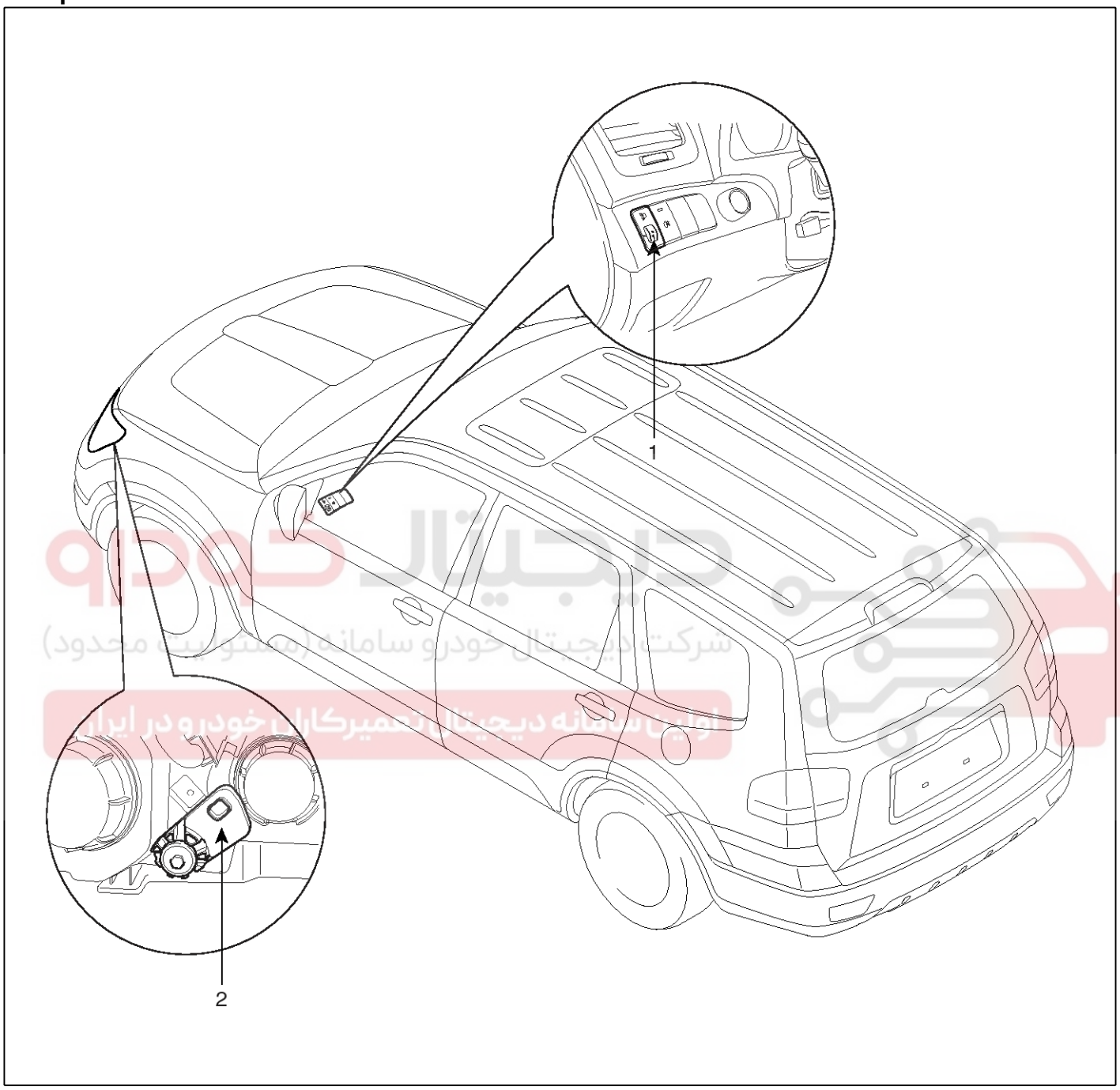
4. Remove the auto light connector.

Installation

1. Reconnect the auto light connector.
2. Install the auto light sensor.
3. Install the crash pad.

Head lamp leveling Device

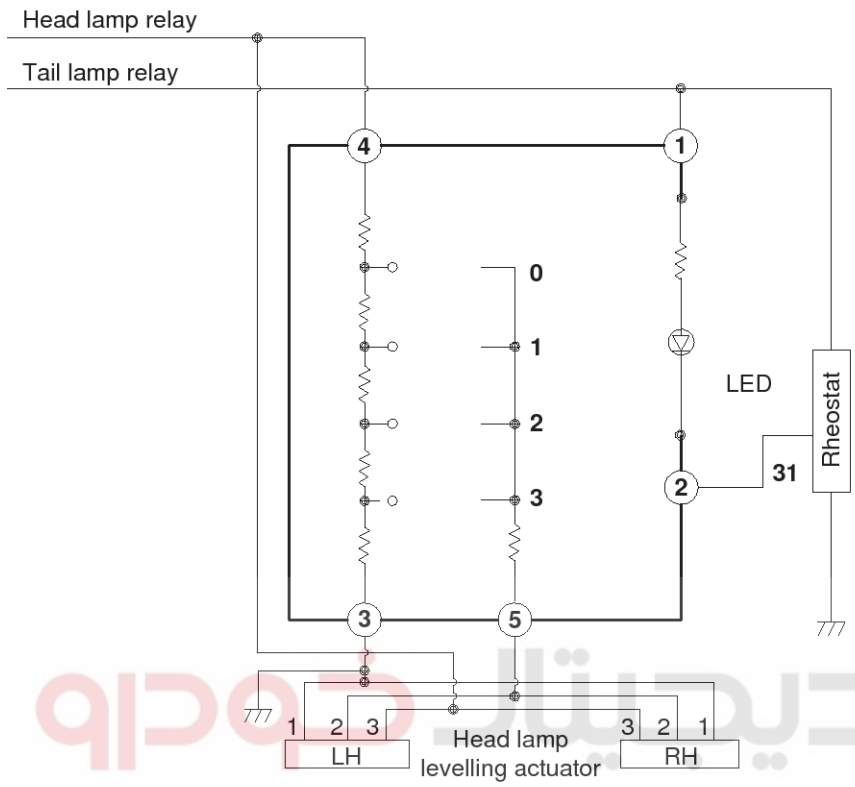
Component Location



SHMBE9091L

1. Head lamp leveling switch
2. Head lamp leveling actuator

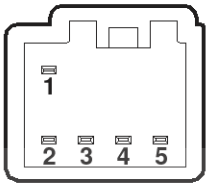
Circuit Diagram



PIN CONNECTION

PIN NO	Description
1	Illumination(+)
2	Rheostat
3	Ground
4	IGN
5	Actuator (+)

Head lamp leveling SW connector



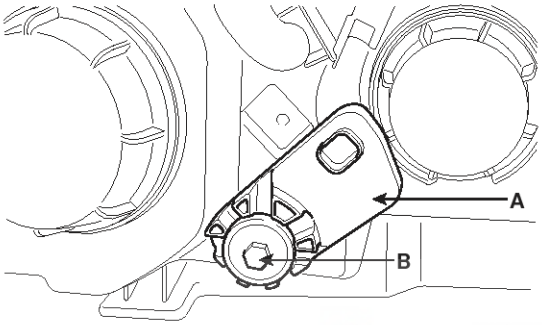
Head lamp leveling actuator connector

SFDBE8287L

Head lamp leveling Actuator

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the head lamp assembly (Refer to the head lamp).
3. Remove the head lamp leveling actuator (A) by loosening the adjusting bolt (B) after rotating it to an arrow direction.



SHMBE9092L

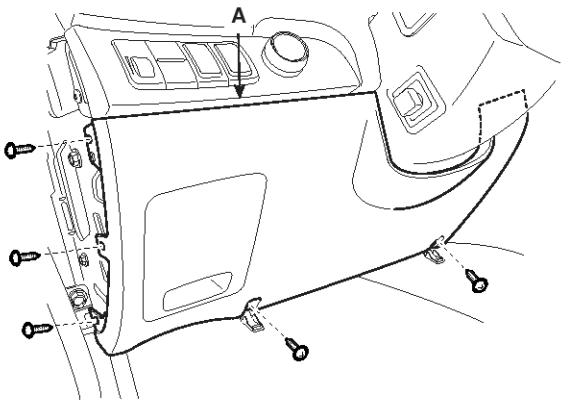
Installation

1. Install the head lamp leveling actuator by turning the adjust gear.
2. Install the head lamp assembly.
3. Adjust the head lamp in accordance with the head lamp aiming instructions.

Head Lamp Leveling Switch

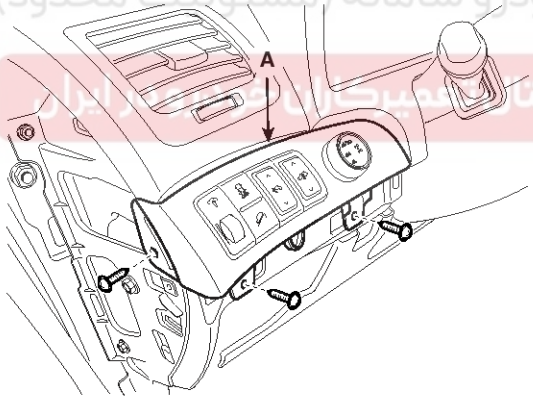
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A) after loosening the screws.



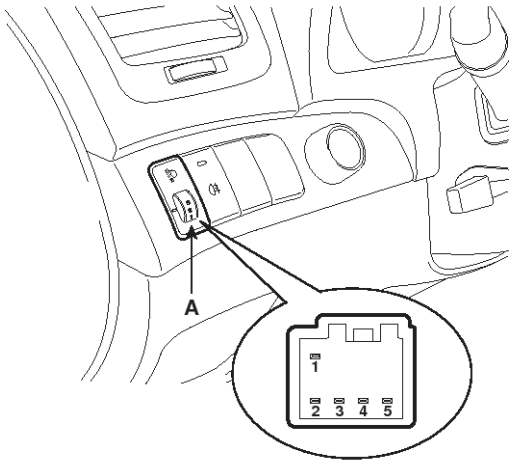
SHMBD8084D

3. Remove the lower crash pad switch assembly (A) after loosening the screws and then disconnect the connectors.



SHMBD8086D

4. Disconnect the head lamp leveling switch (A) connector from the lower crash pad switch.



SHMBE9093L

5. Connect the battery voltage between terminals 3 and 4.
6. Measure the voltage between terminals 4 and 5 (V) at each position.

Position No.	Rotation	Voltage (V)
0	0˚	11.05 ± 0.5V
1	20˚	9.1 ± 0.5V
2	40˚	7.54 ± 0.5V
3	60˚	6.63 ± 0.5V

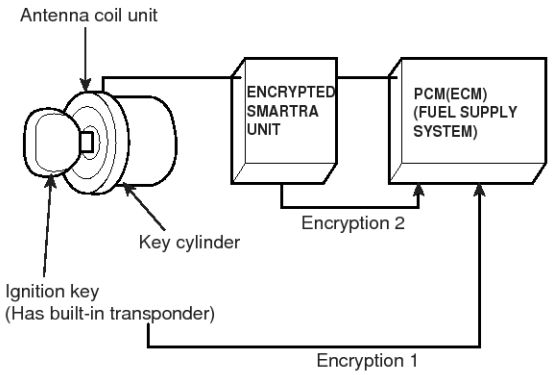
7. If the voltage is not as specified, replace the head lamp leveling switch.

Immobilizer System

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
   - The SMARTRA system consists of a passive challenge - response (mutual authentication)transponder located in the ignition key, an antenna coil, a encoded SMARTRA unit, an indicator light and the PCM(ECM).
   - 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.
   - 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).
   - 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.
   - 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.
   - 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 Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
   - The immobilizer system can store up to eight key codes.
   - If the customer has lost his key, and cannot start the engine, contact KIA motor service station.

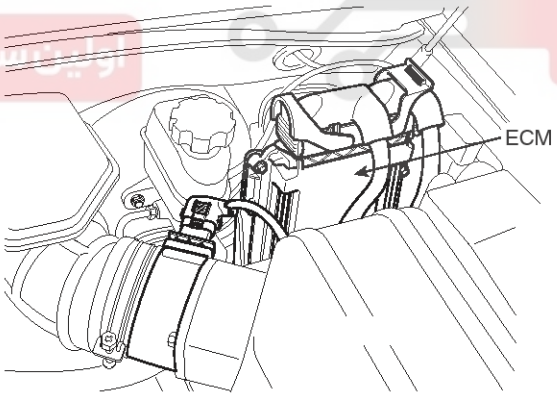


SFDBE8404L

Components Operations

PCM (Power Train Control Module)

1. The PCM(ECM) 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).



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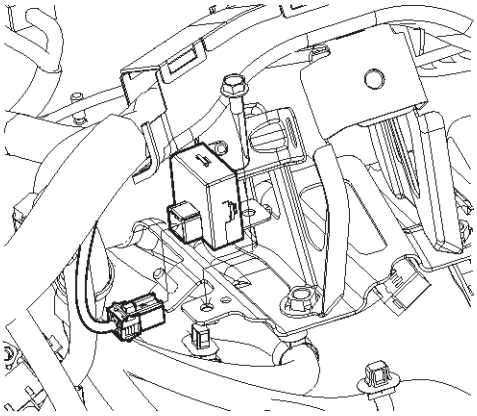
SMARTRA unit (B)

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 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

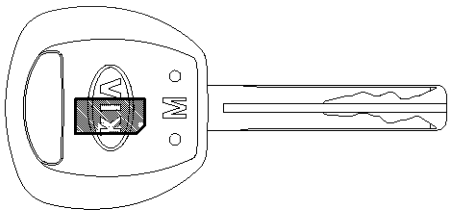
transmitted to the transponder by the antenna. The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.



SHMBE9128L

Transponder (Built-in keys)

The transponder 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.



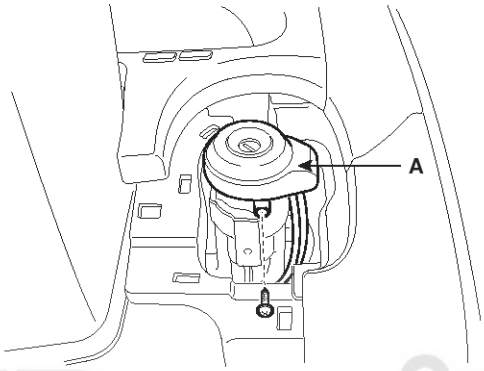
SHMBE9224N

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.



SHMBE9225N

Teaching Procedures

1. Key Teaching Procedure

   Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehicle owner.

   The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. The "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 proceed.

   If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After 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 the 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 recognized by 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 can be 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 invalid.

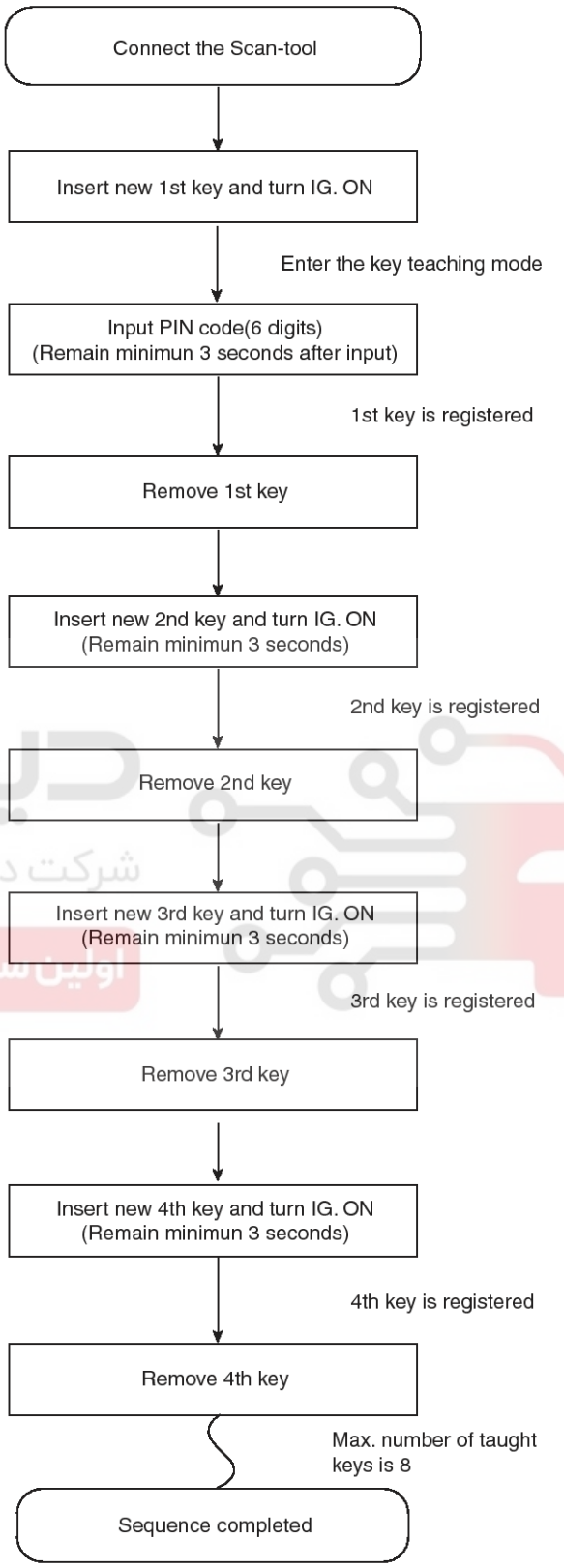
The maximum number of taught keys is 8

If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific fault code is stored.

If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at PCM(ECM).

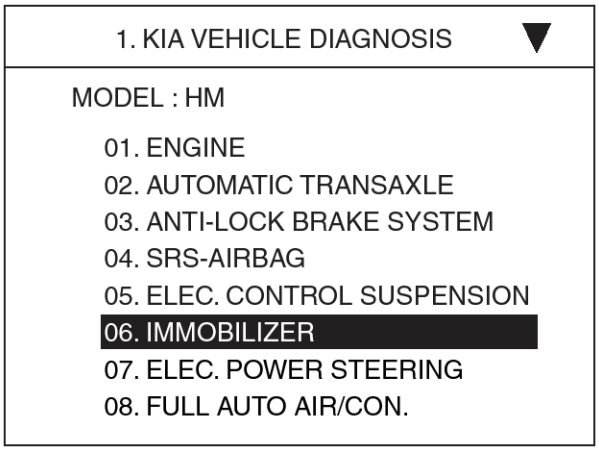
NOTICE

When teaching the 1st key, smartra registers at the same time.

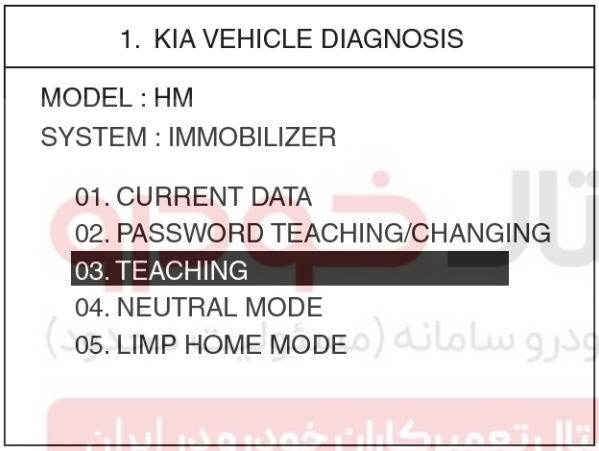


SFDBE8405L

1) PCM(ECM) learnt status.



SHMBE9233N



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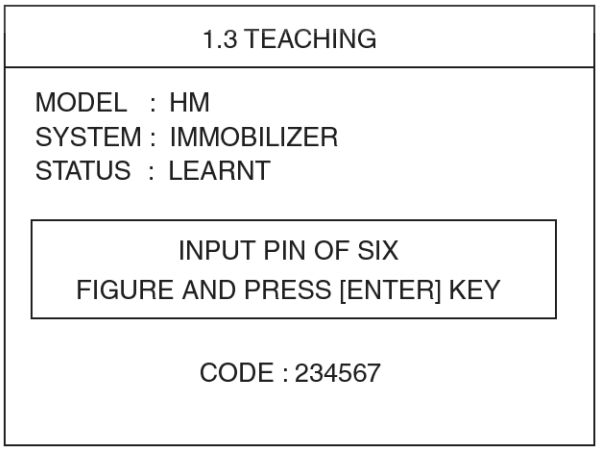

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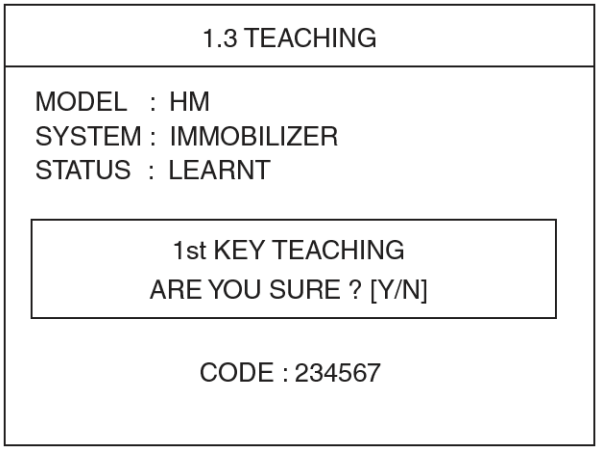

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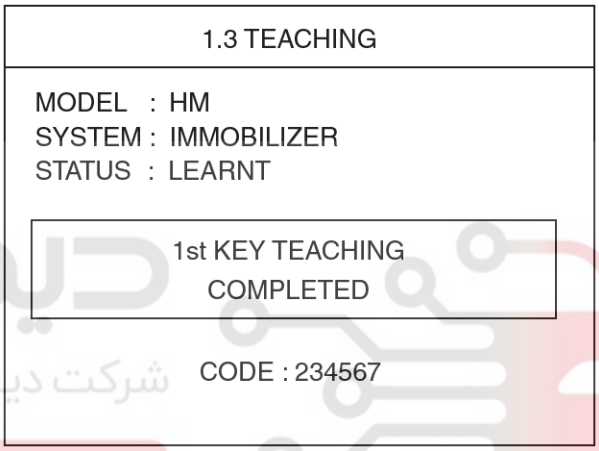

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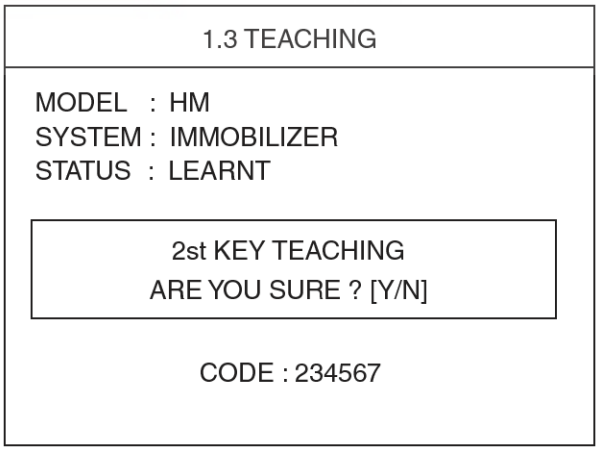

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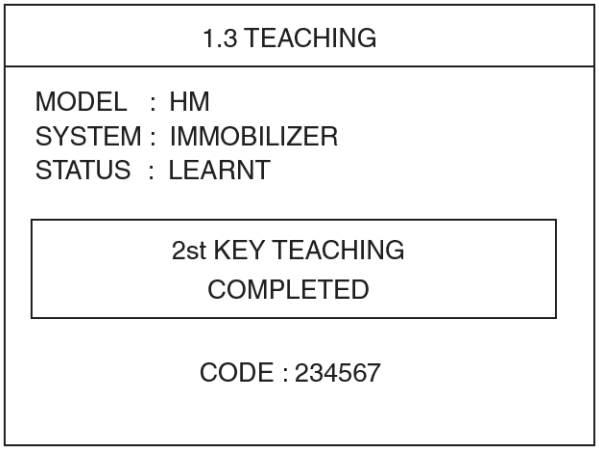
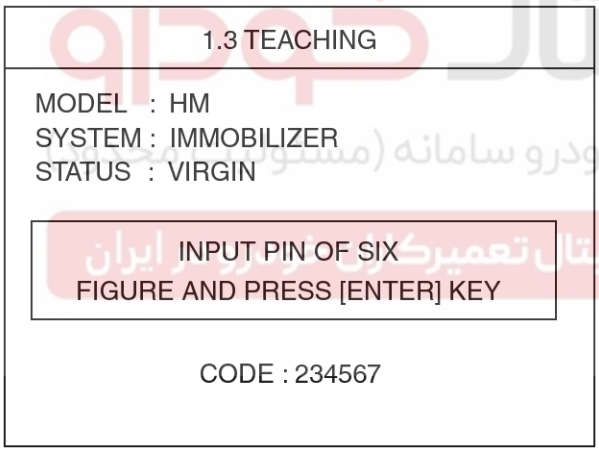


SHMBE9239N

2) PCM(ECM) virgin status.

After replacing new "PCM(ECM)" scantool displays that PCM(ECM) is virgin status in Key Teaching mode.

"VIRGIN" status means that PCM(ECM) has not matched any PIN code before.



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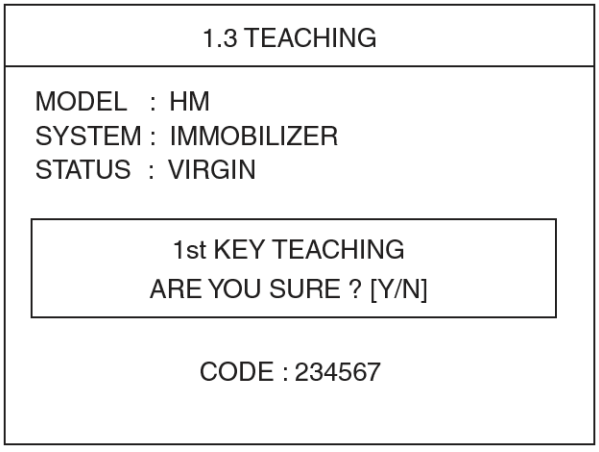

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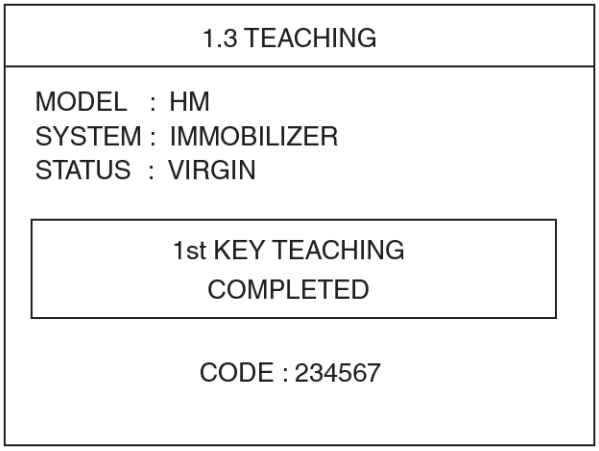

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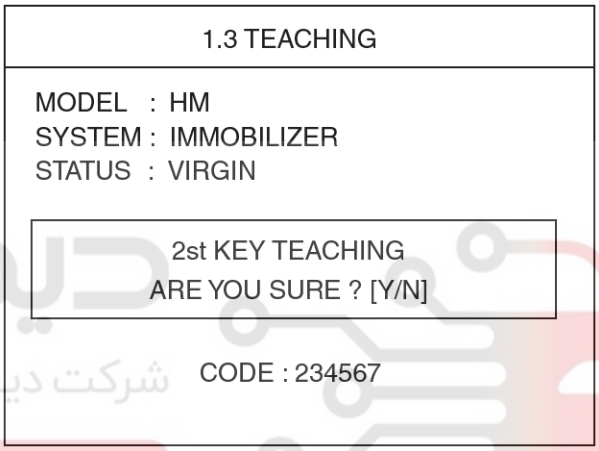

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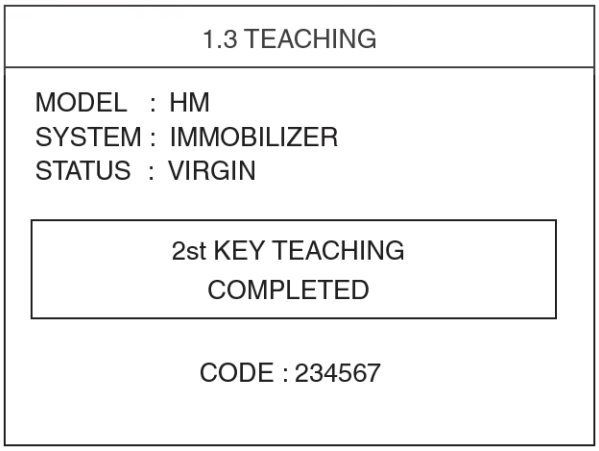


SHMBE9244N

2. 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.

