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# General Information

## General Troubleshooting Information

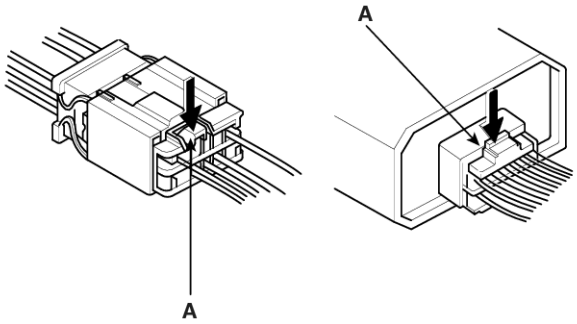
### Before Troubleshooting

1. Check applicable fuses in the appropriate fuse/relay box.
2. Check the battery for damage, state of charge, and clean and tight connections.

   **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.

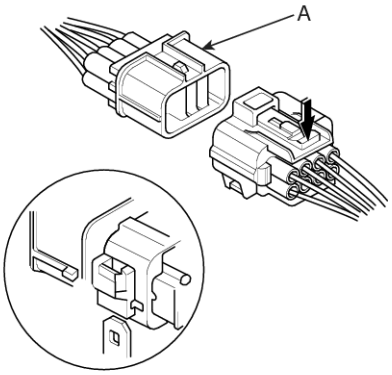
### Handling Connectors

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 ).



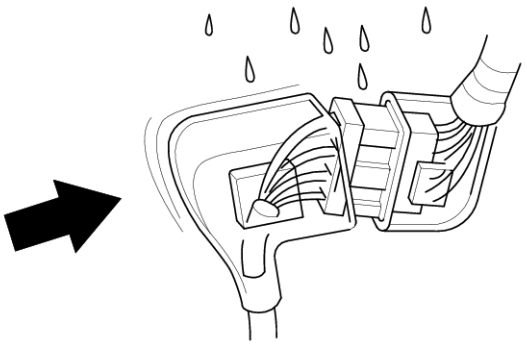

ETKD150A

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.



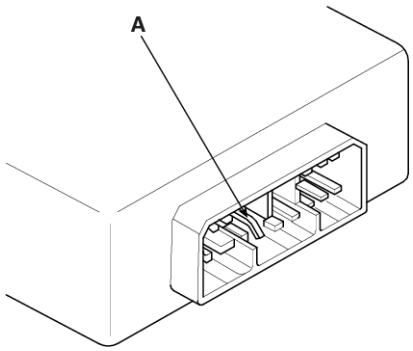
ETKD150C

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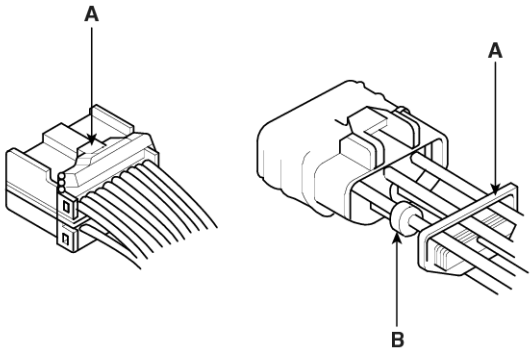


8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



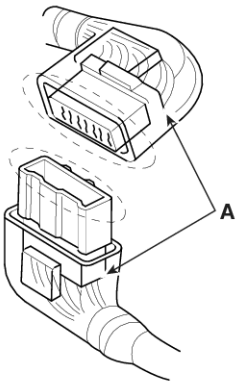

ETKD150D

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



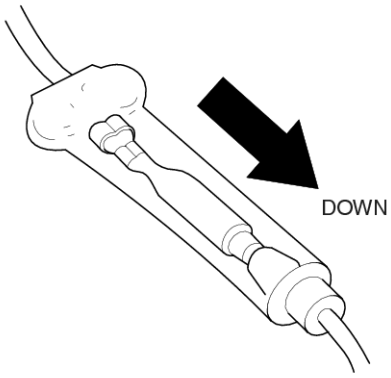

ETKD150E

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

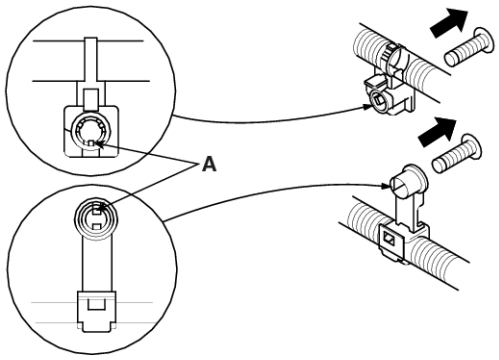
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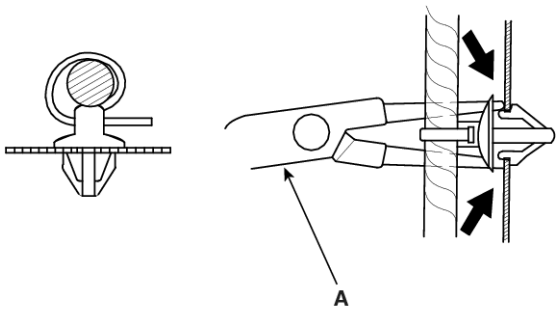
### Handling Wires And Harnesses

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).



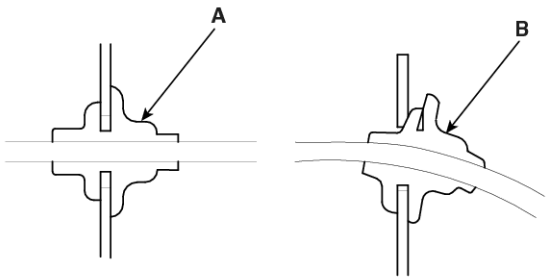

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3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.




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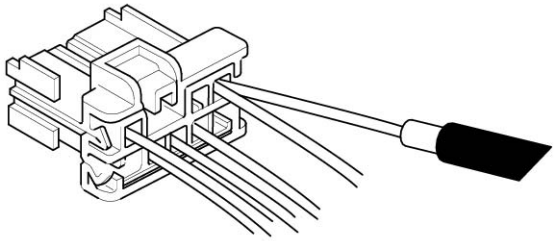
4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave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



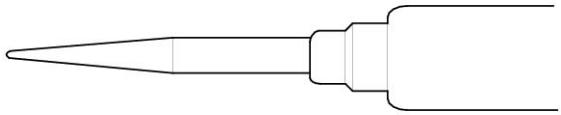
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5. Use a probe with a tapered tip.



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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.

### Installation of the transmitting device.

Electronic-controlled computers are designed not to interrupted by other radio signal but it could be effected even less 25W output of remote-cont roll by wiring an antenna of it or the cables near the computer. Should follow below directions.

1. equip an antenna at the roof or rear-bumber.
2. Antenna cables should keep away over 200mm from the computer or wiring harness because the antenna cables transmit radio signals.
3. decrease the standing-wave ratio by using proper antennas and cables.
4. Not to install remote-controll with a high output.
5. check the status of a engine by generating radio signals with Idling.

**NOTICE**

*The standing-wave ratio : Input impedance Zi can be changed by the length of cables and signals of the remote controll under condition inpedance connects with other cables, antennas and changeable also voltage range.*

*This rate of the maximum and the minimum voltage is called the standing-wave ratio.*

*This means that the rate of the antenna impedance and cable impedance.*

*The volume of radio signals from cables is propotioned to the standing-wave ratio volume so that possibility which have an influence to the electronic part increses.*

### Warning For Treating Cables

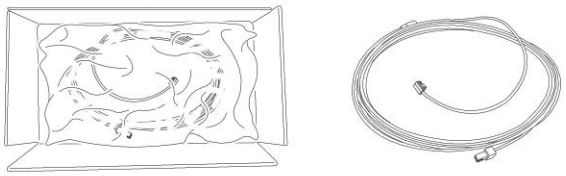
1. Follow permitted bending (over 25˚) - don't bend or curve.
2. Follow permitted temperature (-40℃ ~ 85℃ )
3. Prevention input dust
   - Just before assemble each unit and a inline connetor. Remove a dust cap.
4. Prevention pollution
   - Don't touch and polluted at the end part of the Perul.
5. Prevention damage
   - Not to throw and tread on.
   - Don't pull the cables excessively.
6. Prevention damage
   - Don't twist.

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### Long-term Storage Way Of Cables

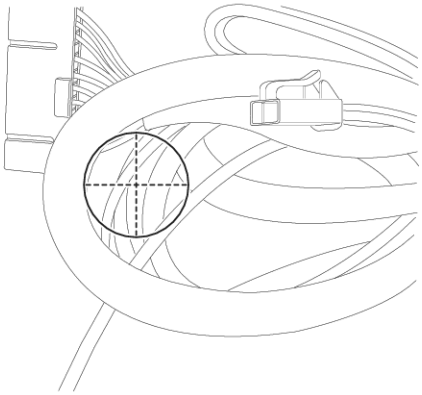


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1. Follow permitted bending (over 25˚) - not to storage by bending/curving status.
2. Follow permitted temperature (-40˚ ~ 85˚) - follow keeping place, temperature option
3. Prevention input dust - packing cables in a plastic bag.
4. Prevention pollution - not storage cables with other stuffs.
5. Prevention damage - not to lay other boxes on the cable box.

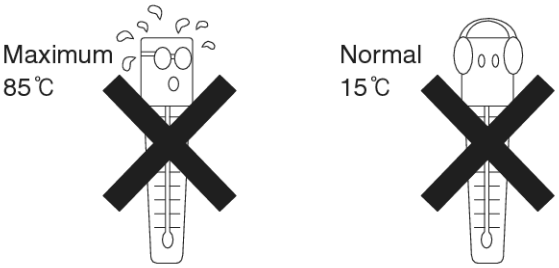
### Detailed warning when a worker treats

1. Manage cables to be over an angle of 25˚ (occurs optical damages when less an angle of 25˚)



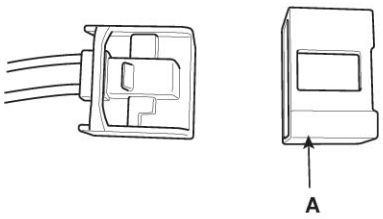
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2. Maintain proper temperature when storage cables. → SPEC ( -40˚ ~ 85˚ )




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3. Remove a dust cap just before assembling at the unit . (to prevent exposing at dust and polluted by touching)



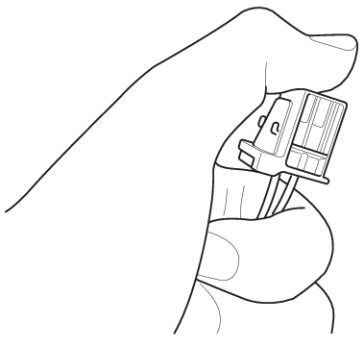

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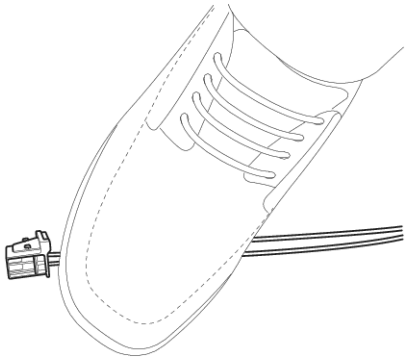


4. Not to touch and contact at the end part of Ferrule.
   (could be occurred optical damage by water or pollutions)



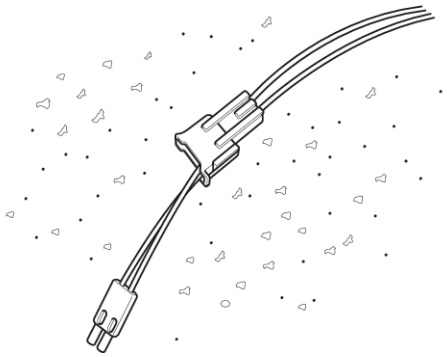
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5. Not to step on cables. (damage of cables and connectors)



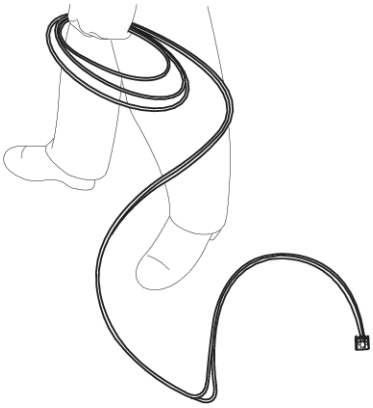
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6. Not to throw cables to the floor in the line process. (damage connetors)



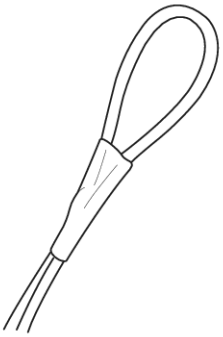
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7. Not to drag cables on the floor. (damage cables and connectors)



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8. Not to twist or bend exccesively when treats extra length.



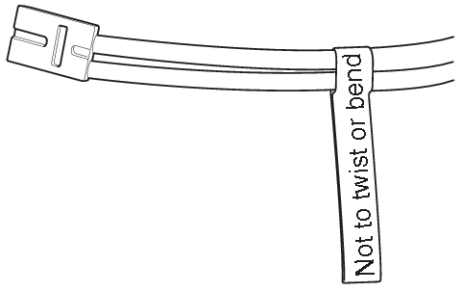
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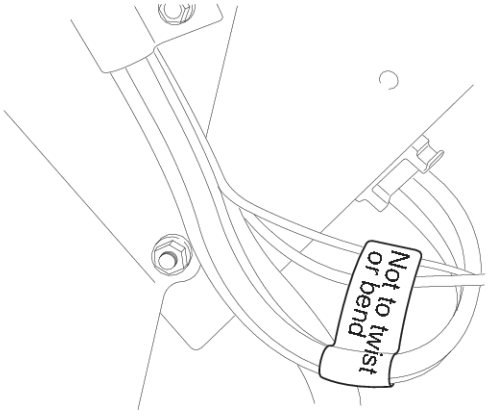
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9. Not to bend or snap the cables indicated parts like the picture in the line process.

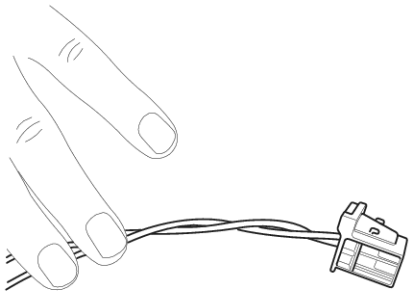



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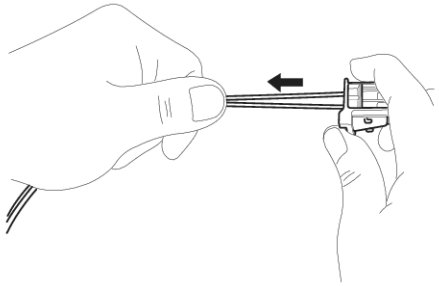

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10. Not to twist cables. (cable stress occuring : damage optical output)



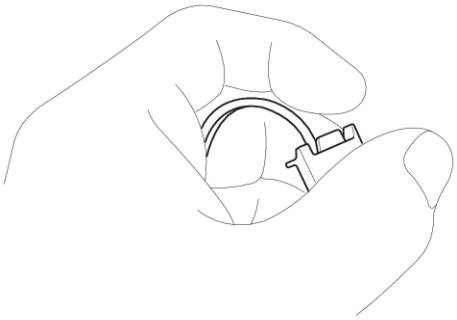
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11. Not to pull cables excessively. (prevent damages at the connected part of cables and Ferrule)

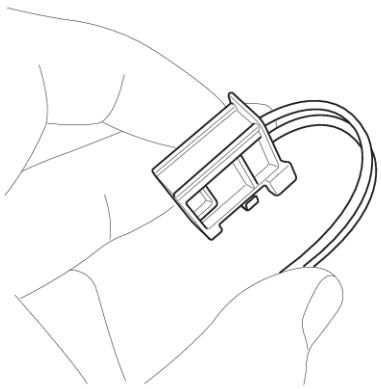


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12. Not to bend cable at the end part of connector. (to avoid optical output damage due to over cable bending)



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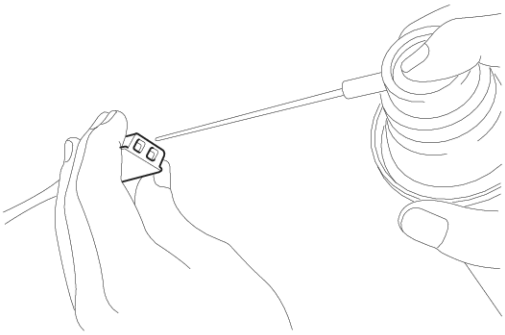
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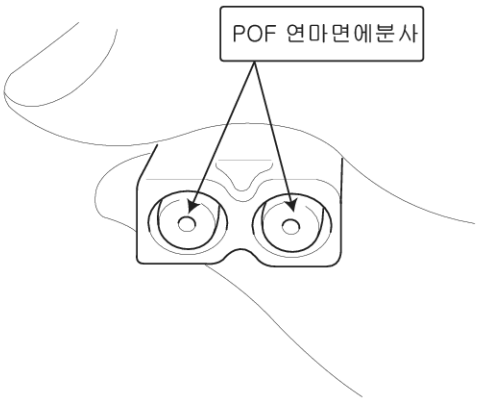
### Dusting Way On The Grinding Surface Of Cables.

- Purpose : cleaning up POF grinding surface due to breakaway of a dust cap or by others. (recovering optical damage)
- Method : spray POF grindng surface with strong dusting spray after separate the cable connector from the unit.
- Needed tools : strong dusting spray 1EA

1. Prepare tools for the work.
2. Separate the cable connector from the unit.
3. Reassemble them after jet a strong dusting spray on the POF grinding surface.

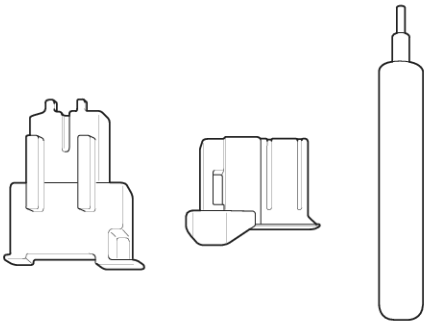


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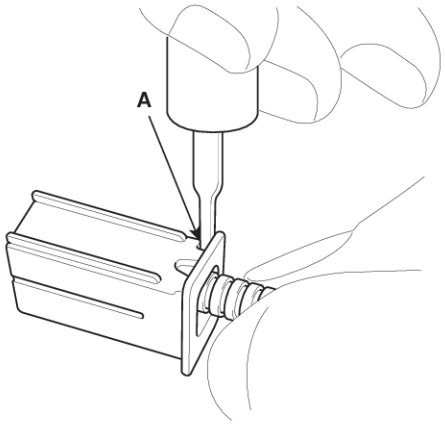
### Changing Way Of The Cable Connector



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- Purpose : changing single connector due to outer shock or unskilled treatment.
- Method : change the connector after divide by lifting damaged connector up using rework key.
- Needed tools : rework key 1EA, one single connector for change.

1. Prepare tools for the work.
2. Separate the connector for the unit.
3. Divide the locked part of the cable connector lifting it up by rework key.

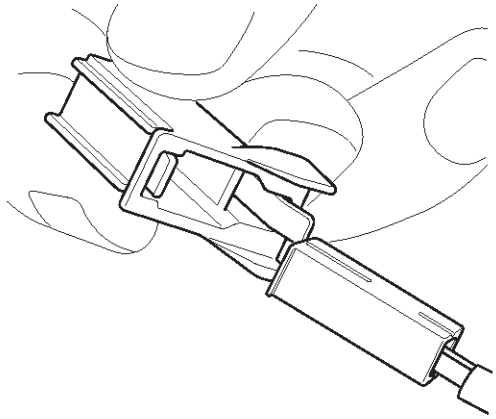



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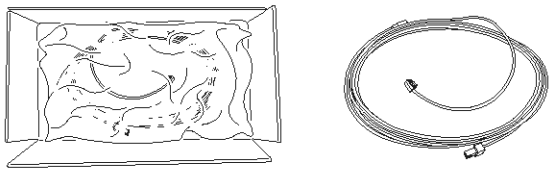
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SHMBE8020D

**Changing Way The Cable Assembly**



SHMBE8021D

- Purpose : changing the defective assembly due to picking, breaking and others.
- Method : change into new cable assembly after remove from car body by cutting cable and remove damaged cable connector.

1. Prepare tools for the work
2. Separate the cable connector from the unit.
3. Change into new cable assembly after cutting cable assebly and separate from the car body. (must be needed re-locking)

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# Audio

## Specifications

### Audio Unit

| Item | | Specification | |
|---|---|---|---|
| Model | | RADIO/CDP/MP3 | RADIO/6CDC/MP3 |
| Power supply | | DC 14.4V | |
| Rated output | | Max 3.2Vrms | |
| Load Impedance | | 10KΩX 4 | |
| Antenna | | 80PF 75Ω | |
| Tuning type | | PLL synthesized type | |
| External amplifier & sub woofer | | External amplifier & sub woofer | |
| Frequency range / Channel space | FM | 87.5~108 MHz/ 100KHz (General), 50KHz(Europe) | |
| | AM | 531~1602 KHz/ 9KHz (General) | |
| | MW | 522~1620 KHz/ 9KHz (Europe) | |
| | LW | 153~279 KHz/ 1KHz (Europe) | |
| | FM | 76.0~90.0 MHz/ 100KHz (Japan) | |
| | AM | 522~1629KHz/ 9KHz (Japan) | |

### Keyboard Unit

| Item | | Specification |
|---|---|---|
| Power supply | Microcomputer | DC 5V |
| | Illumination | DC 14.4V |
| Operation Temperature | | -20℃~ +65℃ |
| Dark current | | MAX 0.5mA |

### Monitor Unit

| Item | Specification |
|---|---|
| Voltage | DC 14.4V |
| Picture Size | 144(H) X 51(V) mm |
| Operation Temperature | -20℃~ +70℃ |
| View Angle | H/V : -45~+45 / -35~ +25degrees |

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**Speaker**

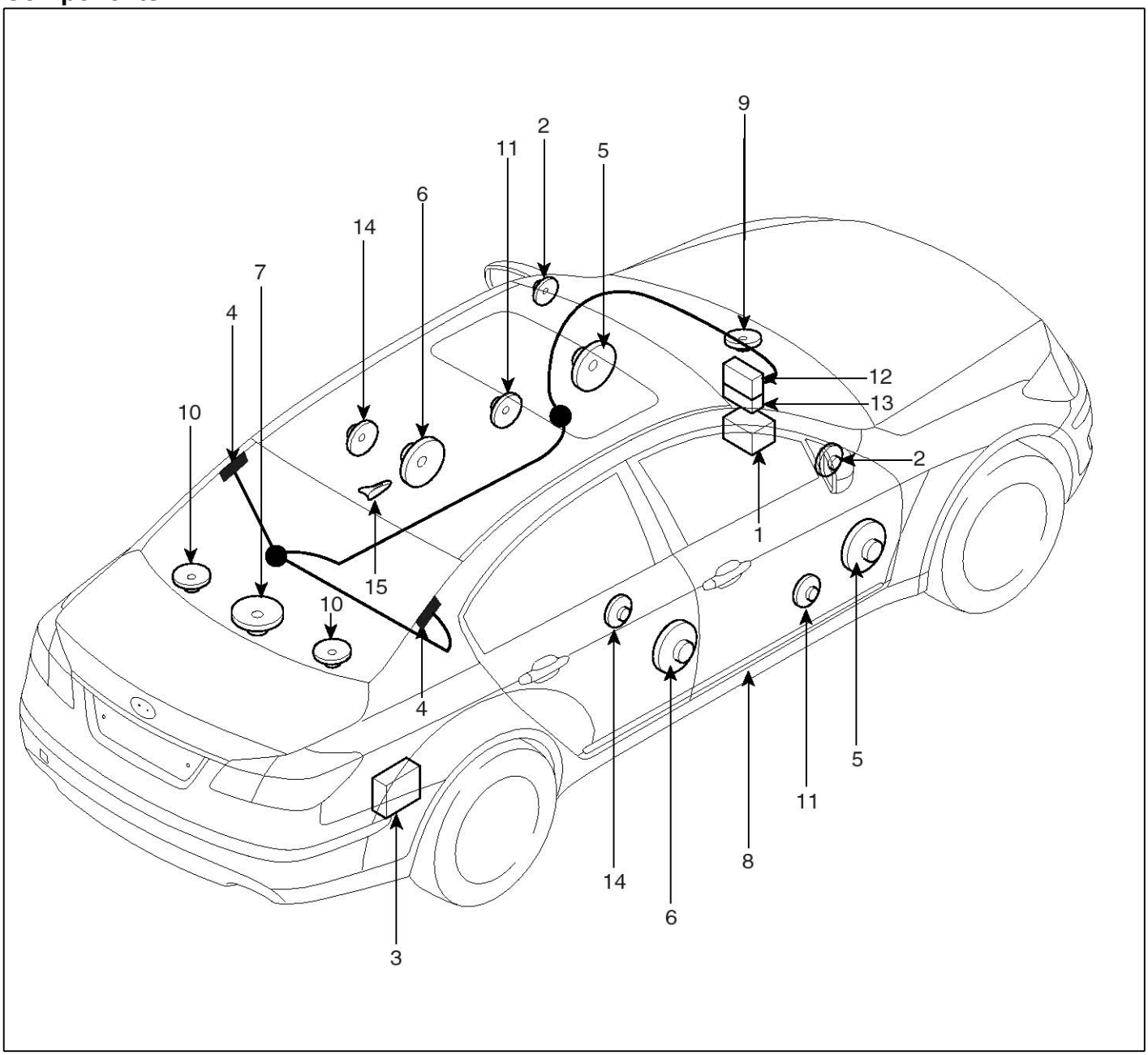
| Model | | General | | Premium | | DIS | |
|---|---|---|---|---|---|---|---|
| Item | | Input Power | Speaker Impedance (Ω) | Input Power | Speaker Impedance (Ω) | Input Power | Speaker Impedance (Ω) |
| Front door | Door speaker | 25W , MAX 50W | 2 ± 0.3 | 25W , MAX 50W | 2 ± 0.3 | 25W , MAX 50W | 2 ± 0.3 |
| | Tweeter speaker | 25W , MAX 50W | 3.4 ± 0.5 | 8 Vrms | 3.6 | 8 Vrms | 3.6 |
| | Middle speaker | - | - | - | - | 8 Vrms | 1.9 ± 0.25 |
| Rear door | Door speaker | 25W , MAX 50W | 2 ± 0.3 | 25W , MAX 50W | 2 ± 0.3 | 25W , MAX 50W | 2 ± 0.3 |
| | Tweeter speaker | - | - | 8 Vrms | 3.6 | 8 Vrms | 3.6 |
| Center speaker | | - | - | 8 Vrms | 2.15 ± 0.25 | 8 Vrms | 2.15 ± 0.25 |
| Sub woofer speaker | | 25W , MAX 50W | 2 ± 0.3 | 16 Vrms | 4.8 ± 1 | 16 Vrms | 4.8 ± 1 |
| Surround speaker | | - | - | 8 Vrms | 2.15 ± 0.25 | 8 Vrms | 2.15 ± 0.25 |
| Center tweeter speaker | | - | - | - | - | 8 Vrms | 3.6 |
| Speaker Number | | 7 EA | | 14 EA | | 17 EA | |

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## Components




SBHBE9445L

1. Audio head unit
2. Front tweeter speaker
3. External amp
4. Glass antenna amp(Radio)
5. Front door speaker
6. Rear door speaker
7. Sub woofer speaker
8. Antenna feeder cable
9. Crash pad center speaker
10. Surround speaker
11. Middle speaker
12. Monitor unit
13. Keyboard unit
14. Rear tweeter speaker
15. Roof antenna

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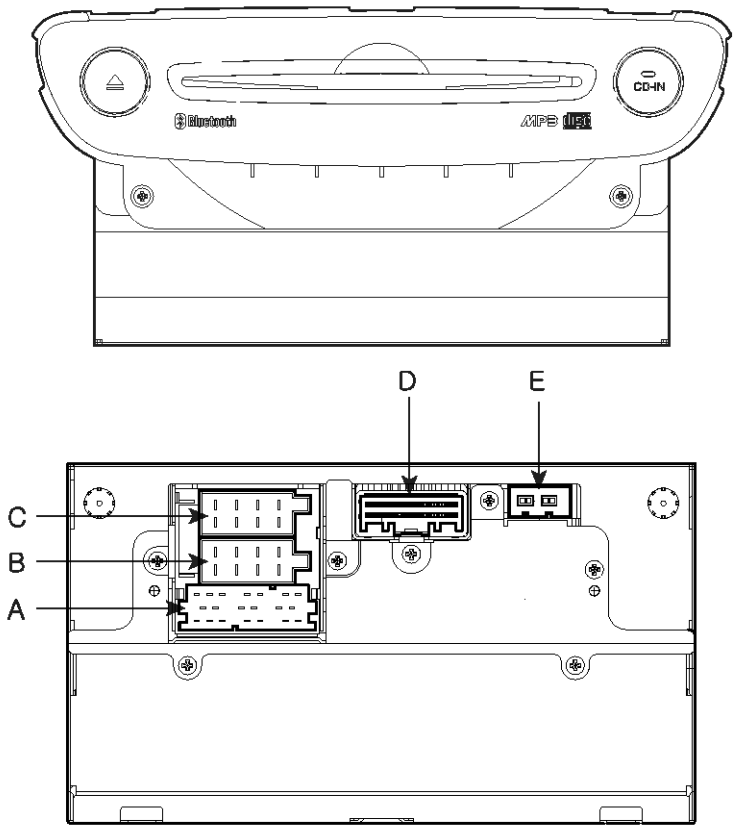
https://autolibrary.ir



## Audio Unit

### Components

[RADIO/CDP/MP3]

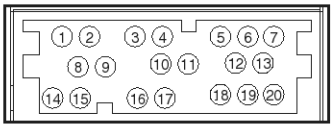


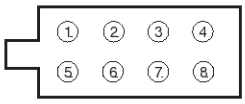

SBHBE8212D

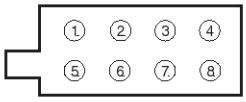
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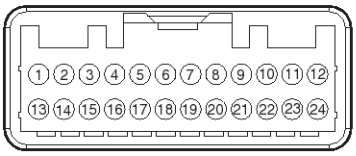
https://autolibrary.ir

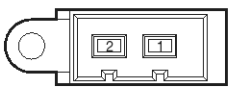


| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | MIC + | 11 | AUX Detect |
| | 2 | MIC - | 12 | USB/IPOD Rx |
| | 3 | AUX R | 13 | USB/IPOD GND |
| | 4 | AUX L | 14 | - |
| | 5 | Amp mute | 15 | IGN |
| | 6 | USB/IPOD Tx | 16 | - |
| | 7 | CAN Low | 17 | - |
| | 8 | Mode | 18 | Amp power |
| | 9 | - | 19 | USB/IPOD VDD |
| | 10 | AUX REF | 20 | CAN High |

| Connecto B | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Rear RH speaker + | 5 | Rear RH speaker - |
| | 2 | Front RH speaker + | 6 | Front RH speaker - |
| | 3 | Front LH speaker + | 7 | Front LH speaker - |
| | 4 | Rear LH speaker + | 8 | Rear LH speaker - |

| Connecto C | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | - | 5 | - |
| | 2 | Illumination + | 6 | ACC |
| | 3 | - | 7 | Illumination - |
| | 4 | BAT + | 8 | Power GND |

| Connecto D | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | - | 13 | Keyboard GND |
| | 2 | Keyboard B+ | 14 | Keyboard D GND |
| | 3 | Keyboard UART Rx | 15 | Keyboard UART Tx |
| | 4 | Keyboard Remote | 16 | - |
| | 5 | - | 17 | - |
| | 6 | - | 18 | - |
| | 7 | - | 19 | - |
| | 8 | - | 20 | - |
| | 9 | - | 21 | - |
| | 10 | - | 22 | - |
| | 11 | - | 23 | - |
| | 12 | Surround | 24 | - |

| Connector E | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Antenna 1 | 2 | Antenna 2 |

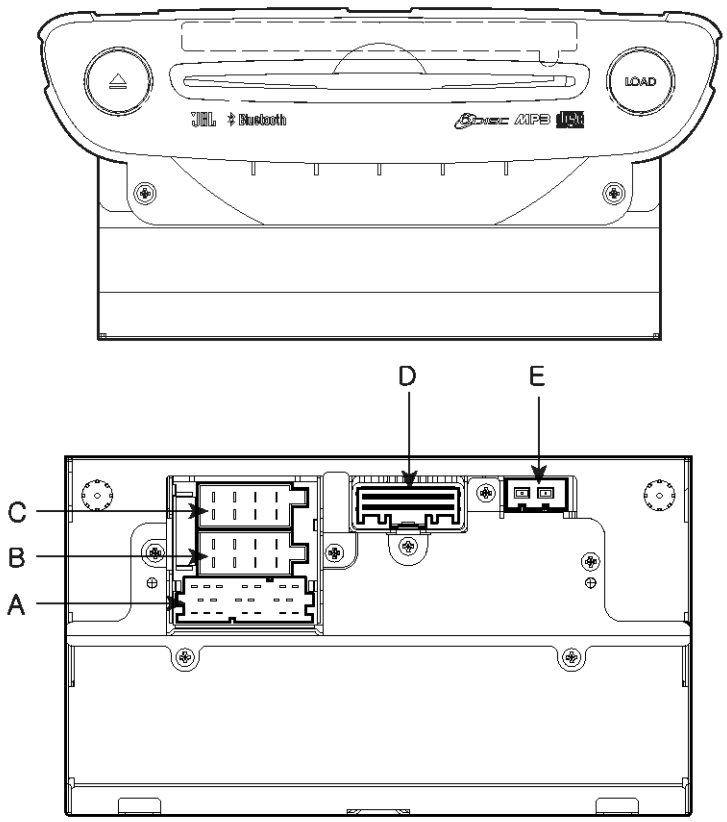
SBHBE9102L

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[RADIO/6CDC/MP3]

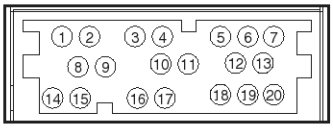


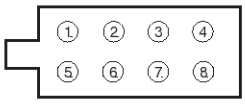

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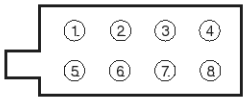
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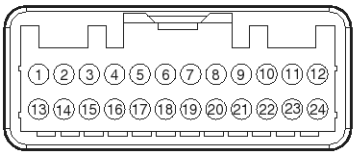
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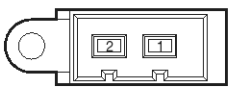


| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | MIC + | 11 | AUX Detect |
| | 2 | MIC - | 12 | USB/IPOD Rx |
| | 3 | AUX R | 13 | USB/IPOD GND |
| | 4 | AUX L | 14 | - |
| | 5 | Amp mute | 15 | IGN |
| | 6 | USB/IPOD Tx | 16 | - |
| | 7 | CAN Low | 17 | - |
| | 8 | Mode | 18 | Amp power |
| | 9 | - | 19 | USB/IPOD VDD |
| | 10 | AUX REF | 20 | CAN High |

| Connecto B | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Rear RH speaker + | 5 | Rear RH speaker - |
| | 2 | Front RH speaker + | 6 | Front RH speaker - |
| | 3 | Front LH speaker + | 7 | Front LH speaker - |
| | 4 | Rear LH speaker + | 8 | Rear LH speaker - |

| Connecto C | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | - | 5 | - |
| | 2 | Illumination + | 6 | ACC |
| | 3 | - | 7 | Illumination - |
| | 4 | BAT + | 8 | Power GND |

| Connecto D | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | - | 13 | Keyboard GND |
| | 2 | Keyboard B+ | 14 | Keyboard D GND |
| | 3 | Keyboard UART Rx | 15 | Keyboard UART Tx |
| | 4 | Keyboard Remote | 16 | - |
| | 5 | - | 17 | - |
| | 6 | - | 18 | - |
| | 7 | - | 19 | - |
| | 8 | - | 20 | - |
| | 9 | - | 21 | - |
| | 10 | - | 22 | - |
| | 11 | - | 23 | - |
| | 12 | Surround | 24 | - |

| Connector E | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Antenna 1 | 2 | Antenna 2 |

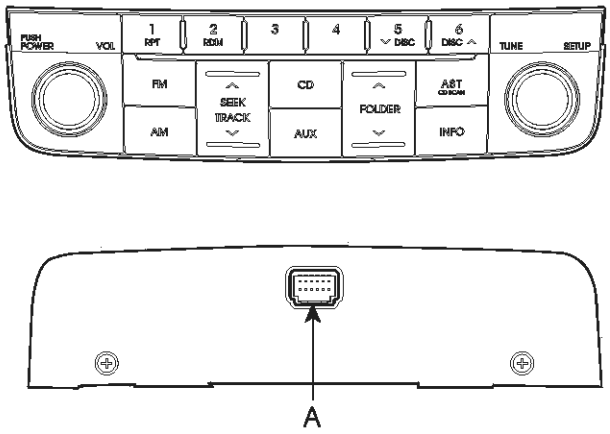
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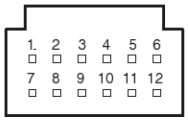
https://autolibrary.ir

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[Keyboard unit]




| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|   | 1 | - | 7 | - |
| | 2 | - | 8 | - |
| | 3 | B+ | 9 | Power GND |
| | 4 | Illumination + | 10 | Illumination - |
| | 5 | Remote PWR | 11 | IGN |
| | 6 | UART Tx | 12 | - |

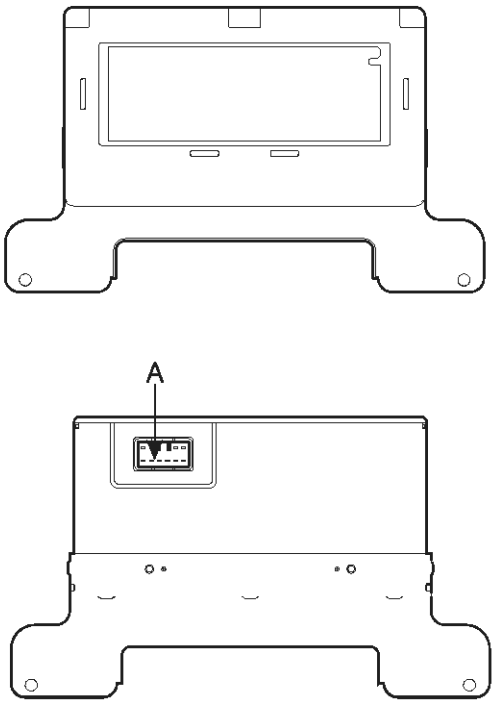
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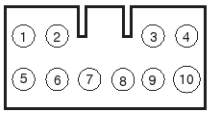
https://autolibrary.ir

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[Monitor unit]




| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Illumination - | 6 | - |
| | 2 | - | 7 | CAN - |
| | 3 | - | 8 | CAN + |
| | 4 | Power GND | 9 | ACC |
| | 5 | Illumination + | 10 | B+ |

SBHBE9104L

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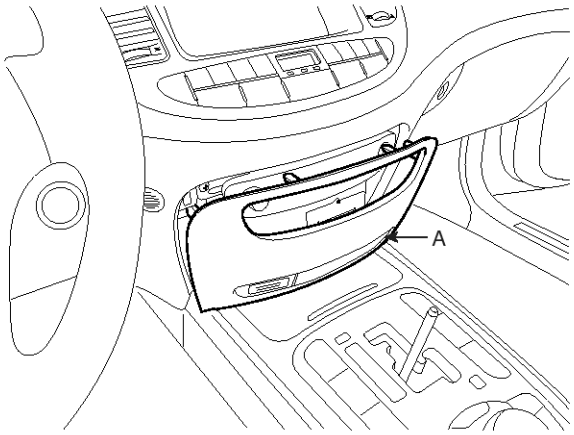
https://autolibrary.ir



## Removal

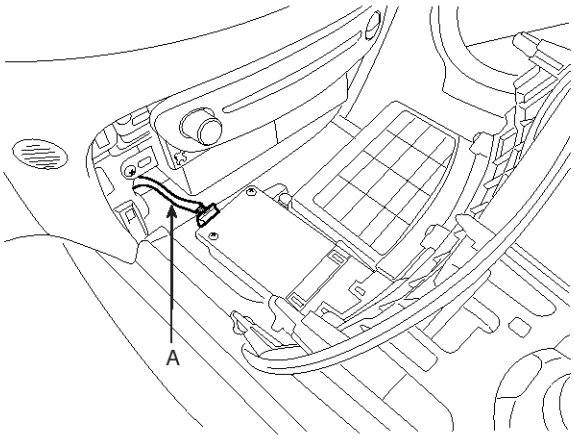
### Audio Unit

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



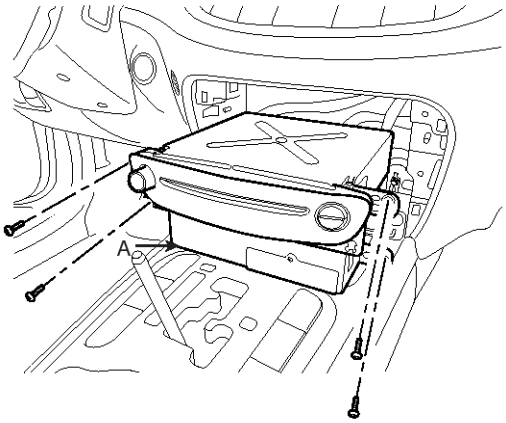

SBHBE8217D

3. Remove the connector (A).



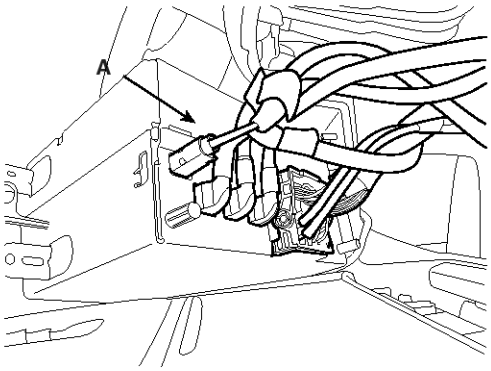

SBHBE8218D

4. Remove the mounting screws and then remove the audio unit (A).




SBHBE8219D

5. Remove the connector (A).




SBHBE8220D

**NOTICE**

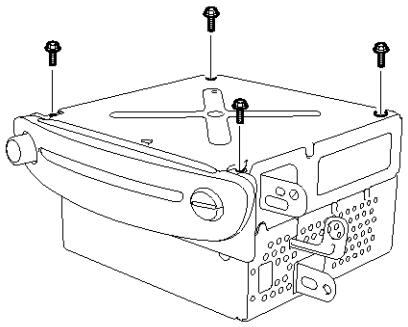
*When the compact disc is not ejected, do not remove it forcibly*

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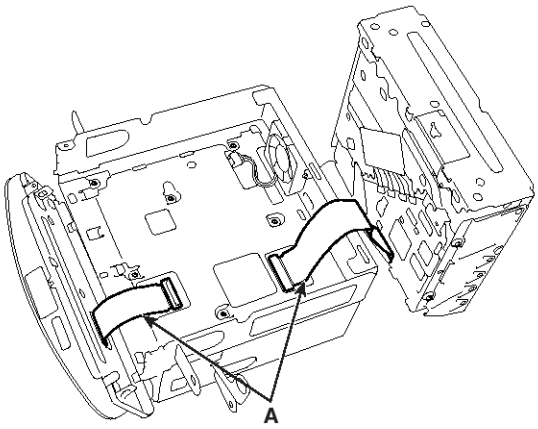


6. When separate the CD rom drive, if necessary, remove the screws (4EA) on the head unit.



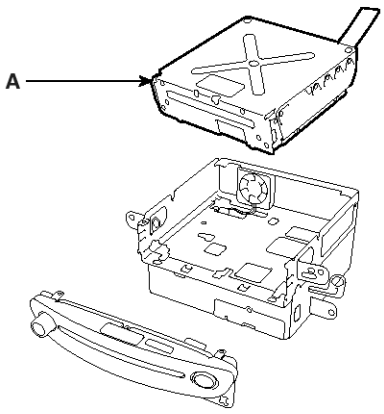
SBHB18015D

7. Remove the connector (A).




SBHB18017D

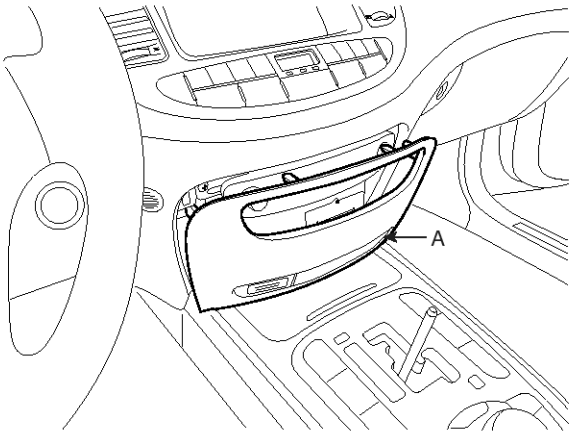
8. Remove the CD rom drive (A).




SBHB18062D

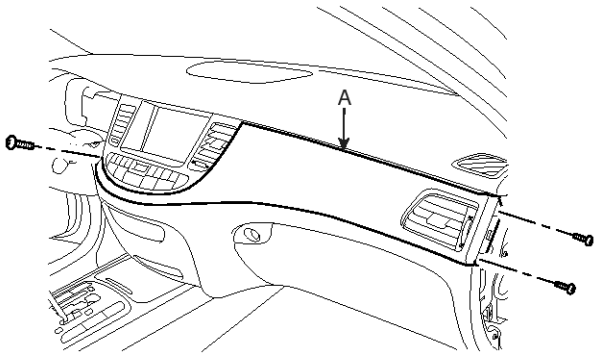
**Keyboard Unit**

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




SBHBE8217D

3. Remove the cluster fascia panel.
4. Remove the crash pad side garnish (A) after removing the screws.



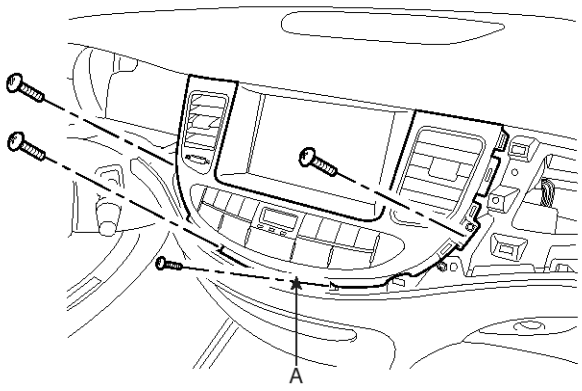

SBHBE8221D

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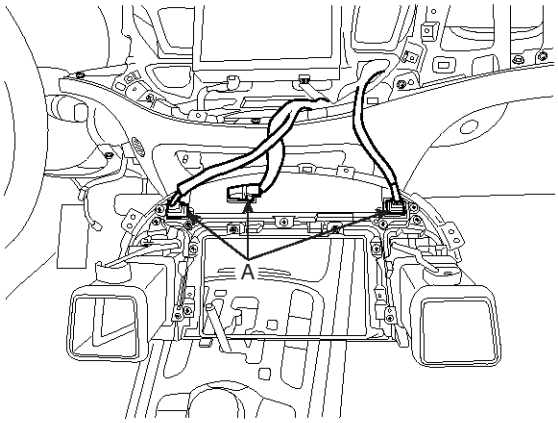


5. Remove the center fascia panel (A) after removing the screws.



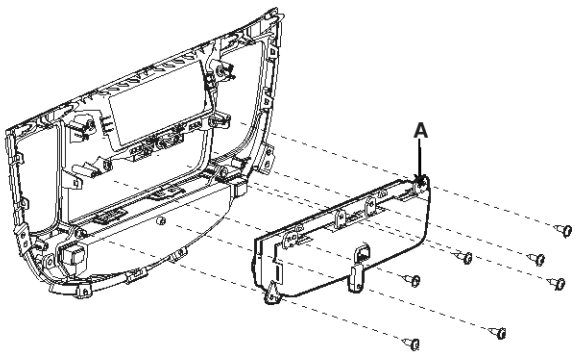

SBHBE8222D

6. Remove the connectors (A).




SBHBE8223D

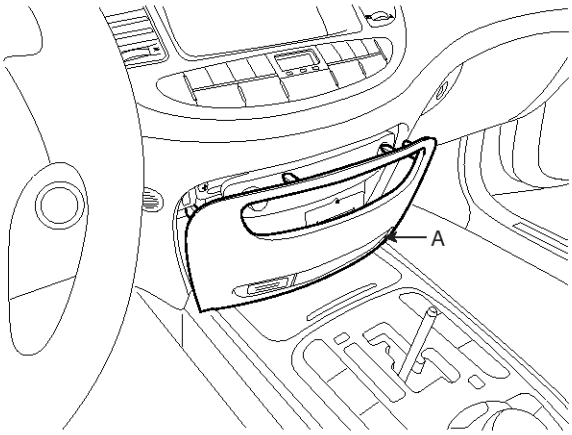
7. Remove the keyboard unit (A) after removing the screws.




SBHBE8224D

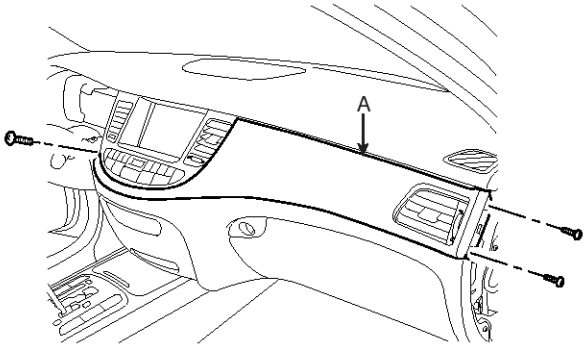
**Monitor Unit**

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




SBHBE8217D

3. Remove the cluster fascia panel.
4. Remove the crash pad side garnish (A) after removing the screws.



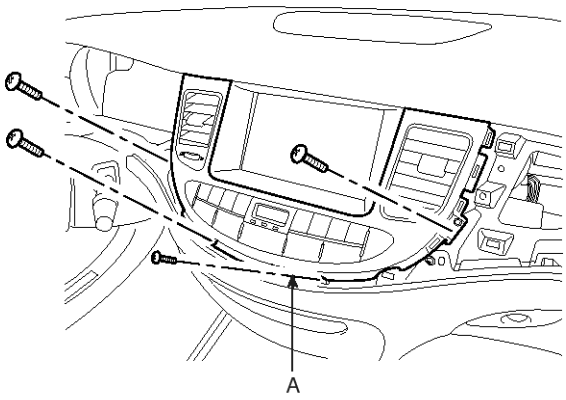

SBHBE8225D

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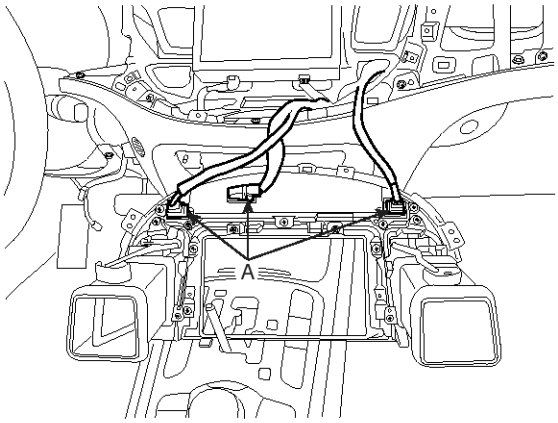


5. Remove the center fascia panel (A) after removing the screws.



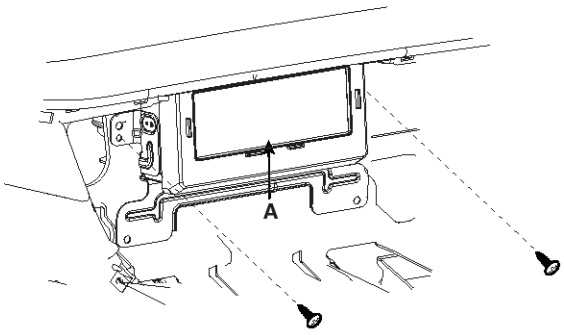

SBHBE8226D

6. Remove the connectors (A).




SBHBE8223D

7. Remove the monitor unit (A) after removing the screws.




SBHBE8228D

## Installation

### Audio Unit

1. Install the audio head unit after connecting the connectors.
2. Install the crash pad lower panel and connectors.
3. Connect the negative (-) battery terminal.

### Keyboard Unit

1. Install the keyboard unit after connecting the connectors.
2. Install the center fascia panel.
3. Install the crash pad side garnish, cluster fascia panel and crash pad lower panel.

### Monitor Unit

1. Install the monitor unit after connecting the connectors.
2. Install the center fascia panel.
3. Install the crash pad side garnish, cluster fascia panel and crash pad lower panel.

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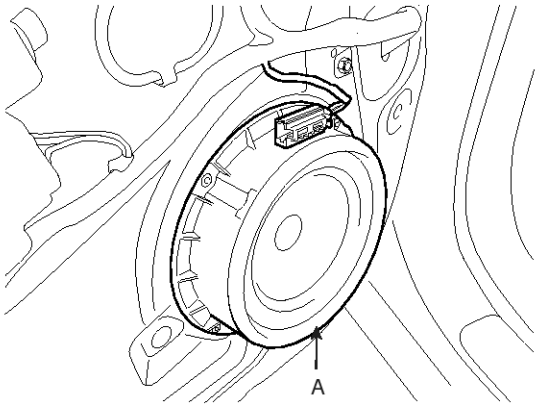


# Speakers

## Removal

### Front Speaker

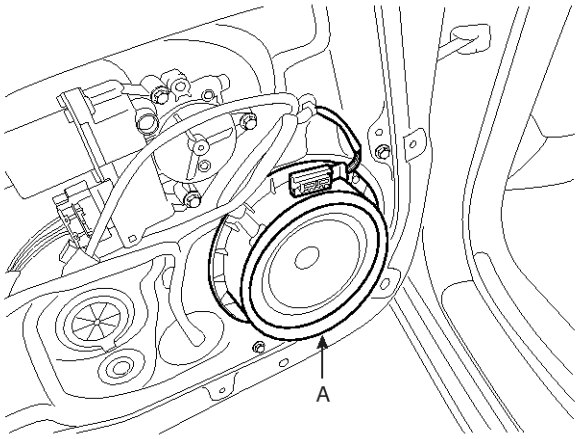
1. Remove the front door trim panel (Refer to the Body group - front door).
2. Remove the front speaker (A) after removing 4 rivets.




SBHBE8230D

### Rear Speaker

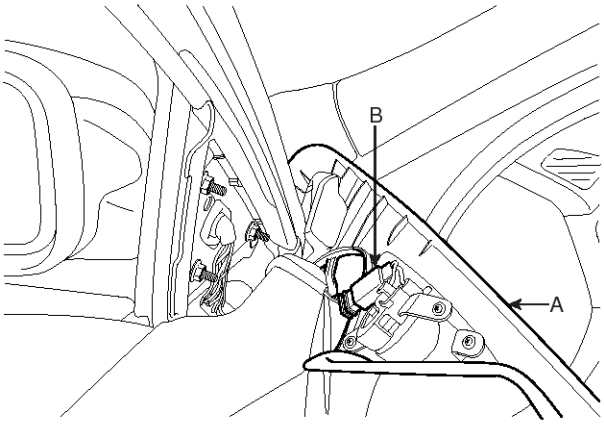
1. Remove the rear door trim panel (Refer to the Body group - rear door).
2. Remove the rear speaker (A) after removing 4 rivets.




SBHBE8235D

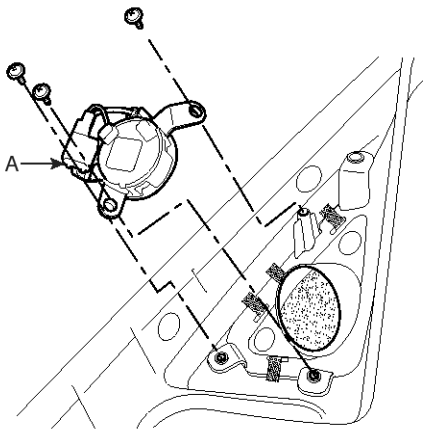
### Front Door Tweeter Speaker

1. Remove the front door delta cover (A) after disconnecting the connector (B). (Refer to the Body group - front door)




SBHBE8231D

2. Remove the tweeter speaker (A).




SBHBE8232D

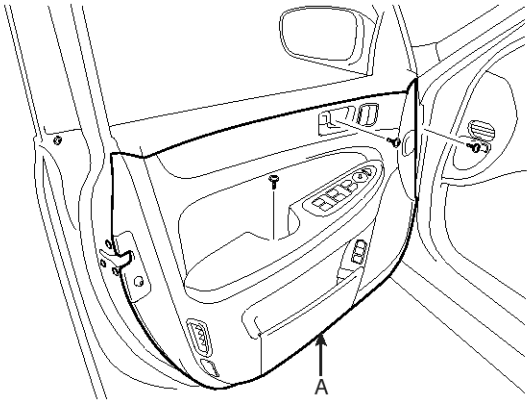
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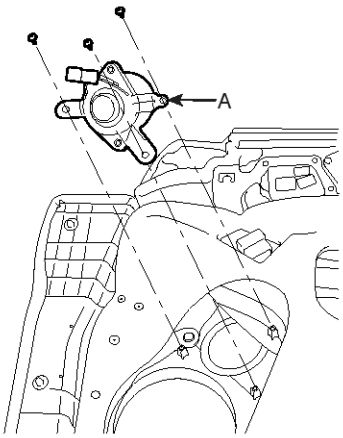
### Front Door Middle Speaker

1. Remove the front door trim panel (A). (Refer to the Body group - front door)




SBHBE8233D

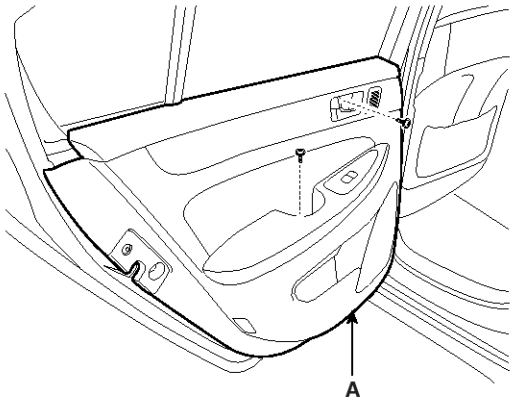
2. Remove the middle speaker (A) after removing the screws.




SBHBE8234D

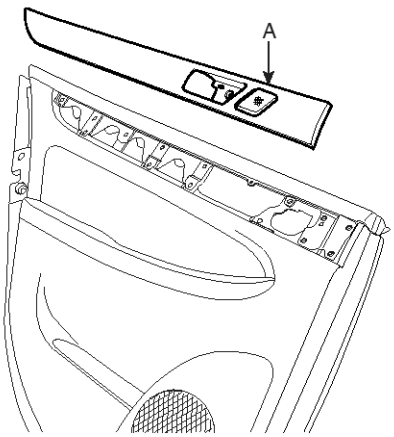
### Rear Door Tweeter Speaker

1. Remove the rear door trim panel (A). (Refer to the Body group - rear door).




SBHBE8363D

2. Remove the door trim garnish (A) after removing the screws inside the door trim panel.



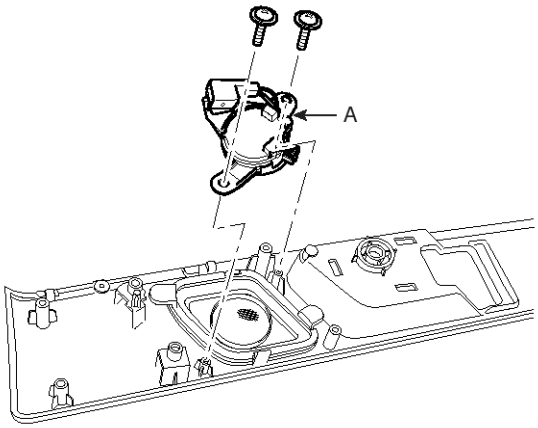

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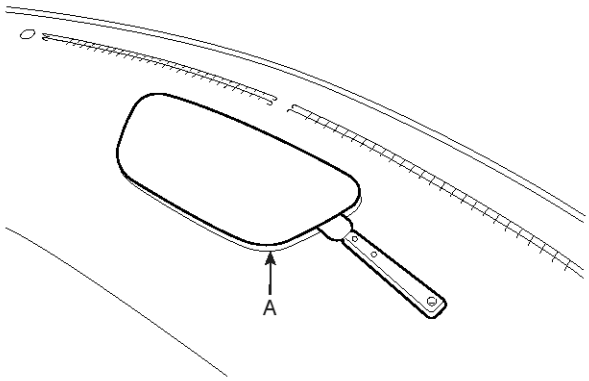
3. Remove the tweeter speaker (A) after removing the screws and connectors.




SBHBE8237D

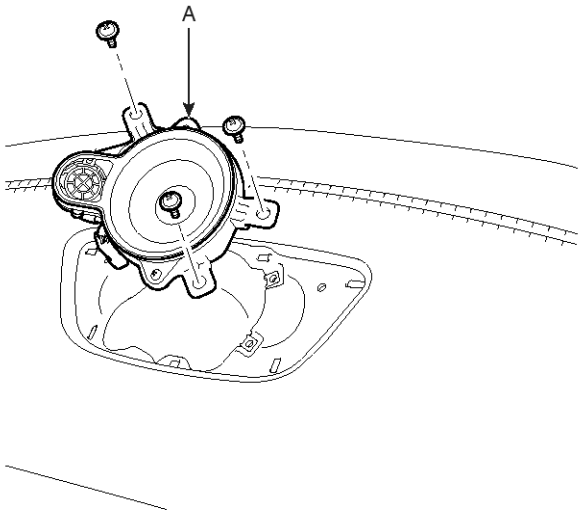
### Crash Pad Center Speaker

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




SBHBE8239D

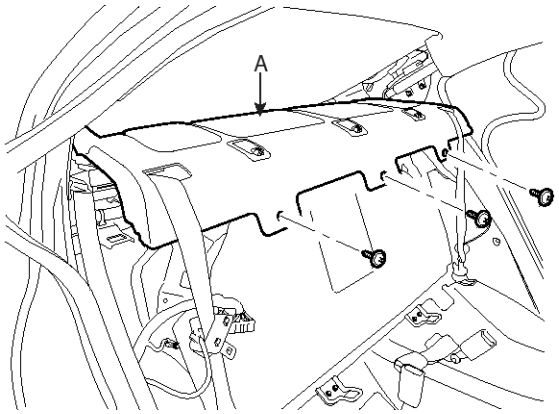
2. Remove the crash pad center speaker (A) after loosening the mounting screws (3EA).




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### Sub Woofer Speaker

1. Remove the rear seat (Refer to the Body group - Rear seat).
2. Remove the rear package tray (A) (Refer to the Body group - Rear seat).



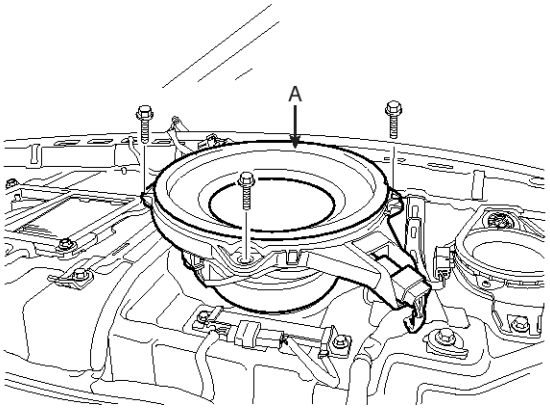

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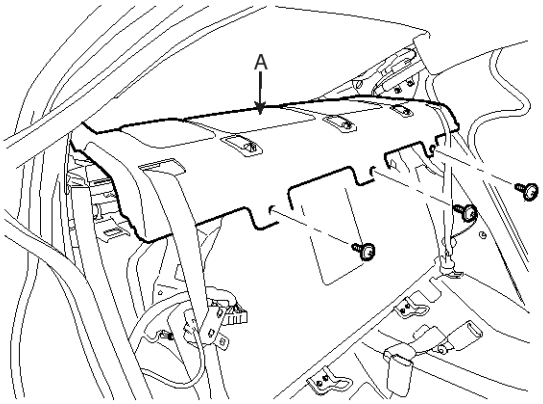
3. Remove the sub woofer speaker (A) after removing bolts (3EA).




SBHBE8242D

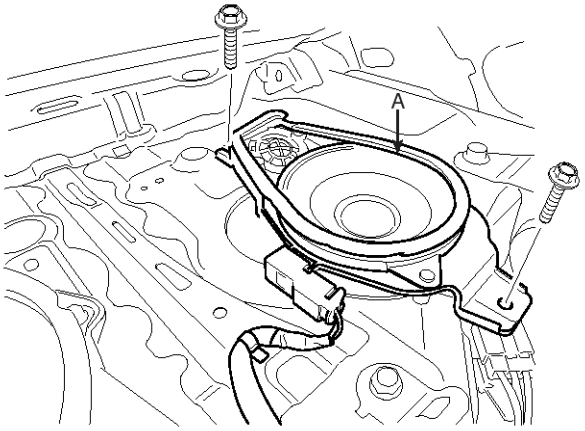
### Surround Speaker

1. Remove the rear seat (Refer to the Body group - Rear seat).
2. Remove the rear package tray (A) (Refer to the Body group - Rear seat).




SBHBE8243D

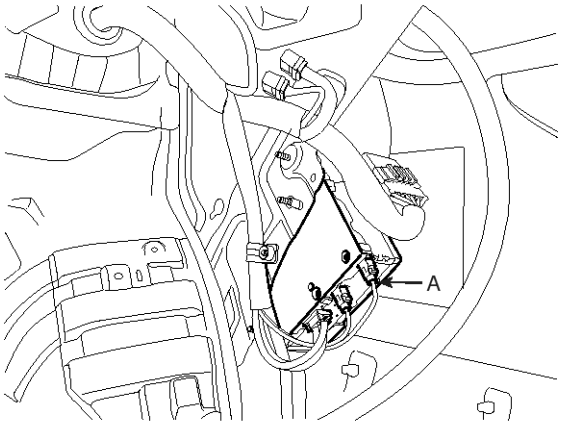
3. Remove the surround speaker (A) after removing bolts (2EA).




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### External Amp

1. Disconnect the negative (-) battery terminal.
2. Remove the right trunk side trim.
3. Remove the external amplifier (A) after removing nuts and connectors.




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## Installation

### Front Speaker

1. Install the front speaker.
2. Install the front door trim.

### Rear Speaker

1. Install the rear speaker.
2. Install the rear door trim.

### Front Door Tweeter Speaker

1. Install the tweeter speaker after connecting the tweeter speaker connector.
2. Install the front door delta cover.

### Front Door Middle Speaker

1. Install the front door middle speaker on the door trim panel.
2. Install the front door trim panel.

### Rear Door Tweeter Speaker

1. Install the tweeter speaker on the door trim garnish after connecting the tweeter speaker connector.
2. Install the door trim garnish on the door trim panel.
3. Install the door trim panel.

### Crash Pad Center Speaker

1. Install the crash pad center speaker after connecting the connector.
2. Install the crash pad center speaker grill.

### Sub Woofer Speaker

1. Install the sub woofer speaker after connecting the connector.
2. Install the rear package tray and rear seat assembly.

### Surround Speaker

1. Install the surround speaker after connecting the connector.
2. Install the rear package tray and rear seat assembly.

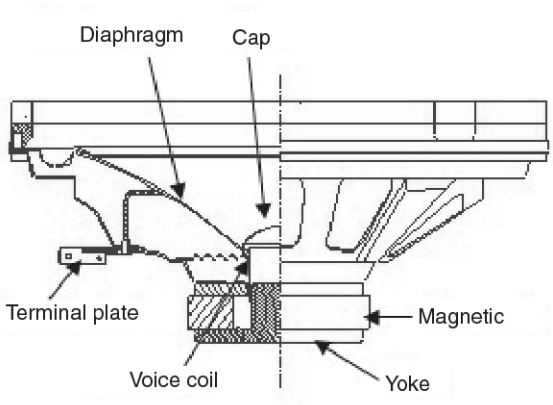
### External Amp

1. Install the external amp after connecting the connector.
2. Install the right trunk side trim.

## Inspection

1. Troubleshooting for Speaker
   1) Basic inspection of speaker

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



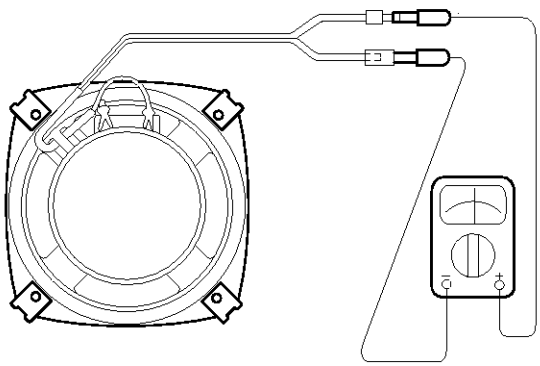

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2) Case Troubleshooting

| No. | Case | Inspection/Remedy |
|---|---|---|
| 1 | Trembling sound | 1. Before replacing the speaker, inspect that the mounting screw is installed normally.<br>2. After re-installing the speaker, verify that no trembling sound is heard.<br>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.<br>2. In case of radio static, check if there is a noise from CD.<br>3. When a noise is heard on turning radio and CD on, replace the speaker with new one.<br>**NOTICE**<br>*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<br>1. Before replacing the speaker, inspect the wiring connection between the battery and the speaker is normal.<br>2. Check the supplying power to the speaker and the resistance, then inspect the sound quality.<br>■ Specified impedance : 2 ~ 4Ω<br>  <br>KTMB060A<br>3. If the speaker works poorly, replace it with new one. |

3) Cautions 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.

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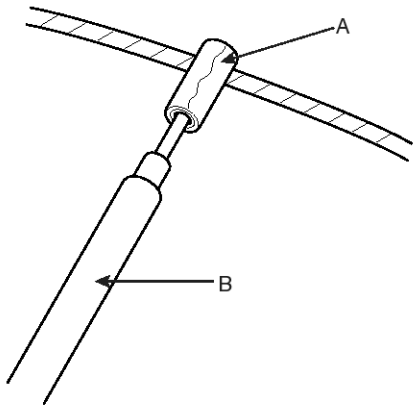


# Antenna

## Inspection

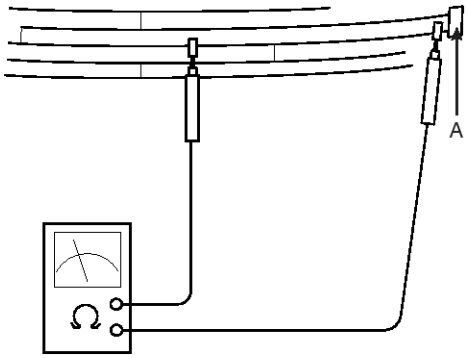
### Glass Antenna Test

1. Wrap aluminum foil (A) around the tip of the tester probe (B) as shown.




ETRF023C

2. Touch one tester probe to the glass antenna terminal (A) hear, and move the other tester probe along the antenna wires to check that continuity exists.



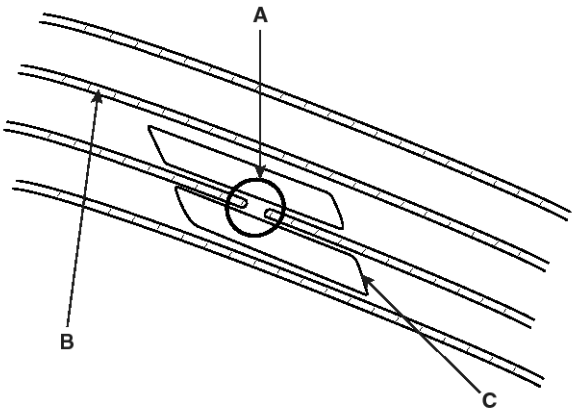

ETRF023D

### Glass Antenna Repair

**NOTICE**

*To make an effective repair, the broken section must be no longer than one inch.*

1. Lightly rub the area around the broken section (A) with fine steel wool, and then clean it with alcohol.

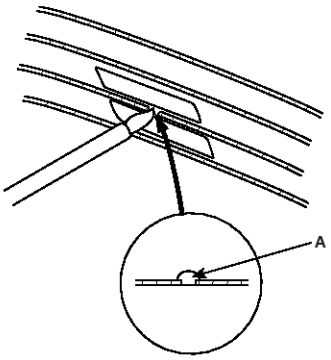



ETKD004K

2. Carefully mask above and below the broken portion of the glass antenna wire (B) with cellophane tape (C ).
3. Using a small brush, apply a heavy coat of silver conductive paint (A) extending about 1/8″on both sides of the break. Allow 30 minutes to dry.

**NOTICE**

*Thoroughly mix the paint before use.*




KTKD006Z

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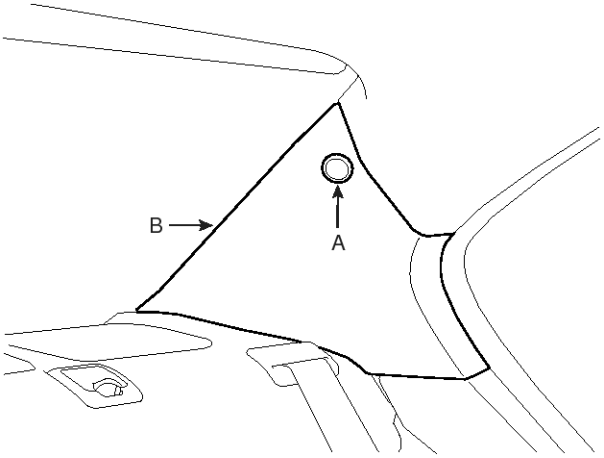
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4. Check for continuity in the repaired wire.
5. Apply a second coat of paint in the same way. Let it dry three hours before removing the tape.

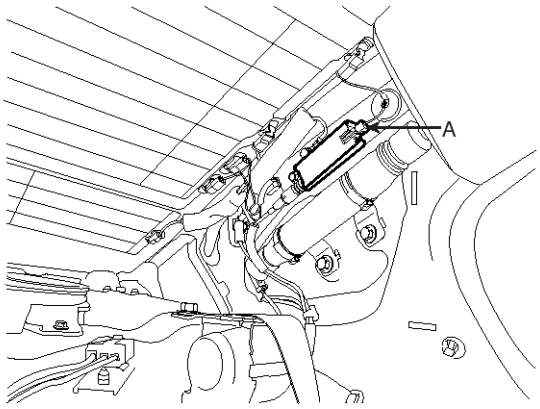
### Glass Antenna Circuit Inspection

1. Remove the rear pillar trim (B) after removing the bolt in the cap (A).

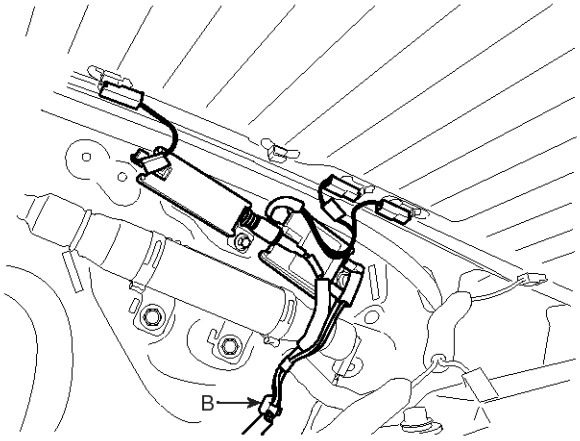



SBHBE8246D

2. Disconnect the antenna feeder cable (B) from the glass antenna amp (A).

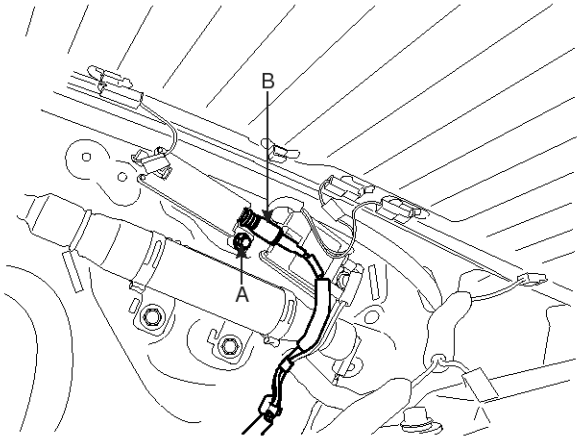



SBHBE8247D




SBHBE8248D

3. Turn the radio ON. Measure the voltage between terminal of the antenna feeder cable (B) and body ground (A).




SBHBE8249D

4. Check for continuity between terminals of harness side connector and antenna grid terminals (AM, FM).
5. Check the grid lines that continuity exists.
6. When a poor radio reception is not repaired through the above inspection methods, replace the amp.

   If the radio reception is still poor, check the radio cable for short and radio head unit for failure.

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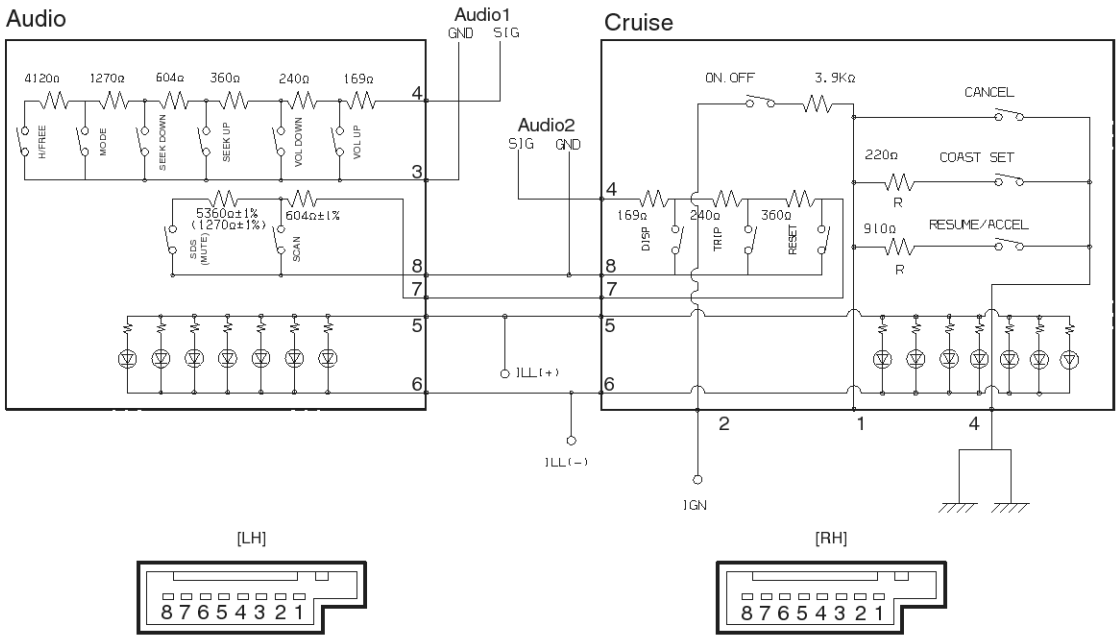


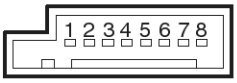
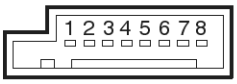
## Audio Remote control

### Circuit Diagram

#### Steering Wheel Remote Control

[Audio + Cruise]




| Connector LH | Connector RH |
|---|---|
|  |  |



| Pin | Description | Pin | Description |
|---|---|---|---|
| 1 | - | 1 | Cruise switch signal input |
| 2 | - | 2 | Cruise switch IGN |
| 3 | Audio 1 GND | 3 | Cruise switch signal output |
| 4 | Audio 1 signal | 4 | Audio 2 signal |
| 5 | Illumination + | 5 | Illumination + |
| 6 | Illumination - | 6 | Illumination - |
| 7 | Communication | 7 | Communication |
| 8 | Audio 2 GND | 8 | Audio 2 GND |

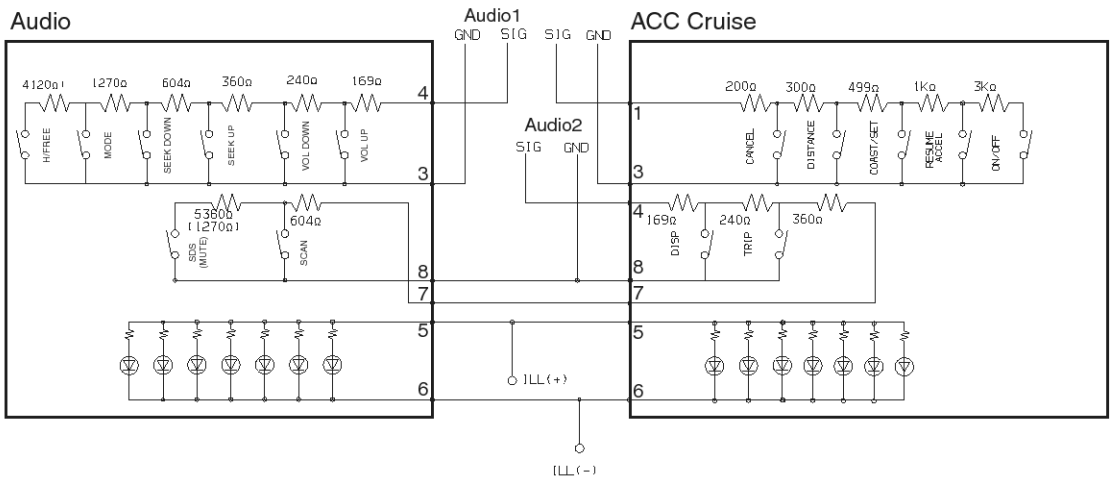
SBHBE9033L

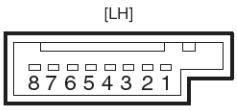
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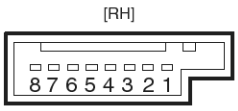
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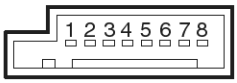
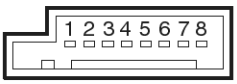


[Audio + ACC Cruise]




| Connector LH | | Connector RH | |
|---|---|---|---|
|   | |   | |
| Pin | Description | Pin | Description |
| 1 | - | 1 | Cruise signal |
| 2 | - | 2 | - |
| 3 | Audio 1 GND | 3 | Cruise GND |
| 4 | Audio 1 signal | 4 | Audio 2 signal |
| 5 | Illumination + | 5 | Illumination + |
| 6 | Illumination - | 6 | Illumination - |
| 7 | Communication | 7 | Communication |
| 8 | Audio 2 GND | 8 | Audio 2 GND |

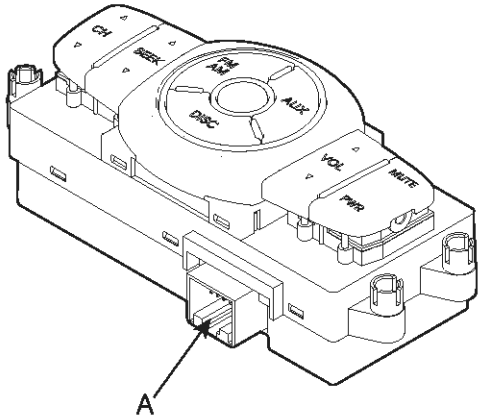
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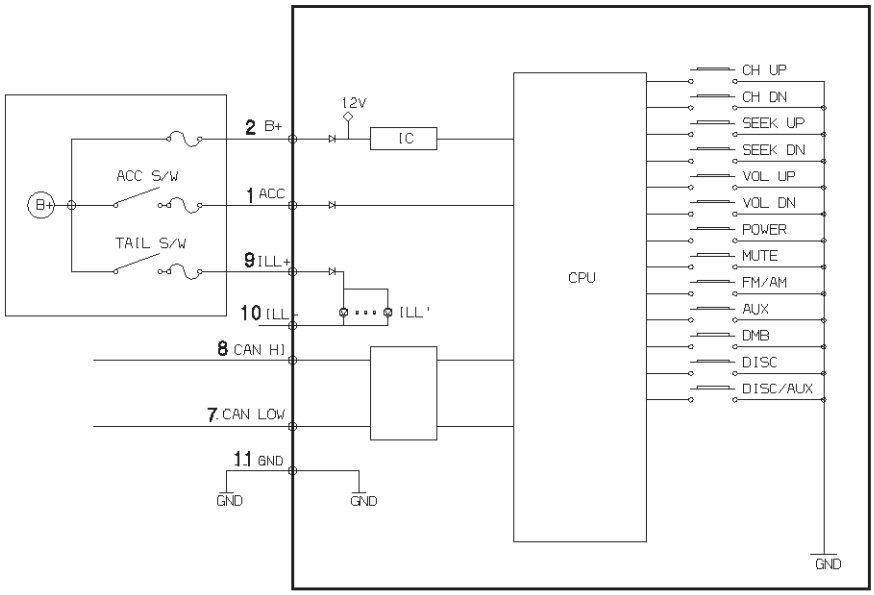
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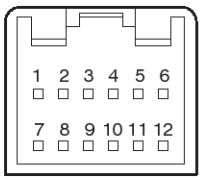


## Rear Seat Audio Remote Control




Rear seat audio remote control

| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|   | 1 | ACC | 7 | CAN low |
| | 2 | BAT + | 8 | CAN high |
| | 3 | - | 9 | Illumination + |
| | 4 | - | 10 | Illumination - |
| | 5 | - | 11 | GND |
| | 6 | - | 12 | - |

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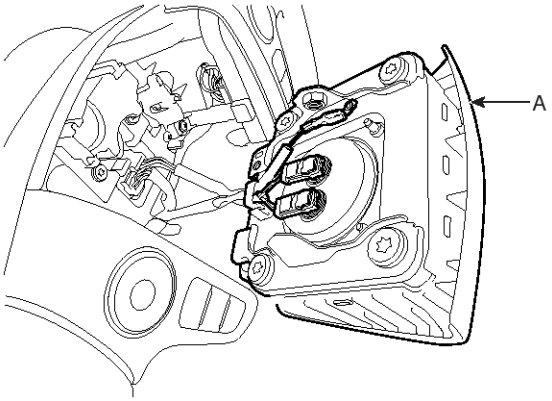
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## Removal

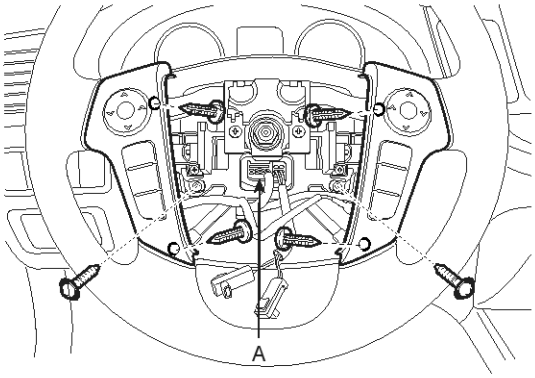
### Steering Wheel Remote Control

1. Disconnect the negative (-) battery terminal.
2. Remove the driver airbag module(A). (Refer to the airbag group)




SBHB18160D

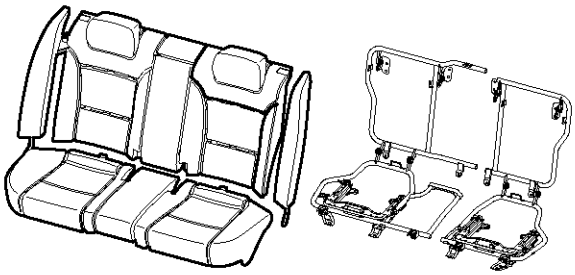
3. Remove the audio remote control switch after remove the steering wheel remote control switch connector ( A) and 3 screws.




SBHBE8307D

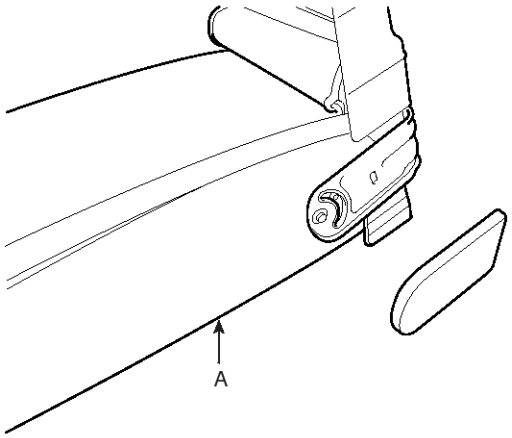
### Rear Seat Audio Remote Control

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

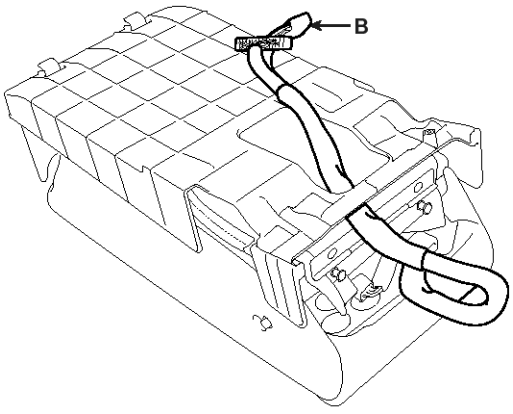


SBHBE8387D

3. Remove the arm rest (A) from the rear seat and disconnect the connector (B).




SBHBE8388D




SBHBE8389D

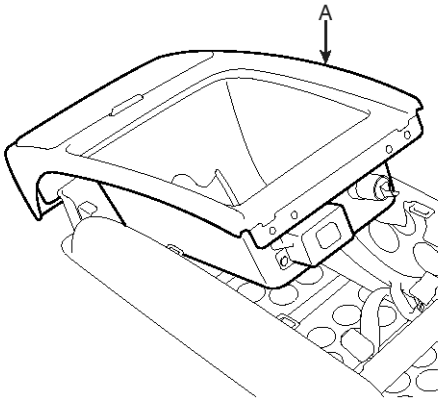
4. Remove the arm rest cover (A) after removing the sc-

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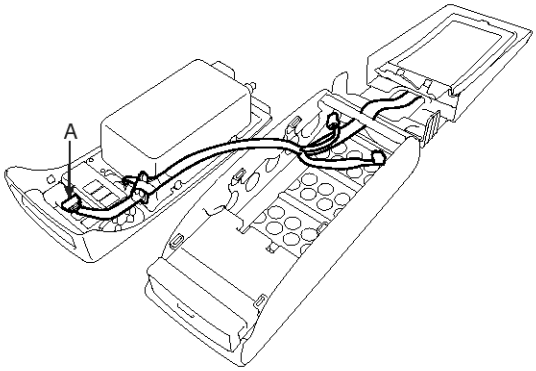


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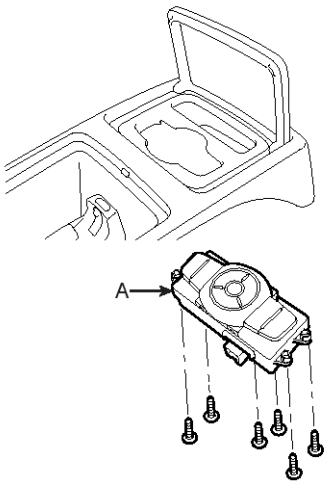

SBHBE8390D

5. Disconnect the rear seat audio remote control connector (A) after removing the arm rest cover.




SBHBE8391D

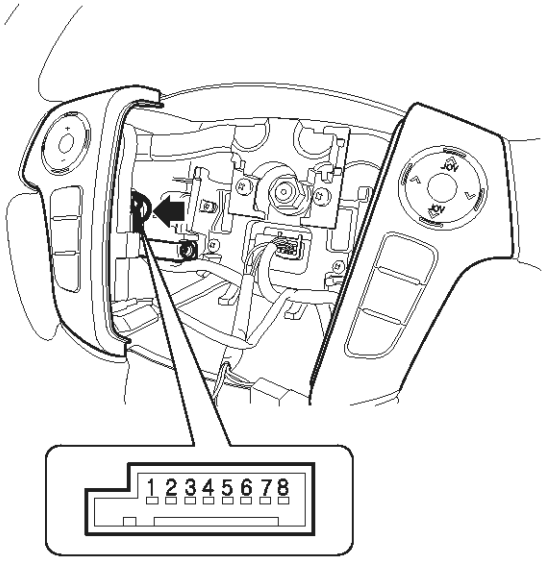
6. Remove the rear seat audio remote control unit (A).




SBHBE8392D

## Inspection

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




SBHBE8252D

| Switch | Connector terminal | Resistance (±5%) |
|---|---|---|
| Volume Up | 3 - 4 | 0.17 kΩ |
| Volume Down | 3 - 4 | 0.41 kΩ |
| Seek Up | 3 - 4 | 0.77 Ω |
| Seek Down | 3 - 4 | 1.37 kΩ |
| Mode | 3 - 4 | 2.64 kΩ |
| Mute | 3 - 4 | 6.76 kΩ |

## Installation

### Steering Wheel Remote Control

1. Install the audio remove control switch to the steering wheel.
2. Install the driver airbag module.

### Rear Seat Audio Remote Control

1. Install the rear seat audio remote control unit to the arm rest cover.
2. Install the arm rest cover and arm rest.
3. Install the rear seat.

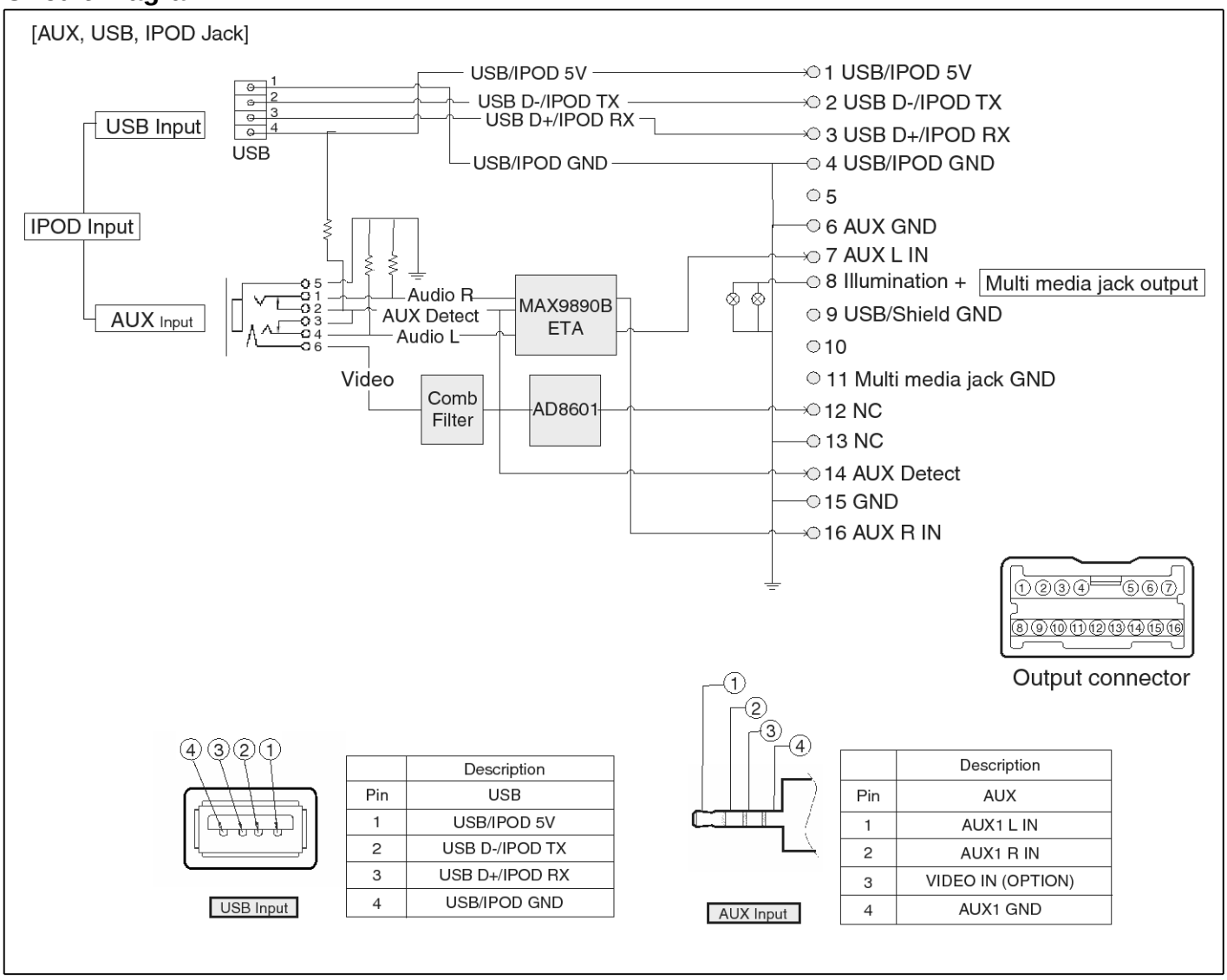
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## AUX(Auxiliary) jack

### Circuit Diagram




| | Description |
|---|---|
| Pin | USB |
| 1 | USB/IPOD 5V |
| 2 | USB D-/IPOD TX |
| 3 | USB D+/IPOD RX |
| 4 | USB/IPOD GND |

| | Description |
|---|---|
| Pin | AUX |
| 1 | AUX1 L IN |
| 2 | AUX1 R IN |
| 3 | VIDEO IN (OPTION) |
| 4 | AUX1 GND |

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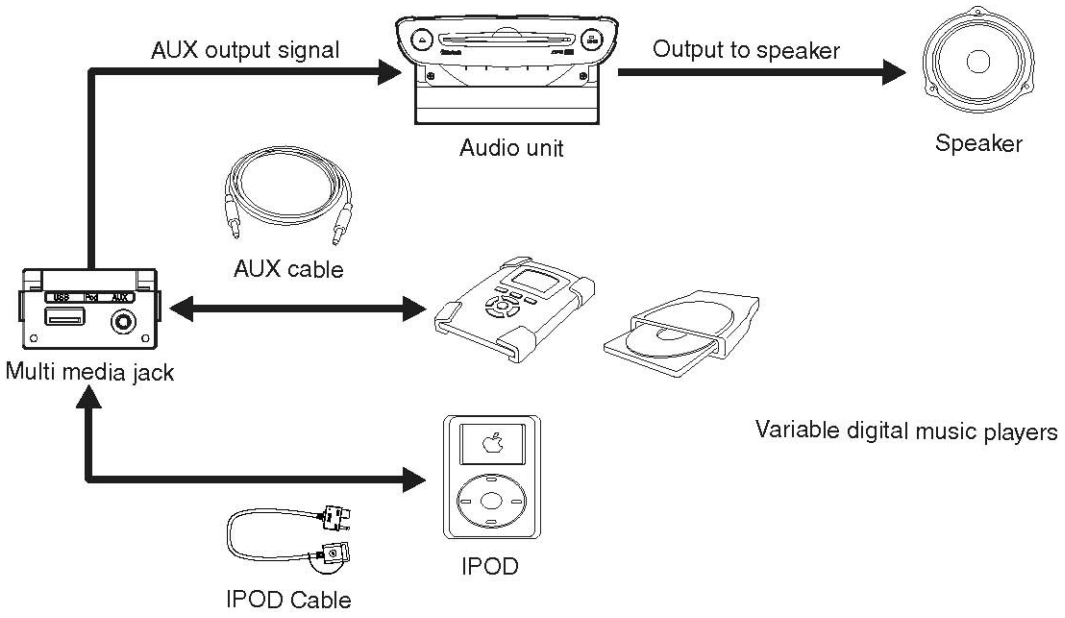
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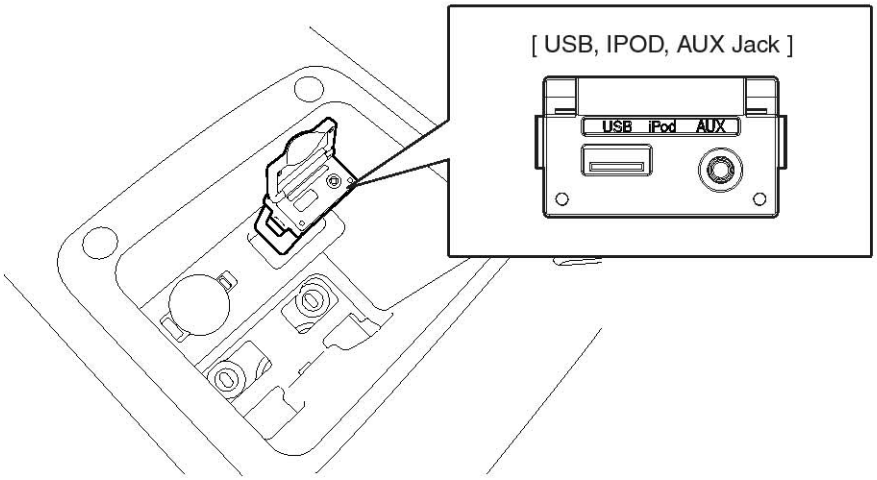


## Description

The AUX JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPOD and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.

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




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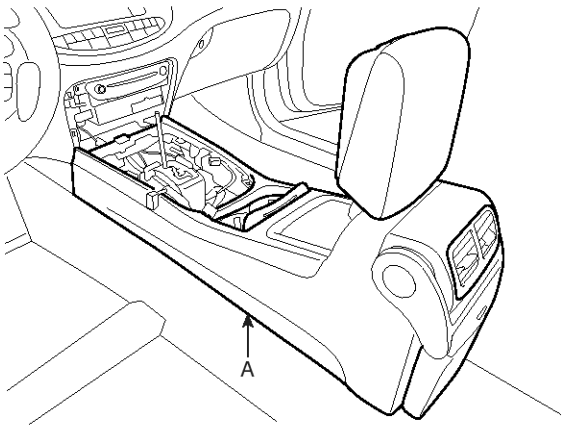
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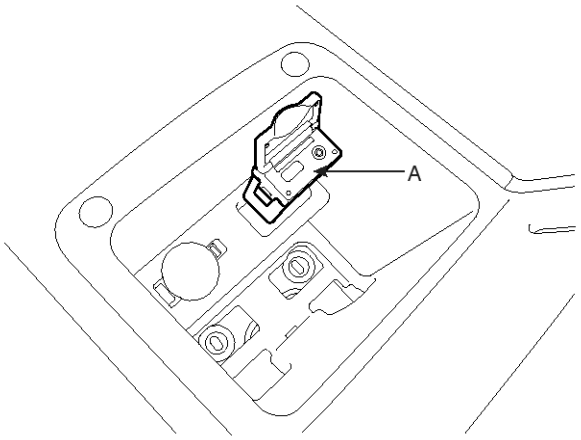
## Removal

1. Remove the floor console (A). (Refer to Body group. - Console)




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2. Disconnect the jack assembly connector from the floor console.
3. Remove the Multi media Jack (A) from the floor console.



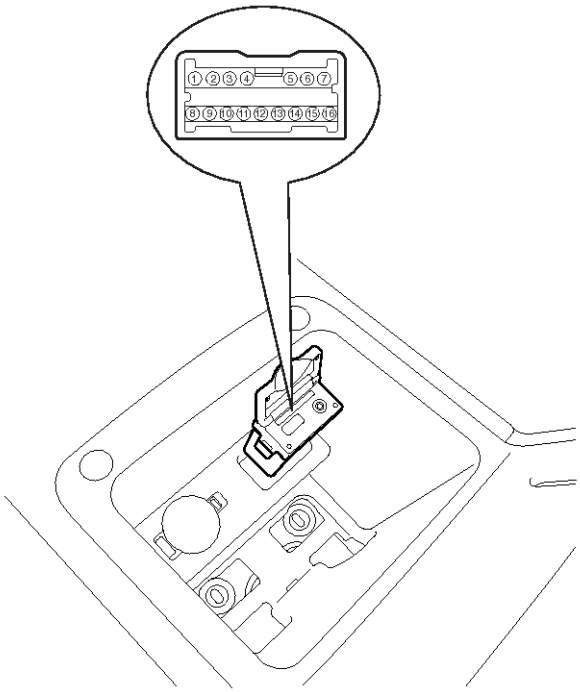

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## Installation

1. Install the Multi media Jack.
2. Connect the Multi Media Jack connector.
3. Install the under cover to the floor console.

## Inspection

1. Disconnect the negative(-) battery terminal.
2. Disconnect the Multi Media Jack connector after from the floor console.



SBHBE8293D

3. To inspect USB/IPOD port, check the voltage between NO.1 and 4 terminal of.

**Standard value:** 5V

4. To inspect AUX Jack, check the voltage between NO. 14 terminal of Jack output connector and NO.4 terminal of USB/IPOD input port at AUX input.

**Standard value:** 5V

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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<br>☐ Most of the time ☐ Engine off |
| **TYPE OF TROUBLE** | ☐ Will not play ☐ Weak ☐ Squealing noise ☐ Display/illumination poor<br>☐ CD skips & jumps ☐ CD will not eject or insert ☐ Others (Describe) : |
| **OTHERS** | ▶ Customer complaint contents :<br>▶ 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. | |

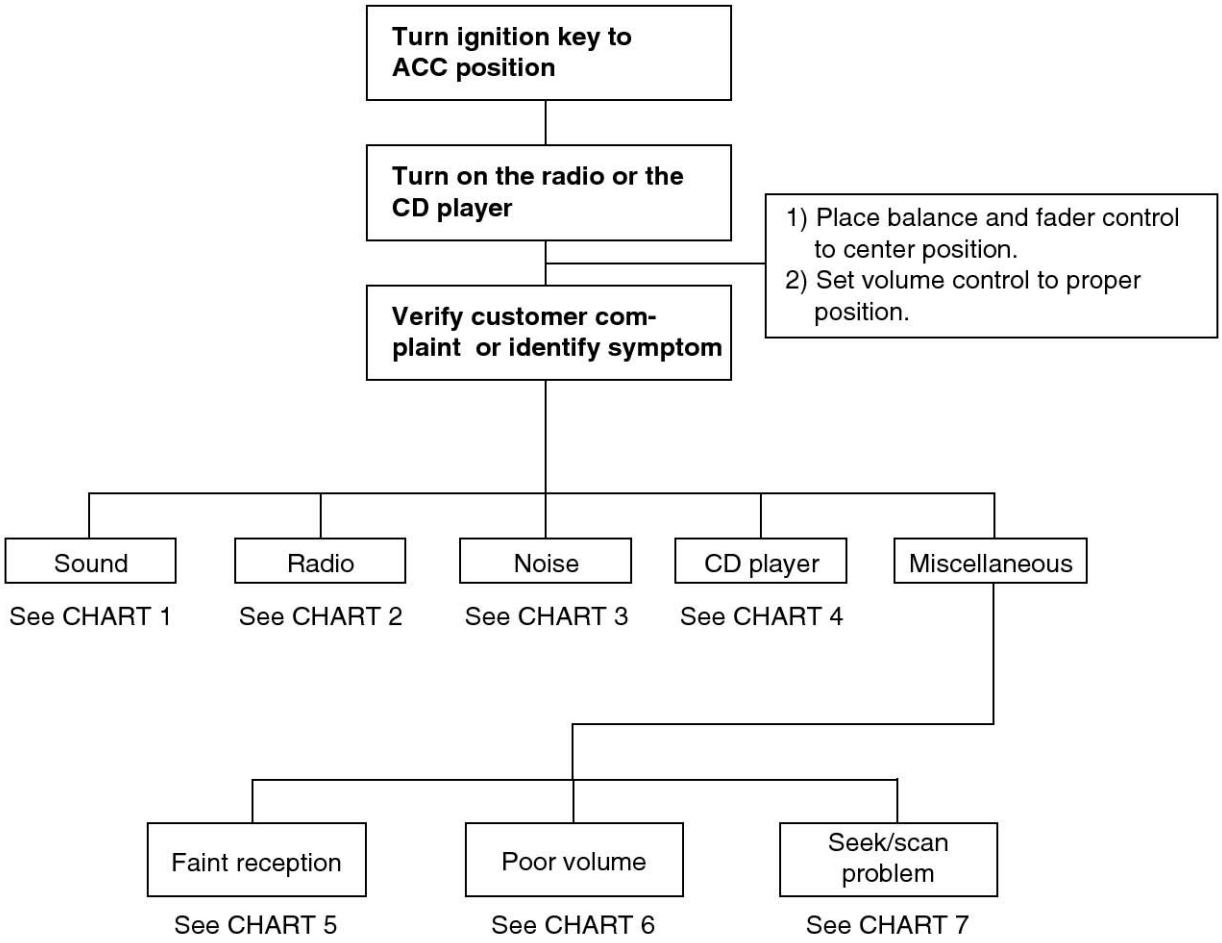
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There are six areas where a problem can occur: wiring harness, the radio, the CD player, and speaker. Troubleshooting enables you to confine the problem to a particular area.



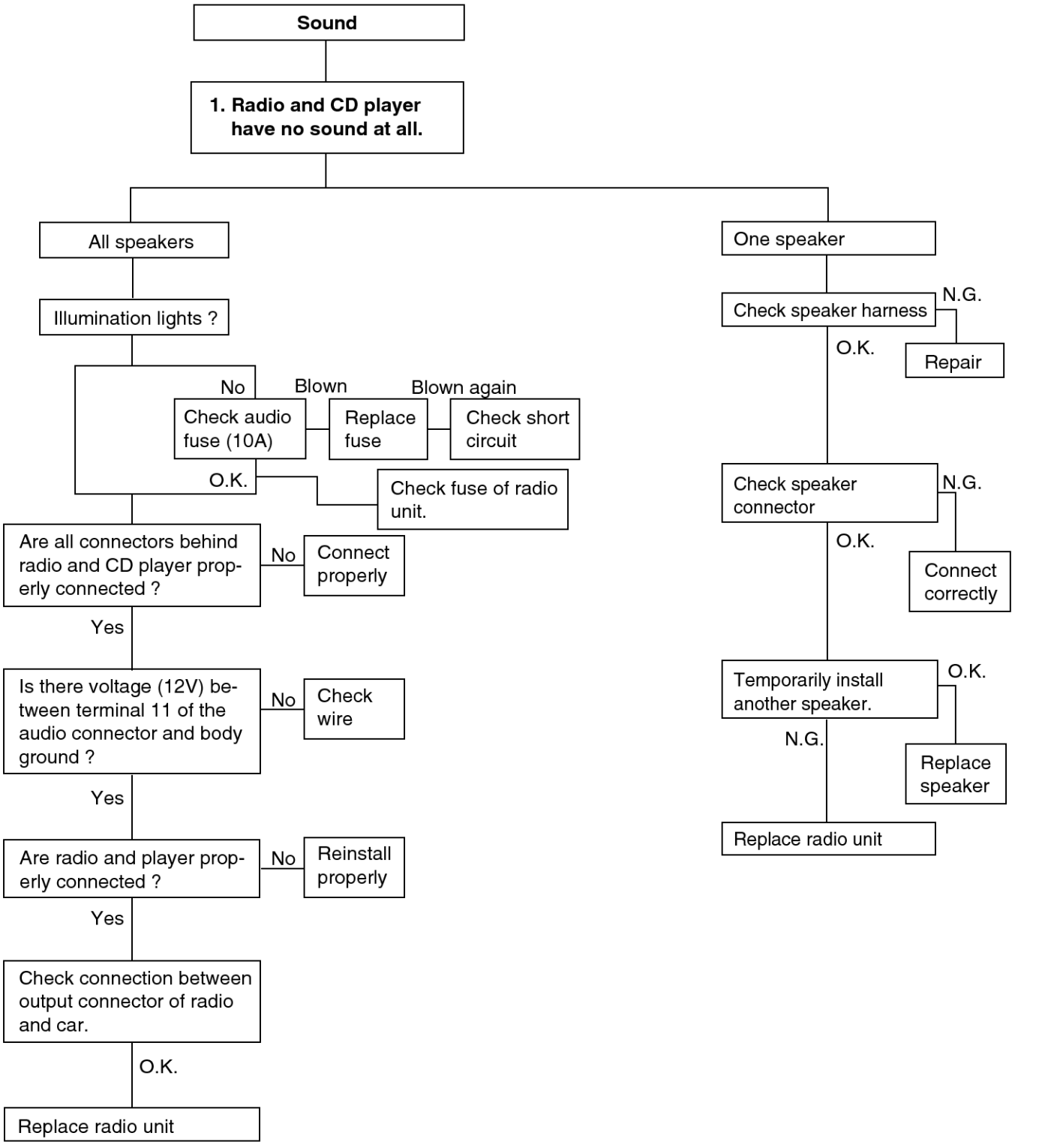

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**Chart 1**

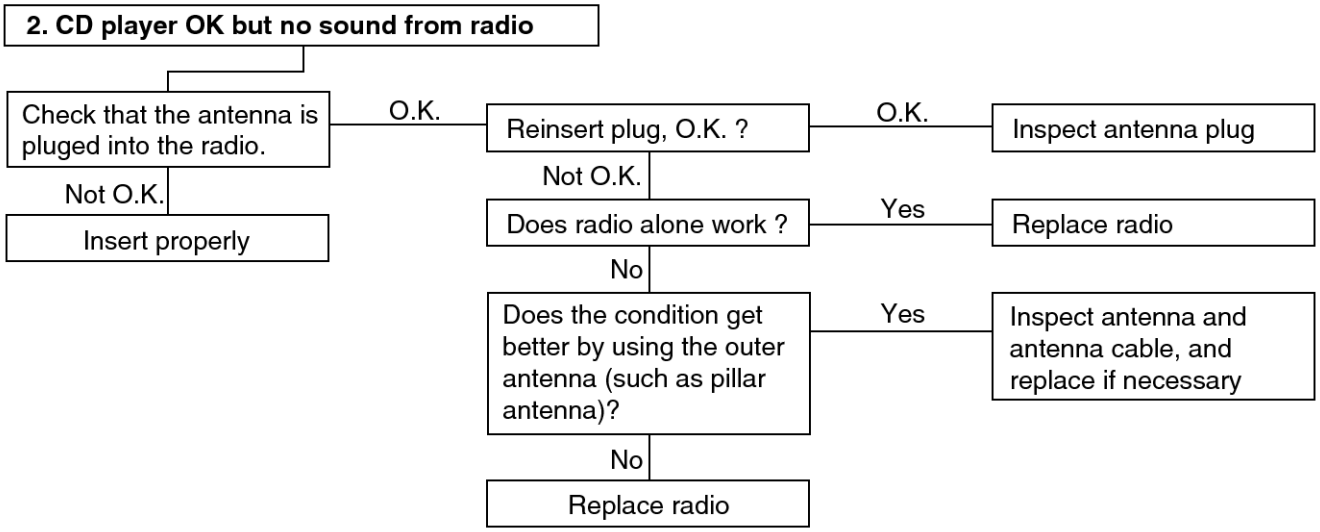



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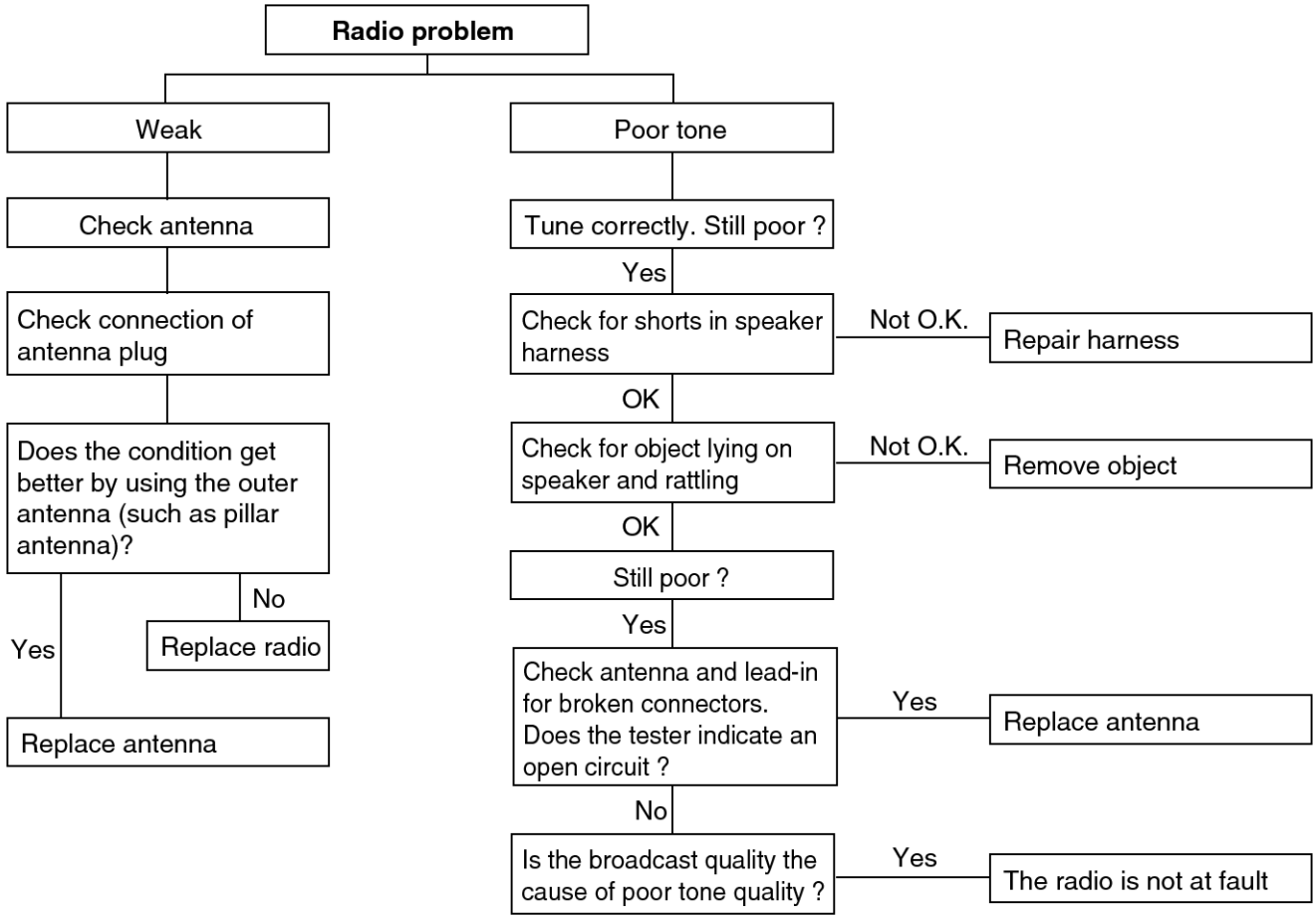
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## Chart 2




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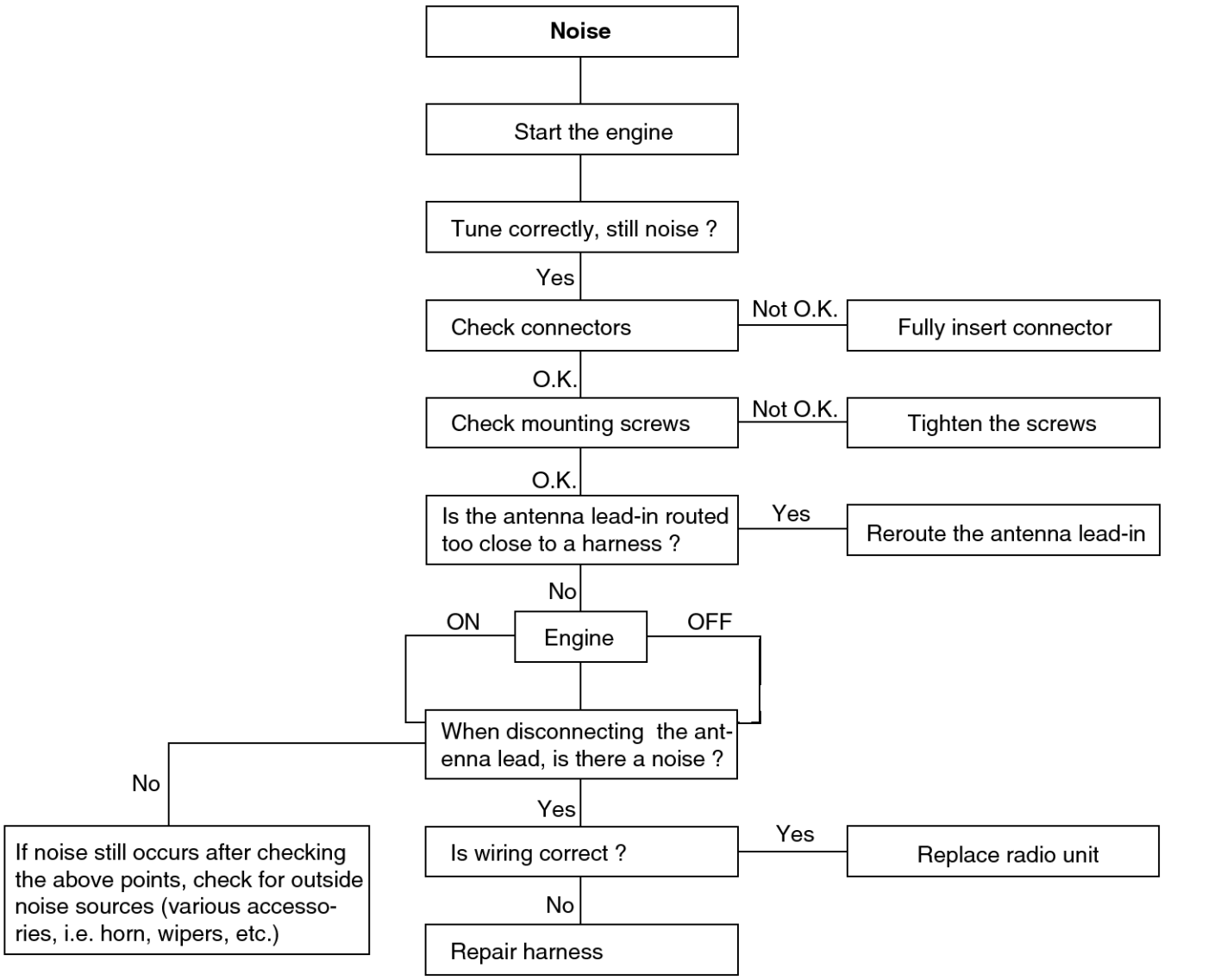
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## Chart 3

1. RADIO




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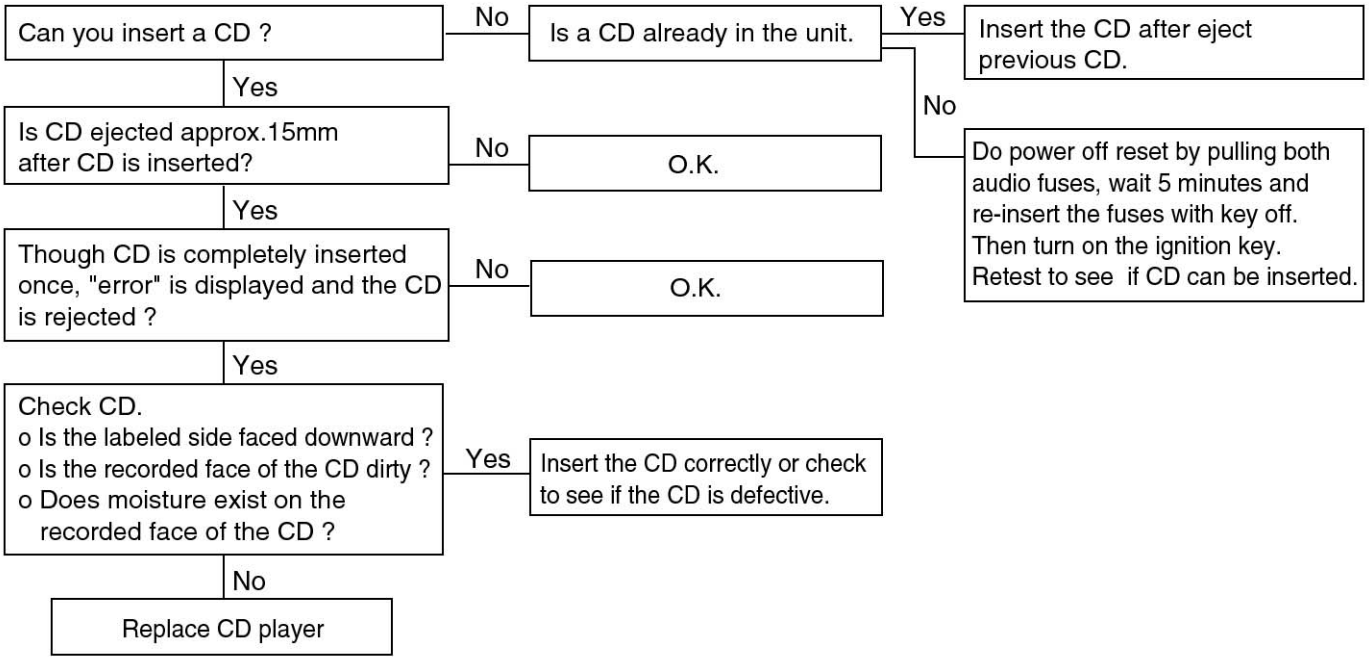
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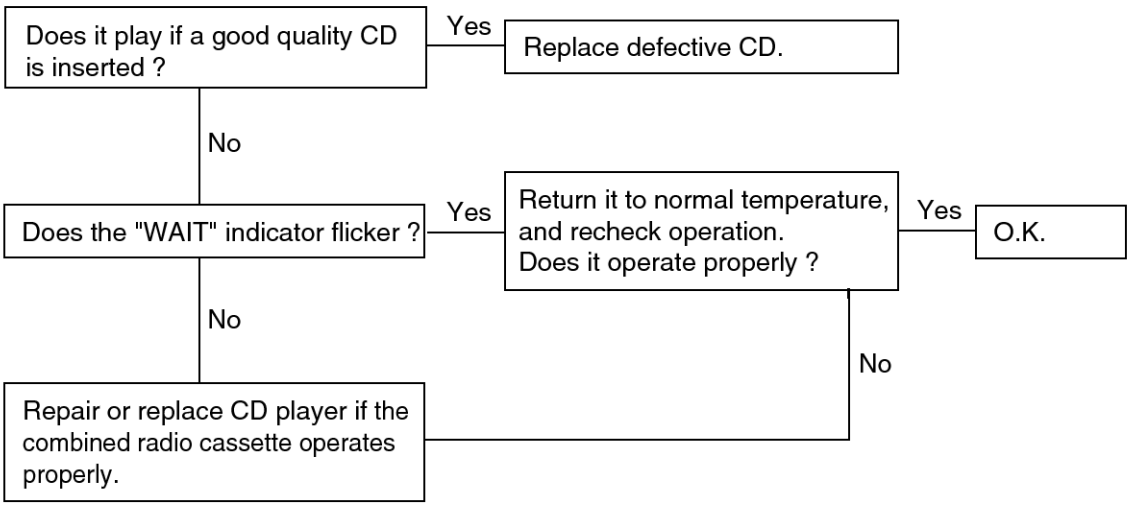
## Chart 4

1. CD WILL NOT BE ACCEPTED




LTIF001H

2. NO SOUND




LTIF001I

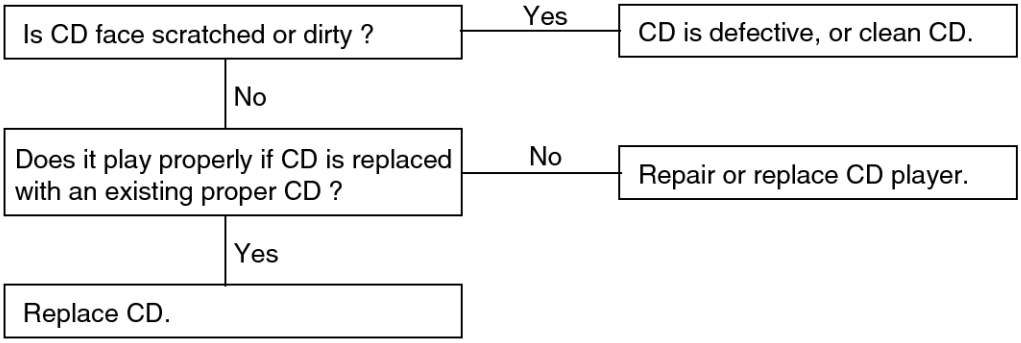
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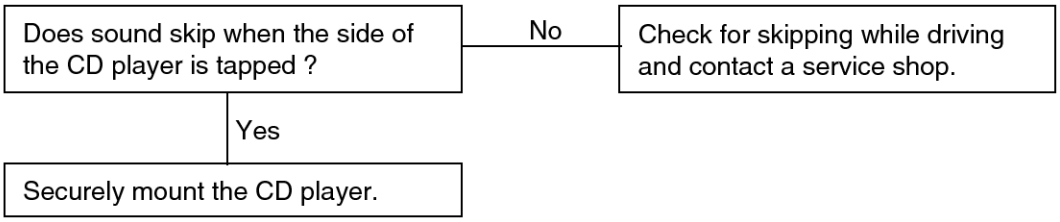


3. CD SOUND SKIPS

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.)



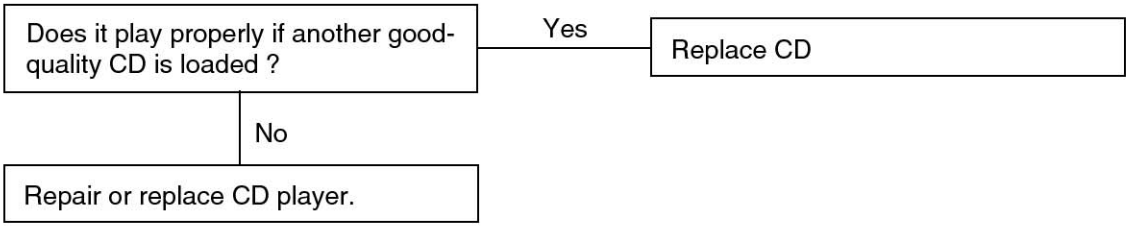

LTIF001J

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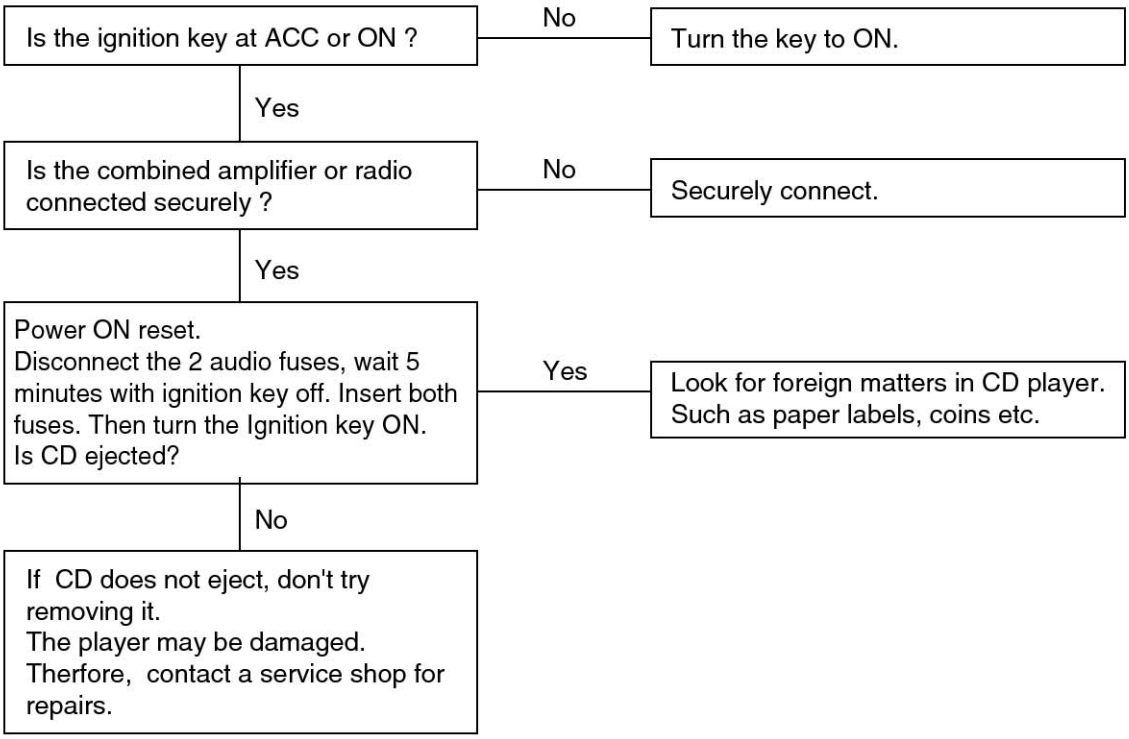
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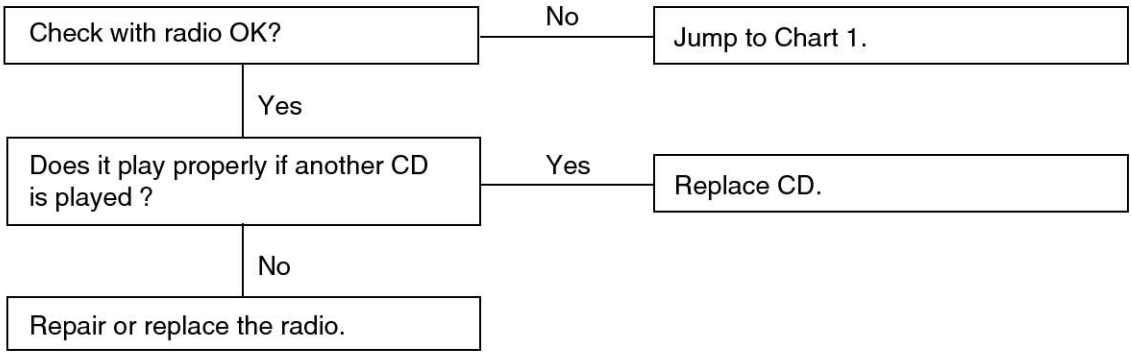
4. SOUND QUALITY IS POOR




5. CD WILL NOT EJECT




6. NO SOUND FROM ONE SPEAKER



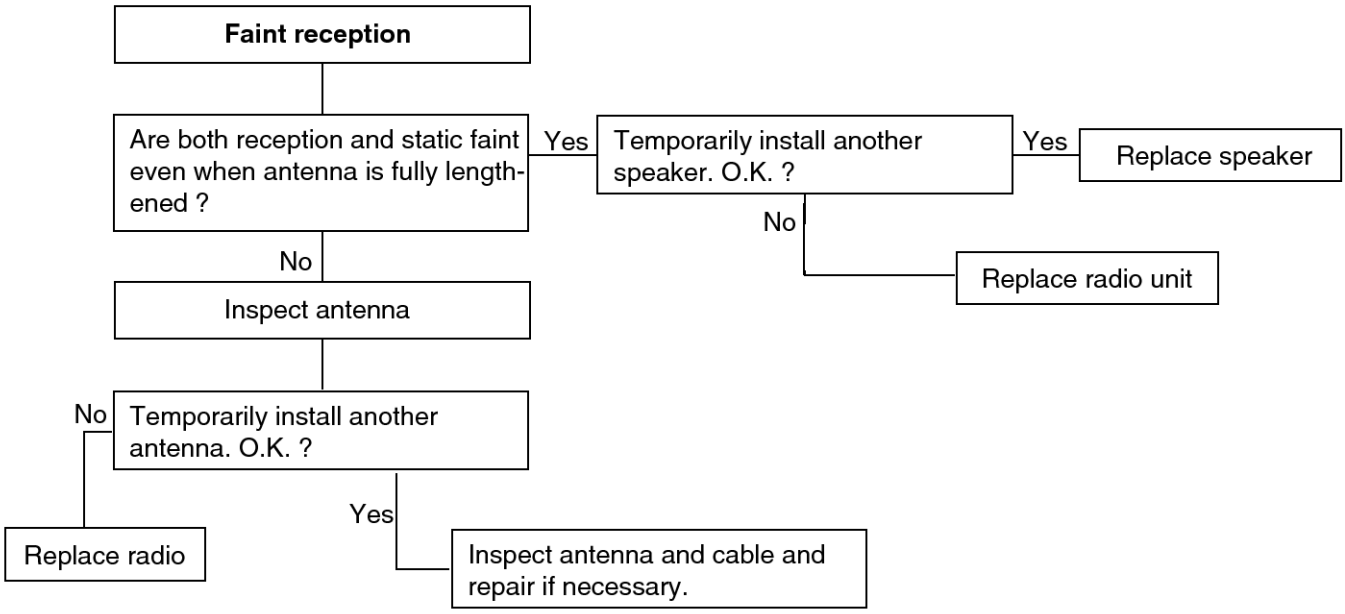

LTIF001K

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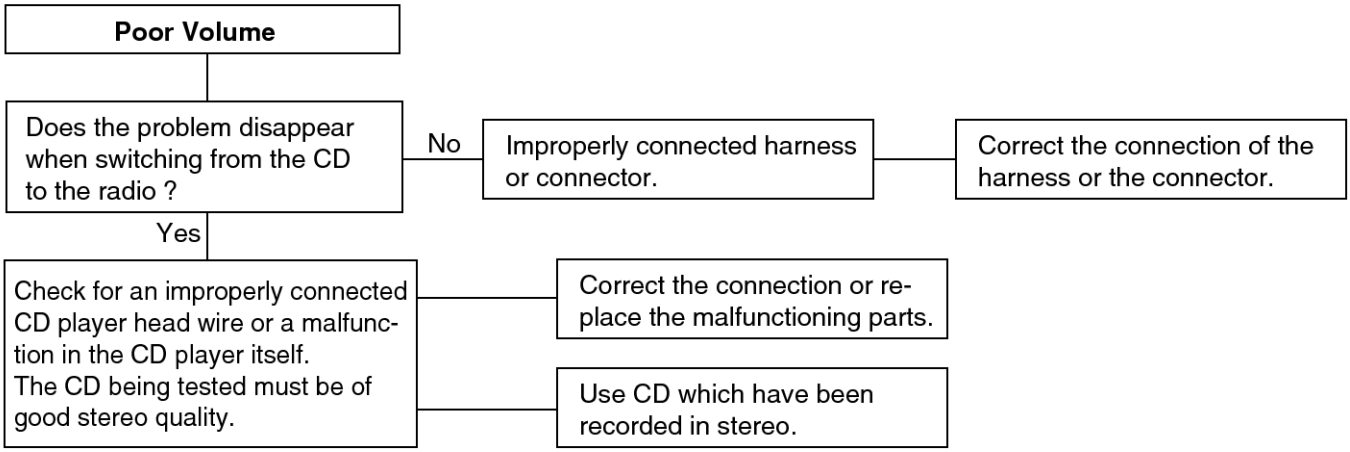


## Chart 5




LTIF001L

## Chart 6



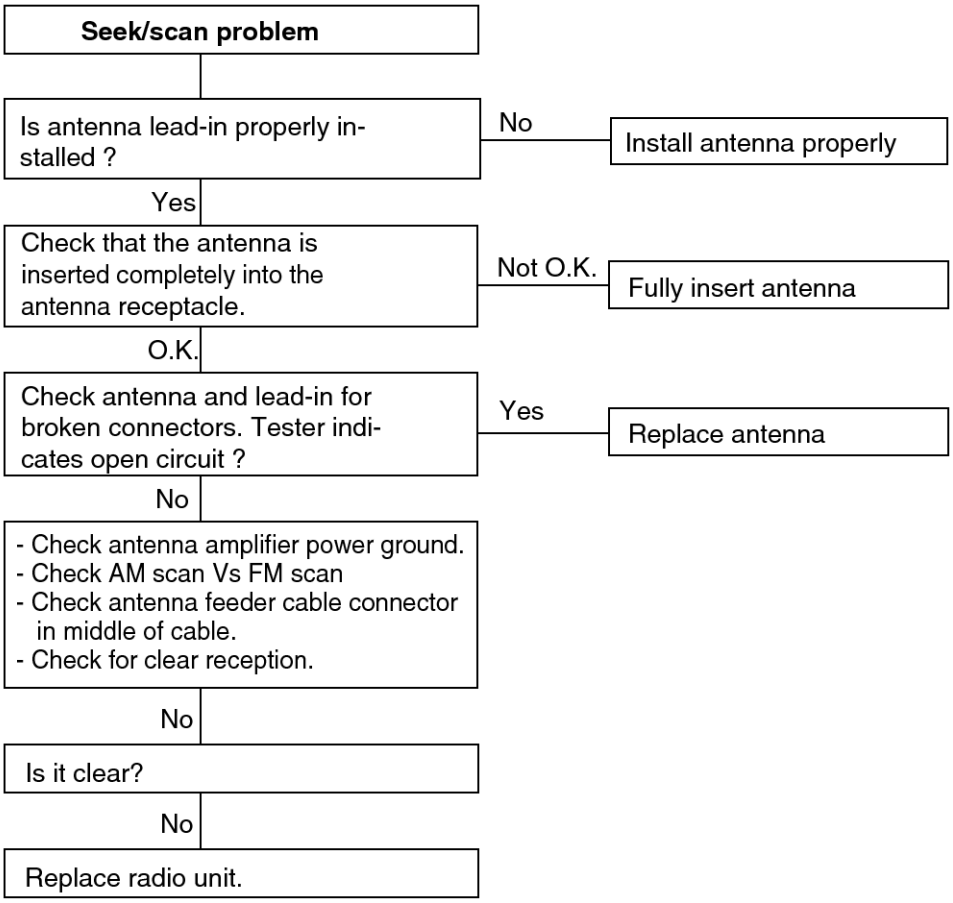

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## Chart 7




LTIF001N

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# DIS(Driver Information System)

## Specification

| Item | Specification |
|---|---|
| Power supply | DC 14.4V |
| Output voltage | 2.0Vrms (CD 0dB) |
| Tuning type | PLL synthesized typ |
| Antenna | 80PF 75Ω |
| Dark current | 6mA |

## DIS (Driver Information System)

- With the increasing complexity of electronic system in modern vehicles, we delivers the necessary expertise in total system integration such as multi media, air conditioning, trip computer and drive information.

1. DIS Concept : Adapted the interface to center keyboard → Possible to change 8 directions. (Jog dial type)
2. MOST & Optical Fiber Communication : Faster transmission of data, Reduced wiring weight and cost due to communication standard.

   ※ MOST : Media Orientated System Transport
3. Integrate a state of art Multi media : Navigation, Bluetooth hands free, USB & i-Pod connector.

   **Main Features**

   - Navigation

     Storage the map information in Head Unit (HDD:30GB) which is apply to an unified navigation with Global Positioning System. (N/America, China)

     Head unit is a combined with navigation in order to reduce the cost and weight.

     Detecting the date is more 10 times fast than previous DVD navigation.
   - Voice Recognition (Only North America)

     SDS : Speech Dialogue System that will allow drivers to get voice navigation guidance without having to manually punch in any information or take driver's eyes off the road to read a monitor's screen, it is possible to listen to radio, make a call, order to navigation.
   - Bluetooth Hands-free

     Equipped with Bluetooth Hands-Free capability allow you to use voice command or steering mounted controls to make and receive calls, keeping your hands on the wheel and your eyes on the road. After completing the initial set-up, you can then pair up 15 cell phones with the system for multiple drivers.
   - i-Pod & USB

     Such as i-Pod, mp3 and walkman are popular with people, therefore, it is possible to operate these devices just connect with it and play through each speaker in the car.

     Possible to play mp3 data with USB memory.

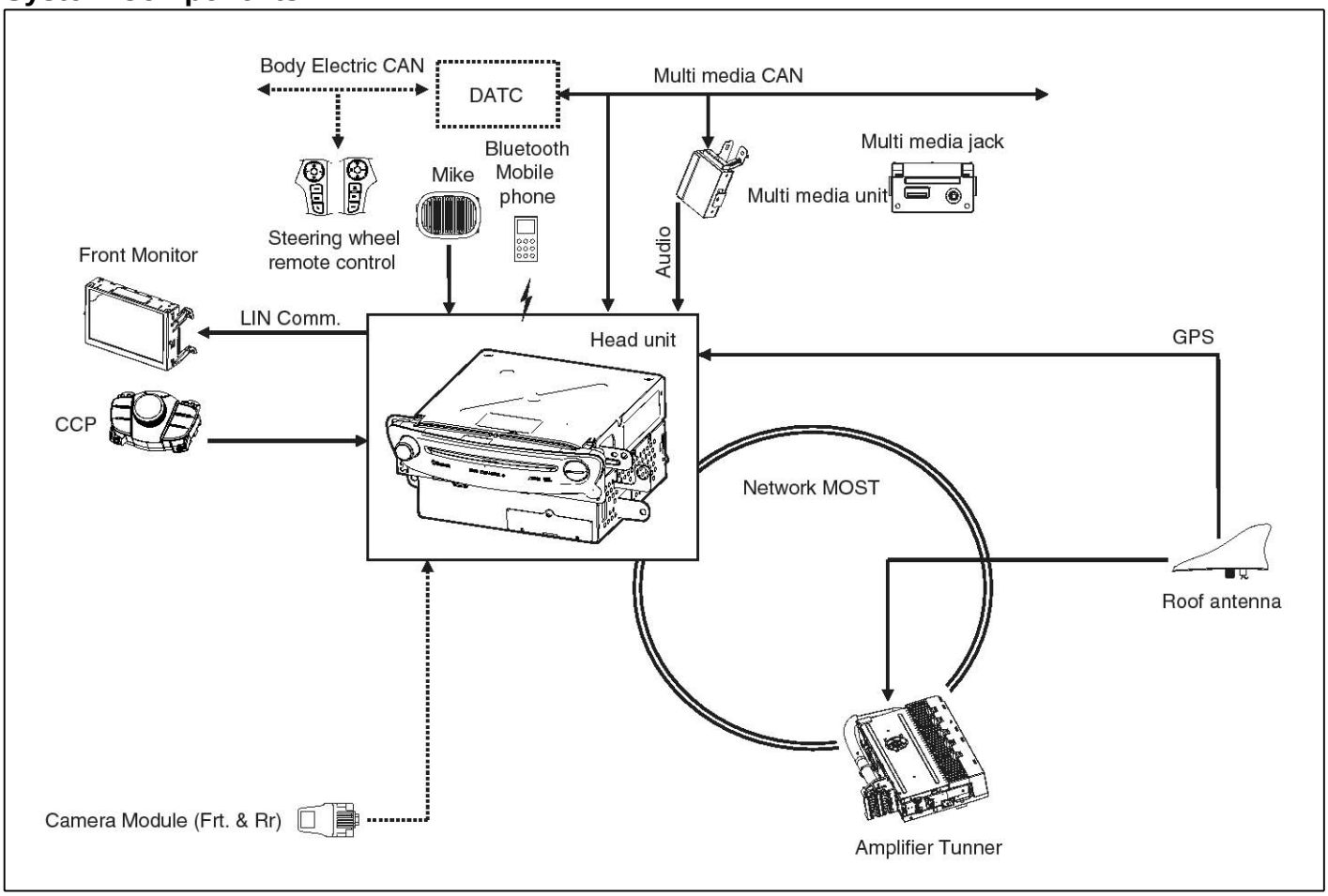
     i-Pod is able to operate with control keyboard.

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## System Components




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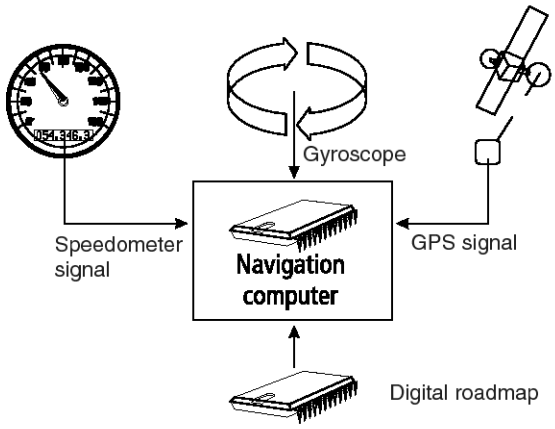
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## Navigation

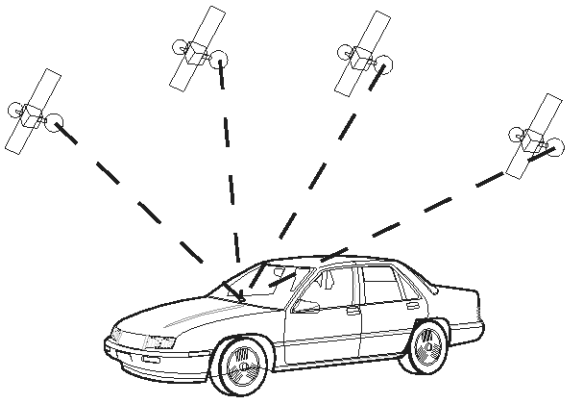
## Description




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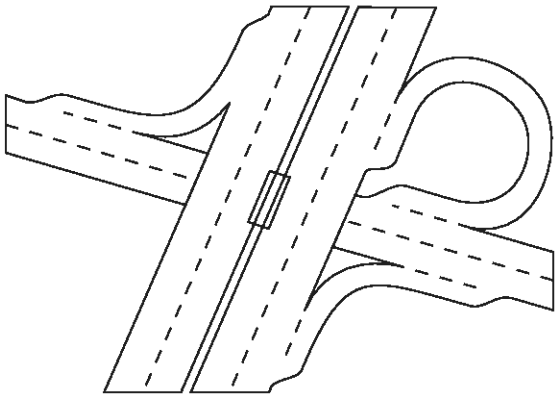
### How Does The Navigation System Work?

The position and movements of the vehicle are recorded by the navigation system's sensors. The distance travelled is determined by the vehicle speedometer signal, rotary motion in bends is detected by a gyro sensor (inertial compass). The position is determined via the GPS (Global Positioning System) satellites. The position can be calculated within a range of approx. 10 m by comparing the sensor signals with the digital map on the navigation CD.



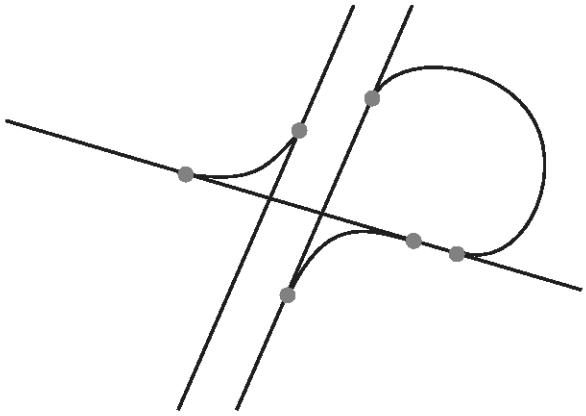
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### The Digital Road Map



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To be able to plan a route to a destination address, the navigation system not only requires the current position of the vehicle but also a digital road map containing the destination address itself and the roads leading to the destination address. This digital road map is on the memory which is located in navigation unit.



SEDBE7118L

The road system is stored on the map data as a line model, i.e. even large junctions have only one focal point that is approached by all roads in point-to-point fashion. Thus the navigation system indicates the distance to the turn-off point as the distance to the centre of the junction. This is why the distances for motorway exits indicated on road signs may not agree with those of the navigation system. The road signs indicate the distance to the beginning of the exit.

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Areas with limited road information

In some areas, not all of the information on a road is available on the map data. Thus, for example, turn-off prohibitions, information on the direction of travel in a one-way street or prohibited entry into a pedestrian zone may be missing. The navigation system will display a warning if you drive into such an area. Local traffic laws always take precedence over navigation system instructions. Always observe the road signs and motor vehicle traffic regulations.

Topicality of the map data

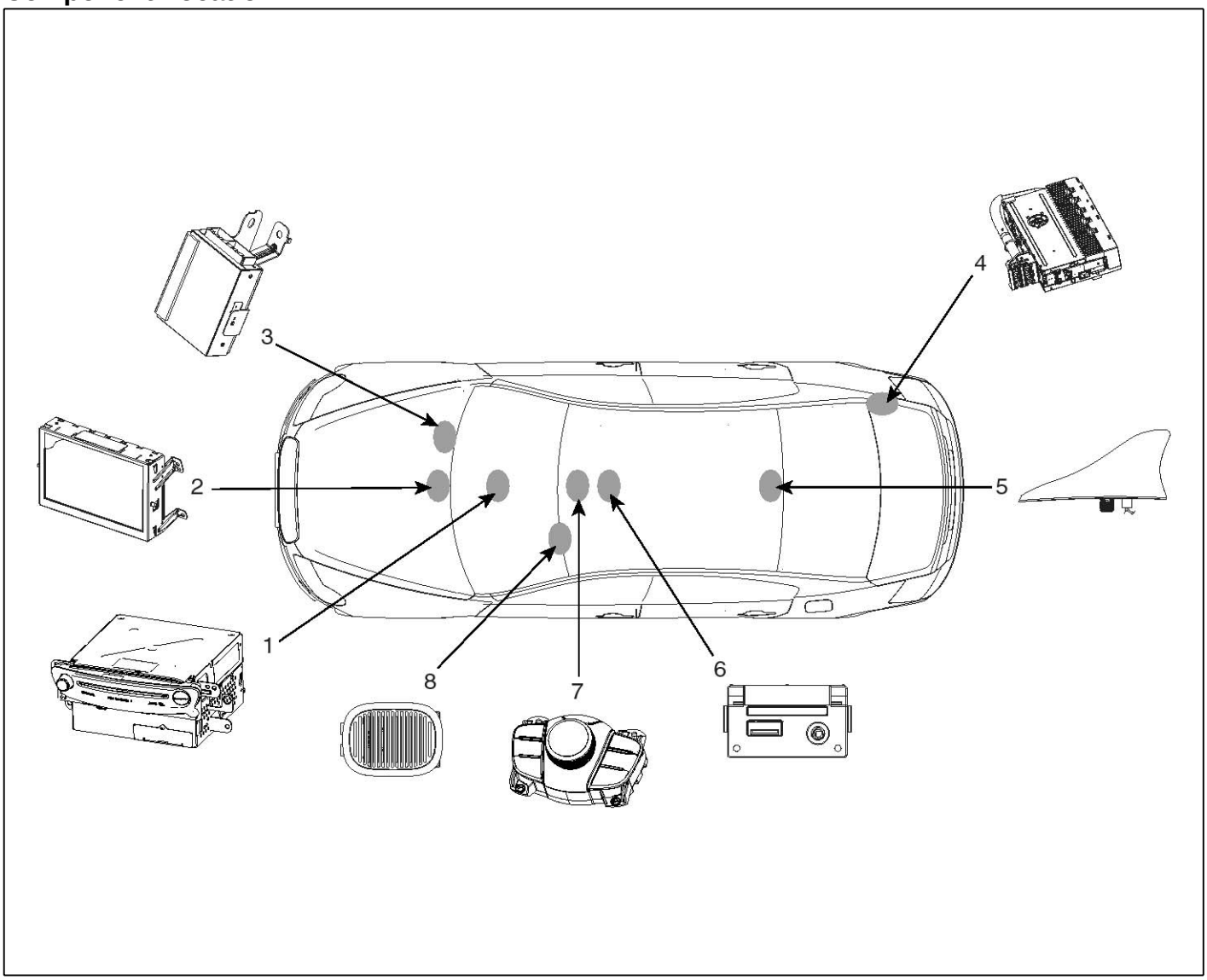
Roughly 10 - 15% of the road system characteristics change each year. Due to these constantly changing traffic conditions (construction of new roads, traffic calming, etc .) we cannot guarantee that the digital road map will be in 100 % agreement with existing traffic conditions. We recommend that you always use the most current version of the map data for navigation.

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## Component Location




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1. A/V & Navigation head unit
2. Front LCD monitor
3. Media unit
4. AV Amplifier Tuner
5. Roof antenna (GPS)
6. Multi media jack
7. CCP (Central Control Panel)
8. Mic

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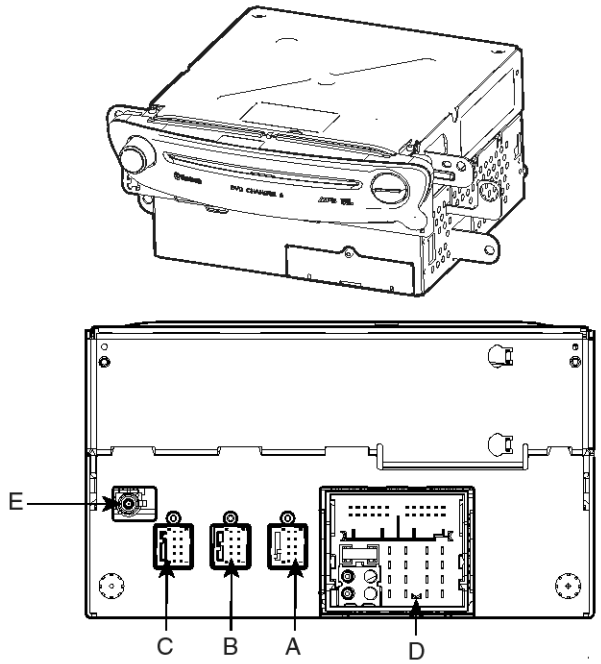
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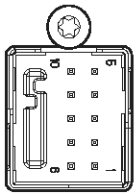
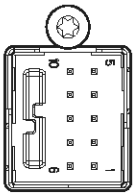
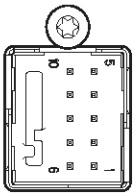


## DIS head unit

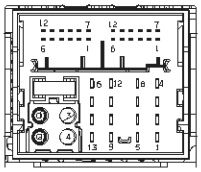
### Component Location

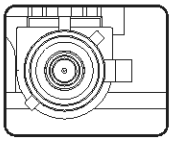
[DIS head unit]




| Connector A (Front LCD monitor) | Connector B (Rear LCD monitor) | Connector C (MTS) | Pin | Description |
|---|---|---|---|---|
|  |  |  | 1 | Tx 0 - |
| | | | 2 | Tx 0 + |
| | | | 3 | Tx 1 - |
| | | | 4 | Tx 1 + |
| | | | 5 | Data |
| | | | 6 | Tx CLK - |
| | | | 7 | Tx CLK + |
| | | | 8 | Tx 2 - |
| | | | 9 | Tx 2 + |
| | | | 10 | GND |

| Connector D | | | | |
|---|---|---|---|---|
| D-A | D-B | Pin | D-C | D-D |
| CU Wakeup | Mic input | 1 | Video input | MOST Rx |
| CU GND | Mic GND | 2 | Video input GND | MOST Tx |
| CU reset | - | 3 | - | MOST NC |
| CU power | - | 4 | - | MOST NC |
| CU Rx | K line | 5 | Camera Video input | |
| CU Tx | Vehicle speed | 6 | Camera GND/Shield | |
| - | - | 7 | - | |
| - | ACC | 8 | - | |
| CAN low | IG1 | 9 | - | |
| RBD | Monitor ON | 10 | Audio L | |
| CAN high | Illumination + | 11 | Audio R | |
| GND | Illumination - | 12 | Audio GND | |
| - | | 13 | | |
| CU Shield | | 14 | | |
| B+ | | 15 | | |
| - | | 16 | | |



| Connector E | Pin | Description |
|---|---|---|
|  | 1 | NAVI/GPS input |

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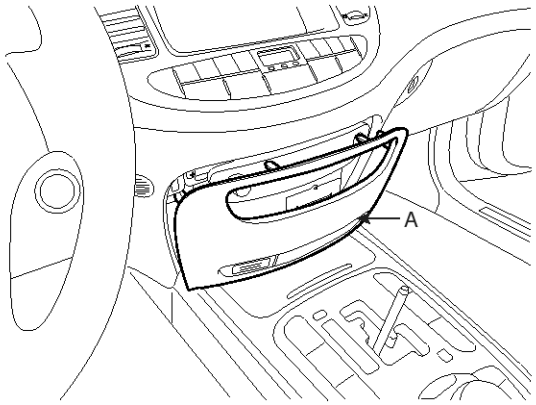
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## Removal

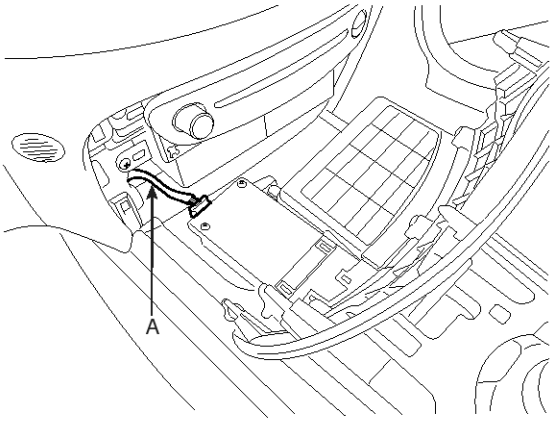
### Dis Head Unit

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



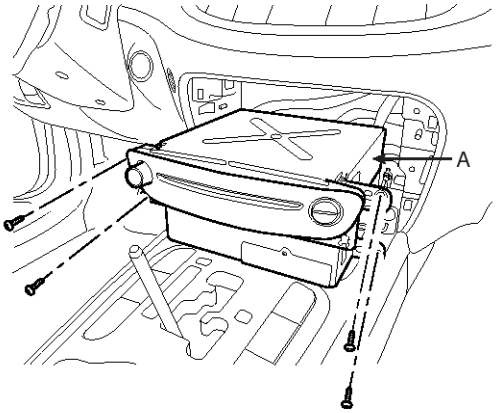

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3. Remove the connector (A).



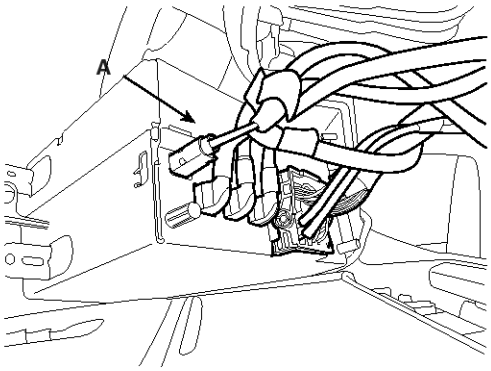

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4. Remove the mounting screws and then remove the DIS head unit (A).




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5. Remove the DIS head unit connectors (A).




SBHBE8264D

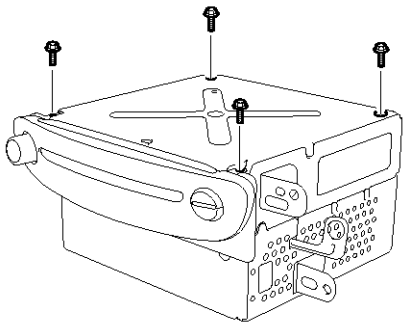
**⚠CAUTION**
**When the compact disc is not ejected, do not remove it forcibly.**

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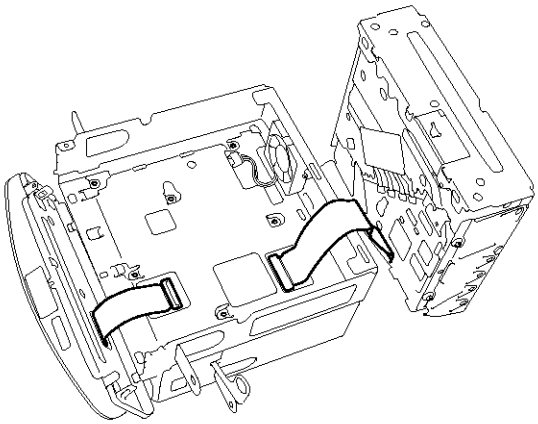


6. When separate the CD/DVD rom drive, if necessary, remove the screws (4EA) on the head unit.



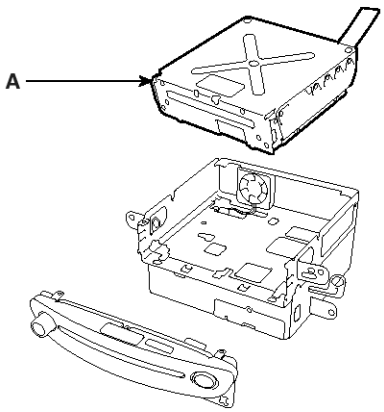
SBHB18015D

7. Remove the connector (A).



SBHB18061D

8. Remove the CD/DVD rom drive (A).

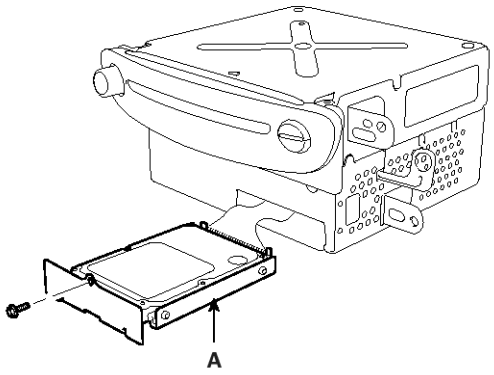



SBHB18062D

**CAUTION**

**When the HDD(hard disc drive) is not ejected, do not remove it forcibly.**

9. Replace the HDD (A) after removing the screw.




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## Installation

### DIS Head Unit

1. Install the DIS head unit after connecting the connectors.
2. Istall the crash pad lower pannel.
3. Connect the negative (-) battery terminal.

## Inspection

### Inspection when replace the DIS head unit

DIS head unit delivers the necessary expertise such as multi media, air conditioning, trip computer and drive information.

For these reasons, further information of vehicle have to be inputed to new DIS head unit when the DIS head unit is replaced.

**NOTICE**

*Below description is only using the scan tool.*

### Engineering Mode

- Check information about hardware devices and software drivers existing in system;
- see information about MOST ring
- see or delete diagnostic error codes saved during operation of the system in Normal Mode;
- activate, deactivate or change different features of the system;
- start different diagnostic functions of the system;
- perform software updates of the existing drivers in the system;

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### Variant Coding

In case replacement the new head unit, should be variant coding at the engineering mode.

1. Check below information about hardware devices in system or vehicle with scan tool.

| Information | Setting |
|---|---|
| CCP | NA/CANADA |
| DVD Region Code | Region code (01) |
| DVD Language | English |
| Navigation | ON |
| MTS | OFF |
| SDS | ON |
| RSE | OFF |
| TV Analog | OFF |
| DMB | OFF |
| Media Unit | ON |
| XM Radio | ON |
| HD Radio | ON |
| Rear Camera | ON |
| Front Camera | ON |
| ECS Height | ON |
| ECS Suspension | ON |
| US Unit | ON (mile) |
| | OFF (Km) |
| AQS | ON |
| Bluetooth | ON |
| Steering Easy Access | ON or OFF |
| Seat Easy Access | ON |
| Door Lock Sound | ON |

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```
    1. HYUNDAI VEHICLE DIAGNOSIS
 MODEL  : GENESIS
 SYSTEM : MULTI MEDIA SYSTEM
          HEAD UNIT
   01. DIAGNOSTIC TROUBLE CODES
   02. READ VERIENT CODING
   03. WRITE VERIENT CODING
   04. ACTUATION TEST
   05. ALL UNIT SOFTWARE VERSION
   06. WAKE UP LINE TEST
   07. RING BREAK TEST
   08. XdB TEST
```

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2. Connect the DLC cable of scan tool to the data link c-onnector and select the "Multi media system".

```
    1. HYUNDAI VEHICLE DIAGNOSIS
 MODEL  : GENESIS

   07. ELEC.CONTROL SUSPENSION
   08. ELEC.PAKING BRAKE
   09. AUTO HEAD LEVELING
   10. SMART CRUISE CONTROL
   11. BODY CONTROL MODULE
   12. MULTI MEDIA SYSTEM
   13. IMMOBILIZER
   14. SMART KEY CODE SAVING
```

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3. Select the "Head unit".

```
    1. HYUNDAI VEHICLE DIAGNOSIS
 MODEL  : GENESIS
 SYSTEM : MULTI MEDIA SYSTEM

   01. HEAD UNIT
   02. TUNER/AMP
   03. TV
   04. SDS
   05. MOZEN
```

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4. Select the "Write verient coding".

```
    1. HYUNDAI VEHICLE DIAGNOSIS
 MODEL  : GENESIS
 SYSTEM : MULTI MEDIA SYSTEM
          HEAD UNIT
   01. DIAGNOSTIC TROUBLE CODES
   02. READ VERIENT CODING
   03. WRITE VERIENT CODING
   04. ACTUATION TEST
   05. ALL UNIT SOFTWARE VERSION
   06. WAKE UP LINE TEST
   07. RING BREAK TEST
   08. XdB TEST
```

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5. Input the setting data option which checked informati-on above 1) table.

