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General Information

General Troubleshooting Information

Before Troubleshooting

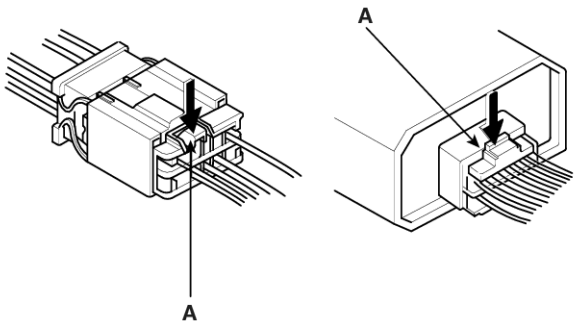
1. Check applicable fuses in the appropriate fuse/relay box.
2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tight connections.

   (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.

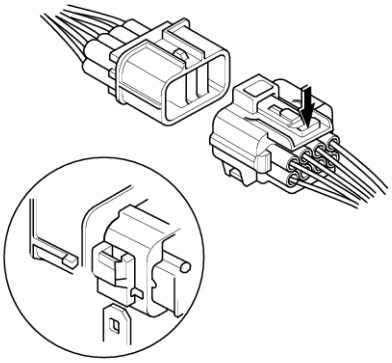
Handling Connectors

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).



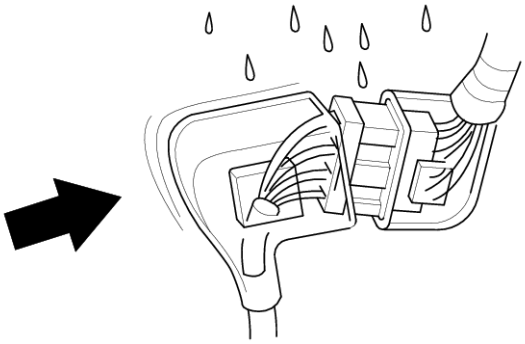
ETKD150A

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

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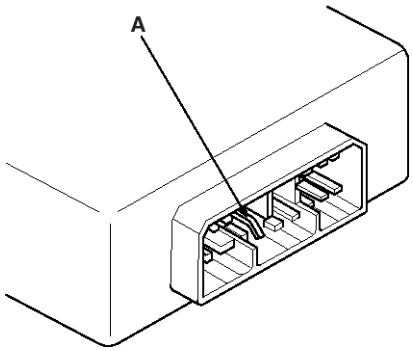
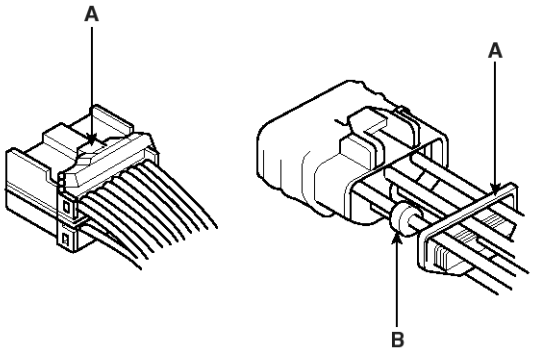
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



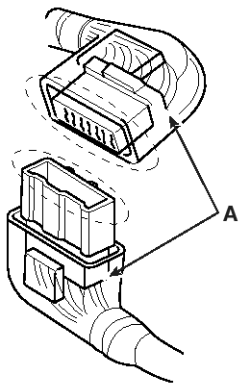
ETKD150D

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



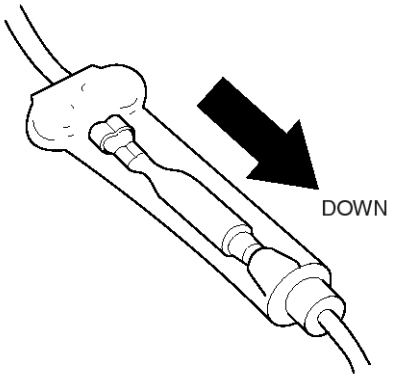
ETKD150E

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



ETKD150F

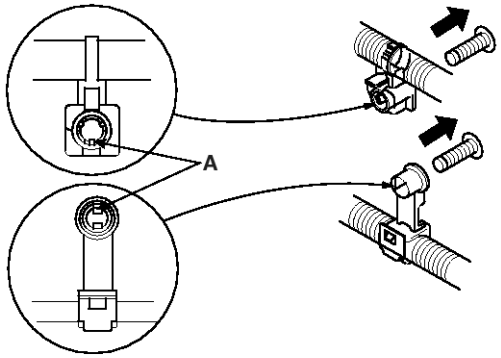
11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.



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

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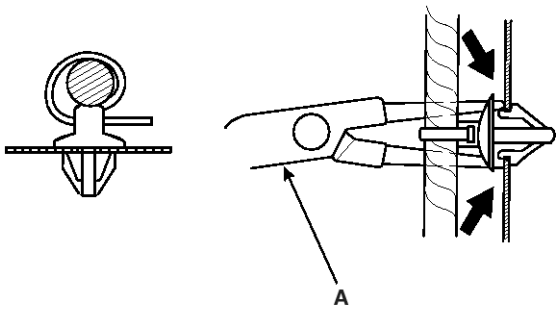
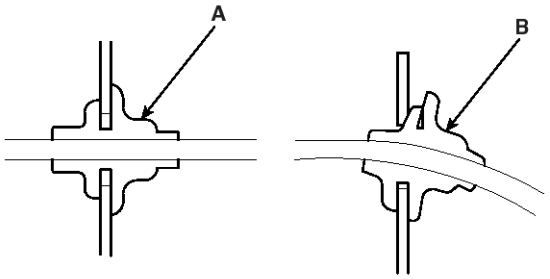
3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



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).

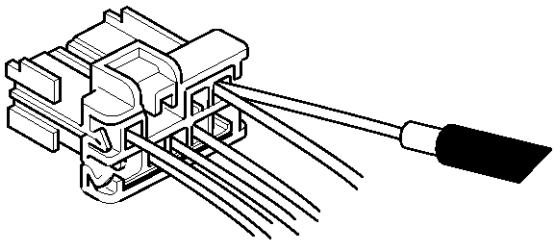


ETKD150J

Testing And Repairs

1. Do not use wires or harnesses with broken insulation.

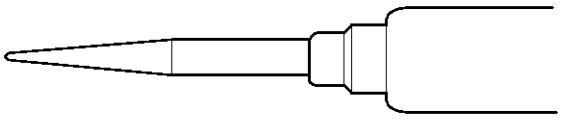
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.
3. When using electrical test equipment, follow the manufacturer's instructions and those described in this manual.
4. If possible, insert the remover tool 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

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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.

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Audio

Specification

Item		Specification		
Model		Radio/MP3/CD/XM (A200)	Radio/MP3/CDC/XM (A300)	Radio/MP3/6CDC/XM (A350 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

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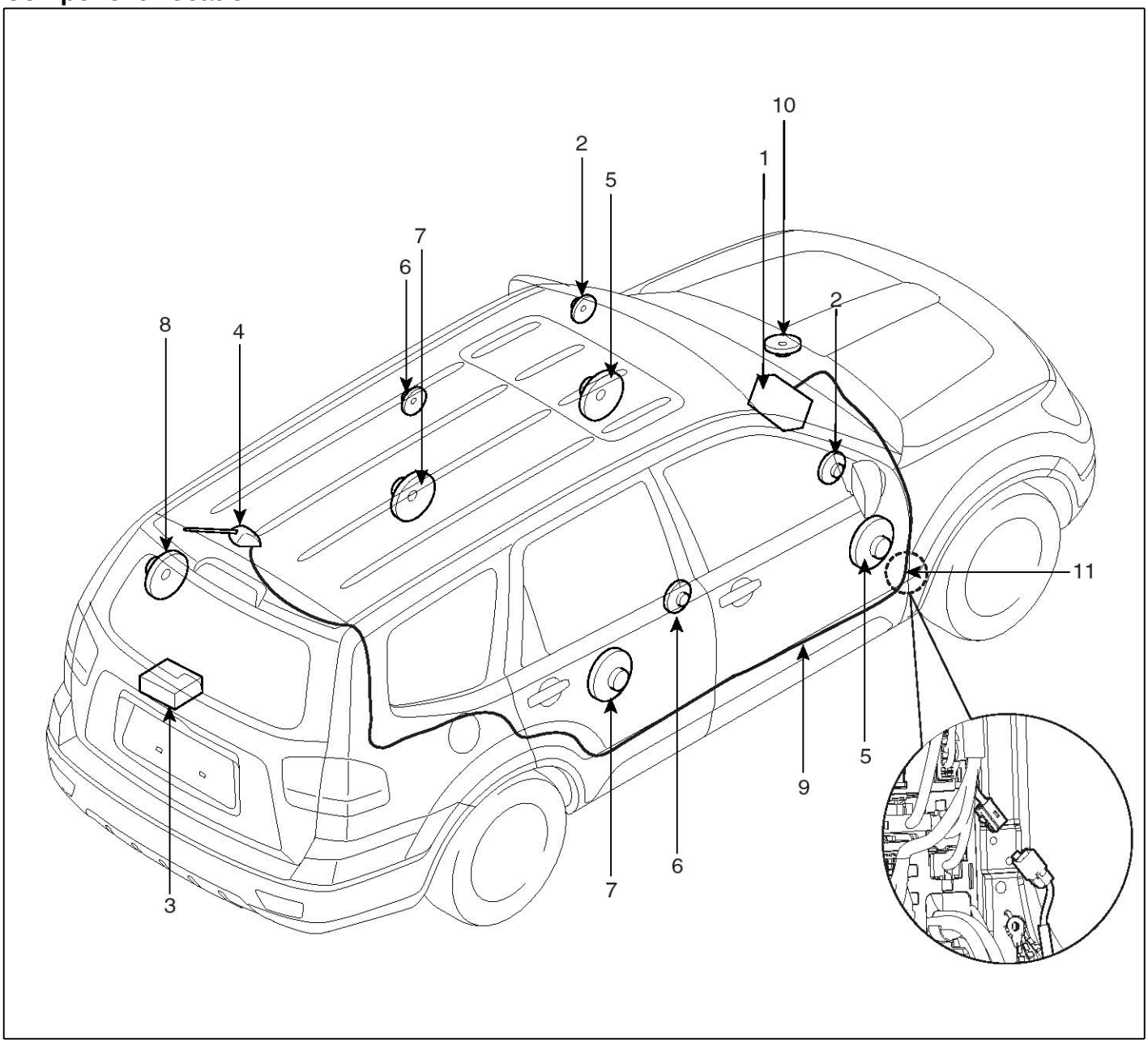
Component Location



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

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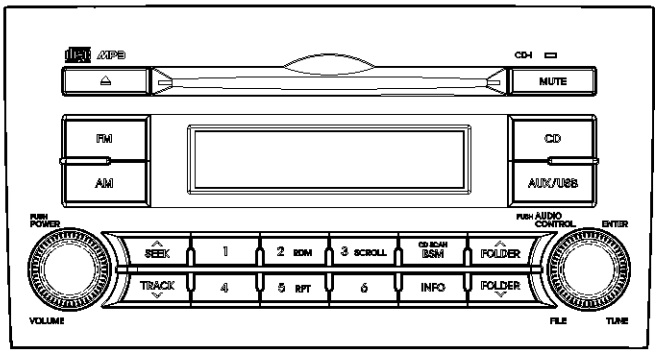
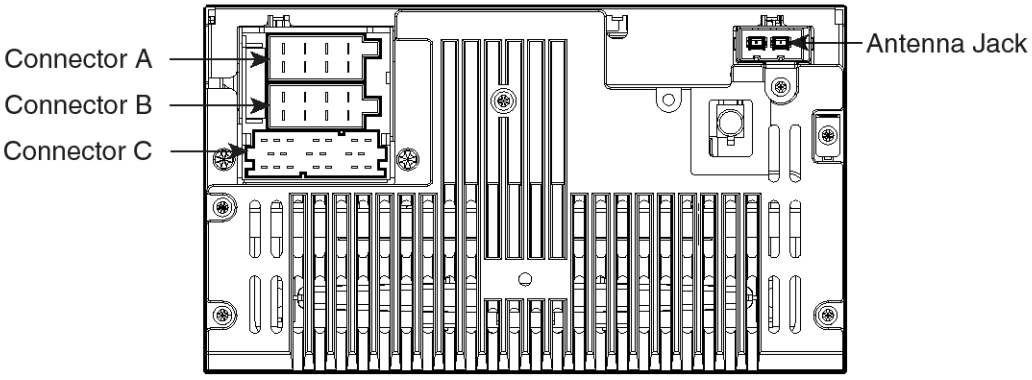
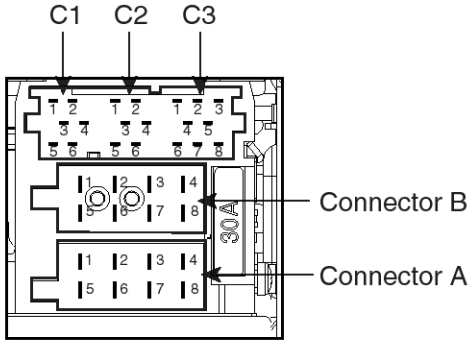
Audio Unit

Component Location

[RADIO/CD/MP3(A200)]







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(-)			-

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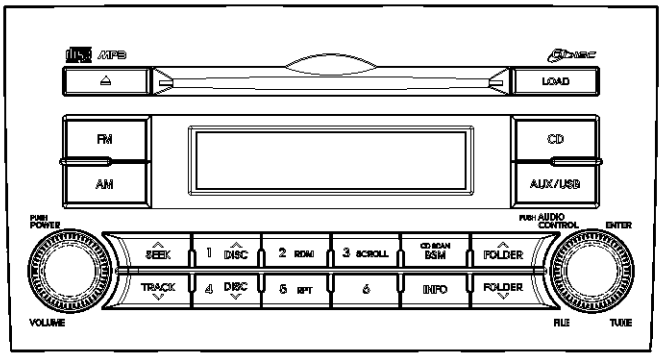
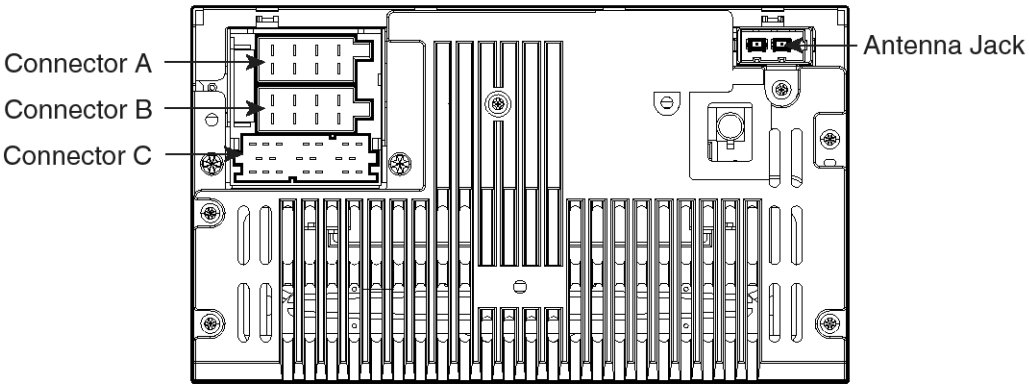
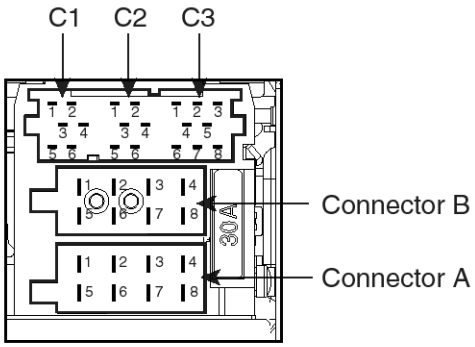
[RADIO/MP3/CDC (A300)]







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

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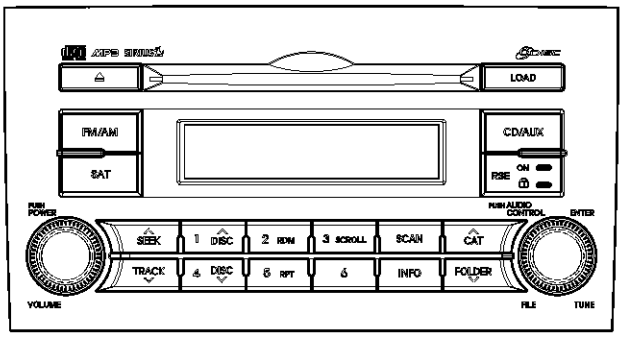
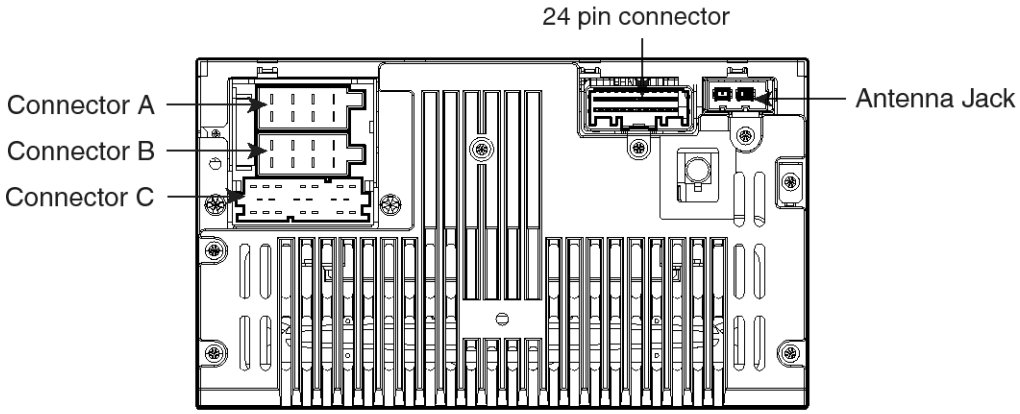
[RADIO/MP3/CDC (A350 RSE)]





SHMBE9102N

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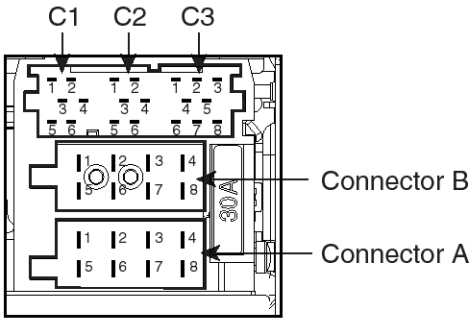
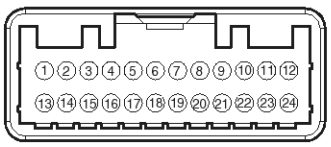


NO	Connector A	Connector B	Connector C1	Connector C2	Connector C3
1	-	Rear right speaker(+)	-	AUX input(R)	-
2	Illumination (+)	Front right speaker(+)	-	AUX input(L)	USB D-
3	Remote control antenna	Front left speaker(+)	External Amp. select	AUX REF	CAN Low
4	Battery +	Rear left speaker(+)	-	AUX Detect	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	-

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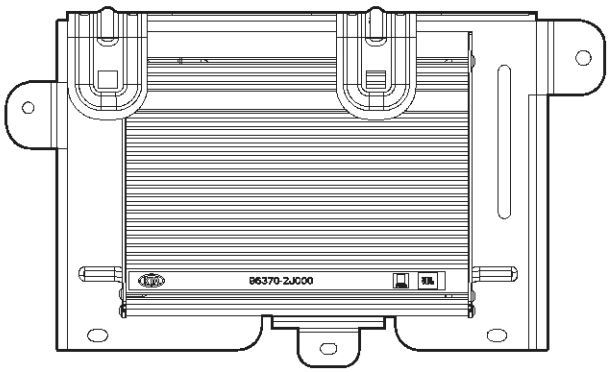
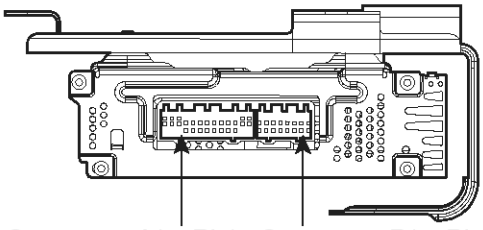
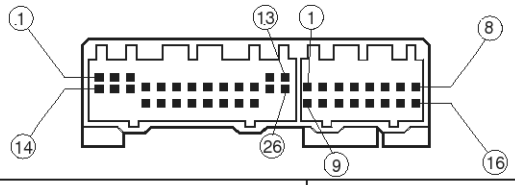
[External Amplifier]







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)	

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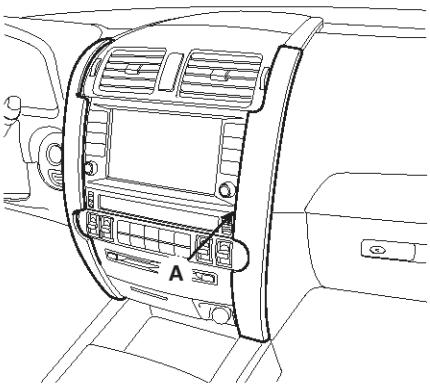
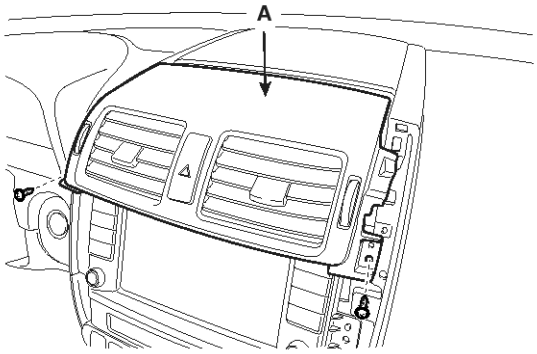
Removal

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.

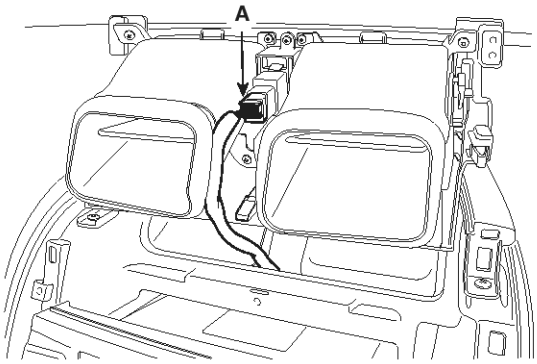


SHMBE8030D

4. Disconnect the hazard lamp connector.

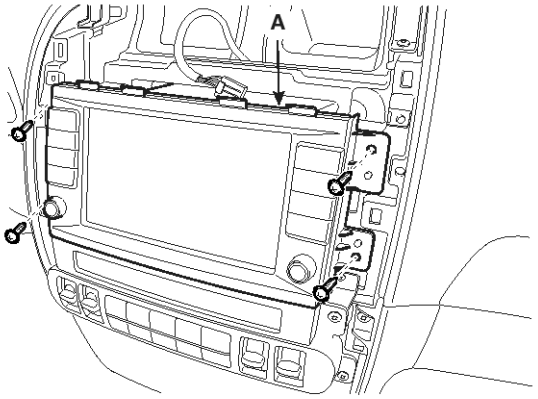
NOTICE

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



SHMBE8028D

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.

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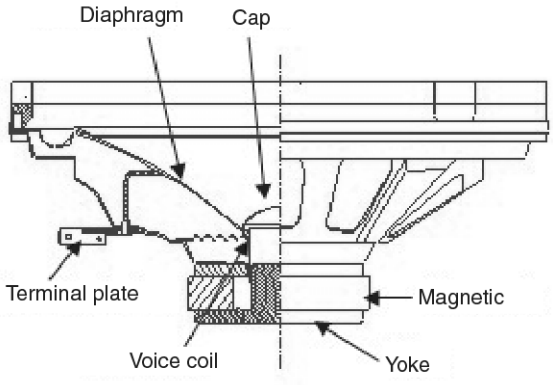
Speakers

Inspection

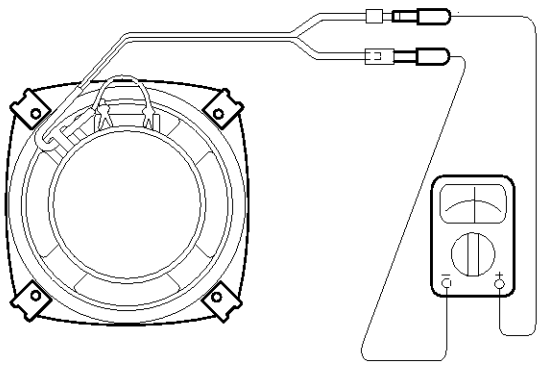
1. Troubleshooting for Speaker
   1) Basic inspection of speaker

      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.



SNFBE8015N

   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.

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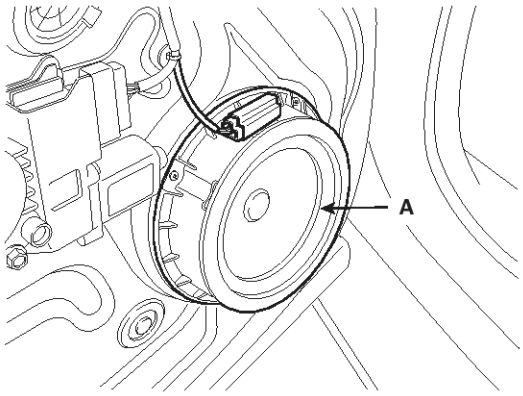
⚠CAUTION

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

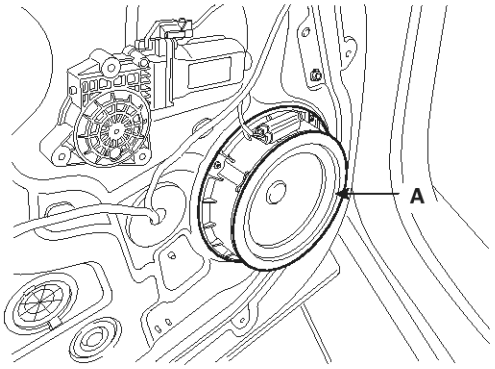
1. Remove the front door trim panel (Refer to the Body group - Front door).
2. Remove the front speaker (A) after removing 4 rivets.



SHMBE8032D

Rear Speaker

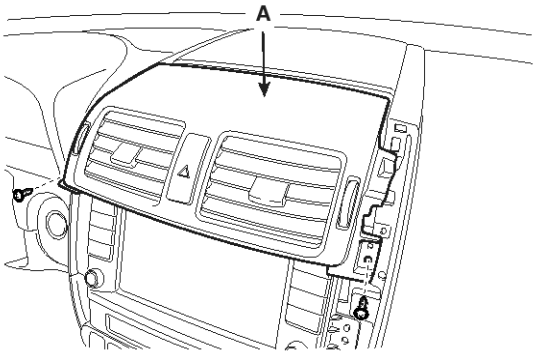
1. Remove the rear door trim panel (Refer to the Body group - Rear door).
2. Remove the rear speaker (A) after removing 4 rivets.



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

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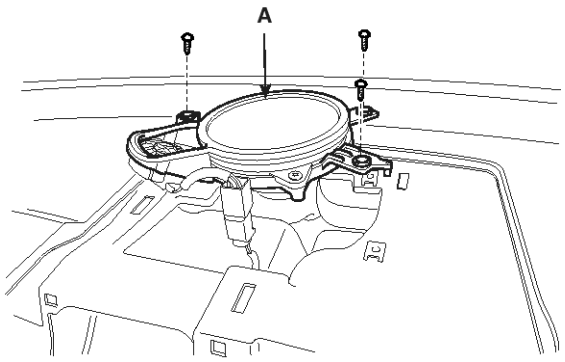
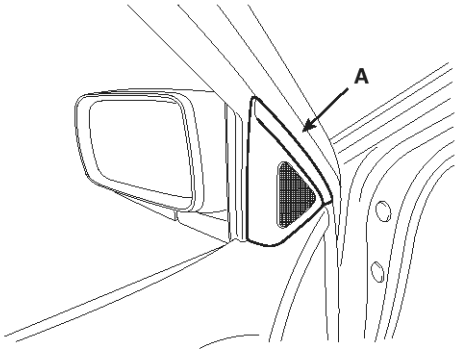
3. Remove the crash pad center speaker grill(A) after loosening the mounting screws(3EA).



SHMBE8036D

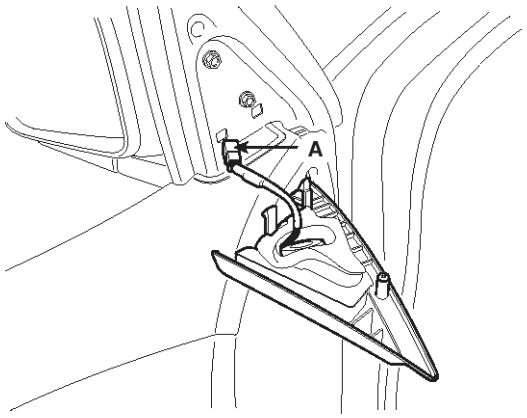
Tweeter Speaker(Front)

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



SHMBE8037D

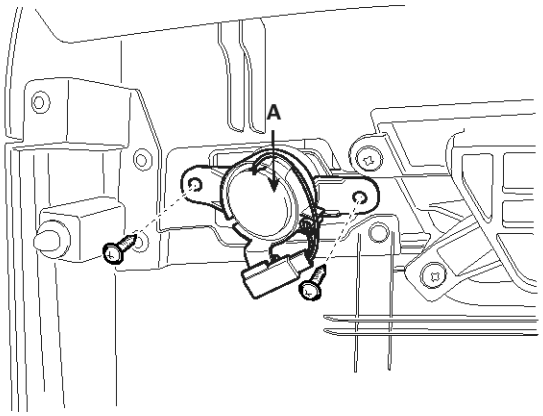
2. Remove the tweeter speaker (A) after disconnecting the connector.



SHMBE8038D

Tweeter speaker(Rear)

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



SHMBE8039D

2. Remove the rear tweeter speaker(A).

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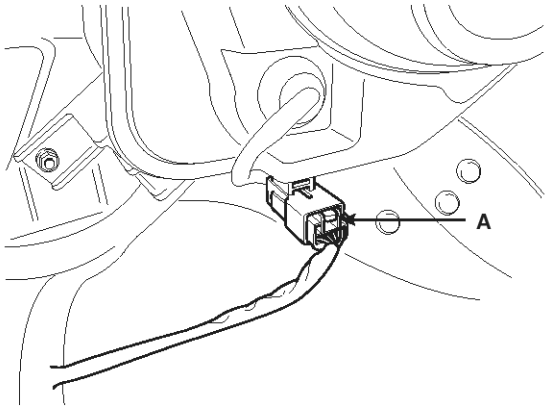
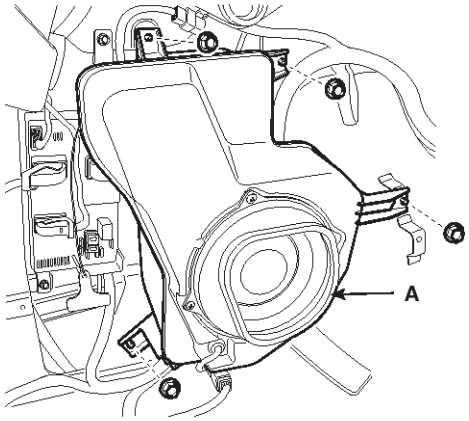
Woofer Speaker

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



SHMBE8040D

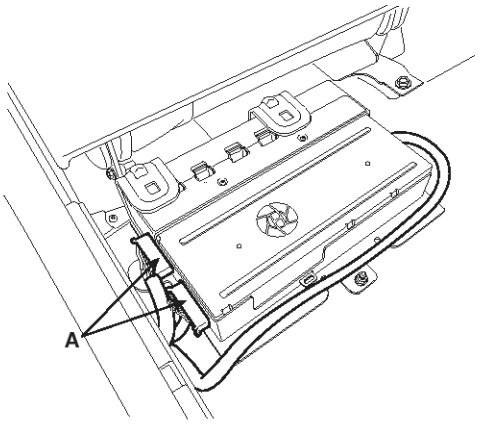
3. Remove the woofer speaker(A) after removing 4 nuts.



SHMBE8041D

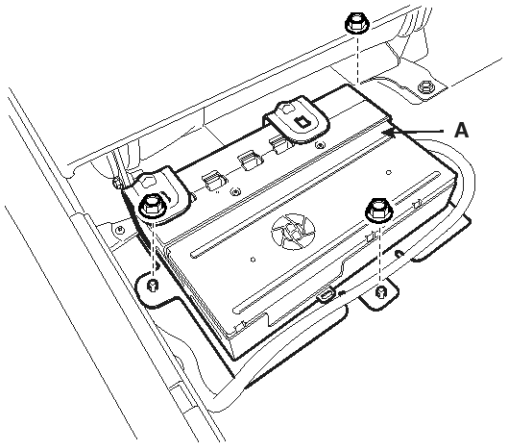
External Amplifier

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

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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.*

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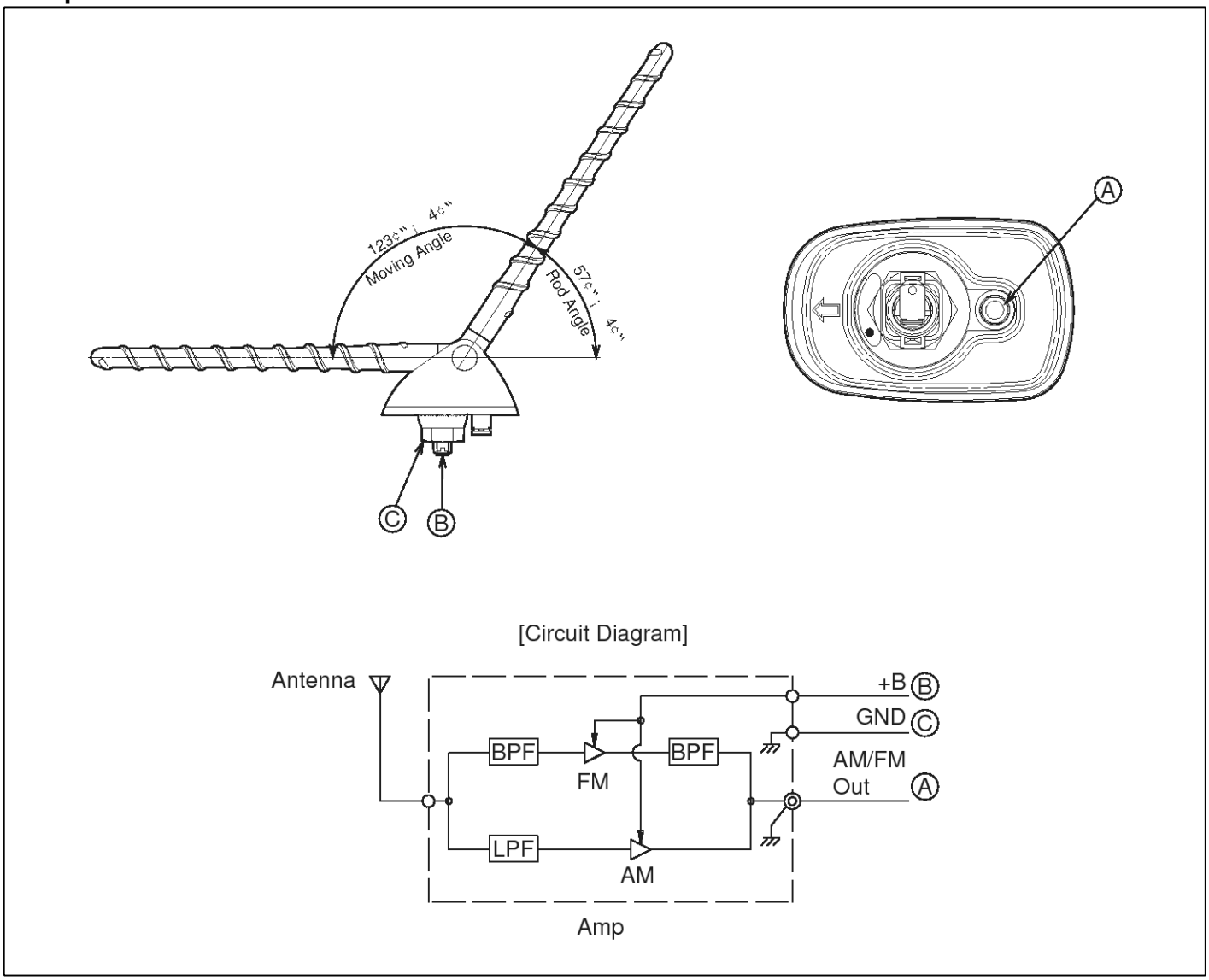
Antenna

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



SHMBE9099L

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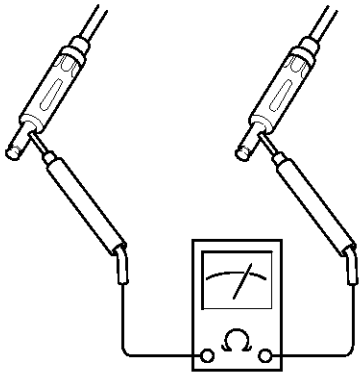
Inspection

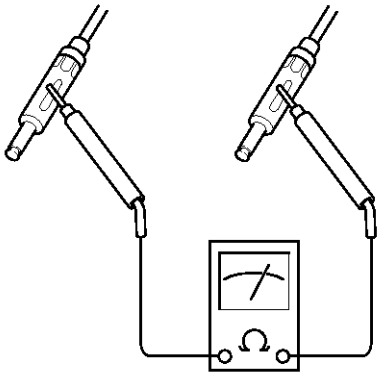
Antenna Cable

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



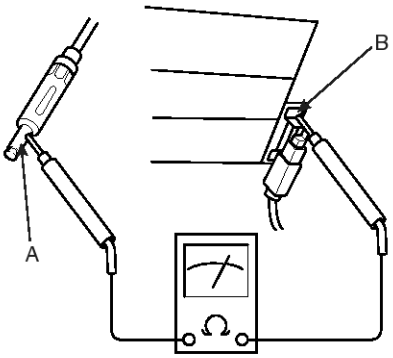
ATJF023C

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



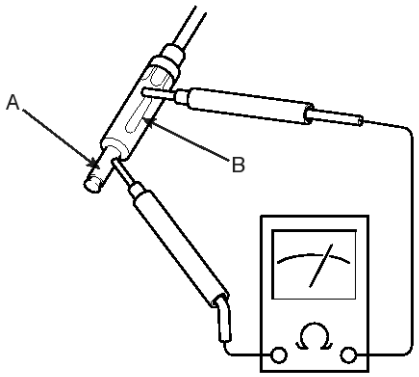
ATJF023D

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.

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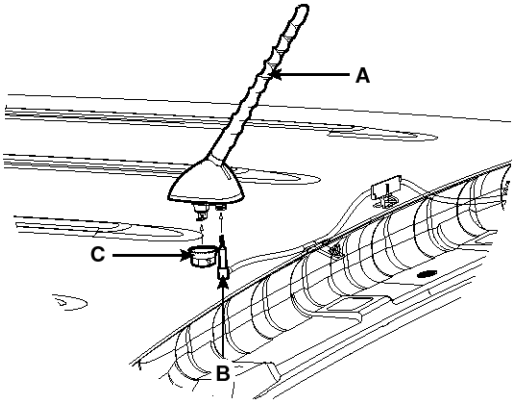
Removal

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.*

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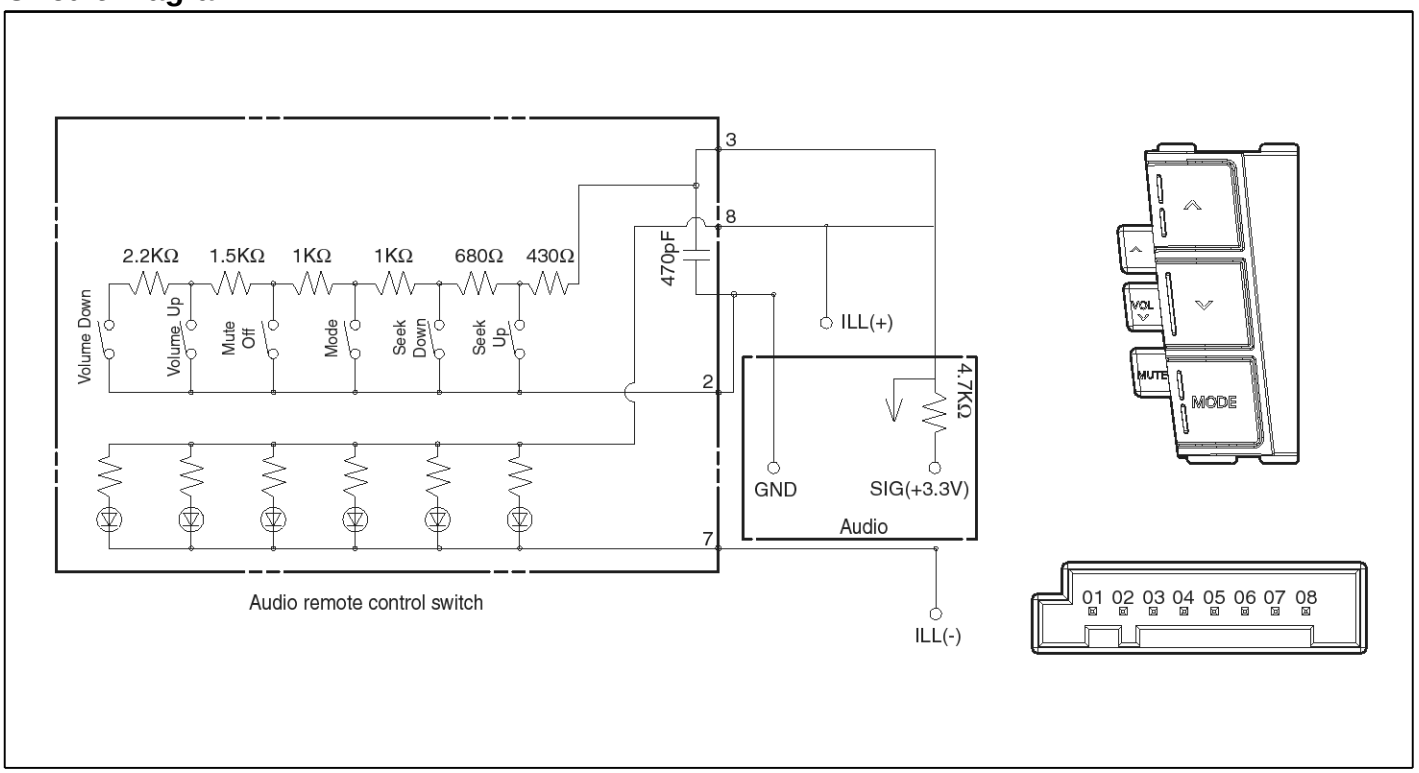
Audio Remote control

Circuit Diagram



SHMBE9110N

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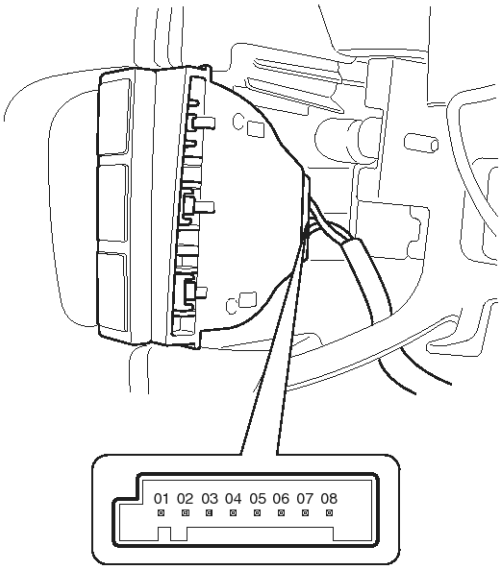
Inspection

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

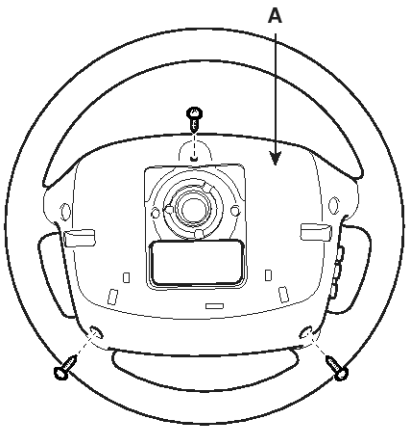


SHMBE8047D

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

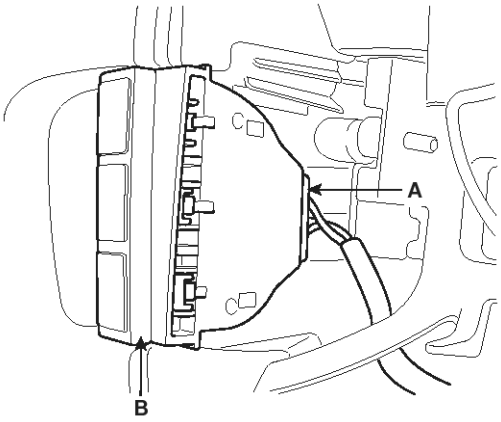
Removal

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 (3EA).



SHMBE8048D

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.

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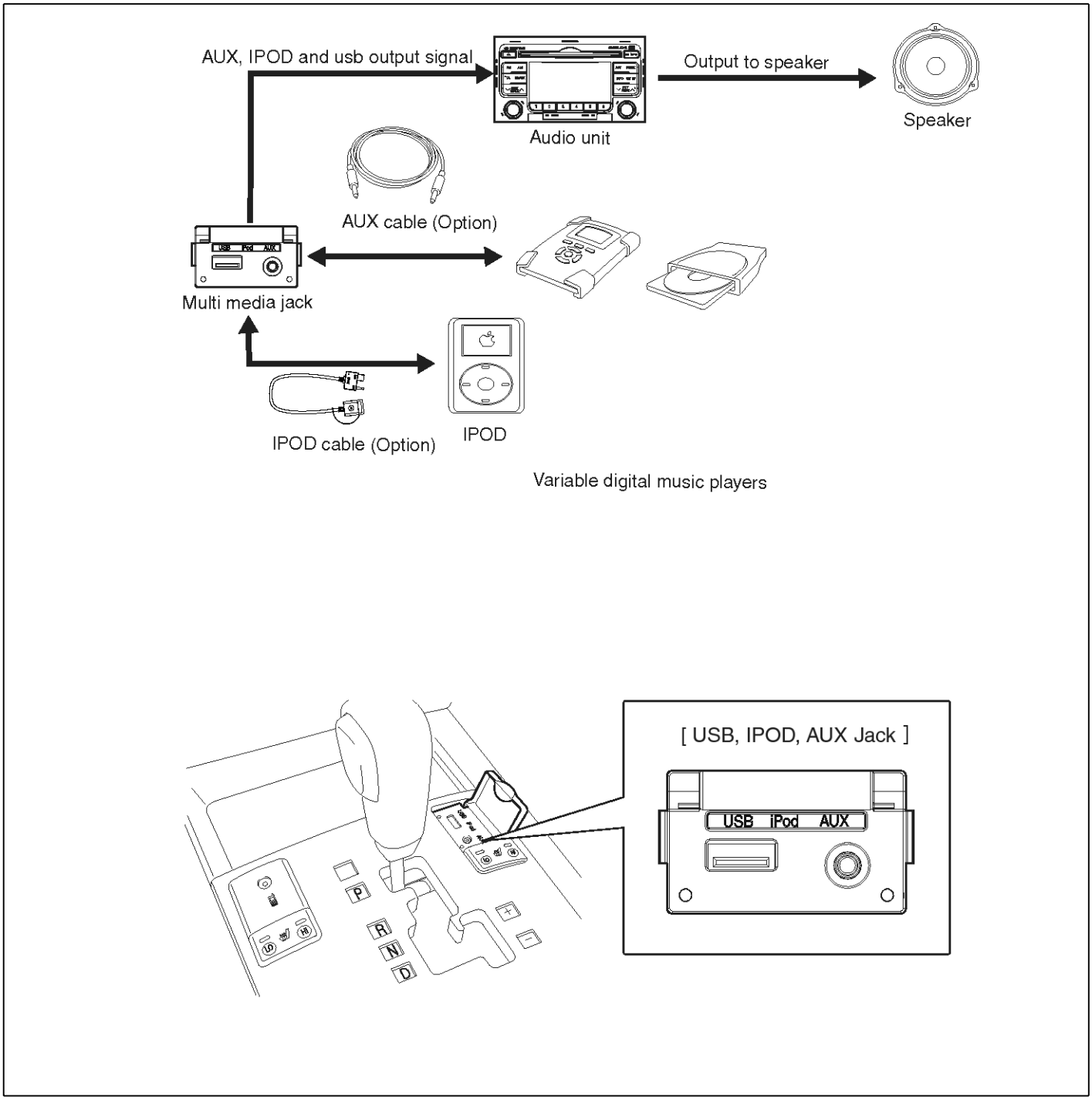
Multimedia jack

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

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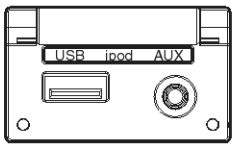
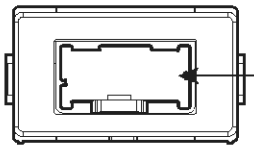
Components

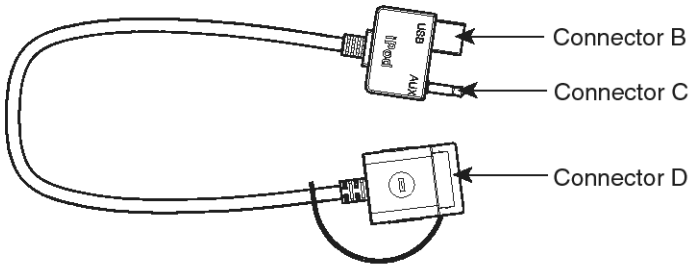
[AUX, USB, IPOD]

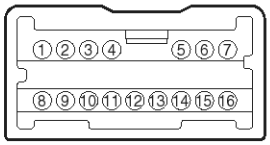
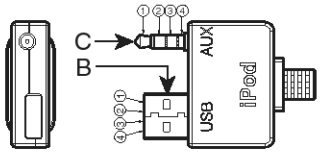
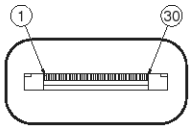


[Jack Connector]



[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

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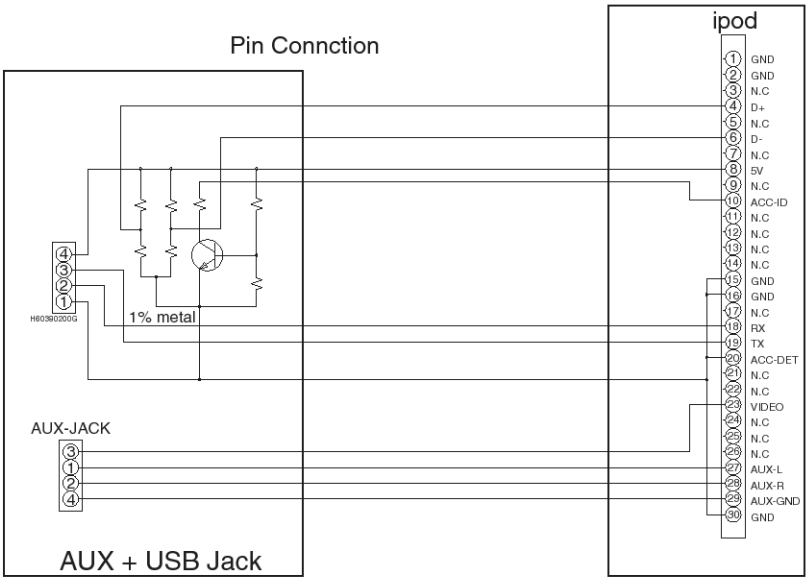
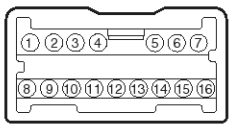
Circuit Diagram

[Aux + USB + iPod] Multimedia jack



Wire Connection Table

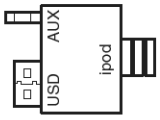
SHORT GND	15	POWER WIRE
	16	
	20	
	30	
8	5V	USB WIRE
4	D+	
6	D-	
29	AUDIO REF	AUDIO WIRE
28	AUDIO R	
27	AUDIO L	
18	RX	UART WIRE
19	TX	
23	VIDEO	VIDEO WIRE
10	ACC-ID	IPOD DET



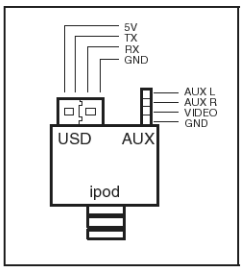
Multi-media jack

Front View

Top View



Pin Connction



SHMBE9308N

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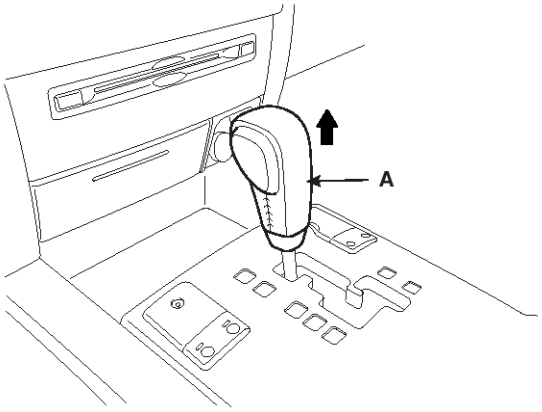
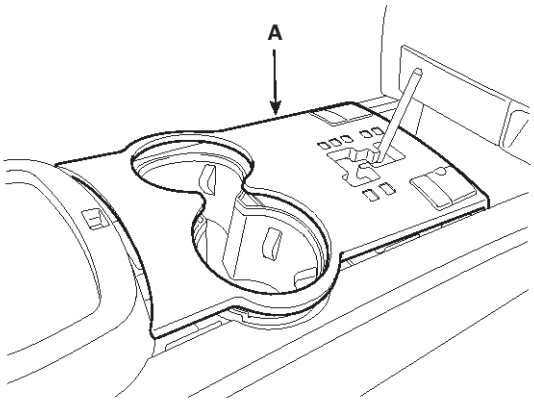
Removal

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



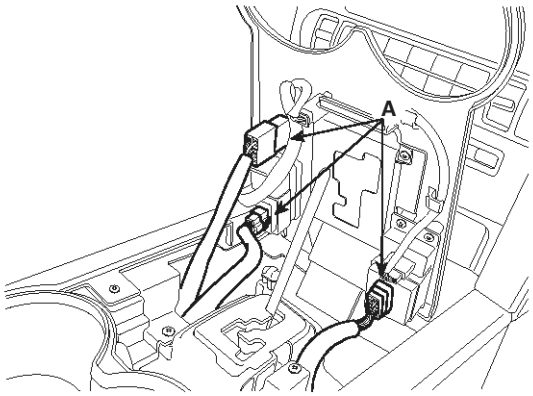
SHMBE8171D

2. Remove the console under cover (A).



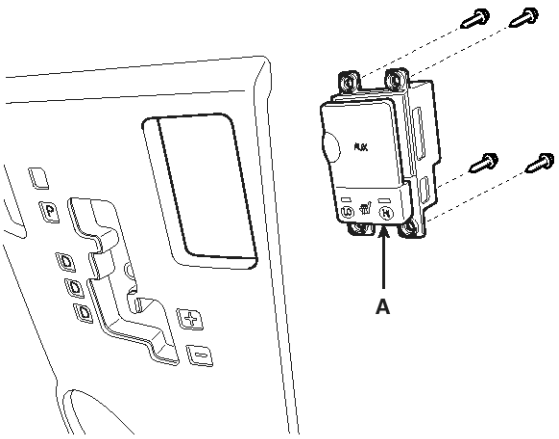
SHMBE8052D

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.

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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

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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.

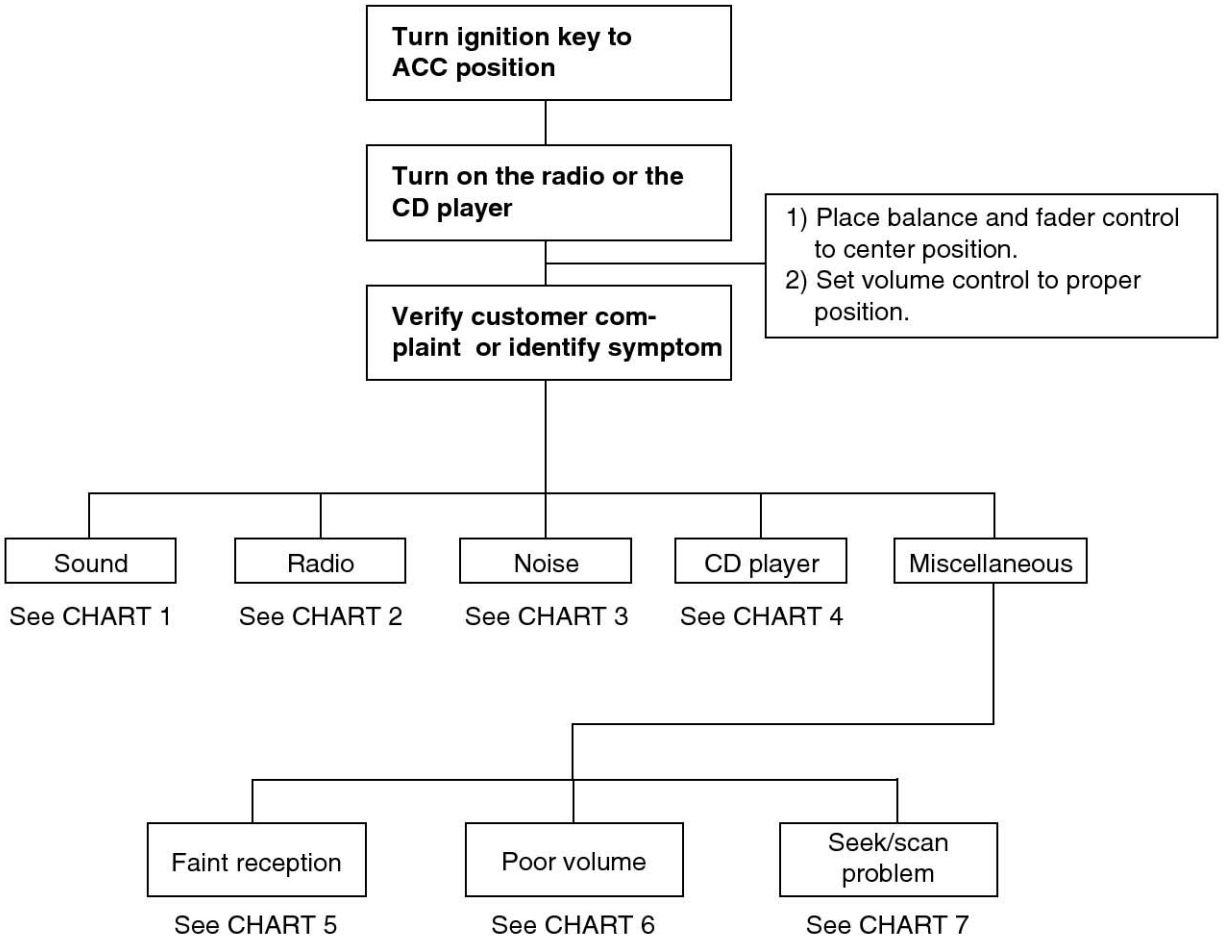

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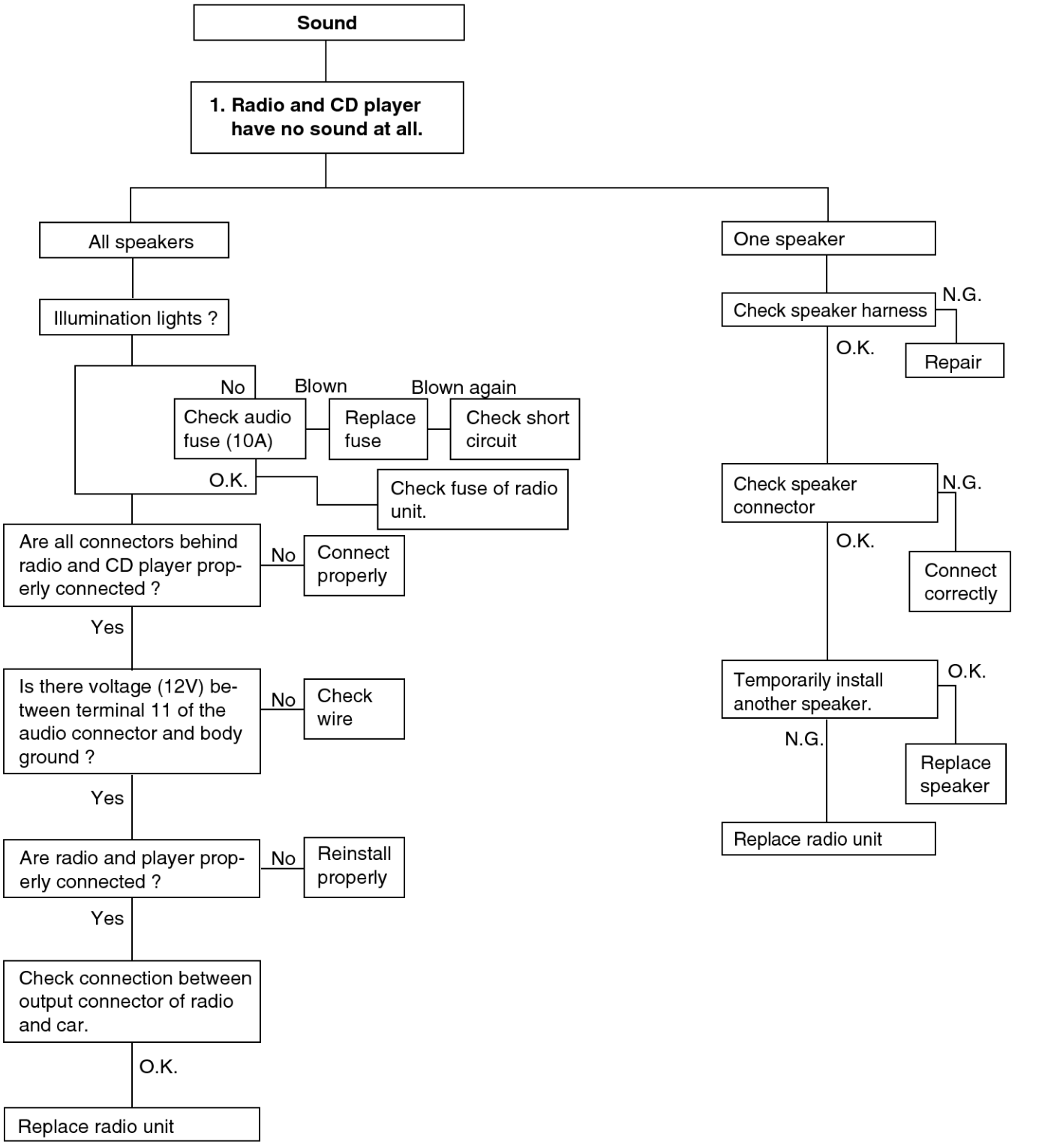
Chart 1



SENBE7048L

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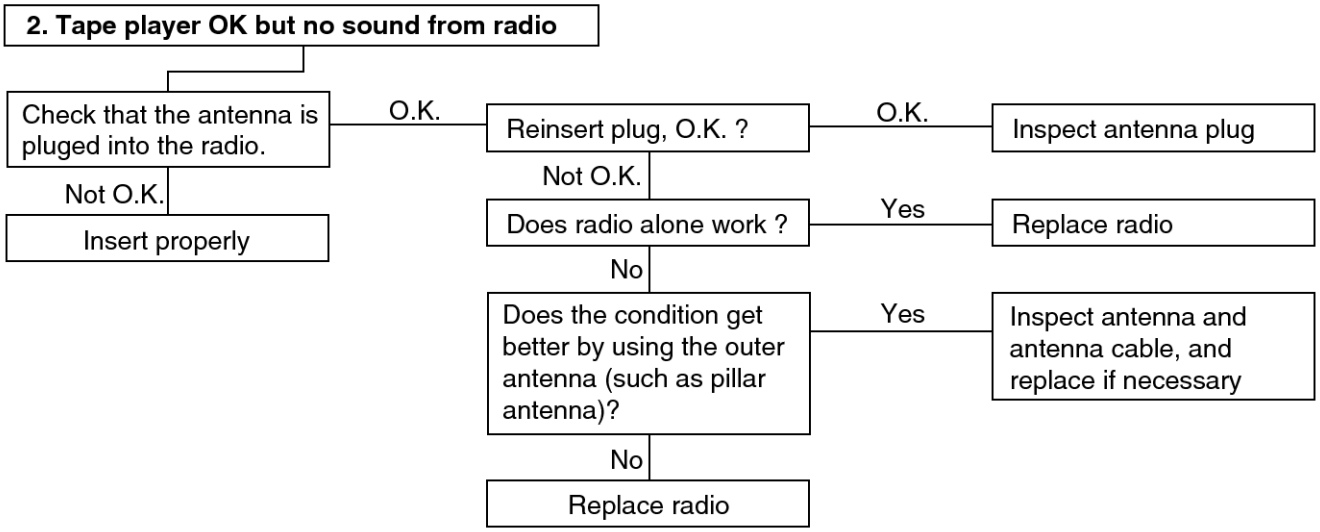
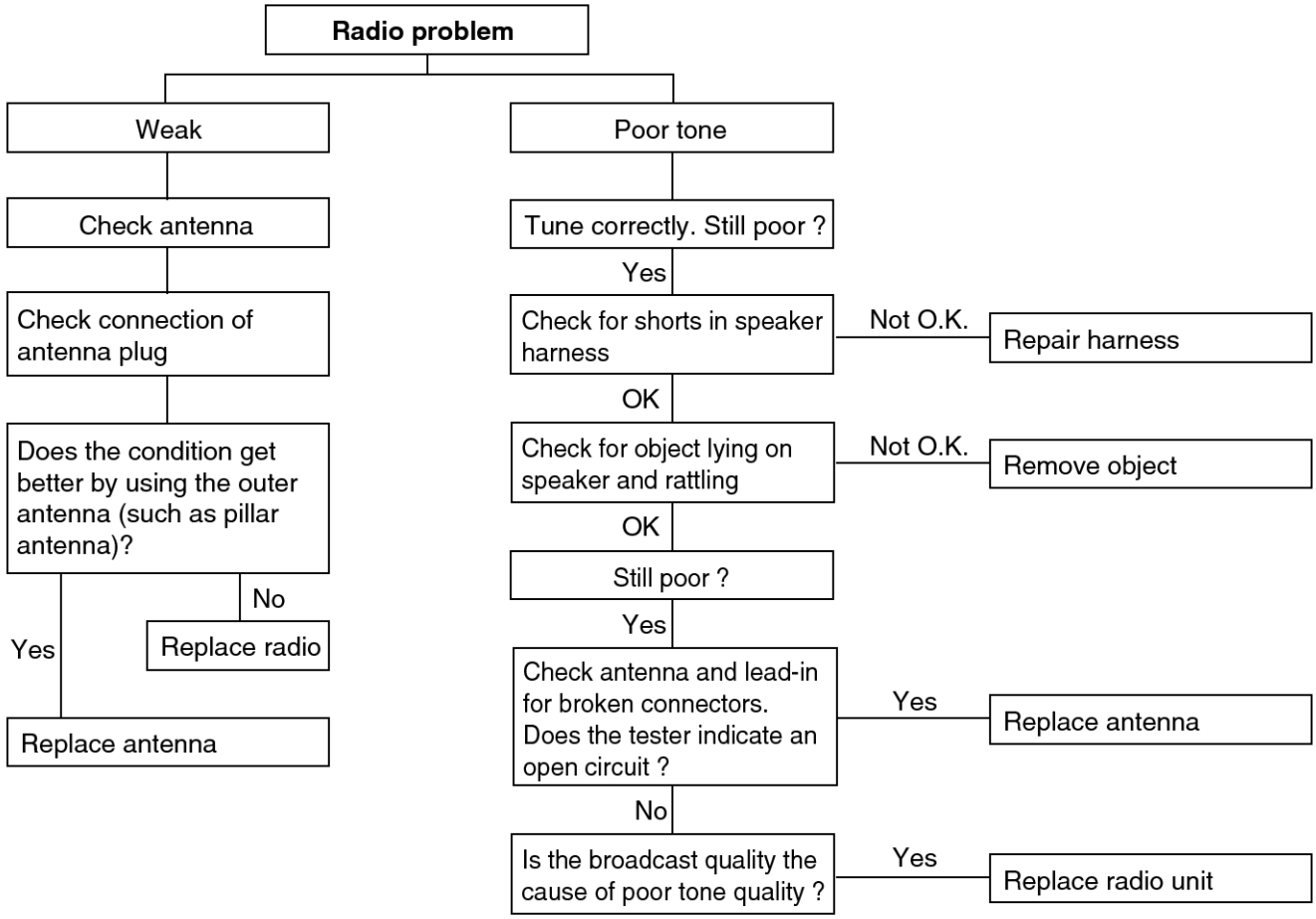


LTIF001C

Chart 2



LTIF001D

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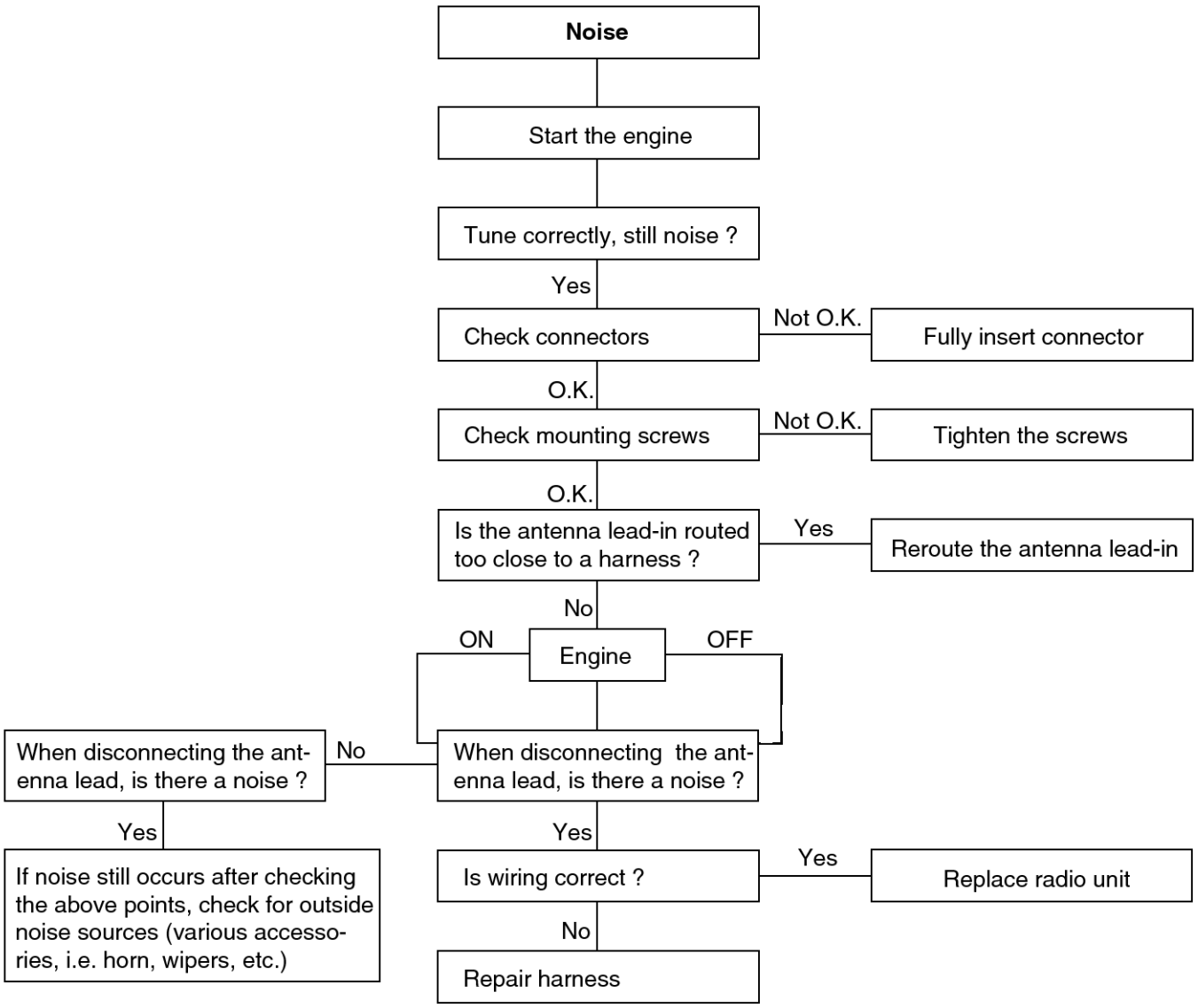
Chart 3

1. RADIO



LTIF001F

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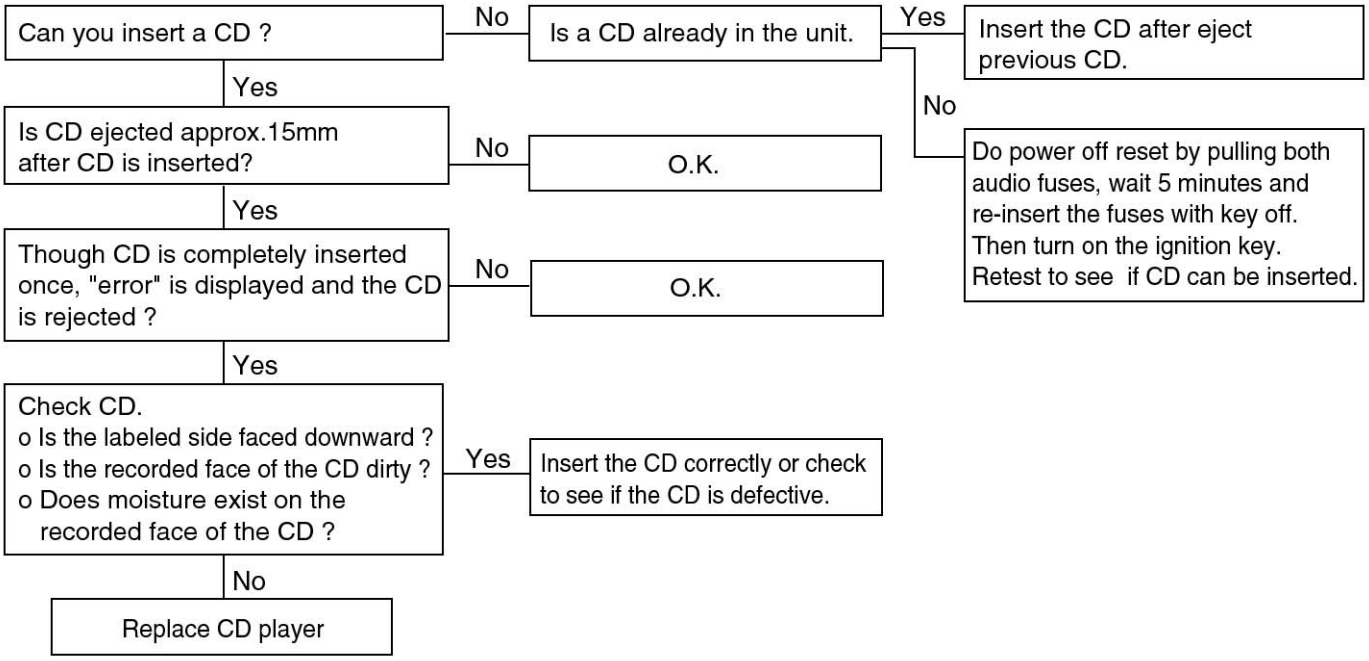
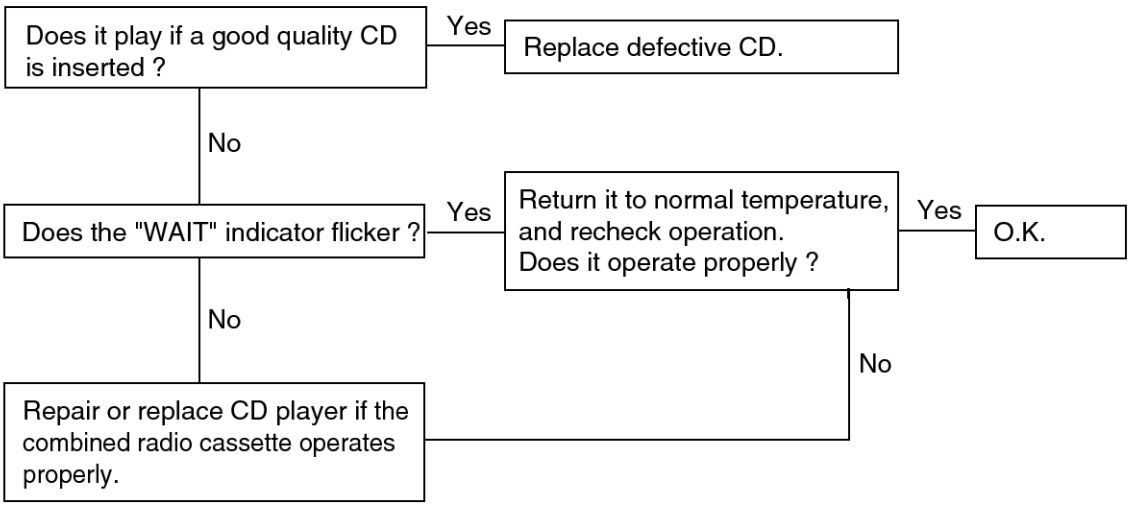
Chart 4

1. CD WILL NOT BE ACCEPTED



LTIF001H

2. NO SOUND



LTIF001I

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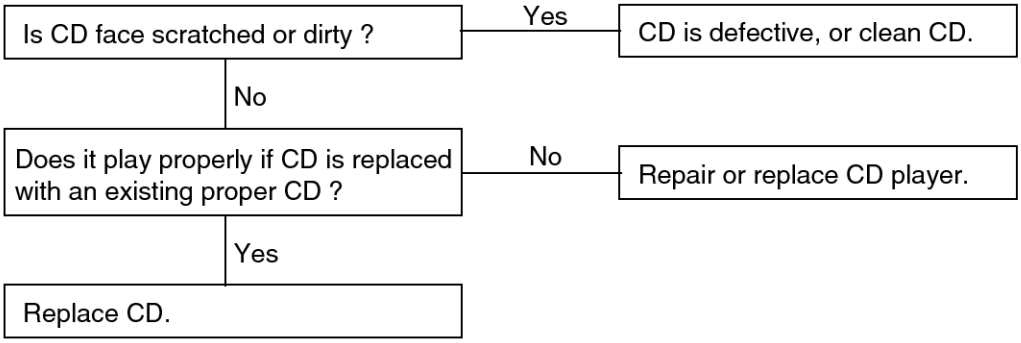
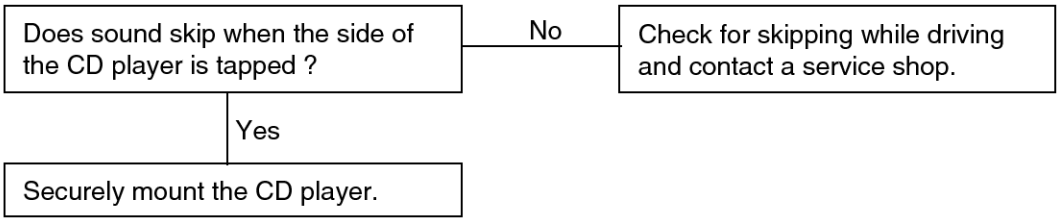
3. CD SOUND SKIPS

1) Sound sometimes skips when parking.



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



LTIF001J

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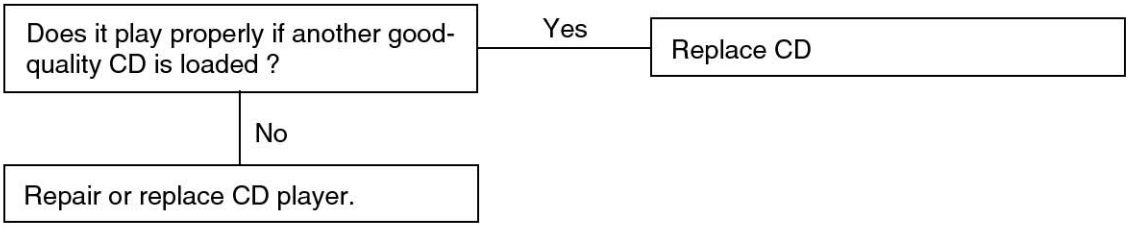
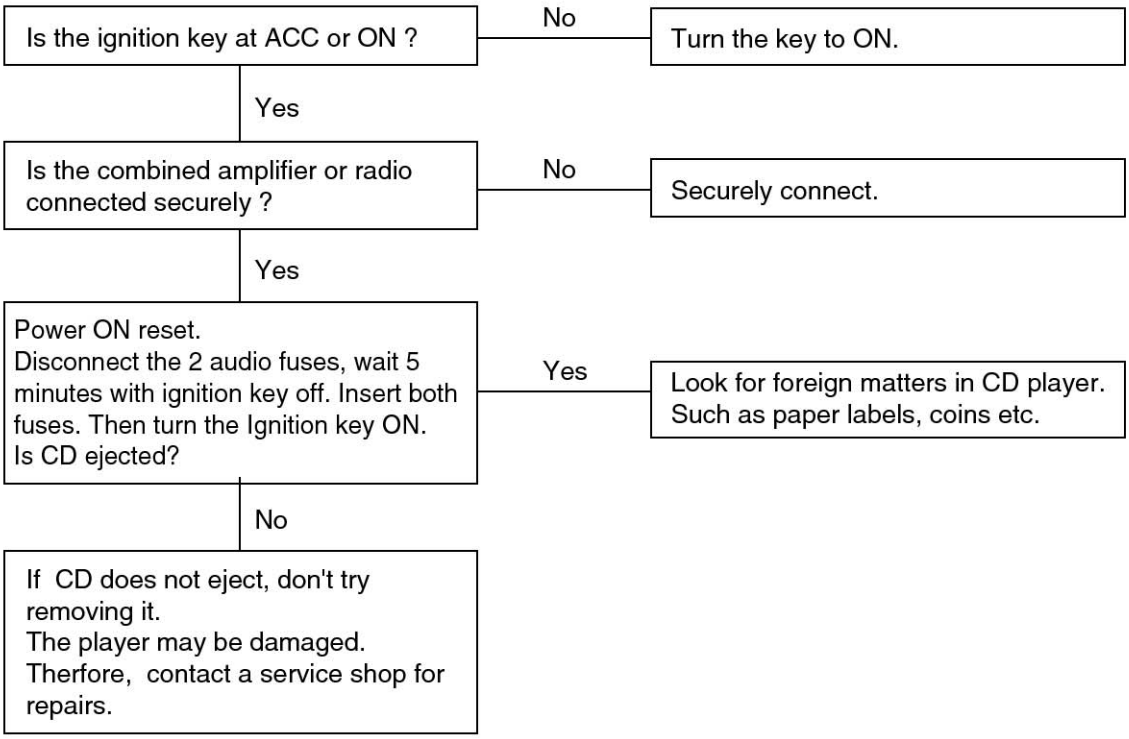
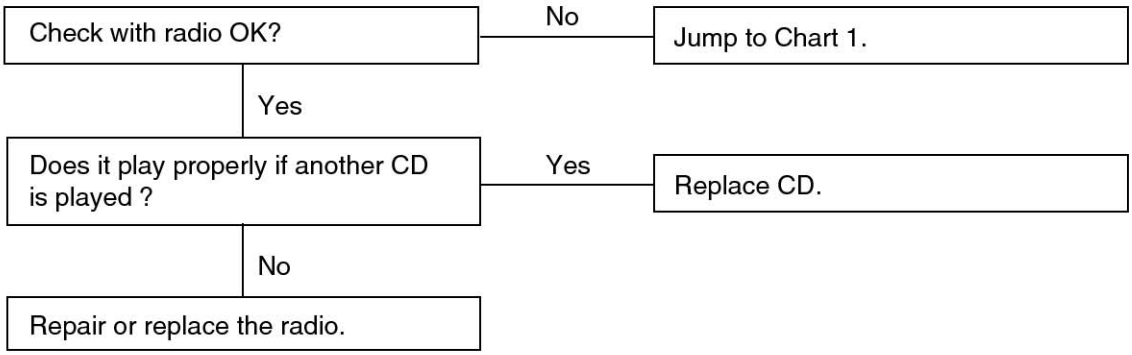
4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER



LTIF001K

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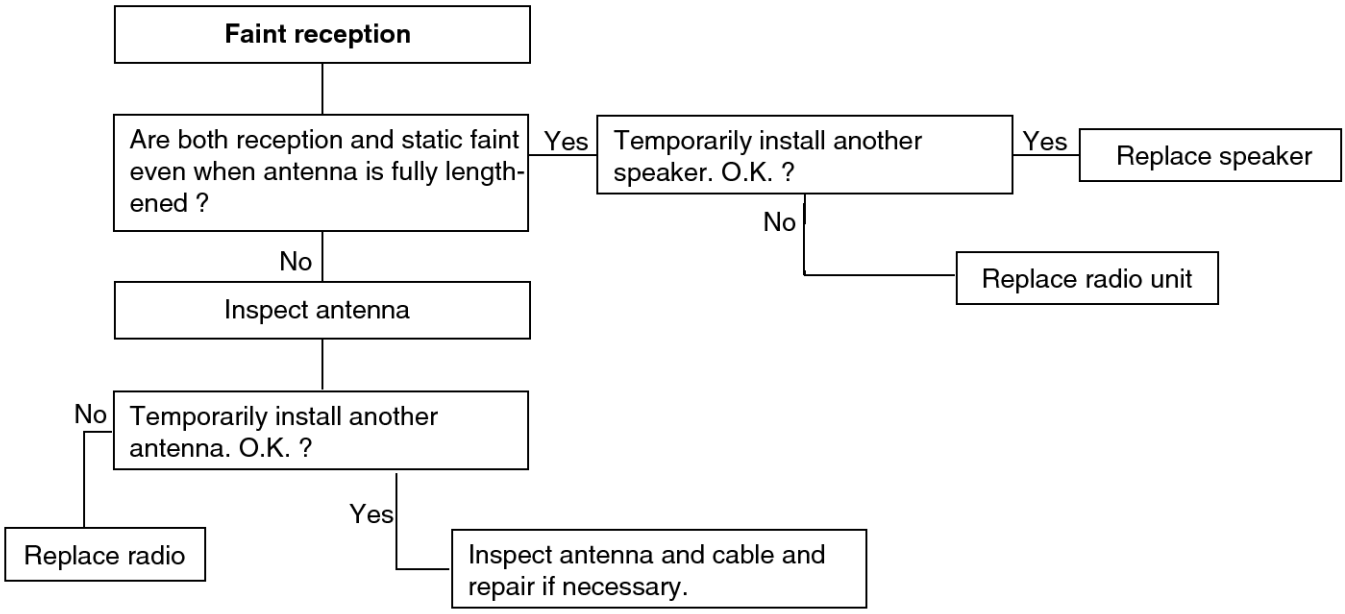
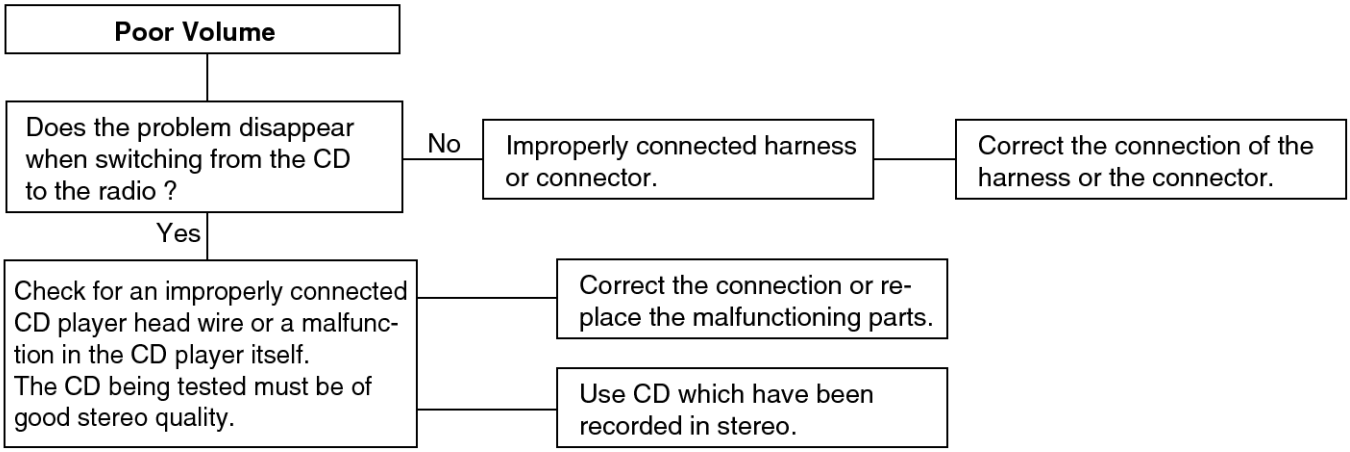
Chart 5



LTIF001L

Chart 6



SENBE7039L

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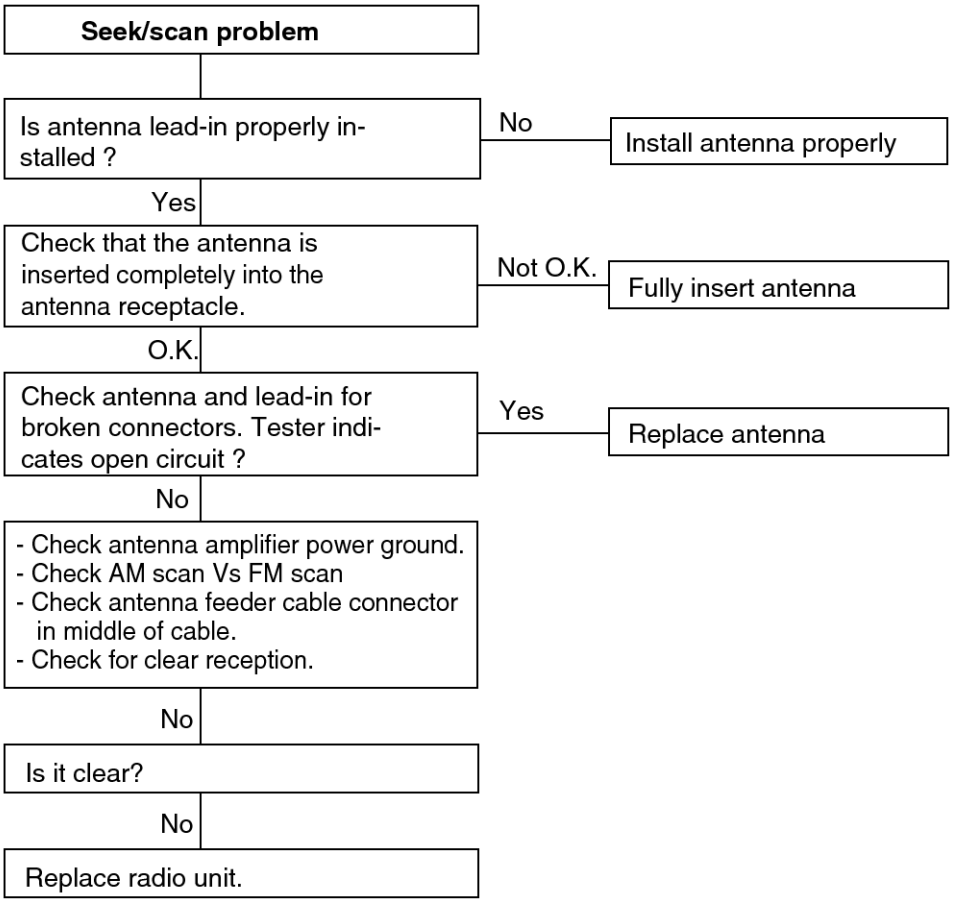
Chart 7



LTIF001N

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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)

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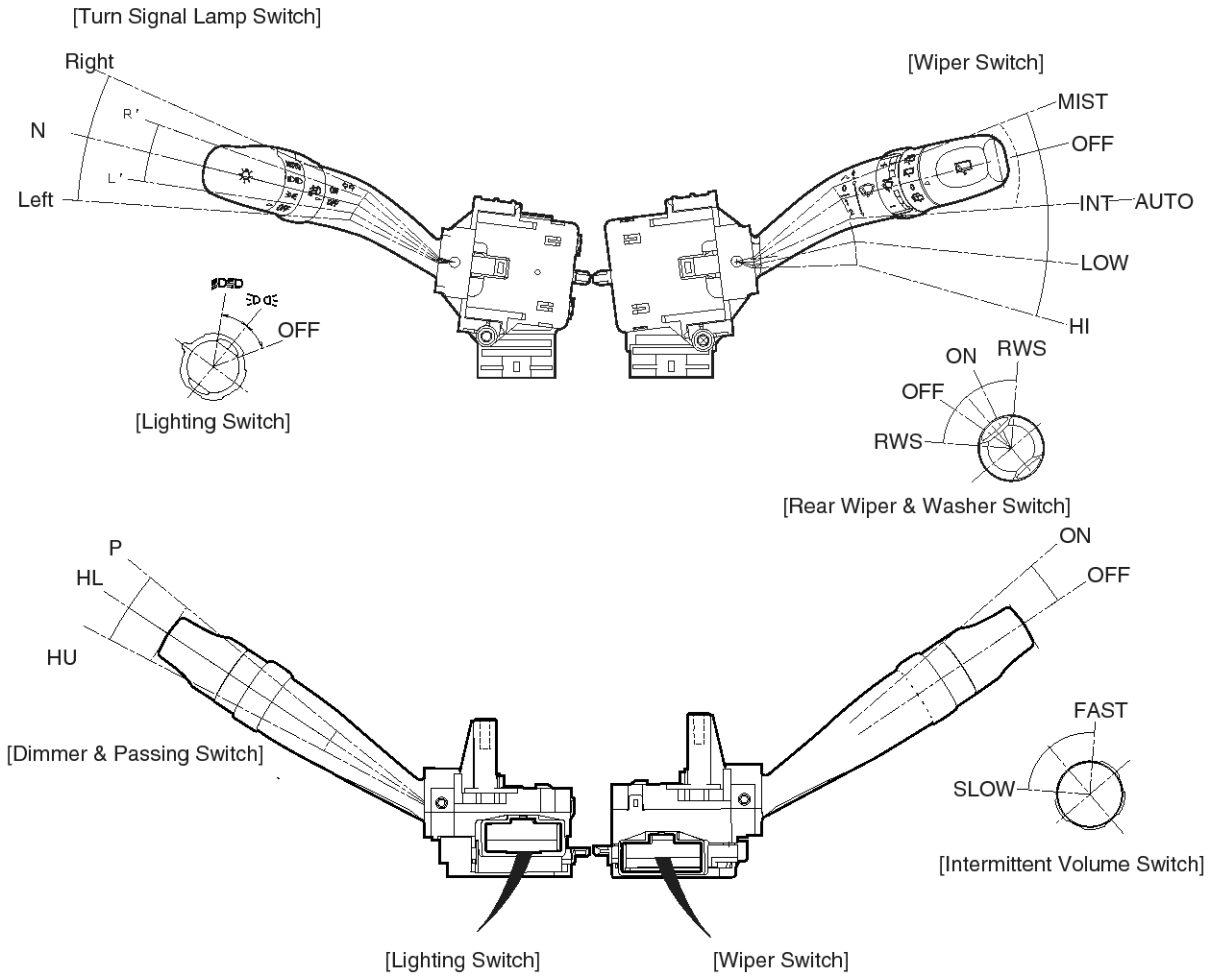
Component



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

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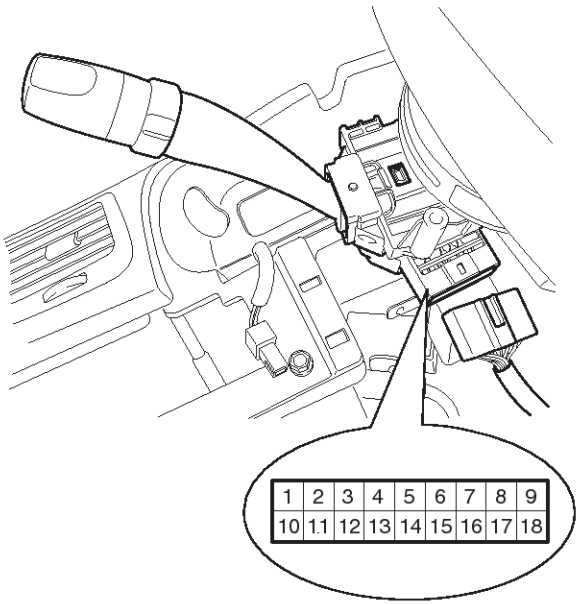
Inspection

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

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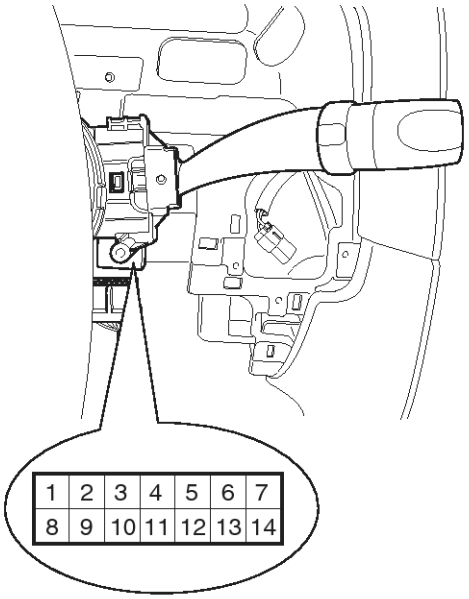
Wiper And Washer Switch Inspection

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

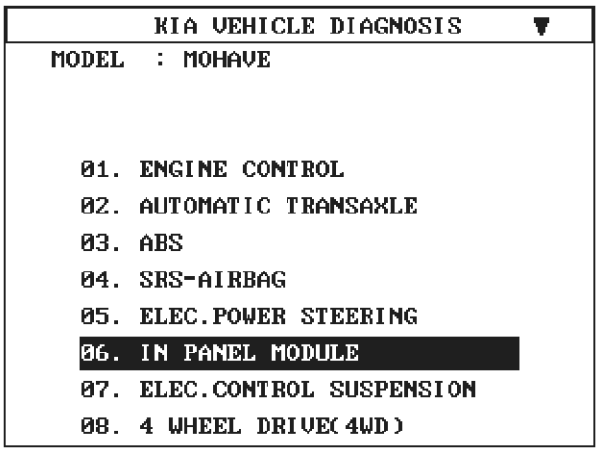
Rear Wiper & Washer Switch

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

SHMBE9084N

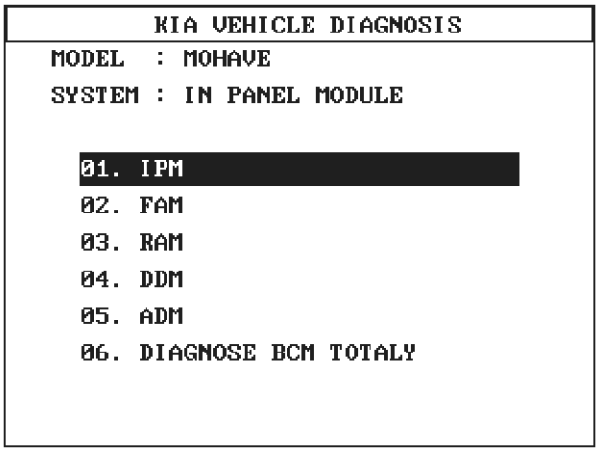
Inspection (With Scan Tool)

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

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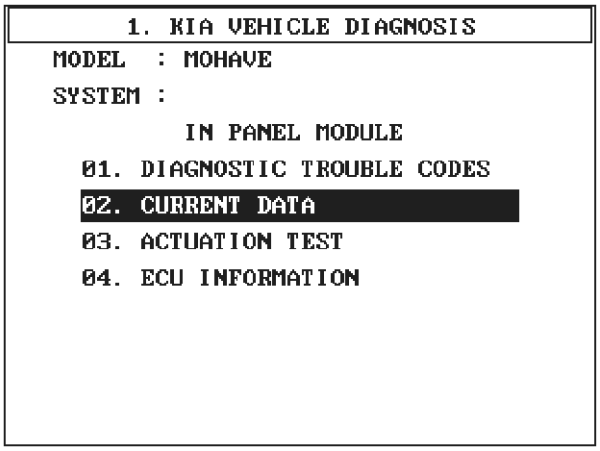
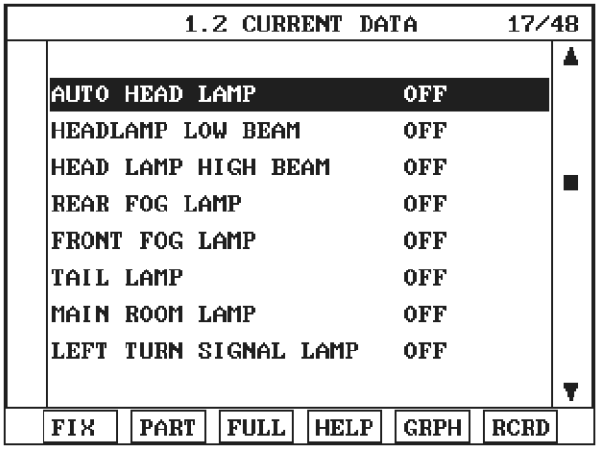
4. Select "Current data".



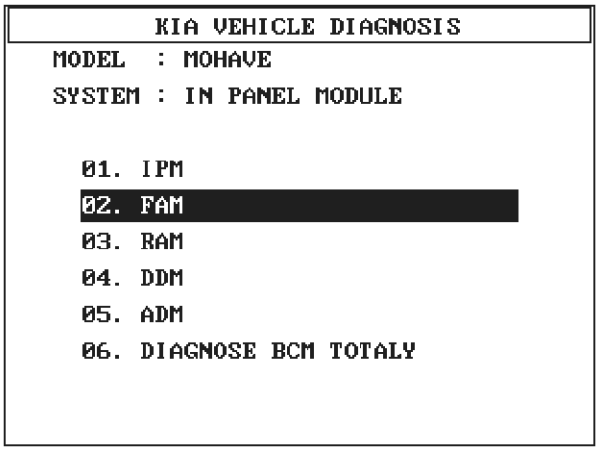
SHMBE9104L

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



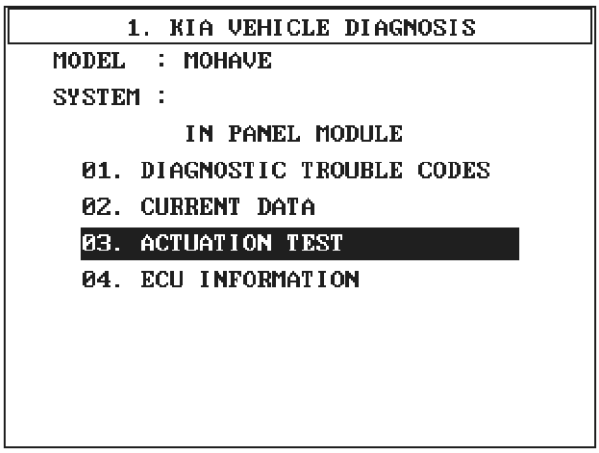
SHMBE9088N

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

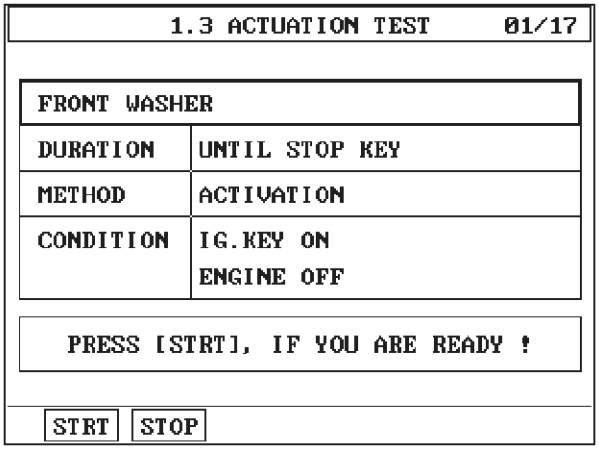


SHMBE9105L

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



SHMBE9106L



SHMBE9091N

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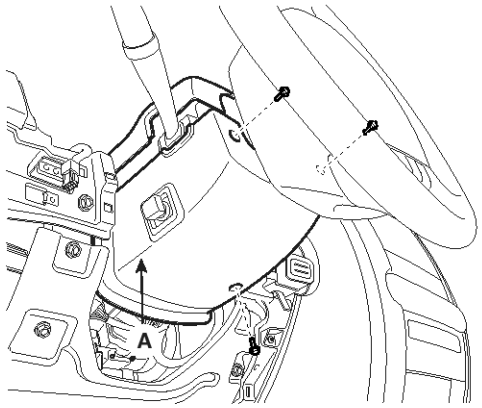
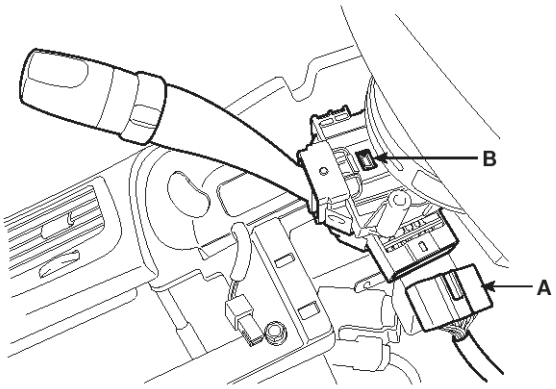
Removal

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).



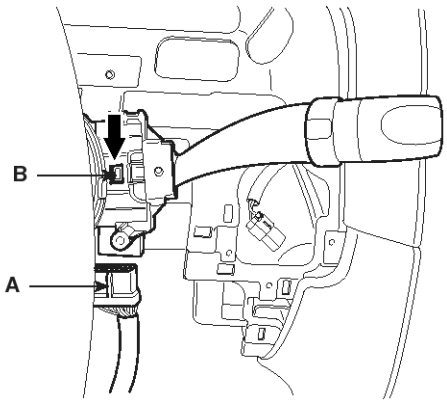
SHMBE8056D

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.

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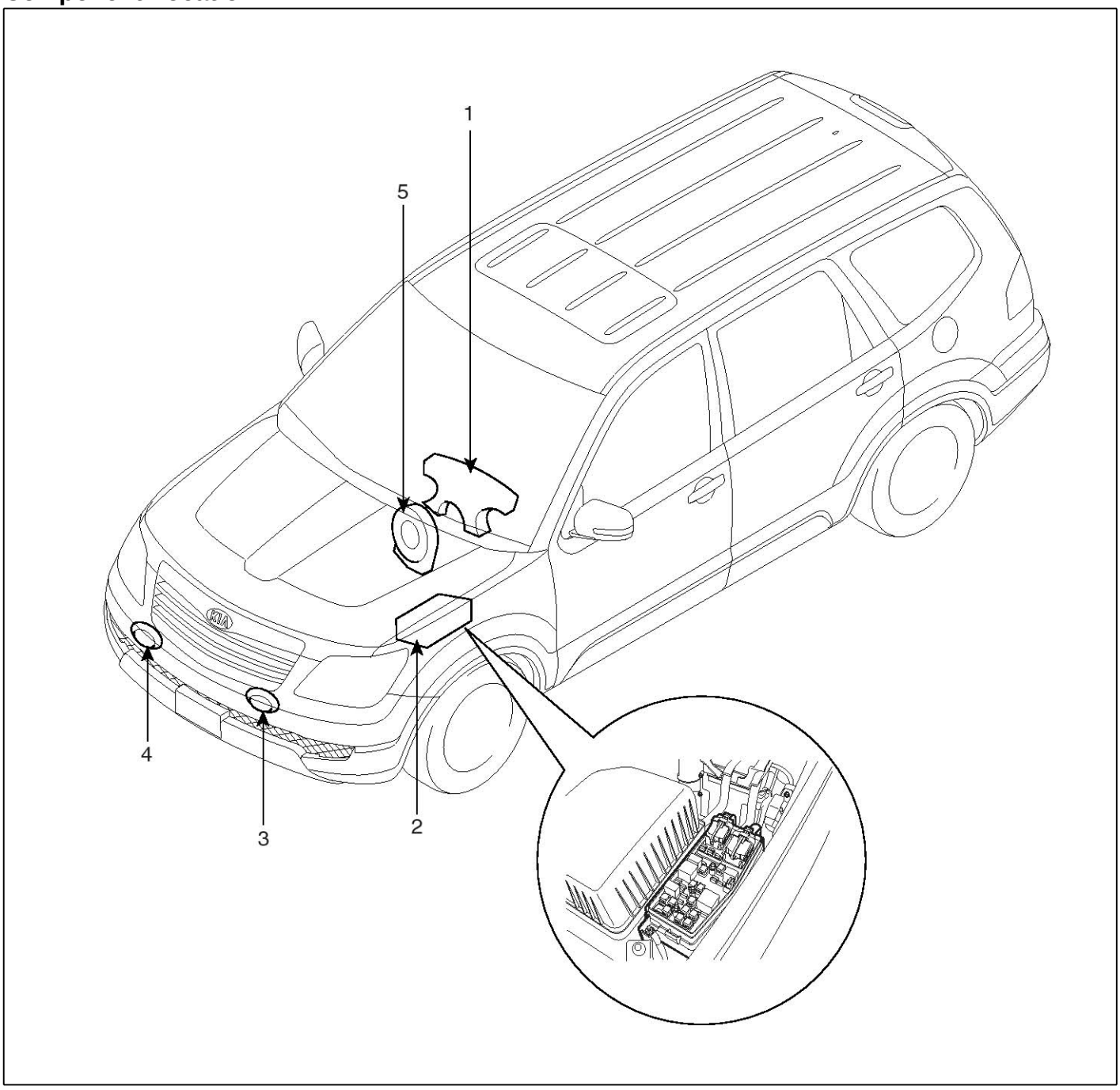
Horn

Component Location



SHMBE8070D

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

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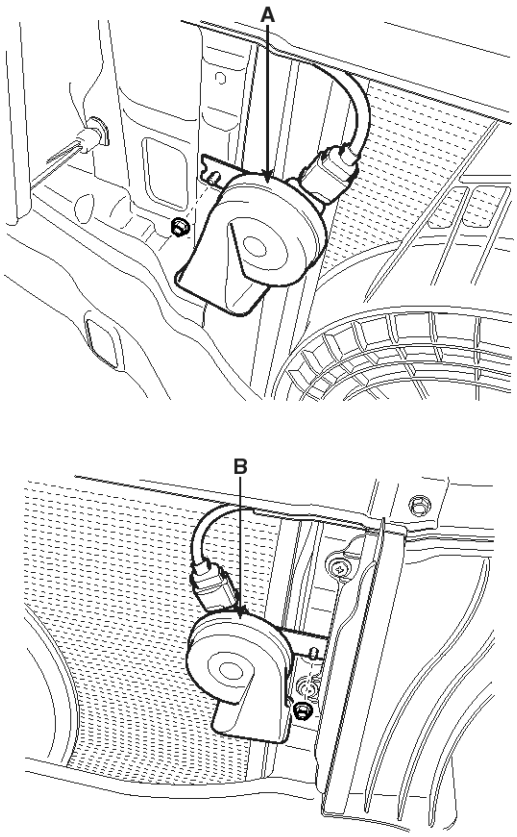
Removal

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

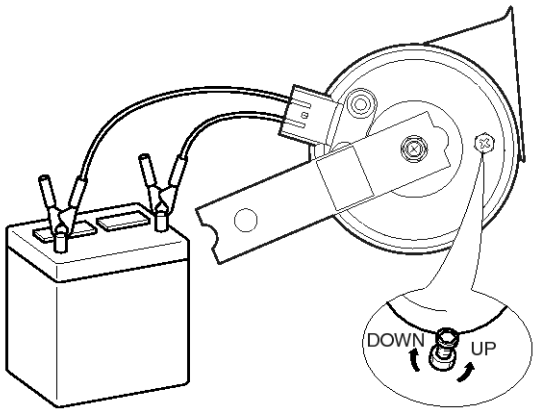
1. Install the horn after connecting the horn connector.
2. Install the front bumper.
   (Refer to the Body group - Front bumper).

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

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Keyless Entry And Burglar Alarm

Specifications

Items	Specifications
Power source	DC 3V
Operating temperature	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	3 year (10 time / day)

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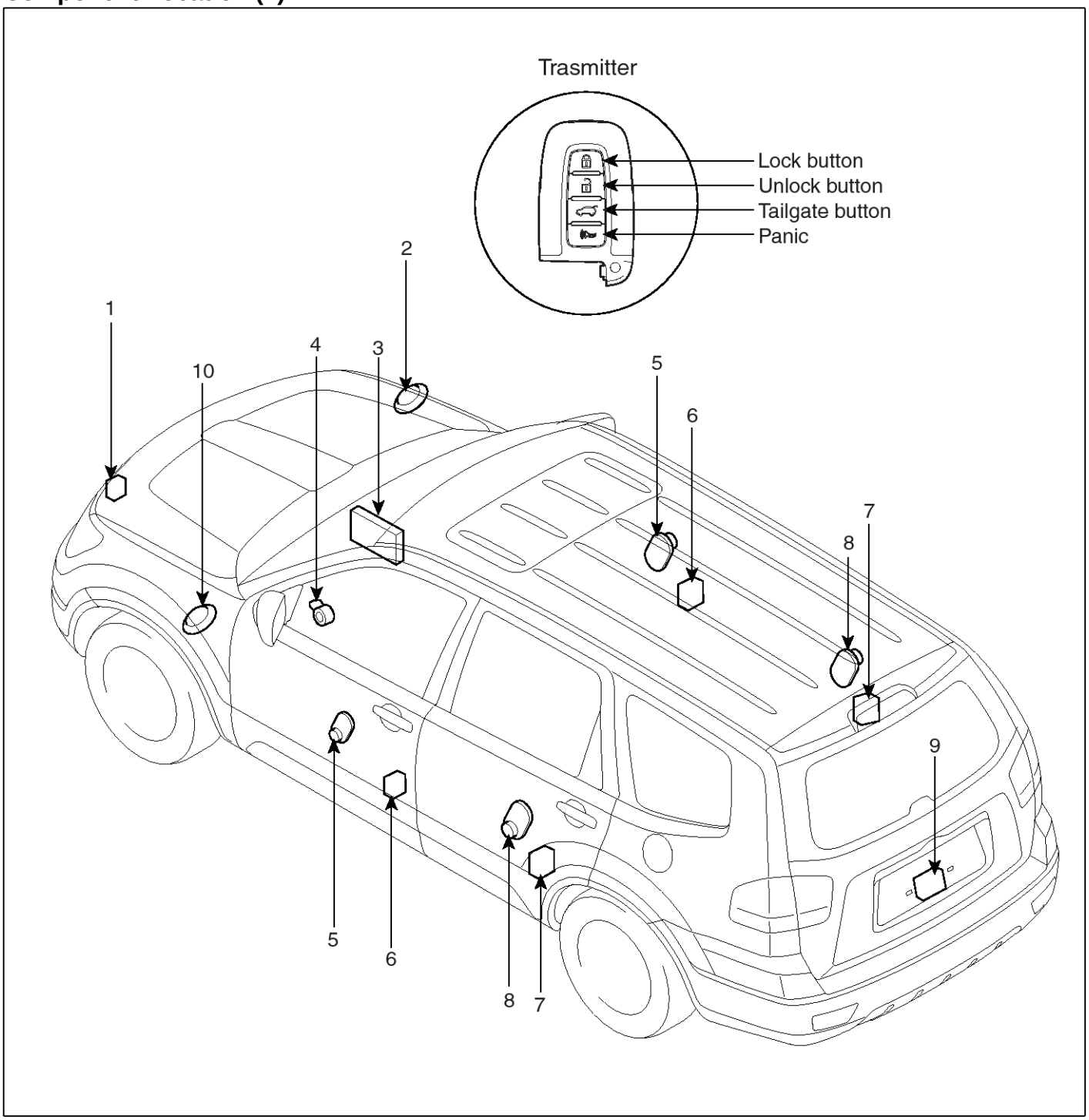
Component Location (1)



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

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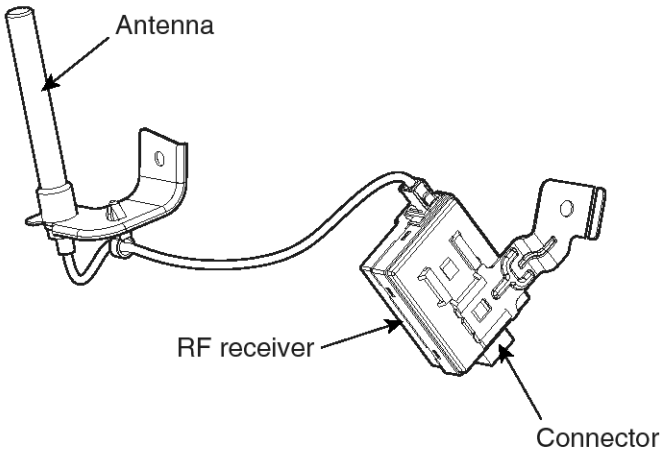
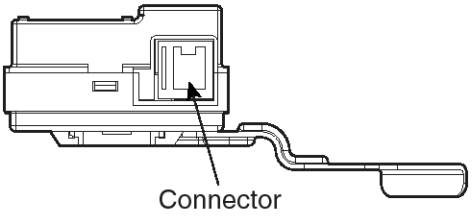
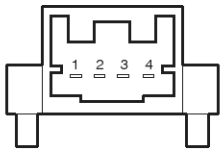
Component Location (2)







No.	Name
1	Receiving data
2	-
3	Power
4	Ground

SHMBE9056L

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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.

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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.

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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 500 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 action 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.

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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.

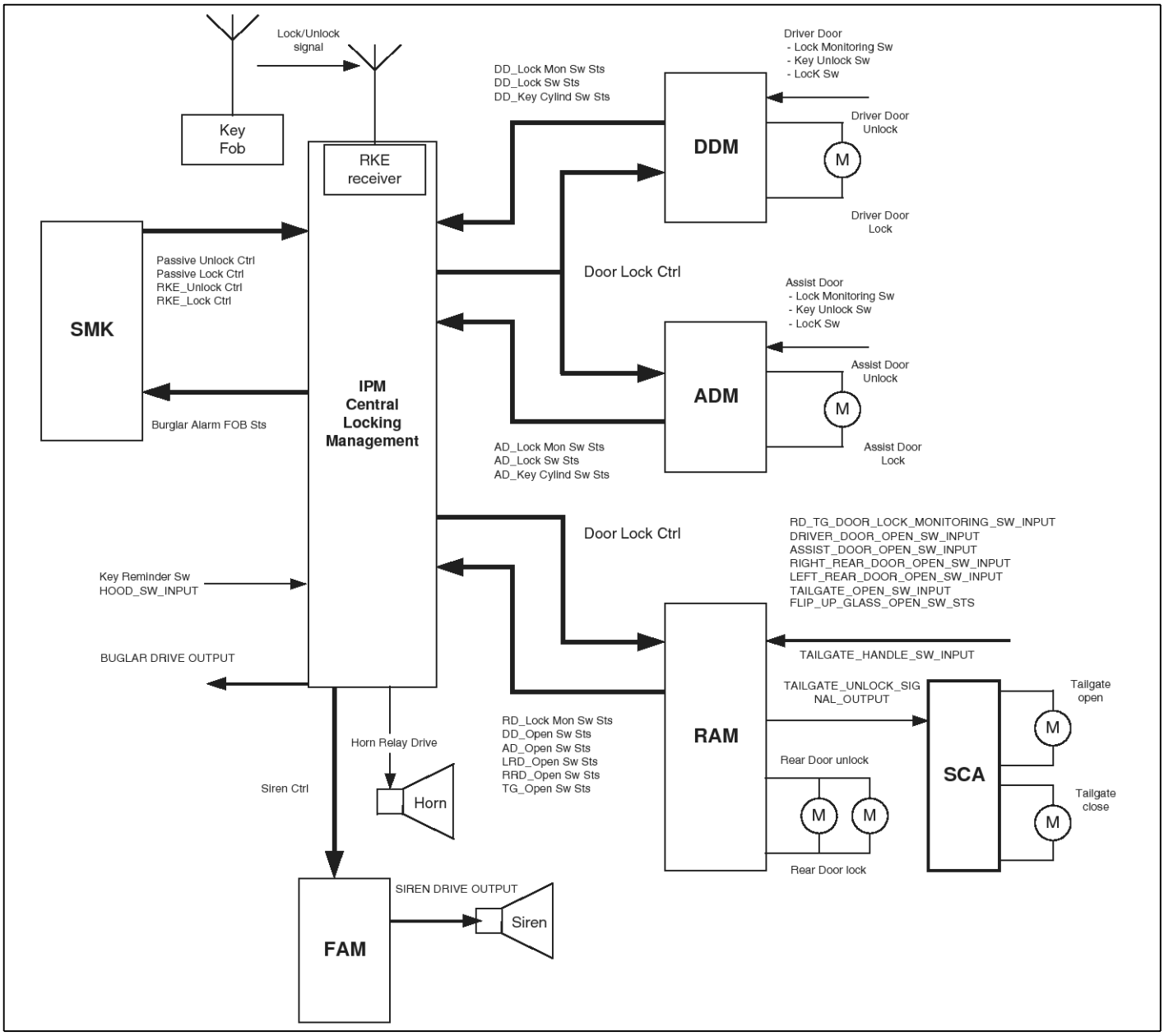
For the rest of this document the following terms are used:

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



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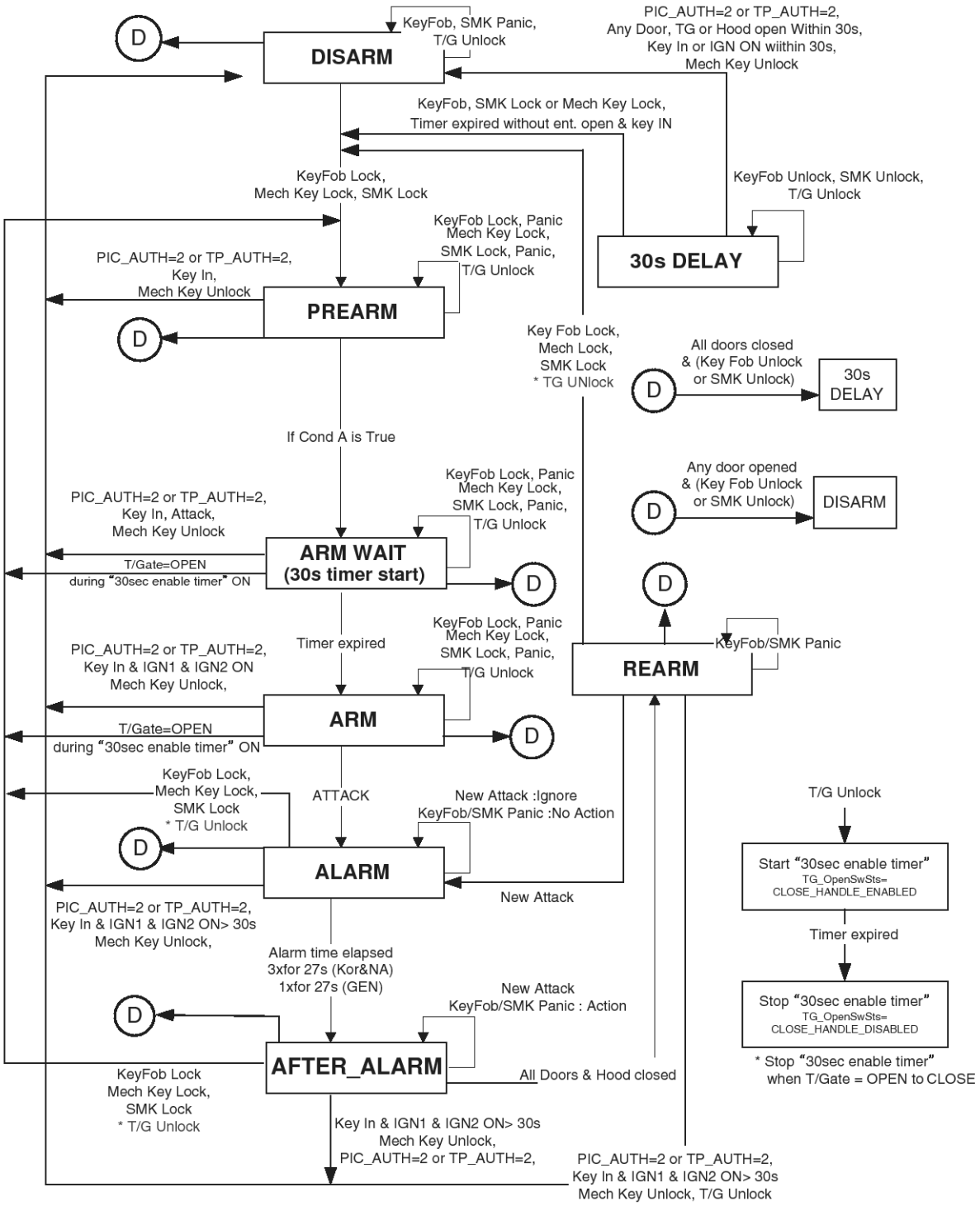
Function

IPM

Description

Burglar Alarm State machine



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

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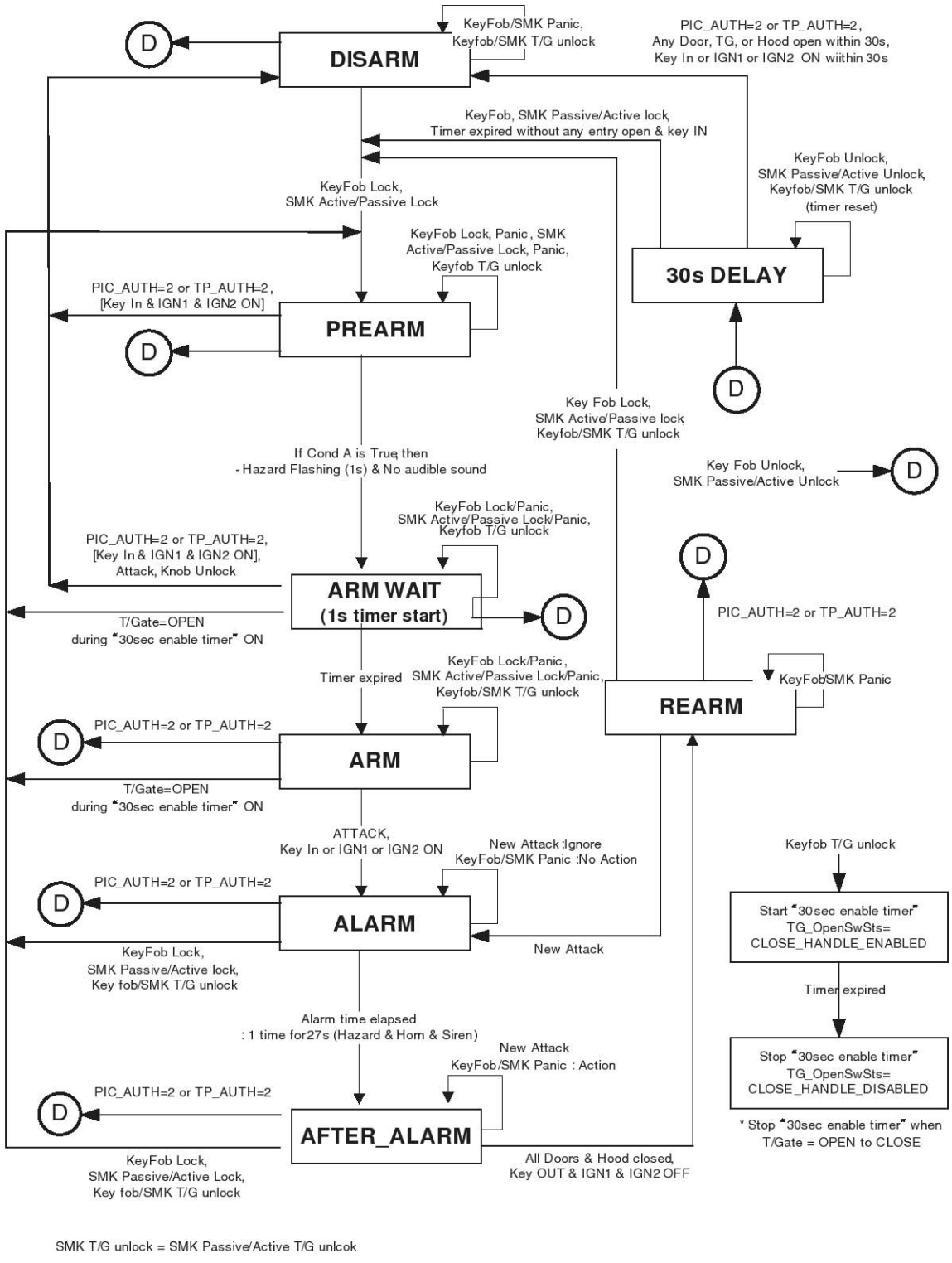
Burglar Alarm State machine for China



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* Waiting for RAM synchronization (tailgate closed handle disabled -> closed handle enabled transition) during 3 sec, see 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.

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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.

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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.

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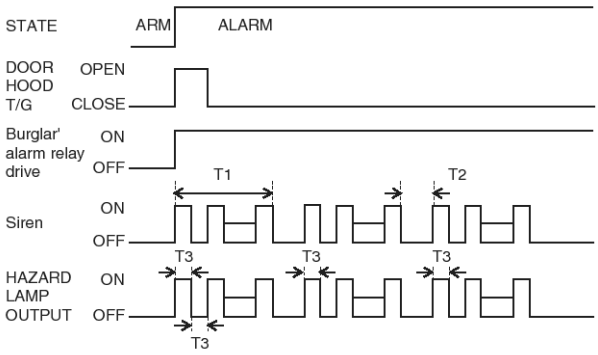
30 sec Delay mode entry for SMK equipment
If key fob unlock signal or SMK active/passive unlock (when equipped) is received in any mode when all doors (including driver, assist, rear doors, tailgate, flip up and hood) are closed, the system goes into 30s delay mode. In this state, if one of the following 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



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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.

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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

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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.

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Description
Error Cases In case of CAN failure, value invalid or undefined of lock monitoring sw, Open sw CAN signals, doors (except tailgate) a-re considered open and unlocked. In DISARM alarm state, in case of CAN failure, value INVALID or undefined of CAN signal tailgate open switch status, t-he 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 alread-y 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 sign-al 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 sig-nal 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

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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:

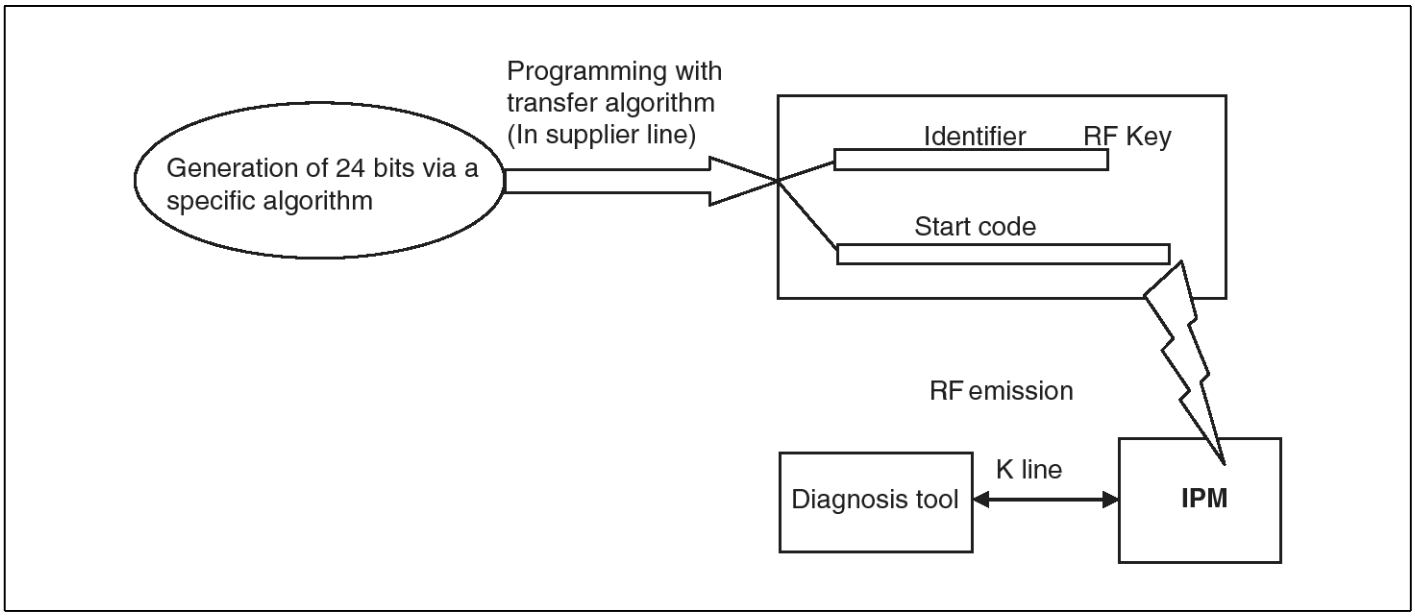
- First by learning Fix Code of the Key.
- Second by synchronizing Rolling Code between IPM and key, by the first frame received outside the learning procedure.

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



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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

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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')

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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

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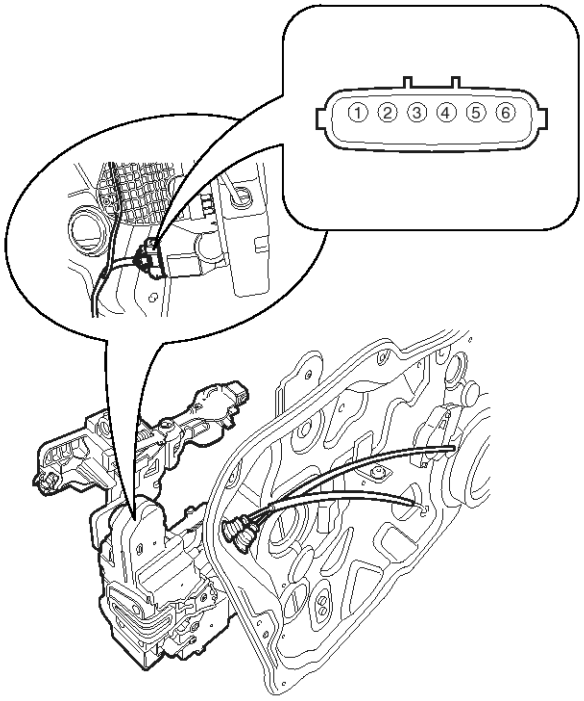
Inspection

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.



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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	⊕	⊖

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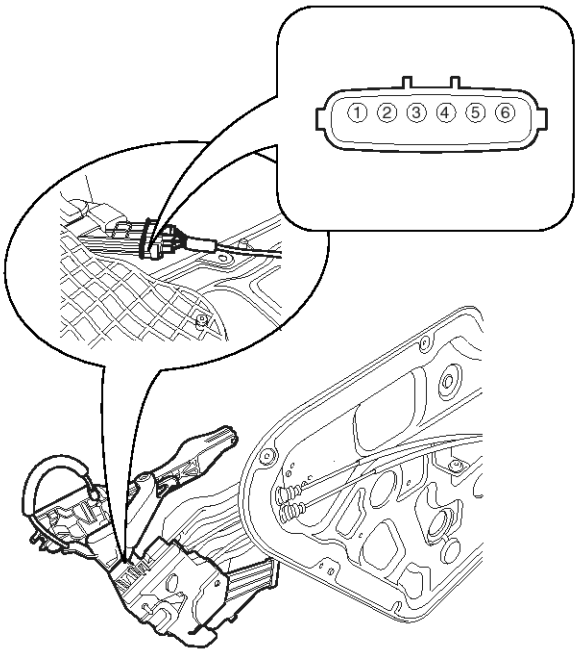
Rear Door Lock Actuator

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.



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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	⊕	⊖

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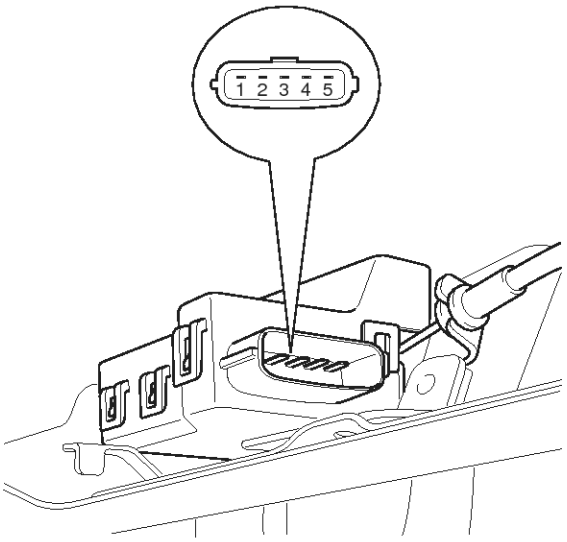
Tailgate Lock Actuator Inspection

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



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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		○	○

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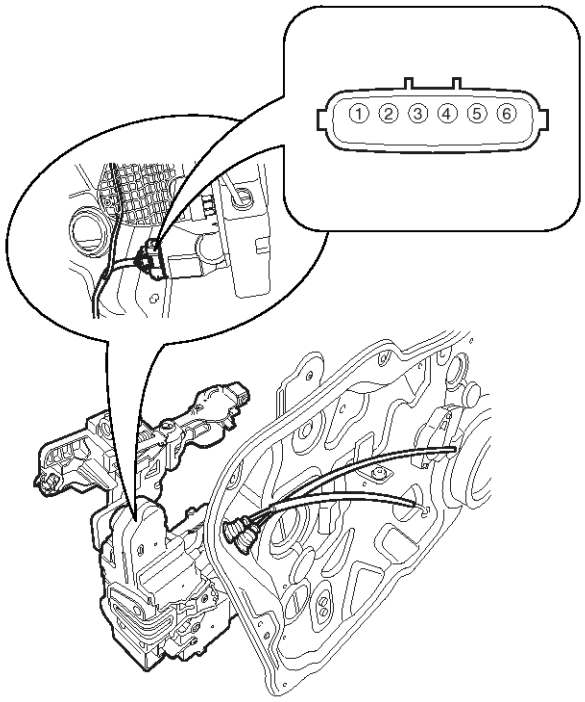
Front Door Lock Switch

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.



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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		○	○	

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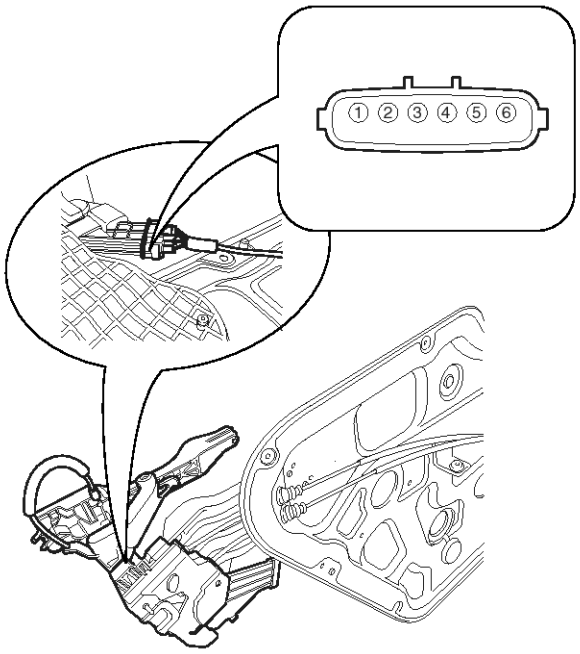
Rear Door Lock Switch

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

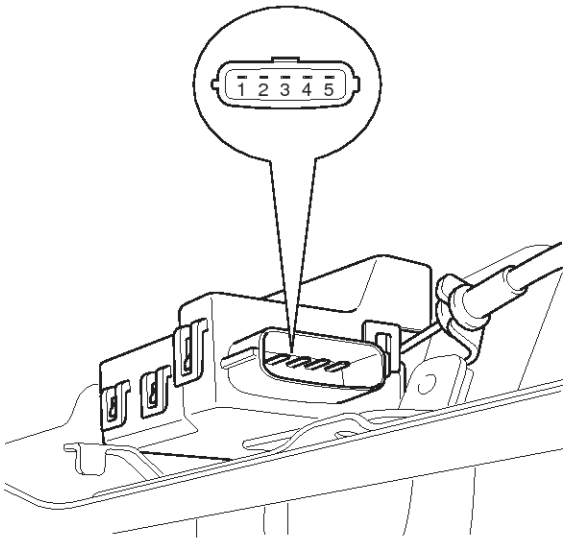
4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position		1	3
Rear Left	Unlock	○———	———○
Terminal / Position		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.

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

SHMBE9054L

Door Switch

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

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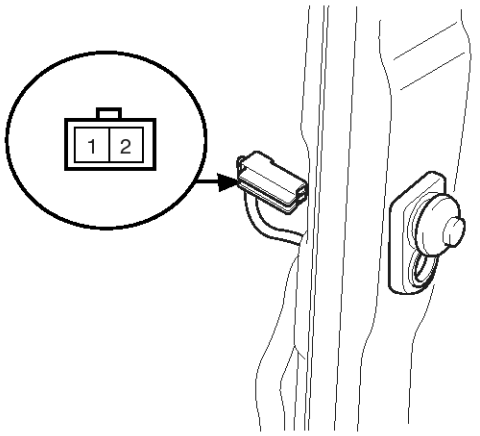


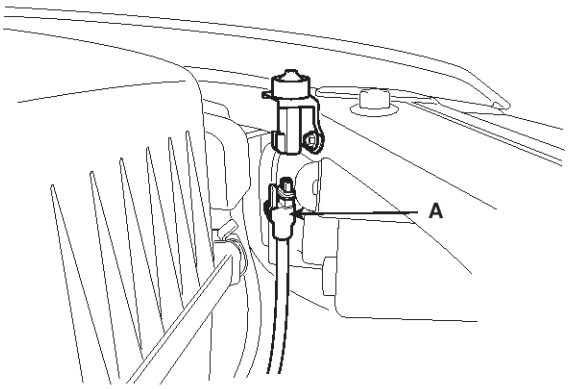
SHMBE8125D

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

SHMBE9067L

Hood Switch

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



SHMBE8127D

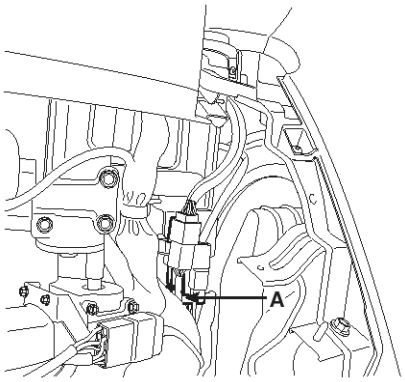
2. Check for continuity between the terminals and ground according to the table.

Terminal / Position	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

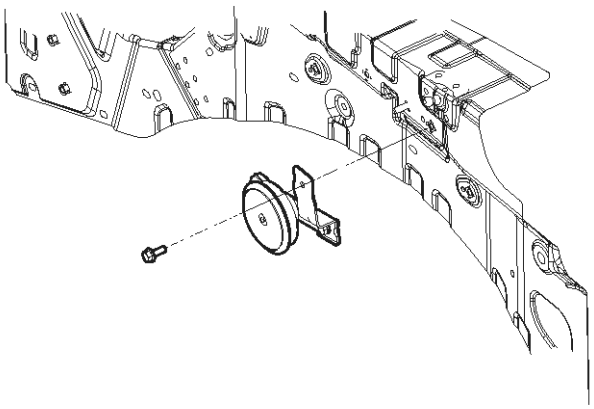
3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	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.

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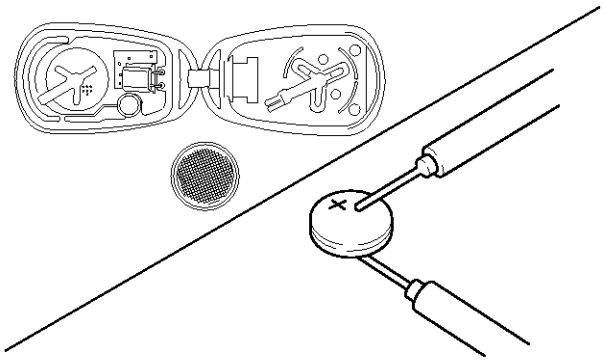
Transmitter

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

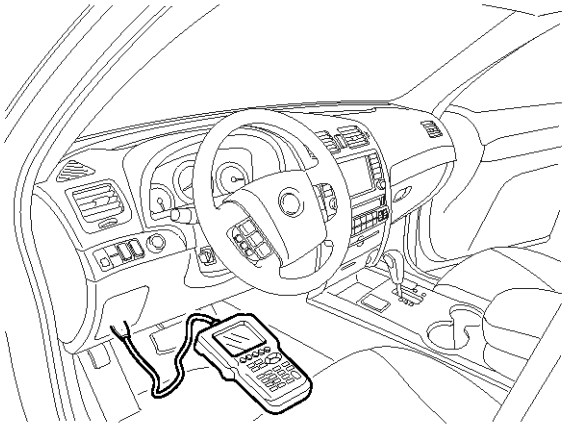


ATLG029A

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).

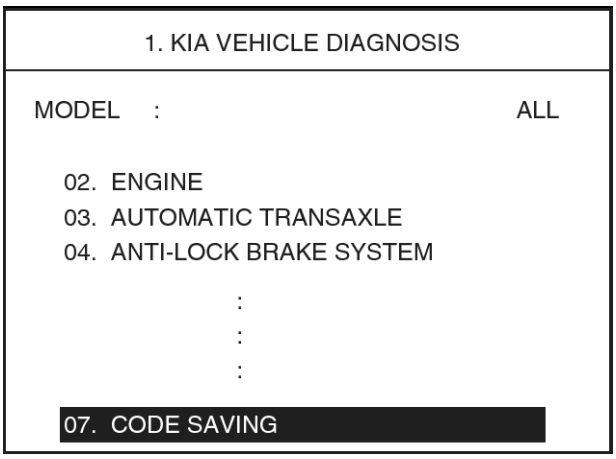
Transmitter Code Registration

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".



SHMBE9112L

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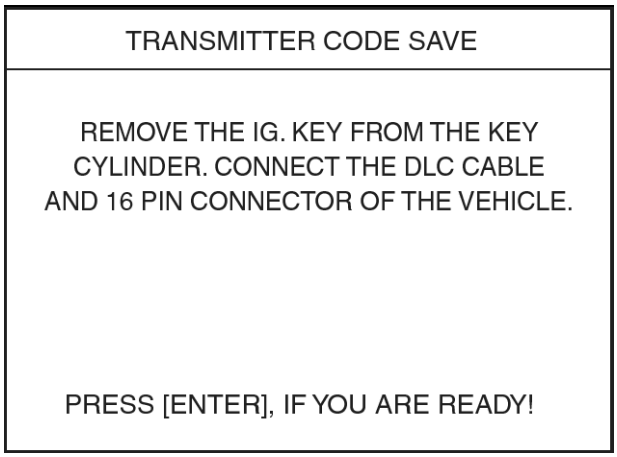
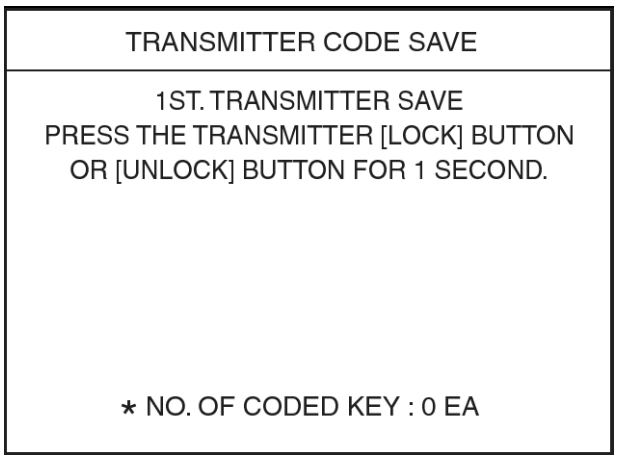
3. After selecting "CODE SAVING" menu, push "ENTER" key, then the screen will be shown as below.

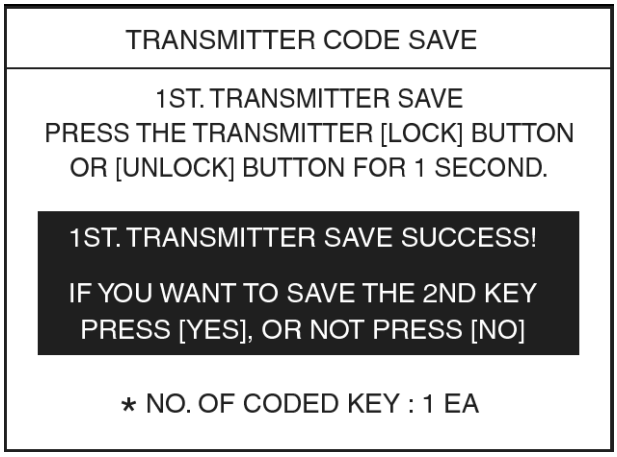


ETRF065M

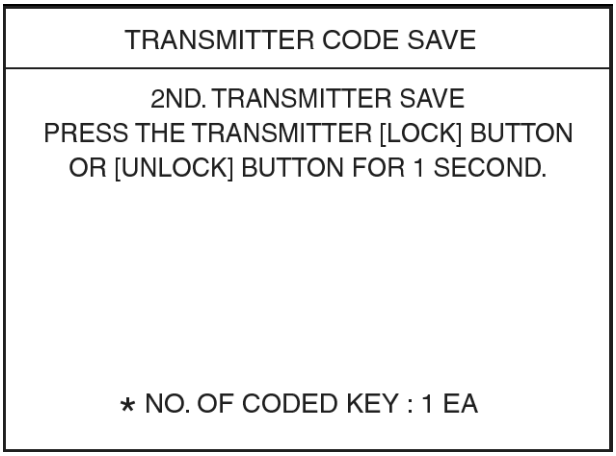
4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.



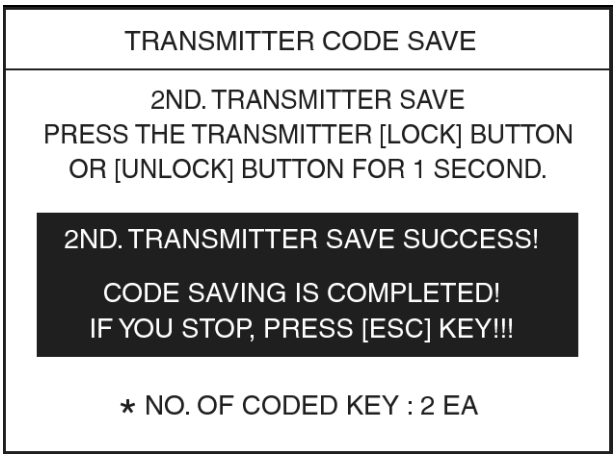
ETRF065N



ETRF065O



ETRF065P



ETRF065Q

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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

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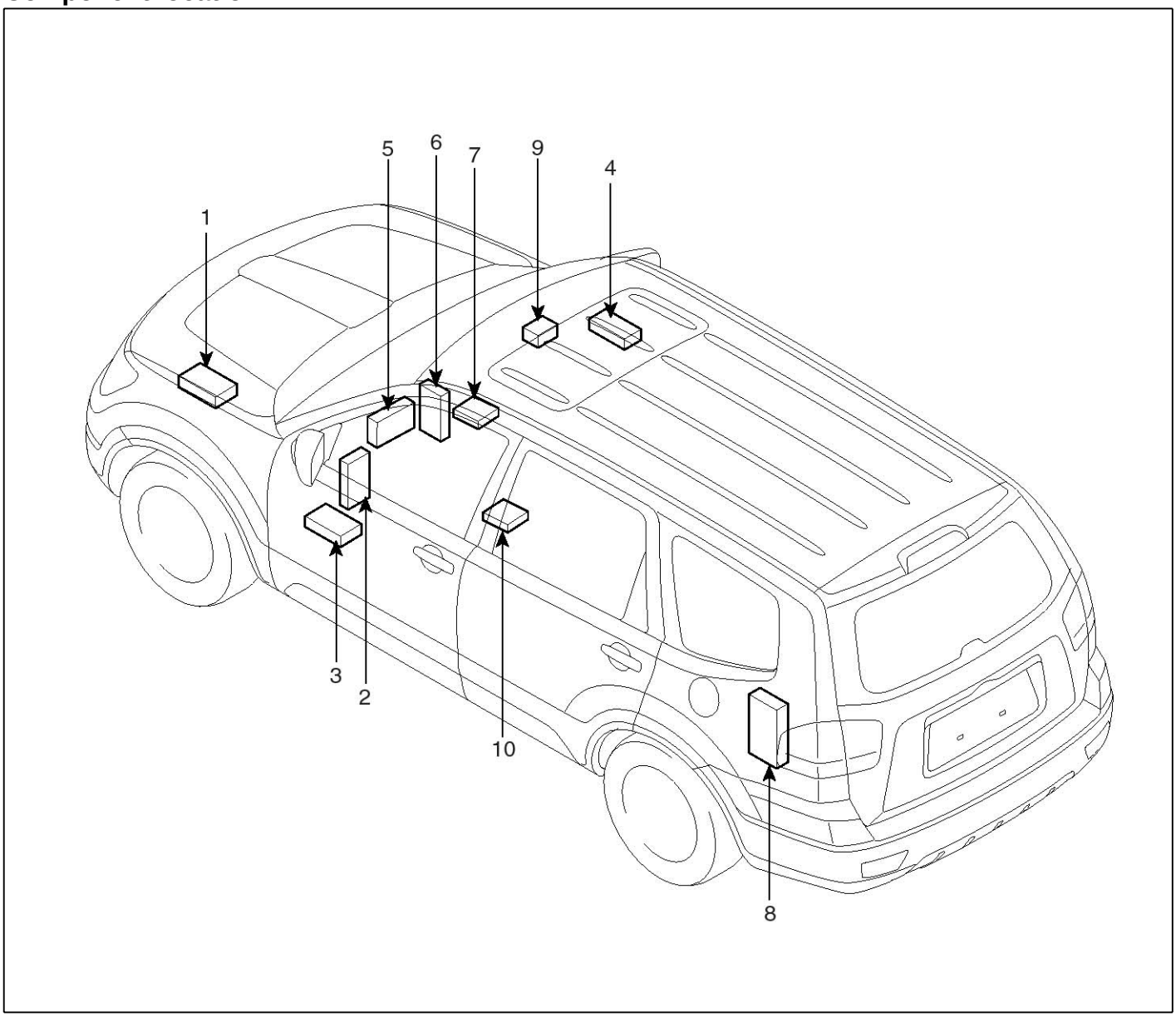
Component location



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)

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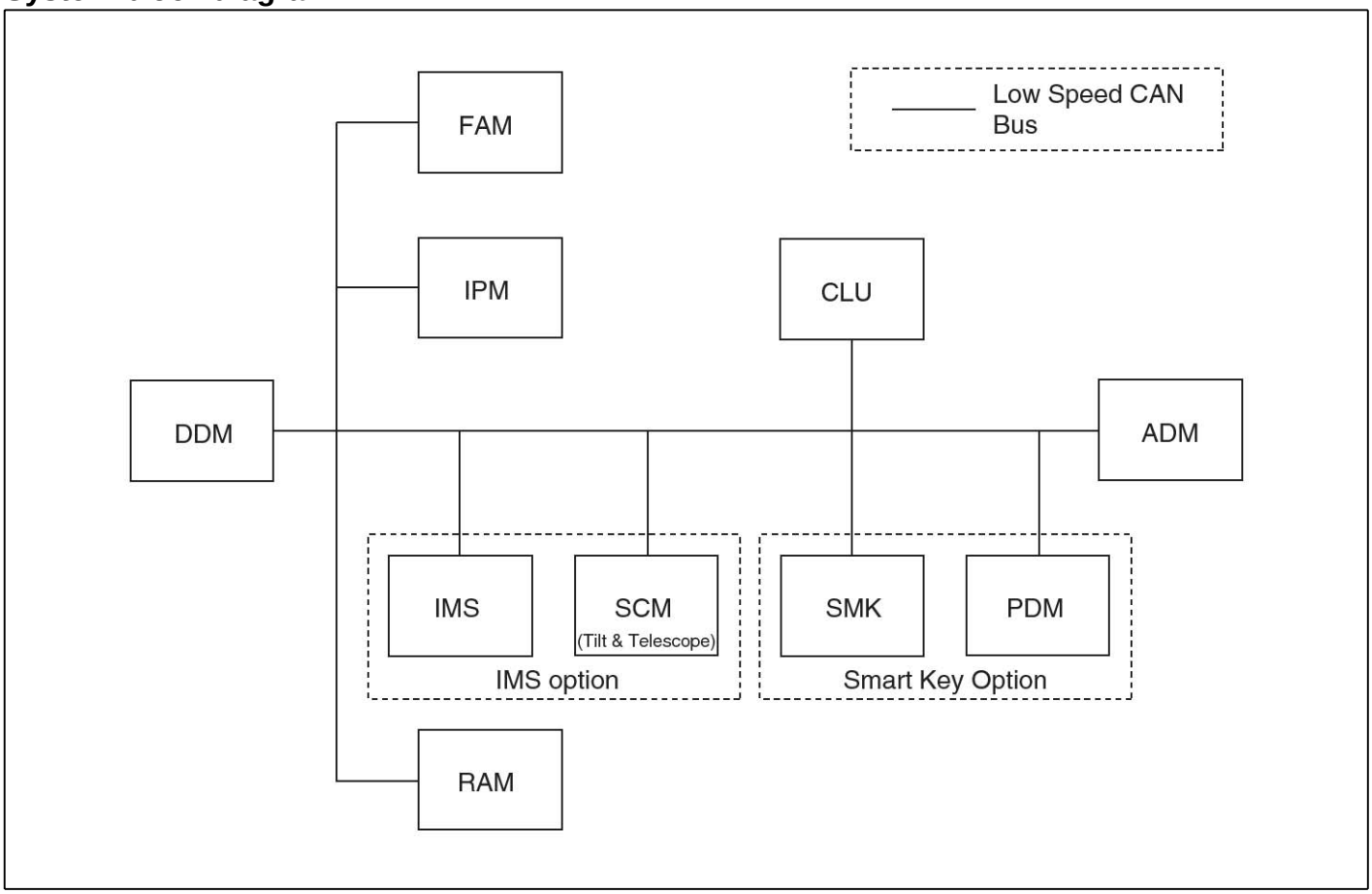
System block diagram



SHMBE9072L

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Operation

Engine and Ignition Key Control

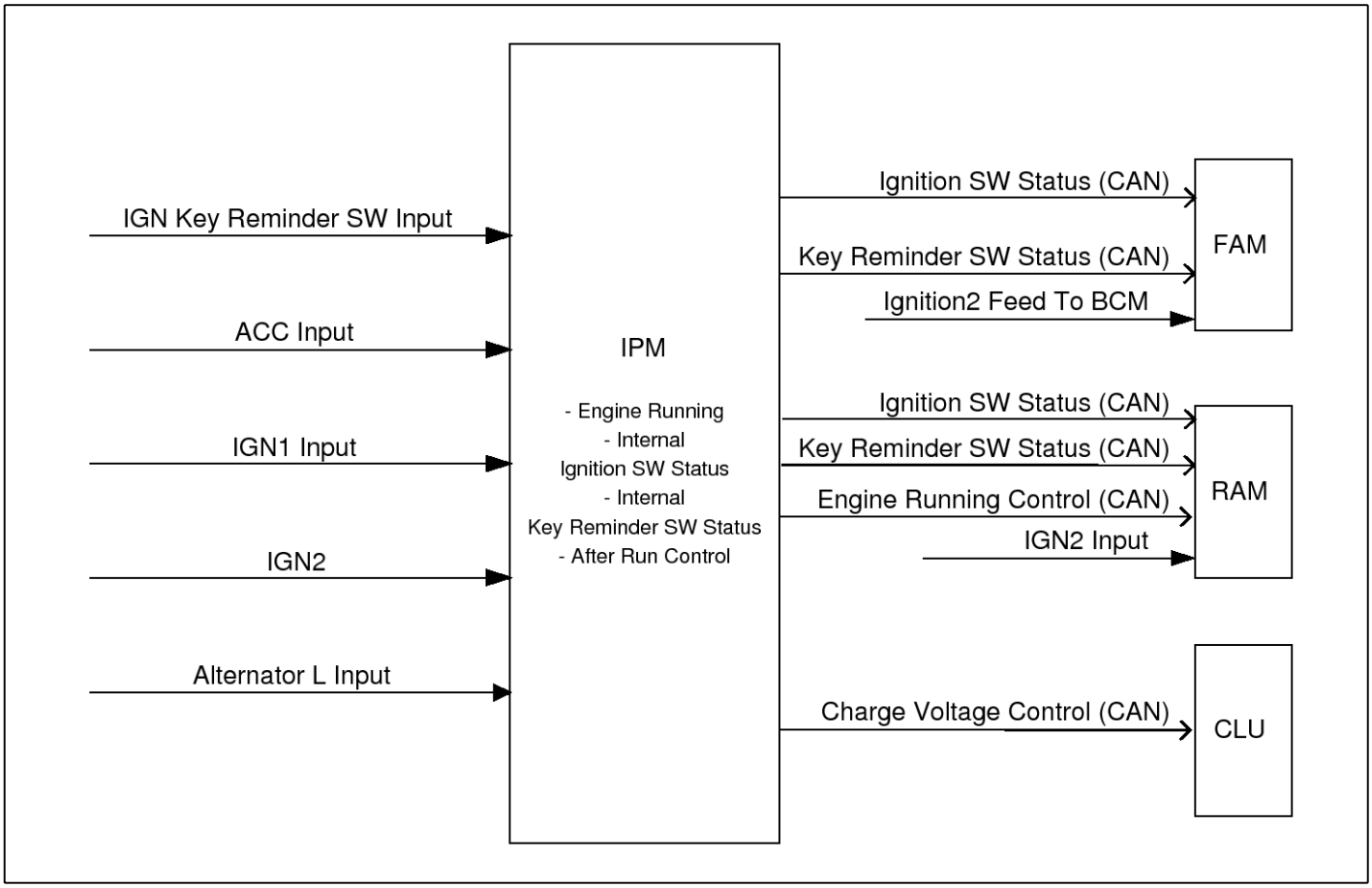
Description

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

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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.

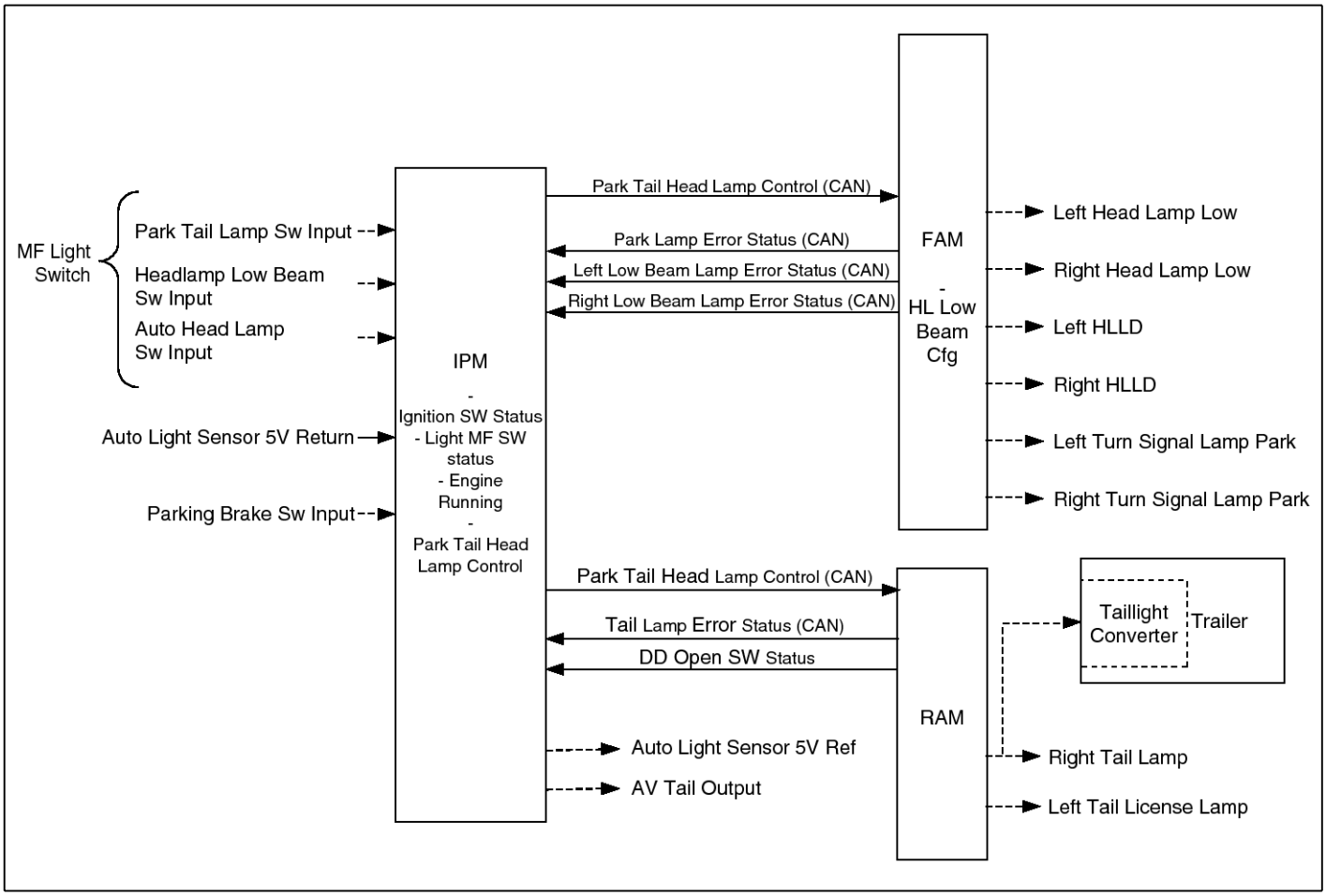
The IPM manages the control logic of the functions, and sends the command to the RAM and the FAM that drive the lamps.

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

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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 S-ensor 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.

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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.

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Head Lamps High Beam

Description

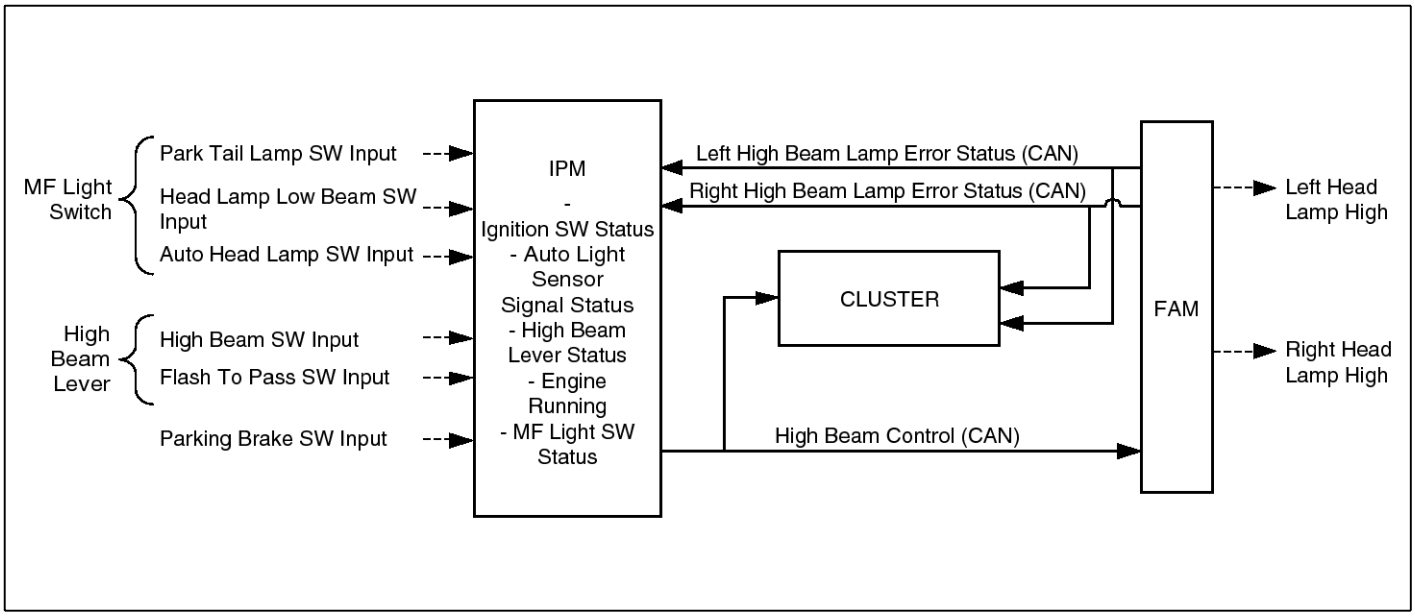
The following functions activate the Headlamps High Beam:

- 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:

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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

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Backup Lamps

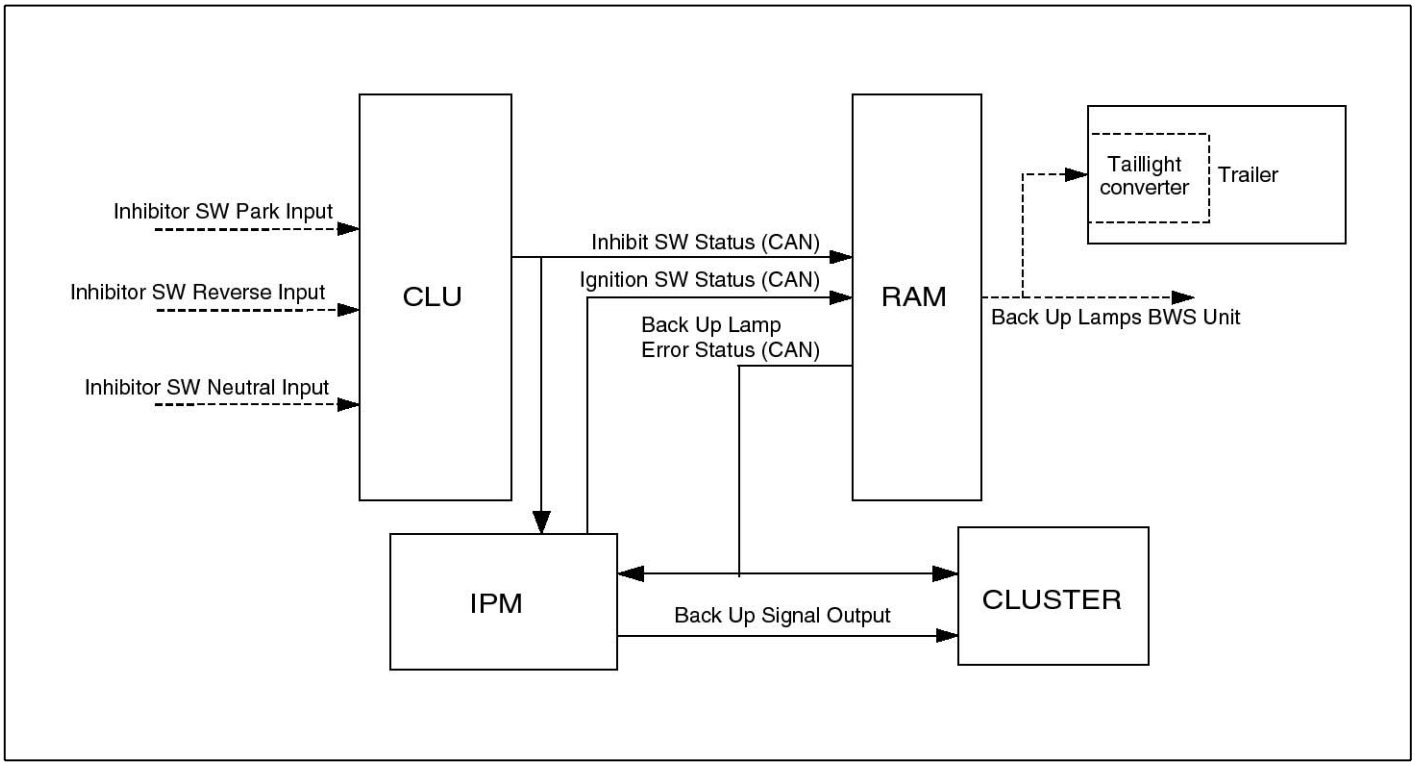
Description

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



SHMBE9015N

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Stop Lamps

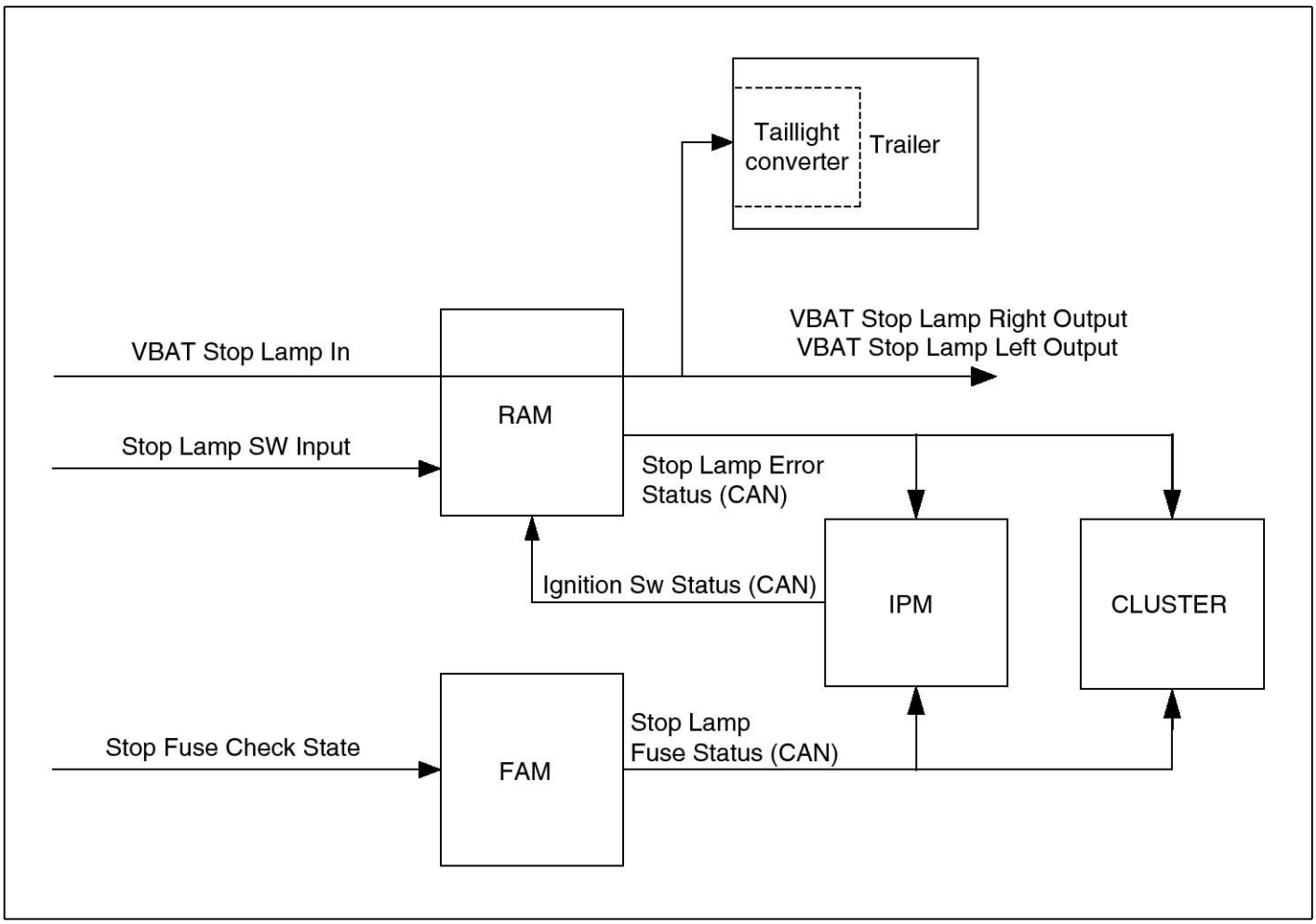
Description

The brake pedal and the stop lamps switch operate on the stop lamps.

The stop lamps switch is directly hardwired to the stop lamps, through the RAM.

A status message is sent by RAM to the IPM to indicate if one lamp is in error or not, and the FAM sends the stop lamp fuse status to the IPM. Therefore Short-To-Ground defects are reported (DTC) by FAM, and Open-Circuit defects by RAM.

Functional Diagram



SHMBE9016N

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Front Fog Lamps

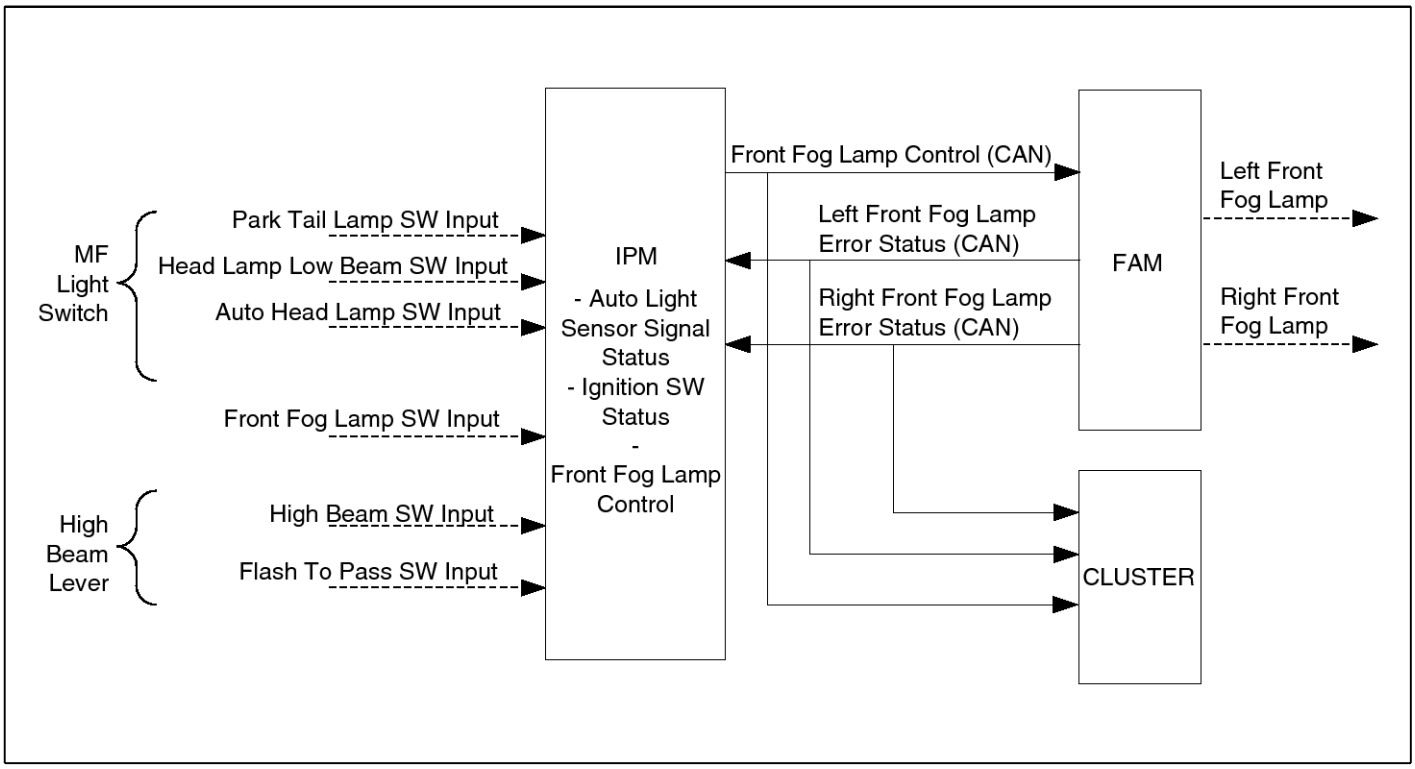
Description

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

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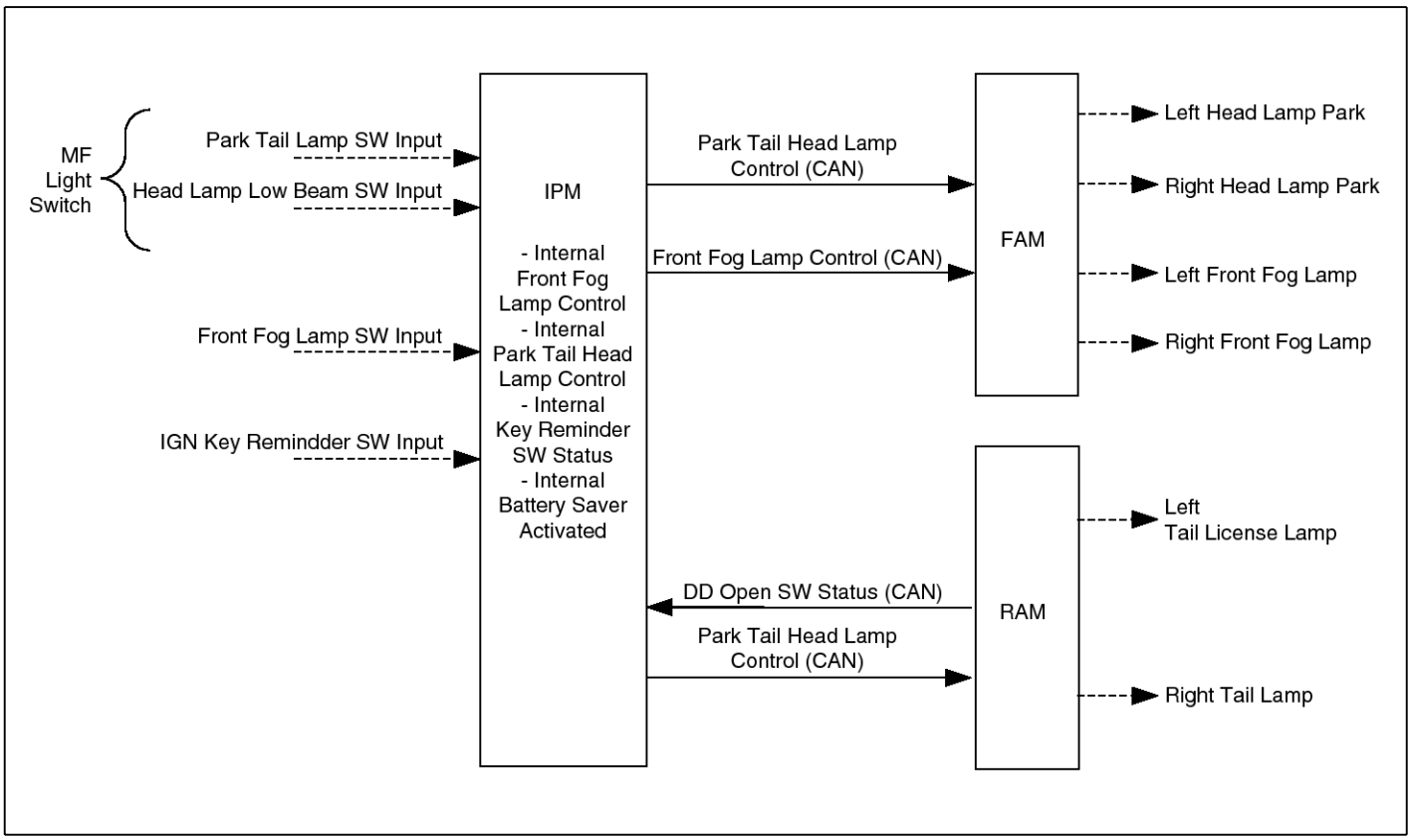

SHMBE9077L

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

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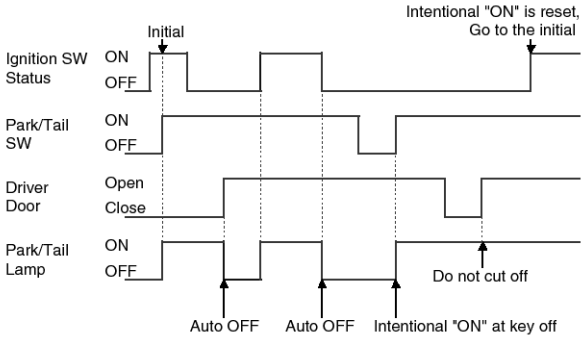
(intentional “park and tail ON”), the Battery Saver function is deactivated.

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

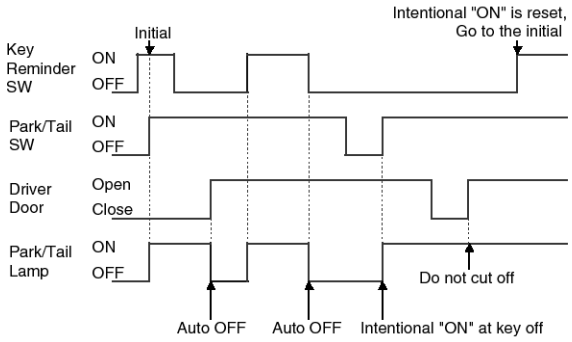
This time sequence diagram is true with an intentional “park and tail ON” due to ‘Head Lamp low beam’ switching sequence ON-> OFF-> ON : Park/Tail lamps are switched to ON.

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

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Turn Signal and Side Repeater Lamps

FAM

Description

The turn signal lamps status is determined by:

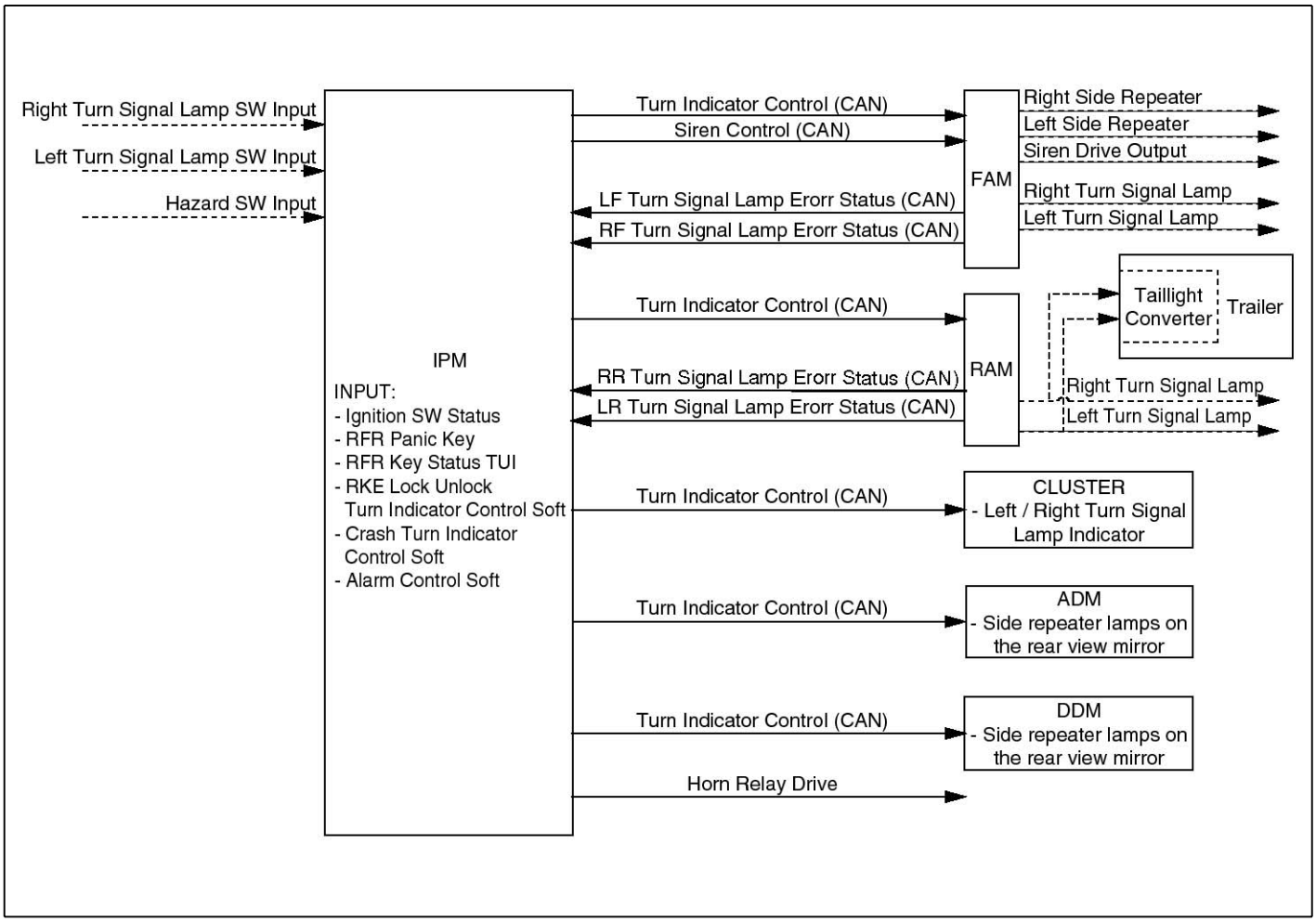
- The left and right turn signal switches
- The hazard switch
- The crash unlock activation
- The RKE lock, unlock, tailgate unlock and panic signals
- The alarm activation

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.

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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

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Interior Lighting

Room Lamps

Description

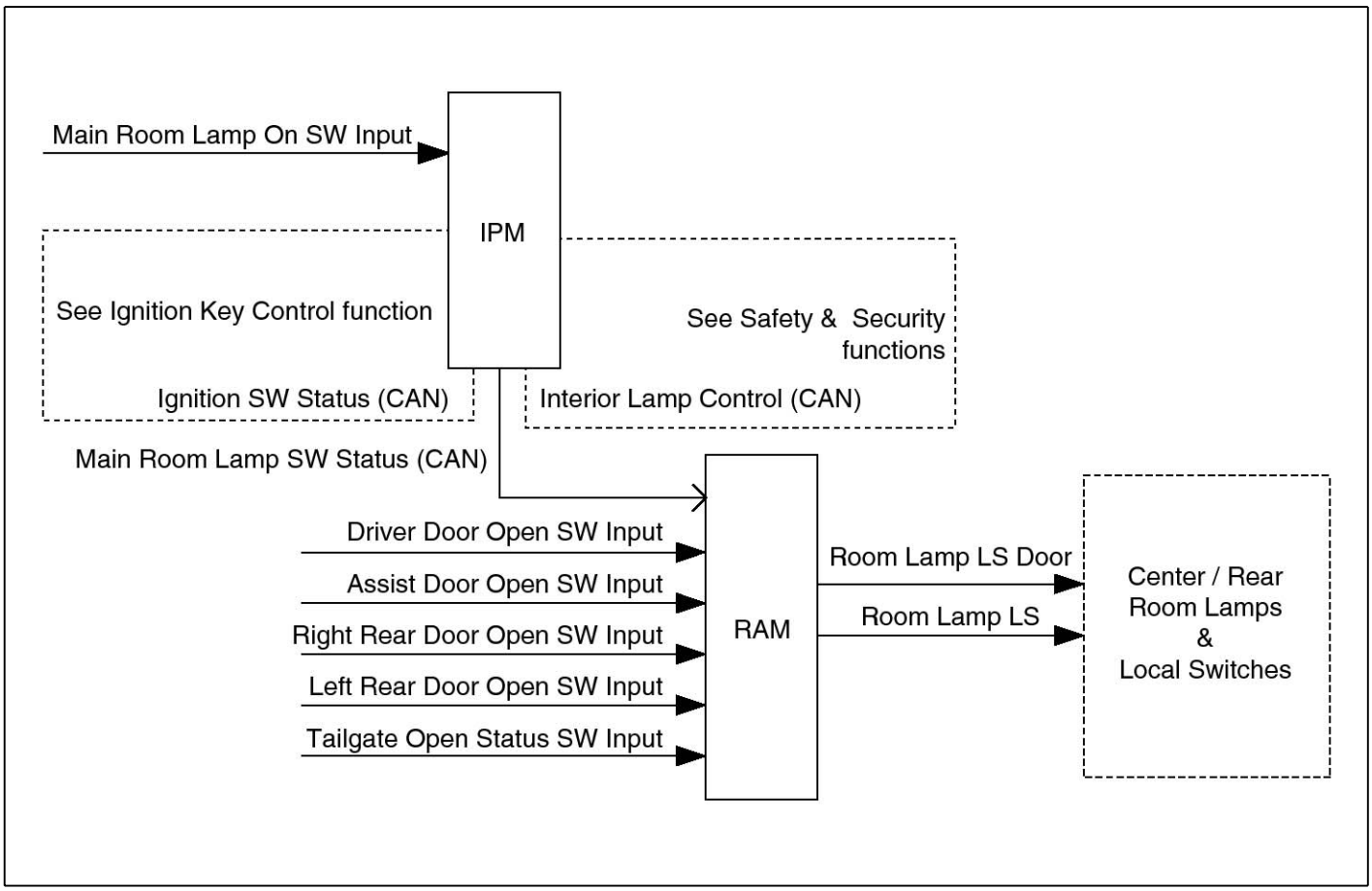
The vehicle is equipped with Room Lamps located on the front and rear interior roof.

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

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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:

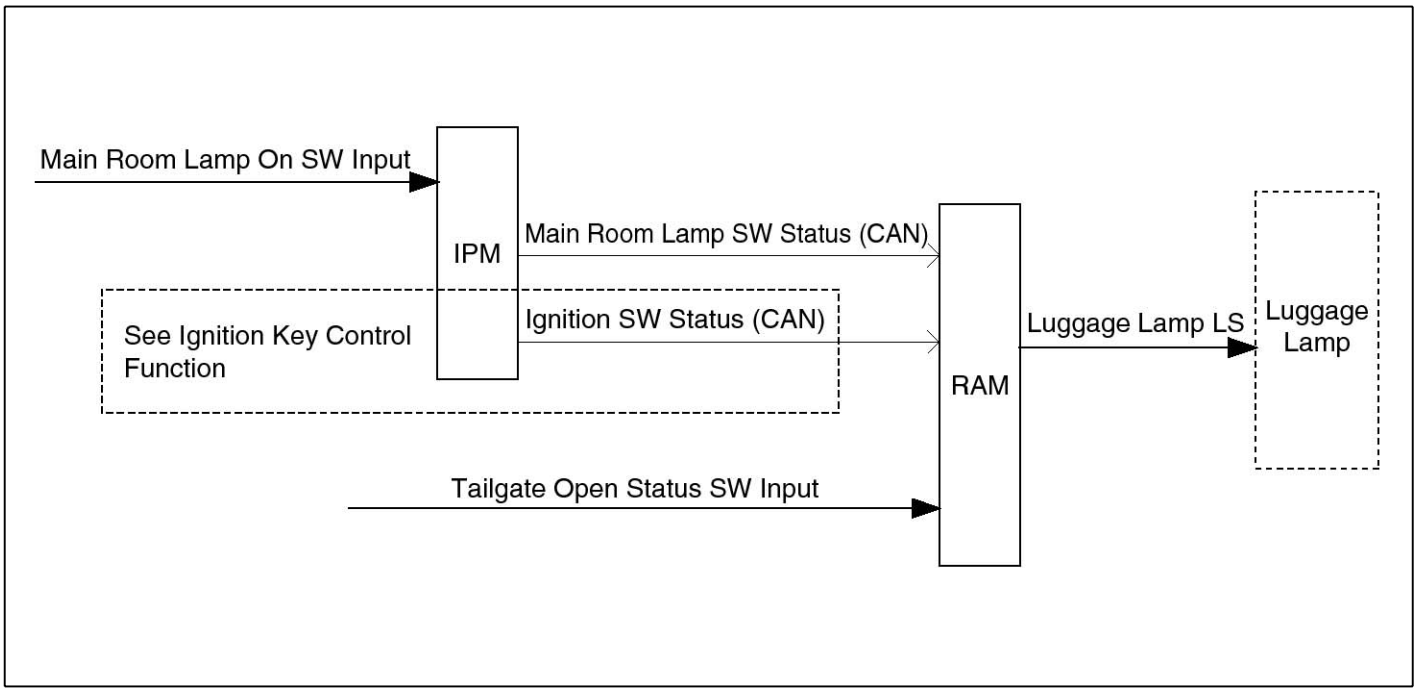
Tailgate status (RAM input)

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



SHMBE9080L

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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:

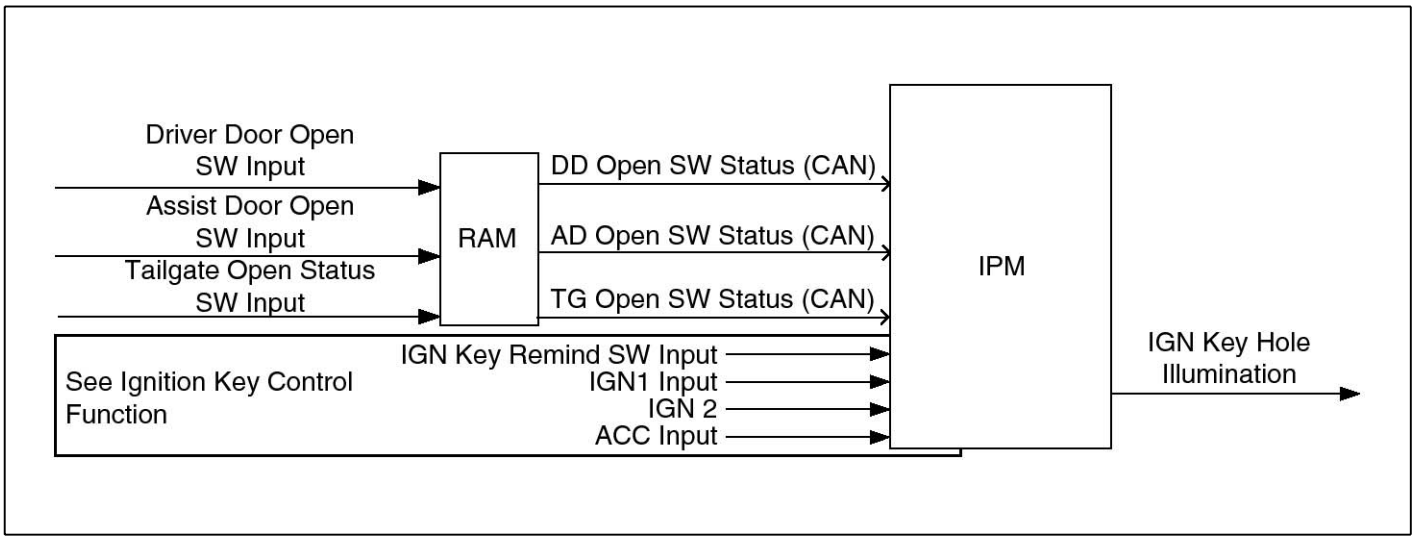
The driver and assist door status (open or close) provided by the RAM,

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

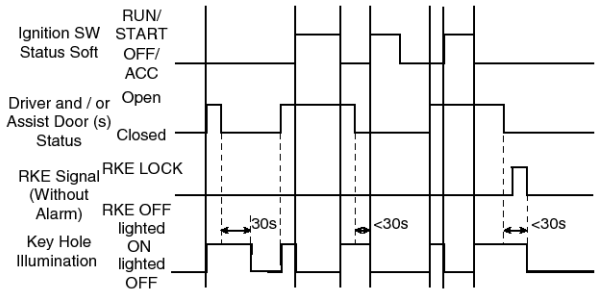
When the system enters arm wait mode by Remote Key or Mechanical cylinder lock switches, the key hole illumination is switched off immediately.

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

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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.

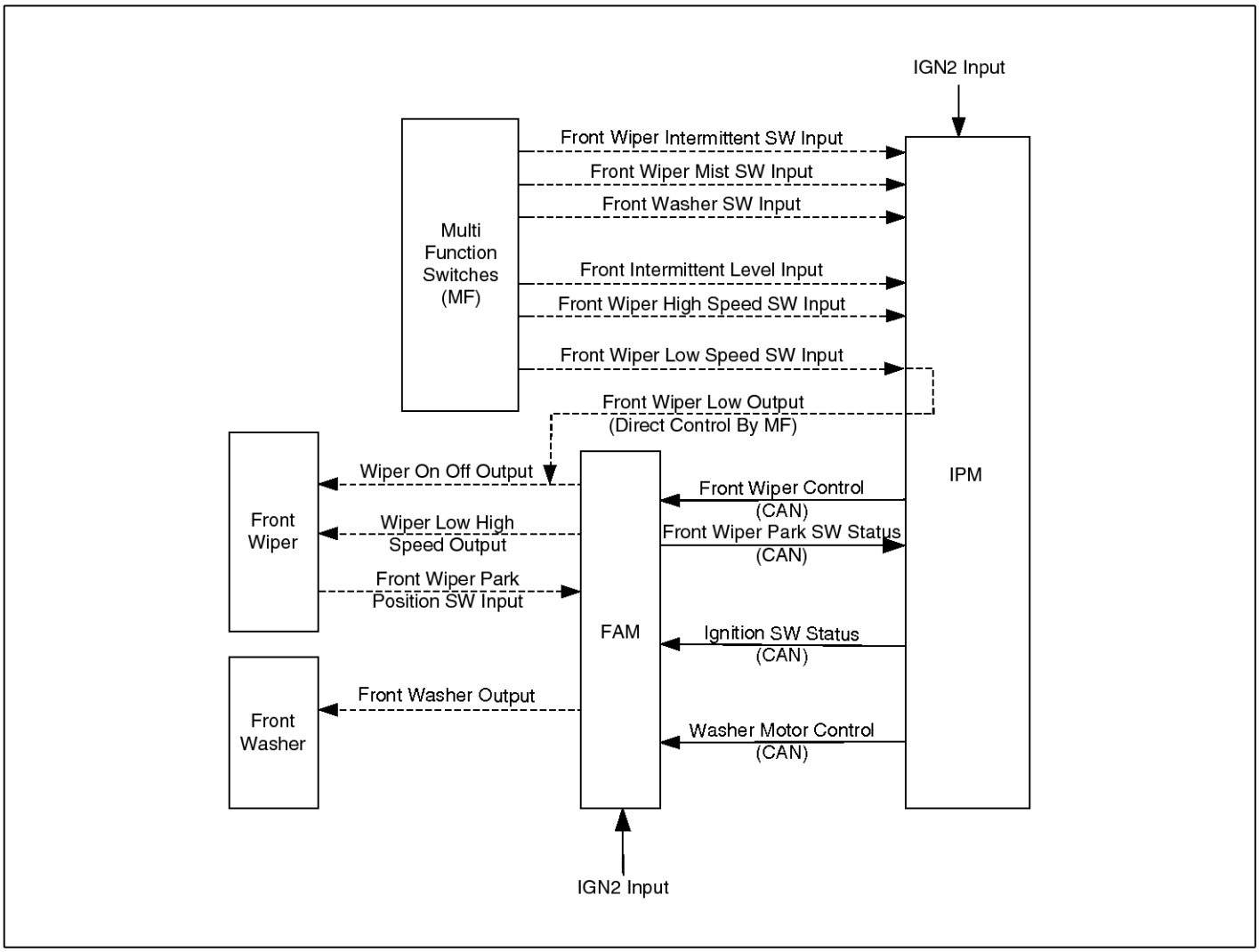
This functionality is directly accessible to the driver. It consists in the possibility to activate or deactivate the wiper of the front windshield. When the driver decides to activate the front wiper, he has to choose between several modes of operation using the MF switch:

- 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

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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

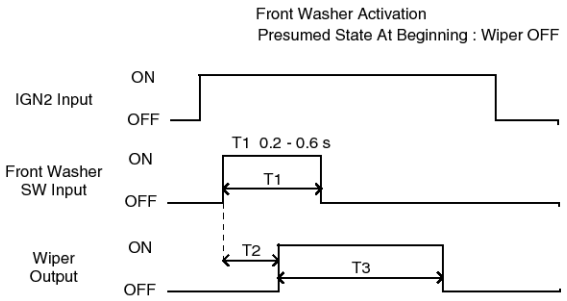
Description

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.

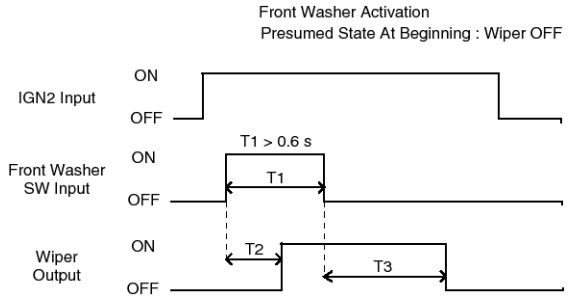
T3 : 0.7 s.

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.

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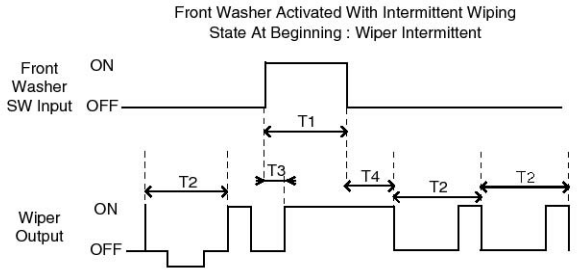
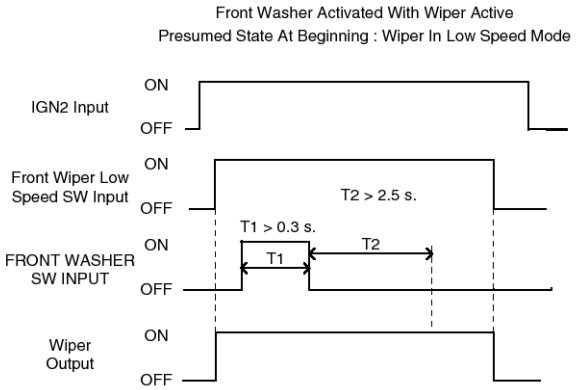
Here are the following wiper modes and the actions:

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.

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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):

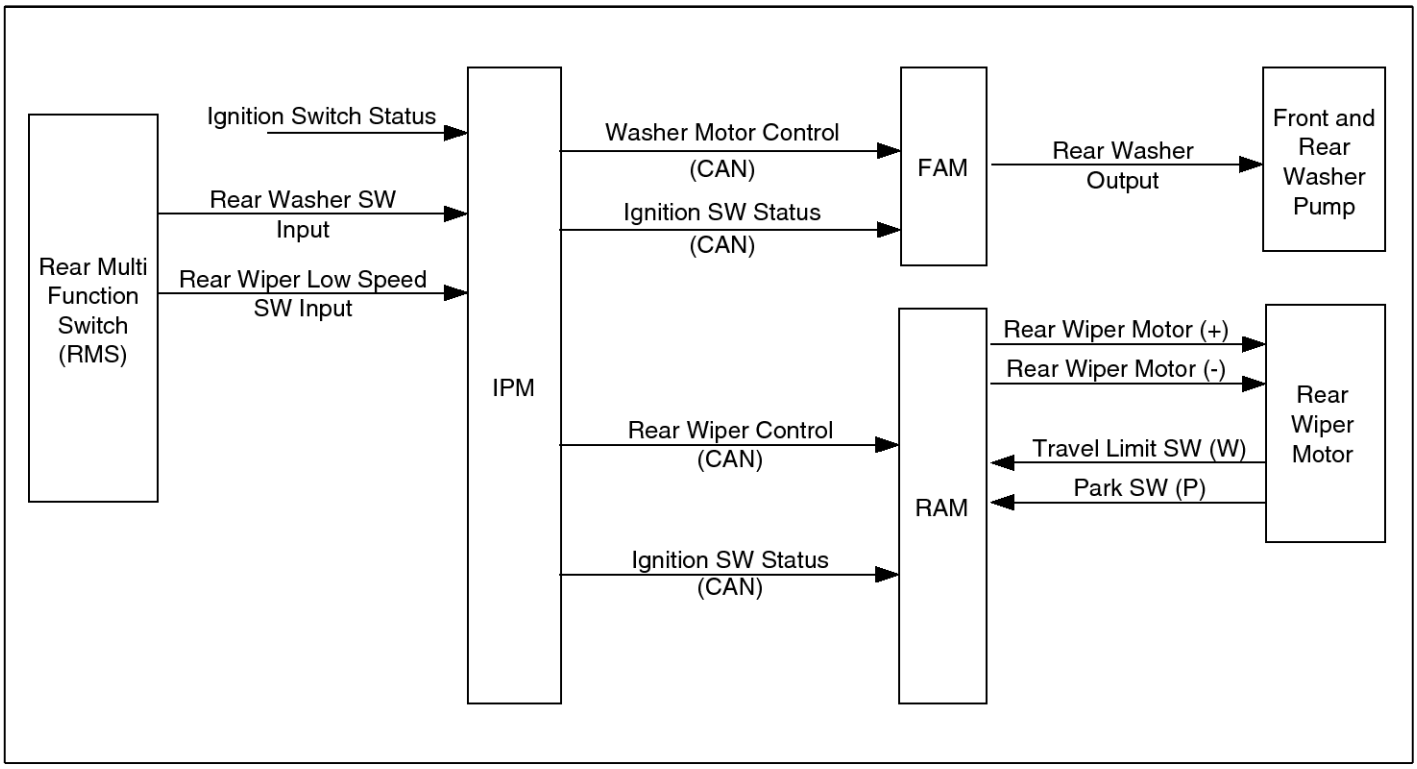
- Continuous low speed
- Rear washer switch

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.

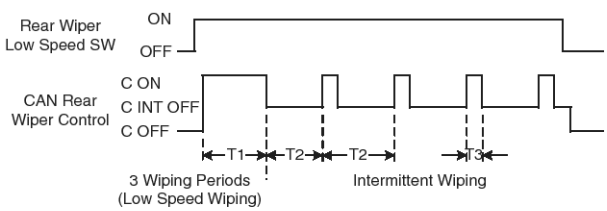
Functional Diagram



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

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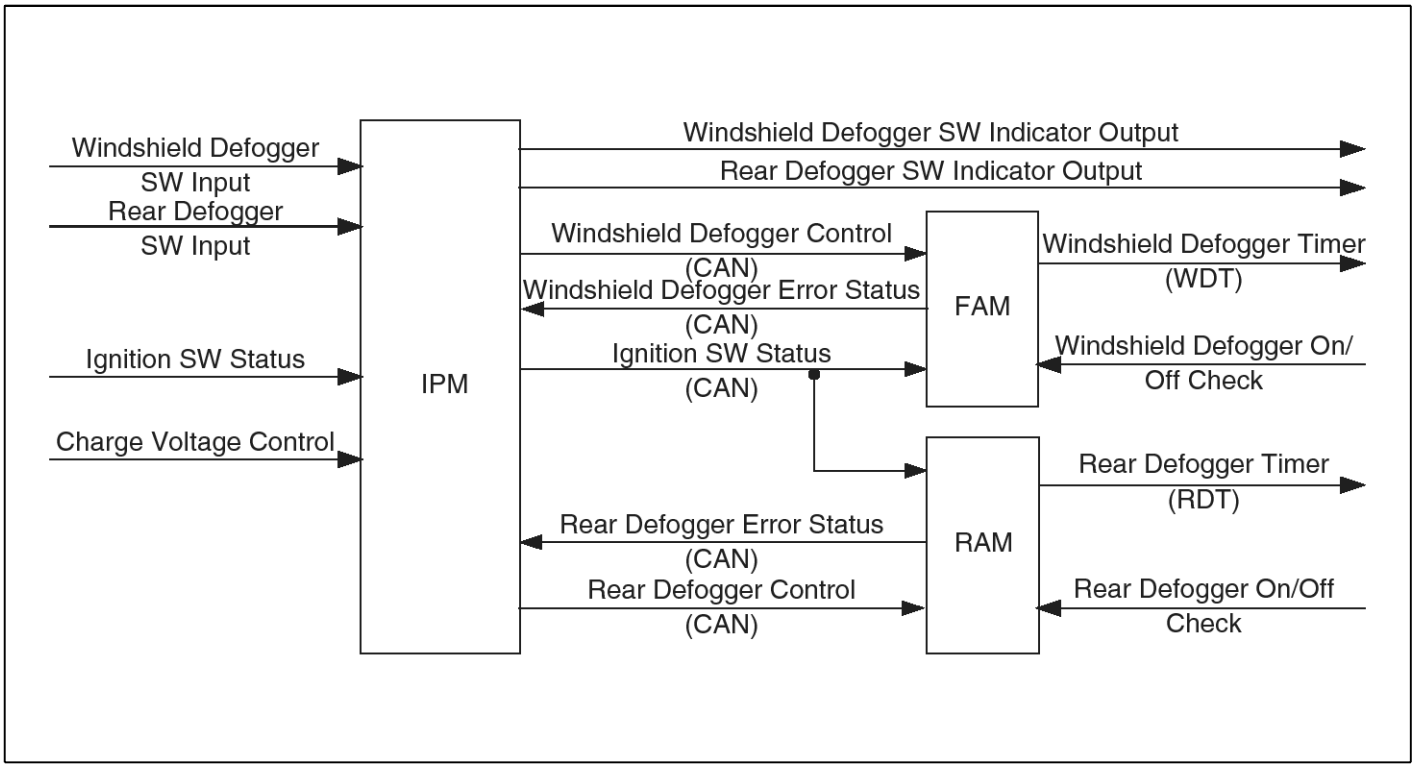
Defogger

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.

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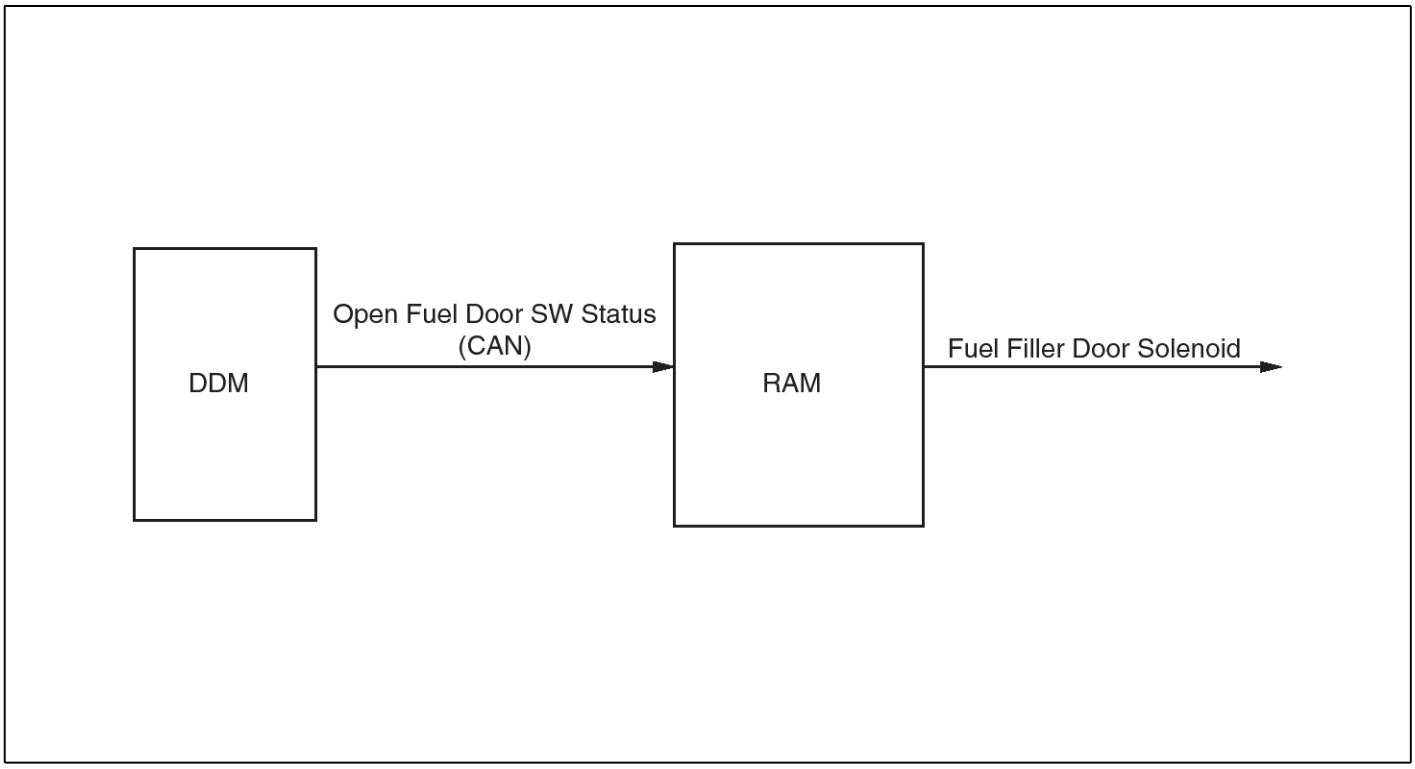
Comfort Function

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 during 500ms 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.

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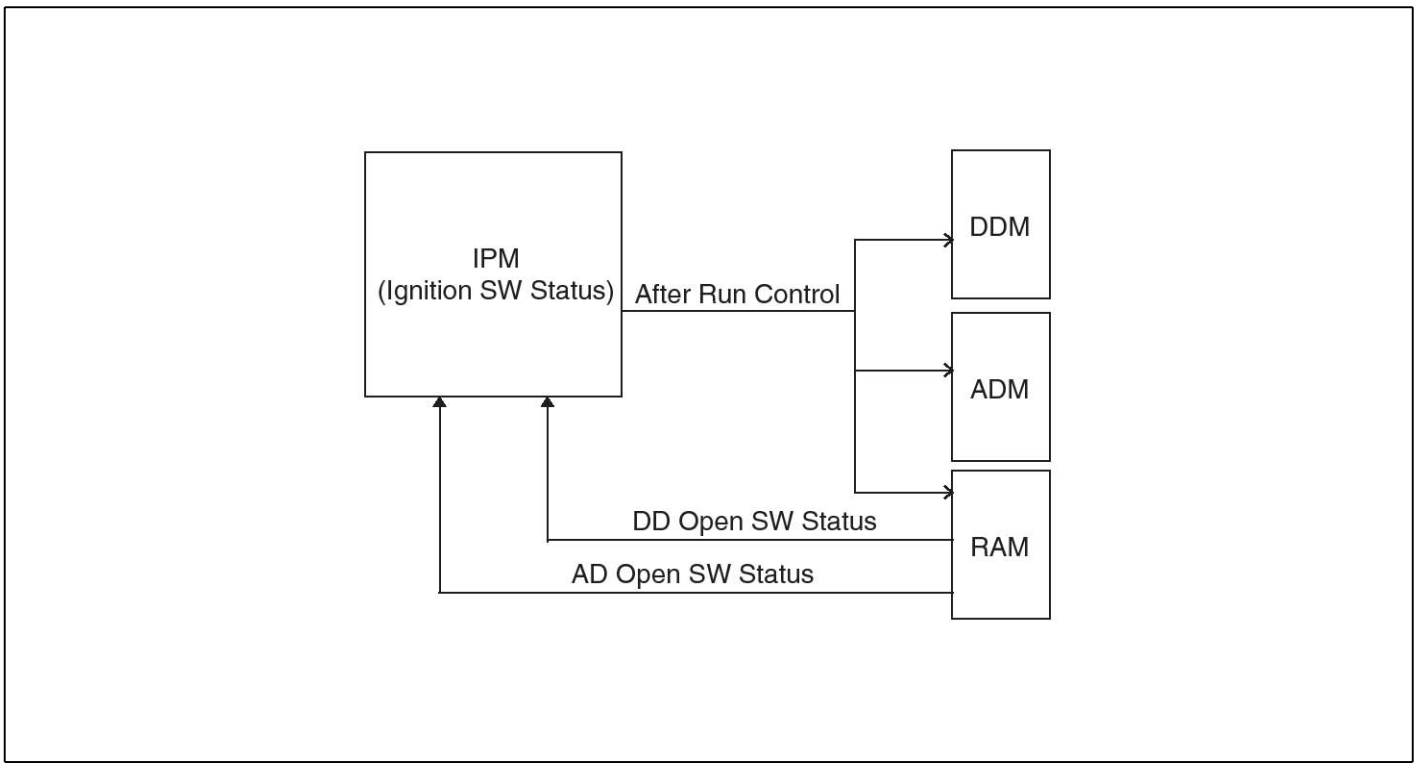
Power Window Timer

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

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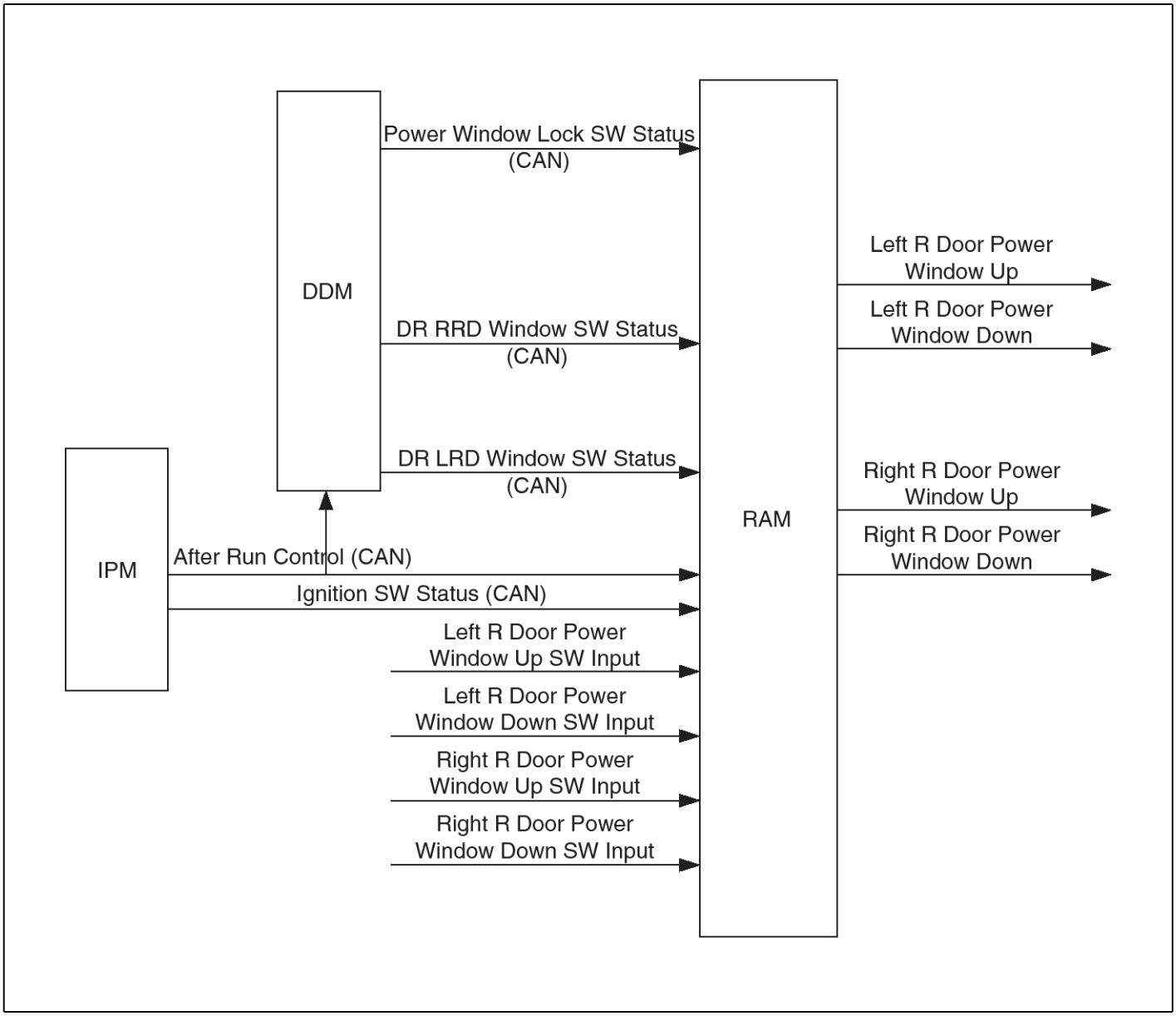
Rear Doors Power Windows

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

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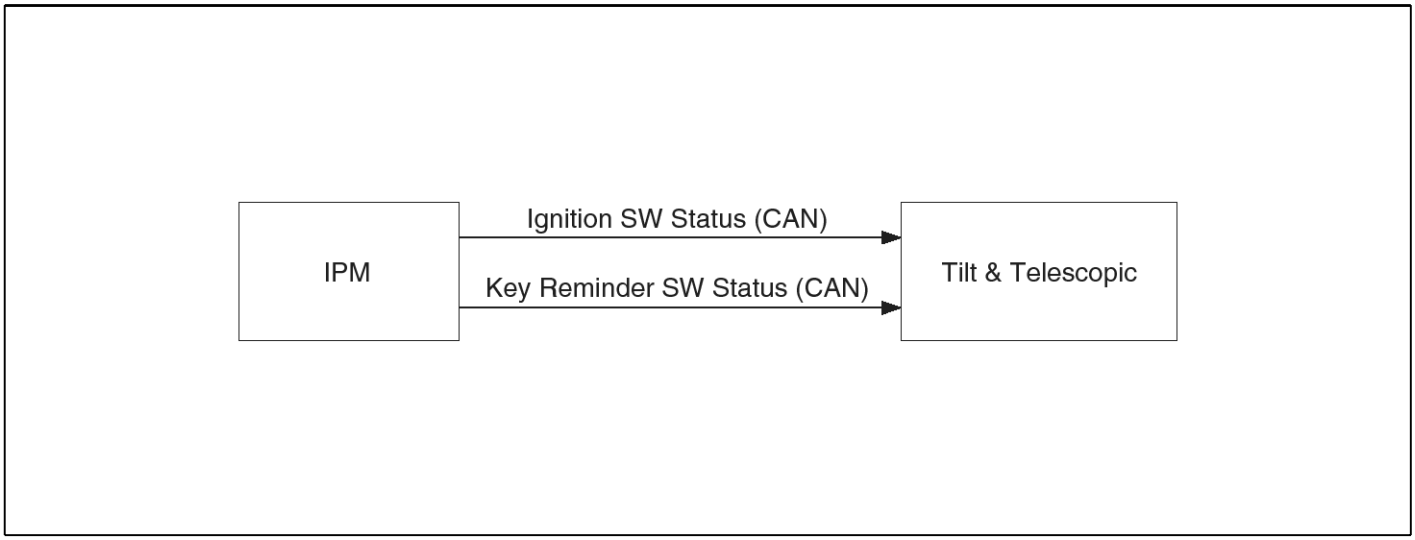
Tilt and Telescopic

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

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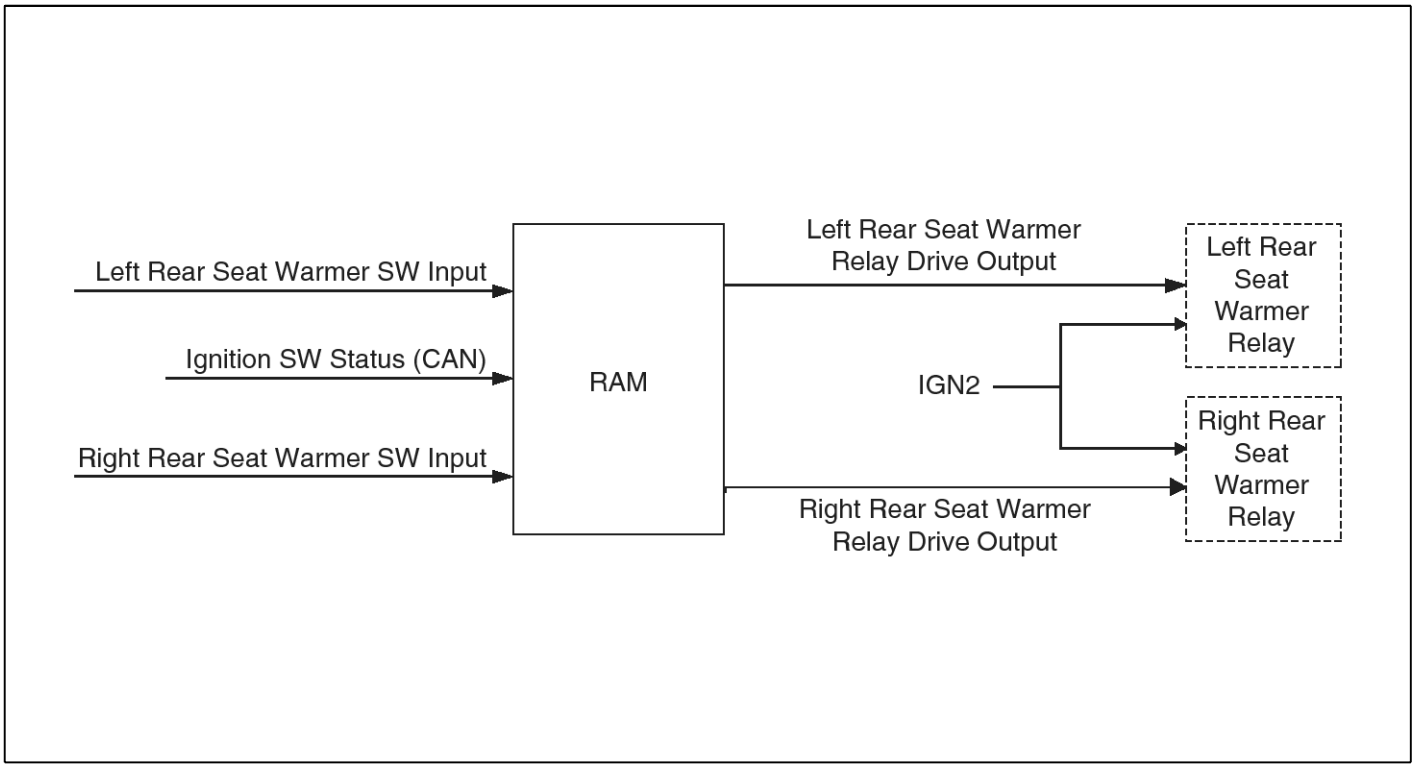
Rear Seat Warmer

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.

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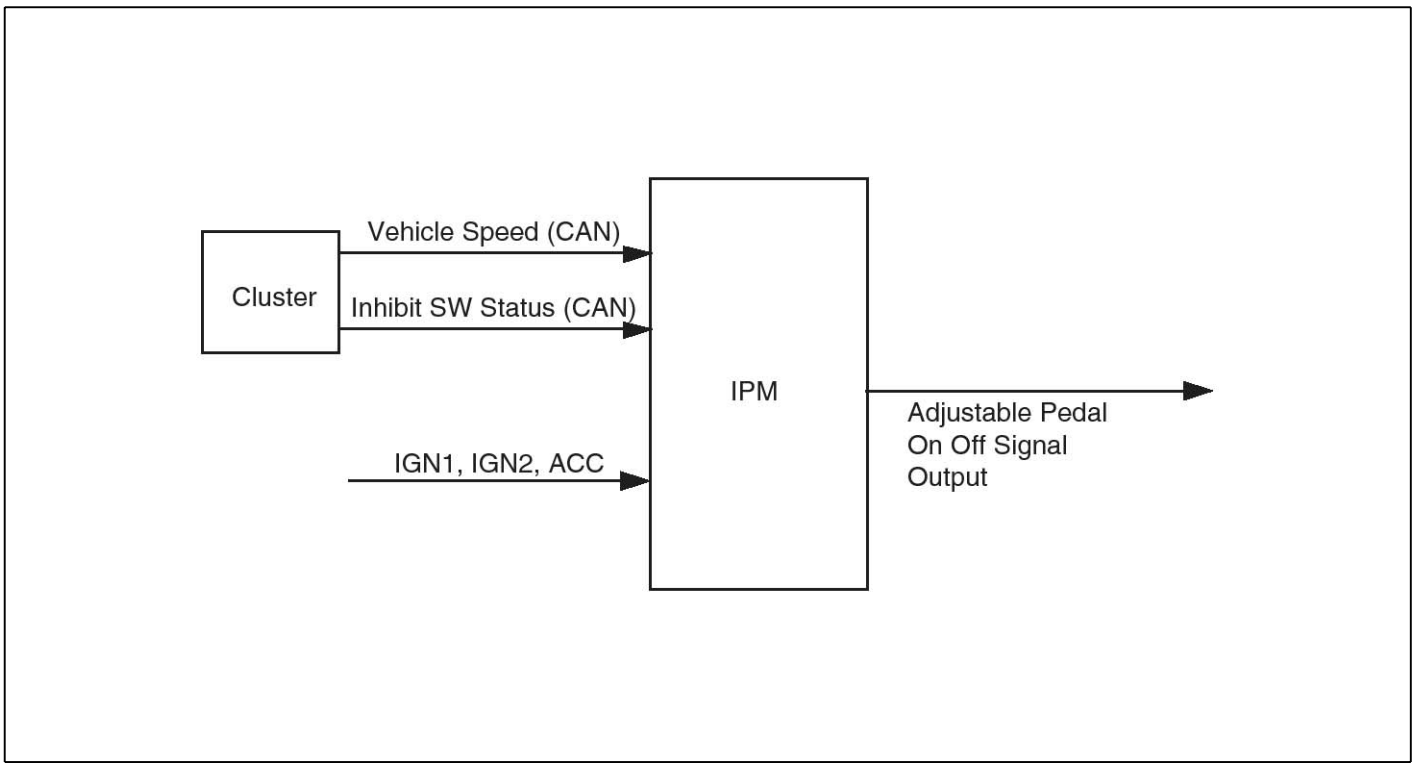
Adjustable pedal

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

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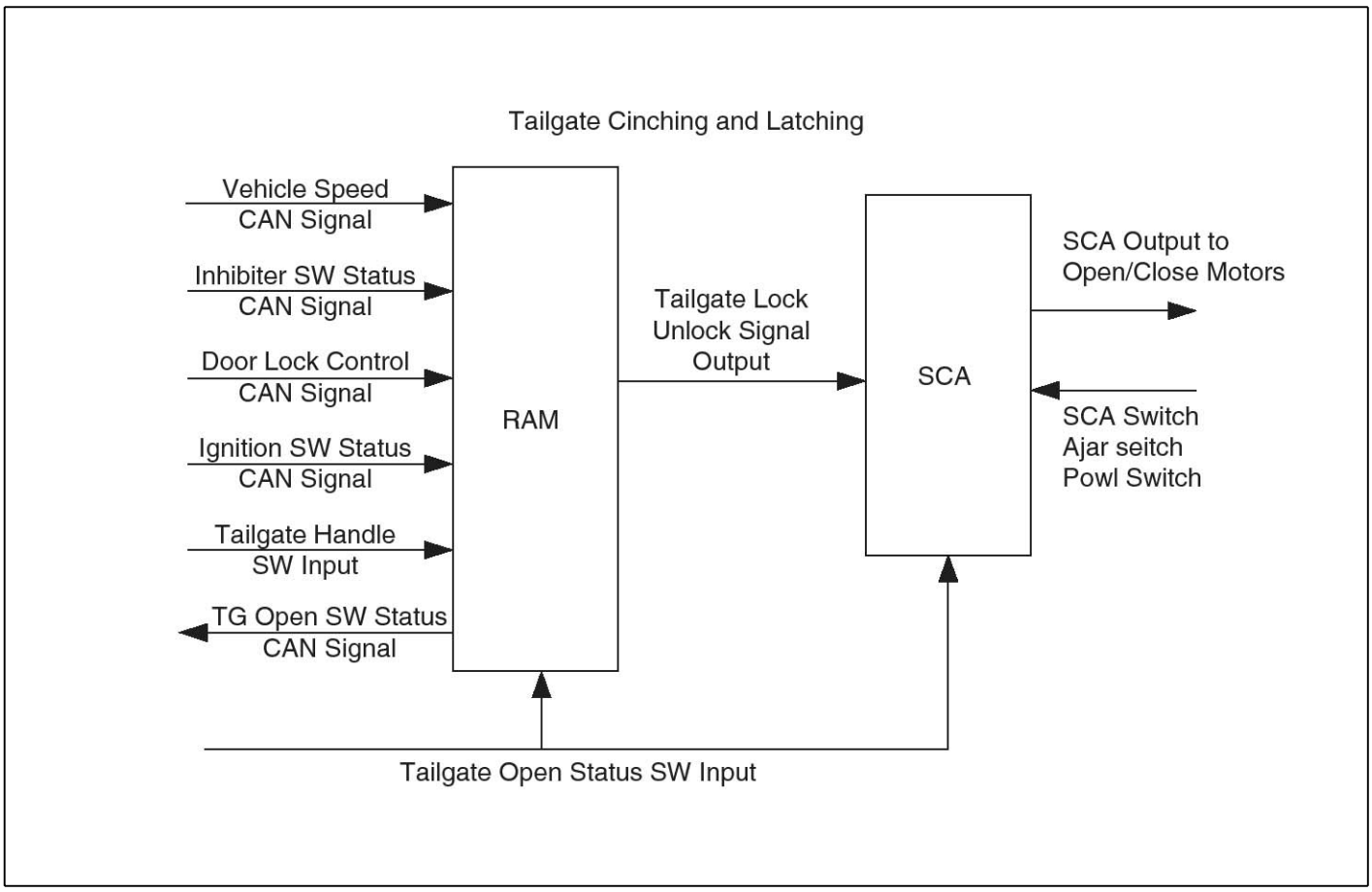
Tailgate Cinching and latching

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:

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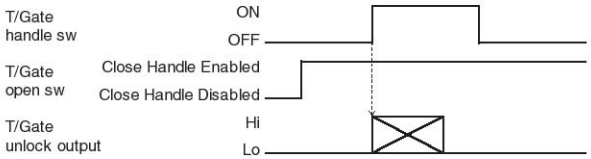
R RD Lock Monitoring SW Input	L RD Lock Monitoring SW Input	Tailgate cinching and latching function state
On	Off	Enabled (1)
Off	On	
On	On	
Off	Off	Disabled

(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

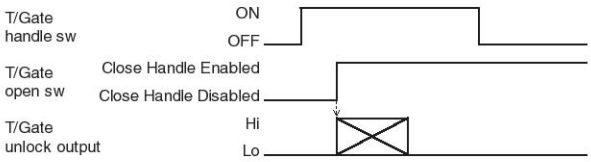
Tailgate unlock logic for latch pulse generation:

→ Case 1



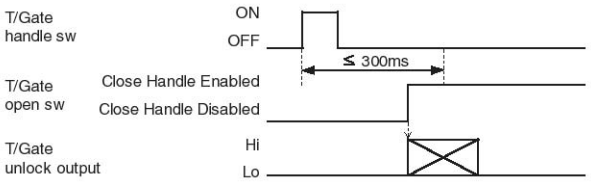
SHMBE9052N

→ Case 2



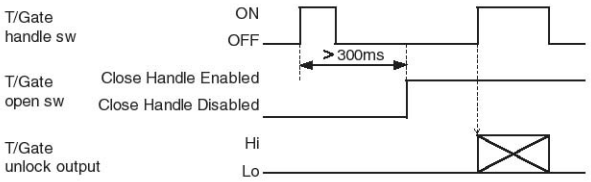
SHMBE9053N

→ Case 3



SHMBE9054N

→ Case 4



SHMBE9055N

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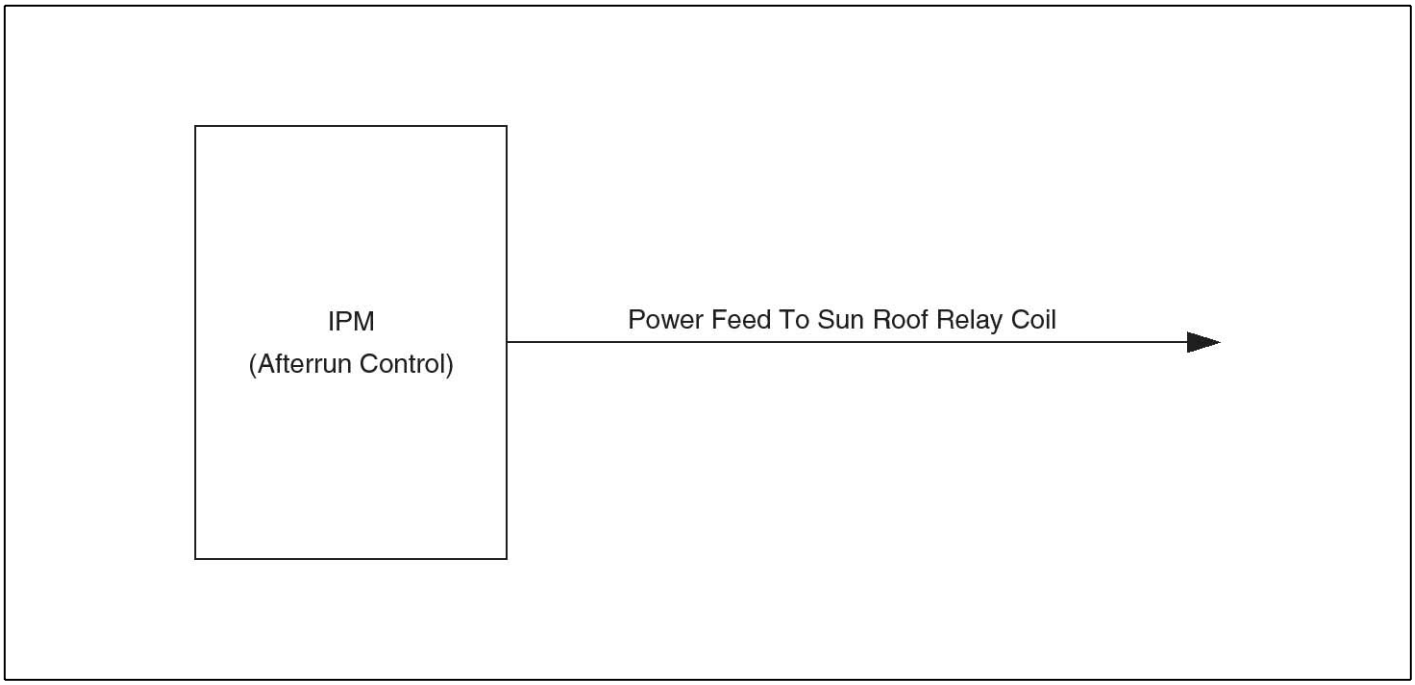
Power Feed To Sun Roof Relay Coil

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

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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

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Stop Lamp Failure	-	This function indicates the stop lamp/fuse failure. The RAM receives on analog input the state of stop lamps and sends it on the CAN. The FAM checks the stop fuse state and sends in on the CAN.
Door Open	Doors open Warning	There are 4 individual door open indicators on the CLU, 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

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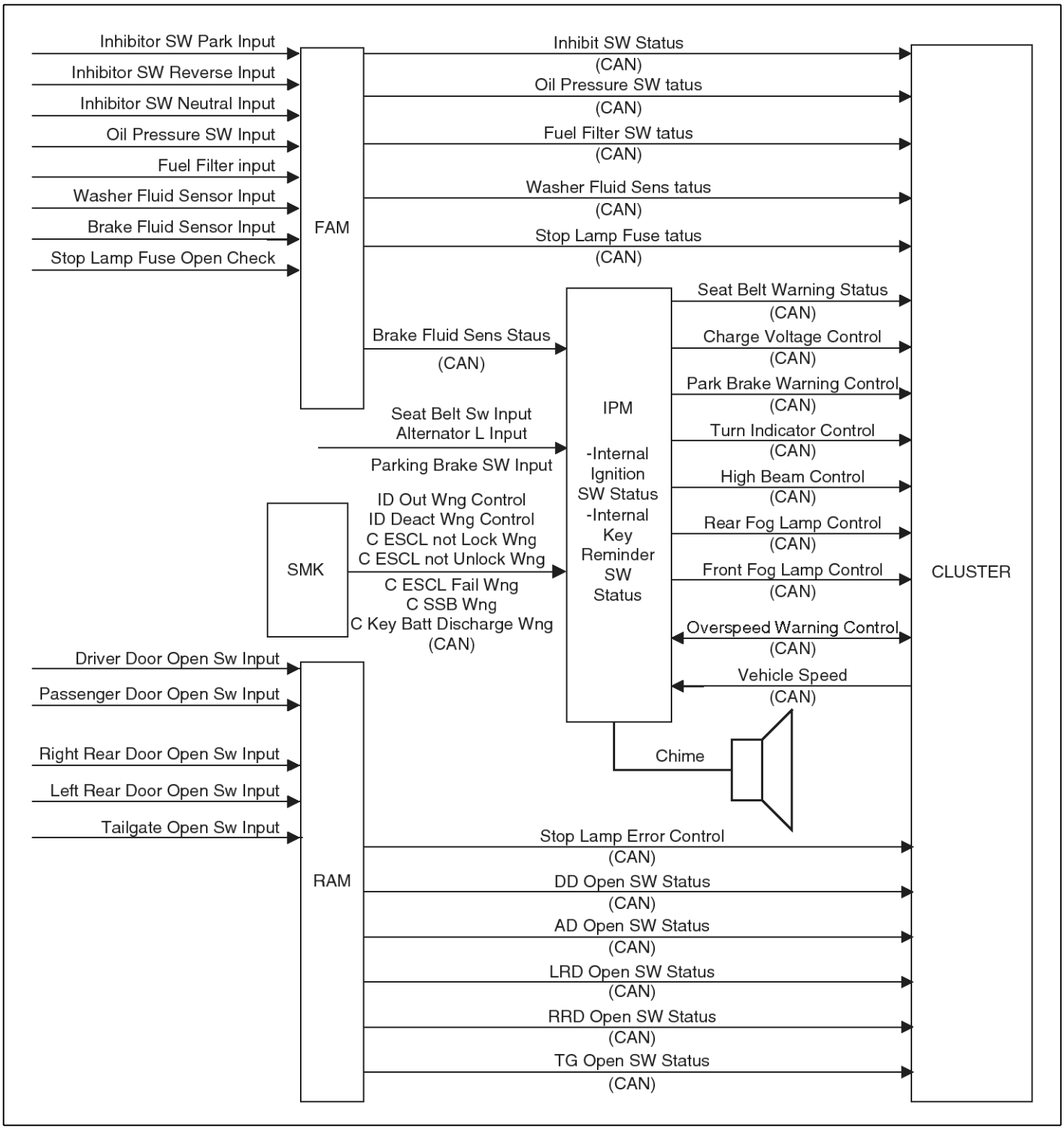
Functional Diagram



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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

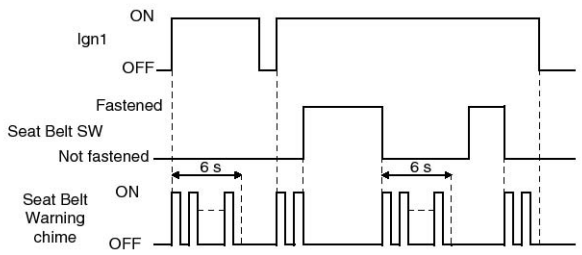
Seat Belt Warning chime :

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.



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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

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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.

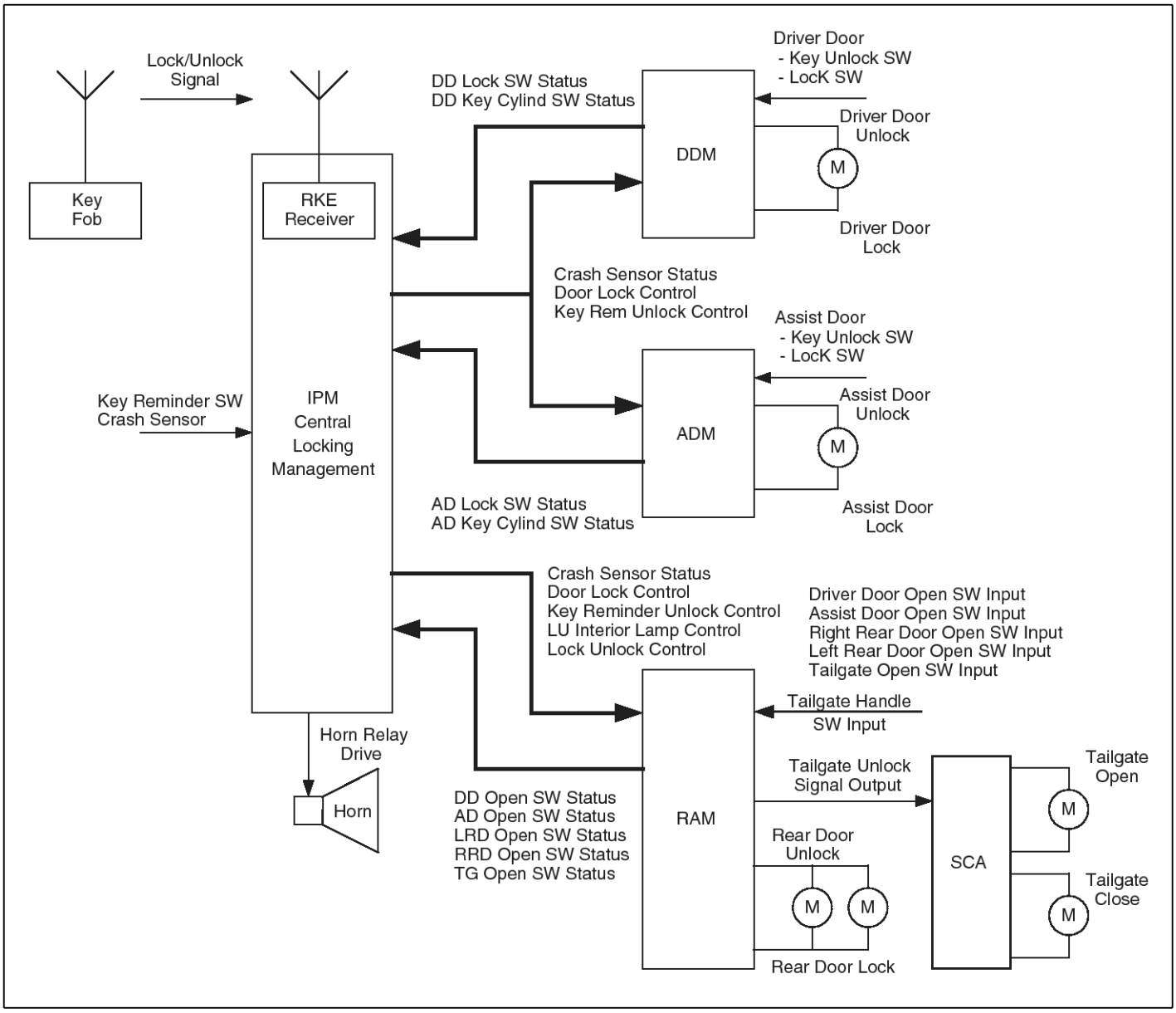
DDM

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



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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

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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

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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:

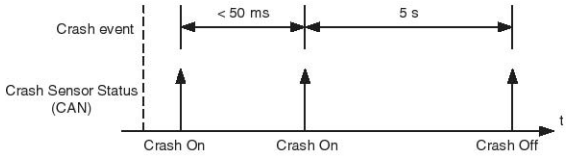
- crash sensor deactivation in ignition switch ACC or OFF position
- turn indicators deactivation in ignition switch OFF position (sending also the Crash Sensor Sts CAN signal with off value)

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:



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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

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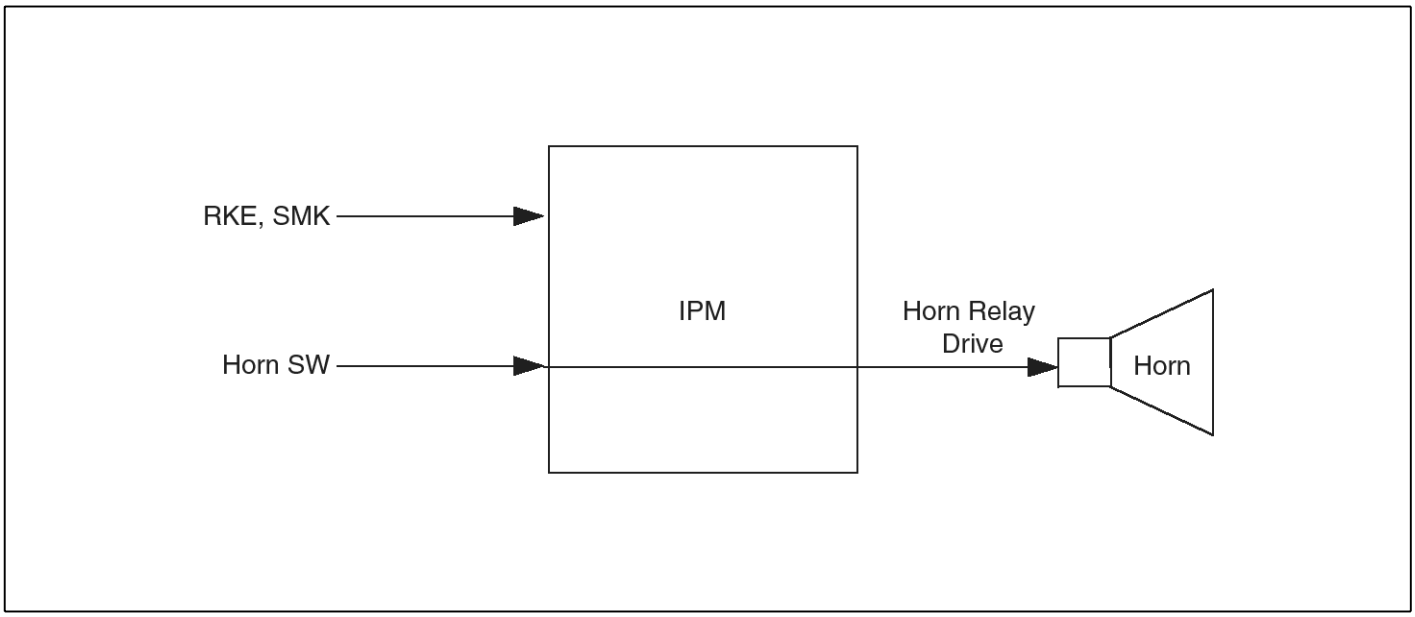
Horn

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



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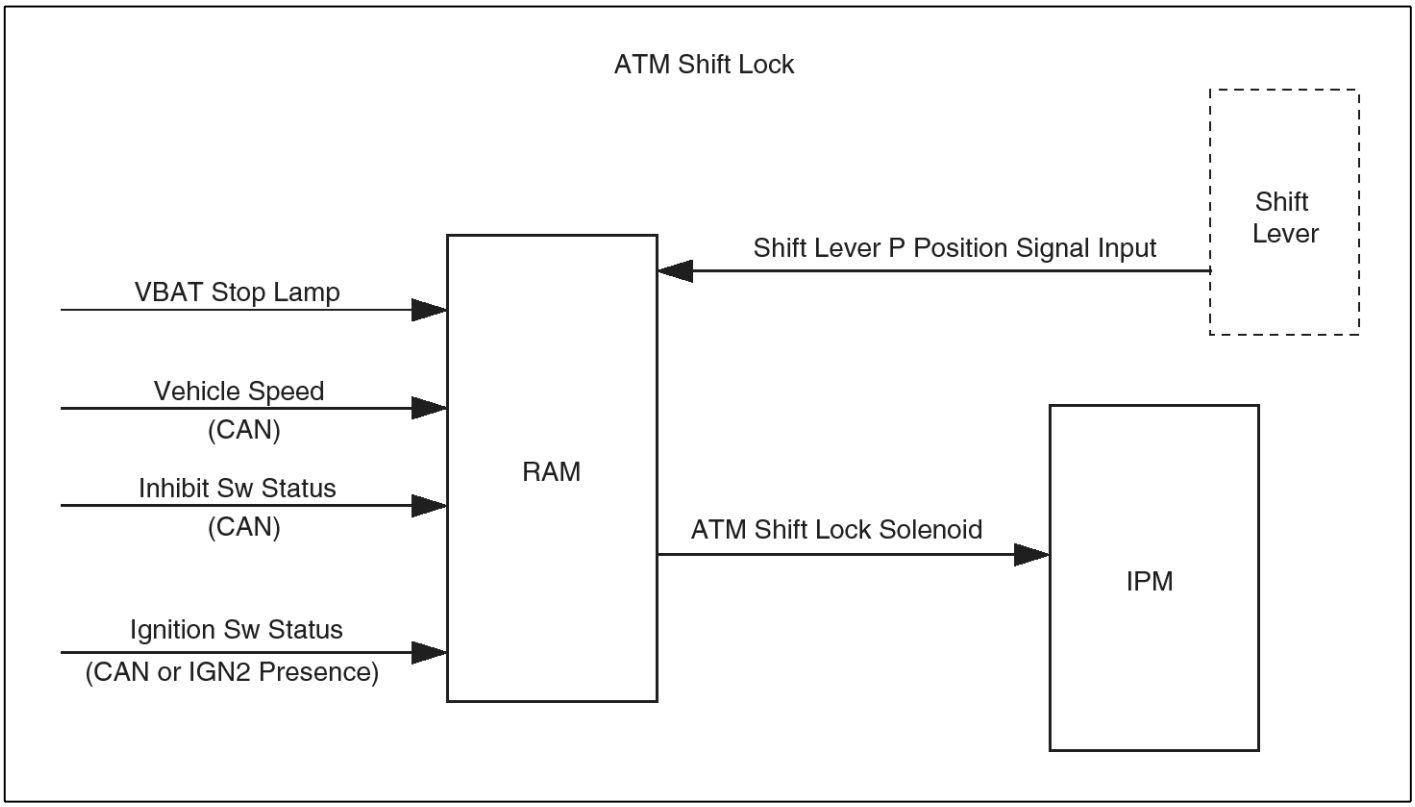
ATM Shift Lock

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



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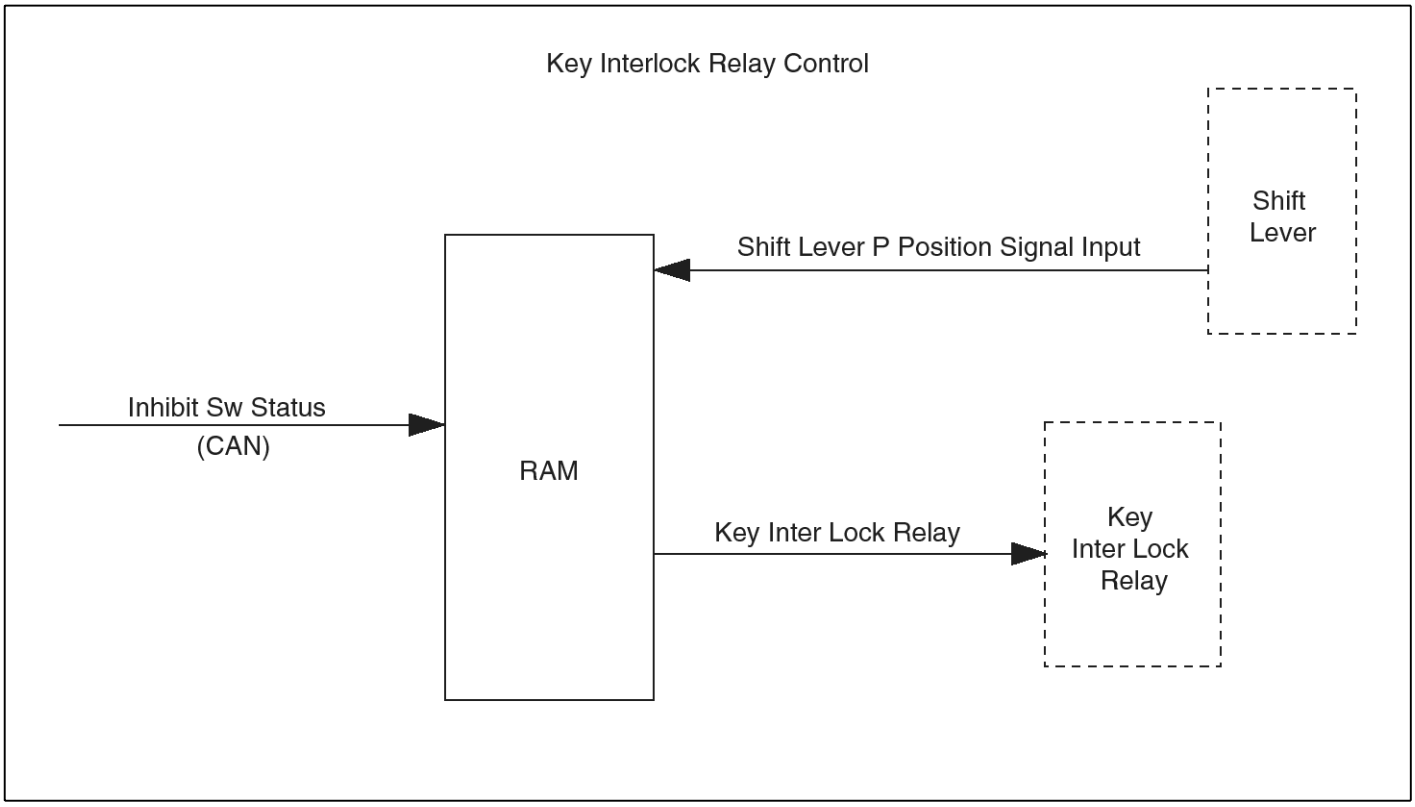
Key Interlock Relay Control

Functional Diagram



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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

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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.

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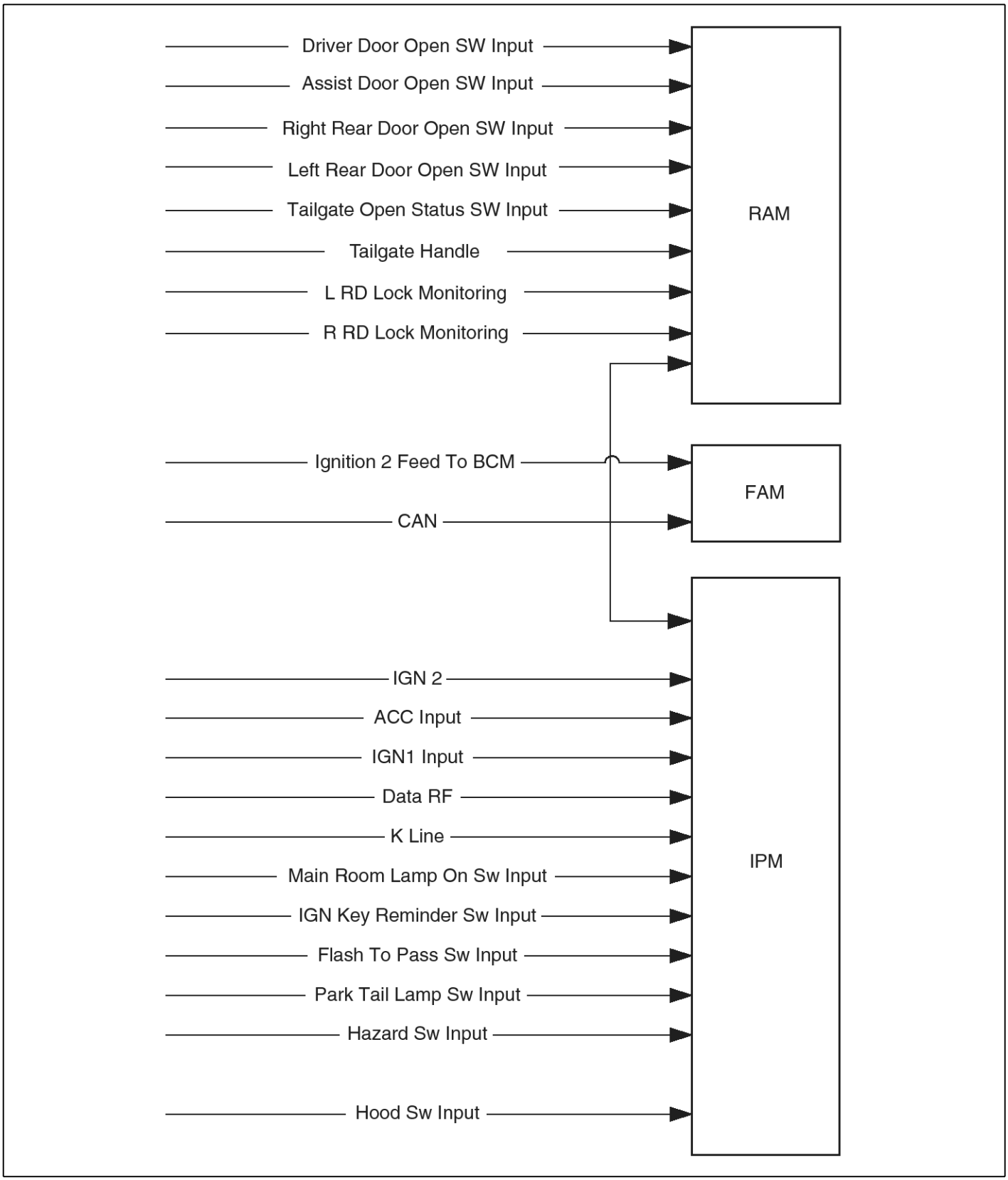
Functional Diagram



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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:

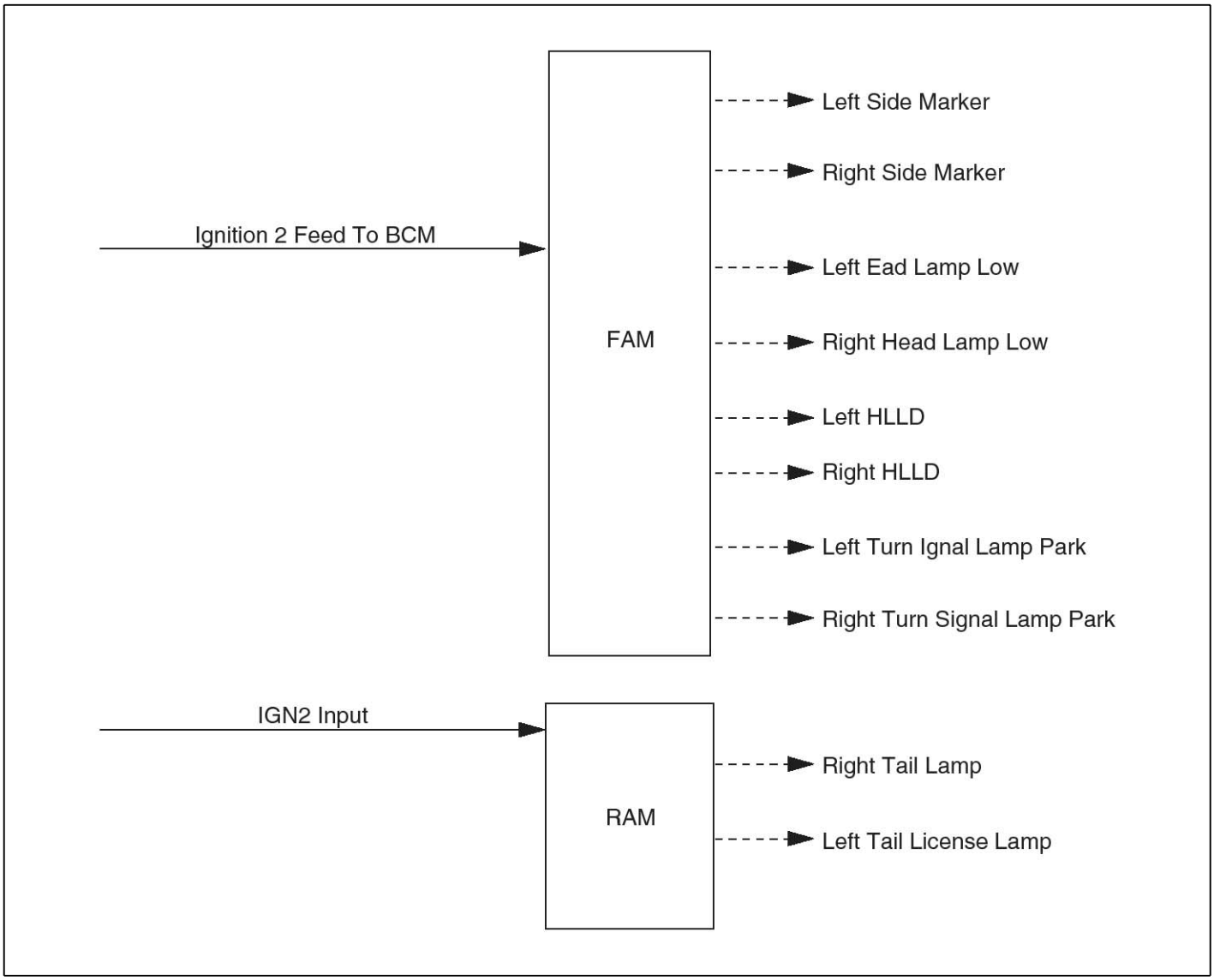
- Software safe mode;
- Hardware safe mode.

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



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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.

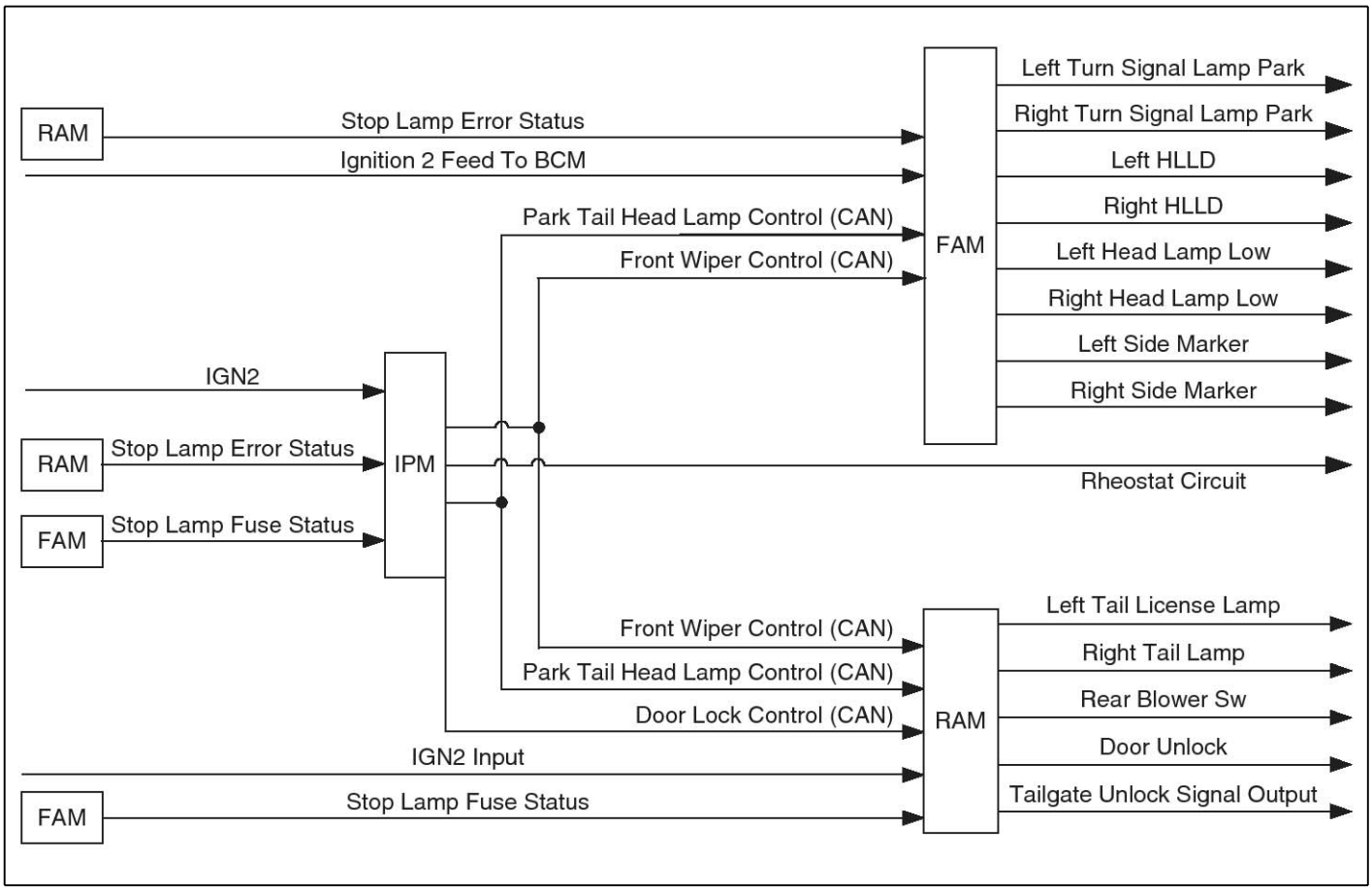
When IGN2 input = OFF, low beams, park/tail lamps and cluster backlighting are turned off.

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



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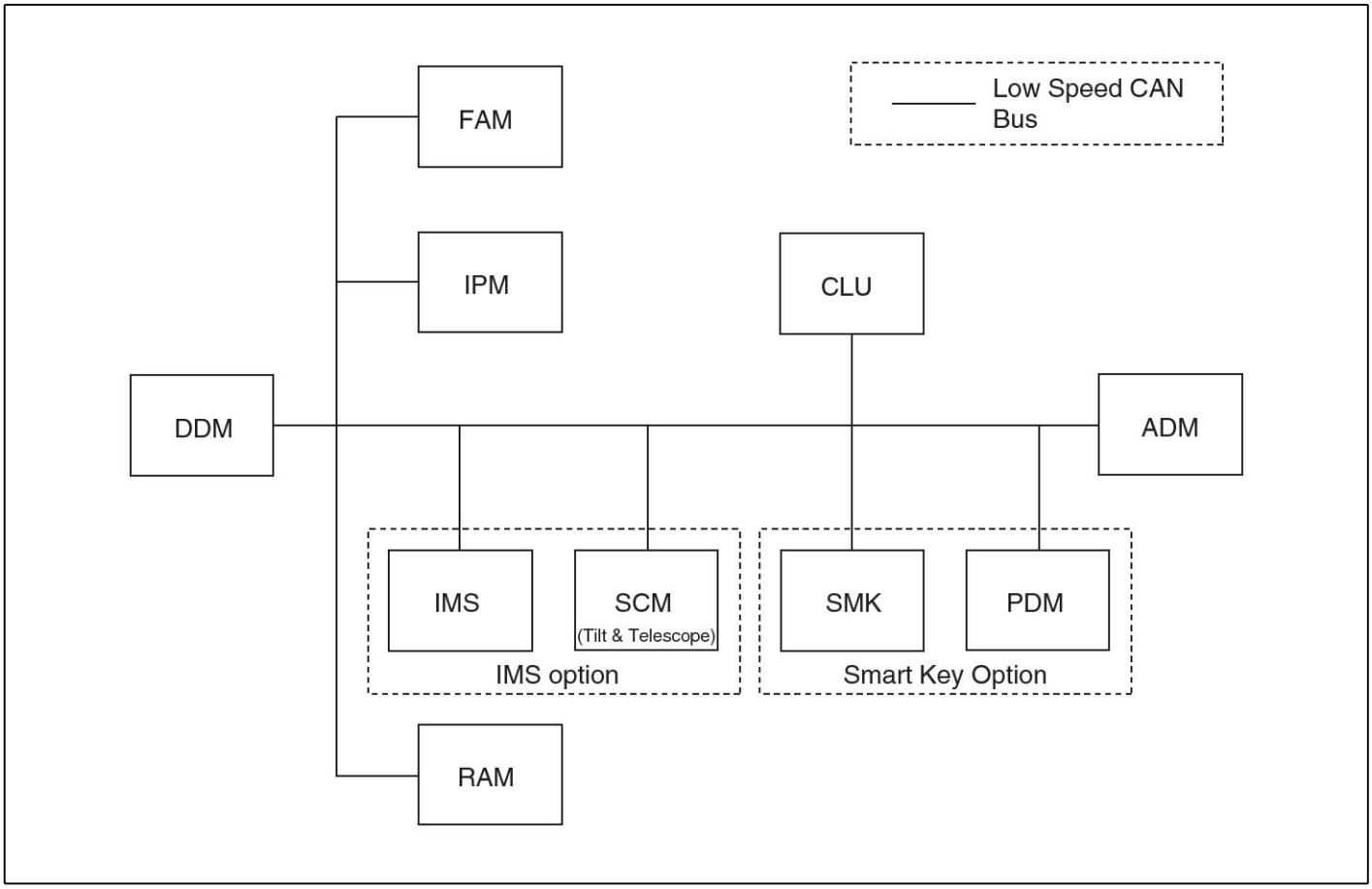
Inspection

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

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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

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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

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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

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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 Failure	Physical error indicated by network management
7	B1605	DDM COMM. Lost & bus Failure	DDM is missing in system configuration information reported from network management.
8	B1606	ADM COMM. Lost & bus Failure	ADM is missing in system configuration information reported from network management.
9	B1607	IMS COMM. Lost & bus Failure	IMS is missing in system configuration information reported from network management.
10	B1608	Lost Communication With SCM, Bus Failure	SCM is missing in system configuration information reported form network management.
11	B1609	Lost communication with SMK, bus failure	SMK is missing in system configuration information reported from network management
12	B1611	FAM COMM. Lost & bus Failure	FAM is missing in system configuration information reported from network management.
13	B1612	RAM COMM. Lost & bus Failure	RAM is missing in system configuration information reported from network management.
14	B1613	CLU COMM. Lost & bus Failure	CLU is missing in system configuration information reported from network 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 network 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

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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

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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

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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

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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

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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

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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

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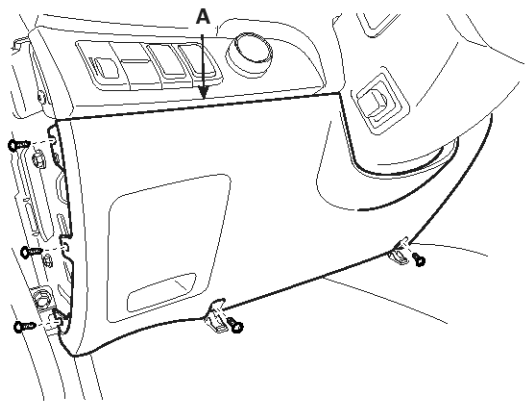
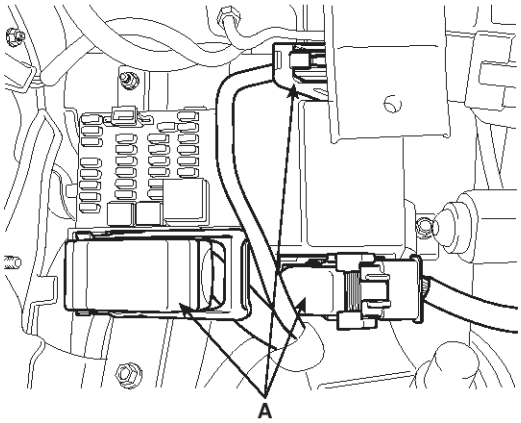
Removal

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



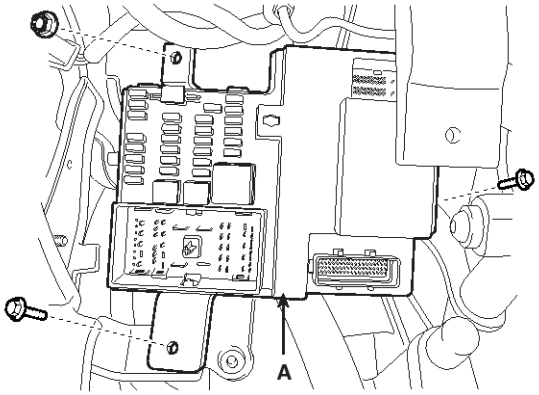
SHMBE8132D

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



SHMBE8133D

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



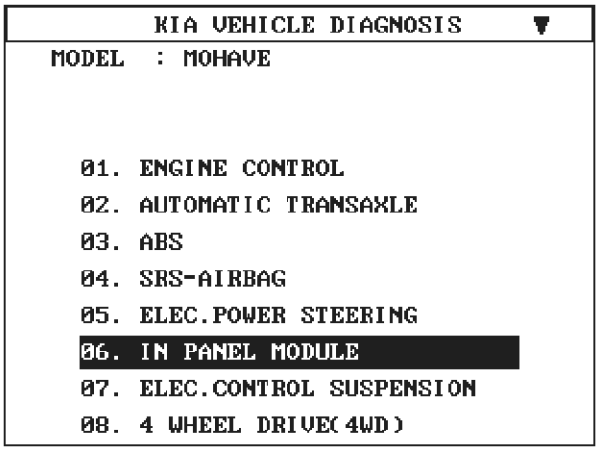
SHMBE8134D

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).