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.

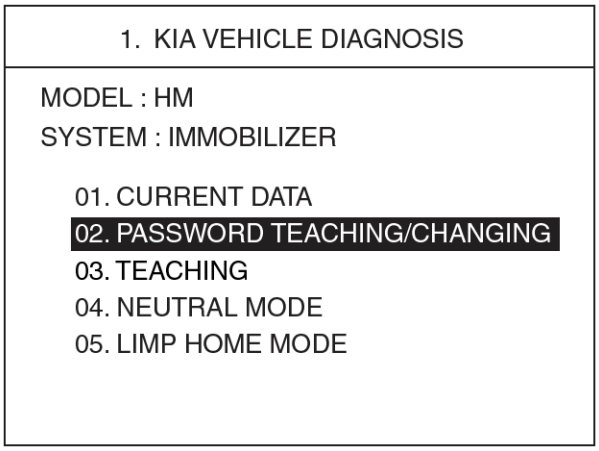
The teaching is started by ignition on, with a valid key (learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

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 incorrect user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times, 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.

1) User password teaching

※ In case of putting wrong password, retry from first step after 10 seconds.



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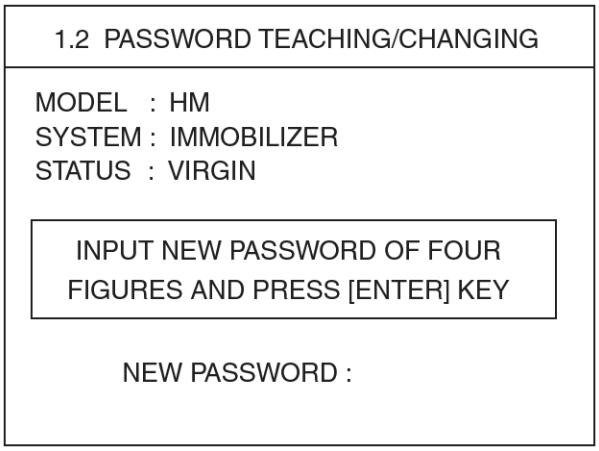

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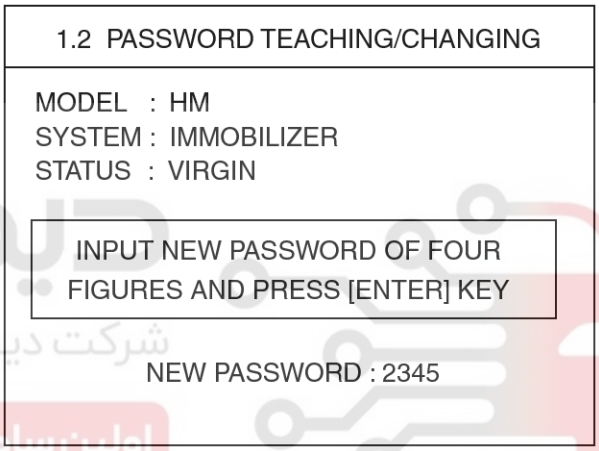

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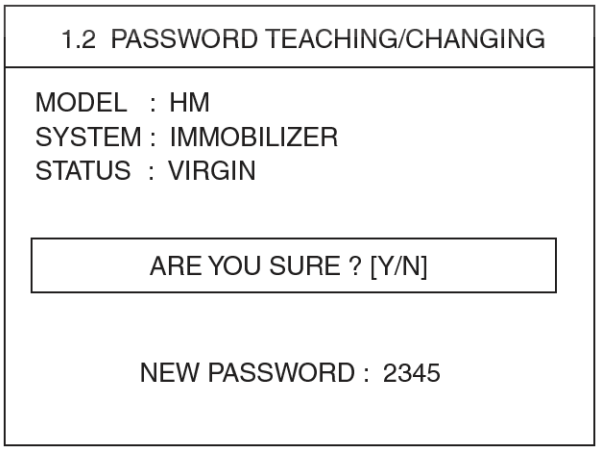

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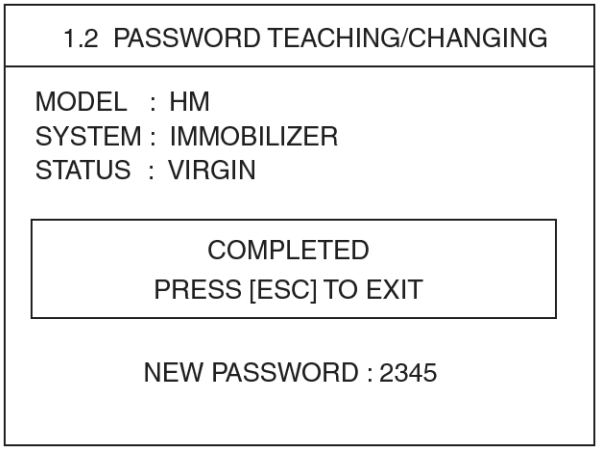
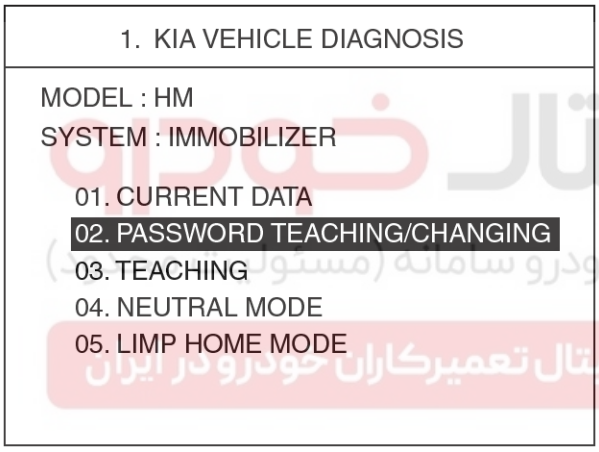


SHMBE9249N

※ In case of putting wrong password, retry from first step after 10 seconds.

2) User password changing



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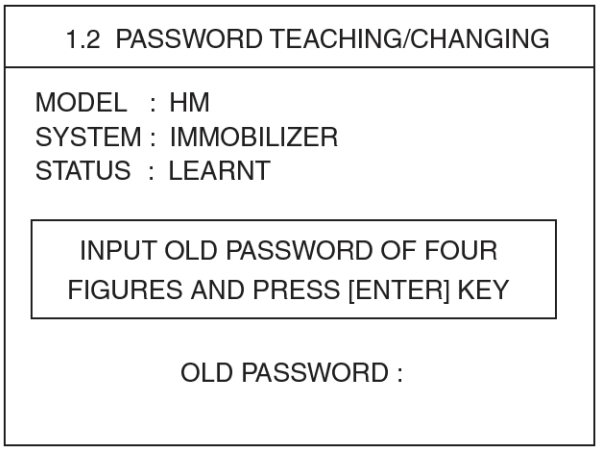

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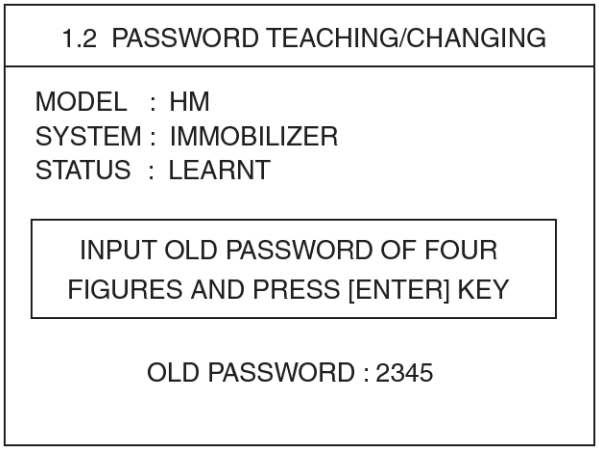

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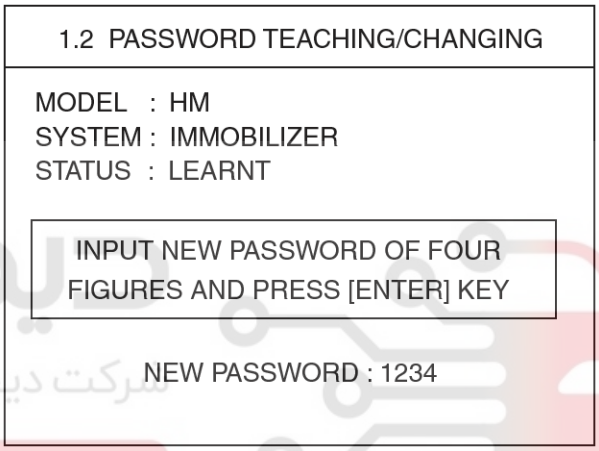

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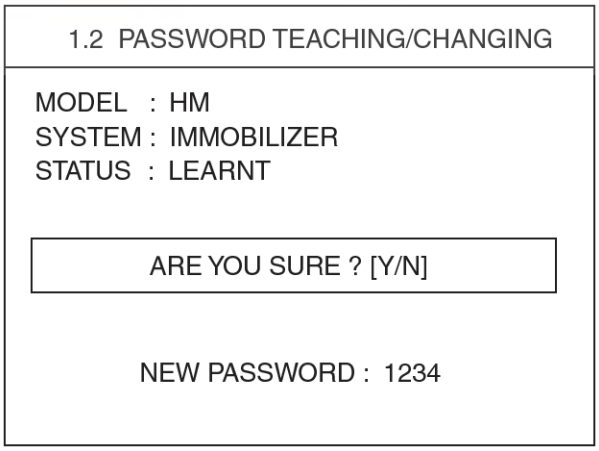

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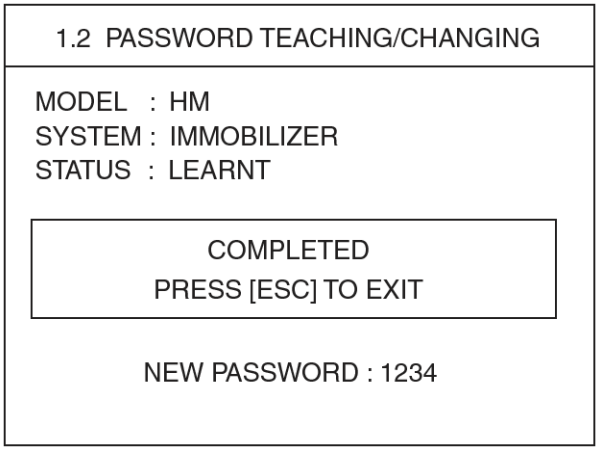


SHMBE9255N

Replacement

Problems And Replacement Parts:

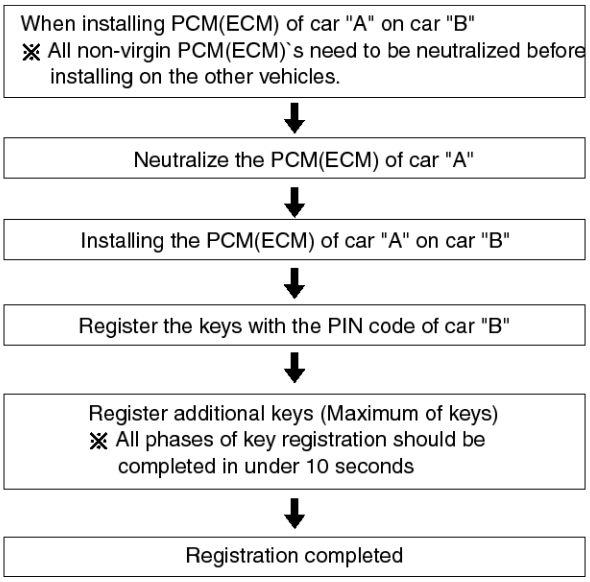
Problem	Part set	Scan tool required ?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	PCM(ECM)	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, PCM(ECM)	YES
SMARTRA unit does not work	SMARTRA unit	NO

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.

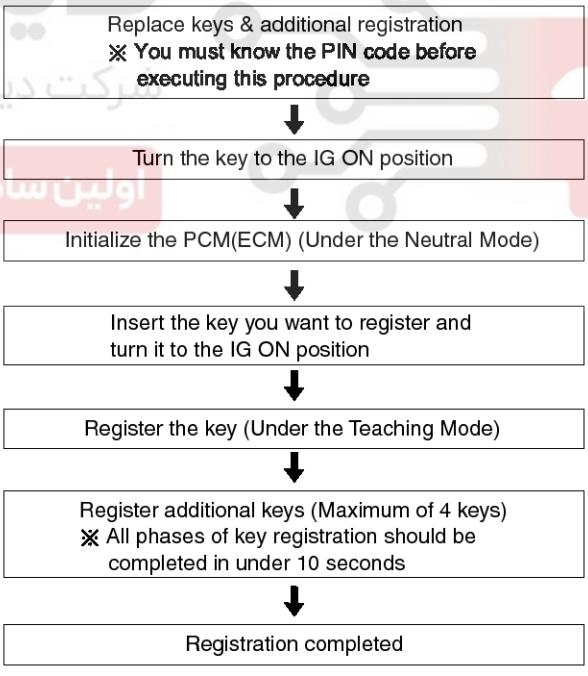
In case of a defective SMARTRA, there is no special procedure required. A new SMARTRA device simply replaces the old one. There are no transponder-related data stored in this device.

1. Things to remember before a replacement (PCM(ECM))



ETBF746A

2. Things to remember before a replacement (Keys & Additional registration)



ETBF746B

NOTICE

1. *When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.*
2. *When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.*

   (Note that key #2 must be used within 10 seconds of removing key #1)
3. *When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.*

   The engine cannot be started even with the registered key #1.
4. *When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.*

   Always remember the 10 seconds zone.
5. *If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.*
6. *Be cautious not to overlap the transponder areas.*
7. *Problems can occur at key registration or vehicle starting if the transponders should overlap.*

Neutralising 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.

NOTICE

- *Neutralizing setting condition*
  - *In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"*
  - *Input correct PIN code by scanner.*
  - *Neutralizing meaning .*

    : PIN code (6) & user password (4) deletion.

    : Locking of ECM (except key teaching permission)
- *Neutralizing meaning:*
  - *PIN Code(6) & User P/Word(4) deletion*
  - *Locking of EMS(except Key Learning permission)*

Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No

SFDBE8407L

1. KIA VEHICLE DIAGNOSIS

MODEL : HM
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE

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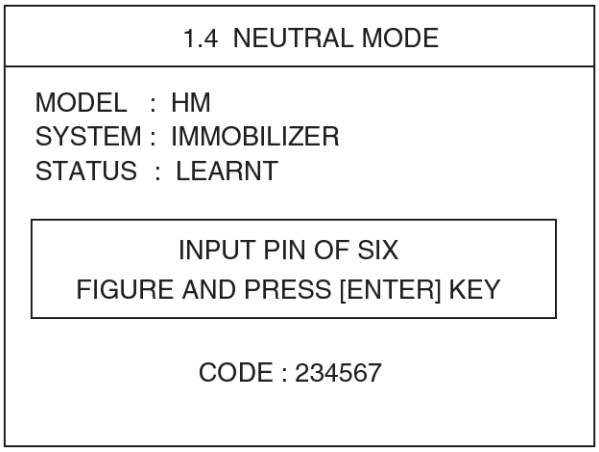

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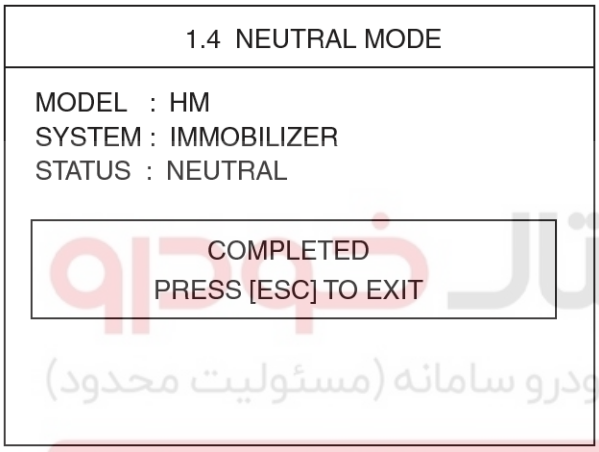

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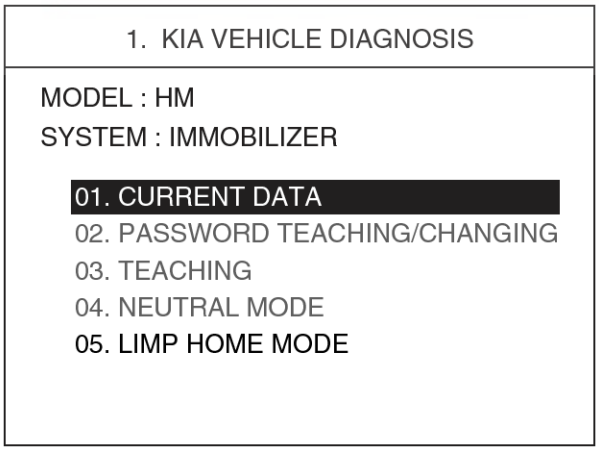

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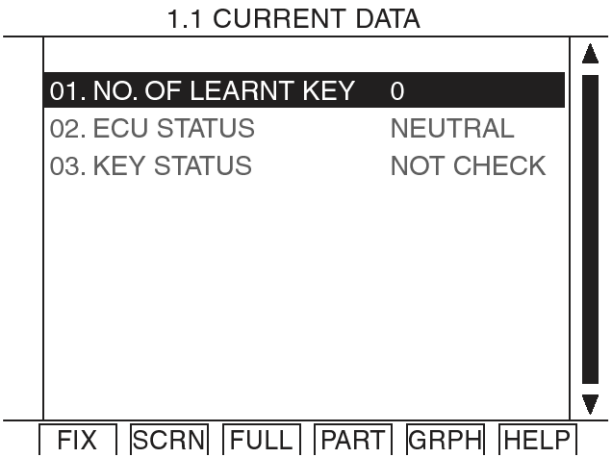

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Neutralising Of SMARTRA

The EMS can be set to the status "neutral" by tester

Ignition key (regardlss 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 chaging 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.

NOTICE

- *Neutralizing Setting condition :*
  - *In case of "SMARTRA status", "Learnt"*
  - *Input correct Pin code by tester*
- *Neutralizing meaning :*
  - *Vehicle password(DPN Code) & SEK Code deletion.*
  - *Permission of New DPN Learning.*

Function / SMARTRA	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS learnt)	No	Yes	No

SFDBE8408L

1. KIA VEHICLE DIAGNOSIS

MODEL : HM
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL

SHMBE9230N

1.6 SMARTRA3 NEUTRAL

MODEL : HM
SYSTEM : IMMOBILIZER
STATUS : LEARNT

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

SHMBE9231N

1.6 SMARTRA3 NEUTRAL

MODEL : HM
SYSTEM : IMMOBILIZER
STATUS : NEUTRAL

COMPLETED
PRESS [ESC] TO EXIT

SHMBE9232N

1.1 CURRENT DATA

01. NO. OF LEARNT KEY 0
02. EMS STATUS
03. KEY STATUS VIRGIN
04. SMARTRA3 STATRS

FIX | SCRN | FULL | PART | GRPH | HELP

SFDBE8412L

Limp Home Function

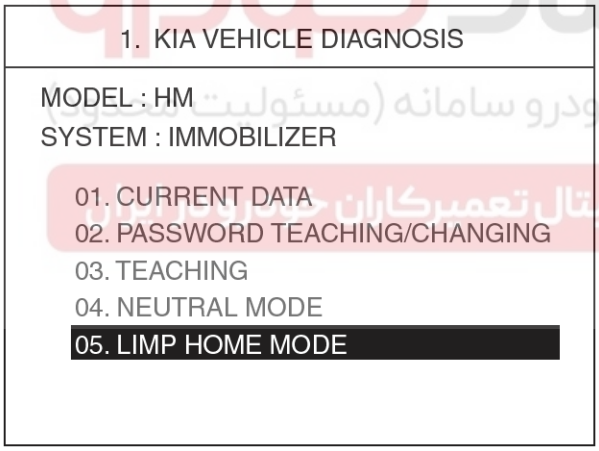
1. LIMP HOME BY TESTER

   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 station.

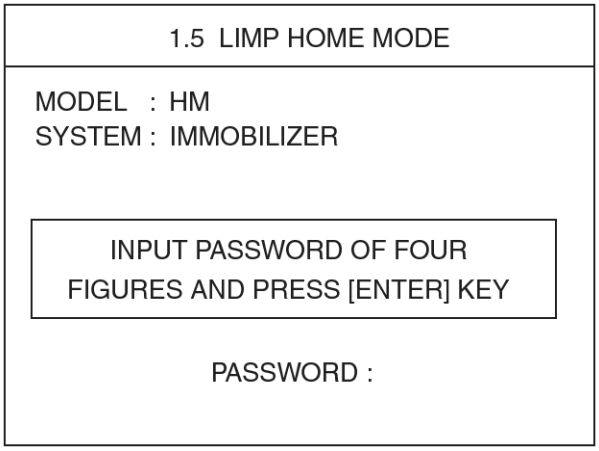
   The user password can be sent to the PCM(ECM) via the special tester menu.

   Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, 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. Disconnecting 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.



SHMBE9256N



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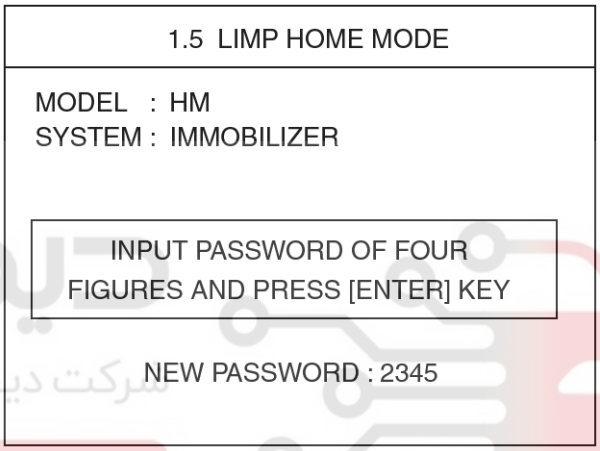

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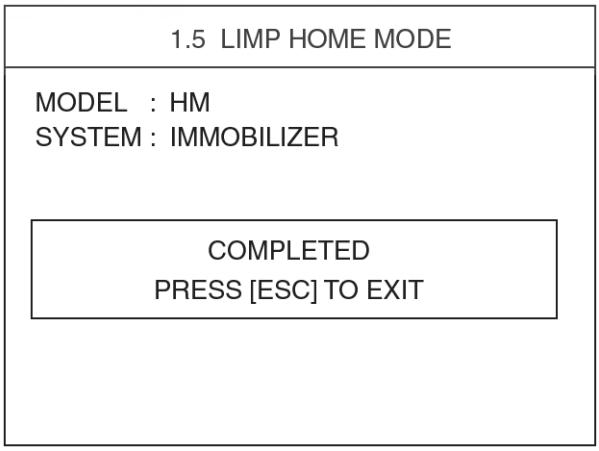

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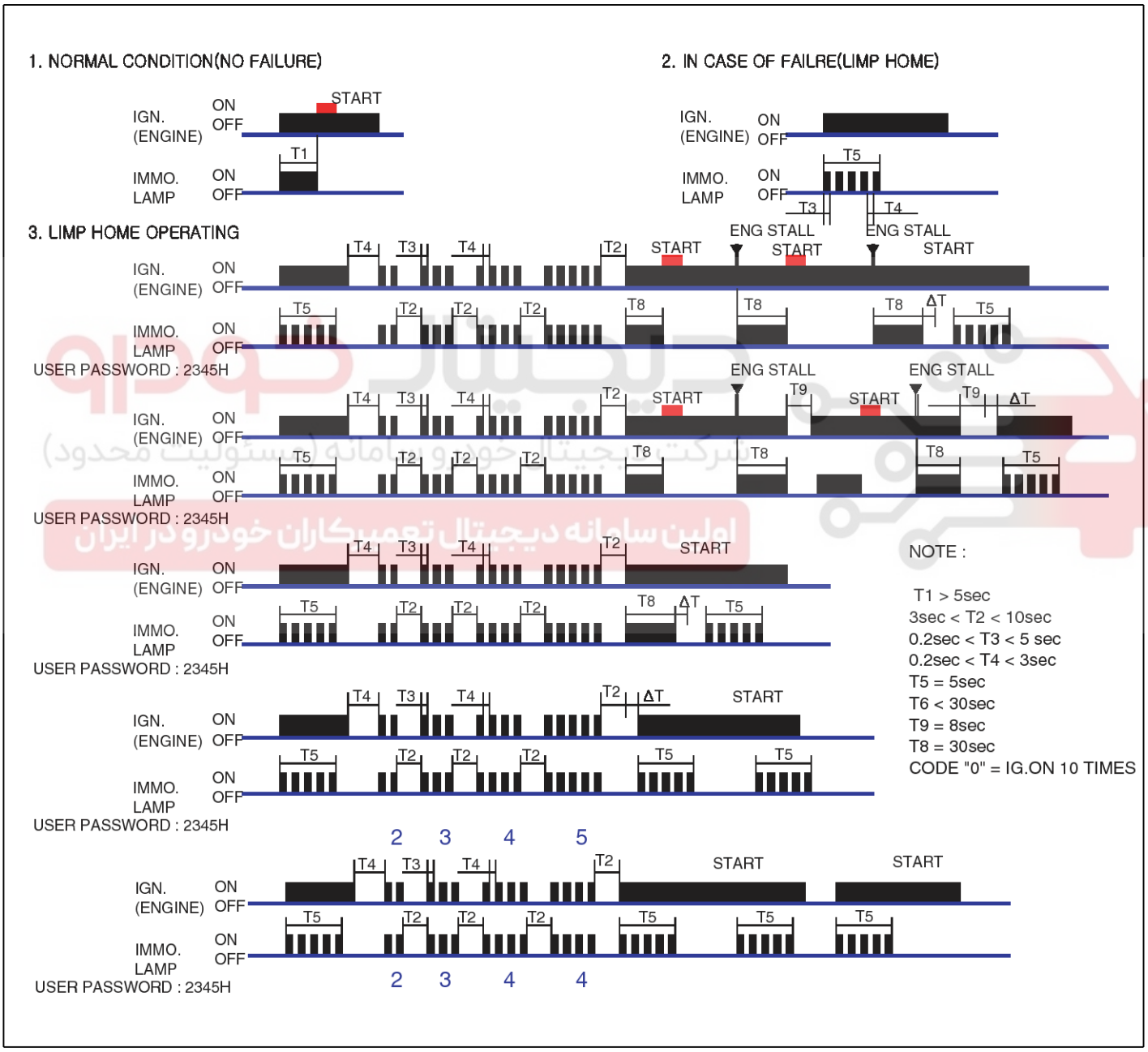
2. Limp Home By Ignition Key

The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is 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.



LTIF740N

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
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. Incorect the Authentication of EMS and SMARTRA 4. Locking of SMARTRA	P169A (SMARTRA Authentication f-ail)
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 f-ault	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 (Ante-nna coil) 3. No transponder (Key without transponder) in the magn-etic 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 er-ror etc.)	P1694 (PCM(ECM) message error)
PCM(ECM) internal perman-ent memory (EEPROM) fault	1. PCM(ECM) internal permanent memory (EEPROM) fa-ult 2. Invalid write operation to permanent memory (EEPRO-M)	P1695 (PCM(ECM) memory error)
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt"Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(A-uthentication 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)

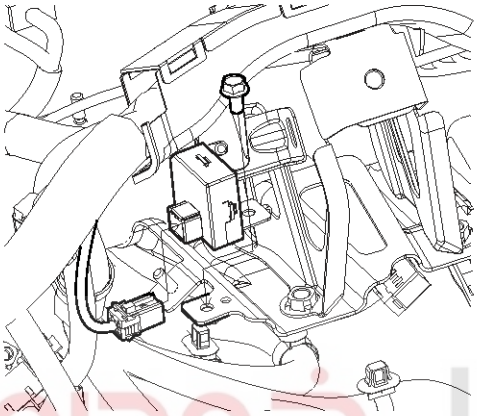
Immobilizer (SMARTRA) DTC List

No.	Fault Code	Monitor Strategy Description	
1	P1610	Non-Immobilizer-EMS connected to an immobilizer	O
2	P1674	Transponder status error	O
3	P1675	Transponder programming error	O
4	P1676	SMARTRA message error	O
5	P169A	SMARTRA fault	O
6	P1690	SMARTRA no response	O
7	P1691	Antenna coil error	O
8	P1692	Immobilizer lamp error	O
9	P1693	Transponder no response error / Invalid response	O
10	P1694	EMS message error	O
11	P1695	EMS memory error	O
12	P1696	Authentication fail	O
13	P1697	HI-SCAN message error	O
14	P1699	Twice overtrial	O

Immobilizer Control Unit

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the BD group - " Crash pad ")
3. Disconnect the 5P connector of the Immobilizer unit and then remove the Immobilizer unit (A) after loosening a bolt.