```
    1. HYUNDAI VEHICLE DIAGNOSIS
 ITEM SELECT    [UP  ]/[DOWN ]
 VERIENT CHANGE [LEFT]/[RIGHT]

 01. NAVIGATION(CHI,EAST)  DISABLE
 02.
 03.
 04.
 05.
 06.
 07.
 08.
```

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## Troubleshooting

### Head Unit DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | U1000 | Head Unit ECM Error |
| 2 | U1003 | Temperature Sensor SignalError in Head Unit |
| 3 | U1006 | Low Voltage Detected |
| 4 | U1007 | High Voltage Detected |
| 5 | U1500 | Wakeup Line Short Circuit To Ground. |
| 6 | U1501 | Wakeup Line Short Circuit To Vcc. |
| 7 | U1540 | Wakeup Line Test Failed at Amplifier |
| 8 | U1900 | GPS Antenna Line Break. |
| 9 | U1920 | DVD Drive Error |
| 10 | U1940 | LIN Front Communication Error. |
| 11 | U1942 | LIN Rear Communication Error. |
| 12 | U1970 | MM CAN Bus Off Error. |
| 13 | U1971 | MM CAN Single Line Error. |
| 14 | U1972 | MM CAN Limp Home Status. |
| 15 | U1980 | Timeout Multimedia CAN Message(Air Conditioner, Cluster, Audio) |
| 16 | U1981 | Timeout Multimedia CAN Message(Vehicle Speed) |
| 17 | U1982 | Timeout Multimedia CAN Message(Body CAN Signal - Camera, ECS, Trip Computer, Alternator, Auto Light) |
| 18 | U1983 | Timeout Multimedia CAN Message (Trip Computer) |
| 19 | U1984 | Timeout Multimedia CAN Message(Inhibitor Signal) |

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## U1000 Head Unit ECM Error

### General Description

Head unit is self diagnostic and control system that communicate with navigation H/UNIT,voice recognition, DVD Changer + MP3 & WMA files play ,USB & iPOD ,bluetooth handsfree,Body control system and information display of DIS on the MOST network.

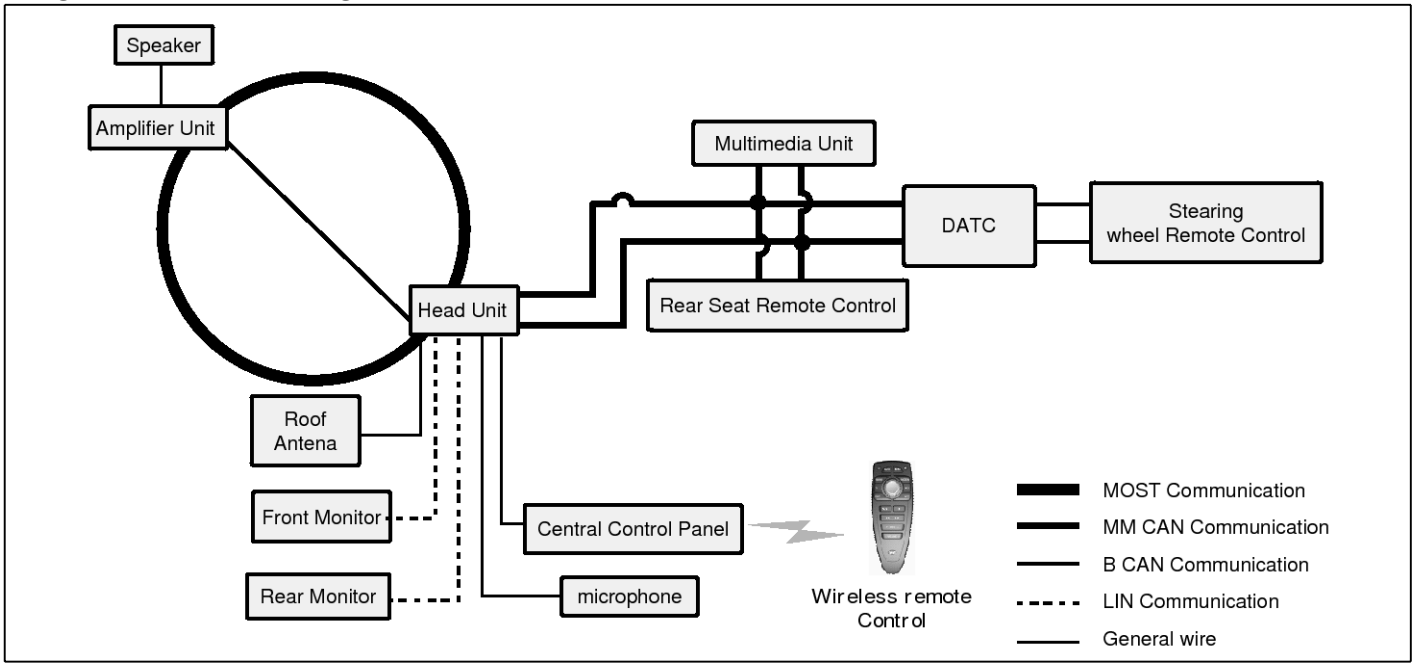
### DTC Description

This code is set when the head unit detects the inside problem by itself.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Self diagnosis | • Head unit |
| Enable Conditions | • IG ON | |
| Threshold value | • One or more of the following conditions become true:<br>- EEPROM test error,<br>- CPU defet,<br>- RAM test or ROM-, F-ROM-checksum error(failure) | |
| Detecting Time | • IG ON or During Self diagnosis | |

### Diagnostic Circuit Diagram




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**Signal Waveform & Data**

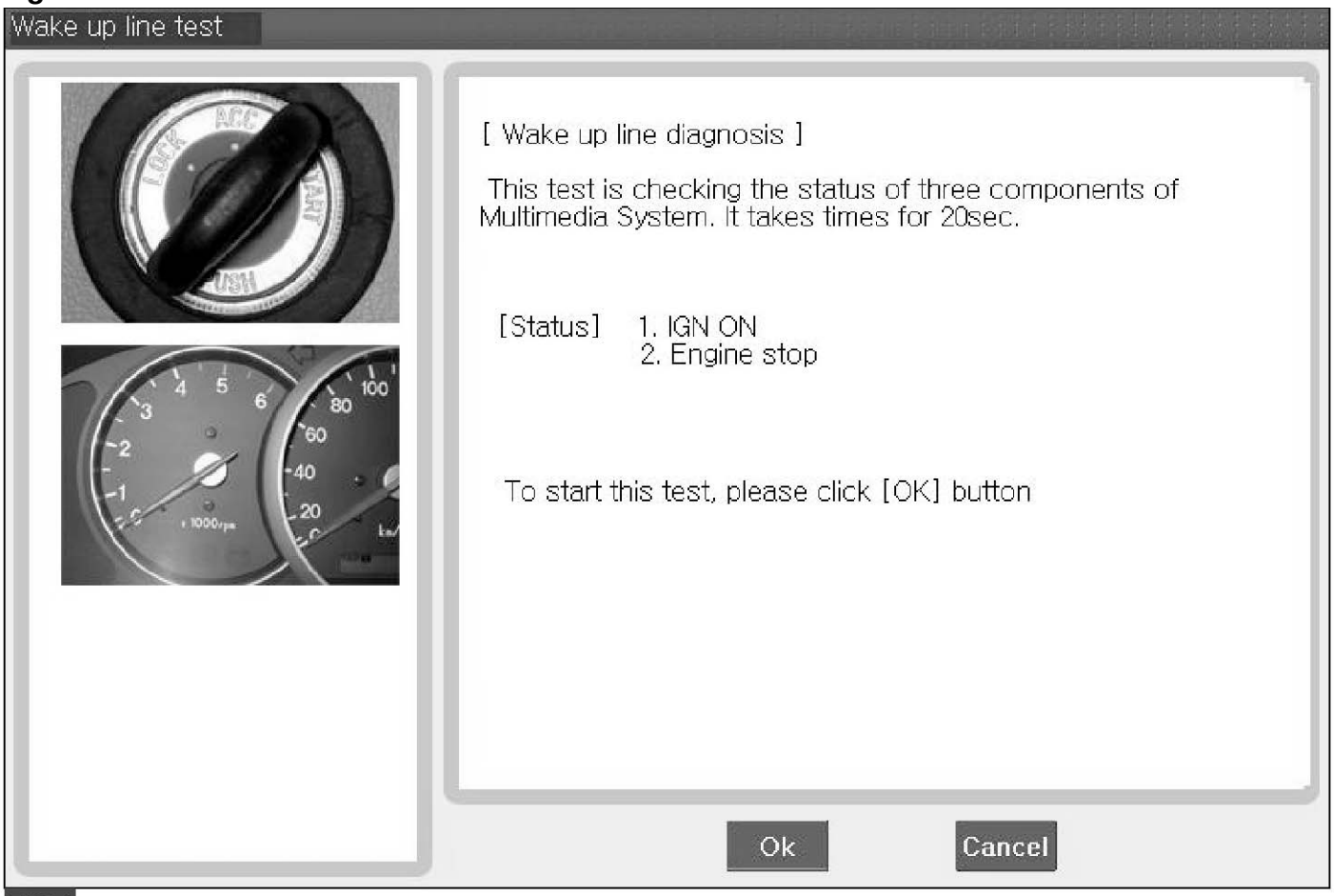



FIG.1

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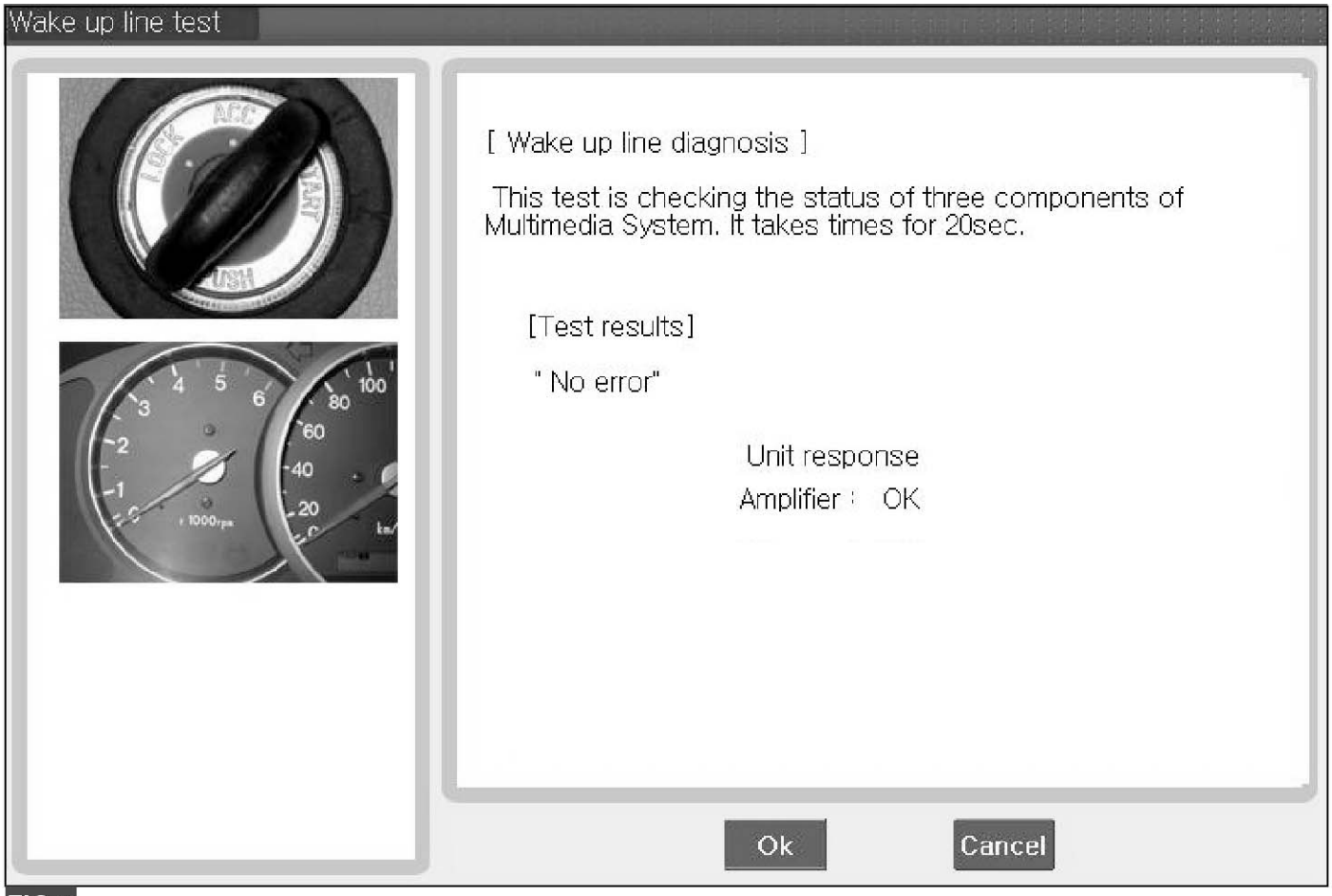



FIG.2

SBHBE9T12L

FIG.1) Start of Wake up line diagnosis

FIG.2) Completion of Wake up line diagnosis

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)"mode and monitor "DTC Status" parameter.
4. Clear recorded DTC using Scan tool.
5. Is the DTC present ?

**YES** ▶ Go to "Wake up line diagnosis" procedure.

**NO** ▶ Fault is intermittent caused by poor contact of Head unit and memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and go to "Verification Vehicle Repair" procedure.

## Wake up line diagonosis

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Wake up line diagosis"mode and monitor "Test results"

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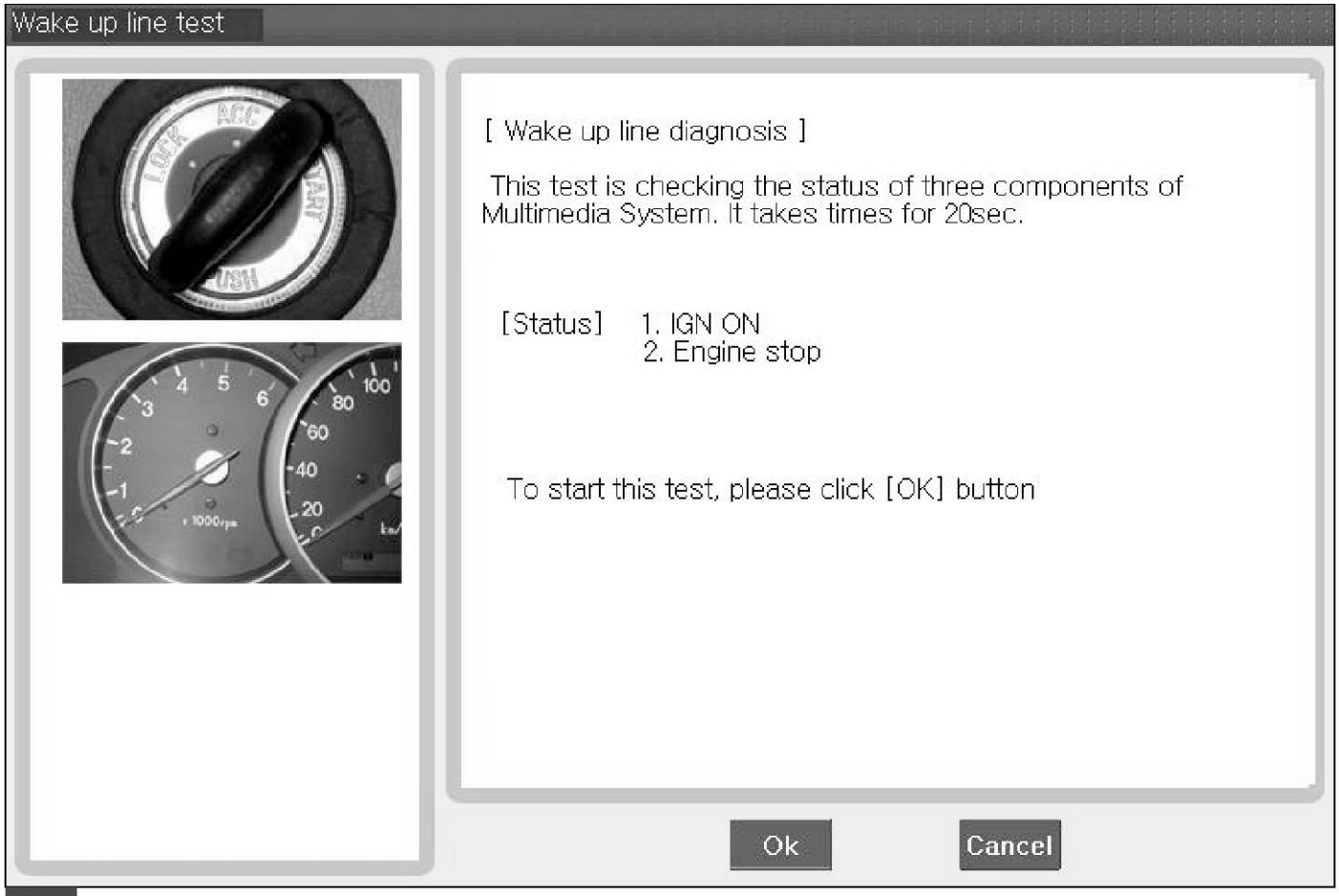



FIG.1

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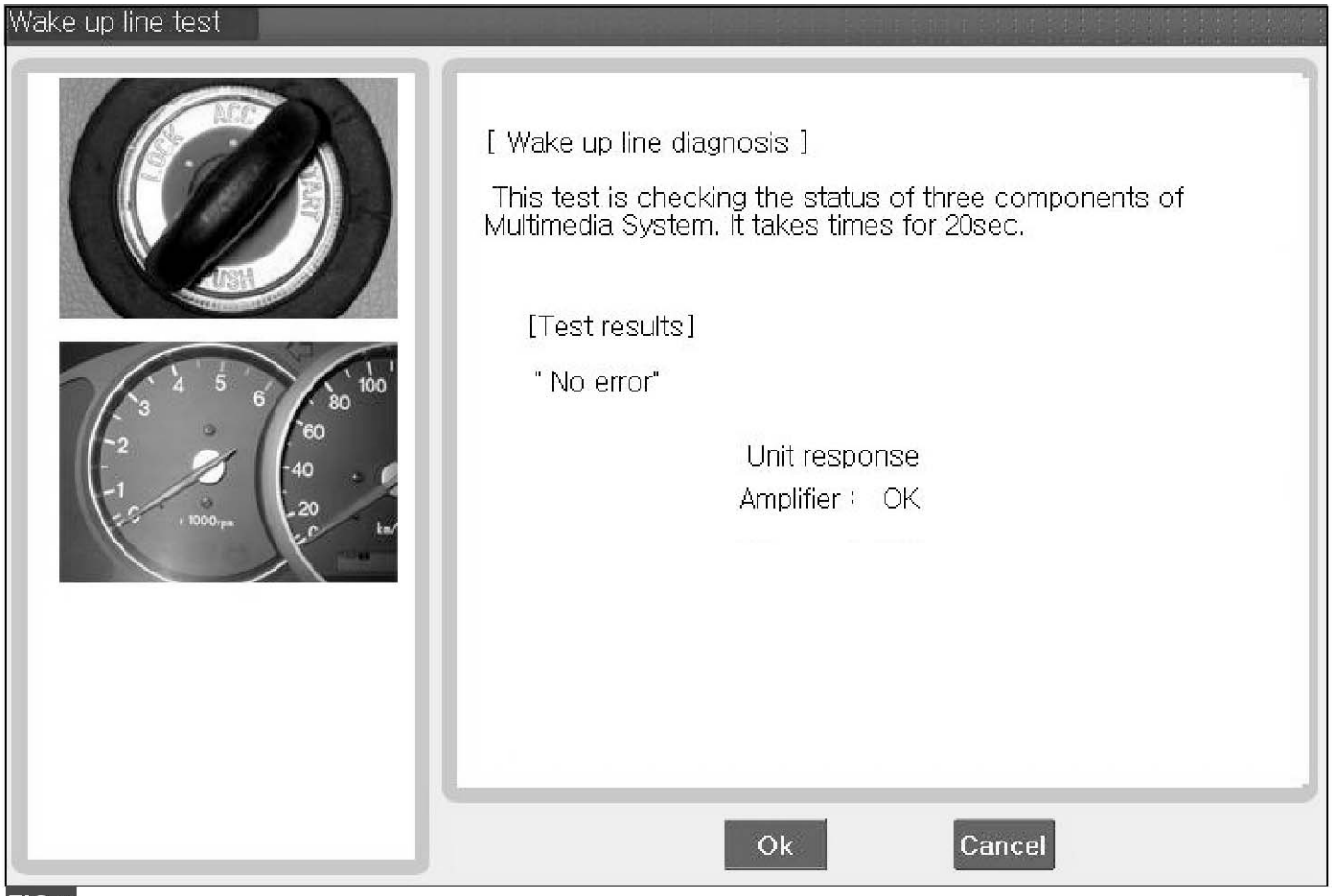



FIG.2

SBHBE9T12L

FIG.1) Start of Wake up line diagnosis

FIG.2) Completion of Wake up line diagnosis

4. Has a problem been found?

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

**NO** ▶ 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.

## 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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# U1003 Temperature Sensor Signal Error in Head Unit

## General Description

The temperature sensor of Head unit detect the temperature rising to prevent abnormal status of Head Unit.

## DTC Description

This code is set when a temperature sensor of Head unit detect that the temperature is over 85℃, At that time Tuner&Amplifier can be abnormal status. If the temperature is around 85℃,the fan is running to make the temperature down. After cooling, Tuner&Amplifier is normal status under 75℃.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Self diagnosis | • Poor air circulation around Head unit<br>• Head unit |
| Enable Conditions | • IG ON | |
| Threshold value | • Temperature > 85℃ | |
| Detecting Time | • Immediately | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

Refer to DTC U1000 : Head Unit ECM Error.

## Monitor Scantool Data

Refer to DTC U1000 : Head Unit ECM Error.

## Wake up line diagonosis

Refer to DTC U1000 : Head Unit ECM Error.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1006 Low Voltage Detected

## General Description

Refer to DTC U1000 : Head Unit ECM Error.

## DTC Description

This code is set when the supplied power of Head unitr is under 9V.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Voltage Monitoring | • Open /short in circuit<br>• battery<br>• Head unit |
| Enable Conditions | • IG ON | |
| Threshold value | • under 9V of battery voltage | |
| Detecting Time | • 30 sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## 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 "Power Circuit Inspection".

## Power Circuit Inspection

1. IG KEY "ON"
2. To set sound is out by Navigation, FA/AM radio and etc.
3. Measure waveform between terminal "1(+)" of Amplifier and chassis ground.
4. Measure waveform between terminal "1(-)" of Amplifier and chassis ground.

**Specification :** battery voltage

5. Is the measured waveform within specifications?

**YES** ▶ Go to next procedure.

**NO** ▶ Check for short circuit in signal harness. Repair as necessary and go to "Verification Vehicle Repair" procedure.

## System Inspection

### ■ Alternator circuit inspection

1. Engine "ON"
2. Turn on the head rights and heat rays at idle status, and accelerate to 2500 RPM for 2 min.
3. Check voltage between battery + terminal and - terminal.

**measurement value :** about 12.5 ~ 14.7V

4. Is the measured waveform within specifications?

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

**NO** ▶ Checking the tension of drive belt, status of engine RPM, fuse, battery, batteru terminal, Alternator B+ terminal, L termanal, FR terminal, C terminal and between battery and Alternator's B+ wire. If there is problem repair that or change and go to "Verification of Vehicle Repair" procedure.

▶ If there is no problem at the above checking, replace pertinent component and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1007 High Voltage Detected

## General Description

Refer to DTC U1000 : Head Unit ECM Error.

## DTC Description

This code is set when the supplied power of Head unit is above 16V.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Voltage Monitoring | • Alternator<br>• Head unit |
| Enable Conditions | • IG ON | |
| Threshold value | • above 16V of battery voltage | |
| Detecting Time | • 30 sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Terminal and Connector Inspection

Refer to DTC U1006 : Low Voltage Detected.

## Power Circuit Inspection

Refer to DTC U1006 : Low Voltage Detected.

## System Inspection

Refer to DTC U1006 : Low Voltage Detected.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1500 Wakeup Line Short Circuit To Ground

## General Description

The purpose of RBD(Ring Break diagnosis) Test is localizing a fatal error in the network. The RBD-Test check a ring break position.

The XdB-Test is a process which analyzes the transmission quality of every optical segment on the MOST network Also, Head unit test the component status by Wake up line diagnosis.

## DTC Description

This code is set when Head unit detects wake up line circuit short to ground.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Wakeup Line circuit short to ground |
| Enable Conditions | • IG ON | |
| Threshold value | • circuit short to ground | |
| Detecting Time | • Immediately | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

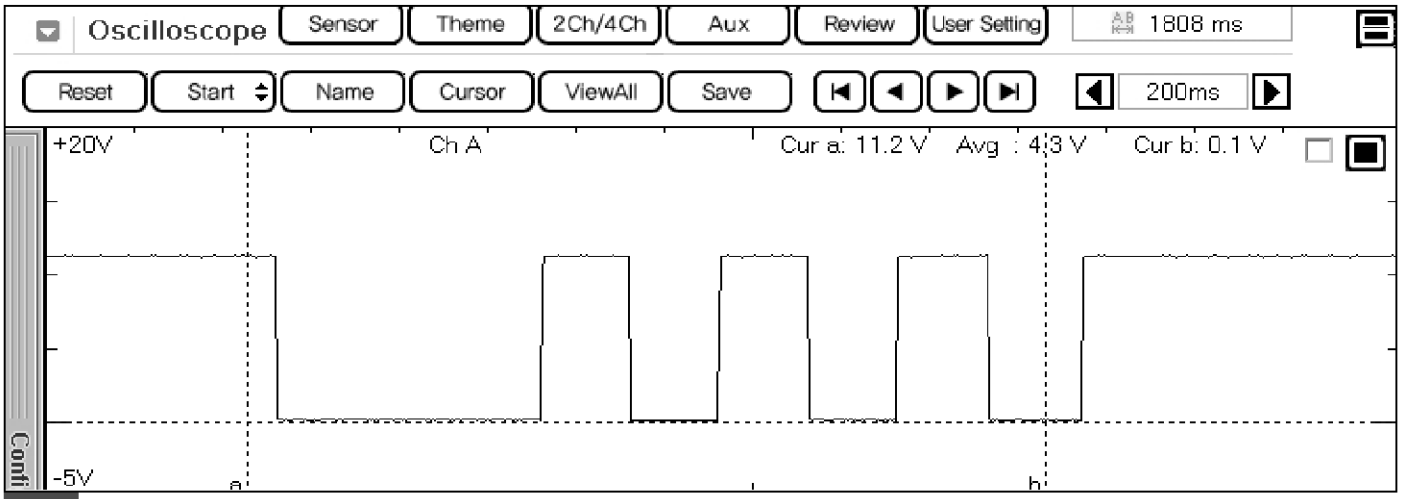



Fig.1

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FIG.1) Normal waveform of wake up line during wake up line test

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### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Ring break dignosis " in Inspection / Test opri-on and monitor "Test results".
4. Checking the component status by "Wake up line dig-nosis"

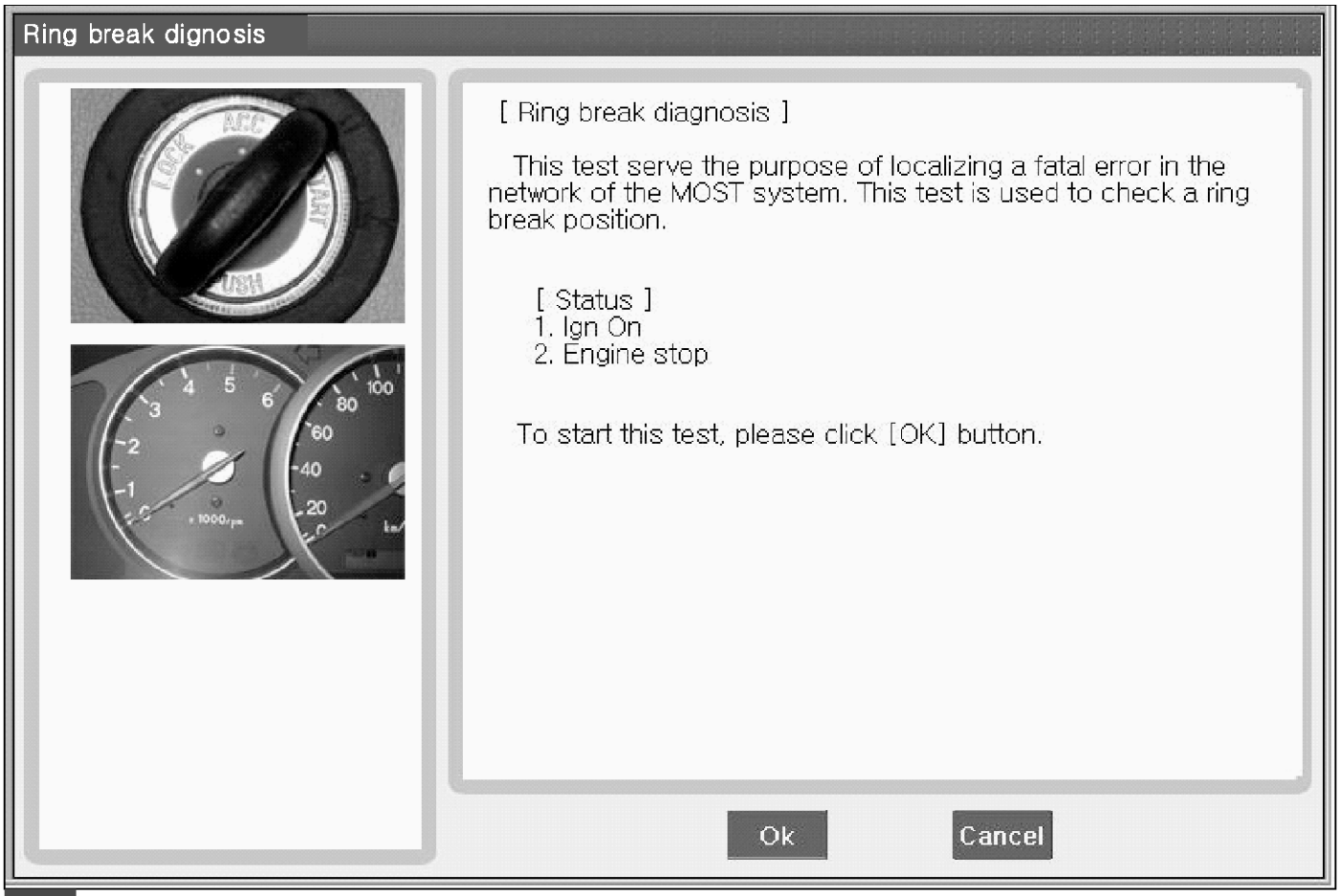



FIG.1

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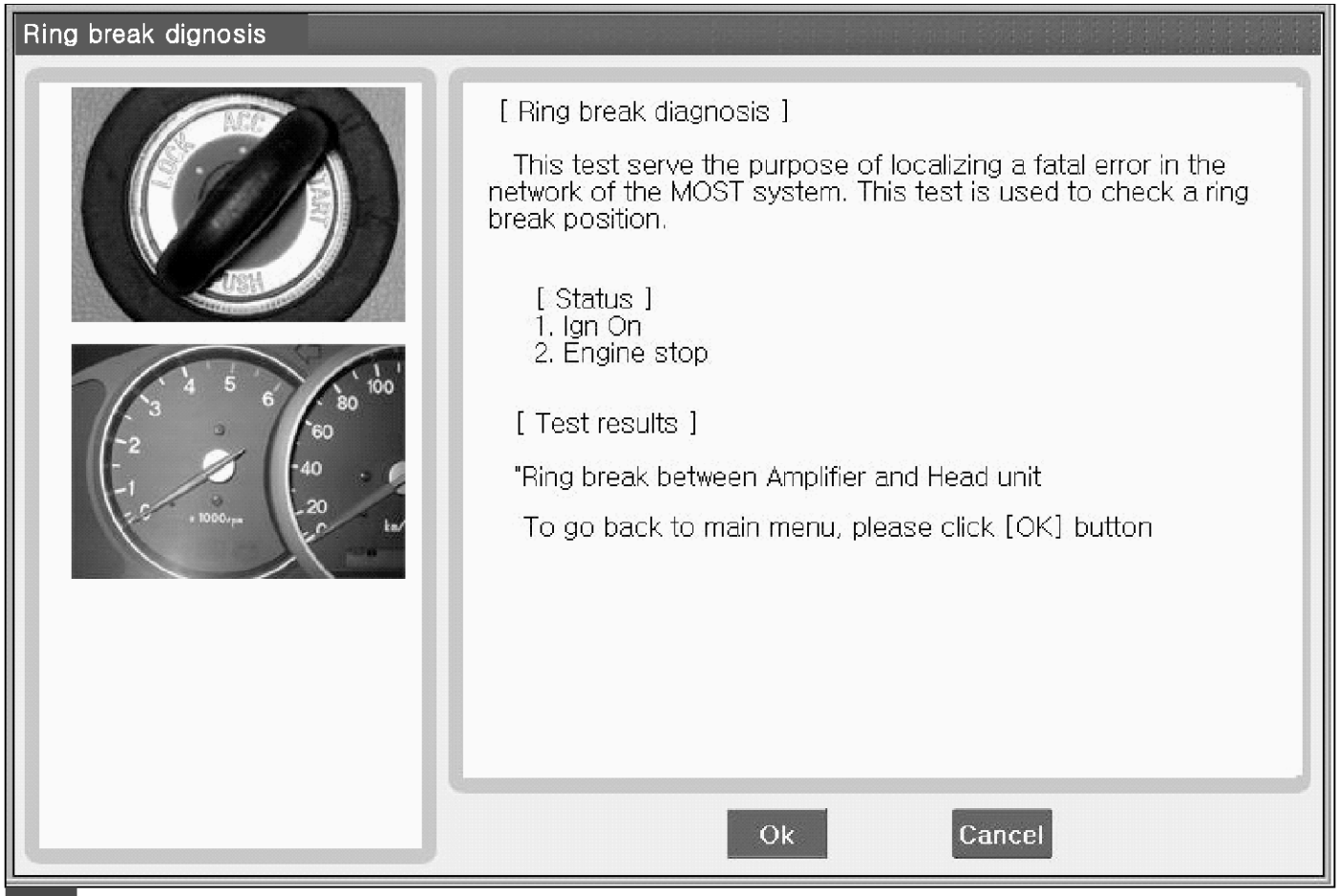



FIG.2

SBHBE9T33L

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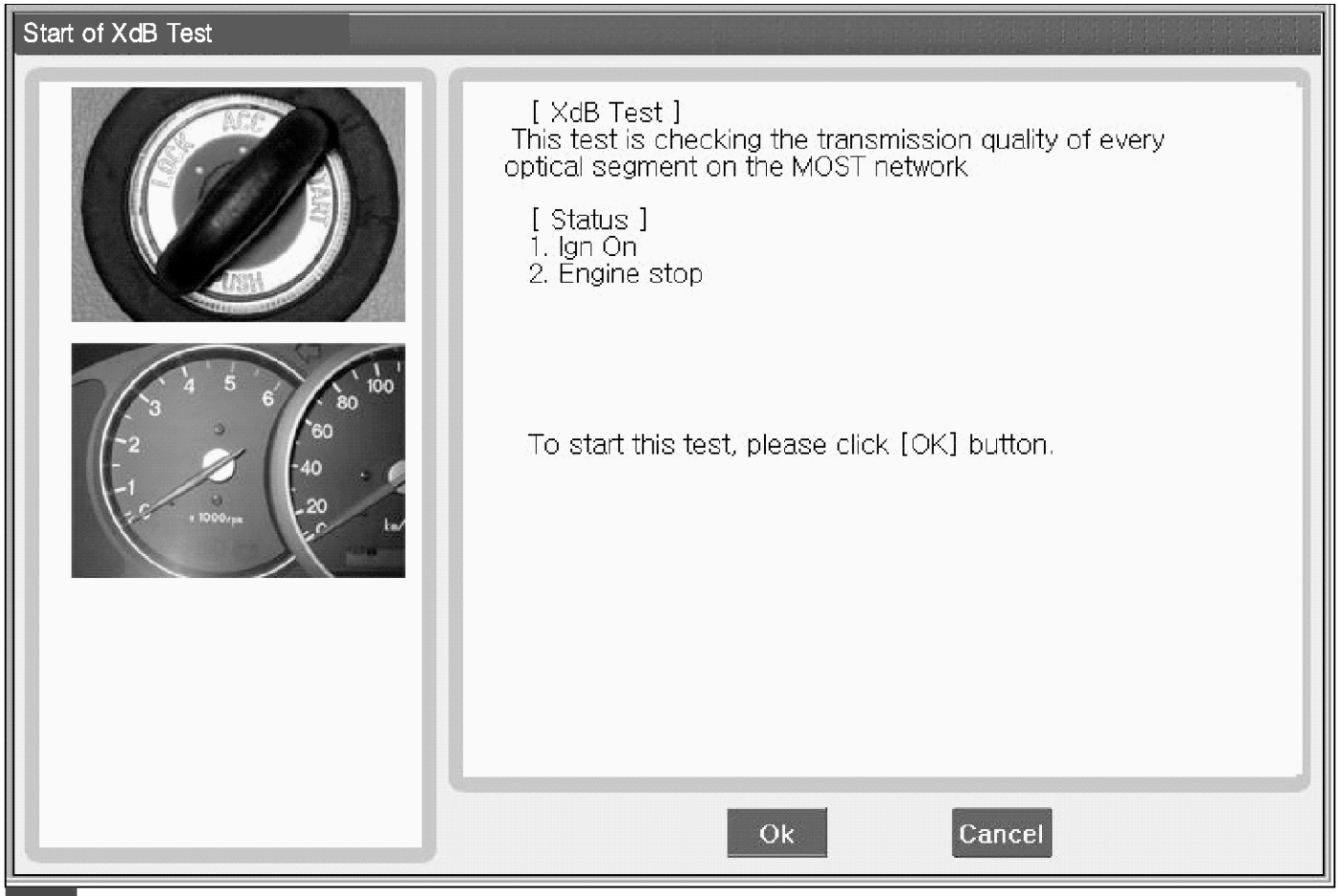



FIG.3

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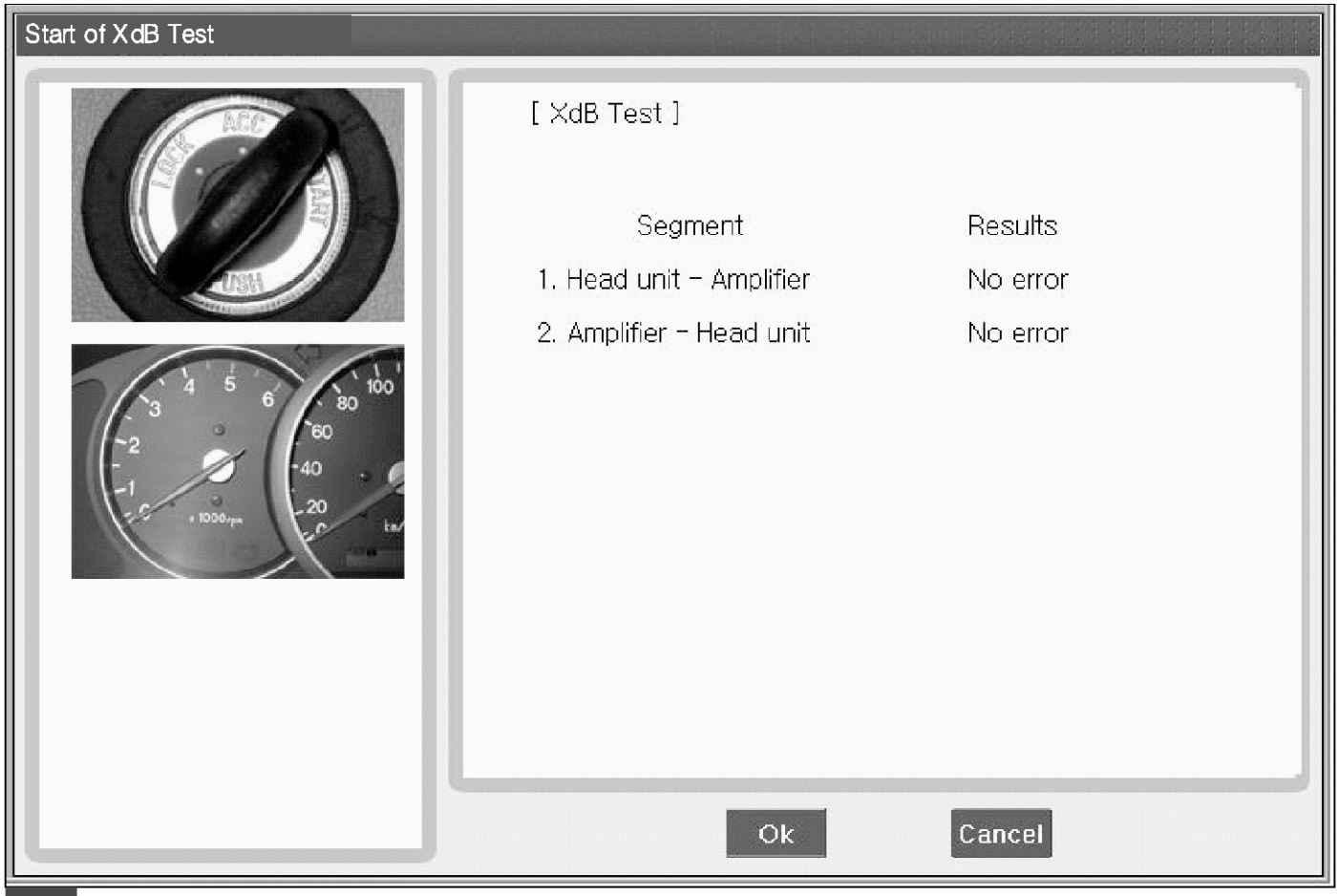



FIG.4

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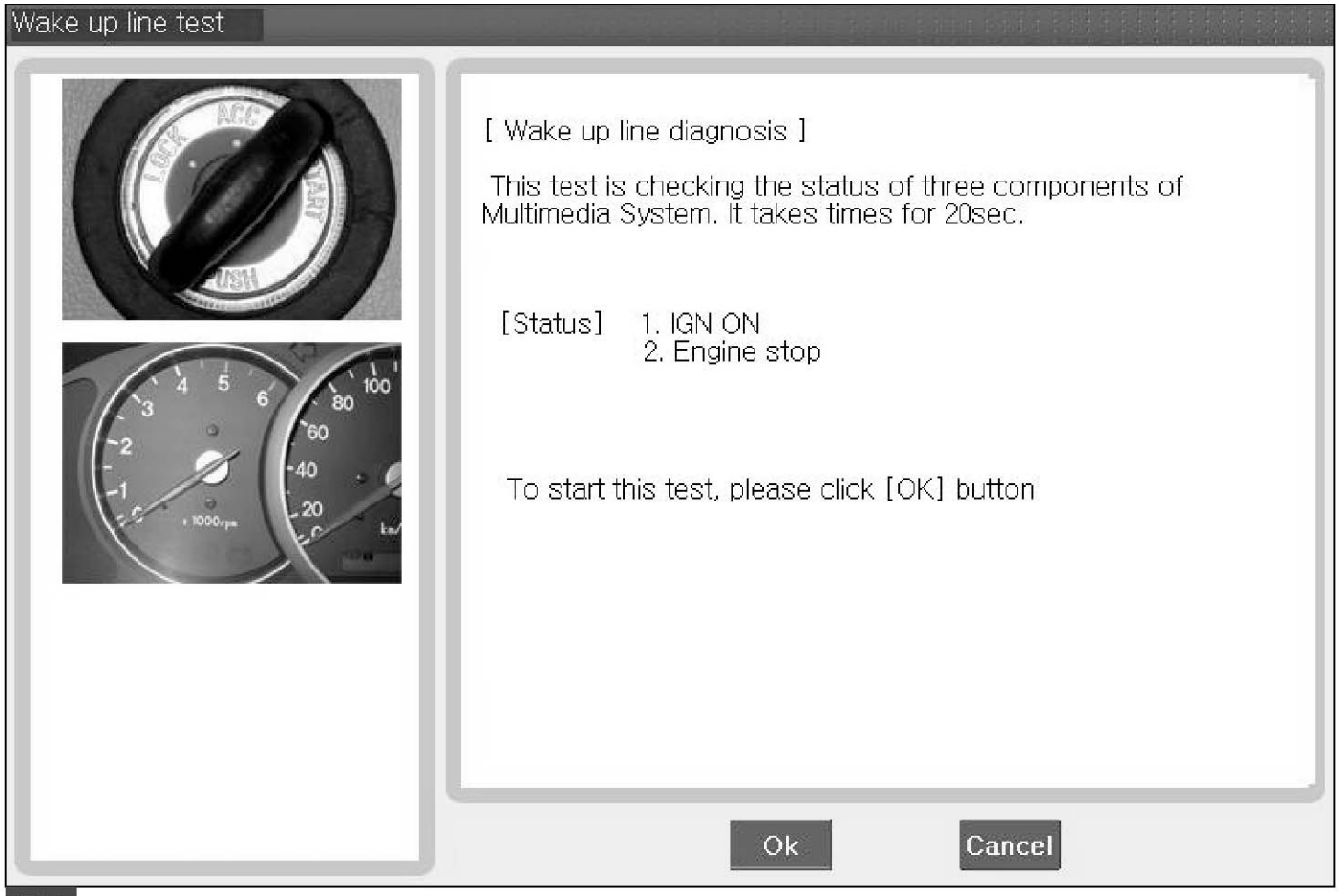



FIG.5

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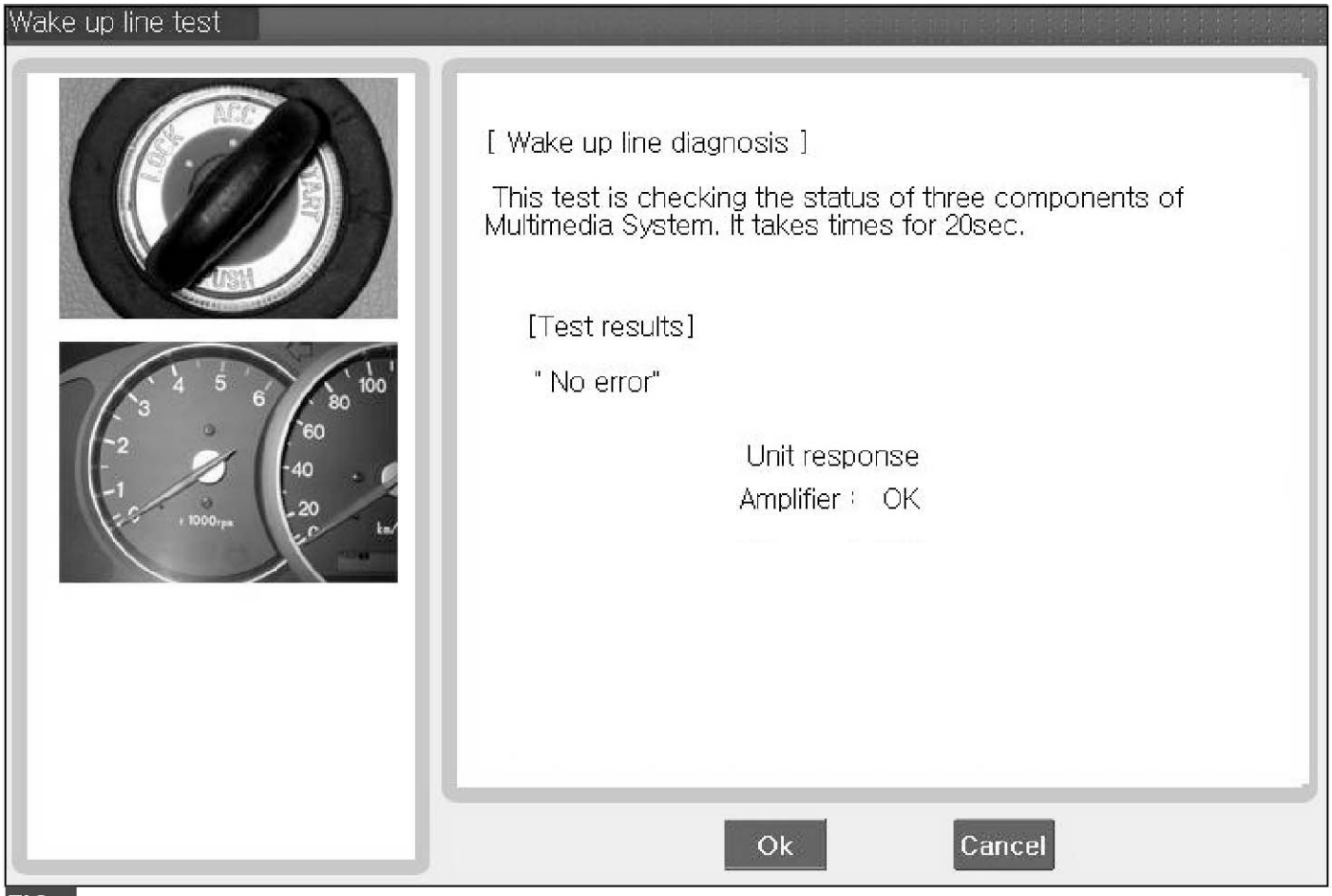



FIG.6

SBHBE9T37L

FIG.1) Ring break diagnosis

FIG.2) Ring break diagnosis between TV Tuner and Head Unit

FIG.3) Start of XdB Test

FIG.4) Result of X dB Test

FIG.5) Test of Wake up line diagnosis

FIG.6) Result of Wake up line test

5. Has a problem been found at wake up line?

**YES** ▶ Go to " Wake up line short circuit to ground inspection " procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or 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.

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### Wake up line short circuit to ground inspection

■ **Check wake up line short circuit to ground**

1. IG "ON" & ENG "ON"
2. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
3. Start "Wake up line diagnosis" and measure waveform each wake up line.
4. Disconneted all connect of components and check the status of each wake up line of chassis ground.

---

**Specification :** If measured waveform is within specification, its nomal.
If measured resistance is ∞ Ω, Its nomal.

---

5. Is the measured waveform within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or 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.
▶ It can be appeared for a second so try to Ign off and on and go to"Verification of Vehicle Repair" procedure.

**NO** ▶ Check the wake up line short circuit to ground and Repair as necessary and go to "Verification Vehicle Repair" procedure.

### Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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## U1501 Wakeup Line Short Circuit To Vcc

### General Description

Refer to DTC U1500 : Wakeup Line Short Circuit To Ground.

### DTC Description

This code is set when Head unit detects wake up line circuit short to battery.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Wakeup Line circuit short to battery |
| Enable Conditions | • IG ON | |
| Threshold value | • Wake up line circuit short to battery | |
| Detecting Time | • Immediately | |

### Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

### Signal Waveform & Data

Refer to DTC U1500 : Wakeup Line Short Circuit To Ground.

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### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Selet "Ring break dignosis " in Inspection / Test opri-on and monitor "Test results".
4. Checking the component status by "Wake up line dig-nosis"

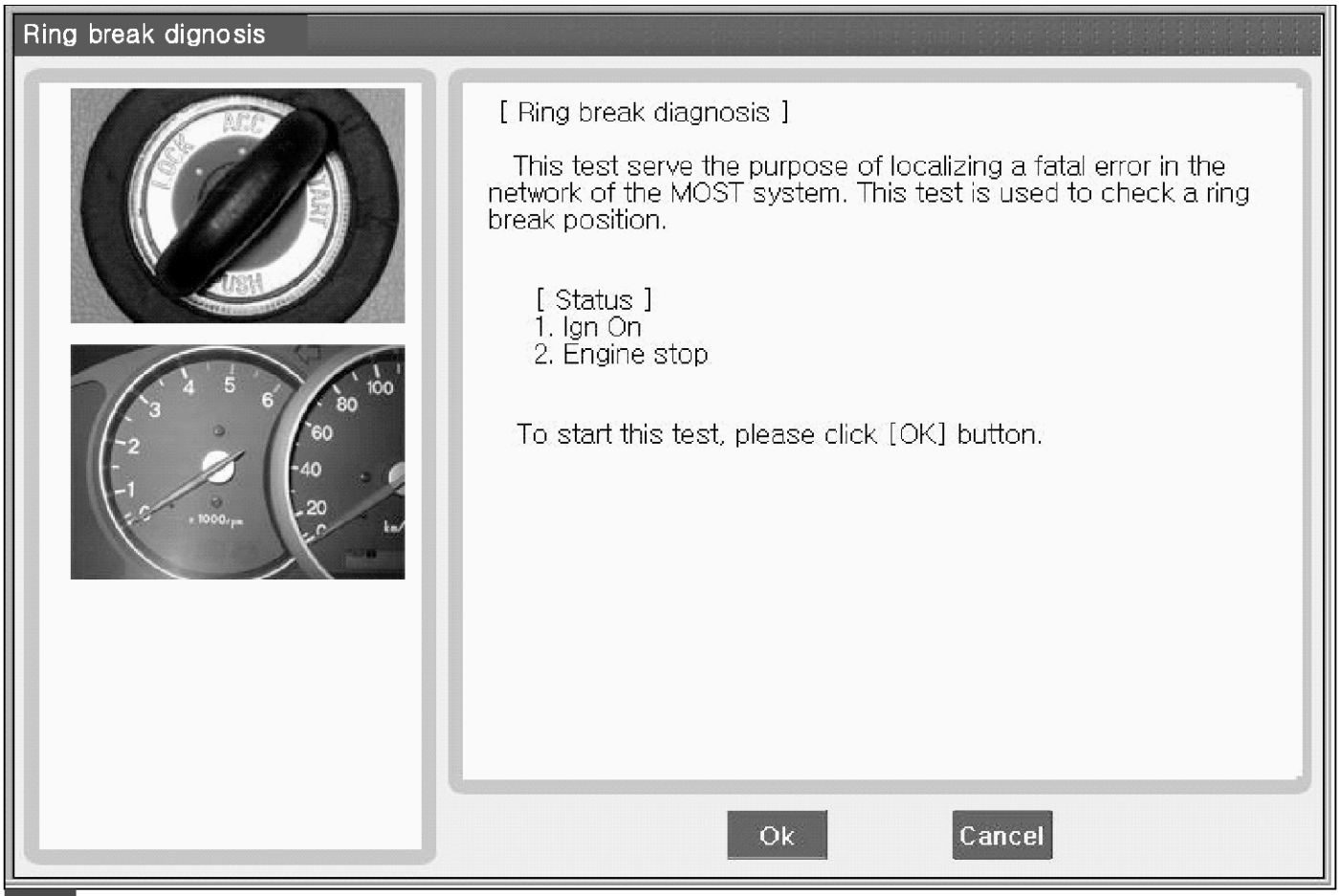



FIG.1

SBHBE9T32L

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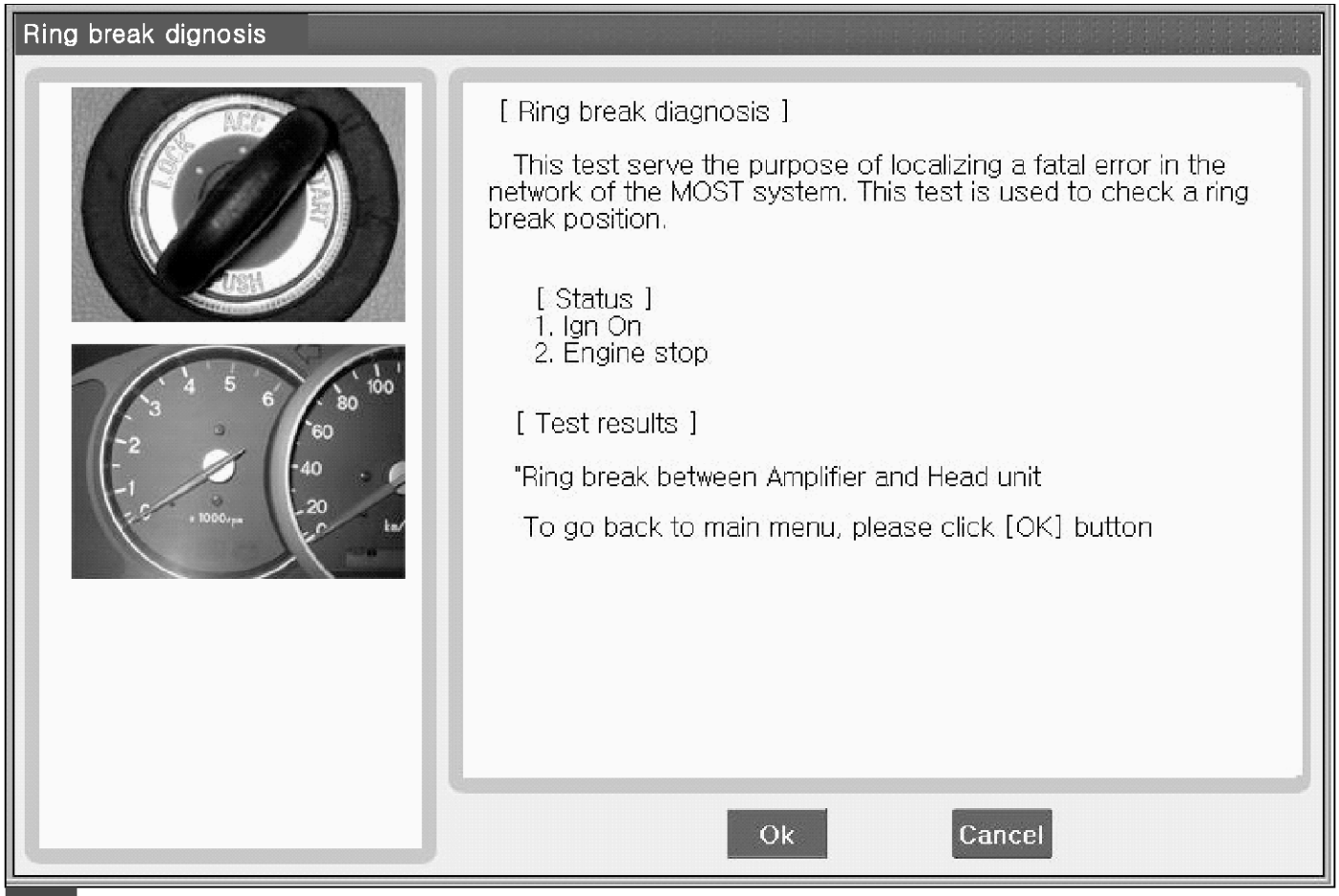



FIG.2

SBHBE9T33L

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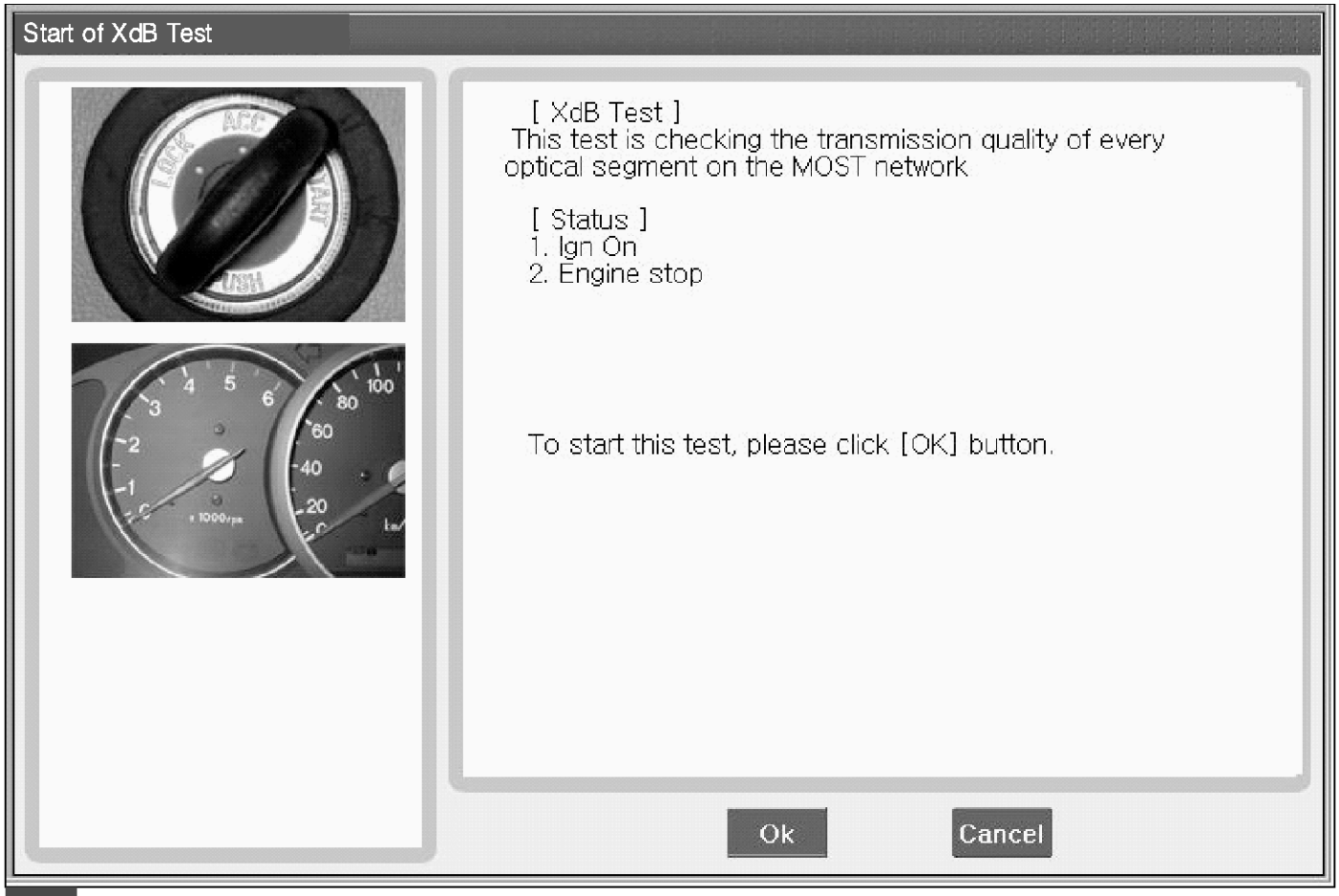



FIG.3

SBHBE9T34L

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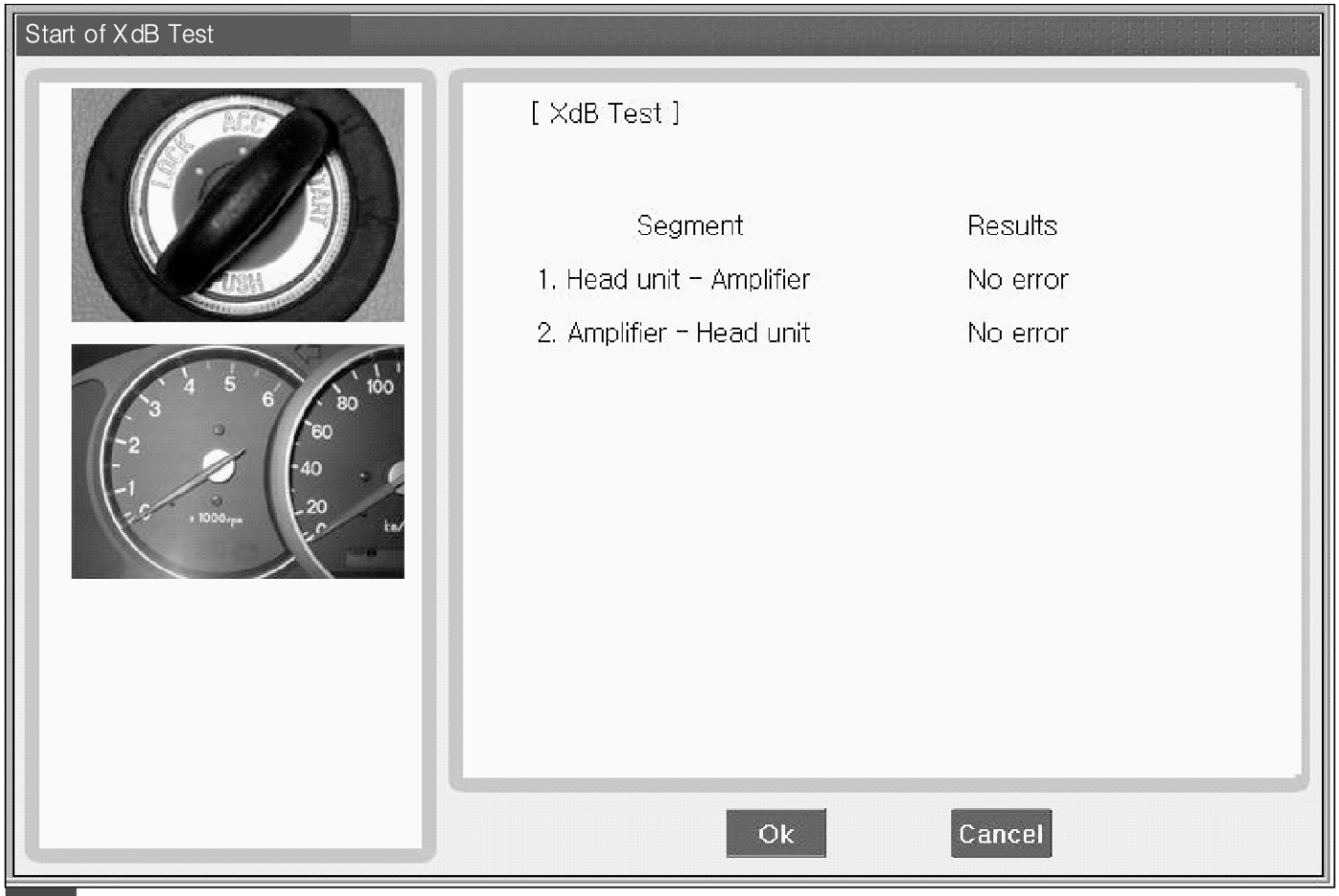



FIG.4

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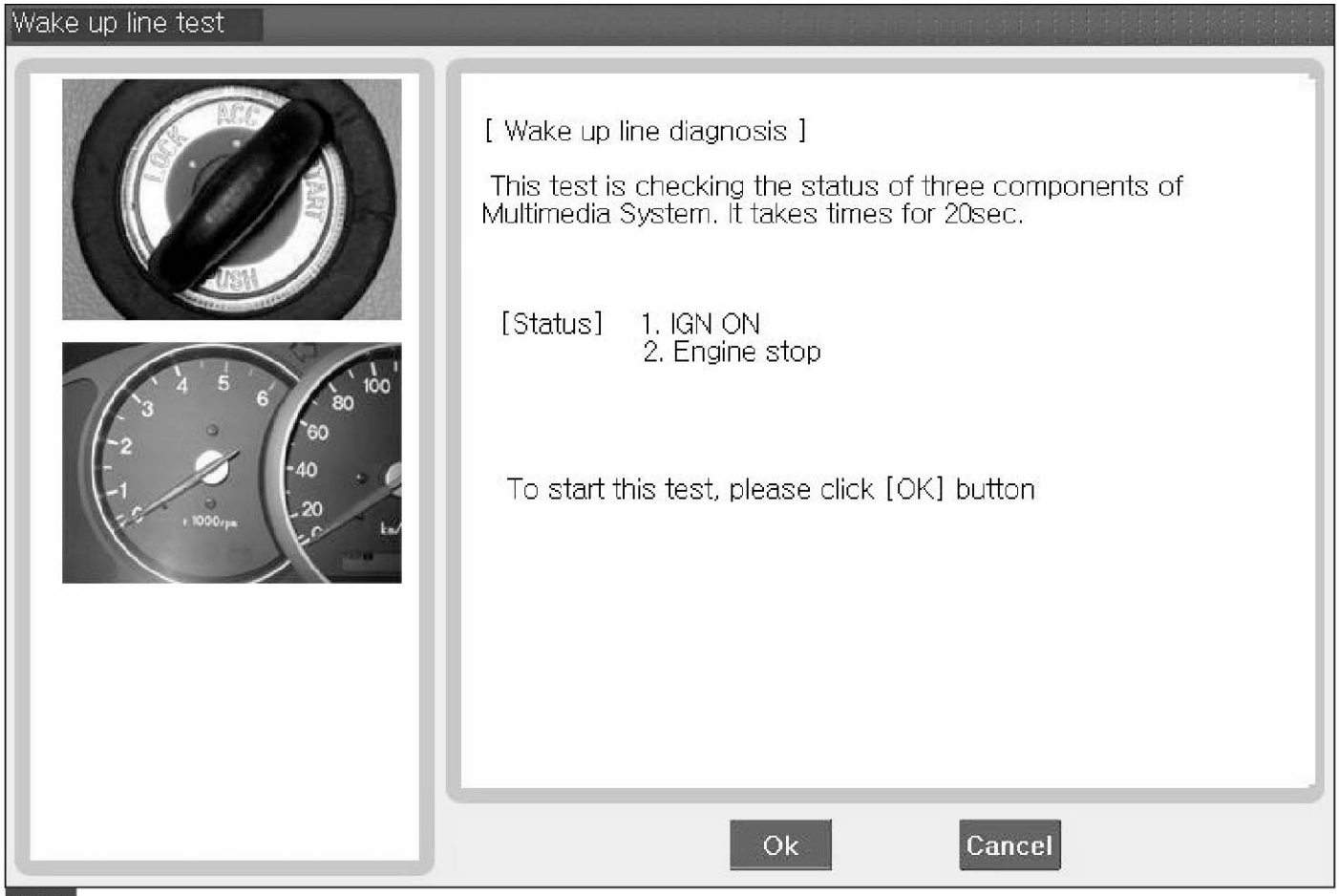



FIG.5

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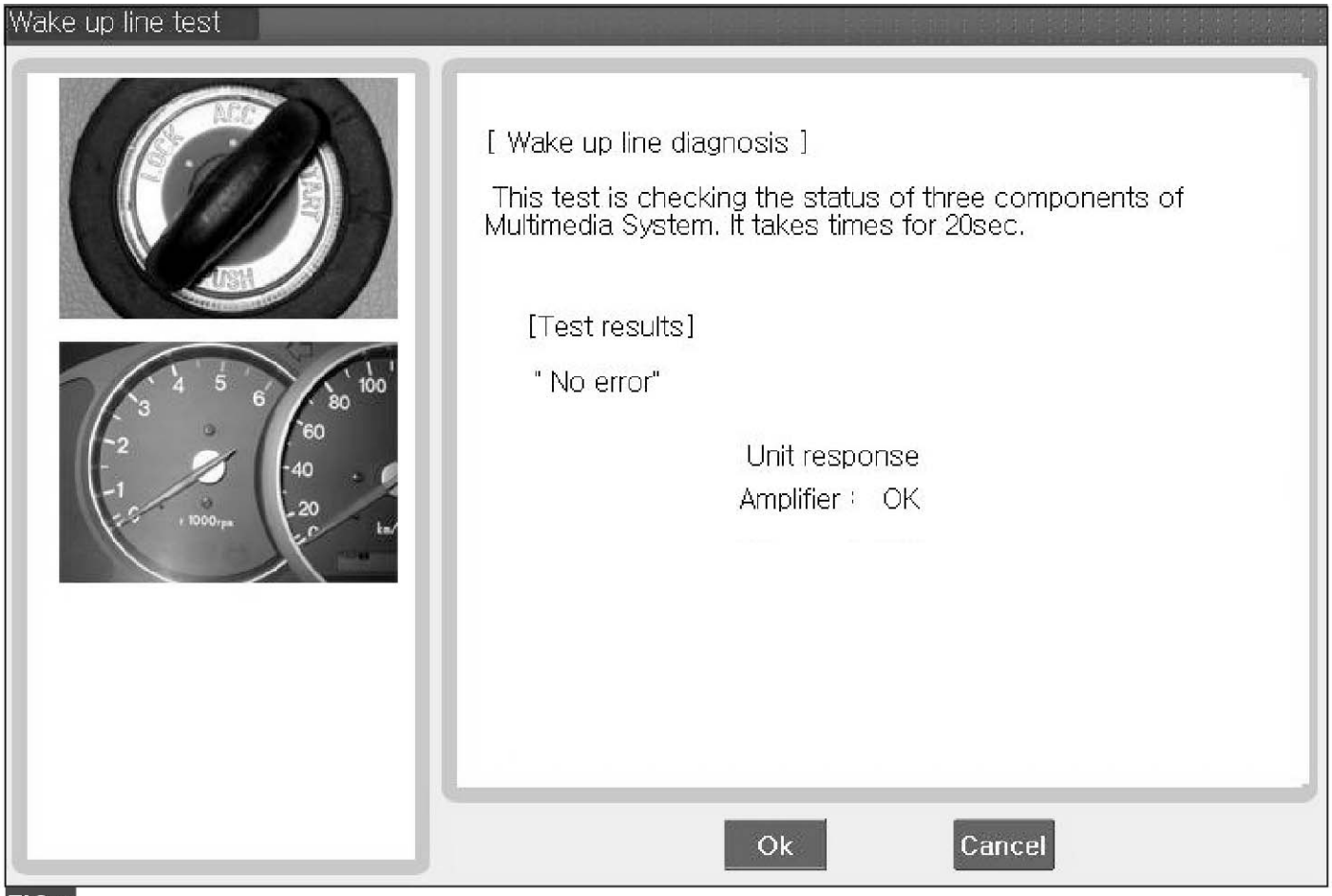



FIG.6

SBHBE9T37L

FIG.1) Ring break diagnosis

FIG.2) Ring break diagnosis between TV Tuner and Head Unit

FIG.3) Start of XdB Test

FIG.4) Result of X dB Test

FIG.5) Test of Wake up line diagnosis

FIG.6) Result of Wake up line test

5. Has a problem been found at wake up line?

**YES** ▶ Go to " Wake up line short circuit to ground inspection " procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or 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.

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### Wake up line short circuit to ground inspection

■ **Check wake up line short circuit to ground**

1. IG "ON" & ENG "ON"
2. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
3. Start "Wake up line diagnosis" and measure waveform each wake up line.
4. Disconneted all connect of components and check the status of each wake up line of chassis ground.

**Specification :** If measured waveform is within specification, its nomal.
If measured voltage is "0", Its nomal.

5. Is the measured waveform within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or 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.
▶ It can be appeared for a second so try to Ign off and on and go to"Verification of Vehicle Repair" procedure.

**NO** ▶ Check the wake up line short circuit to ground and Repair as necessary and go to "Verification Vehicle Repair" procedure.

### Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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## U1540 Wakeup Line Test Failed at Amplifier Unit

### General Description

Refer to DTC U1500 : Wakeup Line Short Circuit To Ground.

### DTC Description

This code is set when Head unit does not receive resonse signal from the Amplifier after sending wake up line signal to Amplifier.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Apmlifier error |
| Enable Conditions | • IG ON | |
| Threshold value | • missing respnse signal from Amplifier | |
| Detecting Time | • Immediately | |

### Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

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### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG "ON" & Engine "OFF"
3. Selet "Ring break dignosis " in Inspection / Test opri-on and monitor "Test results".
4. Checking the component status by "Wake up line dig-nosis"

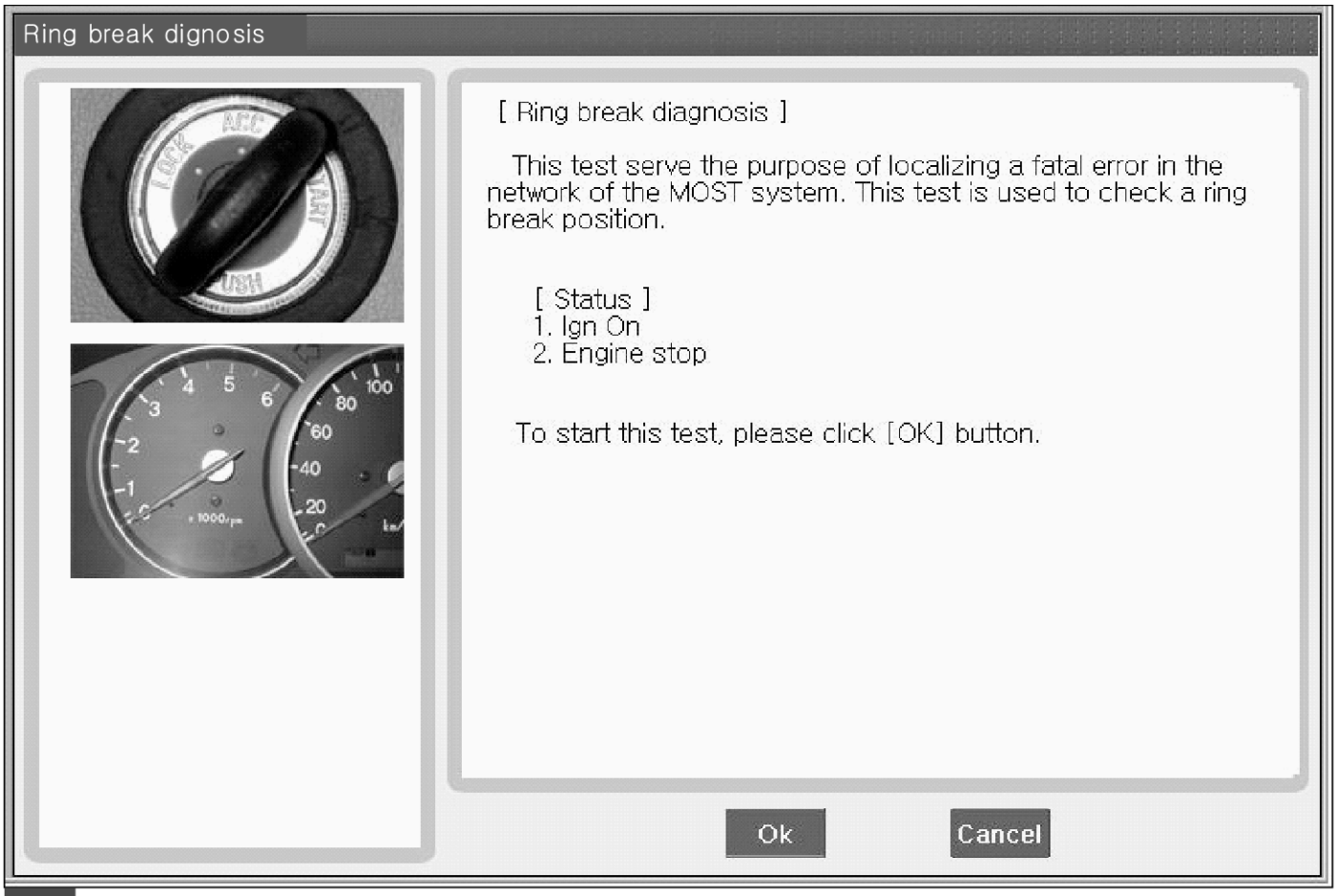



FIG.1

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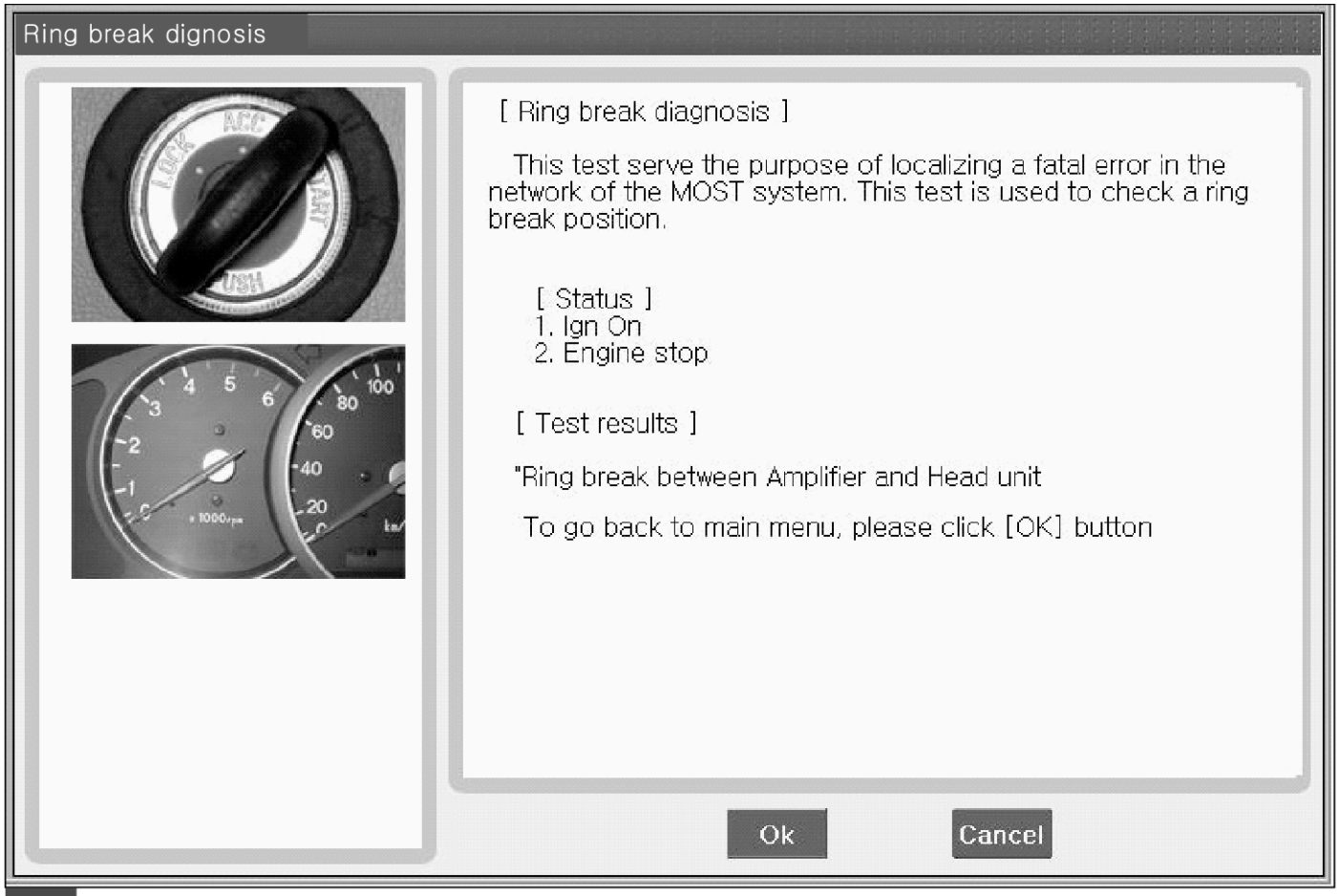



FIG.2

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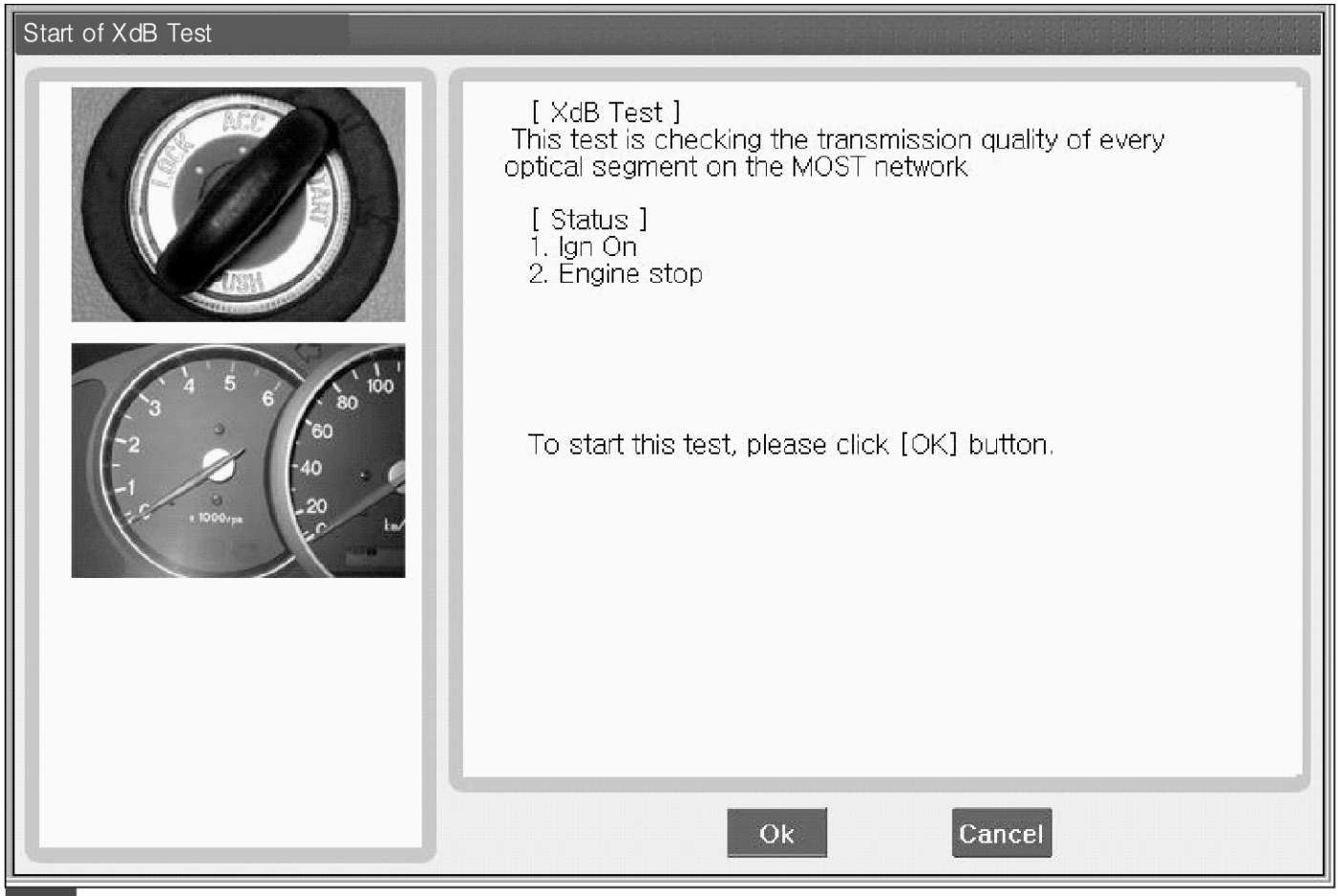



FIG.3

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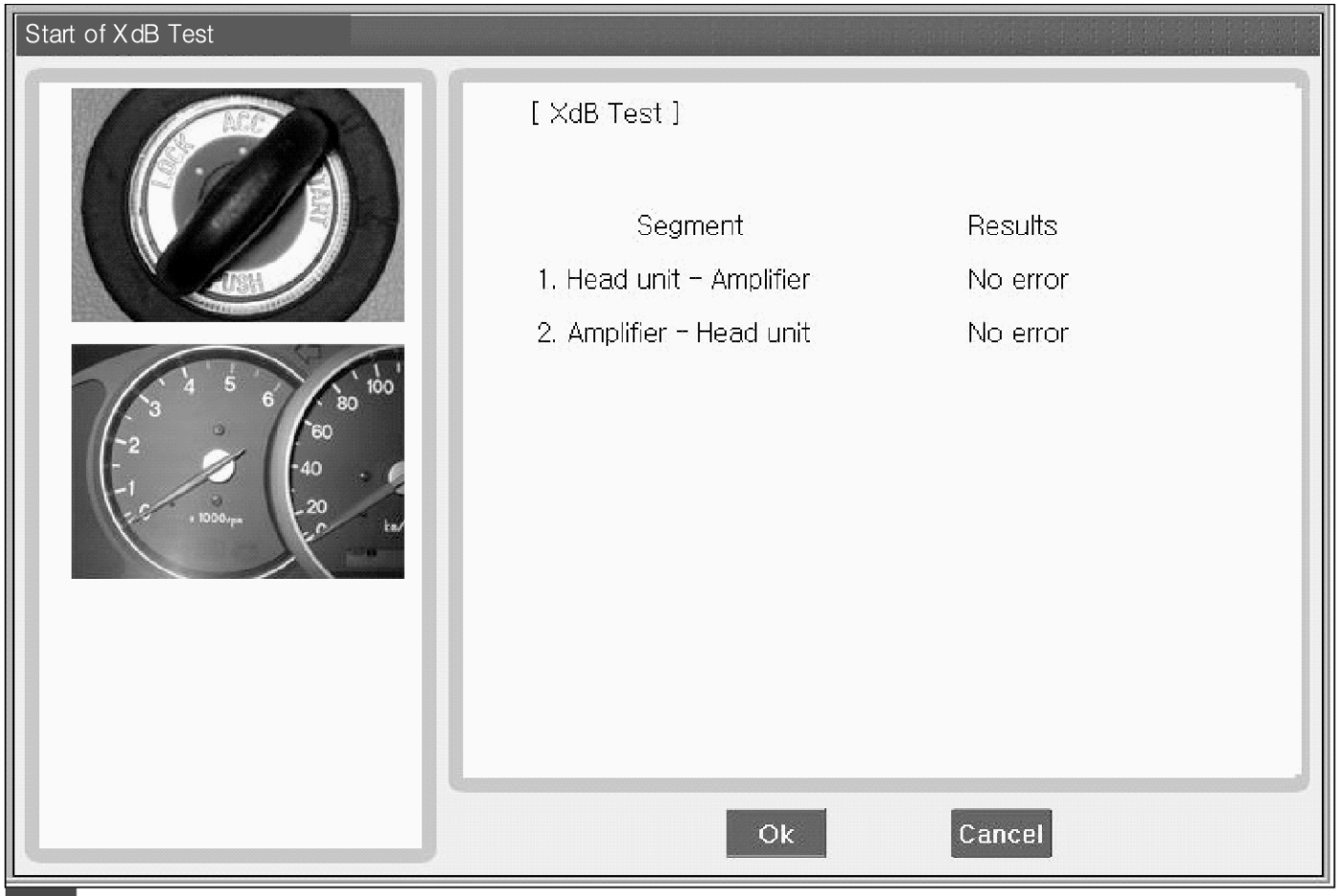



FIG.4

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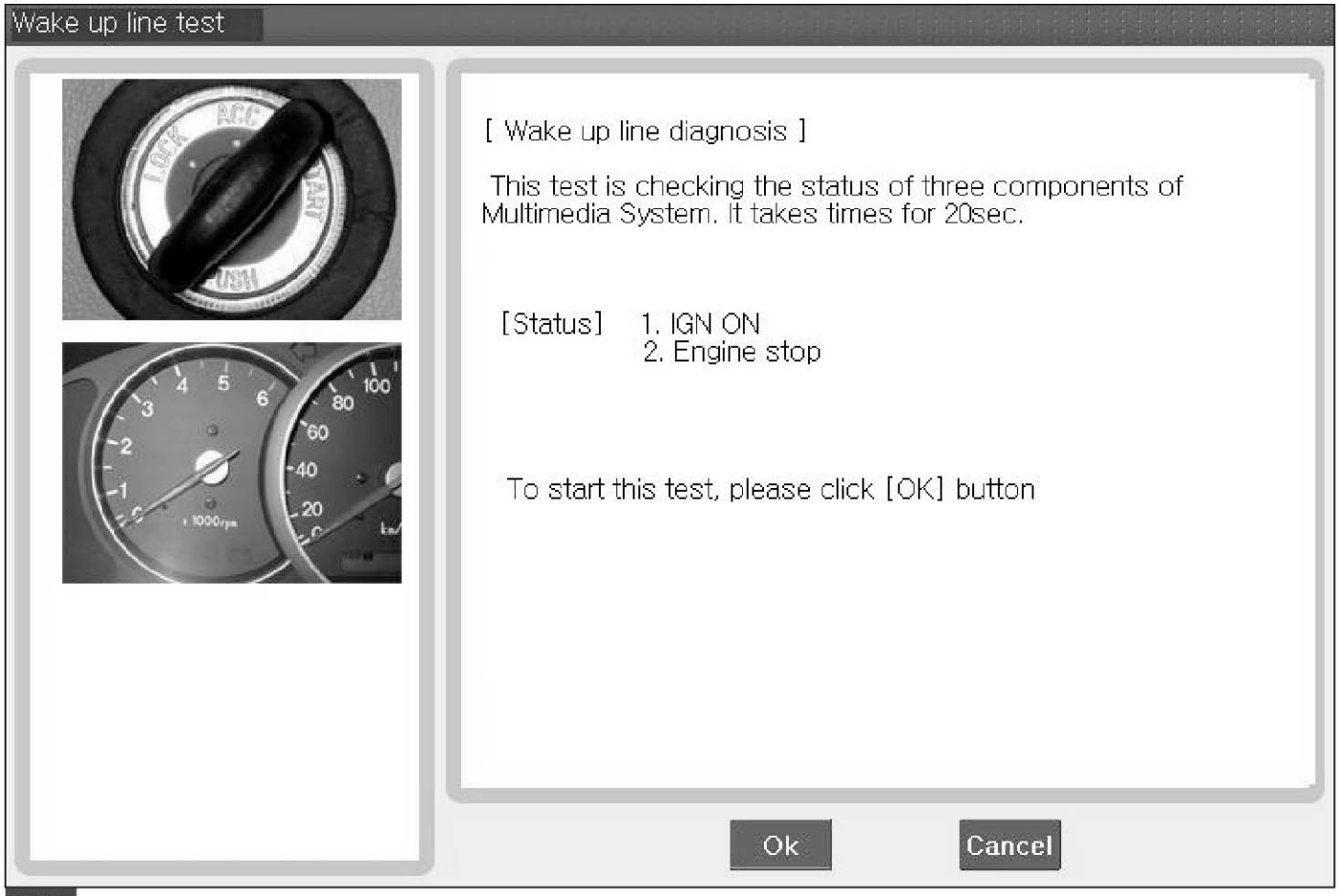



FIG.5

SBHBE9T36L

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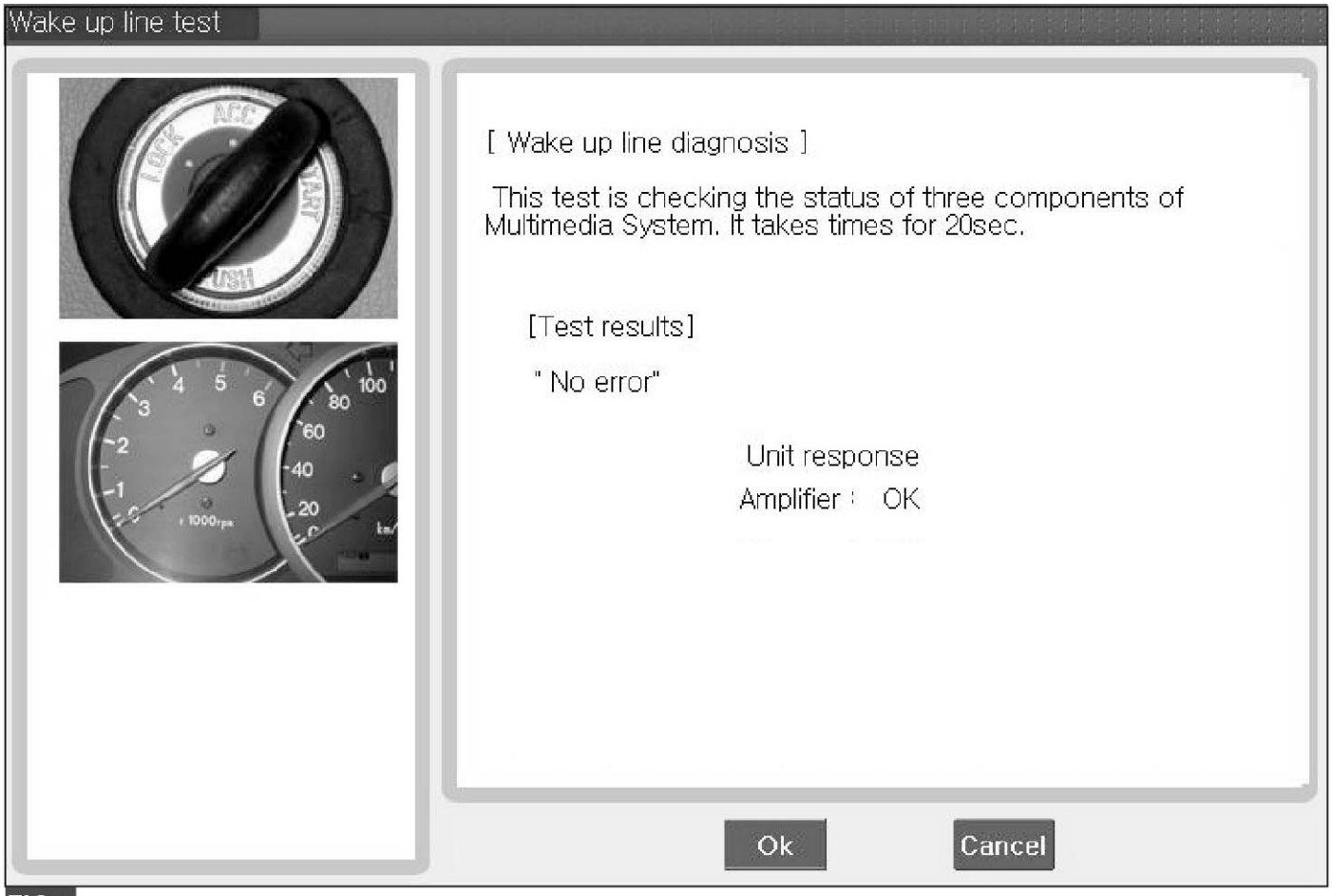



FIG.6

SBHBE9T37L

FIG.1) Ring break diagnosis

FIG.2) Ring break diagnosis between TV Tuner and Head Unit

FIG.3) Start of XdB Test

FIG.4) Result of X dB Test

FIG.5) Test of Wake up line diagnosis

FIG.6) Result of Wake up line test

5. Has a problem been found at wake up line?

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or 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.

▶ It can be appeared for a second so try to Ign off and on and go to"Verification of Vehicle Repair" procedure.

▶ Check the fuse and supplied power and Repair as necessary and go to "Verification Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1900 GPS Antenna Line Break

## General Description

GPS antenna is installed on the roof. GPS signal is transfered to the Head Unit.

## DTC Description

This code is set when Head unit detects the line break of GPS antenna while receiving GPS signal.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • GPS antenna line break<br>• GPS antenna |
| Enable Conditions | • IG ON | |
| Threshold value | • GPS antenna line break | |
| Detecting Time | • During GPS signal is received | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## 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

### ■ Signal Circuit Inspection

1. IG KEY "ON", Engine "ON".
2. Run the navigation.
3. Disconnect the connector of roof antenna.
4. Check the voltage of disconnected connector of roof antenna.

**Specification :** About 12V

5. Is the measured waveform within specifications?

**YES** ▶ After checking the roof antenna, repair as necessary and go to "Verification Vehicle Repair " procedure.

**NO** ▶ Go to "Communication circuit inspection" procedure.

## Communication circuit inspection

1. IG KEY "OFF"
2. Disconnect the connector of roof antenna.
3. Disconnect the connector of Head unit.
4. Measure resistance between the connector of roof antenna and connector of Head unit.

**Specification :** 0Ω

5. Is the measured resistance within specifications?

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

**NO** ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1920 DVD Drive Error

## General Description

Head unit is self diagnostic and control system that comunicate with navigation H/UNIT,voice recognitopn, DVD Changer + MP3 & WMA files play ,USB & iPOD ,bluetooth handsfree,Body control system and information display of DIS on the MOST network.

## DTC Description

This code is set when Head unit does not read the disc or DVD Changer hase a mechanical or electronical problem.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Running check | • Disc error<br>• Head unit error |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • Disc read error | |
| Detecting Time | • After disc inseting. | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Monitor Scantool Data

### ■ Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)"mode and then clear DTC
4. Is the DTC present ?

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

**NO** ▶ This code is set for a second because of a poor connect of Head unit connector or did not clear the DTC.
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.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1940 Front Display SDC Communication Error

## General Description

The front monitor communicate with Head unit by LVDS( Low Voltage Differential Signal)directly on the LIN communication.

The distinction of fornt monotor is

1. A separate monitor
2. 8 inch TFT LCD: VGA resolution (800 x 480 dots)
3. LVDS (Low Voltage Differential Signal)
4. Anti-Glare & Low-Reflection

## DTC Description

This code is set when Head unit detected communication error between Head unit and front monitor.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Running check | • LIN communication error<br>• Front monitor error |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • Communication malfunction with front monitor | |
| Detecting Time | • 10sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

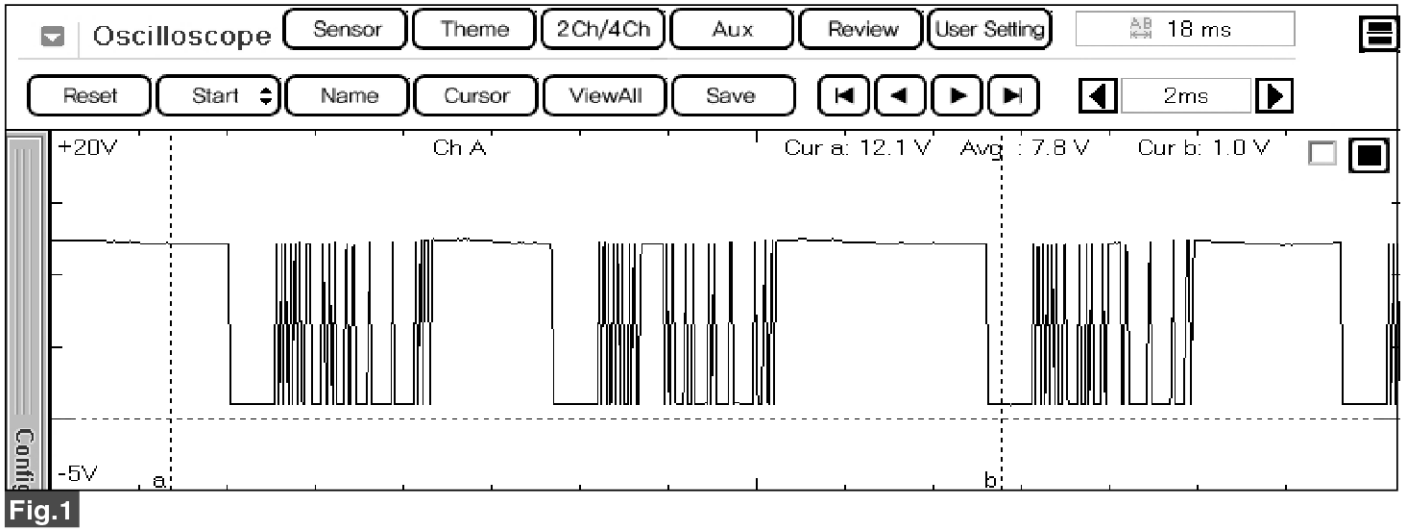



Fig.1

SBHBE9T38L

FIG.1) Measured waveform at the TX CLK+ terminal connected between Head Unit and front Monitor

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## Monitor Scantool Data

### ■ Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)"mode and then clear DTC
4. Is the DTC present ?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ This code is set for a second because of a poor connect of Head unit connector or did not clear the DTC.
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

### ■ Control unit key Inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Disconnect the connector between Head unit and front monitor.
5. Measure waveform to Head unit form front monitor.

**Specification :** The measued waveform is within specification.

6. Is the measured waveform 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** ▶ Check the circuit between Head unit and front monitor.
▶ If the circuit between Head unit and front monitor is nomal, substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1942 Rear Display SDC Communication Error

## General Description

The rear monitor communicate with Head unit by LVDS( Low Voltage Differential Signal)directly on the LIN communication.

The distinction of rear monotor is

1. Monitor tilting function on right and left direction
2. On Screen Display function for rear seat user
3. 8 inch TFT LCD: VGA resolution (800 x 480 dots)
4. LVDS (Low Voltage Differential Signal)
5. Anti-Glare & Low-Reflection

## DTC Description

This code is set when Head unit detects communication error between Head unit and rear monitor.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • LIN communication error<br>• Rear monitor error |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • Communication malfunction with front monitor | |
| Detecting Time | • 10sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

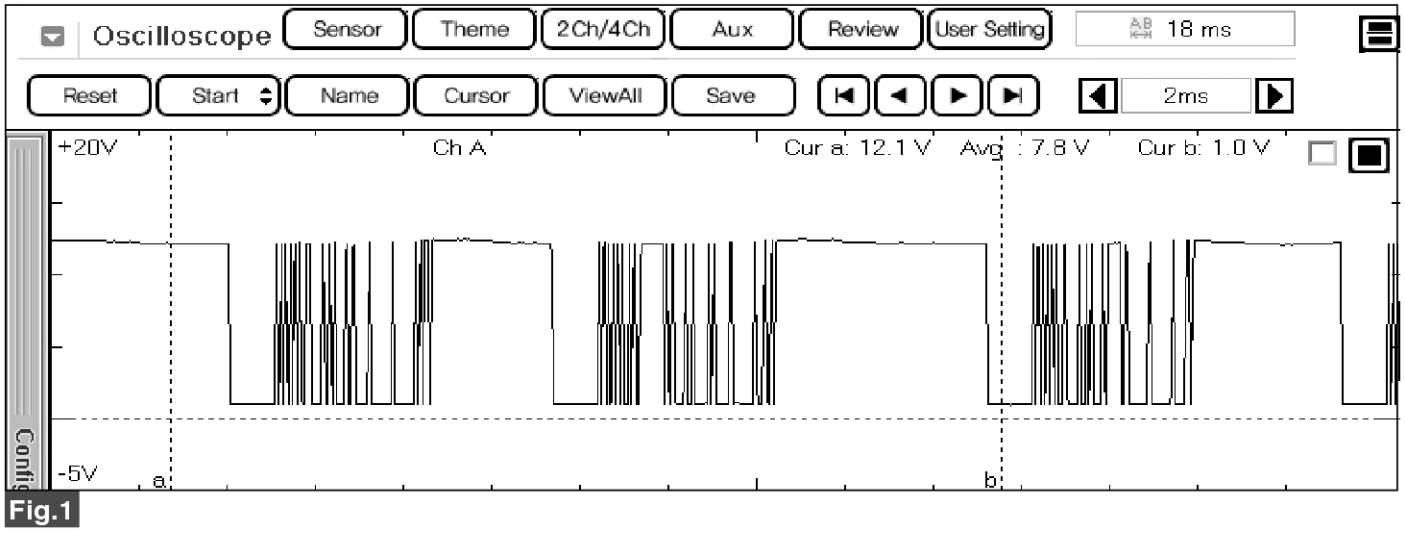



Fig.1

SBHBE9T38L

FIG.1) Measured waveform at the TX CLK+ terminal connected between Head Unit and front Monitor

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## Monitor Scantool Data

### ■ Monitor Scantool Data

1. Ignition OFF and Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)"mode and monitor "DTC Status" parameter.
4. Is the DTC present ?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ This code is set for a second because of a poor connect of Head unit connector or did not clear the DTC.
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

### ■ Control unit key Inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Disconnect the connector between Head unit and front monitor.
5. Measure waveform to Head unit form front monitor.

**Specification :** The measued waveform is within specification.

6. Is the measured waveform 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** ▶ Check the circuit between Head unit and front monitor.
▶ If the circuit between Head unit and front monitor is nomal, substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1970 Multimedia CAN Bus Off Error

## General Description

MM(MultiMedia) CAN is composed of DATC(Air conditioner), Head unit, Media Unit(USB or i-Pod) and Rear Armrest Control. CAN is a communication system which consists of CAN_high line and CAN_low line to share system information between related control units (modules).

## DTC Description

This code is set when each unit set CAN BUS OFF and can not send message any more.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Monitoring CAN status | • a poor connected<br>• MM CAN circuit opened / Short<br>• Head unit supplied power |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • Buss off status occurred in CAN controller chip | |
| Detecting Time | • Immediately | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

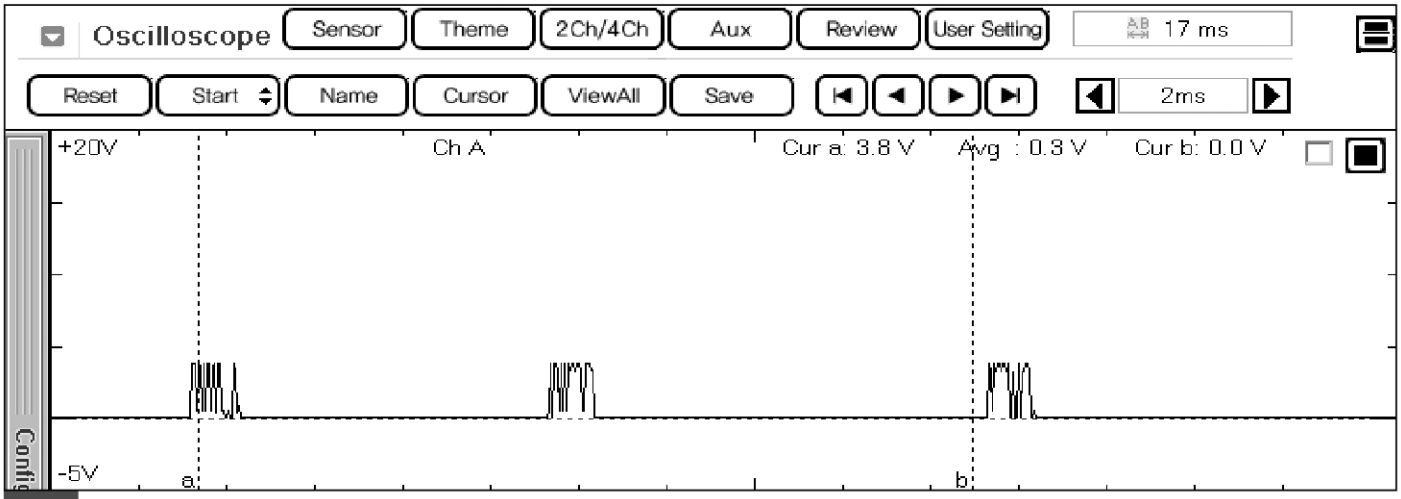



Fig.1

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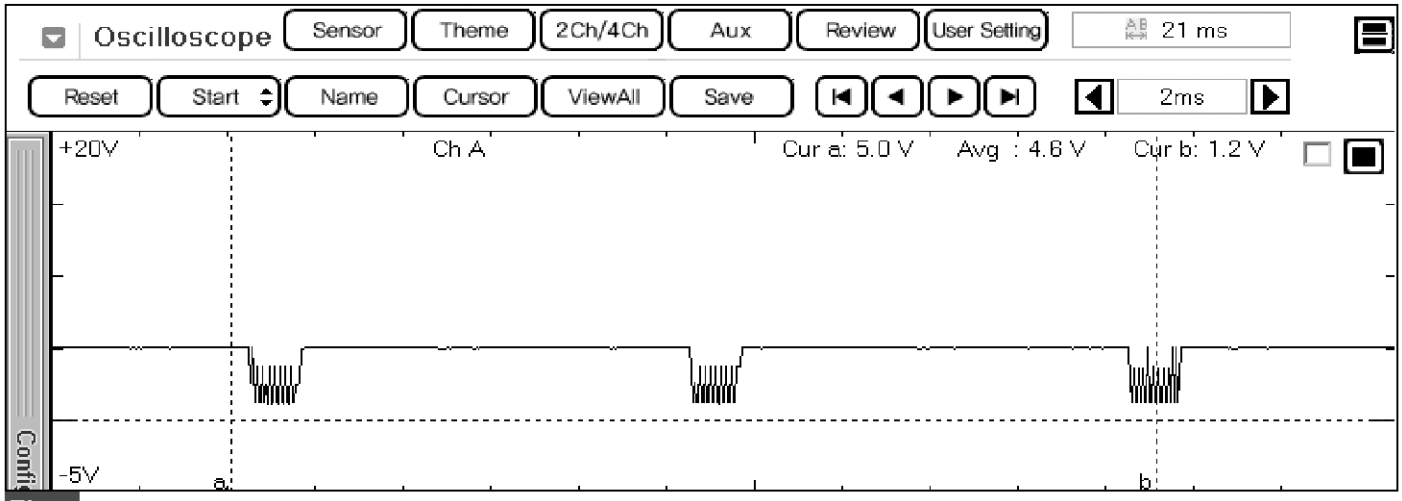



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

### ■ Monitor Scantool Data

1. Ignition OFF and Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & engine "OFF".
3. Selet "Diagnostic Trouble Codes(DTCs)"mode and monitor "DTC Status" parameter.
4. Is the DTC present ?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ This code is set for a second because of a poor connect of Head unit connector or did not clear the DTC.
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 seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1971 Multimedia CAN Single Line Error

## General Description

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## DTC Description

This code is set when CAN circuit is broken in CAN_high line or CAN_low line.

(The Communication is possible even one of can line is broken.)

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • CAN single line mode. |
| Enable Conditions | • IG KEY "ON"<br>• During Multimedia running | |
| Threshold value | • CAN transceiver of Head unit detects single line | |
| Detecting Time | • Continuously | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

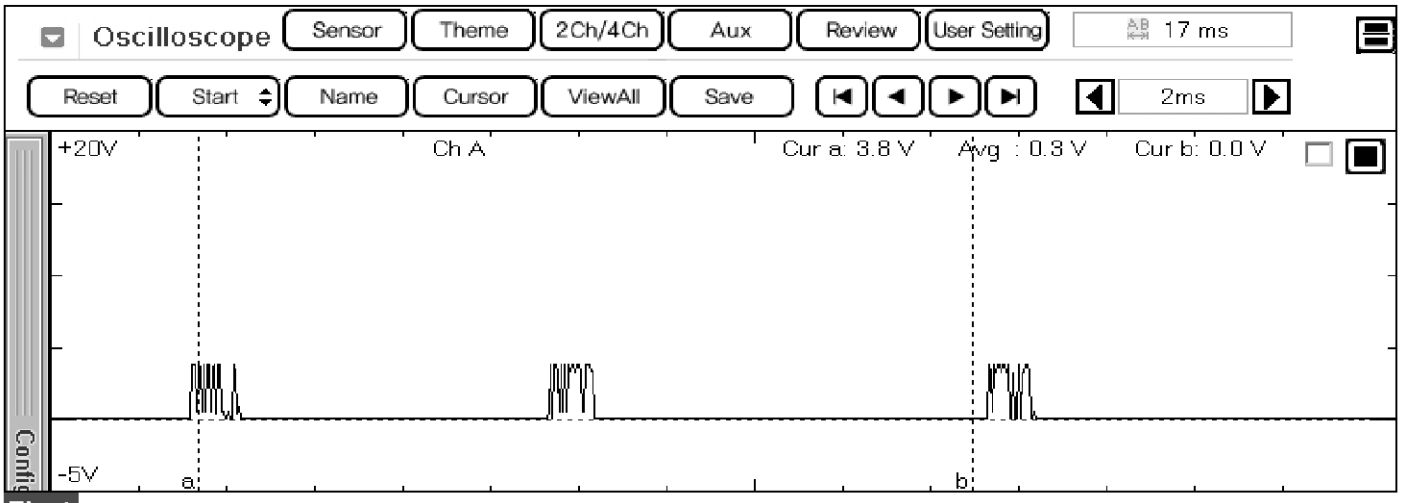



Fig.1

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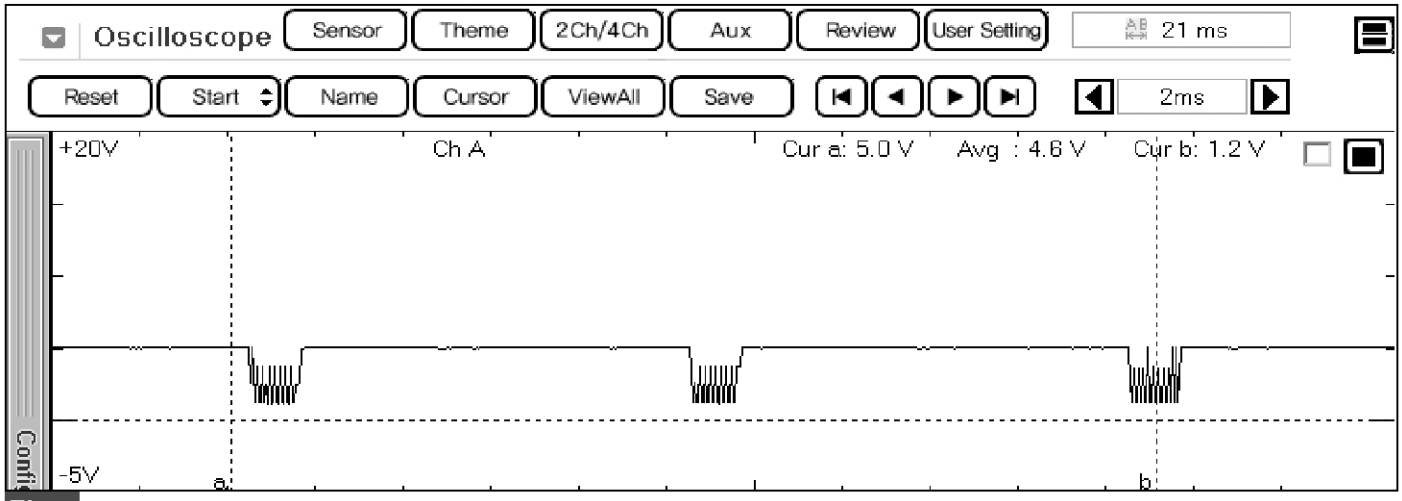



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## Component Inspection

### ■ Rear seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1972 Multimedia CAN Limp Home Status

## General Description

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## DTC Description

This code is set when CAN system is malfunction and go into the limp home mode.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • a poor connected<br>• MM CAN circuit opened / Short<br>• Head unit<br>• Pertinent component |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • Limp home status. | |
| Detecting Time | • Continuously | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

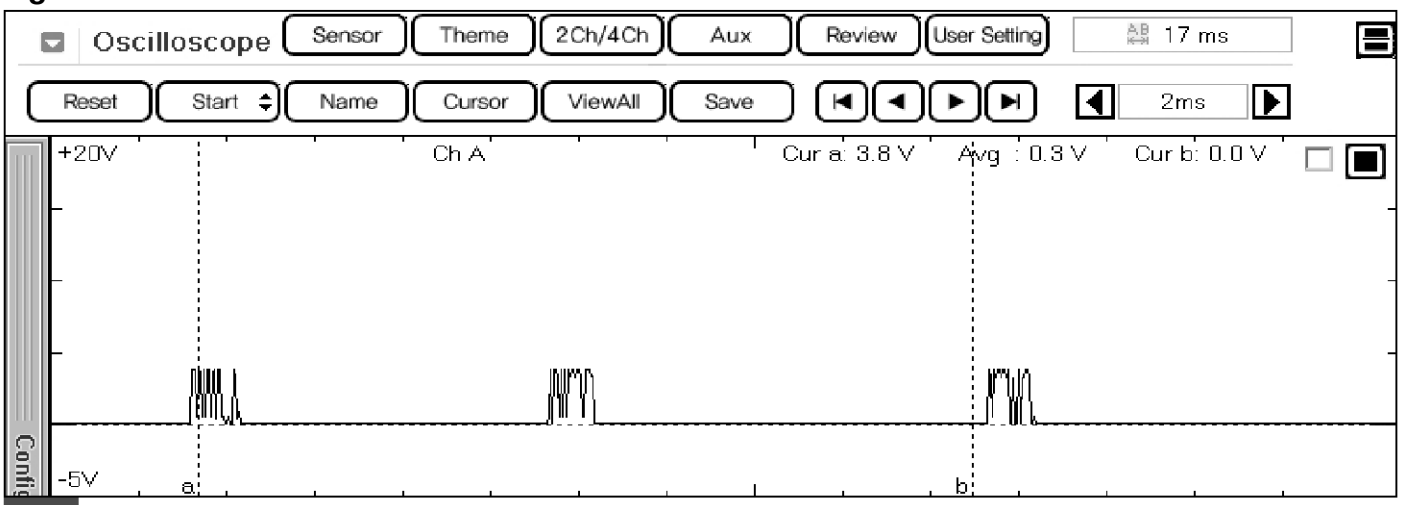



Fig.1

SBHBE9T39L

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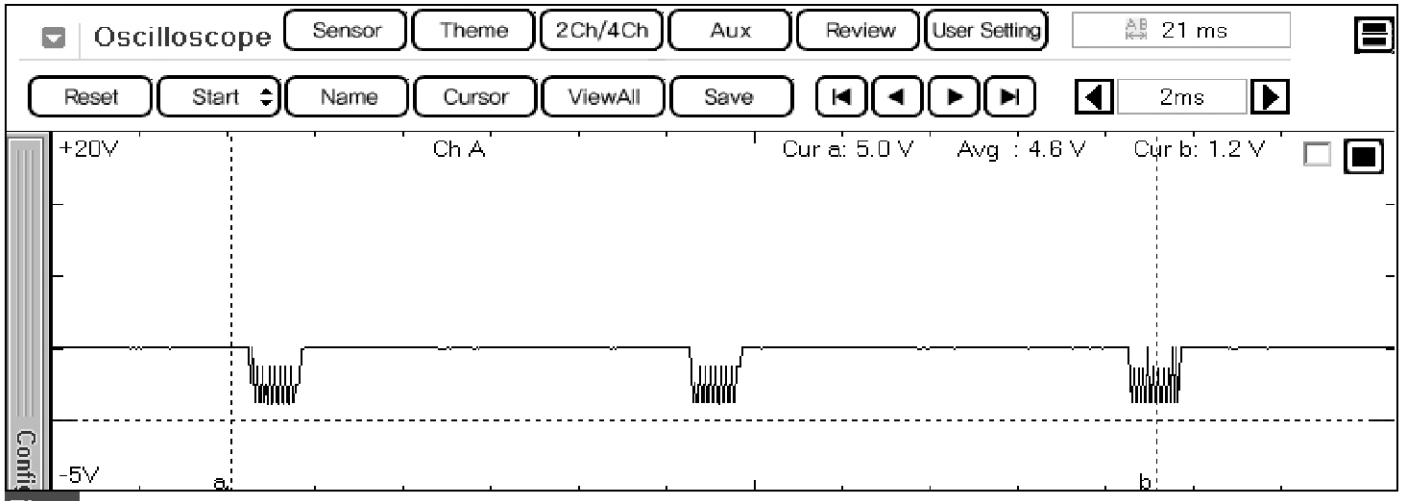



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## Component Inspection

### ■ Rear seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.
▶ Continuously 12V : Check Short circuit to battery, Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
▶ Continuously 0V : Check opened circuit and short circuit to ground, Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.
▶ can be possible measured waveform : Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1980 Timeout Multimedia CAN Message(Air Conditioner, Cluster, Audio)

## General Description

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## DTC Description

This code is set when there is no response from the Airconditioner,Cluster and Audio system on the MM CAN communication system.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Air conditioner, Cluster or audio error |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • CAN message reception failed | |
| Detecting Time | • 700mS | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

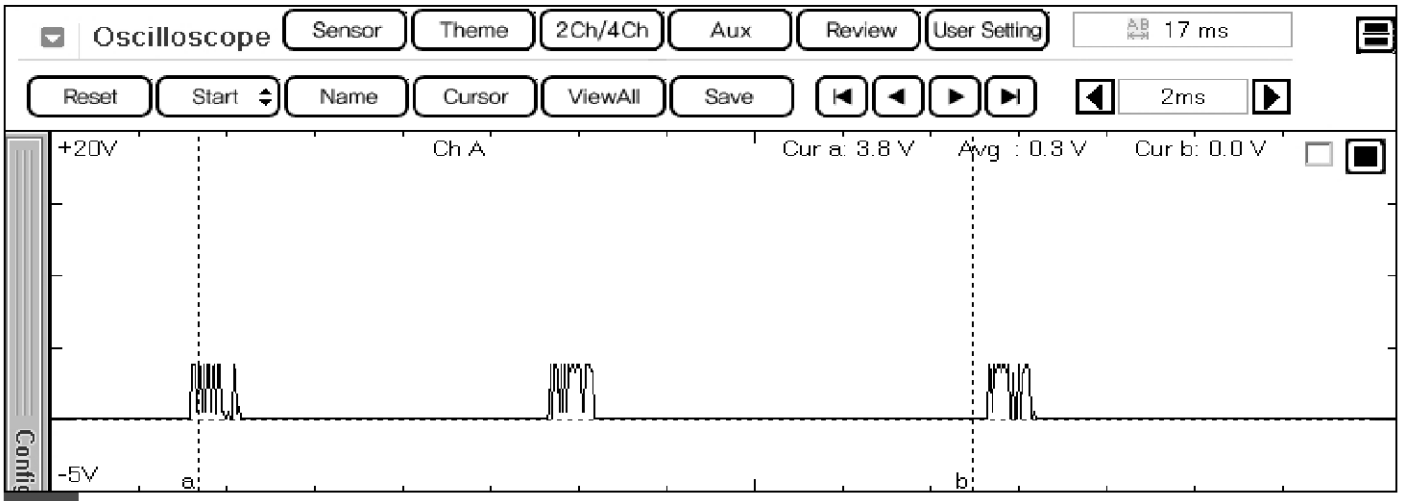



Fig.1

SBHBE9T39L

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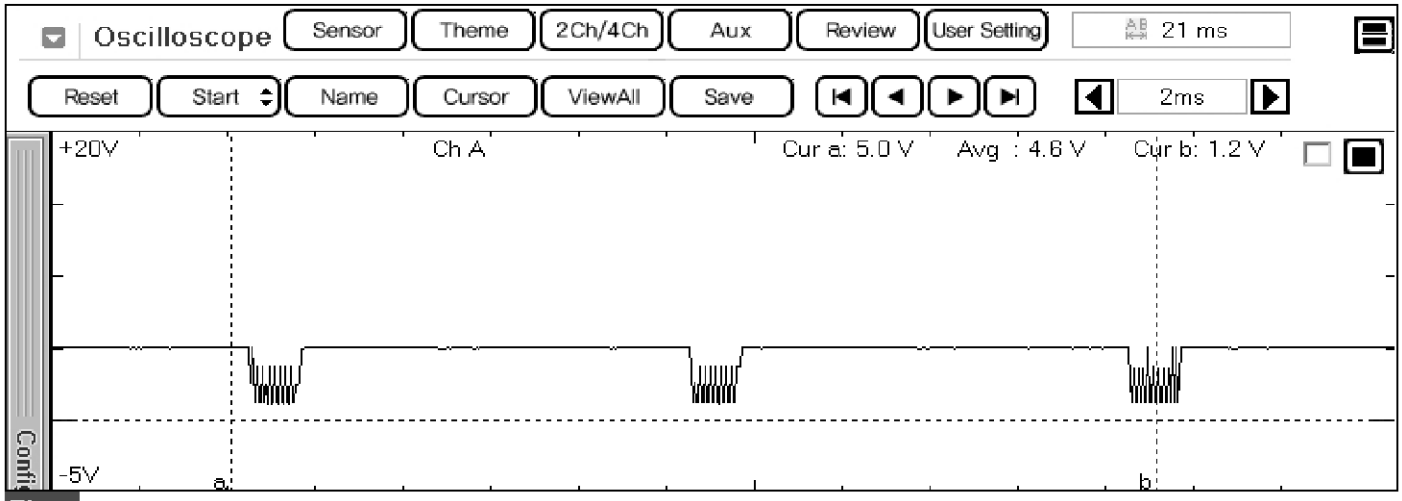



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## Component Inspection

### ■ Rear seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1981 Timeout Multimedia CAN Message(Vehicle Speed)

## General Description

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## DTC Description

This code is set when there is no signal from the vehicle speed on the MM CAN communication system.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Vehicle speed |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • CAN message reception failed | |
| Detecting Time | • 700mS | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

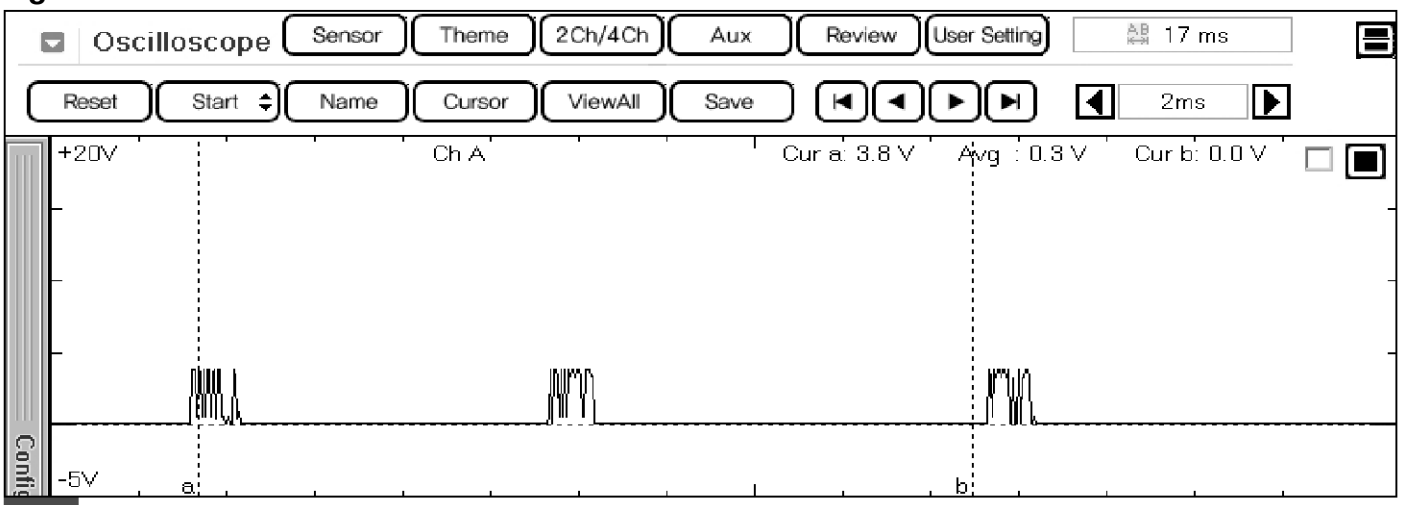



Fig.1

SBHBE9T39L

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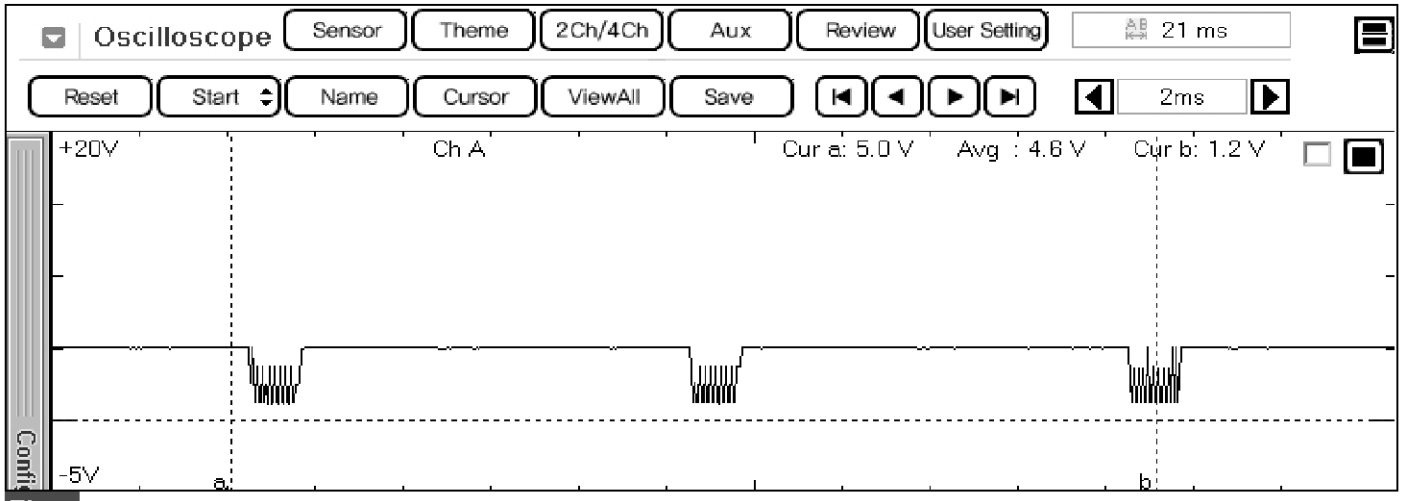



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## Component Inspection

### ■ Rear seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Check the Vehicle Speed sensor data of pertinent system.
▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1982 Timeout Multimedia CAN Message(Body CAN Signal - Camera, ECS, Trip Computer, Alternator, Auto Light)

## General Description

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## DTC Description

This code is set when there is no response from the Body CAN signal consisted of Camera,ECS,Trip Computer, Alternator and Auto Light system.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Circuit of pertinent system |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • CAN message reception failed | |
| Detecting Time | • 700mS | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

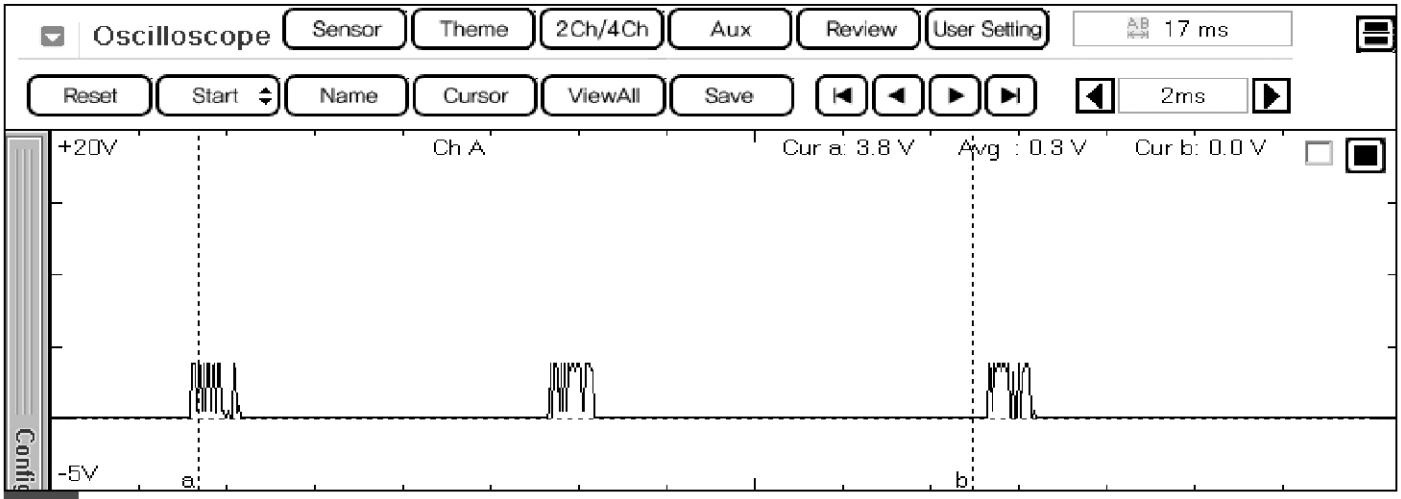



Fig.1

SBHBE9T39L

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https://autolibrary.ir



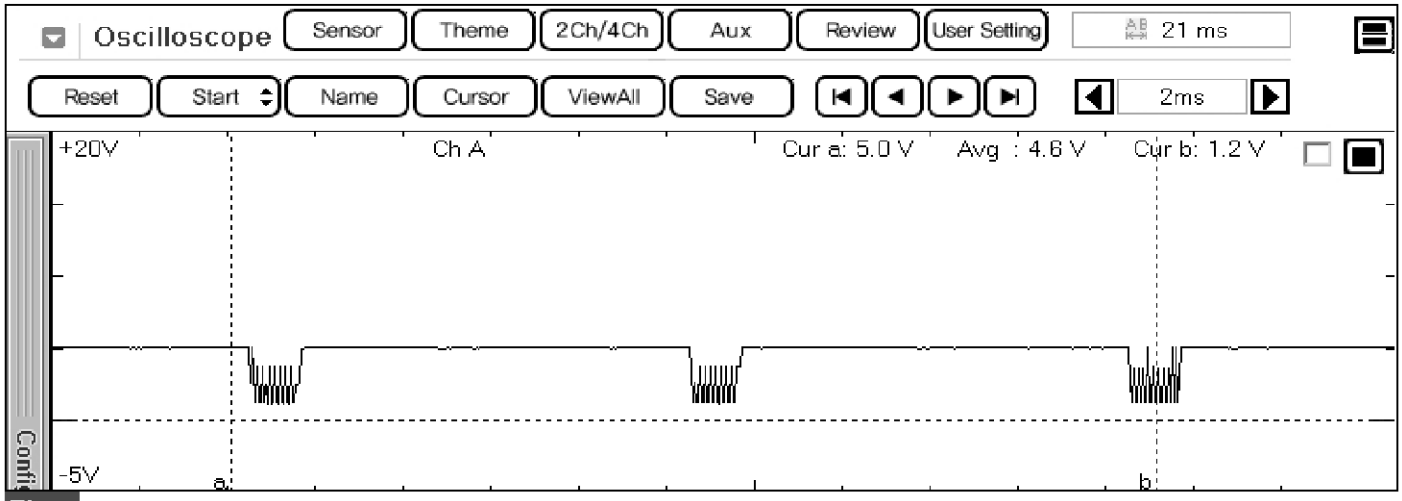



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## Component Inspection

### ■ Rear seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Check the sensor data of pertinent system( camera, ECS, trip computer, alternator,auto light).
▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1983 Timeout Multimedia CAN Message (Trip Computer)

## General Description

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## DTC Description

This code is set when there is no signal from the Trip computer on the MM CAN communication system.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Circuit of Trip computer<br>• Trip computer |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • CAN message reception failed | |
| Detecting Time | • 700mS | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

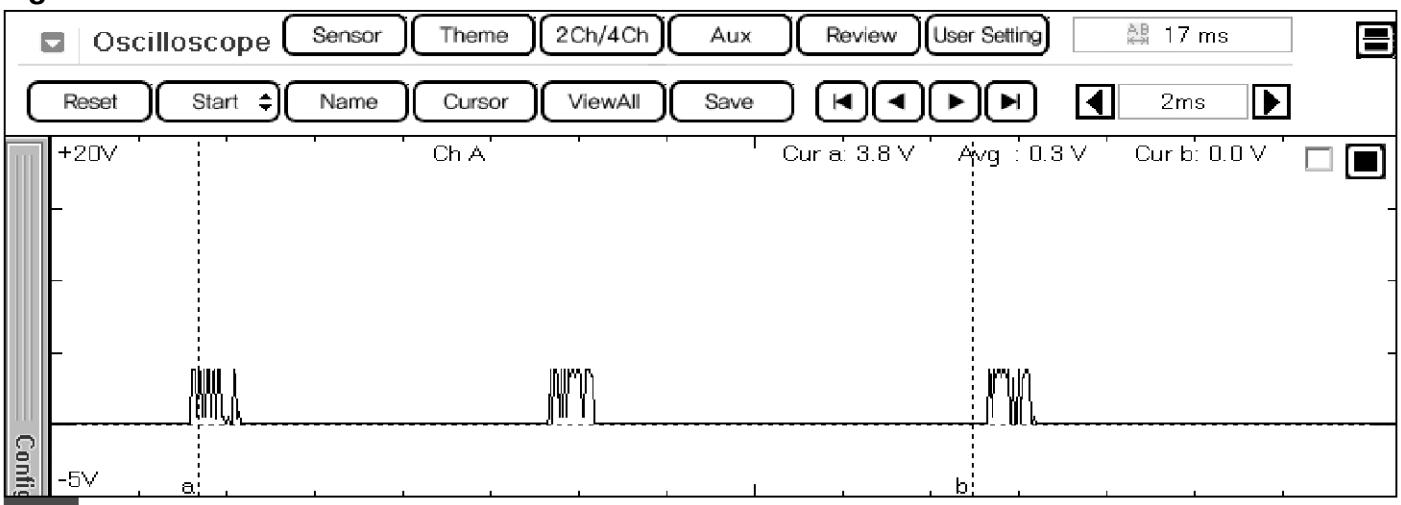



Fig.1

SBHBE9T39L

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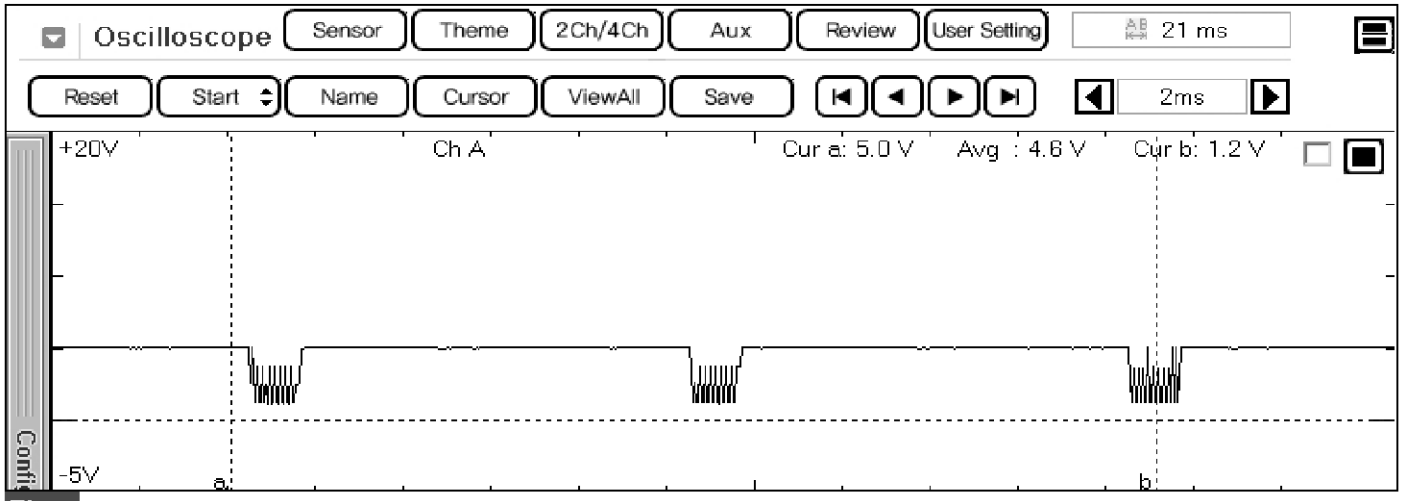



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## Component Inspection

### ■ Rear seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Check the sensor data of pertinent system( Trip computer).
▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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# U1984 Timeout Multimedia CAN Message(Inhibitor Signal)

## General Description

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## DTC Description

This code is set when there is no signal from the inhibitor signal of A/T on the MM CAN communication system.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Auto transmission CAN signal error |
| Enable Conditions | • IG KEY "ON" | |
| Threshold value | • CAN message reception failed | |
| Detecting Time | • 700mS | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Head Unit ECM Error.

## Signal Waveform & Data

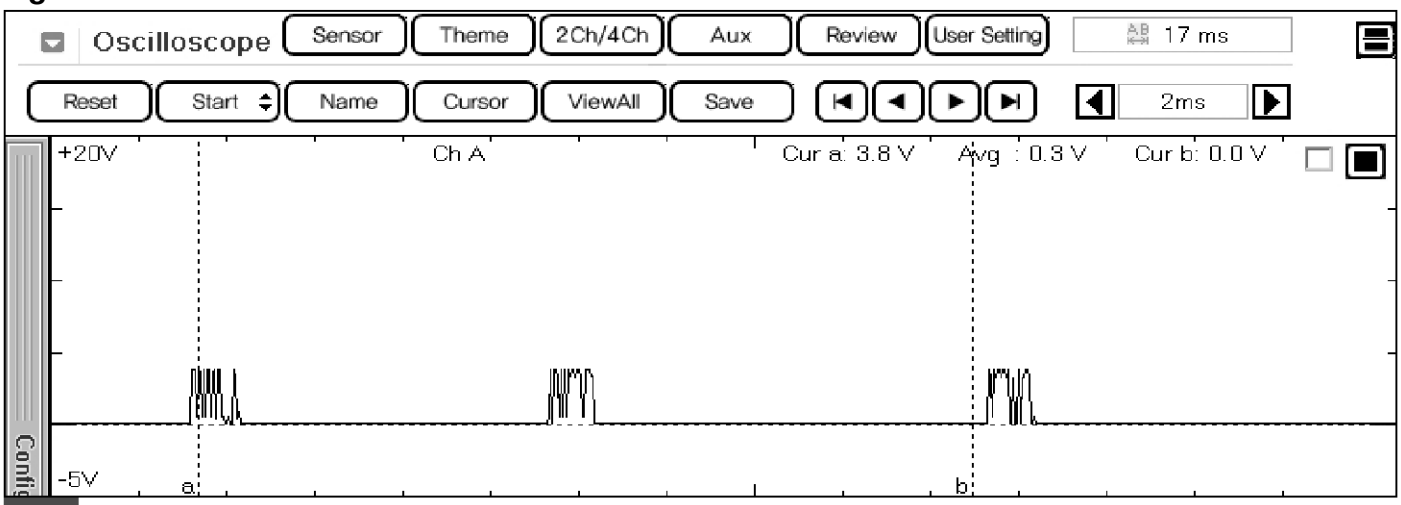



Fig.1

SBHBE9T39L

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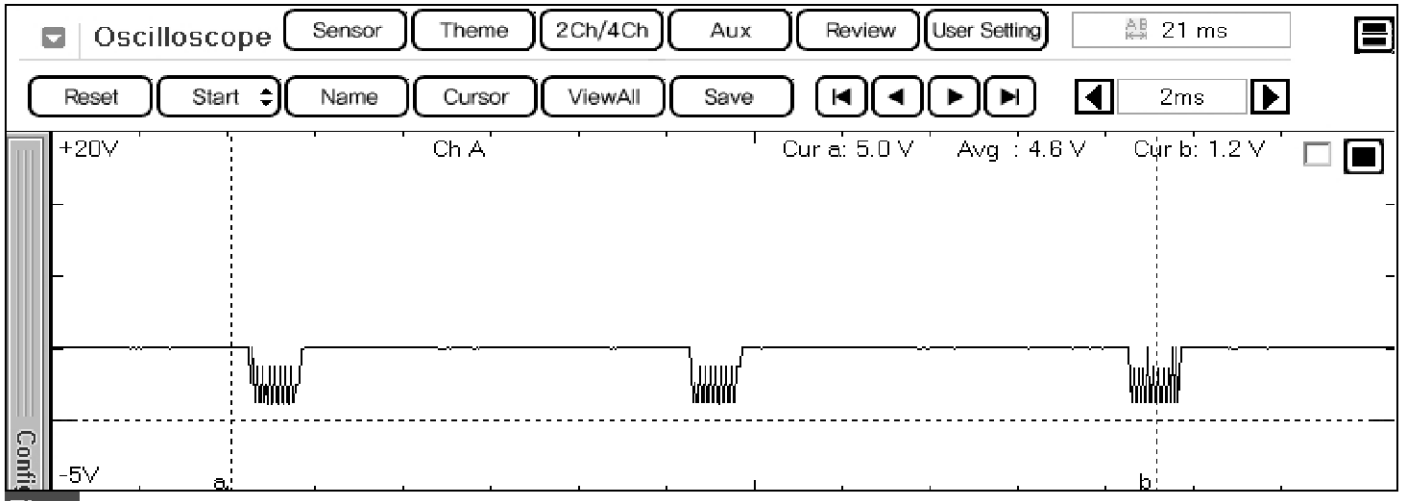



Fig.2

SBHBE9T40L

FIG.1) Normal MM High CAN signal waveform while one input signal is given at armrest control switch of rear seat (measured waveform signal at MM High CAN line of head unit)

FIG.2) Normal MM Low CAN signal waveform while one i nput signal is given at armrest control switch of rear seat (measured waveform signal at MM Low CAN line of head unit)

## Monitor Scantool Data

Refer to DTC U1970 : Multimedia CAN Bus Off Error.

## Component Inspection

### ■ Rear seat entertainment inspection

1. IG "ON" & ENG "ON"
2. Turn on the Head unit and running radio or navigation during running control unit key.
3. Connect scantool to Data Link Connector(DLC) and select oscilloscope option.
4. Measure waveform between Multimedia High Can line of Head unit and Multimedia Low Can line of Head unit.

**Specification :** The measued waveform is within specification.

5. Is the measured waveform 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** ▶ Check the sensor data of pertinent system by DTC guide of auto transmission.
▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Head Unit ECM Error.

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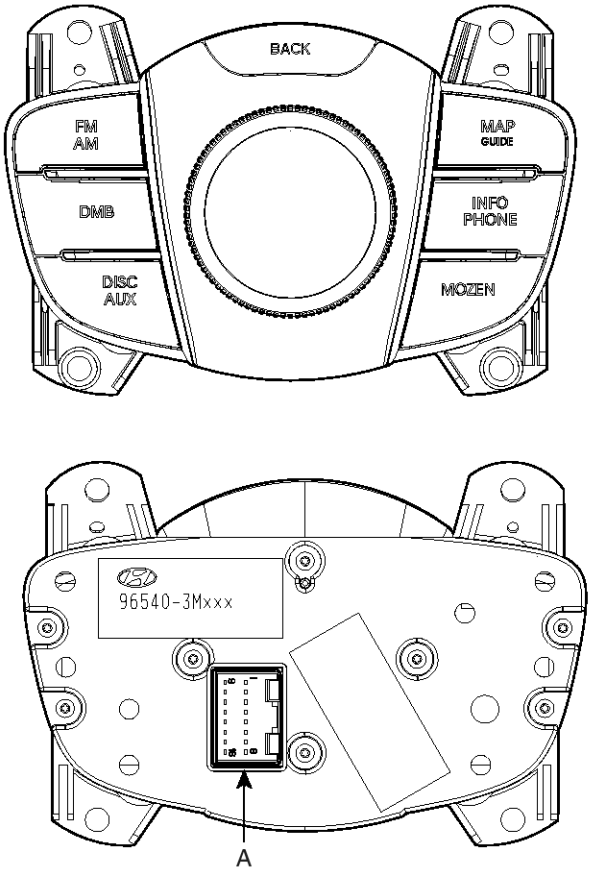
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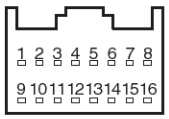


## Keyboard unit

### Component Location

[CCP (Central Control Pad)]




| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | - | 9 | - |
| | 2 | - | 10 | - |
| | 3 | Illumination + | 11 | - |
| | 4 | Illumination - | 12 | - |
| | 5 | GND/Shield | 13 | Reset head unit |
| | 6 | WakeUp signal | 14 | - |
| | 7 | Power | 15 | Rx |
| | 8 | GND/Shield | 16 | Tx |



SBHBE9042L

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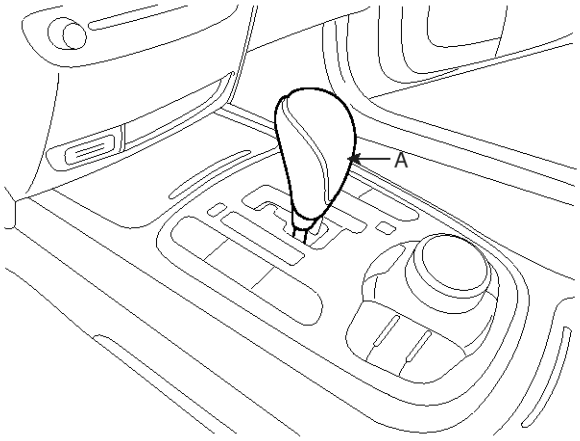
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## Removal

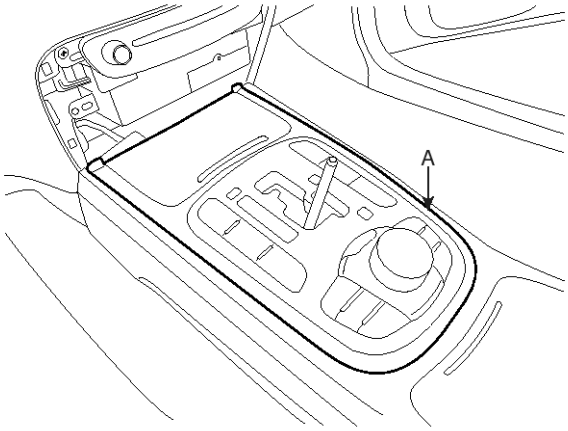
### CCP (Central Control Panel)

1. Remove the knob (A).

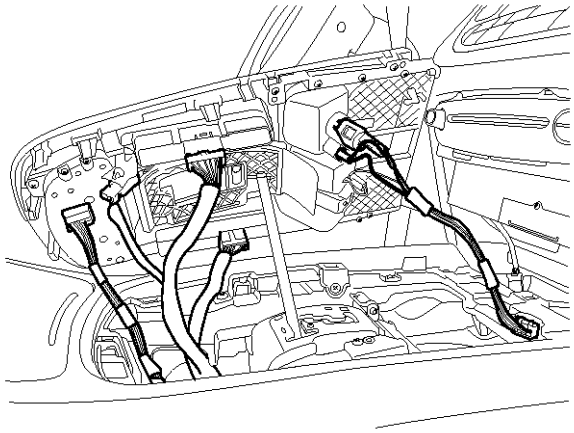



SBHBE8401D

2. Remove the console under cover (A) and remove the connector.

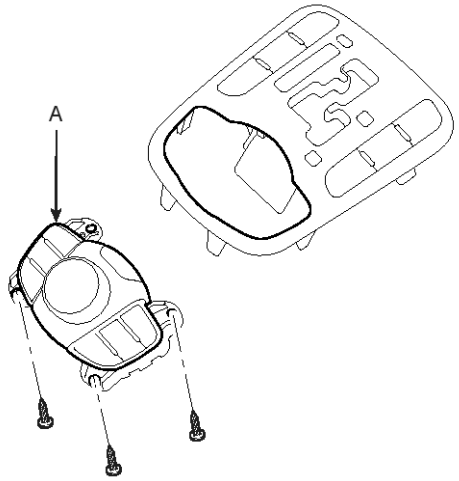



SBHBE8402D



SBHBE8403D

3. Remove the central control panel (A).




SBHBE8404D

## Installation

### CCP (Central Control Panel)

1. Install the central control panel to the console under cover.
2. Install the console under cover and knob.

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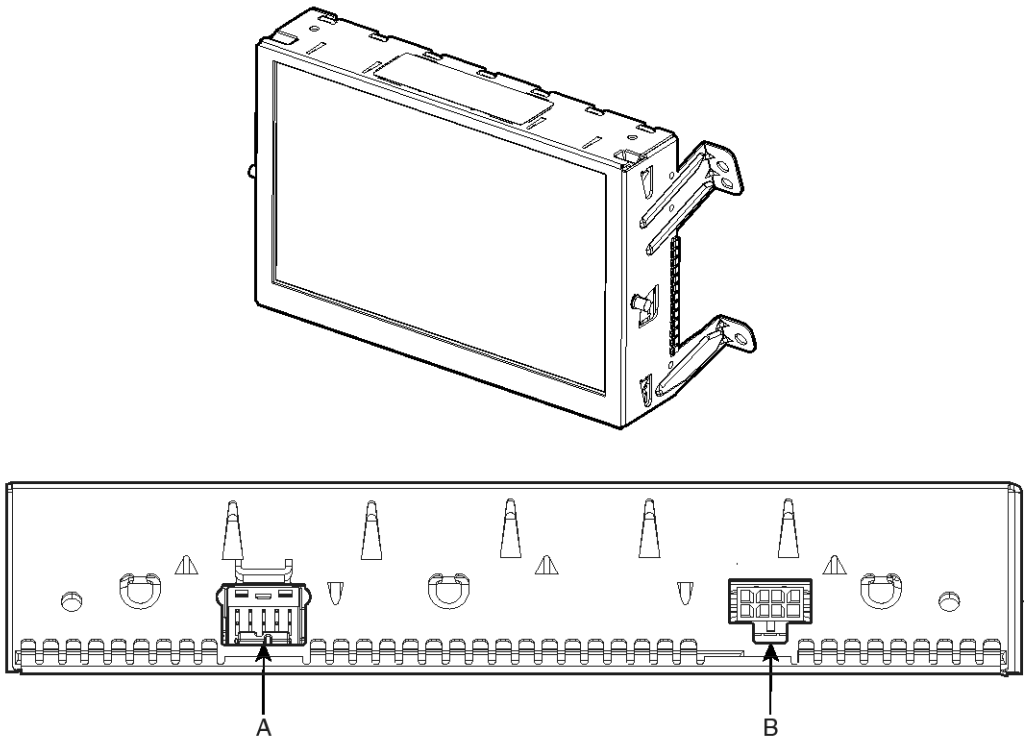
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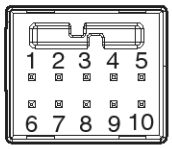


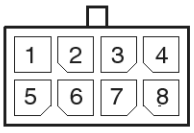
## LCD Monitor

### Component Location

[Front LCD monitor]




| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|   | 1 | Tx 1+ | 6 | Tx CLK+ |
| | 2 | Tx 1- | 7 | Tx CLK- |
| | 3 | Tx 0+ | 8 | GND |
| | 4 | Tx 0- | 9 | Tx 2+ |
| | 5 | Data | 10 | Tx 2- |

| Connector B | Pin | Description | Pin | Description |
|---|---|---|---|---|
|   | 1 | - | 5 | B+ |
| | 2 | - | 6 | GND |
| | 3 | - | 7 | B+ |
| | 4 | - | 8 | GND |

SBHBE9043L

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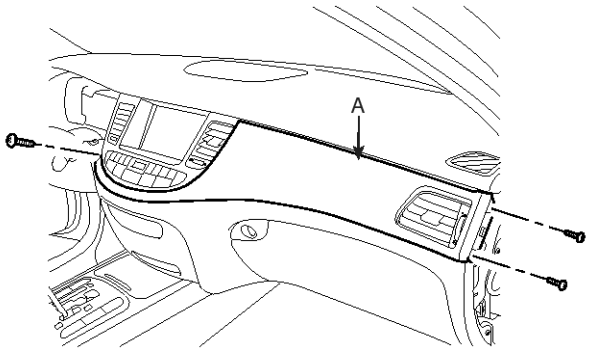
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## Removal

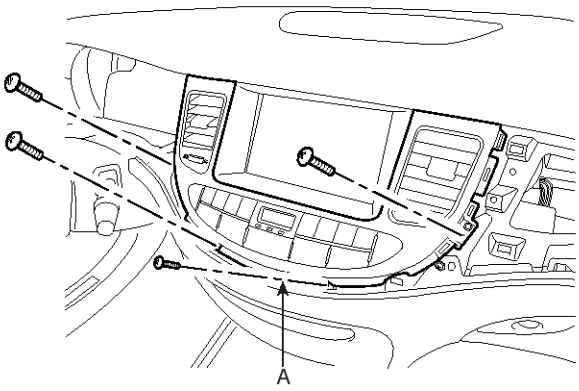
### Front LCD Monitor

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel. (Refer to the Body group - crash pad)
3. Remove the cluster fascia panel.
4. Remove the crash pad side garnish (A) after removing the screws.




SBHBE8265D

5. Remove the center fascia panel (A) after removing the screws.




SBHBE8266D

6. Remove the LCD monitor unit after removing the screws.

## Installation

### Front LCD Monitor

1. Install the LCD monitor unit after connecting the connectors.
2. Install the center fascia panel.
3. Install the crash pad side garnish, cluster fascia panel and crash pad lower panel.

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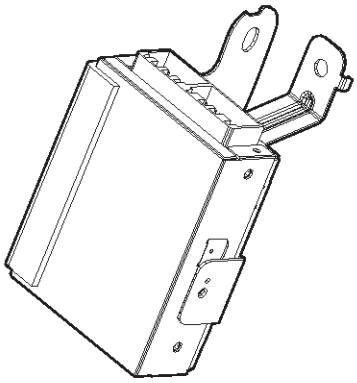
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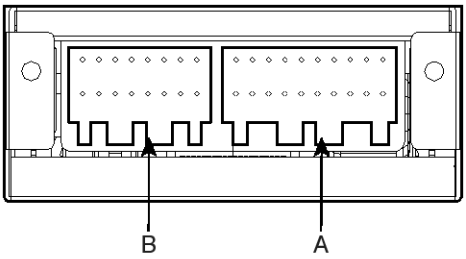


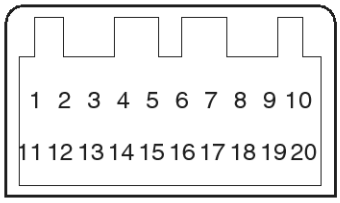
## Media unit

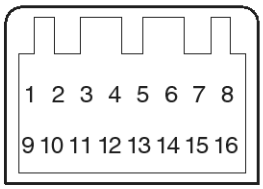
### Component Location

[Media unit]






| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|   | 1 | B+ | 11 | GND |
| | 2 | ACC | 12 | GND |
| | 3 | - | 13 | - |
| | 4 | CAN2 high | 14 | CAN2 low |
| | 5 | - | 15 | - |
| | 6 | CAN1 high | 16 | CAN1 low |
| | 7 | - | 17 | - |
| | 8 | - | 18 | - |
| | 9 | AUX L output | 19 | AUX R output |
| | 10 | AUX GND | 20 | - |

| Connector B | Pin | Description | Pin | Description |
|---|---|---|---|---|
|   | 1 | USB D- /IPOD Tx | 9 | GND |
| | 2 | USB D- /IPOD Rx | 10 | - |
| | 3 | USB /IPOD 5V | 11 | - |
| | 4 | USB /IPOD GND | 12 | - |
| | 5 | - | 13 | - |
| | 6 | AUX L input | 14 | - |
| | 7 | AUX R input | 15 | - |
| | 8 | AUX 1 REF | 16 | AUX 1 detect |

SBHBE9044L

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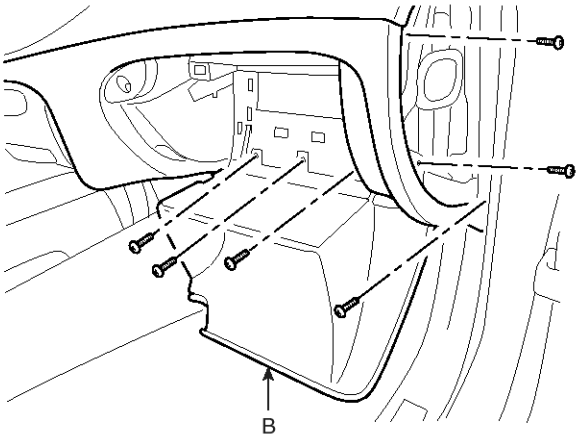
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## Removal

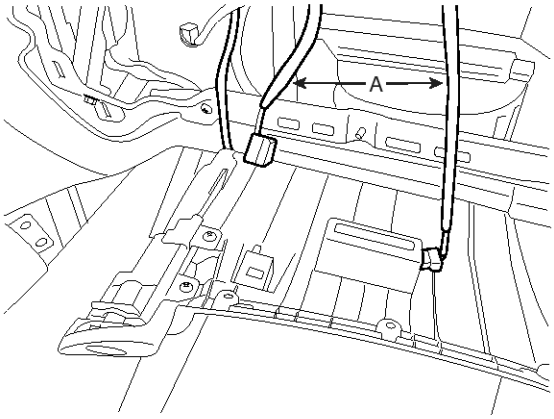
### Media Unit

1. Disconnect the negative (-) battery terminal.
2. Disconnect the pine, then remove the glove box (B). ( Refer to the Body group - crash pad)



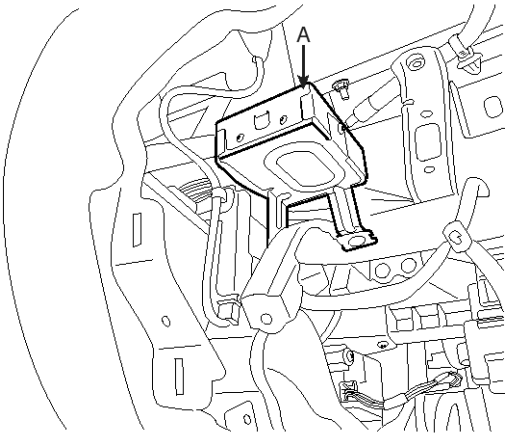

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3. Disconnect the connector (A) on the glove box.




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4. Remove the media unit (A) after disconnecting the c-onnectors.




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## Installation

### Media Unit

1. Install the media unit after connecting the connectors.
2. Install the glove box and glove box housing.
3. Connect the negative (-) battery terminal.

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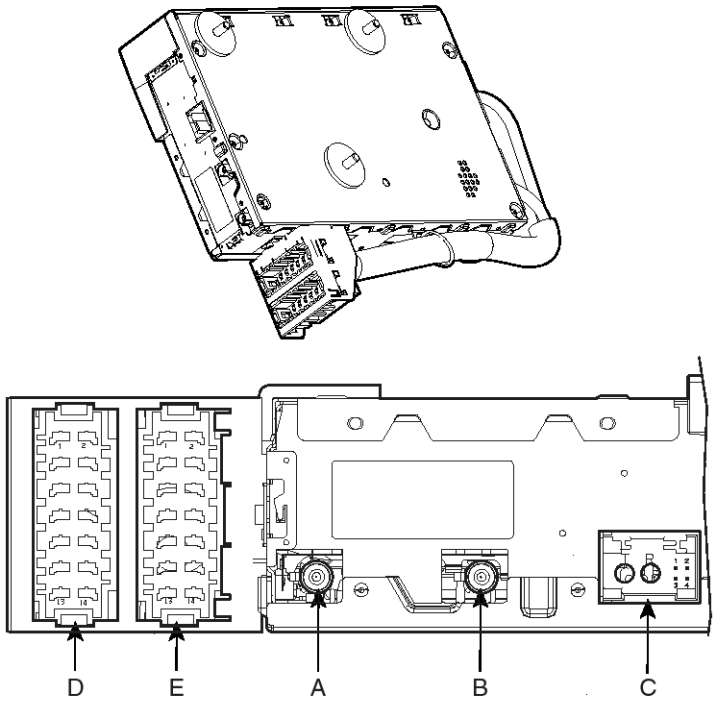
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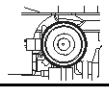


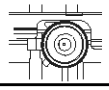
## AMP unit

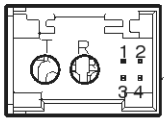
### Component Location

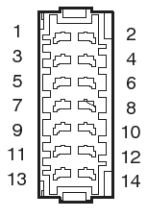
[AV Amplifier]

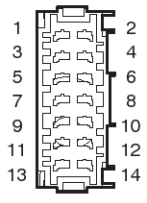



| Connector A | Pin | Description |
|---|---|---|
|  | 1 | Antenna 1 |
| | | |

| Connector B | Pin | Description |
|---|---|---|
|  | 1 | Antenna 2 |
| | | |

| Connector C | Pin | Description |
|---|---|---|
|  | T | Tx LWL |
| | R | Rx LWL |

| Connector D | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Sub woofer 1+ | 8 | Rear left door Speaker - |
| | 2 | Sub woofer 1- | 9 | Rear right door Speaker + |
| | 3 | Sub woofer 2+ | 10 | Rear right door Speaker - |
| | 4 | Sub woofer 2- | 11 | Front right middle Speaker + |
| | 5 | Front left middle Speaker + | 12 | Front right middle Speaker - |
| | 6 | Front left middle Speaker - | 13 | GND |
| | 7 | Rear left door Speaker + | 14 | BAT + |

| Connector E | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Surround speaker LH + | 8 | Front left door speaker 1 - |
| | 2 | Surround speaker LH - | 9 | Front left door speaker 2 + |
| | 3 | Surround speaker RH + | 10 | Front left door speaker 2 - |
| | 4 | Surround speaker RH - | 11 | Front right door speaker 1 + |
| | 5 | Center speaker + | 12 | Front right door speaker 1 - |
| | 6 | Center speaker - | 13 | Front right door speaker 2 + |
| | 7 | Front left door speaker 1 + | 14 | Front right door speaker 2 - |

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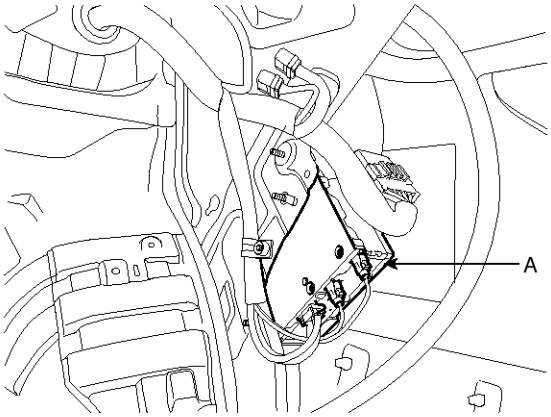
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## Removal

### External Amp

1. Disconnect the negative (-) battery terminal.
2. Open the trunk and remove the right trunk trim. (Refer to the Body group - Trunk)
3. Remove the external amp unit (A) after removing the connectors and nuts.




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## Installation

### External Amp

1. Install the external amp unit after connecting the connectors.
2. Install the right trunk trim.
3. Connect the negative (-) battery terminal.

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## Troubleshooting

### Tuner & Amp DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | U1000 | Tunner & Amplifer Error |
| 2 | U1004 | Temperature Sensor SignalError in Tunner and Amplifier |
| 3 | U1010 | Low Voltage Detected. |
| 4 | U1011 | High Voltage Detected. |
| 5 | U1138 | Fan Operation Error(Fan is running although should be off) |
| 6 | U1139 | Fan Operation Error - no plug put or line open(Fan is not running although it should be on) |
| 7 | U1601 | Data Upgrade Error - Application Software Code 1 Missing or Corrupted |
| 8 | U1602 | Data Upgrade Error - Application Software Code 2 Missing or Corrupted. |
| 9 | U1606 | Data Upgrade Error - Application Software Data Missing or Corrupted. |
| 10 | U1700 | DTCP Sink SW error. |
| 11 | U1702 | DTCP Sink Decode error. |
| 12 | U1710 | Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit |
| 13 | U1711 | Amplifier stage group 2 Error - S/Woofer 2(+), 2(-) short circuit |
| 14 | U1712 | Amplifier stage group 3 Error - Front Middle/Tweeter LH & RH short circuit |
| 15 | U1713 | Amplifier stage group 4 Error - DECK LH, DECK RH, Center Speaker short circuit |
| 16 | U1714 | Amplifier stage group 5 Error - Front LH & RH short circuit |
| 17 | U1941 | AmFm Antenna circuit Open ( not connected ) |
| 18 | U1942 | Fm2 Antenna circuit Low |
| 19 | U1943 | Fm2 Antenna circuit Open |

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## U1000 Amplifer Unit Error

### General Description

The Power Tuner will be applied to domestic, China and general markets. It has some functions like below1. Speech signal transmission by Most communication 2. FM/AM Tuner and Power Amplifier Combined 3. Embedded FM double tuner 4. Antenna diversity function applied for improvement in reception 5. 11 channel audio amplifier ( Logic 7)

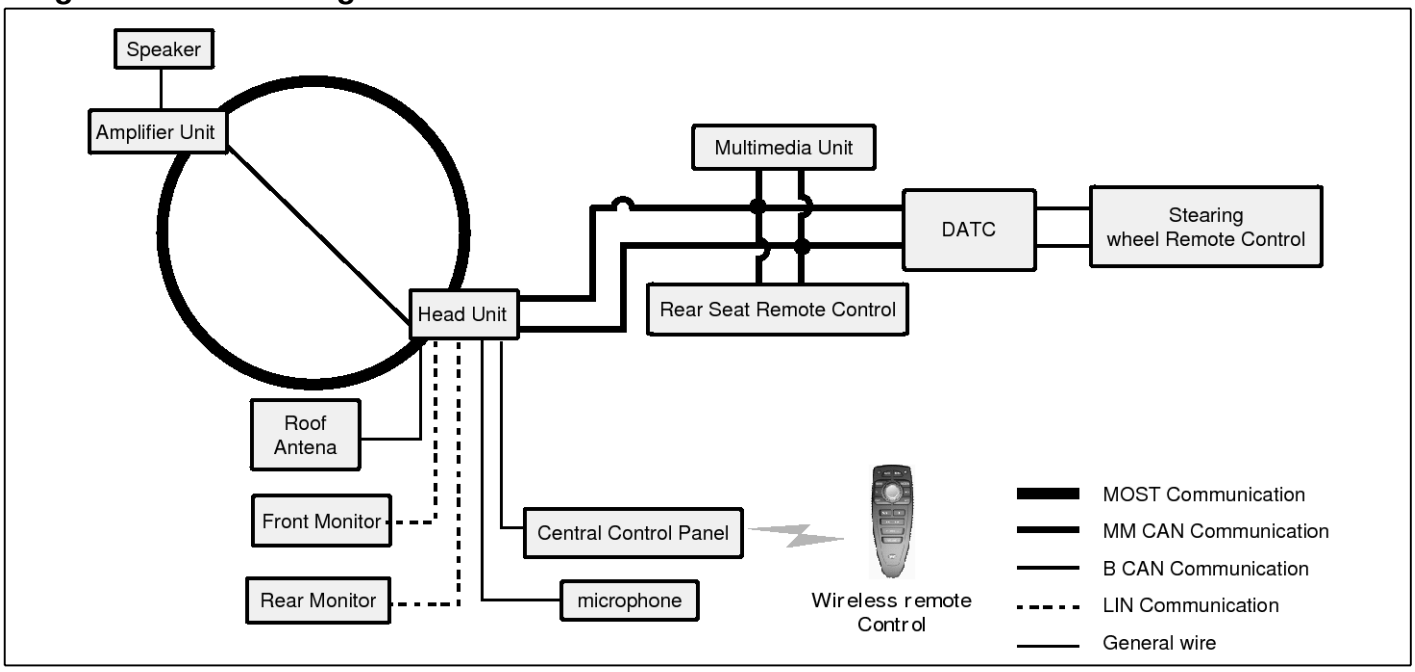
### DTC Description

This code is set when the head unit detecte a defect by self diagnosis.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Self diagnosis | • Tuner & Amplifier |
| Enable Conditions | • IG ON | |
| Threshold value | • When one or more condition is correct with below discr-ibtion<br>- EEPROM test error<br>- CPU error<br>-RAM test or ROM-,F-ROM-checksum error | |

### Diagnostic Circuit Diagram




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### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. IG "ON" & Engine "OFF".
3. Check the component status by wake up line test at I-nspection/Test mode.

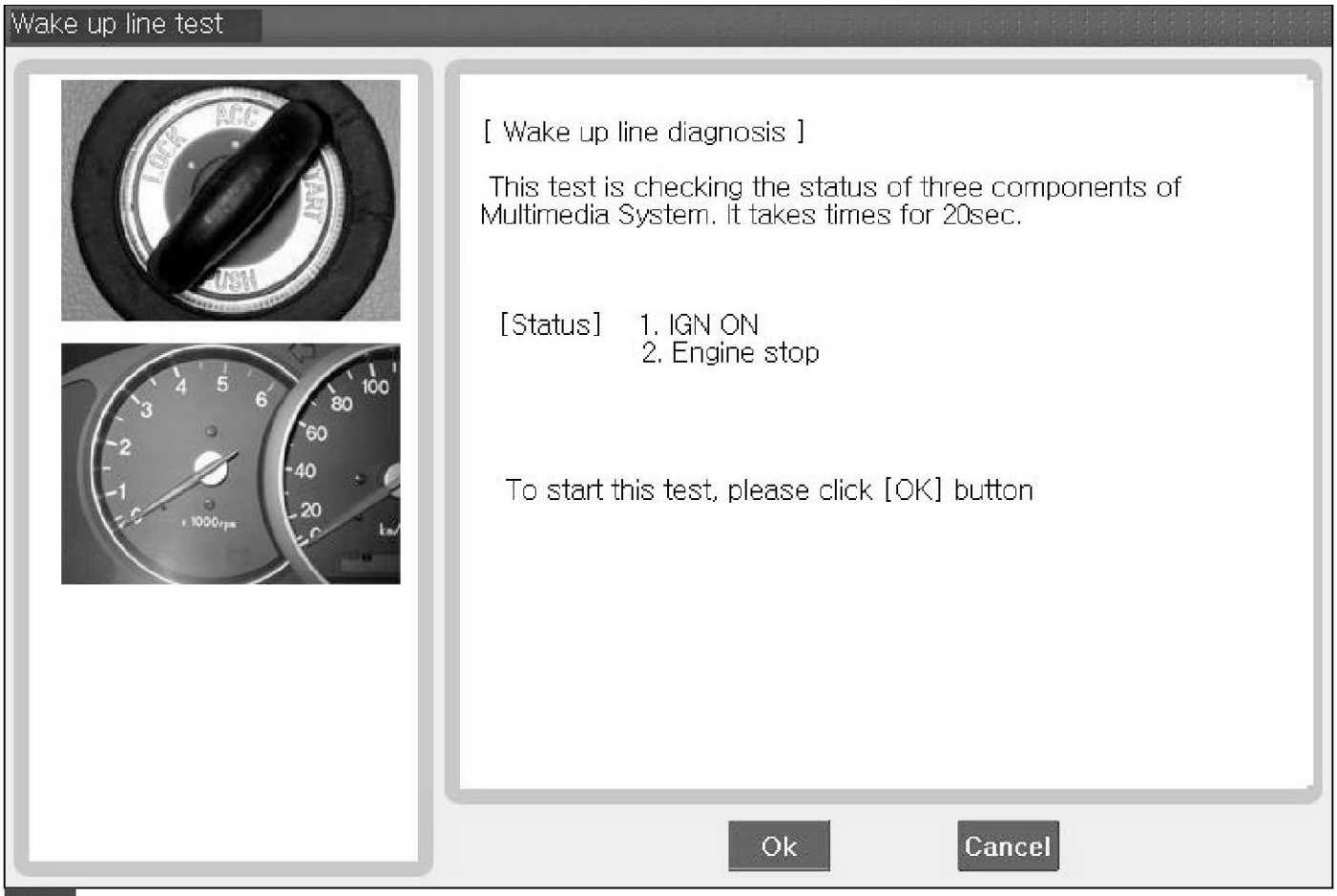



FIG.1

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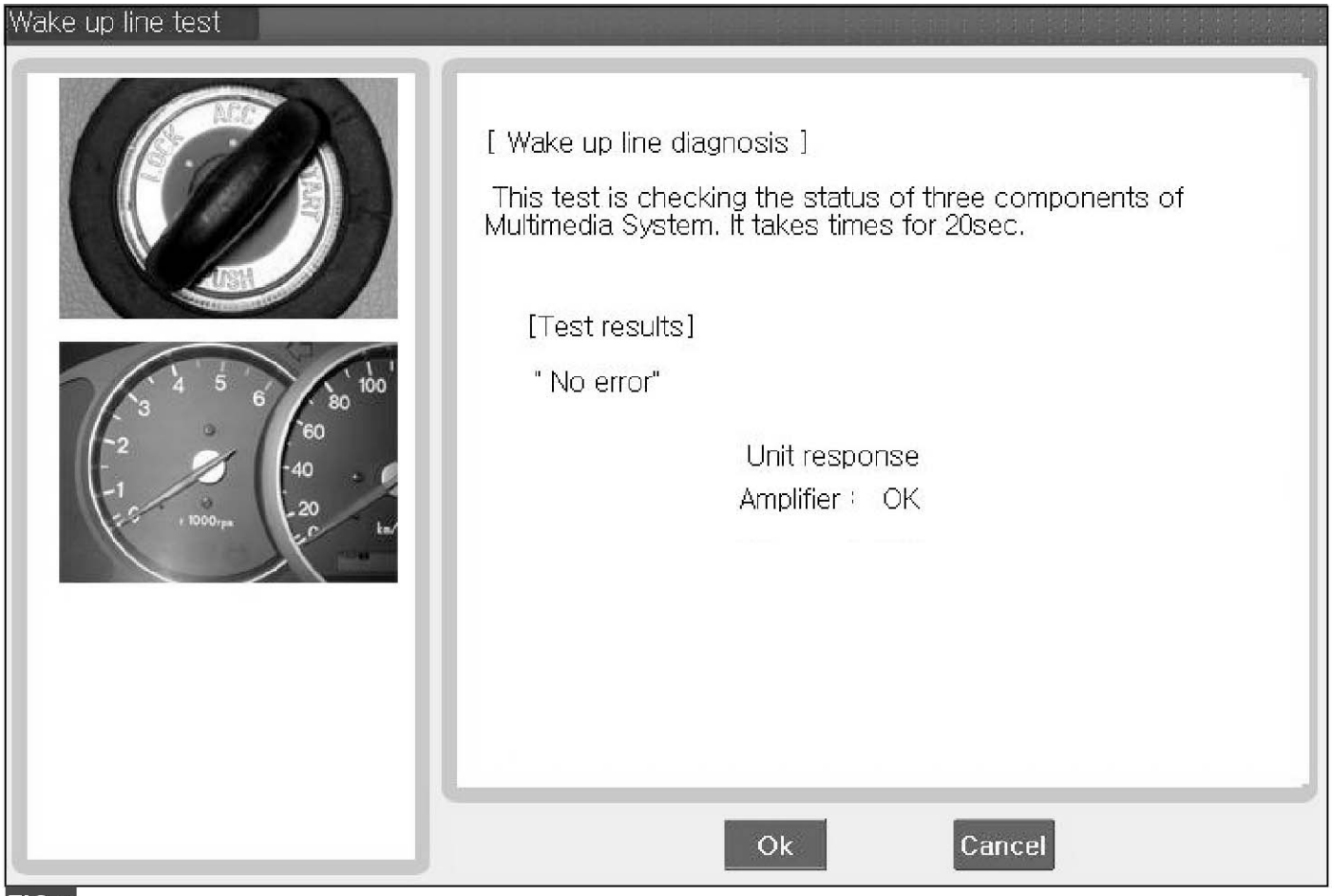



FIG.2

SBHBE9T12L

FIG.1) Wake up line diagnosis test

FIG.2) Result of Wake up line diagnosis test

4. Do you get a defect at component by Wake up line test ?

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

**NO** ▶ 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.
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.

## Verification of Vehicle Repair

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

1. After connecting Scan tool select "DIAGNOSTIC TROUBLE CODES(DTCs)" mode.
2. Clear recorded DTC using Scan tool.
3. After selecting "DIAGNOSTIC TROUBLE CODES(DTCs)" mode and check if DTC is recorded again.
4. Are any DTCs recorded ?

**YES** ▶ Go to the DTC guide of recorded NO. in Scan tool.

**NO** ▶ System operates within specification.

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## U1001 HW Watchdog Executed

### General Description

Refer to DTC U1000 : Amplifer Unit Error.

### DTC Description

This code is set when the head unit detecte a defect by self diagnosis.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Self diagnosis | • Tuner & Amplifier |
| Enable Conditions | • IG ON | |
| Threshold value | • Watchdog error | |
| Detecting time | • IG ON or By self test | |

### Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

### Monitor Scantool Data

Refer to DTC U1000 : Amplifer Unit Error.

### Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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## U1004 Temperature Sensor Signal Error in Tunner and Amplifier

### General Description

The Tuner&Amplifier converts optical communication signal to electrical communication signal. The temperature sensor of Tuner&Amplifier detects the temperature rising to prevent that be abnormal status.

### DTC Description

This code is set when a temperature sensor of Tuner &Amplifier detect that the temperature is over 85℃, At that time Tuner&Amplifier can be abnormal status. If the temperature is around 85℃,the fan is running to make the temperature down. After cooling, Tuner&Amplifier become to be normal status under 75℃.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Siganl monitoring | • Poor air circulation around the Tuner & Amplifier<br>• Tuner & Amplifier |
| Enable Conditions | • IG ON | |
| Threshold value | • Temperature > 85℃ | |
| Detecting time | • Immediately | |

### Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

### Signal Waveform & Data

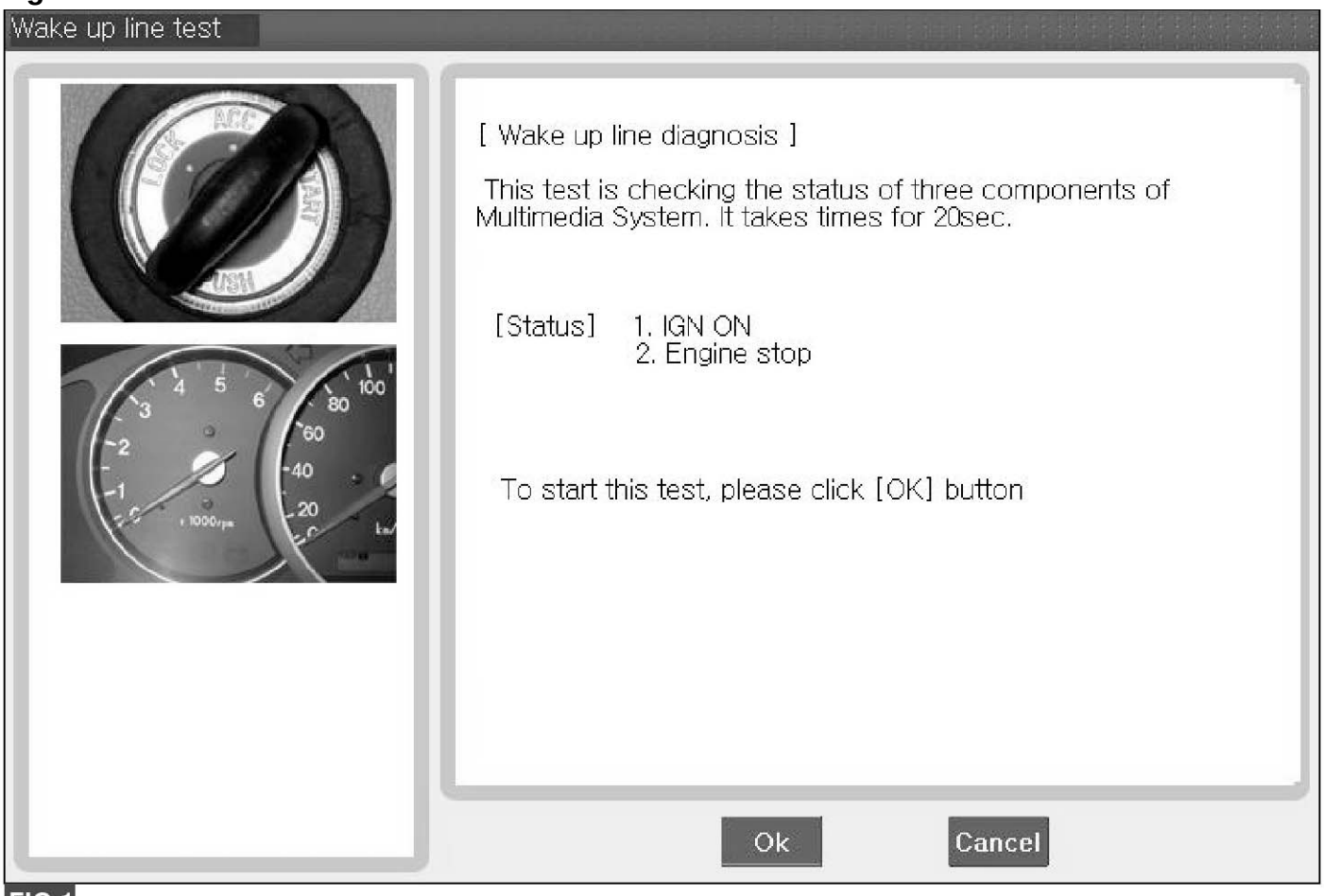



FIG.1

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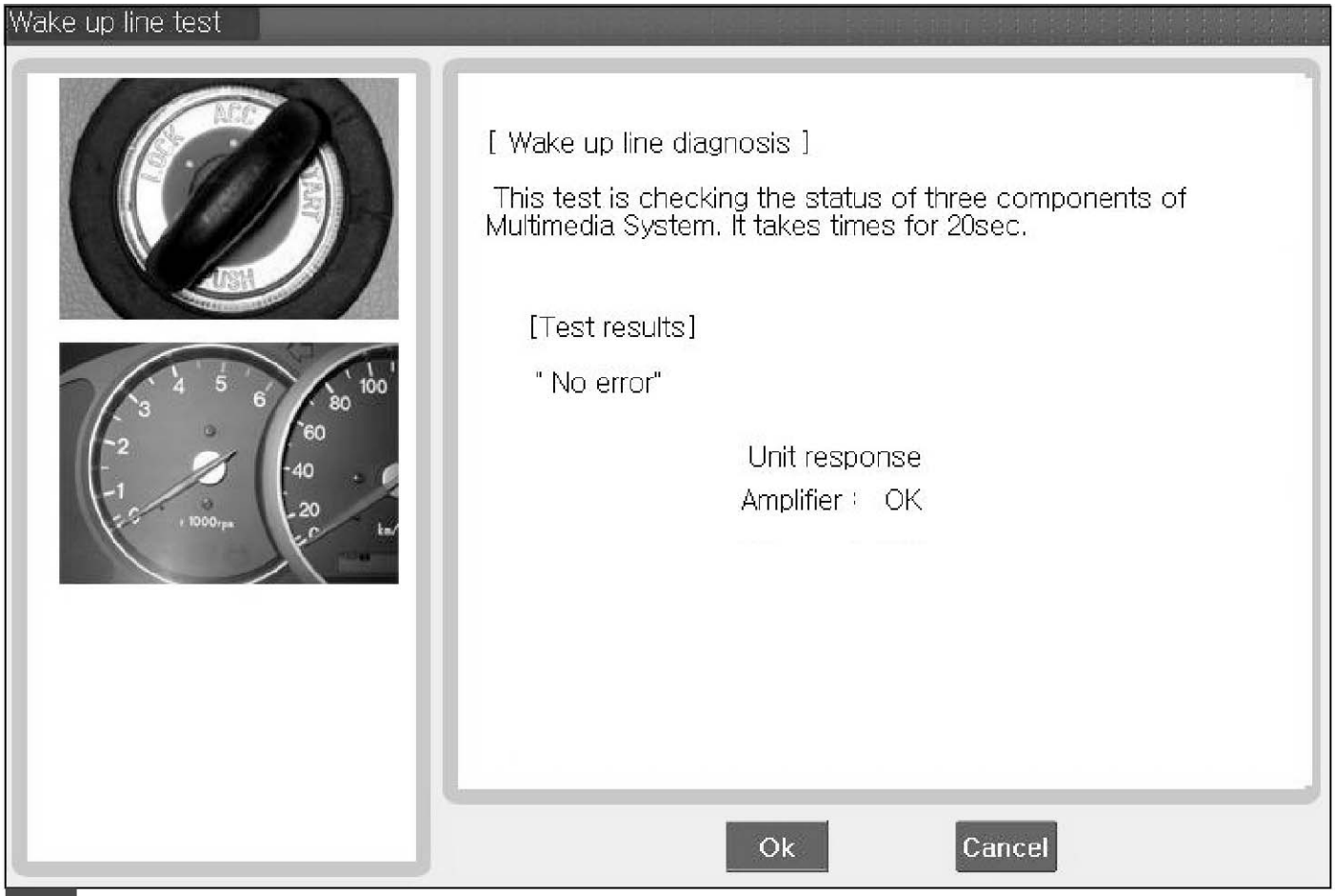



FIG.2

SBHBE9T12L

FIG.1) Start of wake up line diagnosis test
FIG.2) Result of wake up line diagnosis test

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### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. IG "ON" & Engine "OFF".
3. Check the component status by wake up line test at I-nspection/Test mode.

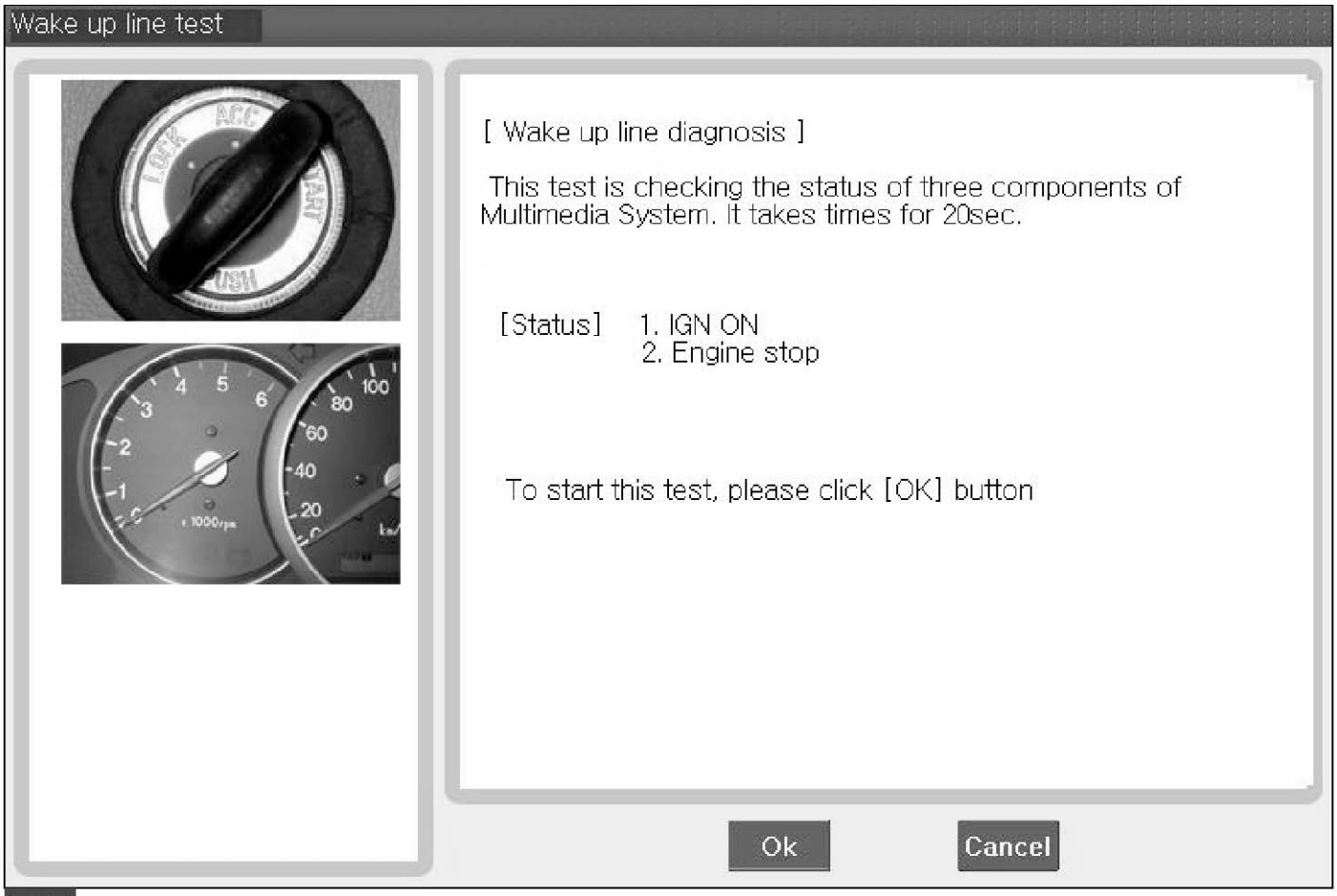



FIG.1

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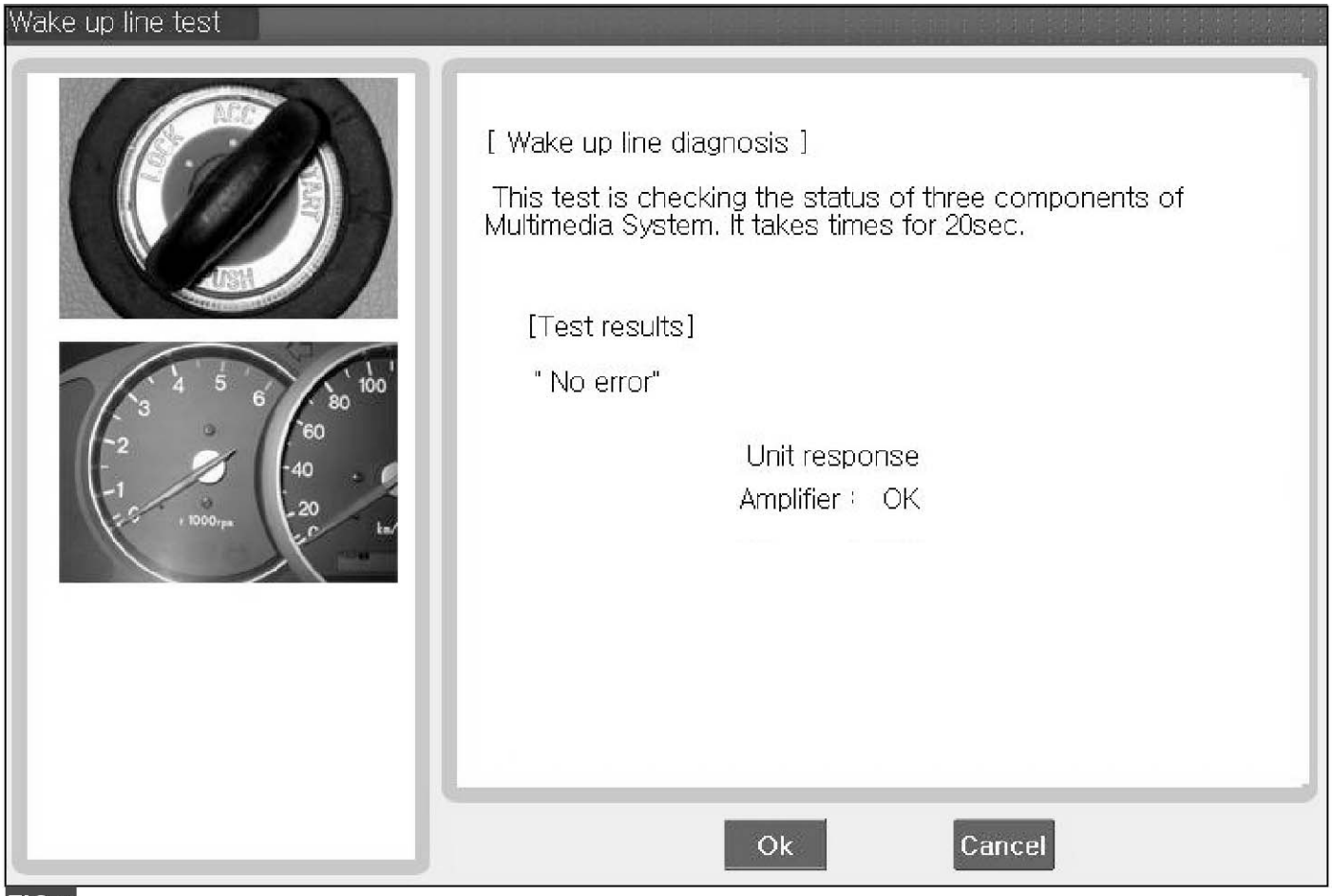



FIG.2

SBHBE9T12L

FIG.1) Start of wake up line diagnosis test

FIG.2) Result of Wake up line diagnosis test

4. Do you get a defect at component by Wake up line test ?

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

**NO** ▶ Check the air circulation is well. If there is blocked with something around Amplifier then remove it for air circulation.

▶ 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.

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.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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## U1010 Low Voltage Detected

### General Description

Refer to DTC U1000 : Amplifer Unit Error.

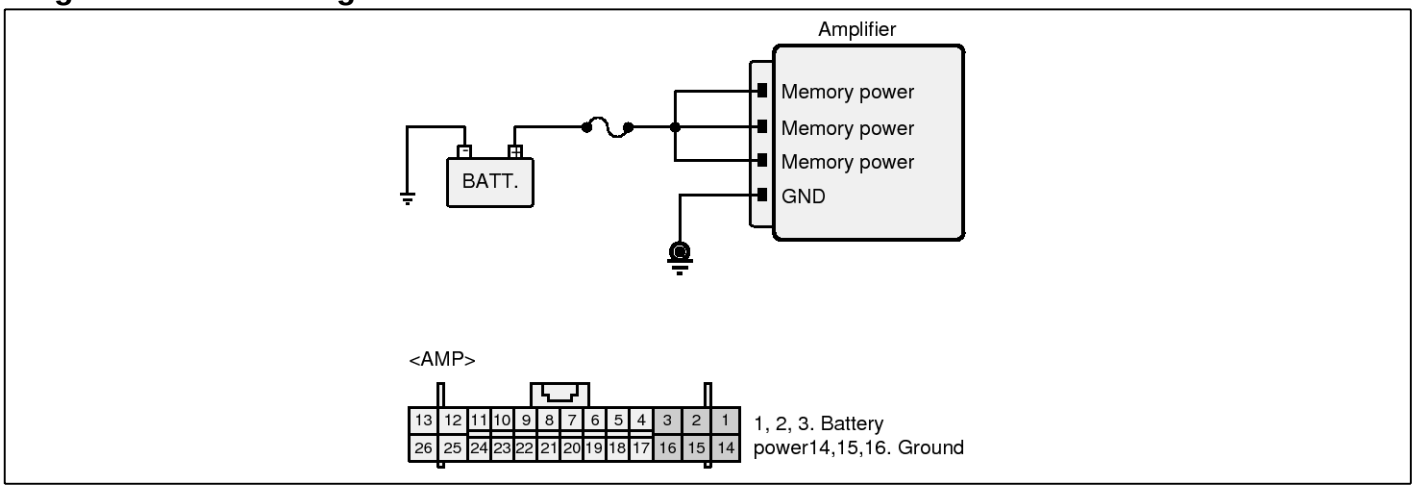
### DTC Description

This code is set when the supplied power of Tuner&Amplifier is under 9V.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Voltage Monitoring | • Open /short in circuit<br>• battery<br>• Tuner & Amplifier |
| Enable Conditions | • IG ON | |
| Threshold value | • under 9V of battery voltage | |
| Detecting time | • 30 sec. | |

### Diagnostic Circuit Diagram




SBHBE9T21L

### Terminal and Connector Inspection

1. Electrical systems consist of a lot of harness and connectors, poor connection of terminals can cause various problems and damage of component.
2. Perform checking procedure as follows.
   1) Check damage of harness and terminals : Check terminals for contact resistance, corrosion and deformation.
   2) Check terminal separation, damage of locking device and connecting condition between terminal and wiring.

   **NOTICE**

   *Disconnect the pin which requires checking at male connector and insert it to the terminal at female connector for checking connecting condition.( After checking, reconnect the pin at correct position.)*

3. Is the problem found?

**YES** ▶ Repair the trouble causing part and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Go to "Power Circuit Inspection".

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## Power Circuit Inspection

1. IG KEY "OFF"
2. Disconnect the Tuner&Amplifier connecter.
3. IG KEY "ON"
4. Check the voltage between Memory voltage of Amplifier unit and GND of Body

**Specification :** Battery voltage

5. Is the measured value within specification?

**YES** ▶ Go to next procedure.

**NO** ▶ Repair open / short to ground of power circuit and go to "Verification of Vehicle Repair" procedure.

## System Inspection

### ■ Alternator circuit inspection

1. Engine "ON"
2. Turn on the head rights and heat rays at idle status, and accelerate to 2500 RPM for 2 min.
3. Check voltage between battery + terminal and - terminal.

**measurement value :** about 12.5 ~ 14.7V

4. Is the measured value within specifications?

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

**NO** ▶ Checking the tension of drive belt, status of engine RPM, fuse, battery, batteru terminal, Alternator B+ terminal, L termanal, FR terminal, C terminal and between battery and Alternator' s B+ wire. If there is problem repair that or change and go to "Verification of Vehicle Repair" procedure.

▶ If there is no problem at the above checking, chage the Alternator and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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## U1011 High Voltage Detected

### General Description

Refer to DTC U1000 : Amplifer Unit Error.

### DTC Description

This code is set when the supplied power of Tuner&Amplifier is above 16V.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Voltage Monitoring | • Alternator<br>• Tuner & Amplifier |
| Enable Conditions | • IG ON | |
| Threshold value | • above 16V of battery voltage | |
| Detecting time | • 30 sec. | |

### Diagnostic Circuit Diagram

Refer to DTC U1010 : Low Voltage Detected.

### Terminal and Connector Inspection

Refer to DTC U1010 : Low Voltage Detected.

### Power Circuit Inspection

Refer to DTC U1010 : Low Voltage Detected.

### System Inspection

Refer to DTC U1010 : Low Voltage Detected.

### Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1138 Fan Operation Error(Fan is running although should be off)

## General Description

Refer to DTC U1000 : Amplifer Unit Error.

## DTC Description

This code is set when the fan in the Tuner&Amplifier is r-unning although it should be off.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Running condition | • Tuner & Amplifier |
| Enable Conditions | • "IG KEY" ON | |
| Threshold value | • Fan is running although should be off. | |
| Detecting time | • over 30 sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

## Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Co-des(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC prese-nt Using a scantool,
5. Are any DTCs present ?

**YES** ▶ Substitute with a known-good pertinent com-ponent and check for proper operation.If the pr-oblem is corrected, replace pertinent compone-nt and then go to "Verification of Vehicle Repair " procedure.

**NO** ▶ Many malfunctions in the electrical system are caused by poor harness and terminals. Fa-ults can also be caused by interference from o-ther electrical systems, and mechanical or che-mical damage.
Check connectors for looseness, poor connect-ion, bending, corrosion, contamination, deterio-ration, or damage. Repair or replace as neces-sary and then go to "Verification of Vehicle Re-pair" procedure.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1139 Fan Operation Error - no plug put or line open(Fan is not running although it should be on)

## General Description

Refer to DTC U1000 : Amplifer Unit Error.

## DTC Description

This code is set when the fan in the Tuner&Amplifier is not running although it should be on.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Tuner & Amplifier |
| Enable Conditions | • "IG KEY" ON | |
| Threshold value | • Fan is not running although should be on. | |
| Detecting time | • over 30 sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

## Component inspection

Refer to DTC U1138 : Fan Operation Error(Fan is running although should be off).

## Verification of Vehicle Repair

Refer to DTC U1138 : Fan Operation Error(Fan is running although should be off).

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# U1601 Data Upgrade Error - Application Software Code 1 Missing or Corrupted

## General Description

The components have each update cd depending on the components of system, so you can use that CD for update. If you update any component, insert the served CD into the head unit and use the menu "Start update from CD " in Scan tool.

## DTC Description

This code is set when the update is failed. But the code is disappeared if the update is done successfully later.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Update fail<br>(Try to update again if update is done well, that DTC will disappear) |
| Enable Conditions | • "IG KEY" ON | |
| Threshold value | • Update fail. | |
| Detecting time | • continuously | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

## Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC present Using a scantool,
5. Are any DTCs present ?