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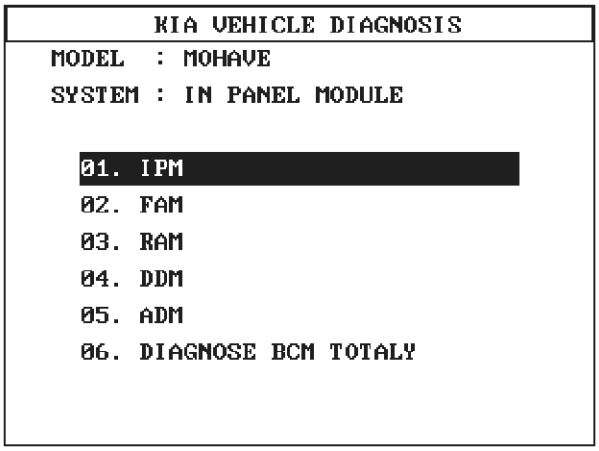
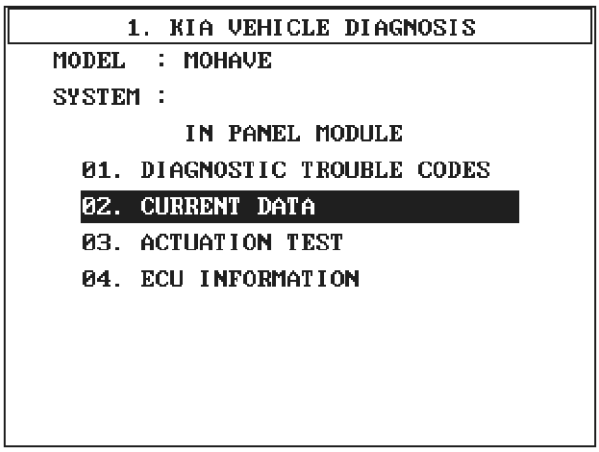
3. Select the module menu to diagnose.

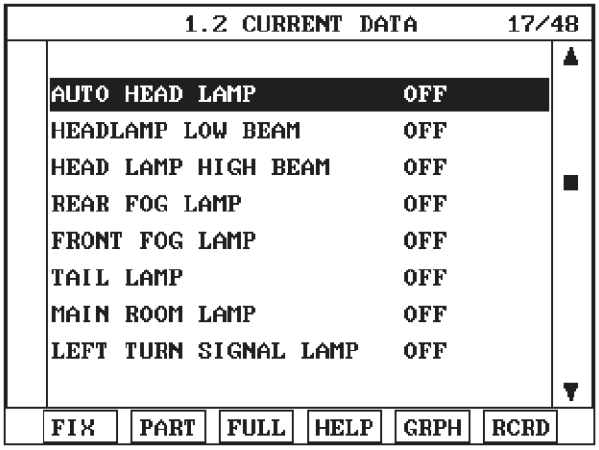


SHMBE9103L

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

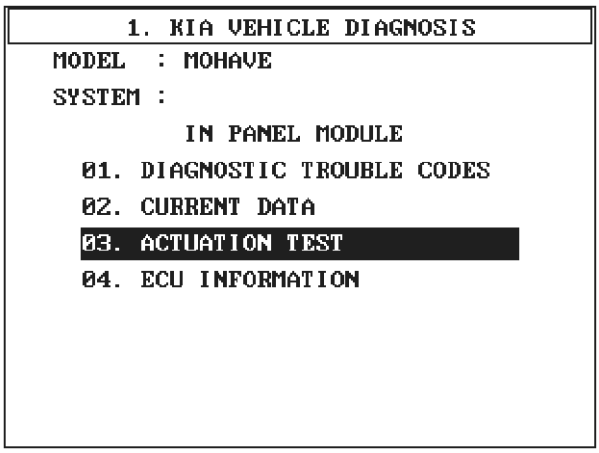


SHMBE9104L

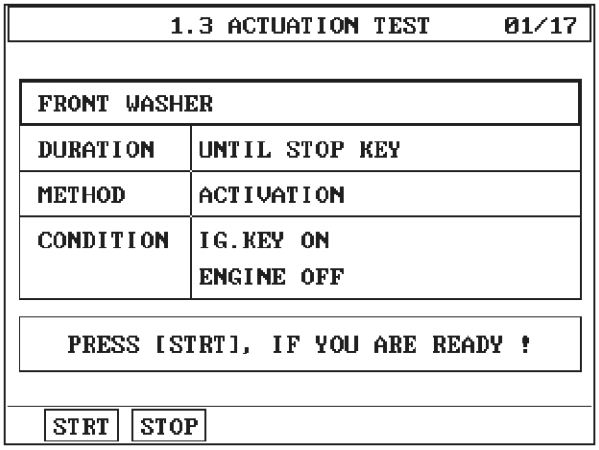


SHMBE9088N

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

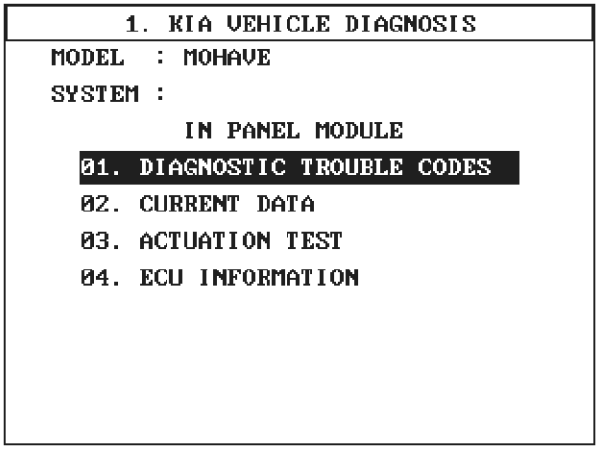


SHMBE9106L



SHMBE9091N

6. Use the "DIAGNOSTIC TROUBLE CODES" mode.



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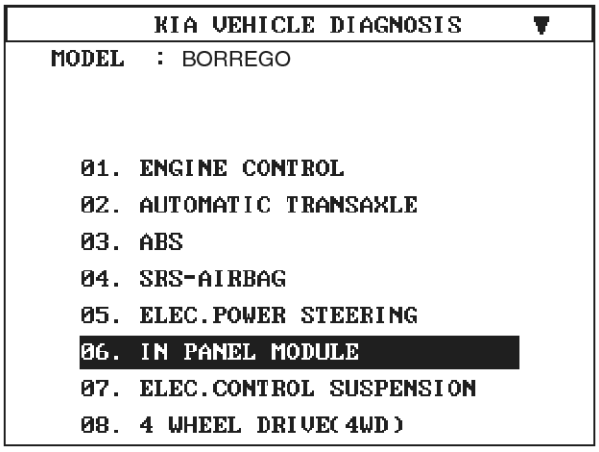
User Option Mode

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)

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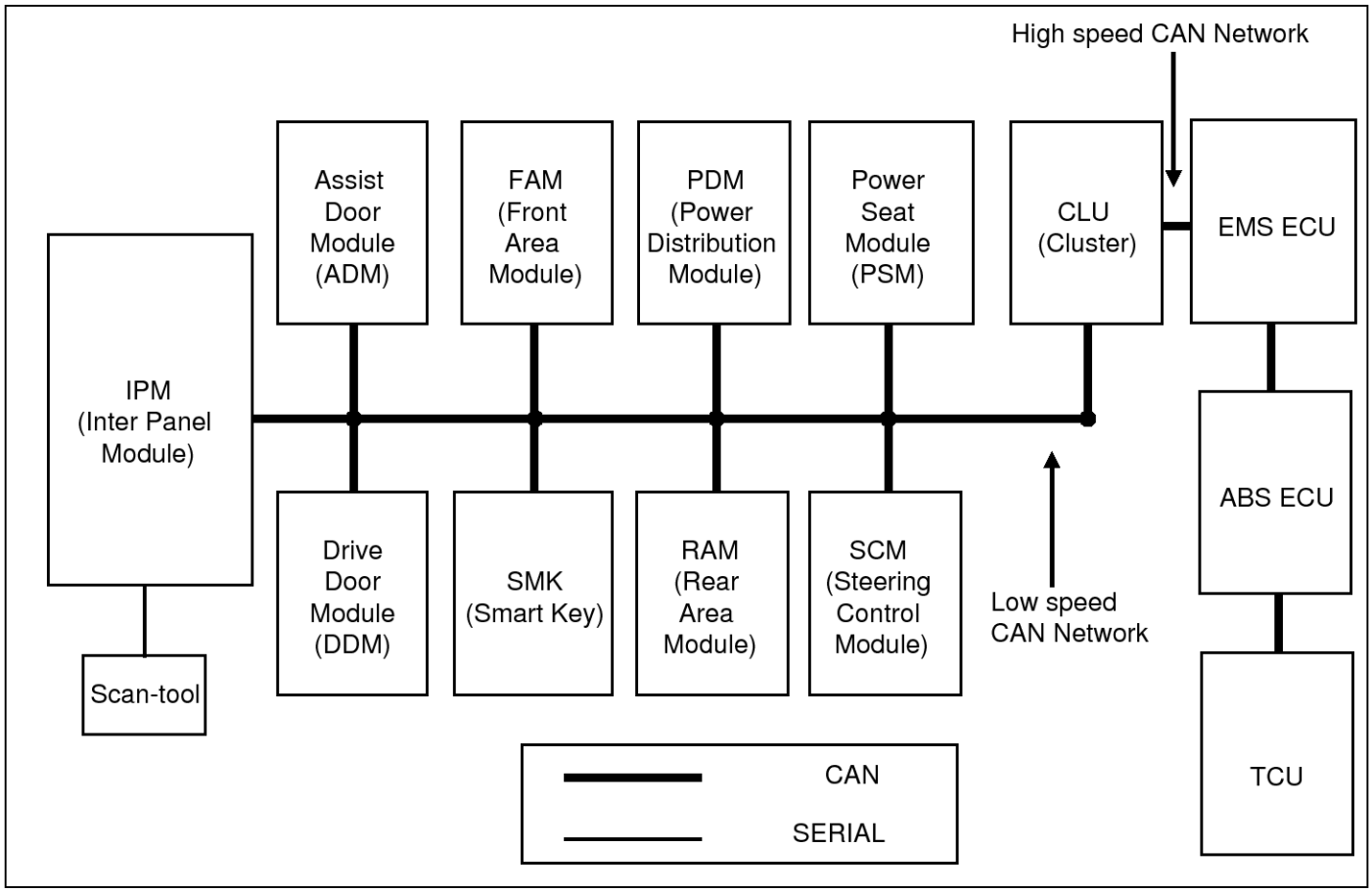
B1102 Battery Voltage Low

General Description

IPM(Inter Panel Module) monitors battery voltage so that IPM operate system is normal.

If battery voltage is abnormal, system does not operate appropriately. Therefore, check battery and charging system together.



SHMBE9C01L

DTC Description

IPM set DTC If the energized battery voltage is lower than 9V for 5sec.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check battery voltage	• Check Battery Voltage
Enable Conditions	• Battery voltage	
Threshold Value	• Battery voltage < 9V	
Diagnostic Time	• 5 seconds after failure detected	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

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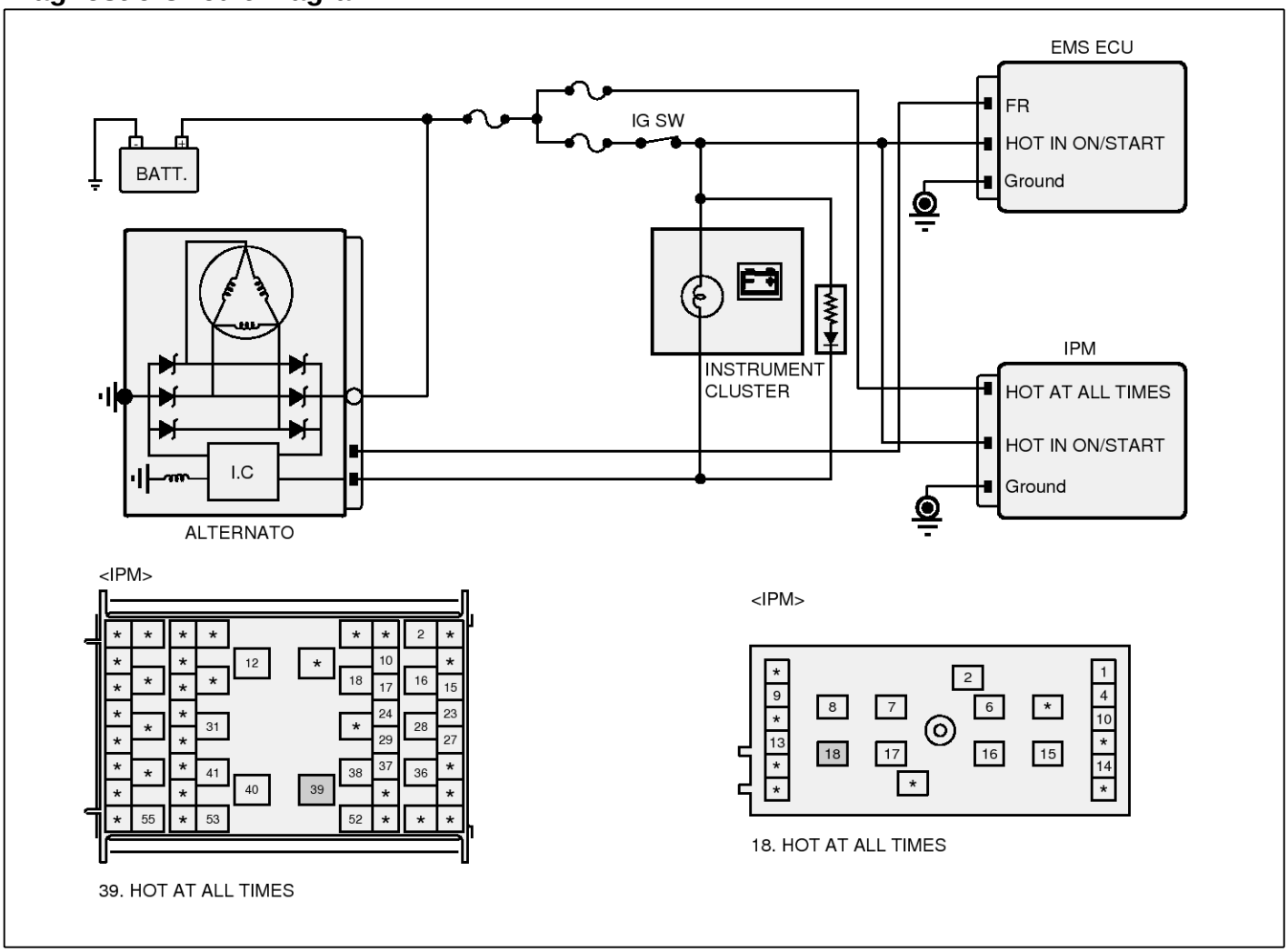
Diagnostic Circuit Diagram



SHMBE9C16L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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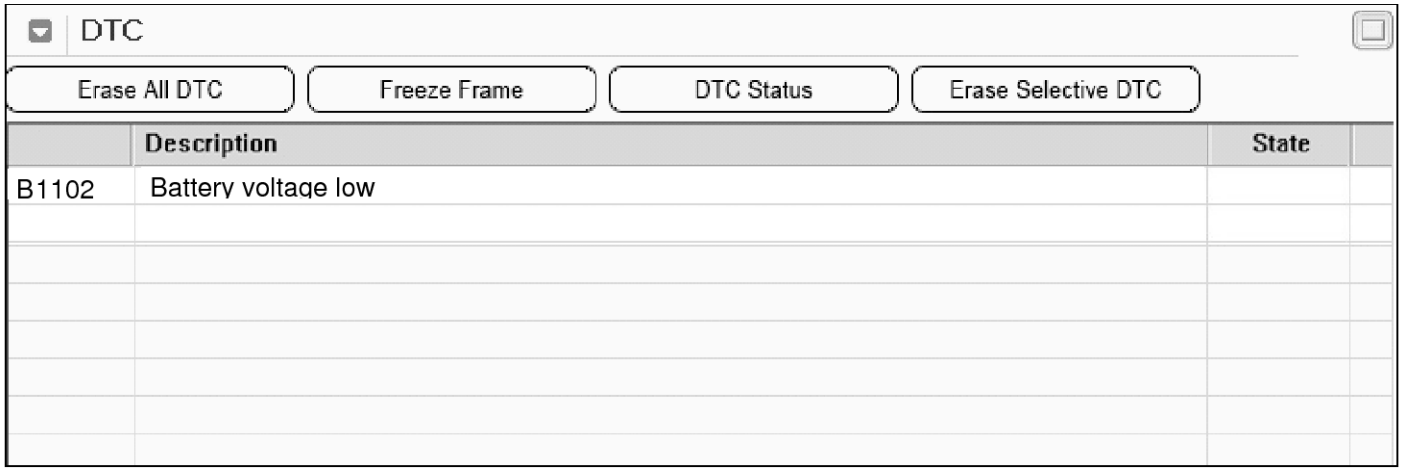

SHMBE9C17L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Check Charging system" procedure.

Charging System Inspection

■ Check Charging System :

1. ENG "ON" and Turn On the electrical load such as Head light and Heater.
2. Check battery voltage(+) and (-) after accellerating 2500 engine RPM at idle status for 2 min.

Specification : About 9 ≤ Vbatt ≤ 16

3. Is the measured voltage within specification ?

YES ▶ Go to "Power Circuit Inspection" procedure.

NO ▶ Check Fuse from Alternator to battery and connection of connector and harness. And then, go to "Verification of Vehicle Repair" procedure .

▶ If harness connection is O.K, howerever, over voltage is detected, repair or replace alternator and then, go to "Verification of Vehicle Repair' procedure.

Power Circuit Inspection

1. IG "OFF".
2. Wait for 1 min. after disconnecting battery (-) cable.
3. Disconnect IPM connector.
4. IG "ON" after connecting battery (-) terminal.
5. Measure voltage between ON/START terminal of IPM harness connector and chassis ground.

Specification : About 9 ≤ Vbatt ≤ 16

6. Is the measured voltage within specification ?

YES ▶ Go to "Ground Circuit Inspection" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit Inspection

1. IG "OFF".
2. Wait for 1 min. after disconnecting battery (-) terminal.

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3. Disconnect IPM connector.
4. Measure resistance between Ground Terminal of IPM harness connector and chassis ground.

Specification : About below 1 Ω.

5. Is the measured value within specification ?

YES ▶ Substitute with a known - good IPM and check for proper operation.
If the problem is corrected, replace the IPM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open in harness and repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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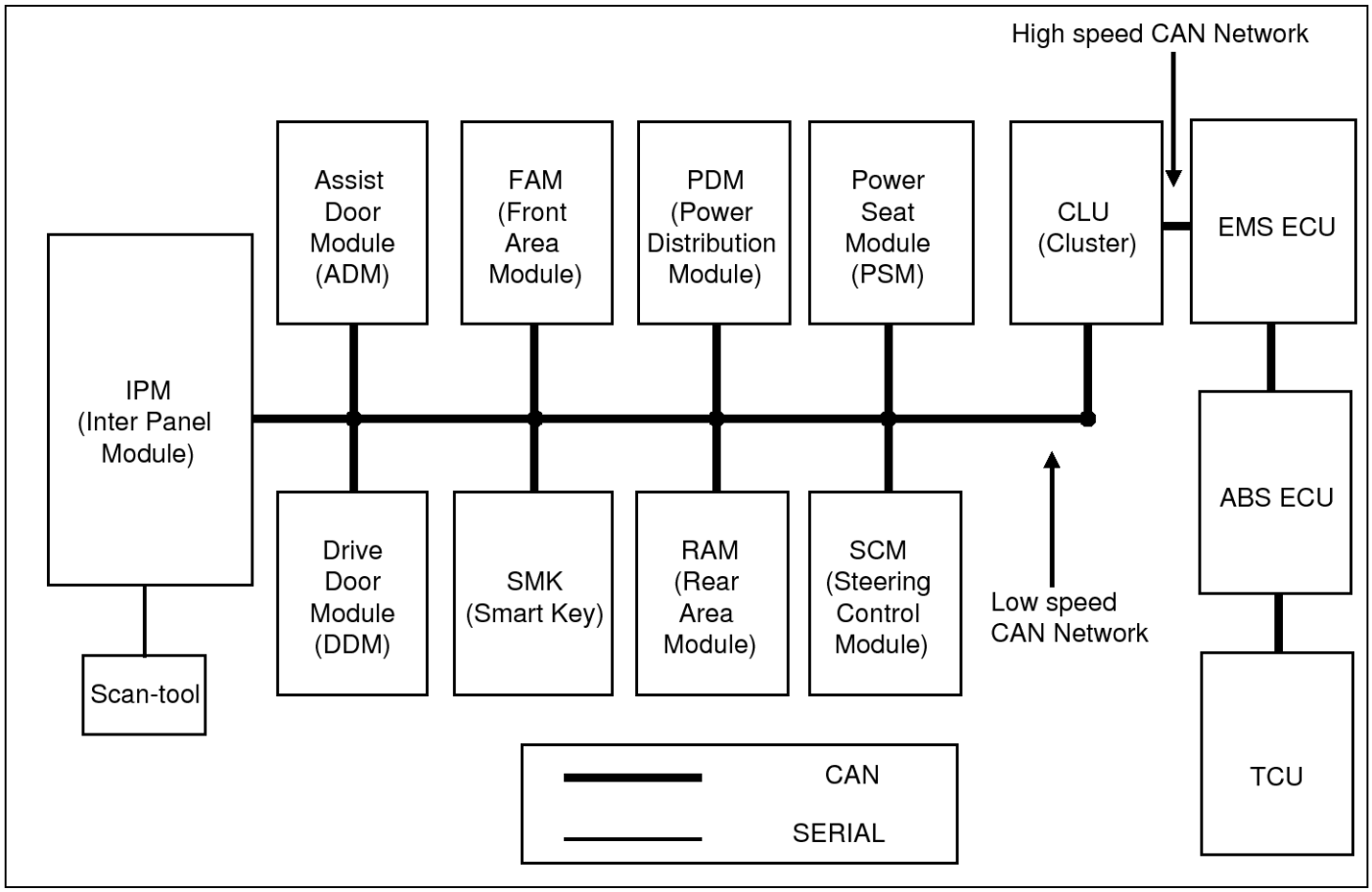
B1581 Ignition Switch Error

General Description

IPM(Inter Panel Module) monitors IGN SW input voltage to operate that system is normal.

In case that IGN switch input voltage is abnormal, because of system malfunction, check battery and charging system.



SHMBE9C01L

DTC Description

When IGN input voltage to IPM is not effective for 500msec such as ACC OFF, & IGN1 OFF & IGN 2 ON status, IPM sets DTC.

DTC Detecting Condition

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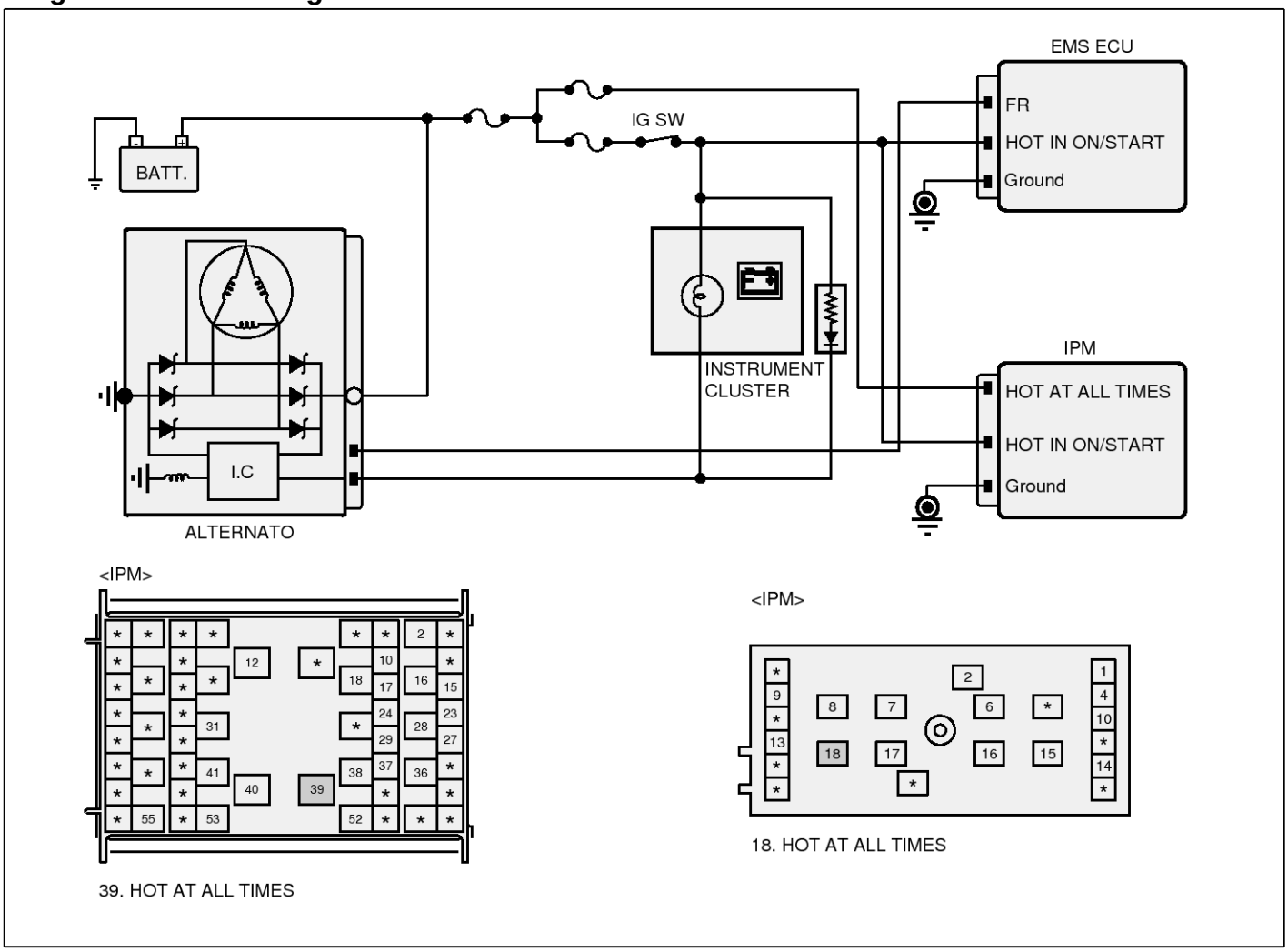
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check IGN status	• Check Battery Voltage • Check Ignition switch contact point or open in Fuse
Enable Conditions	• IGN ON	
Threshold Value	• -	
Diagnostic Time	• 500ms after failure detected	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram



SHMBE9C16L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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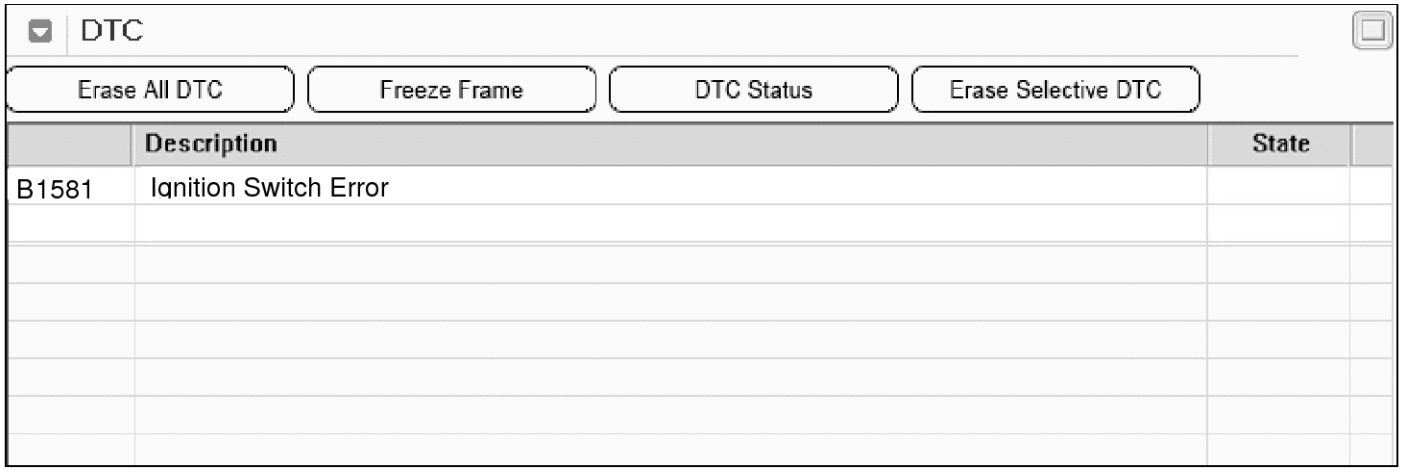

SHMBE9C18L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Check Charging system" procedure.

Charging System Inspection

■ Check Charging System :

1. ENG "ON" and Turn On the electrical load such as Head light and Heater.
2. Check battery voltage(+) and (-) after accellerating 2500 engine RPM at idle status for 2 min.

Specification : About 9 ≤ Vbatt ≤ 16

3. Is the measured voltage within specification ?

YES ▶ Go to "Power Circuit Inspection" procedure.

NO ▶ Check Fuse from Alternator to battery and connection of connector and harness. And then, go to "Verification of Vehicle Repair" procedure .

▶ If harness connection is O.K, howerever, over voltage is detected, repair or replace alternator and then, go to "Verification of Vehicle Repair' procedure.

Power Circuit Inspection

1. IG "OFF".
2. Wait for 1 min. after disconnecting battery (-) cable.
3. Disconnect IPM connector.
4. IG "ON" after connecting battery (-) terminal.
5. Measure voltage between ON/START terminal of IPM harness connector and chassis ground.

Specification : About 9 ≤ Vbatt ≤ 16

6. Is the measured voltage within specification ?

YES ▶ Go to "Ground Circuit Inspection" procedure.

NO ▶ Thoroughly check Point of Ignition switch between SSB SW and IPM, Fuse status, connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Ground Circuit Inspection

1. IG "OFF".
2. Wait for 1 min. after disconnecting battery (-)

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terminal.

3. Disconnect IPM connector.
4. Measure resistance between Ground Terminal of IPM harness connector and chassis ground.

Specification : About below 1 Ω.

5. Is the measured value within specification ?

YES ▶ Substitute with a known - good IPM and check for proper operation.
If the problem is corrected, replace the IPM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open in harness and repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1588 Right Front Wiper/Washer MF Switch

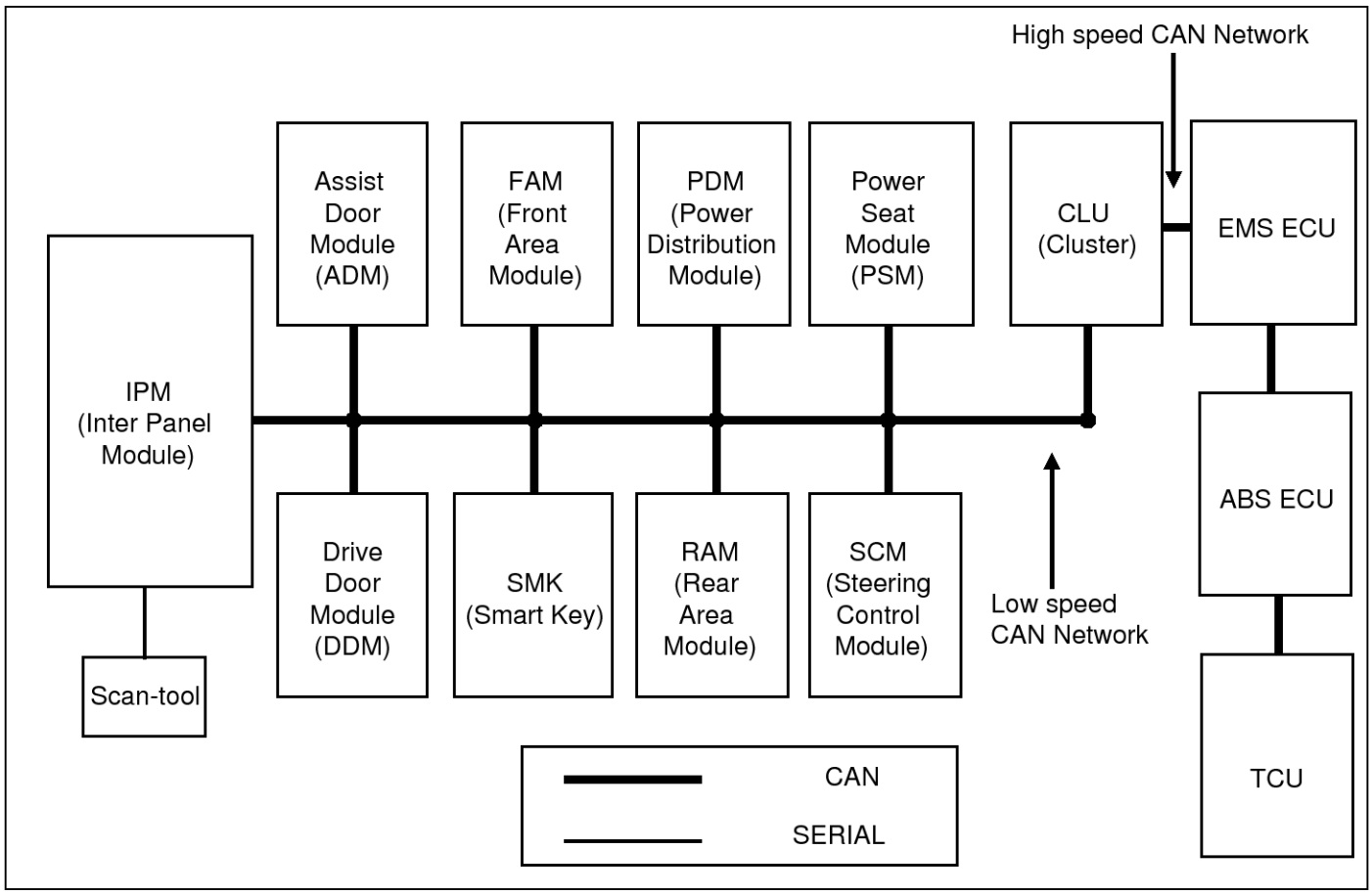
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

If the abnormal signal is received from MF Wiper SW to IPM for 2 seconds, for instance, Both Wiper low and Wiper high signal inputted together, IPM sets DTC.

DTC Detecting Condition

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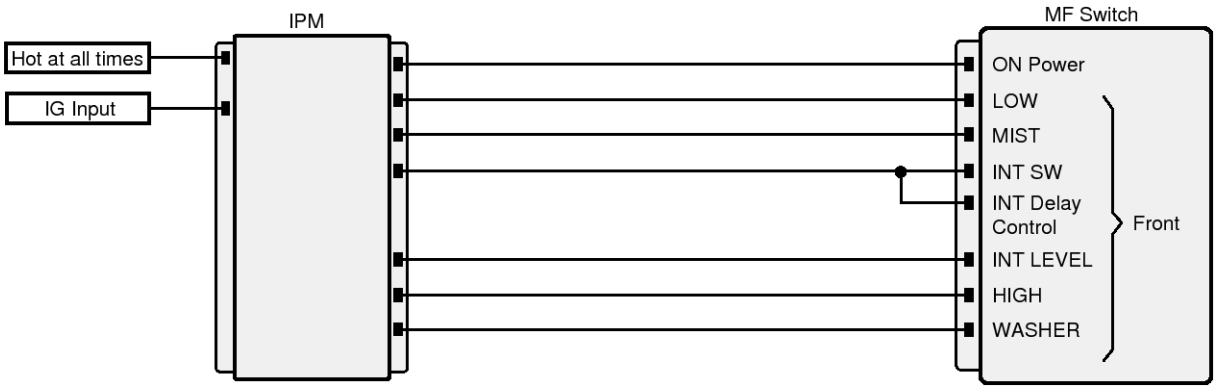
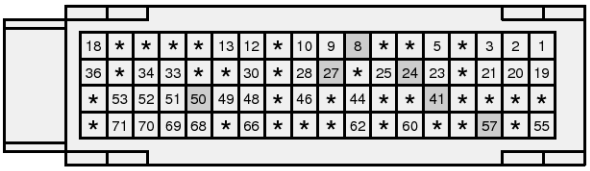
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check all status of MF switch function	• Check MF front wiper switch circuit • Replace IPM after checking all the function of MF switch
Enable Conditions	• IG KEY ON.	
Threshold Value	• -	
Diagnostic Time	• 2 seconds after failure occurs	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram

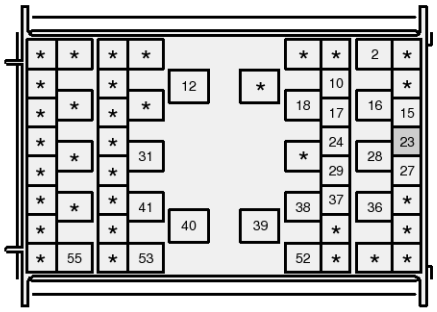


<IPM> BCM-IM



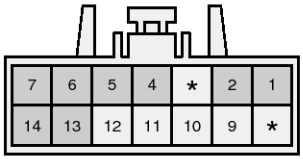
8. Low
24. INT LEVEL
27. MIST
41. WASHER
50. INT SW
57. High

<IPM> BEC-IM



23. ON Power

<MF Switch>



1. High
2. Low
4. MIST
5. Power
6. INT SW
7. WASHER
13. INT LEVEL
14. INT Delay Control

SHMBE9C23L

Scantool Data Analysis

■ Check DTC

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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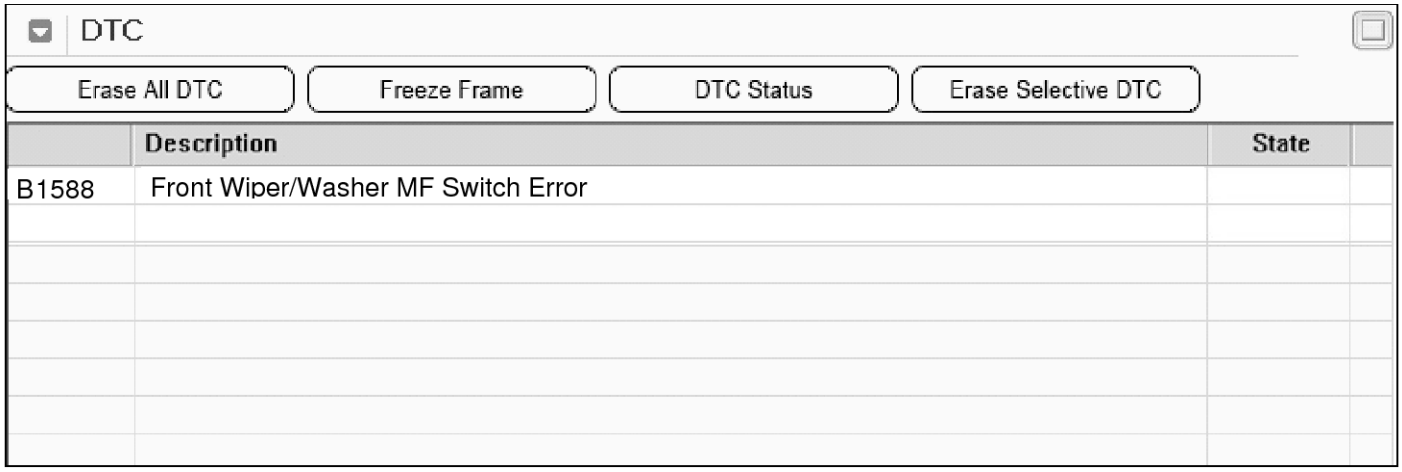

SHMBE9C24L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Front Wiper / Washer SW

1. Connect GDS.
2. IG "ON" & ENG "OFF".
3. Select "Current Data" mode.
4. Check Operating Status of Front Wiper / Washer parameter.

Specification : ON or OFF

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Wiper High Speed-Front	ON	-
Wiper High Speed Switch-Front	ON	-
Wiper Low Speed Switch-Rear	OFF	-
Wiper INT. Switch-Front	OFF	-
Washer-Front	OFF	-
Washer-Rear	OFF	-
Windshield Defog	OFF	-
Defroster-Rear	OFF	-
Parking Brake	OFF	-
Hazard Switch	OFF	-
Seat Belt	OFF	-
Wiper MIST Switch-Front	OFF	-
Flash to Pass	OFF	-
Ignition Key Reminder	Inserted	-
Crash Sensor Input	OFF	-
Ignition 1	OFF	-
Ignition 2	OFF	-
ACC	OFF	-
Hood Open Switch	CLOSE	-
RK RX Status	Not Valid	-
Number of RK(+RK)	No Tx Saved	-

SHMBE9C25L

5. Are all front wiper / washer SW parameter normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Signal Circuit Inspection" procedure.

Signal Circuit Inspection

■ Check short in front wiper/washer switch

1. Disconnect battery (-) cable after IG "OFF".
2. Disconnect MF switch and IPM connetor.
3. Check resistance between one and another terminal of front wiper / washer of MF switch goes to IPM.

Specification : About ∞ Ω

4. Is the measured resistance within specification ?

YES ▶ Substitute with a known - good IPM and check for proper operation.
If the problem is corrected, replace the IPM and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good MF switch and check for proper operation.
If the problem is corrected, replace the MF switch and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check short in signal harness of front wiper / washer switch at MF switch, connected to to I-PM, repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1589 Right Rear Wiper/Washer MF Switch

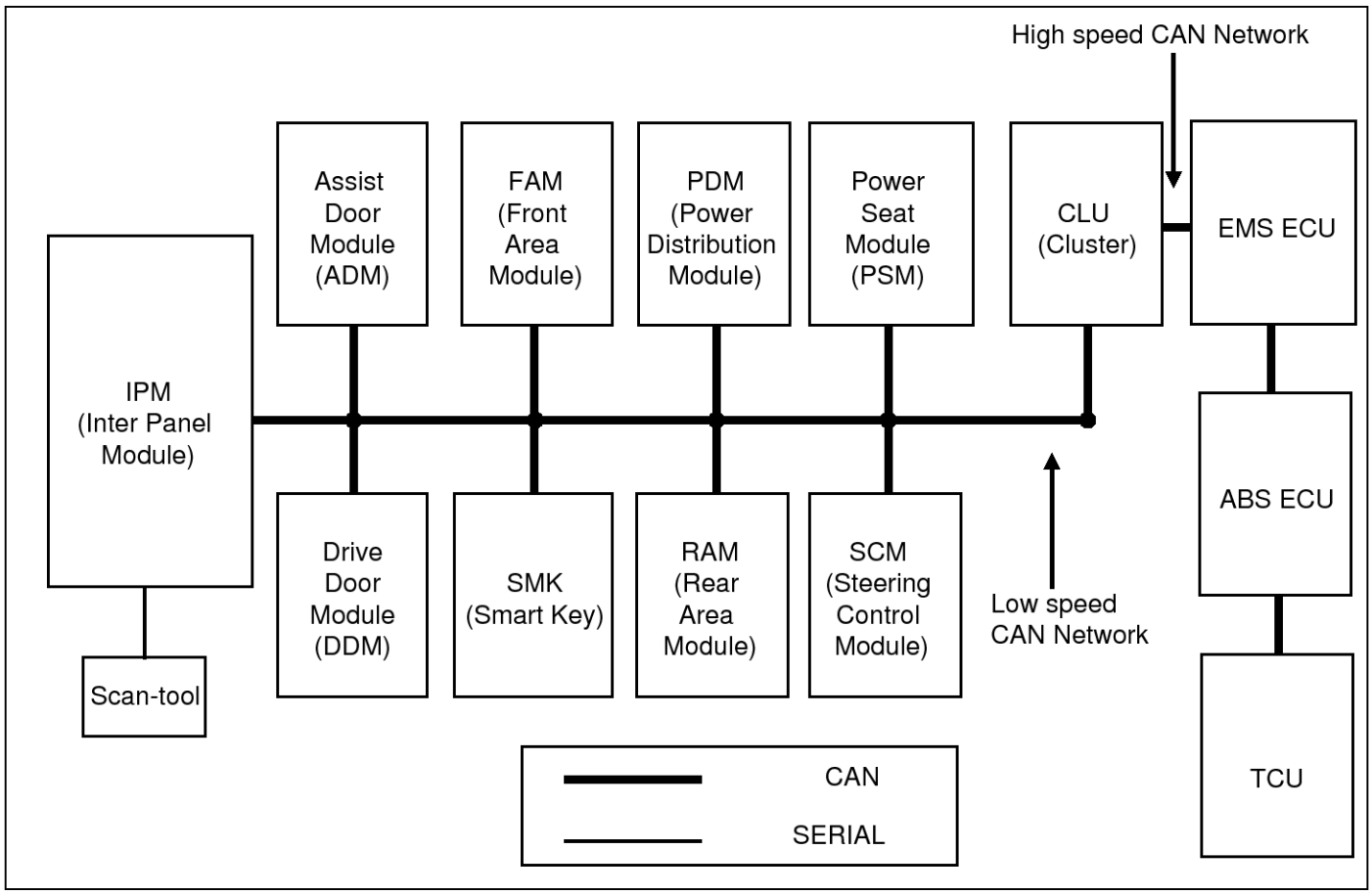
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

If the abnormal signal is received from MF Wiper SW to IPM for 2 seconds, for instance, Both Wiper low and Wiper high signal inputted together, IPM sets DTC.

DTC Detecting Condition

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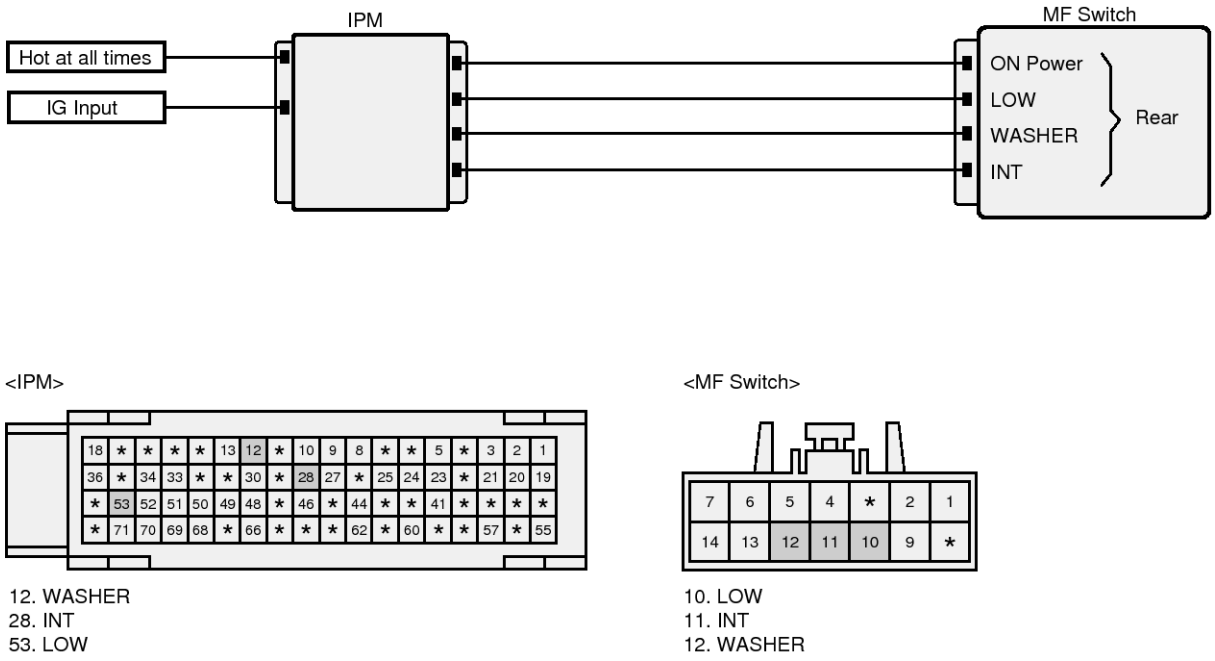
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check all status of MF switch function	• Check MF rear wiper switch circuit • Replace IPM after checking all the function of MF switch.
Enable Conditions	• IG KEY ON.	
Threshold Value	• -	
Diagnostic Time	• 2 seconds after failure occurs	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram



SHMBE9C26L

Scantool Data Analysis

■ Check DTC

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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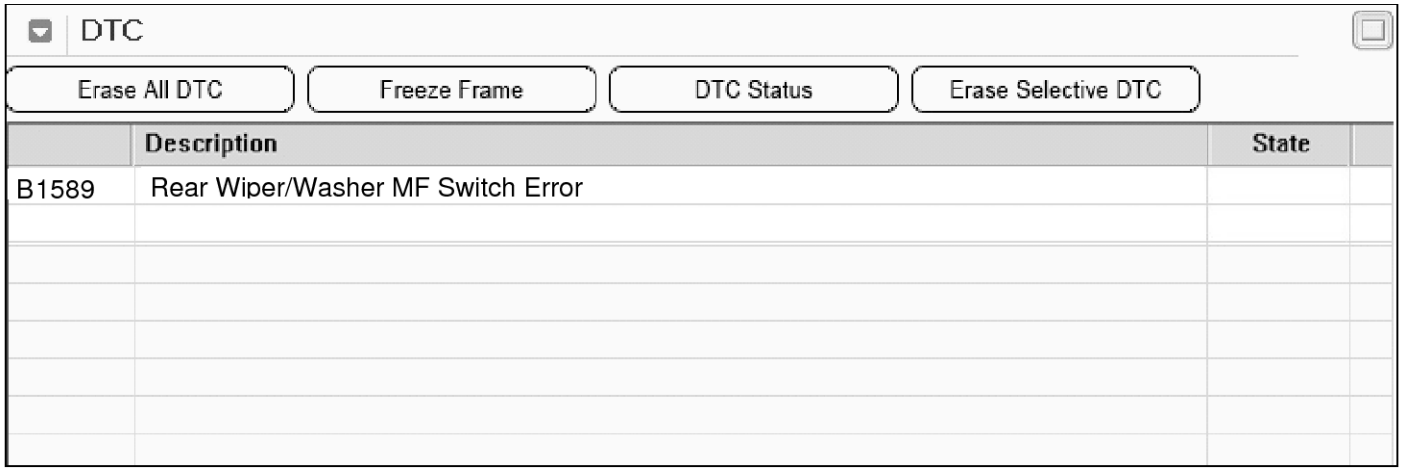

SHMBE9C27L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Front Wiper / Washer SW

1. Connect GDS.
2. IG "ON" & ENG "OFF".
3. Select "Current Data" mode.
4. Check Operating Status of Front Wiper / Washer parameter.

Specification : ON or OFF

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Wiper High Speed-Front	OFF	-
Wiper High Speed Switch-Front	OFF	-
Wiper Low Speed Switch-Rear	OFF	-
Wiper INT. Switch-Front	OFF	-
Washer-Front	OFF	-
Washer-Rear	ON	-
Windshield Defog	OFF	-
Defroster-Rear	OFF	-
Parking Brake	OFF	-
Hazard Switch	OFF	-
Seat Belt	OFF	-
Wiper MIST Switch-Front	OFF	-
Flash to Pass	OFF	-
Ignition Key Reminder	Inserted	-
Crash Sensor Input	OFF	-
Ignition 1	OFF	-
Ignition 2	OFF	-
ACC	OFF	-
Hood Open Switch	CLOSE	-
RK RX Status	Not Valid	-
Number of RK(+RK)	No Tx Saved	-

SHMBE9C28L

5. Are all front wiper / washer SW parameter normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Signal Circuit Inspection" procedure.

Signal Circuit Inspection

■ Check short in rear wiper/washer switch

1. Disconnect battery (-) cable after IG "OFF"
2. Disconnect MF switch and IPM connetor.
3. Check resistance between one and another terminal of rear wiper / washer of MF switch goes to IPM.

Specification : About ∞ Ω

4. Is the measured resistance within specification ?

YES ▶ Substitute with a known - good IPM and check for proper operation.
If the problem is corrected, replace the IPM and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good MF switch and check for proper operation.
If the problem is corrected, replace the MF switch and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check short in signal harness of rear wiper / washer switch at MF switch, connected to to I-PM, repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1590 Light Multifunction Switch Error

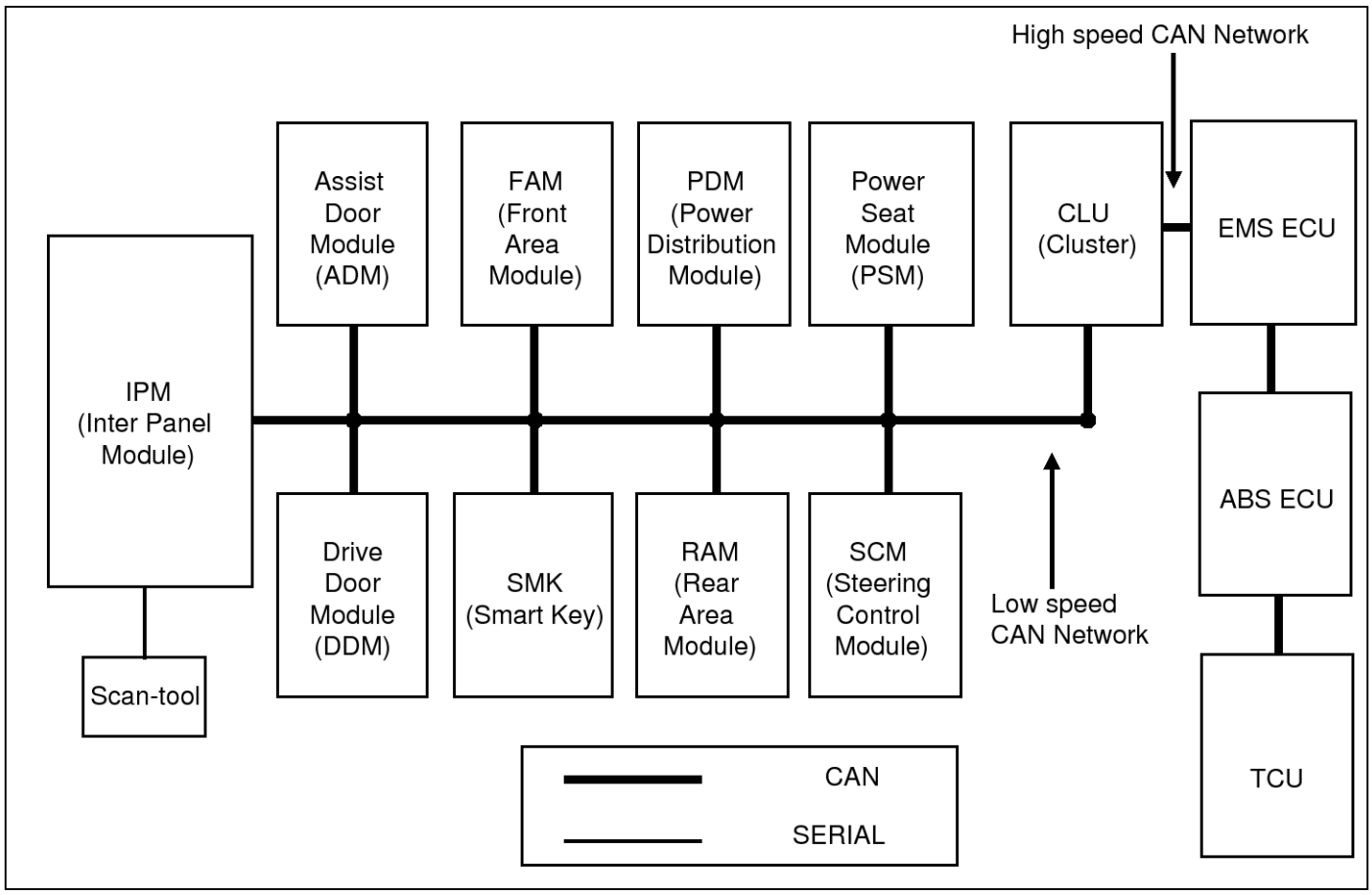
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

IPM sets this DTC If IPM has received abnormal signal from MF Light SW for 2 sec., for instance, Both Auto light SW and Tail Lamp SW are inputted simultaneously.

DTC Detecting Condition

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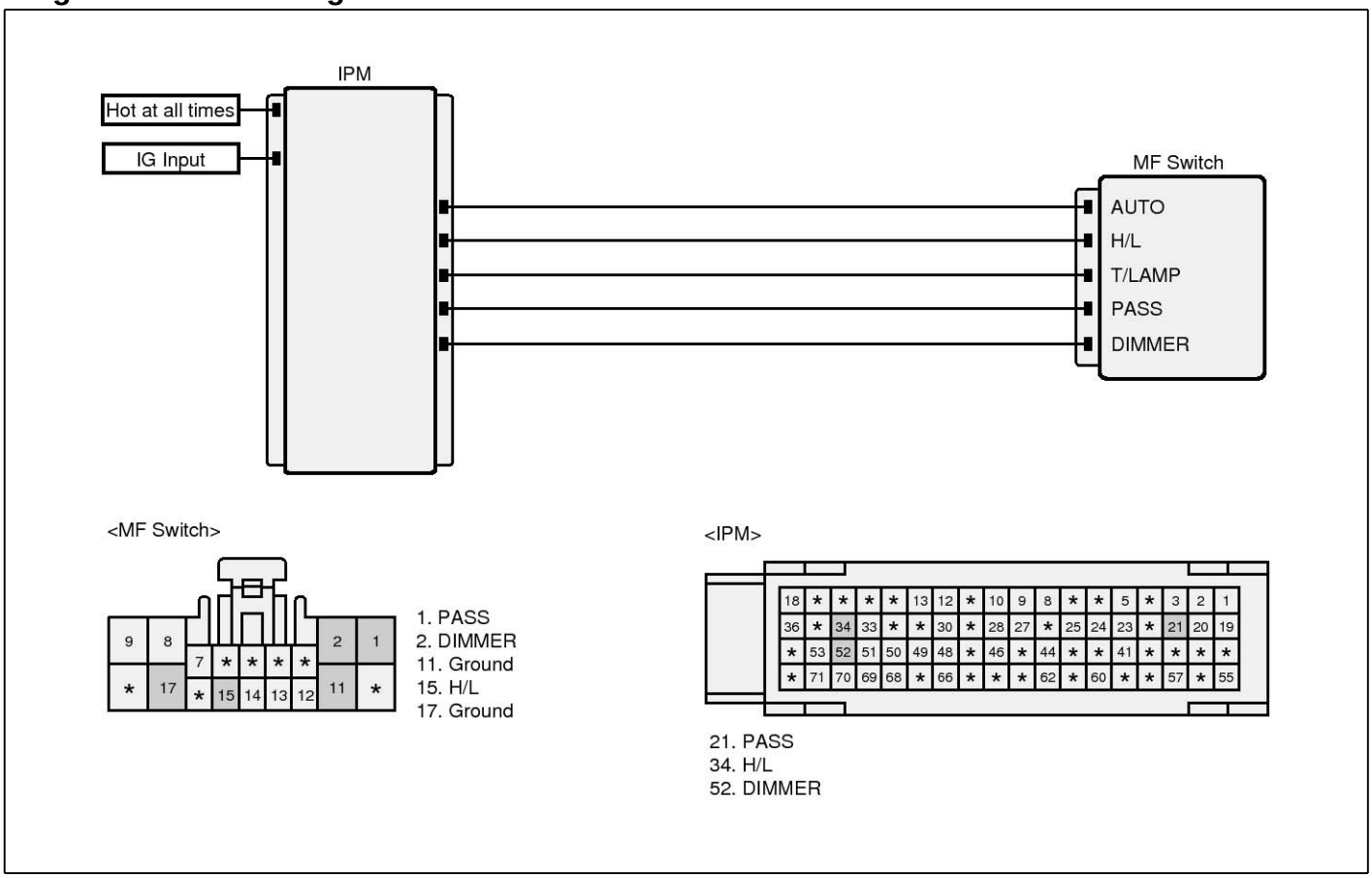
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check MF SW input status	• MF light switch signal circuit • Faulty MF light switch • Faulty IPM
Enable Conditions	• IG KEY ON.	
Threshold Value	• -	
Diagnostic Time	• 2 seconds after failure occurs	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram



SHMBE9C29L

Scantool Data Analysis

■ Check DTC

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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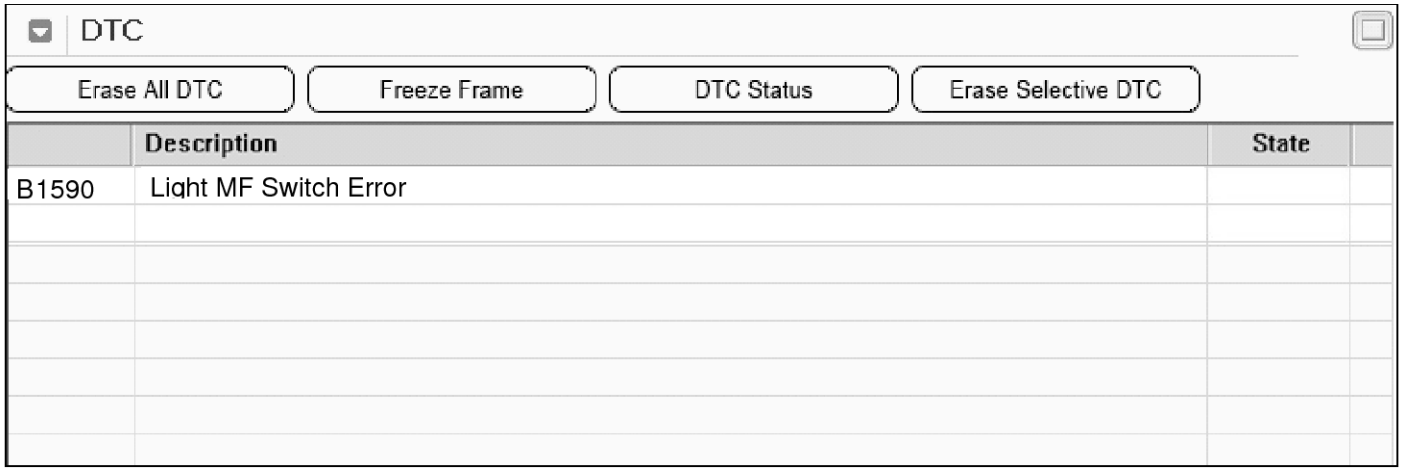

SHMBE9C30L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Head Light

1. Connect GDS.
2. IG "ON" & ENG "OFF".
3. Select "Current Data" mode.
4. Check Operating Status of Head Light parameter.

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
IPM Node Availability	OFF	-
FAM Node Availability	OFF	-
RAM Node Availability	OFF	-
DDM Node Availability	OFF	-
ADM Node Availability	OFF	-
IMS Node Availability	OFF	-
CLU Node Availability	OFF	-
SCM Node Availability	OFF	-
IPM Node Failure	Ok	-
FAM node failure	Ok	-
RAM Node Failure	Ok	-
DDM Node Failure	Ok	-
ADM Node Failure	Ok	-
IMS Node Failure	Ok	-
CLU Node Failure	Ok	-
SCM Node Failure	Ok	-
Auto Head Lamp	OFF	-
Head Lamp Low Beam	ON	-
Head Lamp High Beam	OFF	-
Fog Lamp-Front	OFF	-
Parking Tail Lamp	OFF	-

SHMBE9C31L

5. Are all Head Lamp parameters normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Signal Circuit Inspection" procedure.

Signal Circuit Inspection

■ Check short in light SW

1. IG "OFF" and disconnect battery (-) terminal.
2. Disconnect MF SW and IPM connector.
3. Check resistance between one and another signal terminal of MF SW harness connector.

Specification : About ∞ Ω

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good IPM and check for proper operation.
If the problem is corrected, replace the IPM and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good MF switch and check for proper operation.
If the problem is corrected, replace the MF switch and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check short in signal harness of light SW, and then, go to 'Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1591 Turn Signal Multifunction Switch Error

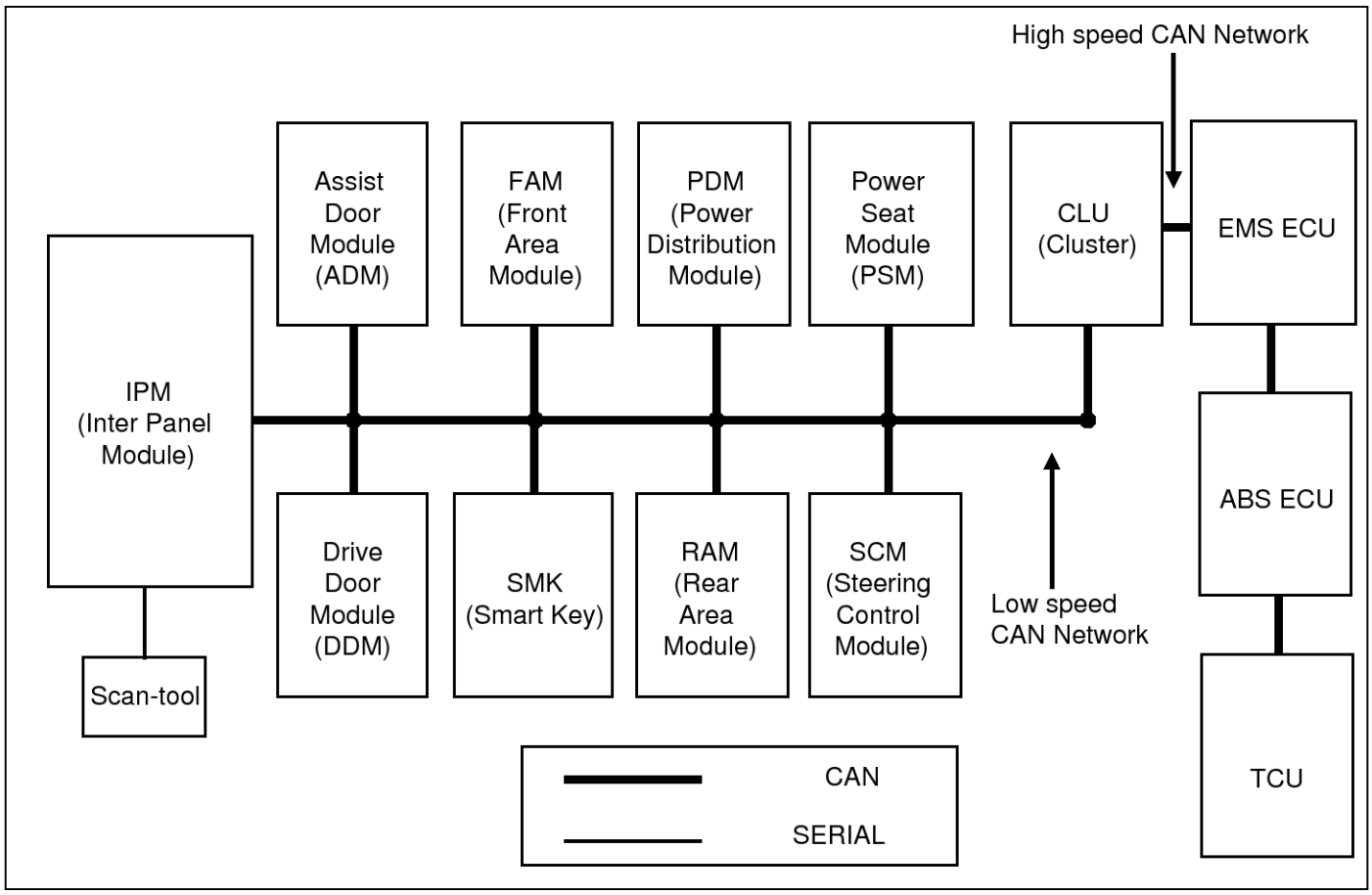
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

IPM sets this DTC If IPM has received abnormal signal from Turn signal SW, for instance, Both Turn Signal left and Turn signal right are inputted simultaneously.

DTC Detecting Condition

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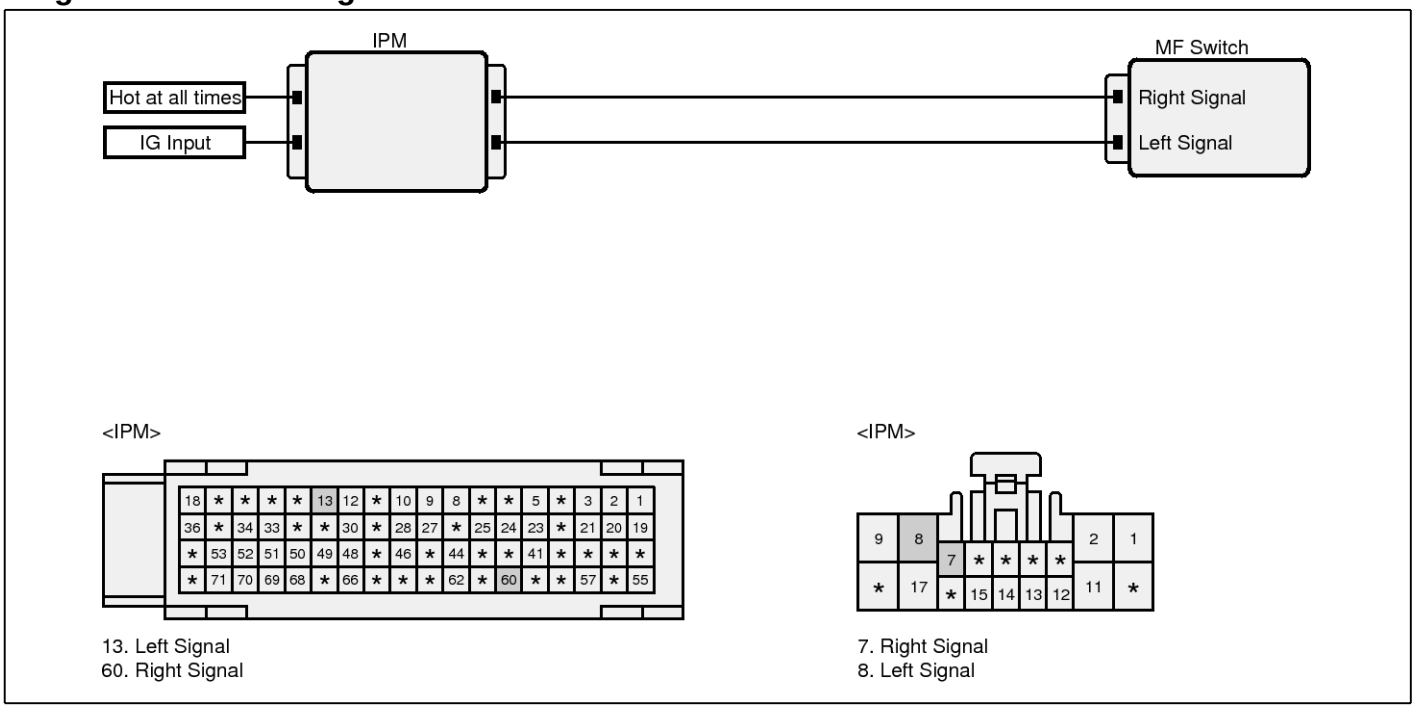
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check MF SW input status	• MF light switch signal circuit • Faulty MF Turn signal switch • Faulty IPM
Enable Conditions	• IG KEY ON.	
Threshold Value	• -	
Diagnostic Time	• 2 seconds after failure occurs	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram



SHMBE9C32L

Scantool Data Analysis

■ Check DTC

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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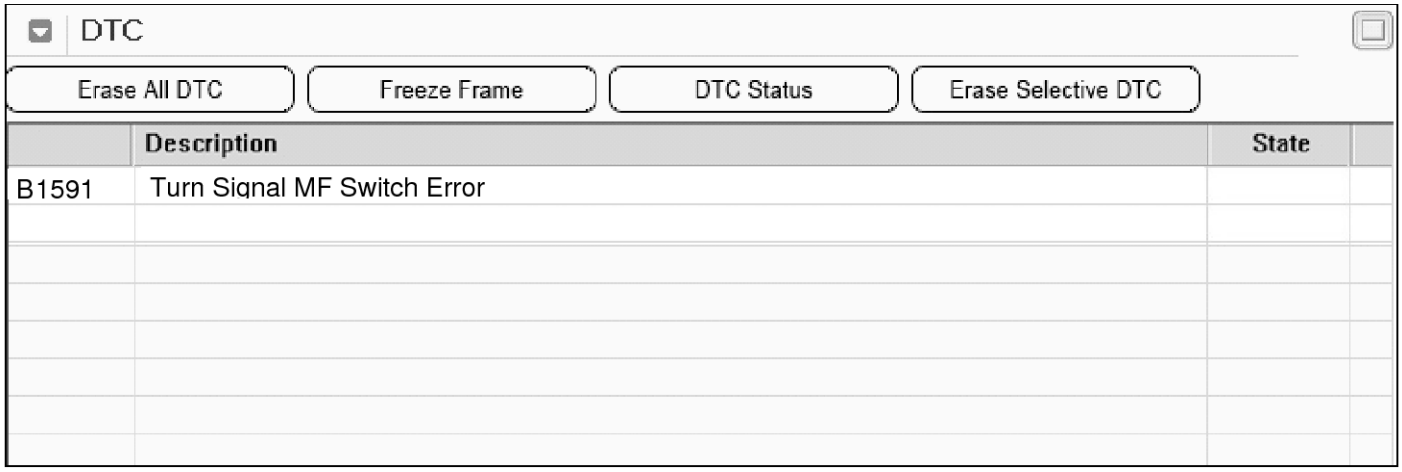

SHMBE9C33L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Turn Signal

1. Connect GDS.
2. IG "ON" & ENG "OFF".
3. Select "Current Data" mode.
4. Check Operating Status of Turn signal parameters.

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Parking Tail Lamp	OFF	-
Main Room Lamp	OFF	-
Turn Signal Lamp-Left	ON	-
Turn Signal Lamp-Right	OFF	-
Wiper Low Speed-Front	OFF	-
Wiper Low Speed Switch-Front	OFF	-
Wiper High Speed-Front	OFF	-
Wiper High Speed Switch-Front	OFF	-
Wiper Low Speed Switch-Rear	OFF	-
Wiper INT. Switch-Front	OFF	-
Washer-Front	OFF	-
Washer-Rear	OFF	-
Windshield Defog	OFF	-
Defroster-Rear	OFF	-
Parking Brake	OFF	-
Hazard Switch	OFF	-
Seat Belt	OFF	-
Wiper MIST Switch-Front	OFF	-
Flash to Pass	OFF	-
Ignition Key Reminder	Inserted	-
Crash Sensor Input	OFF	-

SHMBE9C34L

5. Are all Head Lamp parameters normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Signal Circuit Inspection" procedure.

Signal Circuit Inspection

■ Check short in signal circuit

1. IG "OFF" and disconnect battery (-) terminal.
2. Disconnect MF SW and IPM connector.
3. Check resistance between one and the other signal terminal of Turn signal SW harness connector.

Specification : About ∞ Ω

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good IPM and check for proper operation.
If the problem is corrected, replace the IPM and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good MF switch and check for proper operation.
If the problem is corrected, replace the MF switch and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check short in signal harness of Turn signal SW, and then, go to 'Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1602 CAN BUS Physical Error

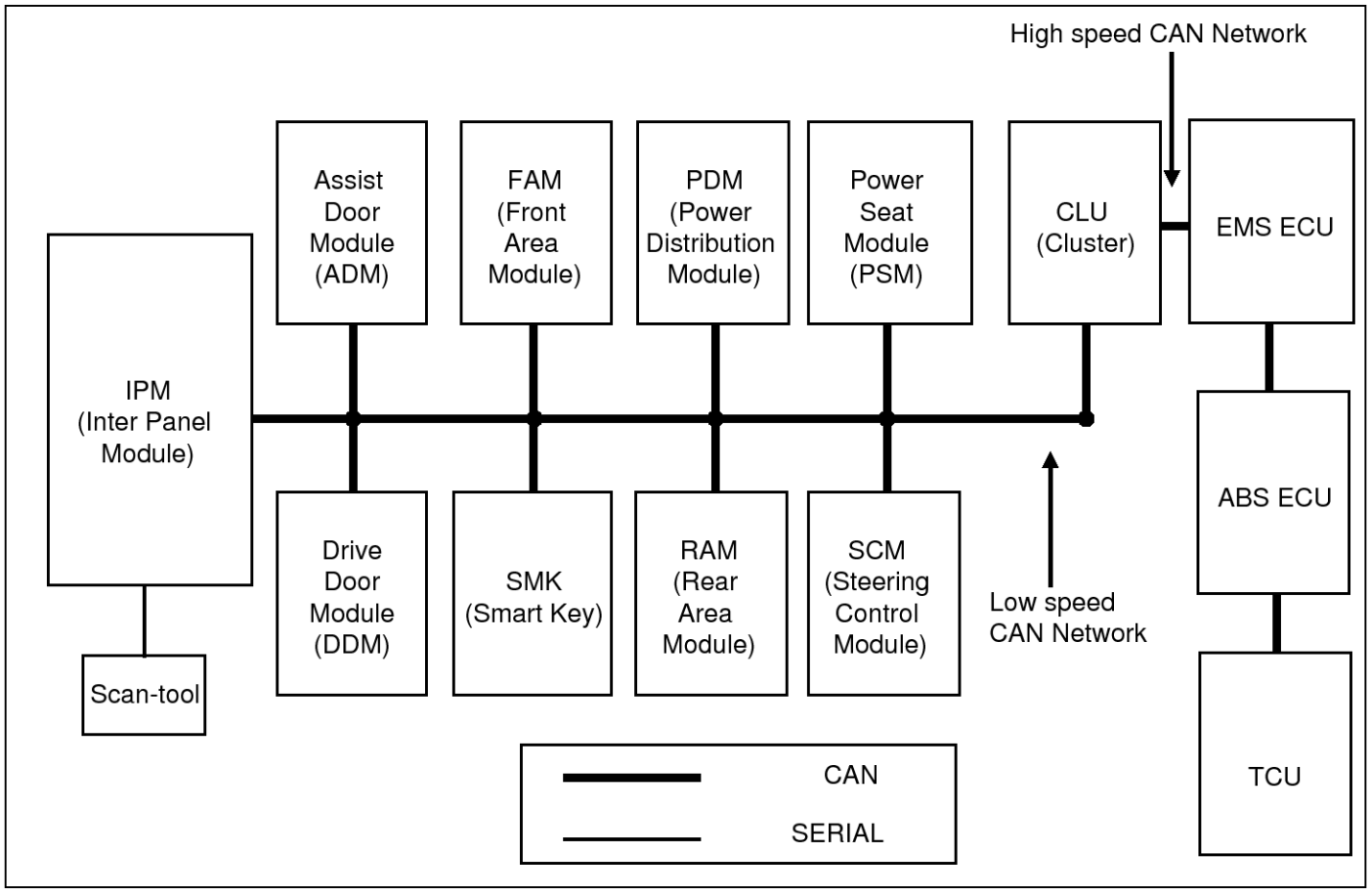
General Description

All 13 units which consists of the Body Electrical Control System are linked by CAN*1 line.

They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), ECW(Electronic Control Wiper), CLU(Cluster), MFSW(Multi Function Switch), PSM(Power Seat Module), SCM(Steering Control Module), PTM(Power Trunk Lid Module), FBWS(Front Back Warning System), DATC(Dual Auto Temperature Control Module).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

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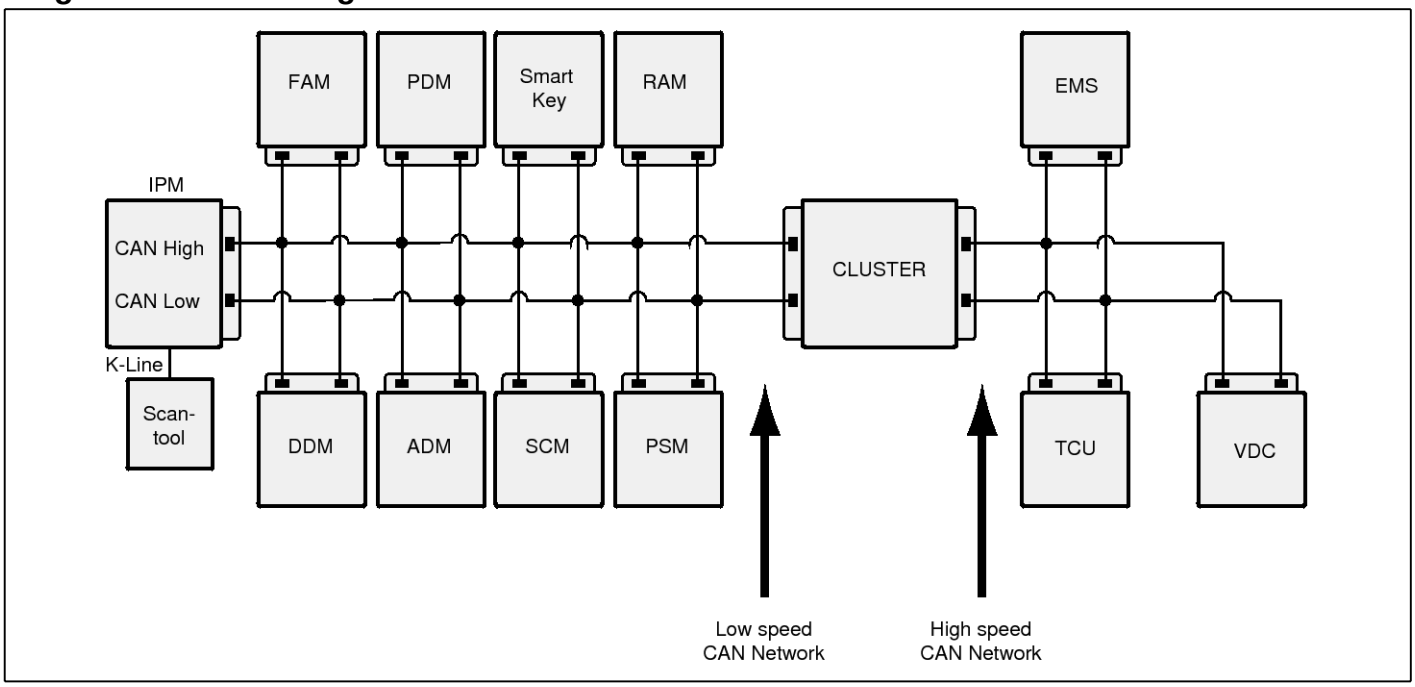
DTC Description

Pattern	Status	
1	Open in CAN High circuit	Communication is normal but DTC set if IPM detects 7 error status as follows. ① Short to battery in CAN High circuit ② Short to ground in CAN High circuit ③ Short to battery in CAN Low circuit ④ Short to ground in CAN Low circuit ⑤ Short between CAN High and Low circuit ⑥ Open or Poor connection in CAN Low circuit ⑦ Open or Poor connection in CAN High circuit
2	Open in CAN Low circuit	
3	Short to battery in CAN High circuit	
4	Short to battery in CAN Low circuit	
5	Short to ground in CAN High circuit	
6	Short to ground in CAN Low circuit	
7	Short between CAN High and Low circuit	

DTC Detecting Condition

Item	Detecting Condition			Possible Cause
DTC Strategy	• CAN communication status			• Short to battery / ground in CAN high circuit • Short to battery / ground in CAN low circuit • Short between CAN high and CAN low circuit • Open or poor connection in CAN high and low circuit • Faulty IPM
Enable Conditions	• IG "ON" • Engine "START" • B/T voltage engerzied to IPM			
Threshold Value	CAN high	0 V	Short to ground	
		B+ V	Short to battery	
	CAN low	0 V	Short to ground	
		B+ V	Short to battery	
Diagnostic Time	• Failure has been continued for 2sec.			
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)			

Diagnostic Circuit Diagram



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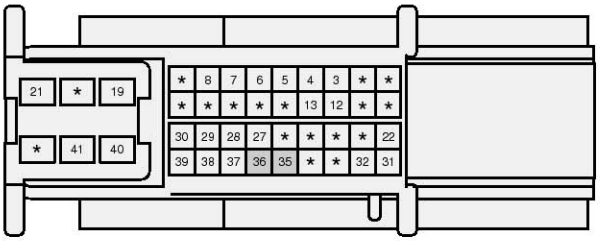
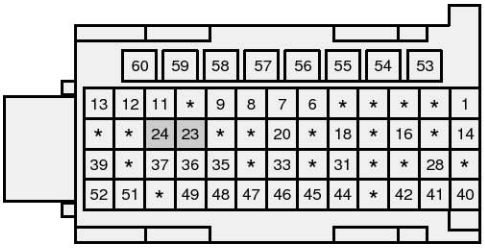
<RAM>



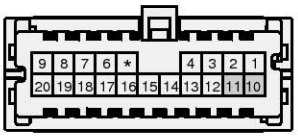
35. Low
36. High

<FAM>



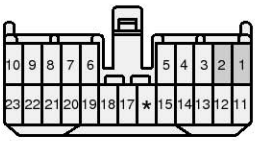
23. Low
24. High

<PDM>



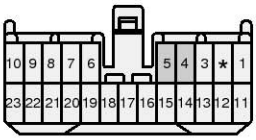
10. Low
11. High

<DDM>



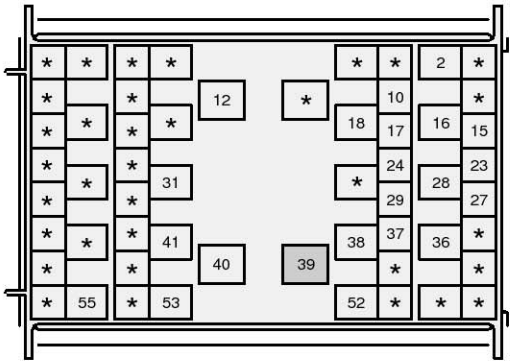
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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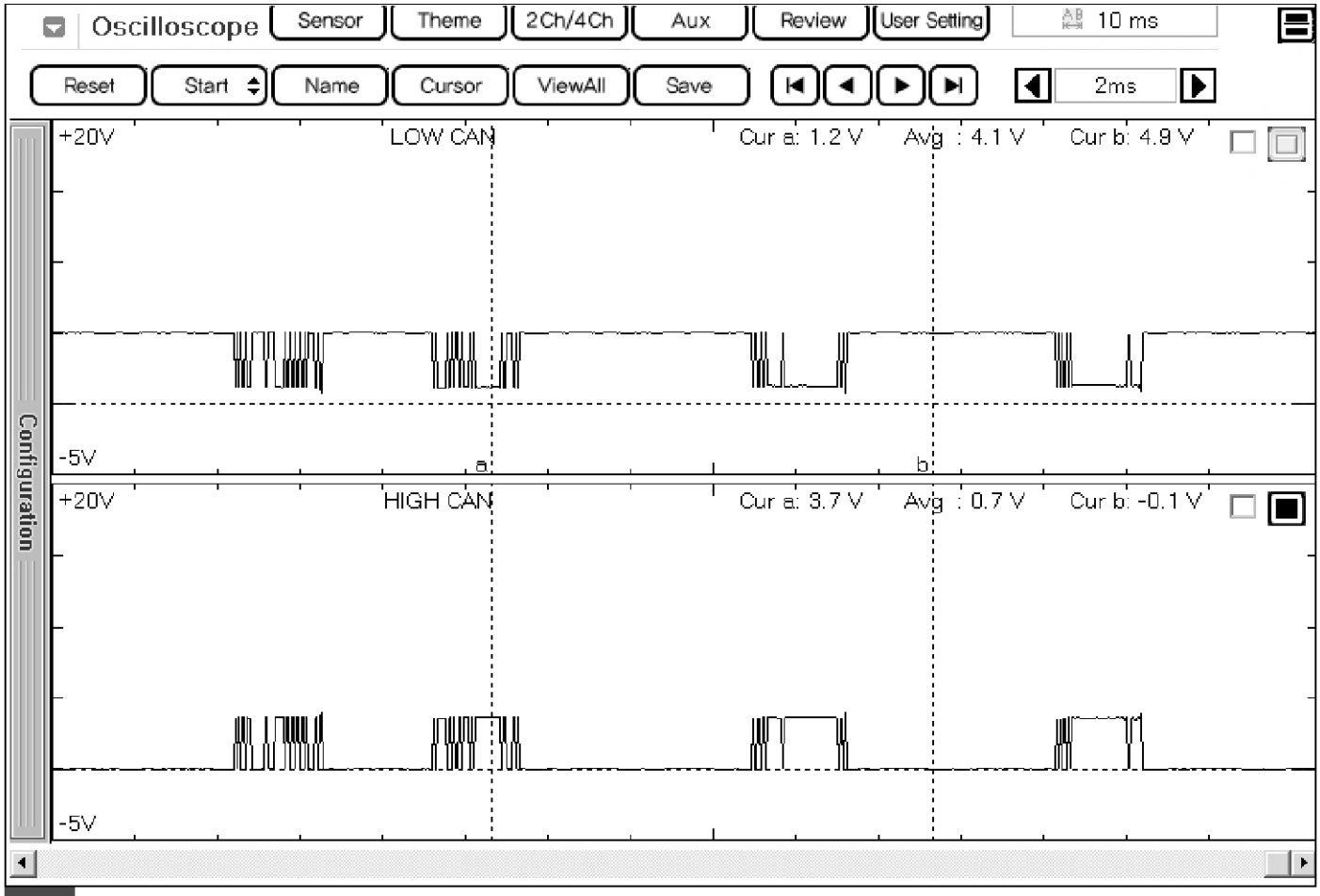

Fig.1

SHMBE9C04L

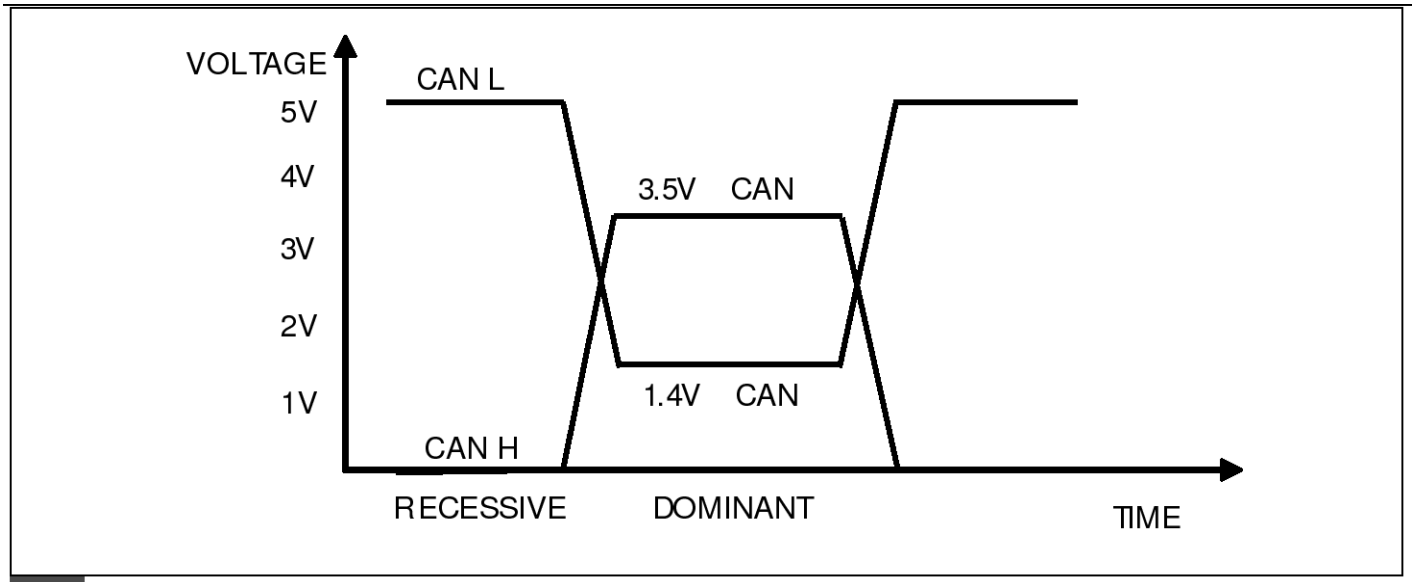

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Monitor Scantool Data

■ **Check DTC**

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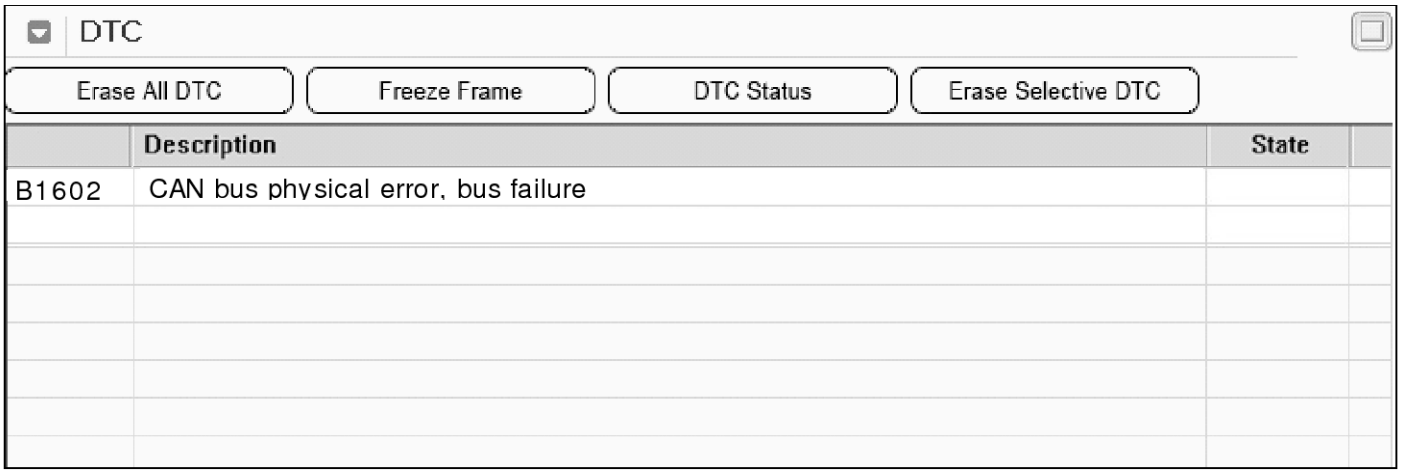
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions"

   (Refer to "DTC Detecting Condition" table)



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5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure.

Signal Circuit Inpsection

■ Check CAN high circuit

1. IG "ON" & ENG "OFF".
2. Connect GDS and select Scope meter fucntion.
3. Measure signal waveform of IPM CAN High line.

Specification : Refer to signal waveform and data

4. Is the measured signal waveform of CAN high circuit normal ?

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YES ▶ Go to next procedure

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

■ Check CAN Low circuit

1. IG "ON" & ENG "OFF"
2. Connect GDS and select Scope meter fucntion.
3. Measure signal waveform of IPM CAN Low line.

Specification : Refer to signal waveform and data

4. Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

■ Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect CAN communication units one by one and monitor DTC to find the cause.

   *CAN communication units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

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YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1605 CAN Time-out DDM

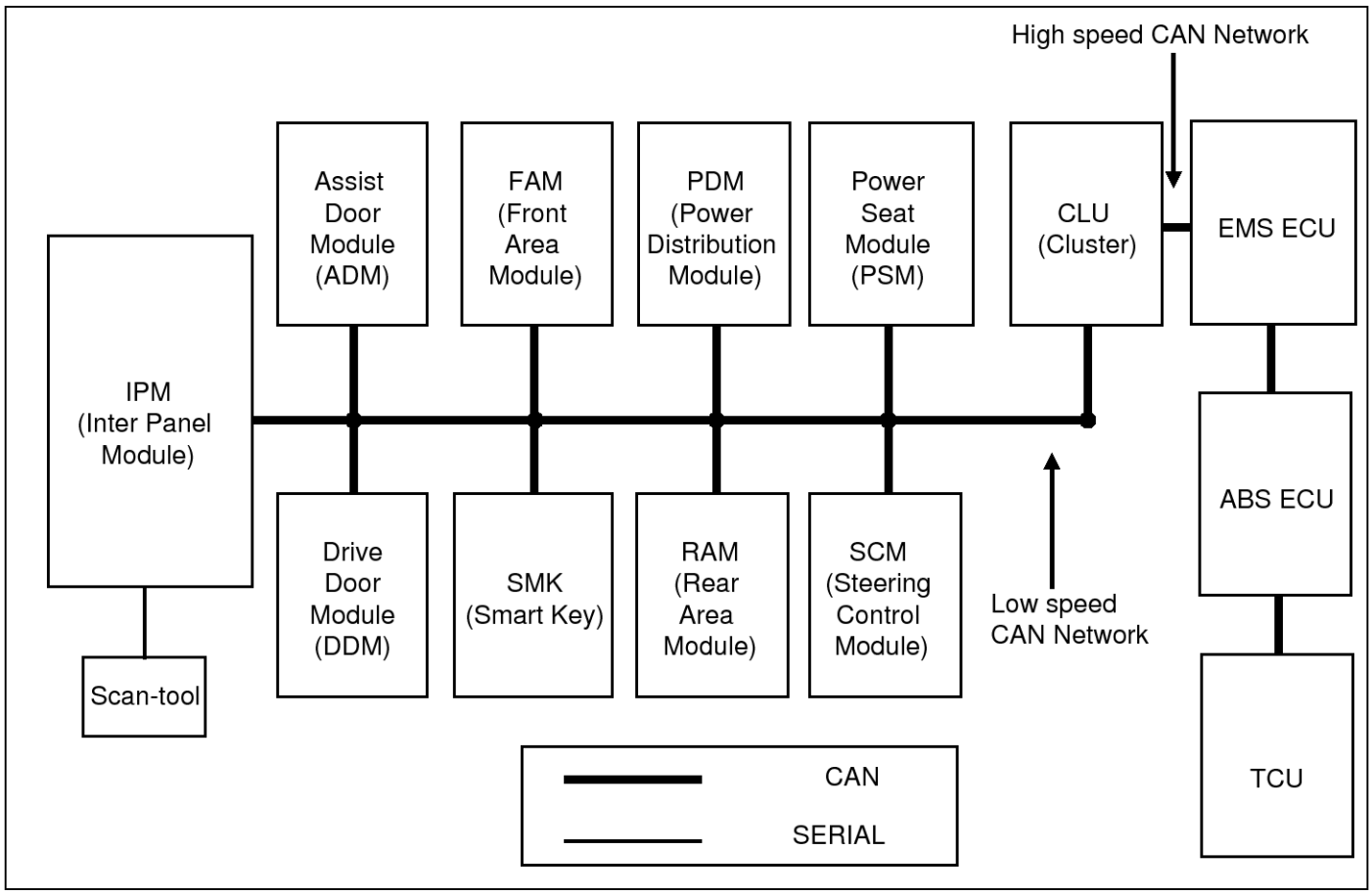
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



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DTC Description

This code is outputted when IPM can't receive data from DDM by CAN Line for 10 sec.

DTC Detecting Condition

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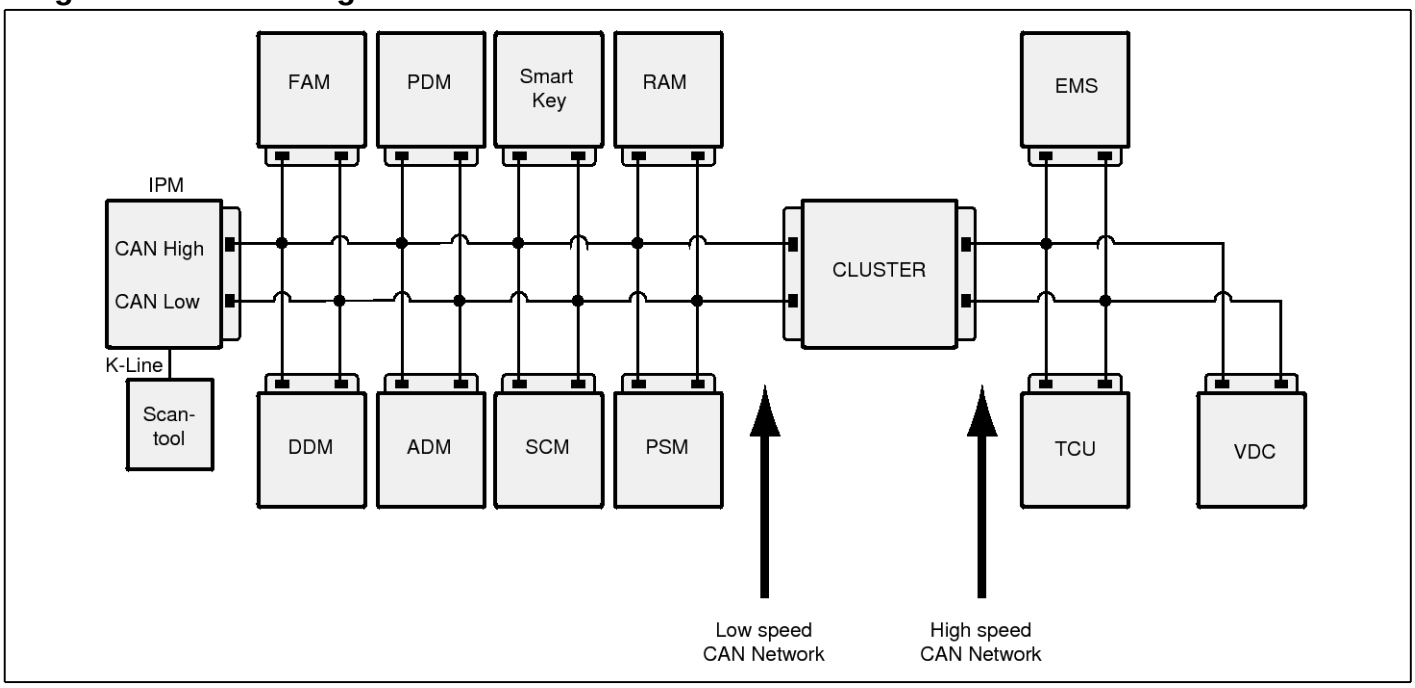
Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ DDM)	• Check DDM connection • Check fuse related DDM • Check open in CAN high/low circuit of DDM • Check open in CAN high/low circuit of DDM
Enable Conditions	• IPM power on	
Threshold Value	• No message from DDM to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from DDM.	

Diagnostic Circuit Diagram



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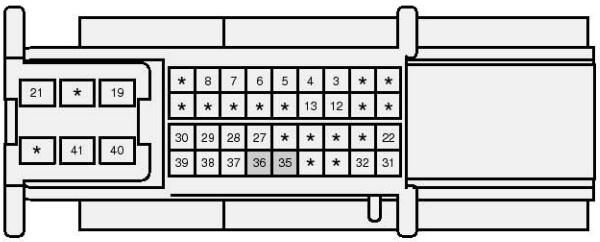
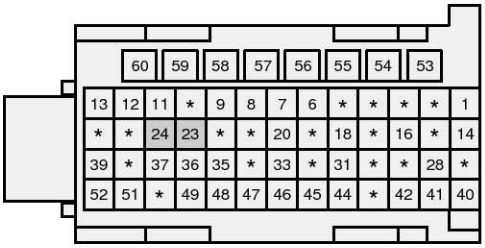
<RAM>



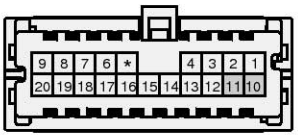
35. Low
36. High

<FAM>



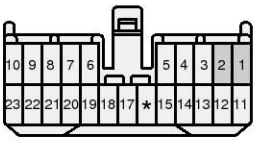
23. Low
24. High

<PDM>



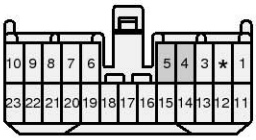
10. Low
11. High

<DDM>



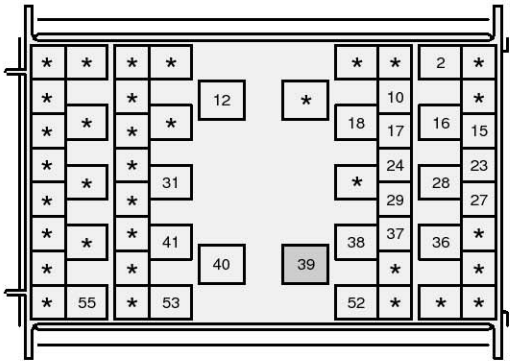
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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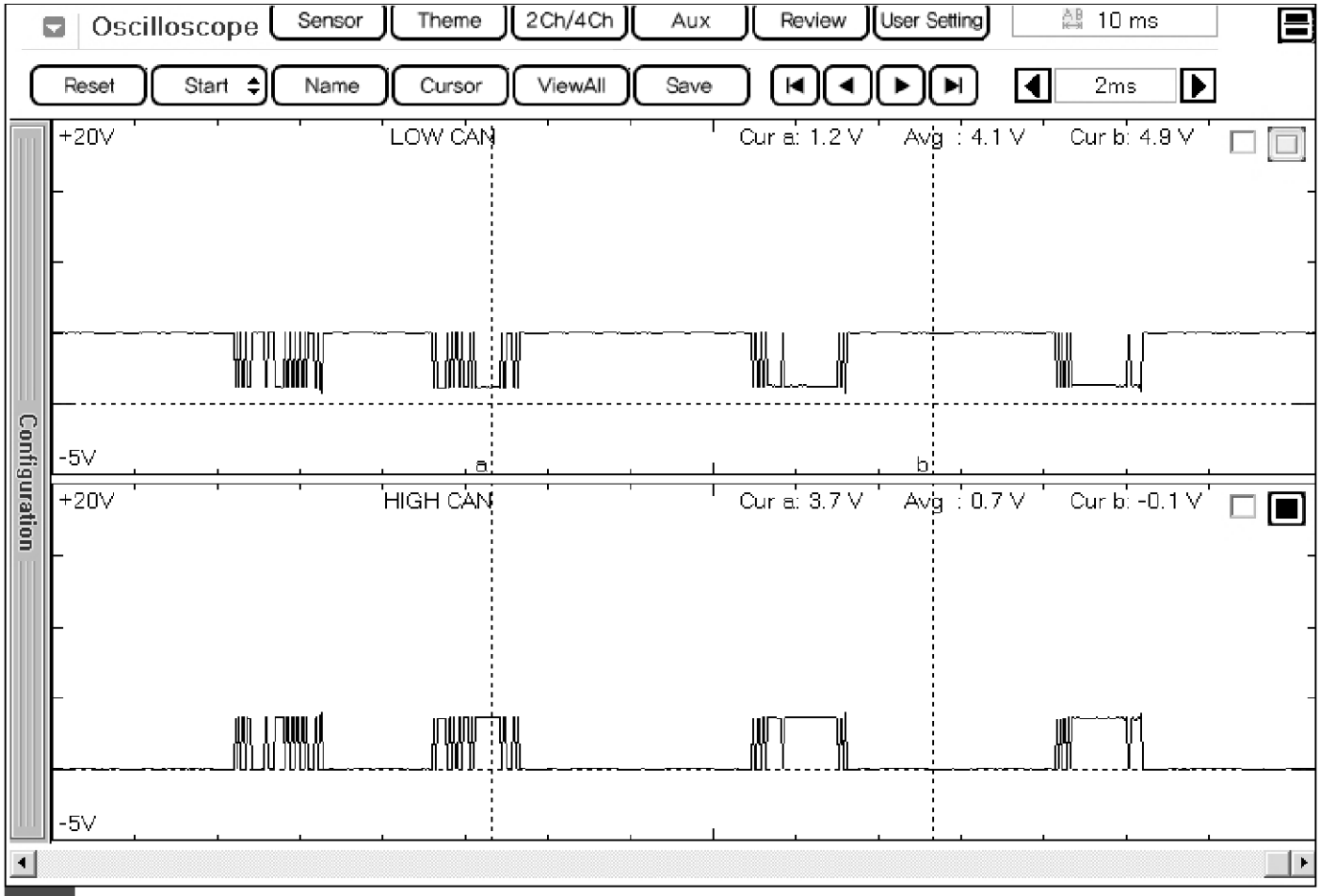

Fig.1

SHMBE9C04L

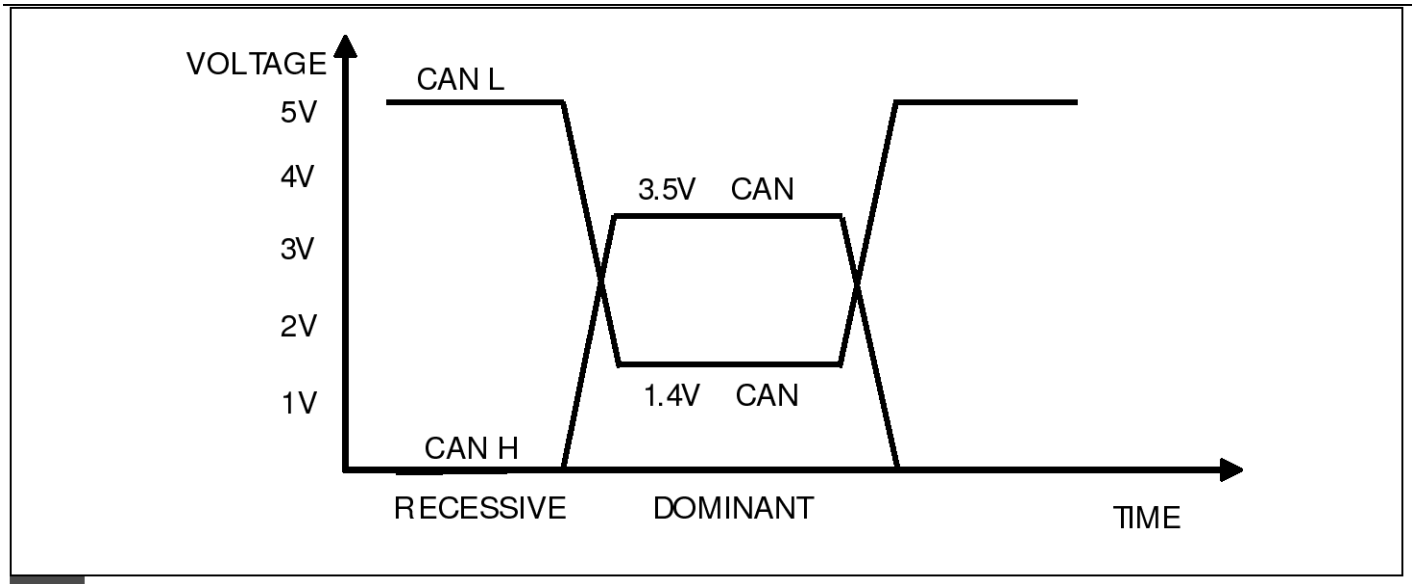

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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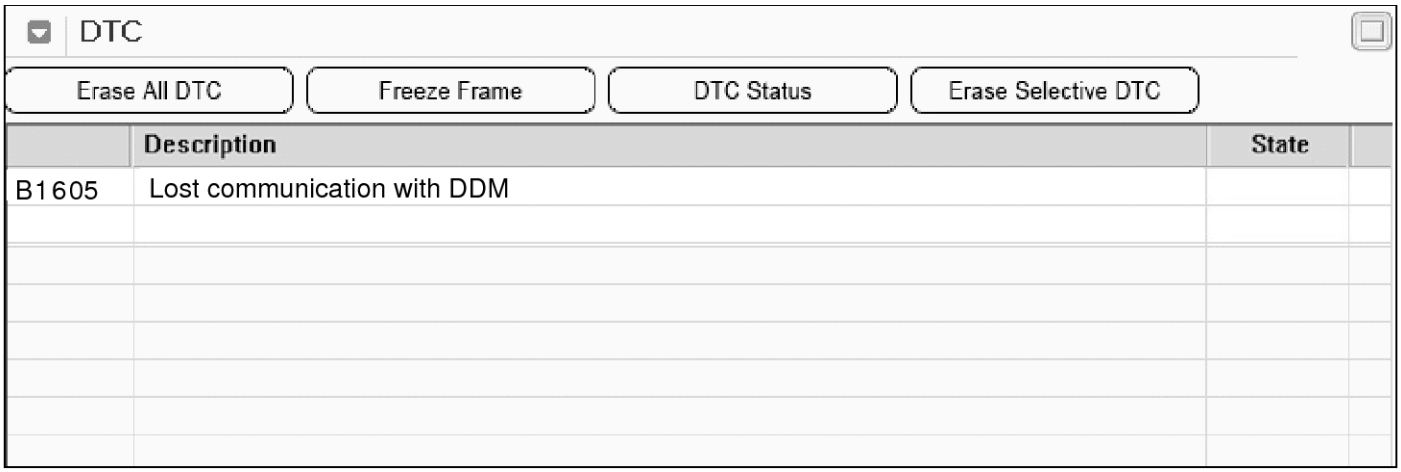
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C07L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or DDM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of DDM CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of DDM CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect DDM and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1606 CAN Time-out ADM

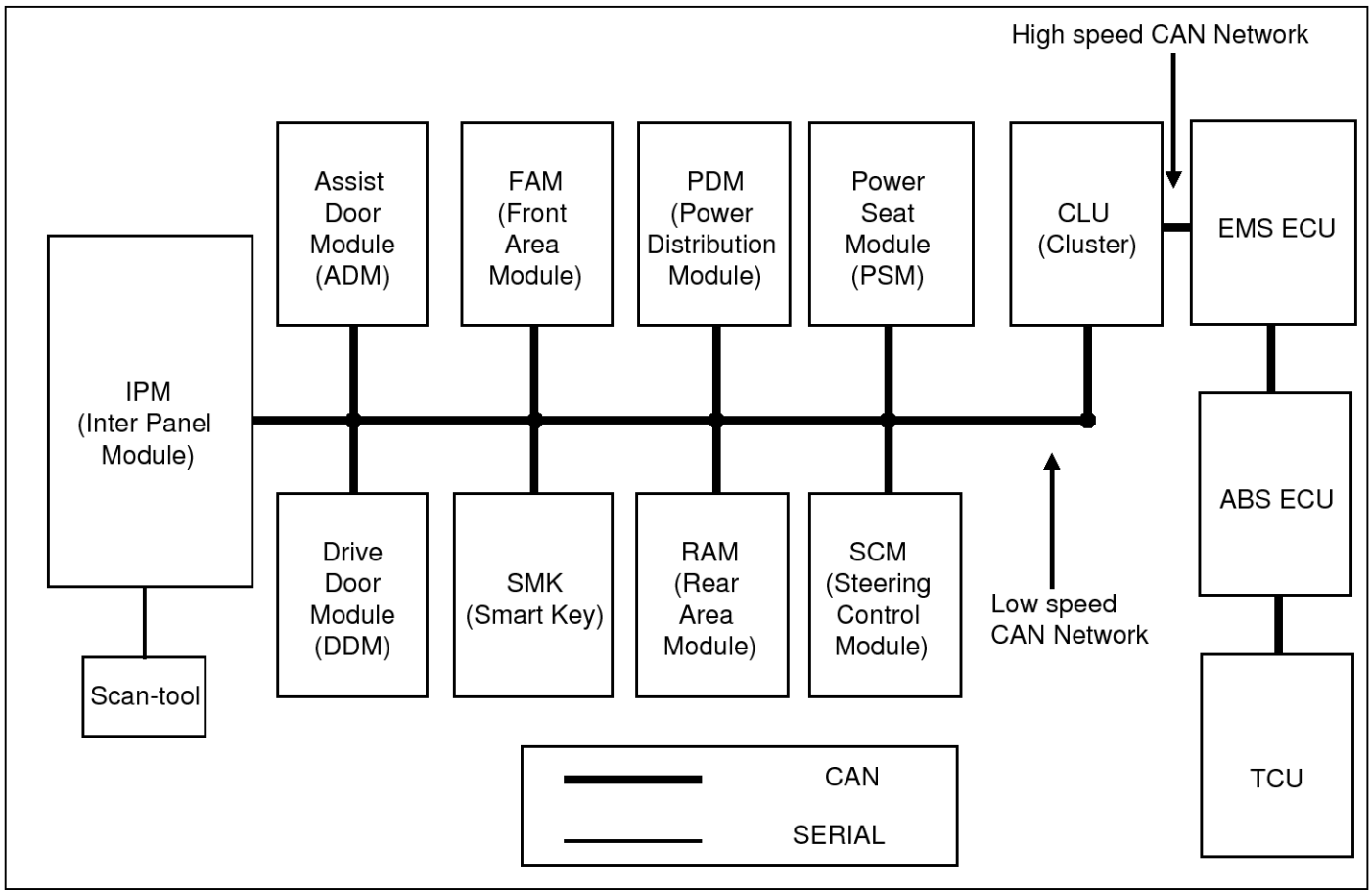
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from ADM by CAN Line for 10 sec.

DTC Detecting Condition

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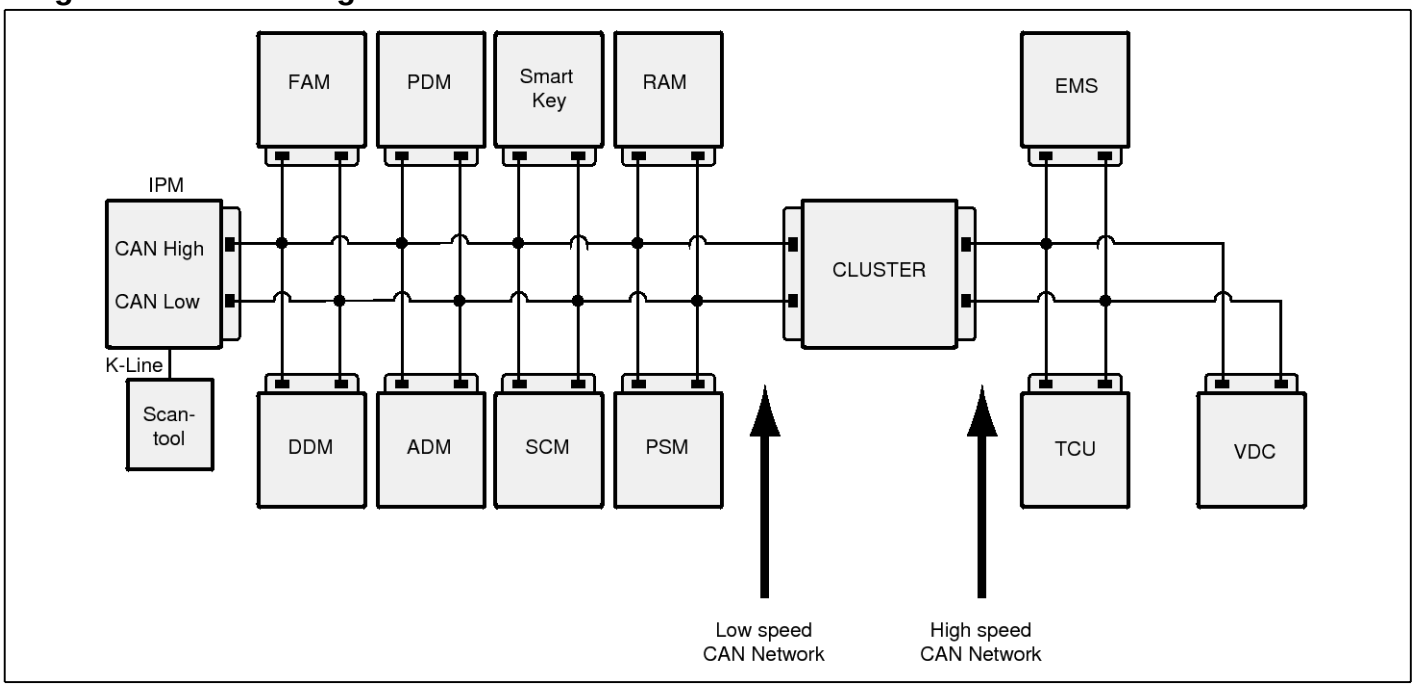
Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ ADM)	• Check ADM connection • Check fuse related ADM • Check open in CAN high/low circuit of ADM • Check open in CAN high/low circuit of ADM
Enable Conditions	• IPM power on	
Threshold Value	• No message from ADM to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from ADM.	

Diagnostic Circuit Diagram

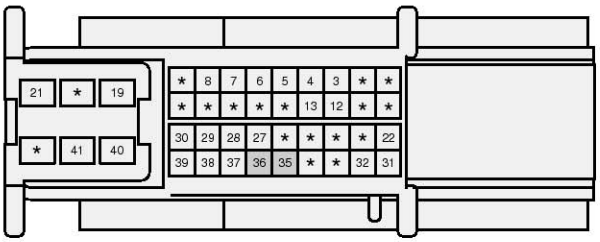


SHMBE9C02L

https://autolibrary.ir

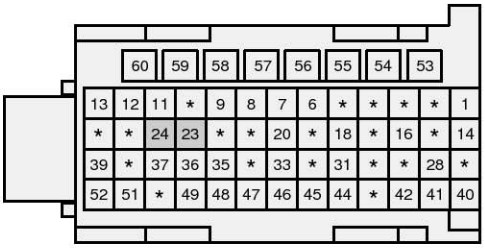
https://autolibrary.ir

<RAM>



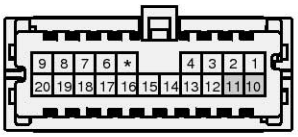
35. Low
36. High

<FAM>



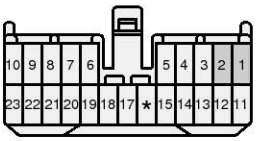
23. Low
24. High

<PDM>



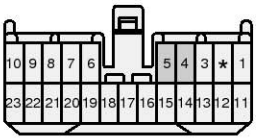
10. Low
11. High

<DDM>



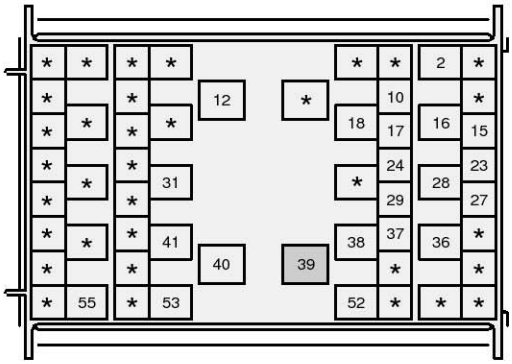
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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https://autolibrary.ir

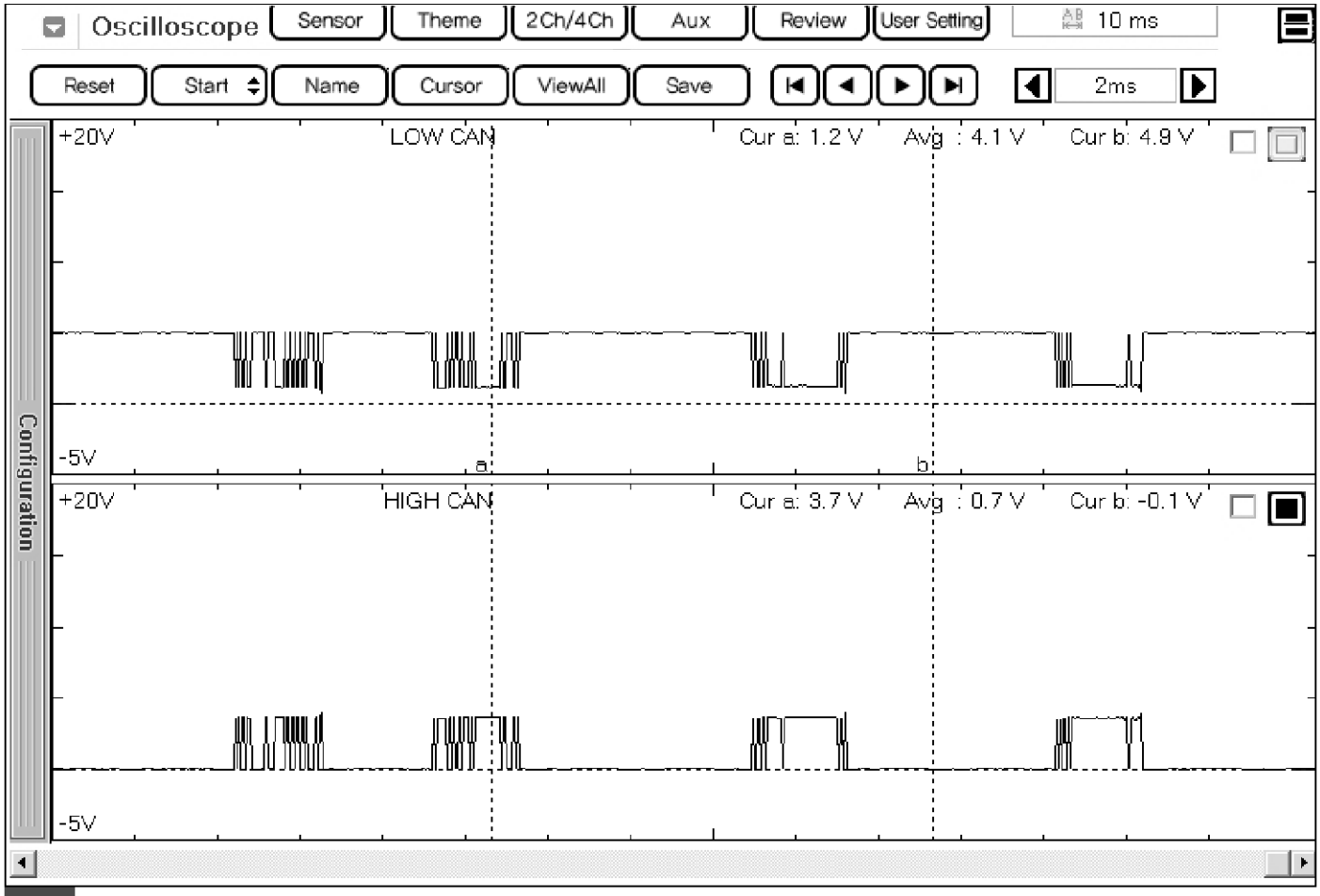

Fig.1

SHMBE9C04L

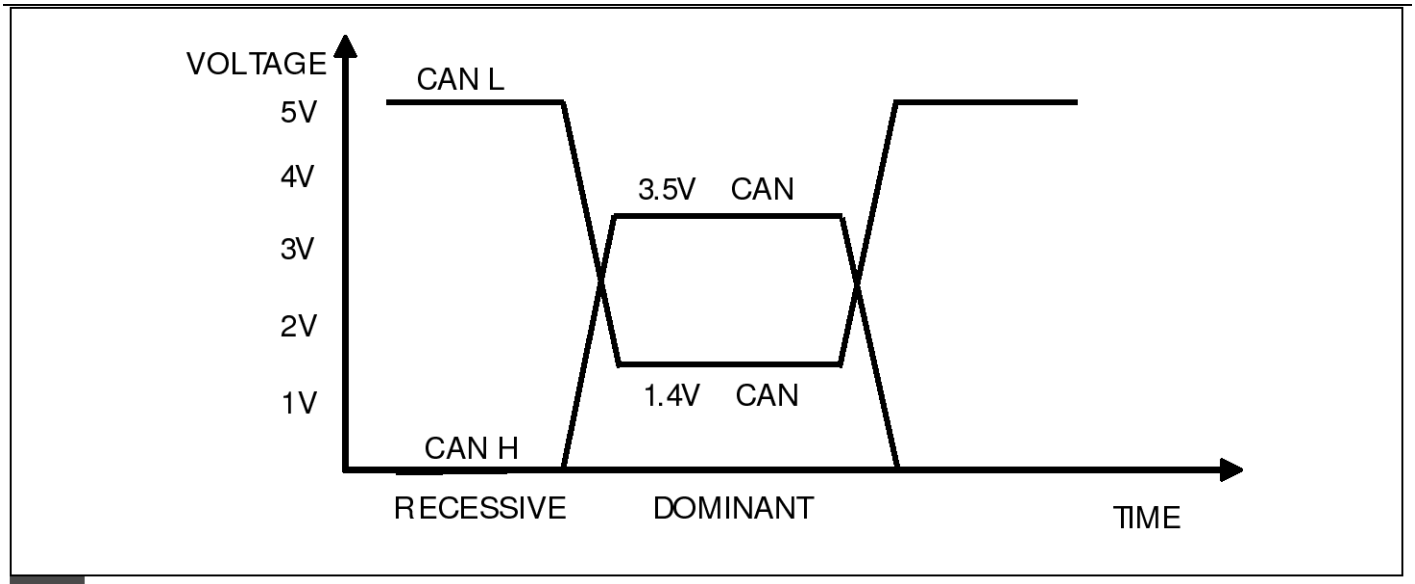

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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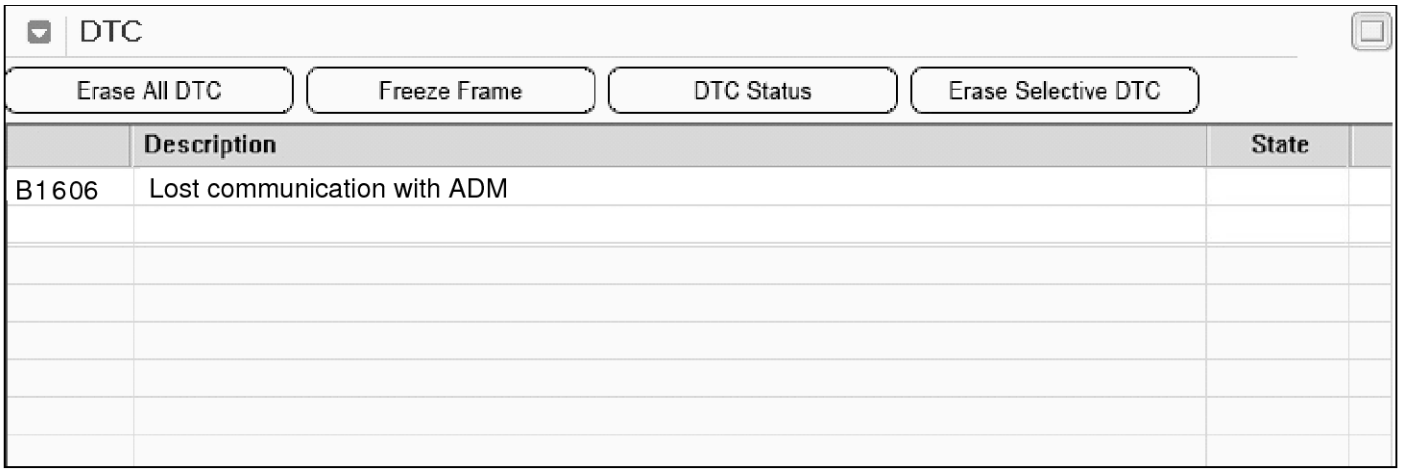
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C08L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or ADM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of ADM CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of ADM CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect ADM and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1607 CAN Time-out P/SEAT

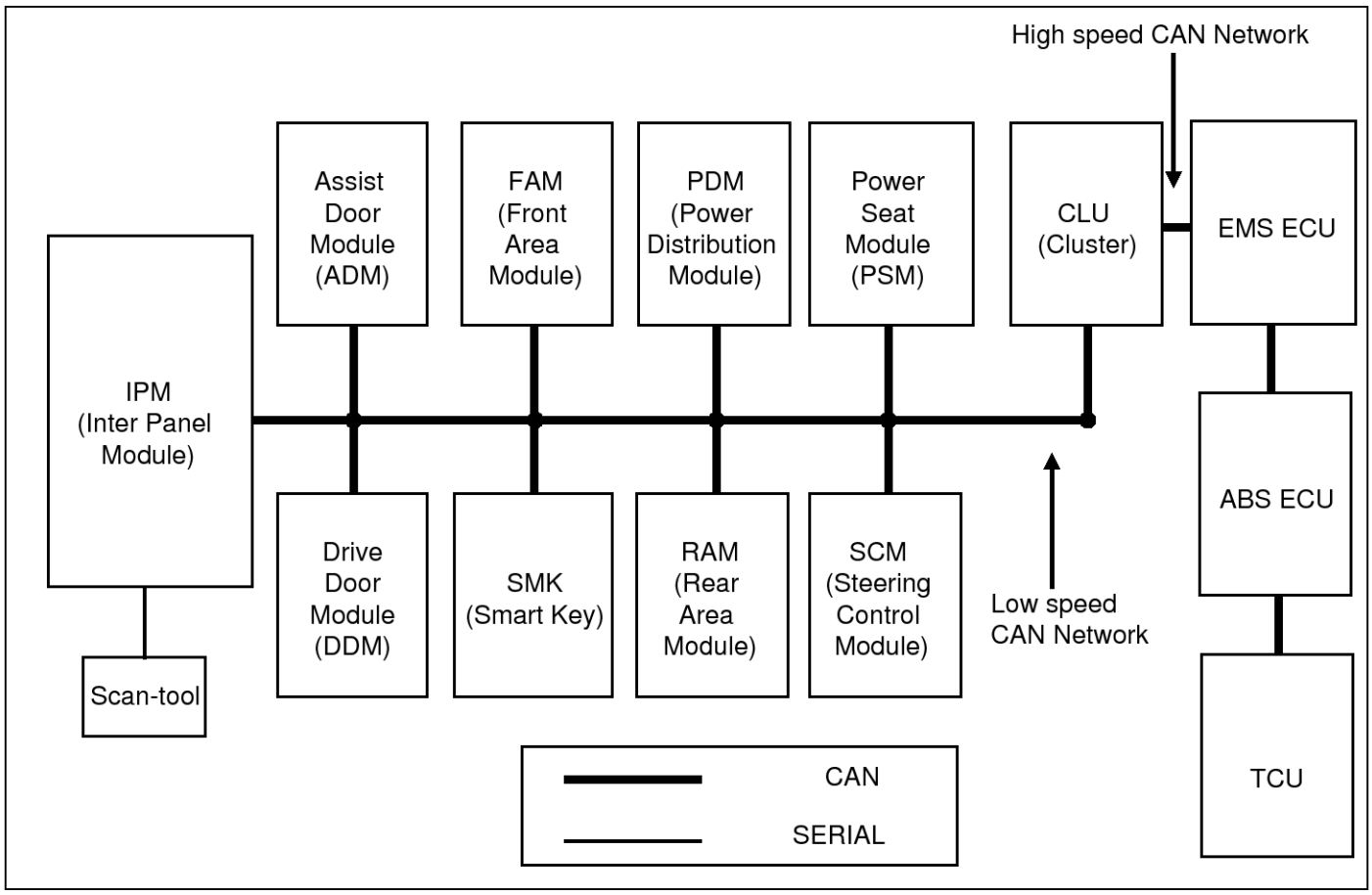
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from PSM by CAN Line for 10 sec.

DTC Detecting Condition

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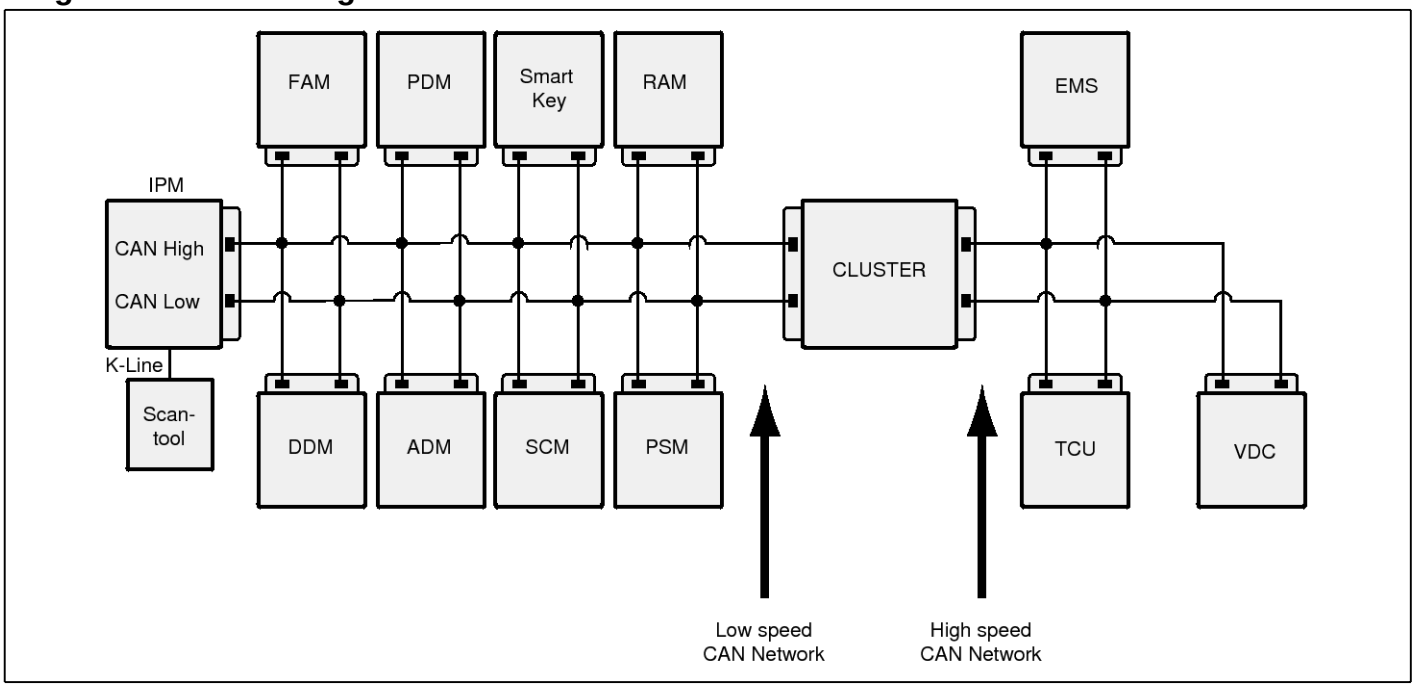
Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ PSM)	• Check PSM connection • Check fuse related PSM • Check open in CAN high/low circuit of PSM • Check open in CAN high/low circuit of PSM
Enable Conditions	• IPM power on	
Threshold Value	• No message from PSM to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from PSM.	

Diagnostic Circuit Diagram



SHMBE9C02L

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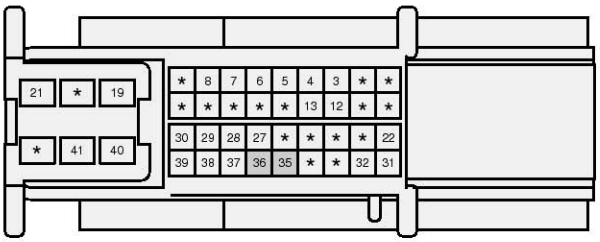
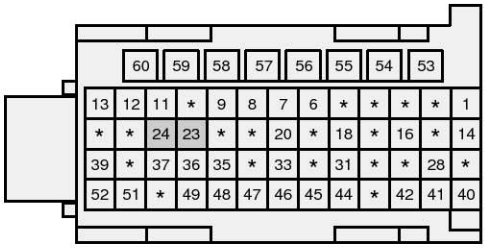
https://autolibrary.ir

<RAM>



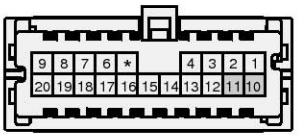
35. Low
36. High

<FAM>



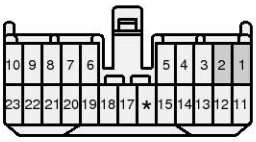
23. Low
24. High

<PDM>



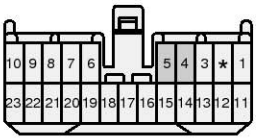
10. Low
11. High

<DDM>



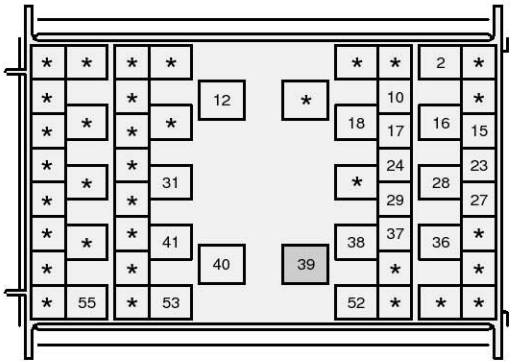
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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https://autolibrary.ir

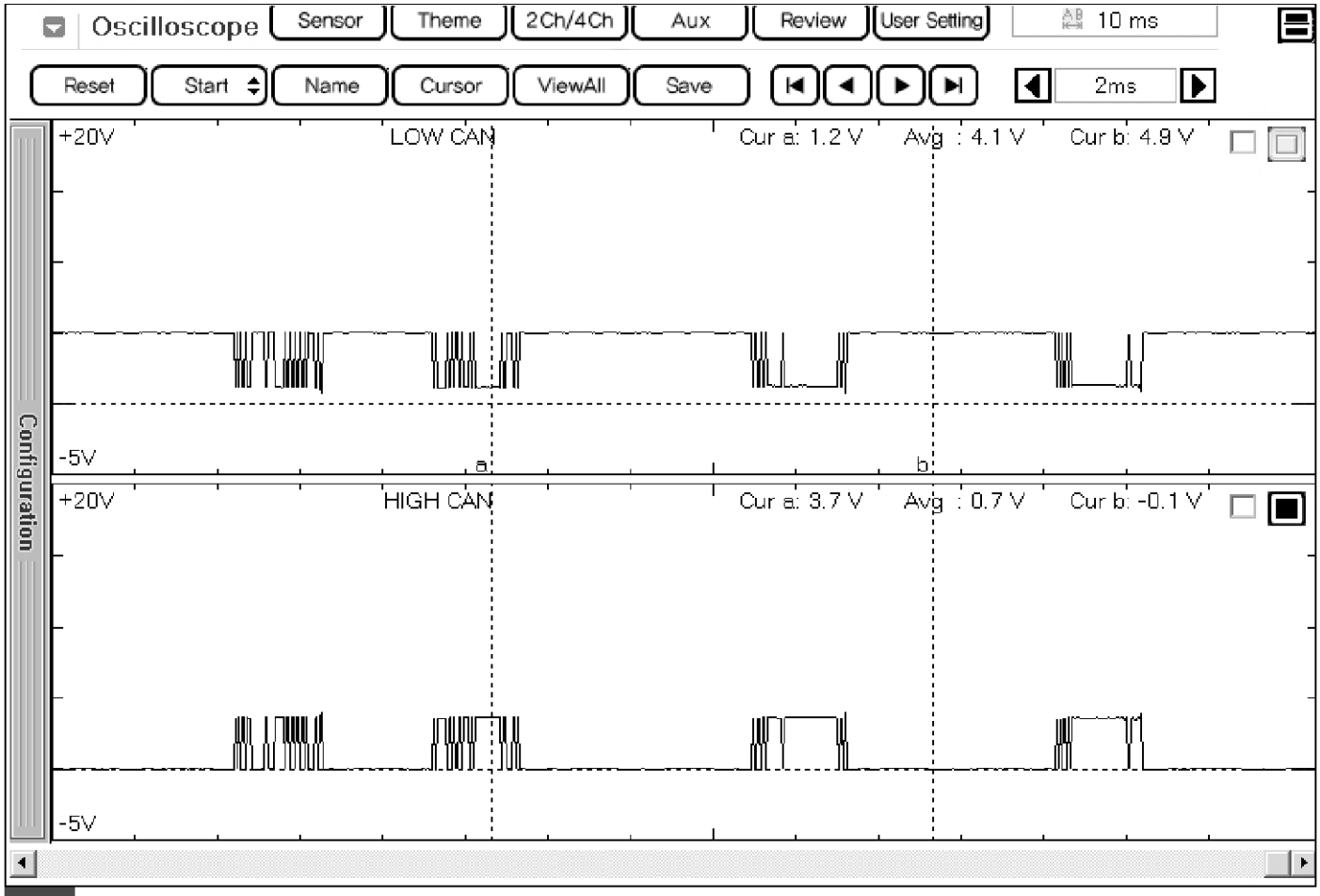

Fig.1

SHMBE9C04L

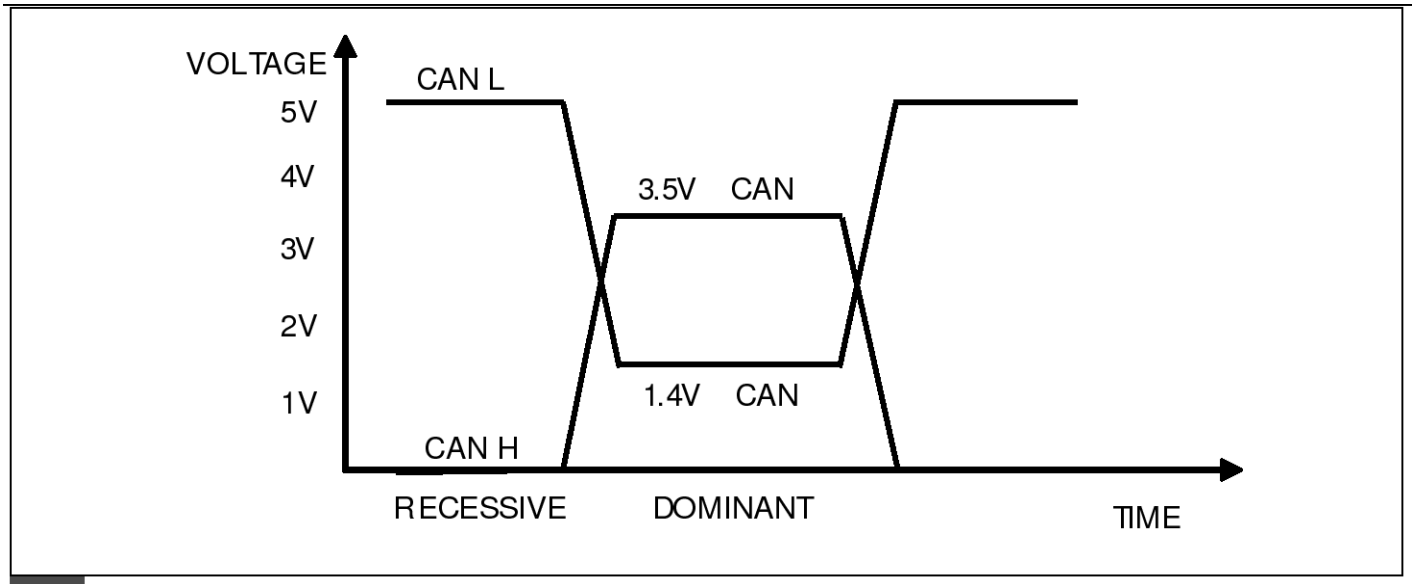

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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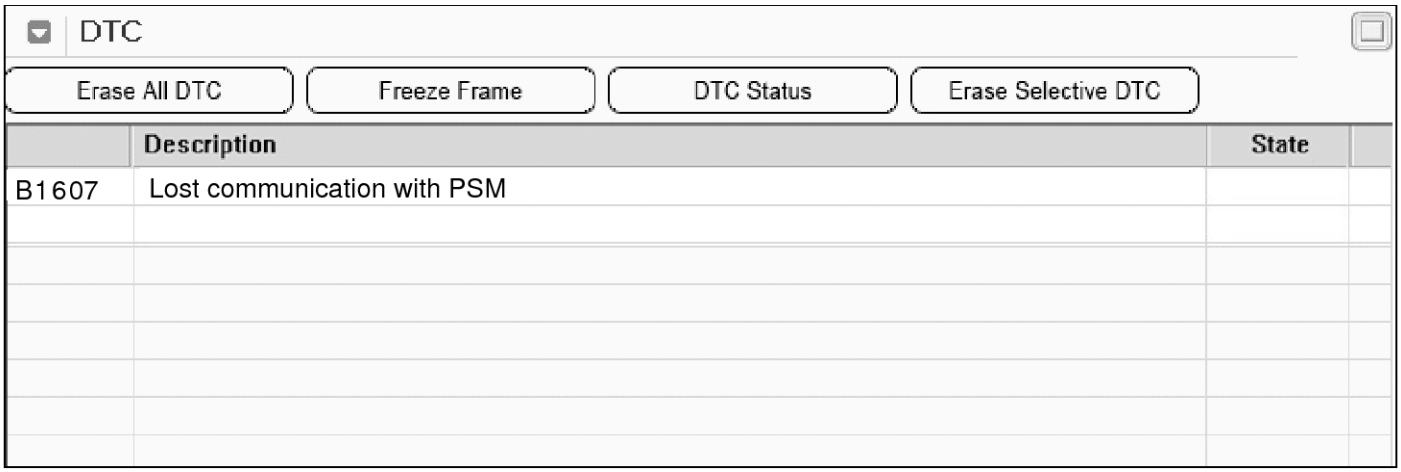
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C09L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or PSM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of PSM CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of PSM CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect PSM and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1608 CAN Time-out TILT/TELE

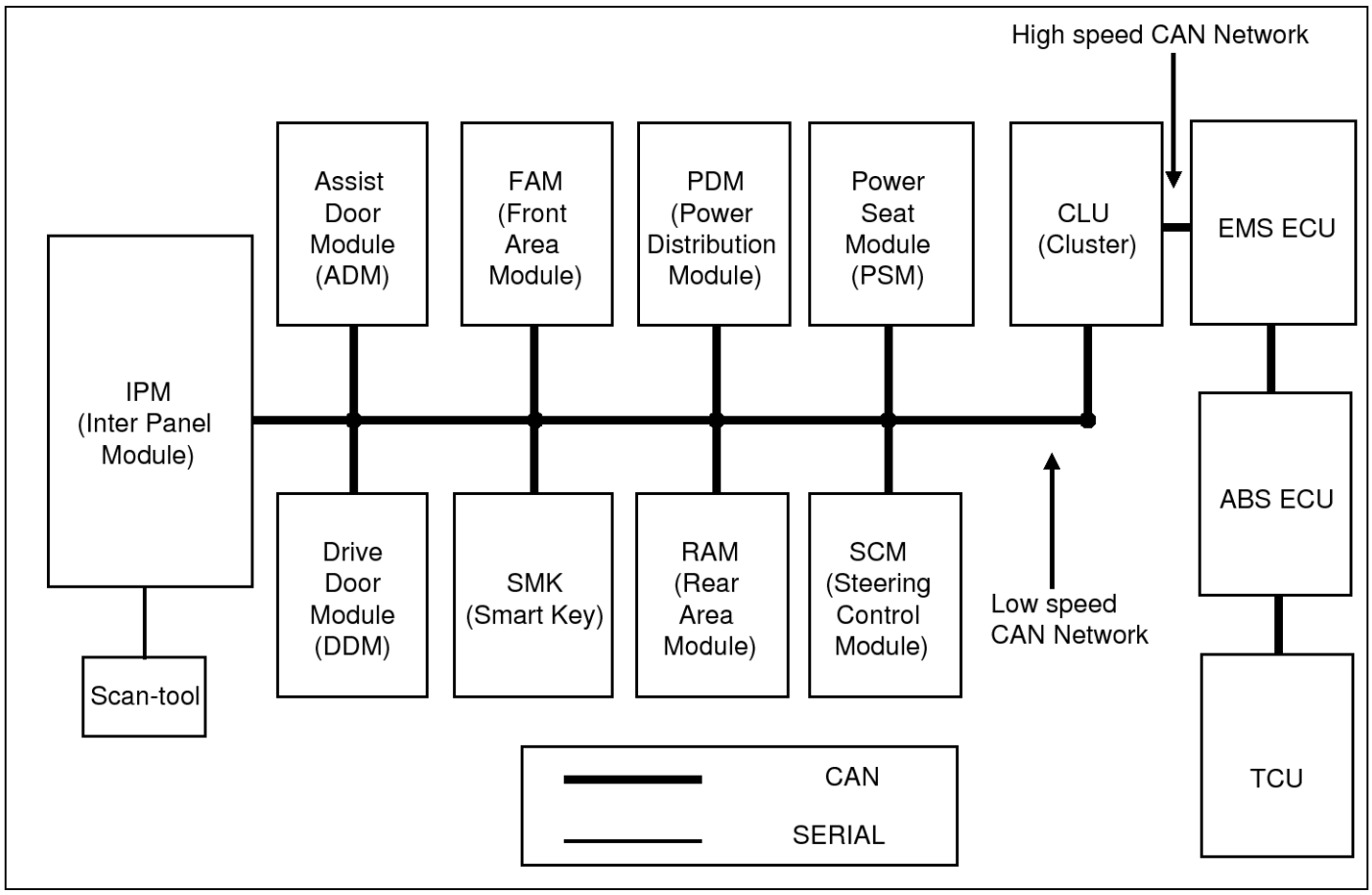
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from SCM by CAN Line for 10 sec.

DTC Detecting Condition

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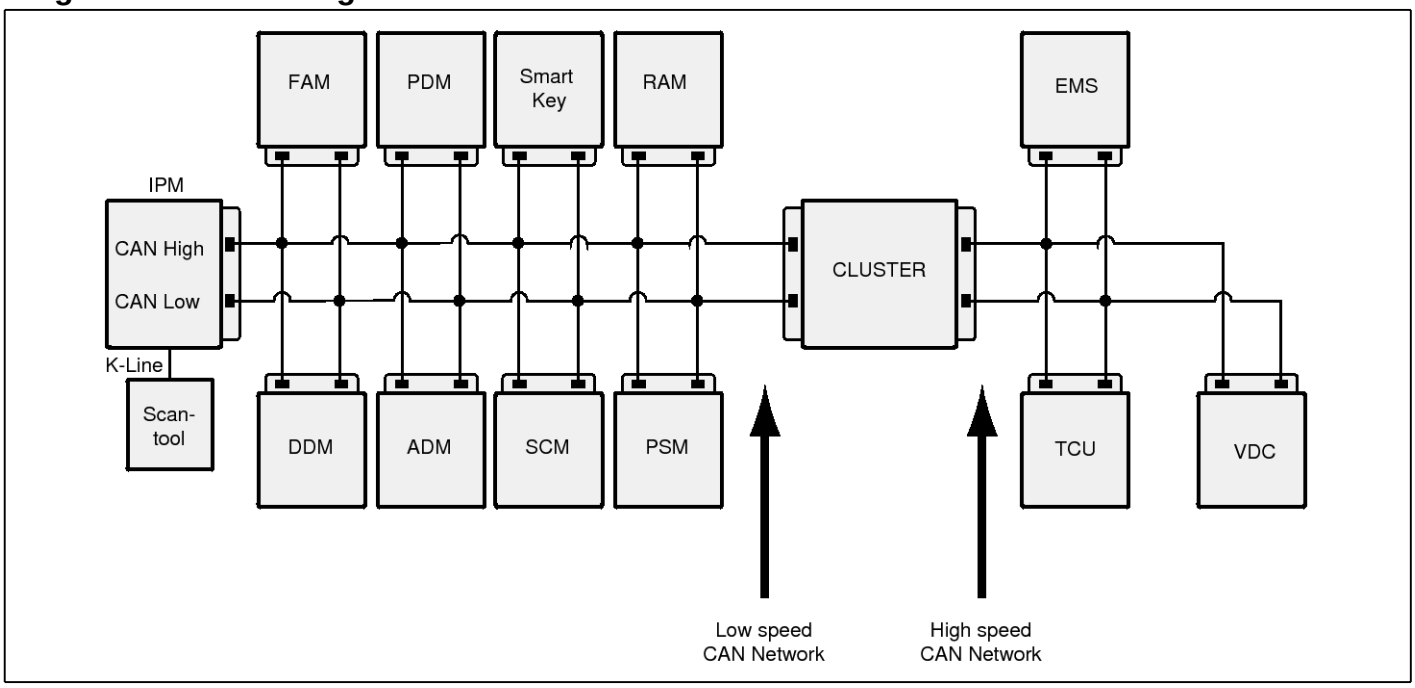
https://autolibrary.ir

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ SCM)	• Check SCM connection • Check fuse related SCM • Check open in CAN high/low circuit of SCM • Check open in CAN high/low circuit of SCM
Enable Conditions	• IPM power on	
Threshold Value	• No message from SCM to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from SCM.	

Diagnostic Circuit Diagram



SHMBE9C02L

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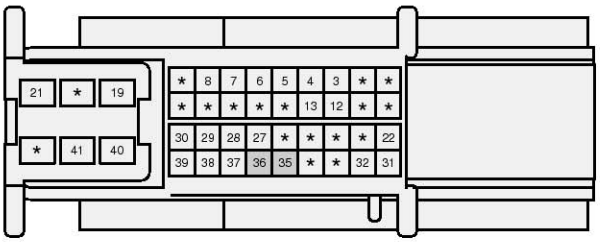
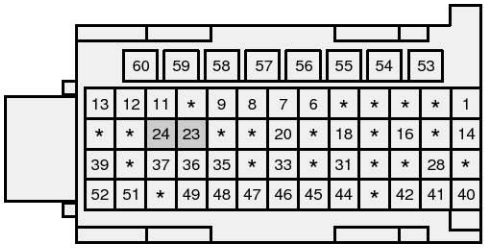
https://autolibrary.ir

<RAM>



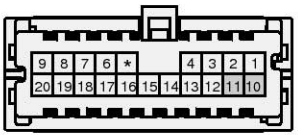
35. Low
36. High

<FAM>



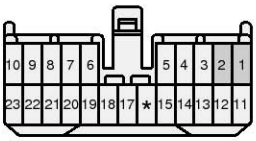
23. Low
24. High

<PDM>



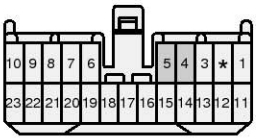
10. Low
11. High

<DDM>



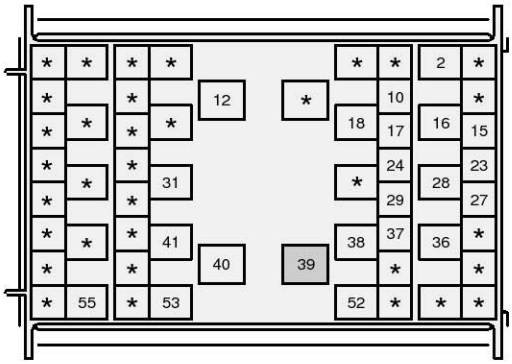
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

https://autolibrary.ir

https://autolibrary.ir

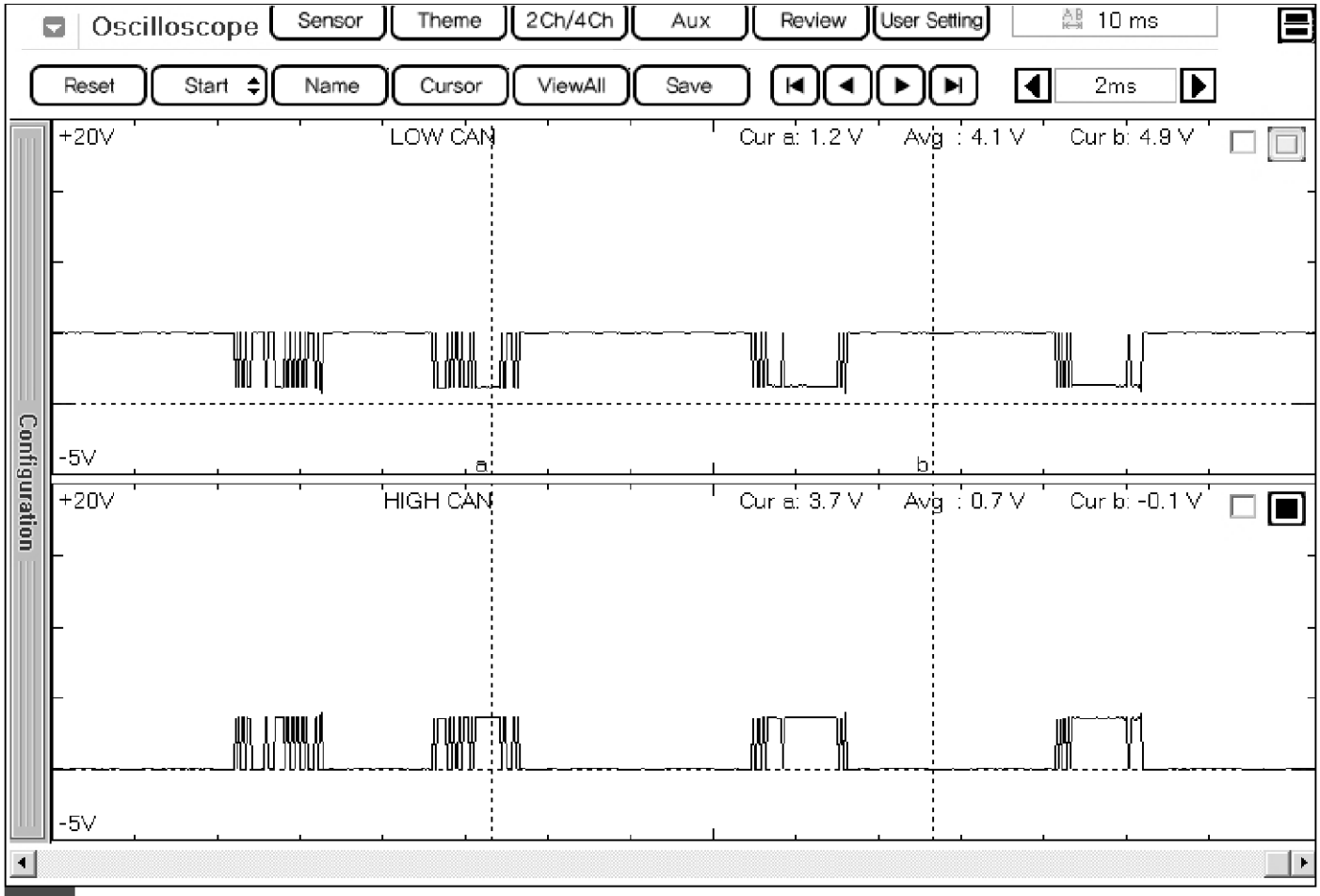


Fig.1

SHMBE9C04L

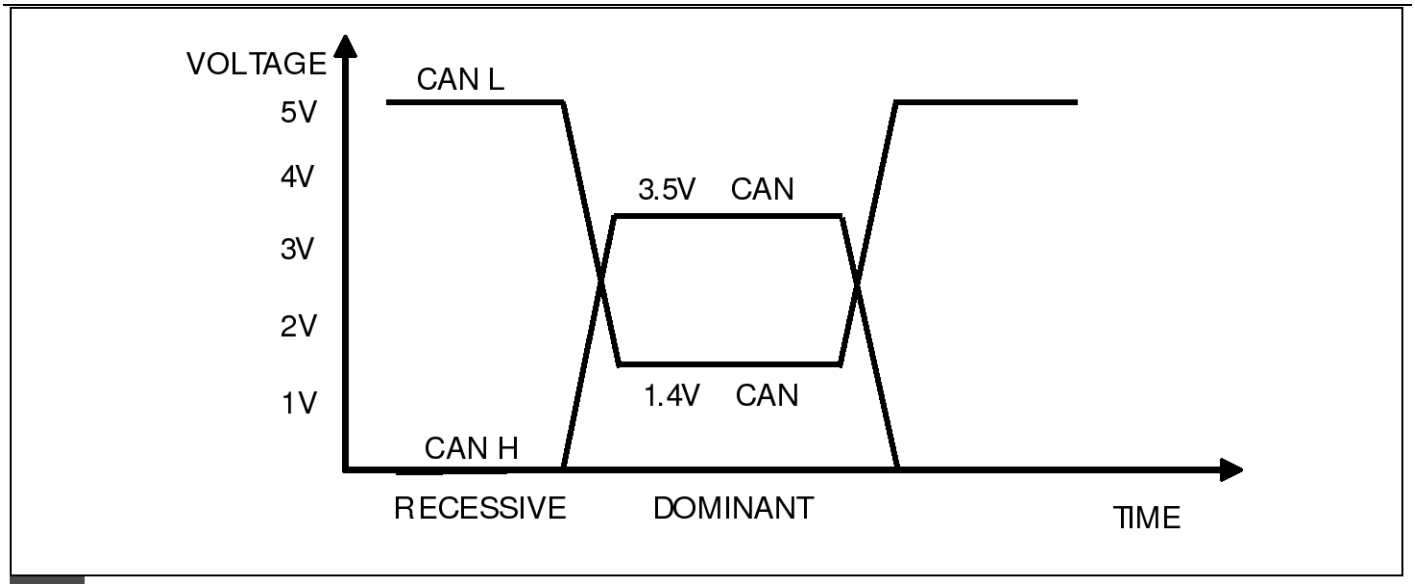


Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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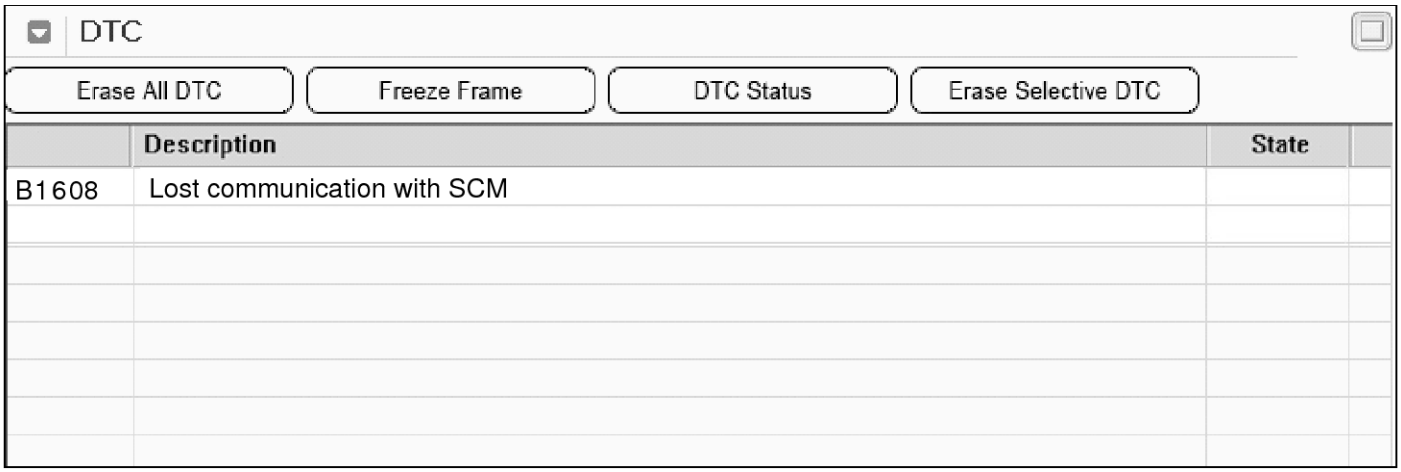
https://autolibrary.ir

2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C10L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or PSM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of PSM CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of PSM CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

https://autolibrary.ir

https://autolibrary.ir

Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect PSM and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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https://autolibrary.ir

B1609 Lost Communication Between BCM and SMK

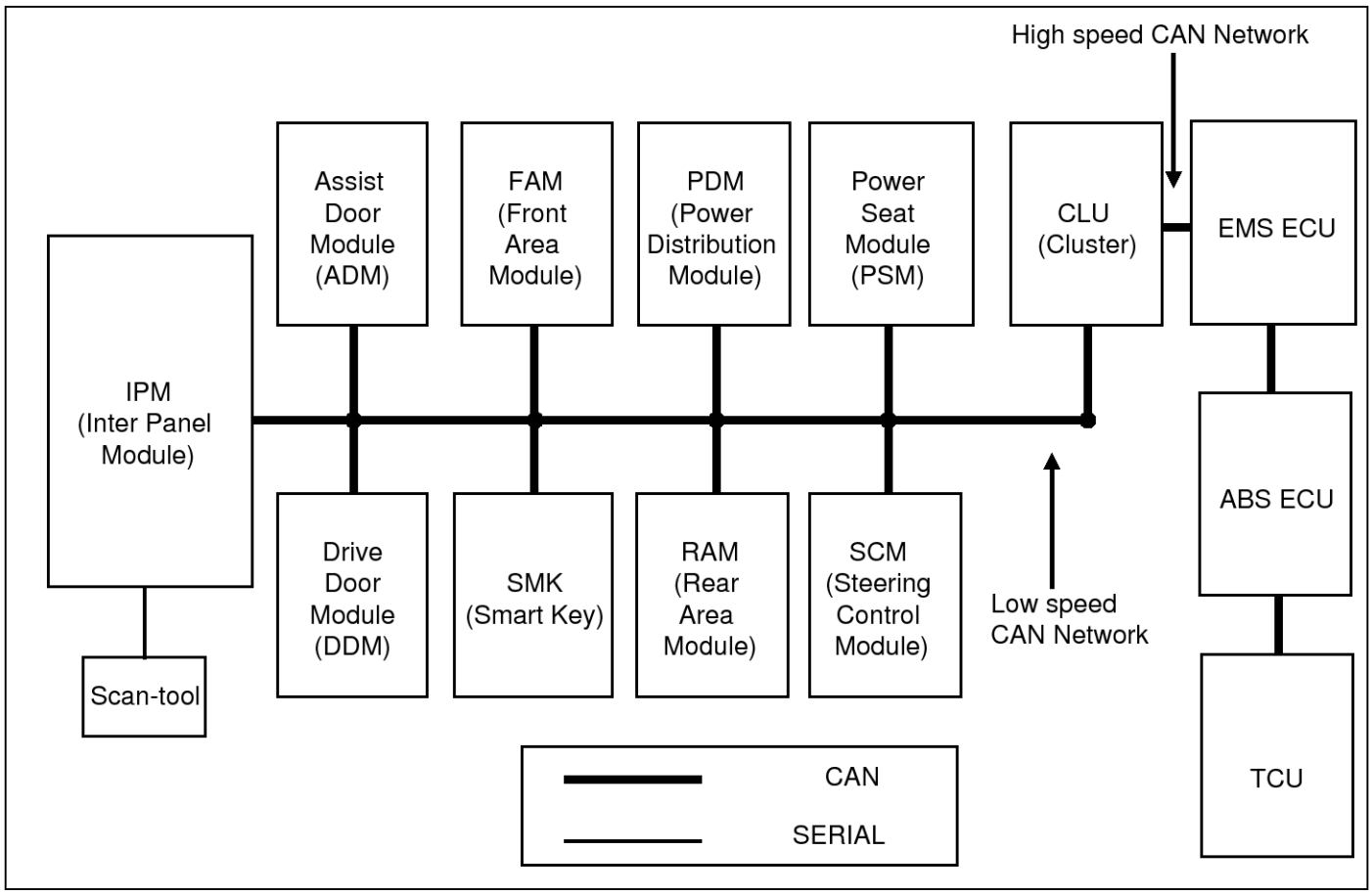
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from SMK by CAN Line for 10 sec.

DTC Detecting Condition

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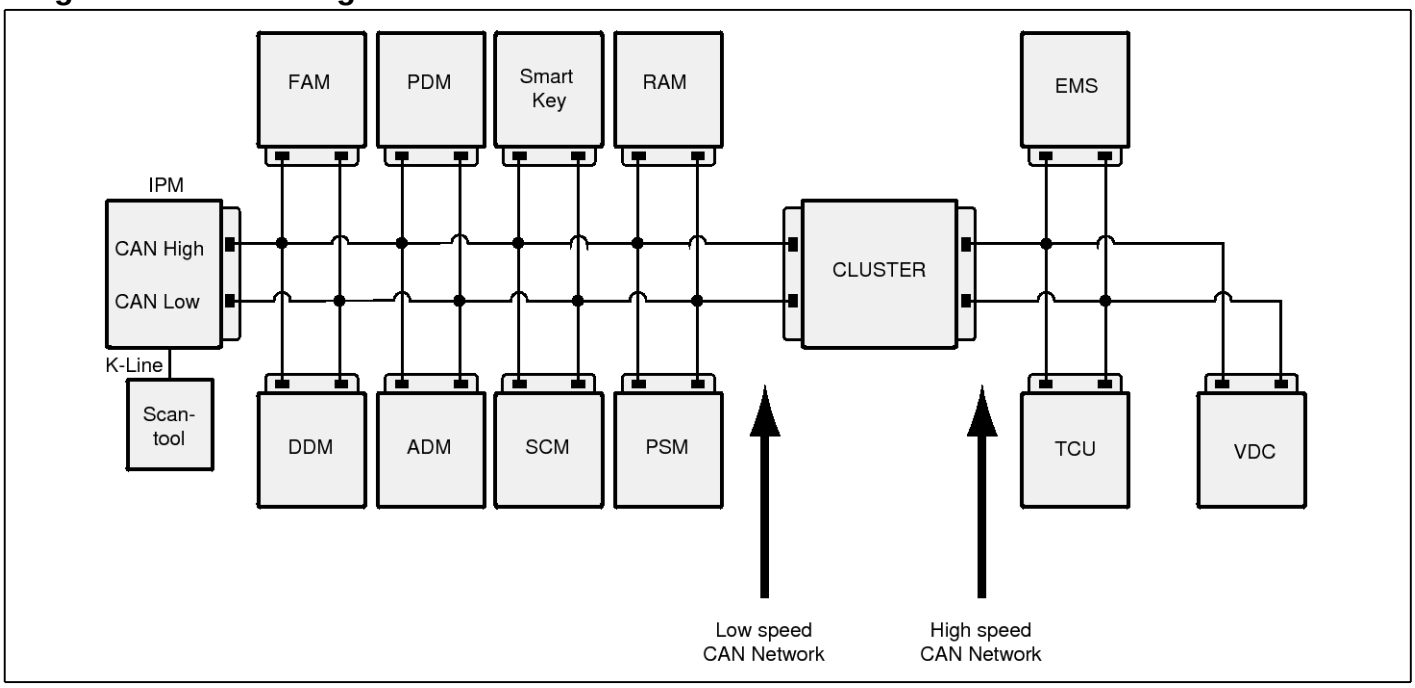
Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ SMK)	• Check SMK connection • Check fuse related SMK • Check open in CAN high/low circuit of SMK • Check open in CAN high/low circuit of SMK
Enable Conditions	• IPM power on	
Threshold Value	• No message from SMK to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from S-MK.	

Diagnostic Circuit Diagram



SHMBE9C02L

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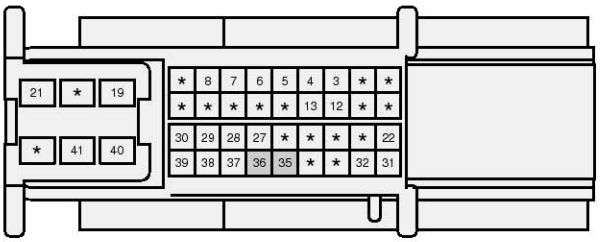
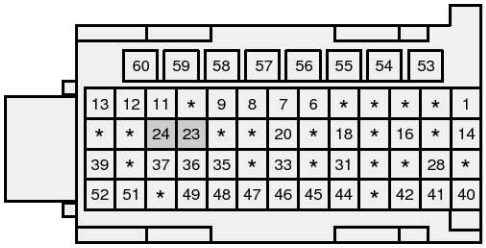
https://autolibrary.ir

<RAM>



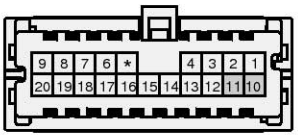
35. Low
36. High

<FAM>



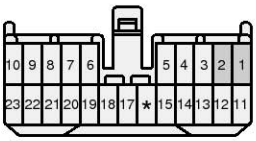
23. Low
24. High

<PDM>



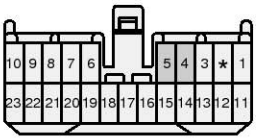
10. Low
11. High

<DDM>



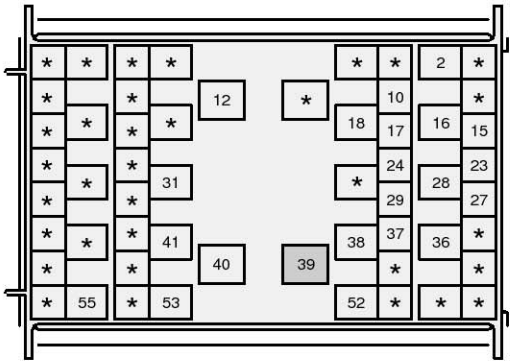
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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https://autolibrary.ir

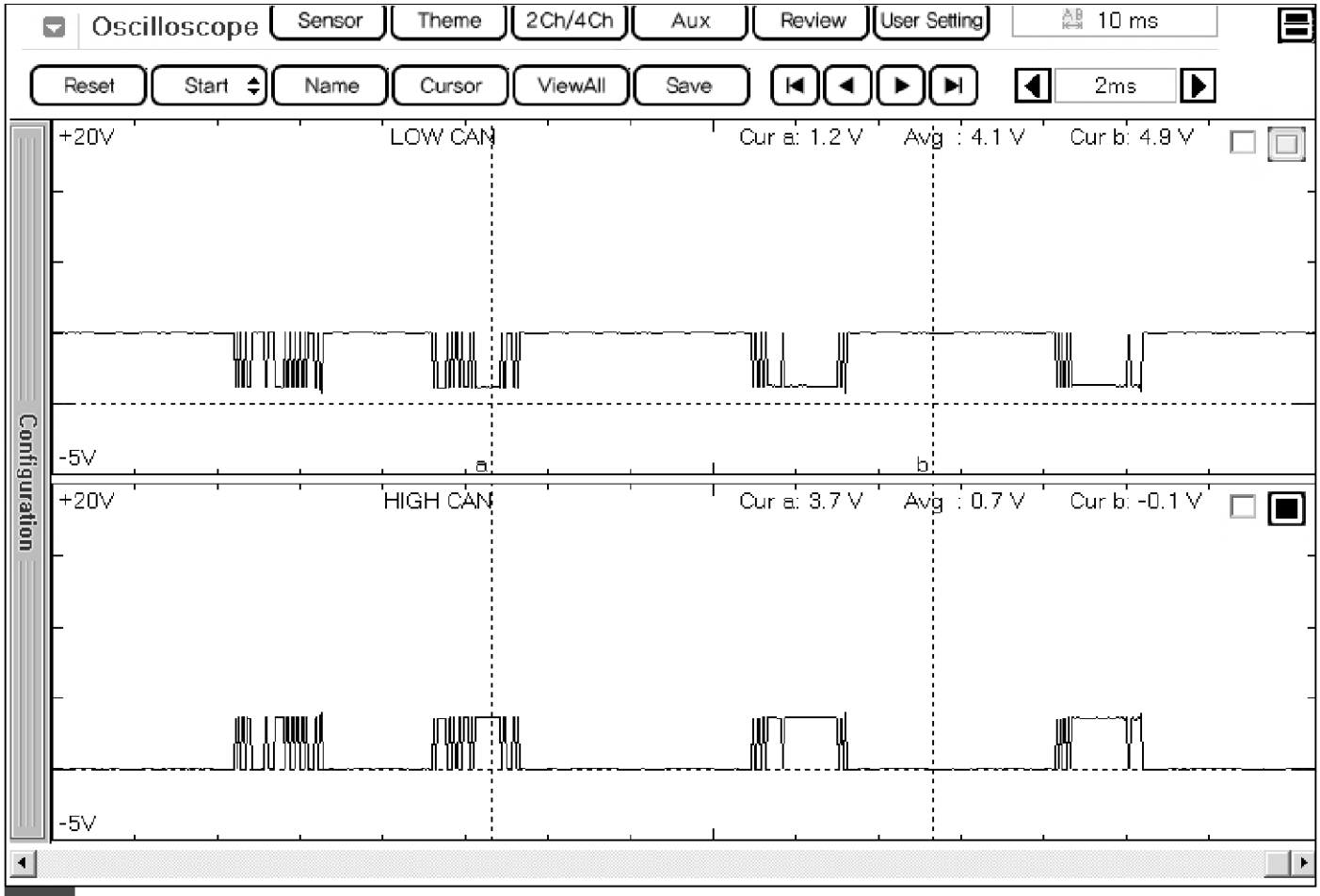

Fig.1

SHMBE9C04L

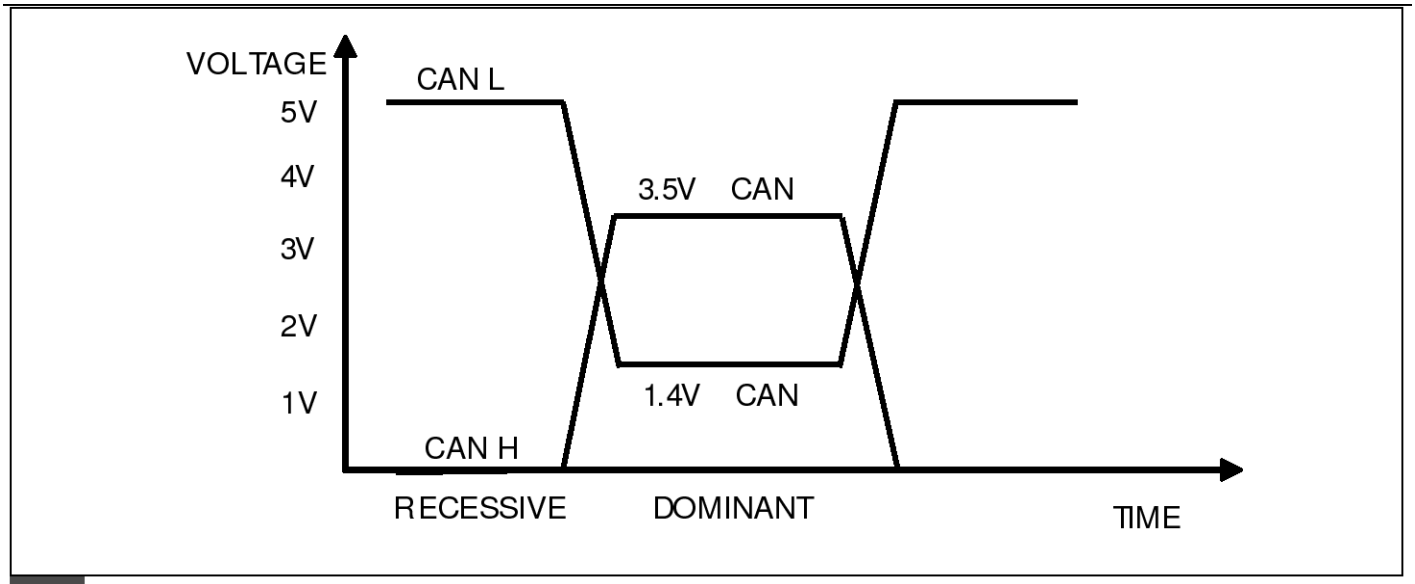

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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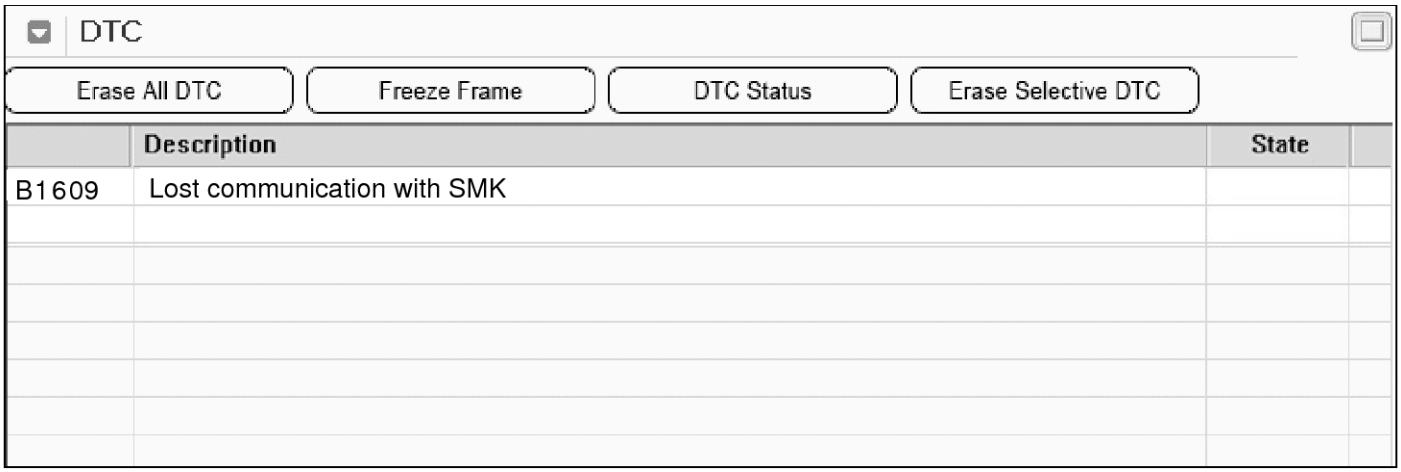
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C11L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or SMK's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of SMK CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of SMK CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect SMK and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1611 CAN Time-out FAM

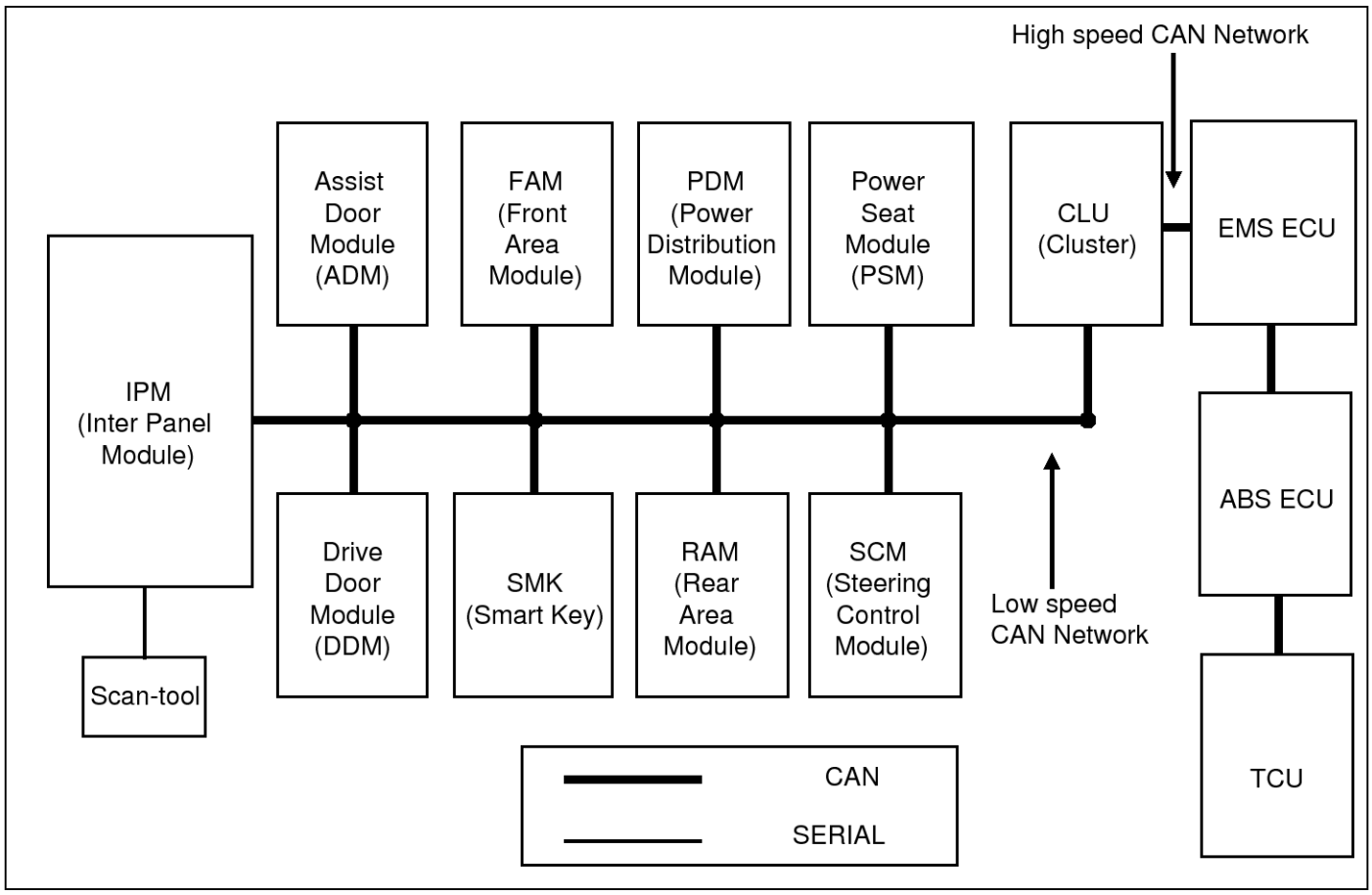
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from FAM by CAN Line for 10 sec.

DTC Detecting Condition

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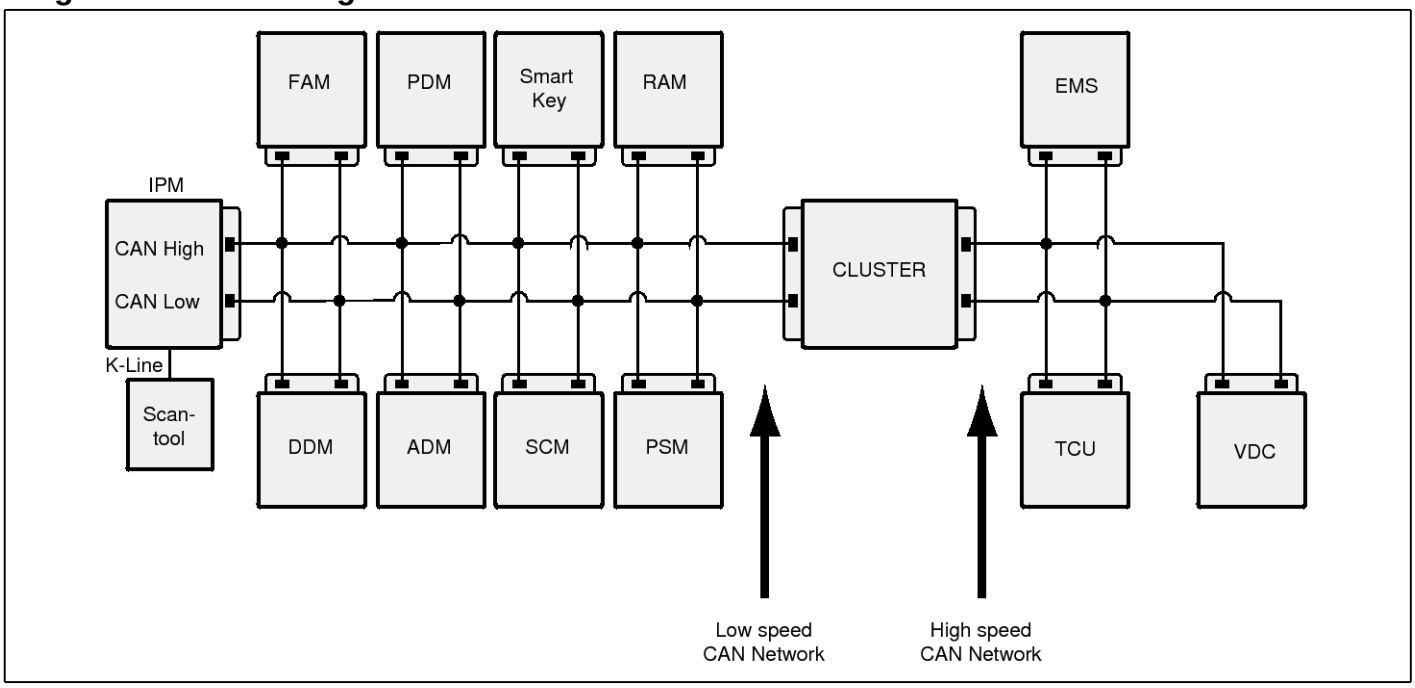
Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ FAM)	• Check FAM connection • Check fuse related FAM • Check open in CAN high/low circuit of FAM • Check open in CAN high/low circuit of FAM
Enable Conditions	• IPM power on	
Threshold Value	• No message from FAM to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from FAM.	

Diagnostic Circuit Diagram



SHMBE9C02L

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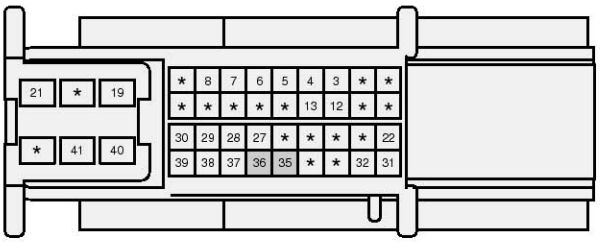
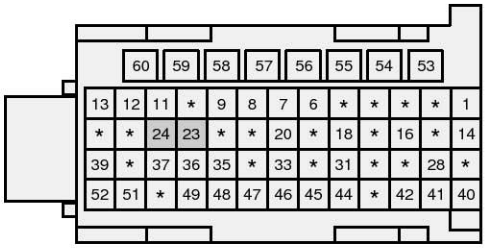
<RAM>



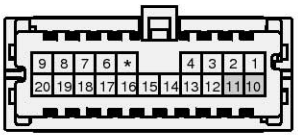
35. Low
36. High

<FAM>



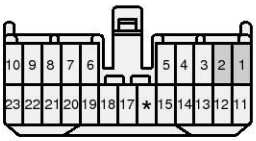
23. Low
24. High

<PDM>



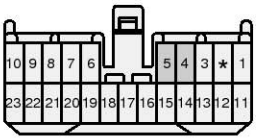
10. Low
11. High

<DDM>



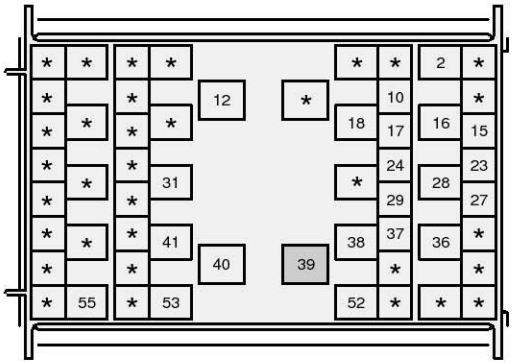
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

https://autolibrary.ir

https://autolibrary.ir

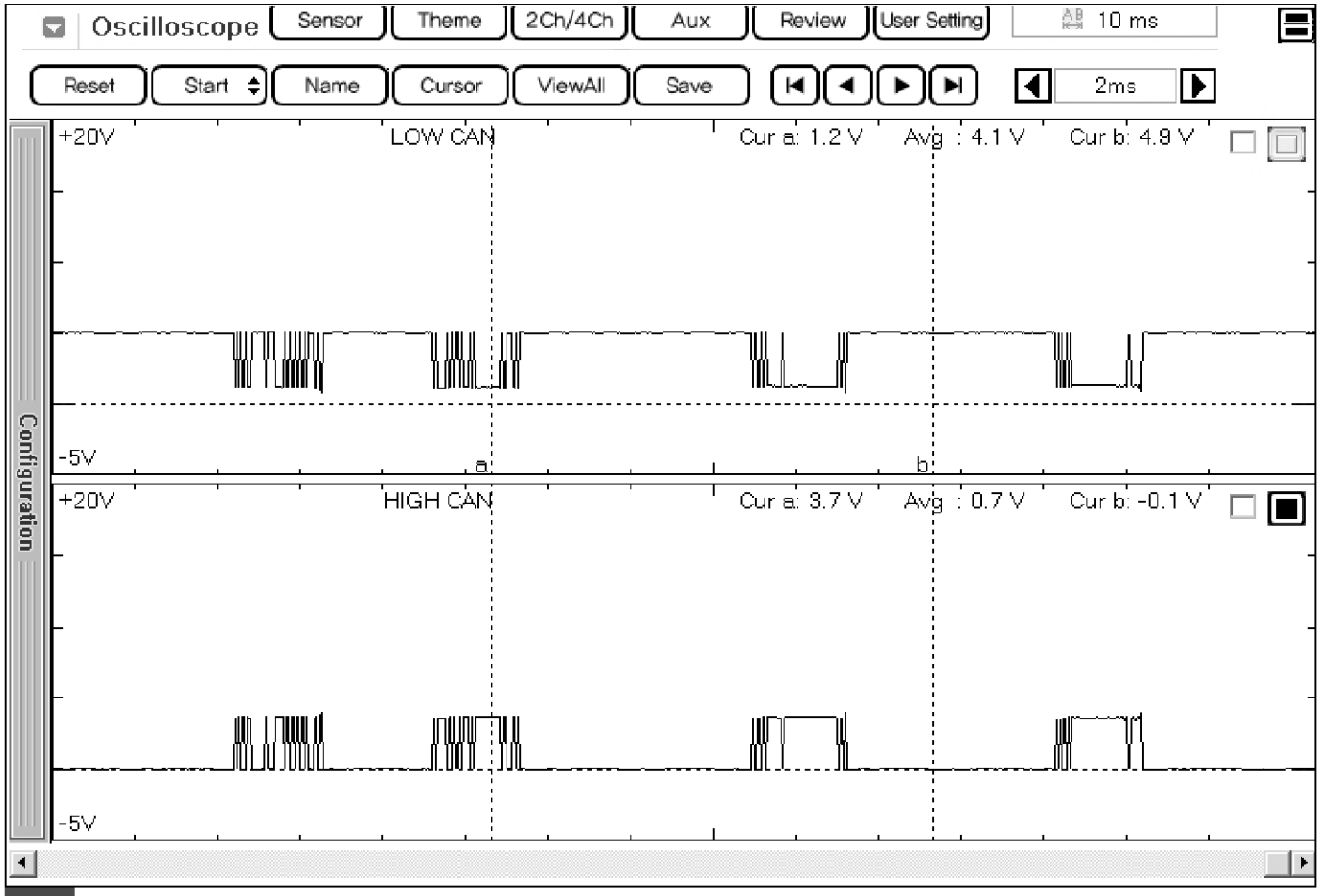


Fig.1

SHMBE9C04L

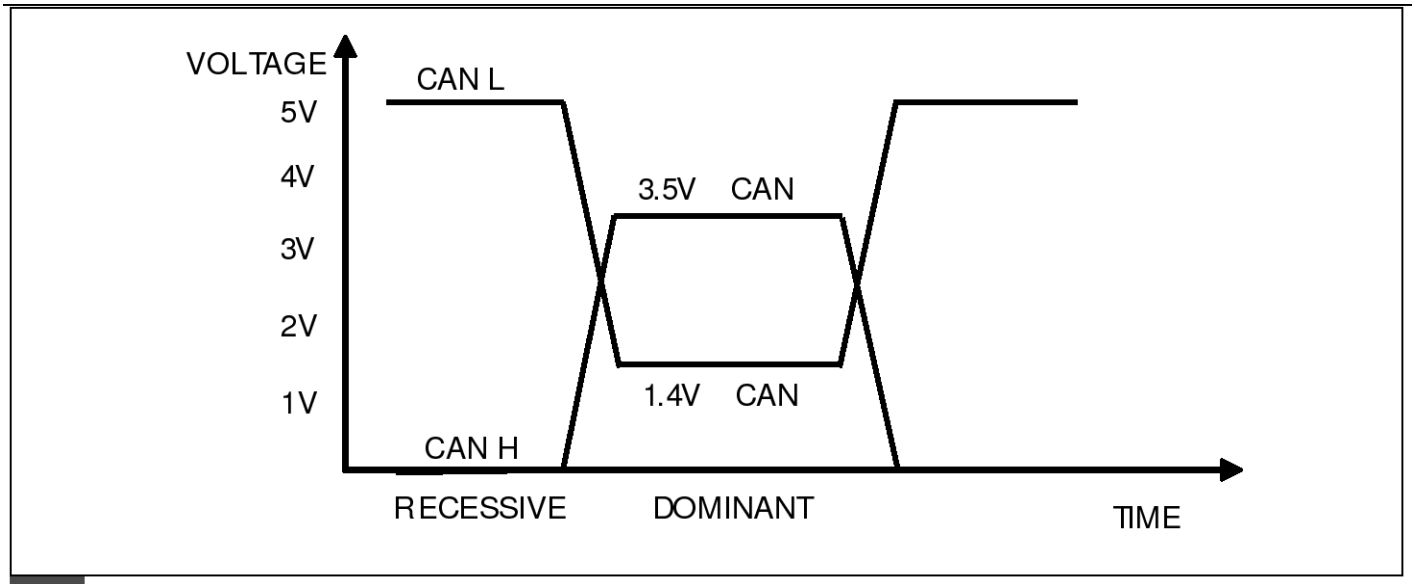


Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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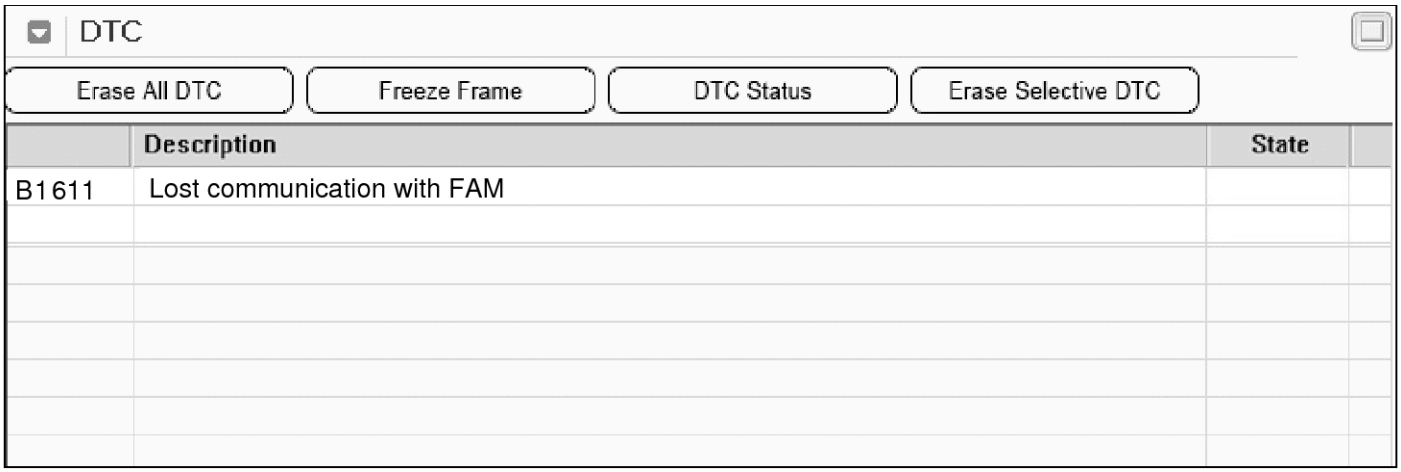
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C13L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or FAM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of FAM CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of FAM CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect FAM and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1612 RAM Communication Lost & Bus Failure

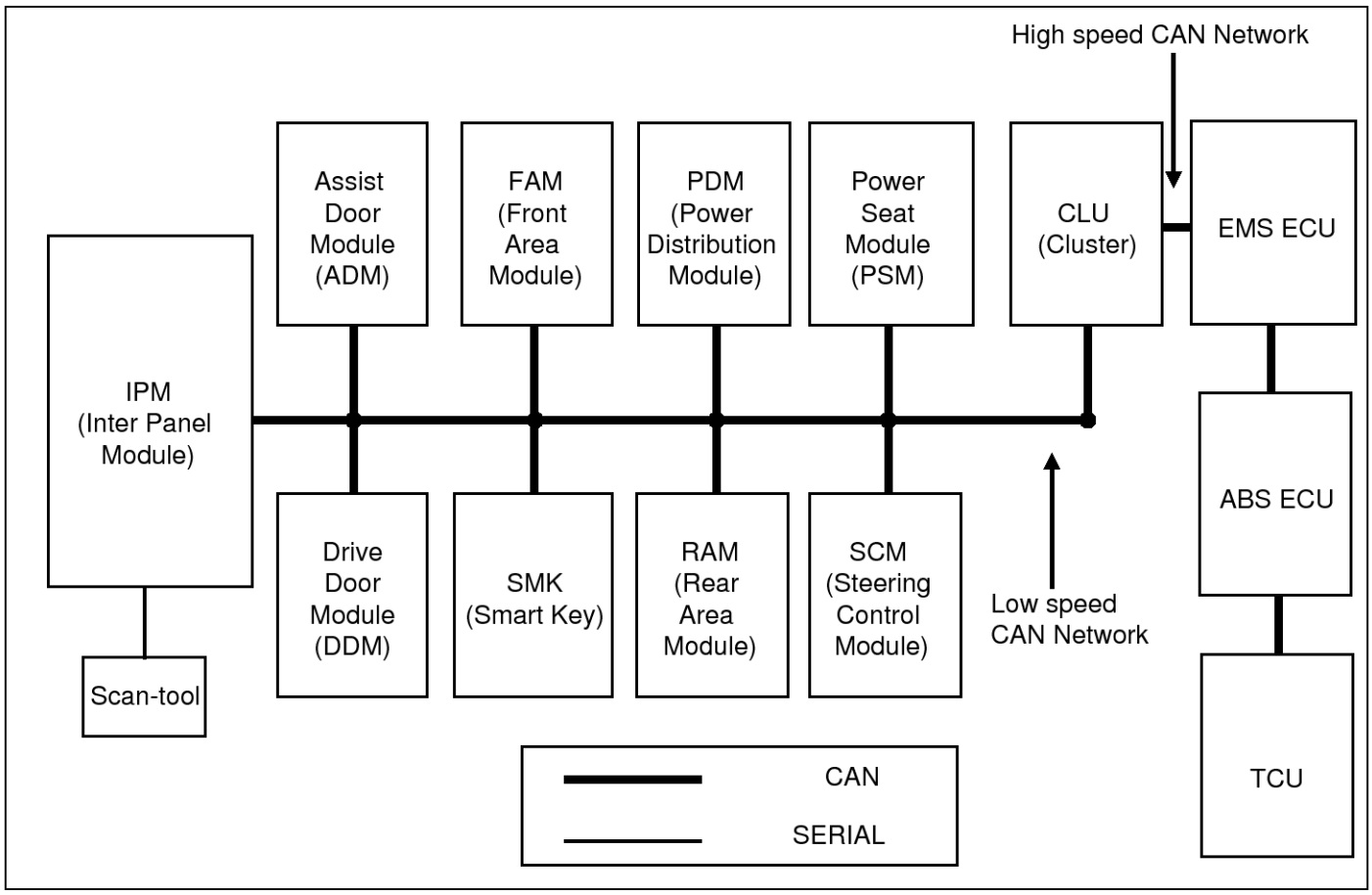
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from RAM by CAN Line for 10 sec.

DTC Detecting Condition

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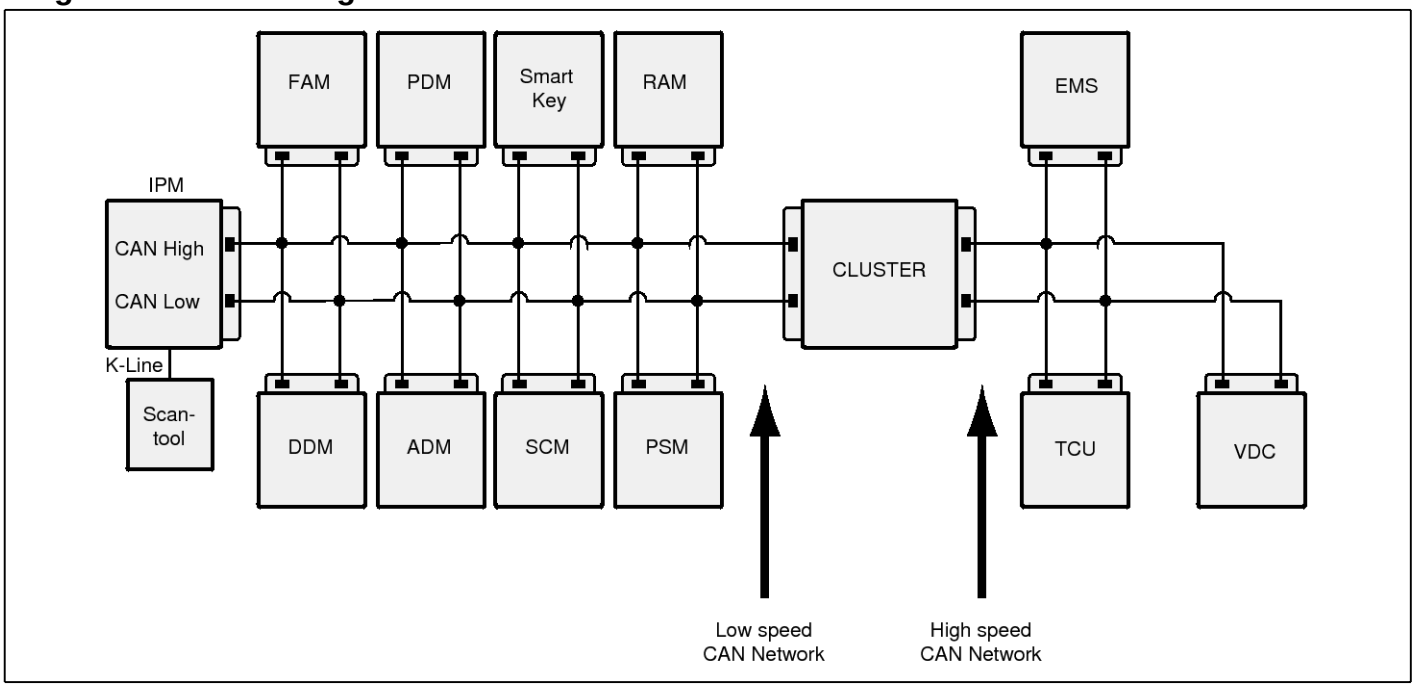
https://autolibrary.ir

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ RAM)	• Check RAM connection • Check fuse related RAM • Check open in CAN high/low circuit of RAM • Check open in CAN high/low circuit of RAM
Enable Conditions	• IPM power on	
Threshold Value	• No message from RAM to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from RAM.	

Diagnostic Circuit Diagram

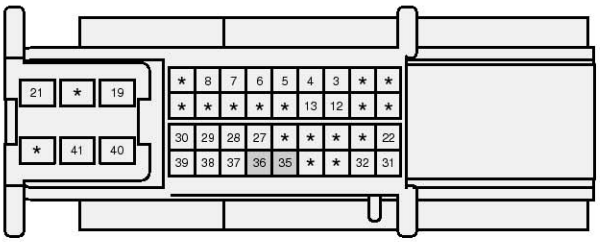


SHMBE9C02L

https://autolibrary.ir

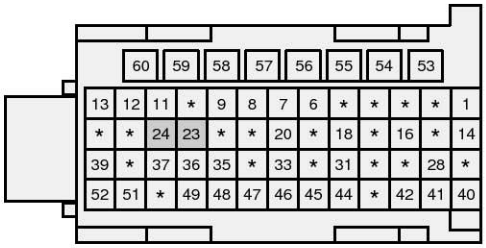
https://autolibrary.ir

<RAM>



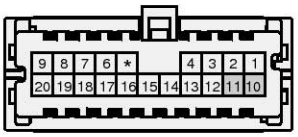
35. Low
36. High

<FAM>



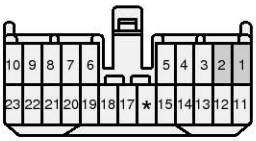
23. Low
24. High

<PDM>



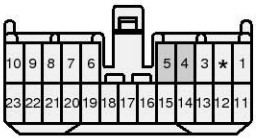
10. Low
11. High

<DDM>



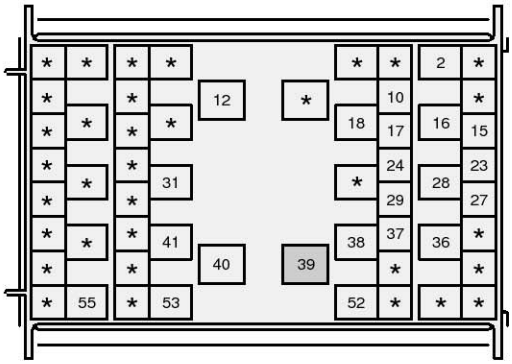
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

https://autolibrary.ir

https://autolibrary.ir

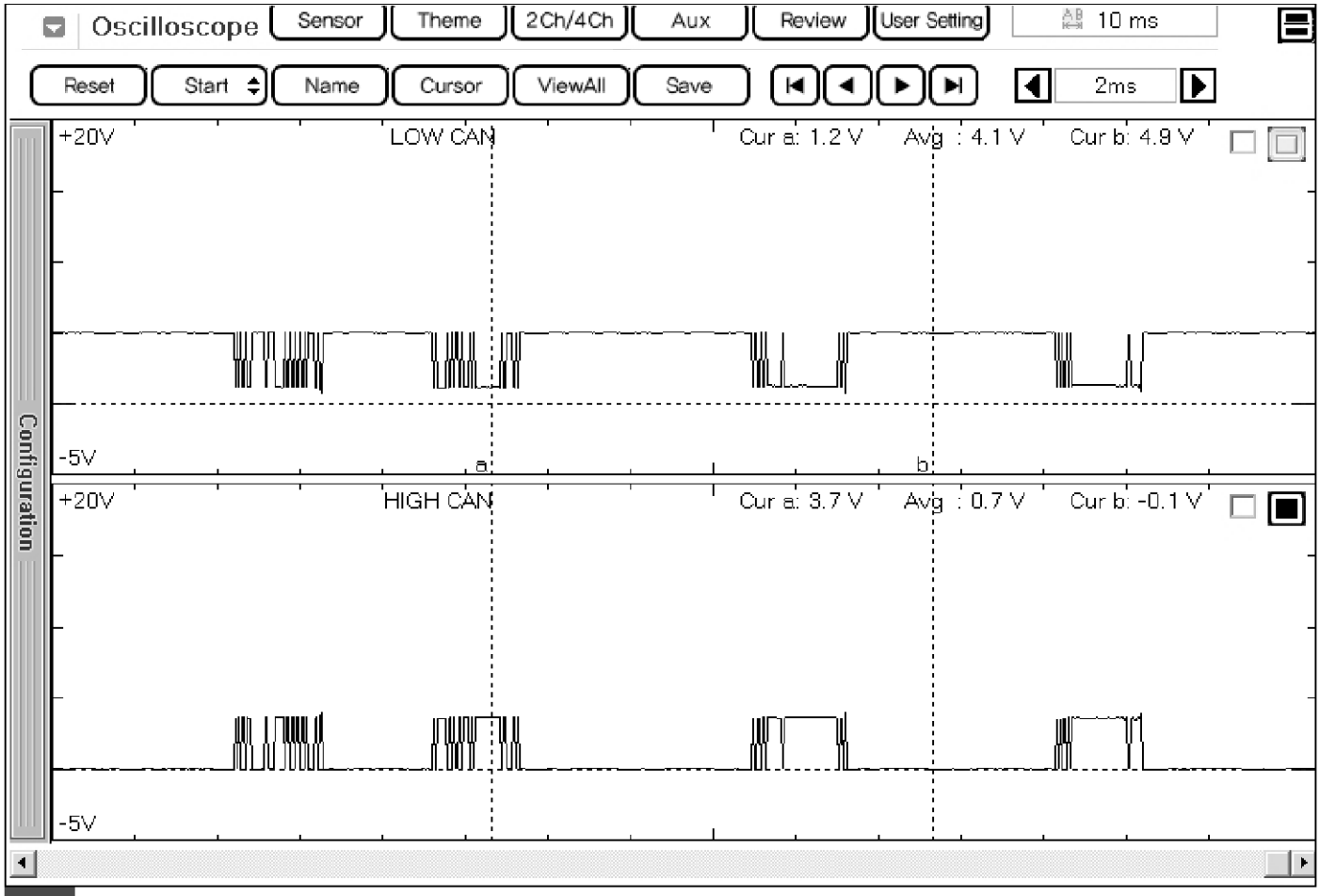


Fig.1

SHMBE9C04L

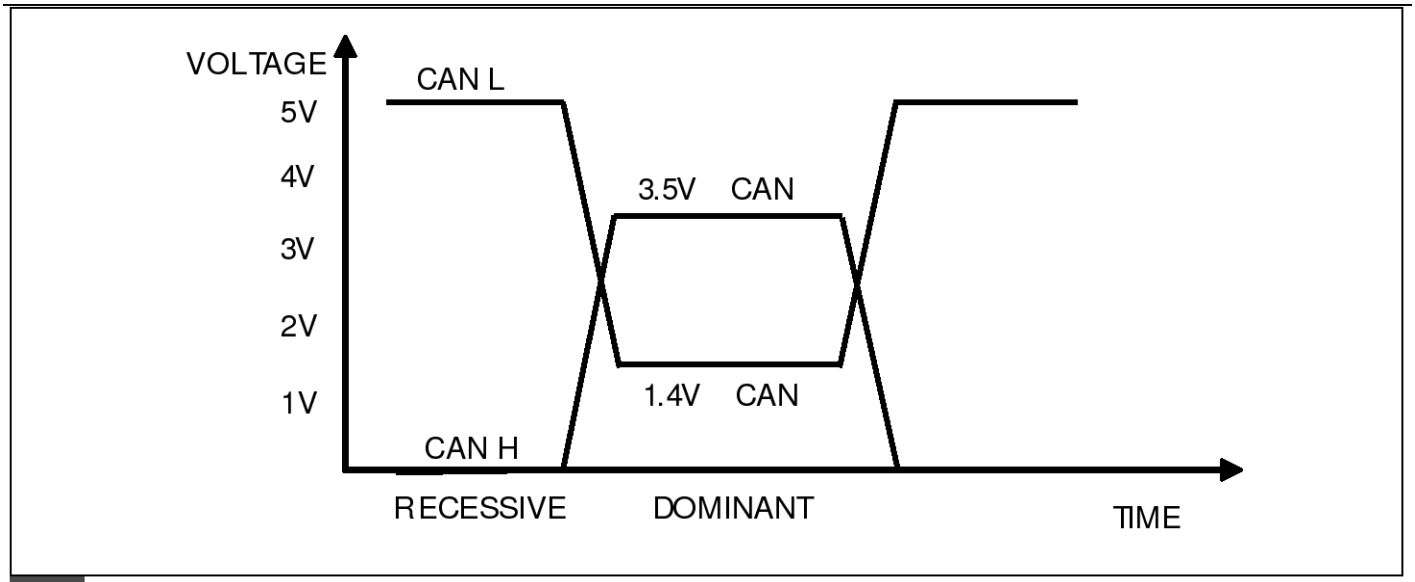


Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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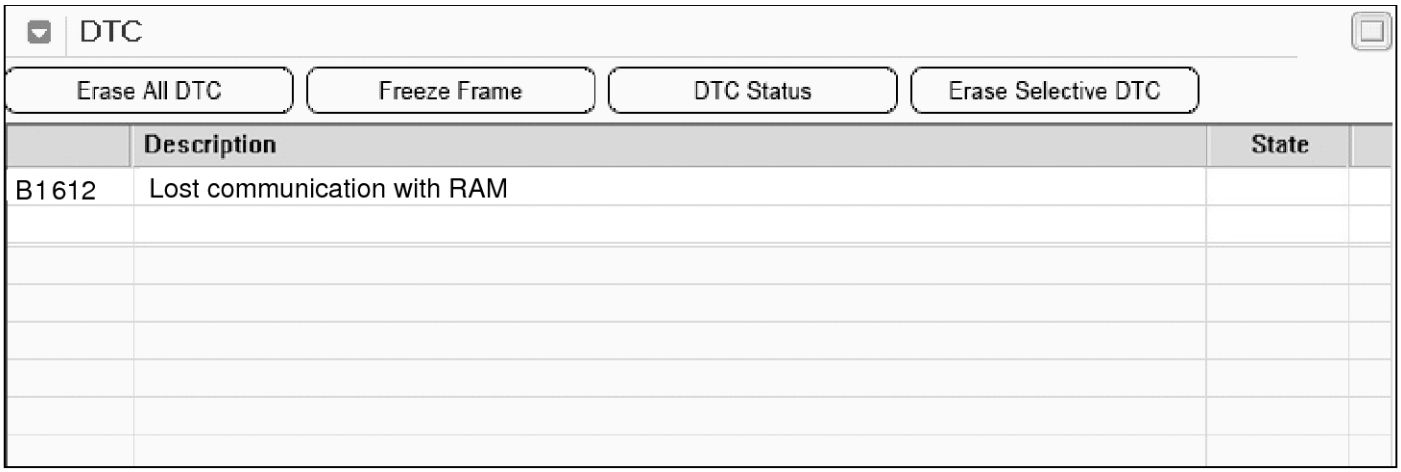
https://autolibrary.ir

2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C14L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or RAM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of RAM CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of RAM CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

https://autolibrary.ir

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect RAM and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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https://autolibrary.ir

B1613 CAN Time-out CLU

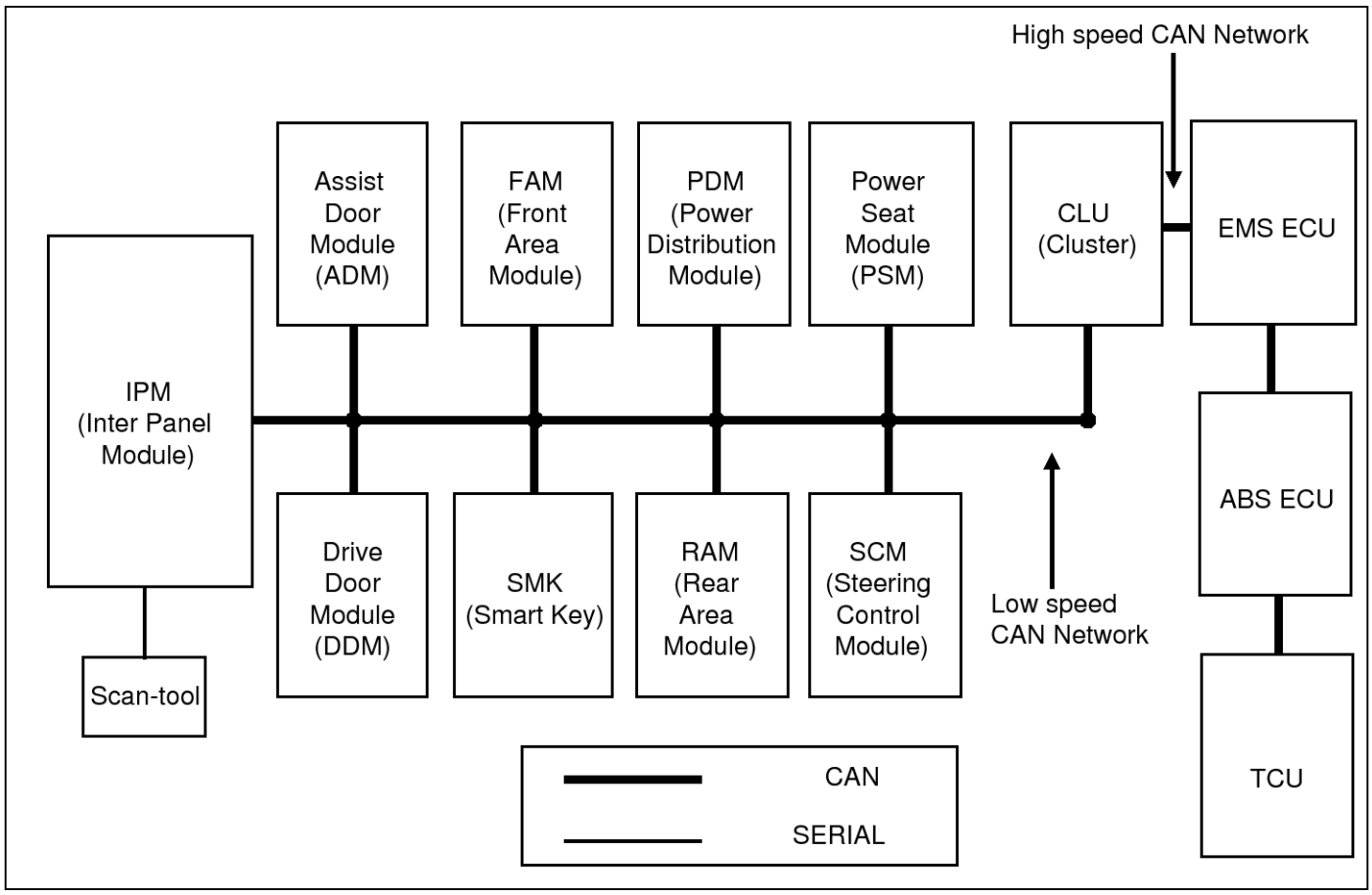
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from CLU by CAN Line for 10 sec.

DTC Detecting Condition

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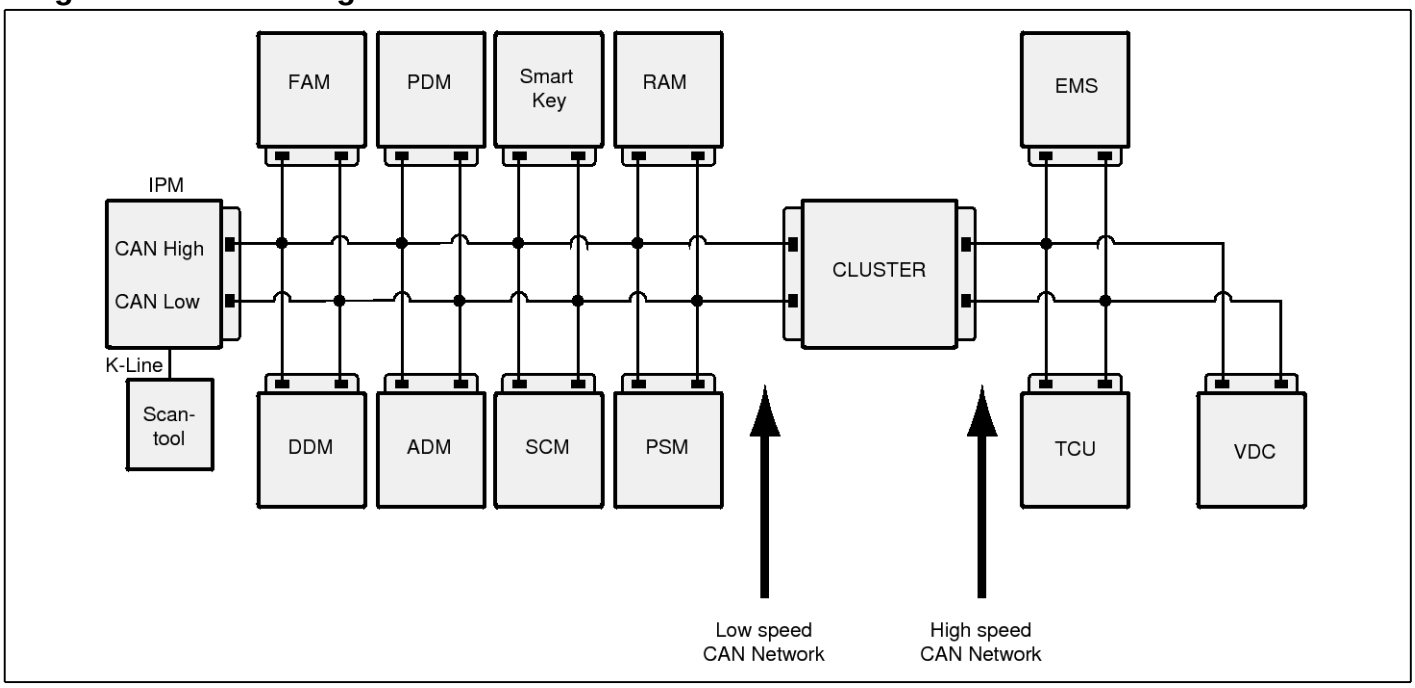
Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ CLU)	• Check CLU connection • Check fuse related CLU • Check open in CAN high/low circuit of CLU • Check open in CAN high/low circuit of CLU
Enable Conditions	• IPM power on	
Threshold Value	• No message from CLU to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from CLU.	

Diagnostic Circuit Diagram



SHMBE9C02L

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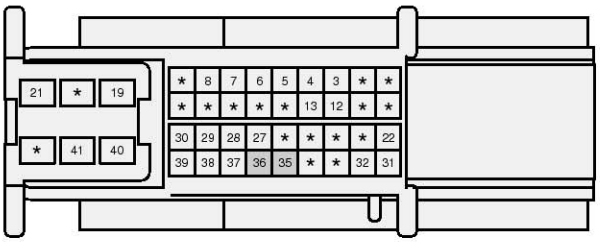
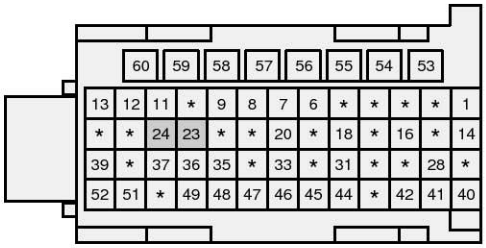
https://autolibrary.ir

<RAM>



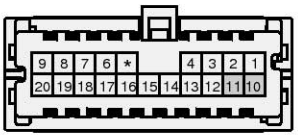
35. Low
36. High

<FAM>



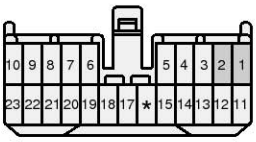
23. Low
24. High

<PDM>



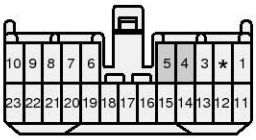
10. Low
11. High

<DDM>



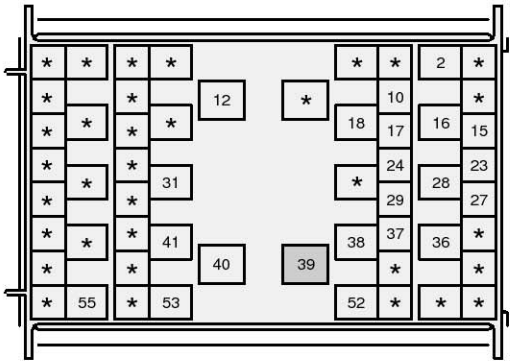
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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https://autolibrary.ir

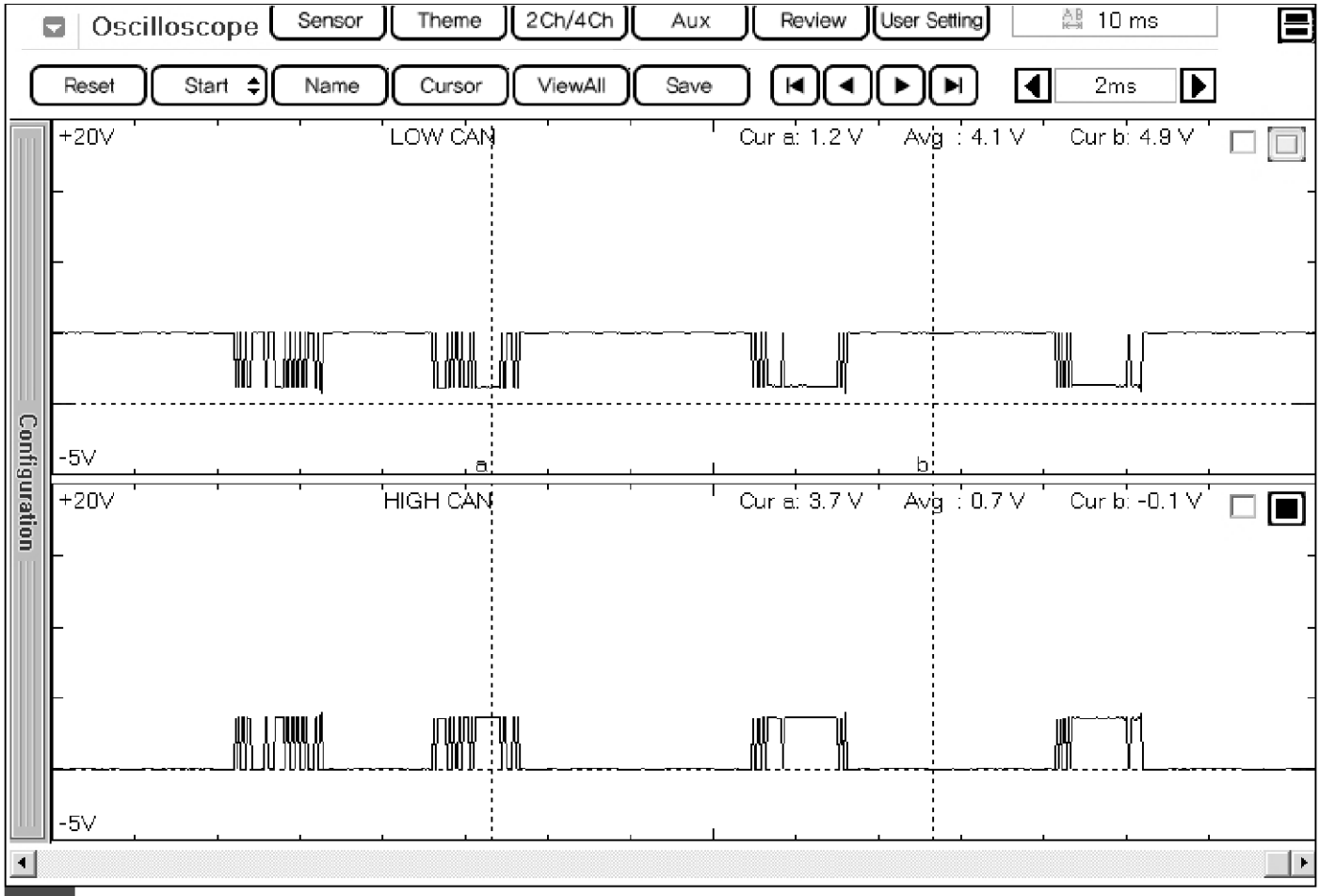

Fig.1

SHMBE9C04L

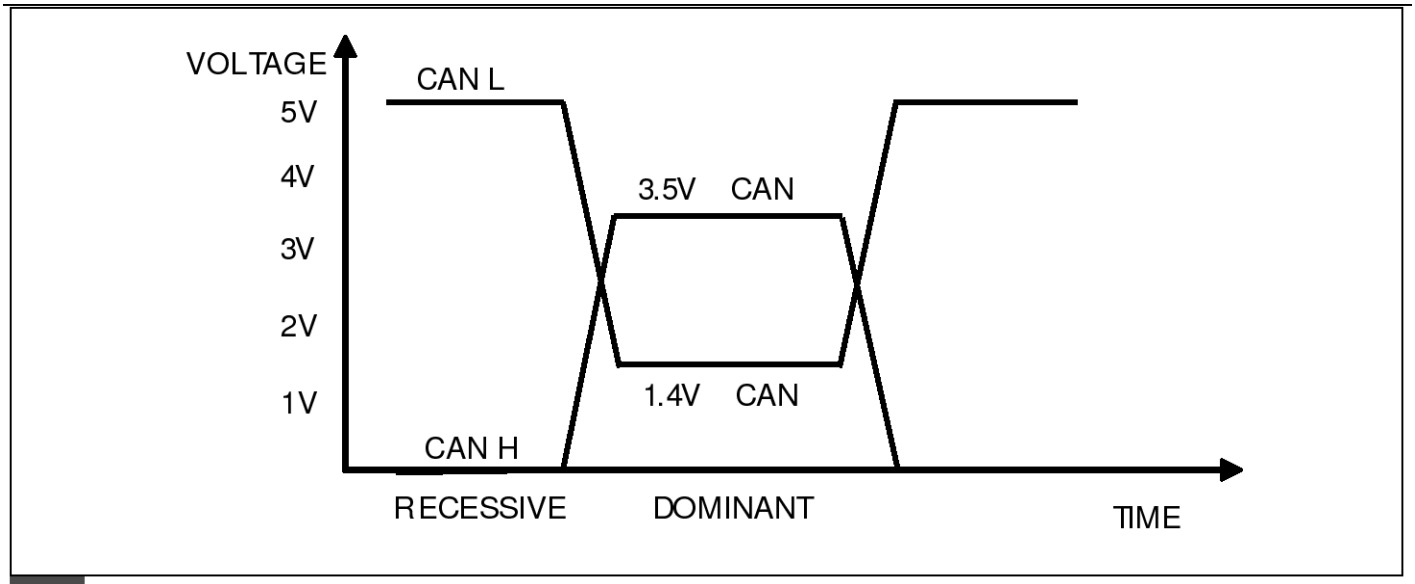

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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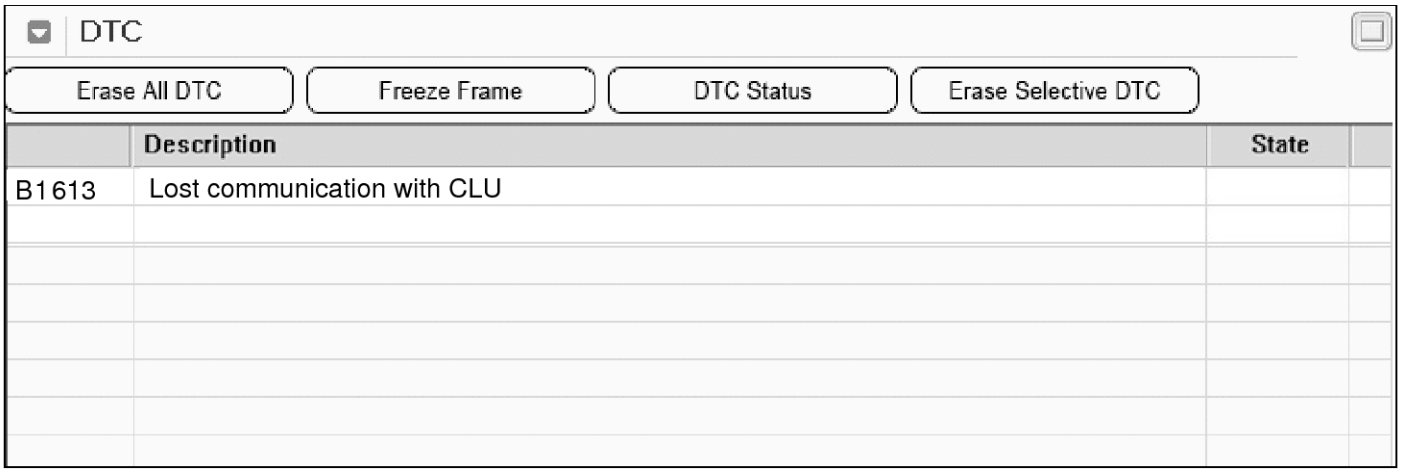
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C15L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or CLU's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of CLU CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of CLU CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to next procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect CLU and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1624 EEPROM Failure

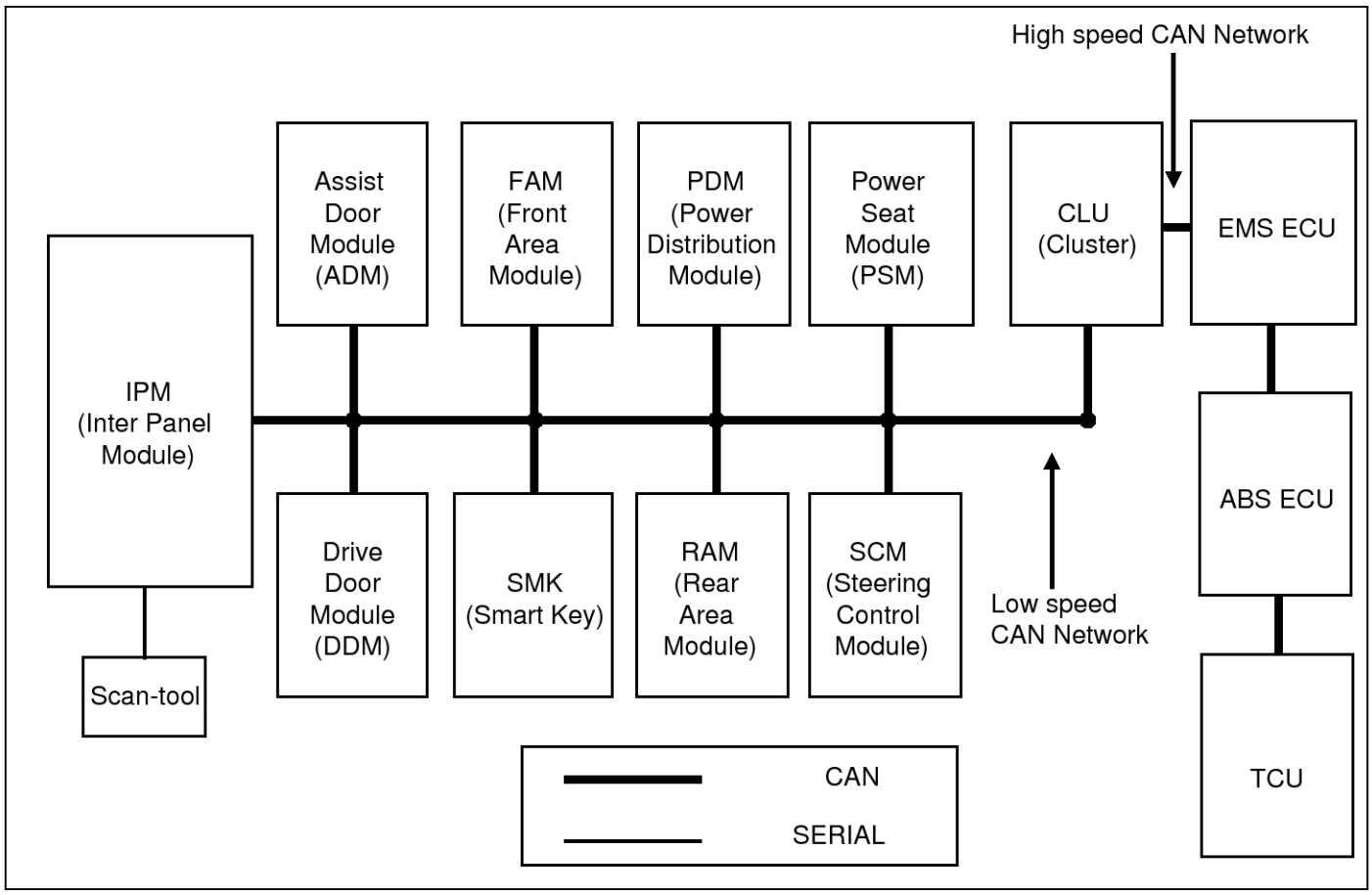
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

IPM sets DTC when EEPRM of Micom in IPM is read / write error.

DTC Detecting Condition

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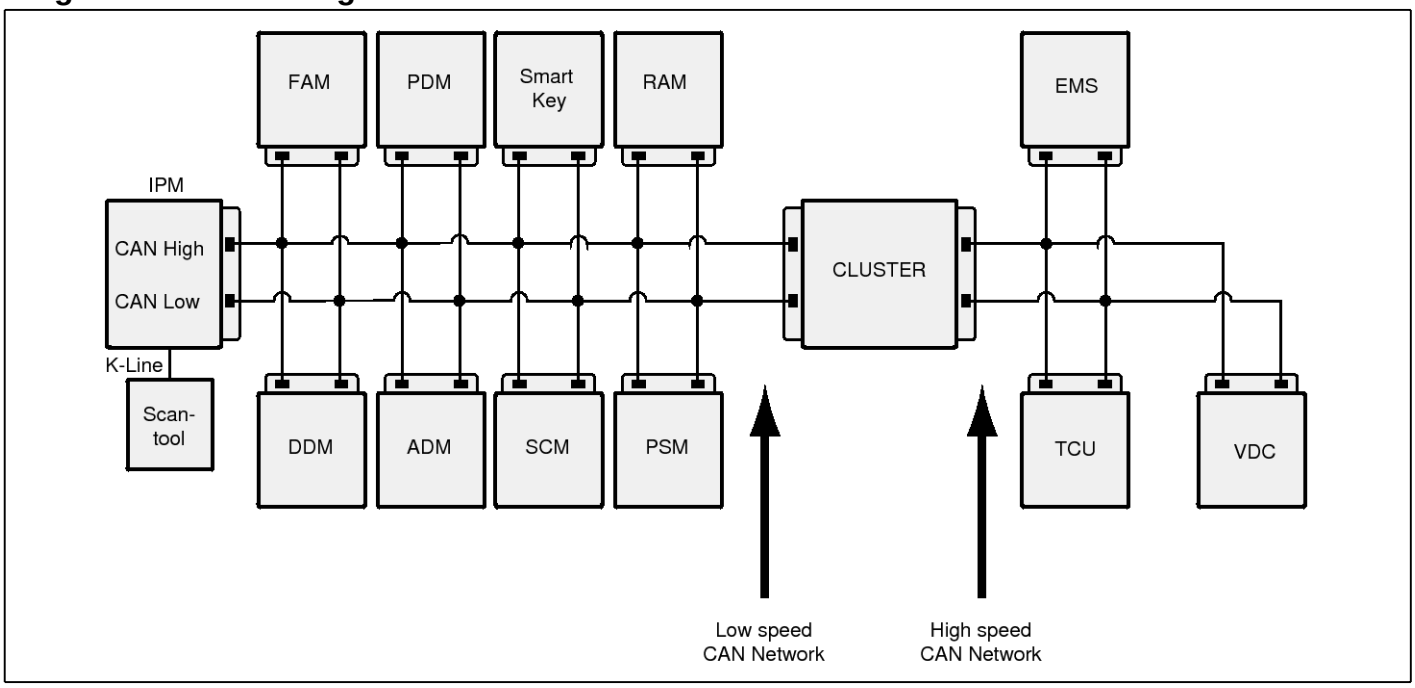
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check EEPROM read / write status	• Faulty IPM
Enable Conditions	• IG ON	
Threshold Value	• EEPROM read / write error	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram



SHMBE9C02L

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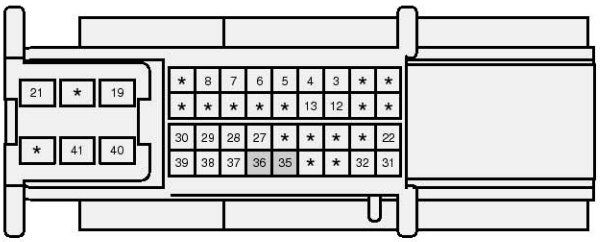
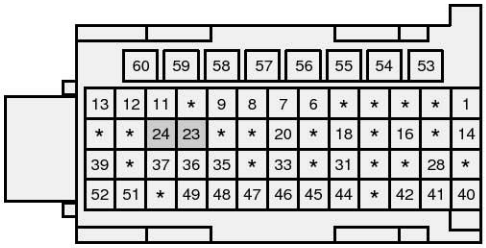
<RAM>



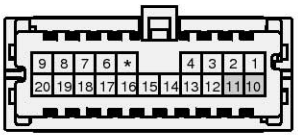
35. Low
36. High

<FAM>



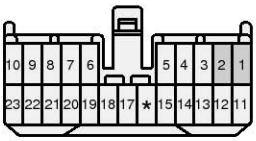
23. Low
24. High

<PDM>



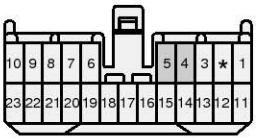
10. Low
11. High

<DDM>



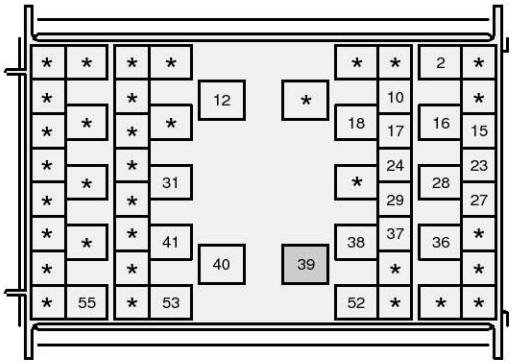
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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https://autolibrary.ir

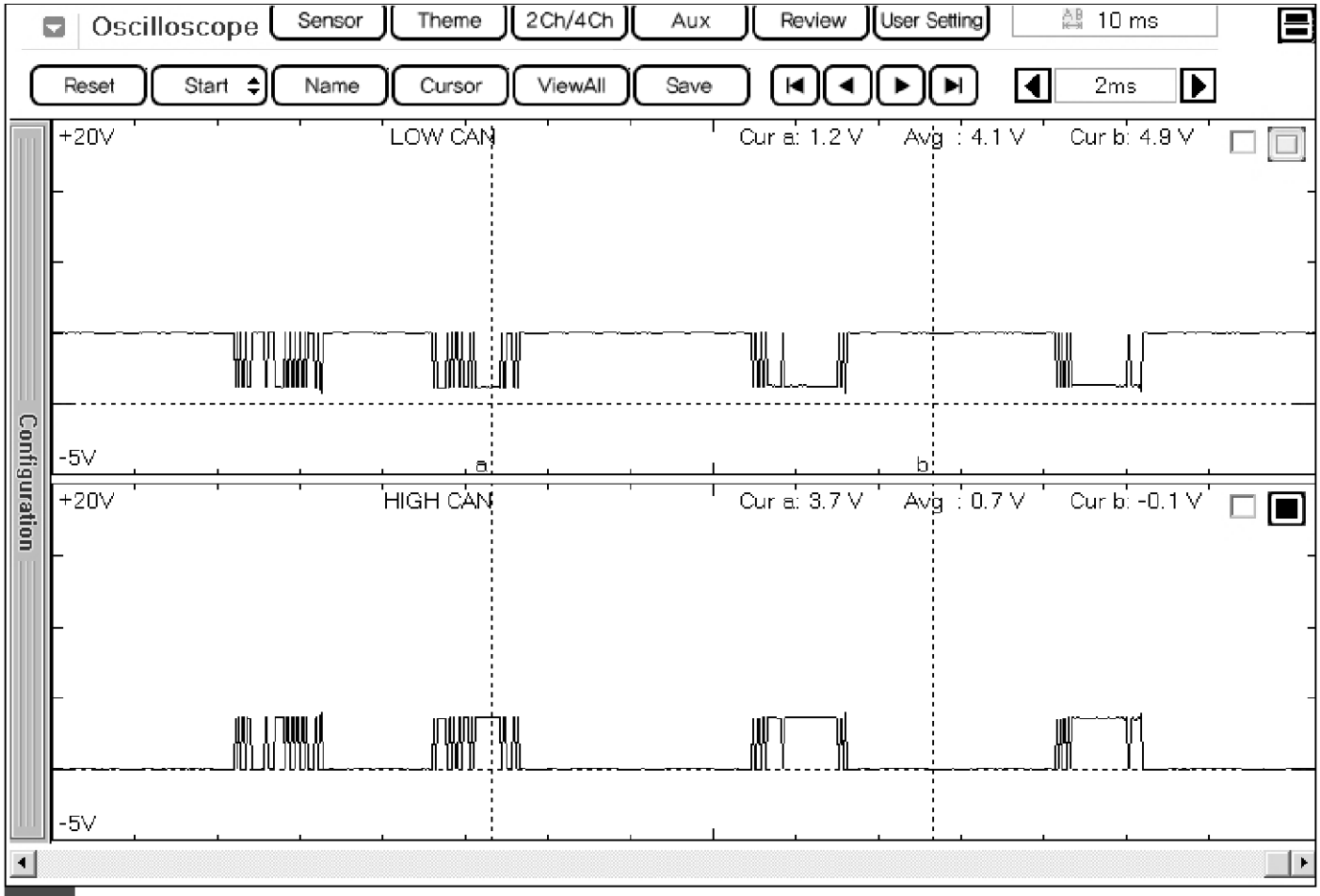

Fig.1

SHMBE9C04L

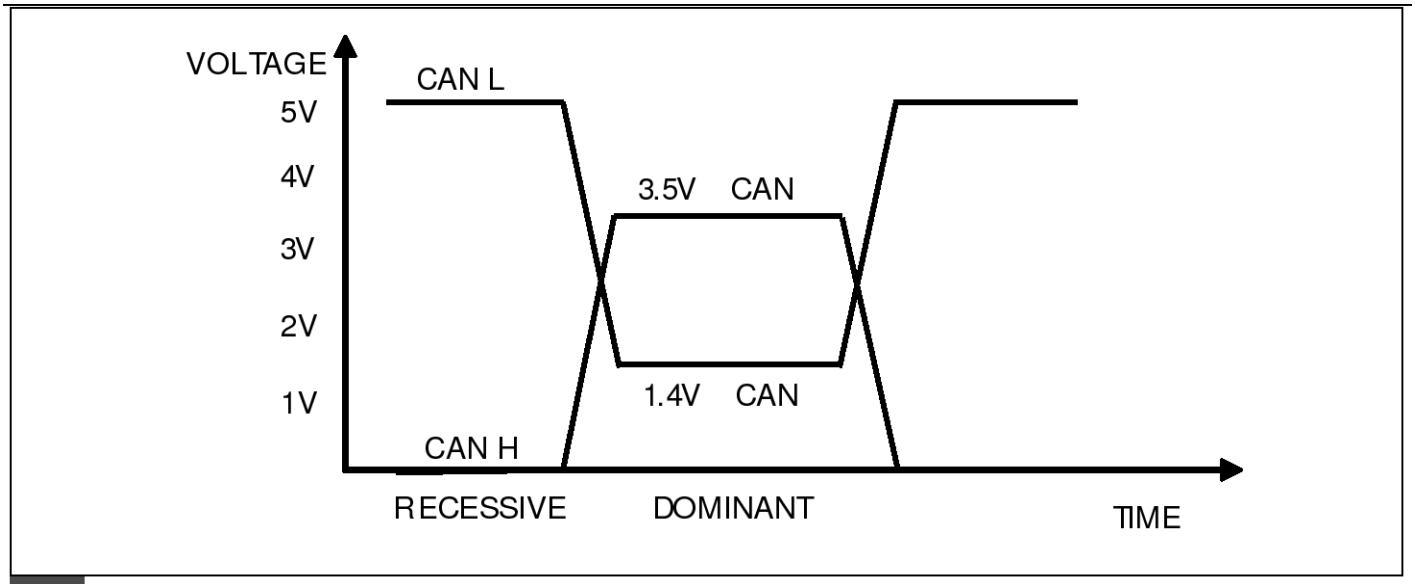

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

■ **Check DTC**

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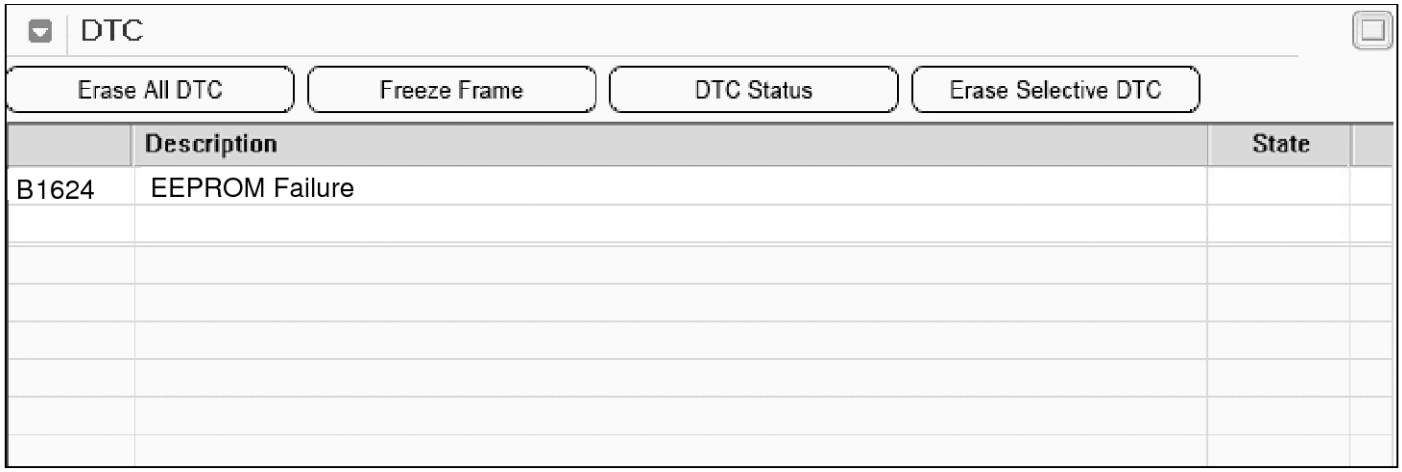
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C19L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of CAN communication in IPM.

1. Replace with a known-good IPM after removing installed IPM.
2. Connect GDS.
3. IG "ON" and engine "OFF".
4. Select "DTC Analysis" mode.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

https://autolibrary.ir

https://autolibrary.ir

NO ▶ System performing to specification at this time.

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https://autolibrary.ir

B1627 EEPROM Corruption

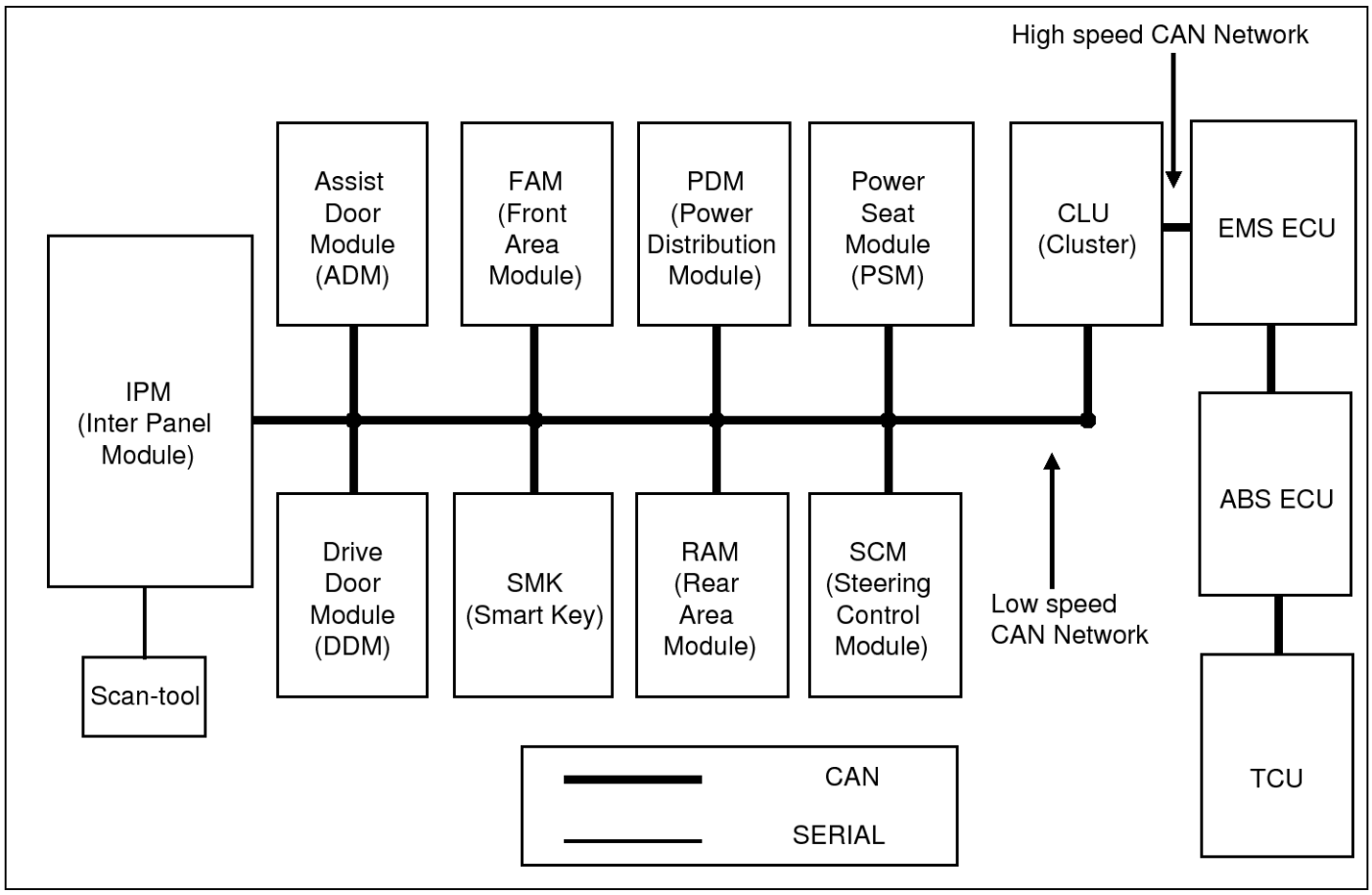
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

IPM sets DTC in case of EEPRM data error.

DTC Detecting Condition

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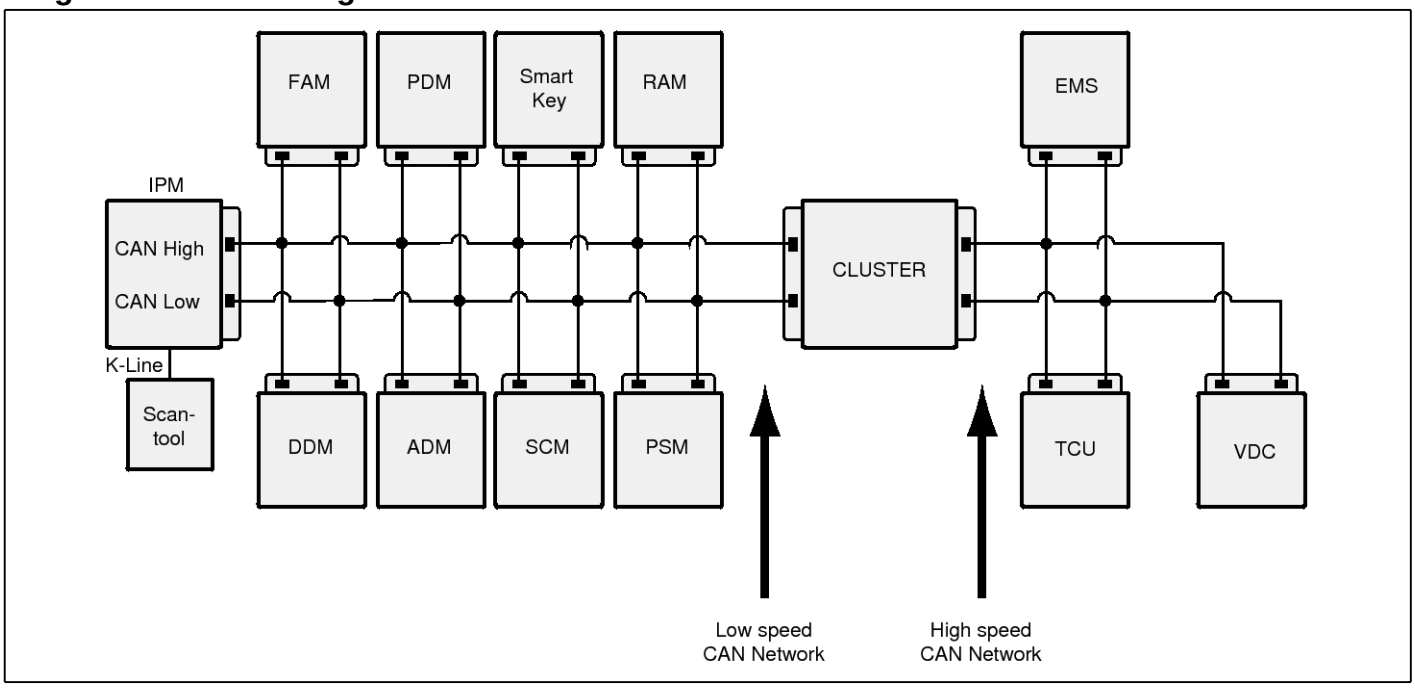
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check EEPROM status	• Faulty IPM
Enable Conditions	• IG ON	
Threshold Value	• EEPROM data error	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram

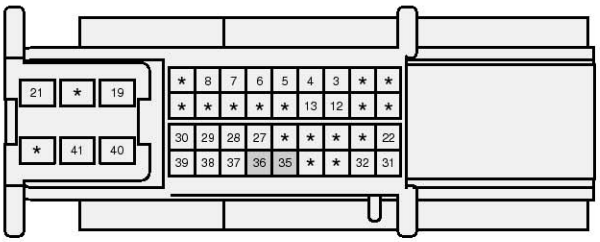


SHMBE9C02L

https://autolibrary.ir

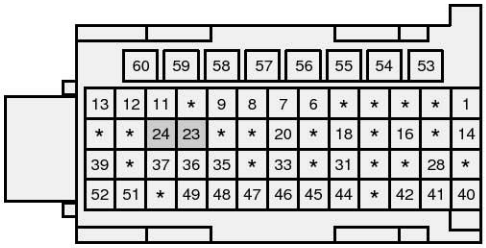
https://autolibrary.ir

<RAM>



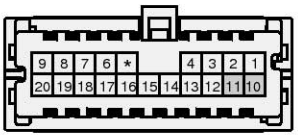
35. Low
36. High

<FAM>



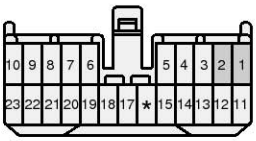
23. Low
24. High

<PDM>



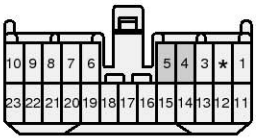
10. Low
11. High

<DDM>



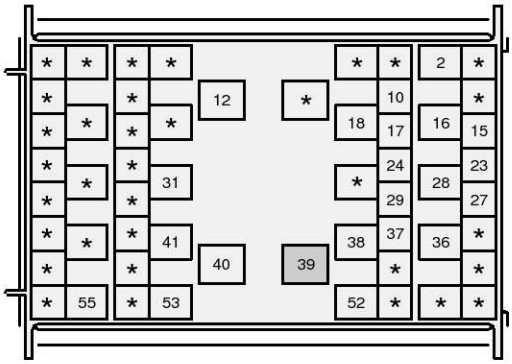
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

https://autolibrary.ir

https://autolibrary.ir

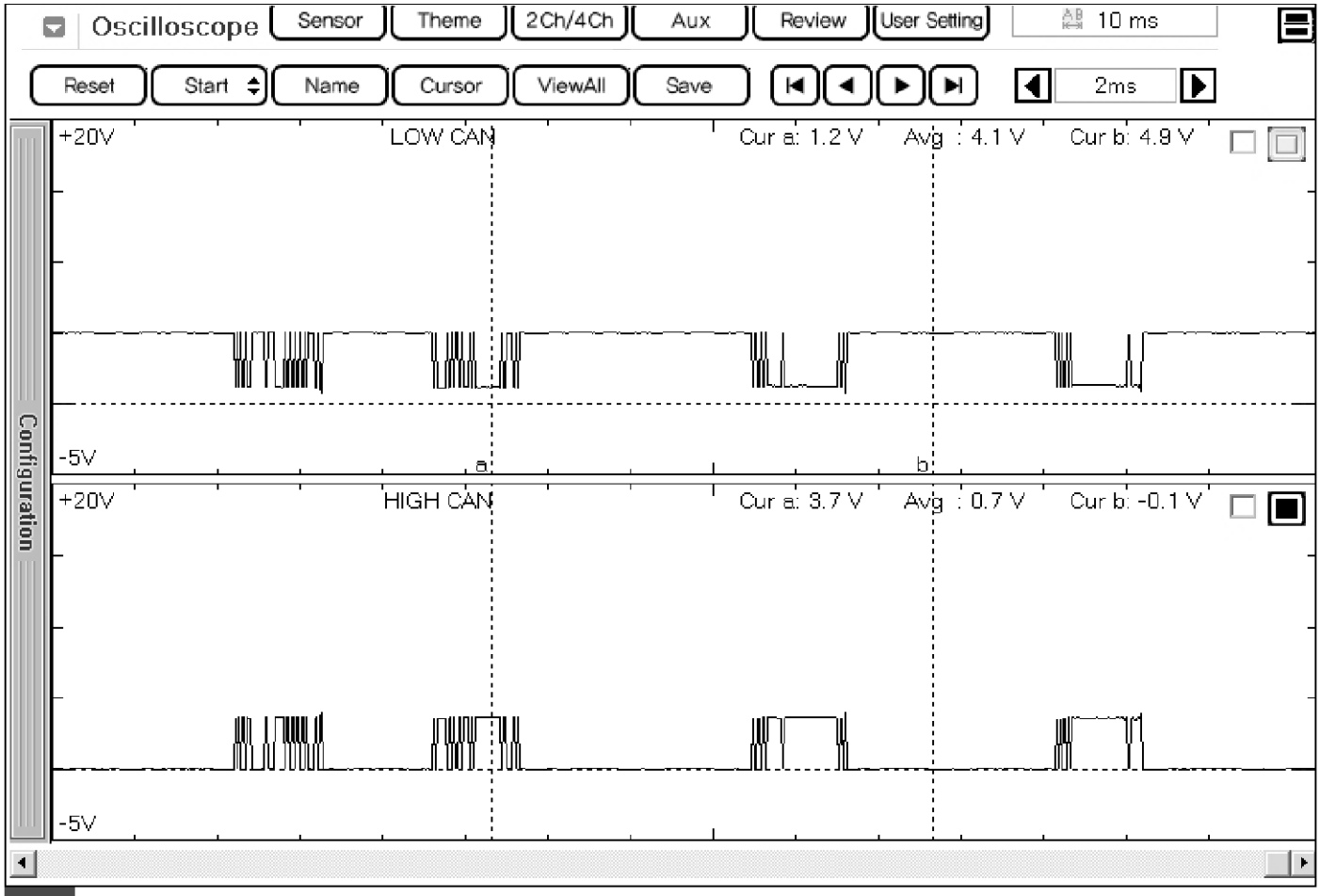


Fig.1

SHMBE9C04L

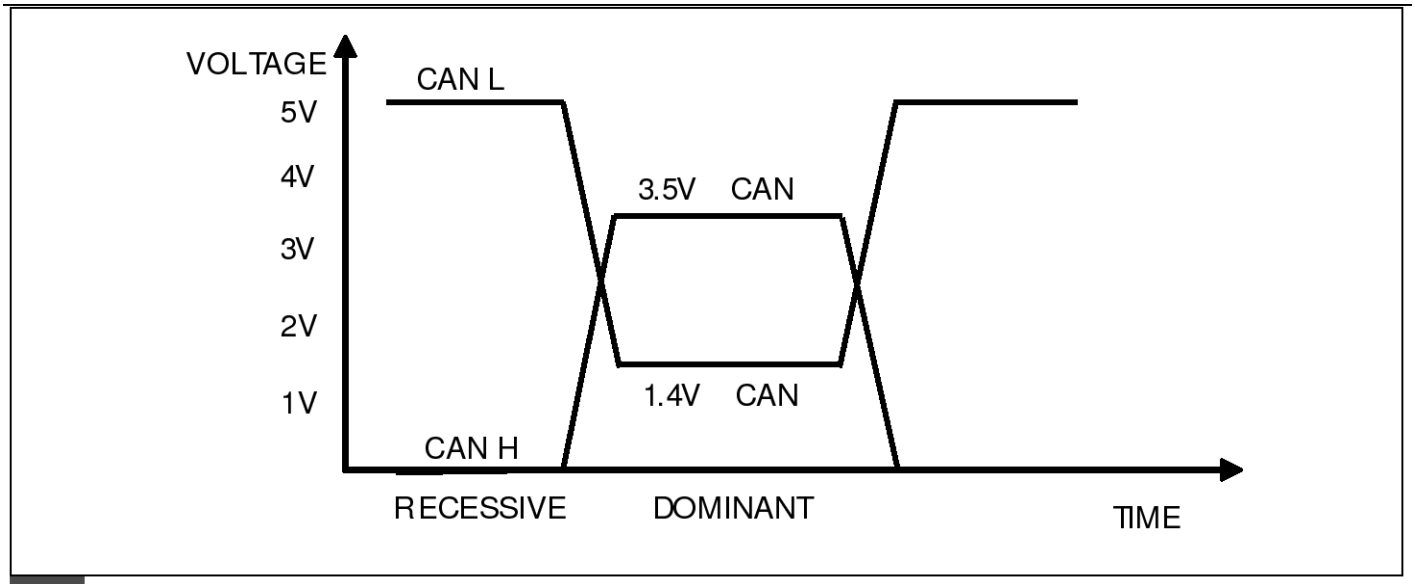


Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

■ **Check DTC**

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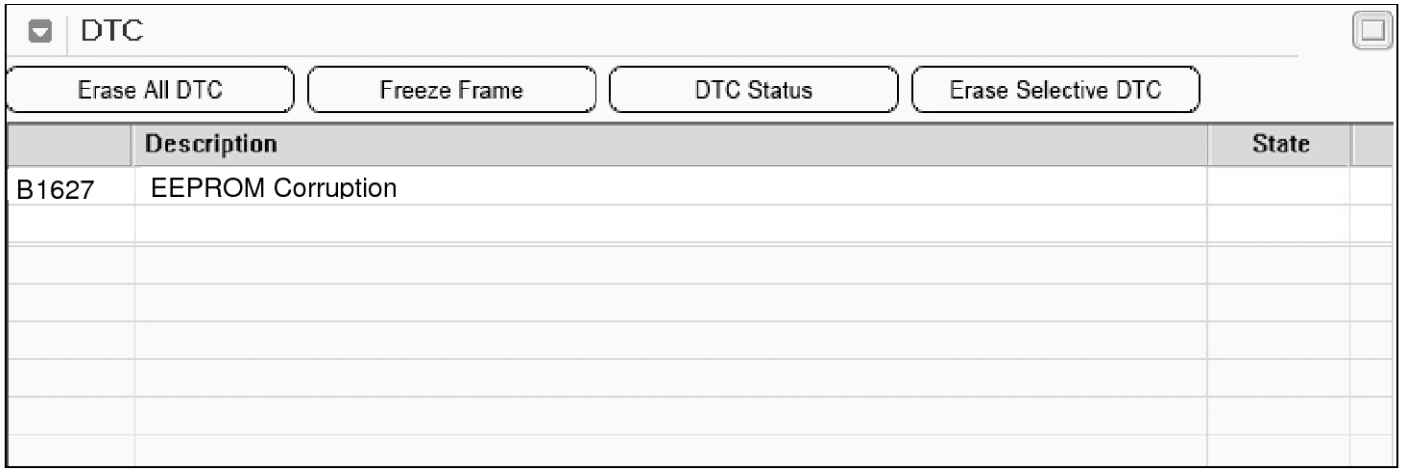
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C20L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of CAN communication in IPM.

1. Replace with a known-good IPM after removing installed IPM.
2. Connect GDS.
3. IG "ON" and engine "OFF".
4. Select "DTC Analysis" mode.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

https://autolibrary.ir

https://autolibrary.ir

NO ▶ System performing to specification at this time.