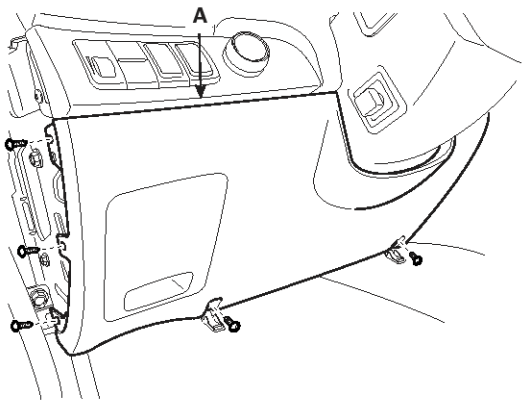
SHMBE9260N

4. Installation is the reverse of removal procedure.

Antenna Coil

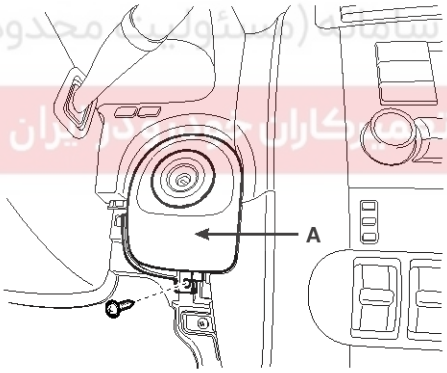
Removal

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



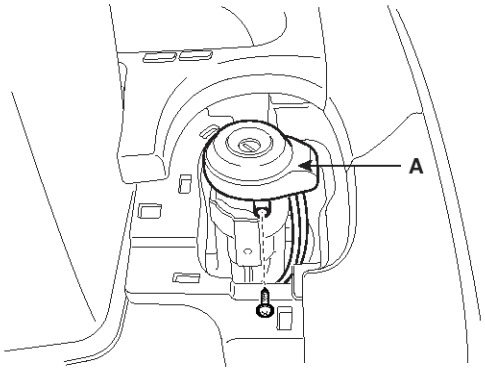
SHMBE8444D

3. Remove the ignition switch cover (A) after loosening a screw.



SHMBE9263N

4. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.



SHMBE9225N

Installation

1. Reassemble the coil antenna after connecting the connector.
2. Reassemble the ignition switch cover.
3. Reassemble the crash pad lower panel.

Rear Parking Assist System

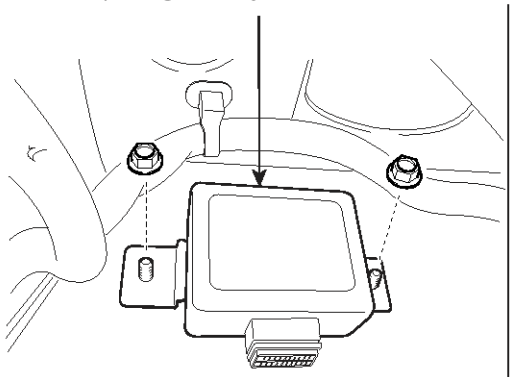
Rear Parking Assist System Control Unit

Specification

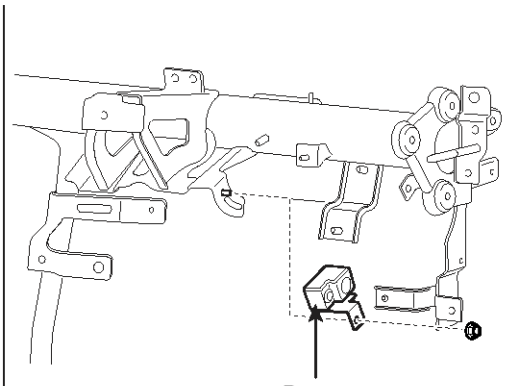
Item		Specification
Rear parking assist system control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-22˚F ~ + 176˚F (-30˚C ~ + 80˚C)
	Operation current	MAX 600 mA
	Operation frequency	40 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage 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 ~ + 176˚F (-30˚C ~ + 80˚C)
	Beam width	Horizontal : 100±5˚(70cm), Vertical : 60±5˚(50cm)
	Number of sensors	3 (Right, center, 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)

Component Location

Rear parking assist system control unit

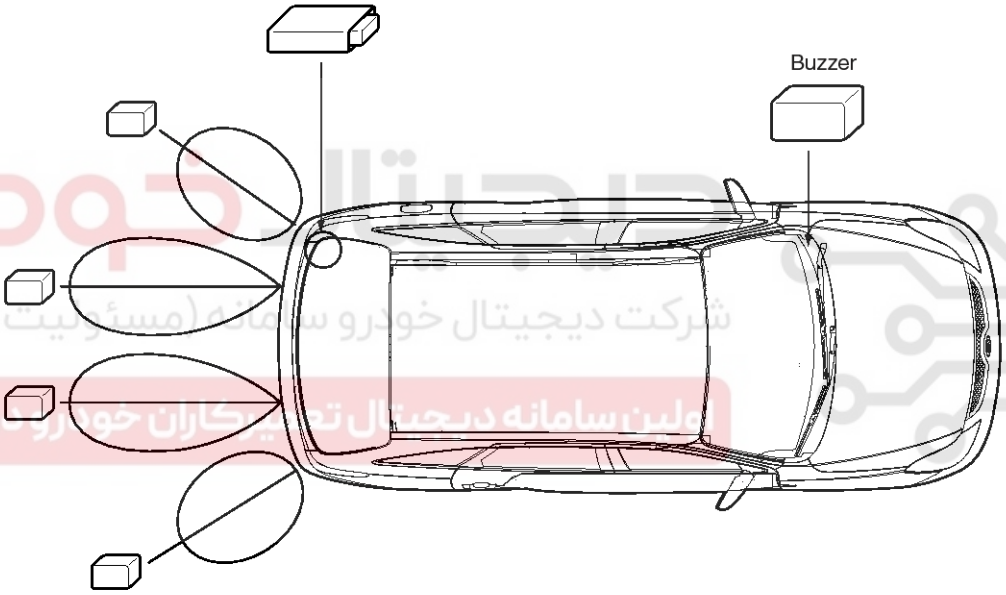


Left rear quater panel



Buzzer

Rear parking assist system control unit

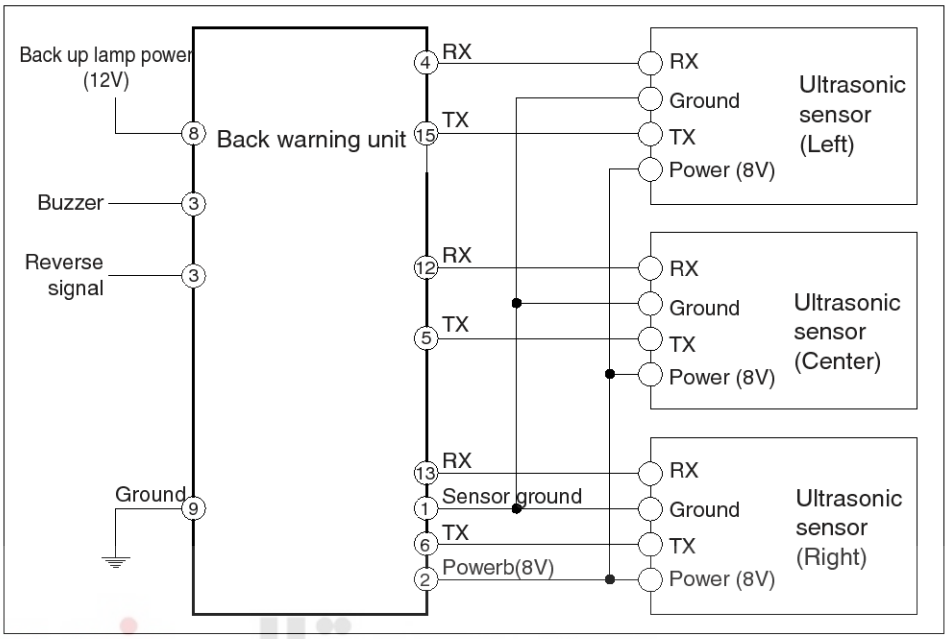


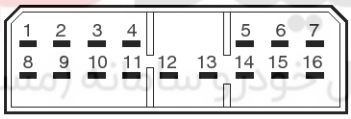
Ultrasonic sensor

- 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

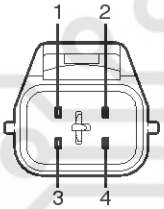
SHMBE9264N

Circuit Diagram





(Rear parking assist system control unit connector)



(Ultrasonic sensor connector)

Pin configuration

Pin No.	Signal	Test : Desired result
1	Sensor ground	0V
2	Sensor power	8V (While operating)
3	Buzzer	0V (While operating)
4	RX - Sensor(Left)	0~1V voltage change (Inspect waveform)
5	TX - Sensor(Center)	0~3V voltage change (Inspect waveform)
6	TX - Sensor(Right)	0~3V voltage change (Inspect waveform)
8	Back up lamp power	12V (While shifting to "R")
9	Ground	0V
12	RX - Sensor(Center)	0~1V voltage change (Inspect waveform)
13	RX - Sensor(Right)	0~1V voltage change (Inspect waveform)
15	TX - Sensor(Left)	0~3V voltage change (Inspect waveform)

PIN NO	SIGNAL
1	8V
2	GND
3	TX
4	RX

SHMBE9265N

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).

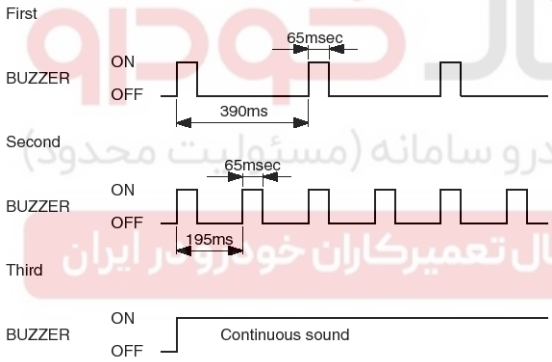
Alarm Range

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



SHMBE9266N

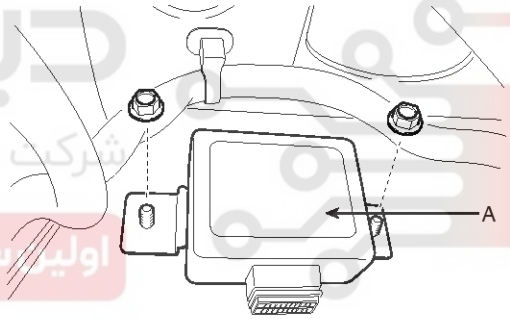
NOTICE

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.*

Removal

1. Remove the rear left quarter trim of the trunk (Refer to the Body group - "Interior trim")
2. Loosen the mounting nuts and remove the rear parking assist system control module unit (A) from the quarter panel.



SHMBE8398D

Installation

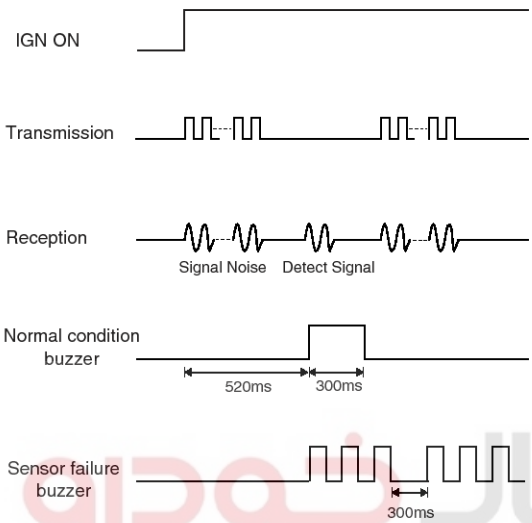
1. Reassemble the rear parking assist system control module.
2. Reassemble the rear left quarter trim.

Diagnosis

1. DIAGNOSIS

   Turn the ignition switch ON, then shift the transaxle lever to 'R'. The Back Warning System is then checked.

   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.5 seconds from power approval.



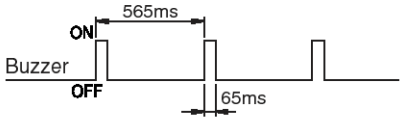
SHMBE9267N

2. DIAGNOSIS MODE

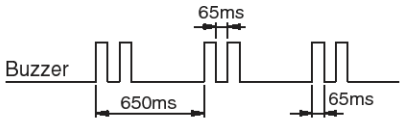
   Switch on diagnosis mode upon system failure.

   In case of system failure, then it indicates the failed point as follows.

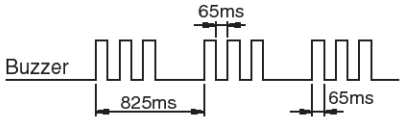
(1) Left side sensor failure buzzer



(2) Center sensor failure buzzer



(3) Right side sensor failure buzzer



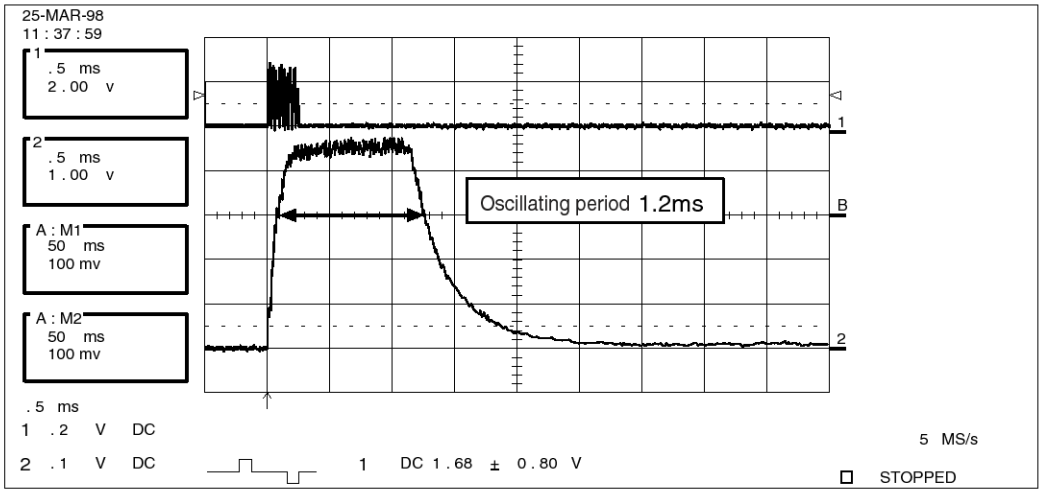
SHMBE9268N

Sensor Connection Checking

Transmit ultrasonic wave to the sensors, boost input signal, and detect wave.

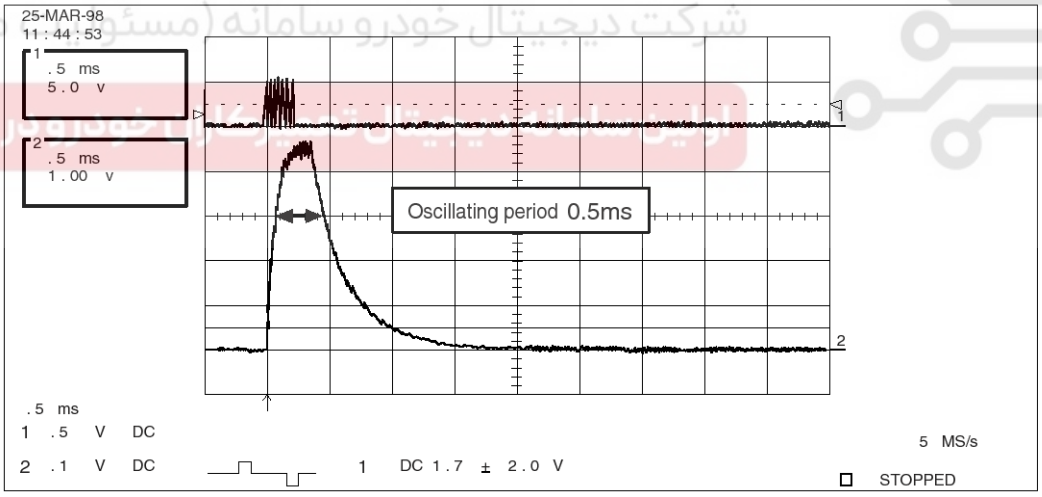
Waveform will be found, oscillating for a certain period of time.

1. Waveform for a normal sensor connection



BTKG230F

2. Waveform for a failed sensor connection



BTKG230G

NOTICE

Sensor connection will be checked for oscillating period of input signal 3V. If oscillating period is more than 0.8ms, it is normal.

a. Left sensor failure : beep-beep-beep

b. Center sensor failure : beep beep-beep beep-beep beep

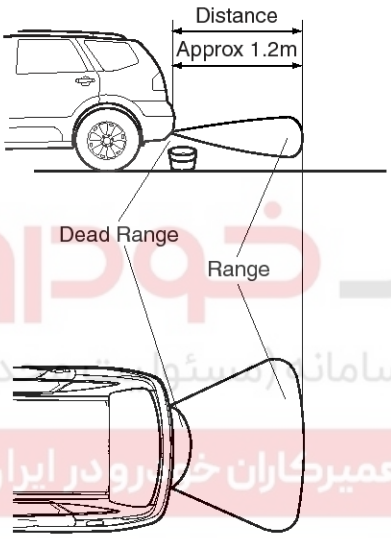
c. Right sensor failure : beep beep beep-beep beep beep-beep beep beep

Warning

1. Range detected by back sensors is limited.

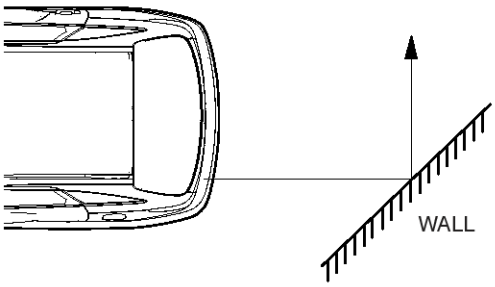
   Watch back before reversing
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
   1) Needles, ropes, rods, or other thin objects.
   2) Cotton, snow and other material absorbing ultrasonic wave

      (for example, fire extinguisher device covered with snow)



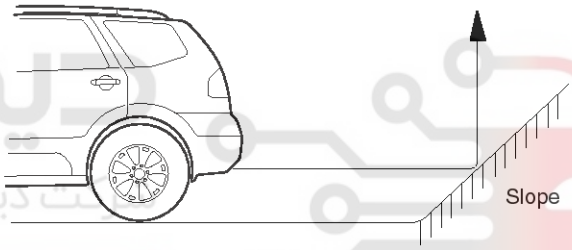
SHMBE9269N

4. Reversing toward the sloped walls.



SENBE7525L

5. Reversing toward the sloped terrain.



SHMBE9270N

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.

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.

Ultrasonic Sensor

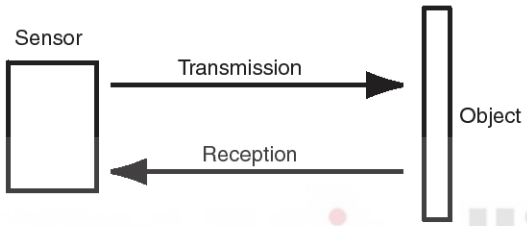
Operation

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

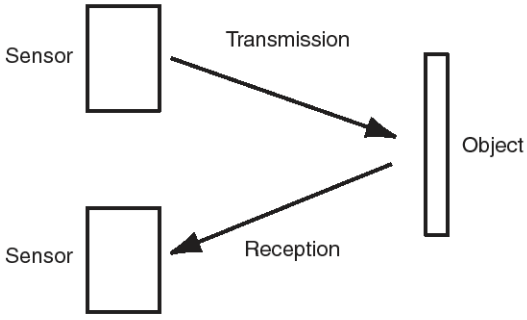
Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



ETRF762A

2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



ETRF762B

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.

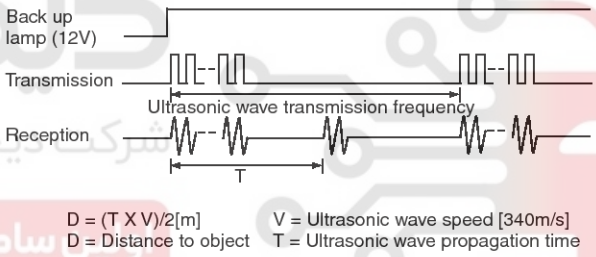
The propagation speed formula of ultrasonic wave in air is following :

v=331.5 + 0.6t (m/s)

v=ultrasonic wave propagation speed

t=ambient temperature

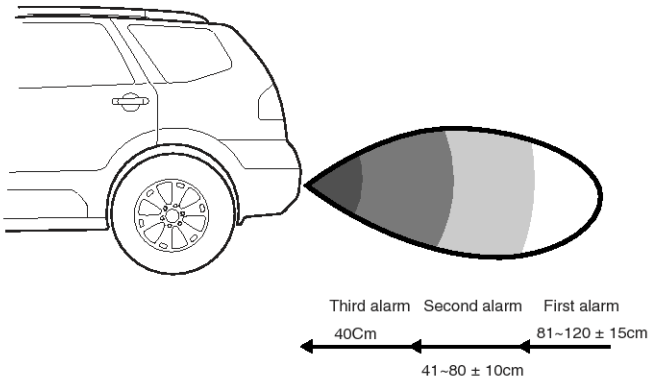
The basic principle of distance measurement using ultrasonic wave is :



ETRF762C

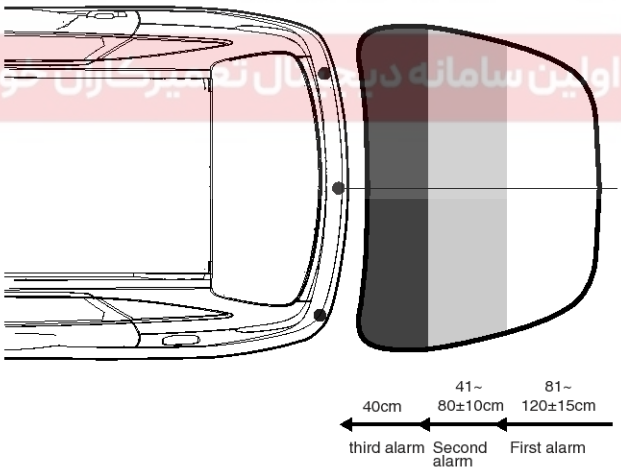
Sensor detection range

[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.

SHMBE9271N

NOTICE

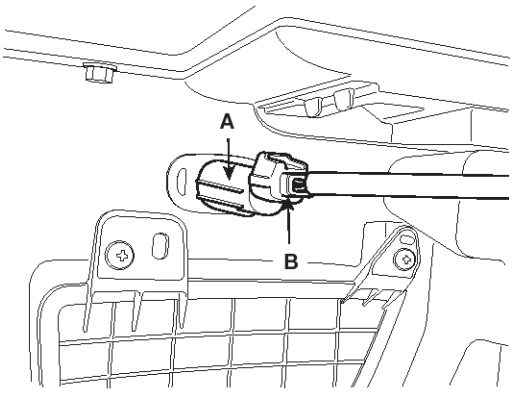
1. *14cm (Diameter) plastic rod is used for the test target.*
2. *The test result may differ by a different target object.*
3. *Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.*
4. *The following object may not be detected.*
   - *Sharp object or thin object like rope.*
   - *Cotton, sponge, snow or other materials absorbing sonic wave.*
   - *Smaller objects than 14cm (Diameter), 1m length.*

Removal

1. Remove the rear bumper (Refer to the Body group - "Rear bumper")
2. Disconnect the wiring harness connector (A) from the rear bumper.