**YES** ▶ Try to update again and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

**NO** ▶ 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.
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.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1602 Data Upgrade Error - Application Software Code 2 Missing or Corrupted

## General Description

Refer to DTC U1601 : Data Upgrade Error - Application Software Code 1 Missing or Corrupted.

## DTC Description

This code is set when the update is failed. But the code is disappeared if the update is done successfully later.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Update fail<br>(Try to update again if update is done well, that DTC will disappear) |
| Enable Conditions | • "IG KEY" ON | |
| Threshold value | • Update fail. | |
| Detecting time | • continuously | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

## Component inspection

Refer to DTC U1601 : Data Upgrade Error - Application Software Code 1 Missing or Corrupted.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1606 Data Upgrade Error - Application Software Data Missing or Corrupted

## General Description

Refer to DTC U1601 : Data Upgrade Error - Application Software Code 1 Missing or Corrupted.

## DTC Description

This code is set when the update is failed. But the code is disappeared if the update is done successfully later.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Update fail<br>(Try to update again if update is done well, that DTC will disappear) |
| Enable Conditions | • "IG KEY" ON | |
| Threshold value | • Update fail. | |
| Detecting time | • continuously | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

## Component inspection

Refer to DTC U1601 : Data Upgrade Error - Application Software Code 1 Missing or Corrupted.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1700 DTCP Sink SW error.

## General Description

Digital Transmission Content Protection, or DTCP, is a digital rights management (DRM) technology that aims to protect copyright when sending and receiving of Audio/Video DVD signal by encrypting interconnections between devices.

## DTC Description

This code is set when the software error is detected during DTCP is working in Tuner&Amplifier.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Tuner & Amplifier |
| Enable Conditions | • "IG KEY" ON | |
| Threshold value | • 3 times interrupted/ Non successful startup processes. | |
| Detecting time | • During starting | |

## Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

## Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC present Using a scantool,
5. Are any DTCs present ?

**YES** ▶ Try to update again and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known-good pertinent component and check for proper operation.If the problem is corrected, replace pertinent component and then go to "Verification of Vehicle Repair " procedure.

**NO** ▶ 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.
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.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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## U1702 DTCP Sink Decode error.

### General Description

Refer to DTC U1700 : DTCP Sink SW error.

### DTC Description

This code is set when the decode error is detected during DTCP is working in Tuner&Amplifier.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Tuner & Amplifier |
| Enable Conditions | • IG ON | |
| Threshold value | • Detect a DTCP decode error. | |
| Detecting time | • During playback of music data | |

### Diagnostic Circuit Diagram

Refer to DTC U1000 : Amplifer Unit Error.

### Component inspection

Refer to DTC U1700 : DTCP Sink SW error.

### Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1710 Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit

## General Description

The Power Tuner will be applied to domestic, China and general markets. It has some functions like below1. Speech signal transmission by Most communication 2. FM/AM Tuner and Power Amplifier Combined 3. Embedded FM double tuner 4. Antena diversity function applied for improvement in reception 5. 11 channel audio amplifier ( Logic 7). The speaker is installed at front in-panel(sensor speaker), each 4 doors, center deck(sub wooger) and each side of deck like above.

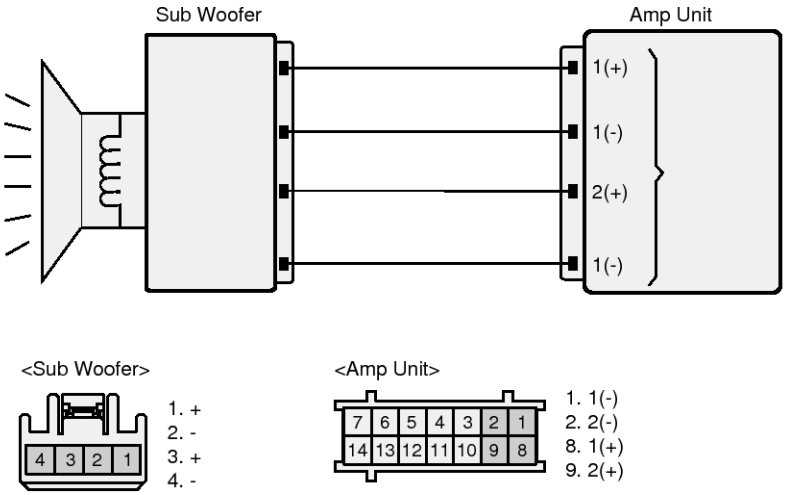
## DTC Description

This code is set when sub woofer 1 circuit short over 30 sec after ignition on.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Sub woofer 1(+), 1(-) shortcut<br>• Sub wooger |
| Enable Conditions | • IG ON | |
| Threshold value | • Battery shortcut | |
| Detecting time | • over 30 sec. | |

## Diagnostic Circuit Diagram




SBHBE9T22L

## 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.

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## Signal Circuit Inspection

1. IG KEY "ON"
2. To set sound is out by Navigation, FA/AM radio and etc.
3. Measure waveform between terminal "1(+)" of Amplifier and chassis ground.
4. Measure waveform between terminal "1(-)" of Amplifier and chassis ground.

**Specification :** 5.8 ~ 6.1V

5. Is the measured waveform within specifications?

**YES** ▶ Go to next procedure.

**NO** ▶ Check for short circuit in signal harness. Repair as necessary and go to "Verification Vehicle Repair" procedure.

## Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC present Using a scantool,
5. Are any DTCs present ?

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

**NO** ▶ 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.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1711 Amplifier stage group 2 Error - S/Woofer 2(+), 2(-) short circuit

## General Description

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## DTC Description

This code is set when sub woofer 2 circuit short over 30 sec during ignition on.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Sub woofer 2(+),2(-) shortcut<br>• Sub wooger |
| Enable Conditions | • IG ON | |
| Threshold value | • Battery shortcut | |
| Detecting time | • over 30 sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## Terminal and Connector Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## Signal Circuit Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## Component inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1712 Amplifier stage group 3 Error - Front Middle/Tweeter LH & RH short circu - it

## General Description

Refer to DTC U1710 : Amplifier stage group 1 Error - S/ Woofer 1(+), 1(-) short circuit.

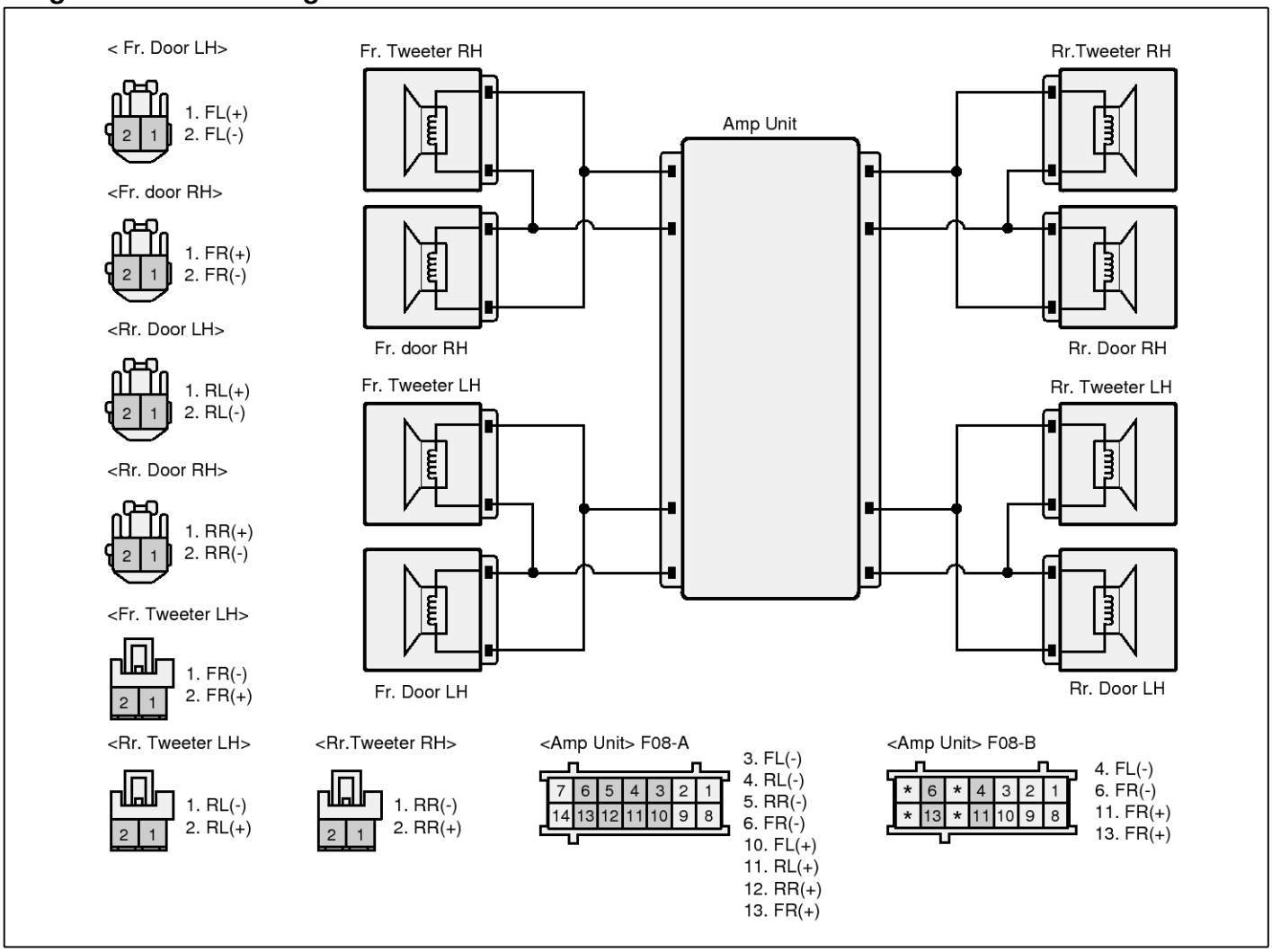
## DTC Description

This code is set when circuit of LH & RH'middle/tweeter of front door or citcuit of LH & RH'middle/tweeter of rear door short over 30 sec during ignition on.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Short to chasis gound or battery in front doors (LH, RH circuit )<br>• Short to chasis gound or battery in rear doors (LH, RH circuit)<br>• Front doors LH or RH speaker |
| Enable Conditions | • IG ON | |
| Threshold value | • Battery shortcut | |
| Detecting time | • over 30 sec. | |

## Diagnostic Circuit Diagram




SBHBE9T23L

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### Terminal and Connector Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

### Signal Circuit Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

### Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC present Using a scantool,
5. Are any DTCs present ?

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

**NO** ▶ 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.

### Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1713 Amplifier stage group 4 Error - DECK LH, DECK RH, Center Speaker shor - t circuit

## General Description

Refer to DTC U1710 : Amplifier stage group 1 Error - S/ Woofer 1(+), 1(-) short circuit.

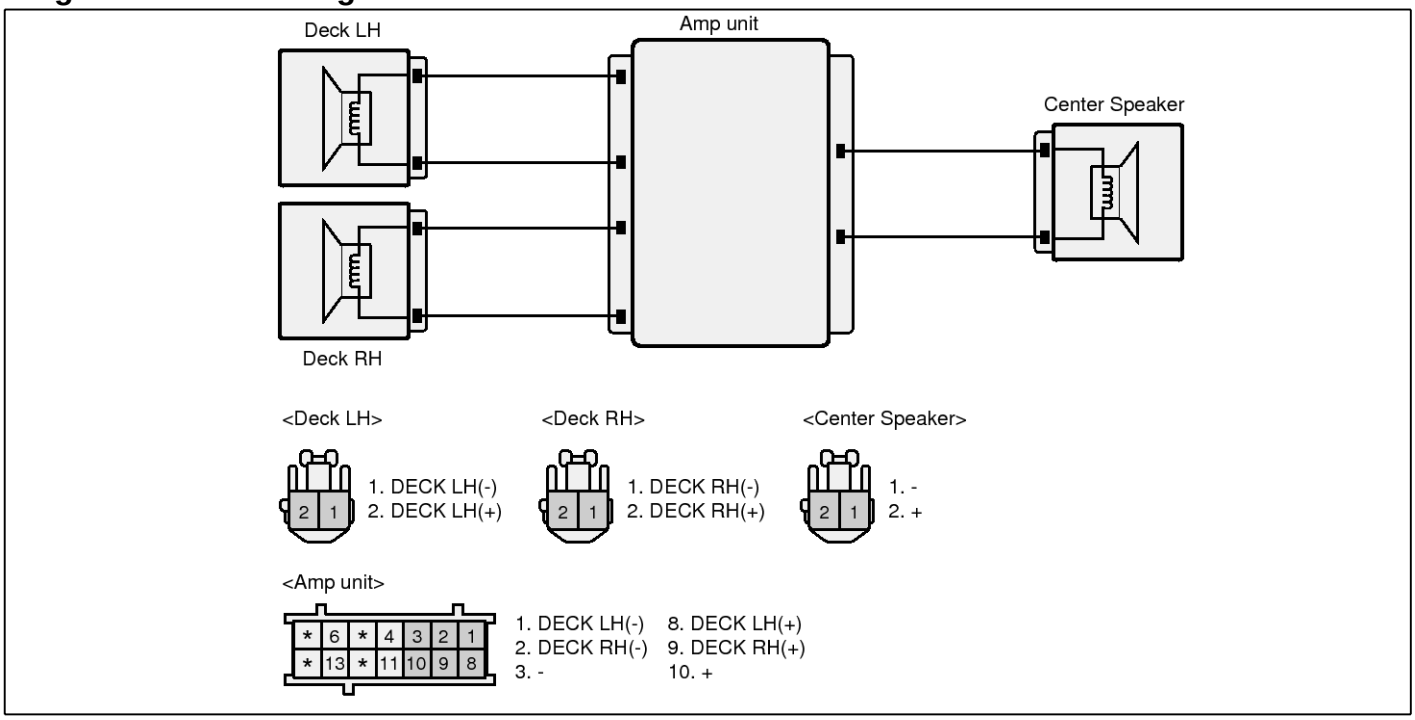
## DTC Description

This code is set when LH & RH'deck or sensor speaker circuit shorted over 30 sec during ignition on.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Short to chasis gound or batte- ry in front doors (LH & RH deck or sensor speaker)<br>• Deck LH & RH speaker<br>• Center speakerr |
| Enable Conditions | • IG ON | |
| Threshold value | • Battery shortcut | |
| Detecting time | • over 30 sec. | |

## Diagnostic Circuit Diagram




SBHBE9T24L

## Terminal and Connector Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/ Woofer 1(+), 1(-) short circuit.

## Signal Circuit Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/ Woofer 1(+), 1(-) short circuit.

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### Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC present Using a scantool,
5. Are any DTCs present ?

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

**NO** ▶ 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.

### Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1714 Amplifier stage group 5 Error - Front LH & RH short circuit

## General Description

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## DTC Description

This code is set when LH & RH  fornt door or sensor speaker circuit  short over 30 sec during ignition on.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Short to chasis gound or battery in front doors(front door speaker LH&RH)<br>• Front door speaker LH&RH |
| Enable Conditions | • IG ON | |
| Threshold value | • Battery shortcut | |
| Detecting time | • over 30 sec. | |

## Diagnostic Circuit Diagram

Refer to DTC U1713 : Amplifier stage group 4 Error - DECK LH, DECK RH, Center Speaker short circuit.

## Terminal and Connector Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## Signal Circuit Inspection

Refer to DTC U1710 : Amplifier stage group 1 Error - S/Woofer 1(+), 1(-) short circuit.

## Component inspection

Refer to DTC U1713 : Amplifier stage group 4 Error - DECK LH, DECK RH, Center Speaker short circuit.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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## U1941 AmFm Antenna circuit Open ( not connected )

### General Description

This antena in glass receive AM/FM radio. It's glass antenna.

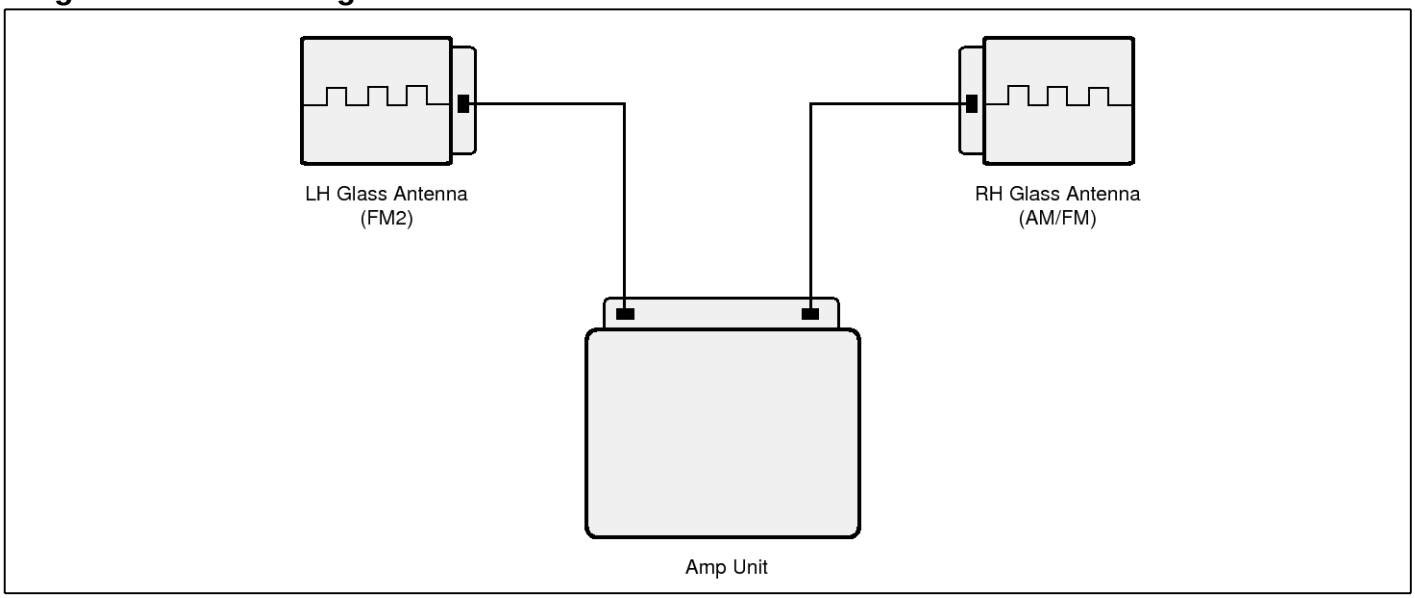
### DTC Description

This code is set when antena circuit is opened.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Antena not connected<br>• Antena |
| Enable Conditions | • IG ON | |
| Threshold value | • Antena not connected | |
| Detecting time | • - | |

### Diagnostic Circuit Diagram




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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 "Signal Circuit Inspection" procedure.

## Signal Circuit Inspection

1. IG KEY "OFF"
2. Disconnected AM/FM glass antenna connector and Tuner&Amplifier connector.
3. Measure resistance between connector of antenna circuit and connector of Tuner&Amplifier circuit.

**Specification :** 0Ω

4. Is the measured resistance within specifications?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check for short circuit in signal harness. Repair as necessary and go to "Verification Vehicle Repair" procedure.

## Component inspection

Refer to DTC U1713 : Amplifier stage group 4 Error - DECK LH, DECK RH, Center Speaker short circuit.

## Verification of Vehicle Repair

Refer to DTC U1000 : Amplifer Unit Error.

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# U1942 Fm2 Antenna circuit Low

## General Description

This antenna in glass receive FM2 radio. It's glass antenna.

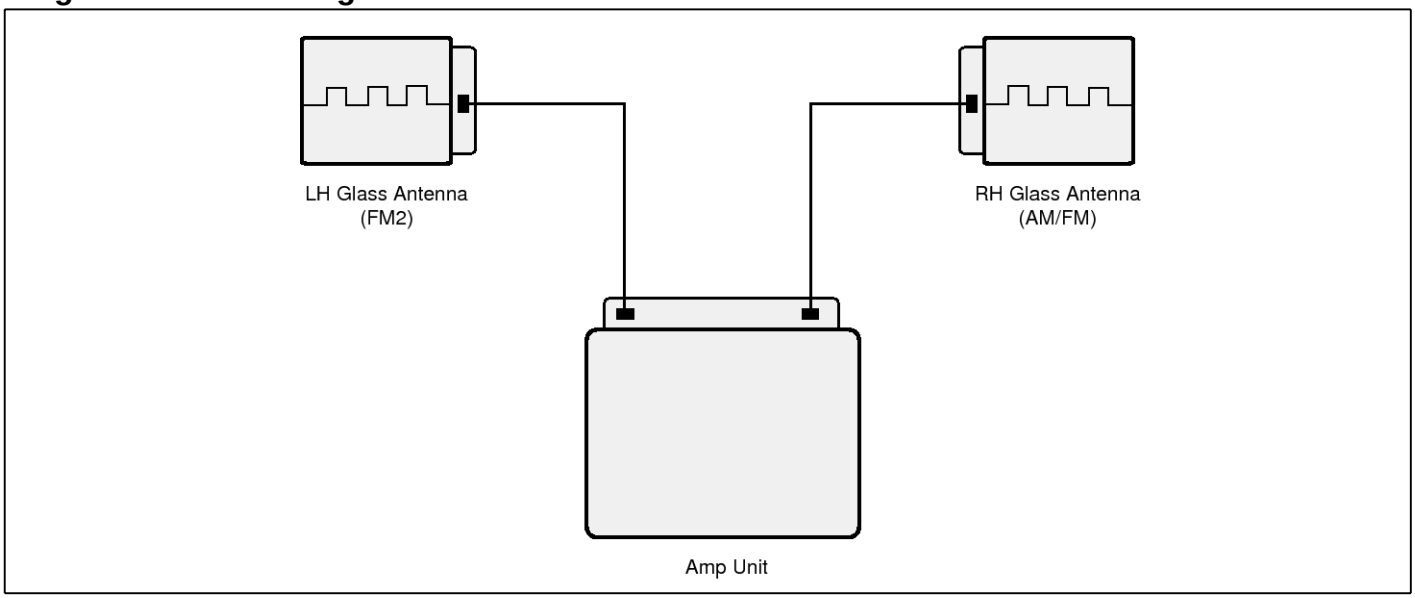
## DTC Description

This code is set when antenna circuit Shorted to chasis gound.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Antenna Short to chasis gound<br>• Antena |
| Enable Conditions | • IG ON | |
| Threshold value | • Antenna Short to chasis gound | |
| Detecting time | • over 1 sec. | |

## Diagnostic Circuit Diagram




SBHBE9T26L

## 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. Disconnected FM2 glass antenna connector and Tuner&Amplifier connector.
3. Measure resistance between connector of antenna circuit and chasis gound.

**Specification :** infinity

4. Is the measured resistance within specifications?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check for short circuit in signal harness. Repair as necessary and go to "Verification Vehicle Repair" procedure.

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### Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC present Using a scantool,
5. Are any DTCs present ?

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

**NO** ▶ 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.

### Verification of Vehicle Repair

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

Refer to DTC U1000 : Amplifer Unit Error.

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# U1943 Fm2 Antenna circuit Open

## General Description

This antenna in glass receive FM2 radio. It's glass antenna.

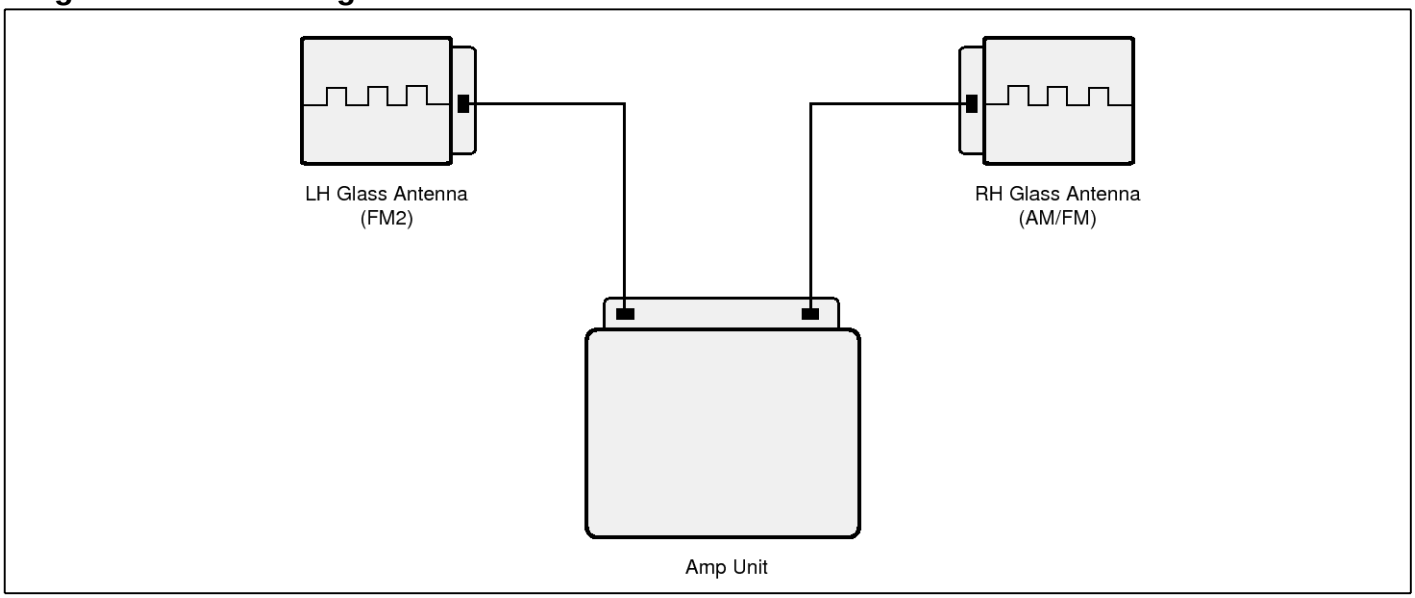
## DTC Description

This code is set when antena circuit is opened.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal condition | • Antenna circuit is opene<br>• Antena |
| Enable Conditions | • IG ON | |
| Threshold value | • Antenna Short to chasis gound | |
| Detecting time | • over 1 sec. | |

## Diagnostic Circuit Diagram




SBHBE9T26L

## 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. Disconnected FM2 glass antenna connector and Tuner&Amplifier connector.
3. Measure resistance between connector of antenna circuit and chasis gound.

**Specification :** infinity

4. Is the measured resistance within specifications?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check for short circuit in signal harness. Repair as necessary and go to "Verification Vehicle Repair" procedure.

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## Component inspection

1. Ignition "ON" & Engine "OFF".
2. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
3. Using a scantool, Clear DTC.
4. After IG OFF ↔ IG ON 2~3times, Check DTC present Using a scantool,
5. Are any DTCs present ?

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

**NO** ▶ 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.

## Verification of Vehicle Repair

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

Refer to DTC U1000 : Amplifer Unit Error.

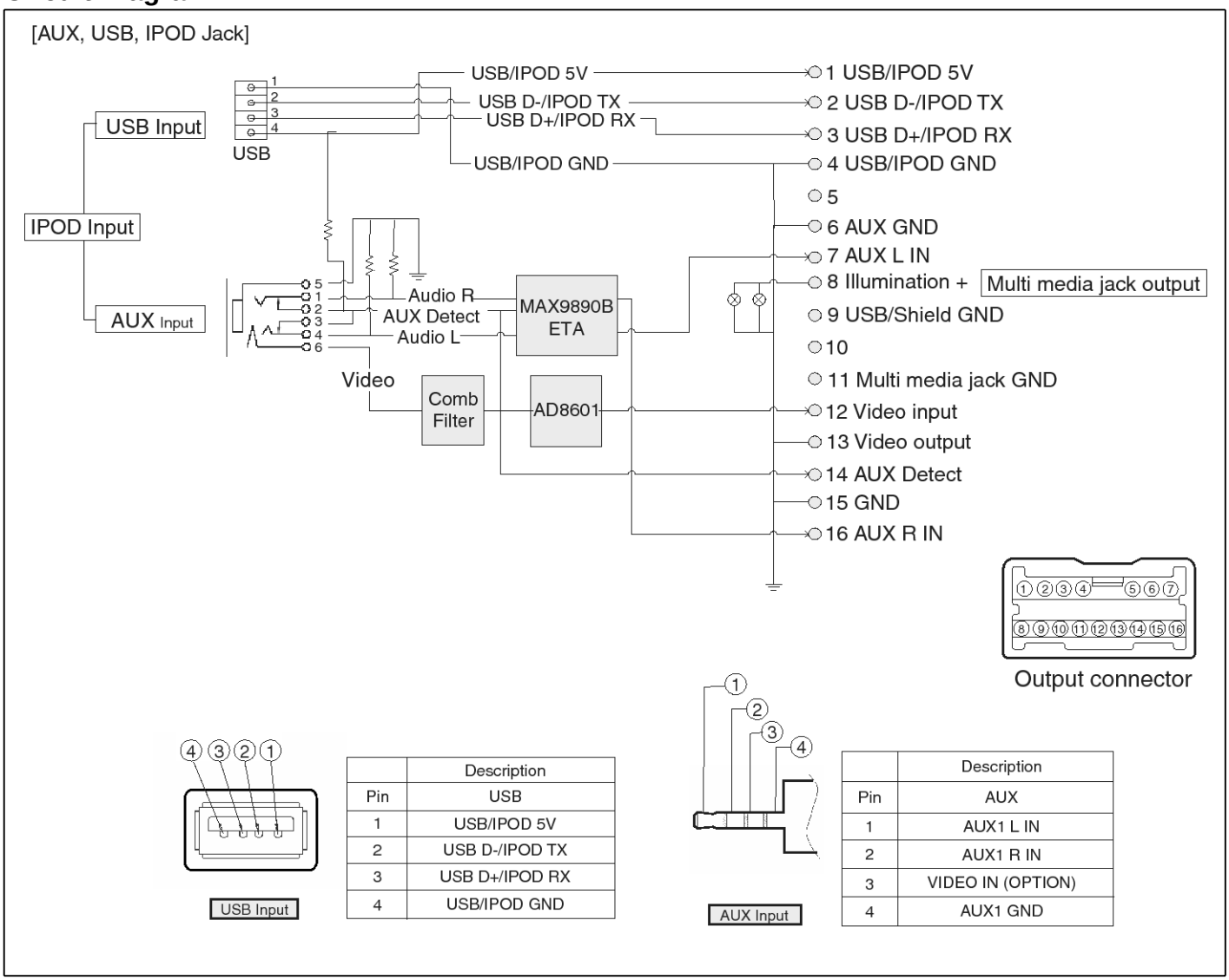
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## A/V Jack

### Circuit Diagram




| | Description |
|---|---|
| Pin | USB |
| 1 | USB/IPOD 5V |
| 2 | USB D-/IPOD TX |
| 3 | USB D+/IPOD RX |
| 4 | USB/IPOD GND |

| | Description |
|---|---|
| Pin | AUX |
| 1 | AUX1 L IN |
| 2 | AUX1 R IN |
| 3 | VIDEO IN (OPTION) |
| 4 | AUX1 GND |

SBHBE9283L

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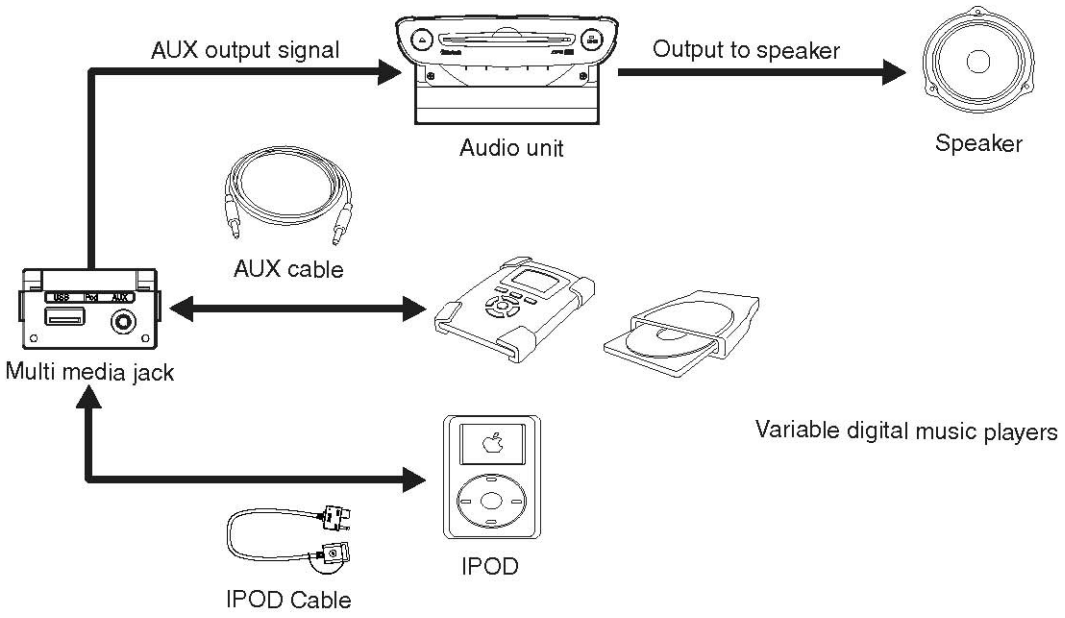
https://autolibrary.ir

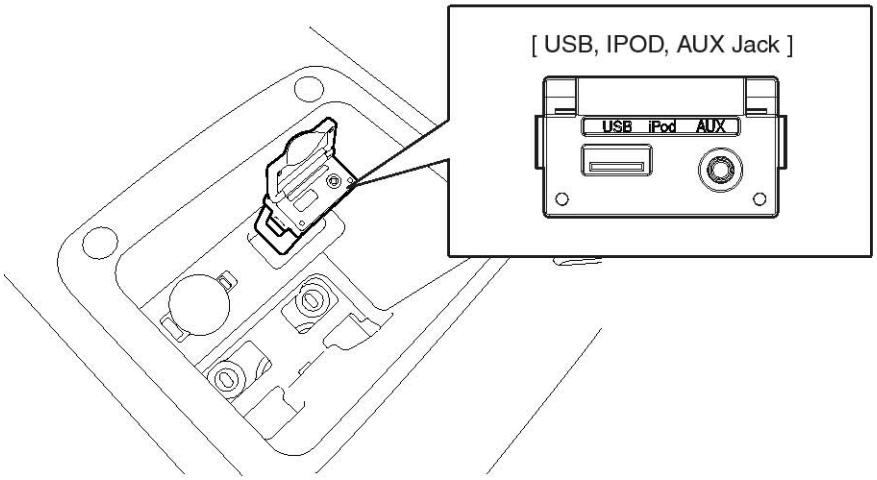


## Description

The AUX JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPOD and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.

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




SBHBE9037L

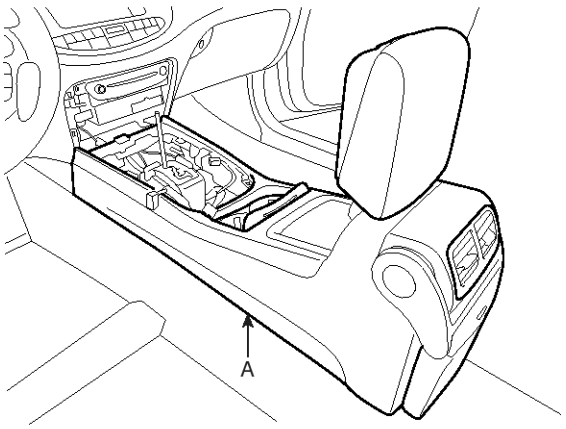
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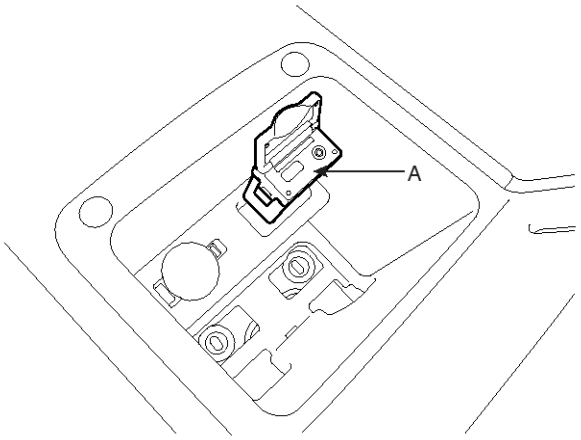
## Removal

1. Remove the floor console (A). (Refer to Body group - Console)




SBHBE8291D

2. Disconnect the jack assembly connector from the floor console.
3. Remove the Multi media Jack (A) from the floor console.



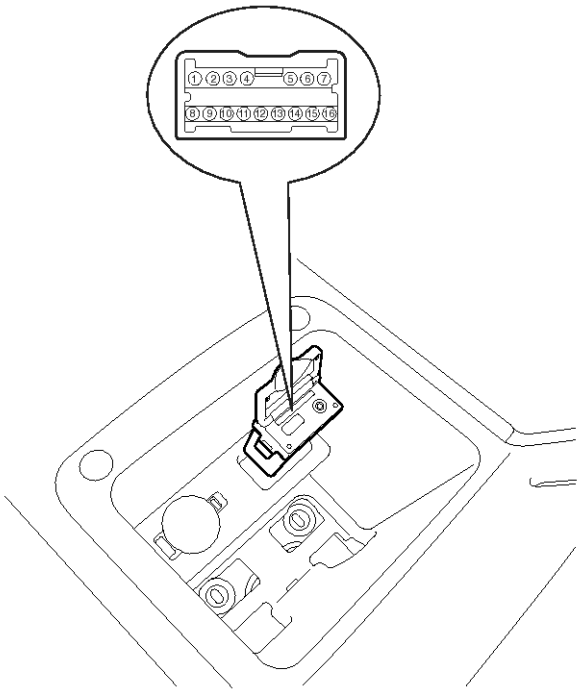

SBHBE8292D

## Installation

1. Install the Multi media Jack.
2. Connect the Multi Media Jack connector.
3. Install the under cover to the floor console.

## Inspection

1. Disconnect the negative(-) battery terminal.
2. Disconnect the Multi Media Jack connector after from the floor console.



SBHBE8293D

3. To inspect USB/IPOD port, check the voltage between NO.1 and 4 terminal of.

**Standard value:** 5V

4. To inspect AUX Jack, check the voltage between NO. 14 terminal of Jack output connector and NO.4 terminal of USB/IPOD input port at AUX input.

**Standard value:** 5V

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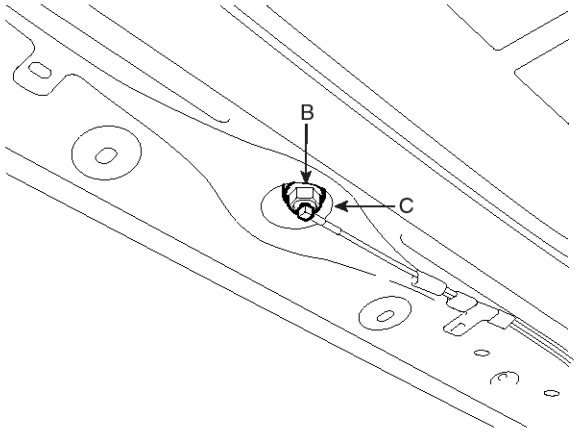


## The Other DIS Component

### Removal

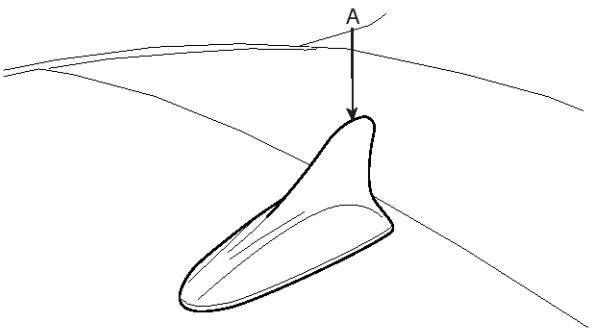
#### Roof Antenna

1. Remove the rear roof trim. (Refer to the Body group - Roof trim)
2. Disconnect the GPS cable (C) after removing a nut ( B).




SBHBE9447L

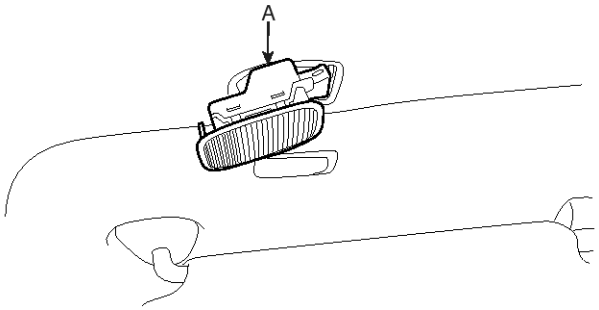
3. Remove the roof antenna (A).




SNFBE9039D

#### Hands free Mic

1. Remove the hands free mic.




SBHBE8405D

### Installation

#### Roof Antenna

1. Connect the GPS cable and XM radio cable.
2. Install the roof trim.

#### Hands free Mic

1. Install the hands free mic.

#### Media Orientated system transport(MOST)

1. The outline
   - MOST(Media Orientated System Transport) is the agreement or high lan system to operate and connect multimedia unit distance of light foundation with 1 POF.
   - Optical Fiber Communication is the communication process that transmit the information through Optical Fiber Cable in a different way with wire communication using metal center wire wireless communication using frequency.
   - POF(Plastic Optical Fiber) : It is used in vehicles with plastic fiber cable using plastic with core and clading materials.
   - System outline
     a. Structure : ring type
     b. Transmision speed : 24.8Mbps
     c. Interface : standardization in MOST organization(Germany)
     d. Application : digital audio, navigation

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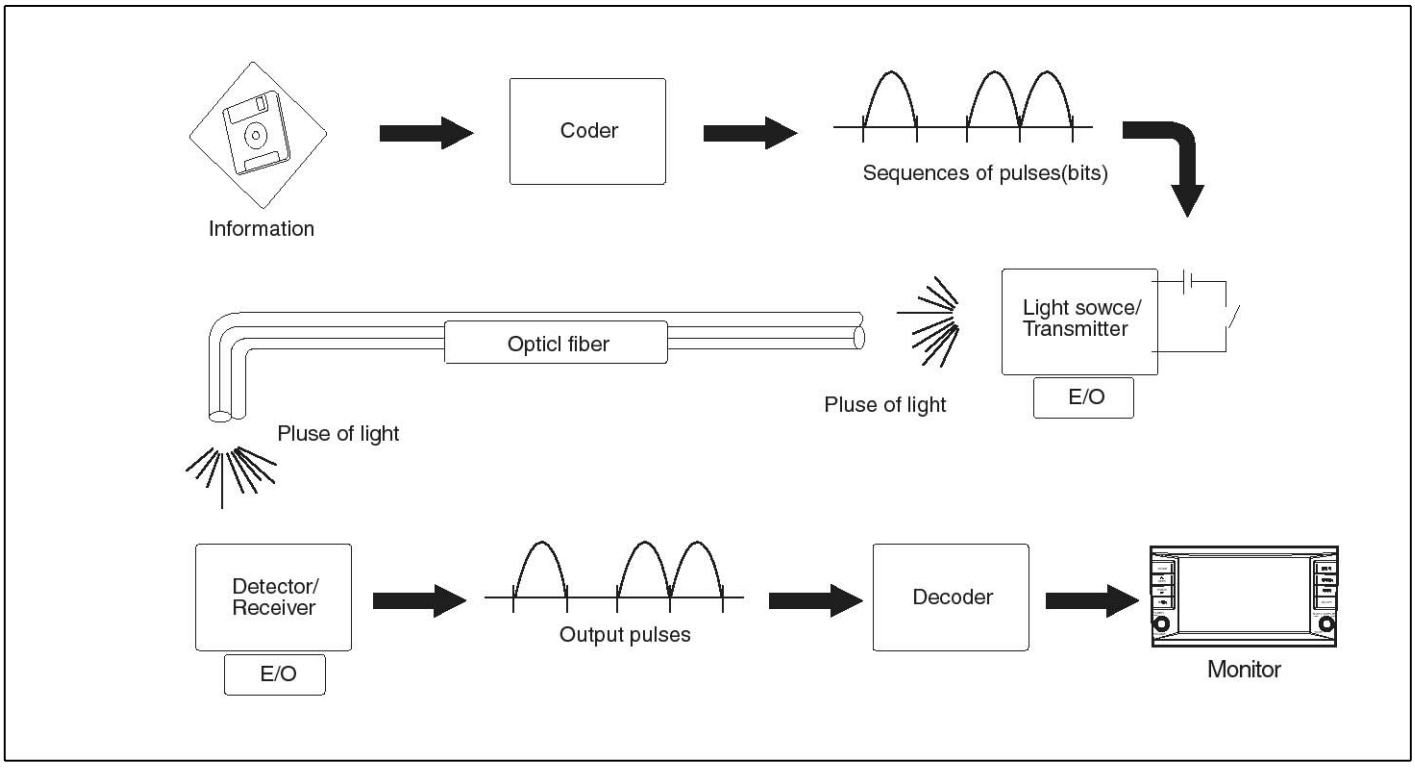
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2. Characteristic
   - Simple structure of ring type : It is easy to design and keep up and it has excellent module extension.
   - Optical area lan system construction : possibility of mass storage high speed transmision.
   - No barrier by noise : quantity upgrade for multimedia working.
   - Reduction of circuit quantity and weight and connector quantity compared with wire : It is higher in assembly and maintenance relationed with working ability and fuel efficiency,
   - Possibility of multi functional data transmision : digital audio, vedio, control sign and so on.
3. Organization of Optical Fiber Communication

| | |
|---|---|
| 1.Coder | conversion to electric sign that information makes code |
| 2.Light source/Transceiver | coversion electric sign to optical sign and incidence to optical fiber. |
| 3.Optical Fiber Cable | transmision optical sign to its destination. |
| 4.Optical Fiber Repeater | coverage about distortion present situation of optical sign by optical damage and dispersion(optical sign → electric sign → amplification → optical sign) |
| 5.Detector / Transceiver | conversion to electric sign by detector optical sign transferred through |
| 6.Decorder | conversion coded electric sign to original information form. |

4. Optical communication organization chart



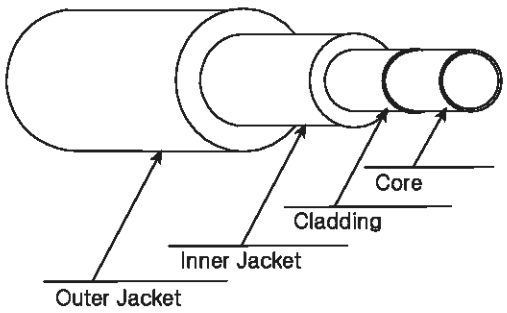

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5. Structure and Characteristic of POF




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- Cable = fiber + outter jacket + inner jacket
- Fiber = core + clading
- Core = core to transfer light with PMMA(Poly methyl methacrylate)(light transit layer)
- Clad : differ refraction rate to be whole total reflection of light and layer next to core with (F-PMMA : Fluorine Poly Methyl Methacrylate)(break layer)
- Jacket : prevention and handle of optical fiber to prevent damage and wear and moisture with Polyamide. (coating layer)

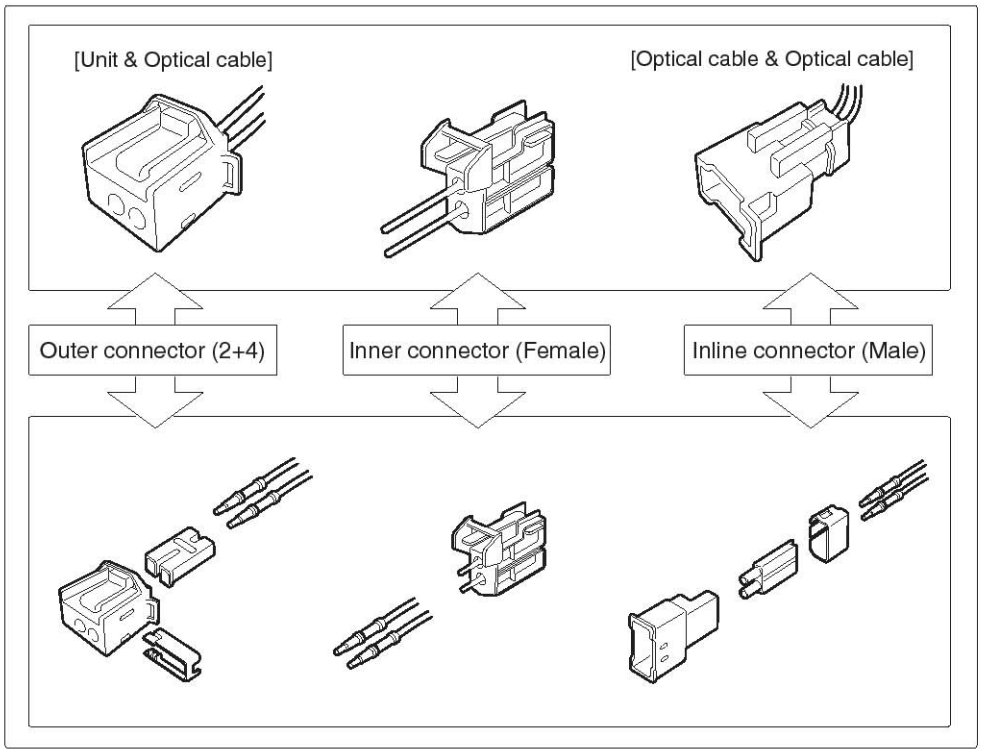
6. Characteristic of POF
   - Refraction rate of Clad is lower than core, so the light transferred from one end side of optical fiber causes total reflection in core and contact surface of clad and moves to end side of optical fiber.
   - Light trasmit efficiency rate of POF is much higher because cross section that light is processing posseses 98% of whole optical fiber.

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7. Main connector shape




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8. Direction and caution in handling optical cable(general subject reference)
9. Method in optical cable's keeping for long(general subject reference)
10. Method in removal of grind surface dust of optical cable(general subject reference)
11. Method in optical cable connector replace(general subject reference)
12. Method in optical cable ass'y(general subject reference)

### Detachment

* Direction and caution in handling optical cable

a. A/V, navi system detachment/caution of optical cable not to be bended or twisted.
b. Temperature control not to be against permissible temperature in a works or storage.(-40℃ ~ 85℃)
c. Attachment of dust cap for the dust not to be input in connector and each unit in case of detachment of optical cable.
d. No hand or dust contact in end side surface of Ferrule of optical cable.
e. No throwing or steping on floor.
f. No optical twisting.

## Troubleshooting

### VRS DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | U1001 | Microphone 1 not connected |
| 2 | U1002 | Microphone 1 shortcut |

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# U1001 Microphone 1 not connected

## General Description

A microphone is

1. a high effective AKG microphone
2. installed at the ceiling of driver seat
3. speech received and handsfree

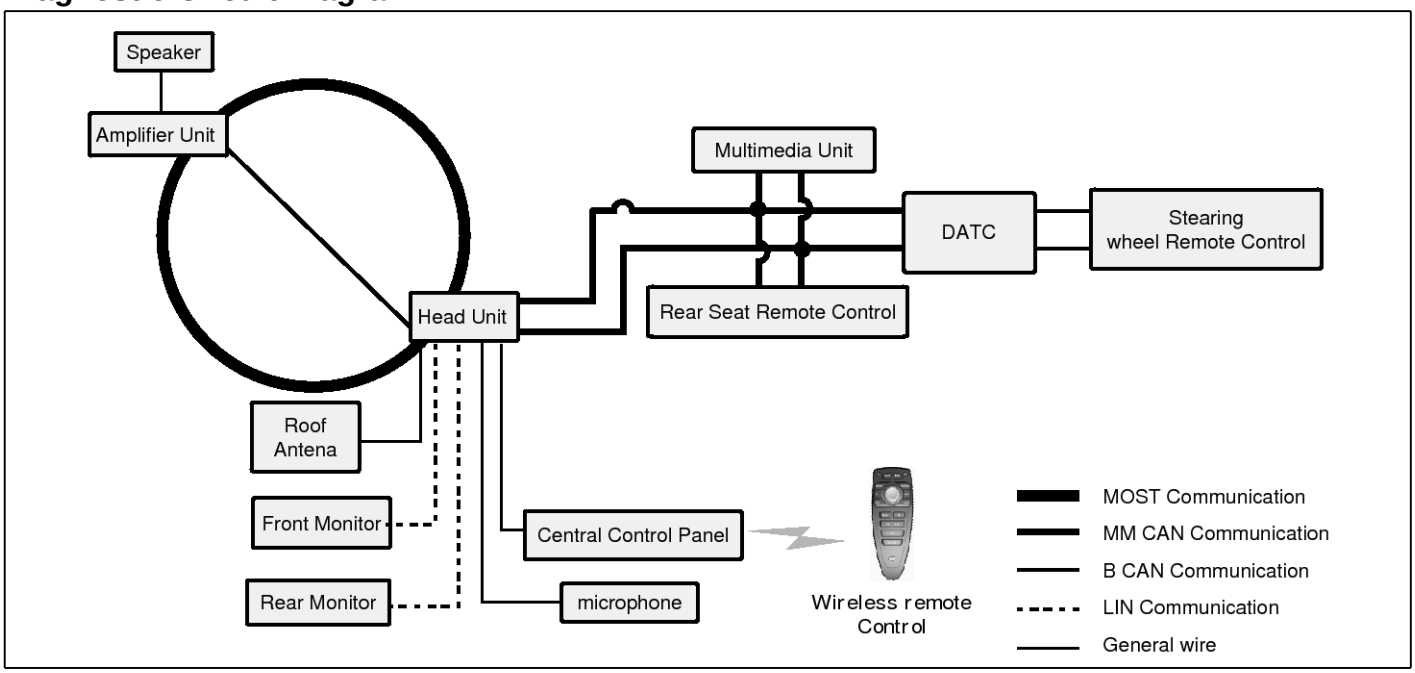
## DTC Description

This code is set when a circuit of a microphone is opened .

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Self diagnosis | • Disconneted connetor of a microphone<br>• circuit is opene<br>• a microphone |
| Enable Conditions | • IG ON | |
| Threshold value | • A microphone circuit is opened. (Disconneted connetor) | |
| Diagnosis Time | • immediately | |

## Diagnostic Circuit Diagram




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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 "Signal Circuit Inspection" procedure.

## Signal Circuit Inspection

1. IG "OFF".
2. Disconnected a microphone connector.
3. IG KEY "ON"
4. Measure waveform between terminal (+) of a microphoneee circuit and chasis gound.

**Specification :** about 7.8V

5. Is the measured value within specifications?

**YES** ▶ Go to next procedure.

**NO** ▶ Check for short circuit in signal harness. Repair as necessary and go to "Verification Vehicle Repair" procedure.

## Check for short circuit

1. IG KEY "OFF"
2. Disconnected connectors of a microphone and Head unit.
3. Measure resistance between terminal (-) of a microphonee circuit and terminal (-) of Head unit circuit.

**Specification :** 0Ω

4. Is the measured resistance within specifications?

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

**NO** ▶ Check for short circuit in signal harness. Repair as necessary and go to "Verification Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. After connecting Scan tool select "DIAGNOSTIC TROUBLE CODES(DTCs)" mode.
2. Clear recorded DTC using Scan tool.
3. After selecting "DIAGNOSTIC TROUBLE CODES(DTCs)" mode and check if DTC is recorded again..
4. Are any DTCs recorded ?

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

**NO** ▶ Go to "Signal Circuit Inspection" procedure.

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# U1002 Microphone 1 shortcut

## General Description

Refer to DTC U1001 : Microphone 1 not connected.

## DTC Description

This code is set when a circuit of a microphone short to chasis gound.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Self diagnosis | • short circuit<br>• a microphone |
| Enable Conditions | • IG ON | |
| Threshold value | • Supply voltage under 0.2V | |
| Diagnosis Time | • immediately | |

## Diagnostic Circuit Diagram

Refer to DTC U1001 : Microphone 1 not connected.

## Terminal and Connector Inspection

Refer to DTC U1001 : Microphone 1 not connected.

## Signal Circuit Inspection

Refer to DTC U1001 : Microphone 1 not connected.

## Check for short circuit

Refer to DTC U1001 : Microphone 1 not connected.

## Verification of Vehicle Repair

Refer to DTC U1001 : Microphone 1 not connected.

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# Multifunction switch

## Specification

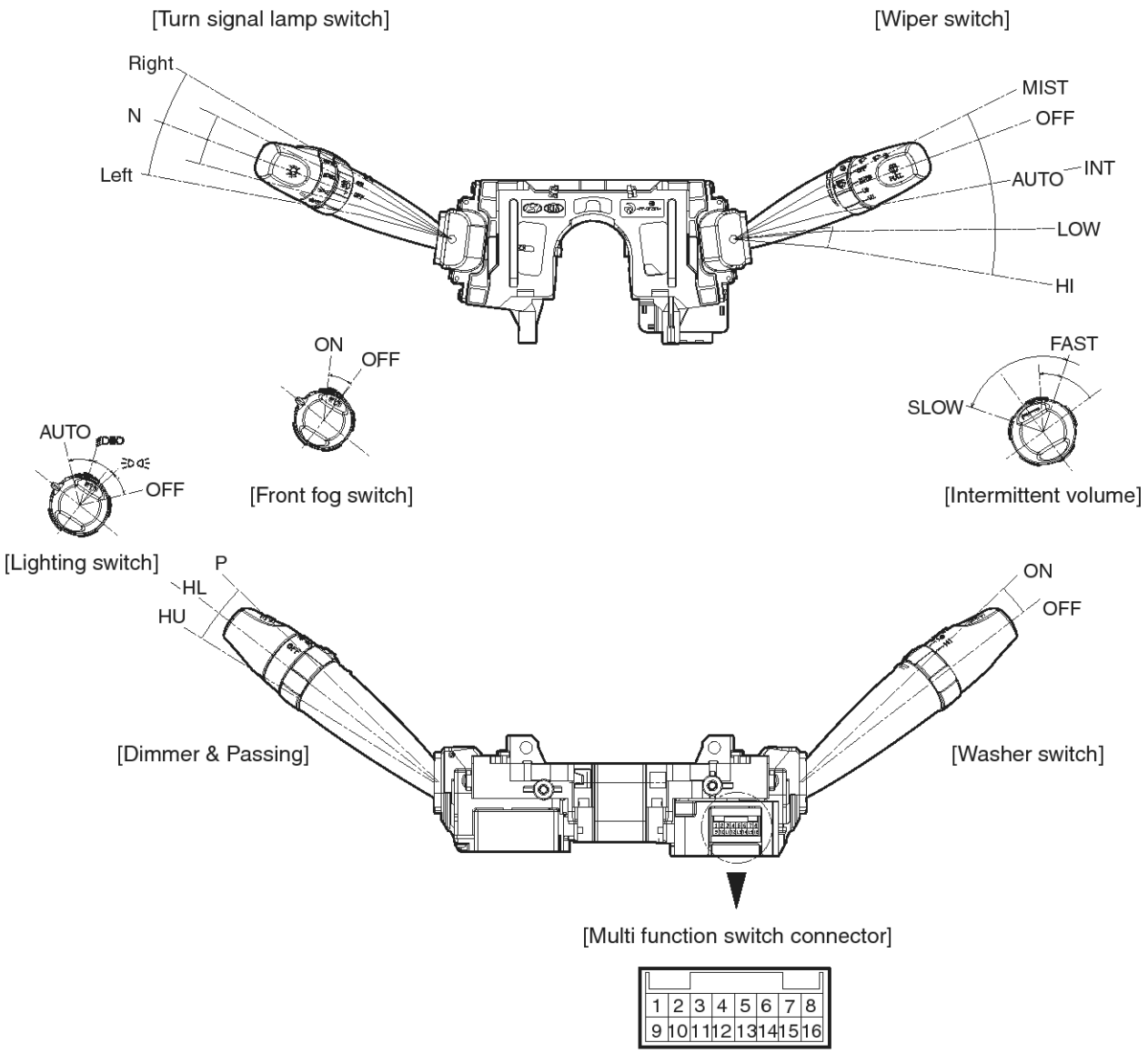
| Items | | Specifications |
|---|---|---|
| Rated voltage | | DC 12V (Test voltage: 14.5V) |
| Operating temperature range | | -30˚C ~ +80˚C |
| Rated load (12V) | Lighting switch | 0.4A (Relay load) |
| | Wiper switch | 0.2A (Relay load) |
| | Washer switch | 0.2A (Relay load) |

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## Component Location




**Circuit connection**

| Pin | Description | Pin | Description |
|---|---|---|---|
| 1 | Audio signal 2 | 9 | Wiper |
| 2 | Audio GND 2 | 10 | Head lamp |
| 3 | Audio signal 1 | 11 | Washer |
| 4 | Audio GND 1 | 12 | - |
| 5 | CAN High | 13 | - |
| 6 | CAN Low | 14 | Cruise GND |
| 7 | IGN 1 | 15 | Cruise signal |
| 8 | B+ | 16 | GND |

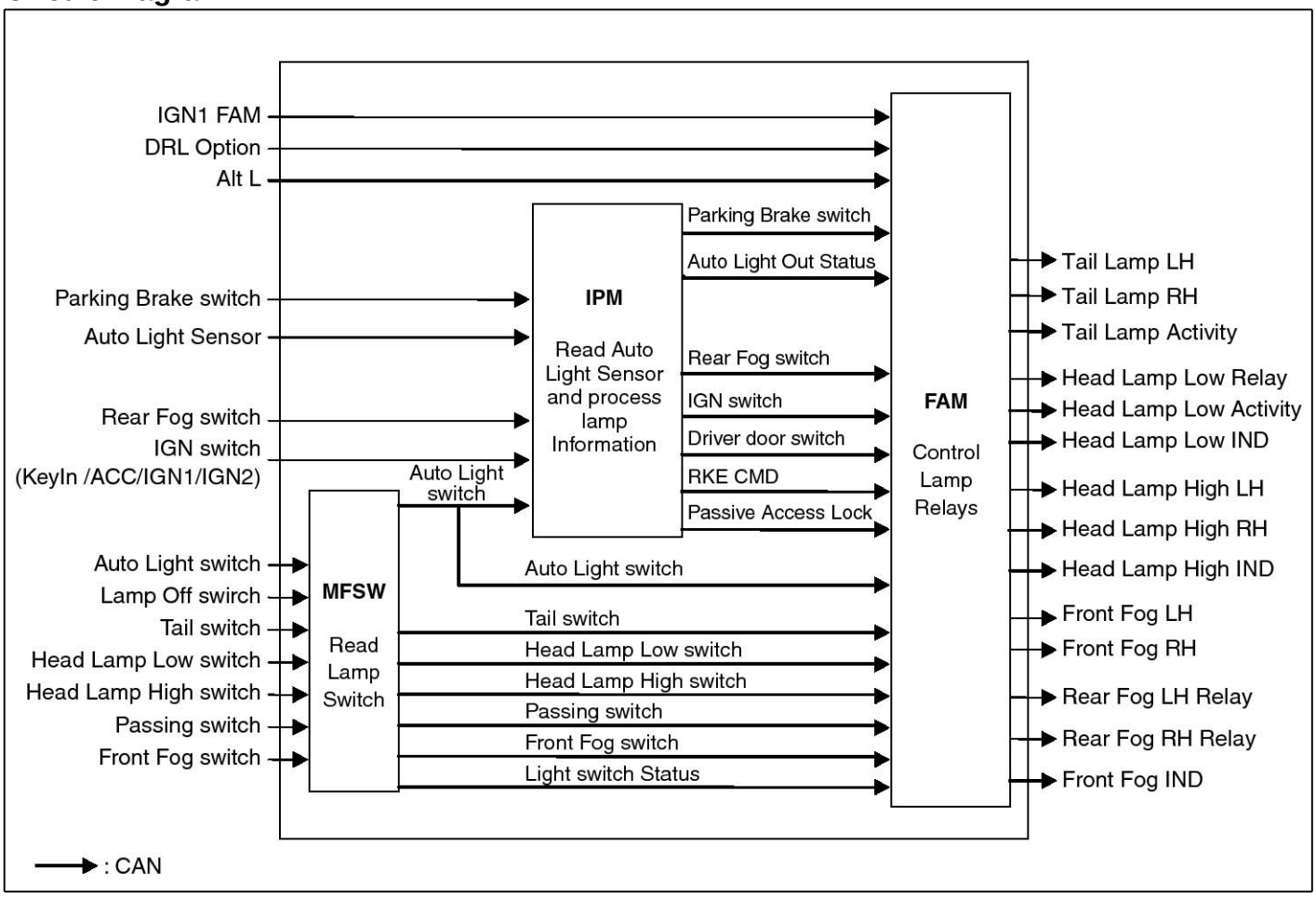
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## Circuit Diagram




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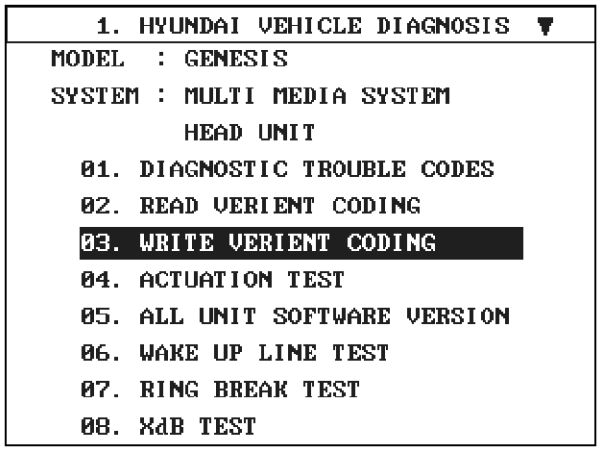
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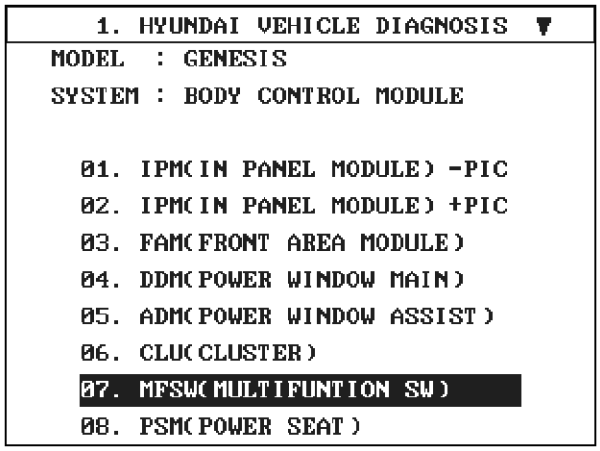


## Inspection

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

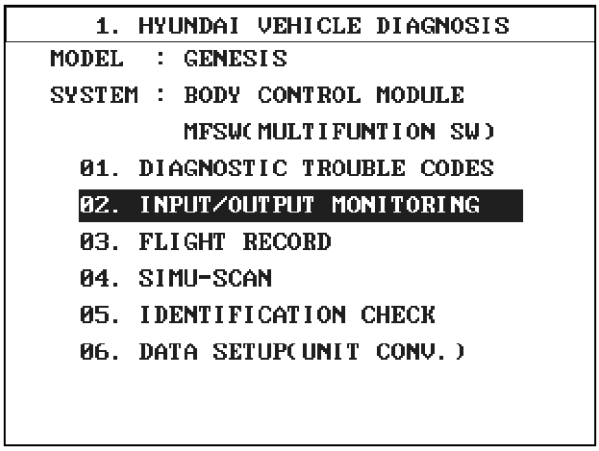



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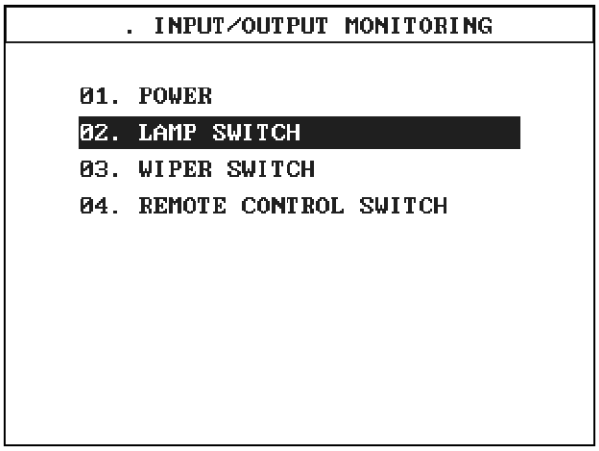

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3. Select "Input/output monitoring".

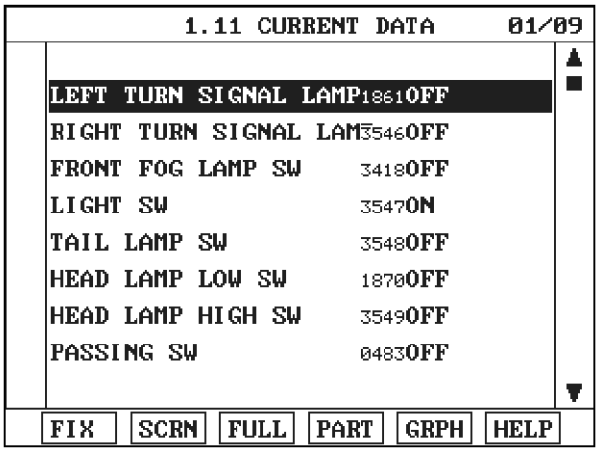



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4. Check the input/output condition of "Lamp switch".




SBHBE9287L



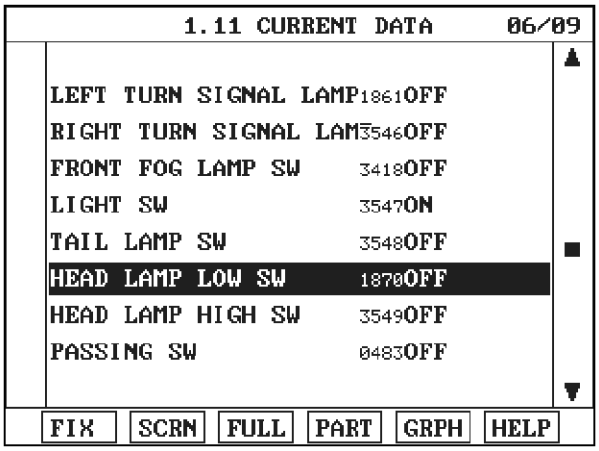

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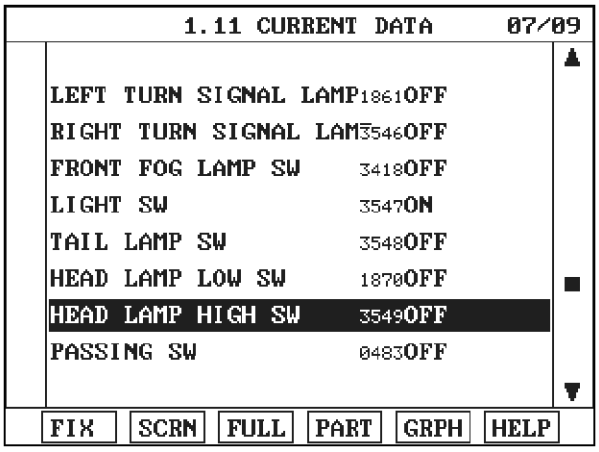
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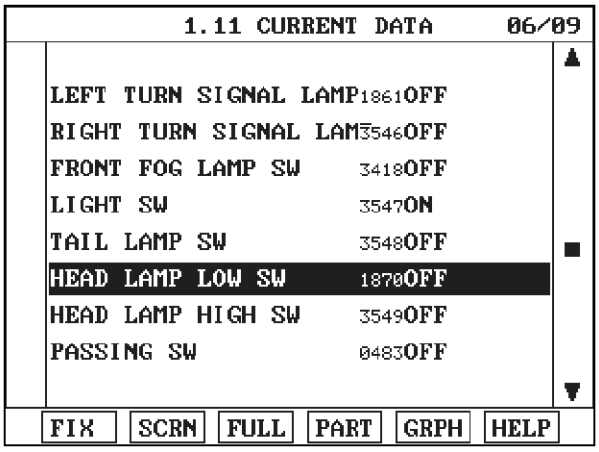
5. Check the input/output condition of "LAMPS".



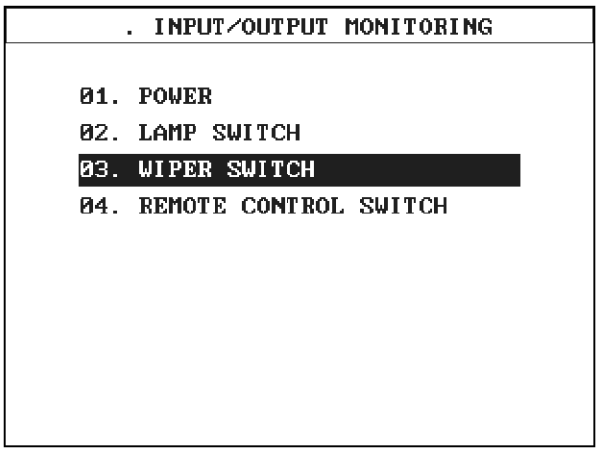

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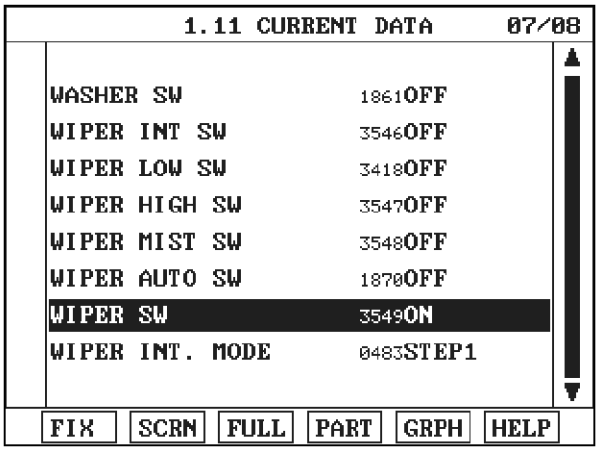



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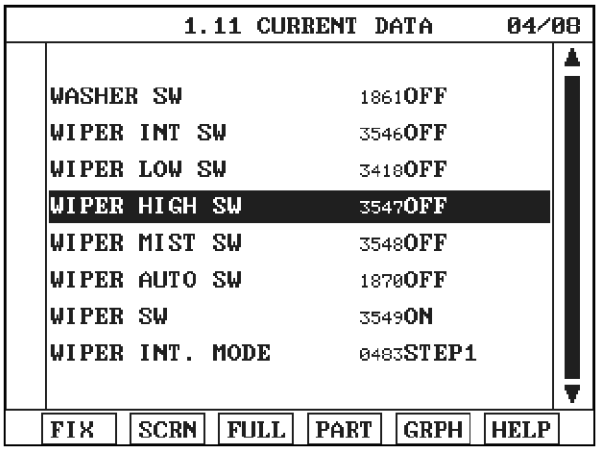



SBHBE9292L

6. Check the input/output condition of "WIPER".




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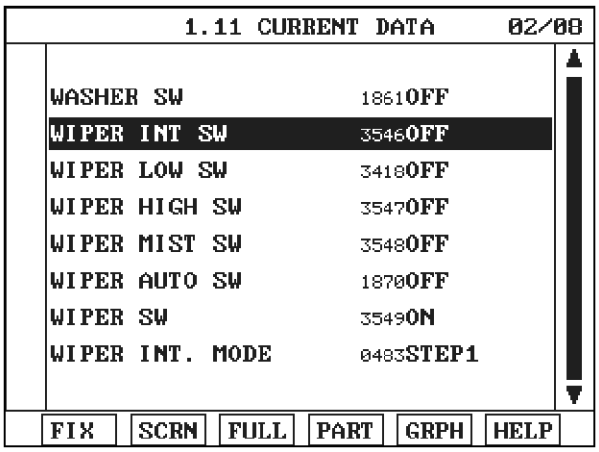



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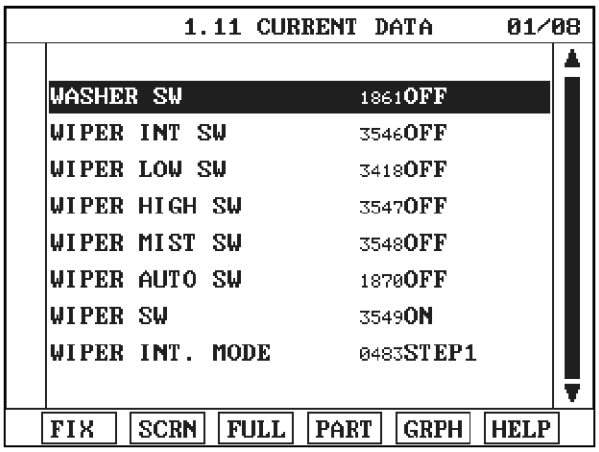
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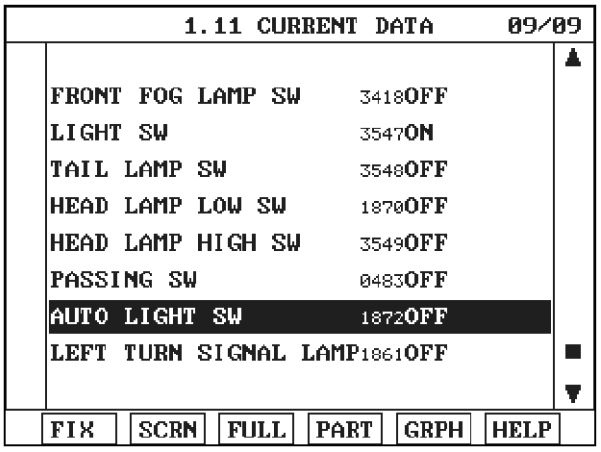



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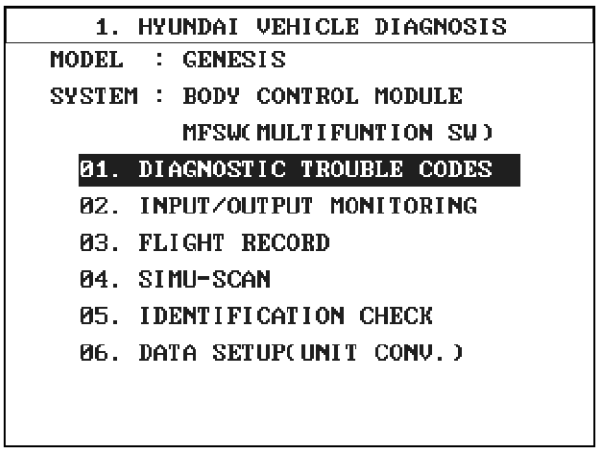

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7. Check the input/output condition of "AUTO LIGHT".




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8. To check the DTC of the multifunction switch, select "DIAGNOSTIC TROUBLE CODES"




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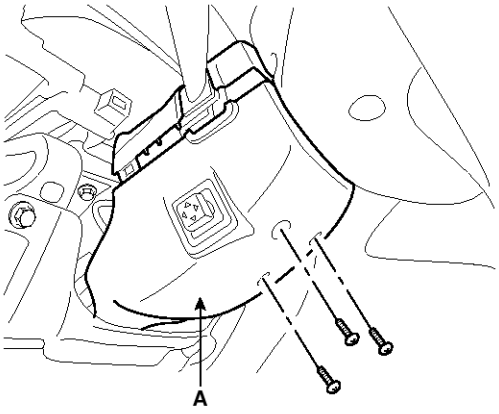
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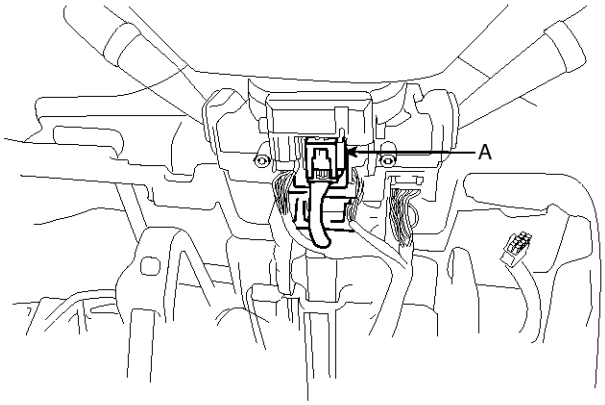
## Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 3 screws and connector.

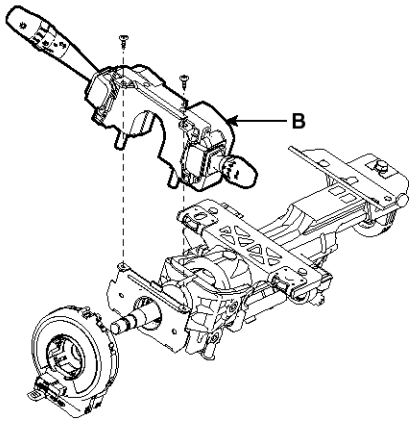



SBHBE8106D

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




SBHBE8107D




SBHBE8105D

## Installation

1. Install the multifunction switch after connecting the connectors.
2. Install the steering column upper and lower shrouds.

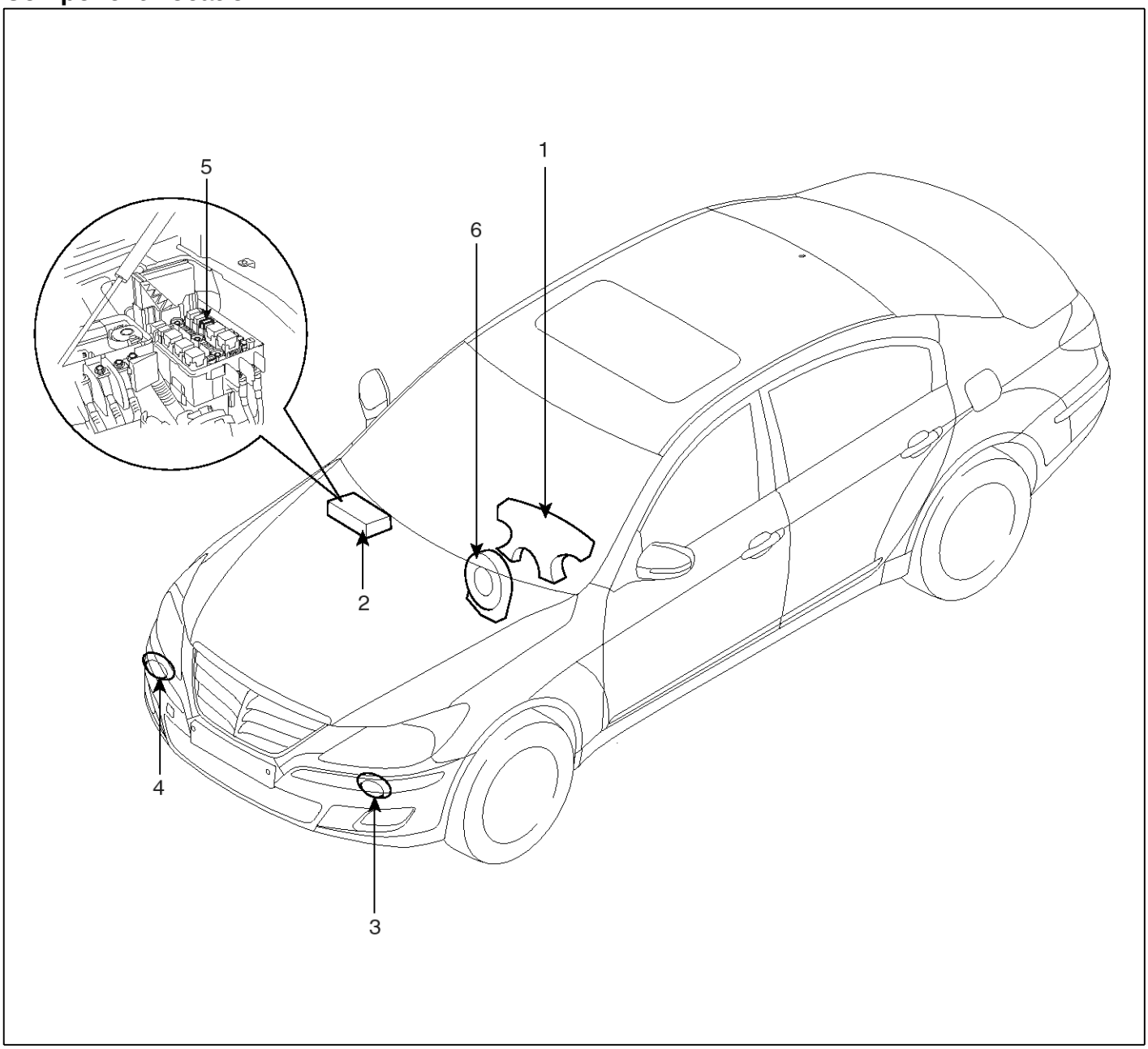
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# Horn

## Component Location




SBHBE8198D

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

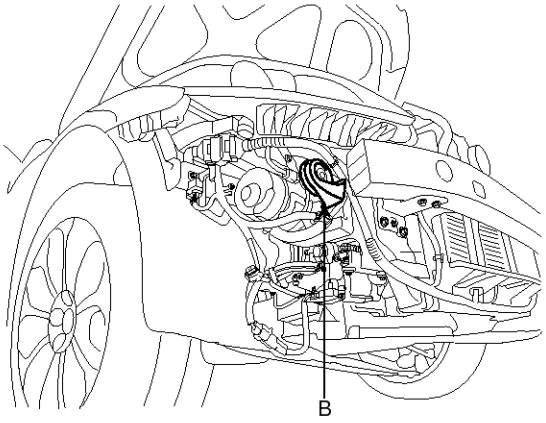
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## Replacement

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 (B) and low pitch horn (A).




SBHBE8199D

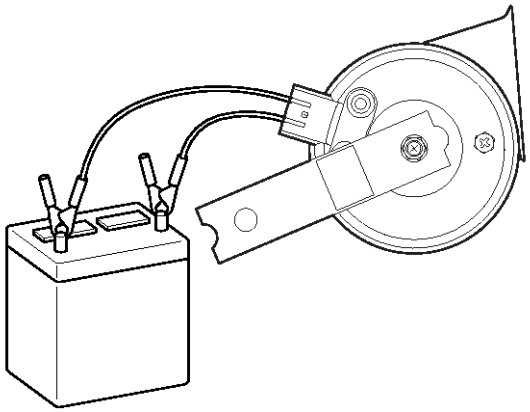
## Installation

1. Connect the horn connector, then reassemble the high pitch horn and low pitch horn.
2. Reassemble the front bumper.

## Inspection

Test the horn by connecting battery voltage to the 1 terminal and ground the 2 terminal.

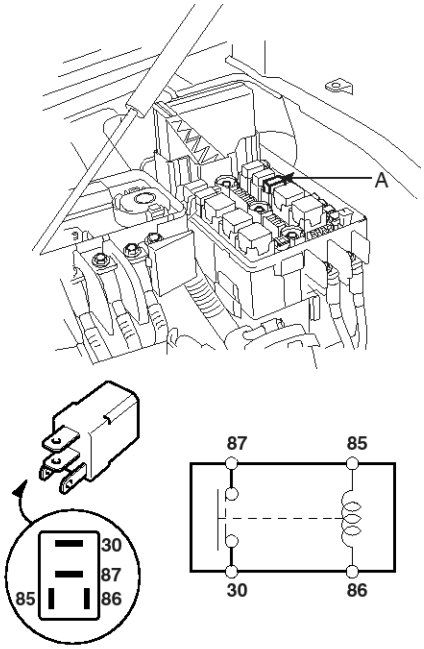
The horn should make a sound. If the horn fails to make a sound, replace it.



SBHB18128D

## Horn Relay Inspection

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




SBHBE8200D

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

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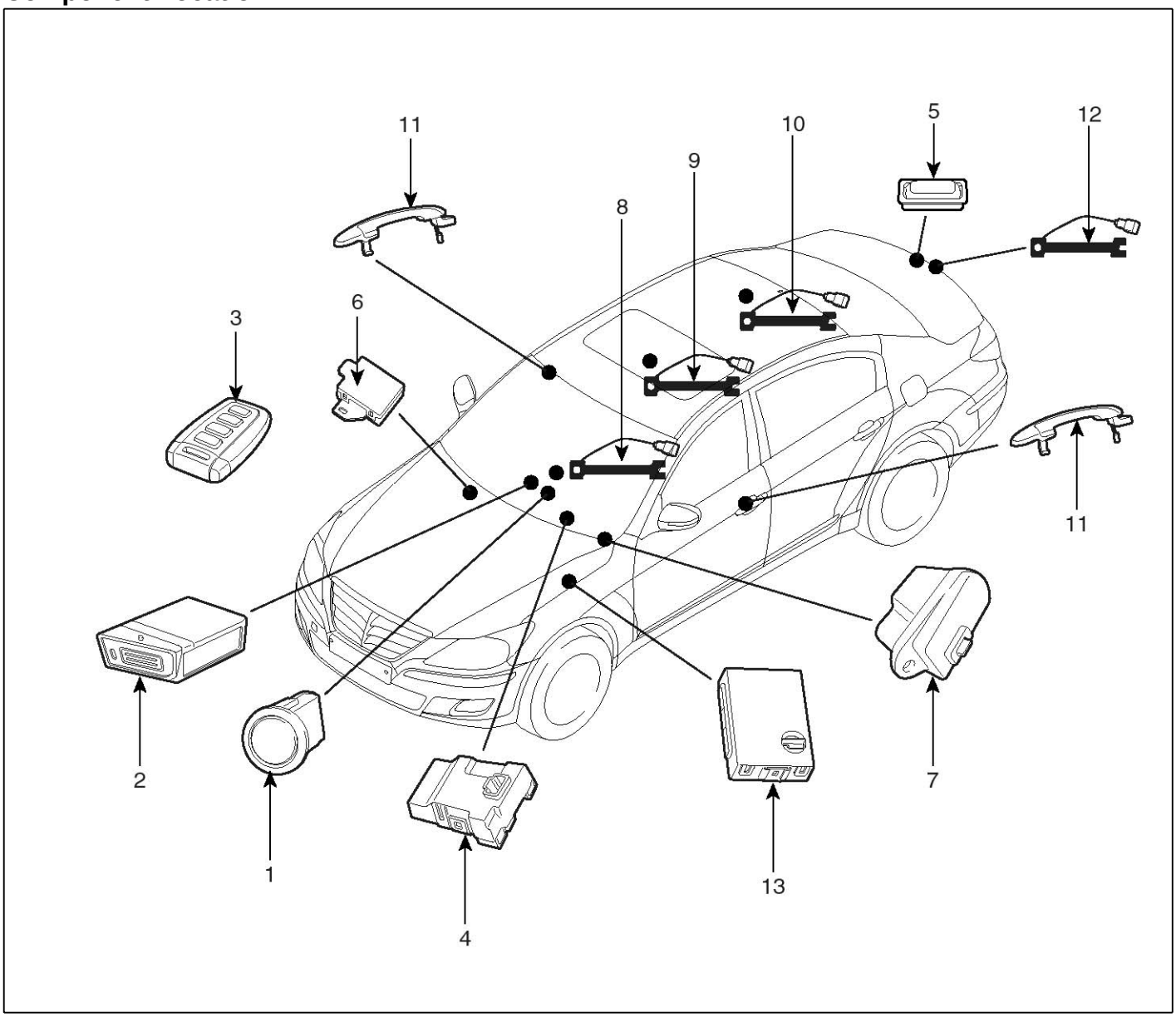
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# Button Engine Start System

## Component Location




SBHB18129D

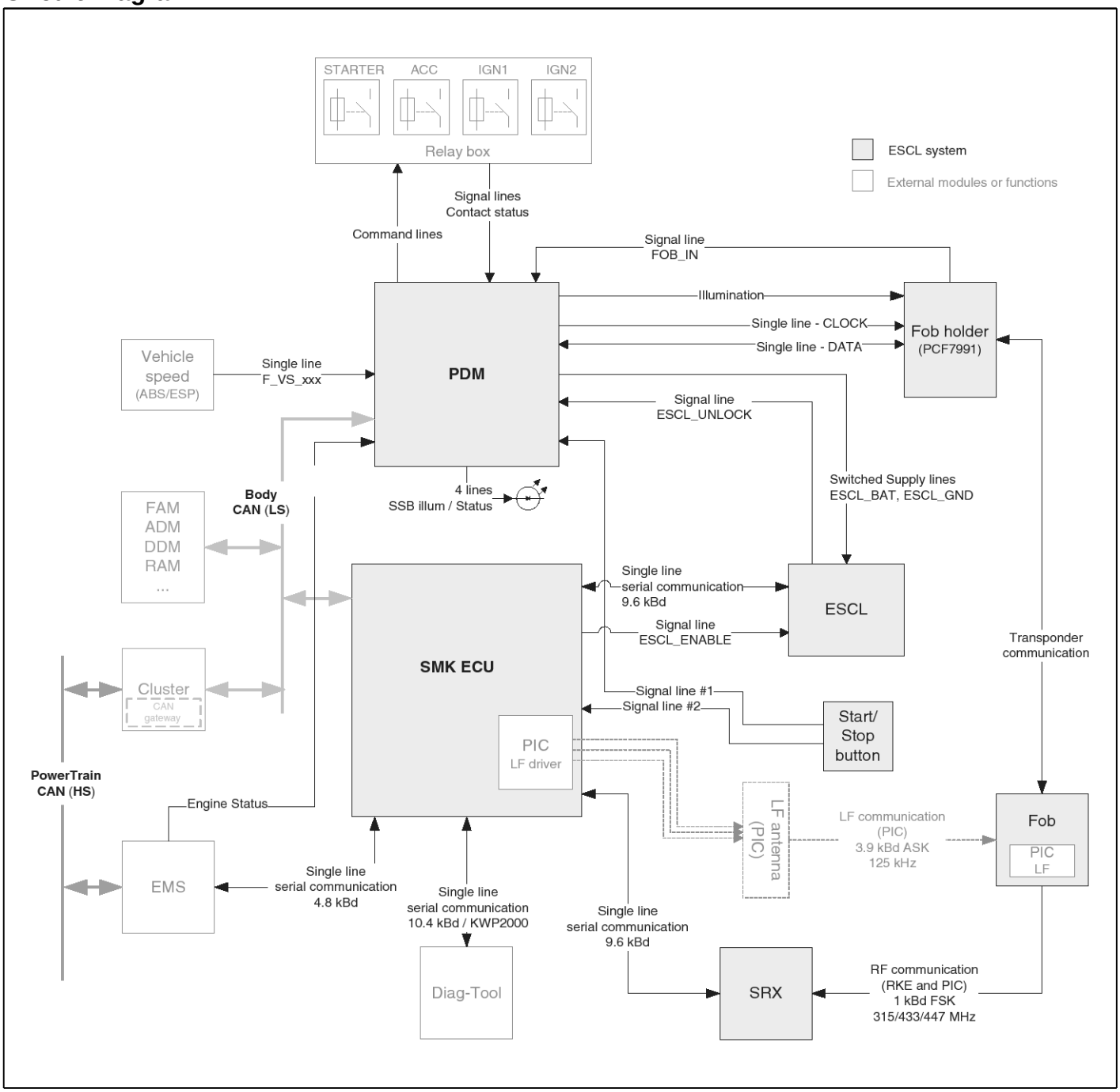
1. Start Stop Button(SSB)
2. FOB key holder
3. FOB key
4. PDM(Power Distribution Module)
5. Trunk lid switch
6. RF receiver
7. ESCL(Electrical Steering Column Lock)
8. Interior antenna 1
9. Interior antenna 2
10. Interior antenna 3
11. Door handle & door antenna
12. Bumper antenna
13. IPM(Instrument Panel Module)

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## Circuit Diagram




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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.

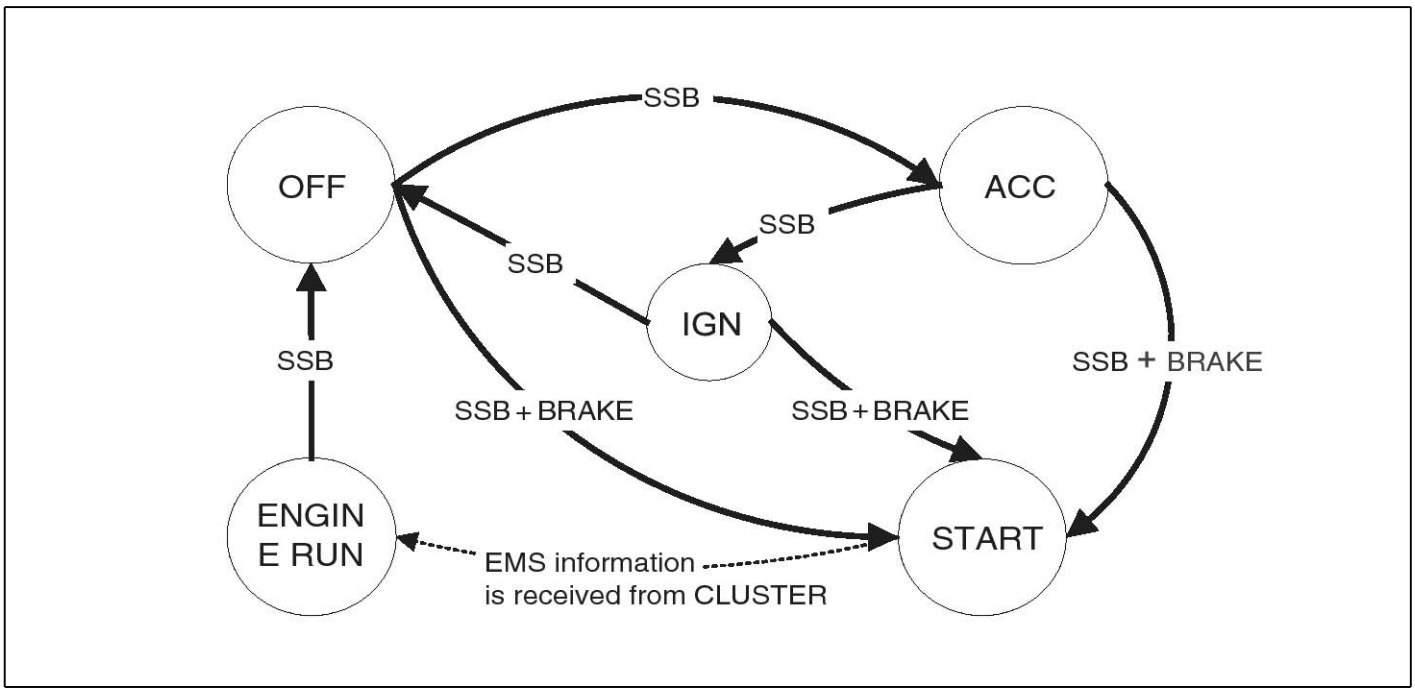
If the conditions for engine cranking are not satisfied while a push on the SSB is detected and a valid fob authenticated, the system will unlock the steering column and switch the terminals to IGN. Another push on the SSB will be necessary to start the engine.

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**

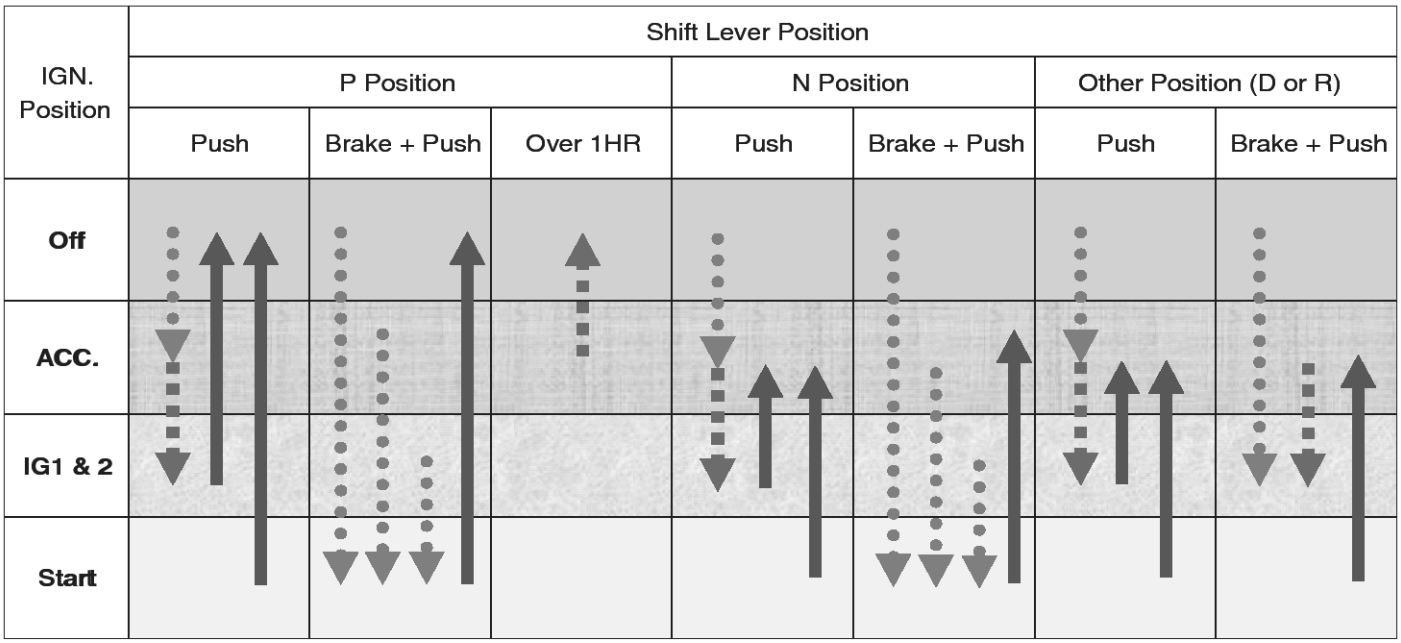
| No. | Ignition conditions | Start Button LED status |
|---|---|---|
| 1 | IG OFF | LED OFF |
| 2 | IG ACC | Amber color LED ON |
| 3 | IG ON (Engine OFF) | Green color LED ON |
| 4 | Cranking | Maintain LED status before cranking |
| 5 | Engine running | LED OFF |

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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

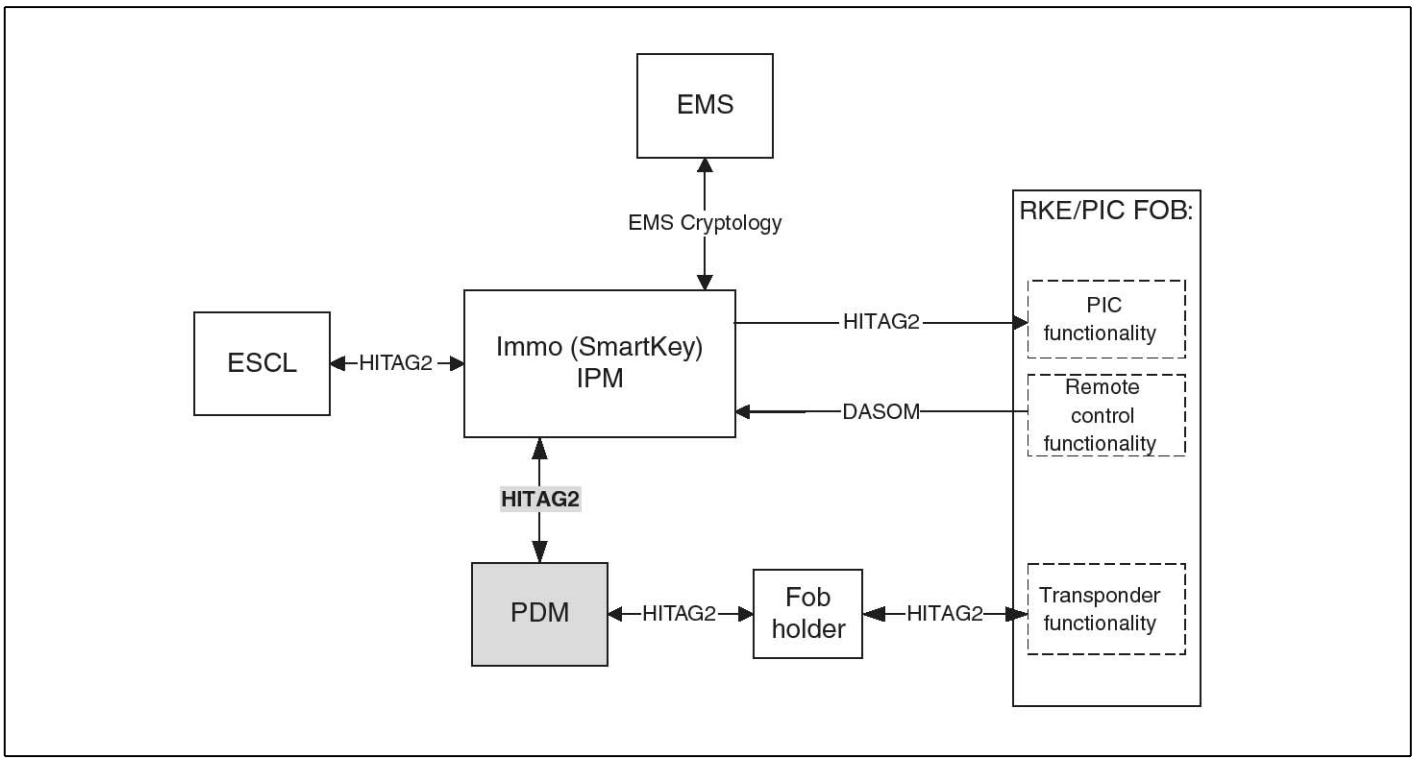
The SMK manages all function related to:

- "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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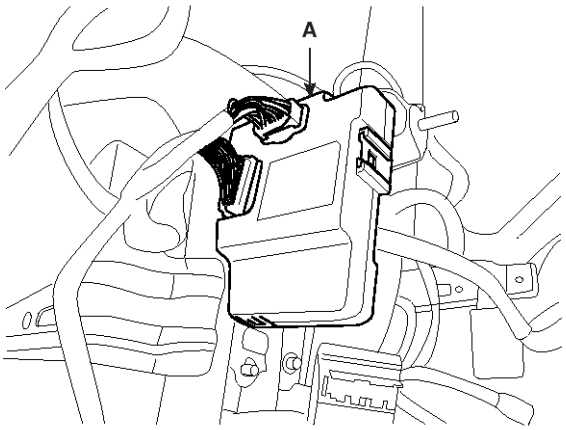
The unit behaves as Master role in the whole system.

In case of SMART KEY application, for example “Passive Access”, “Passive Locking” and “Passive Authorization a-re integrated for ESCL/Terminal switching Operations”.

It collects information about vehicle status from other mo-dules (vehicle speed, alarm status, driver door open...), r-eads the inputs (e.g. SSB, Capacitive Sensor / Lock Butt-on, PARK position Switch), controls the outputs (e.g. ext-erior and interior antennas), and communicates with oth-ers devices via the CAN network as well as a single line i nterfaces.

The diagnosis and learning of the components of the BE-S System are also handled by the SMK.

**PDM**




SBHBE8442D

The PDM (A) manages the functions related to the "termi-nal 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 switchi-ng the power and ground ESCL supply lines depending on vehicle status. The purpose of this function is to prev-ent the ESCL to be energized if ACC or IGN are switched on.

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The PDM is also controlling the illumination of the SSB a-s 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 t hat the control of the terminal and of the ESCL power is secured even in case of failure of one of the two microcontrollers, system inconsistency or interruption of communication on the CAN network.

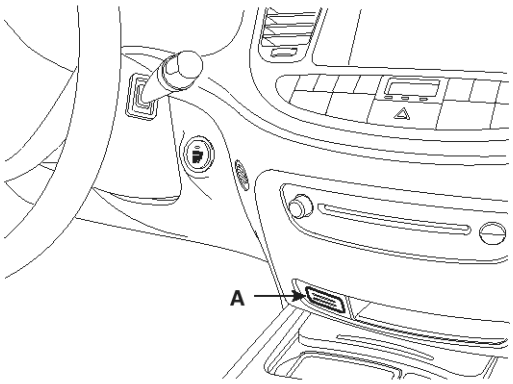
In case, failure of one of the two controllers, the remaining controller shall disable the starter relay and the ESCL power supply. The IGN1 and IGN2 terminals relays shall be maintained in the state memorized before the failure and the driver shall be able to switch those IGN terminals off by pressing the SSB with EMERGENCY_STOP pressing sequence. However, engine restart will not be allowed. The state of the ACC relay will depend on the type of failure.

The PDM is diagnosed through theSMK MUT service, using the CAN network.

The main functions of the PDM are:

- Control of Terminal relays
- Monitoring of the Vehicle speed received from sensor or ABS/ESP ECU.
- Control of SSB LEDs (illumination, clamp state) and FOB HOLDER illumination.
- Control of ESCL power lines and monitoring of the E-SCL 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




SBHBE8305D

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:

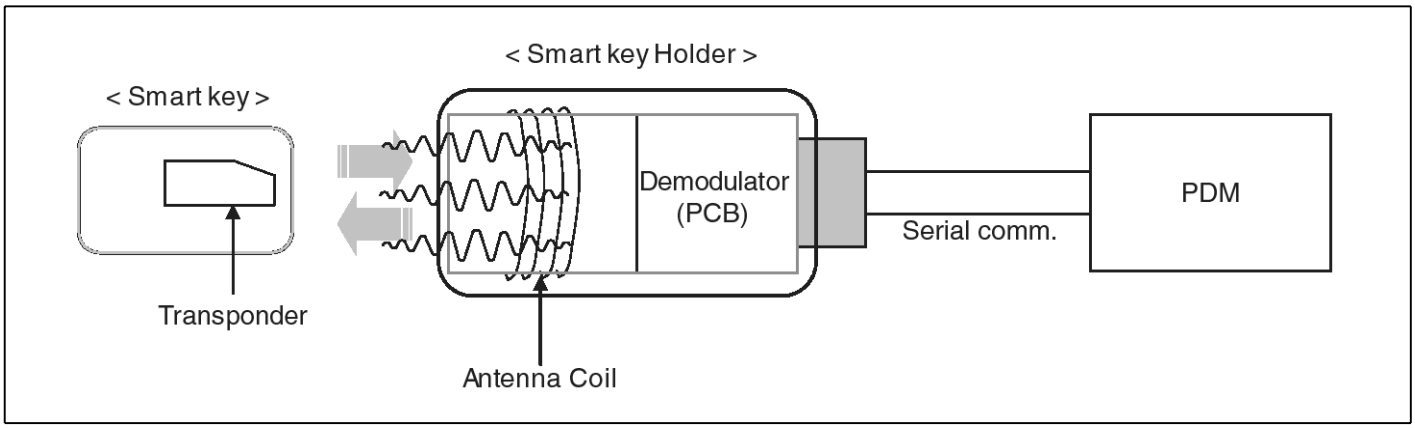
- Transponder base station
- Fob mechanical lock
- Illumination

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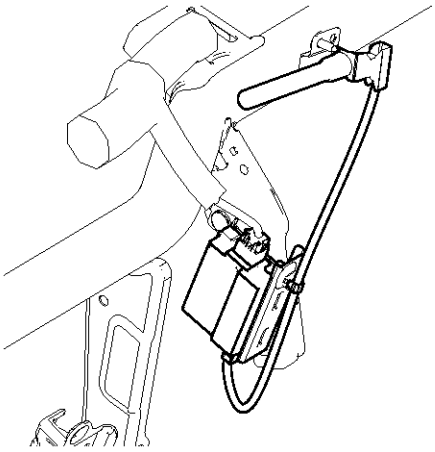


### Transponder




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### External Receiver(SRX)



SBHBE8443D

The data transmitted by the RKE or Smart key Fob is received by an external RF receiver called as SRX. This receiver will be same as that one for the SMK applications, with respect to electronics, housing, connector and software.

This receiver is connected to the SMK via a serial communication line.

### Terminal And Starter Relays

Relays will be used to switch the terminals ACC / IGN1 / IGN2. Those normally-open relays will be driven by the PDM and located either in the passenger or engine compartment depending on the vehicle architecture.

Only one relay coil is connected to the terminal outputs of the PDM.

Those relays should integrate a resistor connected in parallel to the coil in order to reduce the transients during commutation.

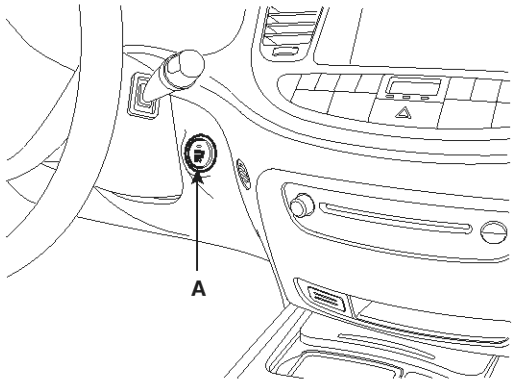
### Start/Stop Button(SSB)

A single stage push button is used for the driver to operate the vehicle. Pressing this button allows:

- To activate the power modes ‘Off’, ’Accessory’, ‘Ignition’ and 'Start' by switching the corresponding terminals
- To start the engine
- To stop the engine

The contact will be insured by a micro-switch and a backlighting is provided to highlight the marking of the button whenever necessary.

Two (2) LED colors are located in the center of the button to display of the status of the system. Another illumination LED is also integrated into the SSB for the lighting of the "Engine Start/Stop" characters.




SBHB18045D

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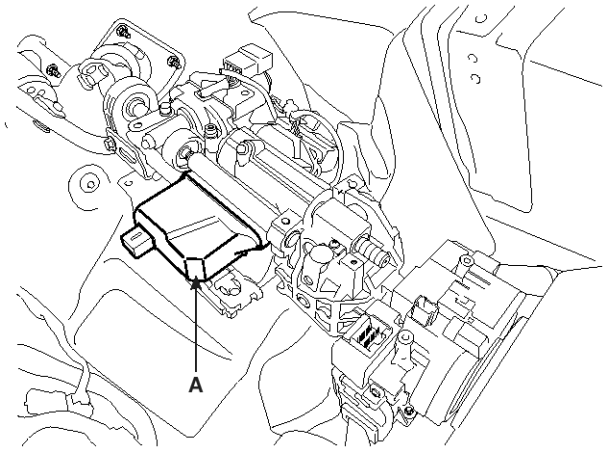
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### Electronic Steering Column Lock (ESCL)

The ESCL(A) is needed to lock the steering column in order to prevent unauthorized usage of the vehicle. In order to achieve the required safety integrity level, the ESCL is controlled and monitored by 2 independent units, the SMK and the PDM. Such redundant architecture guarantees that the ESCL motor is supplied only during locking/unlocking operation and that it is disconnected from the battery and ground lines otherwise to avoid unexpected operation while the vehicle is in motion.

Data are exchanged between the ESCL and SMK through an encrypted serial communication interface.




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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 pattern 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.

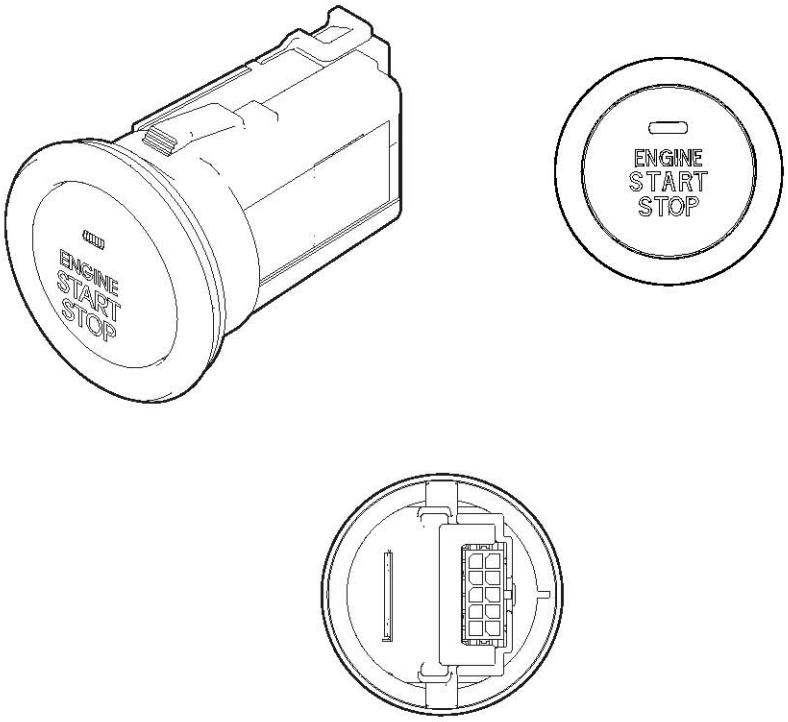
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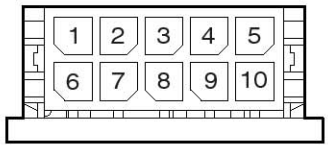
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## Start/Stop Button

### 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(IPM) |
| 3 | Start/Stop button LED Amber(PDM) | 8 | Start/Stop button LED Blue(PDM) |
| 4 | Start/Stop button illum. GND(PDM) | 9 | Rheostat |
| 5 | Start/Stop button illum. power | 10 | - |

SBHBE9333L

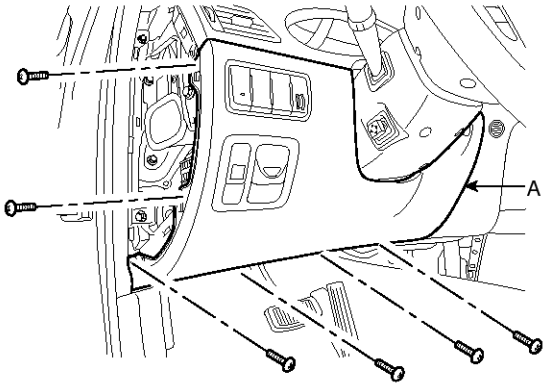
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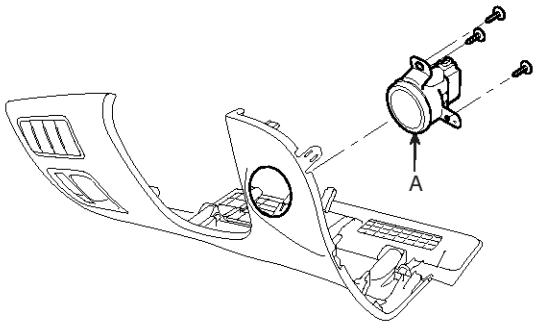
## Removal

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




SBHBE8186D

3. Remove the start/stop button (A) after loosening a mounting screw and connector.




SBHBE8187D

## Installation

1. Install the connector.
2. Install the start/stop button.
3. Install the crash pad lower panel.

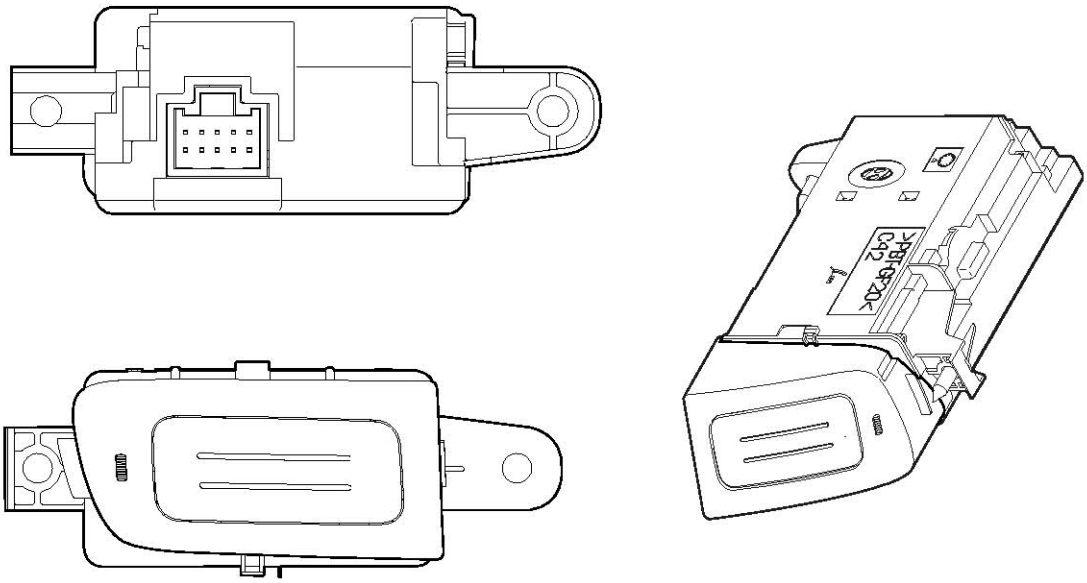
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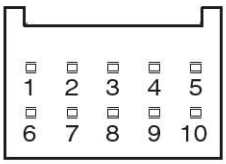
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## Fob Holder

### 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 | - |

SBHBE9334L

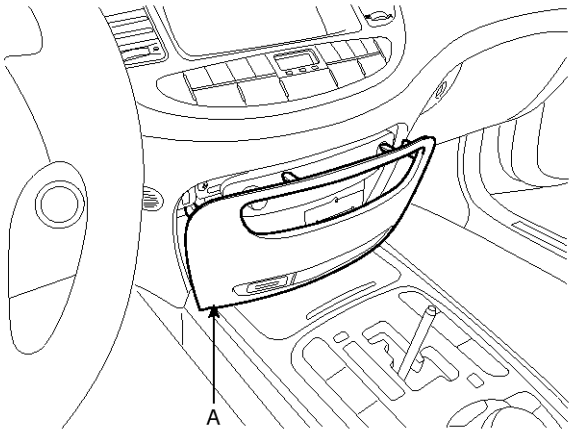
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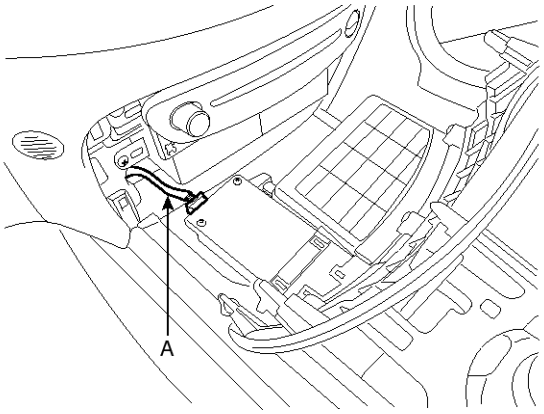
## Removal

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



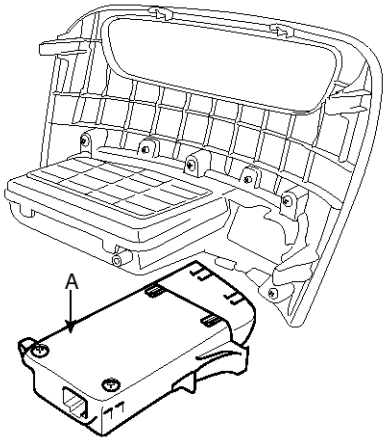

SBHBE8189D

3. Remove the connector (A).




SBHBE8190D

4. Remove the Fob holder assembly(A) after loosening the mounting screw.




SBHBE8191D

## Installation

1. Install the fob hoder assembly.
2. Install the crash pad lower panel.

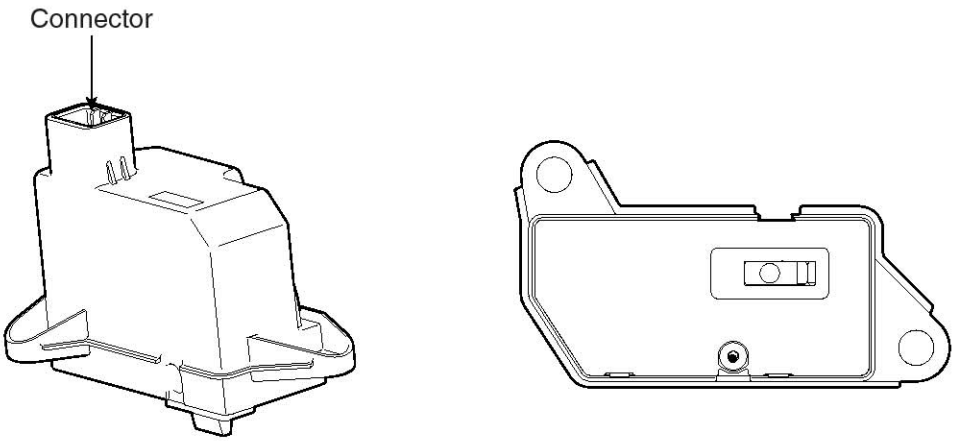
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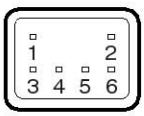
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## ESCL(Electronic Steering Column Lock)

### Component




Connector (6 pins)

| Pin No. | Description |
|---|---|
| 1 | - |
| 2 | Ground |
| 3 | Power(12V) |
| 4 | ESCL-Enable (Lock) |
| 5 | ESCL- Unlock |
| 6 | Data line |

SHMBE9008L

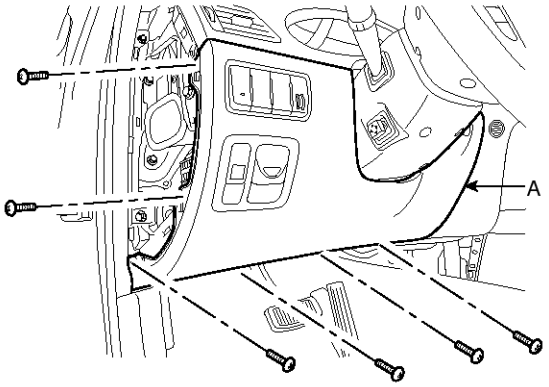
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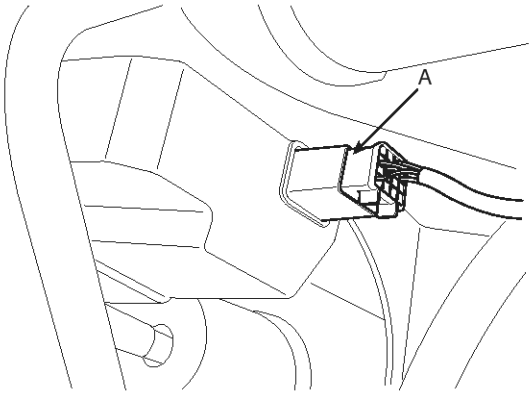
## Removal

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



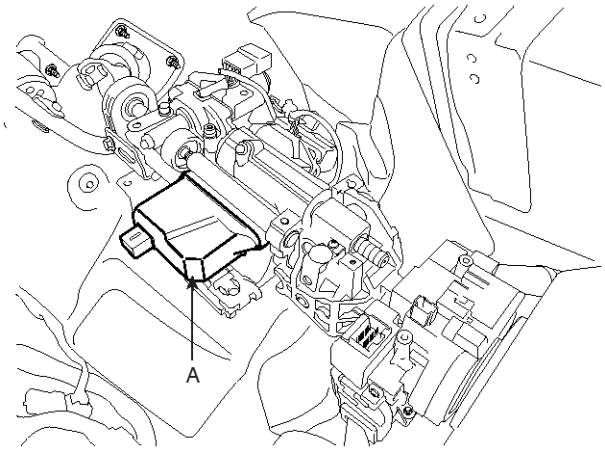

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3. Disconnect the electronic steering column lock connector(A).




SHMB18005D

4. Remove the electronic steering column lock(A). (Refer to Steering system - "Steering column and shaft")




SBHBE8193D

## Installation

1. Install the electronic steering column lock.
2. Install the crash pad lower panel.

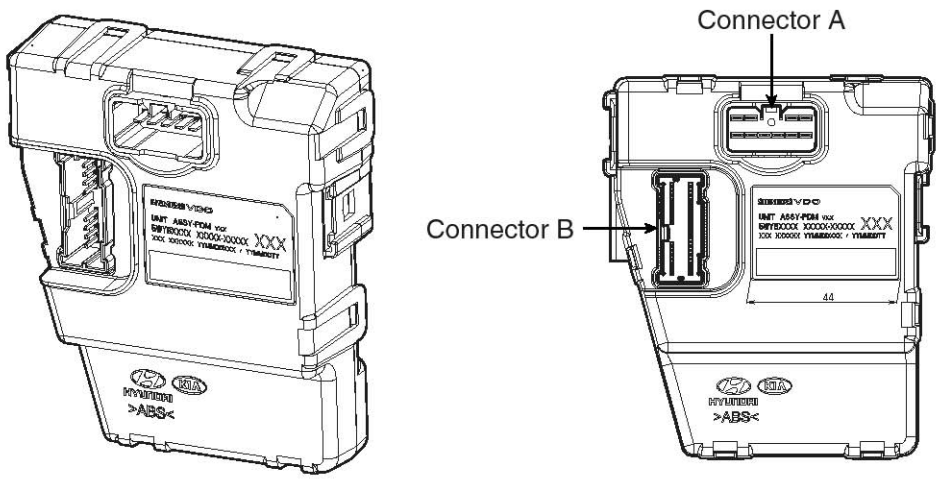
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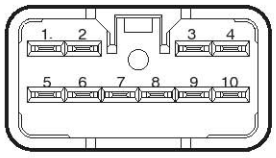
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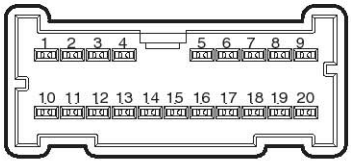


## PDM(Power Distribution Module)

### 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 |

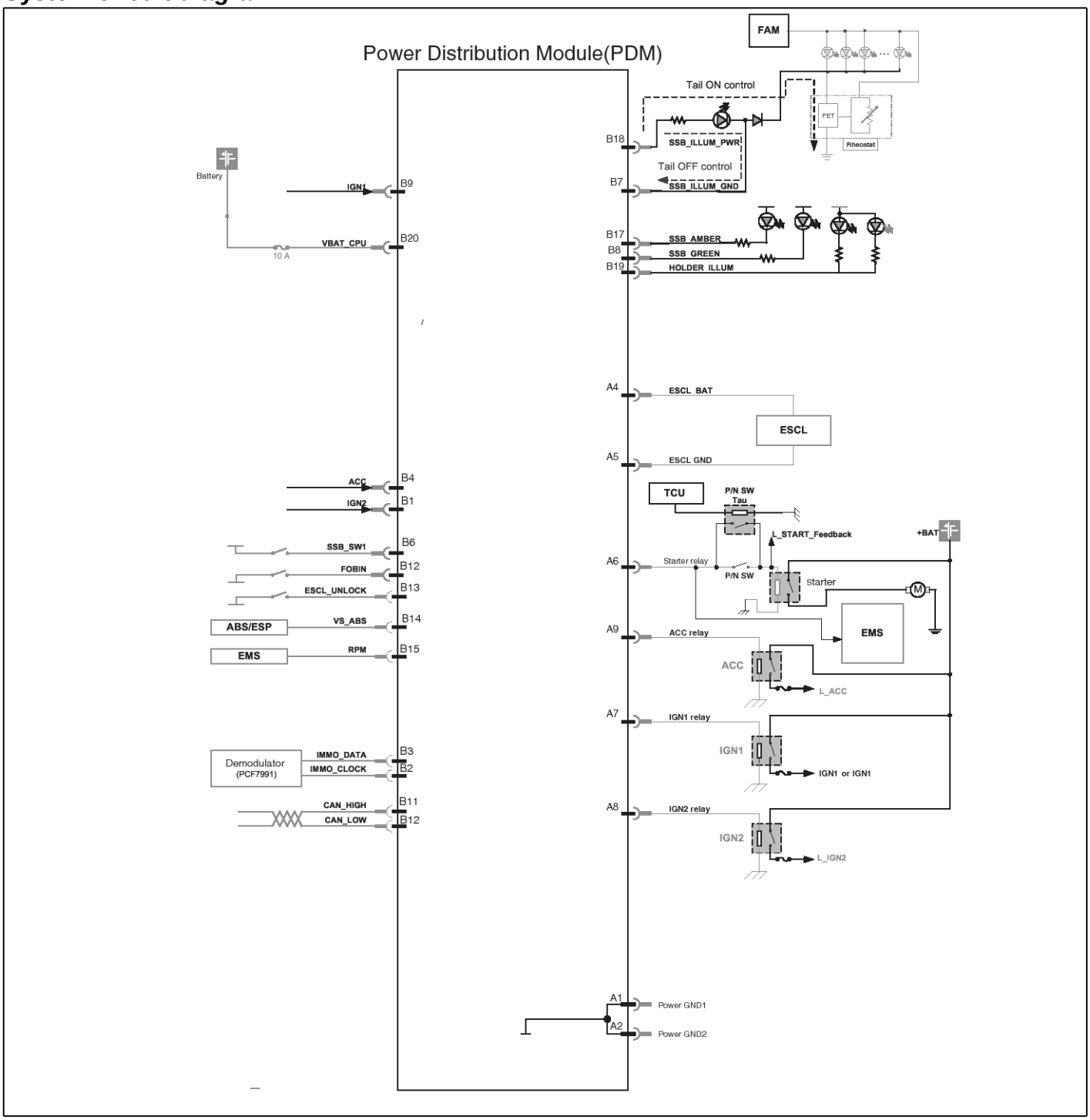
SHMBE9009L

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## System circuit diagram




SHMBE9010L

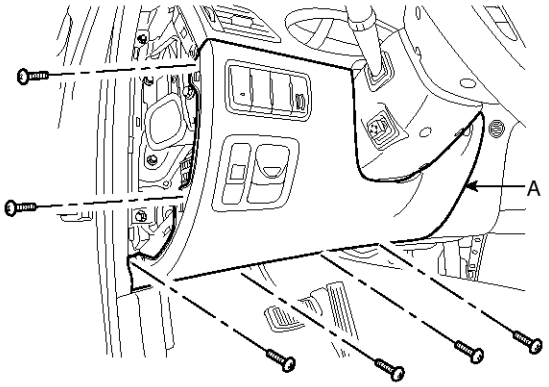
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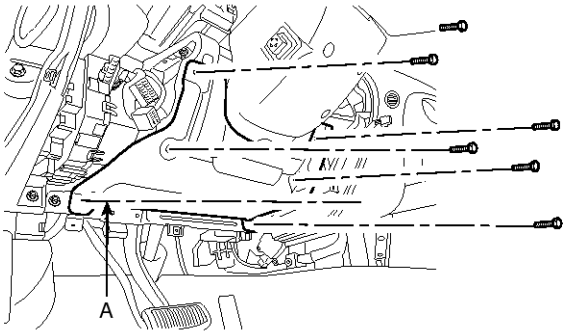
## Removal

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



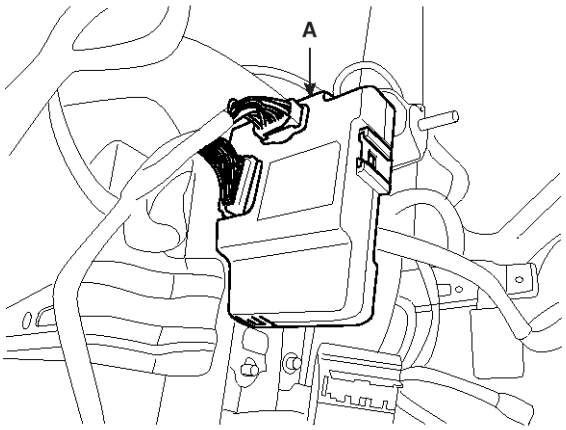

SBHBE8186D

3. Remove the reinforcing panel (A).




SBHBE8196D

4. Remove the power distribution module(A) after loosening a bolt and nut.




SBHBE8442D

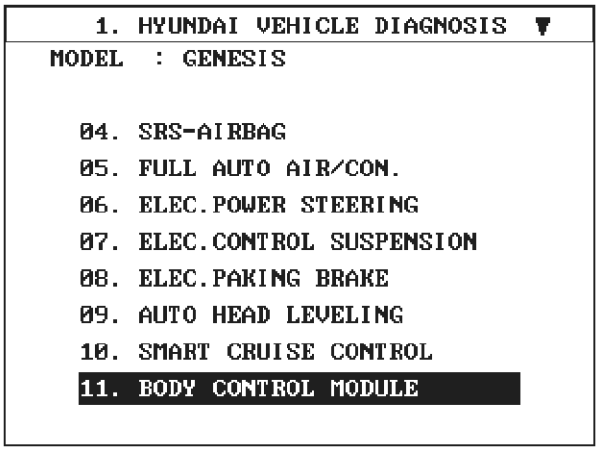
## Installation

1. Install the power distribution module.
2. Install the crash pad lower panel.

## 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 "Body control module" menu if you want to check PDM.



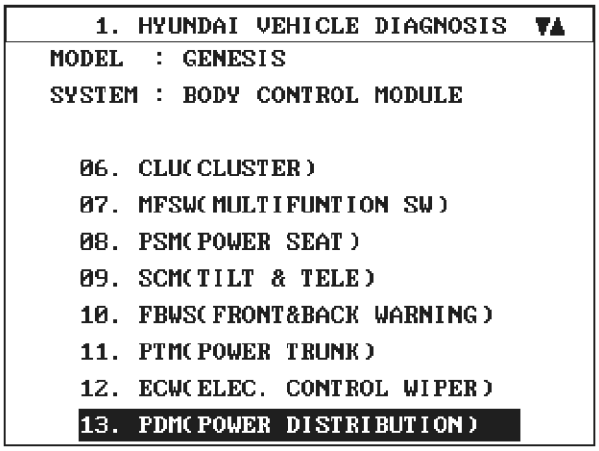

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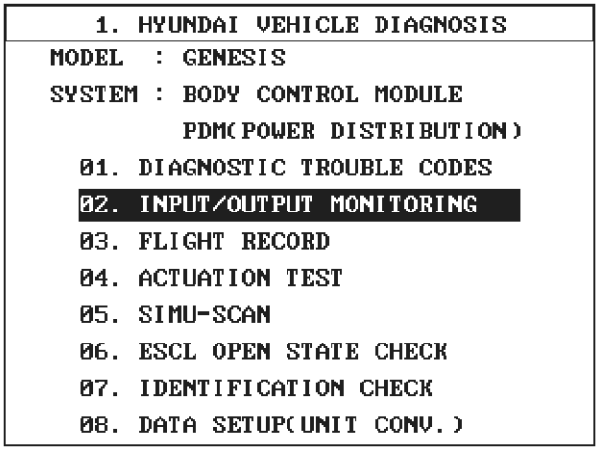


3. Select "PDM" in the manu.

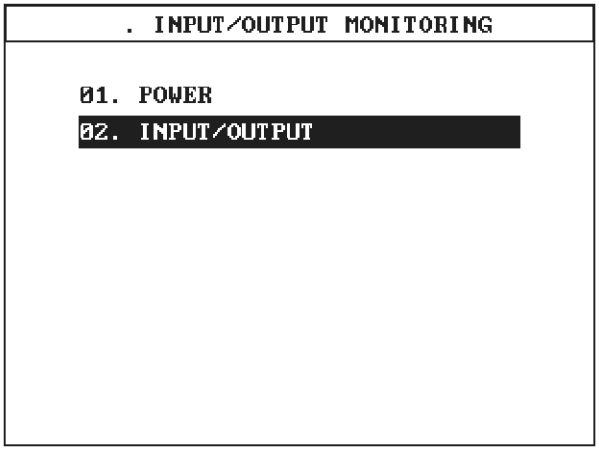



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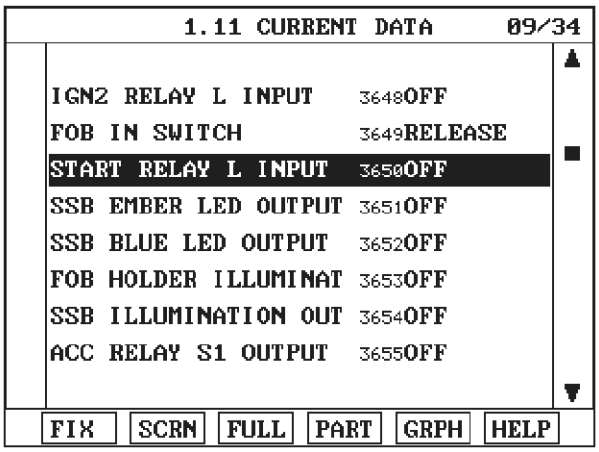
4. Select Input/output monitoring", if you want to check current data of PDM. It provides the input/output status of each module.




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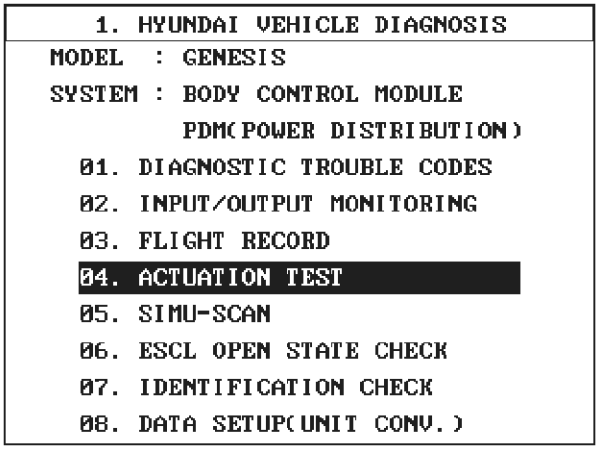



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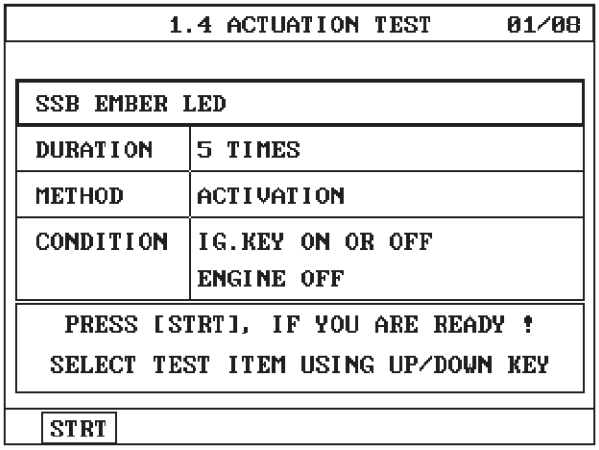



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5. If you want to check PDM data operation forcefully, select "Actuation test".




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**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 |
| 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 |

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| | | |
|---|---|---|
| 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 |

| No. | Description |
|---|---|
| 1 | SSB Ember LED |
| 2 | SSB Green LED |
| 3 | Fob Holder Illumination |
| 4 | SSB Illumination |
| 5 | ACC Output |
| 6 | ING1 Output |
| 7 | ING2 Output |
| 8 | Start Output |
| 9 | Perform ESCL Open Check |

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# Smart key System

## Specification

### IPM (SMART KEY Unit)

| Items | Specification |
|---|---|
| Rated voltage | DC 12V |
| Operating voltage | DC 9 ~ 16V |
| Operating temperature | -30˚C ~ 75˚C |
| Load | Max. 3mA |

### RF Receiver

| Items | Specification |
|---|---|
| Frequency | 433.92 MHz (China : 315 MHz) |
| Antenna type | FSK (Frequency Shift Keying) |

### Smart Key FOB

| Items | Specification |
|---|---|
| Battery | Lithium battery 3V 1EA |
| Distance | 30m |
| Battery life | More than 2years |
| Push buttons | Door lock / unlock, Trunk lid |
| Frequency(Rx) | 125 kHz |
| Frequency(Tx) | 433.92 MHz (China : 315 MHz) |
| Numbers | 2EA |

### Antenna

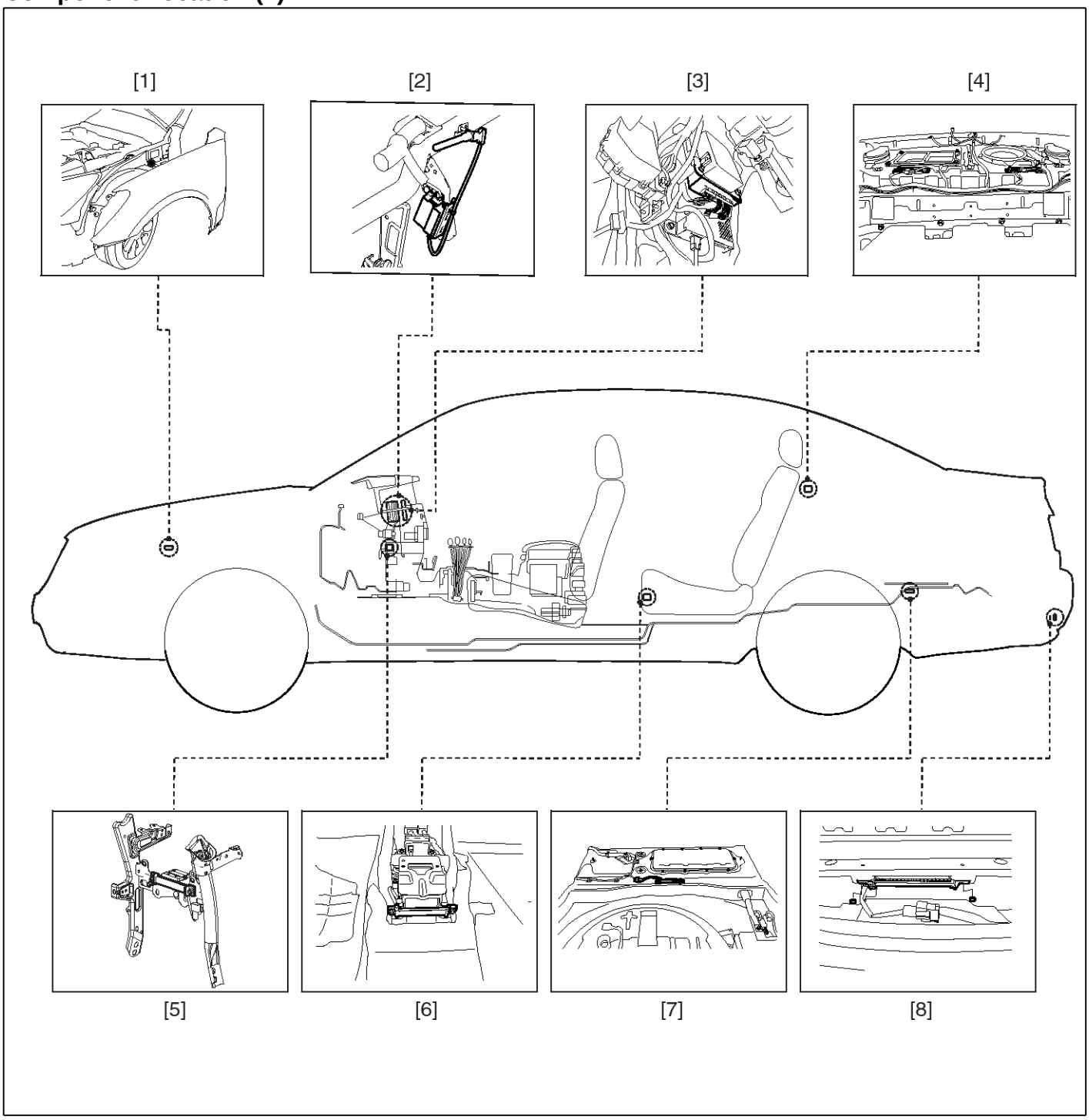
| Items | Specification |
|---|---|
| Rated voltage | DC 12V |
| Operating voltage | DC 9 ~ 16V |
| Operating temperature | -30˚C ~ 75˚C |
| Frequency | 125kHz |
| Numbers | Interior(5EA), Door(2EA), Bumper(1EA) |

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## Component Location (1)




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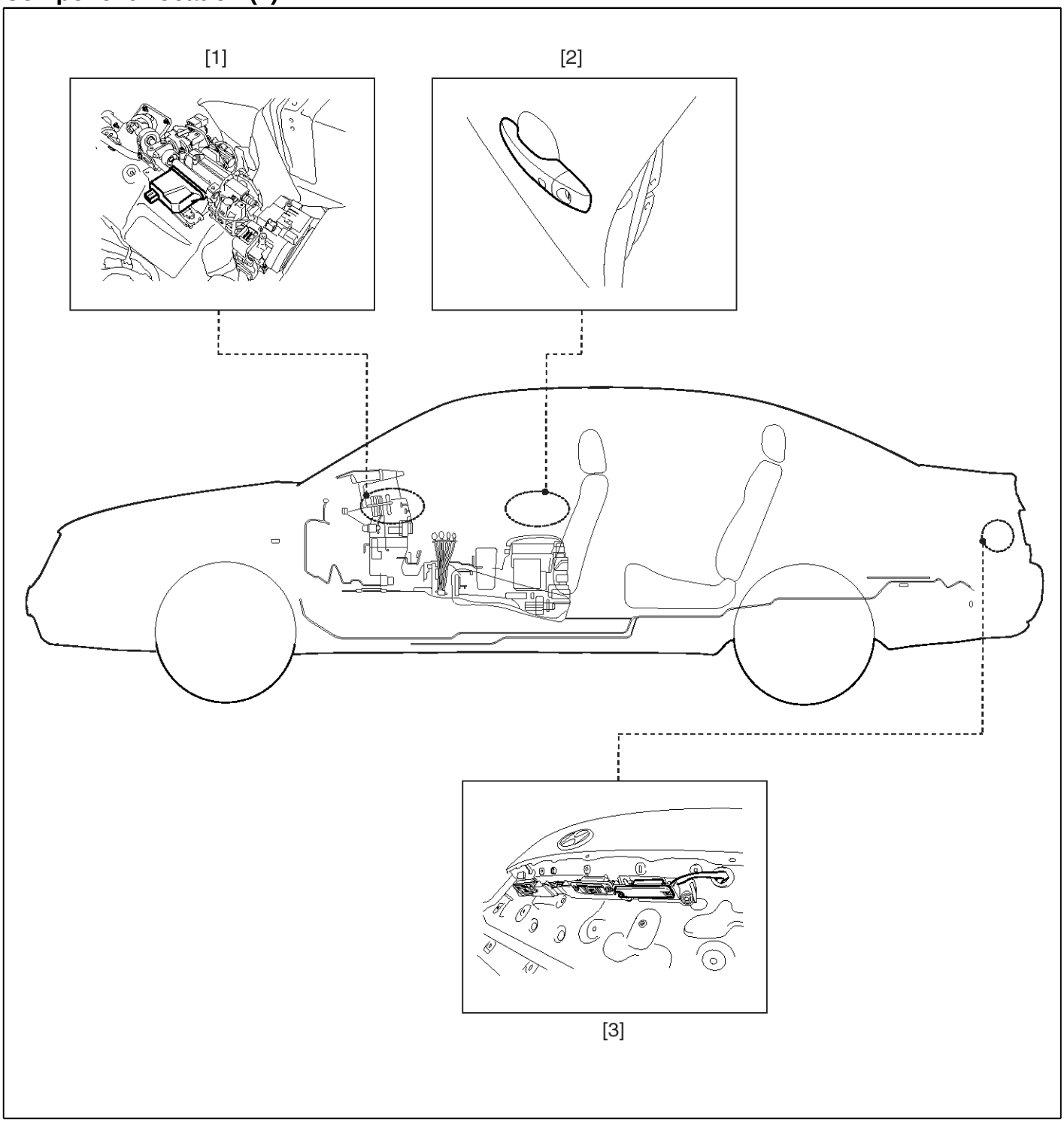
1. Buzzer
2. RF receiver
3. IPM (SMART KEY unit)
4. Interior antenna 3 (hat shelf)
5. Interior antenna 1
6. Interior antenna 2
7. Trunk antenna
8. Bumper antenna

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## Component Location (2)




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1. Electronic Steering Column Lock (ESCL)
2. Door outside handle
3. Trunk lid switch

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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 trunk/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/LIN (depends on the vehicle) as well as a single line interface to further devices of the car.

It reads the inputs (Push button in door handle, Start Stop Button (SSB), PARK position Switch), controls the outputs (e.g. exterior and interior antennas), and communicates via the CAN as well as a single line interface to further devices of the car.

For communication with the SMART KEY FOB, SMK ECU generates a request (challenge) as an encoded and modulated 125 kHz signal at the inductive antenna outputs and receives the SMART KEY FOB's response via the external RF receiver.

The main functional blocks of the SMK ECU are:

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

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

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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.

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### Smart Key Reminder 2

1. Preconditions:

   All terminals OFF && any door (including tail gate) open && no FOB-IN && no locking status (checked by SMK periodically every 100ms, as long as CAN/LIN active)

2. Vehicle action:

   Closing last door or tail gate with knobs locked state, or with a locking in progress

3. SMK actions:

   Before elapsing 500ms after the closing if all doors are locked then:

   - IF NO FOB-IN ACTIVE

     SMK performs a search for the fobs in the interior of the vehicle.

     The same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication)

   - IF FOB-IN ACTIVE

     SMK sends request toward PDM to search valid TP

   If no fob has been found, no action is required.

   If any valid fob or valid TP has been found, SMK sends unlock command via CAN and activates ext. buzzer warning.

   If any valid fob has been found, SMK sends unlock command via CAN/LIN and activates ext. buzzer warning.

### Smart Key Door Lock Warning

### Door Lock Warning 1

1. Preconditions:

   While (at least one door knob is unlocked) && (ACC ON or IGN ON) && (No FOB-IN) &&:

   - (All doors are closed) && (tailgate closed)

2. Event:

   - User presses the push button in door handle or tailgate

3. SMK actions:

   SMK performs a search for the fobs outside of the vehicle; the same LF-strategy has to be used as it is defined for "Scenario Access with I/O Distinction".

### Door Lock Warning 2

1. Preconditions:

   Same as passive locking precondition but with at least one door open.

2. Event:

   User presses the door handle Push button .

3. SMK actions:

   SMK performs a search for the fobs outside of the vehicle; the same LF-strategy has to be used as it is defined for "Scenario Access with I/O Distinction".

   If no fob has been found, no action is required.

   If the preconditions are no longer valid during buzzer active time (3 seconds), the SMK ECU stops the buzzer immediately.

### Door Lock Warning 3

1. Preconditions:

   Same as passive locking precondition

2. User action:

   - User presses the door handle Push button

3. SMK ECU actions:

   - If ATWS(Anti Theft Warning System) is in DISARM status, SMK ECU performs a search for the fob inside of the vehicle (use "Door Lock Warning 3" scenario)

If no fob has been found, the passive locking is performed.

If any valid fob has been found, SMK ECU activates the external buzzer.

If the activity timer elapsed or ACC ON or IGN1 ON or NOT All door closed or FOB-IN, the SMK ECU stops the buzzer immediately.

After searching of inside fob, SMK ECU also performs a search for fobs outside of the vehicle.

### Smart Key Lamp Warning

1. SMK actions:

   As long as the preconditions are valid, the SMK ECU performs a periodical search for the fobs in the interior of the vehicle; the same LF-strategy has to be used as it is defined for the ID out warning (registering only, no authentication); periodical means, the search is done every 3 seconds.

   If no fob has been found, the SMK ECU starts Key out indicator lamp activation as all preconditions are valid and will perform another search 3 seconds later.

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

### Failsafe Functions (Backup For Limp Home)

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

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

### User Information Functions

### ID OUT Warning

1. Preconditions:
   - (ACC or IGN1) && (any door open or tailgate open)
2. Event:

   The last opened door is closed
3. SMK action:

   SMK searches for a SMART KEY FOB in the interior.
   - If no valid SMART KEY FOB is found, the SMK activates external buzzer and also sends ID OUT WNG via CAN (exterior buzzer warning and internal buzzer warning).
   - If a door is opened and closed again during terminals on and inside valid fob, SMK re-enables the authentication and stops the warning. If the terminal is in ACC, SMK shall turn on immobilizer lamp .

**NOTICE**

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

### Fob Deactivation

After the fob deactivation, SMK activates exterior buzzer and also sends by CAN/LIN request for BCM internal buzzer activation. If the ATWS goes to DISARM mode during buzzer warning, the warning stops immediately.

### Immobilizer Lamp

Cases like releasing the MSL Knob in OFF position will switch off the immobilizer lamp. Removing the PIF from the MSL and reinserting the PIF and pushing the MSL Knob will switch the lamp on again.

### Fob Battery Low Voltage Detection

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

If the fob has detected a low battery voltage, the LED will not be switched on at button press.

### Learning Description

In this chapter, the learning procedure for SMK, PDM, ESCL and FOBs is described.

For the learning of the SMK, PDM, ESCL and FOBs, it's necessary to have a connection to the diagnostic tool.

### Learning MODE

Whatever the mode, the learning procedures are managed by the SMK.

Prior to start learning service, Fob-In signal must be active and the vehicle secrect code (called as PIN code) should be known.

### Teaching MODE

This mode is used by the dealers in order to replace SMK and/or PDM and/or ESCL and/or the set of keys, or to register additional keys for an existing system. That means the system already has been learnt with certain PIN Code. The PIN Code is fixed for the life time of the vehicle, therefore the same PIN Code must be used in this mode. Otherwise learning will be failed

### Teaching MODE Procedure Description (Step By Step)

Objective: Key teaching procedure at service station

Initial state:

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

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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 system is learnt **transponder and smart key** by once at same time.

**<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>**

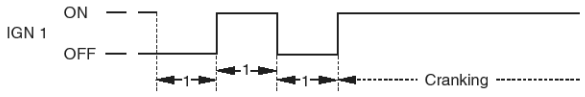
- If PIN code is inputted over 3 times, it is impossible to learnt and neutralization during 1 hour.

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### Starting After Replacing (Vergin 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 b-utton once.




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## Inspection

### Self Diagnosis With Scan Tool

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

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

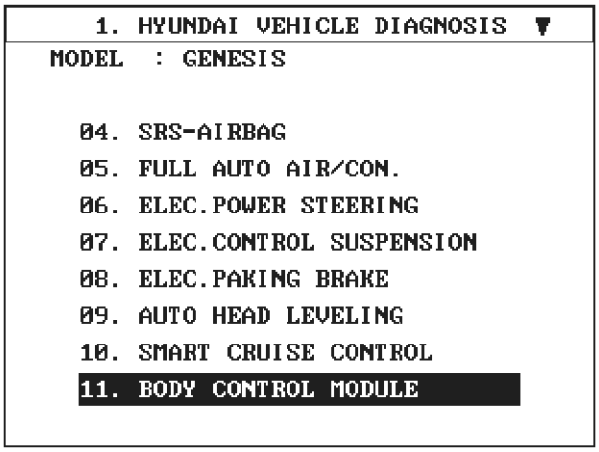
1. Problem in SMART KEY unit input.
2. Problem in SMART KEY unit.
3. Problem in SMART KEY unit output.

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

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

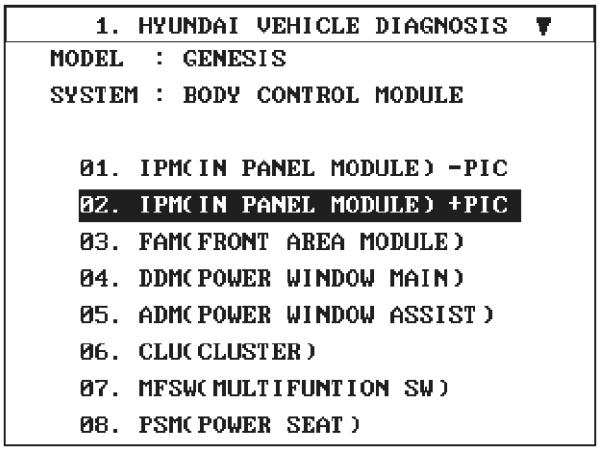
### Switch Diagnosis

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel, turn the power on scan tool.
2. Select the vehicle model and then "Body Control Module" system.



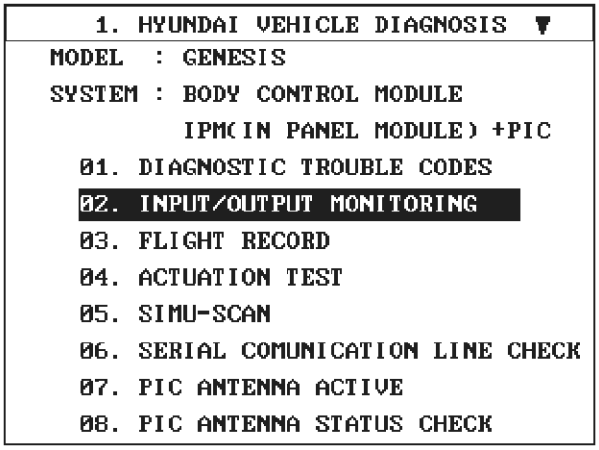

SBHBE9250L

3. Select the "IPM + PIC".

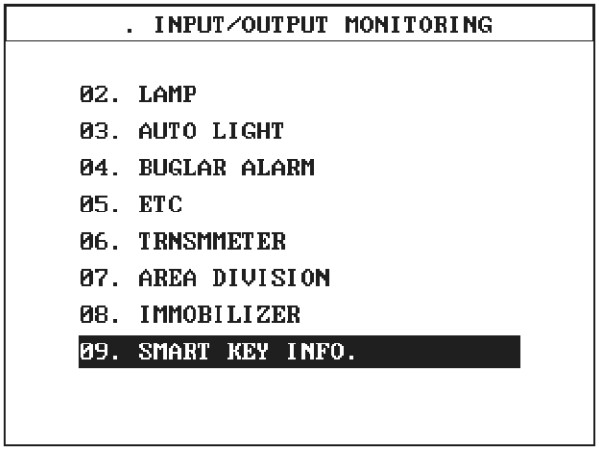



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4. After IG ON, select the "Input/output monitoring".




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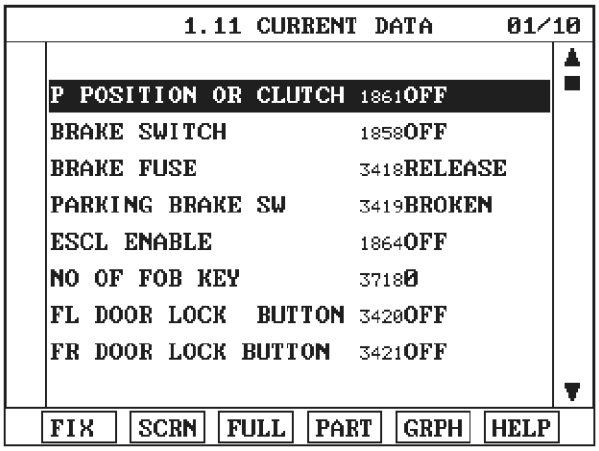

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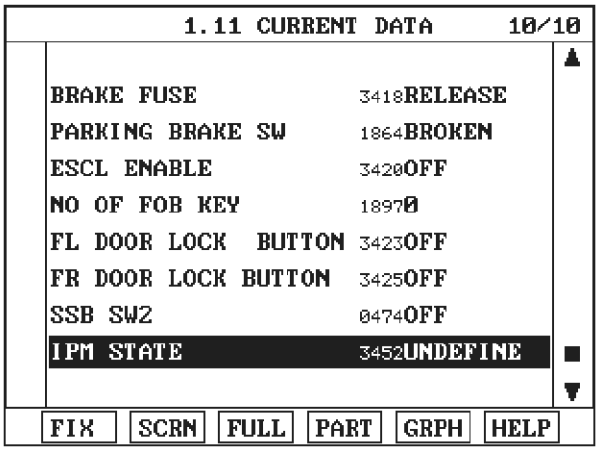
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5. You can see the situation of each switch on scanner after connecting the ""Input/output monitoring" process.



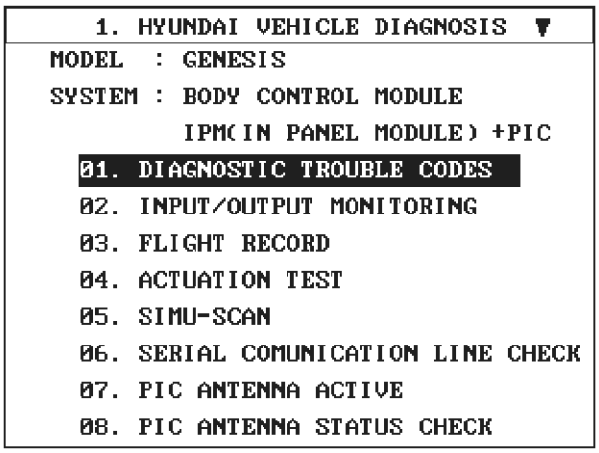

SBHBE9254L



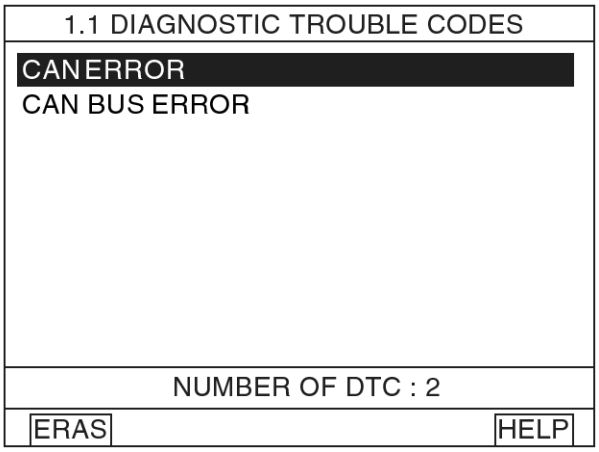

SBHBE9255L

### 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 "Diagnostic trouble codes".




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### Antenna Actuation Diagnosis

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. After IG ON, select the "PIC antenna active".