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https://autolibrary.ir

B1628 Module Configuration Conflict

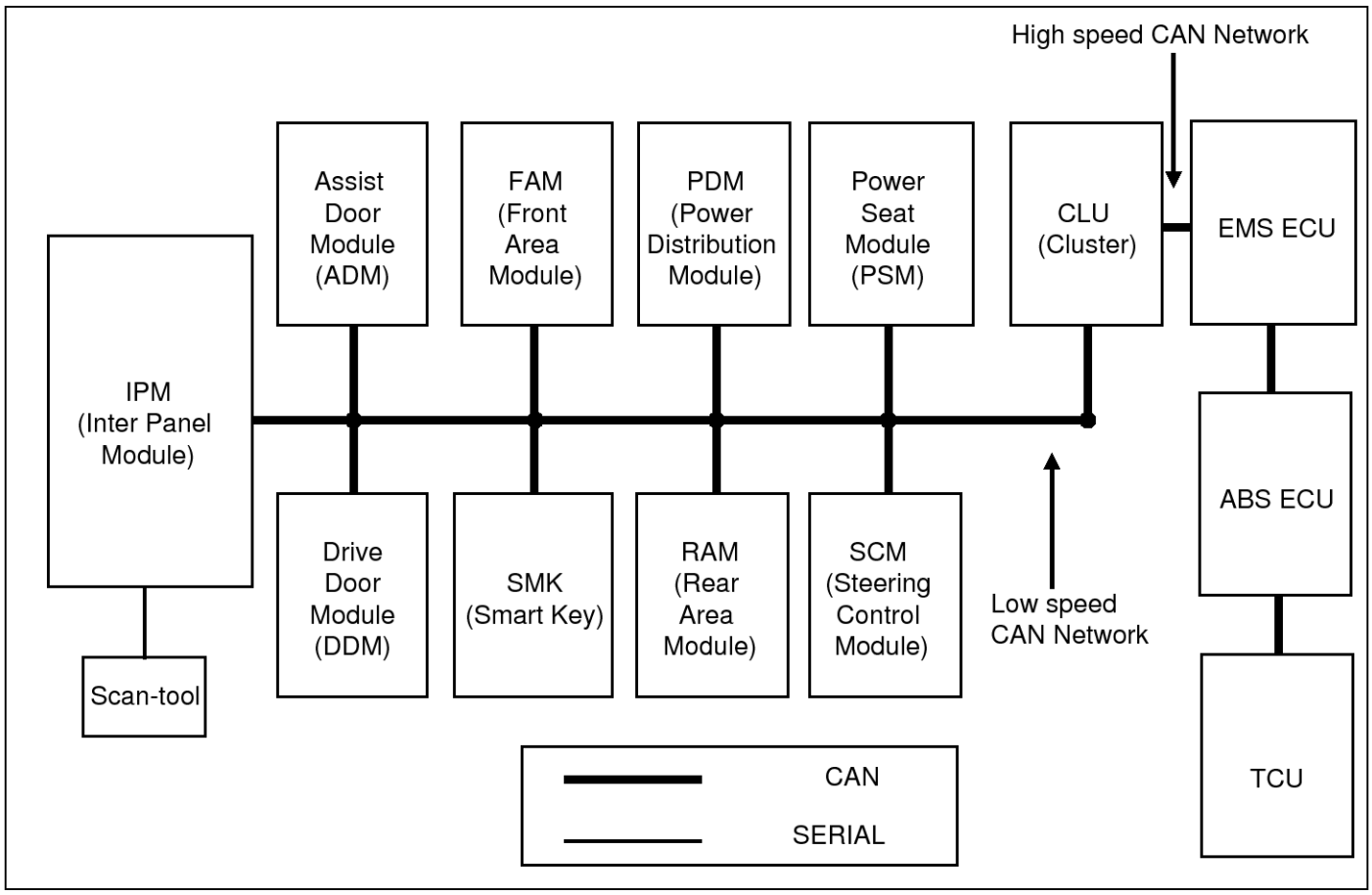
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

In case that RF Module in IPM is not matached with local frequency,such as RF module for North America but IPM for Korea, IPM sets DTC.

DTC Detecting Condition

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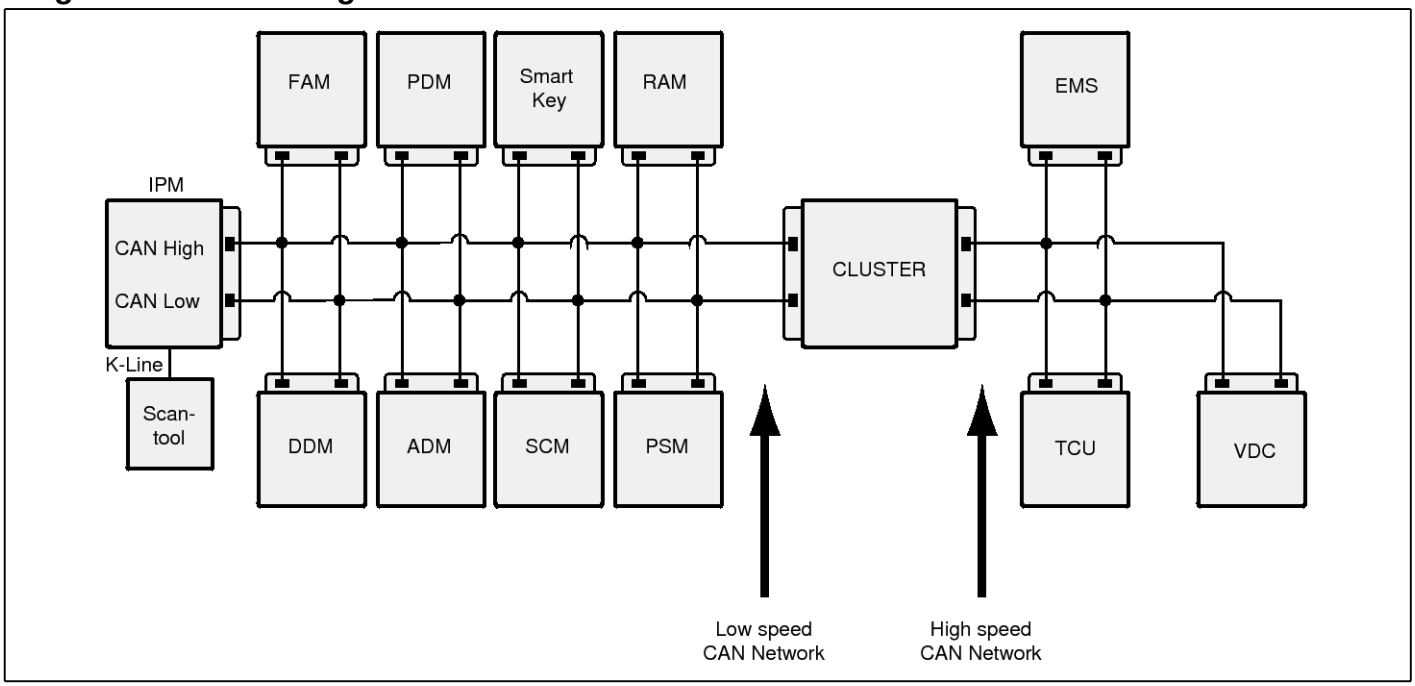
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check matching between RKE frequency and Module f-requency	• Check wrong IPM
Enable Conditions	• IG ON	
Threshold Value	• Detected that RF Module frequency is unmatching with local frequency	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram



SHMBE9C02L

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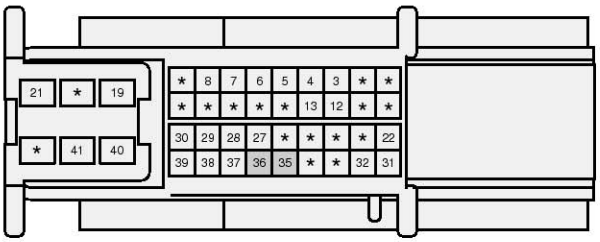
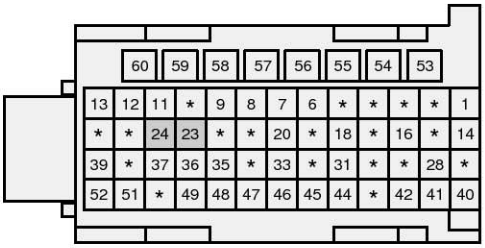
<RAM>



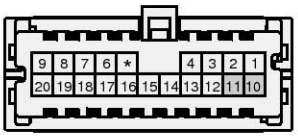
35. Low
36. High

<FAM>



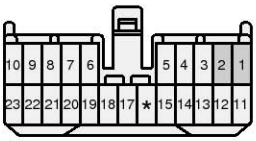
23. Low
24. High

<PDM>



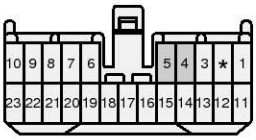
10. Low
11. High

<DDM>



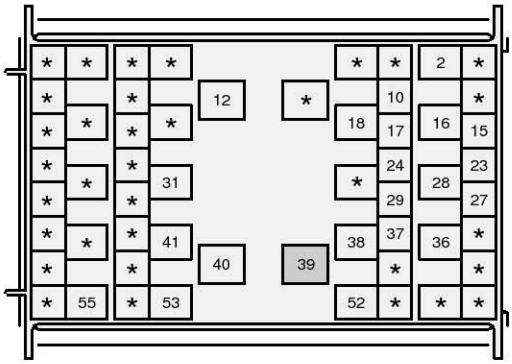
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

https://autolibrary.ir

https://autolibrary.ir

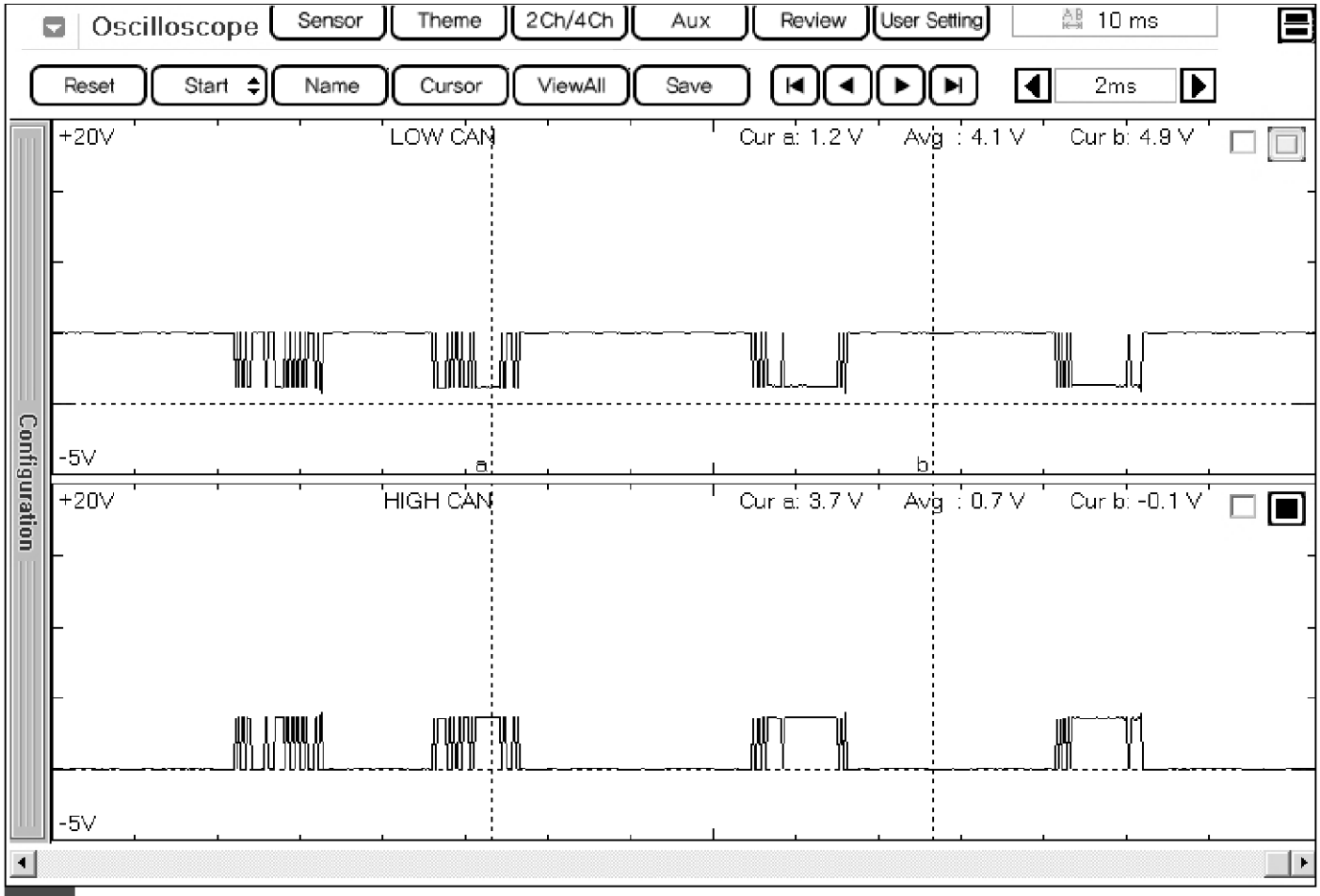


Fig.1

SHMBE9C04L

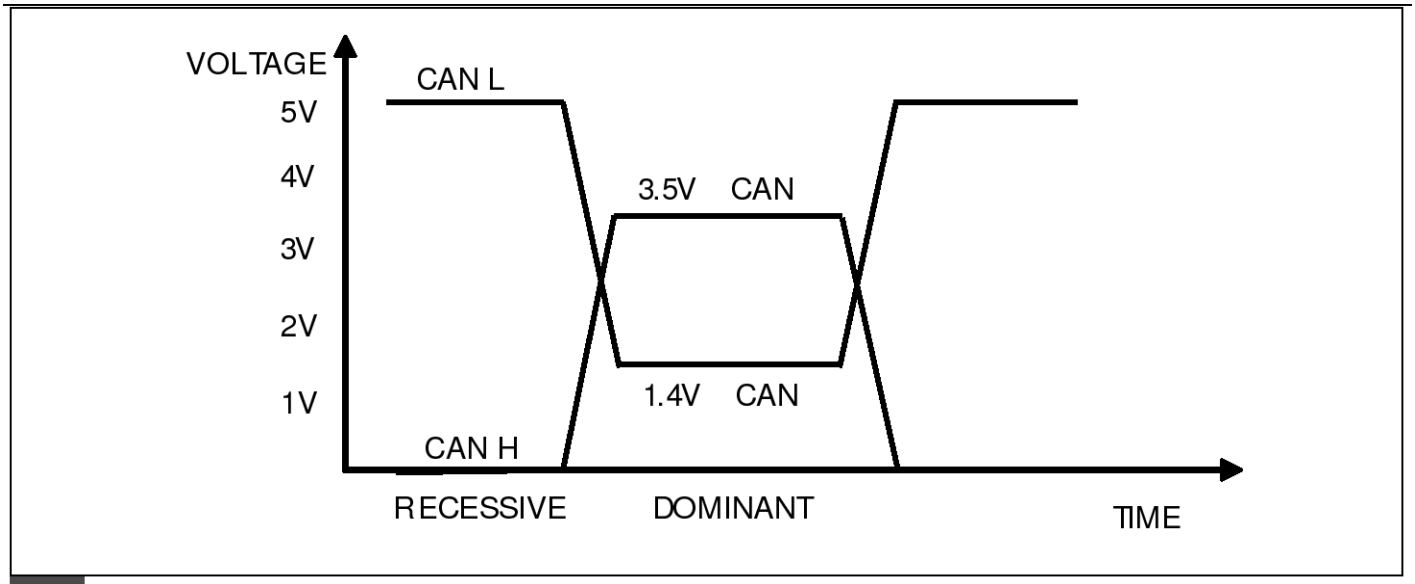


Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

■ **Check DTC**

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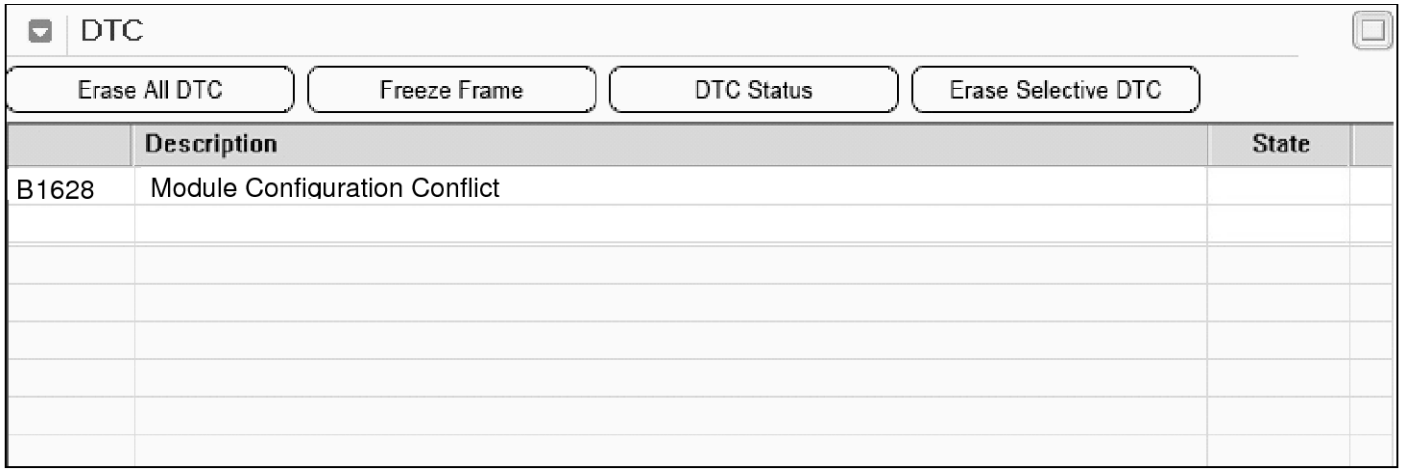
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C21L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of CAN communication in IPM.

1. Replace with a known-good IPM after removing installed IPM.
2. Connect GDS.
3. IG "ON" and engine "OFF".
4. Select "DTC Analysis" mode.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

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NO ▶ System performing to specification at this time.

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https://autolibrary.ir

B1646 S/W Rescue Mode

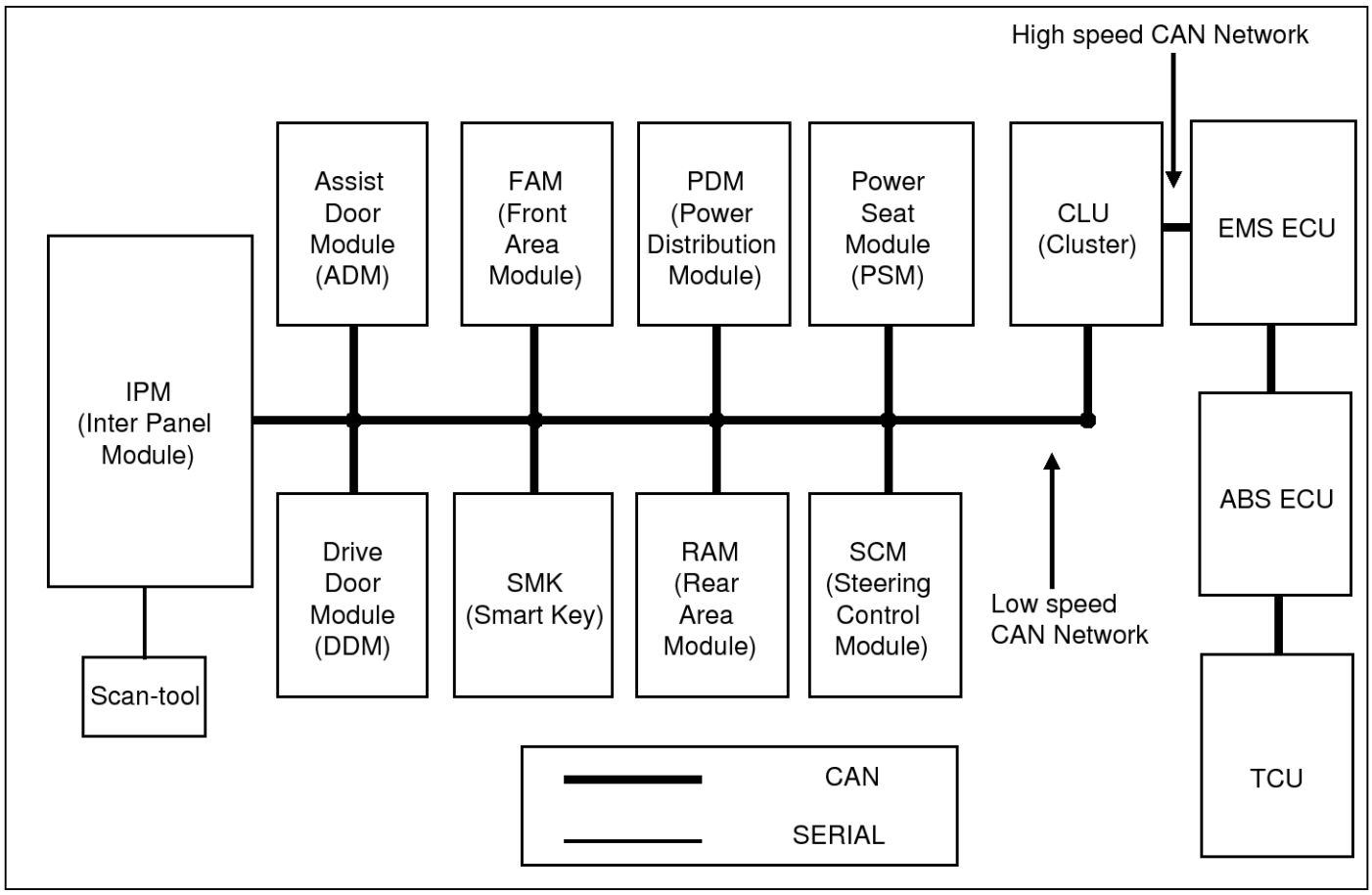
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

If FAM or RAM are missing on the CAN Line or it is impossible to communicate via CAN because of faulty IPM, FAM or RAM, IPM sets This DTC.

DTC Detecting Condition

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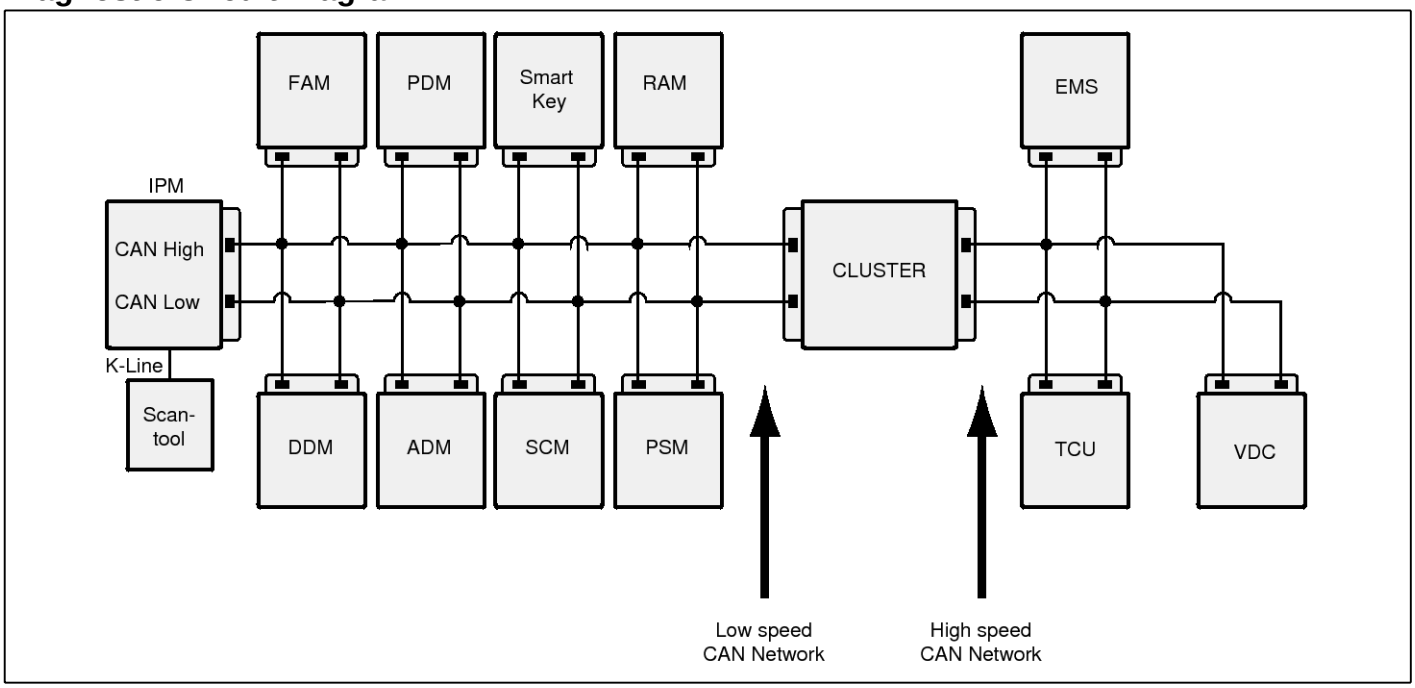
Item	Detecting Condition	Possible Cause
DTC Strategy	• Check Network status	• Check CAN Line • Check operation of FAM, IPM, RAM
Enable Conditions	• IGN ON	
Threshold Value	• Detected RF Module is installed that frequency is different from local frequency	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)	

Diagnostic Circuit Diagram



SHMBE9C02L

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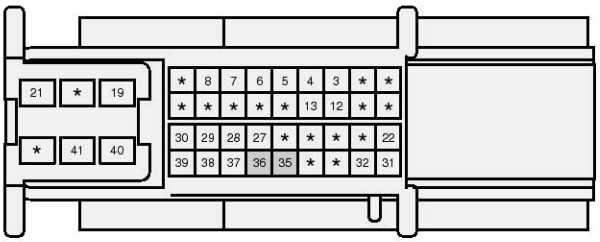
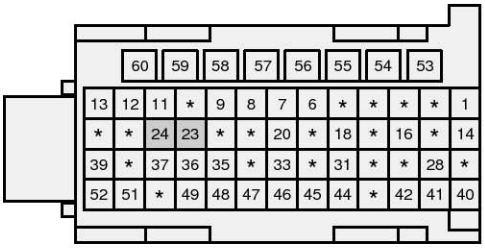
<RAM>



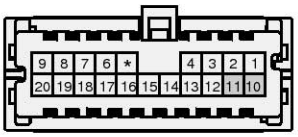
35. Low
36. High

<FAM>



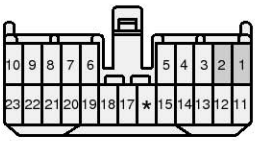
23. Low
24. High

<PDM>



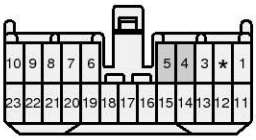
10. Low
11. High

<DDM>



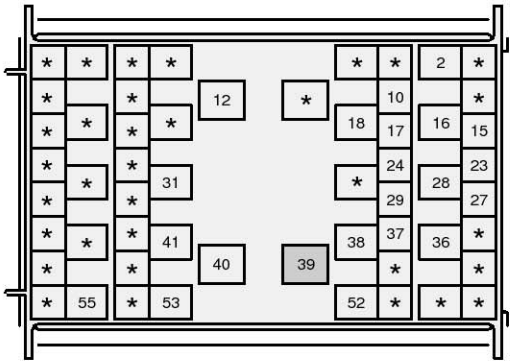
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

https://autolibrary.ir

https://autolibrary.ir

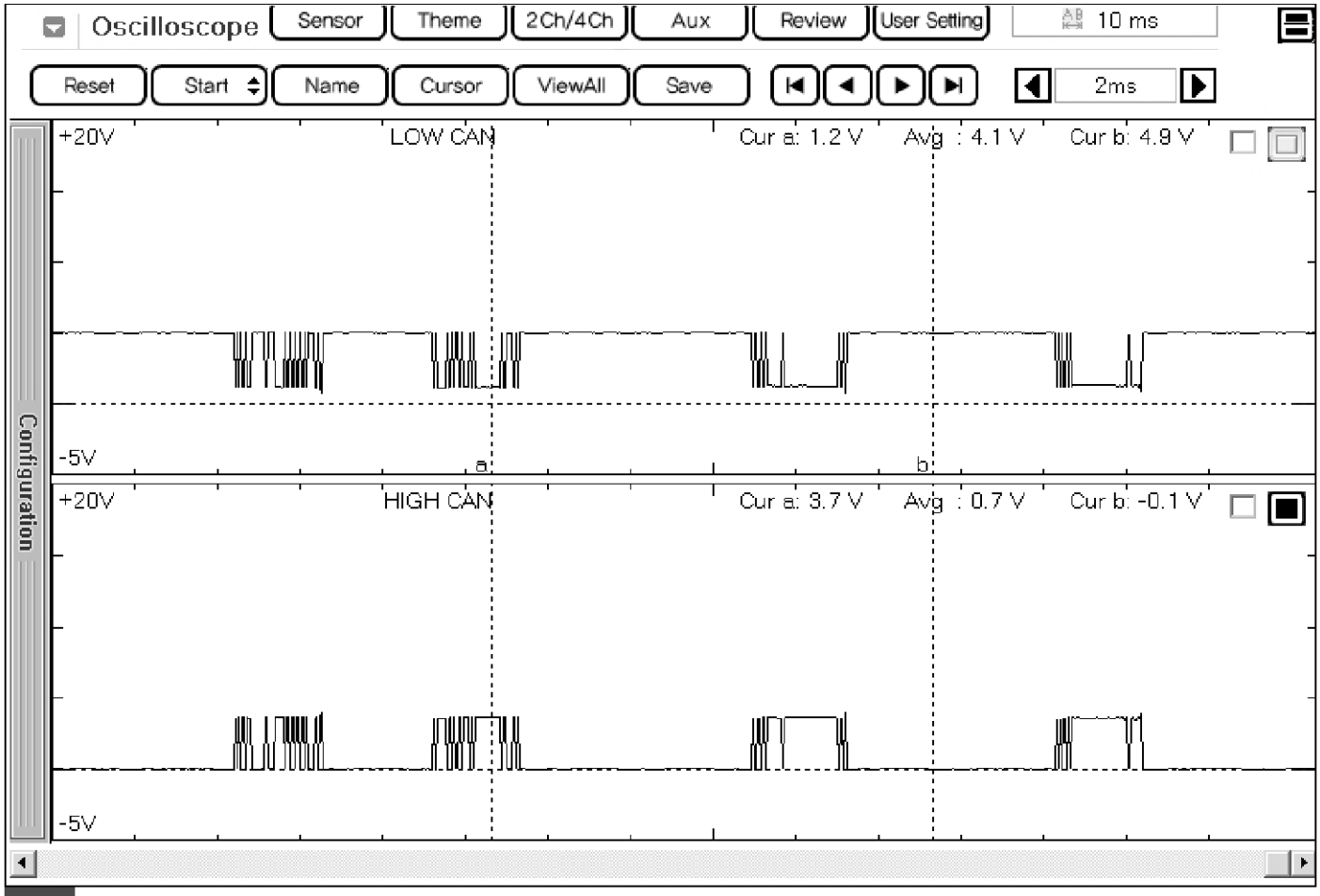


Fig.1

SHMBE9C04L

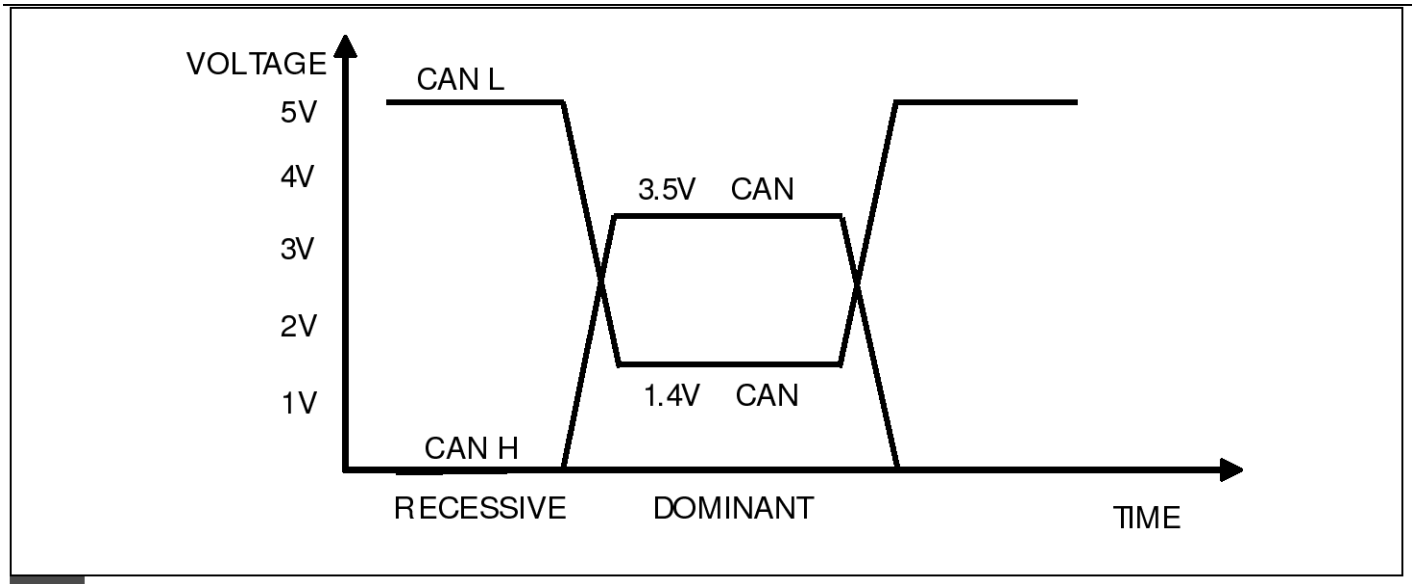


Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

■ **Check DTC**

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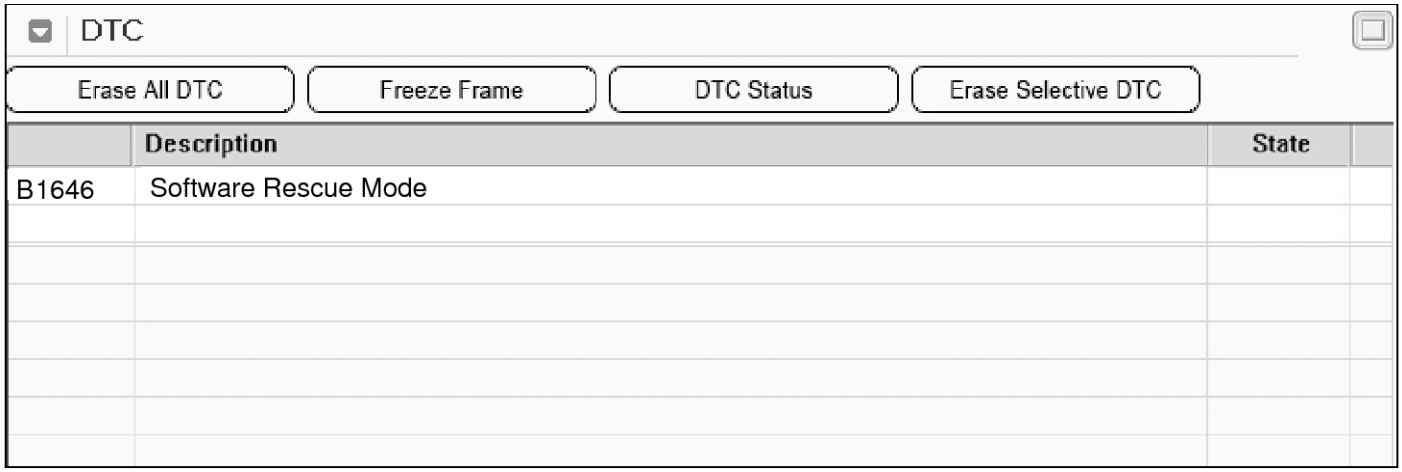
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C22L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or IPM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of CAN communication in IPM.

1. Replace with a known-good IPM after removing installed IPM.
2. Connect GDS.
3. IG "ON" and engine "OFF".
4. Select "DTC Analysis" mode.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

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NO ▶ System performing to specification at this time.

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B1681 Lost Communication Between BCM and PDM

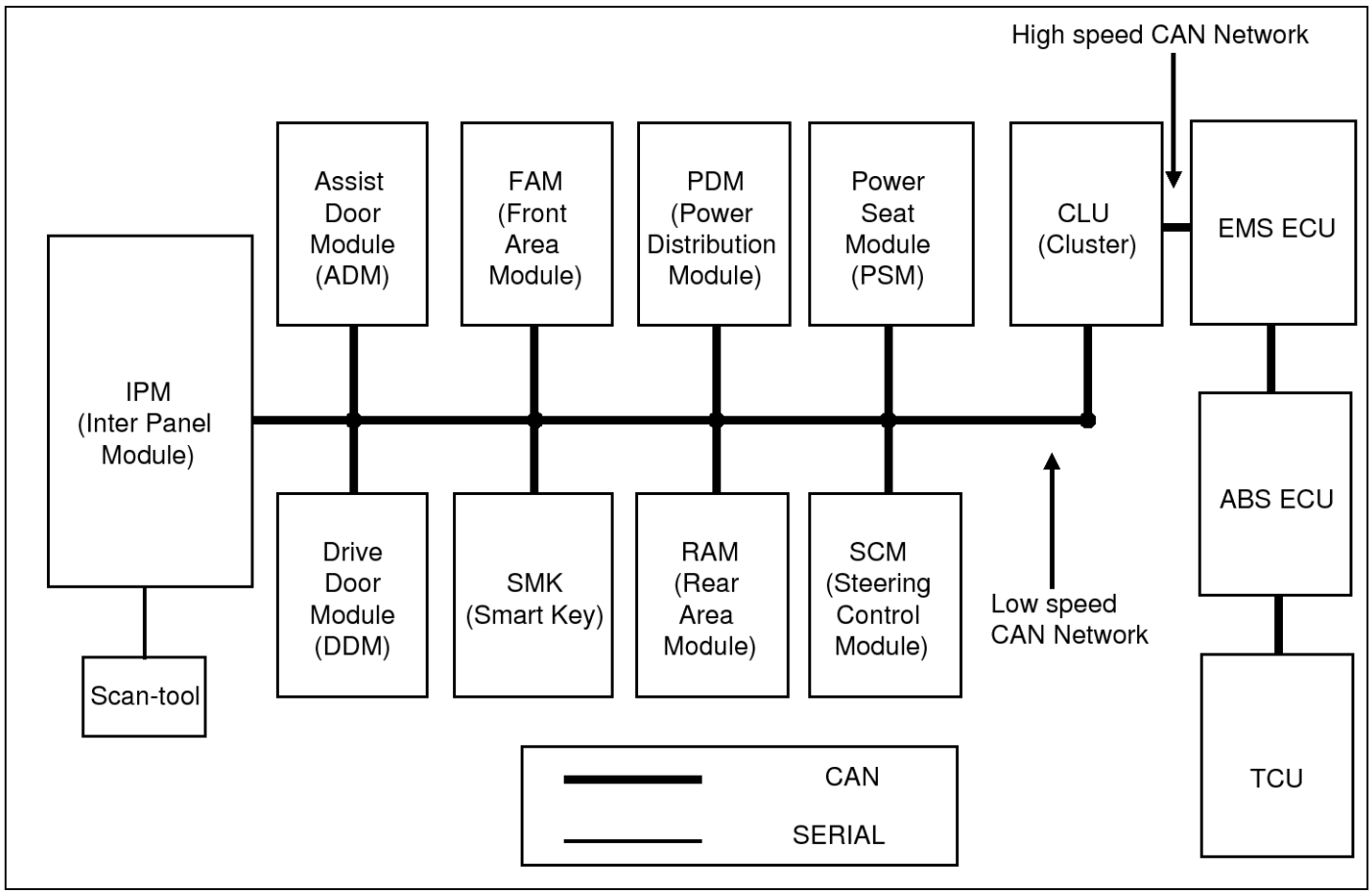
General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9C01L

DTC Description

This code is outputted when IPM can't receive data from PDM by CAN Line for 10 sec.

DTC Detecting Condition

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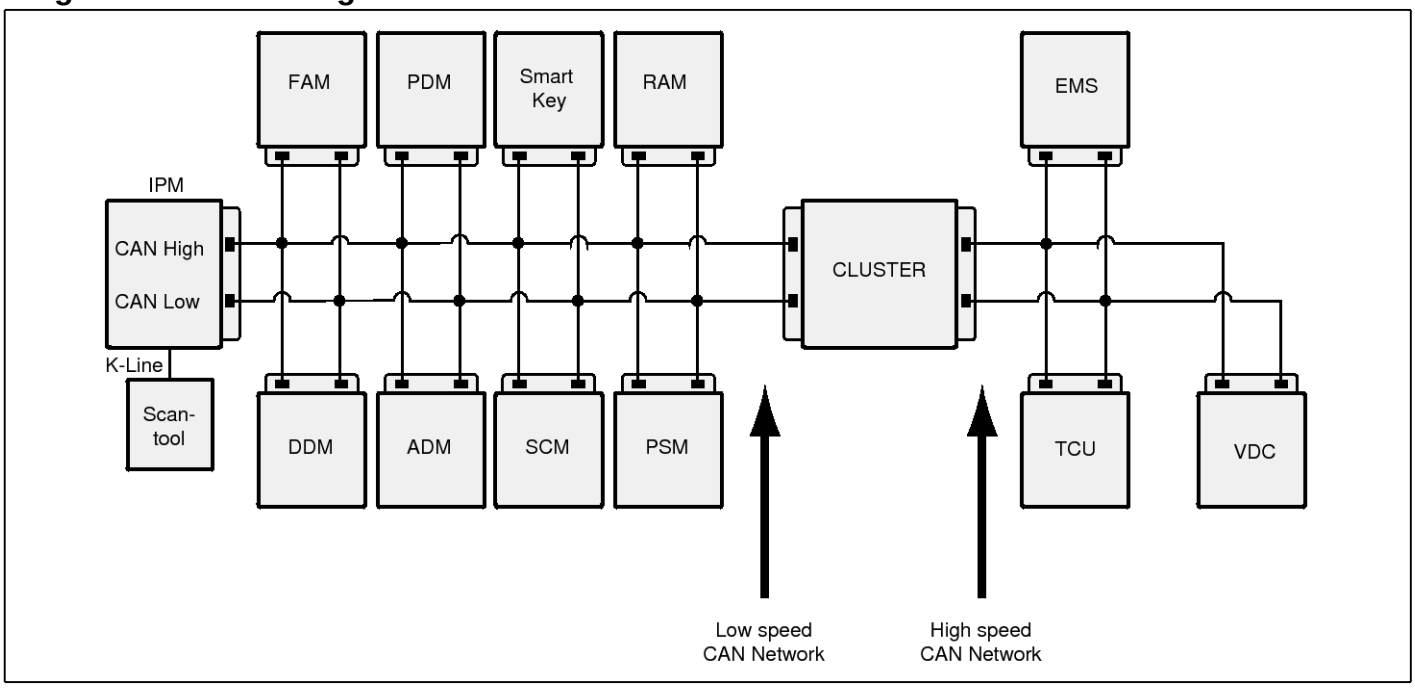
Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Comm. Check (IPM ↔ PDM)	• Check PDM connection • Check fuse related PDM • Check open in CAN high/low circuit of PDM • Check open in CAN high/low circuit of CLU
Enable Conditions	• IPM power on	
Threshold Value	• No message from CLU to IPM for 10 sec.	
Diagnostic Time	• 10 sec	
DTC Erasing Time	• DTC is erased immediately after receiving data from PDM.	

Diagnostic Circuit Diagram



SHMBE9C02L

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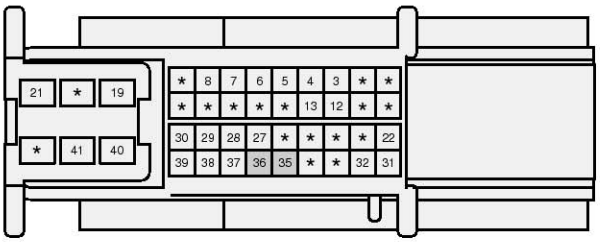
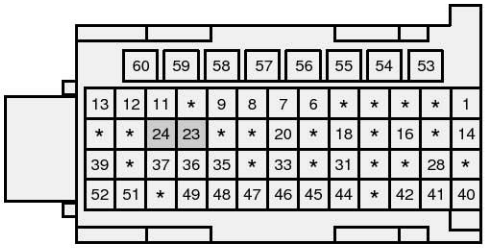
<RAM>



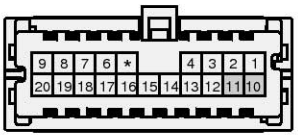
35. Low
36. High

<FAM>



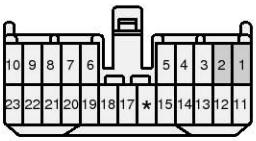
23. Low
24. High

<PDM>



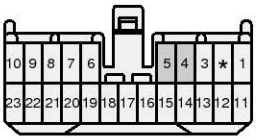
10. Low
11. High

<DDM>



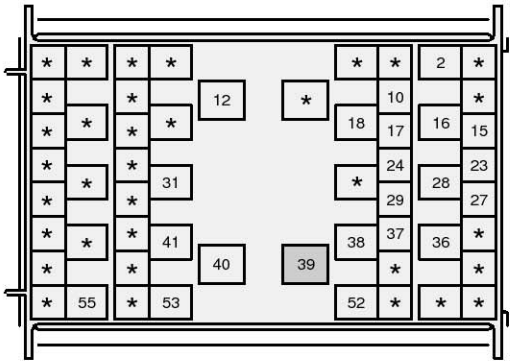
1. High
2. Low

<ADM>



4. High
5. Low

<IPM>



30. High
39. Low

SHMBE9C03L

Signal Waveform & Data

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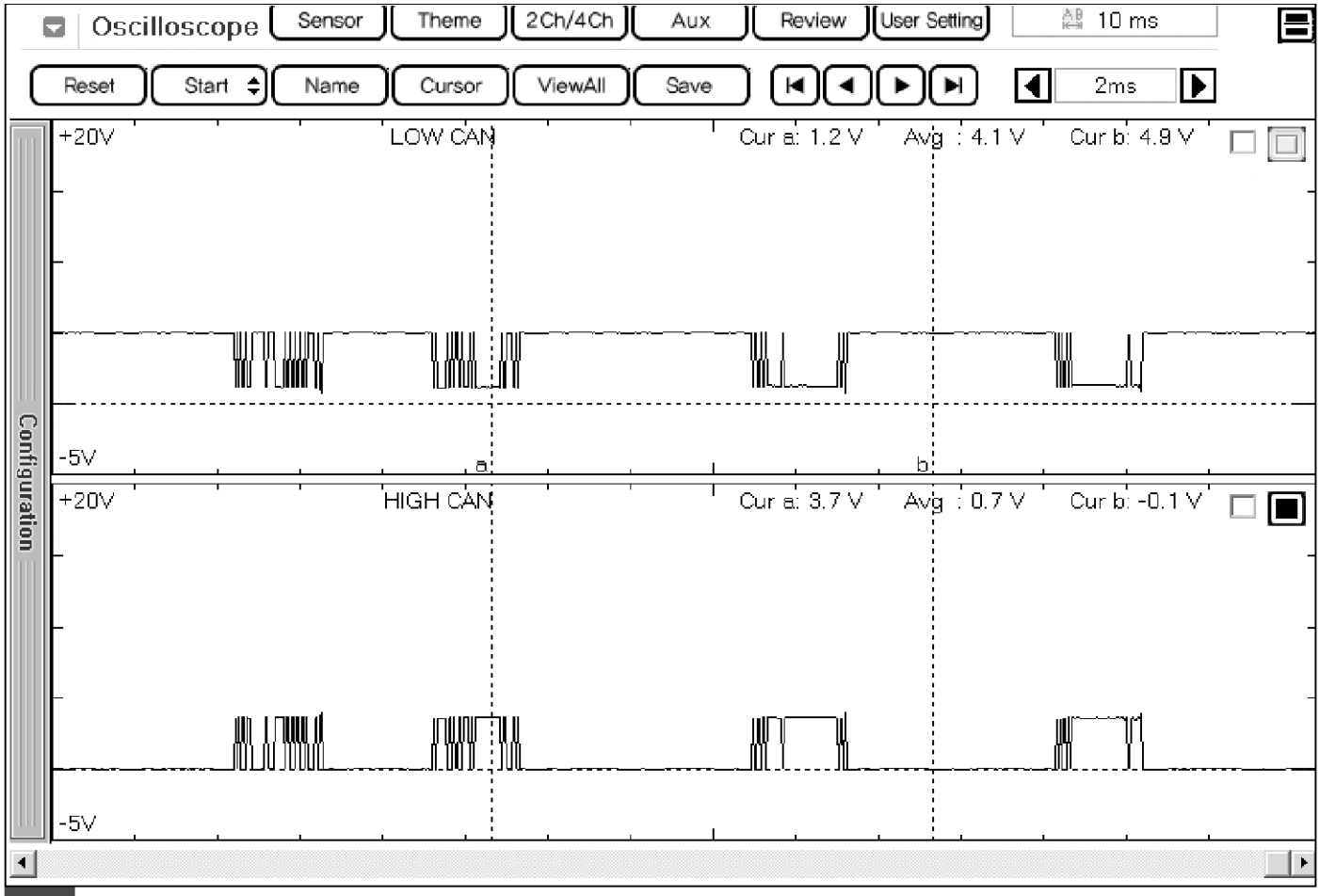

Fig.1

SHMBE9C04L

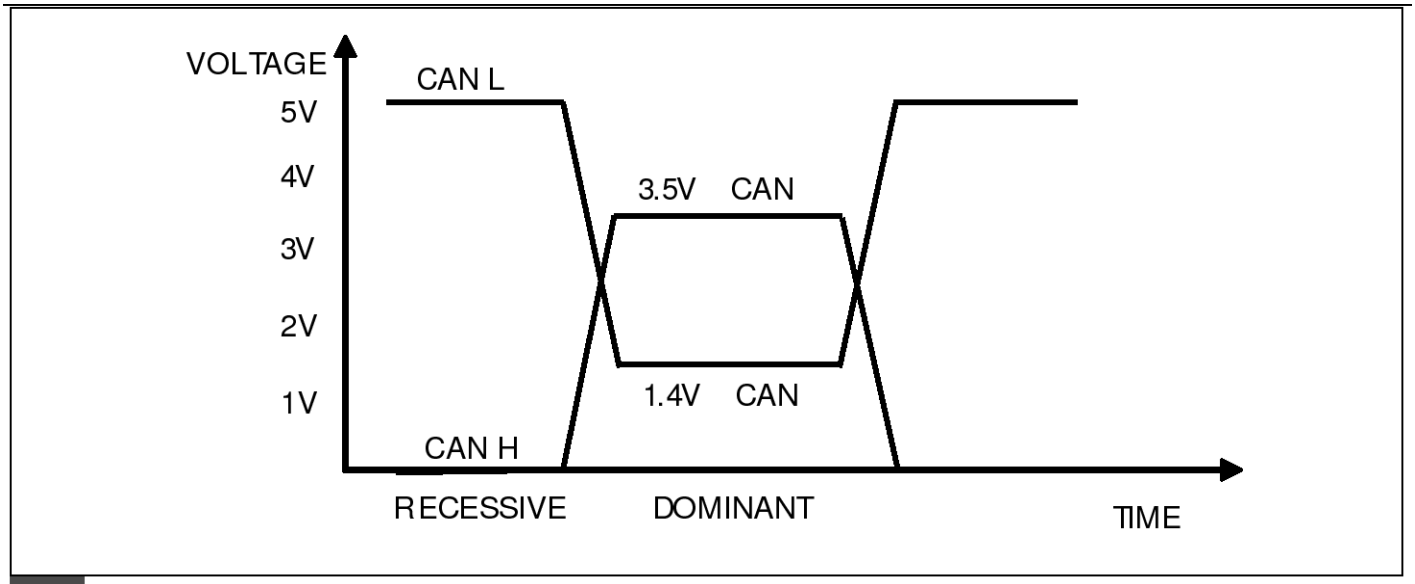

Fig.2

SHMBE9C05L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.

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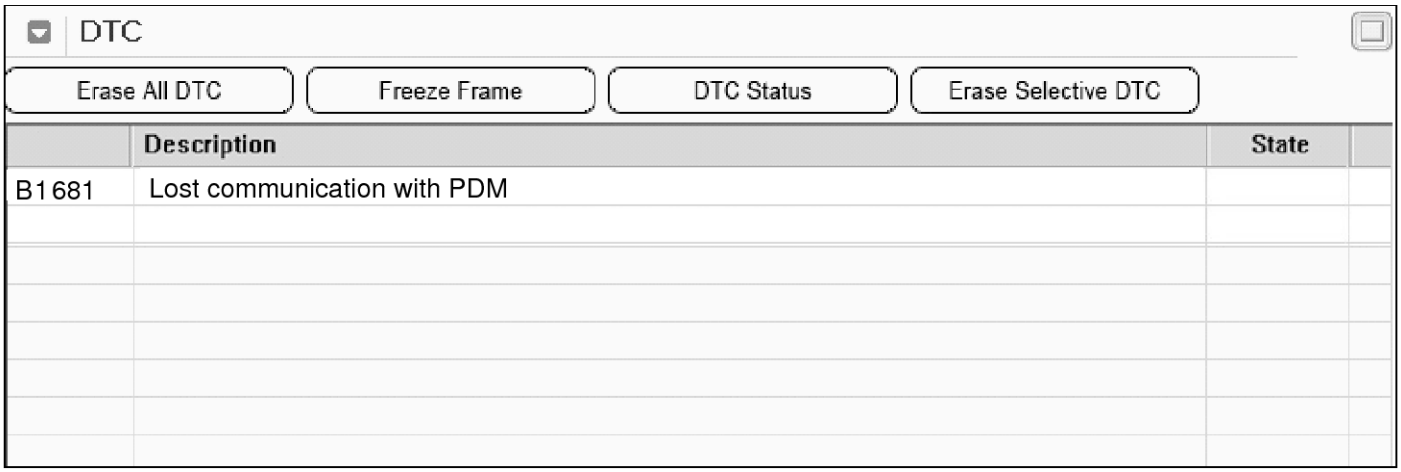
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9C12L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in IPM's and/or PDM's connector or was repaired and IPM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Signal Circuit Inpsection " procedure .

Signal Circuit Inpsection

1. Check CAN high circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of PDM CAN High line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN high circuit normal ?

YES ▶ Go to next procedure

NO ▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low circuit
   1) IG "ON" & ENG "OFF"
   2) Connect GDS and select Scope meter fucntion.
   3) Measure signal waveform of PDM CAN Low line.

Specification : Refer to signal waveform and data

   4) Is the measured signal waveform of CAN low circuit normal ?

YES ▶ Go to "Component Inspection" procedure.

NO ▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

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Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect PDM and monitor DTC to find the cause.
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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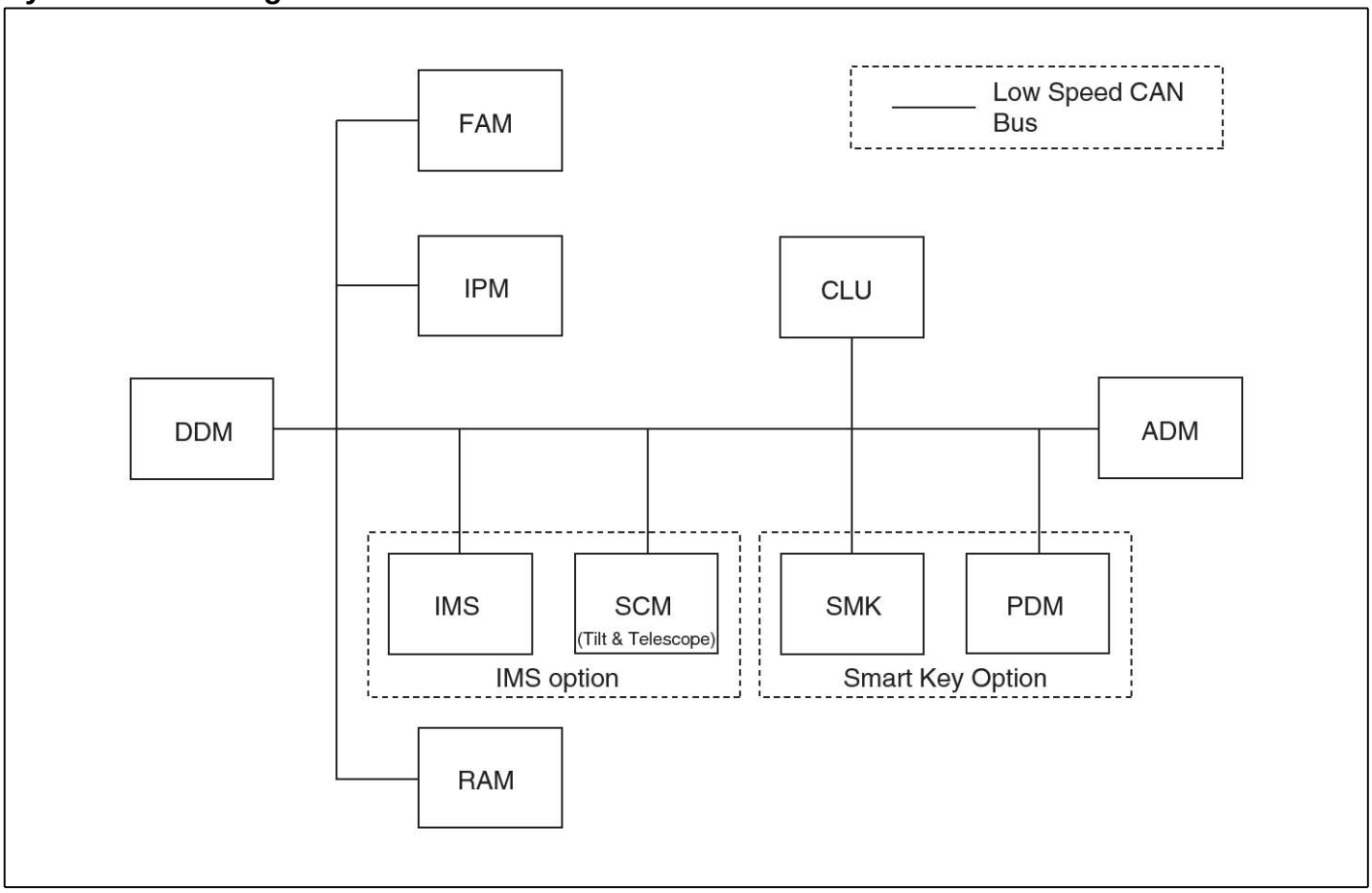
Body network system

Driver Door Module (DDM)

System Block Diagram



SHMBE9072L

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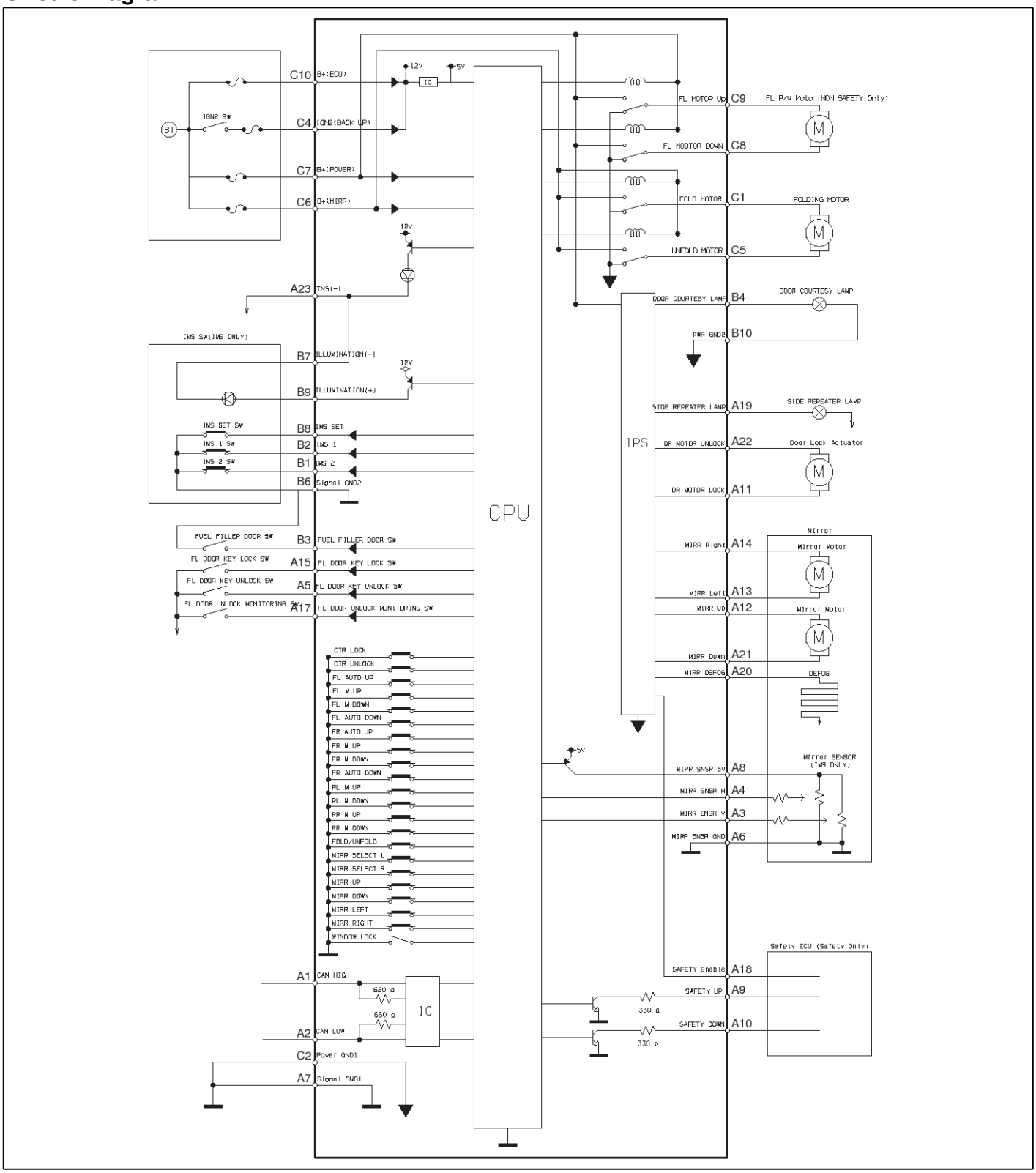
Circuit Diagram



SHMBE9279N

※ Connector pin information

- Refer to the power window switch - "component"

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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

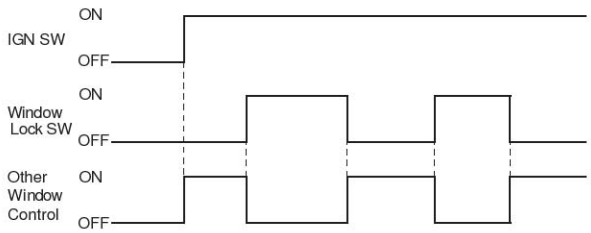
1. According to the input at DR as window manual up/down, RL window manual up/down, RR window manual up/down Switch of the SW ASSY P/WDW main, the inputted signal will be sent out (ADM, RAM) through CAN Communication. Simultaneously, DDM will send out manual up/down, auto up/down signal.

   (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.

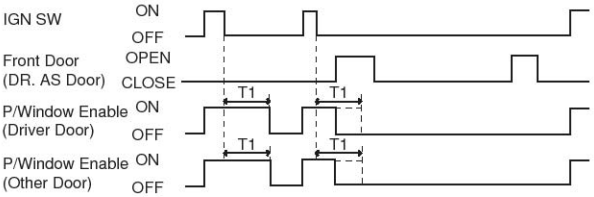
(Message: Power Window Lock Sw Sts = LOCK)



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

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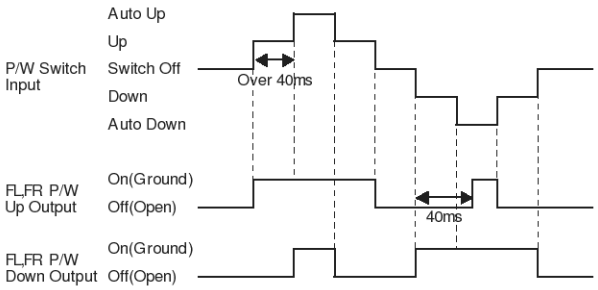
Safety Power Window

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 :AD Window Ctrl)
2. P/WDW main SW (DDM) control signal of down, auto up, auto down.



SHMBE9282N

Power Window control

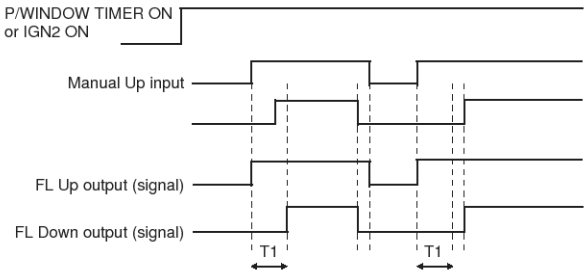
1. P/Window enable signal on condition
   - P/Window timer(from IPM) ON or IGN2 (DDM itself) ON

     (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

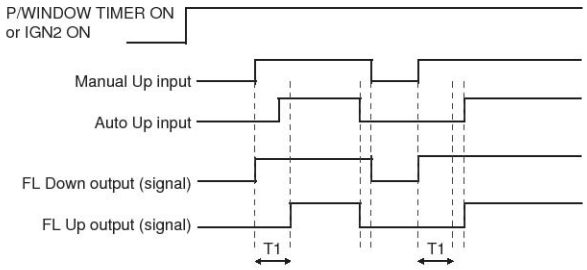
* P/WINDOW TIMER(FROM IPM) OFF & IGN2(DDM ITSELF) OFF, independently of Switch's state UP SIGNAL and DOWN SIGNAL are OFF state preservation

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

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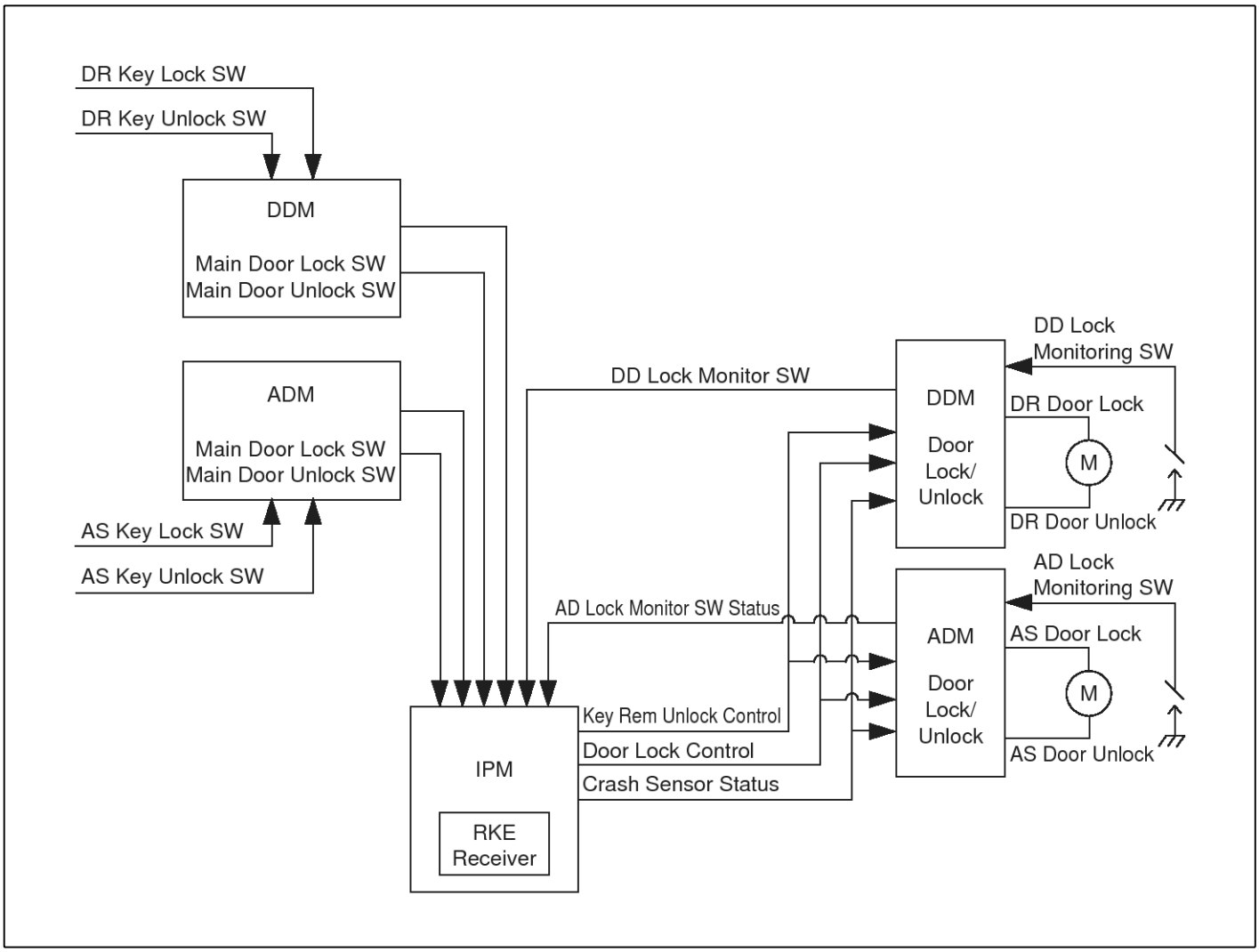
Door Lock/Unlock (controlled by IPM)



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

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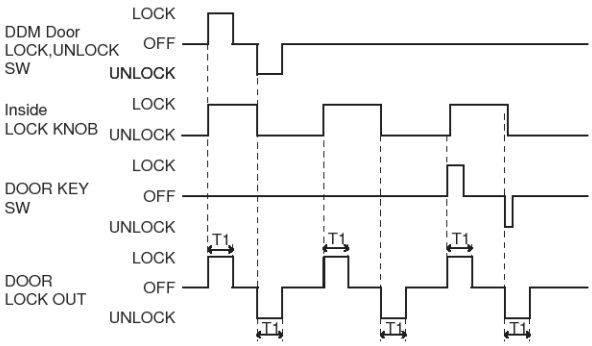
Assist Door	Key Cylinder	Lock	All Door Lock
		Unlock	All Door Unlock
	Knob	Lock	No Action
		Unlock	No Action
	Main SW (P/WDW SW)	Lock	All Door Lock
		Unlock	All Door Unlock
RKE		Lock	All Door Lock
		Unlock	All Door Unlock

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.

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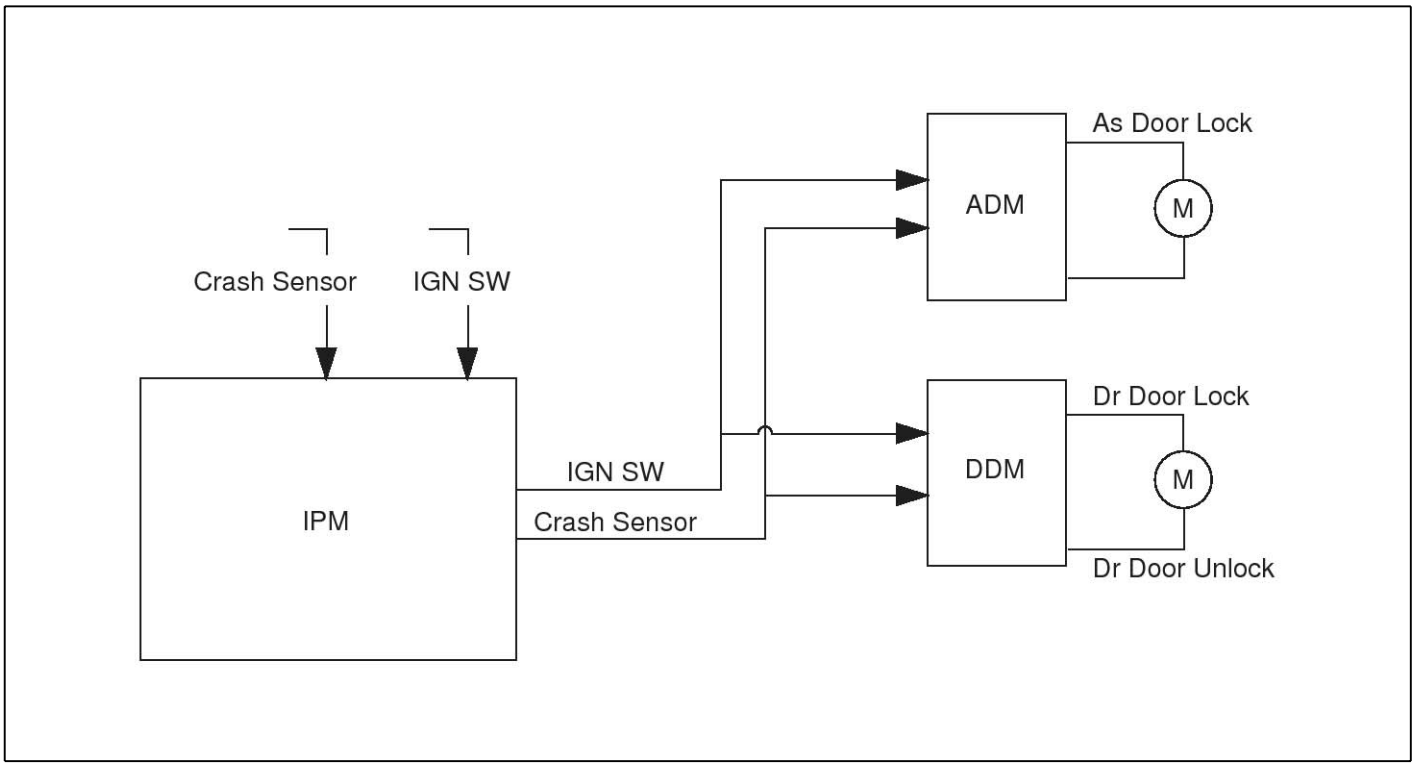
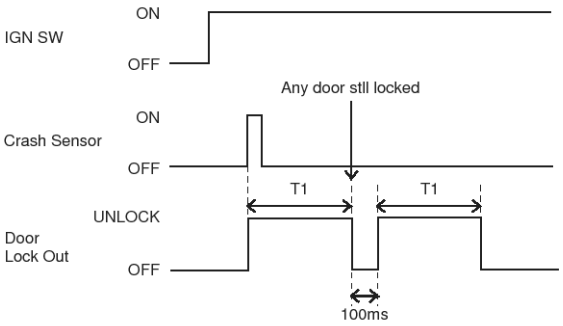
Crash Unlock (controlled by DDM)



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

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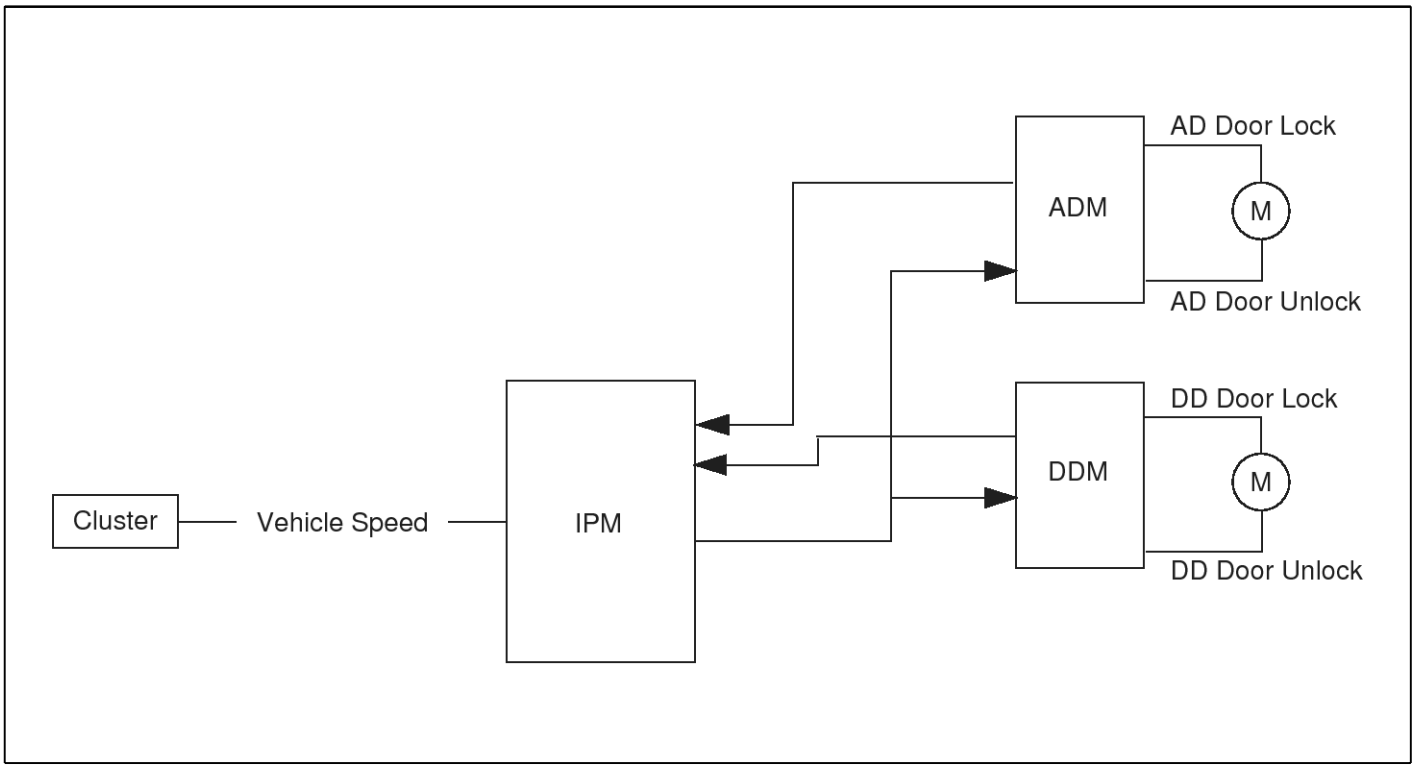
Auto Door Lock



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"

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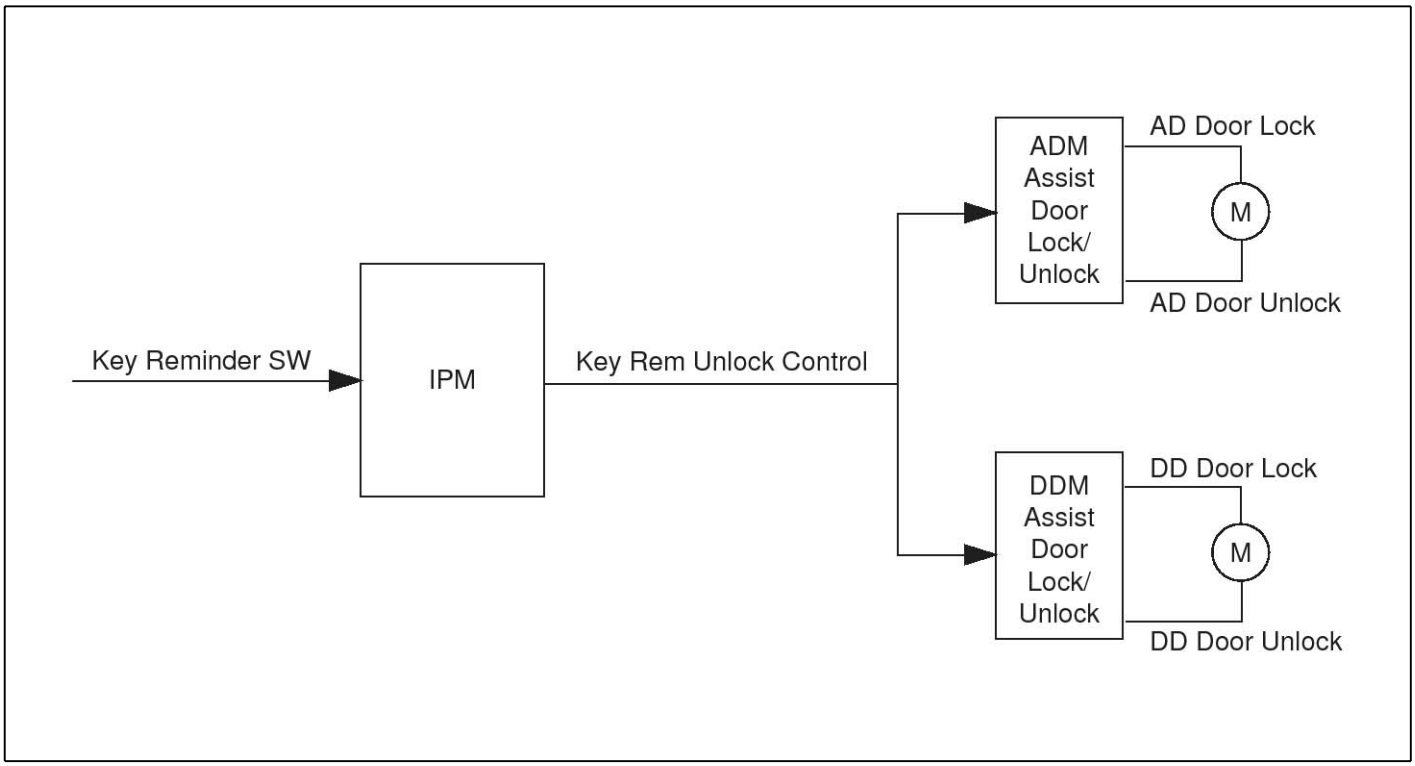
Key Reminder Unlock



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)

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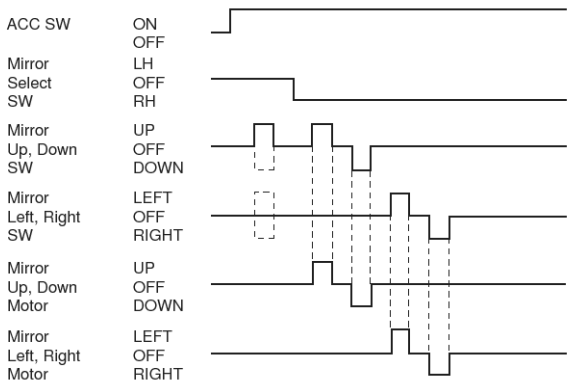
Outside Mirror

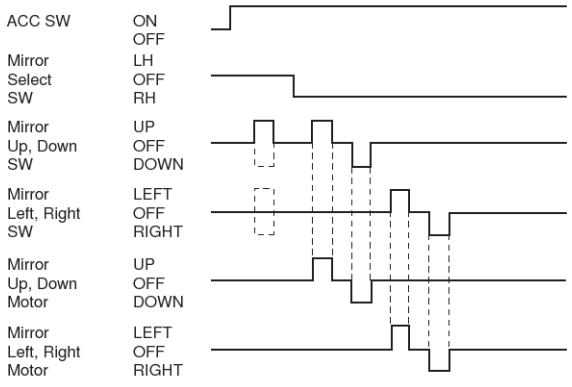
Manual Control

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.



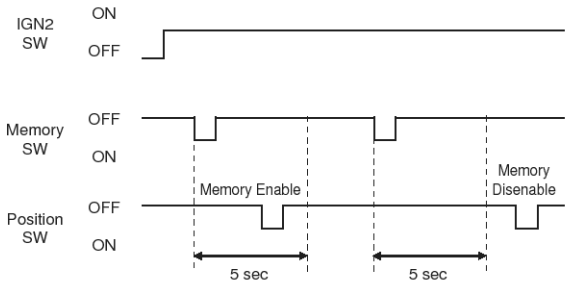
SHMBE9292N

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



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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)

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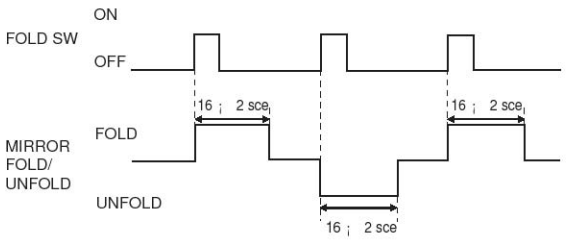
Reminder Operation By Memory Switch

1. When the each position switch is pressed at the ON state of the IGN2 or B+ (drive door open or for 30 seconds after drive door close), the mirror shall be positioned according to the memorized value.
2. If the position switch (POS1 or POS2) has not been memorized, then the reminding operation shall not be performed.
3. During reminding operation, if a position switch (POS1 or POS2) is pressed, then the latest pressed switch shall govern the reminding operation.
4. Prohibit Condition for the Reminding Operation
   - When the mirror manual switch is being operated.
   - If "Ignition Sw Sts" of the CAN communication data sent by the IPM is not "Run"

     (On condition of ACC is “off”, be able to remind during drive door open or for 30 seconds after drive door close)
   - 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

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)

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- 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.

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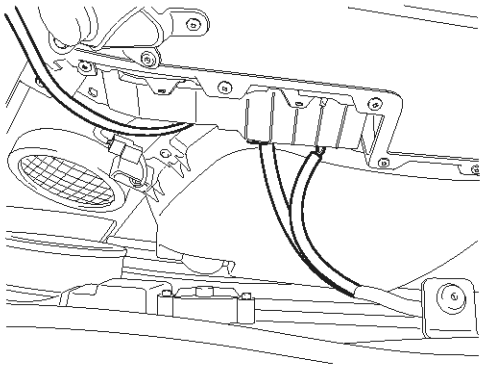
2. When entering RESCUE MODE, It moves as the next.
   - Door Unlock it's on for 0.5 seconds.
   - OSRVM Defogger, It's on for 20 minutes.
   - Illumination is much on.
   - The another function is identical with NORMAL MODE movement.
3. When Inhibit Sw Sts message is OFF/ACC or IGN SW is off and CAN 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.

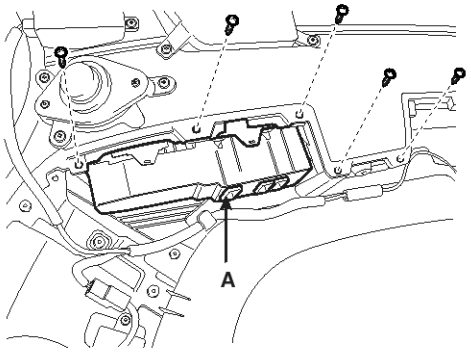
Power window Main SW Input Filtering Time

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

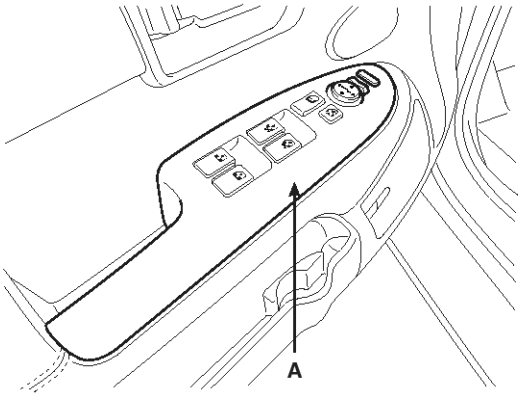
1. Disconnect the negative battery terminal.
2. Remove the front door trim panel. (Refer to the Body group - Front door)
3. Remove the door module (A) mounting screws (5EA) after disconnecting the connector (3EA) from the module.





SHMBE8141D

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.

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Diagnostic troubleshooting

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

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B1603 CAN Bus Off

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*1 line.

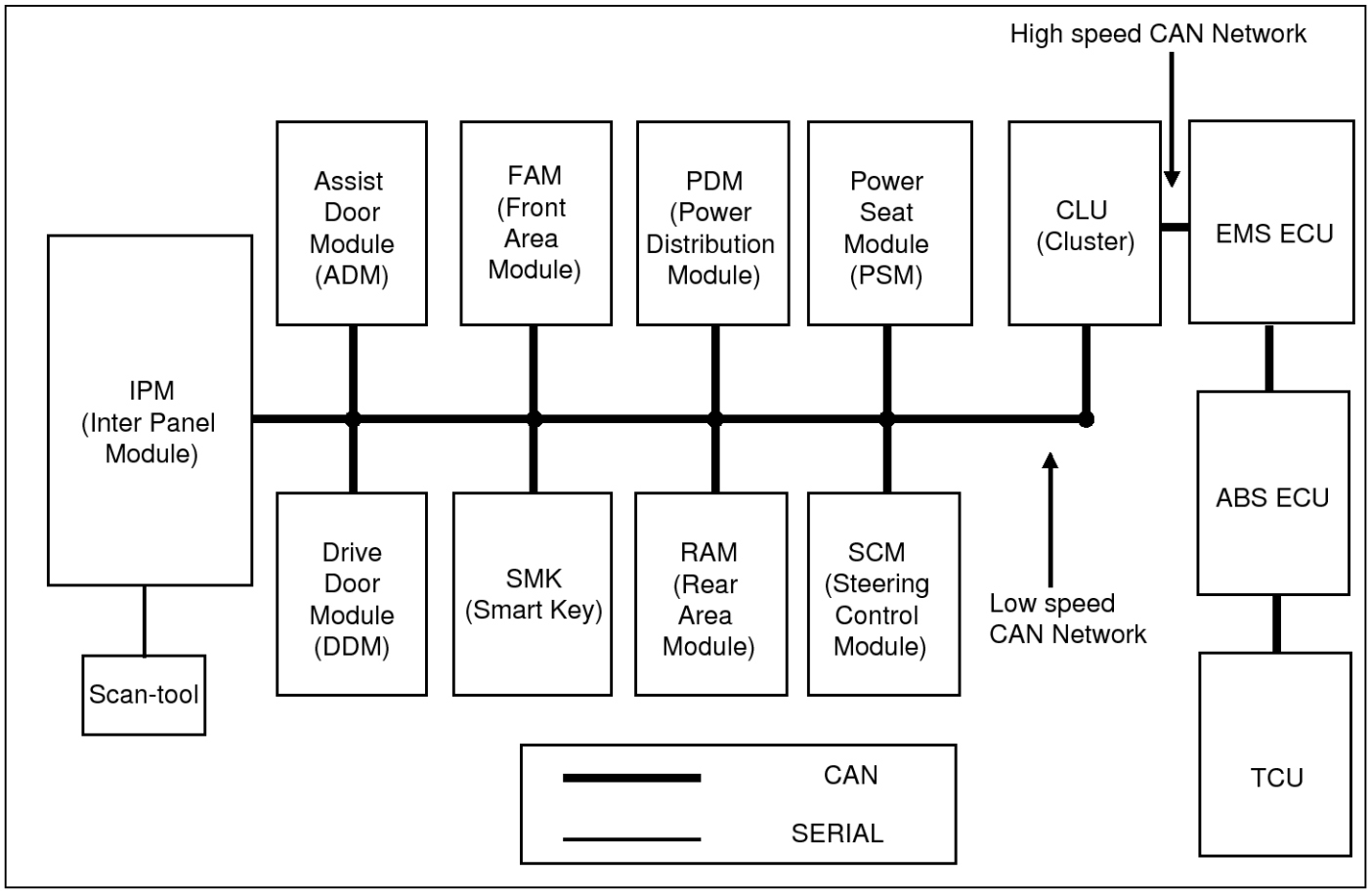
They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



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DTC Description

This is DTC which is related with communication error between IPM and other units. (※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

)DTC is set when short circuit between CAN high and low, which is connected to CAN IC in DDM, is short to

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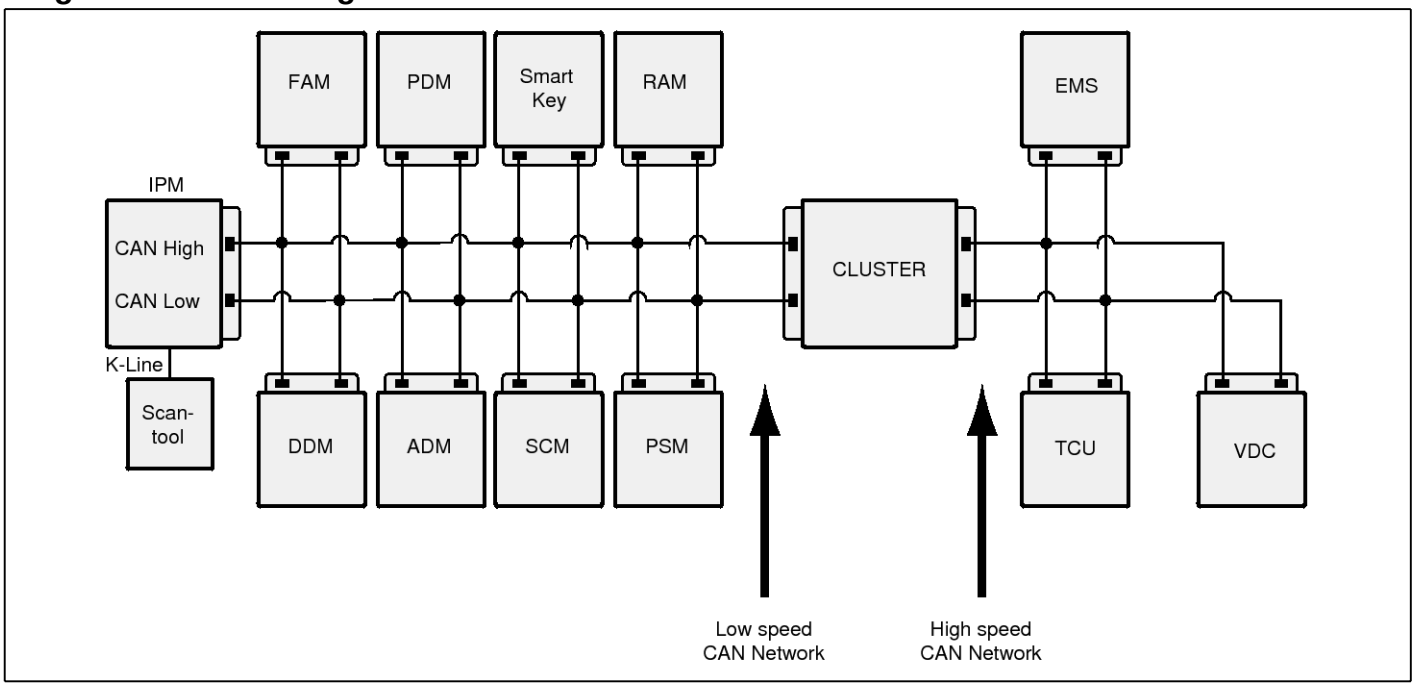
ground or battery. And, If Data can not be transferred, however, Data receiving is possible, via CAN line because of Software and Hardware failure of CAN.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN commumication Line Check	• Short to battery or ground in C-AN high circuit. • Short to battery or ground in C-AN low circuit. • Short circuit between CAN low and CAN high • Poor Connection or Open in C-AN low and CAN high circuit.
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key	
Threshold Value	• CAN high /low : 0 V or B+	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram



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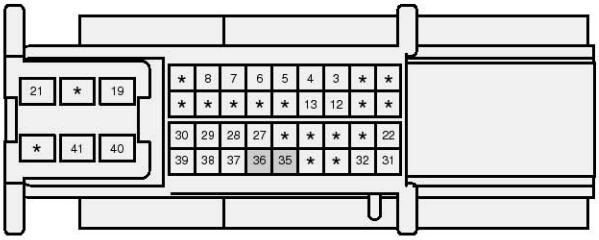
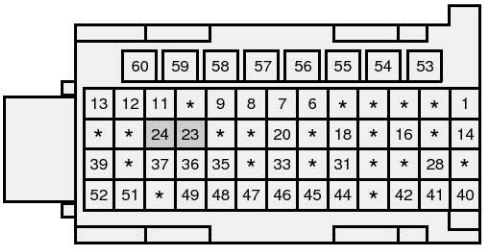
<RAM>



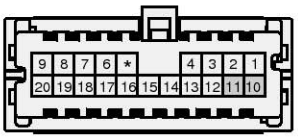
35. Low
36. High

<FAM>



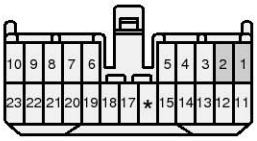
23. Low
24. High

<PDM>



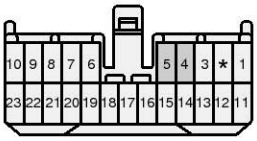
10. Low
11. High

<DDM>



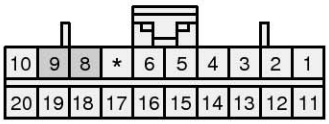
1. High
2. Low

<ADM>



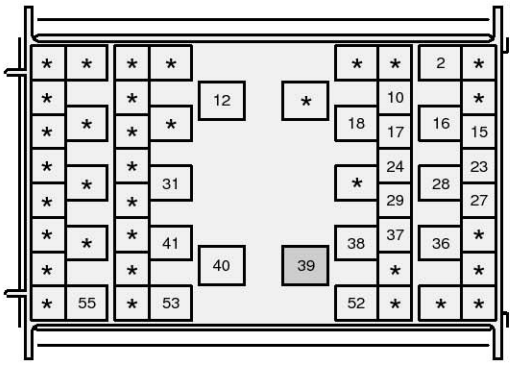
4. High
5. Low

<SCM>



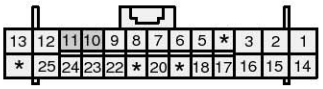
8. High
9. Low

<IPM>



30. High
39. Low

<SMART KEY CONTROL MODULE>



10. HIGH
11. LOW

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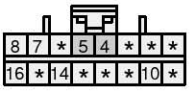

4. HIGH
5. LOW

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Signal Waveform & Data

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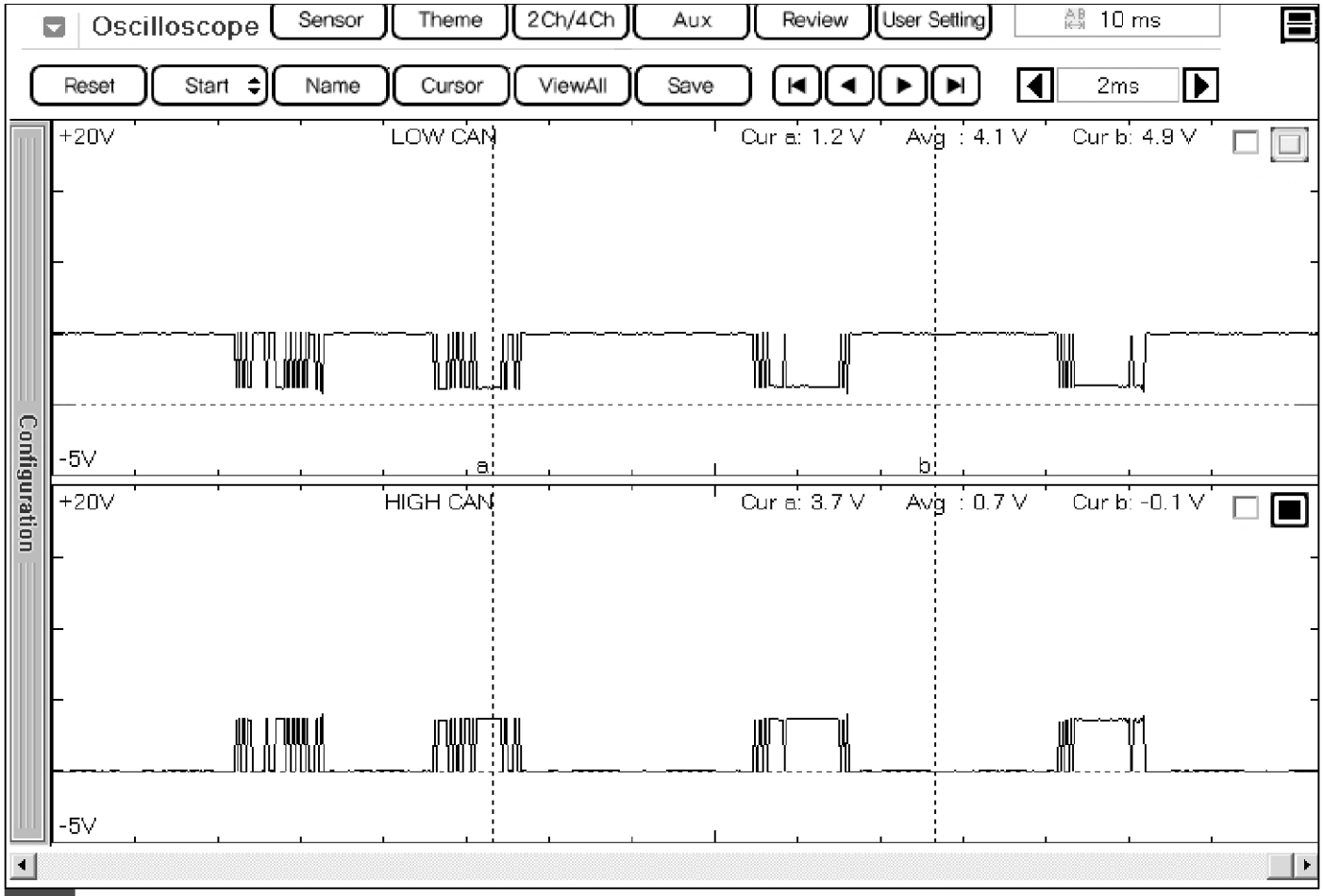

Fig.1

SHMBE9E01L

Fig 1) CAN Low/High Signal Waveform

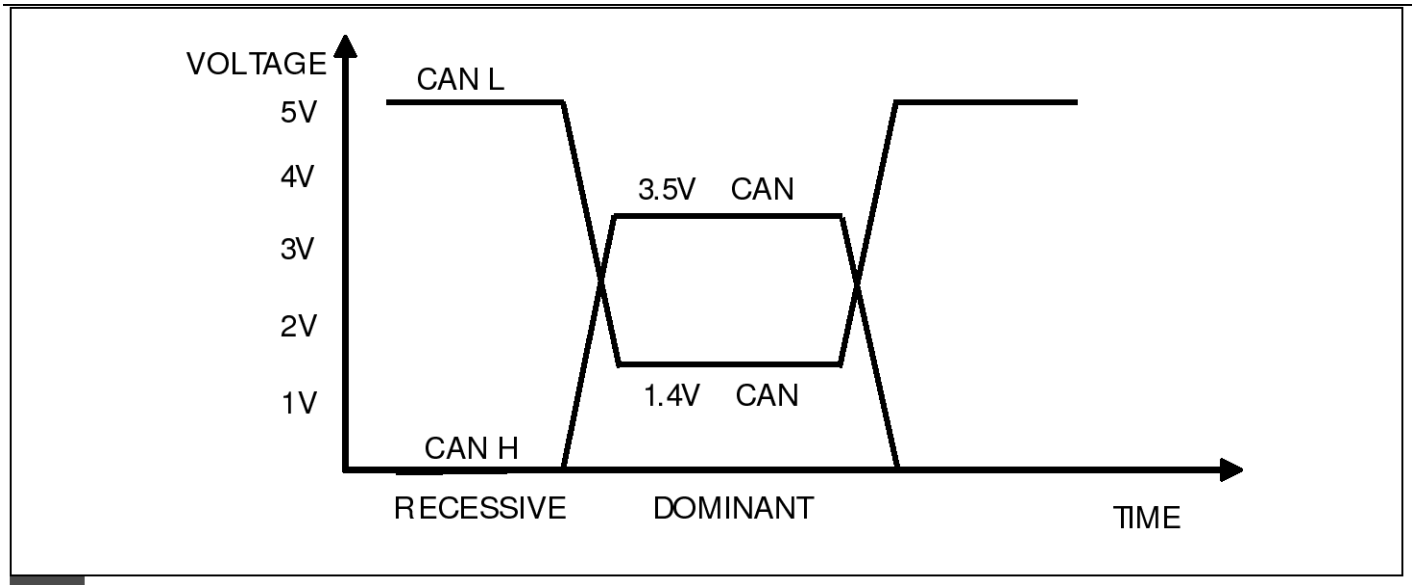

Fig.2

SHMBE9E02L

Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

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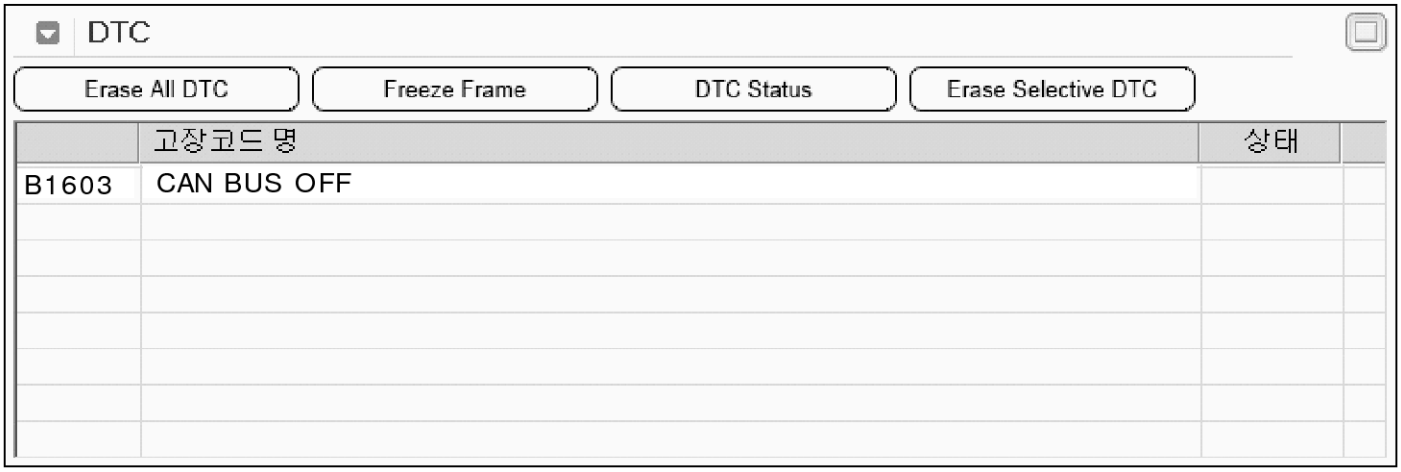
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



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5. Is the same DTC occurred again?

YES ▶ Go to "Terminal and Connector Inspection" procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or DDM's connector or was repaired and DDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect CAN communication units one by one and monitor DTC to find the cause.

   *CAN communication units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), RAM(Rear Area Module), SMK(Smart Key)
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.

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2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1910 Outside Mirror - Left Horizontal Motor or Sensor Error

General Description

L/H Mirror is controlled by pressing direction switch (UP, DOWN, LEFT, RIGHT) with IG ON after L/H Mirror is selected by Power Window Main Switch.

DTC Description

DDM sets DTC when there is no movement signal from positioning sensor in drive mirror.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Current detection at horizontal driving motor IC	• Short to ground in horizontal driving motor of driver side outside mirror • Faulty Driving motor
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current is detected over 2.5A at Horizontal Driving Motor IC in Driver side Mirror	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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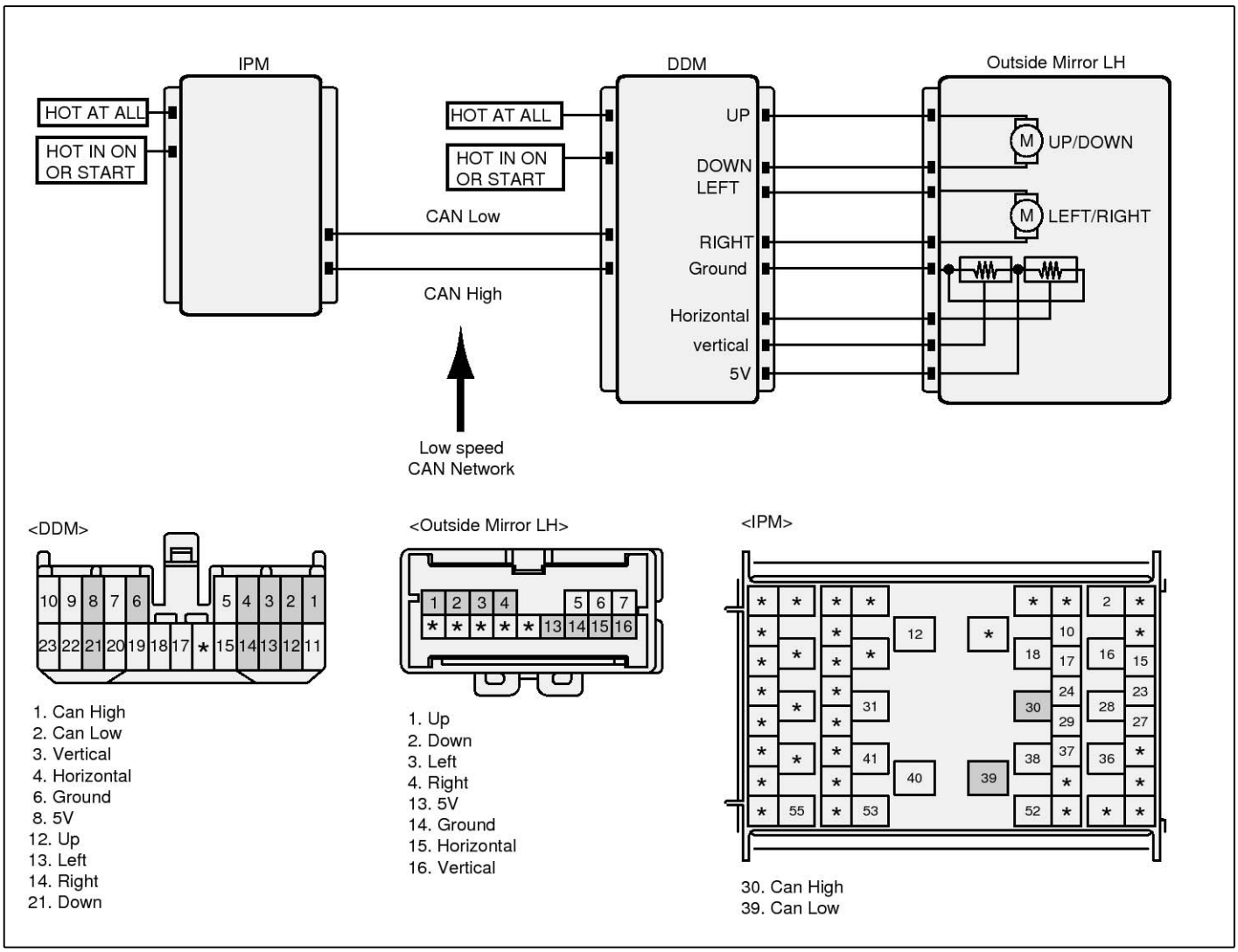

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Signal Waveform & Data

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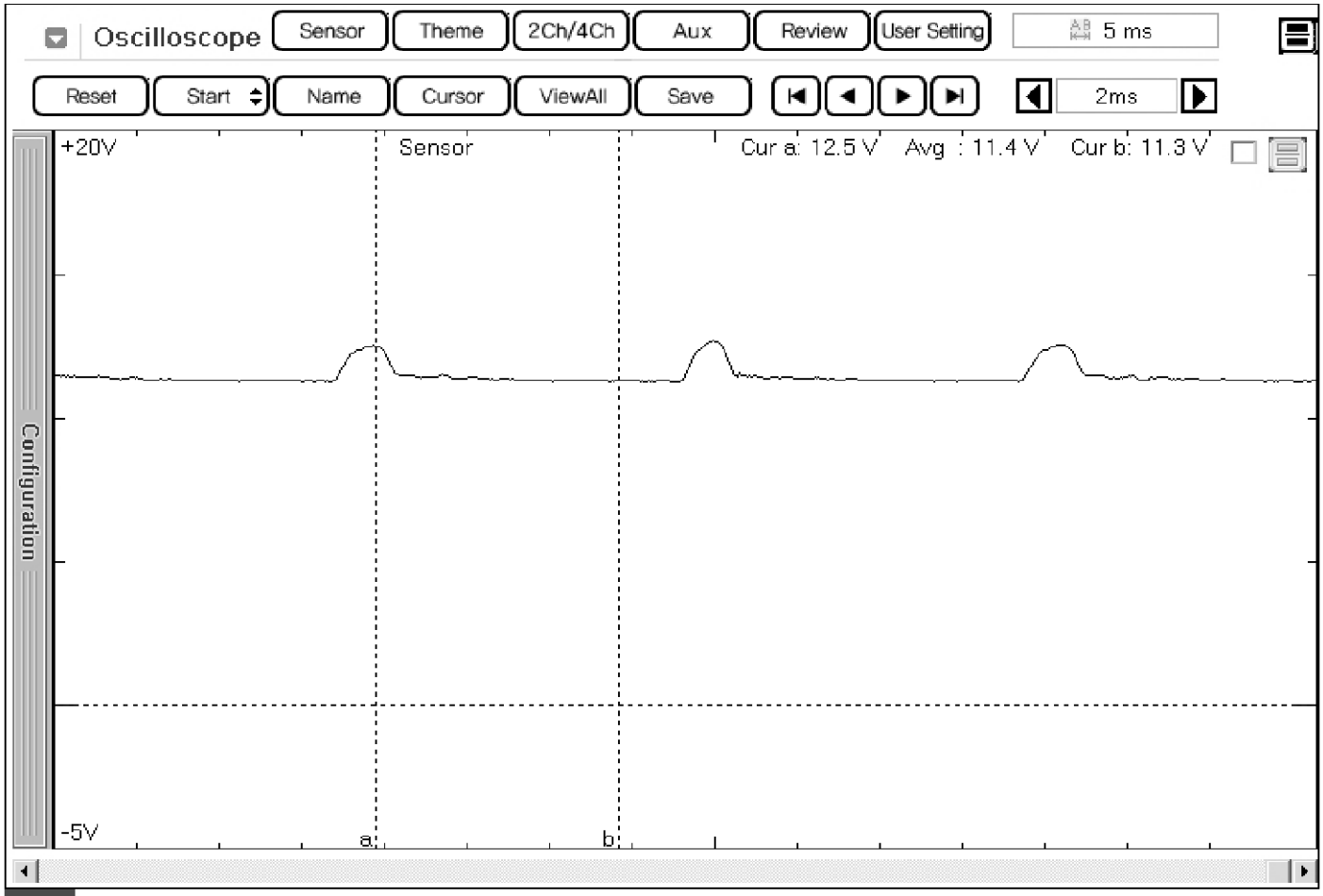

Fig.1

SHMBE9E04L

Fig 1) Signal Waveform of Horzontal motor/sensor of Driver side rear view

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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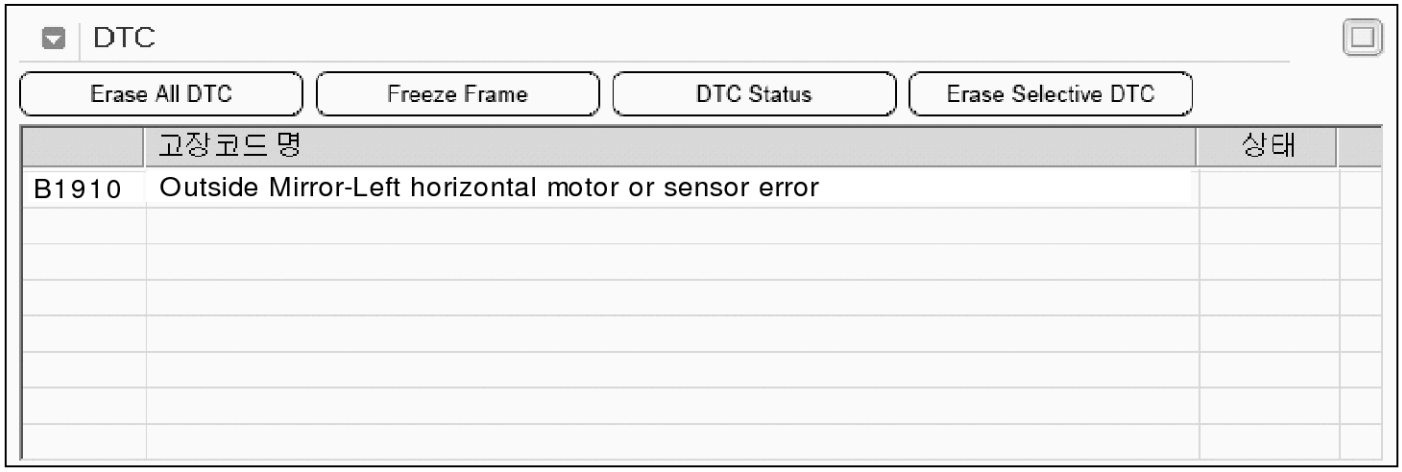

SHMBE9E08L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or DDM's connector or was repaired and DDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Check mirror motor

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "LH Outside Mirror (LEFT, RIGHT)" test.

Specification : Turned to pressed direction

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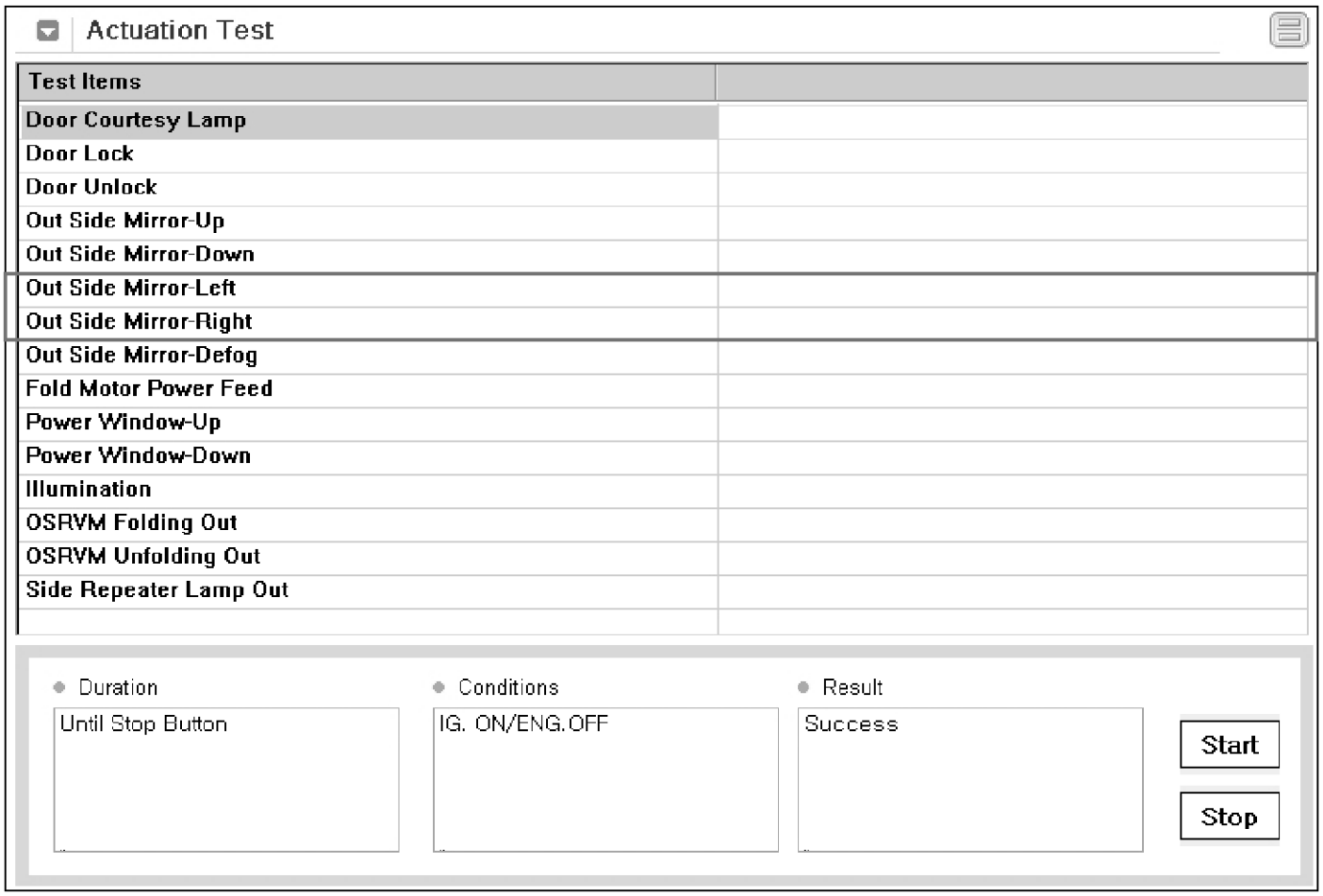

SHMBE9E09L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Drive Mirror Switch-Left" is turned to "Left or Right" when the control switch is pressed. (LEFT, RIGHT)

Specification : Service data is switched. (Left ↔ Right)

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Driver Door Unlock Switch	OFF	-
Key Cylinder Door Lock Switch	OFF	-
Key Cylinder Door Unlock Switch	OFF	-
Fuel Filler Open Switch	OFF	-
Ignition 2 Switch	ON	-
Power Window Lock Switch	OFF	-
Front Left Window Up Switch	OFF	-
Front Left Window Down Switch	OFF	-
Front Left Window Auto Up Switch	OFF	-
Front Left Window Auto Down Switch	OFF	-
Front Right Window Up Switch	OFF	-
Front Right Window Down Switch	OFF	-
Rear Left Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
Rear Right Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
IMS Mode1 Switch	OFF	-
IMS Mode2 Switch	OFF	-
IMS Set Switch	OFF	-
Outside Mirror Select Switch	LH	-
Outside Mirror Adjust	Right	-

SHMBE9E10L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.
If control line and power line from DDM are normal, replace an drive mirror motor(L/H).
If control line is normal, but power line from DDM is abnormal, replace a DDM.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF"
2. With controlling mirror with mirror switch of power window main switch, check voltage change(Input signal change) of terminal of horizontal sensor.

Specification : It is as same as the signal waveform and data

3. Is the measured signal waveform within specification ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check open or short in circuit of Mirror Vertical(LEFT/RIGHT) Sensor.
If the circuit of Mirror Horizontal(LEFT/RIGHT) Sensor is normal, replace the driver side mirror and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1911 Outside Mirror - Left Vertical Motor or Sensor Error

General Description

L/H Mirror is controlled by pressing direction switch (UP, DOWN, LEFT, RIGHT) with IG ON after L/H Mirror is selected by Power Window Main Switch.

DTC Description

DDM sets DTC when there is no movement signal from positioning sensor in drive outside rear view mirror.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Current detection at vertical driving motor IC	• Short to ground in vertical driving motor of driver side outside mirror • Faulty Driving motor
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current is detected over 2.5A at Horizontal Driving Motor IC in Driver side Mirror	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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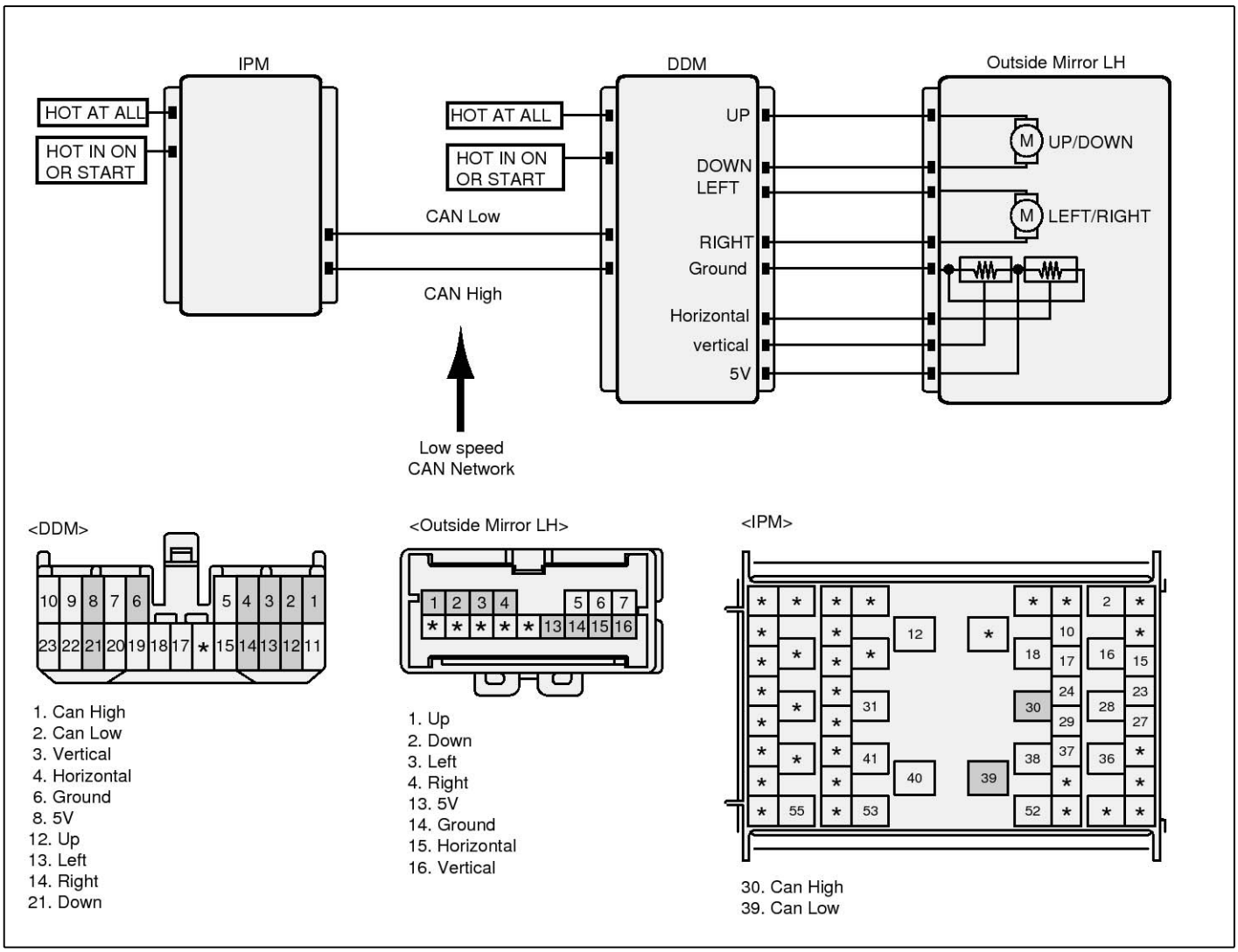

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Signal Waveform & Data

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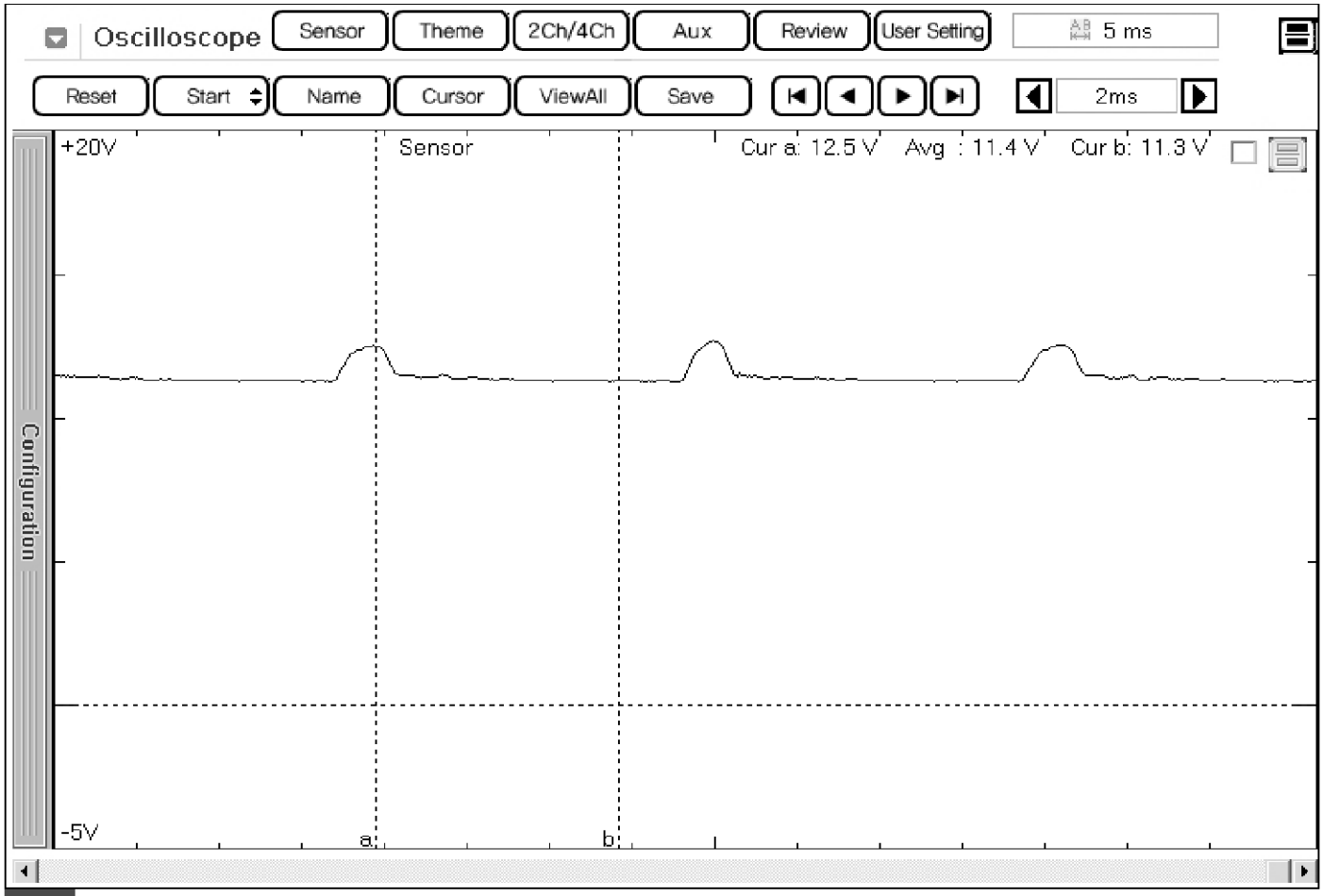

Fig.1

SHMBE9E04L

Fig 1) Signal Waveform of Vertical motor/sensor of Driver side rear view mirror

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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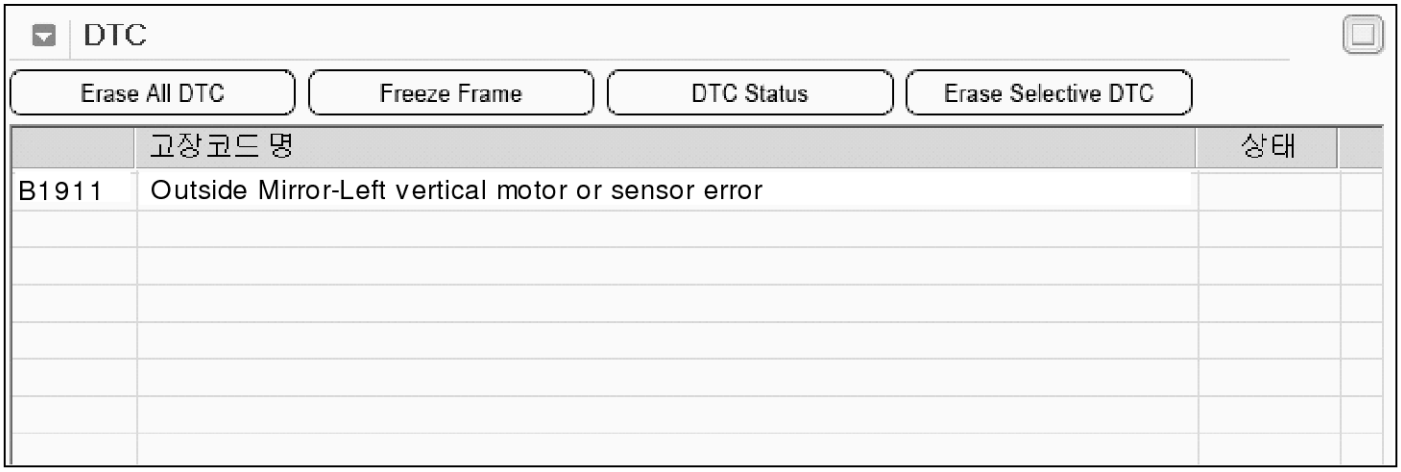

SHMBE9E05L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or DDM's connector or was repaired and DDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Check mirror motor

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "LH Outside Mirror (UP, DOWN)" test.

Specification : Turned to pressed direction

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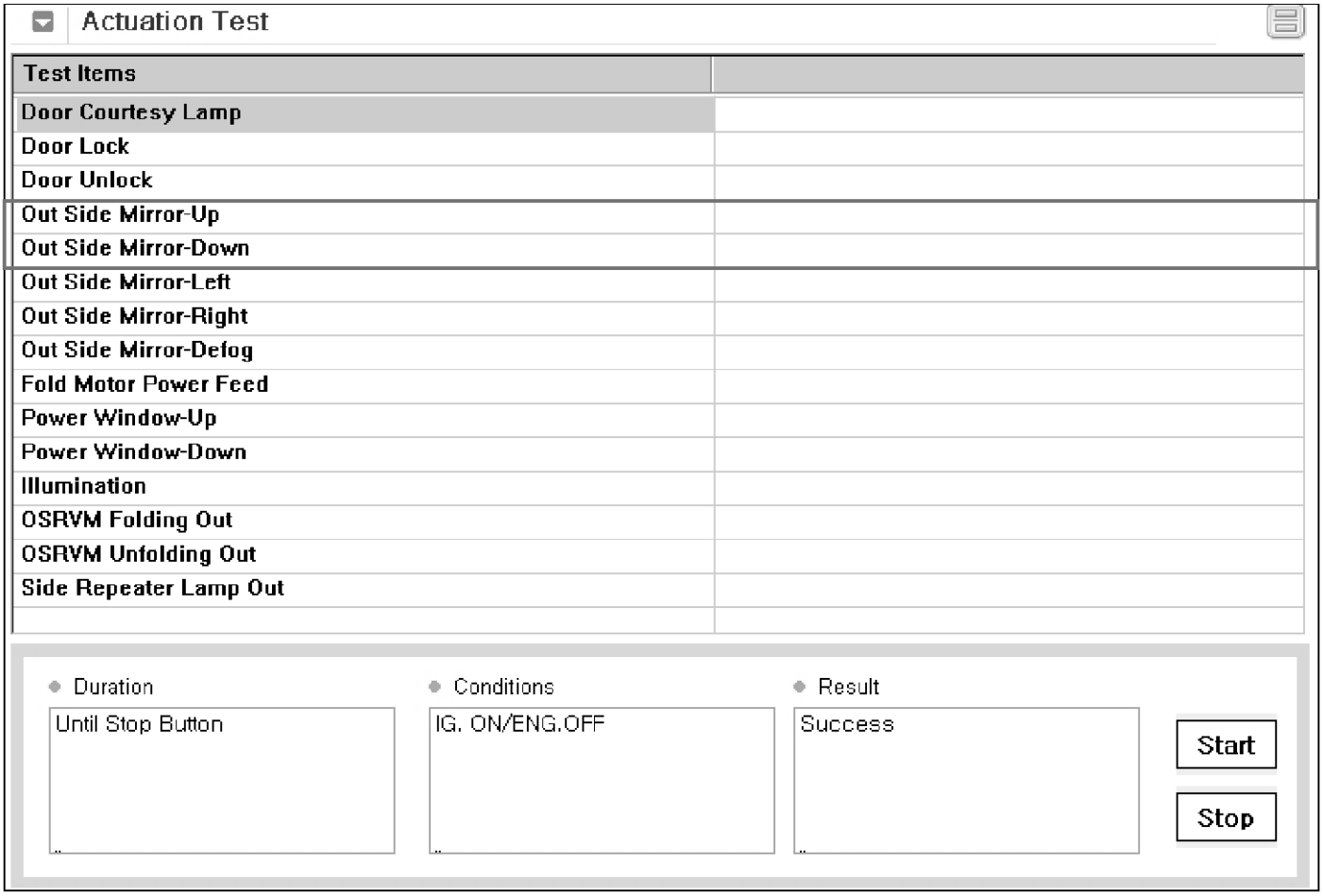

SHMBE9E06L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Drive Mirror Switch-Left" is turned to "UP or DOWN" when the control switch is pressed. (UP, DOWN)

Specification : Service data is switched. (UP ↔ DOWN)

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Driver Door Unlock Switch	OFF	-
Key Cylinder Door Lock Switch	OFF	-
Key Cylinder Door Unlock Switch	OFF	-
Fuel Filler Open Switch	OFF	-
Ignition 2 Switch	ON	-
Power Window Lock Switch	OFF	-
Front Left Window Up Switch	OFF	-
Front Left Window Down Switch	OFF	-
Front Left Window Auto Up Switch	OFF	-
Front Left Window Auto Down Switch	OFF	-
Front Right Window Up Switch	OFF	-
Front Right Window Down Switch	OFF	-
Rear Left Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
Rear Right Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
IMS Mode1 Switch	OFF	-
IMS Mode2 Switch	OFF	-
IMS Set Switch	OFF	-
Outside Mirror Select Switch	LH	-
Outside Mirror Adjust	Right	-

SHMBE9E10L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.
If control line and power line from DDM are normal, replace a driver outside mirror motor(L/H) .
If control line is normal, but power line from DDM is abnormal, replace a DDM.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF"
2. With controlling mirror with mirror switch of power window main switch, check voltage change(Input signal change) of terminal of vertical sensor.

Specification : It is as same as the signal waveform and data

3. Is the measured signal waveform within specification ?

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YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Mirror Vertical(UP/DOWN) Sensor.
If the circuit of Mirror Vertical(UP/DOWN) Sensor is normal, replace the driver side mirror and go to "Verification of Vehicle Repair" procedure .

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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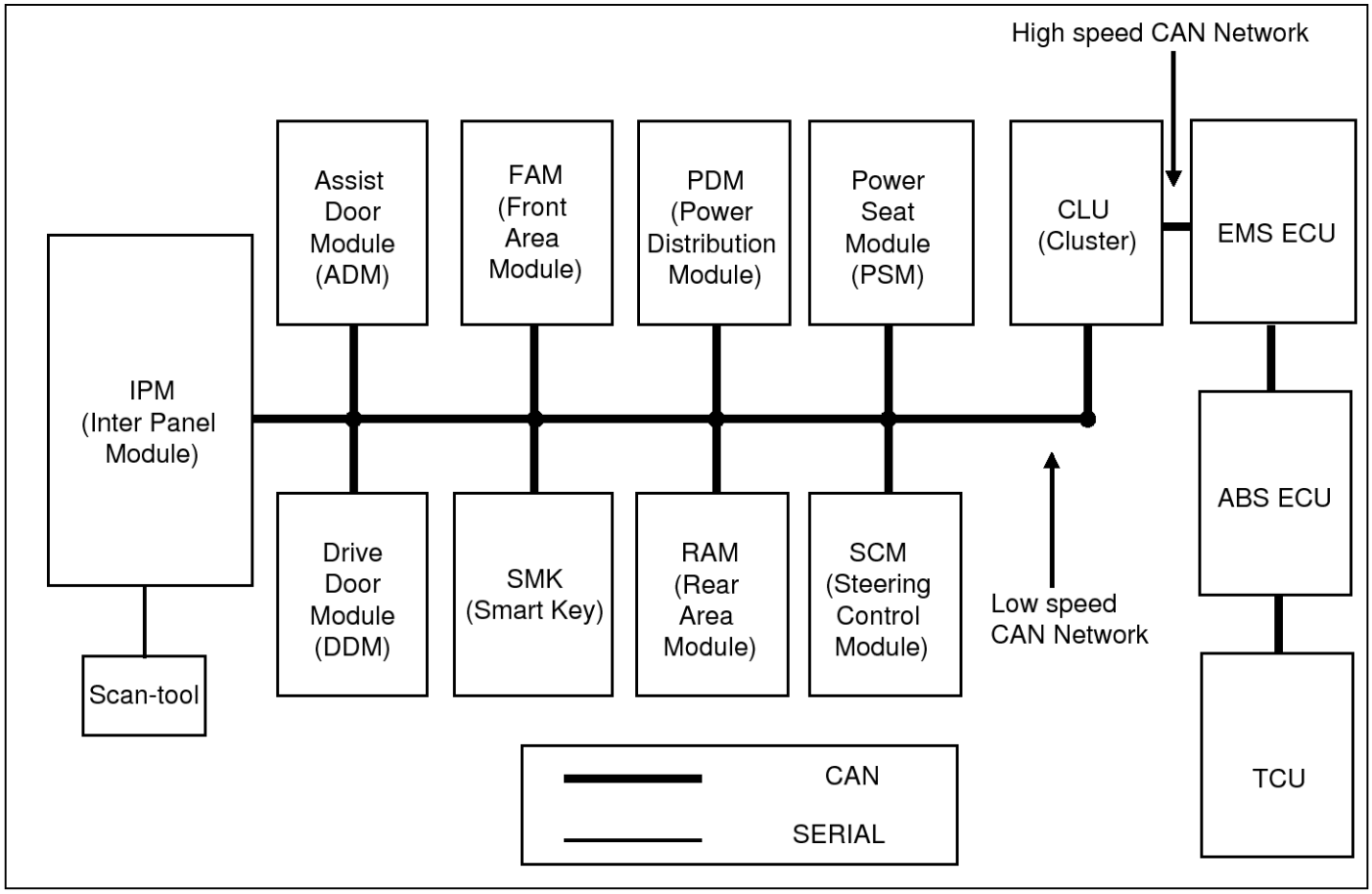
B1952 Outside Mirror Defogger Error

General Description

If operating defog SW,which signal goes to IPM at first and its signal goes to ADM through the CAN communication. DDM controls defog relay with this signal.



SHMBE9E00L

DTC Description

DDM sets DTC when DDM detects open circuit in mirror defog driving IC.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in defog driving IC	• Open in defog circuit • Faulty defog
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current is detected below 150mA at Driving Motor IC	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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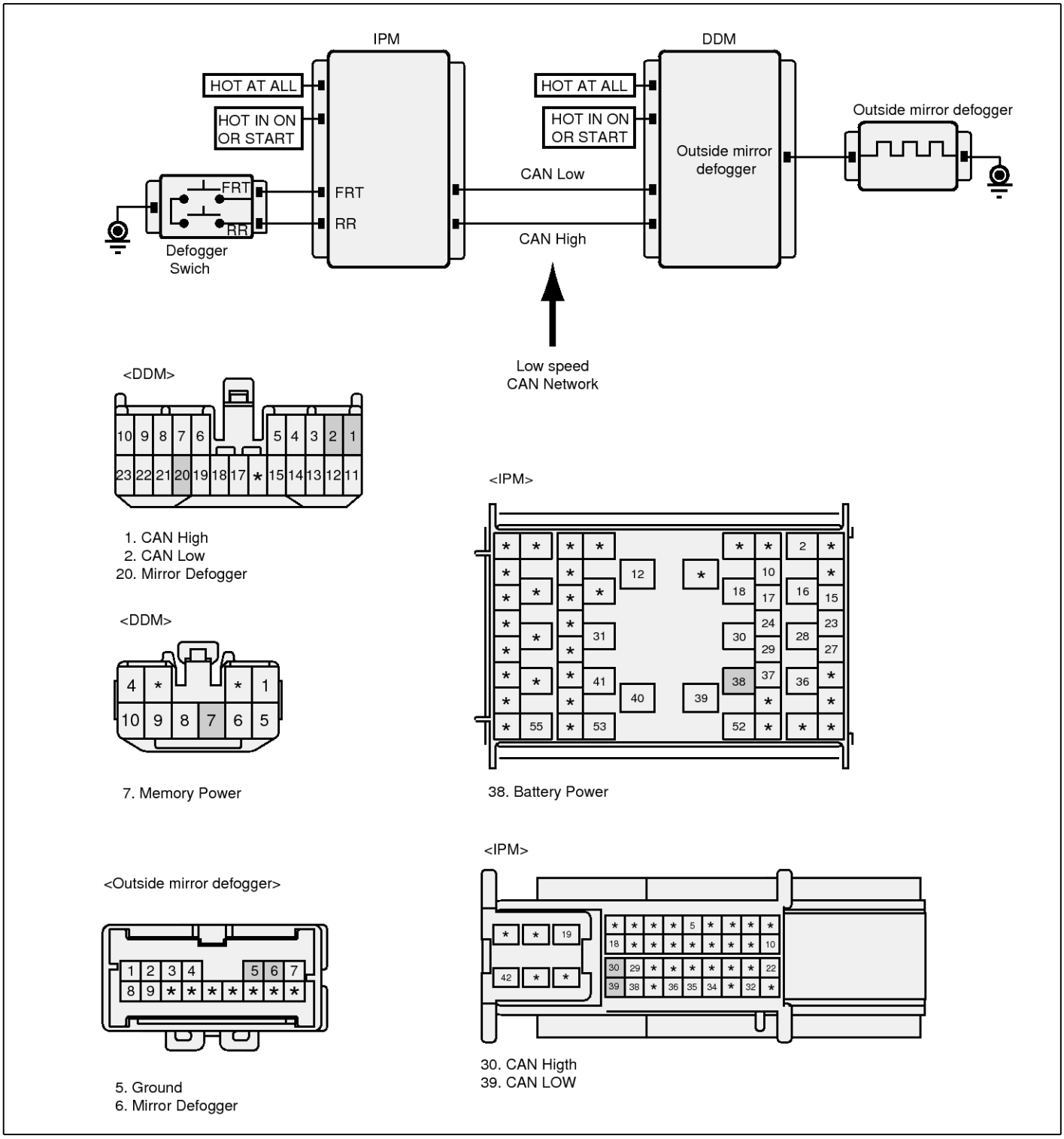

SHMBE9E22L

Scantool Data Analysis

■ Check DTC

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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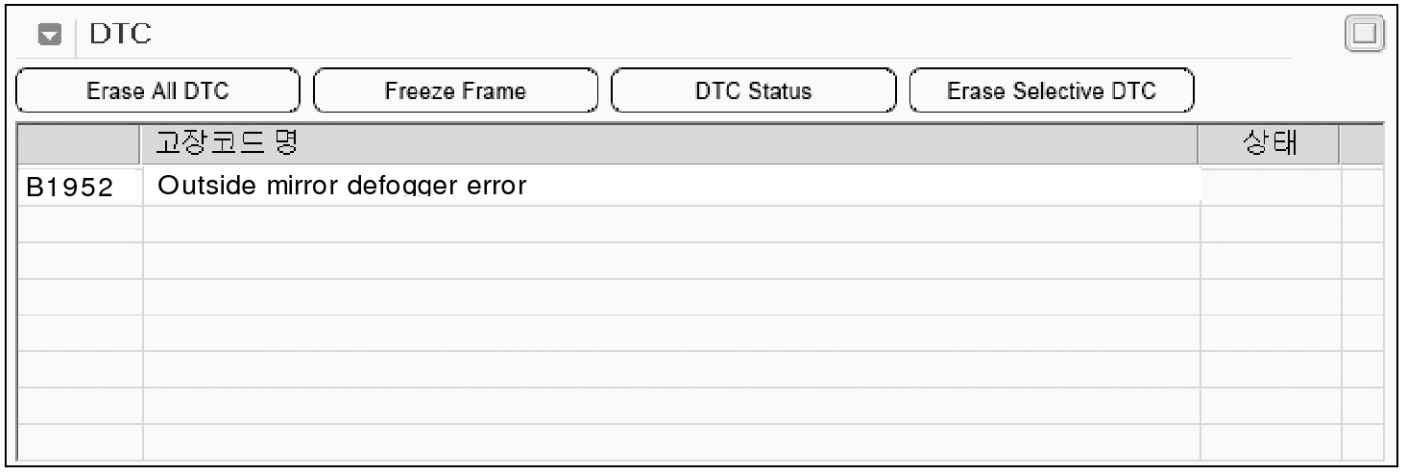

SHMBE9E16L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or DDM's connector or was repaired and DDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check defog in rear view mirror

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "driver rear view mirror" test

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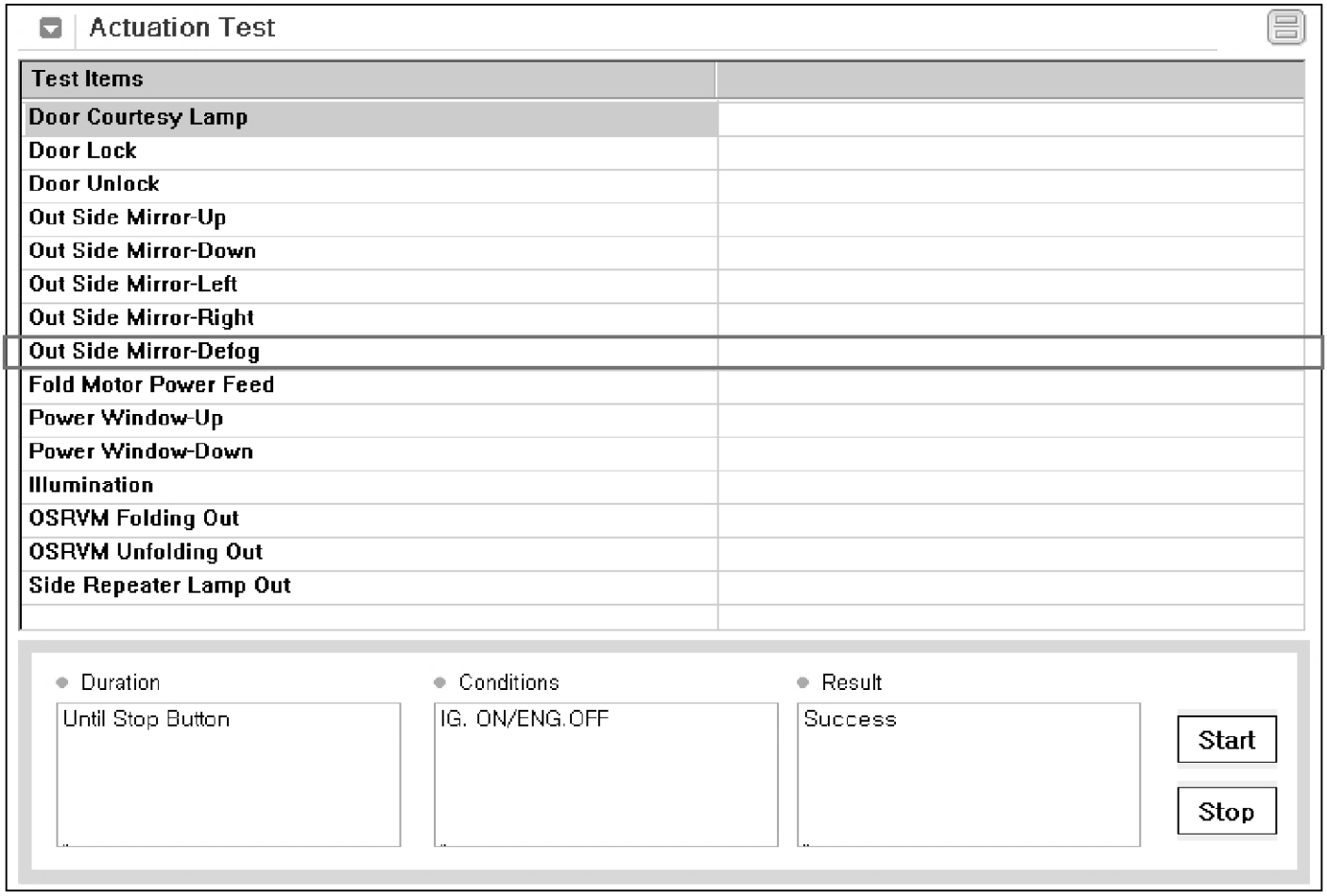

SHMBE9E17L

5. Is the Defog in rear view Mirror normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Power Circuit Inspection' procedure.

Power Circuit Inspection

■ Defog in Driver rear view mirror

1. IG "ON" & ENG "ON"
2. Make ON status with turning ON the defog switch for outside rear view mirror of Driver side.
3. Check voltage between signal terminal of outside rear view of Driver side goes to DDM and chassis ground.

Specification : About 12 V

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good DDM and check for proper operation.
If the problem is corrected, replace the DDM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check fuse is blown off, defog of outside rear view mirror for driver and open or short in signal circuit of outside rear view mirror for driver side. And then, repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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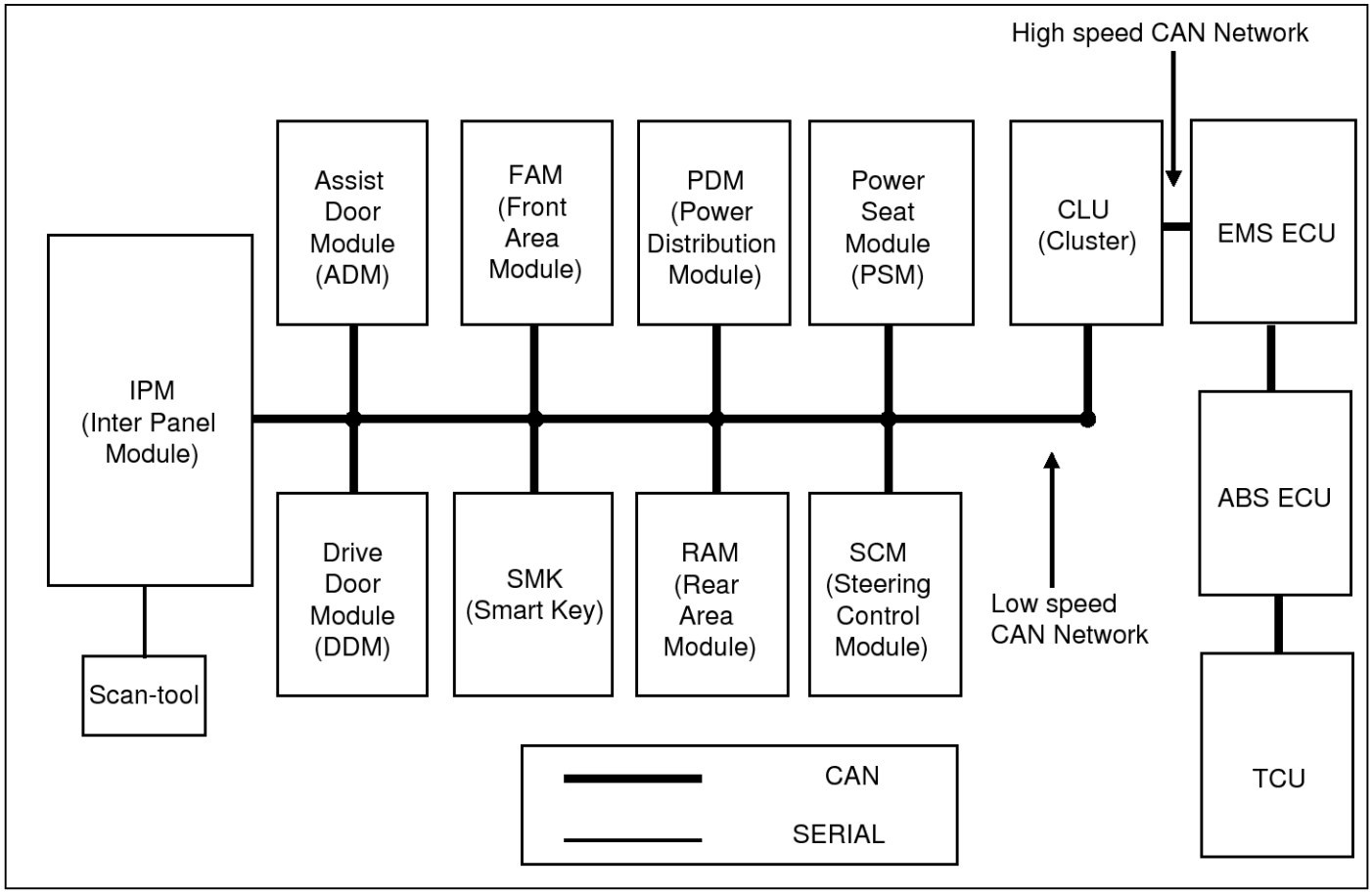
B2330 Driver Door Lock Actuator Error

General Description

If operating lock/unlock the Power Door Lock SW,which signal goes to DDM at first and its signal goes to ADM, RAM through the CAN communication. ADM controls Door Lock Actuator with this signal.



SHMBE9E00L

DTC Description

DDM sets DTC when DDM detects open circuit in Door Lock Actuator.

DTC Detecting Condition

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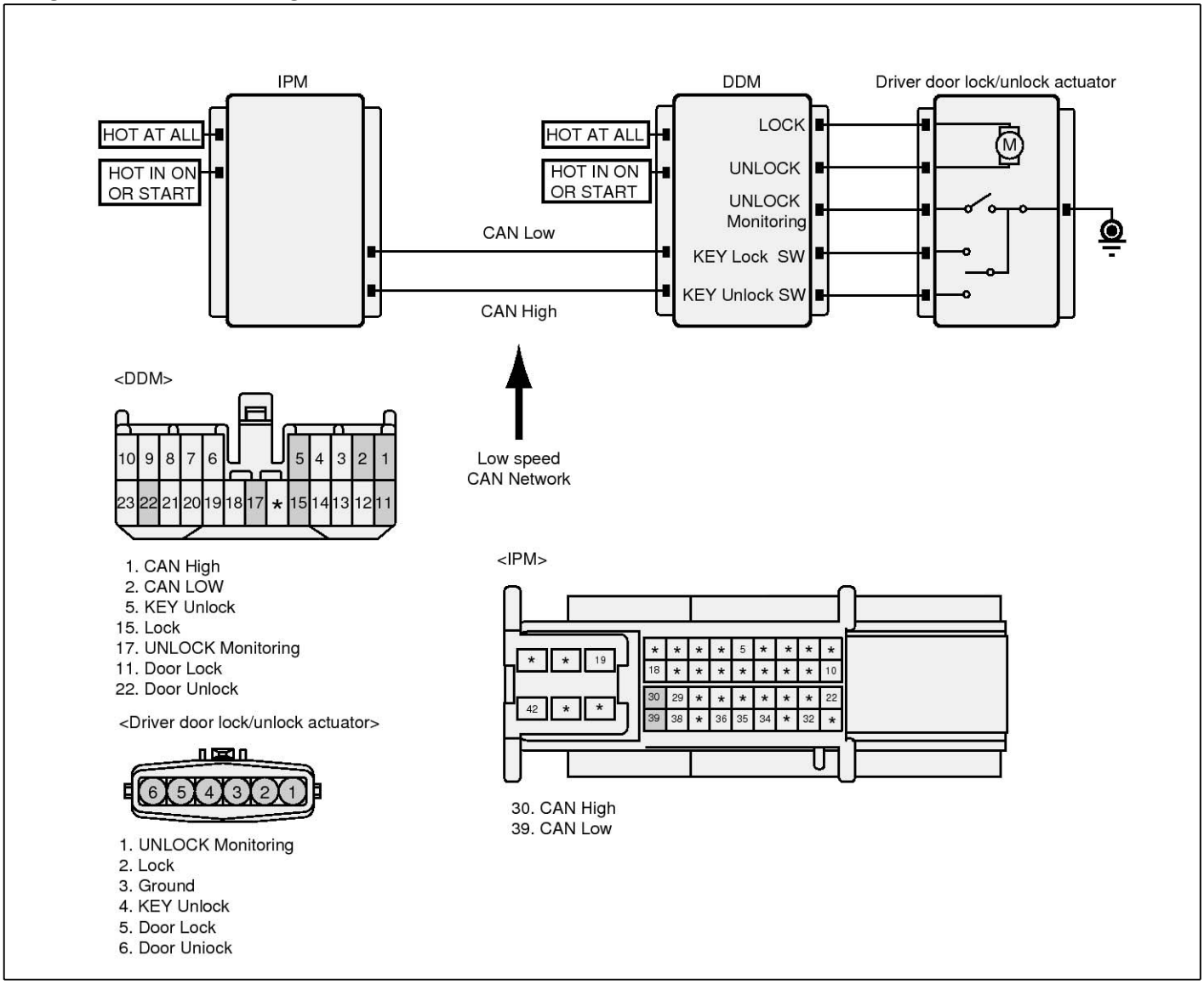
Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in Door Lock Actuator	• Short to ground in driving motor • Faulty Driving motor
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current is detected below 150mA at Driving Motor IC	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram



SHMBE9E21L

Scantool Data Analysis

1. Connect GDS.

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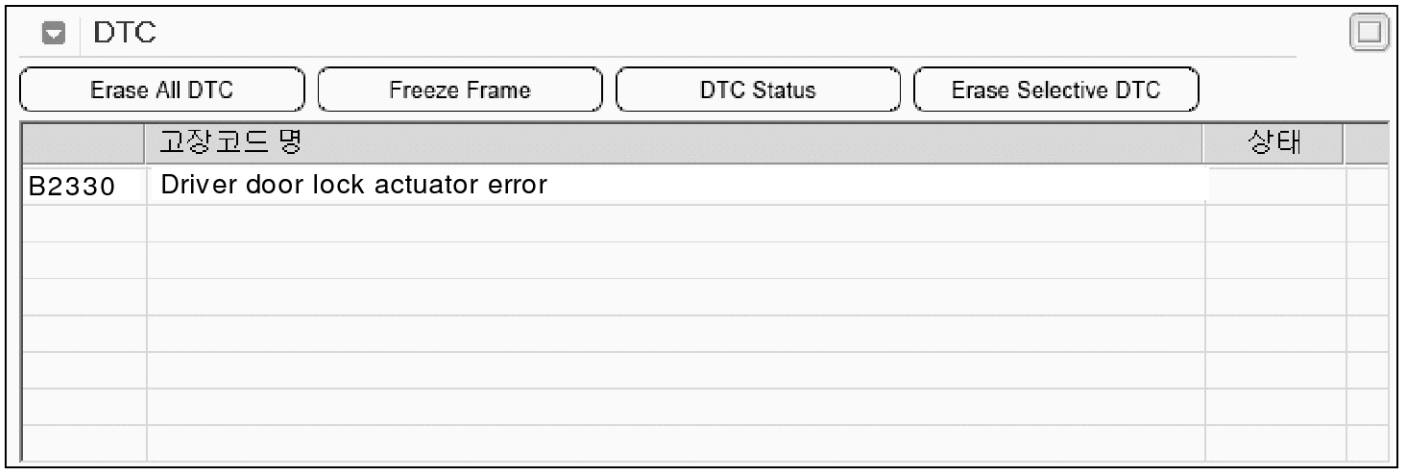
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9E12L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or DDM's connector or was repaired and DDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check mirror motor

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "LH Door Lock " test.

Specification : Turned to pressed direction

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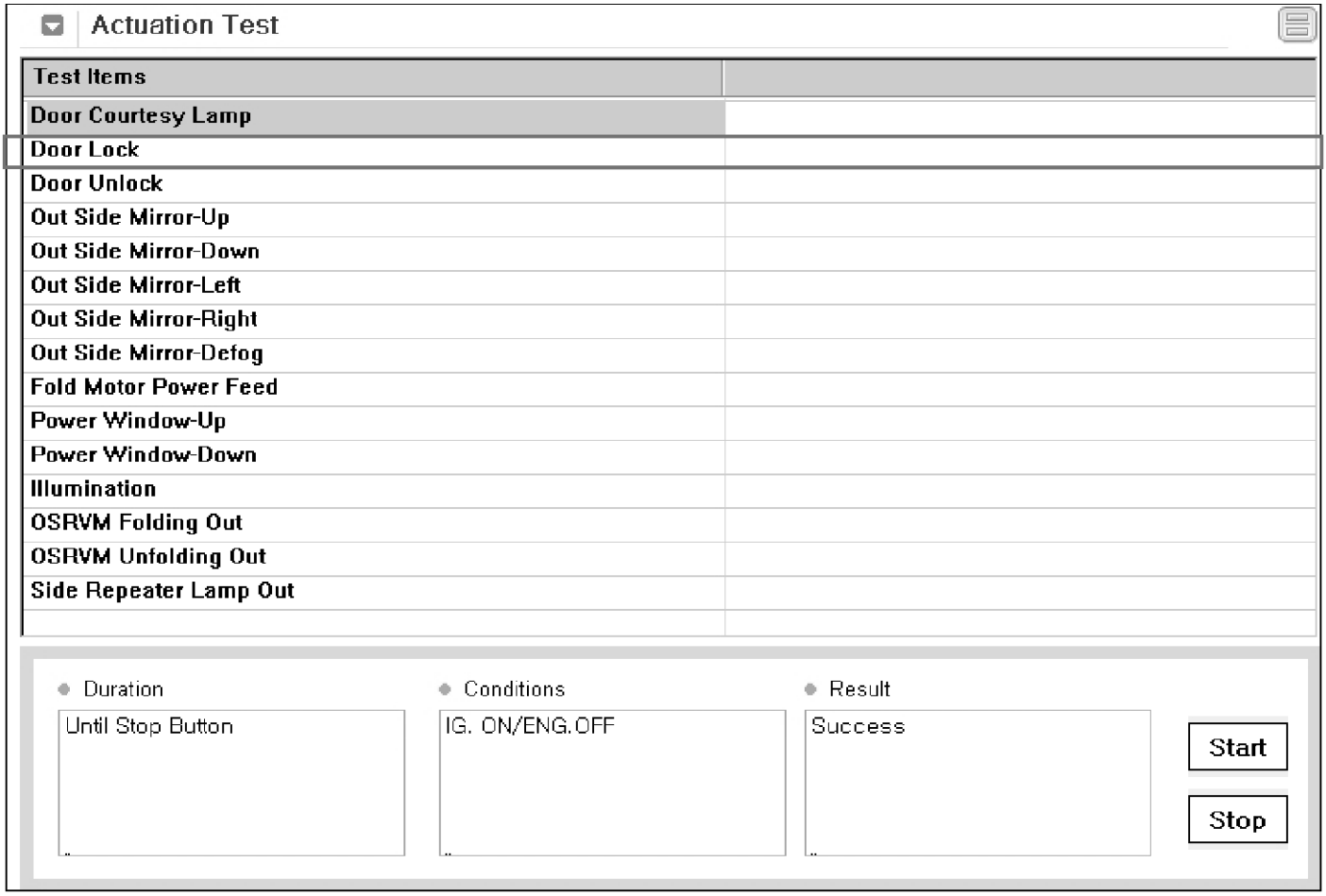

SHMBE9E13L

5. Is the Door Lock status normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Control Circuit Inspection' procedure.

Control Circuit Inspection

■ Check open or short in circuit of Assist Door Lock Actuator

1. Disconnect battery (-) terminal after IG "OFF"
2. Disconnect DDM connector.
3. Check resistnace between control terminal of unlock detection of DDM harness connector and ground.

Specification : Lock - About 1 Ω, Unlock - ∞ Ω

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good DDM and check for proper operation.
If the problem is corrected, replace the DDM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ In case of open or short in door lock actuator circuit, repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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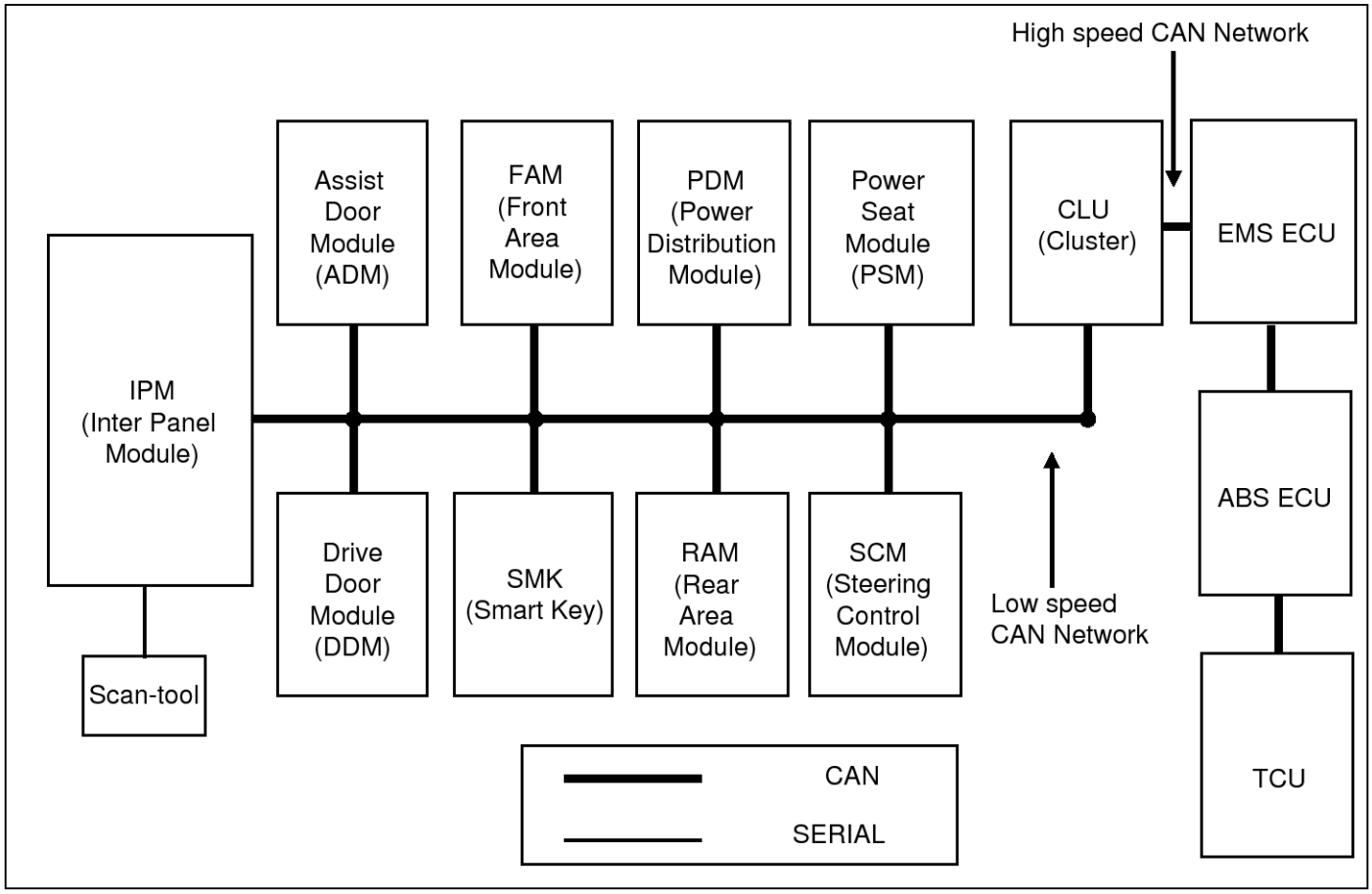
B2331 Driver Door Unlock Actuator Error

General Description

If operating lock/unlock the Power Door Lock SW,which signal goes to DDM at first and its signal goes to ADM, RAM through the CAN communication. DDM controls Door Unlock Actuator with this signal.



SHMBE9E00L

DTC Description

DDM sets DTC when DDM detects open circuit in Door Unlock Actuator.

DTC Detecting Condition

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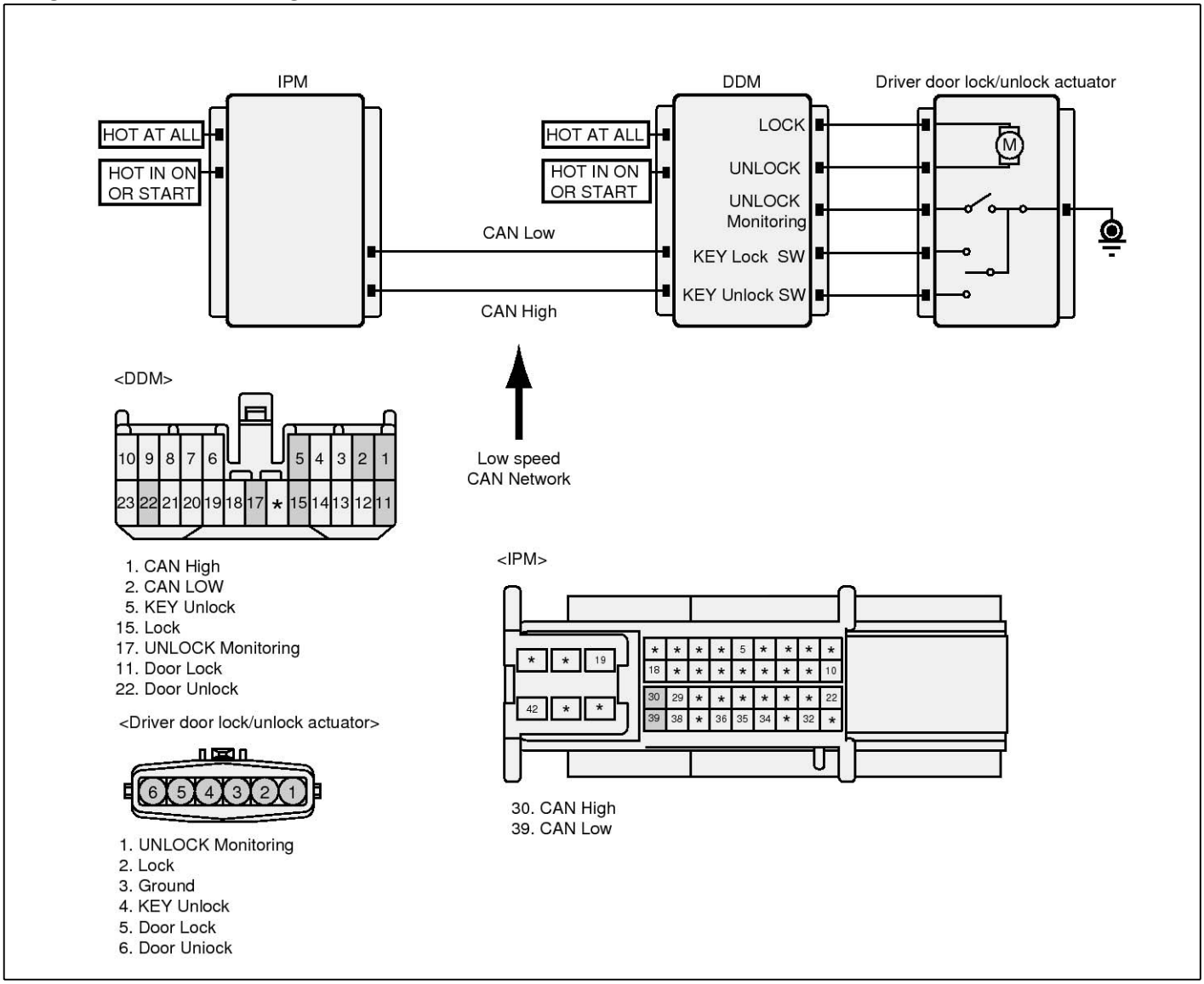
Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in Door Unlock Actuator	• Open in driving motor • Faulty Driving motor
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current is detected below 150mA at Driving Motor IC	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram



SHMBE9E21L

Scantool Data Analysis

1. Connect GDS.

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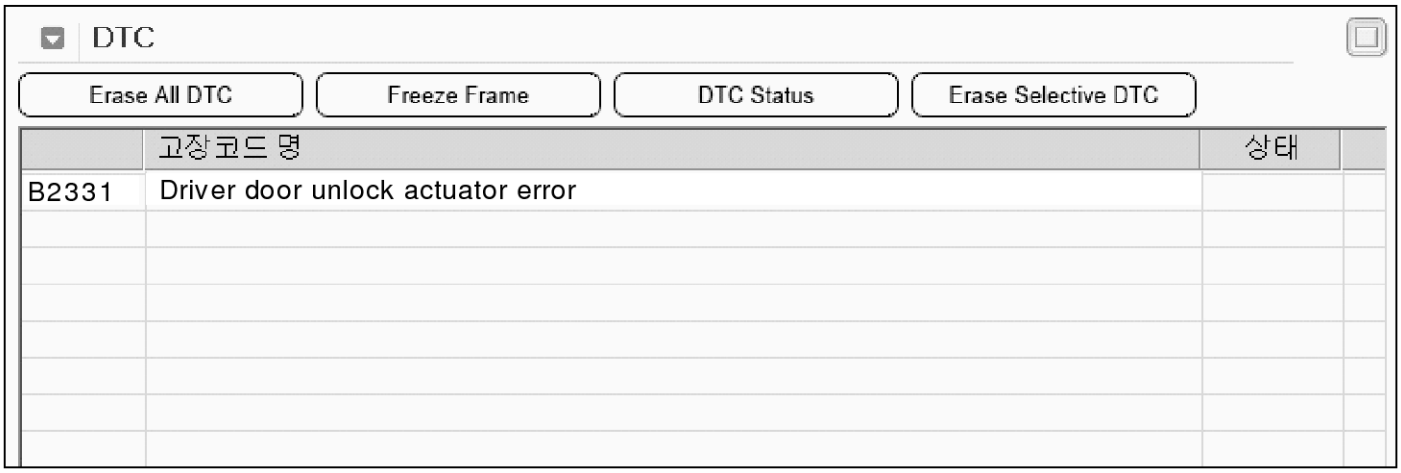
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9E14L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or DDM's connector or was repaired and DDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check mirror motor

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "LH door unlock " test.

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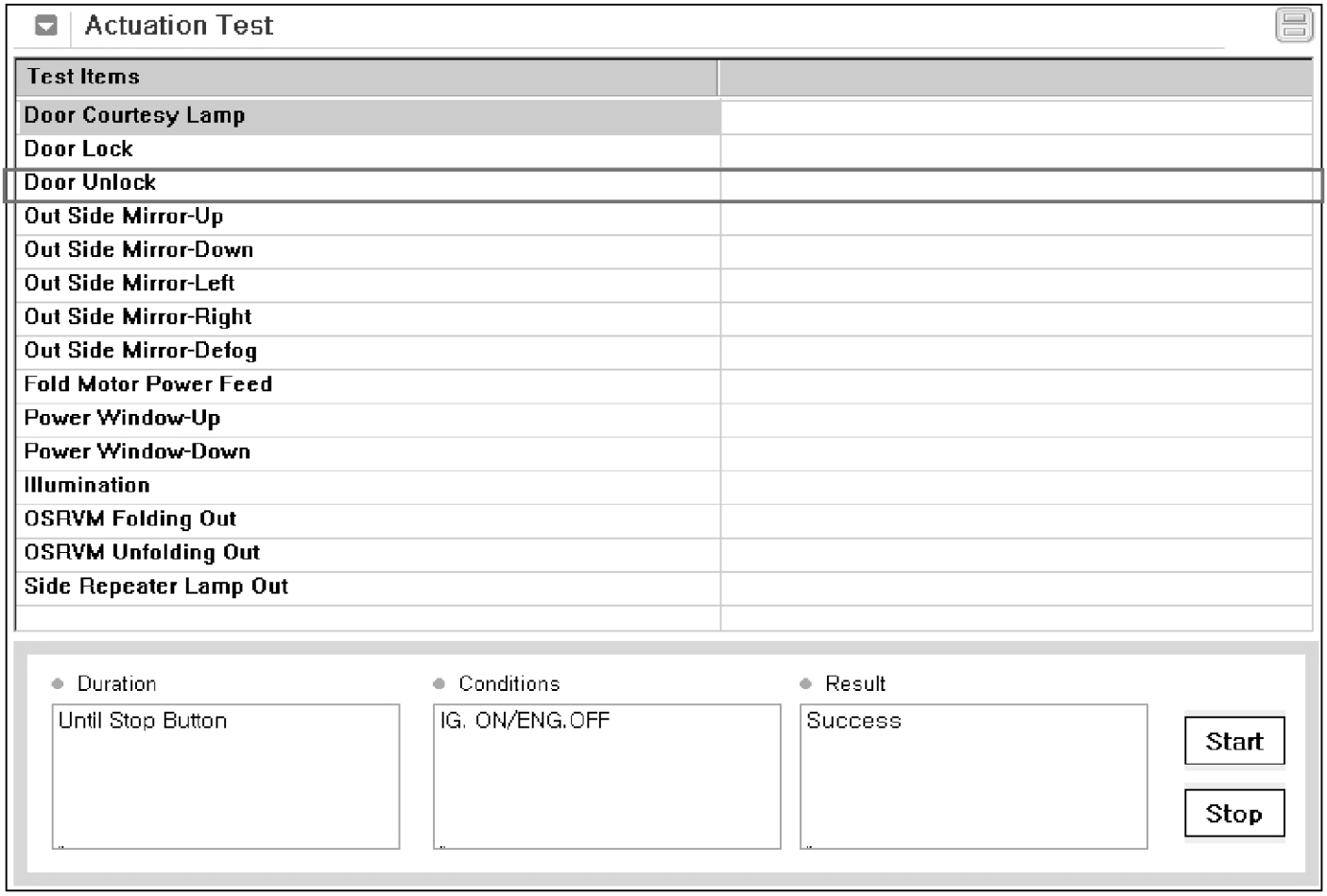

SHMBE9E15L

5. Is the Door Unlock status normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Control Circuit Inspection' procedure.

Control Circuit Inspection

■ Check open or short in circuit of Door Unlock Actuator

1. Disconnect battery (-) terminal after IG "OFF"
2. Disconnect DDM connector.
3. Check resistnace between control terminal of unlock detection of DDM harness connector and ground.

Specification : Lock - About 1 Ω, Unlock - ∞ Ω

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good DDM and check for proper operation.
If the problem is corrected, replace the DDM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ In case of open or short in door unlock actuator circuit, repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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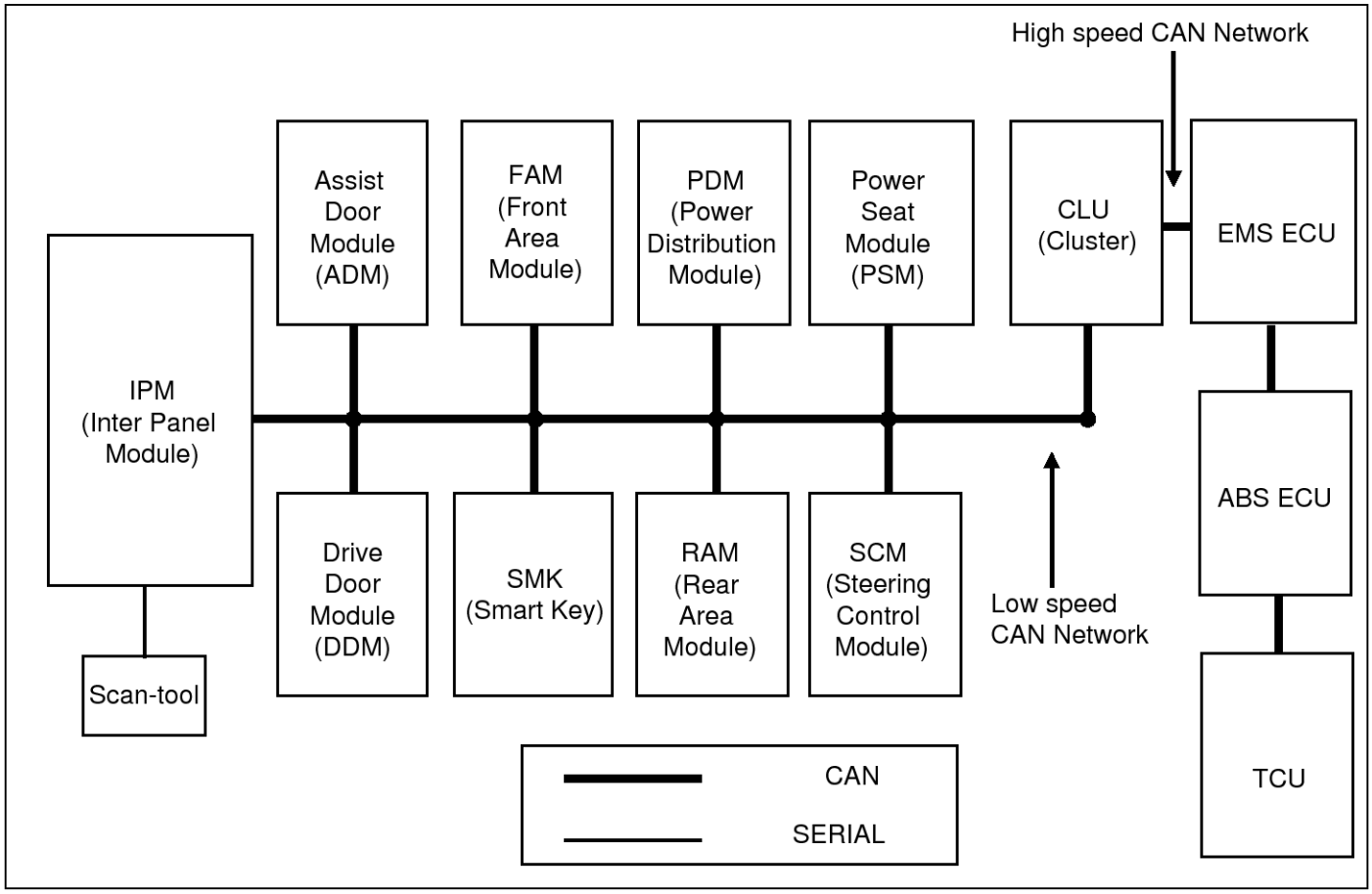
B2529 Driver Door Courtesy Lamp Error

General Description

If opening the Driver side Door, the switch signal is ON. And, this signal goes to RAM which send it to ADM through CAN. Finally DDM turns the door cutesey lamp ON.



SHMBE9E00L

DTC Description

DDM sets DTC when DDM detects open circuit in door courtesy lamp driving IC.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in door courtesy lamp driving IC	• Open circuit in door courtesy l-amp • Faulty door courtesy lamp
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Door courtesy lamp works on	
Threshold Value	• Current is lower than 40mA	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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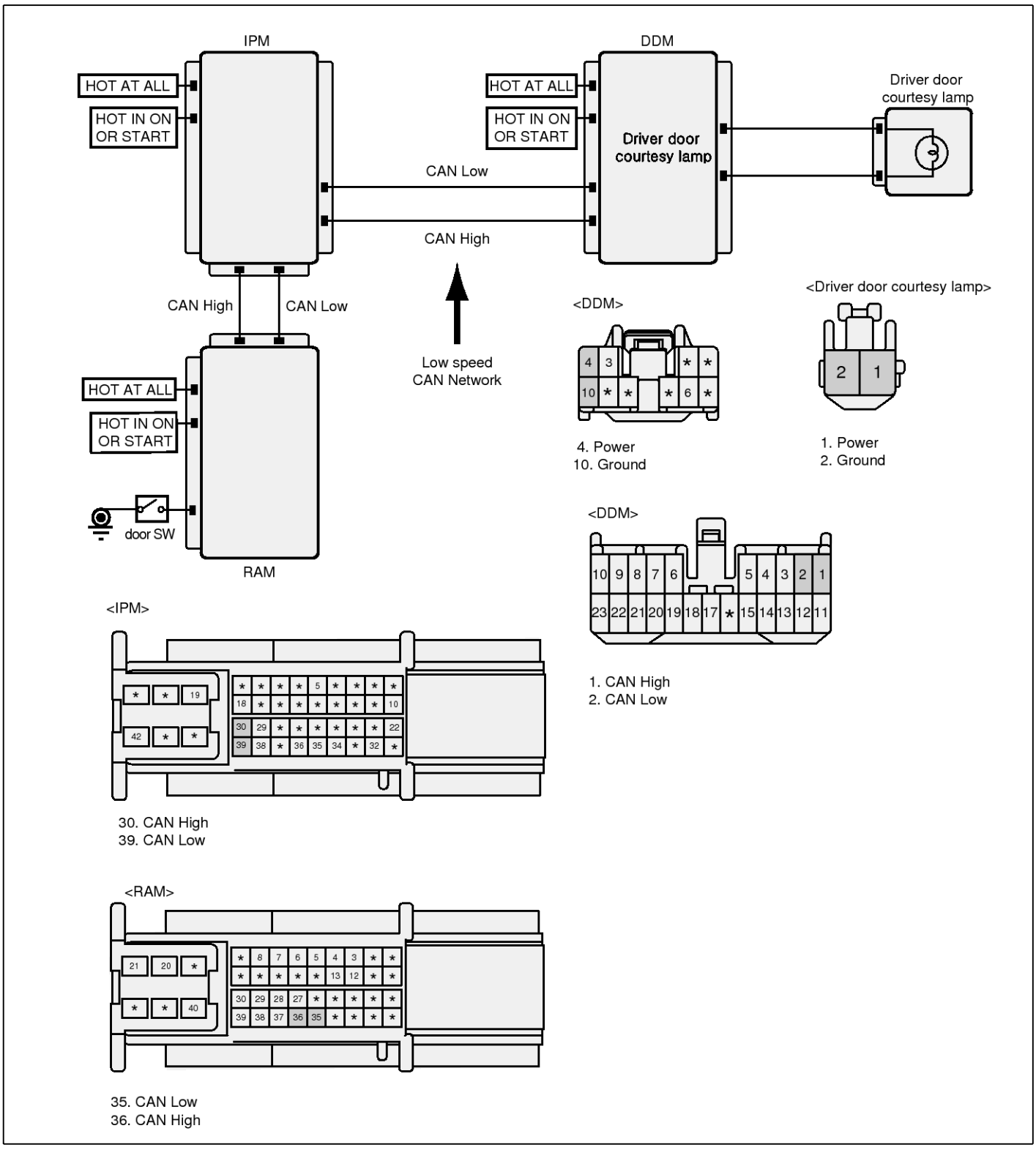

SHMBE9E23L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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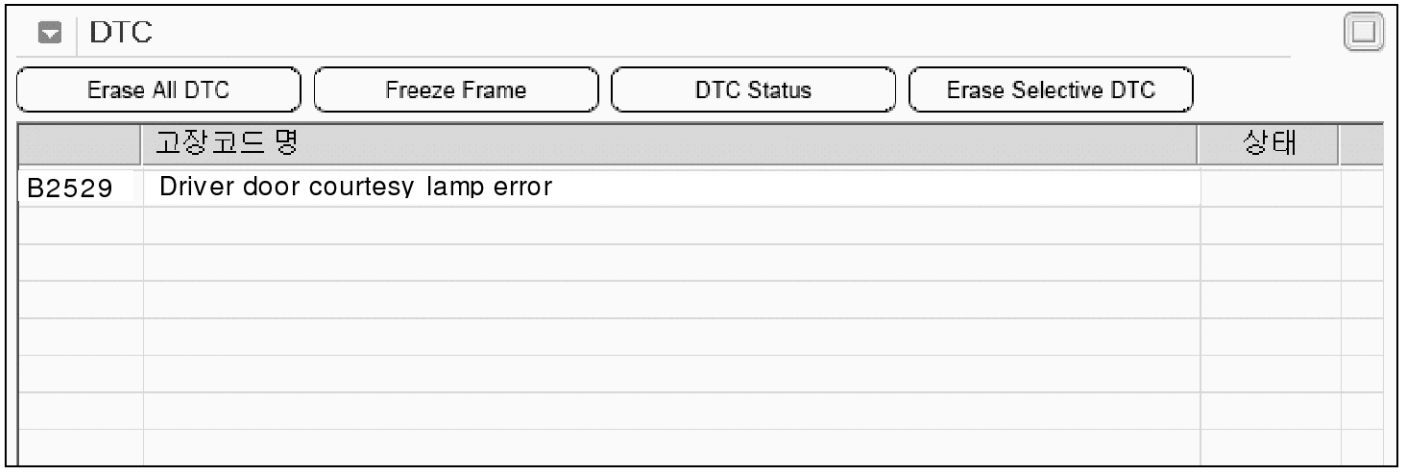

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5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or DDM's connector or was repaired and DDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check assist door courtesy lamp

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Door courtesy lamp" test

Specification : ON or OFF

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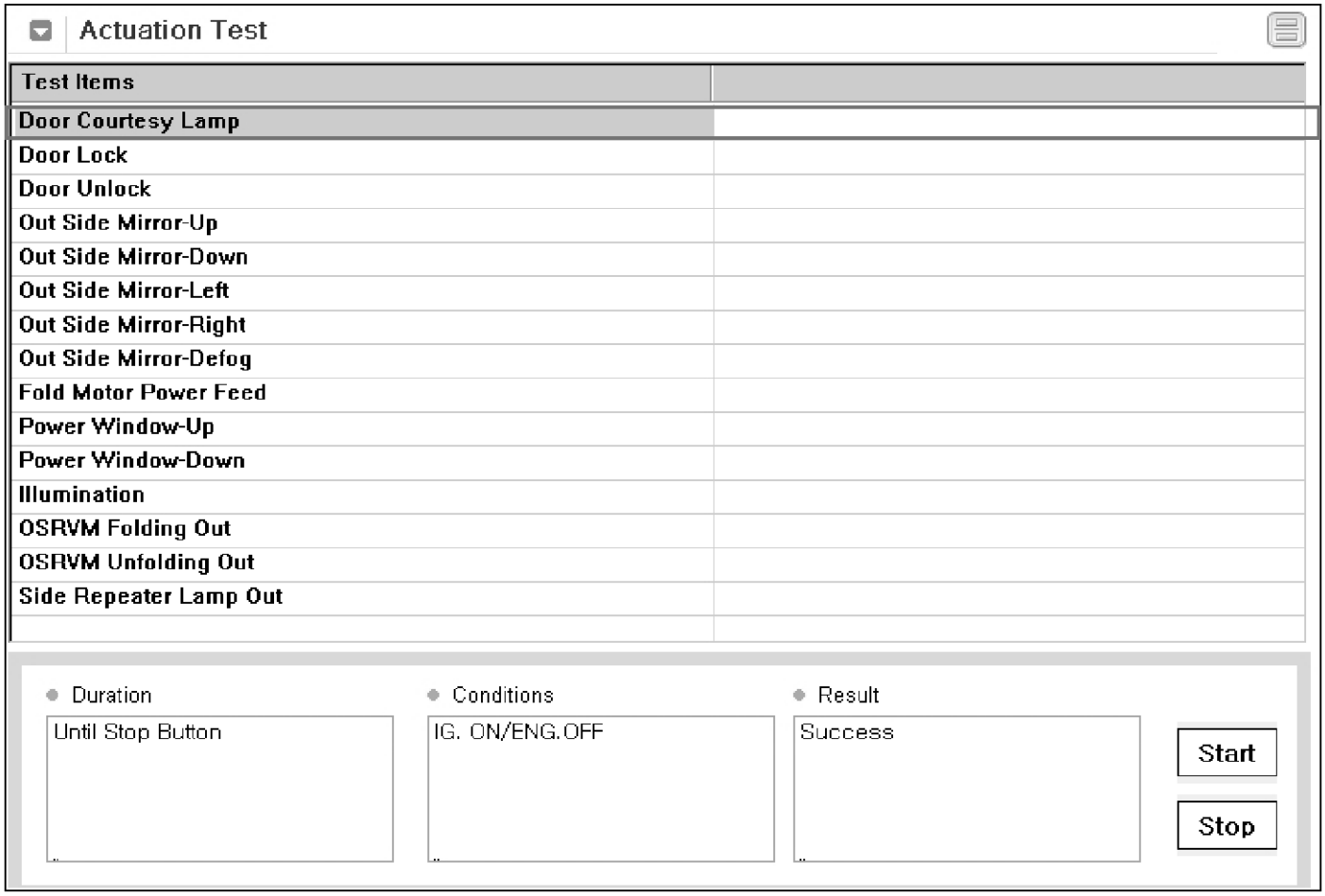

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5. Is the service data normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Control Circuit Inspection' procedure.

Control Circuit Inspection

■ Check open in door courtesy lamp circuit

1. Disconnect battery (-) terminal after IG "OFF"
2. Disconnect DDM and door courtesy lamp connector.
3. Check resistance between one and the other of dDM harness connetor.

Specification : About 1 Ω

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good DDM and check for proper operation.
If the problem is corrected, replace the DDM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open in door courtesy lamp circuit, repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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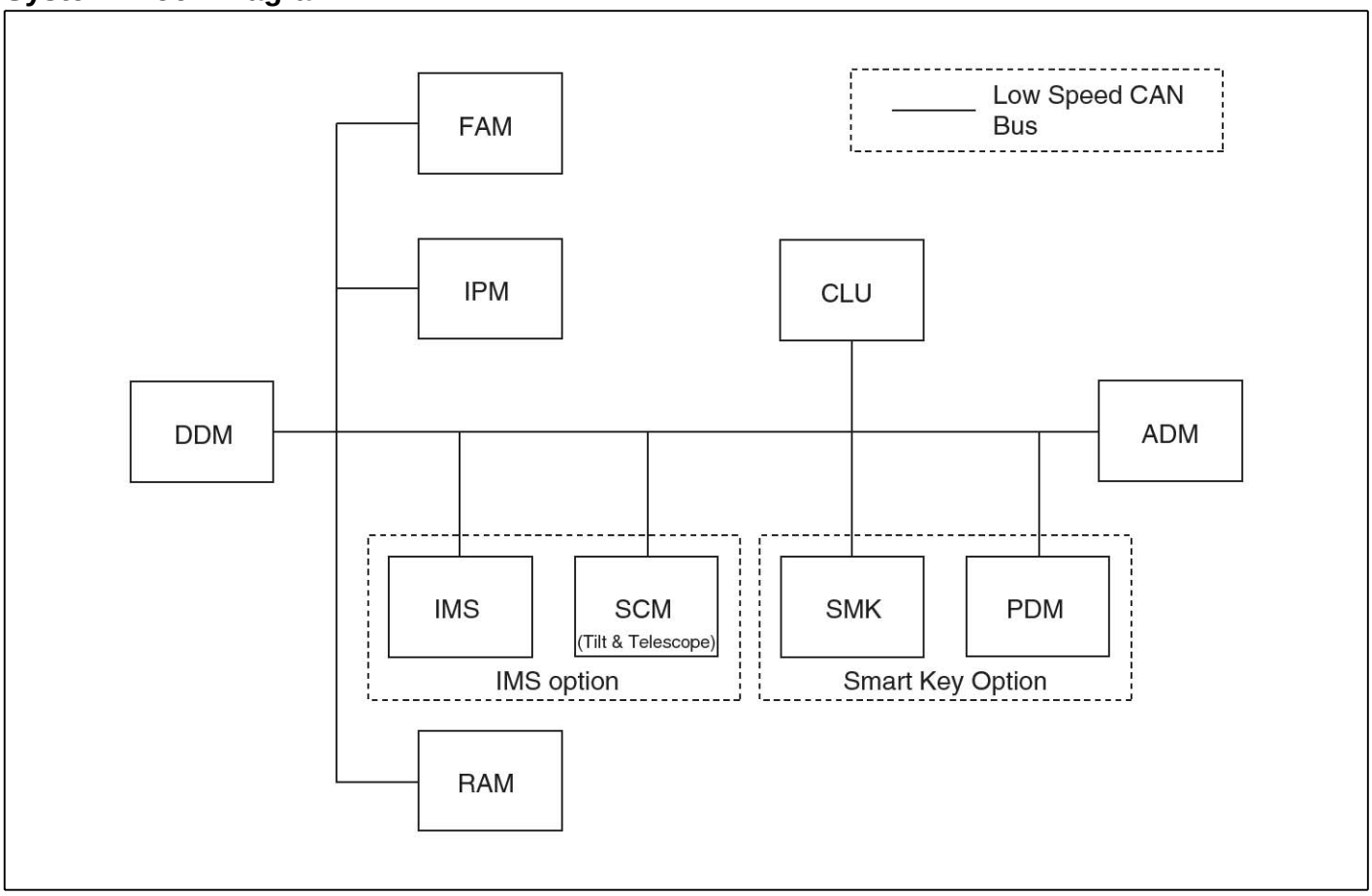
Assist Door Module (ADM)

System Block Diagram



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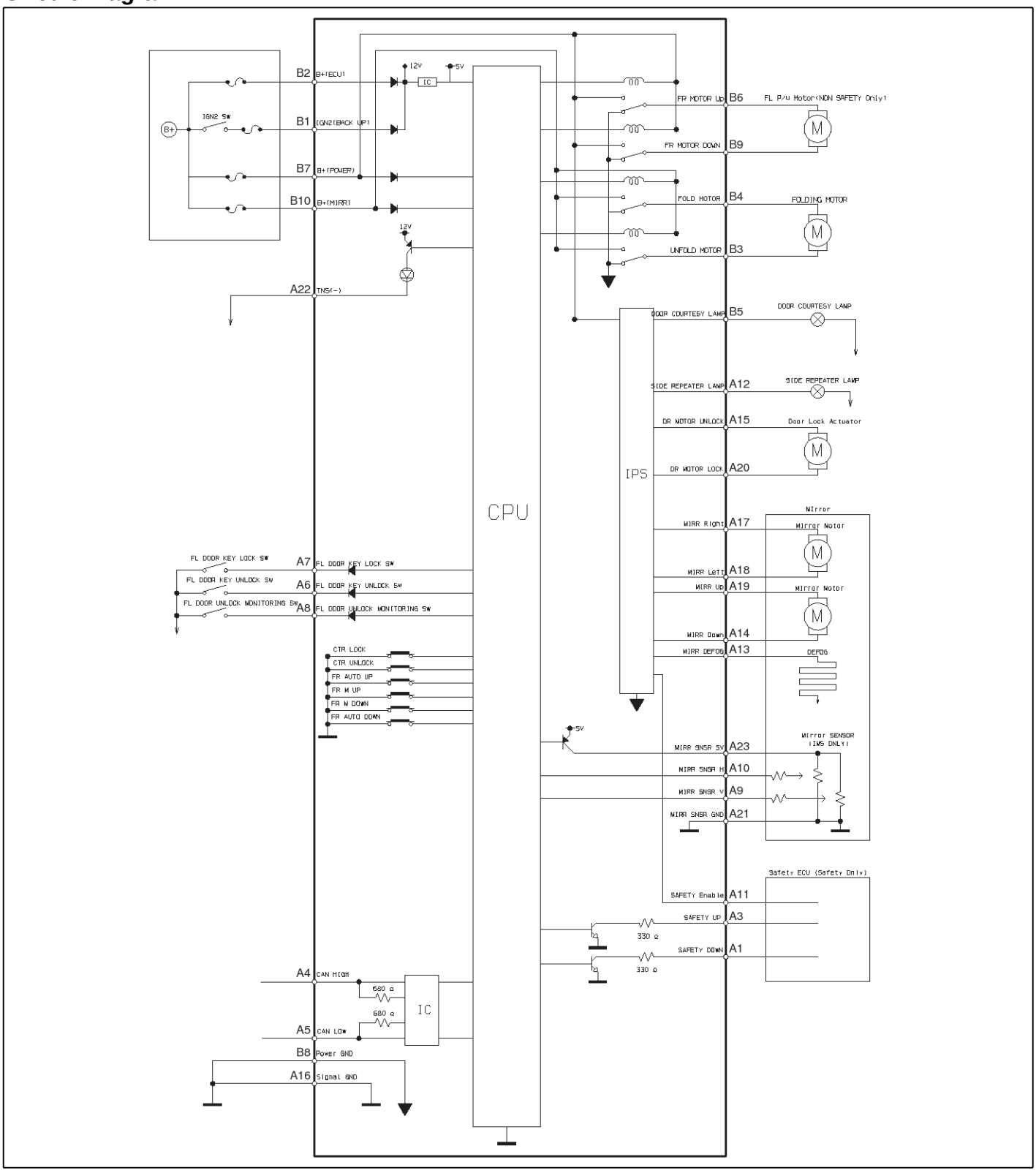
Circuit Diagram



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※ Connector pin information

- Refer to the power window switch - "component"

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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

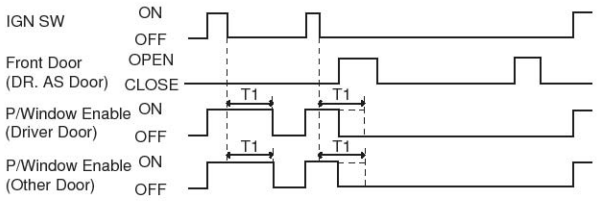
Power Window

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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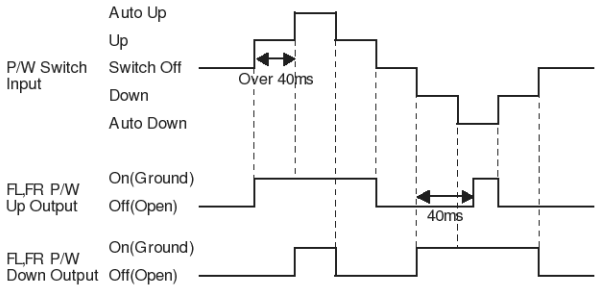
Safety Power Window

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

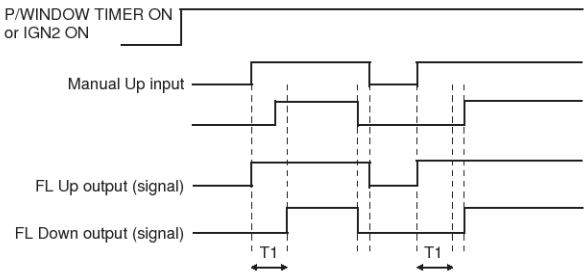
1. P/Window enable signal on condition
   - P/window timer(from IPM) ON or IGN2 (ADM itself) ON

     (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

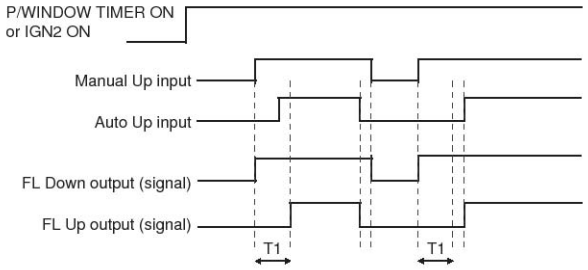
* P/Window timer (from IPM) OFF & IGN2 (DDM ITSELF) OFF, independently of Switch's state Up Signal And down signal are OFF state preservation

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



SHMBE9283N

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



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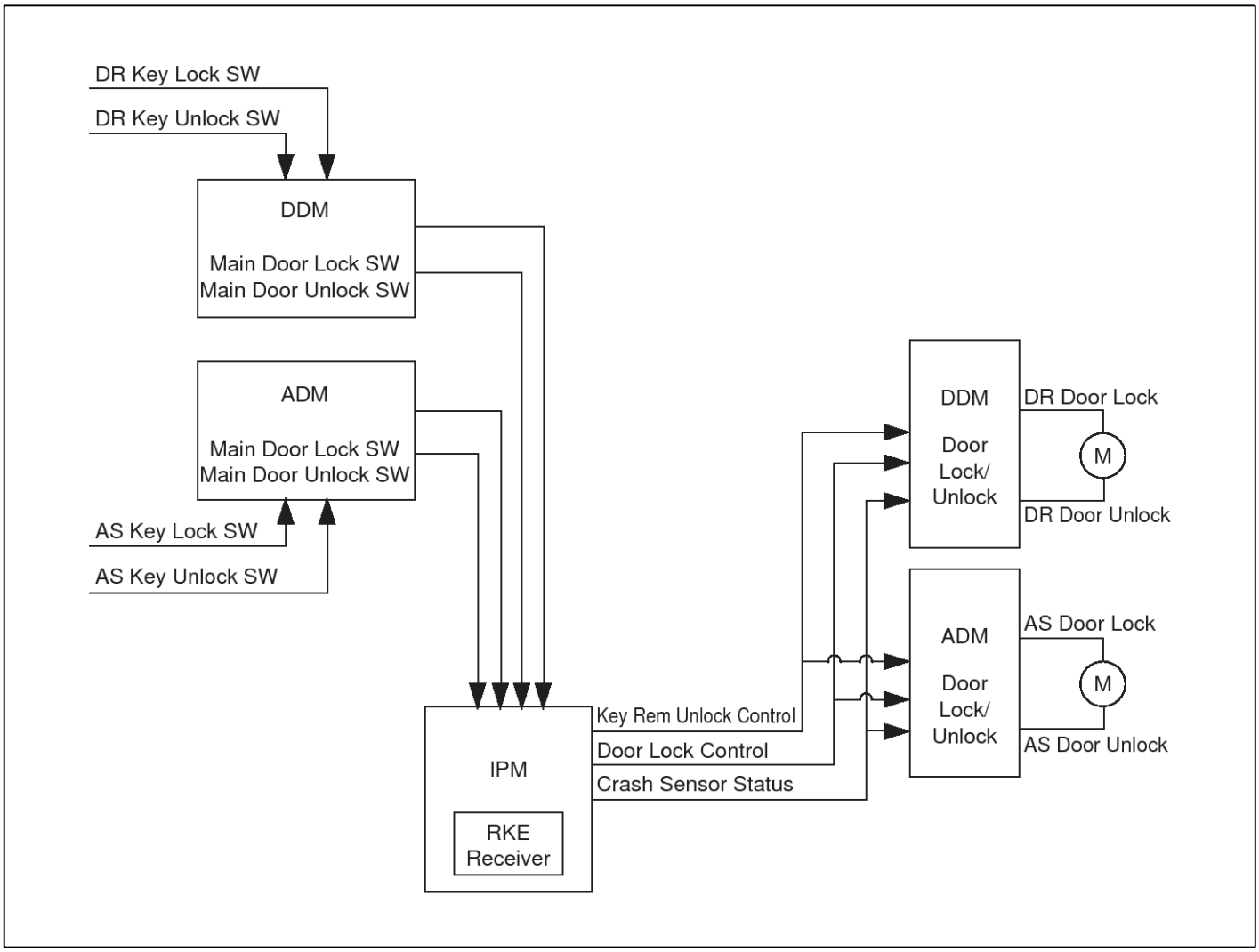
Door Lock/Unlock (Controlled by IPM)



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

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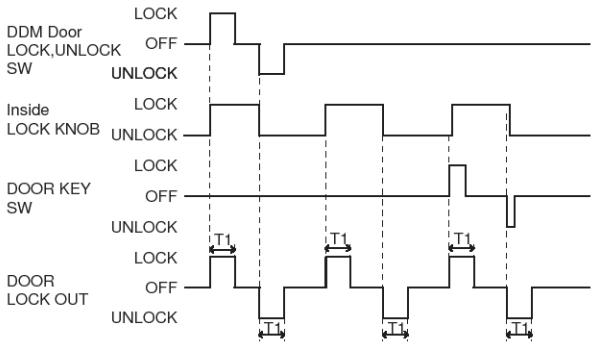
Assist Door	Key Cylinder	Lock	All Door Lock
		Unlock	All Door Unlock
	Knob	Lock	No Action
		Unlock	No Action
	Main SW (P/WDW SW)	Lock	All Door Lock
		Unlock	All Door Unlock
RKE		Lock	All Door Lock
		Unlock	All Door Unlock

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.

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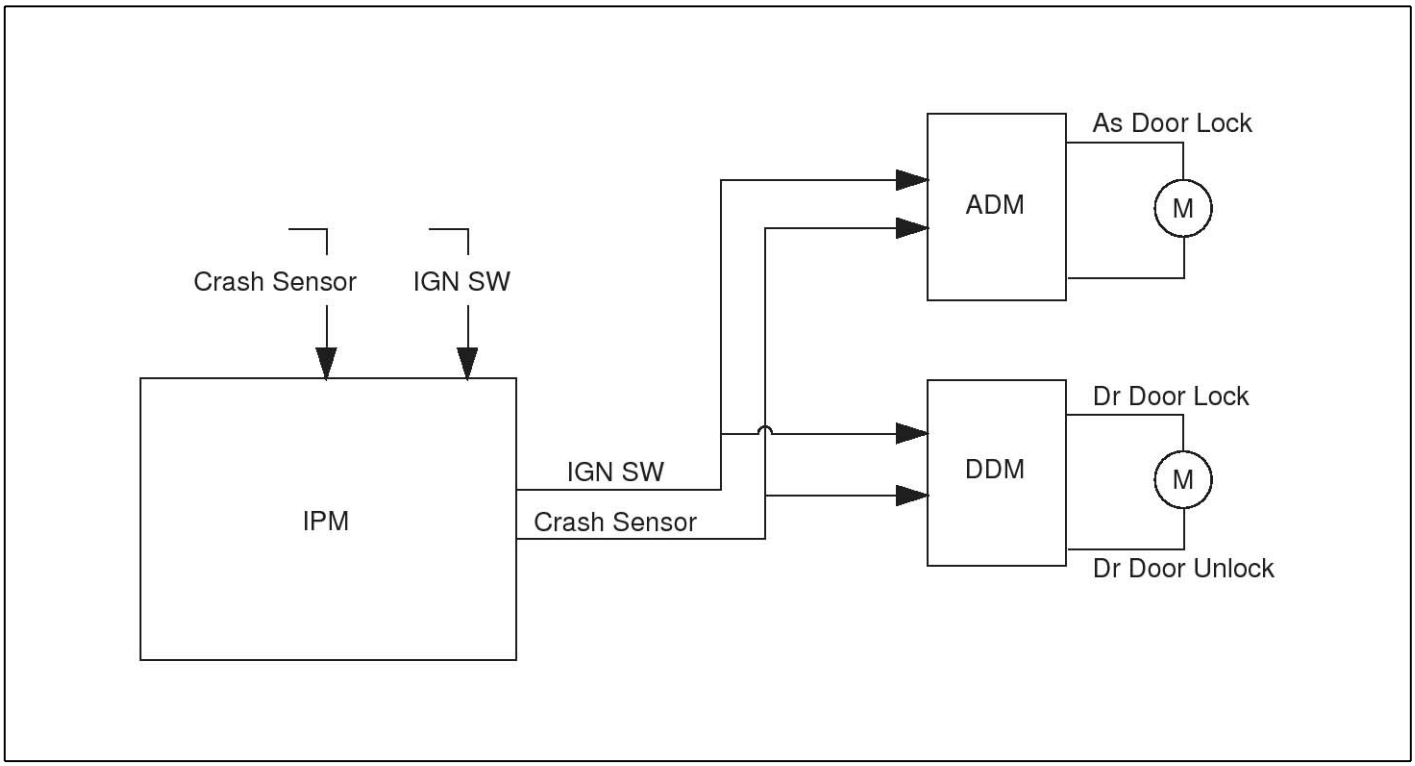
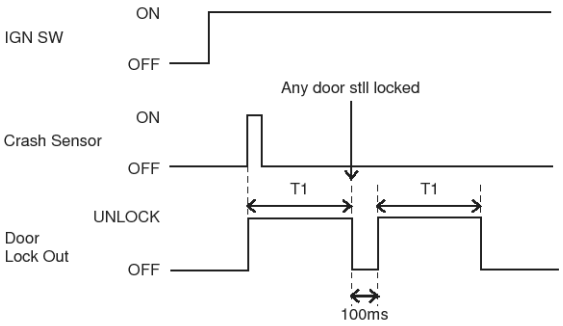
Crash Unlock (Controlled by ADM)



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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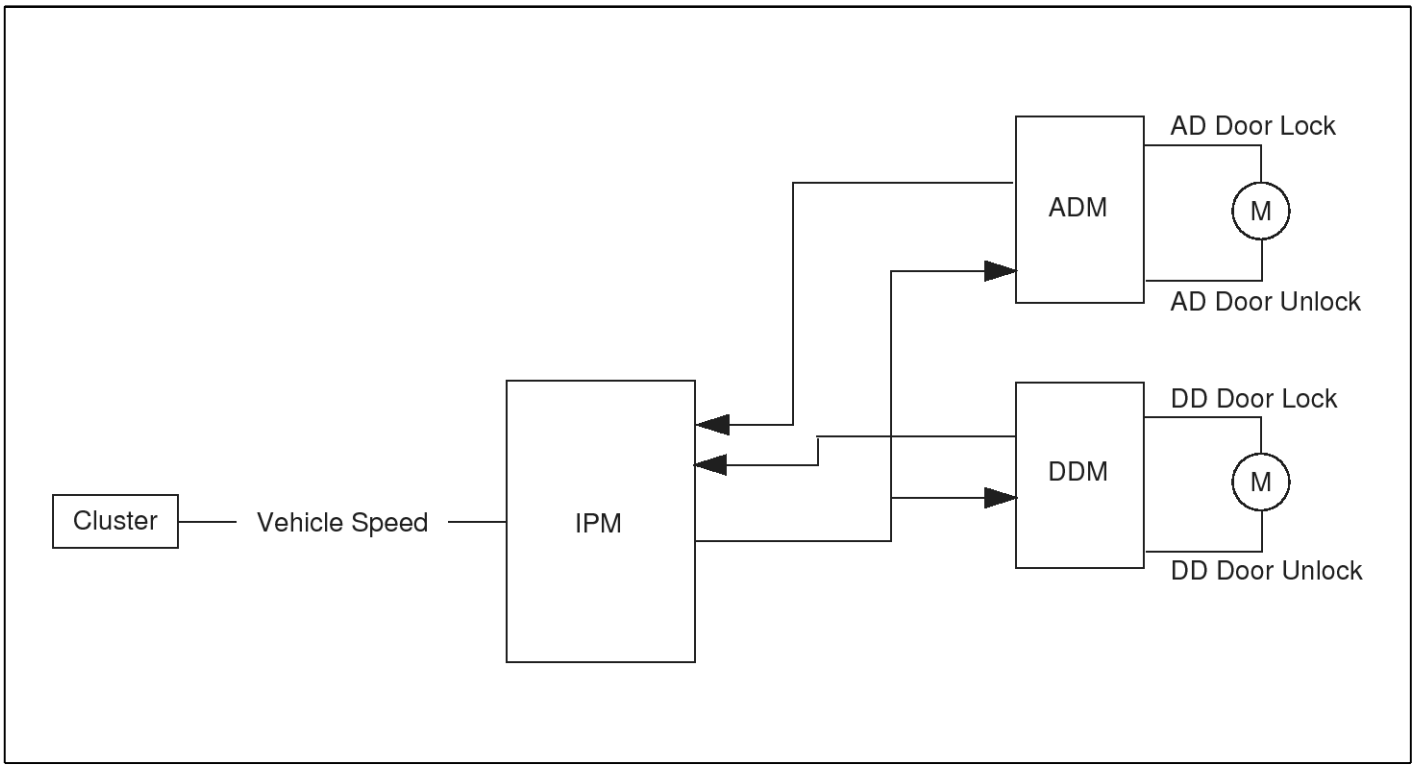
Auto Door Lock



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"

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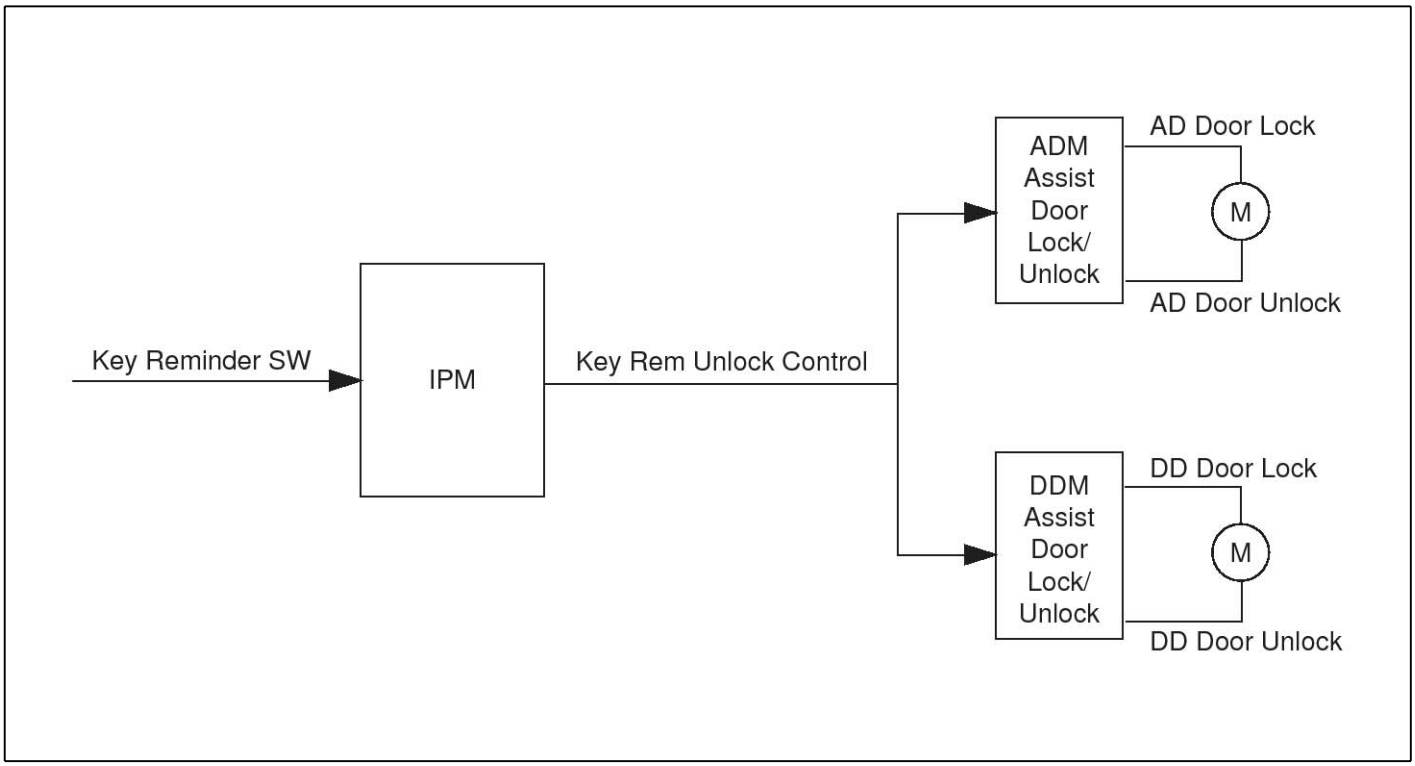
Key Reminder Unlock



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)

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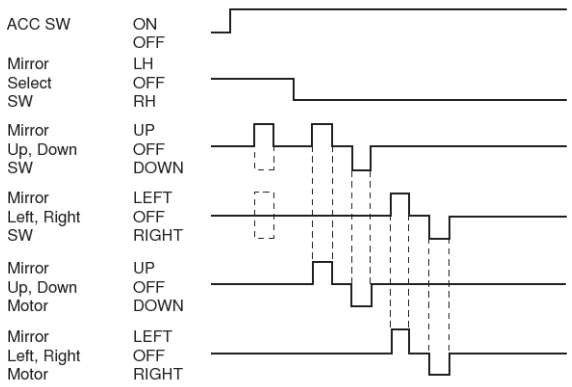
Outside Mirror

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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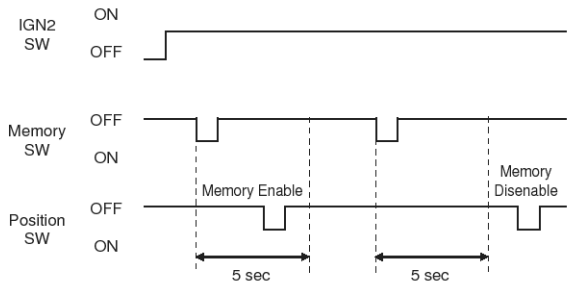
Memory Operation By Memory Switch



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.

Reminder Operation By Memory Switch

1. At the location where MEMORY is O/S MIRROR when IMS Memory Commend Message is forwarded to RETURN1 or RETURN2 from DDM, RETURN.
2. If the position switch (POS1 or POS2) has not been memorized, then the reminding operation shall not be performed.
3. During reminding operation, if a position switch (POS1 or POS2) is pressed, and then the latest pressed switch shall govern the reminding operation.
4. Prohibit Condition for the Reminding Operation
   - When the mirror manual switch is being operated.

     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

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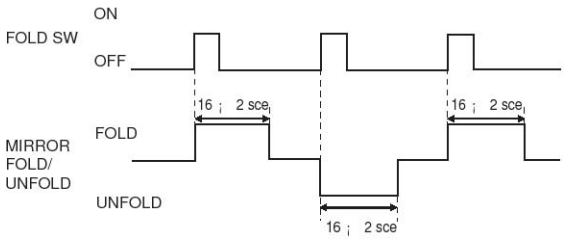
Fold/Unfold

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)

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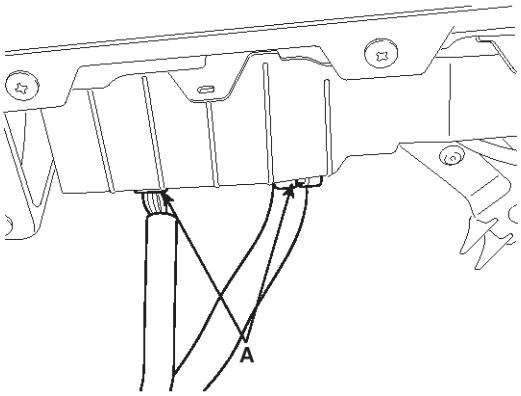
Rescue Mode

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

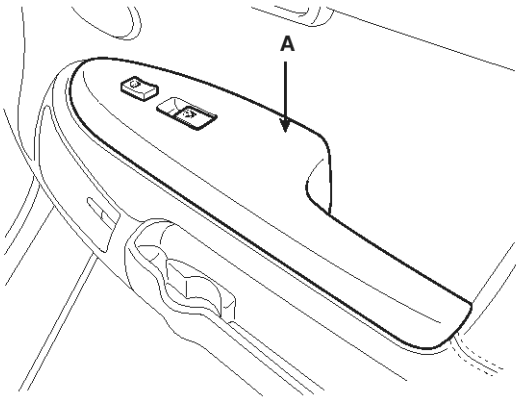
Removal

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.



SHMBE8144D

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.

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Diagnostic troubleshooting

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 e-rror	Assist door courtesy lamp circuit open error

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B1603 CAN Communication Bus Off

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*¹ line.

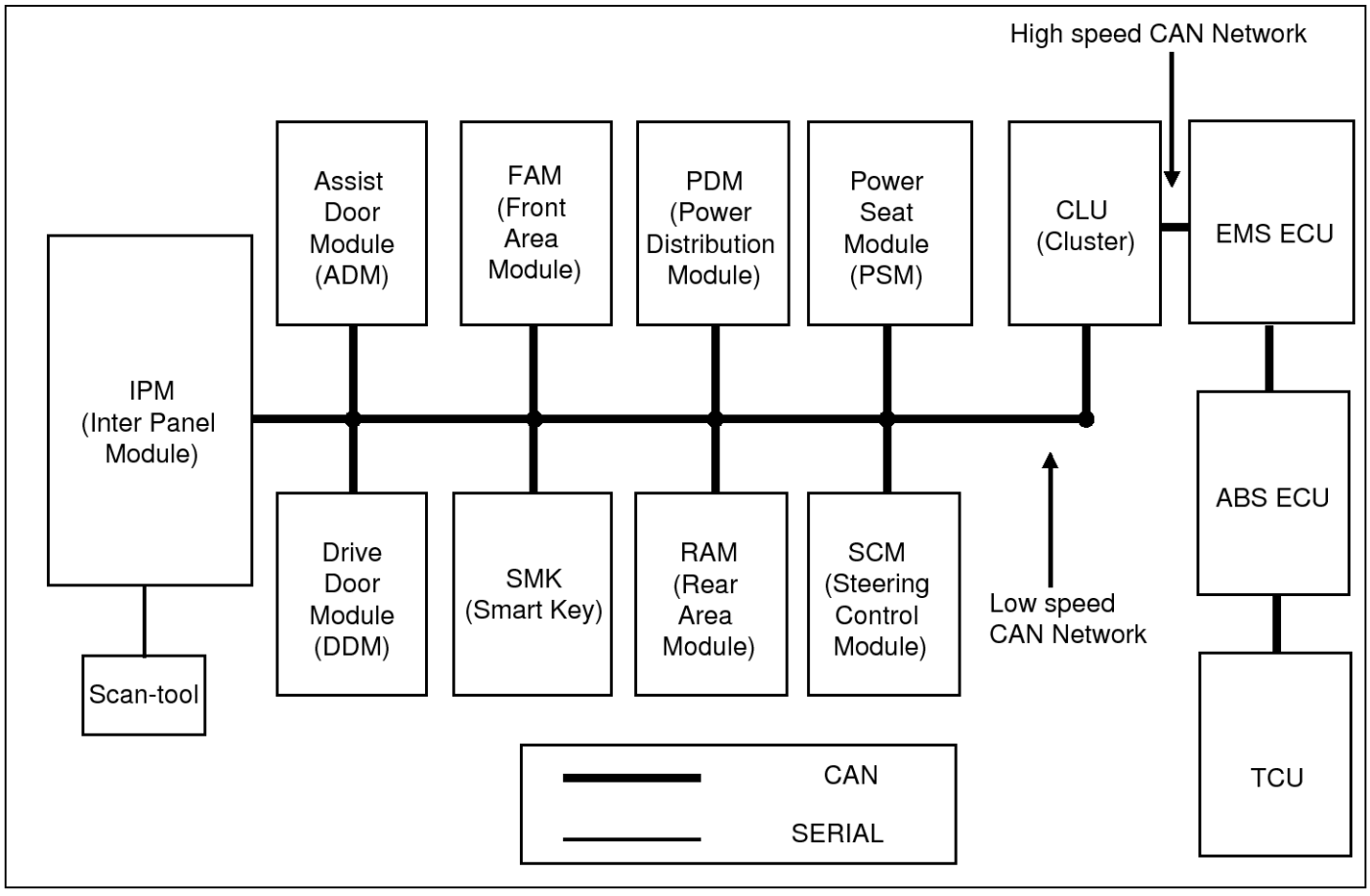
They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*¹ CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other

.*² LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9F00L

DTC Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key))

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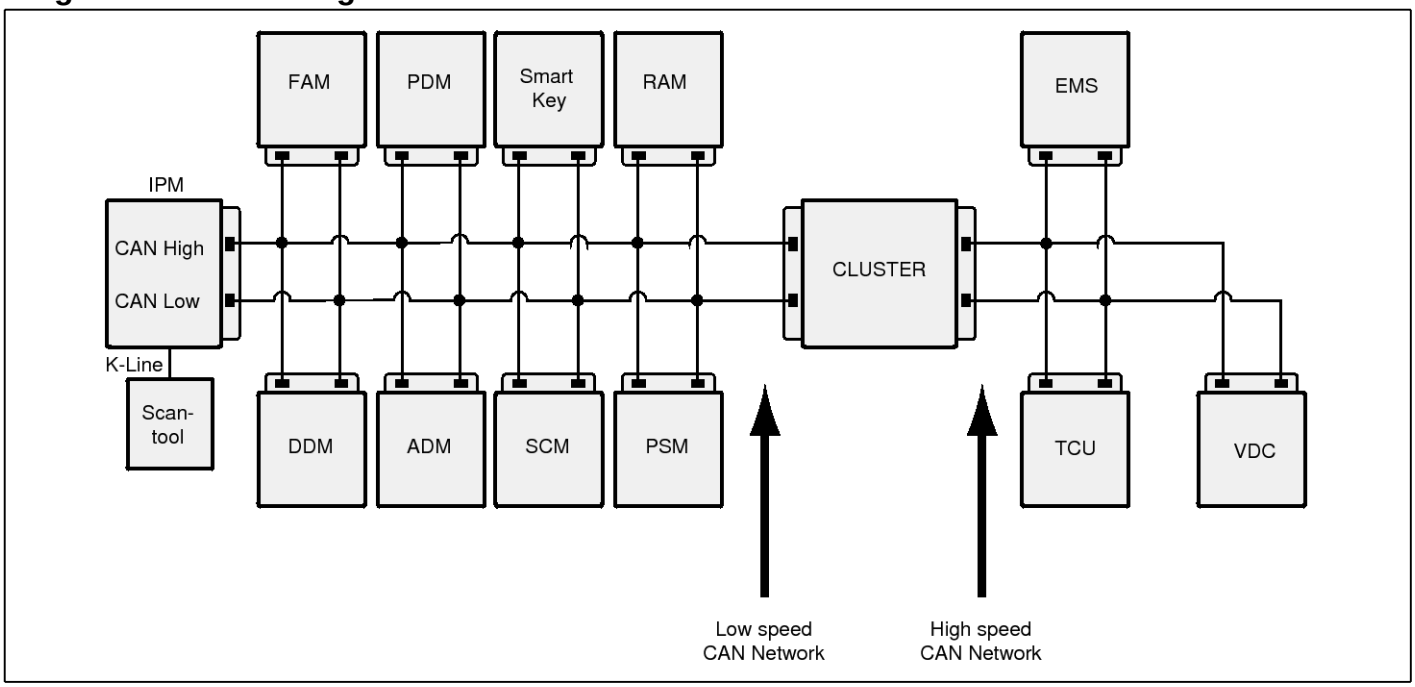
This DTC is set when Communication is not in normal status because CAN communication error or CAN hardware error is detected

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Communication Check	• Poor Connection in CAN high/low • CAN High and Low Line short to ground coincident • CAN High and Low Line short to battery coincident • Short circuit between CAN low and CAN high • Open in CAN low or high
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key	
Threshold Value	• CAN high /low : 0 V or B+	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram



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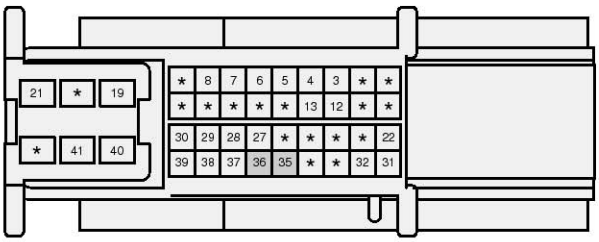
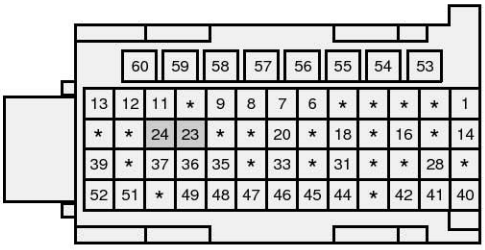
<RAM>



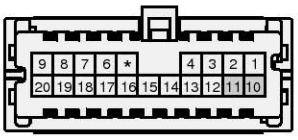
35. Low
36. High

<FAM>



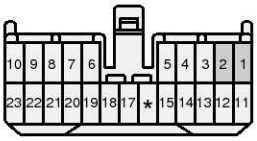
23. Low
24. High

<PDM>



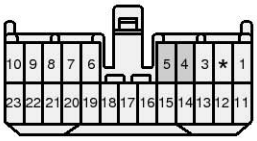
10. Low
11. High

<DDM>



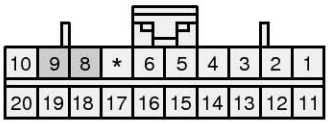
1. High
2. Low

<ADM>



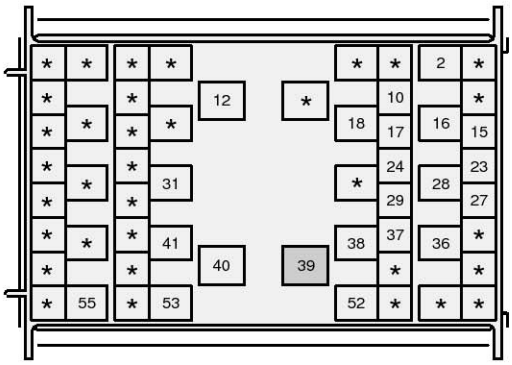
4. High
5. Low

<SCM>



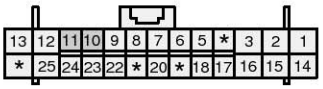
8. High
9. Low

<IPM>



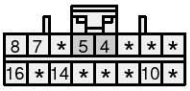
30. High
39. Low

<SMART KEY CONTROL MODULE>



10. HIGH
11. LOW

<IMS>



4. HIGH
5. LOW

SHMBE9F62L

Signal Waveform & Data

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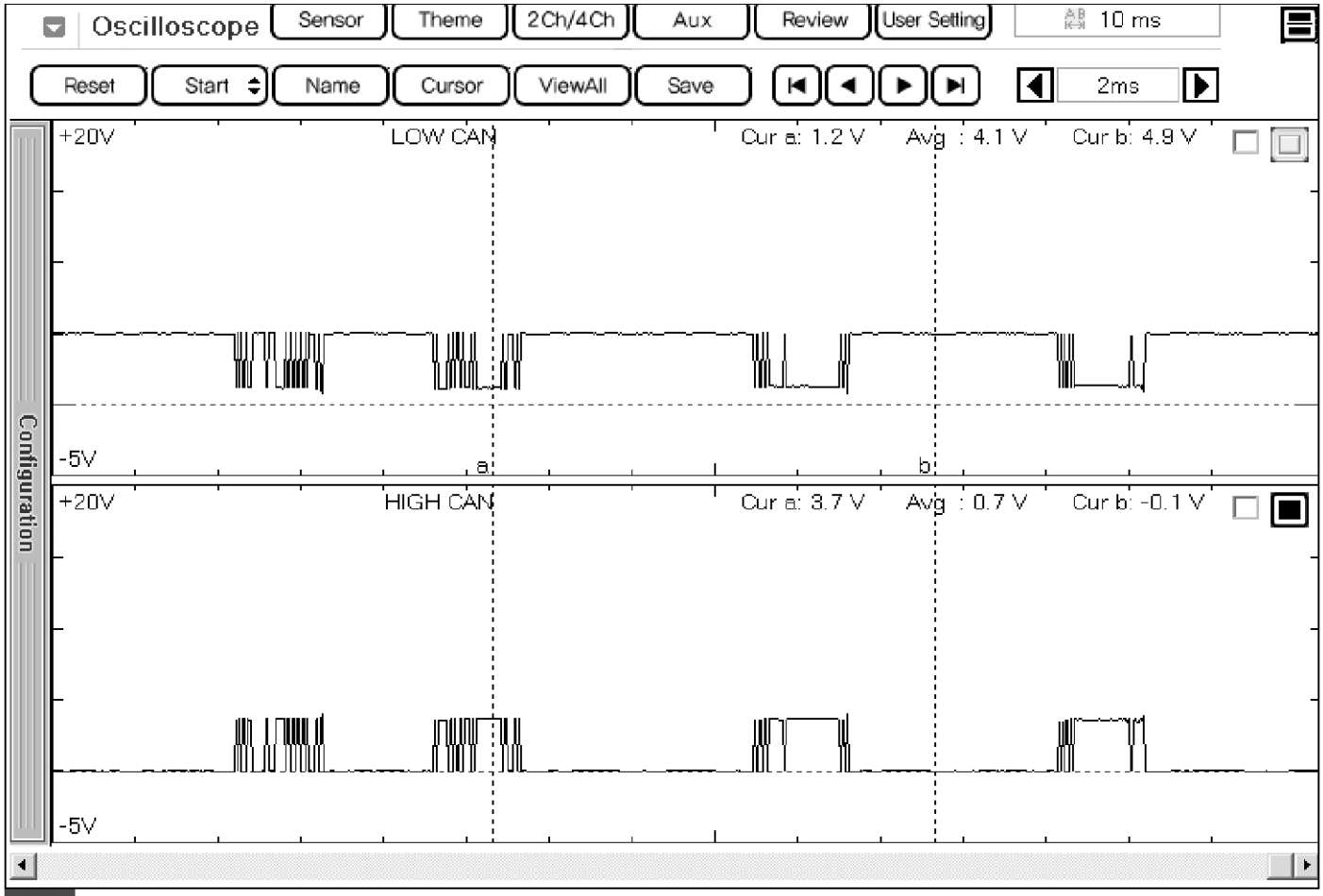

Fig.1

SHMBE9F01L

Fig 1) CAN Low/High Signal Waveform

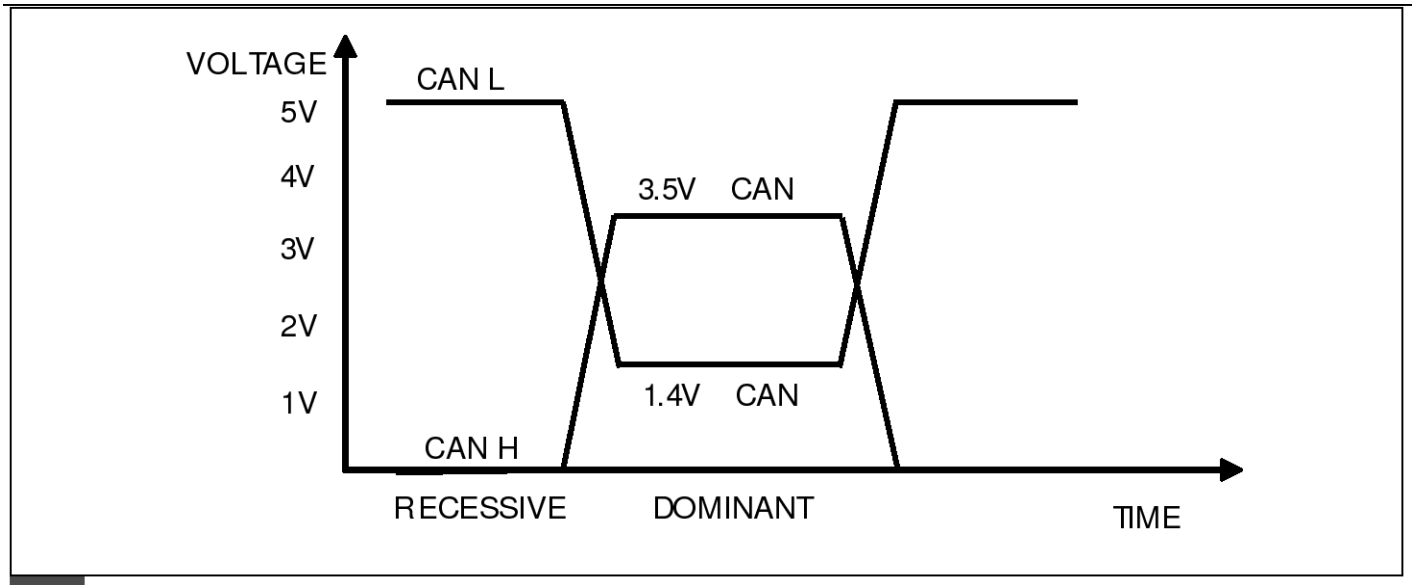

Fig.2

SHMBE9F02L

Fig 1) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

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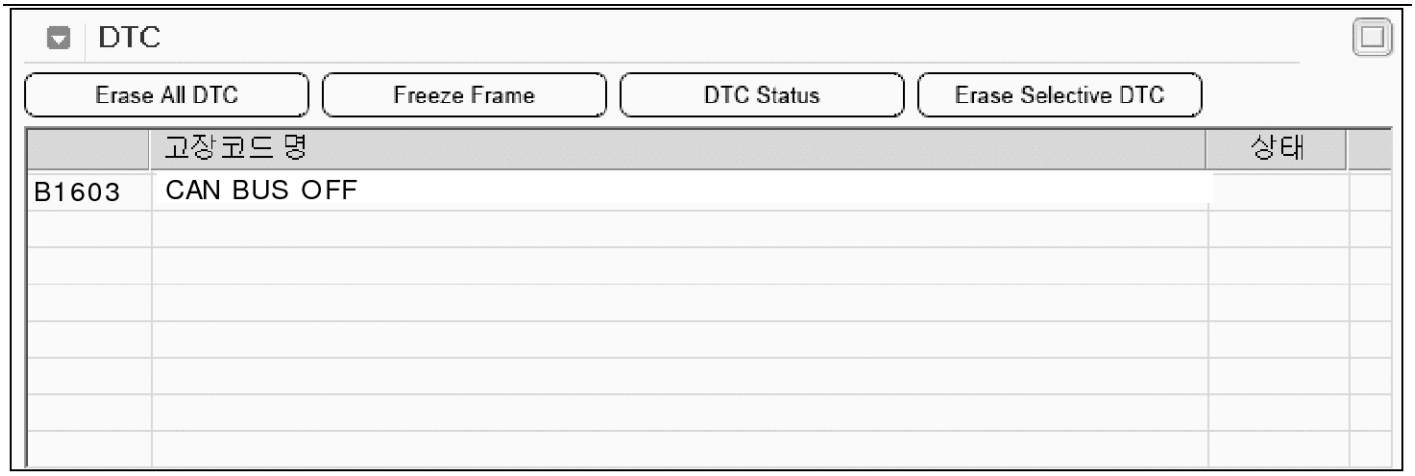
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9F03L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or ADM's connector or was repaired and ADM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of CAN communication units.

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect CAN communication units one by one and monitor DTC to find the cause.

   *CAN communication units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).
5. Is the code erased?

YES ▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.

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2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure..

NO ▶ System performing to specification at this time.

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B1912 Outside Mirror - Right horizontal Motor or Sensor

General Description

Assist Mirror is controlled by pressing direction switch (UP, DOWN, LEFT, RIGHT) with IG ON after

Assist Mirror is selected by Power Window Main Switch.

DTC Description

ADM sets DTC when there is no movement signal from positioning sensor in assist mirror.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Current Detection at Horizontal Driving Motor IC in Assist Mirror	• Short to ground in Horizontal Driving motor circuit • Faulty Driving Motor
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current detected over 2.5A at Horizontal Driving Motor IC in Assist Mirror	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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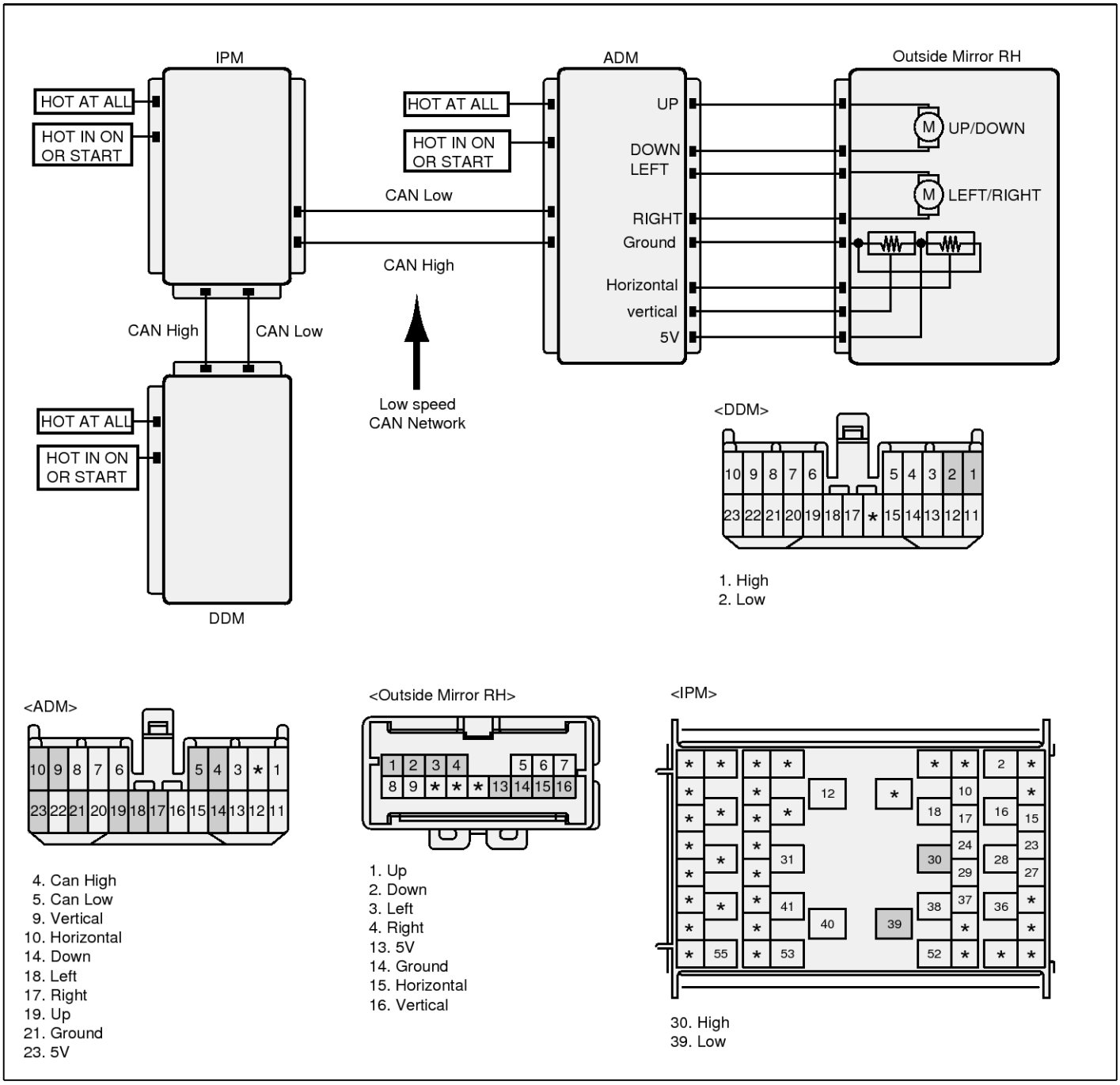

SHMBE9F20L

Signal Waveform & Data

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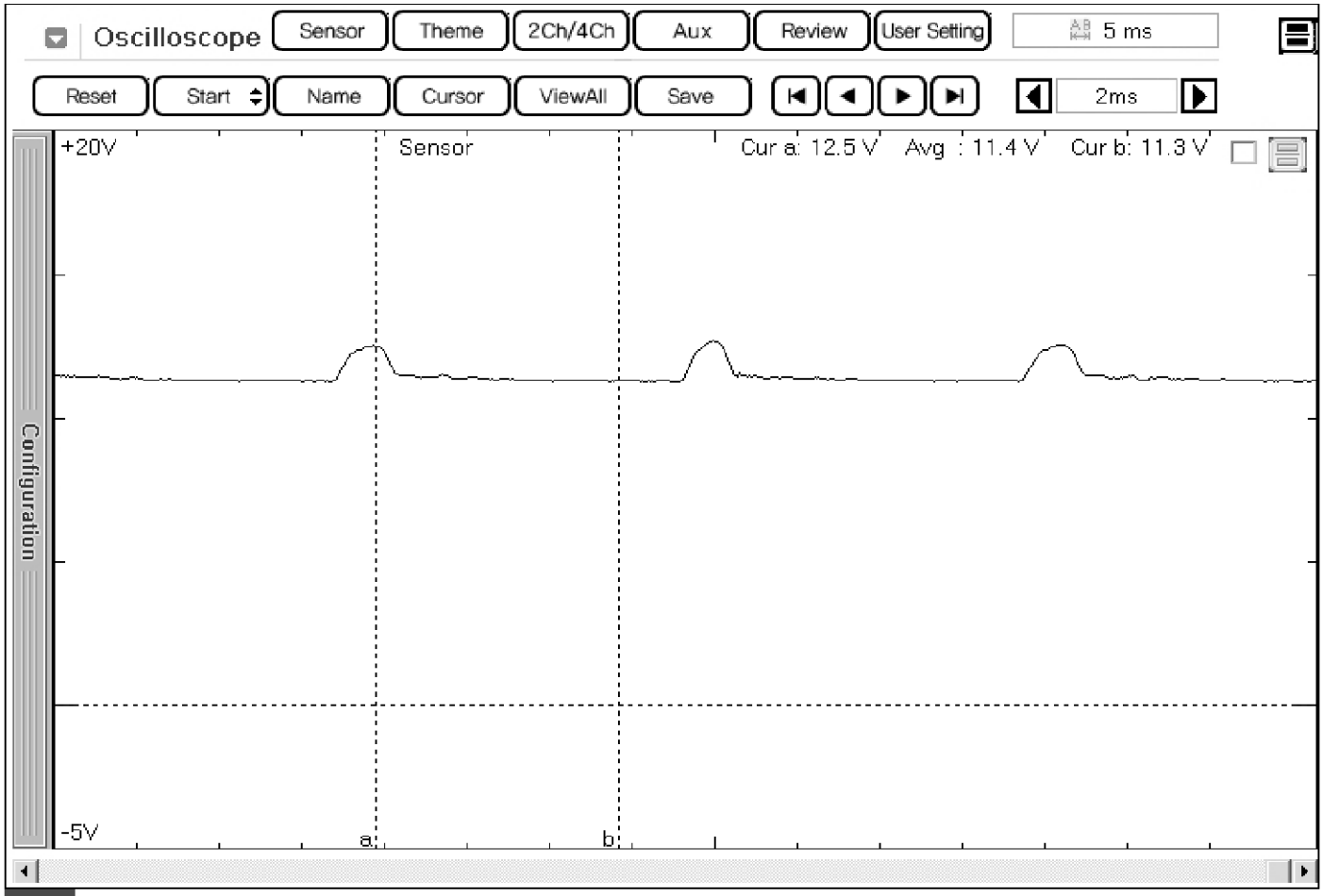

Fig.1

SHMBE9F04L

Fig 1) Signal Waveform of Horizontal motor/sensor of Assist mirror

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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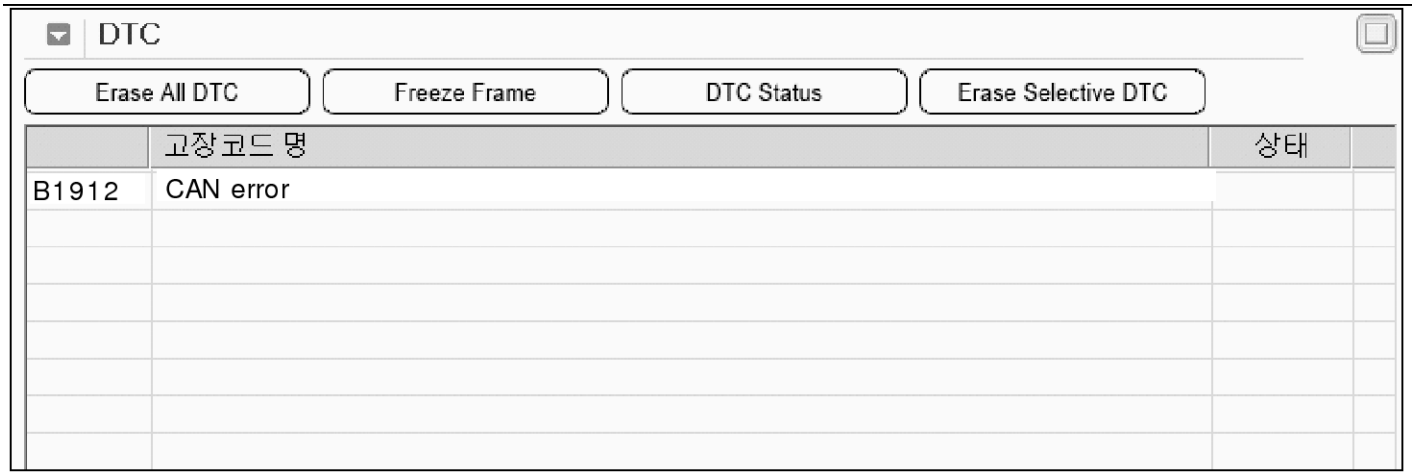

SHMBE9F08L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or ADM's connector or was repaired and ADM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Check mirror motor

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Execute "RH Outside Mirror (LEFT, RIGHT)" test.
4. Disconnect CAN communication units one by one and monitor DTC to find the cause.

Specification : Turned to pressed direction

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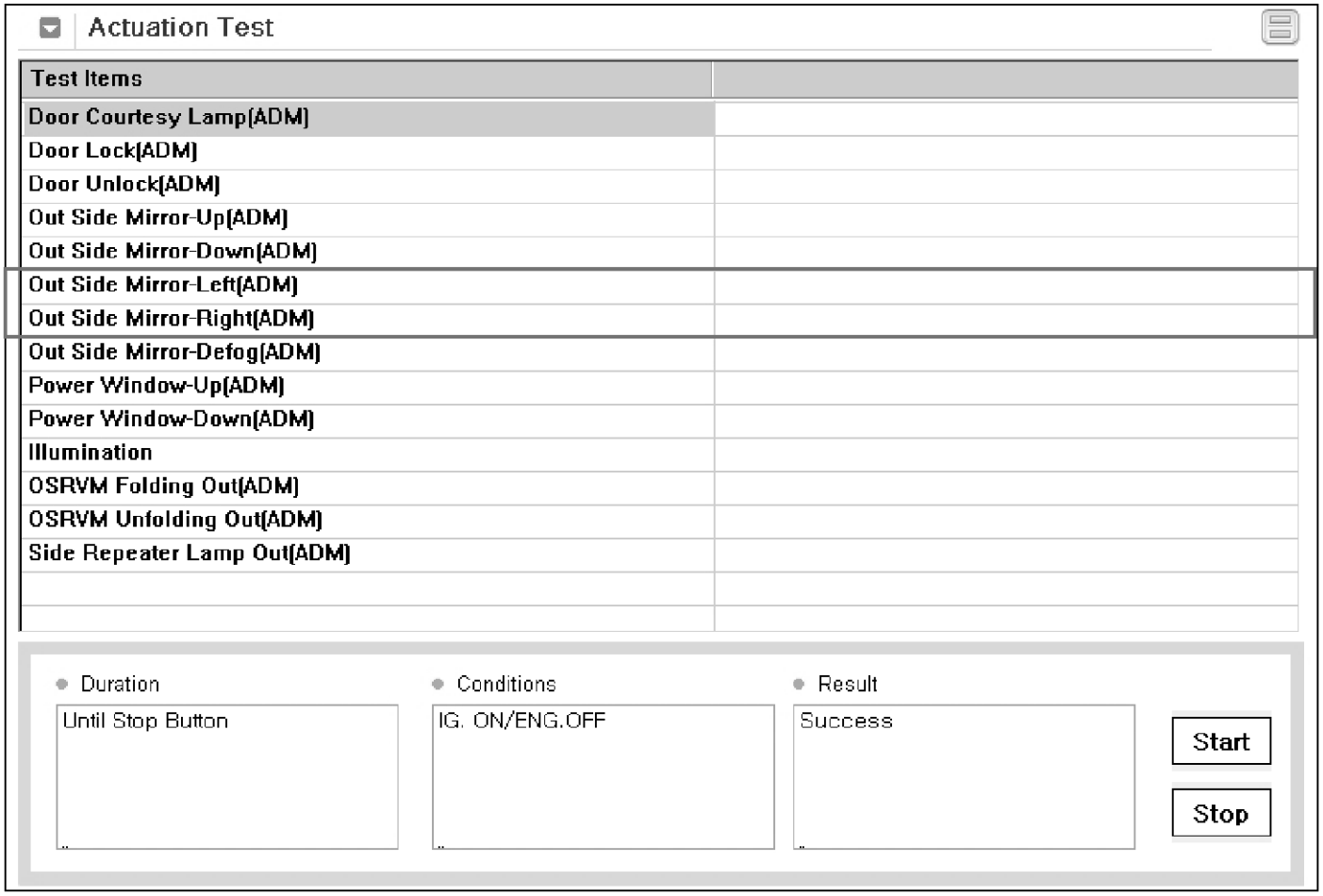

SHMBE9F09L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Assist Mirror Switch-Right" is turned to "Right or Left" when the control switch is pressed. (RIGHT, LEFT)

Specification : Service data is switched. (Right ↔ Left)

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Driver Door Unlock Switch	OFF	-
Key Cylinder Door Lock Switch	OFF	-
Key Cylinder Door Unlock Switch	OFF	-
Fuel Filler Open Switch	OFF	-
Ignition 2 Switch	ON	-
Power Window Lock Switch	OFF	-
Front Left Window Up Switch	OFF	-
Front Left Window Down Switch	OFF	-
Front Left Window Auto Up Switch	OFF	-
Front Left Window Auto Down Switch	OFF	-
Front Right Window Up Switch	OFF	-
Front Right Window Down Switch	OFF	-
Rear Left Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
Rear Right Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
IMS Mode1 Switch	OFF	-
IMS Mode2 Switch	OFF	-
IMS Set Switch	OFF	-
Outside Mirror Select Switch	RH	-
Outside Mirror Adjust	RIGHT	-

SHMBE9F10L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.
If control line and power line from ADM are normal, replace an assist mirror motor(R/H).
If control line is normal, but power line from ADM is abnormal, replace a ADM.

NO ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. Measure the signal waveform of "Horizontal Sensor" with pressing the power window main switch.

Specification : It is same as Signal waveform and Data

3. Is the signal waveform normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

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YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Mirror Horizontal(Left/Right) Sensor.
If the circuit of Mirror Horizontal(LEFT/RIGHT) Sensor is normal, replace the assist mirror and go to "Verification of Vehicle Repair" procedure .

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure..

NO ▶ System performing to specification at this time.

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B1913 Outside Mirror - Right vertical Motor or Sensor

General Description

Assist Mirror is controlled by pressing direction switch (UP, DOWN, LEFT, RIGHT) with IG ON after

Assist Mirror is selected by Power Window Main Switch.

DTC Description

ADM sets DTC when there is no movement signal from positioning sensor in assist mirror.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Current Detection at Vertical Driving Motor IC in Assist Mirror	• hort to ground in vertical Drivin-g motor circuit • Faulty Driving Motor
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current detected over 2.5A at Vertical Driving Motor IC in Assist Mirror	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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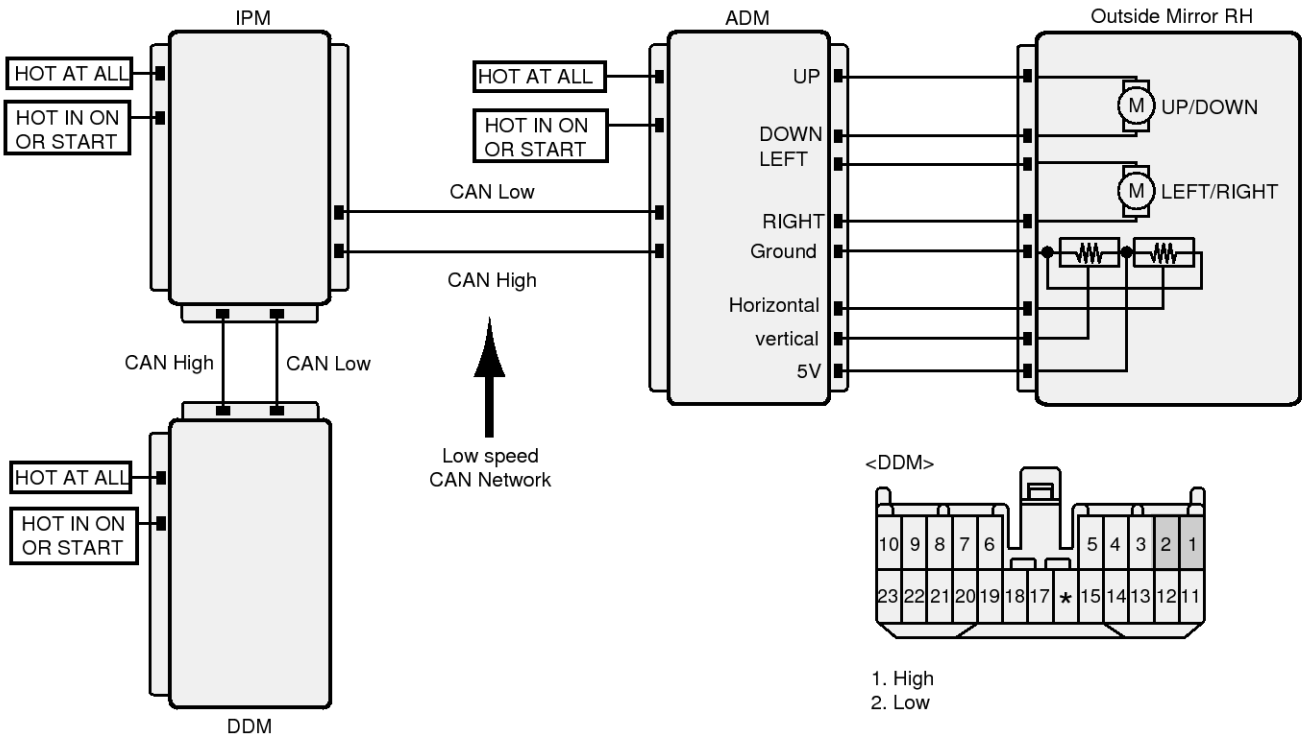
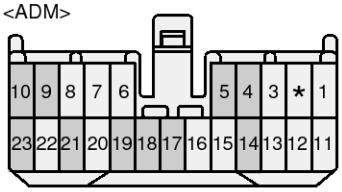


<DDM>

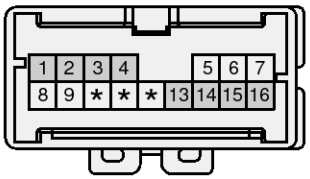
1. High
2. Low

<ADM>



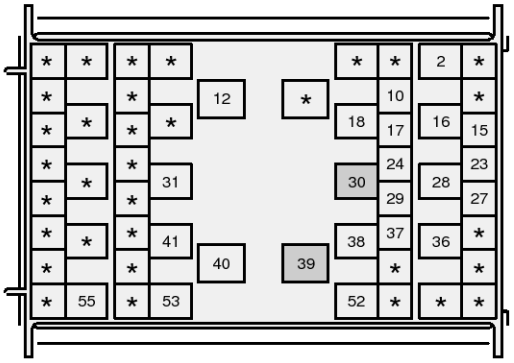
4. Can High
5. Can Low
9. Vertical
10. Horizontal
14. Down
18. Left
17. Right
19. Up
21. Ground
23. 5V

<Outside Mirror RH>



1. Up
2. Down
3. Left
4. Right
13. 5V
14. Ground
15. Horizontal
16. Vertical

<IPM>



30. High
39. Low

SHMBE9F20L

Signal Waveform & Data

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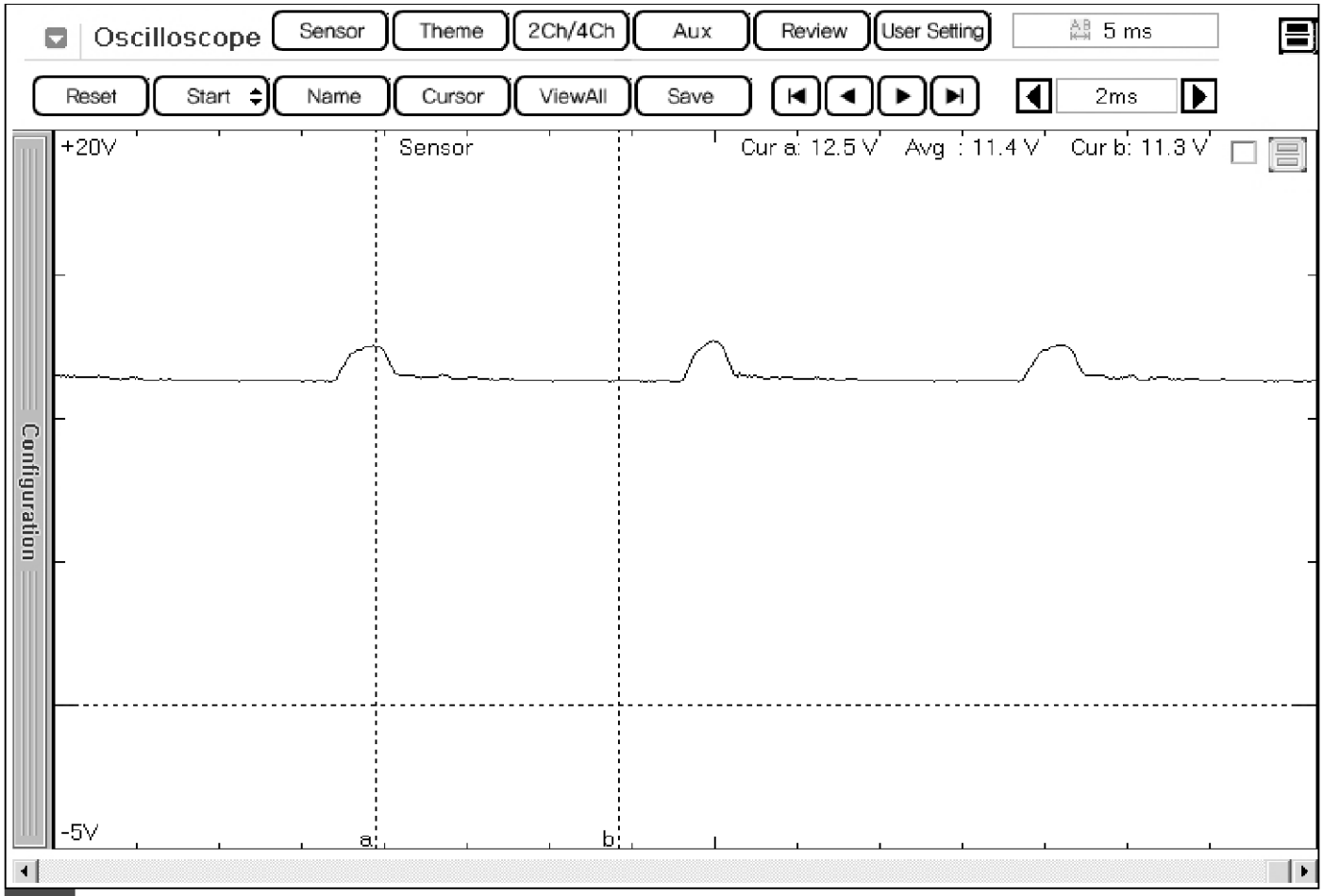

Fig.1

SHMBE9F04L

Fig 1) Signal Waveform of vertical motor/sensor of Assist mirror

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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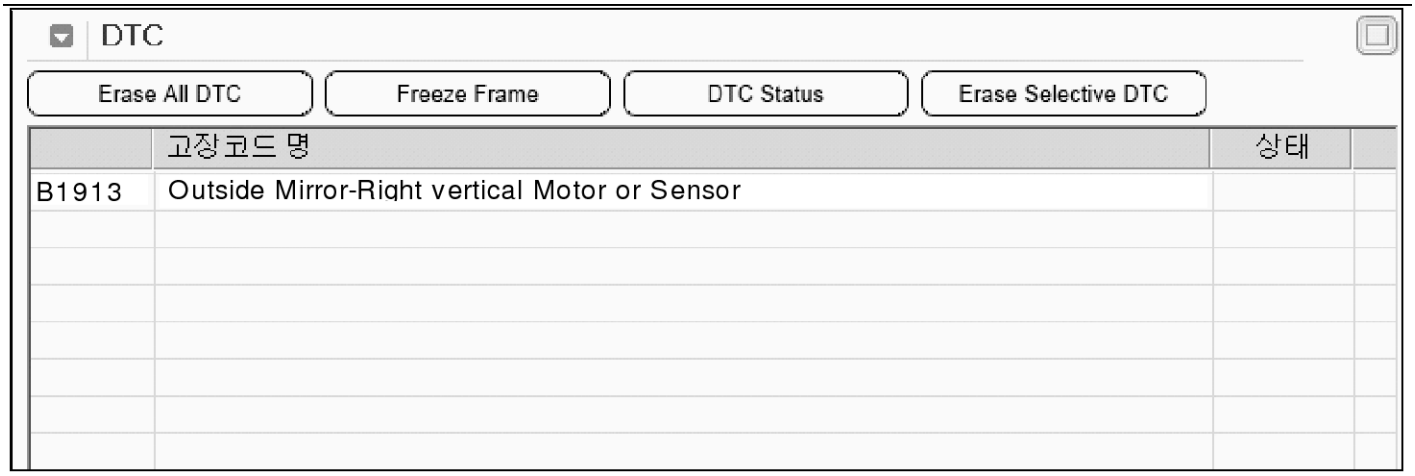

SHMBE9F05L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or ADM's connector or was repaired and ADM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Check mirror motor

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "RH Outside Mirror (UP, DOWN)" test.

Specification : Turned to pressed direction

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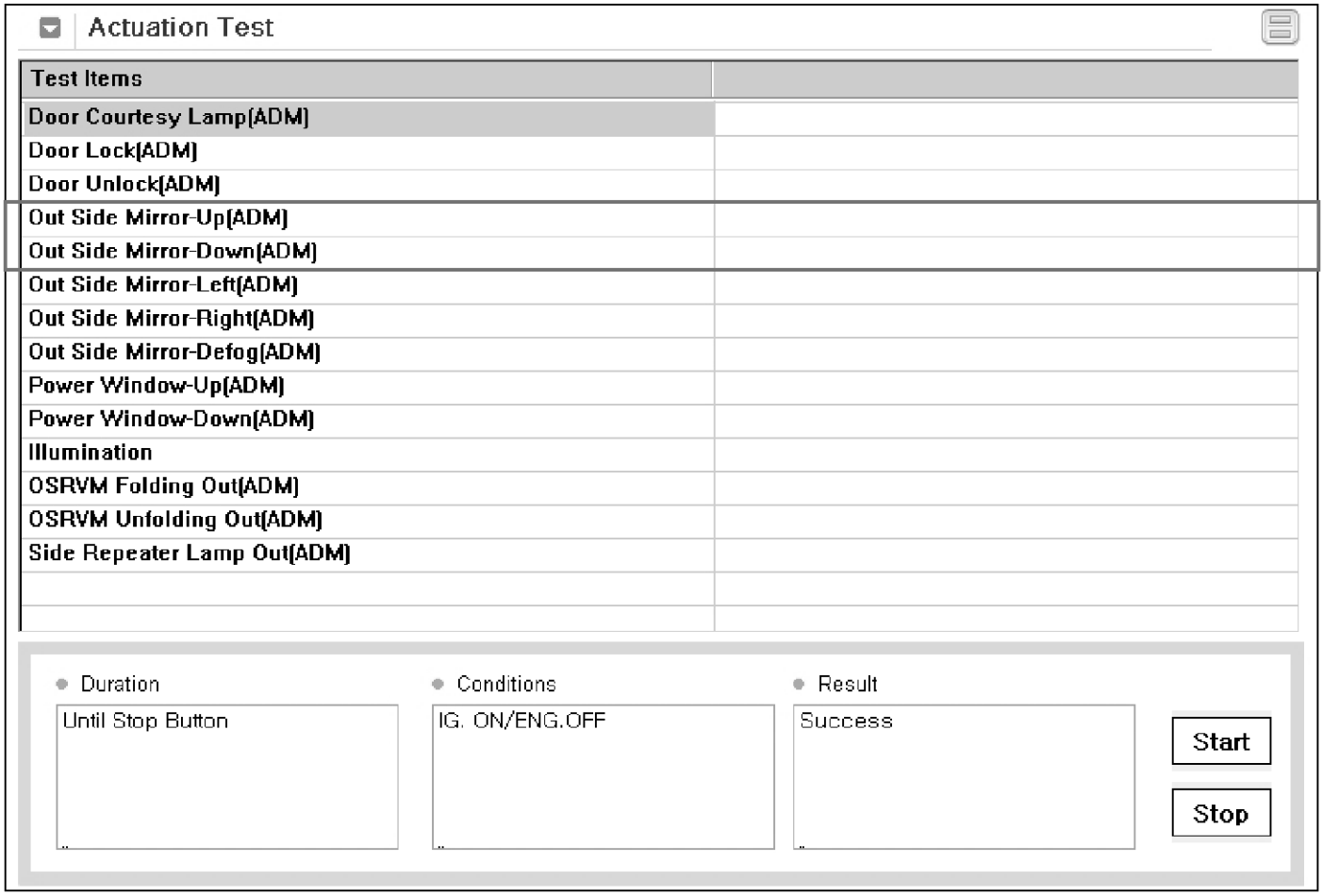

SHMBE9F06L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Assist Mirror Switch-RH" is turned to "UP & DOWN" when the control switch is pressed. (UP, DOWN)

Specification : Service data is switched. (UP ↔ DOWN)

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Driver Door Unlock Switch	OFF	-
Key Cylinder Door Lock Switch	OFF	-
Key Cylinder Door Unlock Switch	OFF	-
Fuel Filler Open Switch	OFF	-
Ignition 2 Switch	ON	-
Power Window Lock Switch	OFF	-
Front Left Window Up Switch	OFF	-
Front Left Window Down Switch	OFF	-
Front Left Window Auto Up Switch	OFF	-
Front Left Window Auto Down Switch	OFF	-
Front Right Window Up Switch	OFF	-
Front Right Window Down Switch	OFF	-
Rear Left Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
Rear Right Window Up Switch	OFF	-
Rear Left Window Down Switch	OFF	-
IMS Mode1 Switch	OFF	-
IMS Mode2 Switch	OFF	-
IMS Set Switch	OFF	-
Outside Mirror Select Switch	RH	-
Outside Mirror Adjust	RIGHT	-

SHMBE9F10L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure..
If control line and power line from ADM are normal, replace an assist mirror motor(R/H).
If control line is normal, but ADM is abnormal, replace ADM.

NO ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. With controlling mirror with mirror switch of power window main switch, check voltage change(Input signal change) of terminal of vertical sensor.

Specification : It is as same as signal waveform and data

3. Is the signal output normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

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YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Mirror Vertical(UP/DOWN) Sensor.
If the circuit of Mirror Vertical(UP/DOWN) Sensor is normal, replace the assist mirror and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure..

NO ▶ System performing to specification at this time.

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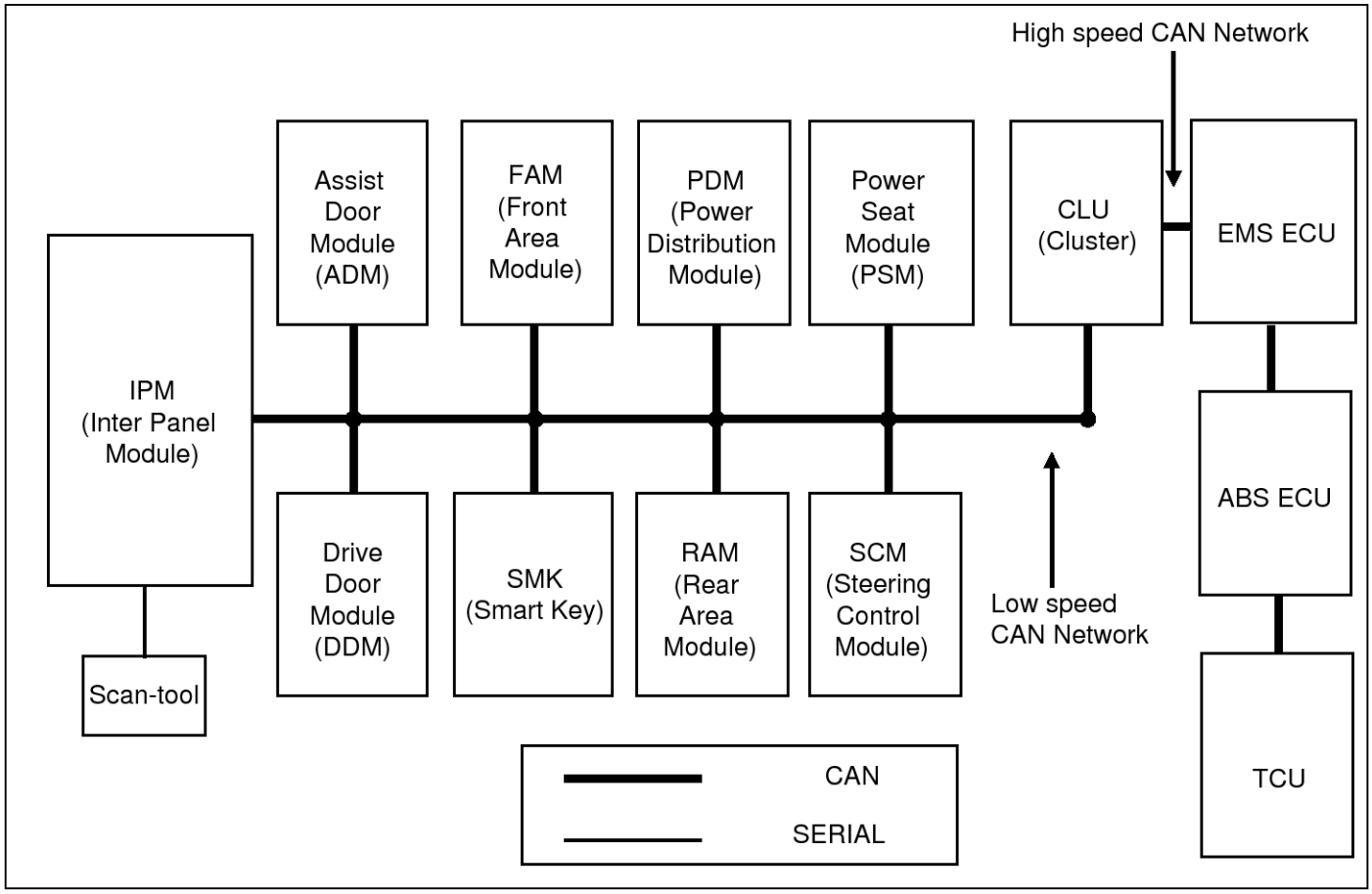
B1952 Outside Mirror Defogger Error

General Description

If operating the Rear Glass Defog SW, its signal goes to IPM at first and its signal goes to ADM, through the CAN communication. ADM controls Defog Relay to get rid of defog on the rear glass with this signal.