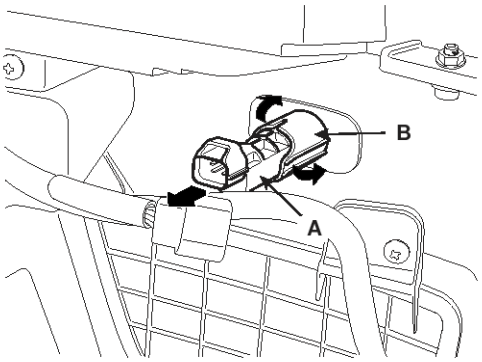
SHMBE8401D

3. Disconnect the sensor (A) connector (B) inside the rear bumper.



SHMBE8402D

4. Pull out the sensor (A) by opening the sensor holder (B) out.



SHMBE8403D

Installation

1. Connect the connector, and then reassemble the sensor.
2. Reassemble rear bumper.

Smart key System

Specification

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)

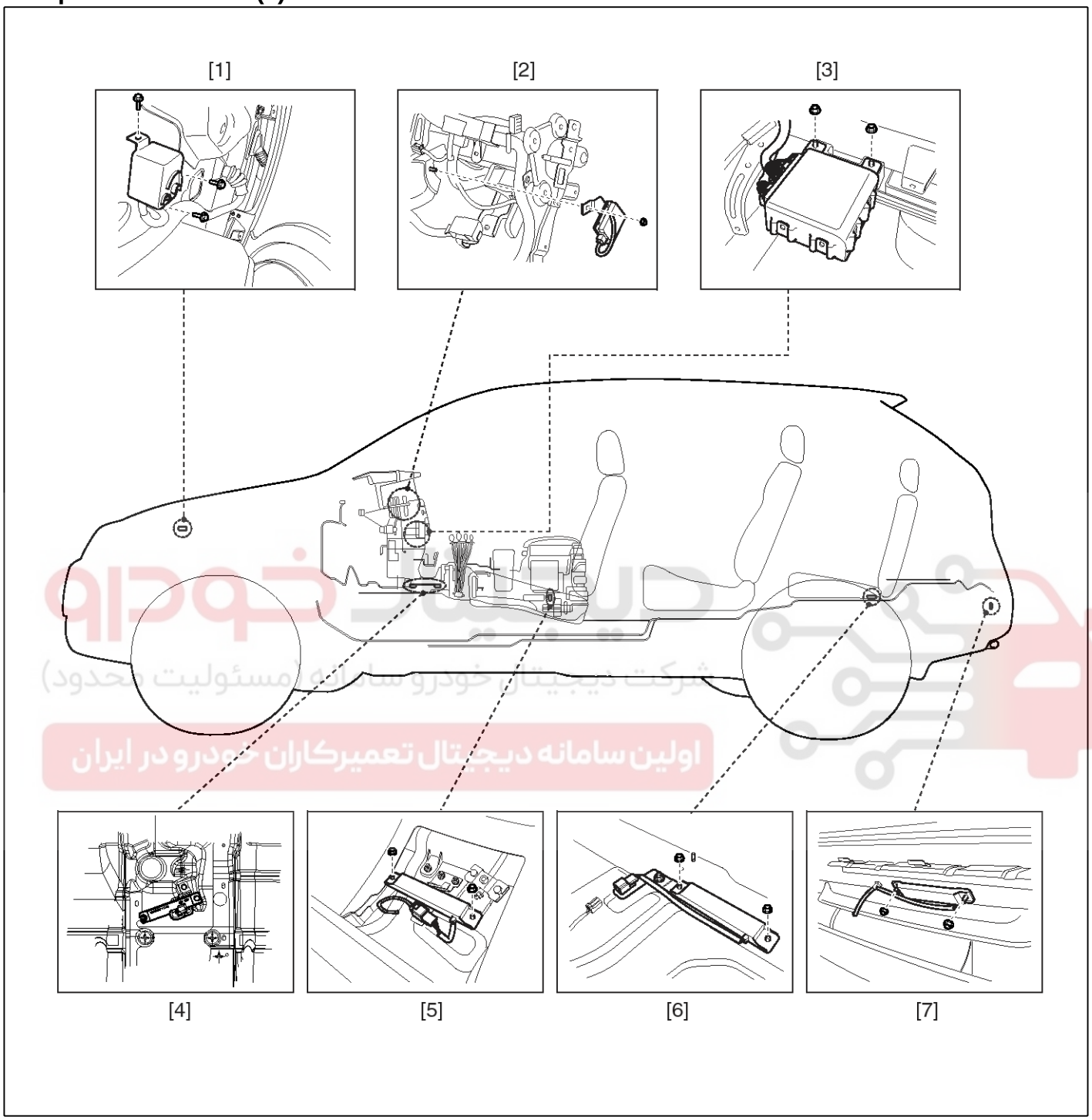
Smart Key Fob

Items	Specification
Battery	Lithium battery 3V
Distance	30m
Battery life	More than 2years
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)

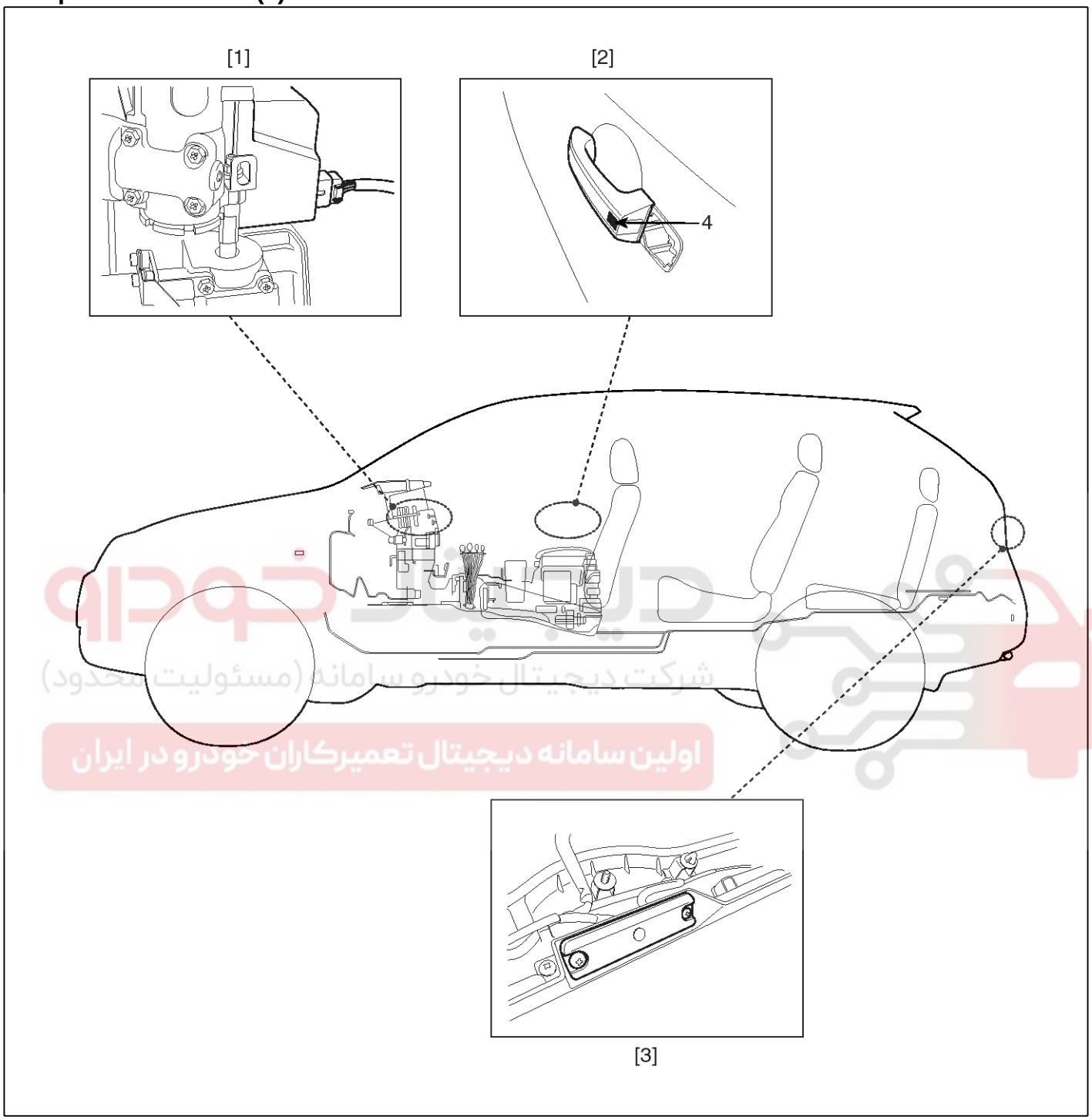
Component Location (1)



SHMBE9385N

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)



SHMBE8409D

1. Electronic Steering Column Lock(ESCL)
2. Door outside handle
3. Tailgate switch
4. Door outside handle button

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 or touching 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.

In a similar manner the vehicle's Electrical Steering Column Lock (ESCL) is released. 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
- Passive access tailgate via the trunk lid switch at the trunk
- Passive locking via tailgate
- Max. 2 fobs can be handled by the system
- Immobilizer backup antenna driver integrated into 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:

   - Pressing Push button in door hadle
   - Touching door handle, i.e. by CAPA SENSOR

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 release ESCL and 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), PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates via the CAN.

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

The system supports up to 2 SMART KEY FOBs to be used with one vehicle; actually, the SMART KEY system is planned with 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.

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 trunk/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 trunk interior: two in the passenger compartment and one in the trunk.

2. Bidirectional Immobilizer Antenna (for Limp Home):

   The Immobilizer Backup Antenna is used for sending and receiving data: it emits a magnetic field (125 - 135 kHz challenge) and receives changes in the field strength (response of Transponder).

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.

Another button is installed at the trunk lid.

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 trunk access range is also min. 0.7m measured from the antenna position.

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

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.

Passive Trunk Warning

Whenever the trunk is closed, SMK ECU uses a suitable search strategy to avoid trunk buzzer warning by a fob outside the vehicle. Then SMK searches for a SMART KEY FOB in the interior of the trunk. If a valid SMART KEY FOB is found in the trunk, the SMK ECU activates SMK external buzzer (TBD) to inform the user that the trunk has been closed with a fob inside the trunk.

SMK will send the trunk open command to BCM for trunk reopening if Trunk reopening bit is set(BK)For this functionality, a "valid" SMART KEY FOB means any SMART KEY FOB that belongs to the vehicle, even if it's DEACTIVATED.

NOTICE

- *A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning. Due to the penetration of the bumper antenna into the trunk area the lid may open without an Identification Device outside.*
- *A blind spot in the trunk similar to any RF disturbance may lead to no trunk warning*

Activation And Deactivation Of Fob

If the ATWS (Anti Theft Warning System) goes into ARM mode (information received by CAN along with the fob number that has triggered the change from DISARM to ARM, SMK performs an interior searching for a fob.

If any SMART KEY FOB is detected inside the vehicle, SMK defines the FOB as invalid until the ATWS goes into DISARM mode. Also SMK send the command for internal buzzer to BCM and BCM internal buzzer warning will be lasted for 5sec unless ATWS goes to DISARM.

- When vehicle has been locked by (Passive or RKE), a valid fob that does not send the lock command is found inside the vehicle.
- When vehicle has been locked by Auto-Lock (automatic lock of the vehicle 30 seconds after unlocking, without opening of any door.

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:

   - 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

   - 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 tail gate) 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 tail gate 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:

   - 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)

   - 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) &&:

   - (All doors are closed) && (tailgate closed)

2. Event:

   - 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:

   - User presses the door handle Push button

3. SMK ECU actions:

   - 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 trunk (or tailgate depending of the vehicle configuration): use of mechanical key

User Information Functions

ID OUT Warning

1. Preconditions:
   - (ACC or IGN1) && (any door open or tailgate open)
2. Event:

   The last opened door is closed
3. SMK action:

   SMK searches for a SMART KEY FOB in the interior.
   - 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).
   - 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.

NOTICE

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

Fob Deactivation

After the fob deactivation, SMK activates exterior buzzer and also sends by CAN/LIN request for BCM internal buzzer activation. If the ATWS goes to DISARM mode during buzzer warning, the warning stops immediately.

Immobilizer Lamp

Cases like releasing the MSL Knob in OFF position will switch off the 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, ESCL and FOBs is described.

For the learning of the SMK, PDM, ESCL 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 secrect 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 ESCL 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 ESCL and SMART FOB are already learnt with same PIN code
- PDM replacement: PDM is not learnt, SMK and ESCL and SMART FOB are already learnt with same PIN code
- ESCL replacement: ESCL is not learnt, SMK and PDM and SMART FOB are already learnt with same PIN code
- Additional or new keys teaching: SMK and PDM and ESCL 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
↓
ESCL start to learn
↓
Smart key #1 learnt
↓
SMK/PDM/ESCL 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, ESCL, 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.

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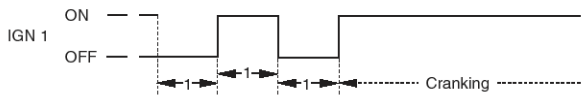
Starting After Replacing (virgin Start)

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

- It is for starting at virgin condition
- All related parts are virgin condition (Smart key, IPM, PDM, ESCL ECM)
- ESCL is always unlock at virgin
- 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.



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Inspection

Self Diagnosis With Scan Tool

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

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

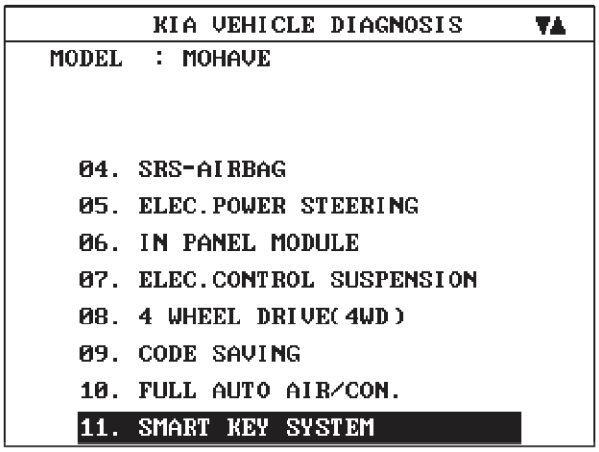
1. Problem in SMART KEY unit input.
2. Problem in SMART KEY unit.
3. Problem in SMART KEY unit output.

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 scan tool to the data link connector in driver side crash pad lower panel, turn the power on scan tool.
2. Select the vehicle model and then SMART KEY system.



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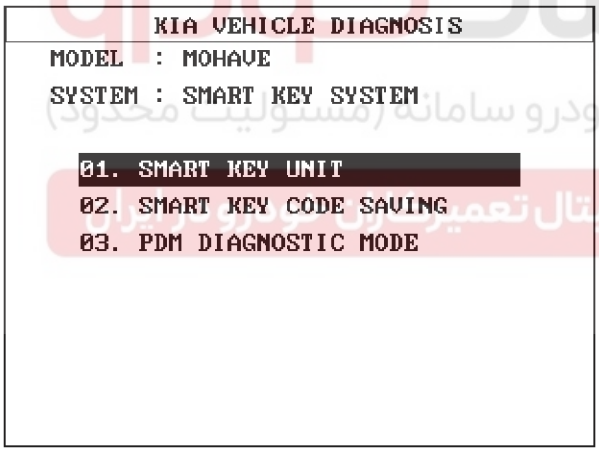
3. Select the "SMART KEY UNIT".



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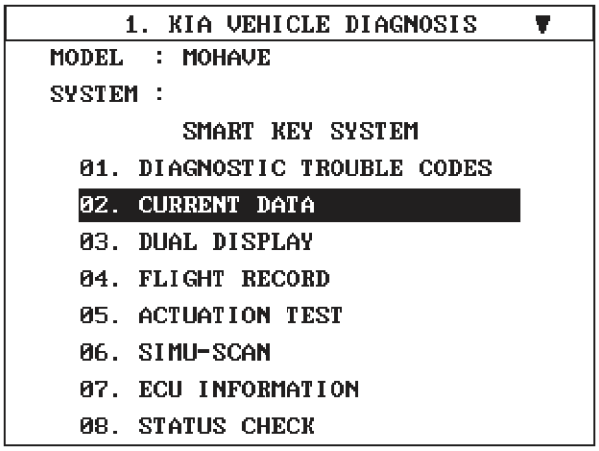
4. After IG ON, select the "Current data".



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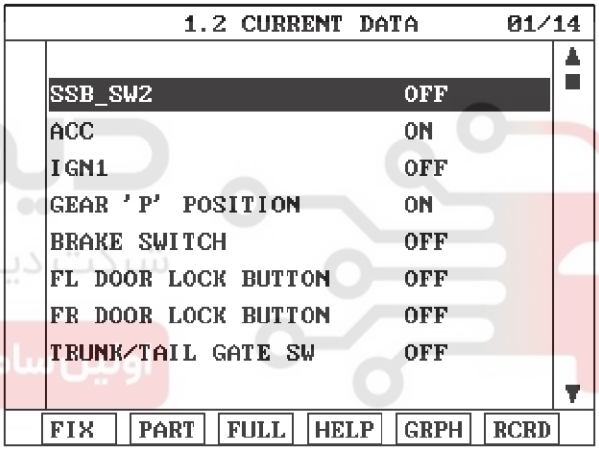
5. You can see the situation of each switch on scanner after connecting the "current data" process.



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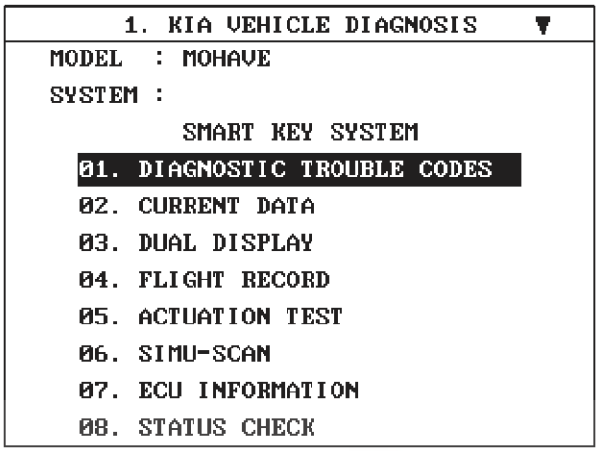
Communication Diagnosis With Scan Tool (Self Diagnosis)

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



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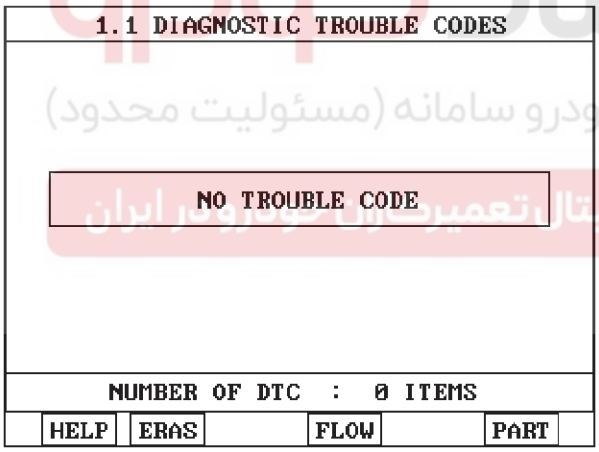

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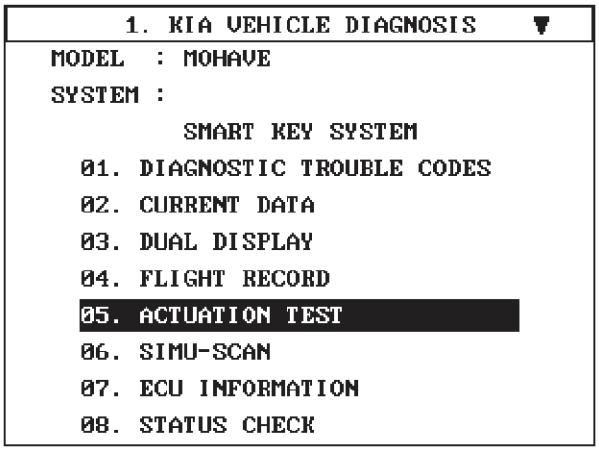
Antenna Actuation Diagnosis

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



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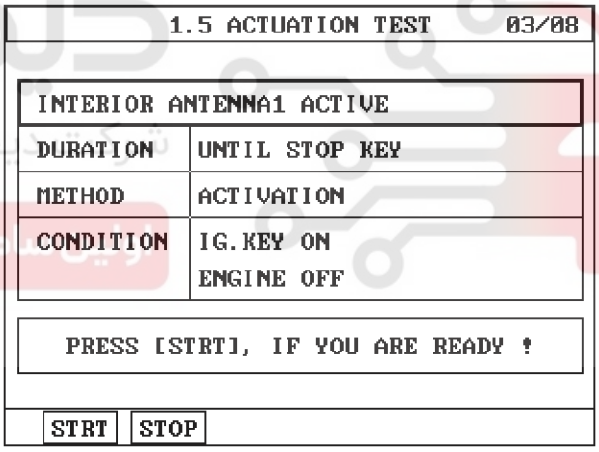
3. Set the smart key near the related antenna and operate it with a scanner.



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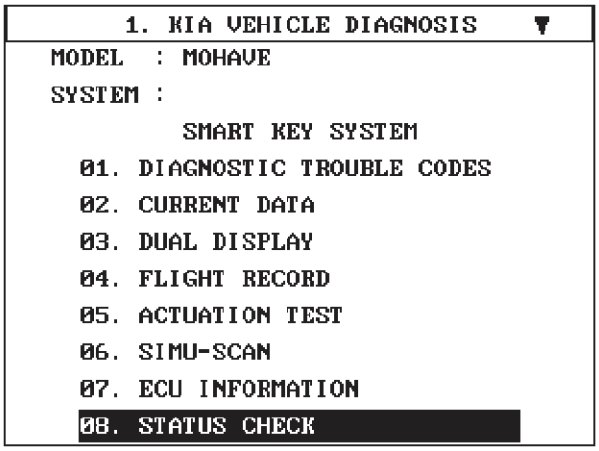
4. If the LED of smart key is blinking, the smart key is normal.
5. If the LED of smart key is not blinking, check the voltage of smart key battery.
6. Antenna actuation
   - Interior antenna 1
   - Interior antenna 2
   - Interior antenna 3
   - Bumper antenna
   - Driver door antenna
   - Assistant door antenna
   - Immobilizer indicator

Antenna Status Check

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. Select the "STATUS CHECK".



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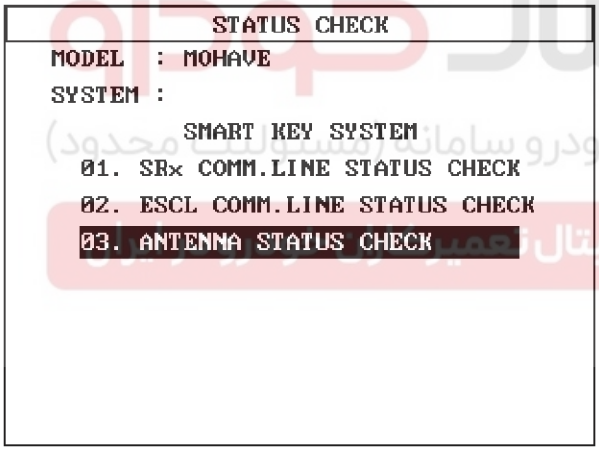
3. After IG ON, select the "ANTENNA STATUS CHECK".



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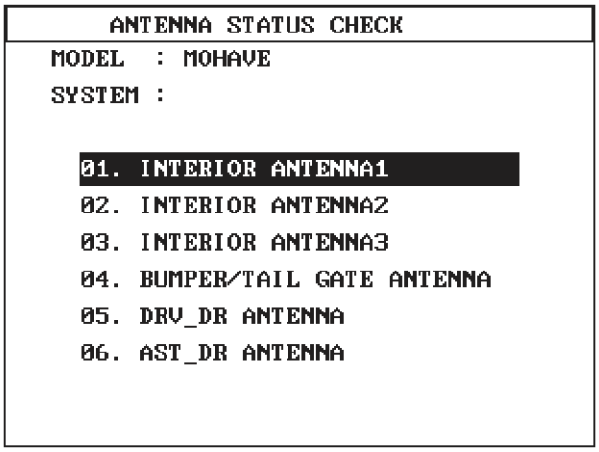
4. Set the smart key near the related antenna and operate it with a scanner.



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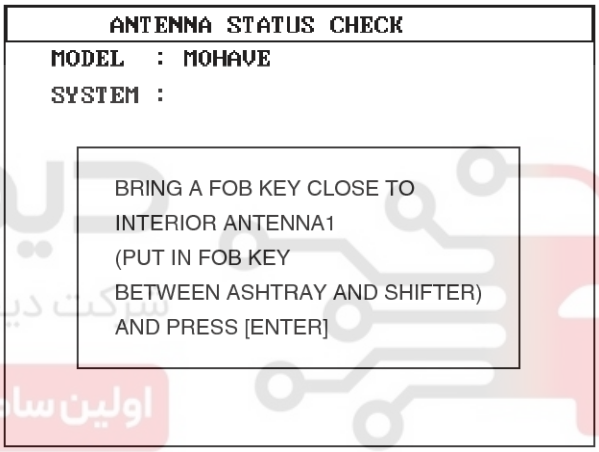

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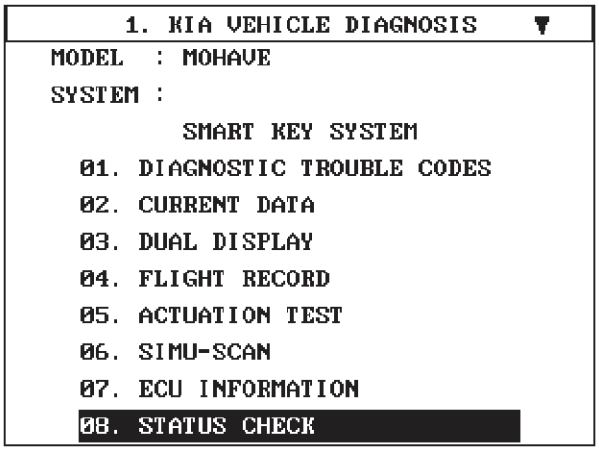
5. If the smart key works normally, the related antenna, smart key (transmission, reception) and exterior receiver are normal.
6. Antenna status
   - Interior antenna 1
   - Interior antenna 2
   - Interior antenna 3
   - Bumper antenna
   - Driver door antenna
   - Assistant door antenna

Serial Communication Status Check

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. Select the "STATUS CHECK".



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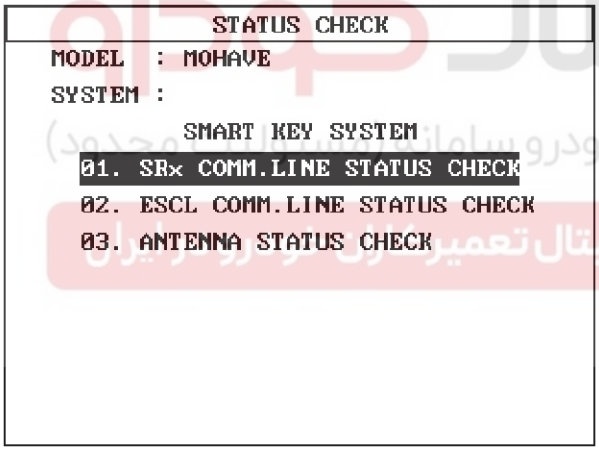
3. After IG ON, select the "SRx COMM. LINE STATUS CHECK".



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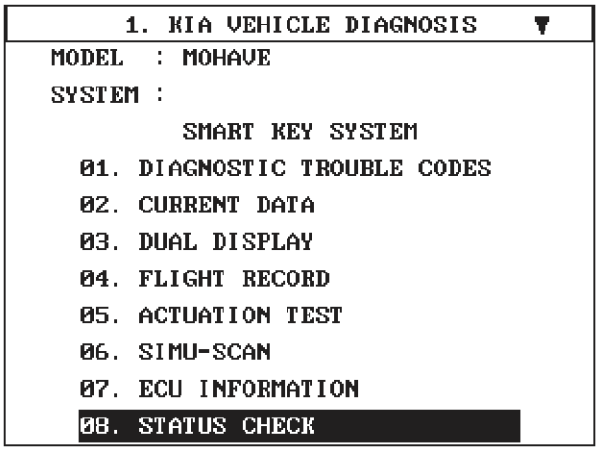
4. Check the serial communication line with a scanner.
5. If the smart key works normally, the communication of smart key unit, exterior receiver are normal.
6. If the smart key does not work properly, check the following items.
   - Disconnection or no response of the exterior receiver communication line.
   - The exterior receiver communication line disconnection and ground connection.

ESCL Communication Status Check

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. Select the "STATUS CHECK".



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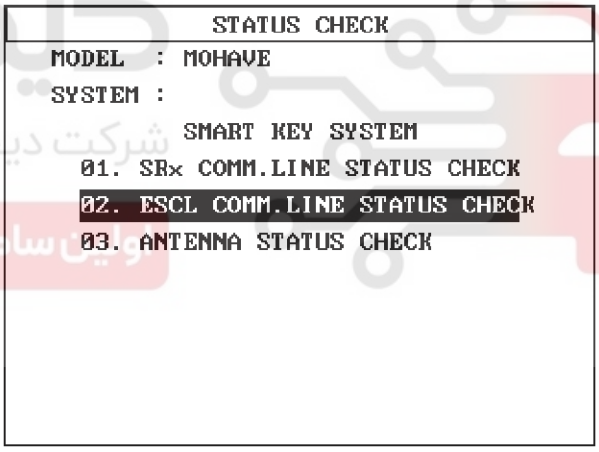
3. After IG ON, select the "ESCL COMM. LINE STATUS CHECK".



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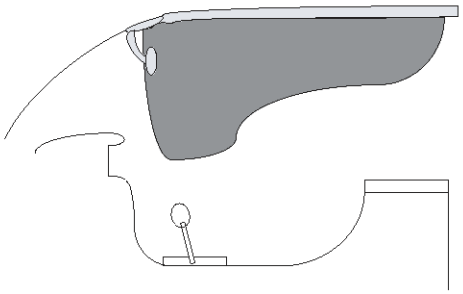
4. Check the ESCL communication line with a scanner.
5. If the smart key works normally, the communication of ESCL(Electronic Steering Column Lock) is normal.
6. If the smart key does not work properly, check the following items.
   - The ESCL disconnection or no response
   - The ESCL disconnection and ground connector

Interior Antenna Actuation Check

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



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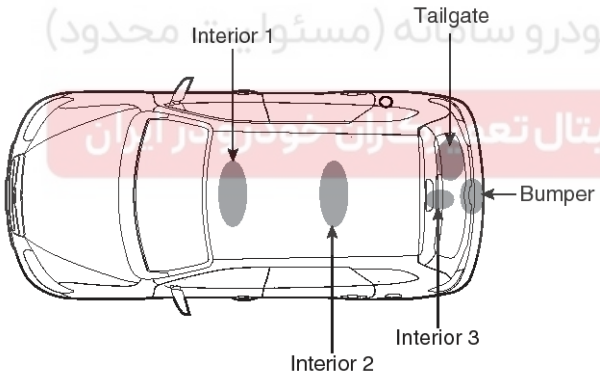
2. If the ignition is ON, the antenna works normally.
3. Check the interior antenna ignition mode.
4. Set the smart key in the following shade area and actuate the antenna. Check the LED of smart key is blinking.



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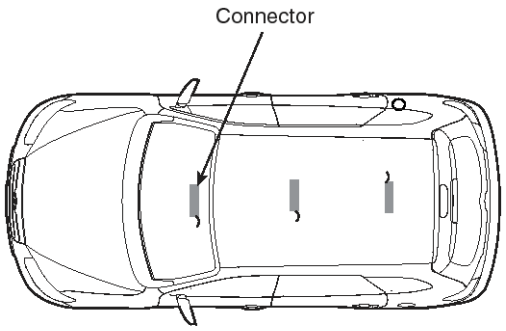
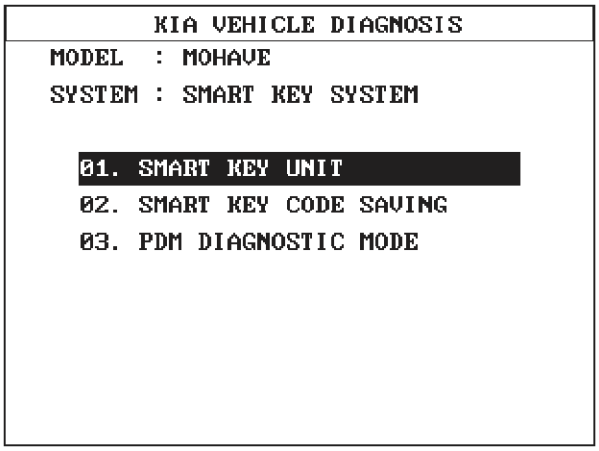
5. If the LED of smart key is not blinking, check the antenna in shade area.