```
    1. HYUNDAI VEHICLE DIAGNOSIS
MODEL  : GENESIS
SYSTEM : BODY CONTROL MODULE
         IPM(IN PANEL MODULE) +PIC
  01. DIAGNOSTIC TROUBLE CODES
  02. INPUT/OUTPUT MONITORING
  03. FLIGHT RECORD
  04. ACTUATION TEST
  05. SIMU-SCAN
  06. SERIAL COMUNICATION LINE CHECK
  07. PIC ANTENNA ACTIVE
  08. PIC ANTENNA STATUS CHECK
```

SBHBE9257L

```
          PIC ANTENNA ACTIVE
MODEL  : GENESIS
SYSTEM : BODY CONTROL MODULE

  01. INTERIOR ANTENNA 1
  02. INTERIOR ANTENNA 2
  03. TRUNK ANTENNA
  04. BUMPER ANTENNA
  05. EXTERIOR LEFT SIDE ANTENNA
  06. EXTERIOR RIGHT SIDE ANTENNA
  07. REAR PACKAGE TRAY ANTENNA
```

SBHBE9258L

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

```
          PIC ANTENNA ACTIVE
MODEL  : GENESIS
SYSTEM : BODY CONTROL MODULE

        INTERIOR ANTENNA 1

              ACTIVE

LED OF FOB KEY TWINKLE,
ANTENNA - FOB KEY RESPONSE NORMAL


PRESS [ESC] TO EXIT
```

SBHBE9259L

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
   - BUMPER/ TRUNK ANTENNA
   - DRV_DR ANTENNA
   - AST_DR ANTENNA
   - REAR PACKAGE TRAY ANTENNA

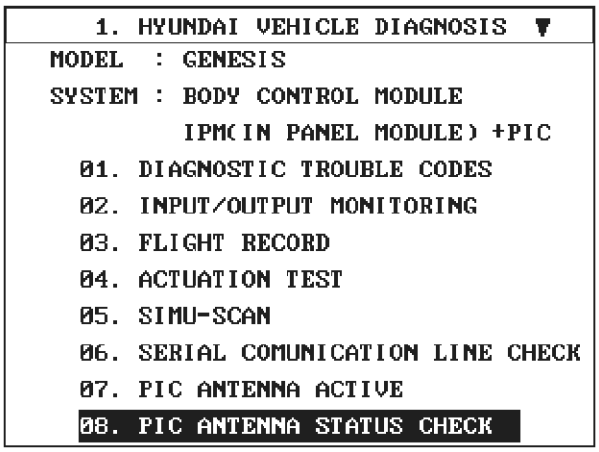
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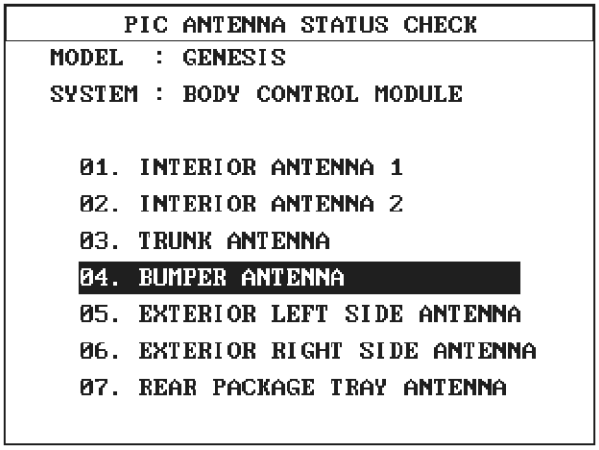
### Antenna Status Check

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. Select the "IPM + PIC".
3. After IG ON, select the "PIC ANTENNA STATUS CHECK".

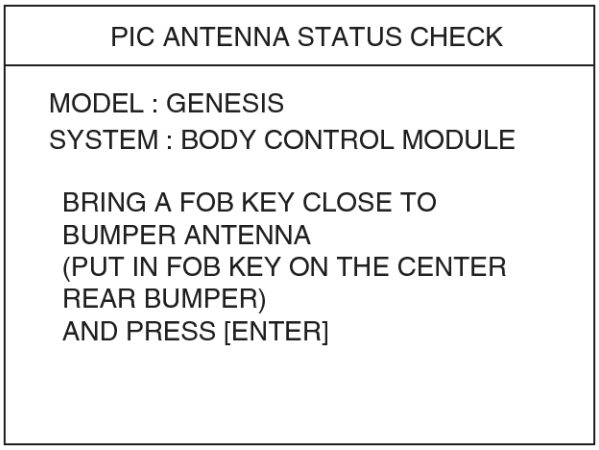



SBHBE9260L

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




SBHBE9261L




SBHBE9262L

5. If the smart key runs normal , the related antenna, smart key(transmission, reception)and exterior receiver are normal.
6. Antenna status
   - INTERIOR ANTENNA 1
   - INTERIOR ANTENNA 2
   - BUMPER/ TRUNK ANTENNA
   - DRV_DR ANTENNA
   - AST_DR ANTENNA
   - REAR PACKAGE TRAY ANTENNA

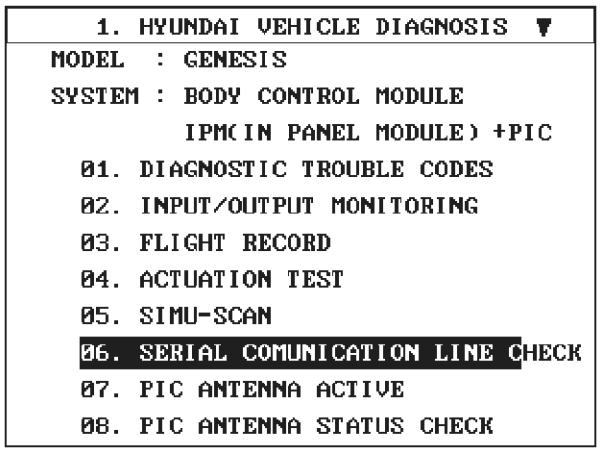
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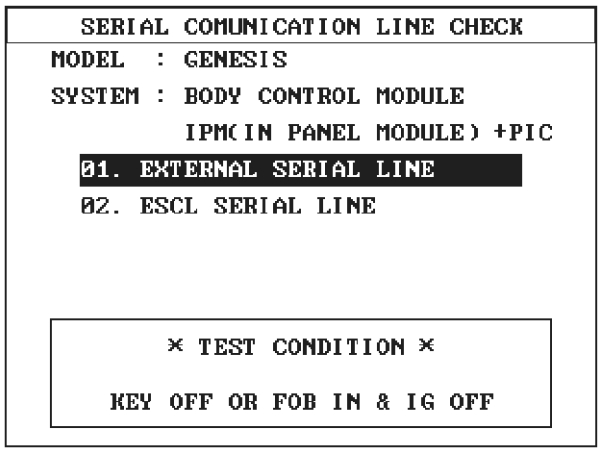
### Serial Communication Status Check

1. Connect the cable of scan tool to the data link connector in driver side crash pad lower panel.
2. Select the SERIAL COMMUNICATION STATUS CHECK".




SBHBE9263L

3. After IG ON, select the "External serial line".




SBHBE9264L

4. Check the serial communication line with a scanner.
5. If the smart key runs normal, the communication of smart key unit, exterior receiver and ESCL (Electronic Steering column Lock) are normal.
6. If the smart key runs abnormal, check the following items.
   - Disconnection or no response of the exterior receiver communication line.
   - The exterior receiver communication line disconnection and ground connection.
   - The ESCL disconnection or no response
   - The ESCL disconnection and ground connection

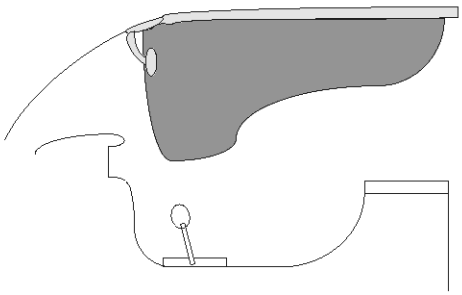
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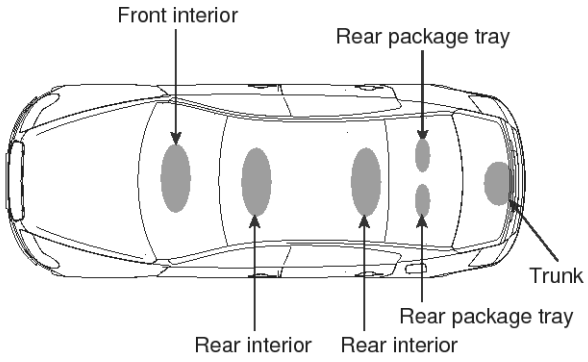
### Interior Antenna Actuation Check

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



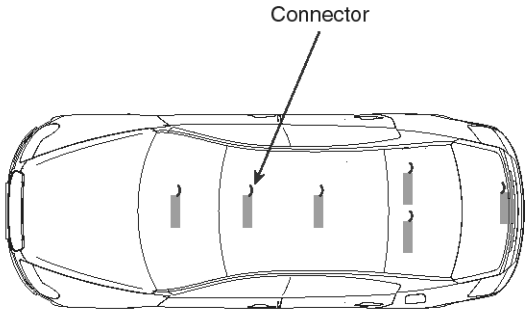
KTCF113A

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




SBHBE9265L

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




SBHBE9266L

## Troubleshooting

### SMK DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1625 | ECM reception Error |
| 2 | B1971 | Park Position Error |
| 3 | B1978 | ESCL failure |

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# B1625 ECM Communication Data Failure

## General Description

IPM communicates with ECM through the serial communication line. If ECM requests authetication from IPM after IG ON, IPM check authentication with transponder then, sends this signal to ECM whether authentication is O.K or not.

IPM is located inside of instrument panel, left knee of driver side. ECM is installed at near the brake booster, right side of engine room compartment.

## DTC Description

IPM 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.

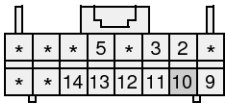
## DTC Detecting Condition

| Item | Detecting Condition | Possible cause |
|---|---|---|
| DTC Strategy | • Check received Data Status from ECM | • Poor Connection in Harness<br>• Input Power to IPM<br>• Open or short in EMS communication line.<br>• Faulty IPM<br>• Faulty ECM |
| Enable Conditions | • Data that IPM received from ECM is error after IGN OFF to IGN ON | |
| Threshold value | • Received data error from ECM | |
| Failsafe | • - | |

## Diagnostic Circuit Diagram

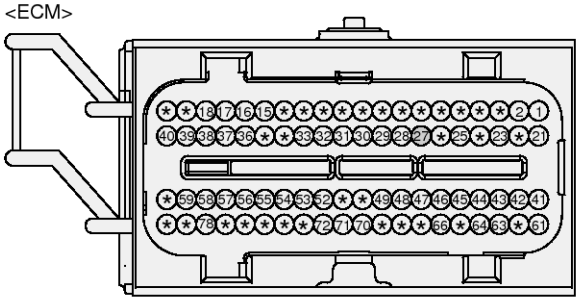



<IPM>




10. EMS_COM

<ECM>



27. EMS_COM

SBHBE9A01L

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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 IPM side and erase the DTC with scantool.
6. Has the DTC gone after erasing with scantool ?

**YES** ▶ Check poor connection between harness connector and IPM 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 IPM 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 IPM connector and ECM connector.
3. Measure resistance between signal terminal of IPM 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 IPM 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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# B1971 Parking Position Input Error

## General Description

Parking Position Switch indicates that Shift Lever is in P range or not. IPM decides that engine starting is enable after receiving Parking Position Switch signal.

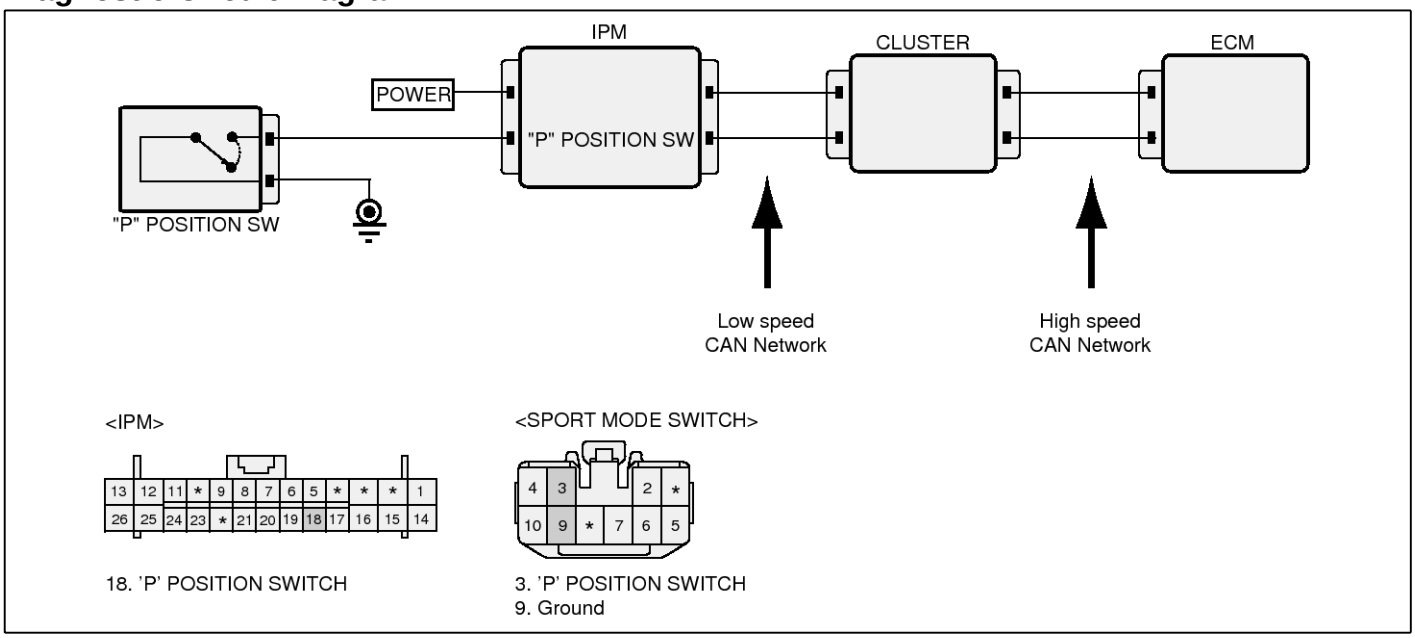
## DTC Description

IPM 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<br>• Faulty Parking Switch<br>• Faulty IPM |
| Enable Conditions | • After battery Voltage is energized to IPM | |
| Threshold value | • After IGN ON, Vehicle speed is over 3km/h with brake switch ON for 10 seconds. | |
| Failsafe | • - | |

## Diagnostic Circuit Diagram




SBHBE9A02L

## 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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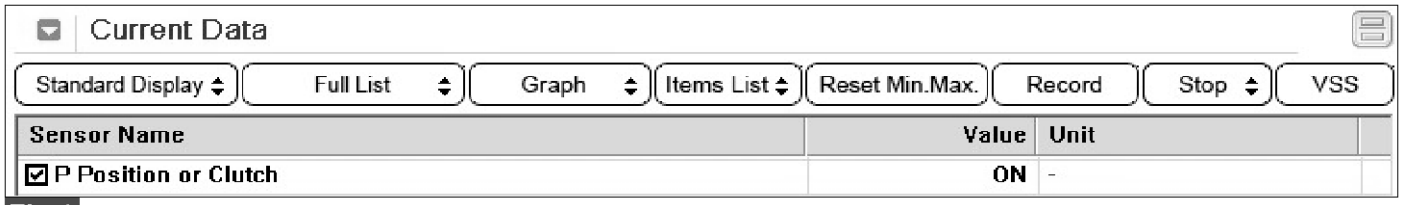



Fig.1

SBHBE9A10L

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 ?

**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** ▶ 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

Refer to DTC B1625 : ECM Communication Data Failure.

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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 IPM is located inside of instrument panel, left knee of driver side.

It consists of ESCL control Module, IPM, PDM and SSB( engine Start Stop Button)

It is operating as follows1.

Pushing SSB → 2. Switch 1 signal goes to PDM, Switch 2 signal goes to IPM → 3.PDM supplies power supply to ESCL → 4.IPM 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

IPM receives ESCL lock or unlock stuatus signal from ESCL and PDM(via CAN). And then, IPM compares PDM is lock or unlock signal with ESCL is lock or unlock signal. If the both signals are unmathing, IPM sets DTC B1971.

## DTC Detecting Condition

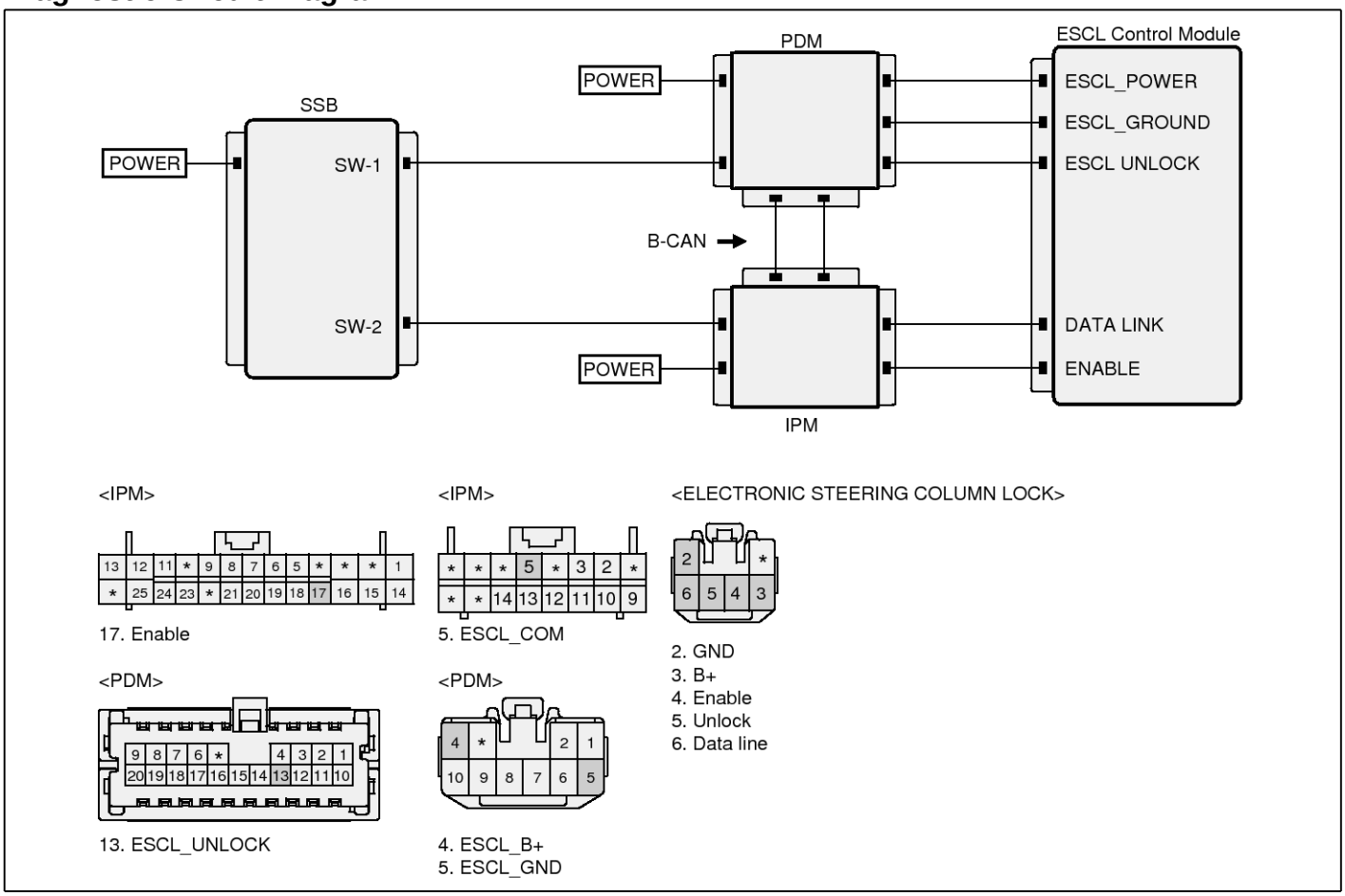
| Item | Detecting Condition | Possible cause |
|---|---|---|
| DTC Strategy | • Check voltage and Data | • Poor connection in harness or connector.<br>After battery voltage is supplied to IPM<br>- If IPM detects pins related ESCL are failed<br>1. Faulty ESCL control Module<br>2. Open or short in battery / ground curcuit of ESCL<br>3. Open or short to battery / ground in communicantion circuit of ESCL<br>4. Open in O_ESCL Enable circuit from IPM<br>5. Open or short in ESCL_Unlock circuit to PDM<br>- DTC is set although it is not ESCL fault<br>6. No battery voltage to PDM<br>7. Short to battery in power relay on the PDM line such as ACC, IGN1, IGN2, Starter Rly<br>8. When actuation test for PDM<br>9. It is leant status but not with same PIN code for all IPM/PDM/ESCL<br>• Faulty IPM<br>• Faulty PDM<br>• Faulty ESCL control Module |
| Enable Conditions | • After battery voltage is suppiled to IPM | |
| Threshold value | • When both signal from ESCL lock or unlock status and PDM lock or unlock stuatus are unmatching | |
| Failsafe | • - | |

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## Diagnostic Circuit Diagram




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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 IPM side.

   - It is case that DTC is set on PDM although it is not ESCL fault as follows

   1. No battery voltage to PDM

   2. Short to battery in power relay on the PDM line such as ACC, IGN1, IGN2, Starter Rly

   3. When actuation test for PDM

   4. It is leant status but not with same PIN code for all IPM/PDM/ESCL

6. Has the DTC gone after erasing DTC with scantool ?

**YES** ▶ Check poor connection between harness connector and ESCL, PDM 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 check current dat as follows if there is DTC B1971 ESCL failure

### ■ Check current Data

1. Select current data parameters related IPM with scantool.
2. Monitor "ESCL ENABLE" are normal.
3. Select current data parameter related PDM.
4. Monitor "ESCL BATTERY OUTPUT" , "ESCL GND OUTPUT" and "ESCL UNLOCK STATE INPUT" are normal

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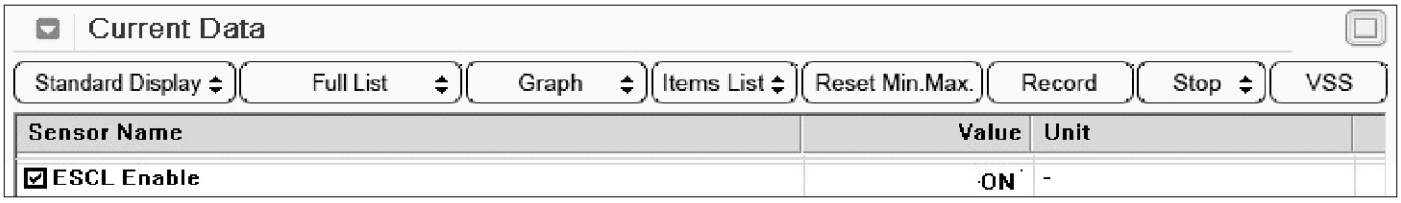
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**Specification :**

- Current Data parameter related IPM -

1.ESCL ENABLE : It is ON, if IPM sends enable signal to ESCL.



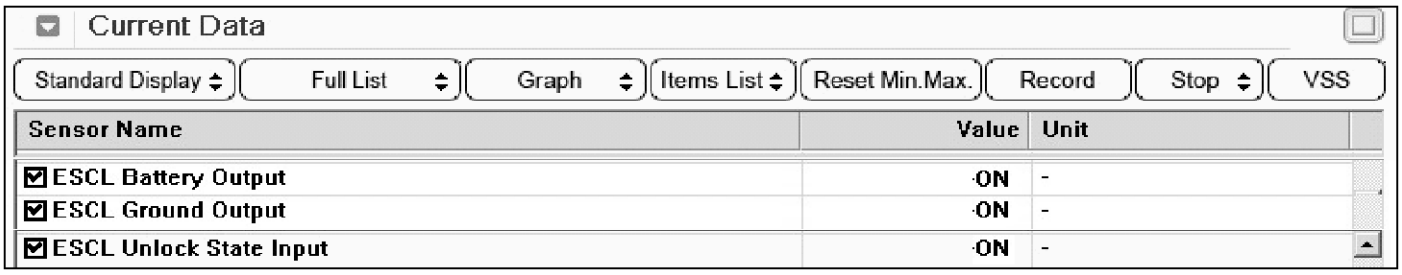

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- Current Data parameter related PDM -

1.ESCL BATTERY OUTPUT : It will be changed form OFF to ON when PDM supplies operation voltage with PDM.

2.ESCL GND OUTPUT : It shows ON when ground for ESCL is O.K.

3.ESCL UNLOCK STATE INPUT : In case that ESCL bolts is unlock, it will be ON.




SBHBE9A12L

4. Are all parameters related ESCL funtioning normally ?

**YES** ▶ Check poor connection between harness connector and ESCL, PDM 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** ▶ 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.

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## 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.
2. Disconnect ESCL control Module, PDM and IPM 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 IPM 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 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.
▶ After replacing ESCL control module or IPM, 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

Refer to DTC B1625 : ECM Communication Data Failure.

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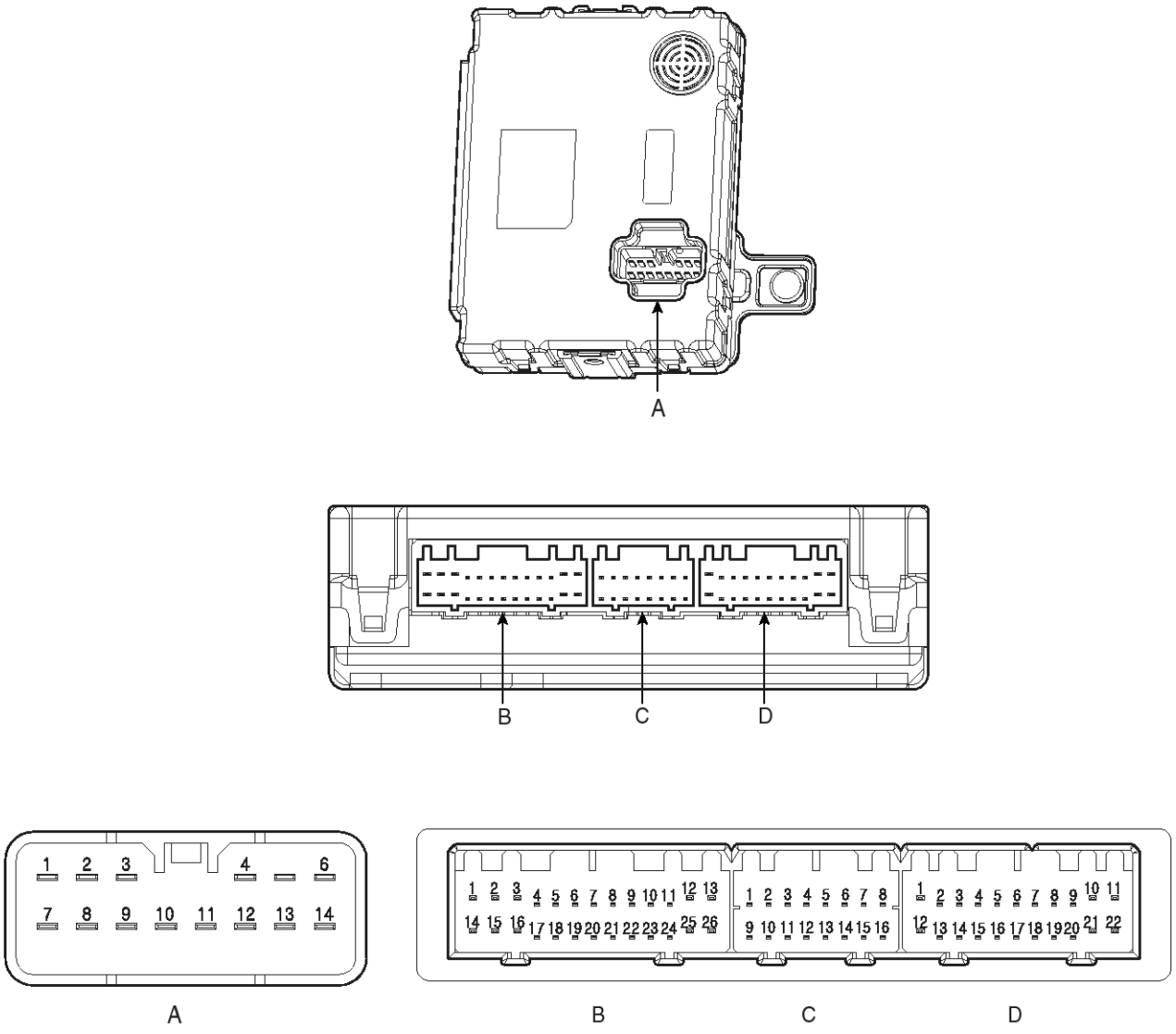
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## Smart key unit

### Components

[IPM]




SBHBE8149D

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**Connector Pin Information**

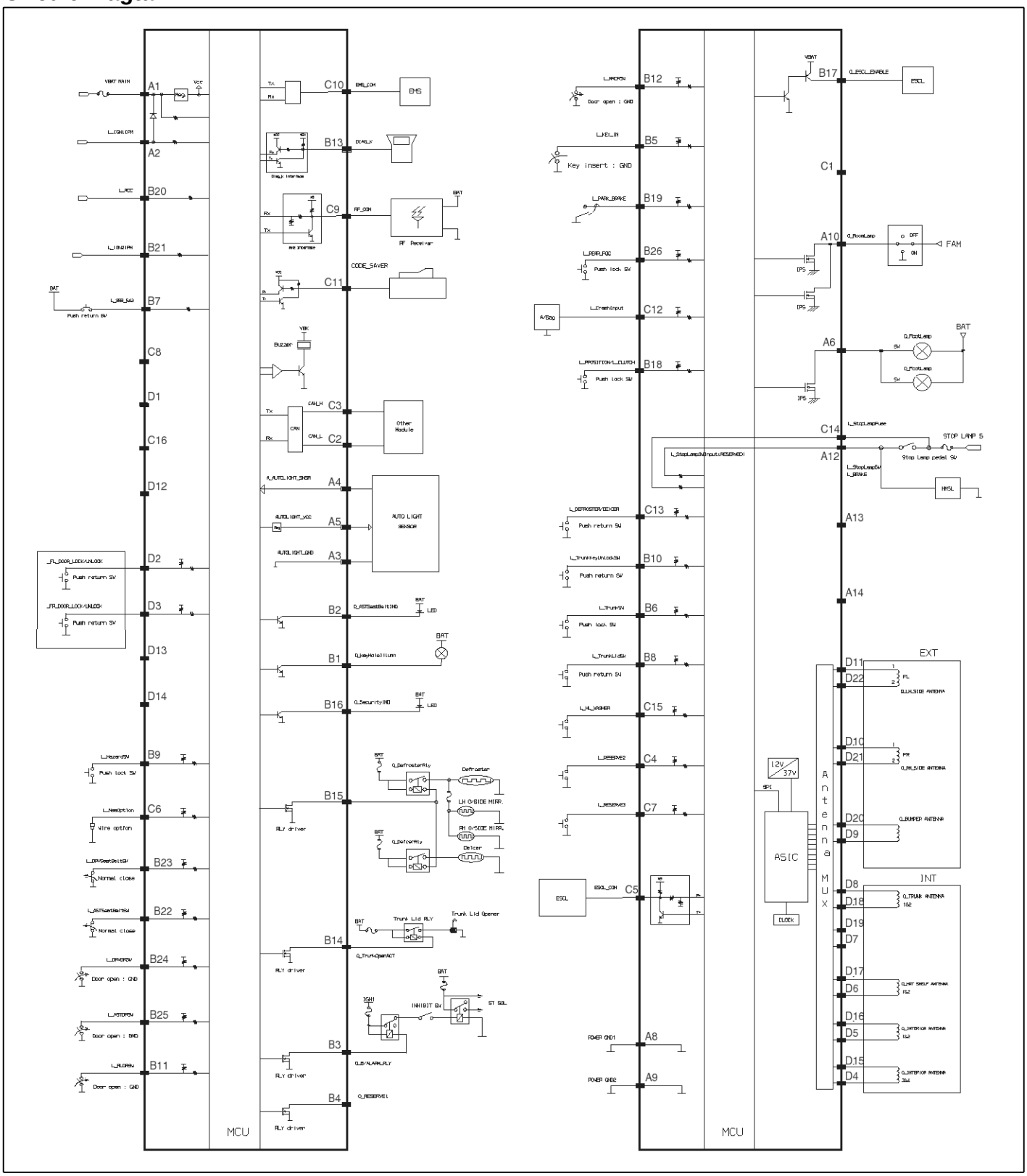
| Pin | Connector A | Pin | Connector B | Pin | Connector C | Pin | Connector D |
|---|---|---|---|---|---|---|---|
| 1 | BAT | 1 | Key hole ILL | 1 | - | 1 | - |
| 2 | IGN IPM | 2 | Assist seat belt IND | 2 | CAN low | 2 | Front left door lock/un-lock |
| 3 | Autolight GND | 3 | B/Alarm relay | 3 | CAN high | 3 | Front right door lock/u-nlock |
| 4 | Autolight sensor | 4 | - | 4 | - | 4 | Interior 2 antenna 2 |
| 5 | Autolight VCC | 5 | Key In | 5 | ESCL COM | 5 | Interior 1 antenna 2 |
| 6 | Foot lamp | 6 | Trunk switch | 6 | - | 6 | Hat shelf antenna 2 |
| 7 | - | 7 | SSB switch 2 | 7 | - | 7 | - |
| 8 | Power GND 1 | 8 | Trunk lid switch | 8 | - | 8 | Trunk 1 antenna 1 |
| 9 | Power GND 2 | 9 | Hazard switch | 9 | RF COM | 9 | Bumper antenna 2 |
| 10 | Room lamp | 10 | Trunk key unlock swit-ch | 10 | EMS COM | 10 | RH side antenna 1 |
| 11 | - | 11 | Rear left door switch | 11 | Code saver | 11 | LH side antenna 1 |
| 12 | Stop lamp | 12 | Rear right door switch | 12 | Crash input | 12 | - |
| 13 | - | 13 | Diagnosis | 13 | Defroster/Deicer | 13 | - |
| 14 | - | 14 | Trunk open act | 14 | Stop lamp fuse | 14 | - |
| | | 15 | Defroster relay | 15 | Head lamp washer | 15 | Interior 2 antenna 1 |
| | | 16 | Security IND | 16 | - | 16 | Interior 1 antenna 1 |
| | | 17 | ESCL Enable | | | 17 | Hat shelf antenna 1 |
| | | 18 | P position | | | 18 | Trunk 1 antenna 2 |
| | | 19 | Parking brake | | | 19 | - |
| | | 20 | ACC | | | 20 | Bumper antenna 1 |
| | | 21 | IGN2 IPM | | | 21 | RH side antenna 2 |
| | | 22 | Assist seat belt switch | | | 22 | LH side antenna 2 |
| | | 23 | Driver seat belt switch | | | | |
| | | 24 | Driver door switch | | | | |
| | | 25 | Assist door switch | | | | |
| | | 26 | Rear Fog | | | | |

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## Circuit Diagtam




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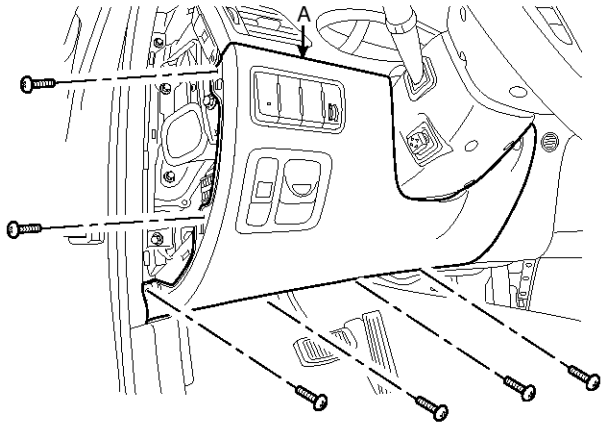
https://autolibrary.ir



## Removal

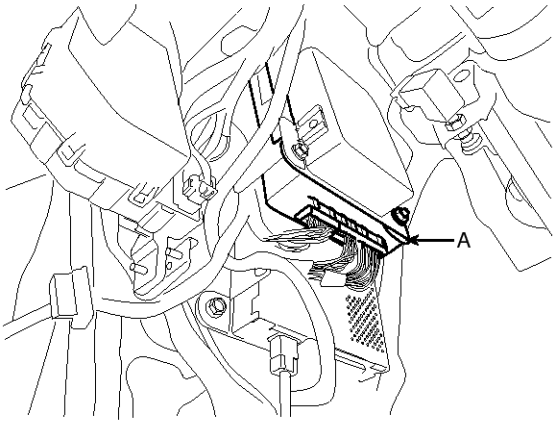
### Smart Key Unit

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

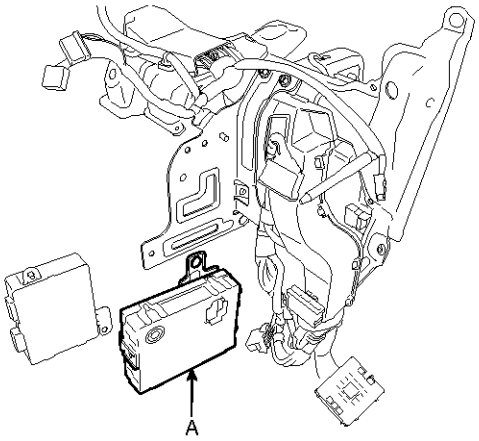



SBHBE8160D

3. After loosening the smart key unit mounting nuts and disconnect the connector, remove the smart key unit (A).



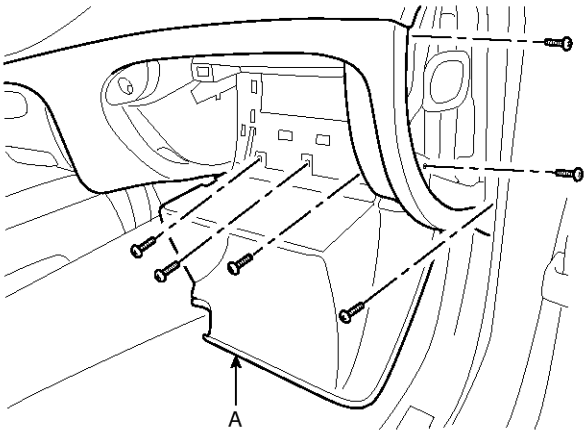

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SBHBE8162D

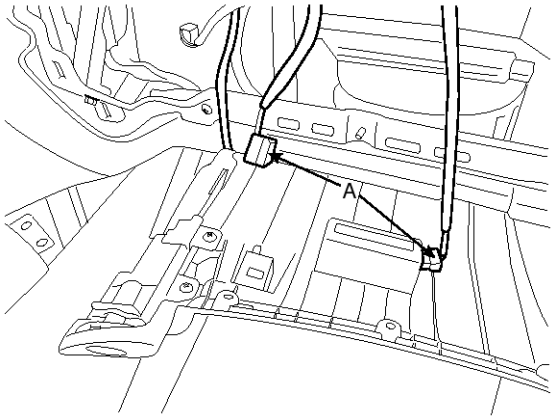
### RF Receiver

1. Disconnect the negative (-) battery terminal.
2. After loosening the mounting screws and bolts, then remove the glove box (A). (Refer to the body group - Crash pad)




SBHBE8163D

3. Remove the glove box housing connector (A).



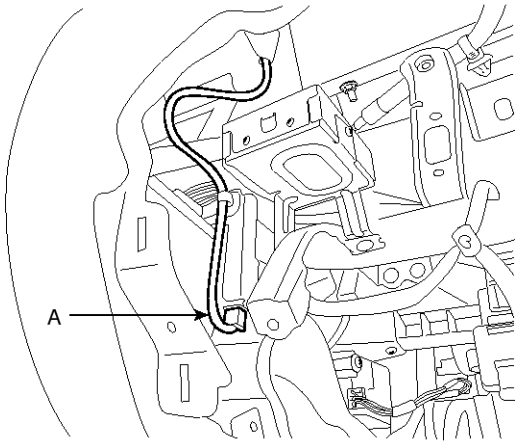

SBHBE8164D

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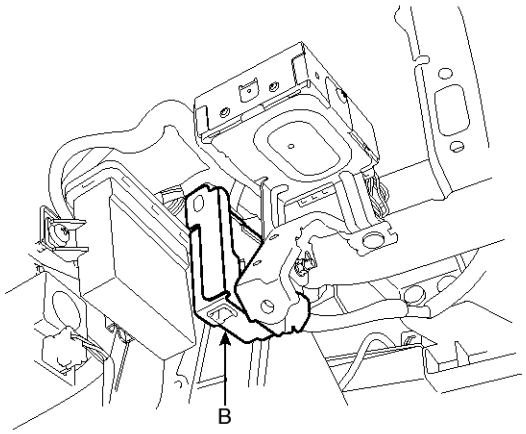
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4. After loosening the mounting nuts and connector (A), then remove the RF receiver (B).



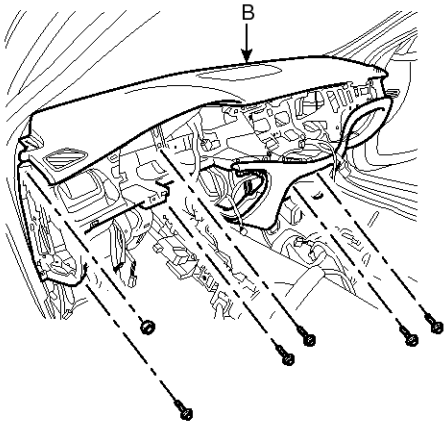

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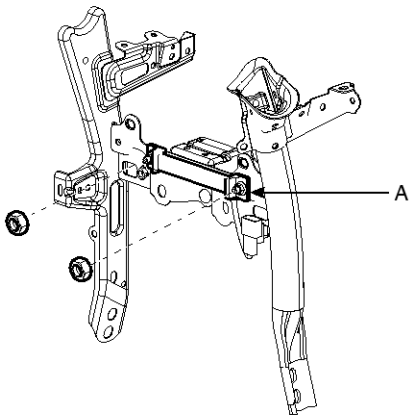
**Interior 1 Antenna**

1. Disconnect the negative (-) battery terminal.
2. Remove the main crash pad (B) after removing the b-olts and nuts. (Refer to the Body group - Trunk)




SBHBE8166D

3. Remove the interior 1 antenna (A) after removing the nut and connector.




SBHBE8167D

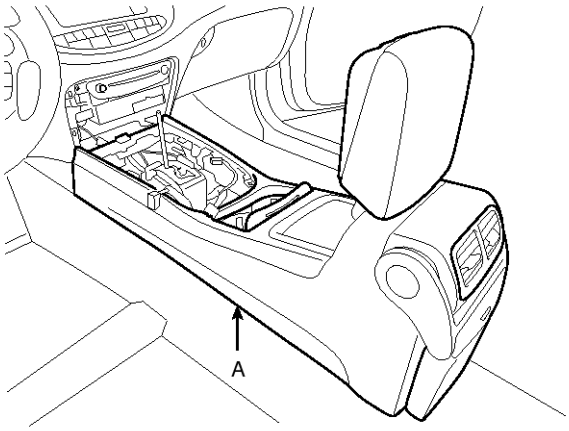
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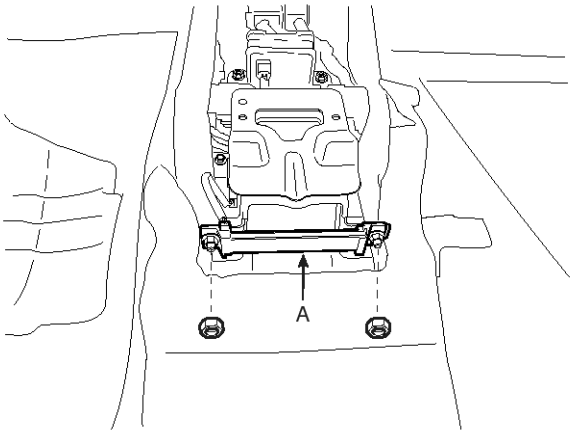
### Interior 2 Antenna

1. Disconnect the negative (-) battery terminal.
2. Remove the floor console assembly (A) after removing the bolts and nuts. (Refer to the Body group - Console)




SBHBE8168D

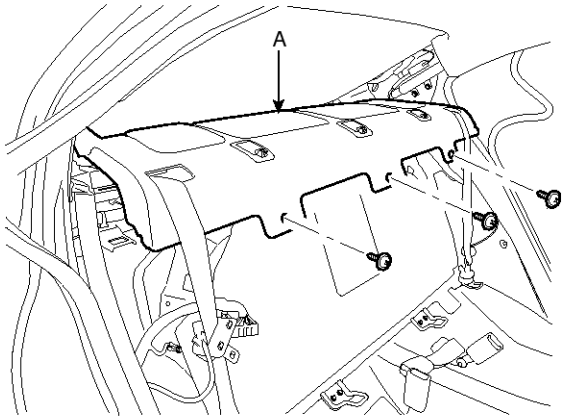
3. Remove the interior 2 antenna (A) after removing the nut and connector.




SBHBE8169D

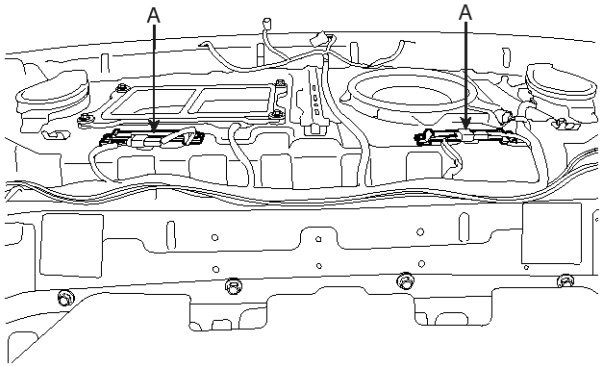
### Interior 3 Antenna

1. Disconnect the negative (-) battery terminal.
2. Remove the rear seat assembly. (Refer to the Body group - Rear seat)
3. Remove the package tray trim (A) after removing the screws.




SBHBE8170D

4. Remove the interior 3 antenna (A) after removing the nut and connector.




SBHBE8171D

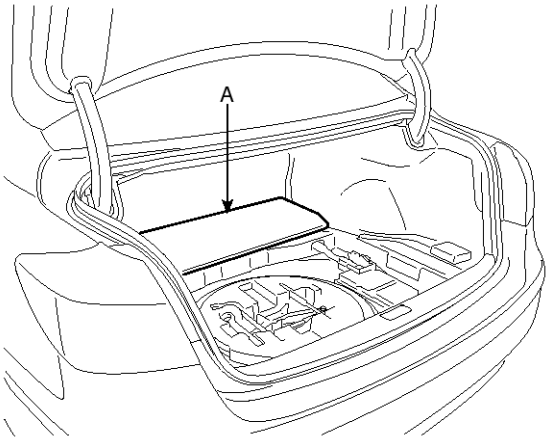
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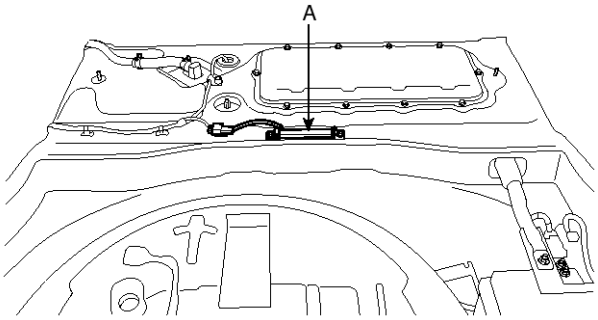
### Trunk Antenna

1. Disconnect the negative (-) battery terminal.
2. Remove the trunk carpet (A).




SBHBE8172D

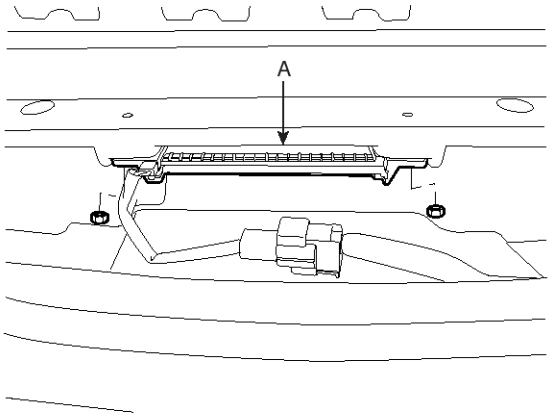
3. Remove the trunk antenna (A) after removing the nut and connector.




SBHBE8173D

### Exterior Bumper Antenna

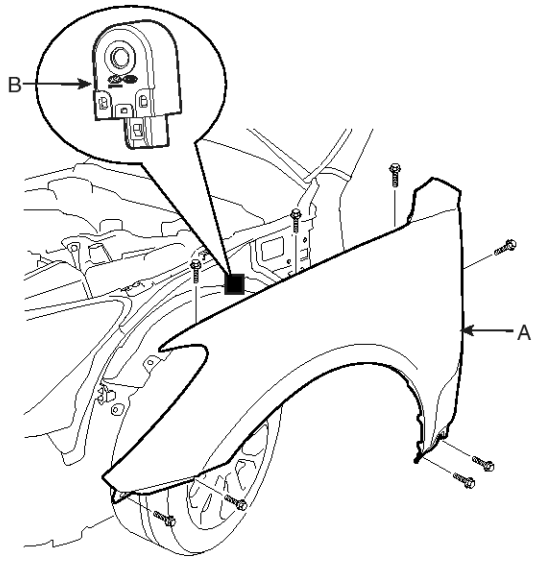
1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper. (Refer to the Body group - Rear bumper)
3. After loosening the antenna connector on the rear bumper and nuts(2EA), remove the exterior bumper antenna (A).




SBHBE8175D

### Buzzer

1. Disconnect the negative (-) battery terminal.
2. Remove the fender (A). (Refer to the Body group - Fender)




SBHBE8176D

3. Remove the buzzer (B) in the clip hole after disconnecting the connector on the side rail panel.

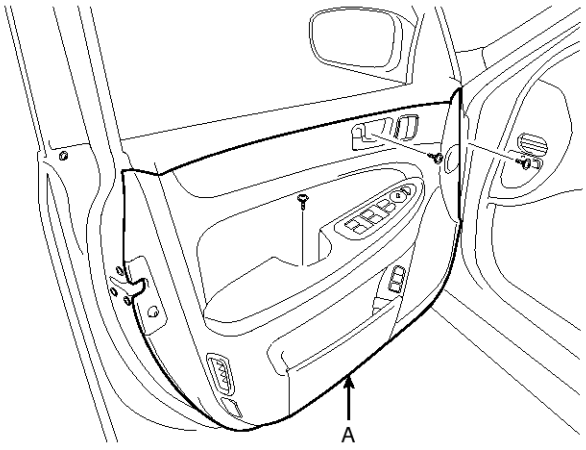
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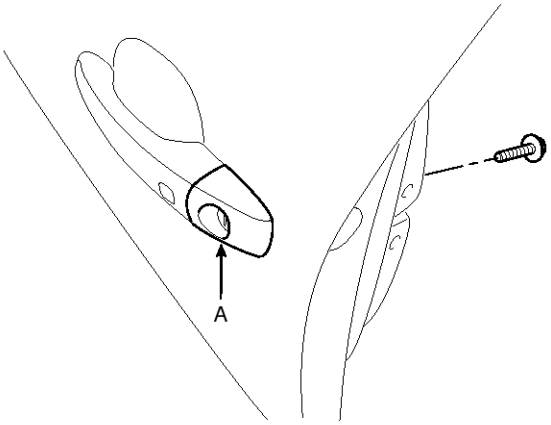
### Door Outside Handle

1. Disconnect the negative (-) battery terminal.
2. Disconnect the connector after removing the door trim (A). (Refer to the Body group - Front door)



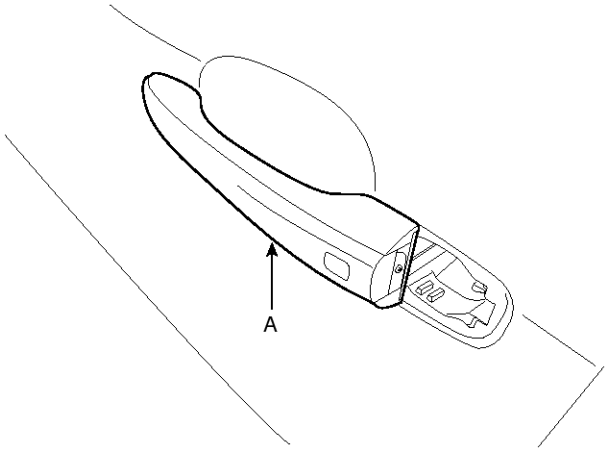

SBHBE8177D

3. After loosening the mounting bolt, then remove the key holder (A).




SBHBE8178D

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




SBHBE8179D

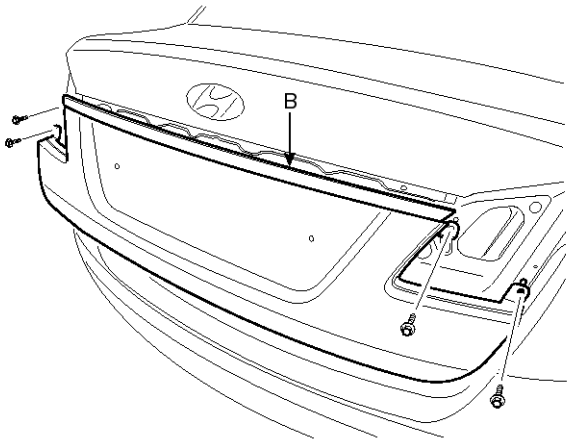
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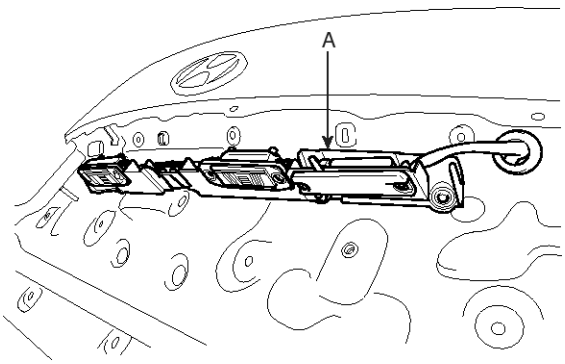
### Trunk Lid Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the Trunk lid panel (B). (Refer to the Body group - Trunk lid panel)




SBHBE8180D

3. Remove the trunk lid switch from the trunk lid switch assembly (A) after loosening the bolts.




SBHBE8181D

## Installation

### Smart Key Unit

1. Install the smart key unit and connector.
2. Install the crash pad lower panel.
3. Connect the negative (-) battery terminal and check the smart key system.

### RF Receiver

1. Install the connector and RF receiver.
2. Install the glove box housing connector and glove box.
3. Connect the negative (-) battery terminal and check the smart key system.

### Interior 1 Antenna

1. Install the interior 1 antenna and connector.
2. Install the main crash pad.
3. Connect the negative (-) battery terminal and check the smart key system.

### Interior 2 Antenna

1. Install the interior 2 antenna and connector.
2. Install the floor console assembly.
3. Connect the negative (-) battery terminal and check the smart key system.

### IInterior 3 Antenna

1. Install the interior 3 antenna and connector.
2. Install the package tray trim and rear seat assembly.
3. Connect the negative (-) battery terminal and check the smart key system.

### Trunk Antenna

1. Install the trunk antenna and connector.
2. Install the trunk carpet.
3. Connect the negative (-) battery terminal and check the smart key system.

### Exterior Bumper Antenna

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

### Buzzer

1. Install the buzzer in the clip hole and connector on the side rail panel.
2. Install the fender.
3. Connect 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.

### Trunk Lid Switch

1. Install the trunk lid switch and trunk lid panel.
2. Install the negative (-) battery terminal and check the smart key system.

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## Inspection

### Smart Key Unit

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

### Smart Key Switch

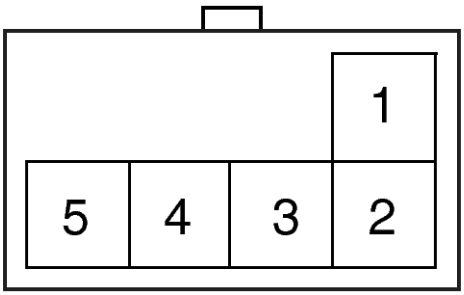
- Refer to the BE group - inspection / self diagnosis with scan tool

### Antenna

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

### Trunk Lid Switch

1. Check for continuity between the terminals.




SBHBE8182D

2. If continuity is not specified, inspect the switch

| Terminal \ Position | OFF | ON(PUSH) |
|---|---|---|
| 1 | | ○ |
| 2 | | ○ |

SBHBE9267L

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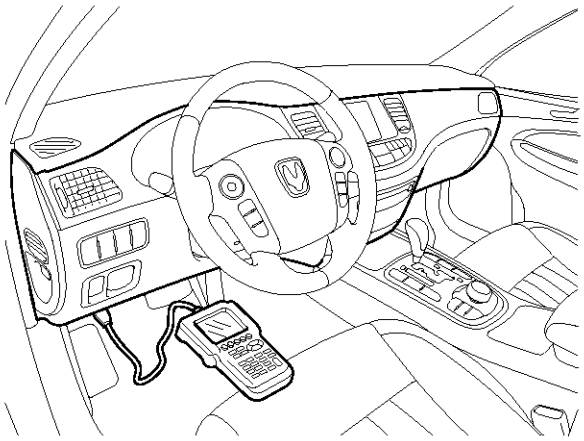
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## Smart Key

### Smart Key Code Saving

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.



SBHBE8201D

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

scan image
SBHBE9268L

SBHBE9268L

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

scan image
SBHBE9269L

SBHBE9269L

scan image
SBHBE9270L

SBHBE9270L

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

scan image
SBHBE9271L

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SBHBE9272L

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




SBHBE9273L

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




SBHBE9274L

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




SBHBE9275L

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




SBHBE9276L

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## Keyless Entry And Burglar Alarm

### Specification

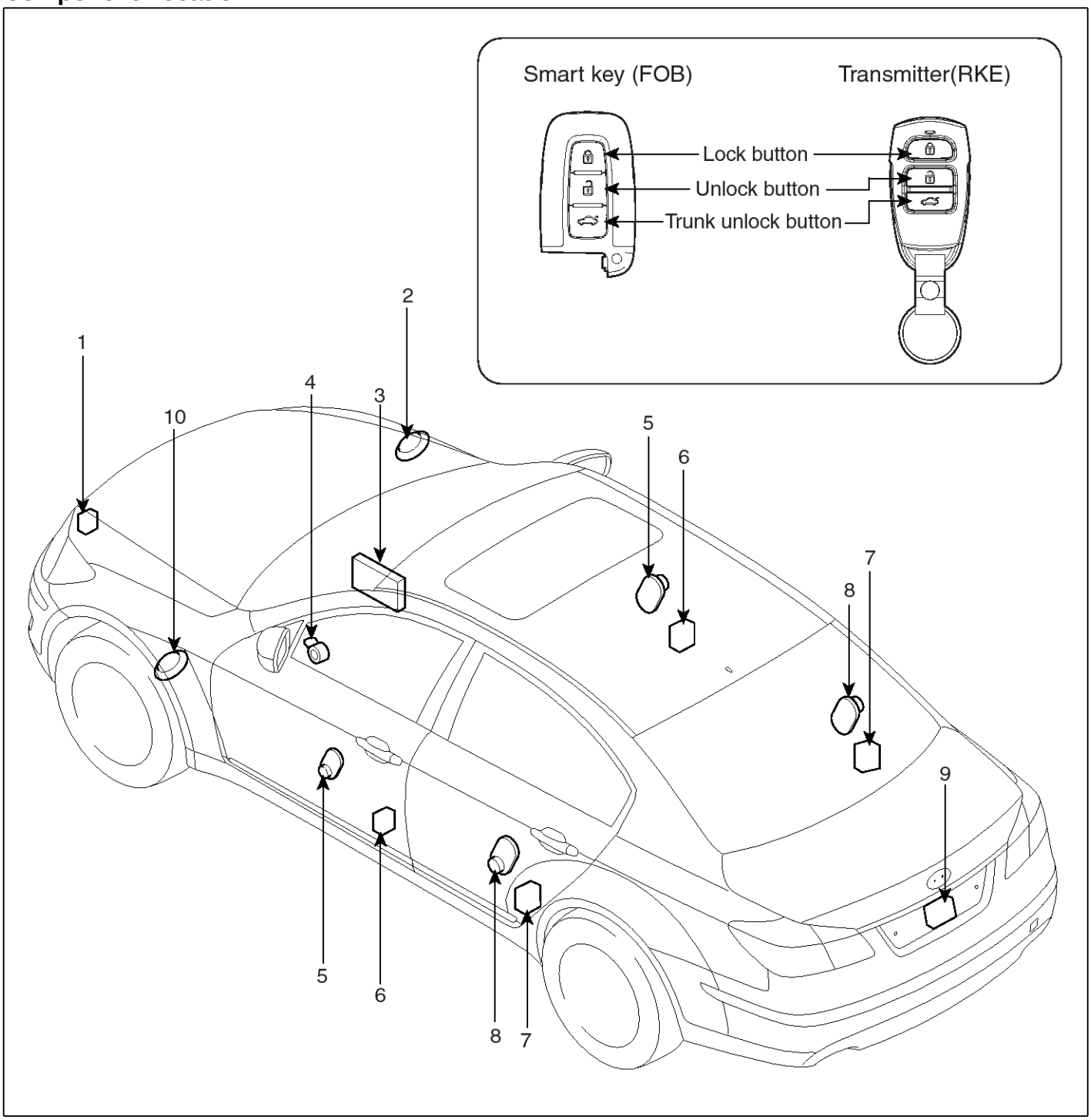
| Items | Specifications |
|---|---|
| Power source | 3V |
| Operating temperature | -20˚C ~ +65˚C |
| RF | FSK |
| RF Transmission frequency | 315 MHz |
| Indicator | LED |
| Battery | 1EA (CR2032 - 3V 220mA) |
| Life of Battery | 3 years min.10 cycles per a day4 |
| Button number | 3 |
| Button | Lock |
| | Unlock |
| | Trunk |

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## Component Location




SBHBE9451L

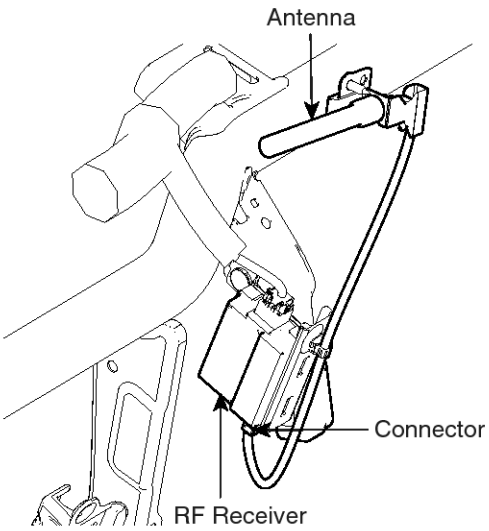
1. Hood switch
2. Burglar horn
3. RF receiver
4. Key warning switch
5. Front door switch
6. Front door lock actuator & switch
7. Rear door lock actuator & switch
8. Rear door switch
9. Power trunk lid switch
10. Door lock/ unlock buzzer

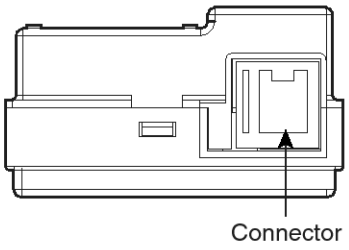
https://autolibrary.ir

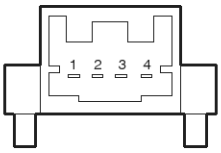
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## Component Location




| Pin | Description |
|---|---|
| 1 | Rx data |
| 2 | - |
| 3 | Power |
| 4 | GND |

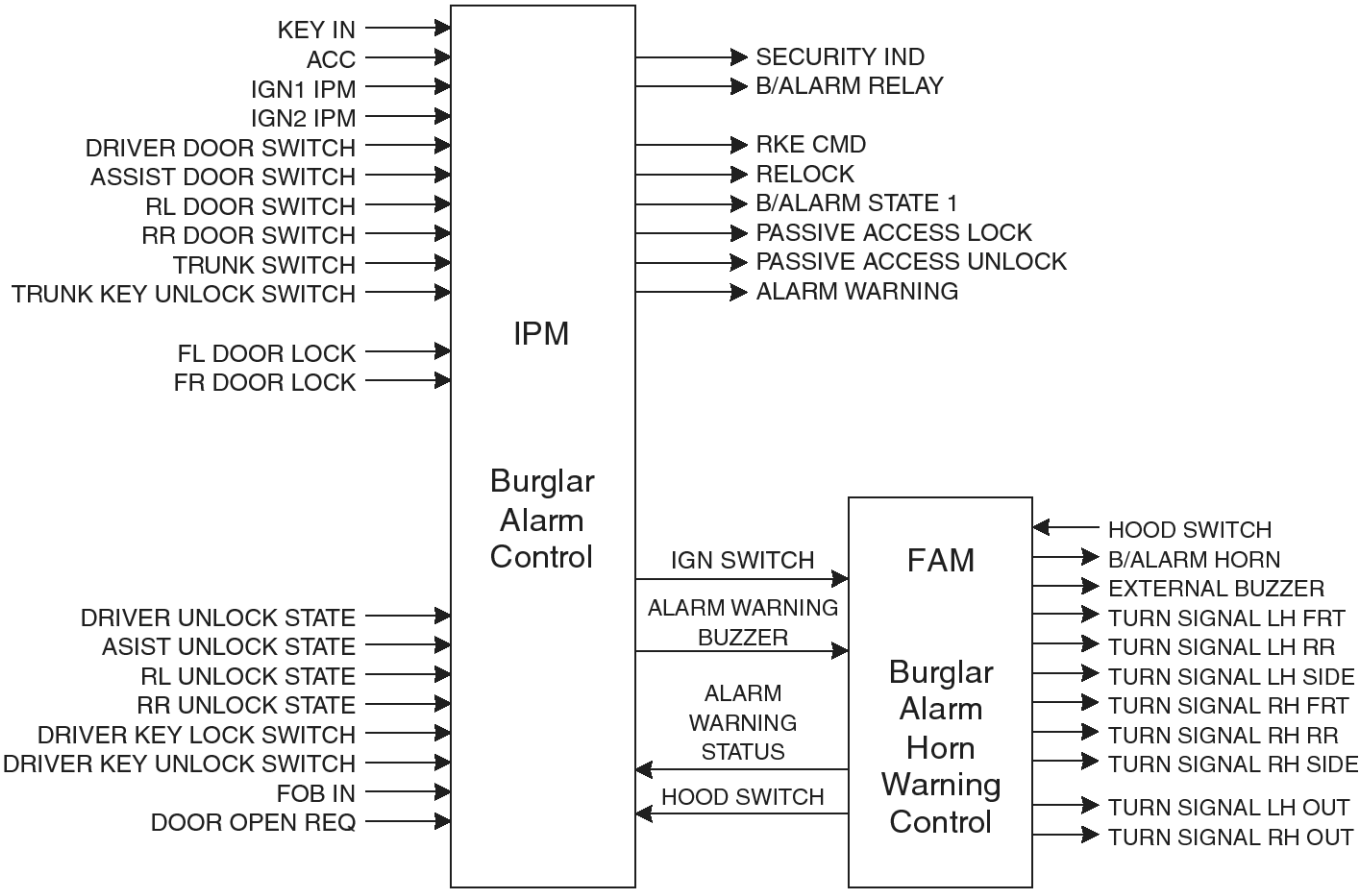
SBHBE9050L

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## Description




SBHBE9001L

### Burglar Alarm system

The Burglar Alarm system is a theft protection feature w-hich ;

Armed by

- Turning the mechanical key lock switch in driver side door .
- By RKE or Passive LOCK command.
- All door lock and then all door closed.

Triggers an Alarm when

- Any doors open.
- Hood open.
- Trunk open by unknown event.
- (Key In = ON) or (IGN1 IPM = ON) or (IGN2 IPM = O-N) event only in China variant.

Disarmed by

- Turning the mechanical key unlock switch in driver si-de door.
- By RKE or Passive UNLOCK command.

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## Operation

### IPM Bugler alarm

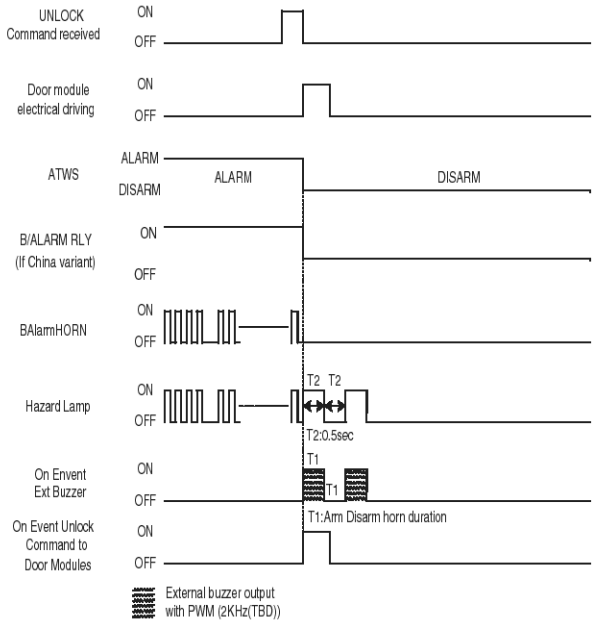
### DISARM

LED is Blinking if IGN KEY OUT = TRUE, otherwise LED OFF.

If ATWS state is changed to DISARM, IPM shall cancel 5 sec lock confirmation timer.

1. Condition 1

| Initial condition | ALARM state | |
|---|---|---|
| Event | • IGN KEY ON during 30sec or Alt L = Off → ON | |
| | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) and Any door open<br>• LOCK (by RKE CMD) but confirmation failure<br>• TRUNK (Trunk open by RKE CMD) | • UNLOCK (by RKE Unlock or SMK Unlock) and Any door open<br>• TRUNK (Trunk open by RKE Trunk or SMK Trunk)<br>• LOCK (by RKE Lock or SMK Lock) but confirmation failure |
| Action | • The state goes to DISARM state<br>• Alarm Hazard flashing, Horn are off<br>• Only UNLOCK (by RKE CMD or RKE Unlock or SMK Unlock)<br>• Alarm warning buzzer 2times, Hazard 2 times | |




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2. Condition 2

| Initial condition | DISARM state and (IGN KEY OUT) and Any door open | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • UNLOCK (by RKE Unlock or PAS Unlock) |
| Action | • No state change<br>• Only UNLOCK (by RKE CMD or RKE Unlock or SMK Unlock)<br>• Alarm warning buzzer 2times, Hazard 2 times | |

3. Condition 3

| Initial condition | ARM WAIT state |
|---|---|
| Event | • Any entrance open<br>• Any door is unlocked<br>• KEY IN or ACC or ST |
| | • Mechanical UNLOCK |
| Action | • The state goes to DISARM state |

4. Condition 4

| Initial condition | AUTO-LOCK TIMER 1 state | |
|---|---|---|
| Event | • Any entrance open<br>• Lock by AUTOLOCK, but confirmation failure<br>• KEY IN or ACC or ST | |
| | NON-SMK | SMK(Smartkey) |
| | • LOCK (by RKE CMD), but confirmation failure | • LOCK (by RKE Lock or SMK Lock), but confirmation failure |
| | • Mechanical LOCK but confirmation failure | |
| Action | The state goes to DISARM state | |

5. Condition 5

| Initial condition | AUTO-LOCK TIMER 2 state | |
|---|---|---|
| Event | • Any Door Open<br>• KEY IN or ACC or ST<br>• Hood/Trunk Open and Memory Hood/Trunk was Close.<br>• Lock by AUTOLOCK, but Lock confirmation failure | |
| | NON-SMK | SMK(Smartkey) |
| | • LOCK (by RKE CMD), but confirmation failure | • LOCK (by RKE Lock or SMK Lock), but confirmation failure |
| | • Mechanical LOCK but confirmation failure | |
| Action | • The state goes to DISARM state | |

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6. Condition 6

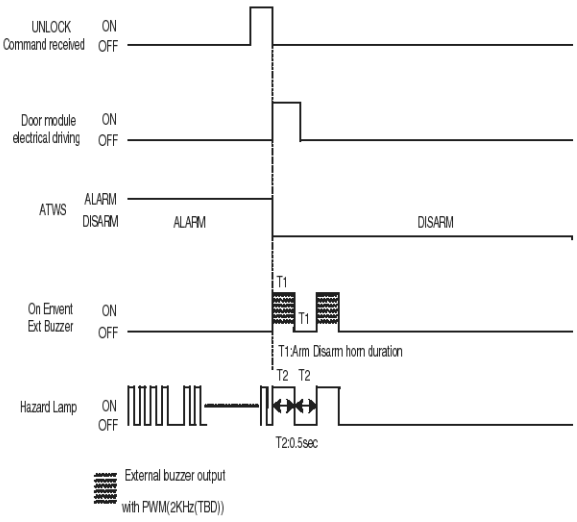
| Initial condition | ARM state or ARM HOLD state |
|---|---|
| Event | • IGN KEY ON<br>• Mechanical UNLOCK |
| Action | • The state goes to DISARM state |

7. Condition 7

| Initial condition | REARM state | |
|---|---|---|
| Event | • IGN KEY ON during 30sec or Alt L = Off → ON | |
| | NON-SMK | SMK(Smartkey) |
| | • TRUNK (Trunk open by RKE CMD)<br>• LOCK (by RKE CMD), but confirmation failure | • TRUNK (Trunk open by RKE Trunk or SMK Trunk)<br>• LOCK (by RKE Lock or SMK Lock), but confirmation failure |
| | • Mechanical UNLOCK<br>• Trunk Open by Mechanic key<br>• Mechanical LOCK but confirmation failure | |
| Action | • The state goes to DISARM state | |

**NOTICE**

*When entered DISARM mode, Horn OFF.*




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**NOTICE**

*We can not disarm anti-theft by unlocking the door with mechanical key directly from the door lock if bi mecha lock unlock is not set*

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**ARM**

1. Condition 1

| Initial condition | ARM state | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • LOCK(Lock by RKE CMD) | • LOCK (by RKE Lock or SMK Lock) |
| Action | • No state change<br>• Only LOCK (by RKE CMD or RKE Lock or SMK Lock)<br>• Alarm warning buzzer 1 time, Hazard 1 time | |

2. Condition 2

| Initial condition | ARM HOLD state |
|---|---|
| Event | • Trunk close for at least Trunk Release Time Out(default 30 sec) in ARMWAIT state |
| Action | • The state goes to ARM state |

3. Condition 3

| Initial condition | ARMWAIT state |
|---|---|
| Event | • ARM WAITING TIMER is expired |
| Action | • The state goes to ARM state |

**ALARM**

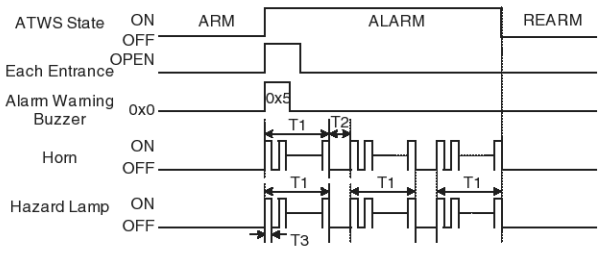
1. Condition 1

| Initial condition | ARM state |
|---|---|
| Event | • Any entrance open |
| Action | • IPM sends Alarm Warning Buzzer<br>→ Non-EC and Non-China Area<br>: IPM sends Alarm Warning Buzzer = 5 :Pattern(Alarm) 3time, then the horn rings 3 times with 27sec(±2 sec) on ,10sec(±2sec) off.<br>→ EC or China Area<br>: IPM sends Alarm Warning Buzzer = 6: Pattern(Alarm) 1time. then the horn rings 1 time for 27sec(±2s-ec)<br>• The hazard is driven also (During Horn driving)<br>• The state goes to ALARM mode |

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T1 : 27s (±2 sec), T2 : 10s (±2 sec), T3 : 0.5s ± 0.1 sec

2. Condition 2

| Initial condition | ARM HOLD state |
|---|---|
| Event | • Any door open or Hood open |
| Action | • IPM sends Alarm Warning Buzzer<br>→ Non-EC and Non-China Area<br>: IPM sends Alarm Warning Buzzer = 5:Pattern(Alarm) 3time, then the horn rings 3 times with 27sec(±2 sec) on ,10sec(±2sec) off.<br>→ EC or China Area<br>: IPM sends Alarm Warning Buzzer = 6:Pattern(Alarm) 1time. then the horn ring 1 time for 27sec(±2sec)<br>• The hazard is driven also (During Horn driving)<br>• The state goes to ALARM mode |

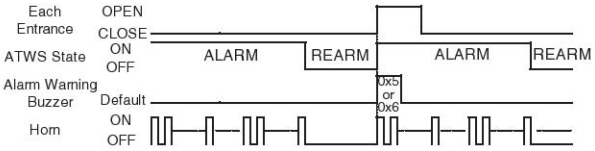
3. Condition 3

| Initial condition | REARM state |
|---|---|
| Event | • Any door open or Hood open or Trunk open |
| Action | • IPM sends Alarm Warning Buzzer<br>→ Non-EC and Non-China Area<br>: IPM sends C_AlarmWarningBuzzer = 5:Pattern(Alarm) 3time, then the horn rings 3 times with 27sec(±2sec) on ,10sec(±2sec) off.<br>→ EC or China Area<br>: IIPM sends C_AlarmWarningBuzzer = 6:Pattern(Alarm) 1time. then the horn ring 1 time for 27sec(±2 sec)<br>• The hazard is driven also (During Horn driving)<br>• The state goes to ALARM mode |

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**ARM WAIT mode**

1. Condition 1

| **Initial condition** | **ARMWAIT State** | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • LOCK (by RKE CMD) | • LOCK (by RKE Lock or SMK Lock) |
| Action | • No state change<br>• Only LOCK (by RKE CMD or RKE Lock or SMK Lock)<br>• Alarm warning buzzer 1 time, Hazard 1 time | |

2. Condition 2

| **Initial condition** | **DISARM State and IGN KEY OUT and All entrances closed** | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • LOCK (by RKE CMD) confirmed | • LOCK (by RKE Lock or SMK Lock) confirmed |
| | • Mechanical LOCK confirmed<br>• (All doors locked) and (Change from Any door open to All doors closed) | |
| Action | • The lock command is sent to DOOR MODULE to drive door lock (request via CAN com) and If DOOR M-ODULE responses during DCM LU Confirm Timeout(default 5sec) that the doors are locked<br>→Then : go to the ARMWAIT state<br>→Else : DISARM state<br>• Start ARMWAITTIMER<br>• Alarm warning buzzer 1 time, Hazard 1 time | |

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3. Condition 3

| Initial condition | ALARM state and All entrances closed | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • LOCK ( by RKE CMD) confirmed | • LOCK (by RKE Lock or SMK Lock) confirmed |
| | • Mechanical LOCK confirmed | |
| Action | • The lock command is sent to DOOR MODULE to drive door lock (request via CAN com) and If DOOR MODULE responses during DCM_LU_Confirm_Timeout (default 5sec) that the doors are locked<br>→Then : goes to the ARM WAIT state<br>→Else : DISARM state<br>• Alarm Hazard flashing, Horn are off<br>• Start ARM WAIT TIMER<br>• Alarm warning buzzer 1 time, Hazard 1 time | |

4. Condition 4

| Initial condition | AUTO LOCK TIMER1 State | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • Lock by RKE CMD confirmed | • Lock by SMK or Passive confirmed |
| | • Mechanical LOCK confirmed | |
| Action | • The lock command is sent to DOOR MODULE to drive door lock (request via CAN com)<br>The CAN lock command contains the keyless ID that generated the last unlock<br>And If DOOR MODULE responses during DCM LU Confirm Timeout (default 5sec) that the doors are locked<br>→Then : goes to the ARM WAIT state<br>→Else : DISARM state<br>• Start ARM WAIT TIMER<br>• Alarm warning buzzer 1 time, Hazard 1 time | |

**REARM mode**

1. Condition 1

| Initial condition | ALARM state |
|---|---|
| Event | • All entrances closed & Alarm Pattern finished |
| Action | • The state goes to REARM STATE |

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**AUTO-LOCK TIMER 1**

1. Condition 1

| Initial condition | ARM state | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • UNLOCK (by RKE Unlock or SMK Unlock) |
| Action | • The state goes to the AUTO-LOCK TIMER 1 state<br>• Start AUTOLOCKTIMER 1<br>• Alarm warning buzzer 2times, Hazard 2 times | |

2. Condition 2

| Initial condition | AUTO-LOCK TIMER 1 state | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • UNLOCK (by RKE Unlock or SMK Unlock) |
| Action | CASE 1 : UNLOCK<br>• No state change<br>• Only Unlock (by RKE CMD or RKE Unlock or SMK Unlock)<br>- Alarm warning buzzer 2times, Hazard 2 times<br>• AUTOLOCKTIMER1 timer restarts<br>CASE 2 : Expire AUTOLOCKTIMER 1<br>• AUTOLOCK | |

3. Condition 3

| Initial condition | ARM WAIT state | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • UNLOCK (by RKE Unlock or SMK Unlock) |
| Action | • The state goes to the AUTO-LOCK TIMER 1 state<br>• Start AUTO LOCK TIMER 1<br>• Alarm warning buzzer 2times, Hazard 2 times | |

4. Condition 4

| Initial condition | DISARM state and All Entrances closed and (IGN KEY OUT) | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • UNLOCK (by RKE Unlock or SMK Unlock)UNLO-CK |
| Action | • The state goes to the AUTO-LOCK TIMER 1 state<br>• Start AUTO LOCK TIMER 1<br>• Alarm warning buzzer 2times, Hazard 2 times | |

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5. Condition 5

| Initial condition | ALARM state and All entrances closed | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • UNLOCK (by RKE Unlock or SMK Unlock) |
| Action | • The state goes to the AUTO-LOCK TIMER 1 state<br>• Start AUTO LOCK TIMER 1<br>• Alarm Hazard flashing, Horn are off<br>• Alarm warning buzzer 2times, Hazard 2 times | |

6. Condition 6

| Initial condition | REARM state | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • UNLOCK (by RKE Unlock or SMK Unlock) |
| Action | • The state goes to the AUTO-LOCK TIMER 1 state<br>• Start AUTO LOCK TIMER 1<br>• Alarm warning buzzer 2times, Hazard 2 times | |

**PREARM**

1. Condition 1

| Initial condition | ARM HOLD | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • UNLOCK (by RKE CMD) | • LOCK (by RKE Lock or SMK Lock) confirmed |
| Action | • Mechanical LOCK<br>• The state goes to the PREARM state | |

2. Condition 2

| Initial condition | AUTO LOCK TIMER2 state | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • LOCK (by RKEvCMD) confirmed | • LOCK (by RKE Lock or SMK Lock) confirmed |
| | • Mechanical LOCK confirmed | |
| Action | • The lock command is sent to DOOR MODULE to drive door lock (request via CAN com)<br>The CAN lock command contains the keyless ID that generated the last unlock (FOB ID number or RKE number), in case of autolock triggered by mechanical unlock and If DOOR MODULE responses during DCM LU Confirm Timeout(default 5sec) that the doors are locked<br>Then : goes to the PREARM state<br>Else : DISARM state | |

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3. Condition 3

| Initial condition | ARMWAIT state | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • TRUNK (Open by RKE CMD) | • TRUNK (Open byRKE Trunk or SMK Trunk) |
| | • TRUNK (Open by Mechanic key) | |
| Action | • The state goes to the PREARM state<br>• Start TRUNKTIMER (Trunk Release Time Out (default 30sec)) | |

4. Condition 4

| Initial condition | DISARM state and IGN KEY OUT | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • (Any door open or Trunk open or Hood open) and LOCK (by RKE CMD) confirmed | • (Any door open or Trunk open or Hood open) and LOCK (by RKE Lock or SMK Lock) confirmed |
| | • (Any door open or Trunk open or Hood open) and Mechanical LOCK confirmed<br>• (All doors locked) and (Change from Any door open to All doors closed) and (Hood open or Trunk open) | |
| Action | • The lock command is sent to DOOR MODULE to drive door lock (request via CAN com) and If DOOR MODULE responses during DCM LU Confirm Timeout(default 5sec) that the doors are locked<br>Then : goes to the PREARM state<br>Else : DISARM state | |

**ARM HOLD**

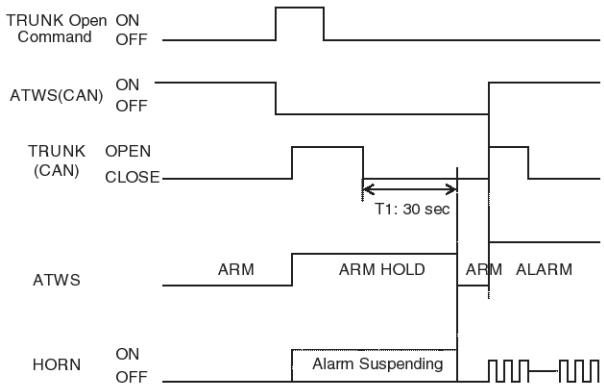
1. Condition 1

| Initial condition | ARM State | |
|---|---|---|
| Event | NON-SMK | SMK(Smartkey) |
| | • TRUNK (open by RKE CMD) | • TRUNK (open by RKE Trunk or SMK Trunk) |
| | • Trunk Open by Mechanic key | |
| Action | • The state goes to the ARM HOLD state<br>• The alarm for the trunk is only suspended, but the alarm for doors and hood keeps on arming | |

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SBHBE9006L

## RESET

1. Condition 1

| Initial condition | During ALARM, REARM |
|---|---|
| Event | • TAKING THE BATTERY OUT(Cold or Warm RESET) |
| Action | • After reset the alarm activities(horn and flashing) should be started newly(No remained time of warning signal).<br>- The IPM sends Alarm Warning Buzzer(=5 or 6) again<br>• After reset Engine Start Inhibition are ON(B/ALARM_Relay = ON) |

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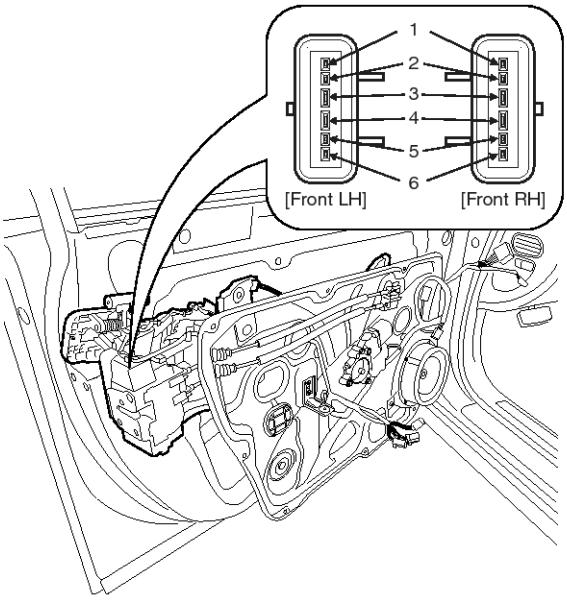
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## Inspection

### Front Door Lock Actuator Inspection

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.




SBHBE9051L

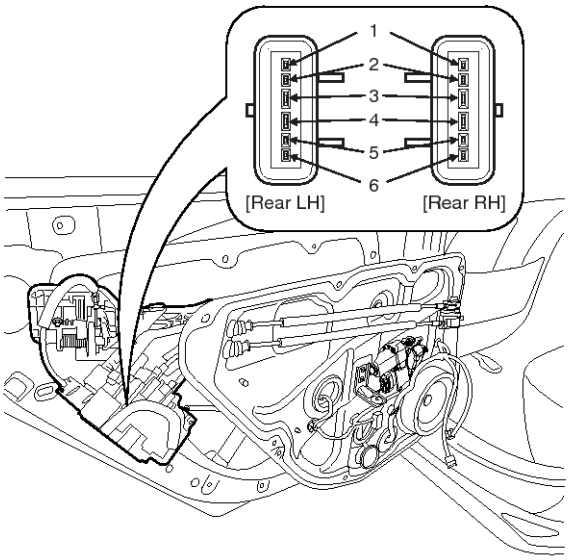
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

| Position \ Terminal | | 3 | 4 |
|---|---|---|---|
| Front left | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |
| Front right | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |

SBHBE9052L

### Rear Door Lock Actuator Inspection

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.




SBHBE9053L

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

| Position \ Terminal | | 3 | 4 |
|---|---|---|---|
| Rear left | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |
| Rear right | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |

SBHBE9054L

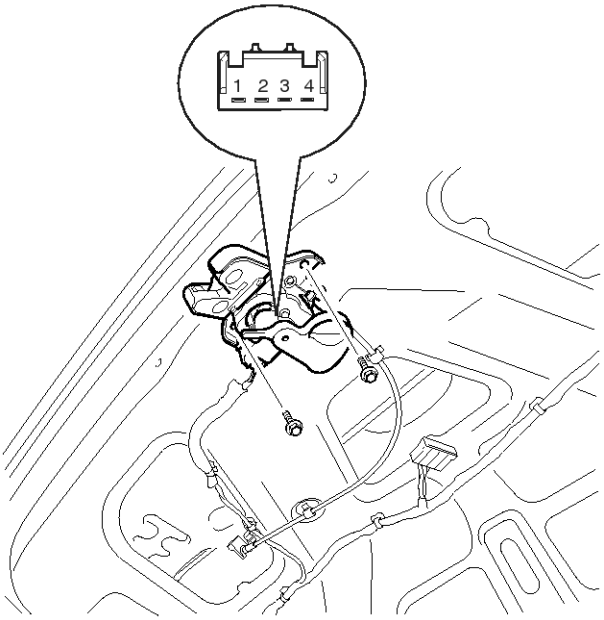
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### Trunk Lid Release Actuator Inspection

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 4P connector from the actuator.




SBHBE8481D

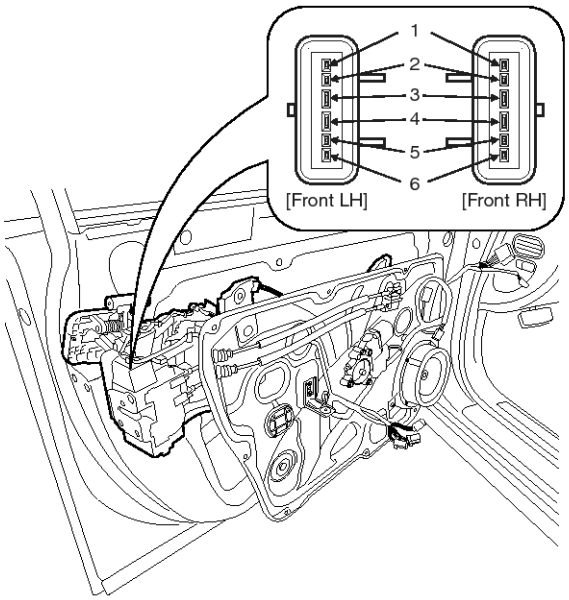
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

| Position \ Terminal | 3 | 1 |
|---|---|---|
| Close → Open | ⊕ | ⊖ |
| Open → Close | | |

SBHBE9055L

### Front Door Lock Switch Inspection

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.




SBHBE9051L

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

| Position \ Terminal | | 2 | 5 | 6 |
|---|---|---|---|---|
| Front left | Clock wise | ○—○ | | |
| | Couter clock wise | ○— | | —○ |
| Front right | Clock wise | ○— | | —○ |
| | Couter clock wise | ○—○ | | |

SBHBE9056L

| Position \ Terminal | | 1 | 2 |
|---|---|---|---|
| Front left | Unlock | ○— | —○ |
| Front right | Unlock | ○— | —○ |

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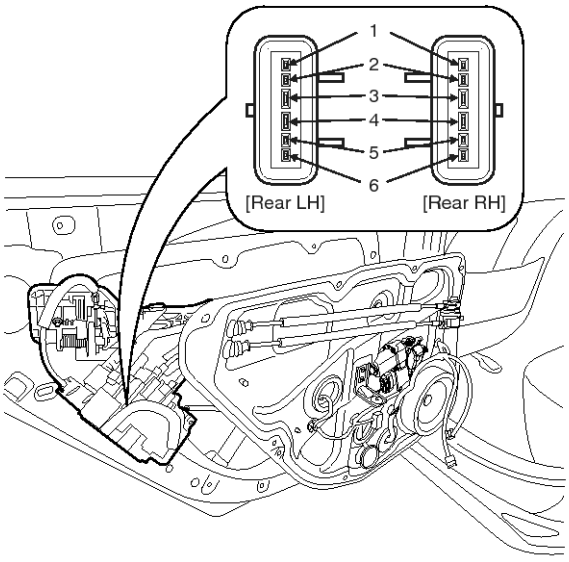
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### Rear Door Lock Switch Inspection

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.




SBHBE9053L

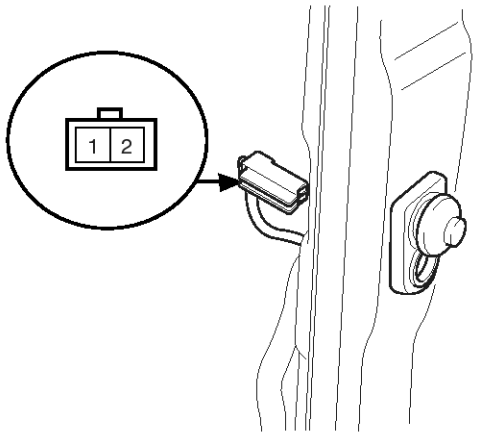
3. Check for continuity between the terminals in each switch position according to the table.

| Position \ Terminal | | 1 | 2 |
|---|---|---|---|
| Rear left | Unlock | ○—— | ——○ |
| Rear right | Unlock | ○—— | ——○ |

SBHBE9058L

### Door Switch Inspection

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



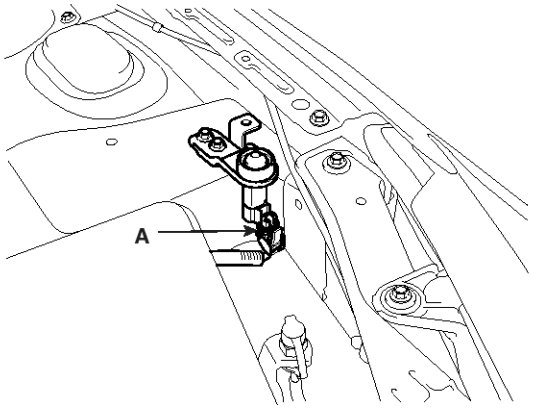

SHMBE8125D

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

ETQF180D

### Hood Switch Inspection

1. Disconnect the 2P connector from the hood switch.




SBHB18153D

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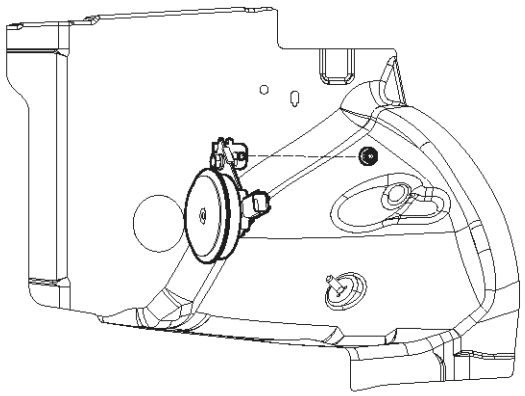
2. Check for continuity between the terminals and ground according to the table.

| Terminal / Position | 1 | 2 |
|---|---|---|
| Hood open (Free) | ○——— | ———○ |
| Hood close (Push) | | |

ETRF122K

### Burglar Horn Inspection

1. Remove the burglar horn after removing a bolt and disconnect the 2P connector from the burglar horn.
2. Test the burglar horn by connecting battery power to the terminal 1 and ground the terminal 2.



SBHB18154D

3. The burglar horn should make a sound. If the burglar horn fails to make a sound replace it.

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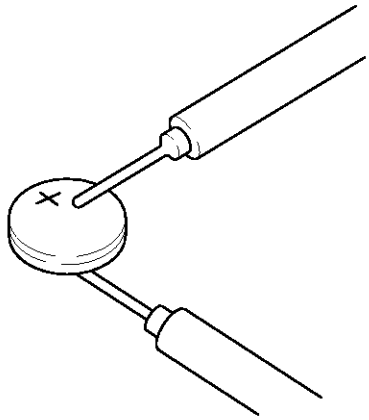


## Transmitter

### 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

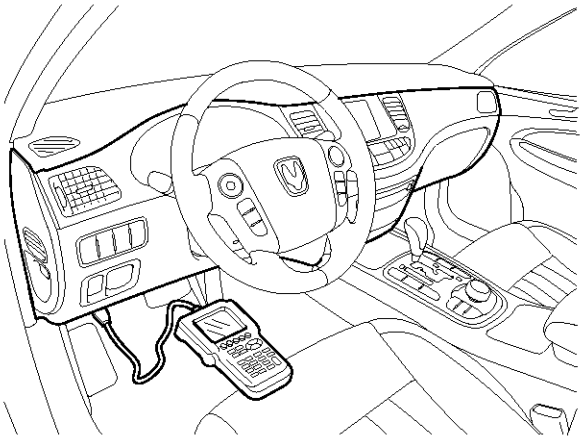


STQBE7143D

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 doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, replace the transmitter.

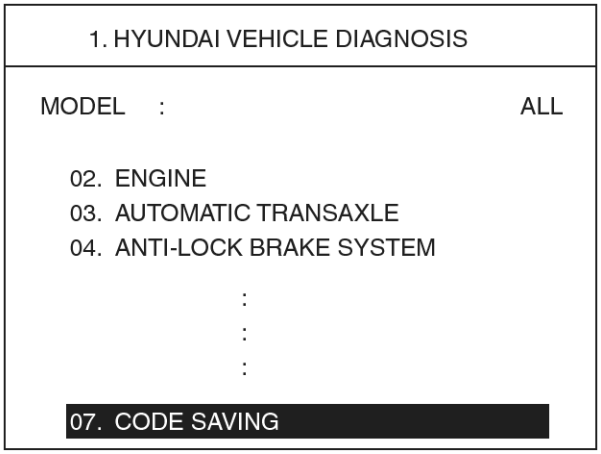
### Transmitter Code Registration

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



SBHBE8201D

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



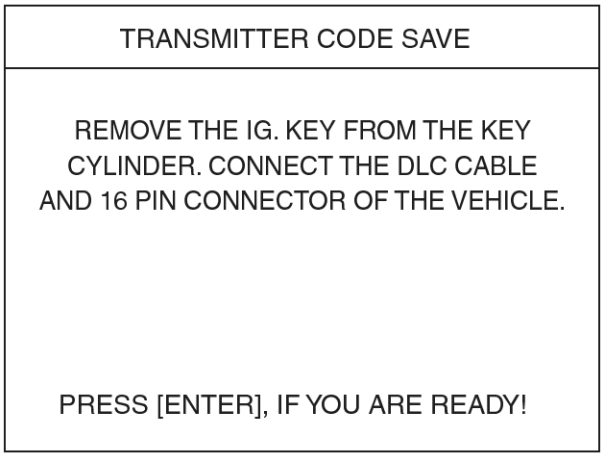

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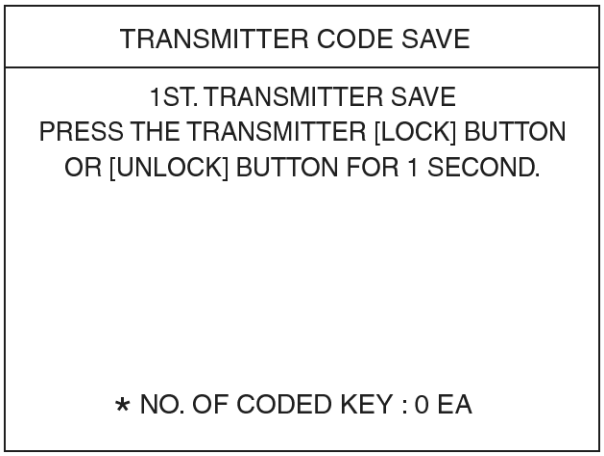


3. After selecting "CODE SAVING" menu, push "ENTER " key, then the screen will be shown as below.

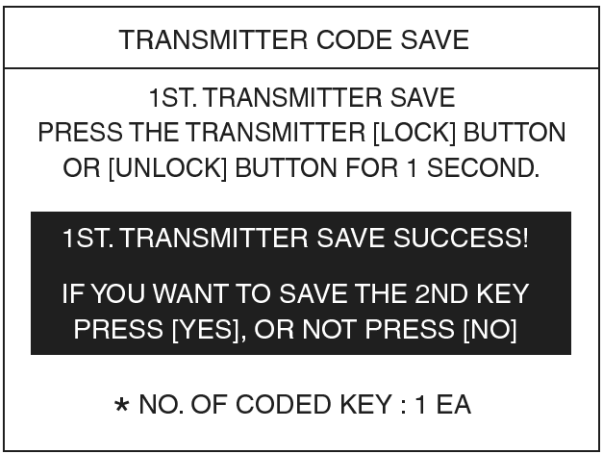



ETRF065M

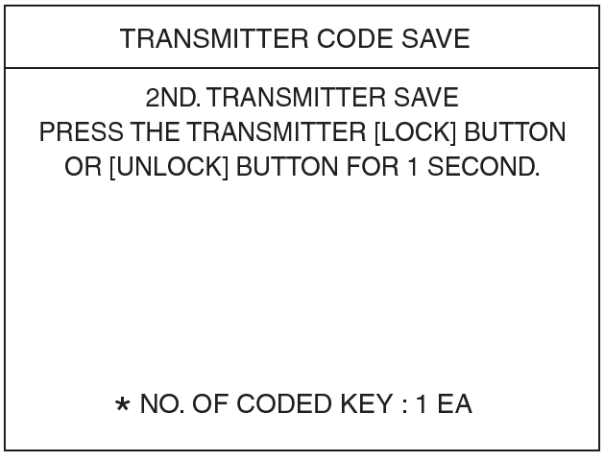
4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.



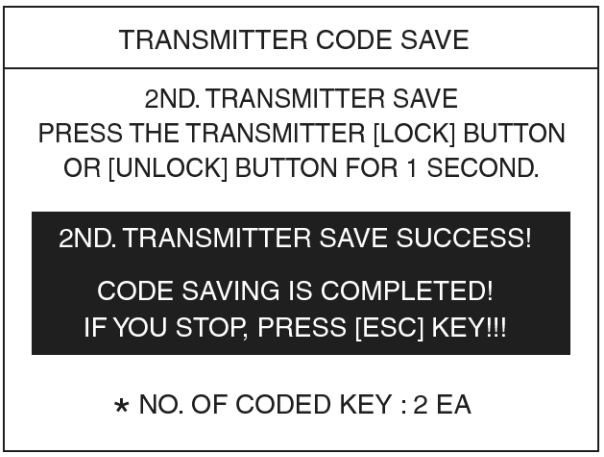

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ETRF065P




ETRF065Q

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# BCM (Body Control Module)

## Specifications

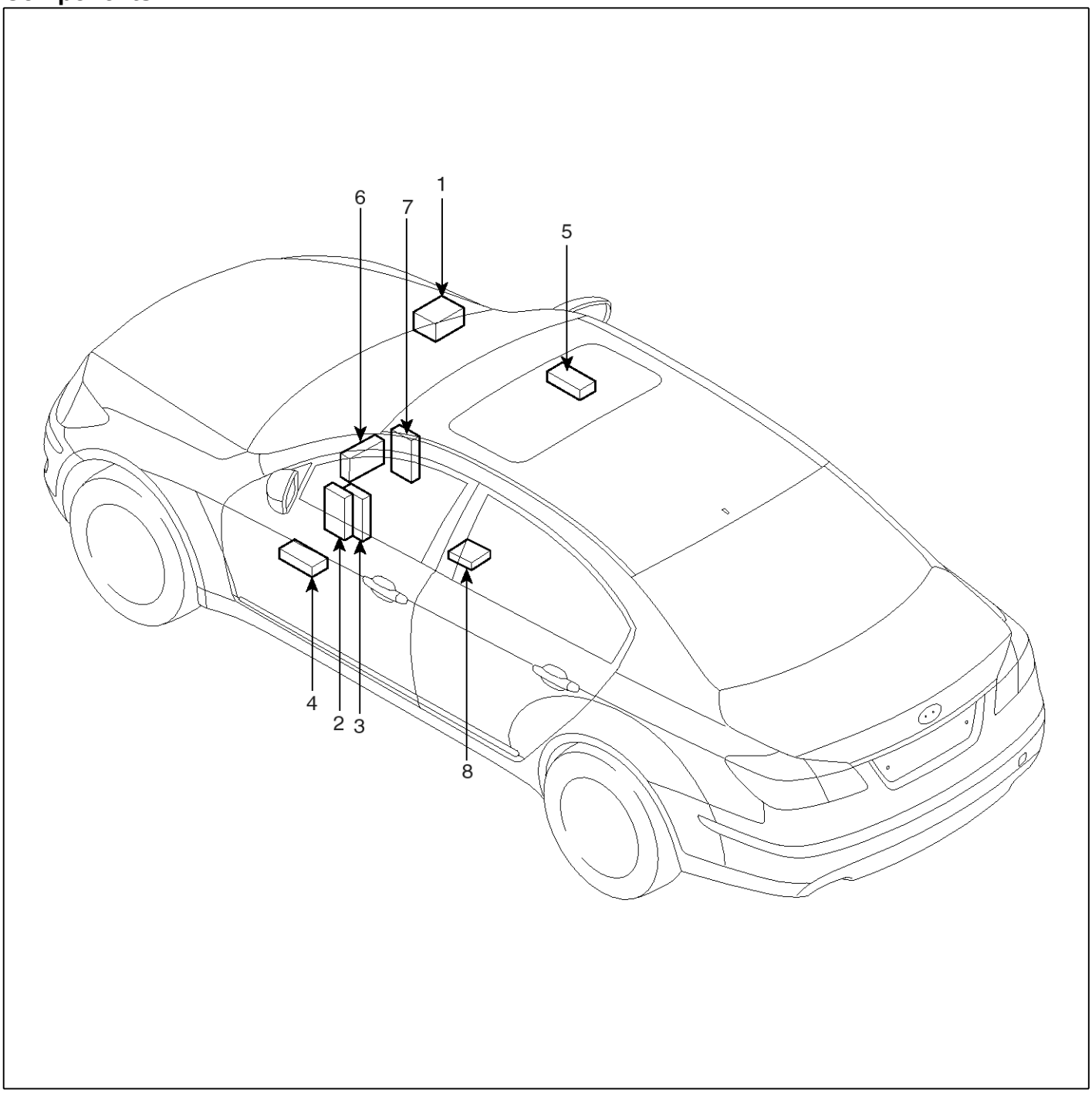
| Items | Specifications |
|---|---|
| Rated voltage | DC 12V |
| Operating voltage | DC 9 ~ 16V |
| Operating temperature | -30°C ~ 75°C |
| Insulation resistance | IPM : 3mA |
| | DDM : 2mA |
| | ADM : 2mA |
| | SCM : 2mA |
| | IMS : 2mA |
| | PDM : 1mA |
| | FAM : 1mA |

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## Components




SBHB18090D

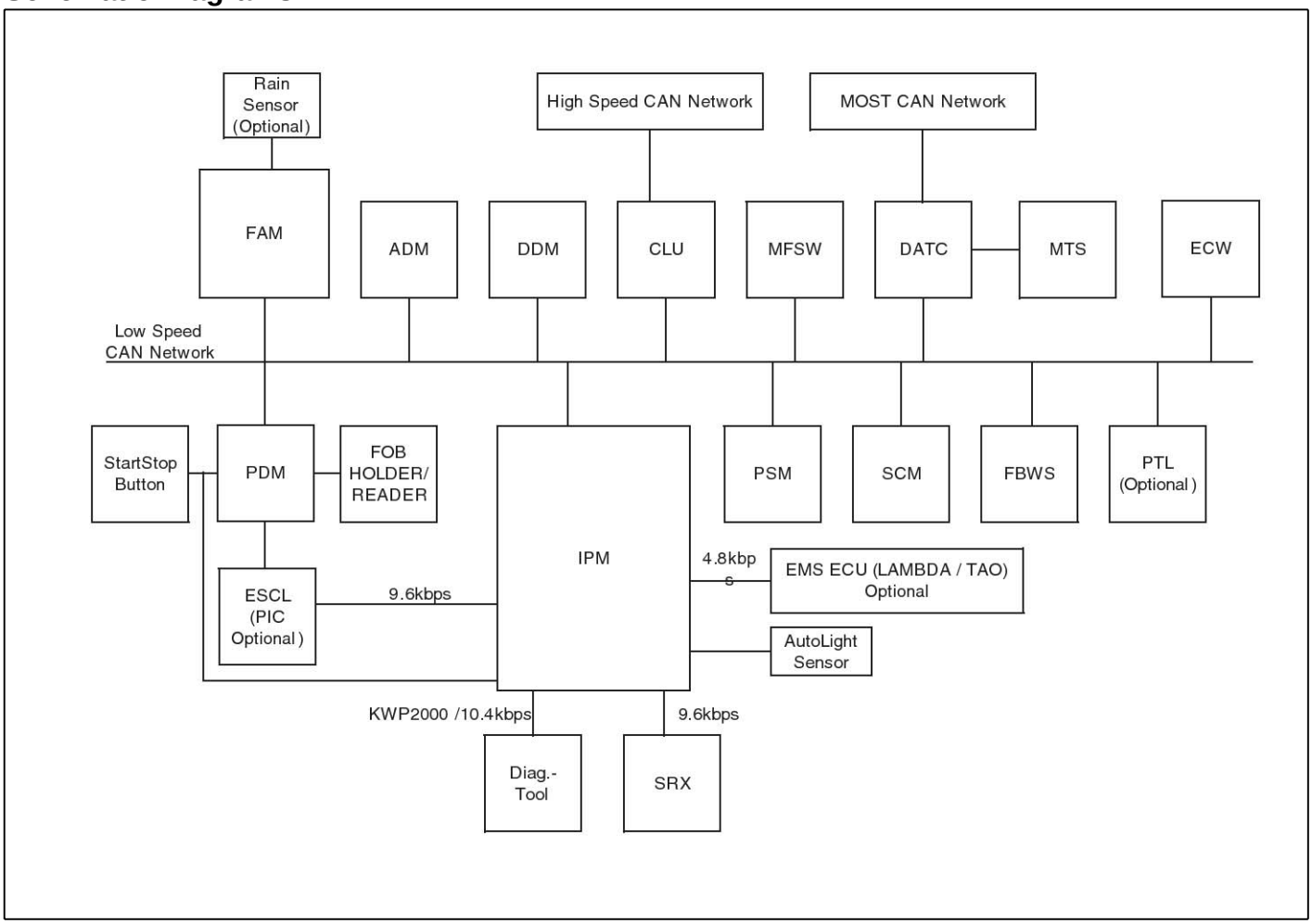
1. FAM (Front Area Module)
2. SCM (Steering Control Module)
3. IPM (Instrument Panel Module)
4. DDM (Driver Door Module)
5. ADM (Assist Door Module)
6. CLU (Cluster)
7. PDM (Power Distribution Module)
8. IMS (Integrated Memory System)

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## Schematic Diagrams




SBHB18084D

IPM : Instrument Panel Module
FAM : Front 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
CLU : Cluster
MFSW : Multi Function Switch
PSM : Power Seat Module
FBWS : Front Back Warning System
PTM : Power Trunk Module
ECW : Electronic Control Window
ESCL : Electronic Steering Column Lock

## Description

Body control module system receives various input switch signals controlling time and alarm functions for the intermittent wiper timer, washer timer, rear defogger timer, seat belt reminder, decayed out room lamp, central door lock, ignition key reminder, power window timer, door warning, tail lamp auto cut, crash door unlock, auto door lock, 2-Turn unlock, ignition key hole illumination control and keyless entry & burglar alarm.

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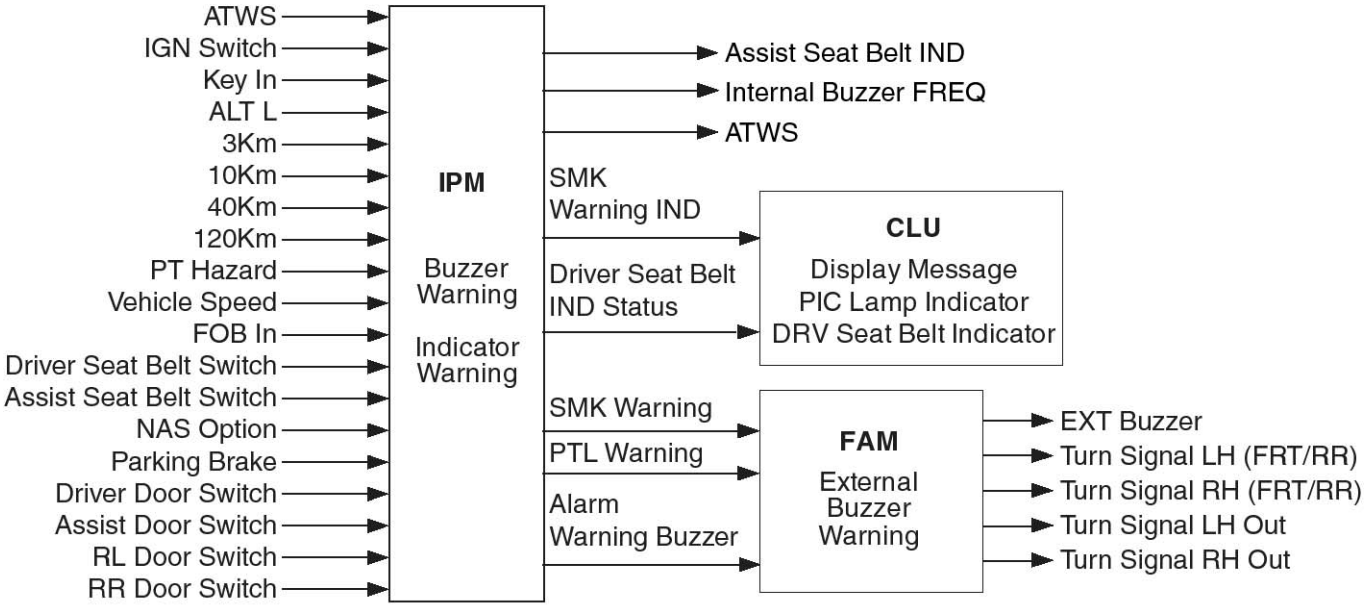


## Operation

### Warning Function Control

The Warning function includes the sub functions.

- Buzzer Warning
- Indicator Warning
- External Buzzer Warning for PIC function
- PIC Lamp Warning
- ESCL System Indicator Warning




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The Buzzer warning control includes the features.

- Overspeed warning in case of more than 120km/h for some of the Middle East countries.
- Key operated warning in case of key inserted and drive door open.
- IPM Internal buzzer priority: 1st has the highest priority.
  - 1st: Diagnostic sound (provided to test the Buzzer by way of Diagnostic tool)
  - 2nd: Seatbelt warning
  - 3rd: Overspeed warning
  - 4th: Key operated warning
  - 5th: Parking Brake warning
  - 6th: “ESCL not blocked” warning (SMK option only )
  - 7th: Key learning sound with High SCAN tool, non SMK option only
  - 8th: Key learning sound with Code Saving tool, non SMK option only
  - 9th: Warnings for SMK systems (4 warnings - SMK option only)
  - 10th: EPB Alarm warning

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1. **Seat Belt Warning Function**

   The driver side indicator in the Cluster is activated by 'Driver SeatBelt Indicator Status' CAN signal and the assistant side indicator is activated by the IPM output 'Assist SeatBelt Indicator'.

   Seat Belt Warning Sound:

   In case of Driver side 6sec Indicator, the cluster module operates it after receiving 'Driver SeatBelt Indicator Status' from the IPM. So if the IPM sends 'Driver SeatBelt Indicator Status = blinking' over 6sec then the IPM sounds buzzer warning one more time.

   Frequency:800 Hz

   Sound period:T2 = 1sec

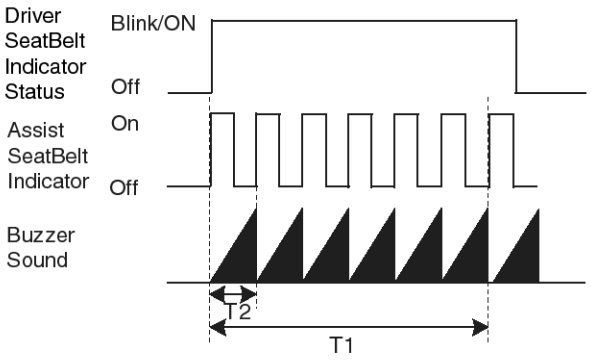
   Sound duration:T1 = 6sec

   Assistant Seat Belt Indicator:

   Duty:50%

   Period:T2 = 1sec

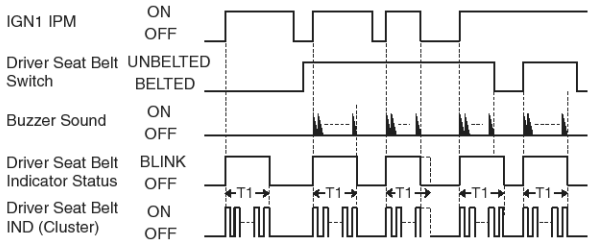
   Duration:T1 = 6sec




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Driver Seat Belt IND and Buzzer Sound Logic Condition

1) While IGN1 On status if IPM detects seatbelt transition UNFASTEN → FASTEN, BUZZER SOUND stops immediately but DRIVER SEAT BELT IND continues working for the remained time.
2) While IGN1 ON status if there is a seatbelt transition FASTEN → UNFASTEN, DRIVER SEAT BELT IND and BUZZER SOUND are always activated for one period.
3) If IGN1 is turned OFF during SEAT BELT WARNING, the DRIVER SEAT BELT IND and BUZZER SOUND stops immediately.
4) If IPM detects IGN ON signal regardless of seatbelt status, DRIVER SEAT BELT IND should be triggered for defined timing for IND check but Buzzer SOUND should be played only in case of unfastened seatbelt.




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T1: 6 ± 1 sec

2. **Key Operated Warning**
   - Condition : (Key IN = ON or ACC=ON or FOB IN= ON) and (IGN1 IPM=OFF, IGN2 IPM=OFF, ALT L=OFF)
   - Input : Driver door switch = Open
   - Output : Buzzer = On
3. **Parking Brake Warning**
   - Condition : (IGN1 = ON) and (10km/h = vehicle speed)
   - Input : Parking Brake = On
   - Output : Buzzer = On
4. **Key Learning Sound**

   When each Key's learning is ended, magnetic buzzer is operated, every one time.
5. **Steering Column Not Locked Warning**

   If all terminals are Off and the ESCL is not locked while the last command was a block command, the IPM generates this warning.
6. **Steering Column IS Not UNLocked Warning**

   After SSB(Start Stop Button) press, If the steering lock is not unlocked due to any failure except ESCL failure, then the IPM generates a corresponding warning.
7. **SMK System Buzzer Warning**

   Warning sounds are necessary for the SMK(smartkey ) system in the following cases:

   FOB IN means FOB is inserted in FOB holder.

   1) ID out warning

      While the valid Fob is not inside car, if all doors are closed at IGN or ACC state, the buzzer warning (external and internal) sound is activated for 3sec.

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2) Deactivation of ID

While the valid Fob is inside car and the vehicle enters ATWS armed, the buzzer warning(internal) sound is activated for 5sec.

The “Deactivation of IDs” warning sound stops, when ATWS disarmed.

3) Door Lock warning 1

While the valid Fob is founded near by outside handle and all doors are closed at ACC or IGN state without Fob IN, the buzzer warning(external) sound is activated for 3sec.

The "Door lock warning1" sound stops, when the activity timer elapsed or (ACC=OFF) or (NOT ALL DOORS CLOSED) or (FOB IN).

4) Door Lock warning 2

While the valid Fob is founded near by outside handle and any door open at terminal OFF state without Fob IN, the buzzer warning(external) sound is activated for 3sec.

The "Door lock warning2" sound stops, when the activity timer elapsed or (ACC=ON) or (IGN1 = ON) or (ALL DOOR CLOSED) or (FOB IN).

5) Door Lock warning 3

While the valid Fob is inside car and all doors are closed at terminal OFF state without FOB in, the buzzer warning(external) sound is activated for 3 sec.

The "Door lock warning3" sound stops, when the activity timer elapsed or (ACC=ON) or (IGN1 = ON) or (NOT ALL DOOR CLOSED) or (FOB IN).

8. **SMK Key Reminder Warning 2 (SMK Option Only)**

Any door opens at terminal OFF state without FOB in . After transition to all door closed within 500msec, if the valid Fob is in side car and all door locked then IPM transmits SMK key reminder warning 2 command (SMK Warning

9. **SMK System Lamp Warning (SMK Option Only)**

While the valid Fob is not inside car and 3Km/h is not set(3km = Off) at (Fob In = Off, ACC = On) or (IGN1 IPM = On) then send SMK Warning IND = (SMK Lamp Waring).

10. **SMK System Trunk Warning (SMK Option Only)**

While the valid Fob is inside trunk and the trunk open state, the IPM detects the trunk closed state then IPM transmits trunk warning command (SMK Warning).

If a 3sec trunk re-opening warning sound is in progress and there is another trunk re-opening warning sound request before the end of the previous 3sec buzzer, the warning is re-triggered for 3 seconds.

11. **ESCL System Indicator Warning**

The IPM sends SMK Warning.

IPM send SMK Warning IND to CLU(Cluster) and PDM by state sending type.

1) Shift “P” Warning ID

This warning appears when the SSB is pushed to stop the engine or to switch off all terminals with the A/T gear M lever in any position except the ‘P’ position. If this warning appears, the terminal system is remains in the [ACC] position state instead of the OFF position.

2) Key Battery Discharge Warning

This indicator appears when the Key battery is running out of power.

3) Steering Column Not Unlock Warning

If the steering lock is not unlocked due to the load applied to the steering wheel when pushing the SSB, the IPM generates a corresponding warning and the SSB indicator light blinks green.

4) Steering Column Not Locked Warning

If all terminals are Off and the ESCL is not locked while the last command was a block command, the buzzer warning(internal) sound is activated.

5) ESCL ECU Fail Warning

This Indicator appears when the ESCL ECU failure is detected in the OFF state. the buzzer warning(internal) sound is activated.

6) Engine Start Operation Indicator

This indicator appears when the system is in the [ACC] or [IGN] state.

7) Authentication Failed Warning

The SSB is operated and no valid fob in interior. There are two patterns for situation; Pattern 1 is that the user presses the SSB to go to [ACC] state from [OFF]. And pattern 2 is that the user presses the SSB to start Engine in [OFF] or [ACC] or [IGN] states.

8) FOB Key Removal Indicator

User turns all terminals off with fob key in holder. There are two patterns for situation; Pattern 1 is that the user turns all terminals off from [IGN] state with Fob key in holder. And pattern 2 is that the user turns all terminals off from [IGN – Engine] with Fob key in holder.

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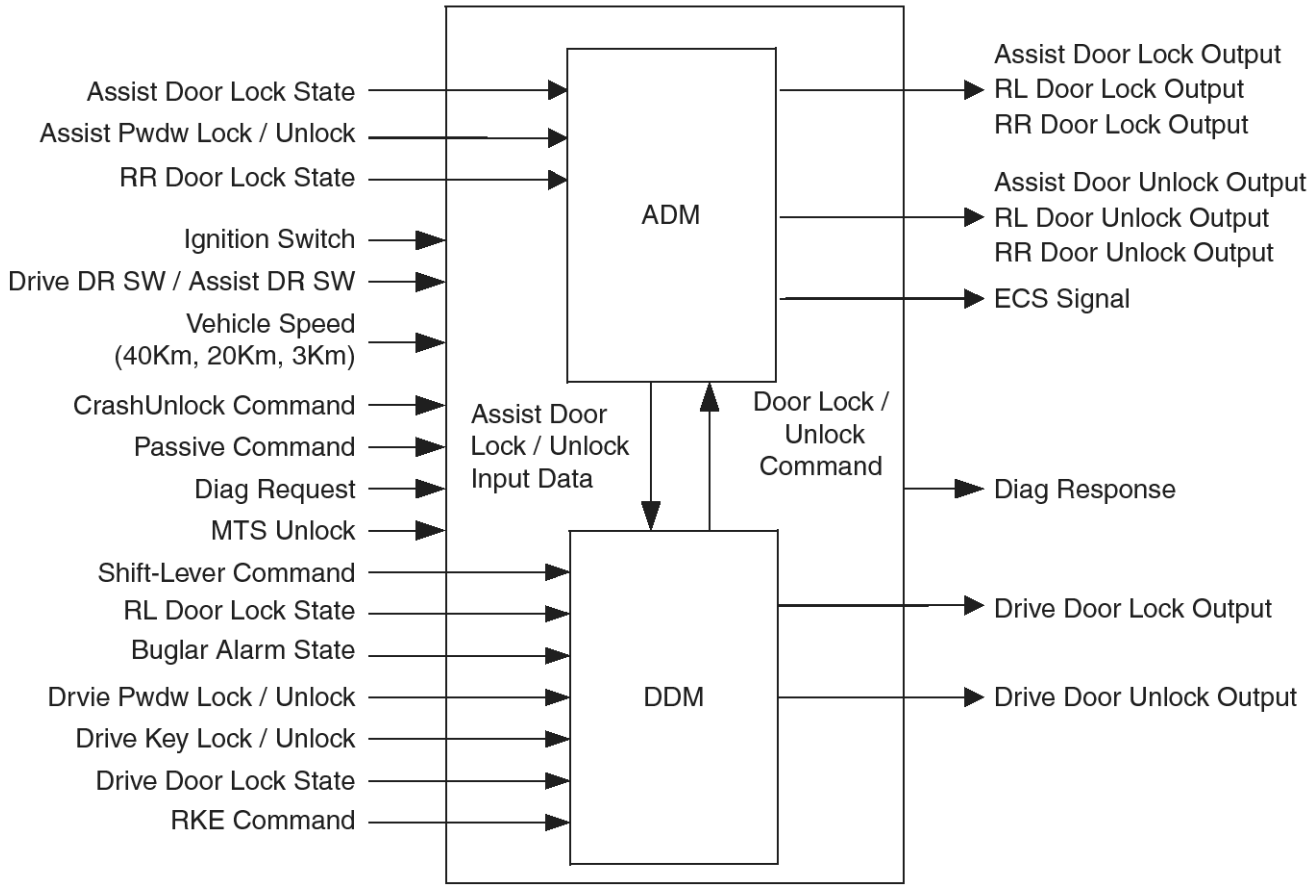
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### Door Lock Control

The Door Lock/Unlock function includes for On/Off control of the following devices:

- Door Lock by Driver and Assist Pwdw Lock switch
- Door Unlock by Driver and Assist Pwdw Unlock switch
- Door Lock/Unlock by Keyless
- Door Lock/Unlock by Passive Keyless Entry
- Door Lock/Unlock by Key
- Door Unlock by Crash or Keyreminder
- Door Lock by Auto door Lock of user mode
- Door Lock by C_ReLock from IPM
- Door Unlock by Auto door Unlock of user mode




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**DDM - Door Lock Function**

| Priority | Requests | CAN Signal | Direction |
|---|---|---|---|
| High | Passive Access Lock | Passive Access Lock | IPM → DDM, ADM |
| | Passive Access Unlock | Passive Access Unlock | |
| | Keyless Lock | Keyless Lock | DDM → ADM |
| | Keyless Unlock | Keyless Unlock | |
| | DRV Key Lock | DRV Key Lock | |
| | DRV Key Unlock | DRV Key Unlock | |
| | DRV Pwdw Lock | DRV Pwdw Door Lock | |
| | DRV Pwdw Unlock | DRV Pwdw Door Unlock | |
| | Auto Door Lock | Autodoo Lock | |
| | Auto Door Unlock | Autodoor Unlock | |
| | Keyreminder1 | Keyreminder 1 | |
| | Keyreminder2 | Keyreminder 2 | |
| Low | DRV Relock | DRVRelock | |

1. **Crash Unlock**
   1) If (Driver Door Unlock Relay = ON) occurred by ( Crash Unlock = Unlock), it is driven for 5 seconds even though ignition switch from on to off.