SHMBE9F00L

DTC Description

ADM sets DTC when ADM detects open circuit in Assist outside Rear View Mirror

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in defog of Assist outside rear view mirror	• Open circuit in defog of Assist outside rear view mirror • Faulty Defog in Assist outside rear view mirror
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Defogging works on	
Threshold Value	• Current is lower than 150mA	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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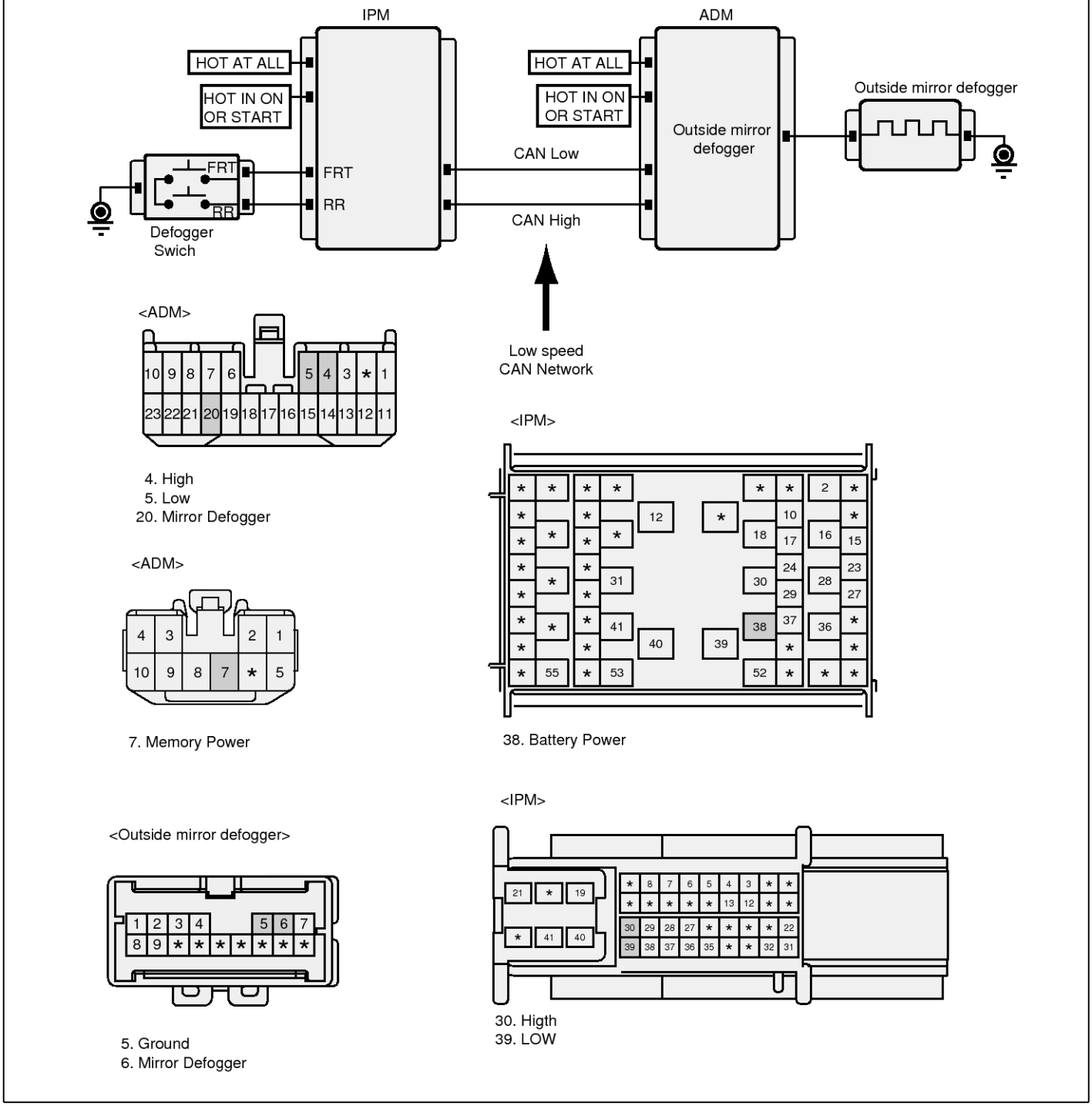

SHMBE9F22L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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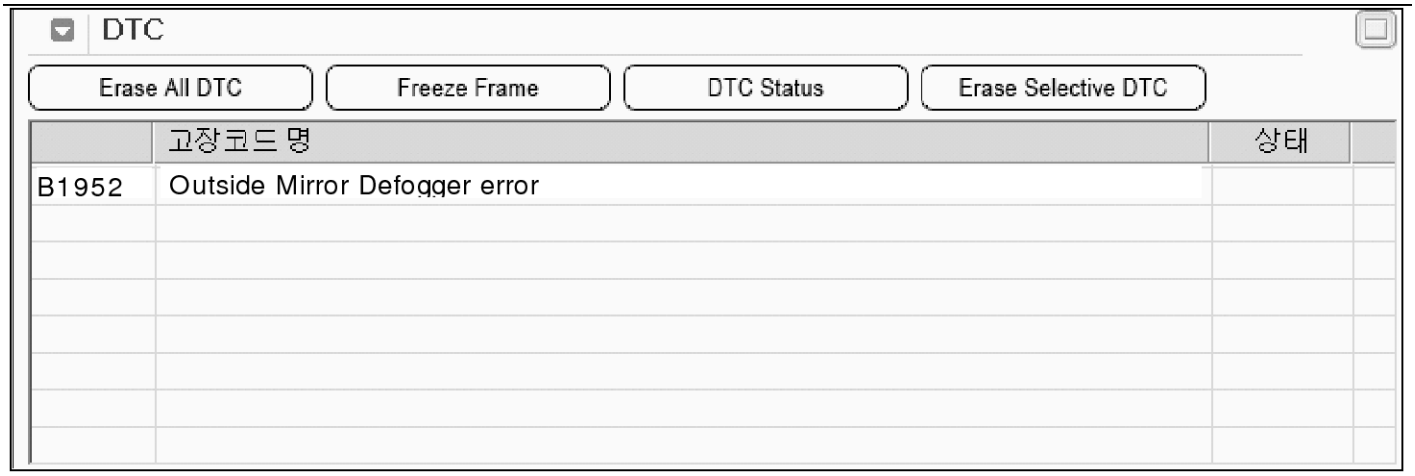

SHMBE9F15L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or ADM's connector or was repaired and ADM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check defog in Assist rear view mirror

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Assist rear view mirror" test

Specification : ON or OFFF

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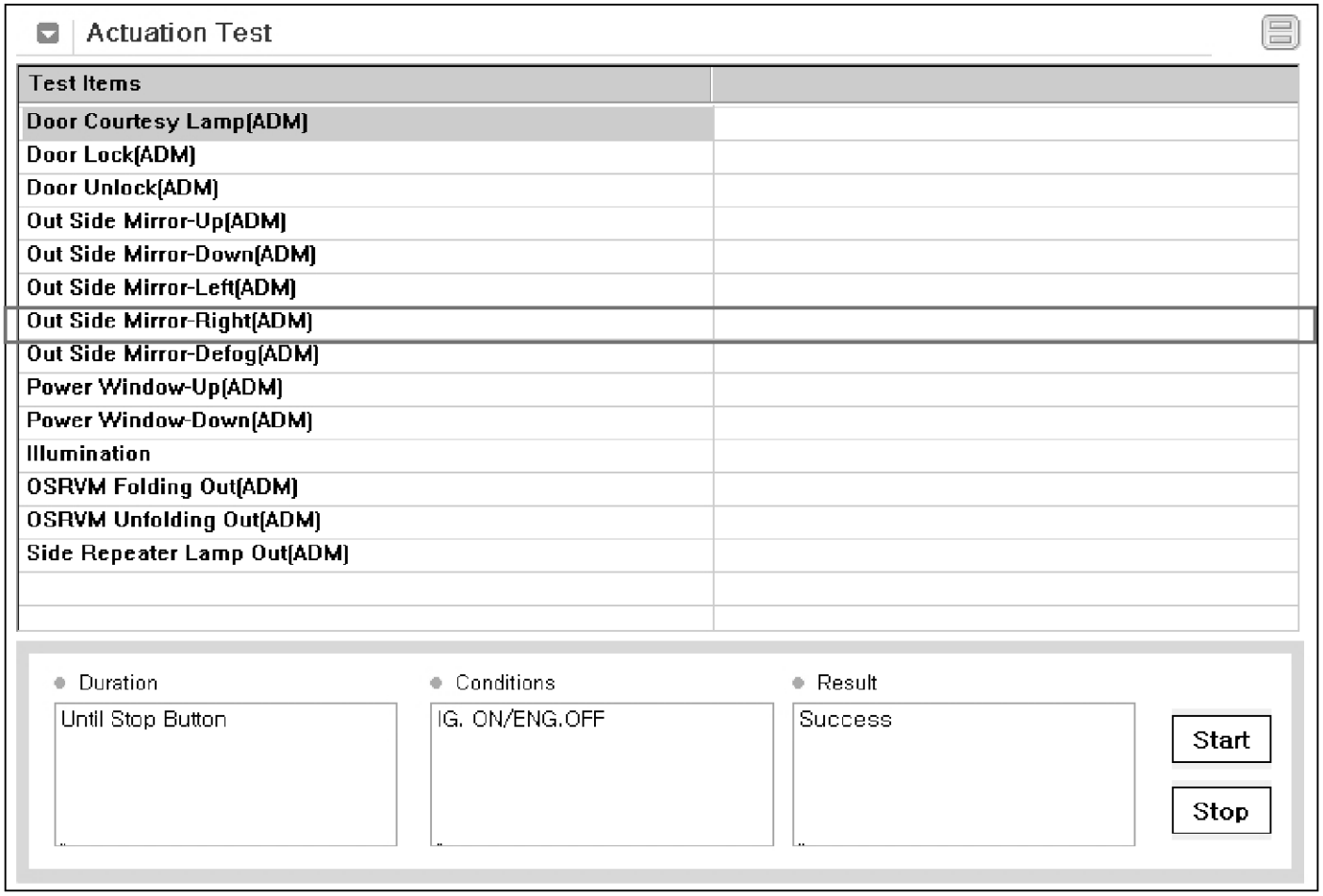

SHMBE9F16L

5. Is the Defog in Assist rear view Mirror normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Power Circuit Inspection' procedure.

Power Circuit Inspection

■ Defog in Driver rear view mirror

1. IG "ON" & ENG "ON"
2. Make ON status with turning ON the defog switch for outside rear view mirror of Driver side.
3. Check voltage between signal terminal of outside rear view of Driver side goes to ADM and chassis ground.

Specification : About 12 V

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

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YES ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check fuse is blown off, defog of outside rear view mirror for driver and open or short in signal circuit of outside rear view mirror for driver side. And then, repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure..

NO ▶ System performing to specification at this time.

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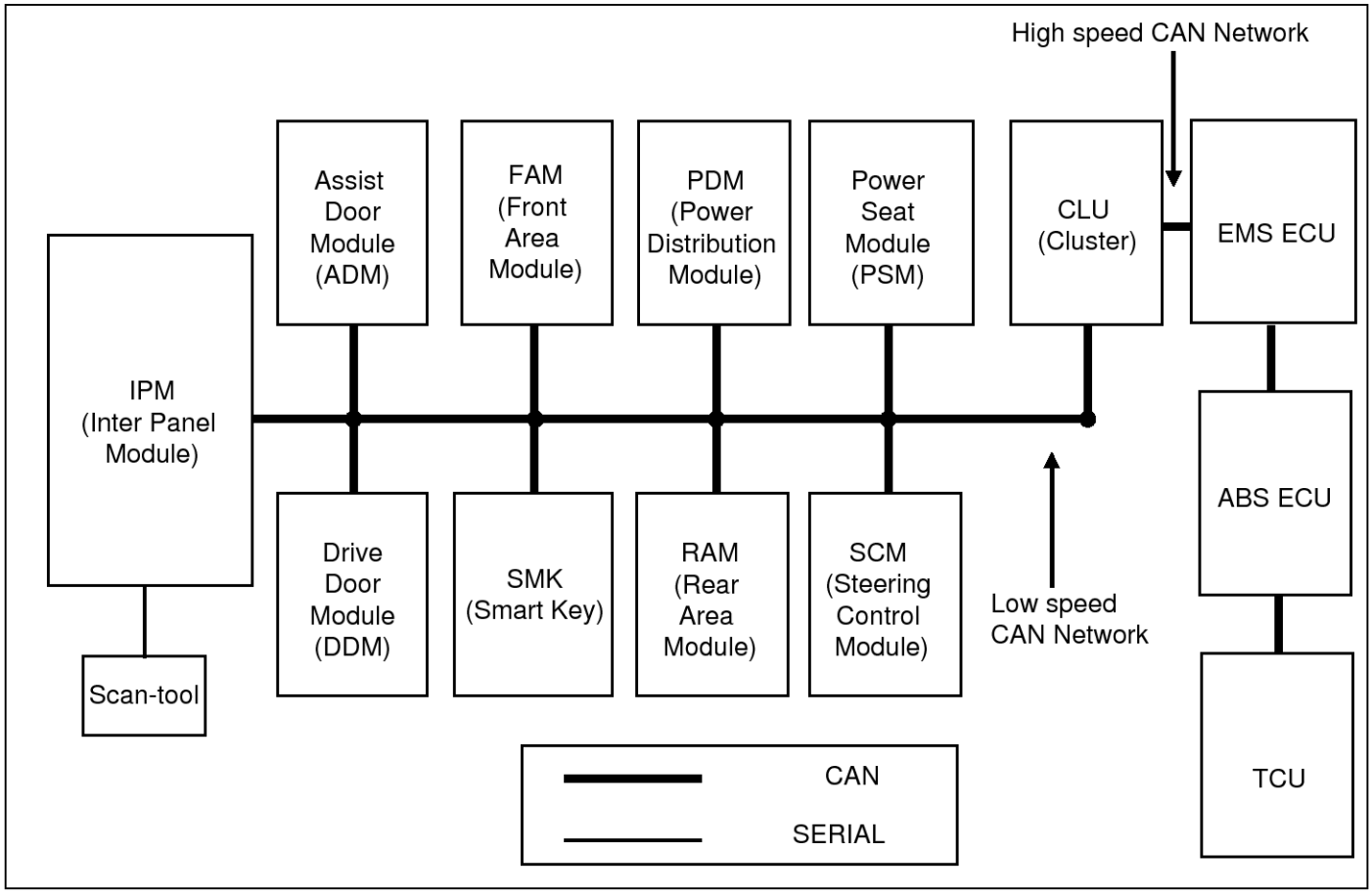
B2332 Assistant Door Lock Actuator Error

General Description

If operating lock/unlock the Power Door Lock SW,which signal goes to DDM at first and its signal goes to ADM, RAM through the CAN communication. ADM controls Door Lock Actuator with this signal.



SHMBE9F00L

DTC Description

ADM sets DTC when ADM detects open circuit in Assist Door Lock Actuator.

DTC Detecting Condition

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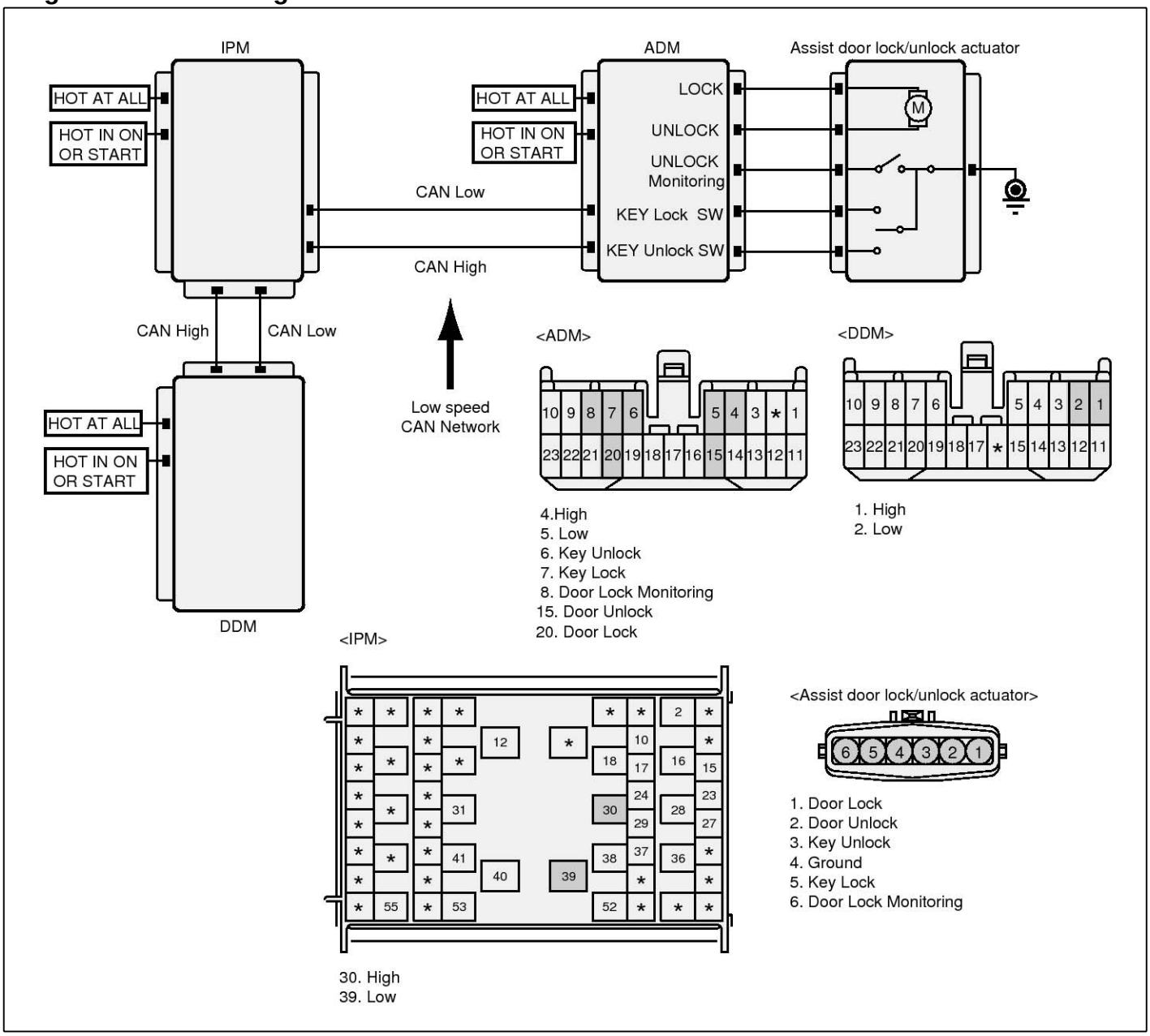
Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in Assist Door Lock Actuator	• Open circuit in Assist Door Lock Actuator • Open circuit in Assist Door Lock Actuator Coil
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current is lower than 150mA	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram



SHMBE9F21L

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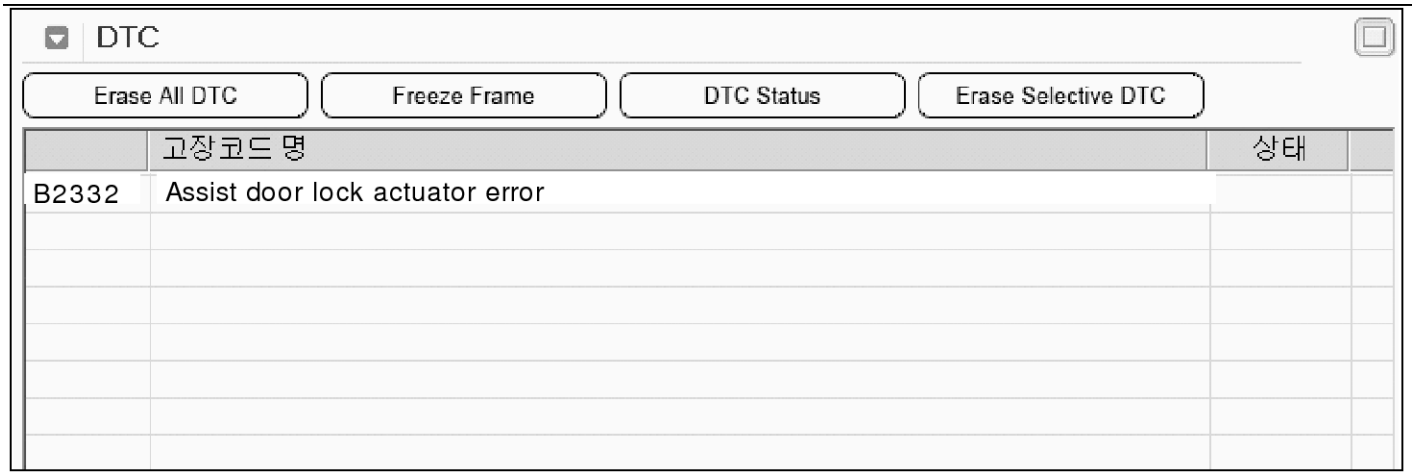
Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9F11L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or ADM's connector or was repaired and ADM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Door Lock

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Assist Door Lock" test

Specification : Turned to pressed direction

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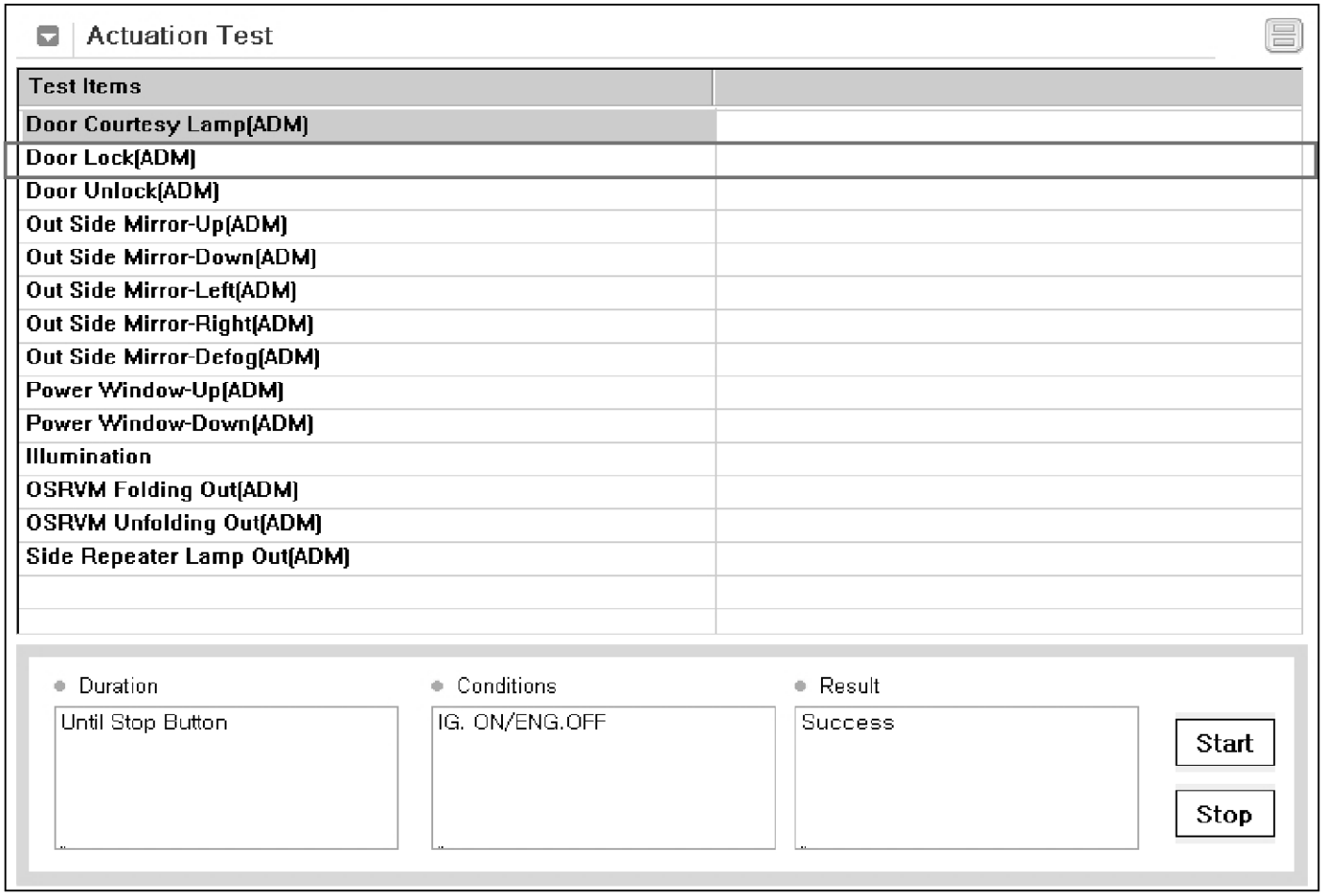

SHMBE9F12L

5. Is the Door Lock status normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Control Circuit Inspection' procedure.

Control Circuit Inspection

■ Check open or short in circuit of Assist Door Lock Actuator

1. Disconnect battery (-) terminal after IG "OFF"
2. Disconnect ADM connector.
3. Check resistnace between control terminal of unlock detection of ADM harness connector and ground.

Specification : Lock - About 1 Ω, Unlock - ∞ Ω

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

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YES ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

NO ▶ In case of open or short in assis door lock actuator circuit, repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure..

NO ▶ System performing to specification at this time.

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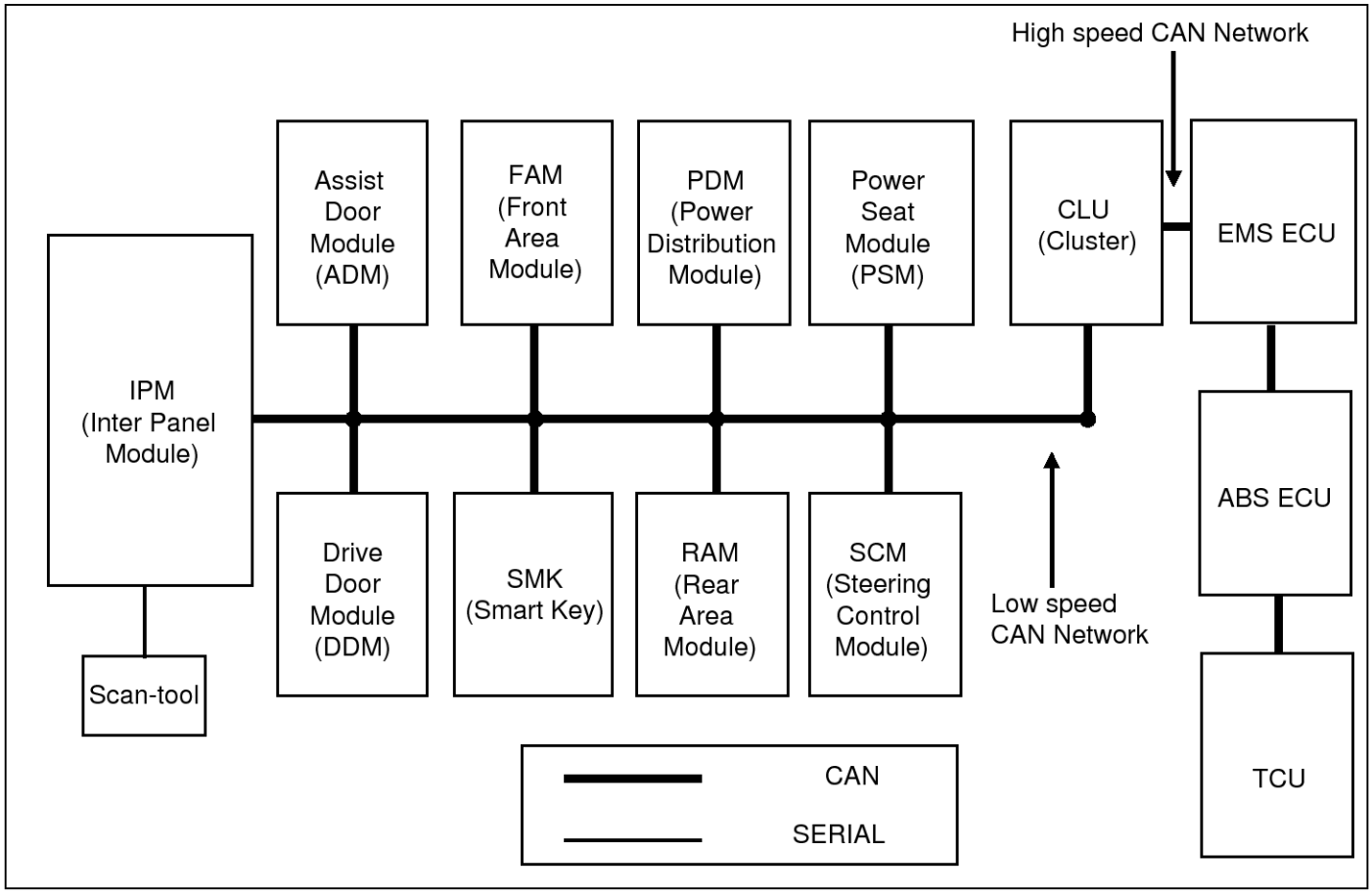
B2333 Assistant Door Unlock Actuator Error

General Description

If operating lock/unlock the Power Door Lock SW,which signal goes to DDM at first and its signal goes to ADM, RAM through the CAN communication. ADM controls Door Lock Actuator with this signal.



SHMBE9F00L

DTC Description

ADM sets DTC when ADM detects open circuit in Assist Door Unlock Actuator.

DTC Detecting Condition

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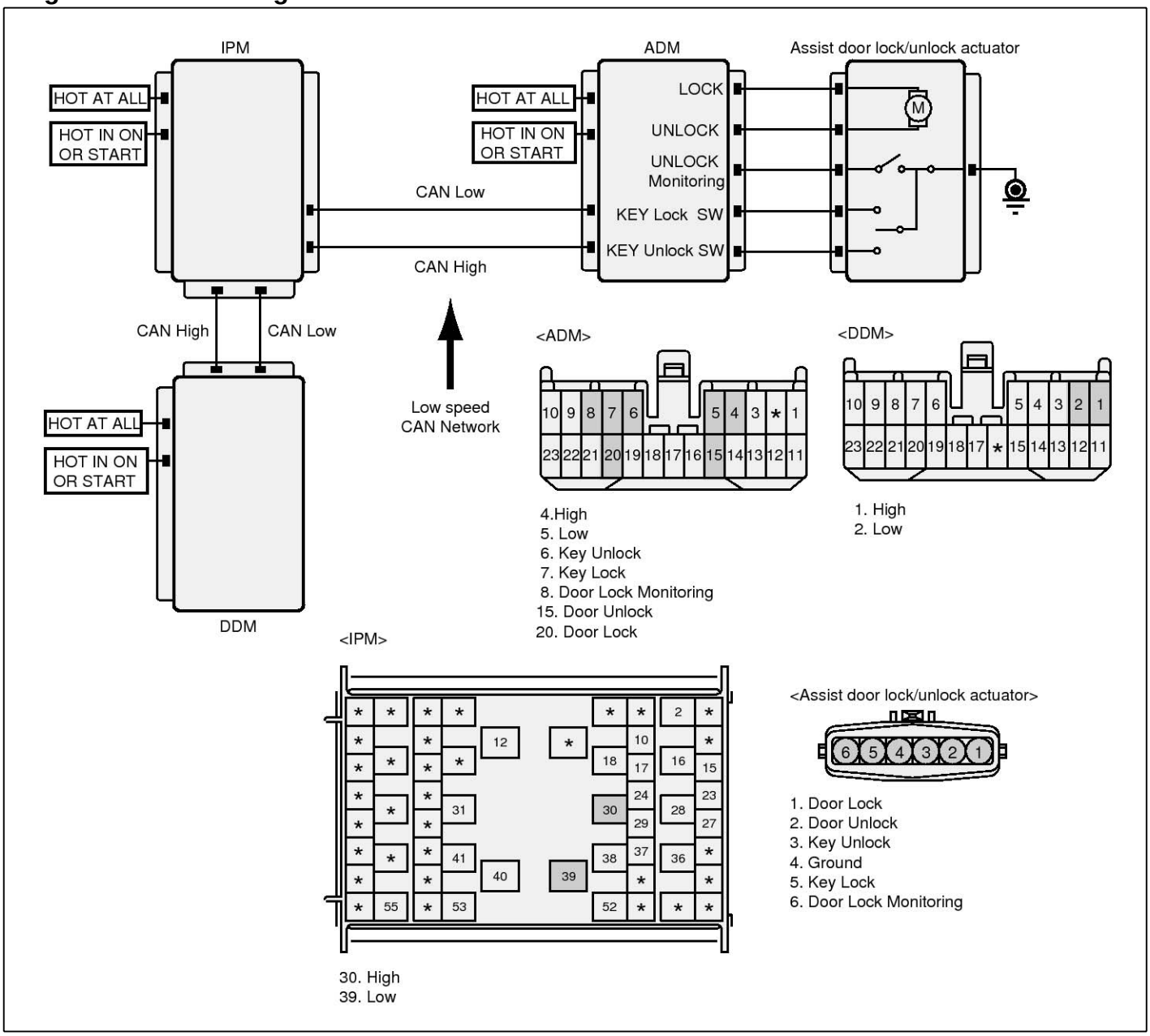
Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in Assist Door Unlock Actuator	• Open circuit in Assist Door Unlock Actuator • Open circuit in Assist Door Unlock Actuator Coil
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • Motor works on	
Threshold Value	• Current is lower than 150mA	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram



SHMBE9F21L

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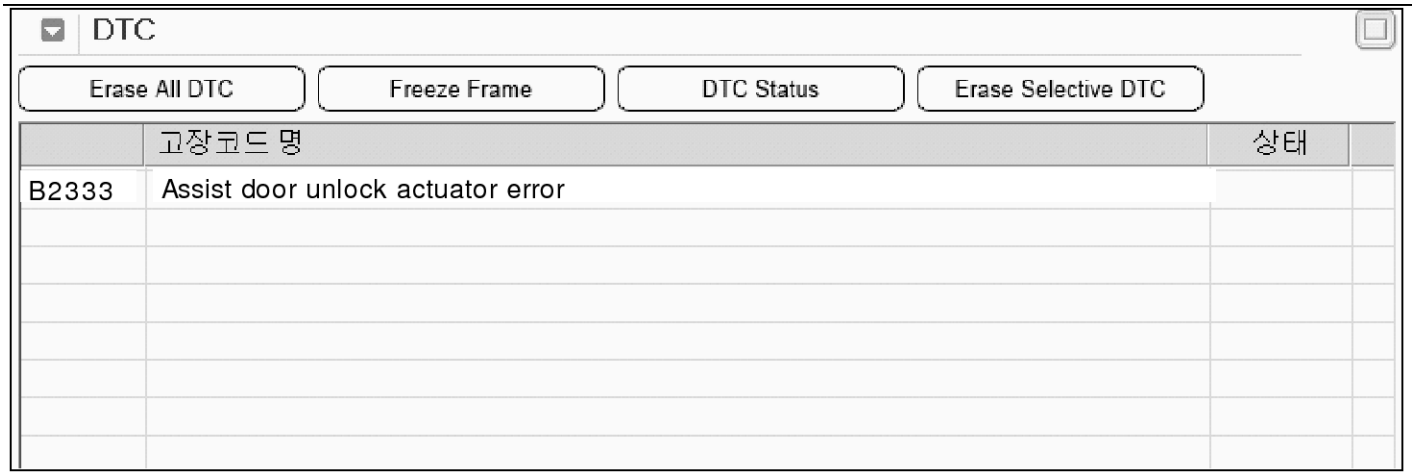
Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9F13L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or ADM's connector or was repaired and ADM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Door Unlock

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Assist Door Unlock" test

Specification : Turned to pressed direction

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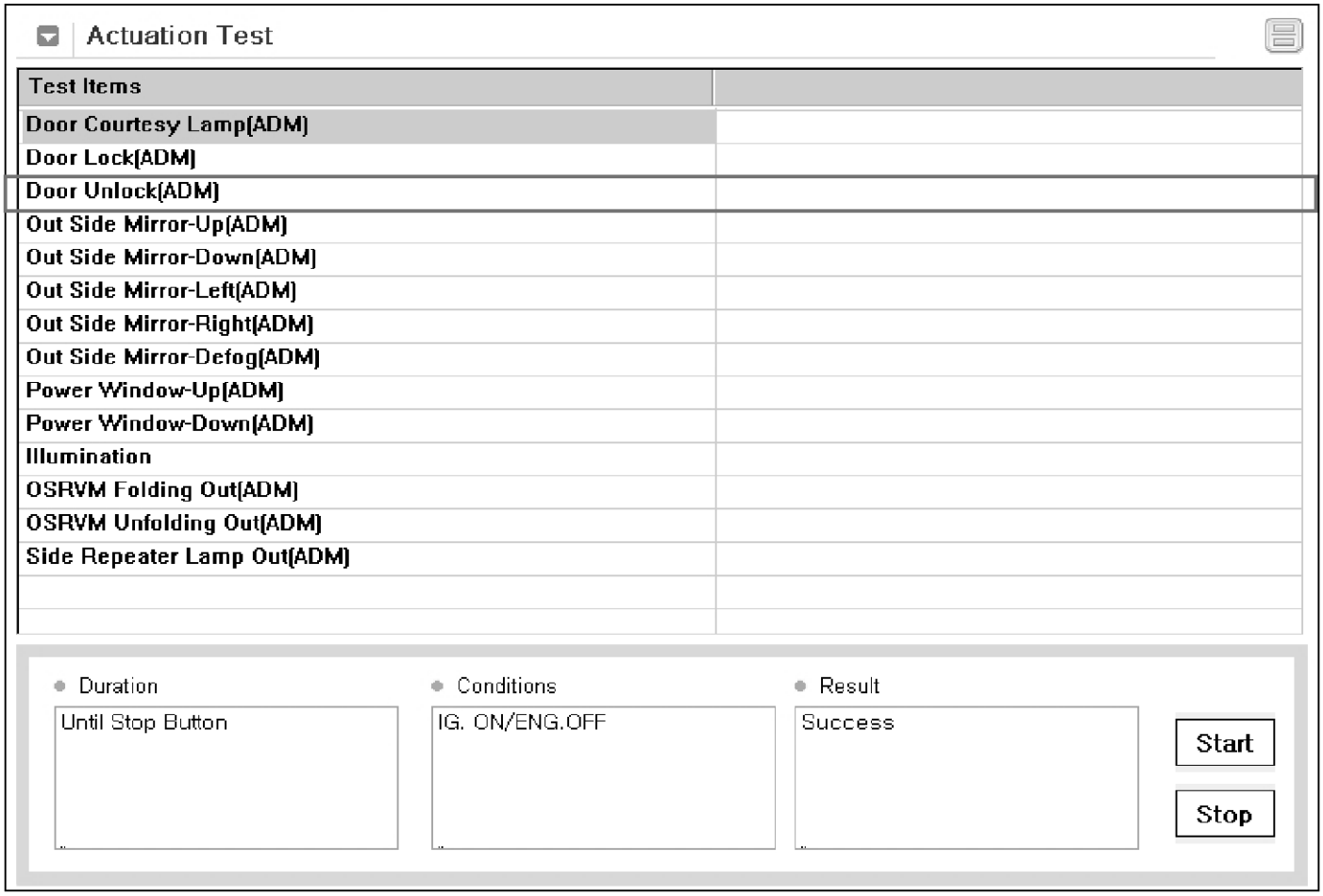

SHMBE9F14L

5. Is the Door Unlock status normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Control Circuit Inspection' procedure.

Control Circuit Inspection

■ Check open / short in assist door unlock actuator circuit

1. Disconnet battery (-) terminal after IG "OFF"
2. Disconnect ADM connector.
3. Check resistance between control terminal of of unlock detection of ADM harness connector and ground.

Specification : LOCK : About 1 Ω, UNLOCK : About ∞ Ω

4. Is the measured value within specification ?

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YES ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

NO ▶ In case of open or short in assis door unlock actuator circuit, repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure..

NO ▶ System performing to specification at this time.

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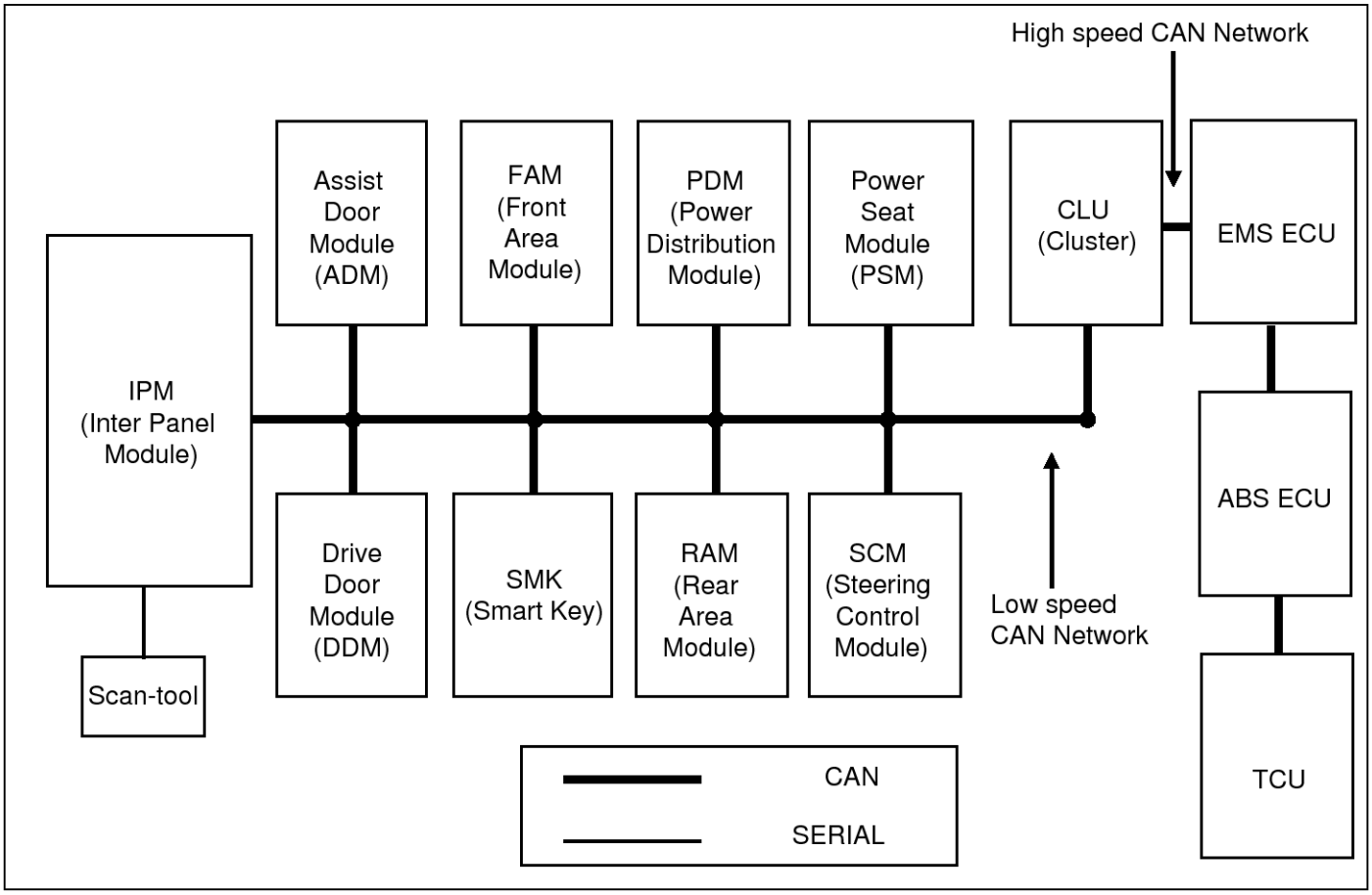
B2533 Assistant Door Courtesy Lamp Error

General Description

If opening the Passenger side Door, the switch signal is ON. And, this signal goes to RAM which send it to ADM through CAN. Finally ADM turns the door cutesey lamp ON.



SHMBE9F00L

DTC Description

ADM sets DTC when ADM detects open circuit in Assist door courtesy lamp driving IC.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• Open circuit in assist door courtesy lamp driving IC	• Open circuit in Assist door courtesy lamp • Faulty Assist door courtesy lamp
Enable Conditions	• Not in START position with IGN Key • 200mS after START position with IGN Key • assist door courtesy lamp works on	
Threshold Value	• Current is lower than 40mA	
Diagnostic Time	• Immediately (DTC status memorized)	
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.) • Disconnecting battery cable	

Diagnostic Circuit Diagram

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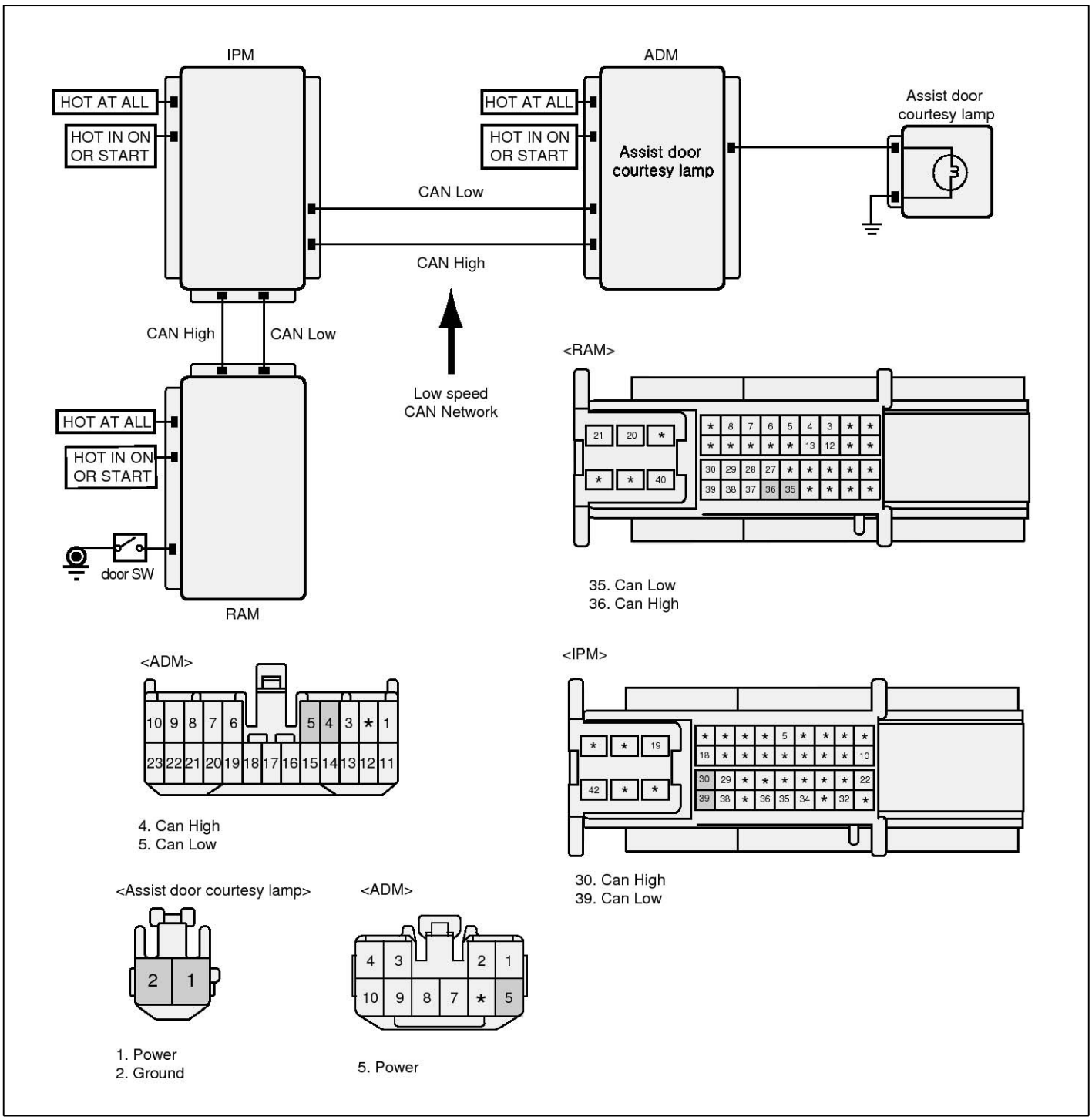

SHMBE9F23L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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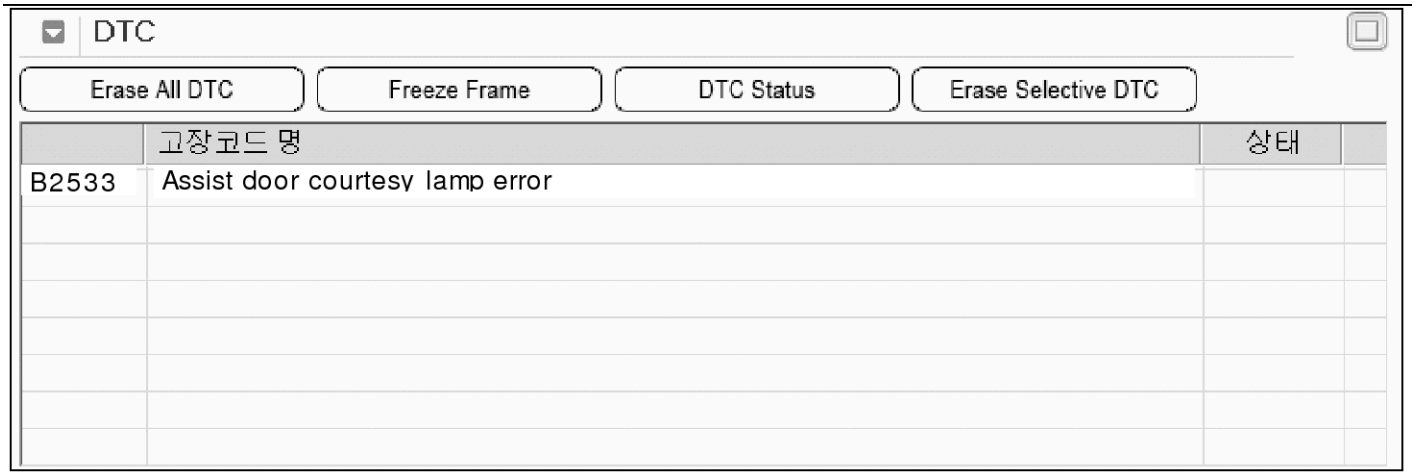

SHMBE9F17L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or ADM's connector or was repaired and ADM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check assist door courtesy lamp

1. Connect GDS
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Assist door courtesy lamp" test

Specification : ON or OFF

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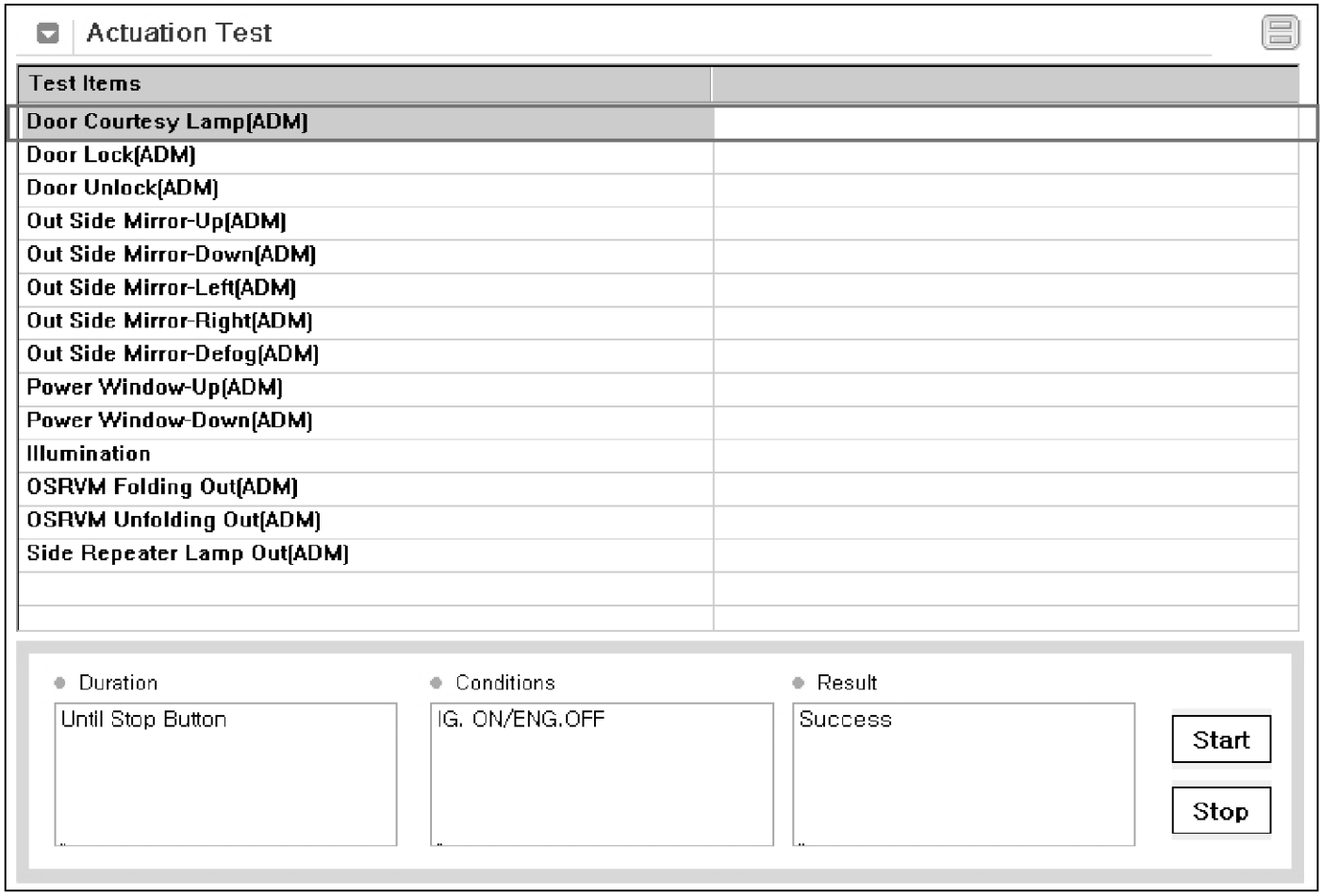

SHMBE9F18L

5. Is the service data normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Terminal and Connector Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Control Circuit Inspection' procedure.

Control Circuit Inspection

■ Check open in assist door courtesy lamp circuit

1. Disconnect battery (-) terminal after IG "OFF"
2. Disconnect ADM and assist door courtesy lamp connector.
3. Check resistance between one and the other of ADM harness connetor.

Specification : About 1 Ω

4. Is the measured value within specification ?

YES ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

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YES ▶ Substitute with a known - good ADM and check for proper operation.
If the problem is corrected, replace the ADM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open in assist door courtesy lamp circuit, repair as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure..

NO ▶ System performing to specification at this time.

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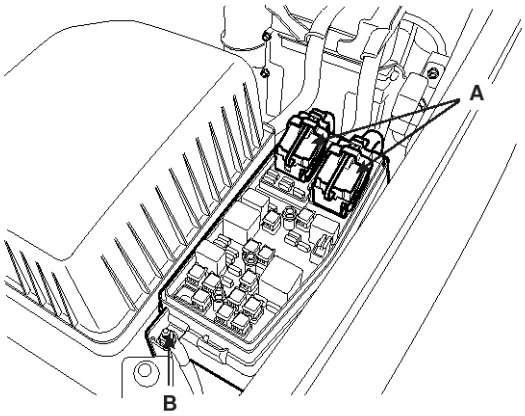
Front Area Module(FAM)

Replacement

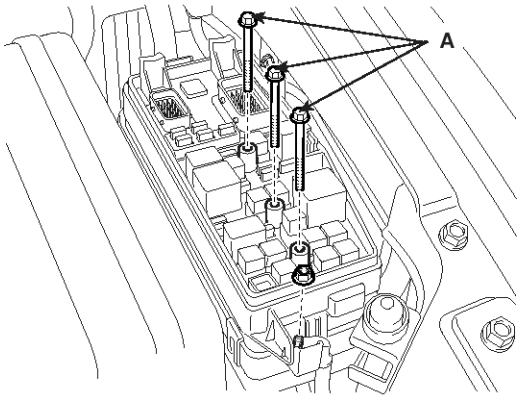
FAM (Front Area Module)

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).



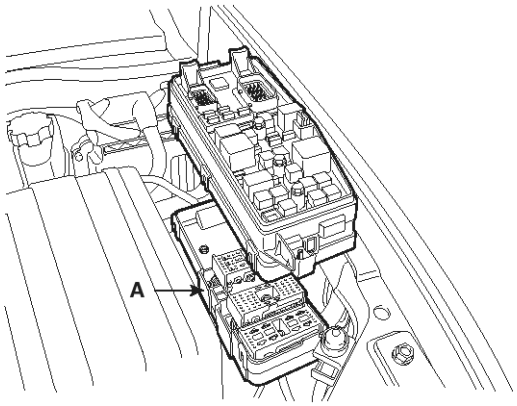
SHMBE8136D

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.

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Diagnostic troubleshooting

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 T-o 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 To 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 G-ND	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 G-ND	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 GN-D	Left parking lamp circuit short to ground error
24	B2577	Left P/Lamp Open	Left parking lamp circuit open error

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B1624 EEPROM Failure

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*1 line.

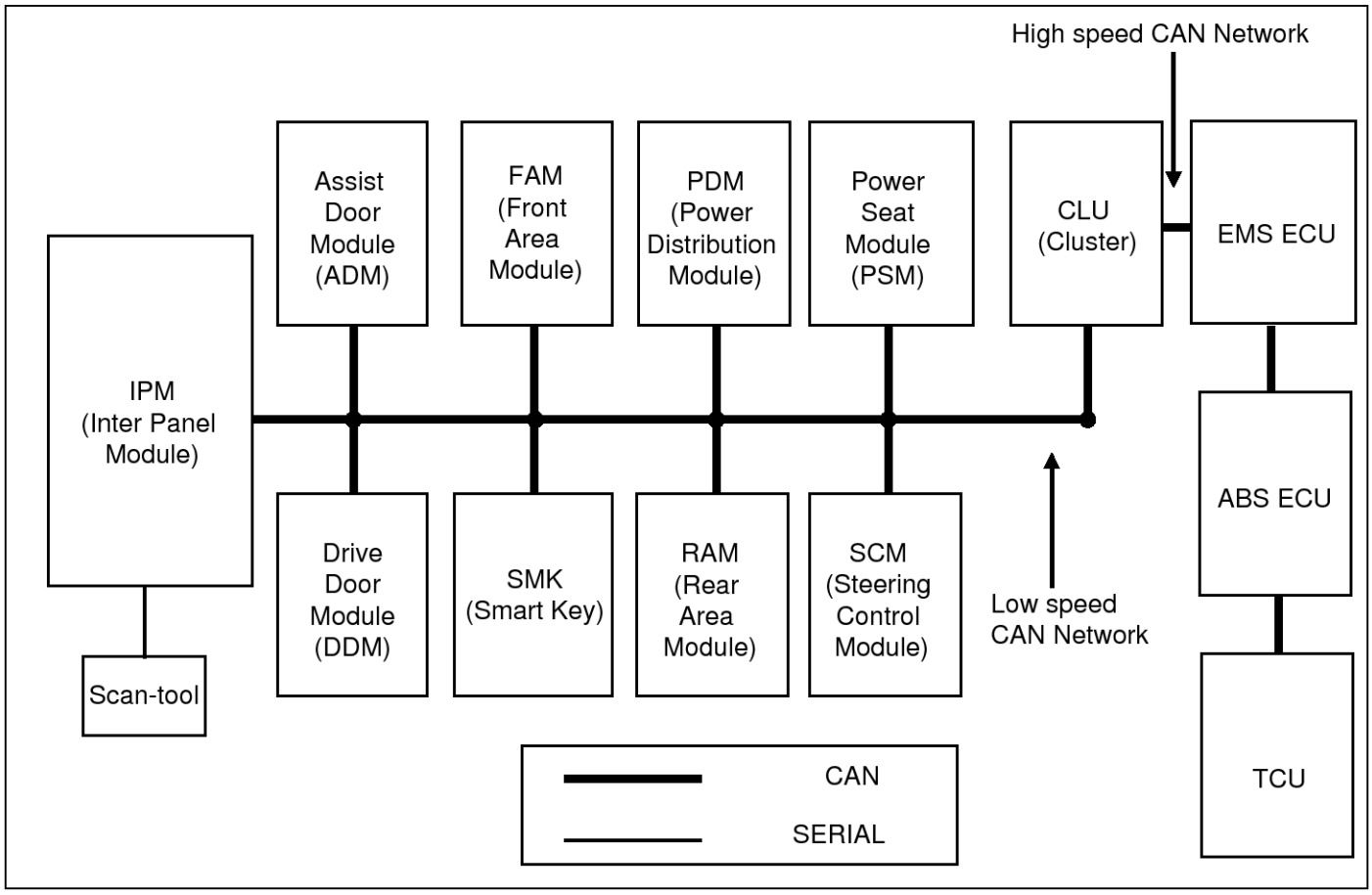
They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9D00L

DTC Description

"B1624" is set when FAM detects write/read failure in EEPROM.

DTC Detecting Condition

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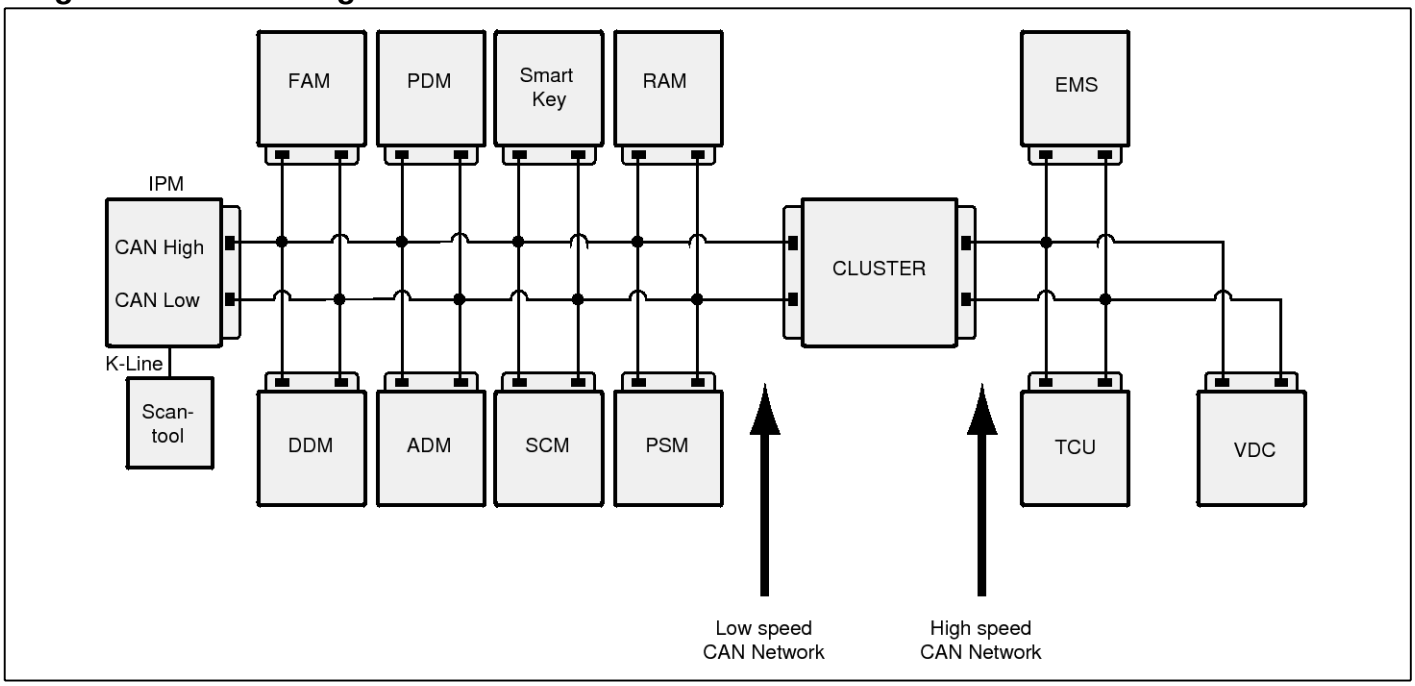
Item	Detecting Condition	Possible Cause
DTC Strategy	• EEPROM read/write state check	• Faulty FAM
Enable Conditions	• ACC "ON"	
Threshold Value	• EEPROM read/write failure	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram



SHMBE9D61L

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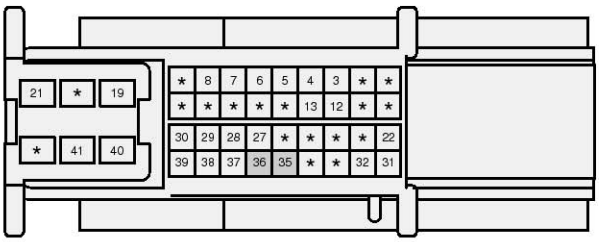
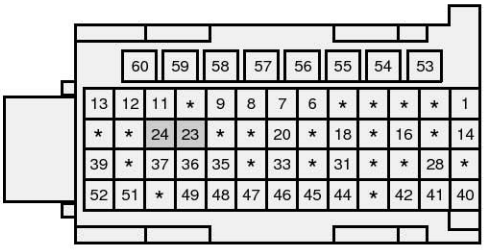
https://autolibrary.ir

<RAM>



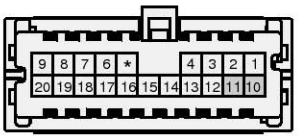
35. Low
36. High

<FAM>



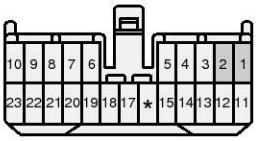
23. Low
24. High

<PDM>



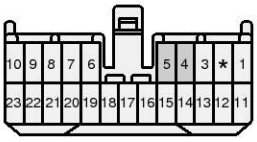
10. Low
11. High

<DDM>



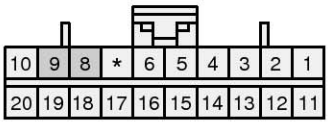
1. High
2. Low

<ADM>



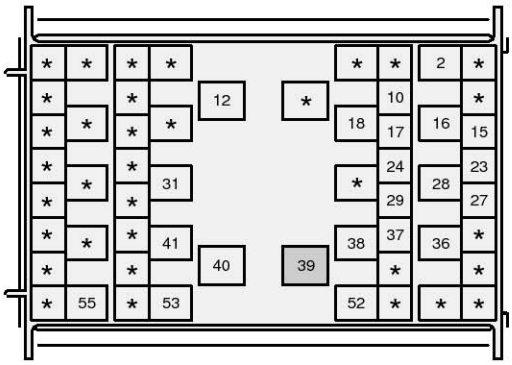
4. High
5. Low

<SCM>



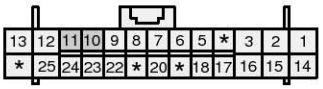
8. High
9. Low

<IPM>



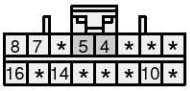
30. High
39. Low

<SMART KEY CONTROL MODULE>



10. HIGH
11. LOW

<IMS>



4. HIGH
5. LOW

SHMBE9D62L

Signal Waveform & Data

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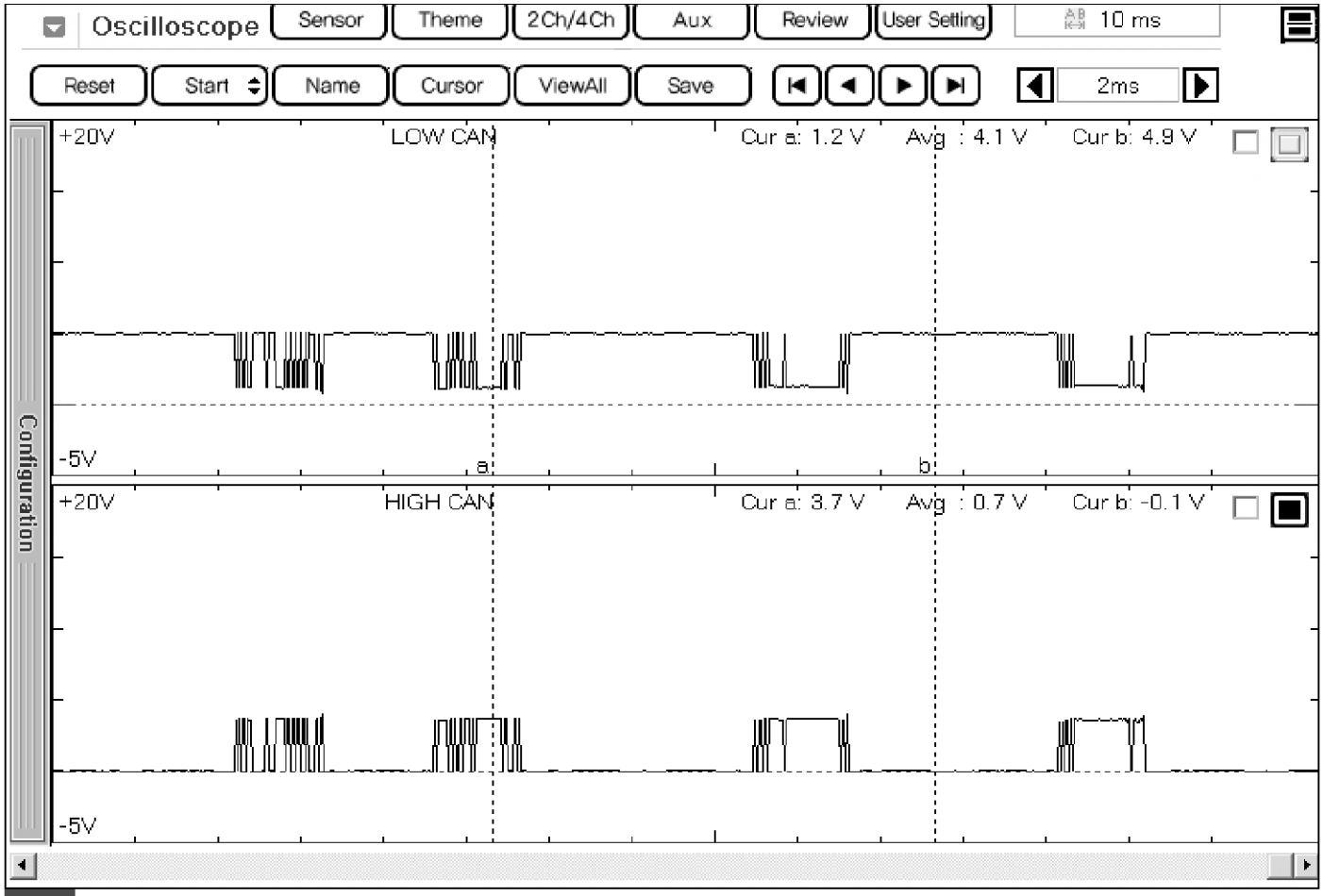

Fig.1

SHMBE9D38L

Fig 1) CAN Low/High Signal

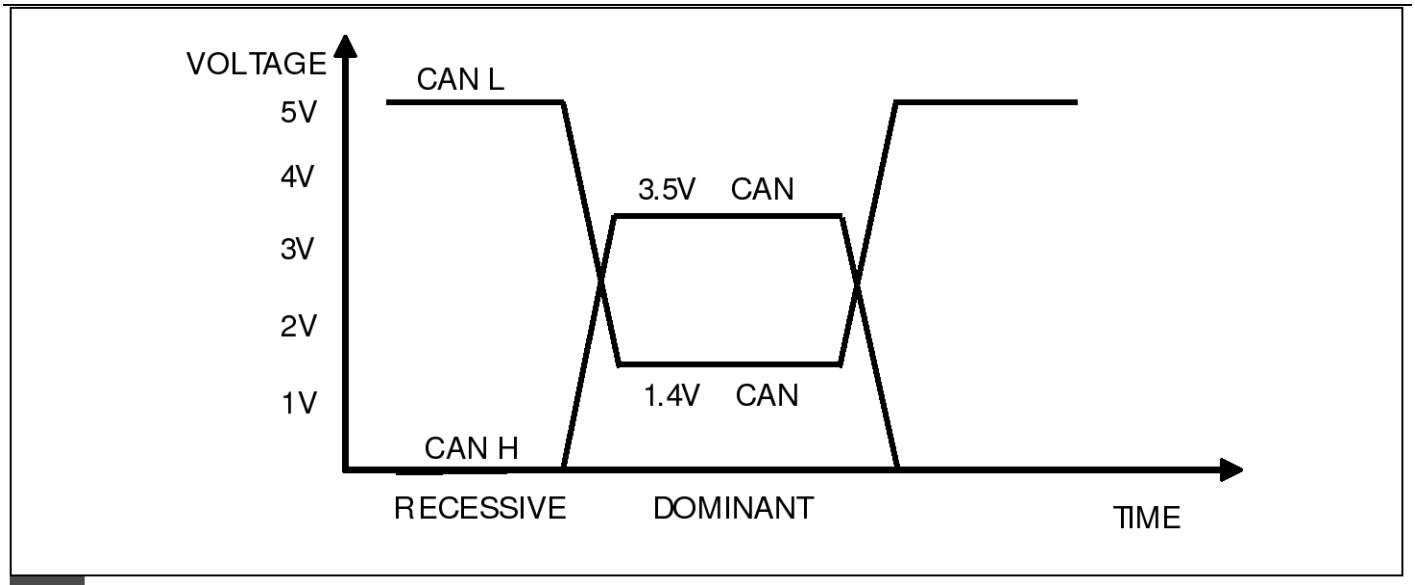

Fig.2

SHMBE9D39L

Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

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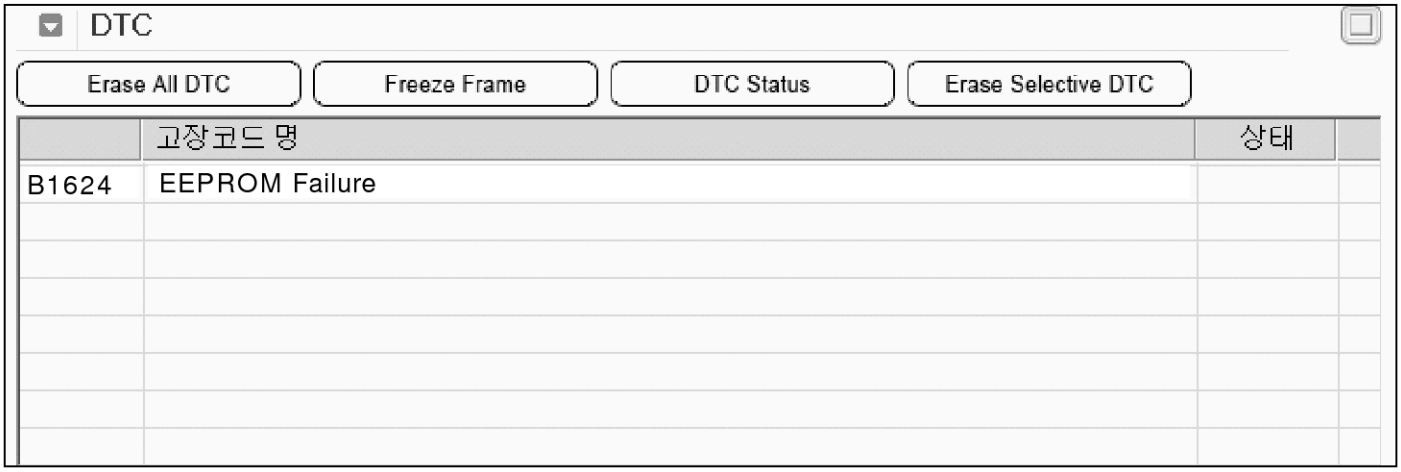
https://autolibrary.ir

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9D40L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

1. IGN "OFF"
2. Substitute with a known - good FAM.
3. IGN "ON" & ENG "OFF"
4. Connect GDS and then select "DTC Analysis" mode.
5. Is the code erased?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure..

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

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NO ▶ System performing to specification at this time.

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https://autolibrary.ir

B1627 EEPROM Corruption

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*1 line.

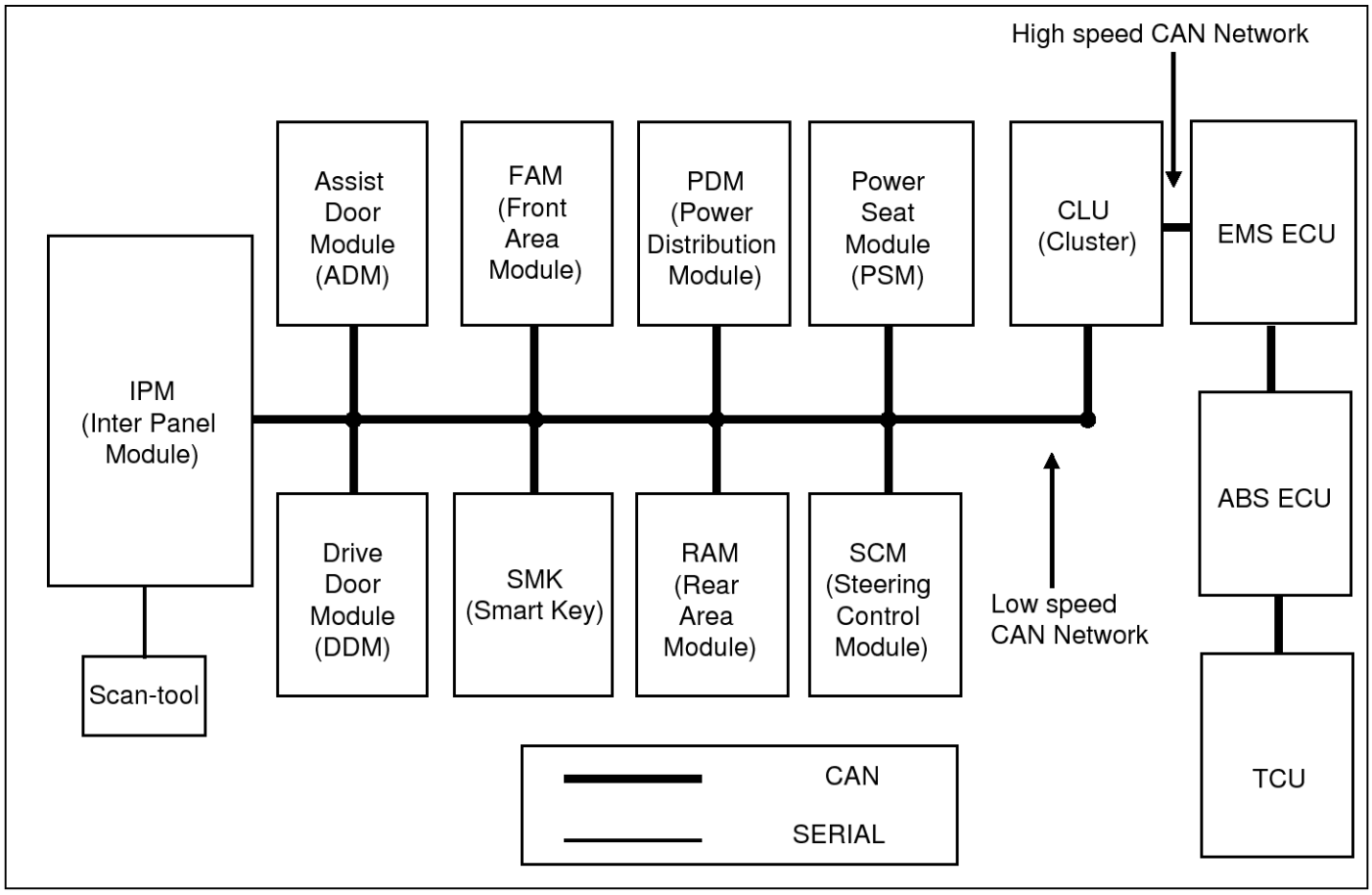
They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9D00L

DTC Description

"B1627" is set when FAM detects faulty data in EEPROM.

DTC Detecting Condition

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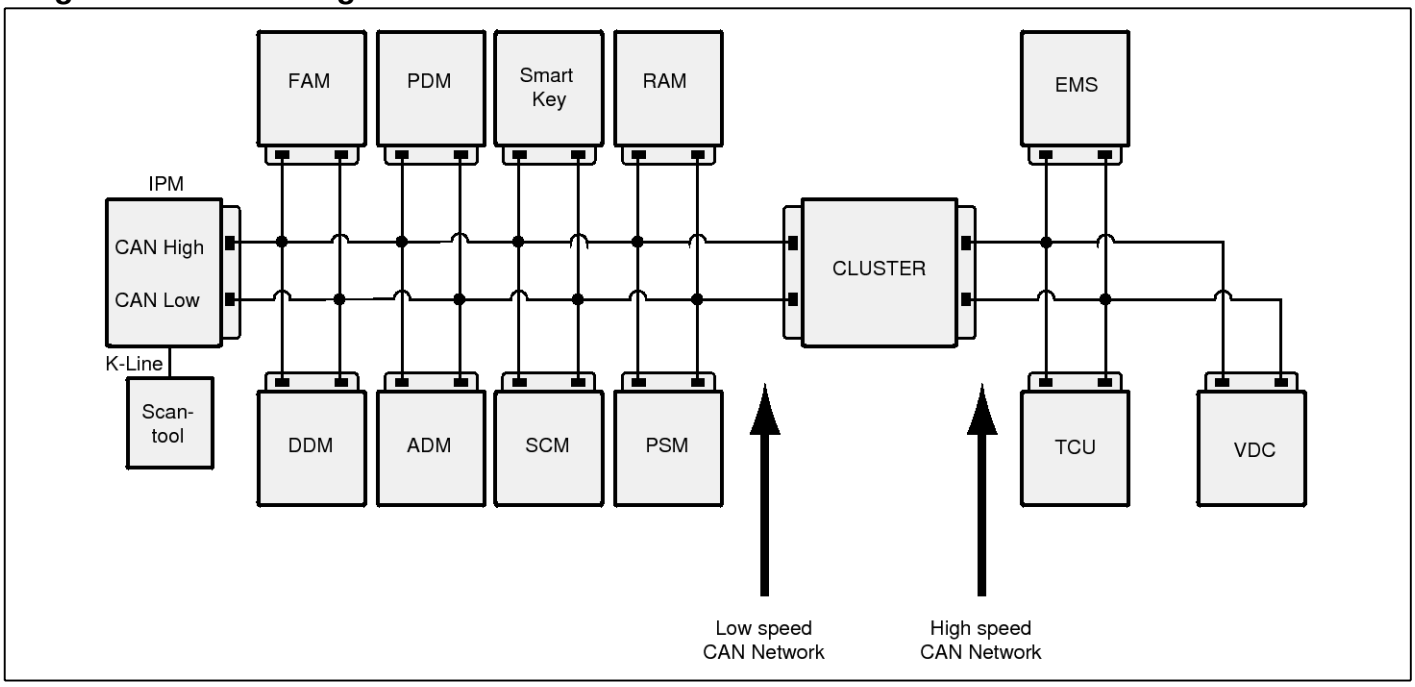
https://autolibrary.ir

Item	Detecting Condition	Possible Cause
DTC Strategy	• EEPROM data state check	• Faulty FAM
Enable Conditions	• ACC "ON"	
Threshold Value	• Faulty EEPROM data	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram



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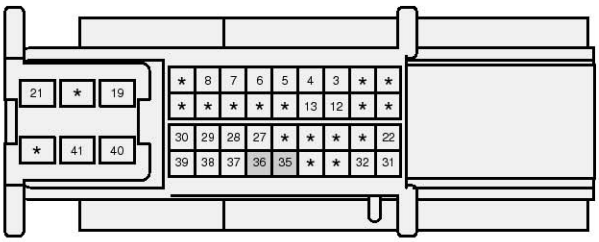
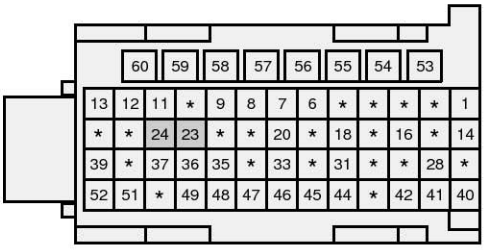
https://autolibrary.ir

<RAM>



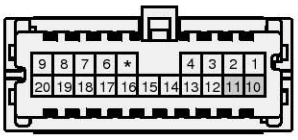
35. Low
36. High

<FAM>



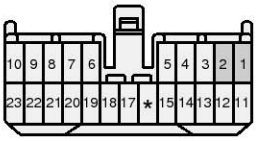
23. Low
24. High

<PDM>



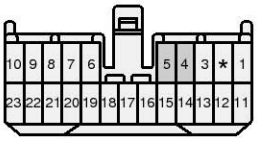
10. Low
11. High

<DDM>



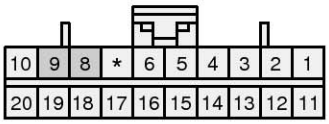
1. High
2. Low

<ADM>



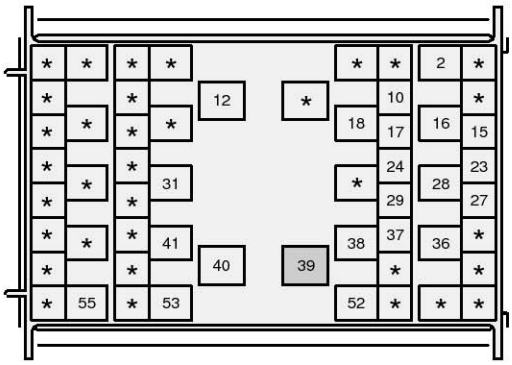
4. High
5. Low

<SCM>



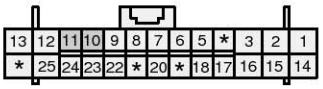
8. High
9. Low

<IPM>



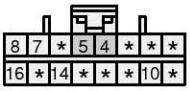
30. High
39. Low

<SMART KEY CONTROL MODULE>



10. HIGH
11. LOW

<IMS>



4. HIGH
5. LOW

SHMBE9D62L

Signal Waveform & Data

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https://autolibrary.ir

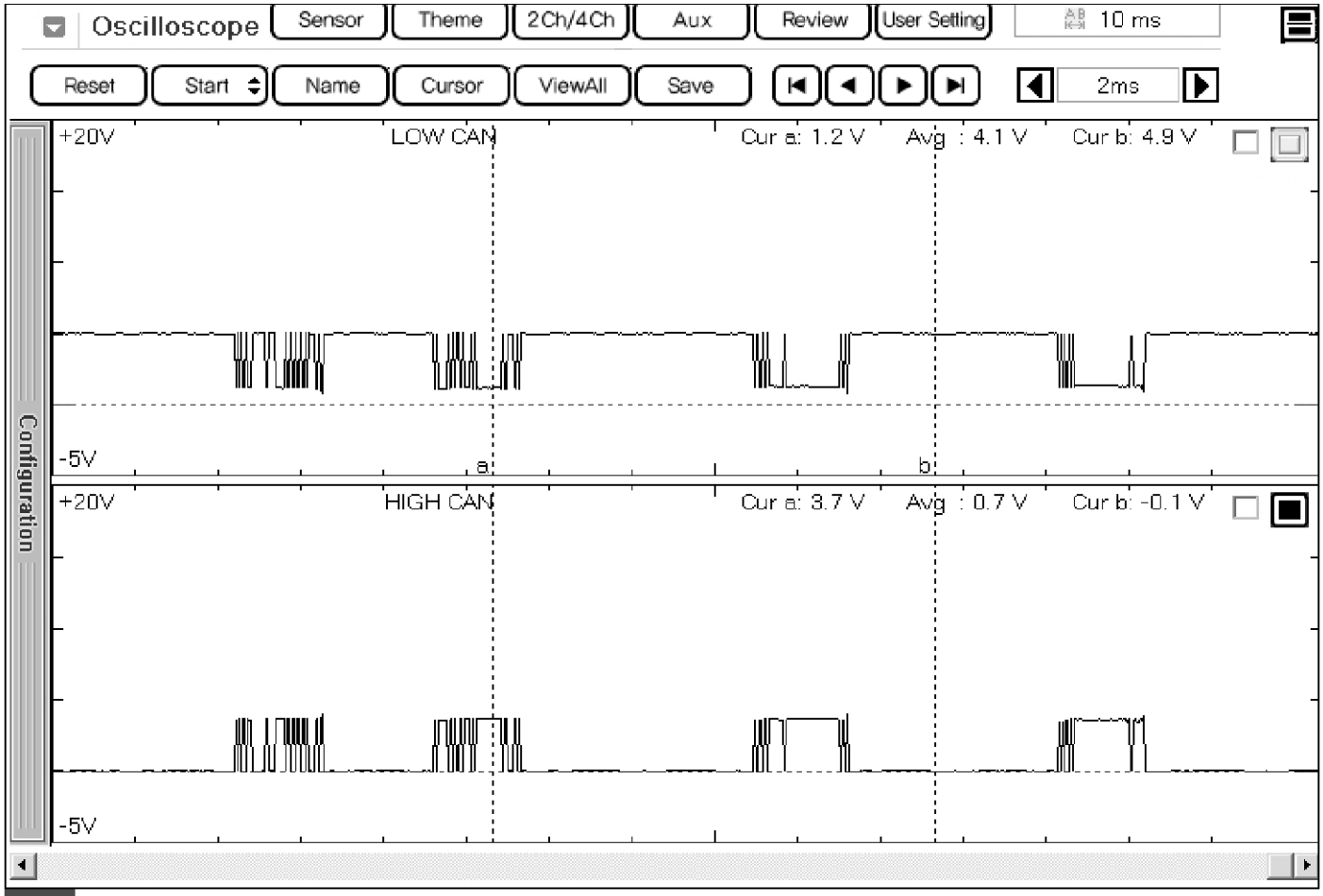

Fig.1

SHMBE9D38L

Fig 1) CAN Low/High Signal

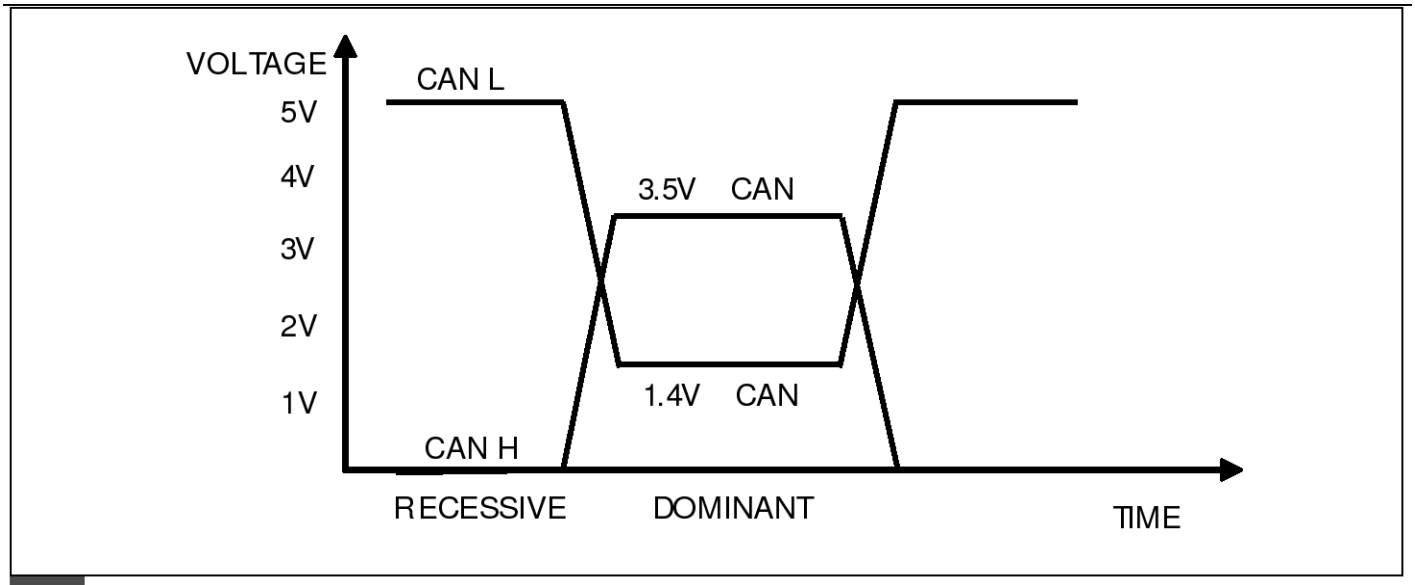

Fig.2

SHMBE9D39L

Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

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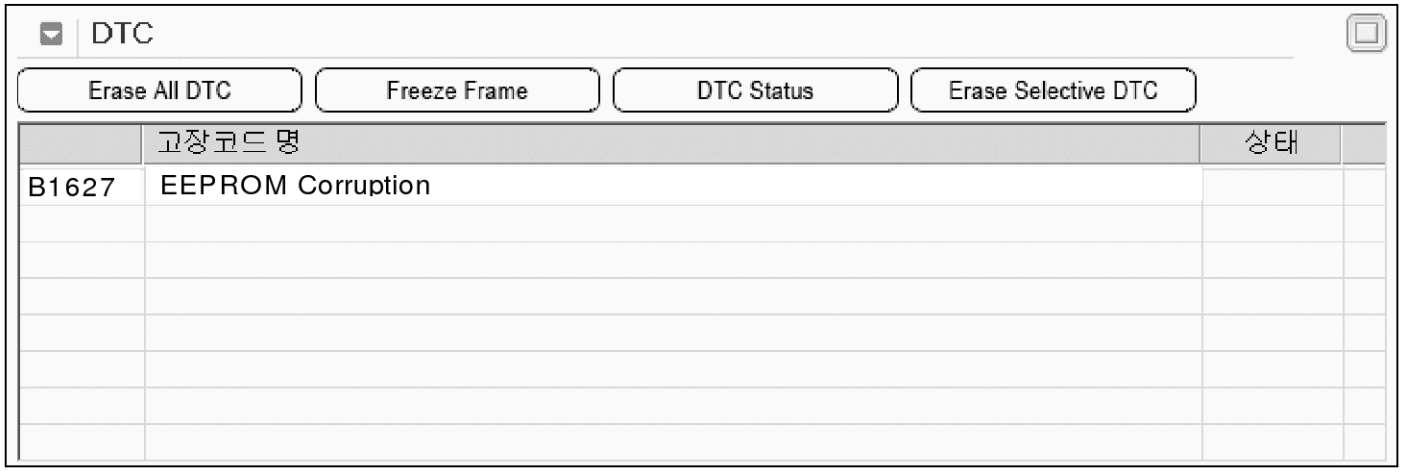
1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9D41L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

1. IGN "OFF"
2. Substitute with a known - good FAM.
3. IGN "ON" & ENG "OFF"
4. Connect GDS and then select "DTC Analysis" mode.
5. Is the code erased?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure..

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

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NO ▶ System performing to specification at this time.

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https://autolibrary.ir

B1646 S/W Rescue Mode

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*1 line.

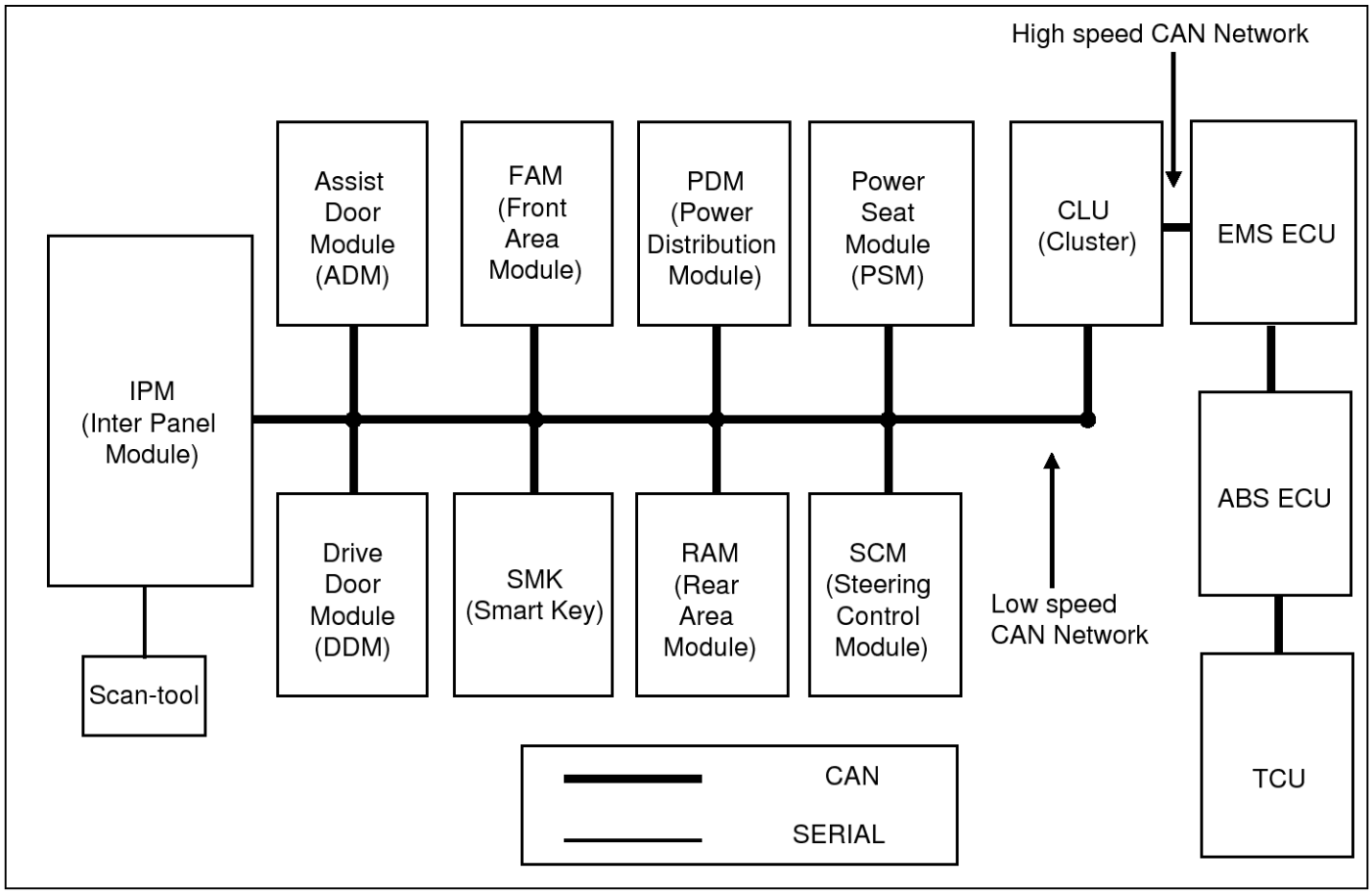
They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)



SHMBE9D00L

DTC Description

"B1646" is set in case of CAN communication failure due to either FAM, RAM not existing at CAN line or IPM, FAM, RAM internal fault.

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DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Network state check	• CAN Line check • FAM, IPM, RAM operation check
Enable Conditions	• ACC "ON"	
Threshold Value	• RF Module being not in accordance with regional frequency installed	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Signal Waveform & Data

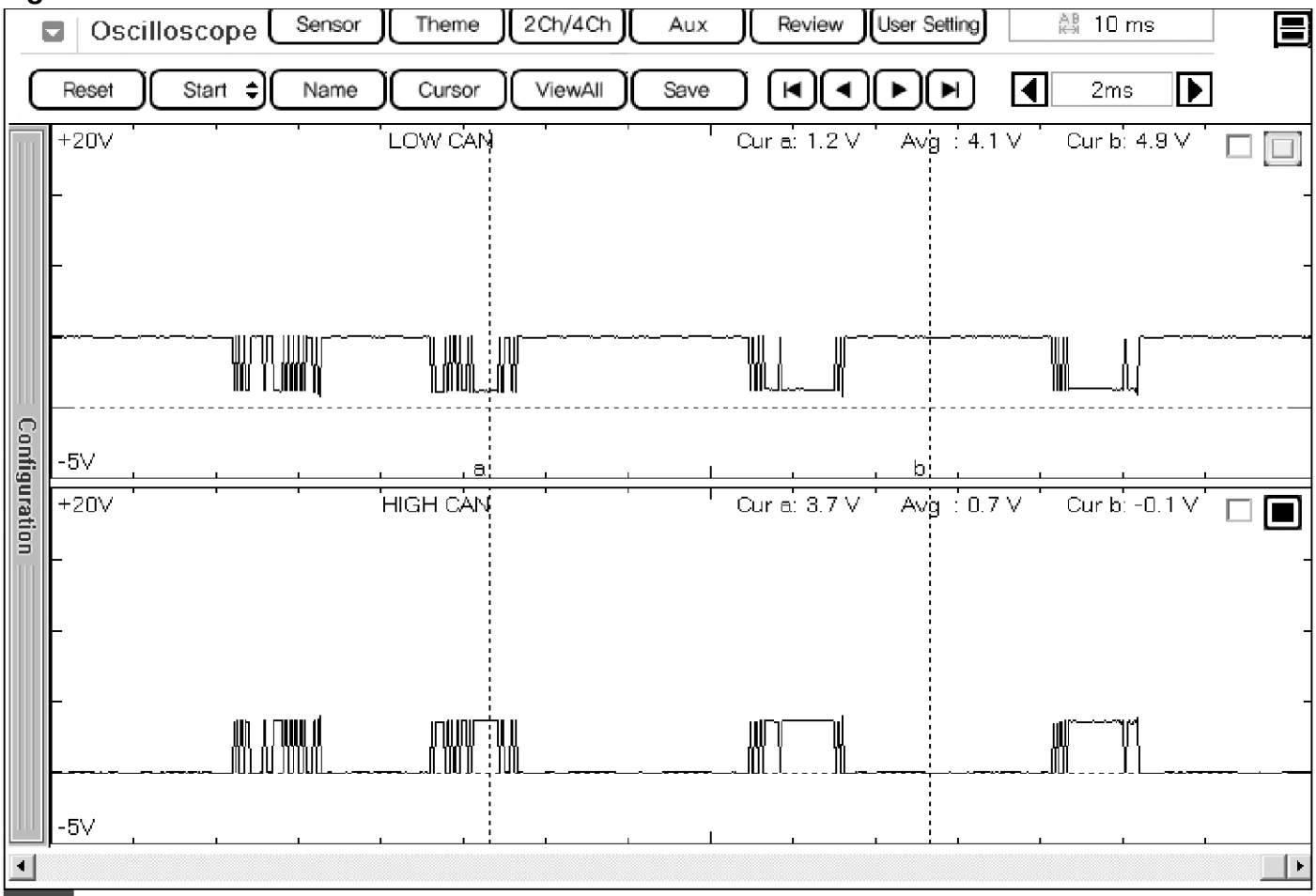

Fig.1

SHMBE9D38L

Fig 1) CAN Low/High Signal

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https://autolibrary.ir

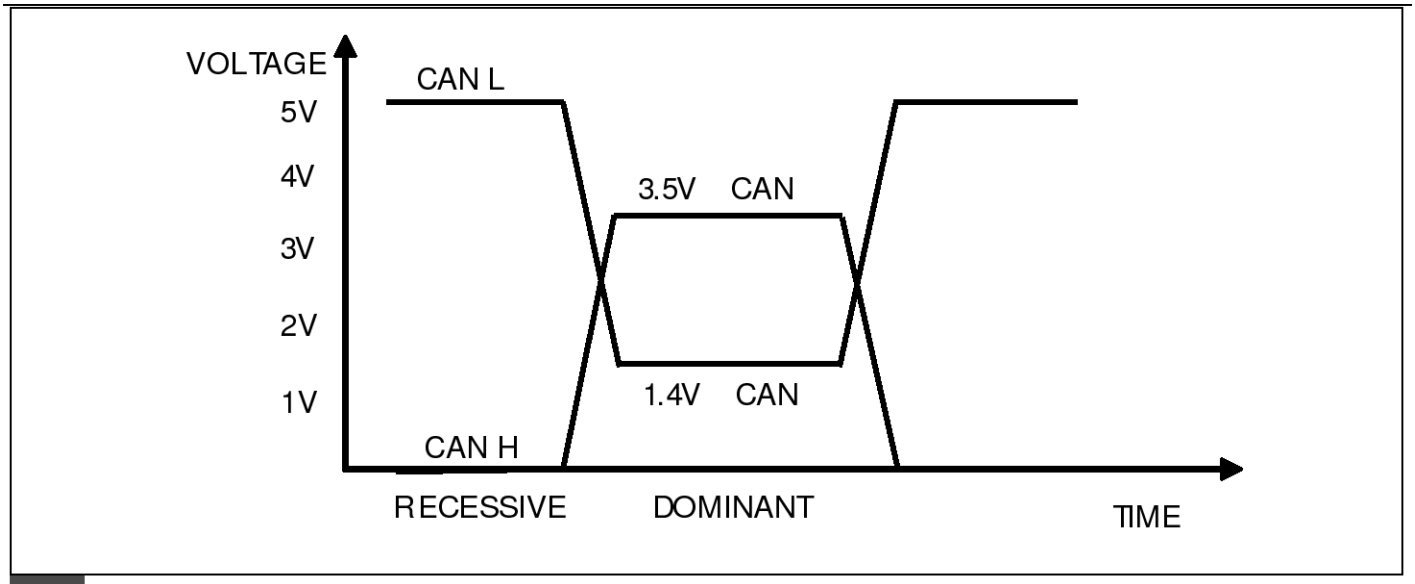


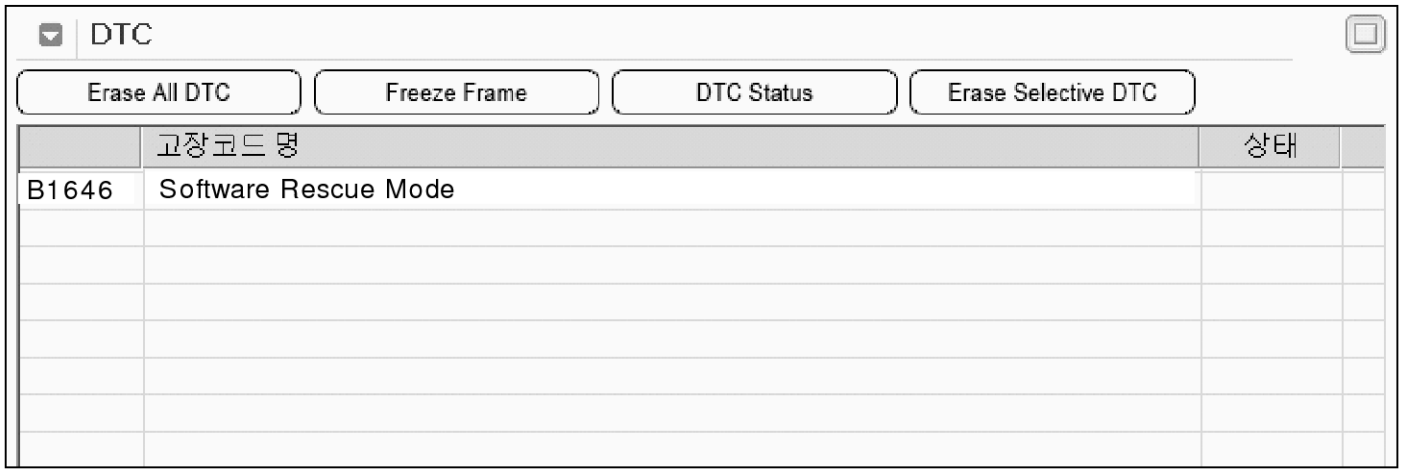
Fig.2

SHMBE9D39L

Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9D42L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

1. IGN "OFF"
2. Substitute with a known - good FAM.
3. IGN "ON" & ENG "OFF"
4. Connect GDS and then select "DTC Analysis" mode.
5. Is the code erased?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure..

NO ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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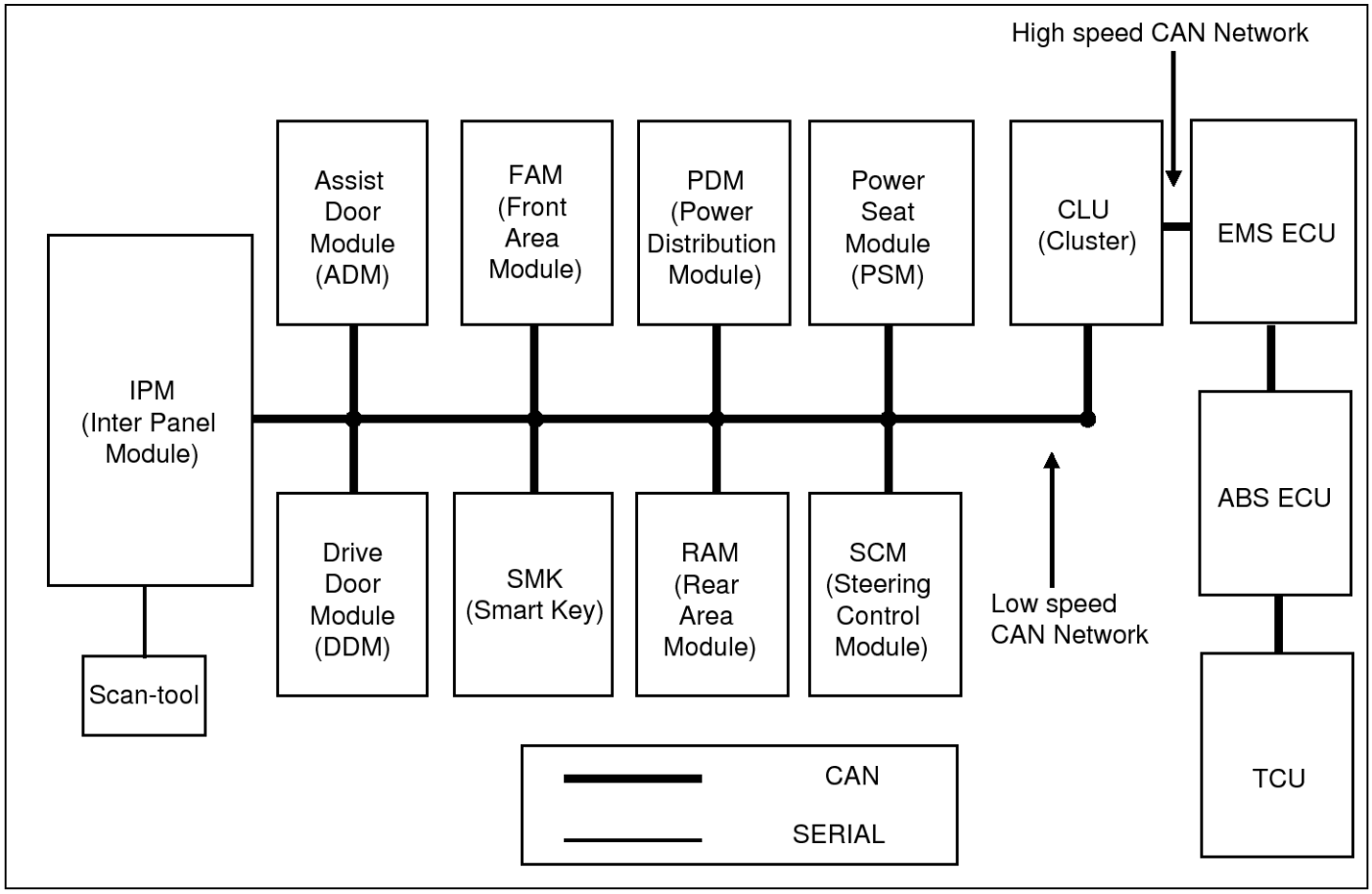
B2119 Windshield Defog Relay Fail

General Description

Once IPM receives windshield defog switch working signal, it sends the signal to FAM by CAN communition. FAM performs a defogging function by operating windshield defog relay.



SHMBE9D00L

DTC Description

This code is set when FAM detects windshield defog relay not working even thought relay working condition is met. (relay fuse open, faulty relay, faulty relay operating IC)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• W/Shield Defog Fuse or Relay state check	• Windshield Defog Relay Fuse Open
Enable Conditions	• ACC "ON"	
Threshold Value	• It is normal if the voltage of each fuse terminal is above 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

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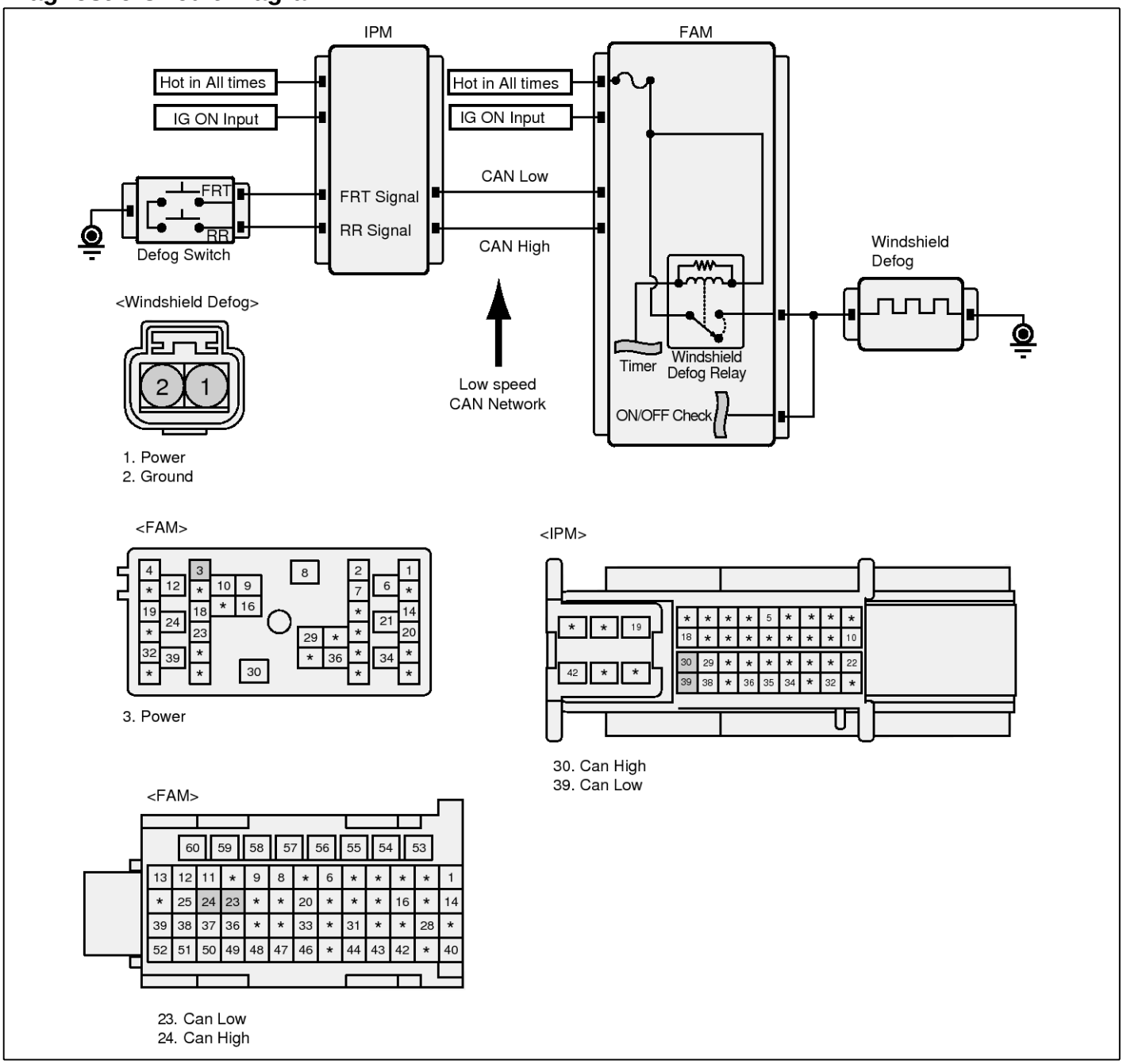
Diagnostic Circuit Diagram



SHMBE9D50L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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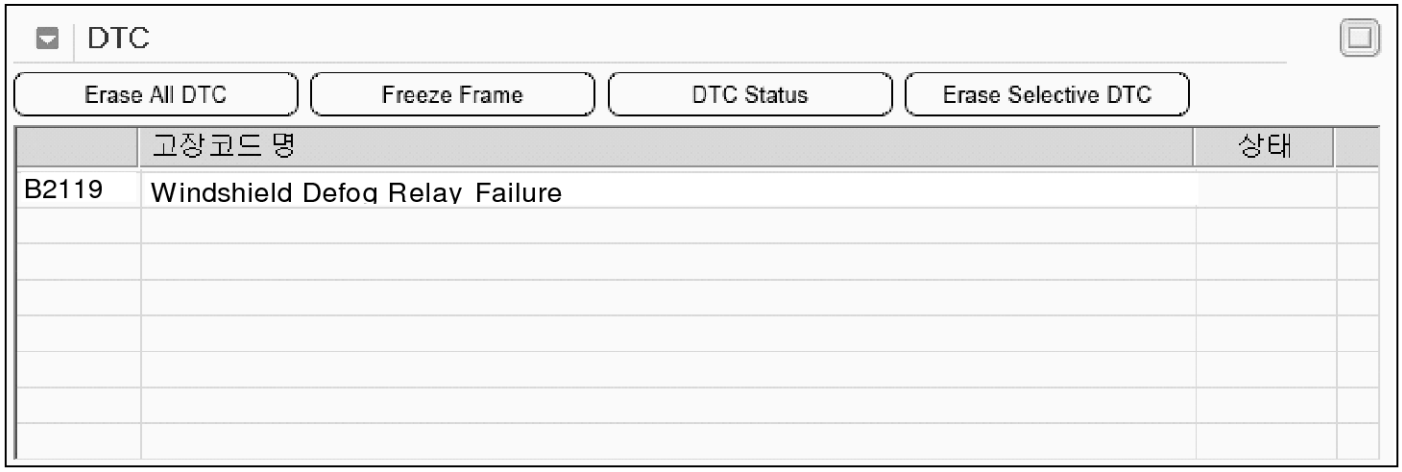


SHMBE9D44L

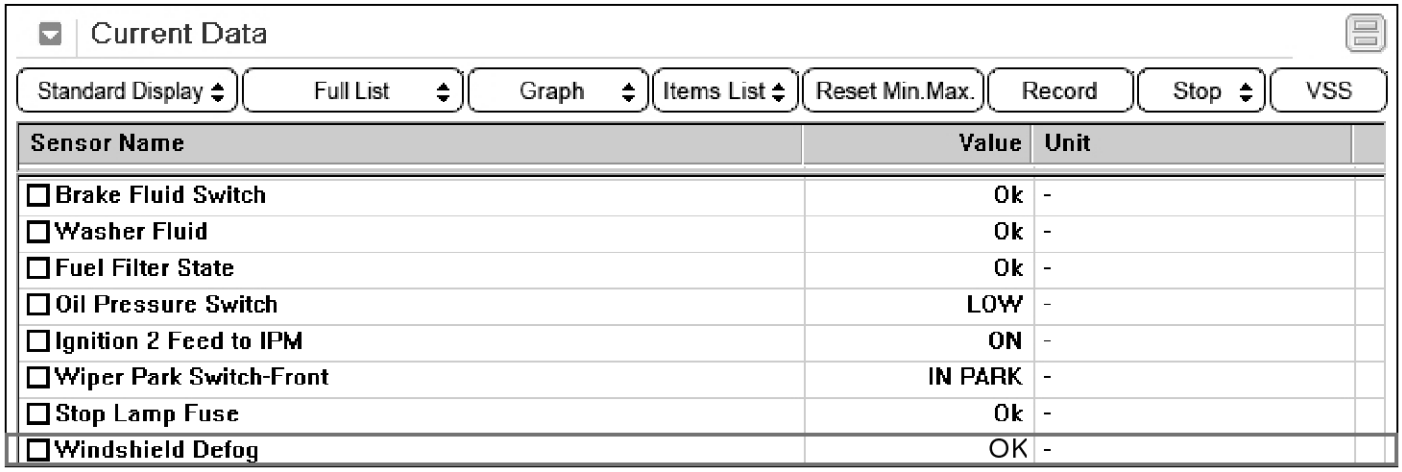
5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Scantool Data Inspection

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Monitor the "Windshield Defog State" parameter on the scantool.



SHMBE9D02L

5. Is the service data normal?

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YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Power Circuit Inspection" procedure.

Power Circuit Inspection

■ Power Circuit of windshield defog relay circuit inspection

1. IG "OFF" or IG "ON" & ENG "OFF"
2. Depress windshield defog switch.
3. Measure the windshield defog working signal voltage of FAM.

Specification : Approx. 12V

4. Is the signal output normal?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check for windshield defog fuse and relay, open or short in circuit of windshield defog relay singnal. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure .

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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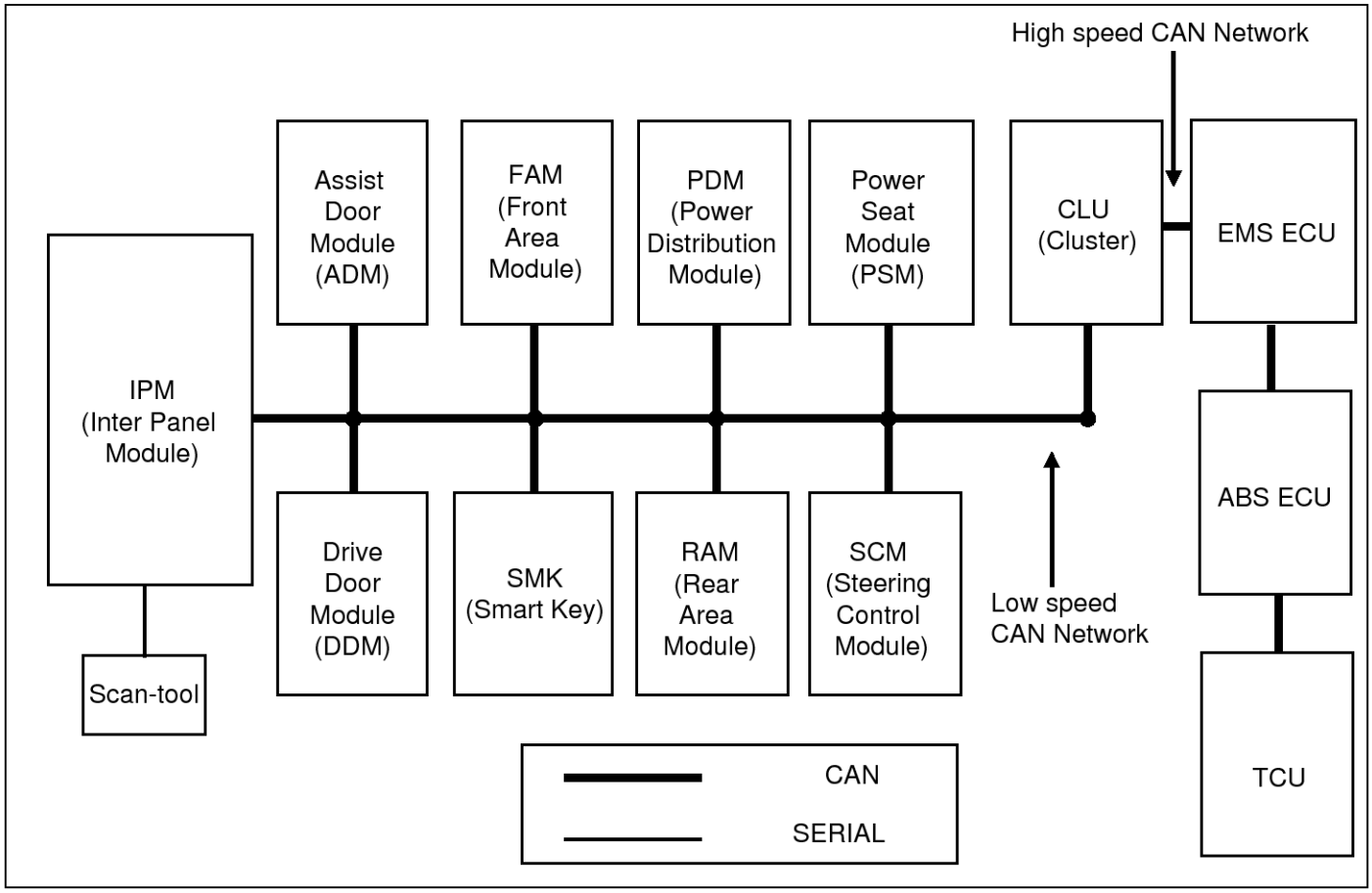
B2535 Right Turn Signal Lamp Short to Ground

General Description

Once IPM receives right turn switch working signal, it sends the signal to FAM by CAN communition. FAM makes right turn signal lamp flickering.



SHMBE9D00L

DTC Description

This code is set when right turn signal lamp circuit is shotted to ground for more than 150ms during right turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in right turn signal lamp circuit • Faulty right turn signal lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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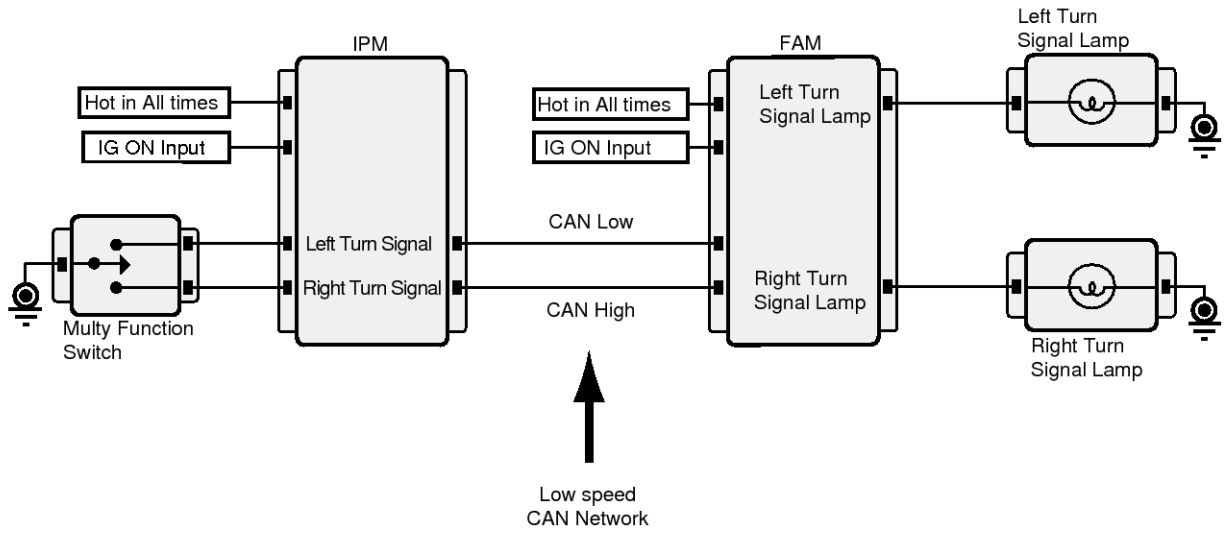
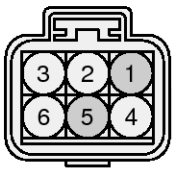
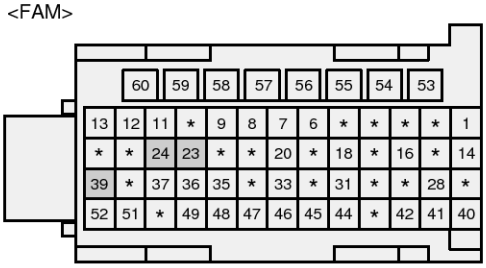


<Head Lamp RH>



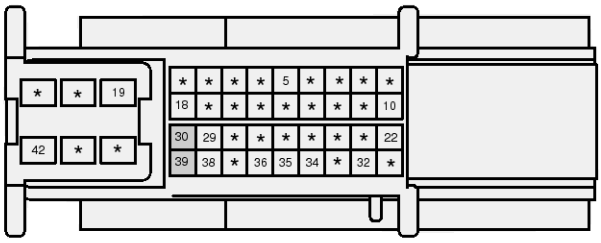
1. Right Turn Signal Lamp
5. Ground

<FAM>



23. CAN LOW
24. CAN HIGH
39. Right Turn Signal Lamp

<IPM>



30. Can High
39. Can Low

SHMBE9D59L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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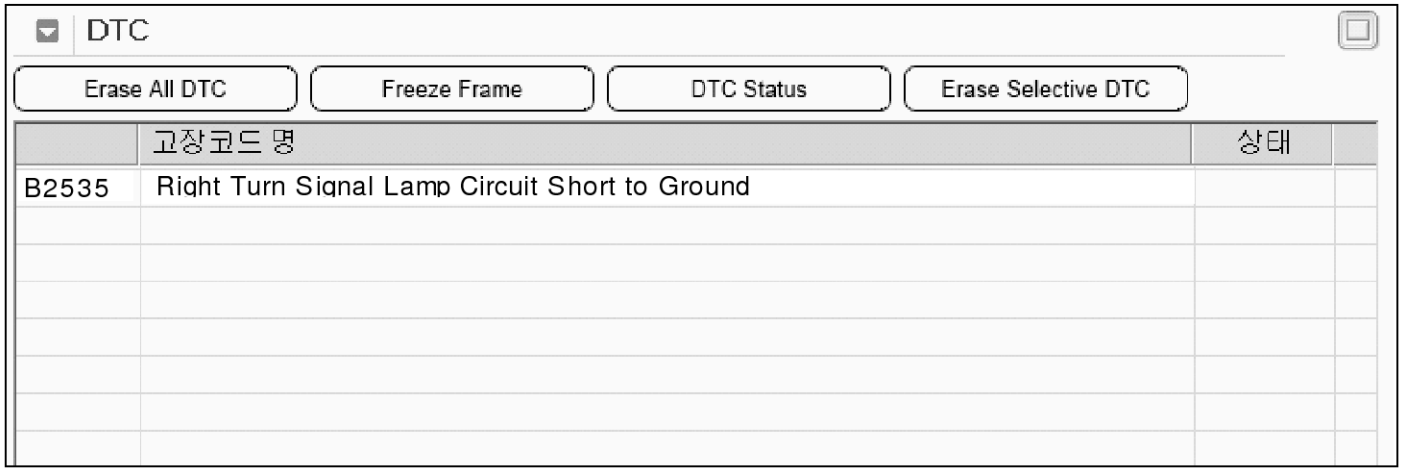

SHMBE9D37L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right turn signal lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right turn signal lamp" test.

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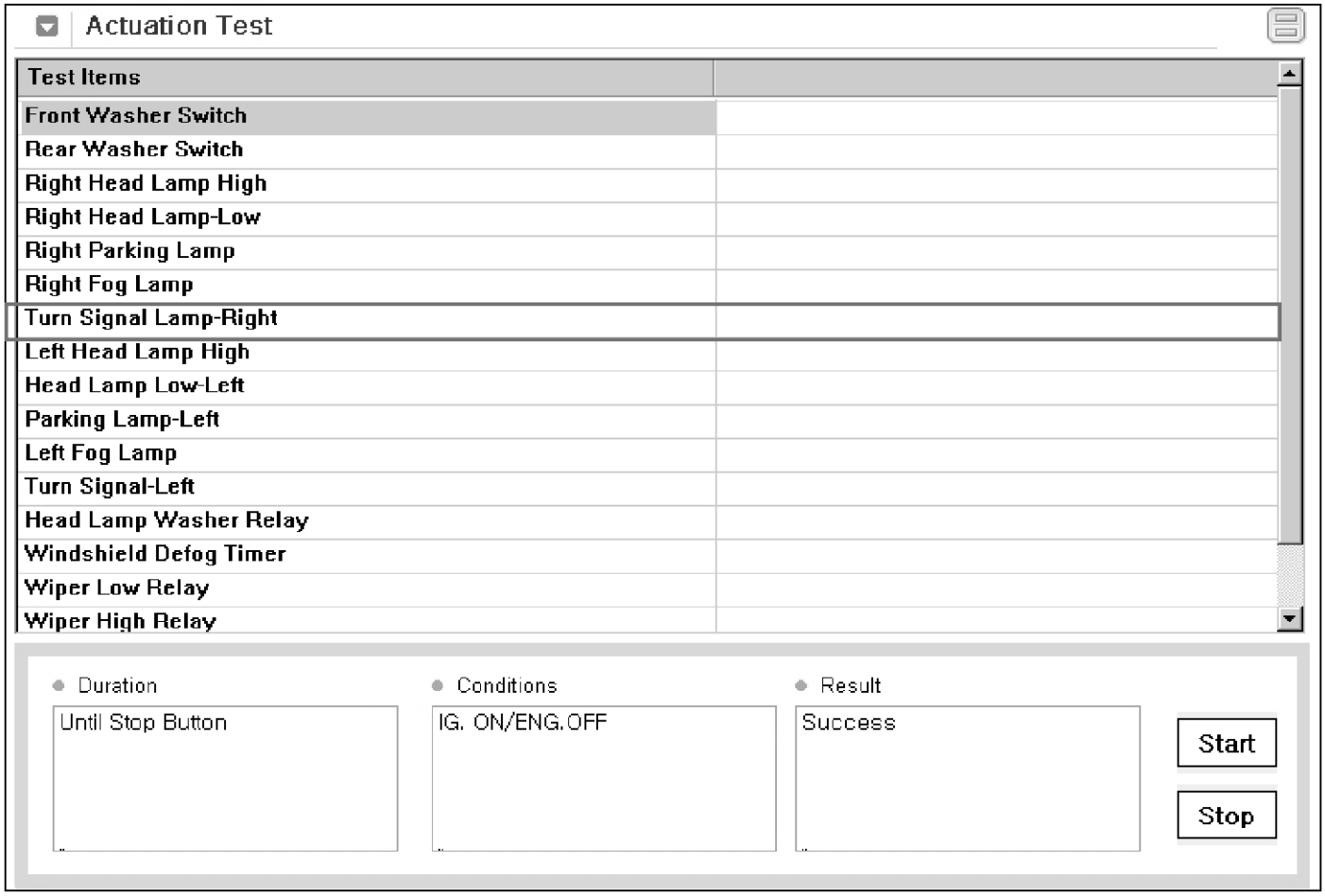

SHMBE9D30L

5. Is right turn signal lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Turn Signal Lamp Circuit Inspection" procedure.

Right Turn Signal Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF" or IG "ON" & ENG "OFF"
2. Disconnect FAM, Right Turn Signal Lamp connector.
3. Measure resistance between the right turn signal lamp terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Right Turn Signal Lamp, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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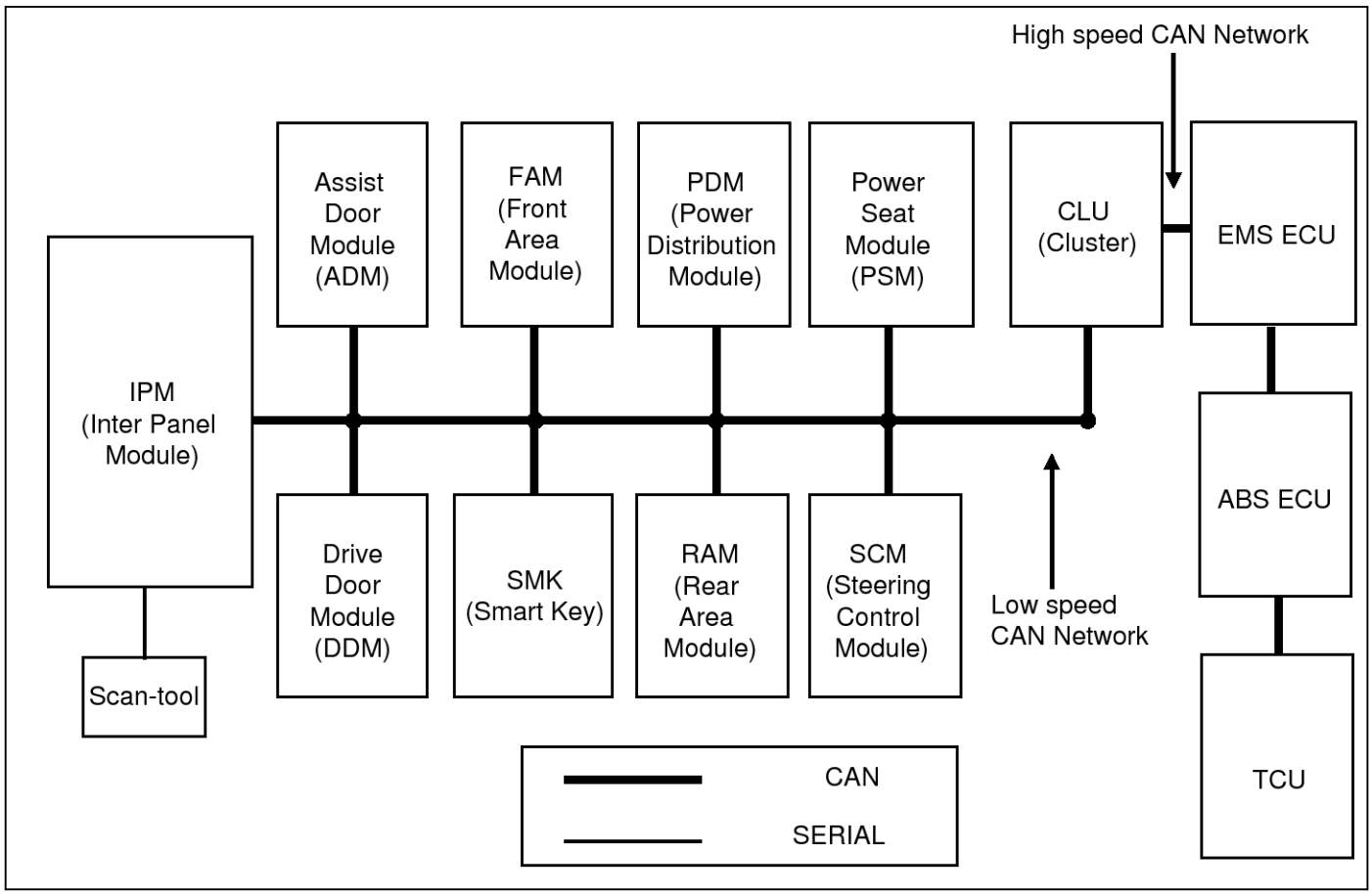
B2537 Right Turn Signal Lamp Open

General Description

Once IPM receives right turn switch working signal, it sends the signal to FAM by CAN communition. FAM makes right turn signal lamp flickering.



SHMBE9D00L

DTC Description

This code is set when right turn signal lamp circuit is open for more than 150ms during right turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in right turn signal lamp circuit • Faulty right turn signal lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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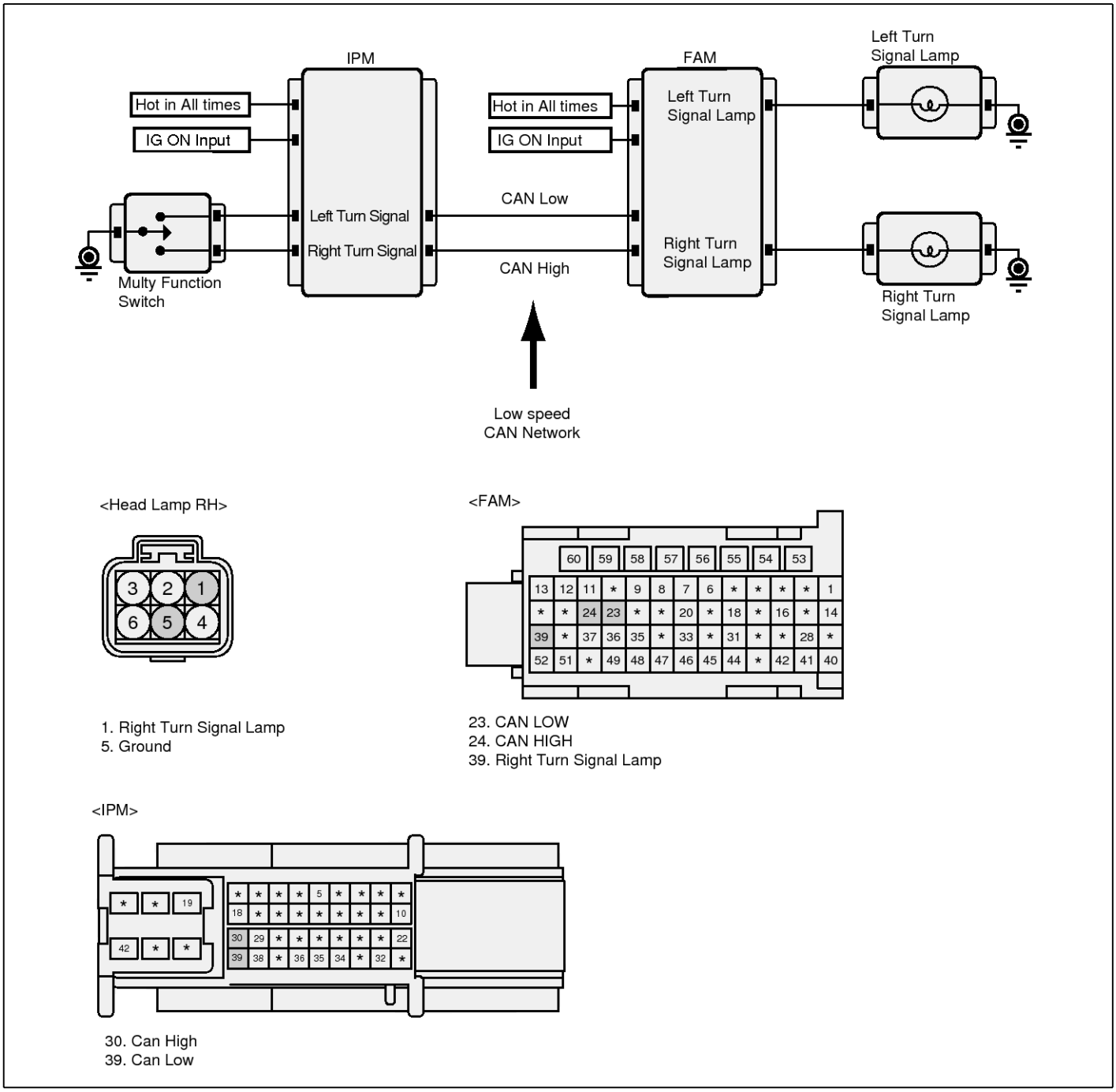

SHMBE9D59L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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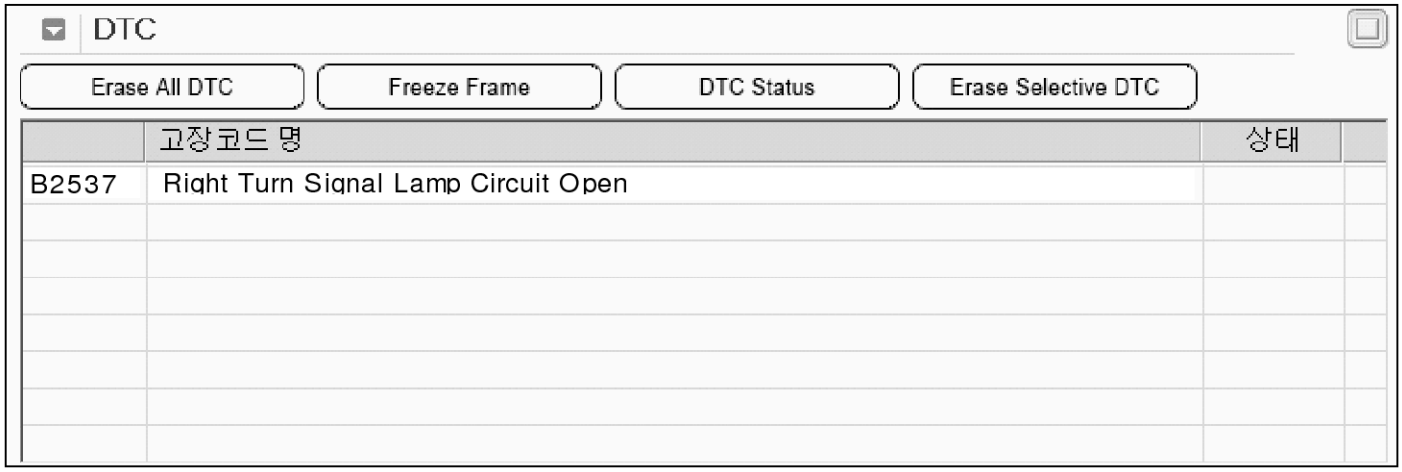

SHMBE9D29L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right turn signal lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right turn signal lamp" test.

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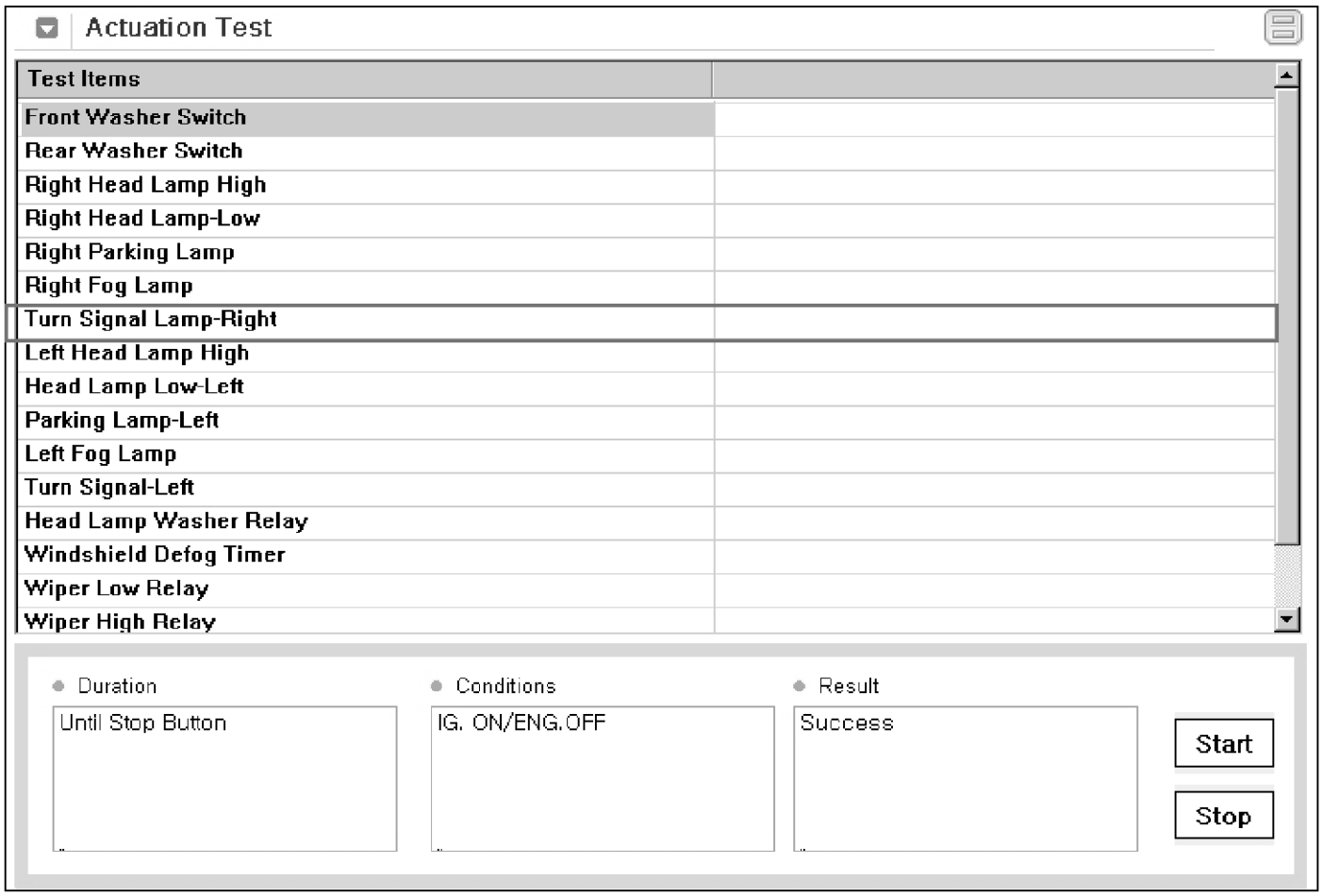

SHMBE9D30L

5. Is right turn signal lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Turn Signal Lamp Circuit Inspection" procedure.

Right Turn Signal Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF" or IG "ON" & ENG "OFF"
2. Disconnect FAM connector.
3. Measure resistance between the right turn signal lamp terminal of FAM harness connector and ground of the right turn signal lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair open in circuit of Right Turn Signal Lamp or Right Turn Signal Lamp internal open, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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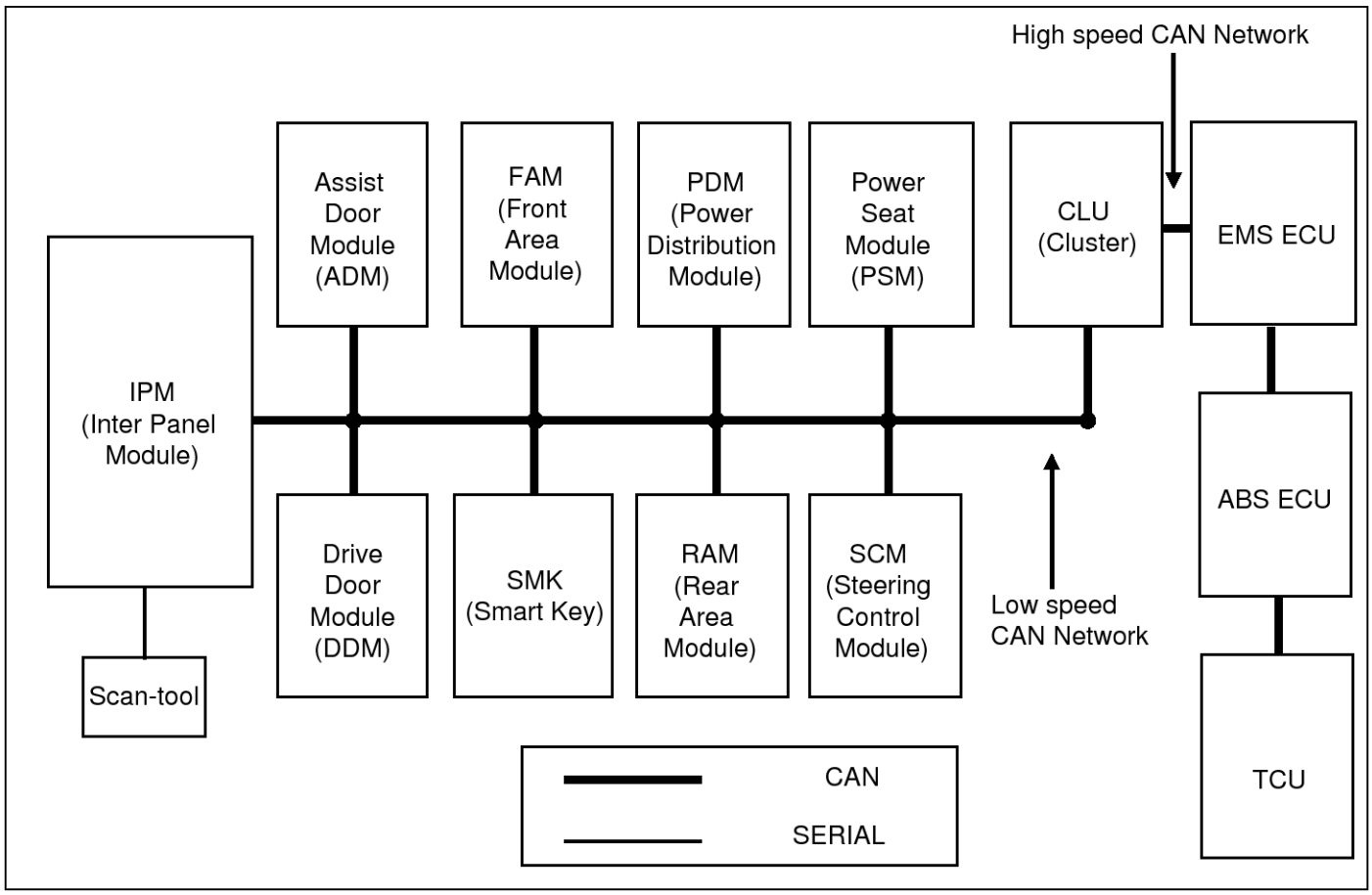
B2539 Left Turn Signal Lamp Short to Ground

General Description

Once IPM receives right turn switch working signal, it sends the signal to FAM by CAN communition. FAM makes right turn signal lamp flickering.



SHMBE9D00L

DTC Description

This code is set when left turn signal lamp circuit is shotted to ground for more than 150ms during left turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in left turn signal lamp circuit • Faulty left turn signal lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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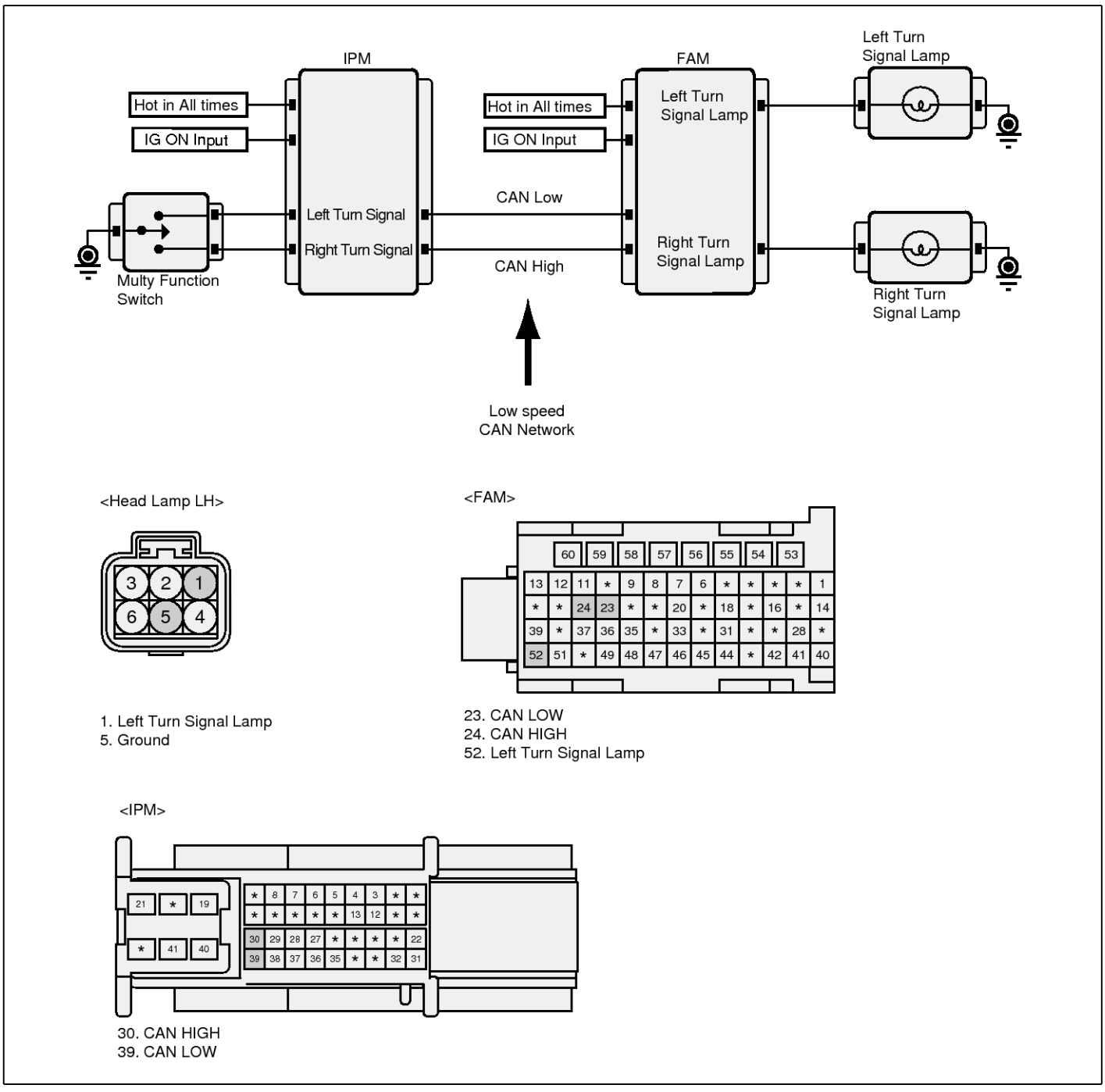

SHMBE9D60L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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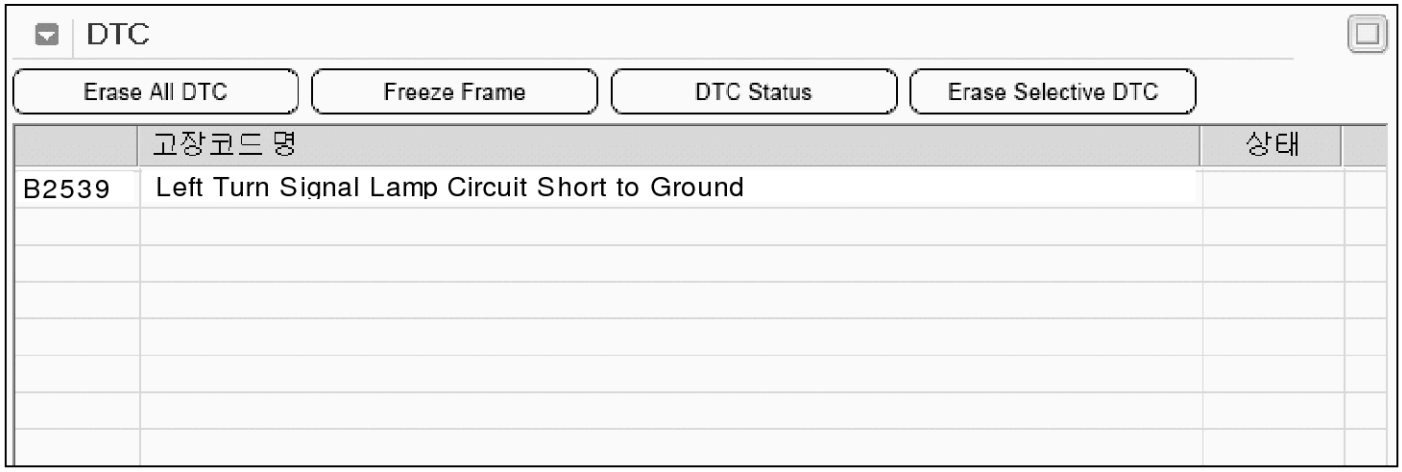

SHMBE9D34L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left turn signal lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "left turn signal lamp" test.

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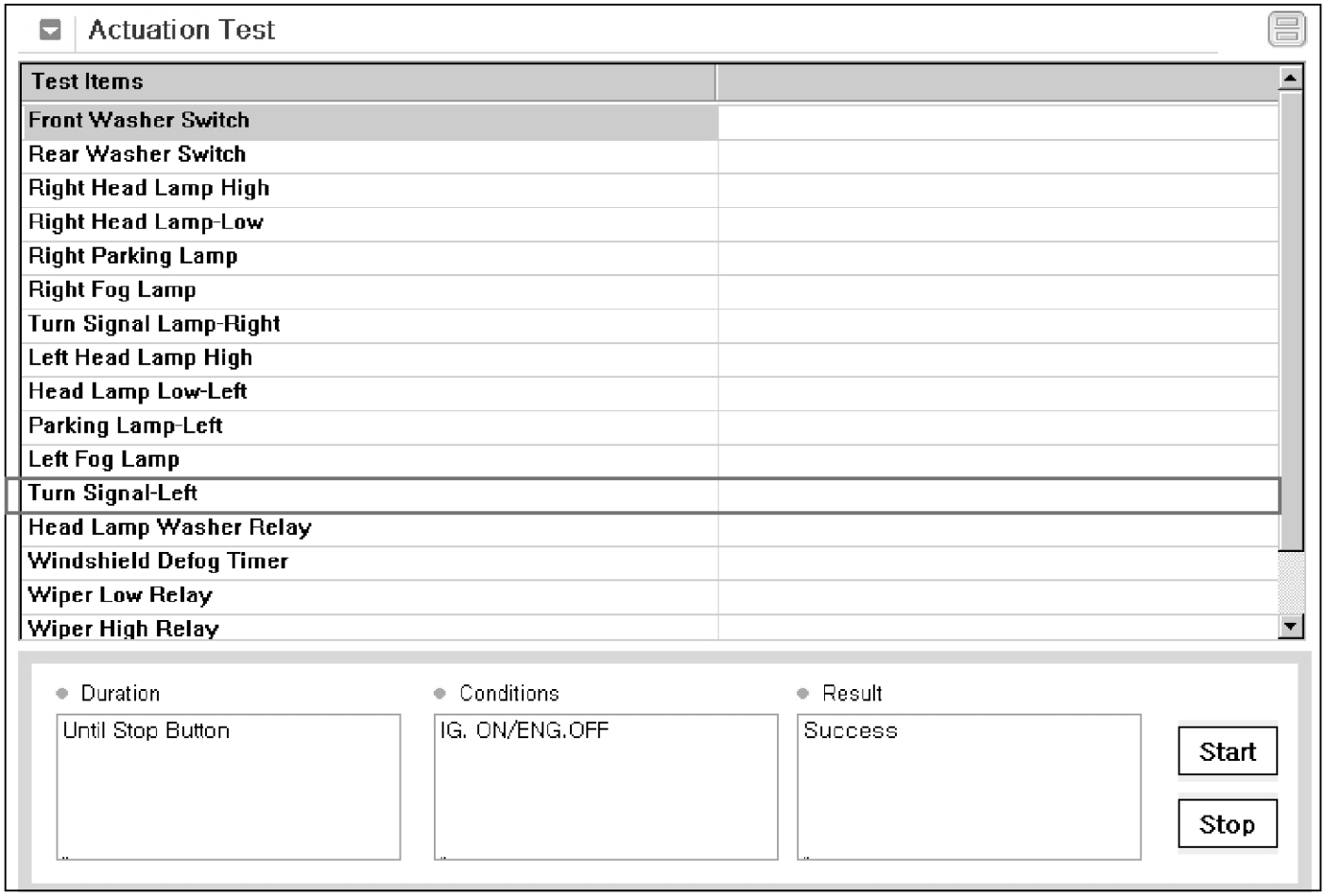

SHMBE9D35L

5. Is left turn signal lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Turn Signal Lamp Circuit Inspection" procedure.

Left Turn Signal Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM, Left Turn Signal Lamp connector.
3. Measure resistance between the Left turn signal lamp terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Left Turn Signal Lamp, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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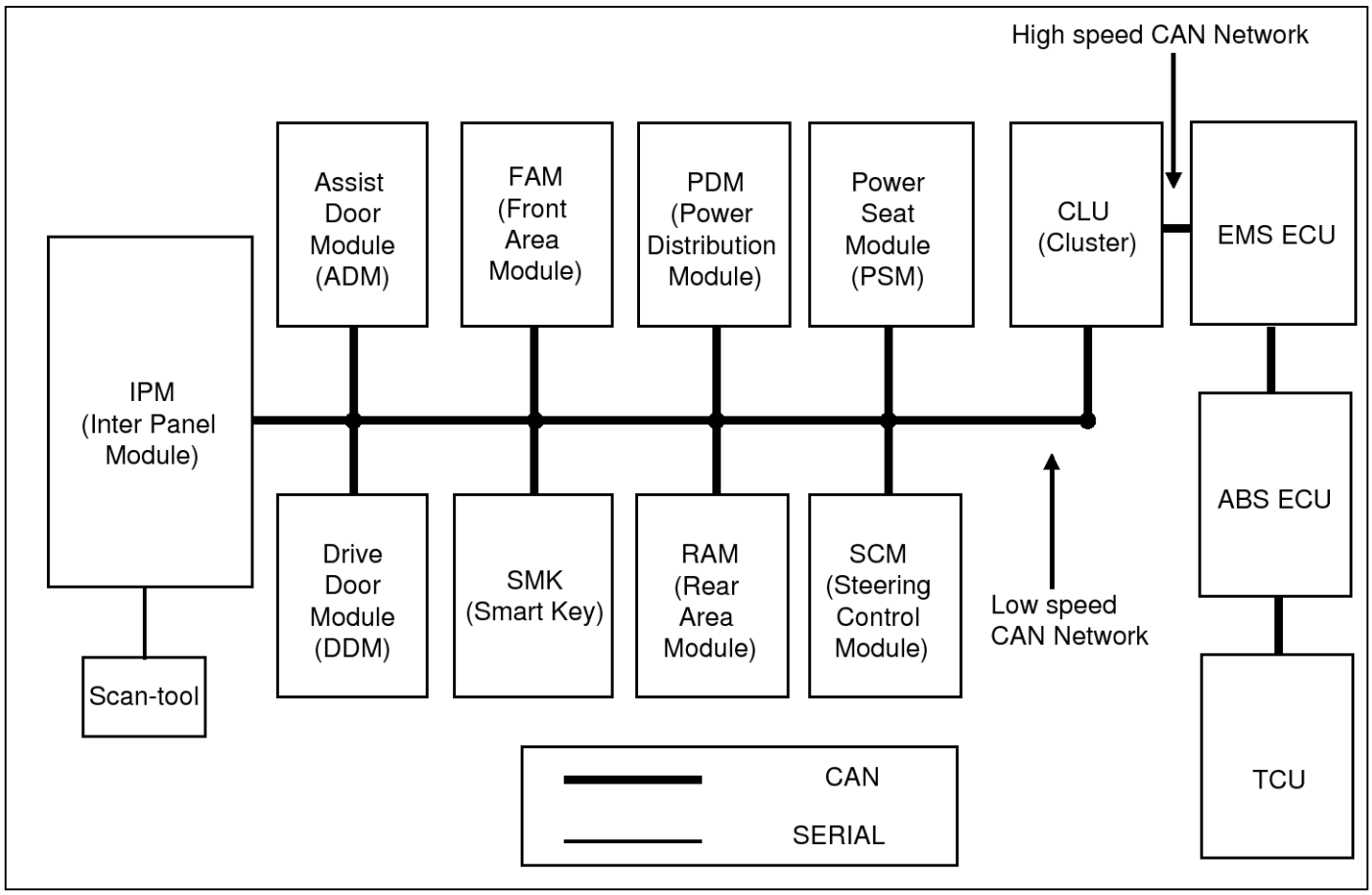
B2541 Left Turn Signal Lamp Open

General Description

Once IPM receives left turn switch working signal, it sends the signal to FAM by CAN communition. FAM makes left turn signal lamp flickering.



SHMBE9D00L

DTC Description

This code is set when left turn signal lamp circuit is open for more than 150ms during left turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in left turn signal lamp circuit • Faulty left turn signal lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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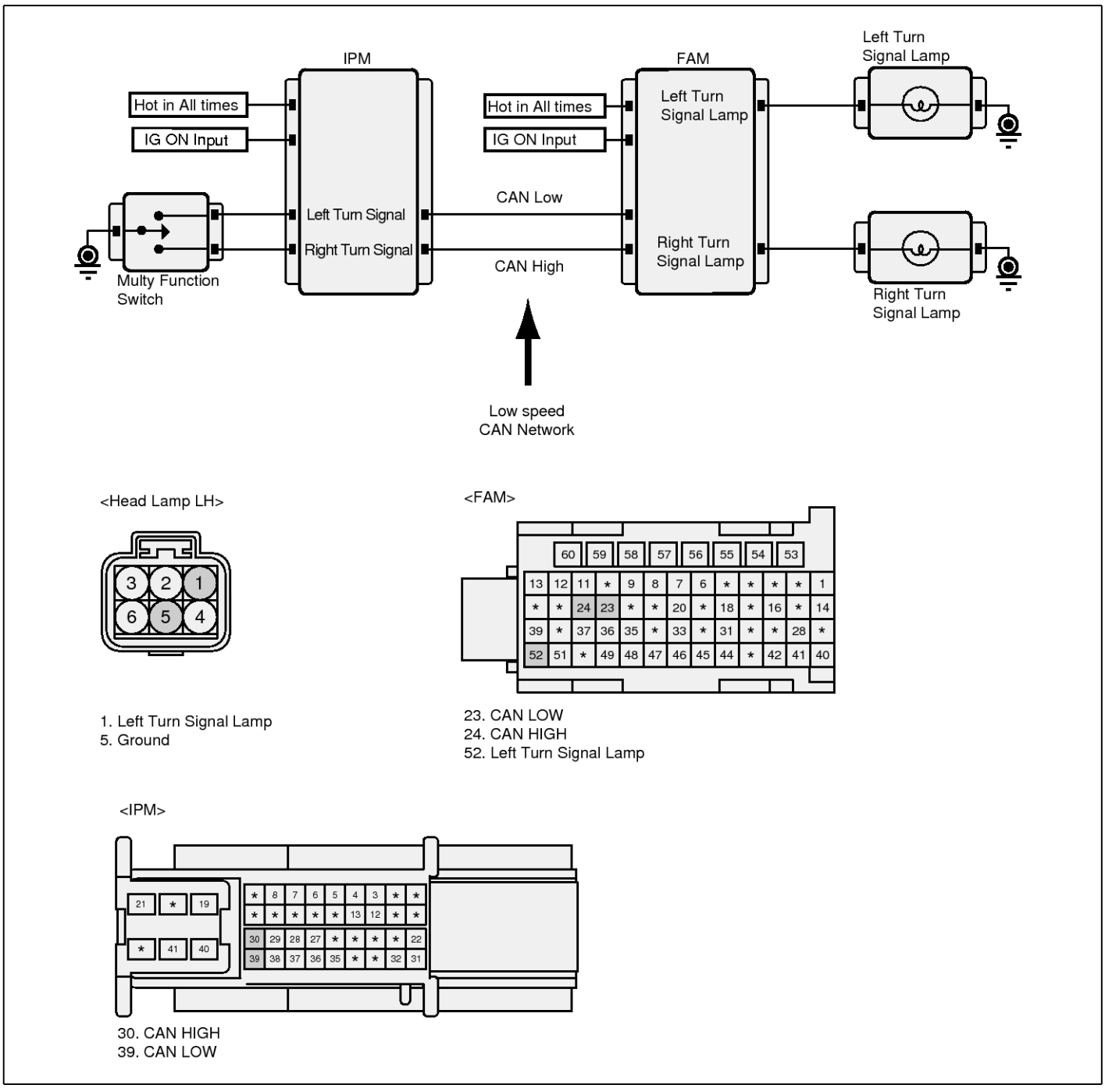

SHMBE9D60L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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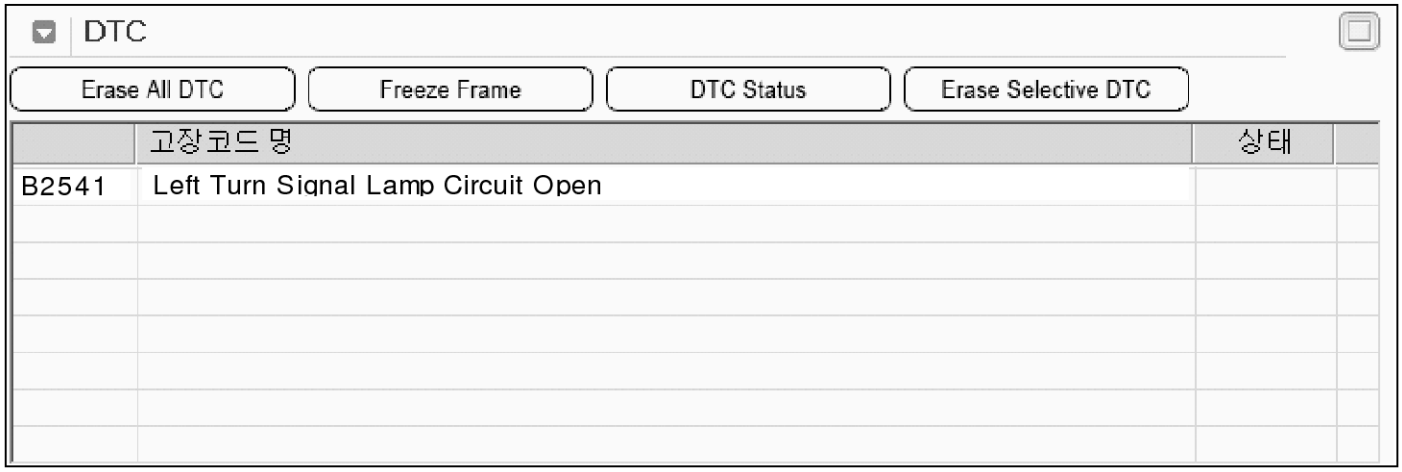

SHMBE9D36L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left turn signal lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "left turn signal lamp" test.

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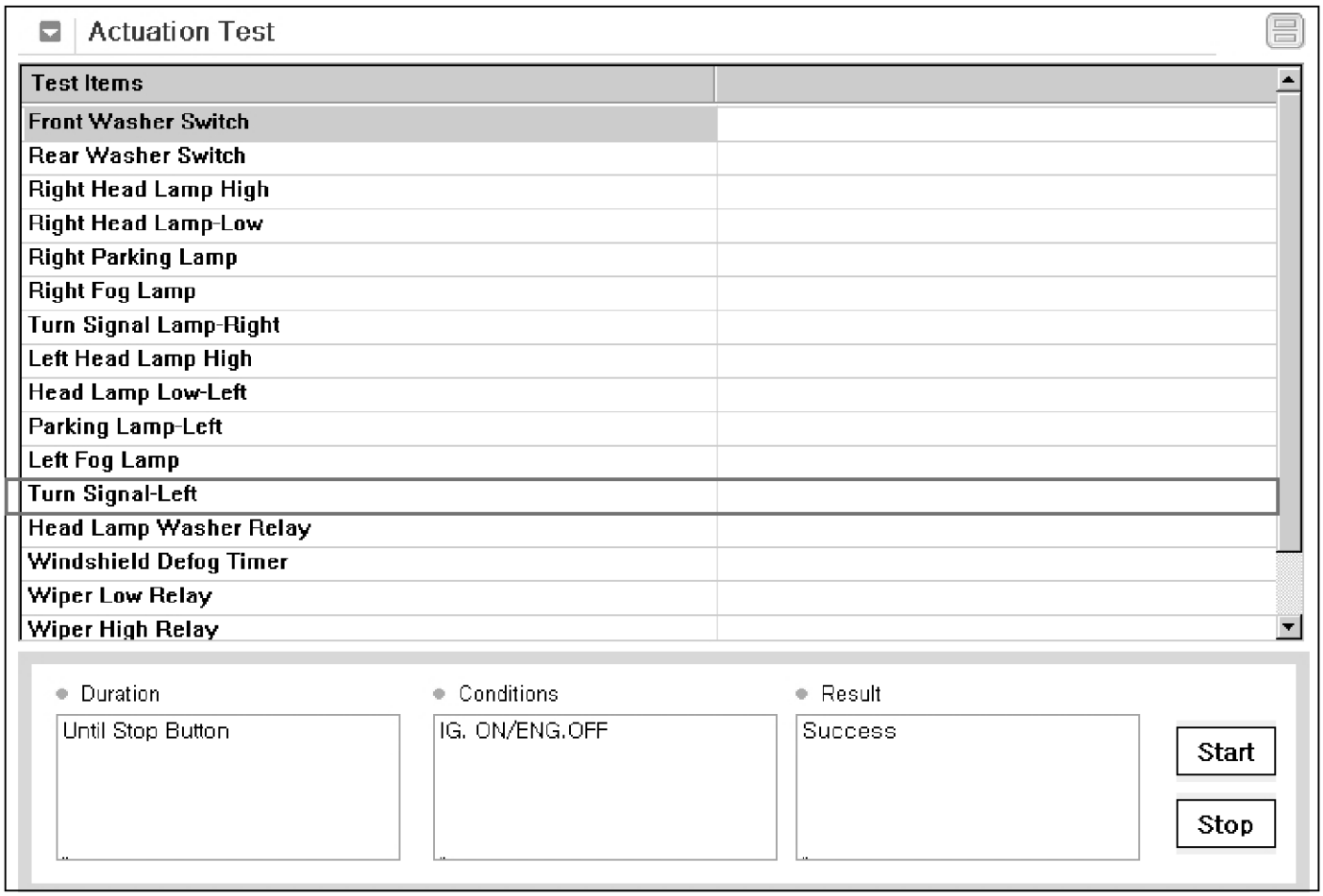

SHMBE9D35L

5. Is left turn signal lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Turn Signal Lamp Circuit Inspection" procedure.

Left Turn Signal Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM connector.
3. Measure resistance between the Left turn signal lamp terminal of FAM harness connector and ground of the left turn signal lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair open in circuit of Left Turn Signal Lamp or Left Turn Signal Lamp internal open, and go to "Verification of Vehicle Repair" procedure .

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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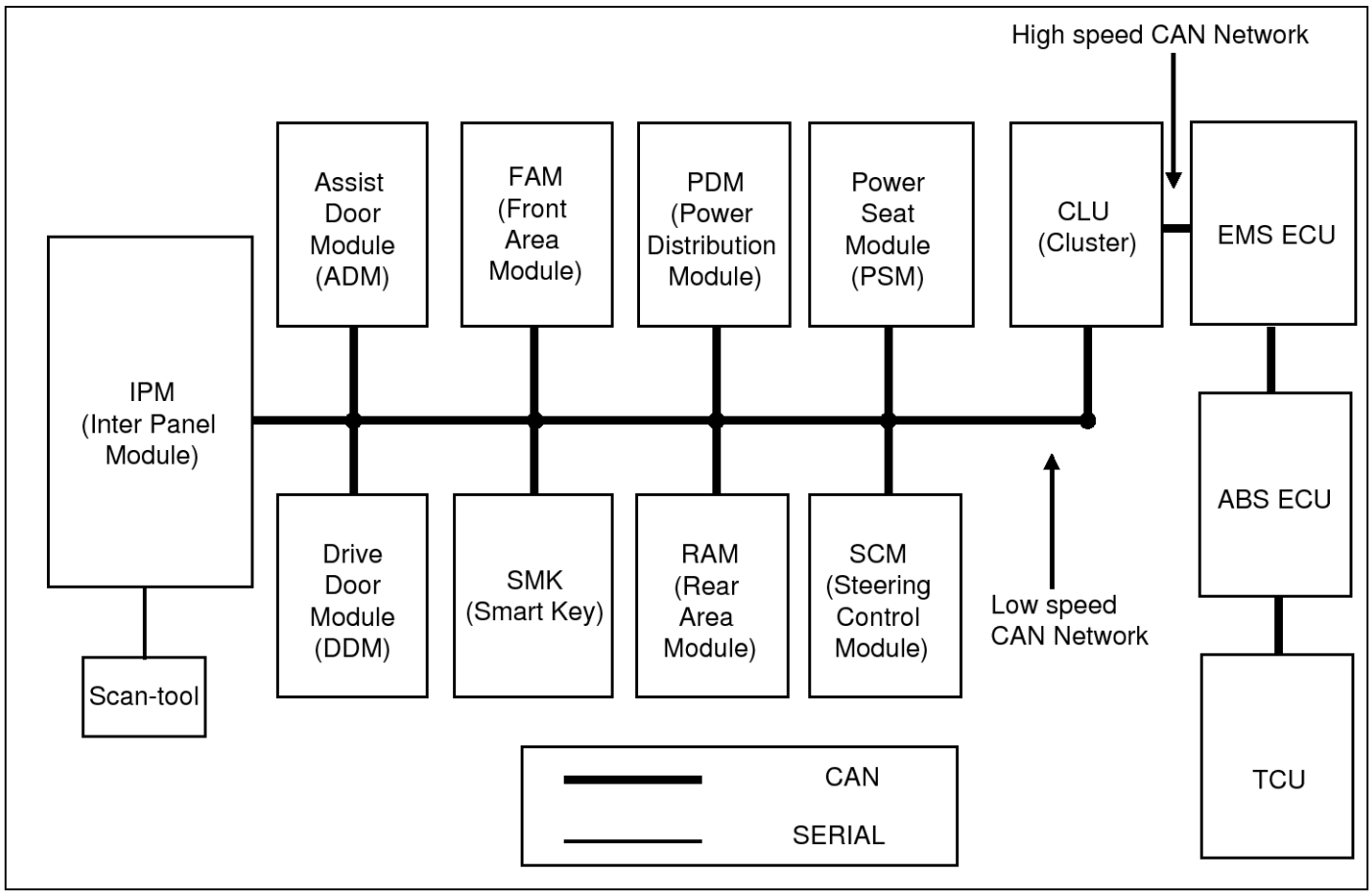
B2543 Right Head Lamp(Low Beam) Short to Ground

General Description

Once IPM receives right headlamp high switch working signal, it sends the signal to FAM by CAN communition. FAM turns on right headlamp high.



SHMBE9D00L

DTC Description

This code is set when right headlamp high circuit is shotted to ground for more than 150ms during right headlamp high operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in right headlamp high circuit • Faulty right headlamp high • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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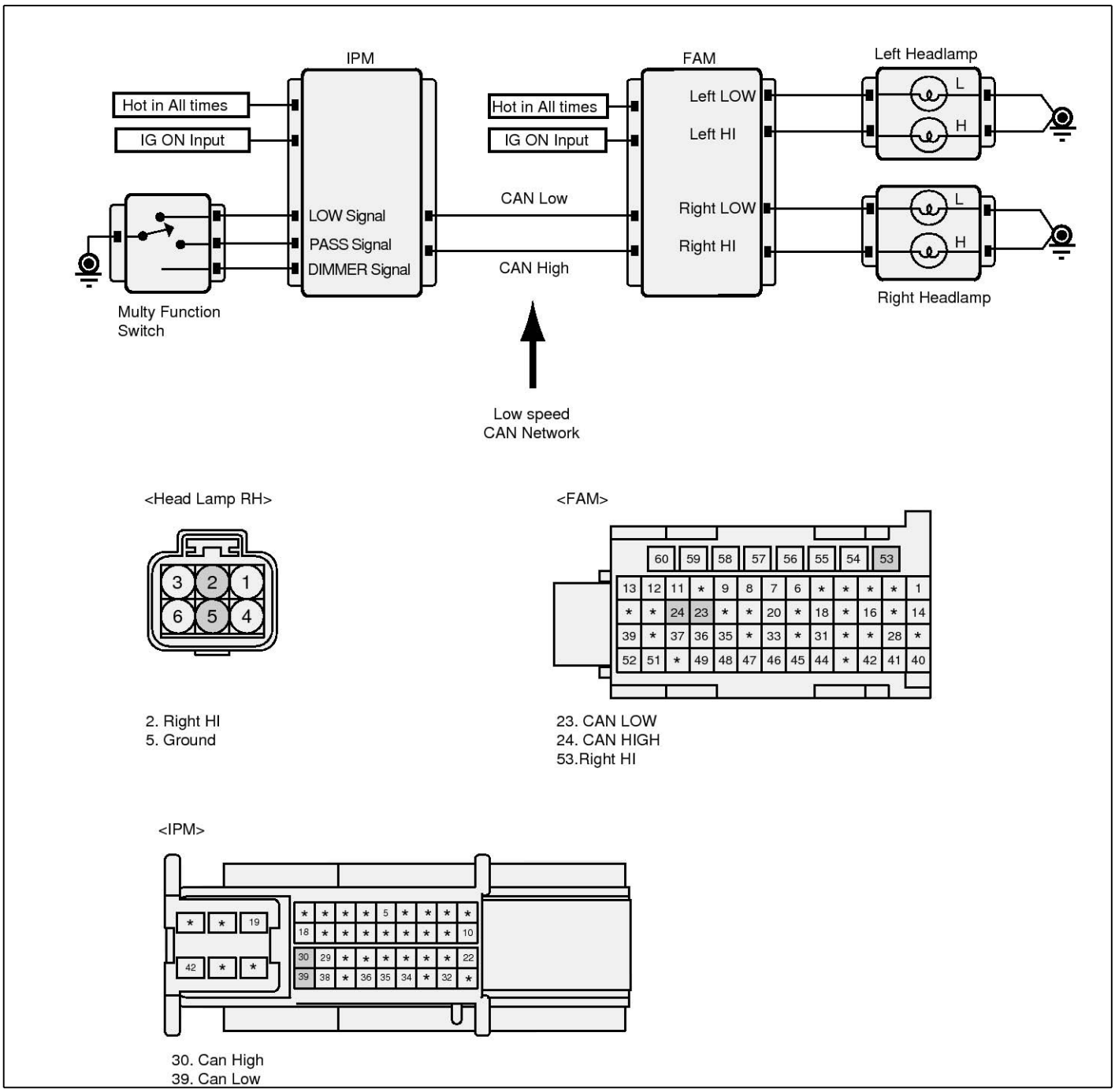

SHMBE9D56L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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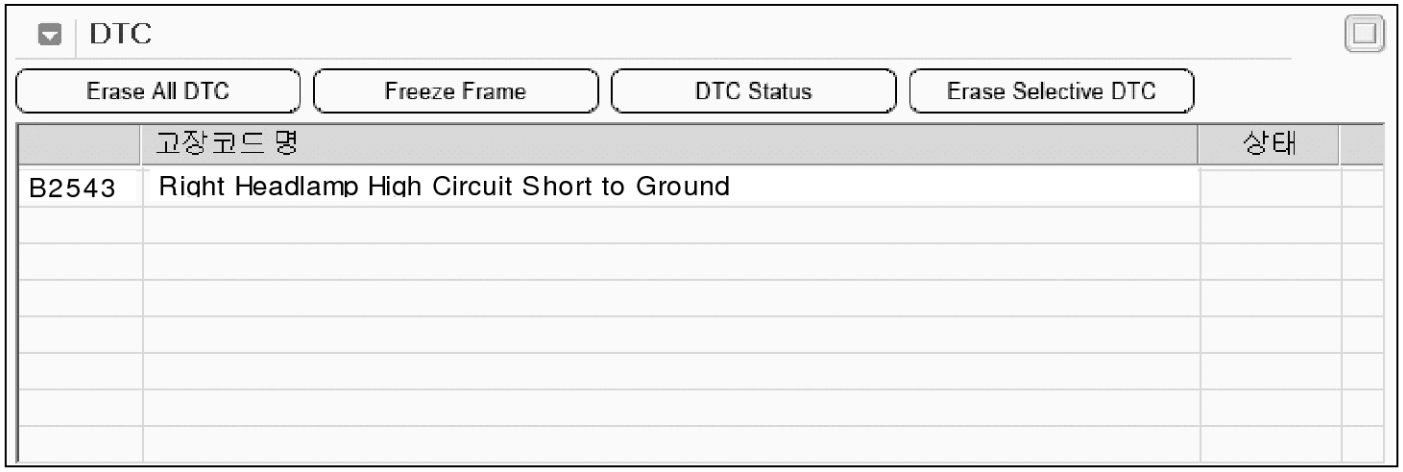

SHMBE9D21L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right headlamp high

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right headlamp high" test.

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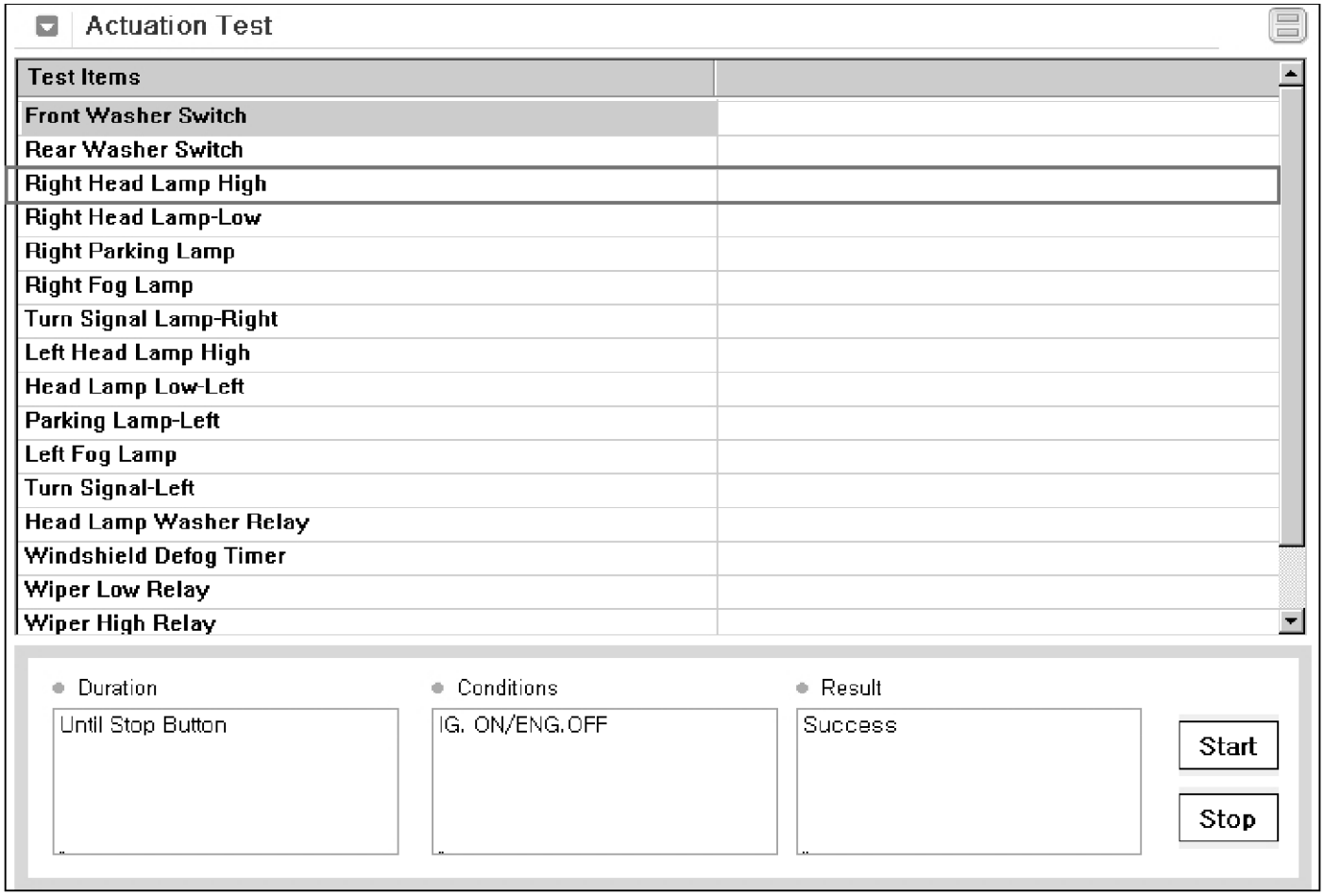

SHMBE9D22L

5. Is right headlamp high working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Headlamp High Circuit Inspection" procedure.

Right Headlamp High Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM, Right Headlamp High connector.
3. Measure resistance between the Right Headlamp High terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Right Headlamp High, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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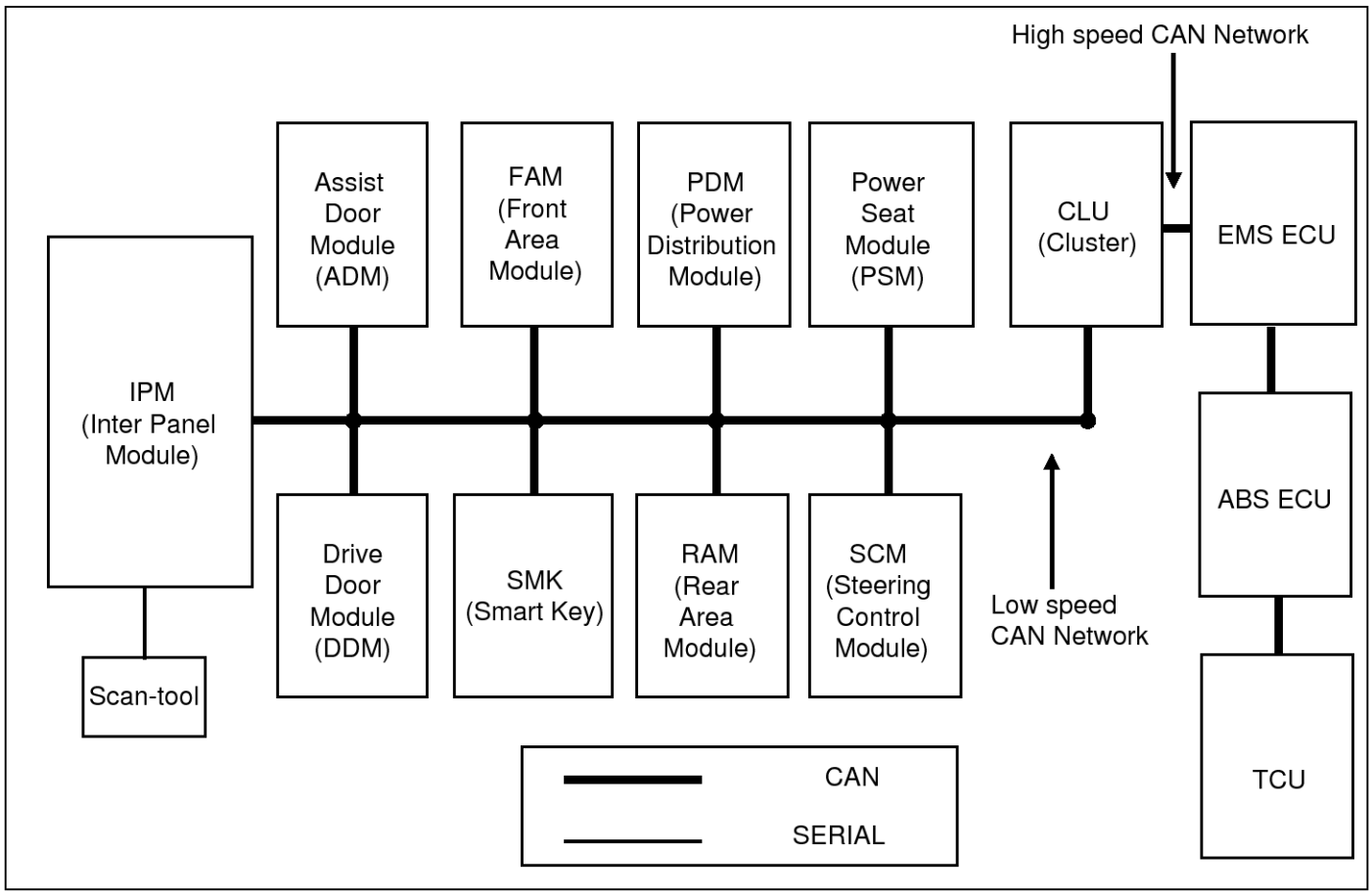
B2545 Right Head Lamp(High Beam) Circuit Open

General Description

Once IPM receives right headlamp high switch working signal, it sends the signal to FAM by CAN communition. FAM turns on right headlamp high.



SHMBE9D00L

DTC Description

This code is set when right headlamp high circuit is open for more than 150ms during right headlamp high operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in right headlamp high circuit • Faulty right headlamp high • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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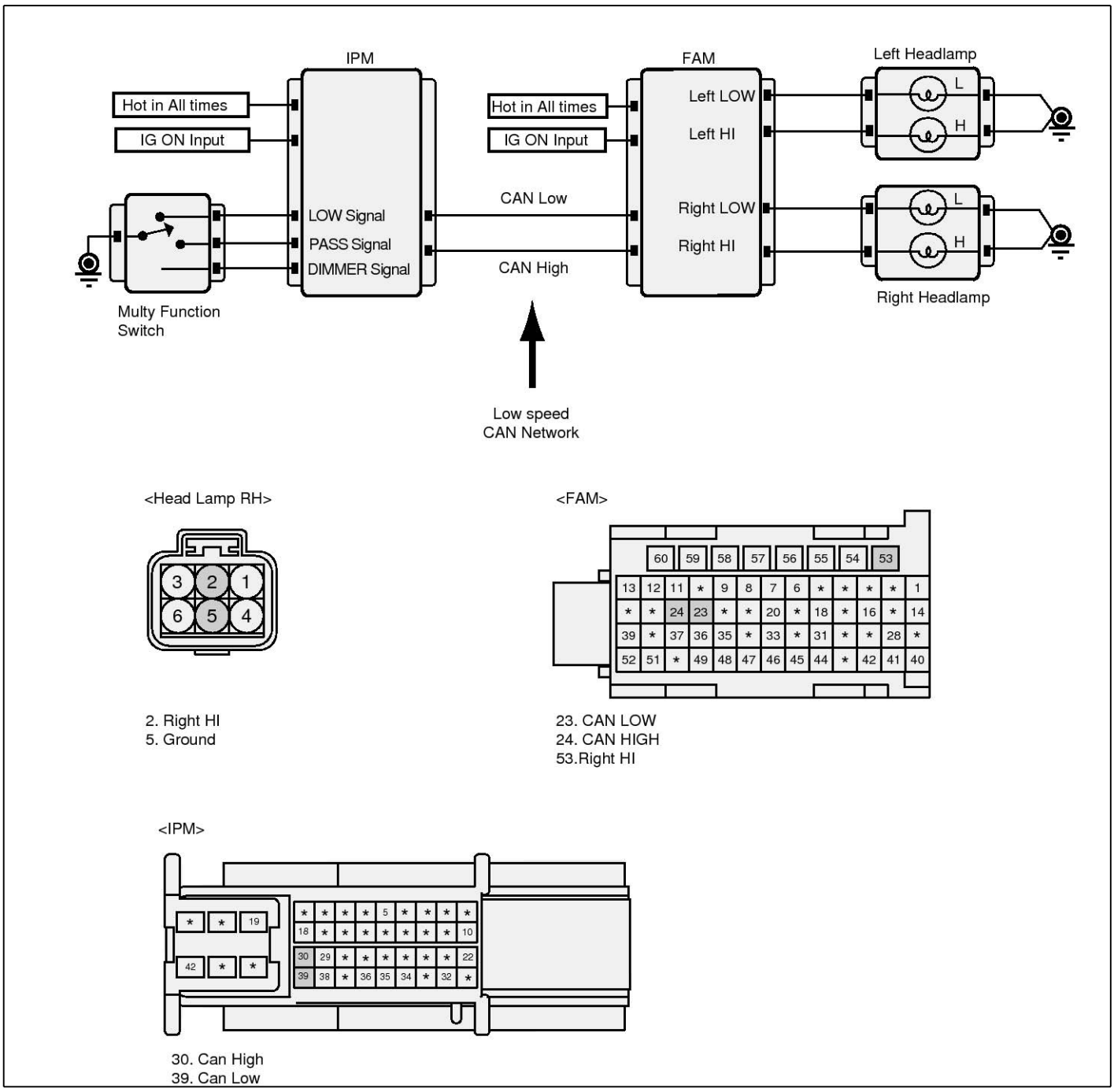

SHMBE9D56L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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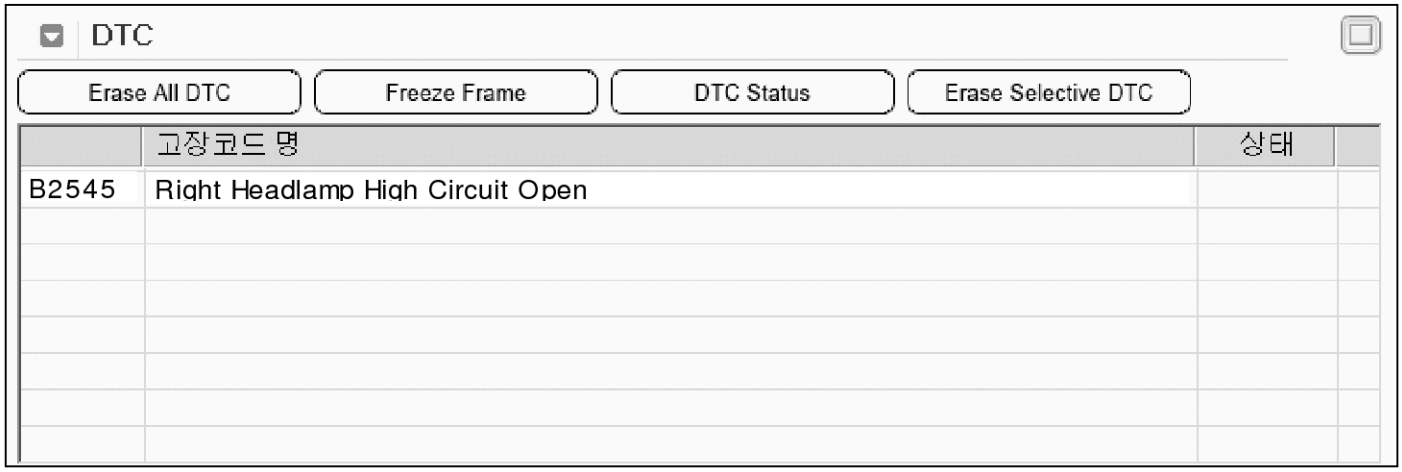

SHMBE9D23L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right headlamp high

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right headlamp high" test.

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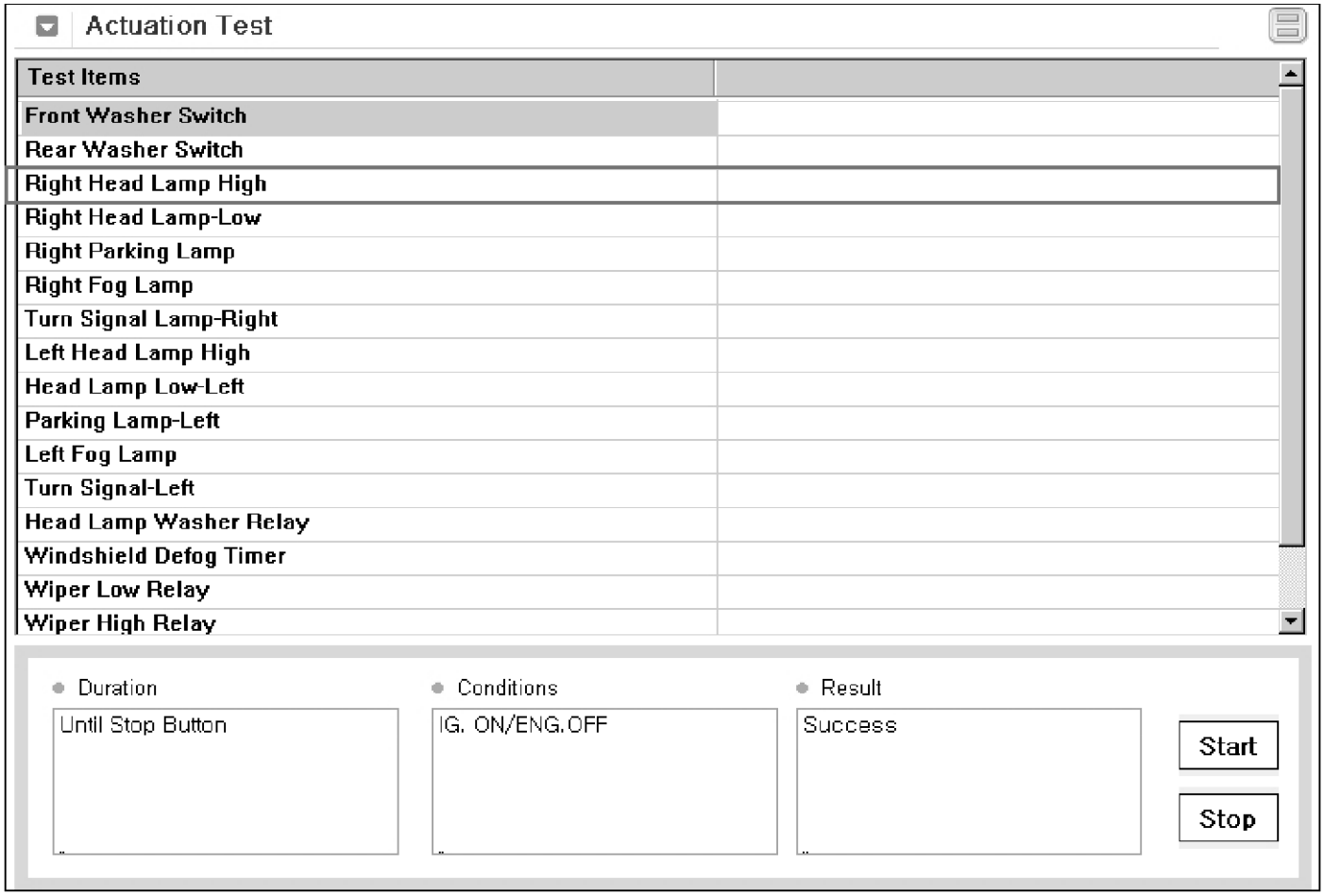

SHMBE9D22L

5. Is right headlamp high working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Headlamp High Circuit Inspection" procedure.

Right Headlamp High Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM connector.
3. Measure resistance between the right headlamp high terminal of FAM harness connector and ground of the left turn signal lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair open in circuit of Right Headlamp High or Right Headlamp High internal open, and go to "Verification of Vehicle Repair" procedure .

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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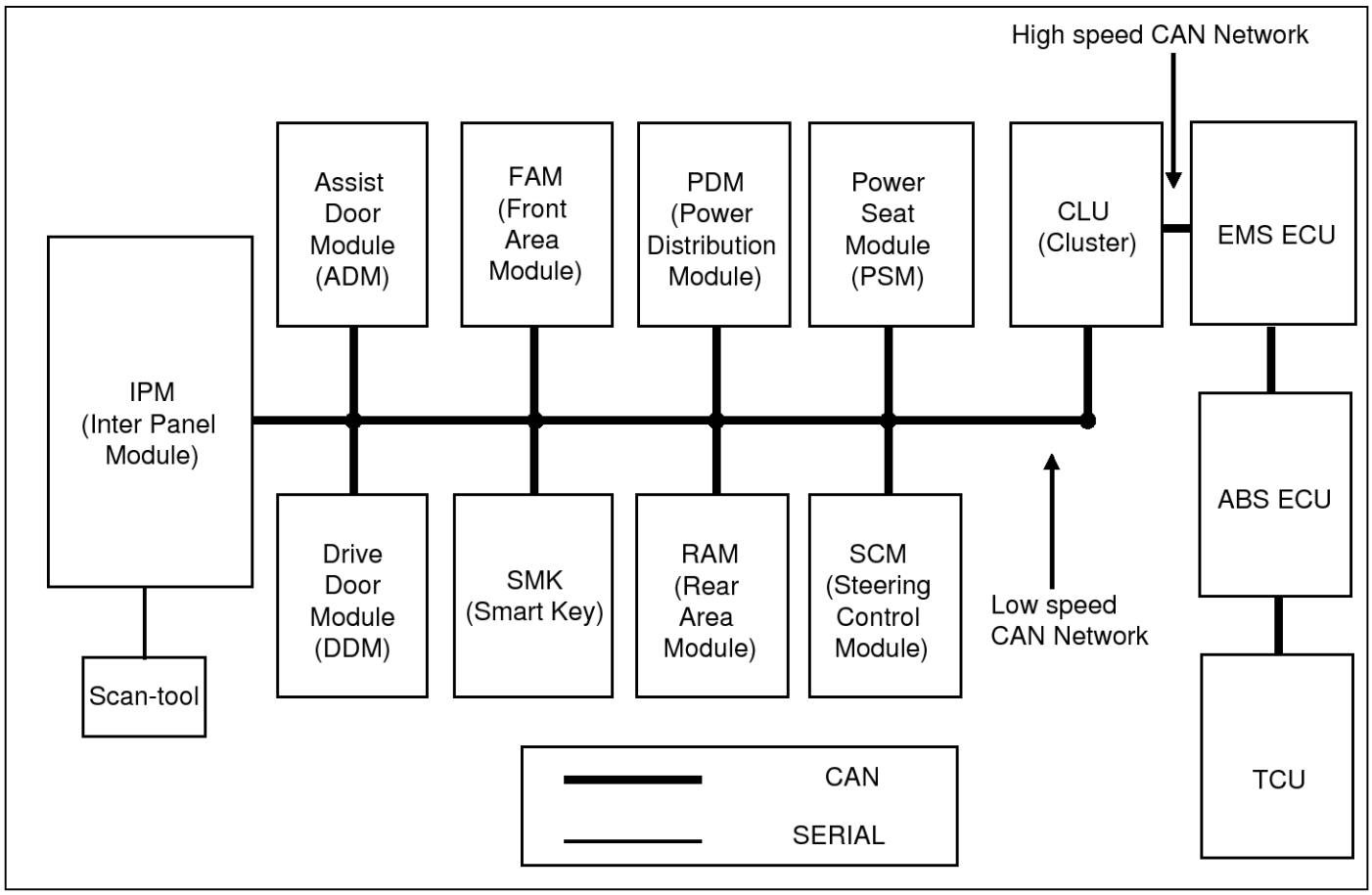
B2547 Left Headlamp(High Beam) Short to Ground

General Description

Once IPM receives left headlamp high switch working signal, it sends the signal to FAM by CAN communition. FAM turns on left headlamp high.



SHMBE9D00L

DTC Description

This code is set when left headlamp high circuit is shotted to ground for more than 150ms during left headlamp high operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in left headlamp high circuit • Faulty left headlamp high • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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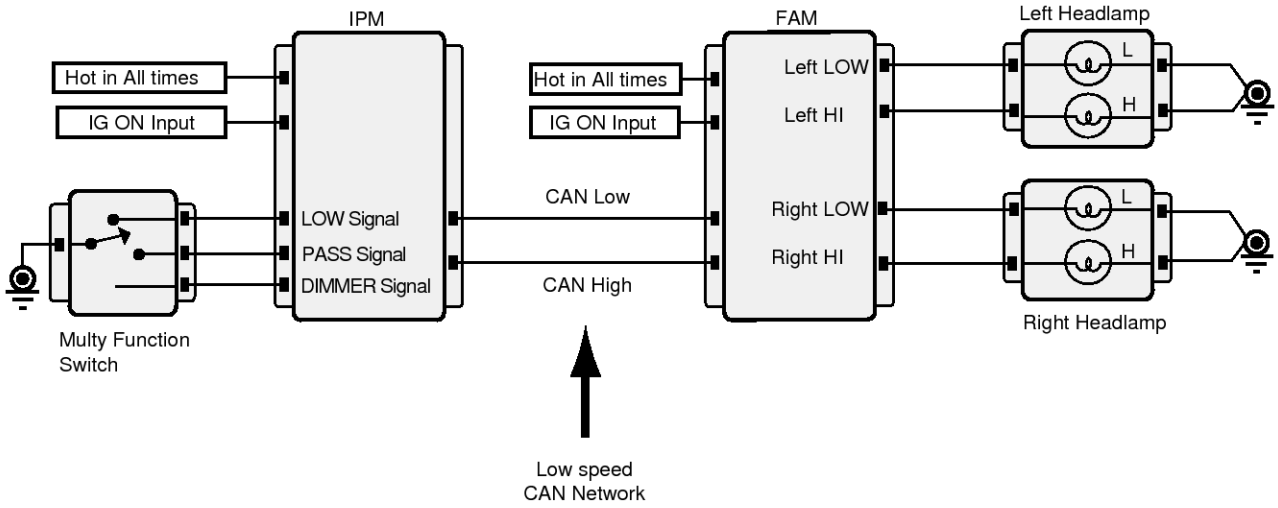
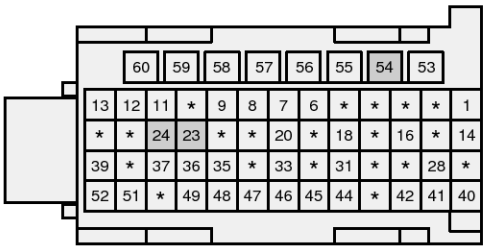


<Head Lamp LH>

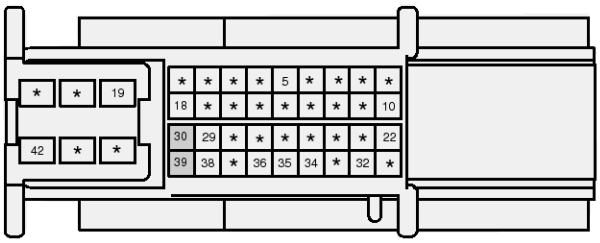
2. Left HI
5. Ground

<FAM>



23. CAN LOW
24. CAN HIGH
54. Left HI

<IPM>



30. Can High
39. Can Low

SHMBE9D55L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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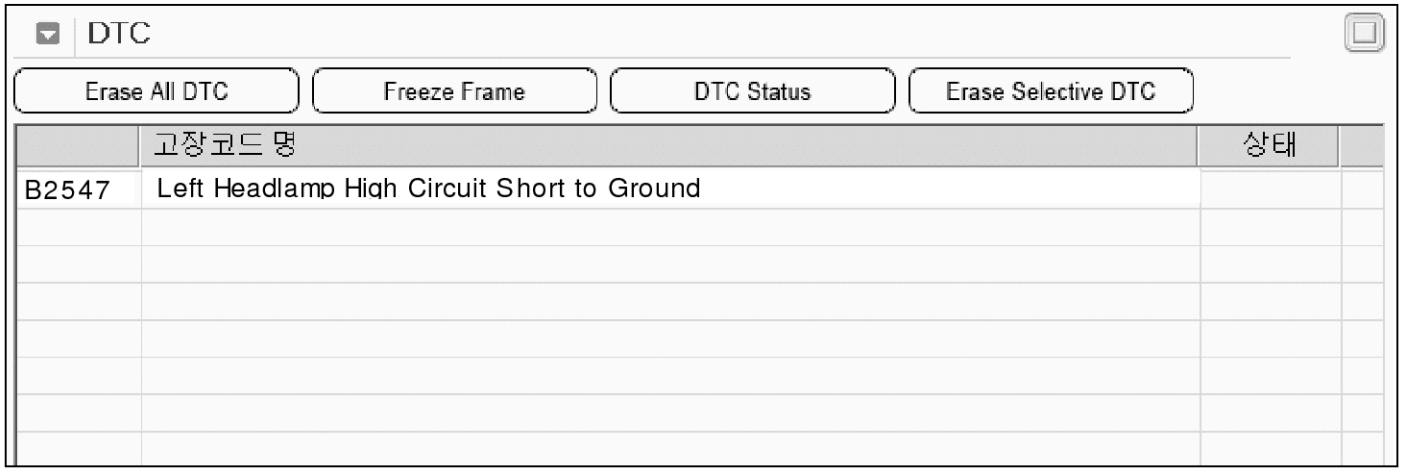

SHMBE9D31L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left headlamp high

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "left headlamp high" test.

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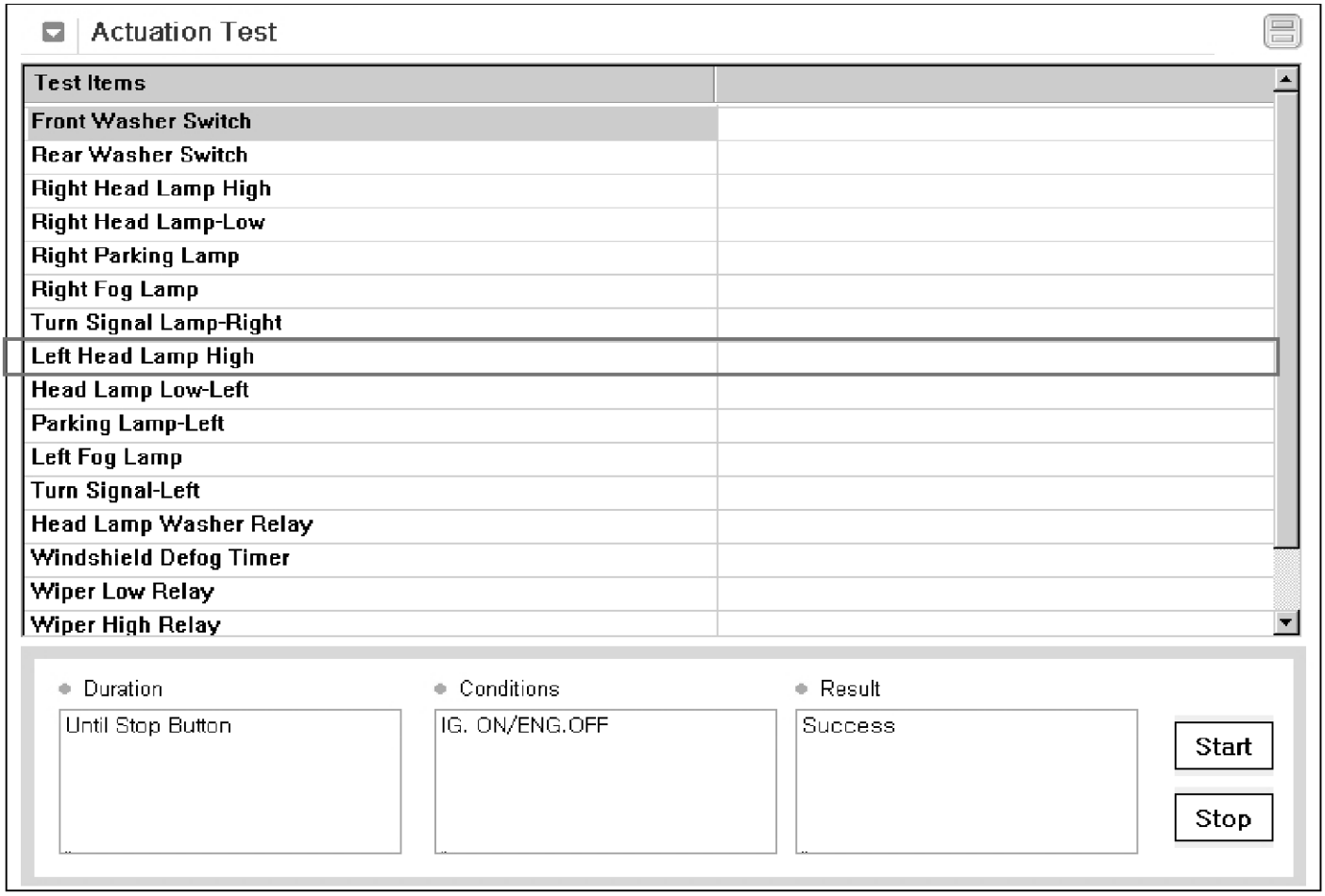

SHMBE9D12L

5. Is left headlamp high working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Headlamp High Circuit Inspection" procedure.

Left Headlamp High Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM, Left Headlamp High connector.
3. Measure resistance between the Left Headlamp High terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Left Headlamp High, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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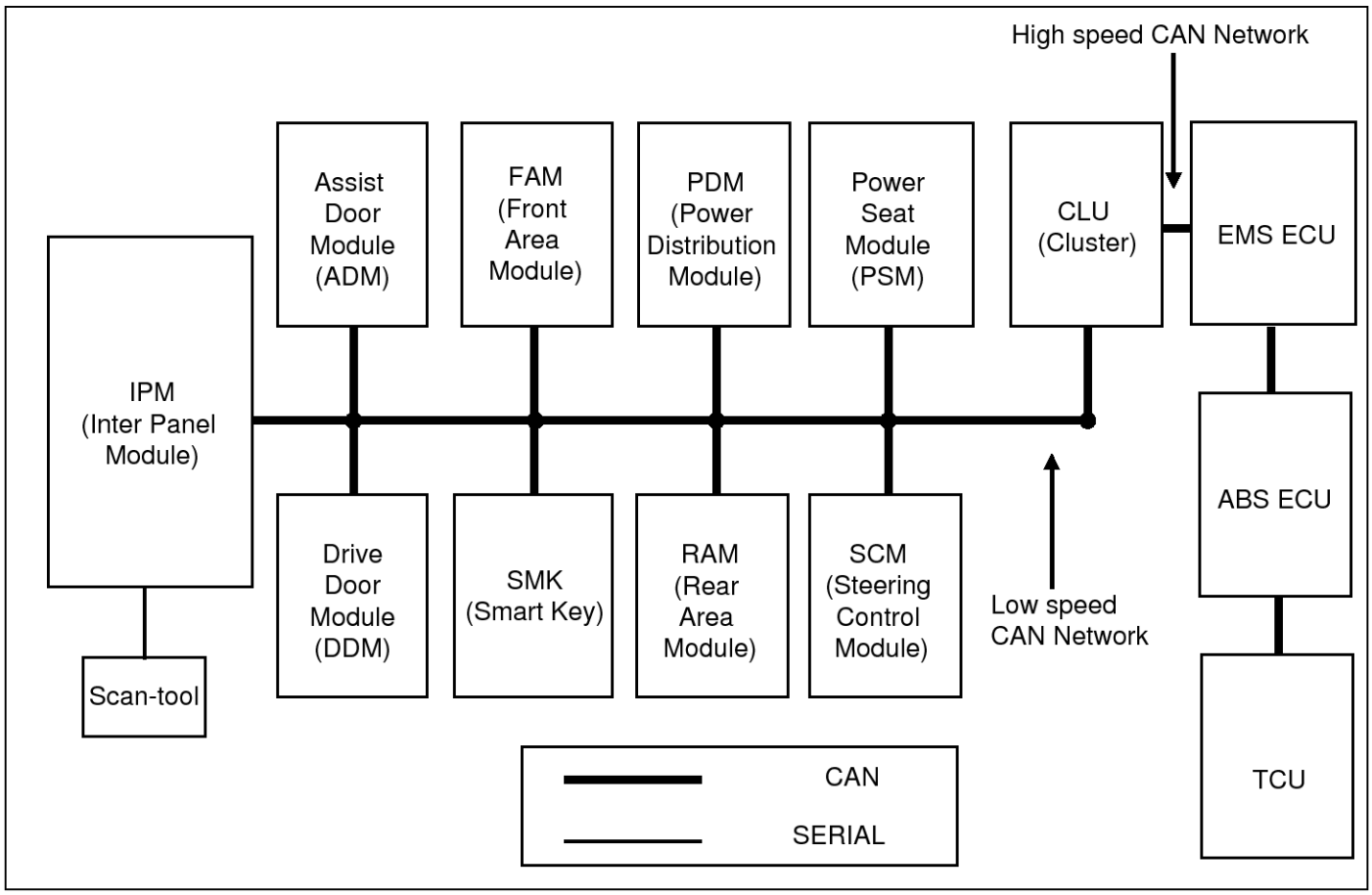
B2549 Left Headlamp(High Beam) Open

General Description

Once IPM receives left headlamp high switch working signal, it sends the signal to FAM by CAN communition. FAM turns on left headlamp high.



SHMBE9D00L

DTC Description

This code is set when left headlamp high circuit is open for more than 150ms during left headlamp high operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in left headlamp high circuit • Faulty left headlamp high • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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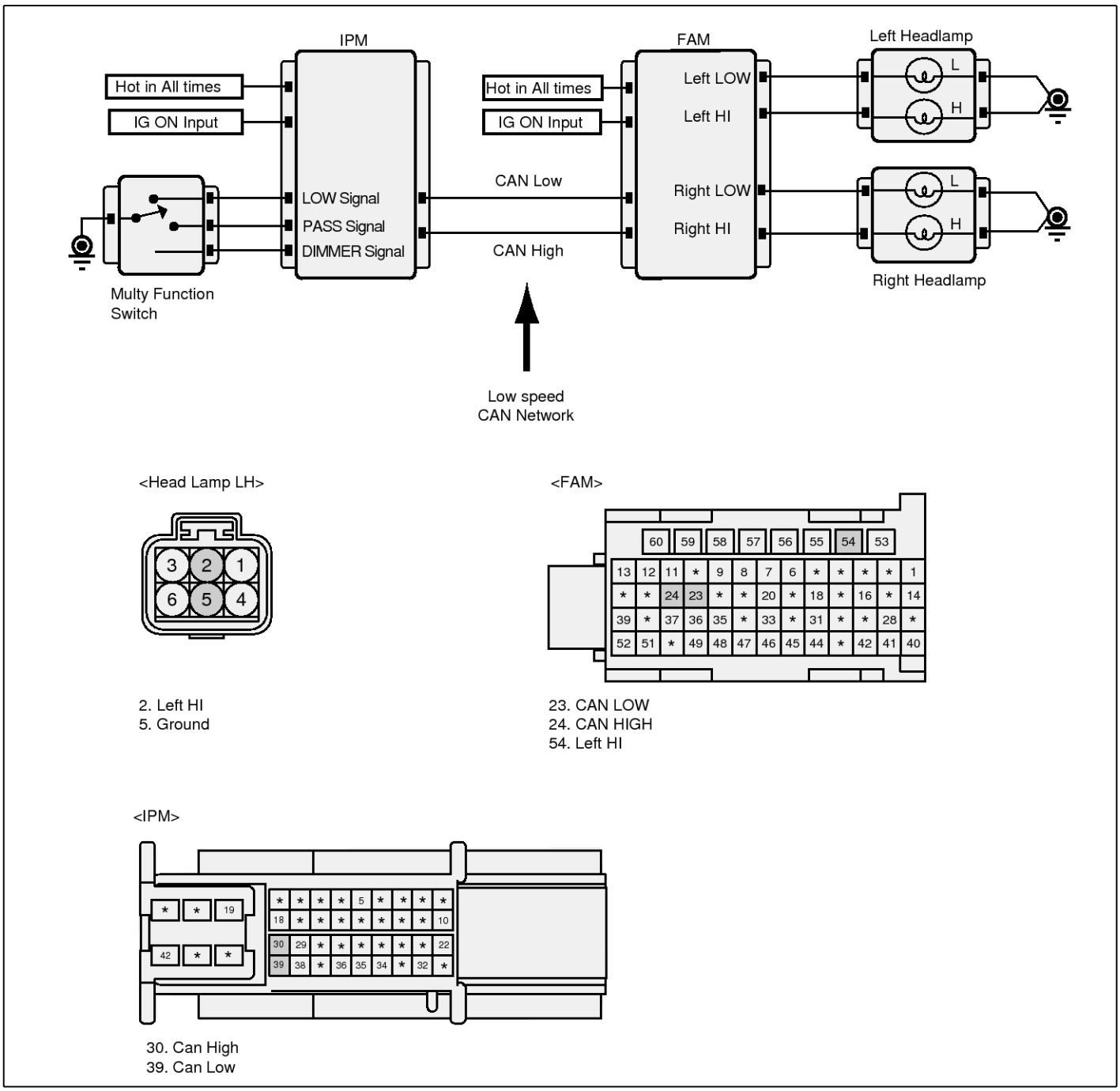

SHMBE9D55L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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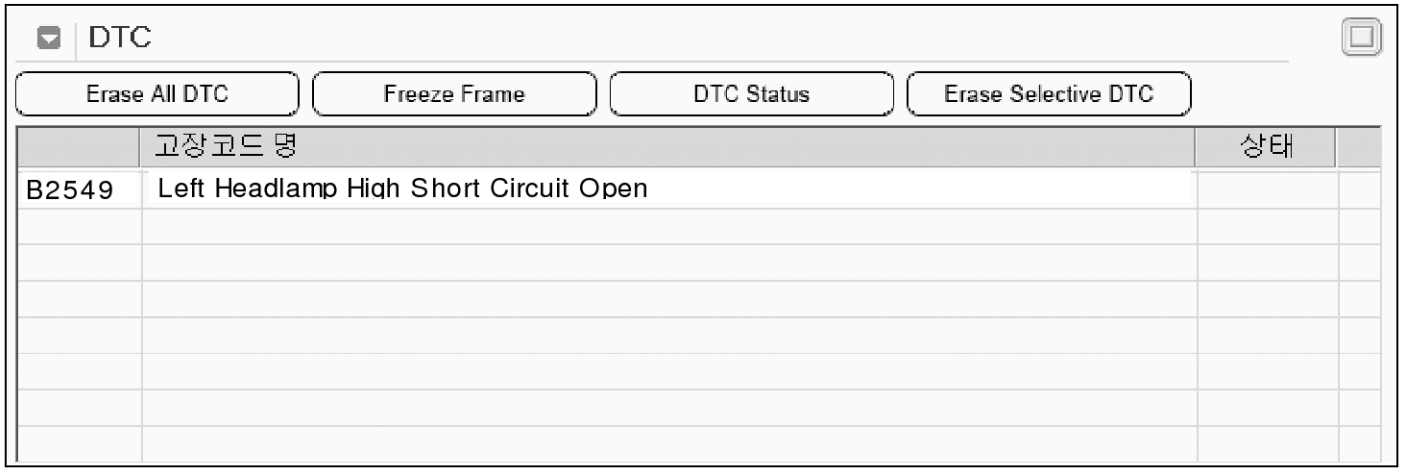

SHMBE9D11L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left headlamp high

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "left headlamp high" test.

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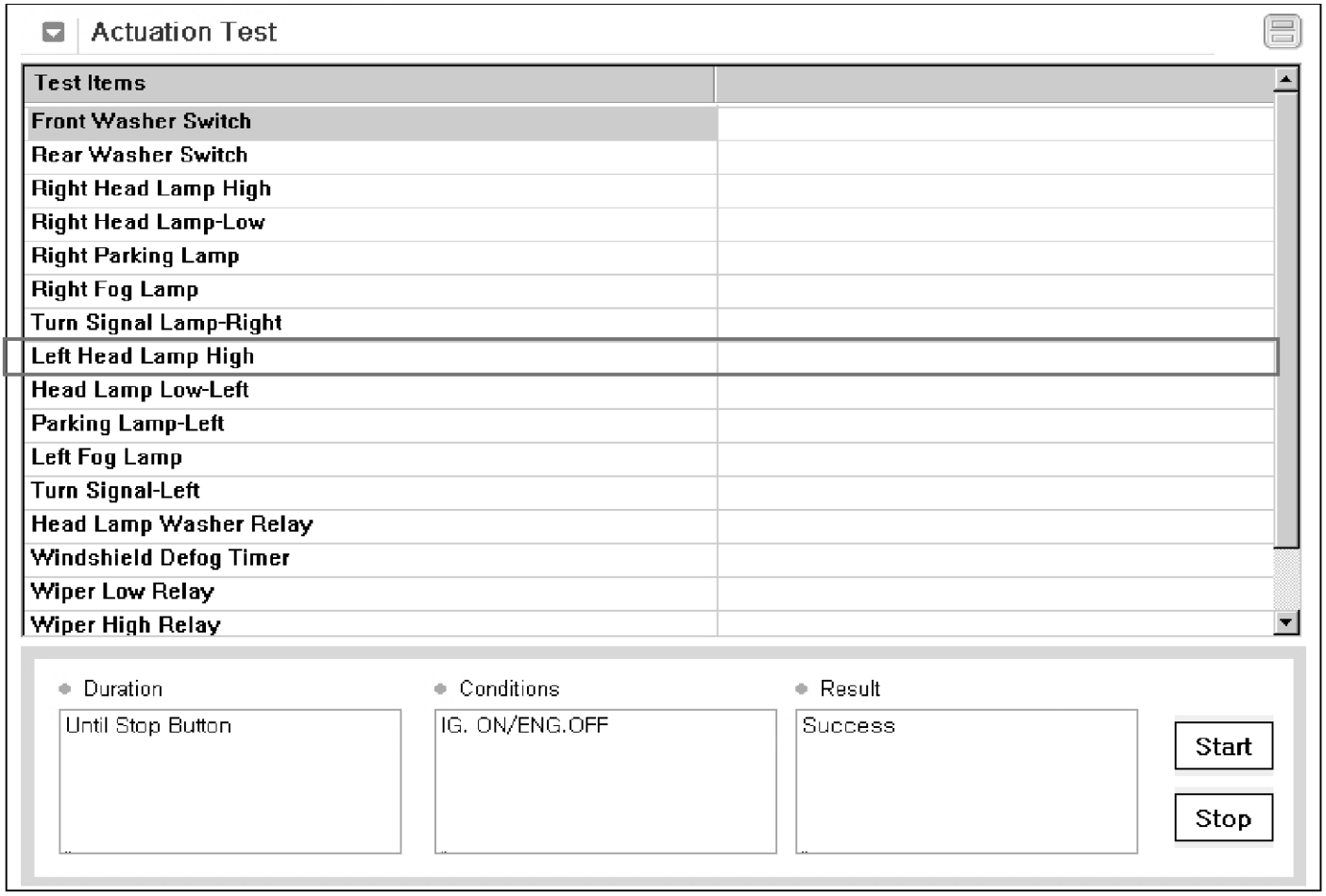

SHMBE9D12L

5. Is left headlamp high working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Headlamp High Circuit Inspection" procedure.

Left Headlamp High Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM connector.
3. Measure resistance between the Left Headlamp High terminal of FAM harness connector and ground of the Left Headlamp High.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair open in circuit of Left Headlamp High or Left Headlamp High internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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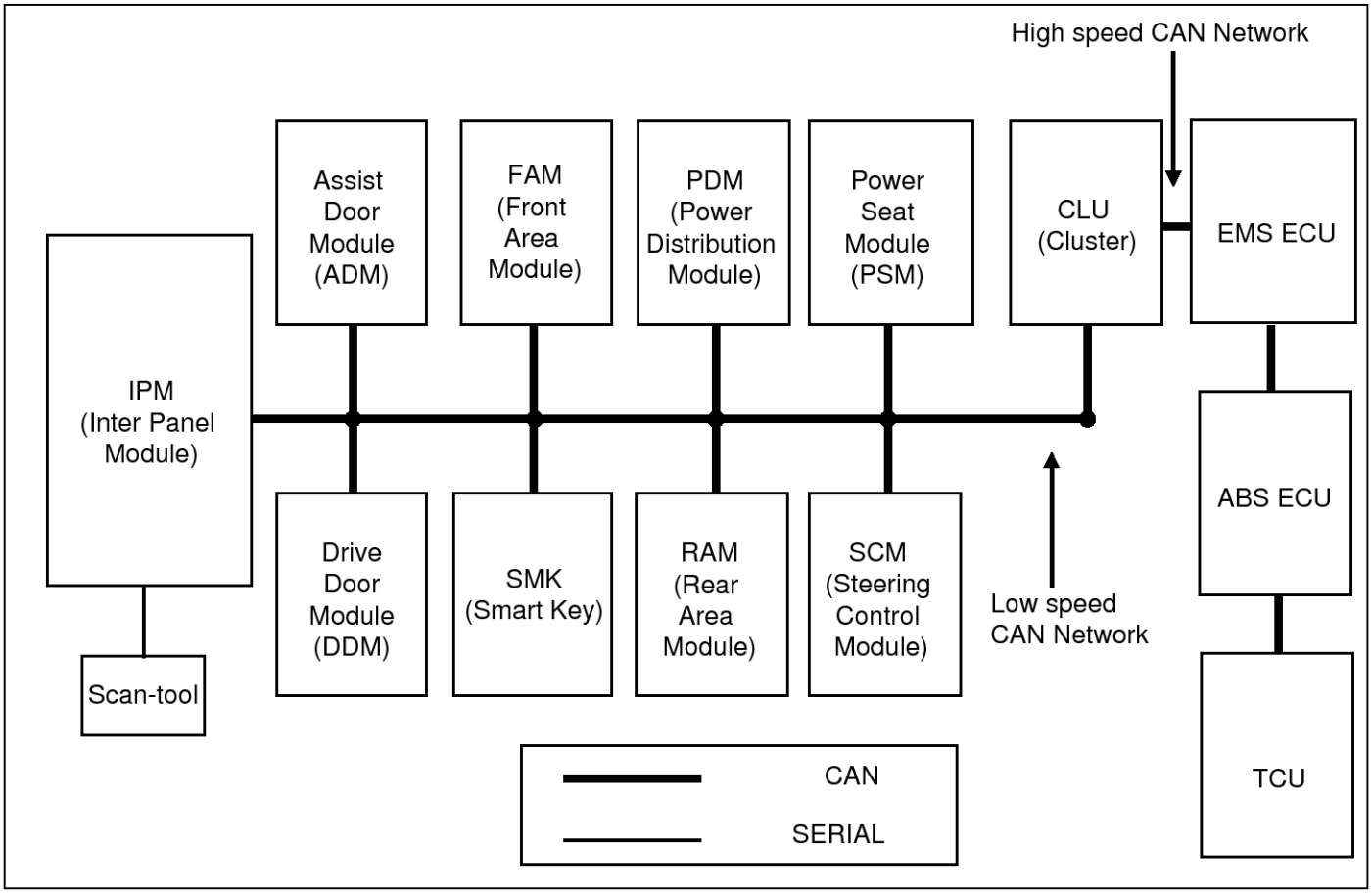
B2551 Right Head Lamp(Low Beam) Short to Ground

General Description

Once IPM receives right headlamp low switch working signal, it sends the signal to FAM by CAN communition. FAM turns on right headlamp low.



SHMBE9D00L

DTC Description

This code is set when right headlamp low circuit is shotted to ground for more than 150ms during right headlamp low operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in right headlamp low circuit • Faulty right headlamp low • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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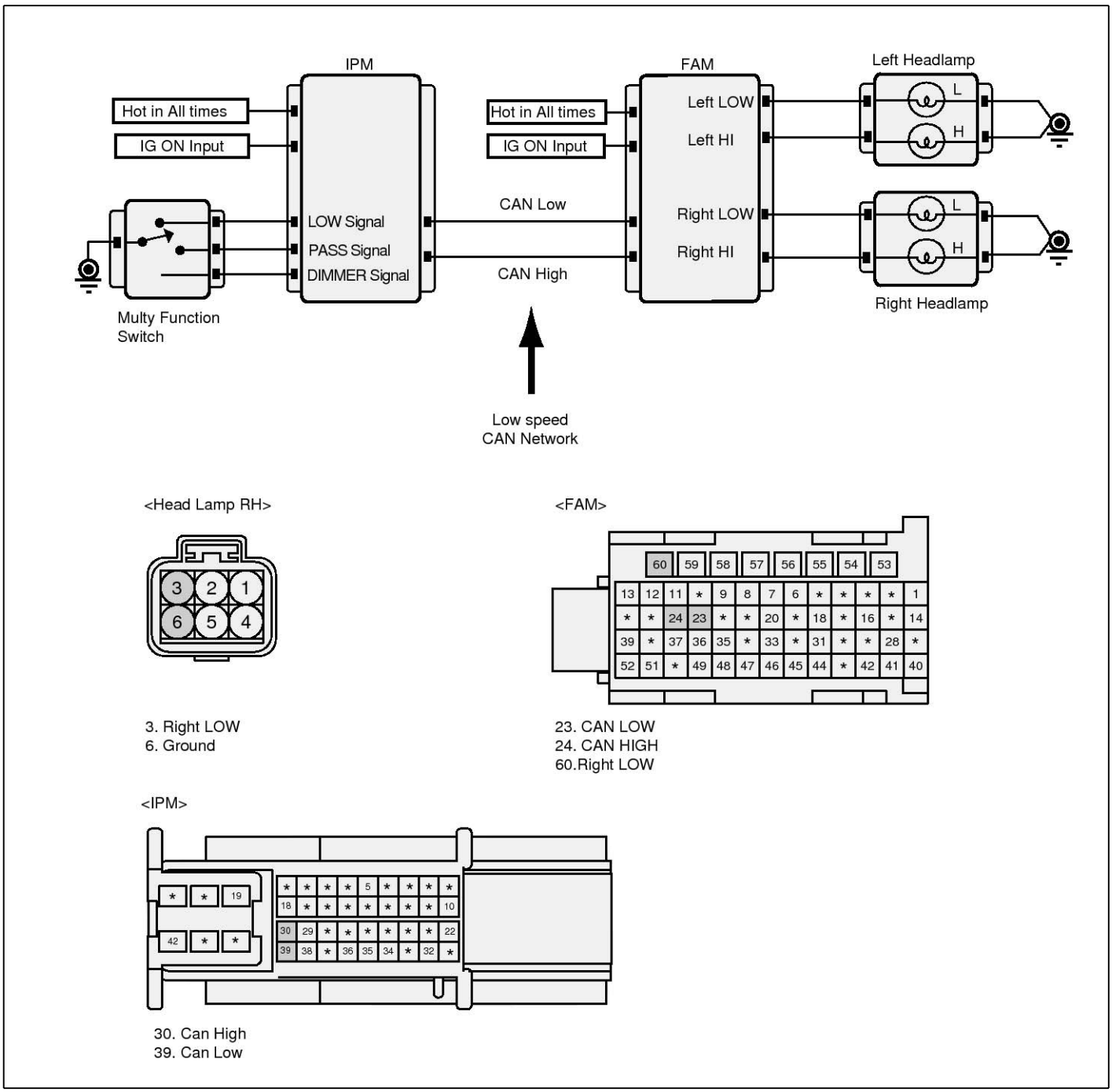

SHMBE9D57L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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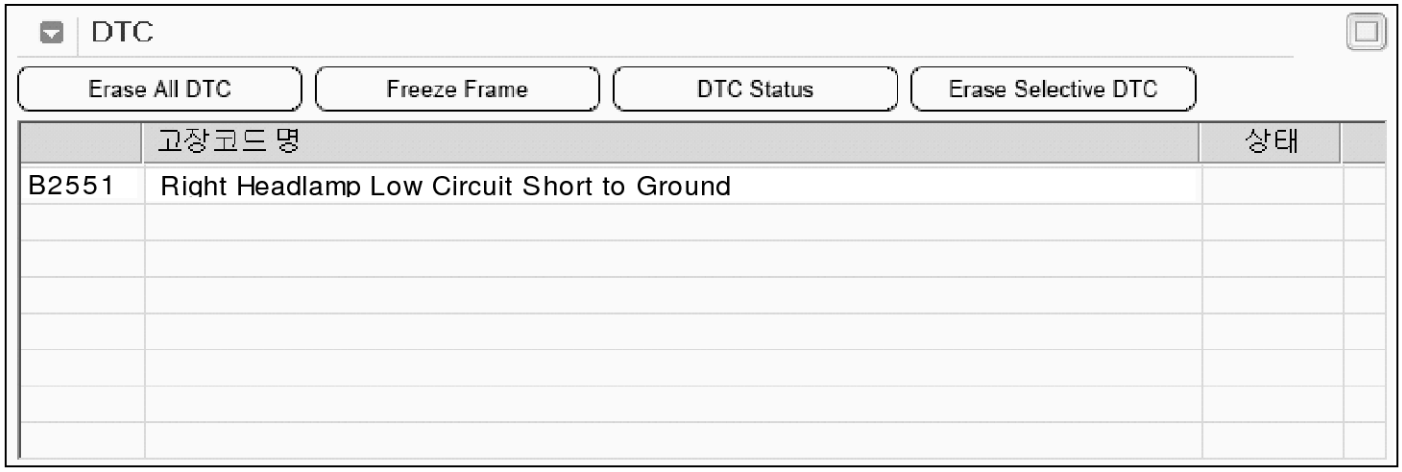

SHMBE9D32L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right headlamp low

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right headlamp low" test

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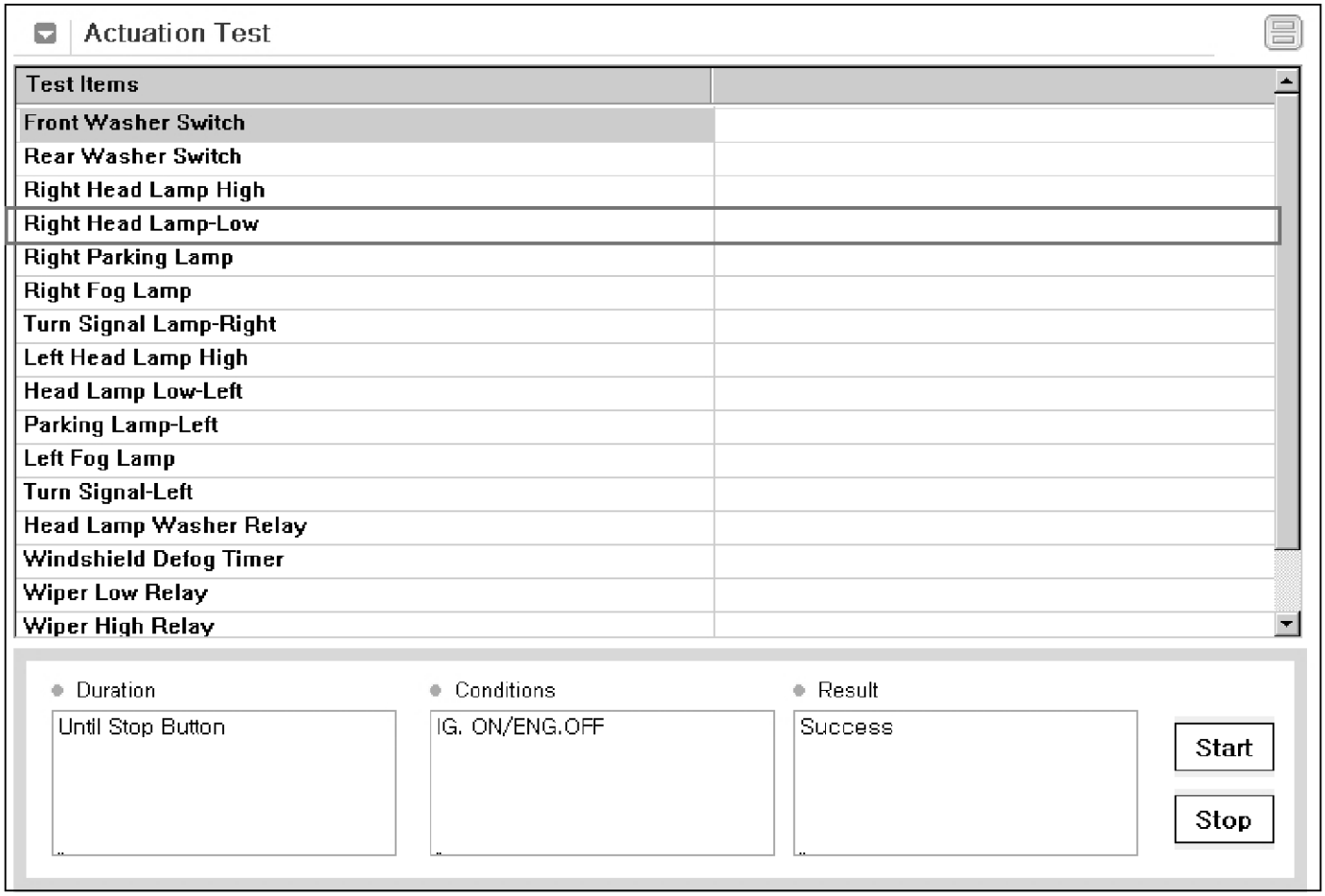

SHMBE9D26L

5. Is right headlamp high working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Headlamp Low Circuit Inspection" procedure.

Right Headlamp Low Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM, Right Headlamp Low connector.
3. Measure resistance between the Right Headlamp Low terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Right Headlamp Low, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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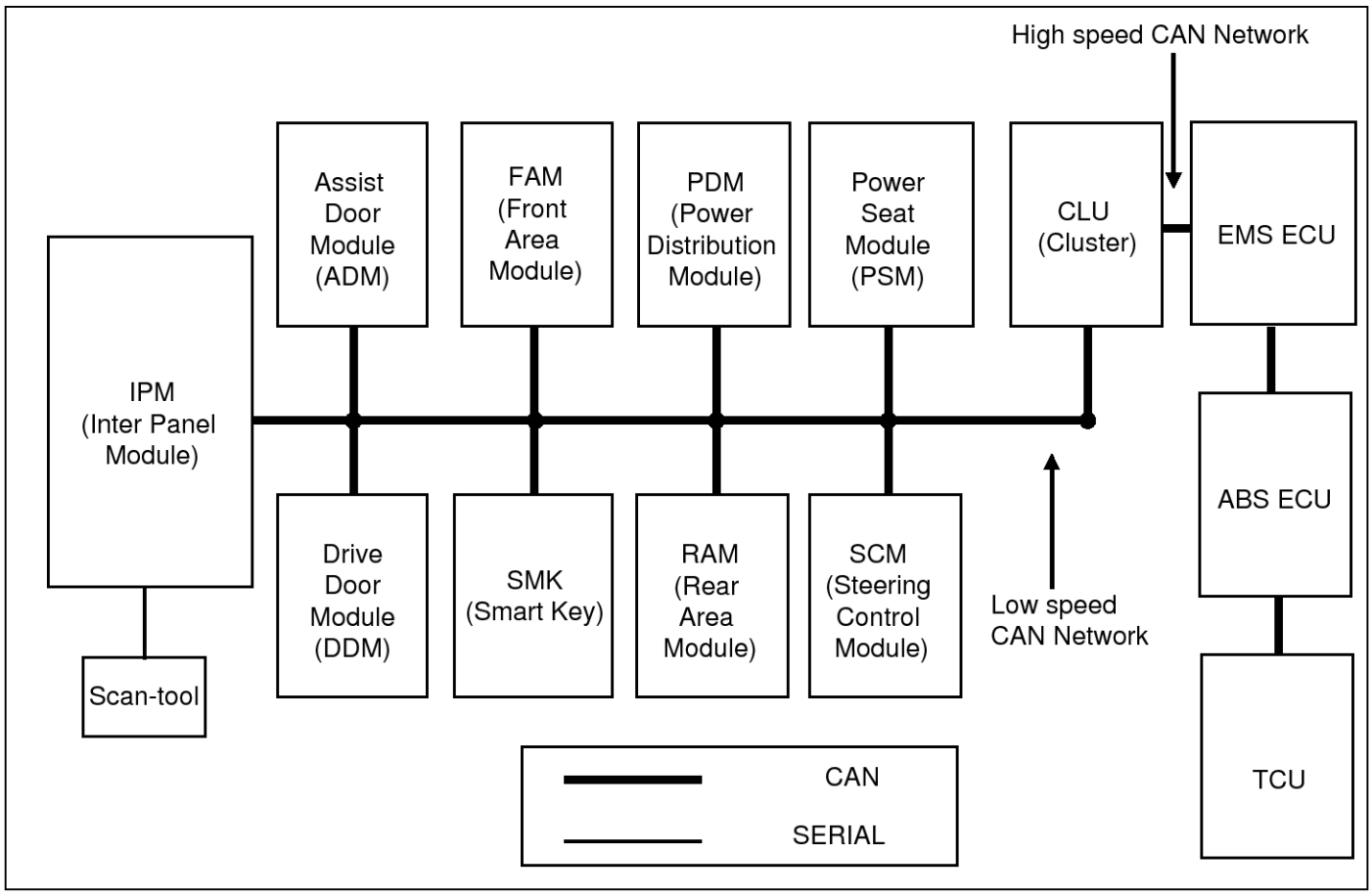
B2553 Right Head Lamp(Low Beam) Circuit Open

General Description

Once IPM receives right headlamp low switch working signal, it sends the signal to FAM by CAN communition. FAM turns on right headlamp low.



SHMBE9D00L

DTC Description

This code is set when right headlamp low circuit is open for more than 150ms during right headlamp low operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in right headlamp low circuit • Faulty right headlamp low • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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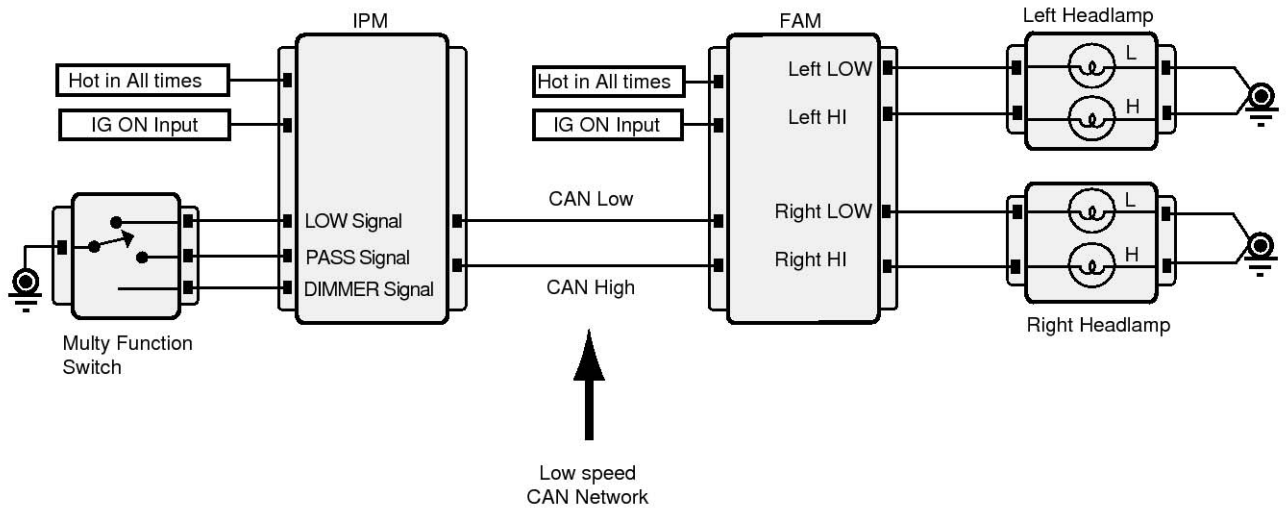
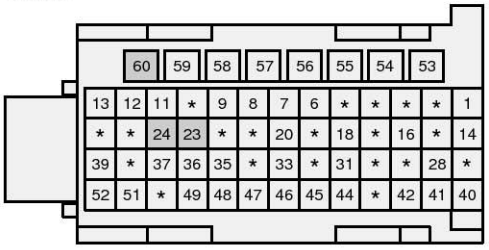


<Head Lamp RH>

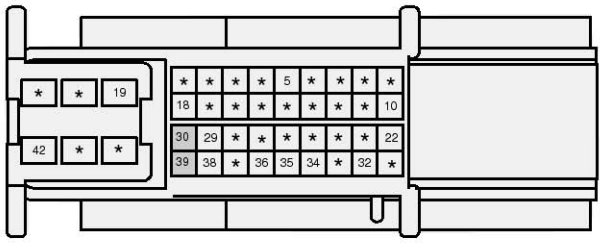
3. Right LOW
6. Ground

<FAM>



23. CAN LOW
24. CAN HIGH
60.Right LOW

<IPM>



30. Can High
39. Can Low

SHMBE9D57L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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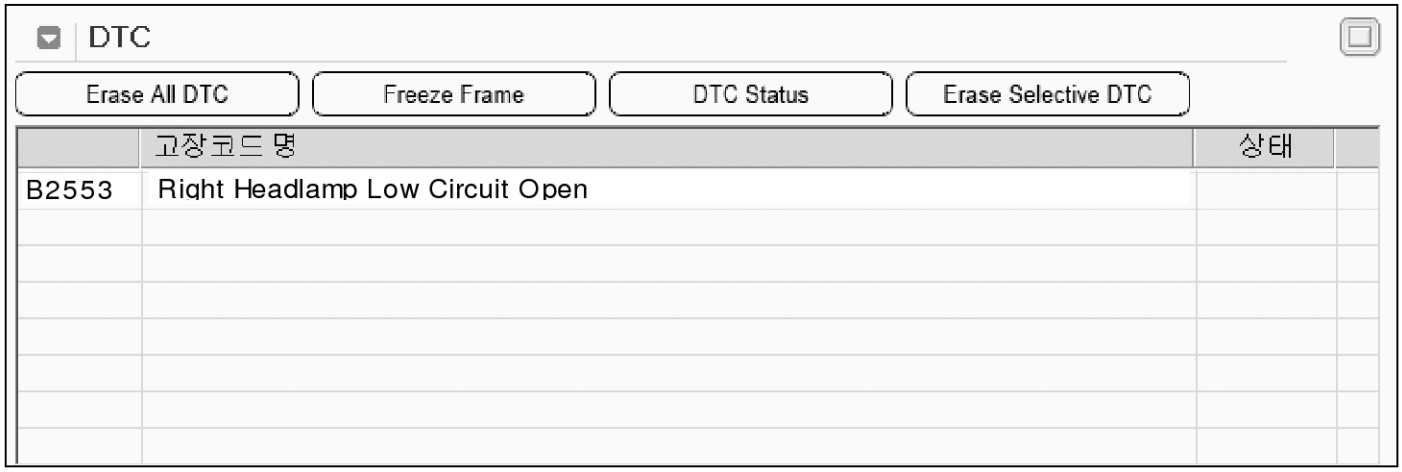

SHMBE9D25L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right headlamp low

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right headlamp low" test.

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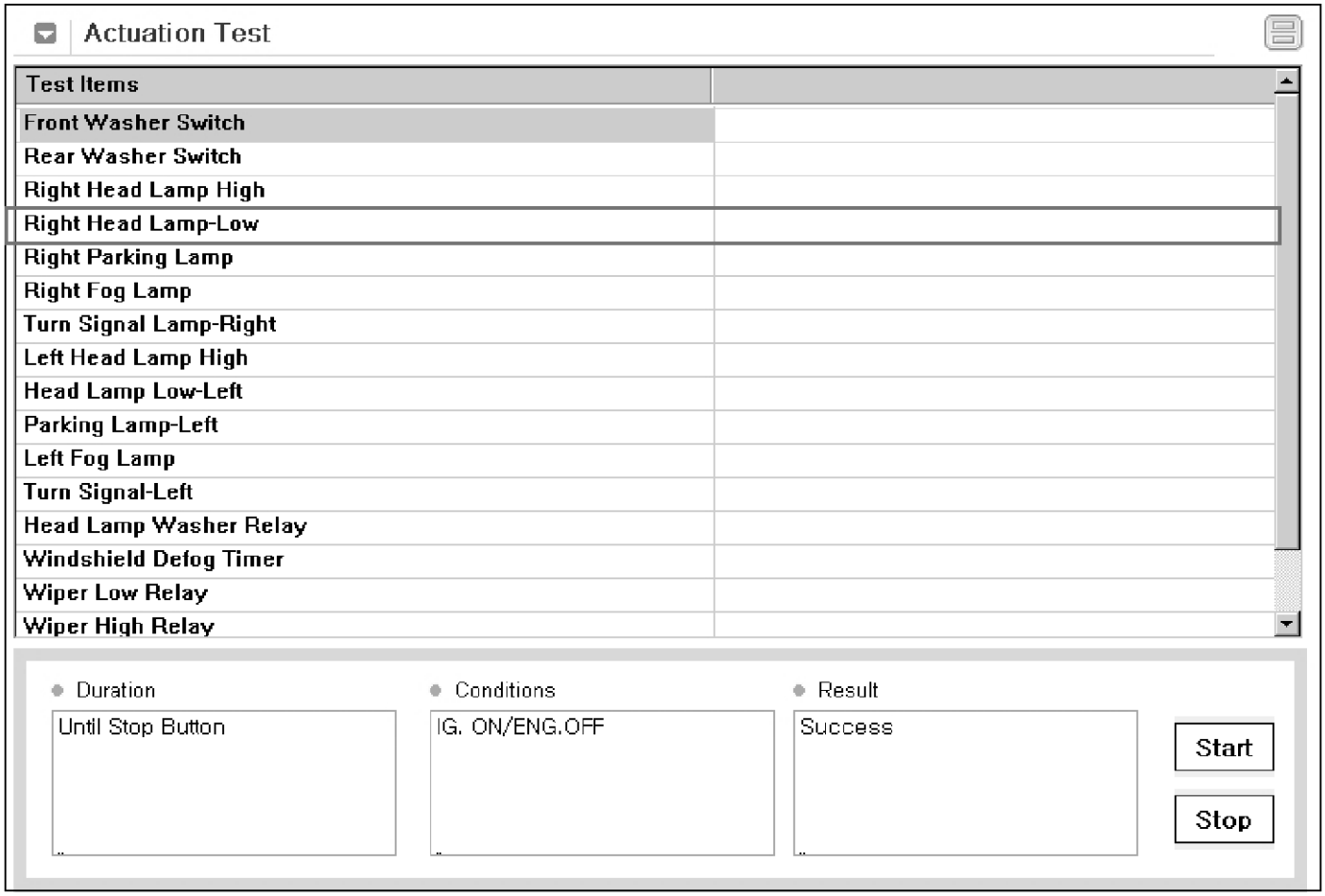

SHMBE9D26L

5. Is right headlamp high working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Headlamp Low Circuit Inspection" procedure.

Right Headlamp Low Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM connector..
3. Measure resistance between the Right Headlamp Low terminal of FAM harness connector and ground of the Right Headlamp Low

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair open in circuit of Right Headlamp Low or Right Headlamp Low internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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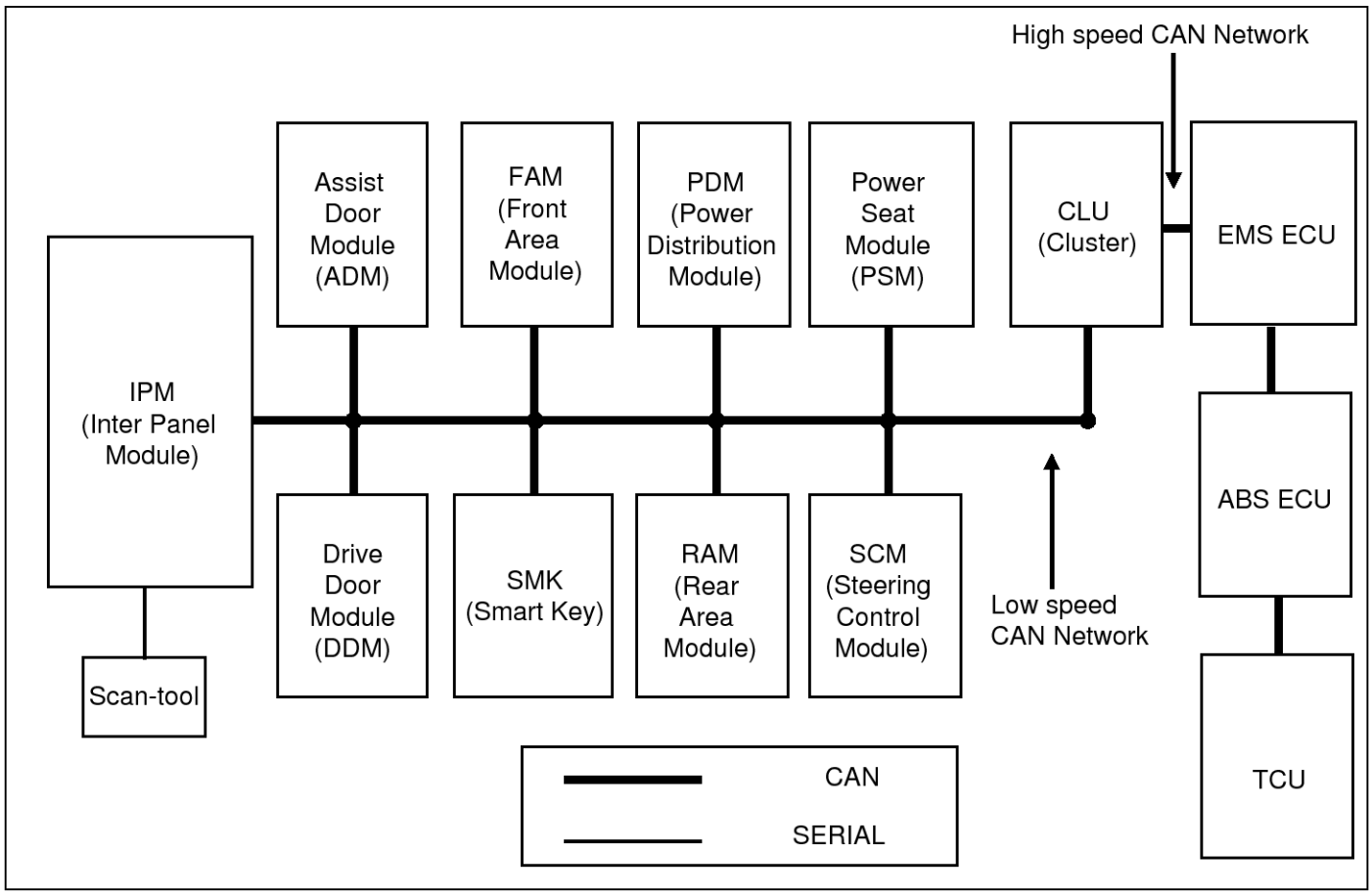
B2555 Left Headlamp(Low Beam) Short to Ground

General Description

Once IPM receives left headlamp low switch working signal, it sends the signal to FAM by CAN communition. FAM turns on left headlamp low.



SHMBE9D00L

DTC Description

This code is set when left headlamp low circuit is shotted to ground for more than 150ms during left headlamp low operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in left headlamp low circuit • Faulty left headlamp low • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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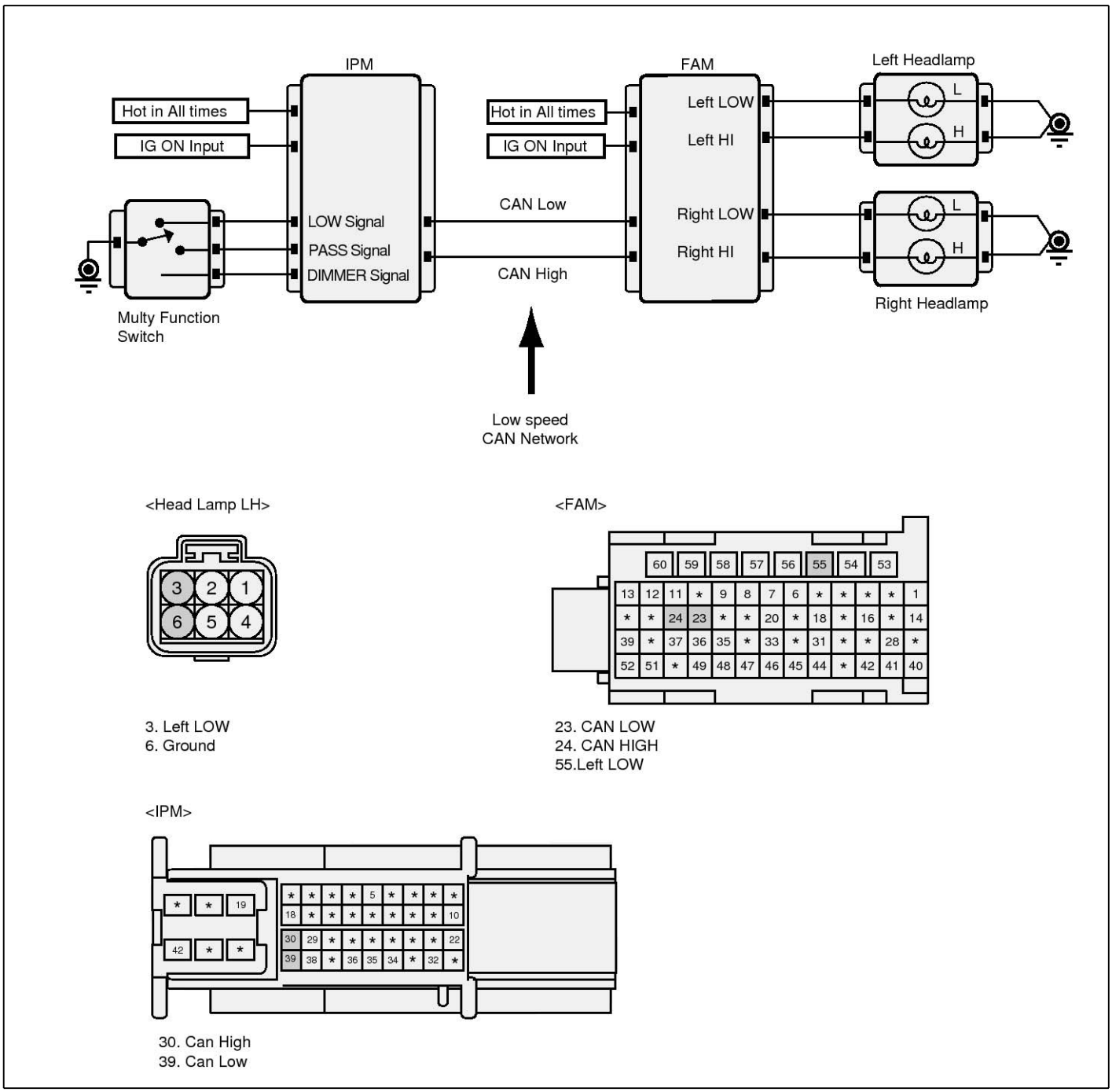

SHMBE9D58L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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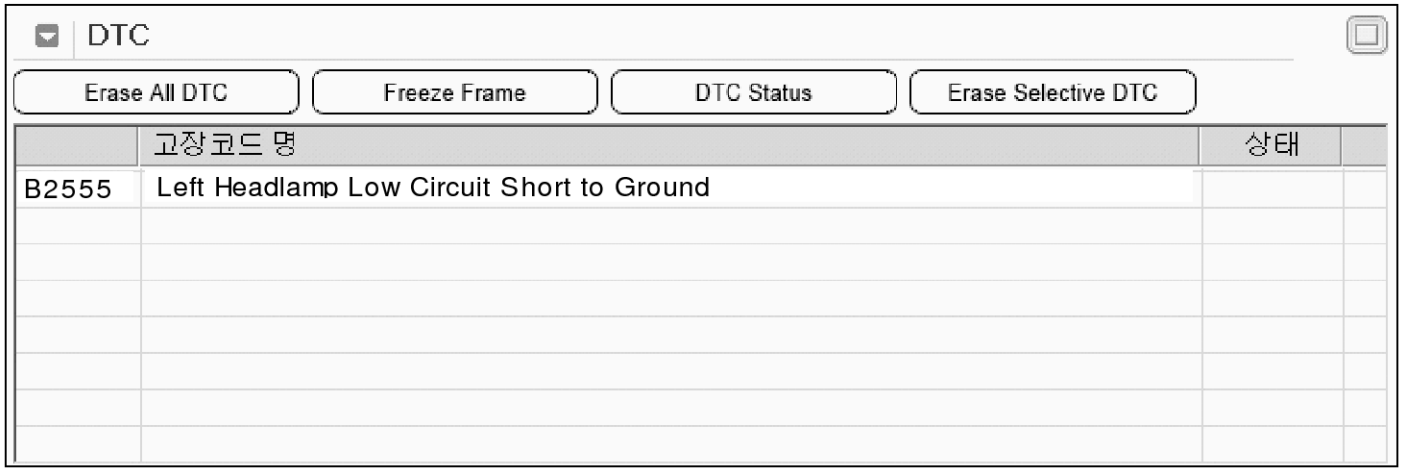

SHMBE9D33L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left headlamp low

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "left headlamp low" test.

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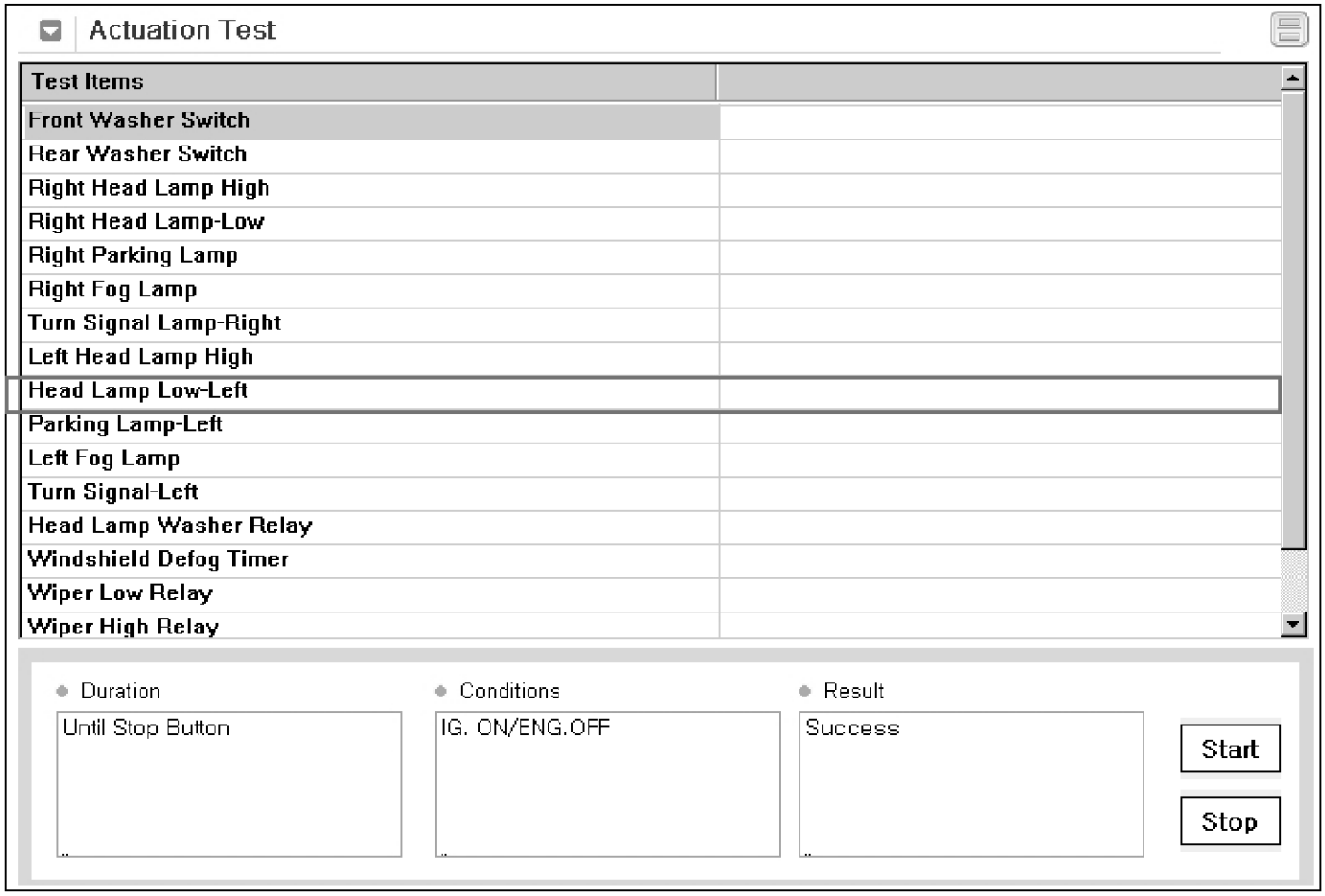

SHMBE9D28L

5. Is left headlamp low working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Headlamp High Circuit Inspection" procedure.