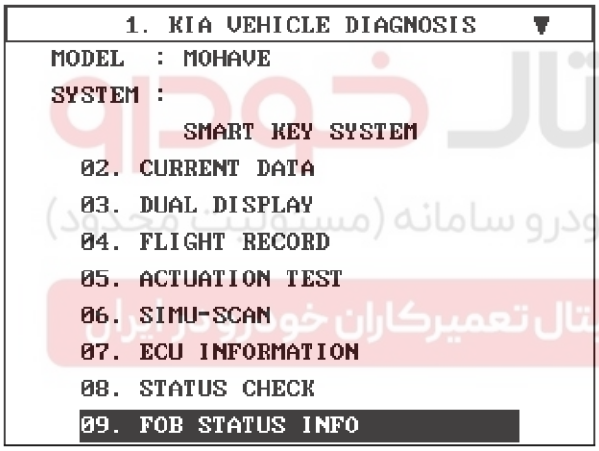
SHMBE9031L

FOB Status Check

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



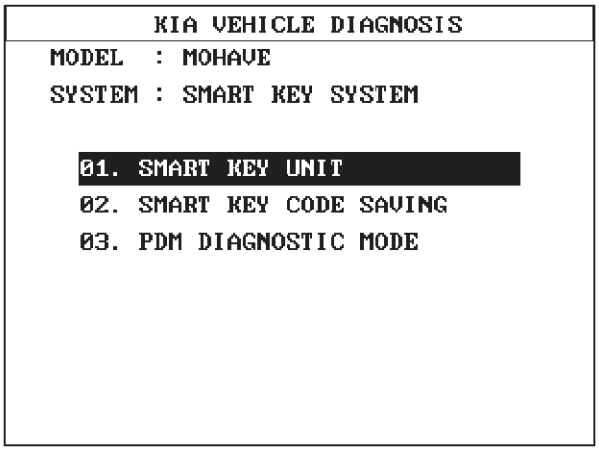
SHMBE9018L



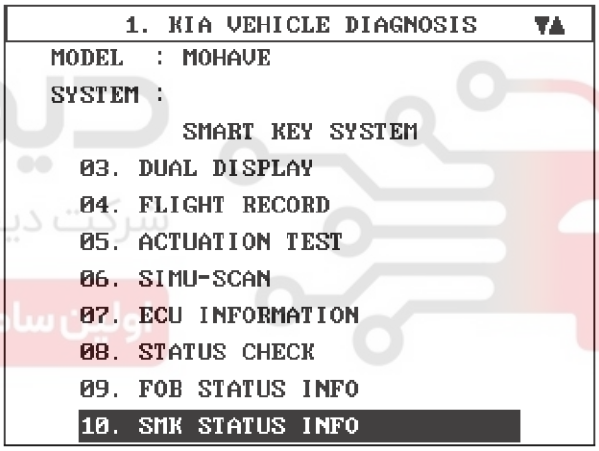
SHMBE9033L

Smart Key Status Check

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



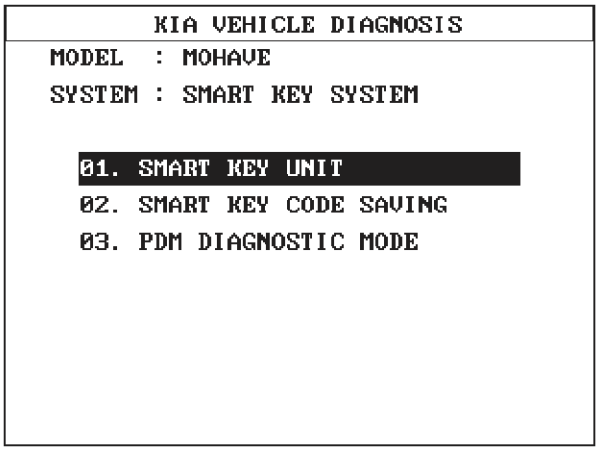
SHMBE9018L



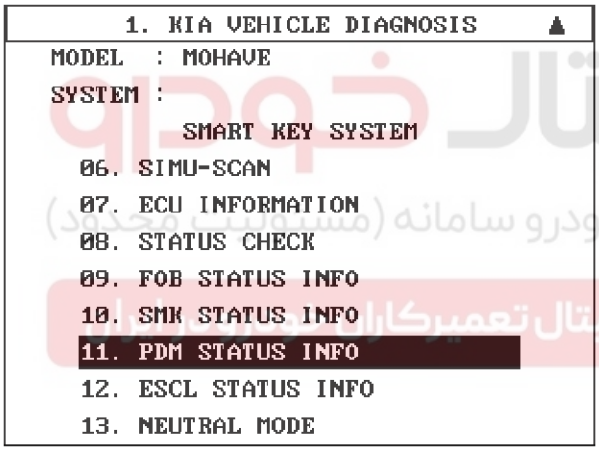
SHMBE9036L

PDM Status Check

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



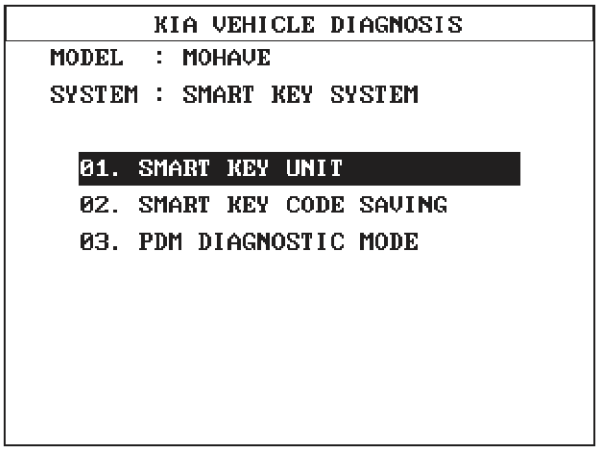
SHMBE9018L



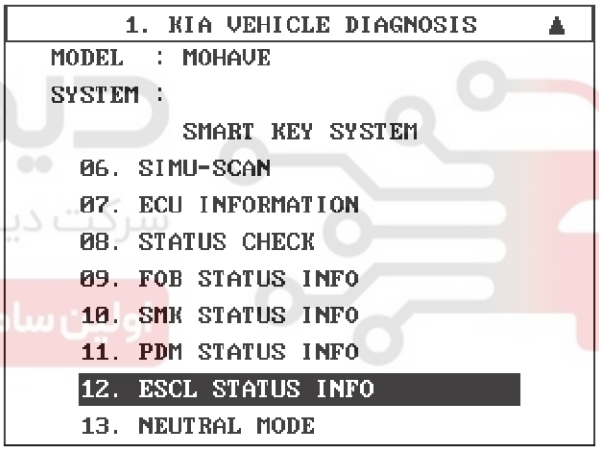
SHMBE9037L

ESCL Status Check

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



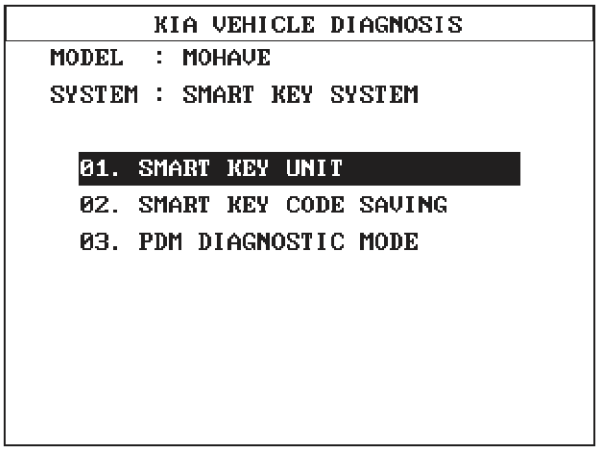
SHMBE9018L



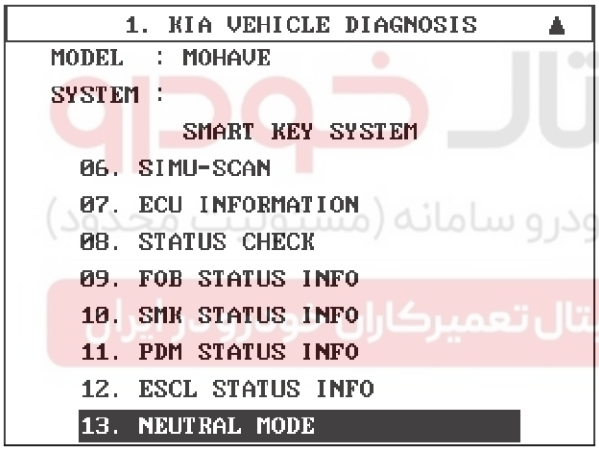
SHMBE9039L

Neutralization Status Check

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



SHMBE9018L



SHMBE9042L

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	Tailgate SW	-
9	Battery Voltage	-
10	Alternater Voltage	-
11	Immobilizer Lamp	-
12	External Buzzer	-
13	ESCL Enable	-
14	SMK 'Power Mode' State	-

Actuator List

No.	Item name	Condition
1	Immo.indicator Lamp	Ignition switch ON Engine off
2	External Buzzer	Ignition switch ON Engine off
3	Interior Antenna 1 Active	Ignition switch ON Engine off
4	Interior Antenna 2 Active	Ignition switch ON Engine off
5	Interior Antenna 3 Active	Ignition switch ON Engine off
6	Trunk Antenna Active	Ignition switch ON Engine off
7	Bumper/tail Gate 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

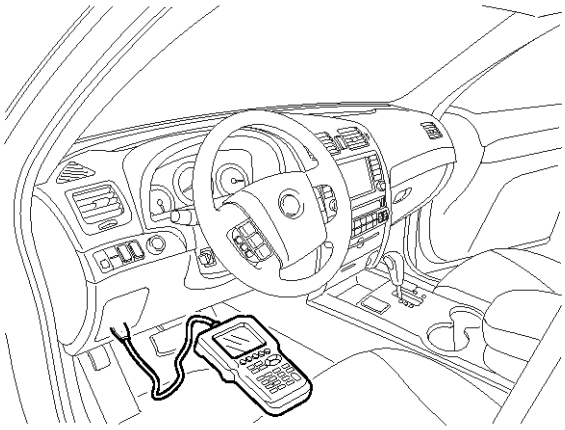
DTC List

NO	DTC	Code Name
1	B1602	CAN Error
2	B1603	CAN Communication Bus Off
3	B1689	CAN time-out PDM
4	B1625	ECM Communication data failure
5	B1971	Parking Position Input Error
6	B1978	ESCL Failure

Smart key

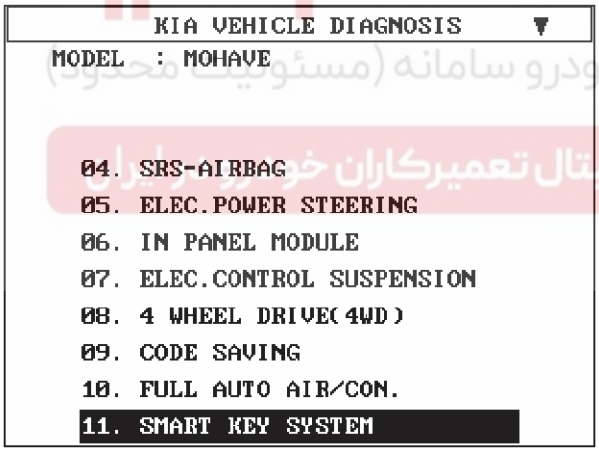
Smart Key Registration

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

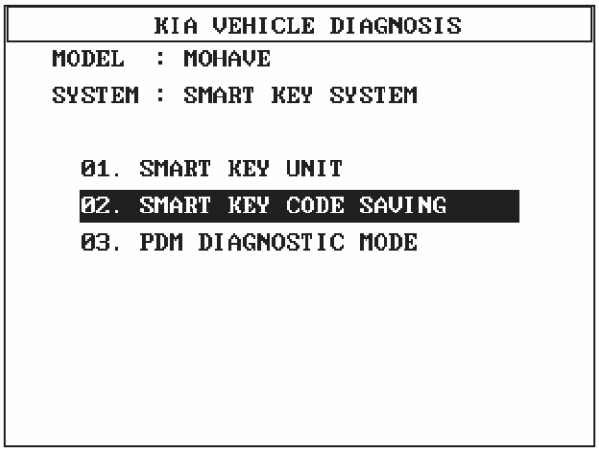


SHMBE9310N

2. After IG ON, select vehicle.
3. Select the “Smart key system” and "Smart key code saving”.

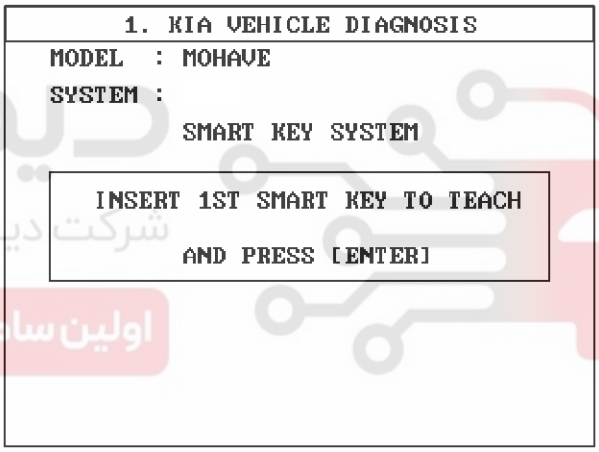


SHMBE9044L



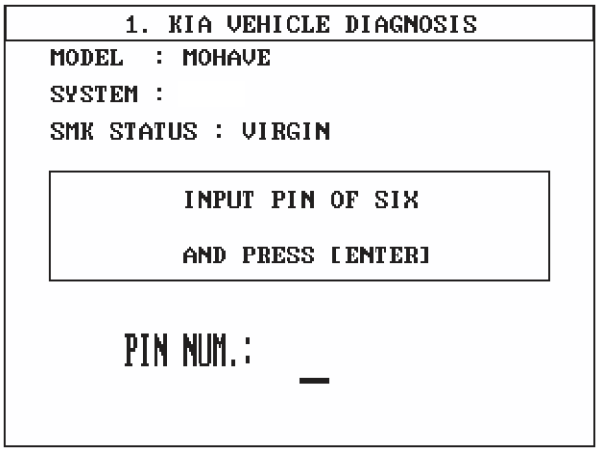
SHMBE9133L

4. Insert into key holder one fob key to be learnt and press “ Enter”.



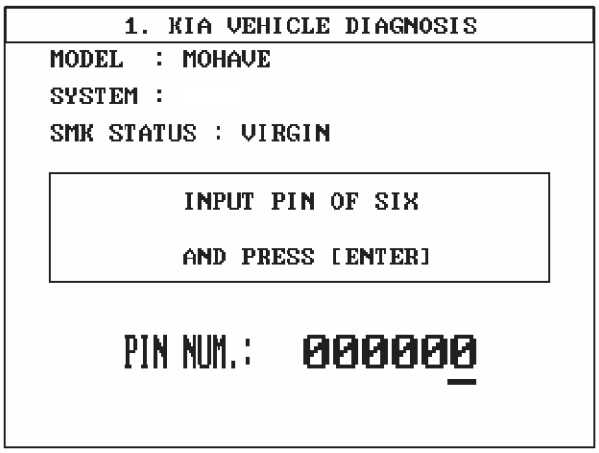
SHMBE9045L

5. Input the pin code to learn.



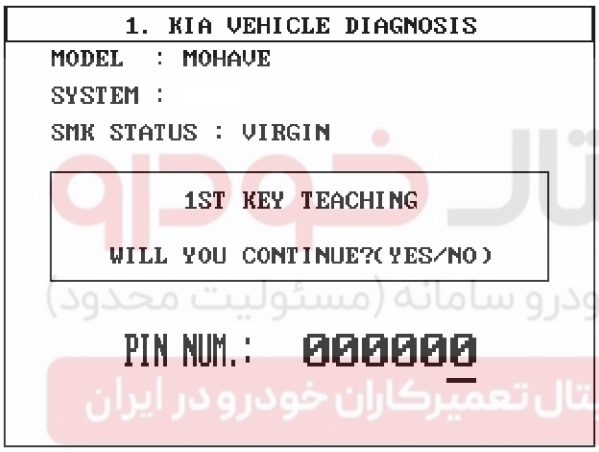
SHMBE9046L

6. Start the first key learning.



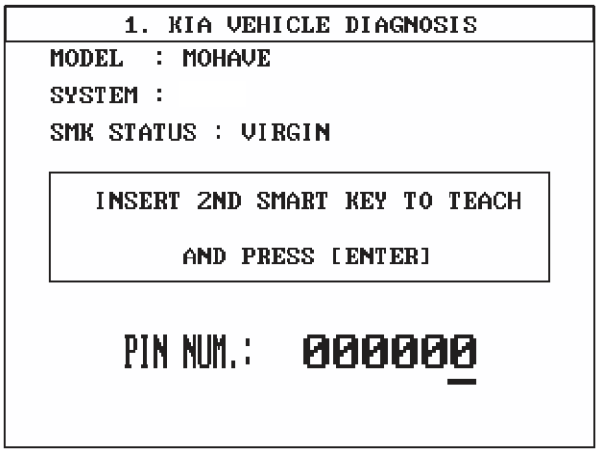
SHMBE9047L

7. Complete the first key learning.



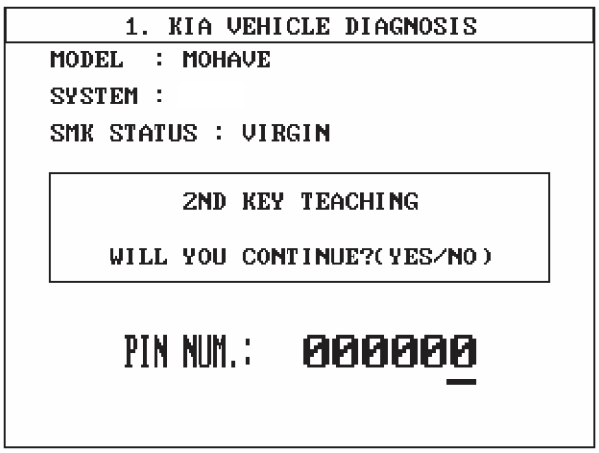
SHMBE9048L

8. Start the second key learning.

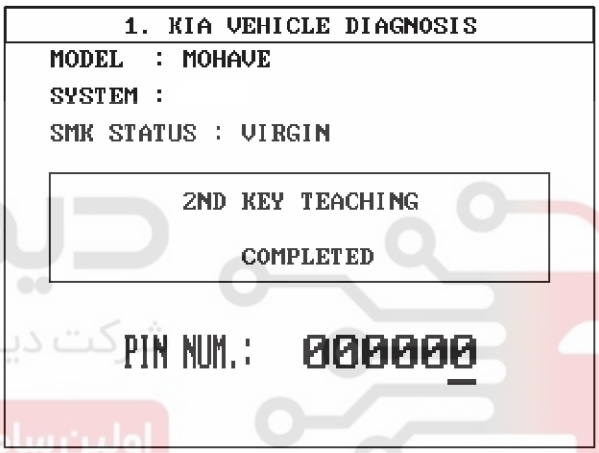


SHMBE9049L

9. Complete the second key learning.



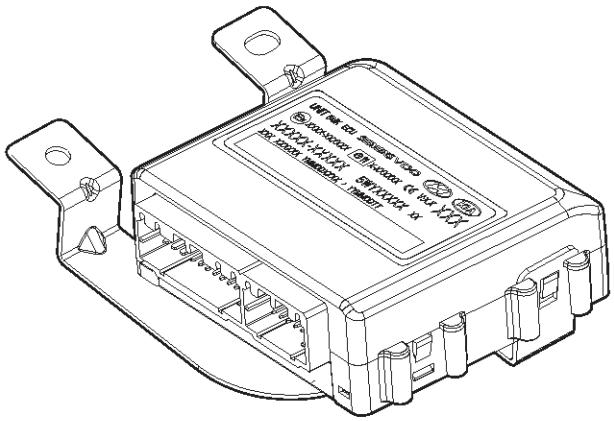
SHMBE9050L

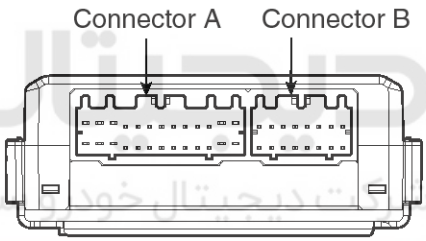


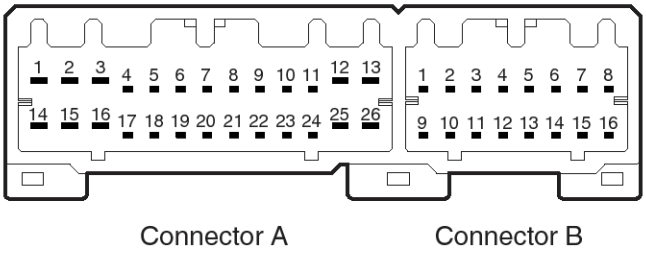
SHMBE9051L

Smart key unit

Components





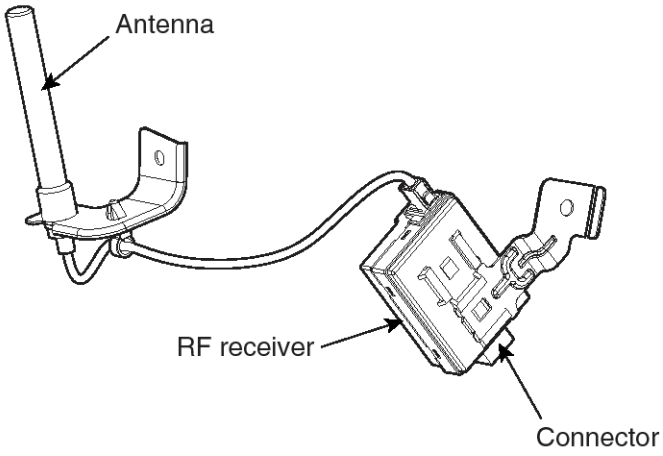


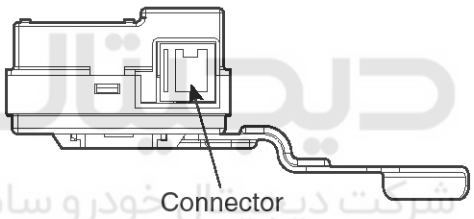
SHMBE9052L

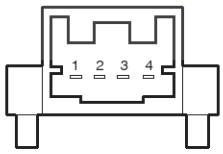
Smart key System BE-361

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	ESCL enable	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	Tailgate Antenna 1
7	Exterior Buzzer	23	Start 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	ESCL communication			12	-
13	RF communication			13	Interior 3 Antenna 2
14	IGN 1			14	Tailgate Antenna 2
15	P position			15	Front-right door Antenna 2
16	Ground 2			16	Front-left door Antenna 2



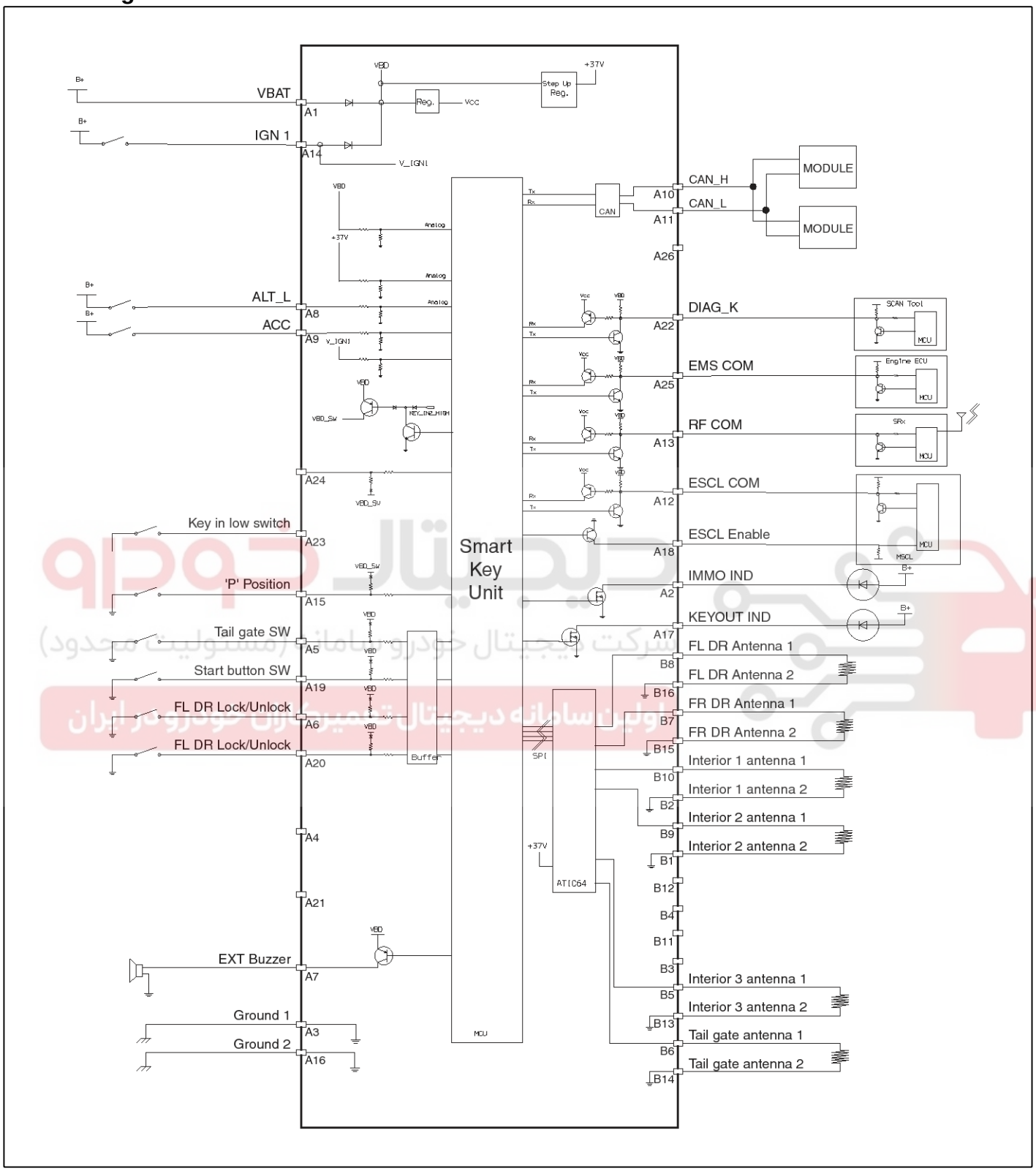




No.	Name
1	Receiving data
2	-
3	Power
4	Ground

SHMBE9056L

Circuit Diagtam



SHMBE9053L

Inspection

Smart Key Unit

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

Smart Key Switch

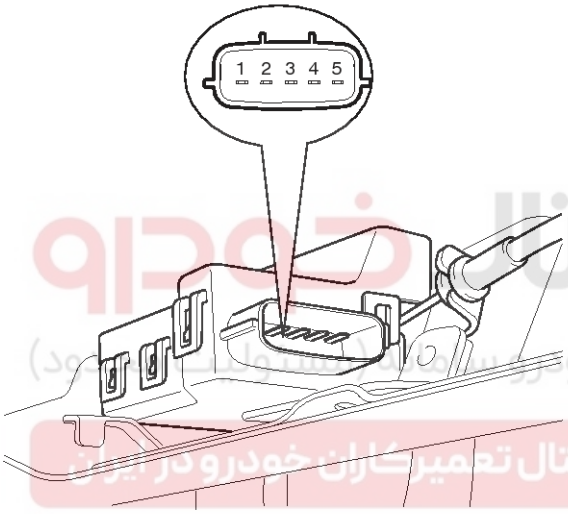
- Refer to the BE group - inspection / self diagnosis with scan tool.