   2) After the 1) condition, if (Crash Unlock = Unlock) is sent from IPM again or any Unlock state switch change to Lock from Unlock, then activate (Driver Door Unlock Relay = ON) for 5 seconds again.
   3) During Crash Unlock active mode, any other Lock or Unlock command ignore if not the reset condition (IGN SW DDM = OFF).
   4) Even though Battery voltage is out of operating area, it is activated.
2. **Auto Door Lock**
   1) You can select AutoDoorLock as following according to Market.
      - According to shift-lever / According to vehicle speed / OFF
   2) According to vehicle speed: If IGN SW DDM is IGN or ST and VehicleSpeed is over 20km/h and any Unlock State is Unlock, DDM sets Auto door Lock ON immediately.
   3) After 1sec from Auto Door Lock is occurred, retry Auto Door Lock up to 3 times if any Unlock State is Unlock.
   4) Unlocked door after retry become “failed door”.
   5) (4) Failed door is released by following.
      IGN SW OFF → ON
      UnlockState = Lock
3. **Auto Door Unlock**
   1) You can select Auto Door Unlock as following according to Market.
      - According to shift-lever / According to Driver Unlock State / According to to Key Off / OFF
   2) According to Driver Unlock State : If (All Door switch = CLOSE) is (Driver Unlock State = Lock → Unlock), Auto door Unlock ON immediately.
   3) According to to Key Off : If (IGN switch DDM = ST or IGN or ACC or Key In) and (Any Unlock State=Lock) is (IGN switch DDM = ST or IGN or ACC or Key In → Key Off), Auto door Unlock ON immediately.

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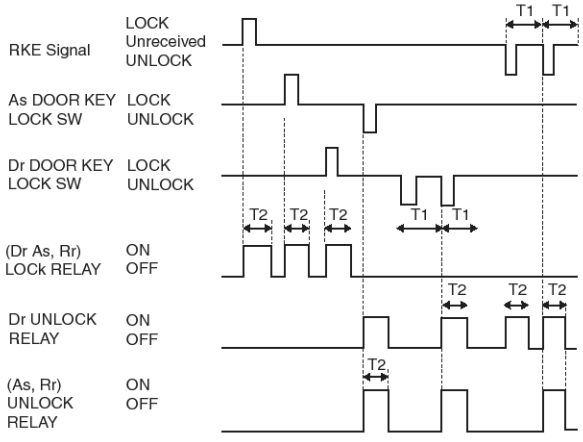
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4. **Keyreminder**
   1) Driver Door Open Keyreminder
      - This function is not activated over the 3km speed
      - If IGN switch DDM is Key In or ACC or IGN or ST, Driver door switch is Open and Driver Unlock State turn to lock from Unlock, Send Keyreminder1 signal from DDM to ADM. Each module (include DDM) activate Unlock output for 1 seconds.
      - If any Lock/Unlock request occurred during retry, Keyreminder is canceled.
      - "After Unlock condition is formed for 0.5±0.1 sec, it does Unlock output even though it does not maintain condition. But, if Unlock state does formed condition as change from Unlock to Lock after 0.5±0.1sec, then stop Unlock output when IGN switch DDM is Key off."
   2) Assist Door Open Keyreminder (North America)
      - This function is not activated over the 3km speed.
      - If IGN switch DDM is Key In or ACC or IGN or ST, Assits Door Switch is Open and Assist Unlock State turn to lock from Unlock, Send Keyreminder1 signal from DDM to all. Each module (include DDM) activate Unlock output for 1 seconds.
      - Judgment of retry output(Keyreminder2) does in starting point of retry output.(After 1.5sec from Keyreminder1)
      - After Unlock condition is formed for 0.5±0.1sec, it does Unlock output even though it does not maintain condition. But, if Unlock state does formed condition as change from Unlock to Lock after 0.5±0.1sec, then stop Unlock output when IGN switch DDM is Key off.
   3) Driver Door Close Keyreminder (North America)
      - This function is not activated over the 3km speed.
      - In condition that IGN switch DDM is Key In or ACC or IGN or ST, Driver door switch from open to closed and within 0.5±0.1 second Driver Unlock State change from Unlock to lock, then activate only Driver Door Unlock Relay for 1 second.
   4) Assist Door Close Keyreminder (North America)
      - This function is not activated over the 3km speed.
      - In condition that IGN Switch DDM is Key In or ACC or IGN or ST, Assist Door Switch from open to closed and within 0.5±0.1 second Assist Unlock State change from Unlock to Lock, then Send Keyreminder1 signal only one time.
   5) SMK Keyreminder
      - This function is not activated over the 3km speed.
      - If SMK Key reminder is operated (Passive Access Unlock = SMK key reminder), Send Keyreminder1 signal from DDM to ADM. Each module (include DDM) activate Unlock output for 1 seconds.

        After that, If one of them remains on lock state , Send the Keyreminder2 signal at DDM for 3 times.

5. **Two turn Unlock (Only North America)**
   - All door unlock signals are output for T2 if driver door key unlock switch is turned ON within T1 after changing driver door key unlock switch from OFF to ON(mechanically, driver door key unlock switch is unlocked and BCM signal is not output). ( All door unlock signals are output even within T1 after RKE UNLOCK signal is received).
   - Driver door unlock signal is output for T2 when RKE UNLOCK signal is received. But, all door unlock signals are output for T2 if RKE UNLOCK signal is received within T1.




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T1 : within 4 ± 1sec.

T2 : 0.5 ± 0.1sec.

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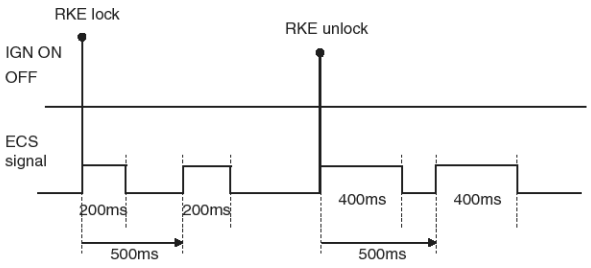


### IPM Door Lock Function

If any one of Driver Door Unlock State or Assist Door Unlock State or Rear Left Door Unlock State or Rear Door Unlock State is changed from Unlock to Lock after IPM sends (Crash Unlock = Unlock), Crash Unlock is activated again until (IGN Switch ADM = KeyOff).

### ADM Door Lock Function

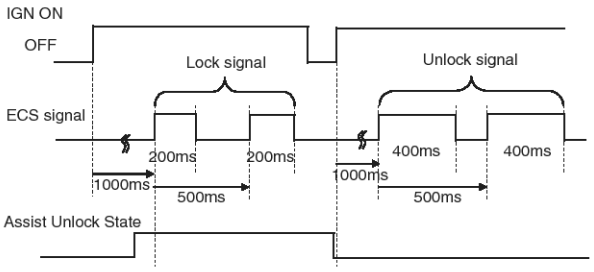
1. **Crash Unlock**
   1) If Assist Door Unlock Relay = ON is occurred by Crash Unlock = Unlock, it is driven for 5 seconds even though ignition switch from on to off.
   2) After the 1) Condition, if (Crash Unlock = Unlock) is again from IPM or any Unlock state switch change to Lock from Unlock, then activate (Assist Door Unlock Relay = ON) for 5 seconds again.
   3) During Crash Unlock active mode, any other Lock or Unlock command ignores if not the reset condition.
   4) Even though Battery voltage is out of operating area, it is activated.
   5) (IGN = OFF) & (Crash Unlock = Unlock) / Ignore.
   6) (Rear Left Door Unlock Relay = Unlock) and (Rear Right Door Unlock Relay = Unlock) is activated at the same time of Assist Door Unlock Relay.
2. **RKE LOCK/UNLOCK output**
   1) When RKE Lock/Unlock are received during IGN switch ADM = Key Off, ECS signal are sent as following from ADM.




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   2) Assist Unlock State Output

      The status of Assist Unlock State is sent as following after 1000ms from IGN SW OFF→ON.



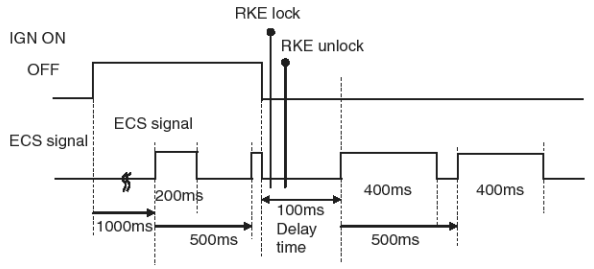

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   3) At competition

      When IGN SW became off from on before the complete output by (2) and RKE request occurred at about the same time, ECS signal is treated as following.

      **NOTICE**

      *The ECS signal is sent according to last request after delay time (100ms).*




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### Trunk Lock Function

DDM sends CAN signal (Trunk Open switch) according to trunk open switch as follows.

1. If trunk open switch is changed from OFF to ON, DDM sends Trunk Open Switch with switch ON for holding time.
2. Trunk Open Switch will be sent with switch OFF automatically after above 1) even if trunk open switch is still ON.

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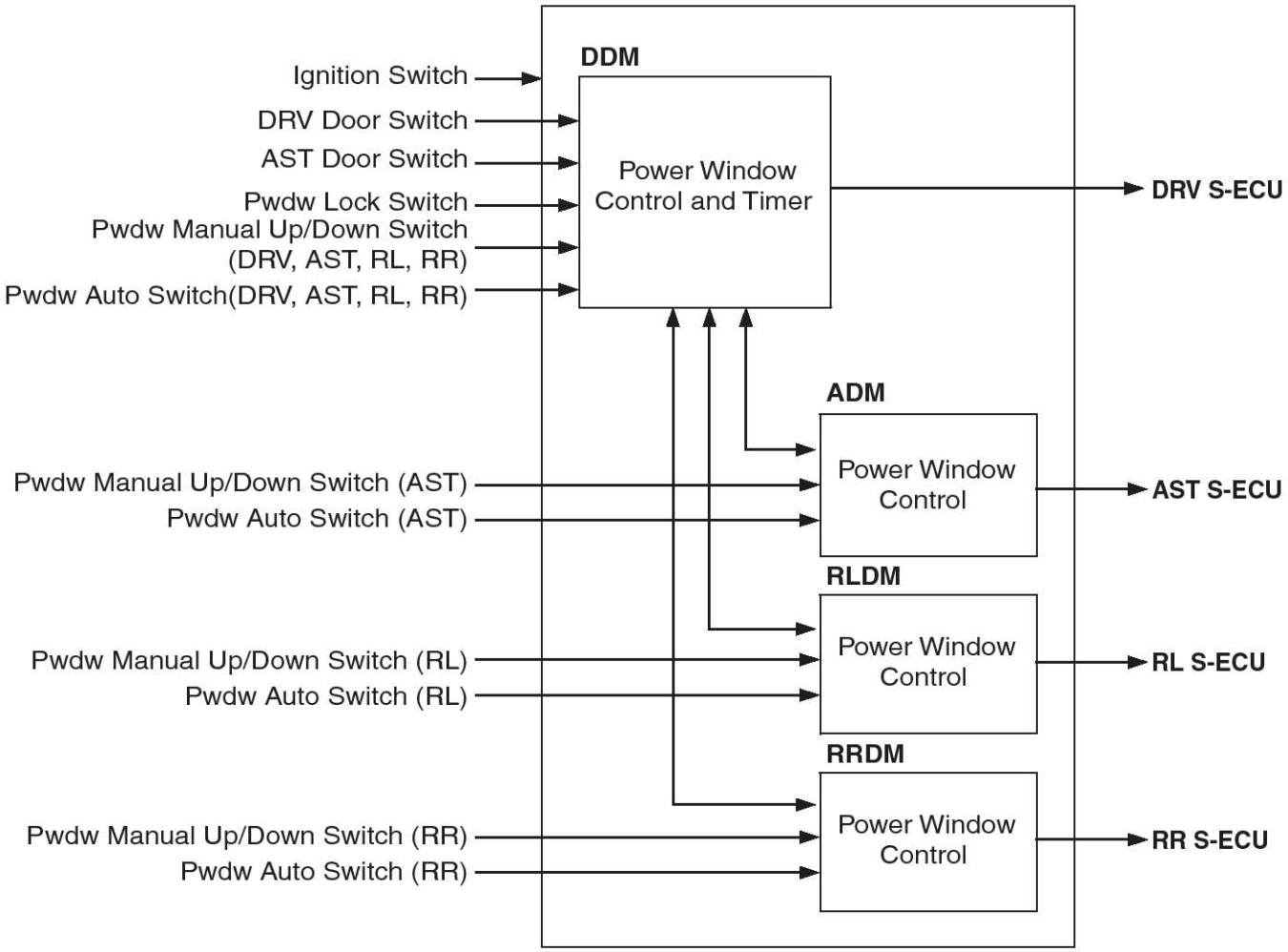
### Power Window Control

Power window function controls the followings.

- Driver power window
- Assist power window
- Rear Left power window
- Rear Right power window
- Power Window Inhibition : ADM, RLDM and RRDM a-re inhibited by Power window Lock Switch

Power window Switch on DDM can control remotely ADM , RLDM and RRDM via CAN or local communication.

Each Power window can control locally oneself.




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### DDM Power Window Function

Outputs the following control signals to S-ECU according to local switch.

- Driver Power window Enable, Driver Power window Up, Driver Power window Down transmits the control signals (the status of ADM switch on DDM and Power window Inhibit) to ADM via CAN

  Outputs the control signals (the status of RLDM and RRDM switch on DDM and RDM Enable DDM) to co-ntrol the Motor of RLDM and RRDM.

1. Power window Enable/Disable Control

   Power window function has Disable, Enable and 30s Timer states.

   Each module is enabled / disabled according to the i-nhibition signal of DDM as following.

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| Inhibition signal of DDM | Power window function | | | |
|---|---|---|---|---|
| | DDM | ADM | RLDM | RRDM |
| ON | Disable | Disable | Disable | Disable |
| OTHER DISABLE | Enable | Disable | Disable | Disable |
| OFF | Enable | Enable | Enable | Enable |

### ADM Power Window Function

Outputs the following control signals to S-ECU

- Assist Power window Enable, Assist Power window Up, Assist Power window Down are controlled according to the remote switch from DDM via CAN, the status of local switch and IGN1 ADM.

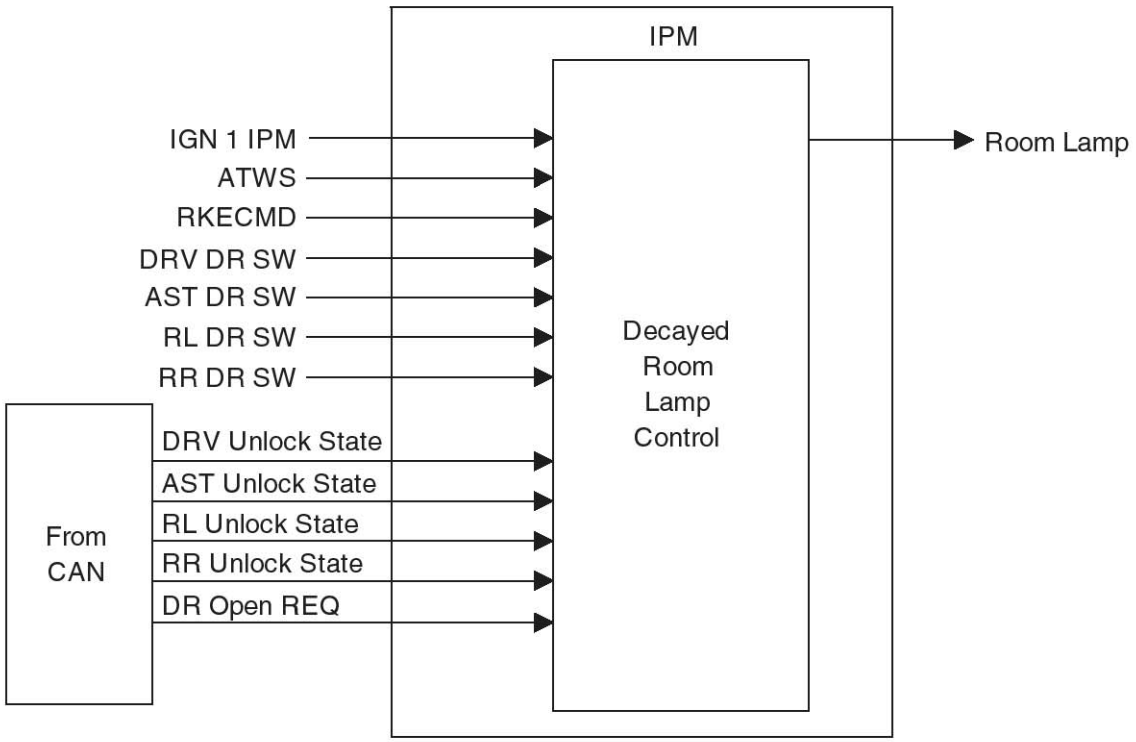
  Power window function is enabled/disabled by Power window Inhibit from DDM via CAN.

1. Power window Enable/Disable Control

   ADM Power window function has Enable, Disable states.

### Decayed Room Lamp Control

The Decayed Room Lamps control the state of the Room Lamps by IPM.




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### IPM Room Lamp Control

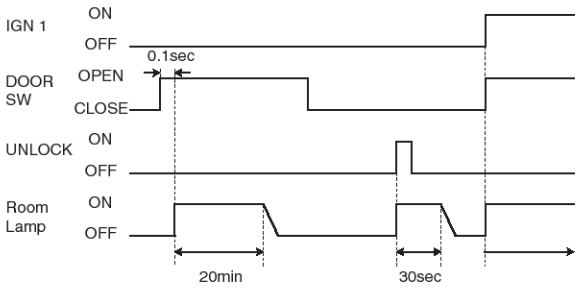
Receive door Lock/Unlock state from each door module
by CAN

1. Transitions from Room lamp OFF state

| State | Description |
|---|---|
| Initial condition | Room lamp OFF & IGN1IPM=OFF & ALL DOOR CLOSED |
| Event | Transition of ALL DOORS CLOSED to ANY DOOR OPEN for more than 0.1sec |
| Action | State changed to ROOM LAMP ON for 20 min<br>Turn ROOM LAMP for a duration of 20 +/-1minutes |

| State | Description |
|---|---|
| Initial condition | Room lamp OFF & IGN1IPM=OFF & ALL DOOR CLOSED |
| Event | UNLOCK by RKE CMD |
| | If SMK variant : UNLOCK by SMK RKE or SMK Passive |
| Action | State changed to ROOM LAMP ON for 30sec.<br>ROOM LAMP is turned ON for 30sec +/- 1 sec. |

| State | Description |
|---|---|
| Initial condition | Room lamp OFF & IGN1IPM=OFF & ALL DOOR CLOSED |
| Event | IGN1 IPM = ON and ANY DOOR OPEN |
| Action | State changed to ROOM LAMP ON<br>The room lamp is turned ON without time limitation |




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2. Transitions from Room lamp ON for 30s state

| State | Description |
|---|---|
| Initial condition | ROOM LAMP ON for 30sec & IGN1 IPM=OFF |
| Event | At least 1 door is opened more than 0.1sec, ANY DOOR OPEN |
| Action | State changed to ROOM LAMP ON for 20min<br>ROOM LAMP is kept ON for 20 +/-1minutes |

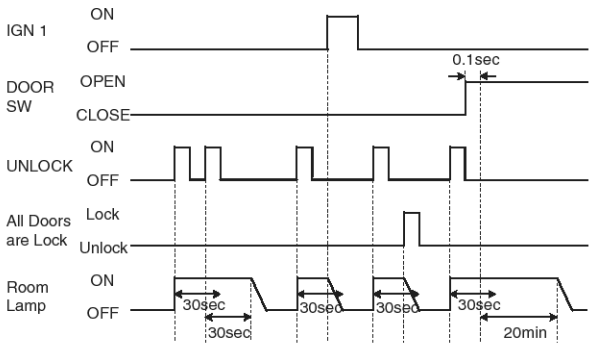
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| State | Description |
|---|---|
| Initial condition | ROOM LAMP ON for 30sec & IGN1 IPM=OFF |
| Event | UNLOCK by RKE CMD |
| | If SMK variant : UNLOCK by SMK RKE or SMK Passive |
| Action | State remains ROOM LAMP ON for 30sec<br>ROOM LAMP ON 30sec +/- 1 sec timer is re-initialized for an other 30sec +/- 1 sec duration |

| State | Description |
|---|---|
| Initial condition | ROOM LAMP ON for 30s & IGN1 IPM=OFF |
| Event | IGN1 IPM=ON<br>ALL DOOR LOCKED<br>30sec timer elapsed<br>ATWS armed |
| Action | State changed to ROOM LAMP DECAYING<br>ROOM LAMP is slowly decayed during 2+/-0.2sec then off. |




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3. Transitions from Room lamp ON for 20min state

| State | Description |
|---|---|
| Initial condition | ROOM LAMP ON for 20min & IGN1 IPM=OFF |
| Event | IGN1 IPM=ON |
| Action | State changed to ROOM LAMP ON<br>The room lamp remains ON without time limitation |

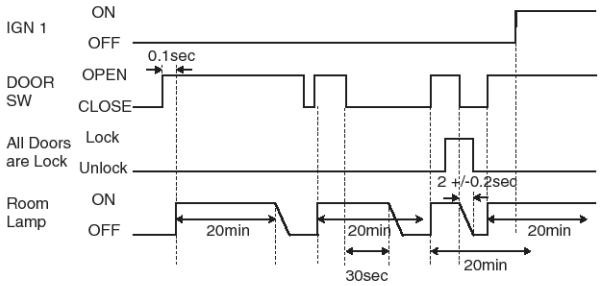
| State | Description |
|---|---|
| Initial condition | ROOM LAMP ON for 20min & IGN1 IPM=OFF |
| Event | ALL DOORS CLOSED |
| Action | State changed to ROOM LAMP ON for 30sec.<br>ROOM LAMP is turned ON for 30sec +/- 1 sec. |

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| State | Description |
|---|---|
| Initial condition | ROOM LAMP ON for 20min & IGN1 IPM=OFF |
| Event | 20min timer elapsed or (ALL DOORS CLOSED & ALL DOORS LOCKED) |
| Action | State changed to ROOM LAMP DECAYING<br>ROOM LAMP is slowly decayed during 2+/-0.2sec then off |




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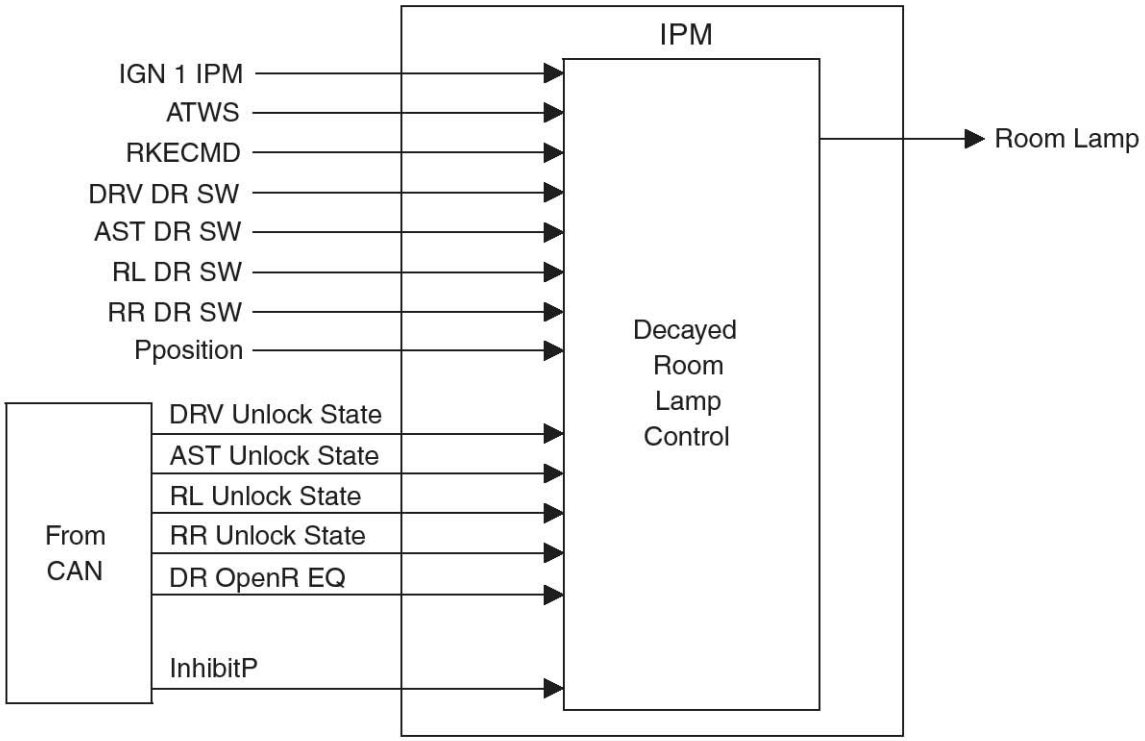
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### Decayed Foot Lamp Control

The Decayed Foot Lamp controls the state of the Foot Lamp by IPM.

IPM receive door Lock/Unlock state from each door module by CAN




SBHBE9020L

1. Transitions from Foot lamp OFF state

| State | Description |
|---|---|
| Initial condition | Foot lamp OFF & IGN1 IPM=OFF & ALL DOORS CLOSED |
| Event | Transition of ALL DOORS CLOSED to ANY DOOR OPEN for more than 0.1sec. |
| Action | State changed to FOOT LAMP ON for 20 min<br>Turn FOOT LAMP for a duration of 20 +/-1minutes |

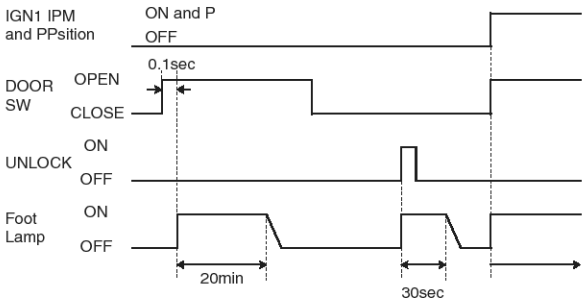
| State | Description |
|---|---|
| Initial condition | Foot lamp OFF & IGN1 IPM=OFF & ALL DOOR CLOSED |
| Event | UNLOCK by RKE CMD |
| | If SMK variant : Unlock by SMK RKE or SMK Passive |
| Action | State changed to FOOT LAMP ON for 30s<br>FOOT LAMP is turned ON for 30sec +/- 1 sec. |

| State | Description |
|---|---|
| Initial condition | Foot lamp OFF & IGN1 IPM=OFF & ALL DOOR CLOSED |
| Event | IGN1 IPM=ON and (ANY DOOR OPEN or P Position=P) |
| Action | State changed to FOOT LAMP ON<br>The Foot lamp is turned ON without time limitation |

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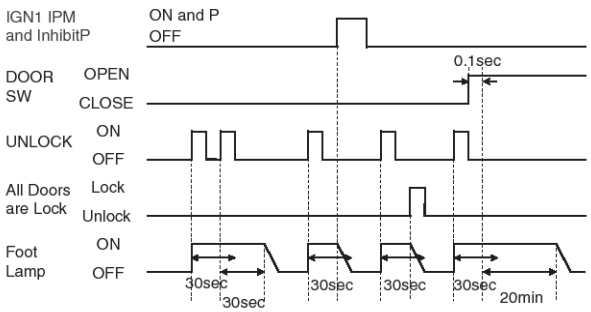

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2. Transitions from Foot lamp ON for 30s state

| State | Description |
|---|---|
| Initial condition | FOOT LAMP ON for 30s & IGN1 IPM=OFF |
| Event | At least 1 door is opened more than 0.1sec (ALL DOOR NOT CLOSED = ON) |
| Action | State changed to FOOT LAMP ON for 20min<br>FOOT LAMP is kept ON for 20 +/-1minutes |

| State | Description |
|---|---|
| Initial condition | FOOT LAMP ON for 30sec & IGN1 IPM=OFF |
| Event | UNLOCK by RKE CMD |
| | If SMK variant :UNLOCK by SMK RKE or SMK Passive |
| Action | State remains FOOT LAMP ON for 30sec.<br>FOOT LAMP ON 30sec +/- 1 sec timer is re-initialized for an other 30sec +/- 1 sec duration |

| State | Description |
|---|---|
| Initial condition | FOOT LAMPON for 30sec & IGN1 IPM=OFF |
| Event | IGN1 IPM=ON & P Position=Off<br>ALL DOOR LOCKED<br>30sec timer elapsed<br>ATWS armed |
| Action | State changed to FOOT LAMP DECAYING<br>FOOT LAMP is slowly decayed during 2+/-0.2sec then off. |




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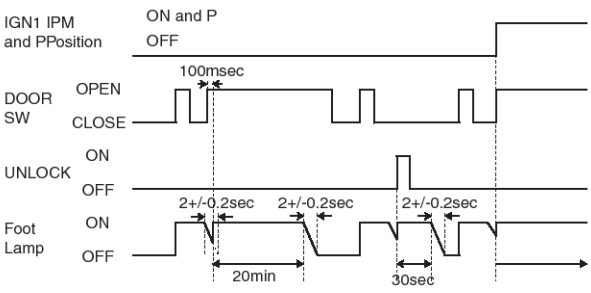
3. Transitions from Foot lamp Decaying state

| State | Description |
|---|---|
| Initial condition | FOOT LAMP DECAYING & IGN1 IPM=OFF |
| Event | Transition of ALL DOORS CLOSED to ANY DOOR OPEN for more than 0.1sec. |
| Action | State changed to FOOT LAMP ON for 20min<br>FOOT LAMP is kept ON for 20 +/-1minutes |

| State | Description |
|---|---|
| Initial condition | FOOT LAMP DECAYING & IGN1 IPM=OFF & ALL DOOR CLOSED |
| Event | UNLOCK by RKE CMD |
| | If PIC variant : UNLOCK by SMK RKE or SMK Passive |
| Action | State changed to FOOT LAMP ON for 30 sec.<br>FOOT LAMP is turned ON for 30sec +/- 1 sec. |

| State | Description |
|---|---|
| Initial condition | FOOT LAMP DECAYING |
| Event | Foot lamp decaying completed |
| Action | State changed to FOOT LAMPOFF<br>Turn OFF the room lamp |

| State | Description |
|---|---|
| Initial condition | FOOT LAMP DECAYING |
| Event | IGN1 IPM=ON and (ANY DOOR OPEN or P Position=P) |
| Action | State changed to FOOT LAMP ON<br>The Foot lamp remains ON without time limitation |




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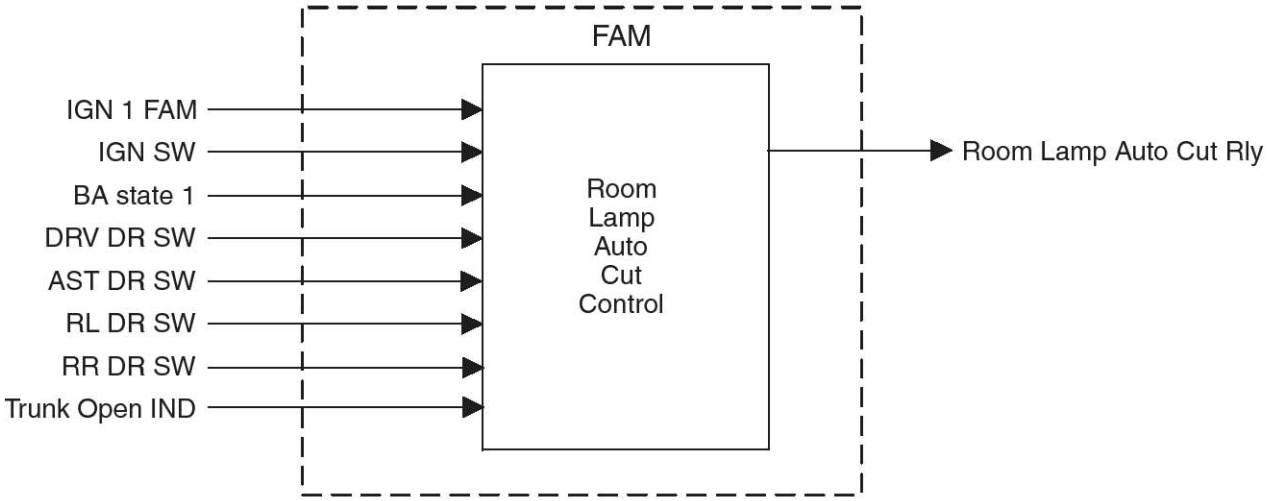
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### Room Lamp Auto Cut Output Control

The Room Lamps Auto Cut controls the state of the Roo-
m Lamps by FAM.




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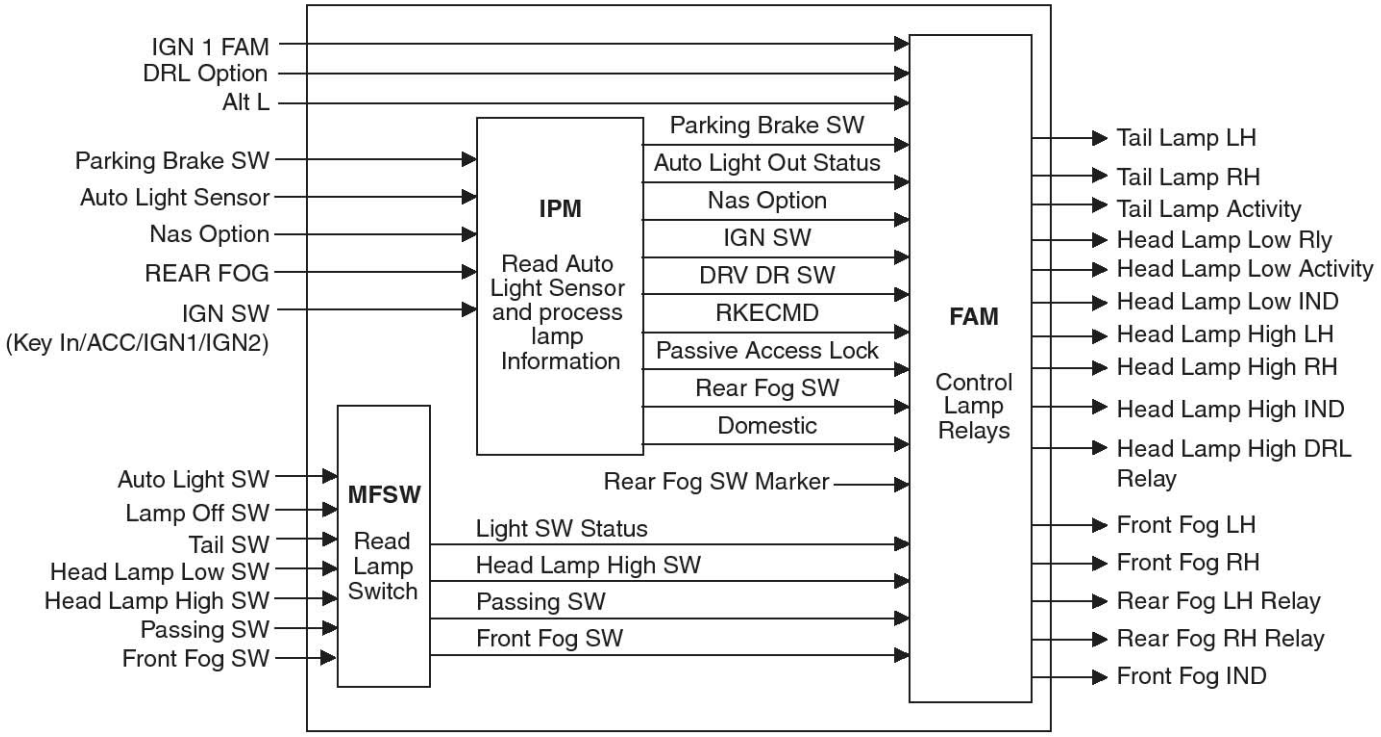
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### Lamp Control

The Lamp function includes the sub functions for On/Off control of the following devices:

- Tail / Head Lamp
- Fog Lamp




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### Tail / Head Lamp Control

Tail / Head Lamp sub functions are controlled by MFSW, IPM and FAM.

The Tail Lamps are turned on and off by Tail Lamp Switch or Auto Light.

The Head Lamps Low and High are turn on and off by Head Lamp Switch or Auto Light.

The DRL controls Head Lamp High when the engine is running.

The Head Lamp High is on when the Passing switch is on.

1. MFSW : lamp switch control

   Input detection of lamp switches (Lamp Off, Tail Lamp, Head Lamp Low, Head Lamp High, Passing, and Auto Light)

   Generate Light Switch Status data compounding by some switch input (Lamp Off, Tail Lamp, Head Lamp Low, Auto Light) for FAM and IPM.

   Generate Head Lamp High switch data for FAM

   Generate Passing switch data for FAM

   Send Light Switch Status, Head Lamp High Switch and Passing Switch data via CAN

2. IPM : Auto light contorl

   The IPM detects Input of Auto Light Sensor level.

   When IGN switch is ACC or IGN or cranking state, the IPM generates CAN signal Auto Light Out Status for FAM.

   * Behaviour for normal state

   From ACC ON state, the IPM monitors the range of this supply and raises up a failure as the supply's voltage is out of range (that is less than 4 Volts, more than 6 Volts).

   The filtering of the error is 300ms to rise up this one, and also 300ms to clear this one.

   Then this failure occurs and as long as this is present , the head lamp low must be turned on, that IPM sends (Auto Light Out Status), without taking care about the sunlight level provided by the sensor.

3. FAM : Auto Light Control

   The FAM controls tail and head lamp low with filtering time according to (Auto Light Out Status)

   The FAM controls continuous turn on mode.

   * Behaviour for normal state

   If the state of IGN Switch FAM is IGN or ST and Light Switch Status state is Auto Light Switch On, then TAIL LAMP RELAY output and HEAD LAMP LOW RELAY output are controlled by FAM with filtering time in accordance with Auto Light Out Status state change that is AUTO LIGHT Sensor's INPUT from IPM and according to specifications for each lamp described in below.

4. FAM : Tail Control

   The FAM memorizes the AUTO CUT state in EEPROM and describes the following features.

   - Turn on and off Tail Lamp by Light switch.
   - Turn on and off Tail Lamp by Auto Light out Status.
   - Automatically cut the Tail Lamps if the driver forgets to turn them off.
   - Output control of Tail Lamp relay
   - Generate Tail Lamp Activity data.

5. FAM : Head lamp Control
   - Turn on and off Head Lamp Low by Light Switch Status.
   - Turn on and off Head Lamp High by Light Switch Status.
   - Turn on and off Head Lamp Low by Auto Light out Status.
   - Turn on and off Head Lamp High and Low by Passing Switch.
   - Output control of Head Lamp Low Relay.
   - Output control of Head Lamp High IPS by PWM Control.
   - Generate Head Lamp High IND data for CLU.
   - Generate Head Lamp Low IND data for CLU.
   - Generate Head Lamp High Activity data for Front Fog Lamp.
   - Generate Head Lamp Low Activity data for Front and Rear Fog Lamp.

6. FAM: DRL Control

   Turn on and off DRL by some condition, using Head Lamp High DRL Relay outputs with dimmed intensity compared with normal High Beam operation.

7. FAM: Follow Me Home Control

   Generate Follow me home function by FAM.

   Head Lamp on during 20min or 30sec according to conditions.

   Turn off Head Lamp Low by Follow Me Home Function.

   * Behaviour for normal state

   After switching off ignition, you generate a call of headlight (head lamp low) and open driver side door and then after close driver door, you will have consequen-

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tly lighting of head lamp low during 30sec.

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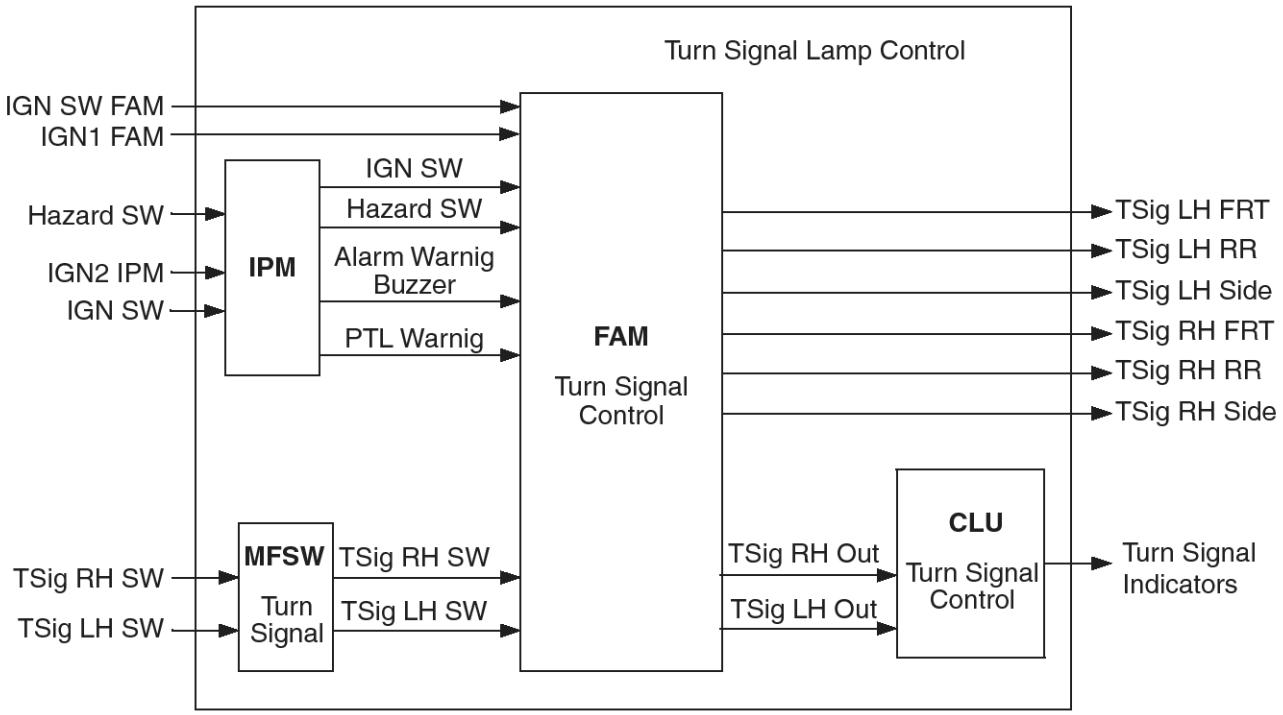
### Fog Lamp Control

Fog Lamp sub functions are controlled by FAM.

- Turn Front Fog Lamp on and off by control of Front Fog IPS.
- Front Fog Lamp on when only Tail Lamp on (Head Lamp on for North America).
- Turn Rear Fog Lamp on and off by control of Rear Fog IPS.
- Rear Fog Lamp on when only Front Fog Lamp on or Head Lamp on.
- Generate Front Fog Lamp Activity data for Rear Fog Lamp.

### Turn Signal Lamp Control

The Turn Signal Lamp Control function controls turn signal lamps and indicators.




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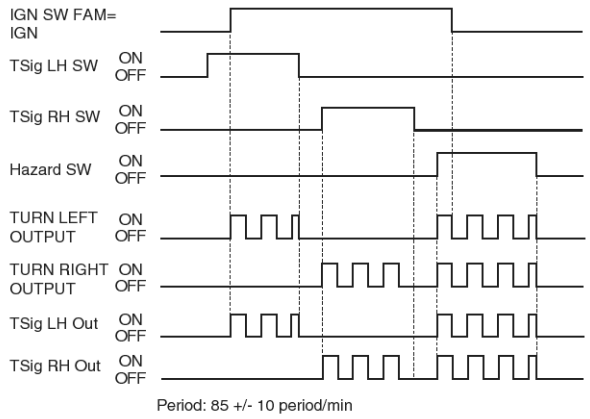
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1. FAM : Normal Operating Condition

   While IGN Switch FAM is IGN state, if Turn Signal R-H Switch or Turn Signal LH Switch or Hazard switch i s ON then turn signal outputs are turned ON following the switch input (LEFT, RIGHT or HAZARD).



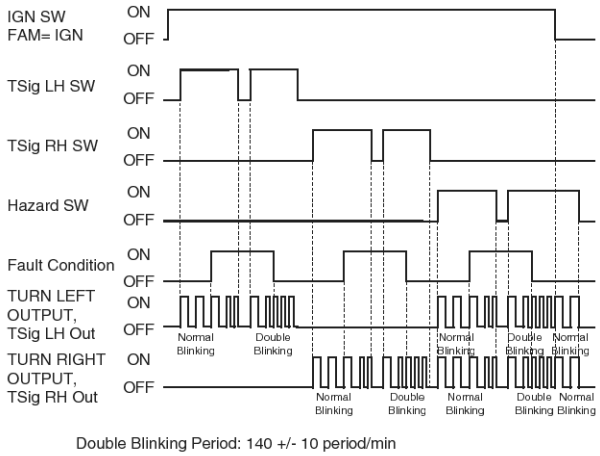

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2. FAM : Double Blinking Condition

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

   The double blinking works at IGN Switch FAM is IGN state, double blinking for Hazard.

   In case of turn signal activation when one of the FR-ONT or REAR is broken-down (Lamp failure), the turn signal blinks with double frequency.




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3. FAM : SCG (SHORT CIRCUIT TO GND) Fault Condition

   If The FAM detects Short circuit to Ground, then FAM turns off the OUTPUT

   .The fault detection is carried out continuously, until f-ault is confirmed by FAM. Once FAM confirms SCG, FAM keeps the fault condition until flasher trigger co-ndition is changed.

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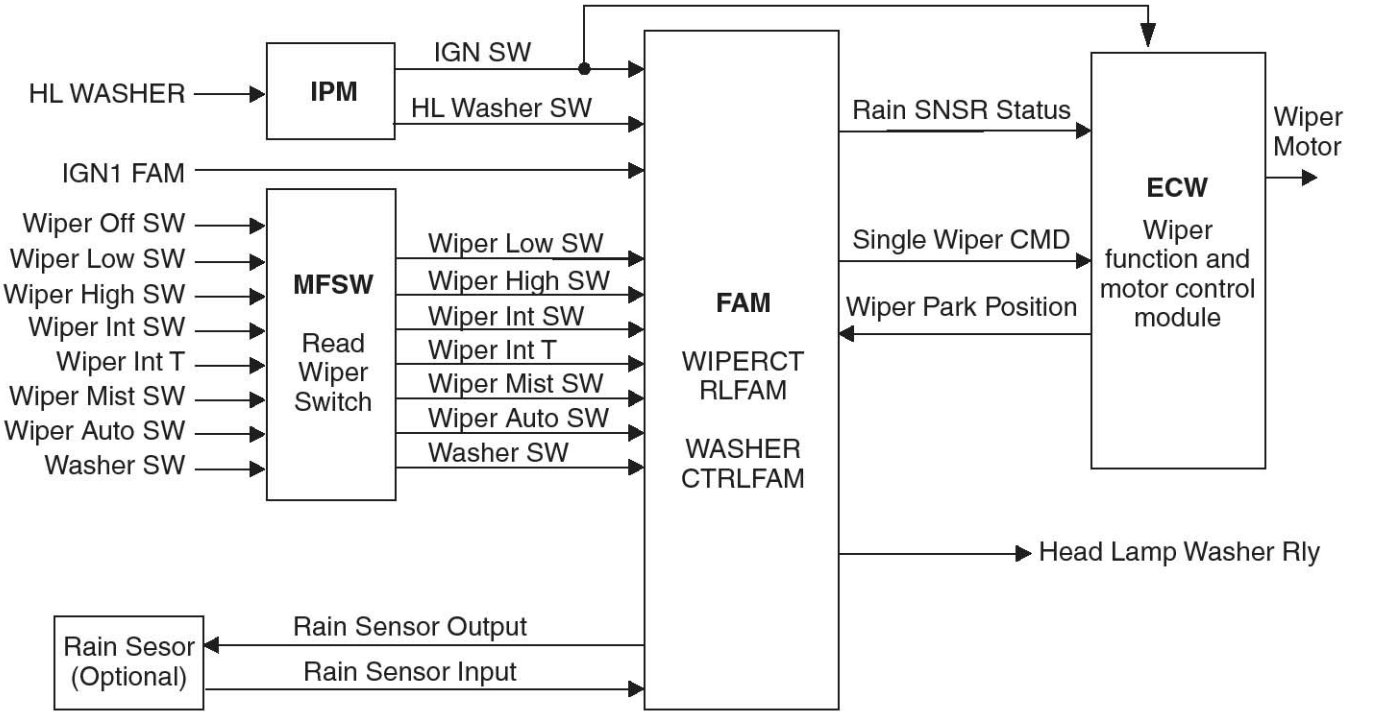
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### Wiper Function Control

Inform wiper module current operation mode to Rain Sensor and transfer Rain sensor command to ECW via CAN network.

The WiperControlFAM manages the Rain sensor communication.




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**Behaviour For Normal State**

1. Rain Sensing Wiping

   If without the rain sensor option, the FAM can't receive Wiper Aut oSW from the multi function switch via CAN.

2. The FAM shall output the various modes according to the following.

| No. | Wiper Mode | Duty Cycle |
|---|---|---|
| 1 | Off, MIST,INT,LOW or HIGH speed mode | 6% +3/-2% |
| 2 | (Auto mode) Sensitivity 0(Step 5) | 12% +3/-2% |
| 3 | (Auto mode) Sensitivity 1(Step 4) | 18% +3/-2% |
| 4 | (Auto mode) Sensitivity 2(Step 3) | 24% +3/-2% |
| 5 | (Auto mode) Sensitivity 3(Step 2) | 30% +3/-2% |
| 6 | (Auto mode) Sensitivity 4(Step 1) | 36% +3/-2% |
| 7 | Washer mode | 42% +3/-2% |
| 8 | (Auto mode) Sensitivity 4(Step 1) with inwipe | 66% +3/-2% |
| 9 | (Auto mode) Sensitivity 3(Step 2) with inwipe | 72% +3/-2% |
| 10 | (Auto mode) Sensitivity 2(Step 3) with inwipe | 78% +3/-2% |
| 11 | (Auto mode) Sensitivity 1(Step 4) with inwipe | 84% +3/-2% |
| 12 | (Auto mode) Sensitivity 0(Step 5) with inwipe | 90% +3/-2% |
| 13 | Sensor test mode (For TRW use only) | 54% +3/-2% |

- OFF, MIST, LOW, and HIGH / Washer operation i n Non AUTO mode.

  MIST, LOW, and HIGH shall be interpreted as driver requested manual modes. The RAIN SENSOR output during these switch positions shall be an "Off" or "Rain Detected" duty cycle.

- AUTO (Sensitivity 0 - 4)

  One of five sensitivity switch positions will signal t he RAIN SENSOR to operate in automatic mode. Sensitivity 0 refers to the least sensitive state(the slowest, step5) while Sensitivity 4 refers to the most sensitive state(the fast, step1).

- WASHER (Washer operation only in AUTO mode by washer Switch)

  WASHER signals the RAIN SENSOR that the Wash Paddle is being depressed and that the wiper system is going through a PROGRAMMED or DEMAND WASH cycle. The RAIN SENSOR output during this switch position is an "Off" or "Rain Detected" duty cycle. The RAIN SENSOR will ignore washer fluid spray.

- In-wipe

  The in-wipe signal specifies when received (Wiper Park Position) from ECW. In-wipe information is provided so the RAIN SENSOR can assure accurate delay times and smooth operation while in the automatic mode.

3. Rain Sensor to FAM

   The Sensor shall output the various modes according to the following:

   - OFF

     OFF is the Sensor's request to the wiper controller to stop wiping.

   - Fault 1 - Internal Fault Detected

     Internal Fault Detected shall attempt to be asserted by the Sensor whenever an internal or onboard software or hardware fault is detected. This signal implies that, through on-board diagnostics, the Sensor has detected a problem within the Sensor module and, therefore, has little or no confidence in its' ability to function properly.

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- Fault 2 - Glass Attachment Fault Detected

  Glass Attachment Fault Detected is asserted when the Sensor module, through internal light intensity monitoring, detects an attachment problem between the Sensor and windshield.

- Fault 3 - No Input Signal Present

  No Input Signal Present is asserted when the Sensor cannot detect a usable input signal from the wiper control for a minimum of 0.5 seconds.

- Rain Detected

  Rain Detected shall be asserted in place of an OFF output in all modes when rain is detected and for 5 minutes following rain detection. Rain Detected is defined as when the internal Rain Intensity variable is greater 40.

- Low Speed Request

  A Low Speed Request shall be asserted in the automatic mode when the Sensor determines that the wiper system should be operating in Low speed. A minimum of 5 consecutive output periods and not more than 10 shall be sent to request a single wipe (command wipe).

- High Speed Request

  A High Speed Request shall be asserted in the automatic mode when the Sensor determines that the wiper system should be operating in High speed.

- Sensitivity Performance

  Sensor sensitivity (ability to respond to various moisture accumulation conditions) performance shall meet the nominal wiper period.

- Output Wipe Mode Smoothing/Response Time

  The Sensor processing algorithms shall contain smoothing characteristics that prevent erratic wipe transitions. Delay time changes, transitions between delay and continuous low speed, and transitions between continuous low speed and continuous high speed shall be smooth.

### Automatic Mode

When the wiper switch is moved to AUTO position (Wiper Auto Switch=ON & Wiper Int Switch=ON) and (IGN Switch FAM = IGN), the Rain sensor is considered to be in " AUTOMATIC" mode.

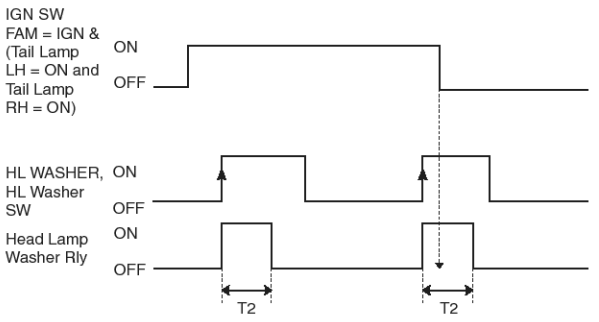
1. If the wiper switch has been left in AUTOMATIC Mode with the vehicle ignition OFF, and then the vehicle ignition switch is turned on, the FAM transmits single wiping command.
2. The FAM transmits a single wiping command whenever rain has been detected(Rain Detected signal from Rain sensor) and the wiper switch is moved to the AUTO position. But The FAM does not transmit single wiping command when the wiper switch is moved to t he AUTO position and OFF signal is being received from Rain sensor. But if the wiper switch is moved to AUTO position for the first time since vehicle ignition switch is turned on then the FAM transmits single wiping command regardless of Rain Detected or OFF signal.
3. Sensitivity Adjustment Function

   The drive may adjust the rain sensor performance by adjusting the sensitivity input. When in AUTOMATIC mode, the FAM transmits single wiping command each time the SENSITIVITY is adjusted upward to a more sensitive setting(downward more then one step). This single wiping command will only be transmitted if Rain Detected signal is being received from the Rain sensor. If the sensitivity adjustment is adjusted upward more than one sensitivity, the FAM will transmit single wiping command unless the time between Increases is more than 2 seconds.

### Head Lamp Washer Function

1. In case of IGN Switch FAM = IGN & (Tail Lamp LH= ON and Tail Lamp RH=ON)status, if head lamp washer Switch input is detected, head lamp washer output is turned ON.
2. In case of (IGN Switch FAM = IGN & Head Lamp Low Relay=ON) status, if washer Switch input is detected more T1 time, head lamp washer output is turned ON .
3. When a washer request arrived during washer activation, the second it's not take in account.

   T1,T2,T3 Time is implemented in the FAM EEPROM.




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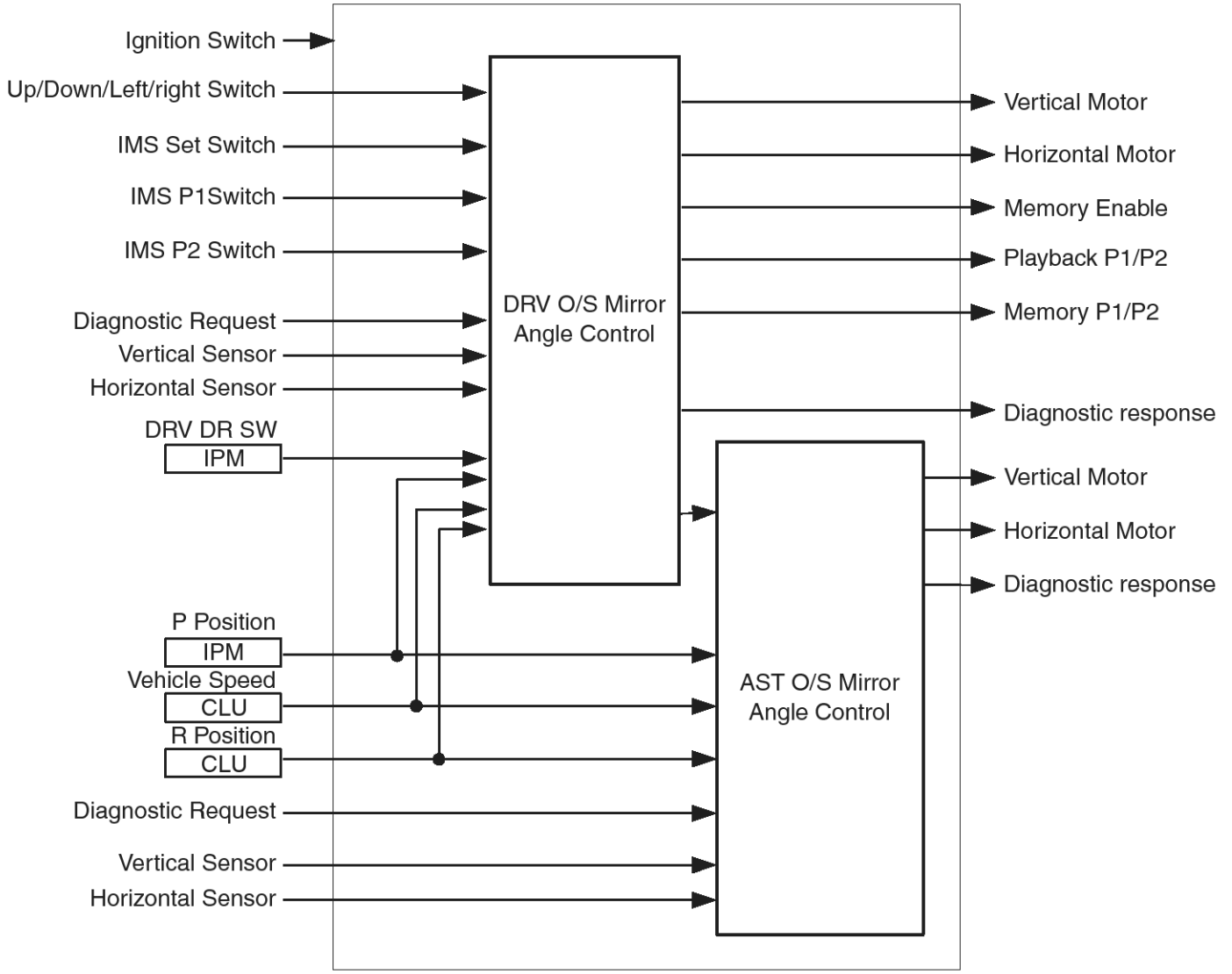
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### The Outside Mirror Control

The Outside Mirror angle control function and IMS function controls the following devices.

- Driver side of Outside Glass control motor and 2 potentio-meters (vertical and horizontal).
- Assist side of Outside Glass control motor and 2 potentio-meters (vertical and horizontal).




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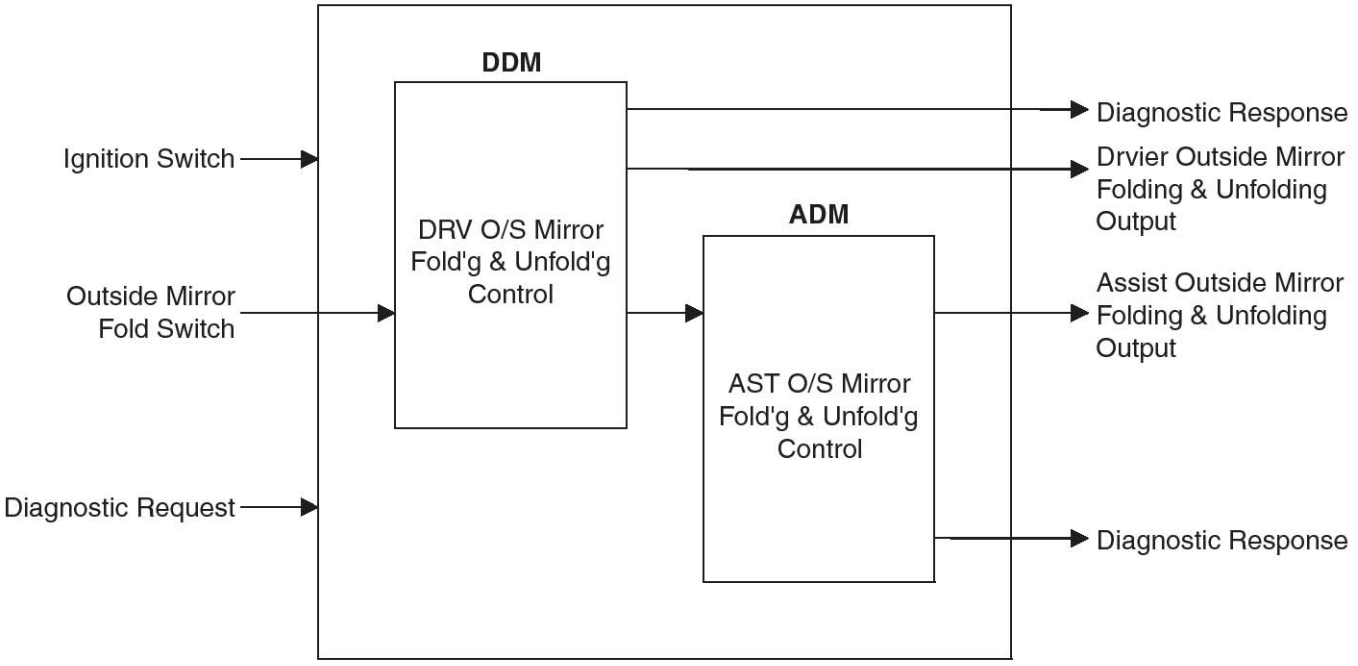
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**The Outside Mirror Folding & Unfolding Control**

- Driver side of Outside Mirror Folding IPS.
- Assist side of Outside Mirror Folding IPS.




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### DDM Operation

1. Operating Condition

   DDM controls the operating condition (Enable or Disable) of the Outside Mirror Folding as follows. Outside Mirror Folding can be controlled by user under operating condition that is in ENABLE, TIMER, and TIMER EXTEND.

   - The Outside Mirror Folding will be enabled when IGN Switch DDM is ACC, IGN or ST.
   - After IGN Switch DDM released from (ACC, IGN or ST), the Outside Mirror Folding will be enabled until 30s normally, which called “TIMER”.
   - In the “TIMER” and timer elapsed 15s±500ms, if user press Outside Mirror Fold Switch ON, “30s Enable Timer” is extended 15s±500ms this is called “TIMER EXTEND” function.D33

2. Fold/Unfold Operation

   When operating condition is in ENABLE, TIMER, and TIMER EXTEND mentioned above, Fold/Unfold is controlled by user operation of Outside Mirror Fold Switch as follows.

| Input | Output | | |
|---|---|---|---|
| User Operation | Driver Outside Mirror Fold | Driver Outside Mirror Unfold | Assist Outside Mirror Fold/Unfold |
| Outside Mirror Fold Switch is ON at Initial Time (Battery Reset) | ON for 15s±500ms to fold OS Mirror. | OFF | Transmits CAN message with FOLD to ADM for 150ms. |
| Outside Mirror Fold Switch is ON if previous operating was unfolding | ON for 15s±500ms to fold OS Mirror | OFF | Transmits CAN message with FOLD to ADM for 150ms. |
| Outside Mirror Fold Switch is ON if previous operating was folding | OFF | ON for 15s±500ms to unfold OS Mirror | Transmits CAN message with UNFOLD to ADM for 150 ms |

### ADM Operation

Fold/Unfold is controlled by Assist Outside Mirror Fold/Unfold command from DDM via CAN communication.

No switch input for controlling Fold/Unfold operation is available in ADM.

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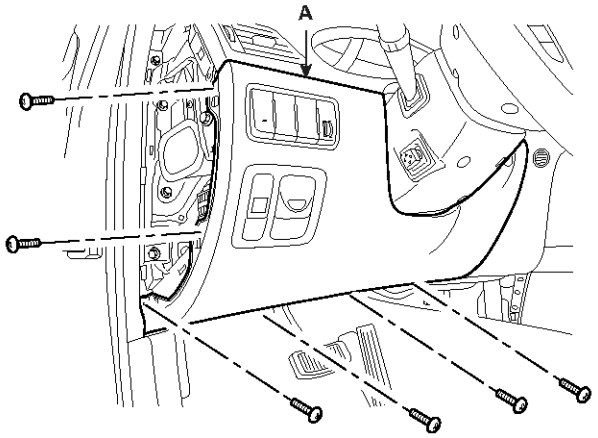
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## Removal

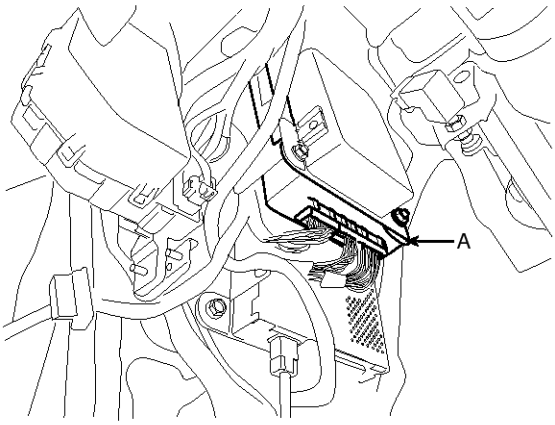
### IPM (Instrument Panel Module)

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

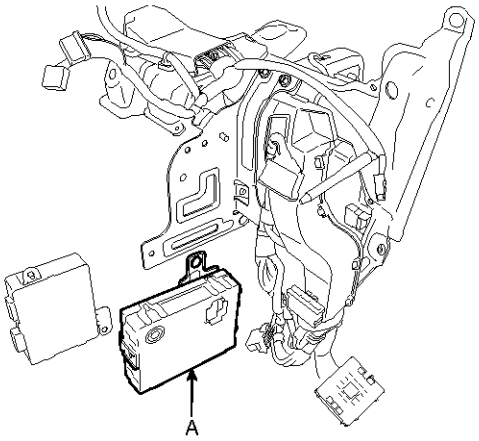



SBHB18091D

3. Remove the IPM (A) after removing the nut and connector.




SBHBE8161D




SBHBE8162D

## Installation

1. Install the IPM after connecting the connector.
2. Install the crash pad lower panel.

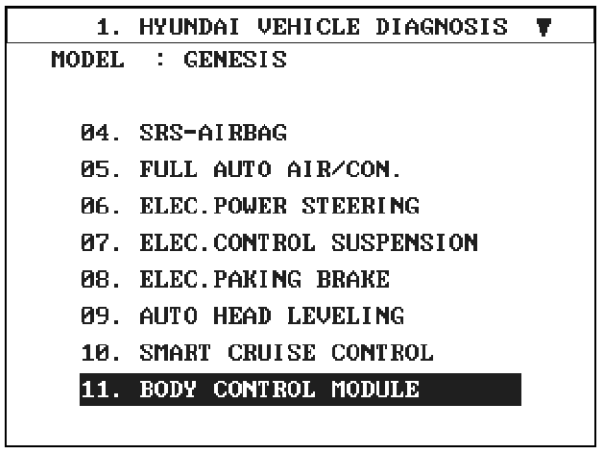
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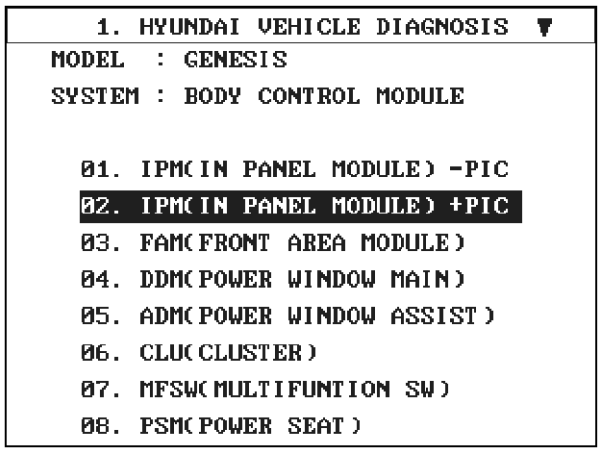
## BCM Diagnosis With Scan Tool

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



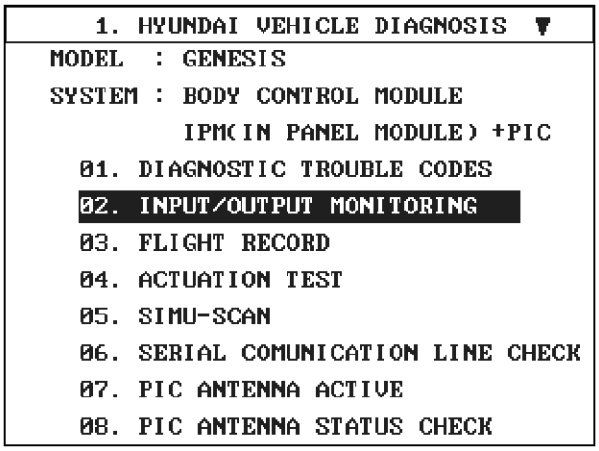

SBHBE9300L

3. Select the module to check.

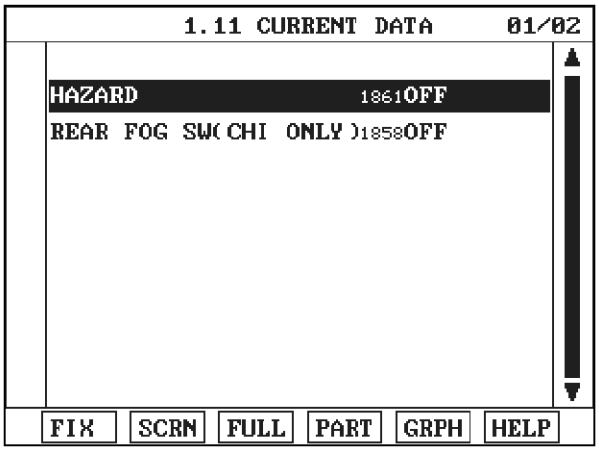



SBHBE9301L

4. Select "Input/output monitoring", if you will check current data of body network system. It provides input/output status of each module.

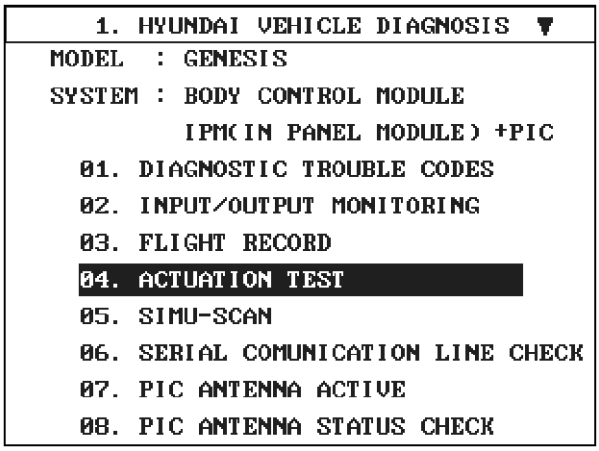



SBHBE9302L




SBHBE9303L

5. If you will check each module data operation forcefully, select "Actuation test".

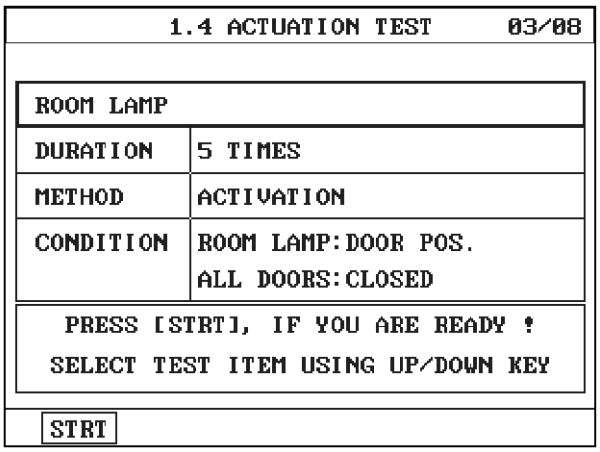



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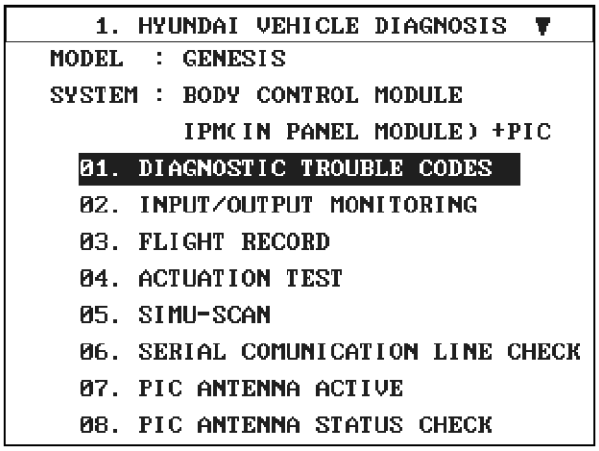
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SBHBE9305L

6. To check the DTC of the each module, select "DIAG-NOSTIC TROUBLE CODES"




SBHBE9306L

## Troubleshooting

### IPM DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1605 | CAN timeout between IPM and DDM |
| 4 | B1606 | CAN timeout between IPM and ADM |
| 5 | B1607 | CAN timeout between IPM and PSM |
| 6 | B1608 | CAN timeout between IPM and SCM |
| 7 | B1611 | CAN timeout between IPM and FAM |
| 8 | B1613 | CAN timeout between IPM and CLU |
| 9 | B1625 | ECM error |
| 10 | B1640 | CAN timeout between IPM and MFSW |
| 11 | B1641 | CAN timeout between IPM and FBWS |

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| | | |
|---|---|---|
| 12 | B1642 | CAN timeout between IPM and PTM |
| 13 | B1643 | CAN timeout between IPM and ECW |
| 14 | B1689 | CAN timeout between IPM and PDM |
| 15 | B1971 | Park Position Error |
| 16 | B1978 | ESCL failure |

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## B1602 CAN Error

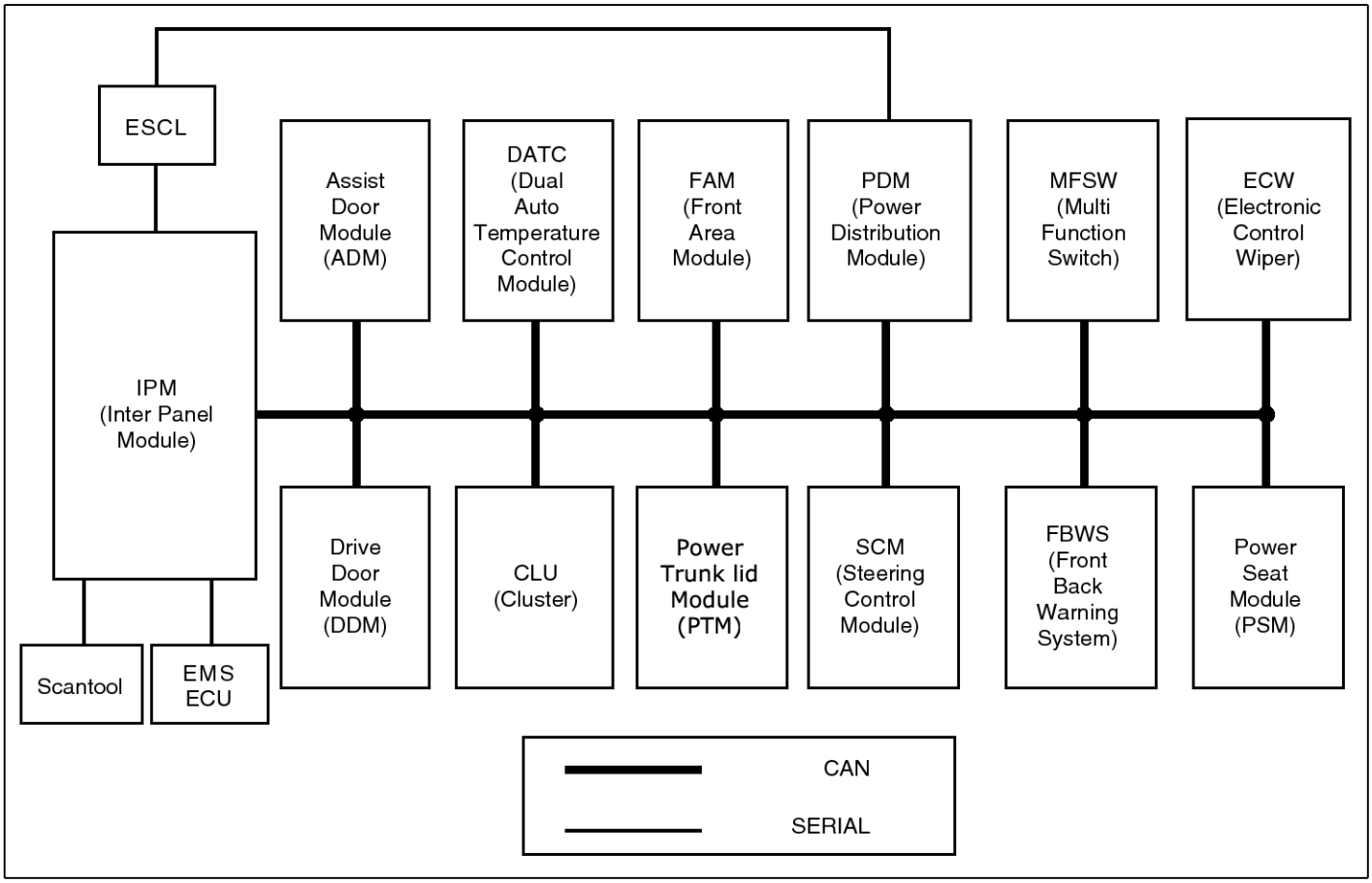
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

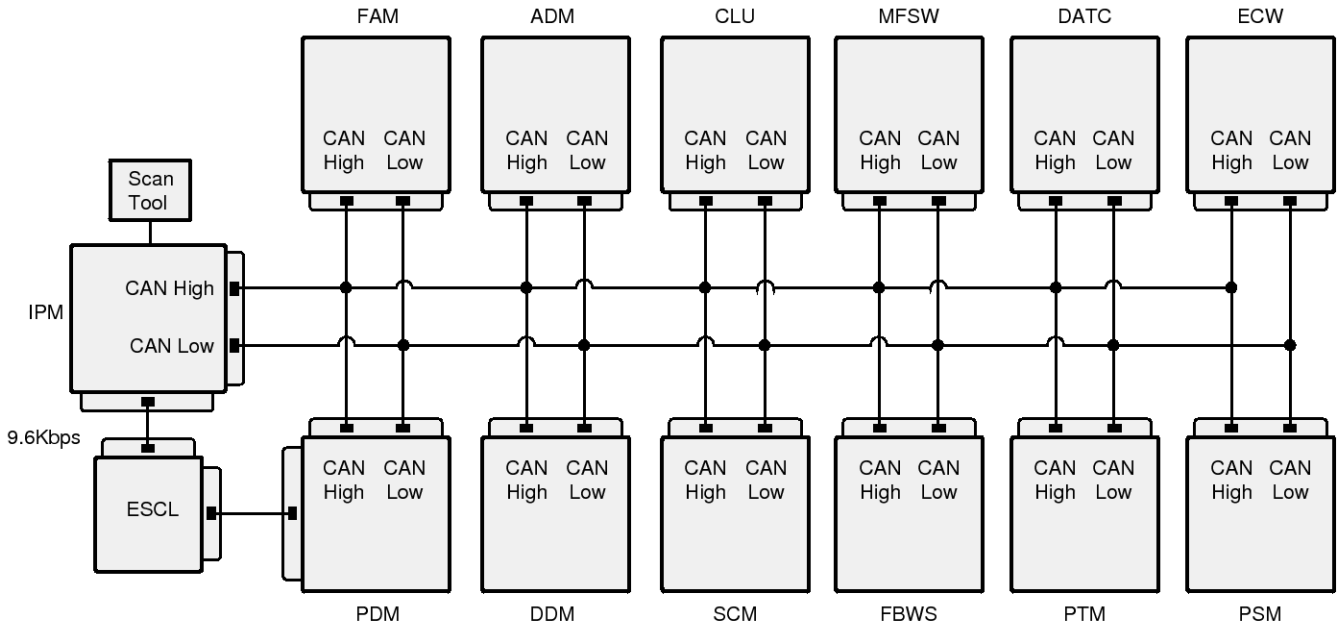
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,PSM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, PSM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

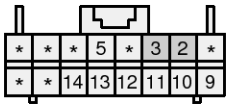



<ECW>



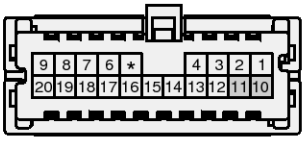
4. Low
5. High

<IPM>



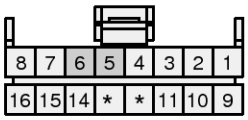
2 . Low
3. High

<PDM>



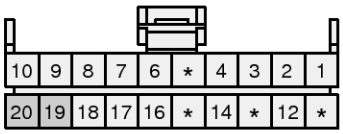
10. Low
11. High

<MFSW>



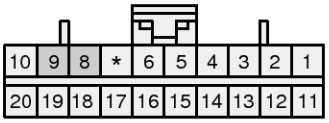
5. High
6. Low

<CLU>



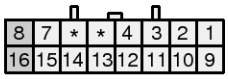
19. Low
20. High

<TILT & TELE>



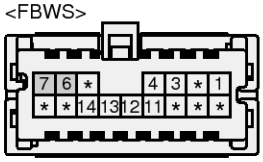
8. High
9. Low

<ADM>



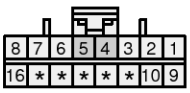
8. High
16. Low

<FBWS>



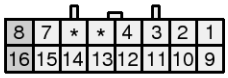
6. High
7. Low

<PSM>



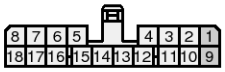
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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## Signal Waveform & Data

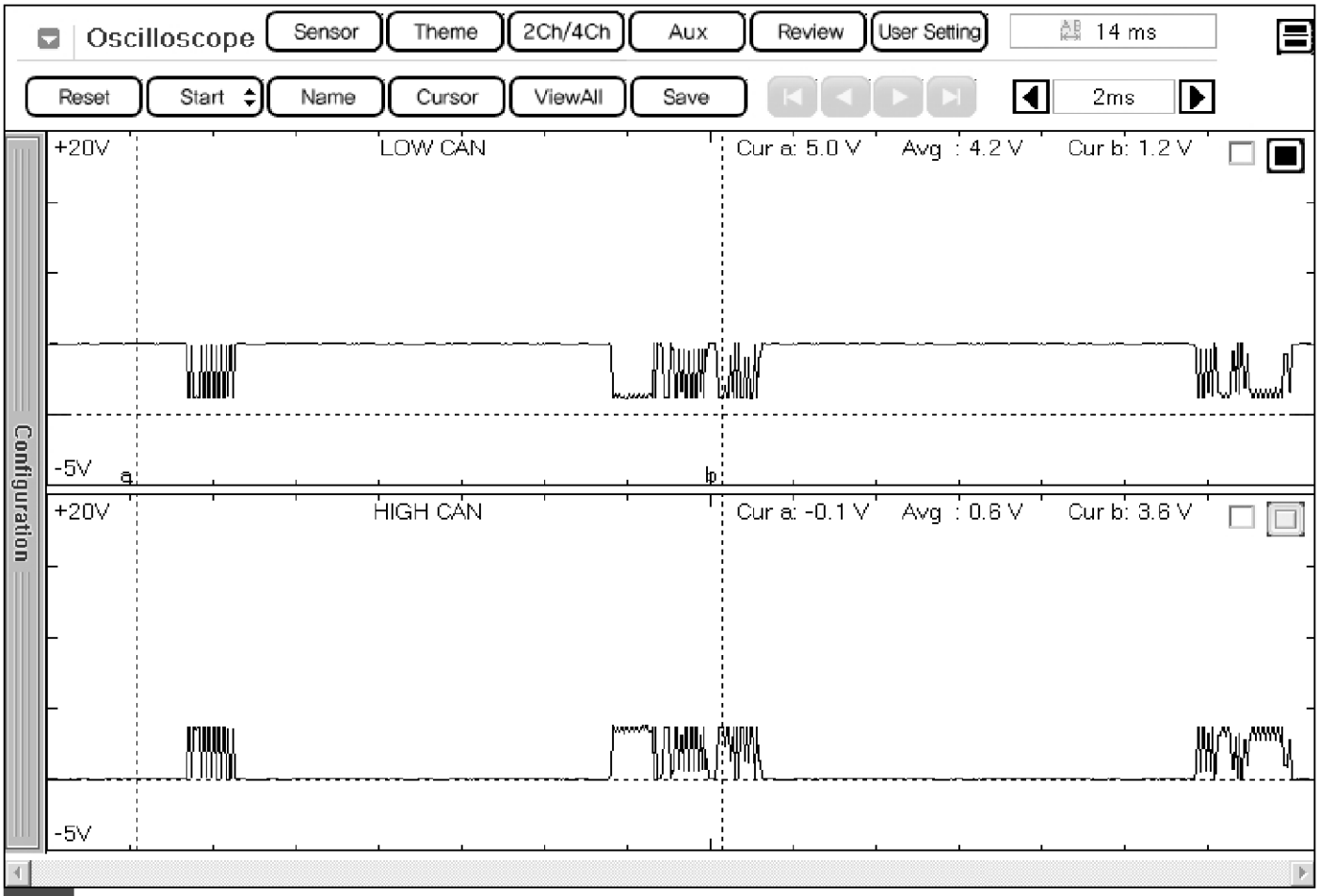



Fig.1

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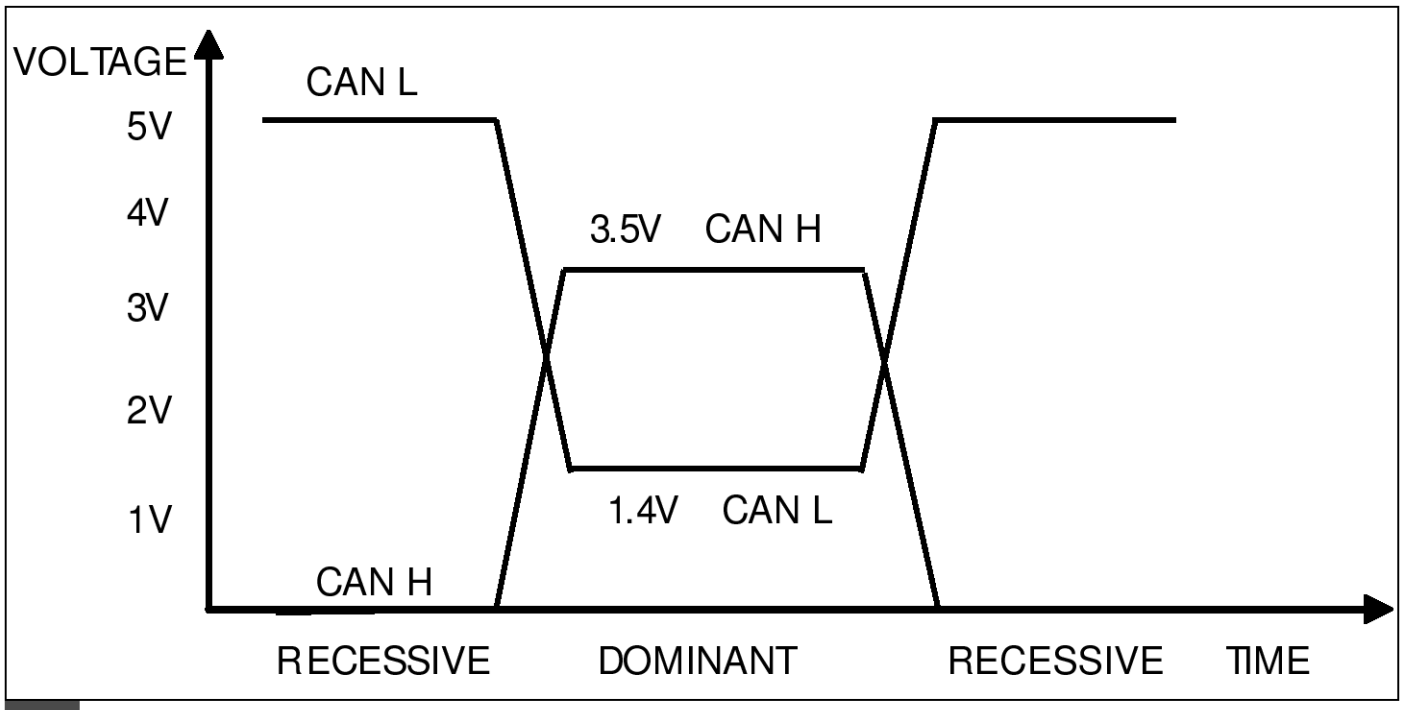



Fig.2

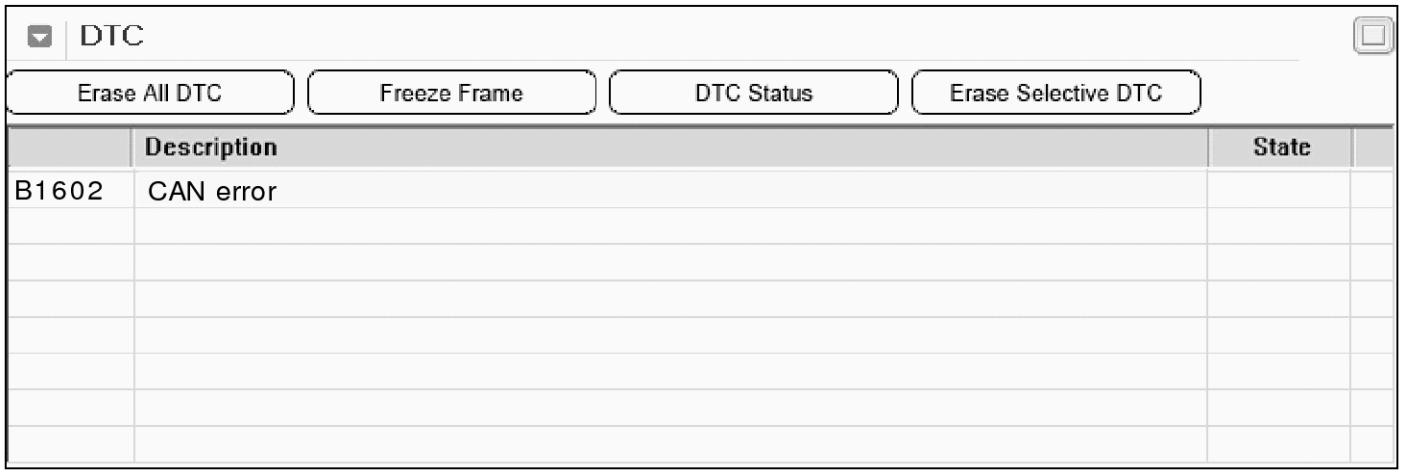
SBHBE9J04L

Fig.1) CAN Low/High Signal Waveform

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).




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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 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.

## 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 "PSM Signal Circuit Inspection" procedure.

## IPM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on IPM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PSM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)
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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# B1603 CAN Communication Bus Off

## General Description

Refer to DTC B1602 : CAN Error.

## 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM 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

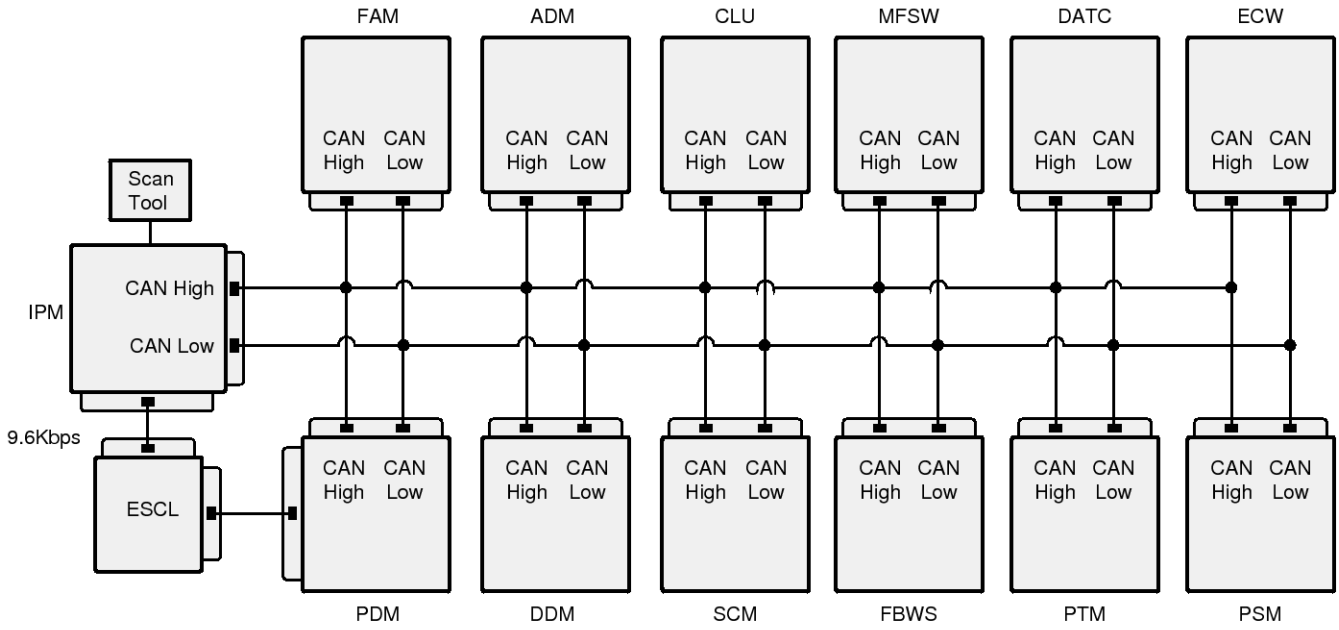
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,PSM are not Sleep condition1. CAN High and Low Line short to ground coincident<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, PSM power on | |
| Threshold Value | • CAN High/Low : 0V or B+ | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

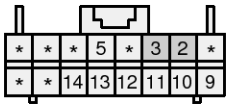



<ECW>



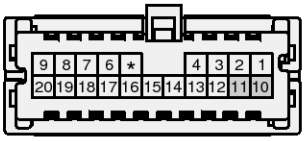
4. Low
5. High

<IPM>



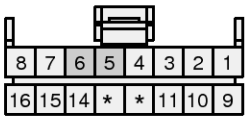
2 . Low
3. High

<PDM>



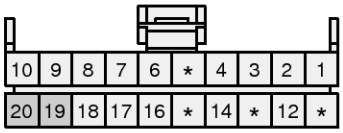
10. Low
11. High

<MFSW>



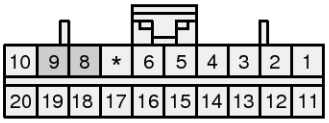
5. High
6. Low

<CLU>



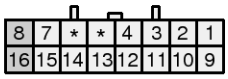
19. Low
20. High

<TILT & TELE>



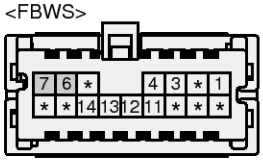
8. High
9. Low

<ADM>



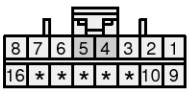
8. High
16. Low

<FBWS>



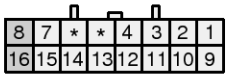
6. High
7. Low

<PSM>



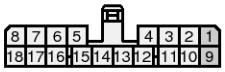
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

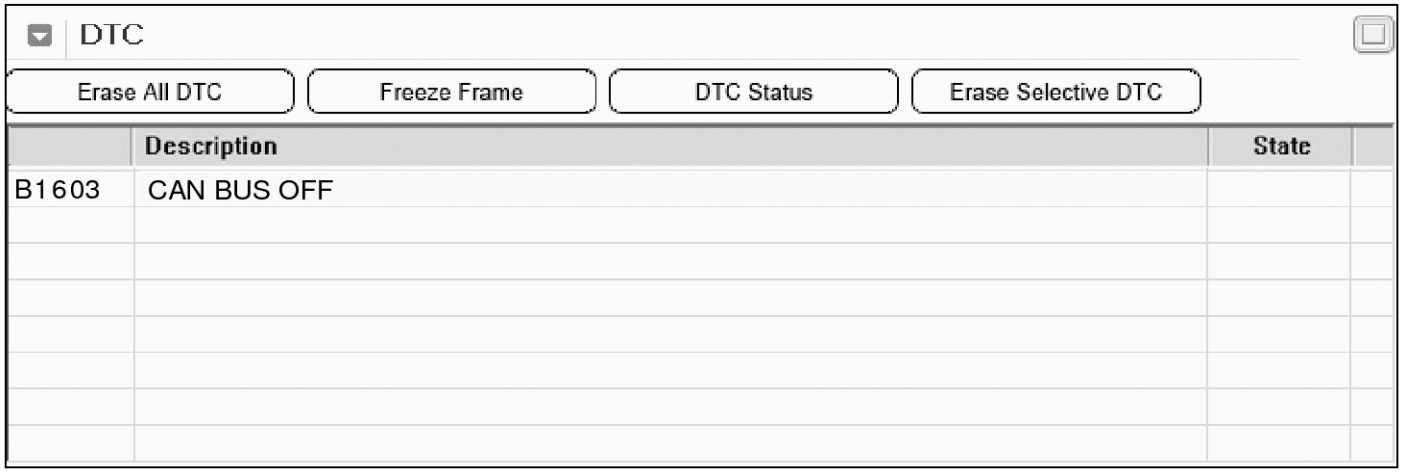
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## Scantool Data Analysis

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).




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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 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), 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)
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

Refer to DTC B1602 : CAN Error.

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# B1605 CAN Time-out DDM

## General Description

Refer to DTC B1602 : CAN Error.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ DDM) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check DDM (Including the related fuses)<br>4. DDM CAN High/Low Lines open |
| 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

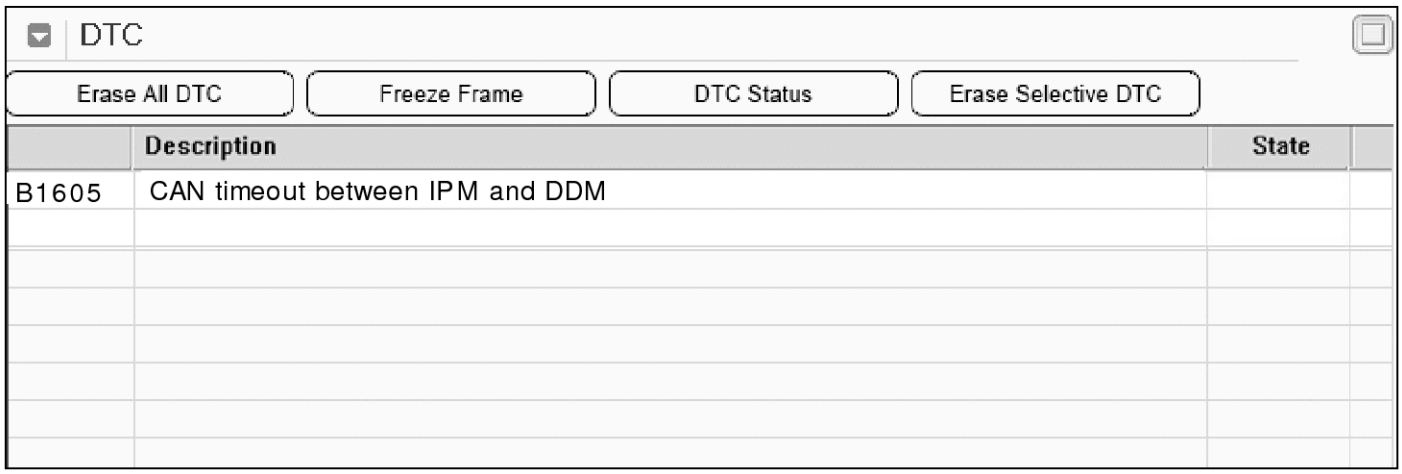
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next 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.

## 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 "DDM Signal Circuit Inspection" procedure.

## DDM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on DDM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on DDM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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. Replace the Power Window Main Switch with the new one and check DTC again.
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

Refer to DTC B1602 : CAN Error.

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## B1606 CAN Time-out ADM

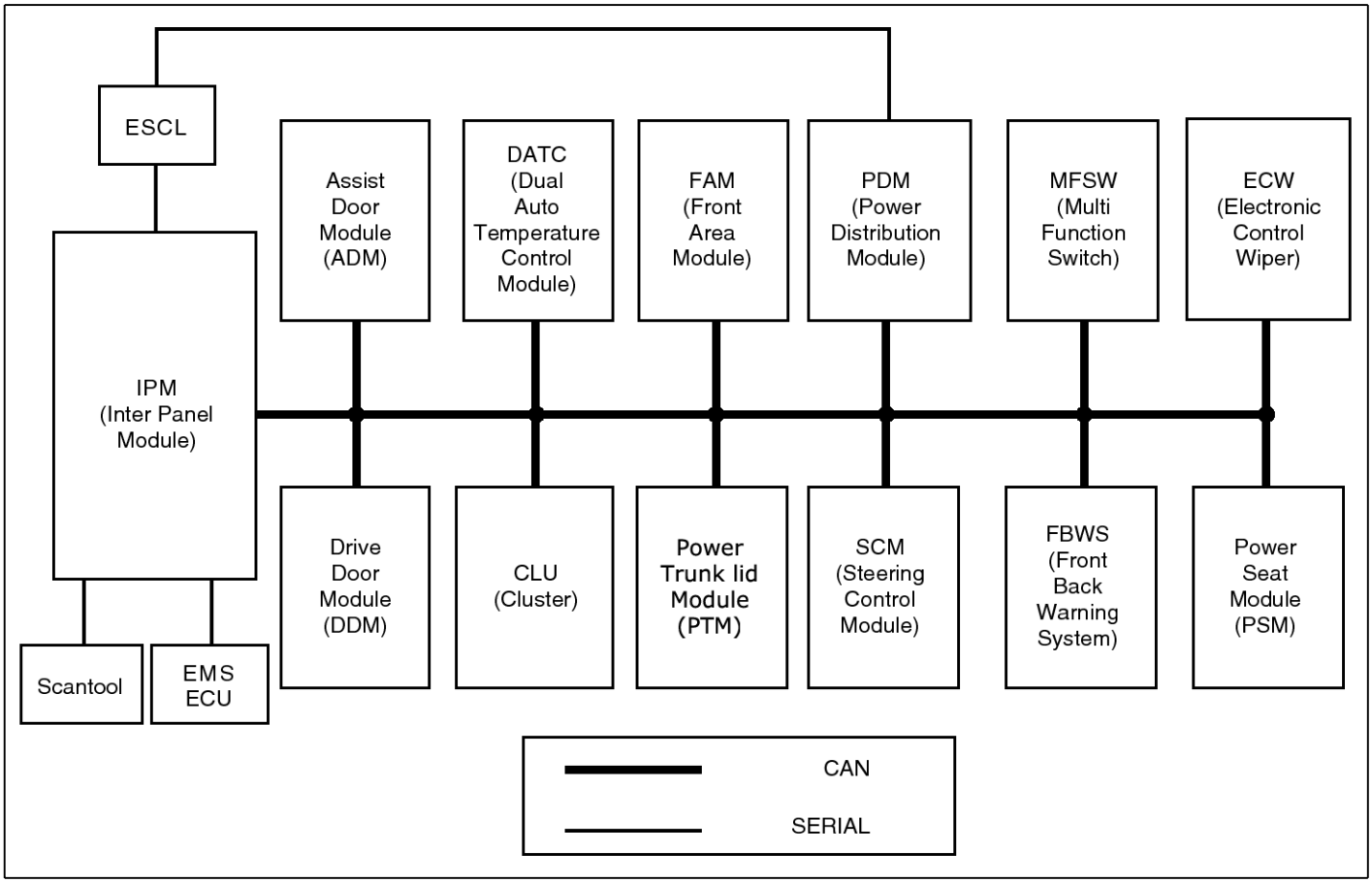
### General Description

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.)




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### DTC Description

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

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## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ ADM) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check ADM (Including the related fuses)<br>4. ADM CAN High/Low Lines open |
| 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

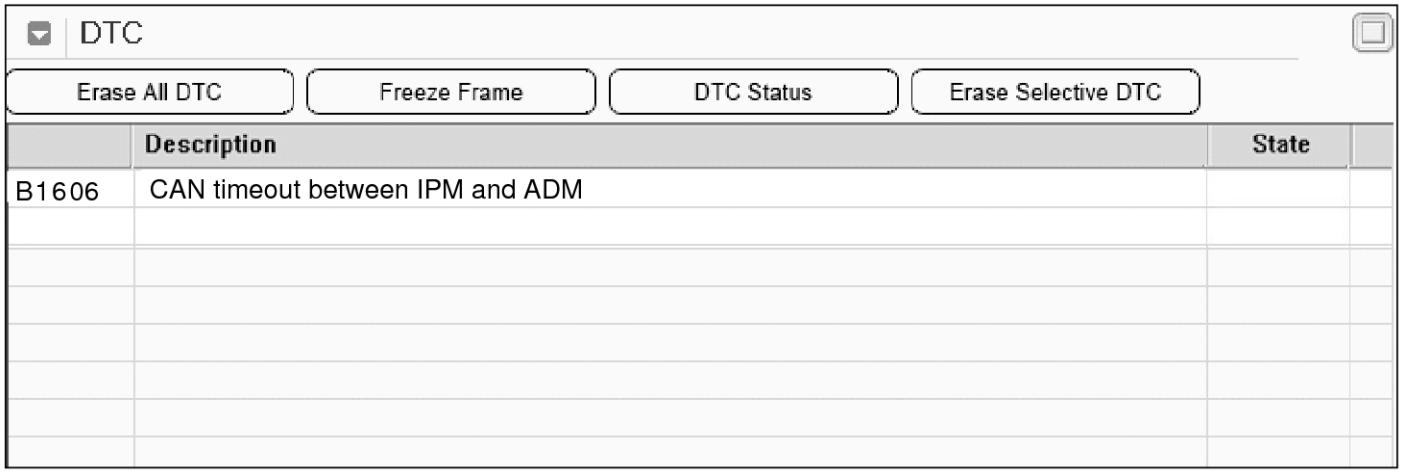
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next 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.

## 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.

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3. Has a problem been found?

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

**NO** ▶ Go to "ADM Signal Circuit Inspection" procedure.

## ADM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ADM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ADM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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. Replace ADM with the new one and check DTC again.
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

Refer to DTC B1602 : CAN Error.

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# B1607 CAN Time-out P/SEAT

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ PSM) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check PSM (Including the related fuses)<br>4. PSM CAN High/Low Lines open |
| 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

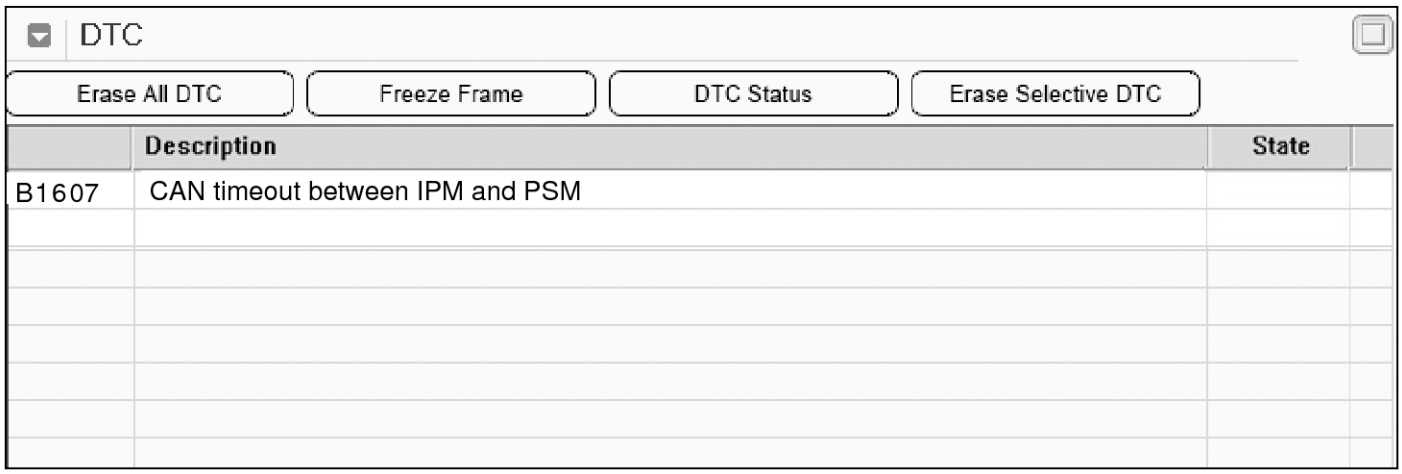
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next 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.

## 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 "PSM Signal Circuit Inspection" procedure.

## PSM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PSM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PSM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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. Replace PSM with the new one and check DTC again .
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

Refer to DTC B1602 : CAN Error.

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# B1608 CAN Time-out TILT/TELE

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ SCM) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check SCM (Including the related fuses)<br>4. SCM CAN High/Low Lines open |
| 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

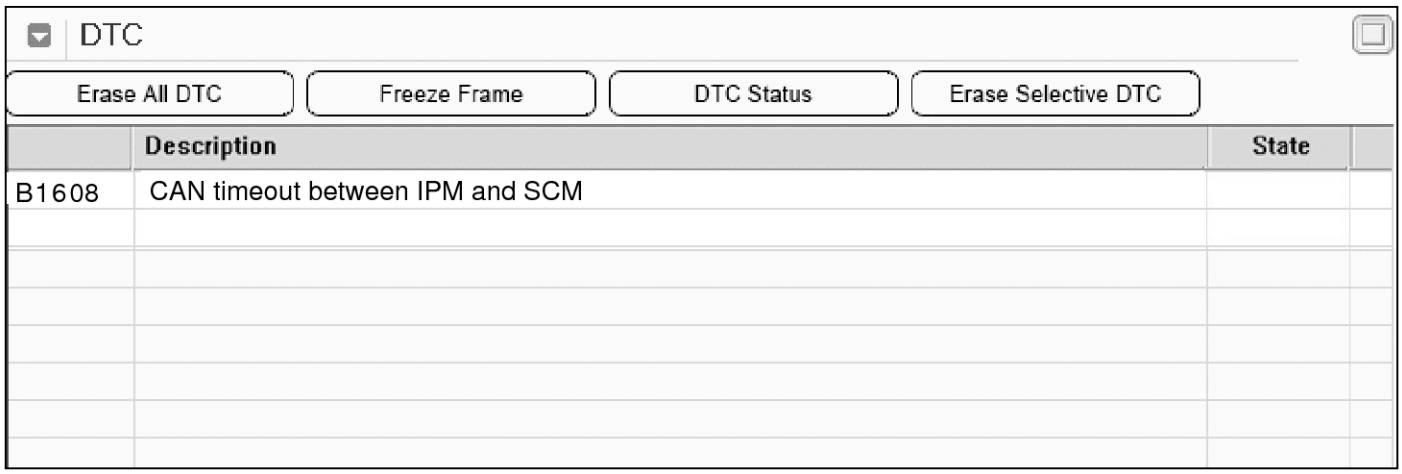
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next 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.

## 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 "SCM Signal Circuit Inspection" procedure.

## SCM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on SCM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on SCM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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. Replace SCM with the new one and check DTC again.
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

Refer to DTC B1602 : CAN Error.

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# B1611 CAN Time-out FAM

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ FAM) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check FAM (Including the related fuses)<br>4. FAM CAN High/Low Lines open |
| 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

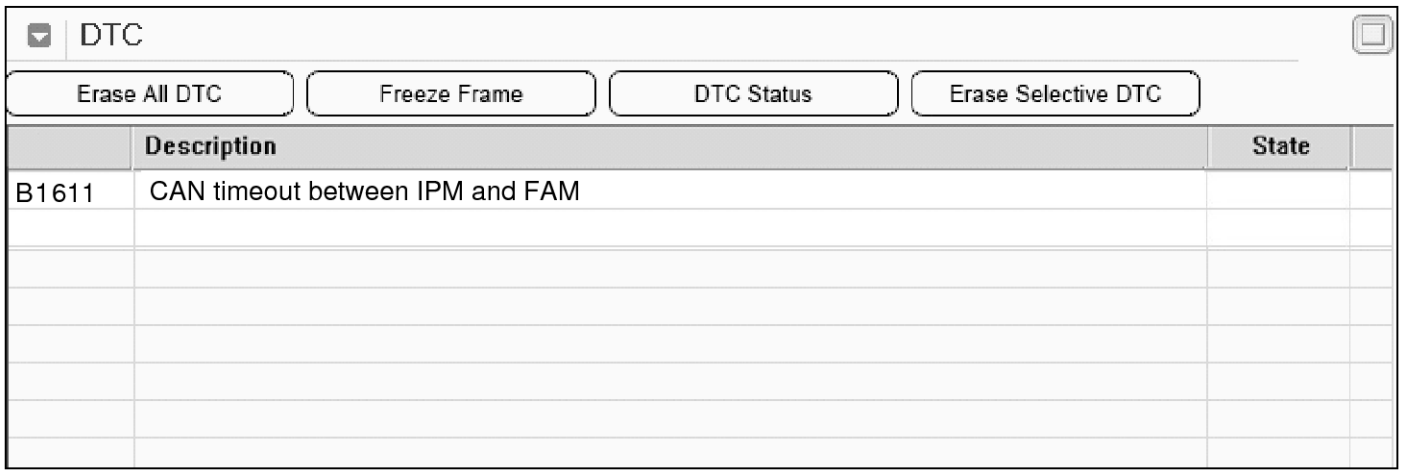
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next 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.

## 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 "FAM Signal Circuit Inspection" procedure.

## FAM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FAM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FAM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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. Replace FAM with the new one and check DTC again .
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

Refer to DTC B1602 : CAN Error.

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# B1613 CAN Time-out CLU

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ CLU) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check CLU (Including the related fuses)<br>4. CLU CAN High/Low Lines open |
| 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

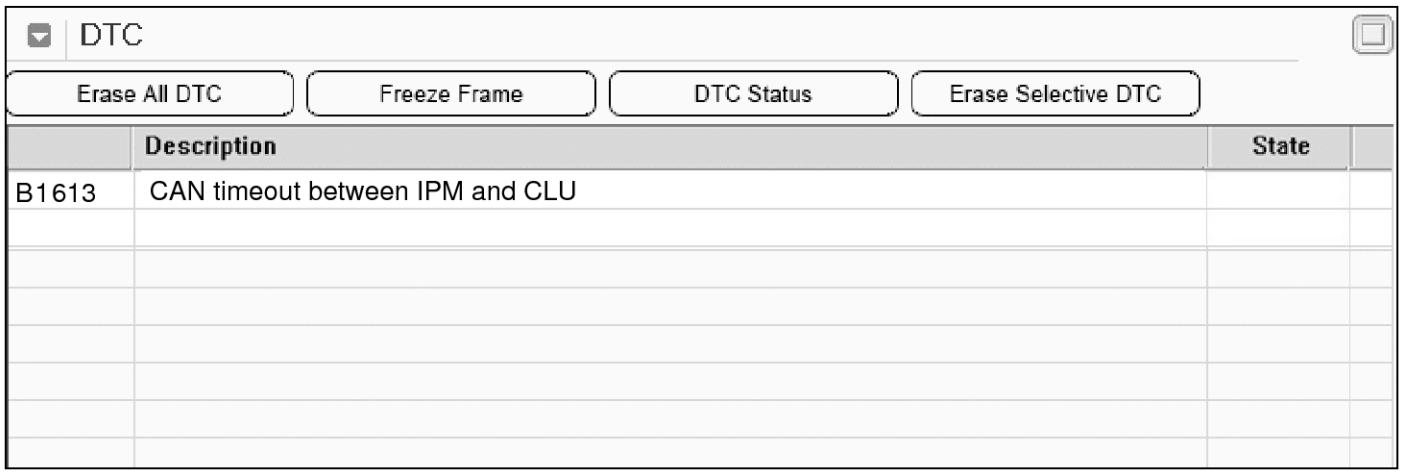
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next 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.

## 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 "CLU Signal Circuit Inspection" procedure.

## CLU Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on CLU CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on CLU CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Component Inspection

Refer to DTC B1611 : CAN Time-out FAM.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1625 ECM Communication Data Failure

### General Description

Refer to DTC B1603 : CAN Communication Bus Off.

### DTC Description

This code is outputted when there is communication error between ECM and IPM.

(Check Sum Error, Data Frame Error, ID Unknown Error, Data Length Error, Time Out Error, etc)

### Diagnostic Circuit Diagram

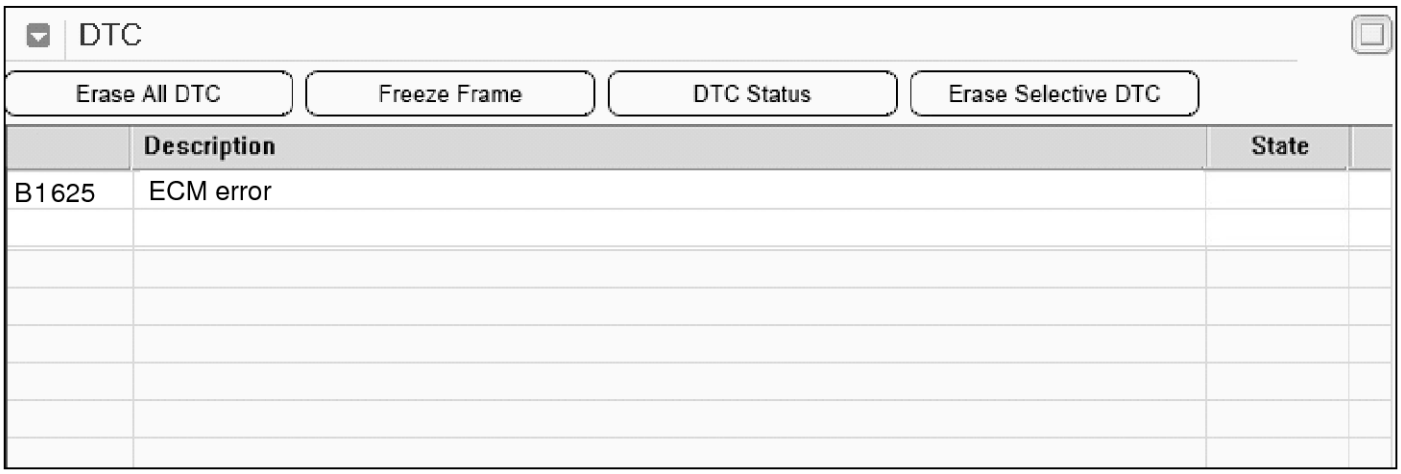
Refer to DTC B1602 : CAN Error.

### Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

### 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?

**YES** ▶ Check open or short on the communication line between ECM and IPM.
Repair as necessary and go to "Verification of Vehicle Repair".
▶ If there is no something wrong, substitute with a known - good ECM and check for proper operation. If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Fault is intermittent caused by poor contact in IPM's and/or ECM'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.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1640 CAN Time-out MFSW

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ MFSW) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check MFSW (Including the related fuses)<br>4. MFSW CAN High/Low Lines open |
| Enable Conditions | • IPM power on | |
| Threshold Value | • No message from MFSW to IPM for 10 sec. | |
| Diagnostic Time | • 10 sec | |
| DTC Erasing Time | • DTC is erased immediately after receiving data from MFSW. | |

## Diagnostic Circuit Diagram

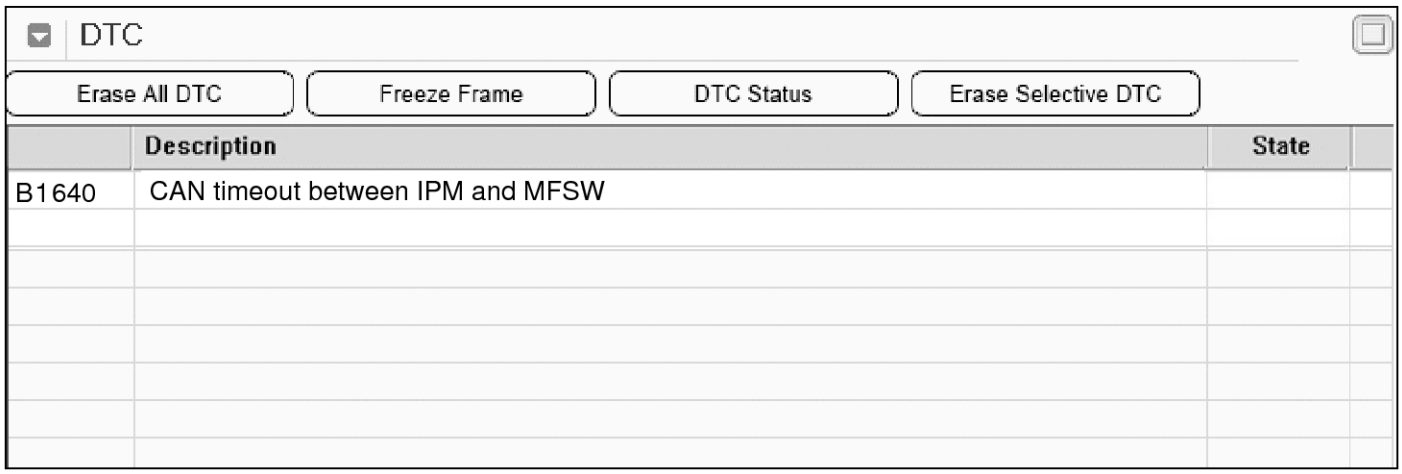
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in IPM's and/or MFSW'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 "MFSW Signal Circuit Inspection" procedure.

## MFSW Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on MFSW CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on MFSW CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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. Replace MFSW with the new one and check DTC again.
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

Refer to DTC B1602 : CAN Error.

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# B1641 CAN Time-out FBWS

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ FBWS) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check FBWS (Including the related fuses)<br>4. FBWS CAN High/Low Lines open |
| Enable Conditions | • IPM power on | |
| Threshold Value | • No message from FBWS to IPM for 10 sec. | |
| Diagnostic Time | • 10 sec | |
| DTC Erasing Time | • DTC is erased immediately after receiving data from FBWS. | |

## Diagnostic Circuit Diagram

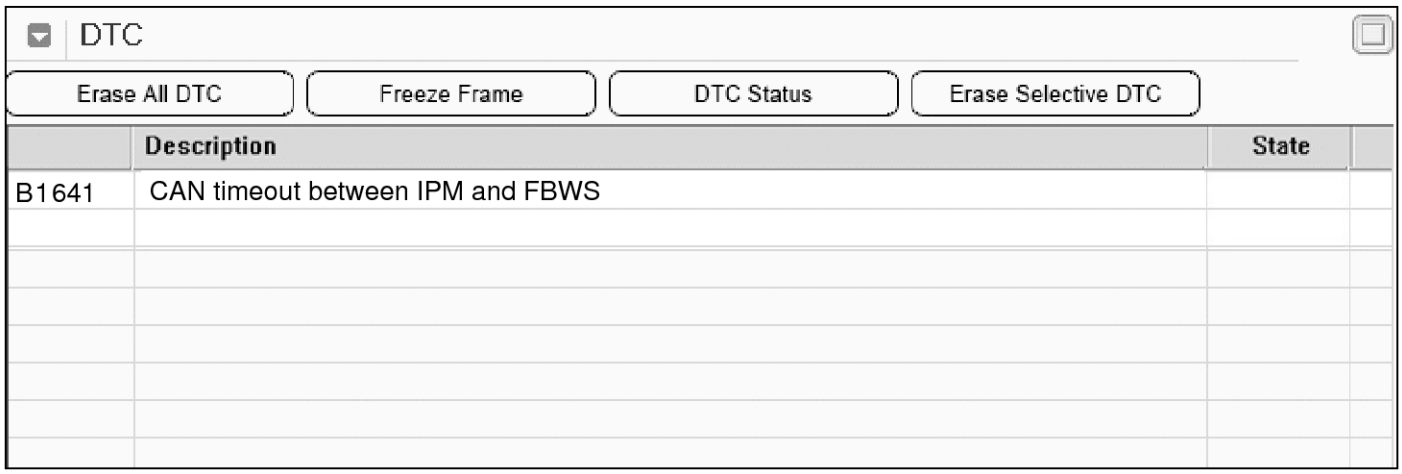
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in IPM's and/or FBWS'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 "FBWS Signal Circuit Inspection" procedure.

## FBWS Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FBWS CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FBWS CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Component Inspection

Refer to DTC B1640 : CAN Time-out MFSW.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1642 CAN Time-out PTM

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ PTM) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check PTM (Including the related fuses)<br>4. PTM CAN High/Low Lines open |
| Enable Conditions | • IPM power on | |
| Threshold Value | • No message from PTM to IPM for 10 sec. | |
| Diagnostic Time | • 10 sec | |
| DTC Erasing Time | • DTC is erased immediately after receiving data from PTM. | |

## Diagnostic Circuit Diagram

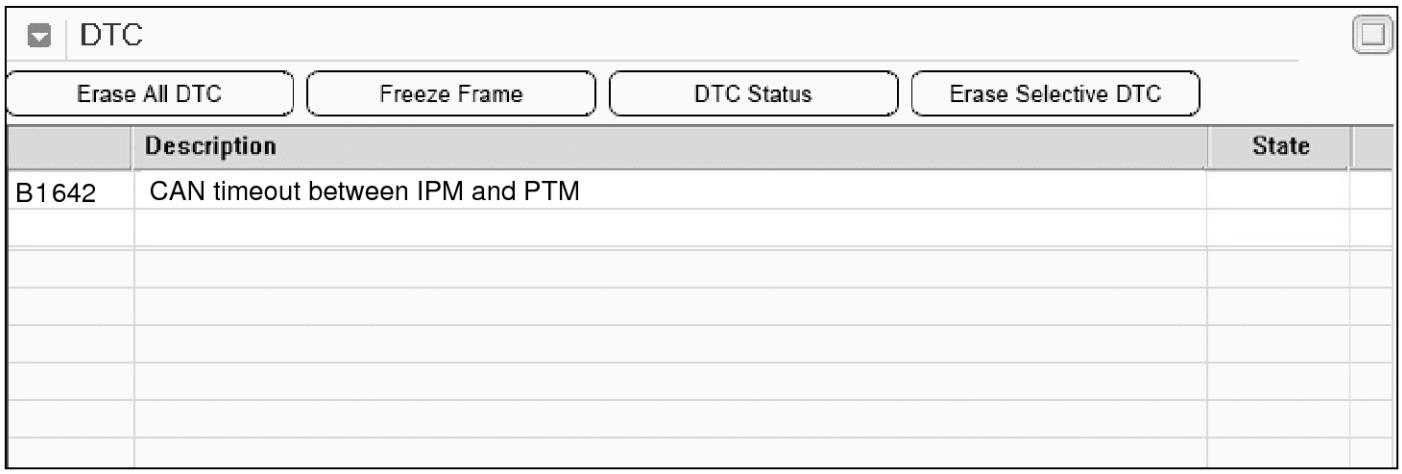
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in IPM's and/or PTM'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 "PTM Signal Circuit Inspection" procedure.

## PTM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PTM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PTM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Component Inspection

Refer to DTC B1640 : CAN Time-out MFSW.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1643 CAN Time-out ECW

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ ECW) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check ECW (Including the related fuses)<br>4. ECW CAN High/Low Lines open |
| Enable Conditions | • IPM power on | |
| Threshold Value | • No message from ECW to IPM for 10 sec. | |
| Diagnostic Time | • 10 sec | |
| DTC Erasing Time | • DTC is erased immediately after receiving data from ECW. | |

## Diagnostic Circuit Diagram

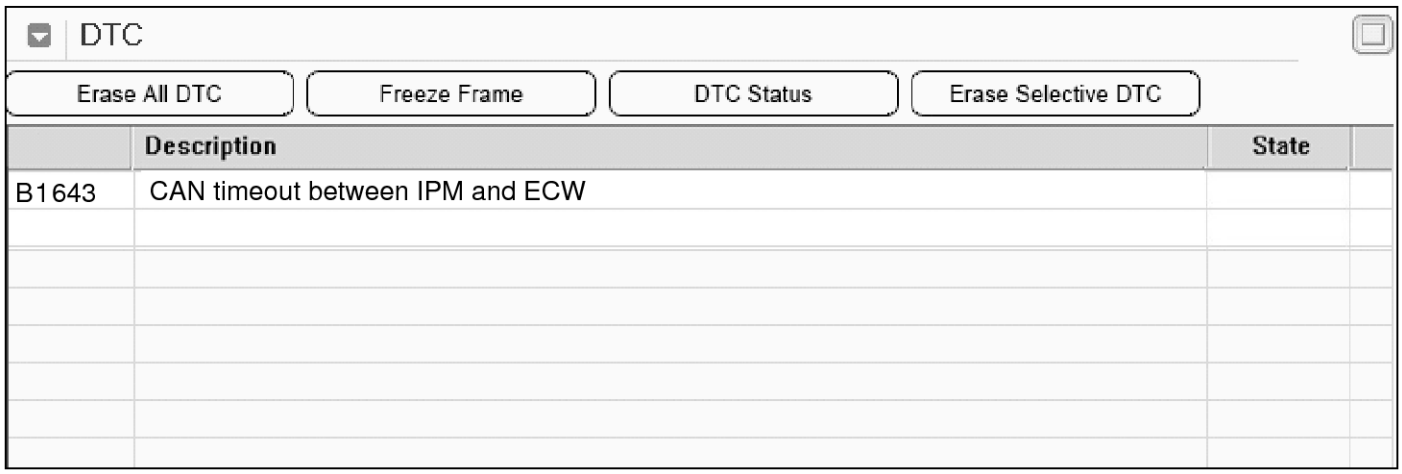
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in IPM's and/or ECW'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 "ECW Signal Circuit Inspection" procedure.

## ECW Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ECW CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ECW CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Component Inspection

Refer to DTC B1640 : CAN Time-out MFSW.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1689 CAN Time-out PDM

## General Description

Refer to DTC B1603 : CAN Communication Bus Off.

## DTC Description

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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Comm. Check (IPM ↔ PDM) | • IG ON<br>1. No receiving CAN Data owing to BUS OFF (Check CAN BUS ERROR DTC is being.)<br>2. IPM CAN High/Low Lines open together<br>3. Check PDM (Including the related fuses)<br>4. PDM CAN High/Low Lines open |
| Enable Conditions | • IPM power on | |
| Threshold Value | • No message from PDM to IPM for 10 sec. | |
| Diagnostic Time | • 10 sec | |
| DTC Erasing Time | • DTC is erased immediately after receiving data from PDM. | |

## Diagnostic Circuit Diagram

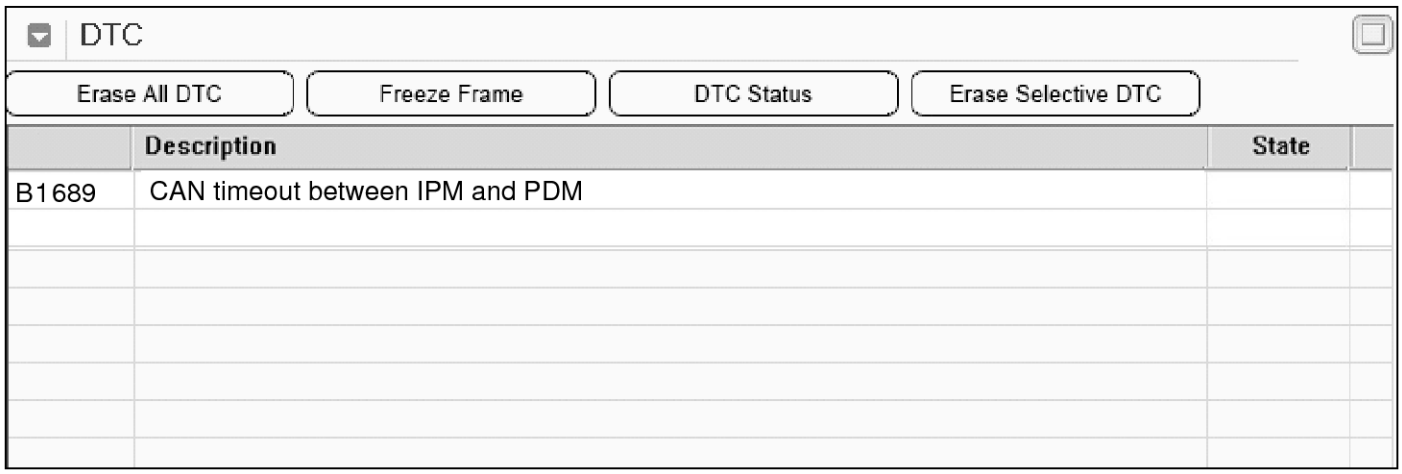
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**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 "PDM Signal Circuit Inspection" procedure.

## PTM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PDM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PDM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Component Inspection

Refer to DTC B1640 : CAN Time-out MFSW.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1971 Parking Position Input Error

### General Description

Refer to DTC B1603 : CAN Communication Bus Off.

### DTC Description

This code is outputted when the Parking Position Switch is "ON" for 10sec and above while the vehicle speed is over 2MPH(3km/h).

### DTC Detecting Condition

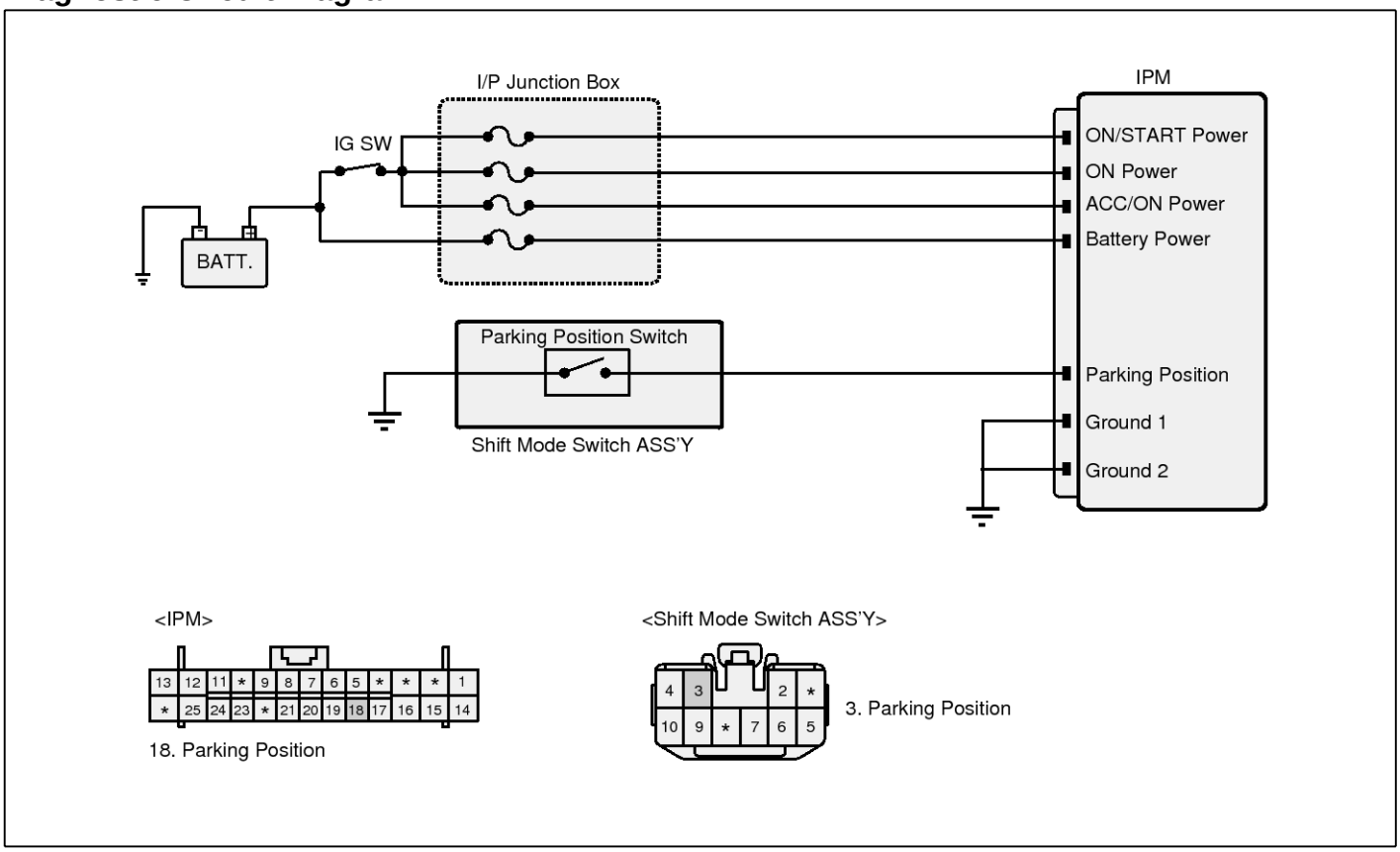
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Check Stop Switch "ON" by the voltage level(Below 2V)<br>• Check the vehicle speed signal from CLU (2MPH_3km/h)<br>• IGN ON | • Check Stop Signal Input state ( ON/OFF) |
| Enable Conditions | • Button Start Vehicle (Option)<br>• Stop Switch : ON<br>• In case of no ESCL error<br>• Vehicle speed : above 2MPH(3km/h) | |
| Threshold Value | • Stop Signal Input ON : Below 2V<br>• Stop Signal Input OFF : Above 7V | |
| Diagnostic Time | • Stop Switch is "ON" for 10sec and above under IG ON and the vehicle speed is over 2MPH(3km/h). | |
| DTC Erasing Time | • IG OFF<br>• Stop Signal Input : OFF<br>• Vehicle speed : Below 2MPH(3km/h)<br>(* DTC is erased immediately when the vehicle condition meet to 1 condition among above 3.) | |