Left Headlamp High Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM, Left Headlamp High connector.
3. Measure resistance between the Left Headlamp High terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Left Headlamp Low, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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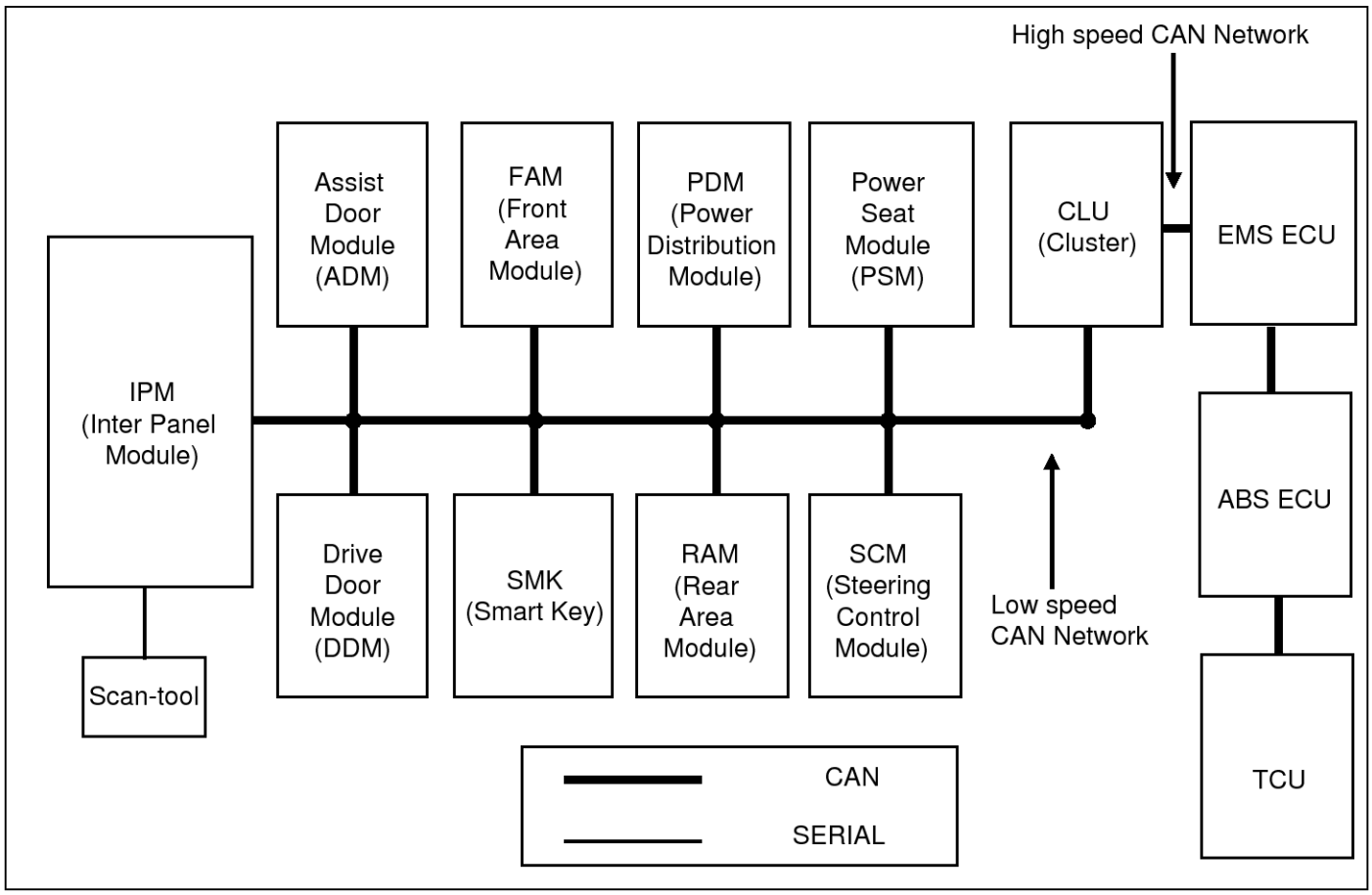
B2557 Left Headlamp(Low Beam) Open

General Description

Once IPM receives left headlamp low switch working signal, it sends the signal to FAM by CAN communition. FAM turns on left headlamp low.



SHMBE9D00L

DTC Description

This code is set when left headlamp low circuit is open for more than 150ms during left headlamp low operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in left headlamp low circuit • Faulty left headlamp low • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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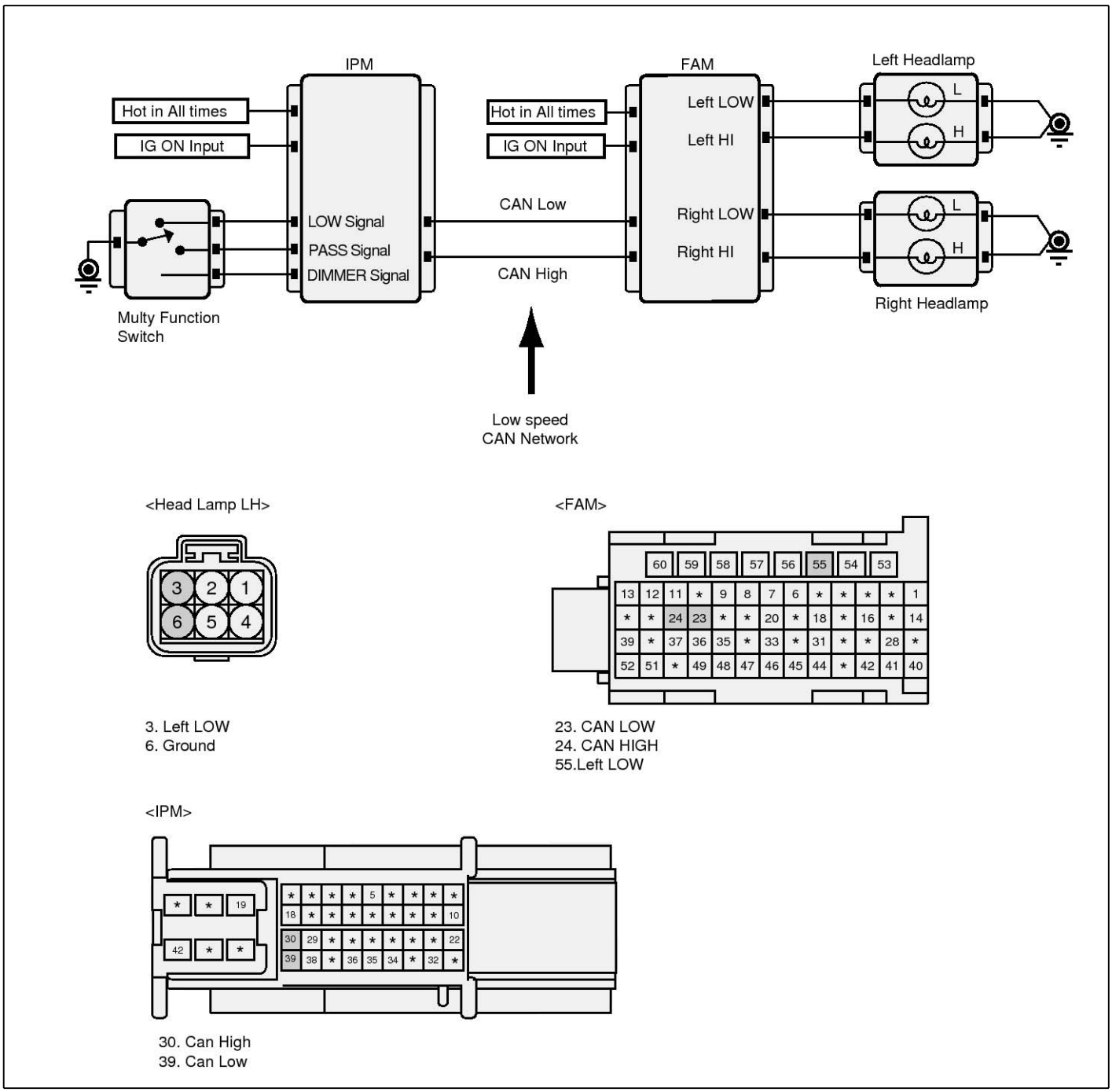

SHMBE9D58L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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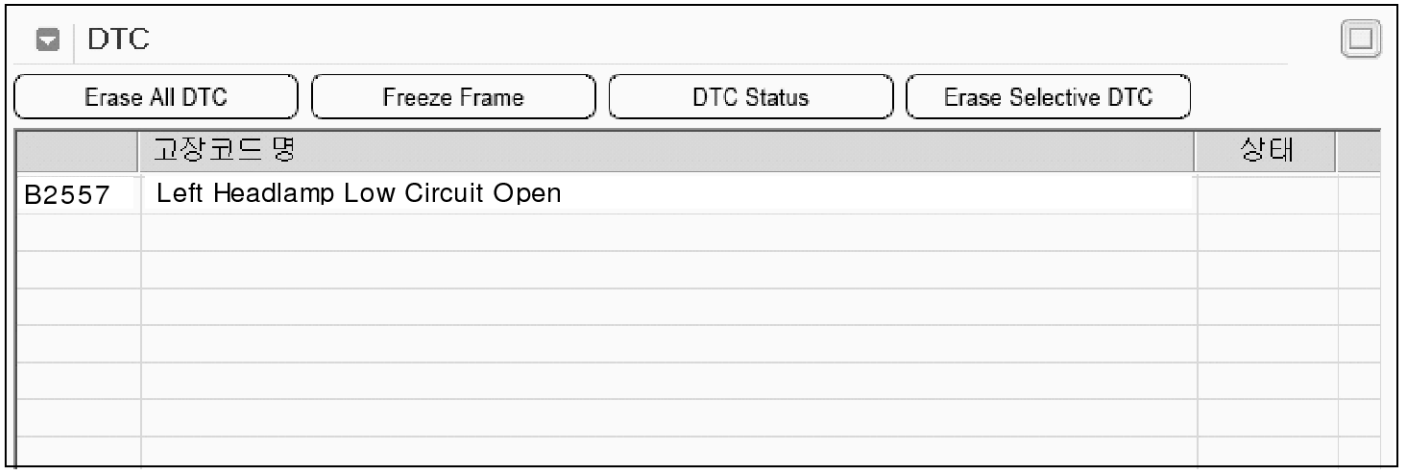

SHMBE9D27L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left headlamp low

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "left headlamp low" test.

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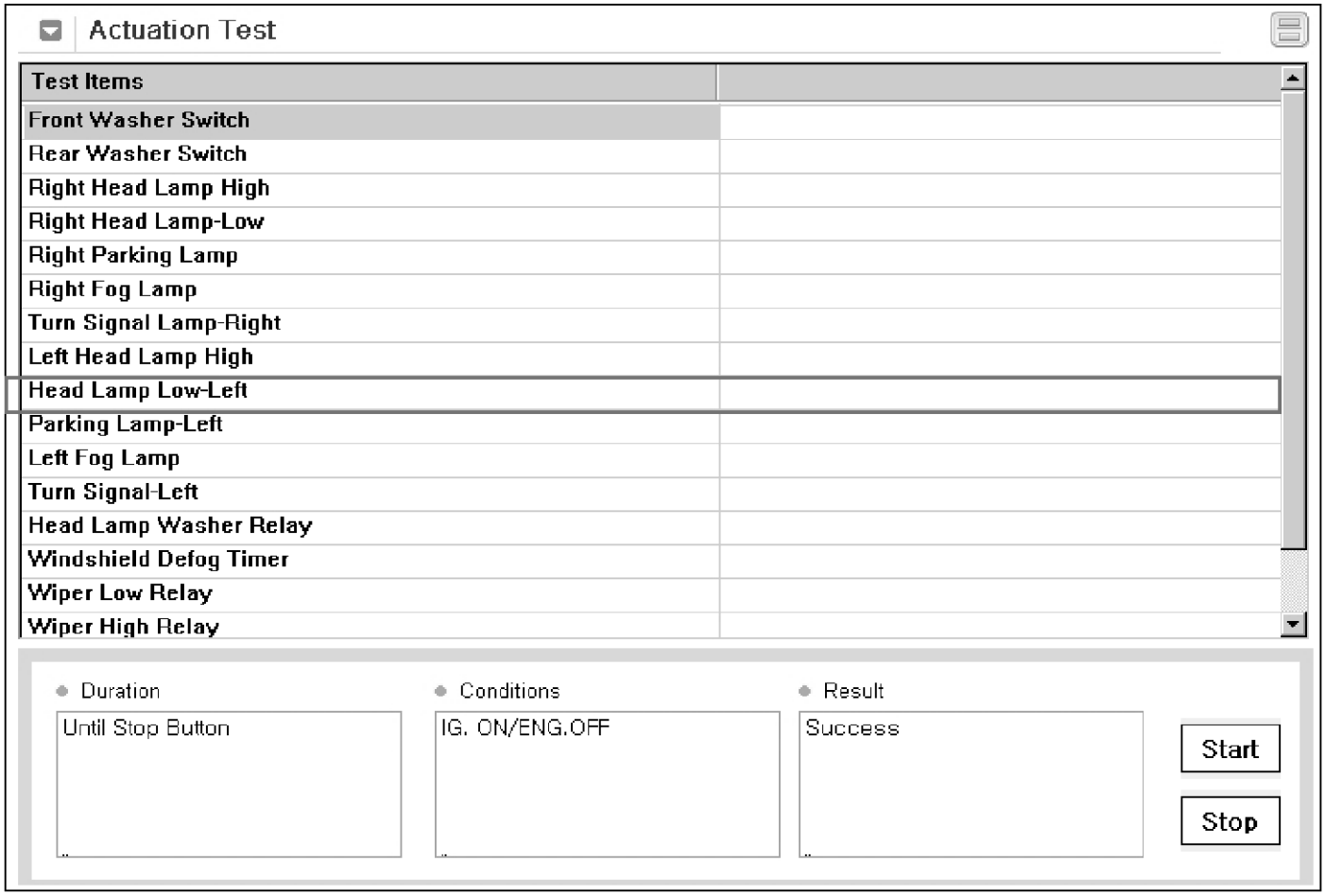

SHMBE9D28L

5. Is left headlamp low working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Headlamp Low Circuit Inspection " procedure.

Left Headlamp Low Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM connector.
3. Measure resistance between the Left Headlamp Low terminal of FAM harness connector and ground of the Left Headlamp Low.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair open in circuit of Left Headlamp Low or Left Headlamp Low internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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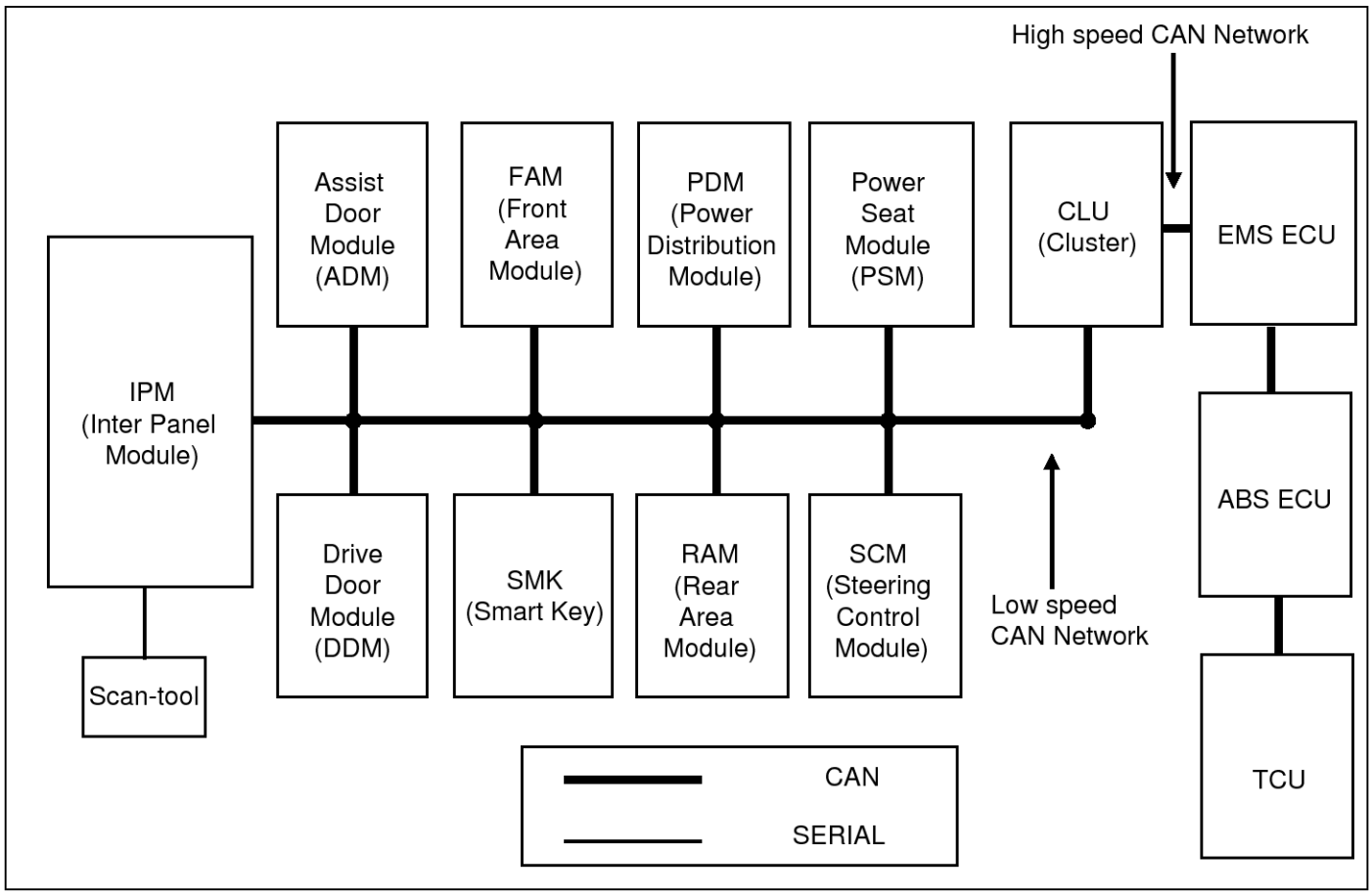
B2559 Right Front Fog Lamp Short to Ground

General Description

Once IPM receives fog lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on fog lamp.



SHMBE9D00L

DTC Description

This code is set when right front fog lamp circuit is shortted to ground for more than 150ms during right front fog lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in right front fo-g lamp circuit • Faulty right front fog lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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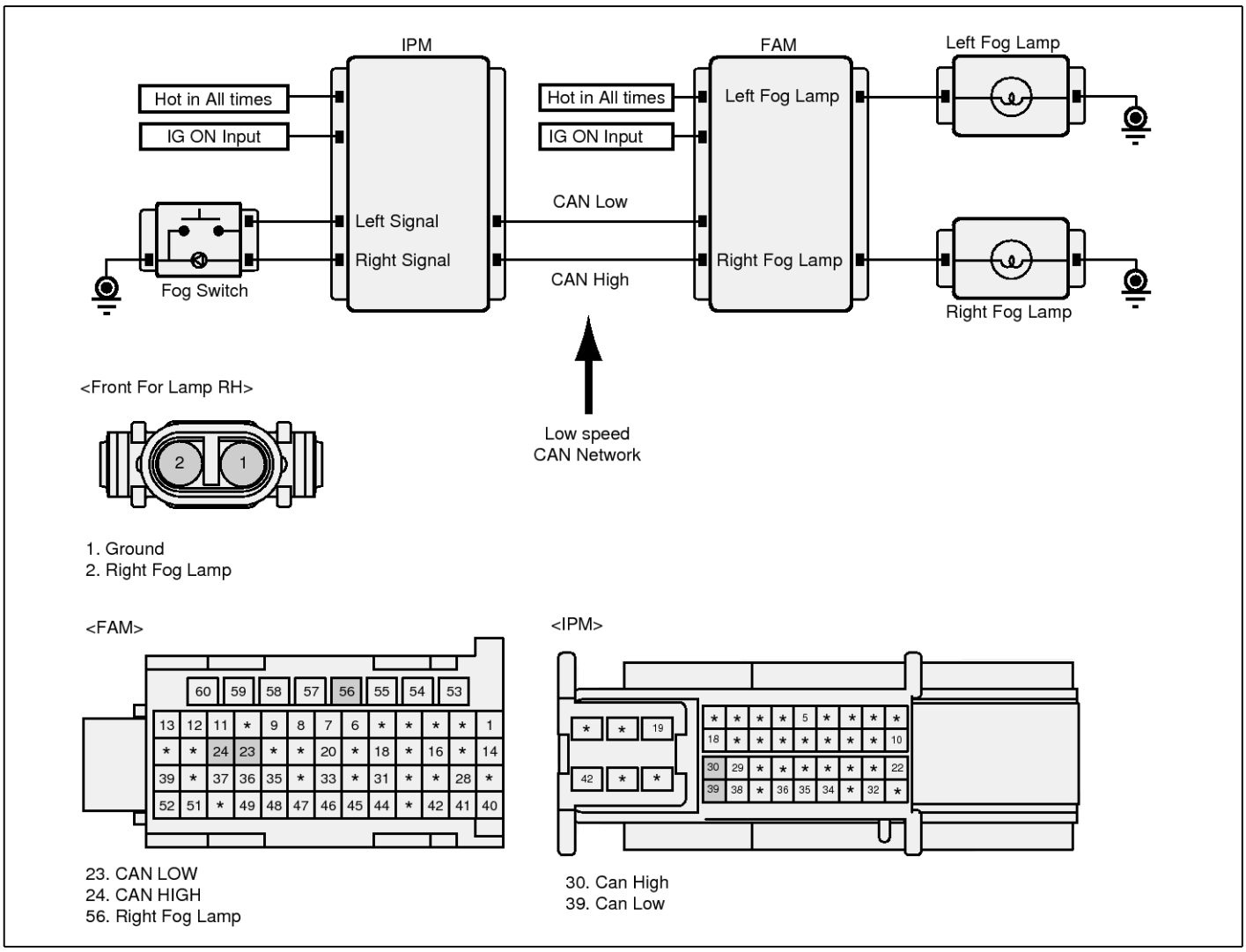

SHMBE9D52L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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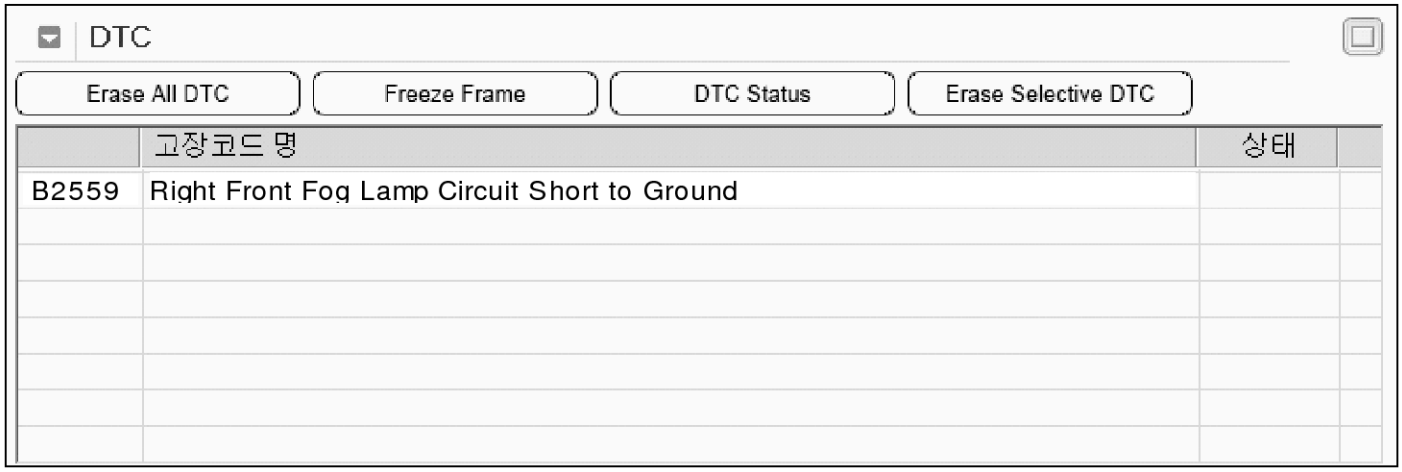

SHMBE9D13L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Right Fog Lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "Right Fog Lamp" test.

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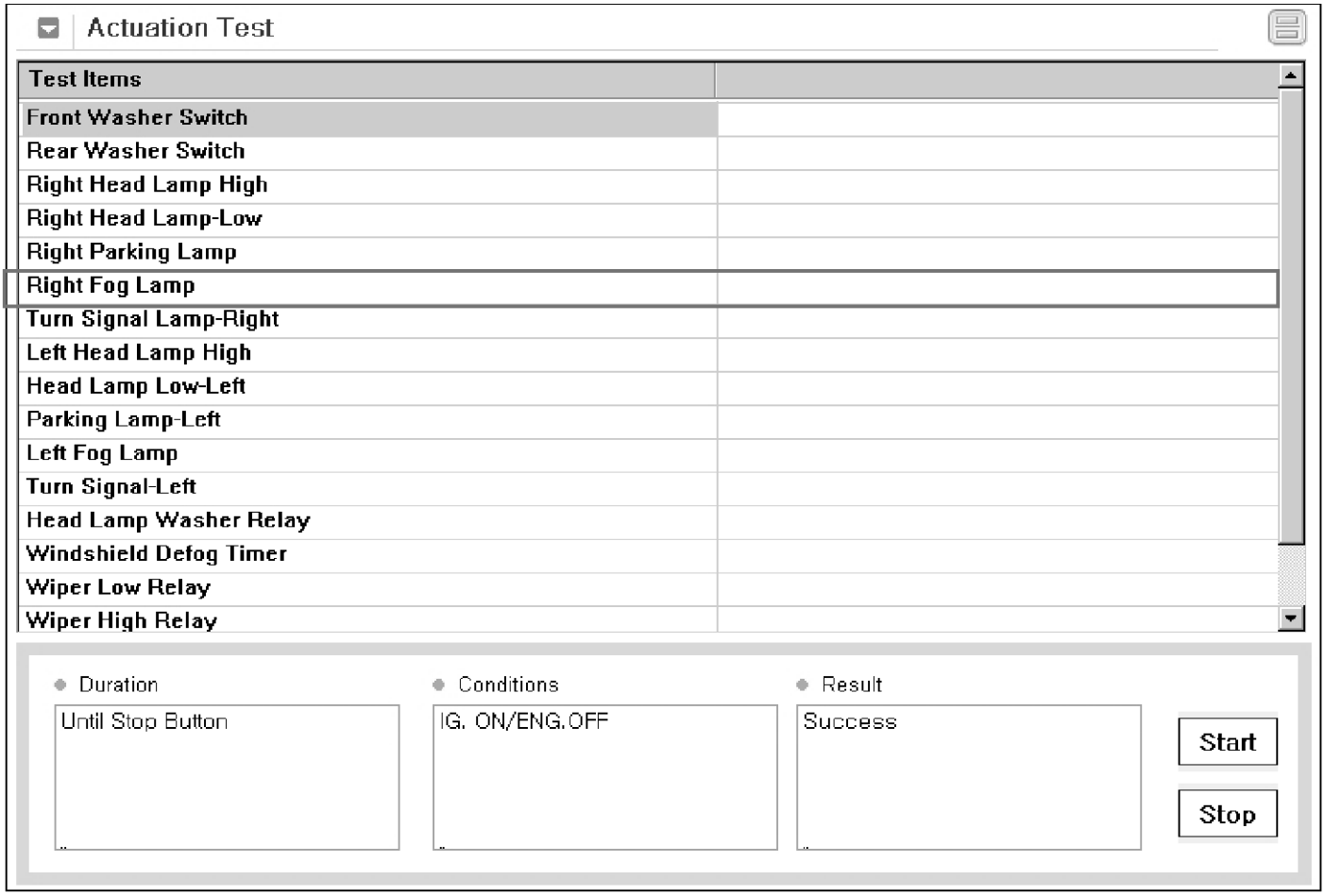

SHMBE9D14L

5. Is Right Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Fog Lamp Circuit Inspection" procedure.

Right Fog Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal..
2. Disconnect FAM, Right Fog Lamp connector.
3. Measure resistance between the Right Fog Lamp terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Right Fog Lamp, and go to "Verification of Vehicle Repair " procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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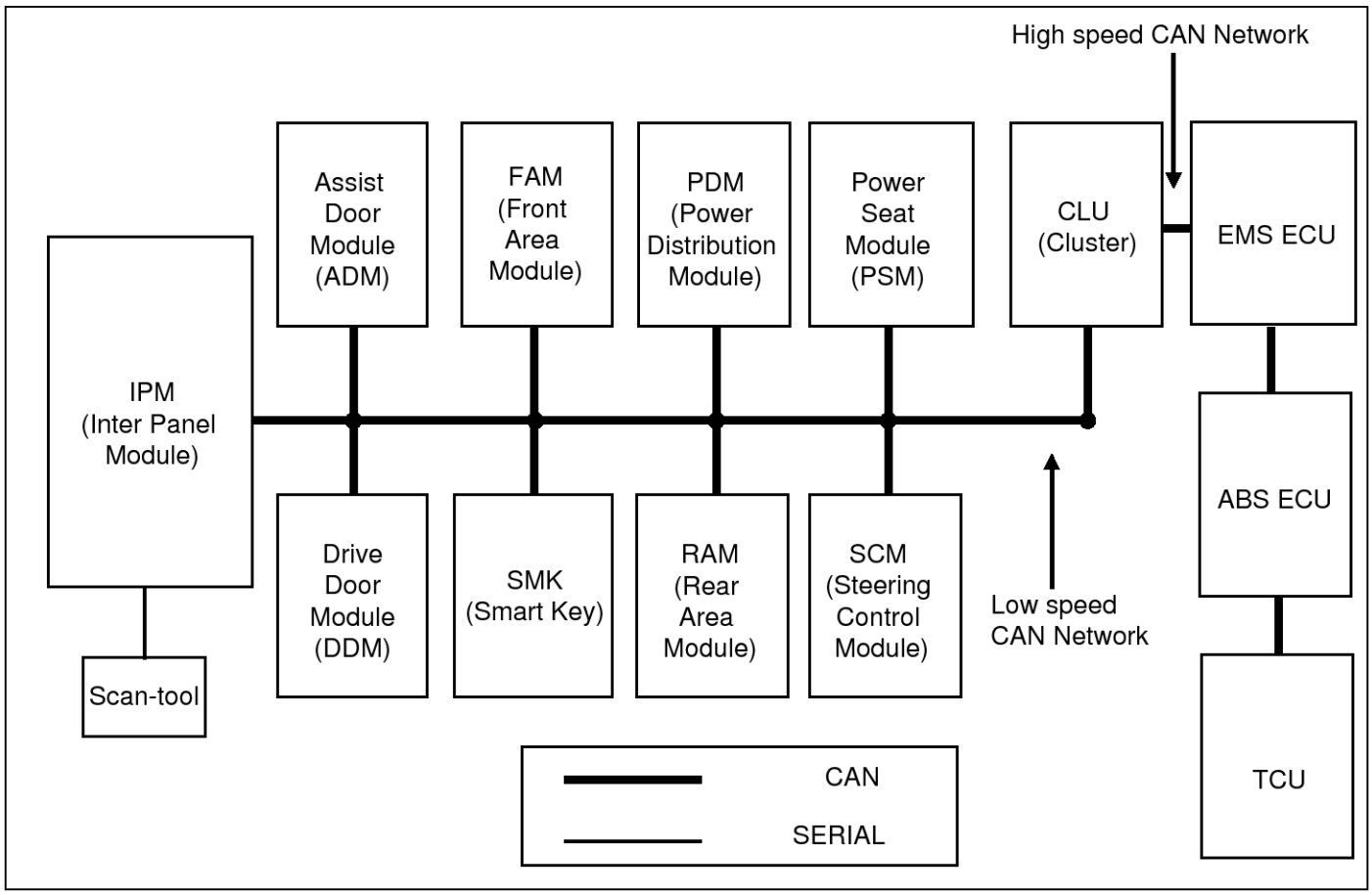
B2561 Right Front Fog Lamp Open

General Description

Once IPM receives fog lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on fog lamp.



SHMBE9D00L

DTC Description

This code is set when right fog lamp circuit is open for more than 150ms during right fog lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in right fog lamp circuit • Faulty right fog lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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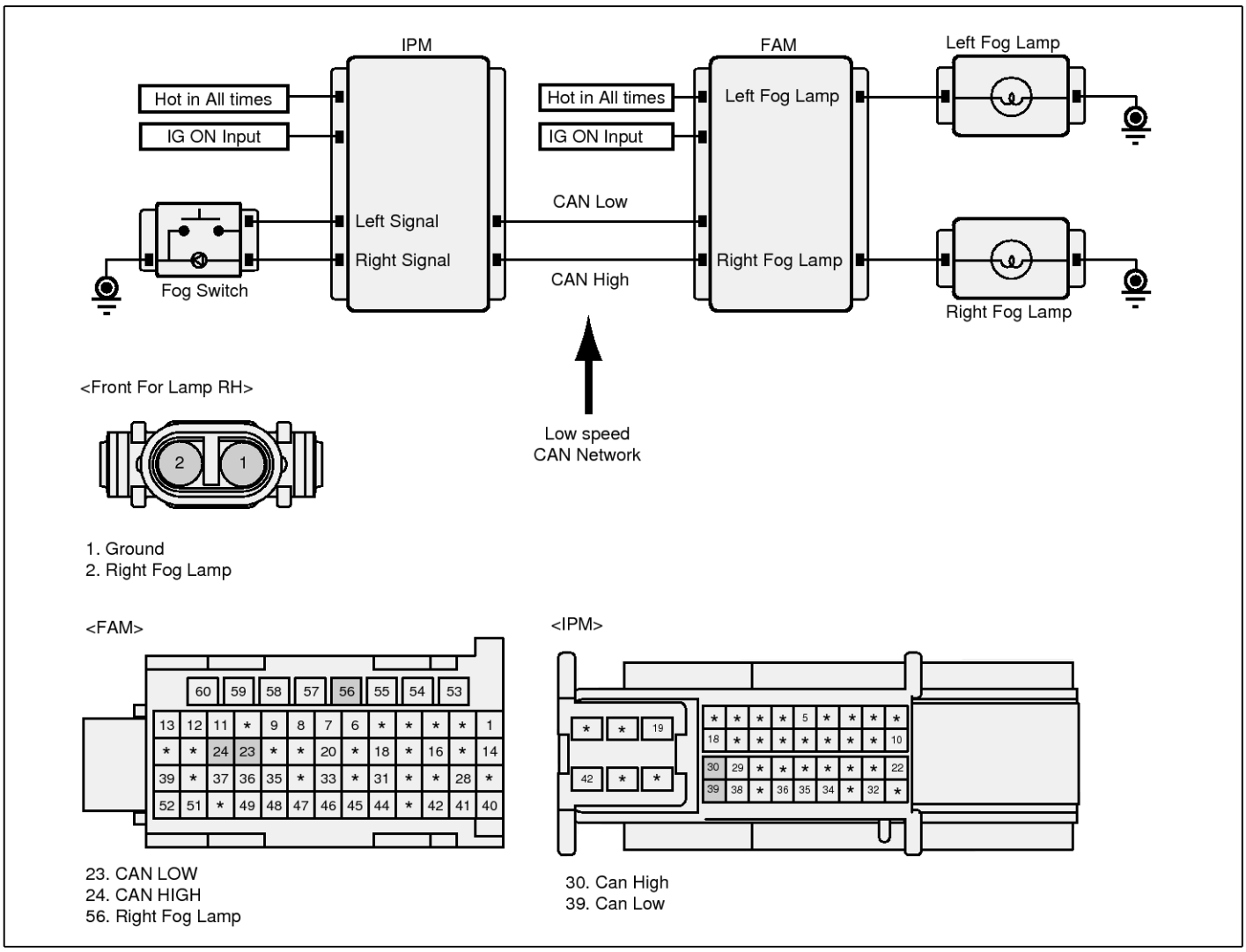

SHMBE9D52L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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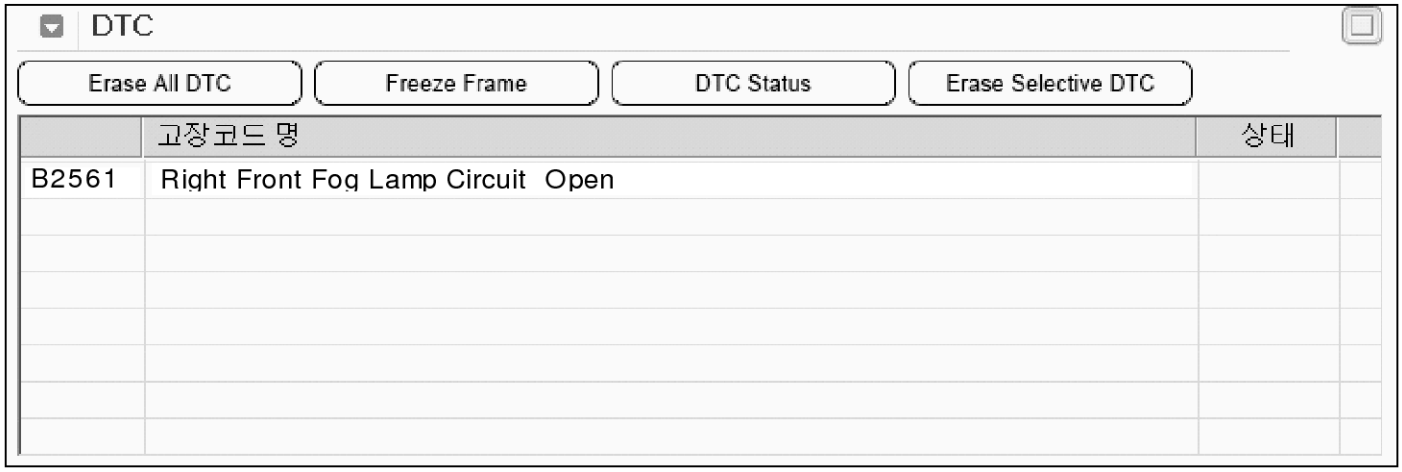

SHMBE9D05L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right fog lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right fog lamp" test.

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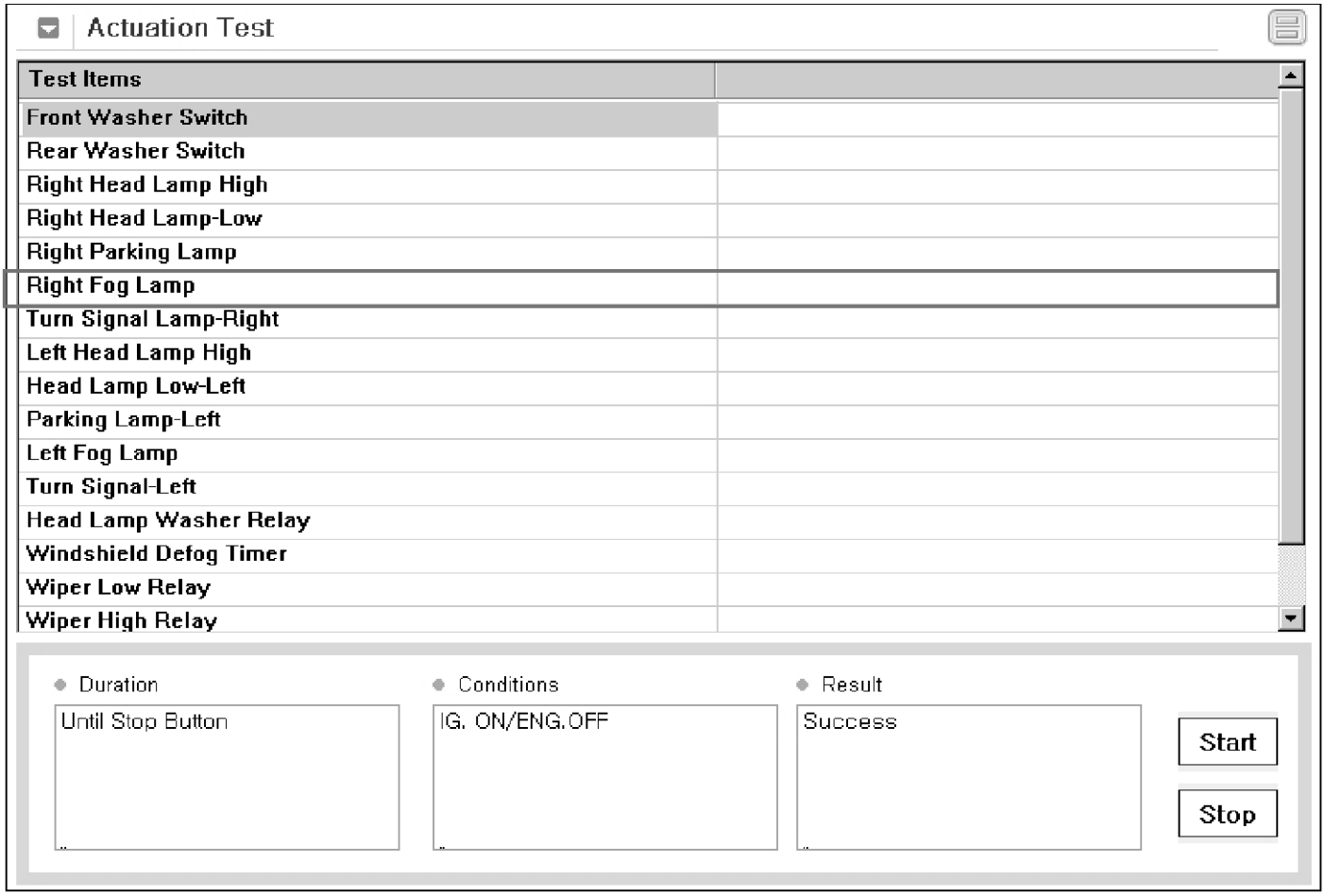

SHMBE9D14L

5. Is Right Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Fog Lamp Circuit Inspection" procedure.

Right Fog Lamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal..
2. Disconnect FAM connector.
3. Measure resistance between the Right Fog Lamp terminal of FAM harness connector and ground of the Right Fog Lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair open in circuit of Right Fog Lamp or Right Fog Lamp internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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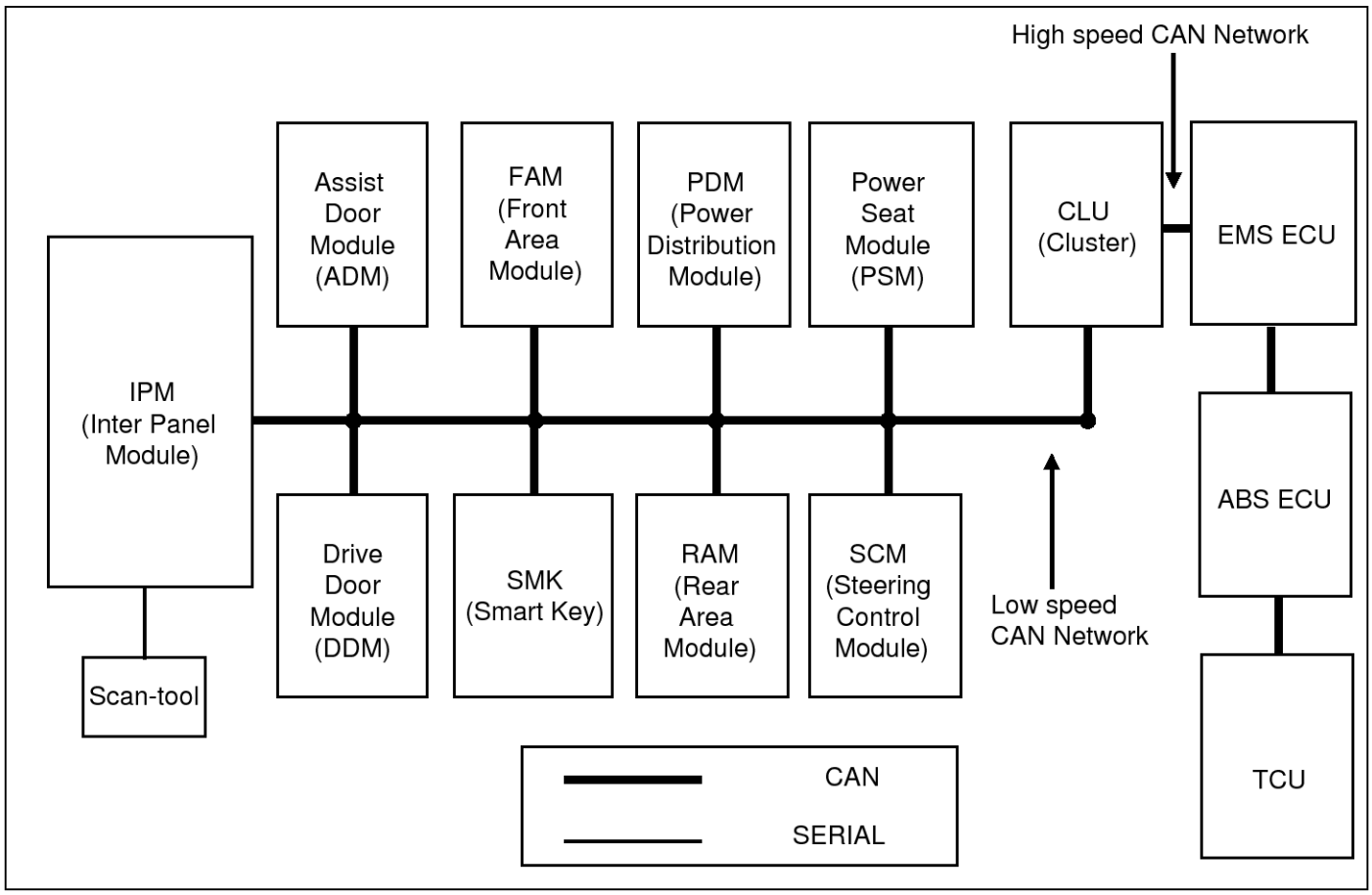
B2563 Left Front Fog Lamp Circuit Short to Ground

General Description

Once IPM receives fog lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on fog lamp.



SHMBE9D00L

DTC Description

This code is set when left front fog lamp circuit is shortted to ground for more than 150ms during left front fog lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in left front fog lamp circuit • Faulty left front fog lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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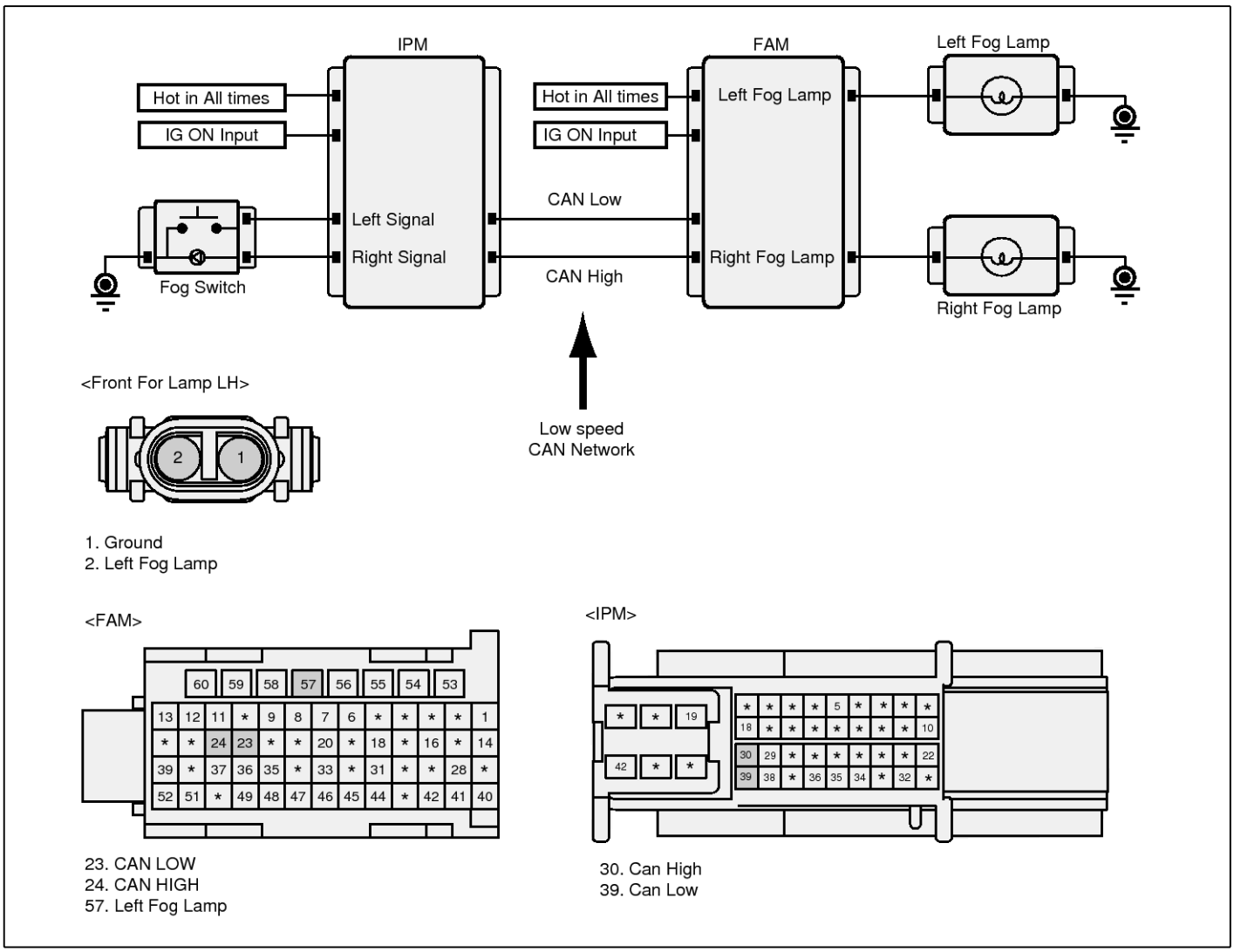

SHMBE9D51L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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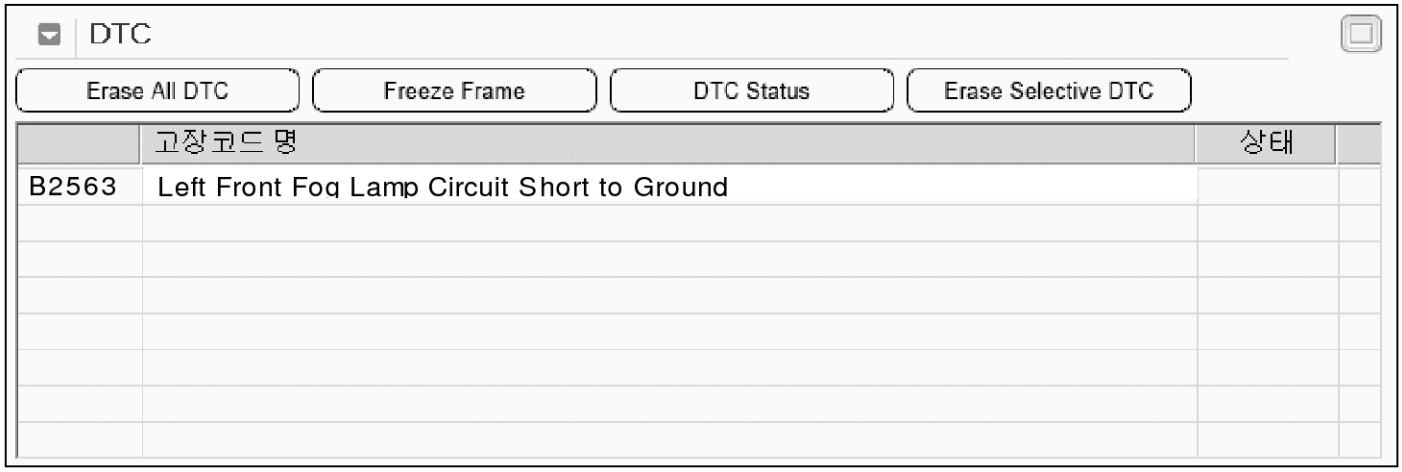

SHMBE9D15L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Left Fog Lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "Left Fog Lamp" test

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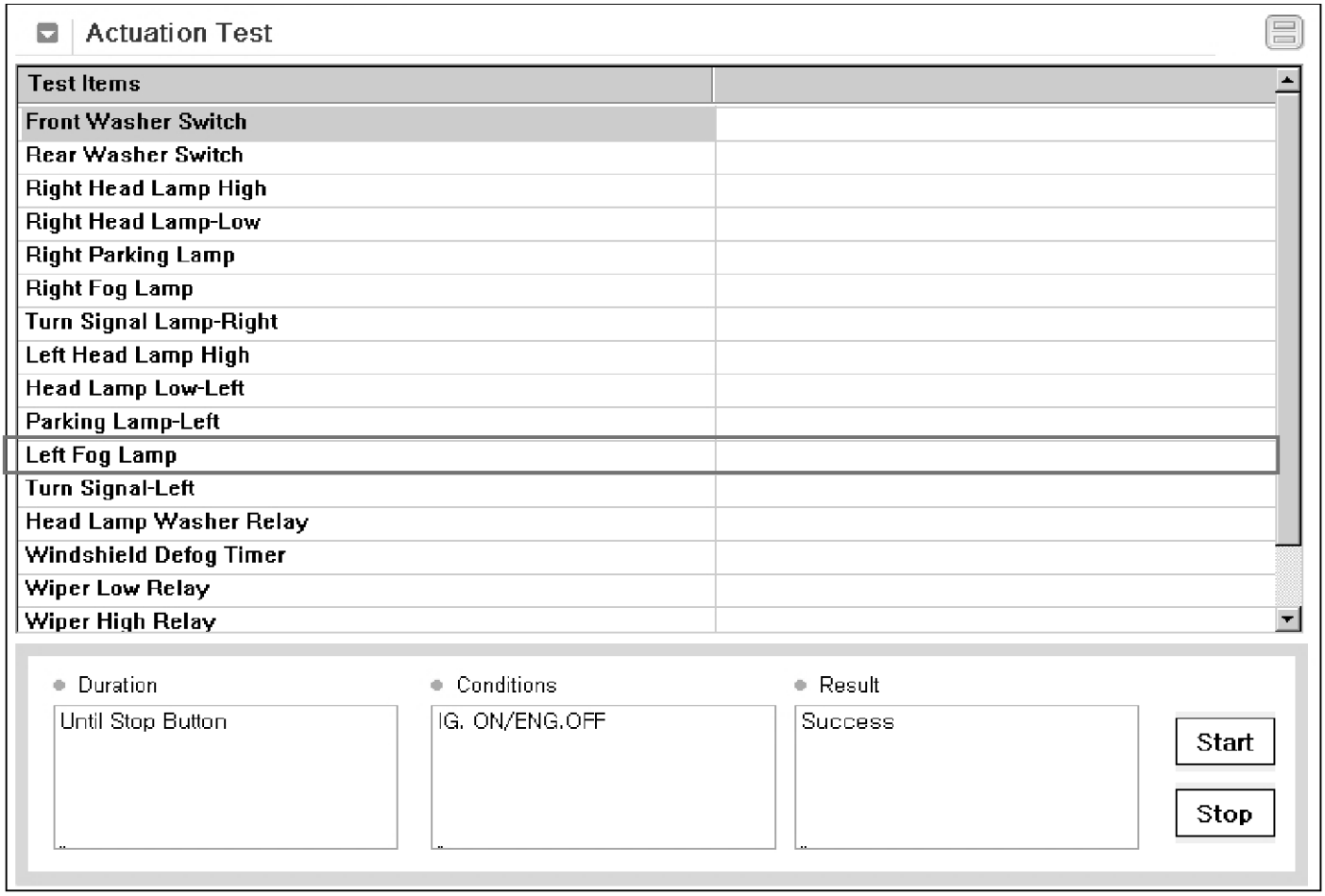

SHMBE9D16L

5. Is Left Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Fog Lamp Circuit Inspection" procedure.

Left Fog Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM, Left Fog Lamp connector.
3. Measure resistance between the Left Fog Lamp terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Left Fog Lamp, and go to "Verification of Vehicle Repair " procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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B2565 Left Front Fog Lamp Open

General Description

Once IPM receives fog lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on fog lamp.

SHMBE9D00L

DTC Description

This code is set when left fog lamp circuit is open for more than 150ms during left fog lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in left fog lamp circuit • Faulty left fog lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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SHMBE9D51L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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SHMBE9D03L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left fog lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "left fog lamp" test.

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SHMBE9D04L

5. Is left headlamp low working normal ?

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   ▶ Go to "Left Fog Lamp Circuit Inspection" procedure.

Left Fog Lamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM connector.
3. Measure resistance between the Left Fog Lamp terminal of FAM harness connector and ground of the Left Fog Lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

   ▶ Substitute with a known - good FAM and check for proper operation.
   If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

   ▶ Repair open in circuit of Left Fog Lamp or Left Fog Lamp internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

   ▶ Go to the applicable troubleshooting procedure.

   ▶ System performing to specification at this time.

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B2571 Right Park Lamp Short to Ground

General Description

Once IPM receives parking lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on parking lamp.

SHMBE9D00L

DTC Description

This code is set when right parking lamp circuit is shortted to ground for more than 150ms during right parking lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in right parking lamp circuit • Faulty right parking lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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SHMBE9D53L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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SHMBE9D17L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Right Parking Lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "Right Parking Lamp" test.

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SHMBE9D18L

5. Is Right Parking Lamp working normal ?

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   ▶ Go to "Right Parking Lamp Circuit Inspection" procedure.

Right Parking Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal..
2. Disconnect FAM, Right Parking Lamp connector..
3. Measure resistance between the Right Parking Lamp terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

   ▶ Substitute with a known - good FAM and check for proper operation.
   If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

   ▶ Repair short to ground in circuit of Right Parking Lamp, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

   ▶ Go to the applicable troubleshooting procedure.

   ▶ System performing to specification at this time.

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B2573 Right Park Lamp Open

General Description

Once IPM receives parking lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on parking lamp.

SHMBE9D00L

DTC Description

This code is set when right parking lamp circuit is open for more than 150ms during right parking lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in right parking lamp circuit • Faulty right parking lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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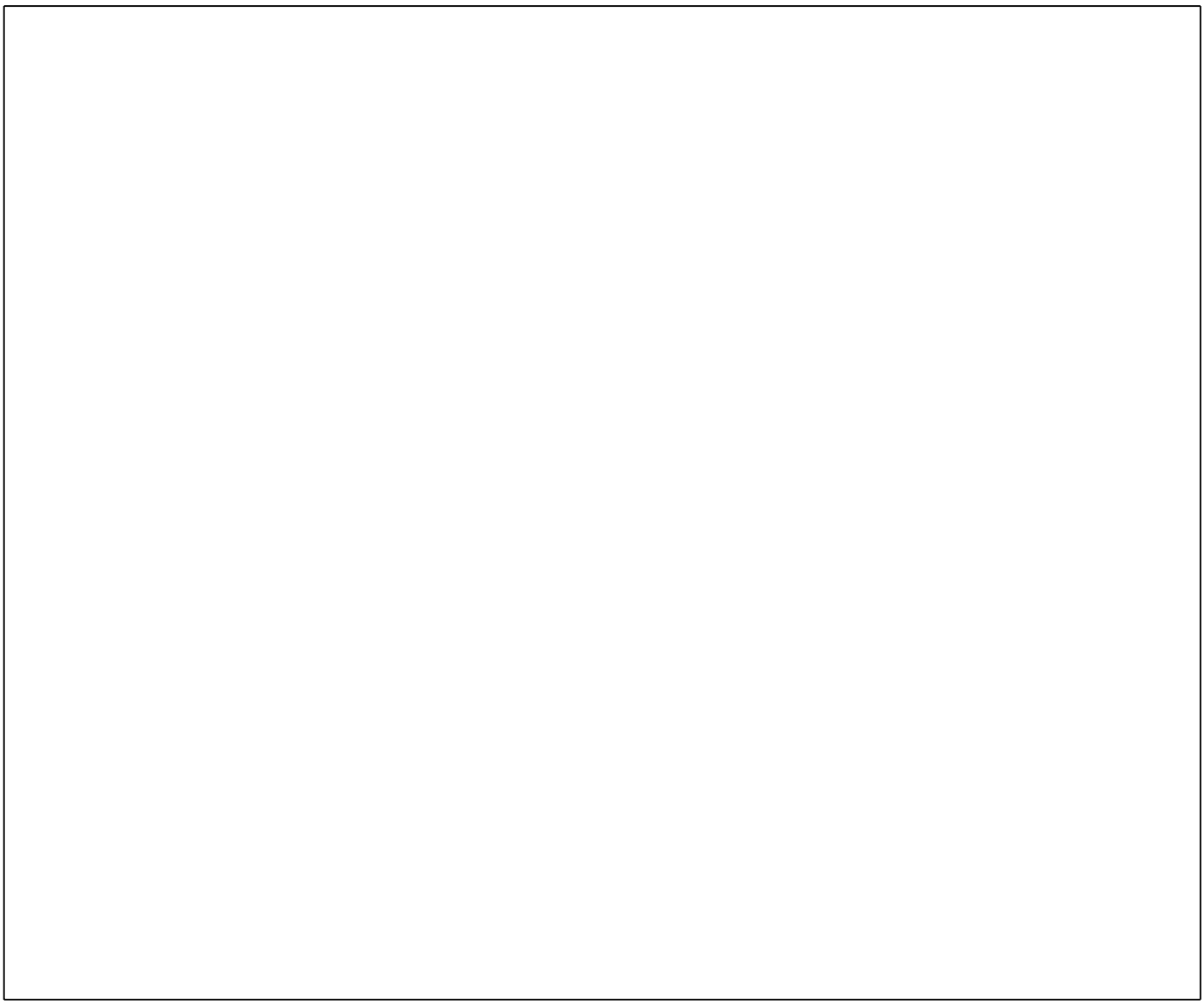

SHMBE9D53L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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SHMBE9D07L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check right parking lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Execute "right parking lamp" test.

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SHMBE9D18L

5. Is right parking lamp working normal ?

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   ▶ Go to "Right Parking Lamp Circuit Inspection" procedure.

Right Parking Lamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal..
2. Disconnect FAM connector.
3. Measure resistance between the Right Parking Lamp terminal of FAM harness connector and ground of the Right Parking Lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

   ▶ Substitute with a known - good FAM and check for proper operation.
   If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

   ▶ Repair open in circuit of Right Parking Lamp or Right Parking Lamp internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

   ▶ Go to the applicable troubleshooting procedure.

   ▶ System performing to specification at this time.

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B2575 Left Park Lamp Short to Ground

General Description

Once IPM receives parking lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on parking lamp.

SHMBE9D00L

DTC Description

This code is set when left parking lamp circuit is shortted to ground for more than 150ms during left parking lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in left parking l-amp circuit • Faulty left parking lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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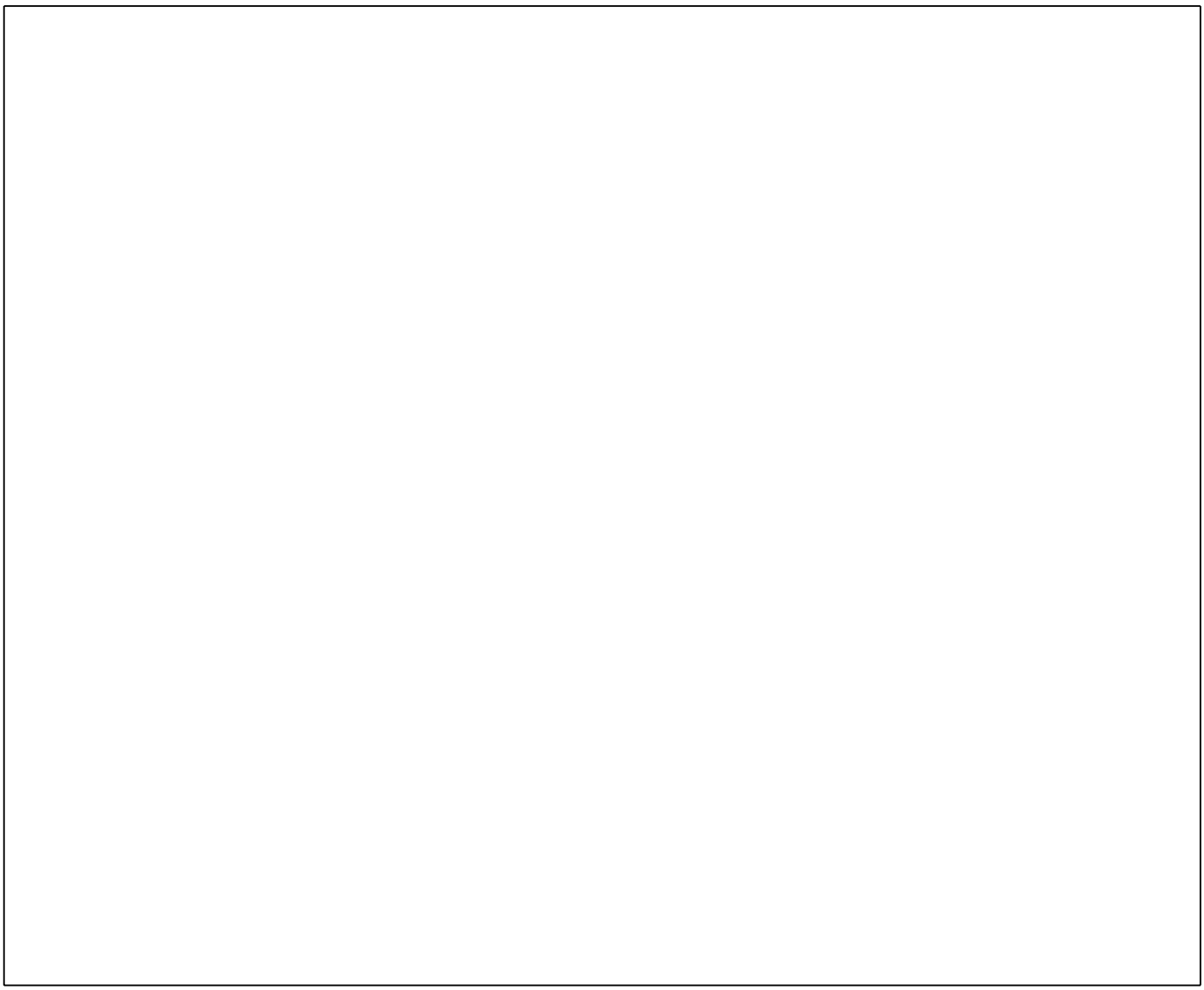

SHMBE9D54L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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SHMBE9D19L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left parking lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "left parking lamp" test.

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SHMBE9D20L

5. Is Left Parking Lamp working normal ?

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   ▶ Go to "Left Parking Lamp Circuit Inspection" procedure.

Left Parking Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM, Left Parking Lamp connector.
3. Measure resistance between the Left Parking Lamp terminal of FAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

   ▶ Substitute with a known - good FAM and check for proper operation.
   If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

   ▶ Repair short to ground in circuit of Left Parking Lamp, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

   ▶ Go to the applicable troubleshooting procedure.

   ▶ System performing to specification at this time.

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B2577 Left Park Lamp Open

General Description

Once IPM receives parking lamp switch working signal, it sends the signal to FAM by CAN communition. FAM turns on parking lamp.

SHMBE9D00L

DTC Description

This code is set when left parking lamp circuit is open for more than 150ms during left parking lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in left parking lamp circuit • Faulty left parking lamp • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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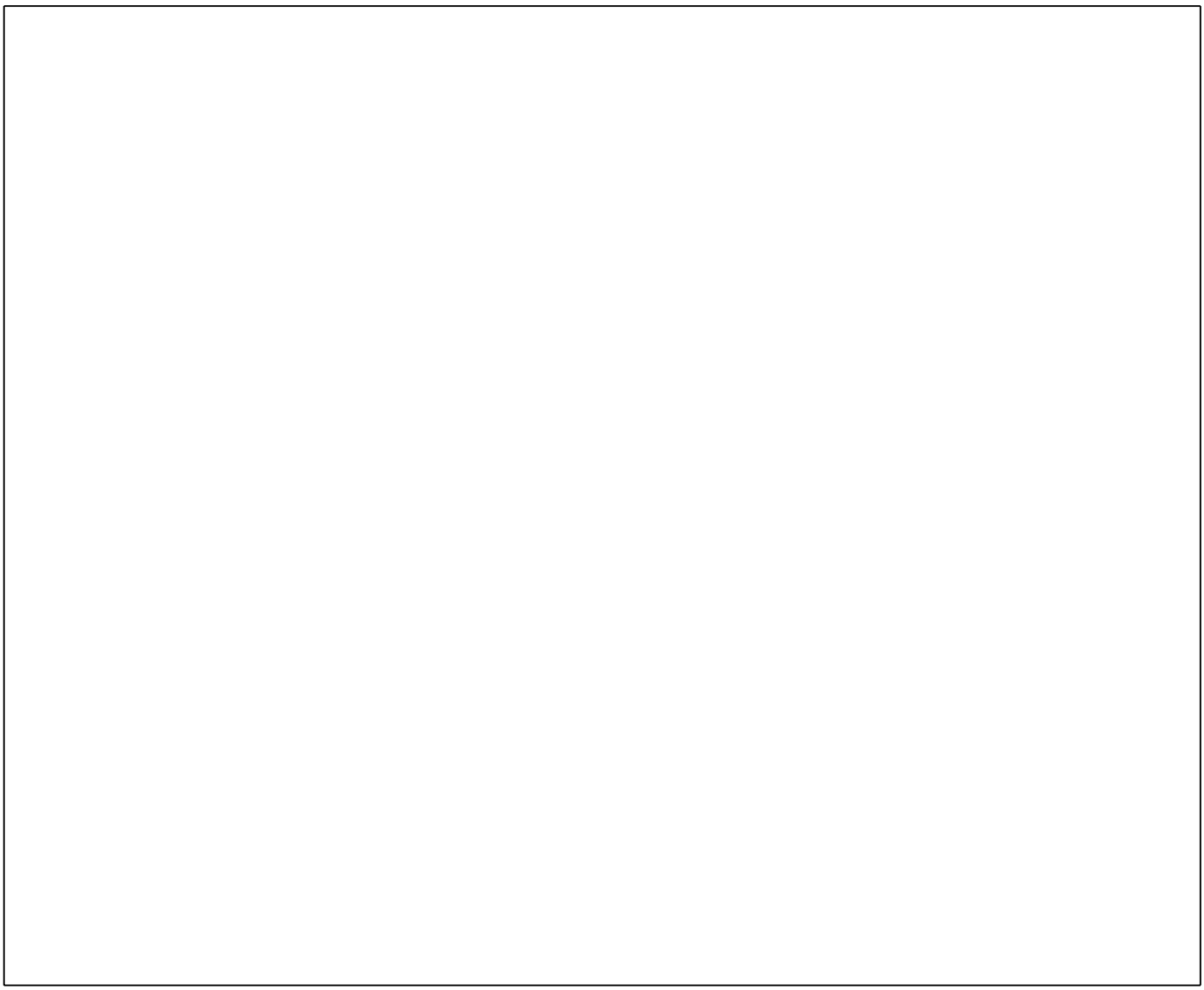

SHMBE9D54L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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SHMBE9D09L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or FAM's connector or was repaired and FAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check left parking lamp

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "left parking lamp" test.

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SHMBE9D20L

5. Is left parking lamp working normal ?

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

   ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   ▶ Go to "Left Parking Lamp Circuit Inspection" procedure.

Left Parking Lamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect FAM connector.
3. Measure resistance between the Left Parking Lamp terminal of FAM harness connector and ground of the Left Parking Lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

   ▶ Substitute with a known - good FAM and check for proper operation.
   If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure..

   ▶ Repair open in circuit of Left Parking Lamp or Left Parking Lamp internal open, and go to " Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

   ▶ Go to the applicable troubleshooting procedure.

   ▶ System performing to specification at this time.

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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.

SHMBE8139D

6. Installation is the reverse of removal procedures.

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Diagnostic troubleshooting

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

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B1624 EEPROM Failure

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*1 line.

They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

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DTC Description

"B1624" is set when RAM detects write/read failure in EEPROM.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• EEPROM read/write state check	• Faulty RAM
Enable Conditions	• ACC "ON"	
Threshold Value	• EEPROM read/write failure	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

SHMBE9G61L

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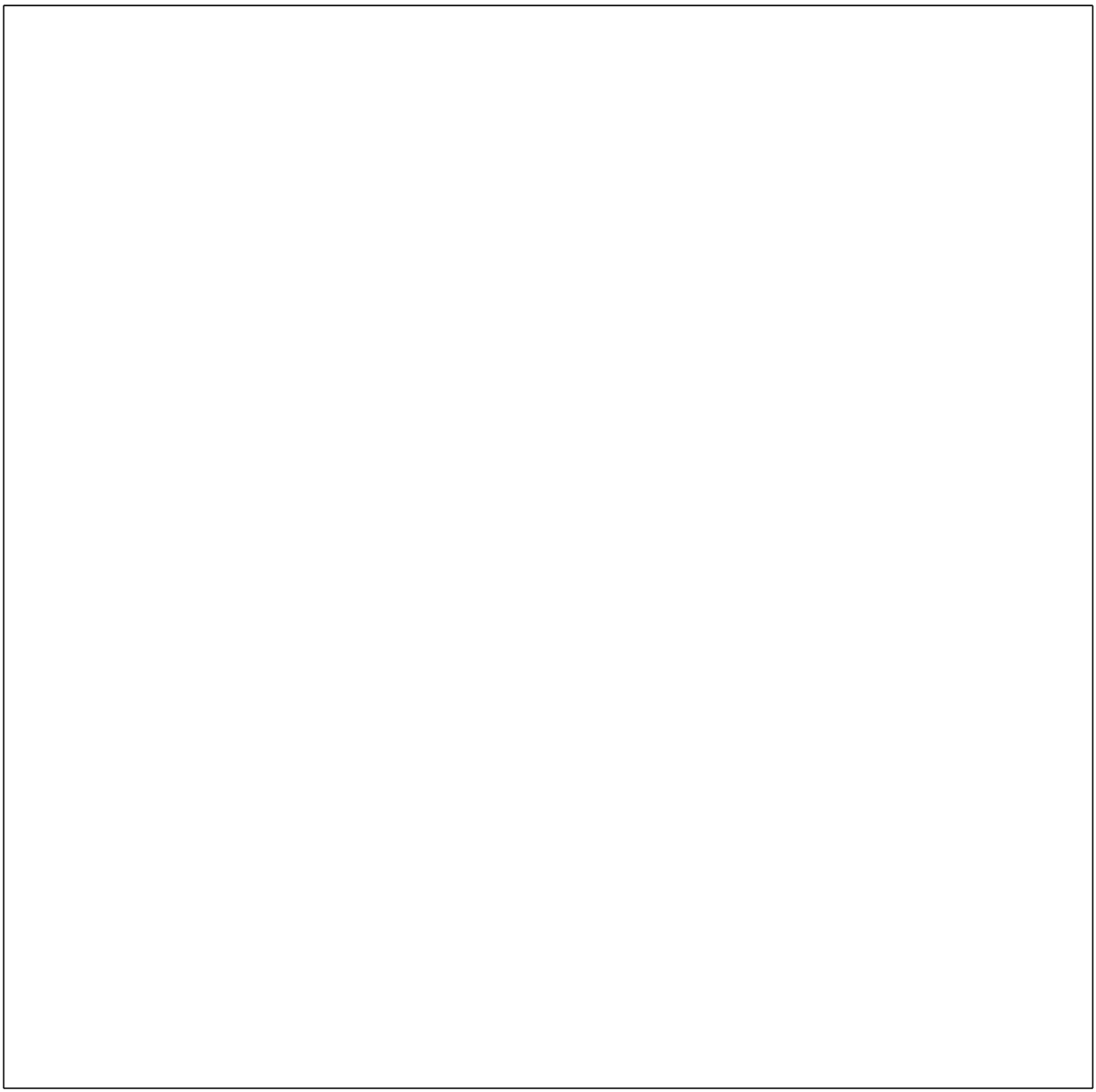

SHMBE9G62L

Signal Waveform & Data

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SHMBE9G14L

Fig 1) CAN Low/High Signal

SHMBE9G15L

Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

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1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

SHMBE9G16L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of RAM.

1. IGN "OFF"
2. Substitute with a known - good RAM.
3. IGN "ON" & ENG "OFF"
4. Connect GDS and then select "DTC Analysis" mode.
5. Is the code erased?

▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

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▶ System performing to specification at this time.

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B1627 EEPROM Corruption

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*1 line.

They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

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DTC Description

"B1627" is set when RAM detects faulty data in EEPROM.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• EEPROM data state check	• Faulty RAM
Enable Conditions	• ACC "ON"	
Threshold Value	• Faulty EEPROM data	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

SHMBE9G61L

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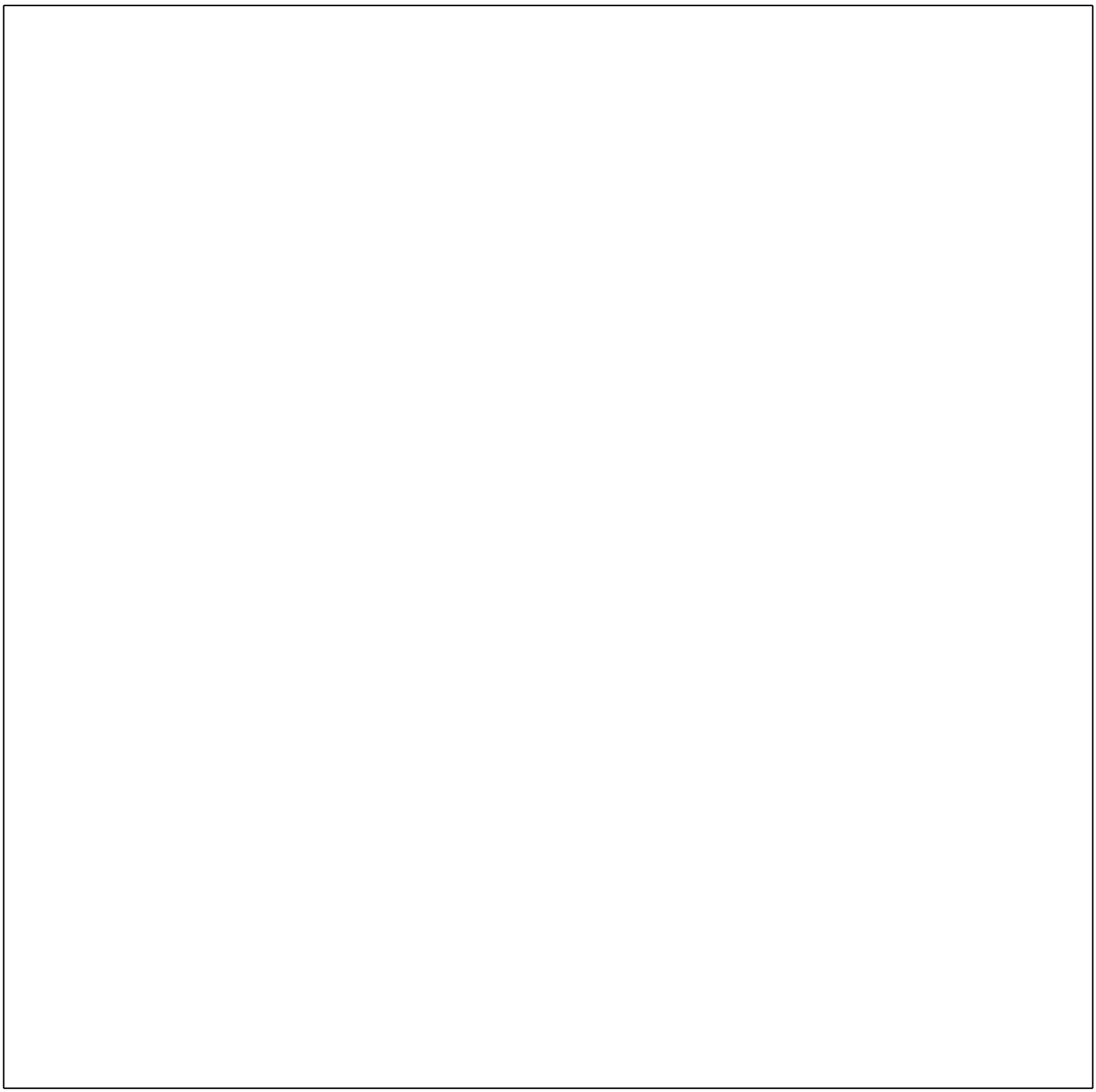

SHMBE9G62L

Signal Waveform & Data

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Fig 1) CAN Low/High Signal

SHMBE9G15L

Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

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1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

SHMBE9G17L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of RAM.

1. IGN "OFF"
2. Substitute with a known - good RAM.
3. IGN "ON" & ENG "OFF"
4. Connect GDS and then select "DTC Analysis" mode.
5. Is the code erased?

▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

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▶ System performing to specification at this time.

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B1646 S/W Rescue Mode

General Description

All 10 units which consists of the Body Electrical Control System are linked by CAN*1 line.

They are IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module),

DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module),

SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key).

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

SHMBE9G00L

DTC Description

"B1646" is set in case of CAN communication failure due to either FAM, RAM not existing at CAN line or IPM, FAM, RAM internal fault.

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DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Network state check	• CAN Line check • FAM, IPM, RAM operation check
Enable Conditions	• IG "ON"	
Threshold Value	• RF Module being not in accordance with regional frequency installed	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

Signal Waveform & Data

SHMBE9G14L

Fig 1) CAN Low/High Signal

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SHMBE9G15L

Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

SHMBE9G18L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

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Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

   ▶ Go to "Component Inspection" procedure.

Component Inspection

Check internal errors of RAM.

1. IGN "OFF"
2. Substitute with a known - good RAM.
3. IGN "ON" & ENG "OFF"
4. Connect GDS and then select "DTC Analysis" mode.
5. Is the code erased?

   ▶ Substitute with a known - good RAM and check for proper operation.
   If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

   ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

   ▶ Go to the applicable troubleshooting procedure.

   ▶ System performing to specification at this time.

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B2115 Rear Defog Relay Fail

General Description

Once IPM receives rear windshield defog switch working signal, it sends the signal to RAM by CAN communition. RAM performs a defogging function by operating rear windshield defog relay.

SHMBE9G00L

DTC Description

This code is set when RAM detects rear windshield defog relay not working even thought relay working condition is met. (relay fuse open, faulty relay, faulty relay operating IC)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Rear W/Shield Defog Fuse or Relay state check	• Rear Windshield Defog Relay Fuse Open
Enable Conditions	• ACC "ON"	
Threshold Value	• It is normal if the voltage of each fuse terminal is above 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

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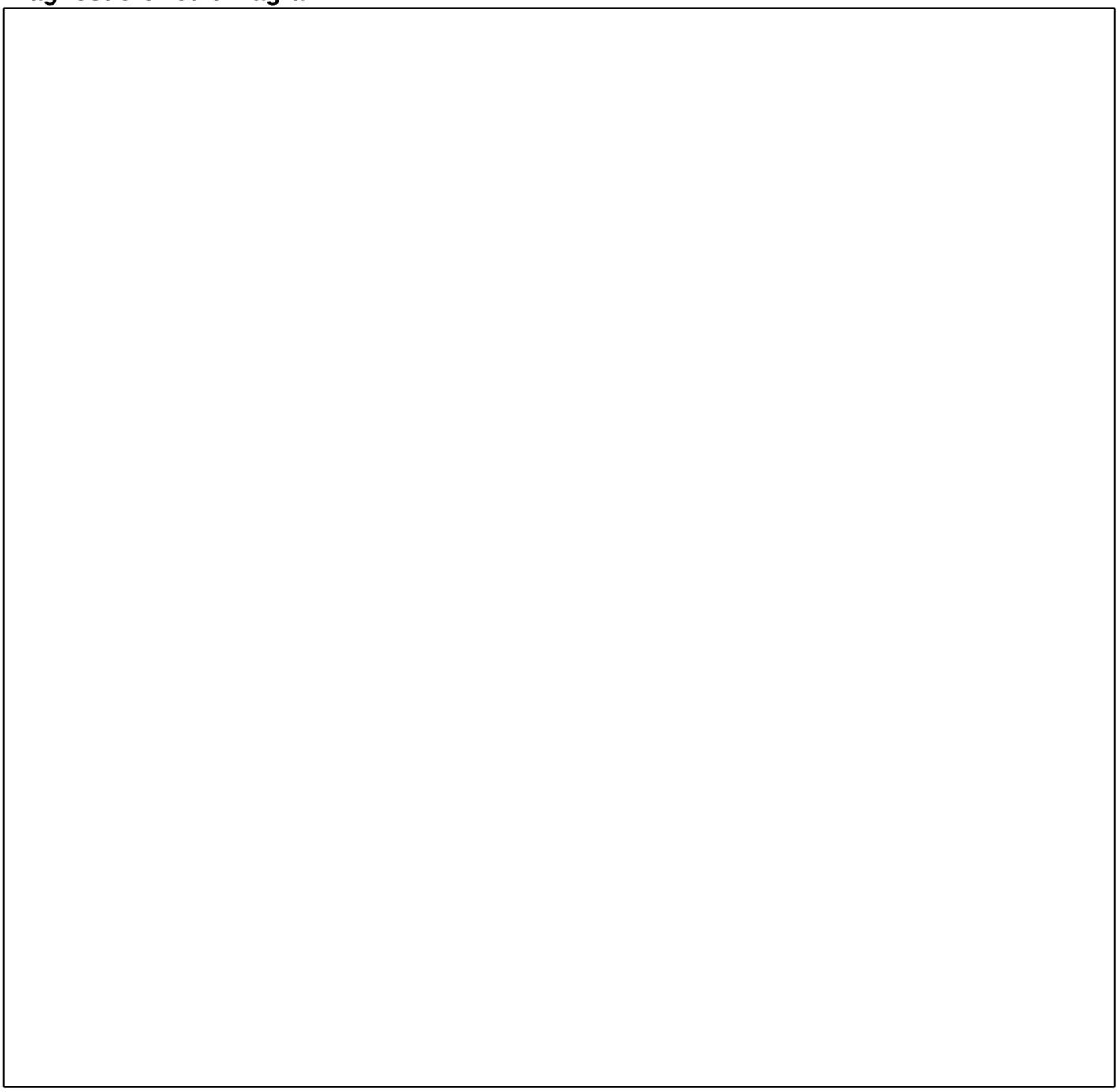
Diagnostic Circuit Diagram



SHMBE9G33L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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SHMBE9G12L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Scantool Data Inspection

1. IG "OFF" and Connect GDS.
2. IG "ON" & ENG "OFF"
3. Select "Current Data" mode.
4. Monitor the "Rear Windshield Defog State" parameter on the scantool.

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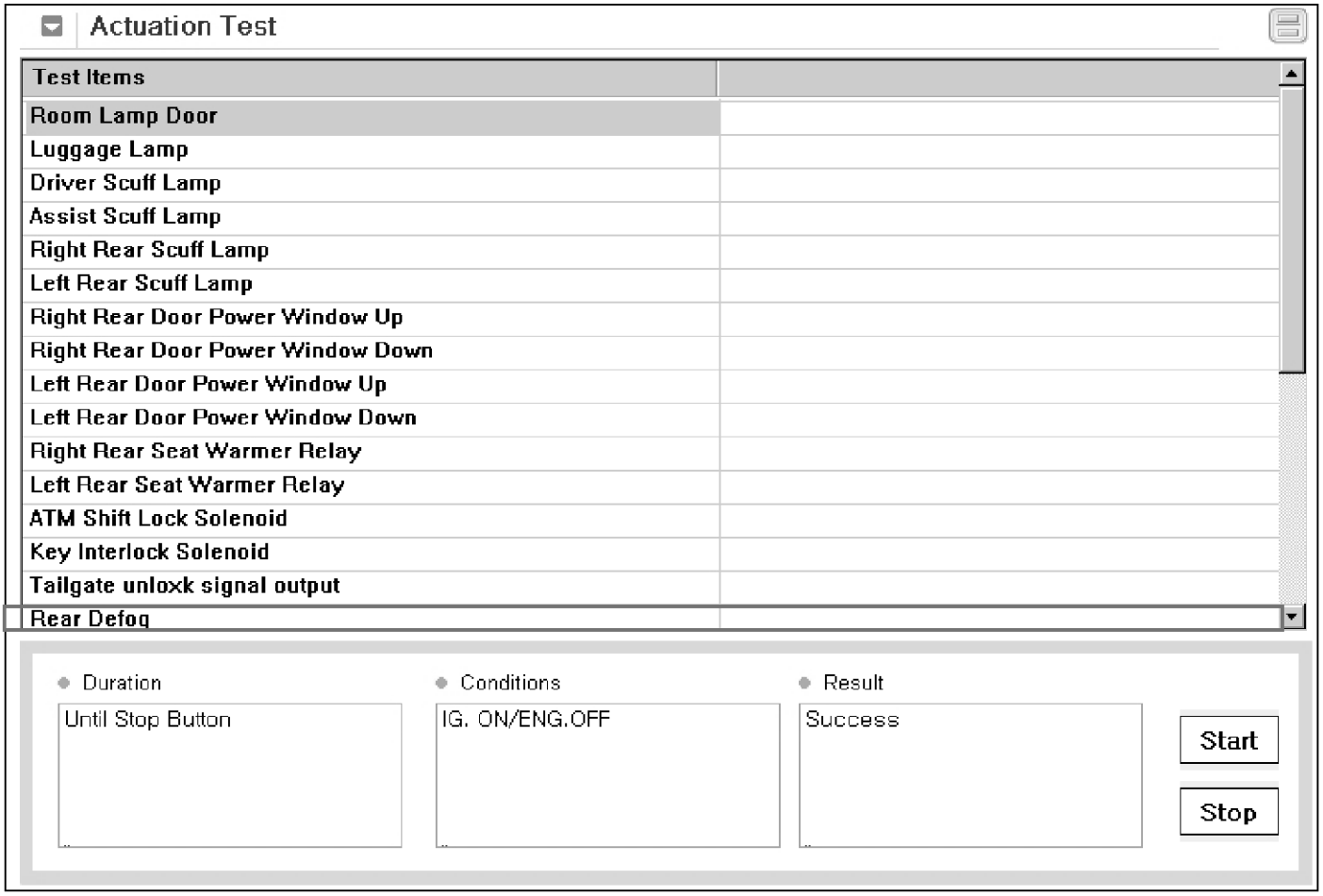

SHMBE9G13L

5. Is the service data normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Power Circuit Inspection" procedure.

Power Circuit Inspection

■ Power Circuit of rear windshield defog relay circuit inspection

1. IG "OFF" or IG "ON" & ENG "OFF"
2. Depress windshield defog switch.
3. Measure the rear windshield defog working signal voltage of RAM.

Specification : Approx. 12V

4. Is the signal output normal?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check for rear windshield defog fuse and relay, open or short in circuit of rear windshield defog relay singnal. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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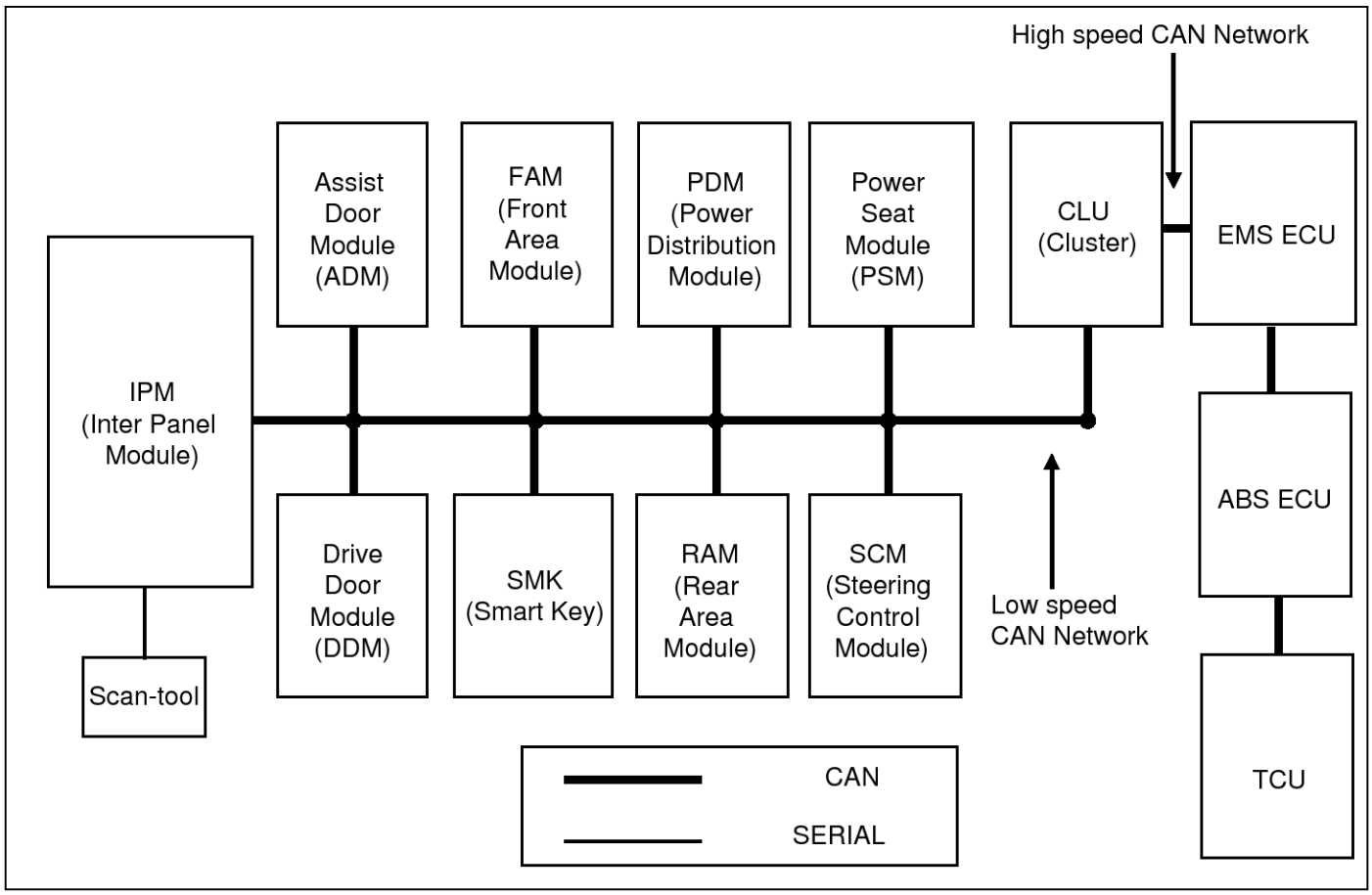
B2441 Right Rear Wiper Park Position Detect Fail

General Description

Once IPM receives rear wiper switch working signal, it sends the signal to RAM by CAN communition. FAM operates rear wiper.



SHMBE9G00L

DTC Description

This code is set when RAM doesn't detect park signal within 5 sec. after rear wiper working.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Check voltage level	• Poor connection • Faulty Rear Wiper motor
Enable Conditions	• IG KEY ON.	
Threshold Value	• Park signal voltage - Wiper working: 12V - Wiper stop at Park position: 0V	
Diagnostic Time	• 5 sec.	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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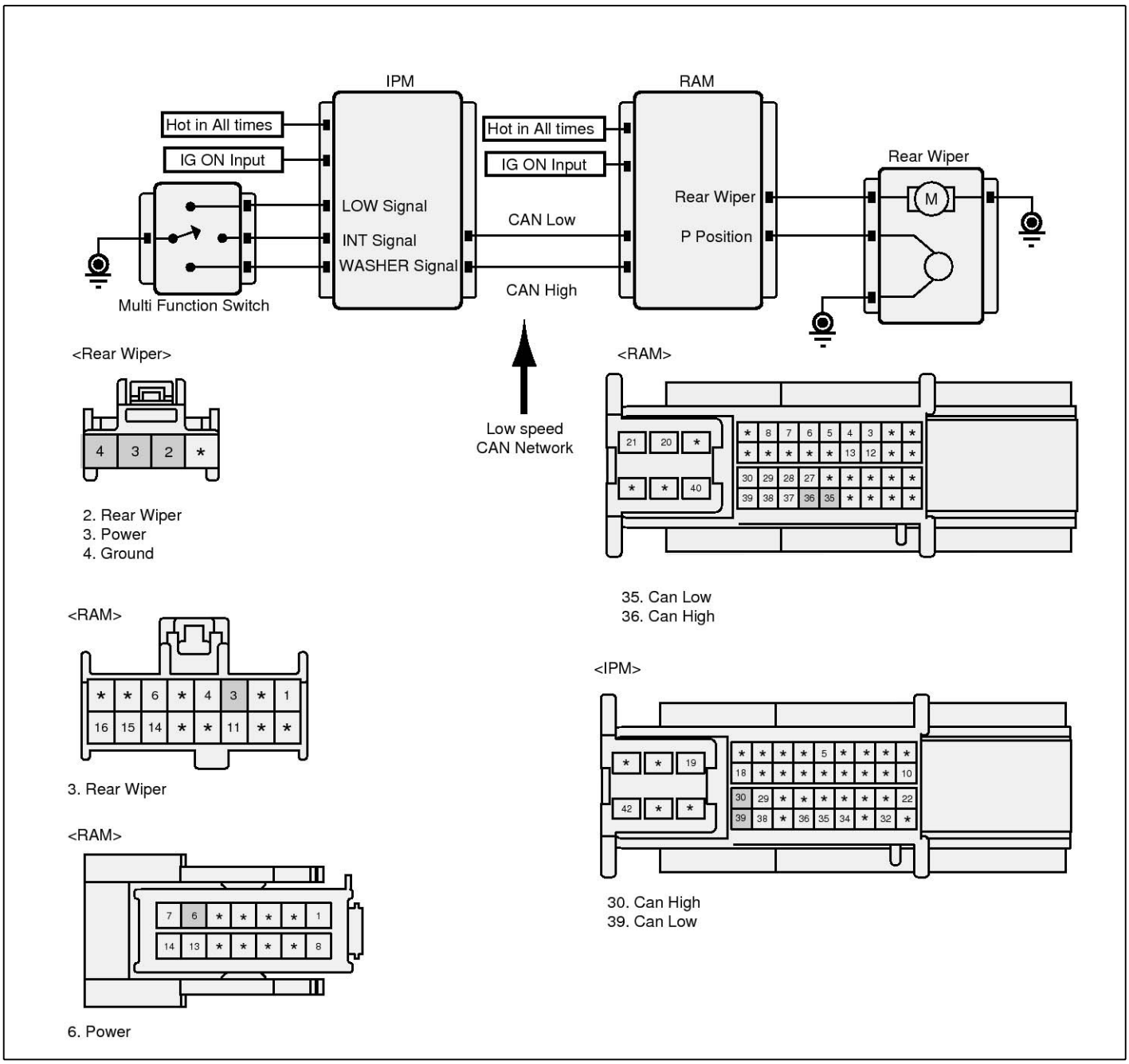

SHMBE9G35L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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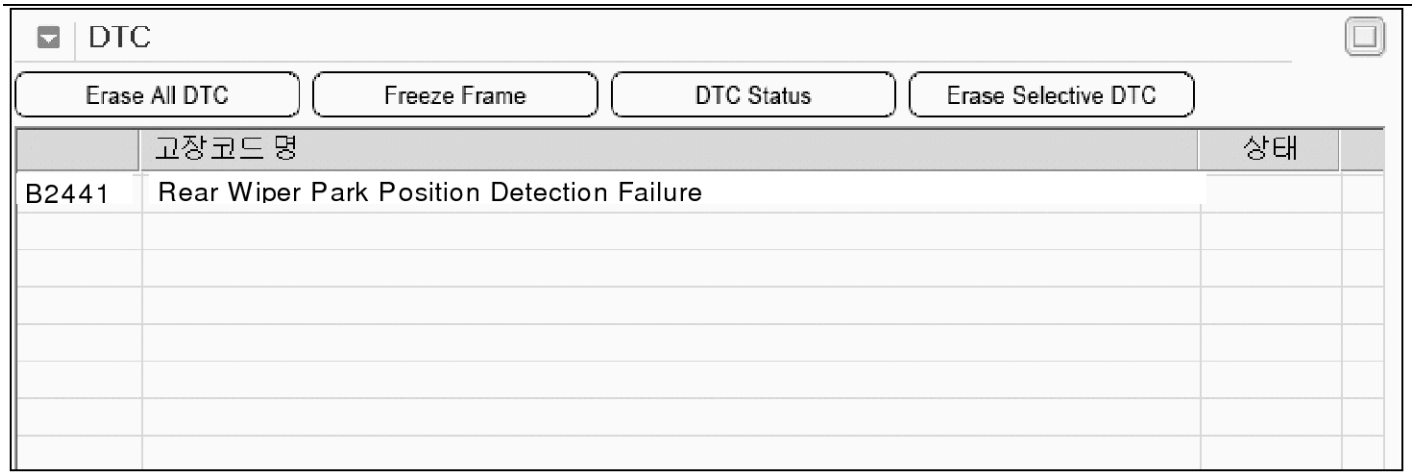

SHMBE9G21L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Rear Wiper Motor

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Rear Wiper Motor" test.

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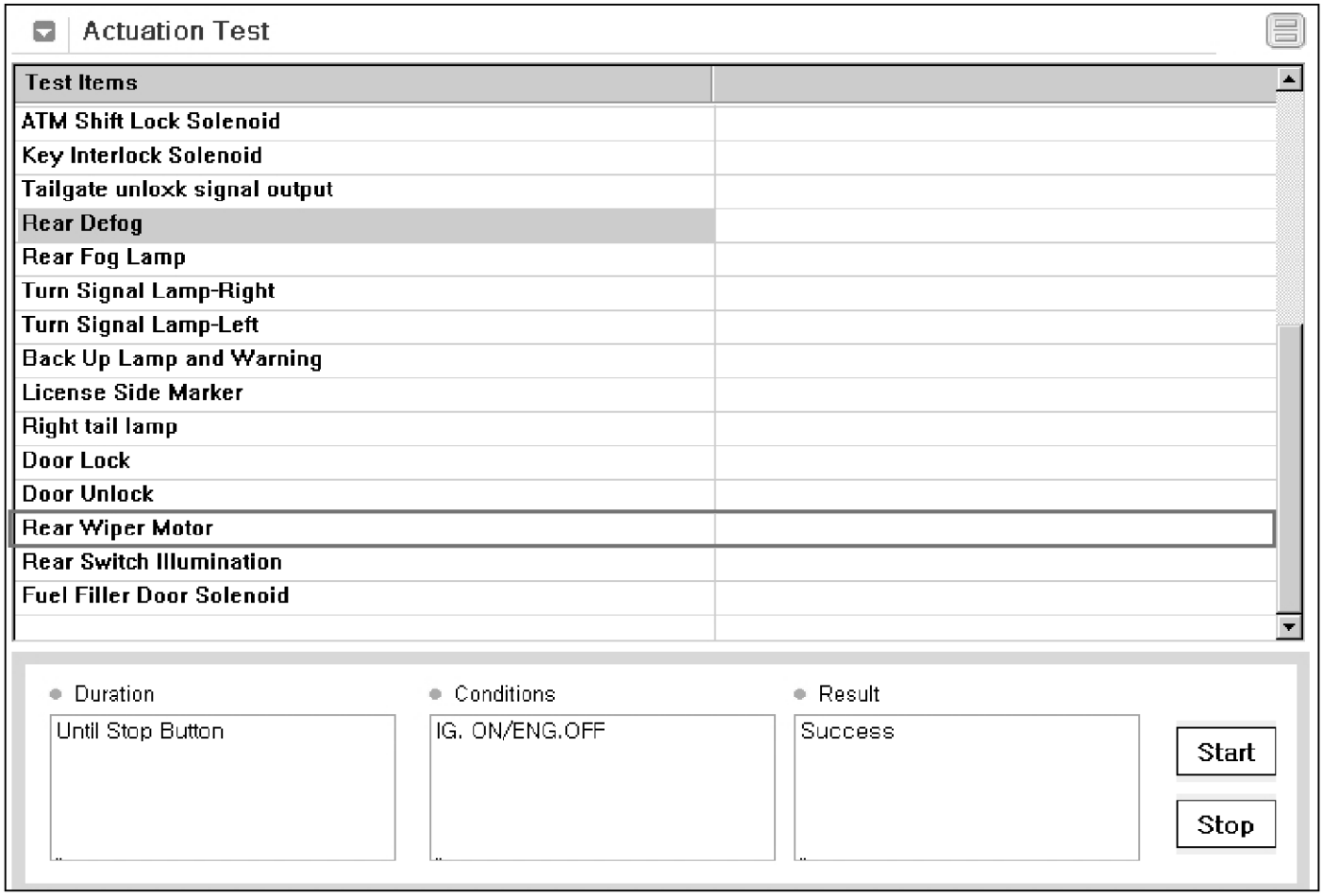

SHMBE9G22L

5. Is the service data normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Wiper Circuit Inspection" procedure.

Rear Wiper Circuit Inspection

■ Check short to ground in harness

1. IG "ON"
2. Measure the rear wiper motor position signal voltage of RAM.

Specification: Park signal voltage
- Wiper working: Approx. 12V
- Wiper stop at park position: Approx. 0V

3. Is the signal output normal?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Check open or short in circuit of rear wiper position singnal. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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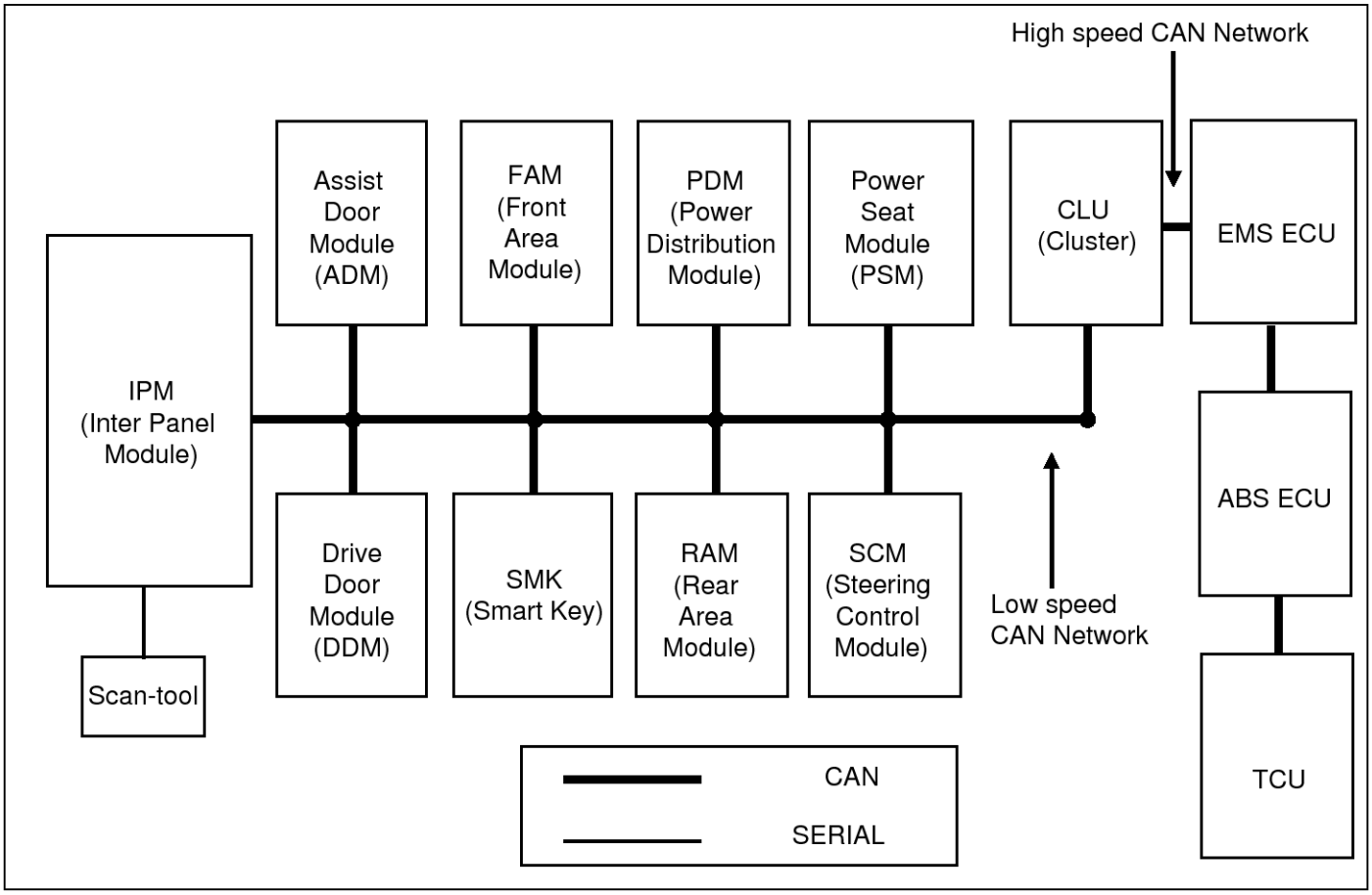
B2535 Right Turn Signal Lamp Short to Ground

General Description

Once IPM receives rear right turn signal lamp switch working signal, it sends the signal to RAM by CAN communition. RAM makes rear right turn signal lamp flickering.



SHMBE9G00L

DTC Description

This code is set when rear right turn signal lamp circuit is shotted to ground for more than 150ms during rear right turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in rear right turn signal lamp circuit • Faulty rear right turn signal lamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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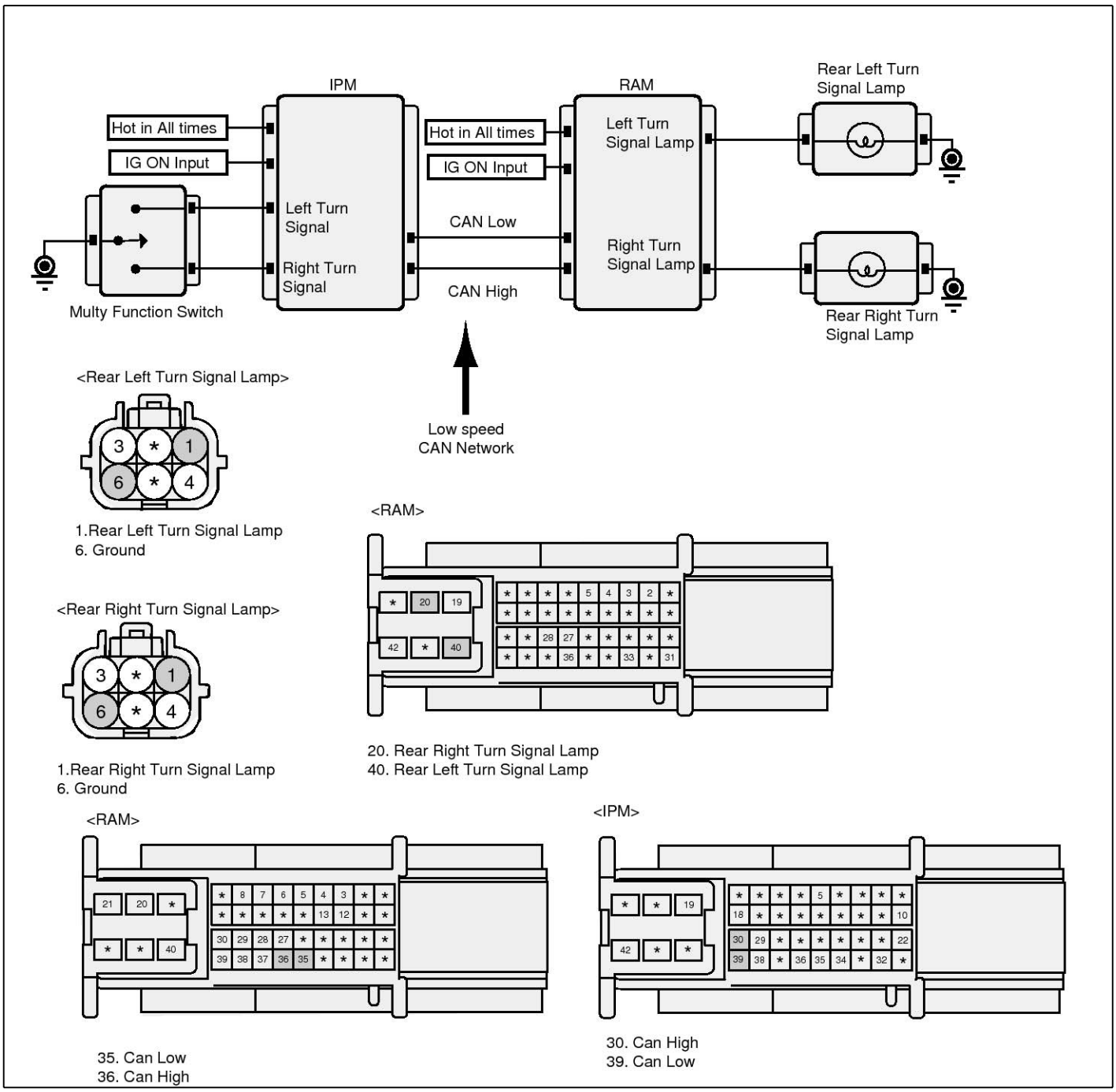

SHMBE9G36L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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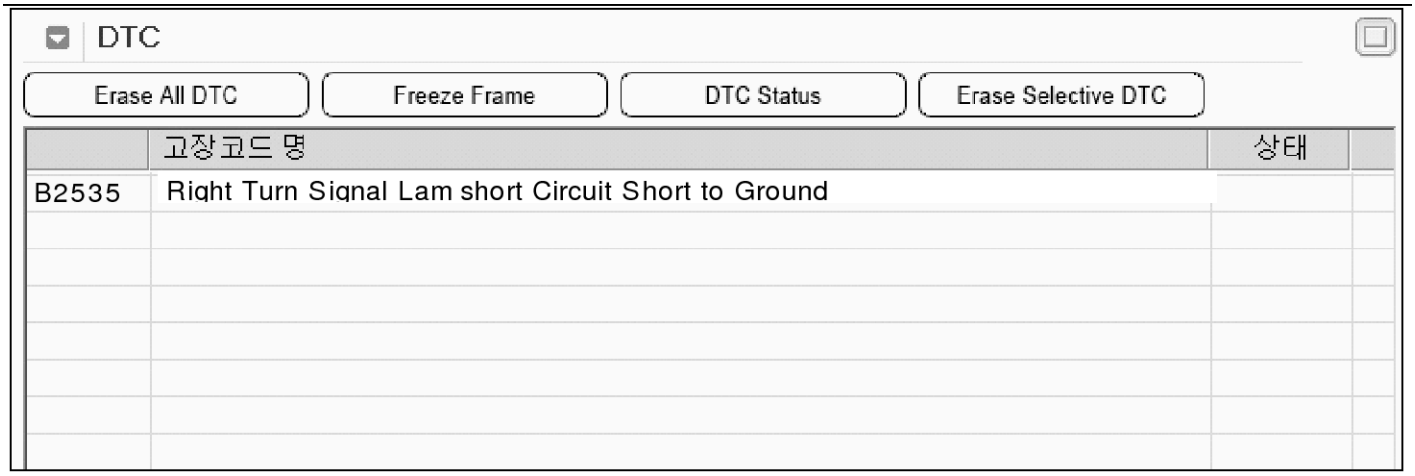

SHMBE9G23L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check rear right turn signal lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "rear right turn signal lamp" test.

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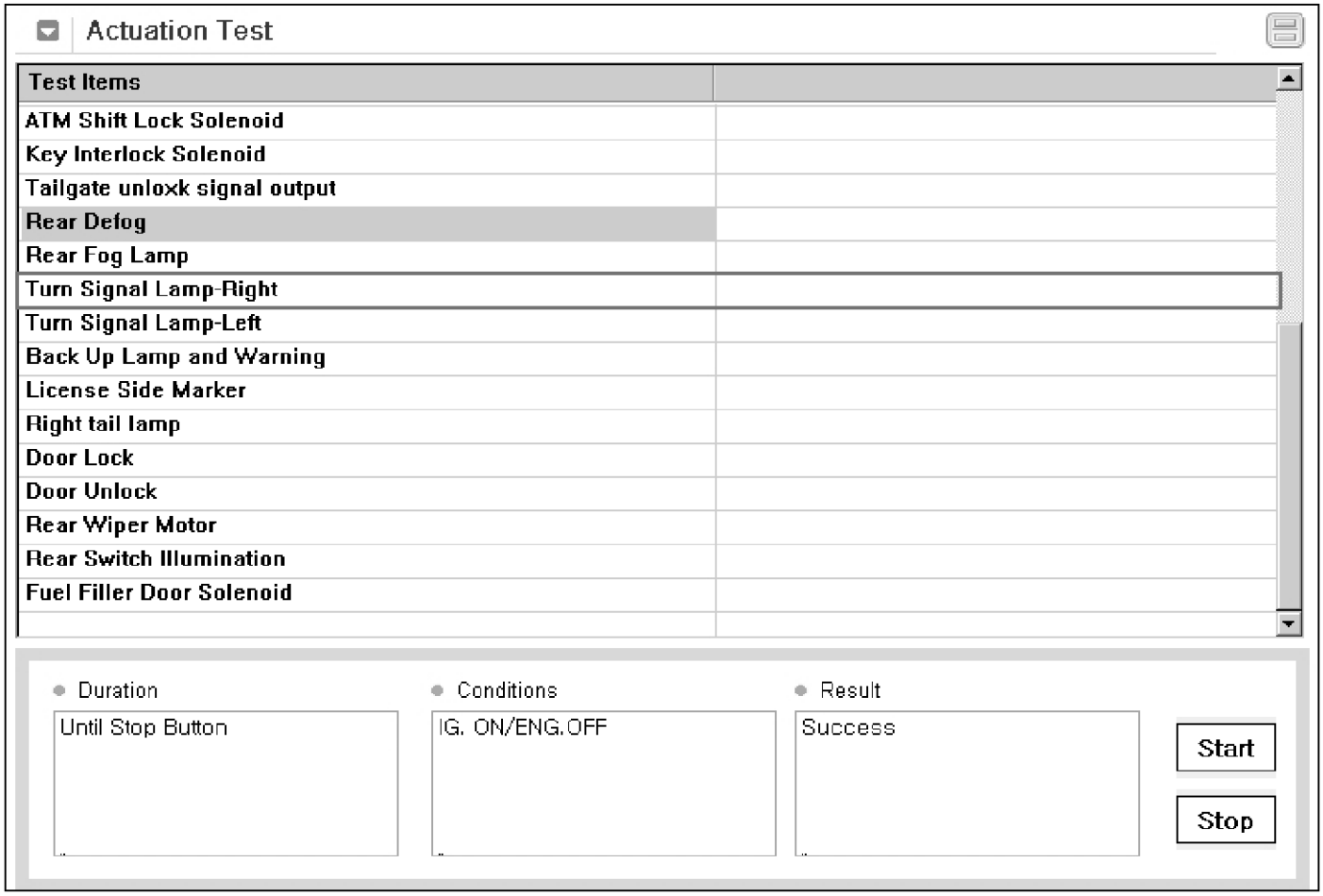

SHMBE9G24L

5. Is the service data normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Right Turn Signal Lamp Circuit Inspection" procedure.

Rear Right Turn Signal Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, Rear Right Turn Signal Lamp connector.
3. Measure resistance between the rear right turn signal lamp terminal of RAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair short to ground in circuit of Rear Right Turn Signal Lamp, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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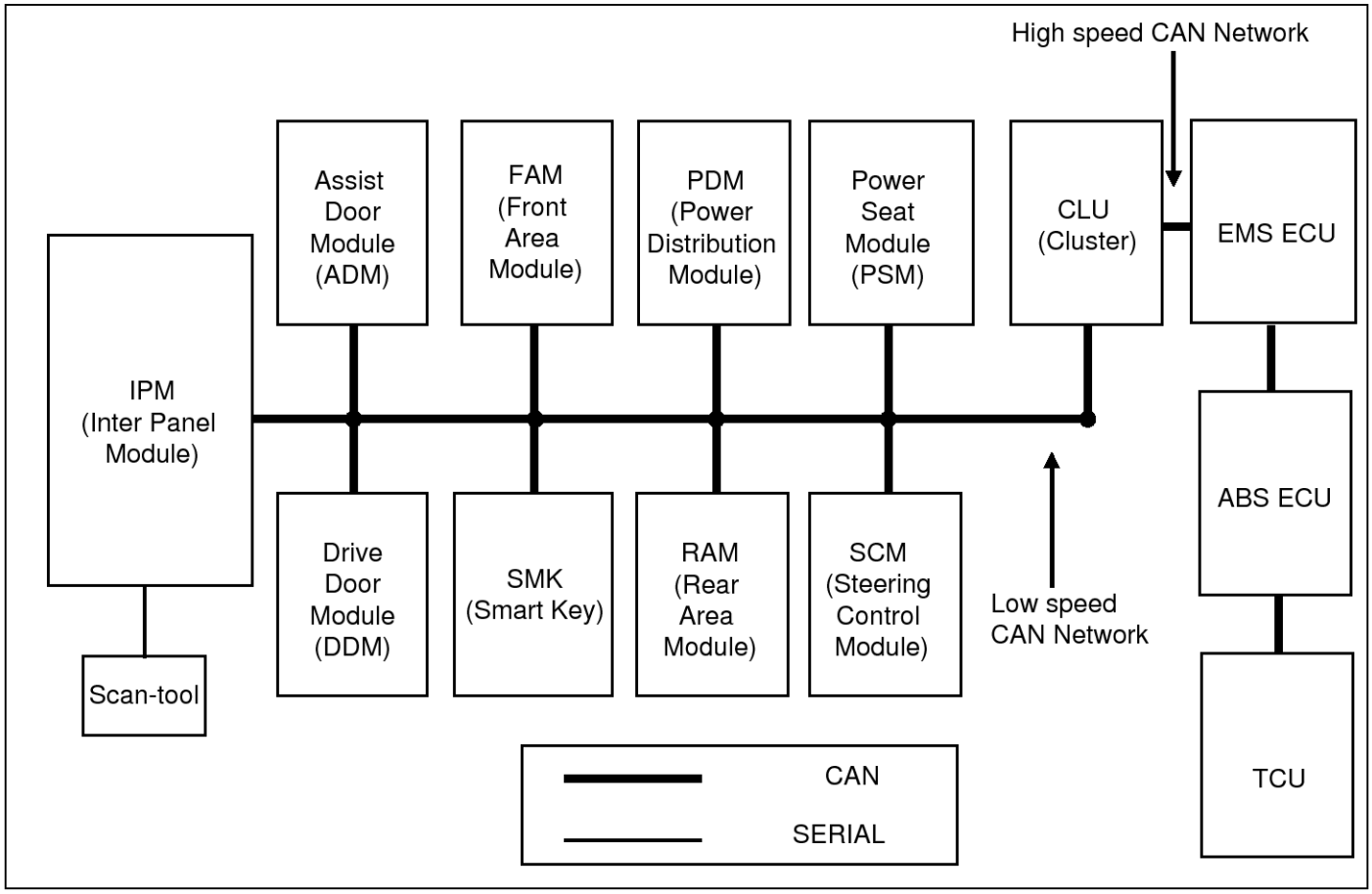
B2537 Right Turn Signal Lamp Open

General Description

Once IPM receives rear right turn signal lamp switch working signal, it sends the signal to RAM by CAN communition. RAM makes rear right turn signal lamp flickering.



SHMBE9G00L

DTC Description

This code is set when rear right turn signal lamp circuit is open for more than 150ms during rear right turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in rear right turn signal lamp circuit • Faulty rear right turn signal lamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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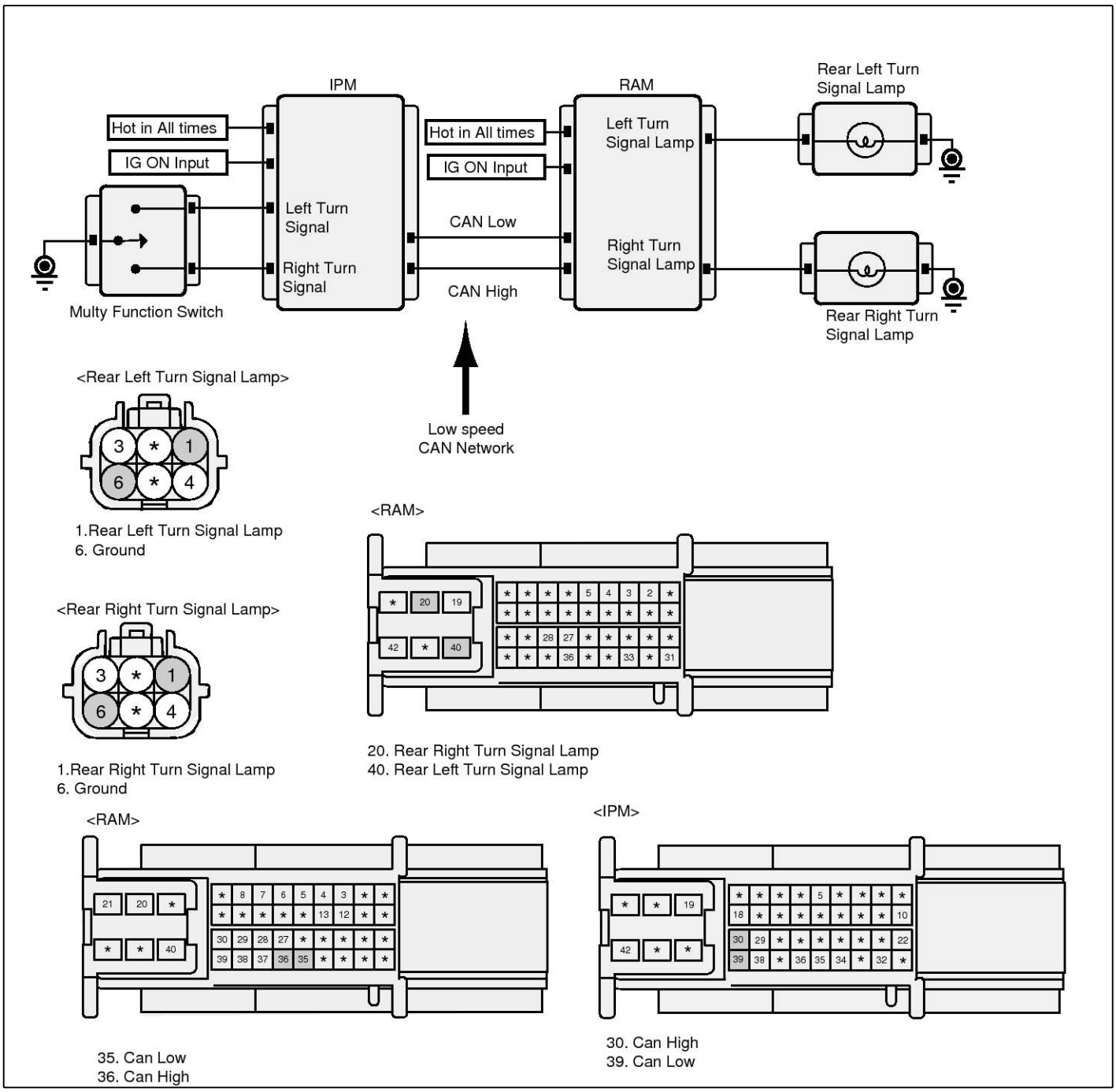

SHMBE9G36L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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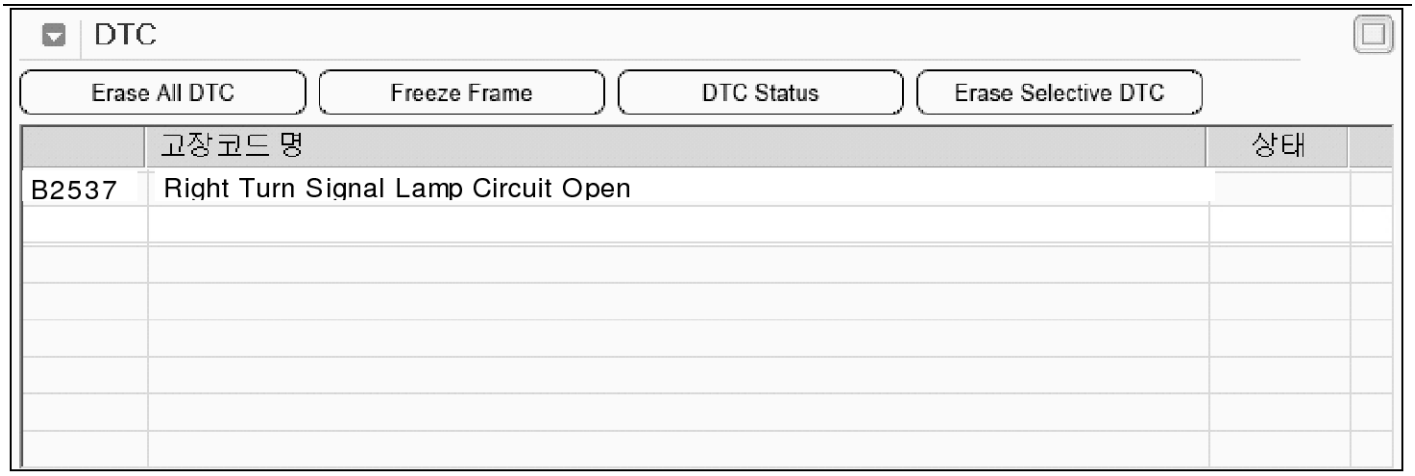

SHMBE9G27L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check rear right turn signal lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "rear right turn signal lamp" test.

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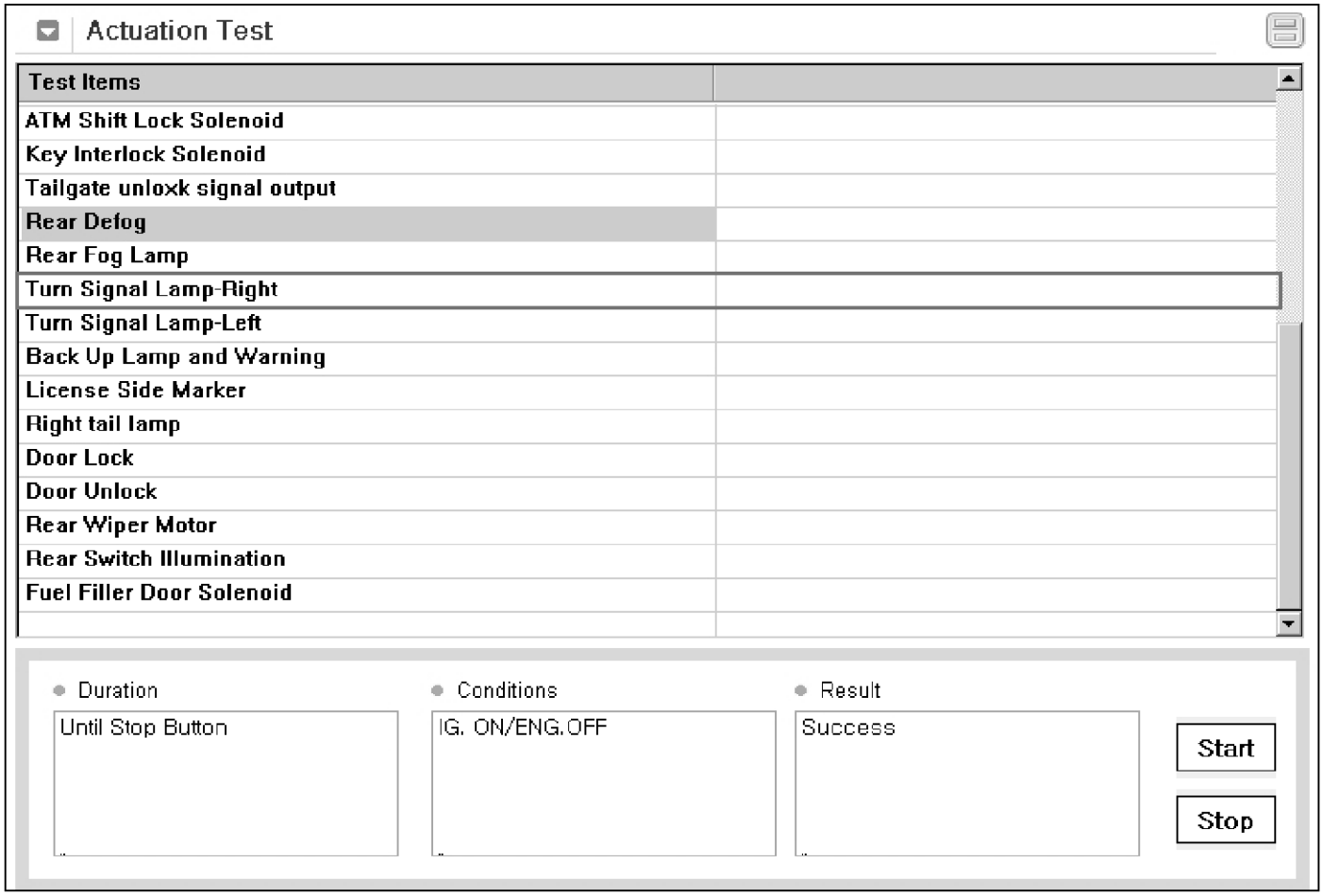

SHMBE9G24L

5. Is the service data normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Right Turn Signal Lamp Circuit Inspection" procedure.

Rear Right Turn Signal Lamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal
2. Disconnect RAM connector.
3. Measure resistance between the rear right turn signal lamp terminal of RAM harness connector and ground of the rear right turn signal lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair open in circuit of Rear Right Turn Signal Lamp or Rear Right Turn Signal Lamp internal open, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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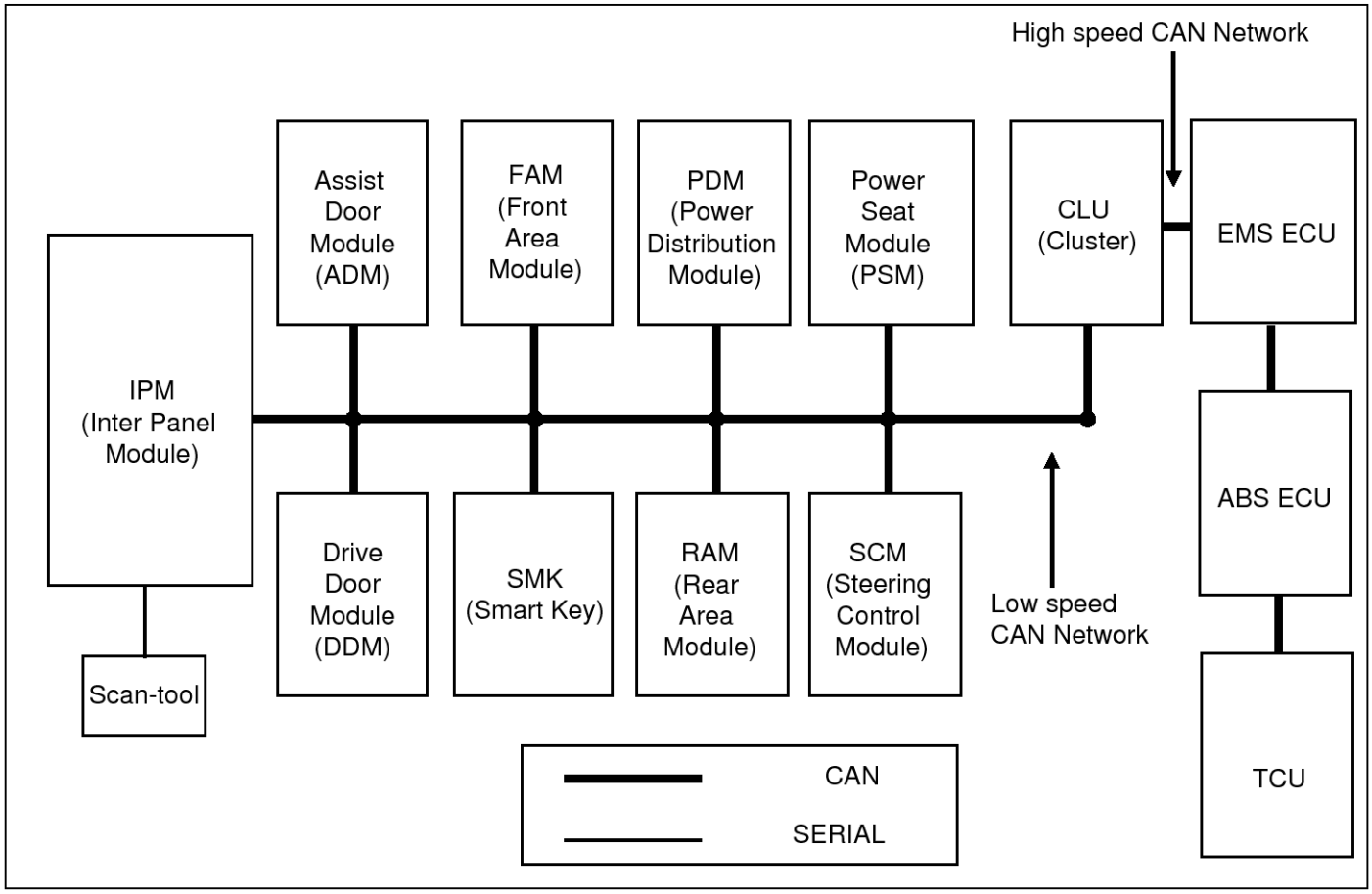
B2539 Left Turn Signal Lamp Short to Ground

General Description

Once IPM receives rear left turn signal lamp switch working signal, it sends the signal to RAM by CAN communition. RAM makes rear left turn signal lamp flickering.



SHMBE9G00L

DTC Description

This code is set when rear left turn signal lamp circuit is shotted to ground for more than 150ms during rear left turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in rear left turn signal lamp circuit • Faulty rear left turn signal lamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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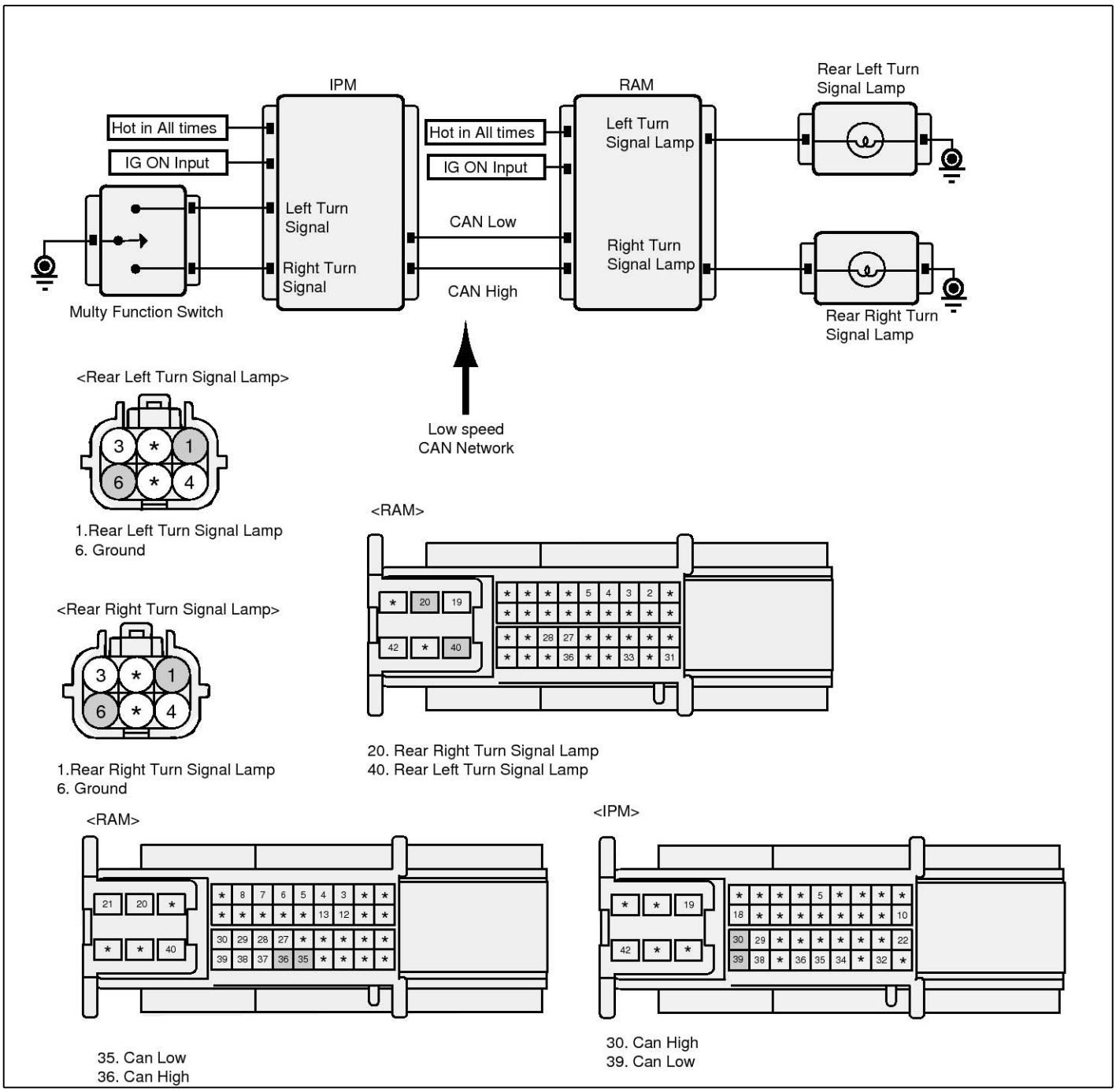

SHMBE9G36L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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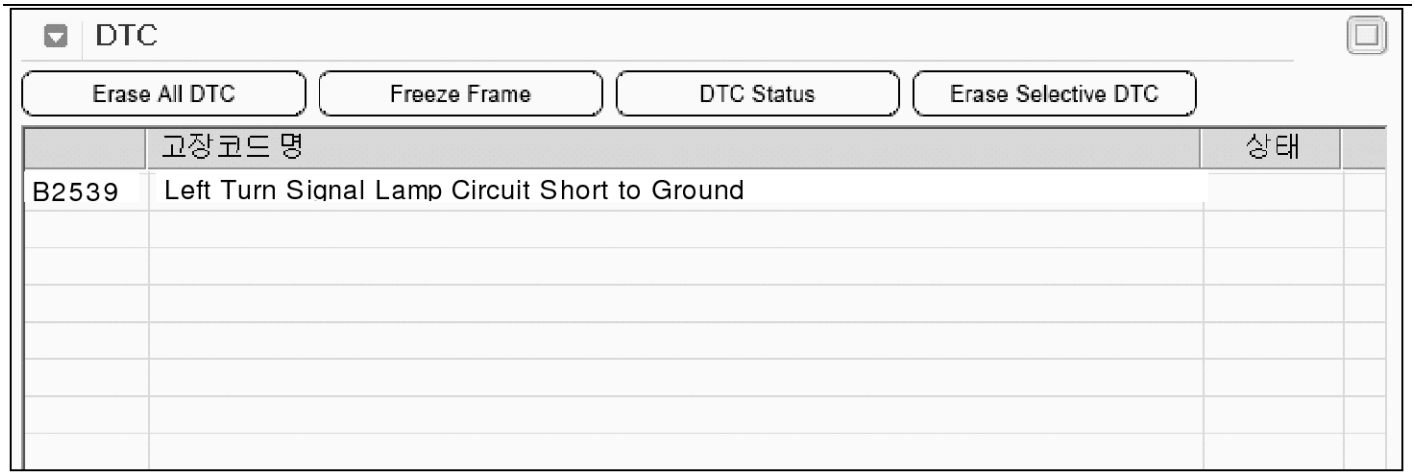

SHMBE9G25L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check rear left turn signal lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "rear left turn signal lamp" test.

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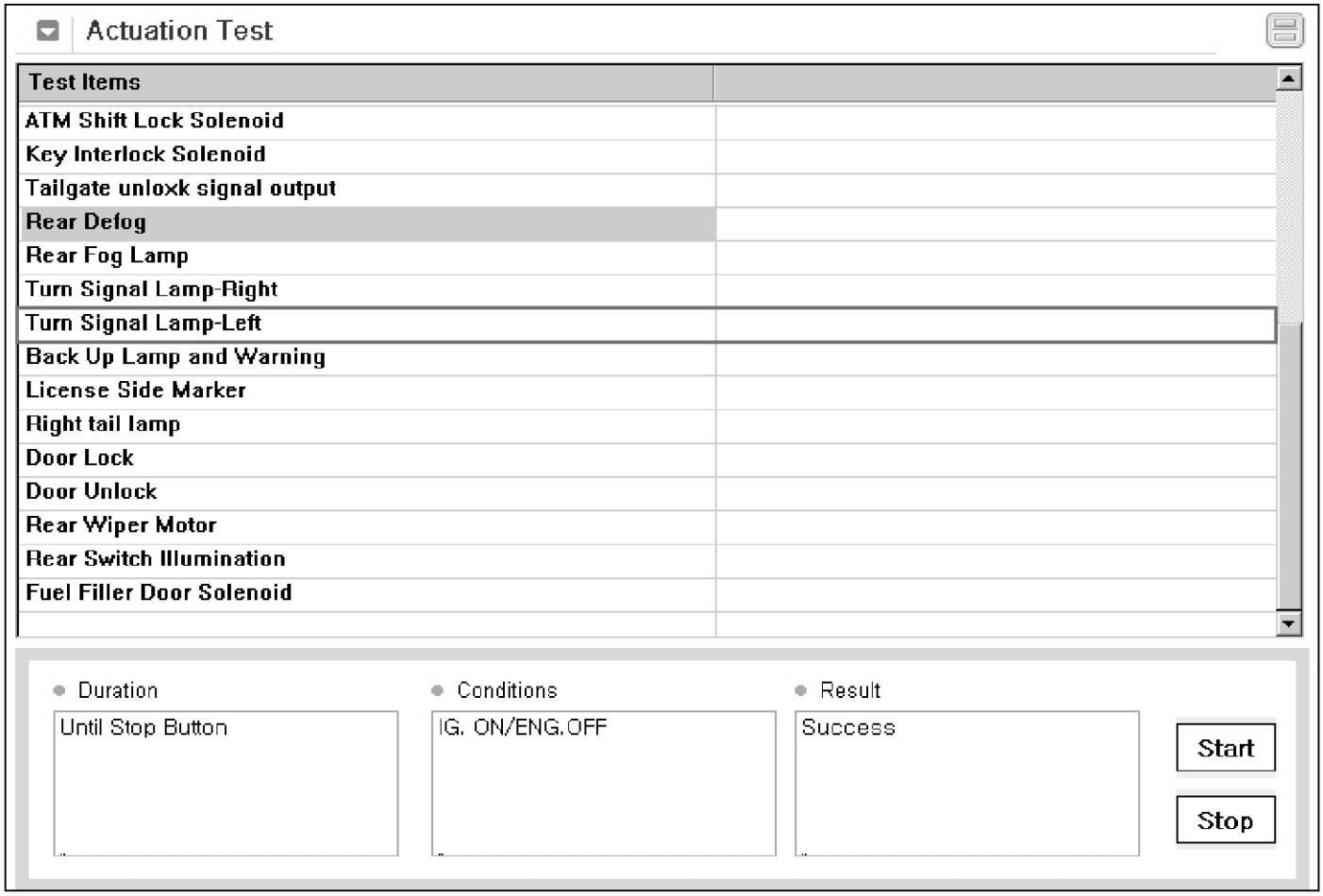

SHMBE9G26L

5. Is the service data normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Left Turn Signal Lamp Circuit Inspection" procedure.

Rear Left Turn Signal Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, Rear Left Turn Signal Lamp connector.
3. Measure resistance between the rear left turn signal lamp terminal of RAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair short to ground in circuit of Rear Left Turn Signal Lamp, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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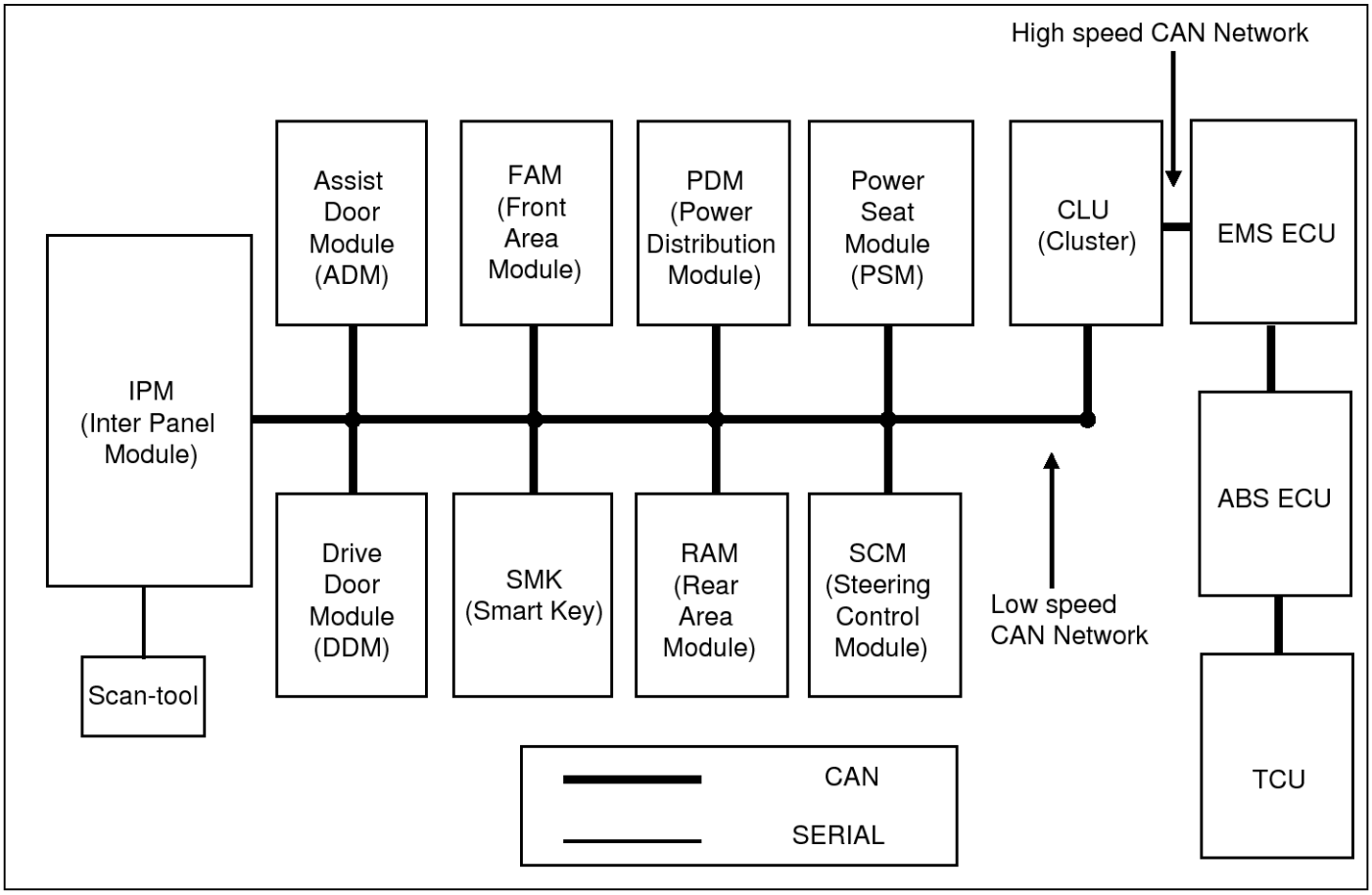
B2541 Left Turn Signal Lamp Open

General Description

Once IPM receives rear left turn signal lamp switch working signal, it sends the signal to RAM by CAN communition. RAM makes rear left turn signal lamp flickering.



SHMBE9G00L

DTC Description

This code is set when rear left turn signal lamp circuit is open for more than 150ms during rear left turn signal lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in rear left turn signal lamp circuit • Faulty rear left turn signal lamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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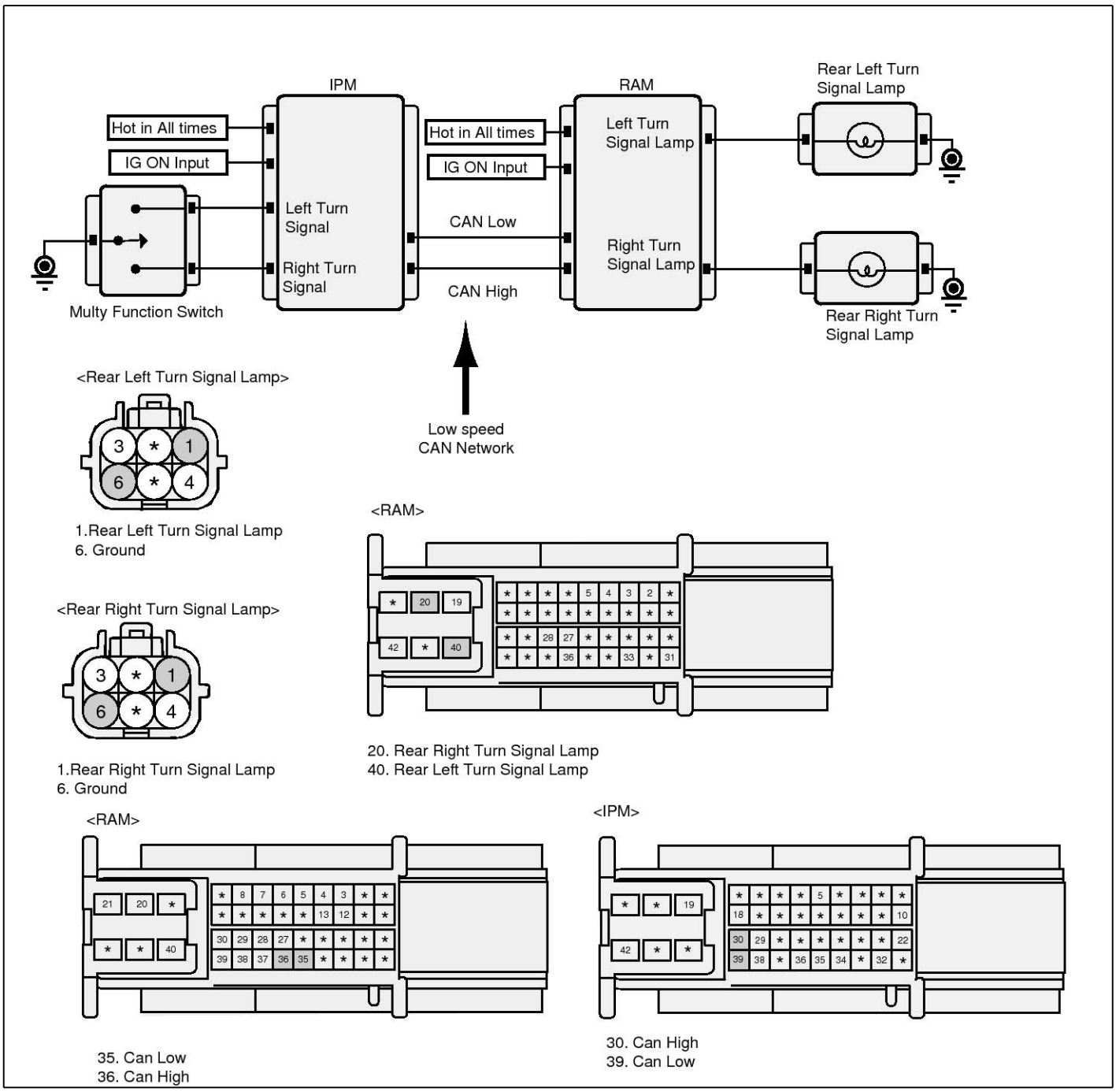

SHMBE9G36L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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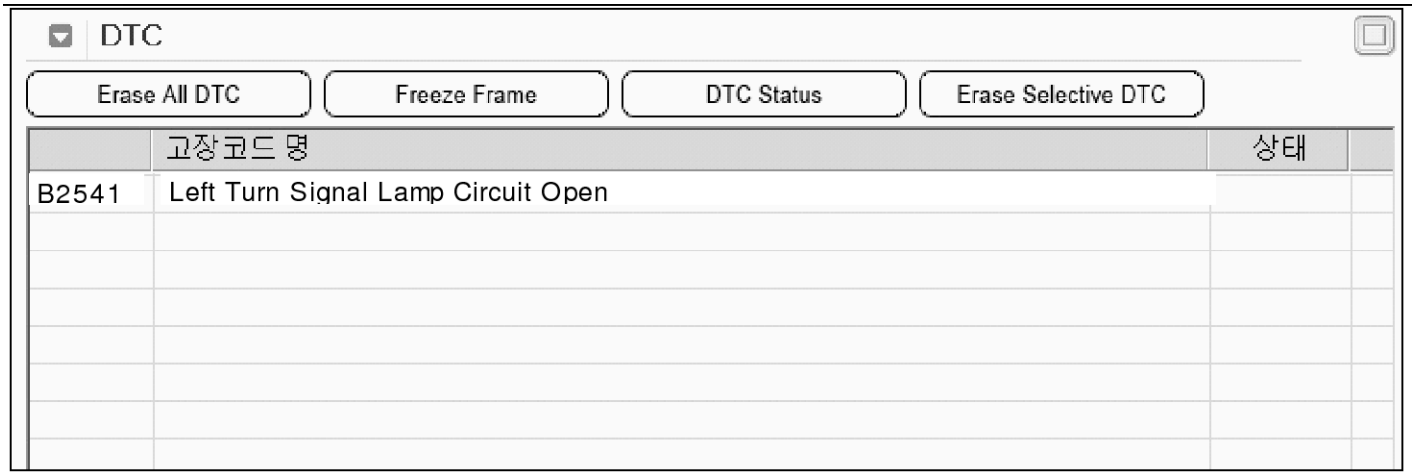

SHMBE9G28L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check rear left turn signal lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "rear left turn signal lamp" test.

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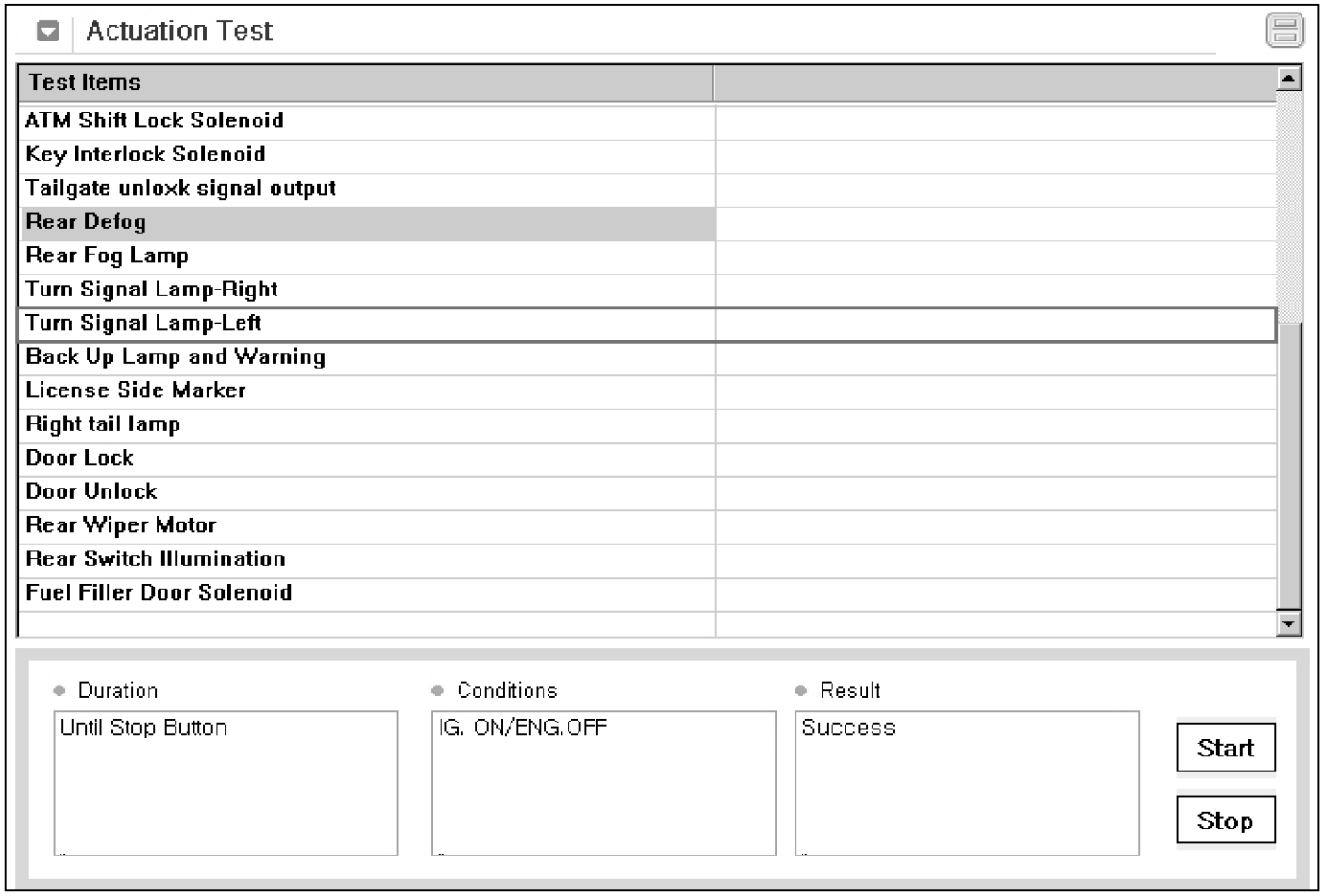

SHMBE9G26L

5. Is the service data normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Left Turn Signal Lamp Circuit Inspection" procedure.

Rear Left Turn Signal Lamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM connector.
3. Measure resistance between the rear left turn signal lamp terminal of RAM harness connector and ground of the rear left turn signal lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair open in circuit of Rear Left Turn Signal Lamp or Rear Left Turn Signal Lamp internal open, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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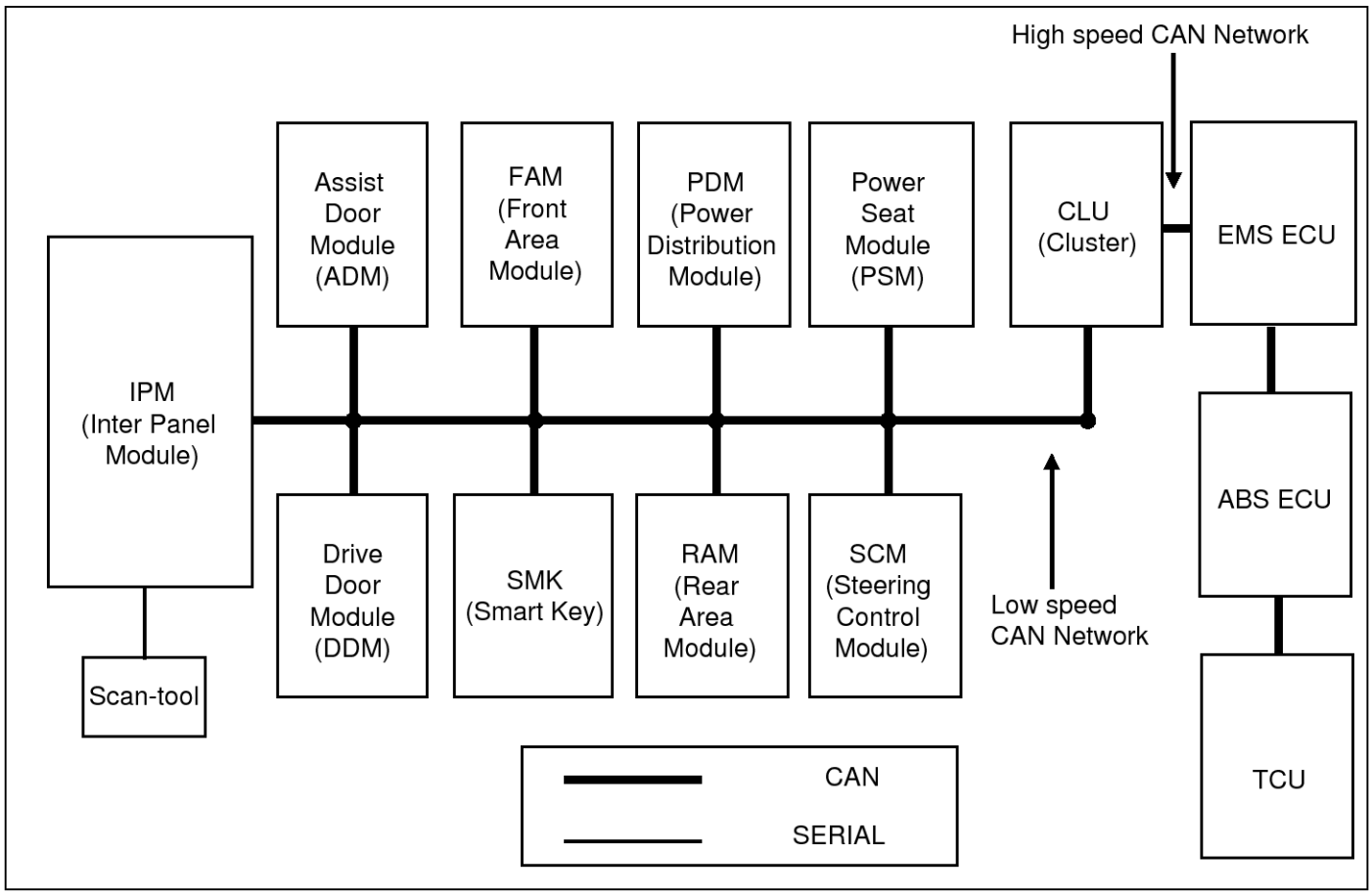
B2567 Rear Fog Lamp Short to Ground

General Description

Once IPM receives fog lamp switch working signal, it sends the signal to RAM by CAN communition. RAM turns on fog lamp



SHMBE9G00L

DTC Detecting Condition

This code is set when left front fog lamp circuit is shortted to ground for more than 150ms during Rear Fog Lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in Rear Fog L-amp circuit • Faulty Rear Fog Lamp. • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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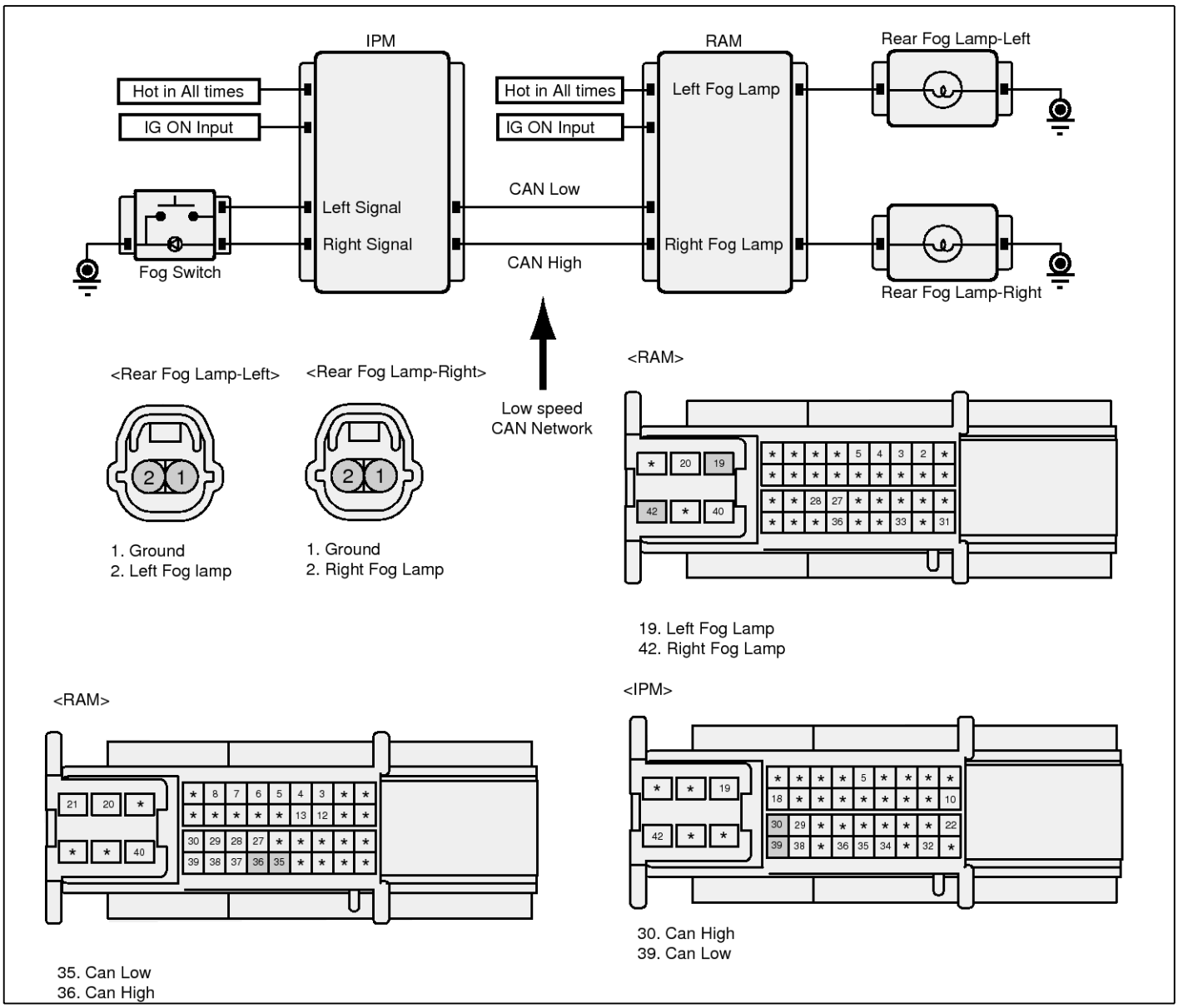

SHMBE9G30L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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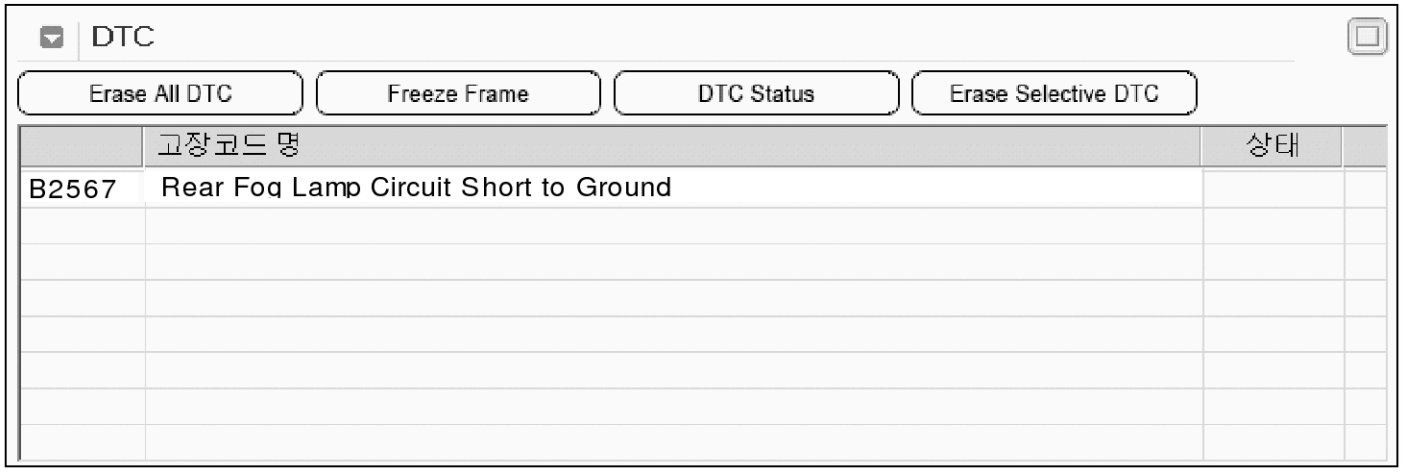

SHMBE9G03L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Rear Fog Lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Rear Fog Lamp" test.

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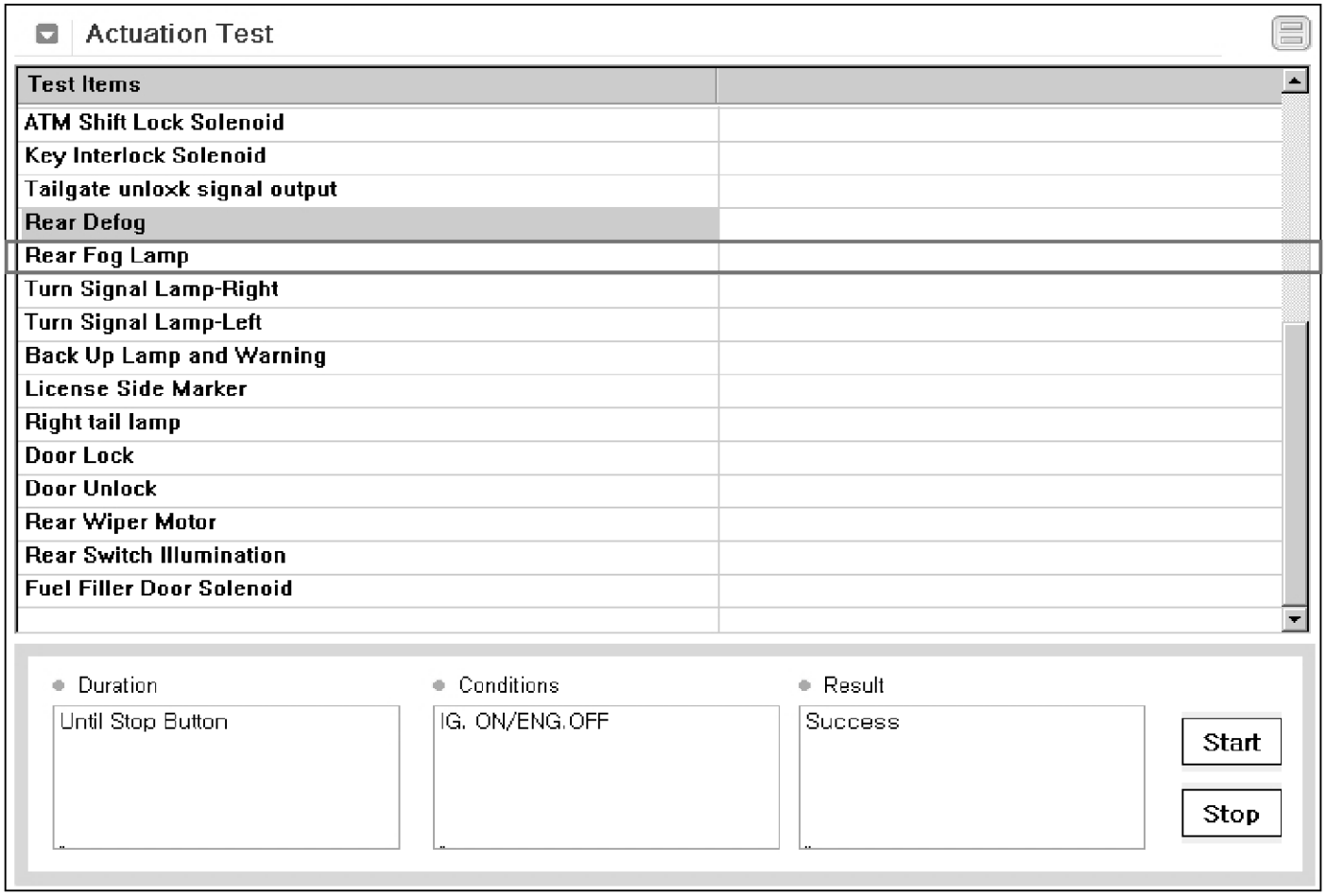

SHMBE9G02L

5. Is Rear Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Fog Lamp Circuit Inspection" procedure.

Rear Fog Lamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, Rear Fog Lamp connector.
3. Measure resistance between the Rear Fog Lamp terminal of RAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of Left Fog Lamp, and go to "Verification of Vehicle Repair " procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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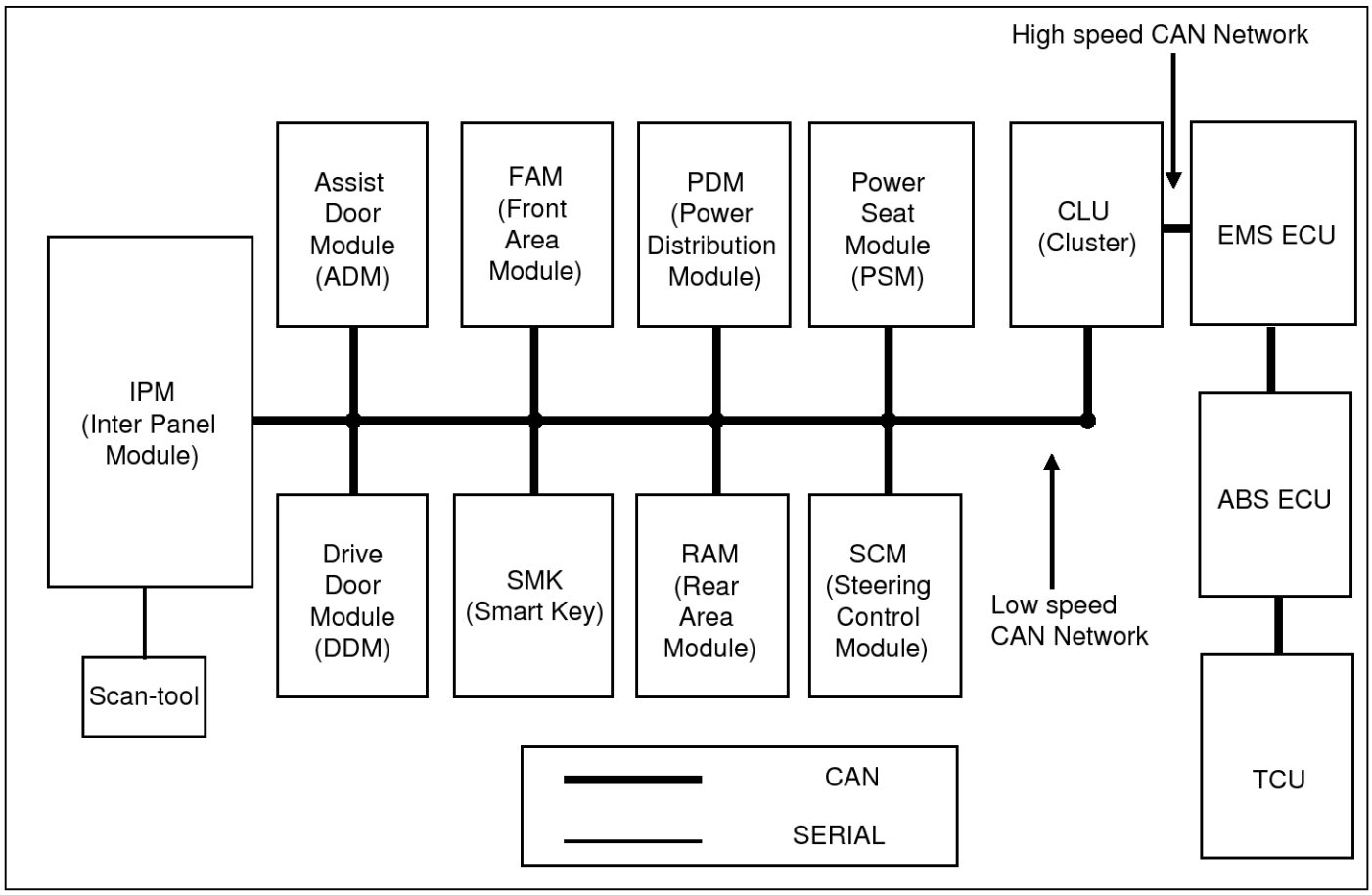
B2569 Rear Fog Lamp Open

General Description

Once IPM receives fog lamp switch working signal, it sends the signal to RAM by CAN communition. FAM turns on fog lamp.



SHMBE9G00L

DTC Description

This code is set when right fog lamp circuit is open for more than 150ms during Rear Fog Lamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in Rear Fog Lamp circuit • Faulty Rear Fog Lamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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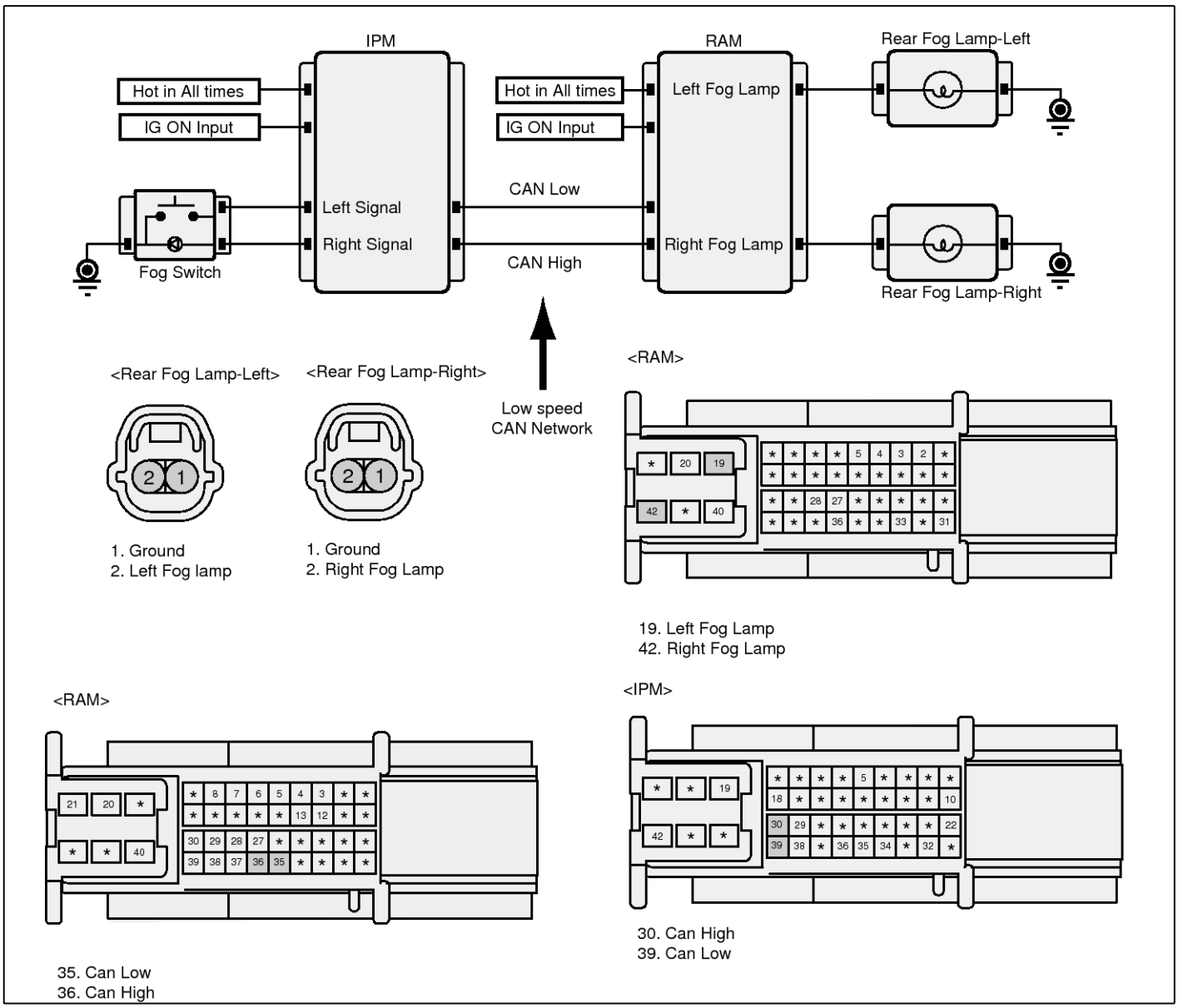

SHMBE9G30L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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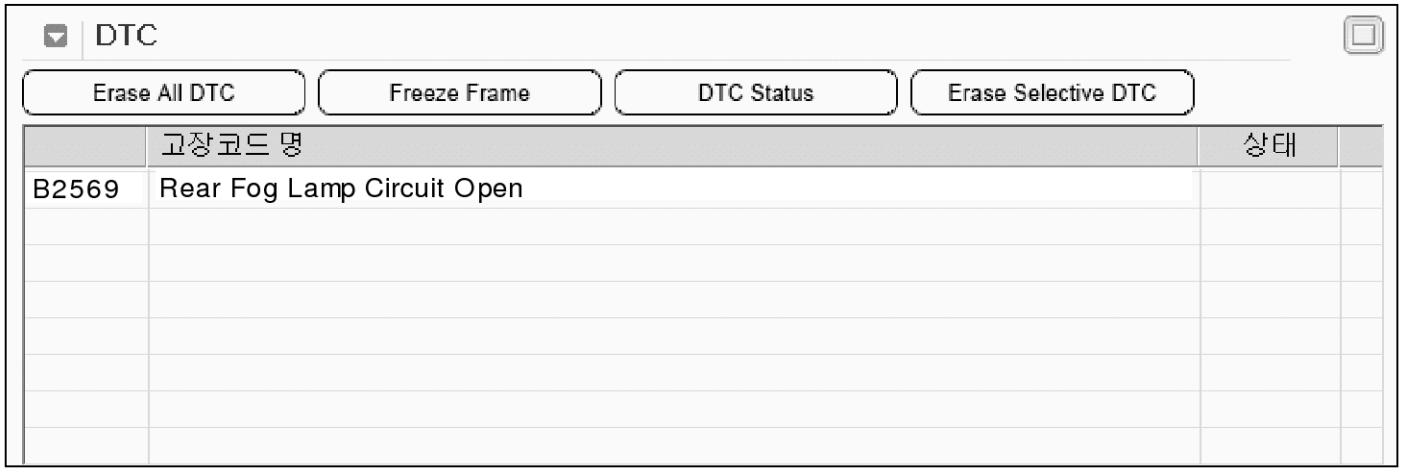

SHMBE9G01L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Rear Fog Lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Rear Fog Lamp" test.

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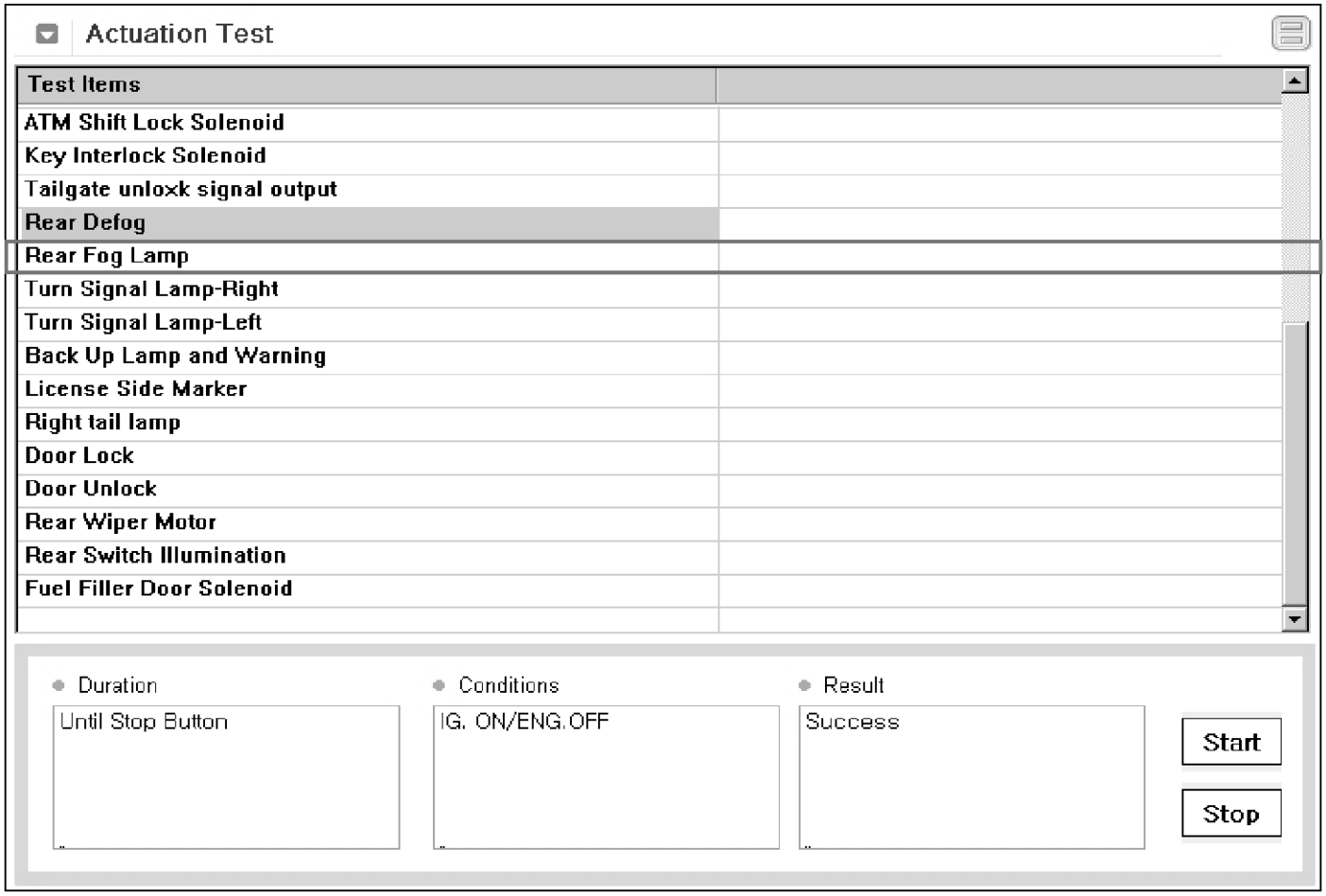

SHMBE9G02L

5. Is Rear Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Fog Lamp Circuit Inspection" procedure.

Rear Fog Lamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM connector.
3. Measure resistance between the Rear Fog Lamp terminal of RAM harness connector and ground of the Rear Fog Lamp.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair open in circuit of Right Fog Lamp or Right Fog Lamp internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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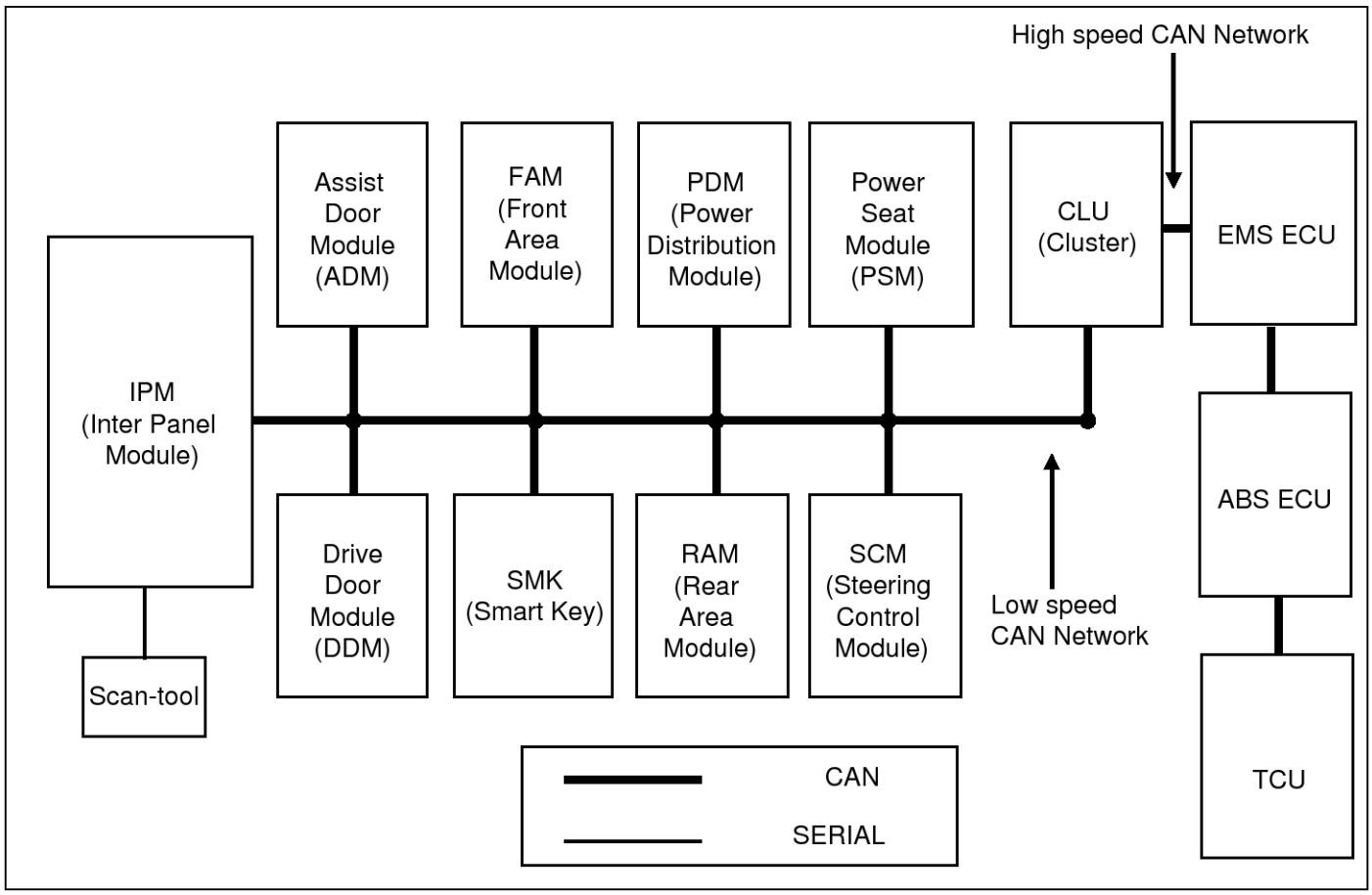
B2579 Right Rear Tail Marker Lamp Short to Ground

General Description

Once IPM receives taillamp switch working signal, it sends the signal to RAM by CAN communition. RAM turns on the right taillamp.



SHMBE9G00L

DTC Description

This code is set when right taillamp circuit is shortted to ground for more than 150ms during right taillamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in right taillamp circuit • Faulty right taillamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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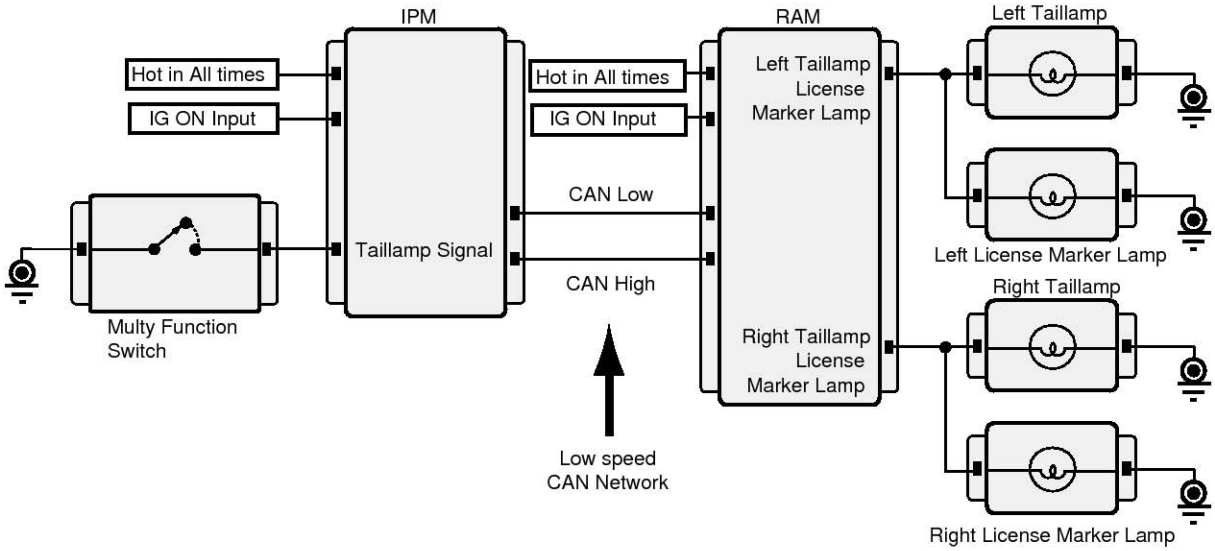
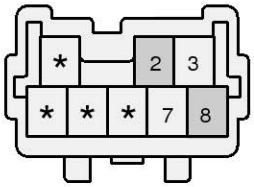
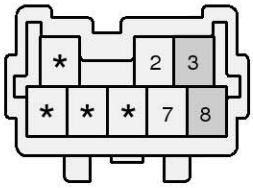


<Right License Marker Lamp >



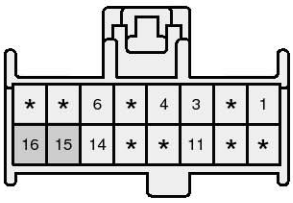
2. Right Taillamp License Marker Lamp
8. Ground

<Left License Marker Lamp>



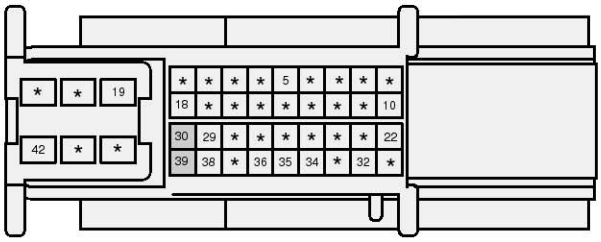
3. Left Taillamp License Marker Lamp
8. Ground

<RAM>



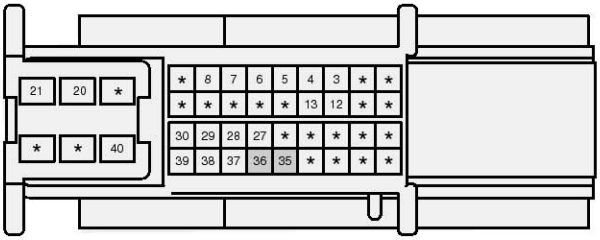
15. Right Taillamp License Marker Lamp
16. Left Taillamp License Marker Lamp

<IPM>



30. Can High
39. Can Low

<RAM>



35. Can Low
36. Can High

SHMBE9G32L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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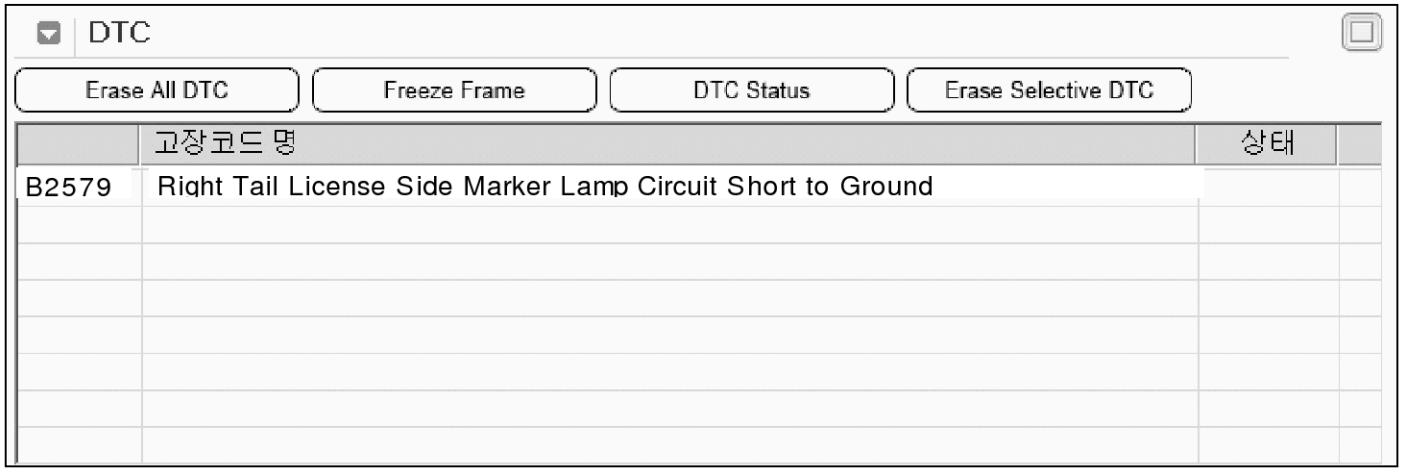

SHMBE9G07L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Taillamp and License Marker Lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Taillamp and License Marker Lamp" test.

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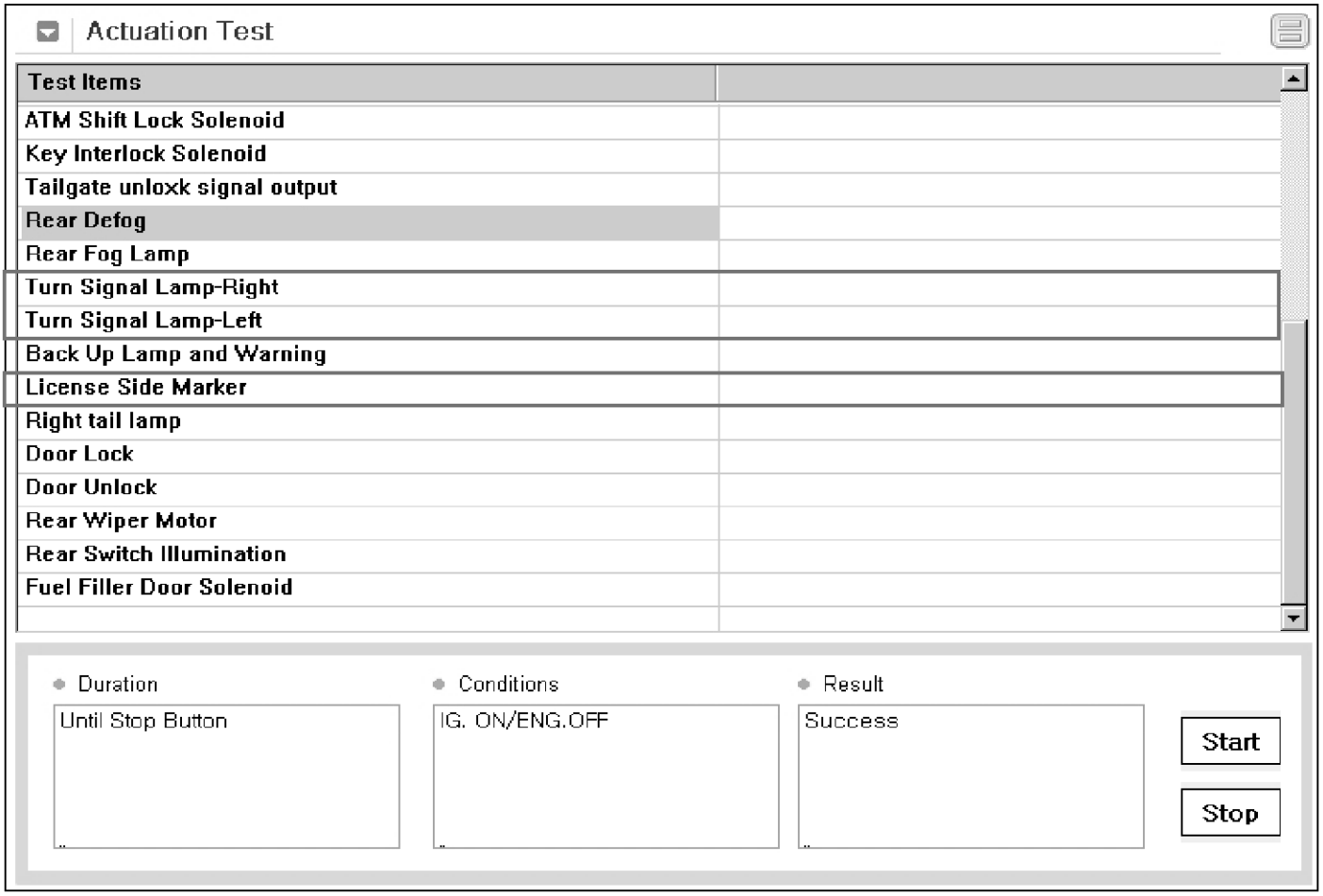

SHMBE9G08L

5. Is Rear Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure..

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Taillamp Circuit Inspection" procedure.

Right Taillamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, right taillamp connector.
3. Measure resistance between the right taillamp terminal of RAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of right taillamp, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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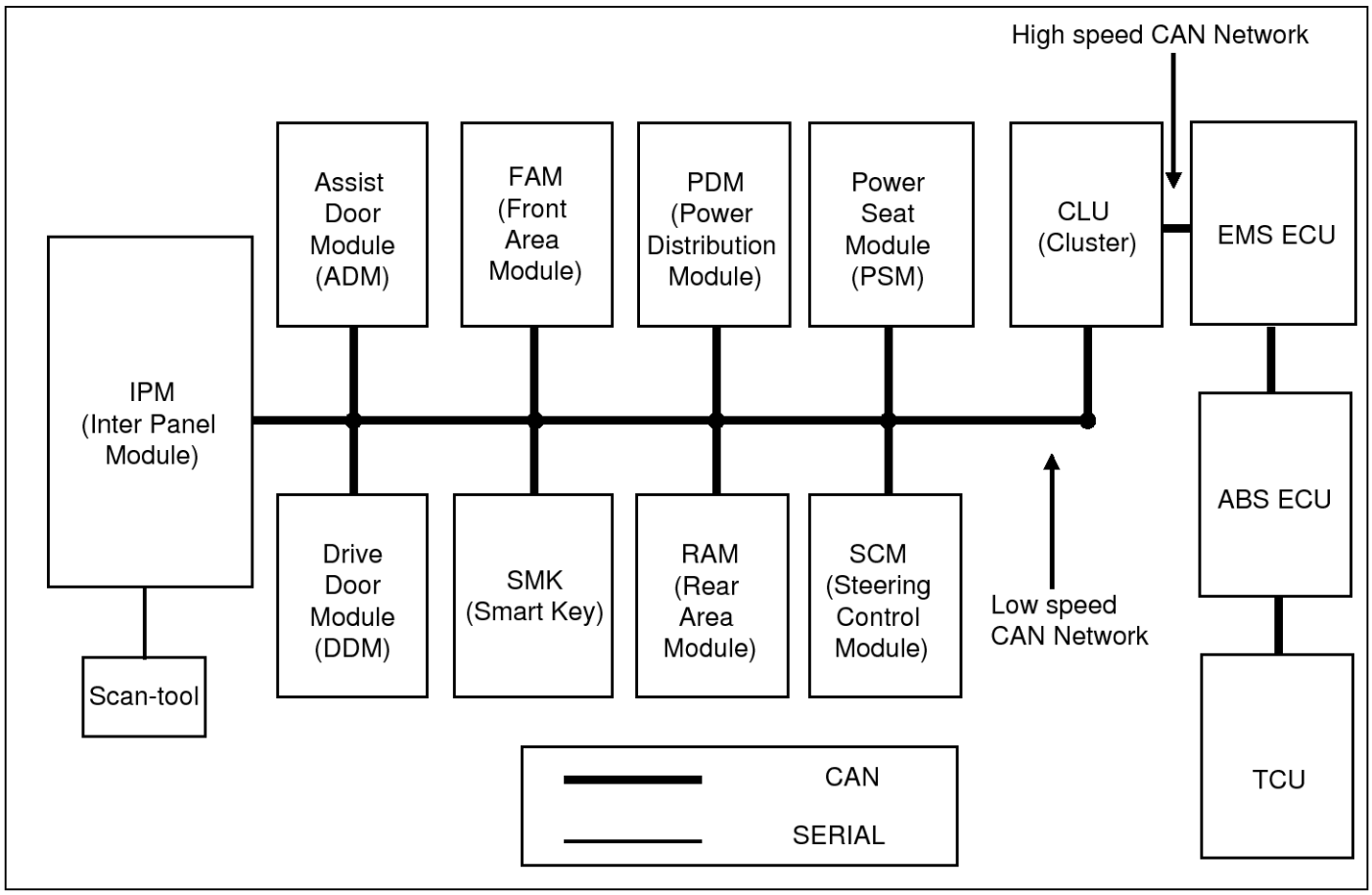
B2581 Right Rear Tail Marker Lamp Open

General Description

Once IPM receives taillamp switch working signal, it sends the signal to RAM by CAN communition. RAM turns on the right taillamp.



SHMBE9G00L

DTC Description

This code is set when right taillamp circuit is open for more than 150ms during right taillamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in right taillamp circuit • Faulty right taillamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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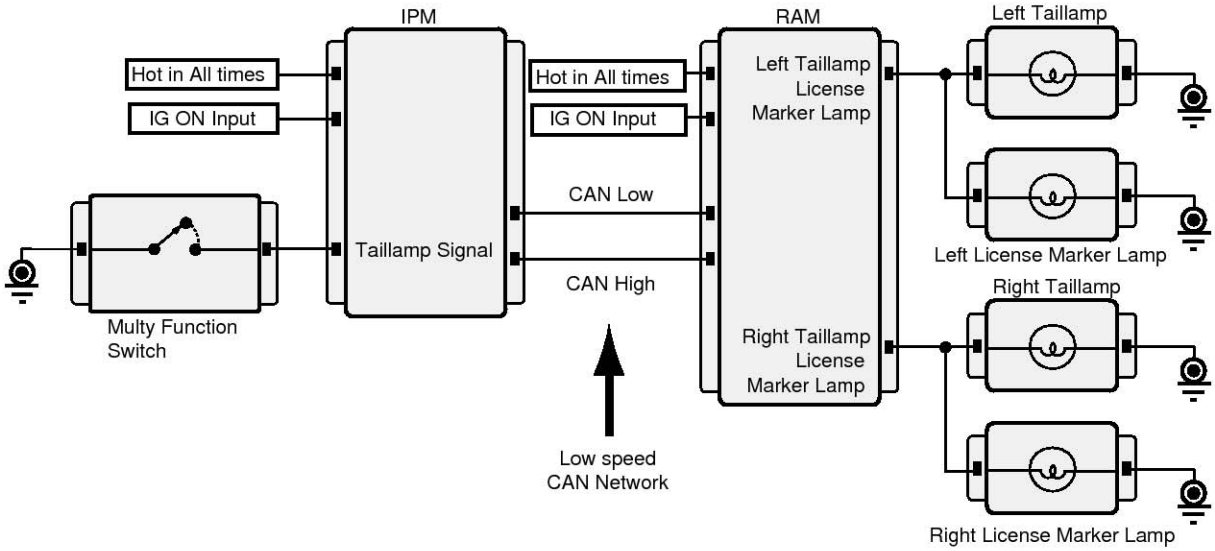
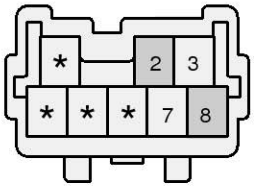
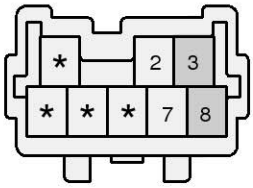


<Right License Marker Lamp >



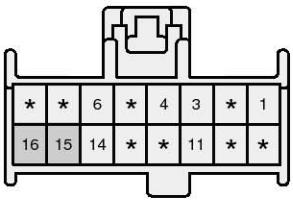
2. Right Taillamp License Marker Lamp
8. Ground

<Left License Marker Lamp>



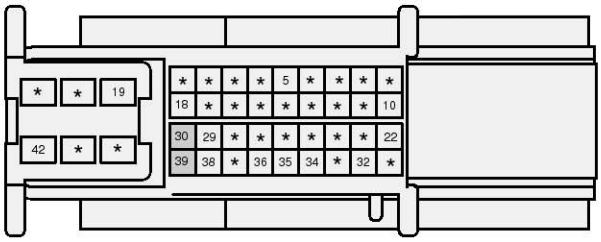
3. Left Taillamp License Marker Lamp
8. Ground

<RAM>



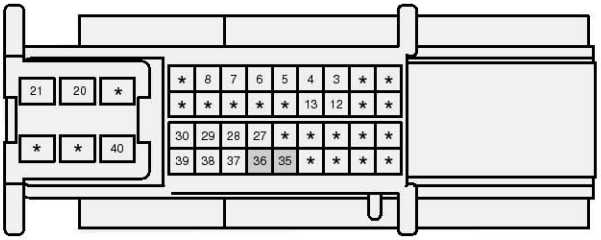
15. Right Taillamp License Marker Lamp
16. Left Taillamp License Marker Lamp

<IPM>



30. Can High
39. Can Low

<RAM>



35. Can Low
36. Can High

SHMBE9G32L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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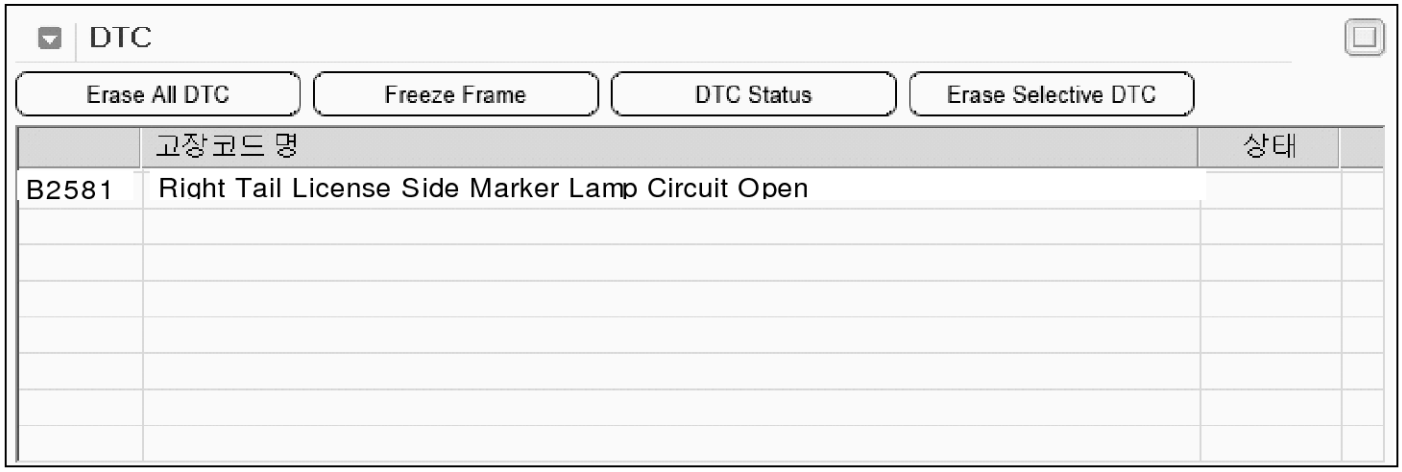

SHMBE9G10L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Taillamp and License Marker Lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Taillamp and License Marker Lamp" test.

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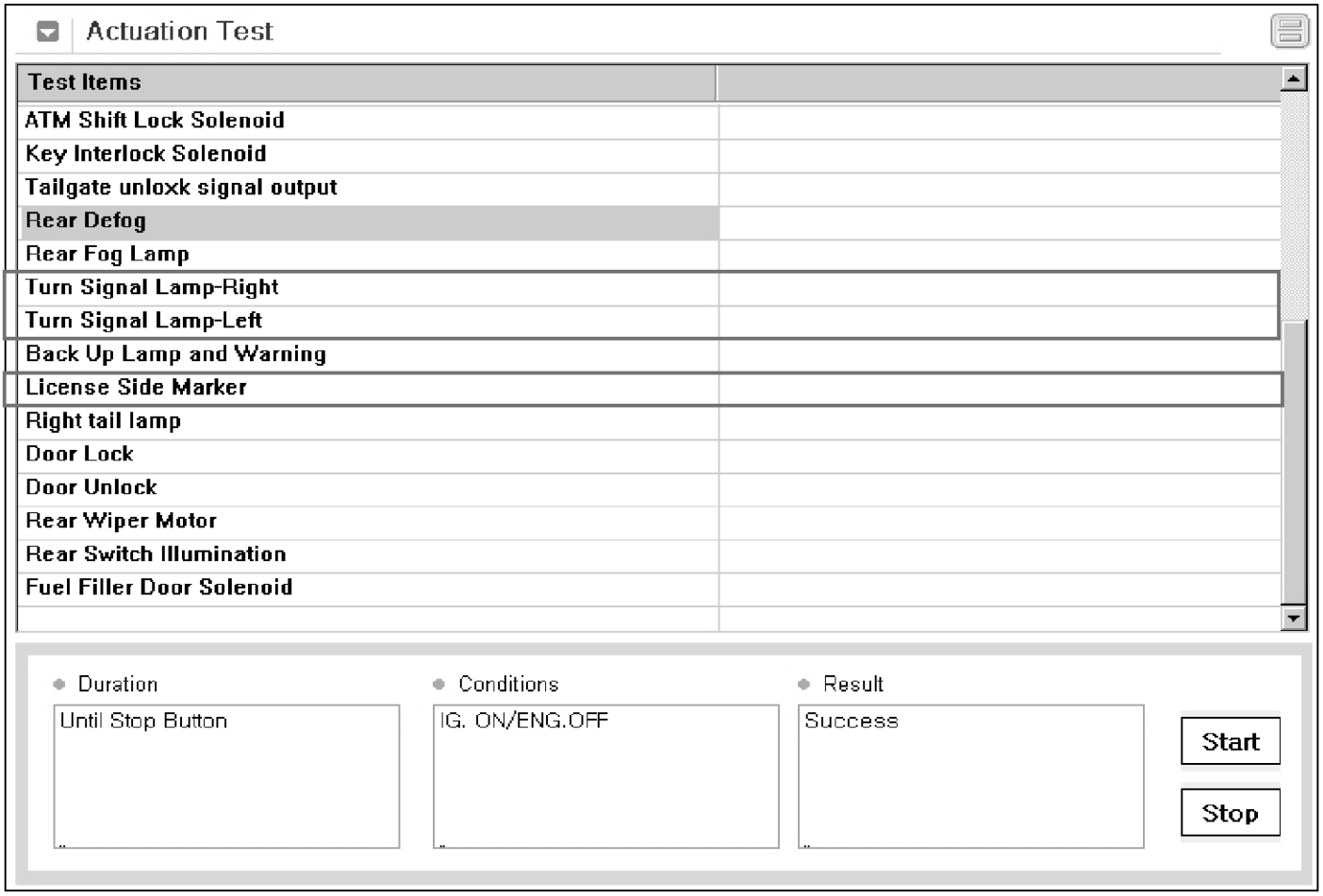

SHMBE9G08L

5. Is Rear Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Right Taillamp Circuit Inspection" procedure.

Right Taillamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, right taillamp connector.
3. Measure resistance between the Right Taillamp terminal of RAM harness connector and ground of the Right Headlamp High.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair open in circuit of Right Headlamp High or Left Headlamp High internal open, and go to "Verification of Vehicle Repair" procedure.

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Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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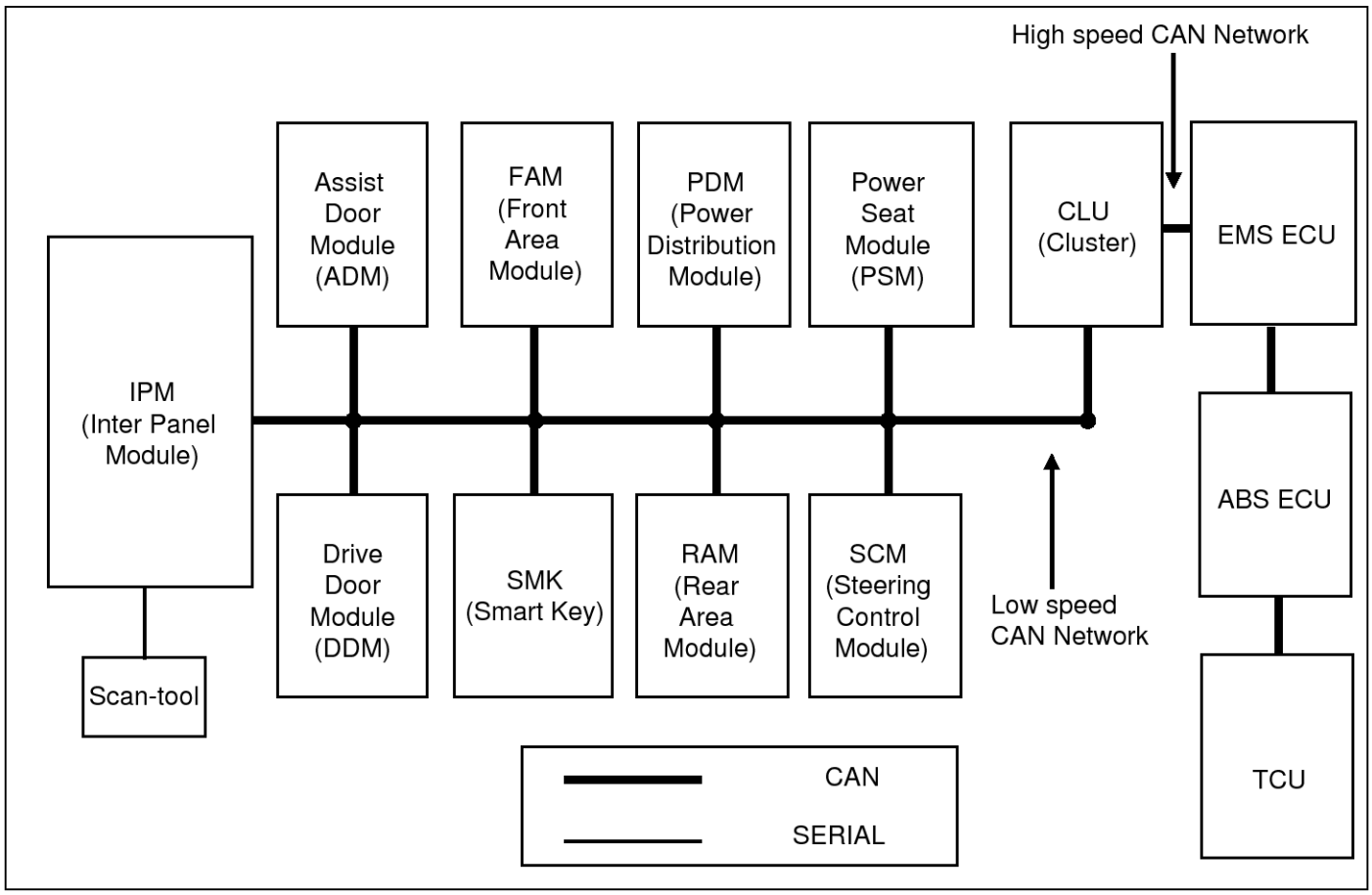
B2583 Left Rear Tail Marker Lamp Short to Ground

General Description

Once IPM receives taillamp switch working signal, it sends the signal to RAM by CAN communition. RAM turns on the left taillamp.



SHMBE9G00L

DTC Description

This code is set when left taillamp circuit is shortted to ground for more than 150ms during left taillamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in left taillamp circuit • Faulty left taillamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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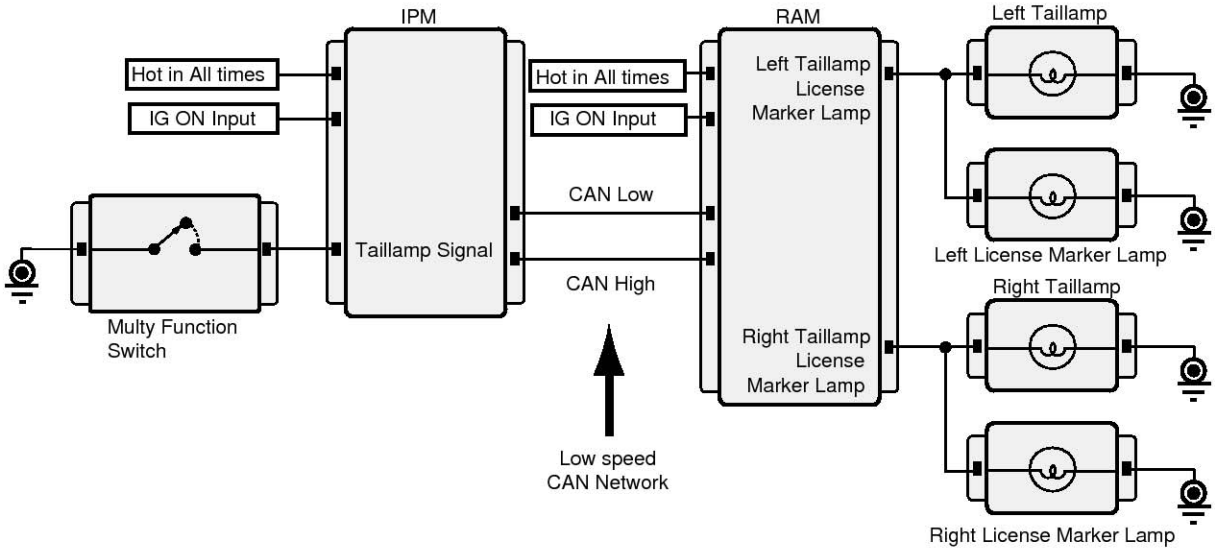
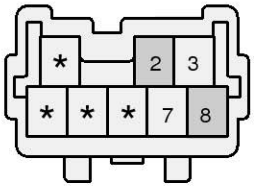
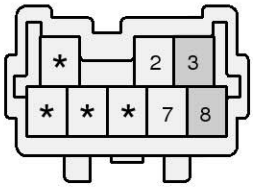


<Right License Marker Lamp >



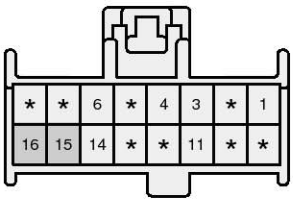
2. Right Taillamp License Marker Lamp
8. Ground

<Left License Marker Lamp>



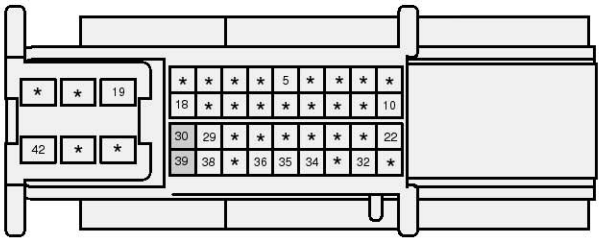
3. Left Taillamp License Marker Lamp
8. Ground

<RAM>



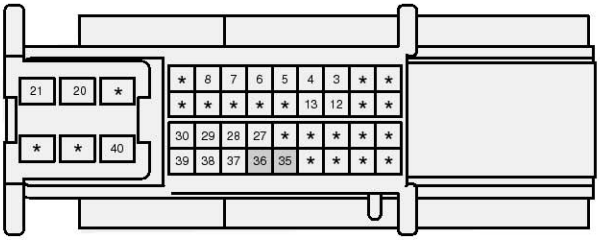
15. Right Taillamp License Marker Lamp
16. Left Taillamp License Marker Lamp

<IPM>



30. Can High
39. Can Low

<RAM>



35. Can Low
36. Can High

SHMBE9G32L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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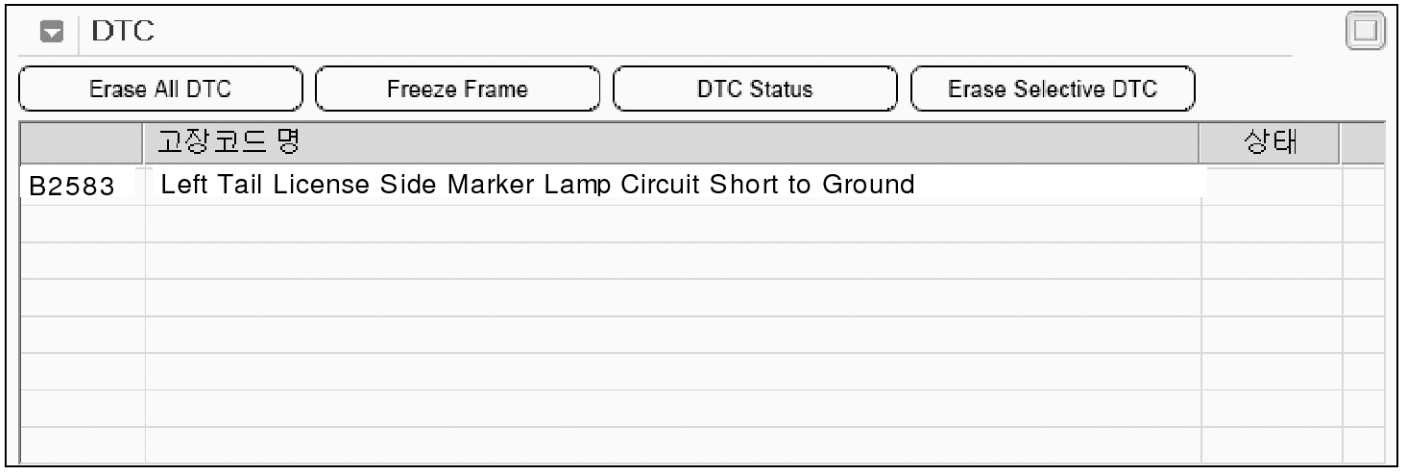

SHMBE9G09L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Taillamp and License Marker Lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Taillamp and License Marker Lamp" test.

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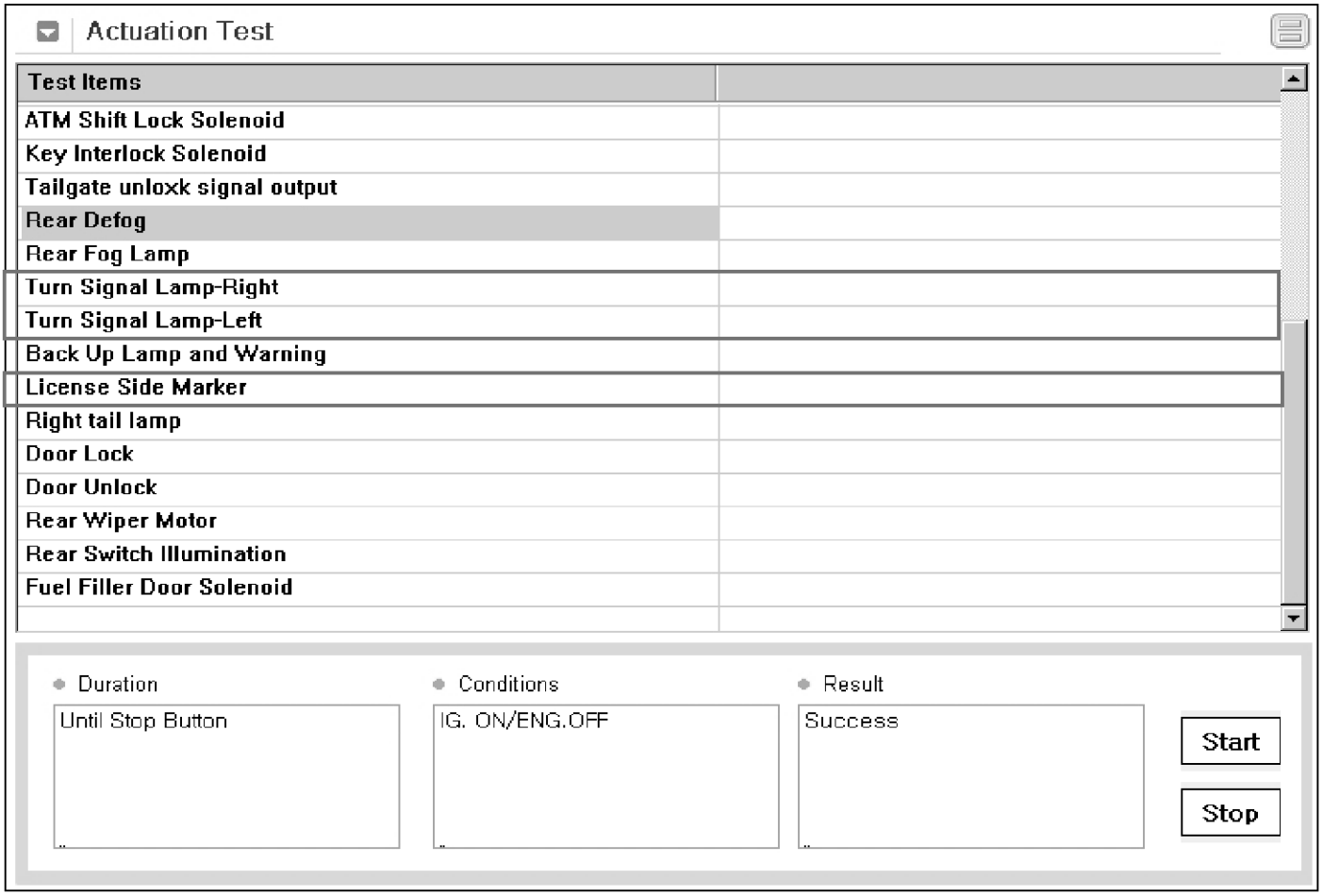

SHMBE9G08L

5. Is Rear Fog Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Taillamp Circuit Inspection" procedure.

Left Taillamp Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, left taillamp connector.
3. Measure resistance between the left taillamp terminal of RAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of left taillamp, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

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After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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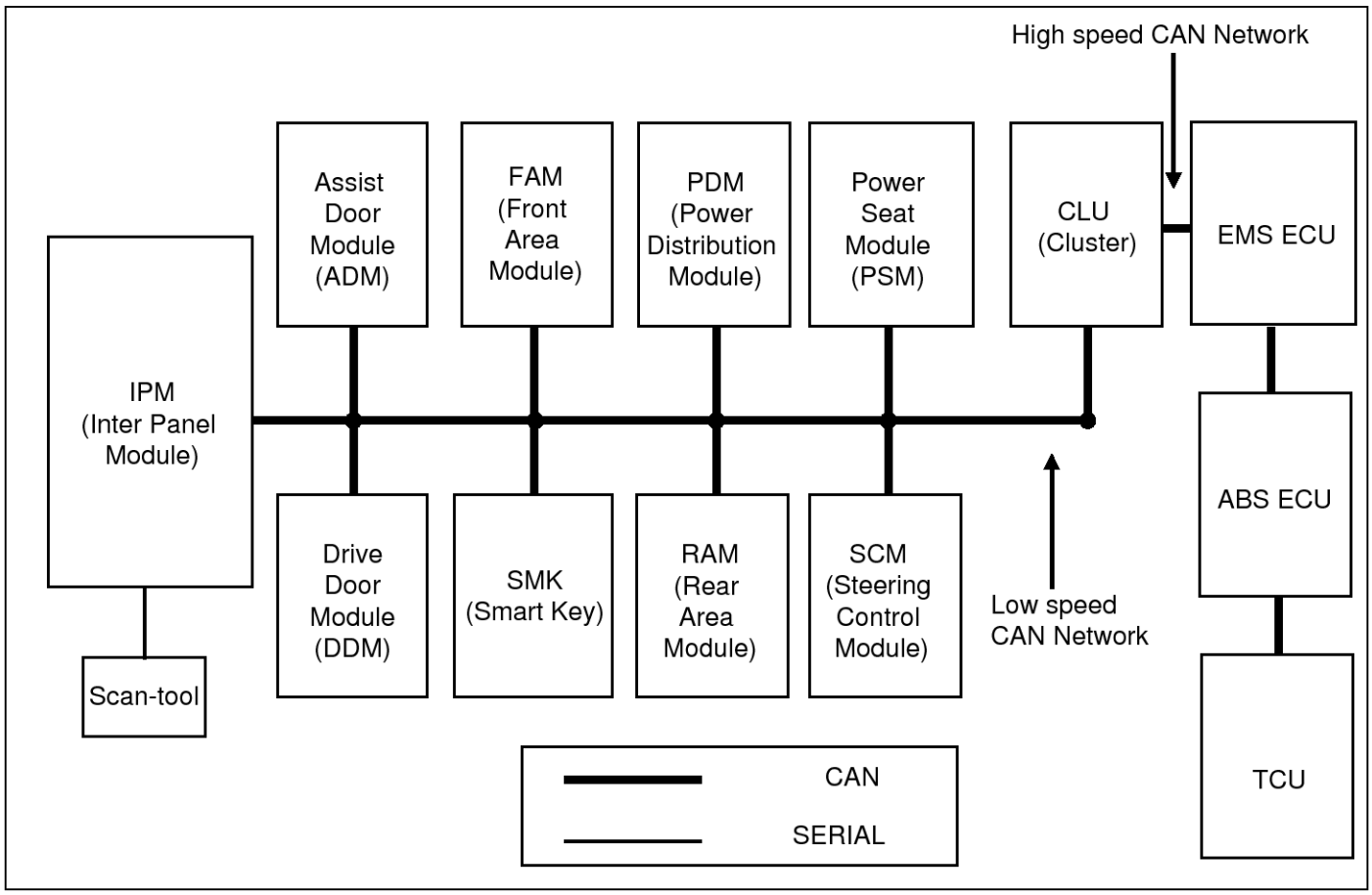
B2585 Left Rear Tail Marker Lamp Open

General Description

Once IPM receives taillamp switch working signal, it sends the signal to RAM by CAN communition. RAM turns on the left taillamp.



SHMBE9G00L

DTC Description

This code is set when left taillamp circuit is open for more than 150ms during left taillamp operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in left taillamp circuit • Faulty left taillamp • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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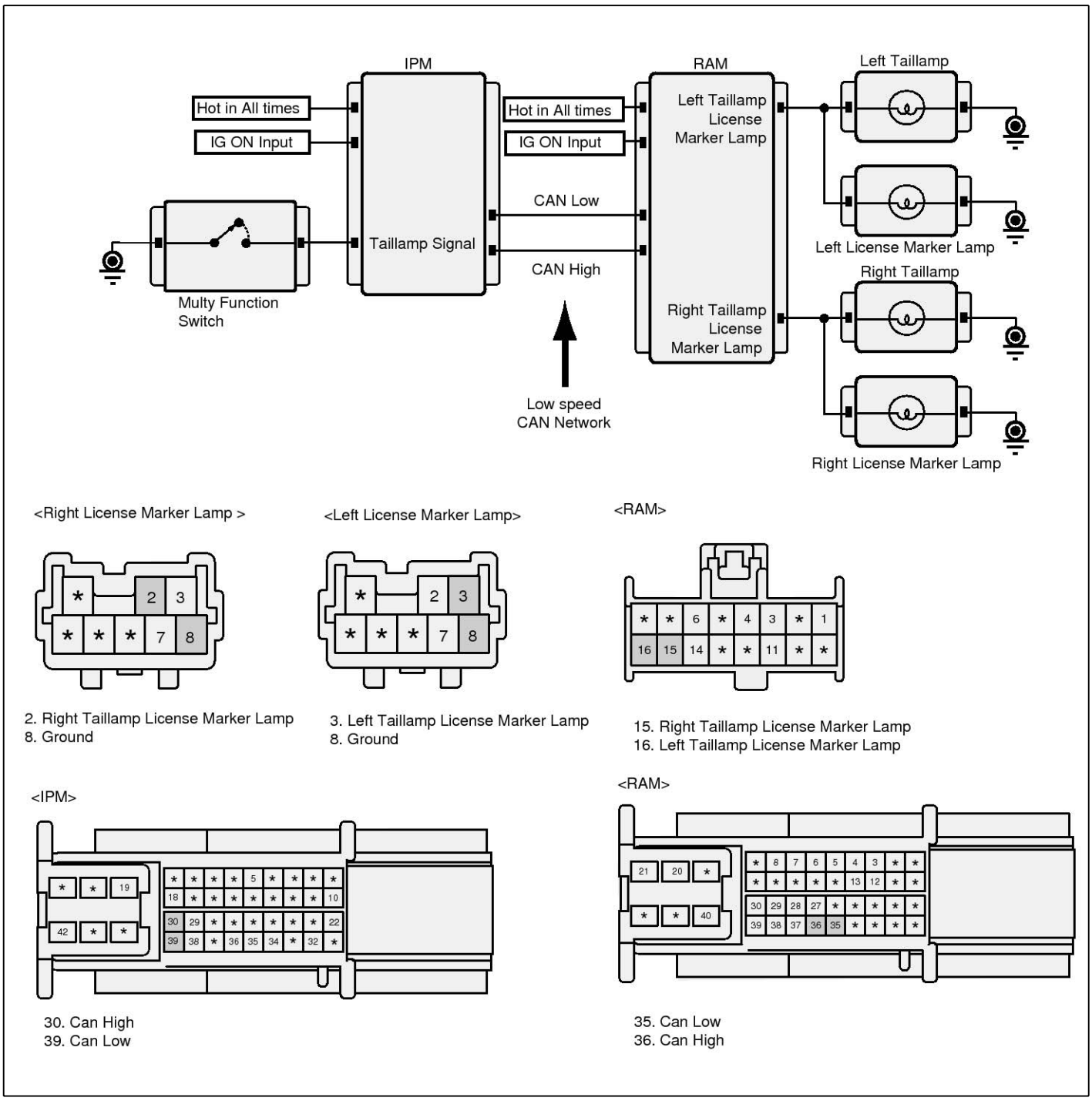

SHMBE9G32L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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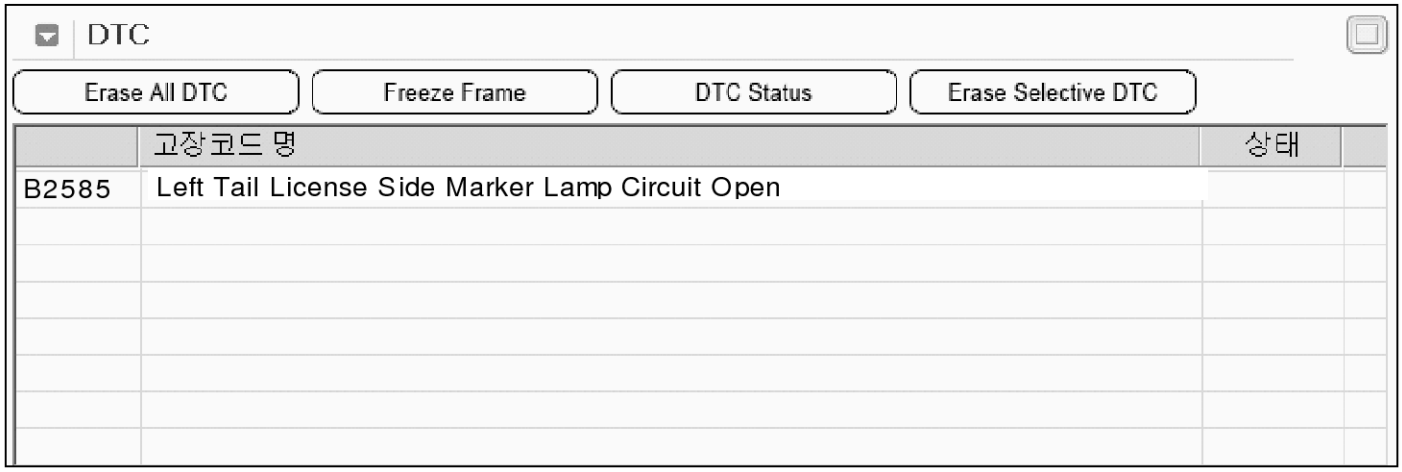

SHMBE9G11L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Taillamp and License Marker Lamp

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Taillamp and License Marker Lamp" test.

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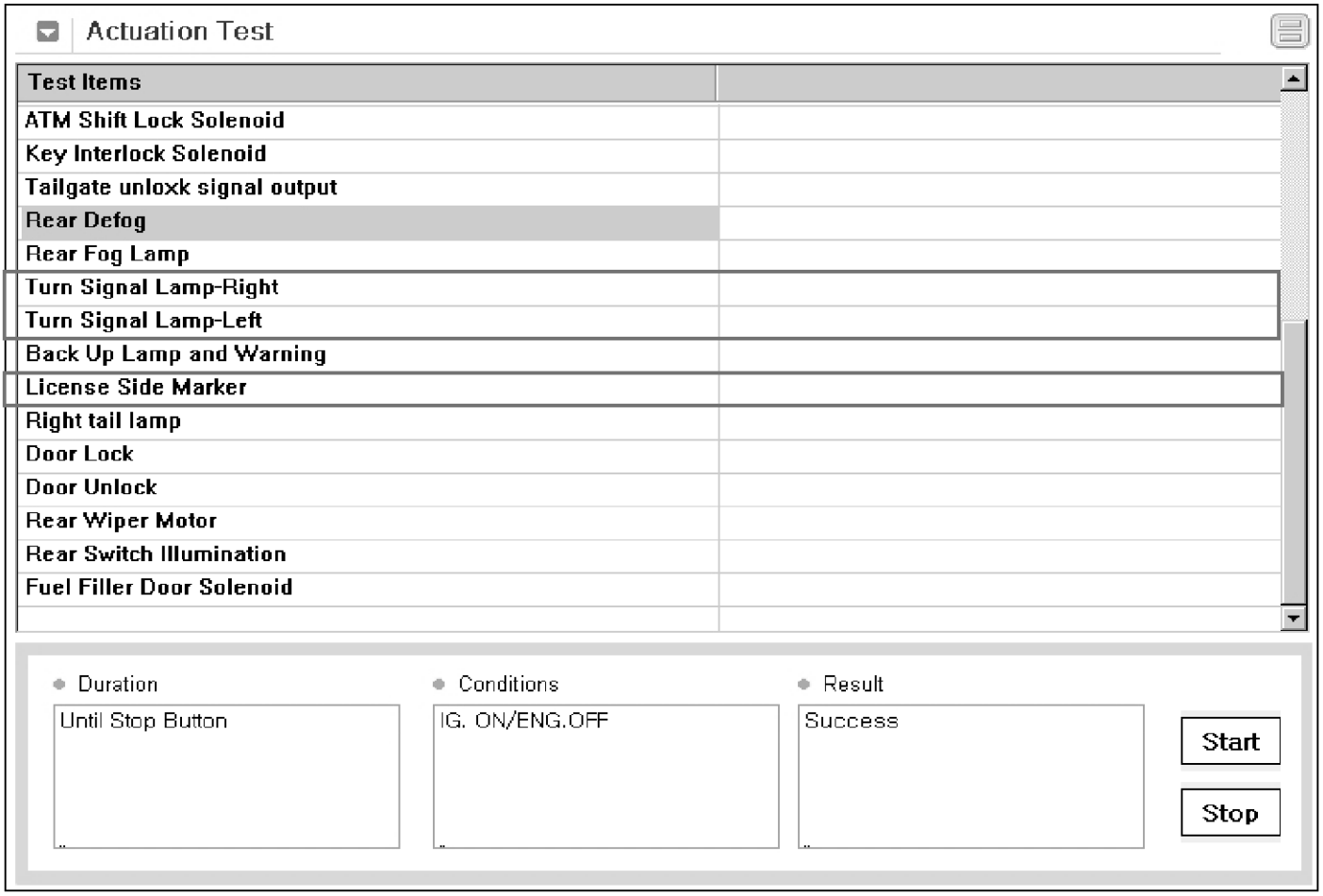

SHMBE9G08L

5. Is Taillamp and License Marker Lamp working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Left Taillamp Circuit Inspection" procedure.

Left Taillamp Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM connector.
3. Measure resistance between the Left Taillamp terminal of RAM harness connector and ground of the Left Headlamp High.

Specification: Approx. 1 Ω

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair open in circuit of Left taillamp or Left taillamp internal open, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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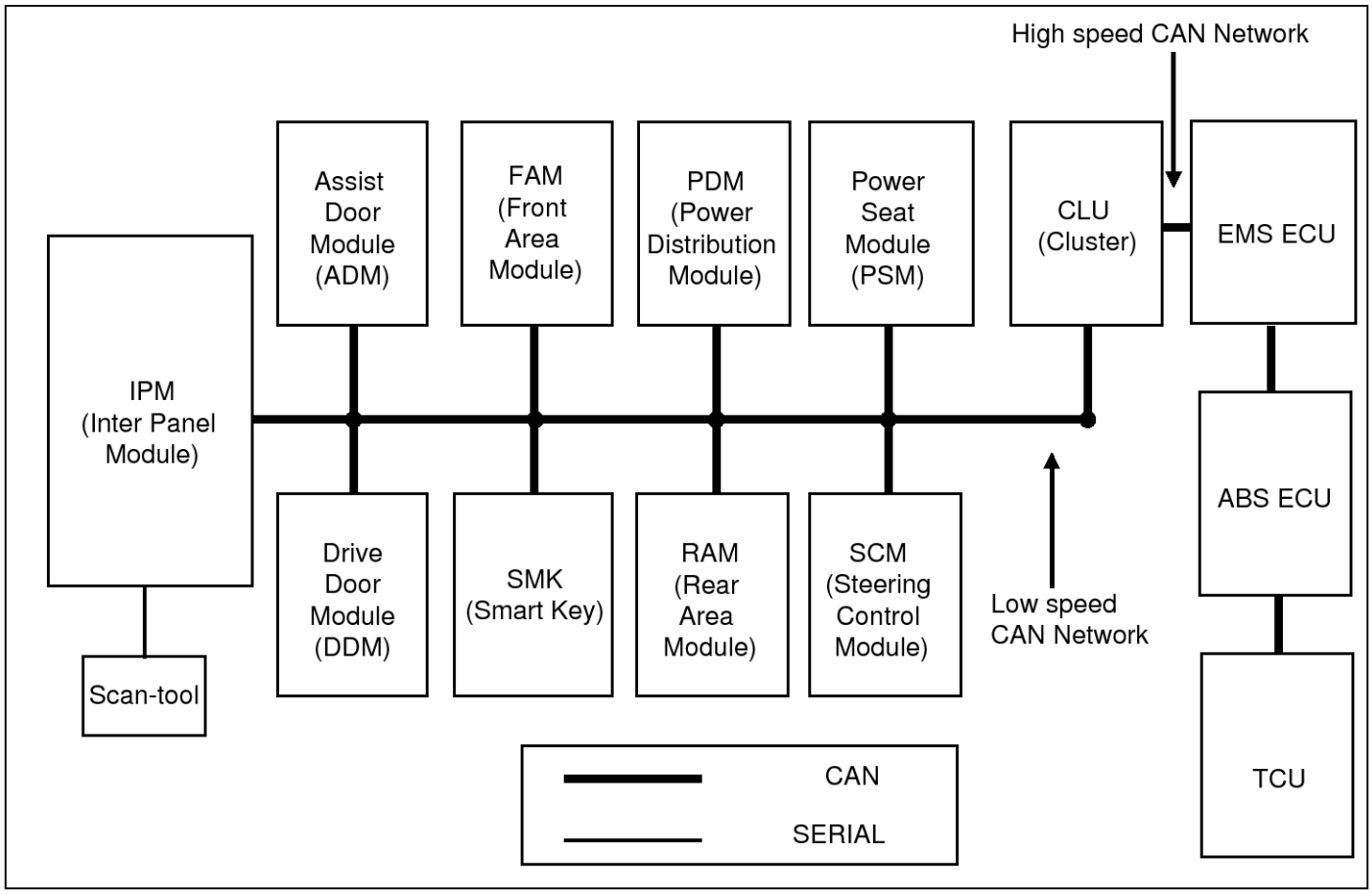
B2587 Back Up Lamp Short to Ground

General Description

TCU receives shift lever position signal When driver sets shift lever at the R position for backward driving. TCU transfers it to cluster by high CAN communication. Cluster transfers it to RAM by low CAN communication. RAM turns on back up lamp.



SHMBE9G00L

DTC Description

This code is set when back up lamp and backwarning system circuit is shortted to ground for more than 150ms during back up lamp and backwarning system operating.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in back up lamp and backwarning system circuit • Faulty back up lamp and backwarning system • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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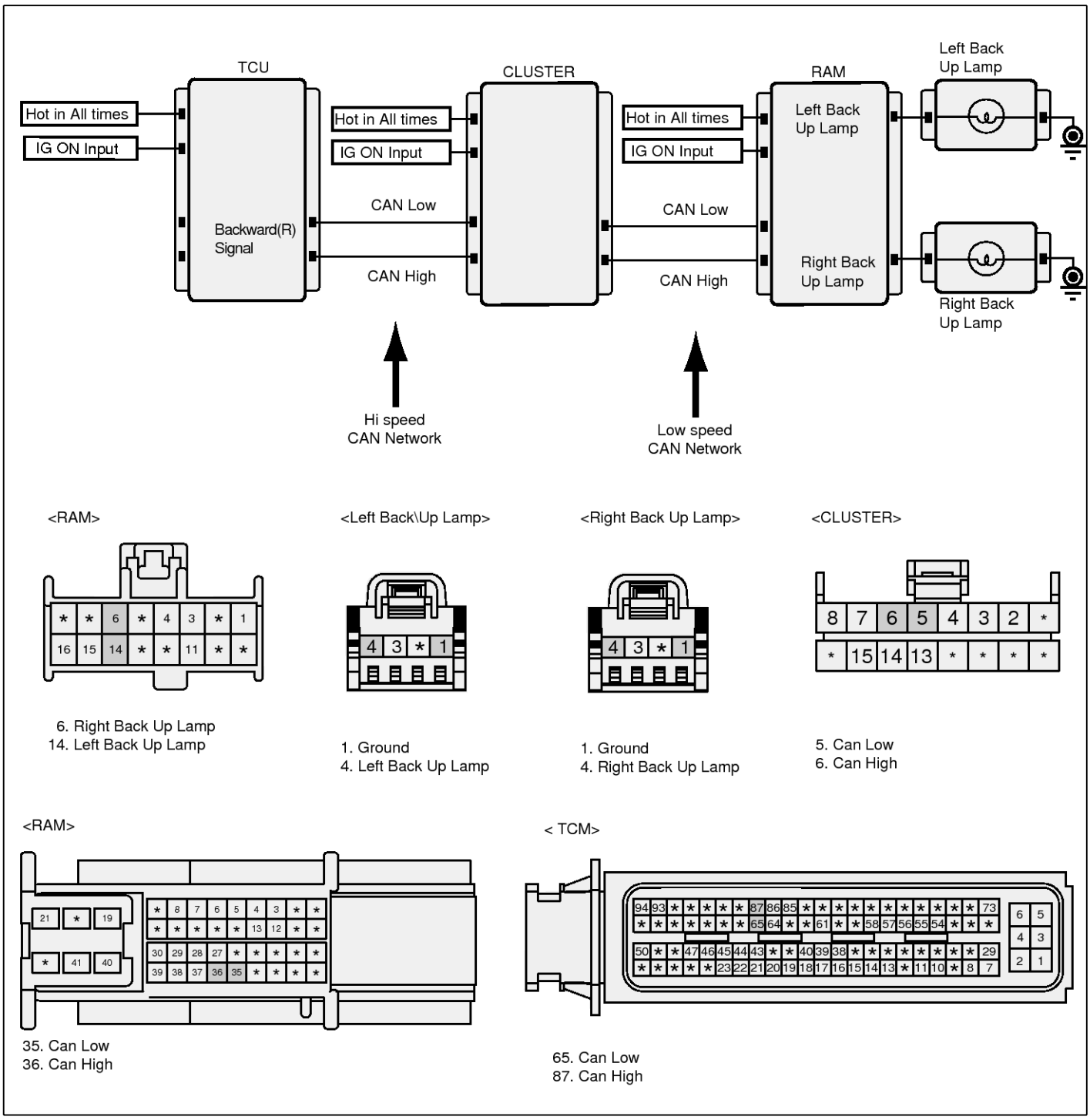

SHMBE9G31L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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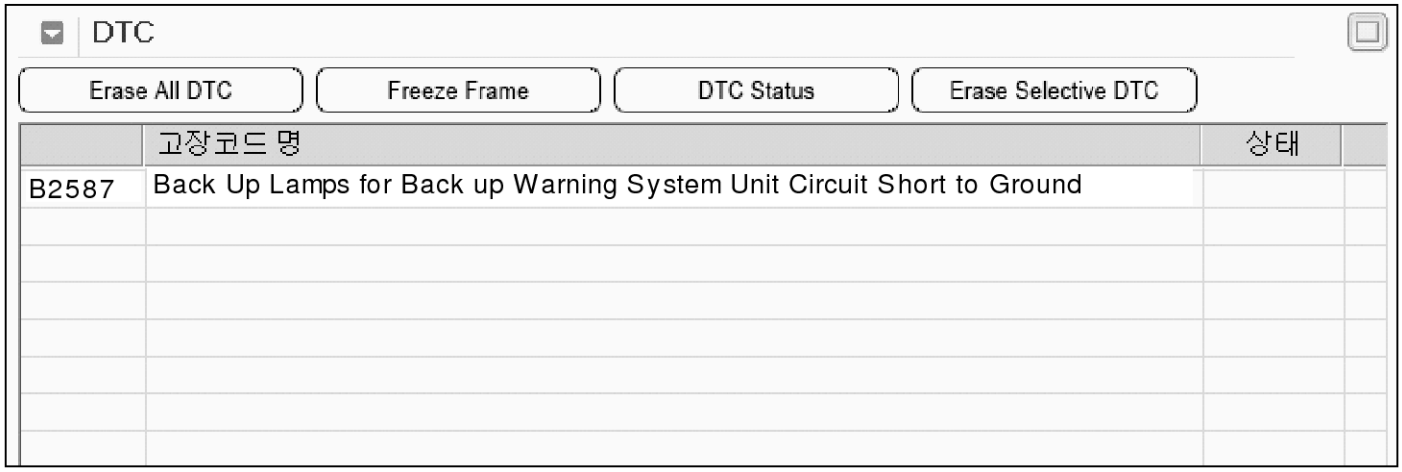

SHMBE9G04L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check back up lamp and backwarning system

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "back up lamp and backwarning system" test.

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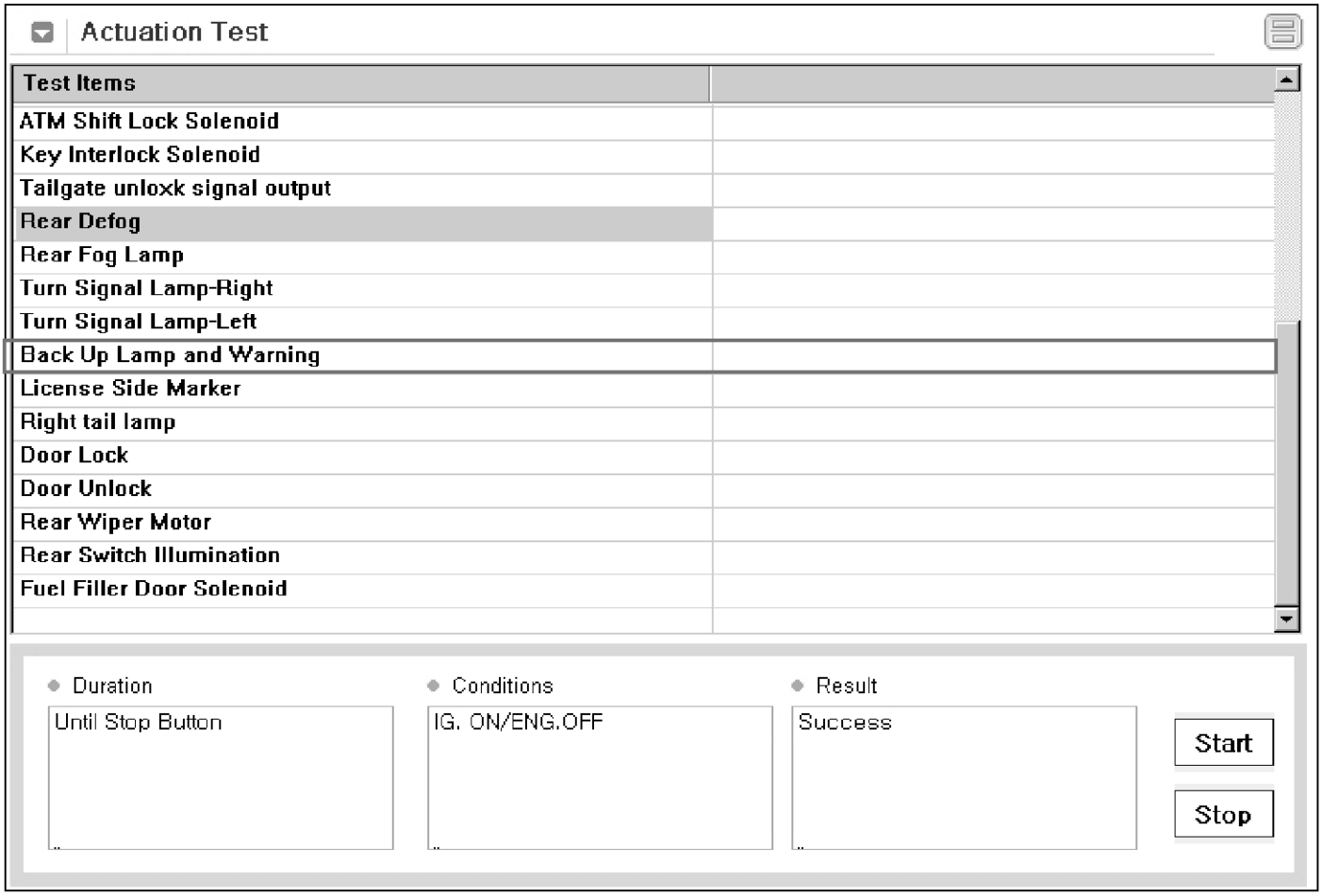

SHMBE9G05L

5. Is back up lamp and backwarning system working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Back Up Lamp and Backwarning System Circuit Inspection" procedure.

Back Up Lamp and Backwarning System Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, back up lamp and backwarning system connector.
3. Measure resistance between the back up lamp and backwarning system terminal of RAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

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YES ▶ Substitute with a known - good BWS and check for proper operation.
If the problem is corrected, replace the BSW and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair short to ground in circuit of back up lamp and backwarning system, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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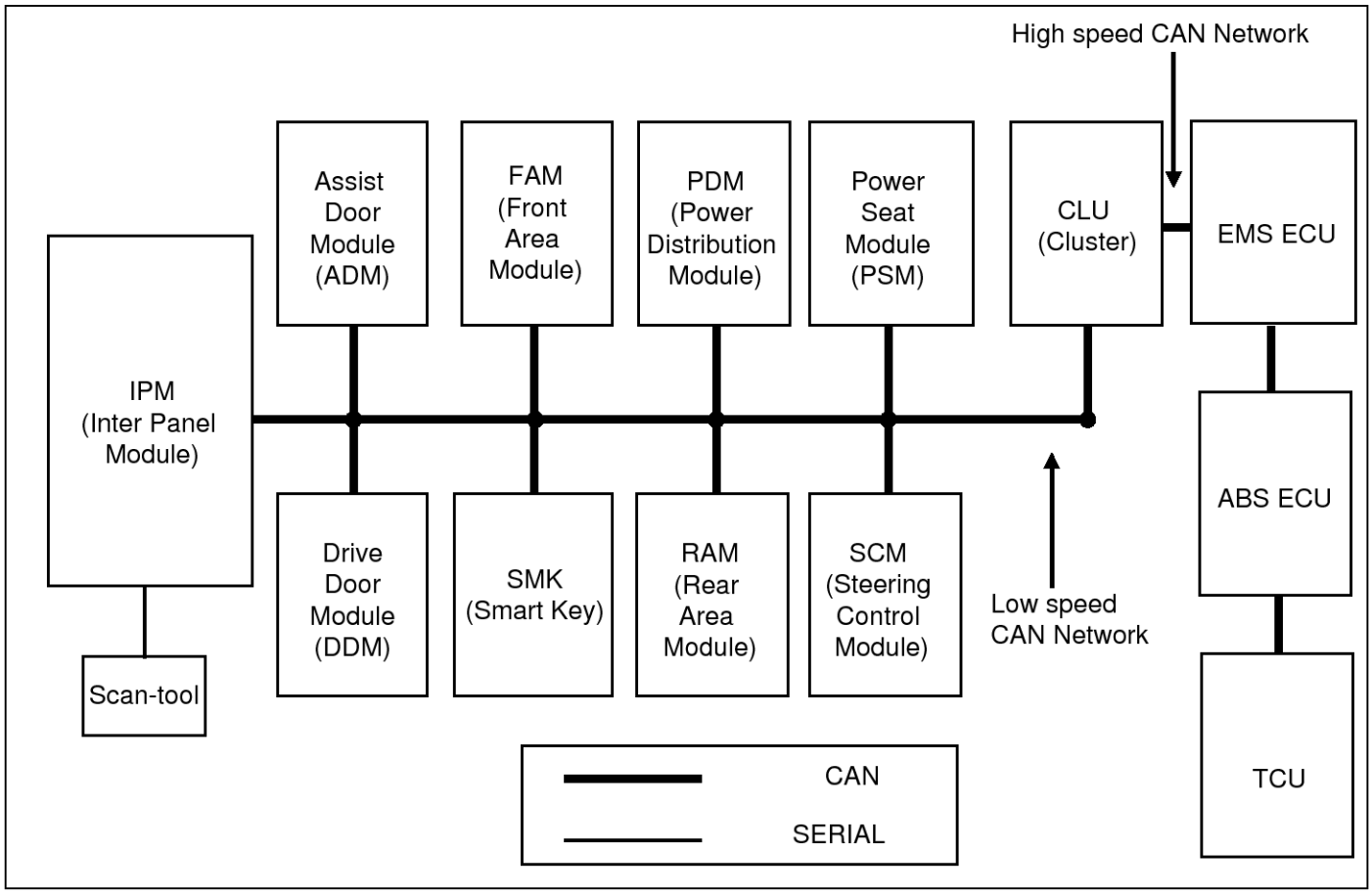
B2589 Back Up Lamp Open

General Description

TCU receives shift lever position signal When driver sets shift lever at the R position for backward driving. TCU transfers it to cluster by high CAN communication. Cluster transfers it to RAM by low CAN communication. RAM turns on back up lamp.



SHMBE9G00L

DTC Description

This code is set when back up lamp and backwarning system circuit is open for more than 150ms during back up lamp operating.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Open in back up lamp and backwarning system circuit • Faulty back up lamp and backwarning system • Faulty RAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is normal if output voltage is 12V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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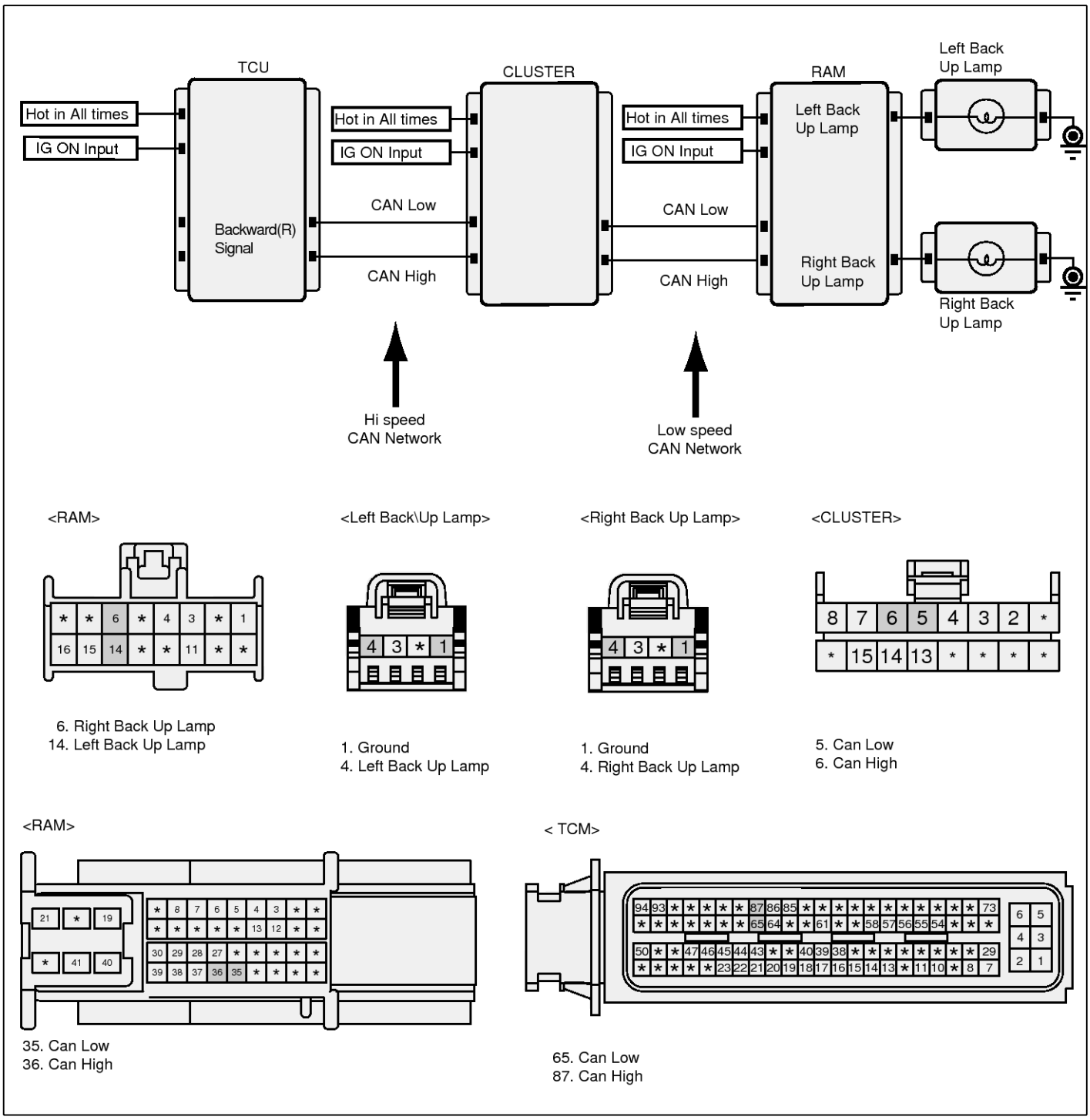
https://autolibrary.ir



SHMBE9G31L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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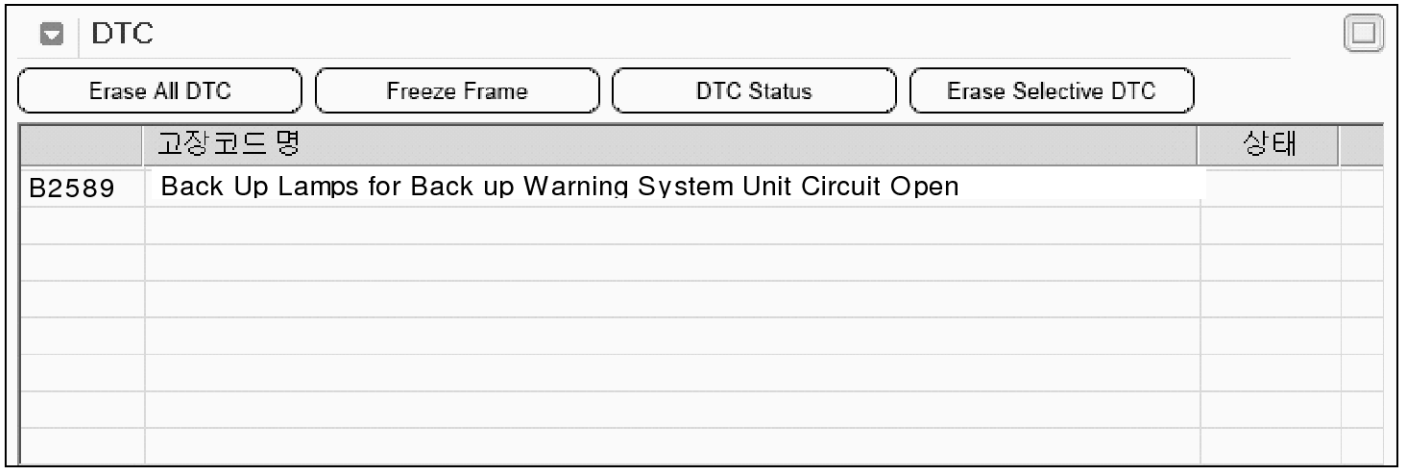

SHMBE9G06L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check back up lamp and backwarning system

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "back up lamp and backwarning system" test..

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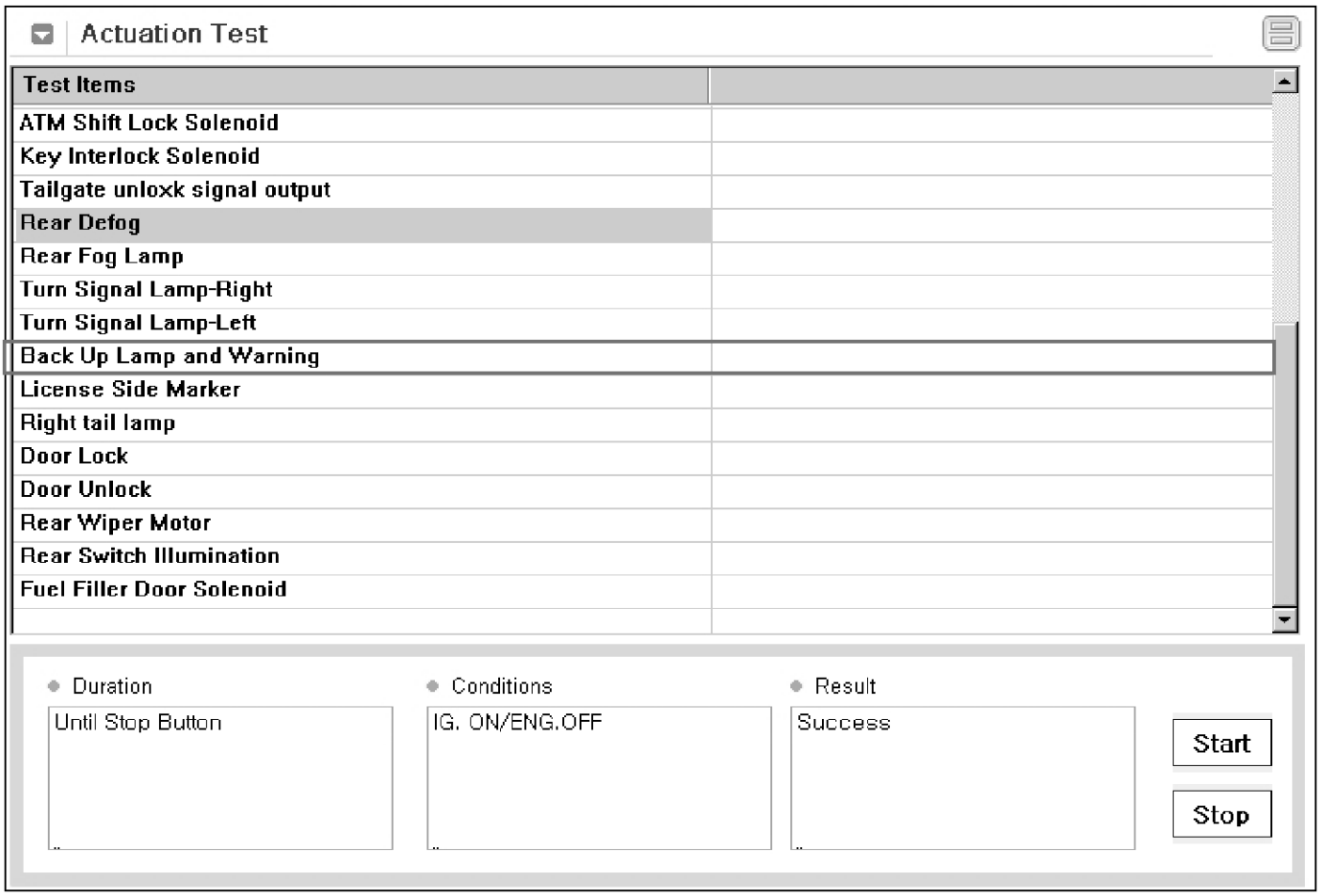

SHMBE9G05L

5. Is back up lamp and backwarning system working normal ?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Back Up Lamp and Backwarning System Circuit Inspection" procedure.

Back Up Lamp and Backwarning System Circuit Inspection

■ Check open in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM connector.
3. Measure resistance between the back up lamp terminal of RAM harness connector and ground of the back up lamp.
4. Measure resistance between the backwarning signal terminal of RAM harness connector and FBWS harness connector.

Specification: Approx. 1 Ω

5. Is the measured resistance within specification?

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YES ▶ Substitute with a known - good BWS and check for proper operation.
If the problem is corrected, replace the BSW and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good FAM and check for proper operation.
If the problem is corrected, replace the FAM and go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair open in circuit of back up lamp and backwarning system or back up lamp internal open, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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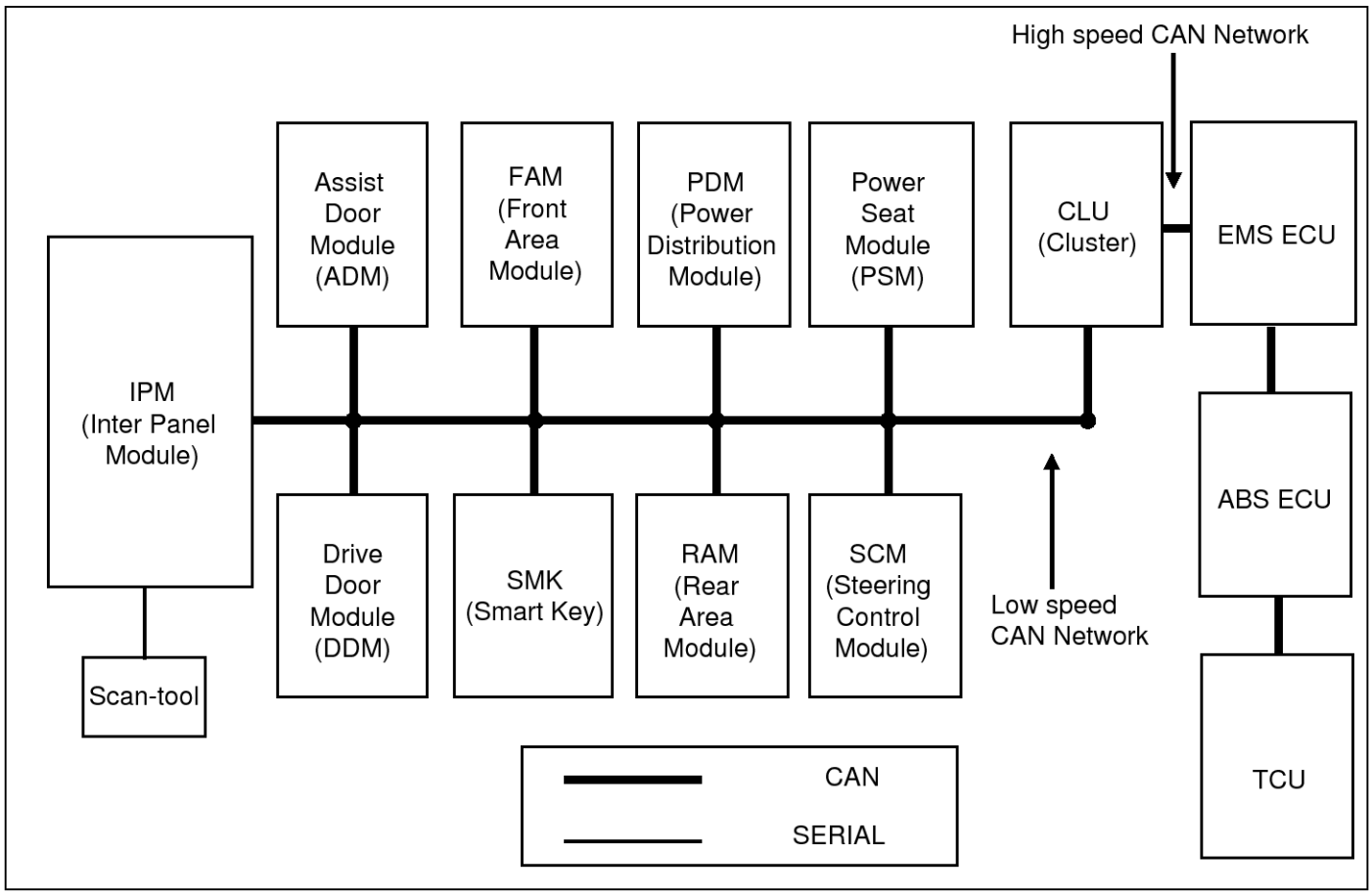
B2599 Right Rear Blower Switch Illumination Circuit Short to Ground

General Description

Once IPM receives taillight switch working signal, it sends the signal to RAM by CAN communition. RAM turns on rear blower switch illumination.