Antenna

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

Tailgate Switch

1. Check for continuity between the tailgate latch terminals.



SHMBE8433D

2. If continuity is not specified, inspect the switch

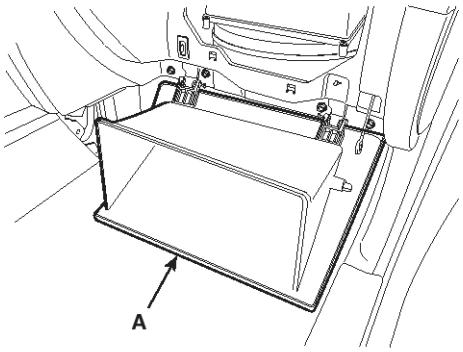
Terminal / Position	5	4	3
Unlock	○	○	○
1st Lock	○	○	
Complete Lock		○	○

SHMBE9054L

Removal

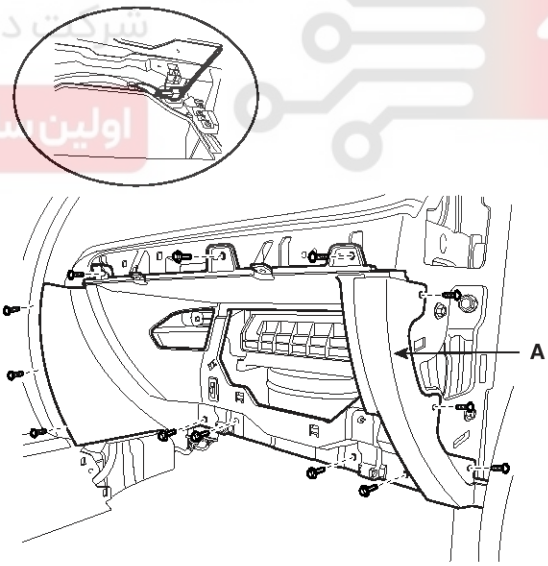
Smart Key Unit

1. Disconnect the negative (-) battery terminal.
2. Remove the passenger side glove box (A).
   (Refer to the Body group – “Crash pad”)



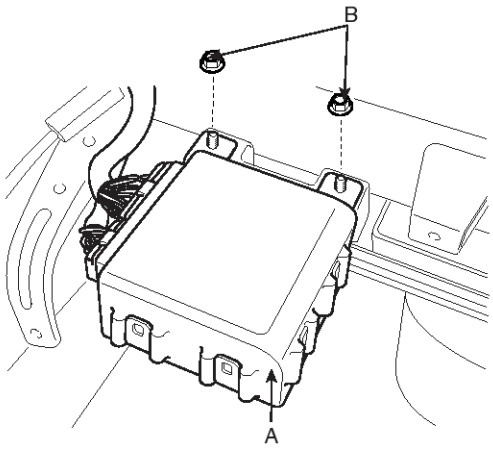
SHMBE8413D

3. After loosening the mounting screws, remove the glove box housing (A).
   (Refer to the Body group – Crash pad”)



SHMBE8414D

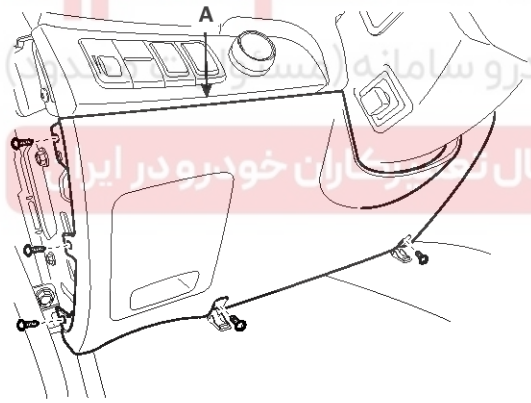
4. After disconnecting the smart key unit connector, loosen the smart key unit mounting nuts(B) and remove the smart key unit(A).



SHMBE8415D

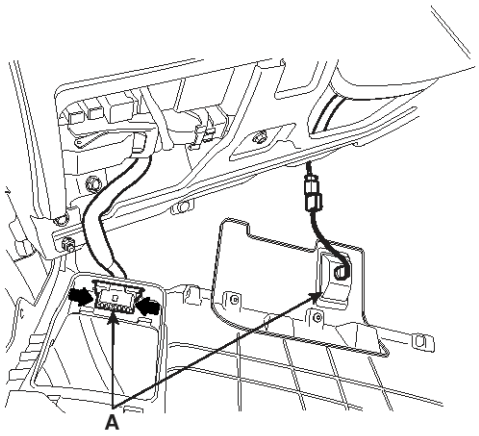
RF Receiver

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



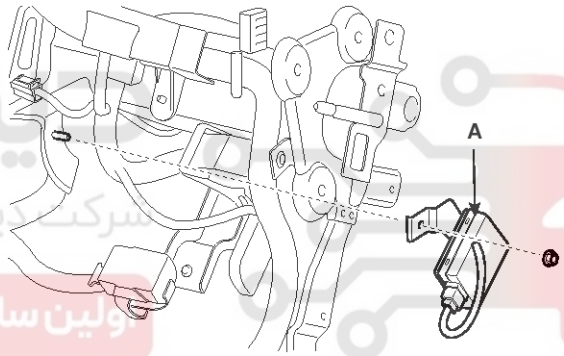
SHMBE8371D

3. Disconnect the connectors (A).



SHMB18035D

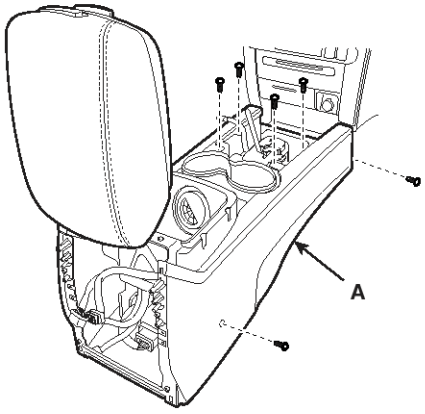
4. After loosening the mounting nut(1EA), disconnect the connector and remove the receiver (A).



SHMBE8418D

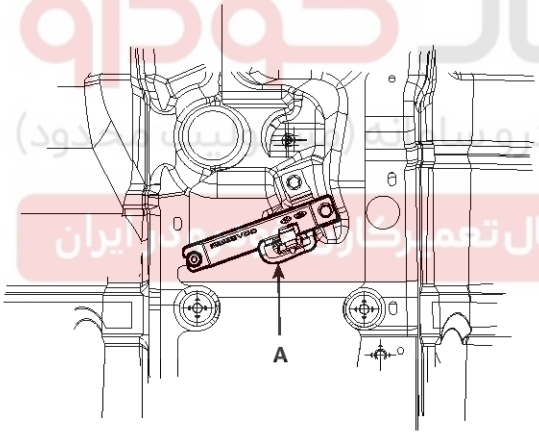
Interior 1 Antenna

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



SHMBE8422D

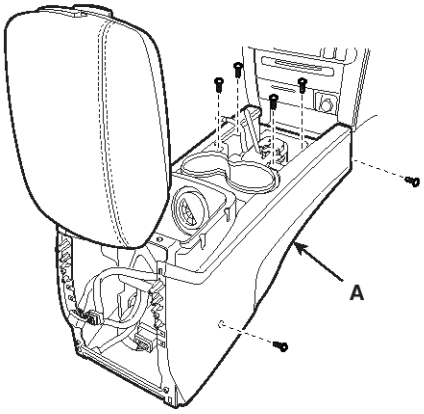
3. After loosening the antenna nuts(2EA) and connector, remove the interior 1 antenna (A).



SHMBE8421D

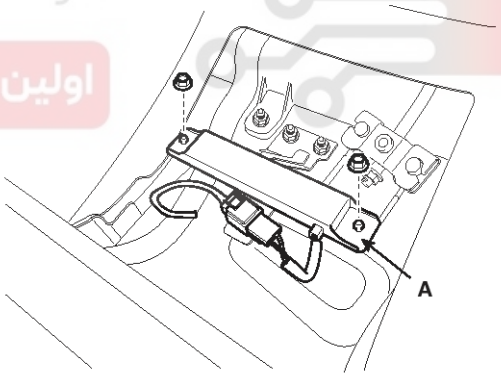
Interior 2 Antenna

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



SHMBE8422D

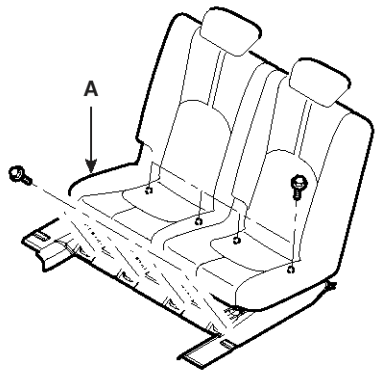
3. After loosening the connector mounting bracket nuts at the back of the console, disconnecting the interior 2 antenna connector.
4. After loosening the nuts(2EA), remove the interior 2 antenna(A).



SHMBE8423D

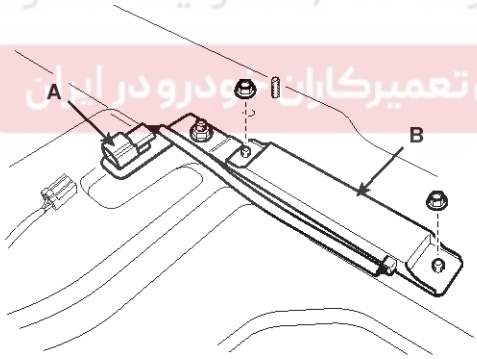
Interior 3 Antenna

1. Disconnect the negative (-) battery terminal.
2. After loosening the mounting bolts, then remove the third seat assembly(A). (Refer to the Body group - Rear seat)



SHMBD8359D

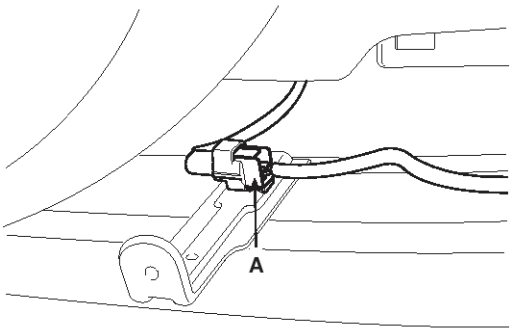
3. After loosening the connector mounting bracket nut(1EA), disconnect the antenna connector(A).
4. After loosening the nuts(2EA), remove the interior 3 antenna(B).



SHMBE8425D

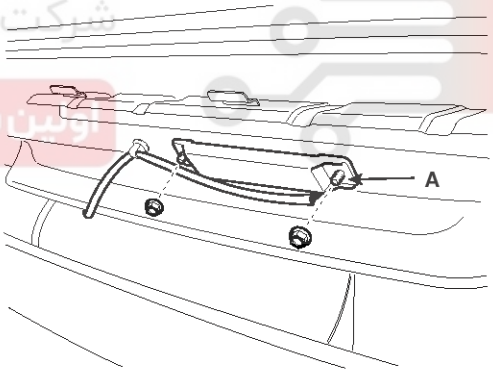
Exterior Bumper Antenna

1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper.
   (Refer to the Body group - Rear bumper)
3. Disconnect the antenna connector(A) on the right side of rear bumper.



SHMBE8426D

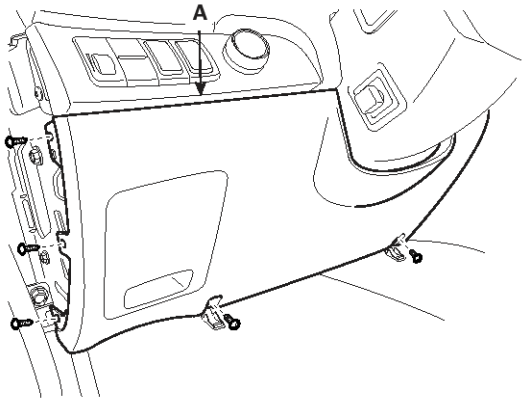
4. After loosening the nuts(2EA), remove the exterior bumper antenna (A).



SHMBE8427D

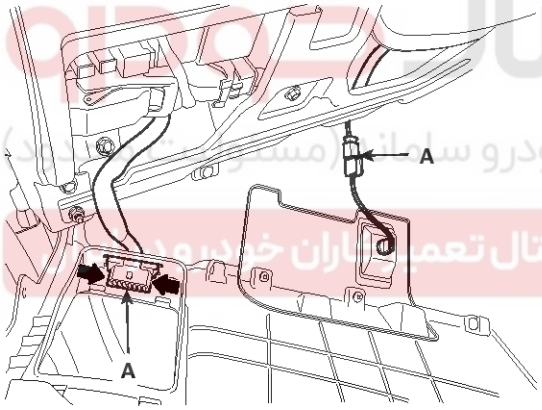
Buzzer

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



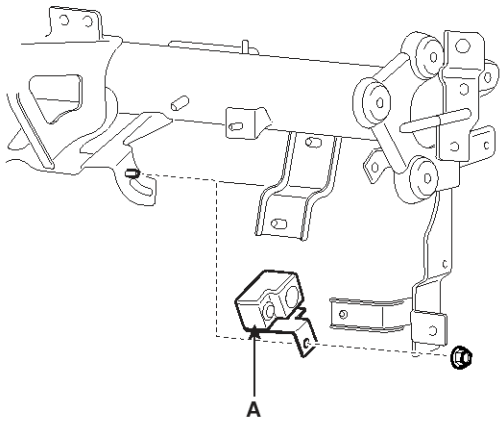
SHMBE8371D

3. Disconnecting the connectors (A).



SHMBE8372D

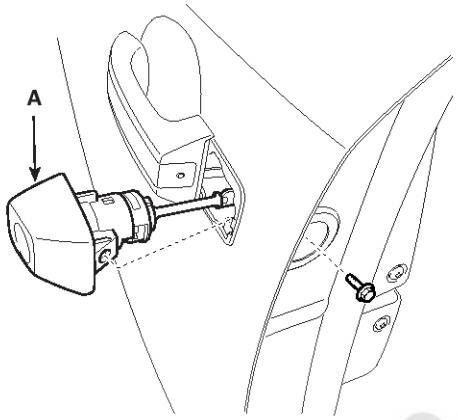
4. Remove the external buzzer (A).



SHMBE8995D

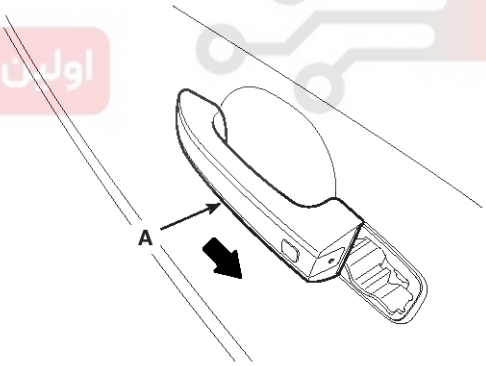
Door Outside Handle

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



SHMBE8429D

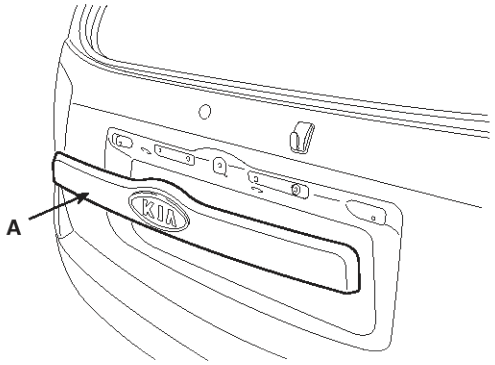
4. Remove the outside handle (A) by sliding it rearward.



SHMBE8430D

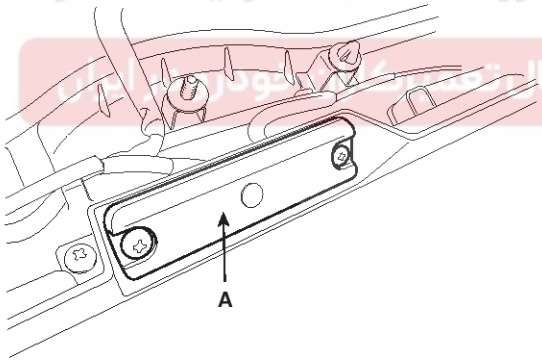
Tailgate Switch

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



SHMBE8431D

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



SHMBE8432D

Installation

Smart Key Unit

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

RF Receiver

1. Install the RF receiver.
2. Install the crash pad lower 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 connector mounting bracket.
3. Install the third seat assembly.
4. 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 crash pad lower panel.
3. Install the negative (-) battery terminal and check the smart key system.

Door Outside Handle

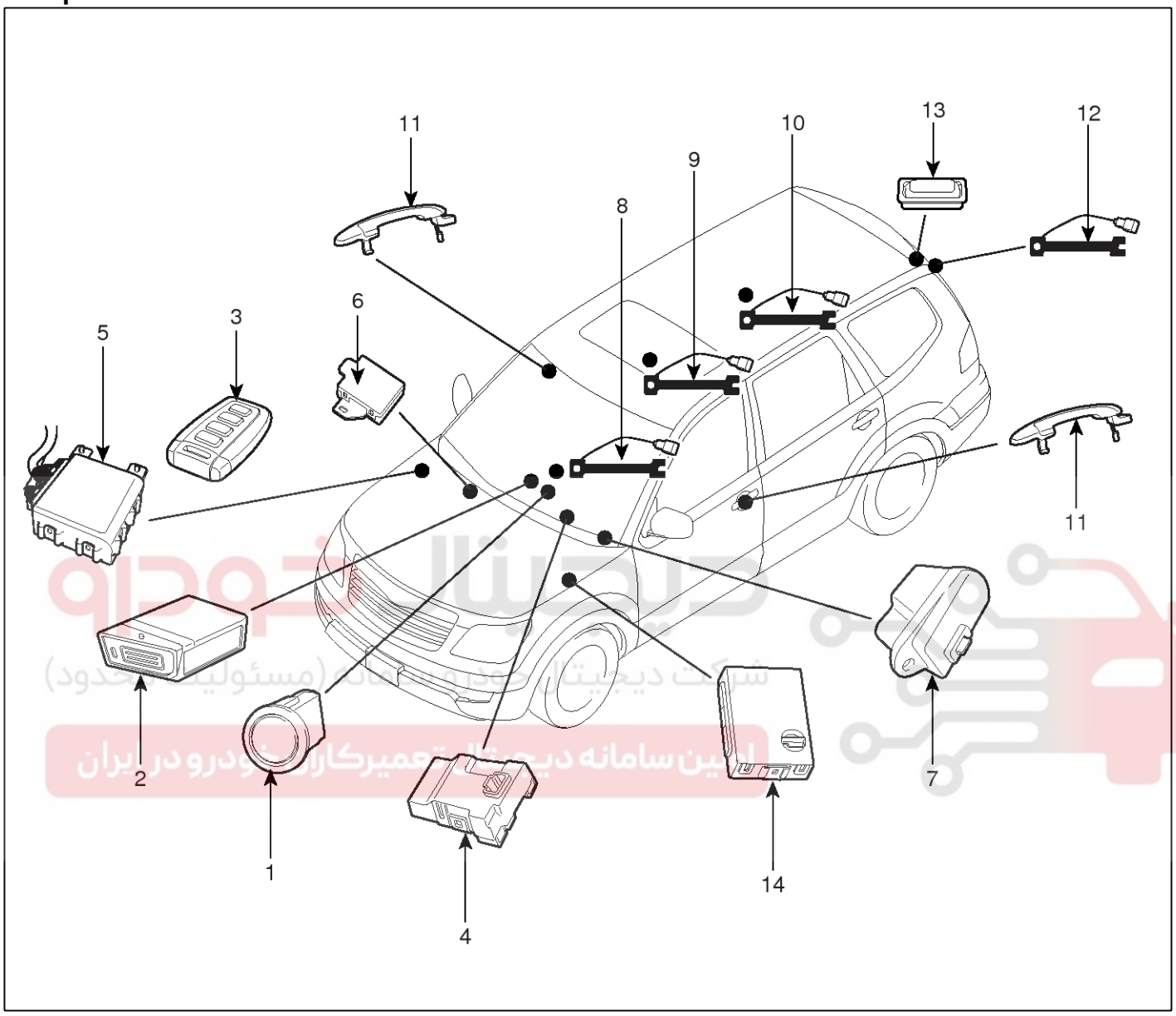
1. Install the outside handle.
2. Install the door trim.
3. Install the negative (-) battery terminal and check the smart key system.

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.

Button Engine Start System

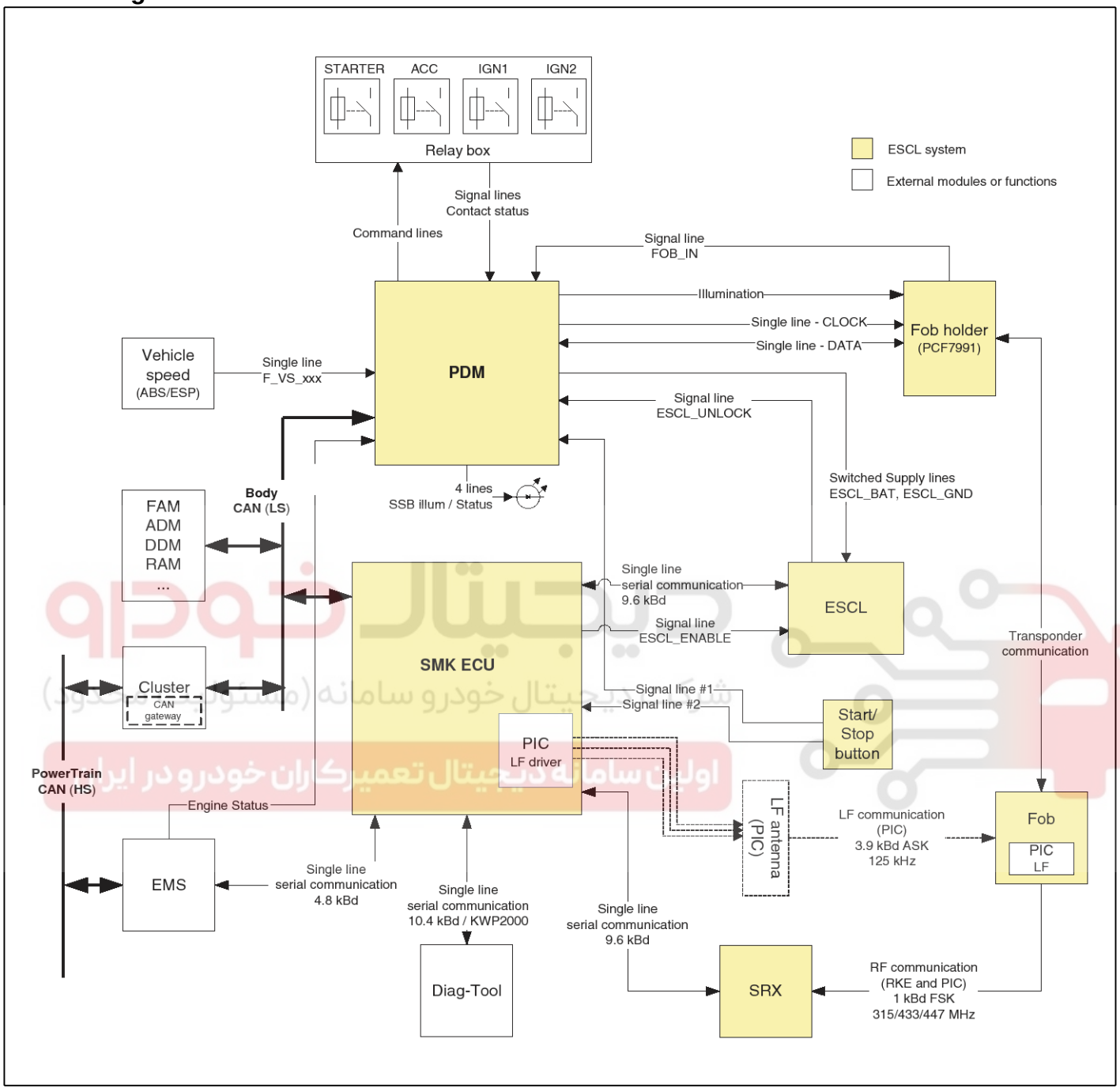
Component Location



SHMBE8438D

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. ESCL(Electrical Steering Column Lock)
8. Interior antenna 1
9. Interior antenna 2
10. Interior antenna 3
11. Door handle & door antenna
12. Bumper antenna
13. Tailgate switch
14. IPM(Instrument Panel Module)

Circuit Diagram



SHMBE9001L

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.
- Steering column locking with an ESCL device; Monitoring of the vehicle status to insure safe activation of the ESCL.
- 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

- Steering column locking/unlocking with ESCL.
- 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. It also manages the locking and the unlocking of the steering column (called as ESCL)without any specific actions by the driver.

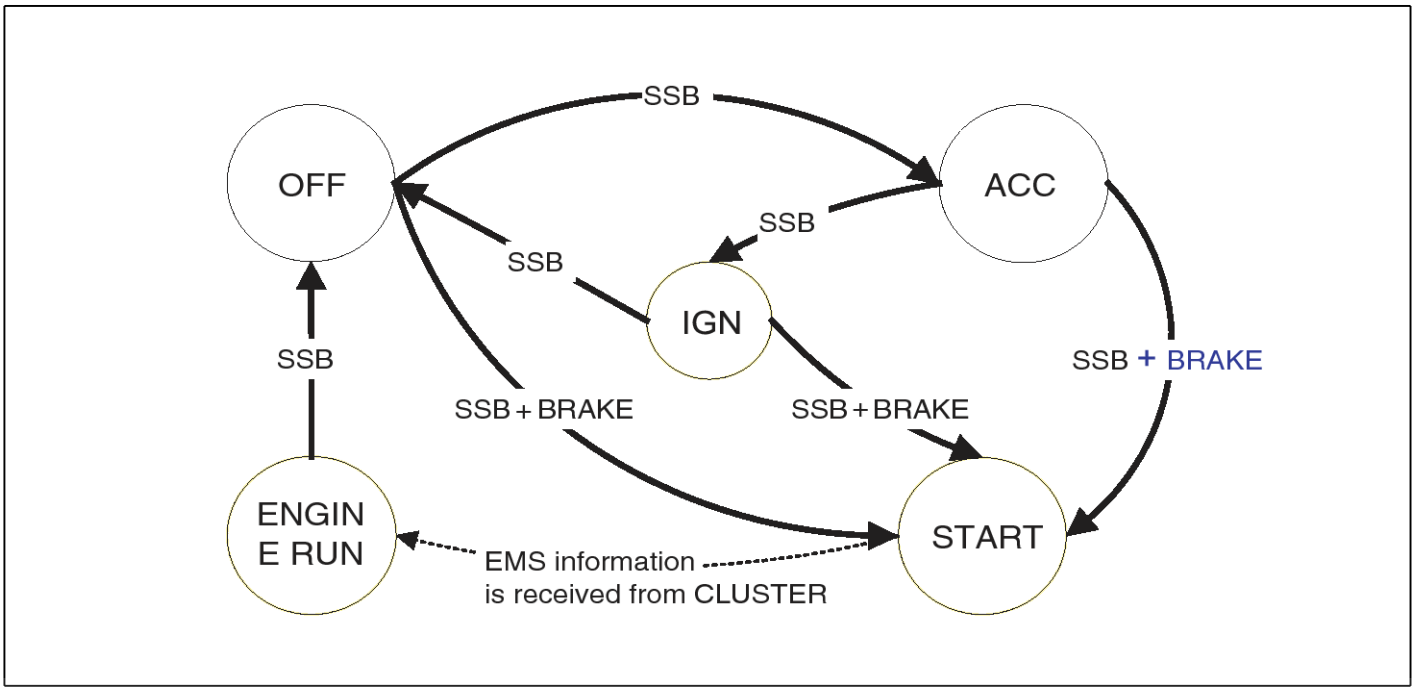
If the driver press the SSB while prerequisites on brakes, fob authentication and transmission status are satisfied, the BES System will proceed with the locking/unlocking of the steering column, the control of the terminal, and the cranking of the engine.

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.

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.