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## Diagnostic Circuit Diagram



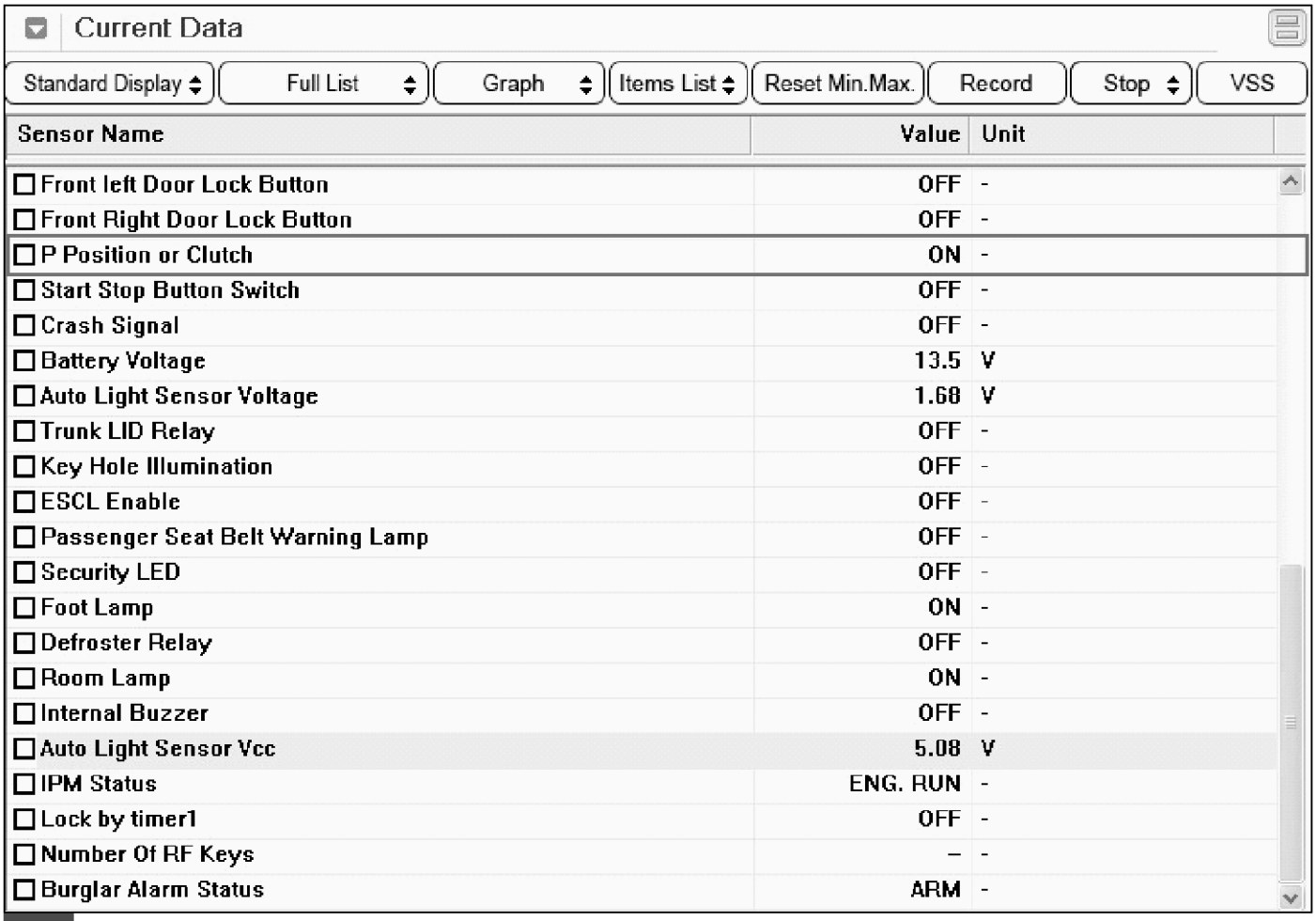

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## Signal Waveform & Data




| Sensor Name | Value | Unit |
|---|---|---|
| Front left Door Lock Button | OFF | - |
| Front Right Door Lock Button | OFF | - |
| P Position or Clutch | ON | - |
| Start Stop Button Switch | OFF | - |
| Crash Signal | OFF | - |
| Battery Voltage | 13.5 | V |
| Auto Light Sensor Voltage | 1.68 | V |
| Trunk LID Relay | OFF | - |
| Key Hole Illumination | OFF | - |
| ESCL Enable | OFF | - |
| Passenger Seat Belt Warning Lamp | OFF | - |
| Security LED | OFF | - |
| Foot Lamp | ON | - |
| Defroster Relay | OFF | - |
| Room Lamp | ON | - |
| Internal Buzzer | OFF | - |
| Auto Light Sensor Vcc | 5.08 | V |
| IPM Status | ENG. RUN | - |
| Lock by timer1 | OFF | - |
| Number Of RF Keys | – | - |
| Burglar Alarm Status | ARM | - |

Fig.1

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Fig.1) "Shift Lever P Position" value at P Position after engine start

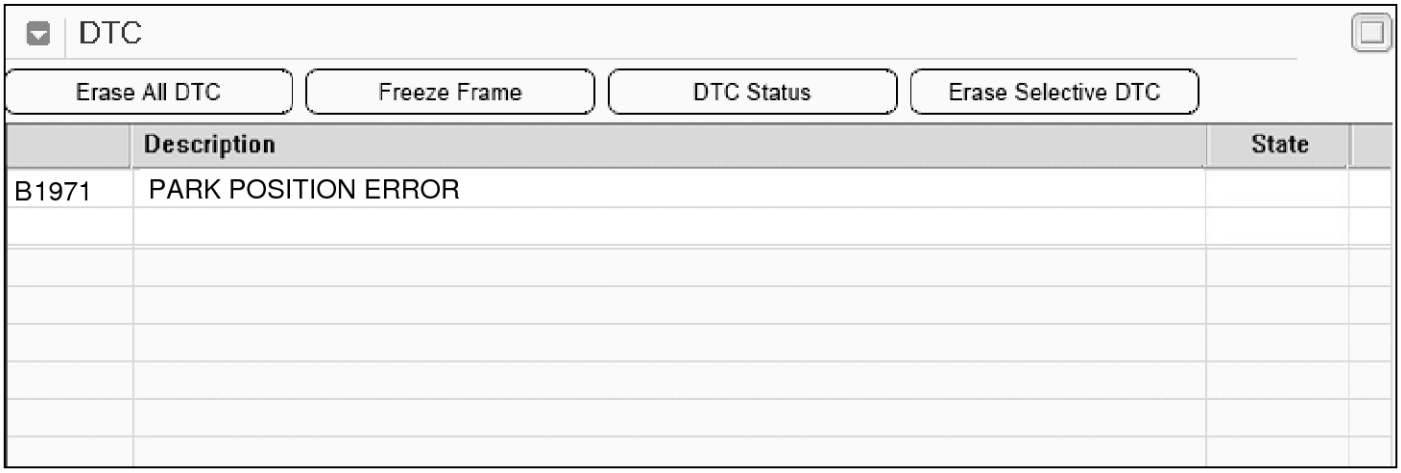
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### Scantool Data Analysis

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).




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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 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.

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## Service Data Analysis

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of Shift Lever P Position.

**Specification :** When the shift lever is positioned at P : ON, at the other range : OFF

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Front left Door Lock Button | OFF | - |
| Front Right Door Lock Button | OFF | - |
| P Position or Clutch | ON | - |
| Start Stop Button Switch | OFF | - |
| Crash Signal | OFF | - |
| Battery Voltage | 13.5 | V |
| Auto Light Sensor Voltage | 1.68 | V |
| Trunk LID Relay | OFF | - |
| Key Hole Illumination | OFF | - |
| ESCL Enable | OFF | - |
| Passenger Seat Belt Warning Lamp | OFF | - |
| Security LED | OFF | - |
| Foot Lamp | ON | - |
| Defroster Relay | OFF | - |
| Room Lamp | ON | - |
| Internal Buzzer | OFF | - |
| Auto Light Sensor Vcc | 5.08 | V |
| IPM Status | ENG. RUN | - |
| Lock by timer1 | OFF | - |
| Number Of RF Keys | – | - |
| Burglar Alarm Status | ARM | - |

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4. Is the service data within specifications?

**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 the P Position Switch and the related circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1978 Electric Steering Column Lock Failure

### General Description

Refer to DTC B1603 : CAN Communication Bus Off.

### DTC Description

This code is outputted when ESCL cannot lock or unlock the steering wheel normally.

(When ESCL Lock/Unlock switch state from PDM to IPM is different from the switch state from ESCL to IPM.)

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## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • IPM monitors the internal error of ESCL and Lock/Unlock state by communicating with ESCL. (ESCL gets power from PDM for to communicate between IPM and ESCL.)<br>• ESCL Lock/Unlock state check by CAN signal from PDM | • IPM power ON<br>1. ESCL internal error check : Check ESCL Failure on GDS among IPM Input/Output monitoring items. (When ON, It's ESCL internal error.)<br>2. Check ESCL Battery/Ground line open : Check ESCL Open state check item among PDM's items on GDS.<br>3. Check ESCL Battery/Ground line short to battery or ground : Check DTC among PDM's DTC list (ESCL BAT SCB, ESCL BAT SCG, ESCL Gnd SCB)<br>4. Check ESCL Comm. Line short to battery or ground or open : Check ESCL Data Line state among IPM items on GDS.<br>5. Check O_ESCL Enable Line's error among IPM's output lines : Check ESCL Enable=ON/OFF item among Input/Output monitoring items on GDS.(When push the button, the Data turns to ON momently.)<br>6. Check L_ESCL_Unlock among PDM's input lines : Check ESCL Unlock item among PDM's Input/Output items on GDS.<br>7. Check PDM's VbatLoad line : Check Vbat_Load among PDM's Input/Output items on GDS .<br>8. Check PDM Power terminal's Relay short to battery : ACC, IGN1, IGN2, Starter SCG among PDM's Input/Output items on GDS<br>9. When push SSB during PDM actuation test(ACC, IGN1, IGN 2, Starter Rly).<br>10. Check IPM/PDM/ESCL learning state (IPM : Learnt, PDM : Learnt, ESCL : Normal) |

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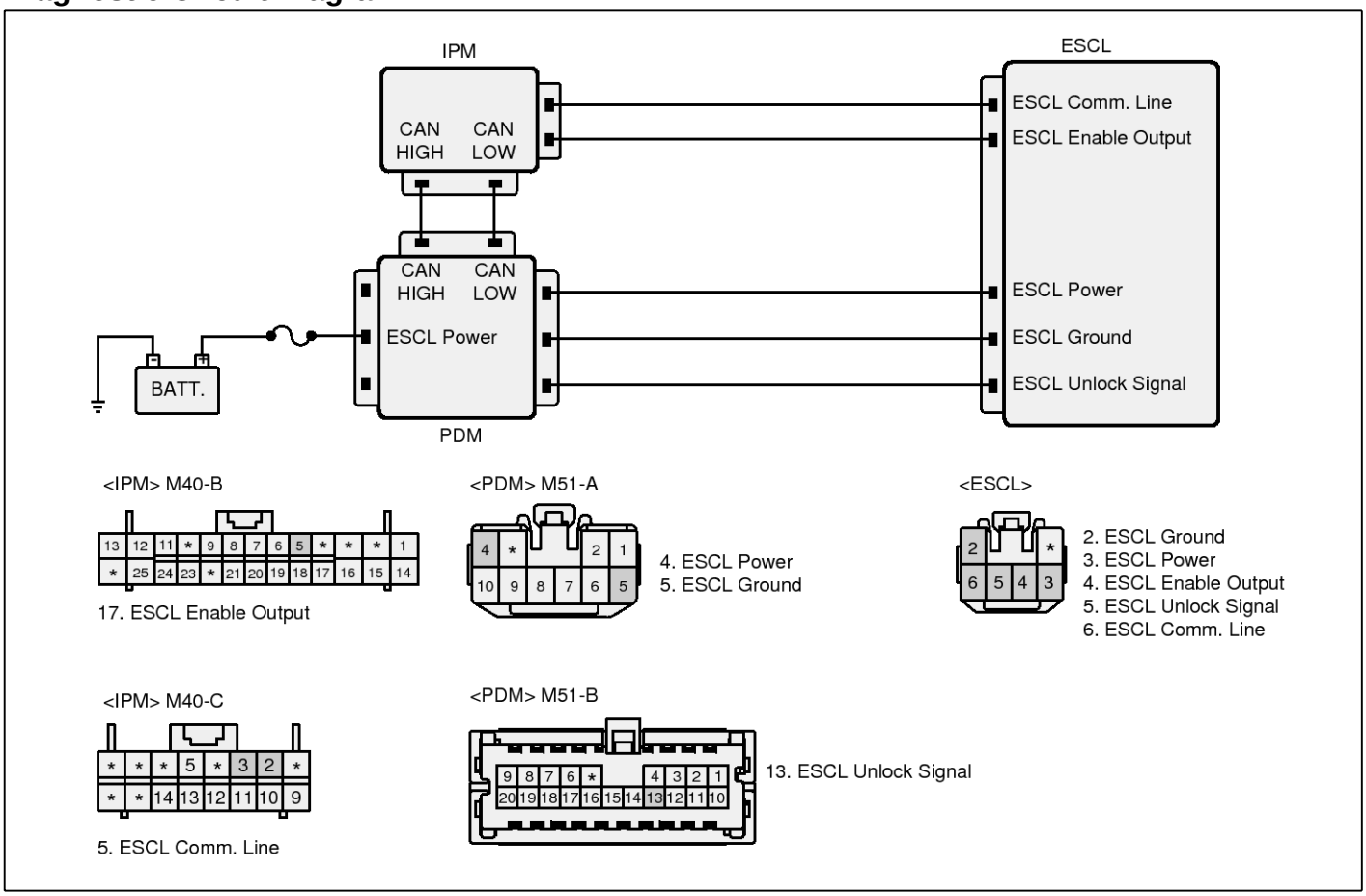
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| Enable Conditions | • Common : IPM power ON<br>• In case of ESCL error<br>1. ESCL internal error<br>2. ESCL Power/Ground Line short to Power/Ground or Open<br>3. ESCL Communication Line short to Power/Ground or Open<br>4. O_ESCL Enable Line from IPM Open<br>5. ESCL_Unlock Line to IPM Open or Short<br>• In case of no ESCL error<br>1. No power to PDM (VBatLoad)<br>2. PDM Power Relay(ACC, IGN1, IGN2, Starter Rly) short to battery<br>3. During PDM actuation test(ACC, IGN1, IGN2, Starter Rly)<br>4. Before finishing IPM/PDM/ESCL learning (All same pin code) | |
| Threshold Value | • PDM's ESCL Unlock/Lock Decision Voltage Level : Transmit the information by CAN after deciding ON(Above 7V)/OFF(Below 2V) at ESCL Unlock Input Pin<br>• IPM decides Unlock/Lock by communication with ESCL<br>• Decide by comparing the results of above 2 items | |
| Diagnostic Time | • When the ESCL's states are different between PDM and IPM while ESCL is working(Unlock↔Lock). | |
| DTC Erasing Time | • 10 sec after the DTC is outputted.<br>(Erasing DTC automatically) | |

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## Diagnostic Circuit Diagram




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**Signal Waveform & Data**

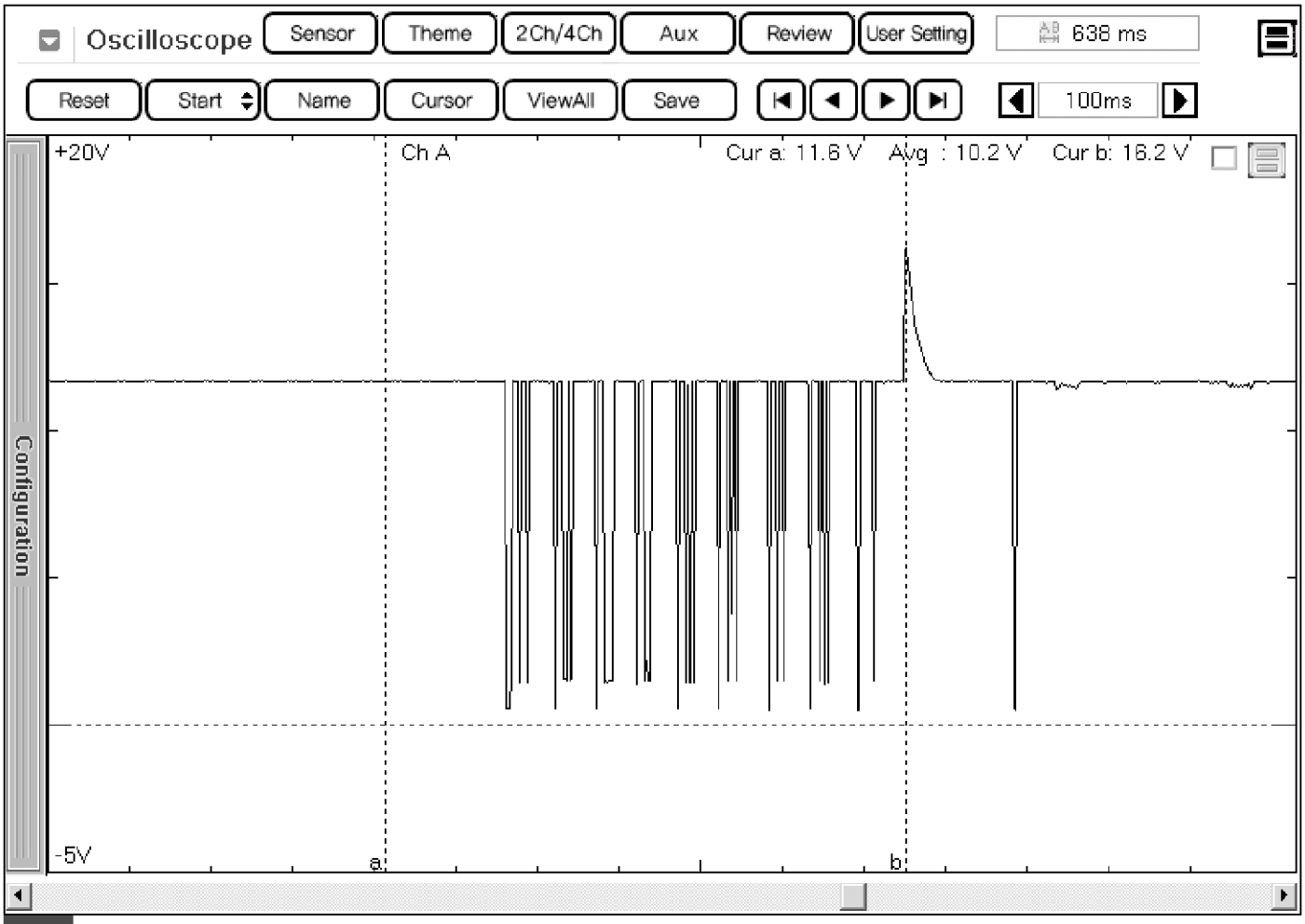



Fig.1

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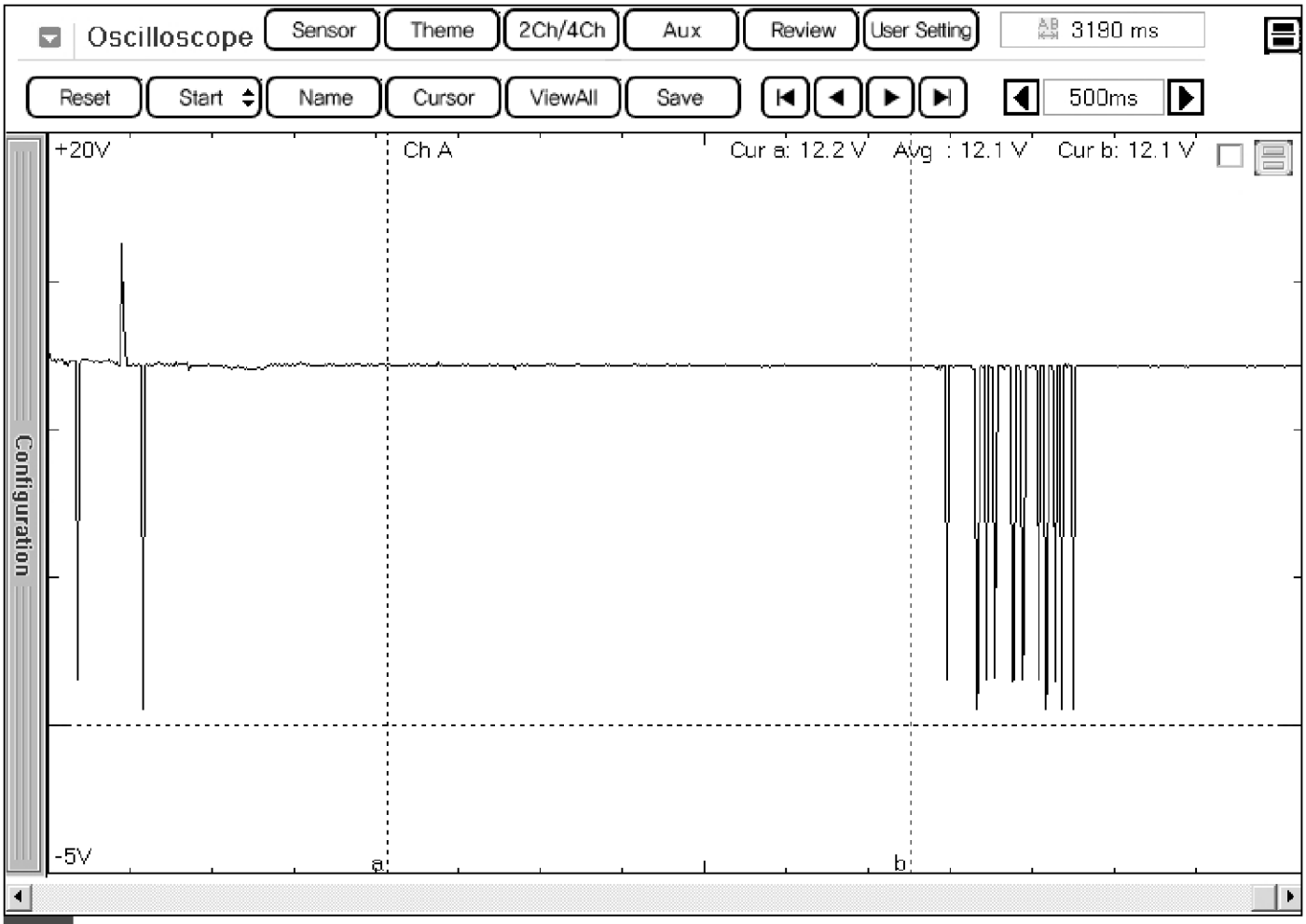



Fig.2

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Fig.1) ESCL Data Signal Waveform(UNLOCK STATE)

Fig.2) ESCL Data Signal Waveform(LOCK STATE)

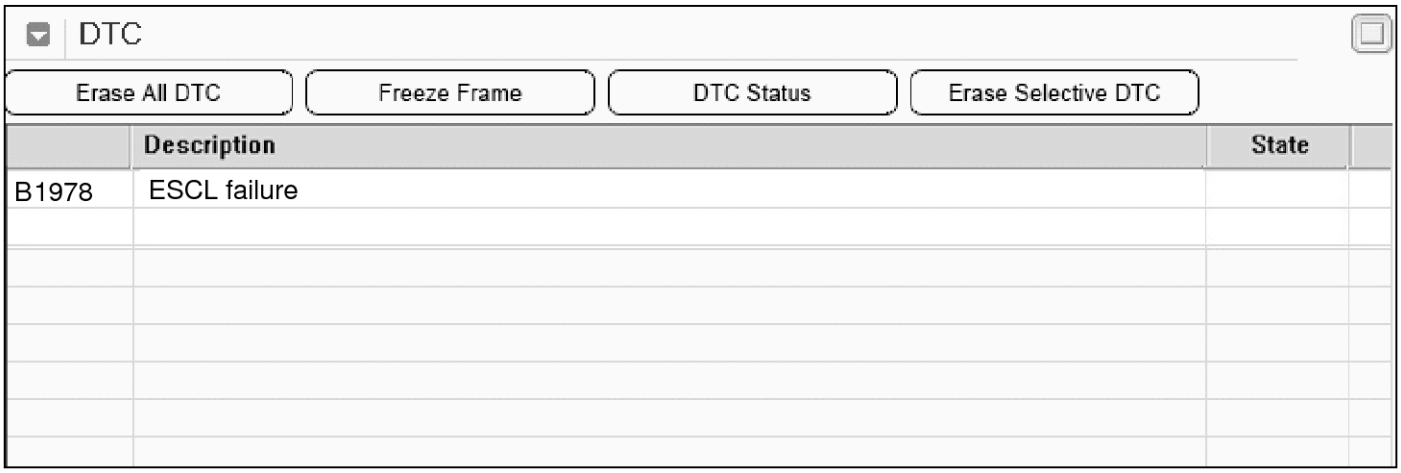
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### Scantool Data Analysis

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).




SBHBE9J22L

5. Is the same DTC occurred again?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in ESCL'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.

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## Service Data Analysis

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of ESCL Enable.

**Specification :** When operate SSB with FOB inside the car ESCL Enable : ON

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Front left Door Lock Button | OFF | - |
| Front Right Door Lock Button | OFF | - |
| P Position or Clutch | ON | - |
| Start Stop Button Switch | OFF | - |
| Crash Signal | OFF | - |
| Battery Voltage | 13.5 | V |
| Auto Light Sensor Voltage | 1.68 | V |
| Trunk LID Relay | OFF | - |
| Key Hole Illumination | OFF | - |
| ESCL Enable | ON | - |
| Passenger Seat Belt Warning Lamp | OFF | - |
| Security LED | OFF | - |
| Foot Lamp | ON | - |
| Defroster Relay | OFF | - |
| Room Lamp | ON | - |
| Internal Buzzer | OFF | - |
| Auto Light Sensor Vcc | 5.08 | V |
| IPM Status | ENG. RUN | - |
| Lock by timer1 | OFF | - |
| Number Of RF Keys | – | - |
| Burglar Alarm Status | ARM | - |

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4. Is the service data within specifications?

**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 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 "PDM Power Circuit and Ground Circuit Inspection" procedure.

## PDM Power Circuit and Ground Circuit Inspection

1. PDM Power Circuit Inspection
   1) IG "ON" & ENG "OFF"
   2) Measure voltage between Power to PDM circuit and chassis ground.
   3) Measure voltage between Power to ESCL circuit and chassis ground.
      (It is available to measure during ESCL operation. )

**Specification :** Approx. 12 V

   4) Are the measured voltage within specifications?

**YES** ▶ Go to "PDM Ground Circuit Inspection" procedure.

**NO** ▶ Check the related fuses and circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. PDM Ground Circuit Inspection
   1) IG "ON" & ENG "OFF"
   2) Measure voltage between PDM ground circuit and chassis ground.

**Specification :** Approx. 0 V

   3) Is the measured voltage within specifications?

**YES** ▶ Go to next procedure.

**NO** ▶ Check open or short on PDM ground circuit (PDM↔ESCL).
Repair as necessary and go to "Verification of Vehicle Repair" procedure.

3. Check Open or Short on ESCL Communication Line
   1) After IG "OFF", disconnect '-' terminal from battery.
   2) Disconnect connectors of IPM, PDM, and ESCL.
   3) Check open or short on ESCL Comm. line(ESCL ↔IPM).
   4) Check open or short on ESCL Enable Output line( ESCL↔IPM).

**Specification for Open check :** Below 1Ω
**Specification for Short check :** ∞ Ω

   5) Are the measured resistances within specifications?

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

**NO** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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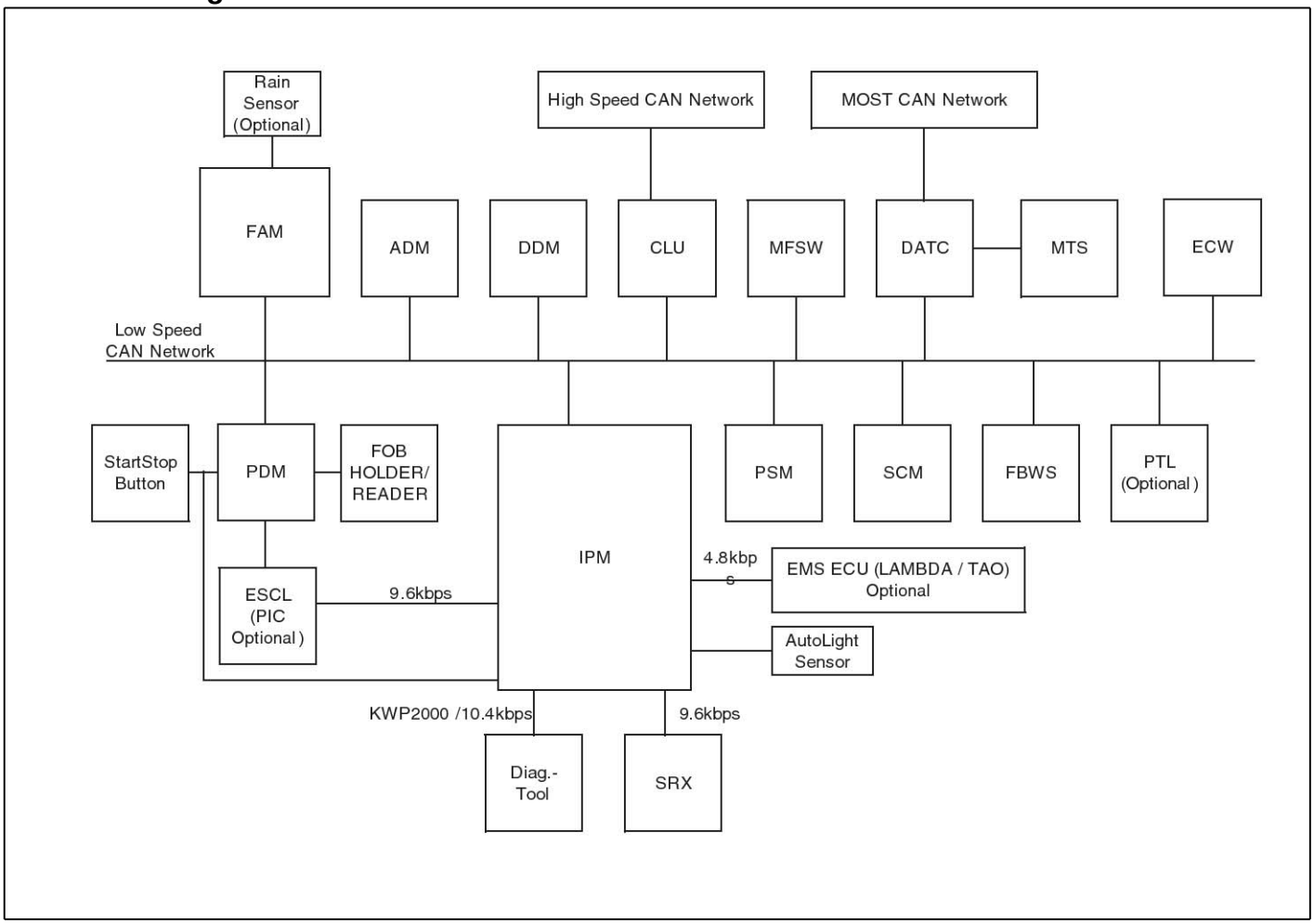
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# Body network system

## Driver Door Module (DDM)

### Schematic Diagram




SBHB18084D

※ Abbreviation description

IPM : Instrument Panel Module

FAM : Front Area Module

DDM : Driver Door Module

ADM : Assist Door Module

IMS : Intergrated Memory System

SCM : Steering Control Module

SMK : Smart Key

PDM : Power Distribution Module

CLU : Cluster

MFSW : Multi Function Switch

PSM : Power Seat Module

FBWS : Front Back Warning System

PTM : Power Trunk Module

ECW : Electronic Control Window

ESCL : Electronic Steering Column Lock

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## Description

The driver door module is a part of a Controller Area Network (CAN), and performs CAN communication with the BCM, FAM, IPM, RAM, ADM, and IMS. 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. Opening and closing the quarter glass by the quarter glass switch.
3. Window UP/DOWN operation by RKE.
4. Manually operating the mirror position by the manual switch (Up, Down, Right, and Left)
5. Saving and replacing the mirror position by the MEMORY switch → For 2 persons
6. Saving and replacing the mirror position by RKE → For 2 persons
7. Out side mirror AUTO reverse operation
8. Out side mirror FOLD/UNFOLD power control
9. CENTRAL DOOR LOCK/UNLOCK function
10. DOOR COURTESY LAMP control
11. Out side mirror DEFOG control
12. Illumination control

## Control Function

### Power Window Control

1. This switch controls power window up/down, automatic up/down from driver & assist side.
   - Driver's power window switch sends input signal through CAN communication by the manual up/down and automatic up/down switch input. At the same time passenger side sends manual up/down and automatic up/down signals to the wires.
   - Each safety window ECU receives the signal and performs manual up/down and automatic up/down functions.
2. Power window lock

   When the driver's power window lock switch is ON, each safety window ECU receives the power window lock command to prohibit the operation by the passenger side doors except the driver's door.
3. Timer function

   Power window switch can be controlled for 30 seconds after the ignition is turned off. This function stops immediately even within 30 seconds if the front door is opened.

### Key Reminder

1. 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 and there will be a series of three output signals every 0.5sec if door condition is "Lock".
2. If Key Reminder unlock message is "SHORT UNLOCK", DOOR UNLOCK lasts for 0.5sec.
3. If Key Reminder unlock message is "LONG UNLOCK ", DOOR UNLOCK lasts for 1sec.
4. Remained action goes on though Key Reminder Unlock message changes to "OFF".

### Priority Of Door Lock/unlock

1. Crash Unlock > Auto Door Lock > Key Reminder > Central Door Lock
2. Higher priority signals take precedence, and will override lower priority signals.
3. If the priority is the same or low, it'll be ignored.

### Out Side Mirror Control By The Switch

1. If the mirror direction switch (up, down, left and right) is pressed when mirror selection switch on driver side power window switch is in outside LH(RH) under ACC ON condition, then mirror motor moves to the corresponding direction.

### Outside Mirror Memory Operation By The Memory Switch

1. If position switch (POS1 or POS2) is pressed within 5 seconds after pressing the memory switch under ignition 2 on, it registers current mirror position. (Switch module sends in LIN communication). (Memory permit status lasts for 5 seconds after memory switch ON. After 5 seconds, memory permits status terminates. In other words, current position is registered if the position switch (POS1 or POS2) is turned on, during the memory permit status). However, RH side mirror position is not registered during the LH side mirror manual switch operation.
2. Memory permit status is released if any of the following conditions is met
   - 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 switch of the CAN communication data sent by the IPM is not "Run" or "Start".
   - If Inhibit switch of the CAN communication data sent by the FAM is not "P".

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- If vehicle speed of the CAN communication data sent by the cluster is "3Km/h" or more.

3. Memory is cleared if the battery is removed.

### Outside Mirror Memory And Replay Operation By Keyless

1. Memory operation
   - Outside mirror LH position is registered in the driver side power window switch when the ignition is turned off from on.
   - When door is locked by the keyless, outside mirror position is registered corresponding to the keyless code.
   - Data related to the memory operation is received from BCM in CAN communication.
2. Replay operation
   - When door is unlocked by the keyless under ignition off state, it replays the position corresponding to the keyless code.
   - Data related to the replay operation is received from BCM in CAN communication on CAN line.
3. Replay prohibit condition
   - If the mirror switch on the LH side is pressed
   - If Ignition switch of the CAN communication data sent by the IPM is not "Run" or "Start".
   - If Inhibit switch of the CAN communication data sent by the FAM is not "P".
   - If vehicle speed of the CAN communication data sent by the CLUSTER is "3Km/h" or more.

### Outside Mirror Memory And Replay Operation By Keyless

1. Memory operation
   - Outside mirror LH position is registered in the driver side power window switch when the ignition is turned off from on.
   - When door is locked by the keyless, outside mirror position is registered corresponding to the keyless code.
   - Data related to the memory operation is received from BCM in CAN communication.
2. Replay operation
   - When door is unlocked by the keyless under ignition off state, it replays the position corresponding to the keyless code.
   - Data related to the replay operation is received from BCM in CAN communication on CAN line.
3. Replay prohibit condition
   - When the inhibit "P" switch is OFF.
   - When RH side mirror switch is pressed.
   - When mirror switch is pressed after ignition on.
   - When the vehicle speed is over 3km/h

### Auto Reverse Function

| No. | Operation | Select SW | Shift Lever | MIR Position | | Manipulation | Result |
|---|---|---|---|---|---|---|---|
| | | | | L | R | | |
| 1 | Basic Operation | LH | P | Position A | Position B | Changing the shift lever from "P" to " R" | MIR L:Auto reverse to position (A-5˚)<br>MIR R:Auto reverse to position (B-5˚) |
| 2 | | RH | P | Position A | Position B | | MIR L:NO change<br>MIR R:Auto reverse to position (B-5˚) |
| 3 | | N | P | Position A | Position B | | MIR L:NO change<br>MIR R:NO change |
| 4 | Returning after Basic Operation | LH | R | Result of No.1 | Result of No.2 | Changing the shift lever from "R" to " P" | MIR L:Return to position (A)<br>MIR R:Return to position (B) |
| 5 | | RH | R | No.1 is being performed | Result of No.2 | | MIR L:NO change<br>MIR R:Return to position (B) |

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### Fail Safe Function

1. If the sensor does not move more than 60mV for the input changes (5 second operation) of the position sensor although the motor is operating, automatic control will stop.
2. The mirror operation signal cannot be displayed into the same direction for more than 15 seconds. (When the mirror is replacing to the saved position or the switch is manually pressed)
3. Monitoring the replacing time
   - If the replacing operation does not stop within 40 seconds, the mirror motor will not outputted and the replacing operation will stop.

### IMS Switch

1. If it's satisfied with the followings
   1) Can communication Data ignition switch sent by IPM is "RUN"
   2) Can communication Data Inhibit switch sent by FAM is "P"
   3) Can communication Data vehicle speed sent by CLUSTER is under "3Km/h"
2. If SET switch is ON, IMS message is SET.
3. If POSITION switch is ON within 5sec since SET switch is ON, IMS message will be sent to MEMORY1 or MEMORY2.

### Seat Manual Swiitch

If Seat switch is controlled, seat control message is sent to seat.

### Courtesy Lamp

1. If driver's door is opened, RAM changes door open Message to ON and Courtesy lamp is ON by DDM.
2. If driver's door is closed, RAM changes door open Message to Off and Courtesy lamp is OFF gradually by DDM.(5±0.5sec)
3. During dim out, If IGN changes to ON or door is closed while Ignition switch is ON, Courtesy lamp is OFF immediately.
4. If Key reminder switch is OFF and door is opened for 20min, Courtesy lamp is OFF immediately.

### Fuel Filler Door Open

When the fuel filler door open switch is turned on, this data is uploaded to the bus through CAN communication.

### Defog Control (O/S Mirror Heat Line)

If rear defog switch is on while IGN is ON, rear defog control of IPM is ON and O/S Mirror Defog is ON by DDM, ADM.

### Rescue Mode

1. The condition to run RESCUE MODE is listed below.
   - Ignition switch Message is in RUN or IGN switch is ON.
   - Any signal received from of park tail head lamp, front wiper control message is received as INVALID or CAN line from IPM is not normal.
   - Drive door courtesy lamp control message is sent as INVALID or Can Line from RAM is not normal
2. If RESCUE MODE runs, operation is as follows.
   - Door unlock is ON for 0.5sec
   - OSRVM Defogger is ON for 20min.
   - Illumination is ON continuously.
   - Other functions are the same as NORMAL mode.
3. If Ignition switch Message is OFF/ACC or IGN switch is OFF or can line from IPM,FAM,RAM is normal, Rescue mode is stopped.

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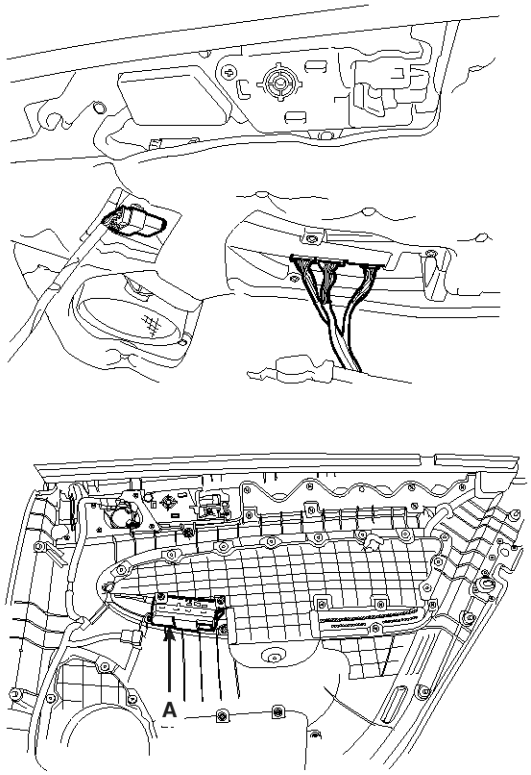
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## Removal

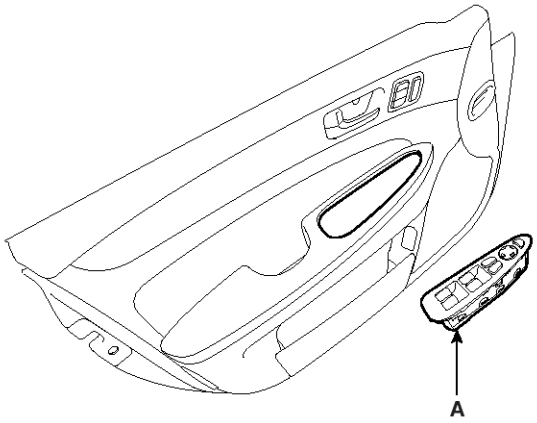
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel (Refer to the Body group - front door)
3. Remove the door module (DDM) (A) from the front door trim panel after disconnecting module connector.

   Be careful not to damage the door module removing the clip.




SBHB18085D

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




SBHB18088D

## Installation

1. Install the door module on the front door trim panel.
2. Install the front door trim panel.
3. Connect the negative (-) battery terminal.

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## Troubleshooting

### DDM DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1681 | DDM and Rear LH SERIAL COMMUNICATION ERROR |
| 4 | B1982 | DDM and Rear RH SERIAL COMMUNICATION ERROR |
| 5 | B1910 | LEFT OSM Horizontal Sensor ERROR |
| 6 | B1911 | LEFT OSM Vertical Sensor ERROR |

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## B1602 CAN Error

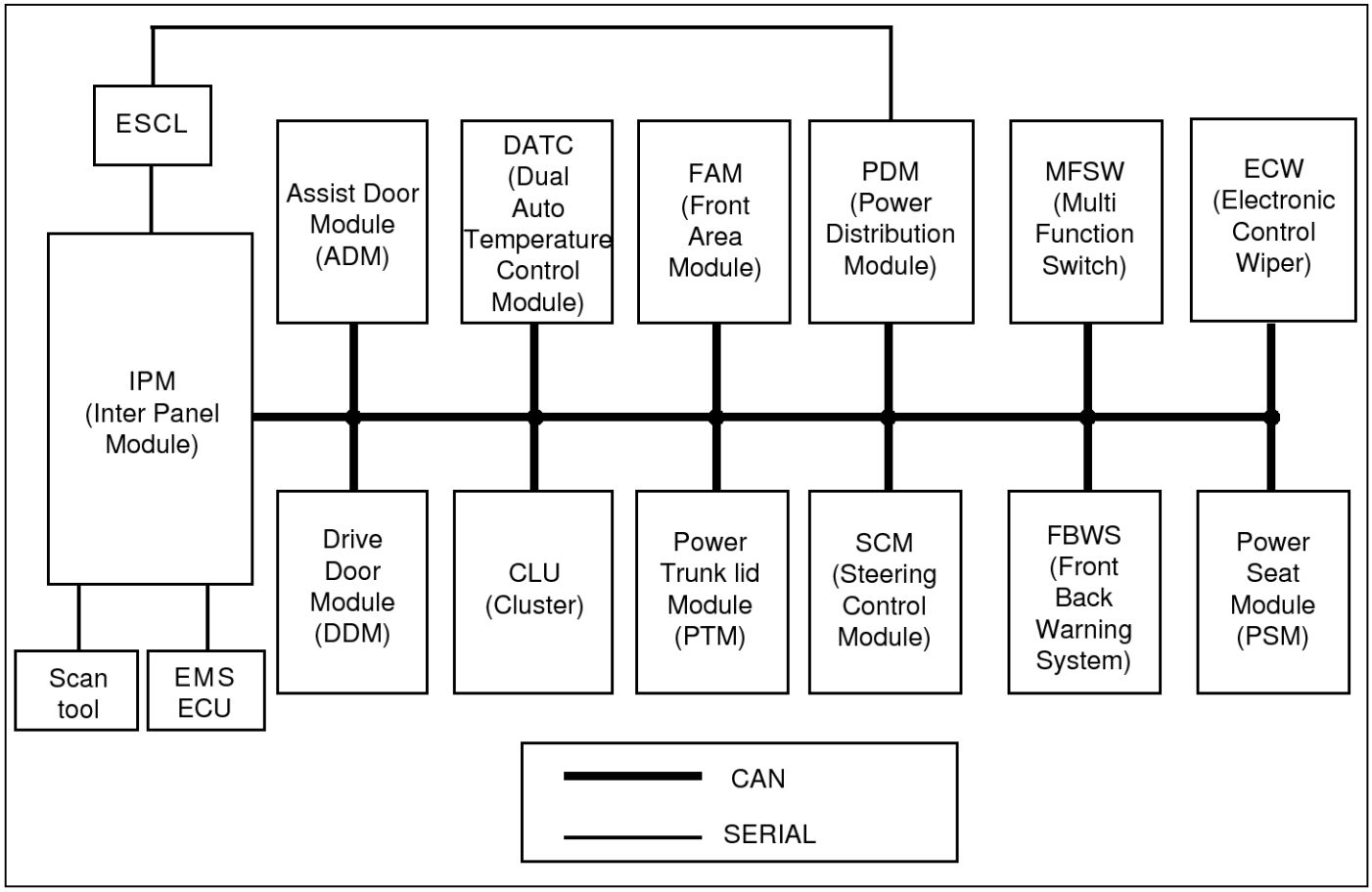
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

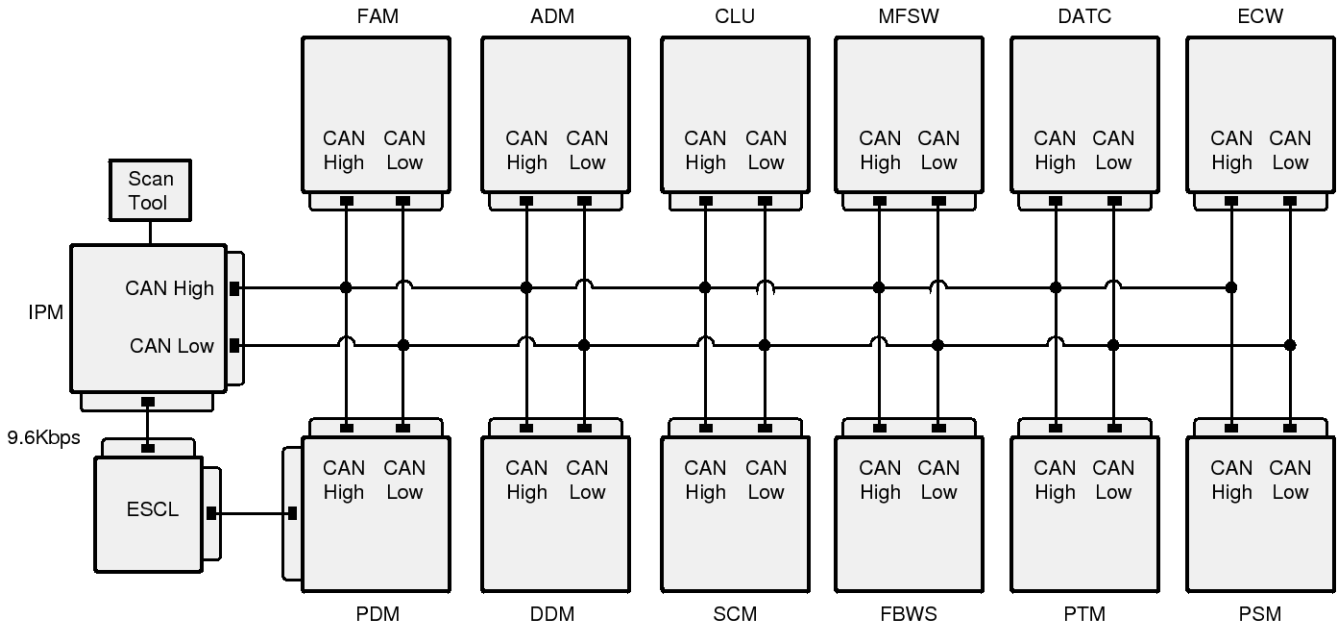
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,DDM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, DDM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

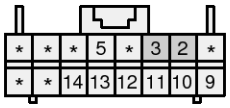



<ECW>



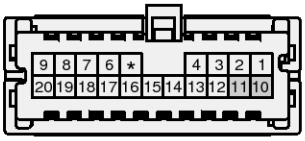
4. Low
5. High

<IPM>



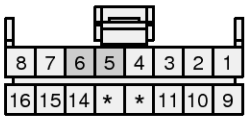
2 . Low
3. High

<PDM>



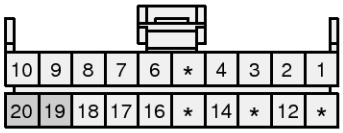
10. Low
11. High

<MFSW>



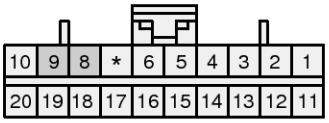
5. High
6. Low

<CLU>



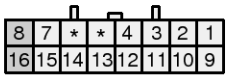
19. Low
20. High

<TILT & TELE>



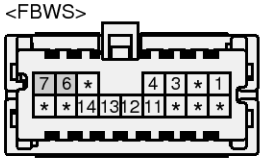
8. High
9. Low

<ADM>



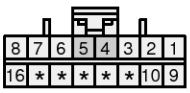
8. High
16. Low

<FBWS>



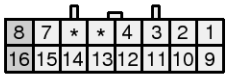
6. High
7. Low

<PSM>



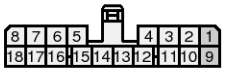
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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**Signal Waveform & Data**

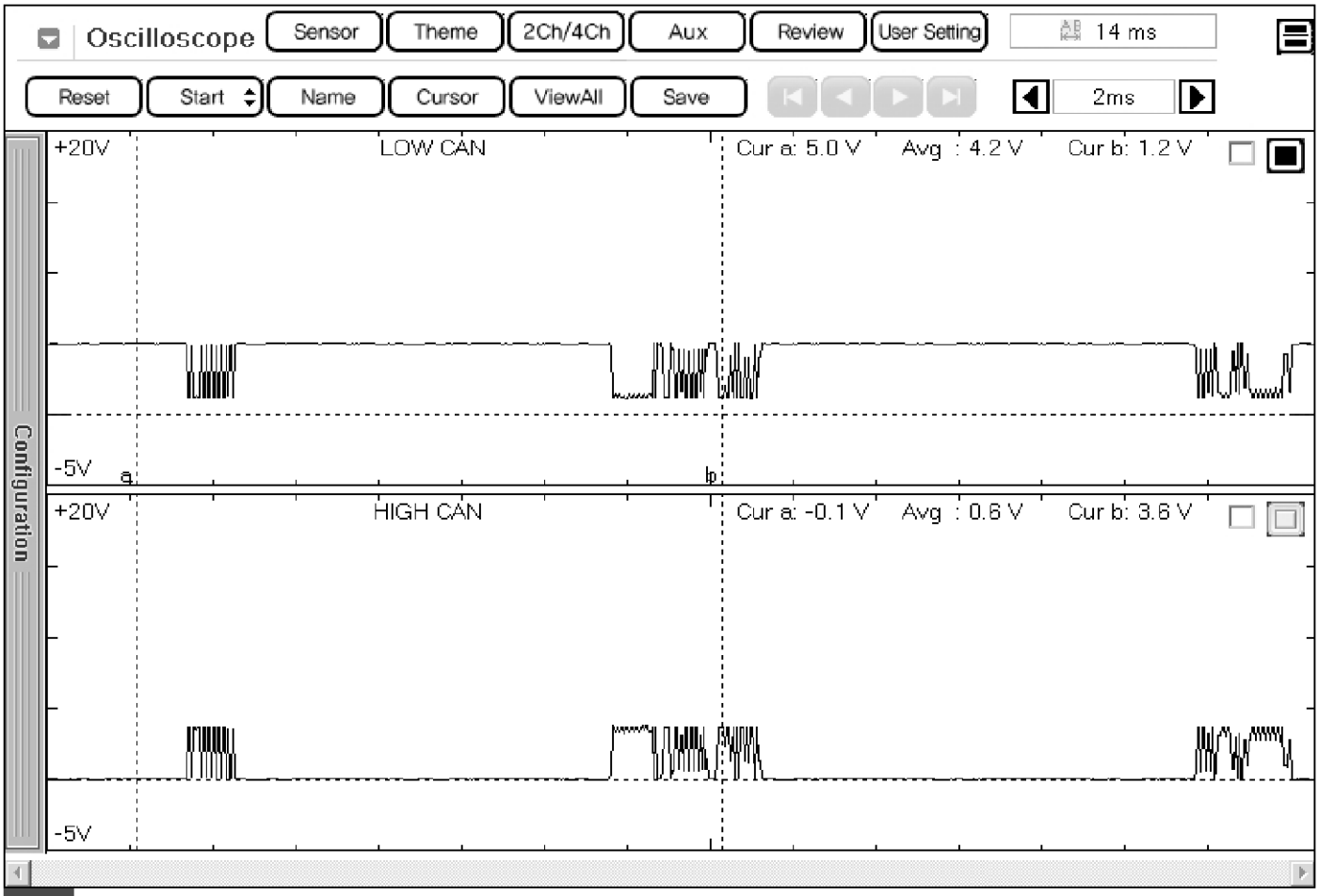



Fig.1

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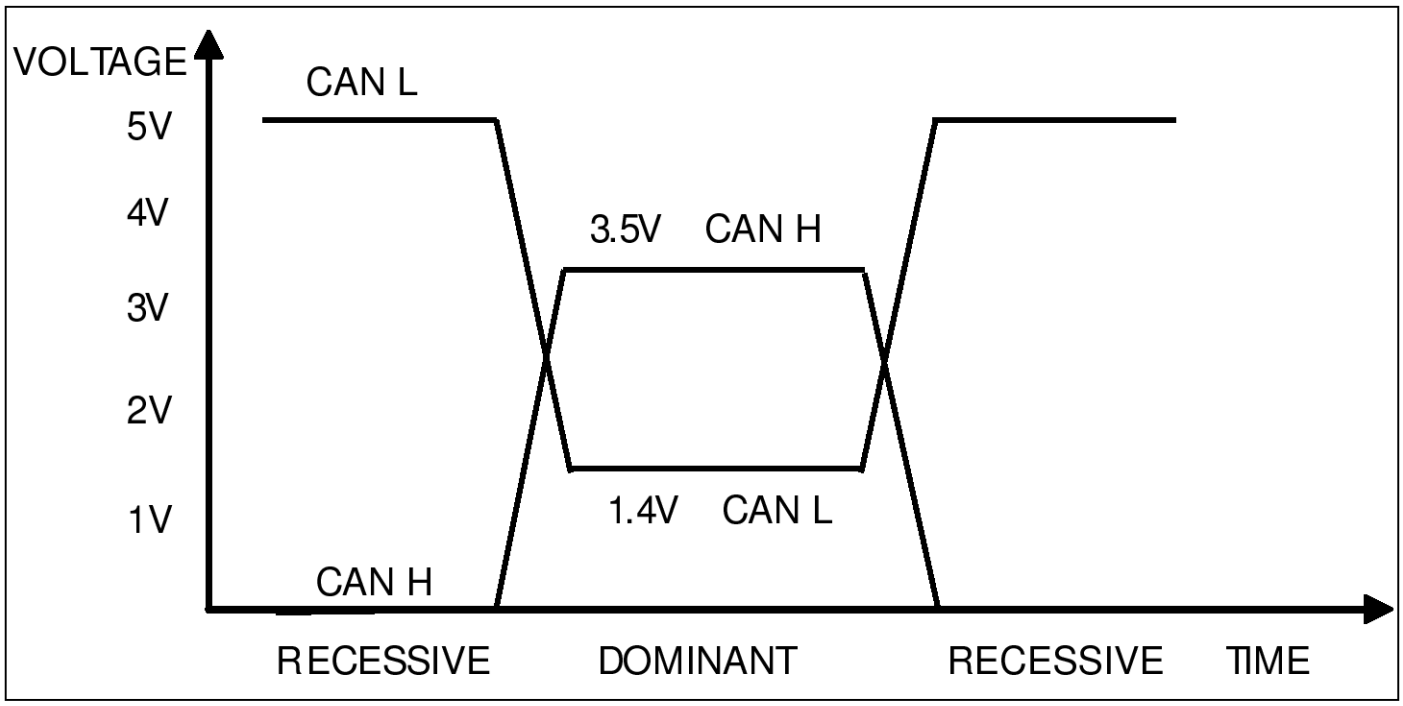



Fig.2

SBHBE9L13L

Fig.1) CAN Low/High Signal Waveform
Fig.2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

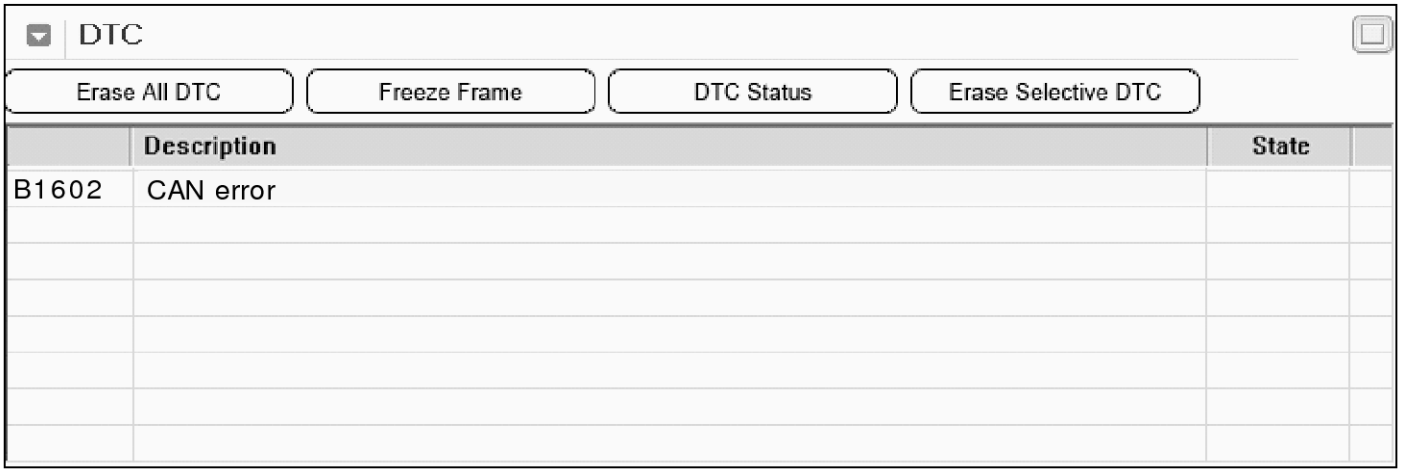
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## Scantool Data Analysis

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).




SBHBE9L14L

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.

## 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 "DDM Signal Circuit Inspection" procedure.

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## DDM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on DDM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on DDM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)

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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## B1603 CAN Communication Bus Off

### General Description

Refer to DTC B1602 : CAN Error.

### 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM 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,DDM are not Sleep condition1. CAN High and Low Line short to ground coincident<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, DDM 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

Refer to DTC B1602 : CAN Error.

### Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

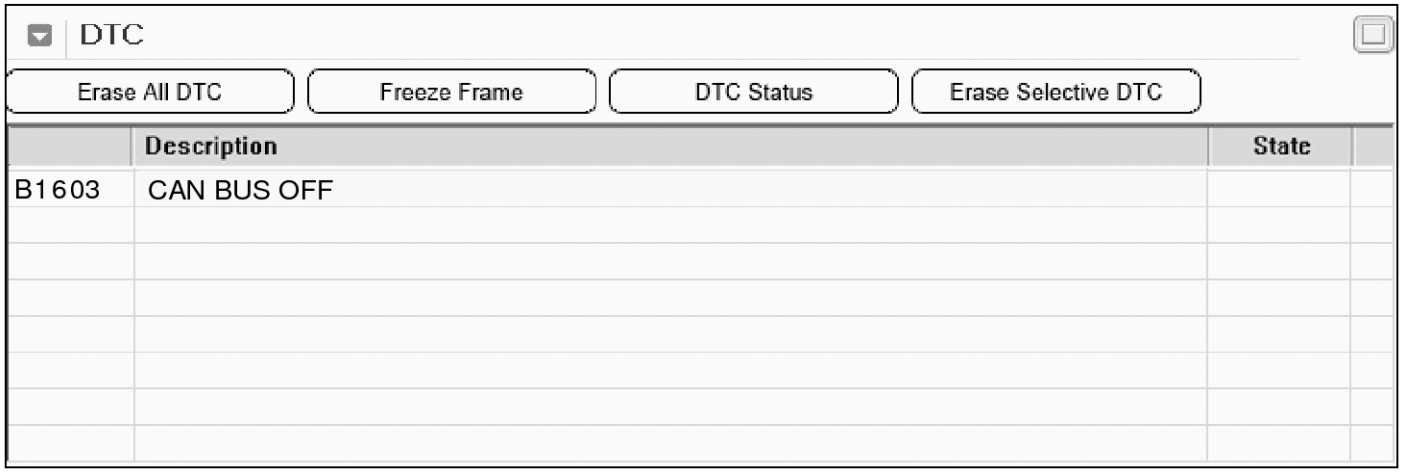
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## Scantool Data Analysis

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).




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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.

## 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), 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)
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

Refer to DTC B1602 : CAN Error.

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## B1681 DDM and Rear LH Serial Communication Error

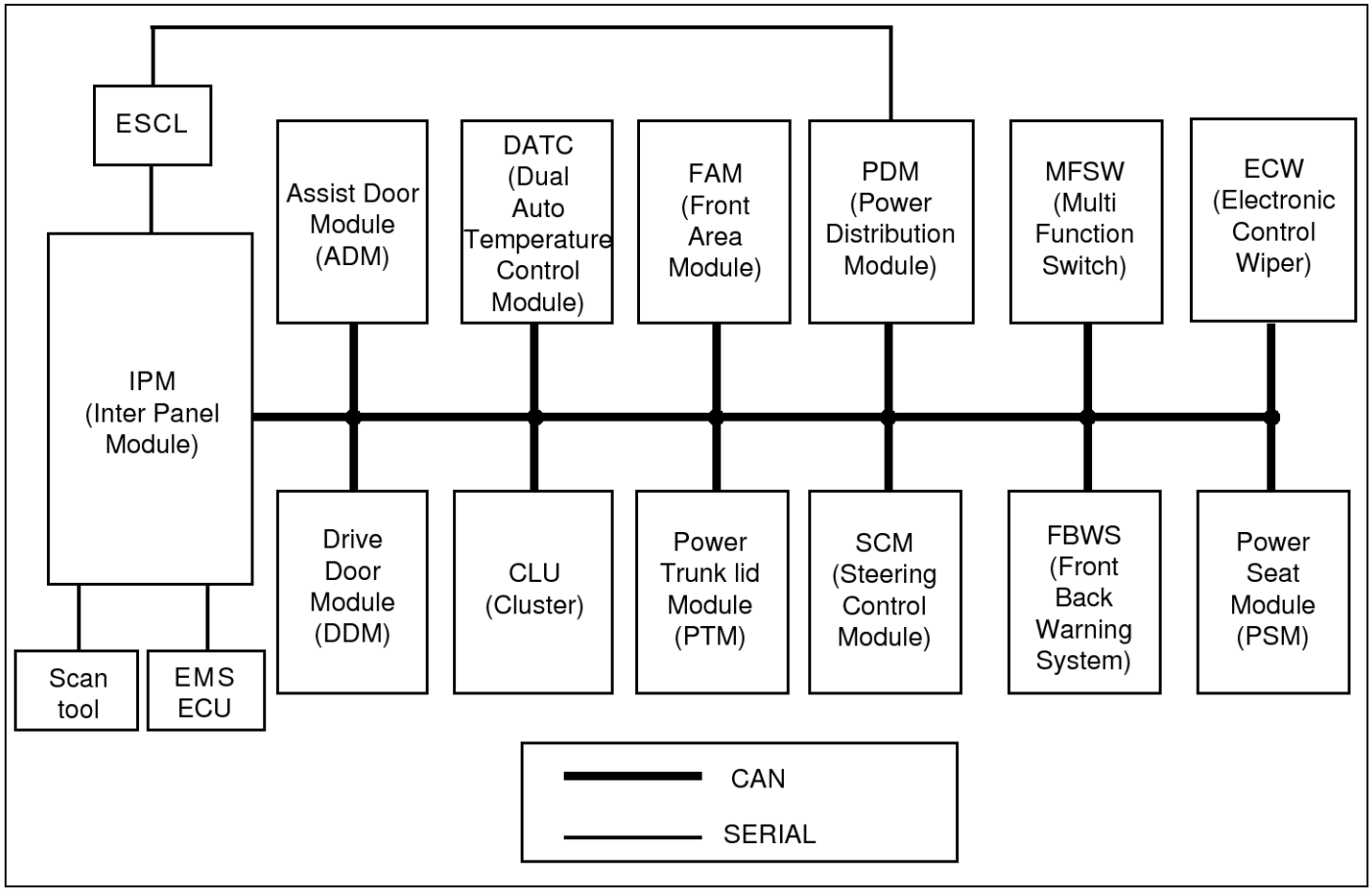
### General Description

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.)




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### DTC Description

This code is outputted when the serial communication protocol is broken between DDM and RLDM by open, short or noise.

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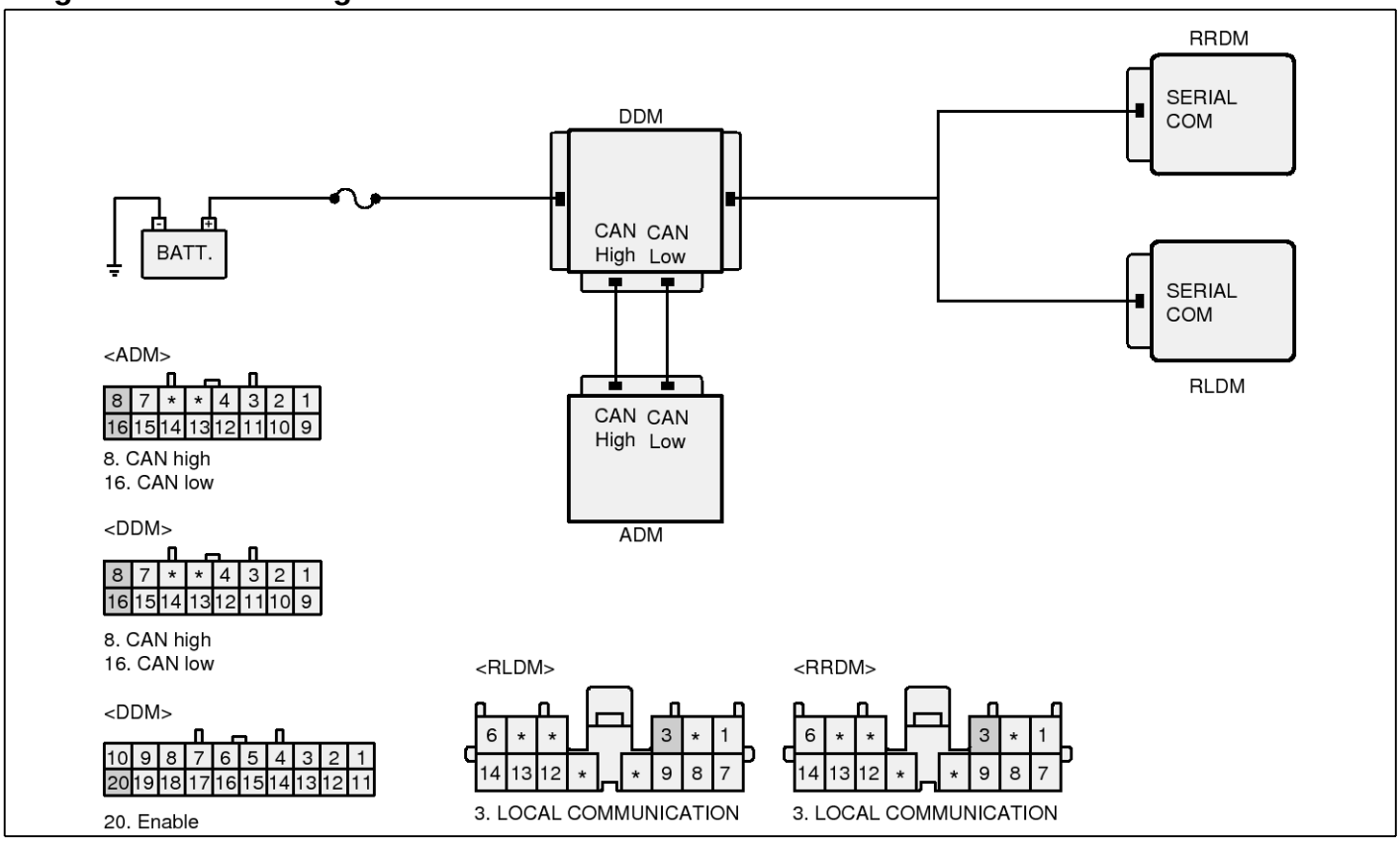
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## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • SERIAL Communication Check | • RLDM Local Comm. Line open<br>• RLDM Local Comm. Line short to battery/ground |
| Enable Conditions | • IG "ON" state after engine start | |
| Threshold Value | • Open, Short to battery or Short to ground<br>• Protocol Error by noise | |
| 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.) | |

## Diagnostic Circuit Diagram




SBHBE9L02L

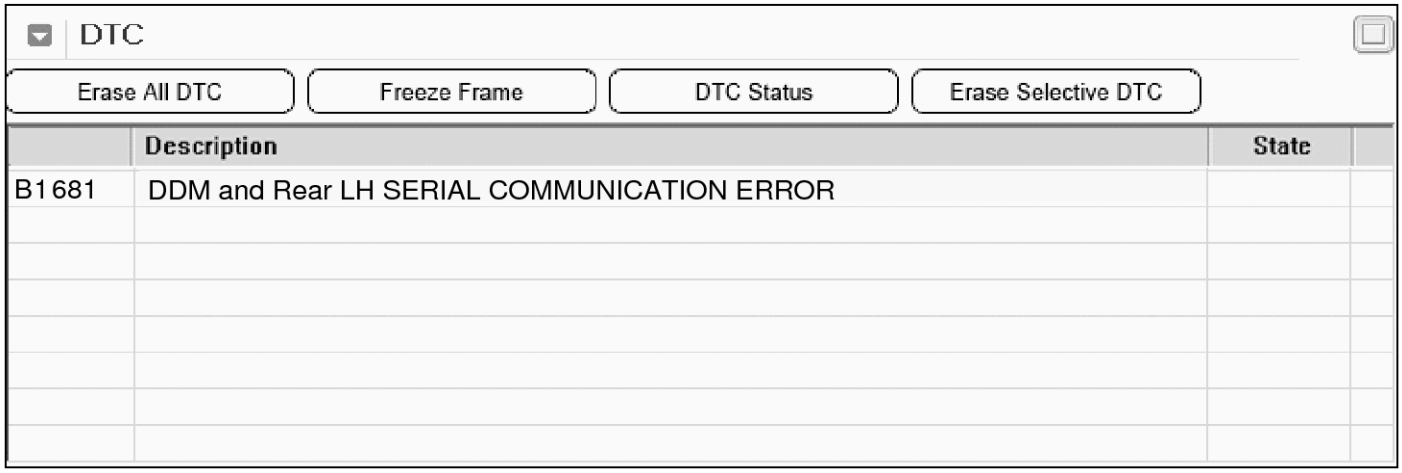
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## Scantool Data Analysis

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).




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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.

## 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 open or short in RLDM Communication Circuit" procedure.

### ■ Check open or short in RLDM Communication circuit

1. After IG "OFF", disconnect '-' terminal cable from battery.
2. Disconnect connectors of DDM,ADM,RRDM and RLDM.
3. Check open or short in line between DDM and RLDM .

**Specification :** Open check : below 1 Ω , Short check : ∞ Ω

4. Are resistances within specifications?

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

**NO** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1682 DDM and Rear RH Serial Communication Error

## General Description

Refer to DTC B1681 : DDM and Rear LH Serial Communication Error.

## DTC Description

This code is outputted when the serial communication protocol is broken between DDM and RRDM by open, short or noise.

## DTC Detecting Condition

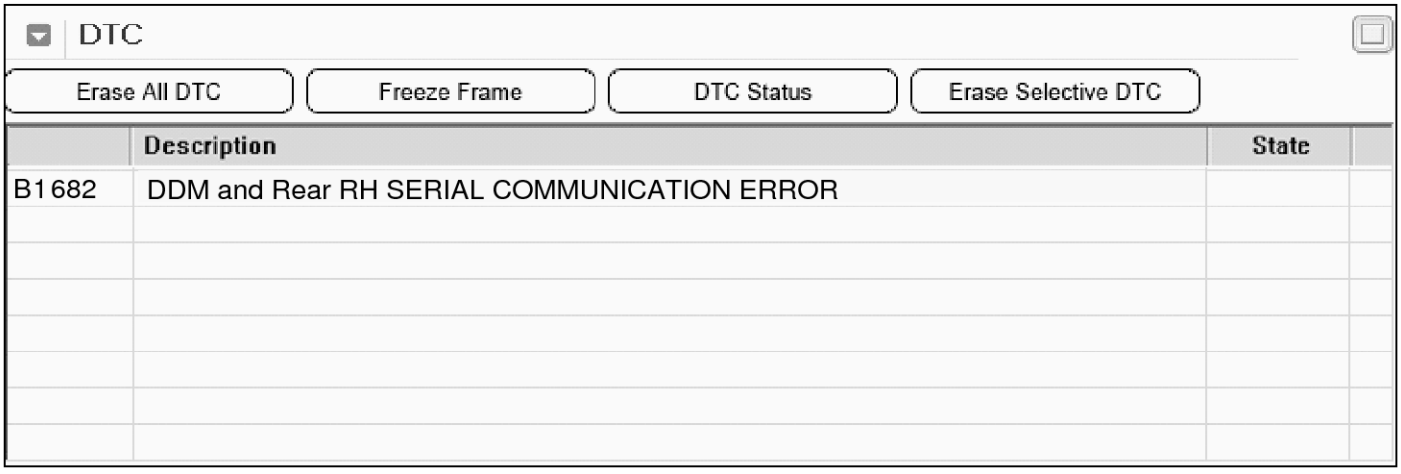
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • SERIAL Communication Check | • RRDM Local Comm. Line open<br>• RRDM Local Comm. Line short to battery/ground |
| Enable Conditions | • IG "ON" state after engine start | |
| Threshold Value | • Open, Short to battery or Short to ground<br>• Protocol Error by noise | |
| 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.) | |

## Diagnostic Circuit Diagram

Refer to DTC B1681 : DDM and Rear LH Serial Communication Error.

## 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?

**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.

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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 " Check open or short in RRDM Communication Circuit" procedure.

### ■ Check open or short in RRDM Communication circuit

1. After IG "OFF", disconnect '-' terminal cable from battery.
2. Disconnect connectors of DDM,ADM,RRDM and RLDM.
3. Check open or short in line between DDM and RRDM .

---

**Specification :** Open check : below 1 Ω , Short check : ∞ Ω

---

4. Are resistances within specifications?

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

**NO** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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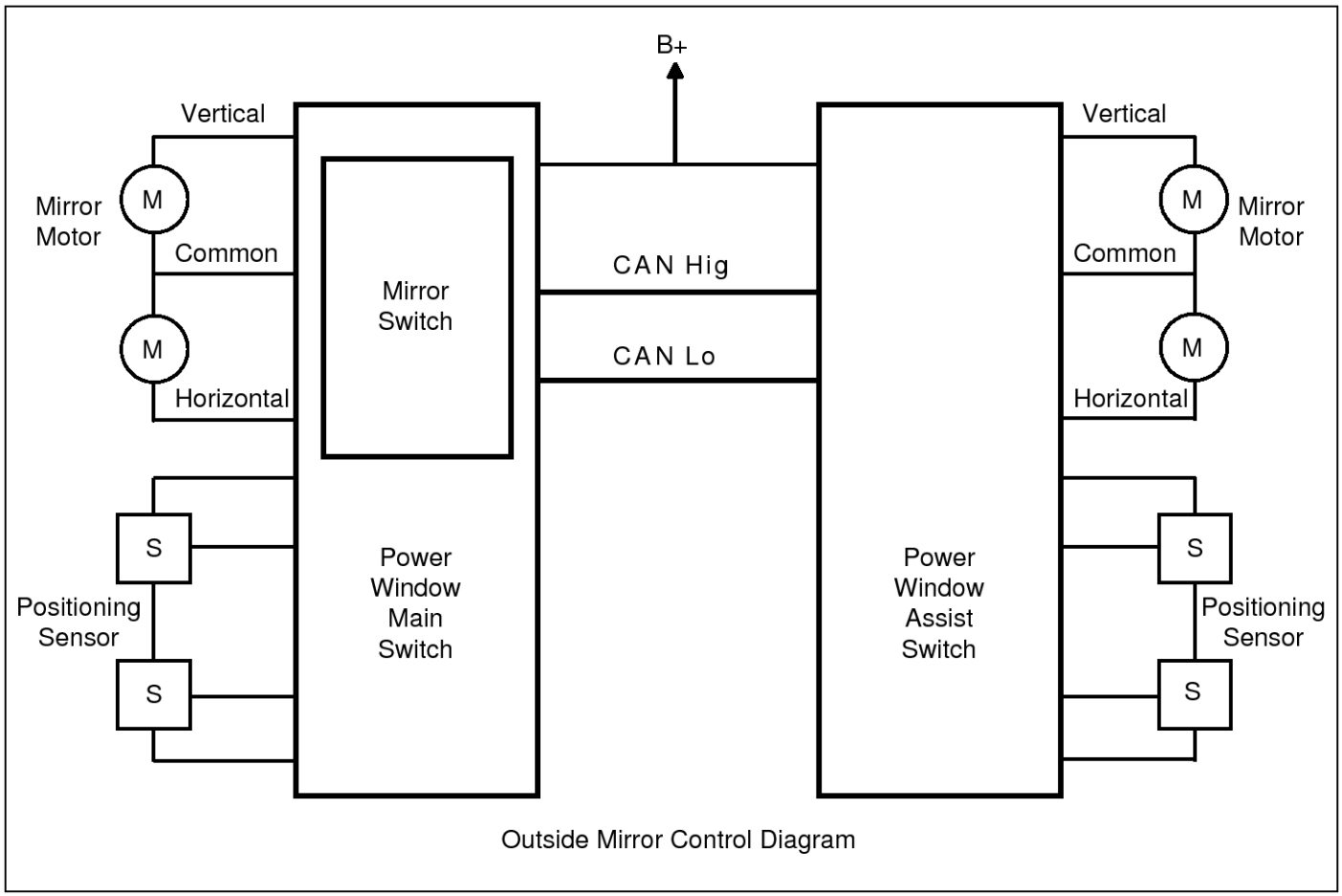
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## B1910 Outside Mirror - Left Horizontal Motor or Sensor Error

### General Description

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




Outside Mirror Control Diagram

SBHBE9L03L

### DTC Description

Case1 : DDM sets DTC when the change value of assist mirror position is less than 0.1V for 5sec while it is not reached to the aimed position.

Case2 : DDM sets DTC when there is counter-direction output which is 0.25V and above while assist mirror is turning to one direction.

Case3 : DDM sets DTC when there is no movement signal from positioning sensor in assist mirror.

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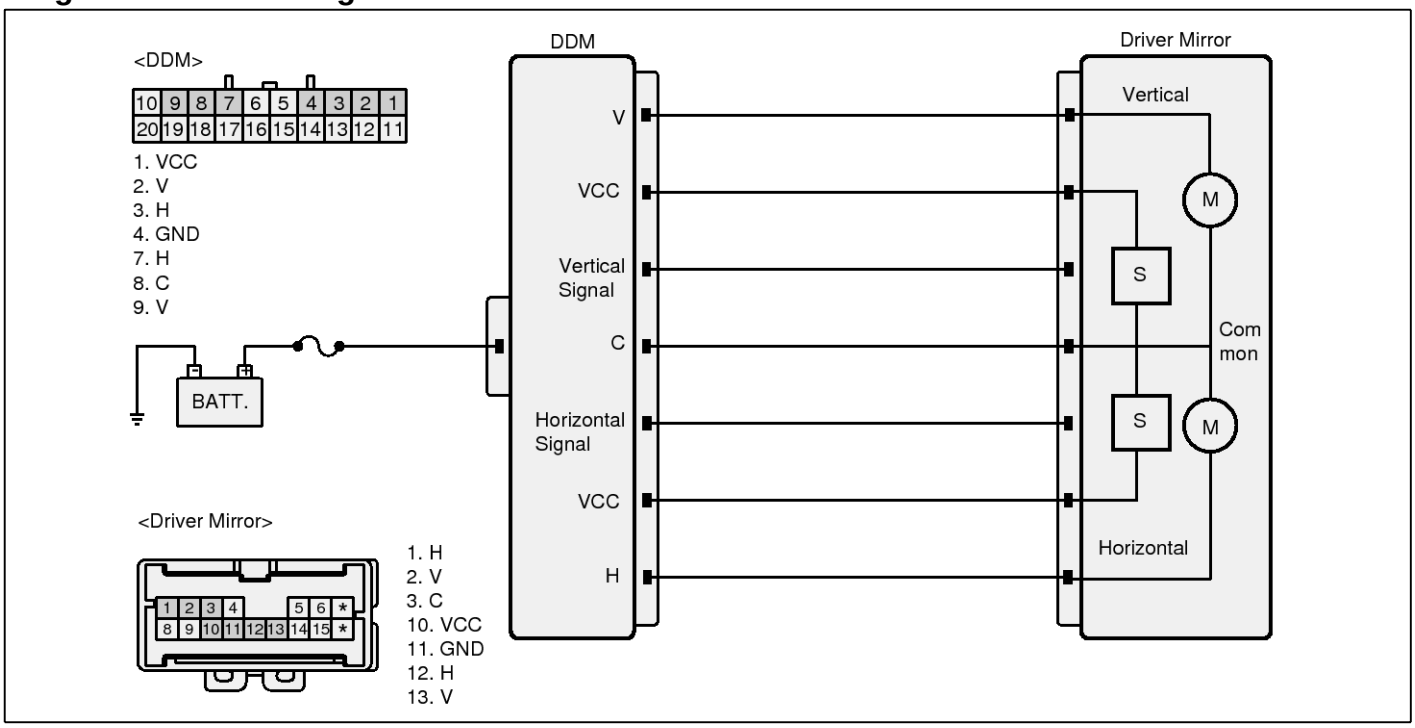
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## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Mirror Vertical Positioning Sensor Check | • Mechanical restriction<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Motor<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Sensor<br>- Check the change of sensor data when motor is controlled. |
| Enable Conditions | • Motor works on | |
| Threshold Value | • No signal change during Mirror turning<br>• Counter-direction outputs against Mirror controlled | |
| 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.) | |

## Diagnostic Circuit Diagram



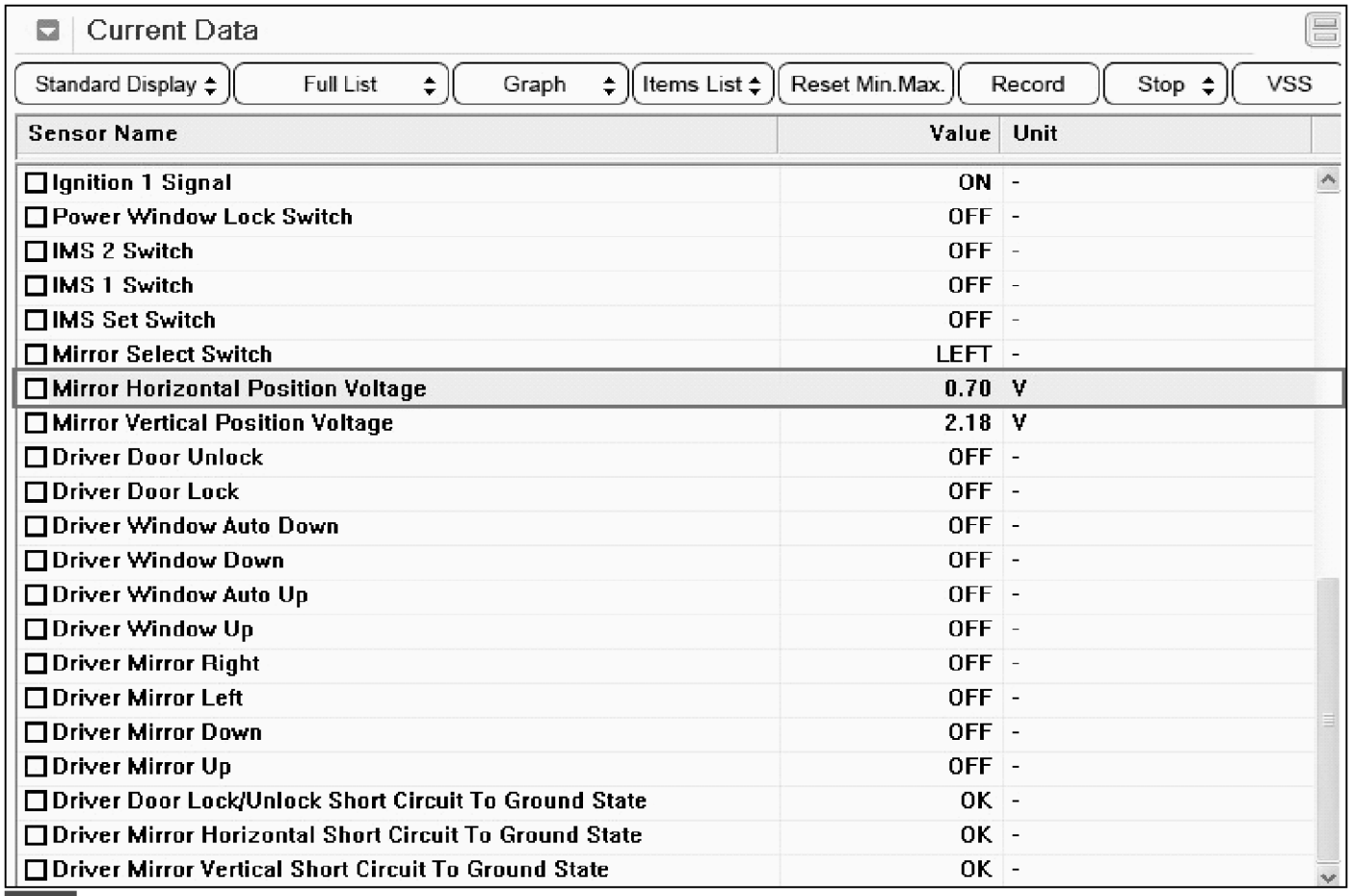

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## Signal Waveform & Data




| Sensor Name | Value | Unit |
|---|---|---|
| Ignition 1 Signal | ON | - |
| Power Window Lock Switch | OFF | - |
| IMS 2 Switch | OFF | - |
| IMS 1 Switch | OFF | - |
| IMS Set Switch | OFF | - |
| Mirror Select Switch | LEFT | - |
| Mirror Horizontal Position Voltage | 0.70 | V |
| Mirror Vertical Position Voltage | 2.18 | V |
| Driver Door Unlock | OFF | - |
| Driver Door Lock | OFF | - |
| Driver Window Auto Down | OFF | - |
| Driver Window Down | OFF | - |
| Driver Window Auto Up | OFF | - |
| Driver Window Up | OFF | - |
| Driver Mirror Right | OFF | - |
| Driver Mirror Left | OFF | - |
| Driver Mirror Down | OFF | - |
| Driver Mirror Up | OFF | - |
| Driver Door Lock/Unlock Short Circuit To Ground State | OK | - |
| Driver Mirror Horizontal Short Circuit To Ground State | OK | - |
| Driver Mirror Vertical Short Circuit To Ground State | OK | - |

Fig.1

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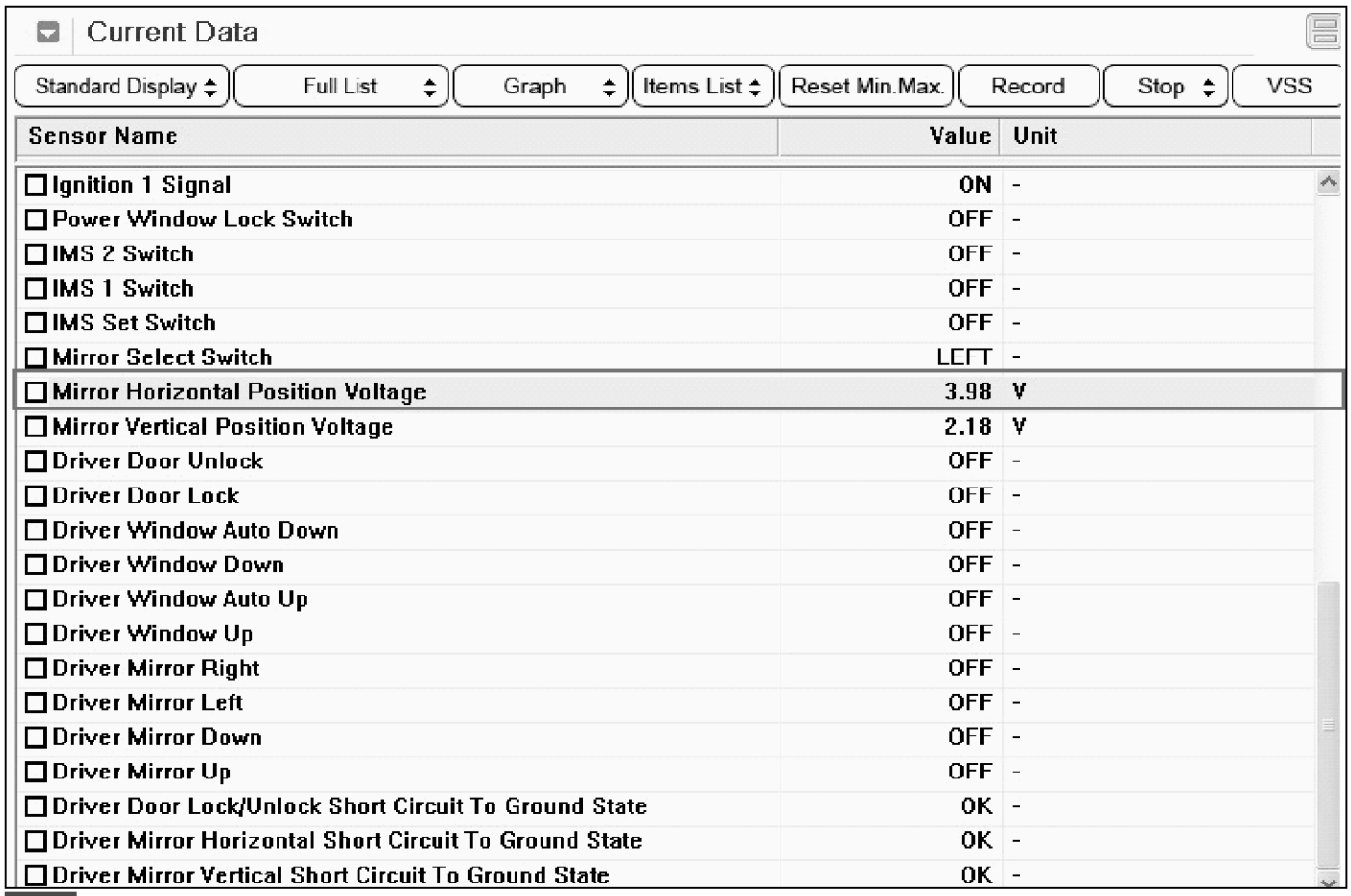



Fig.2

SBHBE9L19L

Fig.1) The minimum value at left side end position.

Fig.2) The maximum value at right side end position.

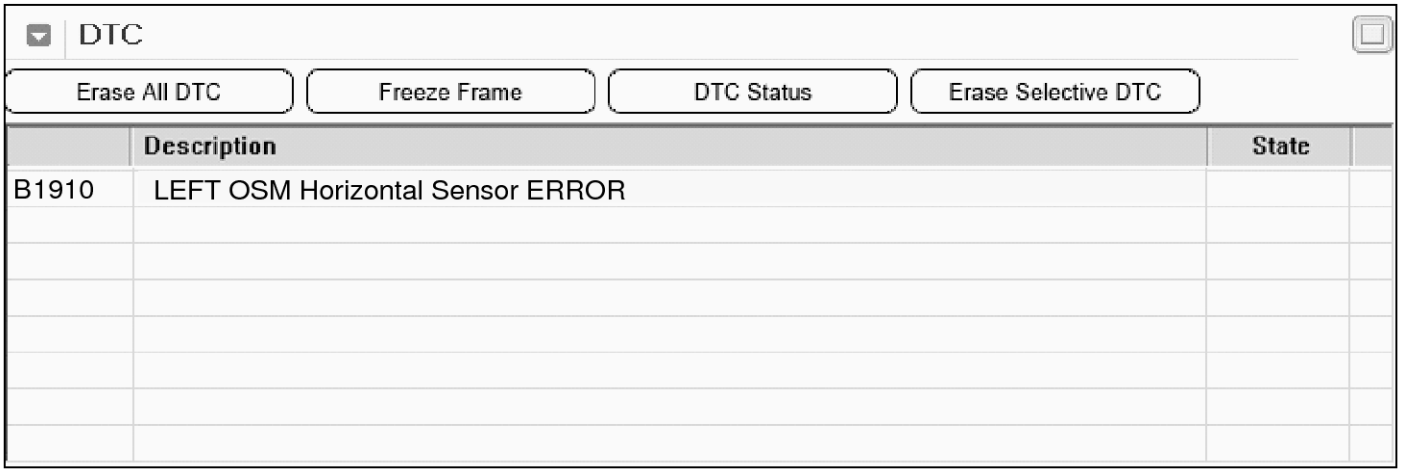
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## Scantool Data Analysis

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).




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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.

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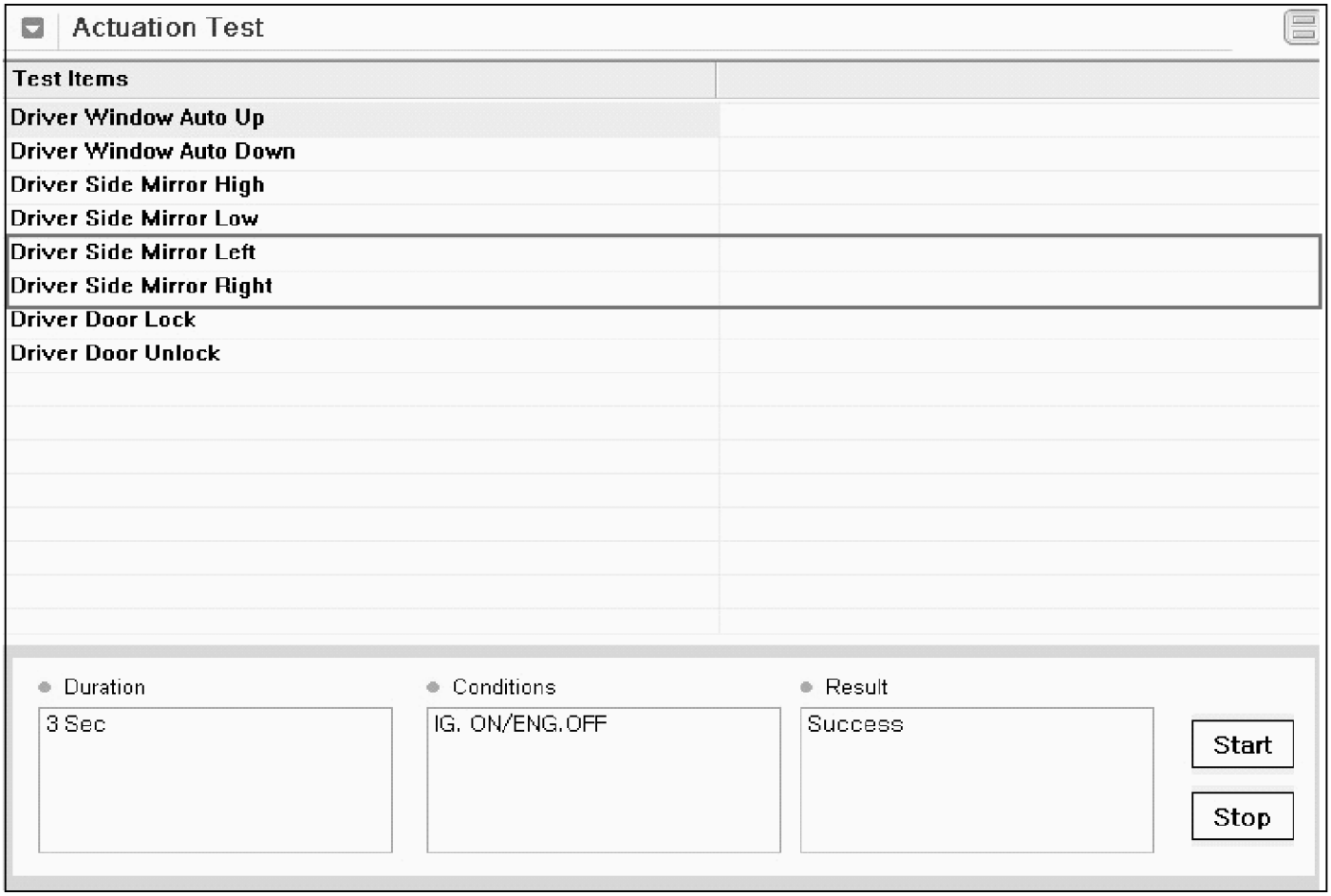


## Component Inspection

### ■ Check mirror motor

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

**Specification :** Turned to pressed direction




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5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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## ■ 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 "ON" when the control switch is pressed. (UP, DOWN , LEFT, RIGHT)

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 14.0 | V |
| Passenger Mirror Right Switch | OFF | - |
| Passenger Mirror Left Switch | OFF | - |
| Passenger Mirror Down Switch | OFF | - |
| Passenger Mirror Up Switch | OFF | - |
| Driver Mirror Right Switch | ON | - |
| Driver Mirror Left Switch | OFF | - |
| Driver Mirror Down Switch | OFF | - |
| Driver Mirror Up Switch | OFF | - |
| Passenger Window Up Switch | OFF | - |
| Passenger Window Auto Up Switch | OFF | - |
| Passenger Window Down Switch | OFF | - |
| Passenger Window Auto Down Switch | OFF | - |
| Rear Right Window Up Switch | OFF | - |
| Rear Right Window Down Switch | OFF | - |
| Driver Window Up Switch | OFF | - |
| Driver Window Auto Up Switch | OFF | - |
| Driver Window Down Switch | OFF | - |
| Driver Window Auto Down Switch | OFF | - |
| Rear Left Window Up Switch | OFF | - |
| Rear Left Window Down Switch | OFF | - |

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4. Is the service data normal?

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

**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.

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## Signal Circuit Inspection

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

**Specification :** Approx. 1~4 V during motor working

4. 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 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

Refer to DTC B1602 : CAN Error.

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# B1911 Outside Mirror - Left Vertical Motor or Sensor Error

## General Description

Refer to DTC B1910 : Outside Mirror - Left Horizontal Motor or Sensor Error.

## DTC Description

Case1 : DDM sets DTC when the change value of assist mirror position is less than 0.1V for 5sec while it is not reached to the aimed position.

Case2 : DDM sets DTC when there is counter-direction output which is 0.25V and above while assist mirror is turning to one direction.

Case3 : DDM sets DTC when there is no movement signal from positioning sensor in assist mirror.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Mirror Vertical Positioning Sensor Check | • Mechanical restriction<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Motor<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Sensor<br>- Check the change of sensor data when motor is controlled. |
| Enable Conditions | • Motor works on | |
| Threshold Value | • No signal change during Mirror turning<br>• Counter-direction outputs against Mirror controlled | |
| 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.) | |

## Diagnostic Circuit Diagram

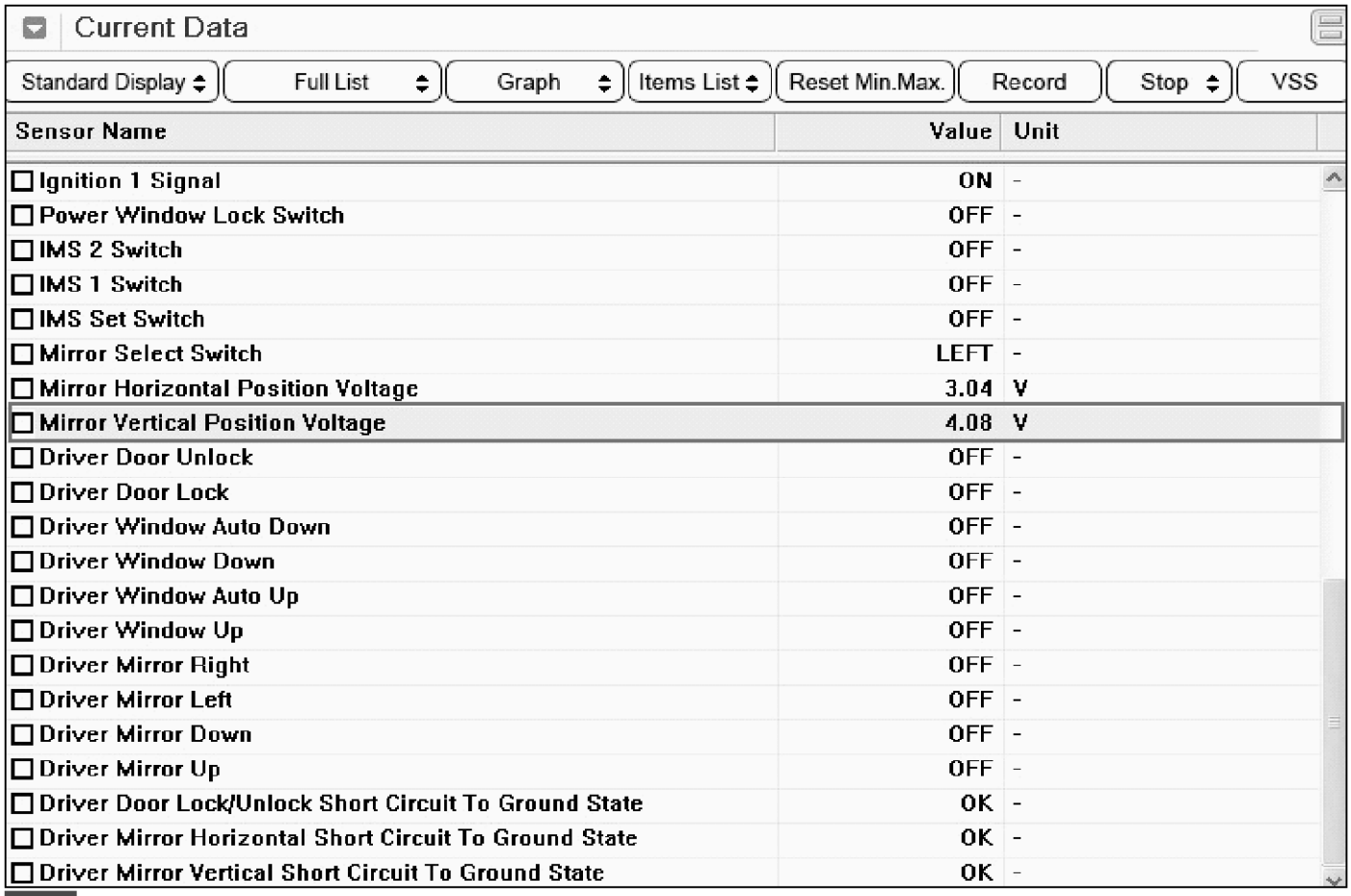
Refer to DTC B1910 : Outside Mirror - Left Horizontal Motor or Sensor Error.

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## Signal Waveform & Data




| Sensor Name | Value | Unit |
|---|---|---|
| Ignition 1 Signal | ON | - |
| Power Window Lock Switch | OFF | - |
| IMS 2 Switch | OFF | - |
| IMS 1 Switch | OFF | - |
| IMS Set Switch | OFF | - |
| Mirror Select Switch | LEFT | - |
| Mirror Horizontal Position Voltage | 3.04 | V |
| Mirror Vertical Position Voltage | 4.08 | V |
| Driver Door Unlock | OFF | - |
| Driver Door Lock | OFF | - |
| Driver Window Auto Down | OFF | - |
| Driver Window Down | OFF | - |
| Driver Window Auto Up | OFF | - |
| Driver Window Up | OFF | - |
| Driver Mirror Right | OFF | - |
| Driver Mirror Left | OFF | - |
| Driver Mirror Down | OFF | - |
| Driver Mirror Up | OFF | - |
| Driver Door Lock/Unlock Short Circuit To Ground State | OK | - |
| Driver Mirror Horizontal Short Circuit To Ground State | OK | - |
| Driver Mirror Vertical Short Circuit To Ground State | OK | - |

Fig.1

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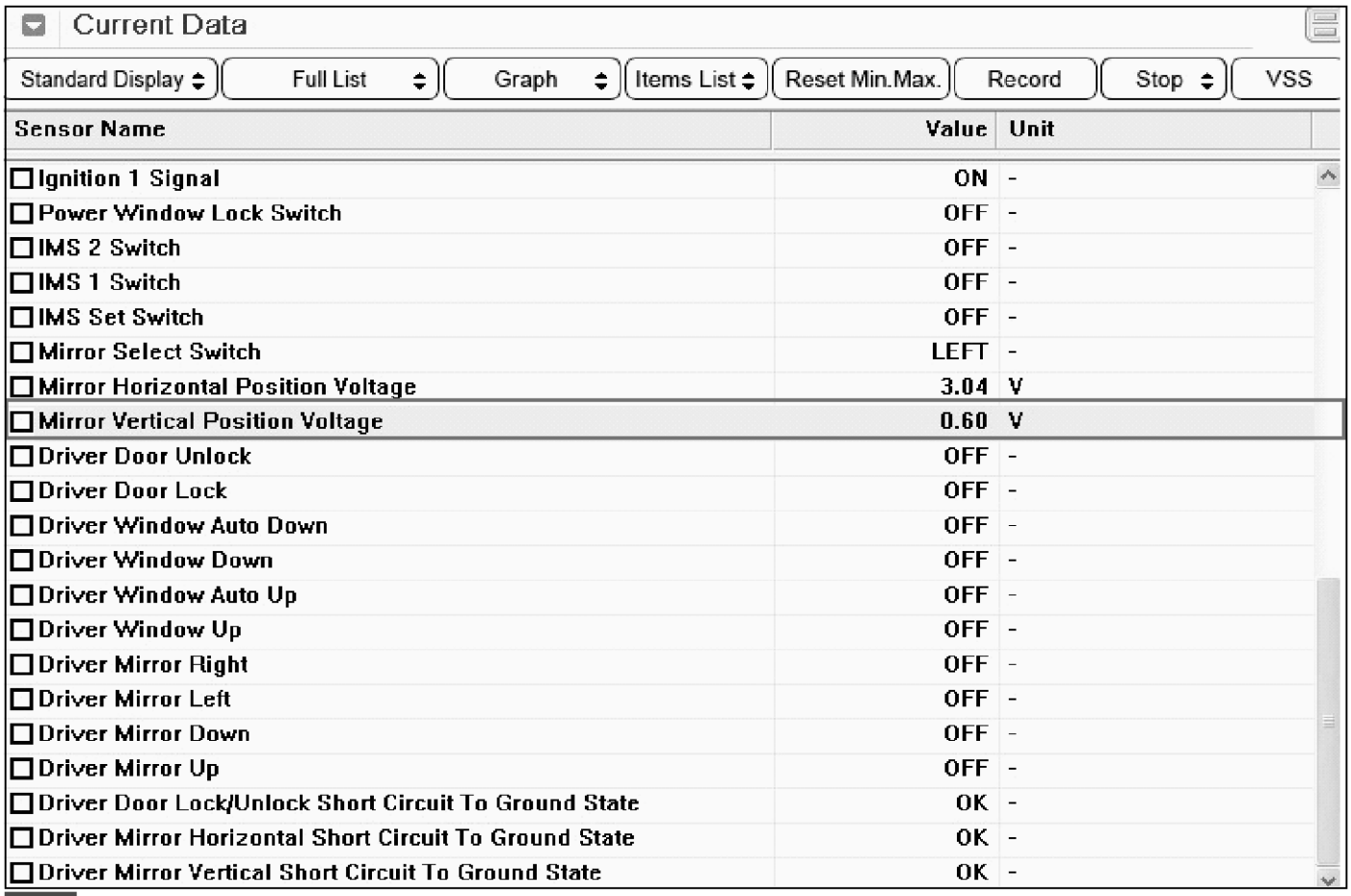



Fig.2

SBHBE9L24L

Fig.1) The maximum value at upside end position.

Fig.2) The minimum value at downside end position.

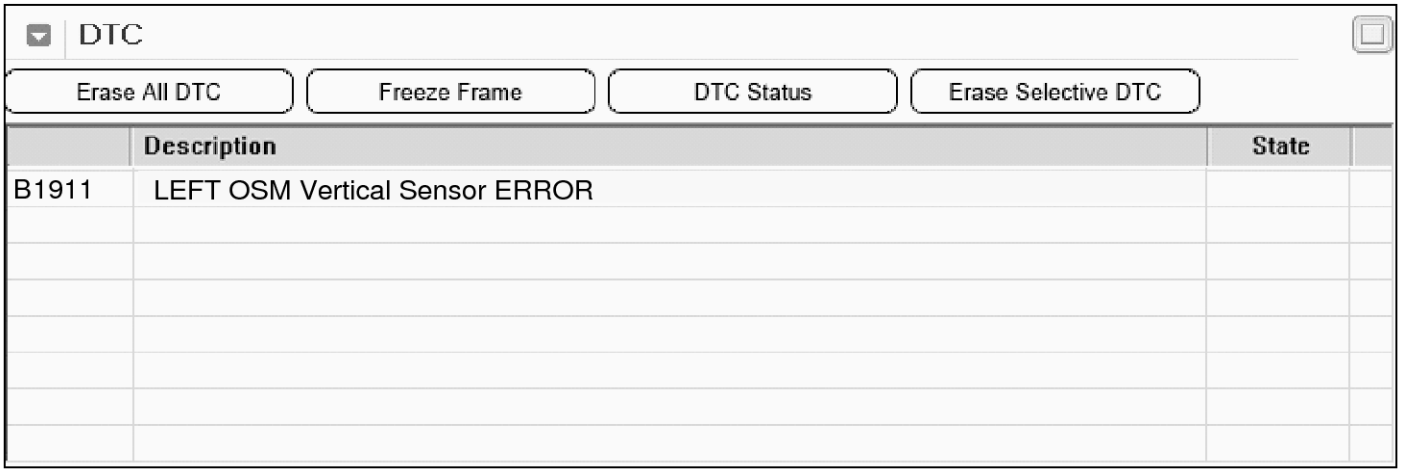
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## Scantool Data Analysis

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).




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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.

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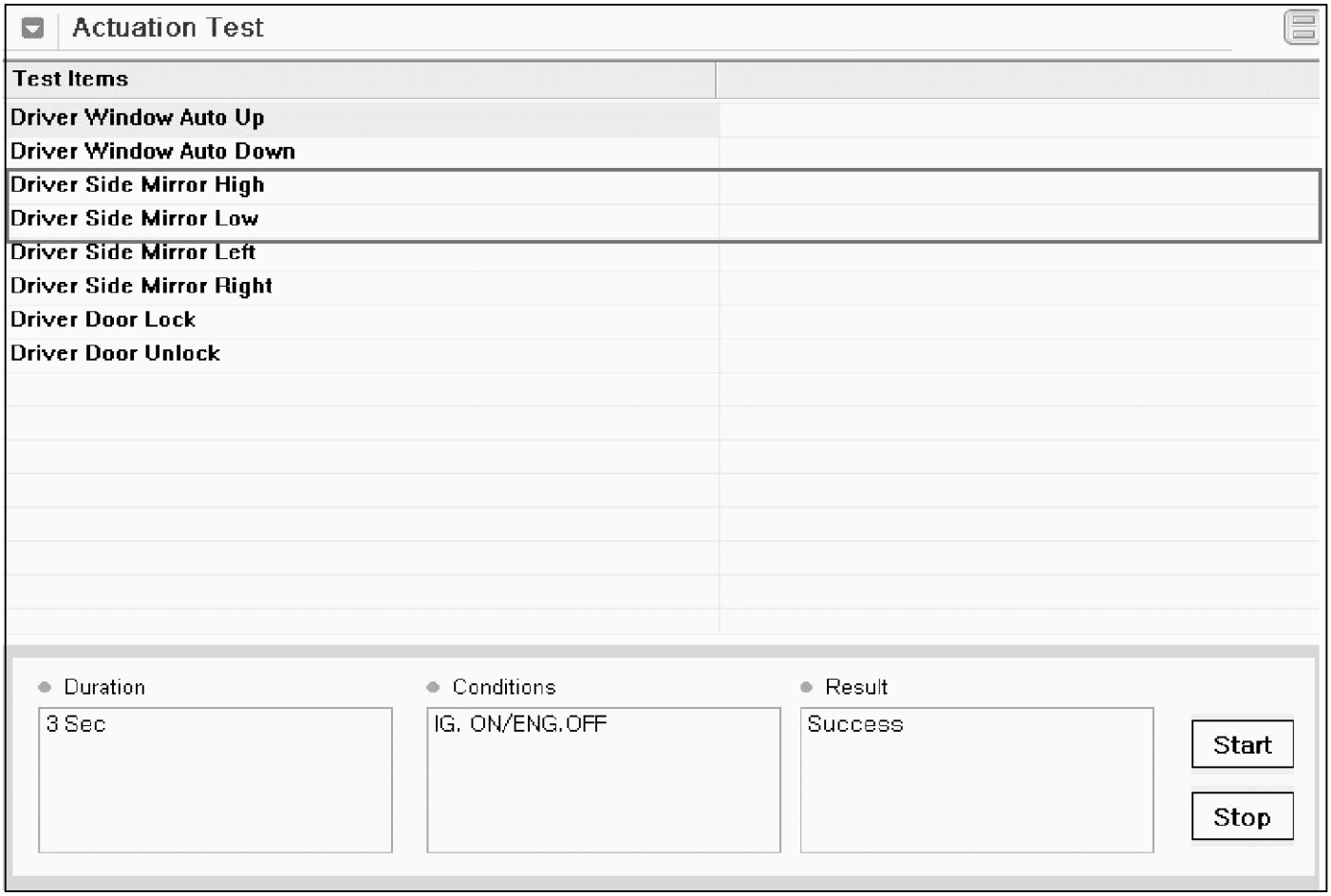


## Component Inspection

### ■ Check mirror motor

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

**Specification :** Turned to pressed direction




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5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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### ■ 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 "ON" when the control switch is pressed. (UP, DOWN , LEFT, RIGHT)

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 14.0 | V |
| Passenger Mirror Right Switch | OFF | - |
| Passenger Mirror Left Switch | OFF | - |
| Passenger Mirror Down Switch | OFF | - |
| Passenger Mirror Up Switch | OFF | - |
| Driver Mirror Right Switch | OFF | - |
| Driver Mirror Left Switch | OFF | - |
| Driver Mirror Down Switch | ON | - |
| Driver Mirror Up Switch | OFF | - |
| Passenger Window Up Switch | OFF | - |
| Passenger Window Auto Up Switch | OFF | - |
| Passenger Window Down Switch | OFF | - |
| Passenger Window Auto Down Switch | OFF | - |
| Rear Right Window Up Switch | OFF | - |
| Rear Right Window Down Switch | OFF | - |
| Driver Window Up Switch | OFF | - |
| Driver Window Auto Up Switch | OFF | - |
| Driver Window Down Switch | OFF | - |
| Driver Window Auto Down Switch | OFF | - |
| Rear Left Window Up Switch | OFF | - |
| Rear Left Window Down Switch | OFF | - |

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4. Is the service data normal?

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

**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

Refer to DTC B1910 : Outside Mirror - Left Horizontal Motor or Sensor Error.

## Signal Circuit Inspection

Refer to DTC B1910 : Outside Mirror - Left Horizontal Motor or Sensor Error.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

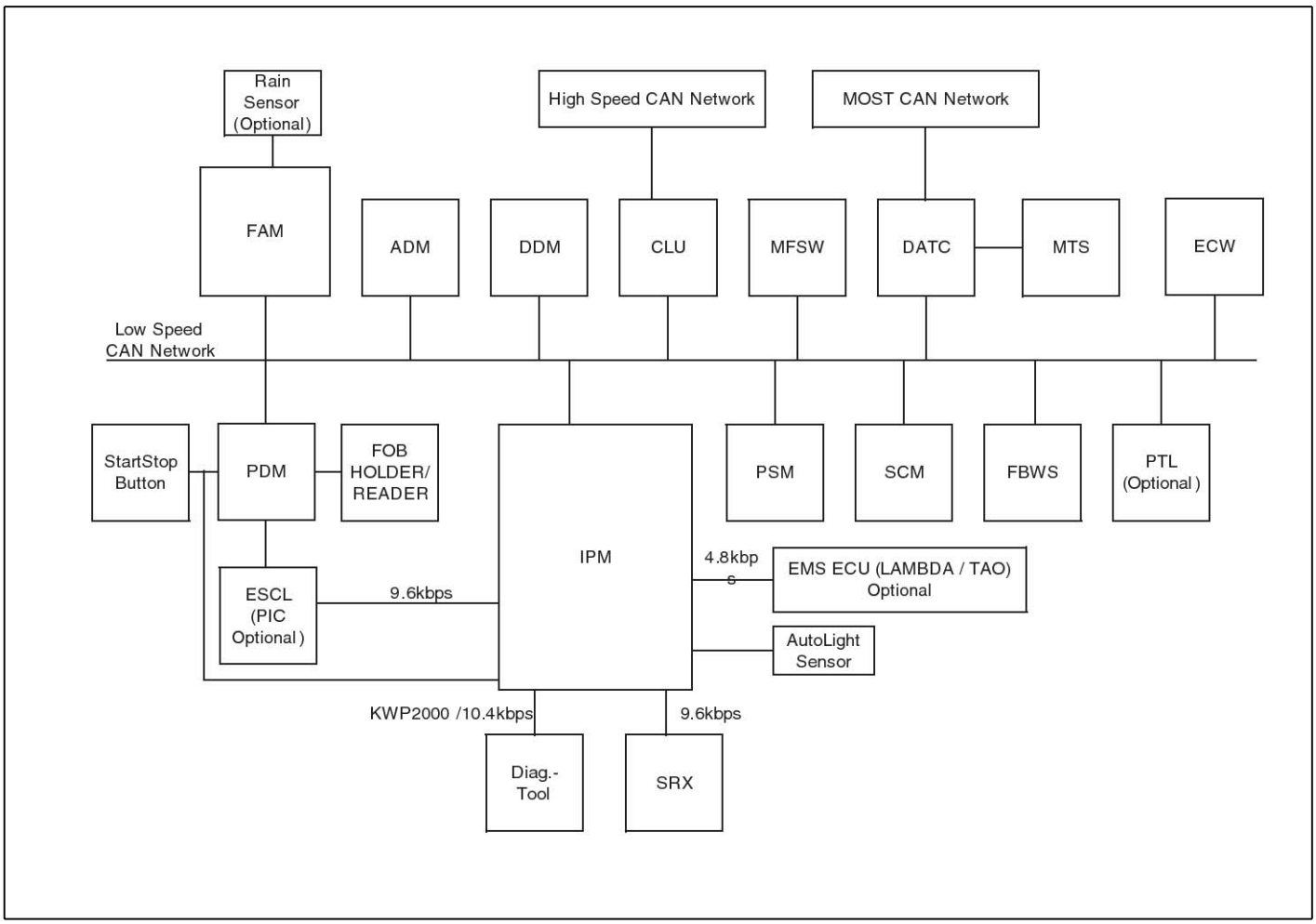
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## Assist Door Module (ADM)

통신 구성도




SBHB18084D

### Description

The assist door module is a part of CAN, and performs CAN communication with the BCM, FAM, IPM, RAM, DDM, and IMS. The driver can control the power window, mirror, door(lock/unlock) by using buttons of the ADM on the door of the driver's seat.

1. Operating the power window by buttons
2. Central Door LOCK/UNLOCK function
3. Manually operating the mirror position by the manual SW (Up, Down, Right, and Left)
4. Saving and replacing the mirror position by the memory switch → For 2 persons
5. Out side mirror AUTO reverse operation
6. Door courtesy lamp control
7. Out side mirror defog control
8. Illumination control

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## Control Function

### Power Window Control

1. This switch controls power window up/down from assist side.
   - According to the input of assist Door module window, up/down switch, output window motor up/down.
   - Power window up/down control from assist side.
2. Timer function

   Power window switch can be controlled for 30 seconds after the ignition is turned off. This function stops immediately even within 30 seconds if the front door is opened.

### Crash Unlock

1. Under the condition "IGN ON", if Crash Sensor message from IPM is ON, Door UNLOCK is output.(5 ± 0.5sec)

### Auto Door Lock

1. If the vehicle is under any of the following conditions and the condition lasts for 3sec, all doors is locked.

   If message from IPM is "Door Lock Control = LOCK ALL", it will be locked for 0.5sec.
   - IGN "RUN" or "START"
   - ALT L ON (Engine is running)
   - Speed of the vehicle is 40Km/h
   - If any door is on "UNLOCK"
2. After LOCK output, if any door is not locked, there will be a series of three Lock output every 0.5sec.
3. If all doors are locked during a series of three output signals, output will be stopped.
4. If any door is not locked after a series of three output signals, output will be stopped.

### Key Reminder

1. 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 and there will be a series of three output signals every 0.5sec if door condition is "Lock".
2. If Key Reminder unlock message is "SHORT UNLOCK", DOOR UNLOCK lasts for 0.5sec.
3. If Key Reminder unlock message is "LONG UNLOCK ", DOOR UNLOCK lasts for 1sec.
4. Remained action goes on though Key Reminder Unlock message changes to "OFF".

### Priority Of Door Lock/unlock

1. Crash Unlock > Auto Door Lock > Key Reminder > Central Door Lock
2. Higher priority signals take precedence, and will override lower priority signals.
3. If the priority is the same or low, it'll be ignored.

### Out Side Mirror Fold/unfold Power Control

1. Supply folding power for 30sec after ACC ON or ACC OFF.
2. FOLD/UNFOLD operation is controlled by fold switch.

### Out Side Mirror Control By The Switch

1. Manual control of left outside mirror

   If the mirror direction switch (up, down, left and right) is pressed when mirror selection switch on driver side power window switch is in outside LH under ACC ON condition, then mirror motor moves to the corresponding direction.
2. Manual control of right outside mirror

   If the mirror direction switch (up, down, left and right) is pressed when mirror selection switch on driver side power window switch is in outside RH under ACC ON condition, then operating signal is sent to passenger side power window switch through CAN communication.

### Outside Mirror Memory Operation By The Memory Switch

1. IMS Message from DDM is sent to RETURN1 or RETURN2, out side mirror returns to the position stored.
2. Memory permit status is released if any of the following conditions is met
   - 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 switch of the CAN communication data sent by the IPM is not "Run" or "Start".
   - If Inhibit switch of the CAN communication data sent by the FAM is not "P".
   - If vehicle speed of the CAN communication data sent by the cluster is "3Km/h" or more.
3. Memory is cleared if the battery is removed

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### Outside Mirror Memory And Replay Operation By The Memory Switch

1. IMS message from DDM is sent to RETURN1 or RETURN2, O/S MIRROR returns to the position stored.
2. Replacing not stored position doesn't work.
3. If RETURN Message is sent during replacing, the last Message has priority.
4. Replacing Prohibition Conditions.
   1) If the mirror switch on the LH side is pressed
   2) If Ignition switch of the CAN communication data sent by the IPM is not "Run".
   3) If Inhibit switch of the CAN communication data sent by the FAM is not "P".
   4) If vehicle speed of the CAN communication data sent by the CLUSTER is "3Km/h".

### Outside Mirror Memory And Replay Operation By Keyless

1. Memory operation
   - If the ignition is turned off after being on, the position of the O/S mirror RH is saved in the switch ASSY power window main.
   - If the door was keyless-locked, the outside mirror RH position is saved corresponding to the keyless code.
2. Replay operation
   - If the door is keyless-unlocked while the IGN SW is off, replacing is made to the saved position corresponding to the keyless code.
3. Replay prohibit condition
   - When the inhibit "P" switch is OFF
   - When RH side mirror switch is pressed
   - When mirror switch is pressed after ignition on
   - When the vehicle speed is over 3km/h

### Auto Reverse Function

| No. | Operation | Select SW | Shift Lever | MIR Position | | Manipulation | Result |
|---|---|---|---|---|---|---|---|
| | | | | L | R | | |
| 1 | Basic Operation | LH | P | Position A | Position B | Changing the shift lever from "P" to "R" | MIR L:Auto reverse to position (A-5°)<br>MIR R:Auto reverse to position (B-5°) |
| 2 | | RH | P | Position A | Position B | | MIR L:NO change<br>MIR R:Auto reverse to position (B-5°) |
| 3 | | N | P | Position A | Position B | | MIR L:NO change<br>MIR R:NO change |
| 4 | Returning after Basic Operation | LH | R | Result of No.1 | Result of No.2 | Changing the shift lever from "R" to "P" | MIR L:Return to position (A)<br>MIR R:Return to position (B) |
| 5 | | RH | R | No.1 is being performed | Result of No.2 | | MIR L:NO change<br>MIR R:Return to position (B) |

### Fail Safe Function

1. If the sensor does not move more than 60mV for the input changes (5 second operation) of the position sensor although the motor is operating, it will be considered there is a harness cutting, motor breakdown, or sensor breakdown and automatic control will stop.
2. The mirror operation signal cannot be displayed into the same direction for more than 15 seconds. (When the mirror is replacing to the saved position or the switch is manually pressed)
3. Monitoring the replacing time
   - If the replacing operation does not stop within 40 seconds, the mirror motor will not outputted and the replacing operation will stop.

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### Courtesy Lamp

1. If assist's door is opened, RAM changes door open Message to ON and Courtesy lamp is ON by ADM.
2. If assist's door is closed, RAM changes door open Message to Off and Courtesy lamp is OFF gradually by ADM.(5±0.5sec)
3. During dim out, If IGN changes to ON or door is closed while Ignition switch is ON, Courtesy lamp is OFF immediately.
4. If Key reminder switch is OFF and door is opened for 20min, Courtesy lamp is OFF immediately.

### Defog Control (O/S Mirror Heat Line)

If rear defog switch is on while IGN is ON, rear defog control of IPM is ON and O/S Mirror Defog is ON by DDM, ADM.

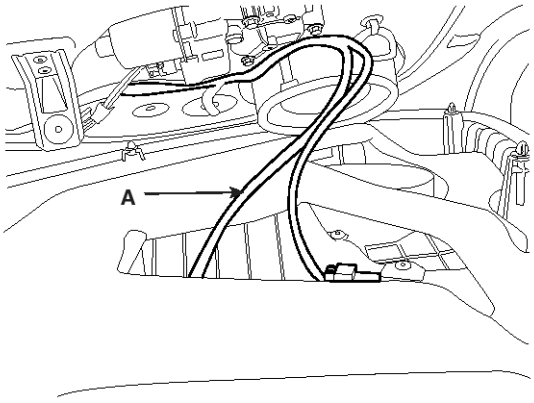
### Rescue Mode

1. The condition to run RESCUE MODE is listed below.
   - Ignition switch Message is in RUN or IGN switch is ON.
   - Any signal received from of park tail head lamp, front wiper control message is received as INVALID or CAN line from IPM is not normal.
   - Drive door courtesy lamp control message is sent as INVALID or Can Line from RAM is not normal.
2. If RESCUE MODE runs, operation is as follows.
   - Door unlock is ON for 0.5sec
   - OSRVM Defogger is ON for 20min.
   - Illumination is ON continuously.
   - Other functions are the same as NORMAL mode.
3. If Ignition switch Message is OFF/ACC or IGN switch is OFF or can line from IPM,FAM,RAM is normal, Rescue mode is stopped.

### Removal

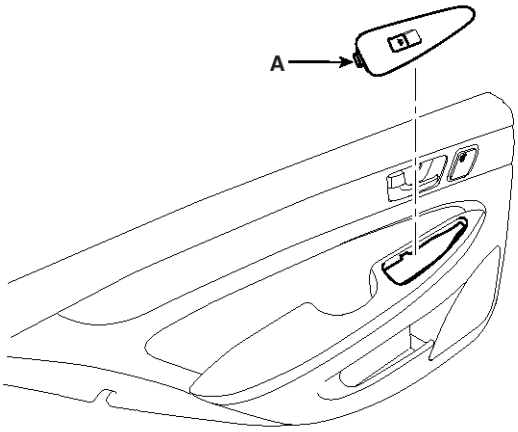
1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel (Refer to the Body group - front door)
3. Remove the door module (ADM) (A) from the front door trim panel after disconnecting module connector.

   Be careful not to damage the door module removing the clip.




SBHB18086D

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




SBHB18089D

### Installation

1. Install the door module on the front door trim panel.
2. Install the front door trim panel.
3. Connect the negative (-) battery terminal.

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## Troubleshooting

### ADM DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1912 | RIGHT OSM Horizotal Sensor ERROR |
| 4 | B1913 | RIGHT OSM Vertical Sensor ERROR |

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## B1602 CAN Error

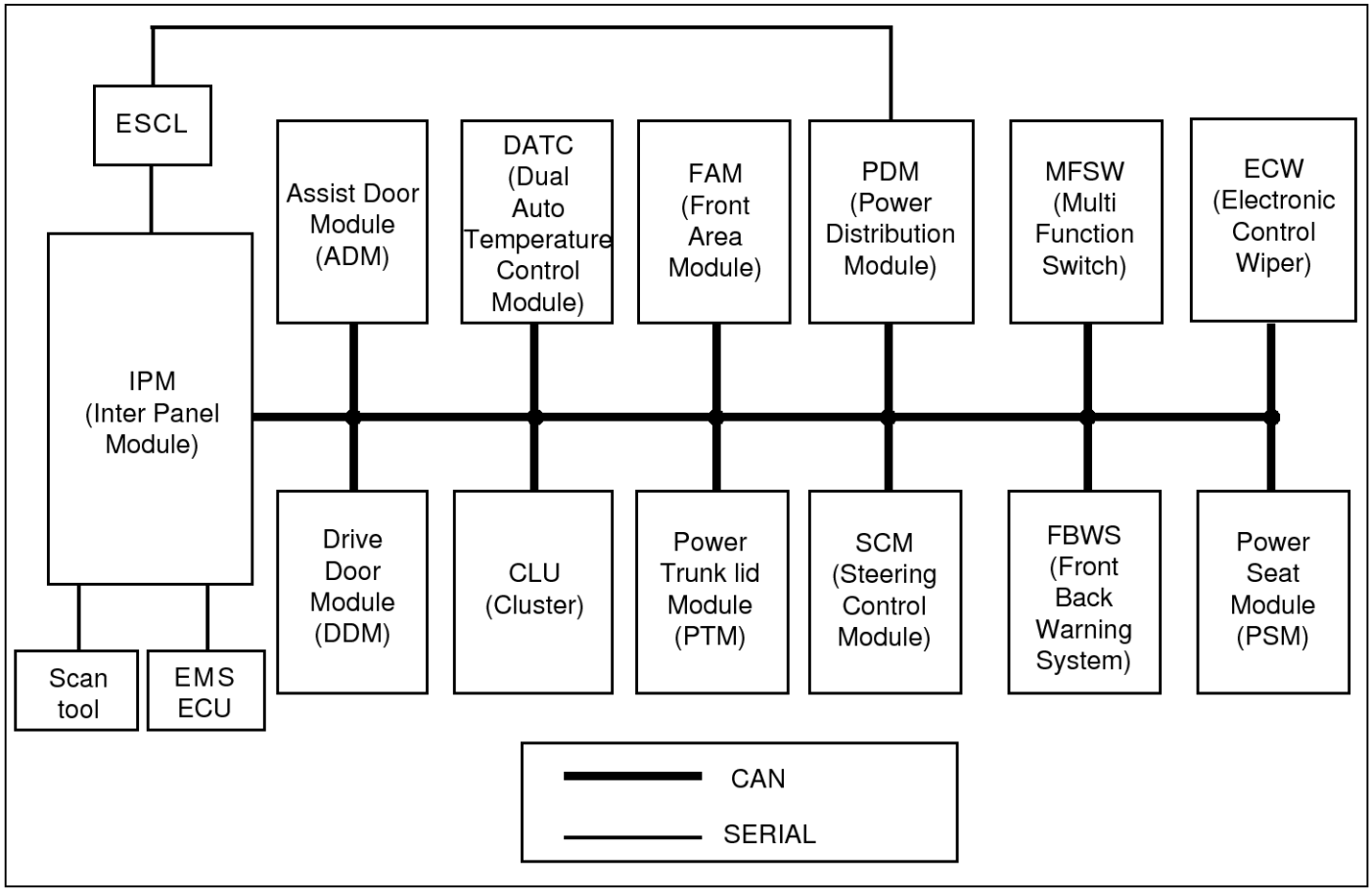
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

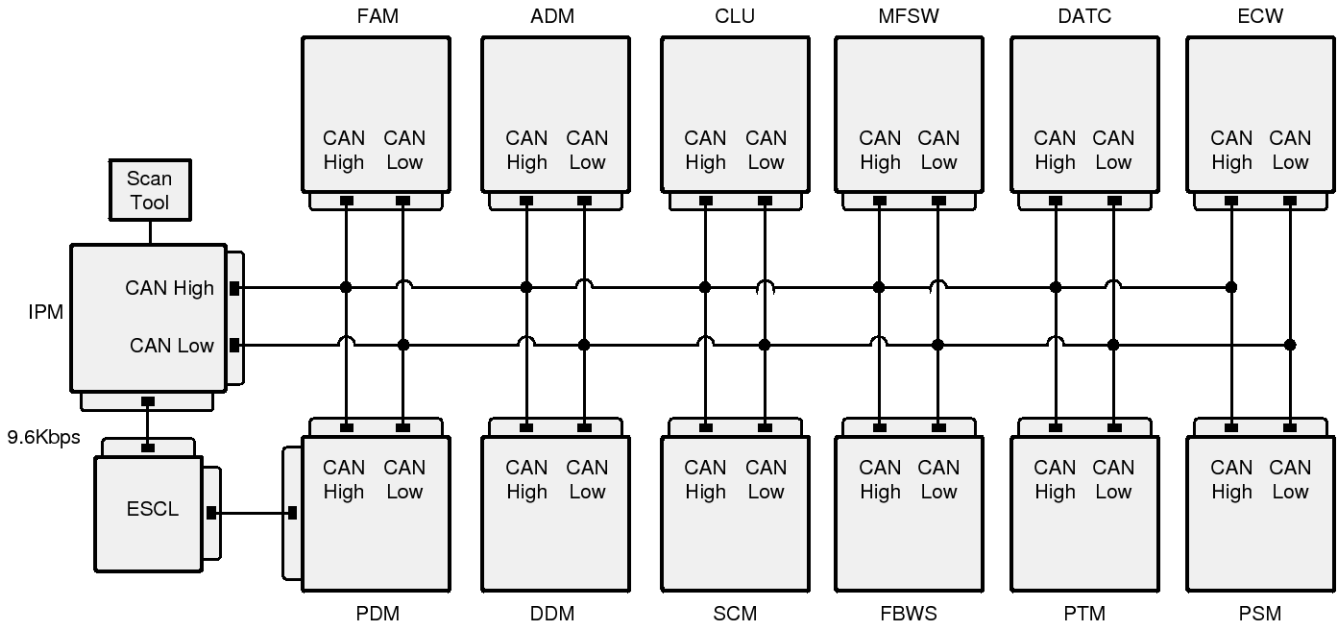
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,ADM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, ADM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

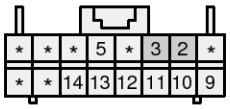



<ECW>



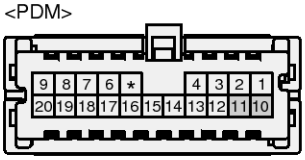
4. Low
5. High

<IPM>



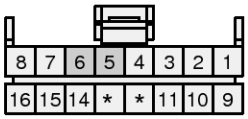
2 . Low
3. High

<PDM>



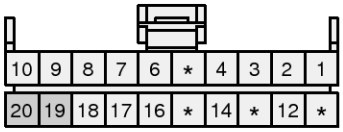
10. Low
11. High

<MFSW>



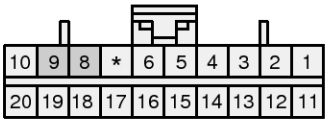
5. High
6. Low

<CLU>



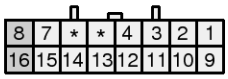
19. Low
20. High

<TILT & TELE>



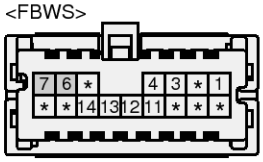
8. High
9. Low

<ADM>



8. High
16. Low

<FBWS>



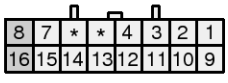
6. High
7. Low

<PSM>



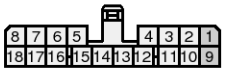
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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**Signal Waveform & Data**

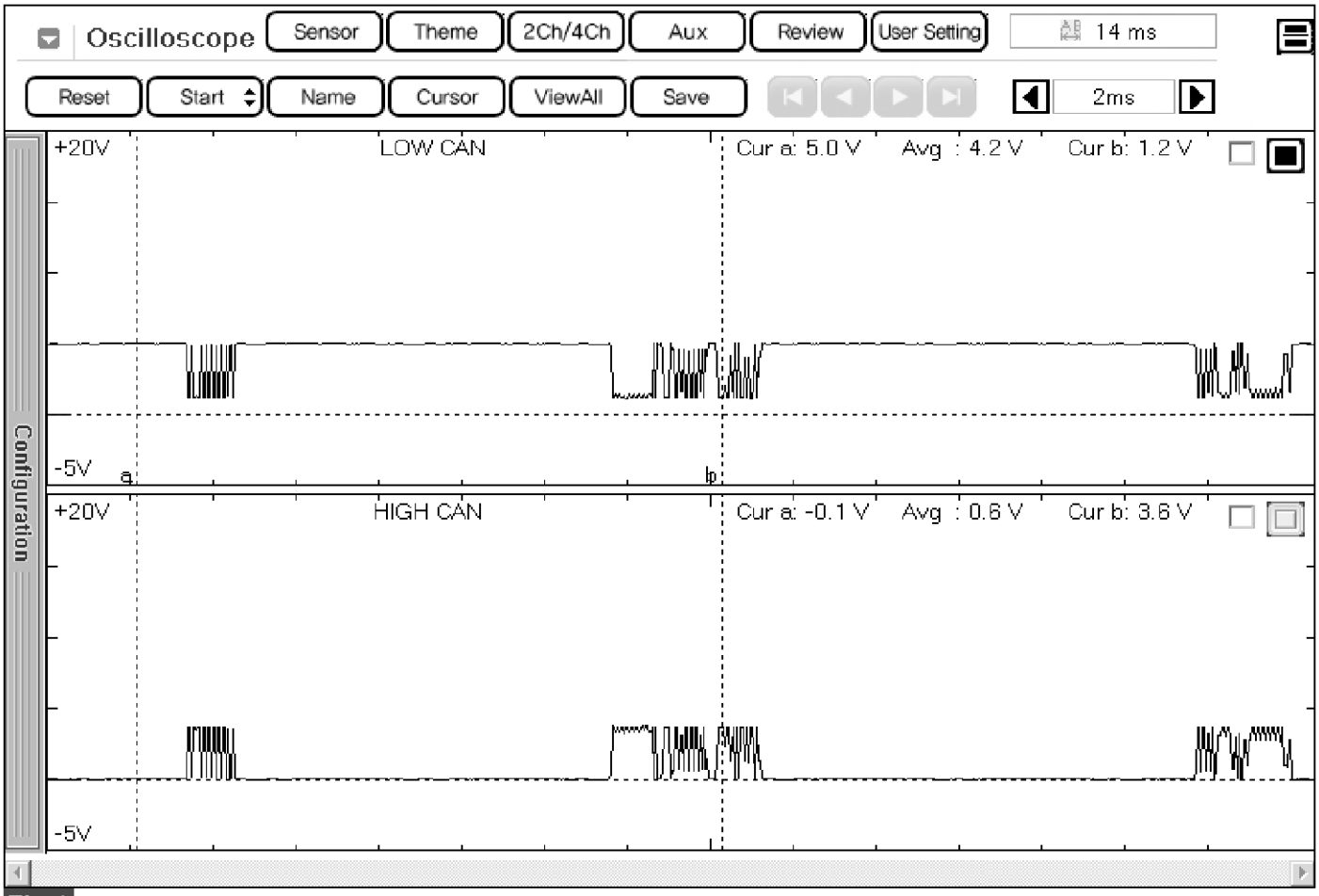



Fig.1

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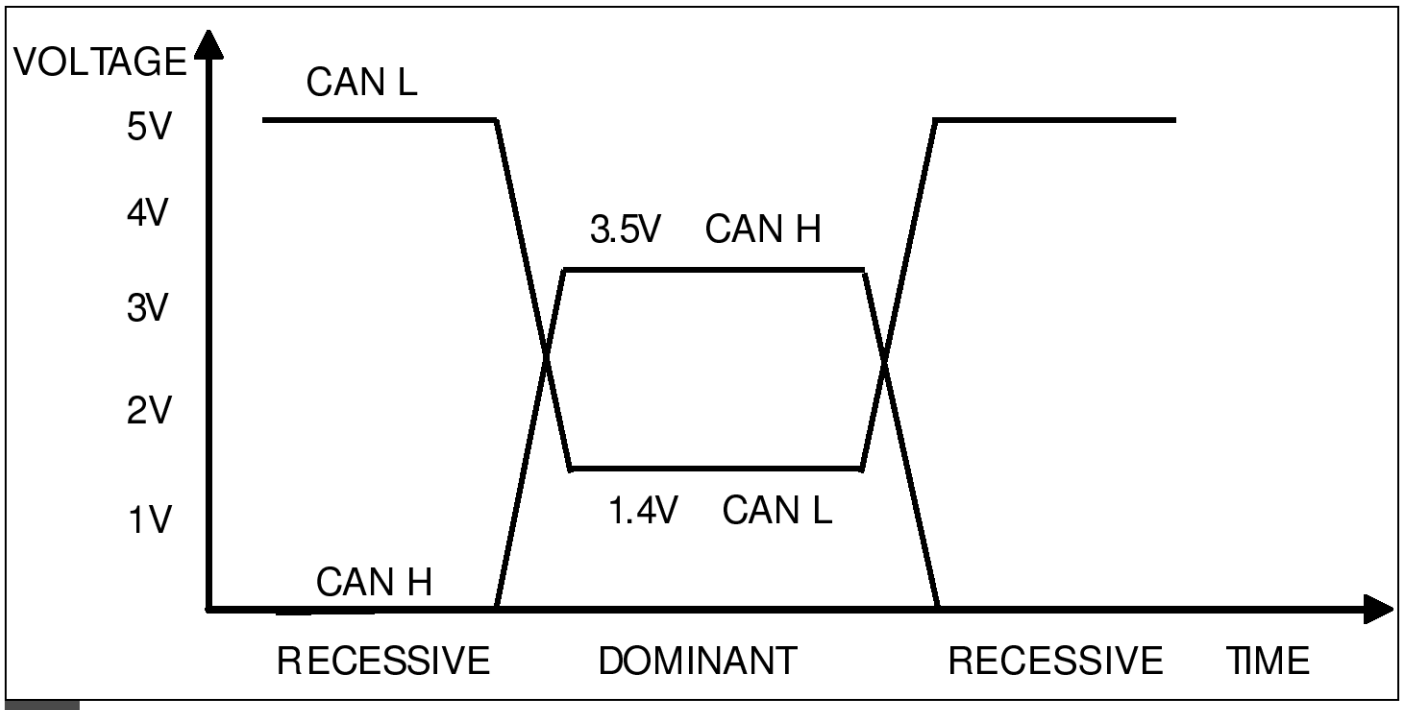



Fig.2

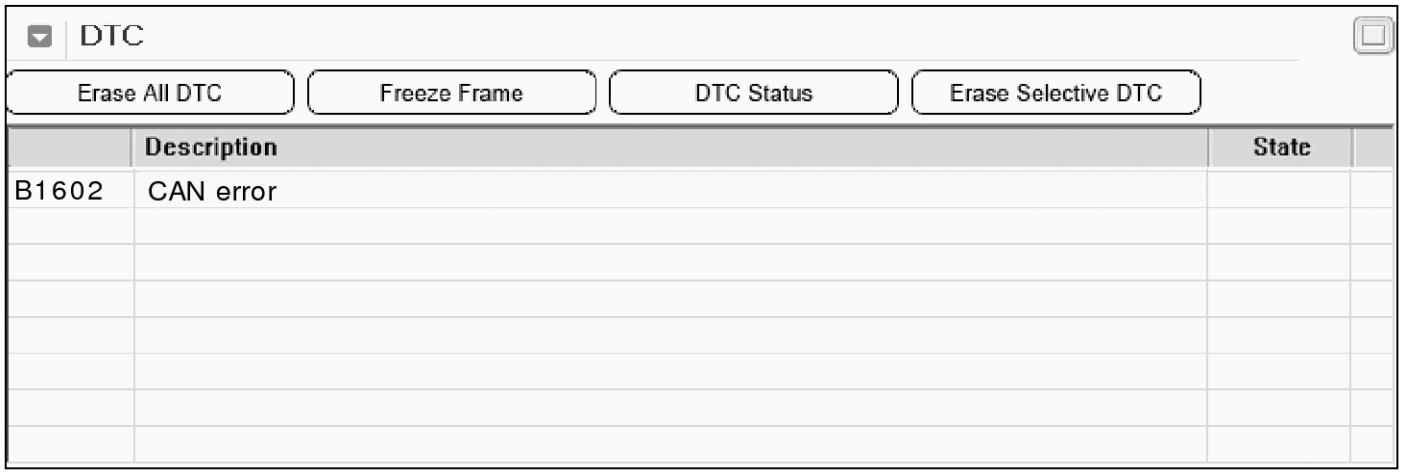
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Fig.1) CAN Low/High Signal Waveform

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).




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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 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 "ADM Signal Circuit Inspection" procedure.

## ADM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ADM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ADM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)
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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## B1603 CAN Communication Bus Off

### General Description

Refer to DTC B1602 : CAN Error.

### 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM 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,ADM are not Sleep condition<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, ADM 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

Refer to DTC B1602 : CAN Error.

### Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

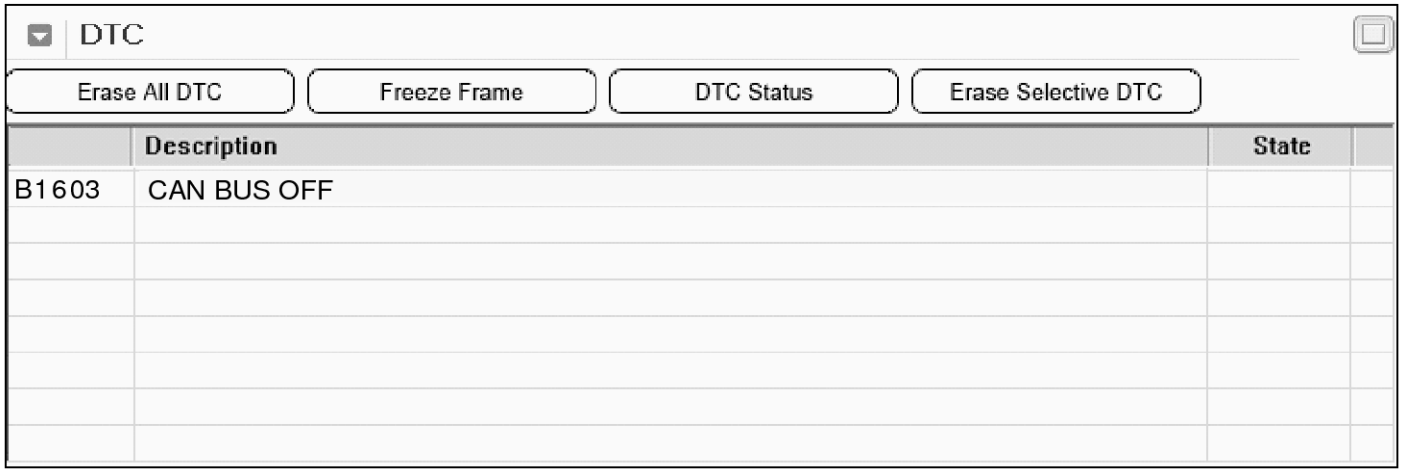
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## Scantool Data Analysis

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).




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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 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), 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)
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

Refer to DTC B1602 : CAN Error.

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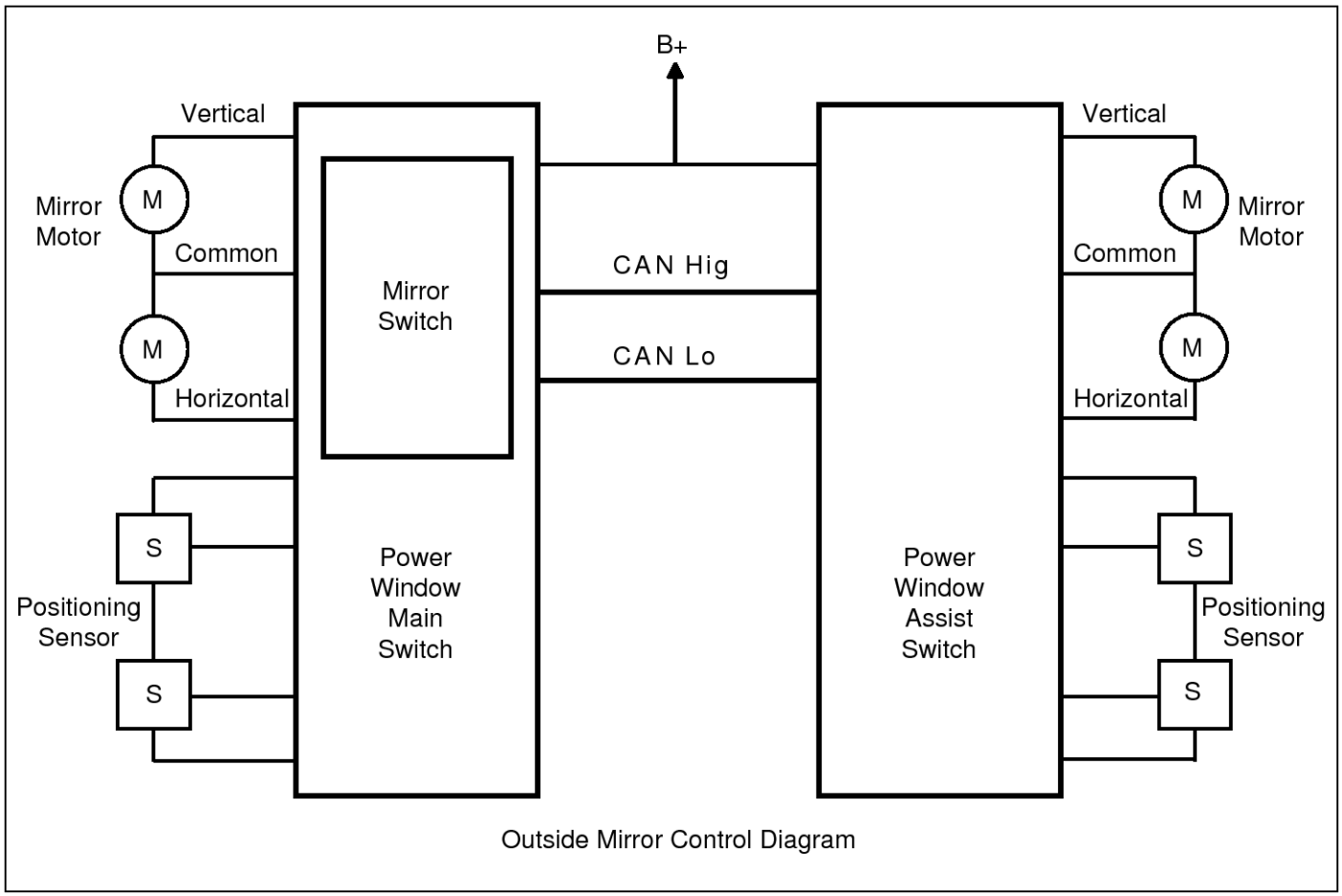
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## B1912 Outside Mirror - Right horizontal Motor or Sensor

### General Description

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




Outside Mirror Control Diagram

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### DTC Description

Case1 : ADM sets DTC when the change value of assist mirror position is less than 0.1V for 5sec while it is not reached to the aimed position.

Case2 : ADM sets DTC when there is counter-direction output which is 0.25V and above while assist mirror is turning to one direction.

Case3 : ADM sets DTC when there is no movement signal from positioning sensor in assist mirror.

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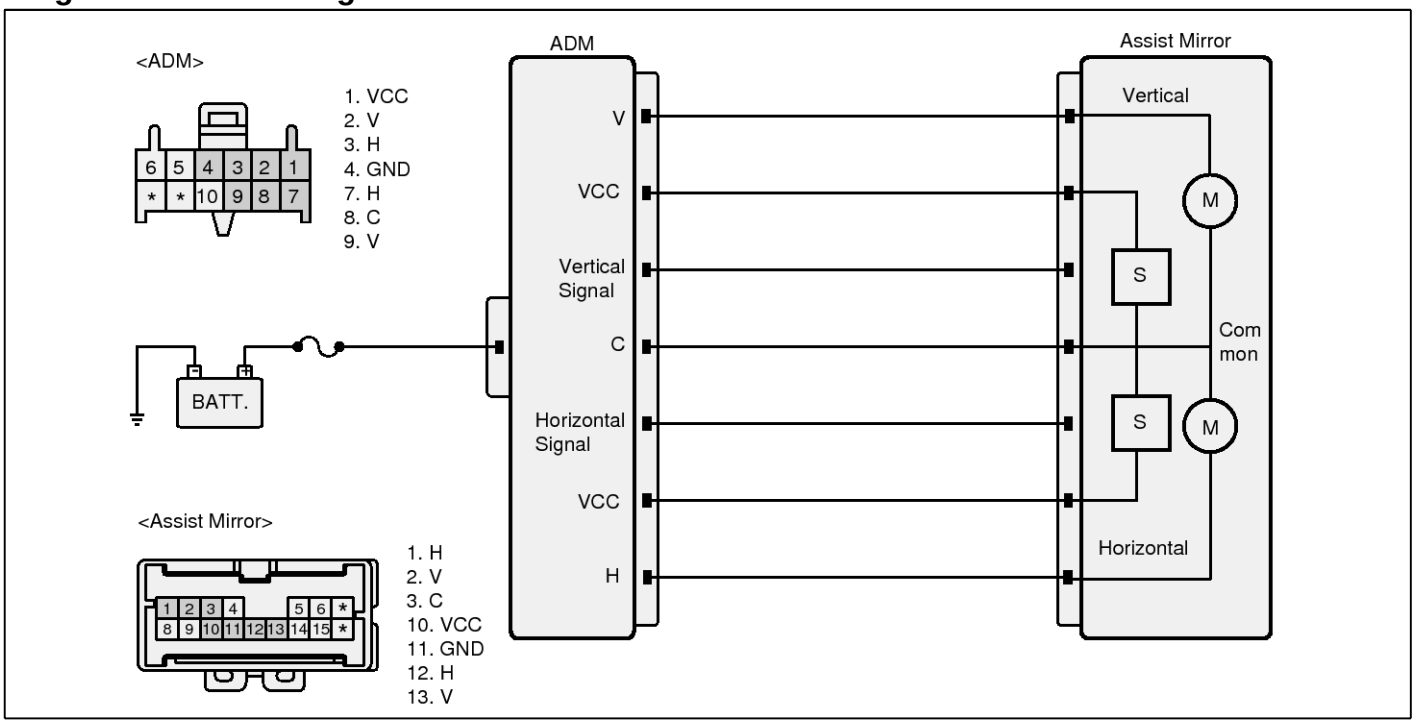
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## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Mirror Horizontal Positioning Sensor Check | • Mechanical restriction<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Motor<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Sensor<br>- Check the change of sensor data when motor is controlled. |
| Enable Conditions | • Motor works on | |
| Threshold Value | • No signal change during Mirror turning<br>• Counter-direction outputs against Mirror controlled | |
| 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.) | |

## Diagnostic Circuit Diagram



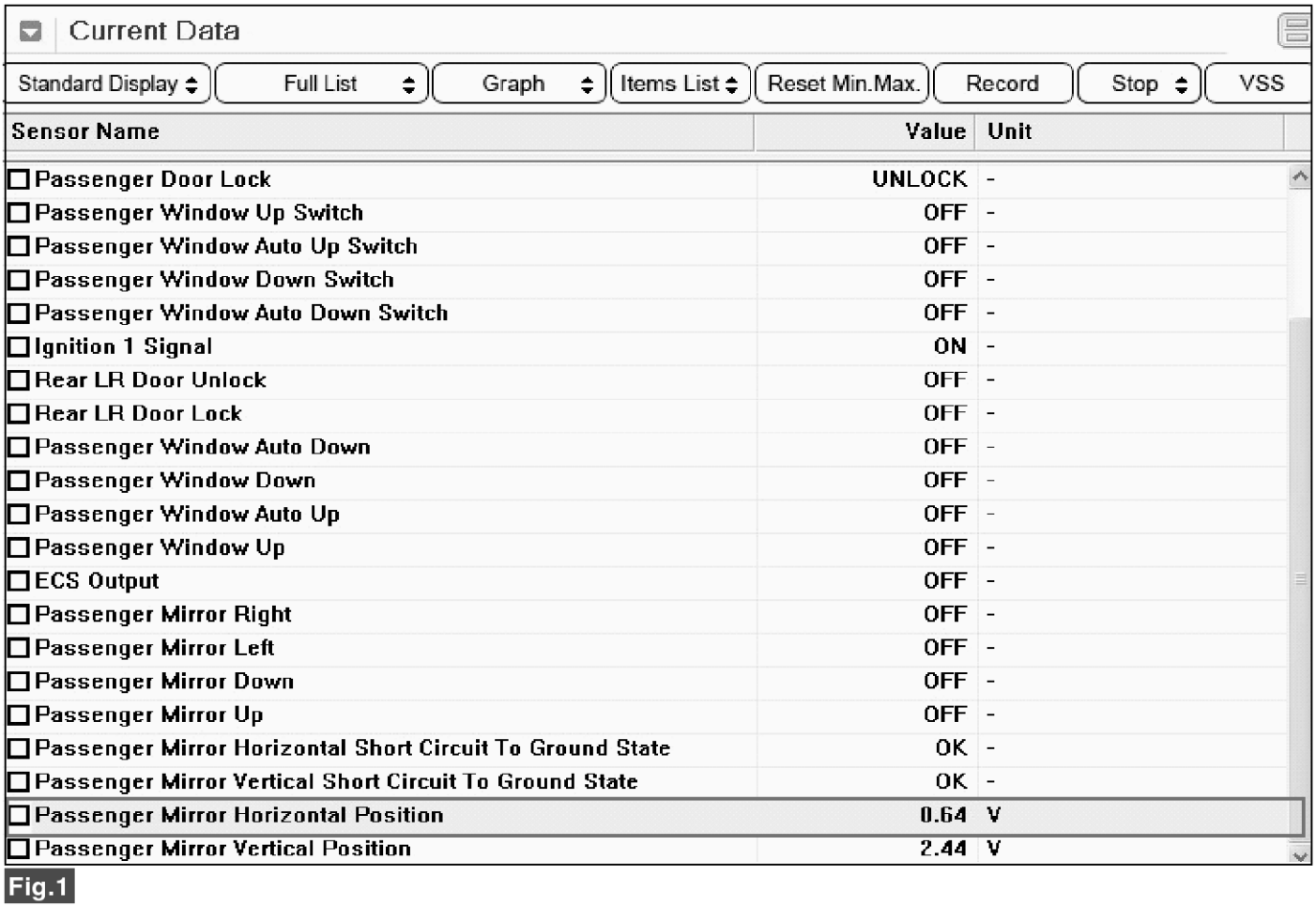

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## Signal Waveform & Data




| Sensor Name | Value | Unit |
|---|---|---|
| Passenger Door Lock | UNLOCK | - |
| Passenger Window Up Switch | OFF | - |
| Passenger Window Auto Up Switch | OFF | - |
| Passenger Window Down Switch | OFF | - |
| Passenger Window Auto Down Switch | OFF | - |
| Ignition 1 Signal | ON | - |
| Rear LR Door Unlock | OFF | - |
| Rear LR Door Lock | OFF | - |
| Passenger Window Auto Down | OFF | - |
| Passenger Window Down | OFF | - |
| Passenger Window Auto Up | OFF | - |
| Passenger Window Up | OFF | - |
| ECS Output | OFF | - |
| Passenger Mirror Right | OFF | - |
| Passenger Mirror Left | OFF | - |
| Passenger Mirror Down | OFF | - |
| Passenger Mirror Up | OFF | - |
| Passenger Mirror Horizontal Short Circuit To Ground State | OK | - |