SHMBE9G00L

DTC Description

This code is set when rear blower switch illumination circuit is shortted to ground for more than 150ms during rear blower switch illumination operating.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Load Mornitoring	• Poor connection • Short to ground in rear blower switch illumination circuit • Faulty rear blower switch illumination • Faulty FAM
Enable Conditions	• IG KEY ON.	
Threshold Value	• It is abnormal if output voltage is 0V.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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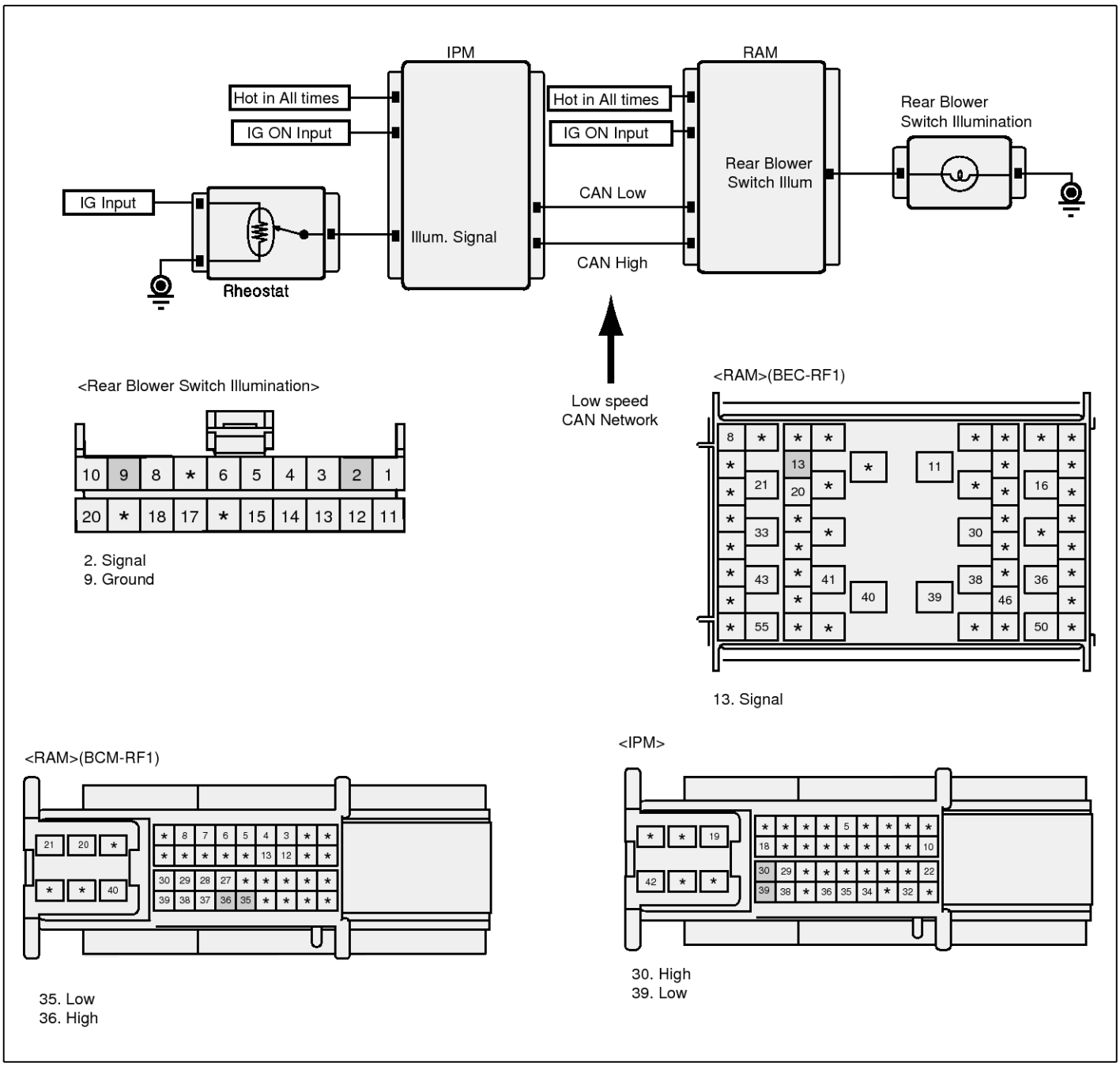

SHMBE9G34L

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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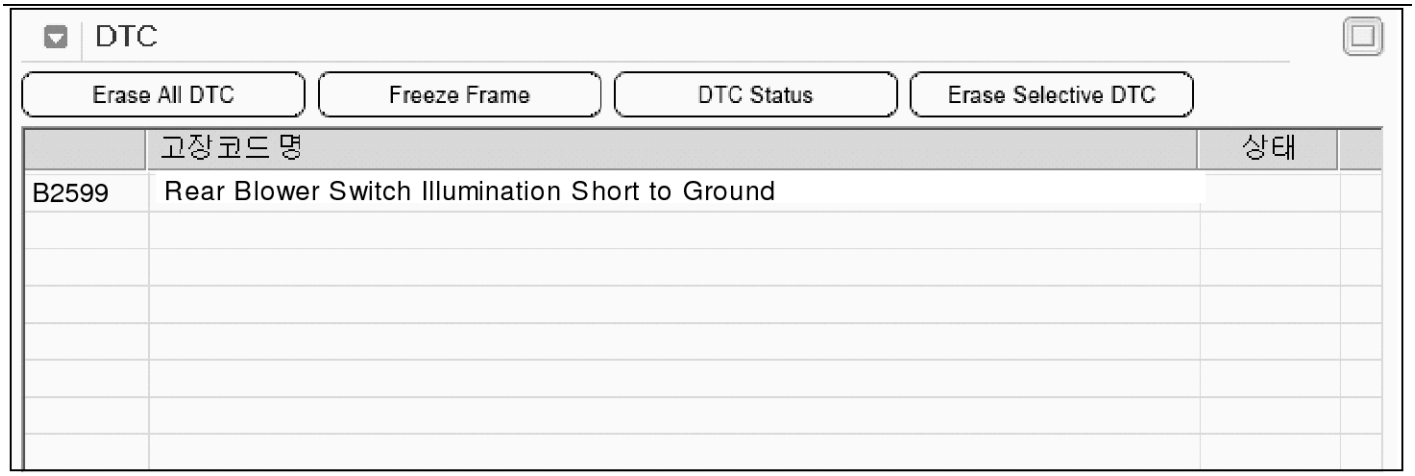

SHMBE9G19L

5. Is the same DTC occurred again?

YES ▶ Go to next procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or RAM's connector or was repaired and RAM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

■ Check Rear Blower Switch Illumination

1. IG "OFF" and connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Rear Blower Switch Illumination" test.

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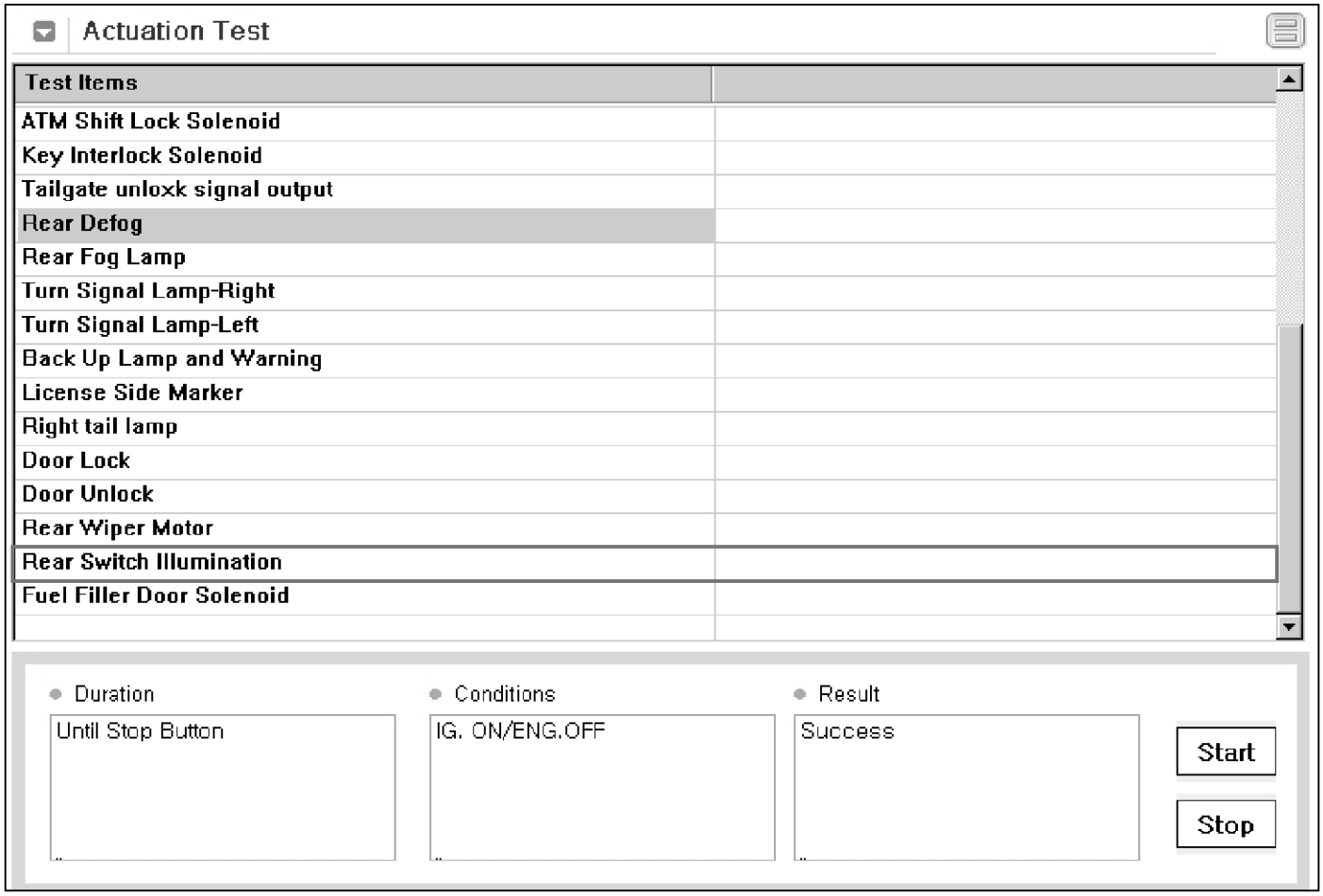

SHMBE9G20L

5. Is the service data normal?

YES ▶ Thoroughly check connectors for looseness , poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Rear Blower Switch Illumination Circuit Inspection" procedure.

Rear Blower Switch Illumination Circuit Inspection

■ Check short to ground in harness

1. IG "OFF", disconnect battery (-) terminal.
2. Disconnect RAM, Rear Blower Switch Illumination connector.
3. Measure resistance between the Rear Blower Switch Illumination terminal of RAM harness connector and chassis ground.

Specification: infinity

4. Is the measured resistance within specification?

YES ▶ Substitute with a known - good RAM and check for proper operation.
If the problem is corrected, replace the RAM and go to "Verification of Vehicle Repair" procedure.

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NO ▶ Repair short to ground in circuit of Rear Blower Switch Illumination, and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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Steering Column Module(SCM)

Diagnostic troubleshooting

SCM DTC List

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

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B1959 Tilt Position Sensor Error

General Description

IMS(Integrated Memory System) is a system which can memorize the position of power seat(PTM), tilt/telescope handle(SCM), side mirror(DDM/ADM) by position sensor and restores them to a previous position. (Memory function is not allowed during driving for safety reason)

DTC Description

SCM sets this code when amount of change of the tilt motor position sensor is little than 8edge (4pulse) for 1sec. This means that tilt motor/sensor stuck due to open or short in circuit or external cause (compulsive restriction)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring the motor's revolution by checking the pulse output of HALL sensor in the motor	• Open in the Tilt motor circuit • Open in the Tilt motor sensor circuit • Faulty Tilt motor/ sensor
Enable Conditions	• When the motor is running	
Threshold Value	• During the Tilt motor is operated, when the pulse input is less than 4 pulses within 1 second.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram

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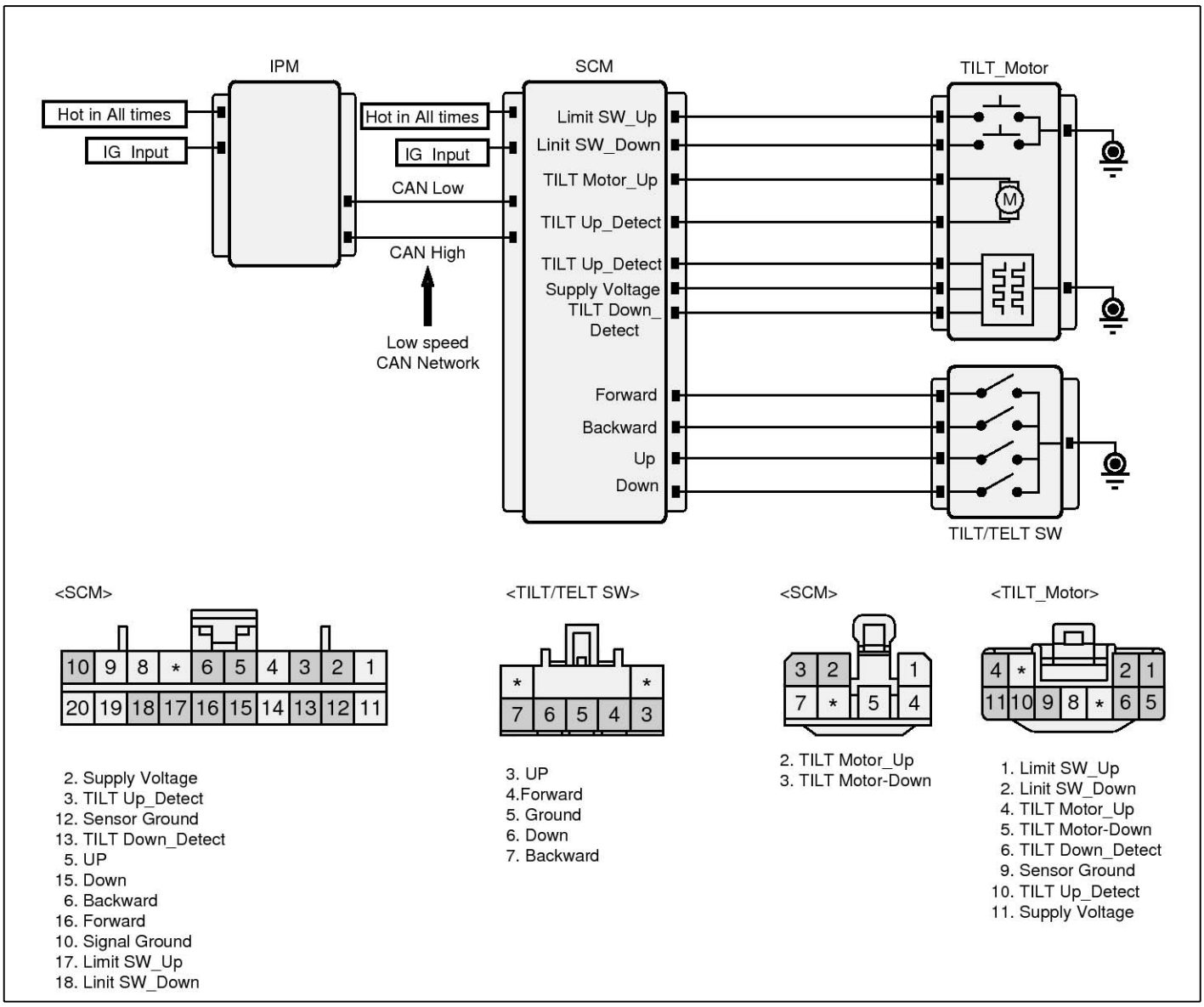

SHMBE9H10L

Signal Waveform & Data

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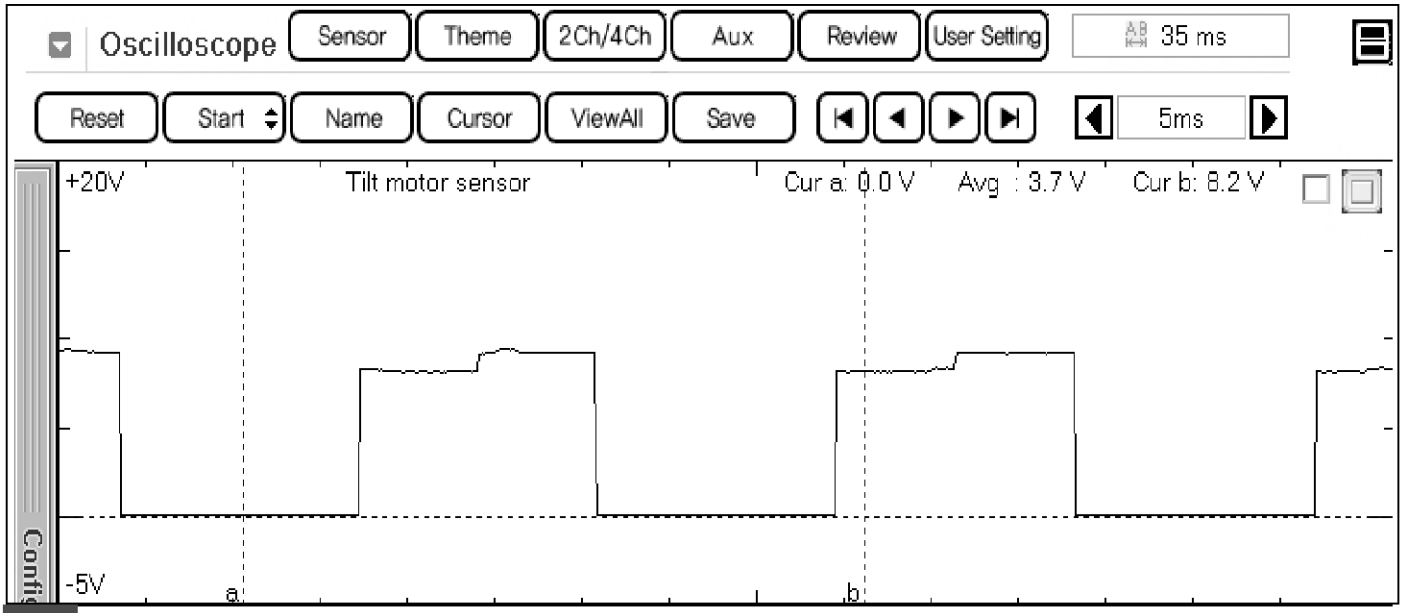


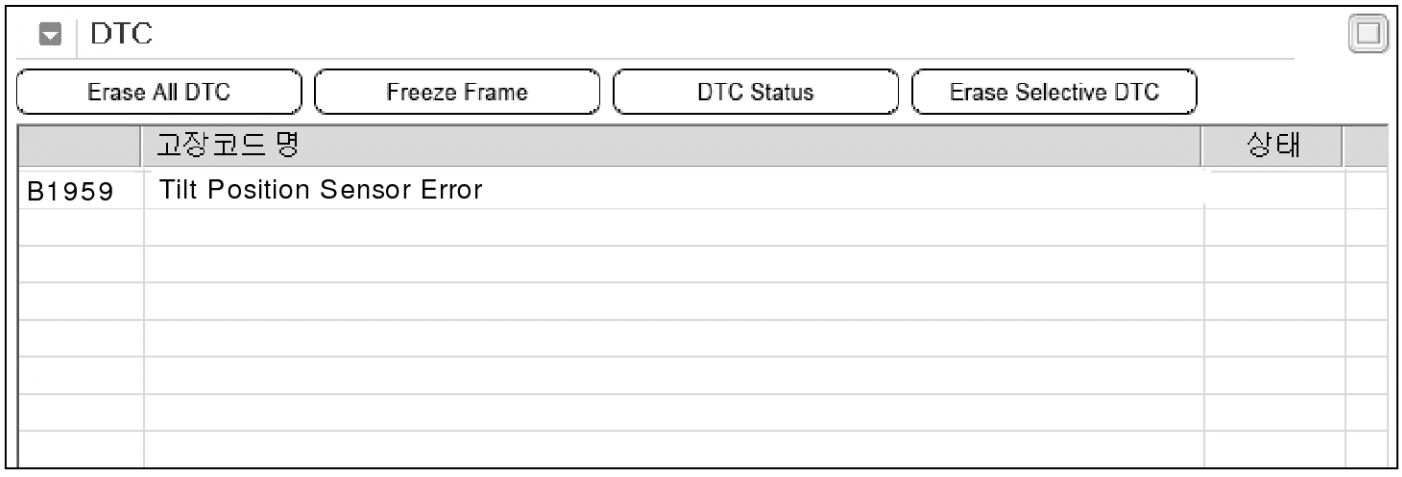
Fig.1

SHMBE9H00L

Fig 1) Normal waveform of tilt motor/position sensor

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9H01L

5. Is the same DTC occurred again?

YES ▶ Go to "Component Inspection" procedure.

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YES ▶ Go to "Component Inspection" procedure.

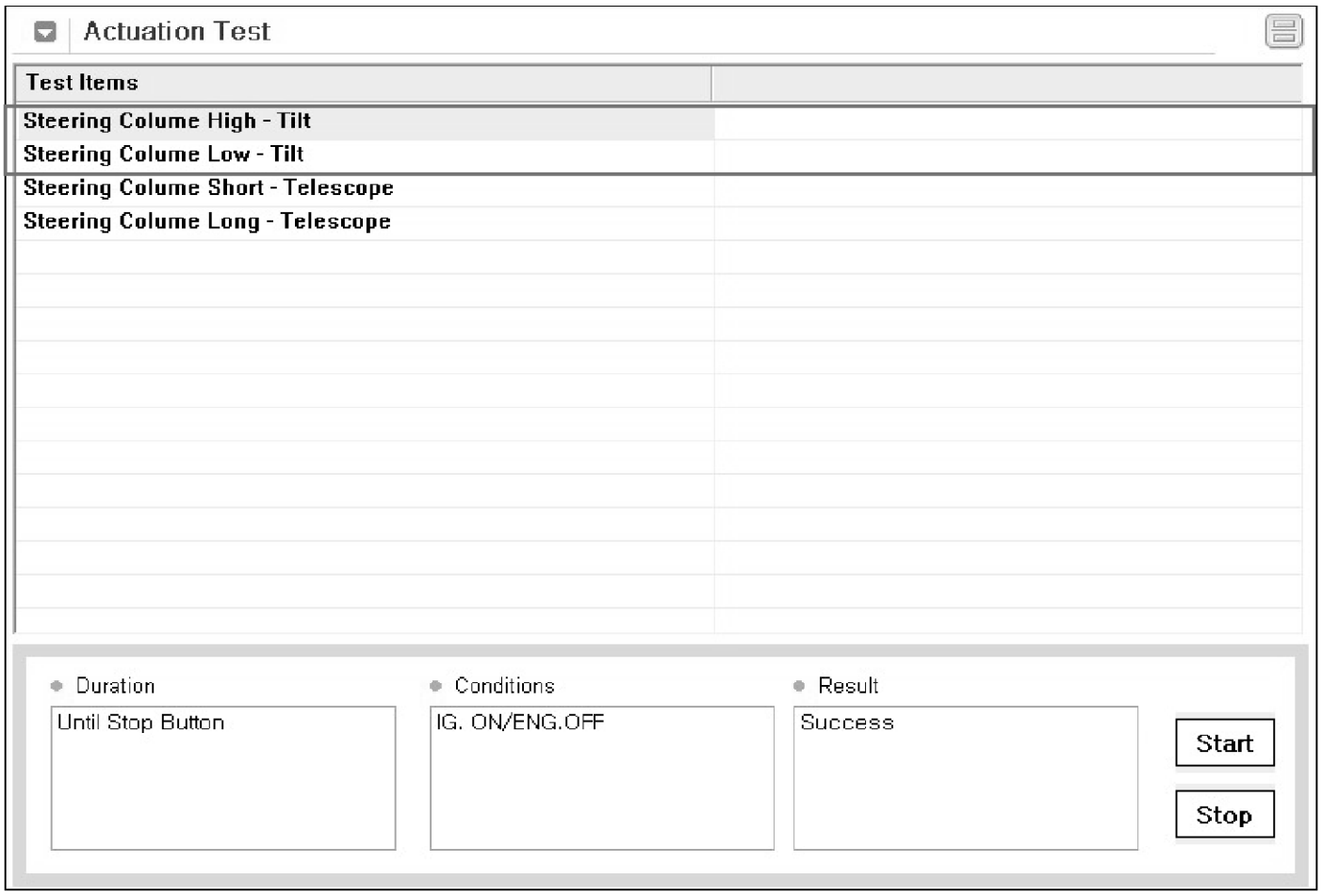
NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or SCM's connector or was repaired and SCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Check tilt motor

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Tilt Steering Column (UP, DOWN)" test.

Specification : Turned to pressed direction



SHMBE9H02L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

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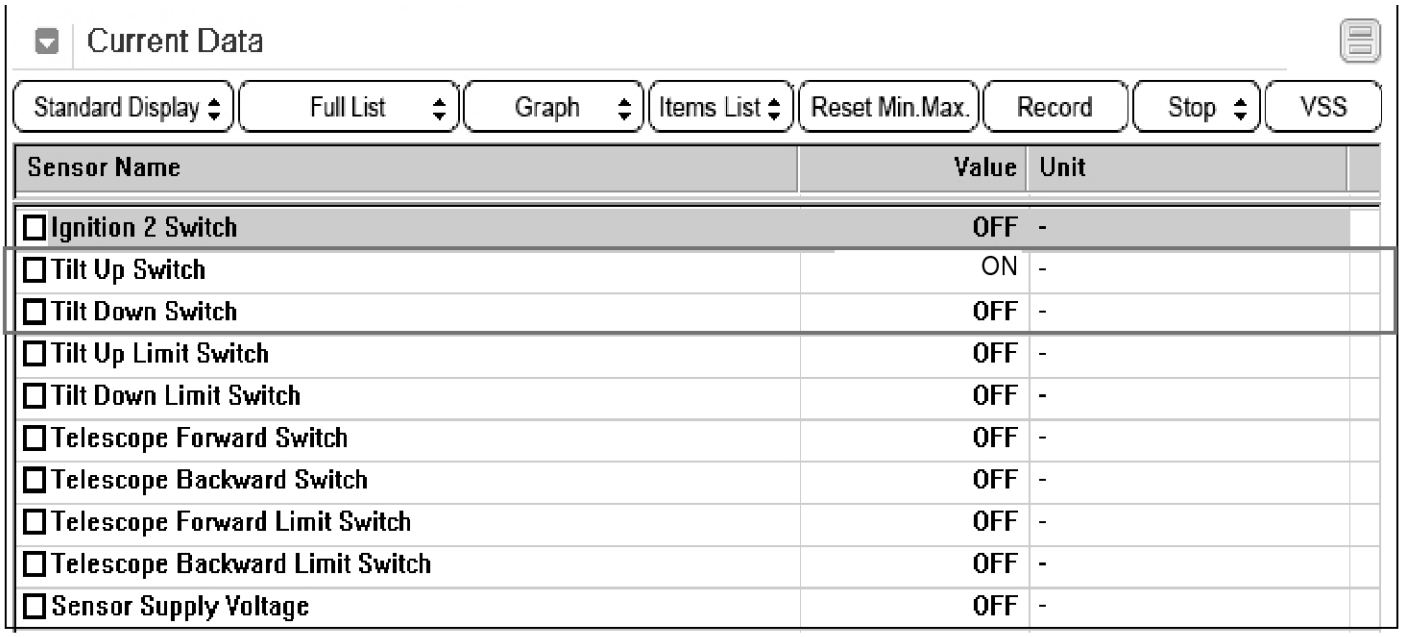
YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Tilt (UP,DOWN) Switch" is turned to "ON" when the control switch is pressed. (UP, DOWN)

Specification : Service data is switched. (ON ↔ OFF)



SHMBE9H03L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. Measure the signal voltage of "Tilt Motor Position Sensor" with pressing the tilt switch.

Approx. 1~4 V during motor working

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3. Is the signal output normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Tilt Motor Position(UP/DOWN) Sensor.
If the circuit of Tilt Motor Position(UP/DOWN) Sensor is normal, replace the tilt motor and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1960 Telescope Motor or Sensor Error

General Description

IMS(Integrated Memory System) is a system which can memorize the position of power seat(PTM), tilt/telescope handle(SCM), side mirror(DDM/ADM) by position sensor and restores them to a previous position. (Memory function is not allowed during driving for safety reason)

DTC Description

SCM sets this code when amount of change of the telescopic motor position sensor is little than 8edge (4pulse) for 1sec. This means that telescopic motor/sensor stuck due to open or short in circuit or external cause (compulsive restriction)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring the motor's revolution by checking the pulse output of HALL sensor in the motor	• Open in the Tilt motor circuit • Open in the Tilt motor sensor circuit • Faulty Tilt motor/ sensor
Enable Conditions	• When the motor is running	
Threshold Value	• During the Telescopic Motor is operated, when the pulse input is less than 4 pulses within 1 second.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram

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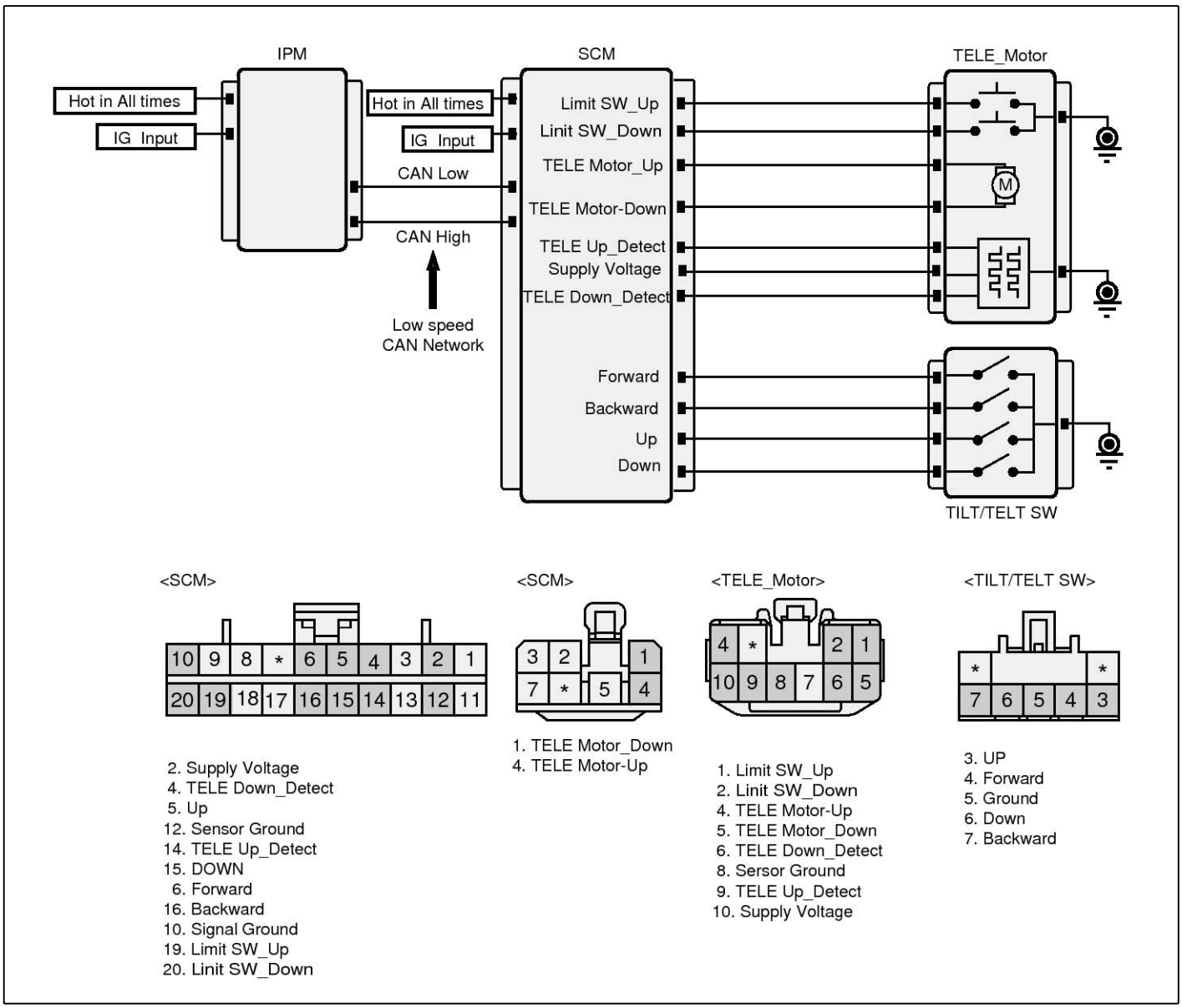

SHMBE9H11L

Signal Waveform & Data

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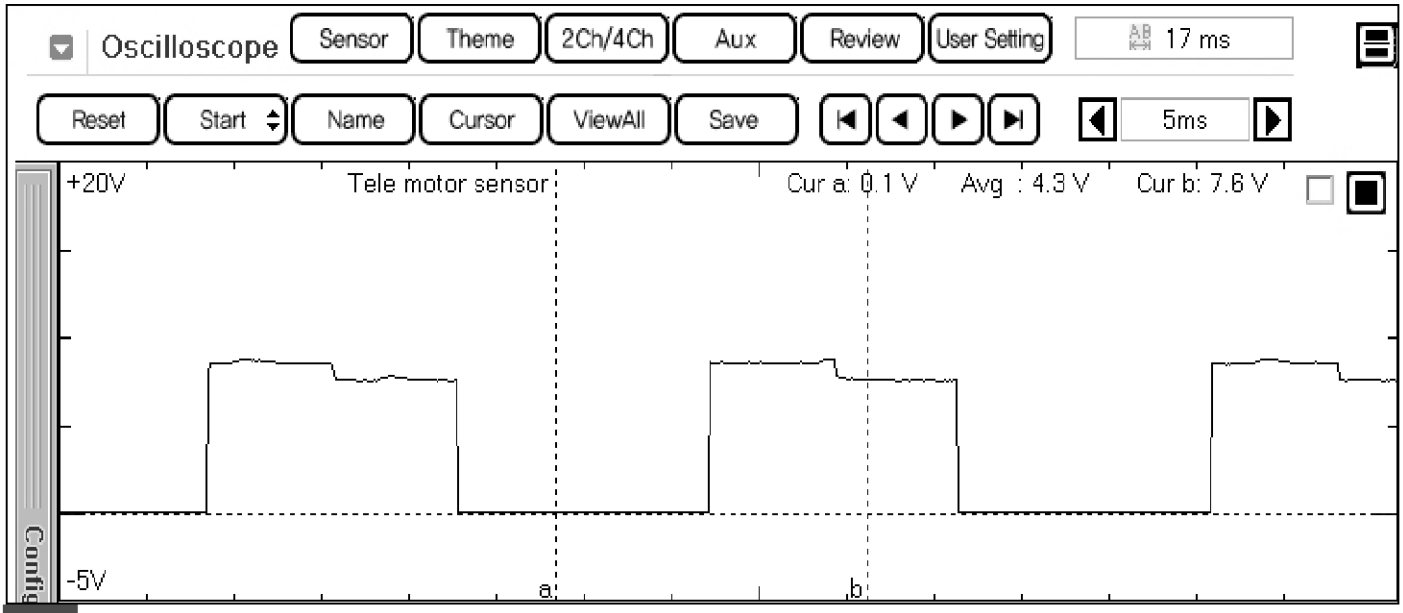


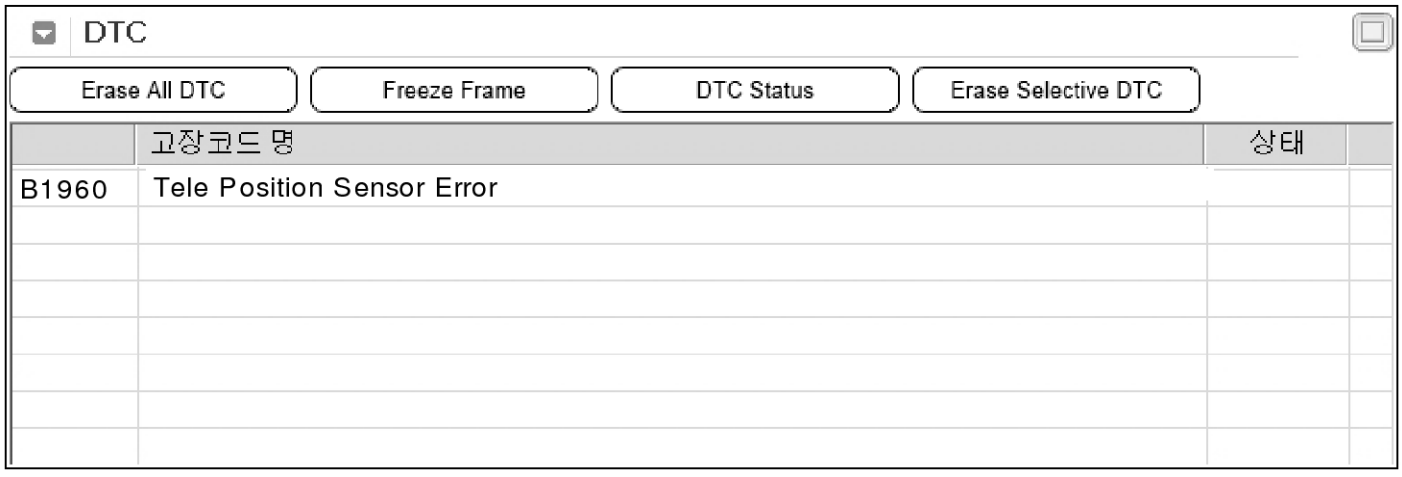
Fig.1

SHMBE9H07L

Fig 1) Normal waveform of telescopic motor/position

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).



SHMBE9H04L

5. Is the same DTC occurred again?

YES ▶ Go to "Component Inspection" procedure.

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YES ▶ Go to "Component Inspection" procedure.

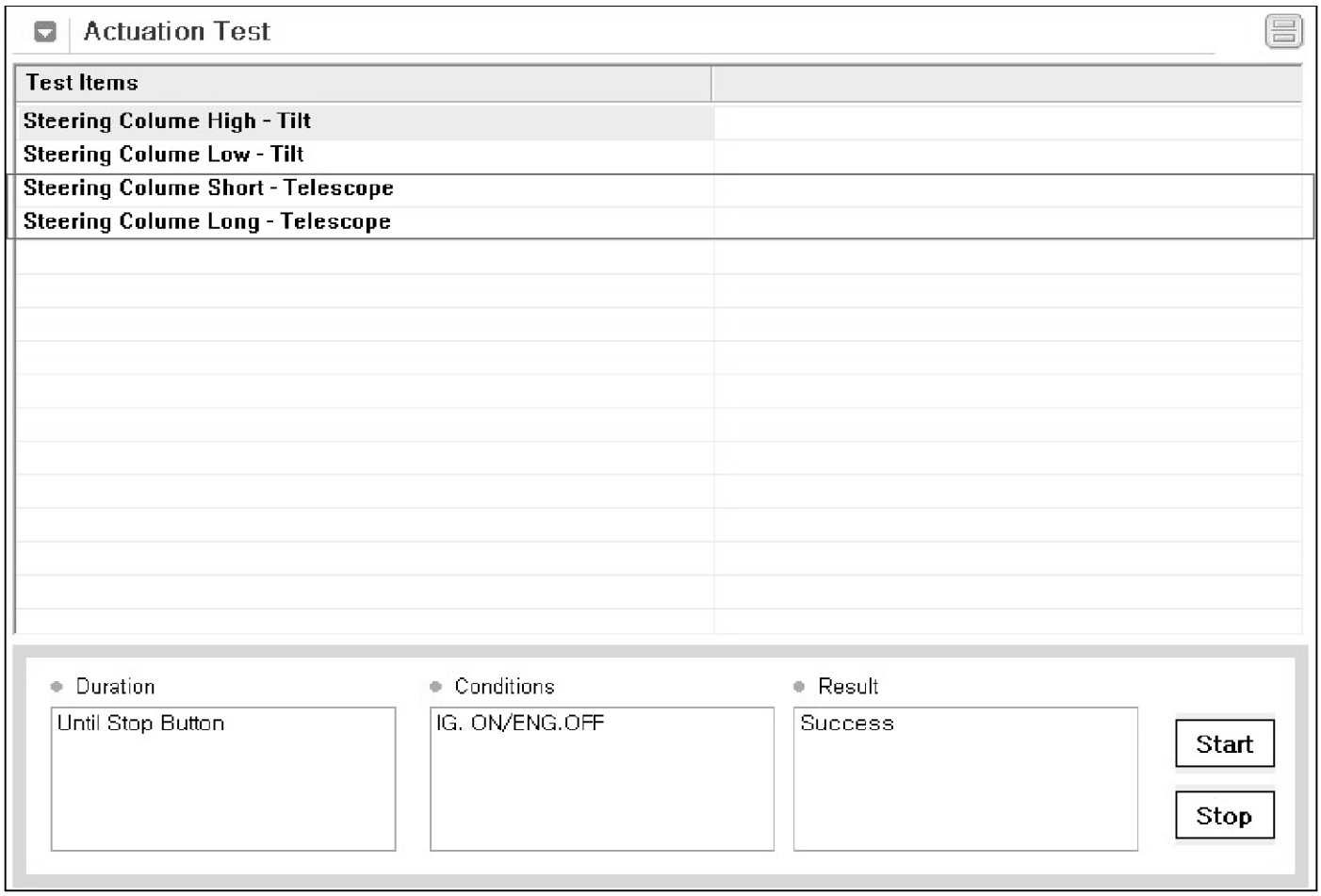
NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or SCM's connector or was repaired and SCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Check tilt motor

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Telescopic Steering Column (FORWARD, BACKWARD)" test.

Specification : Turned to pressed direction



SHMBE9H05L

5. Is motor working normal ?

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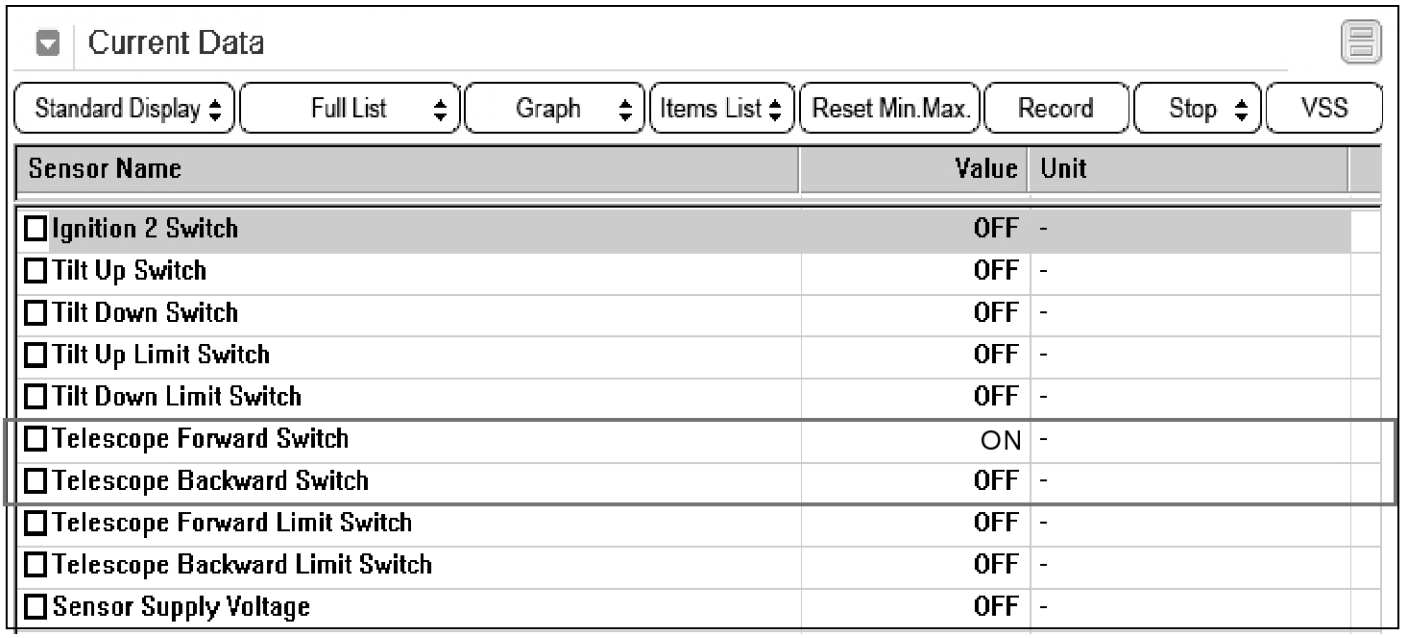
YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Telescopic (FORWARD,BACKWARD) Switch" is turned to "ON" when the control switch is pressed. (FORWARD, BACKWARD)

Specification : Service data is switched. (ON ↔ OFF)



Sensor Name	Value	Unit
Ignition 2 Switch	OFF	-
Tilt Up Switch	OFF	-
Tilt Down Switch	OFF	-
Tilt Up Limit Switch	OFF	-
Tilt Down Limit Switch	OFF	-
Telescope Forward Switch	ON	-
Telescope Backward Switch	OFF	-
Telescope Forward Limit Switch	OFF	-
Telescope Backward Limit Switch	OFF	-
Sensor Supply Voltage	OFF	-

SHMBE9H06L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. Measure the signal voltage of "Telescopic Motor Position Sensor" with pressing the telescope switch.

Specification : Approx. 1~4 V during motor working

3. Is the signal output normal?

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YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Telescopic Motor Position(FORWARD/BACKWARD) Sensor.

If the circuit of Telescopic Motor Position(FORWARD/BACKWARD) Sensor is normal, replace the telescopic motor and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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IMS (Integrated Memory System)

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B1954 Slide Motor Or Sensor Error

General Description

IMS(Integrated Memory System) is a system which can memorize the position of power seat(PTM), tilt/telescope handle(SCM), side mirror(DDM/ADM) by position sensor and restores them to a previous position. (Memory function is not allowed during driving for safety reason)

DTC Description

PSM sets this code when amount of change of the Slide motor position sensor is little than 12edge (6pulse) for 2sec. This means that Slide motor/sensor stuck due to open or short in circuit or external cause (compulsive restriction)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring the motor's revolution by checking the pulse output of HALL sensor in the motor	• Open in the Slide motor circuit • Open in the Slide motor sensor circuit • Faulty Slide motor/ sensor
Enable Conditions	• When the motor is running	
Threshold Value	• During the SEAT is operated, when the pulse input is less than 6 pulses within 2 second.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram

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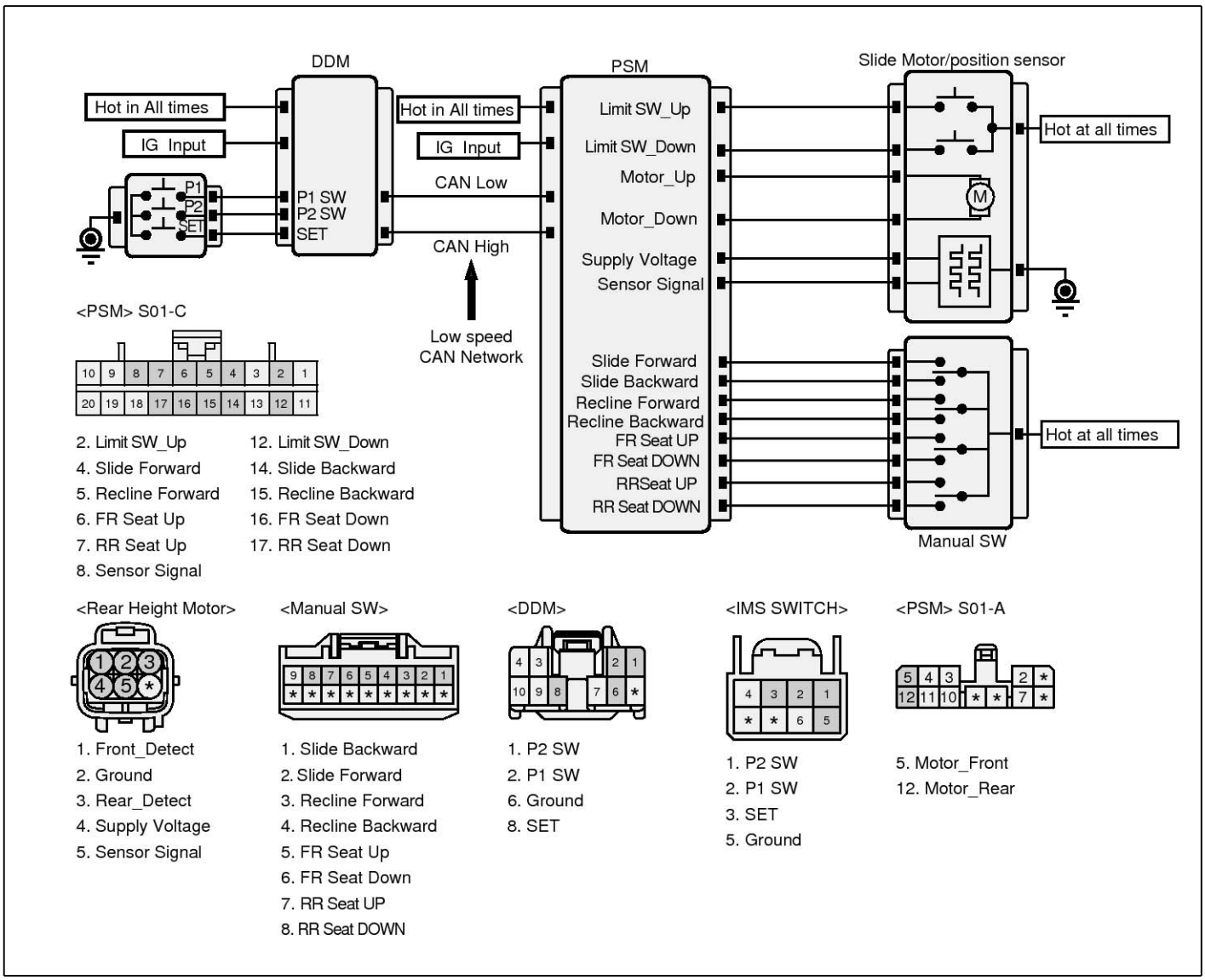

SHMBE9J23L

Signal Waveform & Data

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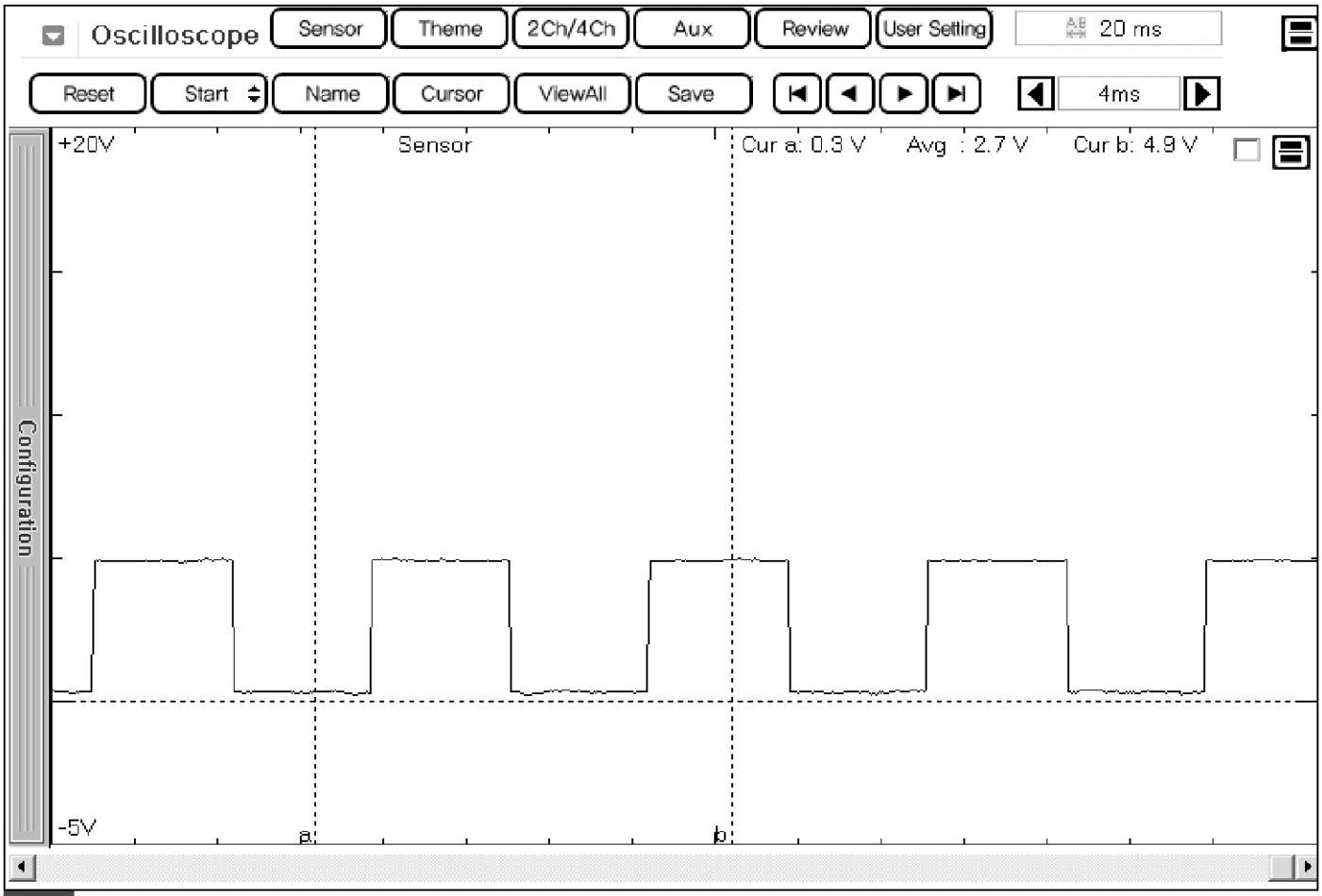

Fig.1

SHMBE9J00L

Fig 1) Normal waveform of Seat Slide Moter/Sensor

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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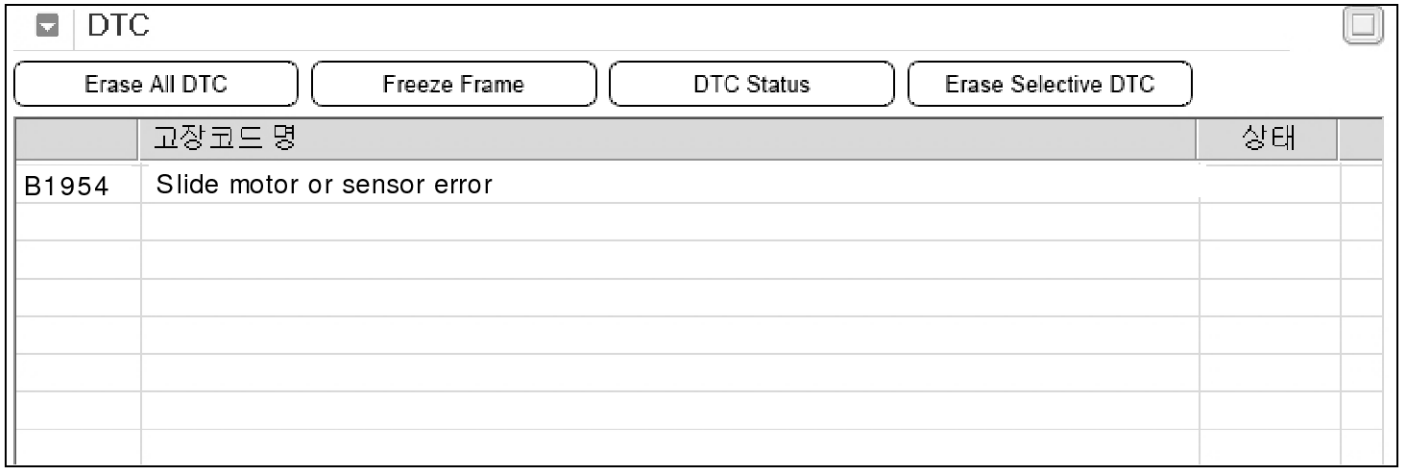

SHMBE9J10L

5. Is the same DTC occurred again?

YES ▶ Go to "Component Inspection" procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or PSM's connector or was repaired and PSM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Slide Motor Check

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Seat Slide Motor (FORWARD, BACKWARD)" test.

Specification : Turned to pressed direction

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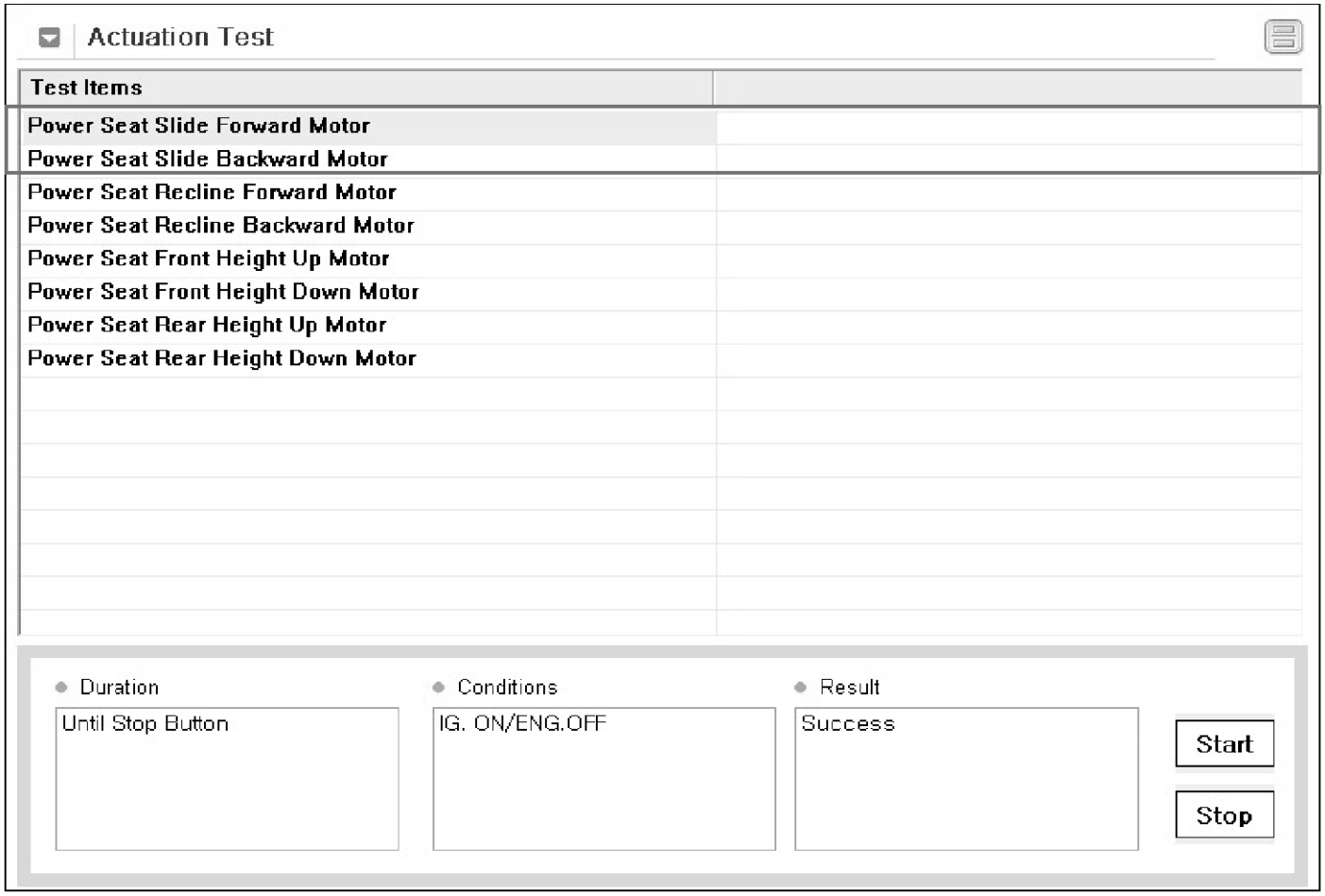

SHMBE9J11L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Slide Switch" is turned to "ON" when the control switch is pressed. (Forward, Backward)

Specification : Service data is switched. (ON ↔ OFF)

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Ignition 2 Switch	ON	-
Power Seat Slide Forward Switch	ON	-
Power Seat Slide Backward Switch	OFF	-
Power Seat Slide Limit Switch-Front	ON	-
Power Seat Slide Limit Switch-Rear	ON	-
Power Seat Recline Forward Switch	OFF	-
Power Seat Recline Backward Switch	OFF	-
Power Seat Recline Limit Switch-Front	OFF	-
Power Seat Recline Limit Switch-Rear	ON	-
Front Height Up Switch	OFF	-
Front Height Down Switch	OFF	-
Rear Height Up Switch	OFF	-
Rear Height Down Switch	OFF	-
"P" Position Switch	ON	-

SHMBE9J12L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. Measure the signal voltage of "Seat Slide Motor / Sensor" with pressing the Recline switch.

Specification : Approx. 1~4 V during motor working

3. Is the signal output normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Slide motor position Sensor.
If the circuit of Slide Motor Position Sensor is normal, replace the Slide motor/sensor and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

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YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1955 Recline Motor Or Sensor Error

General Description

IMS(Integrated Memory System) is a system which can memorize the position of power seat(PTM), tilt/telescope handle(SCM), side mirror(DDM/ADM) by position sensor and restores them to a previous position. (Memory function is not allowed during driving for safety reason)

DTC Description

PSM sets this code when amount of change of the Recline motor position sensor is little than 12edge (6pulse) for 2sec. This means that Recline motor/sensor stuck due to open or short in circuit or external cause (compulsive restriction)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring the motor's revolution by checking the pulse output of HALL sensor in the motor	• Open in the Recline motor circuit • Open in the Recline motor circuit • Faulty Recline motor/ sensor
Enable Conditions	• When the motor is running	
Threshold Value	• During the SEAT is operated, when the pulse input is less than 6 pulses within 2 second.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram

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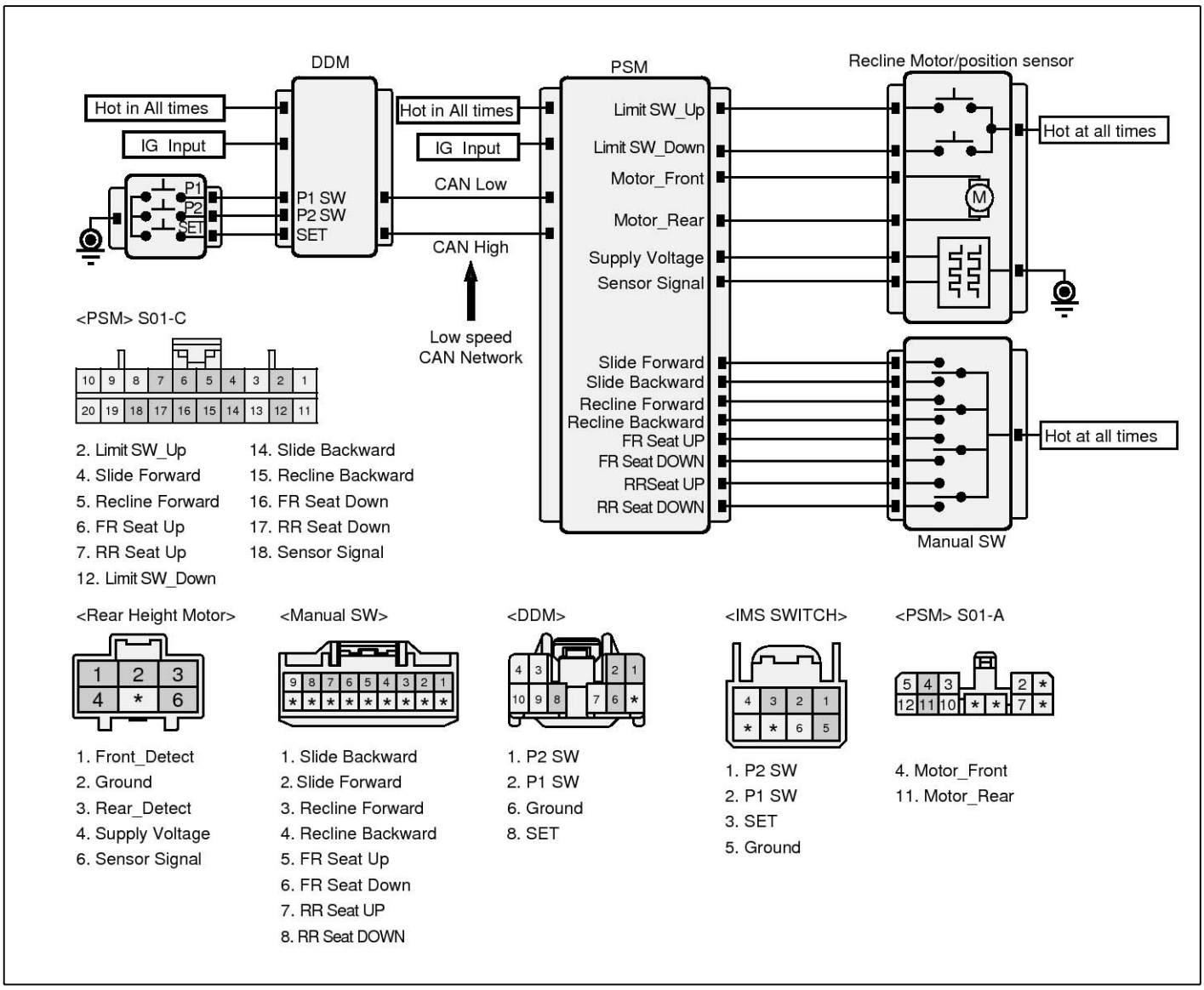

SHMBE9J22L

Signal Waveform & Data

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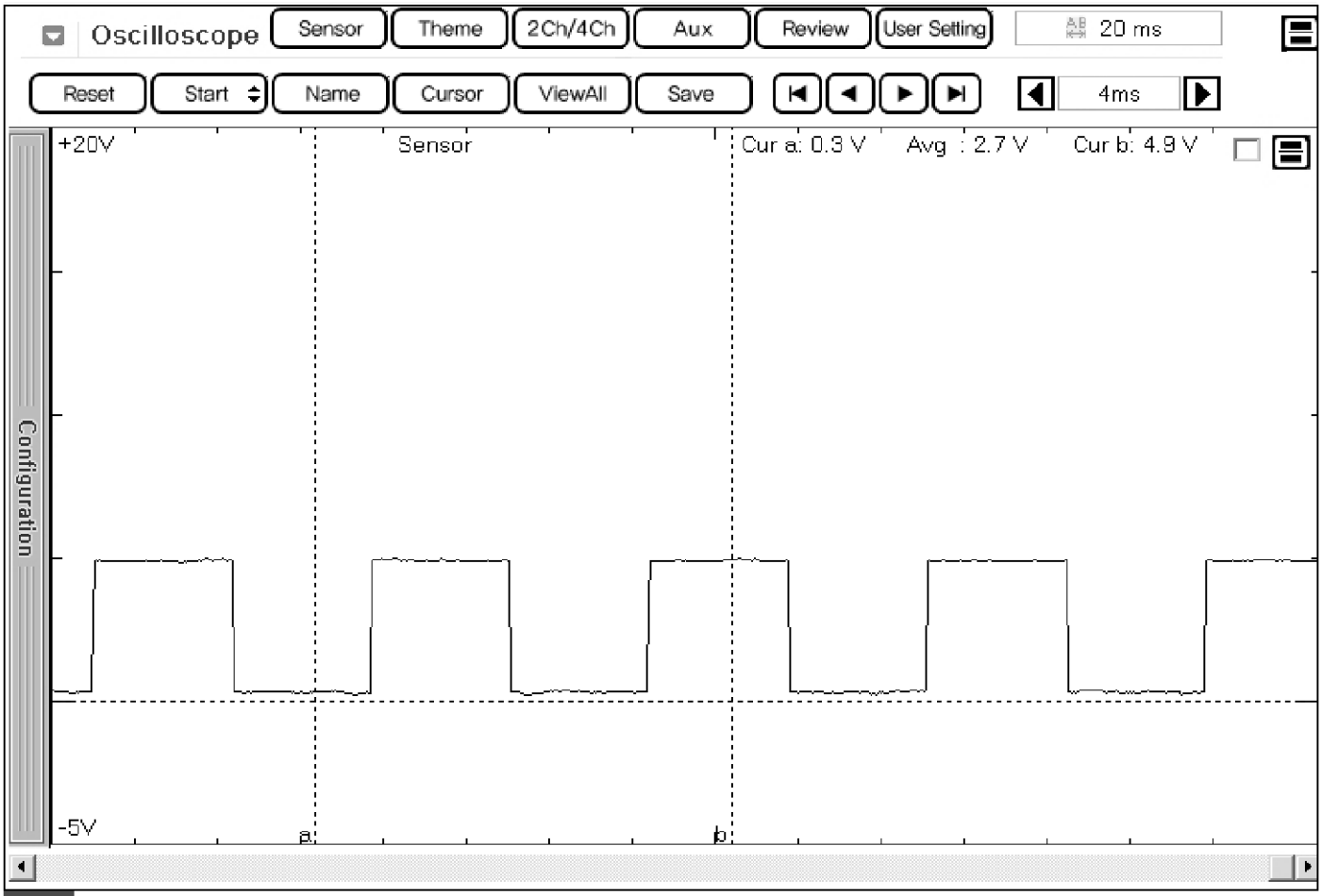

Fig.1

SHMBE9J00L

Fig 1) Normal waveform of seat recline moter position sensor

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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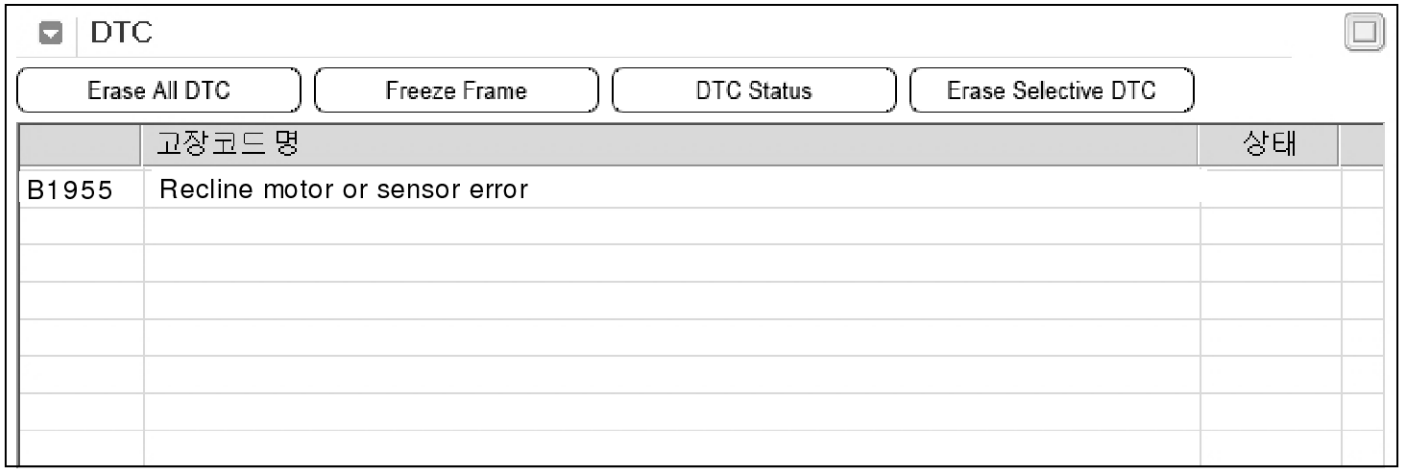

SHMBE9J07L

5. Is the same DTC occurred again?

YES ▶ Go to "Component Inspection" procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or PSM's connector or was repaired and PSM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Recline Motor Check

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Seat Recline Motor (UP, DOWN)" test.

Specification : Turned to pressed direction

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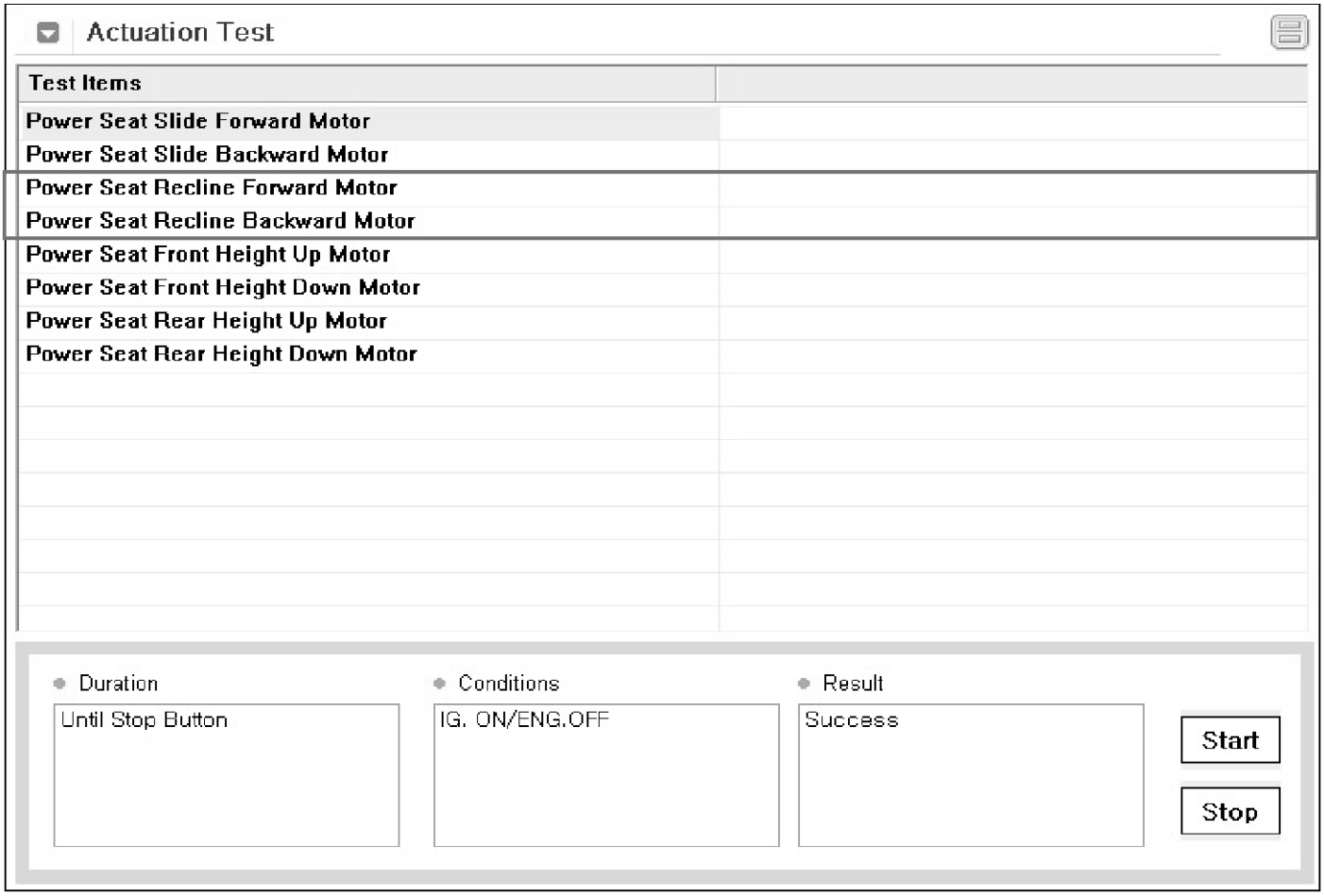

SHMBE9J08L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Recline Switch" is turned to "ON" when the control switch is pressed. (Forward, Backward)

Specification : Service data is switched. (ON ↔ OFF)

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Ignition 2 Switch	ON	-
Power Seat Slide Forward Switch	OFF	-
Power Seat Slide Backward Switch	OFF	-
Power Seat Slide Limit Switch-Front	ON	-
Power Seat Slide Limit Switch-Rear	ON	-
Power Seat Recline Forward Switch	ON	-
Power Seat Recline Backward Switch	OFF	-
Power Seat Recline Limit Switch-Front	OFF	-
Power Seat Recline Limit Switch-Rear	ON	-
Front Height Up Switch	OFF	-
Front Height Down Switch	OFF	-
Rear Height Up Switch	OFF	-
Rear Height Down Switch	OFF	-
"P" Position Switch	ON	-

SHMBE9J09L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. Measure the signal voltage of "Seat Recline Motor / Sensor" with pressing the Recline switch.

Specification : Approx. 1~4 V during motor working

3. Is the signal output normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Recline motor position Sensor.
If the circuit of Recline Motor Position Sensor i s normal, replace the Recline motor/sensor and go to "Verification of Vehicle Repair" procedure .

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

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YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1956 Front Height Motor Or Sensor Error

General Description

IMS(Integrated Memory System) is a system which can memorize the position of power seat(PTM), tilt/telescope handle(SCM), side mirror(DDM/ADM) by position sensor and restores them to a previous position. (Memory function is not allowed during driving for safety reason)

DTC Description

PSM sets this code when amount of change of the Front height motor position sensor is little than 12edge (6pulse) for 1sec. This means that Front height motor/sensor stuck due to open or short in circuit or external cause (compulsive restriction)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring the motor's revolution by checking the pulse output of HALL sensor in the motor	• Open in the Front height motor circuit • Open in the Front height sensor circuit • Faulty Front height motor/ sensor
Enable Conditions	• When the motor is running	
Threshold Value	• During the SEAT is operated, when the pulse input is less than 6 pulses within 1 second.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram

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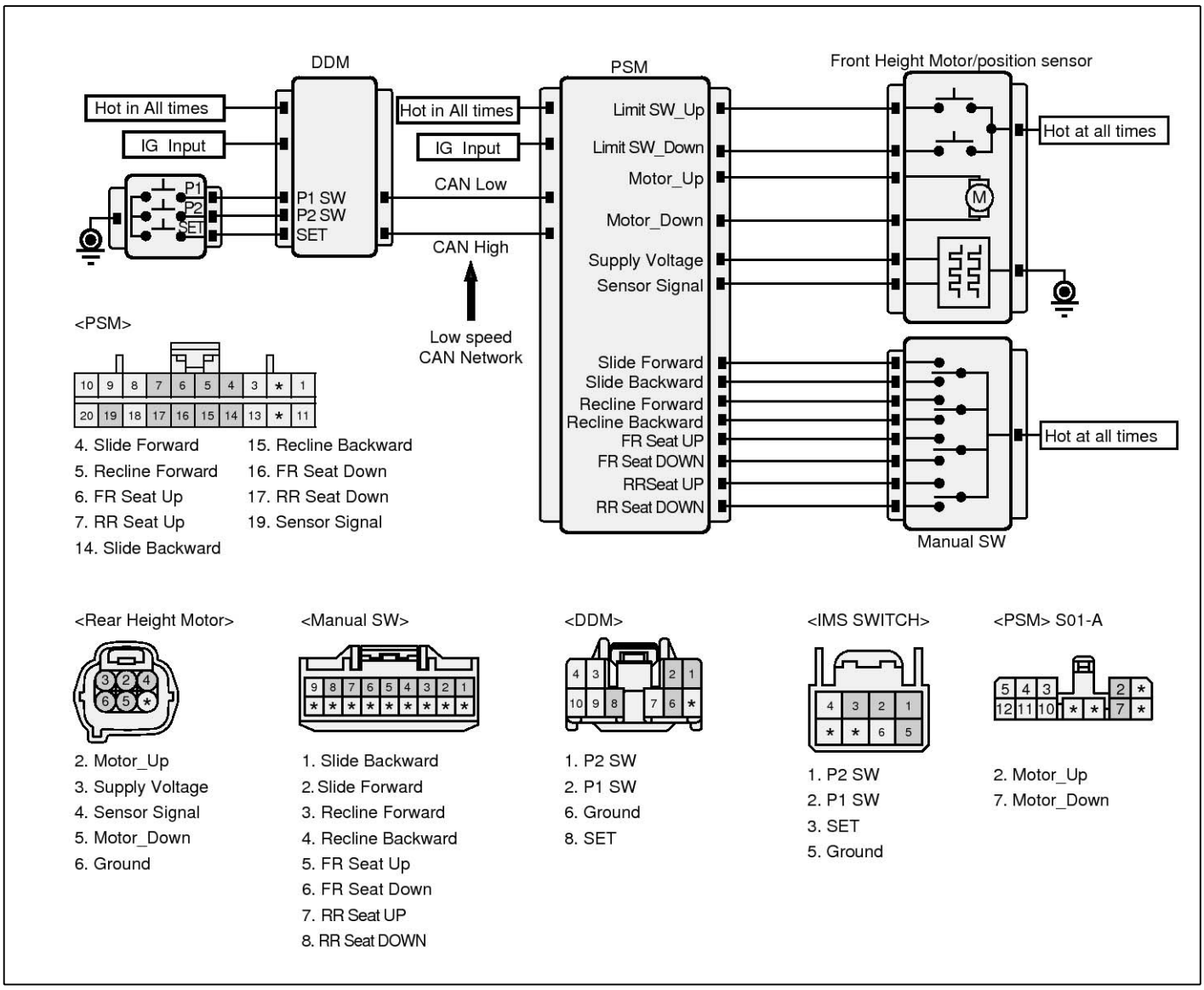

SHMBE9J21L

Signal Waveform & Data

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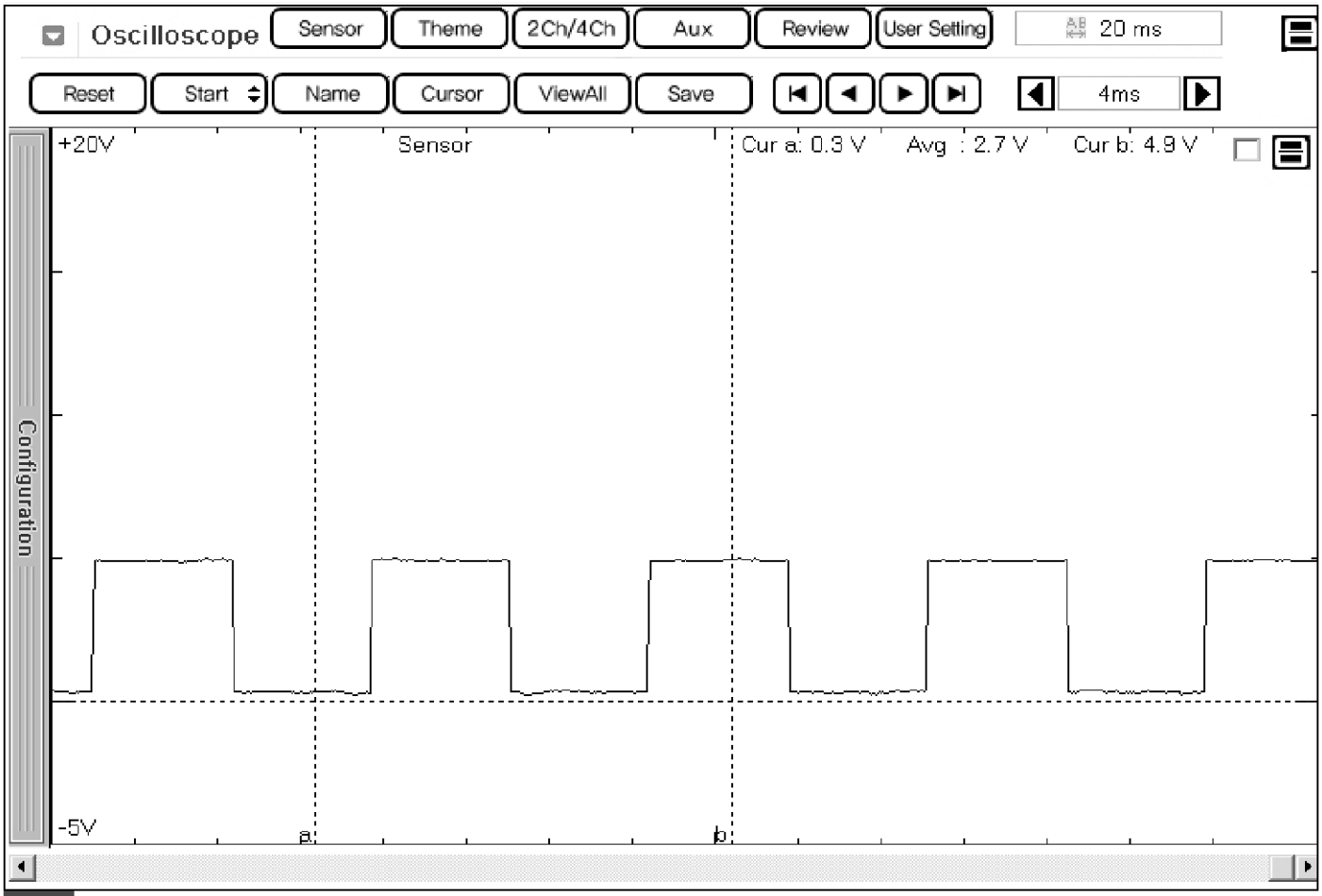

Fig.1

SHMBE9J00L

Fig 1) Normal waveform of seat recline moter position sensor

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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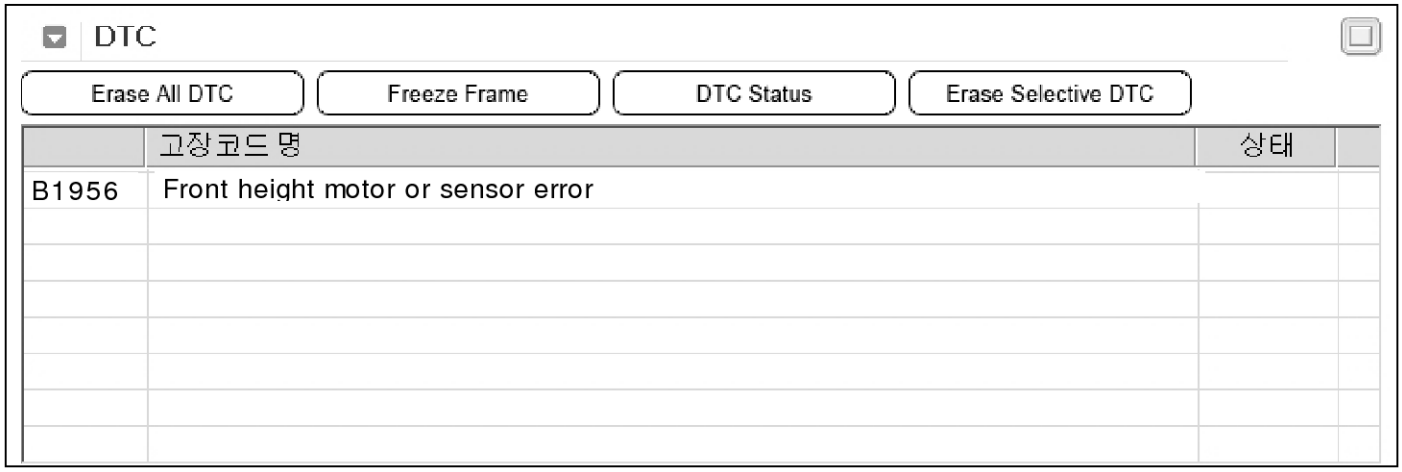

SHMBE9J04L

5. Is the same DTC occurred again?

YES ▶ Go to "Component Inspection" procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or PSM's connector or was repaired and PSM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Front Height Motor Check

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Front Power Seat (UP, DOWN)" test.

Specification : Turned to pressed direction

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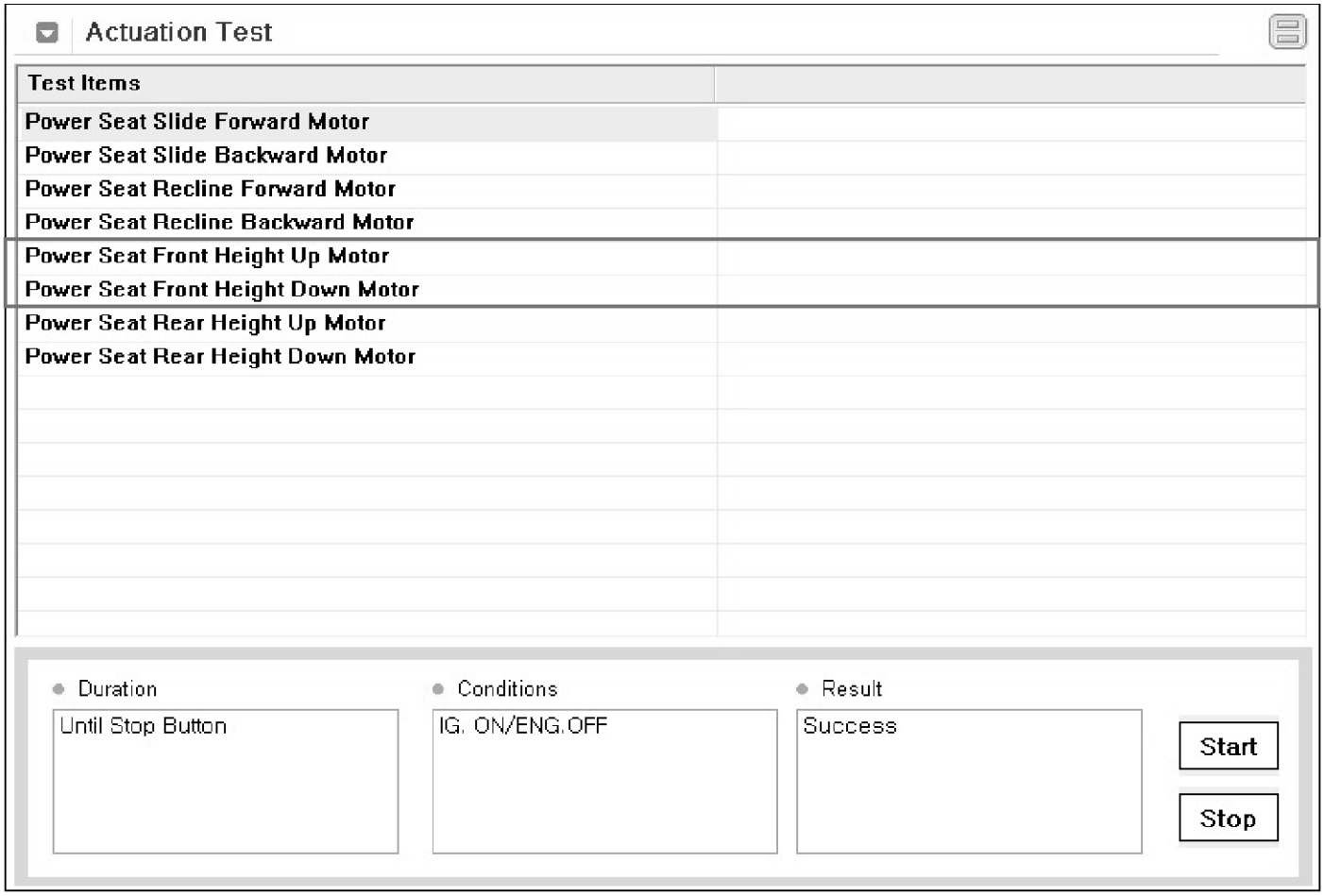

SHMBE9J05L

5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Seat Front Side Switch" is turned to "ON" when the control switch is pressed. (UP, DOWN)

Specification : Service data is switched. (ON ↔ OFF)

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Current Data

Standard Display | Full List | Graph | Items List | Reset Min.Max. | Record | Stop | VSS

Sensor Name	Value	Unit
Ignition 2 Switch	ON	-
Power Seat Slide Forward Switch	OFF	-
Power Seat Slide Backward Switch	OFF	-
Power Seat Slide Limit Switch-Front	ON	-
Power Seat Slide Limit Switch-Rear	ON	-
Power Seat Recline Forward Switch	OFF	-
Power Seat Recline Backward Switch	OFF	-
Power Seat Recline Limit Switch-Front	OFF	-
Power Seat Recline Limit Switch-Rear	ON	-
Front Height Up Switch	ON	-
Front Height Down Switch	OFF	-
Rear Height Up Switch	OFF	-
Rear Height Down Switch	OFF	-
"P" Position Switch	ON	-

SHMBE9J06L

4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. Measure the signal voltage of "Front Height Sensor" with pressing the Front Height Motor switch..

Specification : Approx. 1~4 V during motor working

3. Is the signal output normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Front Height motor position(UP/DOWN) Sensor.
If the circuit of Front Height Motor Position(UP/DOWN) Sensor is normal, replace the Right Rear Height motor and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

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YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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B1957 Right Rear Height Motor Or Sensor Error

General Description

IMS(Integrated Memory System) is a system which can memorize the position of power seat(PTM), tilt/telescope handle(SCM), side mirror(DDM/ADM) by position sensor and restores them to a previous position. (Memory function is not allowed during driving for safety reason)

DTC Description

PSM sets this code when amount of change of the Rear height motor sensor is little than 12edge (6pulse) for 1sec. This means that rear height motor/sensor stuck due to open or short in circuit or external cause (compulsive restriction)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Monitoring the motor's revolution by checking the pulse output of HALL sensor in the motor	• Open in the rear height motor circuit • Open in the rear height sensor circuit • Faulty rear height motor/ sensor
Enable Conditions	• When the motor is running	
Threshold Value	• During the SEAT is operated, when the pulse input is less than 6 pulses within 1 second.	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed	

Diagnostic Circuit Diagram

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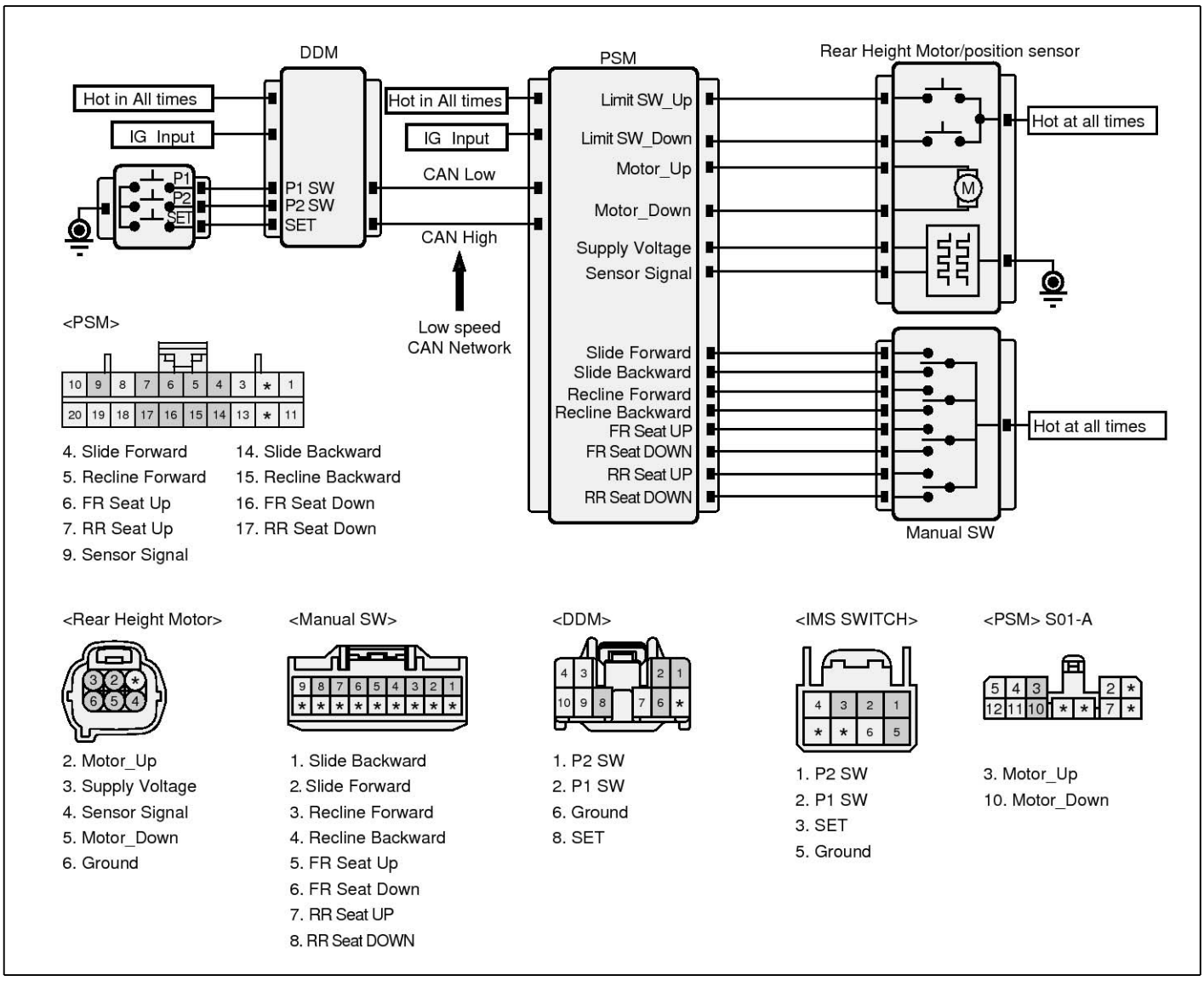

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Signal Waveform & Data

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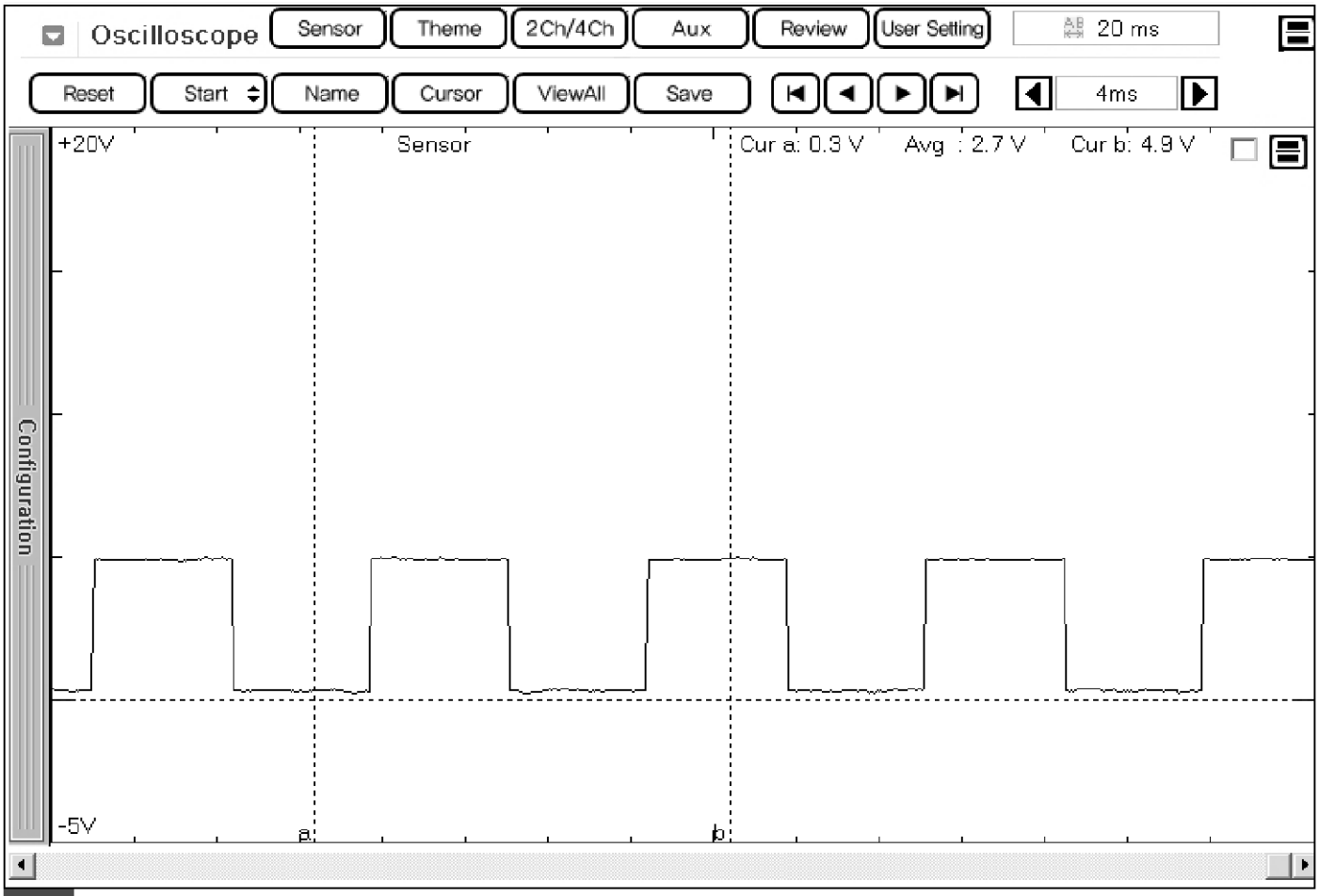

Fig.1

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Fig 1) Normal waveform of seat recline moter position sensor

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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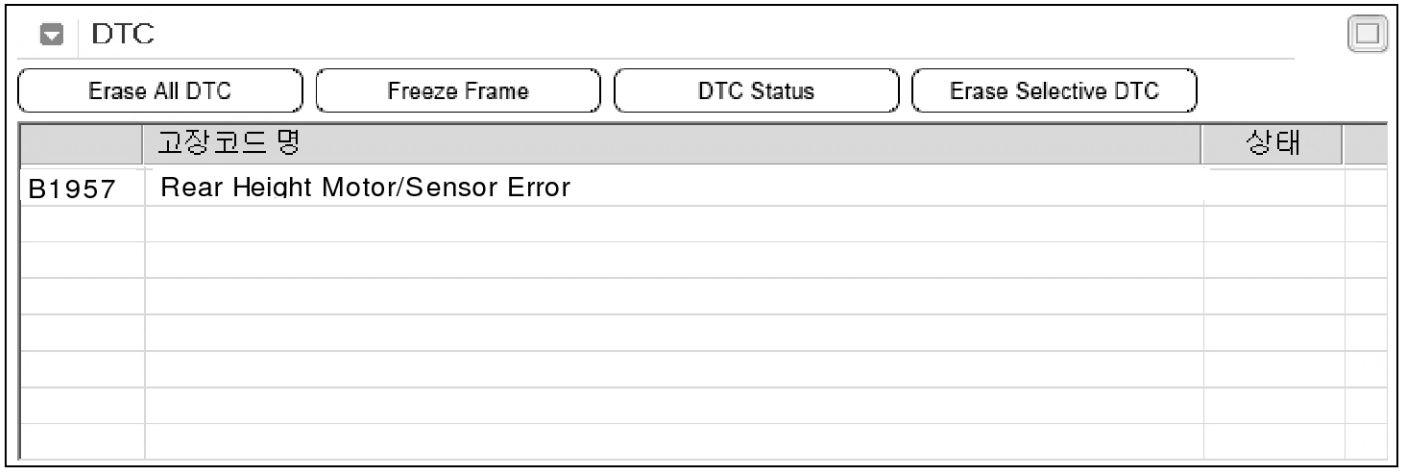

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5. Is the same DTC occurred again?

YES ▶ Go to "Component Inspection" procedure.

NO ▶ Fault is intermittent caused by poor contact in the sensor's and/or PSM's connector or was repaired and PSM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Component Inspection

■ Rear Height Motor Check

1. Connect scantool
2. IG "ON" & ENG "OFF"
3. Select "Actuation Test" mode.
4. Execute "Rear Power Seat (UP, DOWN)" test.

Specification : Turned to pressed direction

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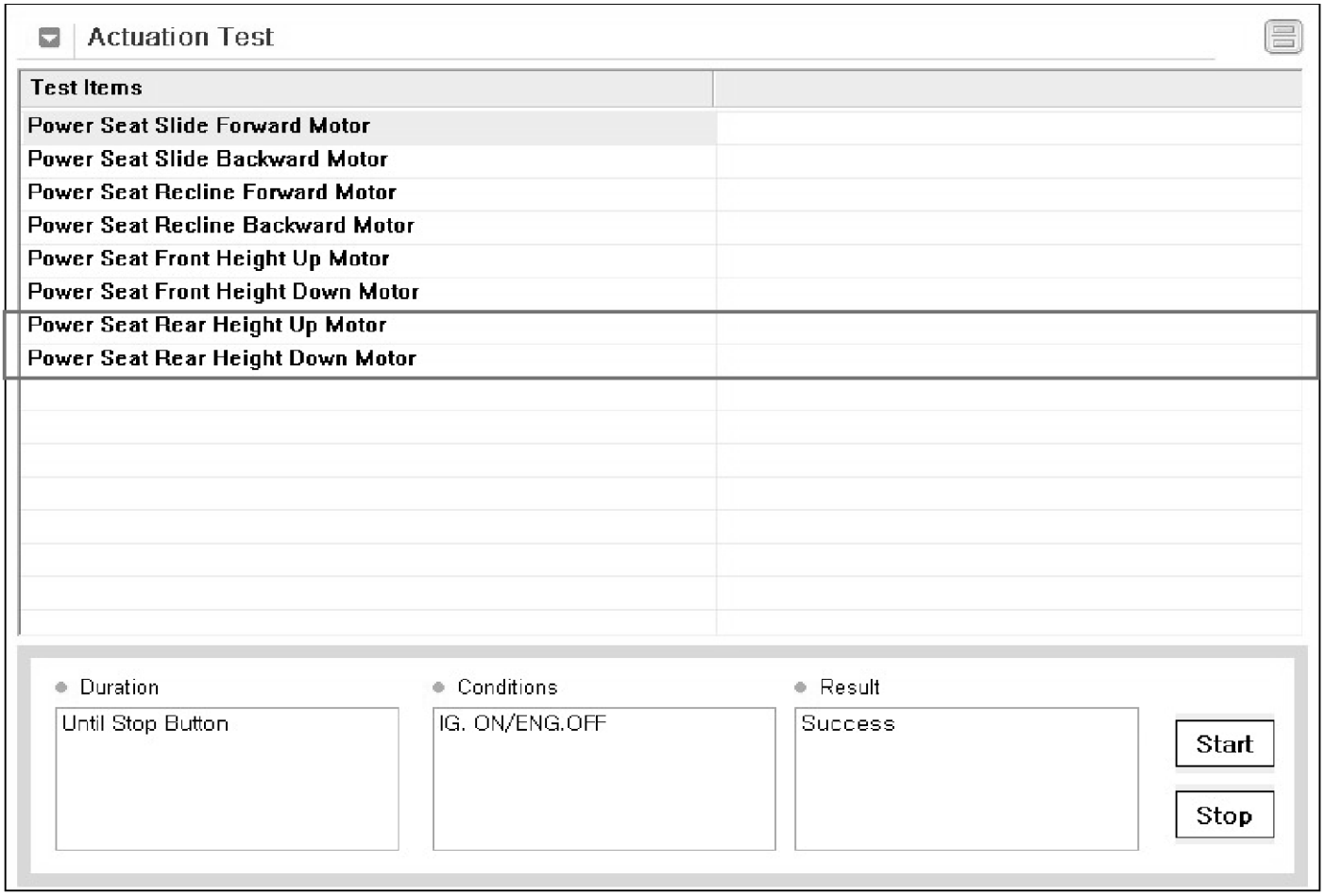

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5. Is motor working normal ?

YES ▶ Go to "W/Harness Inspection" procedure.

NO ▶ Go to next procedure.

■ Check switch

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Seat Rear Side Switch" is turned to "ON" when the control switch is pressed. (UP, DOWN)

Specification : Service data is switched. (ON ↔ OFF)

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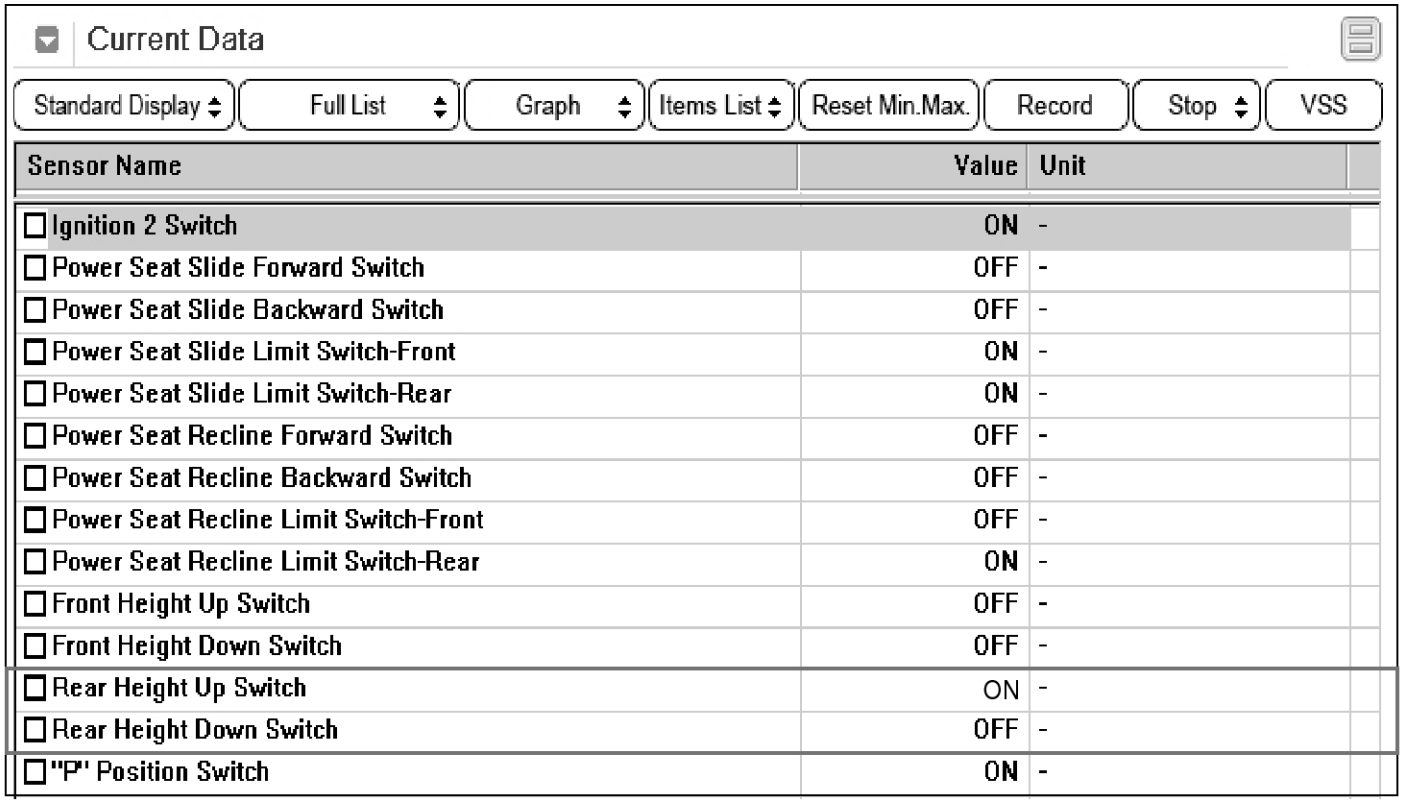

Sensor Name	Value	Unit
Ignition 2 Switch	ON	-
Power Seat Slide Forward Switch	OFF	-
Power Seat Slide Backward Switch	OFF	-
Power Seat Slide Limit Switch-Front	ON	-
Power Seat Slide Limit Switch-Rear	ON	-
Power Seat Recline Forward Switch	OFF	-
Power Seat Recline Backward Switch	OFF	-
Power Seat Recline Limit Switch-Front	OFF	-
Power Seat Recline Limit Switch-Rear	ON	-
Front Height Up Switch	OFF	-
Front Height Down Switch	OFF	-
Rear Height Up Switch	ON	-
Rear Height Down Switch	OFF	-
"P" Position Switch	ON	-

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4. Is the service data normal?

YES ▶ Go to "Terminal and Connector Inspection" procedure.

NO ▶ Substitute with a known - good component and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Signal Circuit Inspection' procedure.

Signal Circuit Inspection

1. IG "ON" & ENG "OFF".
2. Measure the signal voltage of "Rear Height Sensor" with pressing the Rear Height Motor switch.

Specification : Approx. 1~4 V during motor working

3. Is the signal output normal?

YES ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open or short in circuit of Rear Height motor position(UP/DOWN) Sensor.
If the circuit of Rear Height Motor Position(UP/DOWN) Sensor is normal, replace the Right Rear Height motor and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

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YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System performing to specification at this time.

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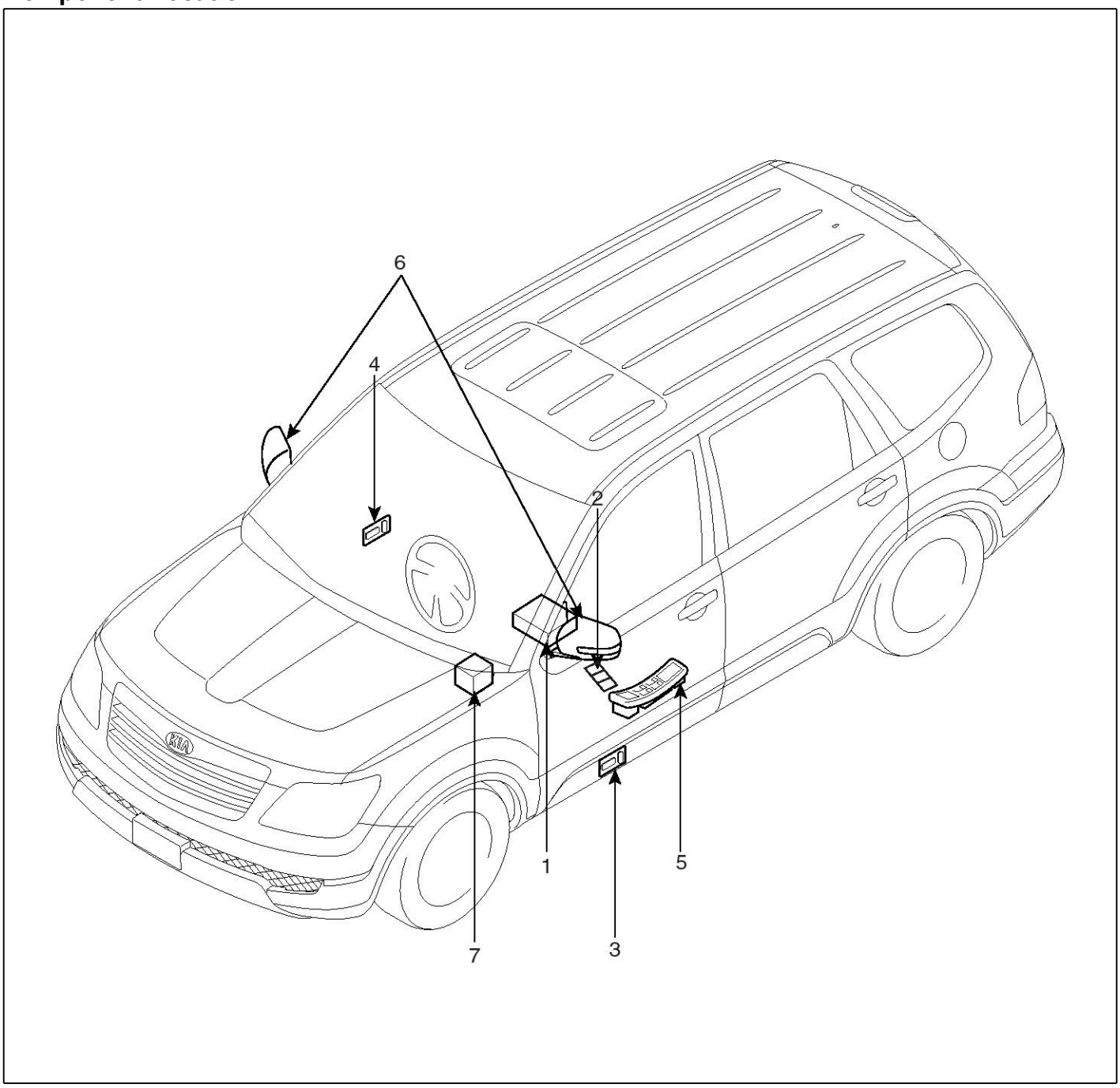
IMS (Integrated Memory System) module

Component Location



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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

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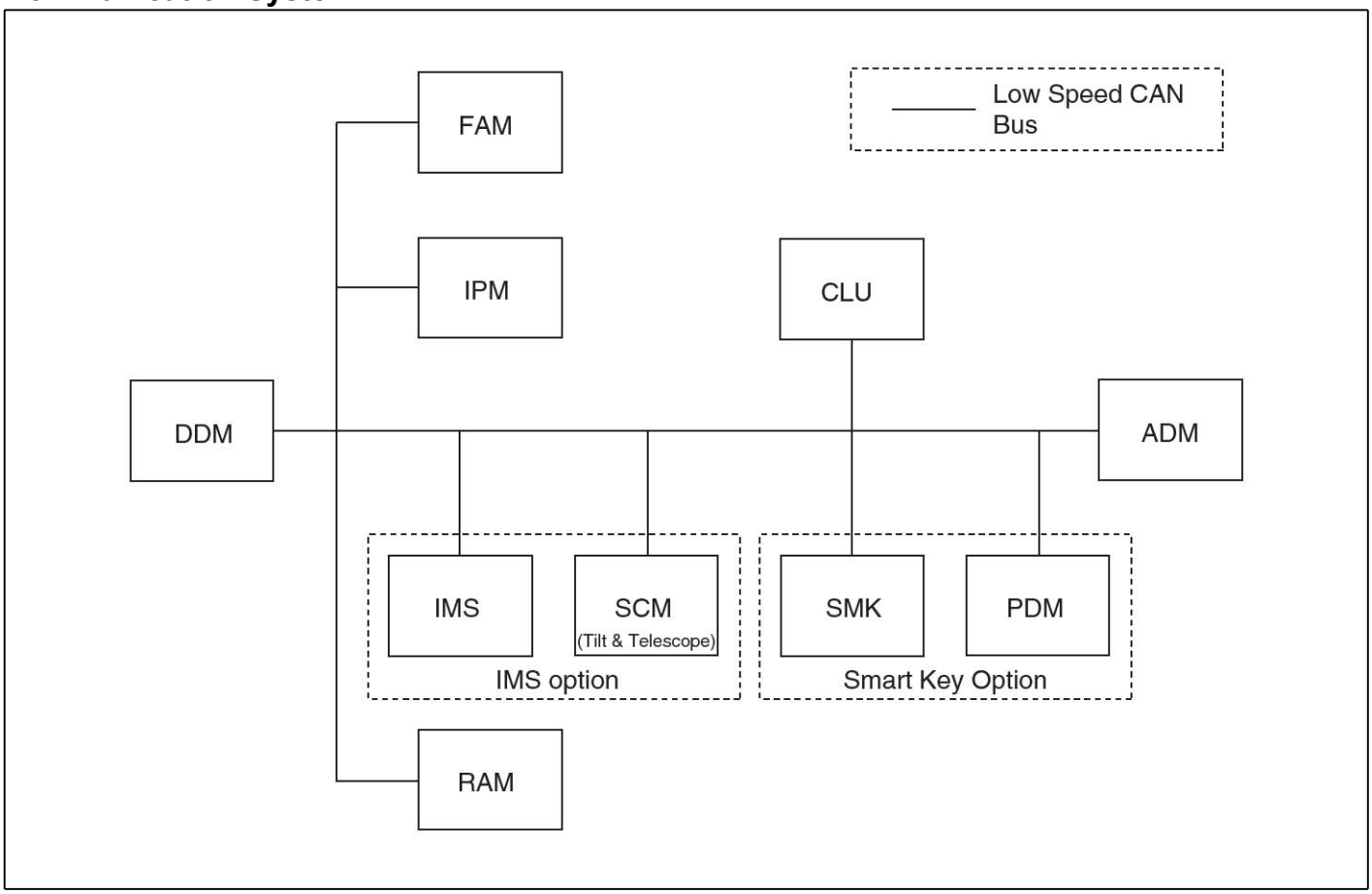
Communication System



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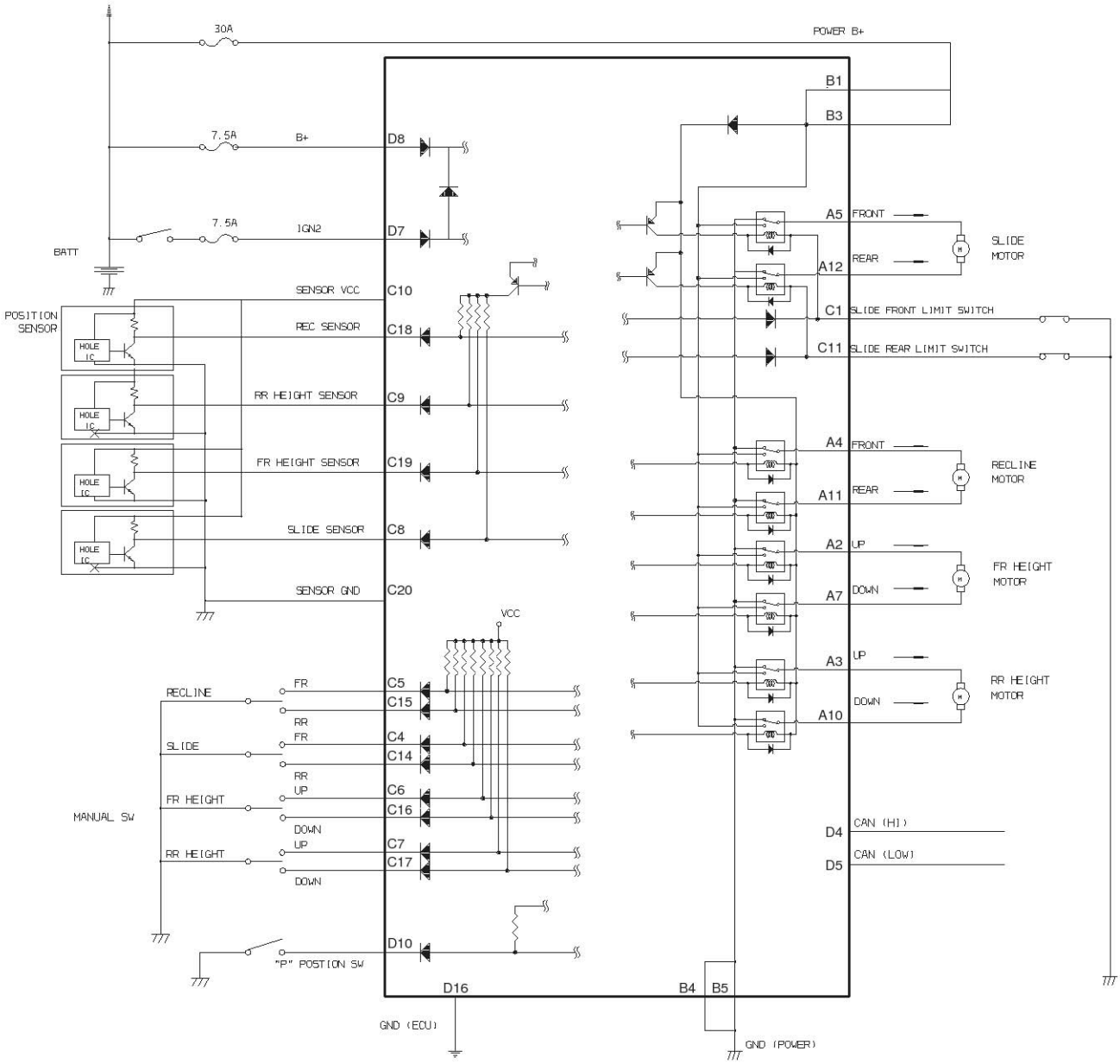
System Diagram



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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”

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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.

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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.

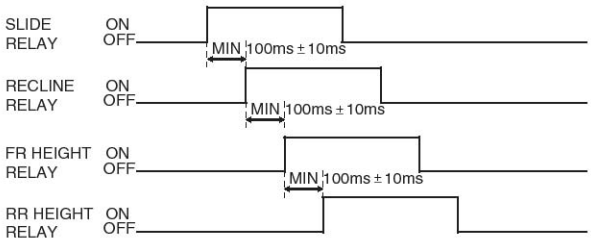
5. Operation control

   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.



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   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

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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)

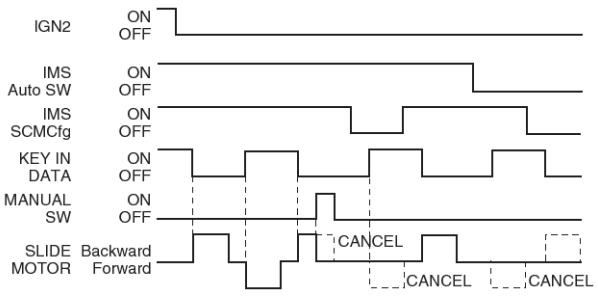
7. When control is halted in the middle of backward operation, the remaining operation will not be completed, and when returning, it will return just as much as it retreated
8. It will move to key out point in case of Get-on gearing by key in despite manual SW input during or after backward operation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



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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

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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

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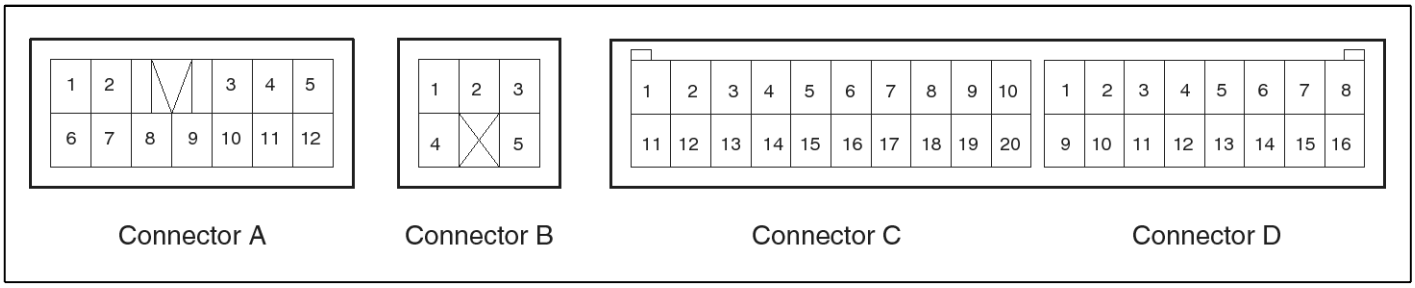
Input/Output Specification

Connector Pin Lay Out



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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

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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	-	-		

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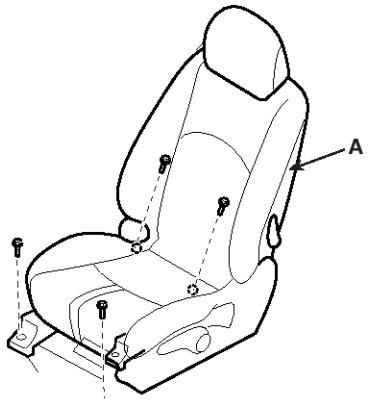
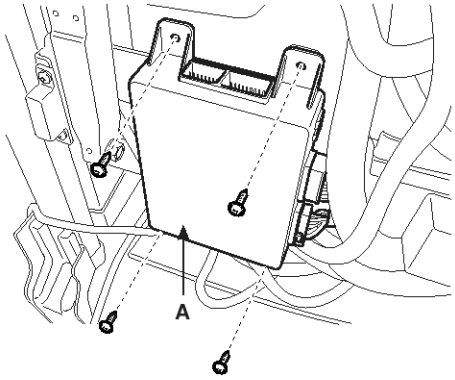
Removal

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.

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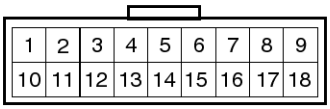
IMS Power Seat Control

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

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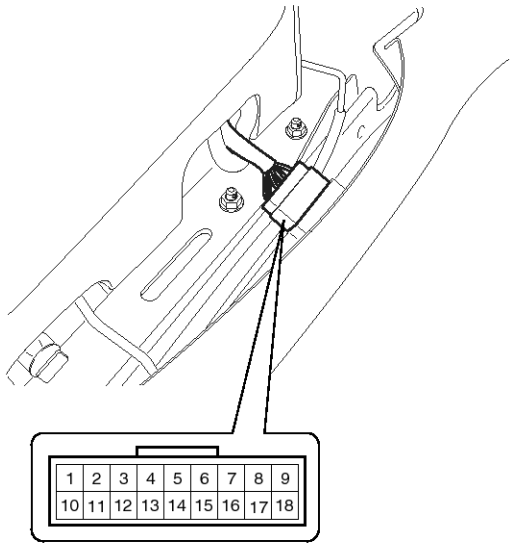
Inspection

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.

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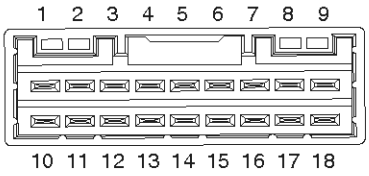
Driver power seat control switch

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

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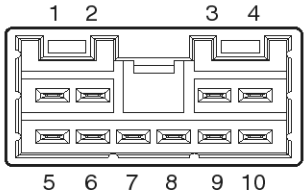
Assist power seat control switch

Assist power seat control switch

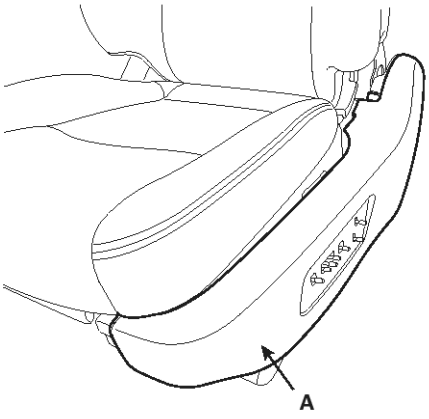
	Slide control			Recline control			Remark
	Right		Neutral		Right		
	Froward	Reward	Slide RH	Recline control	Froward	Reward	
5	●	●			●	●	+
1	●		●				Slide motor
2		●					Slide motor
3				●	●	●	Recline control motor
4				●	●	●	Recline control motor
10				●			Recline control limit
6	●		●				Slide limit
7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



SHMBE9302N

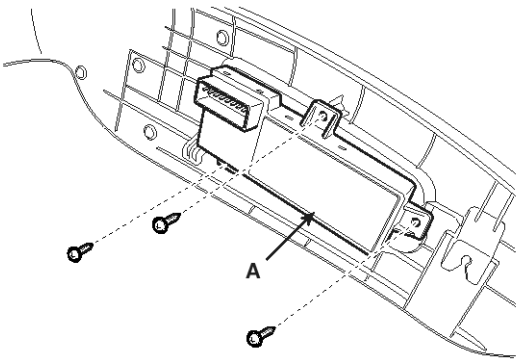
Removal

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.

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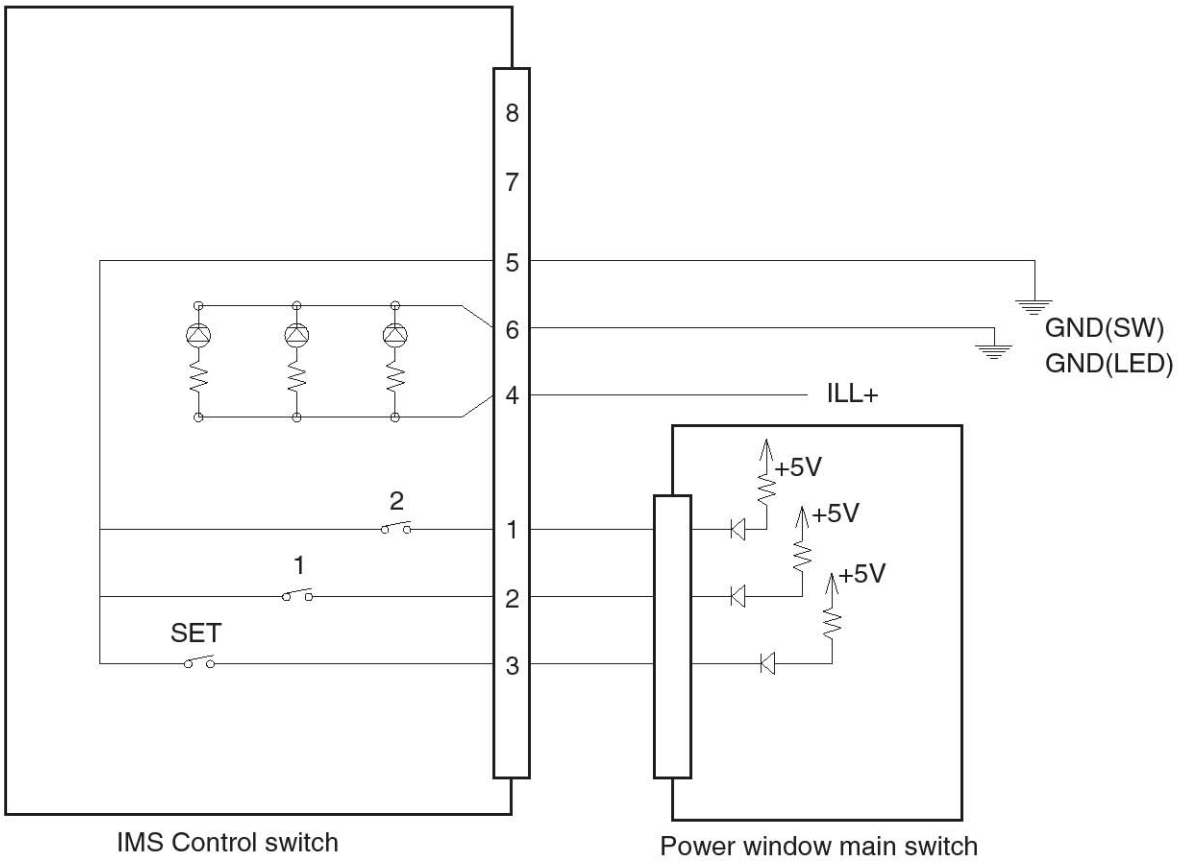
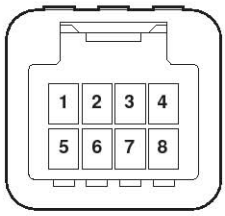
IMS Control Switch

Circuit diagram



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



SHMBE9303N

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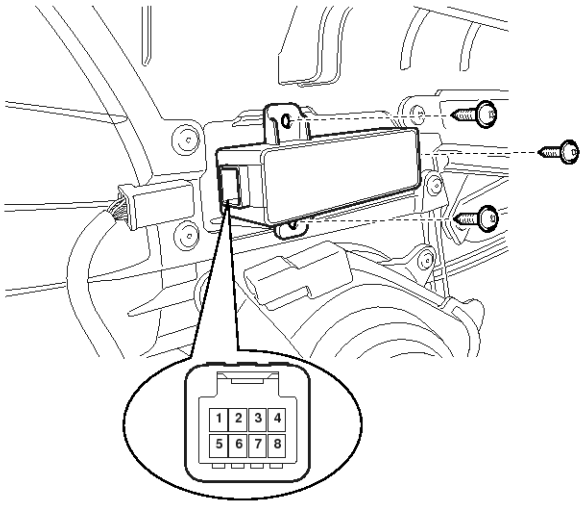
Inspection

1. Disconnect the IMS control switch connector.



SHMBE8159D

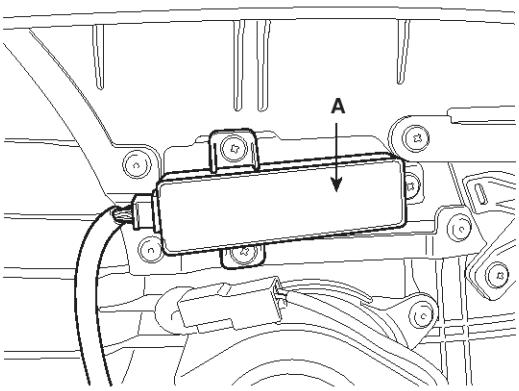
2. With the power IMS control switch in each position, make sure that continuity exists between the terminals below. If continuity is not as specified, replace the IMS control switch.

Position \ Terminal	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.

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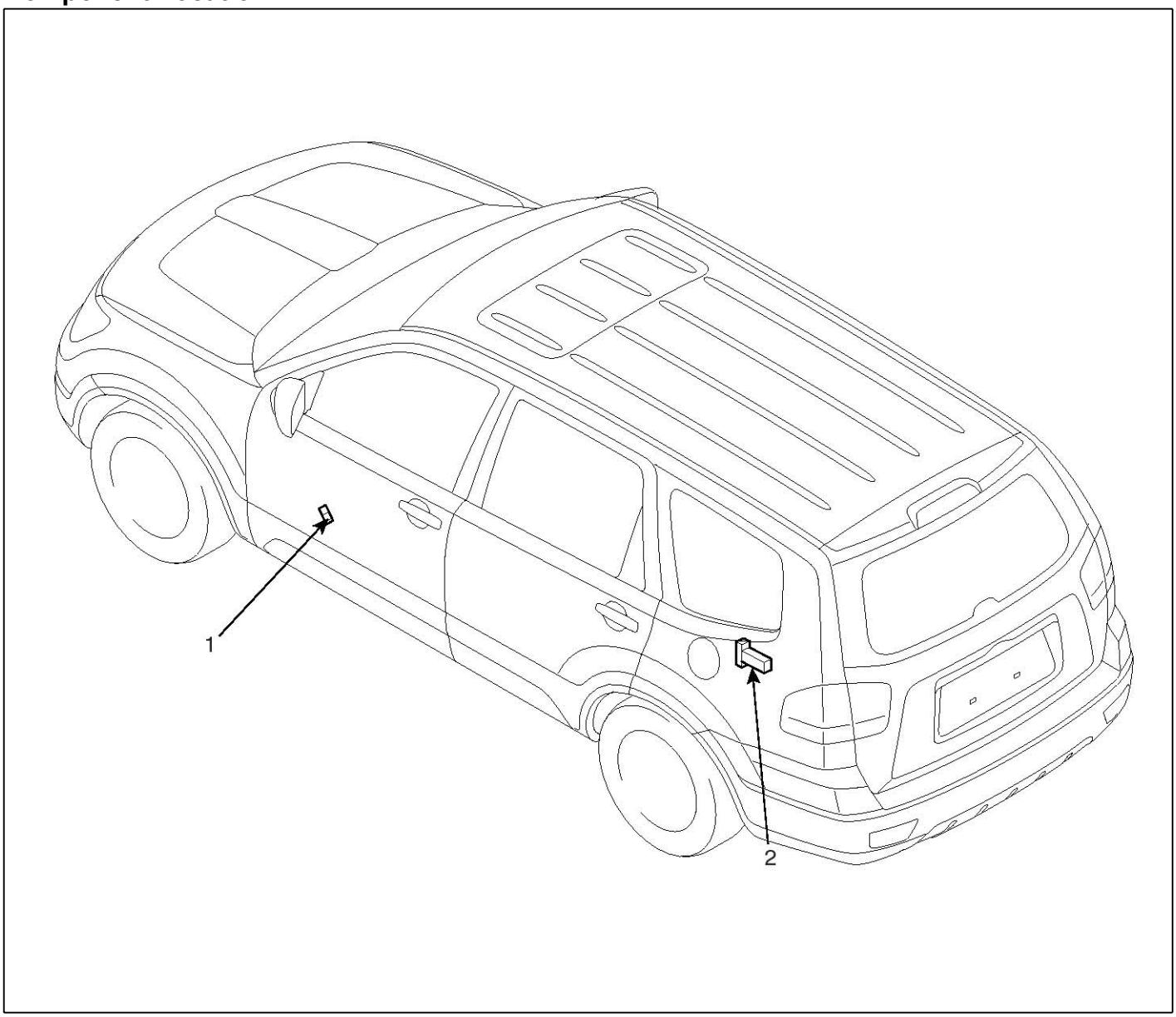
Fuel Filler Door

Component Location



SHMBE8161D

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

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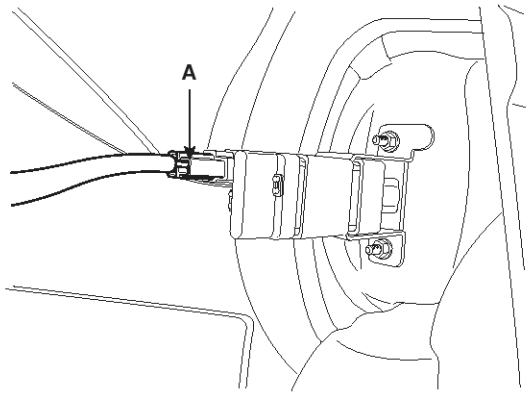
Fuel Filler Door Release Actuator

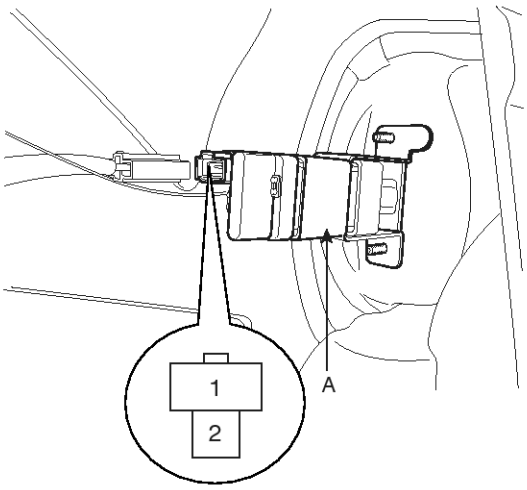
Inspection

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

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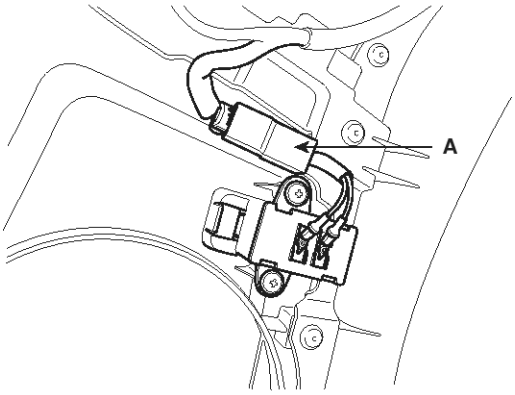
Fuel Filler Door Open Switch

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.

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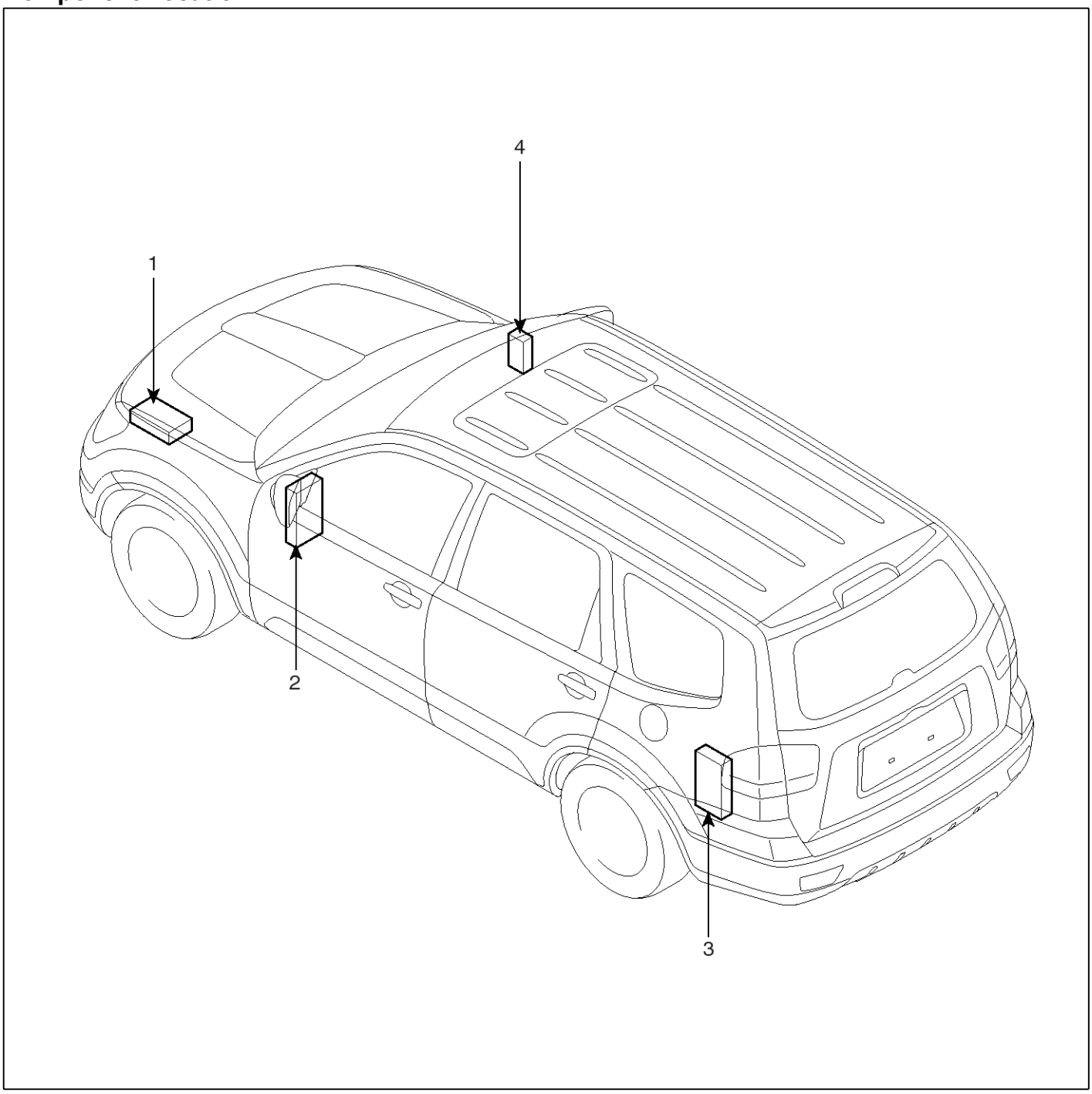
Fuses And Relays

Component Location



SHMBE9116L

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

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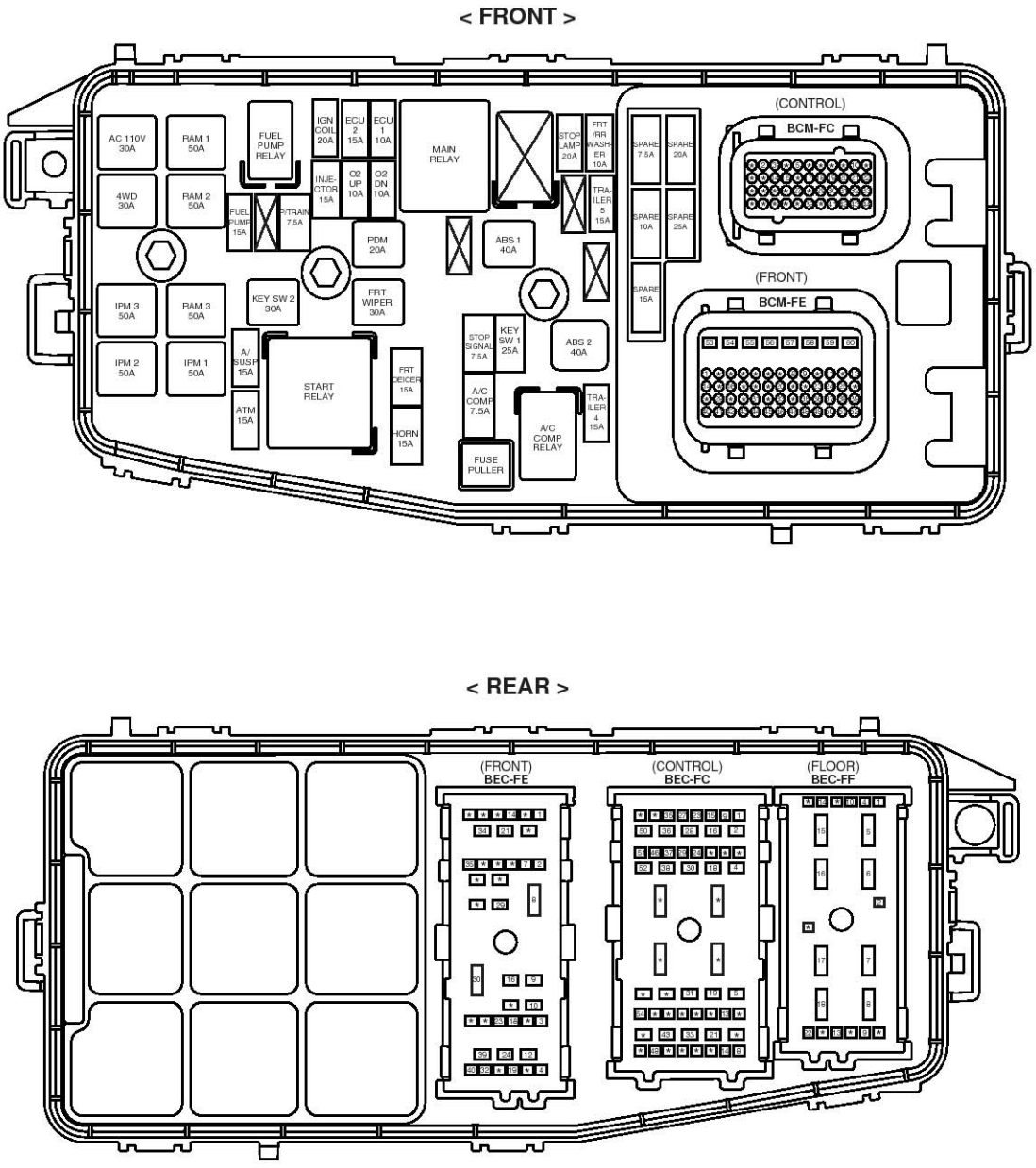
Relay Box (Engine Compartment)

Components

FAM (Front Area Module)



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CIRCUIT

Description		(A)	Circuit Protected
FUSE	FRT/RR WASHER	10A	Front/Rear Washer Motor Relay, Washer Motor
	TRAILER 5	15A	Tail Lamp Converter
	TRAILER 4	15A	Tail Lamp Converter
	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, ECM, ESC 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, Canister Close 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, Camshaft Position Sensor #1 ~ #3(G8BA)
	P/TRAIN	7.5A	ECM, Main Relay, Relay Box(Burglar Horn Relay), Generator(G8BA)
	FUEL PUMP	15A	Fuel Pump Relay, Fuel Sender & Fuel Pump Motor
	A/SUSP	15A	Air Suspension Control Module
	ATM	15A	TCM
FUSIBLE LINK	ABS 2	40A	ABS Control Module
	ABS 1	40A	ABS 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 LINK 30A, TRAILER 2 FUSIBLE LINK 30A)
	IPM 1	50A	IPM(ILLUMI FUSE 7.5A, 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
	AC 110V	30A	AC INVERTER MODULE

※ USE THE DESIGNATED FUSE ONLY

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Inspection

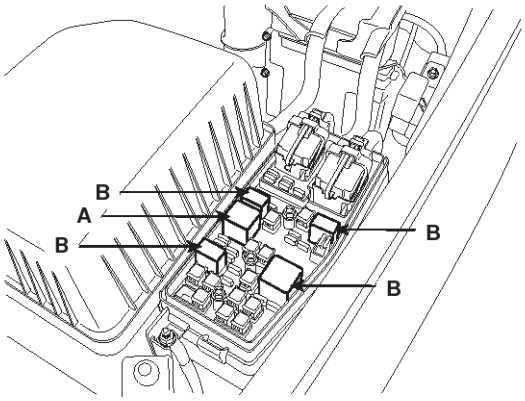
Fuse

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.

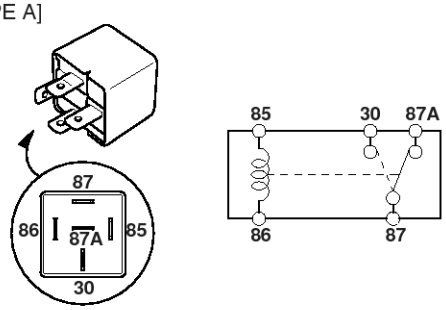
Relay

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



SHMBE9313N

[TYPE A]

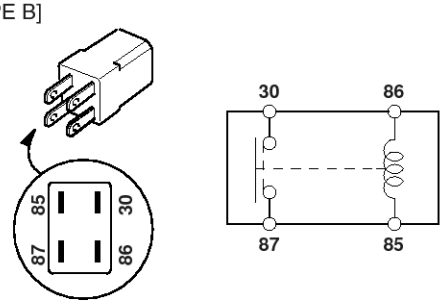


SHMBE9096N

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.

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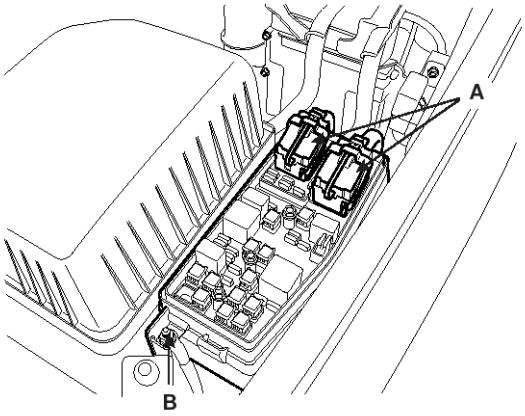
Replacement

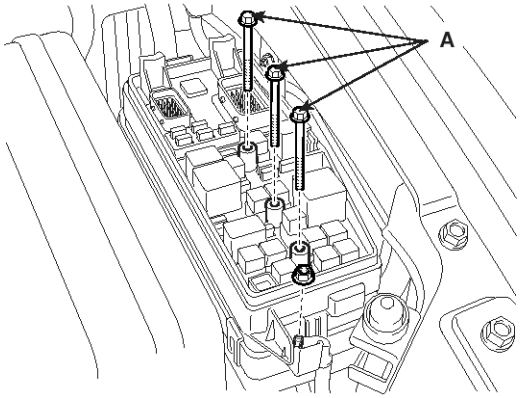
FAM (Front Area Module)

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).



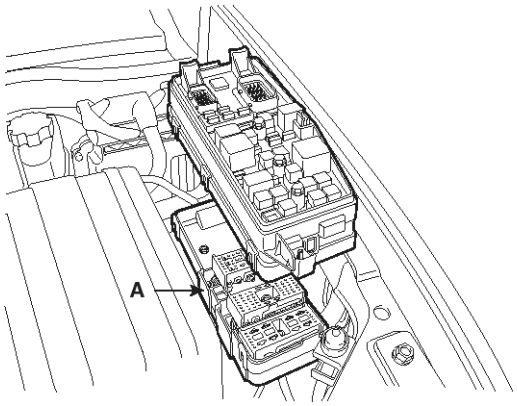
SHMBE8136D

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.

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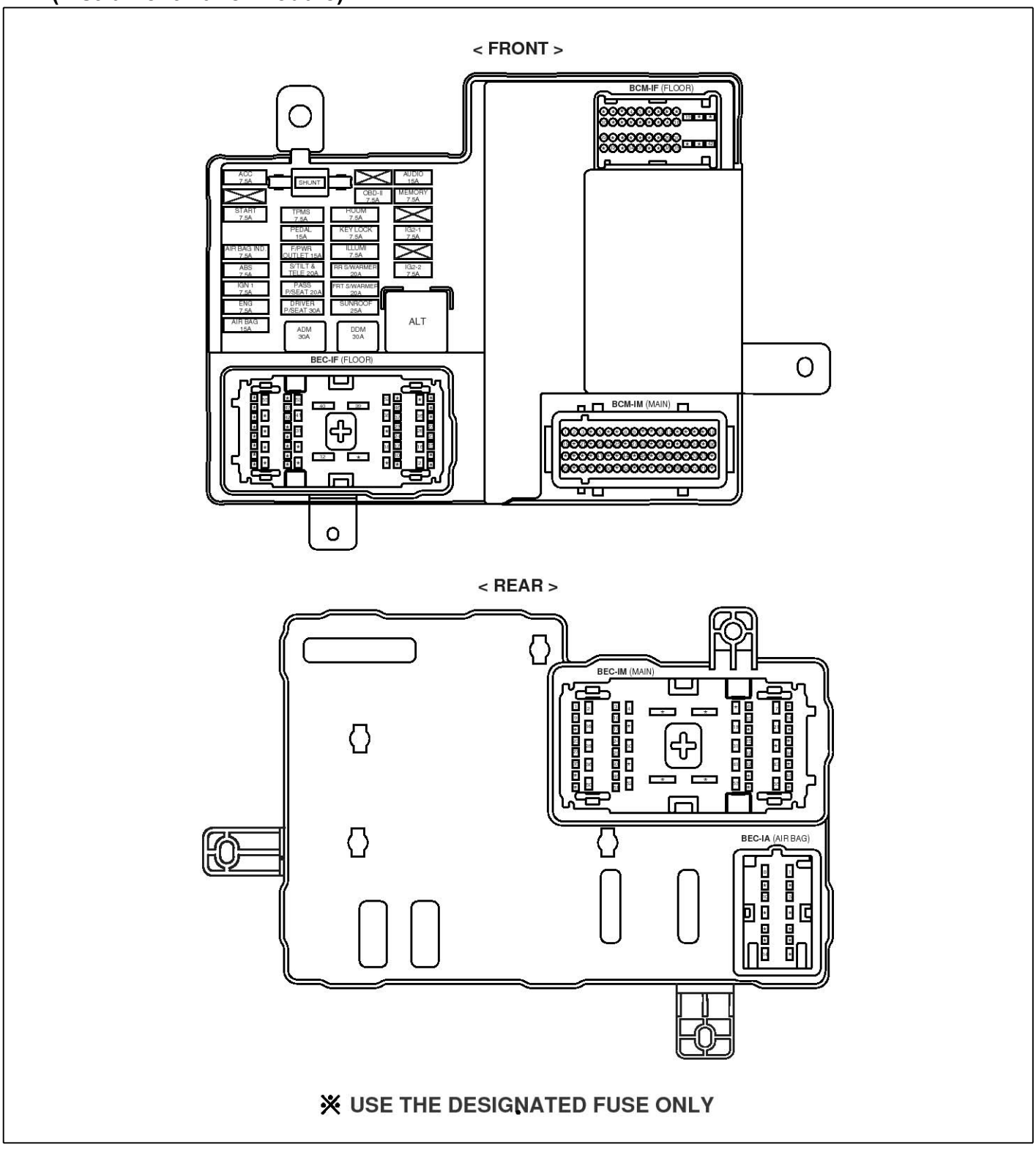
Relay Box (Passenger Compartment)

Components

IPM (Instrument Panel Module)



SHMBE9324N

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CIRCUIT

Description		(A)	Circuit Protected
FUSE	AUDIO	15A	Audio, Rear Monitor, RSE Control Box, DVD Player Can
	MEMORY	7.5A	Front/Rear A/C Control Module, Instrument Cluster(IND.), FAM, RAM, Driver/Assistant Door Module, IMS Control Module, Tilt & Telescopic Module
	IG2-1	7.5A	Front A/C Control Module, Incar Temperature Sensor, Multifunction Switch(Wiper/Washer), Driver/Passenger Seat Warmer Module, Front/Rear Blower Relay, Electro Chromic Mirror, AC Inverter Switch/Module, Trailer Relay, C/FAN HI/LOW 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	Data Link Connector, Multipurpose Check Connector, Start Stop Button Switch, PDM, 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, Ignition Key Interlock
	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
	TPMS	7.5A	Tire Pressure Monitoring Module
	PEDAL	15A	Adjustable Pedal Relay
	F/PWR OUTLET	15A	Front Power Outlet
	S/TILT & TELE	20A	Tilt & Telescopic Module
	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, Rear Monitor, RSE Control Box, DVD Player Can, Smart Key Control Module
	START	7.5A	Burglar Alarm Relay, Start Relay
	AIR BAG IND.	7.5A	Instrument Cluster(Air Bag IND.)
	ABS	7.5A	ABS Control Module, ESC Control Module, DBC Relay, Steering Angle Sensor, Crash Pad Switch LH
	IGN 1	7.5A	Rheostat, Instrument Cluster(MICOM), Multifunction Switch(Cruise Remocon), Generator, Air Suspension Control Module, Audio, PODS Module, Rear Parking Assist Buzzer, Rear Parking Assist Switch, Rear Parking Assist Control Module, Tire Pressure Monitoring Module
	ENG	7.5A	Multipurpose Check Connector, ECM, TCM, Front Wiper Motor, 4WD ECM, Stop Lamp Switch, Free Running Differential Air Pump, Generator(G8BA)
	AIR BAG	15A	SRS Control Module, Telltale Lamp
FUSIBLE LINK	DDM	30A	Driver Door Module, Driver Safety Power Window Motor
	ADM	30A	Assistant Door Module, Passenger Safety Power Window Motor

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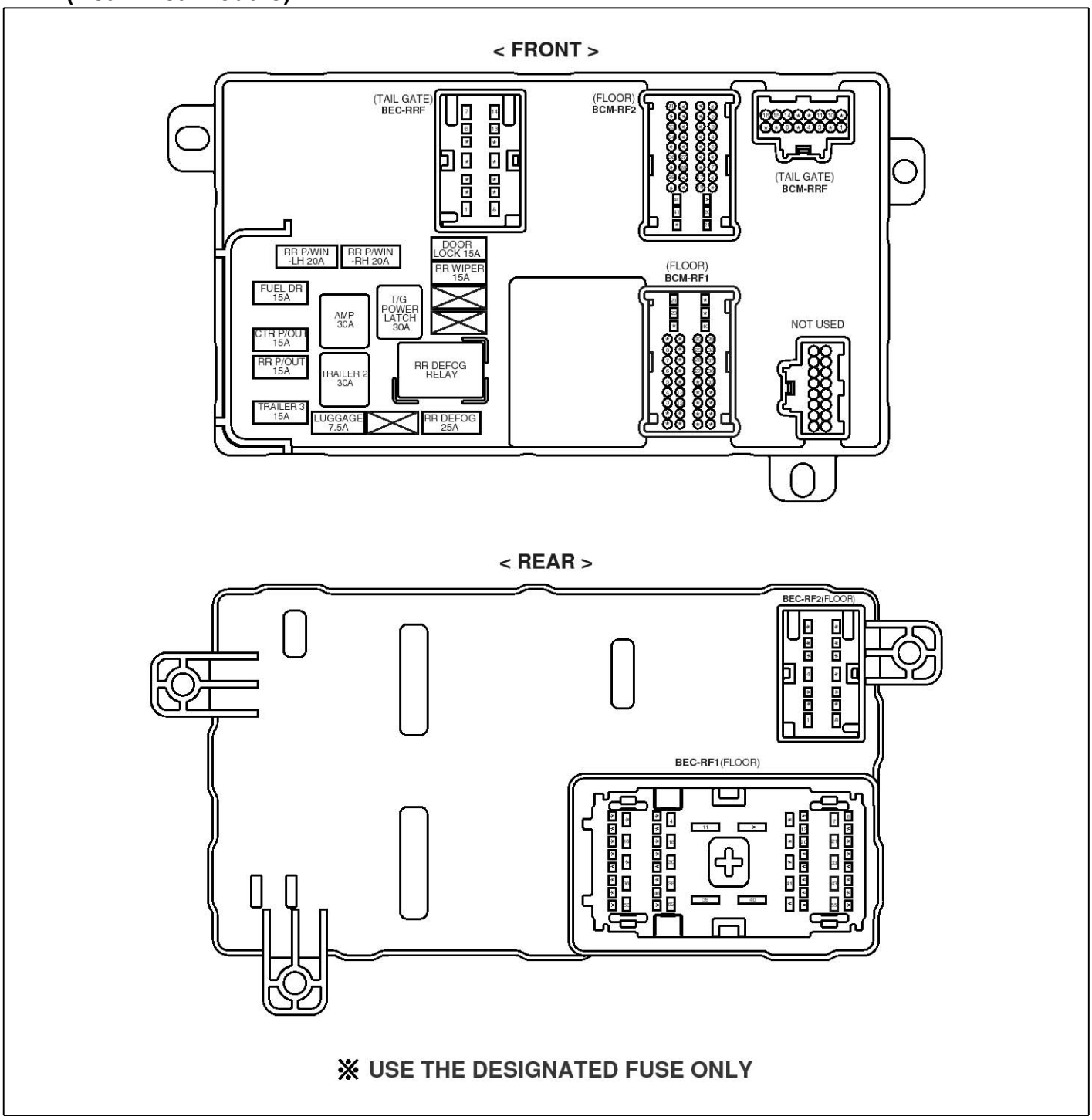
RAM (Rear Area Module)



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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
	TRAILER 3	15A	Tail Lamp Converter
FUSIBLE LINK	T/G POWER LATCH	30A	Tail Gate Control Module
	AMP	30A	AMP
	TRAILER 2	30A	Tail Lamp Converter

※ USE THE DESIGNATED FUSE ONLY

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Inspection

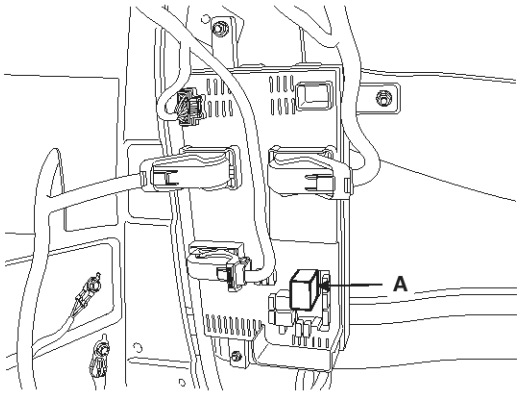
Fuse

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.

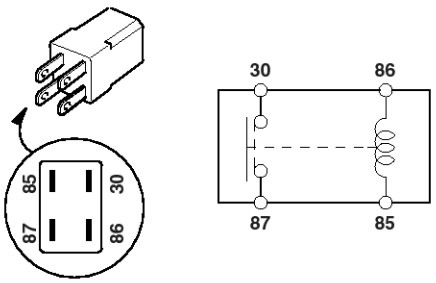
Relay (Rear Defogger)

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

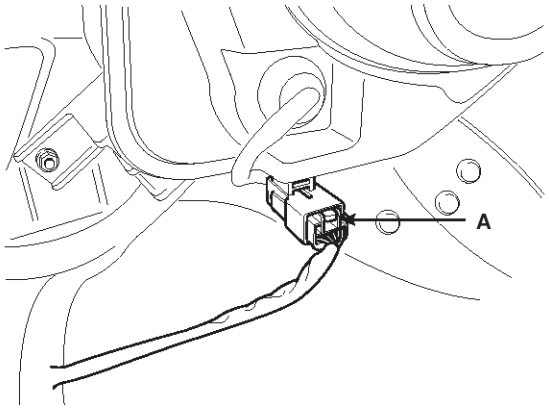
Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

SHMBE9093N

RAM (Rear Area Module)

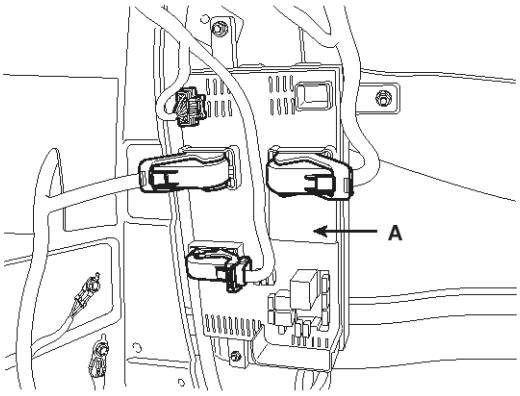
1. Disconnect the nagative(-) battery Terminal.
2. Remove the rear left luggage side trim.

   (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

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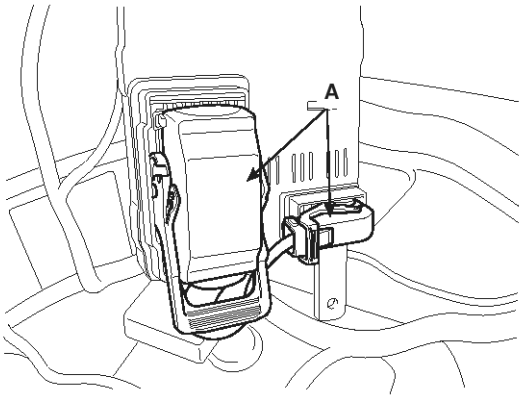
5. Disconnect the back side connector (A) of RAM.



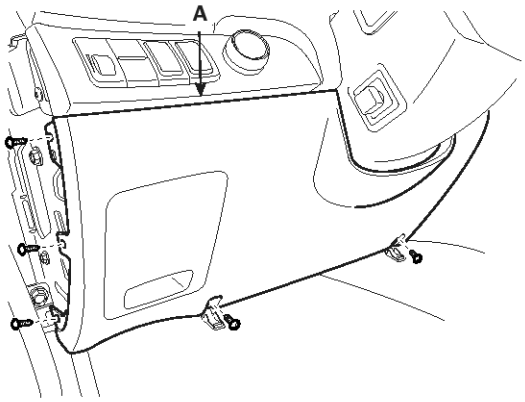
SHMBE8139D

6. Installation is the reverse of removal procedures.

Replacement

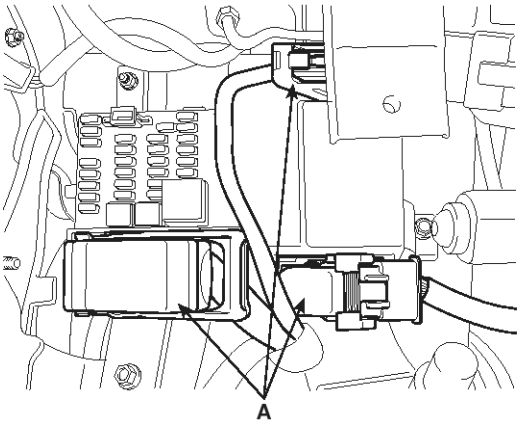
IPM (Instrument Panel Module)

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



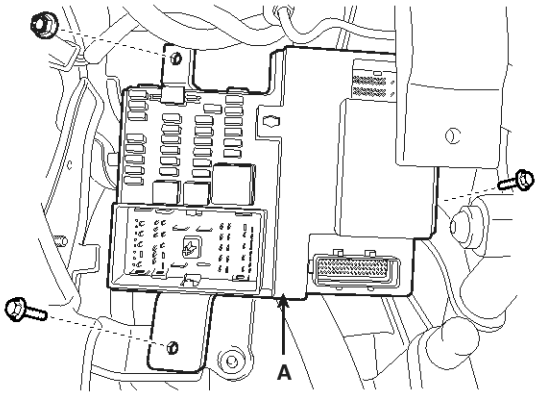
SHMBE8132D

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.

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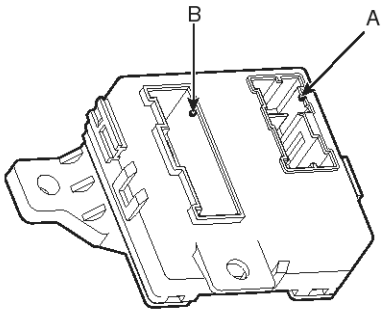
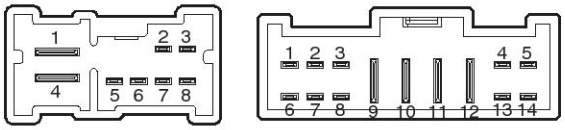
PDM (Power Distribution Module) Relay Box

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.

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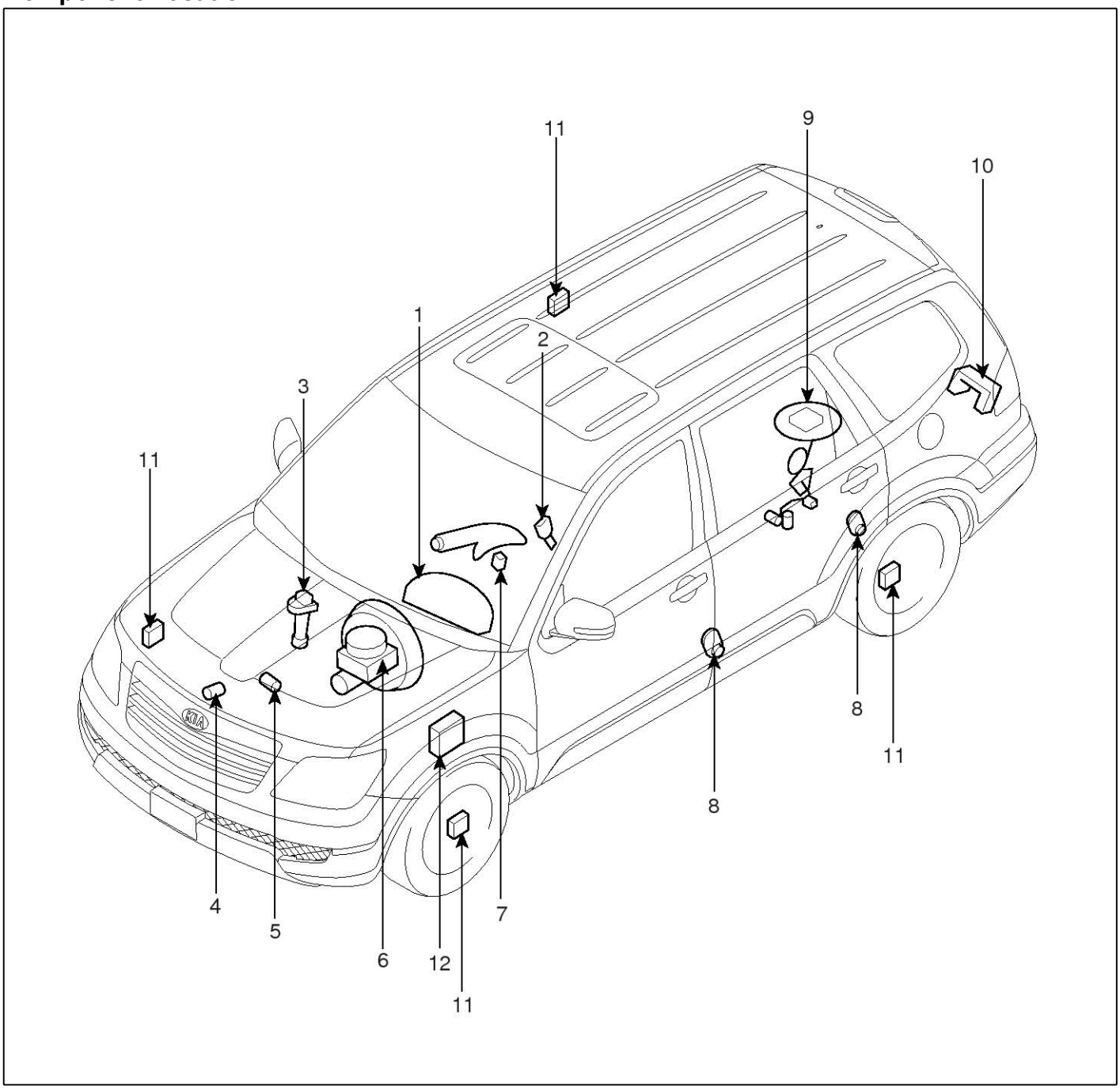
Indicators And Gauges

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

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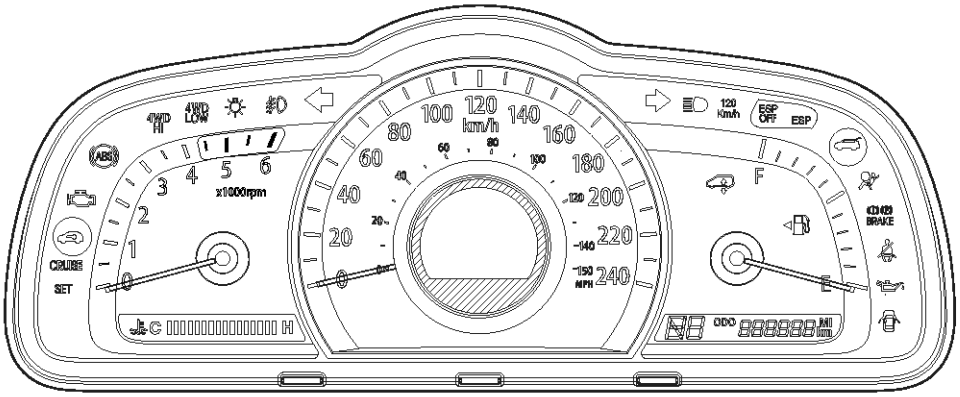
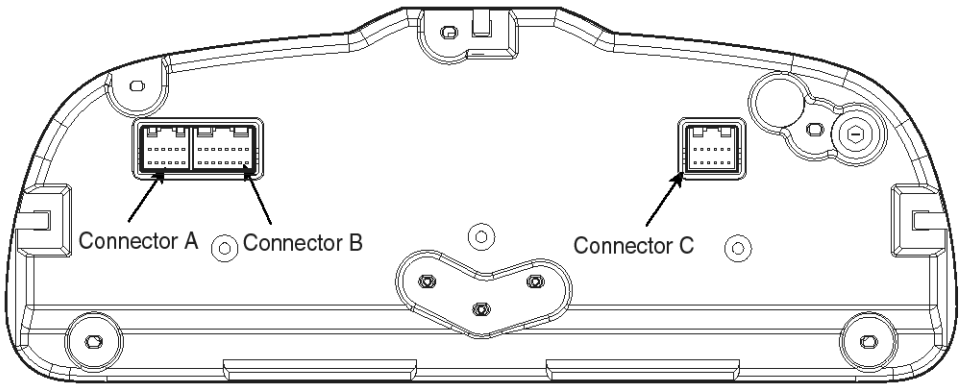
Instrument Cluster

Components

[Front]



[Rear]



SHMBE9117L

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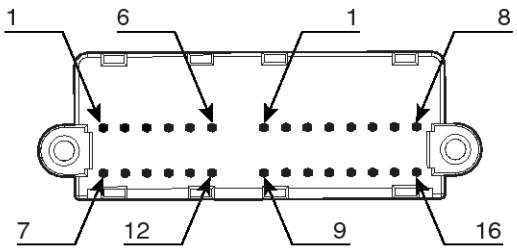

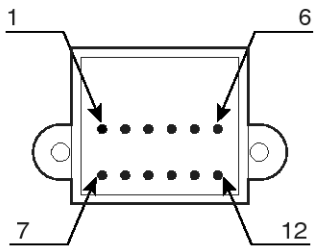

Pin No.	Connector A	Connector B	Connector C
1	Airbag +	-	Fuel input
2	Airbag input	4P OUT	Ground
3	Mode SW	-	-
4	Reset SW	Immobilizer	-
5	-	C CAN LOW	-
6	-	C CAN HIGH	CHECK Engine
7	P	B CAN HIGH	Battery
8	R	B CAN LOW	Ground
9	N	-	IGN1
10	D	-	Diagnosis
11	-	-	-
12	-	-	-
13		Illumination +	
14		Illumination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

SHMBE9118L

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Inspection

Speedometer

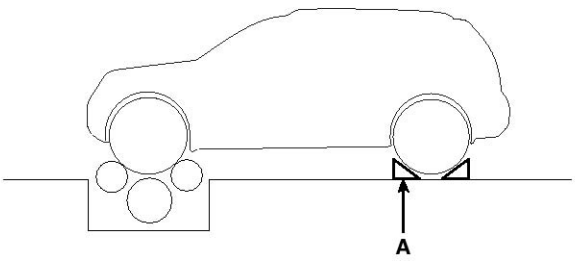
1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks as appropriate.
3. Check if the speedometer indicator range is within the standard values.

⚠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.

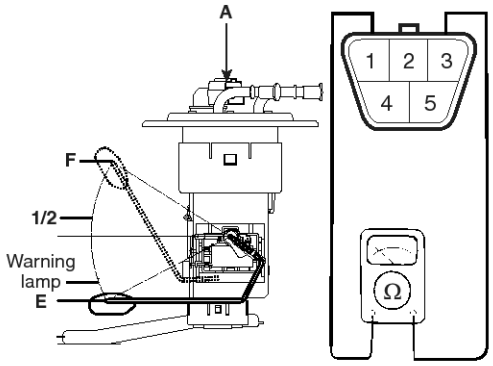
⚠CAUTION

- **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

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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

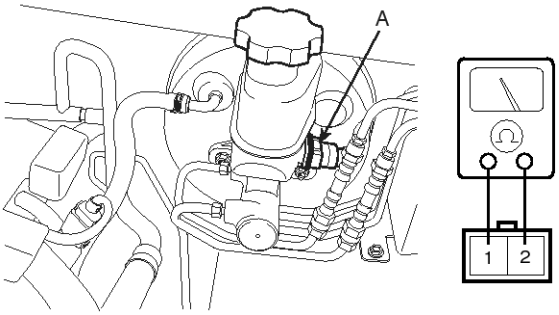
⚠CAUTION

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

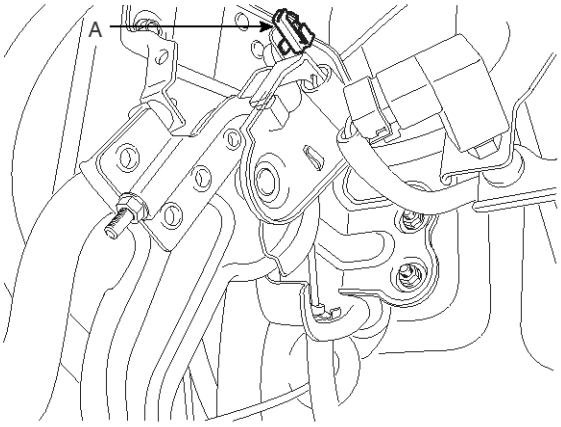
1. Ignition "ON"
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

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.

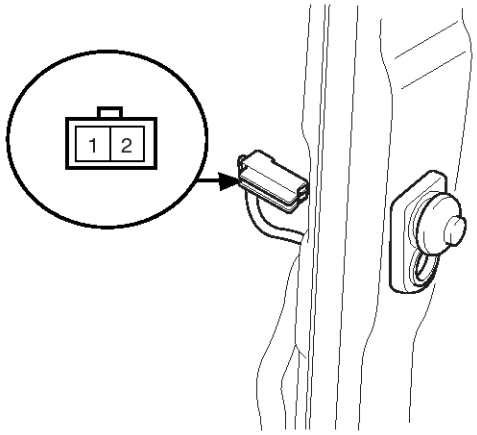
If continuity is not as specified, replace the switch or inspect its ground connection.



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

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

ETQF180D

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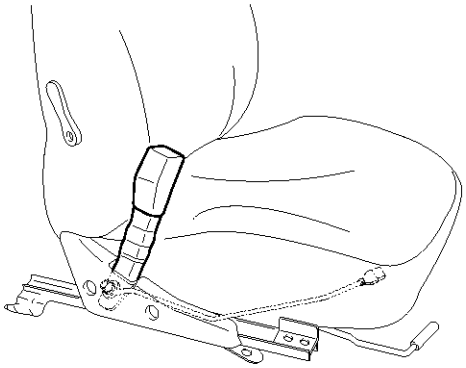
Seat Belt Switch

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

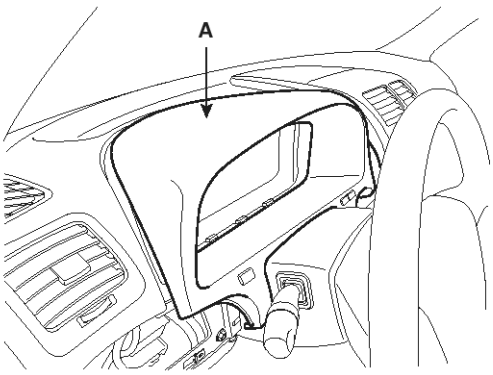
Seat Belt Warning Lamp

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

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

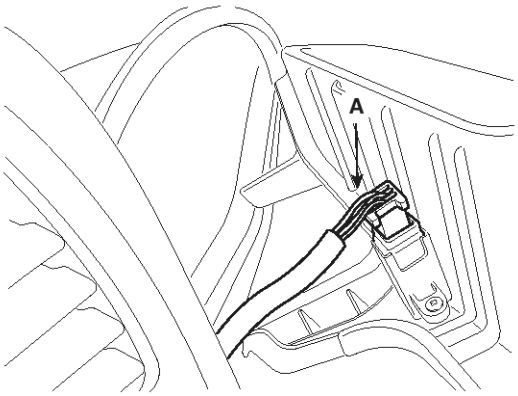
Replacement

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



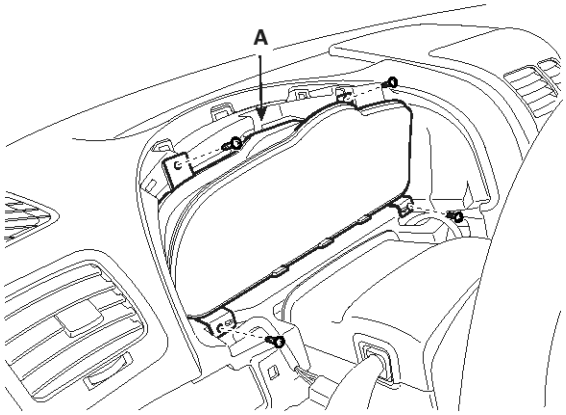
SHMBE8200D

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



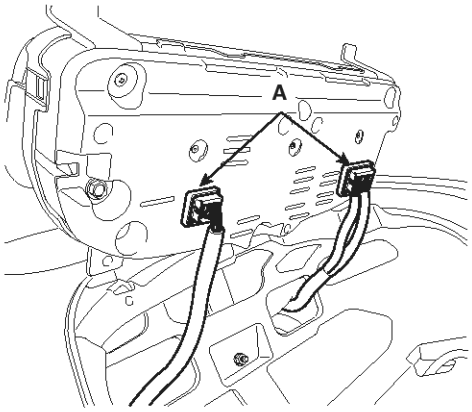
SHMBE8201D

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

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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

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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

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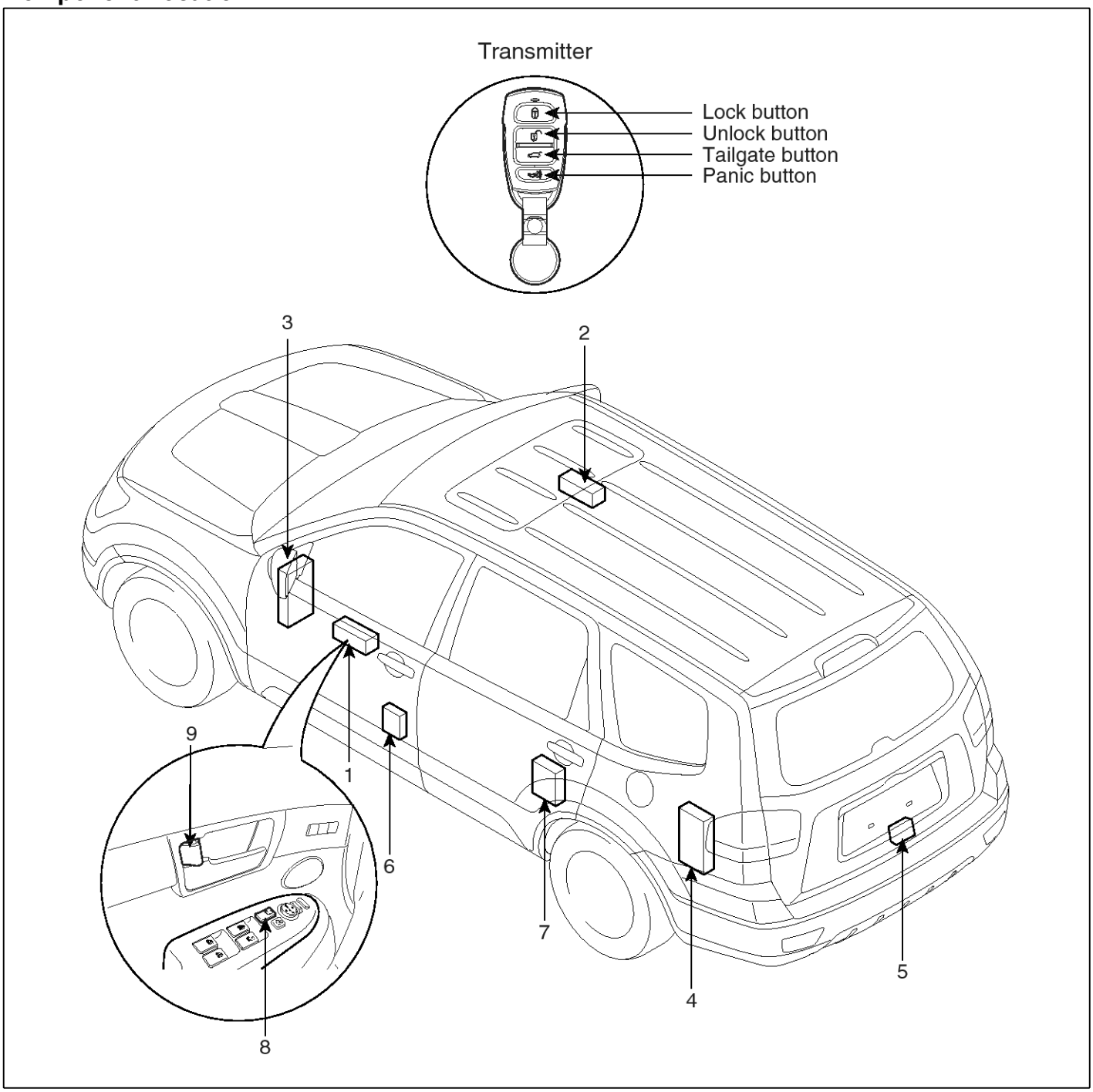
Power Door Locks

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

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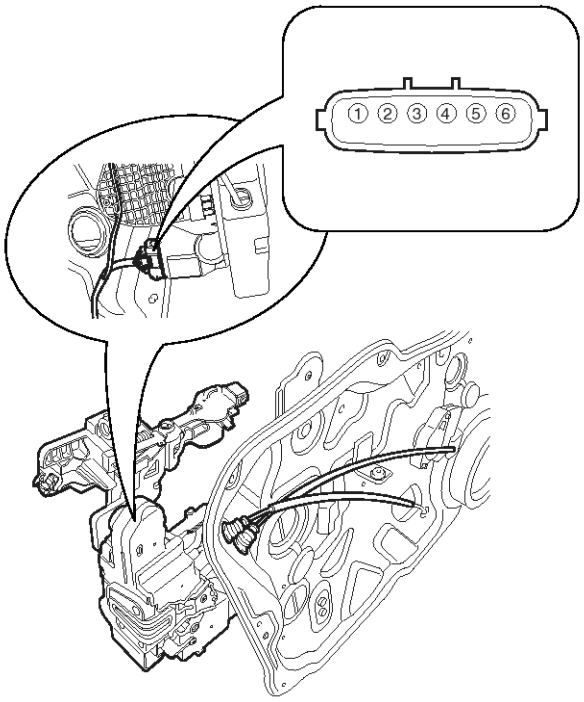
Power Door Lock Actuators

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

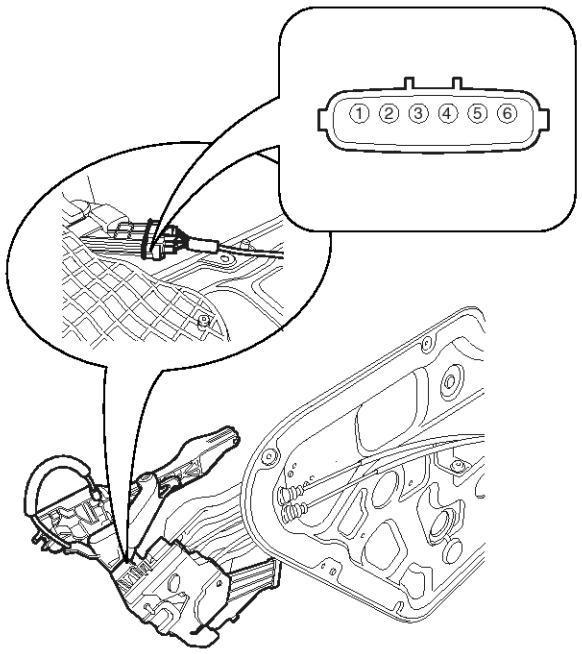
4. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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

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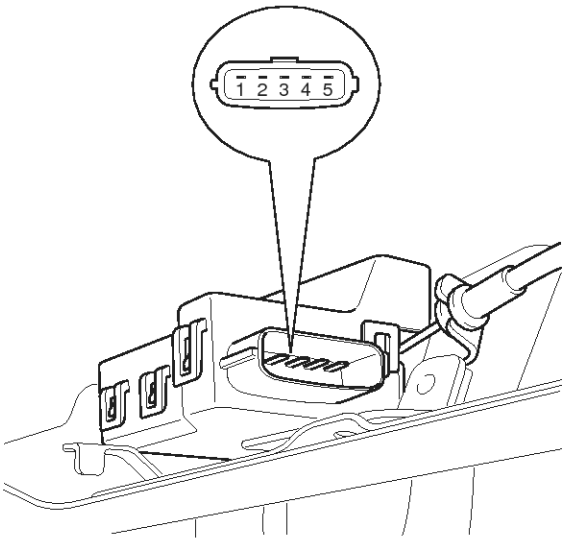
Tailgate Lock Actuator

1. Remove the tailgate trim.
   (Refer to the Body group - tailgate)
2. Disconnect the 5P connector from the tailgate latch.



SHMBE8123D

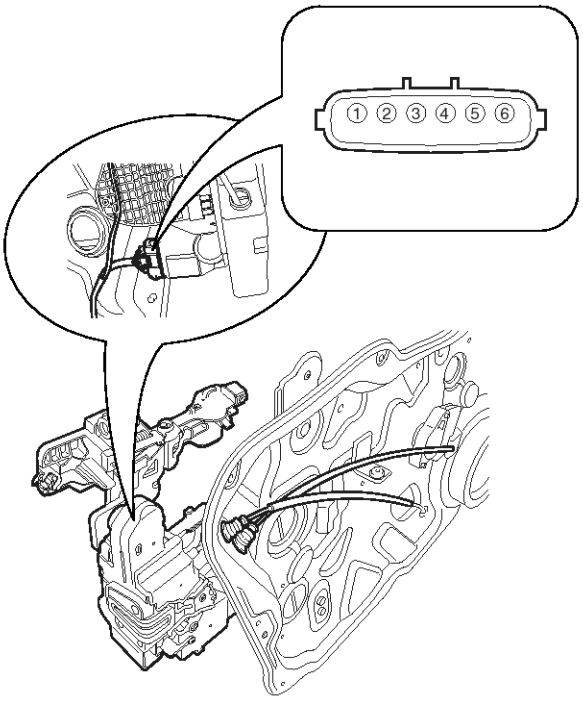
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

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

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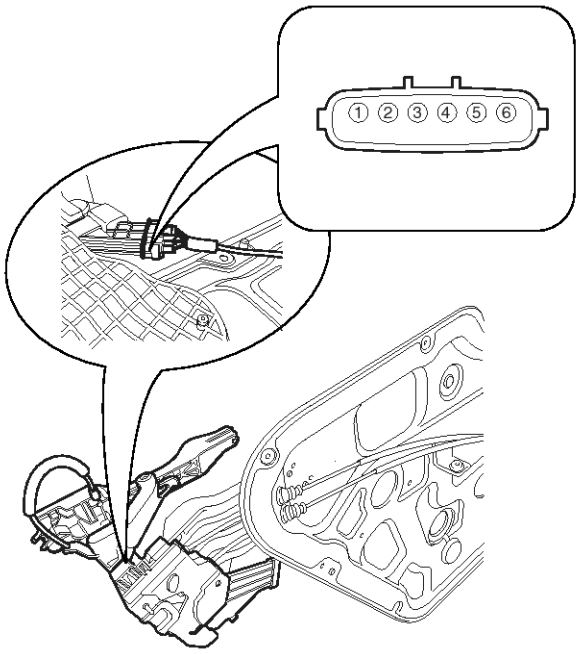
Rear Door Lock Switch

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

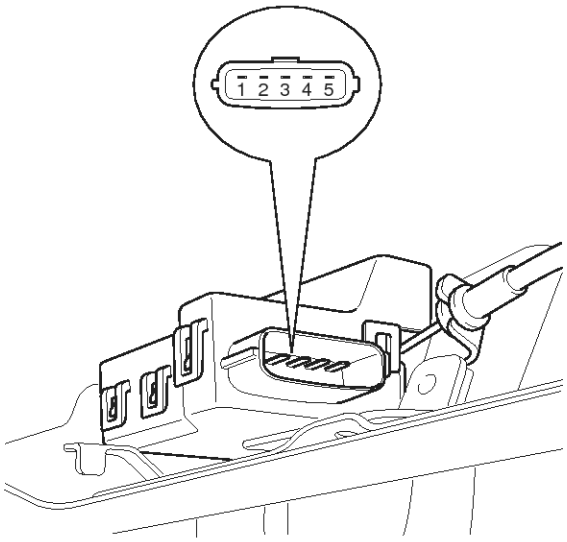
4. Check for continuity between the terminals in each switch position according to the table.

Terminal / Position		1	3
Rear Left	Unlock	○———	———○
Terminal / Position		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.

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

SHMBE9054L

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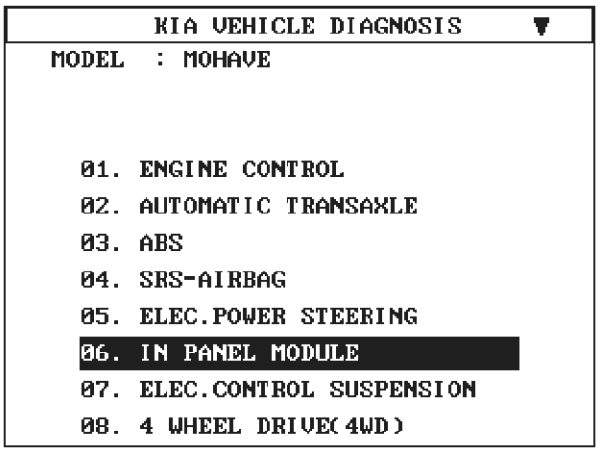
Power Door Lock Switch

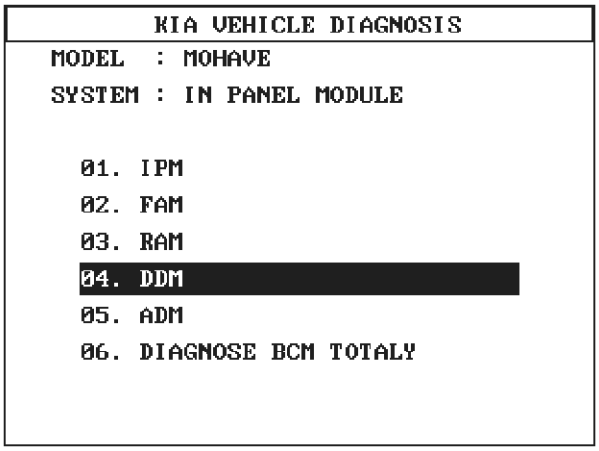
Inspection

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)".



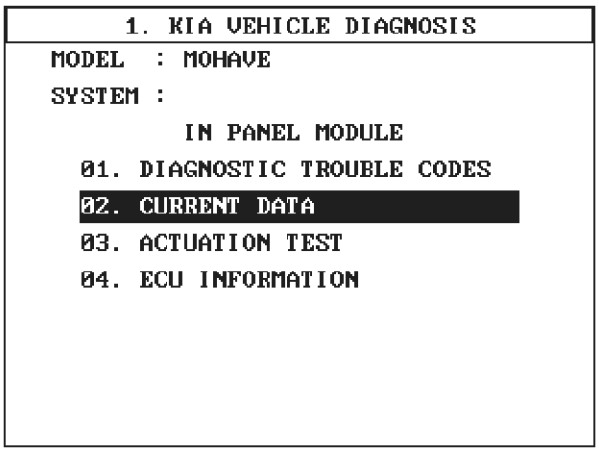
SHMBE9102L

3. Select option "Driver Door Module (DDM)".

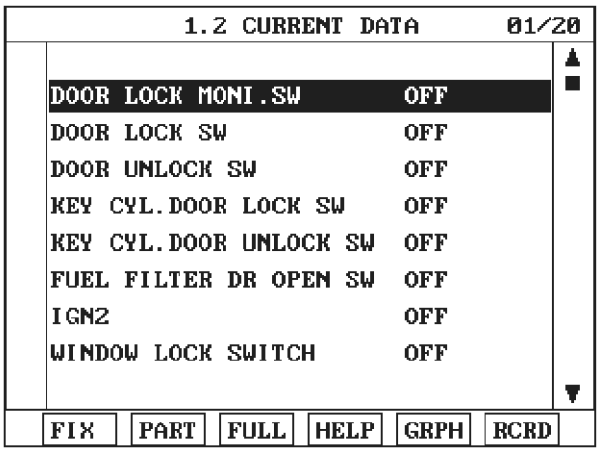


SHMBE9109L

4. Select option "Current Data".



SHMBE9110L



SHMBE9328N

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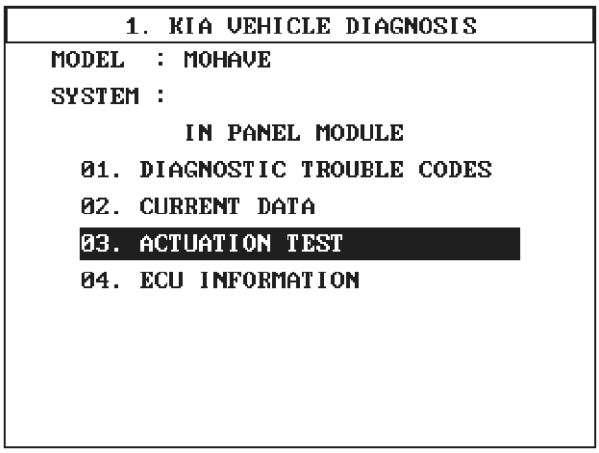
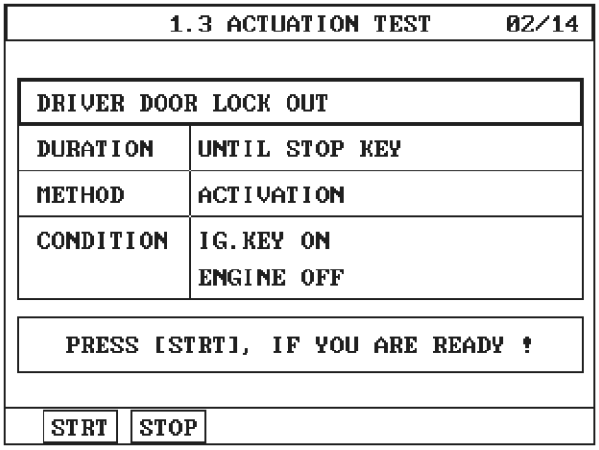
5. To check the Input Value of door lock switch in force mode, select option "Actuation Test".



SHMBE9107L

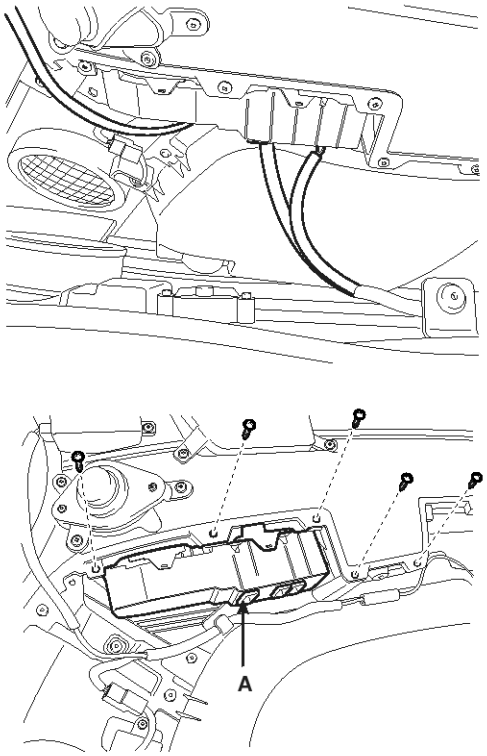


SHMBE9169N

Replacement

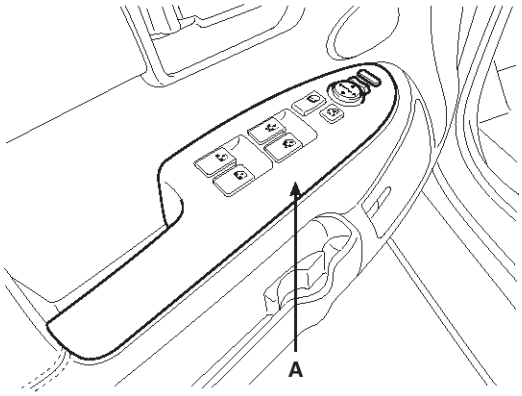
DDM (Drive Door Module)

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

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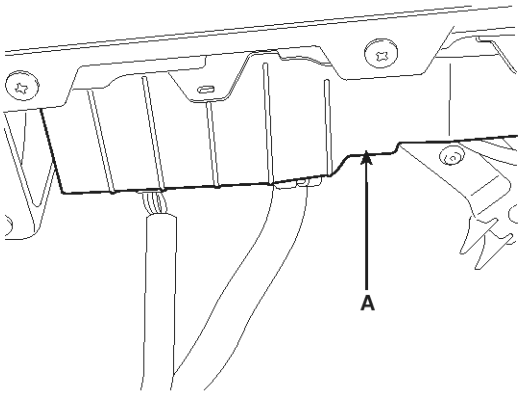
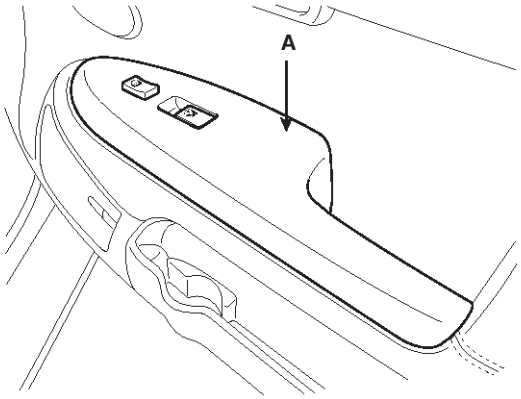
ADM (Assist Door Module)

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

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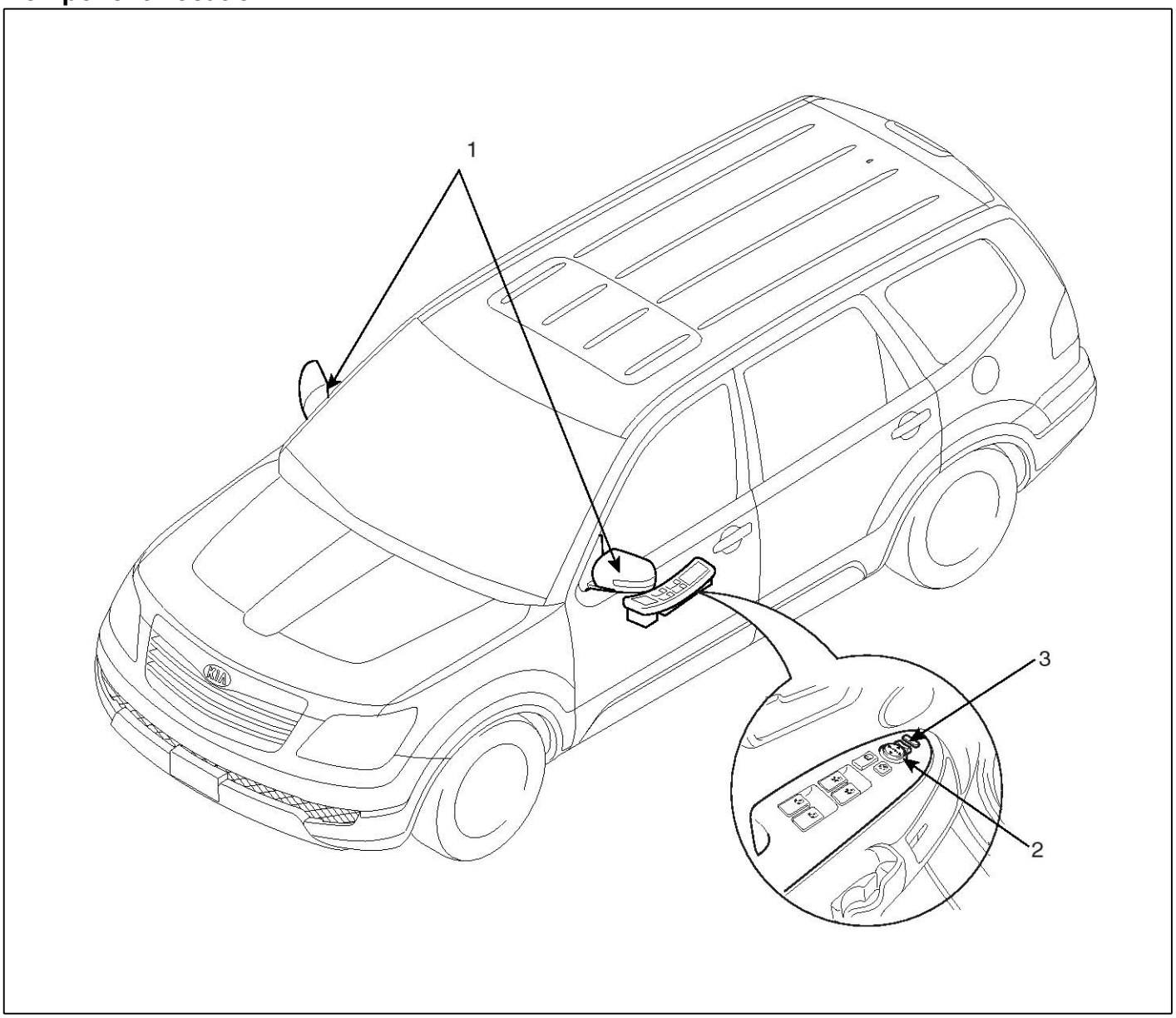
Power Door Mirrors

Component Location



SHMBE8205D

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

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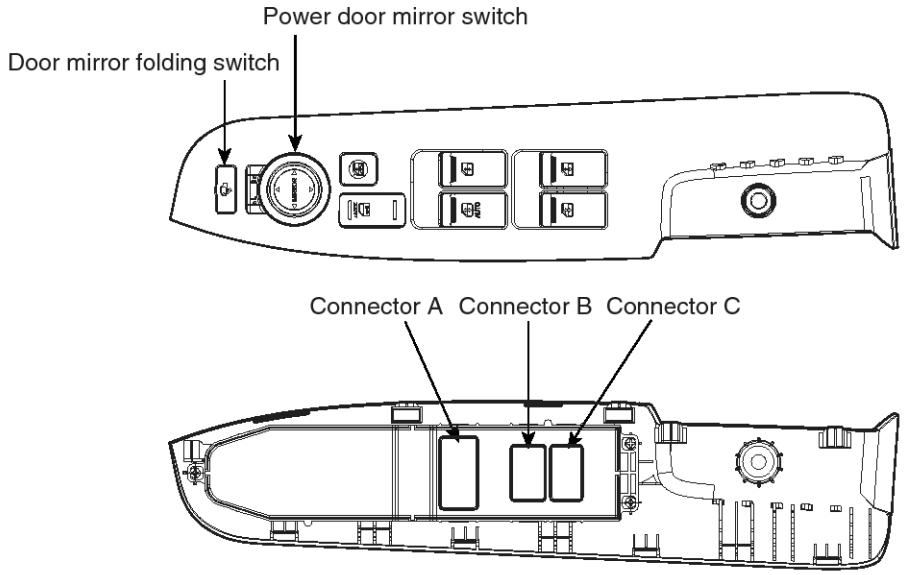
Power Door Mirror Switch

Circuit Diagram



Connector A	Connector B	Connector C
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	-	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

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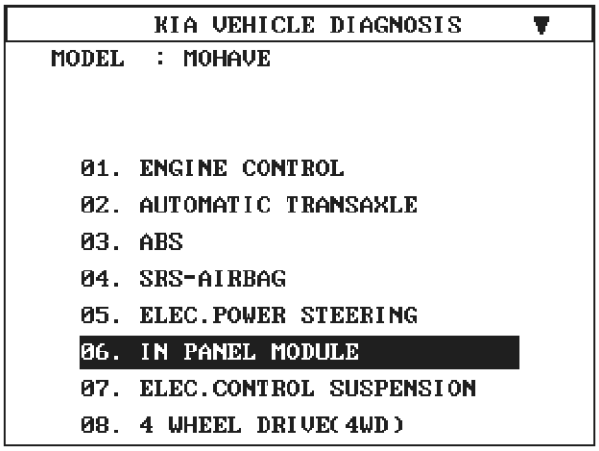
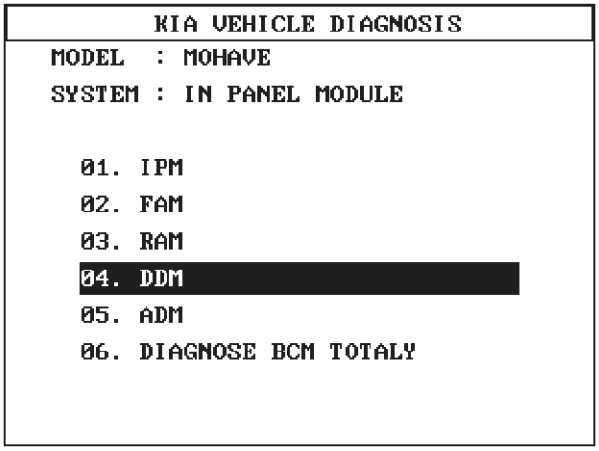
Inspection

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)".



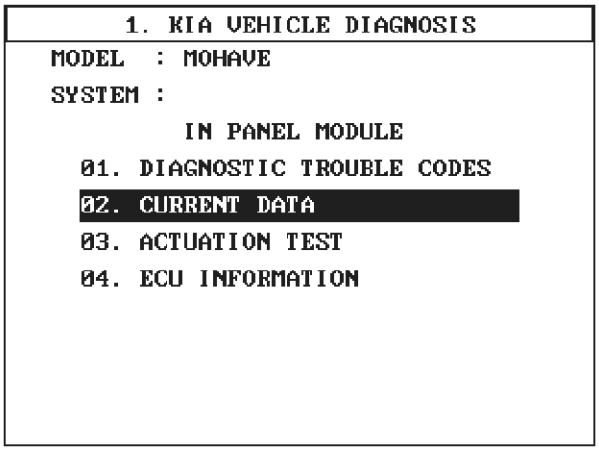
SHMBE9102L

3. Select option "Driver Door Module (DDM)".

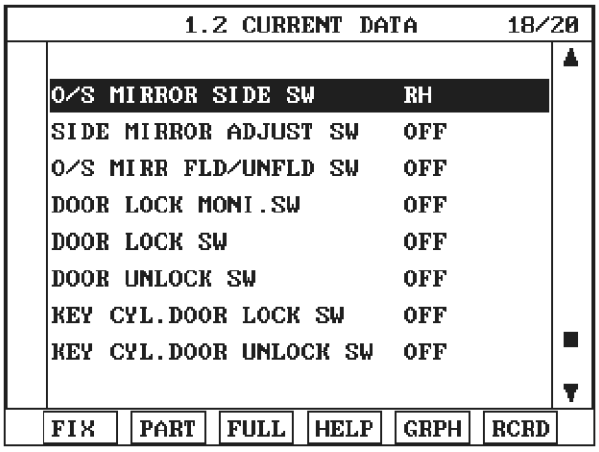


SHMBE9109L

4. Select option "Current Data".



SHMBE9110L



SHMBE9329N

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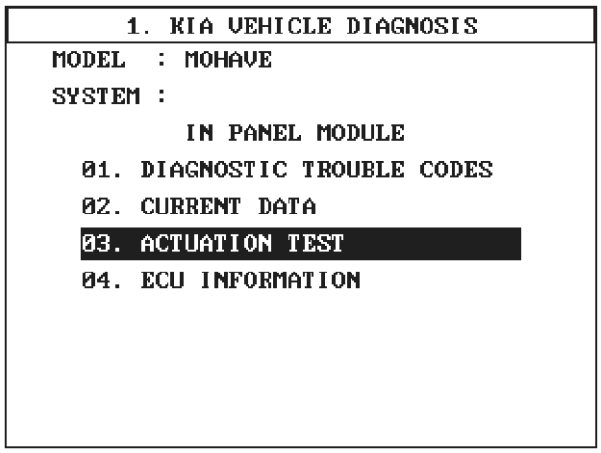
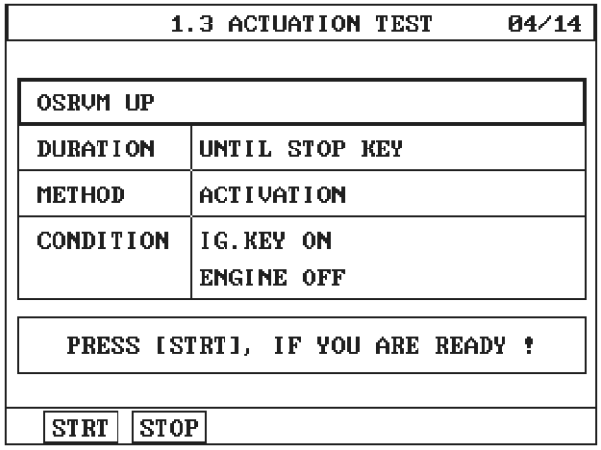
5. To check the input value of door mirror switch in force mode, select option "Actuation Test".



SHMBE9107L

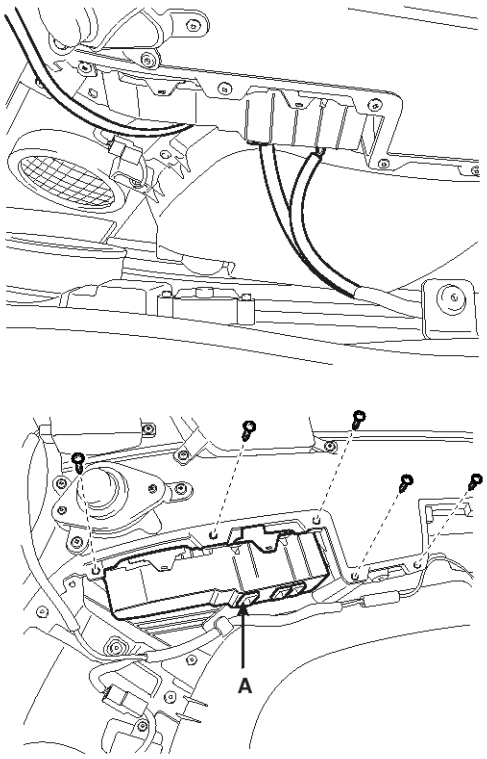


SHMBE9330N

Removal

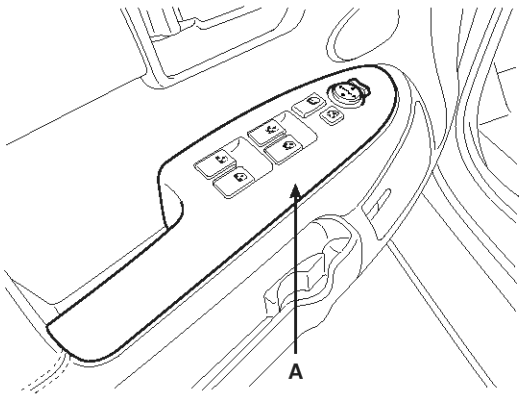
Driver Door Mirror Switch

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

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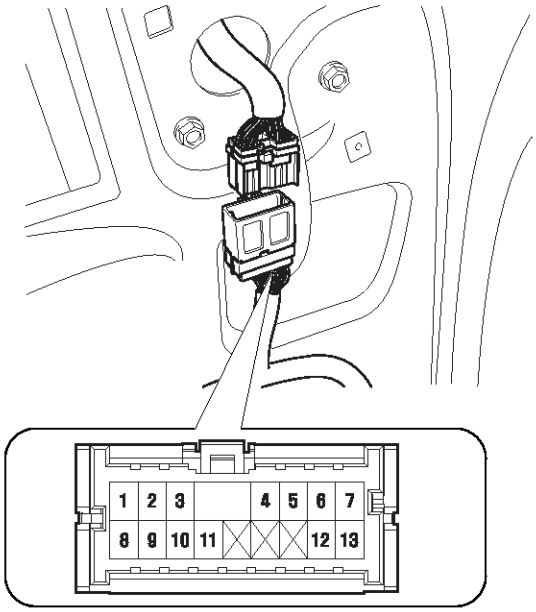
Power Door Mirror Actuator

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	⊕	⊖

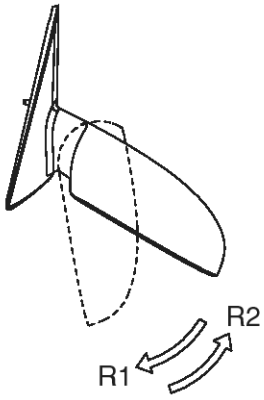
SHMBE9117N

Turn signal Lamp (Side repeater)

Position \ Terminal	1	3
Side repeater	⊕	⊖

SHMBE9118N

Mirror Folding



ETJA055B

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

SHMBE9119L

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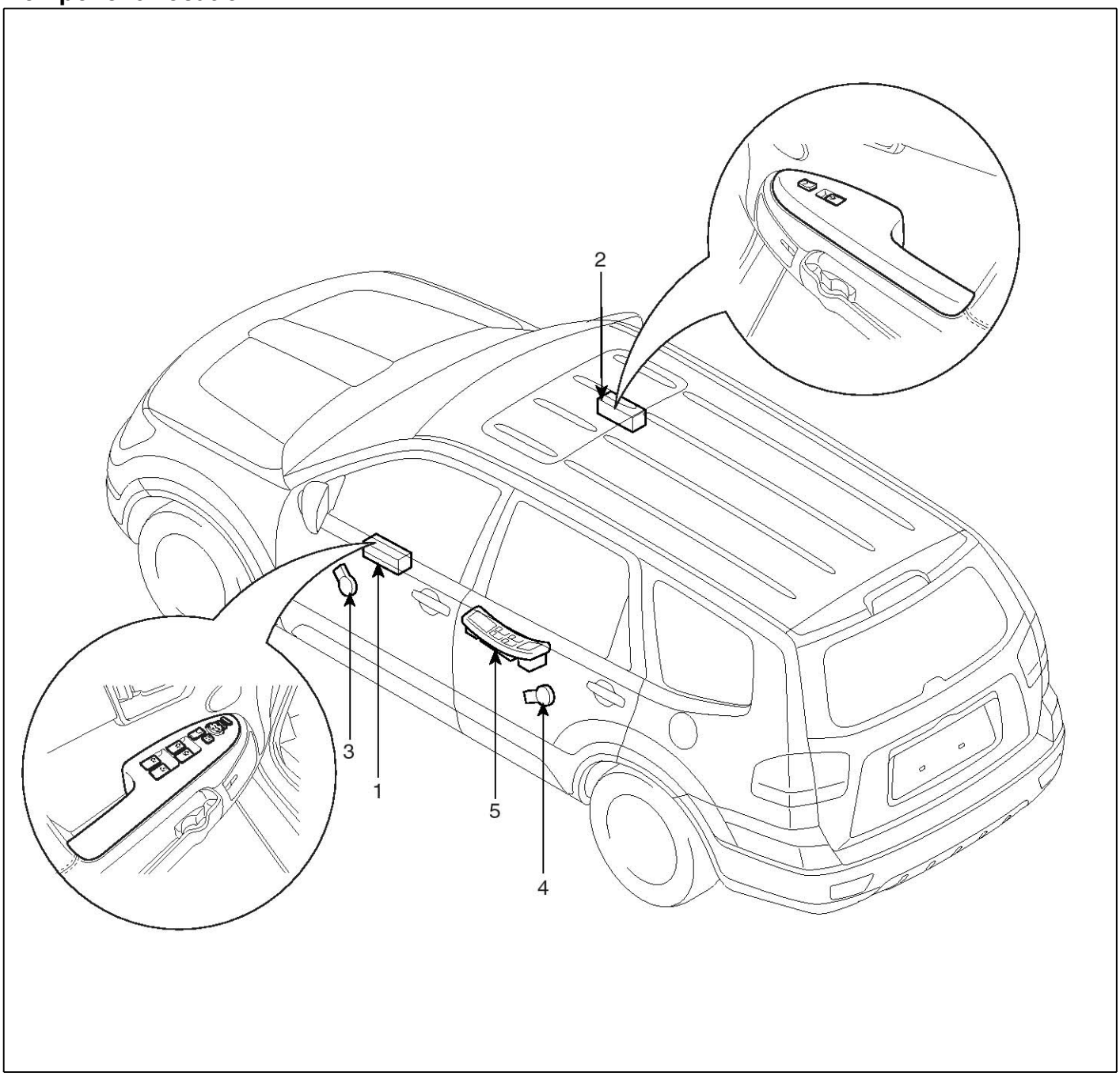
Power Windows

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

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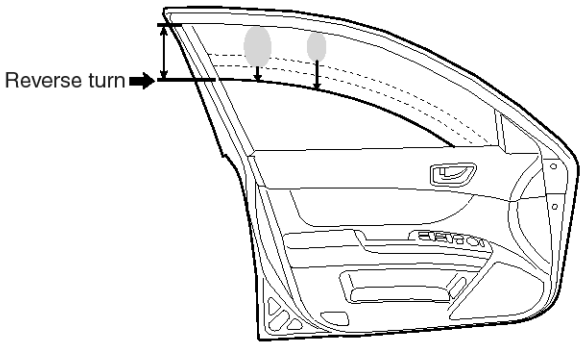
Power Window Motor

Function Of Safety Power Window

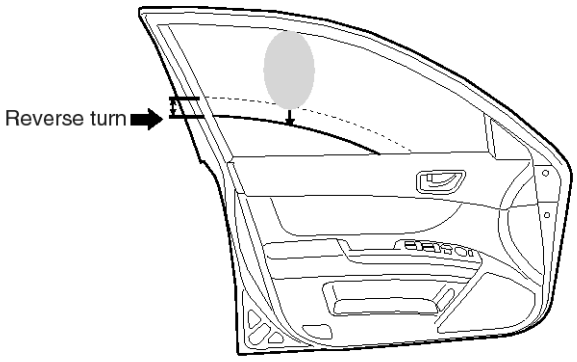
When driver door power window auto-up switch is operated, safety function is activated.

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.



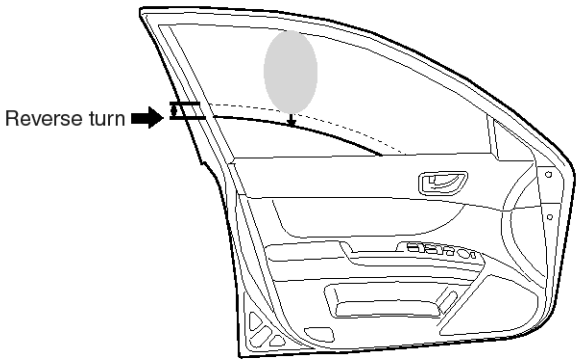
BTLG320B

- 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)

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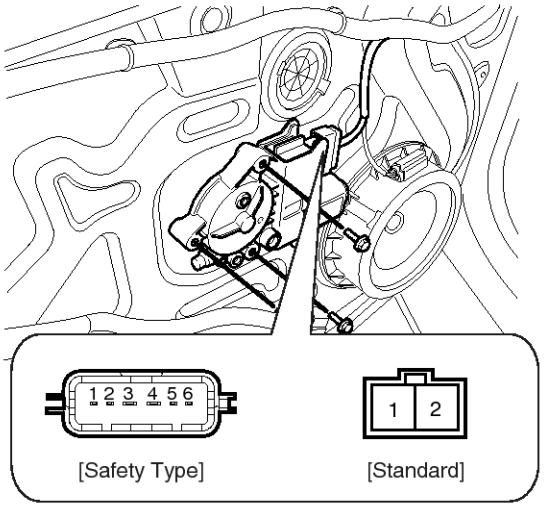
3. Disconnect the motor connector from the motor.



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.

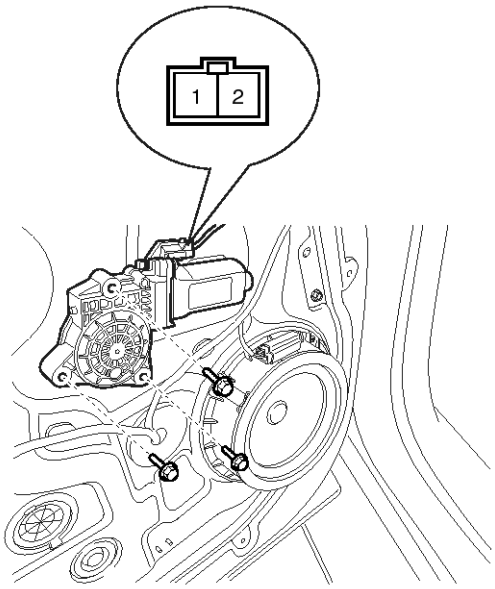
[Safety]

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

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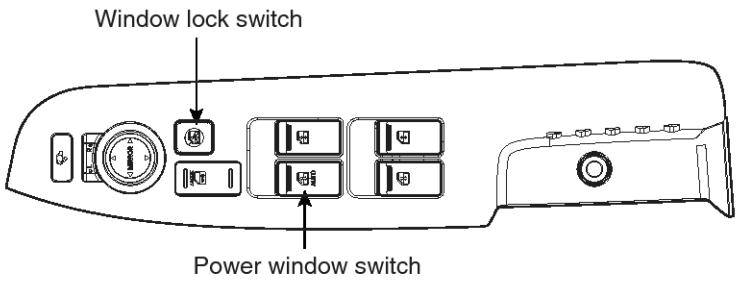
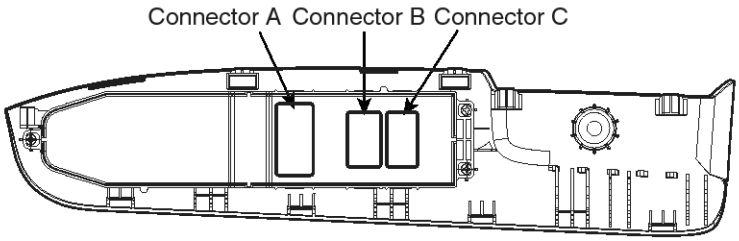
Power Window Switch

Components

Driver Power Window Switch





Connector	<table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td></td><td></td><td></td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td></tr></table>	<table><tr><td>1</td><td>2</td><td></td><td>3</td><td>4</td></tr><tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr></table>	<table><tr><td>1</td><td>2</td><td></td><td>3</td><td>4</td></tr><tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr></table>
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

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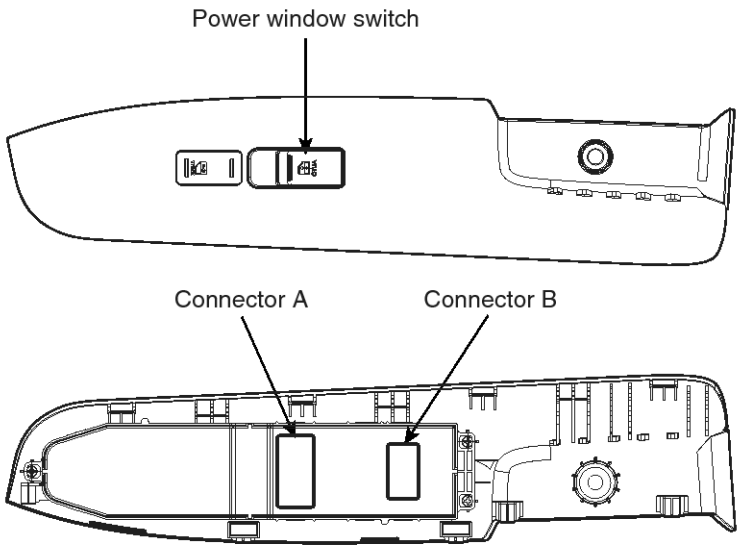
Assist Power Window Switch



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

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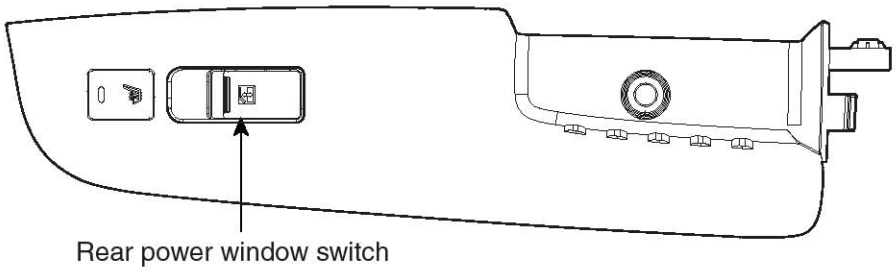
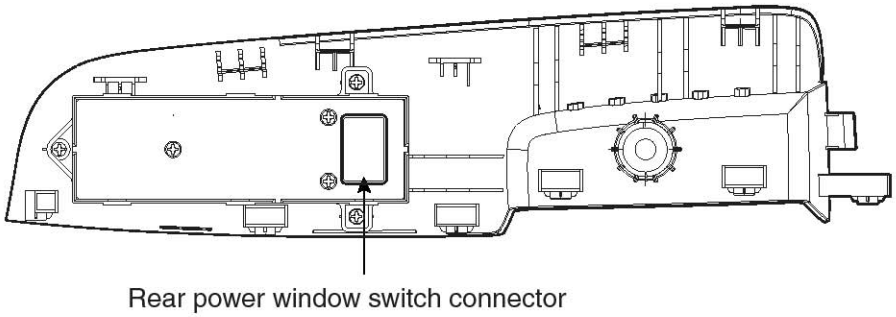
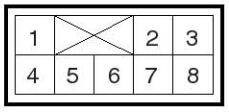
Rear Power Window Switch







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

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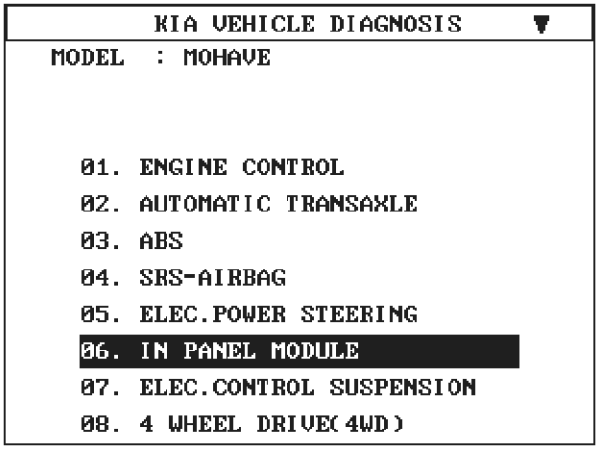
Inspection

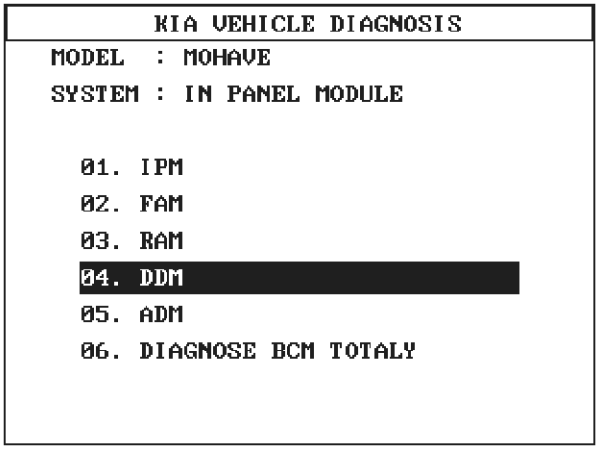
Driver Power Window Switch

1. When checking the power window switch operation, select a vehicle type and "In-panel module (IPM)" menu.



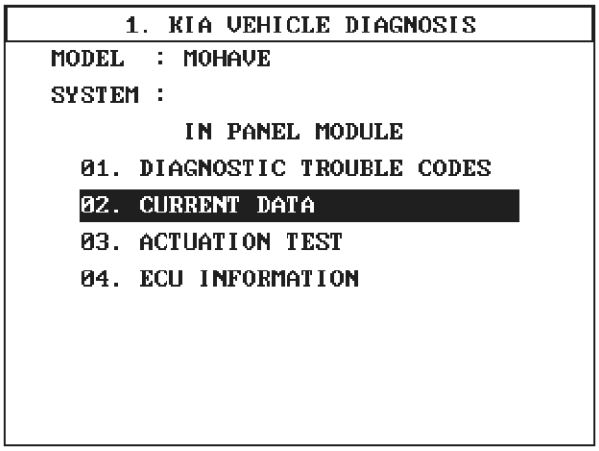
SHMBE9102L

2. Select "Driver Door Module(DDM)".

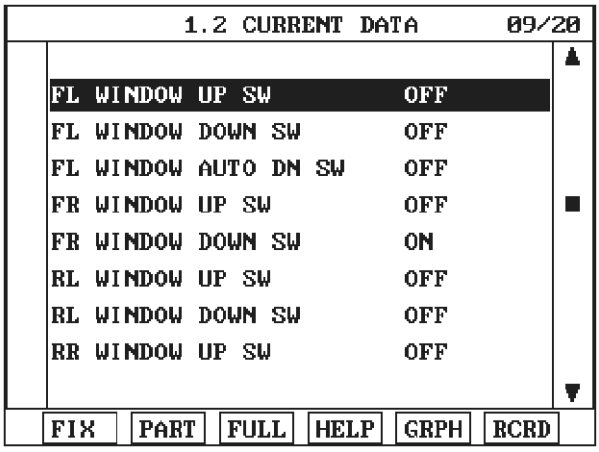


SHMBE9109L

3. Select option "Current Data".



SHMBE9110L



SHMBE9331N

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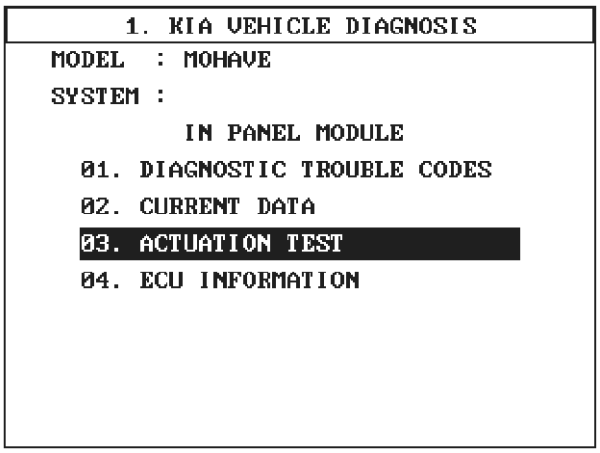
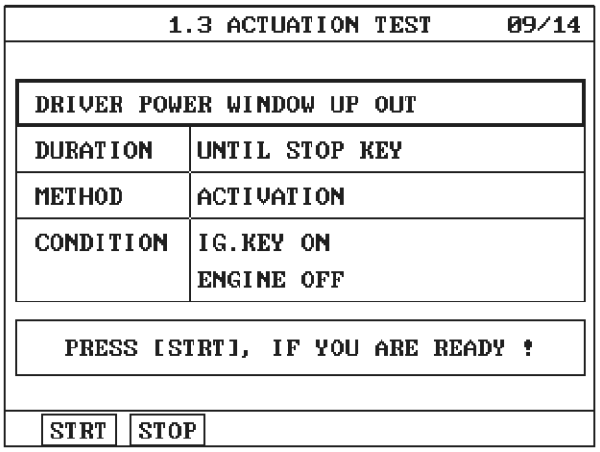
4. To check the input value of power window switch in force mode, select option "Actuation Test".



SHMBE9107L

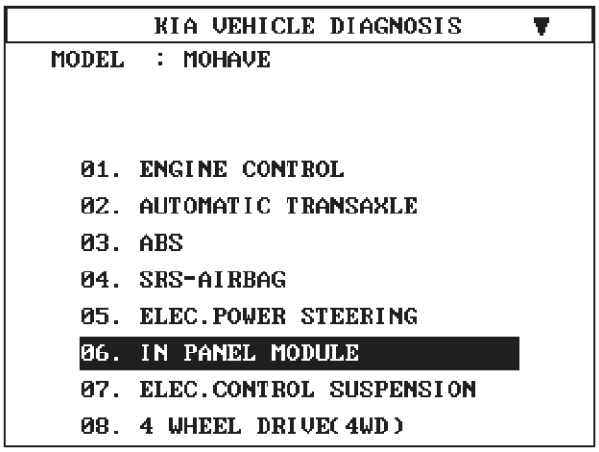


SHMBE9134N

※ Above voltage and numerical value may be different from the real value.

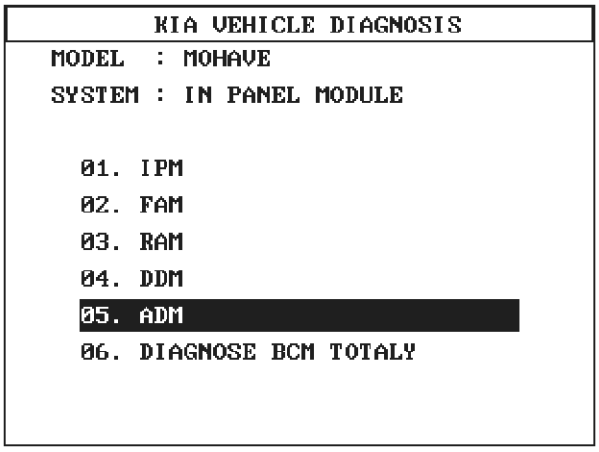
Assist Power Window Switch

1. When checking the assist power window switch, select a vehicle type and "In-panel module (IPM)" menu.



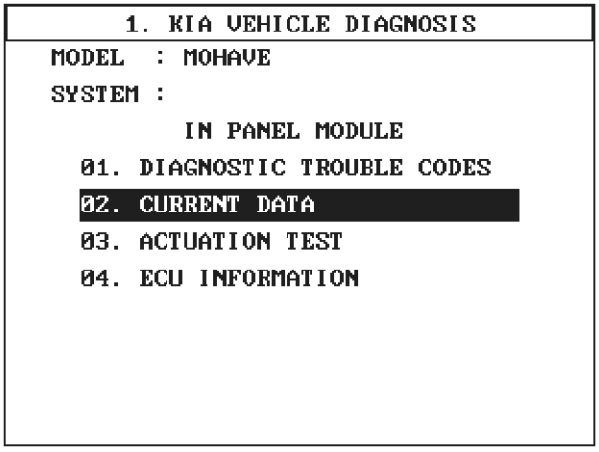
SHMBE9102L

2. Select "Assist Door Module(ADM)".



SHMBE9108L

3. Select option "Current Data".



SHMBE9110L

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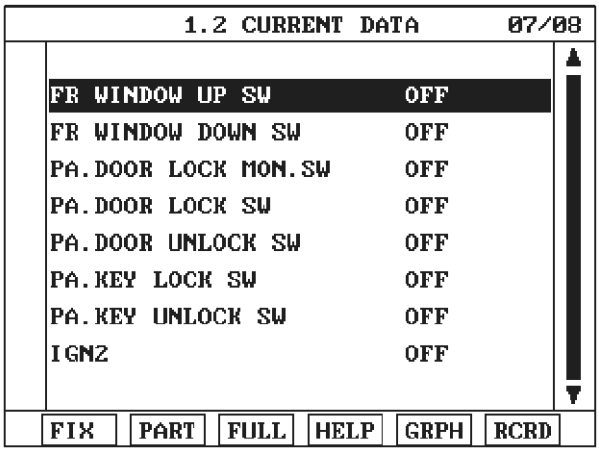
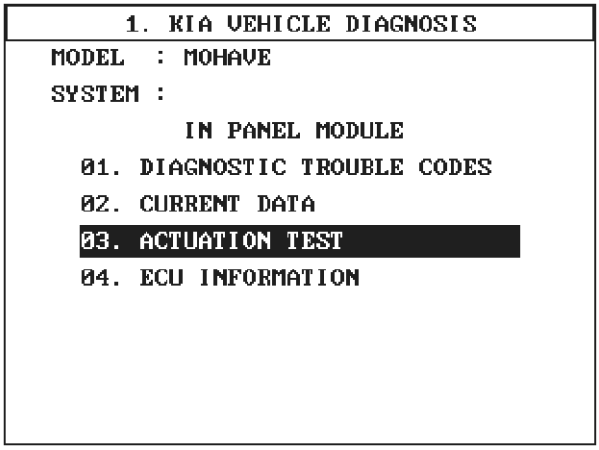
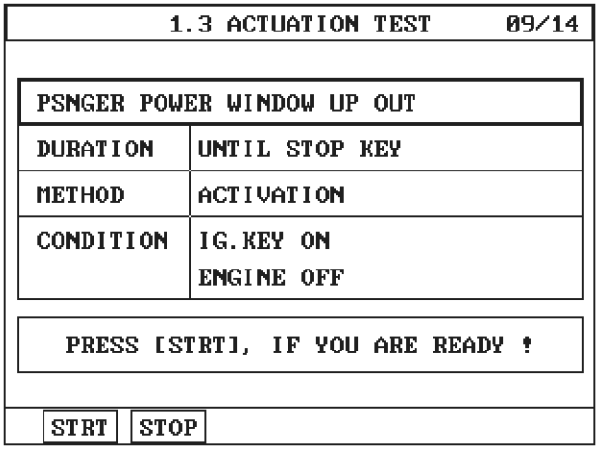


SHMBE9332N

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.

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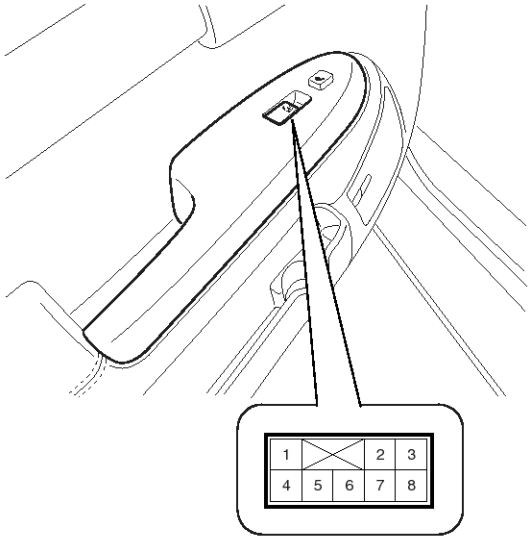
Rear Power Window Switch Inspection

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

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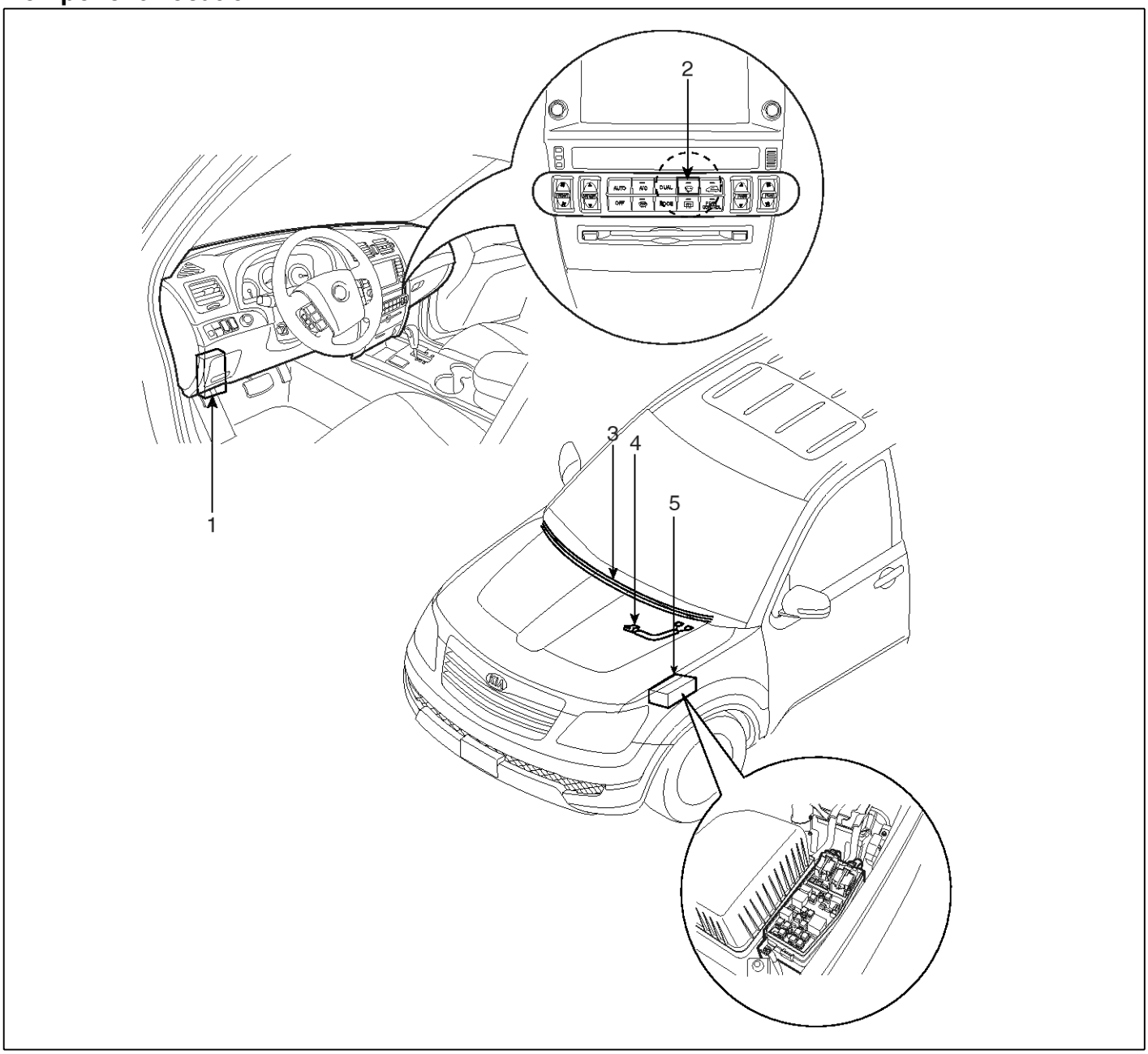
Windshield Deicer

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.

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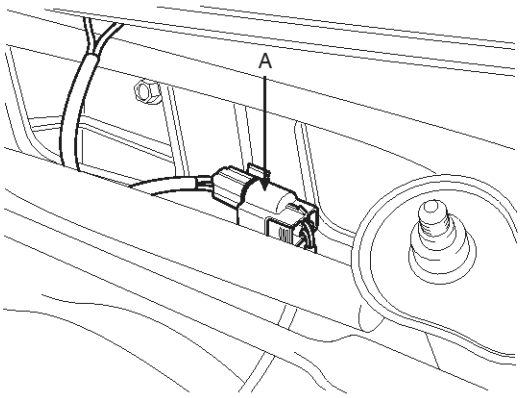
Windshield Deicer

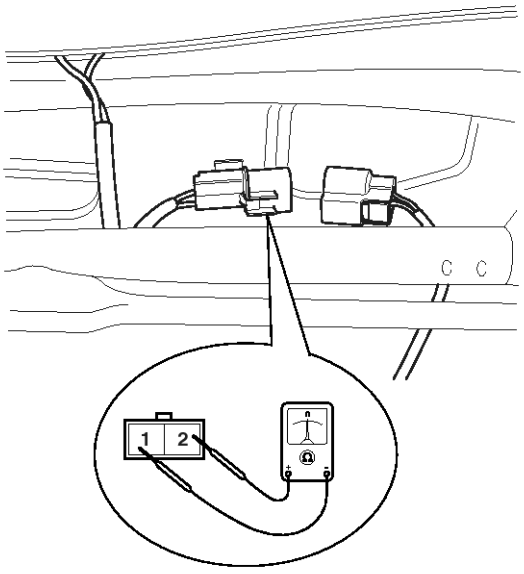
Inspection

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



SHMBE8241D

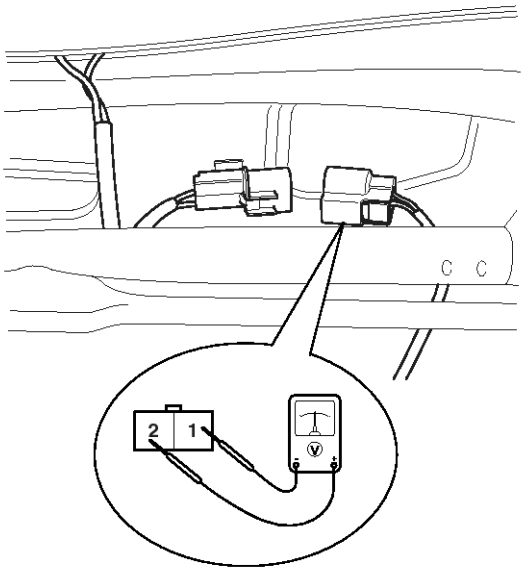
3. Check for continuity between the terminals of deicer lines.



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

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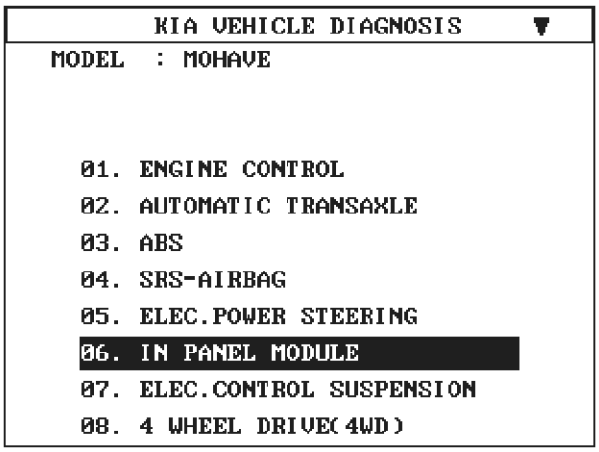
Windshield Deicer Switch

Inspection

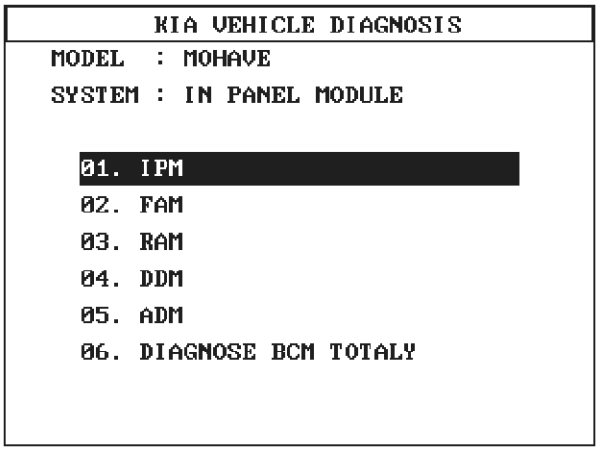
Windshield Deicer Switch

1. When checking the operation, select a vehicle type and menu.



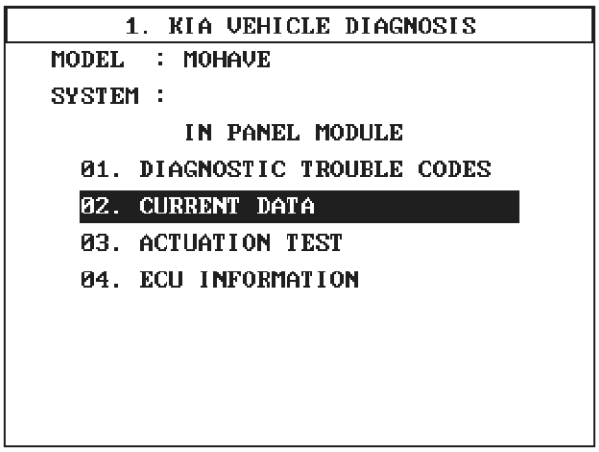
SHMBE9102L

2. Select "Instrument panel module (IPM)".

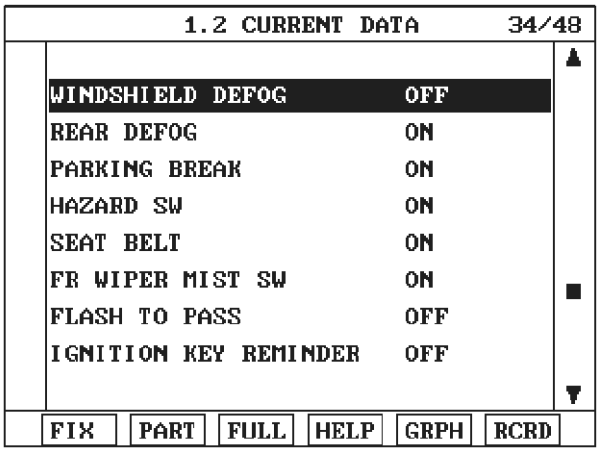


SHMBE9103L

3. Select option "Current Data".



SHMBE9110L



SHMBE9143N

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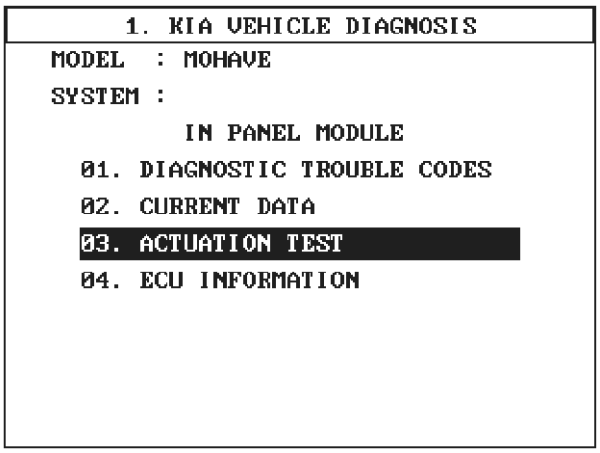
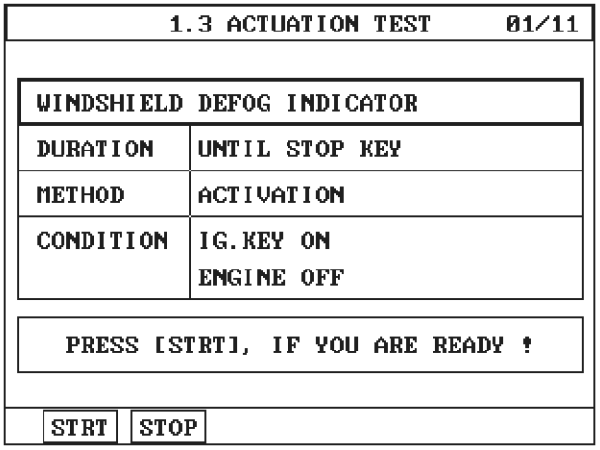
4. To check the input value of windshield deicer switch in force mode, select option "Actuation Test".



SHMBE9107L

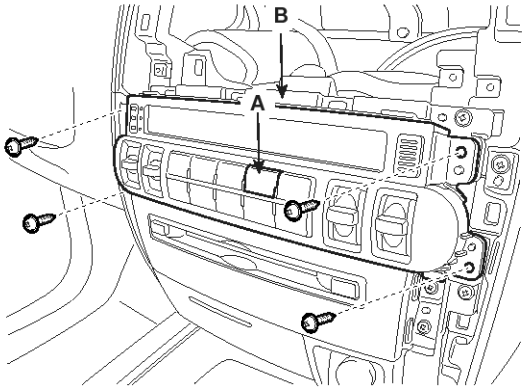


SHMBE9145N

※ Above voltage and numerical value may be different from the real value.

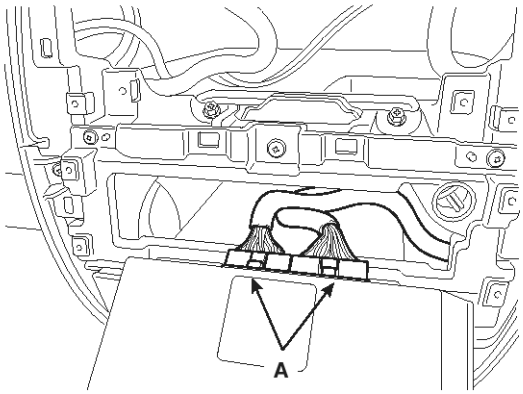
Removal

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.

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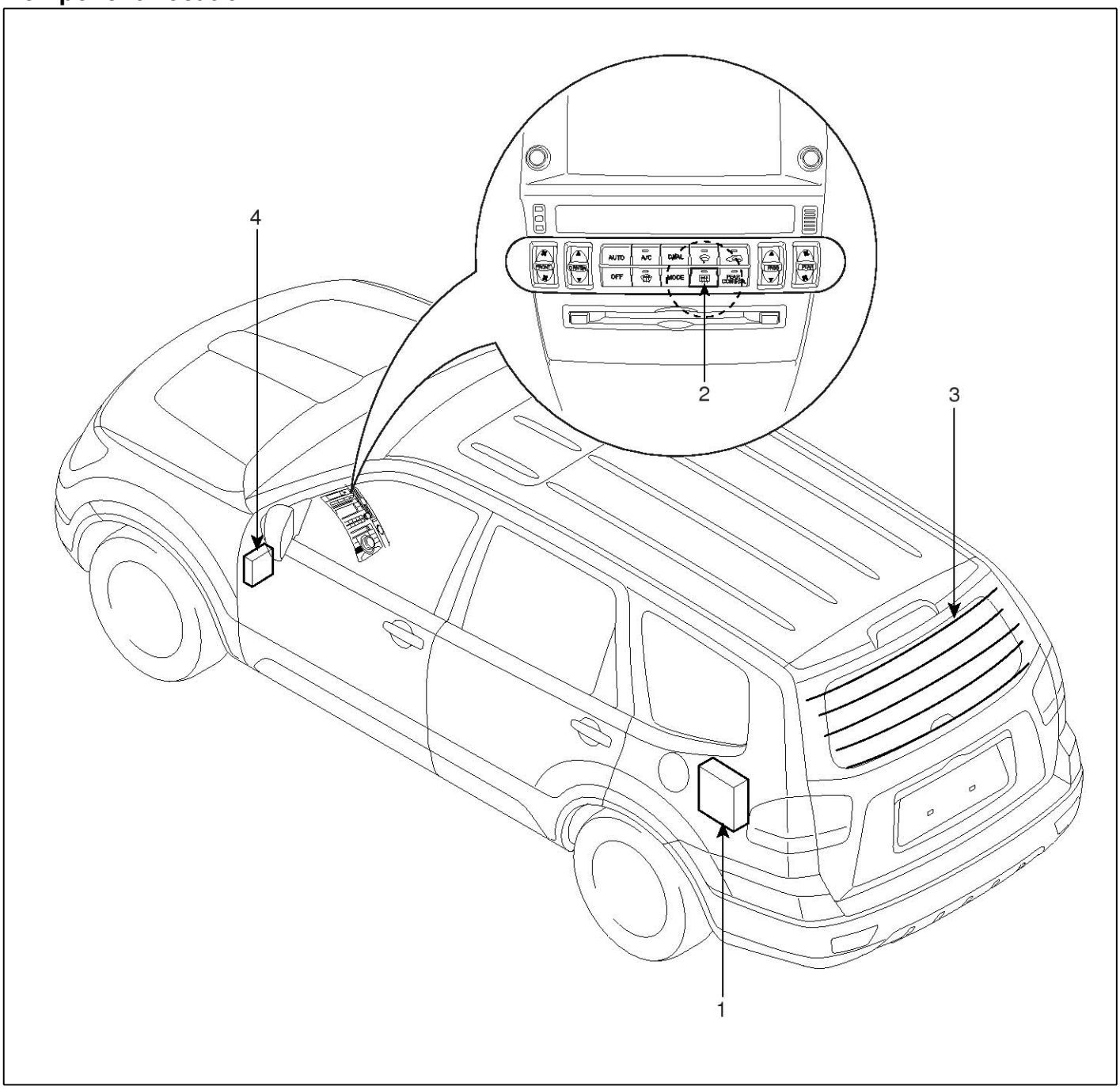
Rear Glass Defogger

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)

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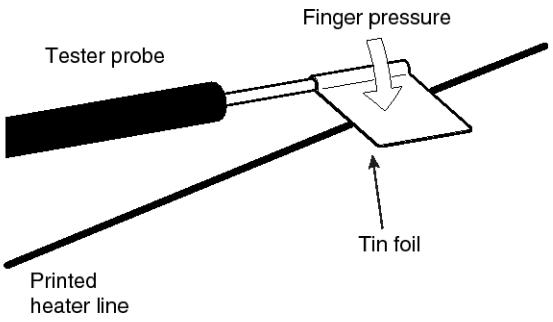
Rear Glass Defogger Printed Heater

Inspection

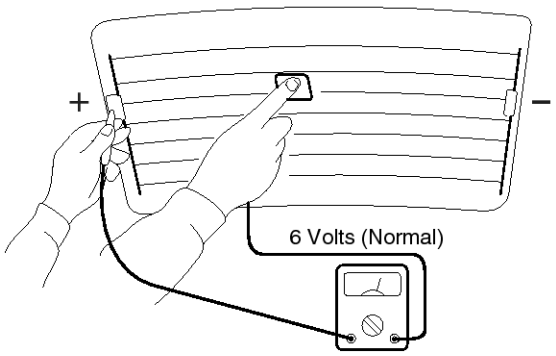
⚠CAUTION

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.



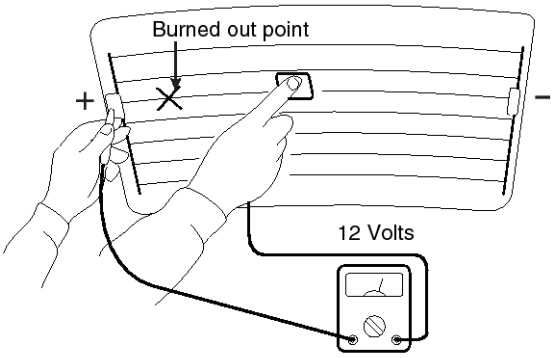
ETA9165A

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.



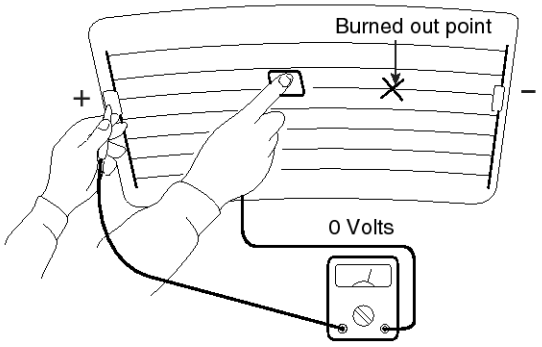
ETA9165B

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

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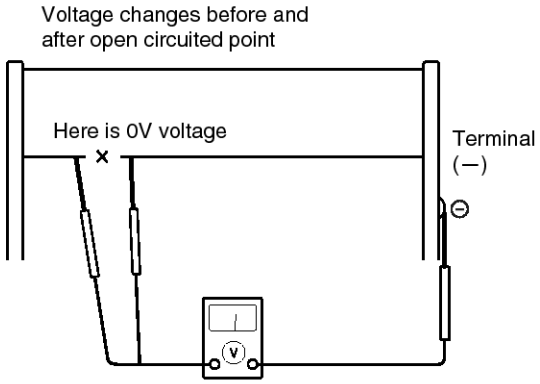
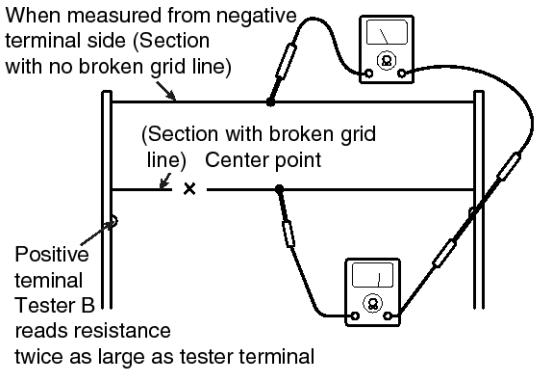
4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.



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.



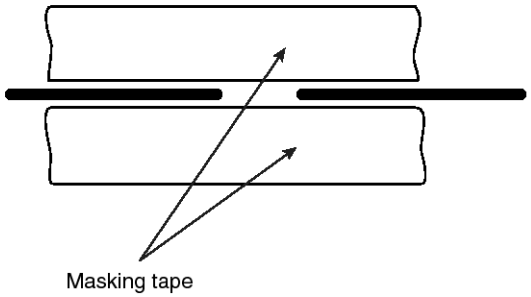
ETA9165F

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

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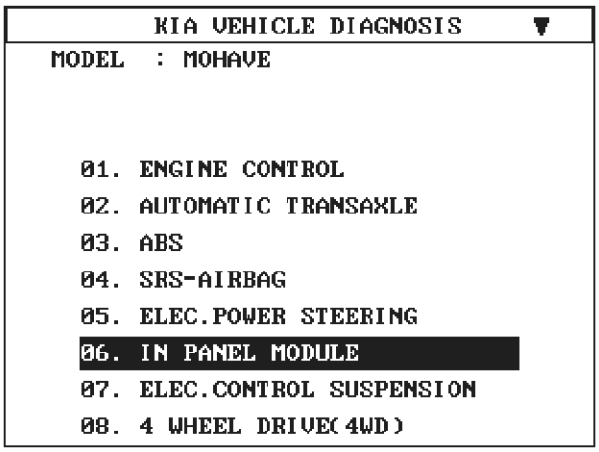
Rear Glass Defogger Switch

Inspection

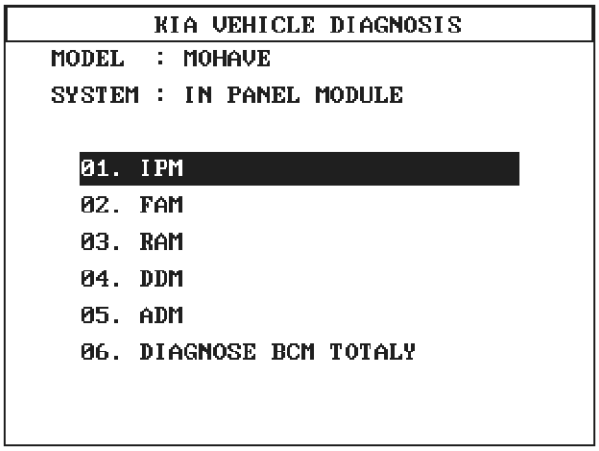
Rear Window Defogger Switch

1. When checking the rear window defogger switch operation, select a vehicle type and menu.



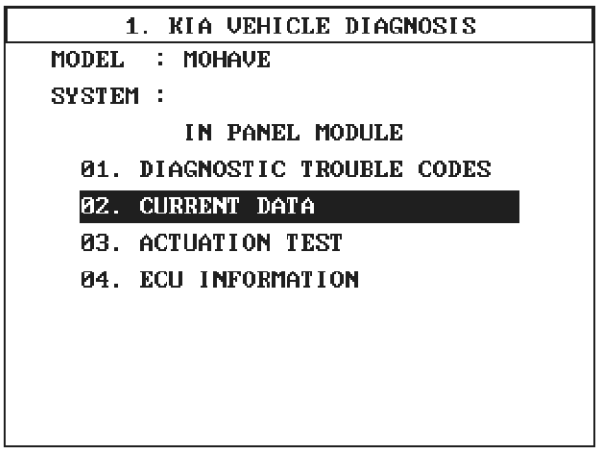
SHMBE9102L

2. Select "Instrument panel module (IPM)".

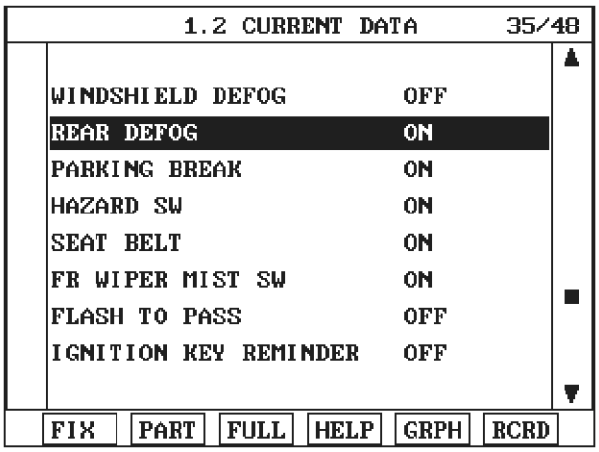


SHMBE9103L

3. Select option "Current Data".



SHMBE9110L



SHMBE9149N

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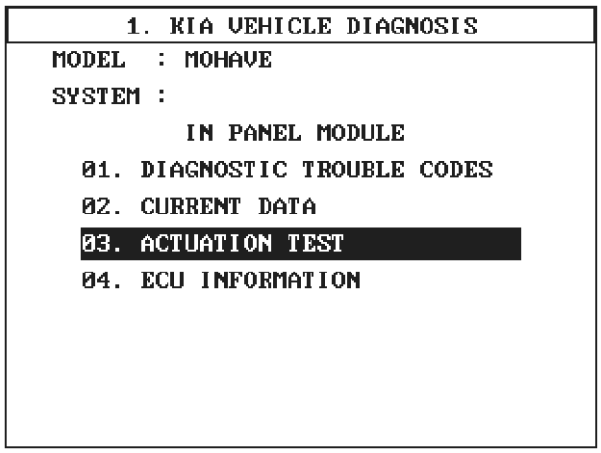
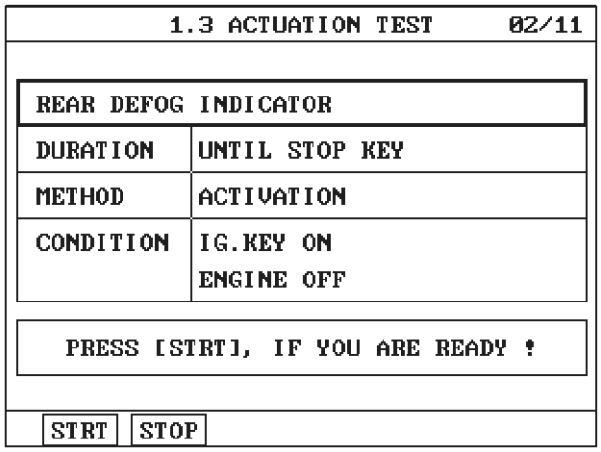
4. To check the input value of rear window defogger switch in force mode, select option "Actuation Test".



SHMBE9107L

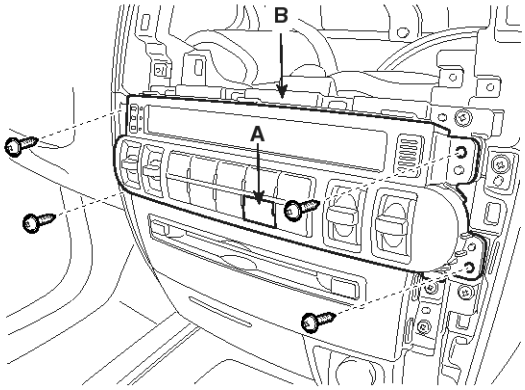


SHMBE9151N

※ Above voltage and numerical value may be different from the real value.

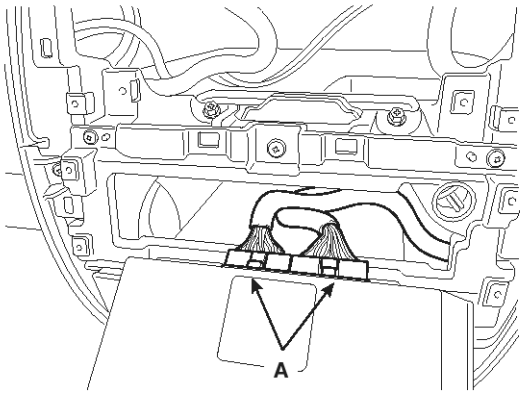
Removal

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.