SHMBE9002L

- Control Ignition and engine ON/OFF by Sending signal to IPM and PDM.
- Display status by LED Lamp ON/OFF. (Amber or Green)

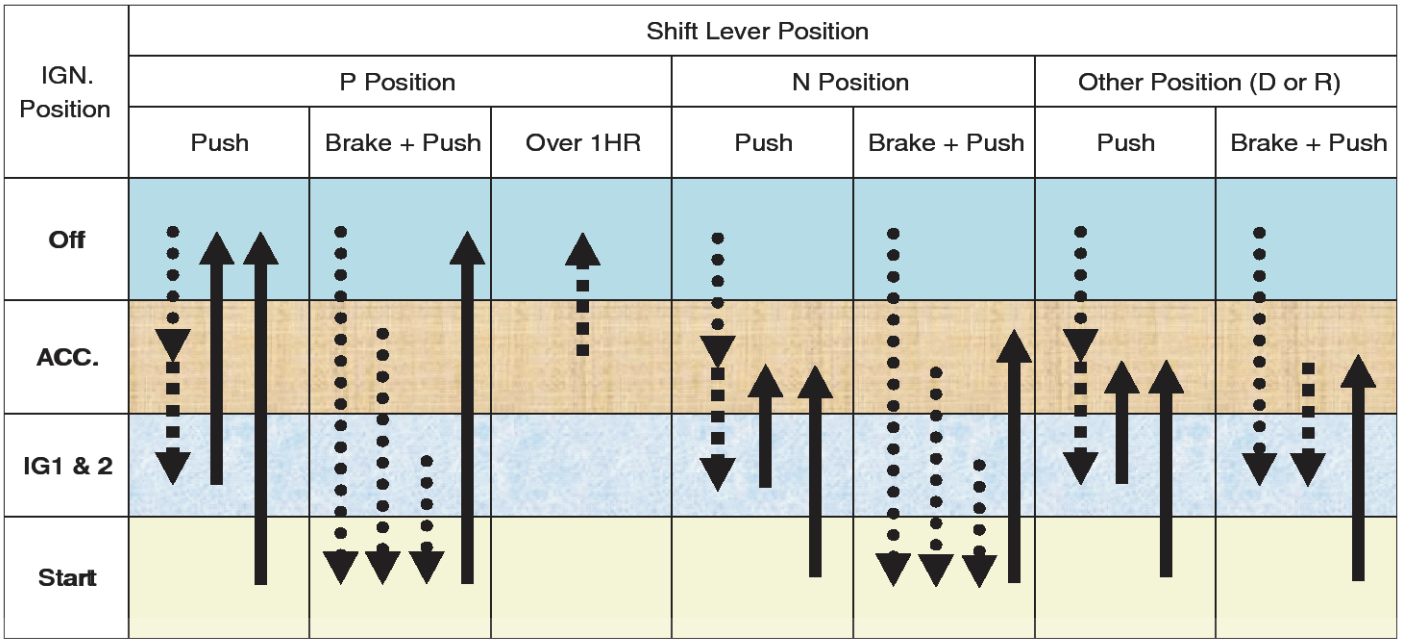
Indicator ON/OFF Condition At Ignition Key Off Condition

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

The shift of Ignition Position



SHMBE9003L

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.

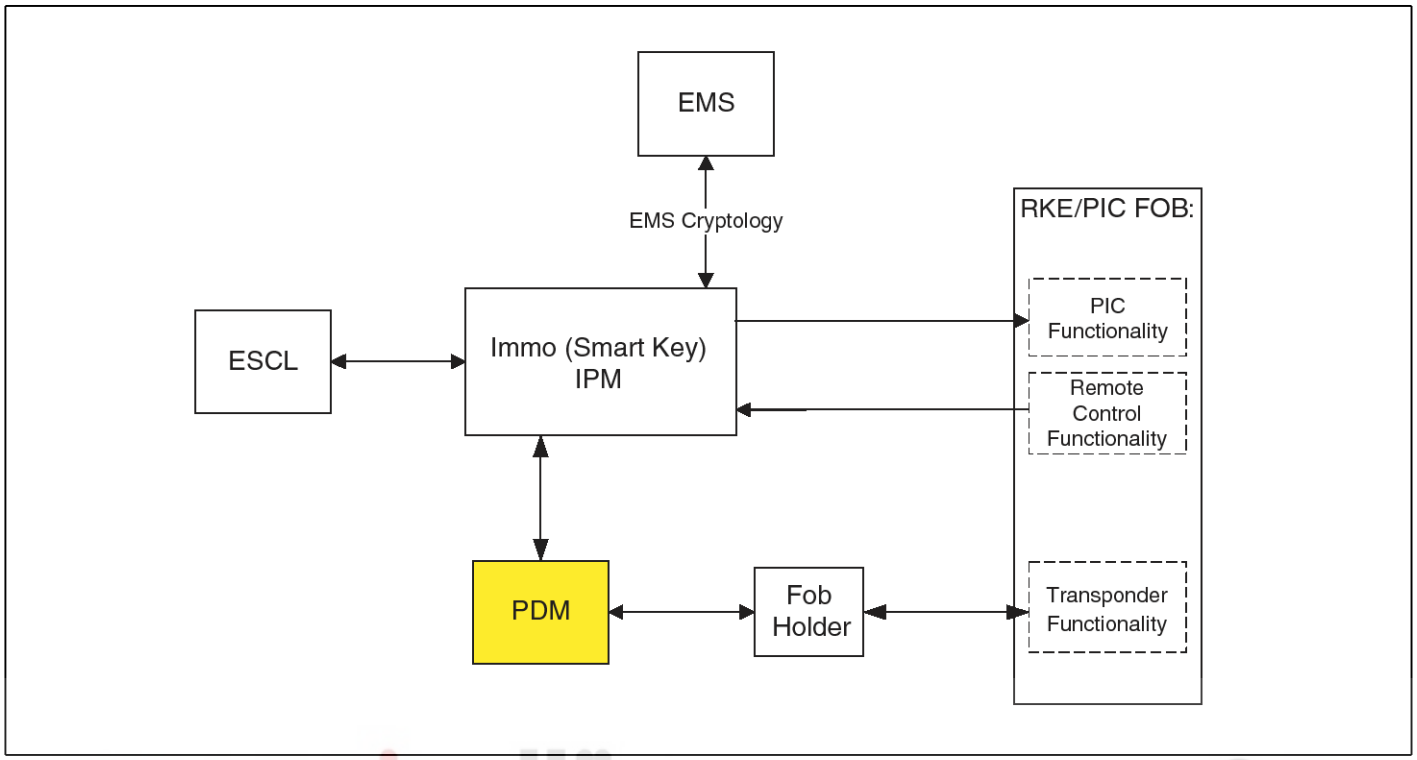
The transmitter, receiver and antennas required for the communication between the fob and the vehicle will differ depending on functionalities and regional areas.

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),
- "ESCL control",
- "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.



SHMBE9004L

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 ESCL/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

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.

It controls also the power supply of the ESCL by switching the power and ground ESCL supply lines depending on vehicle status. The purpose of this function is to prevent the ESCL to be energized if ACC or IGN are switched on.

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, ESCL lock status), controls the outputs (Engine relay output drivers, ESCL power), 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 and of the ESCL power 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 and the ESCL power supply. 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/ESP ECU.
- Control of SSB LEDs (illumination, clamp state) and FOB HOLDER illumination.
- Control of ESCL power lines and monitoring of the ESCL unlock status
- 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

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.

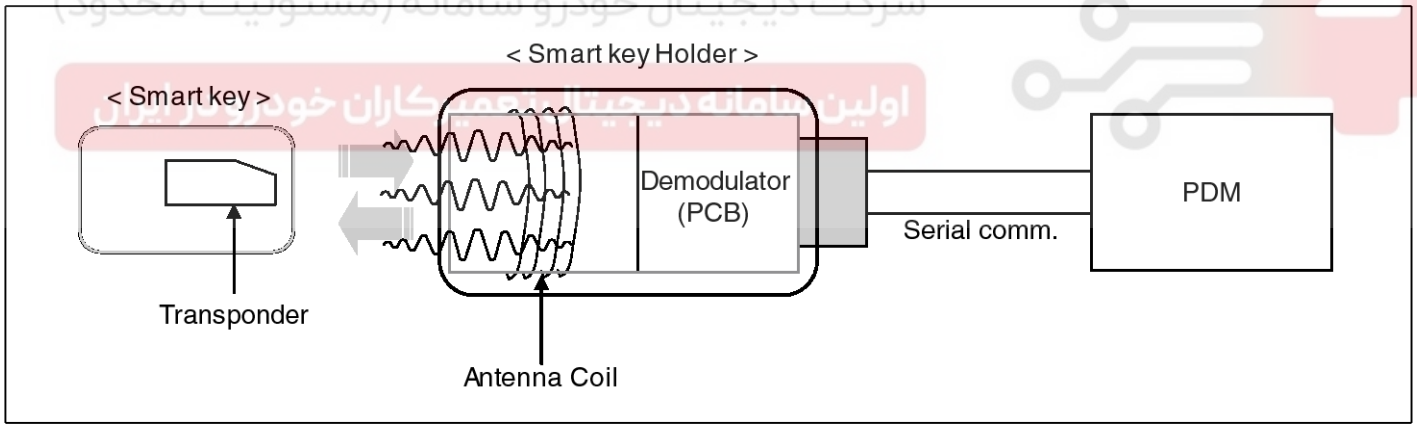
The insertion of the fob into the holder and the communication with the transponder should be possible regardless of the insertion direction of fob to the holder (buttons facing up or bottom).

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



SHMBE9005L

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.

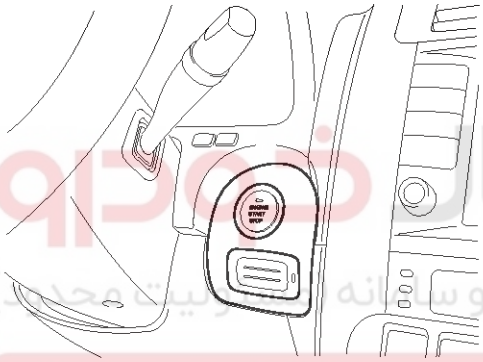
Start/Stop Button(SSB)

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.



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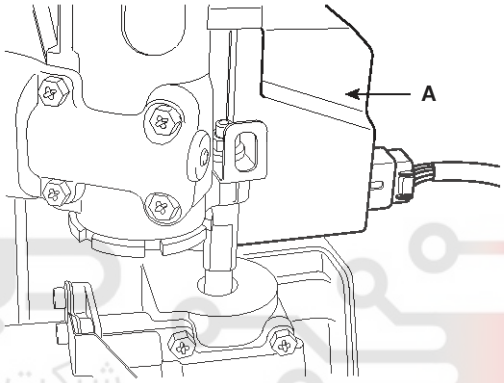
Electronic Steering Column Lock (ESCL)

The ESCL(A) is needed to lock the steering column in order to prevent unauthorized usage of the vehicle. In order to achieve the required safety integrity level, the ESCL is controlled and monitored by 2 independent units, the SMK and the PDM. Such redundant architecture guarantees that the ESCL motor is supplied only during locking/unlocking operation and that it is disconnected from the battery and ground lines otherwise to avoid unexpected operation while the vehicle is in motion.

Data are exchanged between the ESCL and SMK through an encrypted serial communication interface.



SHMB18016D

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, ESCL and Engine status:

System State	Terminal Status	ESCL Status	Engine status
1. OFF - Locked	OFF	Locked	Stopped
2. OFF - Unlocked	OFF	Unlocked	Stopped
3. ACC	ACC	Unlocked	Stopped
4. IGN	IGN1, IGN2, ACC	Unlocked	Stopped
5. Start	IGN1, Start	Unlocked	Cranking
6. IGN - Engine	IGN1, IGN2, ACC	Unlocked	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.

System STATES IN VIRGIN MODE

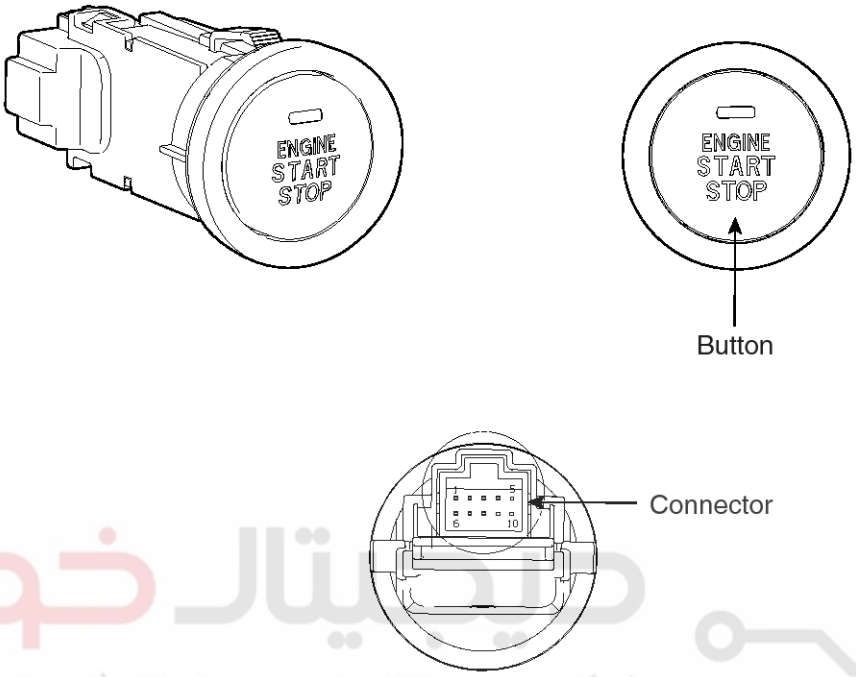
The BES System can be set in 5 different states (OFF LOCKED is not available in virgin mode), depending on the status of the terminals, ESCL and Engine status:

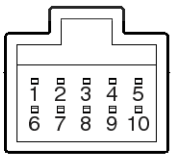
System State	Terminal Status	ESCL Status	Engine status
1. OFF - UNLOCKED	OFF	Unlocked	Stopped
2. ACC	ACC	Unlocked	Stopped
3. IGN	IGN1, IGN2, ACC	Unlocked	Stopped
4. Start	IGN1, START with special p-attern of activation see Chap 6.2.1 for details	Unlocked	Cranking
5. IGN - Engine	IGN1, IGN2, ACC	Unlocked	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.

Start/Stop Button

Component

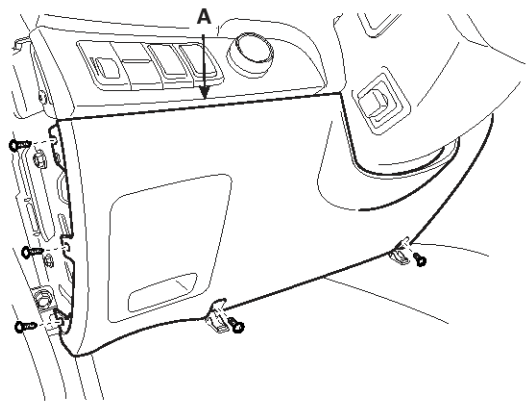


Connector (10 pins)			
Pin No.	Description	Pin No.	Description
1	Start/Stop button switch1(PDM)	6	Battery
2	Battery illumination	7	Start/Stop button switch2(SMK)
3	Start/Stop button LED Amber(PDM)	8	Start/Stop button LED Green(PDM)
4	Start/Stop button illum. GND(PDM)	9	Rheostat
5	Start/Stop button illum. Blue(PDM)	10	-

SHMBE9006L

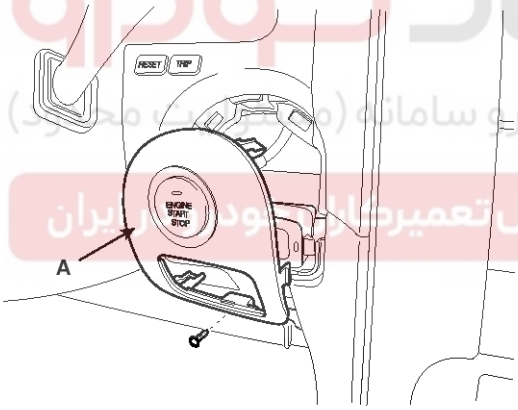
Removal

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



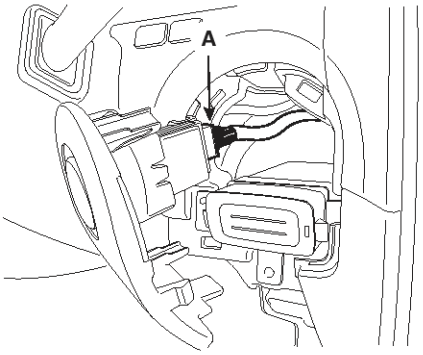
SHMBE8444D

3. Remove the start/stop button cover(A) after loosening the mounting screw.



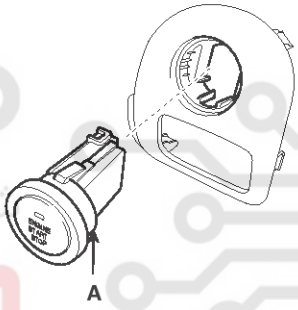
SHMBE9131L

4. Disconnect the connector(A)



SHMBE8446D

5. Remove the start/stop button(A).



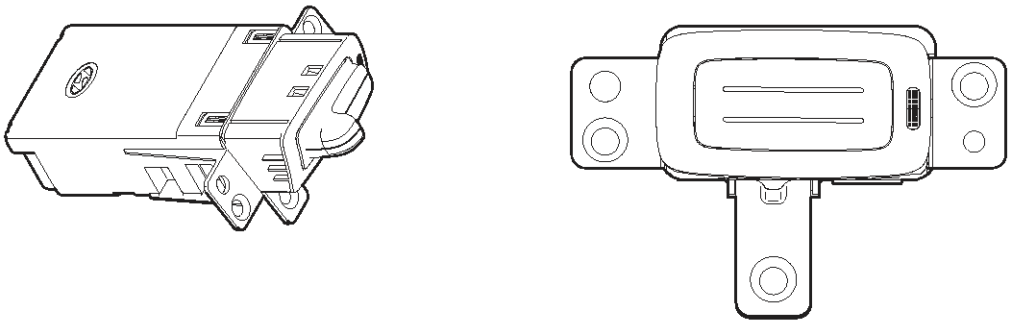
SHMBE8447D

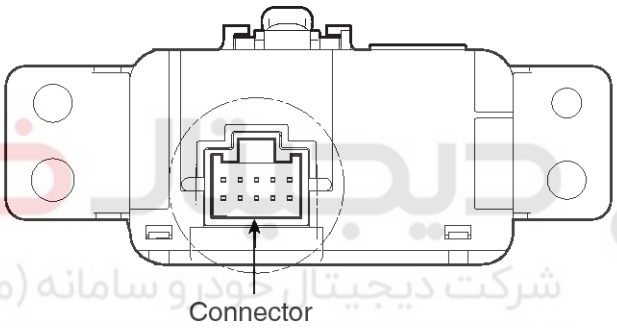
Installation

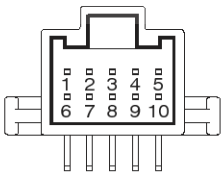
1. Install the start/stop button.
2. Install the start/stop button cover.
3. Install the crash pad lower panel.

Fob Holder

Component



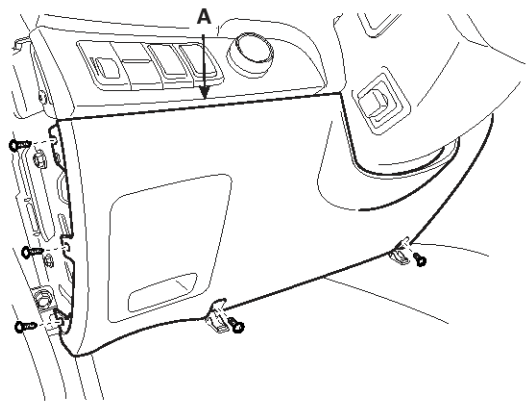


Connector (10 pins)			
Pin No.	Description	Pin No.	Description
1	-	6	Battery
2	Immobilizer clock	7	Immobilizer data
3	Holder illumination(PDM)	8	Illumination battery
4	-	9	Fob in (PDM)
5	GND	10	-

SHMBE9007L

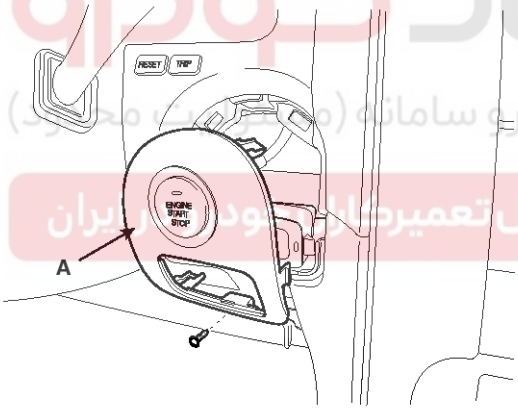
Removal

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



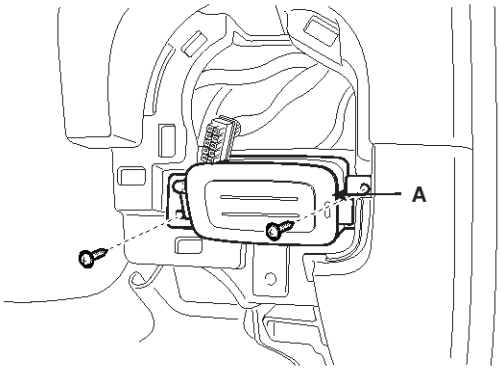
SHMBE8449D

3. Remove the start/stop button(A). (Refer to "Start/Stop button")



SHMBE8450D

4. Remove the Fob holder assembly(A) after loosening the mounting screw.



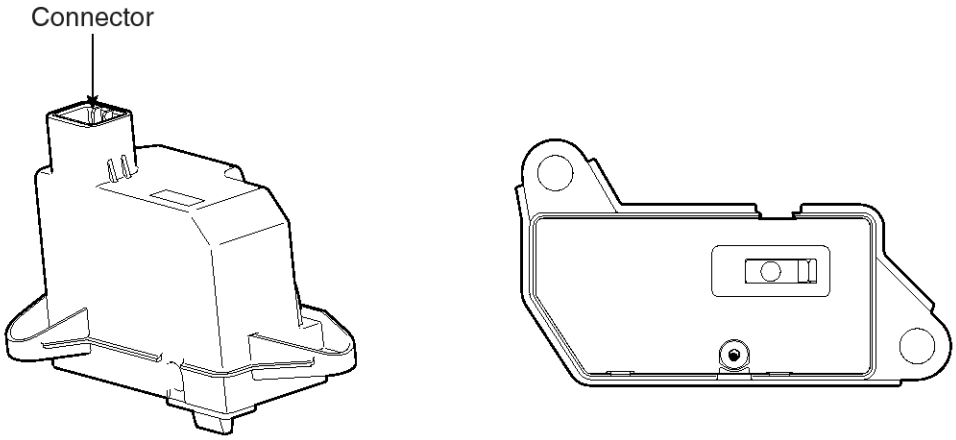
SHMBE8451D

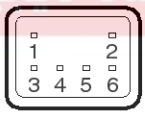
Installation

1. Install the fob hoder assembly.
2. Install the start/stop button.
3. Install the crash pad lower panel.

ESCL(Electronic Steering Column Lock)

Component





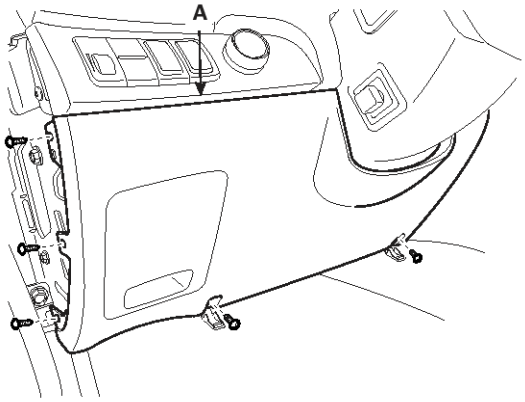
Connector (6 pins)

Pin No.	Description
1	-
2	Ground
3	Power(12V)
4	ESCL-Enable (Lock)
5	ESCL- Unlock
6	Data line

SHMBE9008L

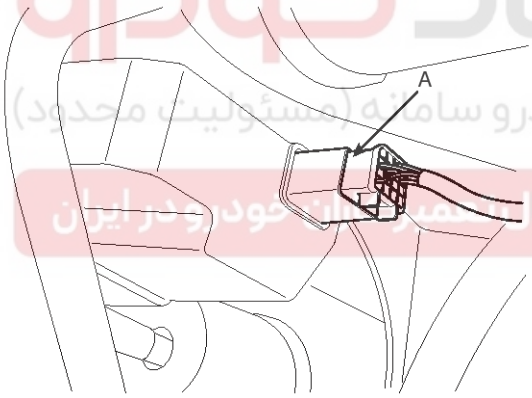
Removal

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



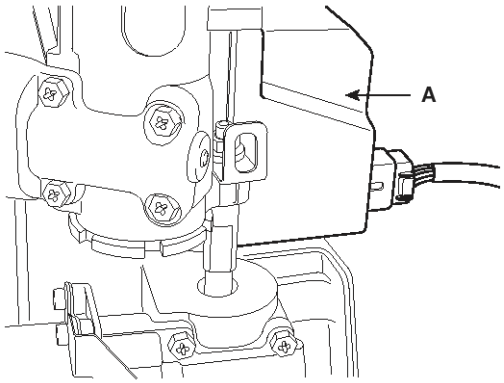
SHMBE8449D

3. Disconnect the electronic steering column lock connector(A).



SHMB18005D

4. Remove the electronic steering column lock(A).
   (Refer to Steering system - "Steering column and shaft")



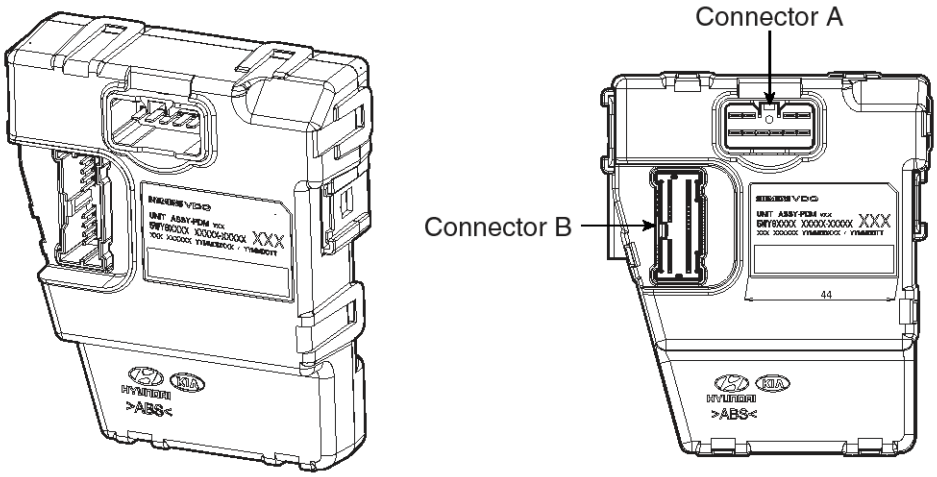
SHMB18016D

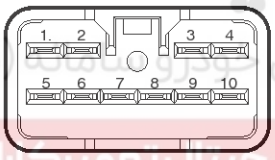
Installation

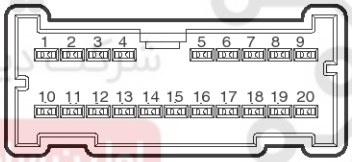
1. Install the electronic steering column lock.
2. Install the crash pad lower panel.