| Passenger Mirror Vertical Short Circuit To Ground State | OK | - |
| Passenger Mirror Horizontal Position | 0.64 | V |
| Passenger Mirror Vertical Position | 2.44 | V |

Fig.1

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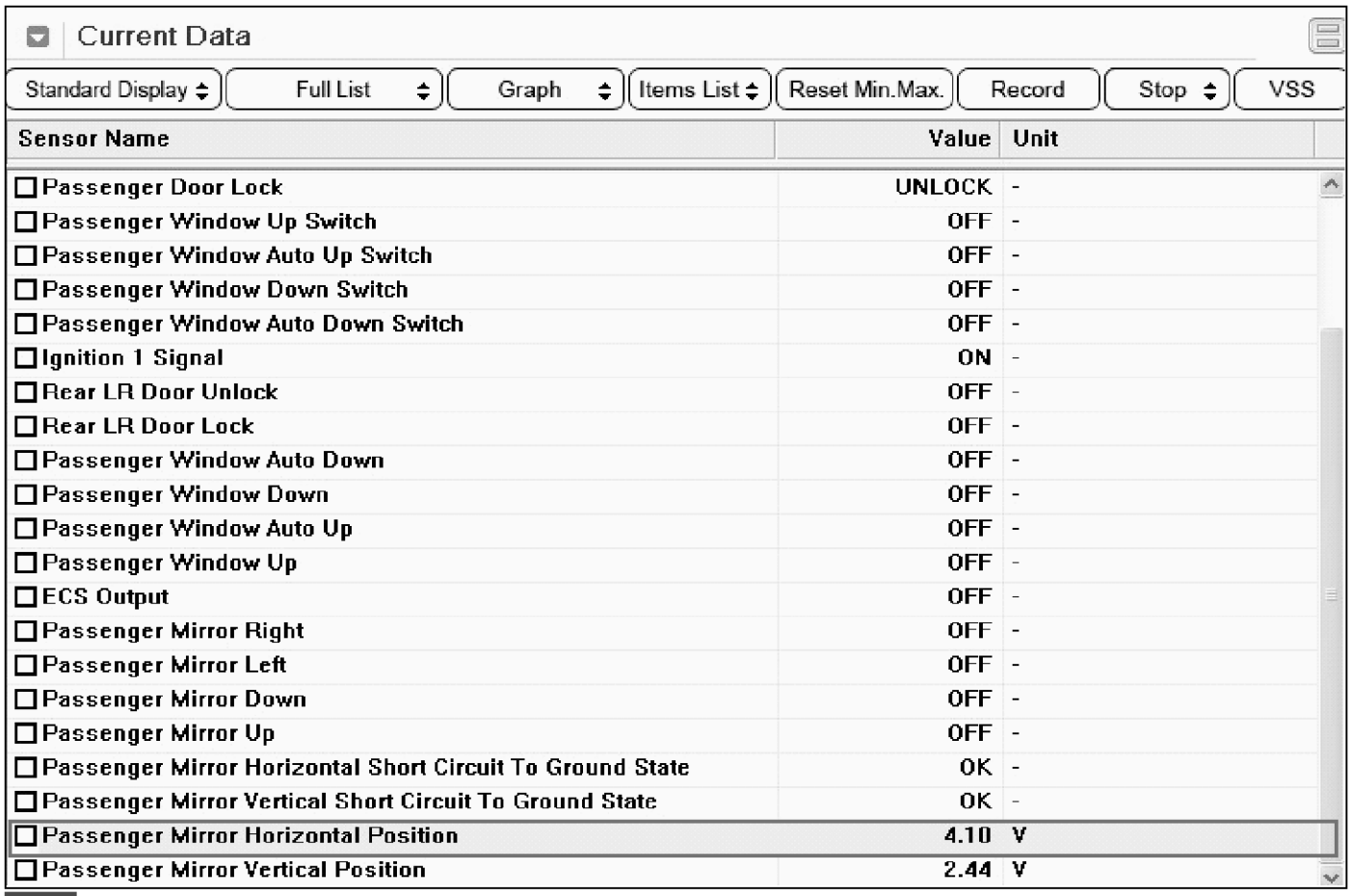



Fig.2

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Fig.1) The minimum value at left side end position.

Fig.2) The maximum value at right side end position.

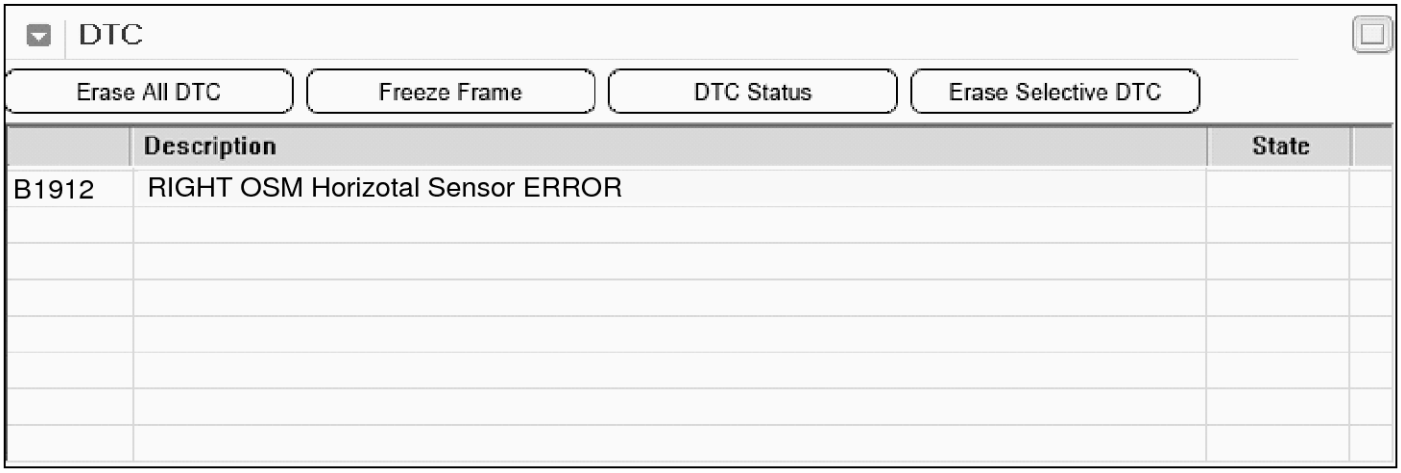
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### Scantool Data Analysis

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).




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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 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.

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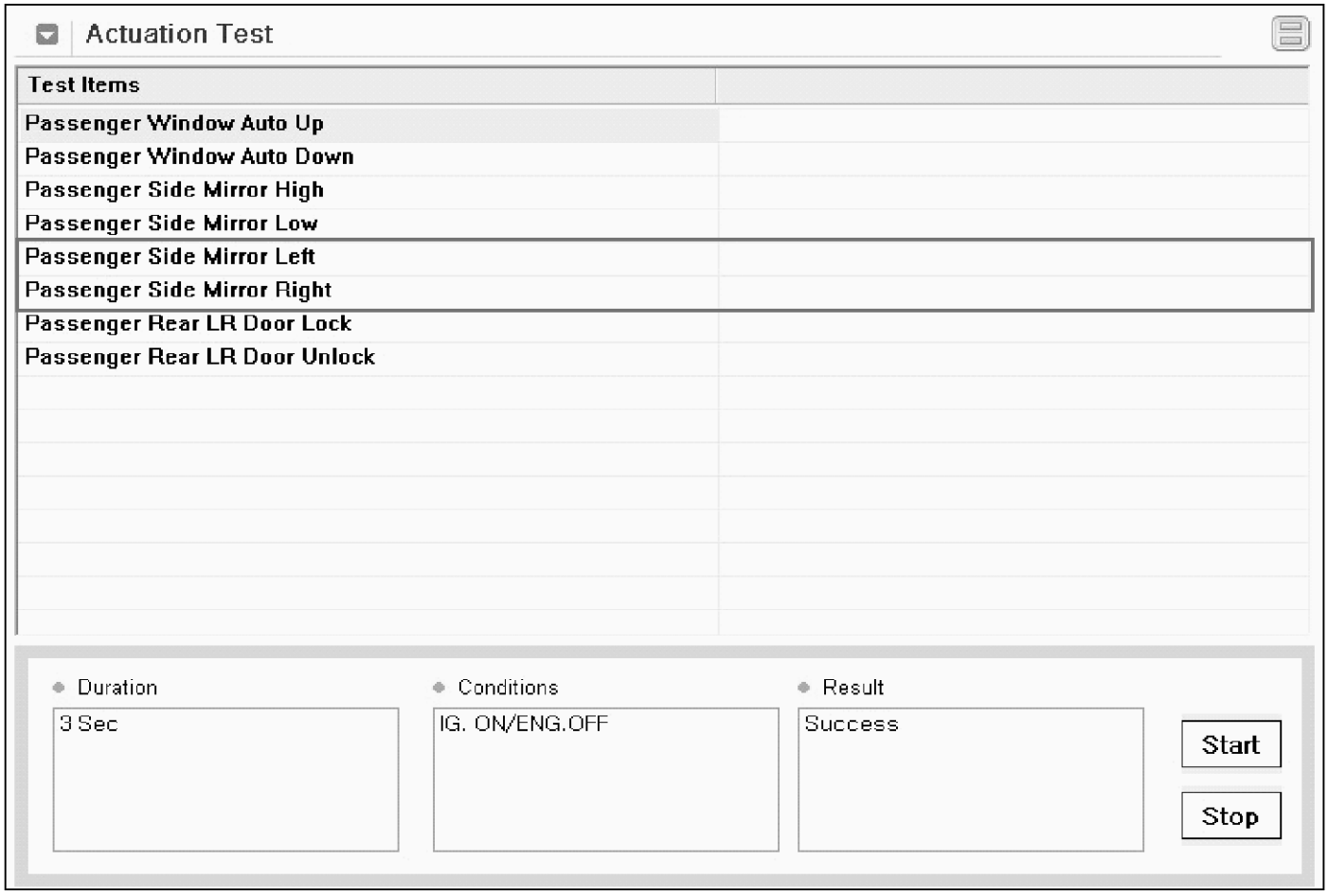


## Component Inspection

### ■ Check mirror motor

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

**Specification :** Turned to pressed direction




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5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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### ■ 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 "ON" when the control switch is pressed. (UP, DOWN, LEFT, RIGHT)

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 14.0 | V |
| Passenger Mirror Right Switch | ON | - |
| Passenger Mirror Left Switch | OFF | - |
| Passenger Mirror Down Switch | OFF | - |
| Passenger Mirror Up Switch | OFF | - |
| Driver Mirror Right Switch | OFF | - |
| Driver Mirror Left Switch | OFF | - |
| Driver Mirror Down Switch | OFF | - |
| Driver Mirror Up Switch | OFF | - |
| Passenger Window Up Switch | OFF | - |
| Passenger Window Auto Up Switch | OFF | - |
| Passenger Window Down Switch | OFF | - |
| Passenger Window Auto Down Switch | OFF | - |
| Rear Right Window Up Switch | OFF | - |
| Rear Right Window Down Switch | OFF | - |
| Driver Window Up Switch | OFF | - |
| Driver Window Auto Up Switch | OFF | - |
| Driver Window Down Switch | OFF | - |
| Driver Window Auto Down Switch | OFF | - |
| Rear Left Window Up Switch | OFF | - |
| Rear Left Window Down Switch | OFF | - |

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4. Is the service data normal?

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

**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.

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### Signal Circuit Inspection

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

**Specification :** Approx. 1~4 V during motor working

4. 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 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

Refer to DTC B1602 : CAN Error.

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# B1913 Outside Mirror - Right vertical Motor or Sensor

## General Description

Refer to DTC B1912 : Outside Mirror - Right horizontal Motor or Sensor.

## DTC Description

Case1 : ADM sets DTC when the change value of assist mirror position is less than 0.1V for 5sec while it is not reached to the aimed position.

Case2 : ADM sets DTC when there is counter-direction output which is 0.25V and above while assist mirror is turning to one direction.

Case3 : 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 | • Mirror Vertical Positioning Sensor Check | • Mechanical restriction<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Motor<br>- In case motor doesn't work although H terminal is 12V and C terminal is 0V when Mirror horizontal control switch is pressed.<br>• Faulty Sensor<br>- Check the change of sensor data when motor is controlled. |
| Enable Conditions | • Motor works on | |
| Threshold Value | • No signal change during Mirror turning<br>• Counter-direction outputs against Mirror controlled | |
| 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.) | |

## Diagnostic Circuit Diagram

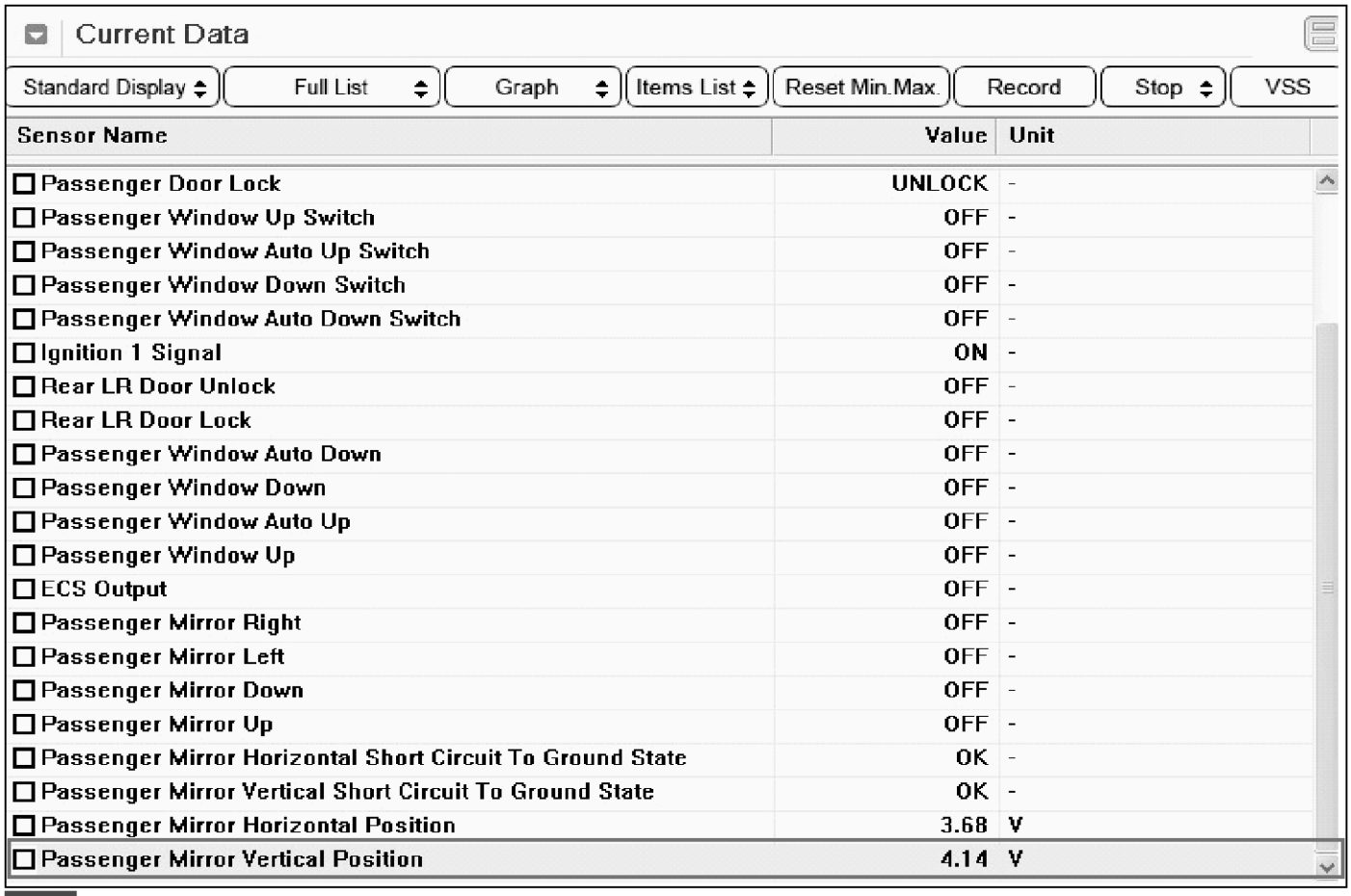
Refer to DTC B1912 : Outside Mirror - Right horizontal Motor or Sensor.

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## Signal Waveform & Data




| Sensor Name | Value | Unit |
|---|---|---|
| Passenger Door Lock | UNLOCK | - |
| Passenger Window Up Switch | OFF | - |
| Passenger Window Auto Up Switch | OFF | - |
| Passenger Window Down Switch | OFF | - |
| Passenger Window Auto Down Switch | OFF | - |
| Ignition 1 Signal | ON | - |
| Rear LR Door Unlock | OFF | - |
| Rear LR Door Lock | OFF | - |
| Passenger Window Auto Down | OFF | - |
| Passenger Window Down | OFF | - |
| Passenger Window Auto Up | OFF | - |
| Passenger Window Up | OFF | - |
| ECS Output | OFF | - |
| Passenger Mirror Right | OFF | - |
| Passenger Mirror Left | OFF | - |
| Passenger Mirror Down | OFF | - |
| Passenger Mirror Up | OFF | - |
| Passenger Mirror Horizontal Short Circuit To Ground State | OK | - |
| Passenger Mirror Vertical Short Circuit To Ground State | OK | - |
| Passenger Mirror Horizontal Position | 3.68 | V |
| Passenger Mirror Vertical Position | 4.14 | V |

Fig.1

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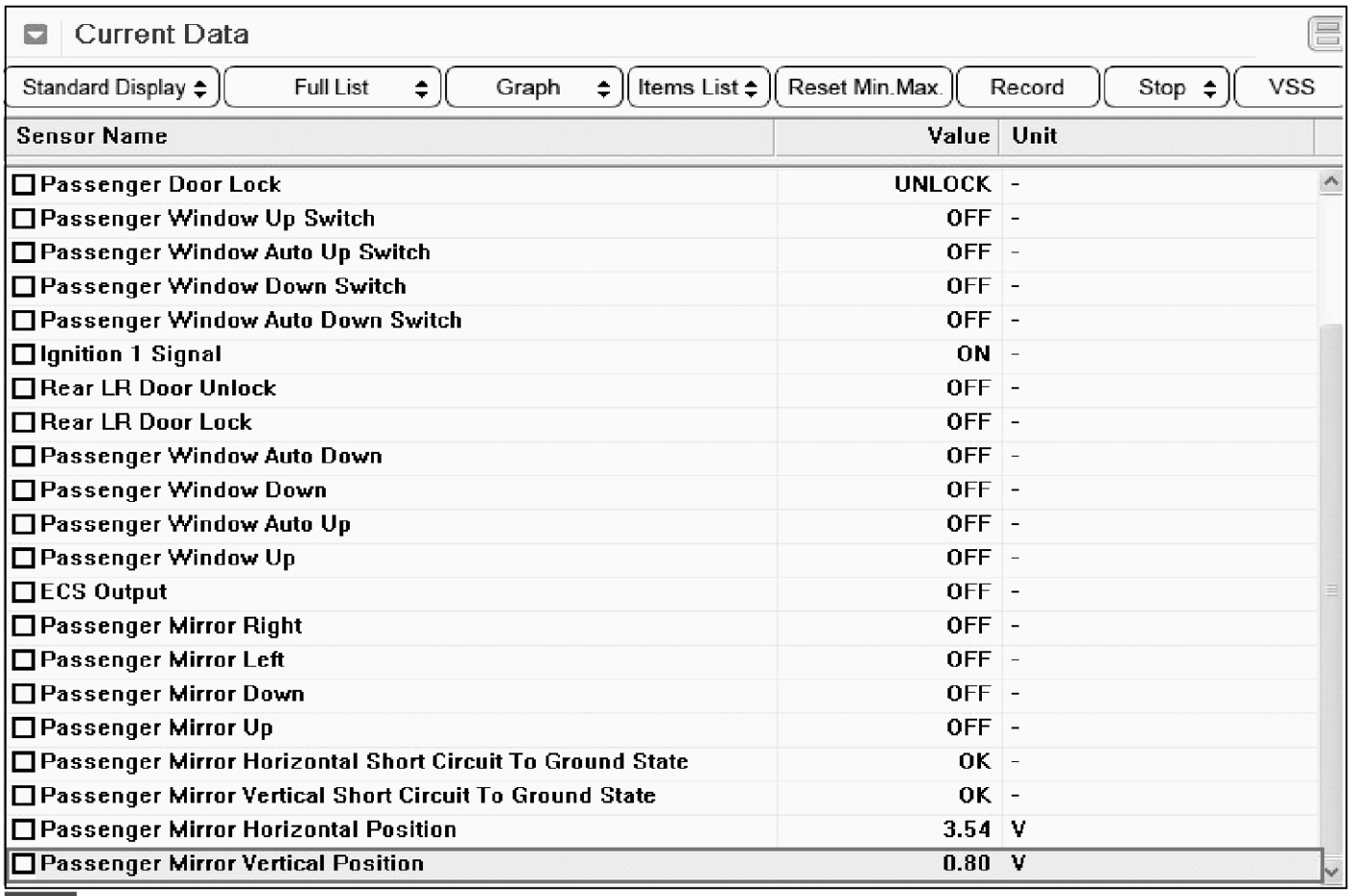



Fig.2

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Fig.1) The maximum value at upside end position.

Fig.2) The minimum value at downside end position.

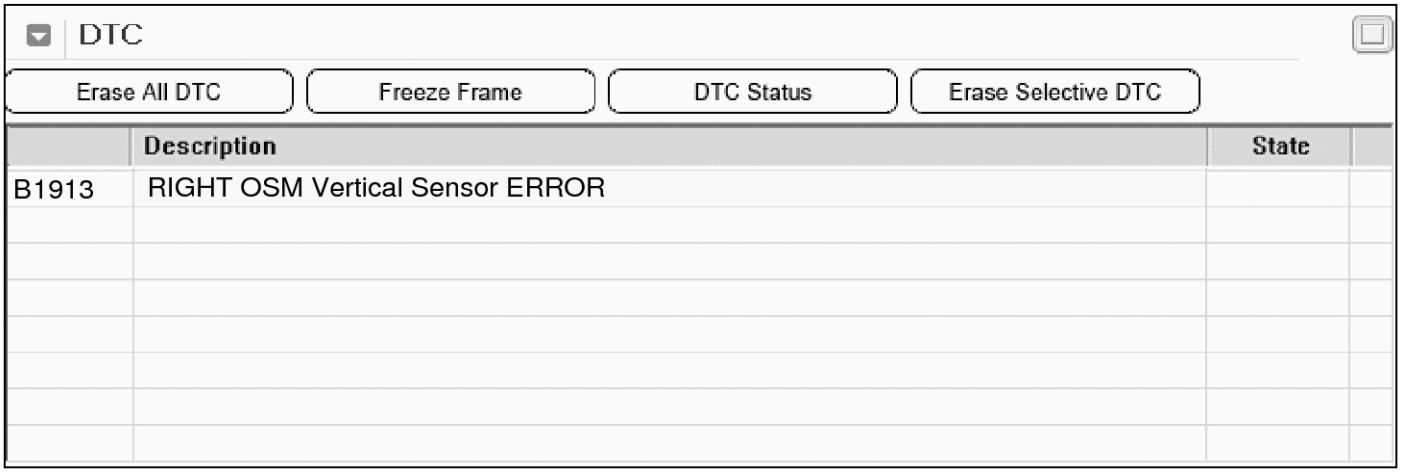
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## Scantool Data Analysis

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).




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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 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.

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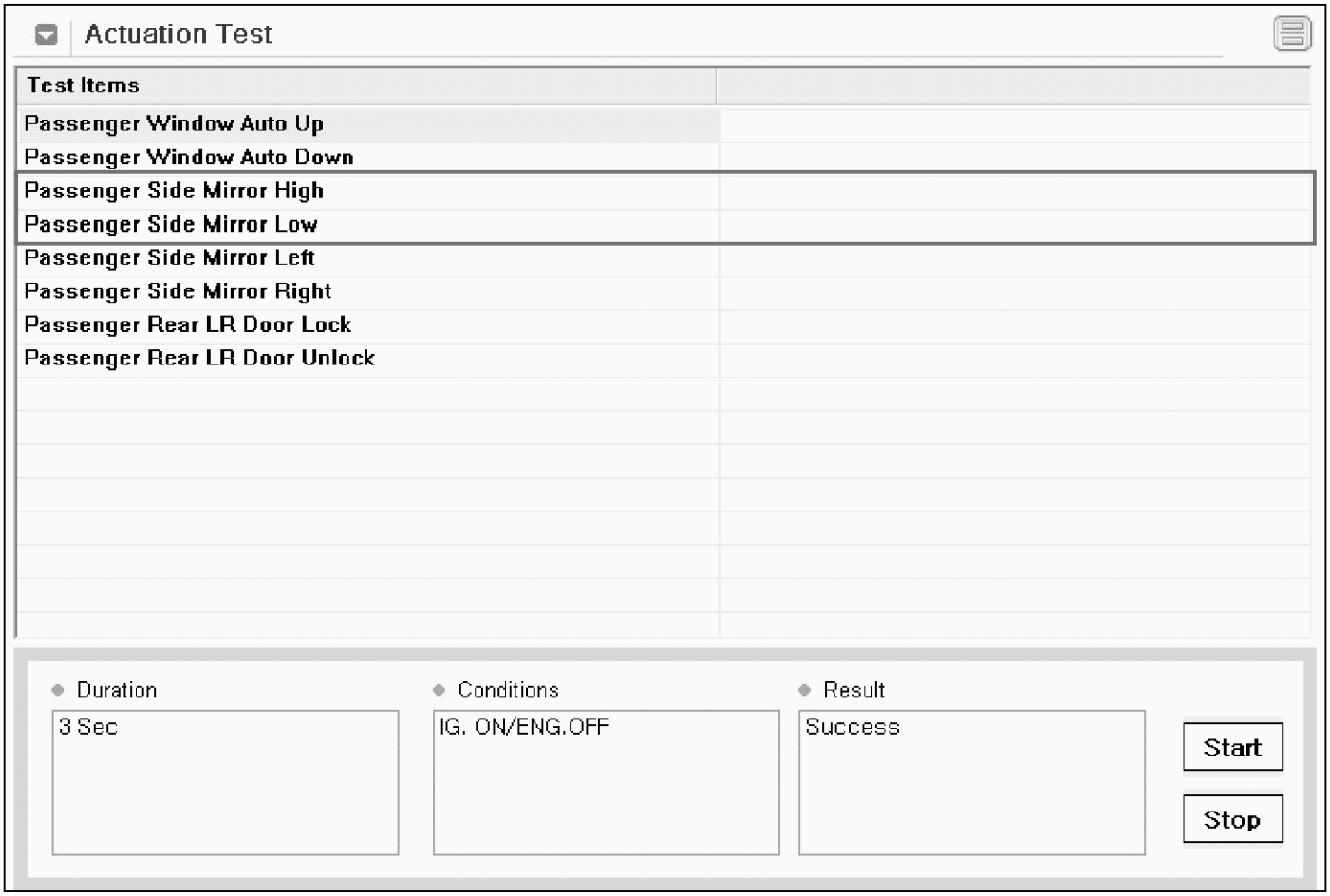


## Component Inspection

### ■ Check mirror motor

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

**Specification :** Turned to pressed direction




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5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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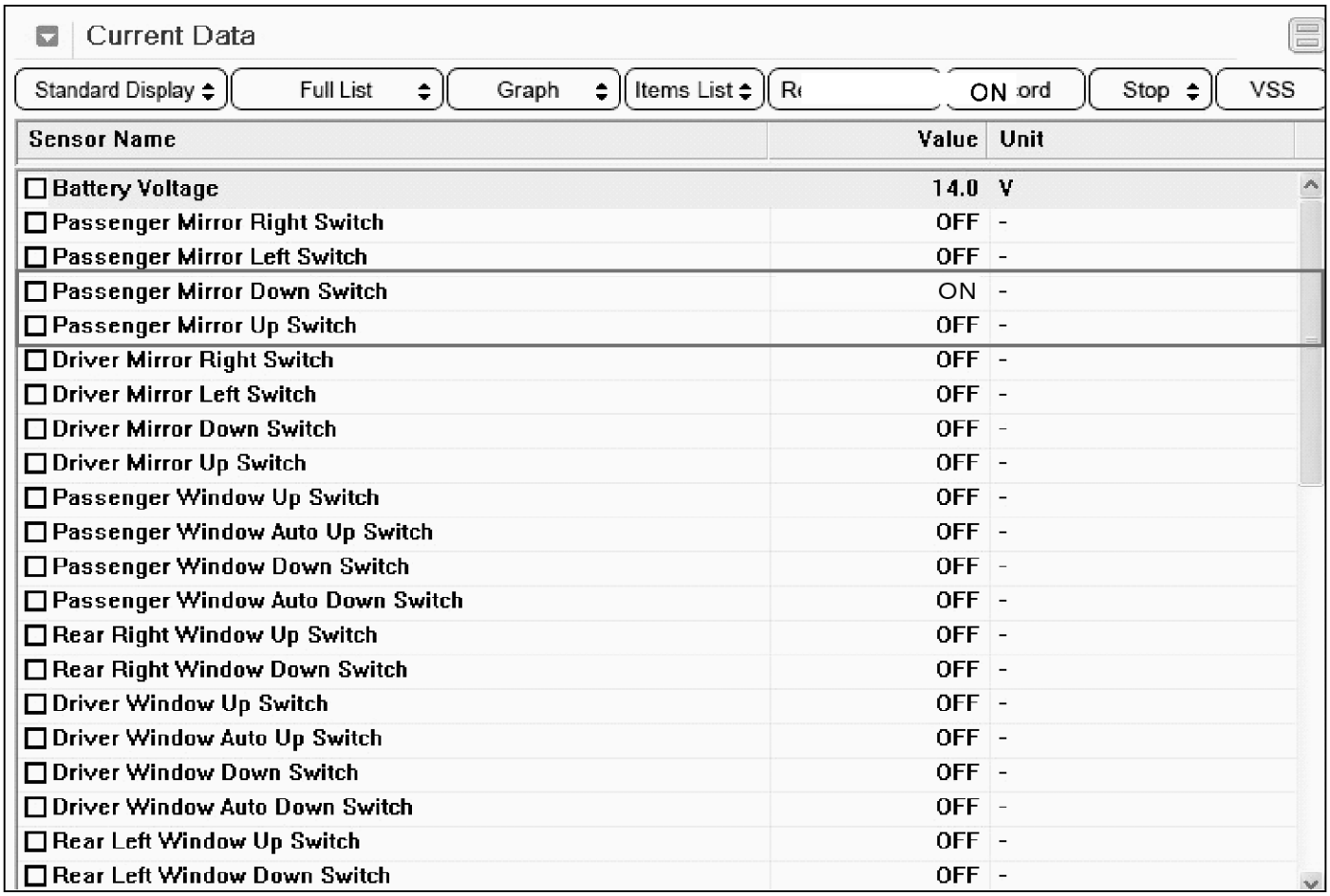
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## ■ Check switch

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

**Specification :** Service data is switched. (ON ↔ OFF)




| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 14.0 | V |
| Passenger Mirror Right Switch | OFF | - |
| Passenger Mirror Left Switch | OFF | - |
| Passenger Mirror Down Switch | ON | - |
| Passenger Mirror Up Switch | OFF | - |
| Driver Mirror Right Switch | OFF | - |
| Driver Mirror Left Switch | OFF | - |
| Driver Mirror Down Switch | OFF | - |
| Driver Mirror Up Switch | OFF | - |
| Passenger Window Up Switch | OFF | - |
| Passenger Window Auto Up Switch | OFF | - |
| Passenger Window Down Switch | OFF | - |
| Passenger Window Auto Down Switch | OFF | - |
| Rear Right Window Up Switch | OFF | - |
| Rear Right Window Down Switch | OFF | - |
| Driver Window Up Switch | OFF | - |
| Driver Window Auto Up Switch | OFF | - |
| Driver Window Down Switch | OFF | - |
| Driver Window Auto Down Switch | OFF | - |
| Rear Left Window Up Switch | OFF | - |
| Rear Left Window Down Switch | OFF | - |

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4. Is the service data normal?

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

**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

Refer to DTC B1912 : Outside Mirror - Right horizontal Motor or Sensor.

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## Signal Circuit Inspection

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

**Specification :** Approx. 1~4 V during motor working

4. 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 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

Refer to DTC B1602 : CAN Error.

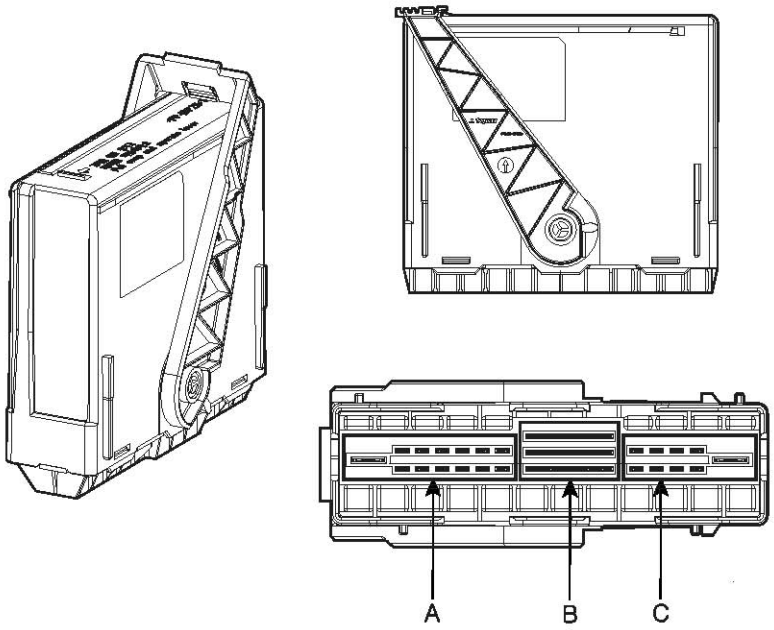
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## Front Area Module(FAM)

### Components




| Pin NO | Connector A<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 | Connector B<br>1 2 3 4 5 6<br>7 8 9 10 11 12<br>13 14 15 16 17 18 | Connector C<br>1 2 3 4 9<br>5 6 7 8 |
|---|---|---|---|
| 1 | Battery 1 | DRL relay | - |
| 2 | H/lamp high L | H/lamp washer relay | Tail lamp L |
| 3 | Front fog R | CAN high | Front fog L |
| 4 | Turn signal L | CAN low | H/lamp high R |
| 5 | Rear turn signal L | Rain sensor output | Power GND 1 |
| 6 | Front turn signal L | Battery main | Power GND 2 |
| 7 | - | H/lamp low relay | Rear fog R |
| 8 | B/alarm horn | Room lamp auto cut relay | Tail lamp R |
| 9 | Rear fog L | - | Battery 2 |
| 10 | Turn signal R | - | |
| 11 | Rear turn signal R | Rain sensor input | |
| 12 | Front turn signal R | - | |
| 13 | Interior lamp | buzzer | |
| 14 | | - | |
| 15 | | - | |
| 16 | | IGN1_FAM | |
| 17 | | DRL option switch | |
| 18 | | Hood switch | |

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## Description

### FAM (Front Area Module)

The FAM includes the functions for the following list :

- Wiper control (Rain sensor communication and transfer Rain sensor request information to Wiper module)
- Lamp control (Tail, Head Lamp Low and High, Front fog, Room Lamp Auto Cut, Rear Fog lamp Control)
- Turn Signal Control
- External Buzzer and Burglar Alarm Horn control
- Input signal sends via CAN for local functions (Hood switch, DRL option)

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## Troubleshooting

### FAM DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1905 | Internal Fault Detected |
| 4 | B1906 | Glass Attachment Fault Detected |
| 5 | B1907 | No Input Signal Present |

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## B1602 CAN Error

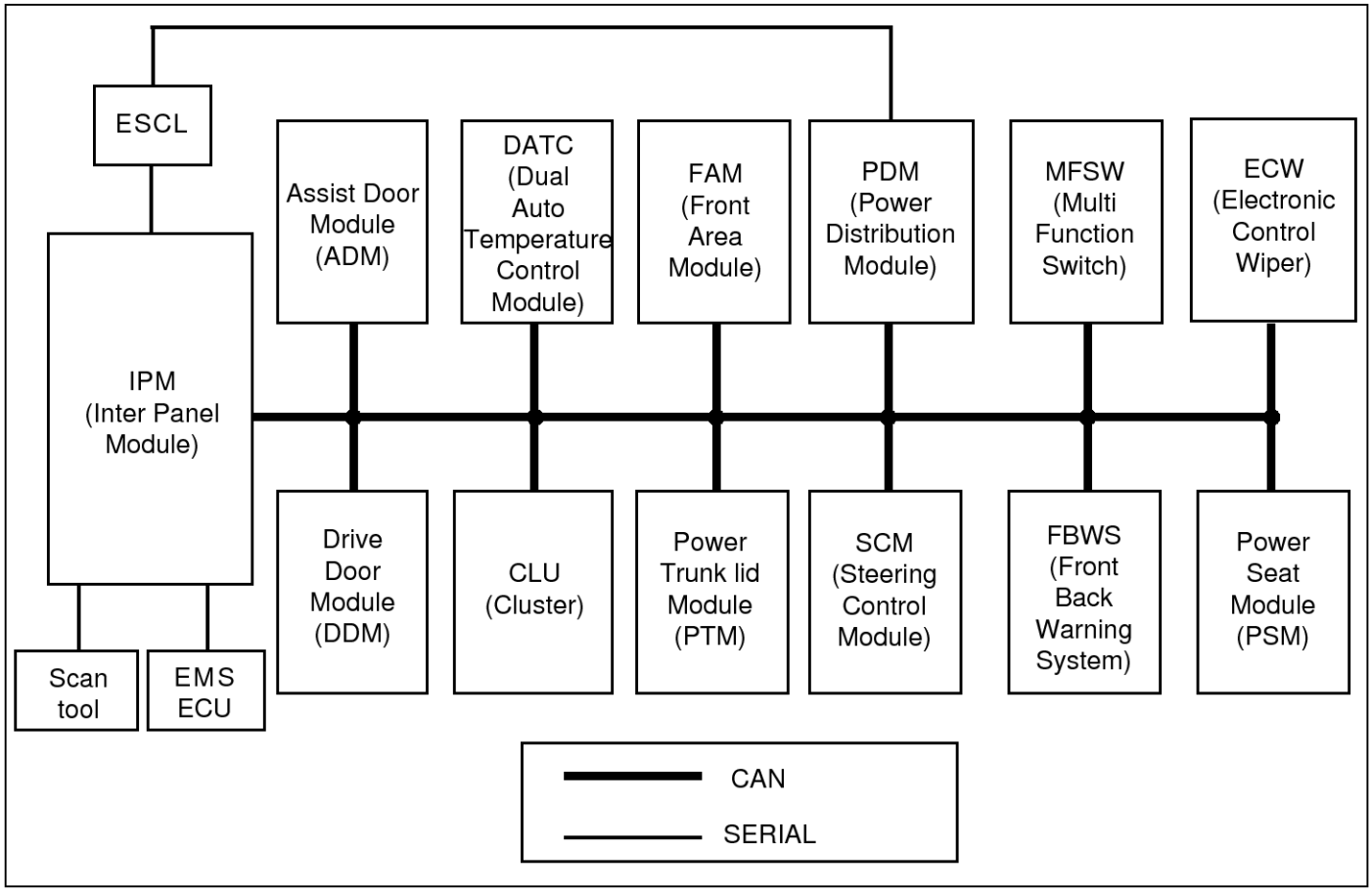
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

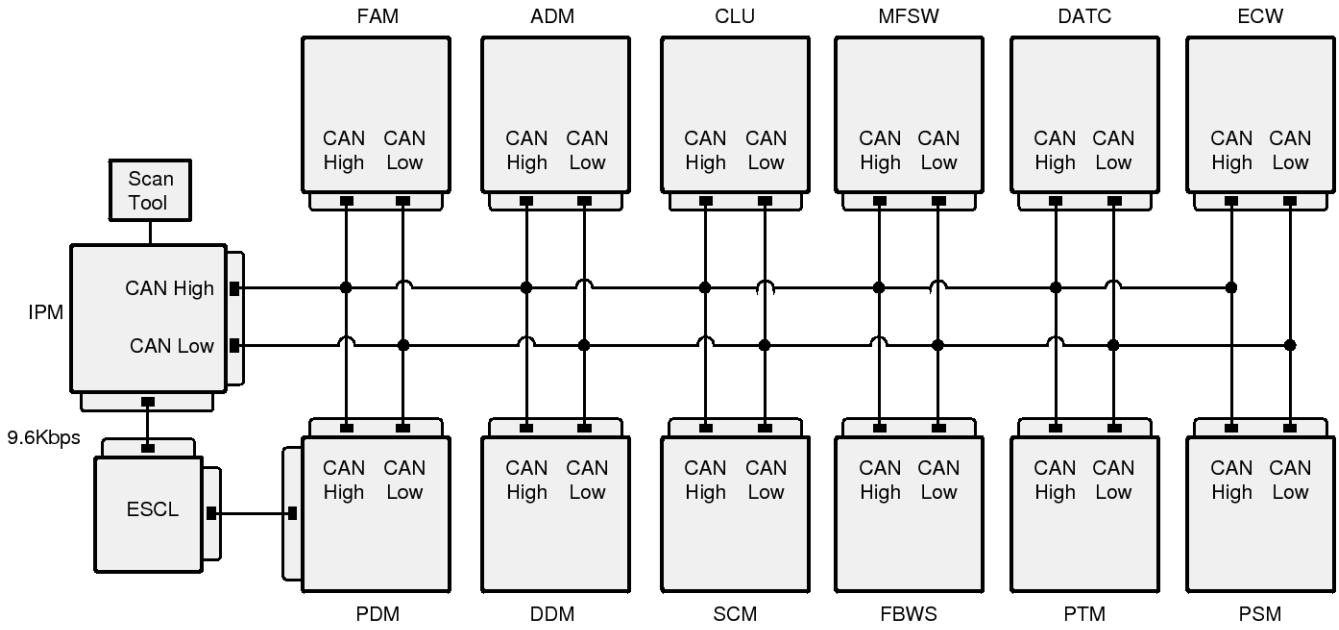
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,FAM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, FAM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

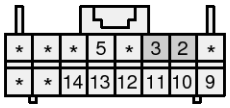



<ECW>



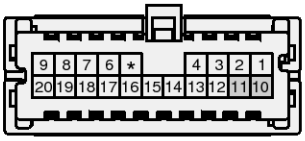
4. Low
5. High

<IPM>



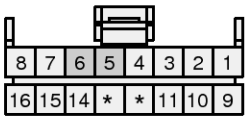
2 . Low
3. High

<PDM>



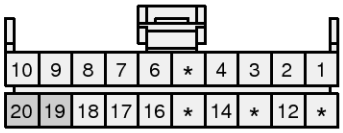
10. Low
11. High

<MFSW>



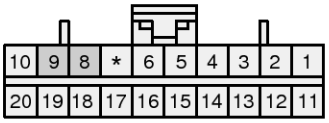
5. High
6. Low

<CLU>



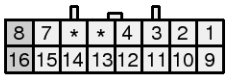
19. Low
20. High

<TILT & TELE>



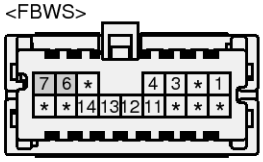
8. High
9. Low

<ADM>



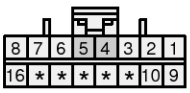
8. High
16. Low

<FBWS>



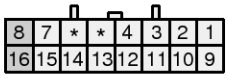
6. High
7. Low

<PSM>



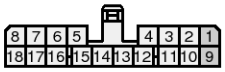
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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**Signal Waveform & Data**

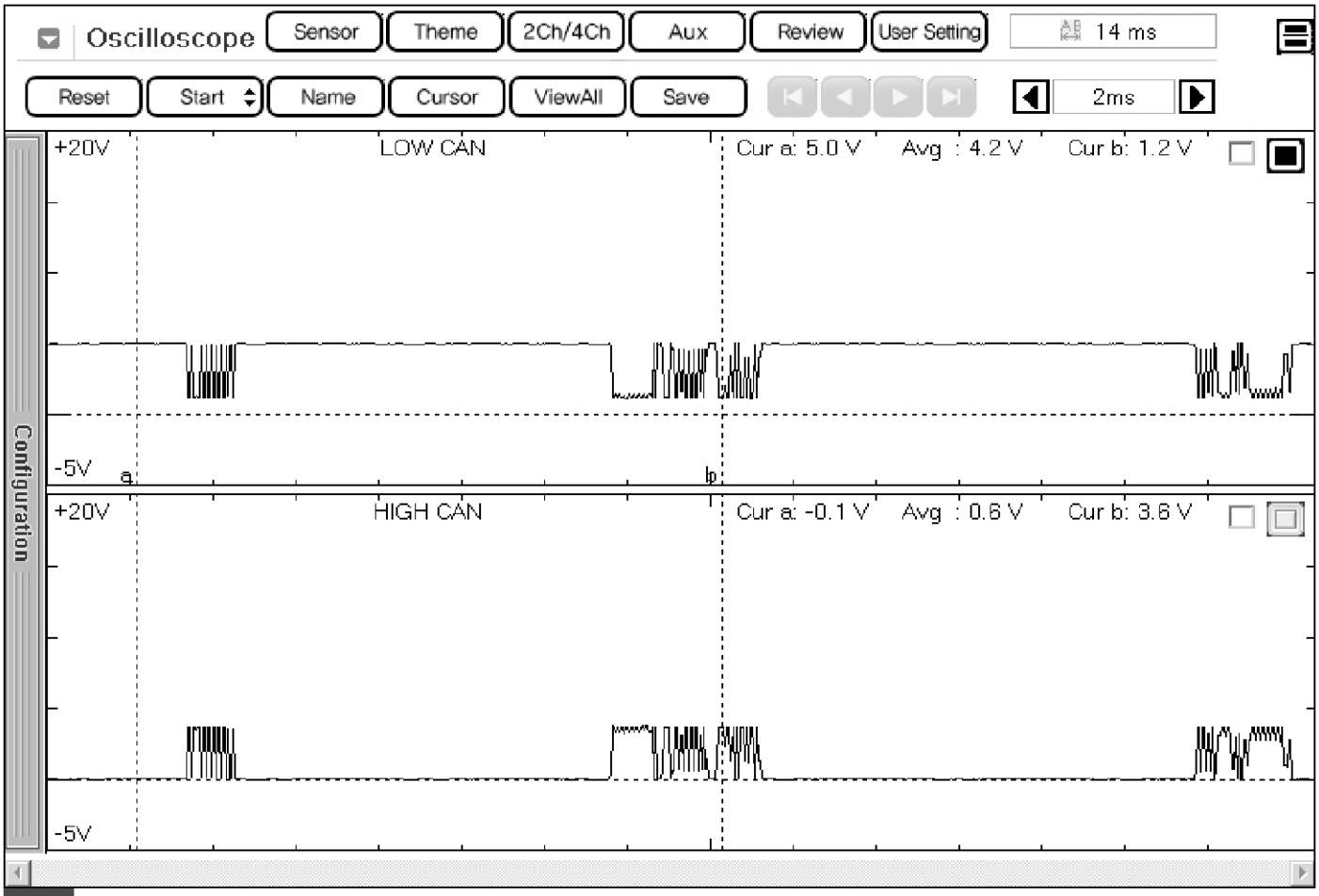



Fig.1

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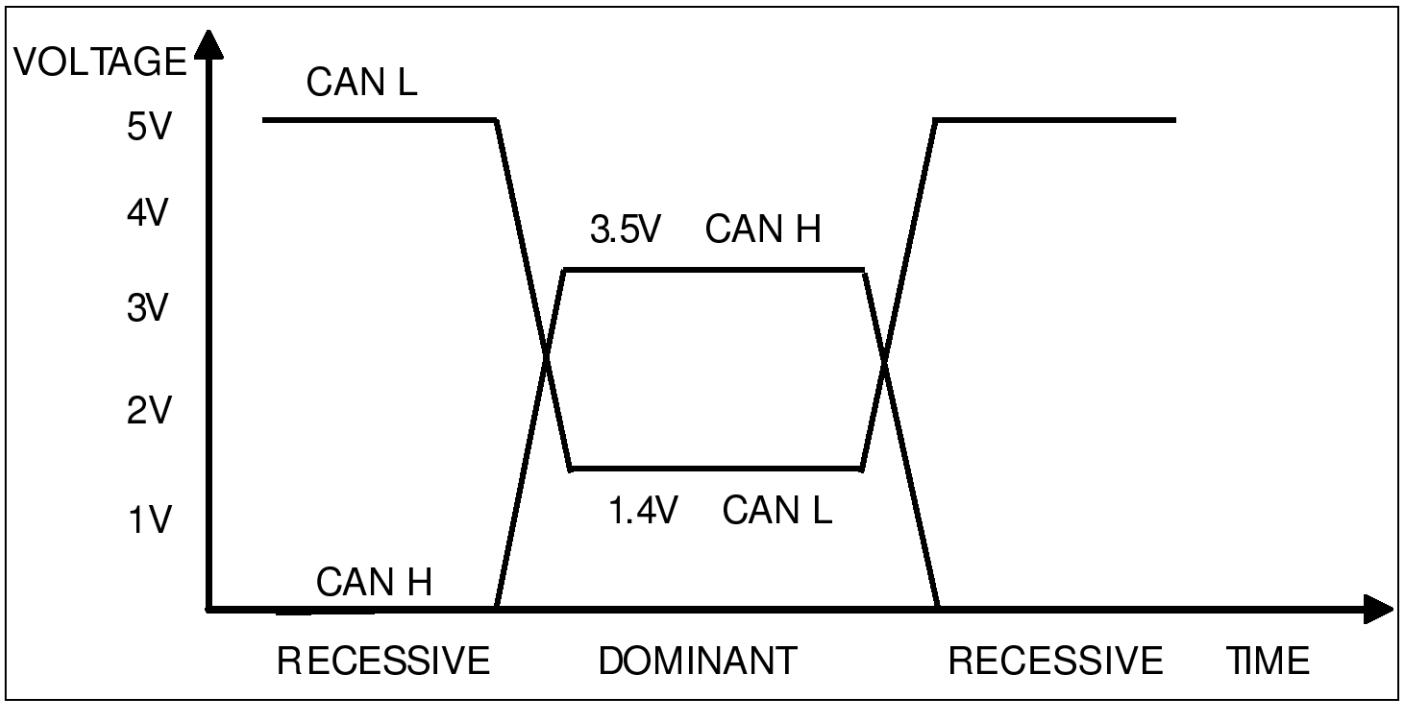



Fig.2

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Fig.1) CAN Low/High Signal Waveform

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

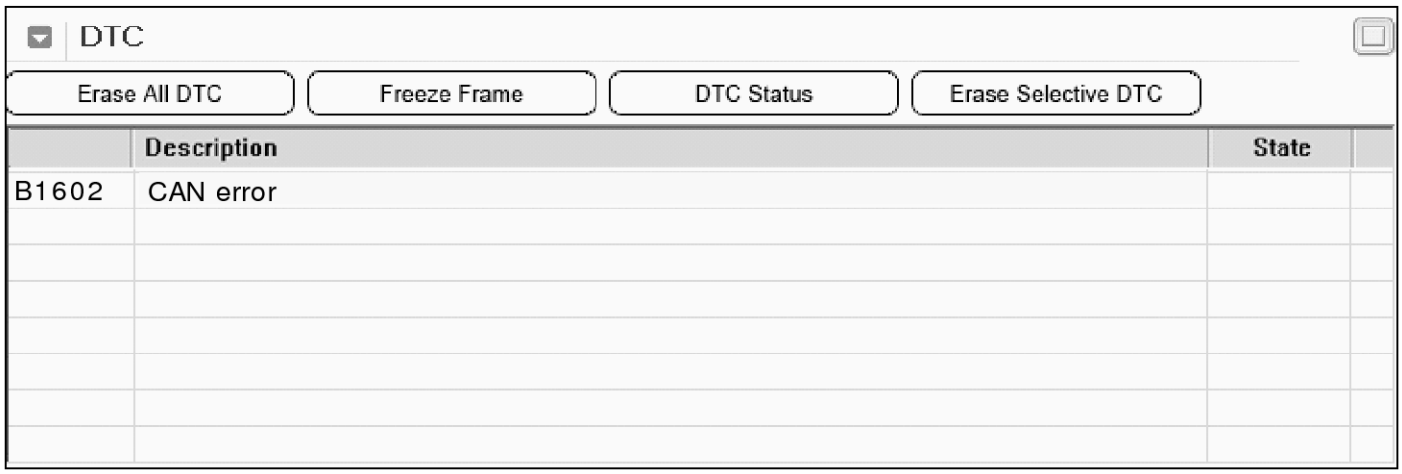
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## Scantool Data Analysis

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).




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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 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 "FAM Signal Circuit Inspection" procedure.

## FAM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FAM CAN High line.

**Specification :** Refer to "Signal Waveform & Data"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FAM CAN Low line.

**Specification :** Refer to "Signal Waveform & Data"

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4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)
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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# B1603 CAN Communication Bus Off

## General Description

Refer to DTC B1602 : CAN Error.

## 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), 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))

Case1: After short between FAM CAN Low Line and High 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,FAM are not Sleep condition<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, FAM 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

Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

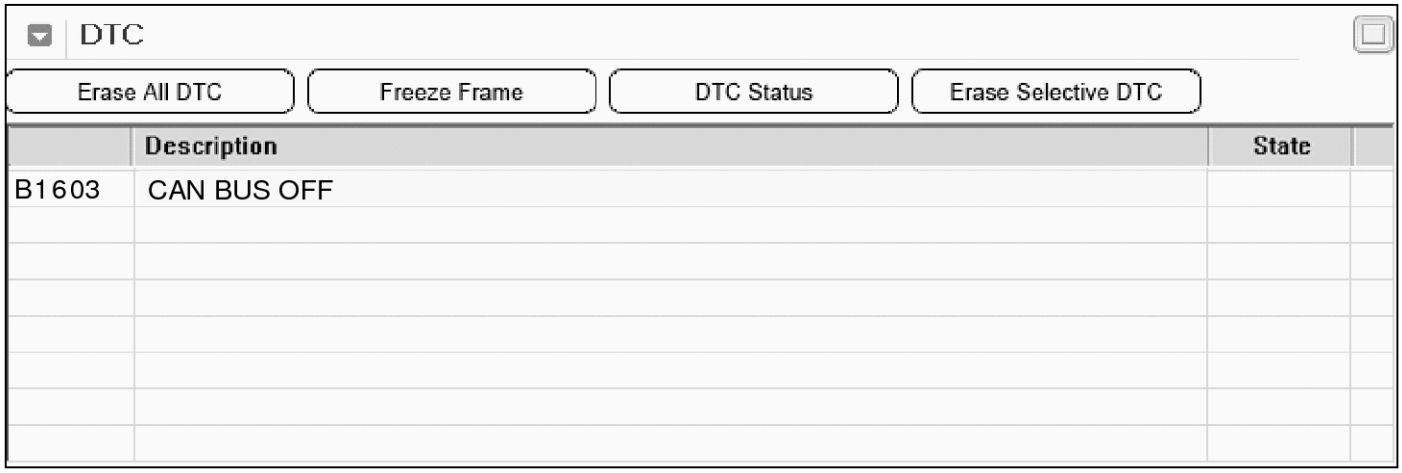
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## Scantool Data Analysis

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).




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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 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

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), 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)
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

Refer to DTC B1602 : CAN Error.

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## B1905 Rain Sensor Fault 1

### General Description

FAM controls the low/high wiper relay according to rain sensor signal when the wiper auto switch is turned to ON under IG ON.

**NOTICE**

*The rain sensor is mounted on the interior side of the front windshield glass behind the rearview mirror. If driver turns the wiper switch to AUTO, this signal is inputted to FAM by LIN communication.*

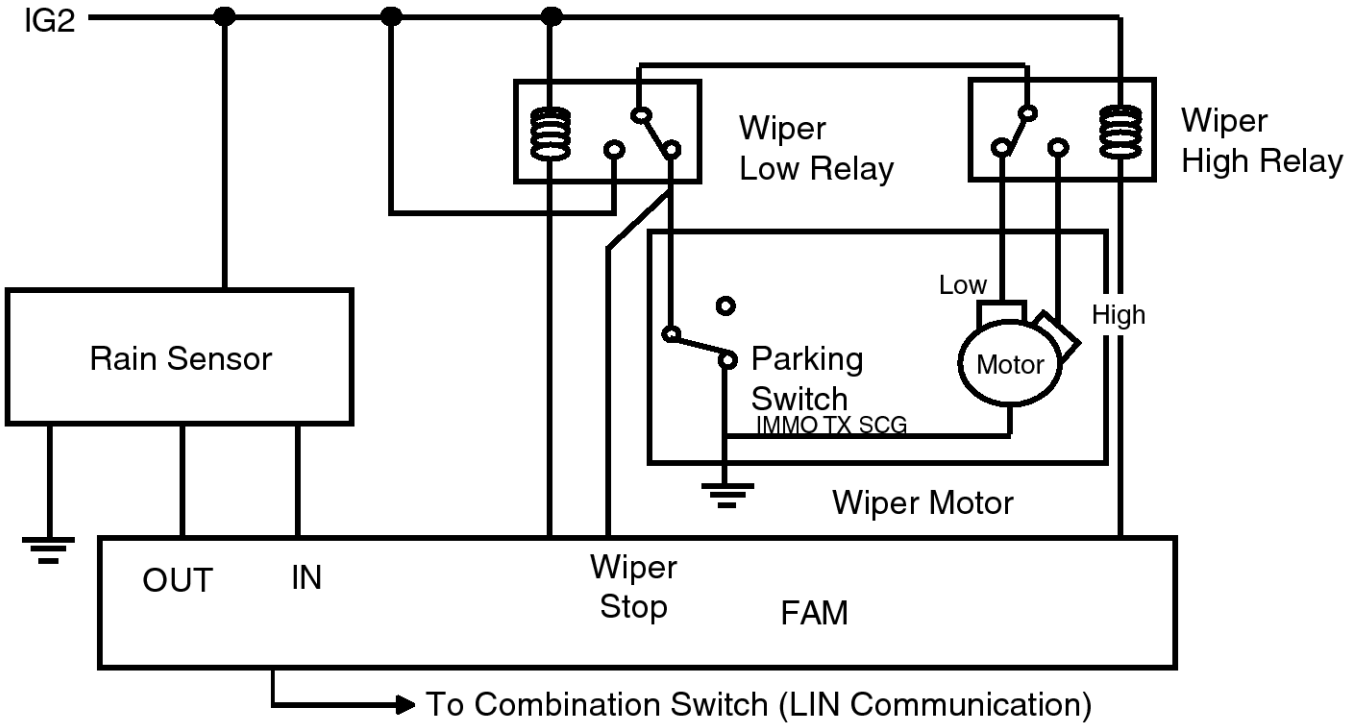
*FAM transmits 5 steps of signals(Slow ↔ Fast) from the wiper auto switch to the rain sensor.*

*At the slowest step among the INT switch, the rain sensor becomes the most insensitive status.*

*At the fastest step among the INT switch, the rain sensor becomes the most sensitive status to measure the amount of rain.*

*So, the sensitiviy of the rain sensor depends on the steps of the INT switch.*

*The rain sensor transmits the desired speed of a wiper by duty signal to FAM.*




[Schematic diagram of rain sensor and FAM]

SBHBE9K16L

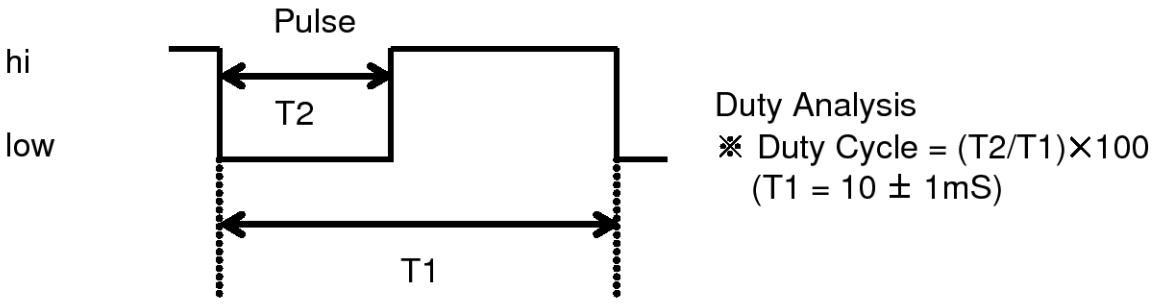
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**[FAM output signal (FAM → Rain sensor)]**

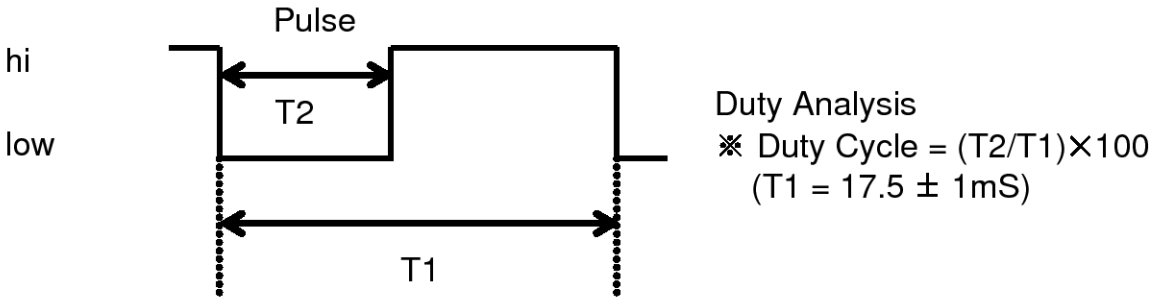
FAM transmits sensitivity step signal from INT switch to t-he rain sensor by pulse signal.




SBHBE9K17L

**[FAM input signal (Rain sensor → FAM)]**

The Rain sensor transmits moisture status and the desir-ed wiper speed to FAM by pulse signal.




SBHBE9K18L

* The Rain sensor has various outputs according to each modes as below. (Duty cycle changes)

**Rain sensor output signal (Rain sensor → FAM)**

| NO | MODE | Duty Cycle |
|---|---|---|
| 1 | OFF | 9.5% +/-3% |
| 2 | Error 1 detection | 23.8% +/-3% |
| 3 | Error 2 detection | 38.0% +/-3% |
| 4 | Error 3 detection | 52.4% +/-3% |
| 5 | Rain detection | 66.7% +/-3% |
| 6 | Low speed demand | 81.0% +/-3% |
| 7 | Fast speed demand | 95.2% +/-3% |
| Every signal cycle is 15 mSec. | | |

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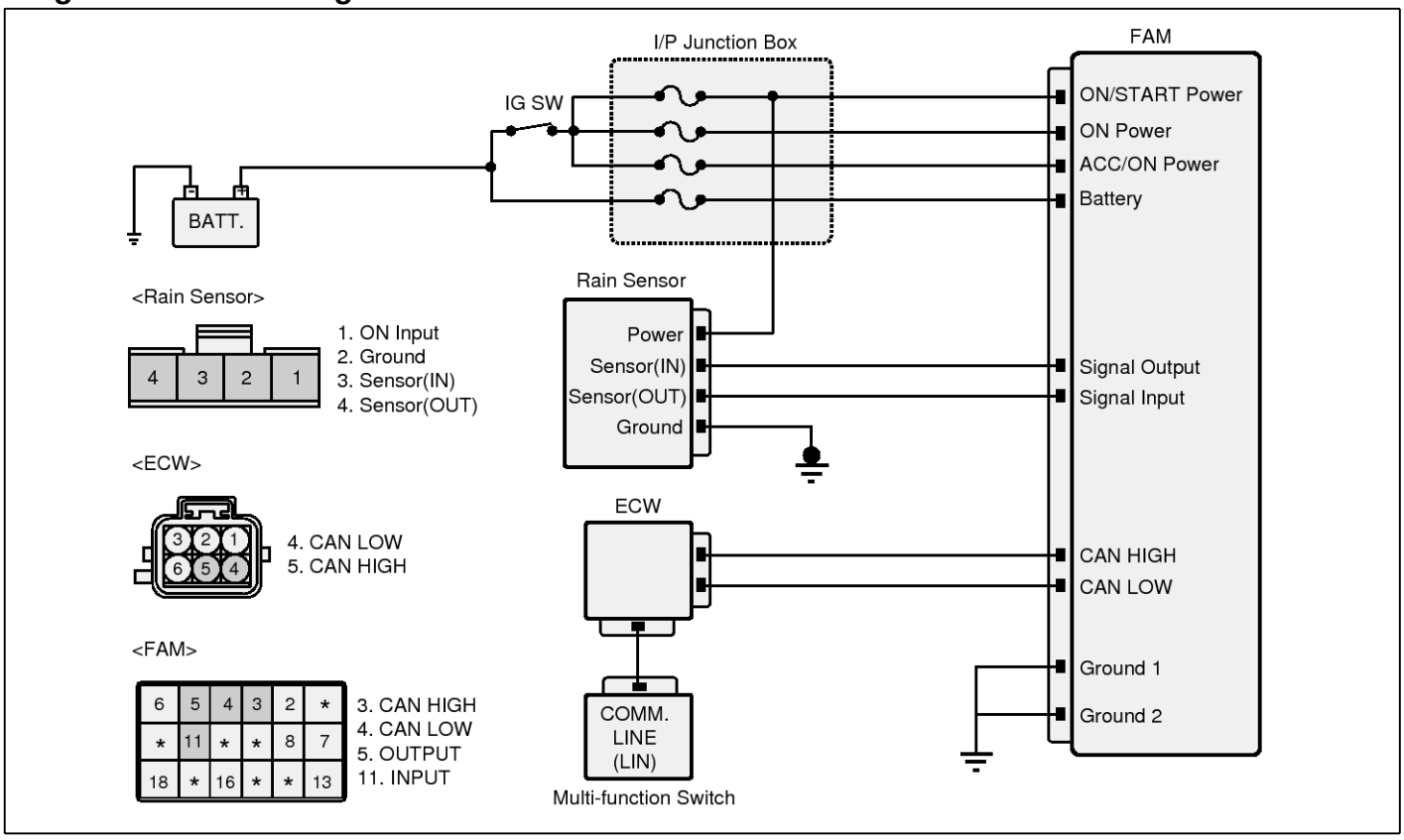
## DTC Description

FAM outputs this code when it detects internal error of r-ain sensor after wiper switch has been turned to AUTO u-nder IG "ON" or IG "ON" & ENG "ON".

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Communication state check from the rain sensor to FA-M<br>• Error monitoring by duty value | • Faulty rain sensor |
| Enable Conditions | • IG "ON" or IG "ON" & ENG "ON"<br>• Wiper switch position is AUTO | |
| Threshold Value | • FAM receives internal error data from the rain sensor. | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed. | |

## Diagnostic Circuit Diagram



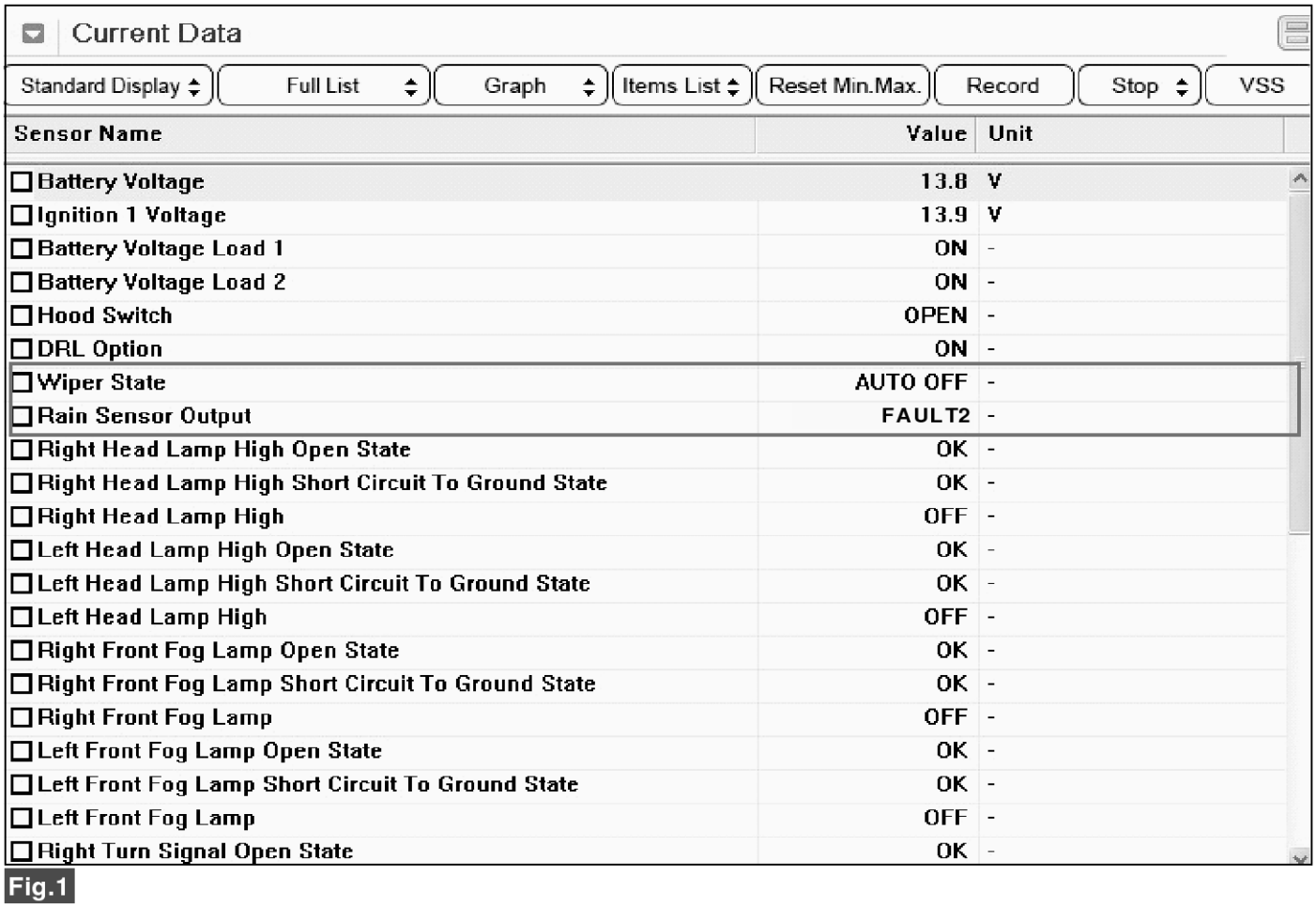

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## Signal Waveform & Data




| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 13.8 | V |
| Ignition 1 Voltage | 13.9 | V |
| Battery Voltage Load 1 | ON | - |
| Battery Voltage Load 2 | ON | - |
| Hood Switch | OPEN | - |
| DRL Option | ON | - |
| Wiper State | AUTO OFF | - |
| Rain Sensor Output | FAULT2 | - |
| Right Head Lamp High Open State | OK | - |
| Right Head Lamp High Short Circuit To Ground State | OK | - |
| Right Head Lamp High | OFF | - |
| Left Head Lamp High Open State | OK | - |
| Left Head Lamp High Short Circuit To Ground State | OK | - |
| Left Head Lamp High | OFF | - |
| Right Front Fog Lamp Open State | OK | - |
| Right Front Fog Lamp Short Circuit To Ground State | OK | - |
| Right Front Fog Lamp | OFF | - |
| Left Front Fog Lamp Open State | OK | - |
| Left Front Fog Lamp Short Circuit To Ground State | OK | - |
| Left Front Fog Lamp | OFF | - |
| Right Turn Signal Open State | OK | - |

Fig.1

SBHBE9K19L

Fig.1) "Wiper State" & "Rain Sensor Output" (With wiper switch "AUTO" & engine running)

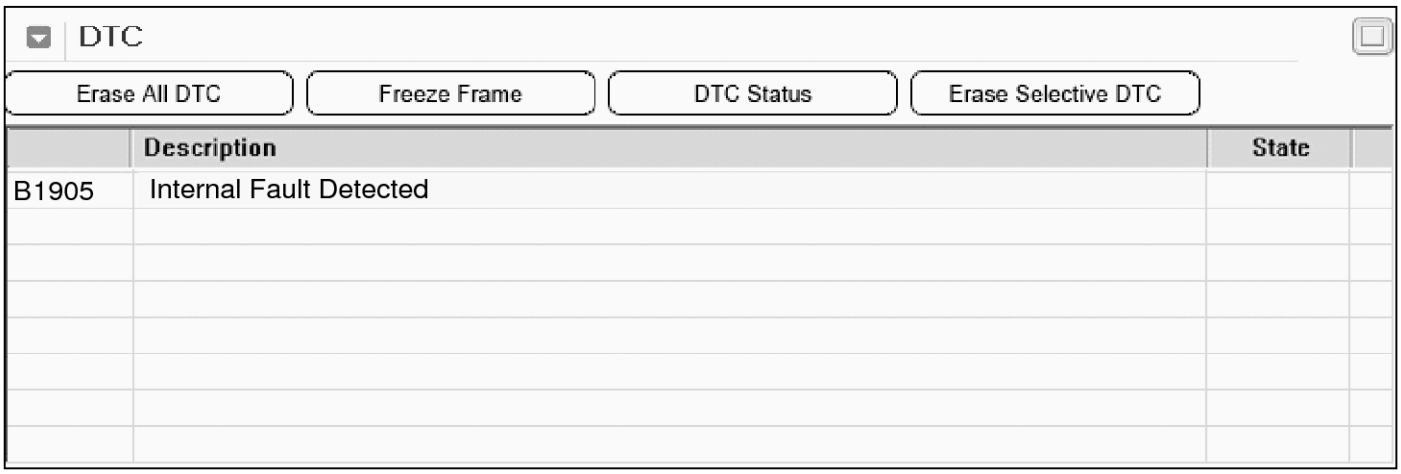
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## Scantool Data Analysis

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).




SBHBE9K20L

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

### ■ Check the rain sensor

1. IG "ON" and engine "OFF".
2. Connect FAM connector.
3. Connect multi-function switch connector.

**Specification :** A wiper works normal under AUTO mode .

4. Do wipers work 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** ▶ 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.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1906 Rain Sensor Fault 2

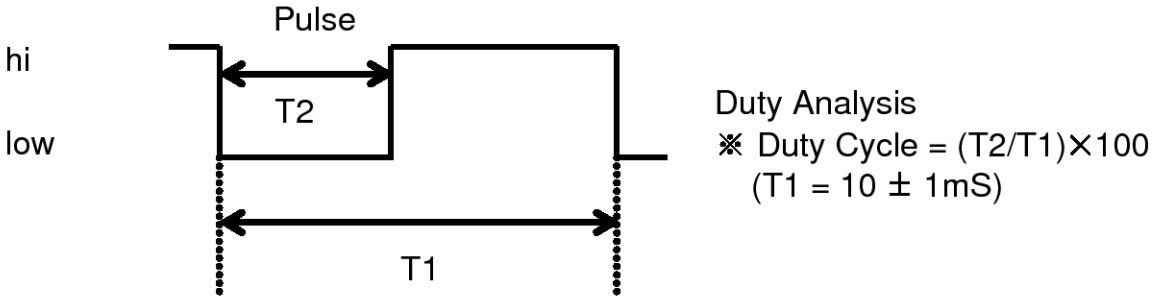
### General Description

FAM controls the low/high wiper relay according to rain sensor signal when the wiper auto switch is turned to ON under IG ON.

As the wiper INT switch is set at AUTO mode, combination switch transmits value of INT step to ECW by LIN communication. And, ECW communicates with FAM by CAN.

**[FAM output signal (FAM → Rain sensor)]**

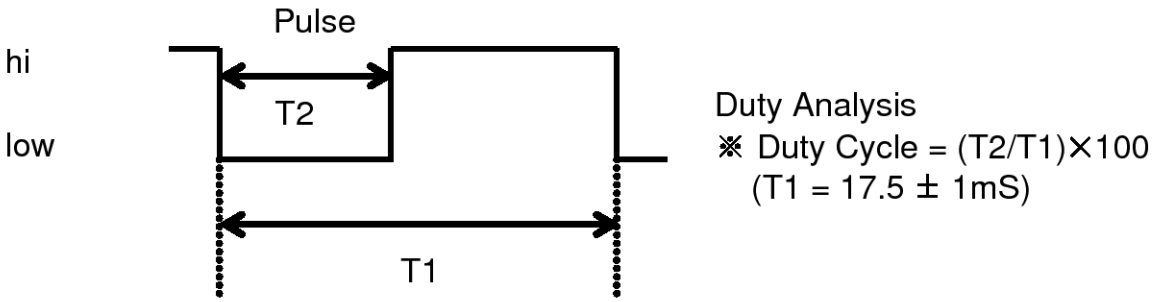
FAM transmits sensitivity step signal from INT switch to the rain sensor by pulse signal.




SBHBE9K17L

**[FAM input signal (Rain sensor → FAM)]**

The Rain sensor transmits moisture status and the desired wiper speed to FAM by pulse signal.




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* The Rain sensor has various outputs according to each modes as below. (Duty cycle changes)

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**Rain sensor output signal (Rain sensor → FAM)**

| NO | MODE | Duty Cycle |
|---|---|---|
| 1 | OFF | 9.5% +/-3% |
| 2 | Error 1 detection | 23.8% +/-3% |
| 3 | Error 2 detection | 38.0% +/-3% |
| 4 | Error 3 detection | 52.4% +/-3% |
| 5 | Rain detection | 66.7% +/-3% |
| 6 | Low speed demand | 81.0% +/-3% |
| 7 | Fast speed demand | 95.2% +/-3% |
| Every signal cycle is 15 mSec. | | |

## DTC Description

The rain sensor is attached to the front windshield glass.
This code is outputted when the rain sensor is attached badly or detached from the front windshield glass.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Communication state check from the rain sensor to FA-M<br>• Error monitoring by duty value | • Bad attachment of the rain sensor<br>• Detachment of the rain sensor |
| Enable Conditions | • IG "ON" or IG "ON" & ENG "ON"<br>• Wiper switch position is AUTO | |
| Threshold Value | • When FAM receives 'Bad attachment' data from the rain sensor.<br>• The rain sensor monitors attachment/detachment state and transmits the information. | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed. | |

## Diagnostic Circuit Diagram

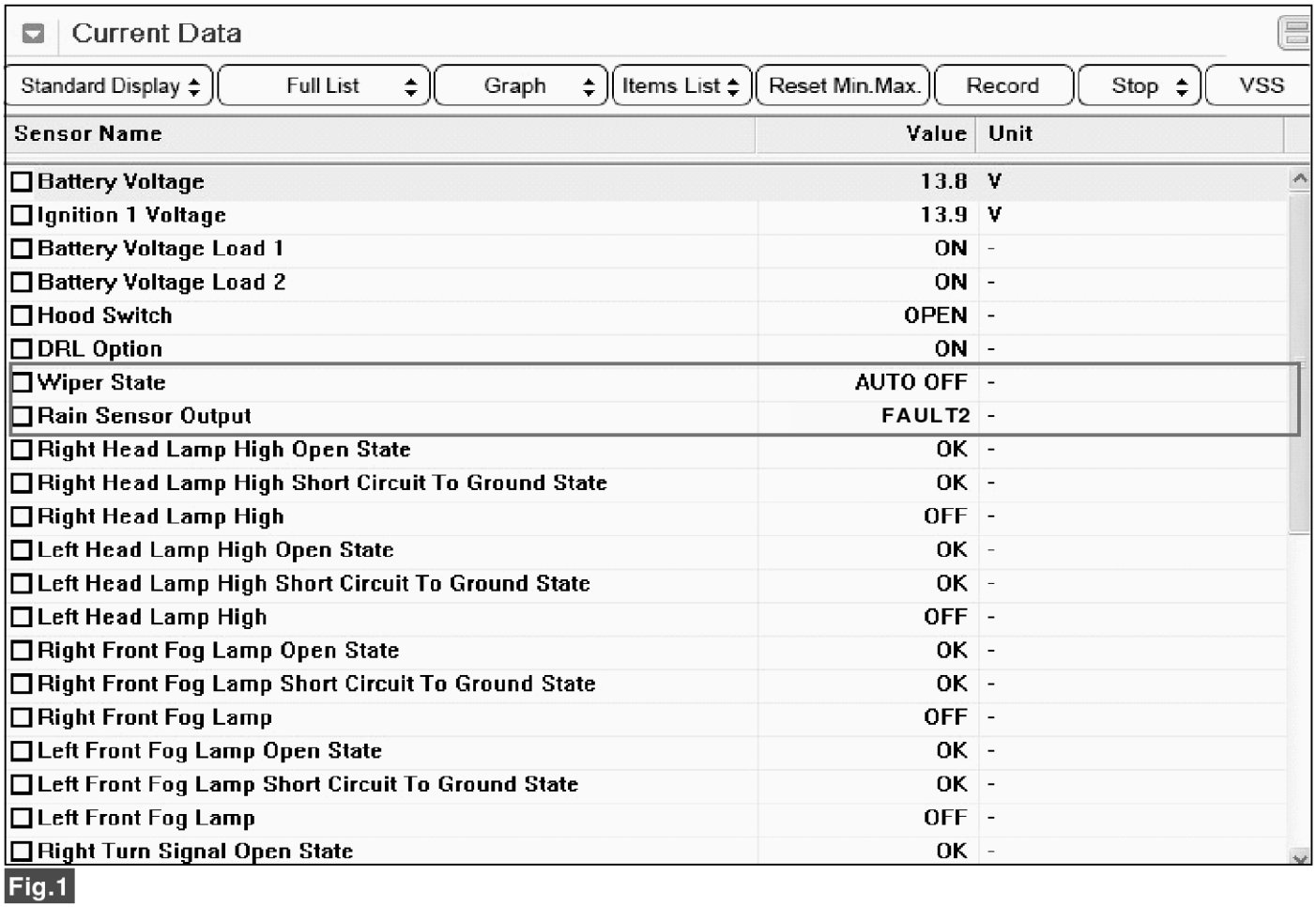
Refer to DTC B1905 : Rain Sensor Fault 1.

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## Signal Waveform & Data




| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 13.8 | V |
| Ignition 1 Voltage | 13.9 | V |
| Battery Voltage Load 1 | ON | - |
| Battery Voltage Load 2 | ON | - |
| Hood Switch | OPEN | - |
| DRL Option | ON | - |
| Wiper State | AUTO OFF | - |
| Rain Sensor Output | FAULT2 | - |
| Right Head Lamp High Open State | OK | - |
| Right Head Lamp High Short Circuit To Ground State | OK | - |
| Right Head Lamp High | OFF | - |
| Left Head Lamp High Open State | OK | - |
| Left Head Lamp High Short Circuit To Ground State | OK | - |
| Left Head Lamp High | OFF | - |
| Right Front Fog Lamp Open State | OK | - |
| Right Front Fog Lamp Short Circuit To Ground State | OK | - |
| Right Front Fog Lamp | OFF | - |
| Left Front Fog Lamp Open State | OK | - |
| Left Front Fog Lamp Short Circuit To Ground State | OK | - |
| Left Front Fog Lamp | OFF | - |
| Right Turn Signal Open State | OK | - |

Fig.1

SBHBE9K19L

Fig.1) "Wiper State" & "Rain Sensor Output" (With wiper switch "AUTO" & engine running)

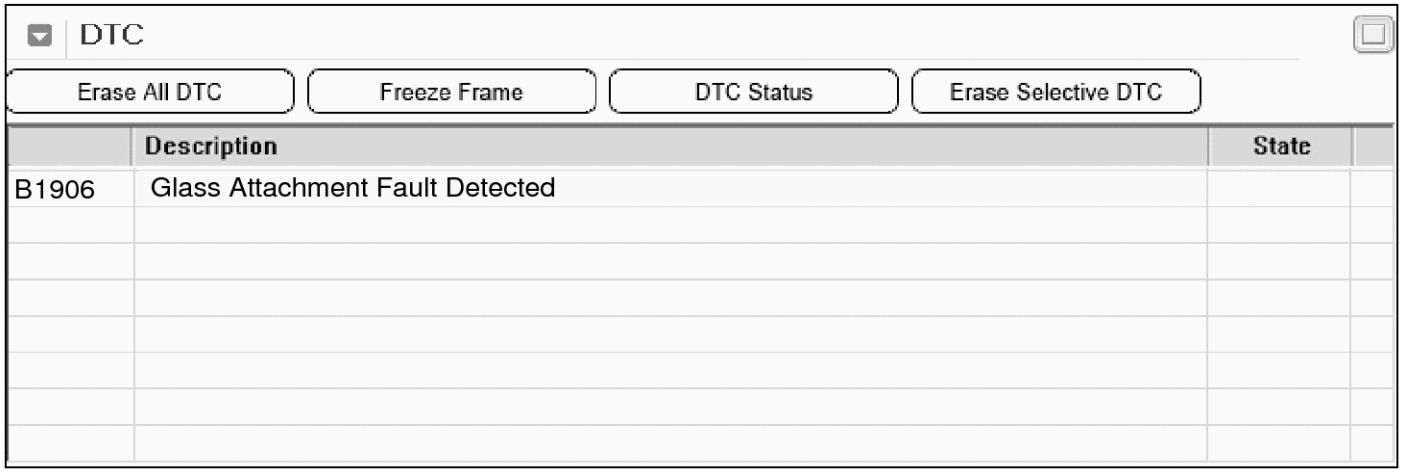
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## Scantool Data Analysis

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).




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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 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

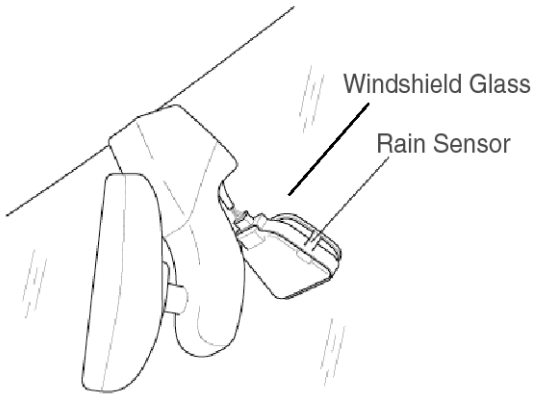
Refer to DTC B1905 : Rain Sensor Fault 1.

## Component Inspection

### ■ Check the rain sensor

1. IG "ON" and engine "OFF".
2. Connect FAM connector.
3. Connect multi-function switch connector.
4. Check whether the rain sensor is mounted on the windshield normally.

**Specification :** A wiper works normal under AUTO mode .




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5. Do wipers work normal and Is the rain sensor mounted on the windshield in good?

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

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1907 Rain Sensor Fault 3

### General Description

Refer to DTC B1906 : Rain Sensor Fault 2.

### DTC Description

FAM outputs this code when FAM can't receive data from the rain sensor.

1. In case of shaking the rain sensor after detaching from windshield.
2. In case each circuits of input and output are shorted to ground.
3. In case each circuits of input and output are shorted to power.
4. In case each circuits of input and output are open.
5. In case the rain sensor connector is disconnected.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Communication state check from the rain sensor to FAM<br>• Malfunction monitoring by signal input or not | • Rain sensor input/output circuits short to power, short to ground or open |
| Enable Conditions | • IG "ON" or IG "ON" & ENG "ON"<br>• Wiper switch position is AUTO | |
| Threshold Value | • There is no signal from the rain sensor to FAM. | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed. | |

### Diagnostic Circuit Diagram

Refer to DTC B1905 : Rain Sensor Fault 1.

### Signal Waveform & Data

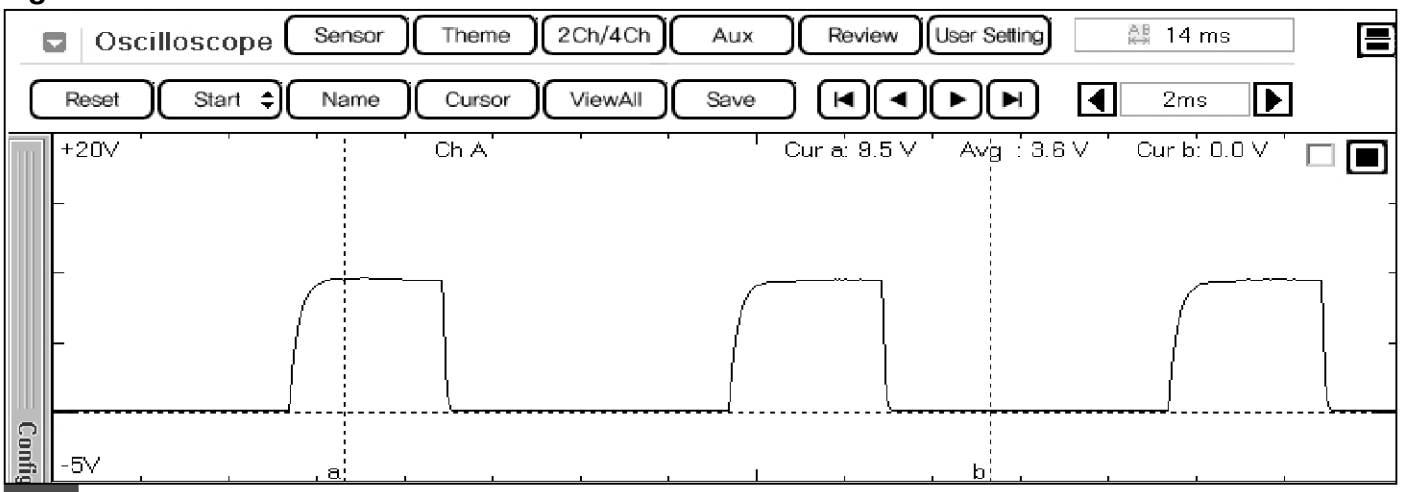



Fig.1

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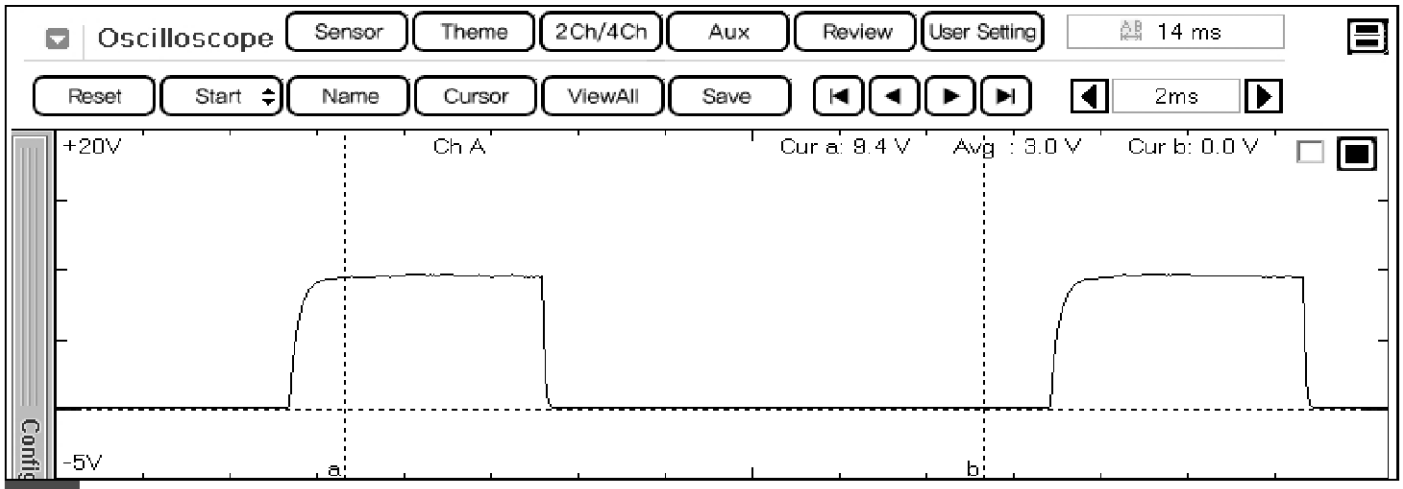



Fig.2

SBHBE9K24L

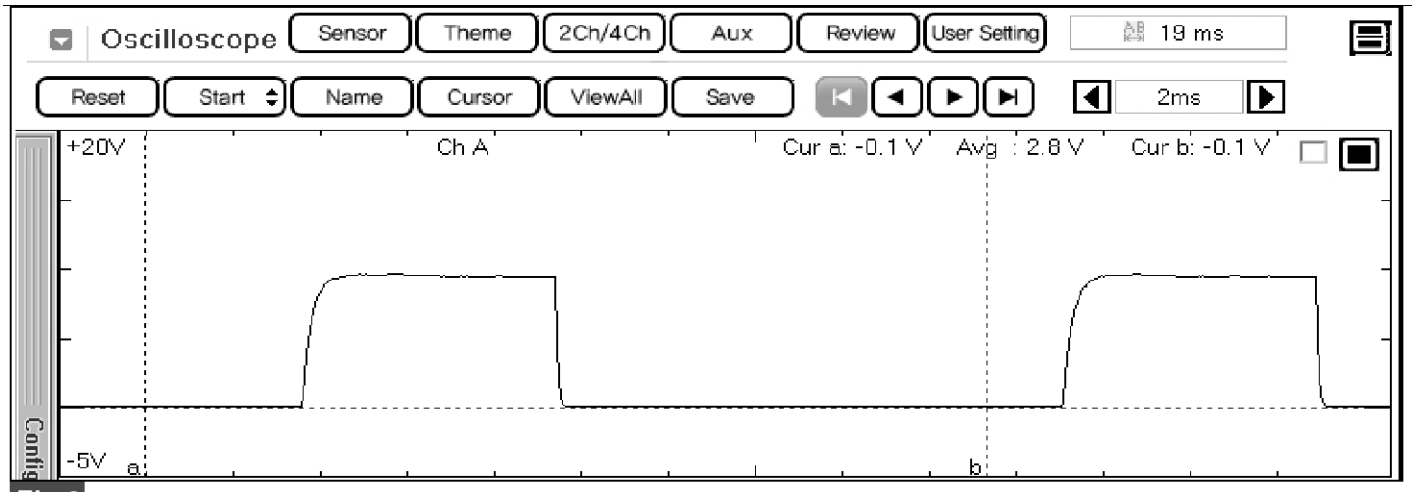



Fig.3

SBHBE9K25L

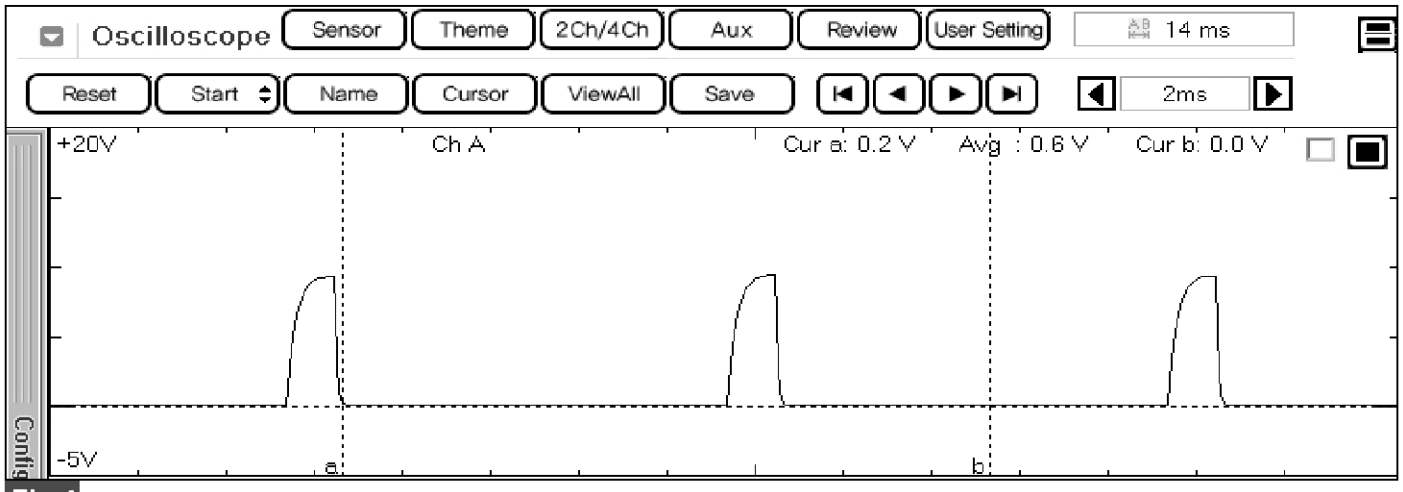



Fig.4

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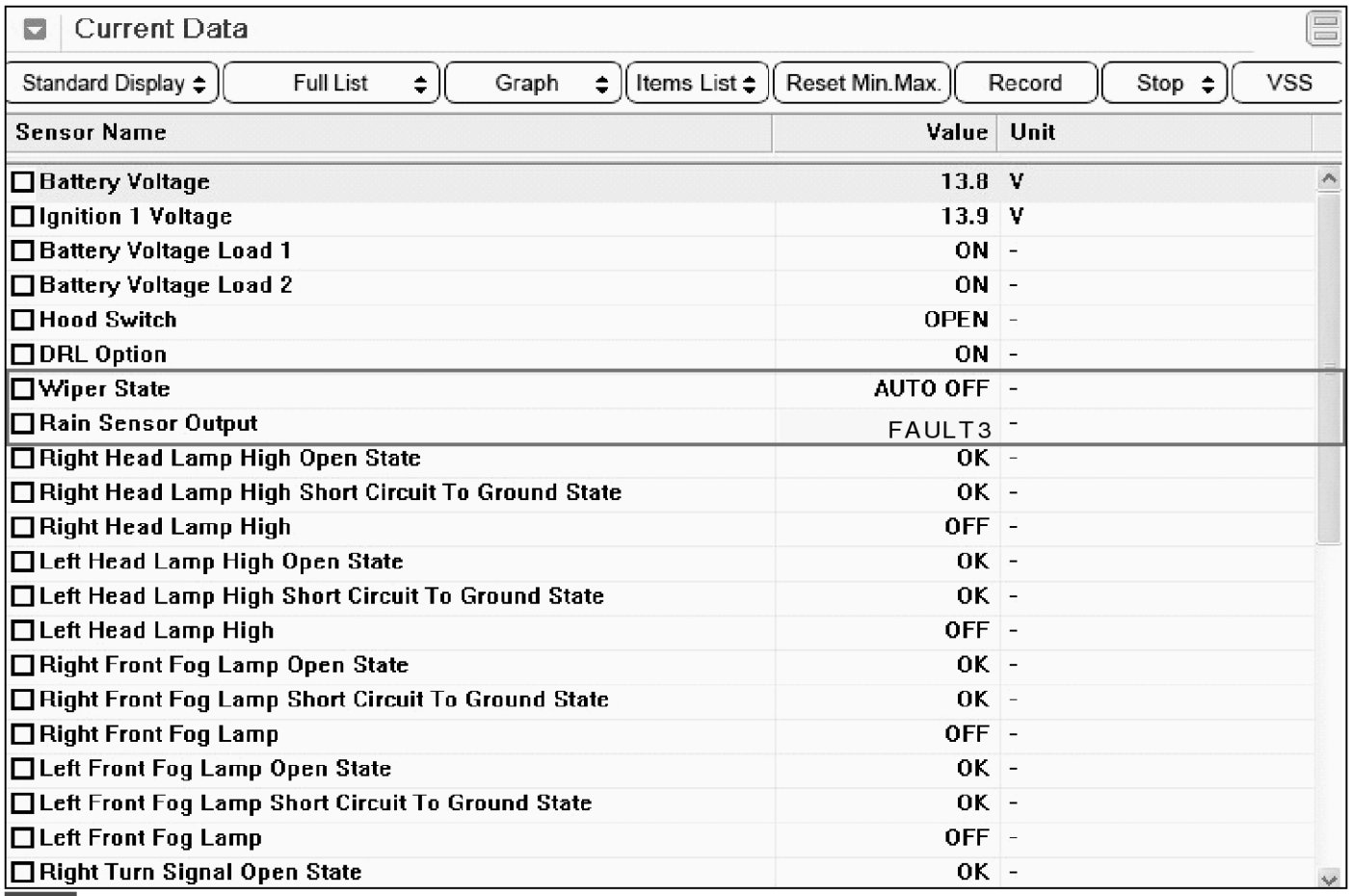



Fig.5

SBHBE9K27L

Fig.1) Signal waveform at Wiper (INT) Switch "Auto Fast" -Rain Sensor output Signal.

Fig.2) Signal waveform at Wiper (INT) Switch "Auto Fast" -Rain Sensor Input Signal.

Fig.3) Signal waveform at Wiper (INT) Switch "Auto low"-Rain Sensor output Signal.

Fig.4) Signal waveform at Wiper (INT) Switch "Auto low"-Rain Sensor Input Signal.

Fig.5) "Wiper state" & "Rain sensor" with Wiper (INT) Switch "AUTO" and idle.

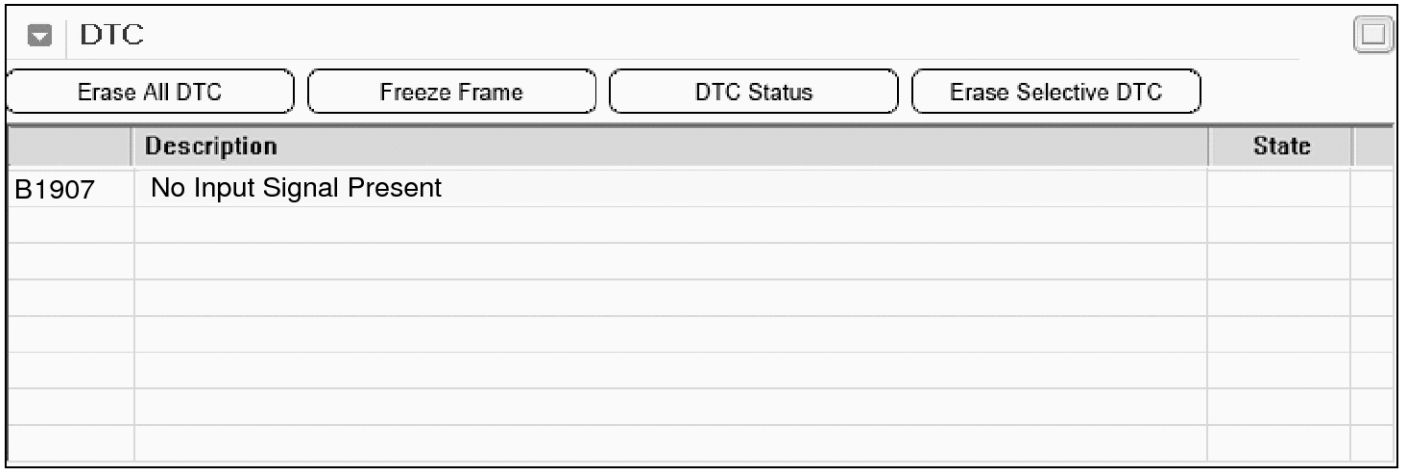
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## Scantool Data Analysis

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).




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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 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 "Signal Circuit Inspection" procedure.

## Signal Circuit Inspection

### ■ Check FAM Input Signal (Rain sensor → FAM)

1. IG KEY "ON" & "ENG "ON"
2. Turn the wiper switch to "AUTO".
3. Select "Oscilloscope" mode.
4. Connect prove A to signal terminal.
5. Check signal waveform on FAM signal input circuit ( Rain sensor → FAM).

**Specification :** Refer to "Signal Waveform & Data"

6. 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.

**NO** ▶ Go to next procedure.

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### ■ Check signal circuit open

1. IG KEY "OFF"
2. Disconnect FAM connector.
3. Disconnect the rain sensor connector.
4. Measure the resistance between both ends of signal circuit (Rain sensor → FAM).

**Specification :** Approx. 0Ω

5. Is the measured value within specification?

**YES** ▶ Check whether short to ground or short to power and 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** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## Steering Column Module(SCM)

### Troubleshooting

#### SCM DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1959 | Tilt Position Sensor Error |
| 4 | B1960 | Tele Position Sensor Error |

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## B1602 CAN Error

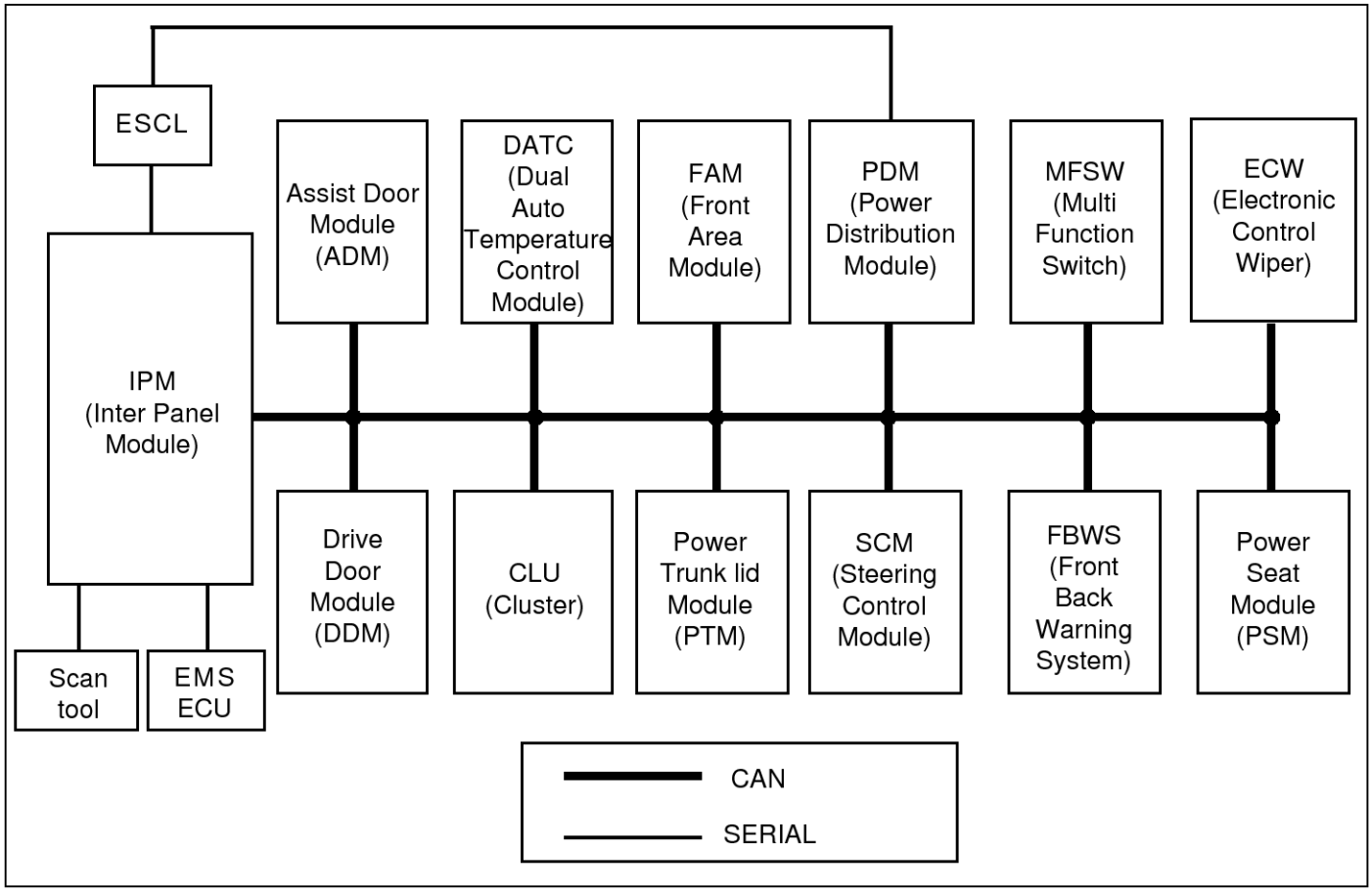
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

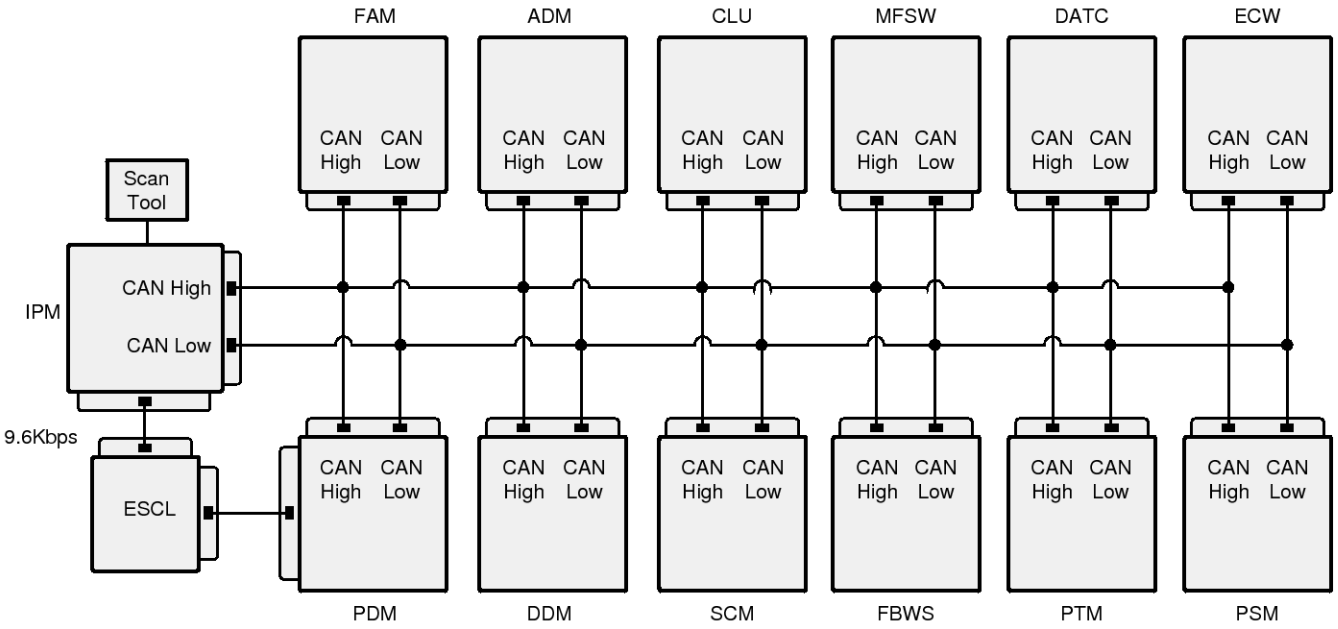
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM, SCM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, SCM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

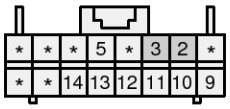



<ECW>



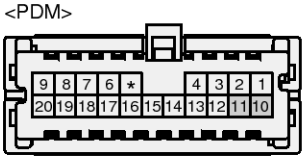
4. Low
5. High

<IPM>



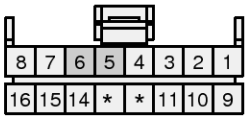
2 . Low
3. High

<PDM>



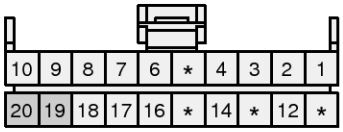
10. Low
11. High

<MFSW>



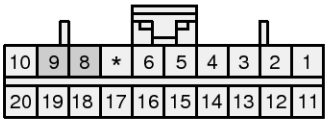
5. High
6. Low

<CLU>



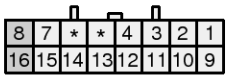
19. Low
20. High

<TILT & TELE>



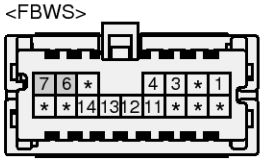
8. High
9. Low

<ADM>



8. High
16. Low

<FBWS>



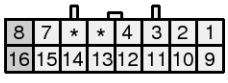
6. High
7. Low

<PSM>



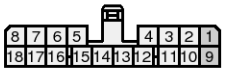
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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**Signal Waveform & Data**

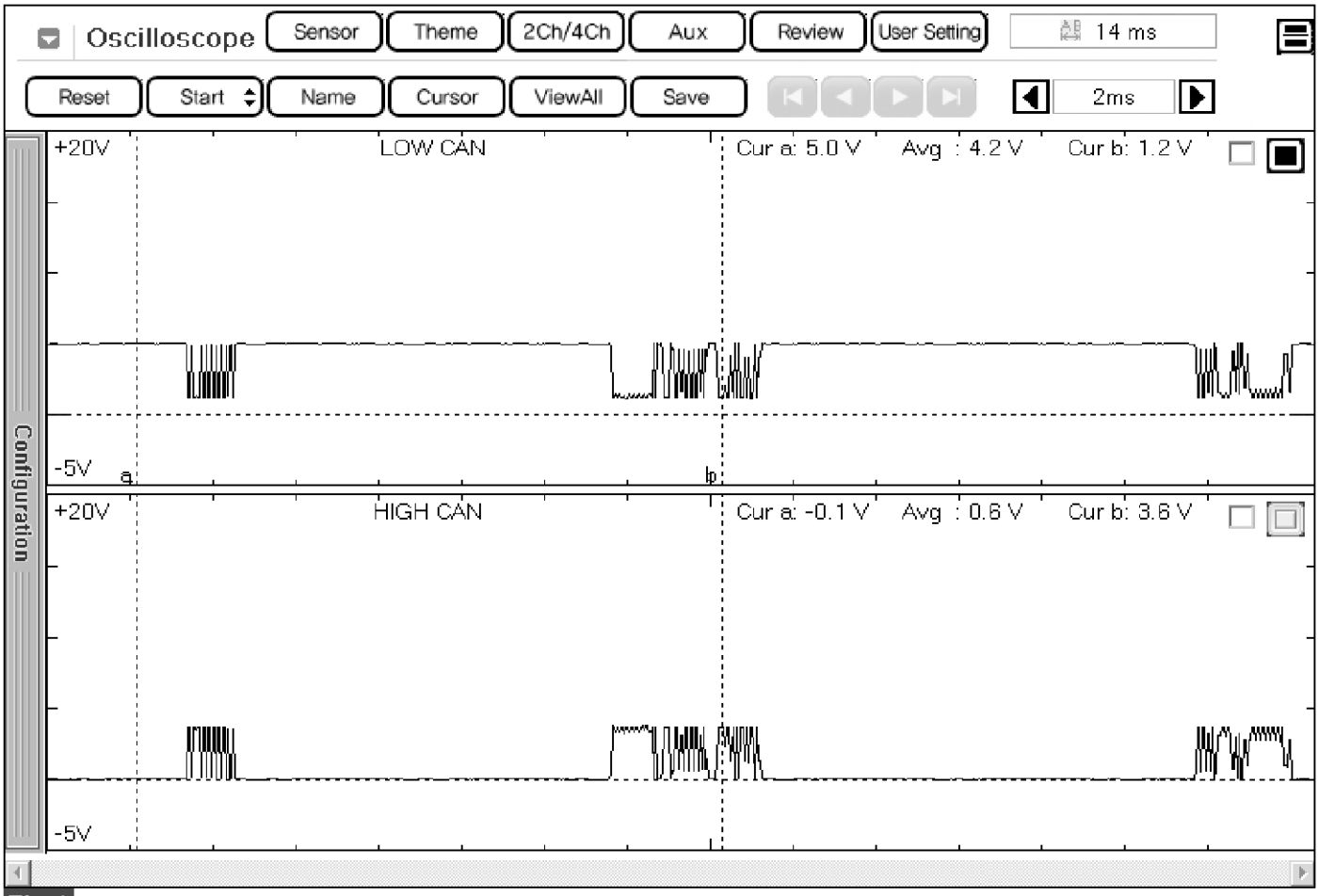



Fig.1

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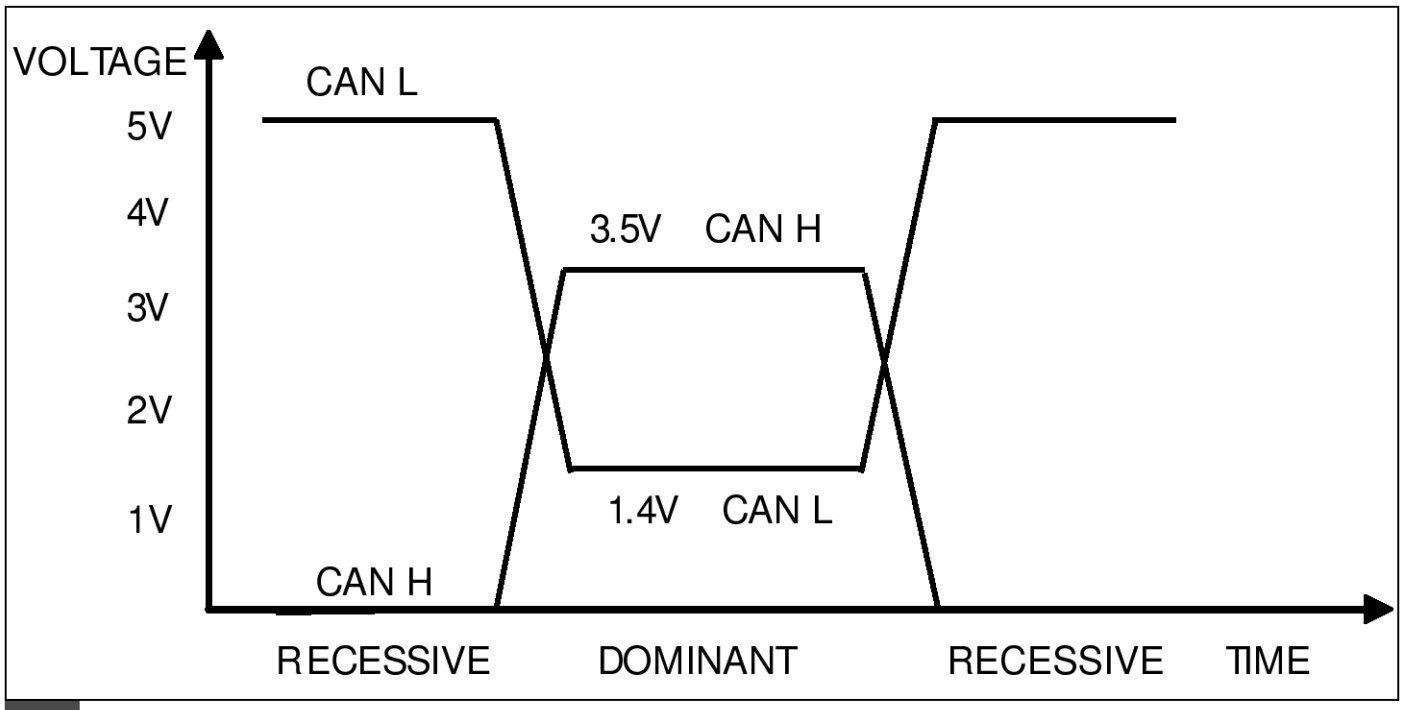



Fig.2

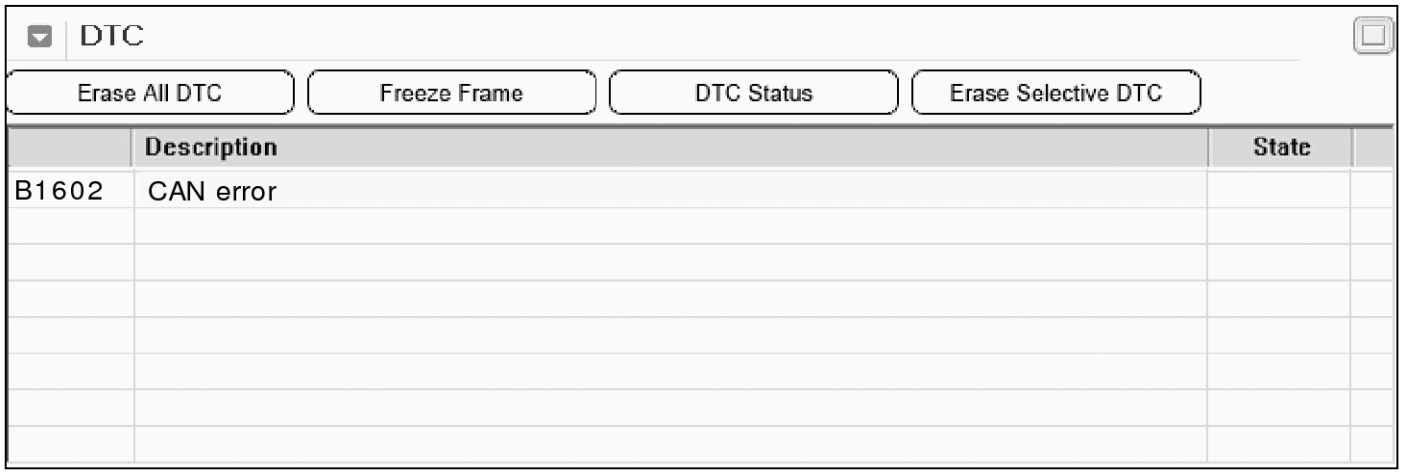
SBHBE9M13L

Fig.1) CAN Low/High Signal Waveform

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).




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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 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.

## 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 "FBWS Signal Circuit Inspection" procedure.

## FBWS Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on SCM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on SCM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)
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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## B1603 CAN Communication Bus Off

### General Description

Refer to DTC B1602 : CAN Error.

### 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), 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))

Case1: After short between SCM CAN Low Line and High Line, short to ground together.

Case2: After short between SCM 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

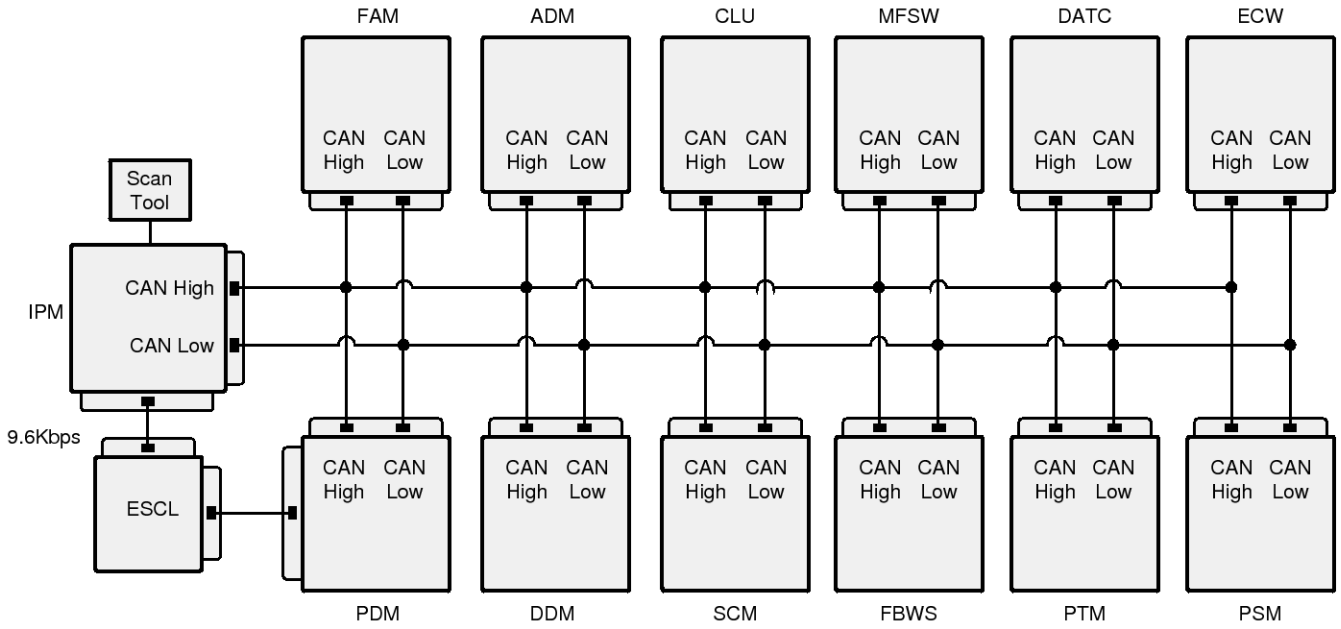
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM, SCM are not Sleep condition<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, SCM power on | |
| Threshold Value | • CAN High/Low : 0V or B+ | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

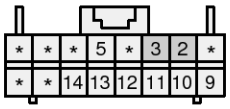



<ECW>



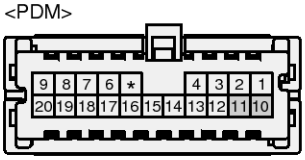
4. Low
5. High

<IPM>



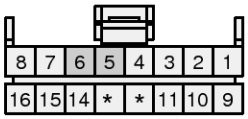
2 . Low
3. High

<PDM>



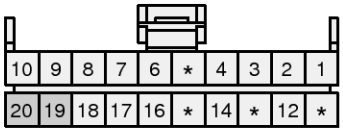
10. Low
11. High

<MFSW>



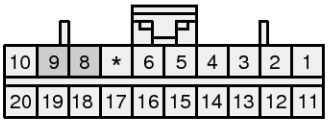
5. High
6. Low

<CLU>



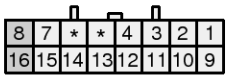
19. Low
20. High

<TILT & TELE>



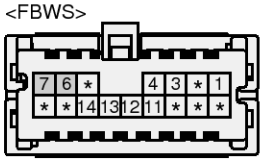
8. High
9. Low

<ADM>



8. High
16. Low

<FBWS>



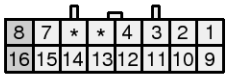
6. High
7. Low

<PSM>



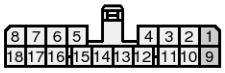
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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**Signal Waveform & Data**

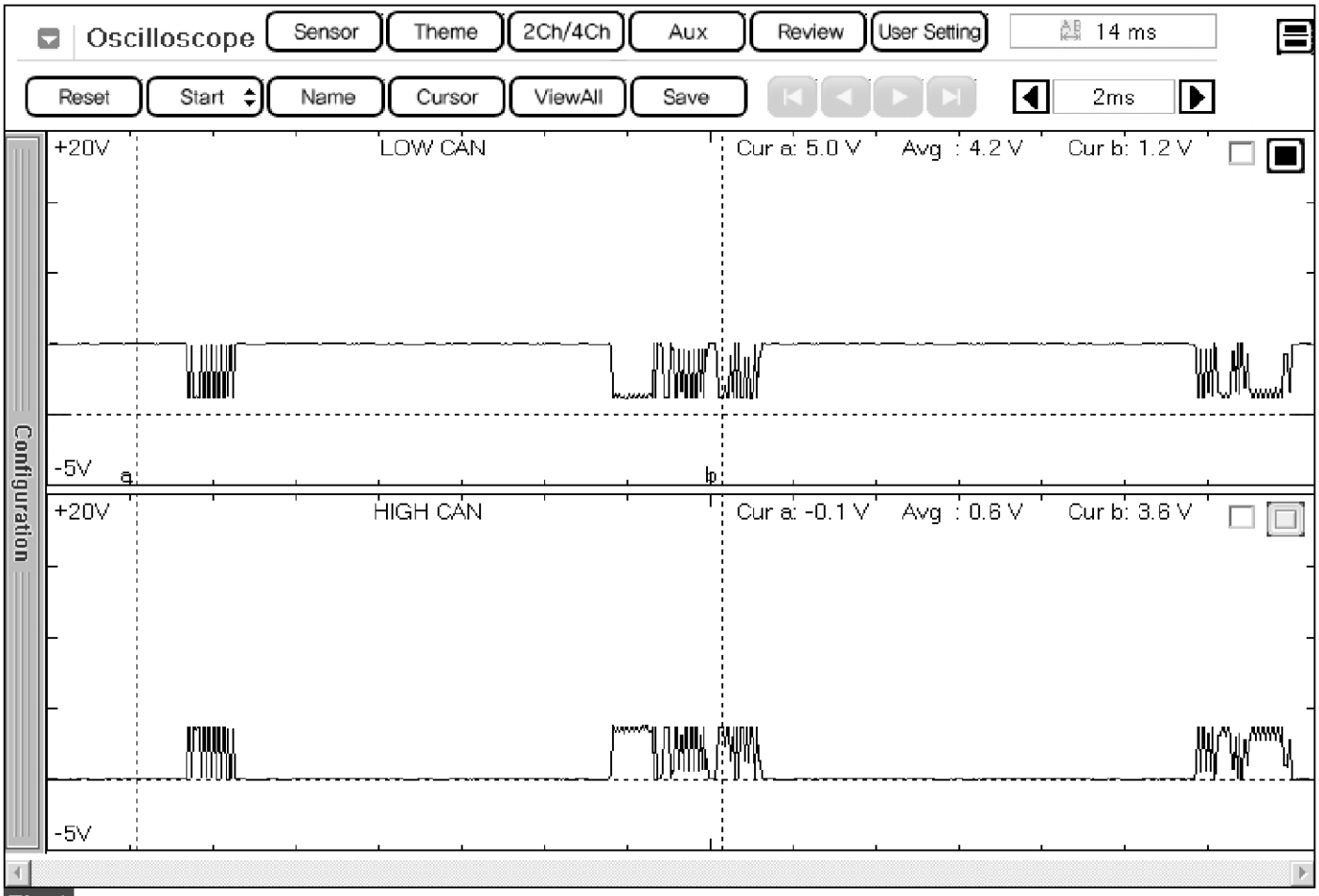



Fig.1

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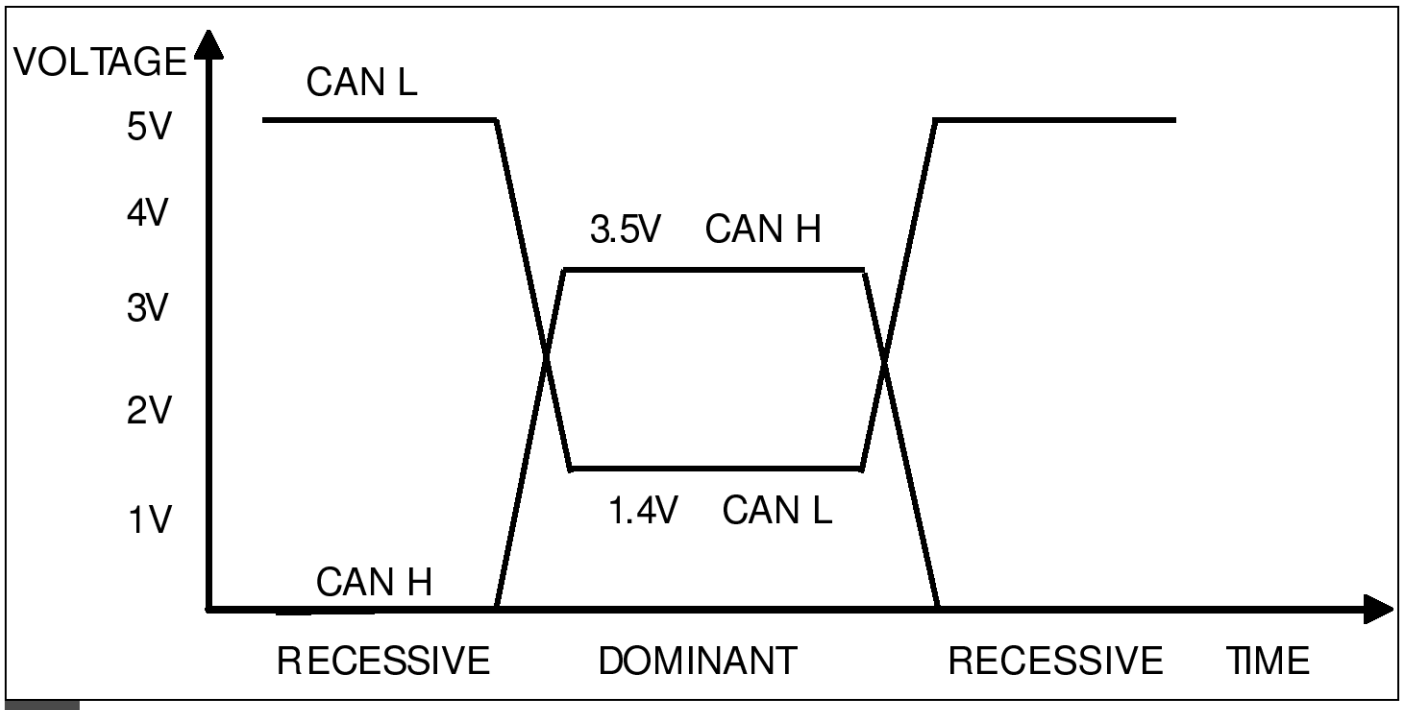



Fig.2

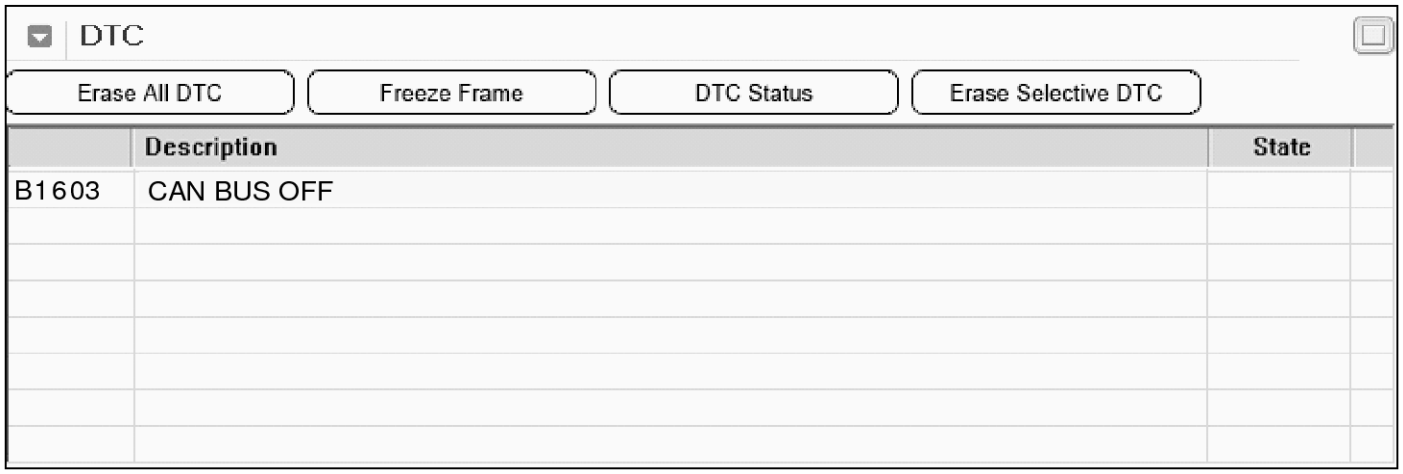
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Fig.1) CAN Low/High Signal Waveform

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).




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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 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.

## 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), 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)

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

Refer to DTC B1602 : CAN 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 12edge (6pulse) for 2sec . 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 | • Tilt Motor position sensor signal check | • IPS(Intelligent Power Switch) terminal short<br>• IPS(Intelligent Power Switch) terminal short<br>• Tilt Motor position sensor (A,B) |
| Enable Conditions | • B+ status error | |
| Threshold Value | • - | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |
| Fail Safe | • Warning BUZZER sounds 10 times | |

## Diagnostic Circuit Diagram

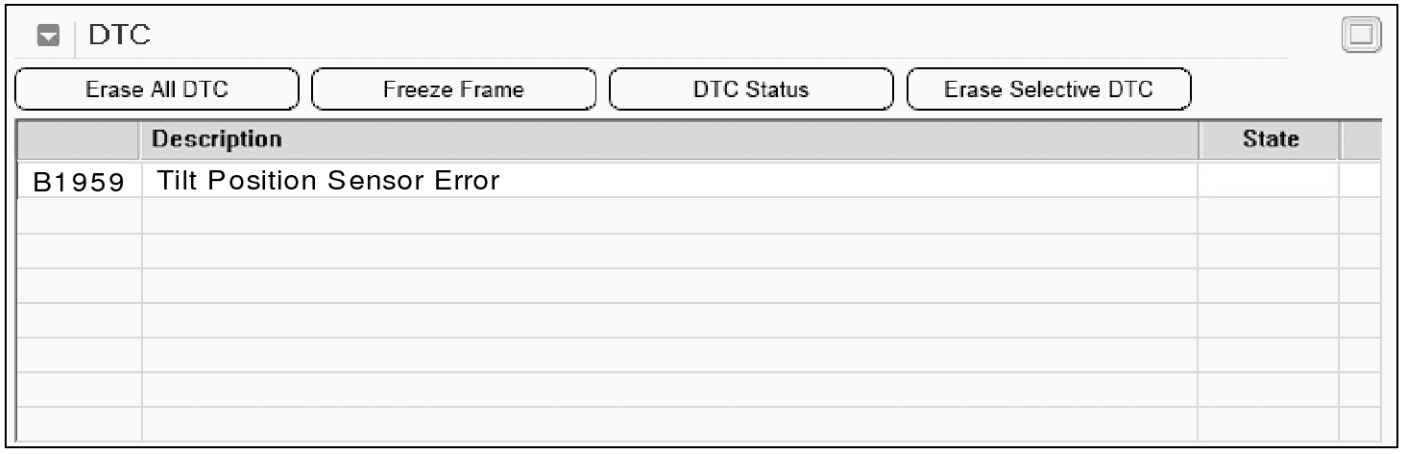
Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

## 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?

**YES** ▶ Go to "Component Inspection" procedure.

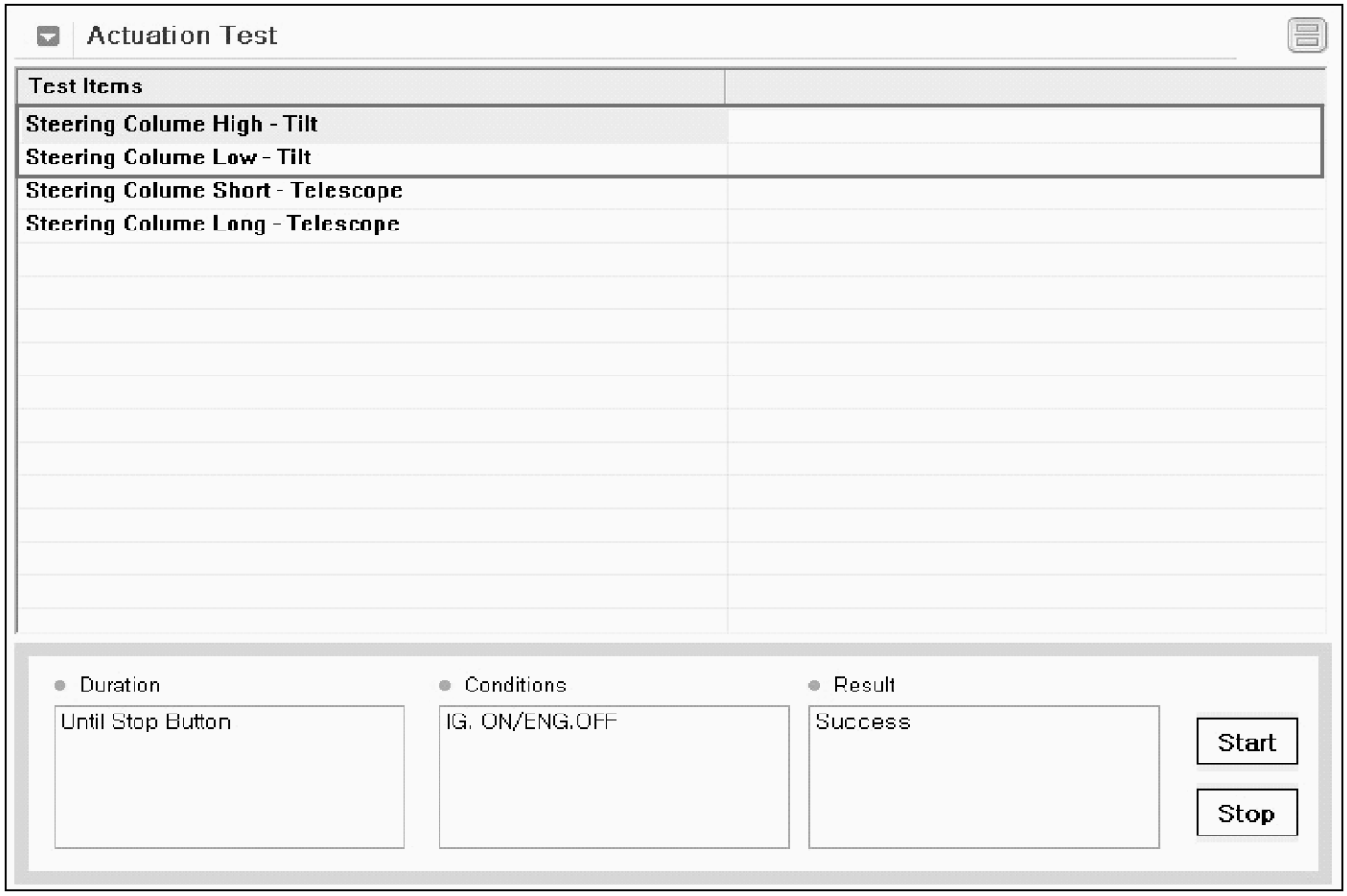
**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or SCM's connector or was repaired and SCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then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




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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 "Tilt (UP,DOWN) 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 |
|---|---|---|
| Sensor Supply Voltage | 10.2 | V |
| Tilt Motor Short Circuit To Ground State | OK | - |
| Telescope Motor Short Circuit To Ground State | OK | - |
| Tilt Motor Open State | OK | - |
| Telescope Motor Open State | OK | - |
| Ignition 1 Signal | ON | - |
| Tilt Up Switch | ON | - |
| Tilt Down Switch | OFF | - |
| Tilt Up Limit Switch | ON | - |
| Tilt Down Limit Switch | ON | - |
| Telescope Forward Switch | OFF | - |
| Telescope Backward Switch | OFF | - |
| Telescope Forward Limit Switch | ON | - |
| Telescope Backward Limit Switch | ON | - |
| Tilt Motor Up Output | OFF | - |
| Tilt Motor Down Output | OFF | - |
| Telescope Motor Forward Output | OFF | - |
| Telescope Motor Backward Output | OFF | - |
| Tilt Position | 88 | edge |
| Telescope Position | 644 | edge |

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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 "Tilt Motor Position Sensor" with pressing the tilt 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 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

Refer to DTC B1602 : CAN Error.

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# B1960 Tele Position Sensor Error

## General Description

Refer to DTC B1959 : Tilt Position Sensor Error.

## DTC Description

SCM sets this code when amount of change of the telescopic motor position sensor is little than 12edge (6pulse) for 2sec. 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 | • Telescopic Motor position sensor signal check | • IPS(Intelligent Power Switch) terminal short<br>• IPS(Intelligent Power Switch) terminal short<br>• Telescopic Motor position sensor (A,B) |
| Enable Conditions | • B+ status error | |
| Threshold Value | • - | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |
| Fail Safe | • Warning BUZZER sounds 10 times | |

## Diagnostic Circuit Diagram

Refer to DTC B1959 : Tilt Position Sensor Error.

## Signal Waveform & Data

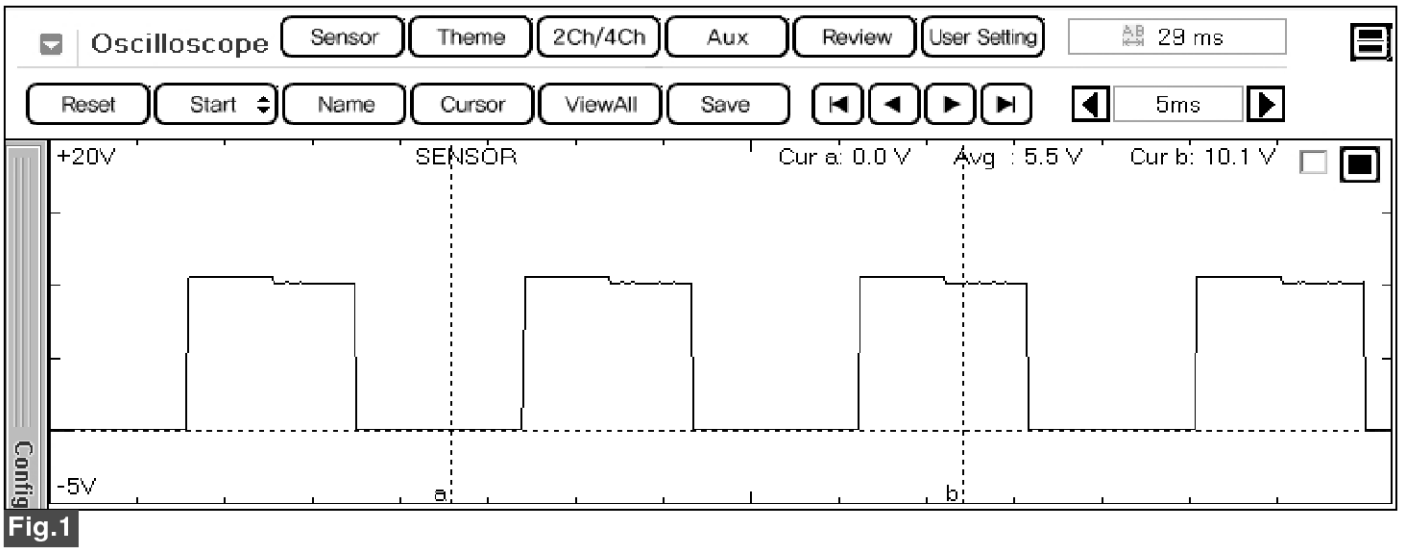



Fig.1

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Fig.1) Normal waveform of telescopic motor/position

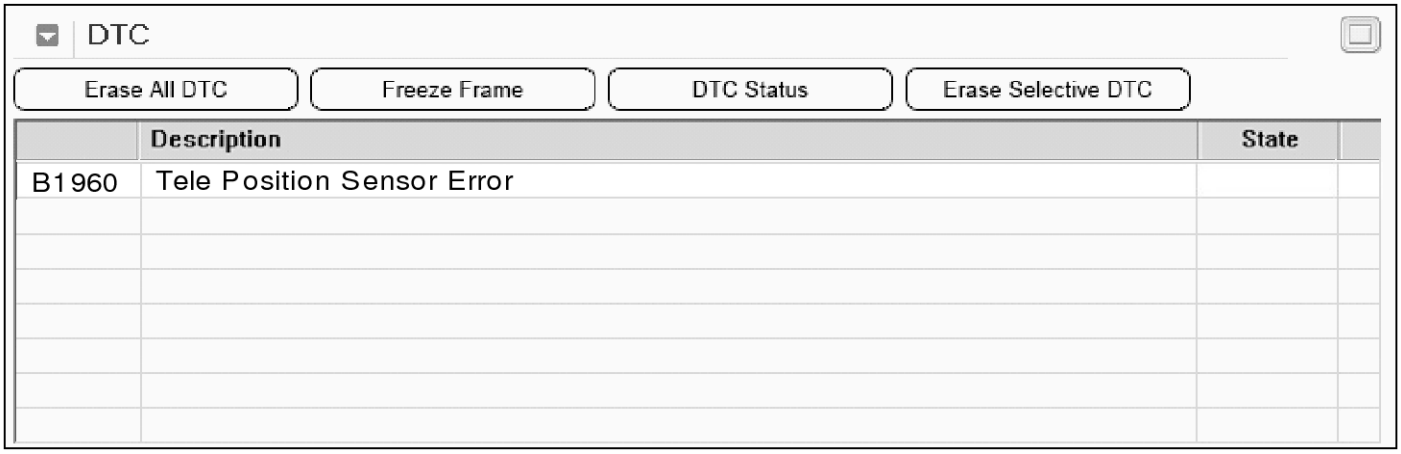
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### Scantool Data Analysis

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).




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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 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.

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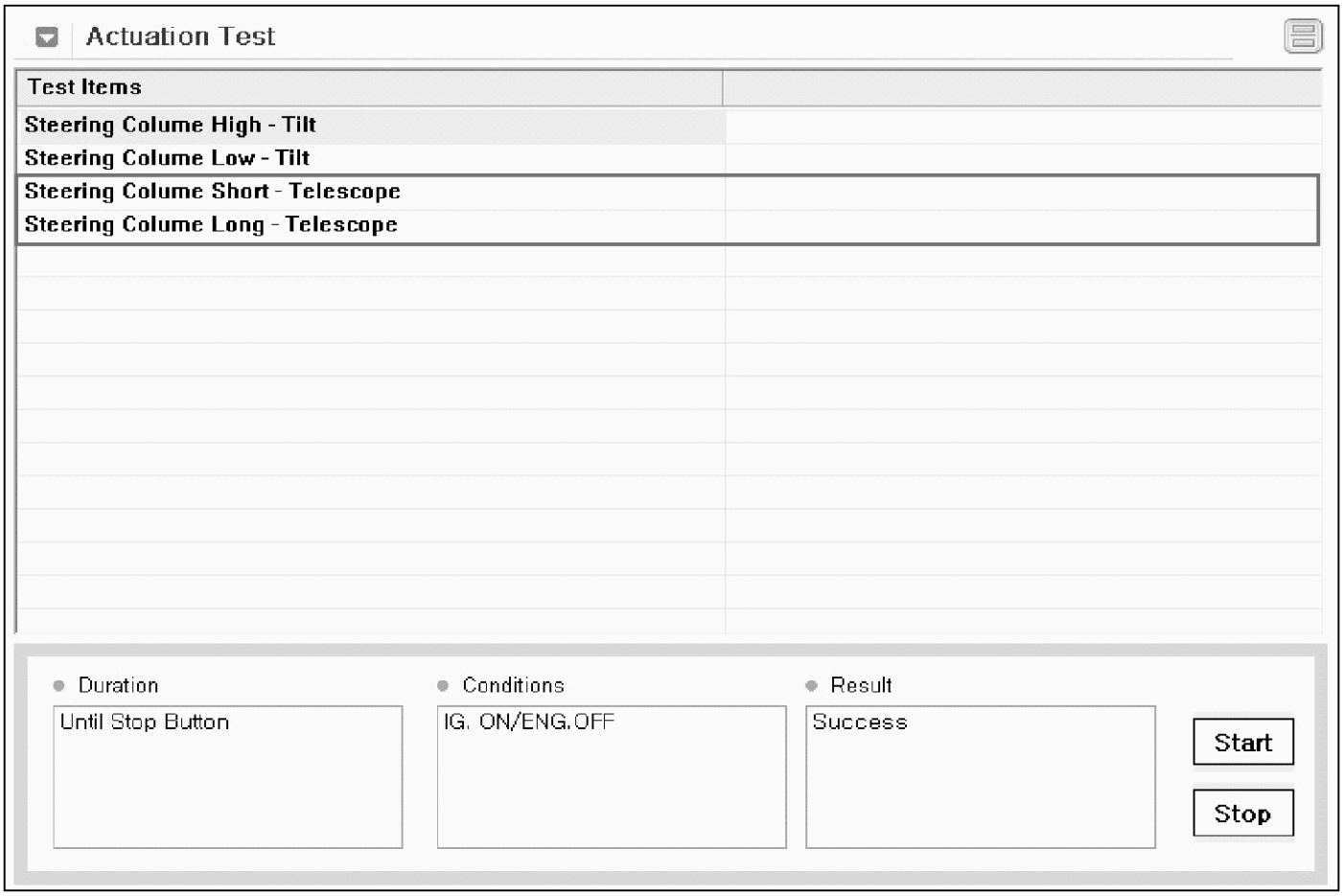


## Component Inspection

### ■ Check telescopic 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




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5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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## ■ 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)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Sensor Supply Voltage | 10.2 | V |
| Tilt Motor Short Circuit To Ground State | OK | - |
| Telescope Motor Short Circuit To Ground State | OK | - |
| Tilt Motor Open State | OK | - |
| Telescope Motor Open State | OK | - |
| Ignition 1 Signal | ON | - |
| Tilt Up Switch | OFF | - |
| Tilt Down Switch | OFF | - |
| Tilt Up Limit Switch | ON | - |
| Tilt Down Limit Switch | ON | - |
| Telescope Forward Switch | ON | - |
| Telescope Backward Switch | OFF | - |
| Telescope Forward Limit Switch | ON | - |
| Telescope Backward Limit Switch | ON | - |
| Tilt Motor Up Output | OFF | - |
| Tilt Motor Down Output | OFF | - |
| Telescope Motor Forward Output | OFF | - |
| Telescope Motor Backward Output | OFF | - |
| Tilt Position | 88 | edge |
| Telescope Position | 644 | edge |

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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.

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### 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?

**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

Refer to DTC B1602 : CAN Error.

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## Electric control Wiper(ECW)

### Troubleshooting

#### ECW DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |

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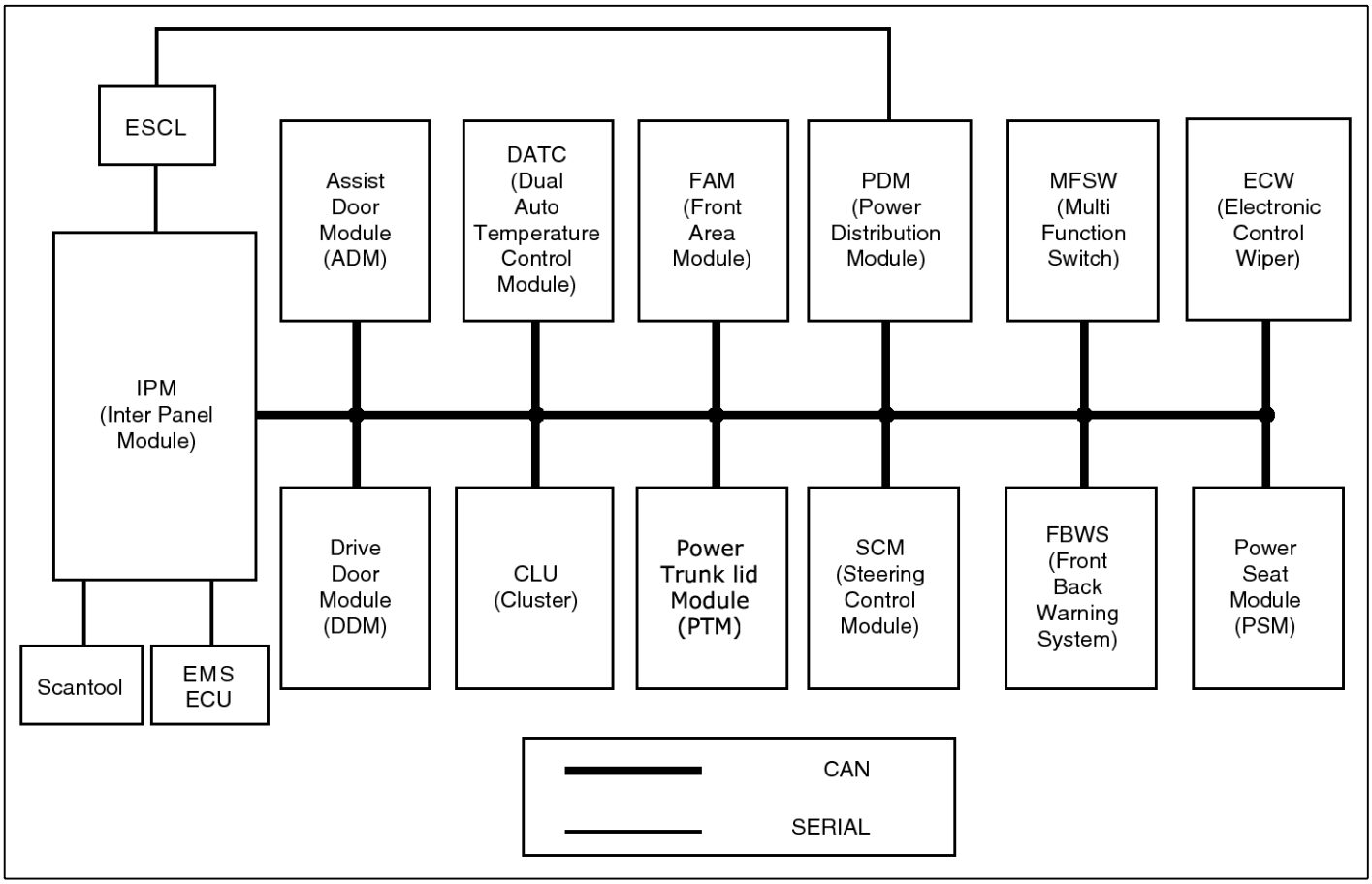
## B1602 CAN Error

### 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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

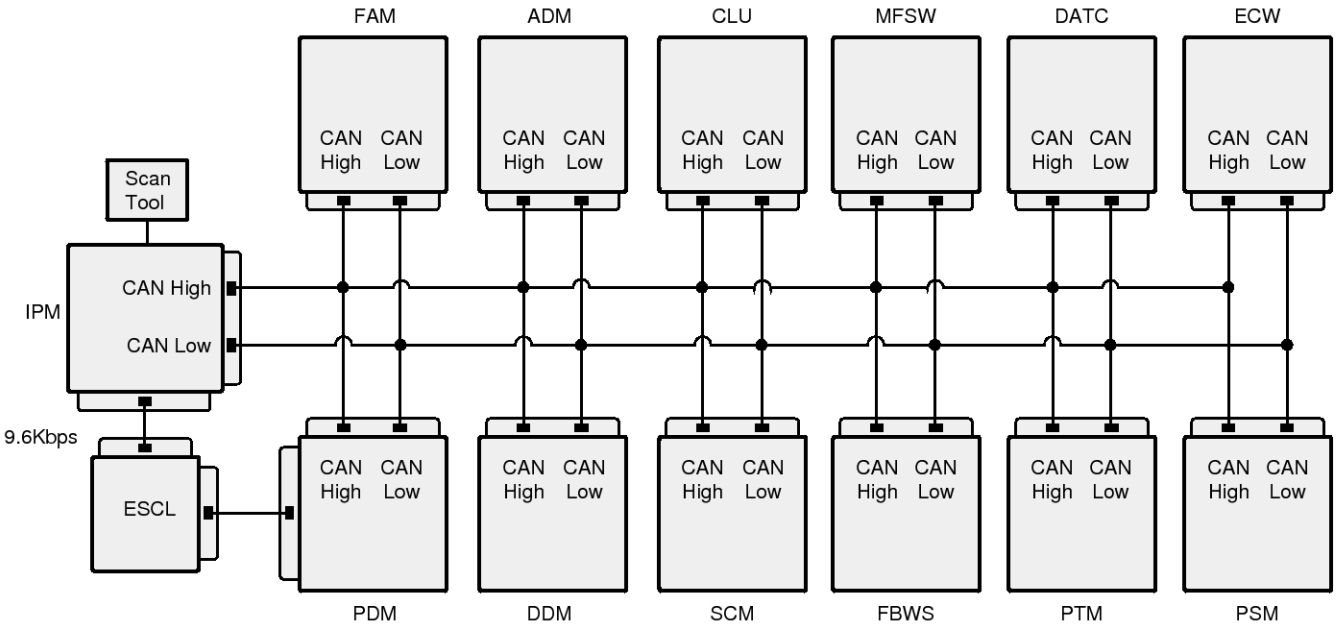
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,ECW are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, ECW power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

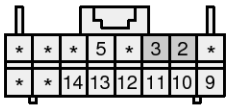



<ECW>



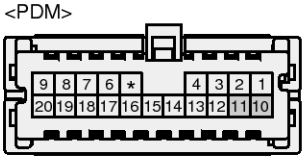
4. Low
5. High

<IPM>



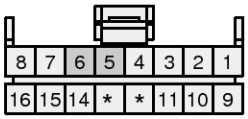
2 . Low
3. High

<PDM>



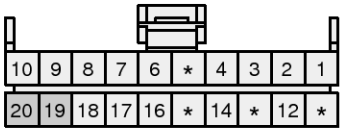
10. Low
11. High

<MFSW>



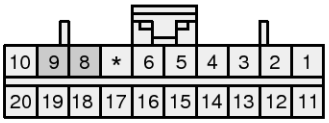
5. High
6. Low

<CLU>



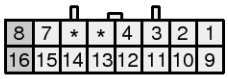
19. Low
20. High

<TILT & TELE>



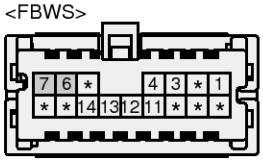
8. High
9. Low

<ADM>



8. High
16. Low

<FBWS>



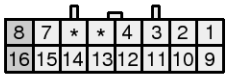
6. High
7. Low

<PSM>



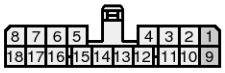
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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**Signal Waveform & Data**

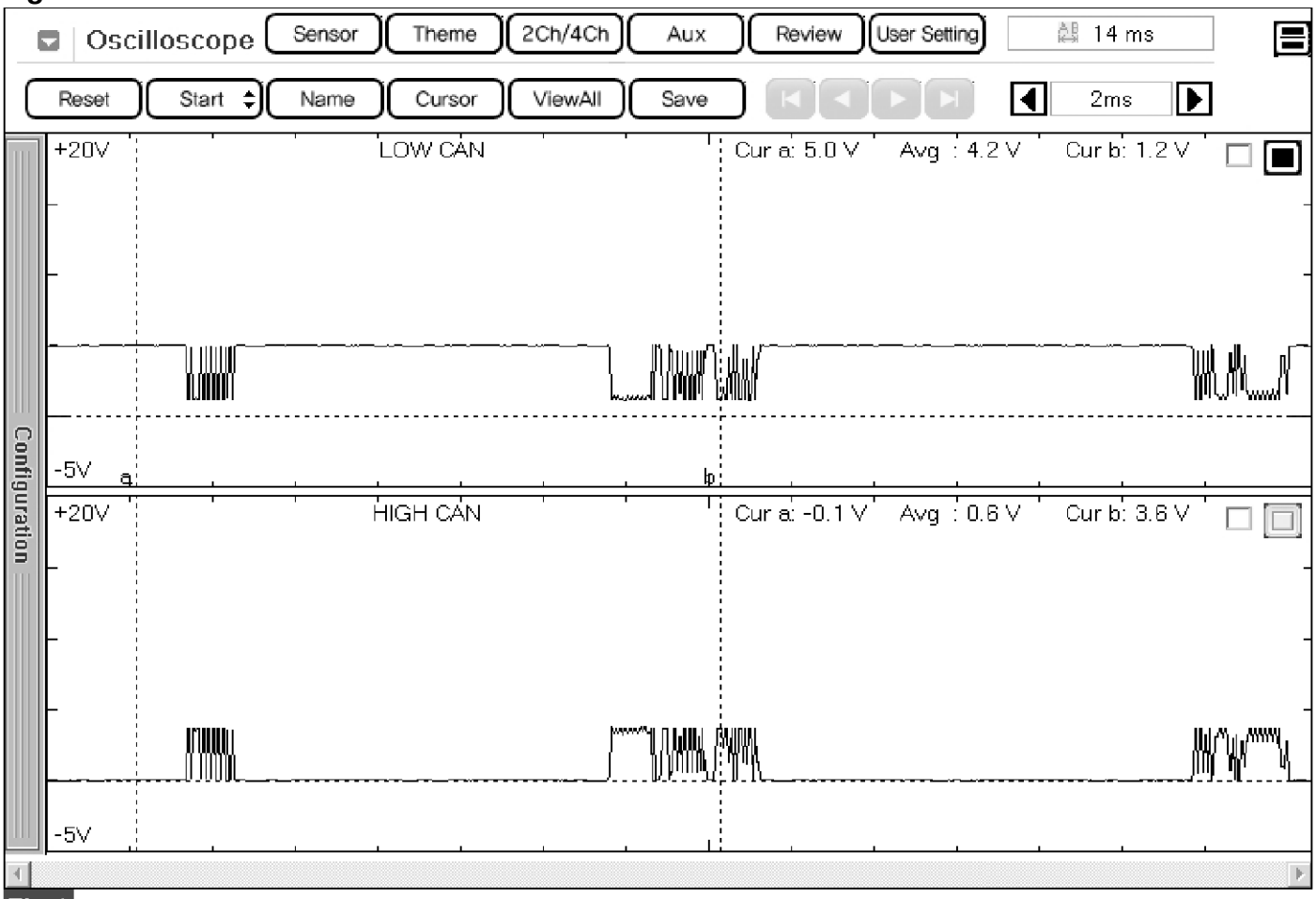



Fig.1

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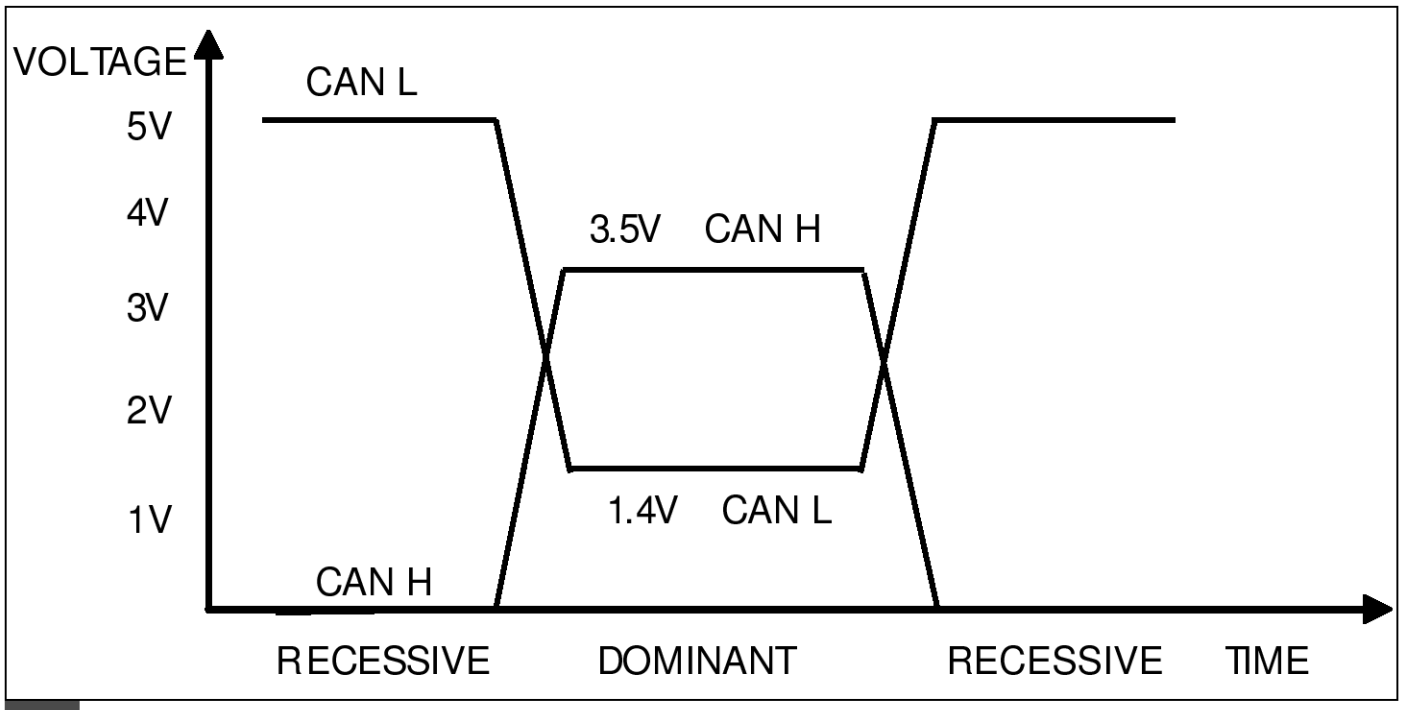



Fig.2

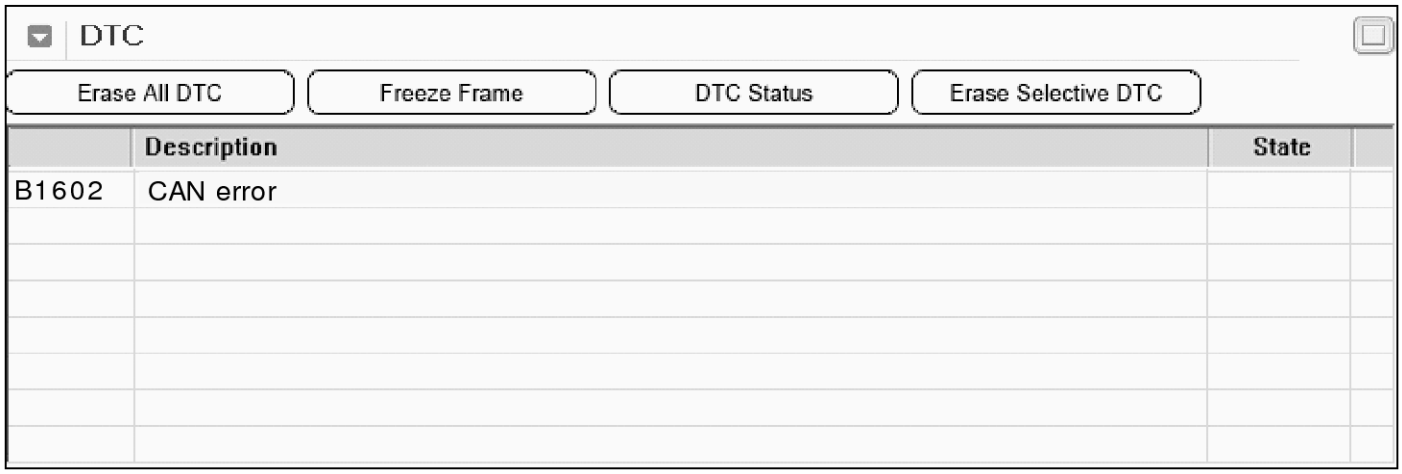
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Fig.1) CAN Low/High Signal Waveform

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).




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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 ECW's connector or was repaired and ECW 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 "ECW Signal Circuit Inspection" procedure.

## ECW Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ECW CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on ECW CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)
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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## B1603 CAN Communication Bus Off

### General Description

Refer to DTC B1602 : CAN Error.

### 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), 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))

Case1: After short between FDM CAN Low Line and High Line, short to ground together.

Case2: After short between FDM 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,ECW are not Sleep condition1. CAN High and Low Line short to ground coincident<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM,ECW 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

Refer to DTC B1602 : CAN Error.

### Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

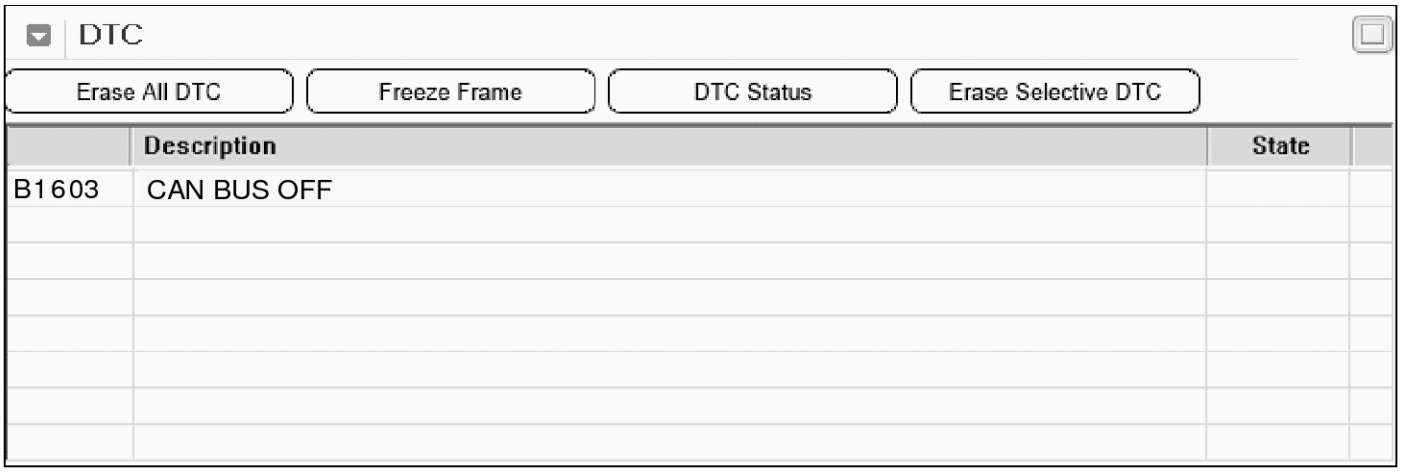
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## Scantool Data Analysis

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).




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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 ECW's connector or was repaired and ECW 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

Refer to DTC B1602 : CAN Error.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## Front Back Warning Sensor(FBWS)

### Troubleshooting

#### FBWS DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1621 | Sensor Power Line Error |
| 4 | B1210 | Front Left Sensor RX signal Fault |
| 5 | B1211 | Front Center Left Sensor RX signal Fault |
| 6 | B1212 | Front Center Right Sensor RX signal Fault |
| 7 | B1213 | Front Right Sensor RX signal Fault |
| 8 | B1214 | Rear Left Sensor RX signal Fault |
| 9 | B1215 | Rear Center Left Sensor RX signal Fault |
| 10 | B1216 | Rear Center Right Sensor RX signal Fault |
| 11 | B1217 | Rear Right Sensor RX signal Fault |

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## B1602 CAN Error

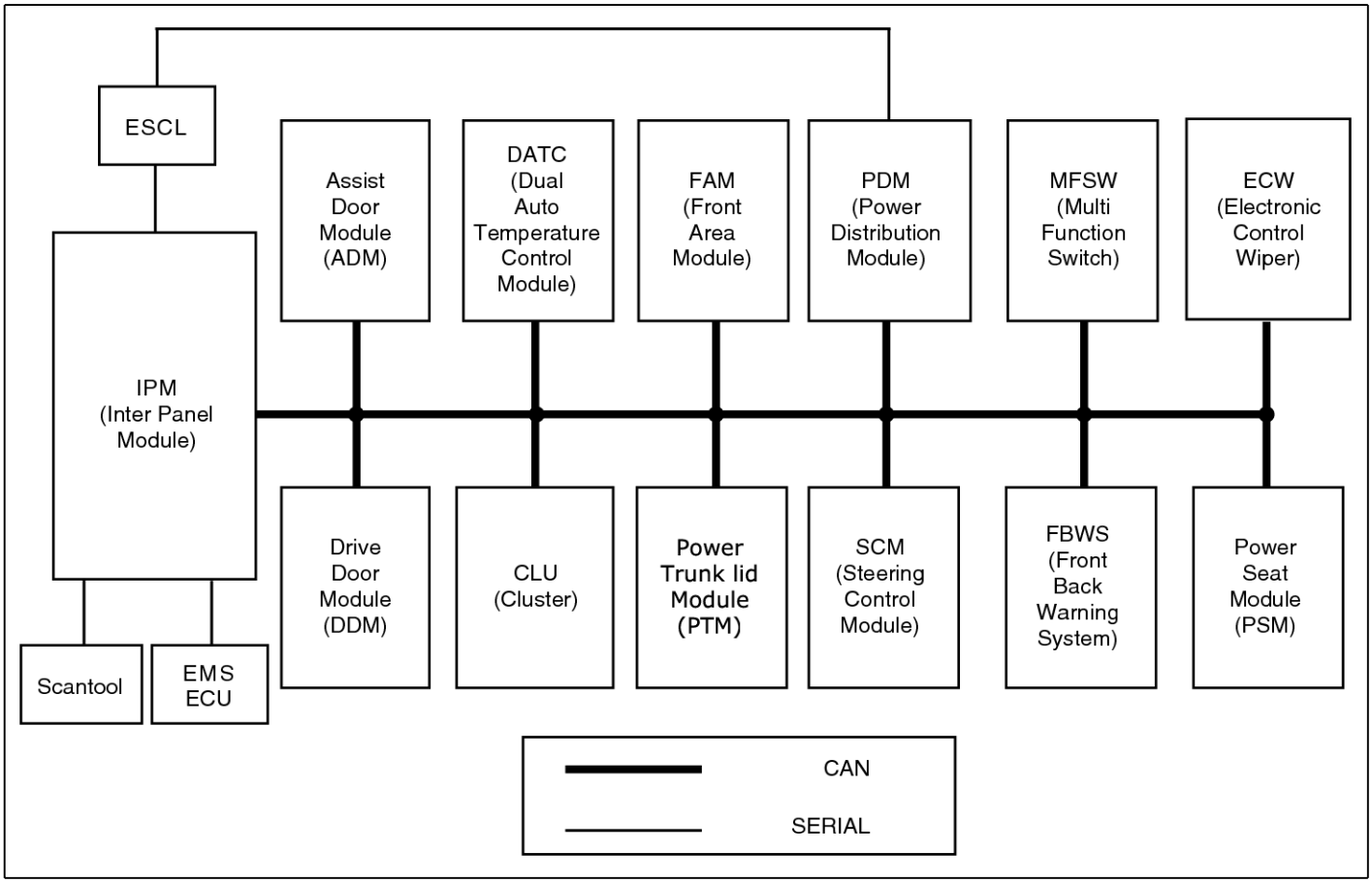
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

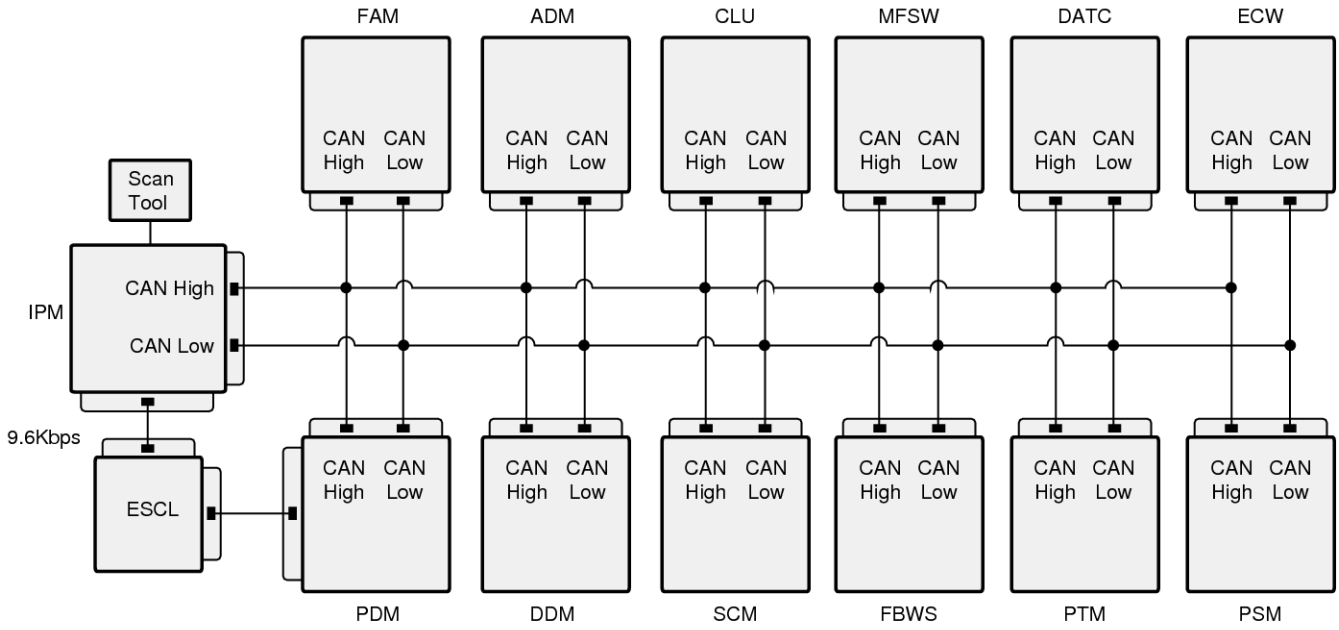
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,FBWS are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, FBWS power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

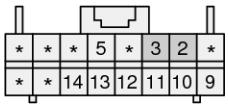



<ECW>



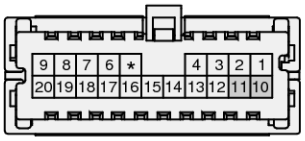
4. Low
5. High

<IPM>



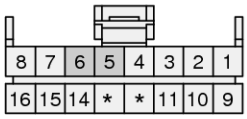
2 . Low
3. High

<PDM>



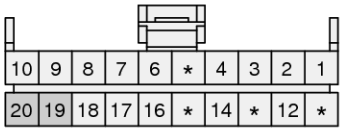
10. Low
11. High

<MFSW>



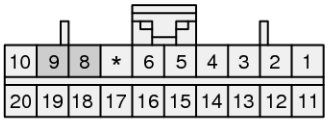
5. High
6. Low

<CLU>



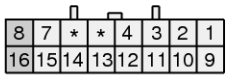
19. Low
20. High

<TILT & TELE>



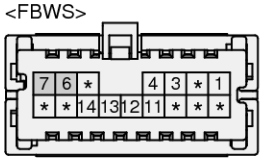
8. High
9. Low

<ADM>



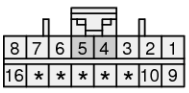
8. High
16. Low

<FBWS>



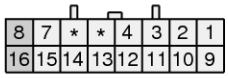
6. High
7. Low

<PSM>



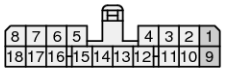
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

SBHBE9H01L

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**Signal Waveform & Data**

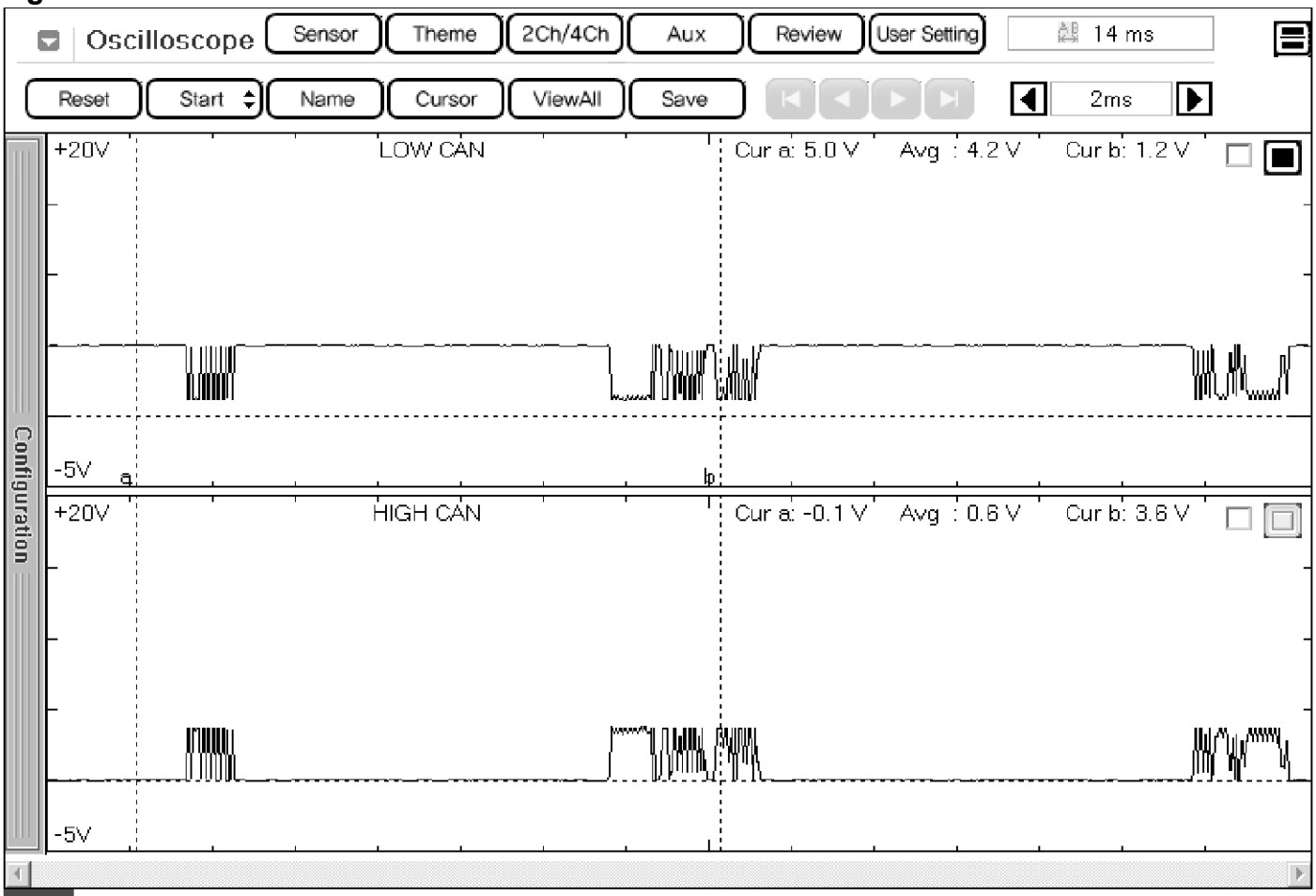



Fig.1

SBHBE9H11L

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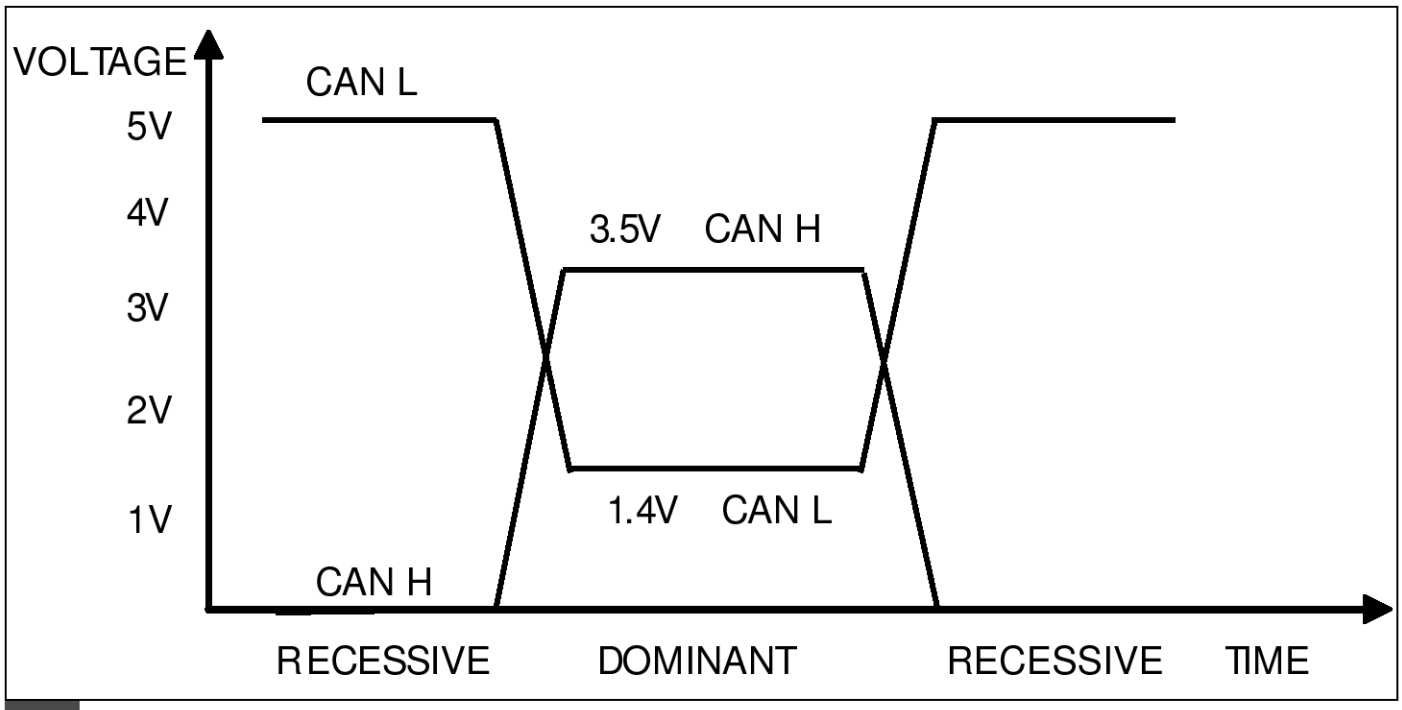



Fig.2

SBHBE9H12L

Fig.1) CAN Low/High Signal Waveform
Fig.2) CAN BUS VOLTAGE LEVEL (LOW SPEED CAN)

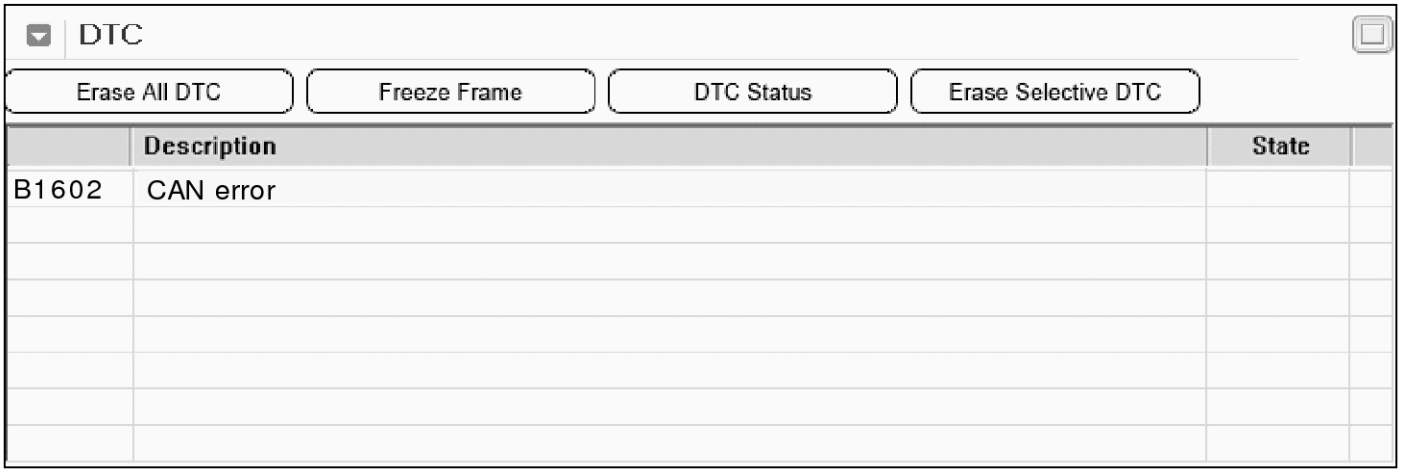
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## Scantool Data Analysis

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).




SBHBE9H13L

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 FBWS's connector or was repaired and FBWS 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 "FBWS Signal Circuit Inspection" procedure.

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## FBWS Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FBWS CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on FBWS CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)

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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## B1603 CAN Communication Bus Off

### General Description

Refer to DTC B1602 : CAN Error.

### 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM 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,FBWS are not Sleep condition<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, FBWS 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

Refer to DTC B1602 : CAN Error.

### Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

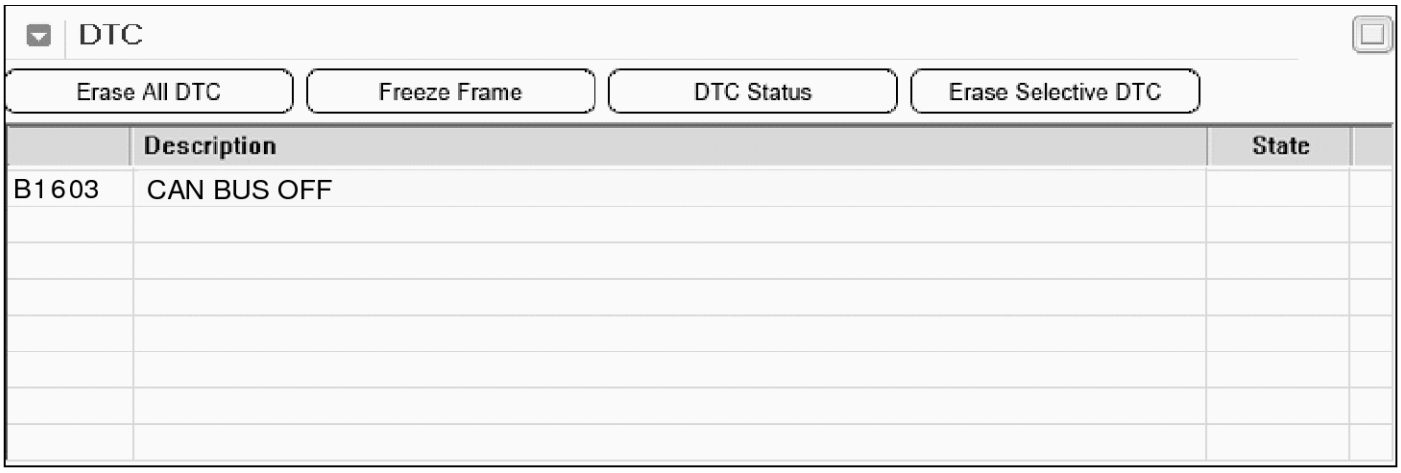
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## Scantool Data Analysis

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).




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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 FBWS's connector or was repaired and FBWS 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

Refer to DTC B1602 : CAN Error.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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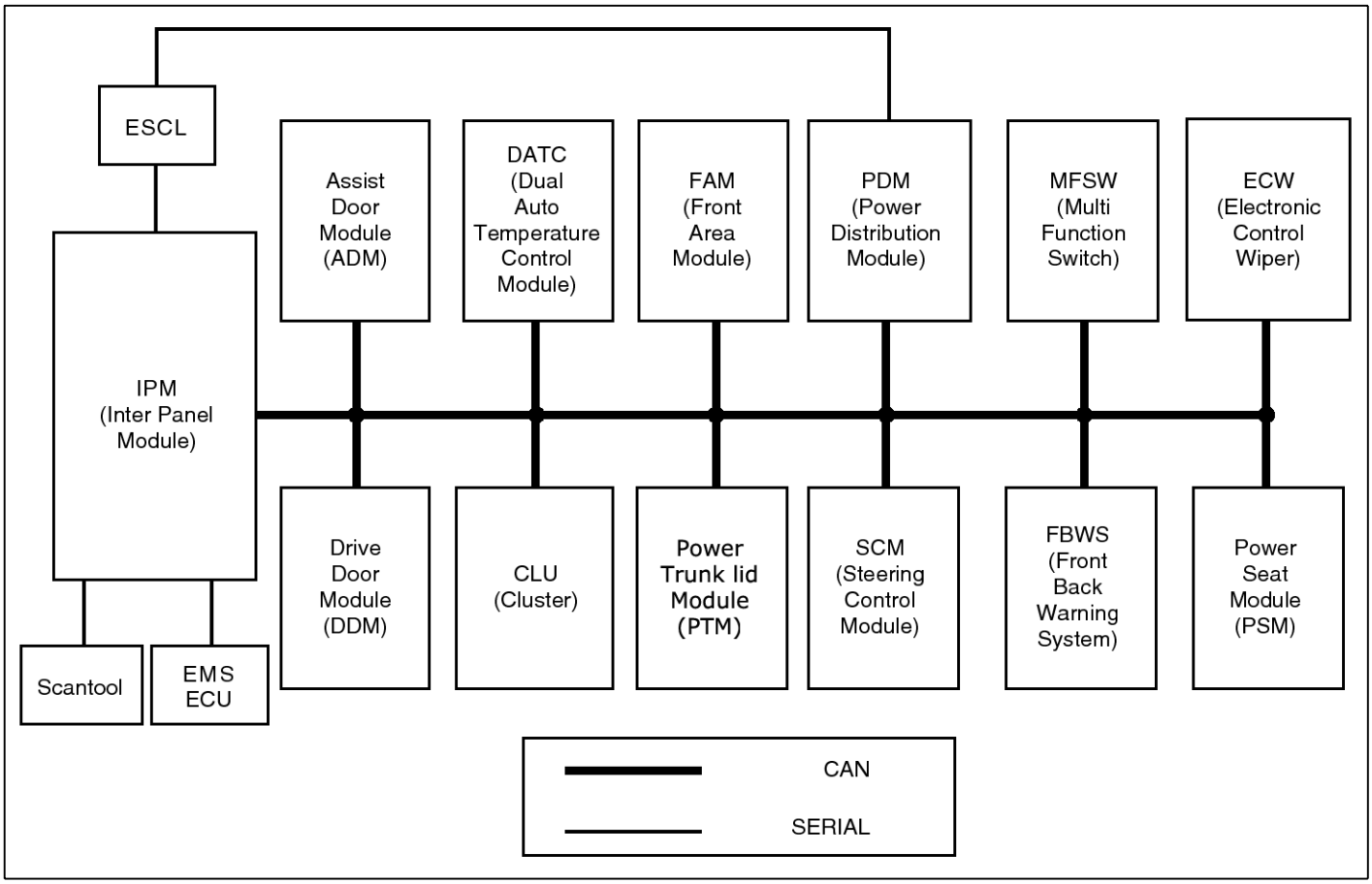
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## B1621 Power Error

### General Description

FBWS is a parking assistant system. It has a supersonic sensor which radiates supersonic to front and rear side of the vehicle to detect supersonic reflected from an obstacle. It calculates distances between vehicle and obstacle if it detects reflected supersonic. It warns being obstacle to drivers through buzzer or displaying on cluster according to distance from obstacle. Warning level is divided into 3 step (warning level rises progressively according to distance from obstacle)




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### DTC Description

This code reports short to battery in power harness of front or rear supersonic sensor.

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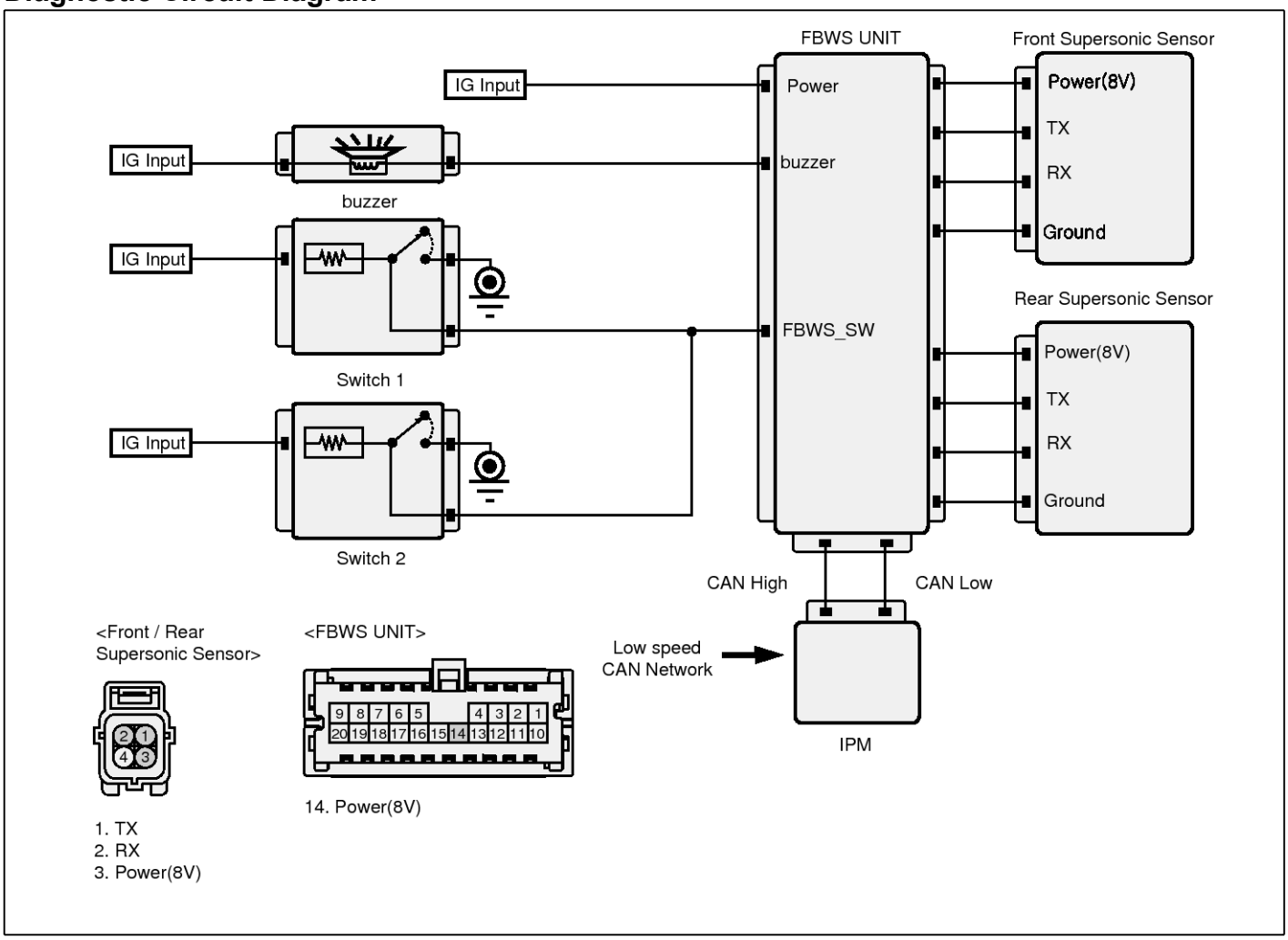
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## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Sensor power harness check | • Sensor power(+8V) short to ground |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • The voltage of sensor power harness is below 6V | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram




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### Signal Waveform & Data

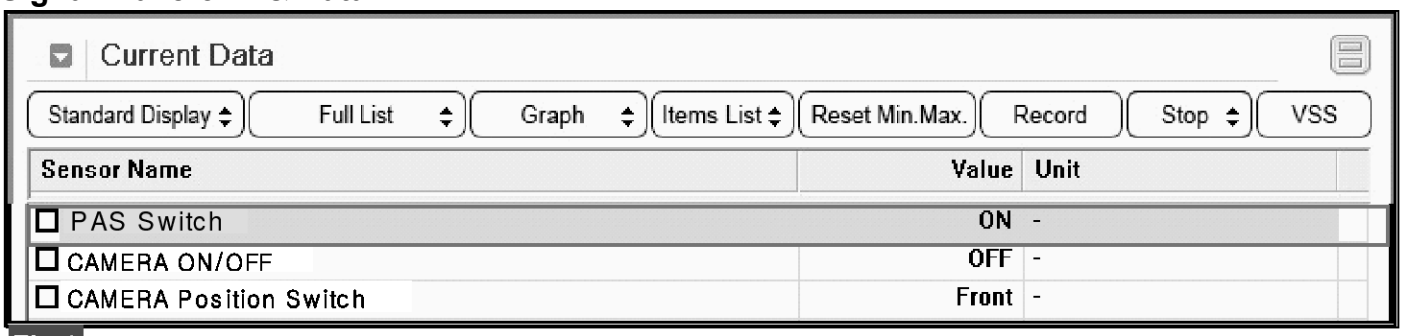


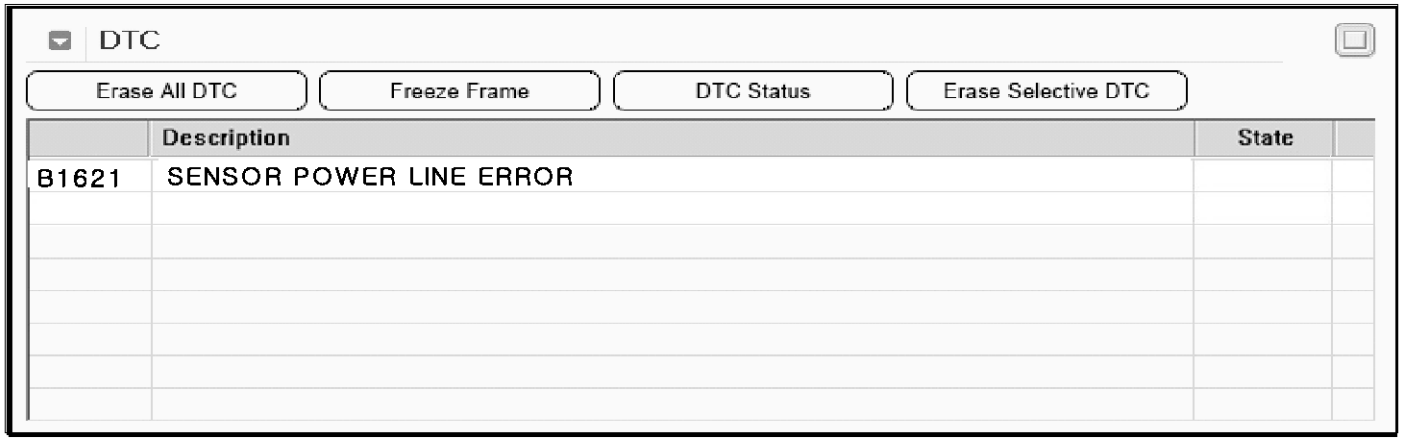

Fig.1

SBHBE9H15L

Fig 1) Normal data of PAS switch depressed at engine r-unning.

### 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 "t-he enable conditions" (Refer to "DTC Detecting Con-dition" table).




SBHBE9H16L

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 FBWS's connector or w-as repaired and FBWS memory was not cleare-d. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamin-ation, deterioration, or damage. Repair or repl-ace as necessary and then go to "Verification of Vehicle Repair" procedure.

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are cause-d by poor harness(es) and terminals. Faults can also be caused by interference from other electrical syste-ms, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor co-nnection, bending, corrosion, contamination, deterior-ation, 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.

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## Power Circuit Inspection

1. IG "ON" & ENG "OFF"
2. Measure the power voltage of "Front Supersonic Sensor" and "Rear Supersonic Sensor". (FBWS side)

**Specification :** Approx. 8 V

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

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1210 Front Left Sensor Fault

### General Description

Refer to DTC B1621 : Power Error.

### DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

### DTC Detecting Condition

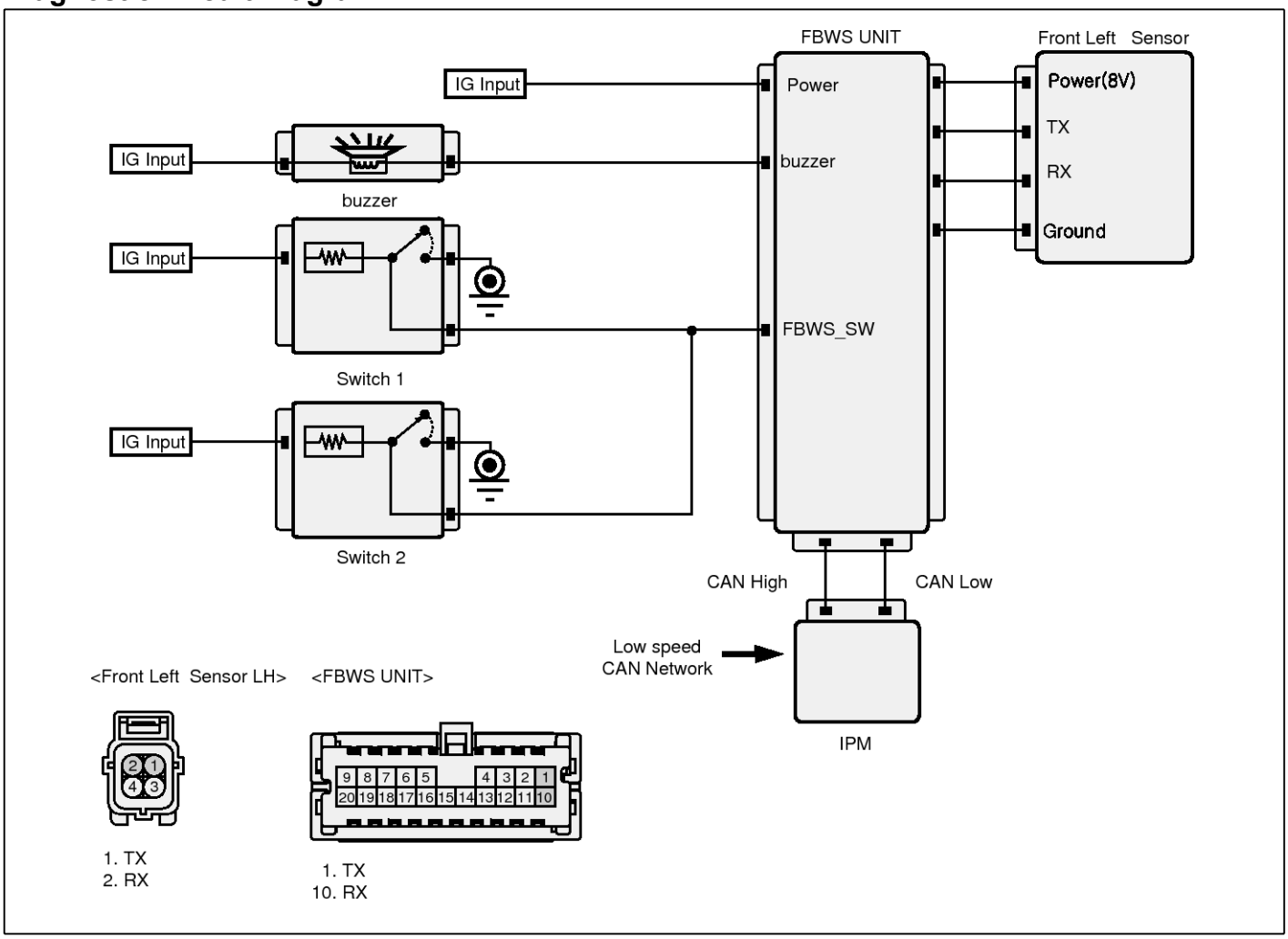
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of front left sensor check | • TX line of Front left sensor open or poor connection.<br>• RX line of Front left sensor open or poor connection.<br>• Ground line of Front left sensor open or poor connection.<br>• Power line of Front left sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to front left sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram




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## Signal Waveform & Data

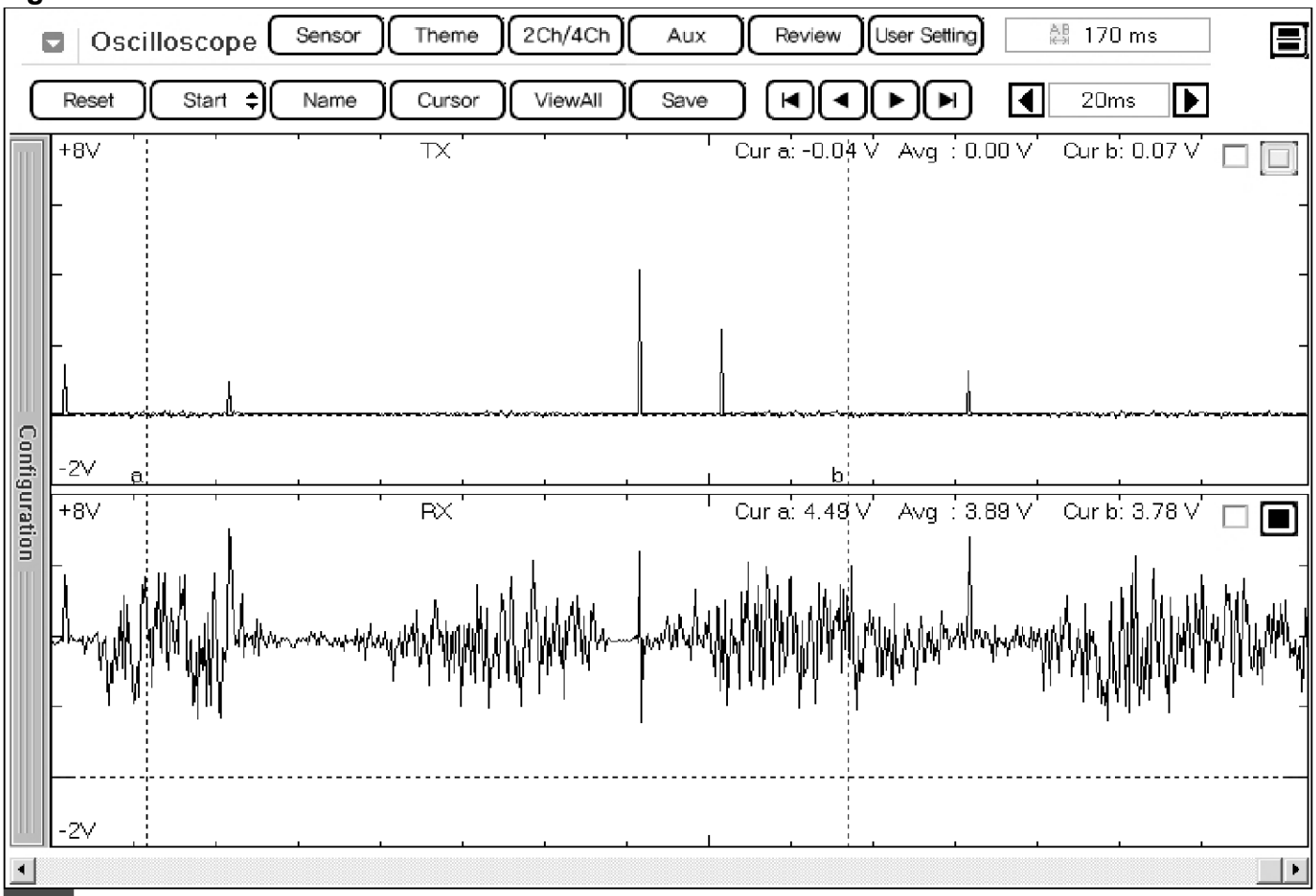



Fig.1

SBHBE9H17L

Fig 1) Normal waveform of front left sensor' TX and RX line under scrubbing it with hand condition.

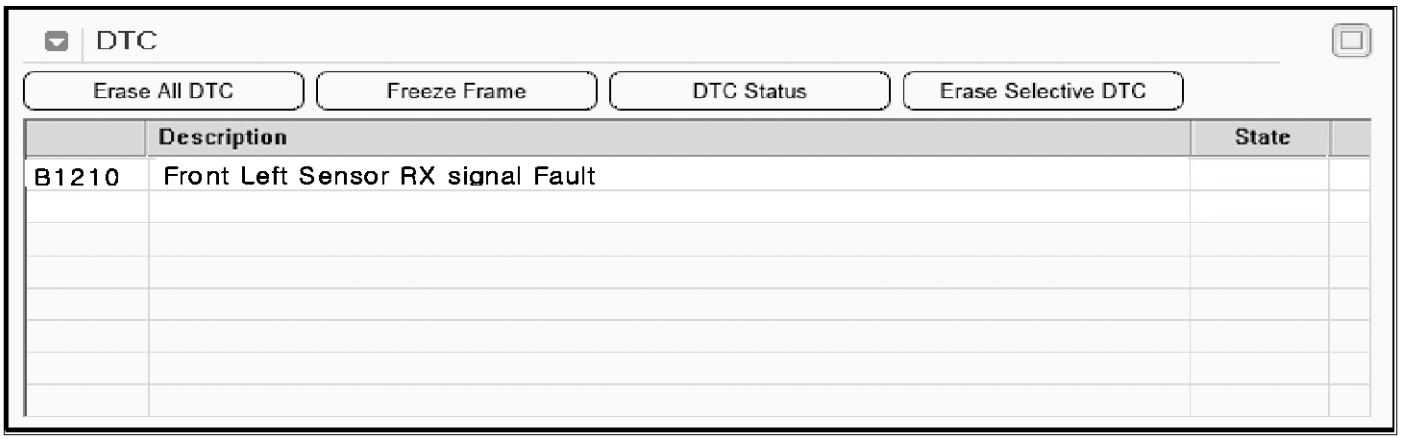
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## Scantool Data Analysis

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).




SBHBE9H18L

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 FBWS's connector or was repaired and FBWS 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 "Power Circuit Inspection" procedure.

## Power Circuit Inspection

1. IG "ON" & ENG "OFF"
2. Measure the power voltage of "Front Left Sensor". (FBWS side)

**Specification :** Approx. 8 V

3. Is the signal output normal?

**YES** ▶ Go to "Ground Inspection" procedure.

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

### ■ Ground Inspection

1. IG "ON" & ENG "OFF"
2. Measure voltage between power and ground terminal of front left sensor.

**Specification :** Approx. 8 V

3. Is the signal output normal?

**YES** ▶ Go to "TX, RX line of front left sensor check" procedure.

**NO** ▶ Repair open or short in ground line between FBWS and front left sensor and go to "Verification of Vehicle Repair" procedure.

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### ■ TX, RX line of front left sensor check

1. KEY "OFF"
2. Disconnect FBWS unit and front left sensor connector.
3. Measure resistance of TX, RX line between FBWS unit and front left sensor harness connector.

**Specification :** Approx. 1 Ω

4. Is measured value normal?

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

**NO** ▶ Repair open or poor connection in TX, RX line between FBWS UNIT and front left sensor harness connector, and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1211 Front Center Left Sensor Fault

### General Description

Refer to DTC B1621 : Power Error.

### DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of front center left sensor check | • TX line of Front center left sensor open or poor connection.<br>• RX line of Front center left sensor open or poor connection.<br>• Ground line of Front center left sensor open or poor connection.<br>• Power line of Front center left sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to front center left sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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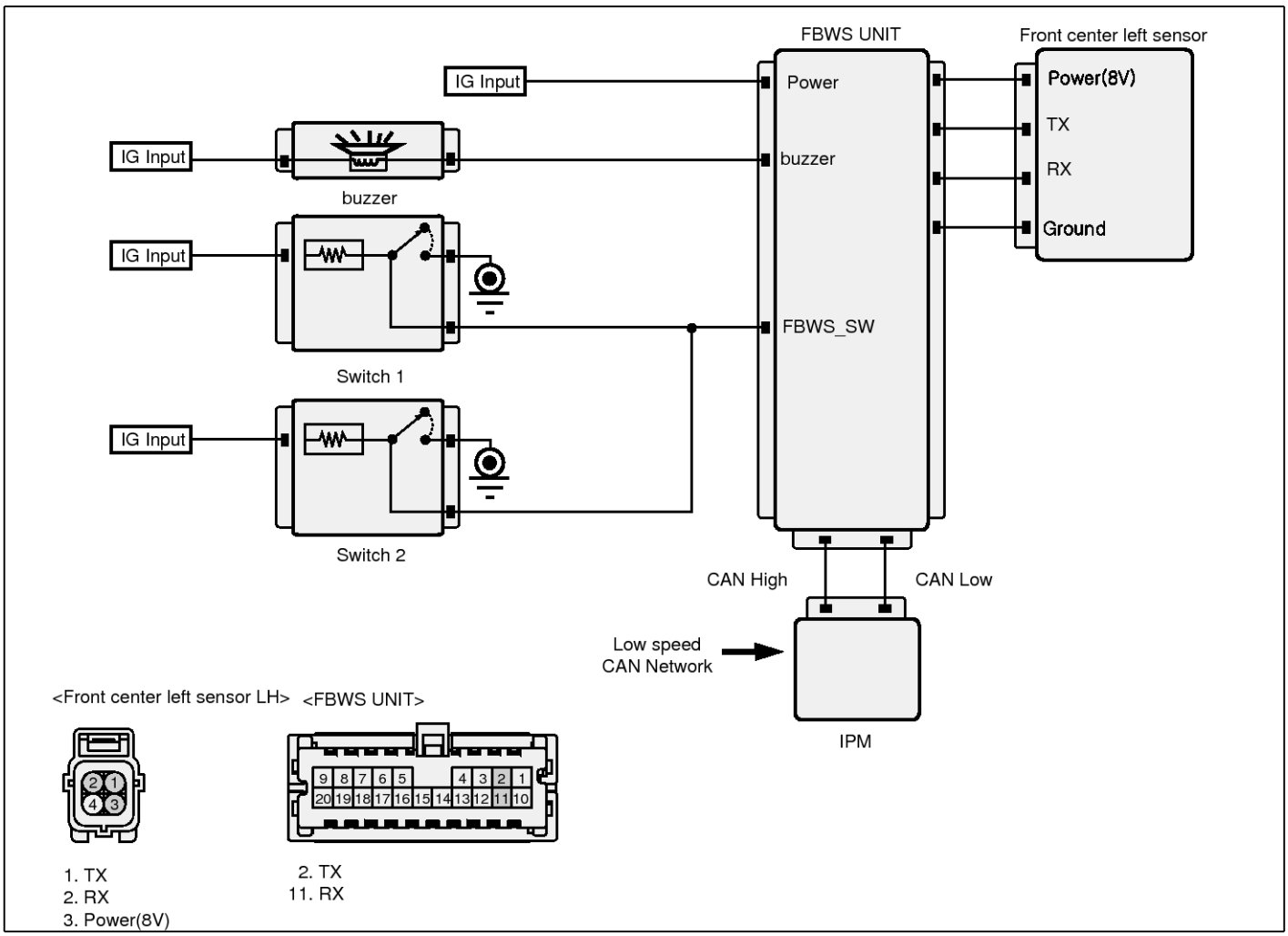


**Diagnostic Circuit Diagram**

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## Signal Waveform & Data

Refer to DTC B1621 : Power Error.

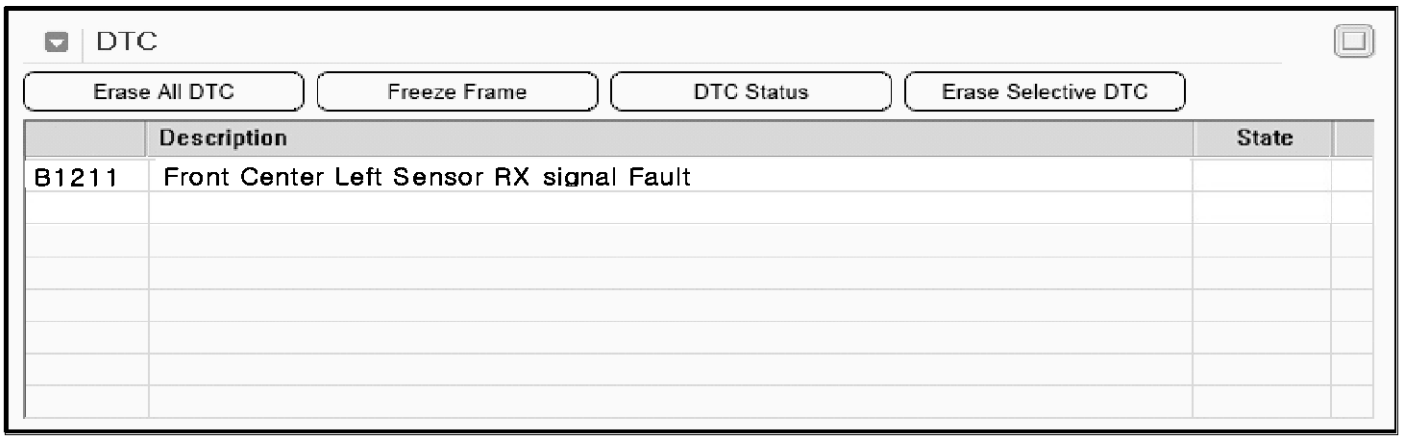
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## Scantool Data Analysis

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).




SBHBE9H19L

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 FBWS's connector or was repaired and FBWS 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

Refer to DTC B1210 : Front Left Sensor Fault.

## Power Circuit Inspection

1. IG "ON" & ENG "OFF"
2. Measure the power voltage of "Front Center Left Sensor". (FBWS side)

**Specification :** Approx. 8 V

3. Is the signal output normal?

**YES** ▶ Go to "Ground Inspection" procedure.

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

## ■ Ground Inspection

1. IG "ON" & ENG "OFF"
2. Measure voltage between power and ground terminal of front center left sensor.

**Specification :** Approx. 8 V

3. Is the signal output normal?

**YES** ▶ Go to "TX, RX line of front left sensor check" procedure.

**NO** ▶ Repair open or short in ground line between FBWS and front left sensor and go to "Verification of Vehicle Repair" procedure.

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### ■ TX, RX line of front center left sensor check

1. KEY "OFF"
2. Disconnect FBWS unit and front center left sensor connector.
3. Measure resistance of TX, RX line between FBWS unit and front center left sensor harness connector..

**Specification :** Approx. 1 Ω

4. Is measured value normal?

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

**NO** ▶ Repair open or poor connection in TX, RX line between FBWS UNIT and front center left sensor harness connector, and go to "Verification of Vehicle Repair" procedure..

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1212 Front Center Right Sensor Fault

### General Description

Refer to DTC B1621 : Power Error.

### DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

### DTC Detecting Condition

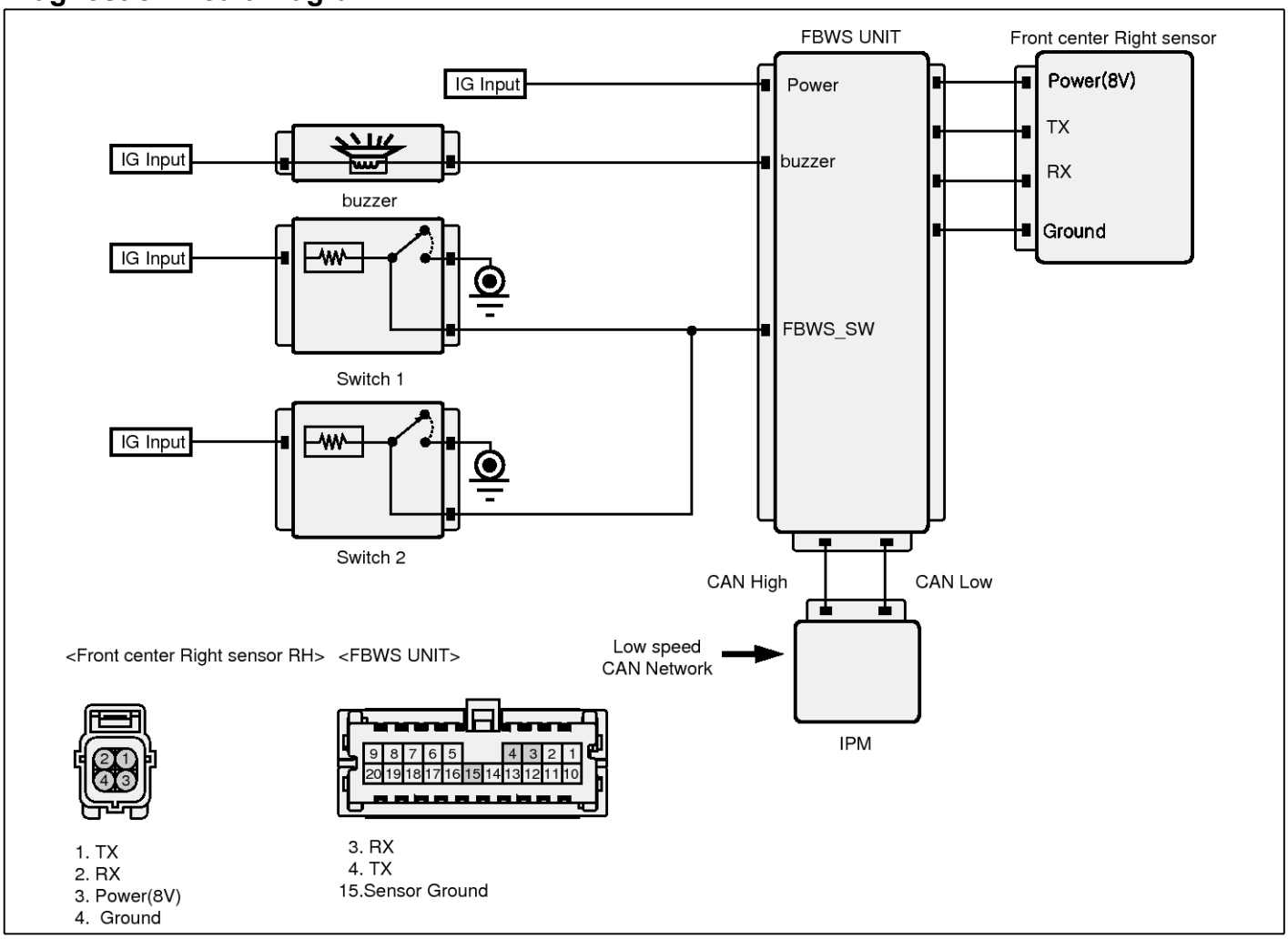
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of front center right sensor check | • TX line of Front center right sensor open or poor connection.<br>• RX line of Front center right sensor open or poor connection.<br>• Ground line of Front center right sensor open or poor connection.<br>• Power line of Front center right sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to front center right sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram




SBHBE9H06L

## Signal Waveform & Data

Refer to DTC B1621 : Power Error.

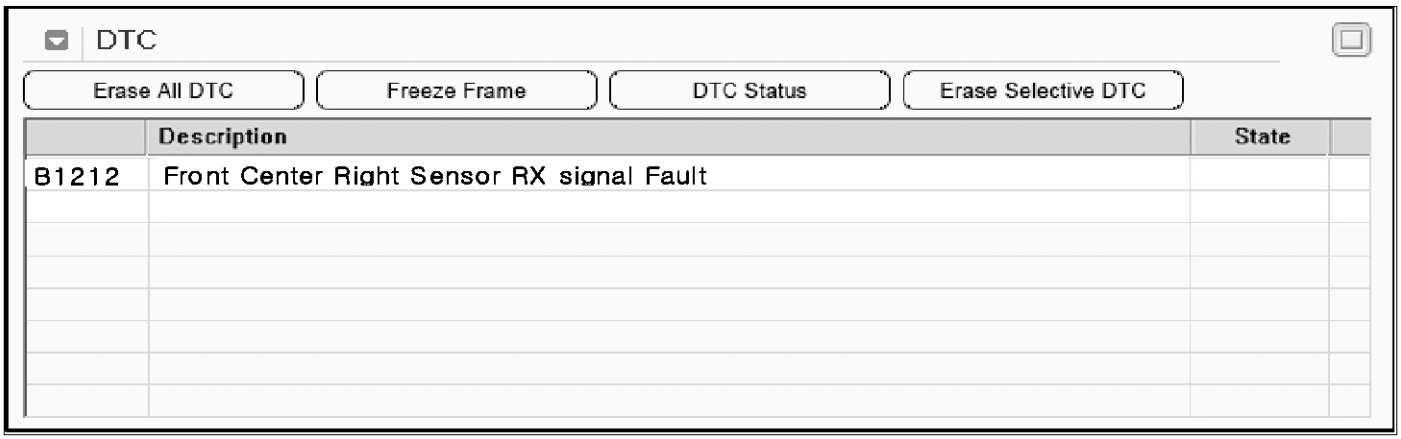
https://autolibrary.ir

https://autolibrary.ir



## 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).




SBHBE9H20L

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 FBWS's connector or was repaired and FBWS 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 "Power Circuit Inspection" procedure.

## Power Circuit Inspection

1. IG "ON" & ENG "OFF"
2. Measure the power voltage of "Front Center Right Sensor". (FBWS side)

**Specification :** Approx. 8 V

3. Is the signal output normal?

**YES** ▶ Go to "Ground Inspection" procedure.

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

### ■ Ground Inspection

1. IG "ON" & ENG "OFF"
2. Measure the power voltage of "Front Center Right Sensor". (FBWS side).

**Specification :** Approx. 8 V

3. Is the signal output normal?