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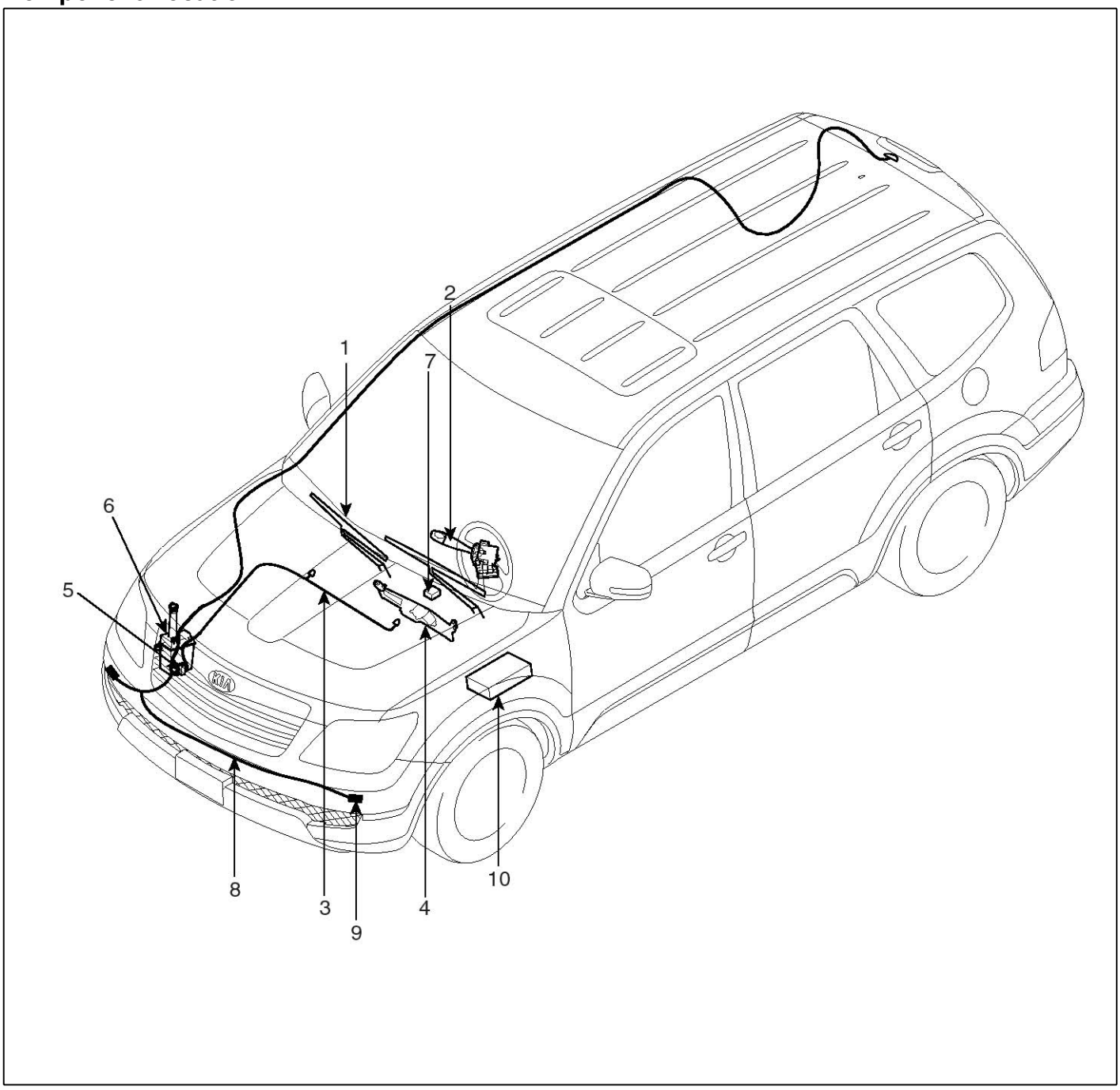
Windshield Wiper/Washer

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)

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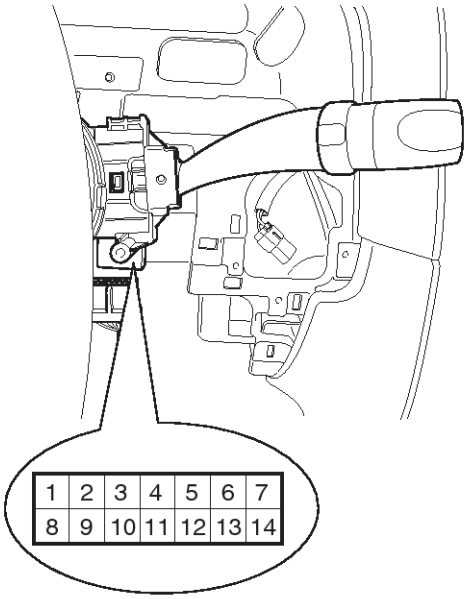
Windshield Wiper-Washer Switch

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

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

SHMBE9082N

Washer Switch

Position \ Terminal	7	5
OFF		
ON	○	○

SHMBE9083N

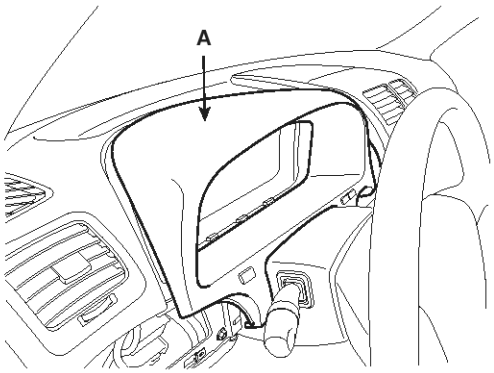
Rear Wiper & Washer Switch

Position \ Terminal	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

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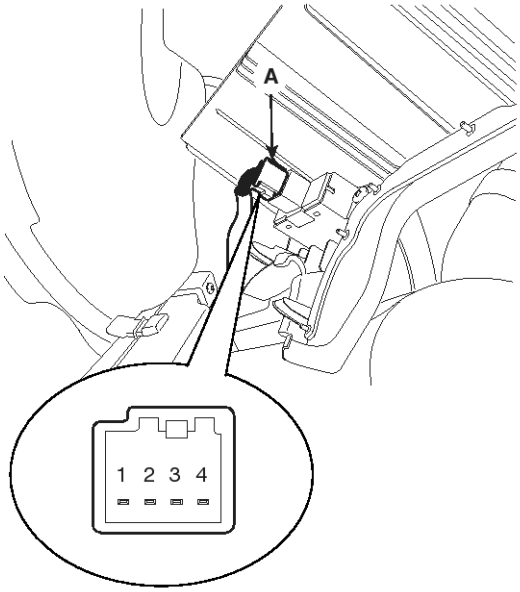
3. Disconnect the head lamp washer switch connector (A).



SHMBE8249D

4. Make sure that the continuity exists between the terminals bolow.

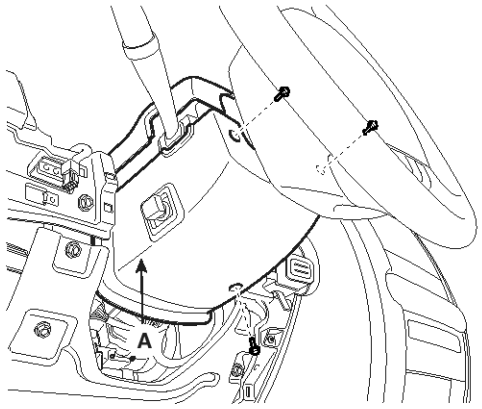
   If continuity is not as specified, replace the head lamp washer switch.

Terminal / Position	ON	OFF	Remark
2			5V
3			GND
1			ILL. (+)
4			ILL. (-)

SHMBE9132L

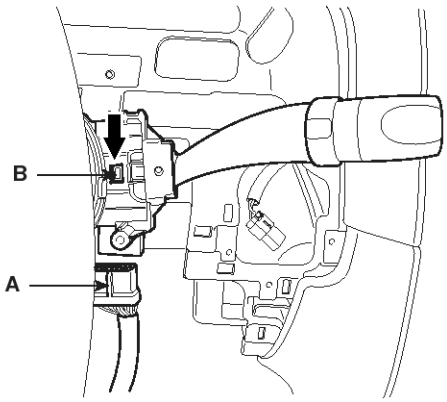
Removal

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.

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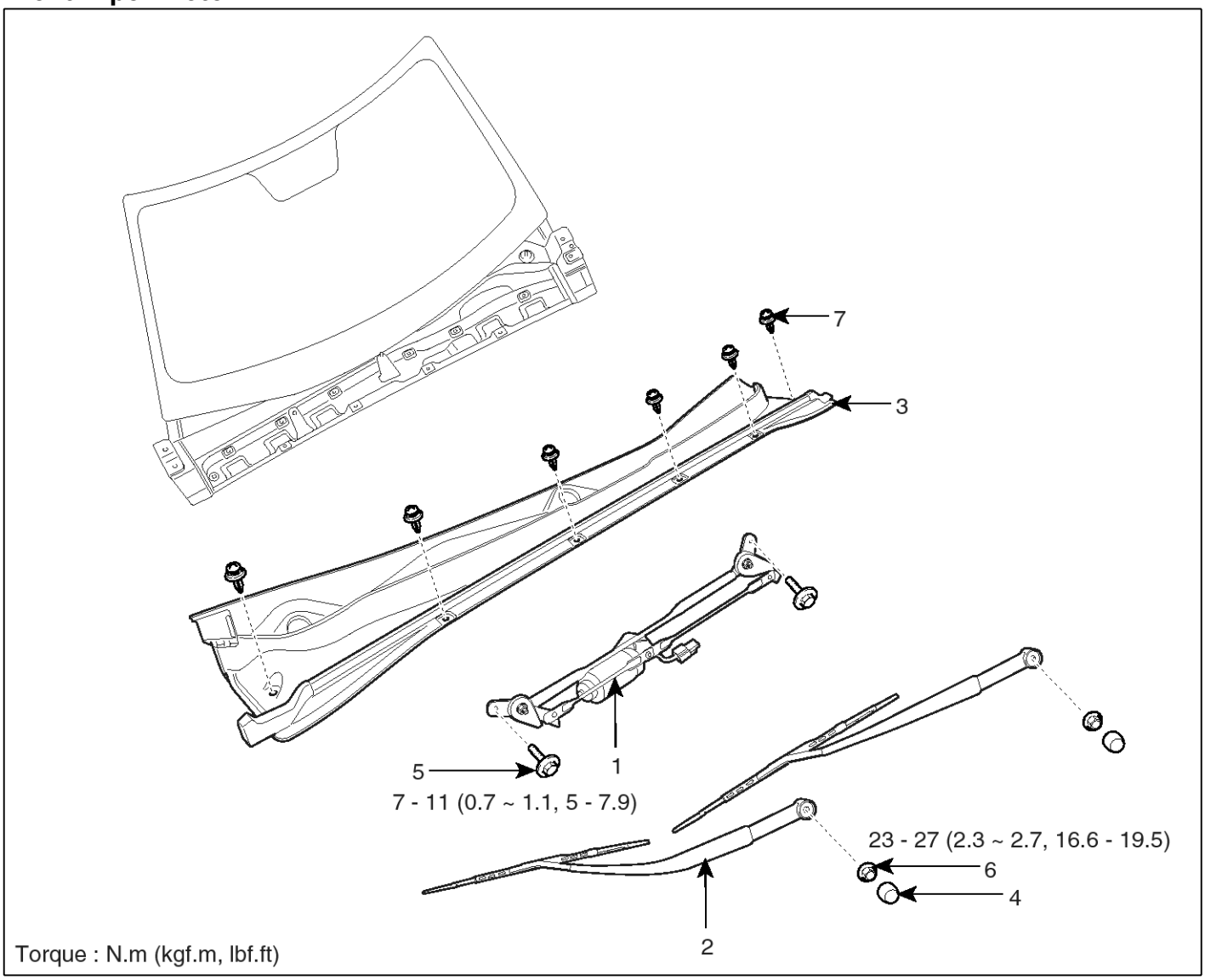
Front Wiper Motor

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

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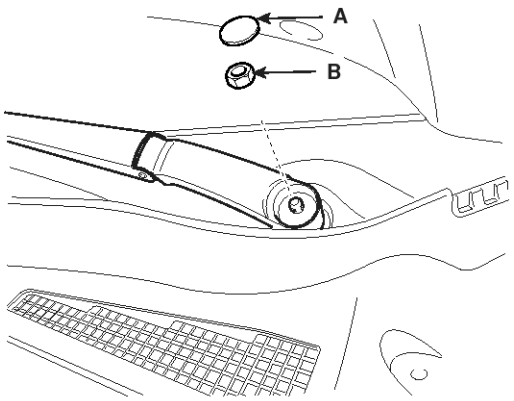
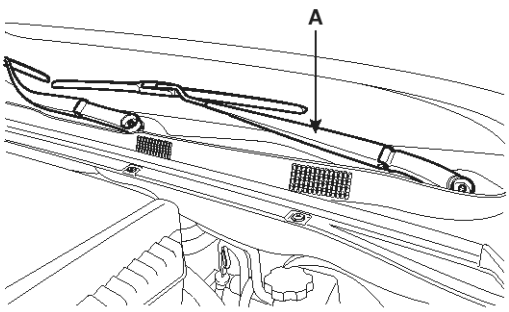
Removal

1. Remove the wiper arm nut (B) after removing the wiper cap (A).



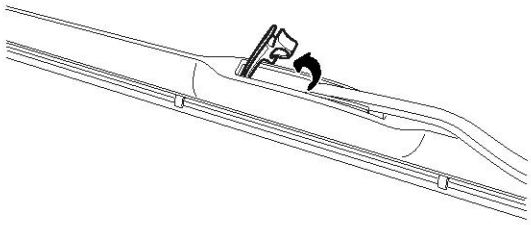
SHMBE8251D

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



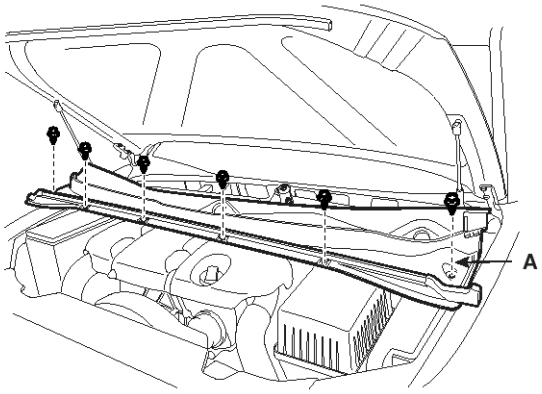
SHMBE9174N

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

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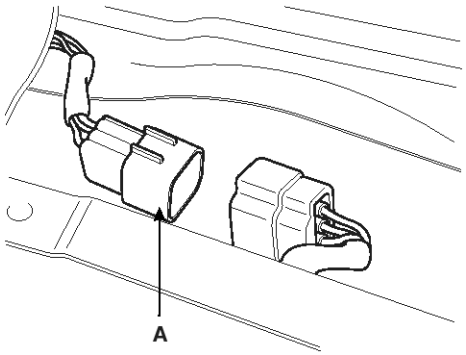
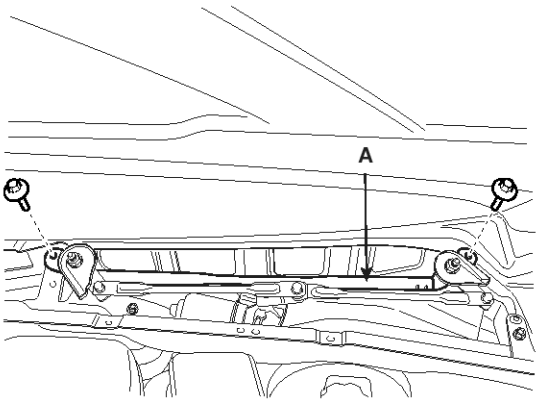
5. Disconnect the wiper motor connector (A).



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.

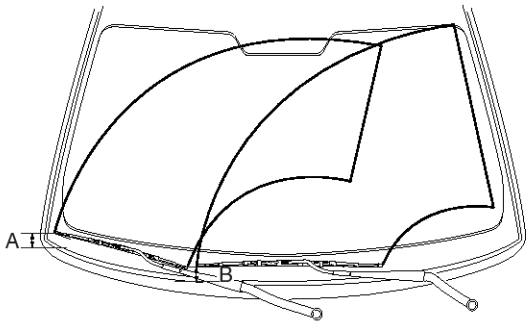
Torque: 7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lbf.ft)

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)

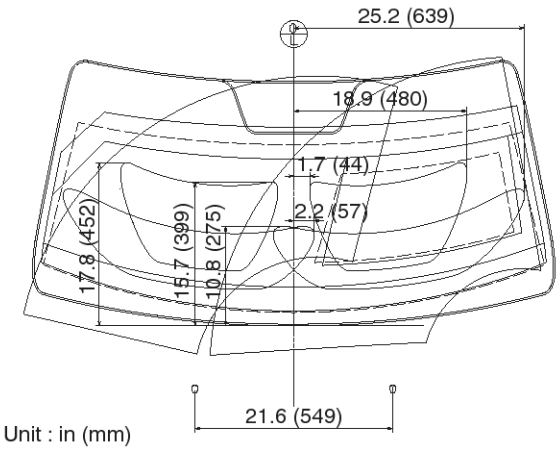
4. Install the wiper arm and blade to the specified position.

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

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Front Washer Motor

Inspection

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

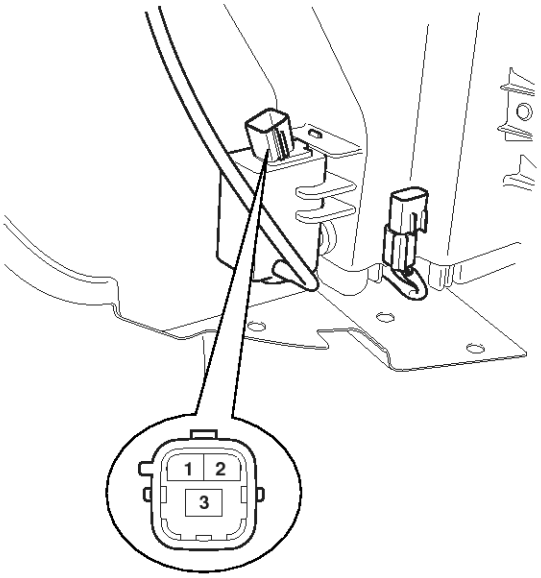
   NOTICE

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

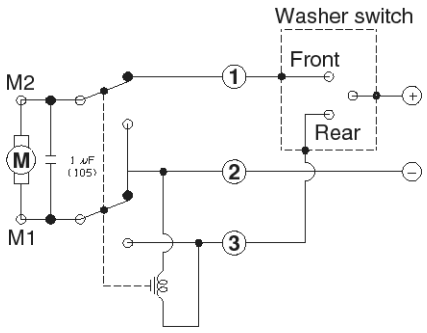
2. Connect positive (+) battery cables to terminal 1 and negative (-) battery cables to terminal 2 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the front nozzles.
4. If they are abnormal, replace the washer motor.

   [Front & Rear washer]

   1. Windshield washer (+)
   2. Ground
   3. Rear washer (+)



SHMBE9176N



<Windshield & Rear washer motor>

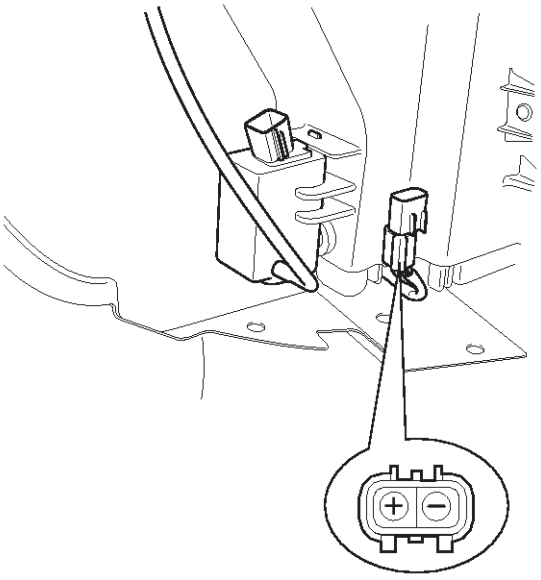
SHMBE9177N

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

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

(Tolerance : -50cc ~ +100cc)

SHMBE9178N

Removal

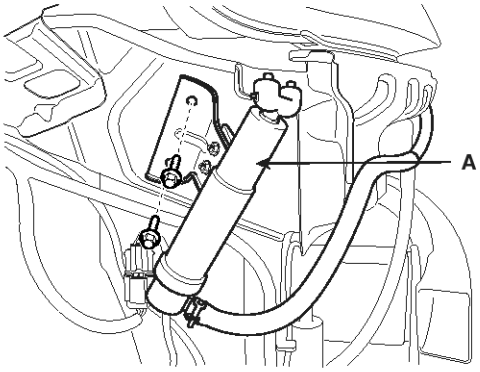
⚠CAUTION

- **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.

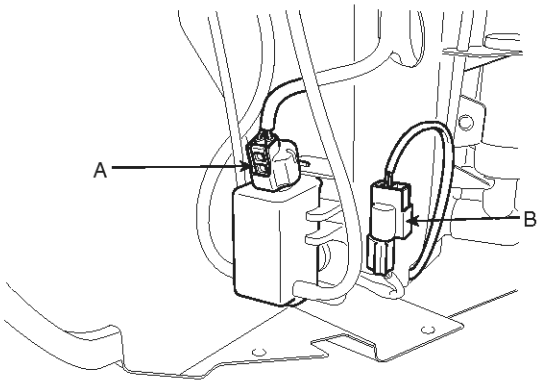
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.

   (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

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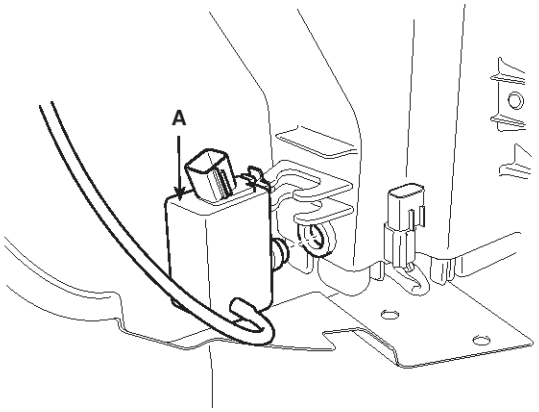
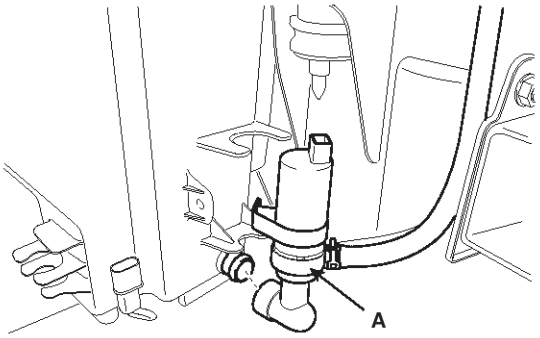
5. Remove the washer motor (A).



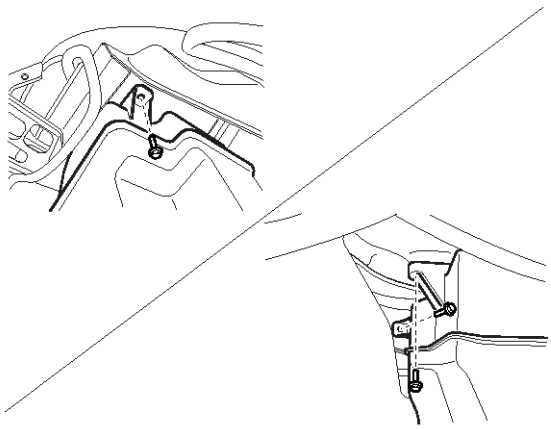
SHMBE8267D

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.

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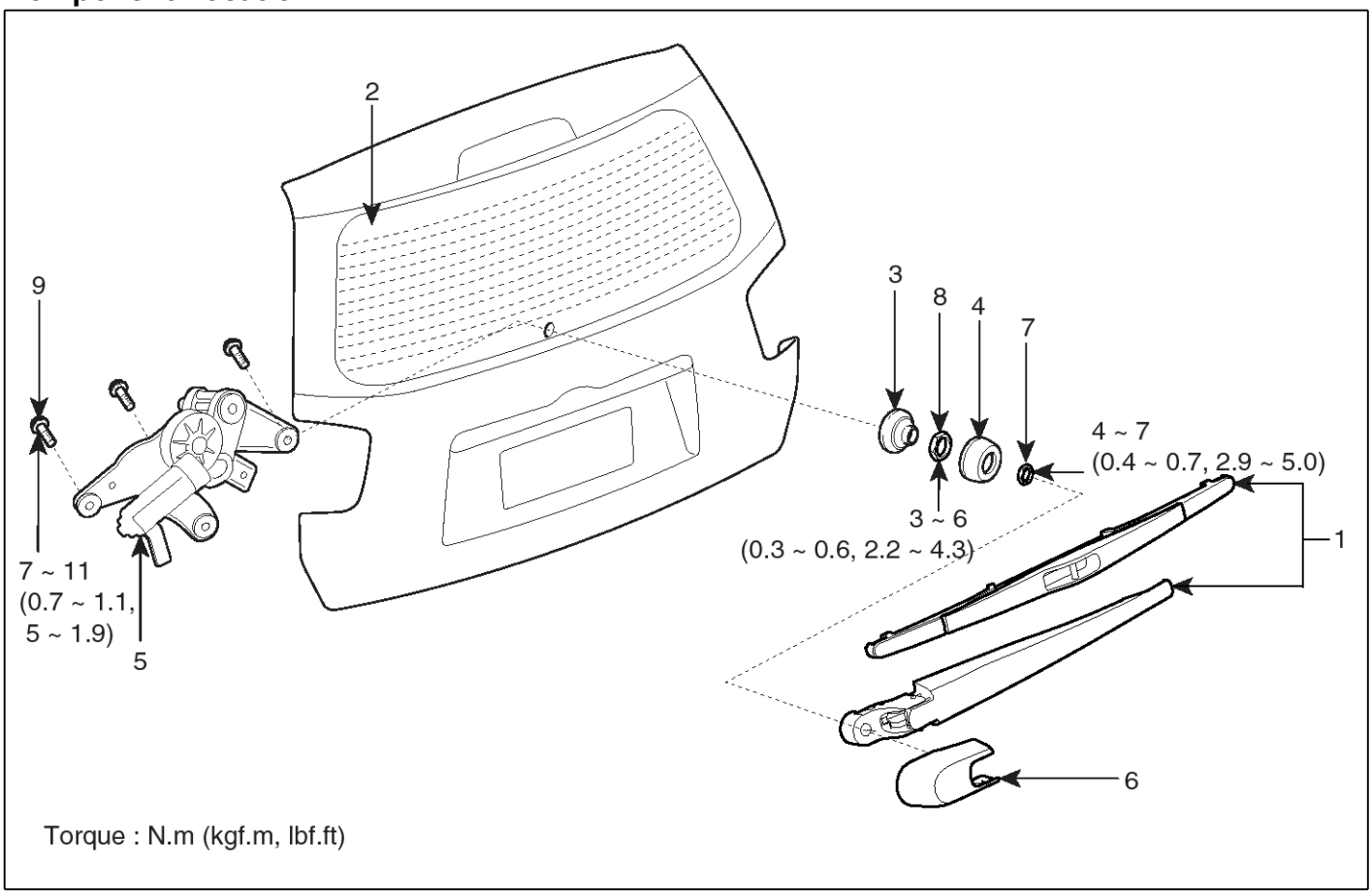
Rear Wiper/Washer

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

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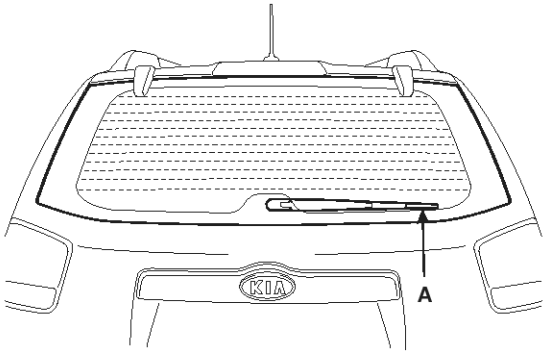
Rear Wiper Motor

Inspection

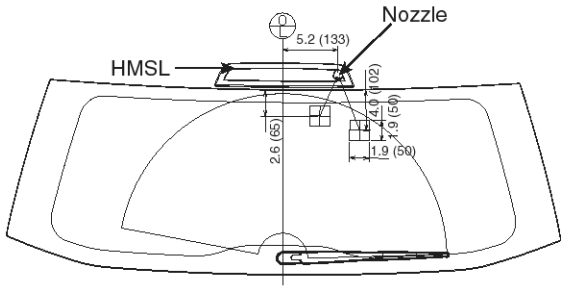
Rear Wiper And Nozzle

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.

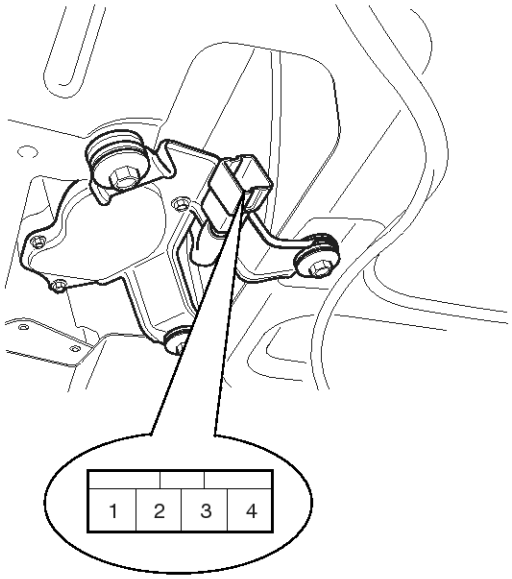


Unit : in (mm)

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.

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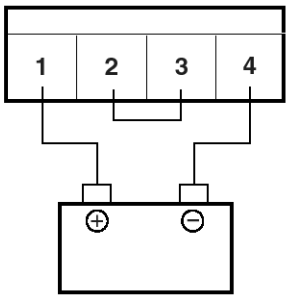
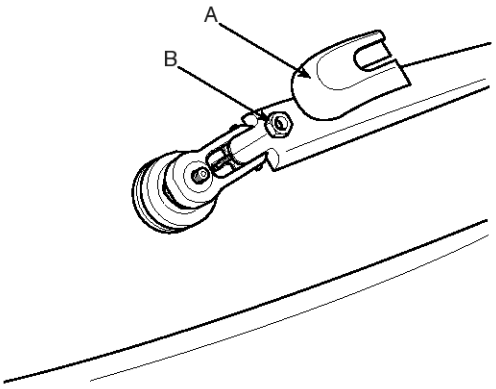
5. Check that the motor stops running at the off position.



ATGE381F

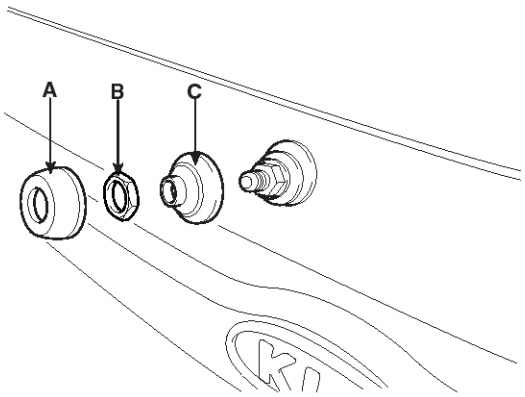
Removal

1. Detach the wiper cap, then remove the rear wiper arm (A) after removing a nut (B).



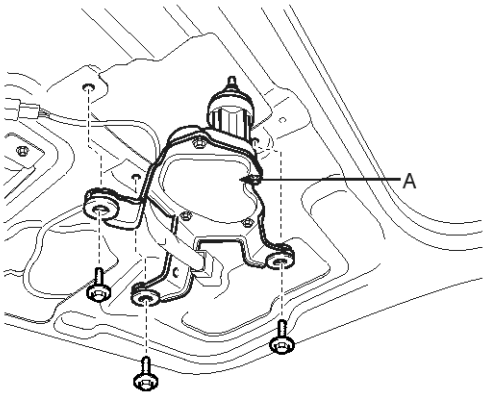
SHMBE8275D

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.

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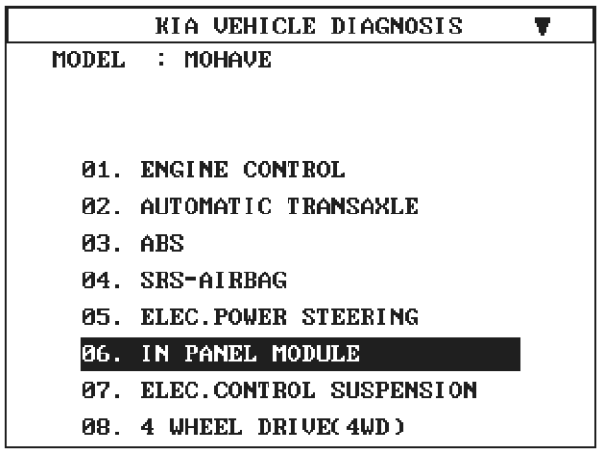
Rear Washer Switch

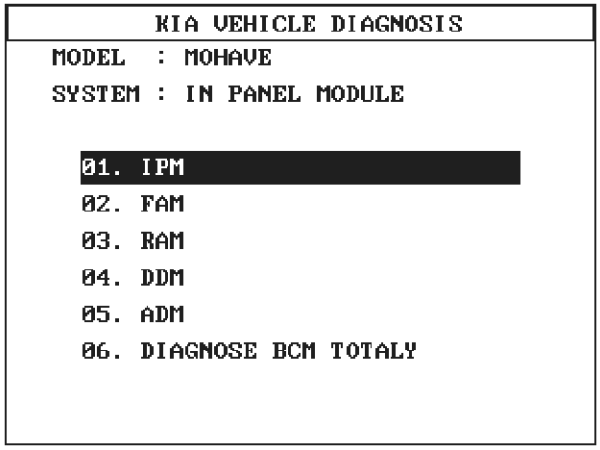
Inspection

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.



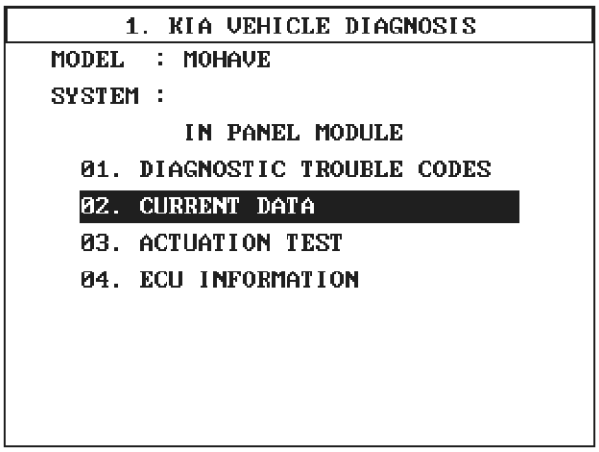
SHMBE9102L

3. Select "Instrument Panel Module (IPM)"



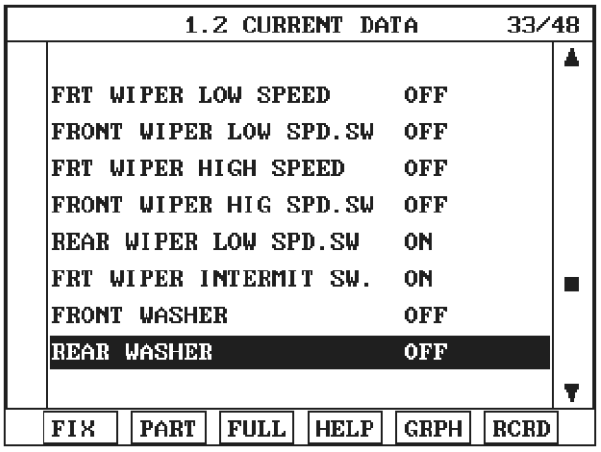
SHMBE9103L

4. Select "Current Data".



SHMBE9110L

5. Check input/output value of rear washer.



SHMBE9334N

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Rear Washer Motor

Inspection

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

   NOTICE

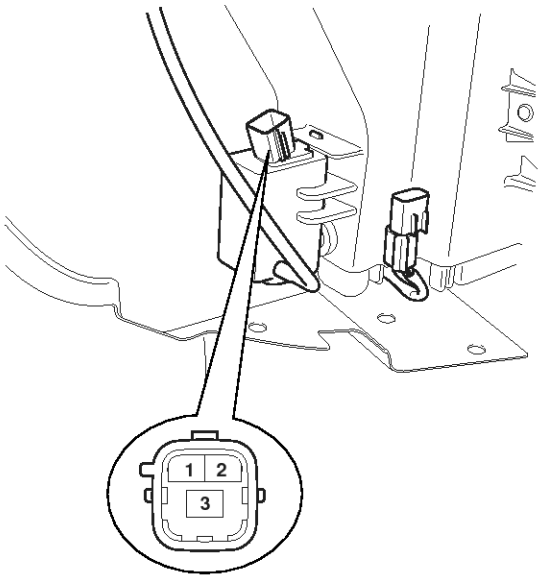
   Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.

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.

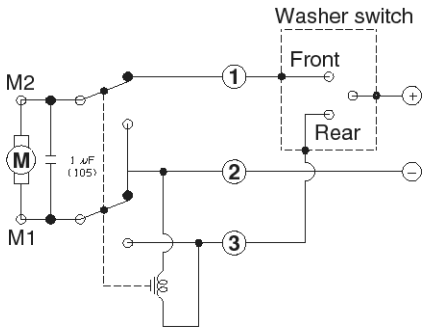
   Replace the motor if it operates abnormally.

   [Front & Rear washer]

   1. Windshield washer (+)
   2. Ground
   3. Rear washer (+)



SHMBE9176N



<Windshield & Rear washer motor>

SHMBE9177N

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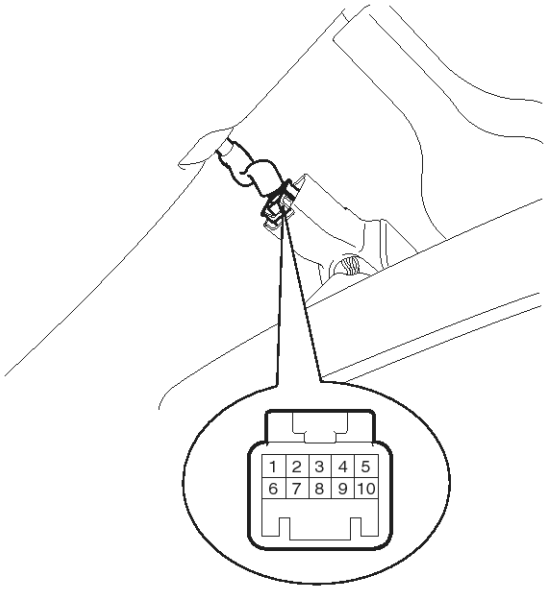
Electro chromic Inside Rear View Mirror

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. :

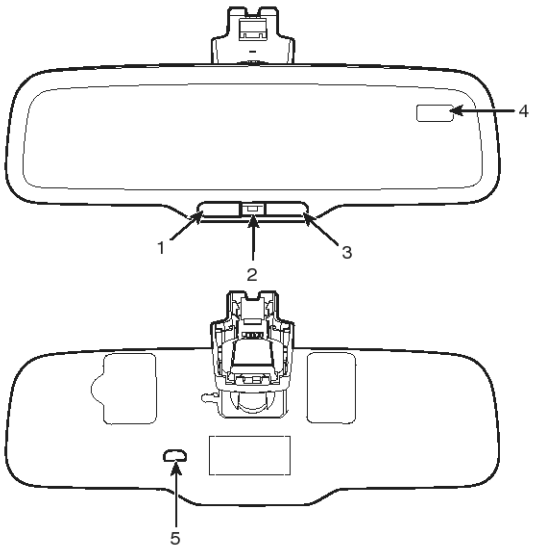
1. IGN (12V)
2. Reverse signal
3. Ground
4. ECM (+)
9. ECM (-)



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

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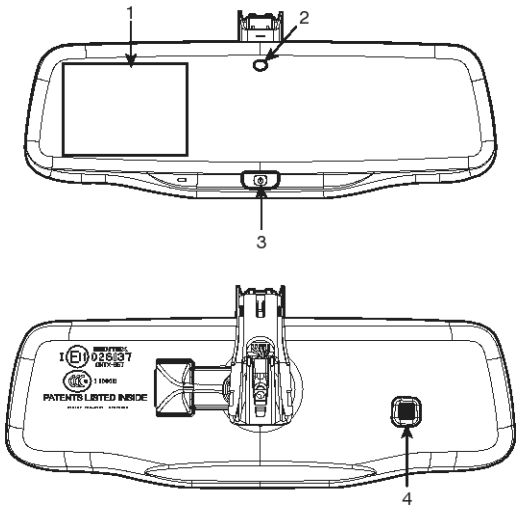
Reverse Display Room Mirror

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.

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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.

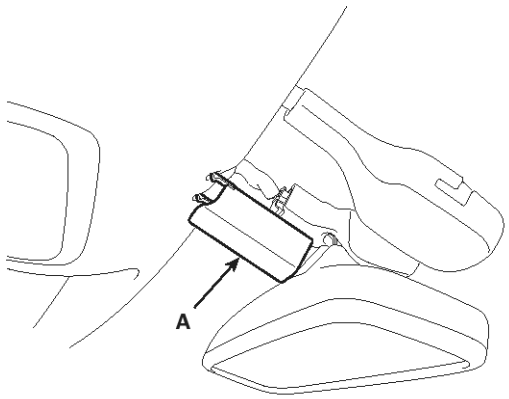
   NOTICE

   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.

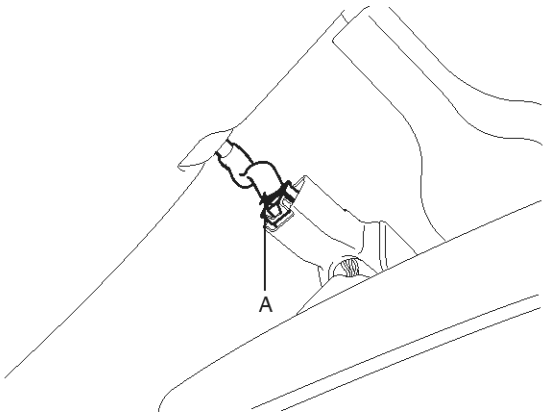
Removal

1. Remove the mirror wiring cover (A).



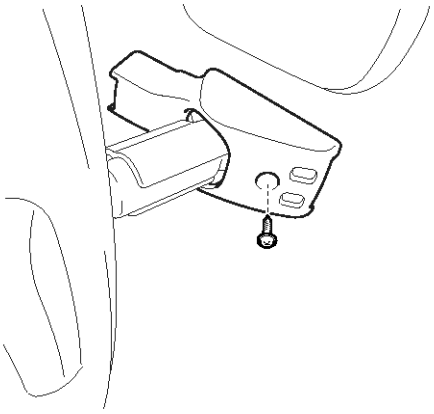
SHMBE8286D

2. Disconnect the mirror connector (A).



SHMBE8285D

3. Remove the mirror mounting screw.

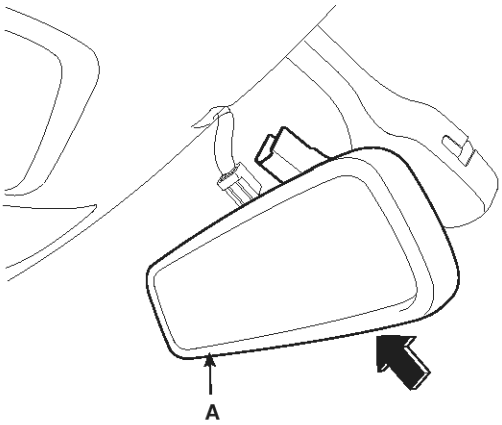


SHMBE8287D

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.

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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.

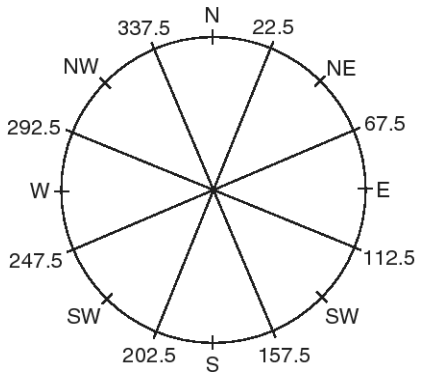
[Switch points]

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

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Compass display interval

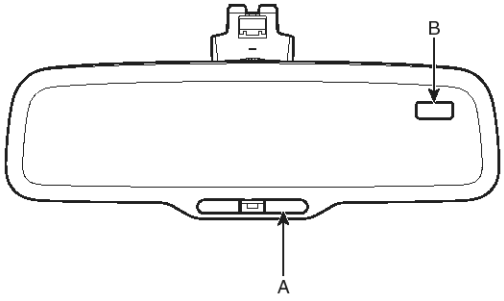
Compass display should be updated at every two seconds.

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 :

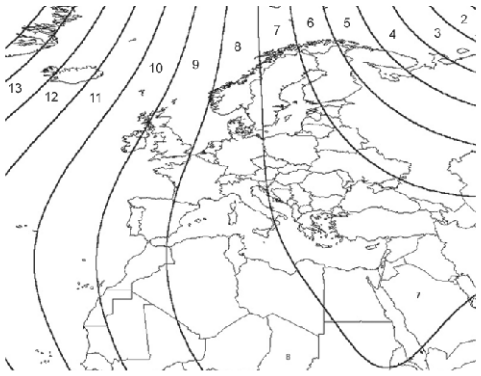
1. Determine the desired zone number based upon your current location on the zone maps.
2. Press and hold the Feature Control button for more than 6 but less than 9 seconds, the current zone number will appear on the display (B).
3. Pressing and holding the feature control button (A) again will cause 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

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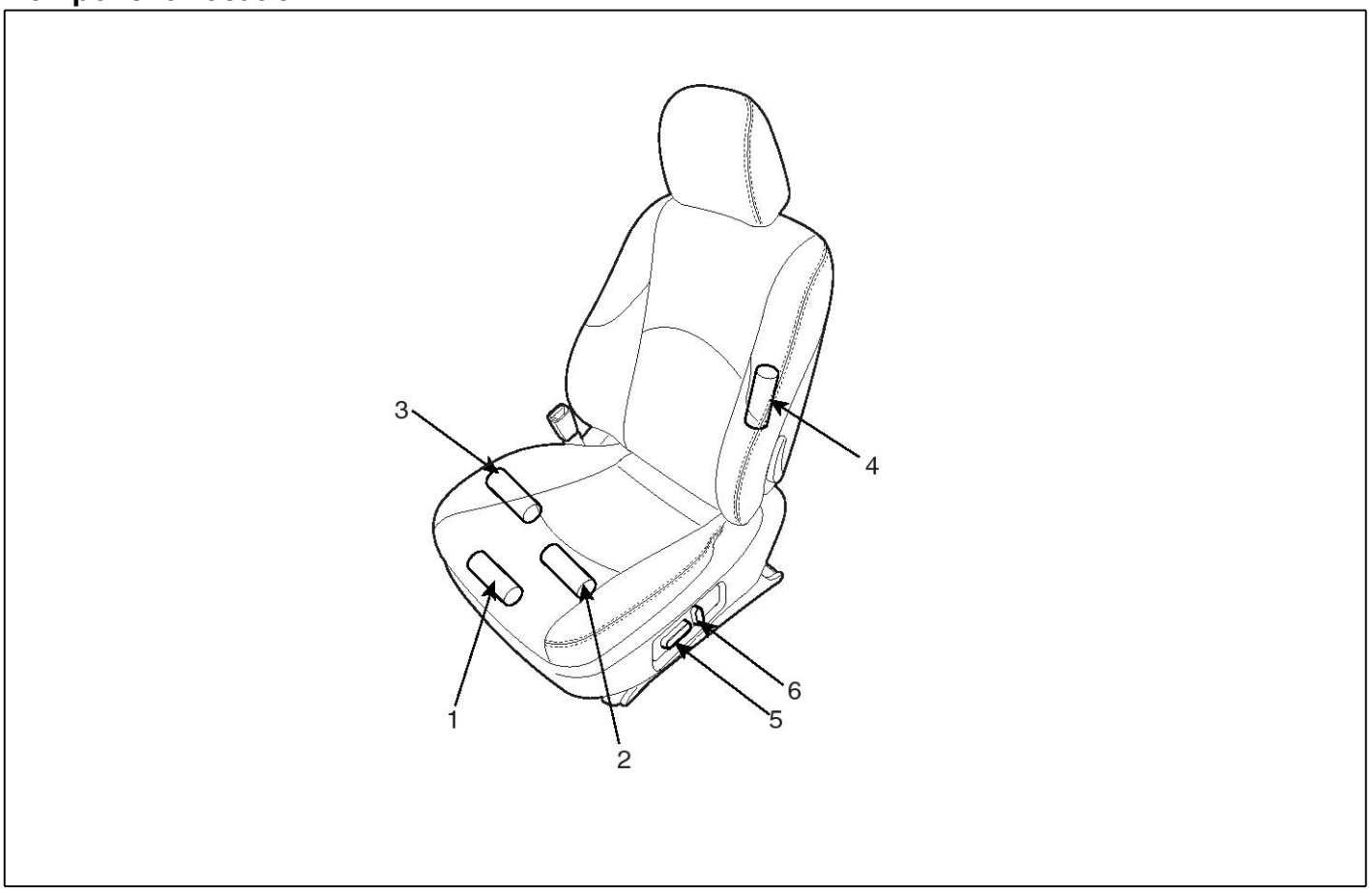
Seat Electrical

Component Location



SHMBE9154N

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

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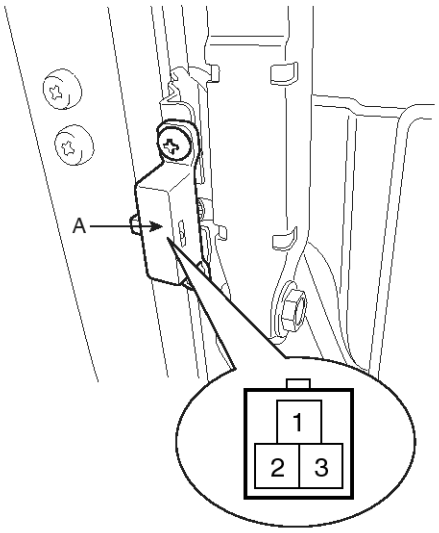
Power Seat Motor

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.



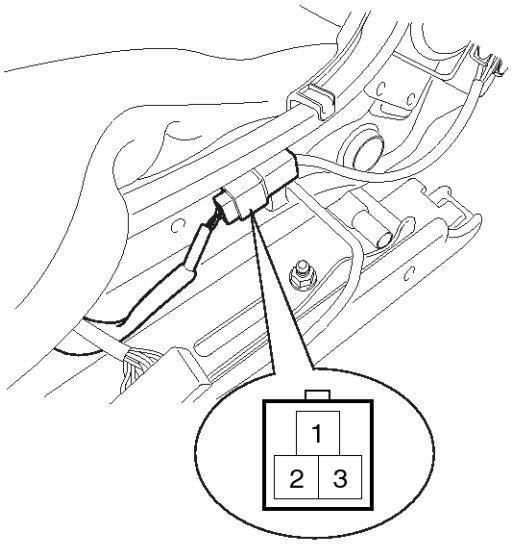
SHMBE8290D

Terminal / Position	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

Terminal / Position	1	2	3
Forward	○		○
Backward	○	○	

SHMBE9316N

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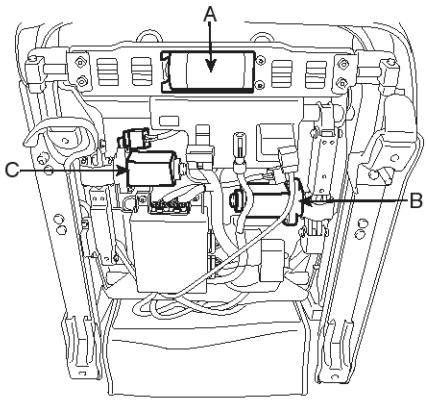
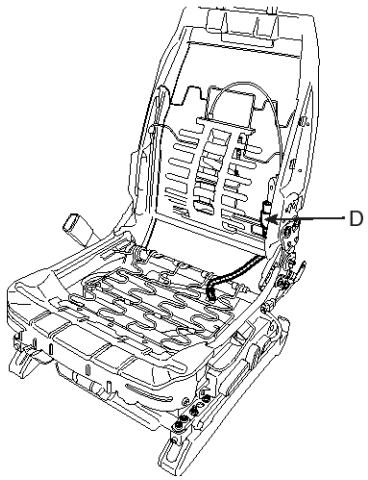
Power Seat Motor

1. Disconnect the connectors for each motor.

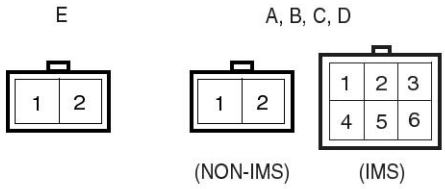


SHMBE8292D



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

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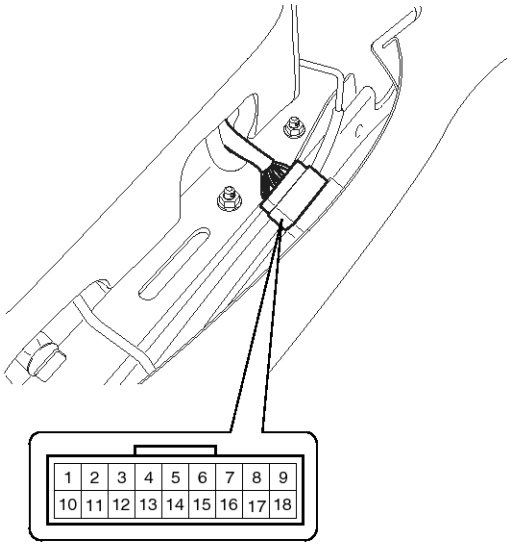
Power Seat Control Switch

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.



SHMBE9158N

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)

SHMBE9159N

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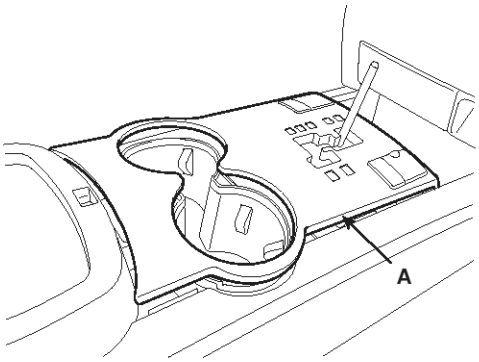
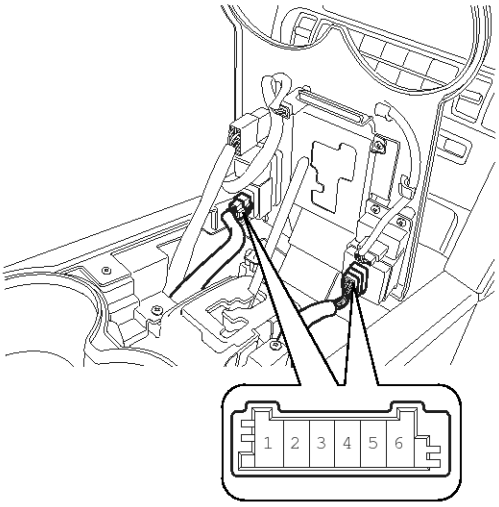
Seat Heater Switch

Inspection

Front Seat Heater Switch

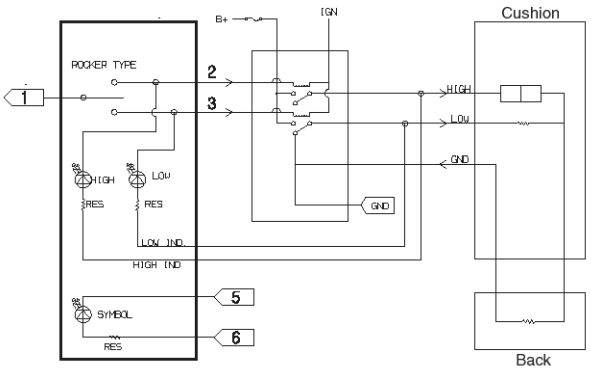
1. Disconnect the negative (-) battery terminal.
2. Remove the seat heater switch from the floor console (A) with scraper.





SHMBE8300D

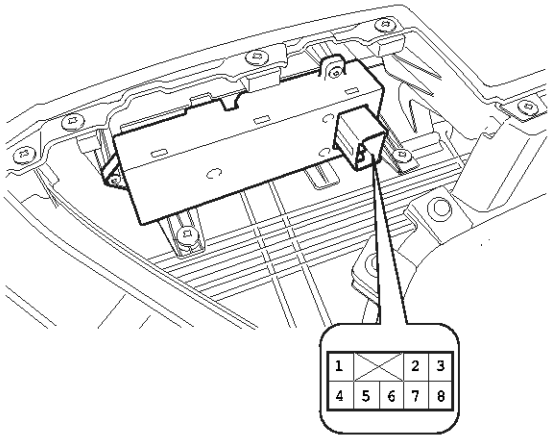
3. Check that continuity exists between the terminals.
   Terminal No : 1. Ground, 2. High signal switch
   3. Low signal switch, 5. Illumination (-),
   6. Illumination (+)



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

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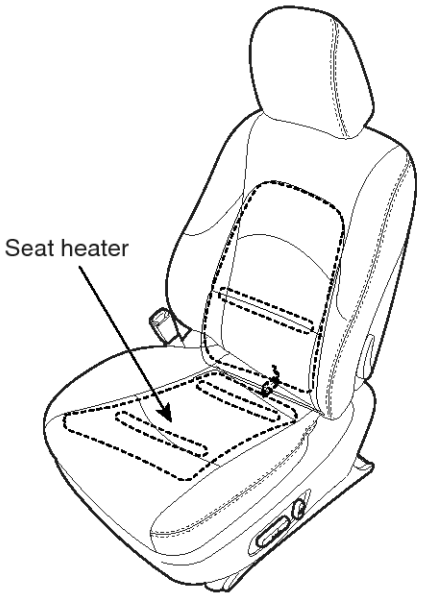
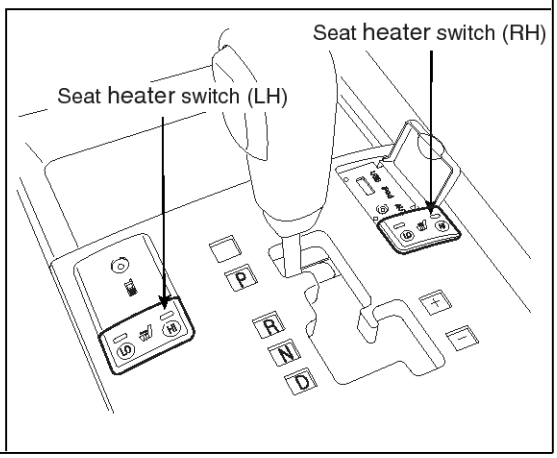
Seat Heater

Component Location

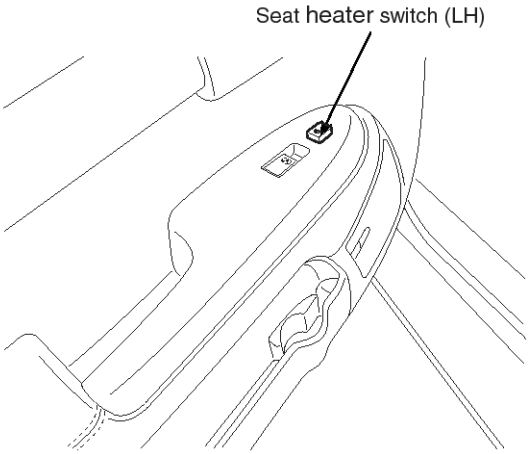
[Driver/Assist Seat]

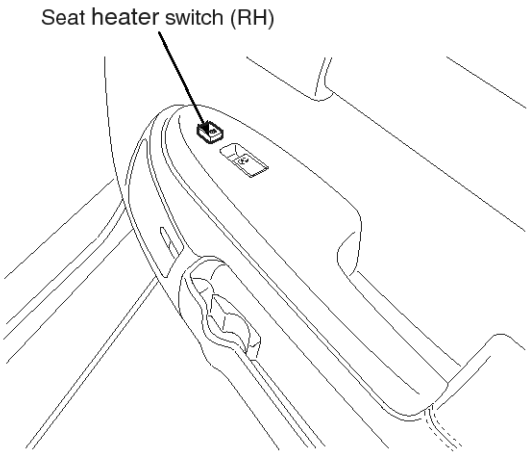




SHMBE9200N

[2nd seat]





SHMBE9201N

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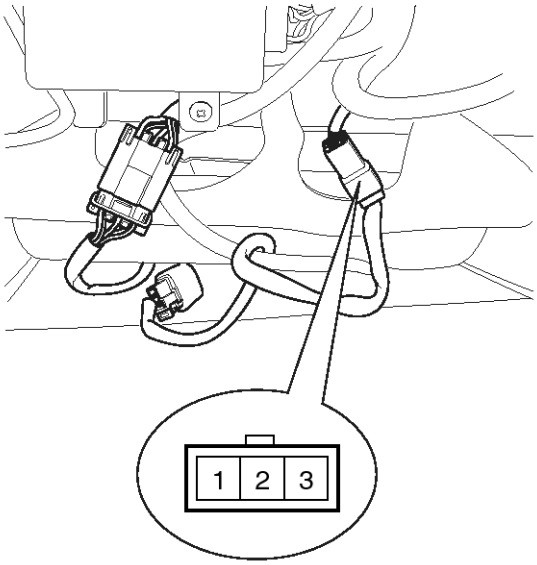
Inspection

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)

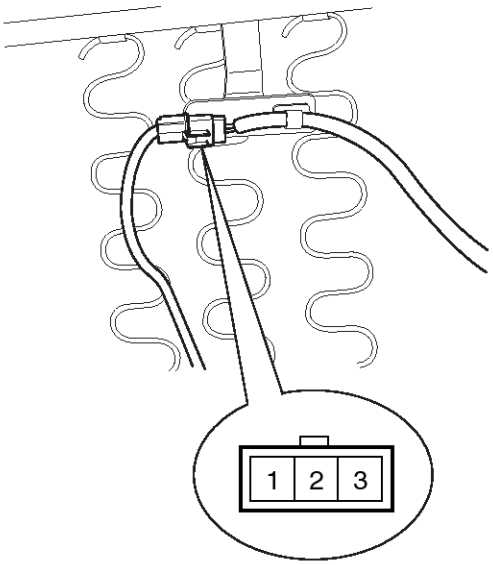
3. Check for continuity between the terminals after disconnecting the connector.

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)

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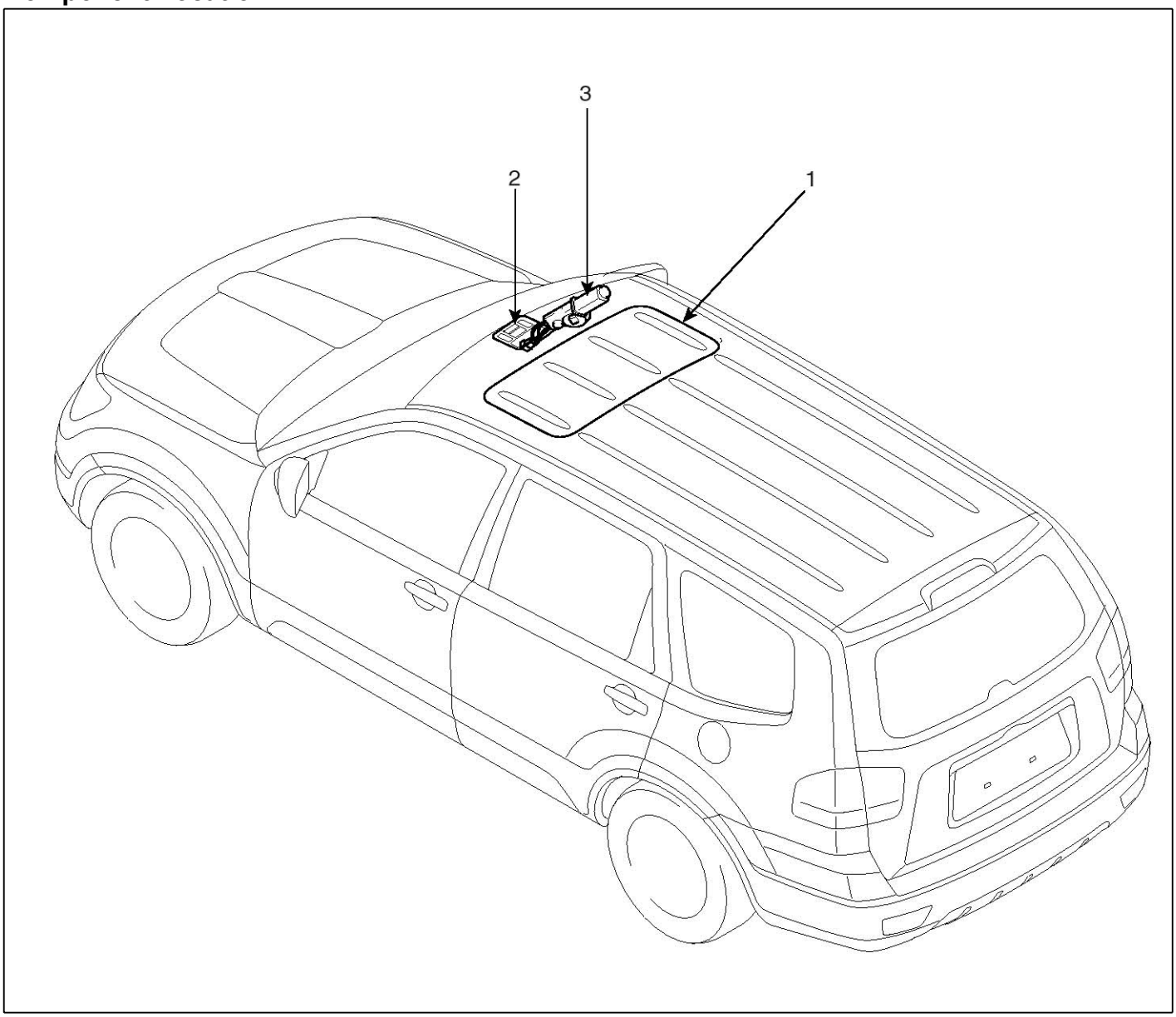
Sun Roof

Component Location



SHMBE8321D

1. Sunroof
2. Sunroof switch
3. Sunroof motor & controller

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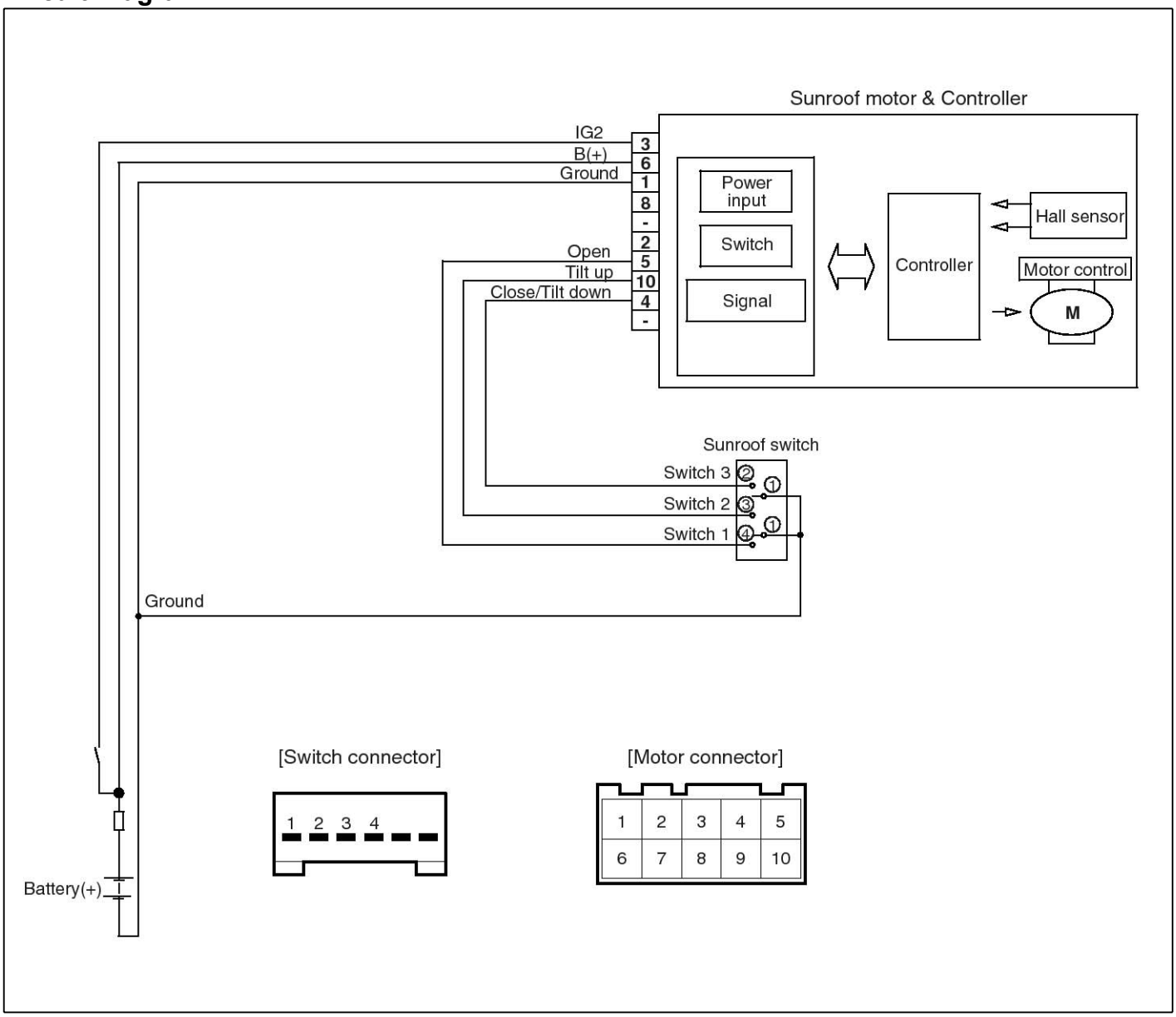
Circuit Diagram



SHMBE9205N

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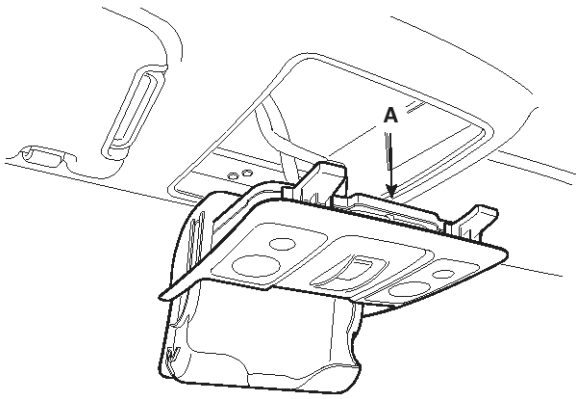
Sunroof Switch

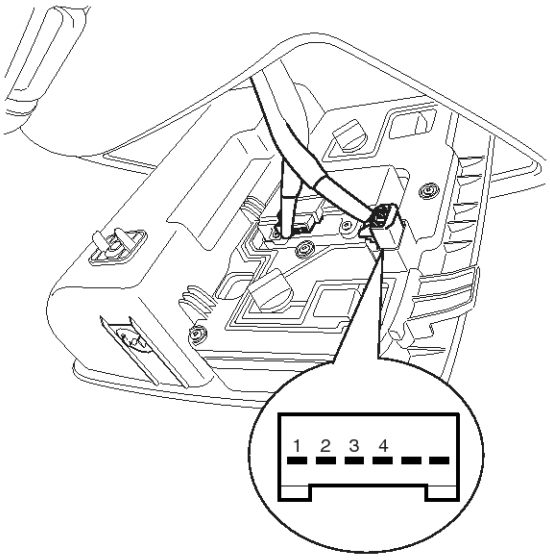
Inspection

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

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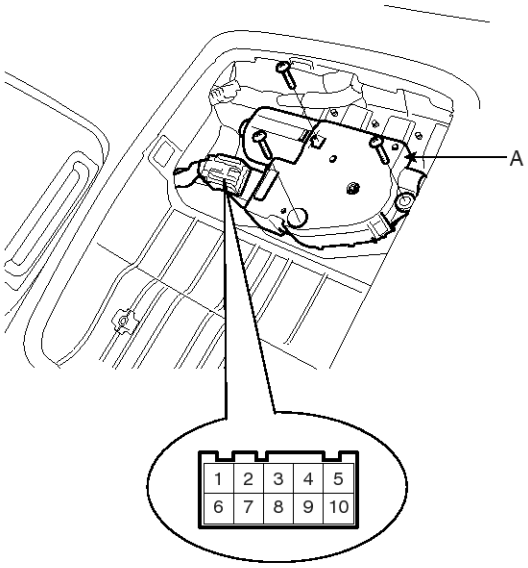
Sunroof Motor

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.

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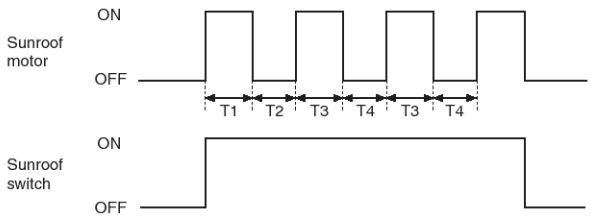
Protecting The Overheated Motor

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.

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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/Side)		10
	Overhead console lamp		10 x 2
	Trunk room lamp (Cargo lamp)		5

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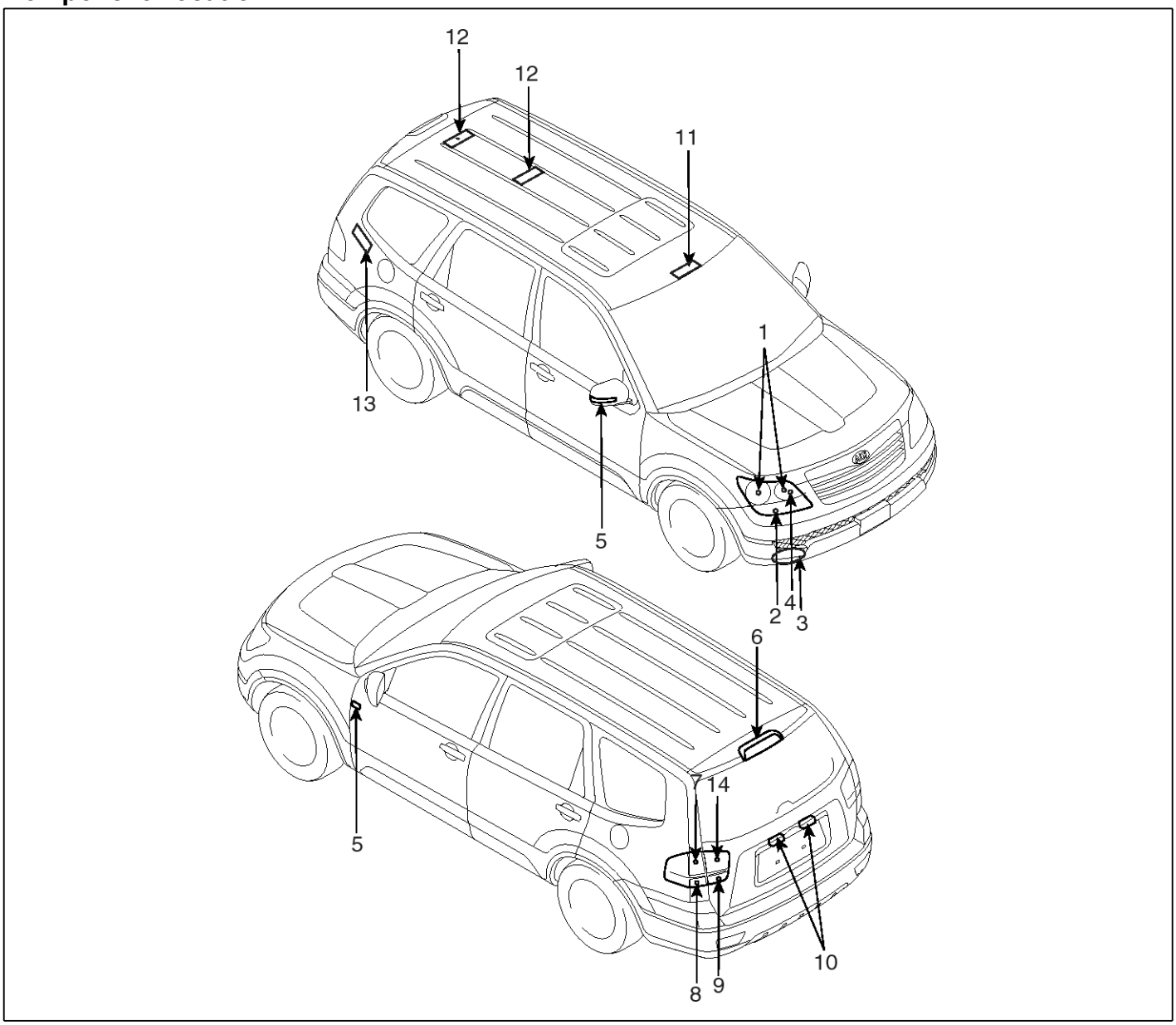
Component Location



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

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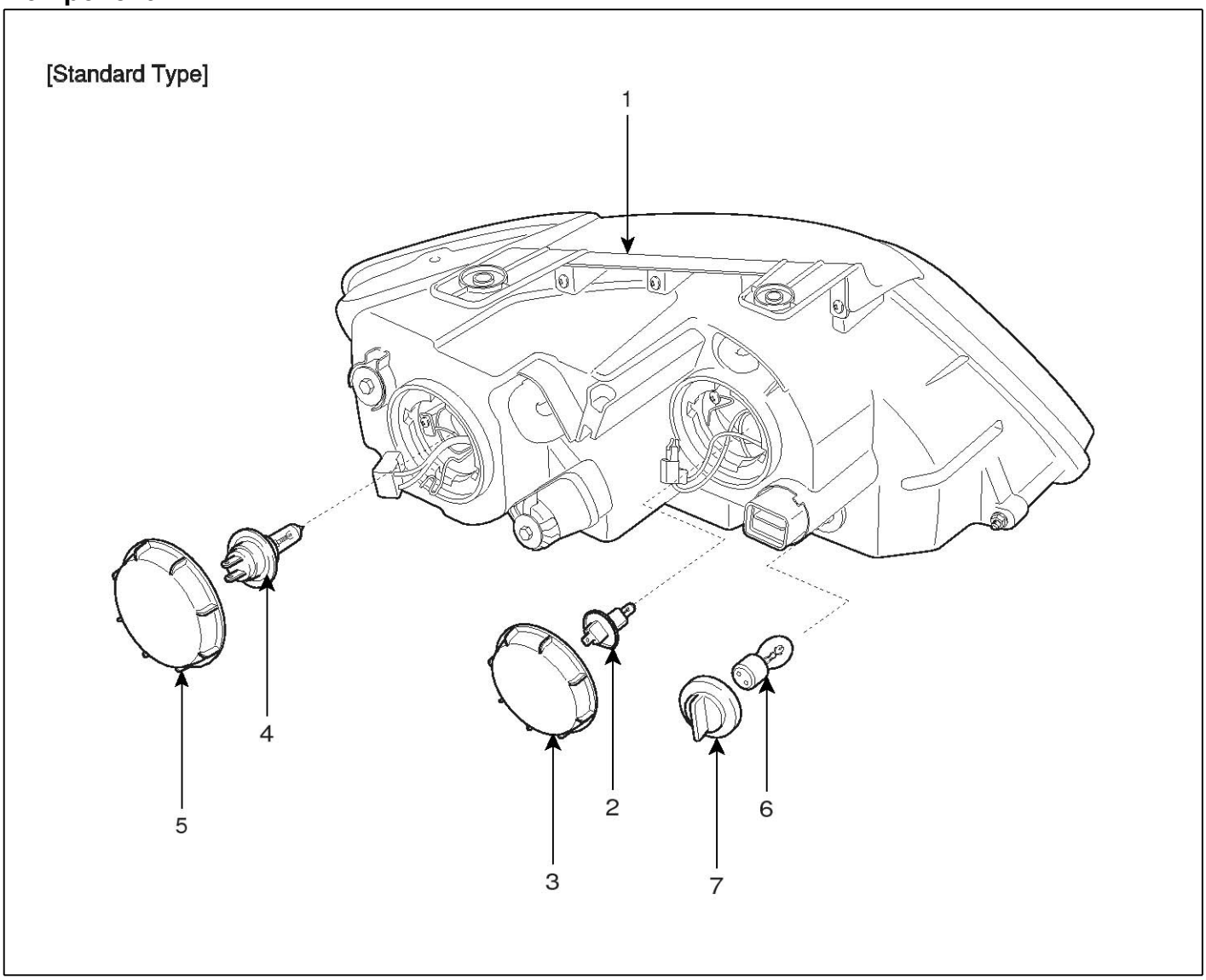
Head Lamps

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

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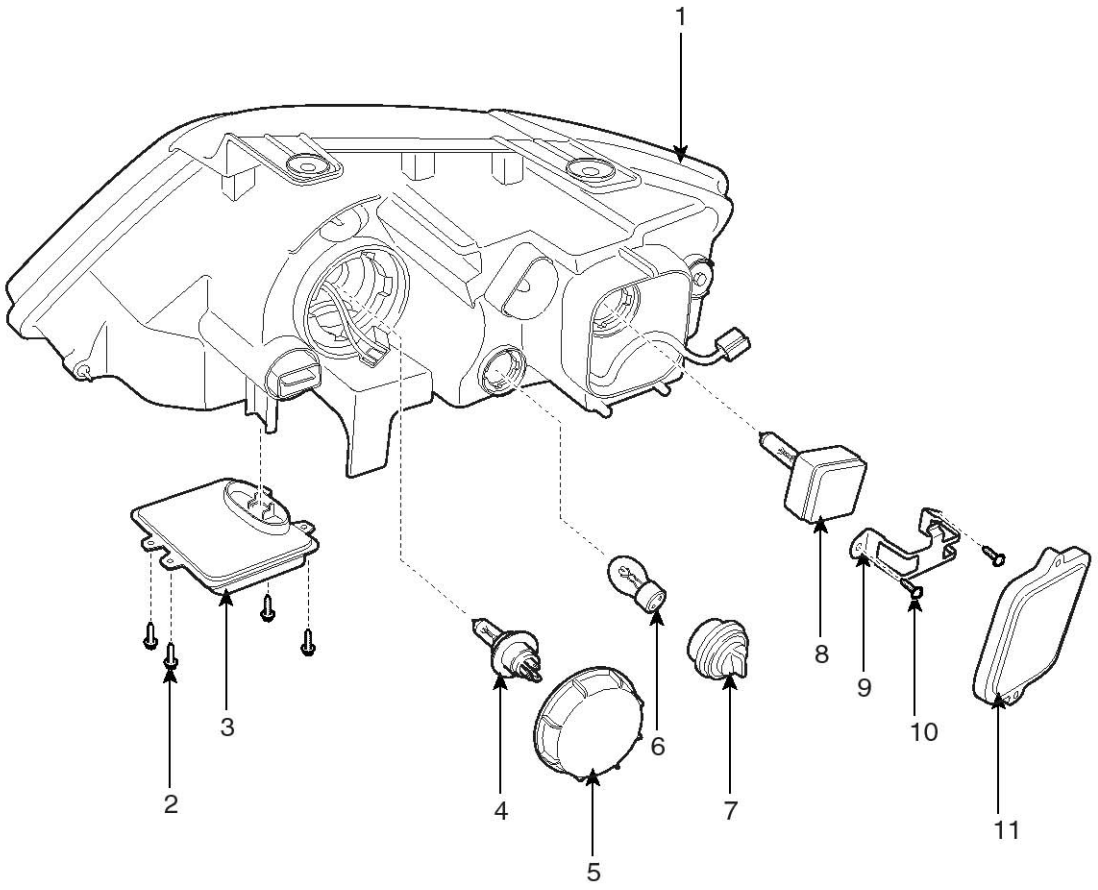
[HID Type]



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

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HID Head Lamp

1. Bulb
   1) Elements

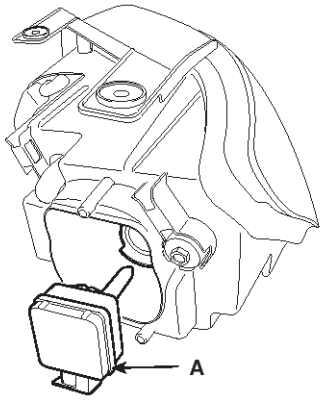
      Xenon gas: Xenon gas activates the initial reaction for rapid illuminating.

      Molybdenum electrode: anode arcing

      Metal halide salts: color composing component
   2) Lightening principle

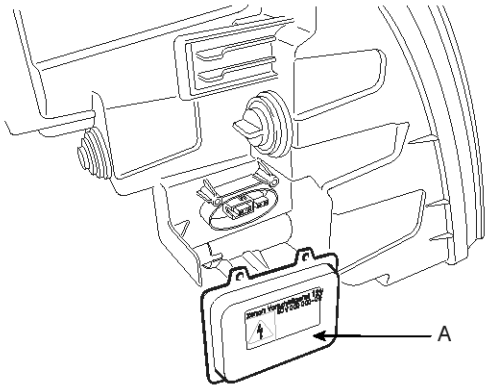
      When Xenon gas and metal halide salt will discharge the molybdenum anode in a capsule, it emits light.
2. Ignitor

   Ignitor (A) is an electromagnetic transformer that receives current from ballast and boost voltage to light on the arc 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.

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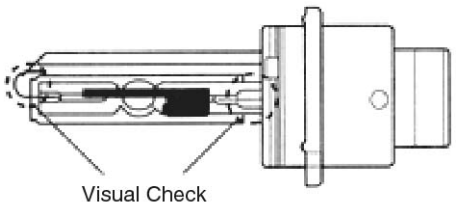
Inspection

1. Check-points upon head lamp failure (HID)
   1) Check the battery voltage. (Low beam will be on when the battery voltage above 9V.)
   2) Check the fuse and relay.
   3) Check the polarity of ballast. (If the polarity are changed, low beam doesn't lighten)
   4) Check the bulb connector securely.
   5) Visually bulb checking (no filament): damaged glass, damaged for upper parts and lower parts of glass tube.
   6) After (1)~(5), replace the ballast and the ignitor. (ballast assembly).



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.

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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

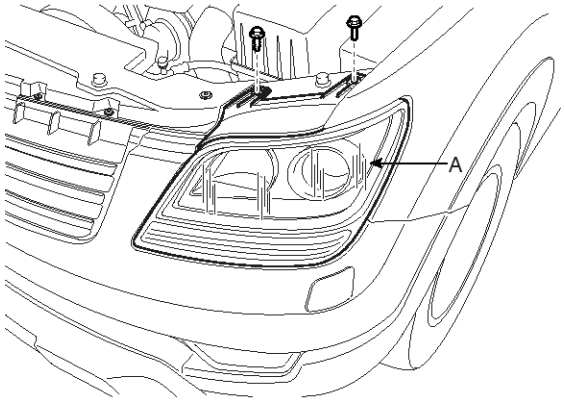
The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.

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.

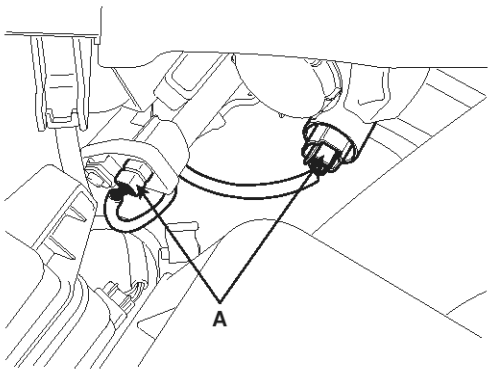
Never turn on the head lamps with the bulb removed from the headlamp assembly.

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

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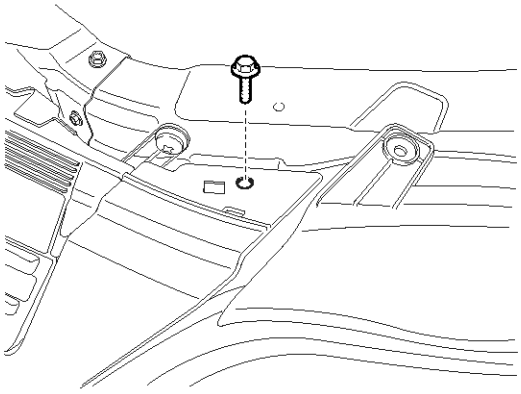
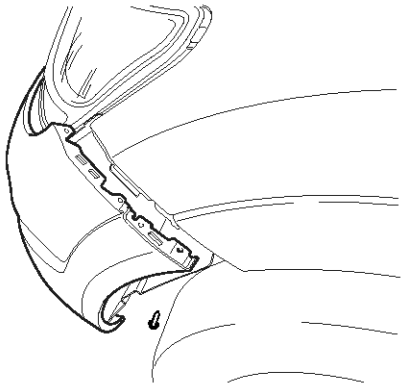
4. Loosen the front bumper upper support bracket bolt.



SHMBE8339D

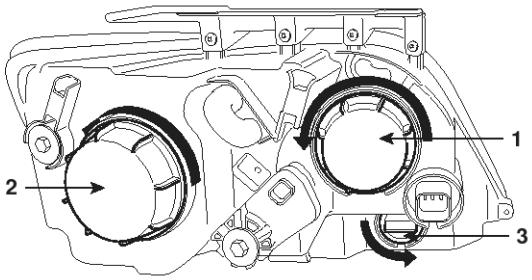
5. Loosen the bumper mounting screw from the side spacer.



SHMBE9191N

6. Remove the head lamp bulb after removing the head lamp assembly.

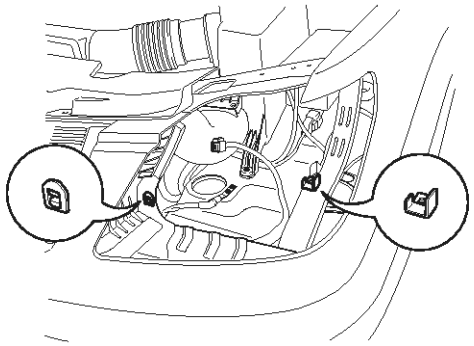
   (1. Head lamp low beam, 2. Head lamp high beam, 3. Turn signal lamp)



SHMBE9192N

NOTICE

Take care that retaining clip (A) is not to be damaged.



SHMBE9193N

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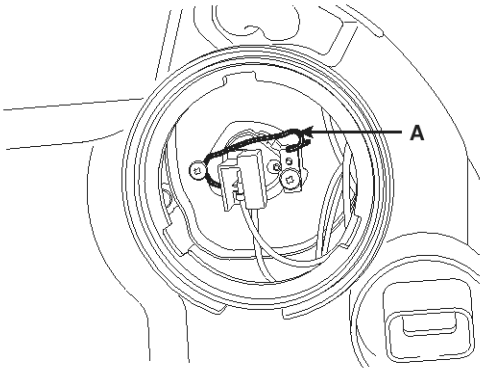
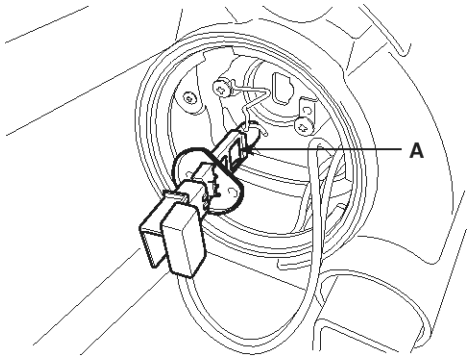
7. Release the lock of the set spring (A) to remove the head lamp high beam bulb.



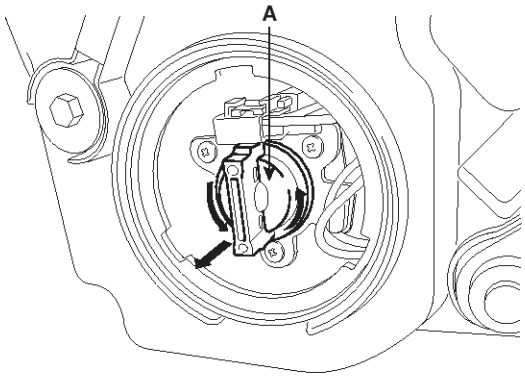
SHMBE9194N

8. Remove the head lamp high beam bulb(A).



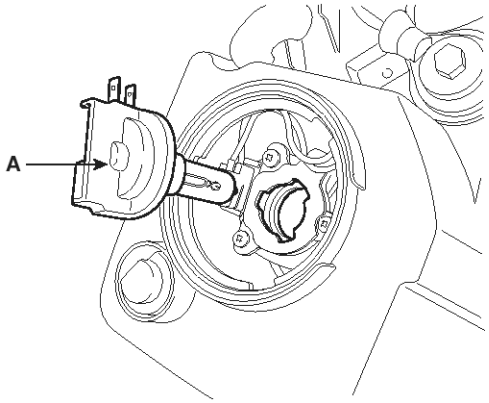
SHMBE9195N

9. Remove the head lamp low beam cap(A) by turning in the counter clock-wise direction.



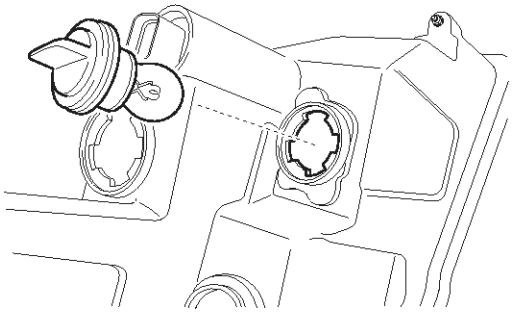
SHMBE9196N

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.

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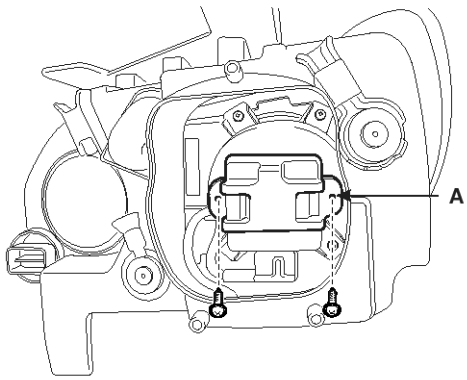
Replacement

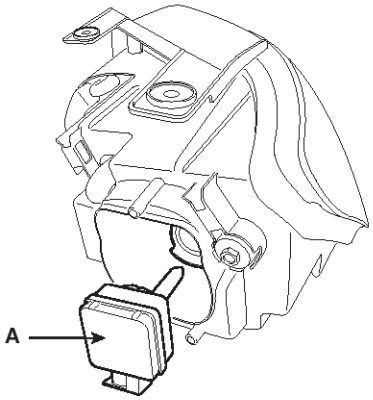
Bulb (HID)

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

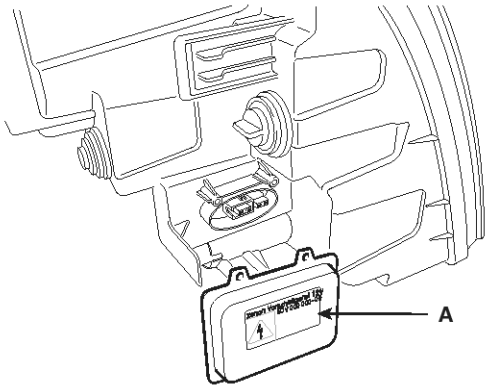
Turn the head lamp switch off to avoid high voltage

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

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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.

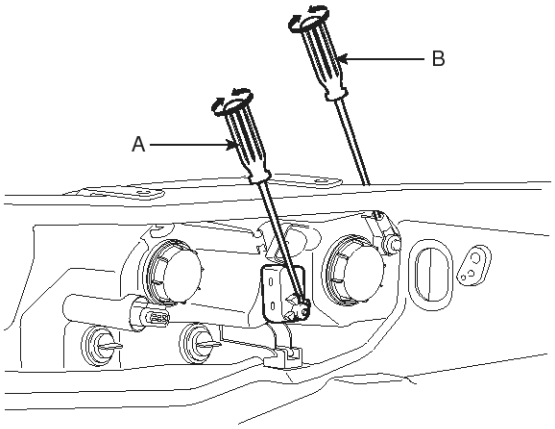
NOTICE

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

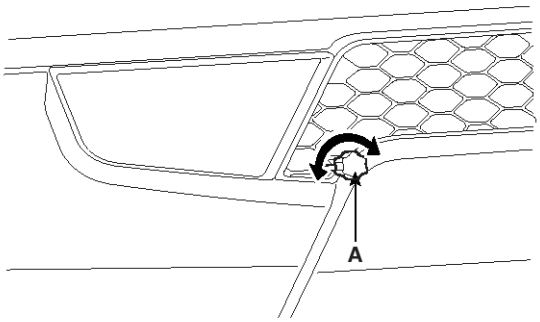
Front Fog Lamp Aiming

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

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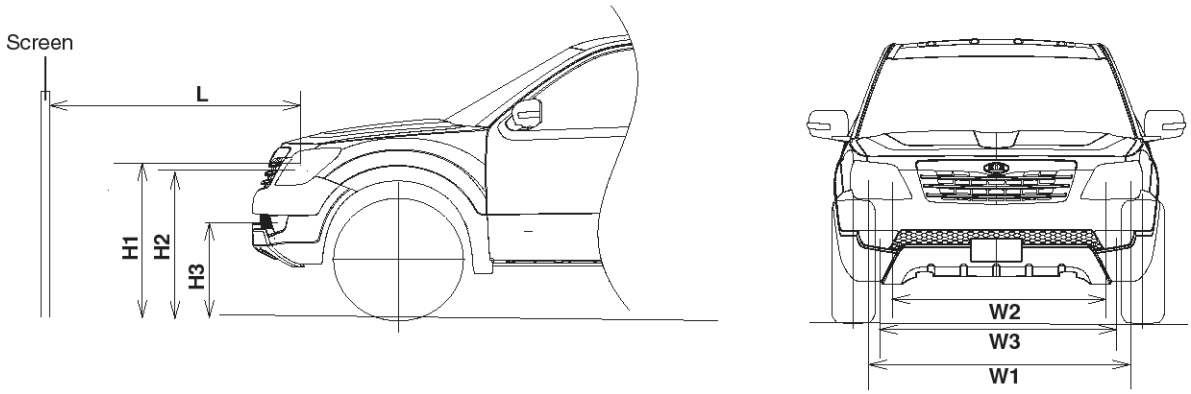

H1 : Height between the head lamp bulb center and ground (Low beam)
H2 : Height between the head lamp bulb center and ground (High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low beam)
W2 : Distance between the two head lamp bulbs centers (High beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

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

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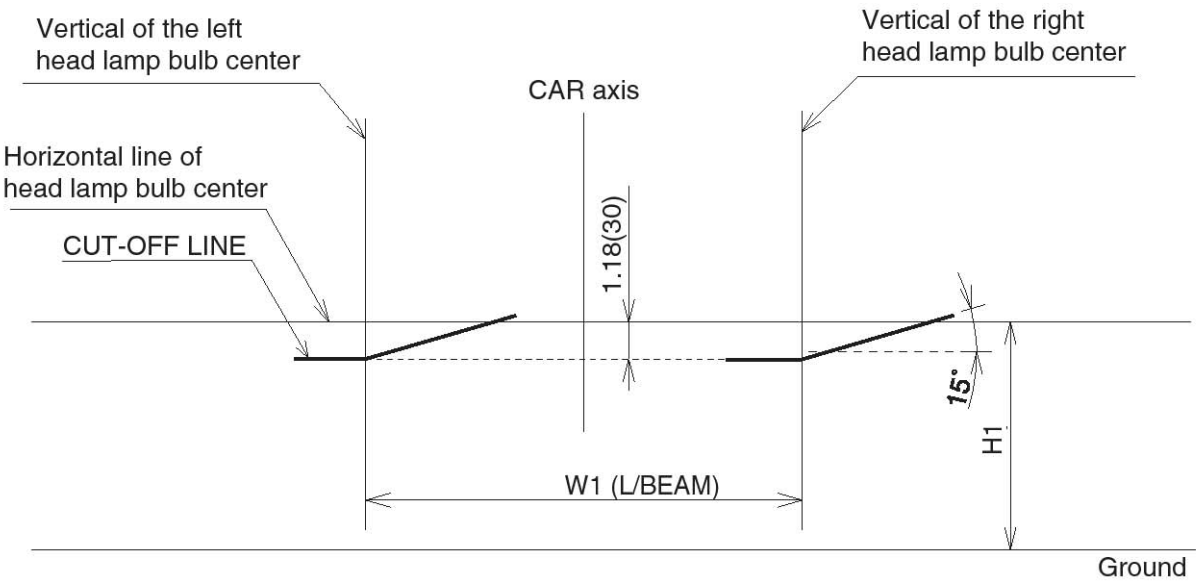
1. Turn the low beam on with driver seated in the vehicle.

   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.



Unit : in.(mm)

SBHBE9471L

2. Turn the high beam on with driver seated in the vehicle.

   The hot point should be projected in the allowable range shown in the picture.

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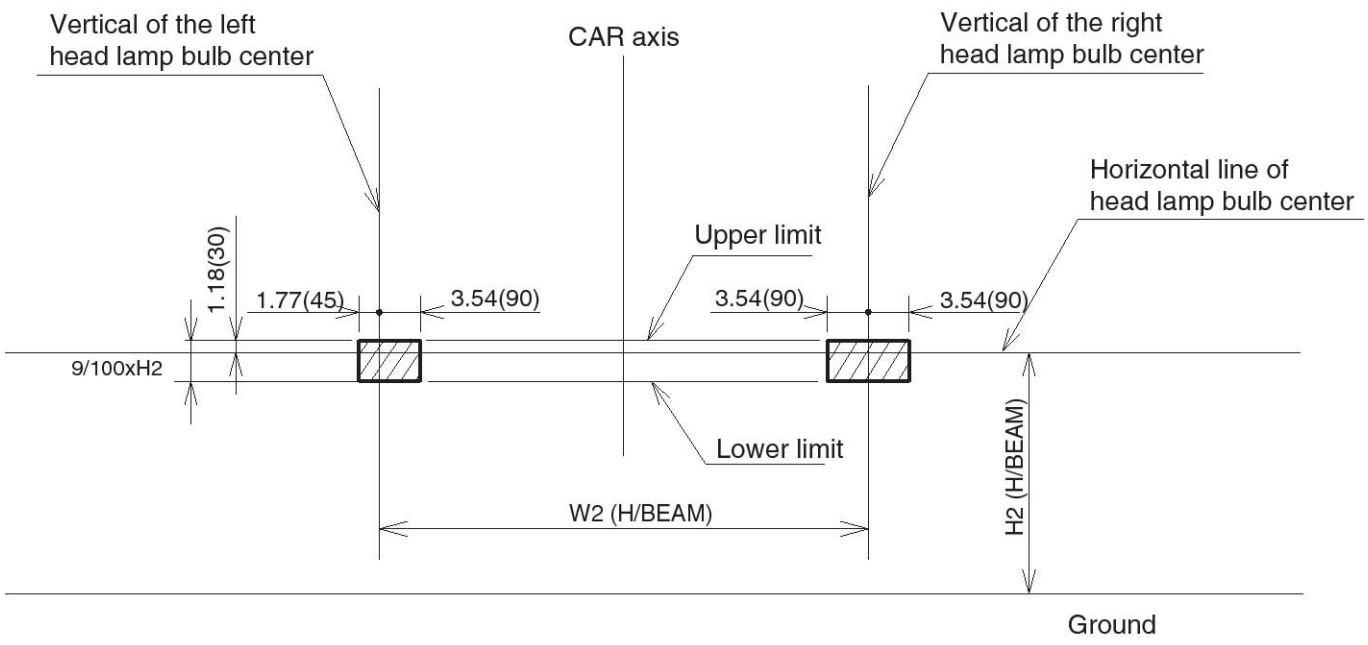
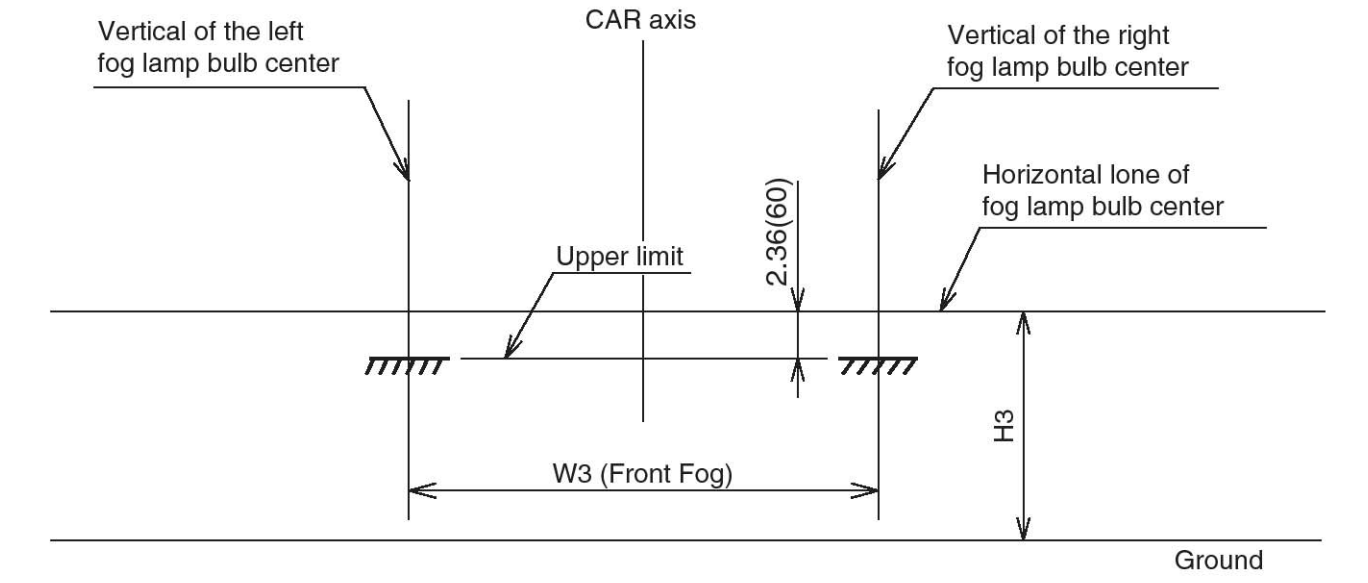


Unit : in.(mm)

SHMBE9125L

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

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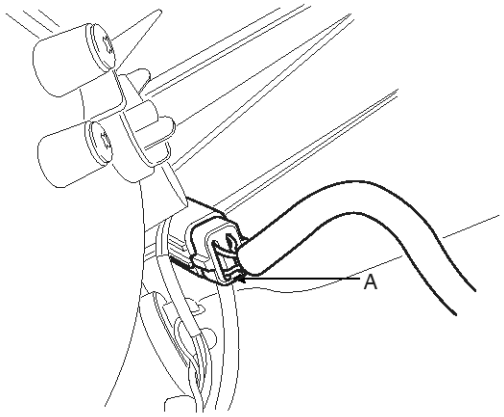
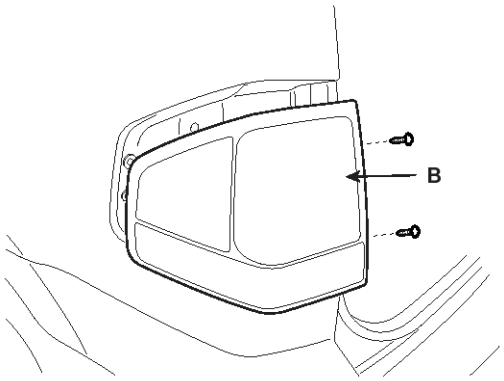
Rear Combination Lamp

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).

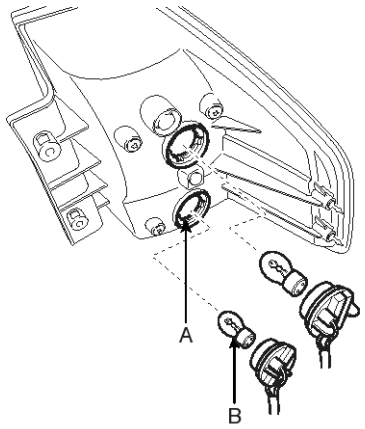


SHMBE8353D



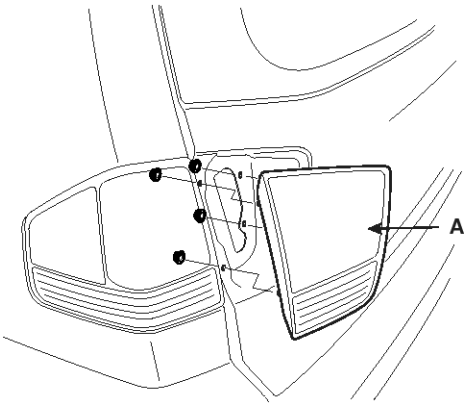
SHMBE8352D

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

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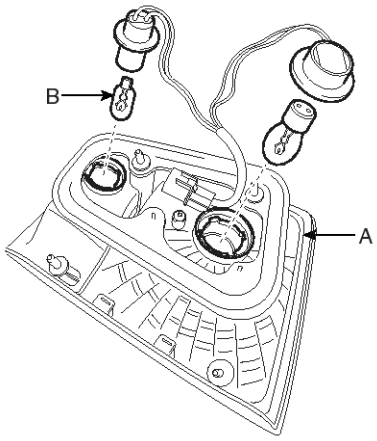
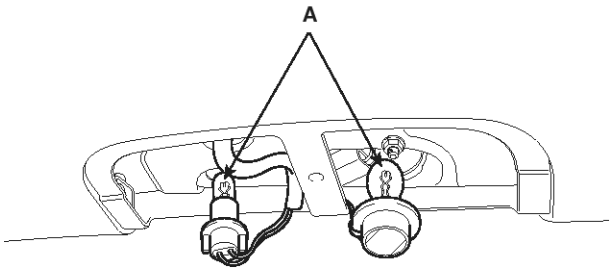
5. Remove the tailgate combination lamp assembly (A) and then replace the bulbs(B).



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.

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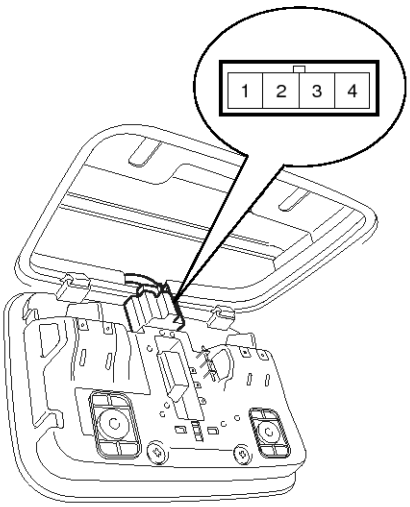
Room Lamp

Inspection

1. Remove the room lamp assembly then check for continuity between terminals.



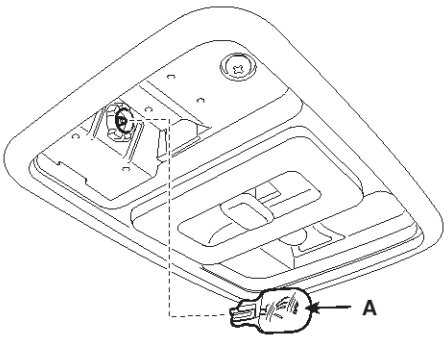
SHMBE9212N

Terminal / Position	1	2	3	4
ON	●		●	●
DOOR	●	●	●	●
OFF				

SHMBE9213N

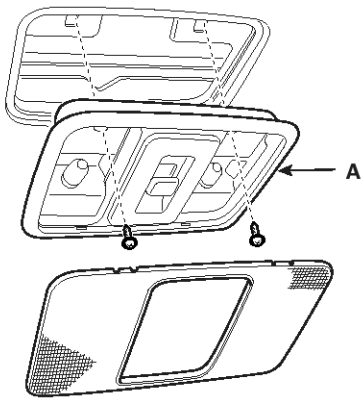
Removal

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.

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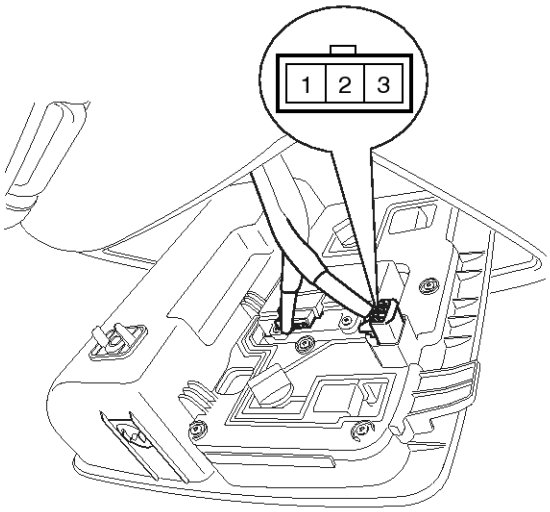
Overhead Console Lamp

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.



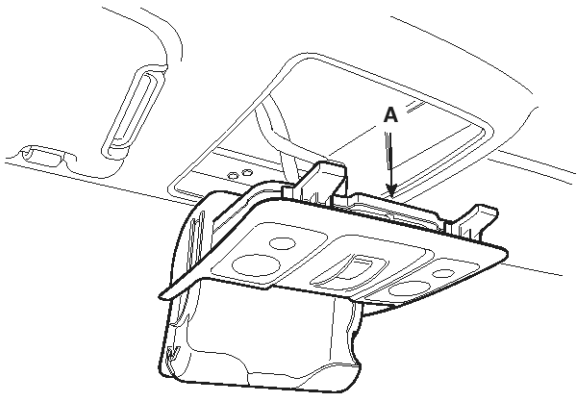
SHMBE8365D

Terminal / Position	1	2	3
ON	○	○	○
DOOR		○	○
OFF			

SHMBE9214N

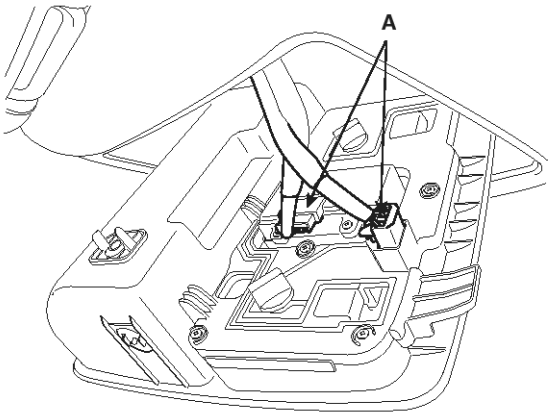
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the mounting 2 screws.
   And then remove the overhead console (A).

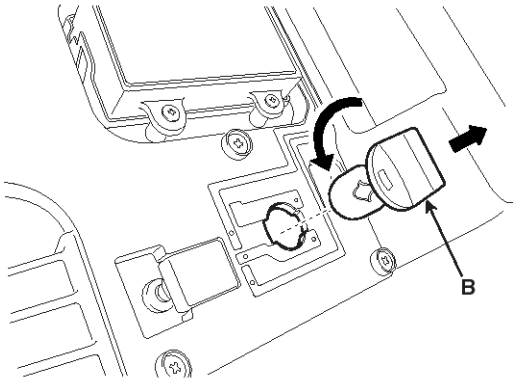


SHMBE8362D

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.

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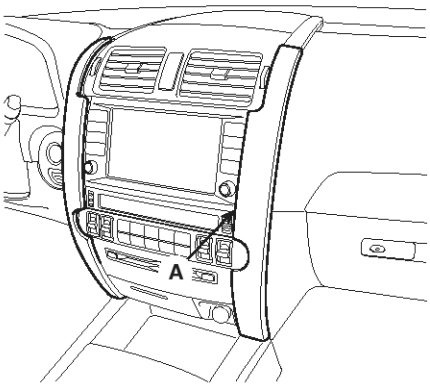
Hazard Lamp Switch

Inspection

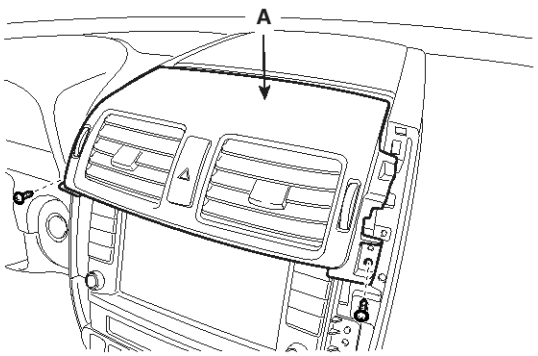
Hazard Lamp Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia side garnish (A).
   (Refer to body group - Crash pad)



SHMBE8367D

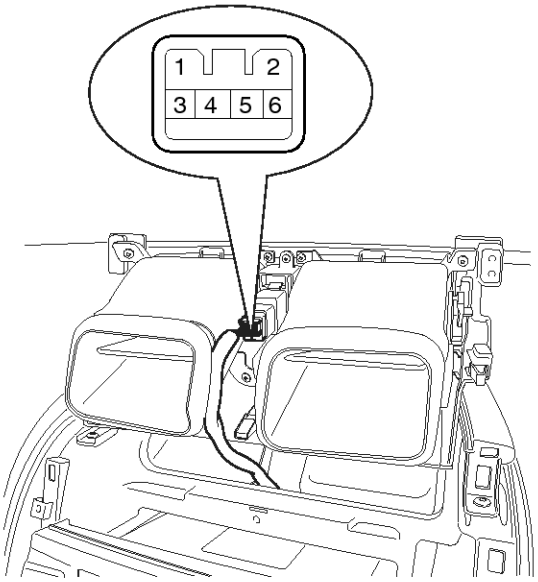
3. Remove the air vent panel (A) after loosening the screws.



SHMBE8368D

4. Disconnect the hazard lamp connector.

5. Operate the switch and check for continuity between terminals with an ohmmeter.



SHMBE8369D

Position / Terminal	ON (Push)	OFF	Remark
3	○		
4	○		
2	○—⏦—▼		ILL(+)
5	○		ILL(-)

SHMBE9216N

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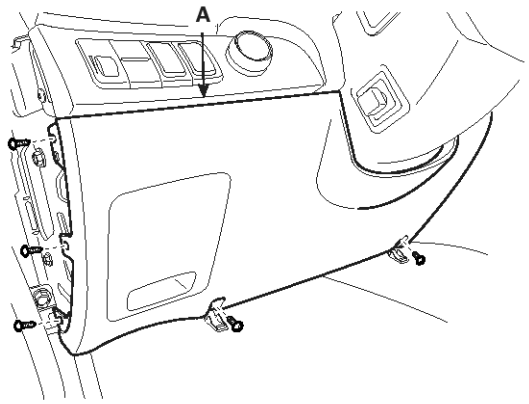
Rheostat

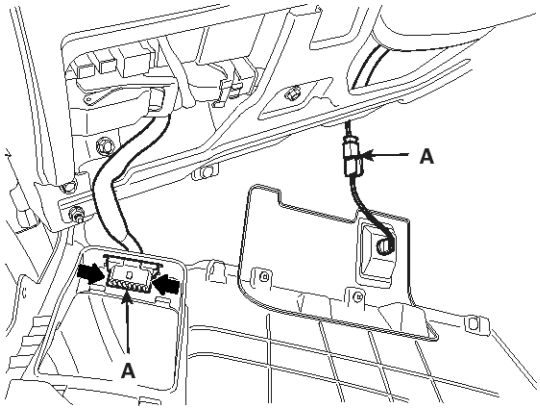
Inspection

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")



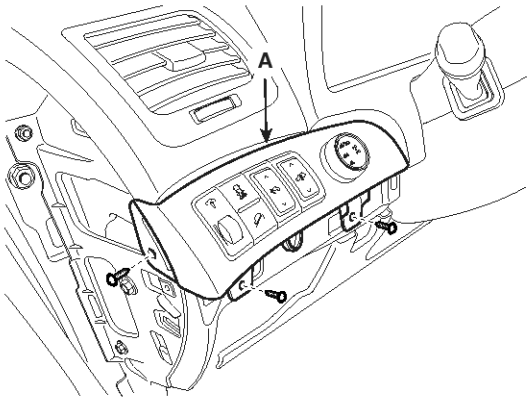
SHMBE8371D

4. Disconnect the connectors (A).



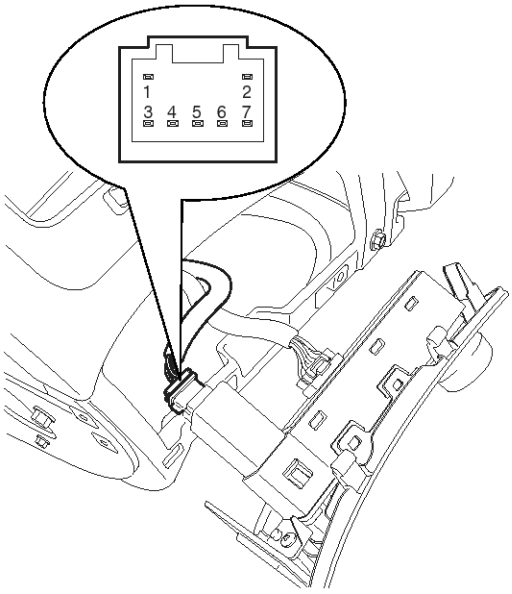
SHMBE8372D

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

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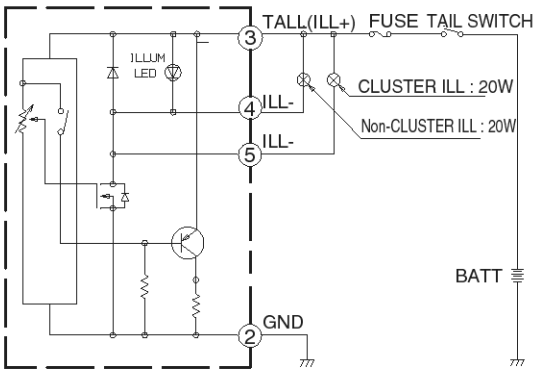
7. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



SHMBE9217N

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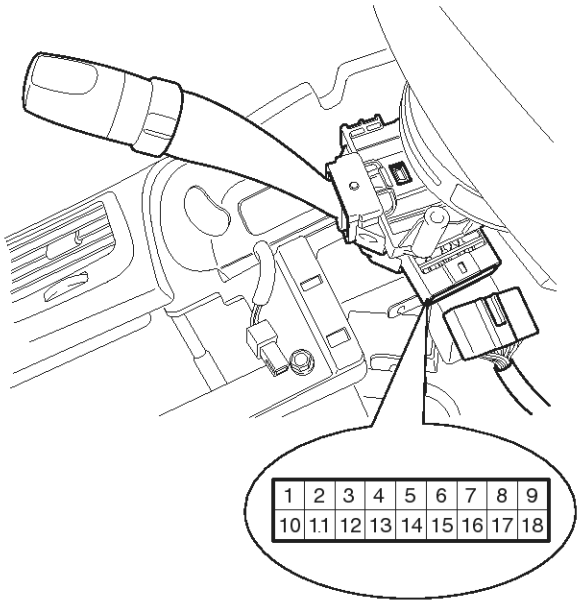
Front Fog Lamps

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.



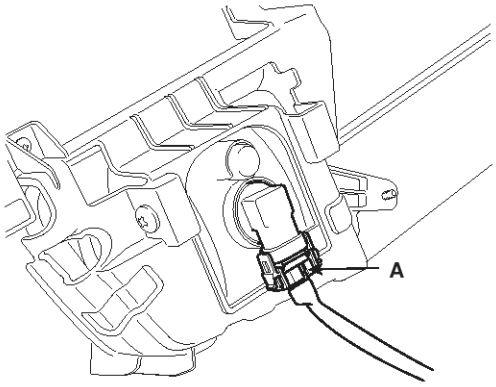
SHMBE8490D

Terminal / Position	12	13
ON		
OFF	○	○

SHMBE9218N

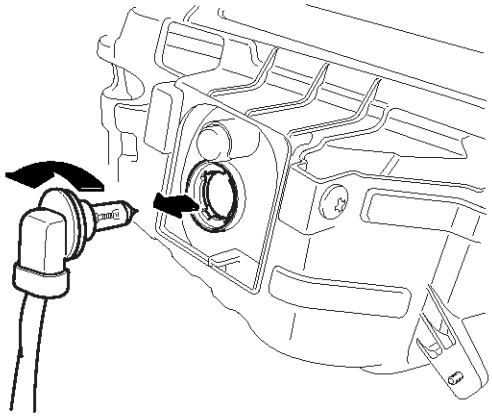
Removal

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.

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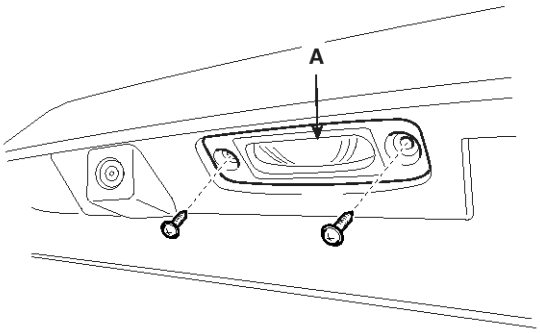
License Lamps

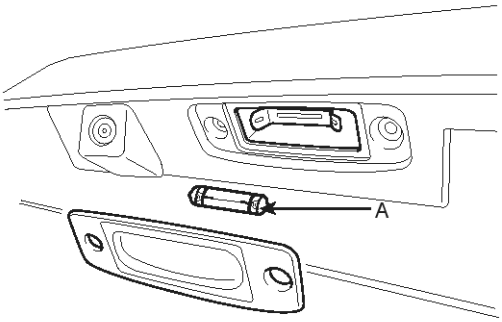
Removal

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.

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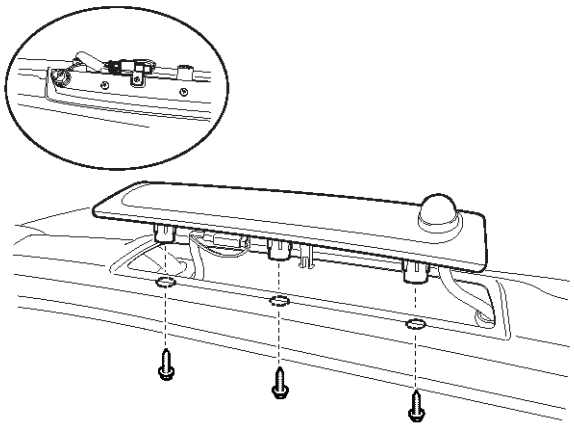
High Mounted stop lamp

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.

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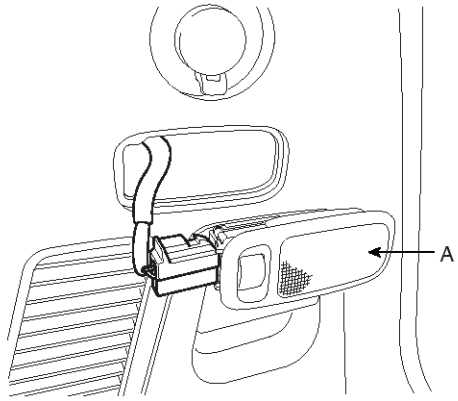
Luggage Room Lamp

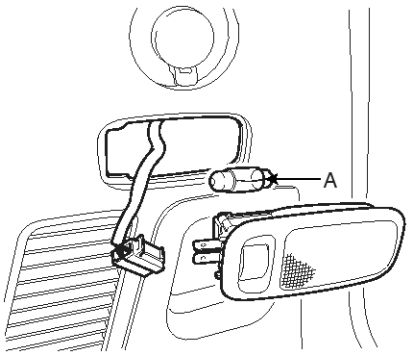
Removal

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.

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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

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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

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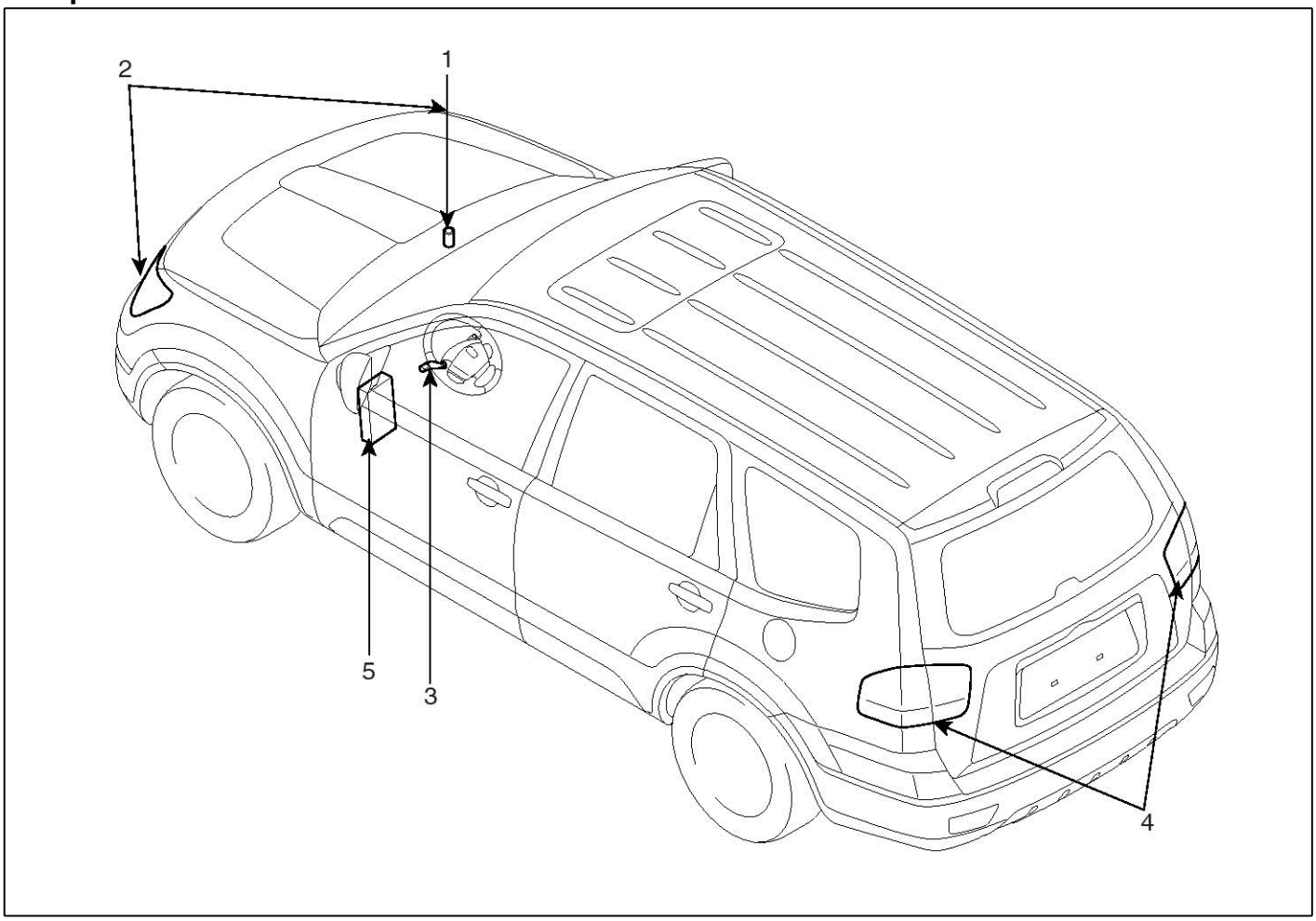
Auto Lighting Control System

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)

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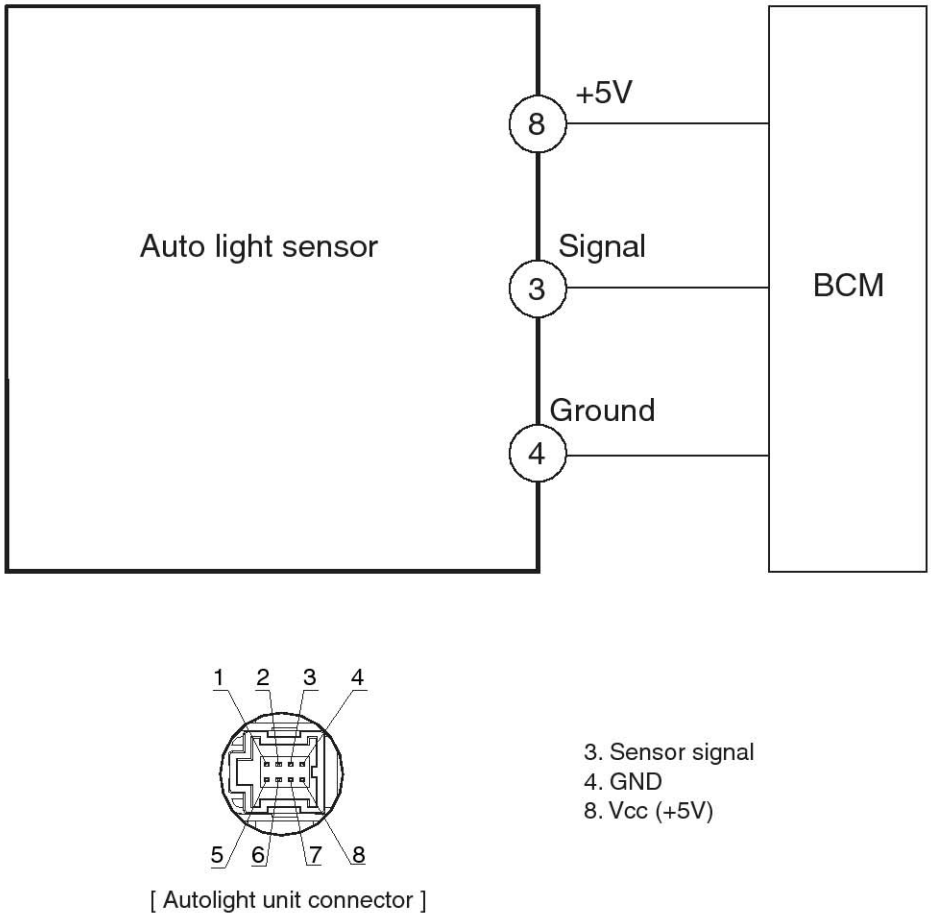
Circuit Diagram



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.

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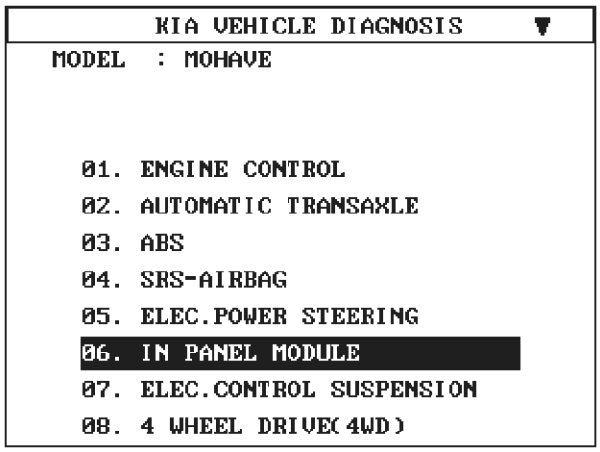
Auto Light Switch

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.



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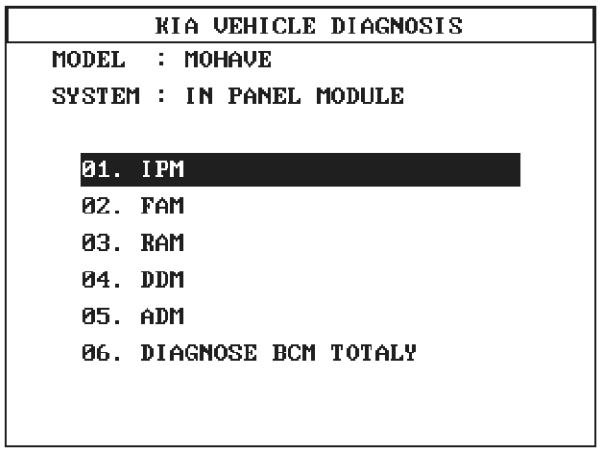
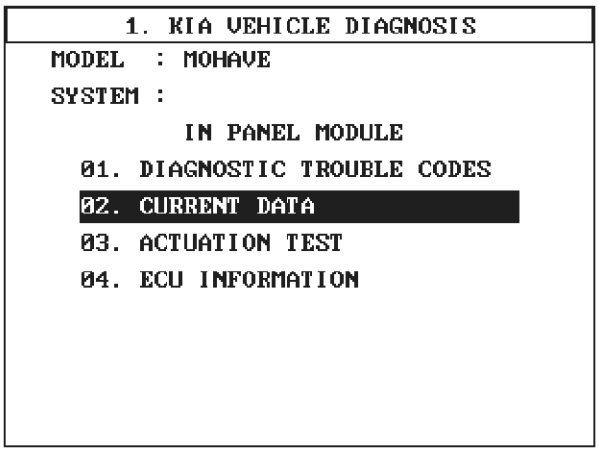


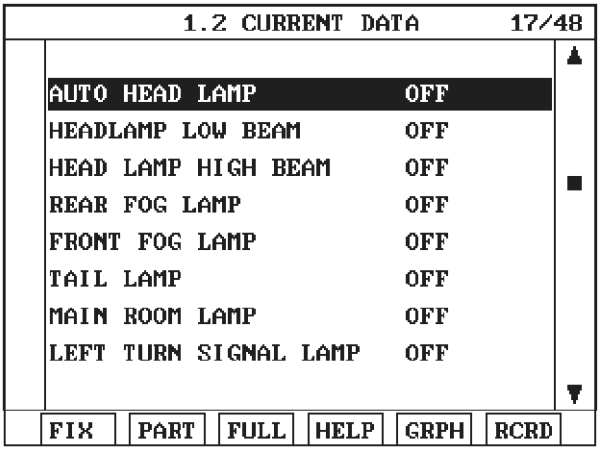
SHMBE9103L

4. Select "Current data". Check auto light value.



SHMBE9110L

5. Check input/output value of auto light.



SHMBE9221N

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Auto Light Sensor

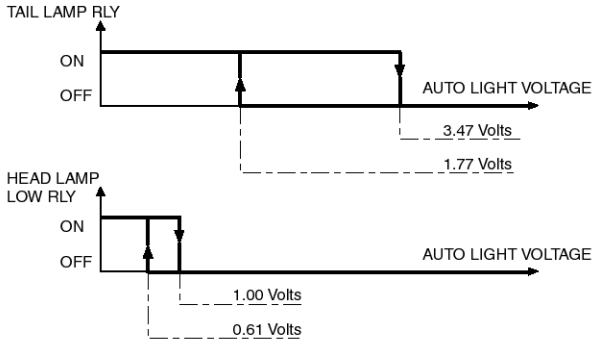
Inspection

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.

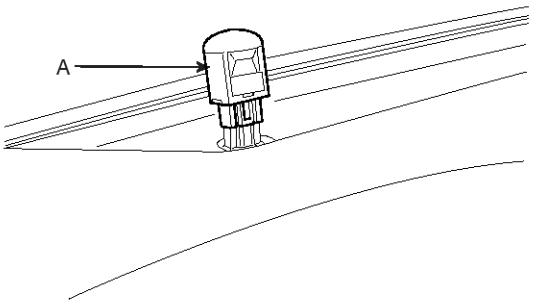


ETBF145K

	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 Photo & auto light sensor (A) from defrost nozzle by using screw (-) driver.



SENBE7511D

3. Remove the auto light connector.

Installation

1. Reconnect the auto light connector.
2. Install the auto light sensor.

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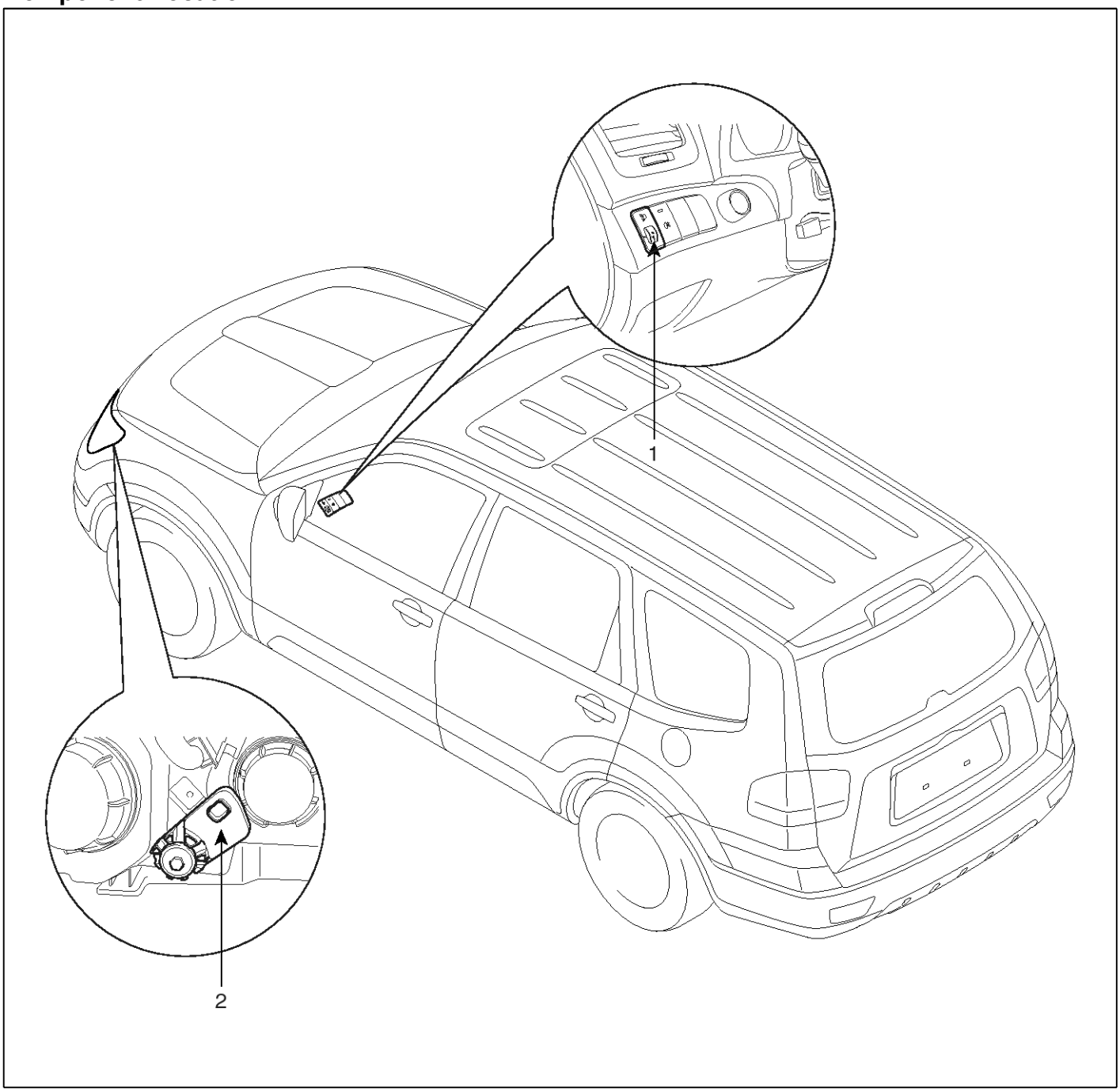
Head lamp leveling Device

Component Location



SHMBE9091L

1. Head lamp leveling switch
2. Head lamp leveling actuator

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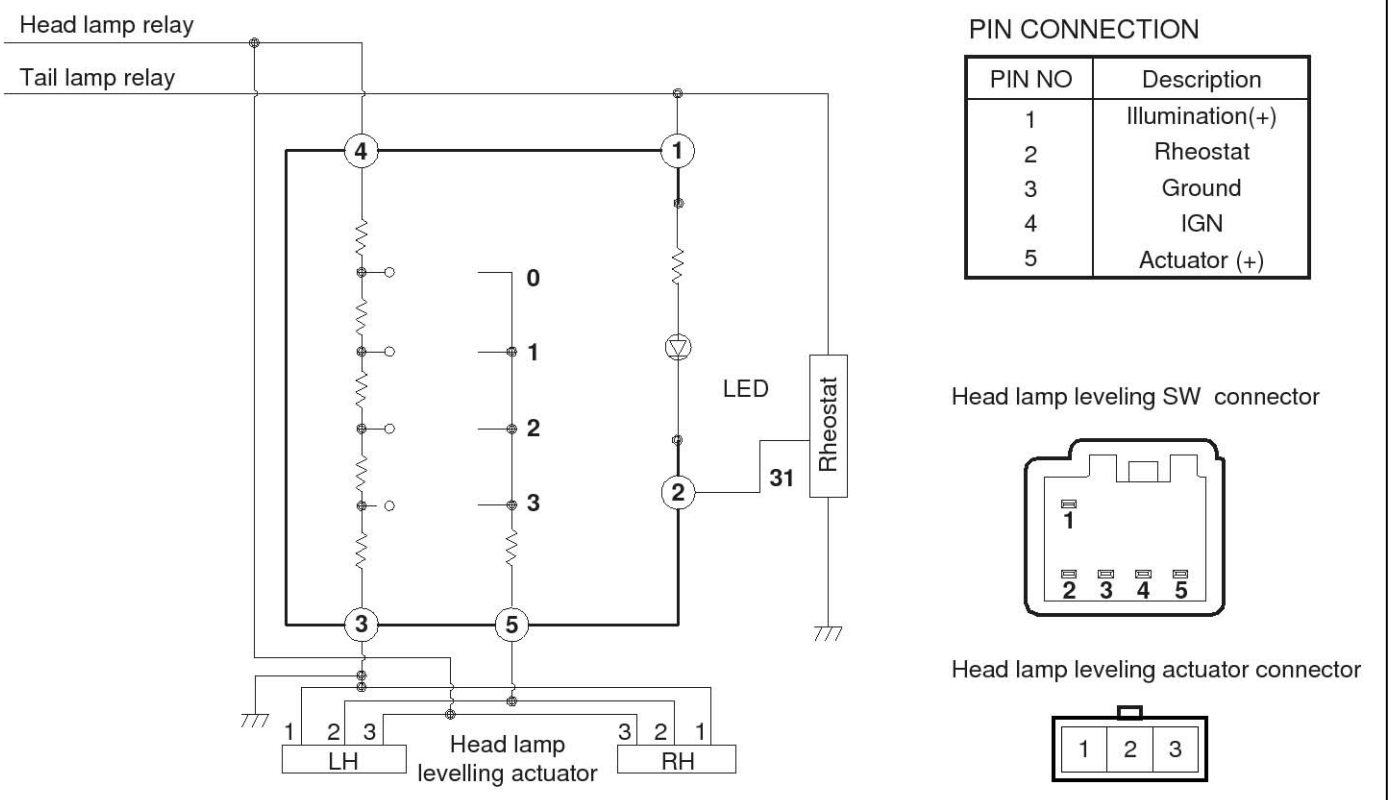
Circuit Diagram



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

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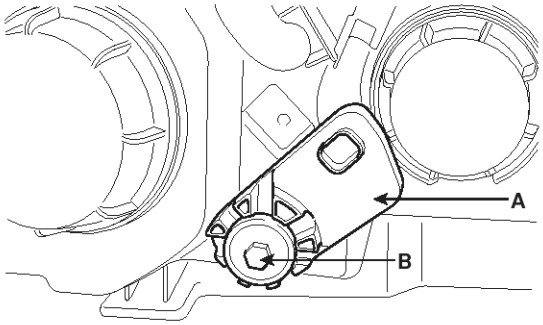
Head lamp leveling Actuator

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.

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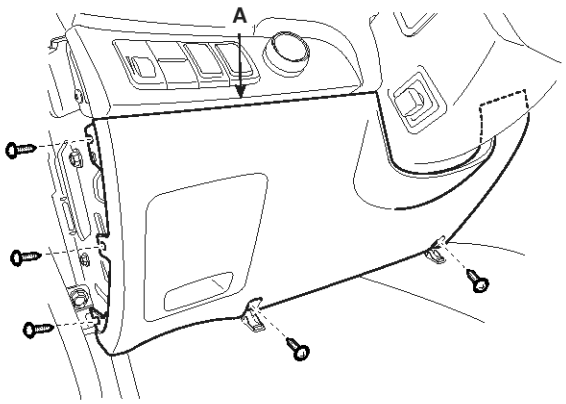
Head Lamp Leveling Switch

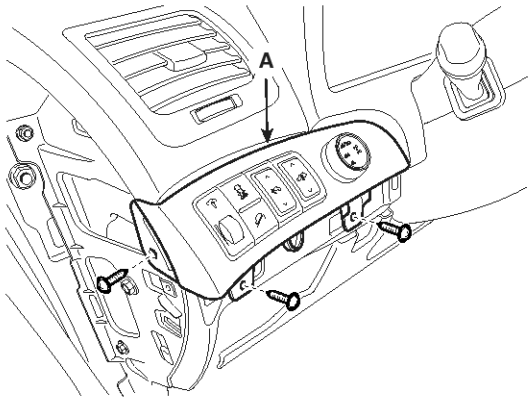
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A) after loosening the screws.



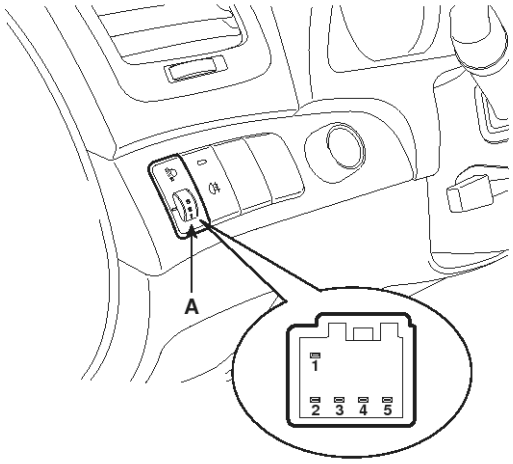
SHMBD8084D

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.

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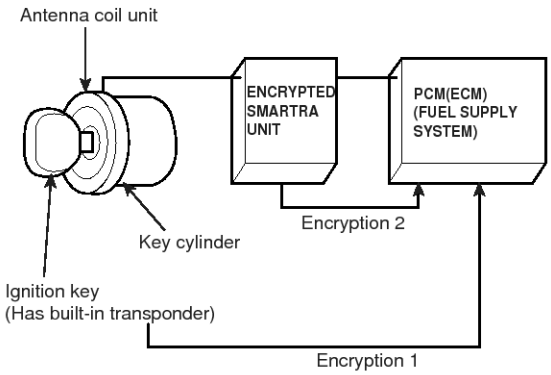
Immobilizer System

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.

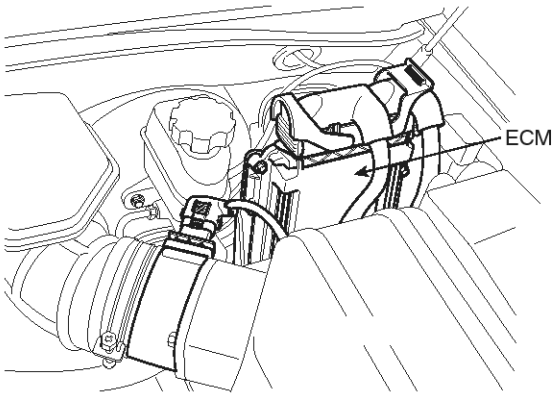


SFDBE8404L

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).



SHMBE9215N

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

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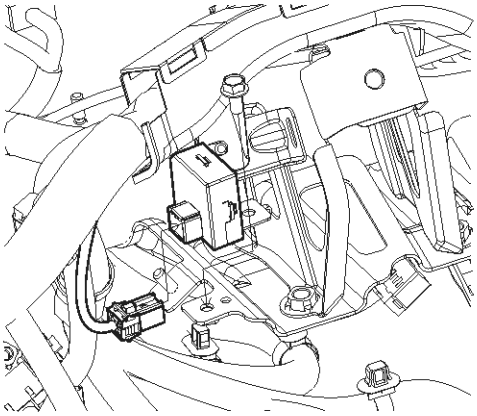
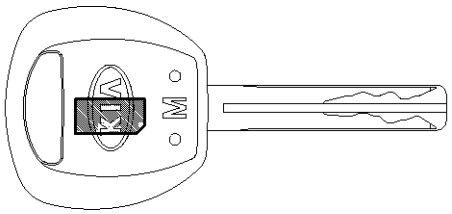
transmitted to the transponder by the antenna. The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice 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.



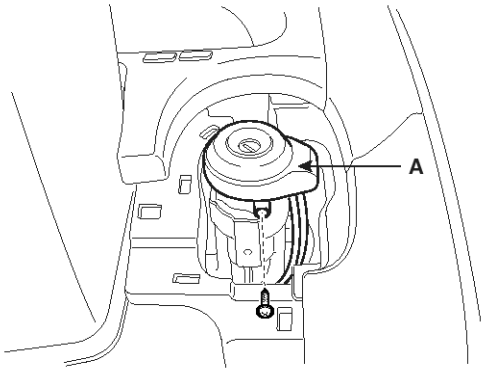
SHMBE9224N

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

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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.

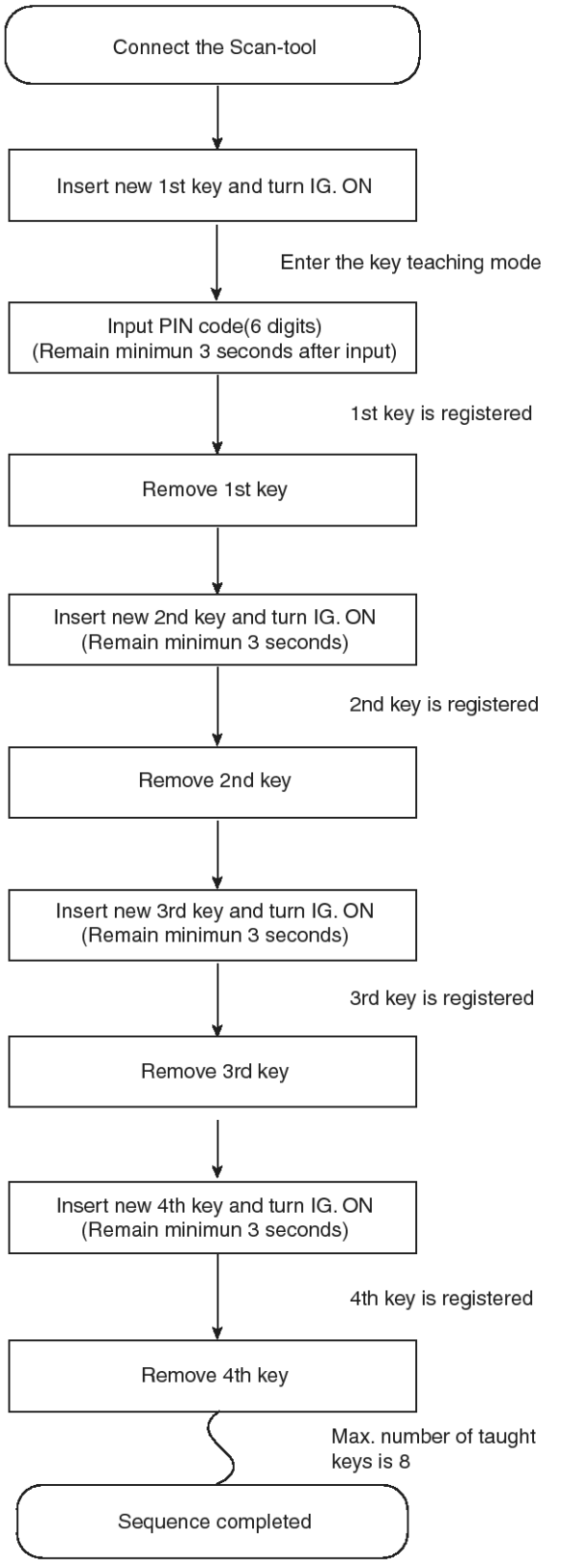
The maximum number of taught keys is 8

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

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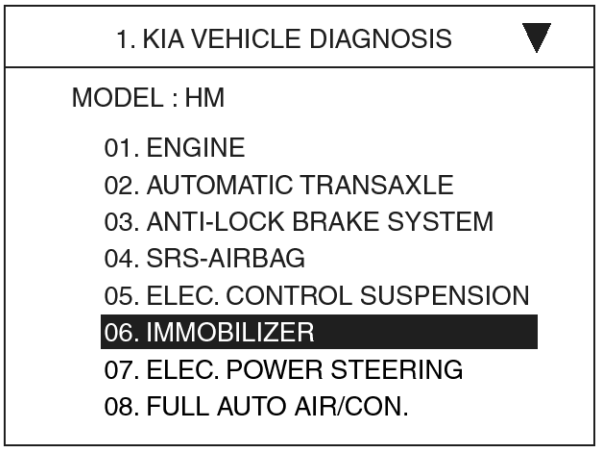
1) PCM(ECM) learnt status.



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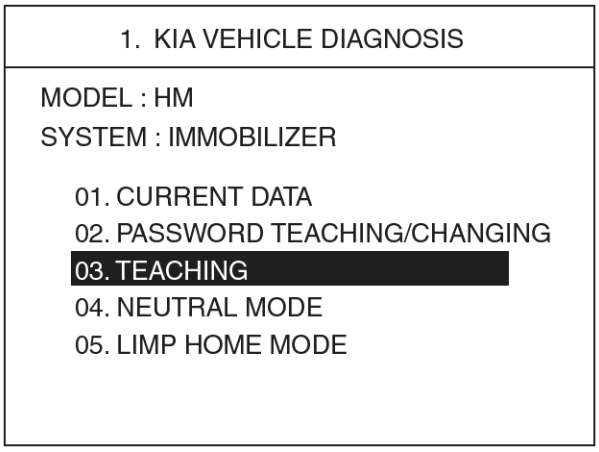

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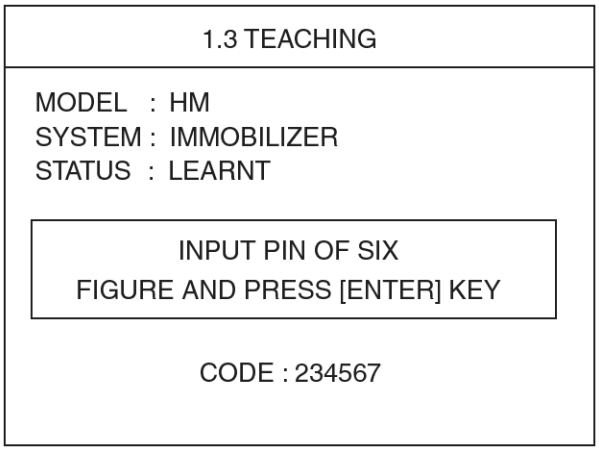

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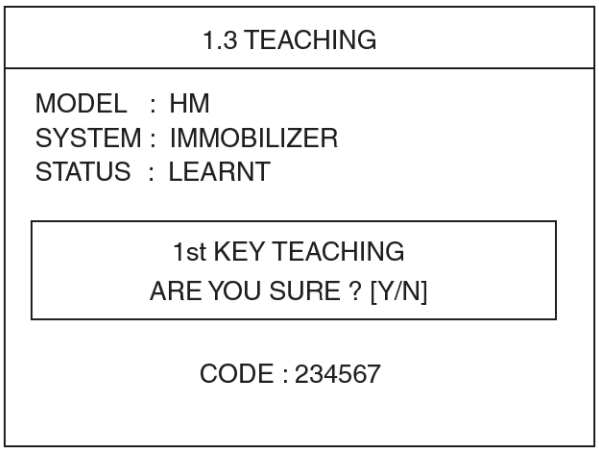

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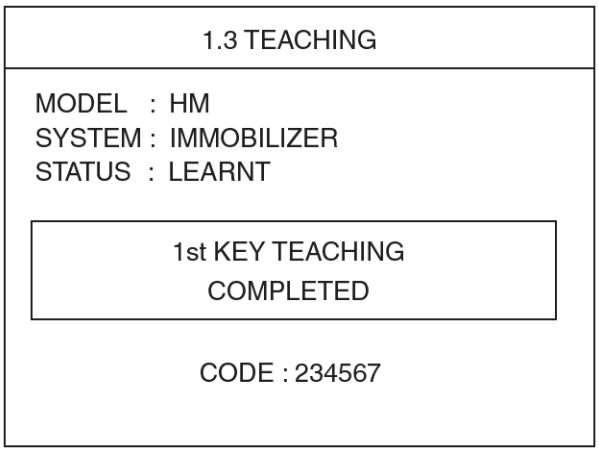

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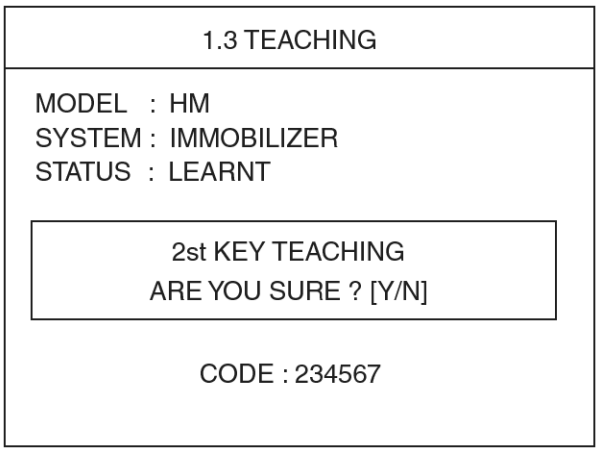

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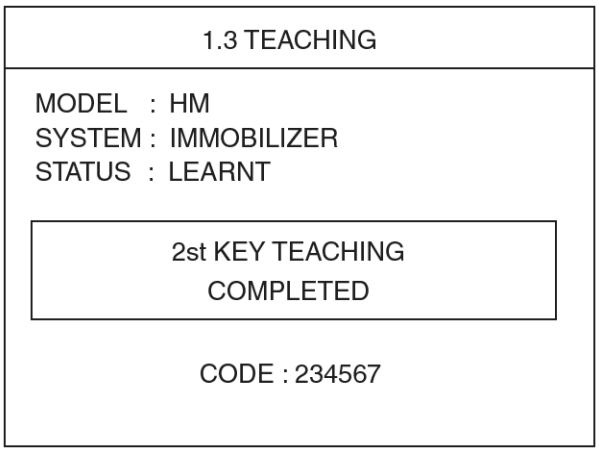
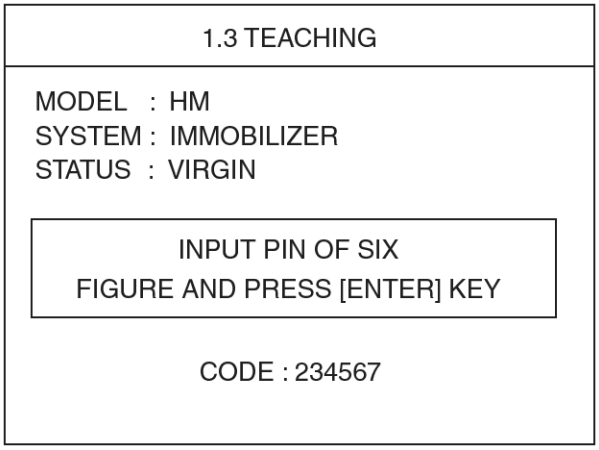


SHMBE9239N

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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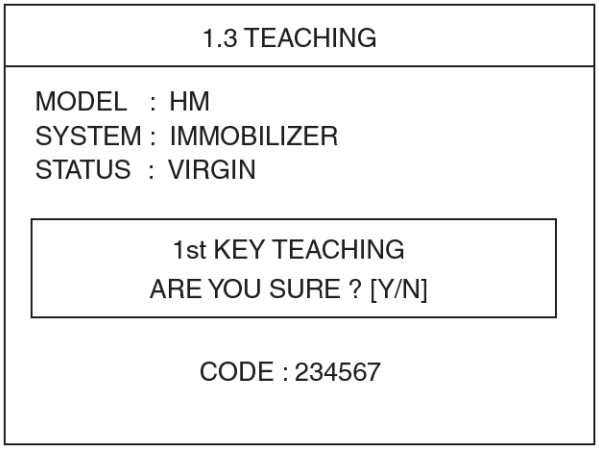

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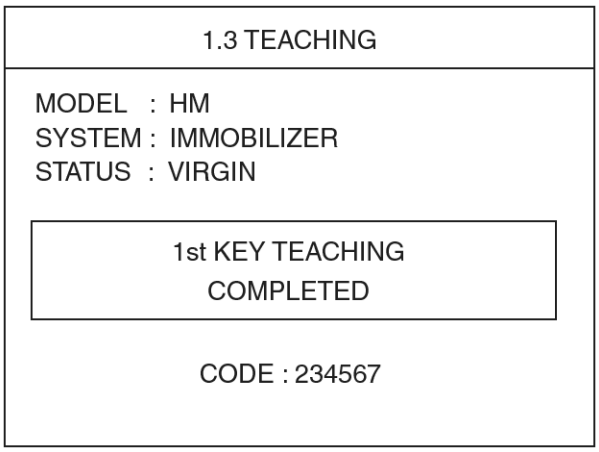

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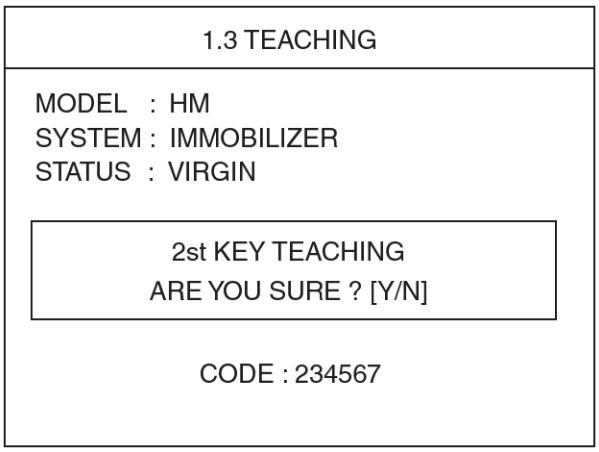

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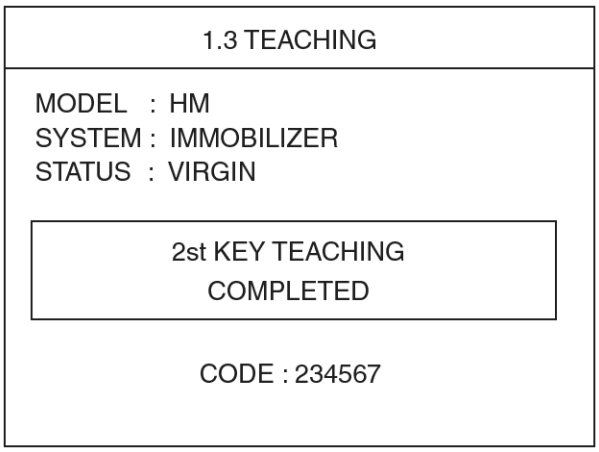

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2. User Password Teaching Procedure

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.

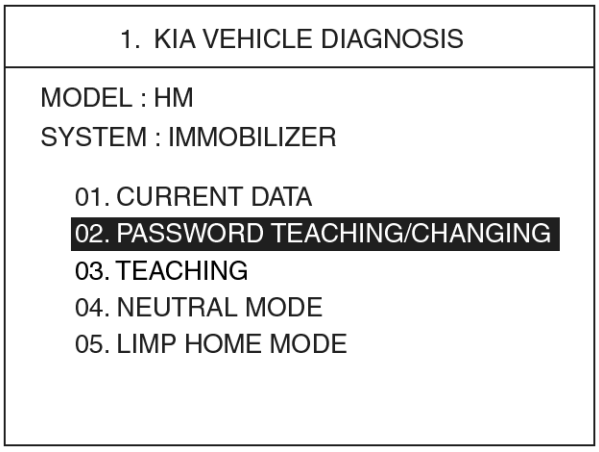
The teaching is started by ignition on, with a valid key (learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

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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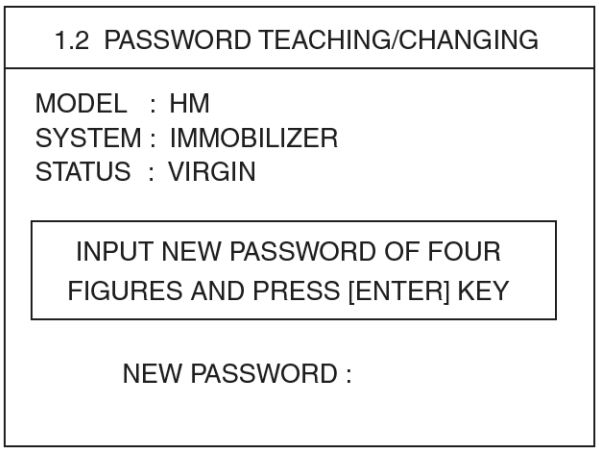

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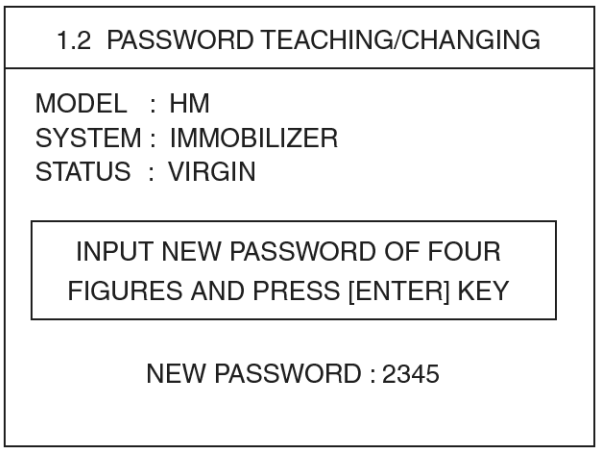

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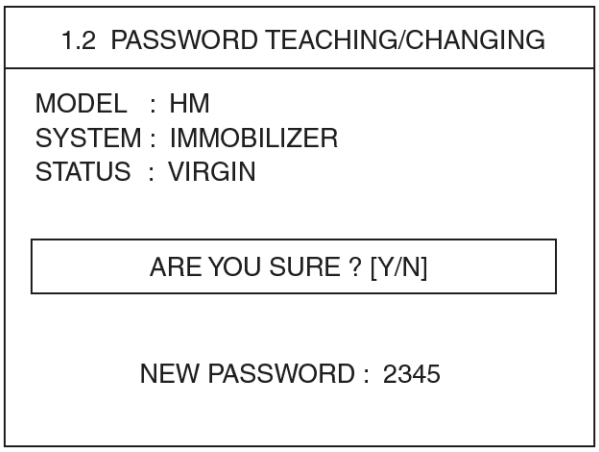

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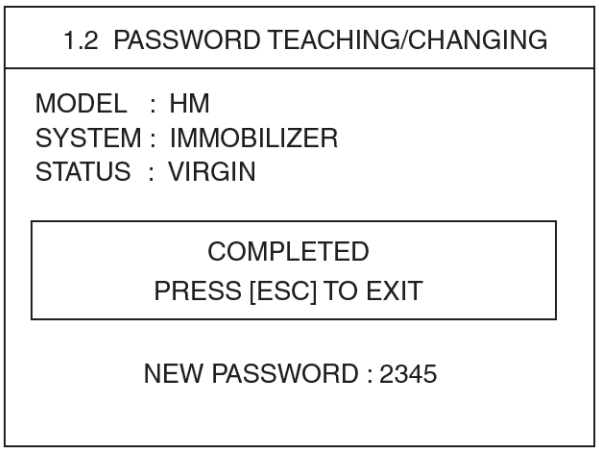

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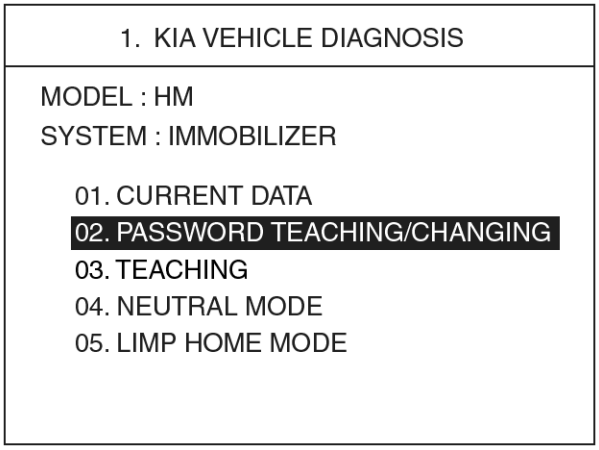
※ In case of putting wrong password, retry from first step after 10 seconds.

2) User password changing



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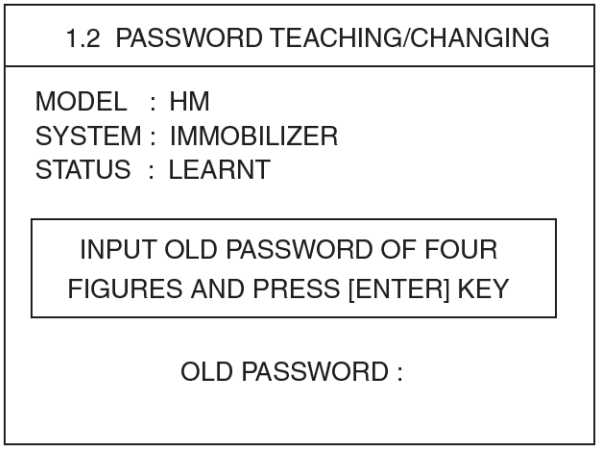

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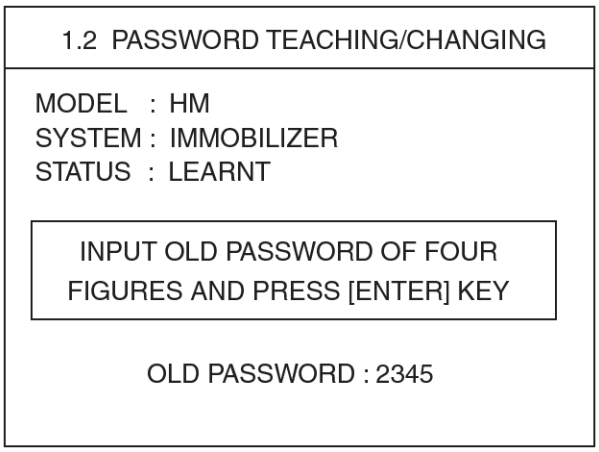

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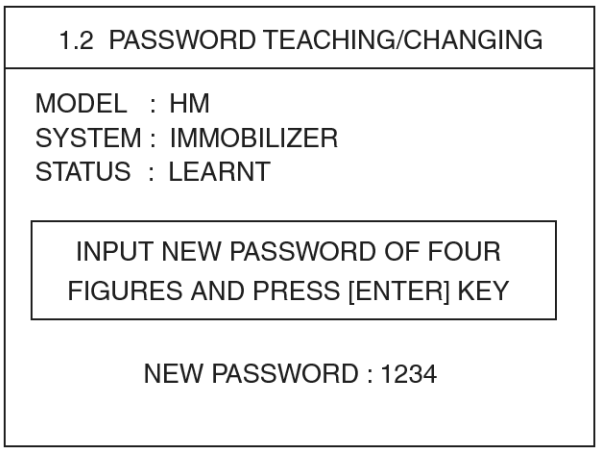

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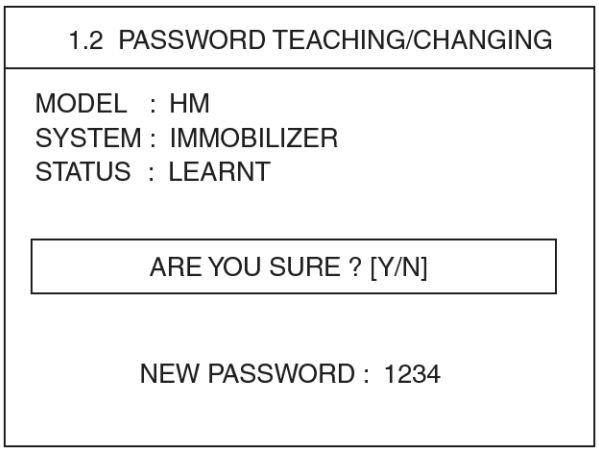

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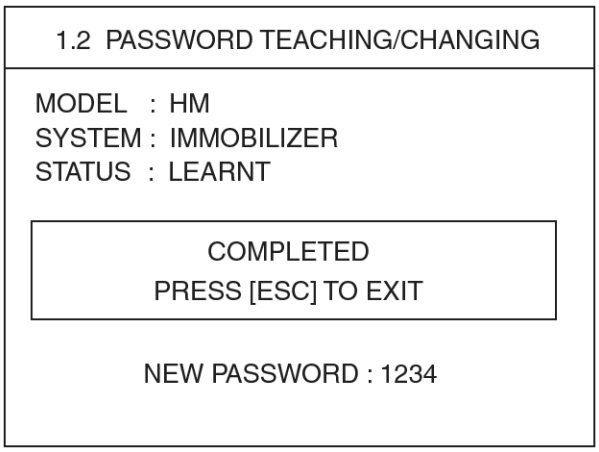

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Replacement

Problems And Replacement Parts:

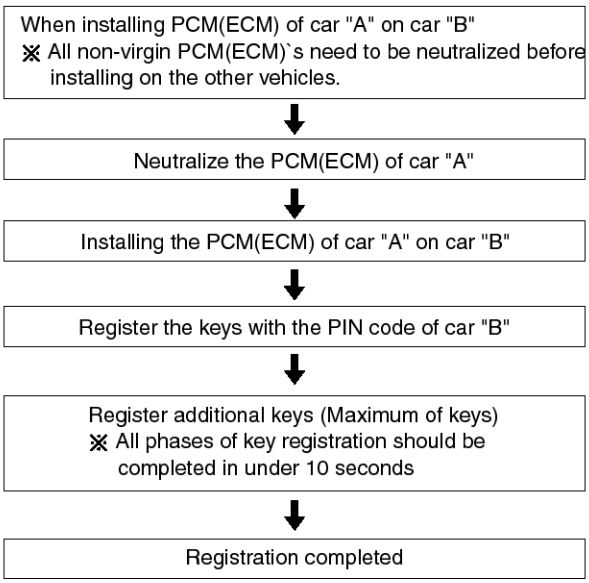
Problem	Part set	Scan tool required ?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	PCM(ECM)	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, PCM(ECM)	YES
SMARTRA 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))



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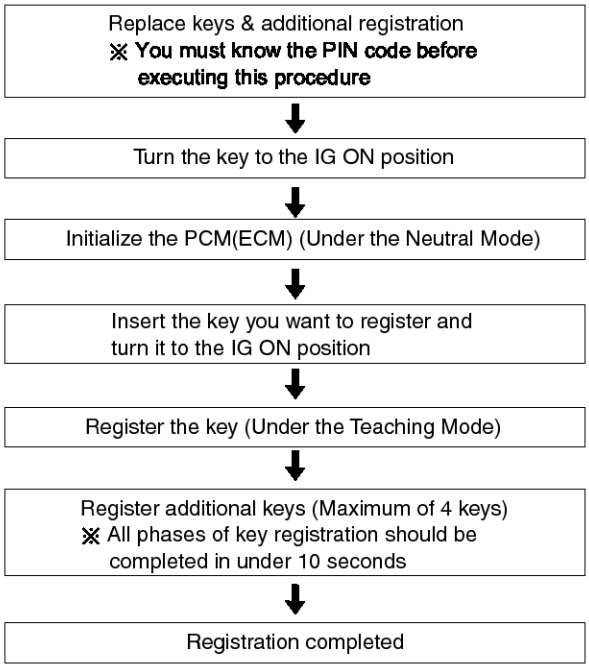
2. Things to remember before a replacement (Keys & Additional registration)



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NOTICE

1. *When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.*
2. *When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.*

   (Note that key #2 must be used within 10 seconds of removing key #1)
3. *When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.*

   The engine cannot be started even with the registered key #1.
4. *When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.*

   Always remember the 10 seconds zone.
5. *If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.*
6. *Be cautious not to overlap the transponder areas.*
7. *Problems can occur at key registration or vehicle starting if the transponders should overlap.*

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

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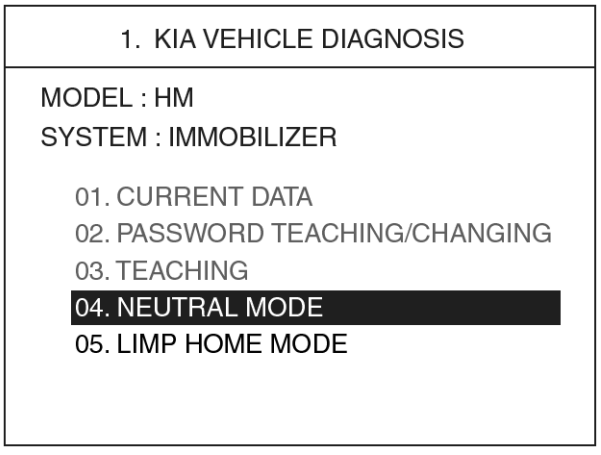

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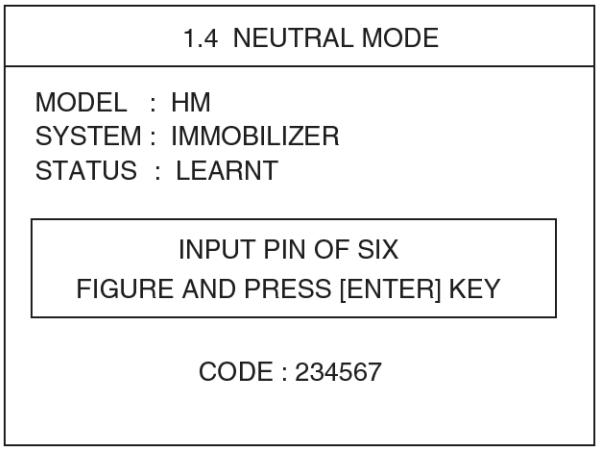

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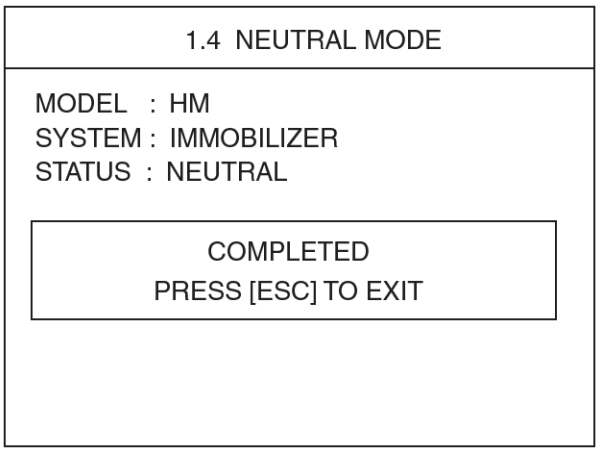

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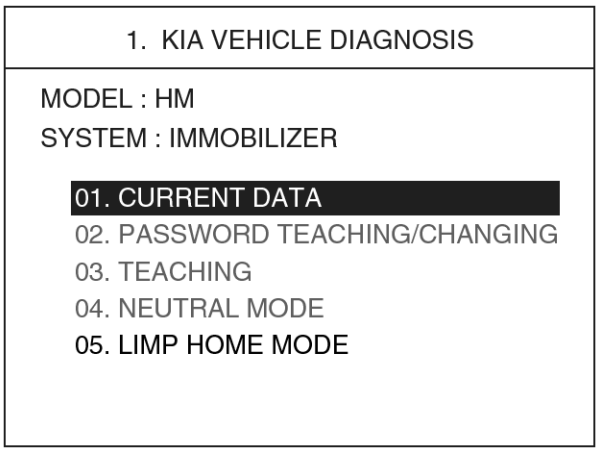

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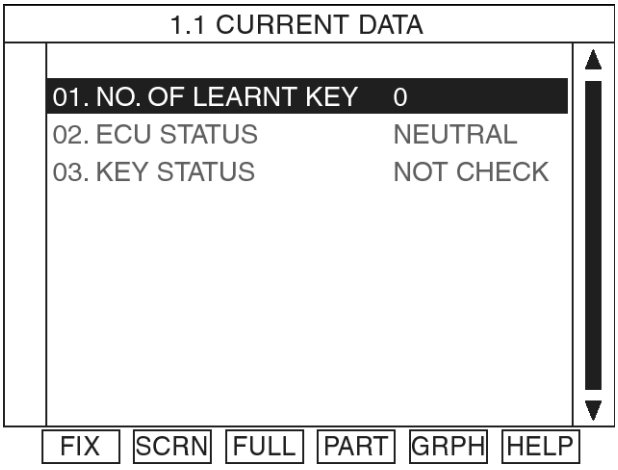

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Neutralising Of SMARTRA

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.

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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

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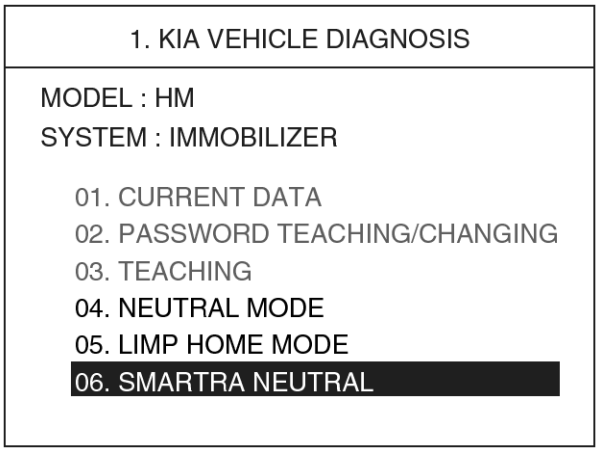

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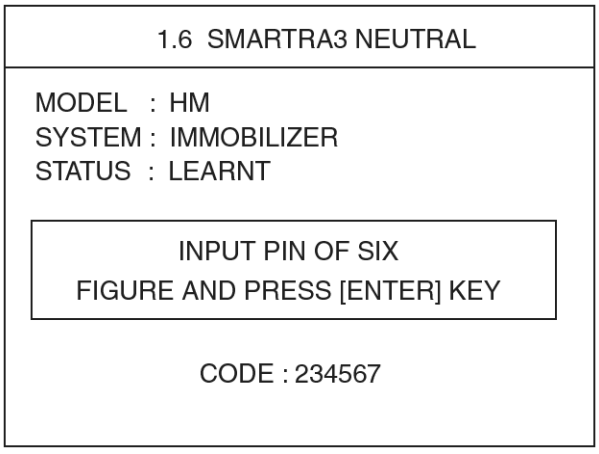

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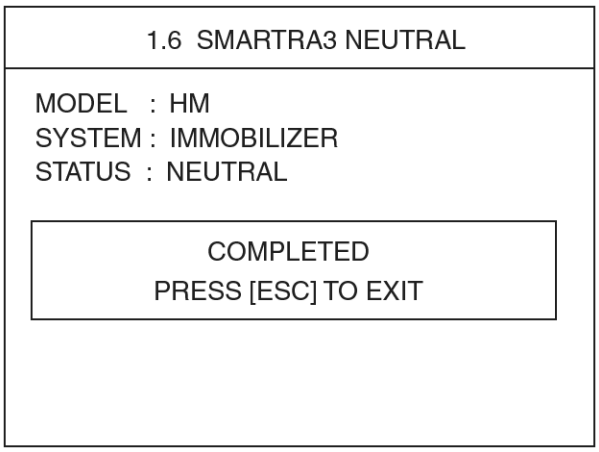

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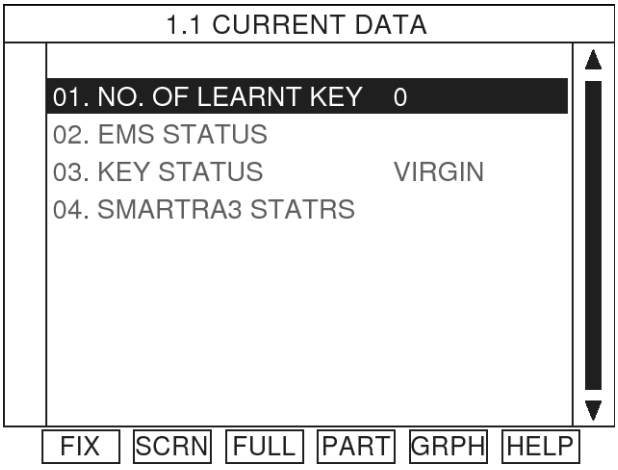

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Limp Home Function

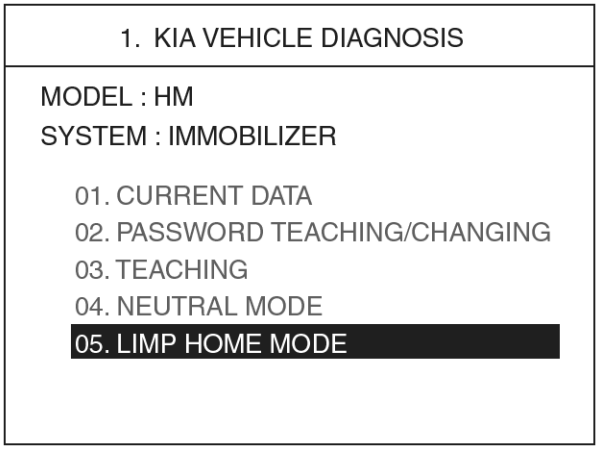
1. LIMP HOME BY TESTER

   If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home 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.



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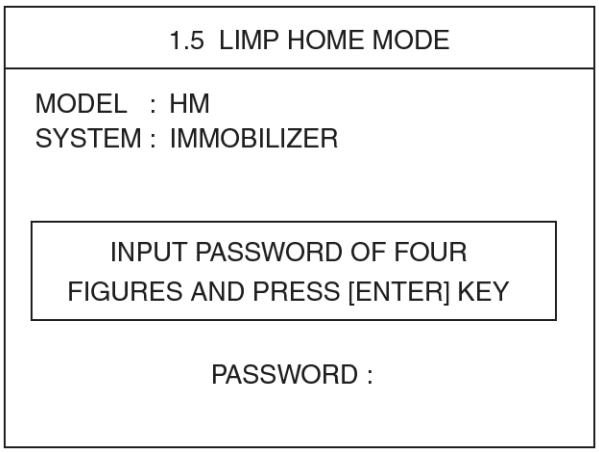

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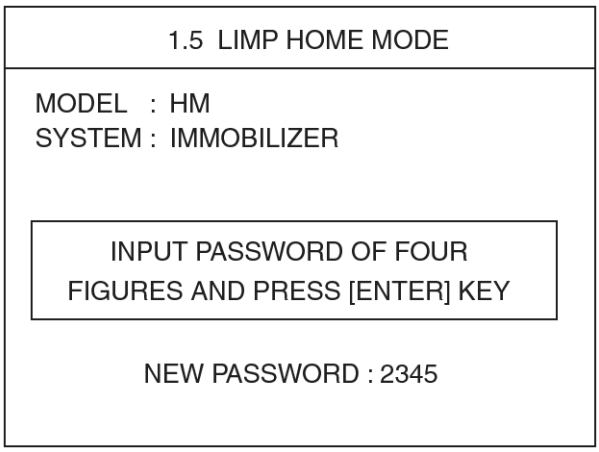

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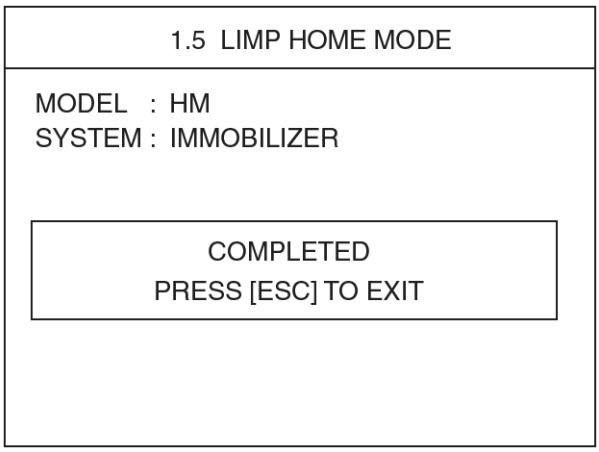

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2. Limp Home By Ignition Key

   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.

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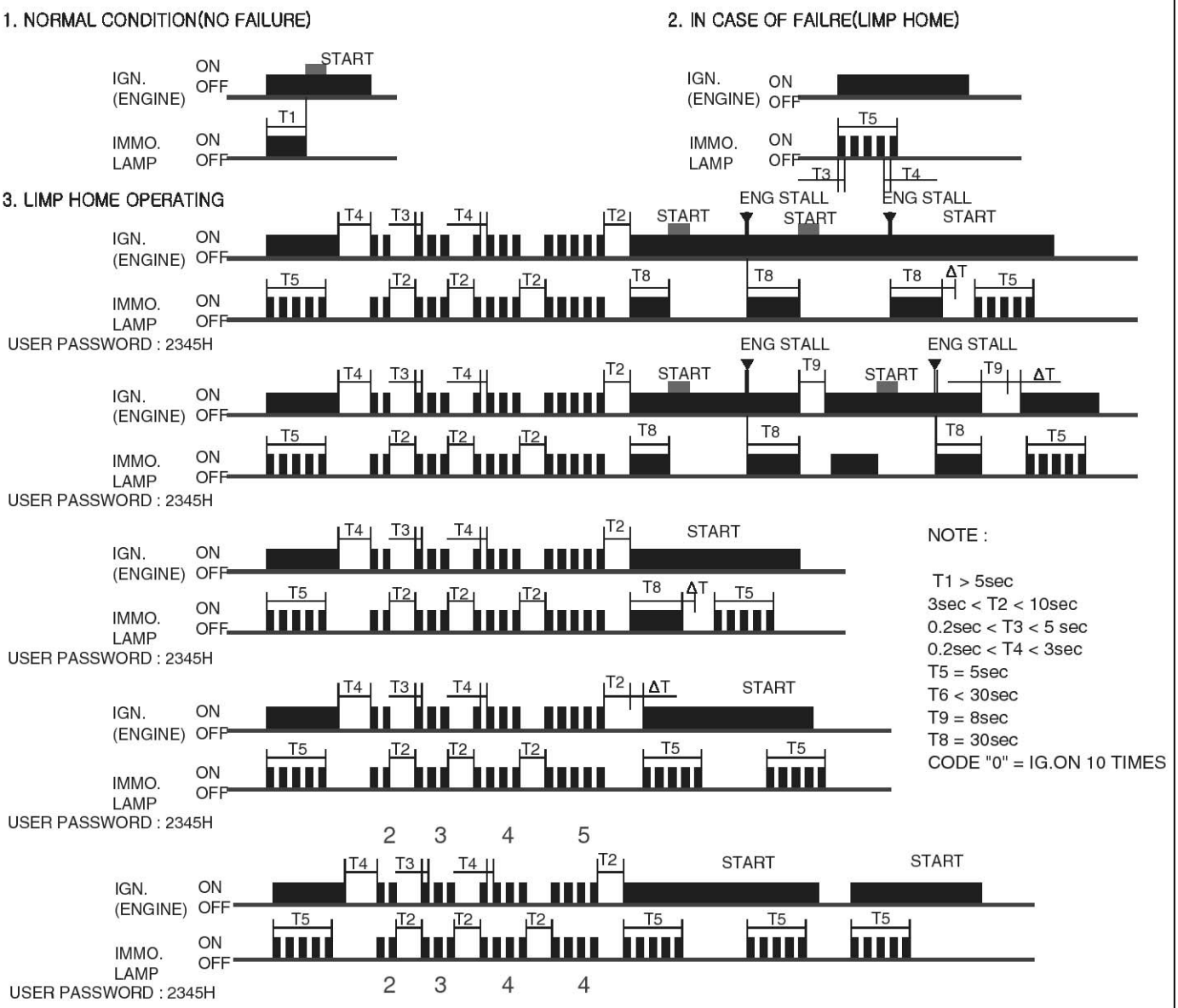

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Diagnosis Of Immobilizer Faults

- 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)

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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

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P1610 Non-Immobilizer-EMS Connected to an Immobilizer

General Description

The immobilizer system consists of a passive challenge-response (mutual authentication) transponder inside the key head, the encoded SMARTRA3 unit /key and the EMS can decode the secret code stored in the SMARTRA3.

The EMS carries out the immobilizer function, the SMATRA3 management and the key management. The immobilizer function is the unlocking of EMS only after detection of a valid ignition key /the SMATRA3 and the locking of EMS after switching off the engine. The EMS communicates the encoded messages to the SMARTRA3 via a dedicated communication line and confirms the key with the SMARTRA3.

The EMS related to immobilizer has the 3 kinds of software. At the first IGN on, the EMS concludes the software of each option (smart key, non-encoded SMARTRA3, encoded SMARTRA3) by communication. It is called “The autodection for EMS”The EMS keeps the previous option before being neutral when it is setted to each option.

DTC Description

The PCM/ECM sets DTC P1610 if Non Immobilizer EMS is installed on vehicle equipped with Immobilizer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Invalid PCM/ECM
Enable Conditions	• IG ON	
Threshold value	• Non Immobilizer PCM/ECM connected	
Detecting time	• Immediately	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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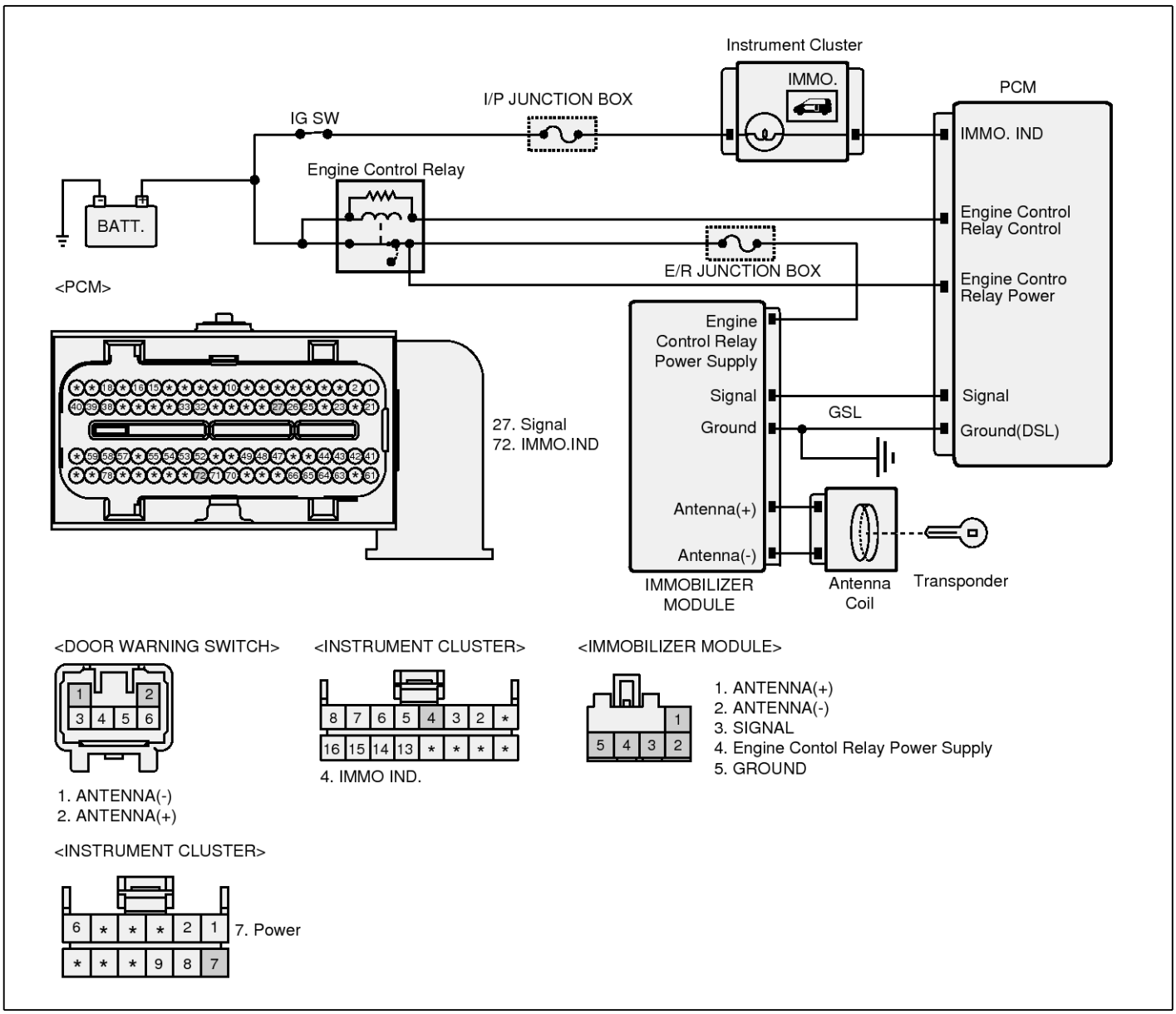

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Monitor Scantool Data

1. Check status
   1) IGN "ON" & Engine "OFF"
   2) Monitor the "ECM Status" Parameter on the Scantool.

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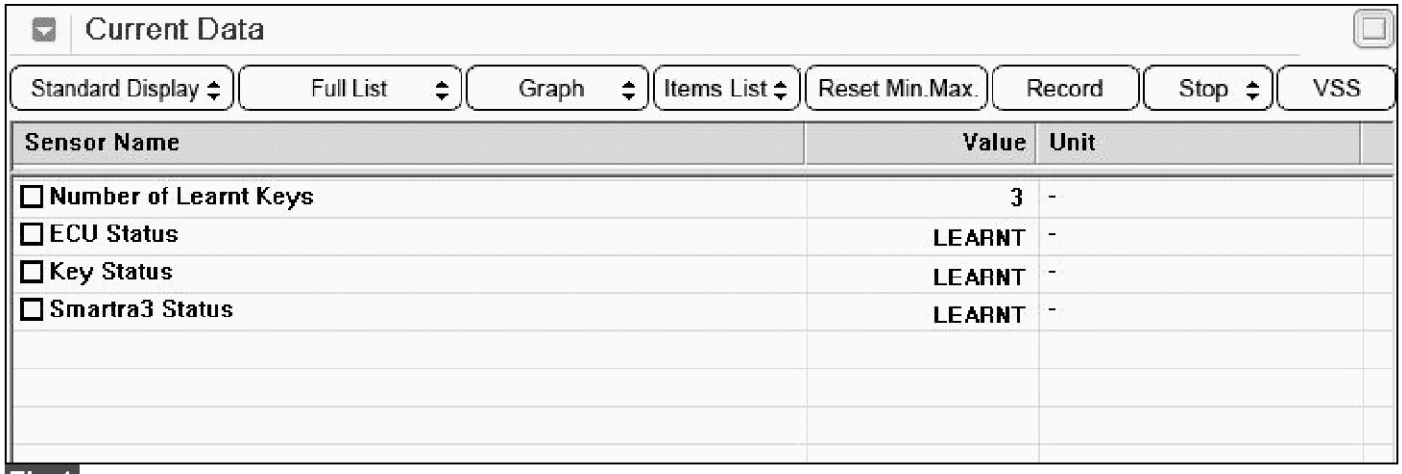

Fig.1

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Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt.

3) Has the ECM been learnt ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a ECM equipped with Immobilizer and perform the Key teaching procedure with scantool and check for proper operation.
If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NOTICE

If the EMS is only replaced using an existing key and SMARTRA3, after replacing the "virgin" or " neutral" EMS, reteaching is possible by key Learning mode of scanner.When the same PIN used in existing vehicle is only inputted, the SMARTRA3 Learning and key Learnings are possible.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1674 Immobilizer-Transponder status Error

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.

The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ECM stores the PIN and the key Learning can be started. The "learnt“ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case,The ECM can’t excute the key learning process.

DTC Description

The ECM sets DTC P1674 if transponder key that can't be register(Transponder not in the password mode or whose transport data has been changed) is inserted for registration procedure.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Invalid transponder. ※ Key not in 'VIRGIN' Status or with invalid ID code
Enable Conditions	• IG ON (On Registering TP Procedure)	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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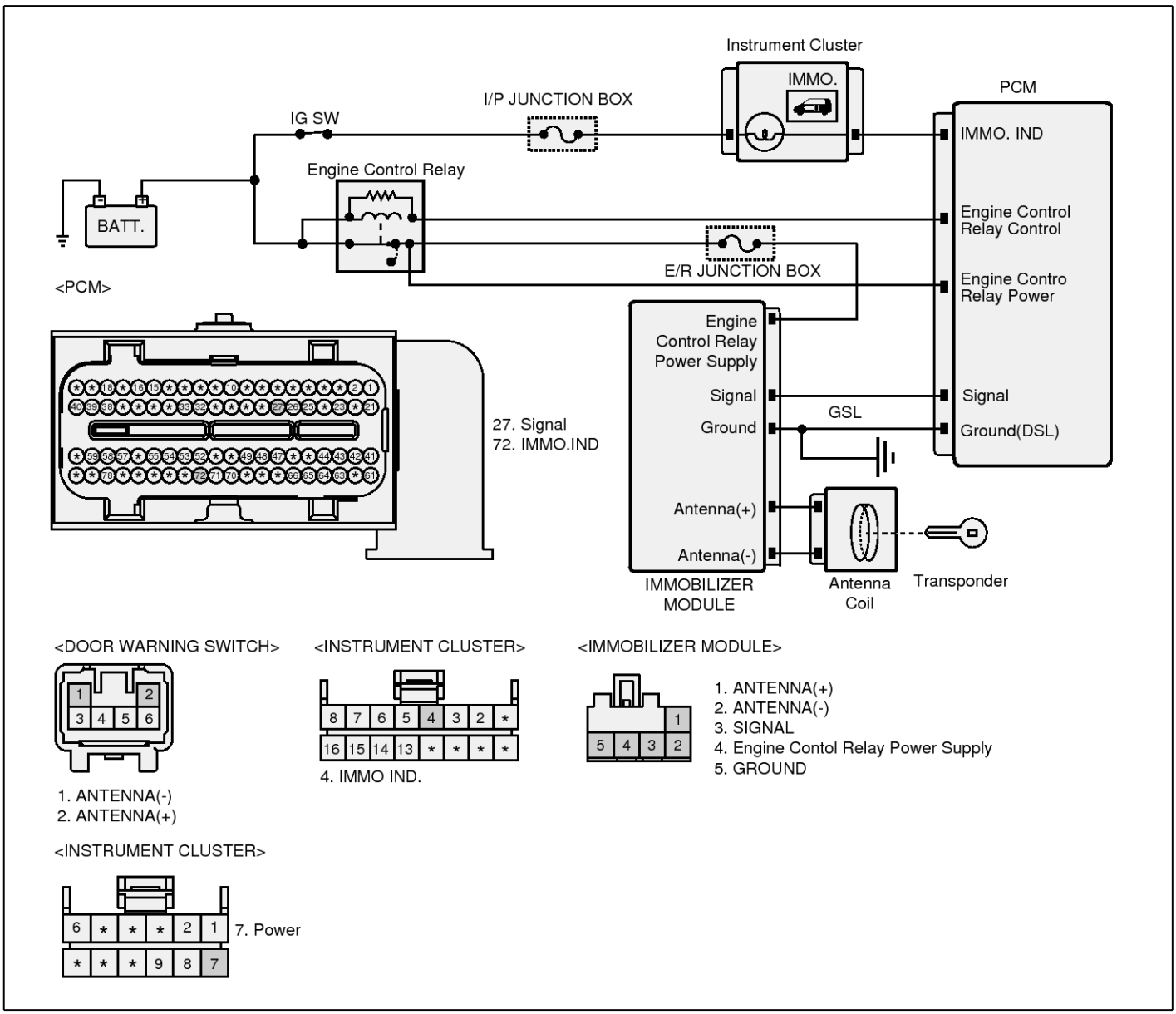

SHMBE9B05L

Monitor Scantool Data

1. Check status
   1) IGN "ON" & Engine "OFF"
   2) Monitor the "ECM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'

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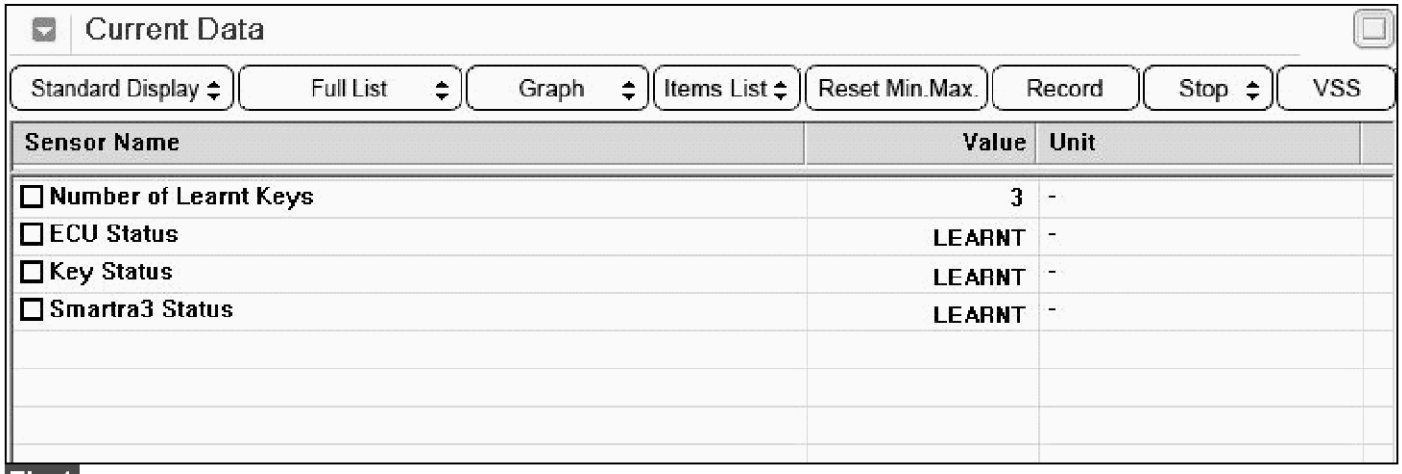

Fig.1

SHMBE9B04L

Fig.1) This data that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

3) Have both the ECM and KEY status been learnt ?

YES ▶ Substitute with known good "virgin" transponder and go to "Component Inspection" Procedure.

NO ▶ Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder
   1) IGN "ON" & Engine "OFF"
   2) Neutralize ECM and Register transponder key by scantool.

      NOTICE
      Pin code is requied to Neutralize ECM and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good transponder and perform key teaching procedure with scanner.
If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1675 Immobilizer-Transponder Programming Error

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.

The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ECM stores the PIN and the key Learning can be started. The "learnt“ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case,The ECM can’t excute the key learning process.

DTC Description

The ECM sets DTC P1675 if characteristic data of transponder doesn't coincide with that of ECM owing to transponder programming error

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Invalid transponder. ※ Invalid characteristic data ※ No transponder or more than two transponder is detected by coil antenna
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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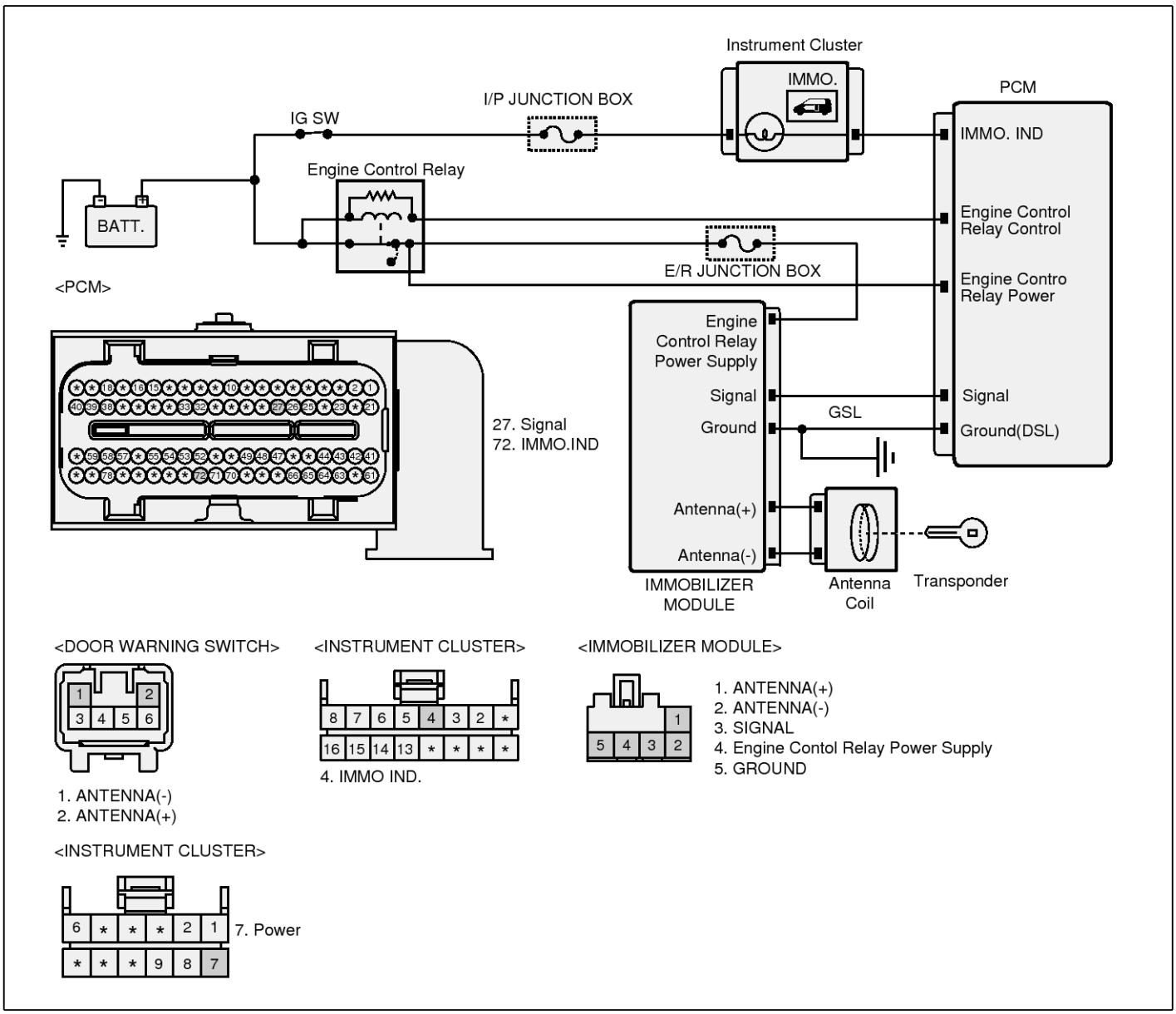

SHMBE9B05L

Monitor Scantool Data

1. Check status
   1) IGN "ON" & Engine "OFF"
   2) Monitor the "ECM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'

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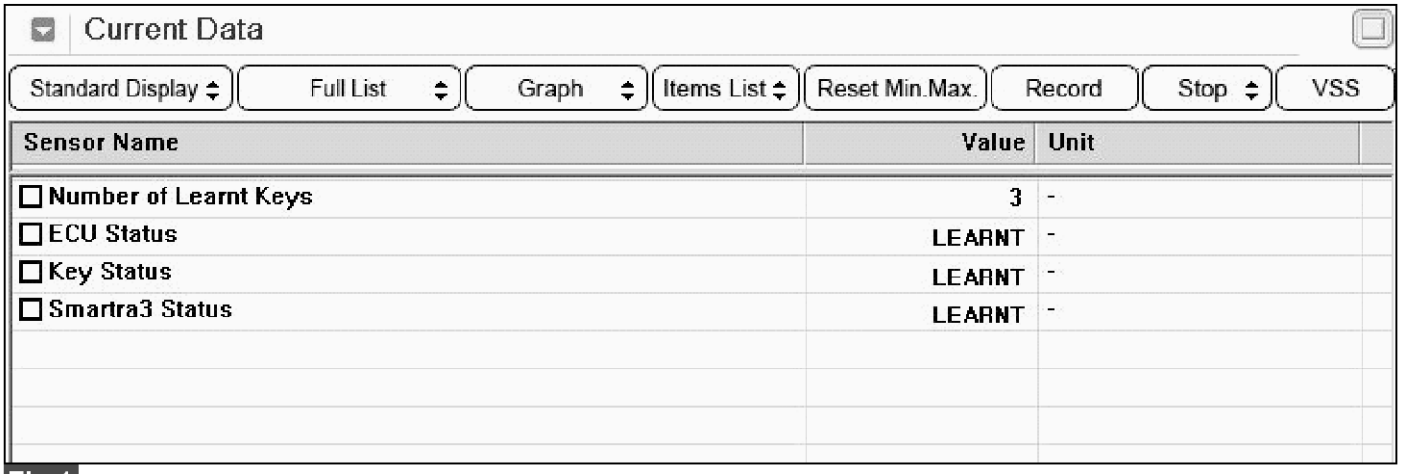

Fig.1

SHMBE9B04L

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt.

3) Has the KEY status learnt ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. And This DTC has not erased in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder and ECU status
   1) IGN "ON" & Engine "OFF" with key intended to register
   2) Monitor the ""ECM,KEY and Smartra STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

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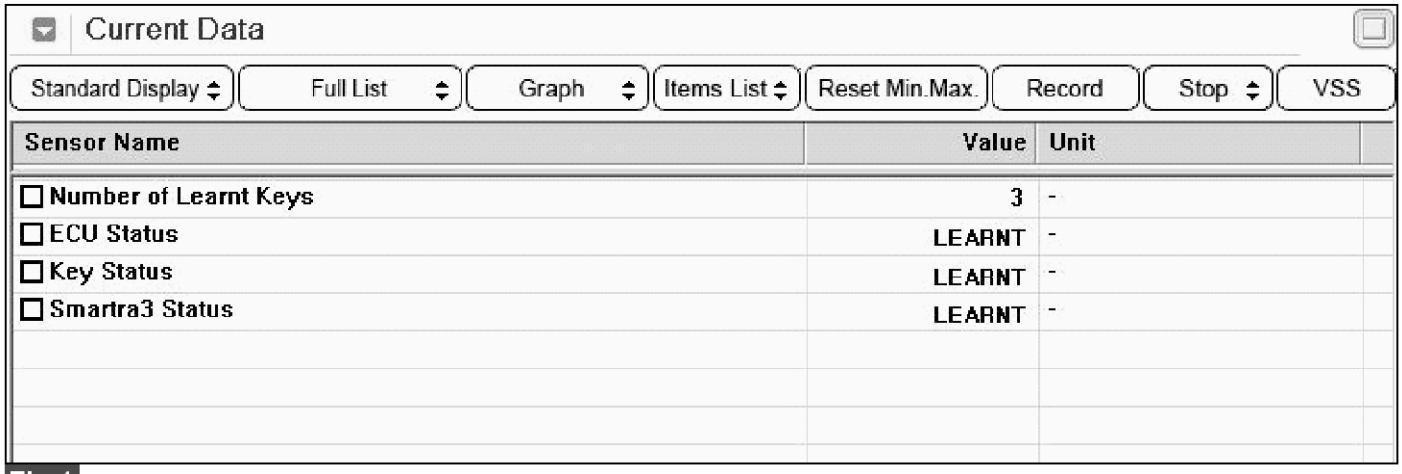

Fig.1

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Fig 1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt.

3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Check Transponder" procedure.

2. Check transponder
   1) IGN "ON" & Engine "OFF"
   2) Neutralize ECM and Register transponder key by scantool.

   NOTICE
   Pin code is requied to Neutralize ECM and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good transponder and perform key teaching procedure with scanner.
If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1676 Immobilizer-Smartra Message Error

General Description

1. The sequences of the PIN code storage are as follows.
   1) Input the PIN code into the scanner when key teaching process.

      he scanner transmits the Encrypted Code to the ECM after converting the PIN code into Encrypted Code.
   2) When the ECM gets the firtst key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3
   3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.

      (If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the ECM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to ECM)
   4) If the SMARTRA3 is learnted normally or the Encrypted Code of the registered SMARTRA3 is the same as the ECM, the ECM begins operation the Transponder Learning.
   5) If the learning of the first transponder, the ECM stores the Encrypted Code in its EEPROM and converts state into learnt state.
2. The SMARTRA3 learning :
   1) starts with EMS request of PIN from scanner through the key teaching procedure.
   2) is possible in case that the status of SMARTAR is “virgin” or “neutral “.
   3) In case that the SMARTRA3 is “learnt”, the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.
   4) is possible regardless of key status.
3. The sequence of the SMARTRA3 confirms are as follows.
   1) After communication with the SMARTRA3, the ECM transmits the random number with requirement of the TP ID information.
   2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the ECM with TP ID information.
   3) The ECM compares the result transmitted from the SMARTRA3 with the result calculated by ECM.

      And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

DTC Description

The ECM sets DTC P1676 if there's any fault in message from SMARTRA to ECU

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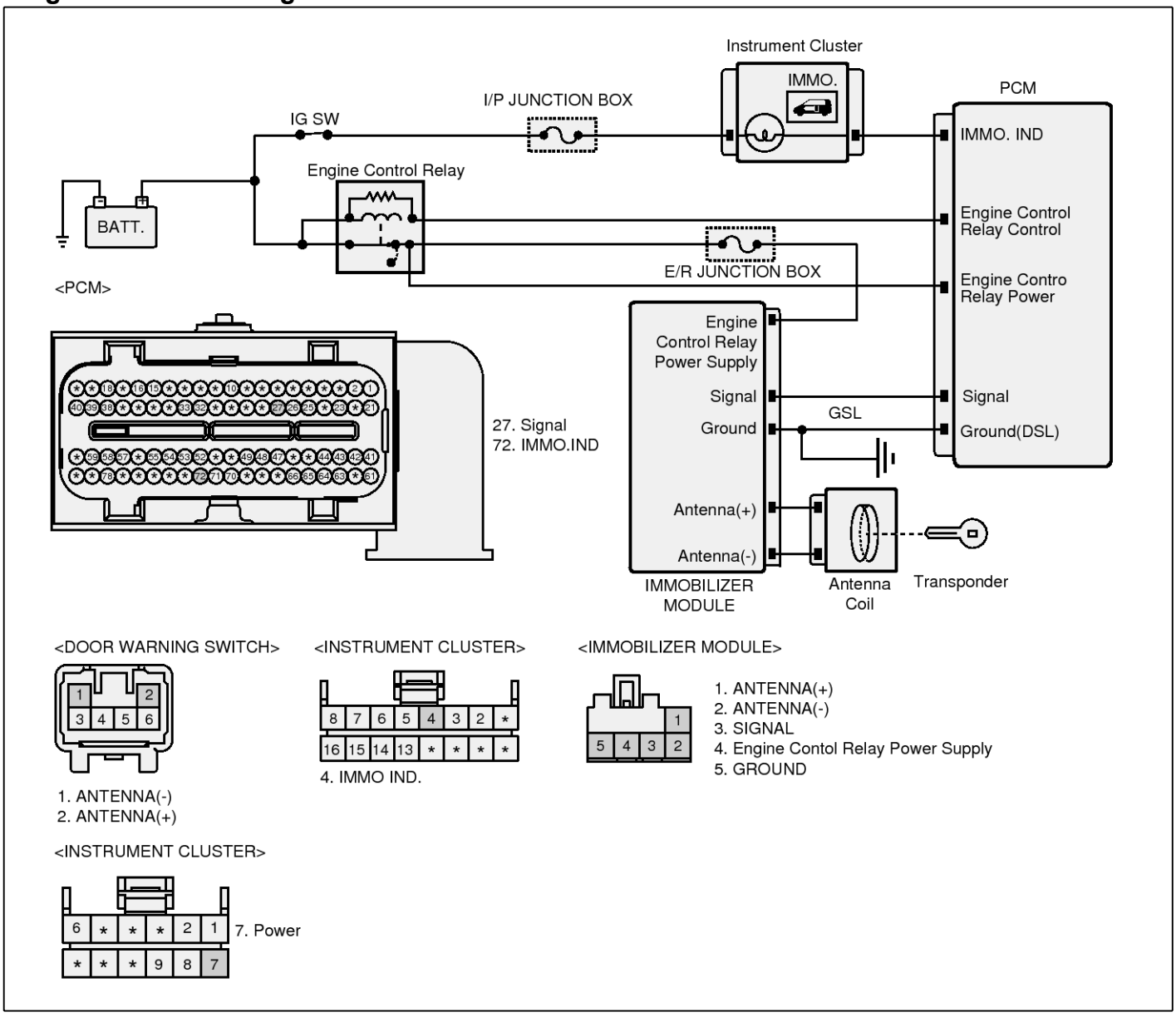
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Faulty SMARTRA
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram



SHMBE9B05L

Monitor Scantool Data

1. Check transponder and ECU status
   1) IGN "ON" & Engine "OFF" with key intended to register
   2) Monitor the "ECU, KEY, Smartra STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

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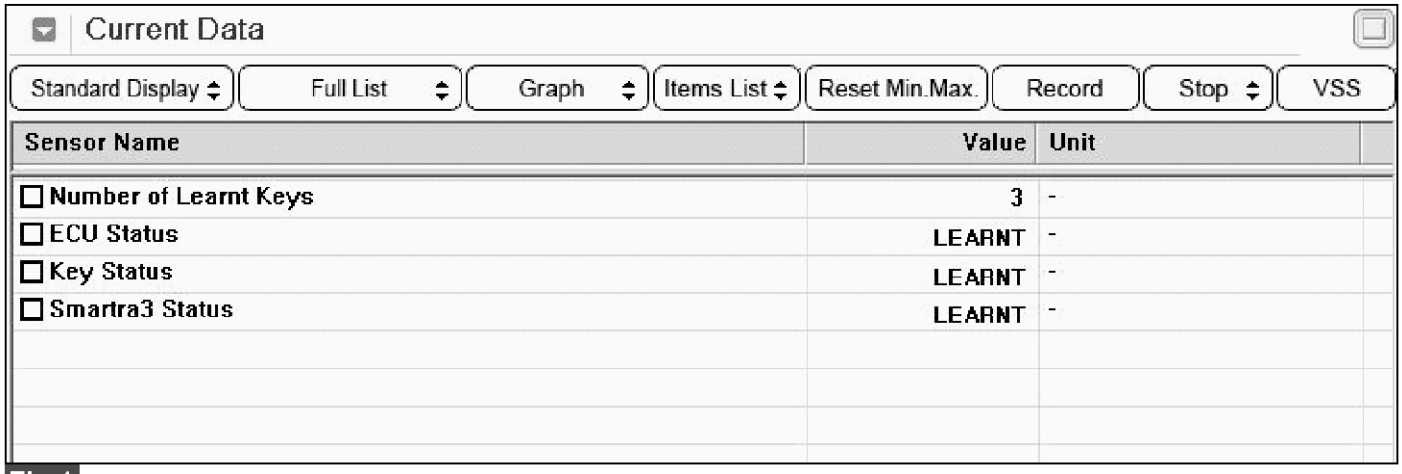

Fig.1

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Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt

3) Has the "Smartra STATUS" been learnt ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. And this DTC has not erased in previous repair . Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Check SMARTRA" procedure.

Component Inspection

1. Check SMARTRA
   1) IGN "ON" & Engine "OFF"
   2) Neutralize SMARTRA with scantool.
   3) Neutralize ECM and Register transponder key by scantool.

      NOTICE

      Pin code is required to Neutralize SMARTRA & ECM and to Register transponder key

   4) Are Neutralizing and Registering Key completed normally ?

YES ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. Or, it has not erased this DTC in previous repair. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good SMARTRA and perform the Key teaching.
If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

NOTICE

If the SMARTRA3 is only replaced using an existing key and ECM, after replacing the "virgin" or "neutral" SMARTRA3, reteaching is possible by key Learning mode of GDS. In this case, all existing key must be retaught.

If SMATRA3 is replaced to another one (used at other vehicle), it can only recycle its neutralized first before replacing.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P169A Immobilizer-SMARTRA Authentication Fail

General Description

1. The sequences of the PIN code storage are as follows.
   1) Input the PIN code into the scanner when key teaching process.

      The scanner transmits the Encrypted Code to the ECM after converting the PIN code into Encrypted Code.
   2) When the ECM gets the firtst key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3
   3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.

      (If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the ECM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to ECM)
   4) If the SMARTRA3 is learnted normally or the Encrypted Code of the registered SMARTRA3 is same as the ECM, the ECM begins operation the Transponder Learning.
   5) If the learning of the first transponder, the ECM stores the Encrypted Code in its EEPROM and converts state into learnt state.
2. The SMARTRA3 learning :
   1) Starts with EMS request of PIN from scanner through the key teaching procedure.
   2) Is possible in case that the status of SMARTAR is “virgin” or “neutral “.
   3) In case that the SMARTRA3 is “learnt”, the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.
   4) Is possible regardless of key status.
3. The sequence of the SMARTRA3 confirms are as follows.
   1) After communication with the SMARTRA3, the ECM transmits the random number with requirement of the TP ID information.
   2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the ECM with TP ID information.
   3) The ECM compares the result transmitted from the SMARTRA3 with the result calculated by ECM.

      And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

DTC Description

The PCM/ECM sets DTC P169A if authentication between PCM/ECM and SMARTRA has failed.

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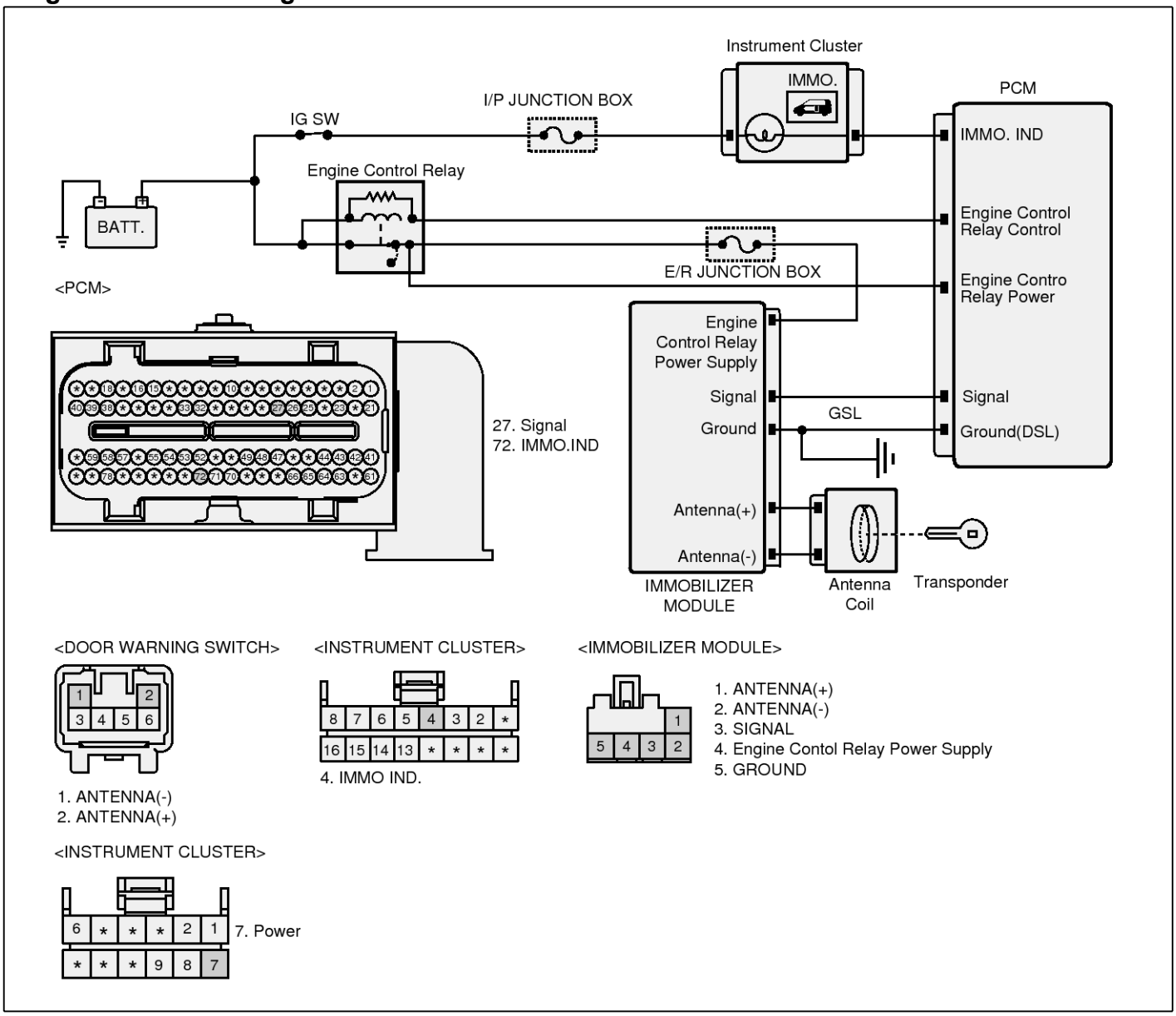
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Locking of SMARTRA
Enable Conditions	• IG ON	
Threshold value	• Virgin SMARTRA at Learnt EMS • Neutral SMARTRA at Learnt EMS • Incorect the Authetication of EMS and SMARTRA • Locking of SMARTRA	
Detecting time	• -	

Diagnostic Circuit Diagram



SHMBE9B05L

Monitor Scantool data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

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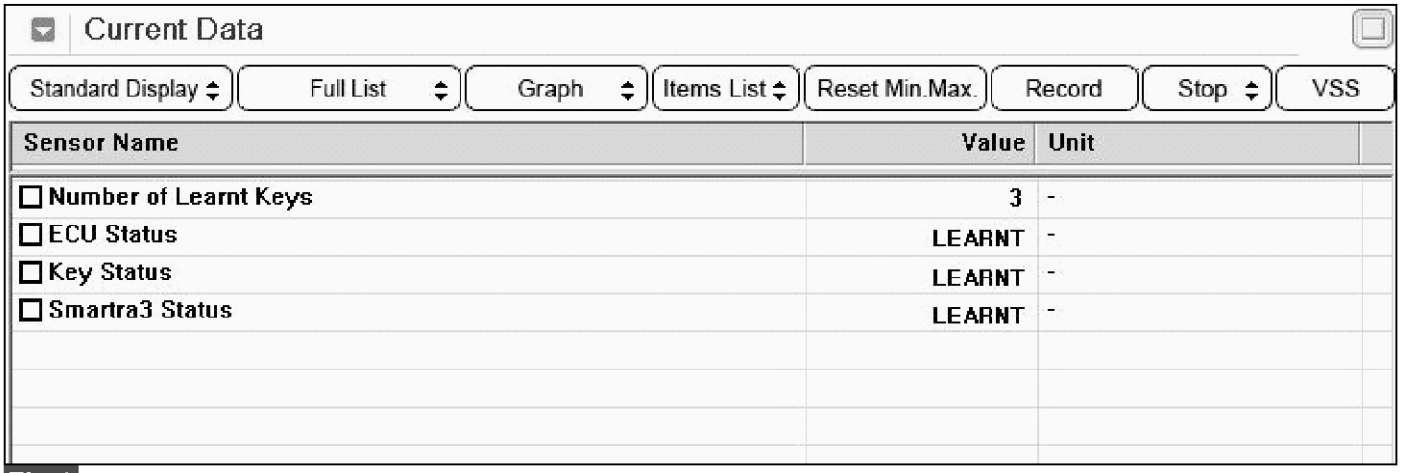

Fig.1

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Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt.

4. Has the "SMARTRA STATUS' been learnt ?

YES ▶ Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" status. Then register transponder and go to "Verification of Vehicle Repair" procedure.

NO ▶Go to 'Component Inspection" procedure.

Component Inspection

1. Check SMARTRA
   1) IG "ON" & Engine "OFF"
   2) Neutralize Both "SMARTRA" and "ECM" and Register transponder key by scantool.

      NOTICE
      Pin code is required to Neutralize SMARTRA and to Register transponder key
   3) Are Neutralizing and Registering completed normally ?

YES ▶Perform all the key teaching procedure with scantool. (All the keys must be retaught) and then, go to "Verification of Vehicle Repair" Procedure.

NO ▶Substitute with a known-good SMARTRA and Perform Key teaching procedure.
▶If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1690 Immobilizer-Smartra No Response

General Description

1. The sequences of the PIN code storage are as follows.
   1) Input the PIN code into the scanner when key teaching process.

      he scanner transmits the Encrypted Code to the ECM after converting the PIN code into Encrypted Code.
   2) When the ECM gets the firtst key learning command, it transmits the SMARTRA3 learnt command and Encrypted Code to the SMARTRA3
   3) If the SMARTRA3 statue is virgin/neutral, the SMARTRA3 stores Encrypted Code in EEPROM and transmits the success message of the Encrypted Code storage.

      (If the SMARTRA3 is learnt, the SMARTRA3 compares Encrypted Code transmitted by the ECM with Encrypted Code stored in EEPROM and transmits the (in)correct Encrypted Code message to ECM)
   4) If the SMARTRA3 is learnted normally or the Encrypted Code of the registered SMARTRA3 is the same as the ECM, the ECM begins operation the Transponder Learning.
   5) If the learning of the first transponder, the ECM stores the Encrypted Code in its EEPROM and converts state into learnt state.
2. The SMARTRA3 learning :
   1) starts with EMS request of PIN from scanner through the key teaching procedure.
   2) is possible in case that the status of SMARTAR is “virgin” or “neutral “.
   3) In case that the SMARTRA3 is “learnt”, the SMARTRA3 will transmits the information if PIN inputted from scanner is same as the PIN in SMARTRA3.
   4) is possible regardless of key status.
3. The sequence of the SMARTRA3 confirms are as follows.
   1) After communication with the SMARTRA3, the ECM transmits the random number with requirement of the TP ID information.
   2) The SMARTRA3 encryptes the random number and transmits the result(Encrypted Random Number) to the ECM with TP ID information.
   3) The ECM compares the result transmitted from the SMARTRA3 with the result calculated by ECM.

      And If result are coincided with each other; the ECS concludes the valid confirmation of the SMARTRA3.

DTC Description

The ECM sets DTC P1690 if there's No Response from SMARTRA.

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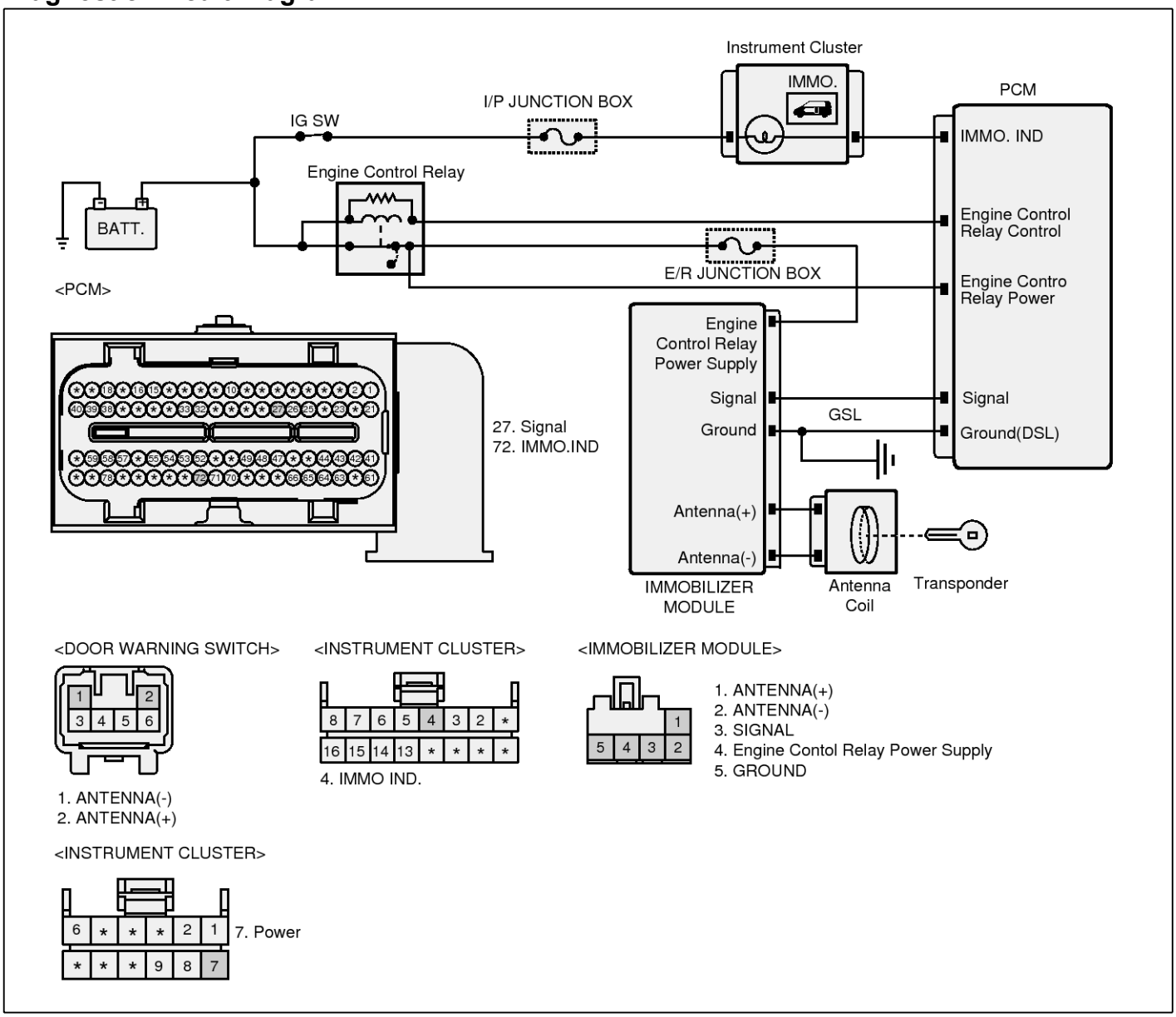
DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Open Circuit in signal harness • Short Circuit in signal harness • Faulty SMARTRA
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram



SHMBE9B05L

Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Monitor the "ECU, KEY and Smartra STATUS" Parameter on the Scantool.

Specification : 'LEARNT'

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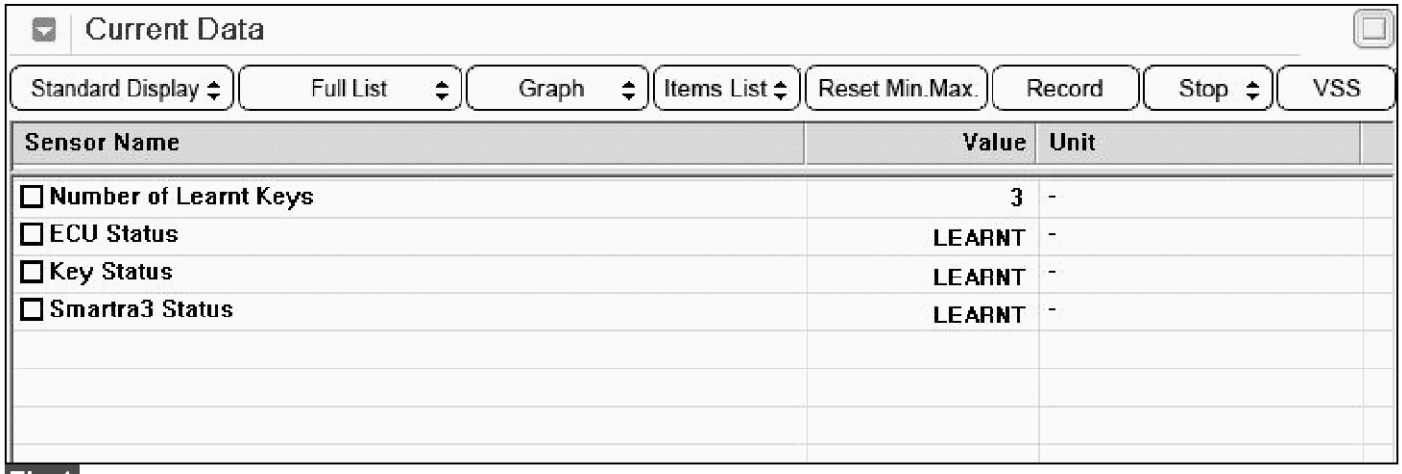

Fig.1

SHMBE9B04L

Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt.

4. Has the "Smartra STATUS' been learnt ?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. And this DTC has not erased in previous repair . Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Go to "Inspection & Repair" procedure

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶Repair as necessary and go to "Verification Vehicle Repair" procedure.

NO ▶Go to "W/Harness Inspection" procedure.

Power circuit Inspection

1. Check for open in harness
   1) Ignition "OFF"
   2) Disconnect SMARTRA Connector.
   3) Ignition "ON" & Engine "OFF"
   4) Measure voltage between Engine Control Relay Power of SMARTRA harness connector and chassis ground.

Specification : 9~16V

   5) Is the measured voltage within specifications?

YES ▶Go to "Signal circuit Inspection" procedure.

NO ▶Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Signal circuit Inspection

1. Check for open in harness
   1) Ignition "OFF"
   2) Disconnect SMARTRA connector.
   3) Measure resistance between signal terminal of smartra harness connector and ECM/PCM harenss connector.

Specification : 1 Ω or less

   4) Is the measured resistance within specifications?

YES ▶Go to "Check for short in harness" procedure .

NO ▶Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for short in harness
   1) Ignition "OFF"
   2) Disconnect SMARTRA connector.
   3) Ignition "ON" & Engine "OFF"
   4) Measure voltage between signal terminal of SMARTRA harness connector and chassis

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ground.

Specification : Approx. 5.48V

5) Is the measured voltage within specifications?

YES ▶Go to "Signal circuit Inspection" procedure

NO ▶Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Ground circuit Inspection

1. Check for open in ground harness
   1) Ignition "OFF"
   2) Disconnect SMARTRA connector.
   3) Measure resistance between ground terminal of SMARTRA harness and chassis ground.

Specification : 1 Ω or less

4) Is the measured resistance within specifications?

YES ▶Go to 'Component Inspection" procedure.

NO ▶Check for open in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Component Inspection

1. Check SMARTRA
   1) IG"ON" & Engine "OFF"
   2) Neutralize Both "SMARTRA" and "ECM" and Register transponder key by scantool.

      NOTICE
      Pin code is required to Neutralize SMARTRA and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶Perform all the key teaching procedure with scantool. (All the keys must be retaught) and then, go to "Verification of Vehicle Repair" Procedure.

NO ▶Substitute with a known-good SMARTRA and Perform Key teaching procedure.
▶If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1691 Immobilizer-Antenna Coil Error

General Description

This wireless communication runs on RF (Radio frequency of 125 kHz). The antenna coil is mounted on the top of ignition lock for RF transmission and receiving. 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 ECM are converted into an RF signal, which is transmitted, to the transponder by the antenna.

DTC Description

The ECM sets DTC P1691 if there's any fault in immobilizer antenna coil.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Open Circuit in antenna coil • Short Circuit in antenna coil • Faulty antenna coil
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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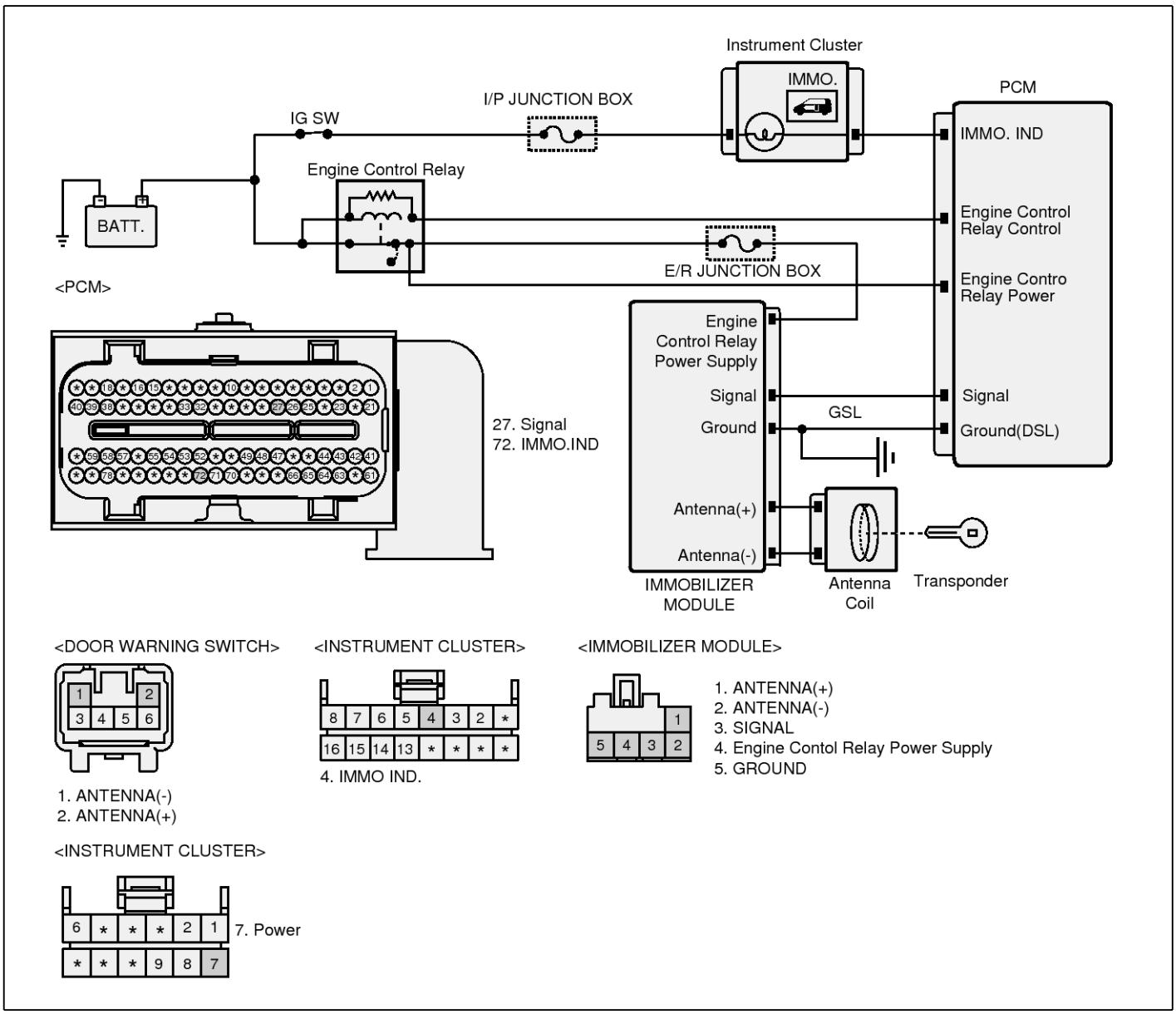

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Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Monitor the "ECU, KEY and Smartra STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

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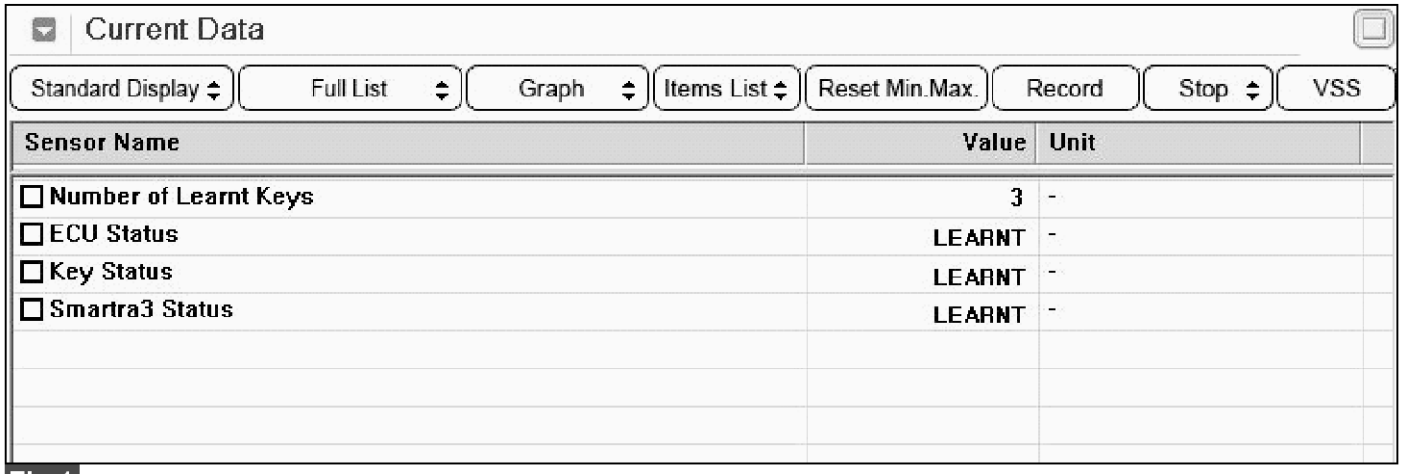

Fig.1

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Fig.1) This data show that 3 keys have been taught, ECU has been learnt, the Key in key cylinder has been learnt and SMARTRA3 has been learnt.

4. Has the "Smartra STATUS' been learnt ?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. And this DTC has not erased in previous repair . Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Go to "Component Inspection" procedure

Component Inspection

1. Check coil antenna.
   1) Ignition "OFF"
   2) Disconnect SMARTRA connector.
   3) Measure resistance between antenna coil(+) and (-) terminal of SMARTRA harness connector.

Specification : Approx 8.5 Ω

   4) Is the measured resistance within specifications?

YES ▶Go to "Check SMARTRA" procedure

NO ▶Check for open or short in antenna coil. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check SMARTRA
   1) IG "ON" & Engine "OFF"
   2) Neutralize Both "SMARTRA" and "ECM" and Register transponder key by scantool.

NOTICE

Pin code is required to Neutralize SMARTRA and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶Perform all the key teaching procedure with scantool. (All the keys must be retaught) and then, go to "Verification of Vehicle Repair" Procedure.

NO ▶Substitute with a known-good SMARTRA and Perform Key teaching procedure.
▶If the problem is corrected, replace SMARTRA and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1692 Immobilizer Indicator Lamp Error

General Description

When driver inserts key and IGN "ON", Immobilizer informs status of system and result of Authentication by blinking of immobilizer lamp on instrument cluster. Through Authentication procedure, immobilizer lamp keep lighting up till engine starts. In normal status. Immobilizer lamp lights up for 30sec Right after ignition "ON". If there's any fault in immobilizer system or in Authentication, lamp blinks 5 times after ignition "ON"

DTC Description

The ECM sets DTC P1692 if there's short circuit in immobilizer lamp circuit.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Short Circuit in immobilizer lamp circuit. • Open/Short in control harness • Faulty PCM/ECM
Enable Conditions	• IG ON	
Threshold value	• Short to GND, Wiring open	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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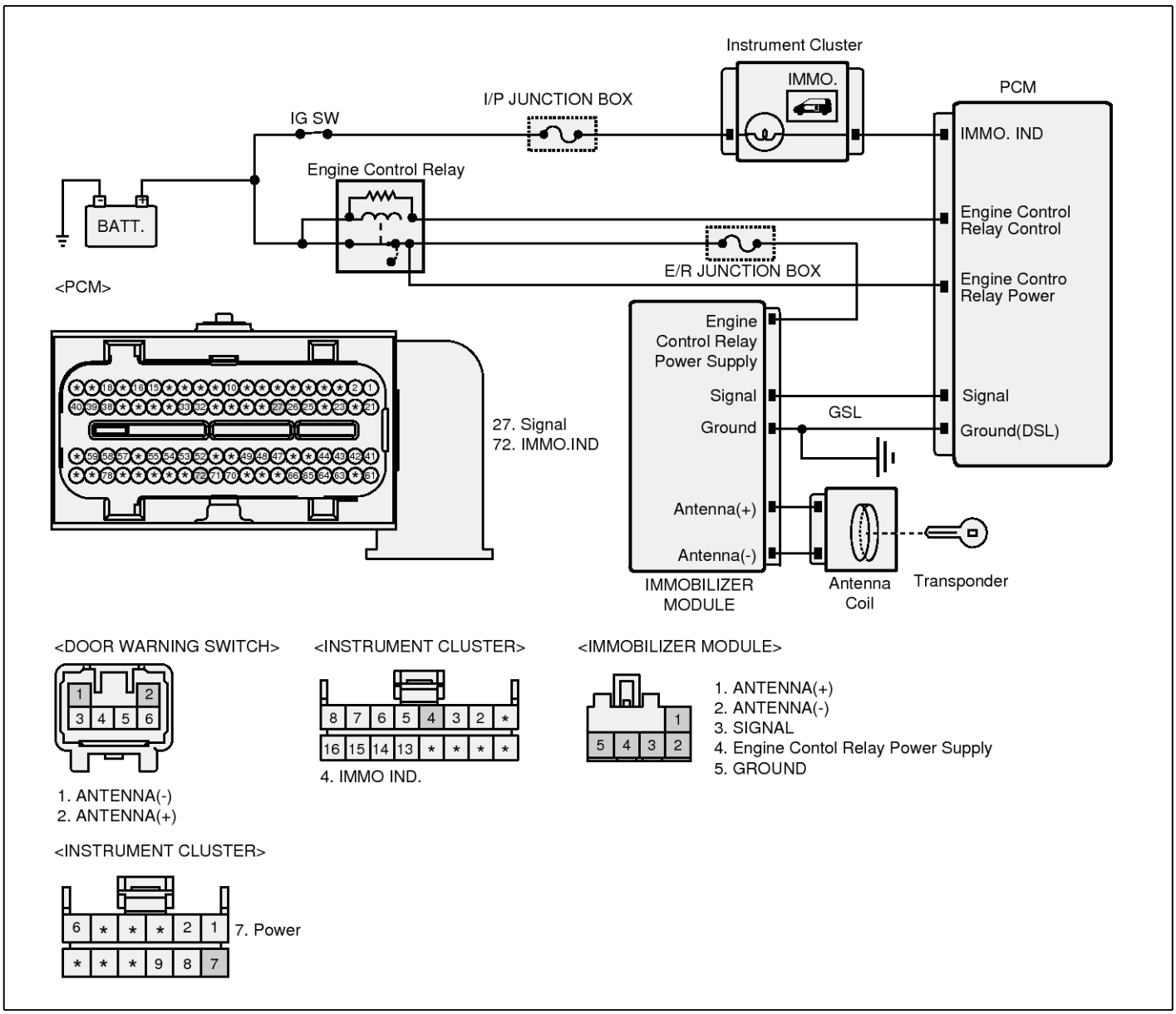

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Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶Repair as necessary and go to "Verification Vehicle Repair" procedure

NO ▶Go to "W/Harness Inspection" procedure

Control circuit inspection

1. Check for open in harness
   1) IG KEY OFF.
   2) Connect SMARTRA connector and disconnect PCM connector .
   3) IG KEY ON & Engine "OFF".
   4) Measure voltage between indicator terminal of PCM harness connector and chassis ground.

Specification : Batt.

   5) Is the measured voltage within specifications?

YES ▶Go to "Component Inspection" procedure

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NO ▶Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

Visual/Physical Inspection

1. Check immobilizer lamp circuit
   1) Ignition "ON" & Engine "OFF".
   2) Check if immobilizer lamp operates properly.

      NOTICE

      Right after ignition "ON", Immobilizer lamp lights up for 30sec.

      If lamp blinks 5 times after ignition "ON", a fault exists in immobilizer system.

   3) Is immobilizer lamp operates properly?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Go to "Component Inspection" procedure.

Component Inspection

1. Check immobilizer lamp.
   1) IG KEY OFF.
   2) Connect SMARTRA connector and disconnect PCM connector.
   3) Ground indicator terminal of PCM harness connector with wire.
   4) IG KEY ON & Engine "OFF".

Specification : Immobilizer lamp "ON"

   5) Is the Immobilizer lamp "ON"?

YES ▶Substitute with a known-good ECM and check for proper operation.
▶If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NOTICE

ECM substitued for old one must be in "Virgin" or "Neutral" status and Pin code is requied to Neutralize ECM and to Register transponder key

NO ▶Check that fuse has blown off and harness between ECM connector and Battery is in normal condition. And. check connectors for loosenness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1693 Immobilizer-Transponder Error

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.

The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ ECM stores the PIN and the key Learning can be started. The "learnt“ ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case, The ECM can’t excute the key learning process.

DTC Description

The ECM sets DTC P1693 if there's abnormal response from transponder.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Corrupted data from Transponder • More than one TP in the magnetic field • No TP(Key without TP) in the magnetic field
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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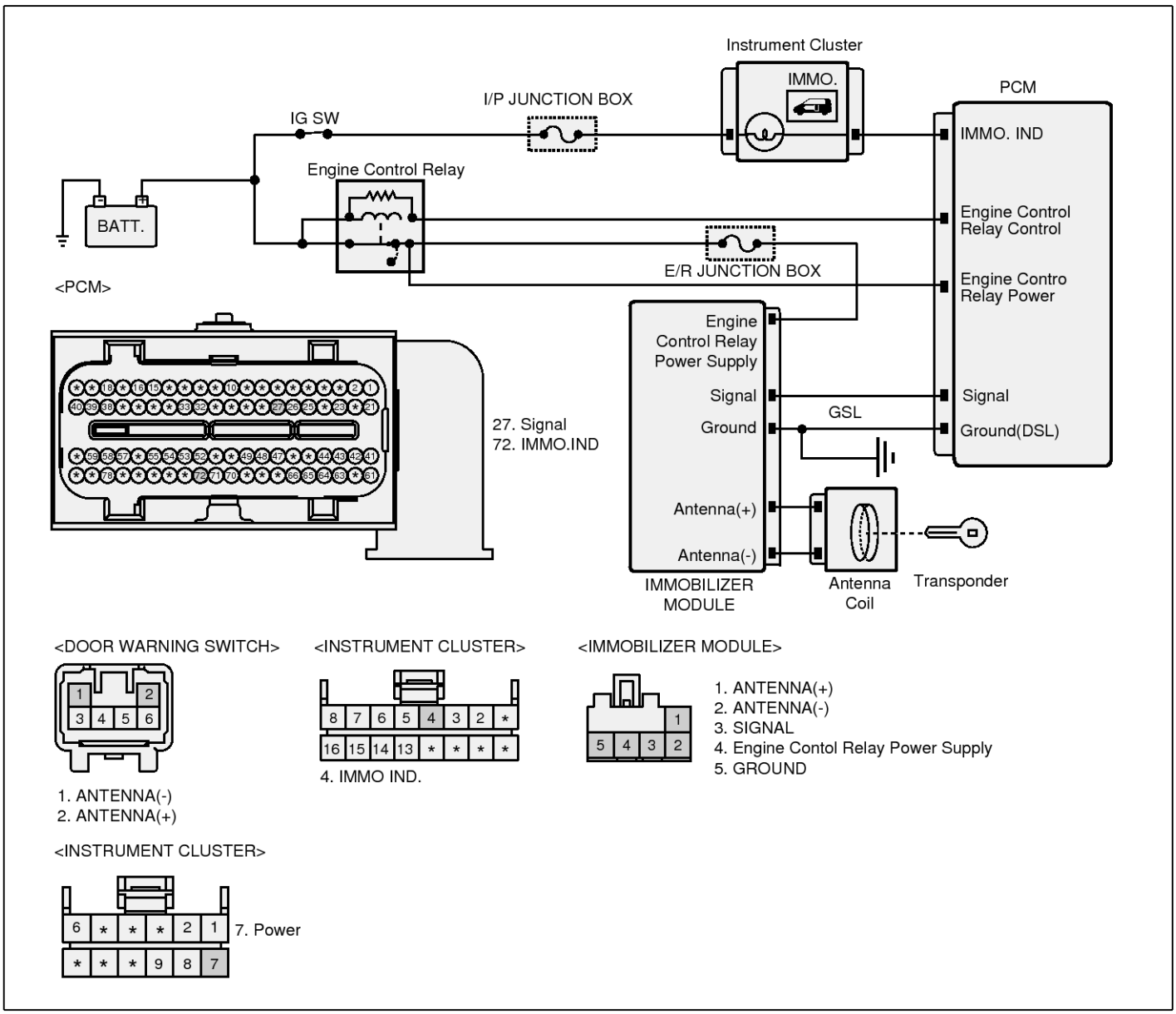

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Monitor Scantool Data

1. Check transponder and ECU status
   1) IG "ON" & Engine "OFF"
   2) Monitor the "ECU, KEY and Smartra STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

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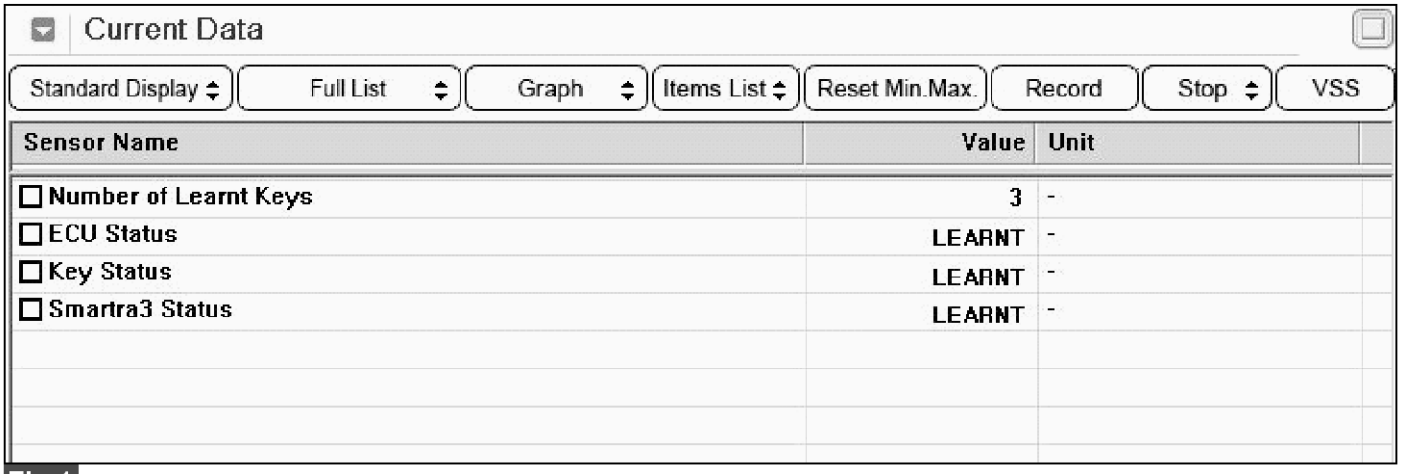

Fig.1

SHMBE9B04L

Fig1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

3) Have both the ECM and KEY status been learnt ?

YES ▶Substitute with known good "virgin" transponder and go to "Component Inspection" Procedure.

NO ▶Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder
   1) IG "ON" & Engine "OFF"
   2) Neutralize ECM and Register transponder key by scantool.

      NOTICE
      Pin code is required to Neutralize ECM and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Substitute with a known-good transponder and perform the key teaching precedure.
▶If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1694 Immobilizer-EMS Message Error

General Description

The ECM and the SMARTRA communicate by dedicated line. During this communication of ECM and SMARTRA, the K line of ECM cannot be used for communication. The ECM controls the communication either to SMARTRA or to other devices(e.g. scanner) on K line by switching of a multiplexer and specific communication procedures. The multiplexer is a part of ECM H/W.

DTC Description

The ECM sets DTC P1694 if Request from EMS is invalid.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Faulty EMS ※ Protocol layer violation - Invalid request - Check sum error
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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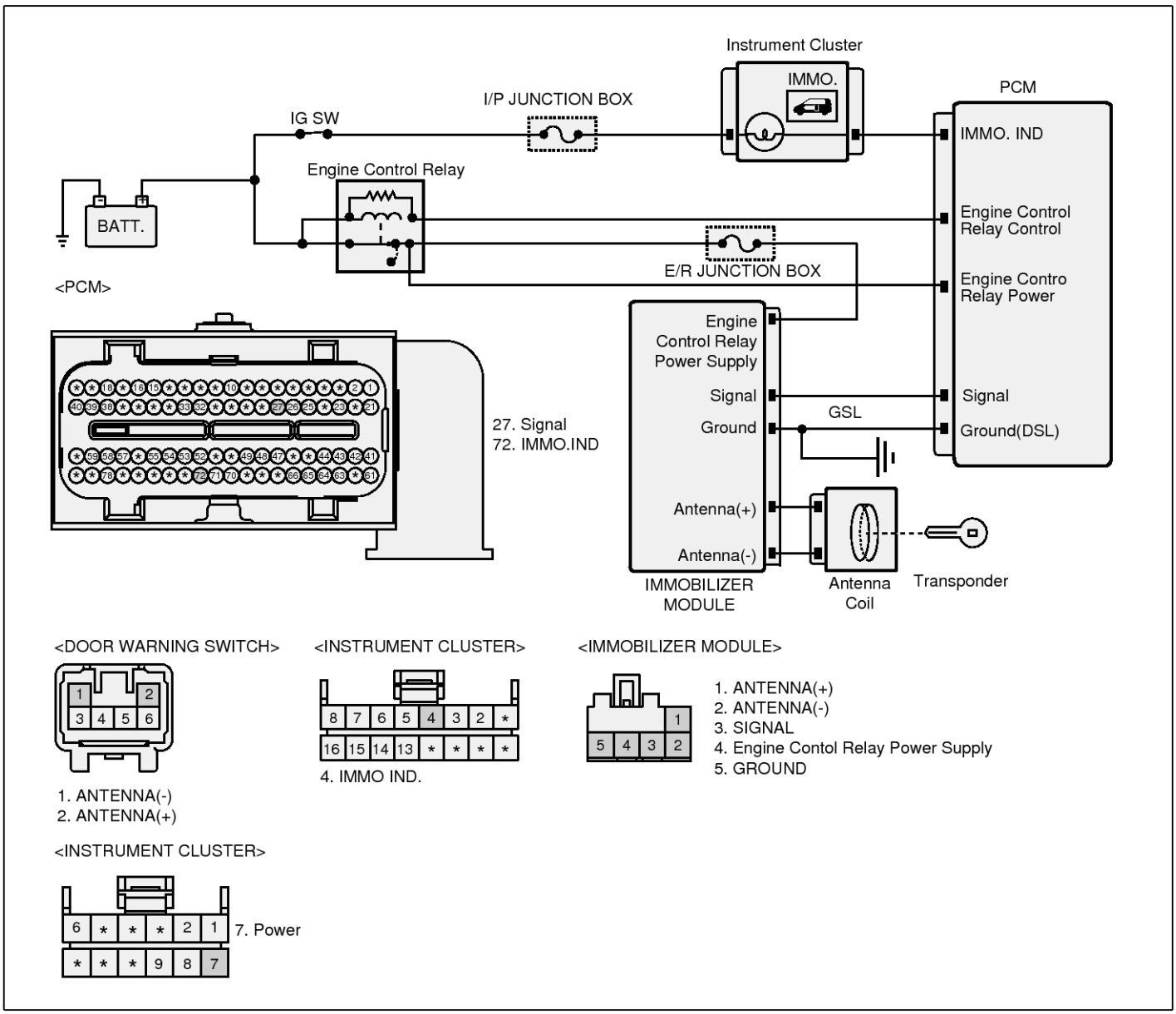

SHMBE9B05L

Monitor Scantool Data

1. Check status
   1) IG "ON" & Engine "OFF"
   2) Monitor the "ECU, KEY and Smartra STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

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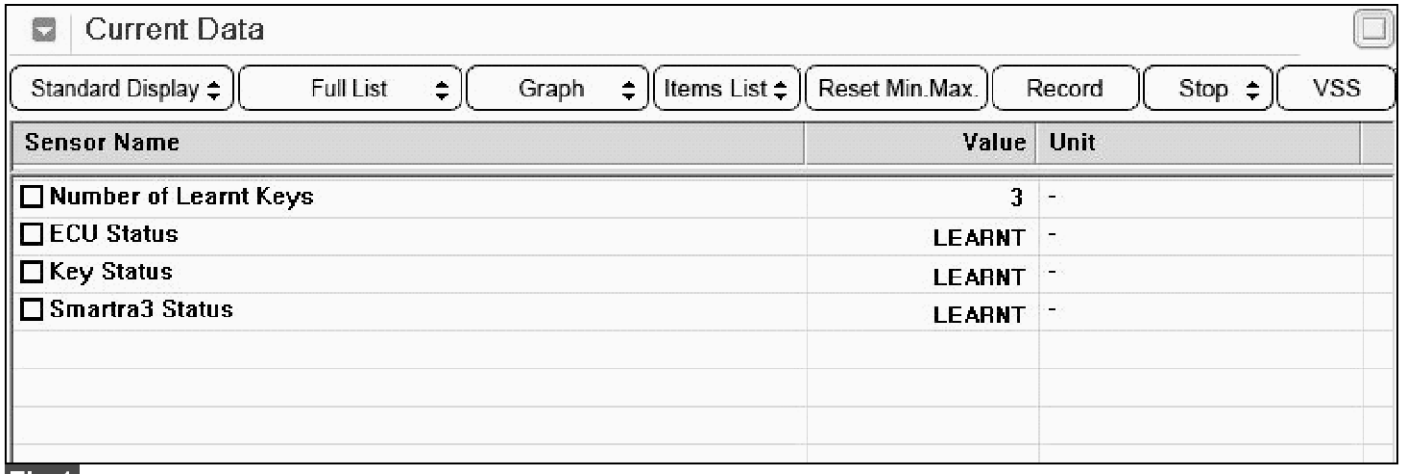

Fig.1

SHMBE9B04L

Fig1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. And this DTC has not erased in previous repair . Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Go to "Component Inspection" procedure

Component Inspection

1. Check ECM
   1) IG "ON" & Engine "OFF"
   2) Neutralize ECM and Register transponder key by scantool.

      NOTICE
      Pin code is requied to Neutralize ECM and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Substitute with a known-good transponder and perform key teaching procedure with scanner.
▶If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

NOTICE
ECM substitued for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1695 Immobilizer-EMS Memory Error

General Description

The relevant data for the immobilizer function are stored at permanent memory (EEPROM or Flash etc.).

The immobilizer data are stored by three independent entries.

The data from EEPROM are evaluated by "2 of 3 decision“. That means all three entries are read and the content is compared before authentication process.

If the contents of all entries are equal, the authentication will run without additional measures.

If only the contents of two entries are equal, the authentication will run and fault code "EEPROM defective“ is stored at ECM.

If the contents of all three entries are different from each other, no authentication will be possible and the fault code "EEPROM defective“ will be stored. The limp home function cannot be activated. The ECM shall be replaced if the EEPROM related fault occurs again after new teaching of all keys.

DTC Description

The ECM sets DTC P1695 if there's any fault in EMS internal permanent memory(EEPROM or Flash etc.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Faulty EMS
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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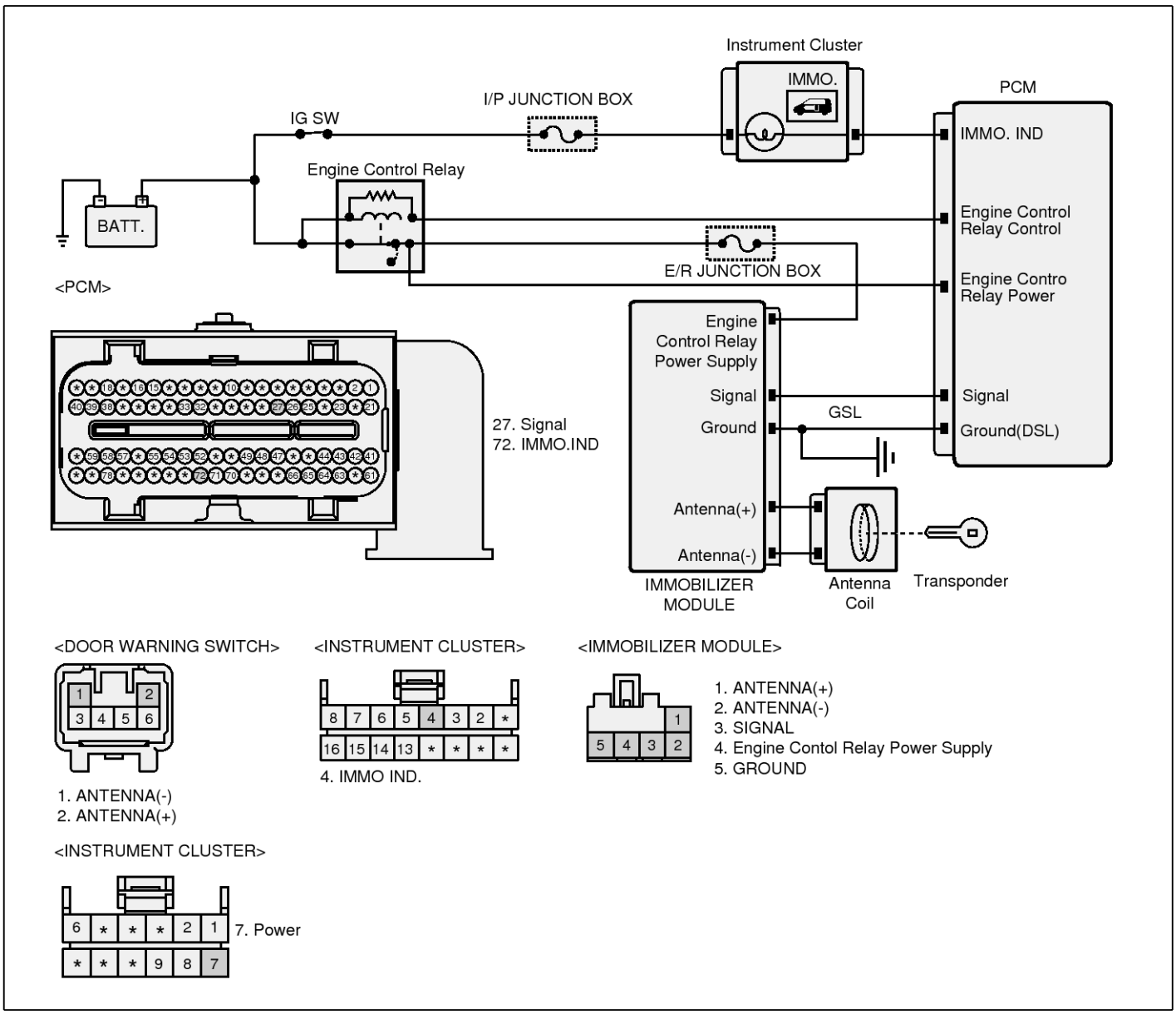

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Monitor Scantool Data

1. Check status
   1) IG "ON" & Engine "OFF"
   2) Monitor the "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter on the Scantool.