PDM(Power Distribution Module)

Component



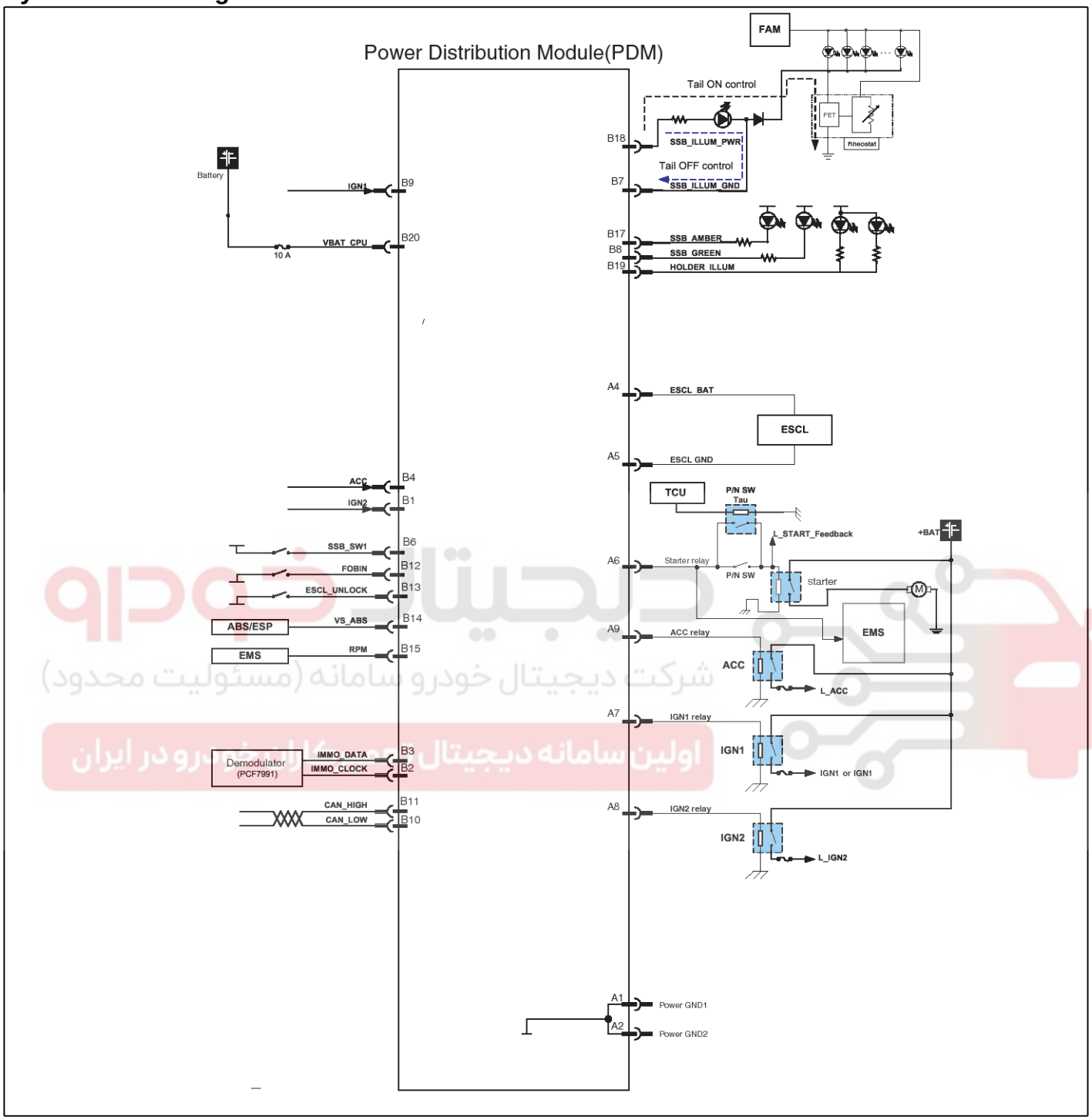




Pin No.	Connector A (10 pin)	Connector B (20 pin)
1	Power ground 1	IGN2
2	Power ground 2	Immobilizer clock
3	-	Immobilizer data
4	ESCL battery	ACC
5	ESCL ground	-
6	Starter relay	SSB switch1
7	IGN1 relay	SSB illumination ground
8	IGN2 relay	SSB LED green
9	ACC relay	IGN1
10	Battery load	CAN L
11		CAN H
12		Fob in
13		ESCL unlock
14		Vehicle speed/ ABS
15		Start EMS
16		Engine speed out
17		SSB LED amber
18		SSB illumination power
19		Holder illumination
20		CPU battery

SHMBE9009L

System circuit diagram

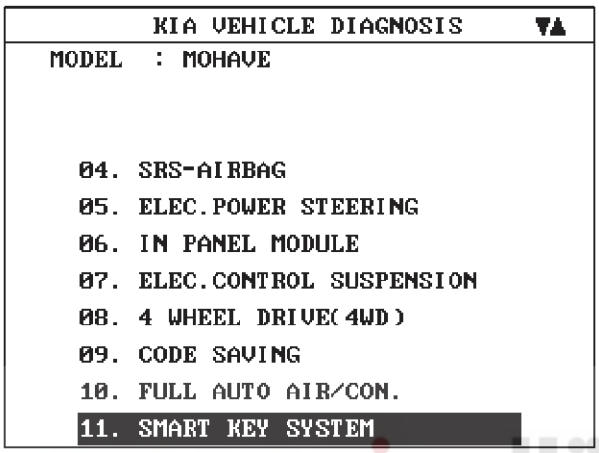


SHMBE9010L

Inspection

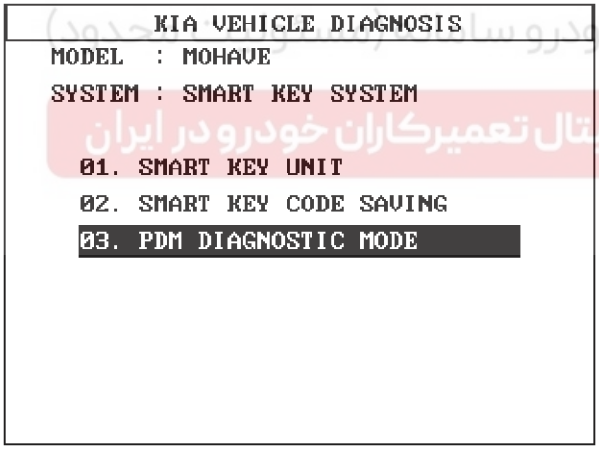
PDM Diagnosis With Scan Tool

1. It will be able to diagnose defects of Smart key with scan tool quickly. Scan tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select model and "Smart key system(SMK)" menu if you want to check PDM.



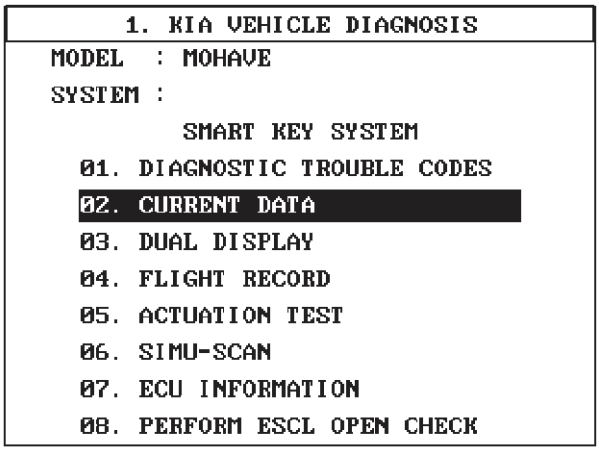
SHMBE9017L

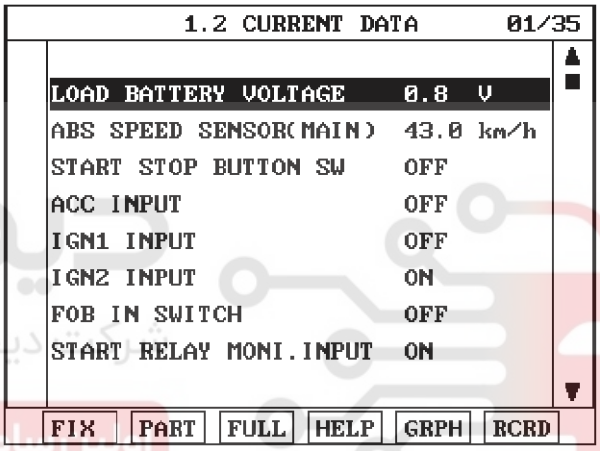
3. Select "PDM" in the manu.



SHMBE9012L

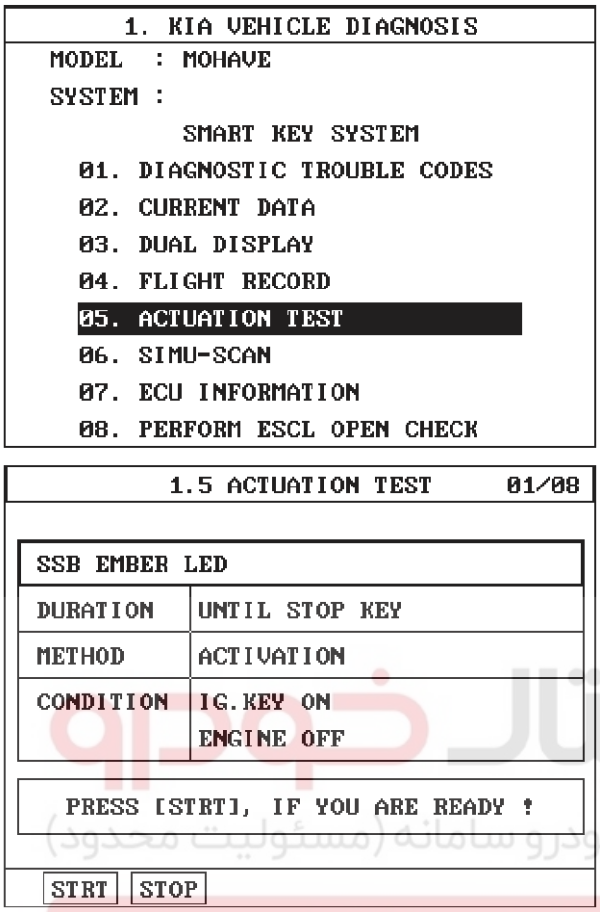
4. Select "Current data", if you want to check current data of PDM. It provides the input/output status of each module.





SHMBE9013L

5. If you want to check PDM data operation forcefully, select "Actuation test".



SHMBE9014L

DTC code list

No.	DTC CODE	Description
1	B1987	Sub micom Failed
2	B1602	CAN ERR
3	B1603	CAN Communication Bus Off
4	B1988	ESCL BAT Short To BAT
5	B1989	ESCL GND Short To BAT
6	B1990	ESCL BAT Short To GND
7	B1991	IMMO TX Short To GND

Input/Output current data

No.	Description	Unit
1	Load Battery Voltage	V
2	Abs Speed Sensor(main)	Km/h
3	Start Stop Button SW	Off/On
4	ACC input	Off/On

Button Engine Start System BE-389

5	IGN1 Input	Off/On
6	IGN2 Input	Off/On
7	Fob In Switch	Release/Insert
8	Start Relay Monitoring Input	
9	SSB Ember LED Output	Off/On
10	SSB Green LED Output	Off/On
11	Fob Holder Illumination Output	Off/On
12	SSB Illumination Output	Off/On
13	ACC Relay Output	Off/On
14	IGN1 Relay Output	Off/On
15	IGN2 Relay Output	Off/On
16	Start Relay S1 Output	Off/On
17	ESCL Battery Output	Off/On
18	ESCL GND Output	Off/On
19	CPU Battery Voltage	V
20	Engine Speed	Data*1.0
21	ACC Relay SCB	Off/On
22	IGN1 Relay SCB	Off/On
23	IGN2 Relay SCB	Off/On
24	Start Relay SCB	Off/On
25	SCC Relay Open	Off/On
26	IGN1 Relay Open	Off/On
27	IGN2 Relay Open	Off/On
28	ACC Output SCB	Off/On
29	IGN1 Output SCB	Off/On
30	IGN2 Output SCB	Off/On
31	Start Output SCB	Off/On
32	ACC Output SCG	Off/On
33	IGN1 Output SCG	Off/On
34	IGN2 Output SCG	Off/On
35	Start Output SCG	Off/On

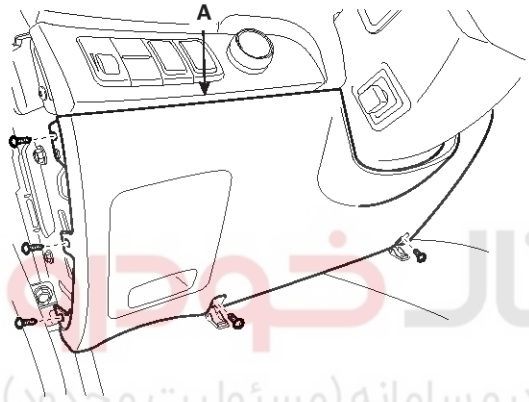
Actuator List

No.	Description
1	SSB Ember LED
2	SSB Green LED
3	FOB Holder Illumination

4	SSB Illumination
5	ACC Output
6	ING1 Output
7	ING2 Output
8	START Output
9	Perform Escl Open Check

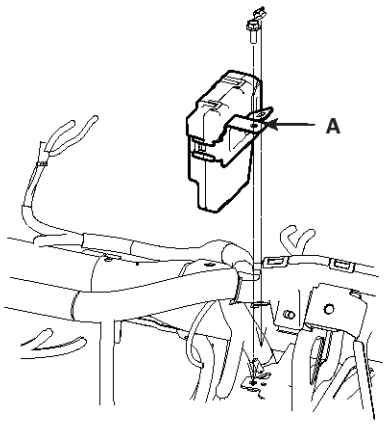
Removal

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



SHMBE8449D

3. Disconnect the power distribution module connector installed on the right bracket side of steering shaft.
4. Remove the power distribution module(A) after loosening a bolt and nut.



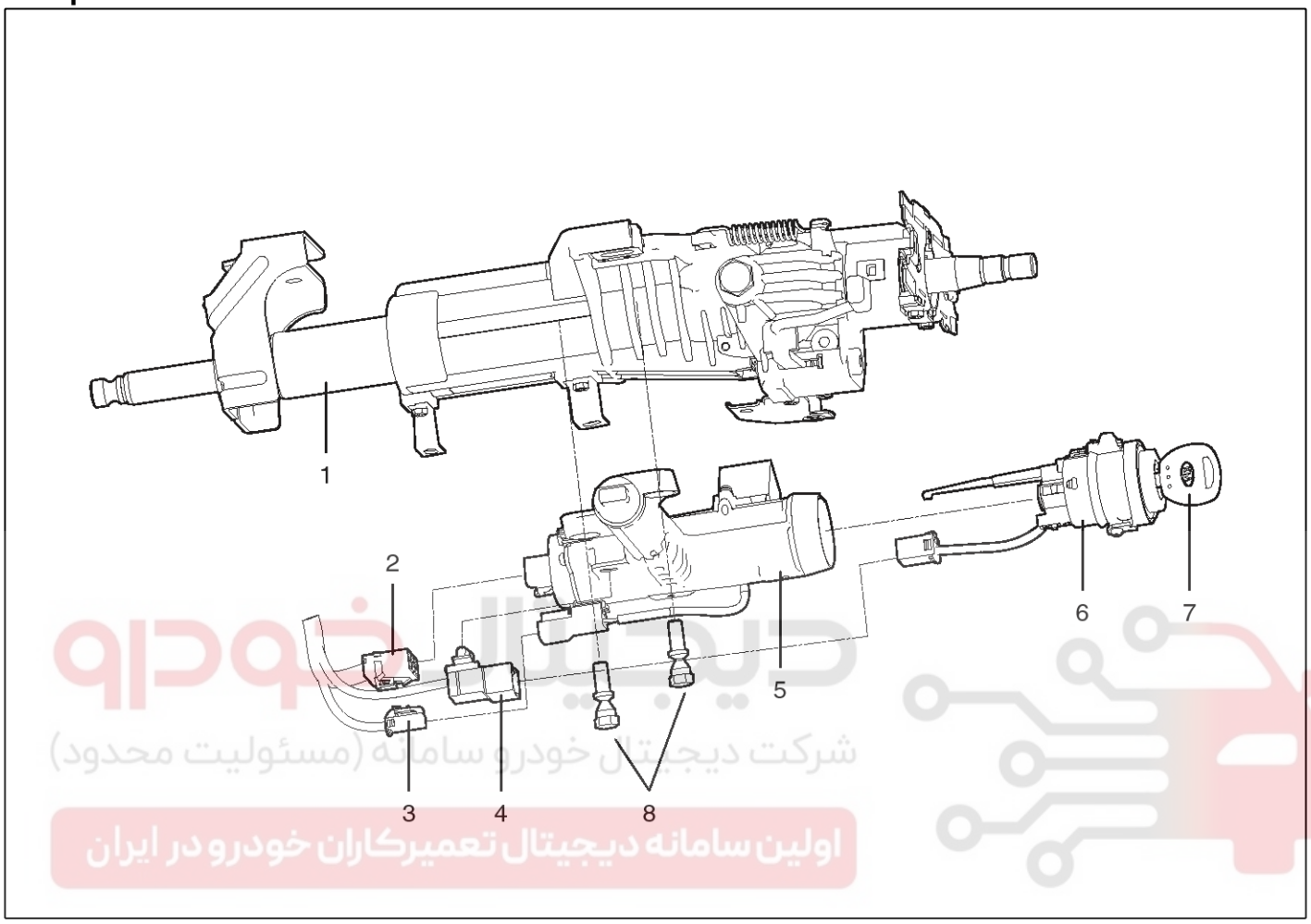
SHMB18007D

Installation

1. Install the power distribution module.
2. Install the crash pad lower panel.

Ignition Switch Assembly

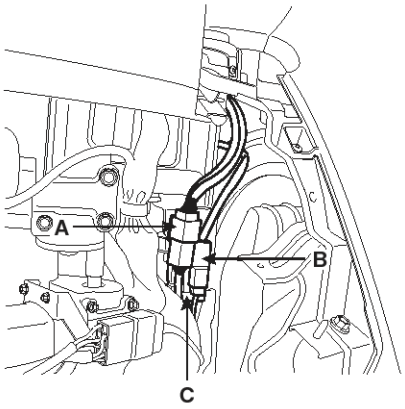
Component



SHMBE9277N

1. Steering column assembly
2. Key warning switch connector
3. Steering lock solenoid connector
4. Ignition switch connector
5. Steering lock body assembly
6. Ignition lock cylinder & switch
7. Key
8. Shear bolts

Inspection



SHMBE9262N

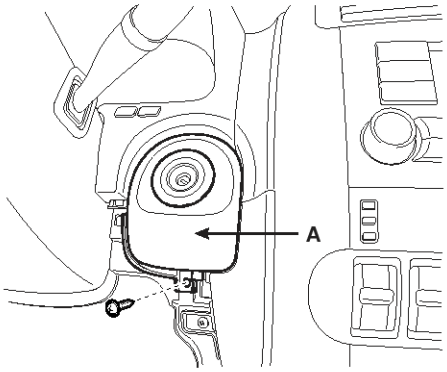
1. Disconnect the ignition switch connector and key warning switch connector from the steering lock body assembly.
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

TERMINAL / POSITION / KEY	IGNITION SWITCH (A)						STEERING (B)		KEY WARNING SWITCH (C)		KEY HOLE ILLUMINATION (A)	
	2	4	6	5	3	1	TRAVEL	TRAVEL	5	6	3	4
LOCK / REMOVAL							LOCK					
LOCK / INSERT							LOCK	UNLOCK				
ACC / INSERT	○	○					UNLOCK		○	○	○	○
ON / INSERT	○	○	○	○	○							
START / INSERT	○		○	○		○						

SHMBE9276N

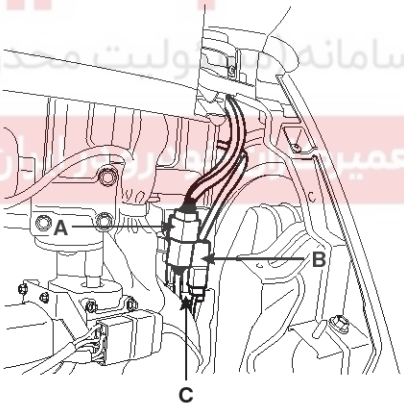
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - crash pad)
3. Remove the ignition switch cover (A).



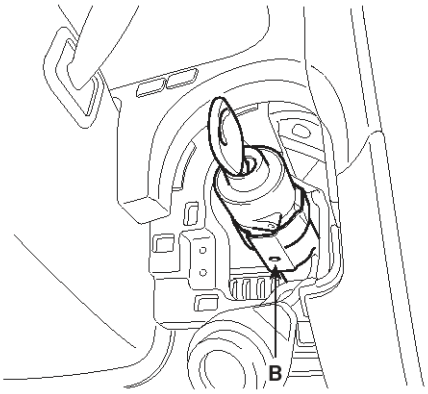
SHMBE9263N

4. Remove the key warning switch and key illumination lamp (B) after disconnecting the 6P connector(A).

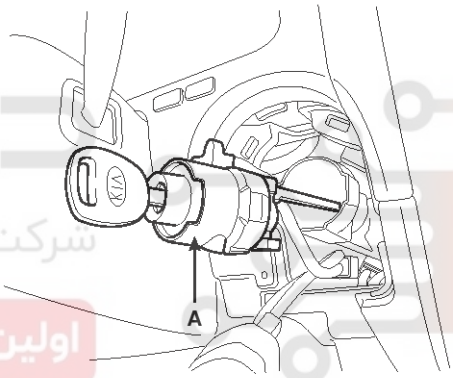


SHMBE9262N

5. If it is necessary to remove the key lock cylinder (A), remove the key lock cylinder after pushing lock pin (B) with key ACC.



SHMBE9274N



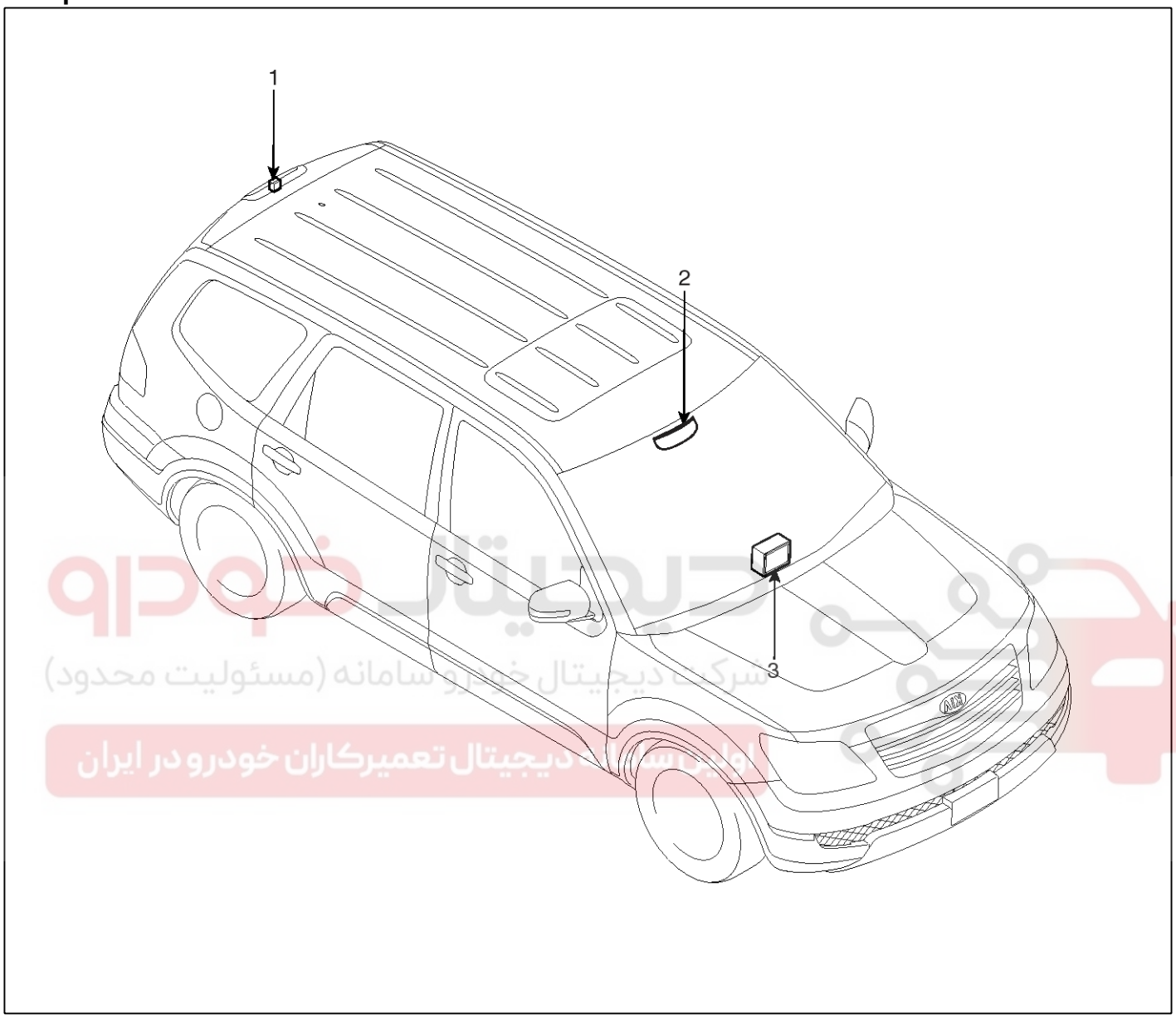
SHMBE9275N

Installation

1. Reassemble the key lock cylinder.
2. Reassemble the key warning switch and key illumination lamp.
3. Reassemble the ignition switch cover.
4. Reassemble crash pad lower panel.

Back View Camera System

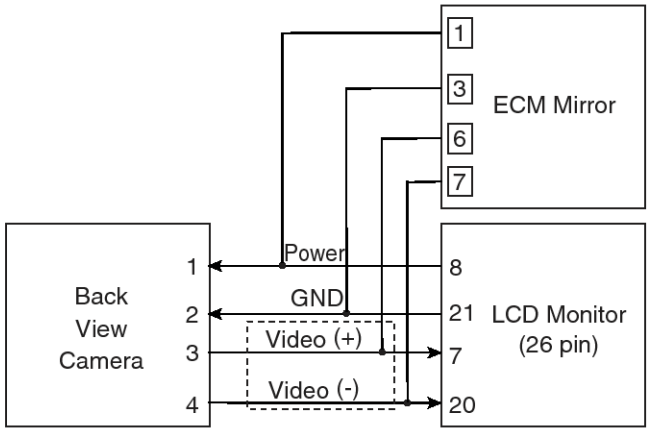
Component Location

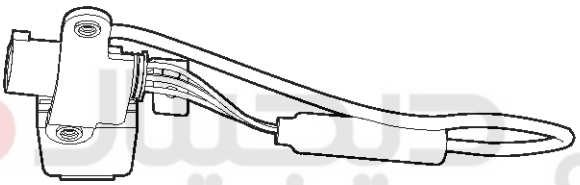


SHMBE9335N

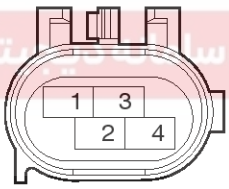
1. Back view camera
2. ECM mirror
3. LCD monitor

Circuit Diagram





Back view camera connector



Pin no.	Name
1	Power
2	Ground
3	Video (+)
4	Video (-)

SHMBE9321N

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 AV monitor or ECM mirror while backing-up.

WARNING

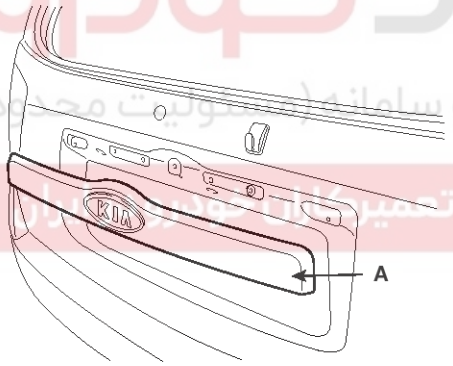
This system is a supplementary function only. It is the responsibility of the driver or always check the inside/ outside rearview mirror and the area behind the vehicle before and while backing up because there is a dead zone that can't see through the camera.

Removal

1. Remove the tailgate trim in the trunk after removing the screws and clips.

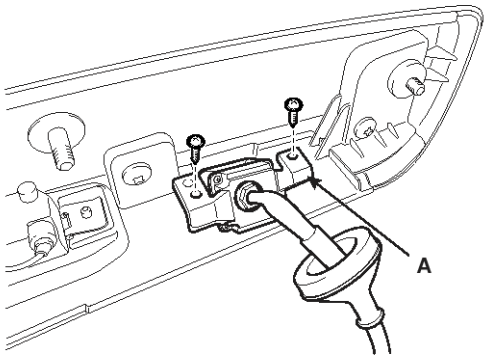
   (Refer to the Body group - Tailgate)

2. Remove the tailgate garnish (A) after disconnecting the connector.



SHMBE8406D

3. Remove the back view camera (A) after removing the screws (2EA).



SHMBE8407D

Installation

1. Install the back view camera.
2. Install the tailgate garnish and trim.