Specification : 'LEARNT'

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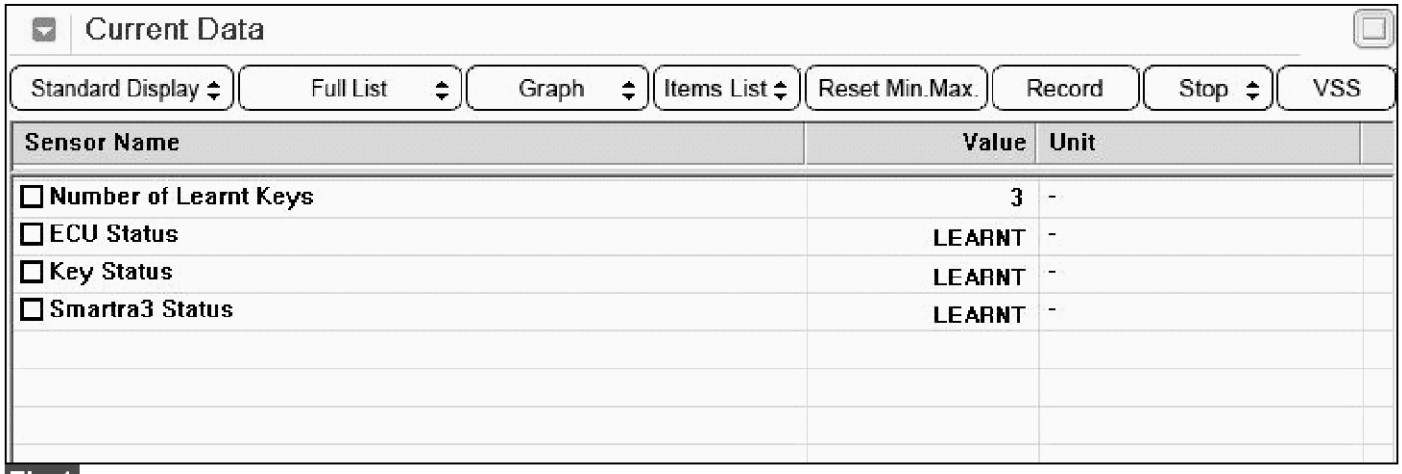

Fig.1

SHMBE9B04L

Fig1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

3) Are "KEY STATUS", "SMARTRA STATUS" and "ECU STATUS' Parameter within specifications?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. And this DTC has not erased in previous repair . Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Go to "Component Inspection" procedure

Component Inspection

1. Check ECM
   1) IG "ON" & Engine "OFF"
   2) Neutralize ECM and Register transponder key by scantool.

      NOTICE
      Pin code is requied to Neutralize ECM and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Substitute with a known-good transponder and perform key teaching procedure with scanner.
▶If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

NOTICE
ECM substitued for old one must be in "Virgin" or "Neutral" status and Pin code is required to Neutralize ECM and to Register transponder key

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1696 Immobilizer-Authentication Fail

General Description

The vehicle immobilizer system consists of the ECM, the SMARTRA3 and ignition keys with built-in transponder.

The ECM carries out the check of ignition key by special encryption algorithm with SMARTRA3 and Transponder.

The encryption algorithm (between ECM and SMARTRA3) is the one offered from BOSCH.

The encryption algorithm (between ECM and Transponder) is Hitag type 2 which is a high level system. With IGN On, the ECM executes the key Authentication after SMARTRA3 authentication. The Engine can be started when the key authentication is confirmed by the SMARTRA3.

The Key teaching procedure starts with ECM request of PIN from Scanner. The "virgin“ ECM stores the PIN and the key Learning can be started. The "learnt“ ECM compares the PIN from tester with the vehicle password in Transponder. If the data are correct, the key Learning can be started.

Scanner requests the Learning of the first key, the SMARTRA3 is registered at first and then the first key is registered by ECM. If the SMARTRA3 status is learnt and PIN number is different, the SMARTRA3 will return the incorrect PIN data to the ECM. In this case, The ECM can’t excute the key learning process.

DTC Description

The ECM sets DTC P1696 if invaild key is inserted into key hole for Authentication

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Invalid transponder.
Enable Conditions	• IG ON	
Threshold value	• Virgin TP at PCM/ECM status “Learnt” • Learnt(Invalid) TP at PCM/ECM status “Learnt”	
Detecting time	• Immediately	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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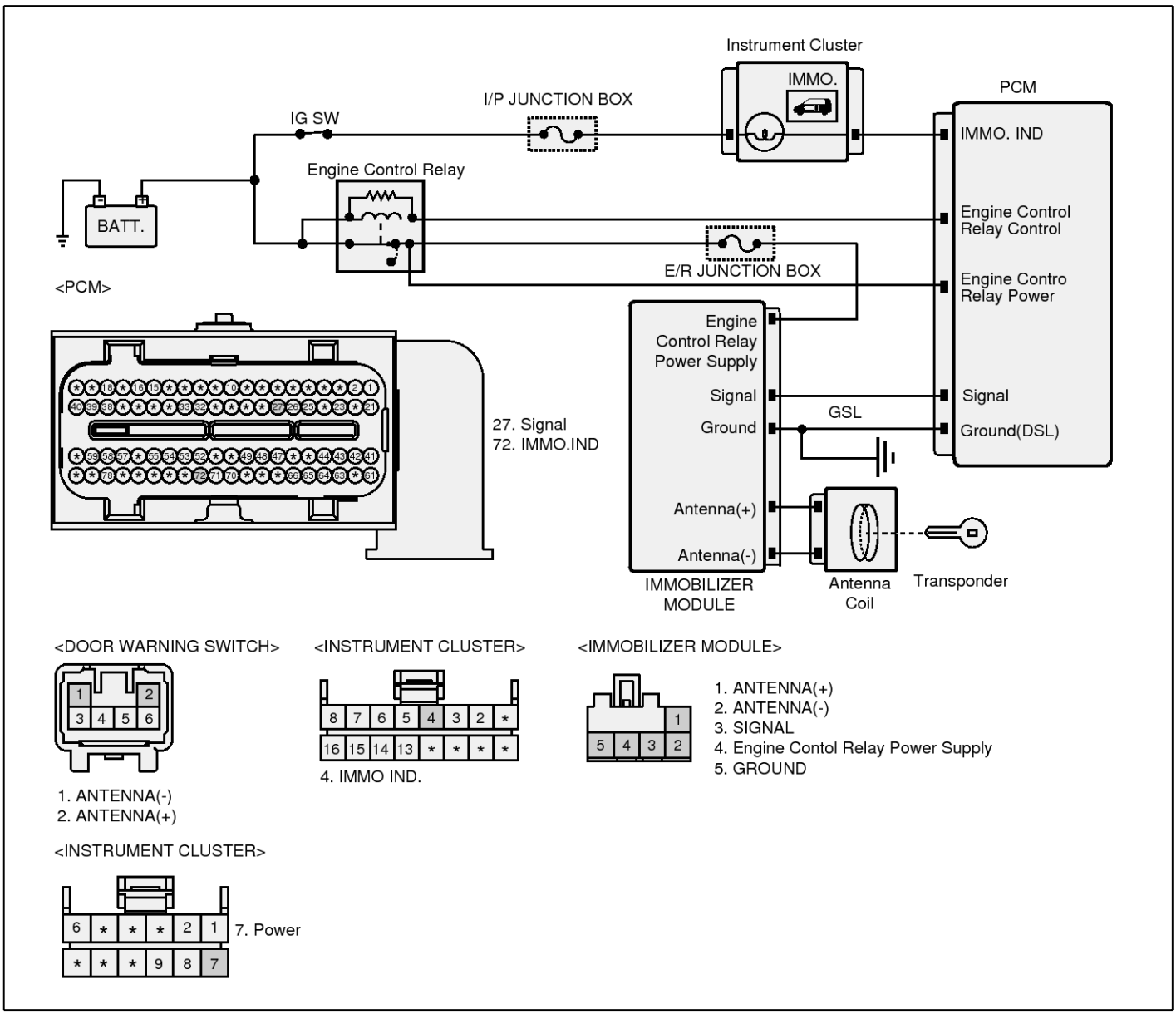

SHMBE9B05L

Monitor Scantool Data

1. Check status
   1) IG "ON" & Engine "OFF"
   2) Monitor the "ECM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'

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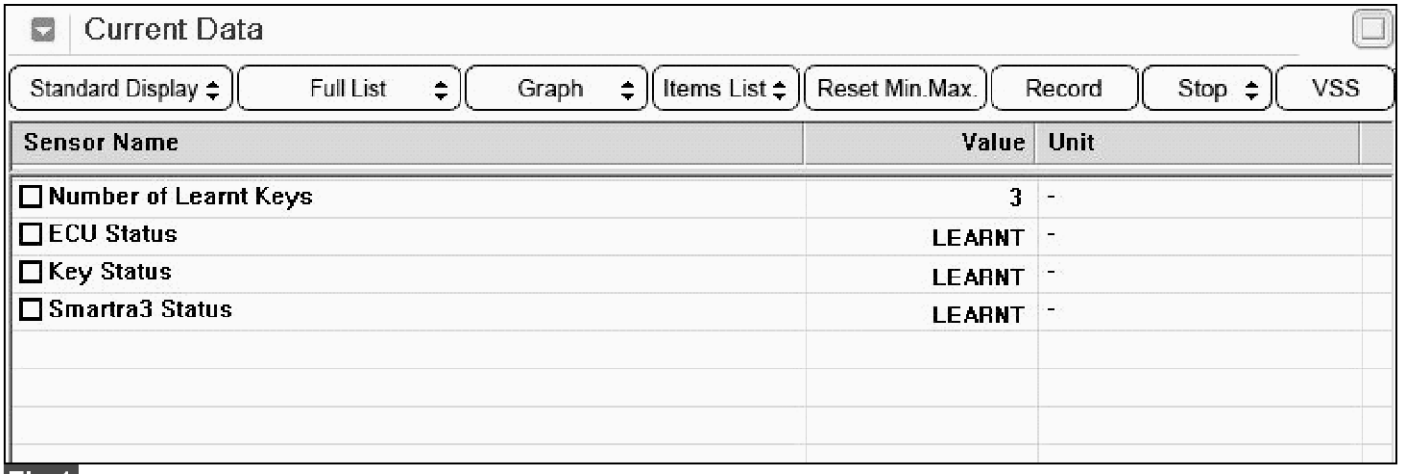

Fig.1

SHMBE9B04L

Fig1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

3) Have both the ECM and KEY status been learnt ?

YES ▶Substitute with known good "virgin" transponder and go to "Component Inspection" Procedure.

NO ▶Go to "Component Inspection" Procedure.

Component Inspection

1. Check transponder
   1) IG "ON" & Engine "OFF"
   2) Neutralize ECM and Register transponder key by scantool.

      NOTICE
      Pin code is requied to Neutralize ECM and to Register transponder key

   3) Are Neutralizing and Registering completed normally ?

YES ▶Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶Substitute with a known-good transponder and perform key teaching procedure with scanner.
▶If the problem is corrected, replace transponder and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1699 Immobilizer-Twice Overtrial

General Description

This is a special function for engine start by vehicle manufacturer. The engine can be started for moving from the production line to an area where the key teaching is conducted.

DTC Description

The ECM sets DTC P1697 if the maximum limit of Twice IGN is Exceeded.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• -	• Twice IGN ≥ 32 times
Enable Conditions	• IG ON	
Threshold value	• -	
Detecting time	• -	
FAIL SAFE	• -	

Diagnostic Circuit Diagram

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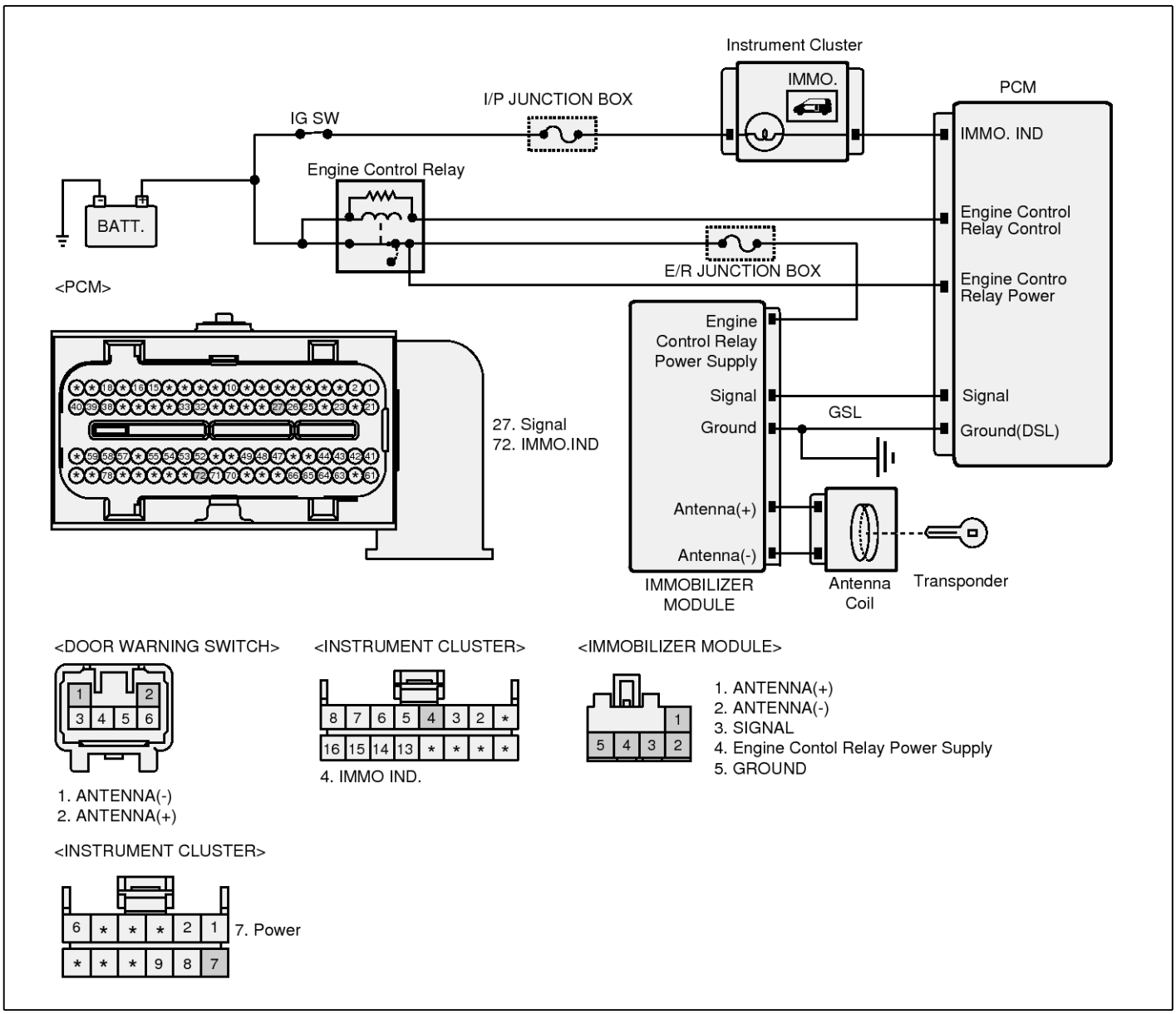

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Monitor Scantool Data

1. Check status
   1) IG "ON" & Engine "OFF"
   2) Monitor the "ECM, Key and Smartra Status" Parameter on the Scantool.

Specification : 'LEARNT'

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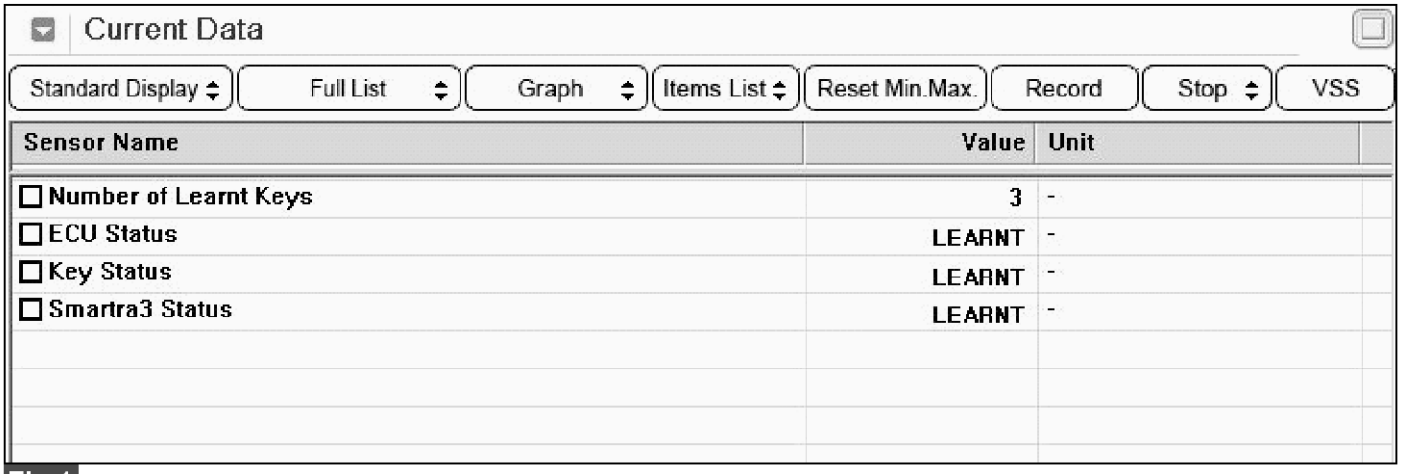

Fig.1

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Fig.1) This data show that 3 keys have been taught, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt.

3) Is the "ECU STATUS' Parameter "Locked"?

YES ▶ Keep "KEY ON" status for 1 hours to withdraw "Locked by Timer" status. Then turn the key OFF for 10seconds. Next register transponder and go to "Verification of Vehicle Repair" procedure.

NO ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, damage on the ECM or SMARTRA. And this DTC has not erased in previous repair . Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
2. Operate the vehicle and monitor the DTC on the scantool
3. Are any DTCs present?

YES ▶Go to the applicable troubleshooting procedure

NO ▶System is performing to specification at this time.

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P1610 Non-Immobilizer-EMS Connected to an Immobilizer

General Description

ECM equipped with Immobilizer function has 4 different Immobilizer S/W(Smartra 2, Smartra 3, PIC and PIC2 START STOP BUTTON SWTICH). With initial IG ON, ECM decides what kind of ECM it is, so call, it is ECM auto-detection.

Immobilizer function is kept its SW Until neutralizing ECM.

DTC Description

ECM sets DTC P1610 if Non START STOP BUTTON SWITCH EMS is installed on vehicle equipped with START STOP BUTTON SWITCH Immobilizer.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Enable Conditions	• IG ON	• Invalid ECM
Threshold value	• Non Immobilizer ECM connected	

Diagnostic Circuit Diagram

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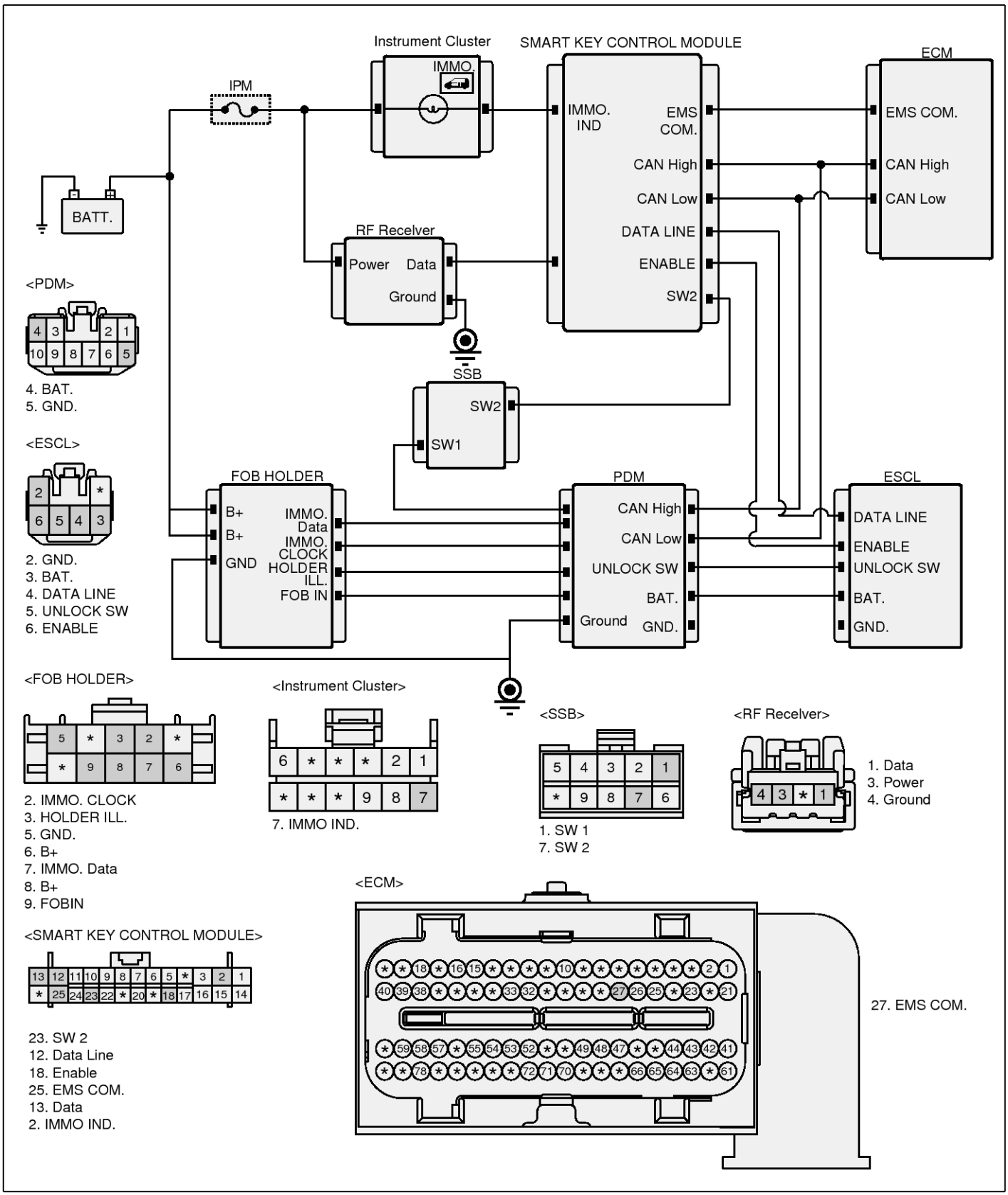

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Monitor Scantool Data

■ Check DTC

1. Connect GDS to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".

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3. Select "Diagnostic Trouble Codes(DTCs)"mode.

NOTICE

If Non START STOP BUTTON SWITCH immobilizer ECM is installed, Checking Current Data is not available. Because ECM will send Not O.K signal to GDS.

4. Is the DTC P1610 present ?

YES ▶ Substitute with a known-good ECM with START STOP BUTTON SWITCH immobilizer and check for proper operation.If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Fault is intermittent caused by poor contact in ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NOTICE

■ *PIN code is programmed in Smart key ECM, Transponder, ESCL, PDM and FOB.*

1. *If the Smart key ECM is not registered with PIN, key teaching process is not proceeded.*
2. *Registering PIN is available after Smart Key ECM is neutralized.*
3. *Neutralization of Engine ECM is available with GDS (Registering PIN code)*
4. *If the virgin engine ECM is installed on vehicle, Engine ECM is automatically programmed PIN code by Smart Key ECM.*
5. *Registering PIN code is only possible for virgin or neutralized status.*

■ *It is possible to acess to All of the learning procedue only with GDS.*

And, FOB key must be inserted in FOB holder in order to proceed learning procedure.

(There is only one menu for registering Smart key on the GDS that makes registering all of the component. In case of replacing each module, New registration should be done with GDS)

- *Smart Key ECM Learning*

  1. Before learning procedure for FOB Key, PDM or ESCL, Smart Key ECM should be registered PIN code first.

  2. In case of replacing Smart Key ECM, All of the keys should be newly registered again.

  3. In case that Smart Key ECM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.

  4. If the battery is discharged during neutralization or Teaching, Timer will start again from begining. Therefore, it is avoidable to wail for 1 hour.

- *PDM Learning*

  1. It is O.K for registering PDM just one time. And, it is available for PDM to neutrailze and re-teach with same PIN code.

  2. In case that Power supply is shut off to ESCL right before first FOB key is registered, Every component status is moved to right before power shut off and previous PIN is used for communication with PDM and Smart key ECM

- *ESCL Learning*

  1. It is O.K for registering ESCL just one time. And, it is available for ESCL to neutrailze and re-teach with same PIN code.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS and check "No. of Key learnt, ECM status and Smartkey ECM status
2. Selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
3. Operate the vehicle within the enable condition and monitor the DTC on the GDS.
4. Are any DTCs present ?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1676 Immobilizer-Smartra Message Error

General Description

1. The secret key code is porgrammed in memory of Smart Key ECM, ESCL, PDM, FOB key
2. The learnt FOB Key identifiers are stored in Smart Key ECM and PDM memory.
3. Corresponding PIN code is learnt and memorized in the Engine ECM

Communication between smart key ECM and ECM, has 2 phase that is IG ON and Engine ON.

After this first IG ON transition phase or starting phase, a commnication between Smart Key ECM and Engine ECM takes place.

■ IG ON Phase (FOB key or Fob Key in Fob holder)

1. Communication between Smart key ECM and ECM, starts from wake-up signal from ECM.
2. After receiving wake-up signal from ECM, Smart Key ECM sends lock or unlock starting signal to ECM.

■ Starting Phase (FOB key or FOB key in Fob Holder)

1. In case driver tries to start engine, although Engine ECM is locked status for starting at IG ON, Engine ECM should send re-authentication to Smart Key ECM. According to the results of re-authentication, it would be decided to start engine or not.

   The Engine ECM controls the engine, in a normal way for starting and running, and starts communication with the Smart Key ECM, sending a PIN request to the Smart Key ECM and waiting for valid release message from it until the release time period has ended.

   In case of Smart Key ECM immobilizer function is locked, the Smart Key ECM answer is the no release message. Engine ECM enters in the locked state, which causes the activation of the imobilization actions of the engine.

   In case of Smart Key ECM immobilizer function state is released, the Smart Key ECM answer is the release message, in cluding the information Smart Key ECM inlearnt mode and the PIN code.

DTC Description

This DTC is set, after Engine ECM sends wake-up signal, if response signal from Smart key ECM is abnormal structure or is not valid message during engine ECM communication.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
Enable Conditions	• IG ON	• Faulty Smart Key ECM
Detecting time	• 1.5 seconds	
Threshold value	• Data error or timing error 1. Data error : Head value error, checksum value error, Smart Key status unknown error 2. Timing Error : : Interval time of response from Smart key ECM after ECM request signal is longer than 40mS	

Diagnostic Circuit Diagram

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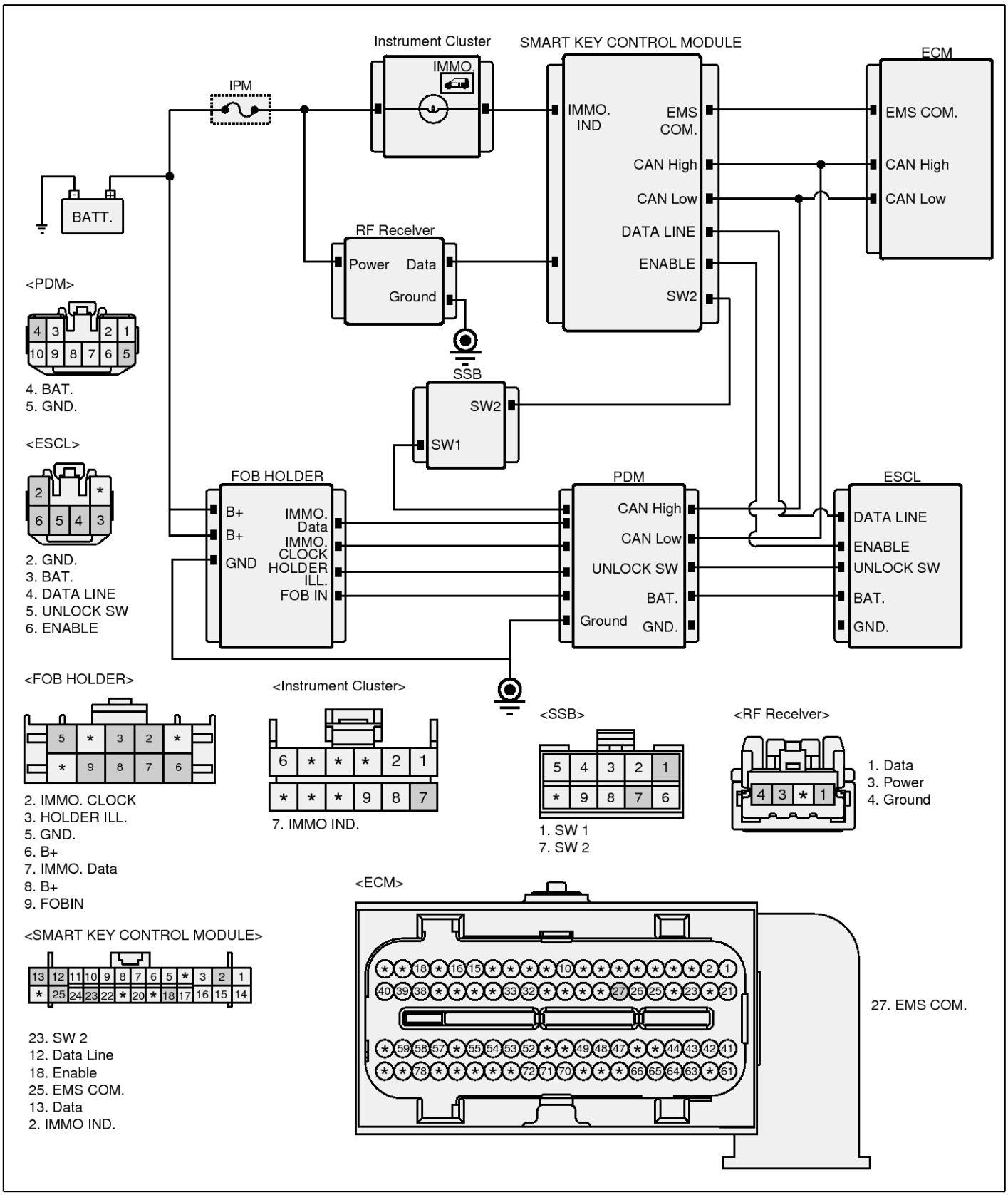

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Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF".
2. Erase DTC after connecting GDS.
3. Check Smart key status if DTC is retrieved.

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Fig.1

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Fig.1) It shows that 2(two) FOB key is registered, Smart Key ECM(integerated in IPM) is learnt status.

4. Is the Smart key ECM learnt status ?

YES ▶ Fault is intermittent caused by poor contact in Smart key ECM and/or ECM's connector or was repaired and Smart key ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

■ Check Smart Key ECM Insepction

1. IG KEY "ON" & Engine "OFF"
2. Neutralize smart key ECM with GDS.
3. Perform key teaching procedure for smart key ECM with GDS.

⚠CAUTION

Pin code must be prepared to Neutralize Smart Key ECM and to perform key teaching procedure.

4. Is the neutralization of Smart Key ECM, Engine ECM and key teaching normal ?

YES ▶ Fault is intermittent caused by poor contact in Smart Key ECM and/or ECM's connector or was repaired and Smart key ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good Smart Key ECM and check for proper operation.
▶ If the problem is corrected, replace Smart Key ECM and then go to "Verification of Vehicle Repair" procedure.

NOTICE

■ *PIN code is programmed in Smart key ECM,*

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Transponder, ESCL, PDM and FOB.

1. *If the Smart key ECM is not registered with PIN, key teaching process is not proceeded.*
2. *Registering PIN is available after Smart Key ECM is neutralized.*
3. *Neutralization of Engine ECM is available with GDS (Registering PIN code)*
4. *If the virgin engine ECM is installed on vehicle, Engine ECM is automatically programmed PIN code by Smart Key ECM.*
5. *Registering PIN code is only possible for virgin or neutralized status.*

■ *It is possible to acess to All of the learning procedue only with GDS.*

And, FOB key must be inserted in FOB holder in order to proceed learning procedure.

(There is only one menu for registering Smart key on the GDS that makes registering all of the component. In case of replacing each module, New registration should be done with GDS)

- *Smart Key ECM Learning*

  1. Before learning procedure for FOB Key, PDM or ESCL, Smart Key ECM should be registered PIN code first.

  2. In case of replacing Smart Key ECM, All of the keys should be newly registered again.

  3. In case that Smart Key ECM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.

  4. If the battery is discharged during neutralization or Teaching, Timer will start again from begining. Therefore, it is avoidable to wail for 1 hour.

- *PDM Learning*

  1. It is O.K for registering PDM just one time. And, it is available for PDM to neutrailze and re-teach with same PIN code.

  2. In case that Power supply is shut off to ESCL right before first FOB key is registered, Every component status is moved to right before power shut off and previous PIN is used for communication with PDM and Smart key ECM

- *ESCL Learning*

  1. It is O.K for registering ESCL just one time. And, it is available for ESCL to neutrailze and re-teach with same PIN code.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS and check "No. of Key learnt, ECM status and Smartkey ECM status
2. Selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
3. Operate the vehicle within the enable condition and monitor the DTC on the GDS.
4. Are any DTCs present ?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1690 Immobilizer-Smartra No Response

General Description

1. The secret key code is porgrammed in memory of Smart Key ECM, ESCL, PDM, FOB key
2. The learnt FOB Key identifiers are stored in Smart Key ECM and PDM memory.
3. Corresponding PIN code is learnt and memorized in the Engine ECM

Communication between smart key ECM and ECM, has 2 phase that is IG ON and Engine ON.

After this first IG ON transition phase or starting phase, a commnication between Smart Key ECM and Engine ECM takes place.

■ IG ON Phase (FOB key or Fob Key in Fob holder)

1. Communication between Smart key ECM and ECM starts from wake-up signal from ECM.
2. After receiving wake-up signal from ECM, Smart Key ECM sends lock or unlock starting signal to ECM.

■ Starting Phase (FOB key or FOB key in Fob Holder)

1. In case driver tries to start engine, although Engine ECM is locked status for starting at IG ON, Engine ECM should send re-authentication to Smart Key ECM. According to the results of re-authentication, it would be decided to start engine or not.

   The Engine ECM controls the engine, in a normal way for starting and running, and start scommunication with the Smart Key ECM, sending a PIN request to the Smart Key ECMand waiting for valid release message from it until the release time period has ended.

   In case of Smart Key ECM immobilizer function is locked, the Smart Key ECM answer is the no release message. Engine ECM enters in the locked state, which causes the activation of the imobilization actions of the engine.

   In case of Smart Key ECM immobilizer function state is released, the Smart Key ECM answer is the release message, in cluding the information Smart Key ECM in learnt mode and the PIN code.

DTC Description

DTC P1690 is set Engine ECM has not received any signals related starting engine, Although Engine ECM sends wake up signal to Smart Key ECM.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
Enable Conditions	• IG ON	• Open or short in circuit • Faulty Smart Key ECM
Detecting time	• 1.5 seconds	
Threshold value	• No response form Smart Key ECM (Communication line error -Open or short)	

Diagnostic Circuit Diagram

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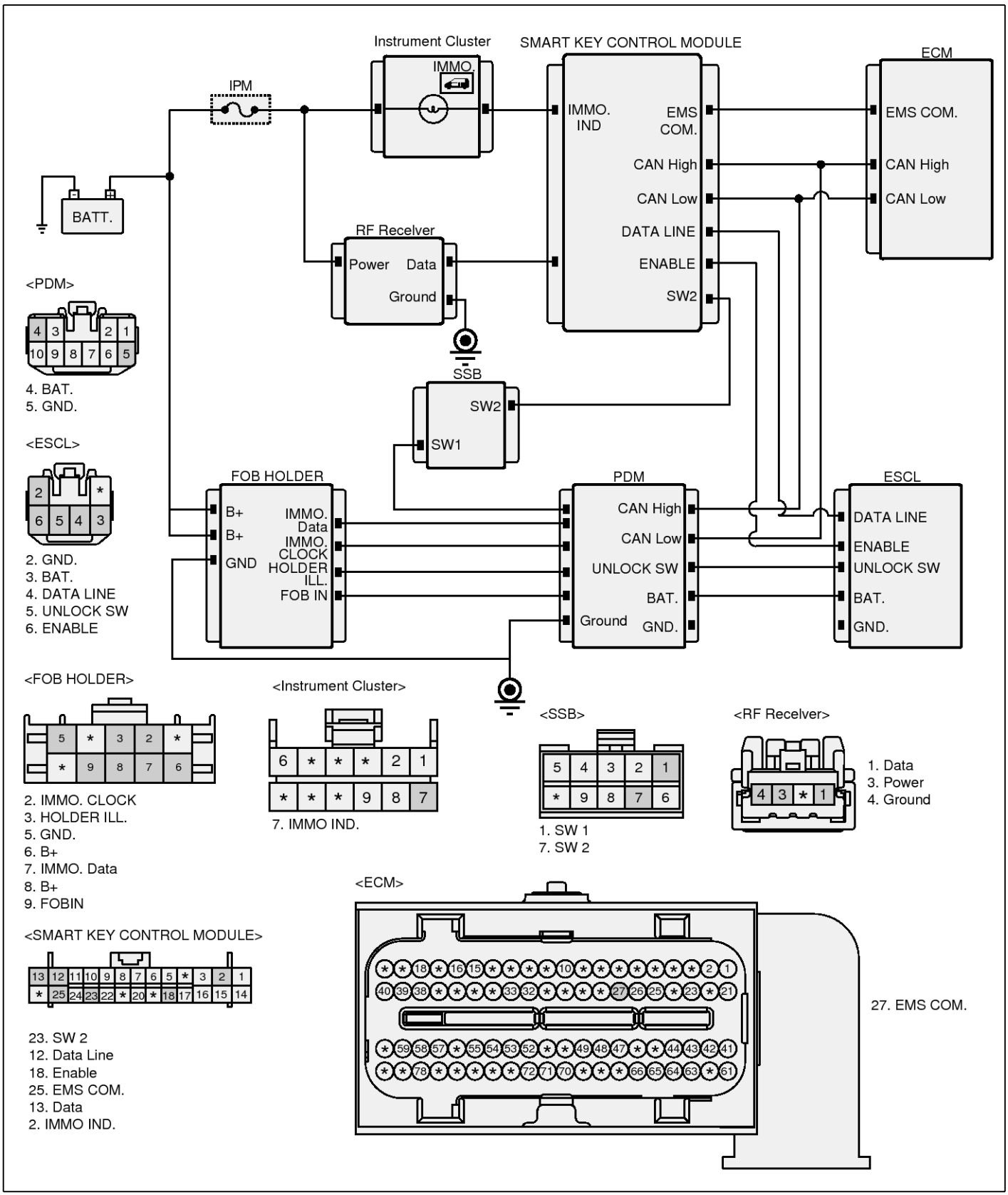

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Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF".
2. Erase DTC after connecting GDS.
3. Check Smart Key ECM status parameter if DTC is

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retrieved.

Fig.1

SHMBE9B01L

Fig.1) It shows that 2(two) FOB key is registered, Smart Key ECM is learnt status.

4. Is the smart Key ECM learnt ?

YES ▶ Fault is intermittent caused by poor contact in Smart key ECM and/or ECM's connector or was repaired and Smart key ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Wire Harness Inspection" procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification Vehicle Repair" procedure

NO ▶ Go to "Signal Circuit Inspection" procedure.

Signal Circuit Inspection

1. IG KEY OFF.
2. Disconnect Engine ECM connector.
3. IG KEY "ON"
4. Measure voltage between signal terminal of ECM harness connector and chassis ground.

Specification : About 12V

5. Is the measured voltage within specification ?

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YES ▶ Go to "Component Inspection" procedure.

NO ▶ Check open or short to signal circuit and then, go to "Verification of Vehicle Repair " procedure.

Component Inspection

■ Check Smart Key ECM insepction

1. IG KEY "ON" & Engine "OFF"
2. Neutralize smart key ECM with GDS.
3. Perform key teaching procedure for smart key ECM with GDS.

   ⚠CAUTION
   Pin code must be prepared to Neutralize Smart Key ECM and to perform key teaching procedure.
4. Is the neutralization of Smart Key ECM, Engine ECM and key teaching normal ?

YES ▶ Fault is intermittent caused by poor contact in Smart Key ECM and/or ECM's connector or was repaired and Smart key ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good Smart Key ECM and check for proper operation.
▶ If the problem is corrected, replace Smart Key ECM and then go to "Verification of Vehicle Repair" procedure.

NOTICE

■ *PIN code is programmed in Smart key ECM, Transponder, ESCL, PDM and FOB.*

1. *If the Smart key ECM is not registered with PIN, key teaching process is not proceeded.*
2. *Registering PIN is available after Smart Key ECM is neutralized.*
3. *Neutralization of Engine ECM is available with GDS (Registering PIN code)*
4. *If the virgin engine ECM is installed on vehicle, Engine ECM is automatically programmed PIN code by Smart Key ECM.*
5. *Registering PIN code is only possible for virgin or neutralized status.*

■ *It is possible to acess to All of the learning procedue only with GDS.*

And, FOB key must be inserted in FOB holder in order to proceed learning procedure.

(There is only one menu for registering Smart key on the GDS that makes registering all of the component. In case of replacing each module, New registration should be done with GDS)

- *Smart Key ECM Learning*

  1. Before learning procedure for FOB Key, PDM or ESCL, Smart Key ECM should be registered PIN code first.

  2. In case of replacing Smart Key ECM, All of the keys should be newly registered again.

  3. In case that Smart Key ECM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.

  4. If the battery is discharged during neutralization or Teaching, Timer will start again from begining. Therefore, it is avoidable to wail for 1 hour.

- *PDM Learning*

  1. It is O.K for registering PDM just one time. And, it is available for PDM to neutrailze and re-teach with same PIN code.

  2. In case that Power supply is shut off to ESCL right before first FOB key is registered, Every component status is moved to right before power shut off and previous PIN is used for communication with PDM and Smart key ECM

- *ESCL Learning*

  1. It is O.K for registering ESCL just one time. And, it is available for ESCL to neutrailze and re-teach with same PIN code.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS and check "No. of Key learnt, ECM status and Smartkey ECM status
2. Selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
3. Operate the vehicle within the enable condition and monitor the DTC on the GDS.
4. Are any DTCs present ?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1695 Immobilizer-EMS Memory Error

General Description

Information related immobilizer,that are classified as 2(two) parts independently, is memorized in EEPROM. ECM check these 2(two) information berfore proceeding immobilizer authentication. With synchronized both information, ECM starts immobilizer authentication procedure. If both information is not synchronized, ECM stops immobilizer authentication, Limphome function will not be activated, and memorizes DTC P1695. If DTC P1695 is retrieved again, after performing new key teaching procedure, ECM should be replaced with new one.

DTC Description

If key/password information in ECM is not matching or there is write error on EEPROM as hardware, DTC P1696 is set.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Enable Conditions	• IG ON	• Faulty ECM
Threshold value	• ECM internal memory error(EEPROM or Flash etc.) • Write error on ECM internal memory (EEPROM or Flash etc.)	

Diagnostic Circuit Diagram

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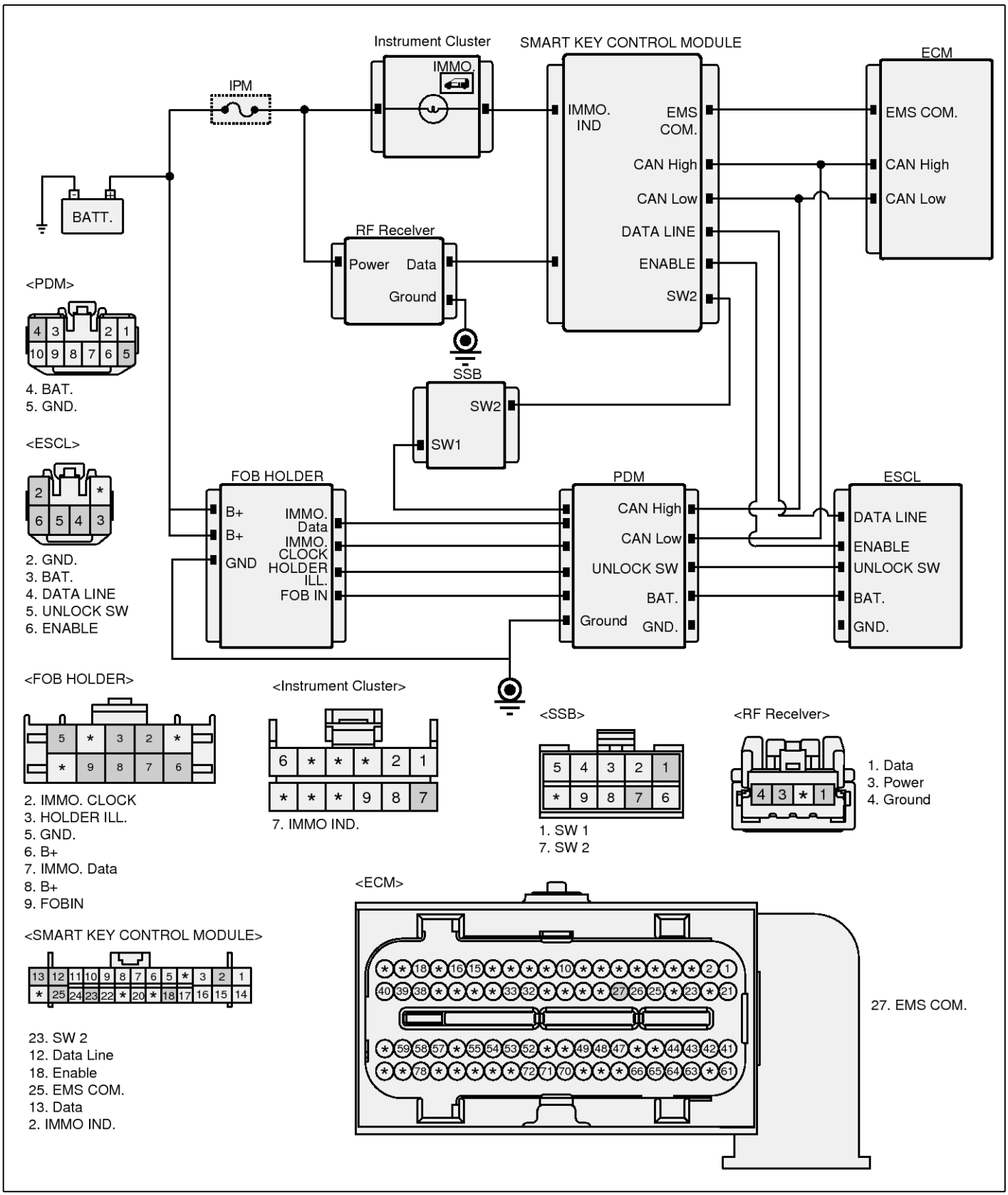

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Signal Waveform & Data

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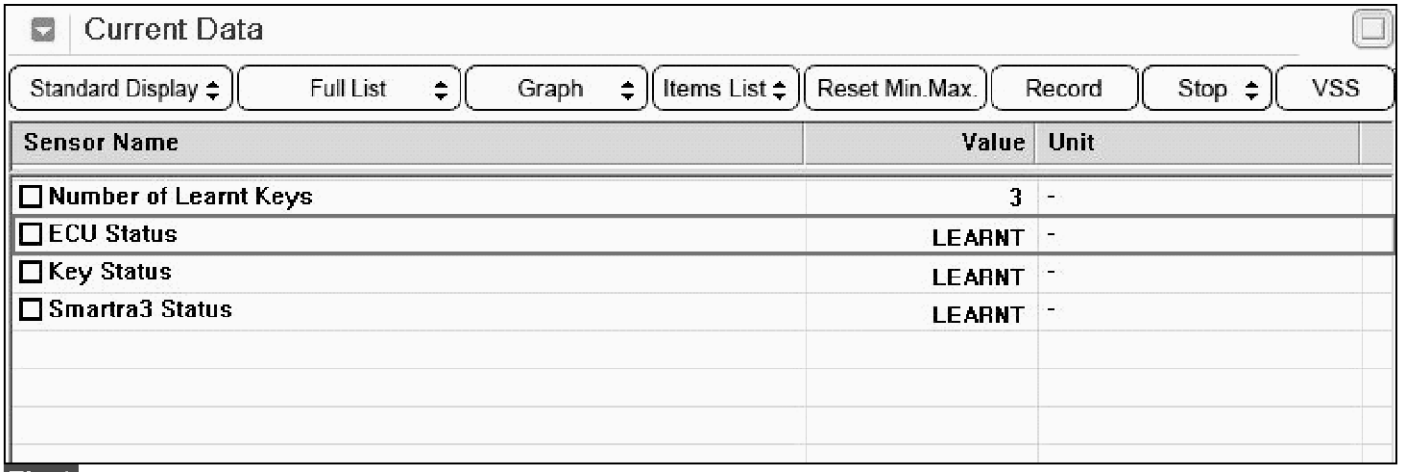

Fig.1

SHMBE9B02L

Fig 1) It shows that ECU is learnt status.(Just ignore rest of others parameter)

Although system is different from smartra system, it is possible only to check ECM status with GDS

Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF"
2. Connect GDS and select immobilizer system (Not PIC or Smart key System)
3. Only just Check Engine status parameter.

NOTICE

This menu is only for checking the ECM status. Just ignore the Rest of others parameter.(This is only way to check ECM status although selected menu system is different)

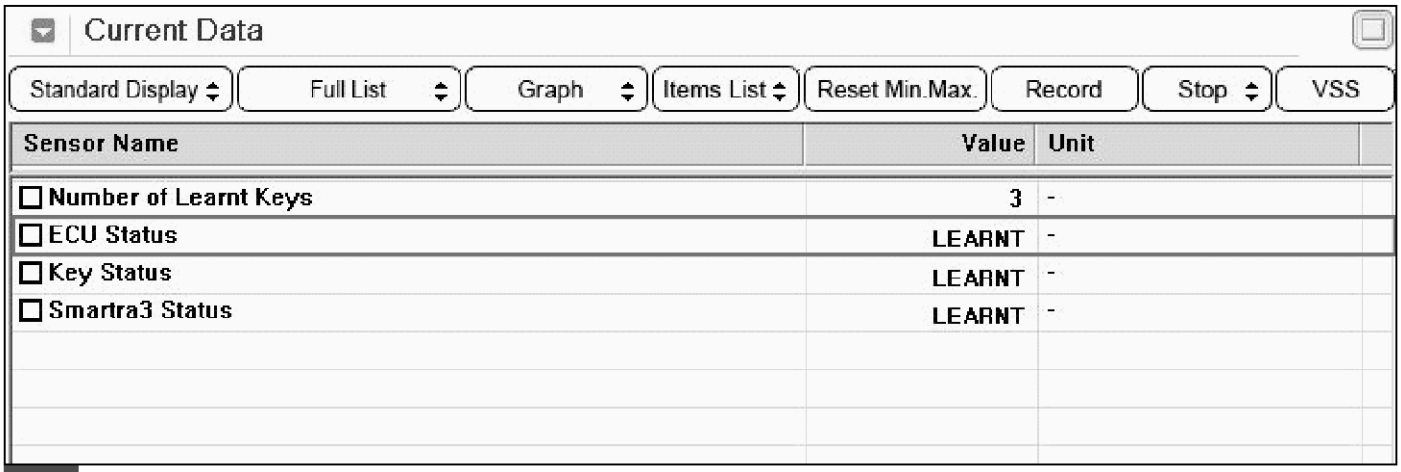

Fig.1

SHMBE9B02L

Fig 1) It shows that ECU is learnt status

(GDS will show that ECM is Not Checked if DTC P1695 is set)

4. Is the ECM status normal ?

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YES ▶ Neutralize the Engine ECM after erasing the DTC with GDS.
Check that system is normal after checking the DTC again.
(If the DTC is set aganin, repalce Engine ECM)
Wait for more than 1 min. with IG ON so that smart key ECM register PIN into Engine ECM automatically.

NO ▶ Perform key teaching procedure after replacing ECM and then, go to "Verification of Vehicle Repair" Procedure.

NOTICE

■ *PIN code is programmed in Smart key ECM, Transponder, ESCL, PDM and FOB.*

1. *If the Smart key ECM is not registered with PIN, key teaching process is not proceeded.*
2. *Registering PIN is available after Smart Key ECM is neutralized.*
3. *Neutralization of Engine ECM is available with GDS (Registering PIN code)*
4. *If the virgin engine ECM is installed on vehicle, Engine ECM is automatically programmed PIN code by Smart Key ECM.*
5. *Registering PIN code is only possible for virgin or neutralized status.*

■ *It is possible to acess to All of the learning procedue only with GDS.*

And, FOB key must be inserted in FOB holder in order to proceed learning procedure.

(There is only one menu for registering Smart key on the GDS that makes registering all of the component. In case of replacing each module, New registration should be done with GDS)

- *Smart Key ECM Learning*

  1. Before learning procedure for FOB Key, PDM or ESCL, Smart Key ECM should be registered PIN code first.

  2. In case of replacing Smart Key ECM, All of the keys should be newly registered again.

  3. In case that Smart Key ECM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.

  4. If the battery is discharged during neutralization or Teaching, Timer will start again from begining. Therefore, it is avoidable to wail for 1 hour.

- *PDM Learning*

  1. It is O.K for registering PDM just one time. And, it is available for PDM to neutrailze and re-teach with same PIN code.

  2. In case that Power supply is shut off to ESCL right before first FOB key is registered, Every component status is moved to right before power shut off and previous PIN is used for communication with PDM and Smart key ECM

- *ESCL Learning*

  1. It is O.K for registering ESCL just one time. And, it is available for ESCL to neutrailze and re-teach with same PIN code.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS and check "No. of Key learnt, ECM status and Smartkey ECM status
2. Selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
3. Operate the vehicle within the enable condition and monitor the DTC on the GDS.
4. Are any DTCs present ?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1696 Immobilizer-Authentication Fail

General Description

Smart key System consists of transponder, which is in the FOB key head, and Smart key ECM. Smart Key System has FOB holder, which includes antenna coil, to communicate with transponder for immobilizer communication.

Smart Key ECM communicates with PDM via serial communication line so that Smart Key ECM sends signal to PDM.

FOB is requested authentication from Smart Key ECM by using the LF antenna with LF communication. And then, FOB sends authentication signal through the SRx with RF communication.

With this procedure, Smart Key ECM sends authentication signal to Engine ECM in order to allow the engine start. Finally, ESCL control module release steering lock with authentication.

Authentication for immobilizer is classified two different way. one is pre- authentication and the other is general authentication.

Regardless of success or failure, Pre-authentication makes Immoblizer lamp remains OFF. However, General authentication makes Immobilizer lamp is ON for 30 seconds If authentication is successful. However, if authentication is failed, Immobilizer lamp is OFF for 10 seconds.

■ Condition for Pre-authentication.

1. OFF and Driver door is open when FOB is in passenger compartment

(Seek every 3 seconds for 30 seconds.)

2. OFF and Driver door is close when FOB is in passenger compartment

3. FOB is inserted in FOB Holder

4. Pressing Brake padel when FOB is in passenger compartment

■ Condition for general authentication

1. Pressing start butteon when FOB is in the passenger compartment

DTC Description

During the Immobilizer authentication, If there is any wrong VIN(Vehicle Identification Number) or MIN(Model Identification Number) signal on the communication message, ECM sets DTC P1696.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
Enable Conditions	• IG ON	• Faulty Smart key ECM
Detecting time	• 1 time	
Threshold value	• Wrong VIN(Vehicle Identification Number), MIN(Model Identification Number) - No DTC P1676 but wrong VIN or MIN	

Diagnostic Circuit Diagram

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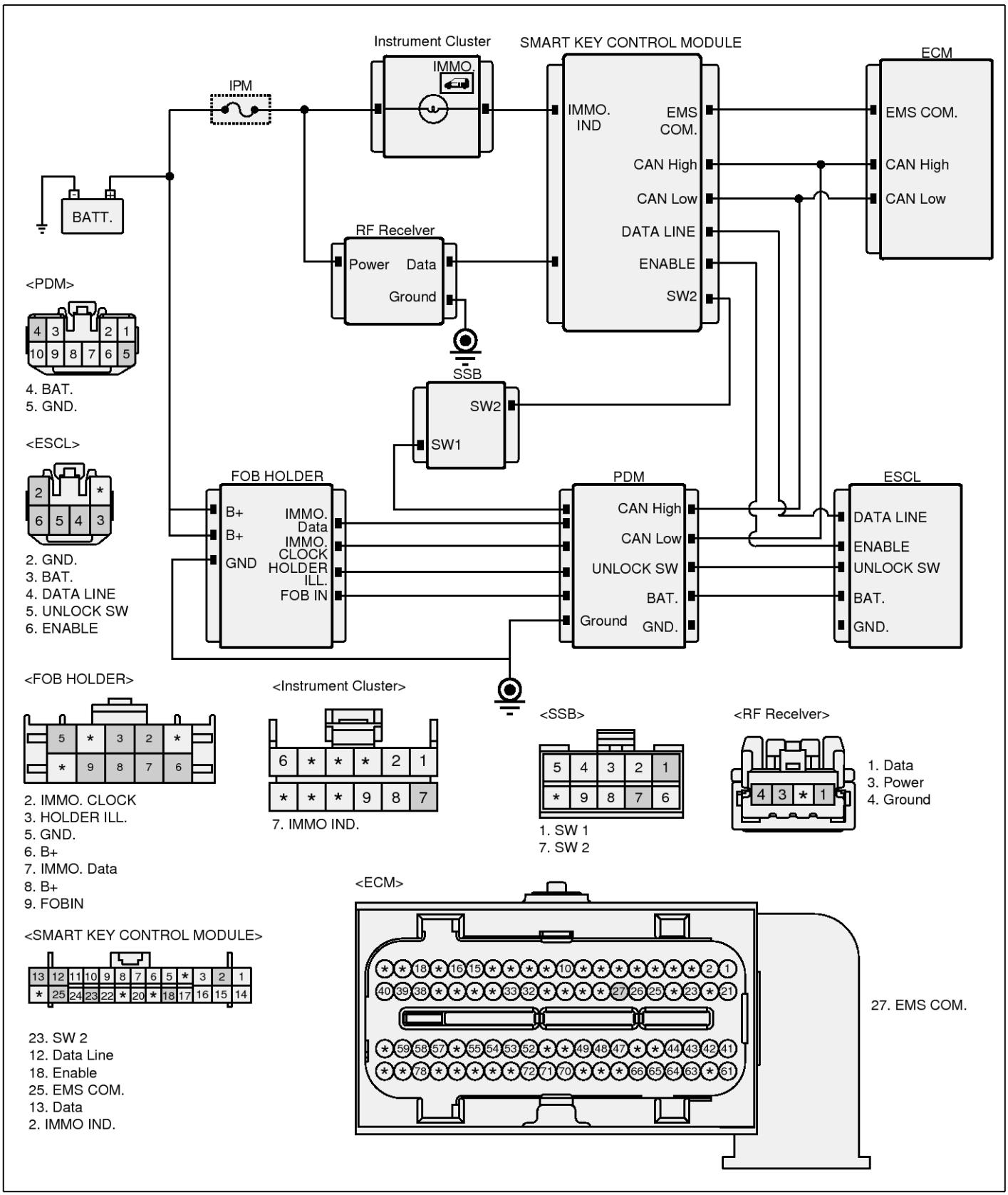
https://autolibrary.ir



SHMBE9B03L

Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF".
2. Erase DTC after connecting GDS.
3. Check Smart Key ECM status parameter if DTC is

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retrieved.

Fig.1

SHMBE9B01L

Fig.1) It shows that 2(two) FOB key is registered, Smart Key ECM(integerated in IPM) is learnt status.

4. Is the smart Key ECM learnt ?

YES ▶ Fault is intermittent caused by poor contact in Smart key ECM and/or ECM's connector or was repaired and Smart key ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Component Inspection" procedure.

Component Inspection

■ Check Smart Key ECM insepction

1. IG KEY "ON" & Engine "OFF"
2. Neutralize smart key ECM with GDS.
3. Perform key teaching procedure for smart key ECM with GDS.

⚠CAUTION

Pin code must be prepared to Neutralize Smart Key ECM and to perform key teaching procedure.

4. Is the neutralization of Smart Key ECM, Engine ECM and key teaching normal ?

YES ▶ Fault is intermittent caused by poor contact in Smart Key ECM and/or ECM's connector or was repaired and Smart key ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good Smart Key ECM and check for proper operation.
▶ If the problem is corrected, replace Smart Key ECM and then go to "Verification of Vehicle Repair" procedure.

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NOTICE

■ *PIN code is programmed in Smart key ECM, Transponder, ESCL, PDM and FOB.*

1. *If the Smart key ECM is not registered with PIN, key teaching process is not proceeded.*
2. *Registering PIN is available after Smart Key ECM is neutralized.*
3. *Neutralization of Engine ECM is available with GDS (Registering PIN code)*
4. *If the virgin engine ECM is installed on vehicle, Engine ECM is automatically programmed PIN code by Smart Key ECM.*
5. *Registering PIN code is only possible for virgin or neutralized status.*

■ *It is possible to acess to All of the learning procedue only with GDS.*

And, FOB key must be inserted in FOB holder in order to proceed learning procedure.

(There is only one menu for registering Smart key on the GDS that makes registering all of the component. In case of replacing each module, New registration should be done with GDS)

- *Smart Key ECM Learning*

  1. Before learning procedure for FOB Key, PDM or ESCL, Smart Key ECM should be registered PIN code first.

  2. In case of replacing Smart Key ECM, All of the keys should be newly registered again.

  3. In case that Smart Key ECM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.

  4. If the battery is discharged during neutralization or Teaching, Timer will start again from begining. Therefore, it is avoidable to wail for 1 hour.

- *PDM Learning*

  1. It is O.K for registering PDM just one time. And, it is available for PDM to neutrailze and re-teach with same PIN code.

  2. In case that Power supply is shut off to ESCL right before first FOB key is registered, Every component status is moved to right before power shut off and previous PIN is used for communication with PDM and Smart key ECM

- *ESCL Learning*

  1. It is O.K for registering ESCL just one time. And, it is available for ESCL to neutrailze and re-teach with same PIN code.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS and check "No. of Key learnt, ECM status and Smartkey ECM status
2. Selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
3. Operate the vehicle within the enable condition and monitor the DTC on the GDS.
4. Are any DTCs present ?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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P1699 Immobilizer-Twice Overtrial

General Description

This is special function that engine can be started for moving to an area where the key learning is processed with twice IG ON. This function is only performed in condtion that Engine EMS, Smart key ECM (integrated in IPM), Transponder, PDM and ESCL are all virgin status.

Engine can be started by the sequence.

■ Ignition ON with no cranking , Ignition OFF, Ignition ON with cranking within a time interval

■ The following timing conditions have to be fulfilled for successful start :

- Engine EMS, Smart key ECM (integrated in IPM), Transponder, PDM and ESCL are all virgin status

1. First Ignition ON more than 0.5 seconds and less than 1.5 seconds.
2. Ignition OFF time is limited by the minimum of 0.2 seconds and the maximum of 1.5 seconds.
3. Ignition ON

The number of engine starts by "twice ignition on" is limited. The maximum value is 32 times regardless of cranking.

DTC Description

DTC P1699 is set if twice ignition ON exceeds maximum limit over 32 times.

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
Enable Conditions	• IG ON	• Exceed the maximum limit of Twice IGN ON
Detecting time	• Exceed the maximum limit of Twice IGN ON (Over 32 times)	

Diagnostic Circuit Diagram

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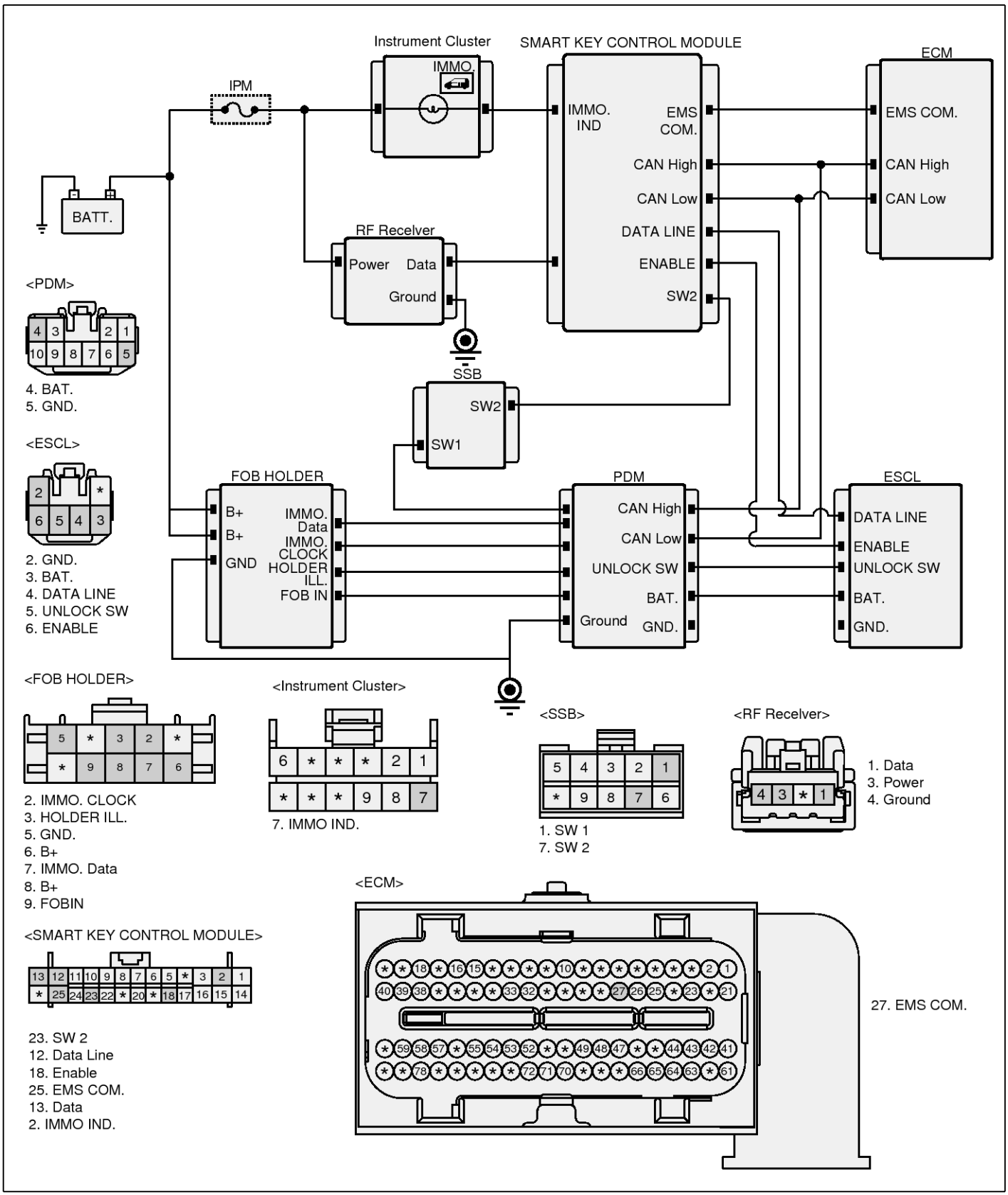

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Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF"
2. Connect GDS and select immobilizer system (Not PIC or Smart key System)

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3. Only just Check Engine status parameter.

NOTICE

This menu is only for checking the ECM status. Just ignore the Rest of others parameter.(This is only way to check ECM status although selected menu system is different)

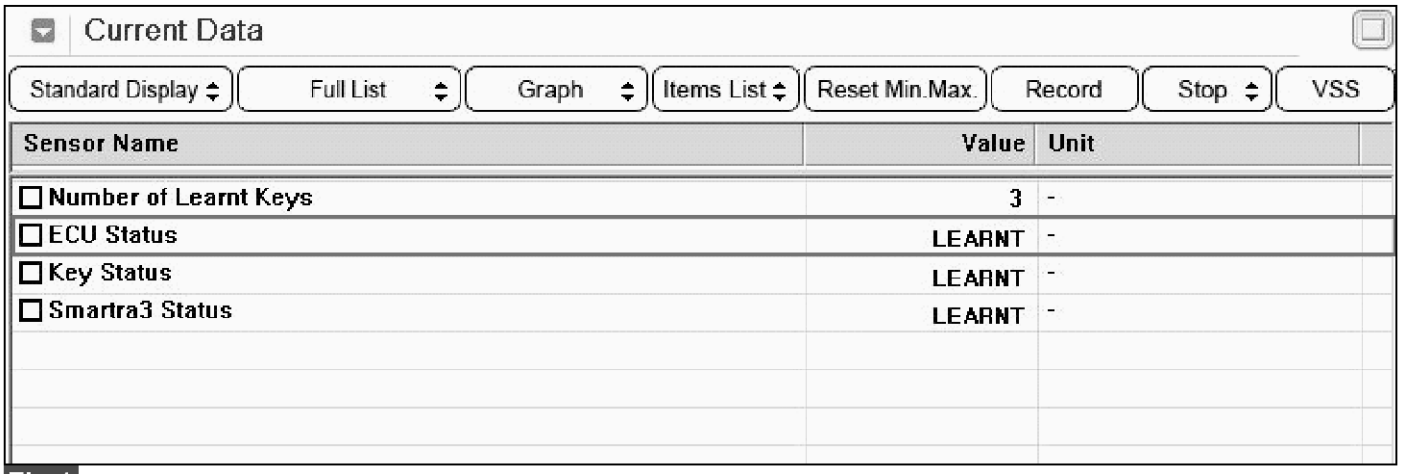

Fig.1

SHMBE9B02L

Fig 1) It shows that ECU is learnt status(Just ignore rest of others parameter)

4. Is the ECM status displayed "Lock" ?

YES ▶ Wait for 1 hour until ECM status is unlock with IG ON.
After ECM status is unlock, perform the key teaching procedure. Finally, go to 'Verification of Vehicle Repair"procedure.

NO ▶ Fault is intermittent caused by poor contact in Smart Key ECM and/or ECM's connector or was repaired and Smart key ECM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NOTICE

■ *PIN code is programmed in Smart key ECM, Transponder, ESCL, PDM and FOB.*

1. *If the Smart key ECM is not registered with PIN, key teaching process is not proceeded.*
2. *Registering PIN is available after Smart Key ECM is neutralized.*
3. *Neutralization of Engine ECM is available with GDS (Registering PIN code)*
4. *If the virgin engine ECM is installed on vehicle, Engine ECM is automatically programmed PIN code by Smart Key ECM.*
5. *Registering PIN code is only possible for virgin or neutralized status.*

■ *It is possible to acess to All of the learning procedue only with GDS.*

And, FOB key must be inserted in FOB holder in order to proceed learning procedure.

(There is only one menu for registering Smart key on the GDS that makes registering all of the component. In case of replacing each module, New registration should be done with GDS)

- *Smart Key ECM Learning*

  1. Before learning procedure for FOB Key, PDM or ESCL, Smart Key ECM should be registered PIN code first.

  2. In case of replacing Smart Key ECM, All of the keys should be newly registered again.

  3. In case that Smart Key ECM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.

  4. If the battery is discharged during neutralization or Teaching, Timer will start again from begining. Therefore, it is avoidable to wail for 1 hour.

- *PDM Learning*

  1. It is O.K for registering PDM just one time.

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And, it is available for PDM to neutrailze and re-teach with same PIN code.

2. In case that Power supply is shut off to ESCL right before first FOB key is registered, Every component status is moved to right before power shut off and previous PIN is used for communication with PDM and Smart key ECM

- *ESCL Learning*

  1. It is O.K for registering ESCL just one time. And, it is available for ESCL to neutrailze and re-teach with same PIN code.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect GDS and check "No. of Key learnt, ECM status and Smartkey ECM status
2. Selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC
3. Operate the vehicle within the enable condition and monitor the DTC on the GDS.
4. Are any DTCs present ?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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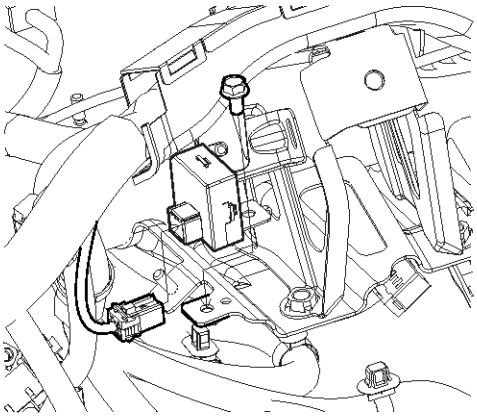
Immobilizer Control Unit

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.

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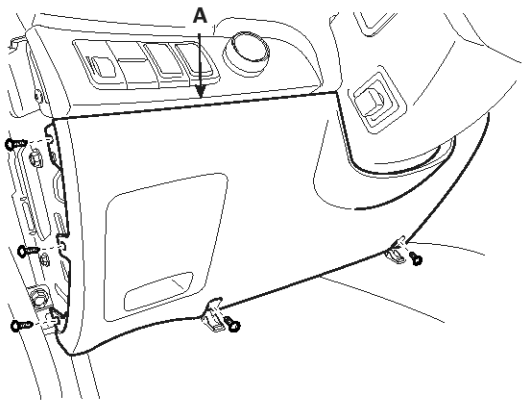
Antenna Coil

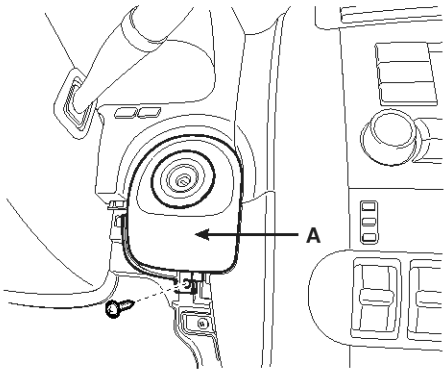
Removal

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



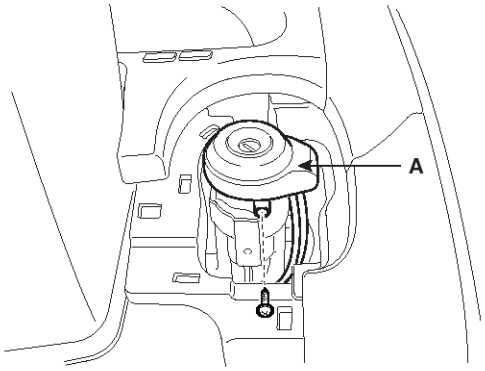
SHMBE8444D

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.

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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)

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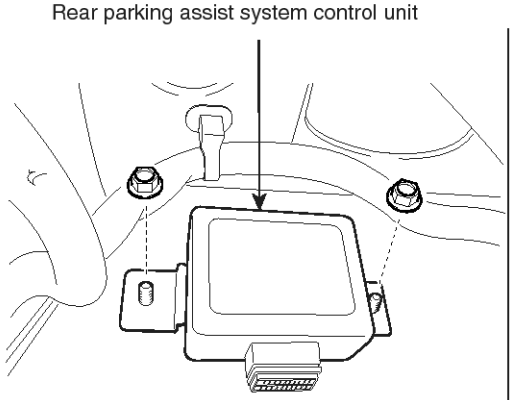
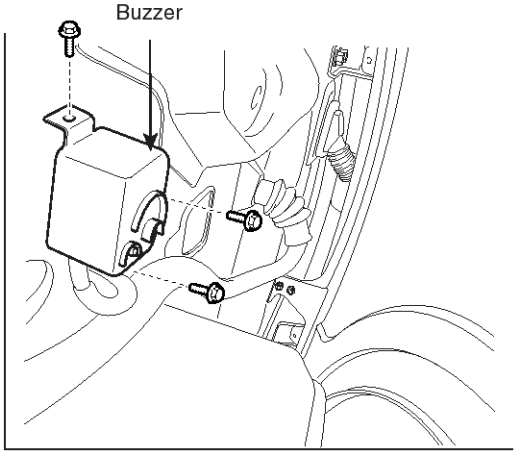
Component Location

Rear parking assist system control unit



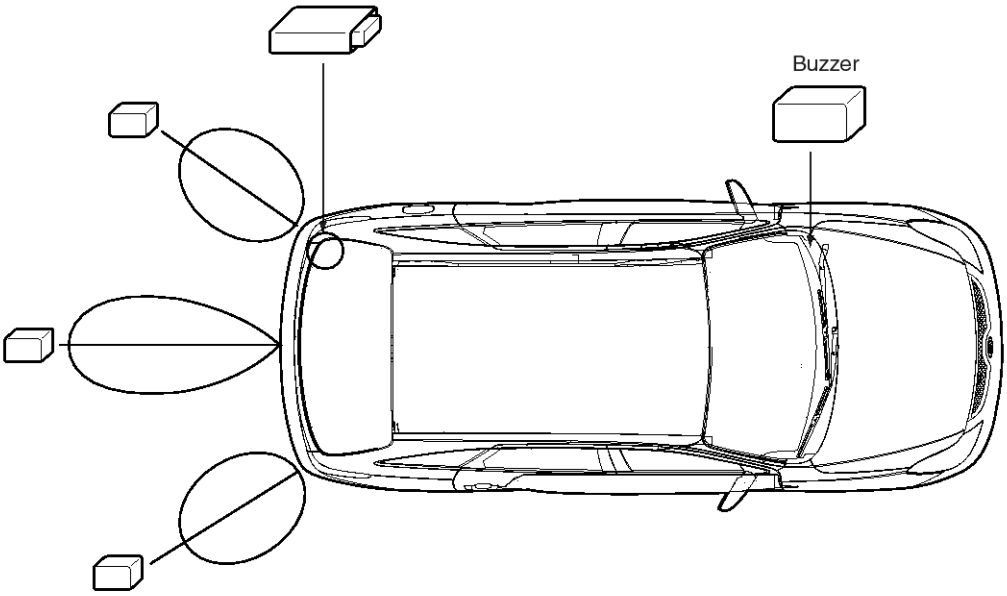
Left rear quater panel

Buzzer



Rear parking assist system control unit

Buzzer



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

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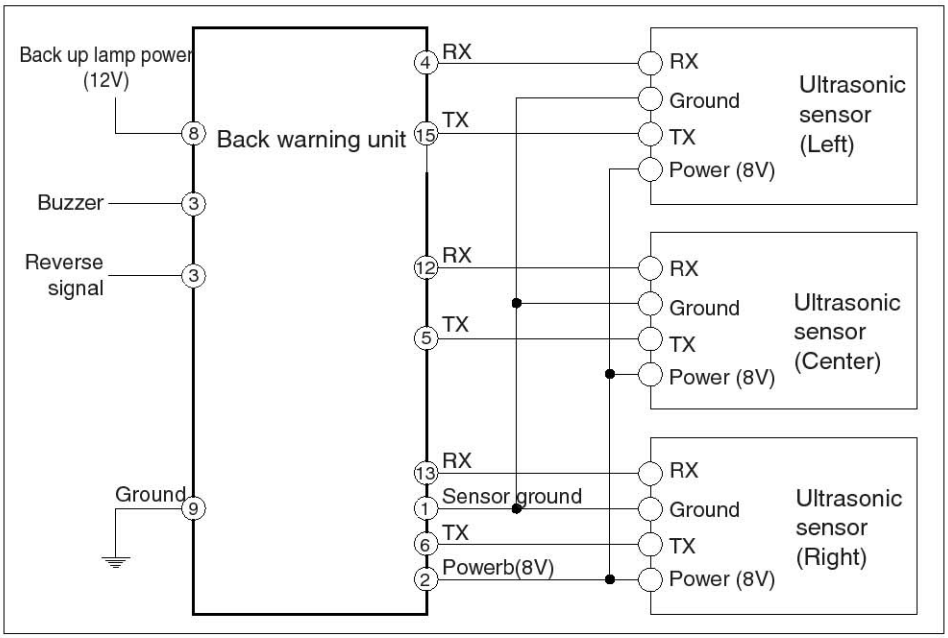
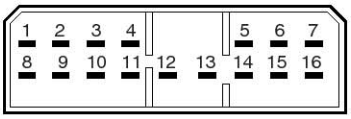
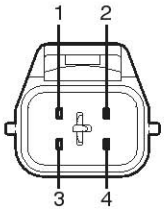
Circuit Diagram





(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).

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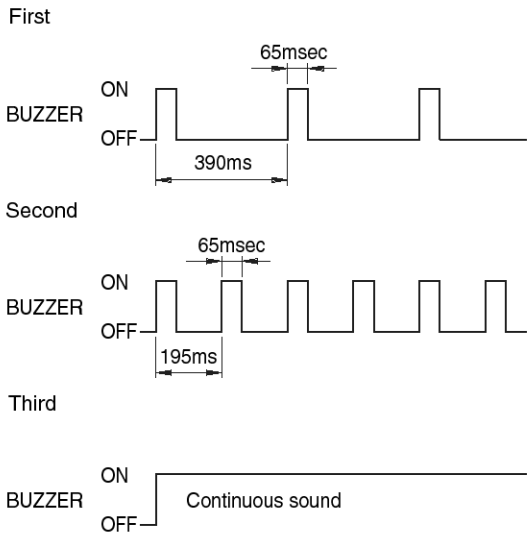
Alarm Range

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

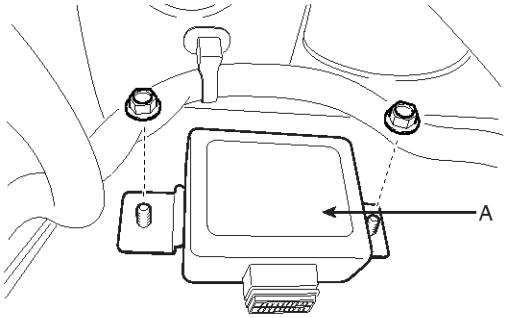
NOTICE

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.

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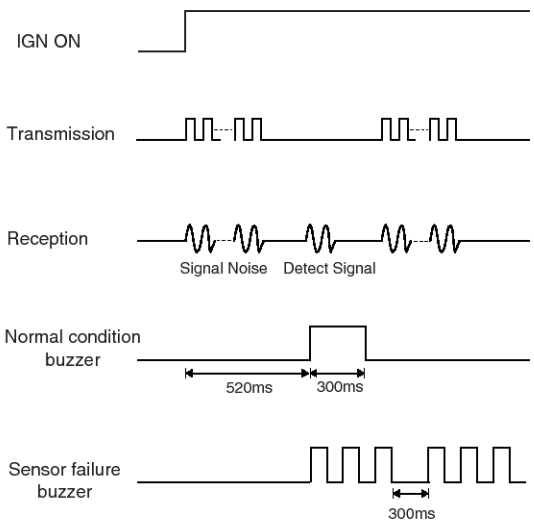
Diagnosis

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.



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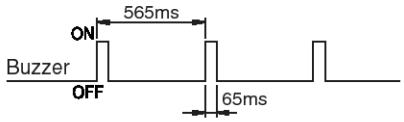
2. DIAGNOSIS MODE

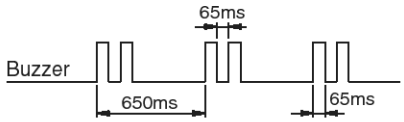
   Switch on diagnosis mode upon system failure.

   In case of system failure, then it indicates the failed point as follows.

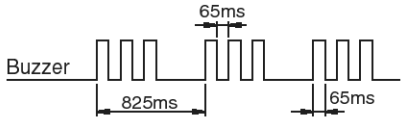
(1) Left side sensor failure buzzer



(2) Center sensor failure buzzer



(3) Right side sensor failure buzzer



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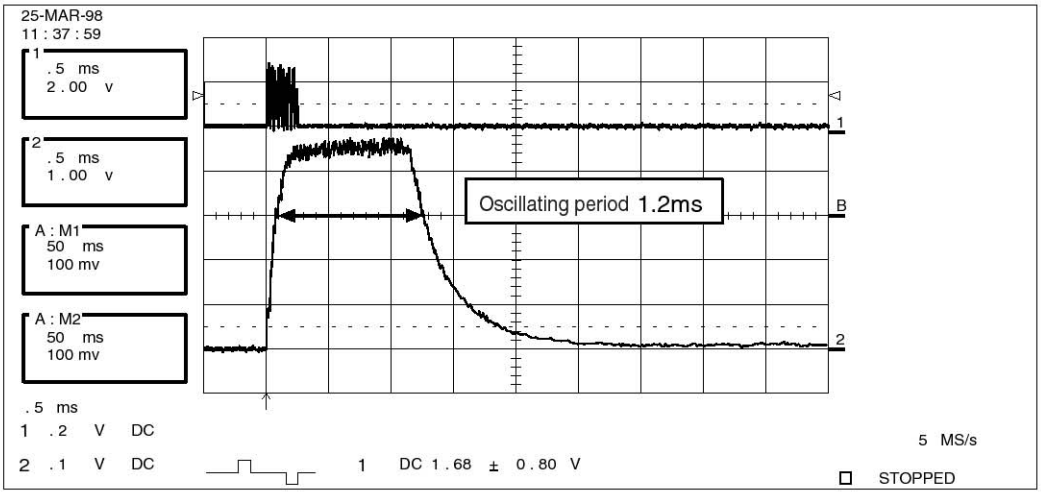
Sensor Connection Checking

Transmit ultrasonic wave to the sensors, boost input signal, and detect wave.

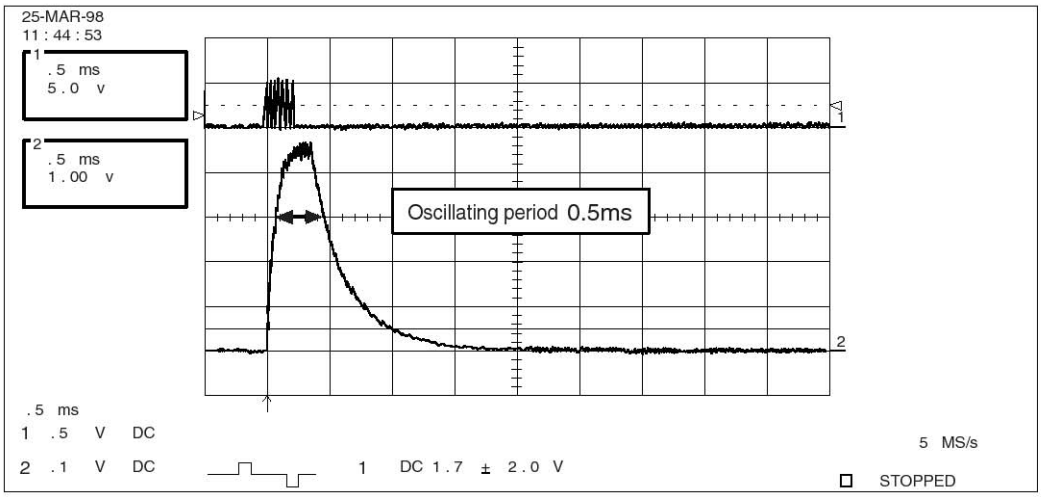
Waveform will be found, oscillating for a certain period of time.

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

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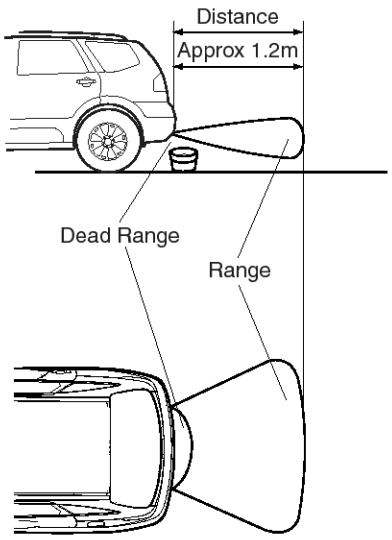
Warning

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)



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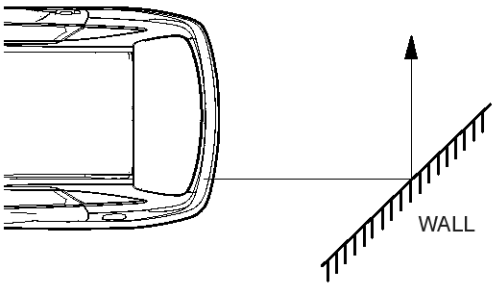
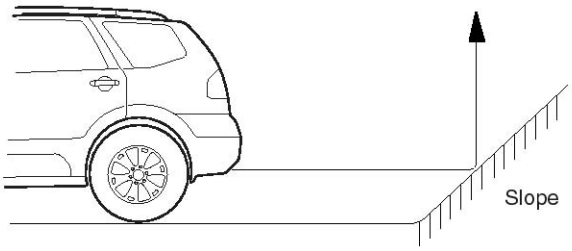
4. Reversing toward the sloped walls.



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.

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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.

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Ultrasonic Sensor

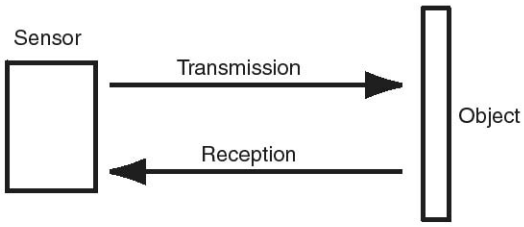
Operation

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

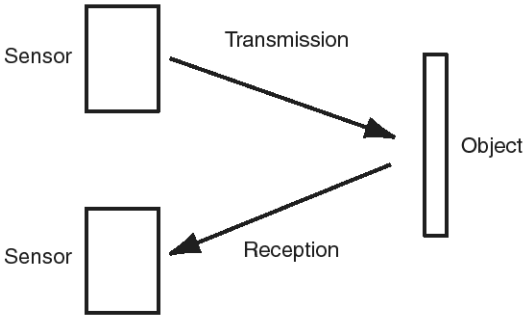
Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

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.

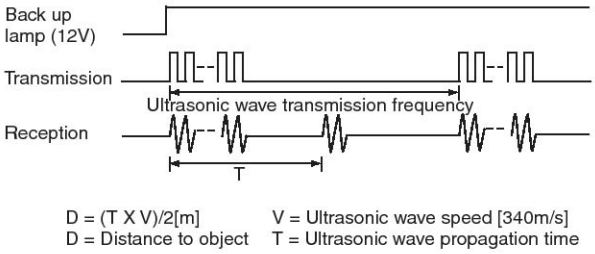
The propagation speed formula of ultrasonic wave in air is following :

$v=331.5 + 0.6t$ (m/s)

v=ultrasonic wave propagation speed

t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



D = (T X V)/2[m]
D = Distance to object
V = Ultrasonic wave speed [340m/s]
T = Ultrasonic wave propagation time

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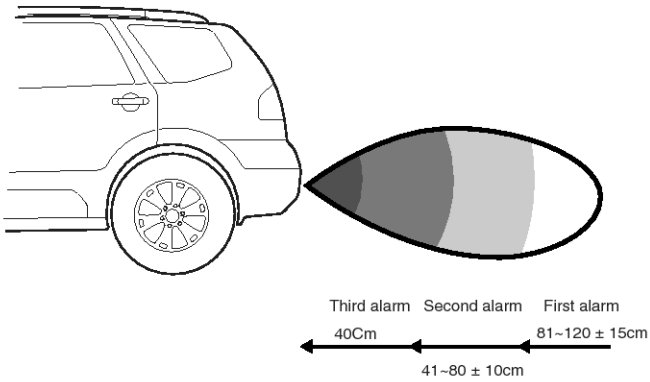
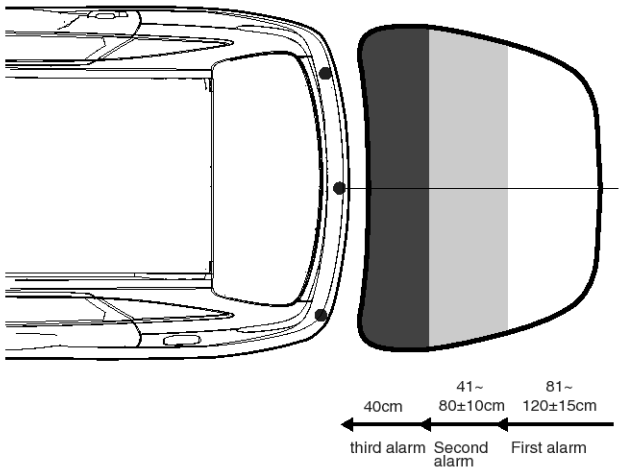
Sensor detection range

[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.

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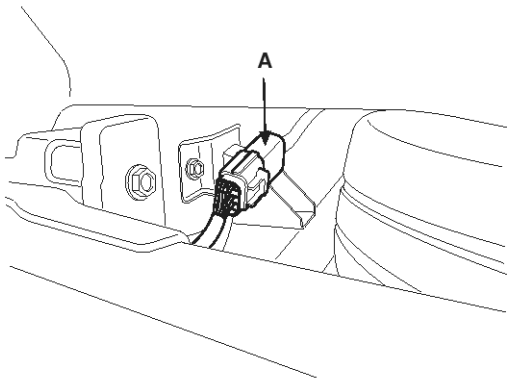
NOTICE

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.*

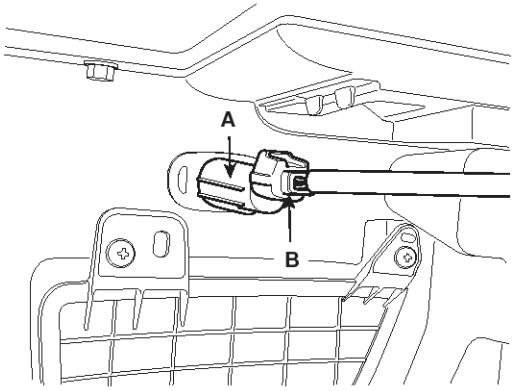
Removal

1. Remove the rear bumper (Refer to the Body group - "Rear bumper")
2. Disconnect the wiring harness connector (A) from the rear bumper.



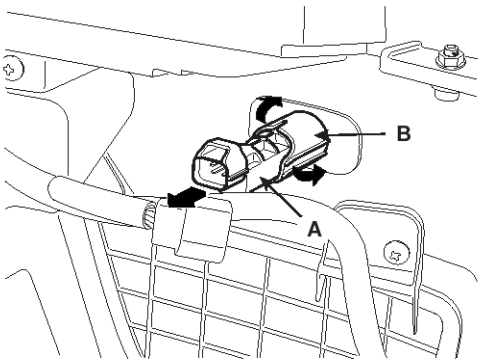
SHMBE8401D

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.

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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)

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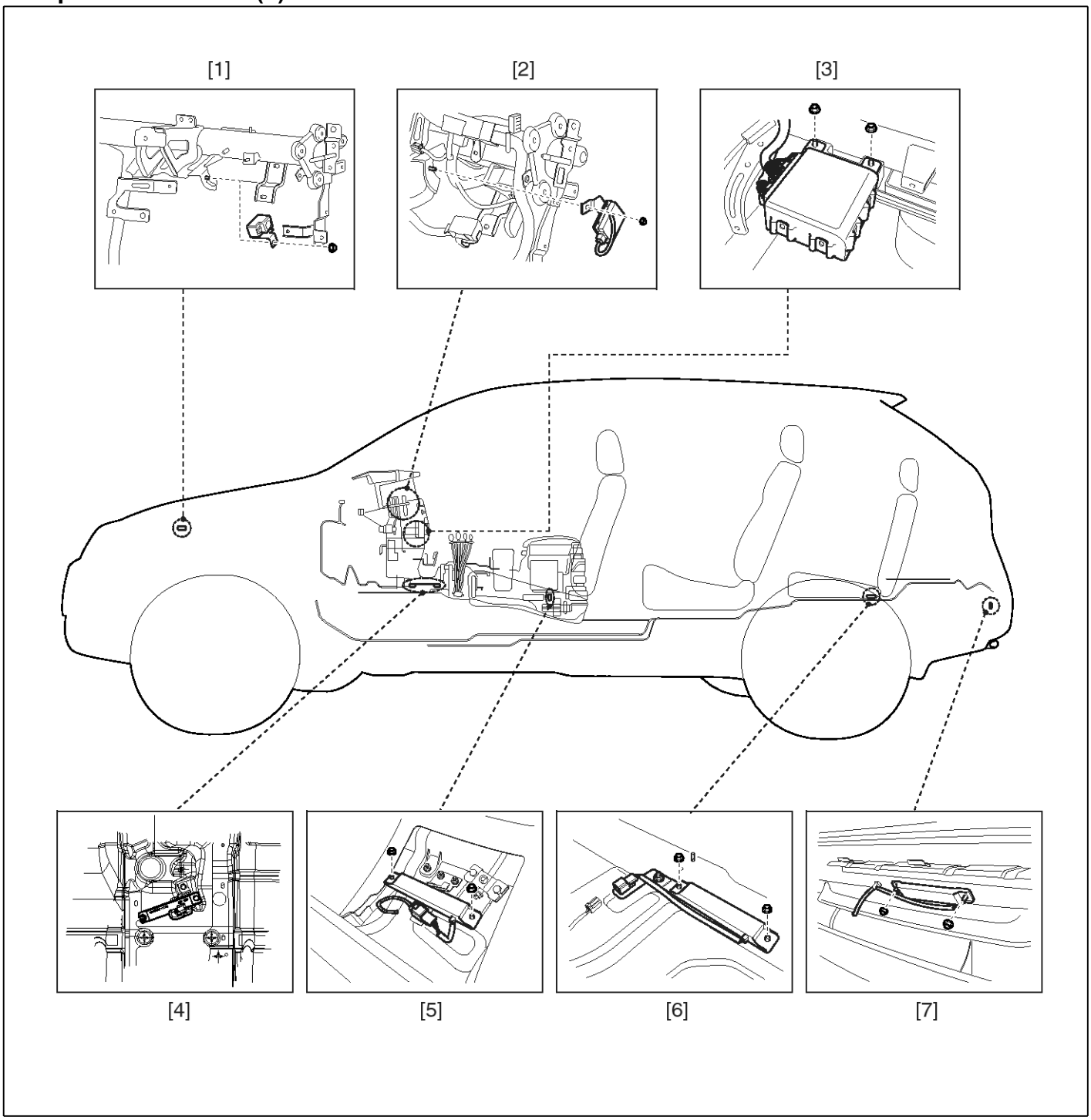
Component Location (1)



SHMBE8408D

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

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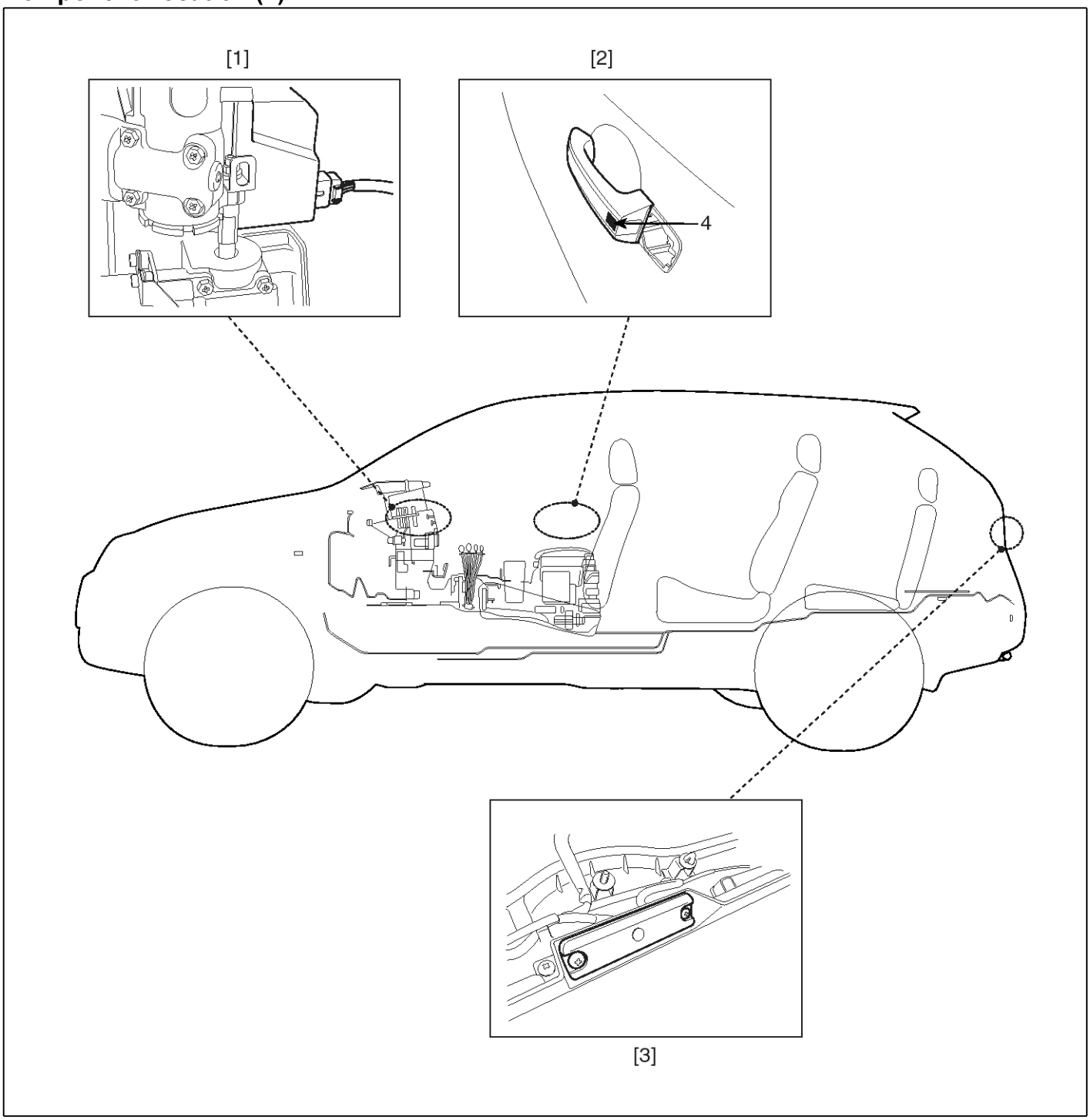
Component Location (2)



SHMBE8409D

1. Electronic Steering Column Lock(ESCL)
2. Door outside handle
3. Tailgate switch
4. Door outside handle button

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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.

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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

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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

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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

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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

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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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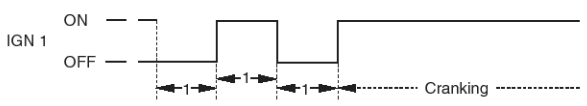
Starting After Replacing (virgin Start)

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.



SHMBE9016L

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

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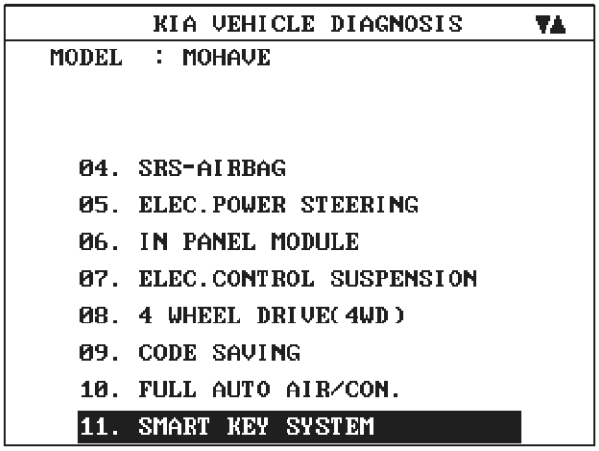
Switch Diagnosis

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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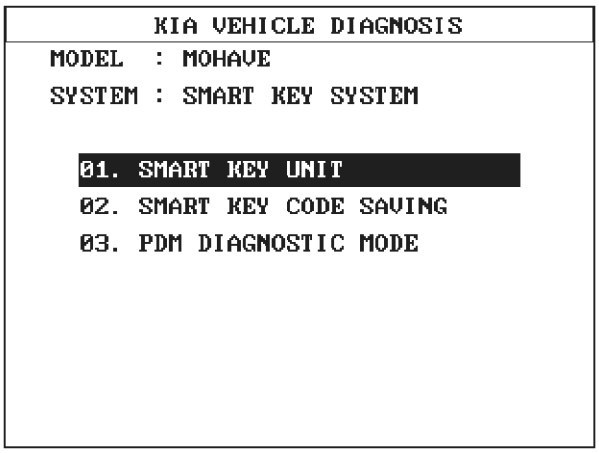
3. Select the "SMART KEY UNIT".



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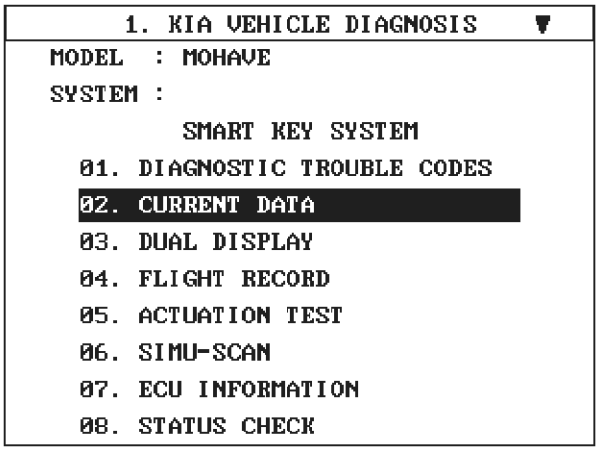
4. After IG ON, select the "Current data".



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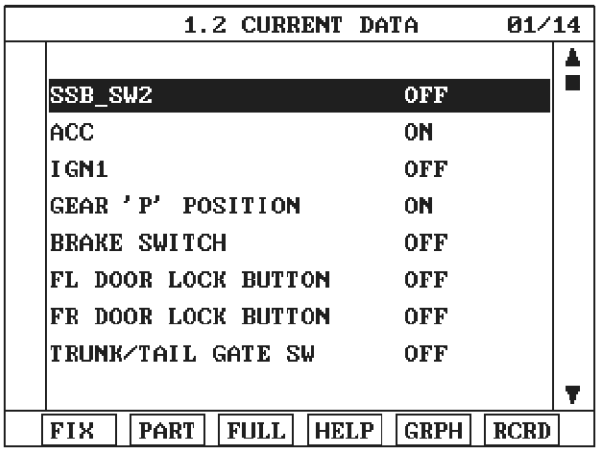
5. You can see the situation of each switch on scanner after connecting the "current data" process.



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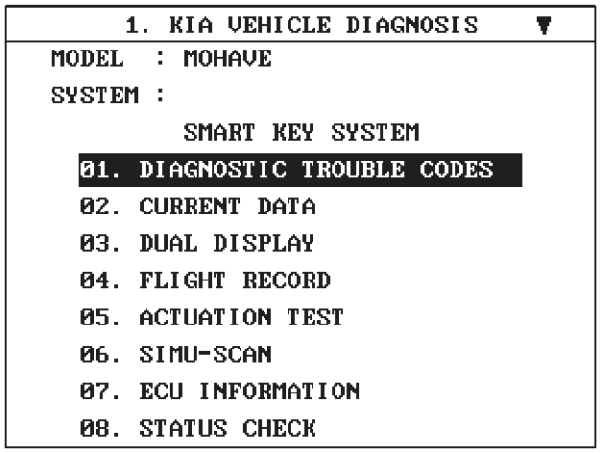
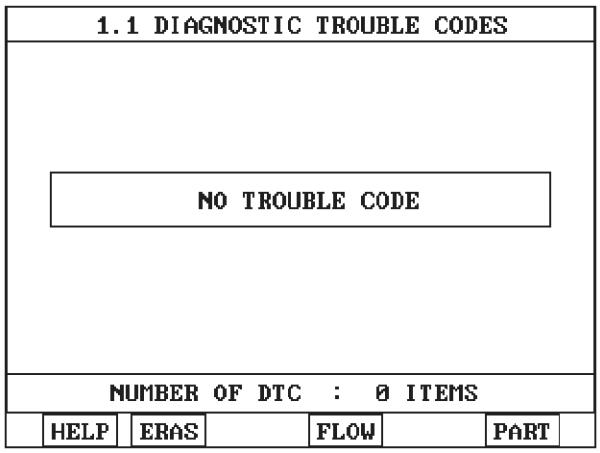
Communication Diagnosis With Scan Tool (Self Diagnosis)

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".



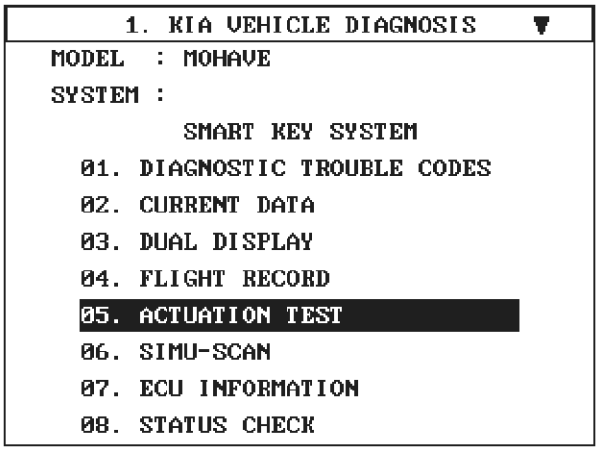
SHMBE9021L



SHMBE9022L

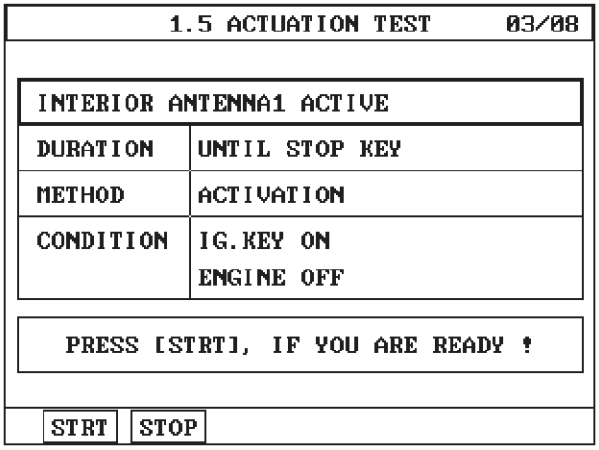
Antenna Actuation Diagnosis

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".



SHMBE9023L

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



SHMBE9024L

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

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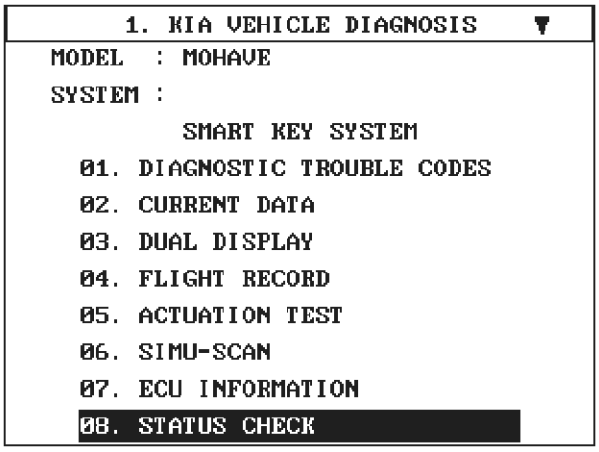
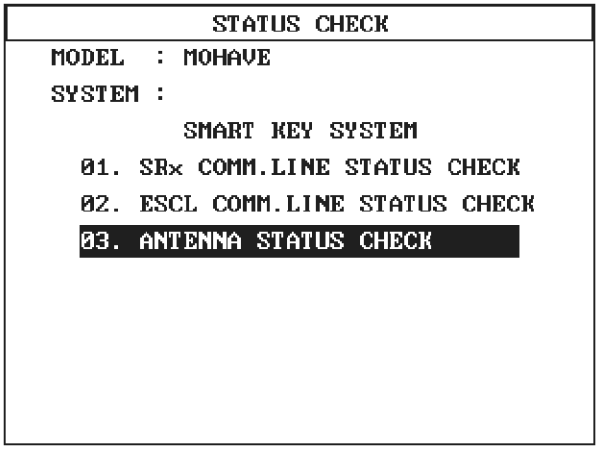
Antenna Status Check

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. Select the "STATUS CHECK".



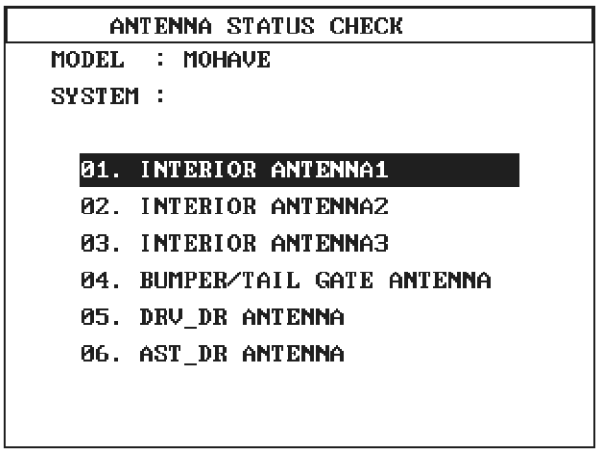
SHMBE9129L

3. After IG ON, select the "ANTENNA STATUS CHECK".

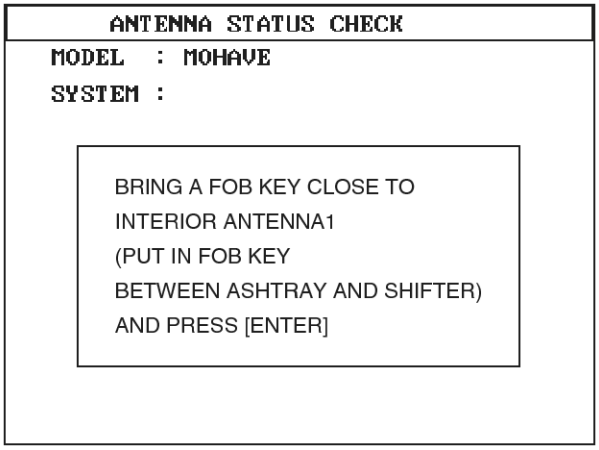


SHMBE9025L

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



SHMBE9026L



SHMBE9027L

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

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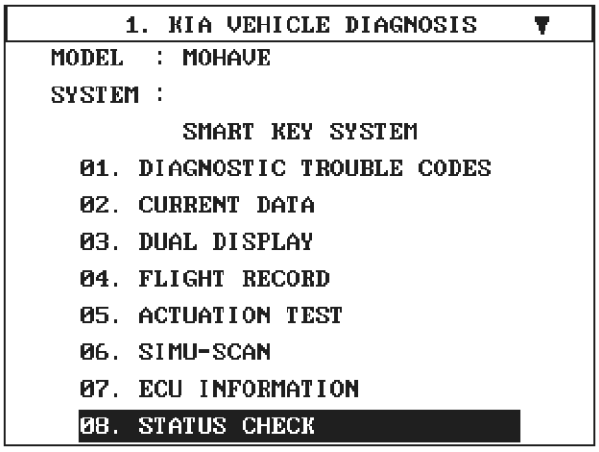
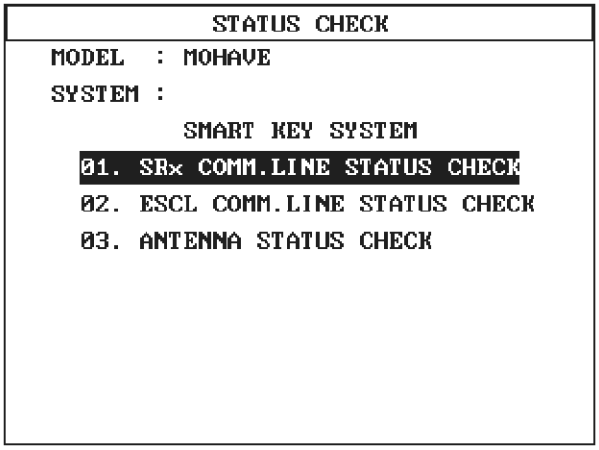
Serial Communication Status Check

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. Select the "STATUS CHECK".



SHMBE9129L

3. After IG ON, select the "SRx COMM. LINE STATUS CHECK".

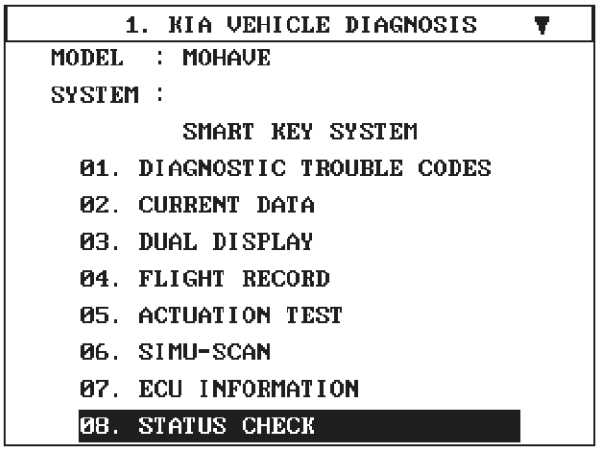


SHMBE9029L

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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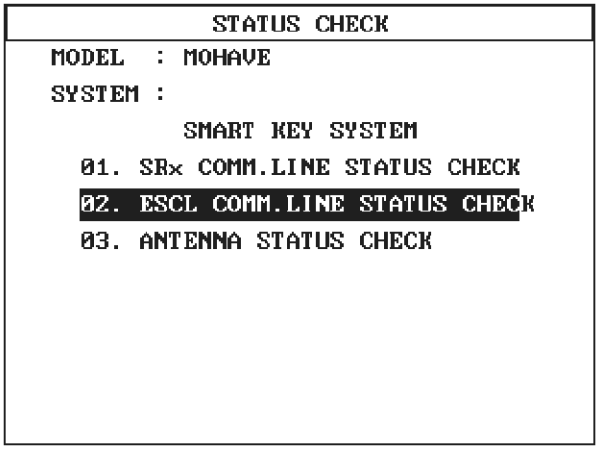
3. After IG ON, select the "ESCL COMM. LINE STATUS CHECK".



SHMBE9130L

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

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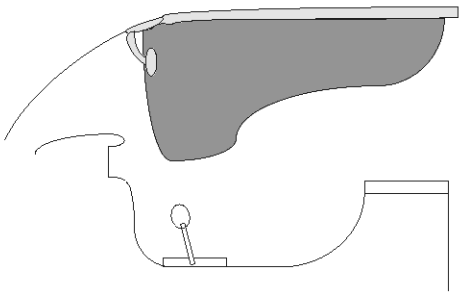
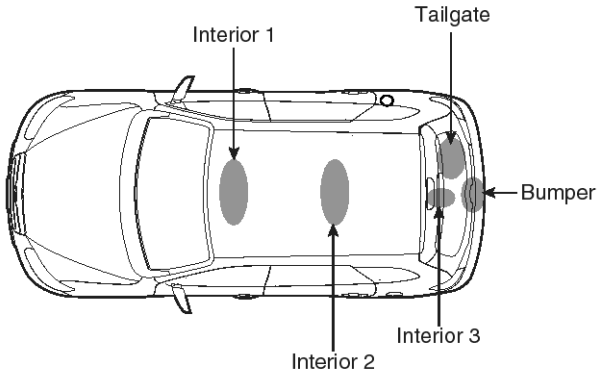
Interior Antenna Actuation Check

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



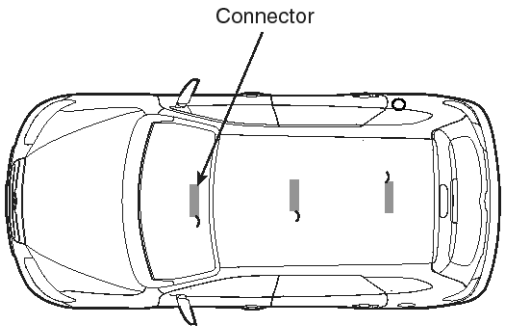
KTCF113A

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.



SHMBE9030L

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



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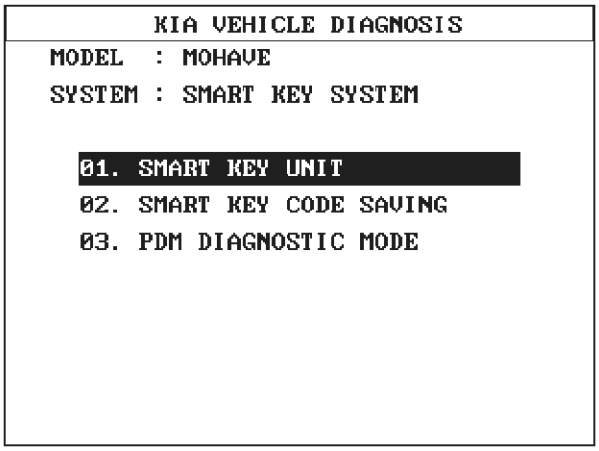
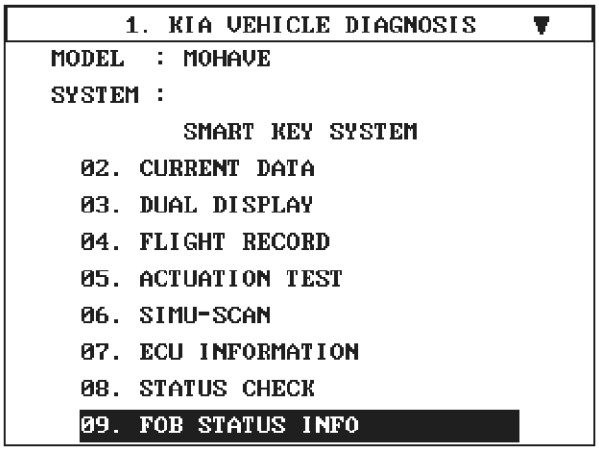
FOB Status Check

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



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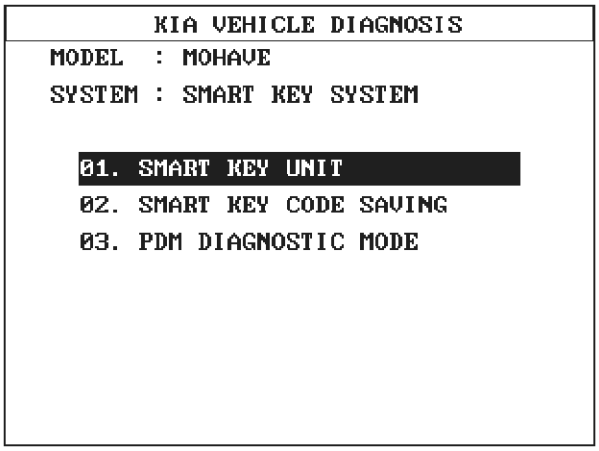
Smart Key Status Check

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".



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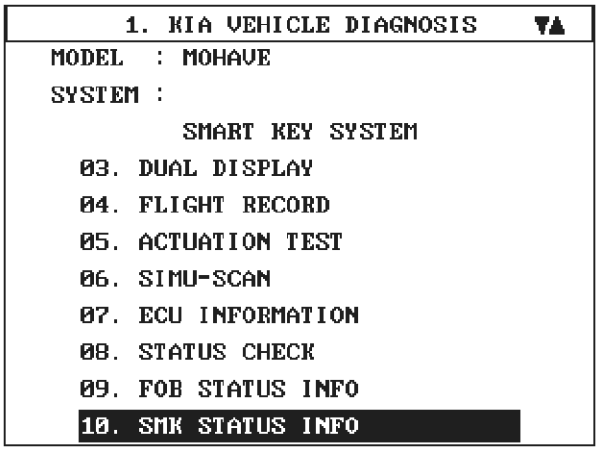

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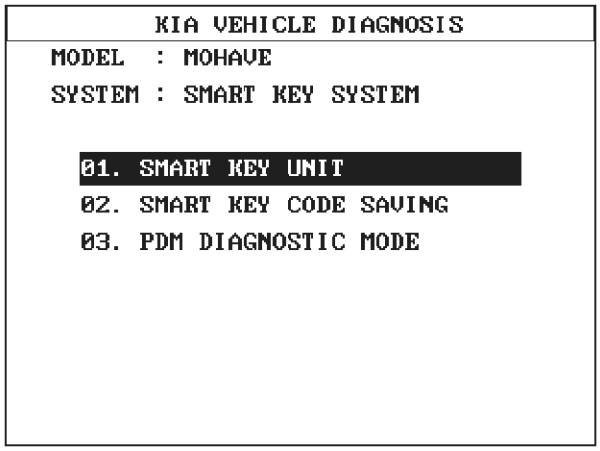
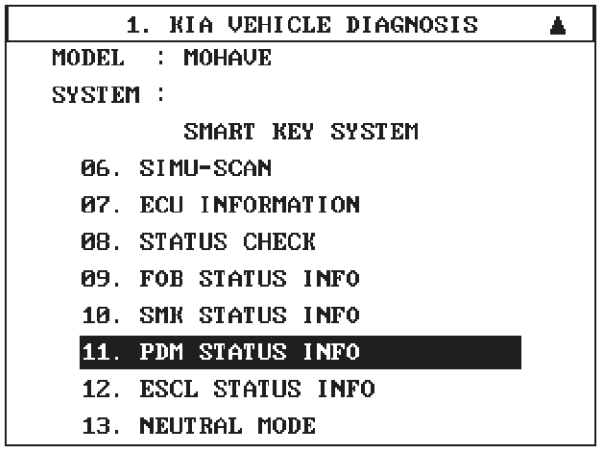
PDM Status Check

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



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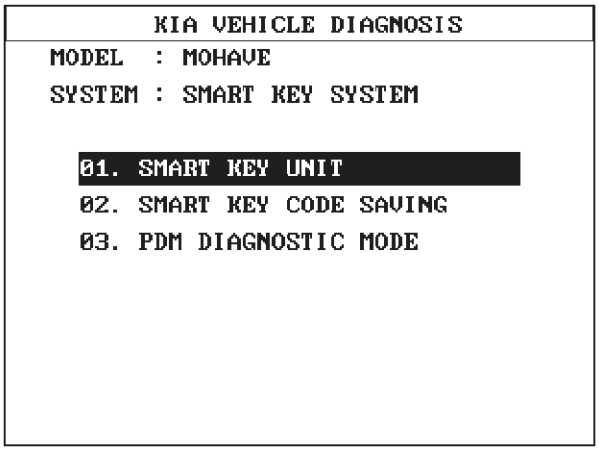
ESCL Status Check

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".



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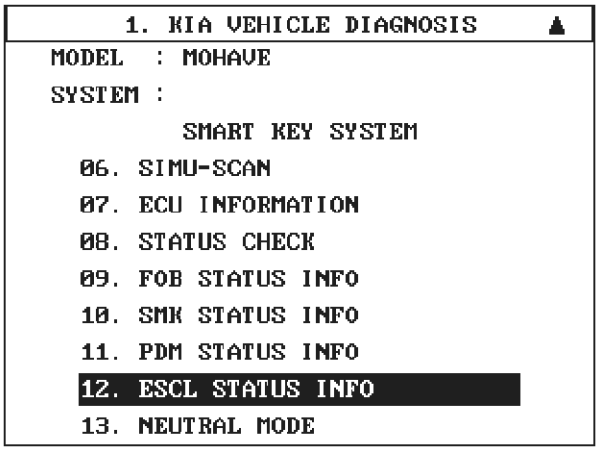

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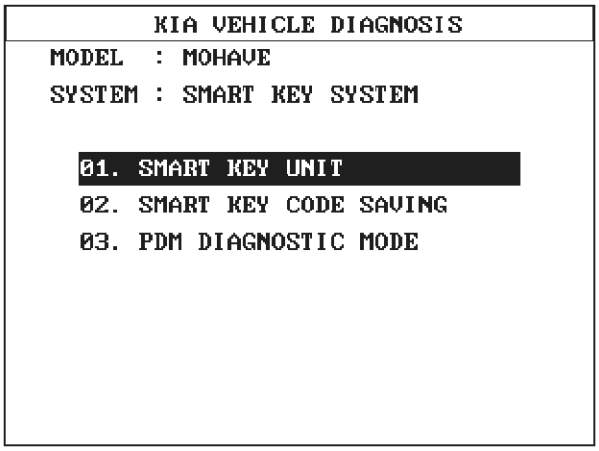
Neutralization Status Check

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".



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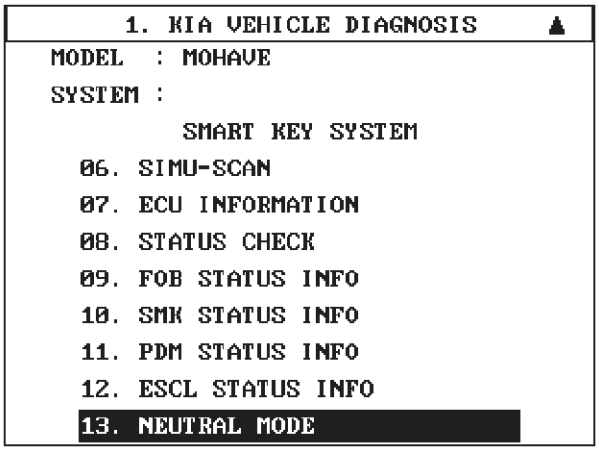

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Input Switch List

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

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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

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B1602 CAN BUS Physical Error

General Description

CAN Communication is a circuit, consists of CAN LOW and CAN HIGH, in order to communicate among control units.

Control Modules are respectively communicating via CAN line in order to control Body Electrical.

DTC Description

DTC B1602 is set if Smart key module detects that CAN HIGH or CAN LOW is short to battery, short to ground, open and short between CAN High and CAN Low each other.

CAN communication is normal if one of CAN HIGH or LOW is open, short to battery or ground.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN Signal Check	• Poor Connection • Power source to Smart Key module • Short to battery in CAN communication • Short to ground in CAN communication • Short between CAN high and CAN low each other • Faulty Smart Key module • Faulty each modules
Enable Conditions	• IG ON	
Threshold value	• CAN communication error for 2 sec.	
Failsafe	• Lamp OFF	

Diagnostic Circuit Diagram

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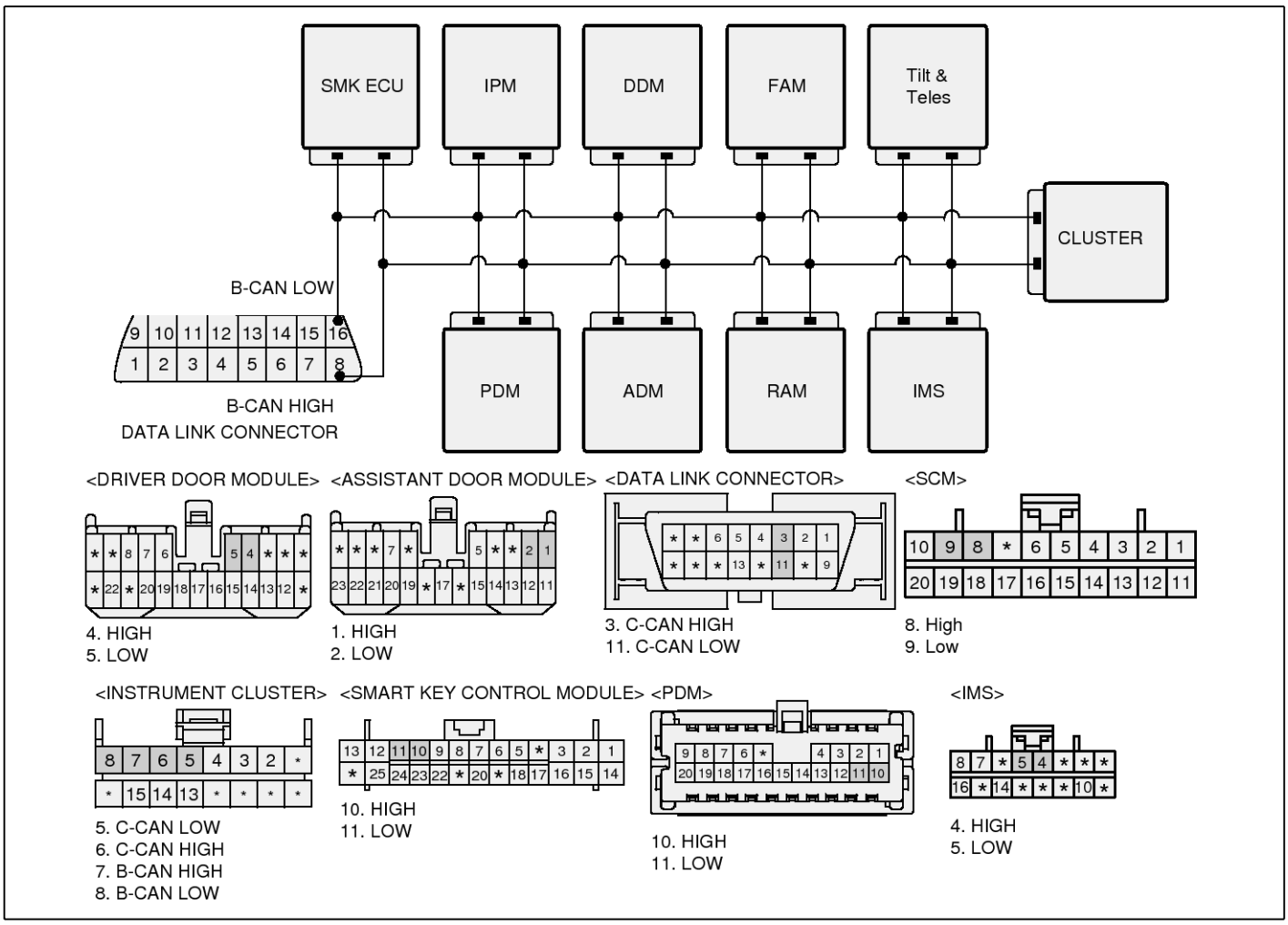

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Signal Waveform & Data

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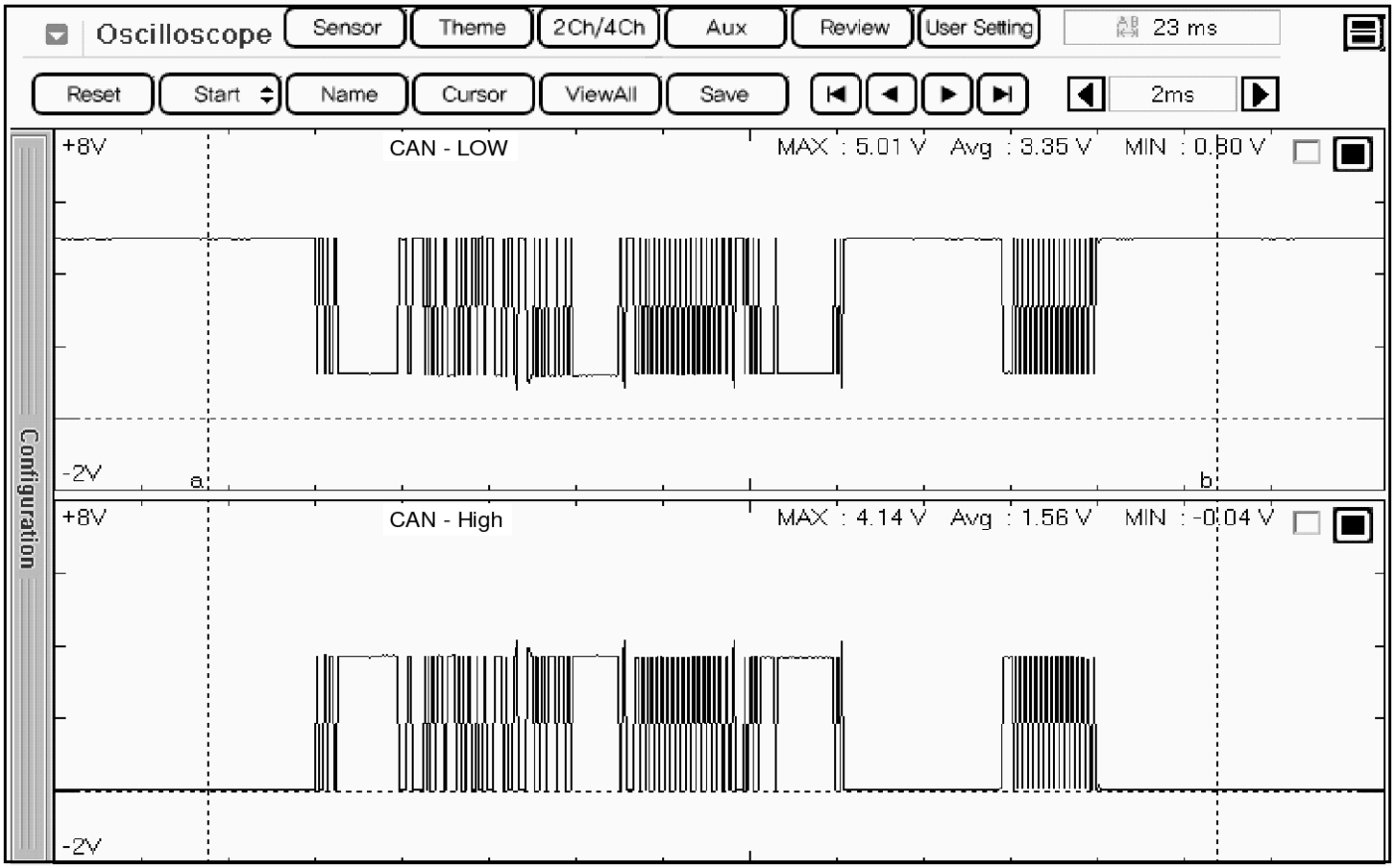

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Monitor Scantool data

■ Check DTC

1. Check DTC with scantool.
2. Check DTC related CAN communication is set on smart key module and every modules.
3. If there is DTC related Module Check the DTC according to troubleshooting guide.
4. Repair and erase the DTC with Scantool.
5. Is the DTC erased ?

YES ▶ Check poor connection between harness connector and SMARTKEY Module or ECM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Check CAN communication Line" procedure.

CAN communication Line Inspection

■ Check CAN communication

1. Connect all of control module connector.
2. IG KEY ON.
3. Make CAN communication is wake up status (Ex. . ON/OFF Door SW)
4. Measure signal waveform of B-CAN-HIGH terminal of Diagnostic connector and chassis ground.
5. Measure signal waveform of B-CAN-LOW terminal of Diagnostic connector and chassis ground.

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Specification : Refer to Signal waveform and Data

6. Is the measrured signal waveform normal ?

YES ▶ Check poor connection between harness connector and SMK Module or ECM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.
▶ Disconnect SMK ECU, IPM, DDM, FAM, Tilt ECU, PDM, ADM, RAM and IMS one by one and then, check that DTC is erased with scantool.
▶ Substitute with a known-good module and check for proper operation. If the problem is corrected, replace module and then go to "Verification of Vehicle Repair" procedure.

NO ▶ If the measured value is battery voltage, check short to battery in CAN line. Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure. In case that Communication is in sleep mode, 12V will be measured. Therefore, check that communication is in Wake up status.
▶ If 0V is detected, Check short to ground, short between CAN high and low each other or open in CAN high or CAN low harness. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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B1603 CAN Bus off

General Description

CAN Communication is a circuit, consists of CAN LOW and CAN HIGH, in order to communicate among control units.

Control Modules are respectively communicating via CAN line in order to control Body Electrical.

DTC Description

Smart key module sets DTC B1603 if smart key module detects short to battery, short to ground in CAN HIGH and CAN low simultaneously.

This DTC means that both CAN HIGH and CAN LOW line are error. Therefore, CAN communication is not available.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN Signal Check	• Poor Connection • Power Source to smart key module • Short to battery in CAN HIGH LOW or ground simultaneously . • Faulty smart key module
Enable Conditions	• IG ON	
Threshold value	• CAN communication Error for 2 sec.	
Failsafe	• -	

Diagnostic Circuit Diagram

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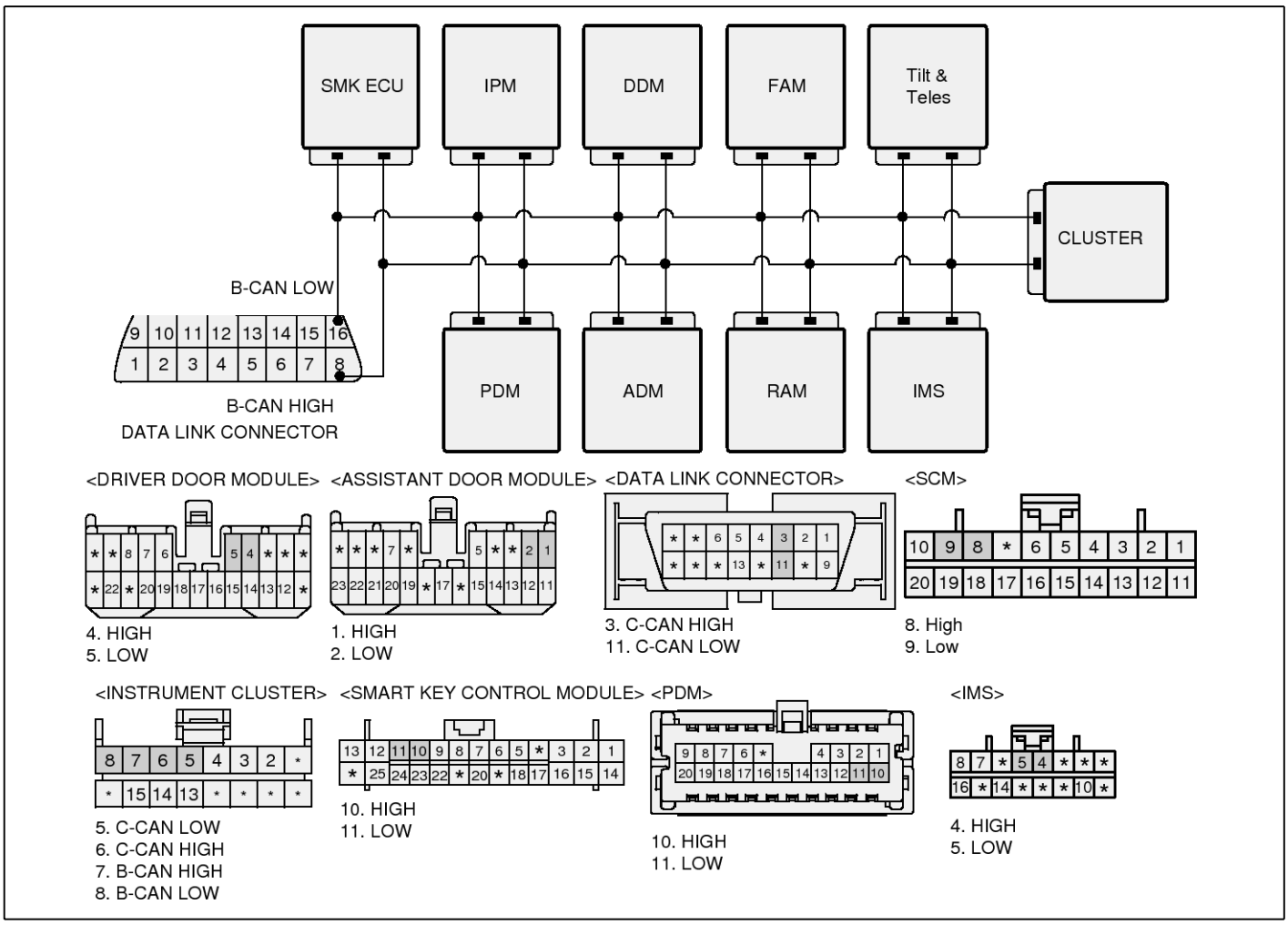

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Signal Waveform & Data

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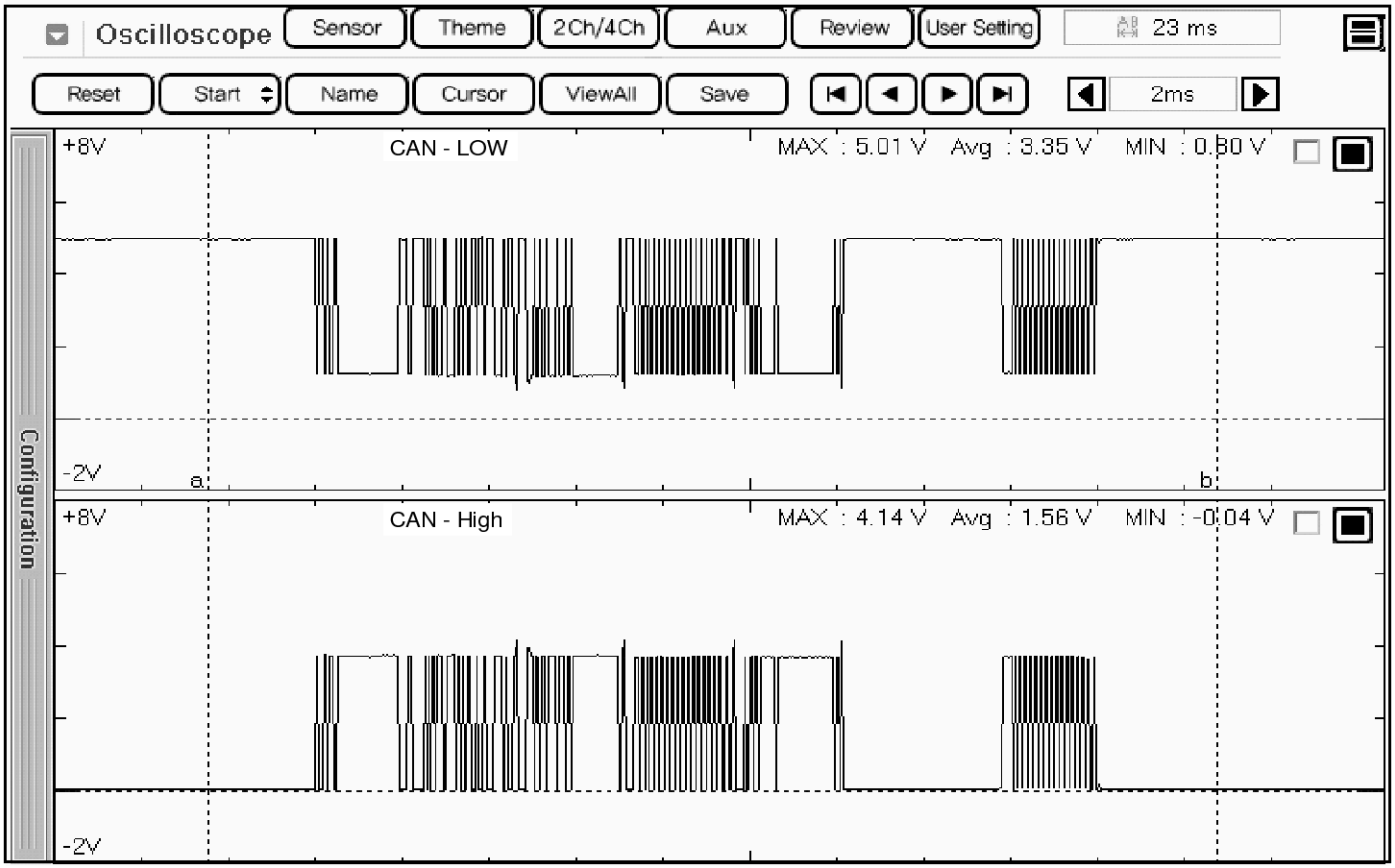

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Monitor Scantool data

■ Check DTC

1. Check DTC with scantool.
2. Check DTC related CAN communication is set on smart key module and every modules.
3. If there is DTC related Module Check the DTC according to troubleshooting guide.
4. Repair and erase the DTC with Scantool.
5. Is the DTC erased ?

YES ▶ Check poor connection between harness connector and SMARTKEY Module or ECM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Check CAN communication Line" procedure.

CAN communication Line Inspection

■ Check CAN communication

1. Connect all of control module connector.
2. IG KEY ON.
3. Make CAN communication is wake up status (Ex. . ON/OFF Door SW)
4. Measure signal waveform of B-CAN-HIGH terminal of Diagnostic connector and chassis ground.
5. Measure signal waveform of B-CAN-LOW terminal of Diagnostic connector and chassis ground.

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Specification : Refer to Signal waveform and Data

6. Is the measrured signal waveform normal ?

YES ▶ Check poor connection between harness connector and SMK Module or ECM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.
▶ Disconnect SMK ECU, IPM, DDM, FAM, Tilt ECU, PDM, ADM, RAM and IMS one by one and then, check that DTC is erased with scantool.
▶ Substitute with a known-good module and check for proper operation. If the problem is corrected, replace module and then go to "Verification of Vehicle Repair" procedure.

NO ▶ If the measured value is battery voltage, check short to battery in CAN line. Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure. In case that Communication is in sleep mode, 12V will be measured. Therefore, check that communication is in Wake up status.
▶ If 0V is detected, Check short to ground, short between CAN high and low each other or open in CAN high or CAN low harness. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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B1625 ECM Communication Data Failure

General Description

ARTKEY Module communicates with ECM through the serial communication line.

If ECM requests authetication from SMARTKEY Module after IG ON, SMARTKEY Module check authentication with transponder then, sends this signal to ECM whether authentication is O.K or not.

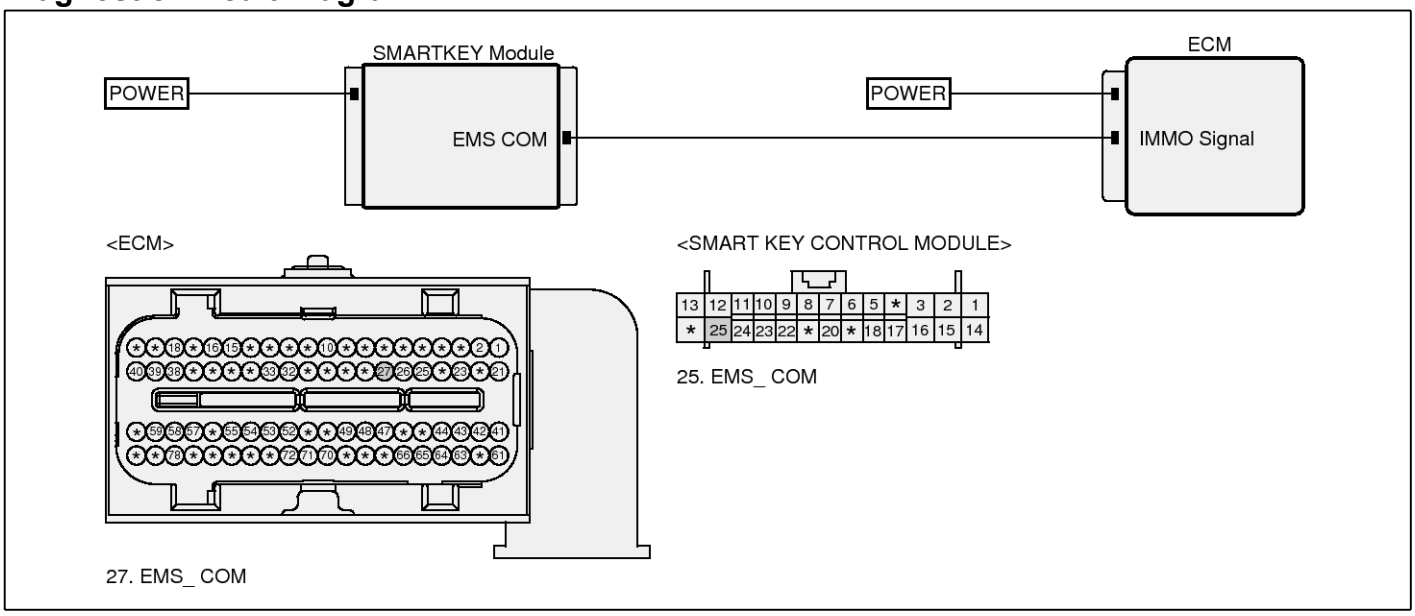
DTC Description

SMARTKEY Module sets DTC B1625 if Data from ECM is error such as check sum error, Data Frame error, ID Unknown error, Data length error and Time out error.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check received Data Status from ECM	• Poor Connection in Harness • Input Power to SMARTKEY Module • Open or short in EMS communication line. • Faulty smart key module • Faulty ECM
Enable Conditions	• Data that SMARTKEY Module received from ECM is error after IGN OFF to IGN ON	
Threshold value	• Received data error from ECM	
Failsafe	• -	

Diagnostic Circuit Diagram



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Monitor Scantool data

■ Check DTC status

1. Check DTC on the ECM with Scantool.
2. Check that there is any DTC related ECM.
3. Perform Troubleshooting the DTC from ECM with appropriate DTC Troubleshooting Guide first.
4. Repair or replace as necessary after erasing DTC with Scantool.
5. Check DTC on SMK Module side and erase the DTC

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with scantool.

6. Has the DTC gone after erasing with scantool ?

YES ▶ Check poor connection between harness connector and SMK Module or ECM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Inspection & Repair " procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Check serial commuication Cricuti Inspection" as follow.

Serial Communicatin Circuit Inspection

■ Check short in serial communication line

1. "IG KEY OFF"
2. Disconnect SMARTKEY Module connector and ECM connector.
3. Measure resistance between serial communication signal terminal of ECM harness connector and chassis ground.

Specificatin : Infinite (∞)

4. Is the measured resistance within specification ?

YES ▶ Go to open in harness as follow

NO ▶ Check short to ground in harness. And then, repair or replace as necessary. Finally, go to " Verification of Vehicle Repair" procedure.

■ Check open in harness

1. IG KEY OFF.
2. Disconnect SMARTKEY Module connector and ECM connector.
3. Measure resistance between signal terminal of SMARTKEY Module harness connector and signal terminal of ECM harness connector.

Specification : About below 1Ω

4. Is the measured resistance within specification ?

YES ▶ Check poor connection between harness connector and SMARTKEY Module or ECM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Check open in signal harness. And, repair or replace as necessary then, go to "Verification of Vehicle Repair " procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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B1689 CAN Time-out PDM

General Description

CAN Communication is a circuit, consists of CAN LOW and CAN HIGH, in order to communicate among control units.

Control Modules are respectively communicating via CAN line in order to control Body Electrical.

DTC Description

Smart Key module sets DTC B1689 if smart key module have not received CAN signal from PDM for 3 sec.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN signal check	• Poor Connection • Power source to Smart Key module • Power source to PDM • Short to battery in CAN communication line • Short to ground in CAN communication line • Short between CAN HIGH AND LOW communication line each other • Faulty Smart Key module • Faulty PDM
Enable Conditions	• IG ON	
Threshold value	• No can signal message from PDM for 3 sec.	
Failsafe	• -	

Diagnostic Circuit Diagram

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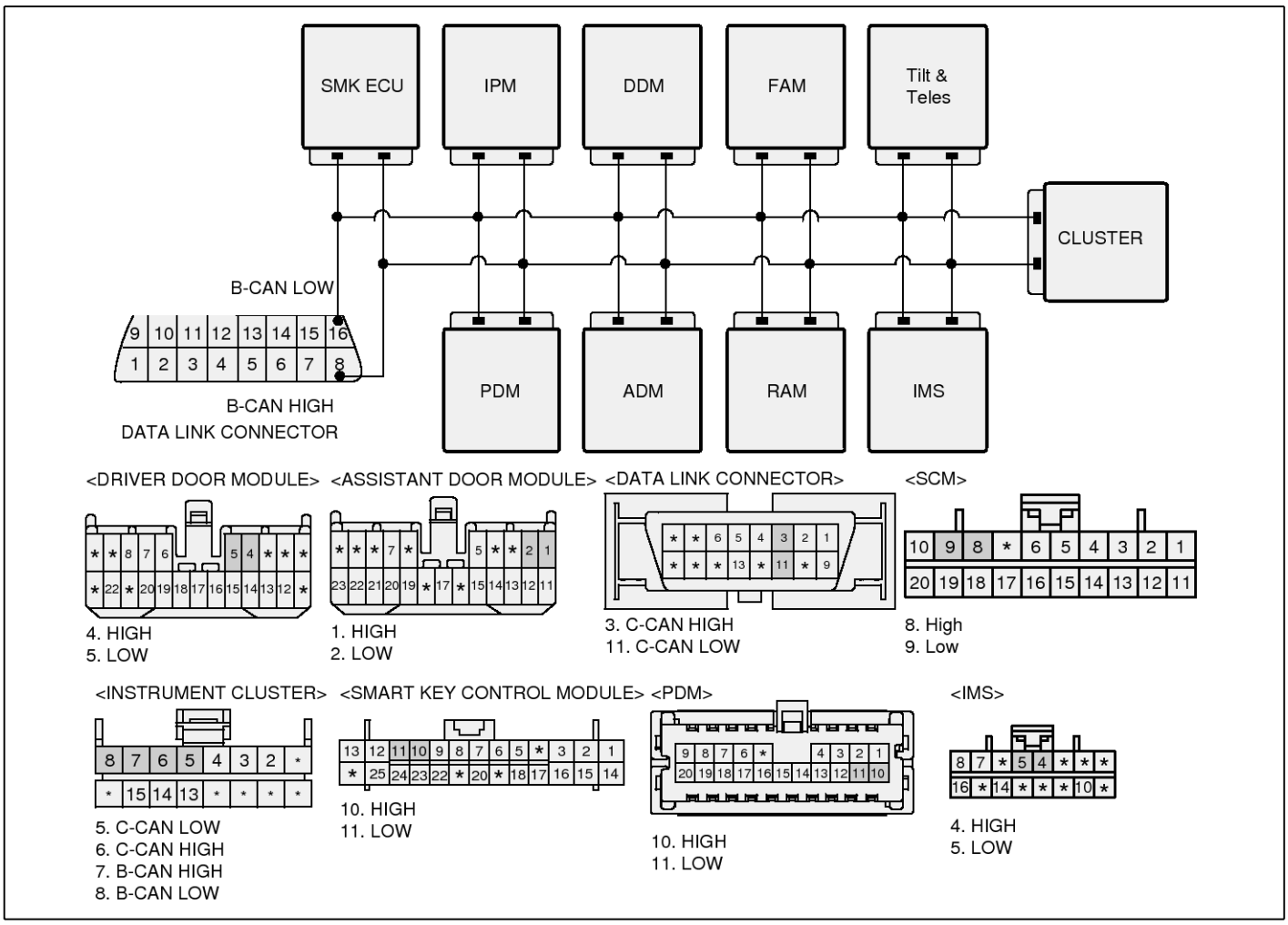

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Signal Waveform & Data

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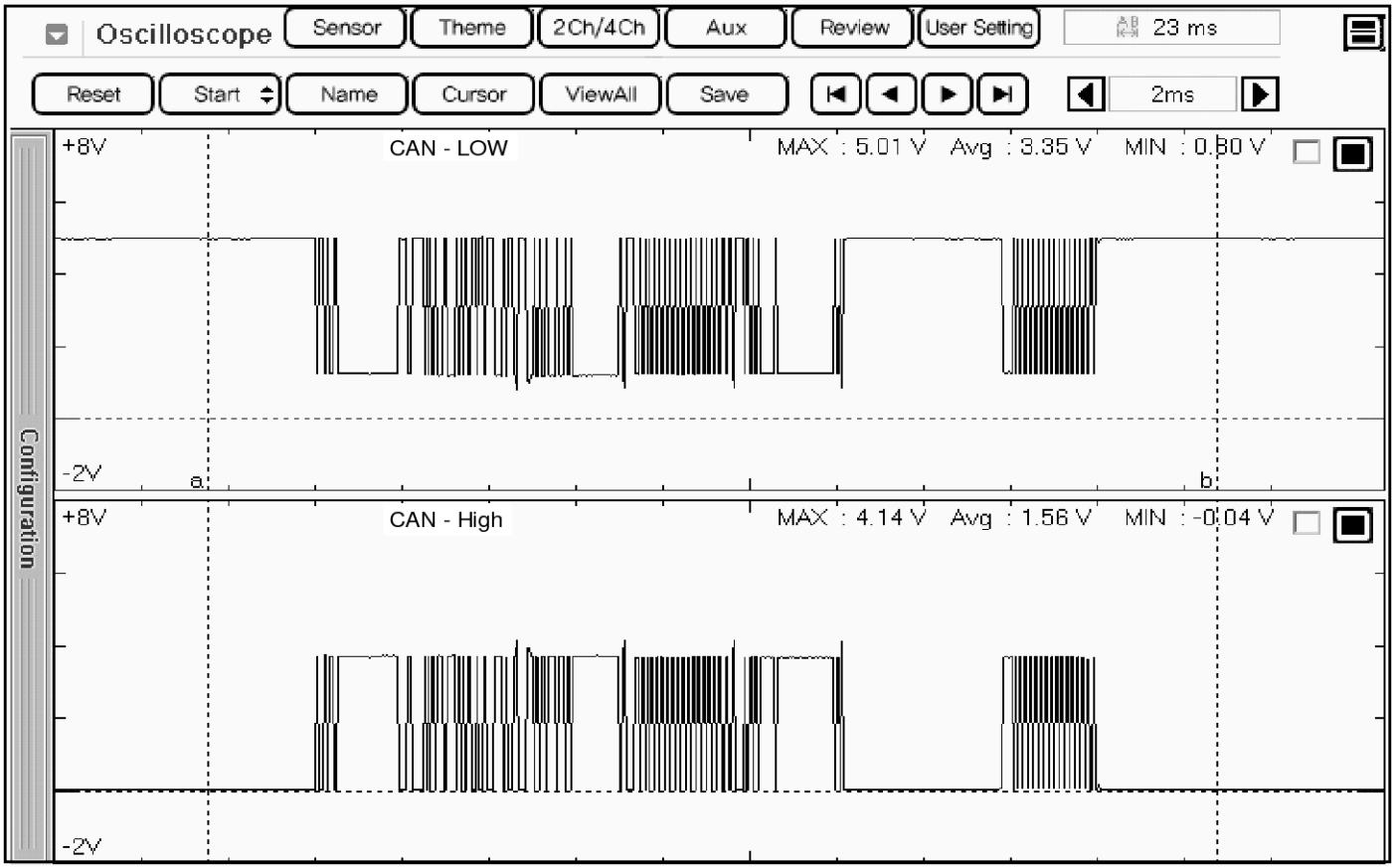

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Monitor Scantool data

■ Check DTC

1. Check DTC with scantool.
2. Check DTC related CAN communication is set on PDM.
3. If there is DTC related PDM, Check the DTC according to troubleshooting guide
4. Repair and erase the DTC with Scantool.
5. Is the DTC erased ?

YES ▶ Check poor connection between harness connector and each module
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to next procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to 'Check CAN communication Line" procedure.

CAN communication Line Inspection

■ Check CAN communication

1. Connect all of control module connector.
2. IG KEY ON.
3. Make CAN communication is wake up status (Ex. . ON/OFF Door SW)
4. Measure signal waveform of B-CAN-HIGH terminal of Diagnostic connector and chassis ground.
5. Measure signal waveform of B-CAN-LOW terminal of Diagnostic connector and chassis ground.

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Specification : Refer to Signal waveform and Data

6. Is the measrured signal waveform normal ?

YES ▶ Check poor connection between harness connector and SMK Module or ECM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.
▶ Disconnect SMK ECU, IPM, DDM, FAM, Tilt ECU, PDM, ADM, RAM and IMS one by one and then, check that DTC is erased with scantool.
▶ Substitute with a known-good module and check for proper operation. If the problem is corrected, replace module and then go to "Verification of Vehicle Repair" procedure.

NO ▶ If the measured value is battery voltage, check short to battery in CAN line. Repair or replace as necessary. And then, go to "Verification of Vehicle Repair" procedure. In case that Communication is in sleep mode, 12V will be measured. Therefore, check that communication is in Wake up status.
▶ If 0V is detected, Check short to ground, short between CAN high and low each other or open in CAN high or CAN low harness. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

■ Check open in CAN communication line

1. IG KEY OFF.
2. Disconnect smart key module and PDM connector.
3. Measure resistance between communication line terminal of smart key module connector and communication line of PDM harness connector.

Specification : About below 1Ω

4. Is the measured resistance within specification ?

YES ▶ Check poor connection between harness connector and SMK Module or PDM
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Repair or replace open in CAN communication line and go to 'Verification of Vehicle Repair " procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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B1971 Parking Position Input Error

General Description

Parking Position Switch indicates that Shift Lever is in P range or not. SMARTKEY Module decides that engine starting is enable after receiving Parking Position Switch signal.

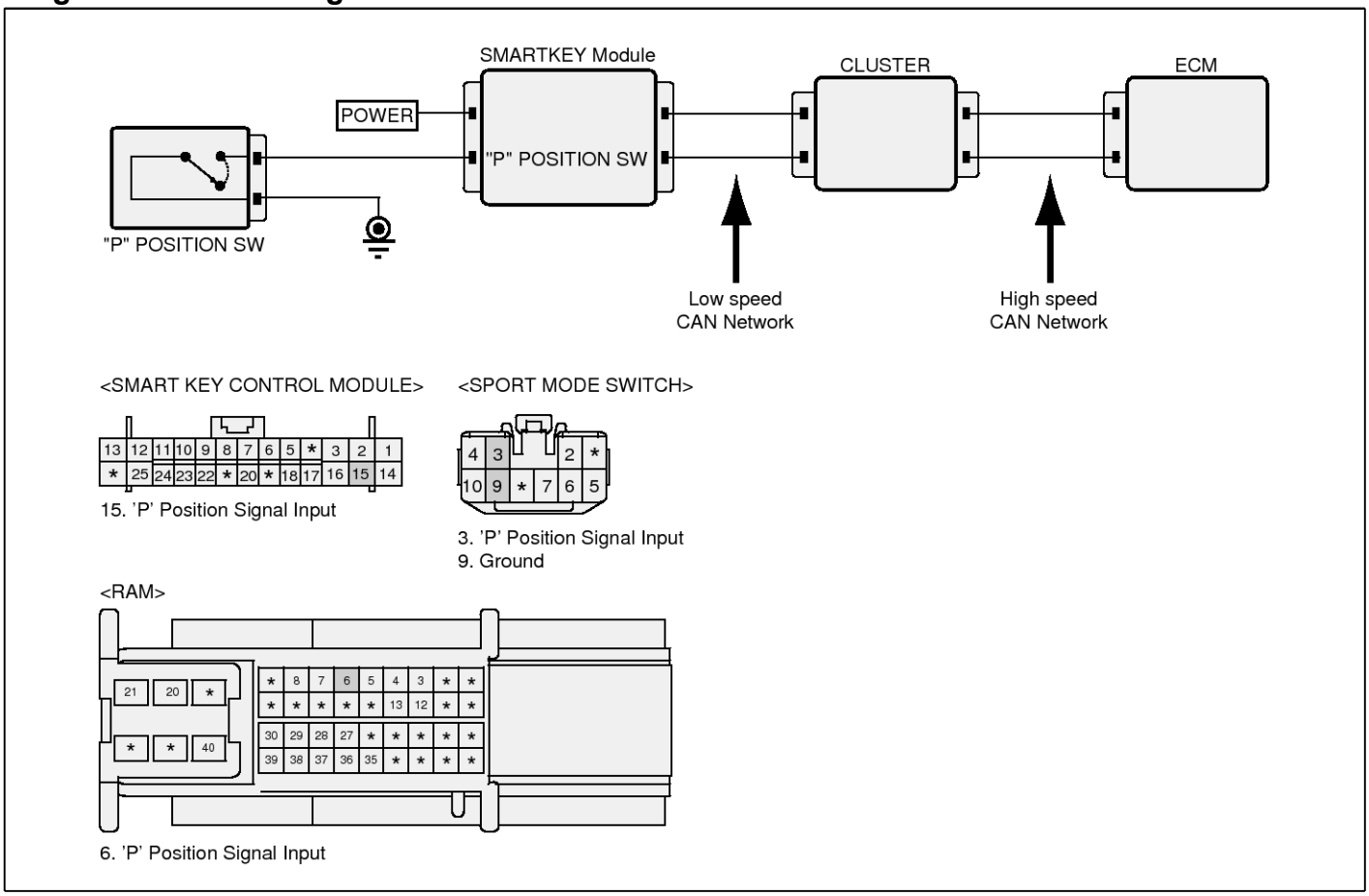
DTC Description

SMARTKEY Module sets DTC B1971 if vehicle speed is over 3km/h while parking switch signal is ON.

DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	• Check Voltage	• Poor Connection in harness • Faulty Parking Switch • Faulty SMARTKEY Module
Enable Conditions	• After battery Voltage is energized to SMARTKEY Module	
Threshold value	• After IGN ON, Vehicle speed is over 3km/h with brake switch ON for 10 seconds.	
Failsafe	• -	

Diagnostic Circuit Diagram



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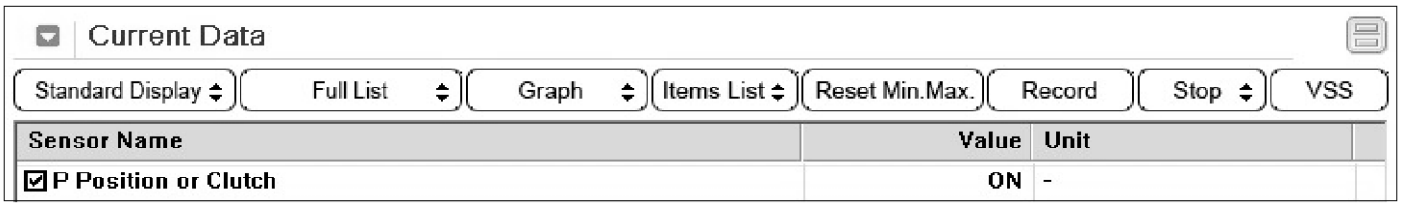
Monitor Scantool data

■ Check parking position switch status.

1. Connect scantool with diagnostic connector.
2. Check current data with scantool. .
3. Check "Shift lever P position" parameter on current data.
4. Check that data is appropriately changeable according to the shift lever position in P or others.

Specification : P position : ON, Not in P position : OFF.



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5. Is the shift lever P position normal ?

YES ▶ Check poor connection between harness connector and Parking Postion switch or IPM

: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to " Inspection & Repair " procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to check "signal circuit Inspection" procedure.

Signal Circuit Inspection

■ Check Signal Circuit

1. IG KEY OFF.
2. Disconnect parking position switch connector.
3. IG KEY ON.
4. Measure voltage between signal terminal of parking position switch harness connector and chassis ground.

Specification : Battery Voltage

5. Is the measured voltage within specification ?

YES ▶ Check open in ground harness. And then, repair or replace as necessary, Finally go to "Verification of Vehicle Repair " procedure.

NO ▶ Check open or short to ground in signal harness. And then, repair or replace as necessary finally go to "Verification of Vehicle Repair " procedure.

Component Inspection

■ Check Parking Position Switch

1. IG KEY OFF.
2. Disconnect Parking Position switch connector.
3. Measure resistance between one and the other connector when parking postion switch ON and OFF.

Specification : Measurement 1 : Infinite (∞), Measurement 2 : About below 1Ω

4. Is the measured resistance within specification ?

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YES ▶ Check poor connection between harness connector and Parking Postion switch or SMART-KEY Module
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector.
Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Substitute with a known-good parking position switch and check for proper operation.
If the problem is corrected, replace parking postion switch and then go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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B1978 Electric Steering Column Lock Failure

General Description

ESCL(Electronic Steering Column Lock) is a system to control the lock or unlock of the Steering Column.

It is installed on steering column and SMARTKEY Module is located inside of instrument panel, left knee of driver side.

It consists of ESCL control Module, SMARTKEY Module, PDM and SSB(engine Start Stop Button)

It is operating as follows

1.Pushing SSB → 2. Switch 1 signal goes to PDM, Switch 2 signal goes to SMARTKEY Module → 3.PDM supplies power supply to ESCL → 4.SMARTKEY Module sends ENABLE signal and operation signal to ESCL → 5.ESCL controls bolt to lock or unlock ESCL → 6.PDM detects ESCL Unlock signal.

DTC Description

SMARTKEY Module receives ESCL lock or unlock stuatus signal from ESCL and PDM(via CAN). And then, SMARTKEY Module compares PDM is lock or unlock signal with ESCL is lock or unlock signal. If the both signals are unmathing, SMARTKEY Module sets DTC B1971.

DTC Detecting Condition

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Item	Detecting Condition	Possible cause
DTC Strategy	• Check voltage and Data	• Poor connection in harness or connector. • After battery voltage is supplied to SMARTKEY Module - If IPM detects pins related ESCL are failed 1. Faulty ESCL control Module 2. Open or short in battery / ground curcuit of ESCL 3. Open or short to battery / ground in communicantion circuit of ESCL 4. Open in O_ESCL Enable circuit from SMARTKEY Module 5. Open or short in ESCL_Unlock circuit to PDM - DTC is set although it is not ESCL fault 6. No battery voltage to PDM 7. Short to battery in power relay on the PDM line such as ACC, IGN1, IGN2, Starter Rly 8. When actuation test for PDM 9. It is leant status but not with same PIN code for all SMARTKEY Module/PDM/ESCL • Faulty SMARTKEY Module • Faulty PDM • Faulty ESCL control Module
Enable Conditions	• After battery voltage is suppiled to SMARTKEY Module	
Threshold value	• When both signal from ESCL lock or unlock status and PDM lock or unlock stuatus are unmatching	
Failsafe	• -	

Diagnostic Circuit Diagram

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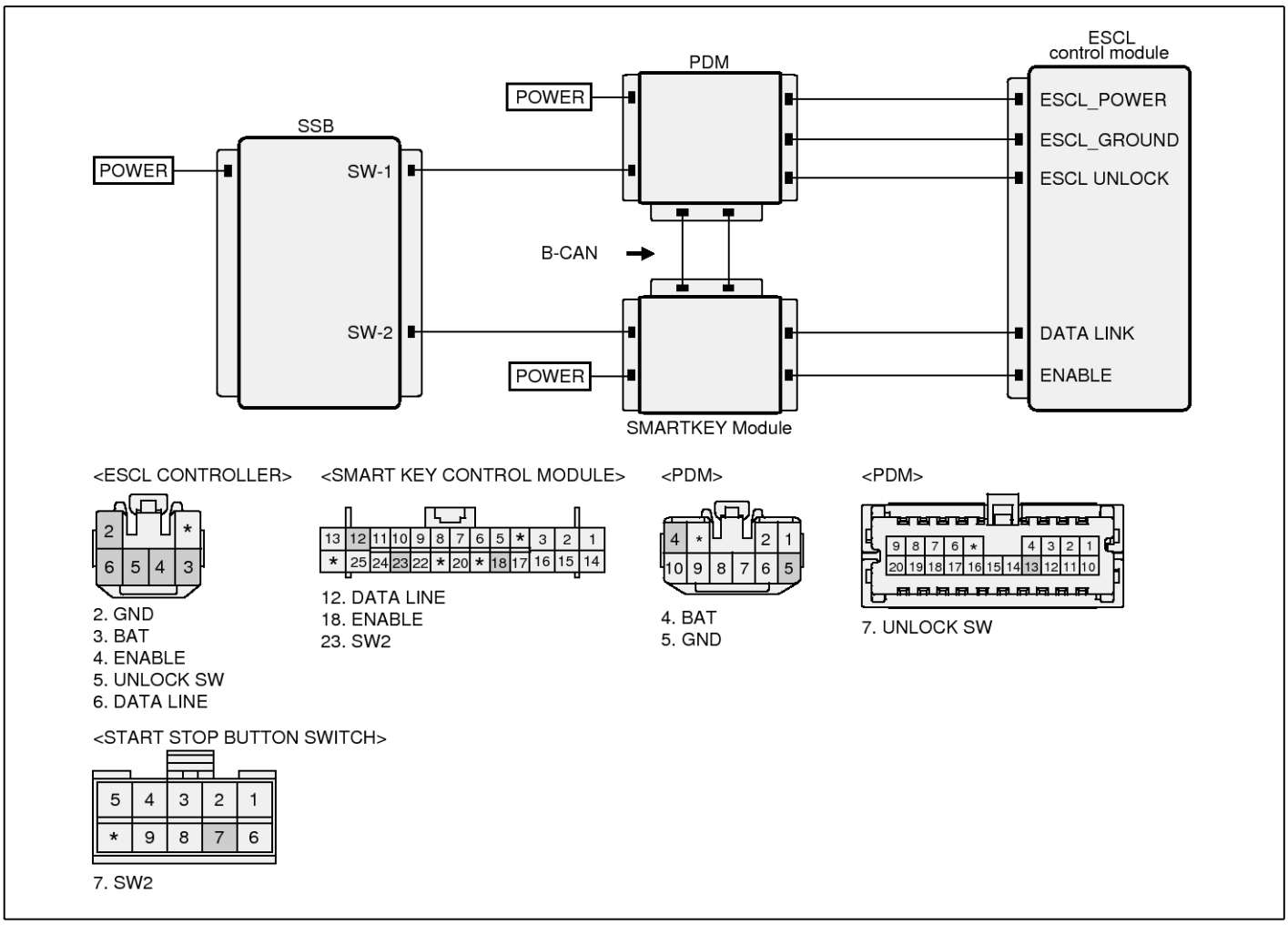

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Monitor Scantool data

■ Check DTC status

1. Check DTC on PDM side with scantool.
2. Check that there is any DTC on PDM side or ESCL side.
3. Inspect DTC related ESCL first if there is any DTC on the PDM side according to DTC troubleshooting guide.
4. After inspetion and repair, erase DTC related ESCL.
5. Erase DTC B1971 ESCL failure on SMARTKEY Module side.
6. Has the DTC gone after erasing DTC with scantool ?

YES ▶ Check poor connection between harness connector and ESCL, PDM or SMARTKEY Module
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to check current dat as follows if there is DTC B1971 ESCL failure.

■ Check current Data

1. Select current data parameters related SMARTKEY Module with scantool.
2. Monitor "ESCL ENABLE" and "SMK State" are normal.
3. Select current data parameter related PDM.
4. Monitor "ESCL BATTERY OUTPUT" , "ESCL GND OUTPUT" and "ESCL UNLOCK STATE INPUT" are normal.

Specification : - Current Data parameter related SMARTKEY Module -
1.ESCL ENABLE : It is ON, if IPM sends enable signal to ESCL
2.SMK State : It shows ESCL current status. It shows ESCL FAULURE if there is a failure

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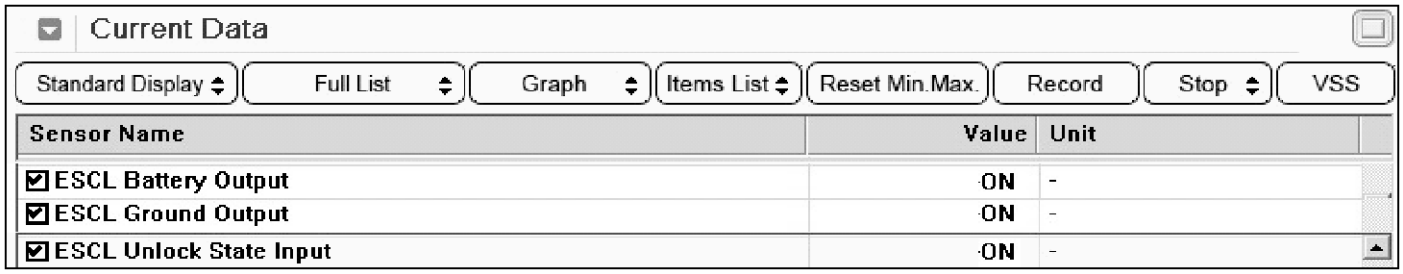
Specification : - Current Data parameter related PDM -
1.ESCL BATTERY OUTPUT : It will be changed form OFF to ON when PDM supplies operation voltage with PDM.
2.ESCL GND OUTPUT : It will be changed form OFF to ON when PDM supplies operation voltage with PDM.
3.ESCL UNLOCK STATE INPUT : In case that ESCL bolts is unlock, it will be ON.



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5. Are all parameters related ESCL funtioning normally ?

YES ▶ Check poor connection between harness connector and ESCL, PDM or SMARTKEY Module
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

NO ▶ Check harness and system related ESCL if " SMK STATE" is shown ESCL FAILURE
▶ If there is any parameter on the system or harness displayed abnormal, check harness and system.
▶ Go to "Inspection & Repair " procedure.

Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals.

   Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,or damage.
3. Has a problem been found?

YES ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

NO ▶ Go to "Check ESCL Circuit " procedure.

Check ESCL circuit

■ Check short to ground in ESCL circuit.

1. IG KEY OFF
2. Disconnect ESCL control Module connector.
3. Measure resistance between all the terminals of ESCL harness connector and chassis ground.

Specification : Infinite

4. Is the measured resistance within specification ?

YES ▶ Go to "Check short to battery in ESCL harness " procedure.

NO ▶ Repair or replace as necessary and then, go to "Verification of Vehicle Repair"procedure.

■ Check short to battery in ESCL harness

1. IG KEY OFF.

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2. Disconnect ESCL control Module, PDM and SMARTKEY Module connector.
3. Measure resistance between each terminal of ESCL control Module harness connector and chassis ground.

Specification : About 0V

4. Is the measured voltage within specification ?

YES ▶ Go to "check open in ESCL harness " as follows

NO ▶ Repair or replace the short to battery as necessary and then, go to 'Verification of Vehicle Repair" procedure.

■ Check open in ESCL harness

1. IG KEY OFF.
2. Disconnect ESCL control Module, PDM and SMARTKEY Module connector.
3. Measure resistance between one and the other terminal of ESCL control module harness connector or IPM harness connector.

Specification : About below 1Ω

4. Is the measured resistance within specification ?

YES ▶ Check poor connection between harness connector and ESCL Control Module, PDM or SMARTKEY Module
: Thoroughly check the looseness, poor connection, bent, corrison, contamination, deformation or damage of connector. Repair or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.
▶ After replacing ESCL control module or SMARTKEY Module, perform Key teaching procedure with scantool.

NO ▶ Repair open in harness or replace as necessary and then, go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
2. Operate the vehicle and monitor the DTC on the scantool.
3. Are any DTCs present?

YES ▶ Go to the applicable troubleshooting procedure.

NO ▶ System is performing to specification at this time.

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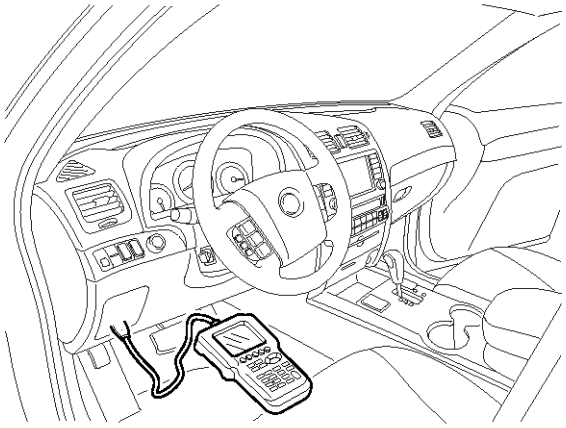
Smart key

Smart Key Registration

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



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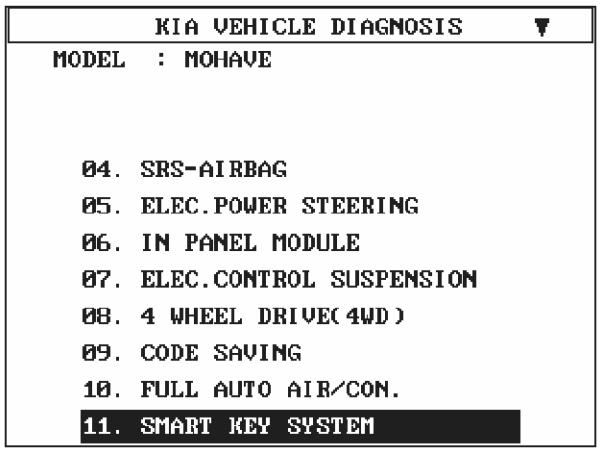
2. After IG ON, select vehicle.
3. Select the “Smart key system” and "Smart key code saving”.



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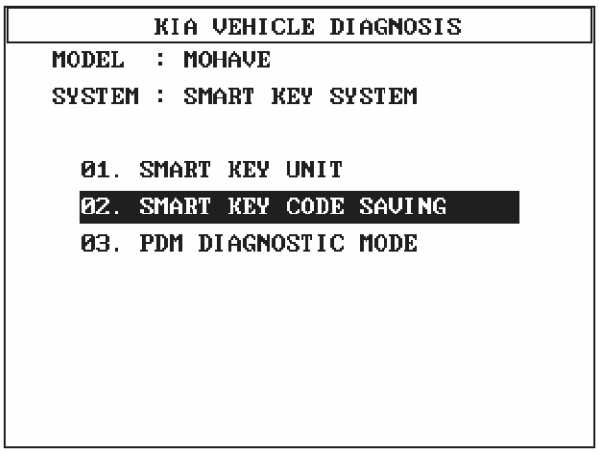

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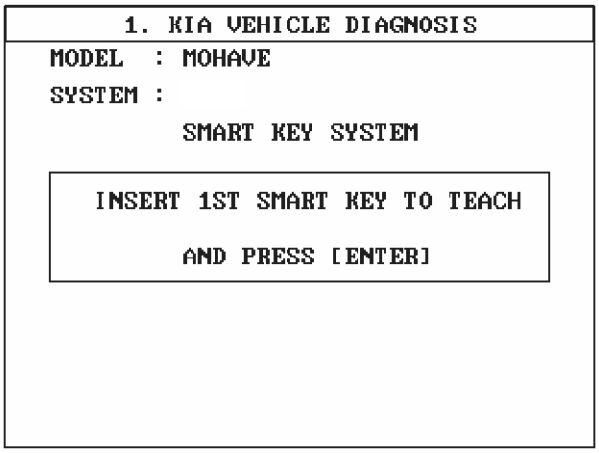
4. Insert into key holder one fob key to be learnt and press “ Enter”.



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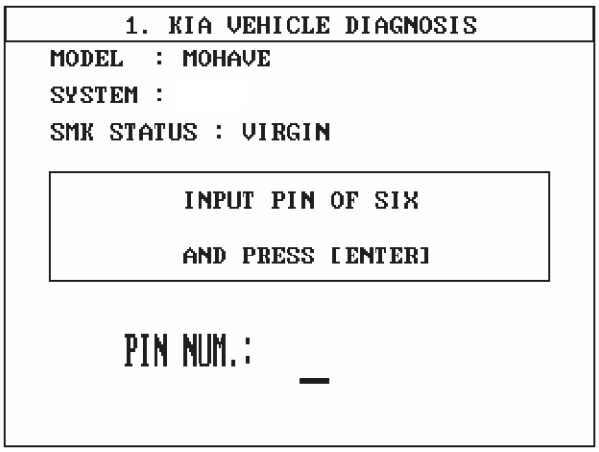
5. Input the pin code to learn.



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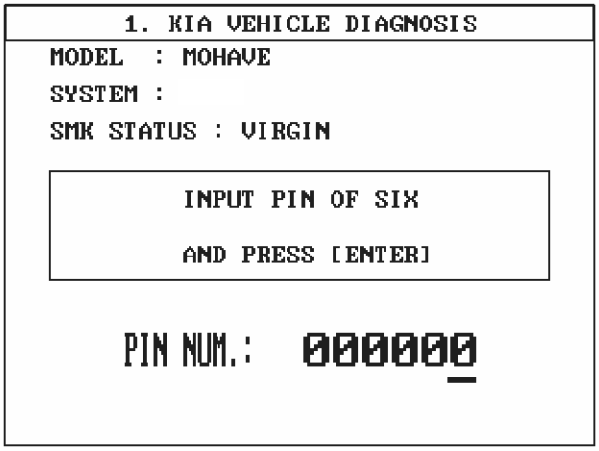
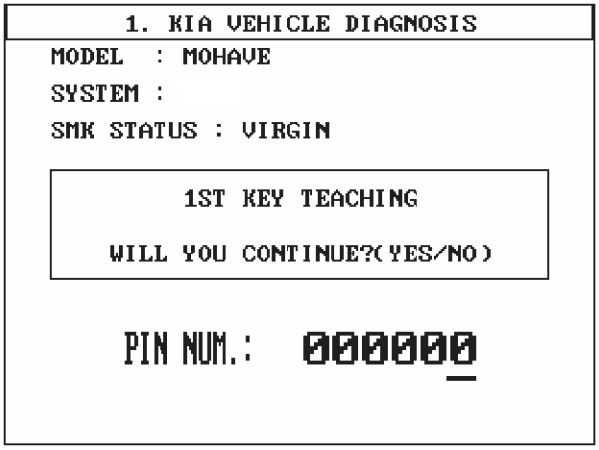
6. Start the first key learning.



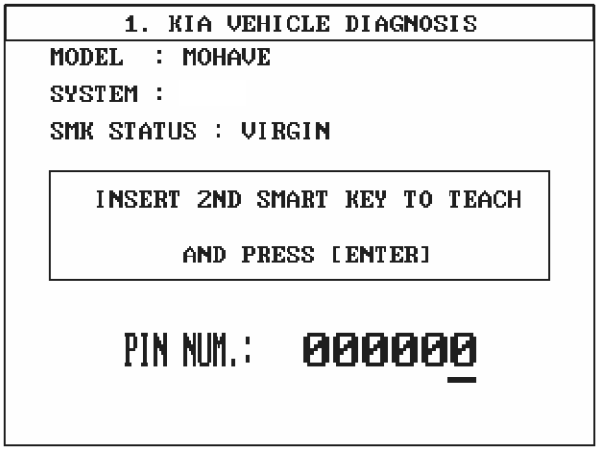
SHMBE9047L

7. Complete the first key learning.



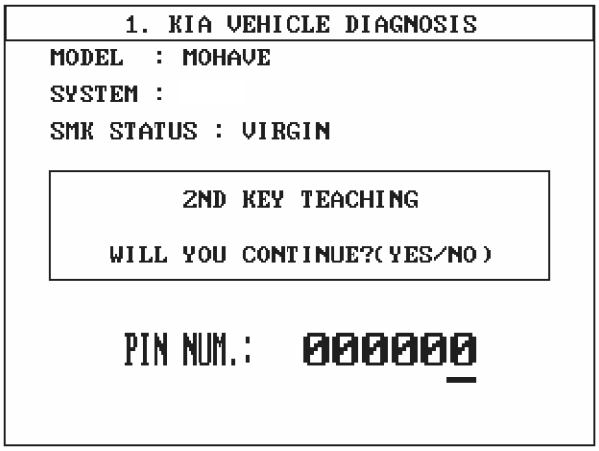
SHMBE9048L

8. Start the second key learning.

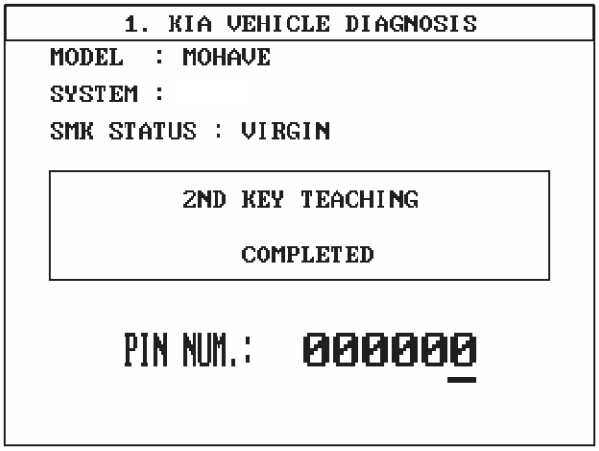


SHMBE9049L

9. Complete the second key learning.



SHMBE9050L



SHMBE9051L

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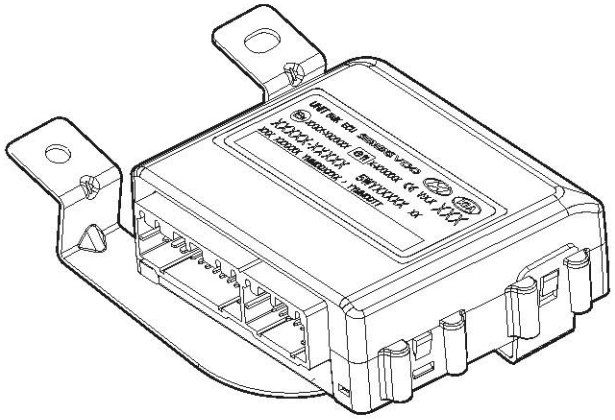
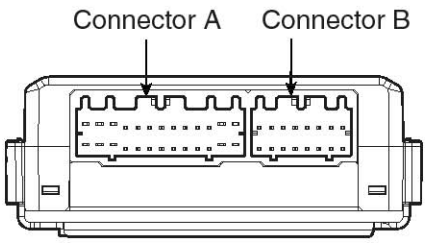
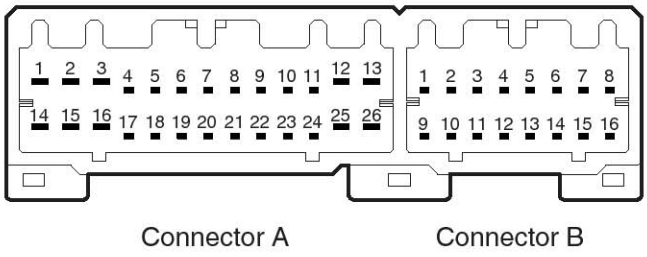
Smart key unit

Components







SHMBE9052L

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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

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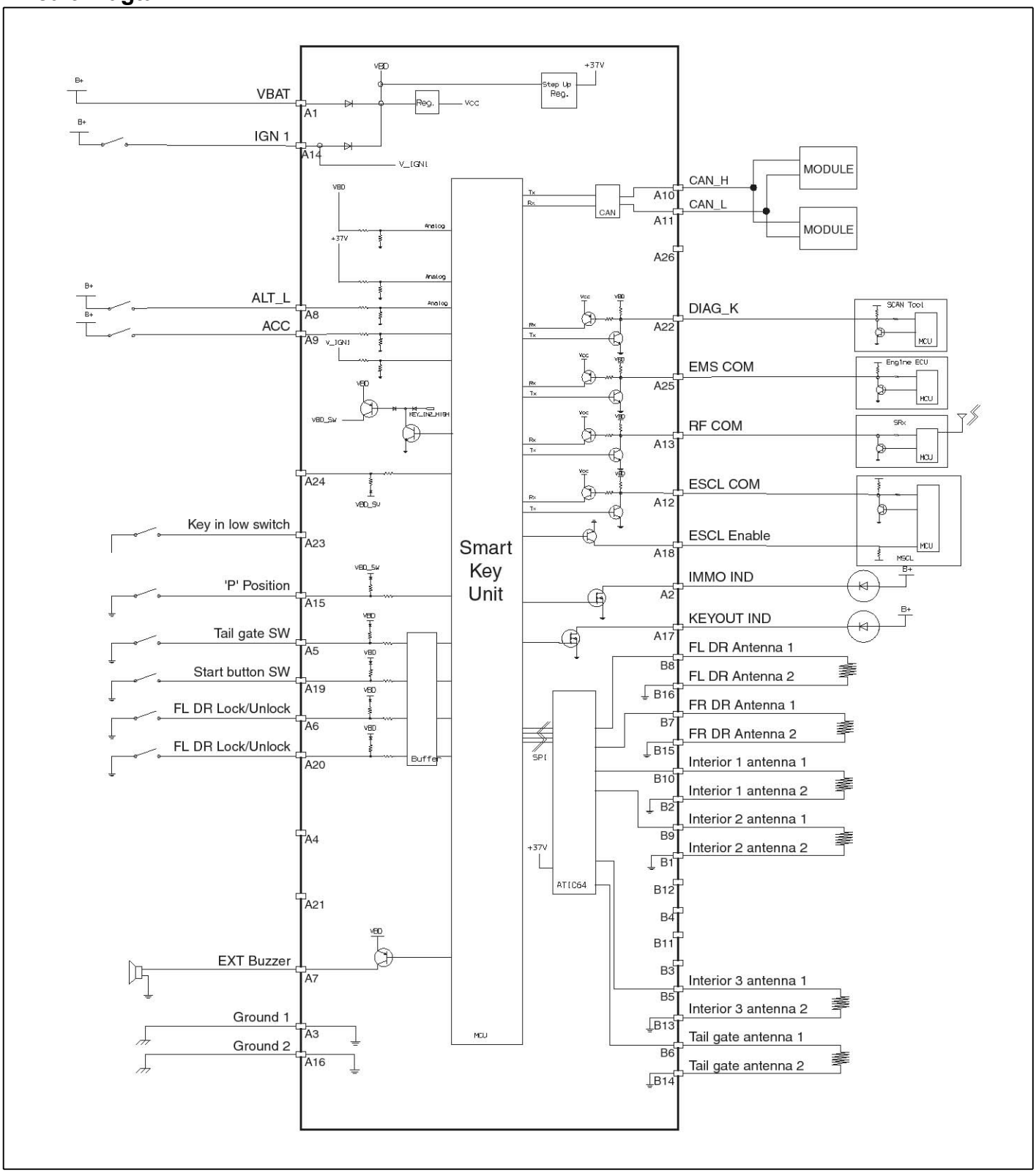
Circuit Diagtam



SHMBE9053L

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Inspection

Smart Key Unit

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

Smart Key Switch

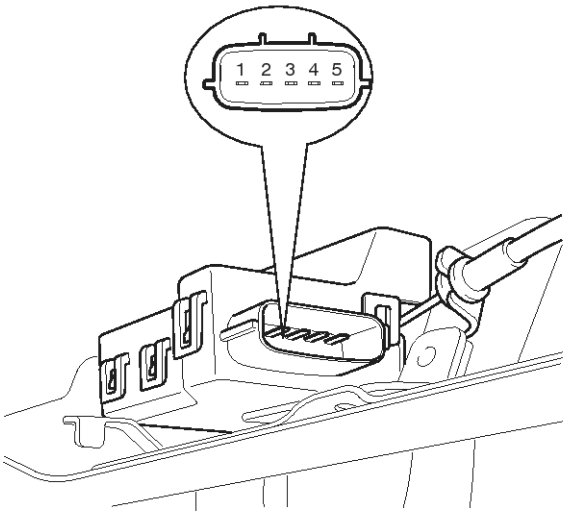
- Refer to the BE group - inspection / self diagnosis with scan tool.

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

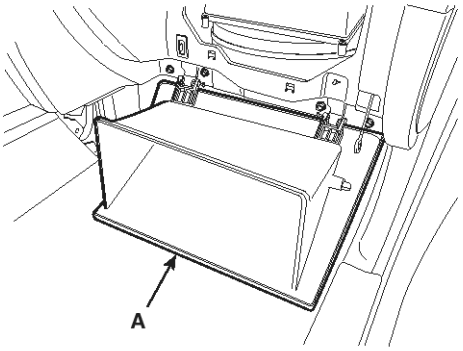
Terminal / Position	5	4	3
Unlock	○	○	
		○	○
1st Lock	○	○	
Complete Lock		○	○

SHMBE9054L

Removal

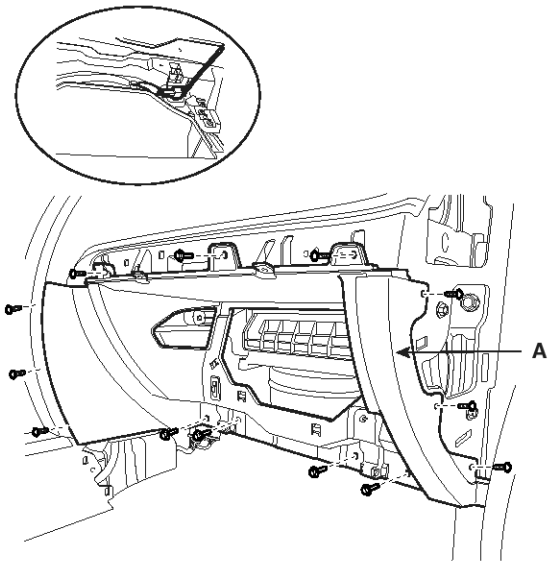
Smart Key Unit

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

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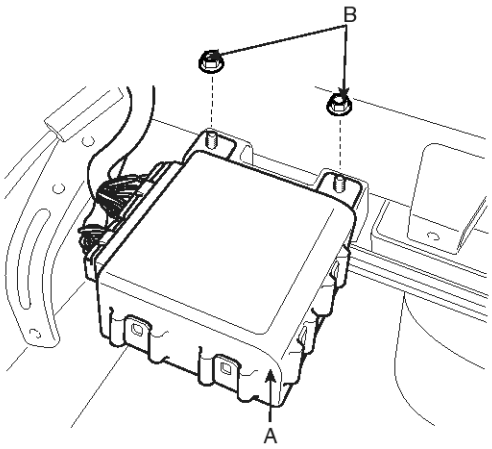
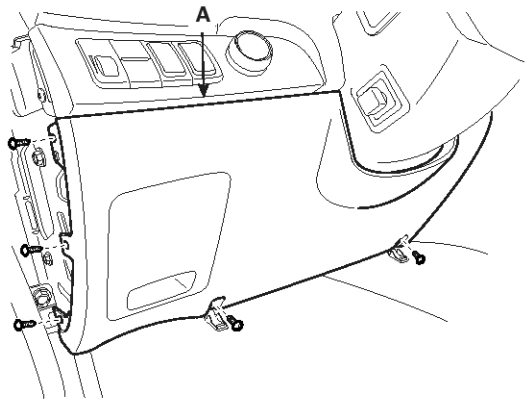
4. After disconnecting the smart key unit connector, loosen the smart key unit mounting nuts(B) and remove the smart key unit(A).



SHMBE8415D

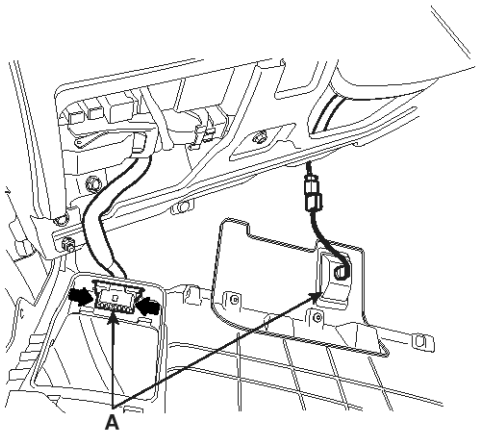
RF Receiver

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



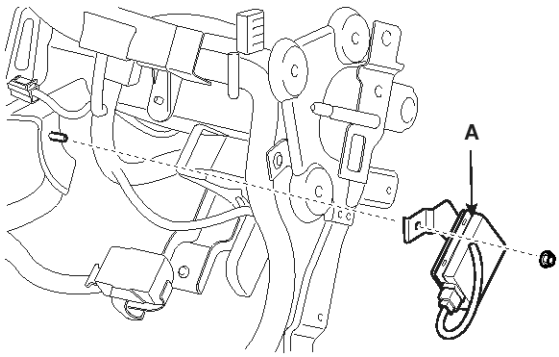
SHMBE8371D

3. Disconnect the connectors (A).



SHMB18035D

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



SHMBE8418D

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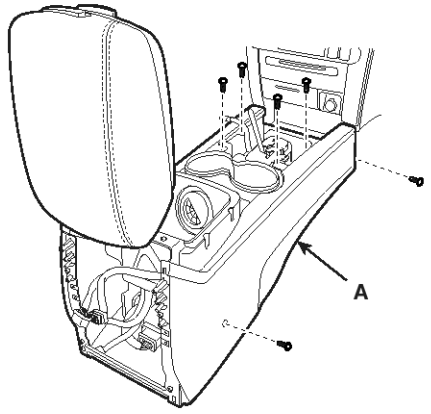
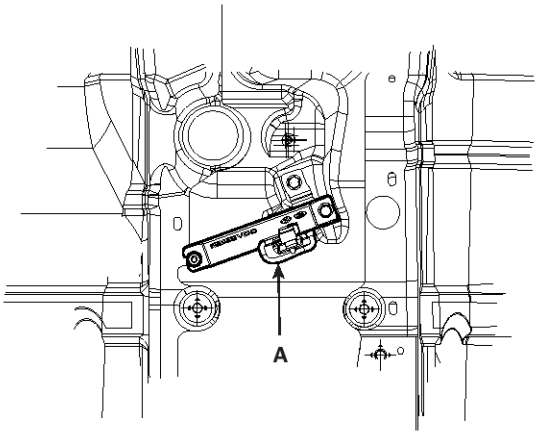
Interior 1 Antenna

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



SHMBE8422D

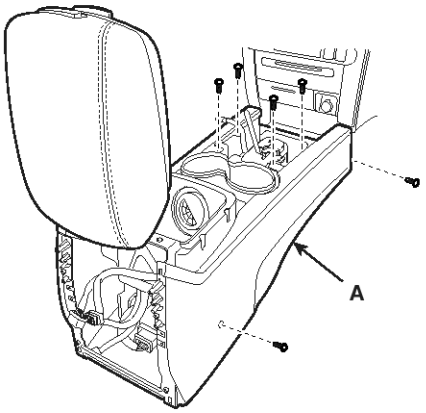
3. After loosening the antenna nuts(2EA) and connector, remove the interior 1 antenna (A).



SHMBE8421D

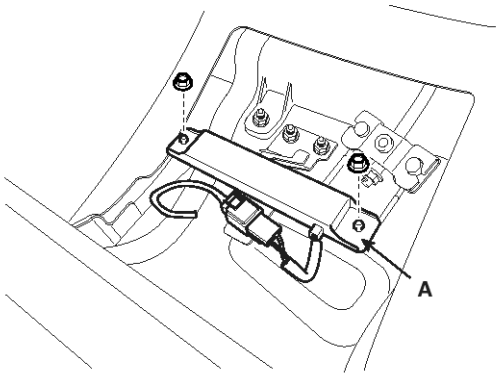
Interior 2 Antenna

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

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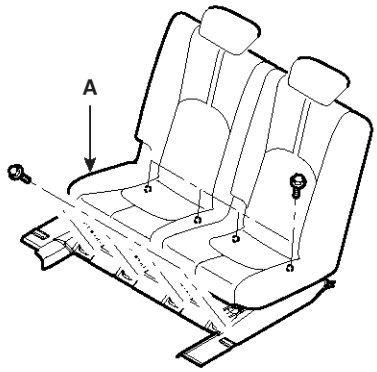
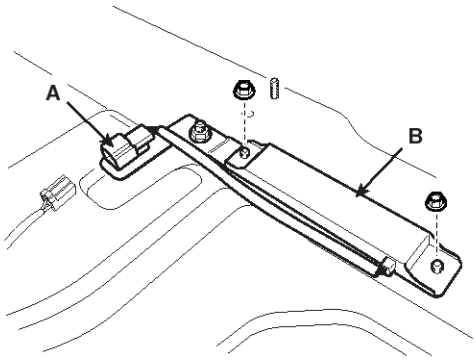
Interior 3 Antenna

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

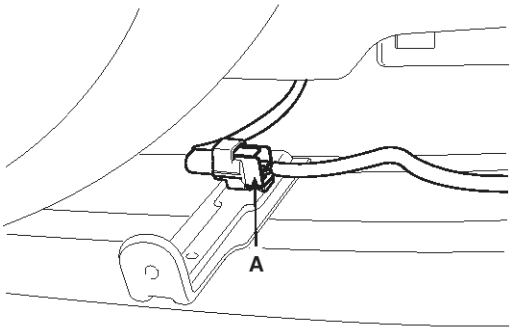
3. After loosening the connector mounting bracket nut(1EA), disconnect the antenna connector(A).
4. After loosening the nuts(2EA), remove the interior 3 antenna(B).



SHMBE8425D

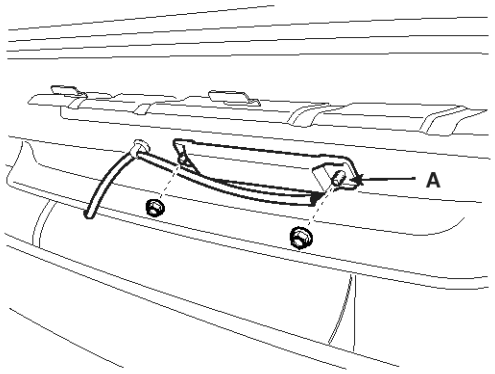
Exterior Bumper Antenna

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

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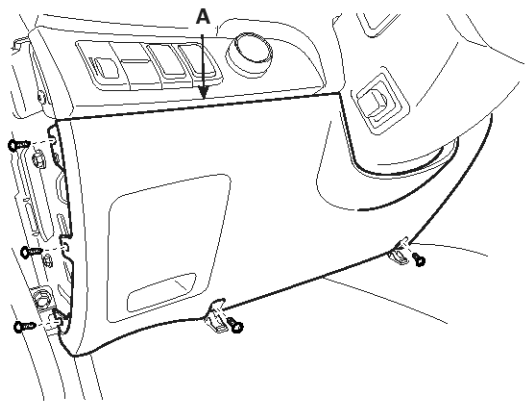
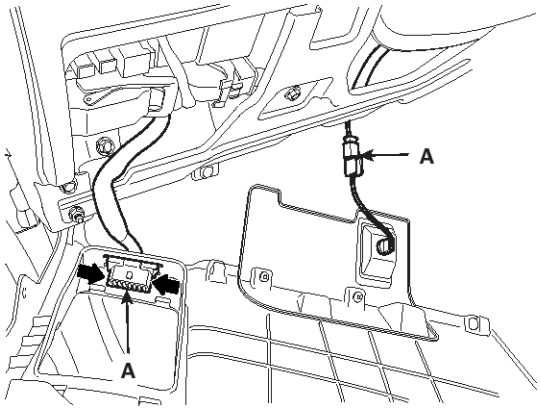
Buzzer

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



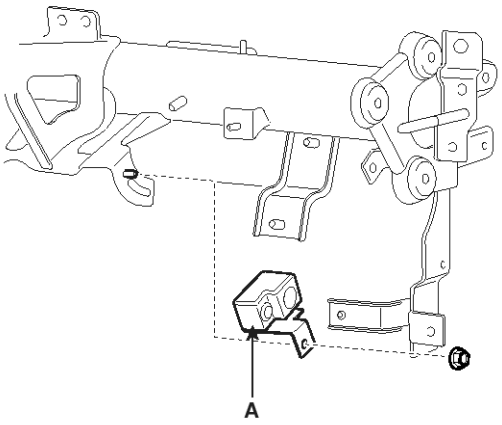
SHMBE8371D

3. Disconnecting the connectors (A).



SHMBE8372D

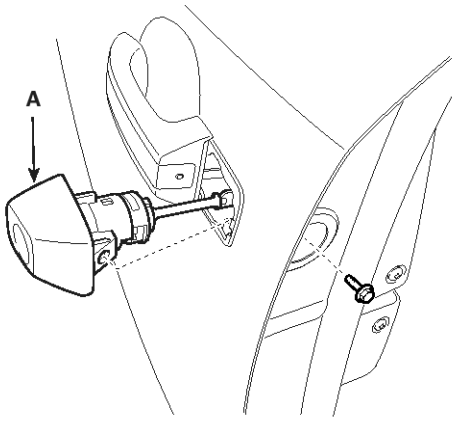
4. Remove the external buzzer (A).



SHMBE8995D

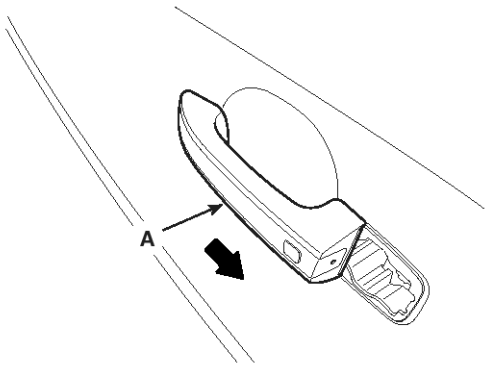
Door Outside Handle

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

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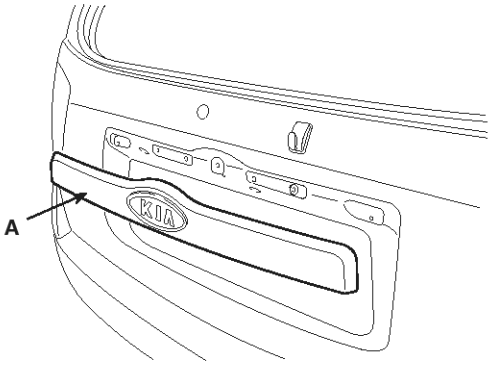
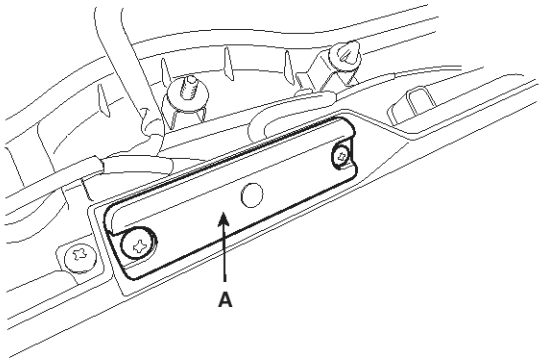
Tailgate Switch

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.

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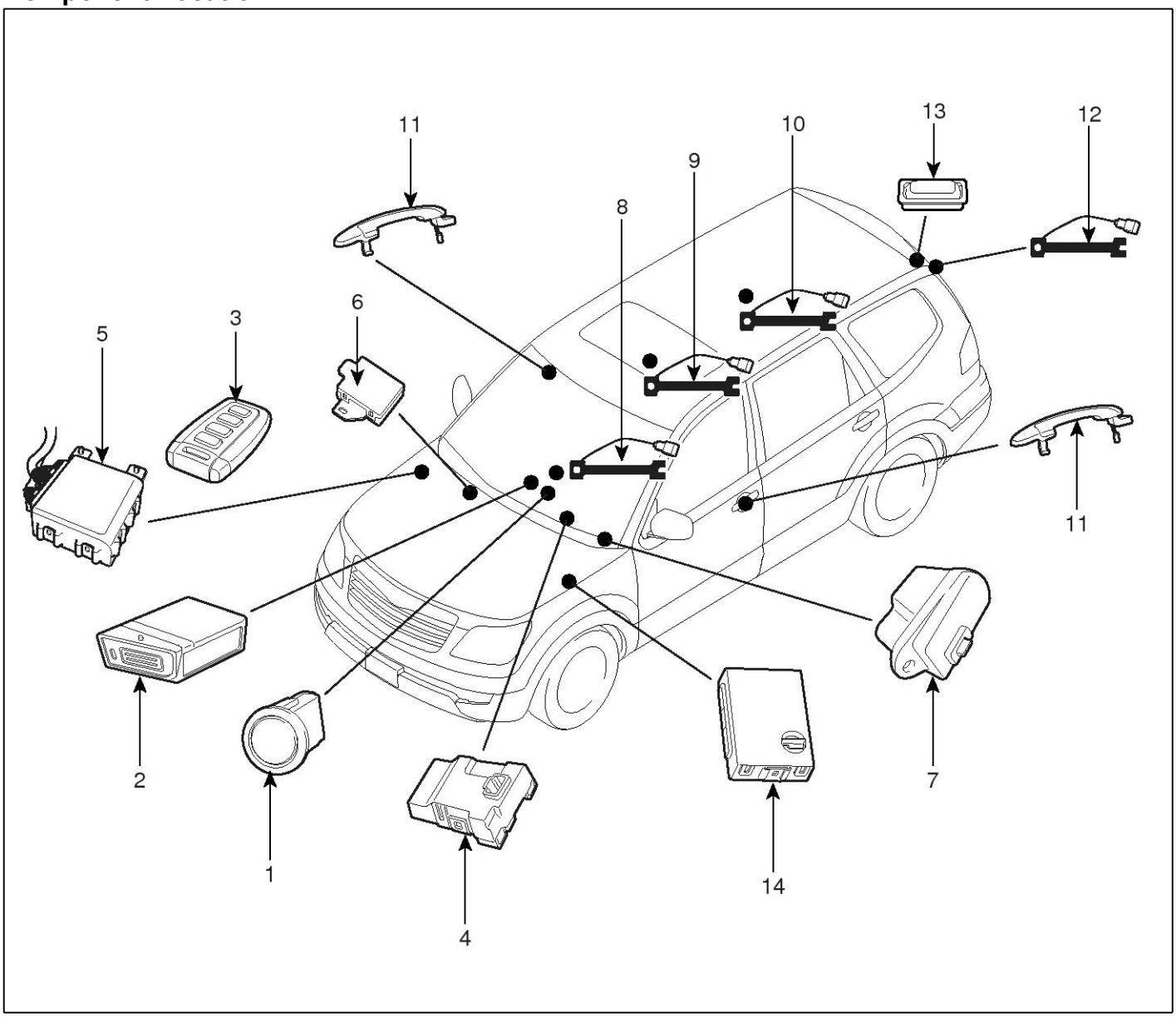
Button Engine Start System

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)

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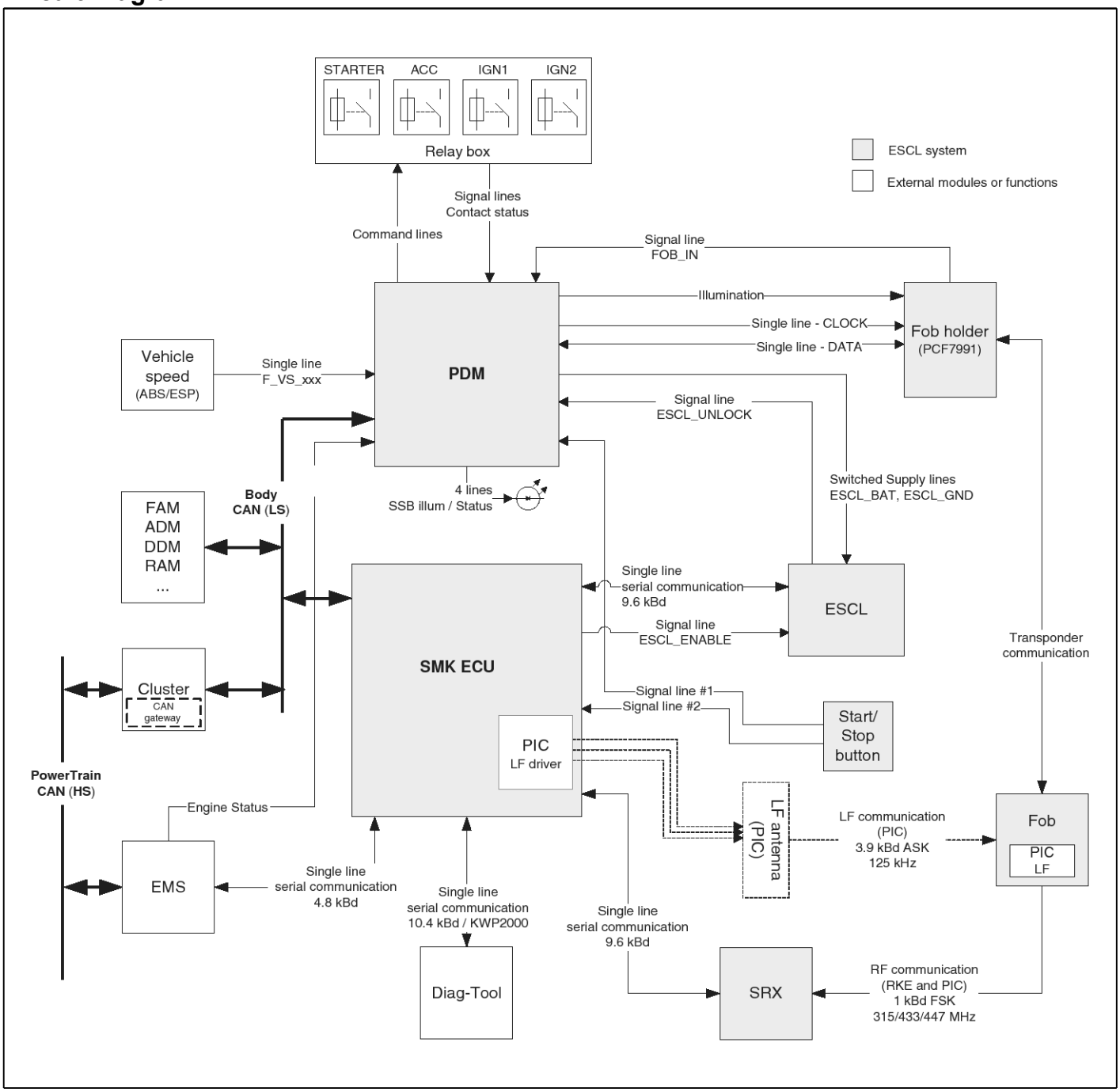
Circuit Diagram



SHMBE9001L

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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.

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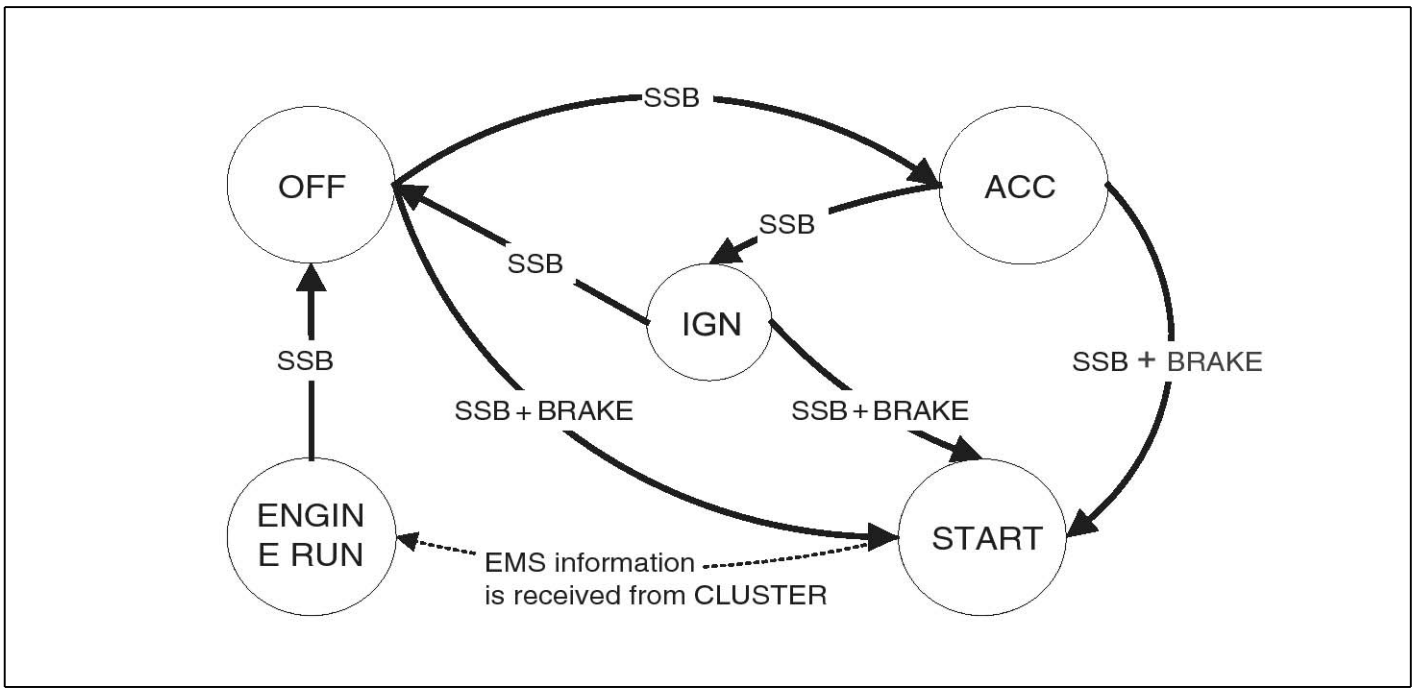

SHMBE9002L

- 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

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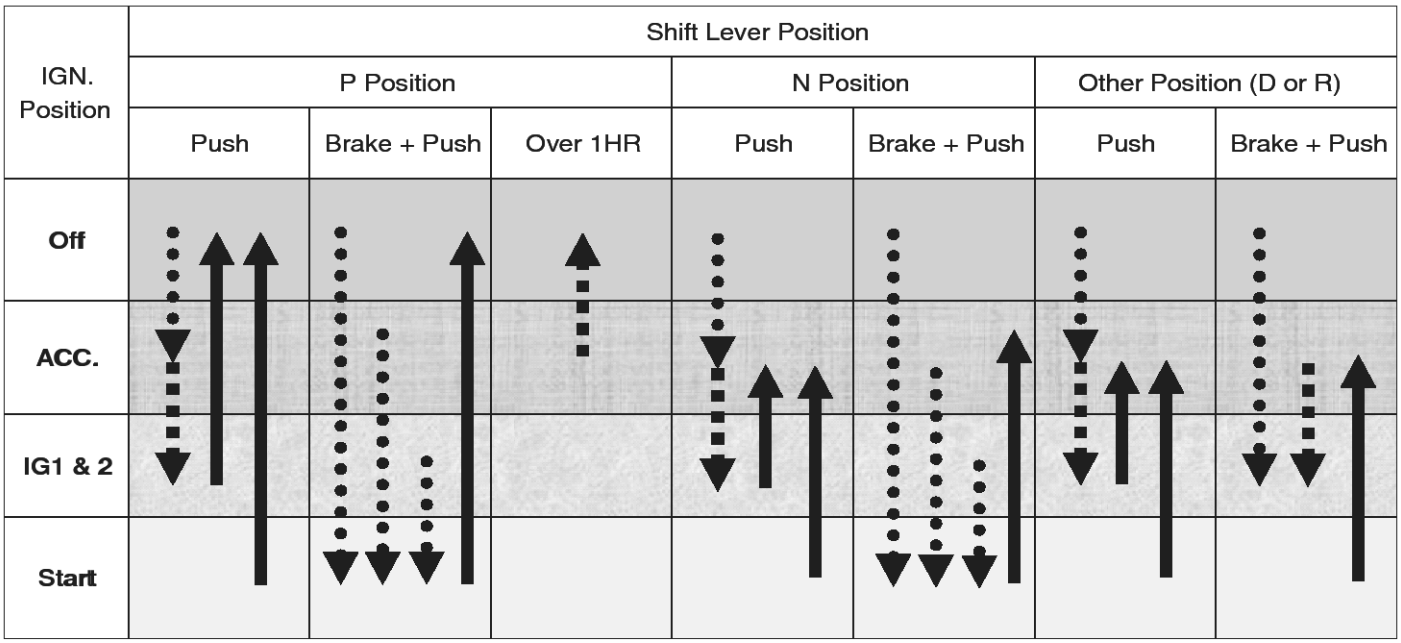
The shift of Ignition Position



Transfer possibility, after Smart key certification

Transfer possibility without Smart key certification

Transfer possibility without Smart key certification

● **Condition of stop engine while driving**

- Press 3 times button within s seconds.
- Press button more than 2 seconds

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.

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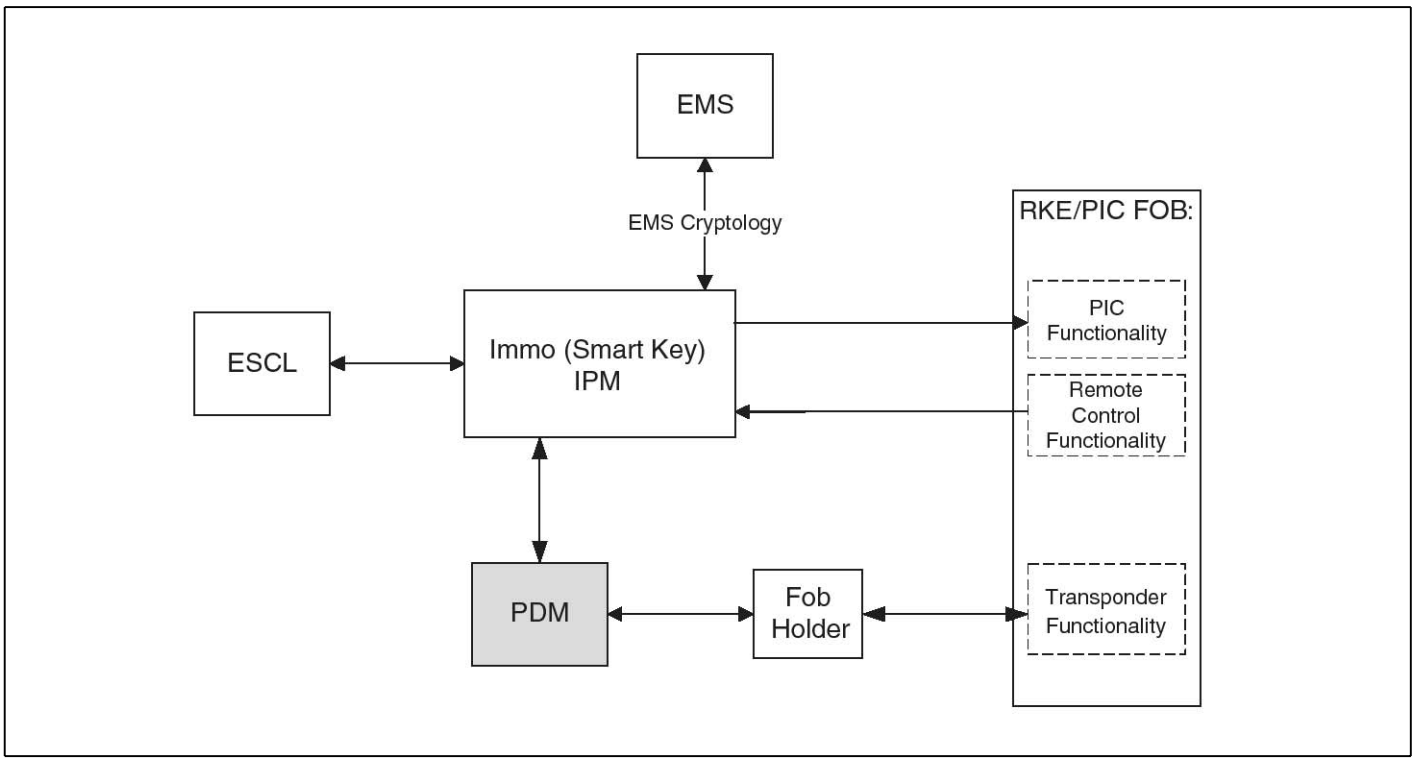

SHMBE9004L

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.

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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.

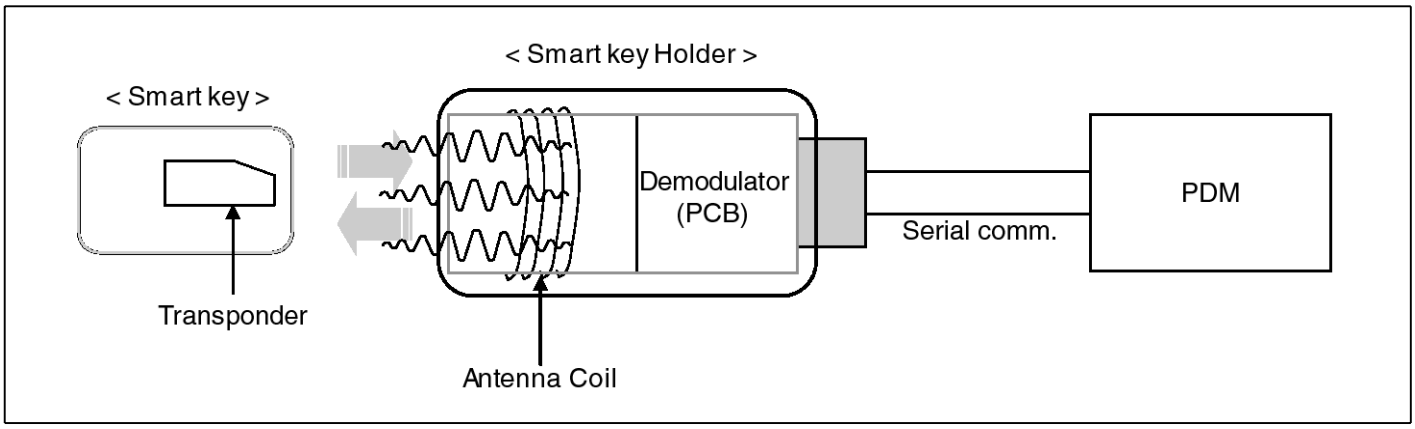
The insertion of the fob into the holder and the communication with the transponder should be possible regardless of the insertion direction of fob to the holder (buttons facing up or bottom).

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.

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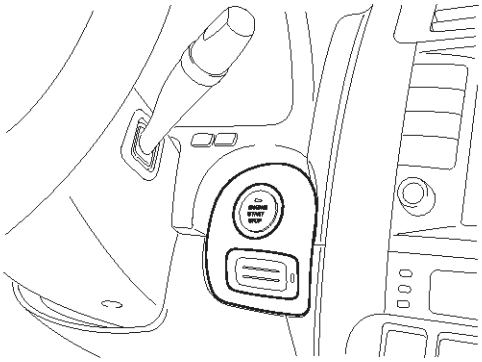
Start/Stop Button(SSB)

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.

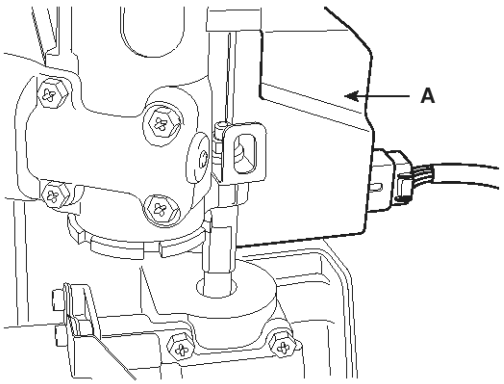


SHMBE8442D

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.



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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.

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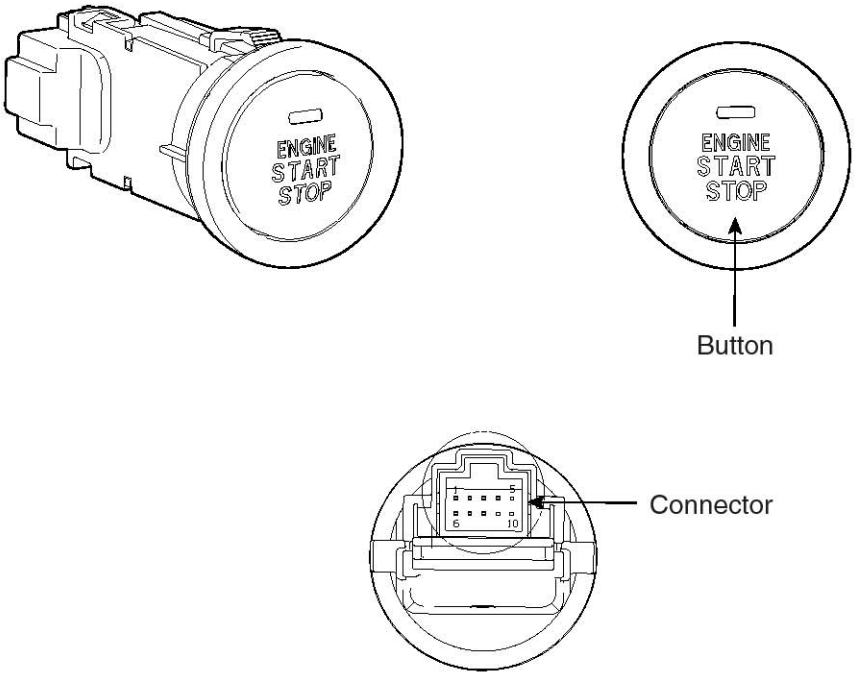
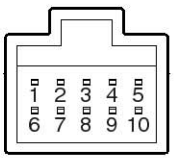
Start/Stop Button

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	-

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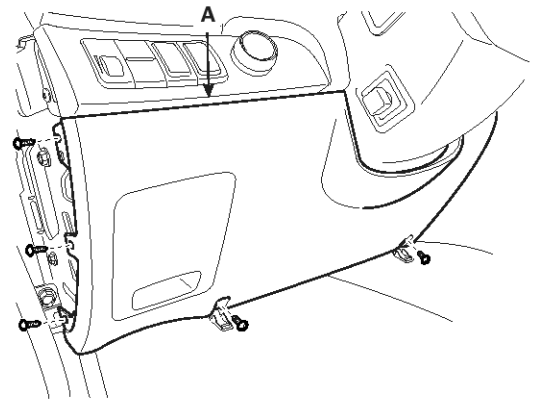
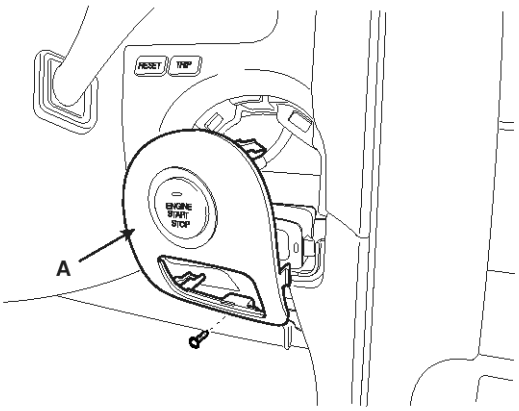
Removal

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.



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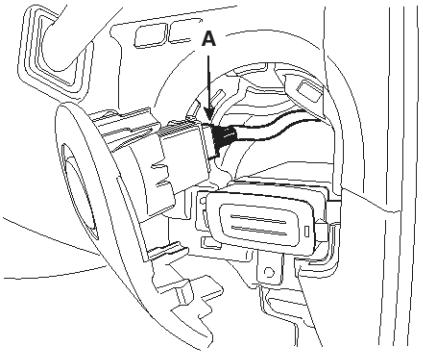
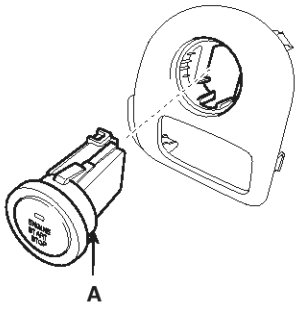
4. Disconnect the connector(A)



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.

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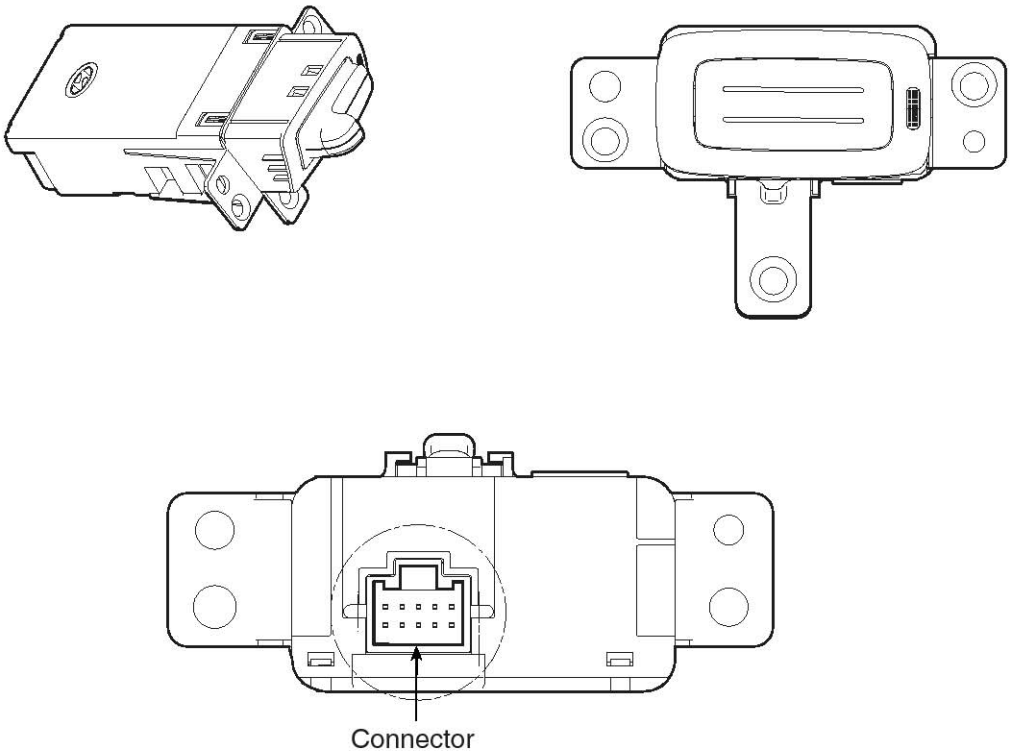
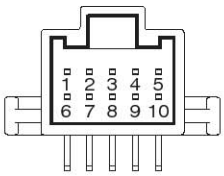
Fob Holder

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	-

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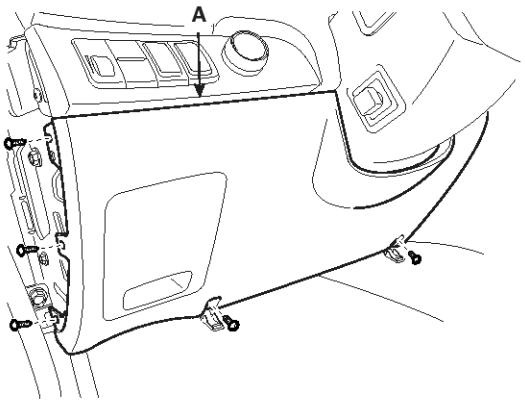
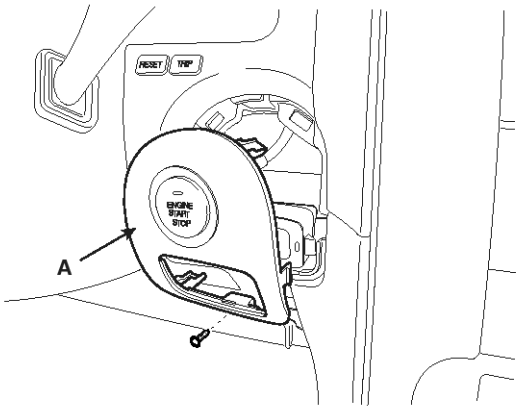
Removal

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



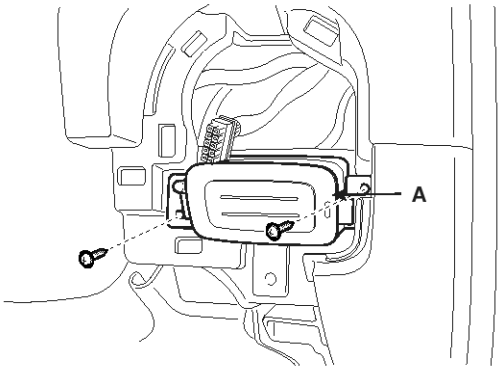
SHMBE8449D

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.

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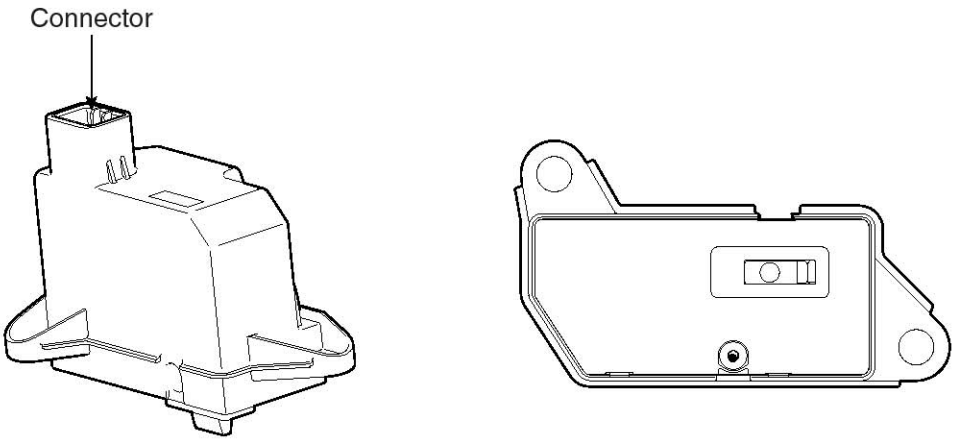
ESCL(Electronic Steering Column Lock)

Component



Connector (6 pins)

Pin No.	Description
1	-
2	Ground
3	Power(12V)
4	ESCL-Enable (Lock)
5	ESCL- Unlock
6	Data line

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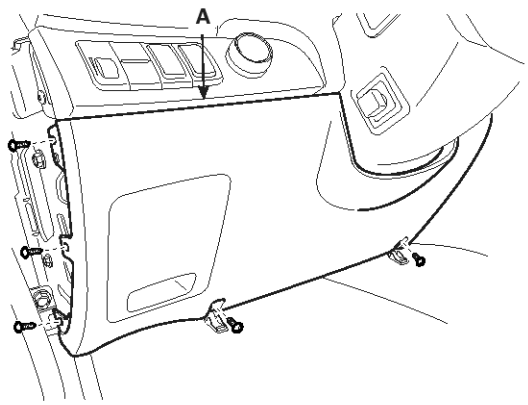
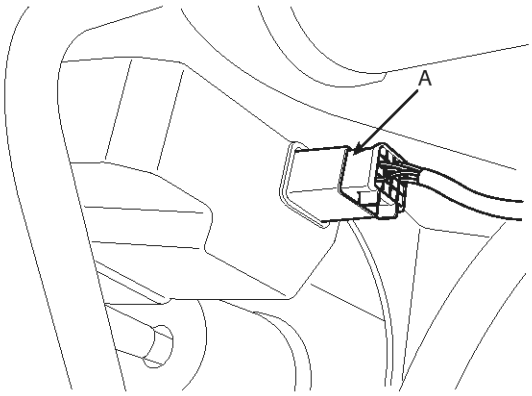
Removal

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



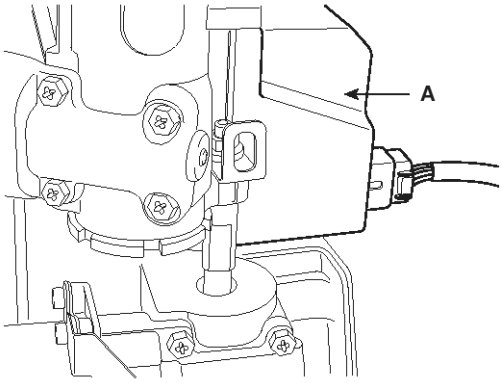
SHMBE8449D

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.

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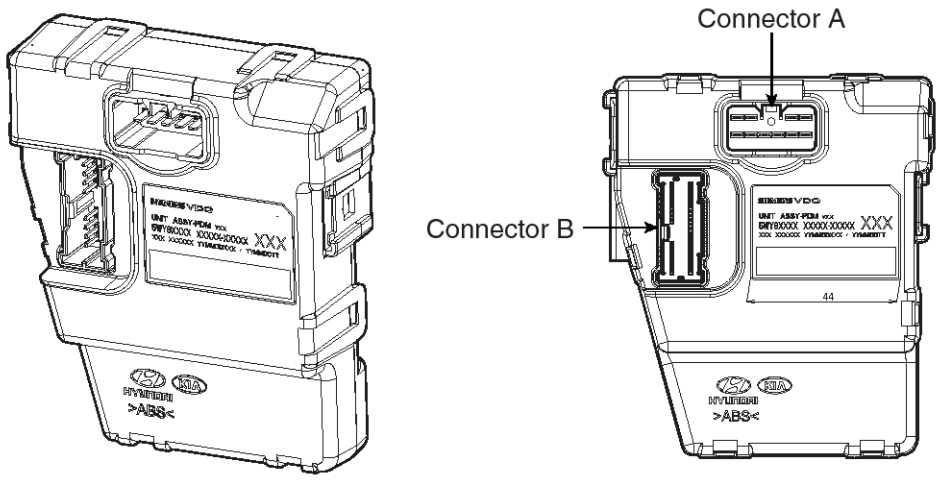
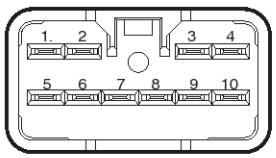
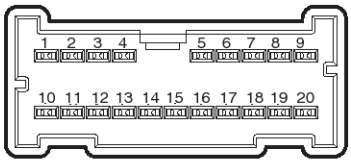
PDM(Power Distribution Module)

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		-
17		SSB LED amber
18		SSB illumination power
19		Holder illumination
20		CPU battery

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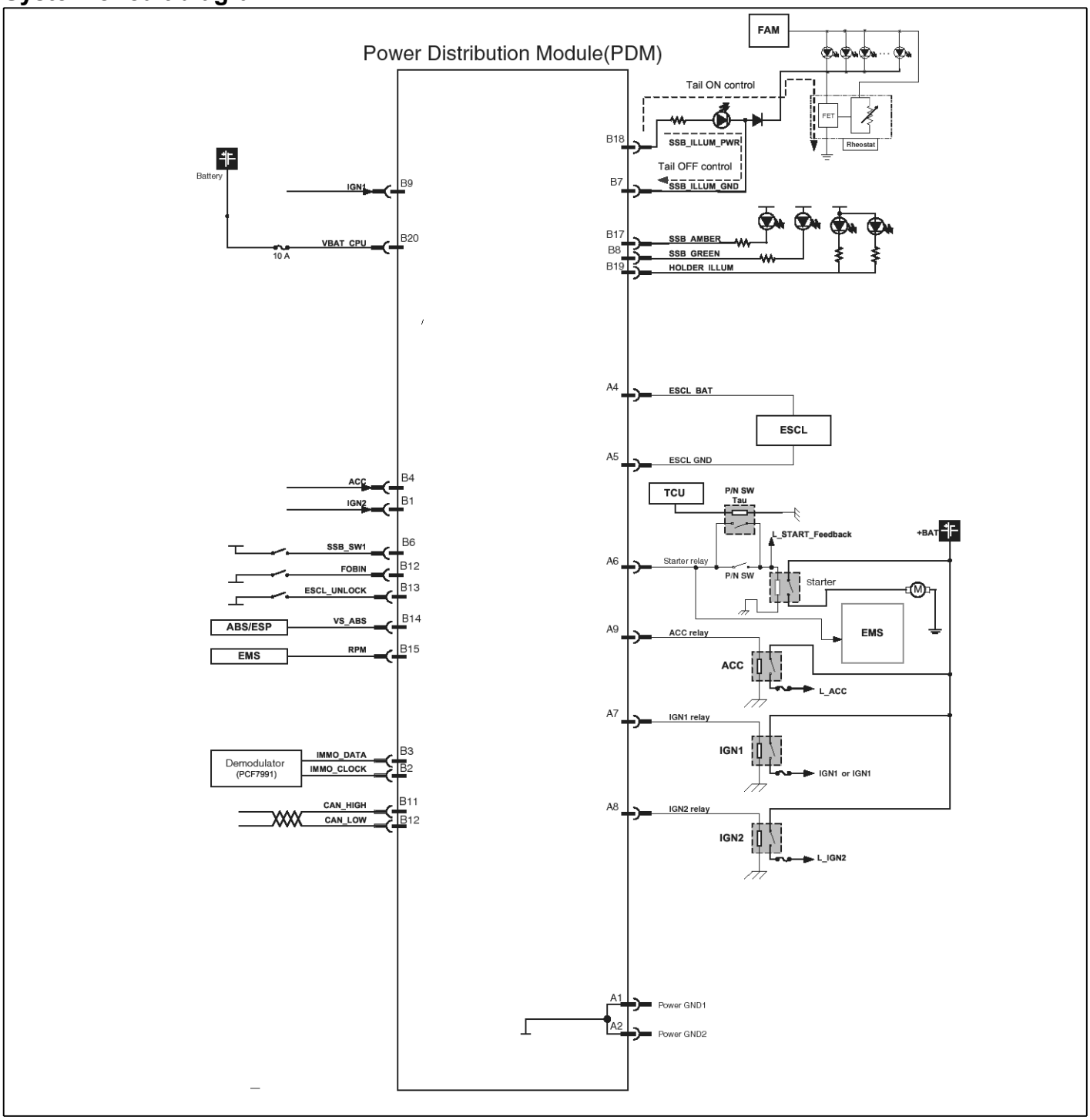
System circuit diagram



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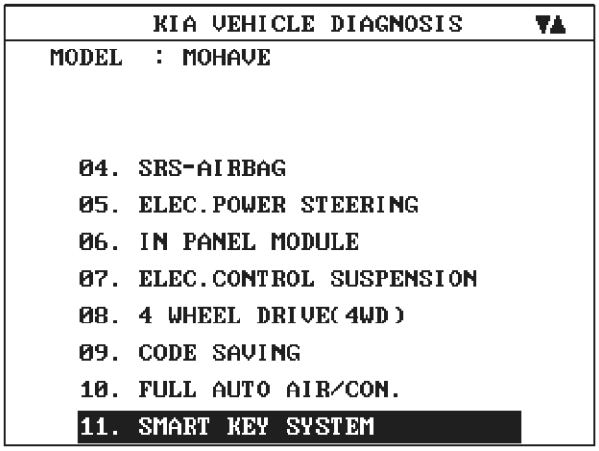
Inspection

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.



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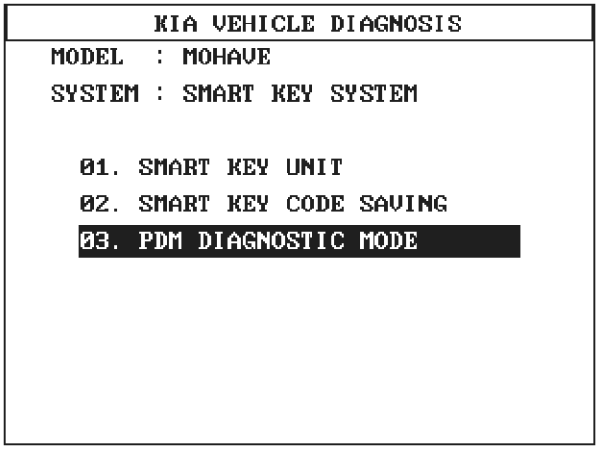
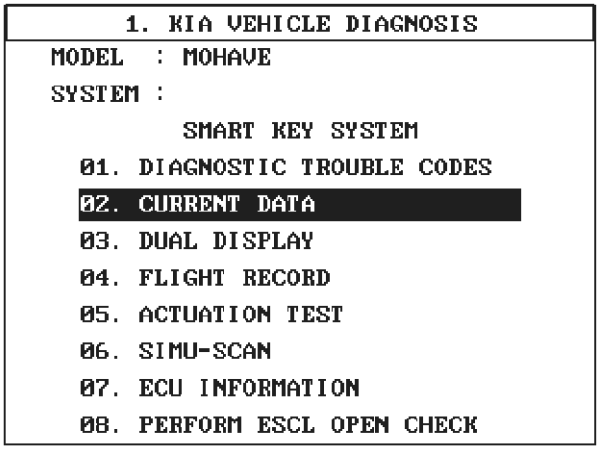
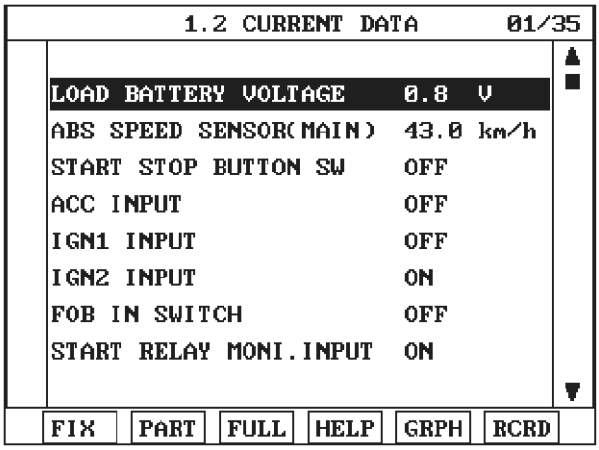
3. Select "PDM" in the manu.



SHMBE9012L

4. Select "Current data", if you want to check current data of PDM. It provides the input/output status of each module.





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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

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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

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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.

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B1602 CAN Error

General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

SHMBE9I01L

DTC Description

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Pattern	Status	
1	Open in CAN High circuit	Communication is normal but DTC set if IPM detects 7 error status as follows. ① Short to battery in CAN High circuit ② Short to ground in CAN High circuit ③ Short to battery in CAN Low circuit ④ Short to ground in CAN Low circuit ⑤ Short between CAN High and Low circuit ⑥ Open or Poor connection in CAN Low circuit ⑦ Open or Poor connection in CAN High circuit
2	Open in CAN Low circuit	
3	Short to battery in CAN High circuit	
4	Short to battery in CAN Low circuit	
5	Short to ground in CAN High circuit	
6	Short to ground in CAN Low circuit	
7	Short between CAN High and Low circuit	

DTC Detecting Condition

Item	Detecting Condition			Possible Cause
DTC Strategy	• CAN communication status			• Short to battery / ground in CAN high circuit • Short to battery / ground in CAN low circuit • Short between CAN high and CAN low circuit • Open or poor connection in CAN high and low circuit • Faulty IPM
Enable Conditions	• IG "ON" • Engine "START" • B/T voltage engerzied to IPM			
Threshold Value	CAN high	0 V	Short to ground	
		B+ V	Short to battery	
	CAN low	0 V	Short to ground	
		B+ V	Short to battery	
Diagnostic Time	• Failure has been continued for 2sec.			
DTC Erasing Time	• DTC is erased immediately after trouble fixed (In case of the past error, perform DTC erasing procedure.)			

Diagnostic Circuit Diagram

SHMBE9I02L

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SHMBE9I19L

Signal Waveform & Data

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SHMBE9I03L

SHMBE9I04L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Monitor Scantool Data

■ **Check DTC**

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1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions"
   (Refer to "DTC Detecting Condition" table)

SHMBE9I05L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or PDM's connector or was repaired and PDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to " Signal Circuit Inpsection " procedure.

Signal Circuit Inpsection

■ Check CAN high circuit

1. IG "ON" & ENG "OFF".
2. Connect GDS and select Scope meter fucntion.
3. Measure signal waveform of PDM CAN High line.

Specification : Refer to signal waveform and data

4. Is the measured signal waveform of CAN high circuit normal ?

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▶ Go to next procedure

▶ Check short to battery / ground in CAN high circuit, and repair or replace as necessary. Go to "Verification of Vehicle Repair" procedure.

■ Check CAN Low circuit

1. IG "ON" & ENG "OFF"
2. Connect GDS and select Scope meter fucntion.
3. Measure signal waveform of PDM CAN Low line.

Specification : Refer to signal waveform and data

4. Is the measured signal waveform of CAN low circuit normal ?

▶ Go to next procedure.

▶ Check short to battery / ground in CAN low circuit and, repair or replace as necessary. And then, go to 'Verification of Vehicle Repair" procedure.

Component Inspection

■ Check internal errors of CAN communication units

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. Disconnect CAN communication units one by one and monitor DTC to find the cause.

   * CAN communication units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)
5. Is the code erased?

▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

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▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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B1603 CAN Bus Off

General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

SHMBE9I01L

DTC Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

Case1: After short between FAM CAN Low Line and High

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Line, short to ground together.

Case2: After short between FAM CAN Low Line and High Line, short to power together.

※ This code is occurred when It is not possible to transmit data by CAN Line in those way of Software and Hardware. But, It is possible to receive data by CAN Line.

This code reports BUS OFF status when data transmit error count number is over 255. The purpose is to verify the status of CAN controller and CAN communication line when error is detected.

According to operation condition, some of module which are connected to CAN line may not detect B1603.

Also, B1602 coincides with B1603 at all times.

⚠CAUTION

Difference between CAN ERROR and CAN BUS ERROR

CAN Error : MIL On, CAN Bus Error : No MIL

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• CAN Communication Check	• IPM,PDM are not Sleep condition 1. CAN High and Low Line short to ground coincident 2. CAN High and Low Line short to battery coincident
Enable Conditions	• IPM, PDM power on	
Threshold Value	• CAN High/Low : 0V or B+	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

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SHMBE9I02L

SHMBE9I19L

Signal Waveform & Data

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SHMBE9I03L

SHMBE9I04L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Monitor Scantool Data

■ **Check DTC**

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1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions"
   (Refer to "DTC Detecting Condition" table)

SHMBE9I06L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or PDM's connector or was repaired and PDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to "Component Inspection" procedure.

Component Inspection

■ Check internal errors of CAN communication in PDM

1. Replace with a known-good PDM after removing installed PDM.
2. Connect GDS.
3. IG "ON" and engine "OFF".
4. Select "DTC Analysis" mode.

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5. Is the code erased?

▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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B1987 Sub Micom Failed

General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

SHMBE9I01L

DTC Description

This code reports the malfunction of NEC MCU inside PDM. This is the case which there is the NEC MCU communication error.

DTC Detecting Condition

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Item	Detecting Condition	Possible Cause
DTC Strategy	• NEC MCU Communication Check	• Short to ground/power or open in communication circuit of NE-C MCU inside PDM • Replace PDM (In case It is unable to verify th-e cause.)
Enable Conditions	• PDM power on	
Threshold Value	• Communication error	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed.	

Diagnostic Circuit Diagram

SHMBE9I02L

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SHMBE9I19L

Signal Waveform & Data

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SHMBE9I03L

SHMBE9I04L

Fig 1) Signal waveform of CAN Low and HIGH
Fig 2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

Monitor Scantool Data

■ **Check DTC**

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1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions"
   (Refer to "DTC Detecting Condition" table)

SHMBE9I07L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in the sensor's and/or PDM's connector or was repaired and PDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to "Component Inspection" procedure.

Component Inspection

■ Check internal errors of CAN communication in PDM

1. Replace with a known-good PDM after removing installed PDM.
2. Connect GDS.
3. IG "ON" and engine "OFF".
4. Select "DTC Analysis" mode.

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5. Is the code erased?

▶ Substitute with a known - good unit and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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B1988 ESCL Battery Short Circuit To Battery

General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

The steering wheel lock/unlock state of ESCL and the required data when EMS(Engine Management System) controls starting are sent to PDM by the serial communication line.

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

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SHMBE9I08L

DTC Description

This code is outputted when power circuit is shorted to battery.

(During no power supply from PDM to ESCL)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• ESCL power output line check (by voltage monitoring)	• Short to power in ESCL power circuit
Enable Conditions	• No power supply from PDM to ESCL	
Threshold Value	• ESCL power circuit is shorted to power (7V and above)	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed. (Under no power supply from PDM to ESCL state)	

Diagnostic Circuit Diagram

SHMBE9I09L

Signal Waveform & Data

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SHMBE9I10L

Fig 1) ESCL Data Signal Waveform

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

SHMBE9I11L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in ESCL's and/or PDM's connector or was repaired and PDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending , corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

Service Data Analysis

1. IG "OFF" and connect GDS.

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2. IG "ON" and select "Current Data" menu.
3. Check the service data of ESCL BATT.

Specification : OFF

SHMBE9I12L

4. Is the service data within specifications?

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

▶ Go to next procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

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▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to "Component Inspection" procedure.

PDM Ground Circuit Inspection

■ Check short at power terminal of PDM

1. IG "ON" & ENG "OFF".
2. Measure voltage between ESCL power terminal of PDM and chassis ground.
   (Measure the voltage while ESCL doesn't work.)

Specification : Approx. 0 V

3. Is the measured voltage within specifications?

▶ Go to next procedure.

▶ Check open or short on the power circuit between PDM and ESCL.
Repair as necessary and go to "Verification of Vehicle Repair"

■ Check short to power on ESCL power circuit

1. IG "ON" & ENG "OFF"
2. Disconnect the connectors of IPM, PDM, ESCL.
3. Measure voltage between ESCL power terminal and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specifications?

▶ Substitute with a known - good ESCL and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good PDM and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

▶ Repair as necessary and go to "Verification of Vehicle Repair".

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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B1989 ESCL Ground Short Circuit To Battery

General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

The steering wheel lock/unlock state of ESCL and the required data when EMS(Engine Management System) controls starting are sent to PDM by the serial communication line.

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

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SHMBE9I08L

DTC Description

This code is outputted when ground circuit is shorted to battery.

(During no power supply from PDM to ESCL)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• ESCL ground output line check (by voltage monitoring)	• Short to power in ESCL ground circuit
Enable Conditions	• No power supply from PDM to ESCL	
Threshold Value	• ESCL ground circuit is shorted to power (7V and above)	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed. (Under no power supply from PDM to ESCL state)	

Diagnostic Circuit Diagram

SHMBE9I09L

Signal Waveform & Data

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SHMBE9I10L

Fig 1) ESCL Data Signal Waveform

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

SHMBE9I13L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in ESCL's and/or PDM's connector or was repaired and PDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending , corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

Service Data Analysis

1. IG "OFF" and connect GDS.

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2. IG "ON" and select "Current Data" menu.
3. Check the service data of ESCL GND.

Specification : OFF

SHMBE9I14L

4. Is the service data within specifications?

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

▶ Go to next procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

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▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to "Component Inspection" procedure.

PDM Ground Circuit Inspection

■ Check short at ground terminal of PDM

1. IG "ON" & ENG "OFF".
2. Measure voltage between ESCL ground terminal of PDM and chassis ground.
   (Measure the voltage while ESCL doesn't work.)

Specification : Approx. 0 V

3. Is the measured voltage within specifications?

▶ Go to next procedure.

▶ Check open or short on the ground circuit between PDM and ESCL.
Repair as necessary and go to "Verification of Vehicle Repair"

■ Check short to power on ESCL GND circuit

1. IG "ON" & ENG "OFF"
2. Disconnect the connectors of IPM, PDM, ESCL.
3. Measure voltage between ESCL ground terminal and chassis ground.

Specification : Approx. 0 V

4. Is the measured voltage within specifications?

▶ Substitute with a known - good ESCL and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good PDM and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

▶ Repair as necessary and go to "Verification of Vehicle Repair".

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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B1990 ESCL Battery Short Circuit To Ground

General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

The steering wheel lock/unlock state of ESCL and the required data when EMS(Engine Management System) controls starting are sent to PDM by the serial communication line.

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

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SHMBE9I08L

DTC Description

This code is outputted when power circuit is shorted to ground.

(During power supply from PDM to ESCL)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• ESCL power output line check (by voltage monitoring)	• Short to ground in ESCL power circuit
Enable Conditions	• Under power supply from PDM to ESCL	
Threshold Value	• ESCL power circuit is shorted to ground(2V and below)	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed. (Under power supply from PDM to ESCL state)	

Diagnostic Circuit Diagram

SHMBE9I09L

Signal Waveform & Data

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SHMBE9I10L

Fig 1) ESCL Data Signal Waveform

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

SHMBE9I15L

5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in ESCL's and/or PDM's connector or was repaired and PDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending , corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to " Verification of Vehicle Repair" procedure.

Service Data Analysis

1. IG "OFF" and connect GDS.

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2. IG "ON" and select "Current Data" menu.
3. Check the service data of ESCL BATT.

Specification : ON

SHMBE9I12L

4. Is the service data within specifications?

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

▶ Go to next procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

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▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to "Component Inspection" procedure.

PDM Ground Circuit Inspection

■ Check short at power terminal of PDM

1. IG "ON" & ENG "OFF".
2. Measure voltage between ESCL power terminal of PDM and chassis ground.
   (Measure the voltage while ESCL doesn't work.)

Specification : Approx. 12 V

3. Is the measured voltage within specifications?

▶ Go to next procedure.

▶ Check open or short on the power circuit between PDM and ESCL.
Repair as necessary and go to "Verification of Vehicle Repair"

■ Check short to ground on ESCL power circuit

1. IG "ON" & ENG "OFF"
2. Disconnect the connectors of IPM, PDM, ESCL.
3. Measure resistance between ESCL power terminal and chassis ground.

Specification : ∞ Ω

4. Is the measured voltage within specifications?

▶ Substitute with a known - good ESCL and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good PDM and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

▶ Repair as necessary and go to "Verification of Vehicle Repair".

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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B1991 Immobilizer TX Short Circuit To Ground

General Description

This is DTC which is related with communication error between IPM and other units.

(※ Control Units : IPM(Inter Panel Module), FAM(Front Area Module), PDM(Power Distribution Module), DDM(Drive Door Module), ADM(Assist Door Module), CLU(Cluster), PSM(Power Seat Module), SCM(Steering Control Module), RAM(Rear Area Module), SMK(Smart Key)

After insert the fob into the fob holder, press SSB button. Then, the communication state between the fob and the immobilizer is inputted to PDM.

*1 CAN (Controller Area Network) : CAN is serial bus communication type which links not only communication system but also control units each other.

*2 LIN (Local Interconnect Network) : LIN is serial communication type which is used in electrical control system. (This is less expensive.)

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DTC Description

This code is outputted when the immobilizer data circuit is shorted to ground.

(In this case, it is not possible to get authorization although the fob is in the holder.)

DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Immobilizer data line check (by voltage monitoring)	• Short to ground in immobilizer data circuit
Enable Conditions	• The communication state between the fob and the fob holder when SSB button is pushed. (The fob is in the holder.)	
Threshold Value	• Short to ground in immobilizer data circuit (2V and below)	
Diagnostic Time	• Immediately	
DTC Erasing Time	• DTC is erased immediately after trouble fixed. (After communication recovery)	

Diagnostic Circuit Diagram

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Signal Waveform & Data

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SHMBE9I16L

Fig 1) IMMO_CLOCK & IMMO_DATE signal waveform

Scantool Data Analysis

1. Connect GDS.
2. IG "ON" and engine "OFF".
3. Select "DTC Analysis" mode.
4. After erase DTC, keep the vehicle condition within "the enable conditions" (Refer to "DTC Detecting Condition" table).

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5. Is the same DTC occurred again?

▶ Go to next procedure.

▶ Fault is intermittent caused by poor contact in PDM's connector or was repaired and PDM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

Service Data Analysis

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of SMART KEY HOLDER INSERT SIGNAL.

Specification : INSERT (When the fob is inserted in the holder.)

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4. Is the service data within specifications?

▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

▶ Go to next procedure.

Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

▶ Go to next procedure.

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Immobilizer TX Terminal Inspection

■ Check short to ground on IMMO TX terminal

1. IG "ON" & ENG "OFF".
2. Disconnect the connectors of IPM,PDM,ESCL.
3. Measure resistance between IMMO TX terminal and chassis ground.

Specification : ∞ Ω

5. Is the measured resistance within specifications?

▶ Substitute with a known - good PDM and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good fob holder and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

▶ Repair as necessary and go to "Verification of Vehicle Repair".

Verification of Vehicle Repair

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "DTC Analysis" mode.
2. Clear the DTCs and Operate the vehicle within DTC Enable conditions in General information.
3. Is any DTC outputted again?

▶ Go to the applicable troubleshooting procedure.

▶ System performing to specification at this time.

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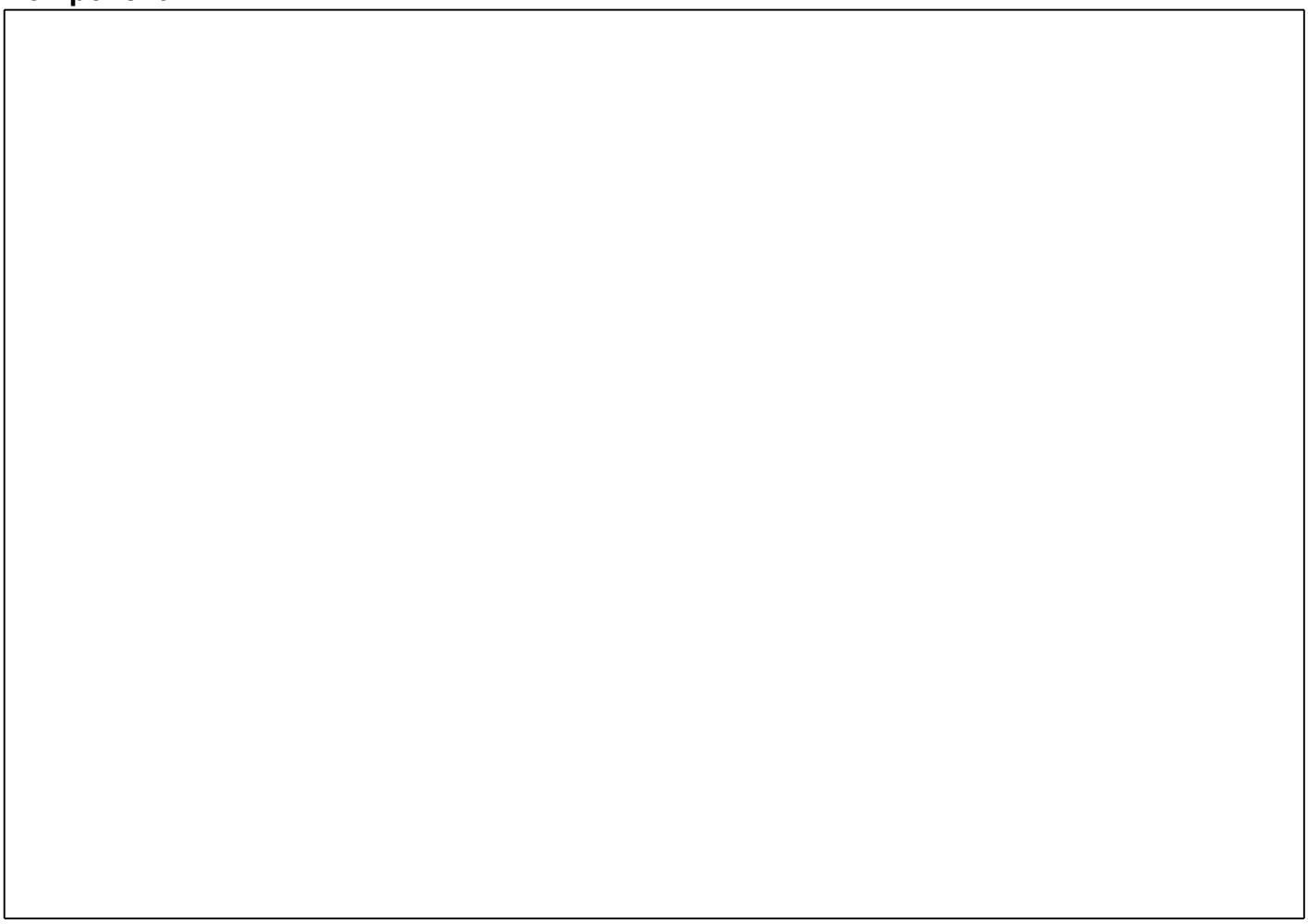
Ignition Switch Assembly

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

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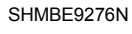
Inspection

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.



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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.

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Back View Camera System

Component Location

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1. Back view camera
2. ECM mirror
3. LCD monitor

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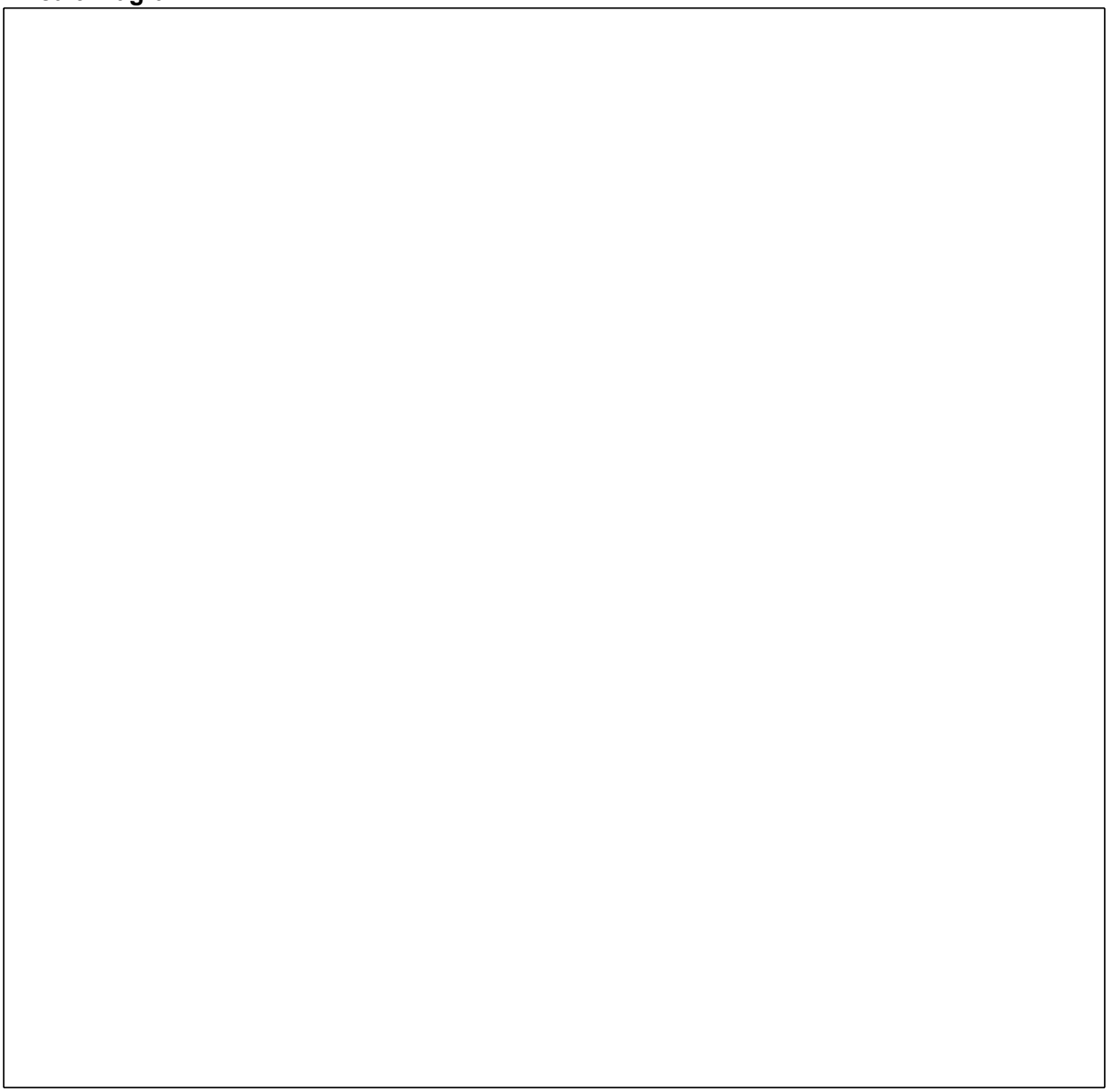
Circuit Diagram



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Description

Back view camera will activate when the backup light is ON with the ignition switch ON and the shift lever in the R 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.

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