**YES** ▶ Go to "TX, RX line of front center right sensor check" procedure.

**NO** ▶ Repair open or short in ground line between FBWS and front center right sensor and go to " Verification of Vehicle Repair" procedure.

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### ■ TX, RX line of front center right sensor check

1. KEY "OFF"
2. Disconnect FBWS unit and front center right sensor connector.
3. Measure resistance of TX, RX line between FBWS unit and front center right sensor harness connector.

**Specification :** Approx. 1 Ω

4. Is measured value normal?

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

**NO** ▶ Repair open or poor connection in TX, RX line between FBWS UNIT and front center right sensor harness connector, and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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https://autolibrary.ir



# B1213 Front Right Sensor Fault

## General Description

Refer to DTC B1621 : Power Error.

## DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of front right sensor check | • TX line of Front right sensor open or poor connection.<br>• RX line of Front right sensor open or poor connection.<br>• Ground line of Front right sensor open or poor connection.<br>• Power line of Front right sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to front right sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram

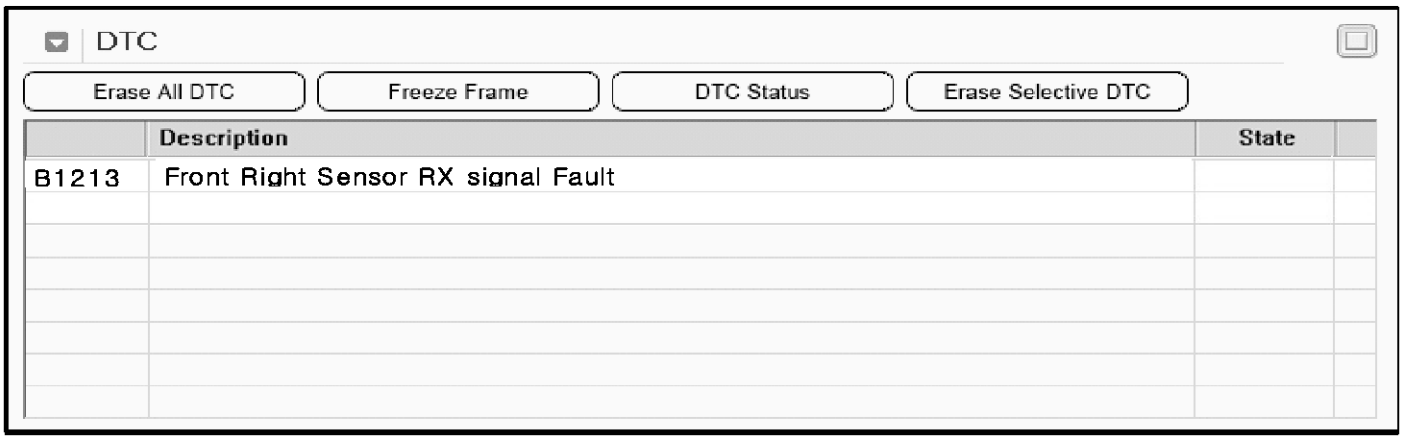
Refer to DTC B1621 : Power Error.

## Signal Waveform & Data

Refer to DTC B1621 : Power Error.

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or FBWS's connector or was repaired and FBWS 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

Refer to DTC B1210 : Front Left Sensor Fault.

### Power Circuit Inspection

Refer to DTC B1210 : Front Left Sensor Fault.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1214 Rear Left Sensor Fault

## General Description

Refer to DTC B1621 : Power Error.

## DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of rear left sensor check | • TX line of rear left sensor open or poor connection.<br>• RX line of rear left sensor open or poor connection.<br>• Ground line of rear left sensor open or poor connection.<br>• Power line of rear left sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to rear left sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram

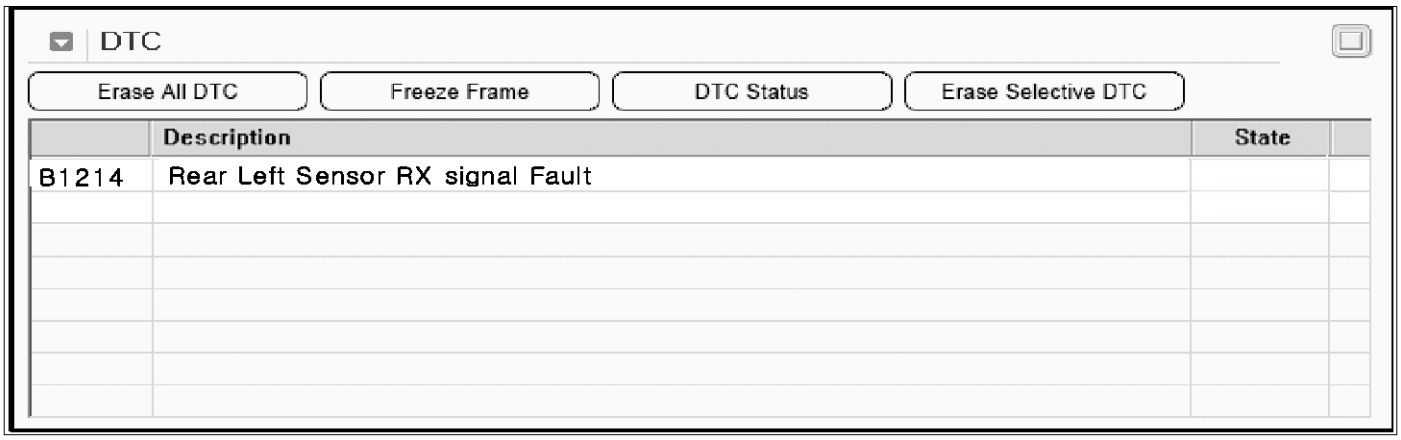
Refer to DTC B1621 : Power Error.

## Signal Waveform & Data

Refer to DTC B1621 : Power Error.

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or FBWS's connector or was repaired and FBWS 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

Refer to DTC B1210 : Front Left Sensor Fault.

### Power Circuit Inspection

Refer to DTC B1210 : Front Left Sensor Fault.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1215 Rear Center Left Sensor Fault

### General Description

Refer to DTC B1621 : Power Error.

### DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

### DTC Detecting Condition

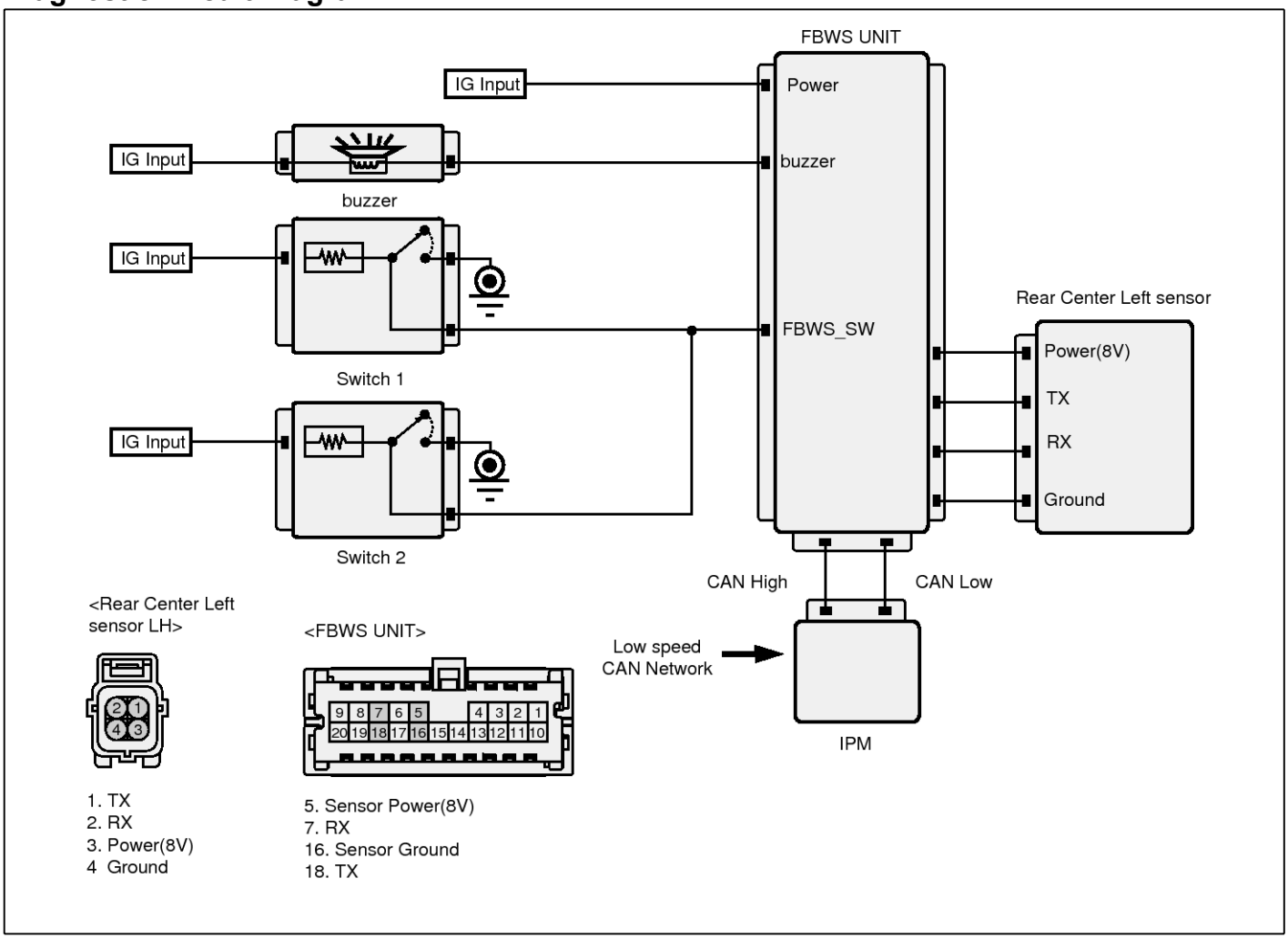
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of rear center left sensor check | • TX line of rear center left sensor open or poor connection.<br>• RX line of rear center left sensor open or poor connection.<br>• Ground line of rear center left sensor open or poor connection.<br>• Power line of rear center left sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to rear left sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram




SBHBE9H07L

## Signal Waveform & Data

Refer to DTC B1621 : Power Error.

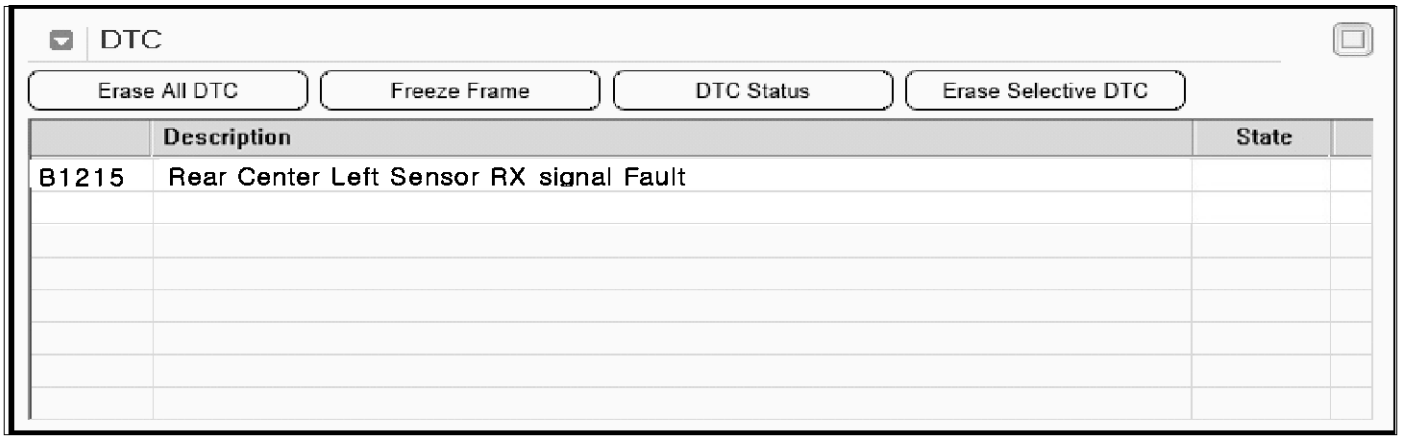
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## Scantool Data Analysis

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).




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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 FBWS's connector or was repaired and FBWS 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

Refer to DTC B1210 : Front Left Sensor Fault.

## Power Circuit Inspection

Refer to DTC B1210 : Front Left Sensor Fault.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1216 Rear Center Right Sensor Fault

### General Description

Refer to DTC B1621 : Power Error.

### DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

### DTC Detecting Condition

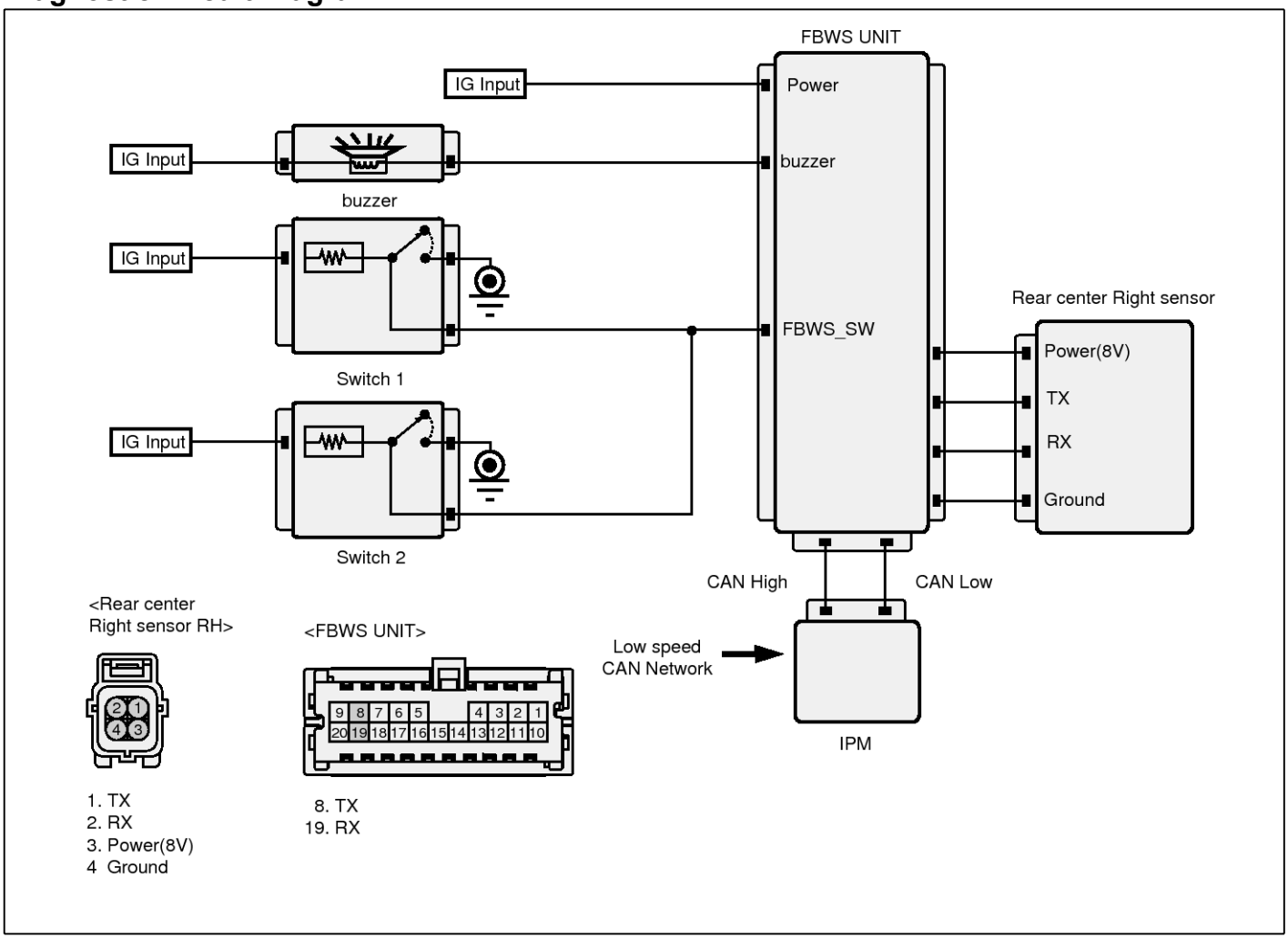
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of front right sensor check | • TX line of rear center right sensor open or poor connection.<br>• RX line of rear center right sensor open or poor connection.<br>• Ground line of rear center right sensor open or poor connection.<br>• Power line of rear center right sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to front right sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram




SBHBE9H09L

## Signal Waveform & Data

Refer to DTC B1621 : Power Error.

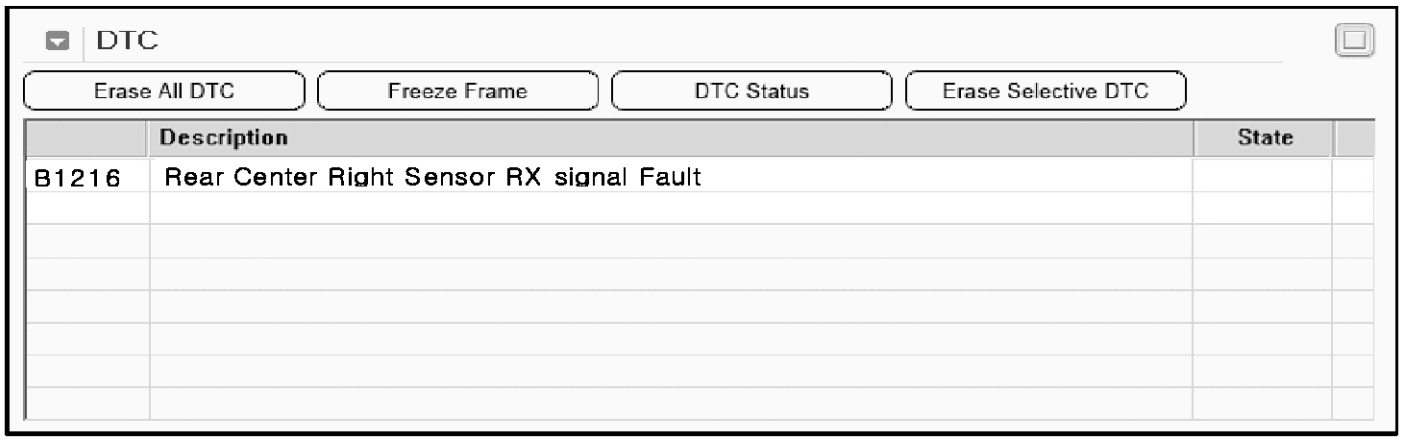
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## Scantool Data Analysis

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).




SBHBE9H24L

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 FBWS's connector or was repaired and FBWS 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

Refer to DTC B1210 : Front Left Sensor Fault.

## Power Circuit Inspection

Refer to DTC B1210 : Front Left Sensor Fault.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1217 Rear Right Sensor Fault

### General Description

Refer to DTC B1621 : Power Error.

### DTC Description

This code reports an error in RX line. The purpose is to verify the status of FBWS UNIT, Sensor and Wire when error is detected..

### DTC Detecting Condition

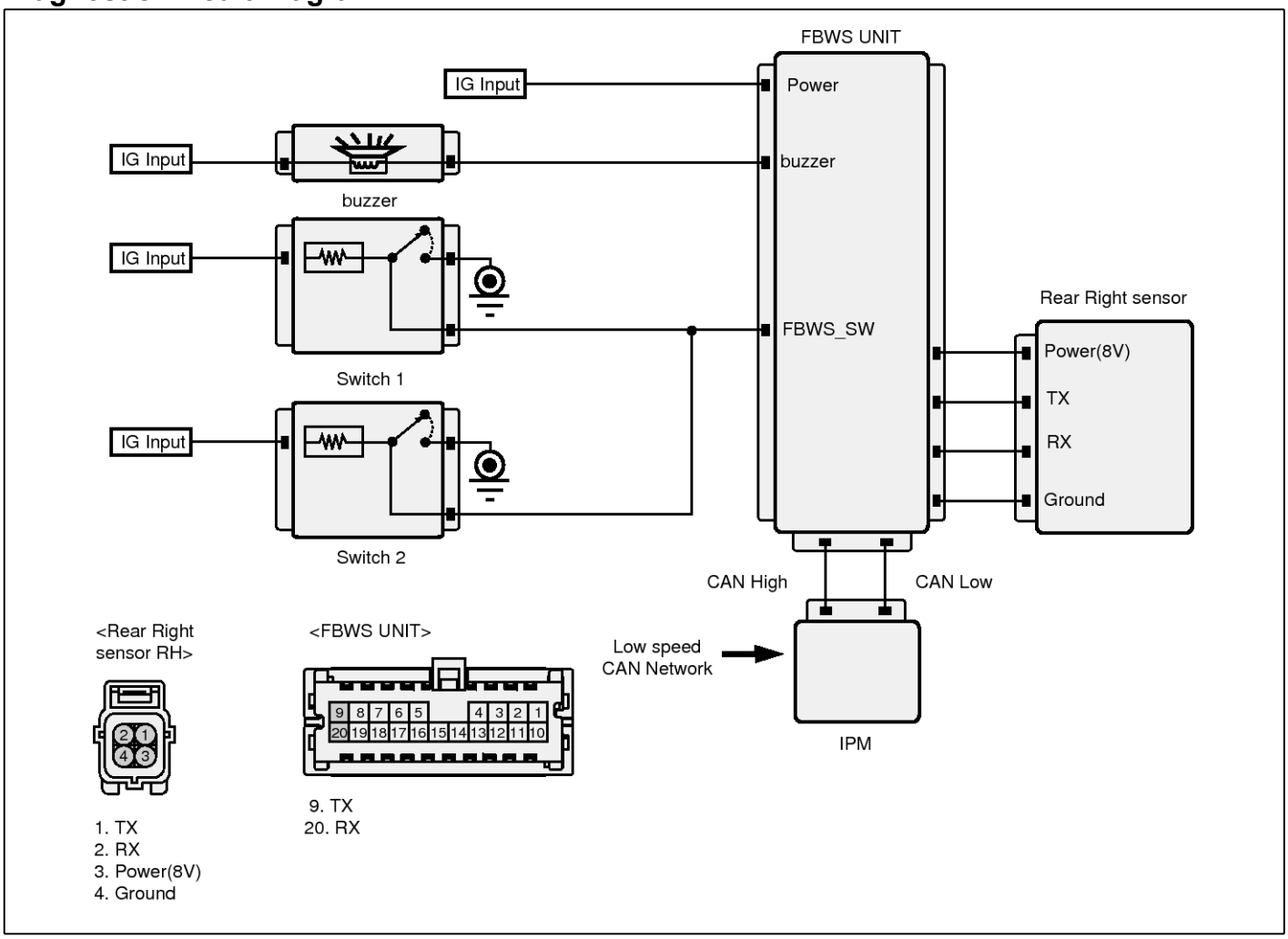
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal output of rear right sensor check | • TX line of rear right sensor open or poor connection.<br>• RX line of rear right sensor open or poor connection.<br>• Ground line of rear right sensor open or poor connection.<br>• Power line of rear right sensor open or poor connection. |
| Enable Conditions | • IG KEY ON. | |
| Threshold Value | • Signal voltage of RX is below 1.5V for more than 0.8ms when TX signal is transmitted to front right sensor for 0.4ms. | |
| Diagnostic Time | • Immediately (1 check lasts 0.3sec after IG KEY ON) | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram




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## Signal Waveform & Data

Refer to DTC B1621 : Power Error.

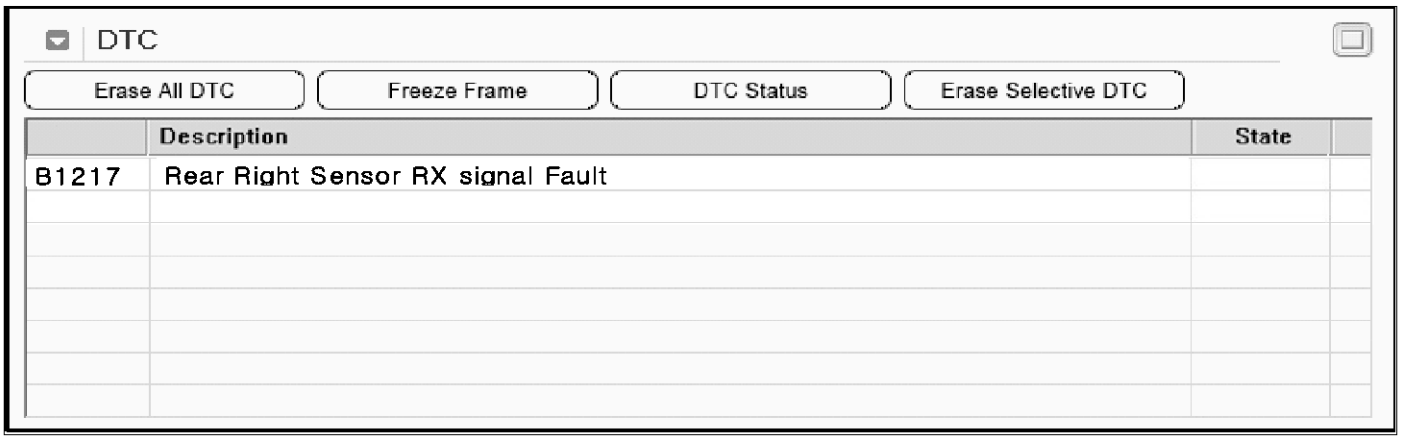
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### Scantool Data Analysis

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).




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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 FBWS's connector or was repaired and FBWS 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

Refer to DTC B1210 : Front Left Sensor Fault.

### Power Circuit Inspection

Refer to DTC B1210 : Front Left Sensor Fault.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## Power Seat Module(PSM)

### Troubleshooting

#### PSM DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1954 | Slide motor or sensor error |
| 4 | B1955 | Recline motor or sensor error |
| 5 | B1956 | Front height motor or sensor error |
| 6 | B1957 | Right Rear Height Motor/Sensor Error |

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## B1602 CAN Error

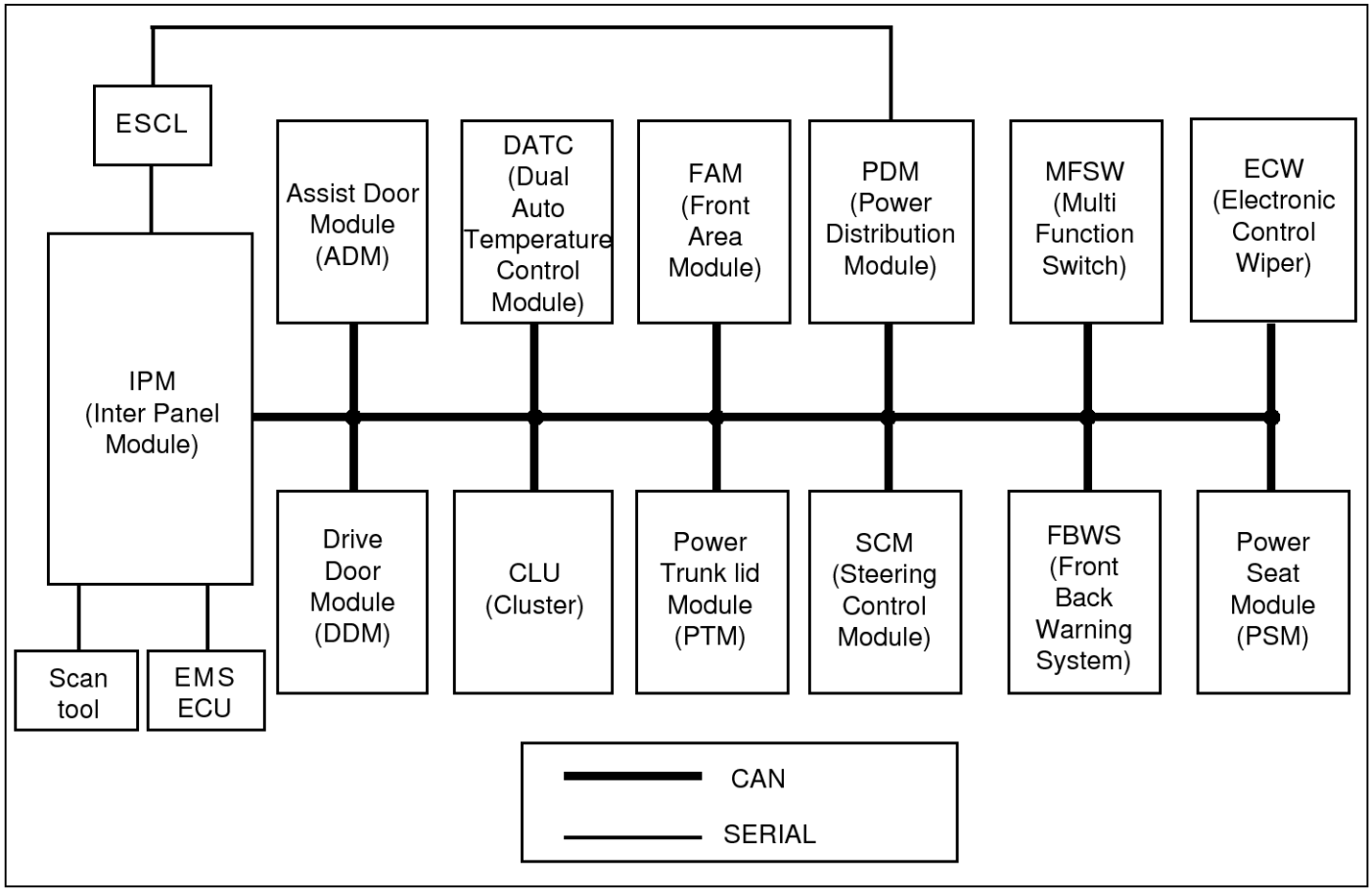
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

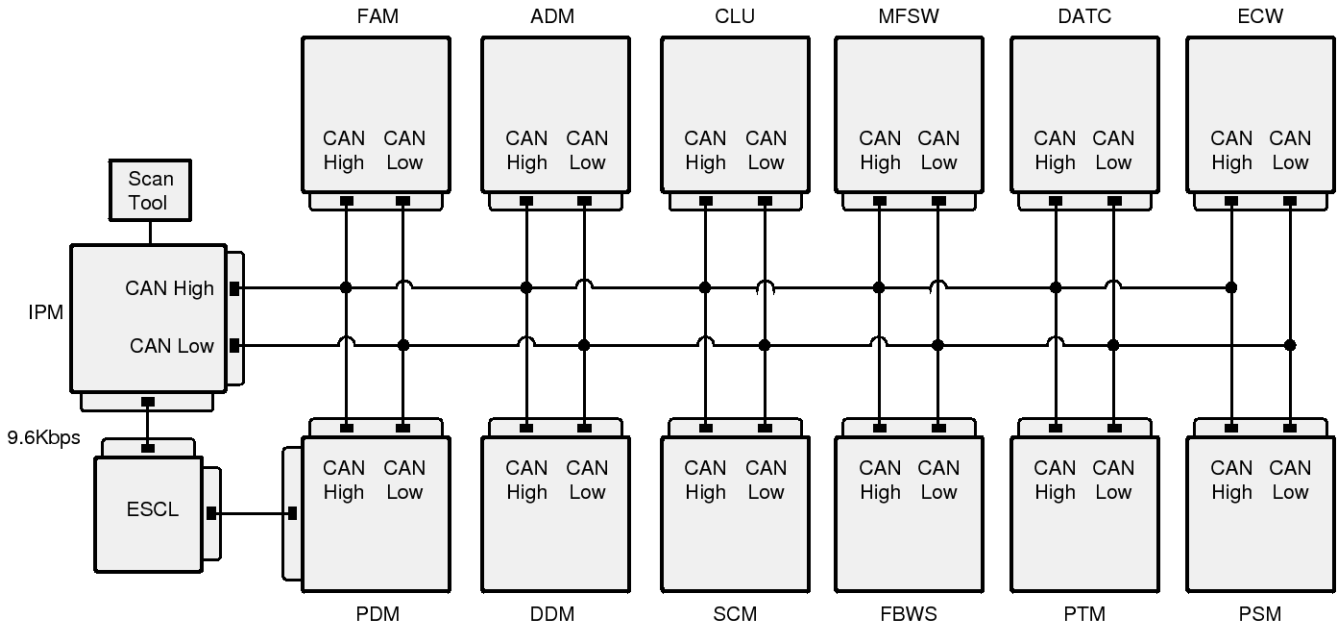
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,PSM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, PSM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

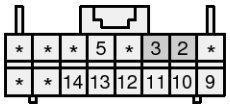



<ECW>



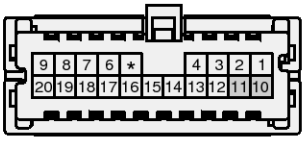
4. Low
5. High

<IPM>



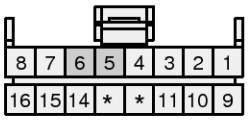
2 . Low
3. High

<PDM>



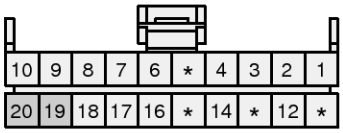
10. Low
11. High

<MFSW>



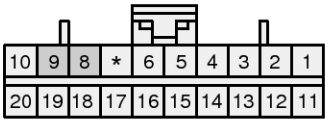
5. High
6. Low

<CLU>



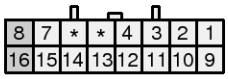
19. Low
20. High

<TILT & TELE>



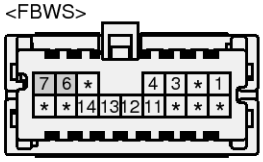
8. High
9. Low

<ADM>



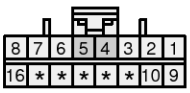
8. High
16. Low

<FBWS>



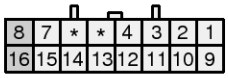
6. High
7. Low

<PSM>



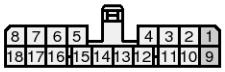
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

SBHBE9P01L

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## Signal Waveform & Data

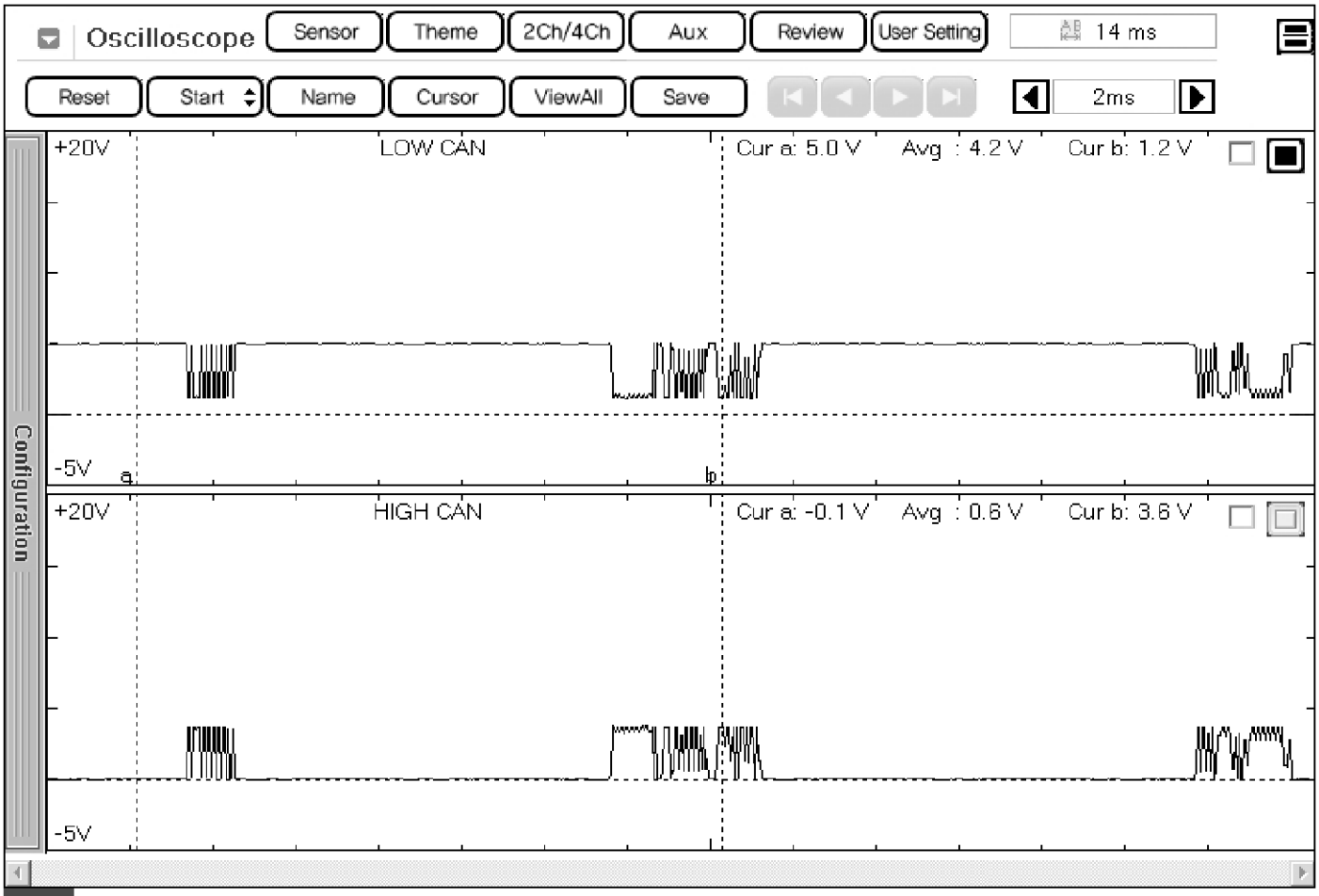



Fig.1

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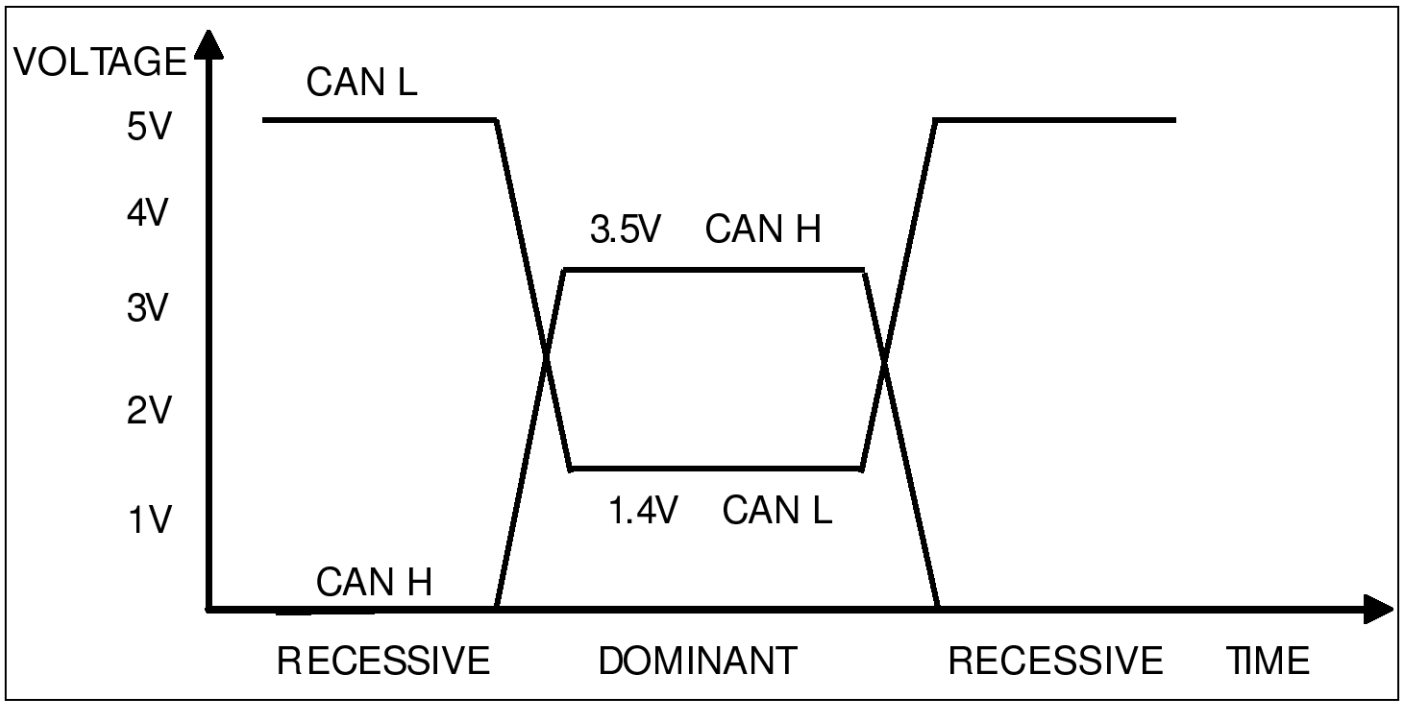



Fig.2

SBHBE9P13L

Fig.1) CAN Low/High Signal Waveform

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

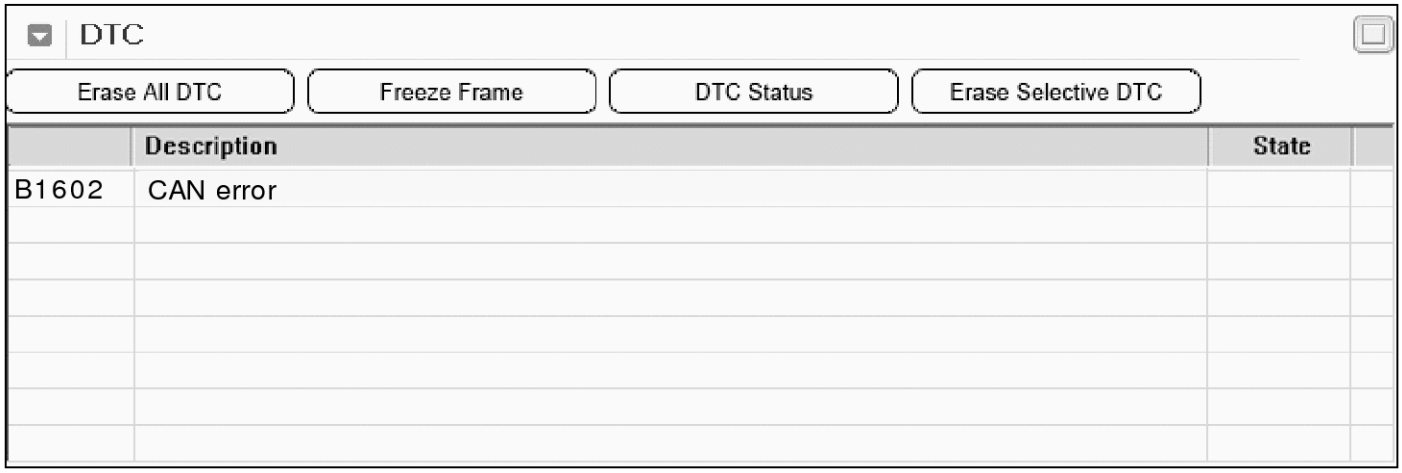
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## Scantool Data Analysis

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).




SBHBE9P14L

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 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.

## 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 "PSM Signal Circuit Inspection" procedure.

## PSM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PSM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PSM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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## 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), 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)
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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# B1603 CAN Communication Bus Off

## General Description

Refer to DTC B1602 : CAN Error.

## 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM 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,PSM are not Sleep condition1. CAN High and Low Line short to ground coincident<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, PSM 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

Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

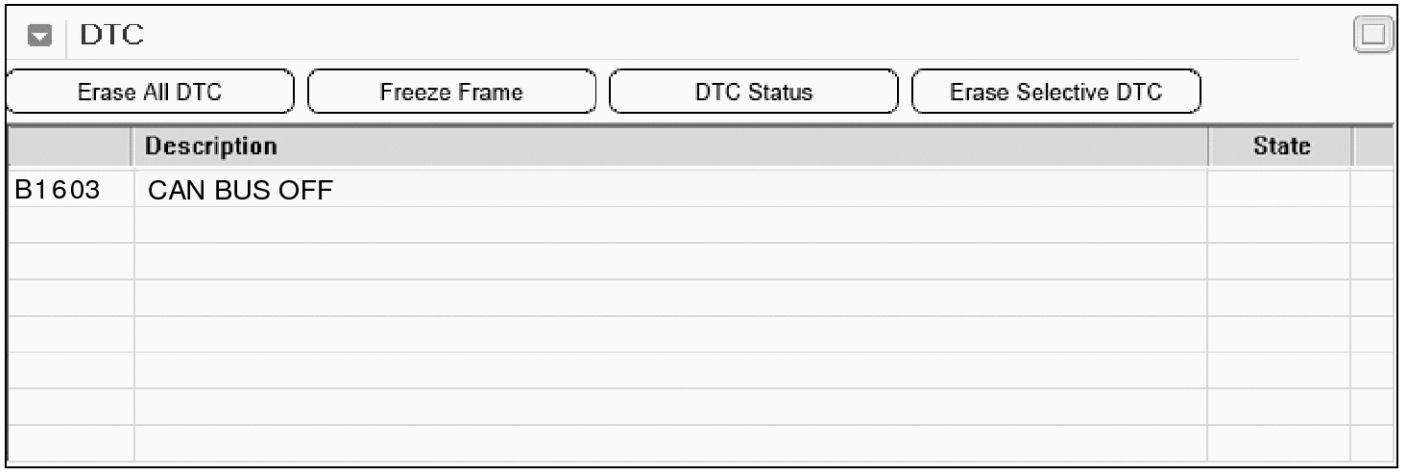
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### Scantool Data Analysis

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).




SBHBE9P15L

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 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.

### 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

Refer to DTC B1602 : CAN Error.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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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)

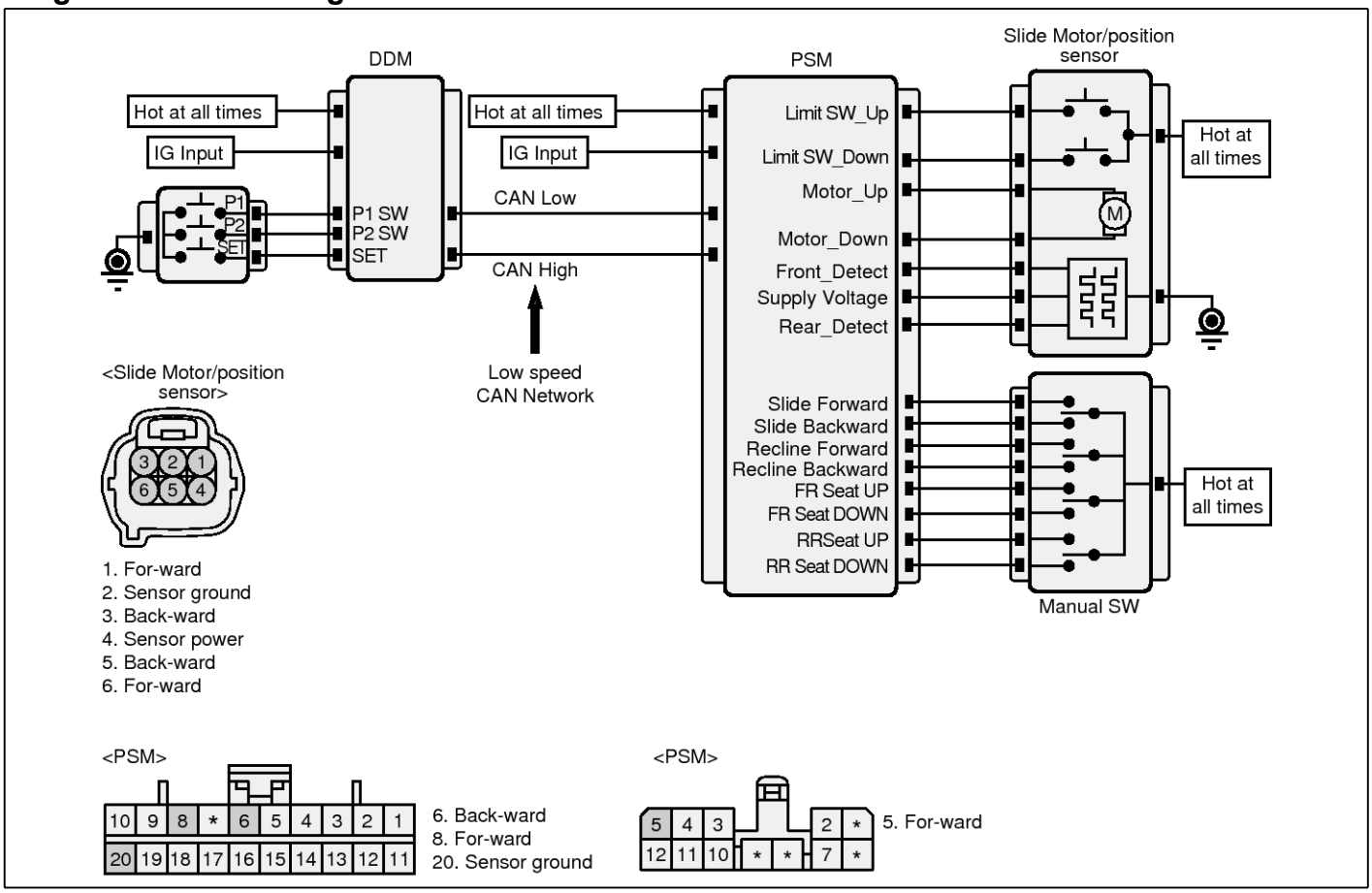
## DTC Description

PSM sets this code when amount of change of the Slide motor position sensor is little than 12edge (6pulse) for 2 sec. 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 | • Slide Motor position sensor signal check | • IPS(Intelligent Power Switch) terminal short<br>• IPS(Intelligent Power Switch) terminal short<br>• Slide Motor position sensor (A, B) |
| Enable Conditions | • B+ status error | |
| Threshold Value | • - | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |
| Fail Safe | • Warning BUZZER sounds 10 times | |

## Diagnostic Circuit Diagram




SBHBE9P02L

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## Signal Waveform & Data

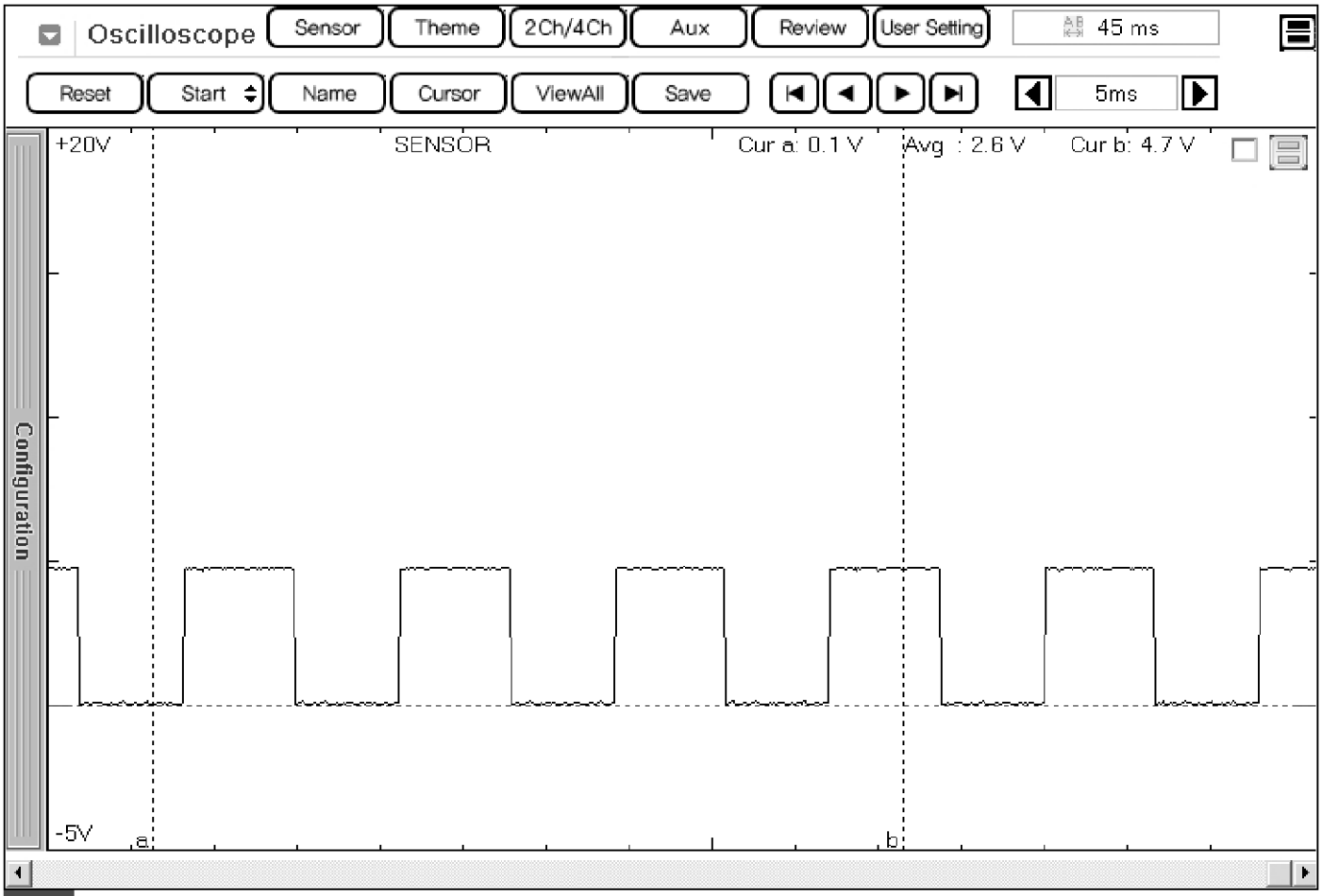



Fig.1

SBHBE9P16L

Fig.1) Normal waveform of Seat Slide Moter/Sensor

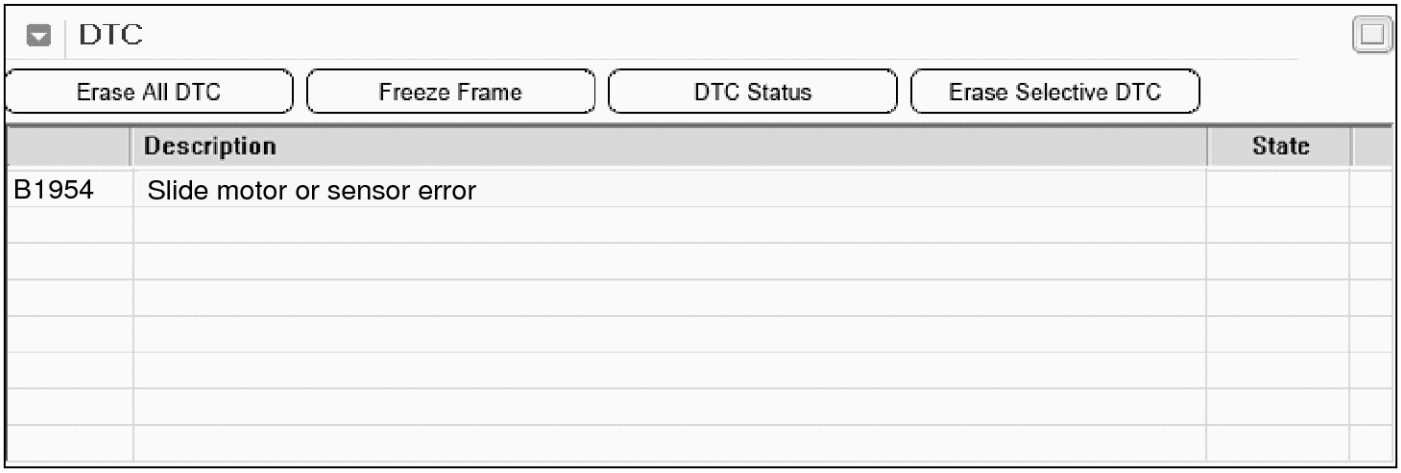
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## Scantool Data Analysis

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).




SBHBE9P26L

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.

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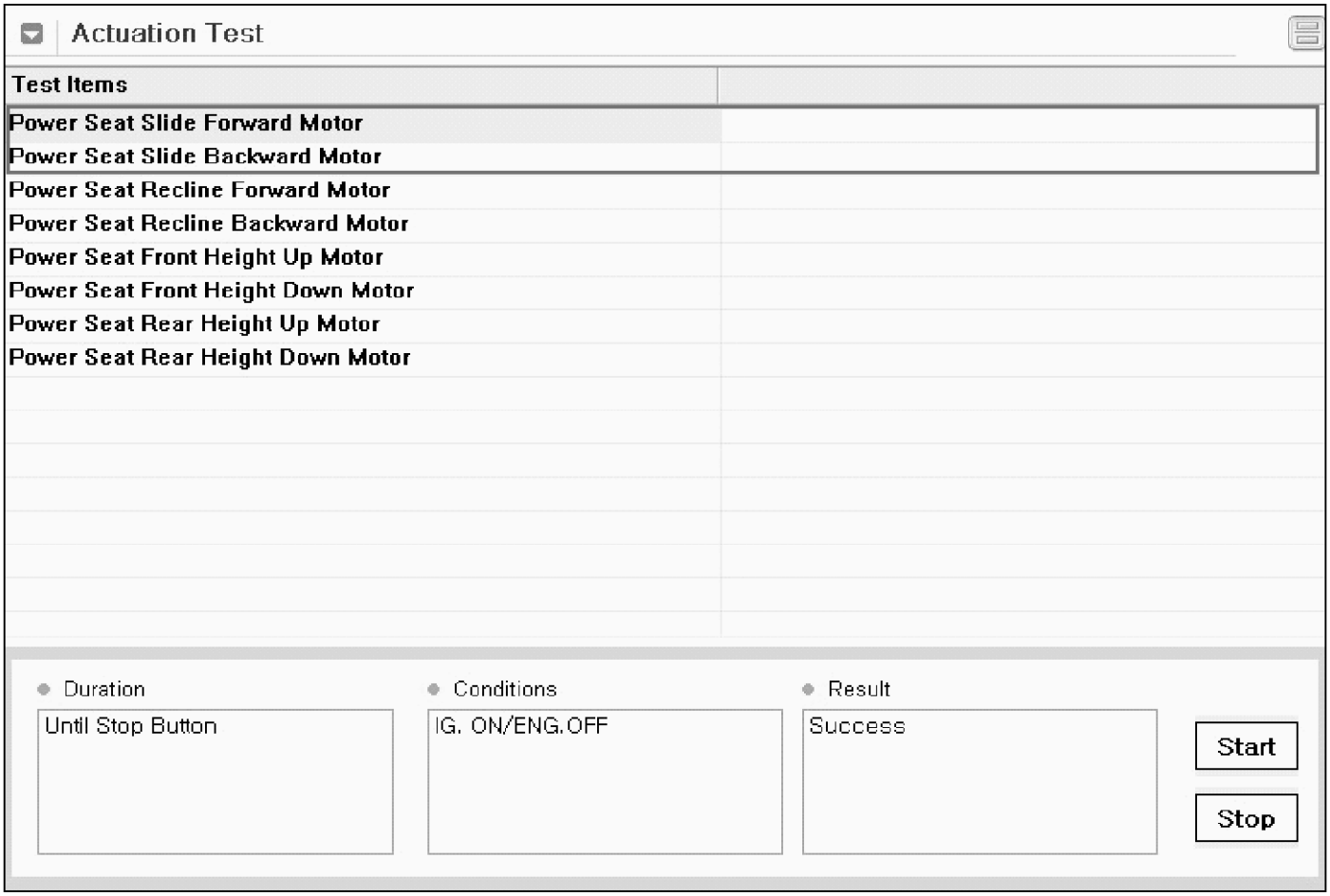


## Component Inspection

### ■ 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




SBHBE9P27L

5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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## ■ 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)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Sensor Supply Voltage | 10.3 | V |
| Slide Motor Short Circuit To Ground State | OFF | - |
| Recline Motor Short Circuit To Ground State | OFF | - |
| Front Height Motor Short Circuit To Ground State | OFF | - |
| Rear Height Motor Short Circuit To Ground State | OFF | - |
| Slide Motor Open State | OFF | - |
| Recline Motor Open State | OFF | - |
| Front Height Motor Open State | OFF | - |
| Rear Height Motor Open State | OFF | - |
| Ignition 1 Signal | ON | - |
| Recline Forward Switch | OFF | - |
| Recline Backward Switch | OFF | - |
| Recline Forward Limit Switch | ON | - |
| Recline Backward Limit Switch | ON | - |
| Slide Forward Switch | ON | - |
| Slide Backward Switch | OFF | - |
| Slide Forward Limit Switch | ON | - |
| Slide Backward Limit Switch | OFF | - |
| Front Height Up Limit Switch | ON | - |
| Front Height Down Limit Switch | OFF | - |
| Rear Height Up Switch | OFF | - |

SBHBE9P28L

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.

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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 '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

Refer to DTC B1602 : CAN Error.

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# B1955 Recline Motor Or Sensor Error

## General Description

Refer to DTC B1954 : Slide Motor Or Sensor Error.

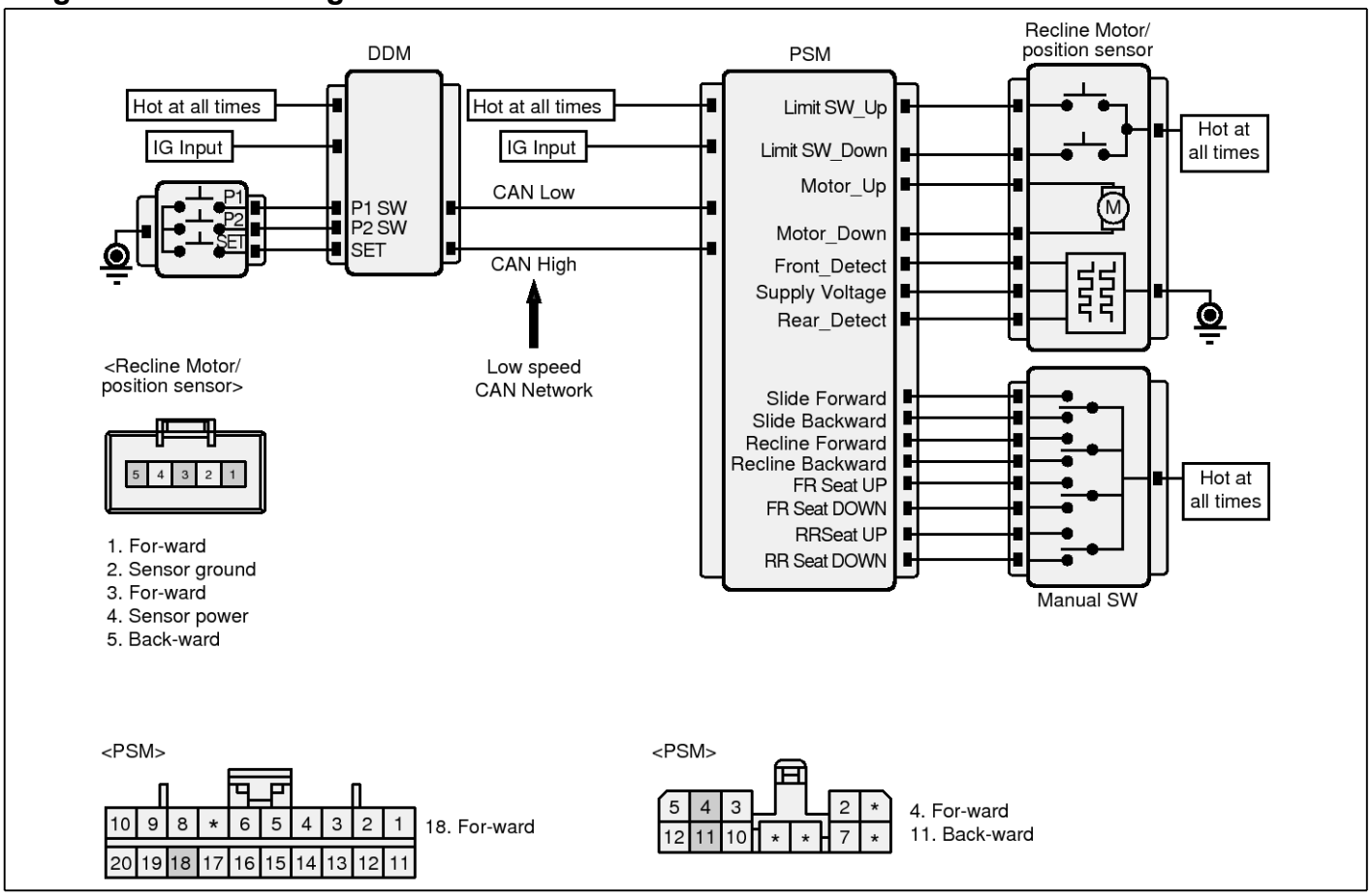
## DTC Description

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 | • Recline Motor position sensor signal check | • IPS(Intelligent Power Switch) terminal short<br>• IPS(Intelligent Power Switch) terminal short<br>• Recline Motor position sensor ( A,B) |
| Enable Conditions | • B+ status error | |
| Threshold Value | • - | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |
| Fail Safe | • Warning BUZZER sounds 10 times | |

## Diagnostic Circuit Diagram




SBHBE9P03L

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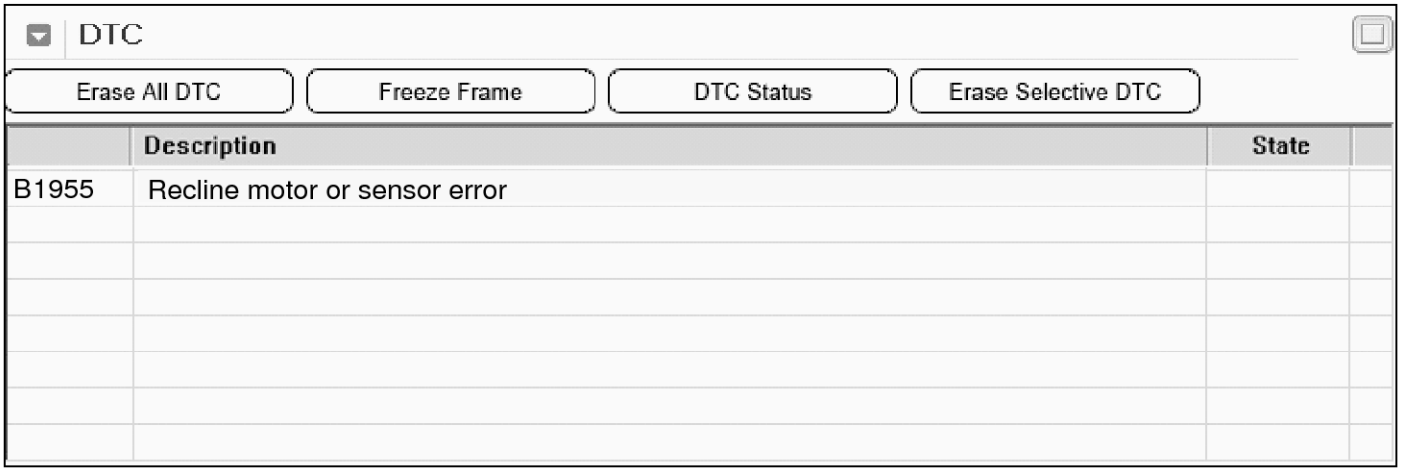


## Signal Waveform & Data

Refer to DTC B1954 : Slide Motor Or Sensor Error.

## 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).




SBHBE9P23L

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.

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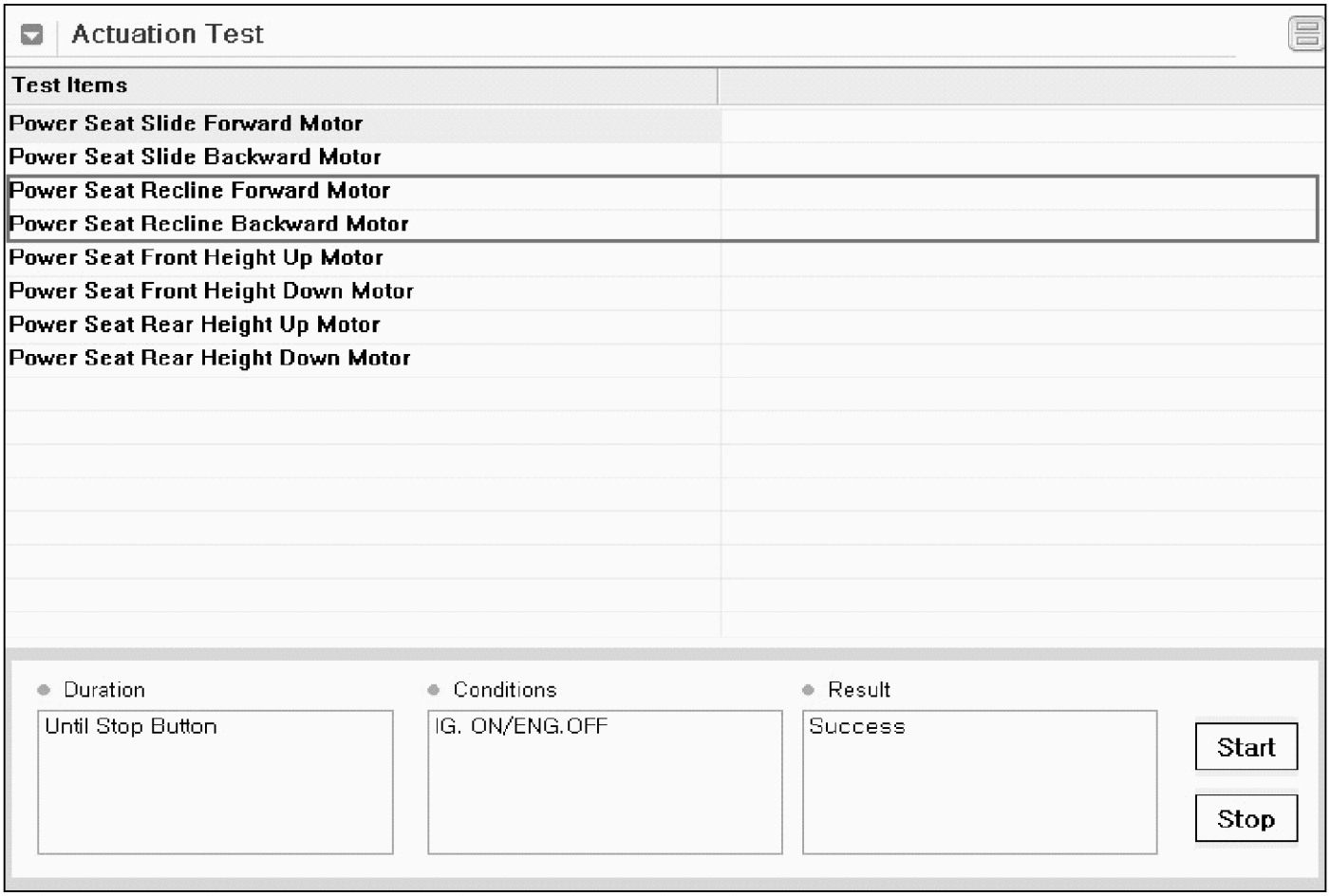


## Component Inspection

### ■ 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




SBHBE9P24L

5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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## ■ 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)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Sensor Supply Voltage | 10.3 | V |
| Slide Motor Short Circuit To Ground State | OFF | - |
| Recline Motor Short Circuit To Ground State | OFF | - |
| Front Height Motor Short Circuit To Ground State | OFF | - |
| Rear Height Motor Short Circuit To Ground State | OFF | - |
| Slide Motor Open State | OFF | - |
| Recline Motor Open State | OFF | - |
| Front Height Motor Open State | OFF | - |
| Rear Height Motor Open State | OFF | - |
| Ignition 1 Signal | ON | - |
| Recline Forward Switch | ON | - |
| Recline Backward Switch | OFF | - |
| Recline Forward Limit Switch | ON | - |
| Recline Backward Limit Switch | ON | - |
| Slide Forward Switch | OFF | - |
| Slide Backward Switch | OFF | - |
| Slide Forward Limit Switch | ON | - |
| Slide Backward Limit Switch | OFF | - |
| Front Height Up Limit Switch | ON | - |
| Front Height Down Limit Switch | OFF | - |
| Rear Height Up Switch | OFF | - |

SBHBE9P25L

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

Refer to DTC B1954 : Slide Motor Or Sensor Error.

### Signal Circuit Inspection

Refer to DTC B1954 : Slide Motor Or Sensor Error.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1956 Front Height Motor Or Sensor Error

## General Description

Refer to DTC B1954 : Slide Motor Or Sensor Error.

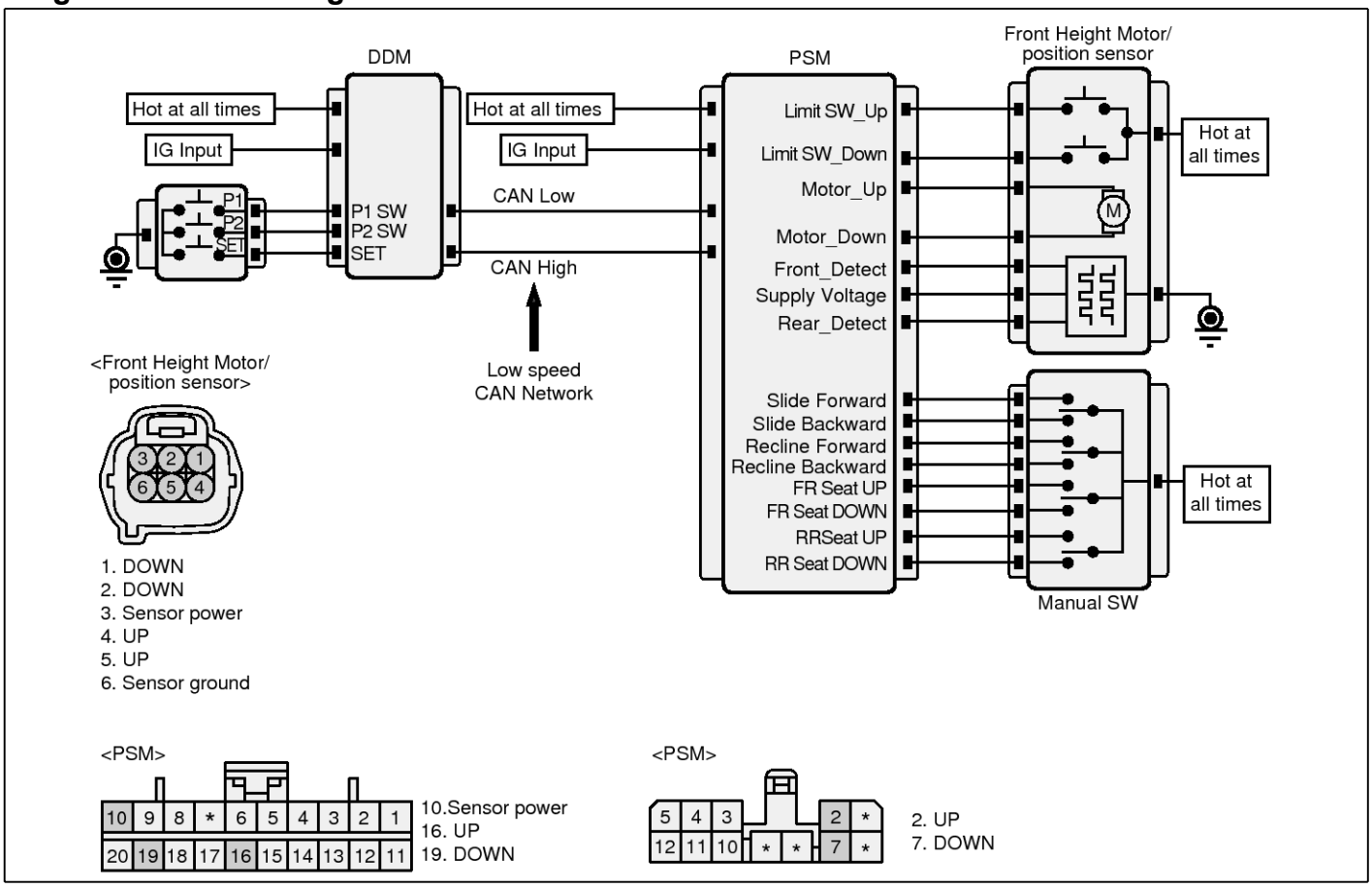
## DTC Description

PSM sets this code when amount of change of the Front height motor position sensor is little than 8edge (4pulse) 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 | • Front Height Motor position sensor signal check | • IPS(Intelligent Power Switch) terminal short<br>• IPS(Intelligent Power Switch) terminal short<br>• Front Height Motor position sensor (A,B) |
| Enable Conditions | • B+ status error | |
| Threshold Value | • - | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |
| Fail Safe | • Warning BUZZER sounds 10 times | |

## Diagnostic Circuit Diagram




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## Signal Waveform & Data

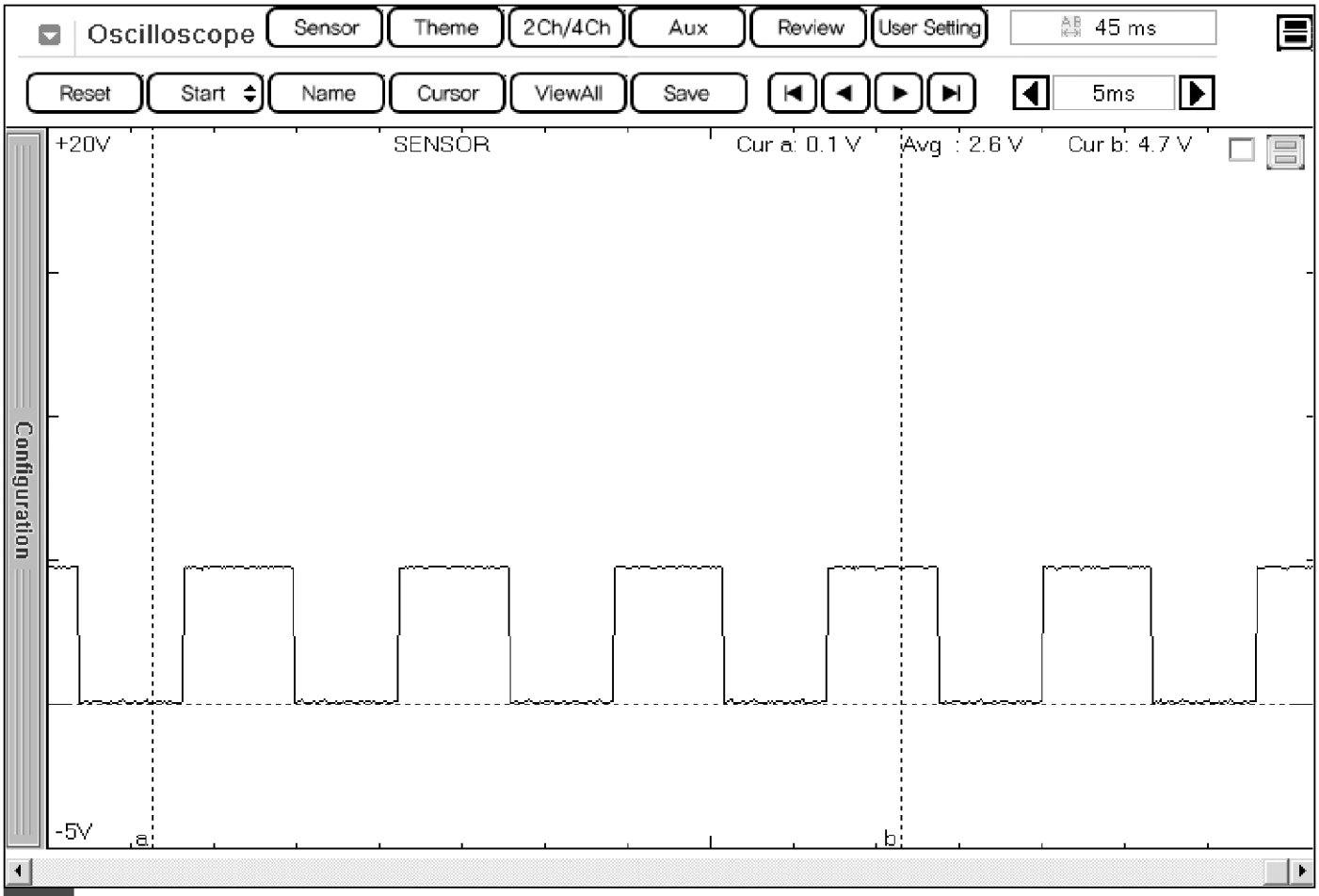



Fig.1

SBHBE9P16L

Fig.1) Normal waveform of Front Height Motor position sensor

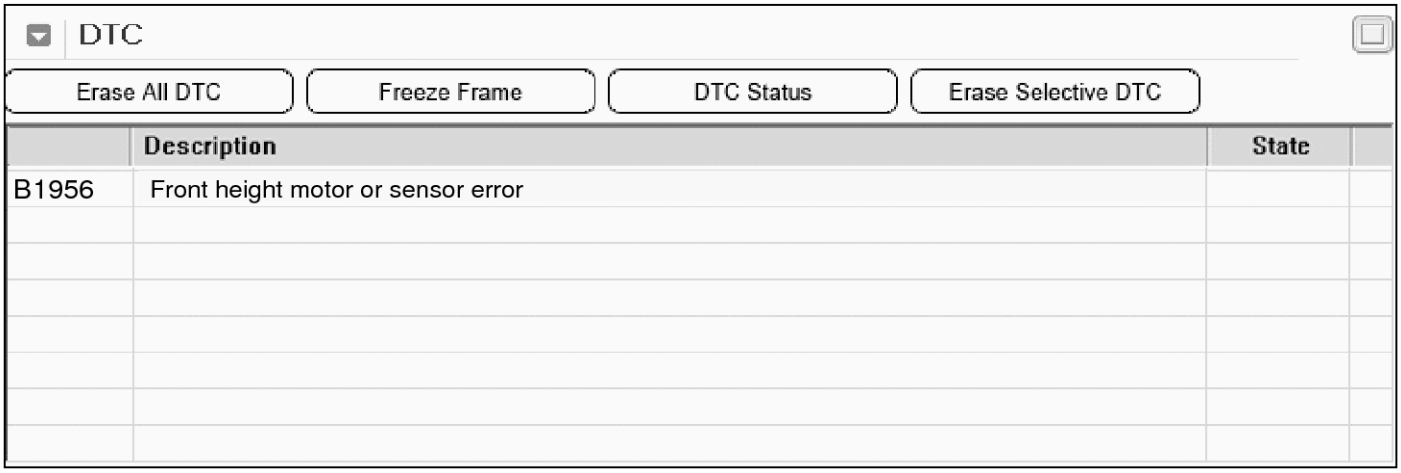
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### Scantool Data Analysis

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).




SBHBE9P20L

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.

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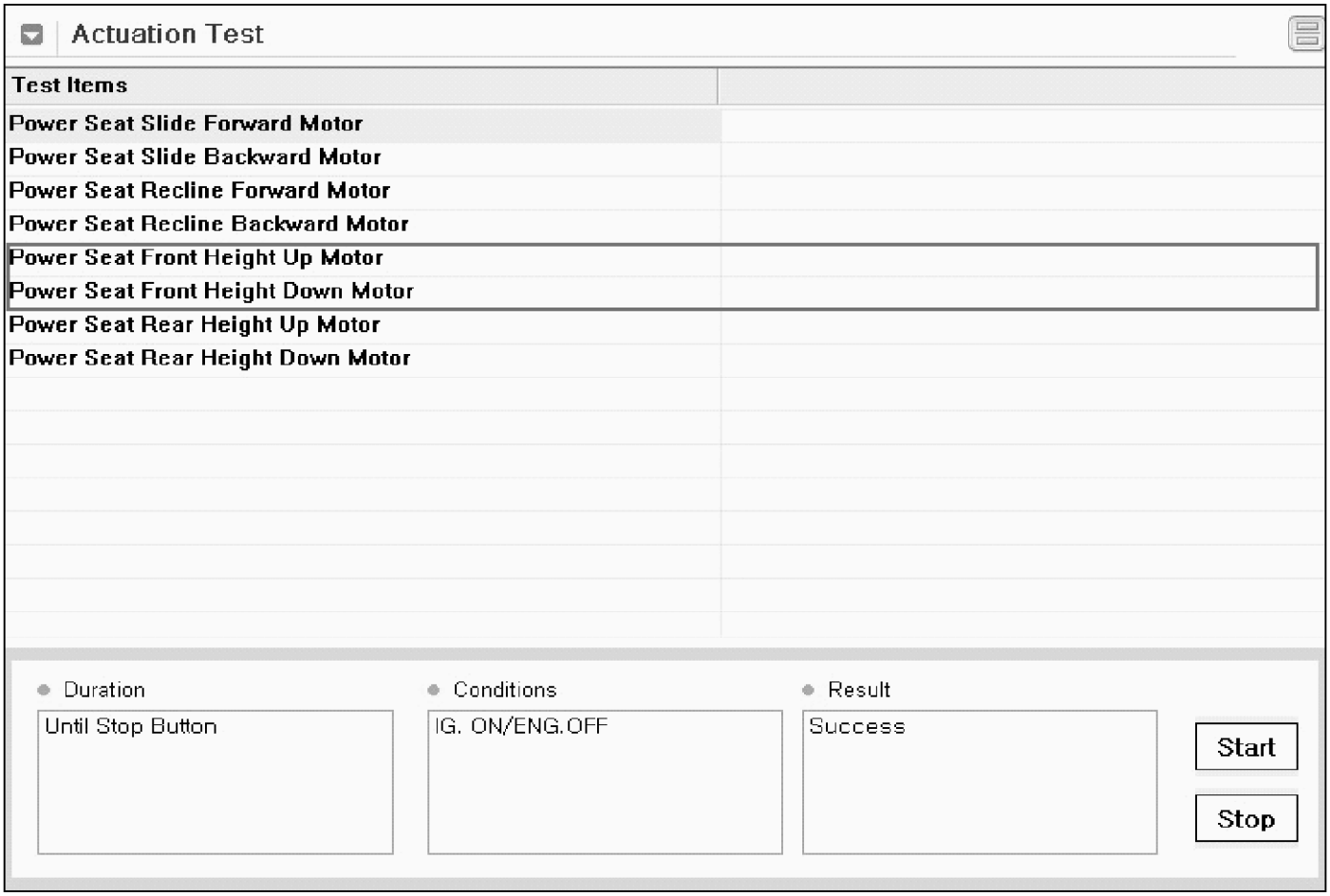


## Component Inspection

### ■ 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




SBHBE9P21L

5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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## ■ 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)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Slide Backward Limit Switch | OFF | - |
| Front Height Up Limit Switch | ON | - |
| Front Height Down Limit Switch | OFF | - |
| Rear Height Up Switch | OFF | - |
| Rear Height Down Switch | OFF | - |
| Front Height Up Switch | ON | - |
| Front Height Down Switch | OFF | - |
| Rear Height Up Limit Switch | ON | - |
| Rear Height Down Limit Switch | ON | - |
| Slide Forward Motor Output | OFF | - |
| Slide Backward Motor Output | OFF | - |
| Recline Forward Motor Output | OFF | - |
| Recline Backward Motor Output | OFF | - |
| Front Height Motor Up Output | OFF | - |
| Front Height Motor Down Output | OFF | - |
| Rear Height Motor Up Output | OFF | - |
| Rear Height Motor Down Output | OFF | - |
| Recline Position | 1968 | edge |
| Slide Position | 0 | edge |
| Front Height Postion | 0 | edge |
| Rear Height Position | 856 | edge |

SBHBE9P22L

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

Refer to DTC B1954 : Slide Motor Or Sensor Error.

## Signal Circuit Inspection

Refer to DTC B1954 : Slide Motor Or Sensor Error.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1957 Rear Height Motor Or Sensor Error

## General Description

Refer to DTC B1954 : Slide Motor Or Sensor Error.

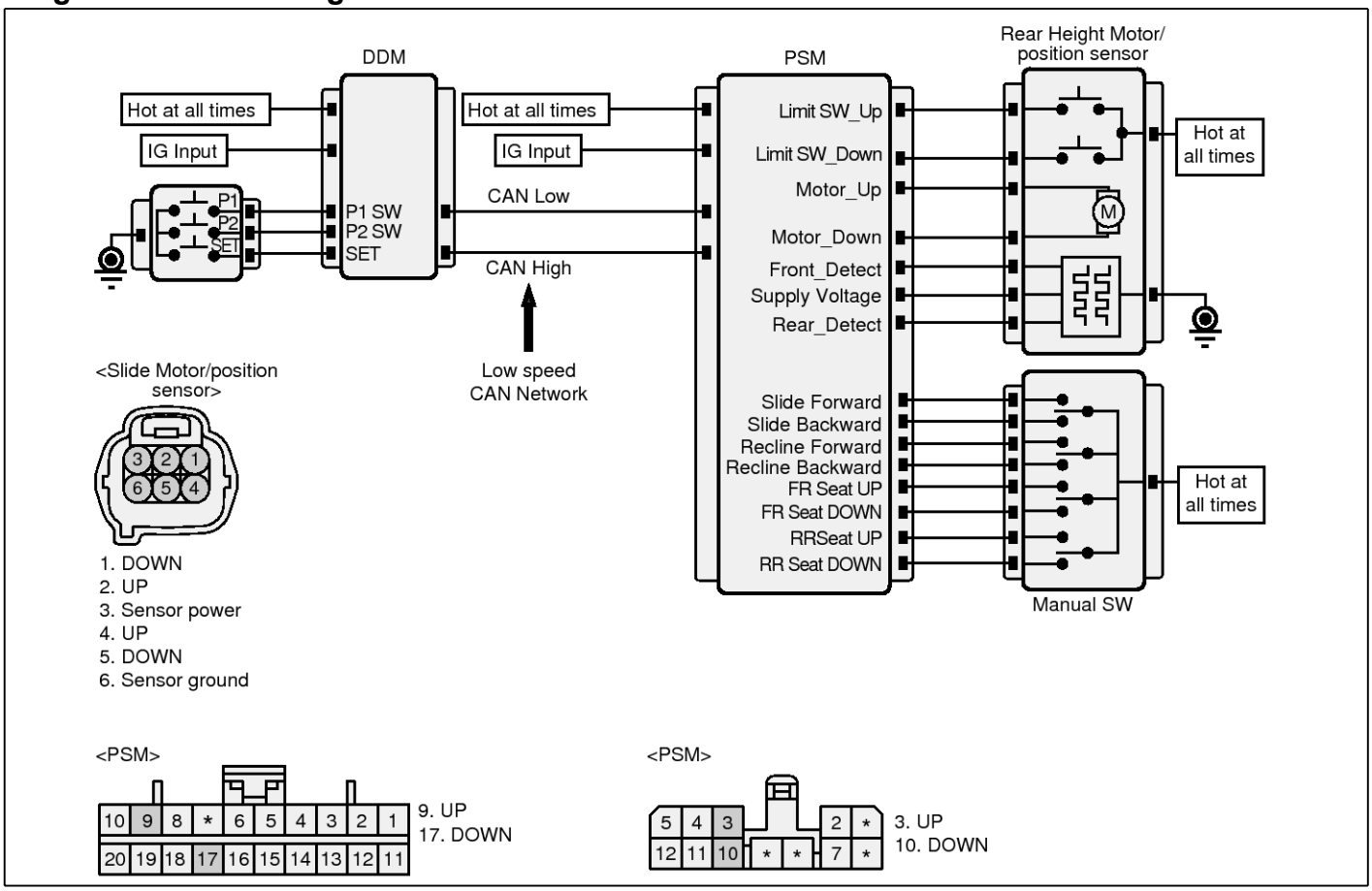
## DTC Description

PSM sets this code when amount of change of the Rear height motor sensor is little than 8edge (4pulse) 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 | • Rear Height Motor position sensor signal check | • IPS(Intelligent Power Switch) terminal short<br>• IPS(Intelligent Power Switch) terminal short<br>• Rear Height Motor position sensor (A,B) |
| Enable Conditions | • B+ status error | |
| Threshold Value | • - | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |
| Fail Safe | • Warning BUZZER sounds 10 times | |

## Diagnostic Circuit Diagram




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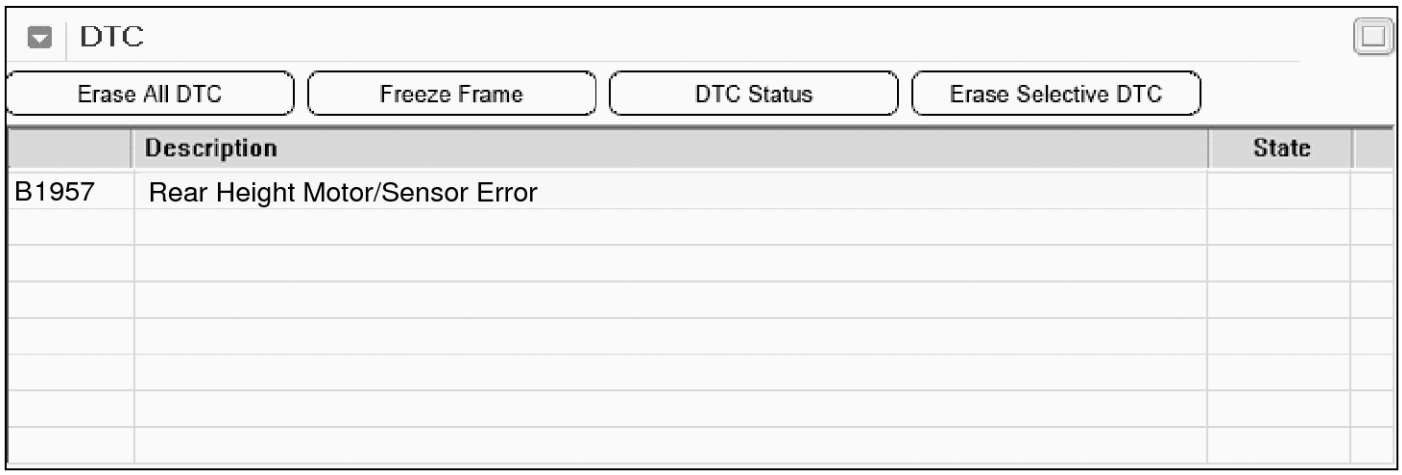


## Signal Waveform & Data

Refer to DTC B1956 : Front Height Motor Or Sensor Error.

## 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?

**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.

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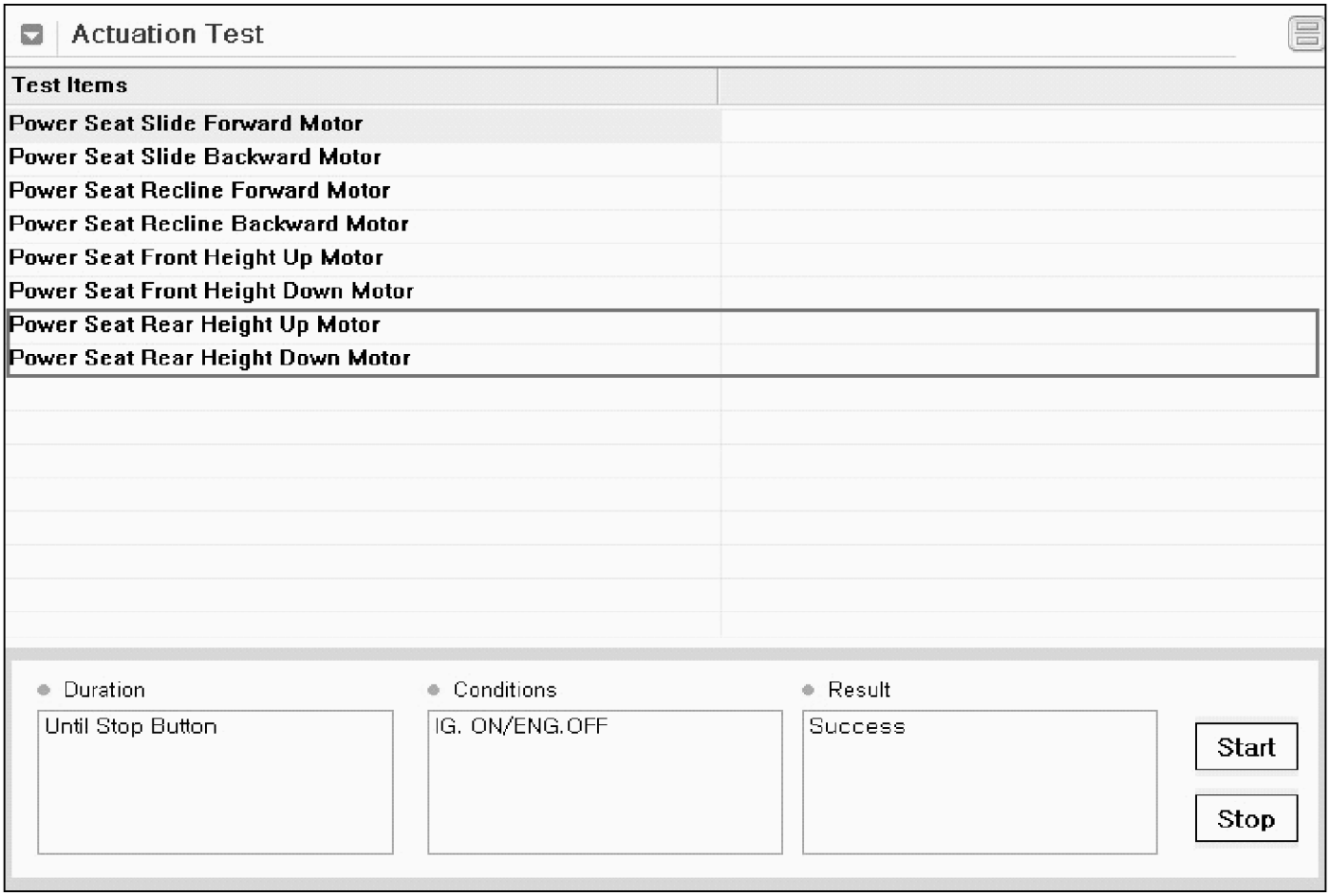


## Component Inspection

### ■ 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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5. Is motor working normal ?

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

**NO** ▶ Go to next procedure.

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## ■ 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)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Slide Backward Limit Switch | OFF | - |
| Front Height Up Limit Switch | ON | - |
| Front Height Down Limit Switch | OFF | - |
| Rear Height Up Switch | ON | - |
| Rear Height Down Switch | OFF | - |
| Front Height Up Switch | OFF | - |
| Front Height Down Switch | OFF | - |
| Rear Height Up Limit Switch | ON | - |
| Rear Height Down Limit Switch | ON | - |
| Slide Forward Motor Output | OFF | - |
| Slide Backward Motor Output | OFF | - |
| Recline Forward Motor Output | OFF | - |
| Recline Backward Motor Output | OFF | - |
| Front Height Motor Up Output | OFF | - |
| Front Height Motor Down Output | OFF | - |
| Rear Height Motor Up Output | OFF | - |
| Rear Height Motor Down Output | OFF | - |
| Recline Position | 1968 | edge |
| Slide Position | 0 | edge |
| Front Height Postion | 0 | edge |
| Rear Height Position | 856 | edge |

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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

Refer to DTC B1954 : Slide Motor Or Sensor Error.

## Signal Circuit Inspection

Refer to DTC B1954 : Slide Motor Or Sensor Error.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## Multi Function Switch(MFSW)

### Troubleshooting

#### MFSW DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1550 | CRUISE SW Circuit short Circuit to ground |
| 2 | B1551 | Audio1_SW Circuit short Circuit to ground |
| 3 | B1552 | Audio2_SW Circuit short Circuit to ground |
| 4 | B1553 | LIGHT MFSW ERROR |
| 5 | B1554 | TURN SIGNAL MFSW ERROR |
| 6 | B1555 | WIPER MFSW ERROR |
| 7 | B1602 | CAN error |
| 8 | B1603 | CAN BUSOFF |

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# B1550 Cruise Switch Error

## General Description

Refer to DTC B1602 : CAN Error.

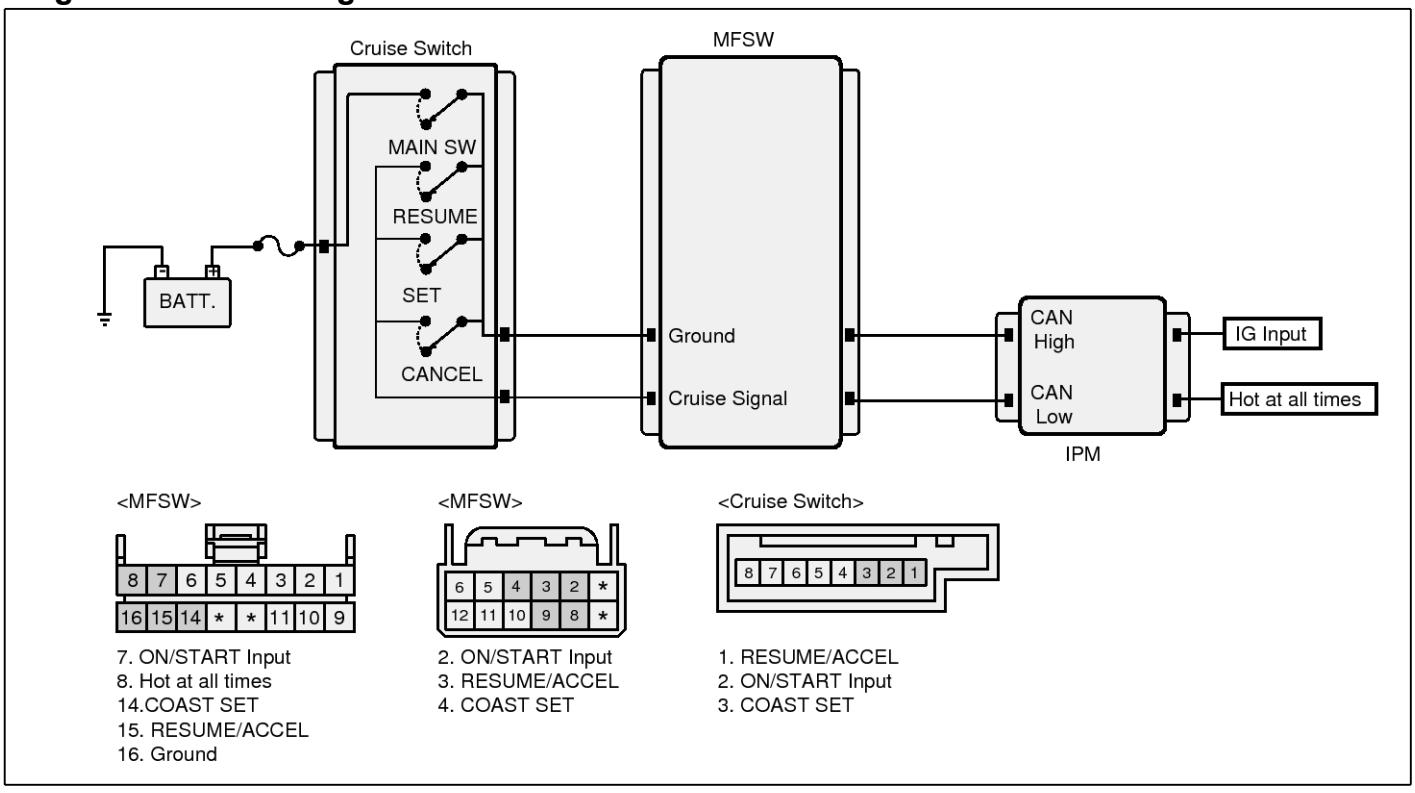
## DTC Description

This code is outputted when the signal line of cruise switch is short to ground.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Cruise switch input signal check | • Cruise switch input line short to ground |
| Enable Conditions | • IG KEY ON.<br>• Engine runing | |
| Threshold Value | • The signal voltage of cruise switch = Approx. 0V | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram




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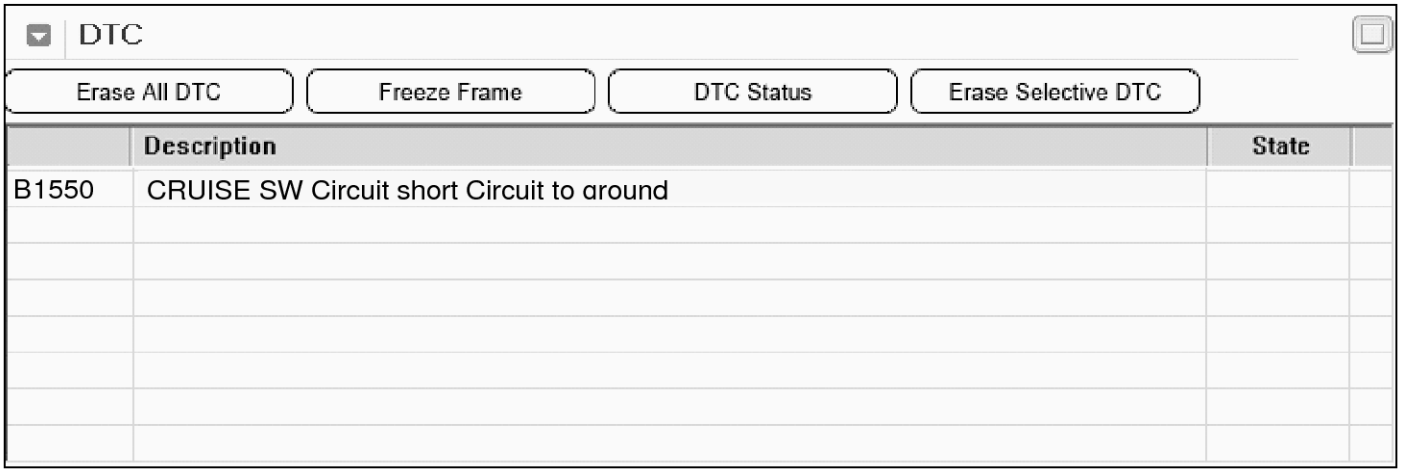
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## Scantool Data Analysis

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).




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5. Is the same DTC occurred again?

**YES** ▶ Go to "Scantool Data Analysis" procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MFSW's connector or was repaired and MFSW 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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## ■ Scantool Data Analysis

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Cruise Switch" is turned to "ON" when the cruise switch is pressed.

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 12.9 | V |
| Ignition 1 Voltage | 12.9 | V |
| Ignition 1 Signal | ON | - |
| Left Turn Signal Lamp Switch | OFF | - |
| Right Turn Signal Lamp Switch | OFF | - |
| Front Fog Lamp Switch | OFF | - |
| Light Switch | OFF | - |
| Tail Lamp Switch | OFF | - |
| Head Lamp Low Switch | OFF | - |
| Head Lamp High Switch | OFF | - |
| Passing Switch | OFF | - |
| Auto Light Switch | OFF | - |
| Washer Switch | OFF | - |
| Wiper INT Switch | ON | - |
| Wiper Low Switch | OFF | - |
| Wiper High Switch | OFF | - |
| Wiper MIST Switch | OFF | - |
| Wiper Auto Switch | ON | - |
| Wiper Switch | ON | - |
| Wiper INT. Mode | STEP 5 | - |
| Cruise Main Switch | ON | - |

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4. 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 "Terminal and Connector Inspection" 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 'Cruise Signal Circuit Inspection' procedure.

## Cruise Signal Circuit Inspection

### ■ Signal circuit short check

1. IG "OFF" and disconnect (-) cable from the battery.
2. Disconnect cruise switch, MFSW connector.
3. Measure resistance of signal line between cruise switch and MFSW.

**Specification :** Below 1Ω

4. Is the measured value normal?

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

**NO** ▶ Repair short in signal line between MFSW and cruise switch and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1551 Audio1 Switch Error

## General Description

Refer to DTC B1602 : CAN Error.

## DTC Description

This code is outputted when the signal line of audio1 switch is short to ground or power.

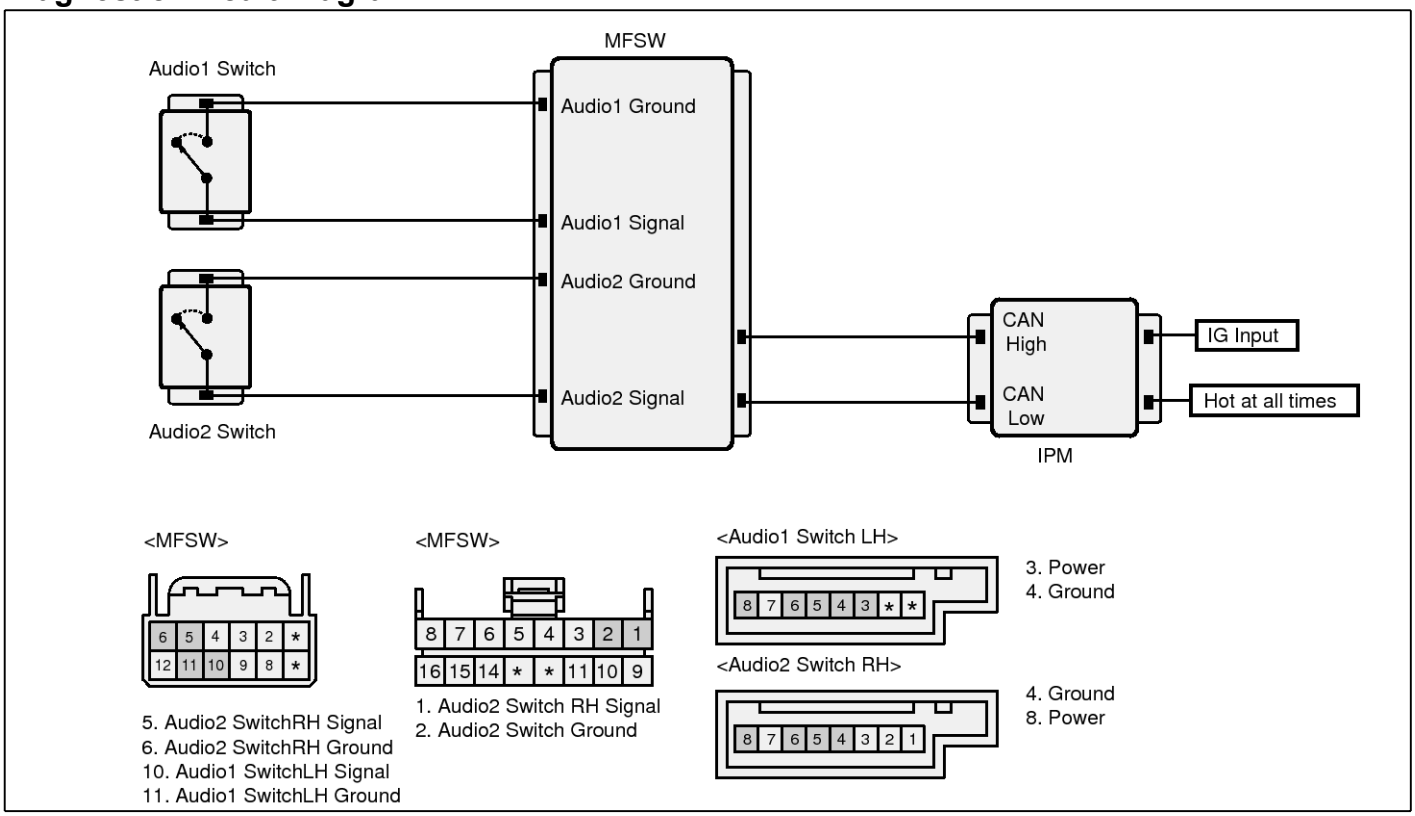
**CAUTION**

**The number of buttons of Audio1(VOLUME UP, VOLUME DN, SEEK UP, SEEK DN, MODE, H/FREE) and Audio2(DISP, TRIP, RESET, SCAN, MUTE, SDS) switch can be changed according to option applied to vehicle.**

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Audio1 switch input signal check | • Audio1 switch input line short to ground |
| Enable Conditions | • IG KEY ON.<br>• Engine runing<br>• ACC. | |
| Threshold Value | • The signal voltage = Approx. 0V | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram




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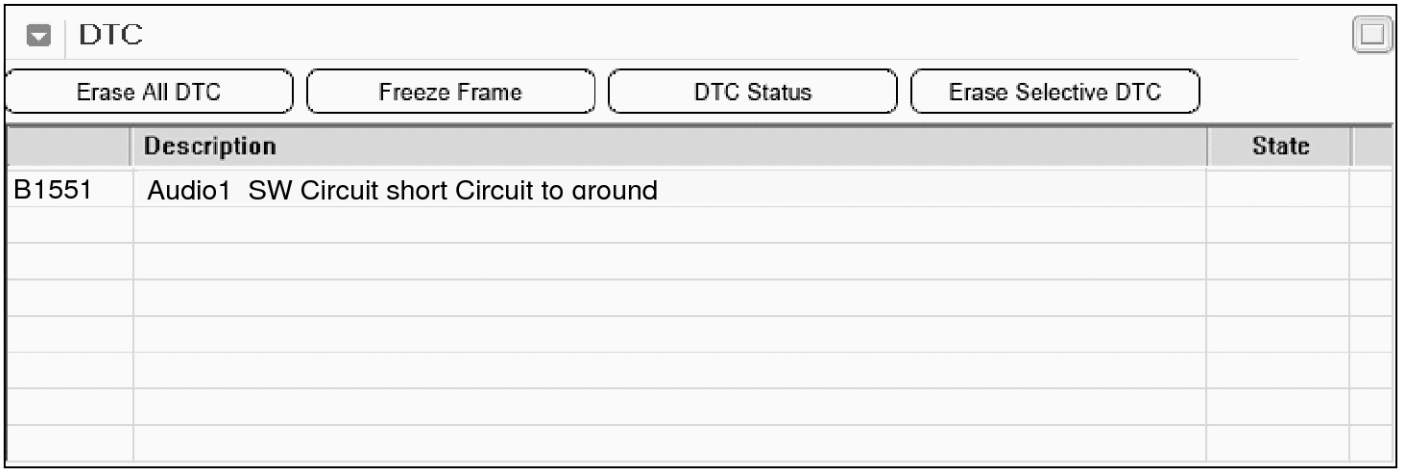
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### Scantool Data Analysis

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).




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5. Is the same DTC occurred again?

**YES** ▶ Go to "Scantool Data Analysis" procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MFSW's connector or was repaired and MFSW 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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## ■ Scantool Data Analysis

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Audio1 Switch(VOLUME UP, VOLUME DN, SEEK UP, SEEK DN, H/FREE)" is turned to "ON" when the Audio1 switch is pressed.

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Washer Switch | OFF | - |
| Wiper INT Switch | ON | - |
| Wiper Low Switch | OFF | - |
| Wiper High Switch | OFF | - |
| Wiper MIST Switch | OFF | - |
| Wiper Auto Switch | ON | - |
| Wiper Switch | ON | - |
| Wiper INT. Mode | STEP 5 | - |
| Cruise Main Switch | OFF | - |
| Cruise Switch Status | OFF | - |
| Audio Mode Switch | ON | - |
| Mute Switch | OFF | - |
| Hands Free Switch | OFF | - |
| Volume Up Switch | OFF | - |
| Volume Down Switch | OFF | - |
| Cluster DISP Switch | OFF | - |
| Cluster ODO/TRIP Switch | OFF | - |
| Seek Up Switch | OFF | - |
| Seek Down Switch | OFF | - |
| Audio Scan Switch | OFF | - |
| Cluster Reset Switch | ON | - |

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4. 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 "Terminal and Connector Inspection" 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 'Audio1 Signal Circuit Inspection' procedure.

## Audio1 Signal Circuit Inspection

### ■ Signal circuit short check

1. IG "OFF" and disconnect (-) cable from the battery.
2. Disconnect audio1 switch, MFSW connector.
3. Measure resistance of signal line between audio1 switch and MFSW.

**Specification :** Below 1Ω

4. Is the measured value normal?

**YES** ▶ Substitute with a known - good MFSW and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good audio1 switch and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Repair short in signal line between MFSW and audio1 switch, and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1552 Audio2 Switch Error

## General Description

Refer to DTC B1602 : CAN Error.

## DTC Description

This code is outputted when the signal line of audio2 switch is short to ground or power.

**⚠CAUTION**

**The number of buttons of Audio1(VOLUME UP, VOLUME DN, SEEK UP, SEEK DN, MODE, H/FREE) and Audio2(DISP, TRIP, RESET, SCAN, MUTE, SDS) switch can be changed according to option applied to vehicle.**

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Audio2 switch input signal check | • Audio2 switch input line short to ground |
| Enable Conditions | • IG KEY ON.<br>• Engine running<br>• ACC. | |
| Threshold Value | • The signal voltage = Approx. 0V | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram

Refer to DTC B1602 : CAN Error.

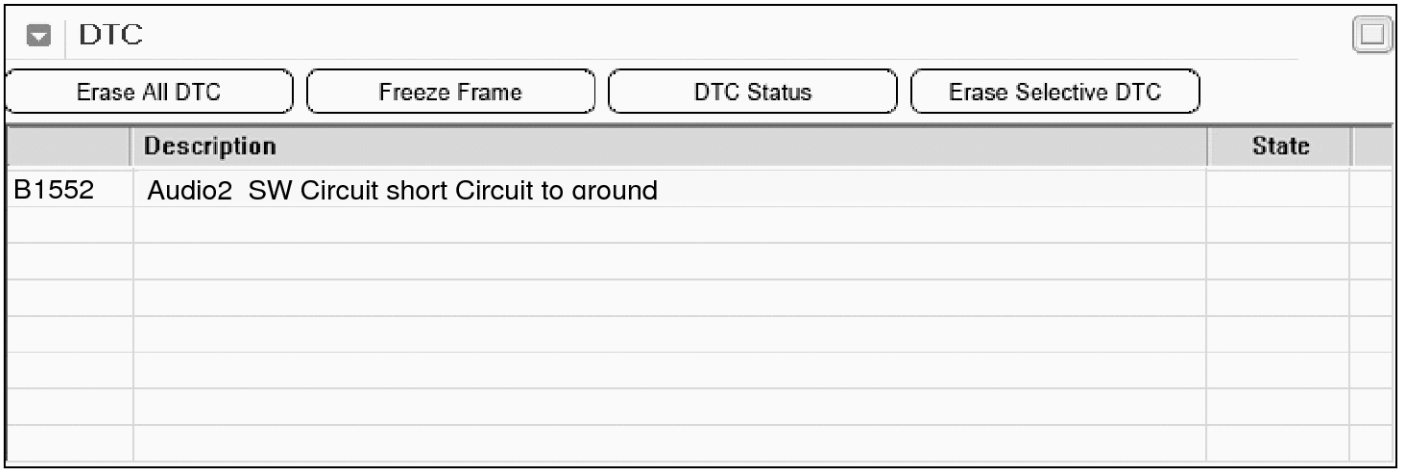
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## Scantool Data Analysis

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).




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5. Is the same DTC occurred again?

**YES** ▶ Go to "Scantool Data Analysis" procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MFSW's connector or was repaired and MFSW 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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## ■ Scantool Data Analysis

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Audio2 Switch(DISP, TRIP, RESET, SCAN, MUTE, SDS)" is turned to "ON" when the Audio1 switch is pressed.

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Washer Switch | OFF | - |
| Wiper INT Switch | ON | - |
| Wiper Low Switch | OFF | - |
| Wiper High Switch | OFF | - |
| Wiper MIST Switch | OFF | - |
| Wiper Auto Switch | ON | - |
| Wiper Switch | ON | - |
| Wiper INT. Mode | STEP 5 | - |
| Cruise Main Switch | OFF | - |
| Cruise Switch Status | OFF | - |
| Audio Mode Switch | OFF | - |
| Mute Switch | OFF | - |
| Hands Free Switch | OFF | - |
| Volume Up Switch | OFF | - |
| Volume Down Switch | OFF | - |
| Cluster DISP Switch | ON | - |
| Cluster ODO/TRIP Switch | OFF | - |
| Seek Up Switch | OFF | - |
| Seek Down Switch | OFF | - |
| Audio Scan Switch | OFF | - |
| Cluster Reset Switch | ON | - |

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4. 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 "Terminal and Connector Inspection" 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 'Audio2 Signal Circuit Inspection' procedure.

## Audio1 Signal Circuit Inspection

### ■ Signal circuit short check

1. IG "OFF" and disconnect (-) cable from the battery.
2. Disconnect audio2 switch, MFSW connector.
3. Measure resistance of signal line between audio2 switch and MFSW.

**Specification :** Below 1Ω

4. Is the measured value normal?

**YES** ▶ Substitute with a known - good MFSW and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known - good audio2 switch and check for proper operation.
If the problem is corrected, replace the component and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Repair short in signal line between MFSW and audio2 switch, and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1553 Light Multifunction Switch Error

## General Description

Refer to DTC B1602 : CAN Error.

## DTC Description

This code is outputted when MFSW receives over two signals of light switch at the same time.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Light switch input signal check | • OFF & Tail input line short<br>• OFF & H/L LOW input line short<br>• OFF & Auto input lne short |
| Enable Conditions | • IG KEY ON.<br>• Engine running(In case of Tail switch, enable conditions are BAT,Key In,ACC,IG KEY ON,engine running. | |
| Threshold Value | • OFF & Tail : the signal voltage of OFF switch and Tail switch is 0V at the same time.<br>• OFF & H/L LOW : the signal voltage of OFF switch and H/H LOW is 0V at the same time.<br>• OFF & Auto : the signal voltage o f OFF switch and Auto switch is 0V at the same time. | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram

Refer to DTC B1554 : Turn Signal Multifunction Switch Error.

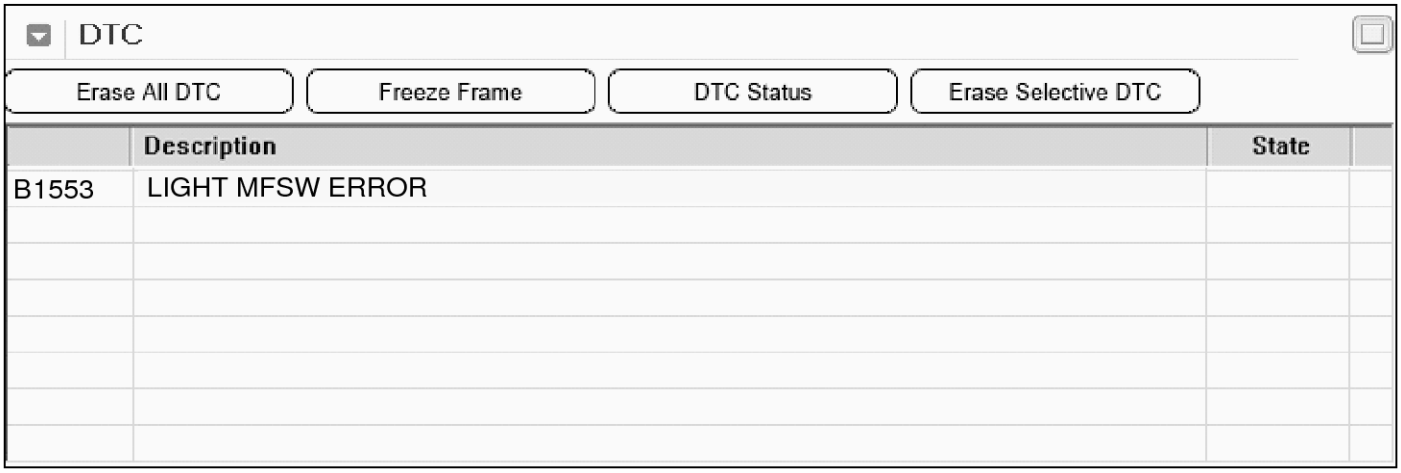
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### Scantool Data Analysis

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).




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5. Is the same DTC occurred again?

**YES** ▶ Go to "Scantool Data Analysis" procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MFSW's connector or was repaired and MFSW 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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## ■ Scantool Data Analysis

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Light Switch" is turned to "ON" when the light switch is turned on.

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 12.9 | V |
| Ignition 1 Voltage | 12.9 | V |
| Ignition 1 Signal | ON | - |
| Left Turn Signal Lamp Switch | OFF | - |
| Right Turn Signal Lamp Switch | OFF | - |
| Front Fog Lamp Switch | OFF | - |
| Light Switch | ON | - |
| Tail Lamp Switch | OFF | - |
| Head Lamp Low Switch | ON | - |
| Head Lamp High Switch | OFF | - |
| Passing Switch | OFF | - |
| Auto Light Switch | OFF | - |
| Washer Switch | OFF | - |
| Wiper INT Switch | ON | - |
| Wiper Low Switch | OFF | - |
| Wiper High Switch | OFF | - |
| Wiper MIST Switch | OFF | - |
| Wiper Auto Switch | ON | - |
| Wiper Switch | ON | - |
| Wiper INT. Mode | STEP 5 | - |
| Cruise Main Switch | OFF | - |

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4. 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 "Terminal and Connector Inspection" 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.

## Componect Inspection

### ■ MFSW internal fault check

1. IGN "ON" & ENG "OFF"
2. After connect GDS, select "DTC Analysis" menu.
3. Substitute with a known - good MFSW.
4. Is the DTC relevant to light switch able to be erased?

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

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1554 Turn Signal Multifunction Switch Error

## General Description

Refer to DTC B1602 : CAN Error.

## DTC Description

This code is outputted when MFSW receives over two signals(turn right & turn left) of turn signal at the same time .

## DTC Detecting Condition

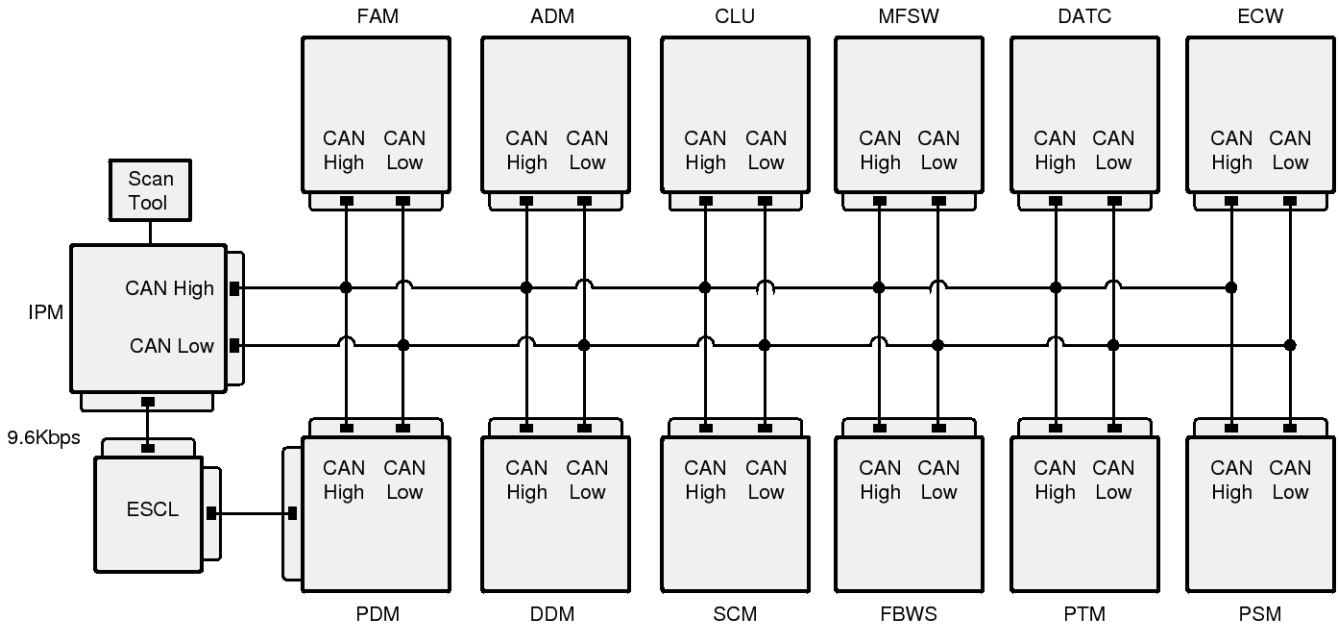
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Turn switch input signal check | • OFF & turn left switch input line short<br>• OFF & turn right switch input line short |
| Enable Conditions | • IG KEY ON.<br>• Engine running | |
| Threshold Value | • OFF & turn right switch: the voltage of OFF switch and turn right switch is 0V at the same time.<br>• OFF & turn left switch : the voltage of OFF switch and turn left switch is 0V at the same time. | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

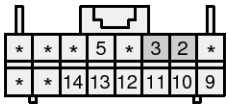



<ECW>



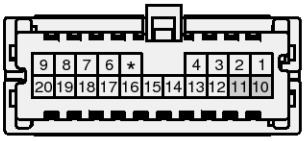
4. Low
5. High

<IPM>



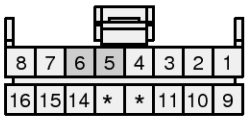
2 . Low
3. High

<PDM>



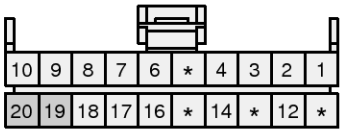
10. Low
11. High

<MFSW>



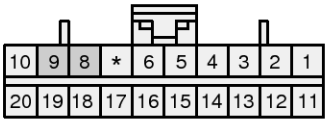
5. High
6. Low

<CLU>



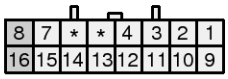
19. Low
20. High

<TILT & TELE>



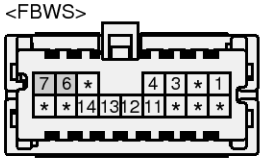
8. High
9. Low

<ADM>



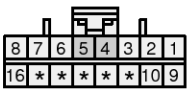
8. High
16. Low

<FBWS>



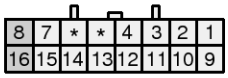
6. High
7. Low

<PSM>



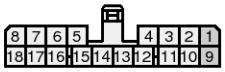
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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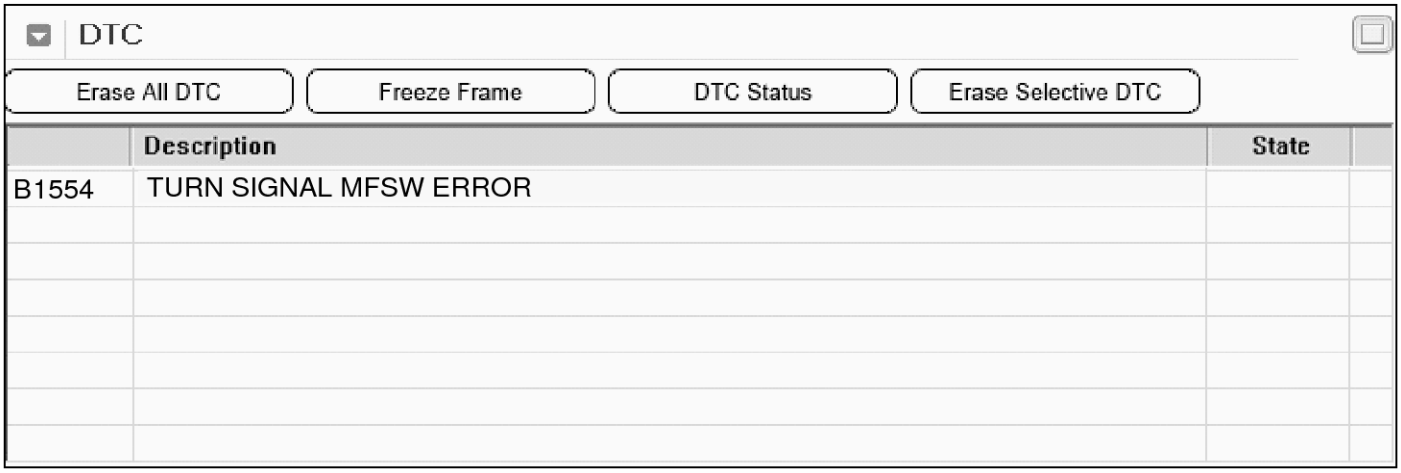
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## Scantool Data Analysis

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).




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5. Is the same DTC occurred again?

**YES** ▶ Go to "Scantool Data Analysis" procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MFSW's connector or was repaired and MFSW 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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## ■ Scantool Data Analysis

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Turn Signal" is turned to "ON" when the turn signal switch is turned on.

**Specification :** Service data is switched. (ON ↔ OFF)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 12.9 | V |
| Ignition 1 Voltage | 12.9 | V |
| Ignition 1 Signal | ON | - |
| Left Turn Signal Lamp Switch | ON | - |
| Right Turn Signal Lamp Switch | OFF | - |
| Front Fog Lamp Switch | OFF | - |
| Light Switch | OFF | - |
| Tail Lamp Switch | OFF | - |
| Head Lamp Low Switch | OFF | - |
| Head Lamp High Switch | OFF | - |
| Passing Switch | OFF | - |
| Auto Light Switch | OFF | - |
| Washer Switch | OFF | - |
| Wiper INT Switch | ON | - |
| Wiper Low Switch | OFF | - |
| Wiper High Switch | OFF | - |
| Wiper MIST Switch | OFF | - |
| Wiper Auto Switch | ON | - |
| Wiper Switch | ON | - |
| Wiper INT. Mode | STEP 5 | - |
| Cruise Main Switch | OFF | - |

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4. 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 "Terminal and Connector Inspection" procedure.

### Terminal and Connector Inspection

Refer to DTC B1553 : Light Multifunction Switch Error.

### Componect Inspection

Refer to DTC B1553 : Light Multifunction Switch Error.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1555 Wiper Multifunction Switch Error

## General Description

Refer to DTC B1602 : CAN Error.

## DTC Description

This code is outputted when MFSW receives over two signals(OFF & INT,OFF & LOW,OFF & HIGH,INT & LOW,INT & HIGH,LOW & HIGH) of wiper switch at the same time.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Wiper switch input signal check | • OFF & INT input line short<br>• OFF & LOW input line short<br>• OFF & HIGH input line short<br>• INT & LOW input line short<br>• INT & HIGH input line short<br>• LOW & HIGH input line short |
| Enable Conditions | • IG KEY ON.<br>• Engine running | |
| Threshold Value | • OFF & INT : The voltage of OFF switch and INT switch is 0V at the same time.<br>• OFF & LOW : The voltage of OFF switch and LOW switch is 0V at the same time.<br>• OFF & HIGH : The voltage of OFF switch and HIGH switch is 0V at the same time.<br>• INT & LOW : The voltage of INT switch and LOW switch is 0V at the same time.<br>• INT & HIGH : The voltage of INT switch and HIGH switch is 0V at the same time. | |
| Diagnostic Time | • Immediately | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

## Diagnostic Circuit Diagram

Refer to DTC B1554 : Turn Signal Multifunction Switch Error.

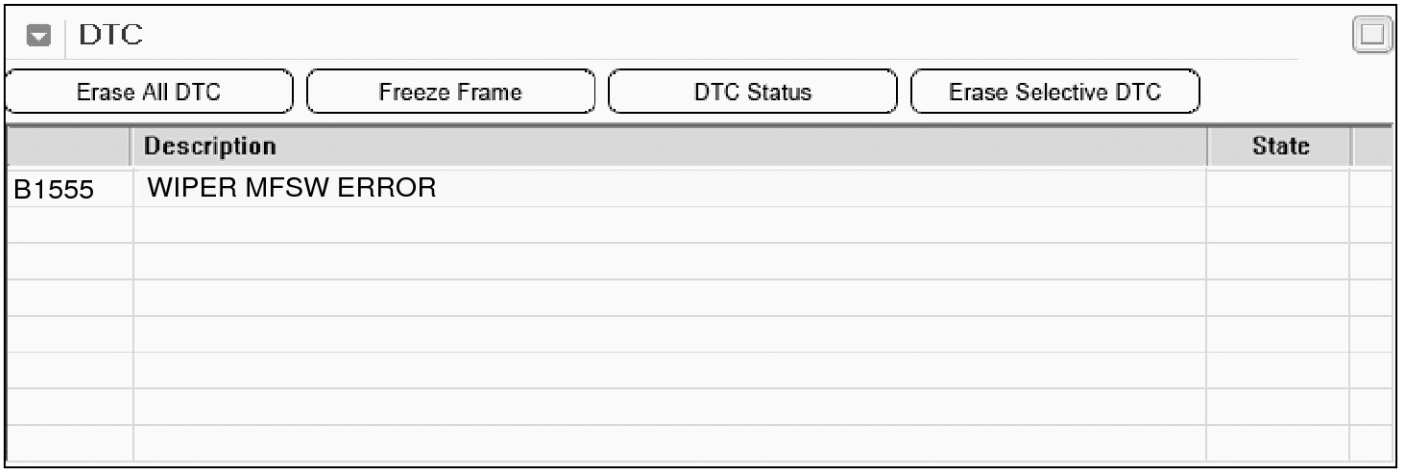
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### Scantool Data Analysis

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).




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5. Is the same DTC occurred again?

**YES** ▶ Go to "Scantool Data Analysis" procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MFSW's connector or was repaired and MFSW 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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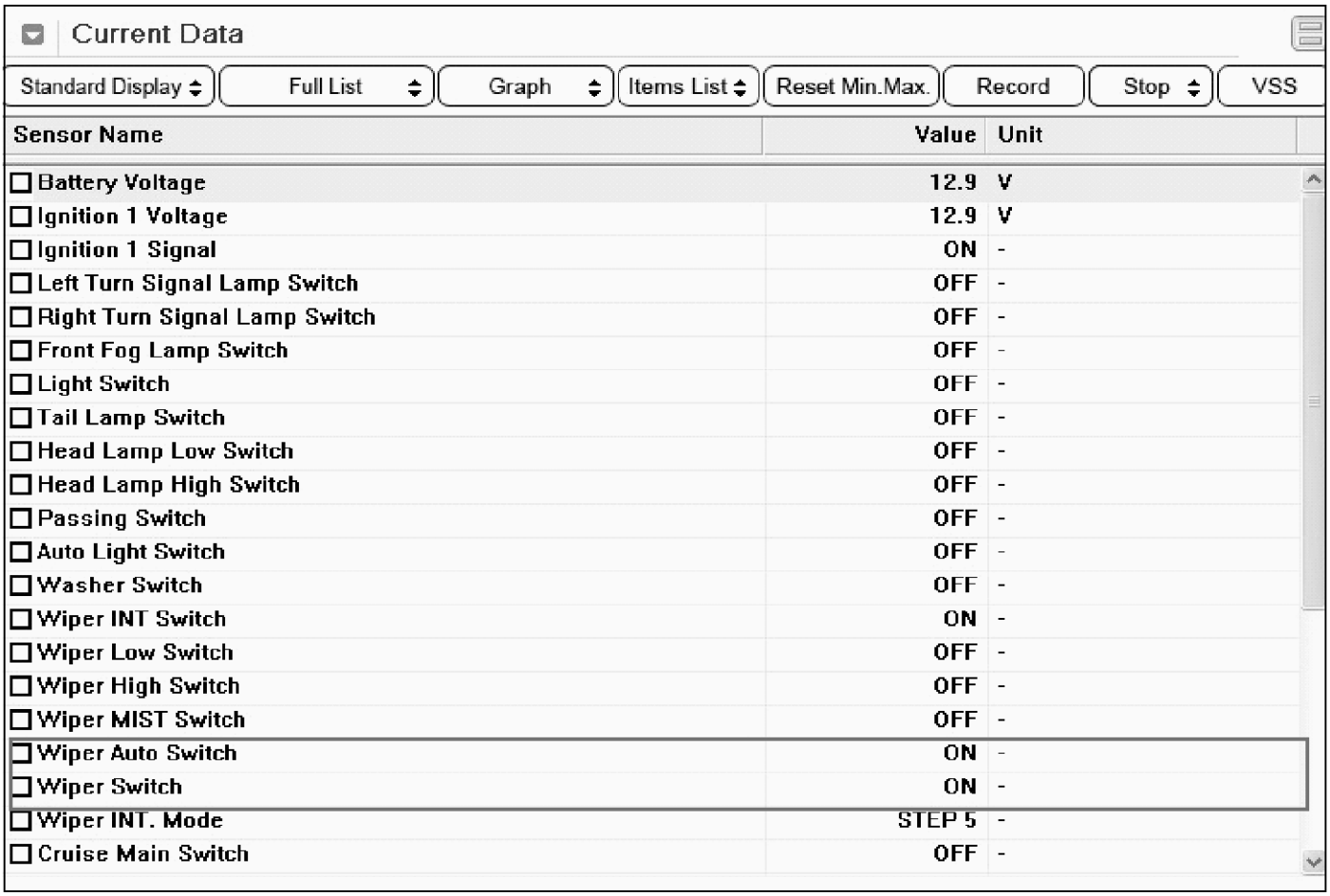


## ■ Scantool Data Analysis

1. IG "ON" & ENG "OFF"
2. After connect GDS, select "Current Date" menu.
3. Check whether "Wiper Switch" is turned to "ON" when the Wiper Switch is turned on.

**Specification :** Service data is switched. (ON ↔ OFF)

**⚠CAUTION**
**When wiper switch is turned on to each step, service data of wiper switch step should be displayed to ON same as wiper switch.**




| Sensor Name | Value | Unit |
|---|---|---|
| Battery Voltage | 12.9 | V |
| Ignition 1 Voltage | 12.9 | V |
| Ignition 1 Signal | ON | - |
| Left Turn Signal Lamp Switch | OFF | - |
| Right Turn Signal Lamp Switch | OFF | - |
| Front Fog Lamp Switch | OFF | - |
| Light Switch | OFF | - |
| Tail Lamp Switch | OFF | - |
| Head Lamp Low Switch | OFF | - |
| Head Lamp High Switch | OFF | - |
| Passing Switch | OFF | - |
| Auto Light Switch | OFF | - |
| Washer Switch | OFF | - |
| Wiper INT Switch | ON | - |
| Wiper Low Switch | OFF | - |
| Wiper High Switch | OFF | - |
| Wiper MIST Switch | OFF | - |
| Wiper Auto Switch | ON | - |
| Wiper Switch | ON | - |
| Wiper INT. Mode | STEP 5 | - |
| Cruise Main Switch | OFF | - |

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4. 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 "Terminal and Connector Inspection" procedure.

### Terminal and Connector Inspection

Refer to DTC B1553 : Light Multifunction Switch Error.

### Componect Inspection

Refer to DTC B1553 : Light Multifunction Switch Error.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1602 CAN Error

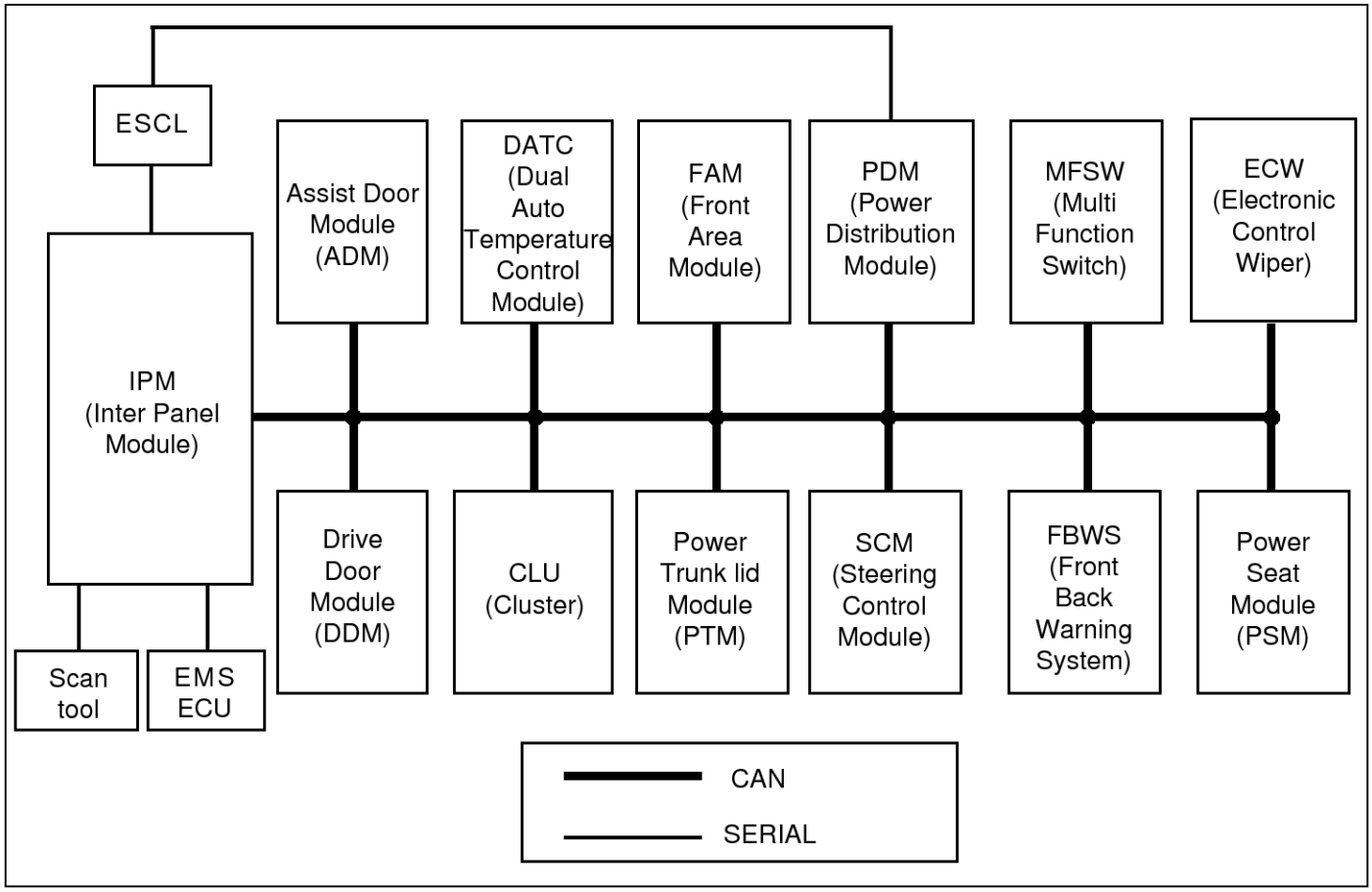
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Ciruit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

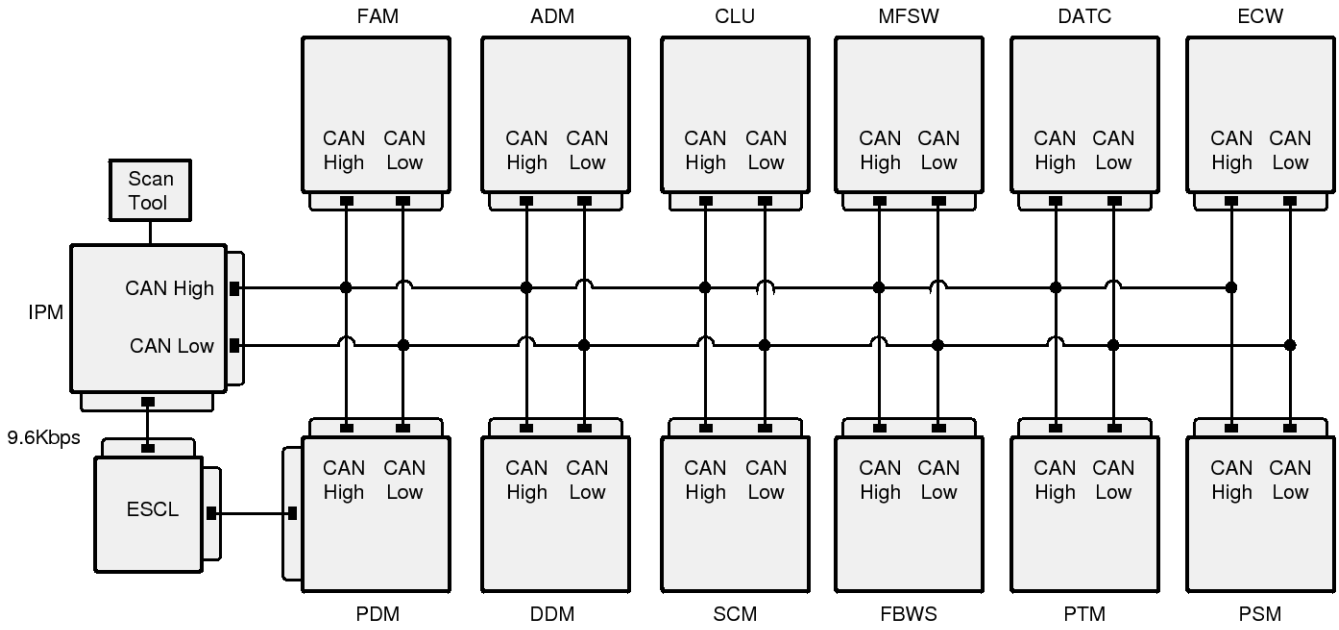
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,MFSW are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6.<br>7. CAN High Line short to 5V power<br>8. CAN High Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, MFSW power on(Under normal communication) | |
| Threshold Value | • IPM, MFSW power on(Under normal communication)<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

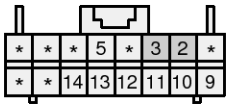



<ECW>



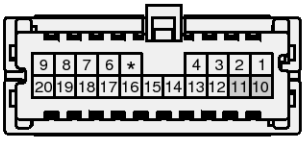
4. Low
5. High

<IPM>



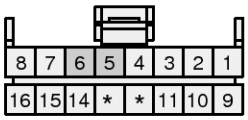
2 . Low
3. High

<PDM>



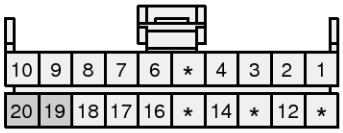
10. Low
11. High

<MFSW>



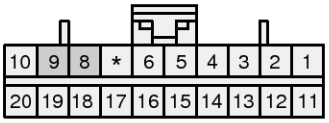
5. High
6. Low

<CLU>



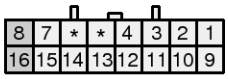
19. Low
20. High

<TILT & TELE>



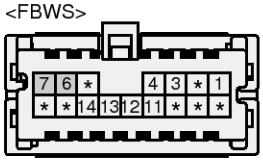
8. High
9. Low

<ADM>



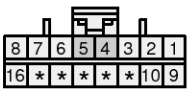
8. High
16. Low

<FBWS>



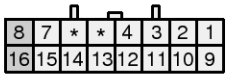
6. High
7. Low

<PSM>



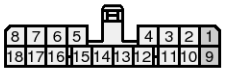
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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## Signal Waveform & Data

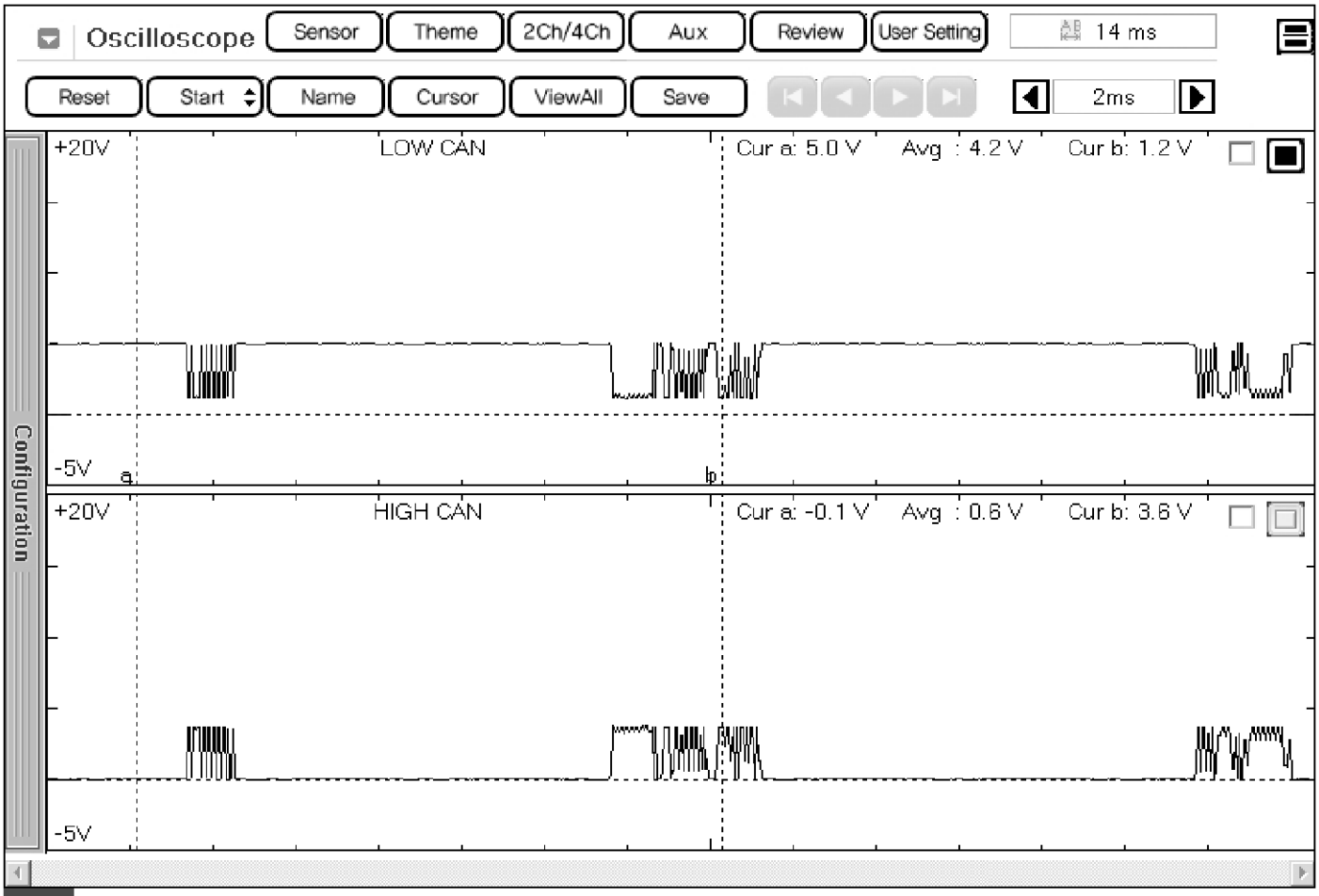



Fig.1

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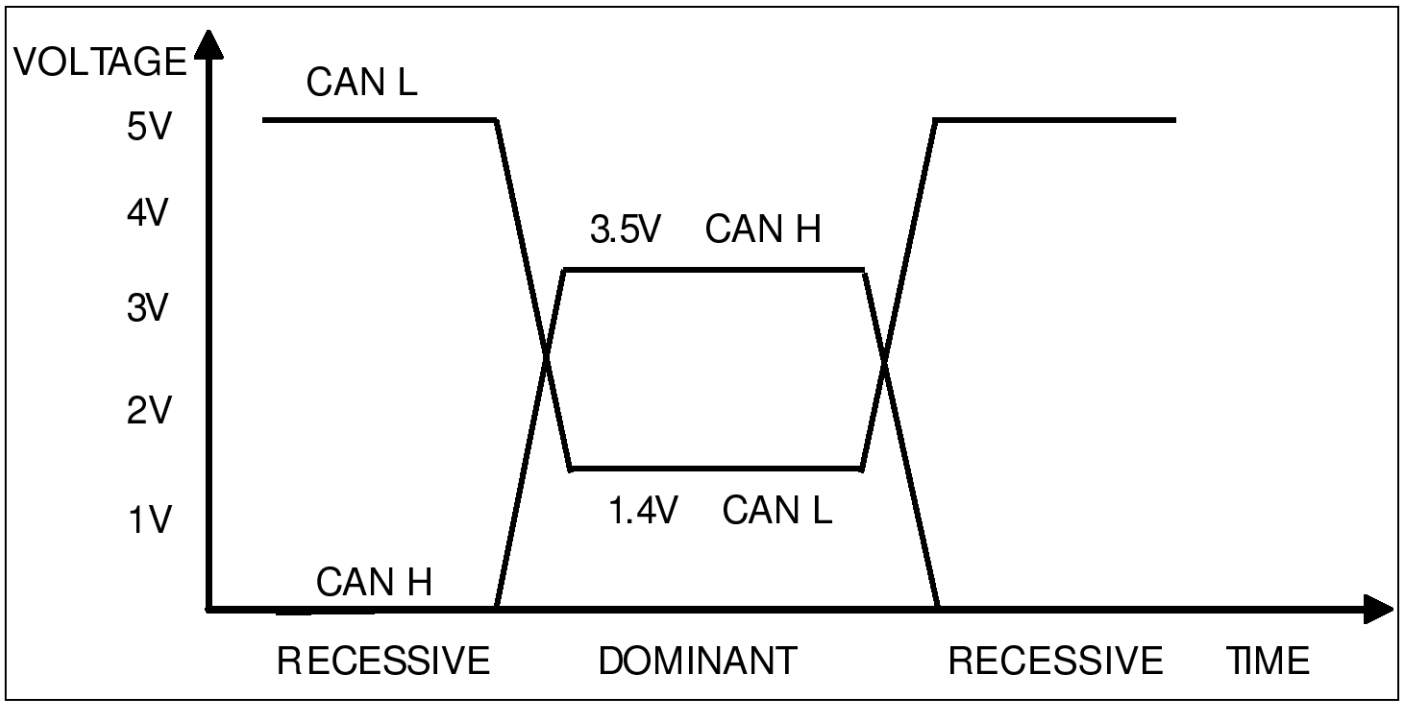



Fig.2

SBHBE9G13L

Fig.1) CAN Low/High Signal Waveform
Fig.2) CAN BUS VOLTAGE LEVEL (LOW SPEED)

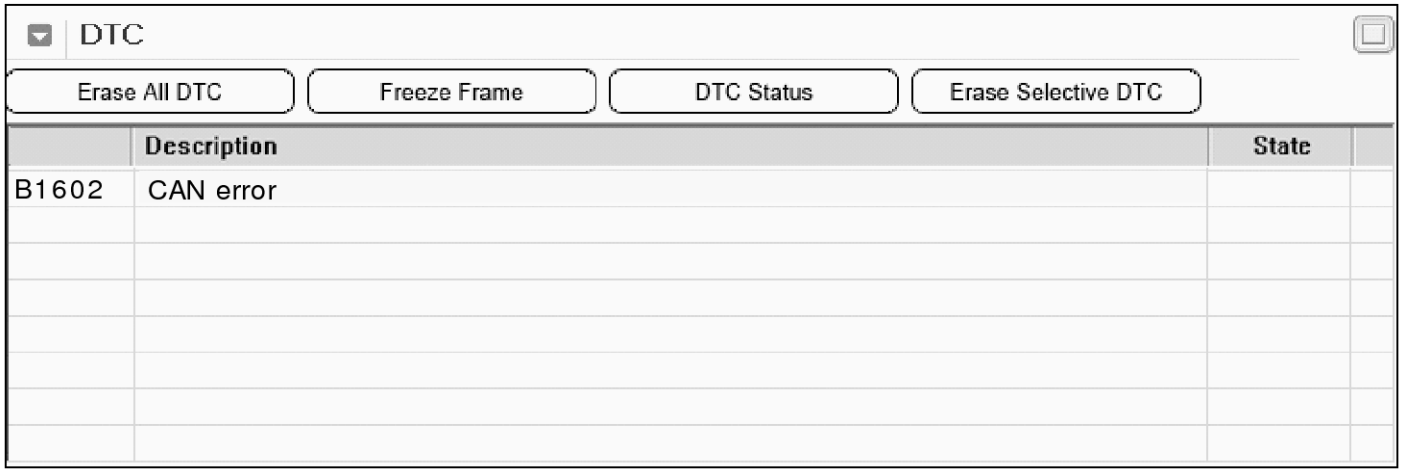
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## Scantool Data Analysis

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).




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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 MFSW's connector or was repaired and MFSW 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 "MFSW Signal Circuit Inspection" procedure.

## MFSW Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Ocilloscope" mode.
   3) Measure the signal waveform on MFSW CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Ocilloscope" mode.
   3) Measure the signal waveform on MFSW CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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## Component Inspection

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), 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)
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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# B1603 CAN Communication Bus Off

## General Description

Refer to DTC B1602 : CAN Error.

## 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM CAN Low Line and High Line, short to power together.

※ This code is occured 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,MFSW are not Sleep condition<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, MFSW 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

Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

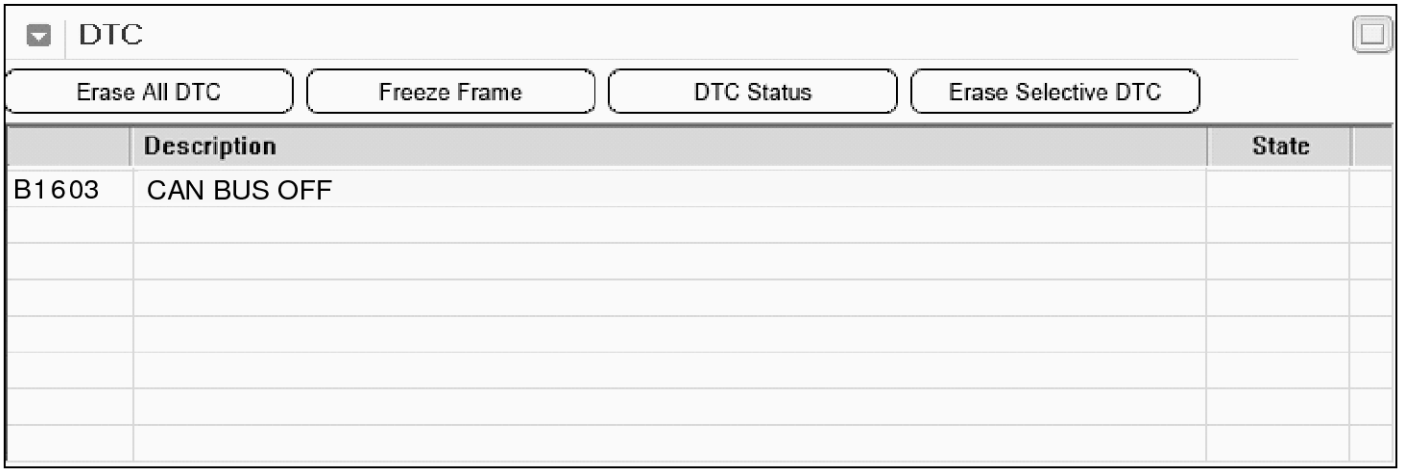
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## Scantool Data Analysis

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).




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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 MFSW's connector or was repaired and MFSW 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

Refer to DTC B1602 : CAN Error.

## Component Inspection

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), 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)
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

Refer to DTC B1602 : CAN Error.

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## Cluster(CLU)

### Troubleshooting

#### CLU DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1562 | Fuel Sender ERR |

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## B1602 CAN Error

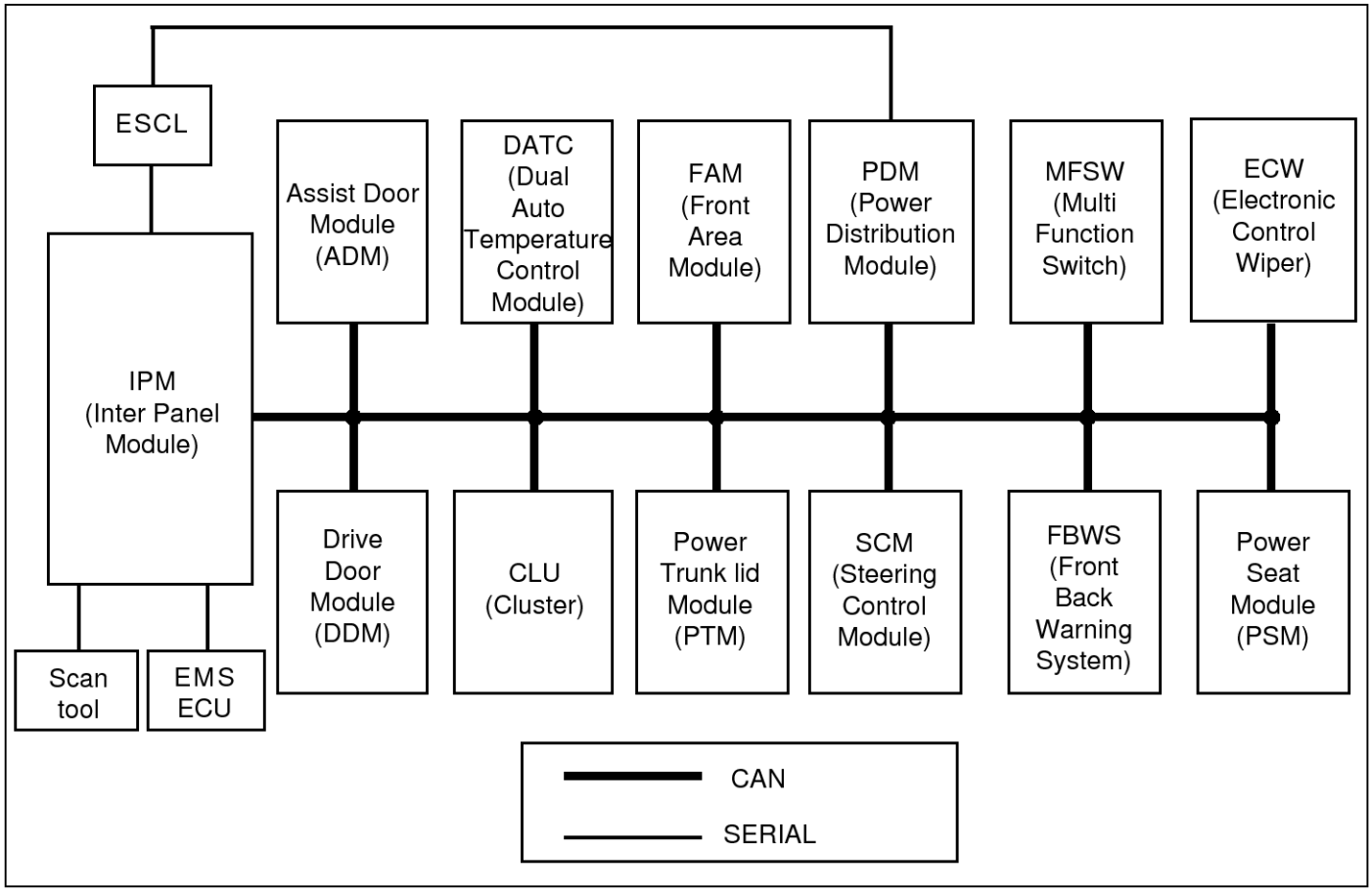
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

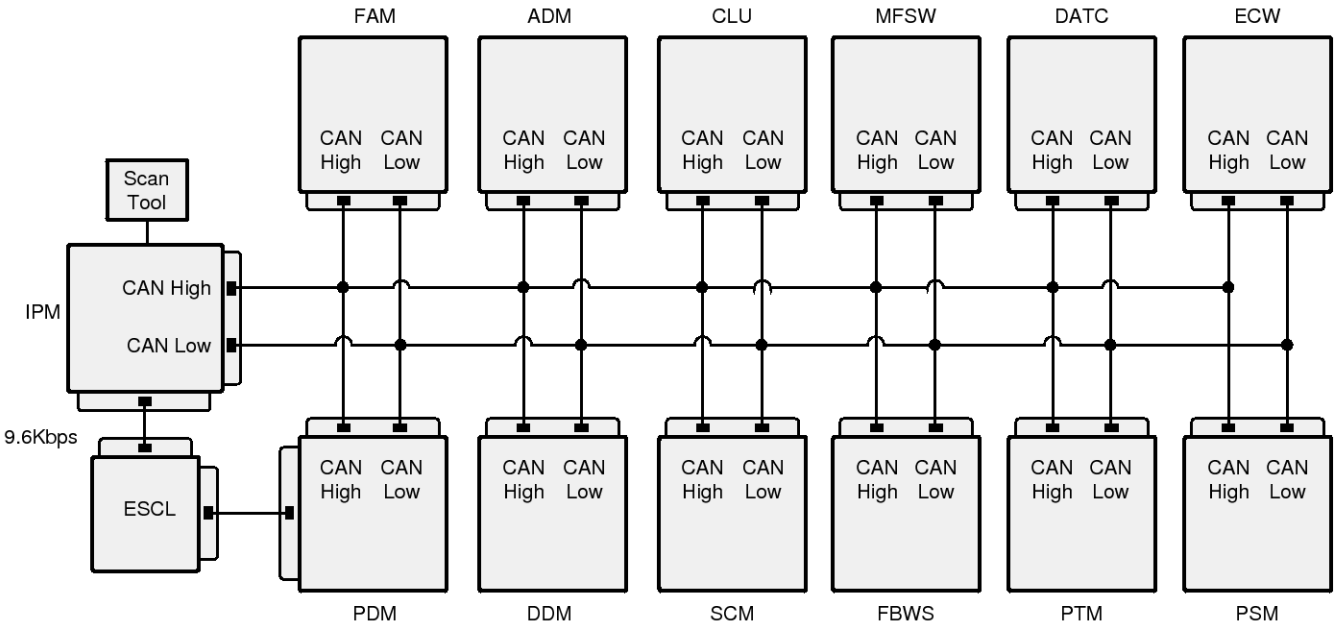
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM, CLU are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, CLU power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

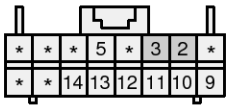



<ECW>



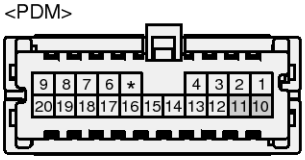
4. Low
5. High

<IPM>



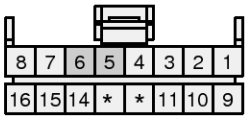
2 . Low
3. High

<PDM>



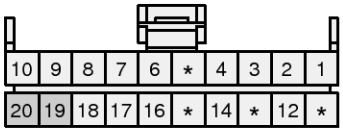
10. Low
11. High

<MFSW>



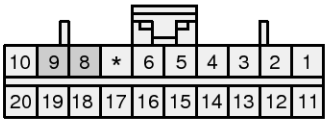
5. High
6. Low

<CLU>



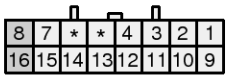
19. Low
20. High

<TILT & TELE>



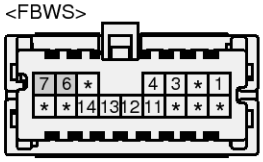
8. High
9. Low

<ADM>



8. High
16. Low

<FBWS>



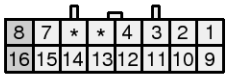
6. High
7. Low

<PSM>



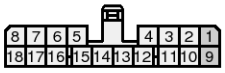
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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## Signal Waveform & Data

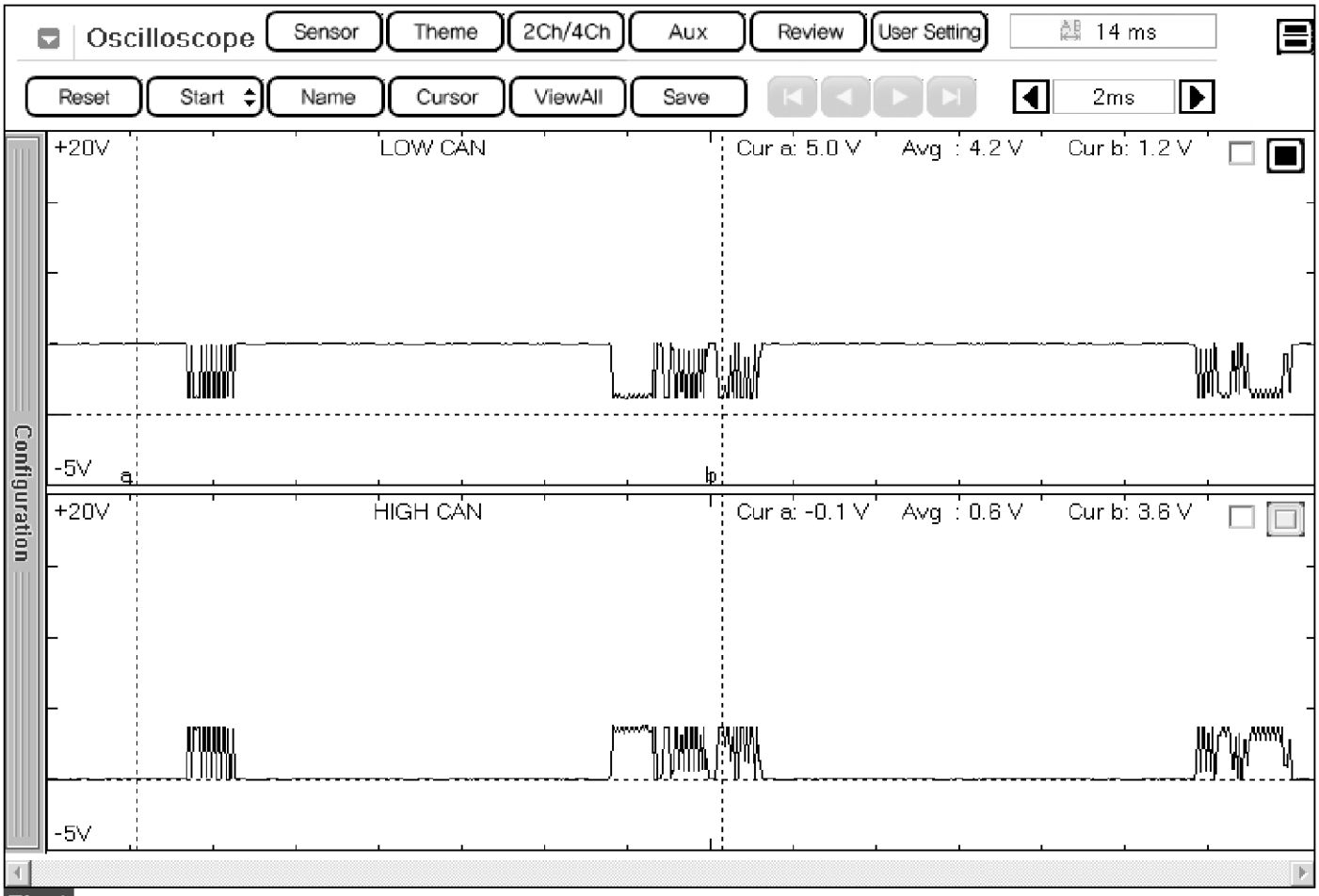



Fig.1

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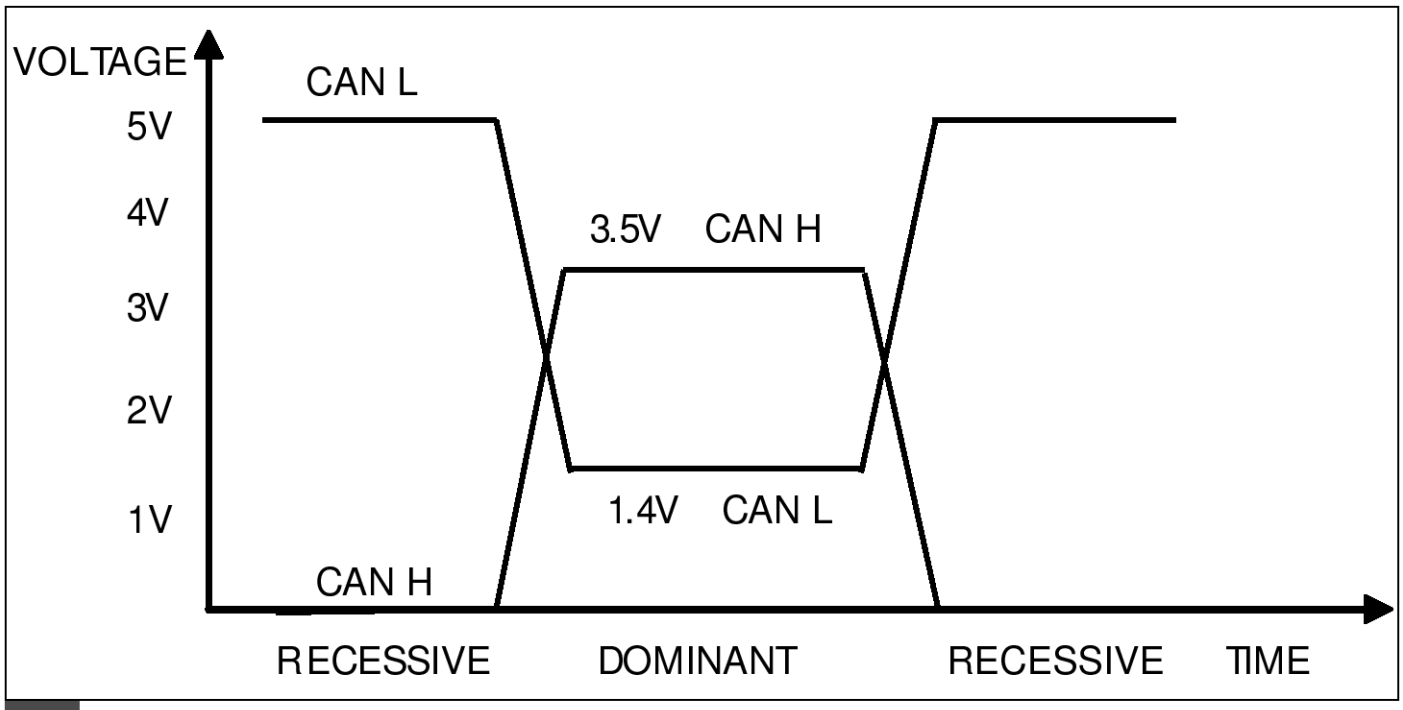



Fig.2

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Fig.1) CAN Low/High Signal Waveform

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

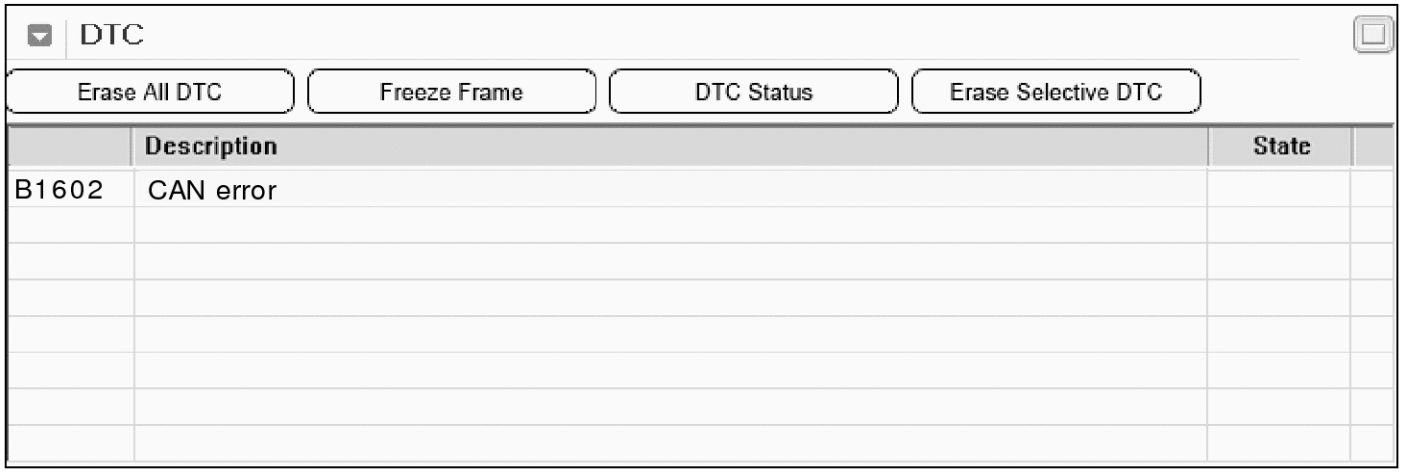
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## Scantool Data Analysis

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).




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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 CLU's connector or was repaired and CLU 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 "CLU Signal Circuit Inspection" procedure.

## CLU Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on CLU CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on CLU CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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## 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), 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)
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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# B1603 CAN Communication Bus Off

## General Description

Refer to DTC B1602 : CAN Error.

## 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), 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))

Case1: After short between CLU CAN Low Line and High Line, short to ground together.

Case2: After short between CLU 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, CLU are not Sleep condition<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, CLU 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

Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

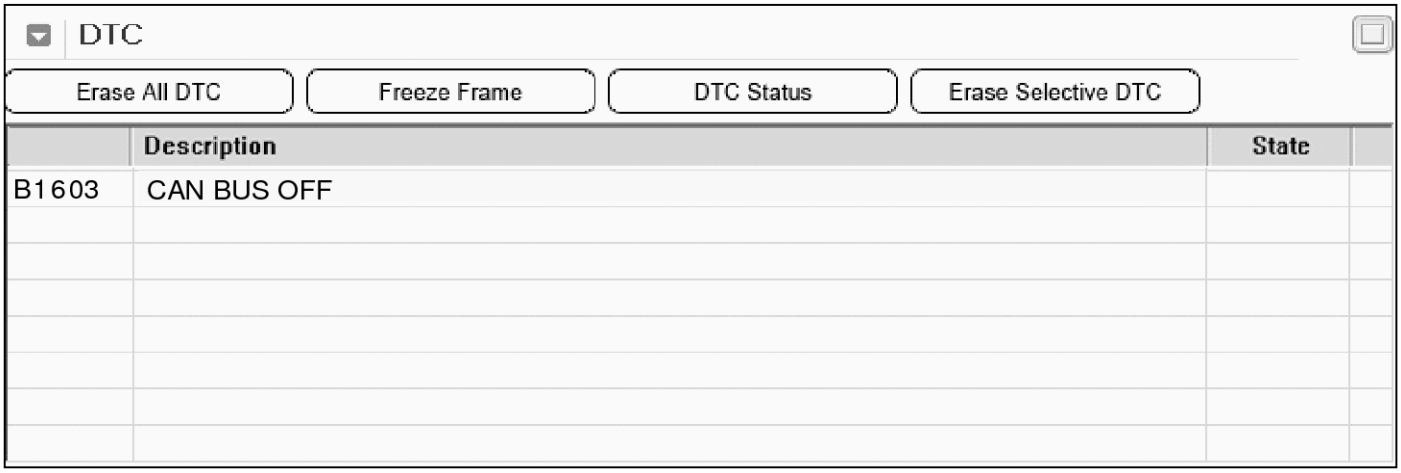
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### Scantool Data Analysis

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).




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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 CLU's connector or was repaired and CLU 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

Refer to DTC B1602 : CAN Error.

### Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1562 Fuel Sender ERR

## General Description

EMS ECU calculates estimated fuel vapor pressure by fuel level value. Fuel vapor pressure is changed by fuel level variation. Fuel vapor pressure is essential factor to monitor operation of Evap. Control System.

By the way, in case the fuel level is too low or too high, it's hard to get reliable value of fuel vapor pressure. So, EMS ECU judges whether fuel level is suitable to monitor Evap. Control System precisely. After power is inputted to a fuel sender from a cluster, fuel level value from a fuel sender is inputted to a cluster.

## DTC Description

This code is outputted when signal circuit of a fuel sender is open or shorted to GND.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Fuel tank sender signal circuit check | • Poor connection or damaged harness<br>• Fuel tank sender resistance check (It depends on fuel level; Approx. 8Ω(Full) ~ 200Ω(Empty)) |
| Enable Conditions | • IG ON | |
| Threshold Value | • Fuel Tank Sender Circuit Open<br>• Fuel Tank Sender Circuit Short | |
| Diagnostic Time | • 20sec | |
| DTC Erasing Time | • 20sec after trouble fixed | |

## Specification

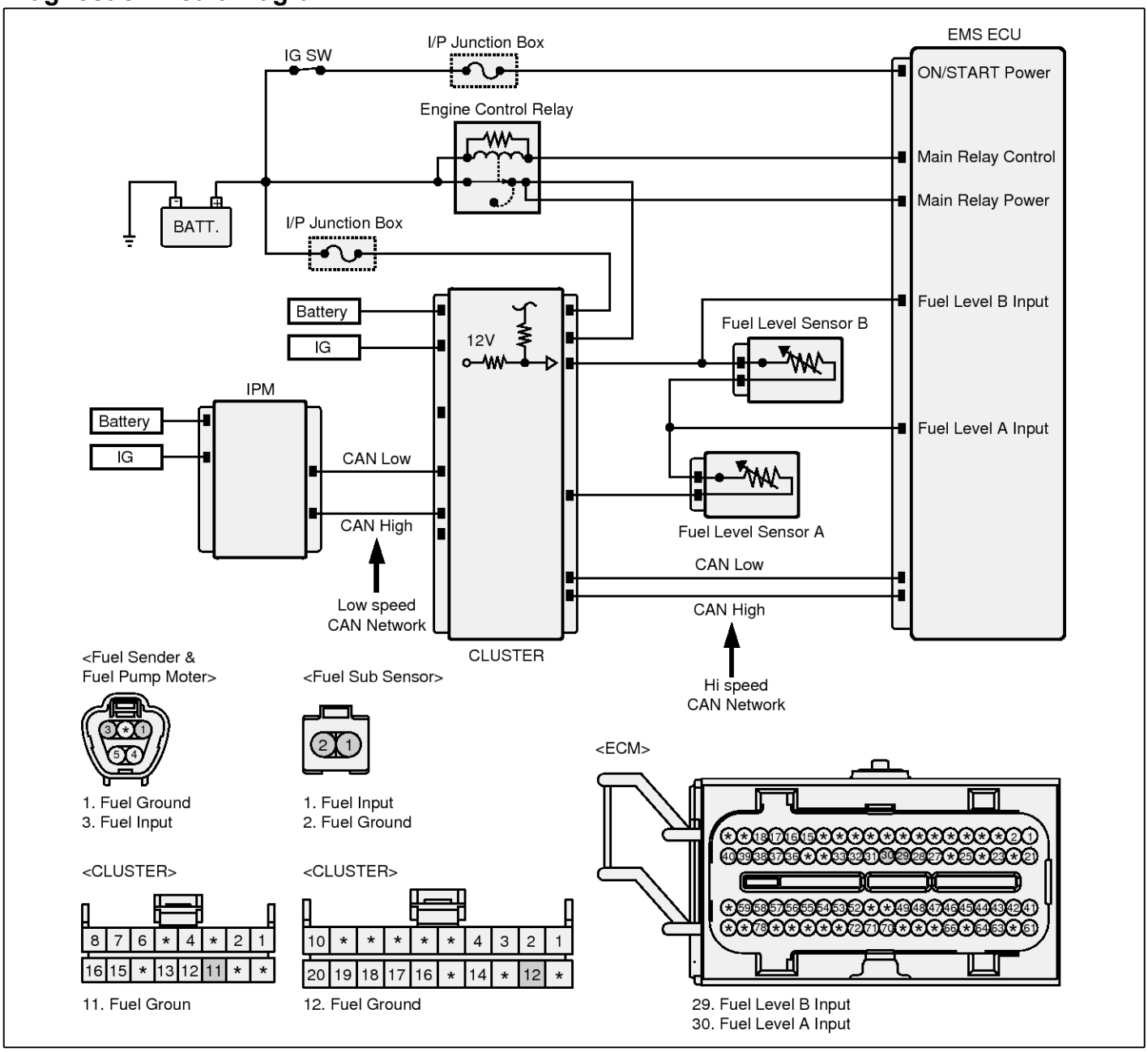
| Fuel Level Sensor | Specification | | | | |
|---|---|---|---|---|---|
| Float Position | 8/8 | 7/8 | 6/8 | 2/8 | MIL ON |
| Fuel Level Sender A Resist.(Ω) | 4 | 15.5 | 15.5 | 41 | 74.6 |
| Fuel Level Senor B Resist.(Ω) | 4 | 20.5 | 41.5 | 100 | 100 |
| Quantity (ℓ) | 74.5 | 64.3 | 56.2 | 23.7 | 11.6 |

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## Diagnostic Circuit Diagram




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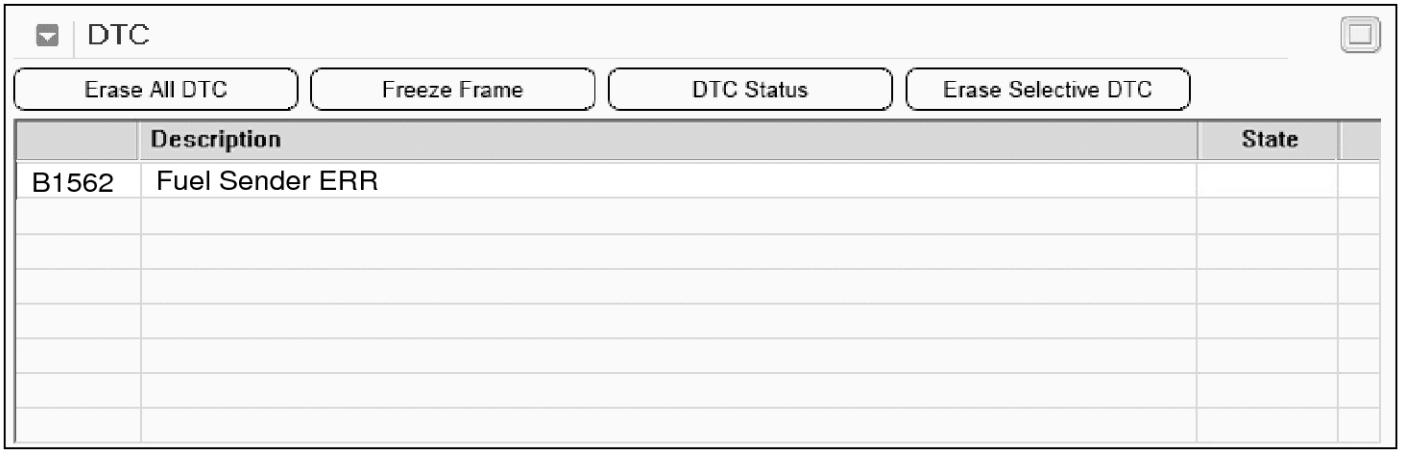
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## Scantool Data Analysis

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).




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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 CLU's connector or was repaired and CLU 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 resistance of fuel level sender

1. IG OFF.
2. Disconnect fuel level sender A, B connectors.
3. Measure resistance between both ends of fuel level sender A,B connectors with varying a float.

**Specification :** 8Ω (Full) ~ 200Ω (Empty) depending on fuel level

4. Are resistances within specifications?

**YES** ▶ Go to next procedure.

**NO** ▶ 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.

## 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** ▶ Fault is intermittent caused by poor contact in the sensor's and/or CLU's connector. 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.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## Power Distribution Module(PDM)

### Troubleshooting

#### PDM DTC List

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN error |
| 2 | B1603 | CAN BUSOFF |
| 3 | B1987 | Sub MCUfailed |
| 4 | B1988 | ESCL BAT SCB |
| 5 | B1989 | ESCL GND SCB |
| 6 | B1990 | ESCL BAT SCG |
| 7 | B1991 | IMMO TX SCG |

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## B1602 CAN Error

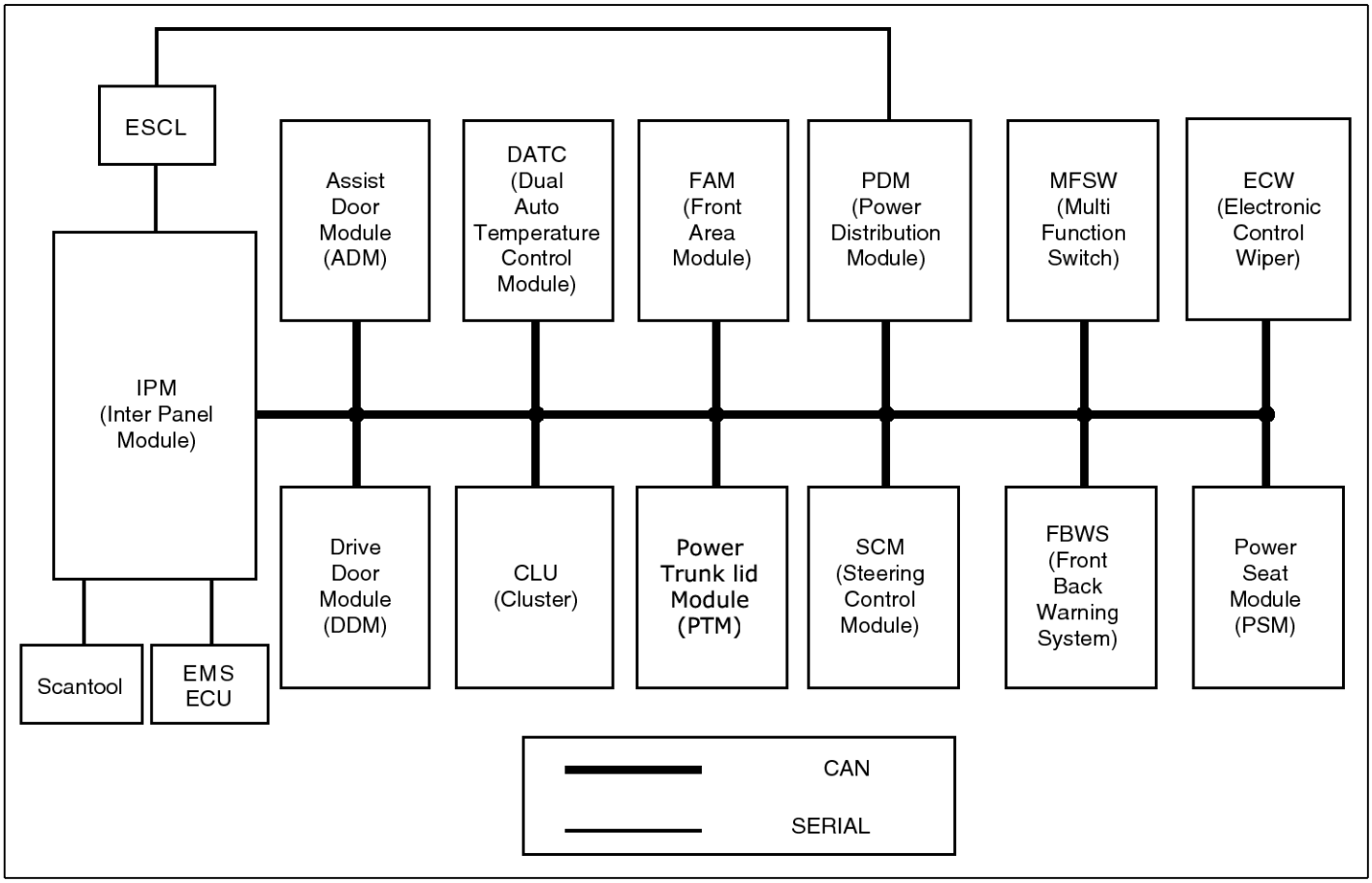
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

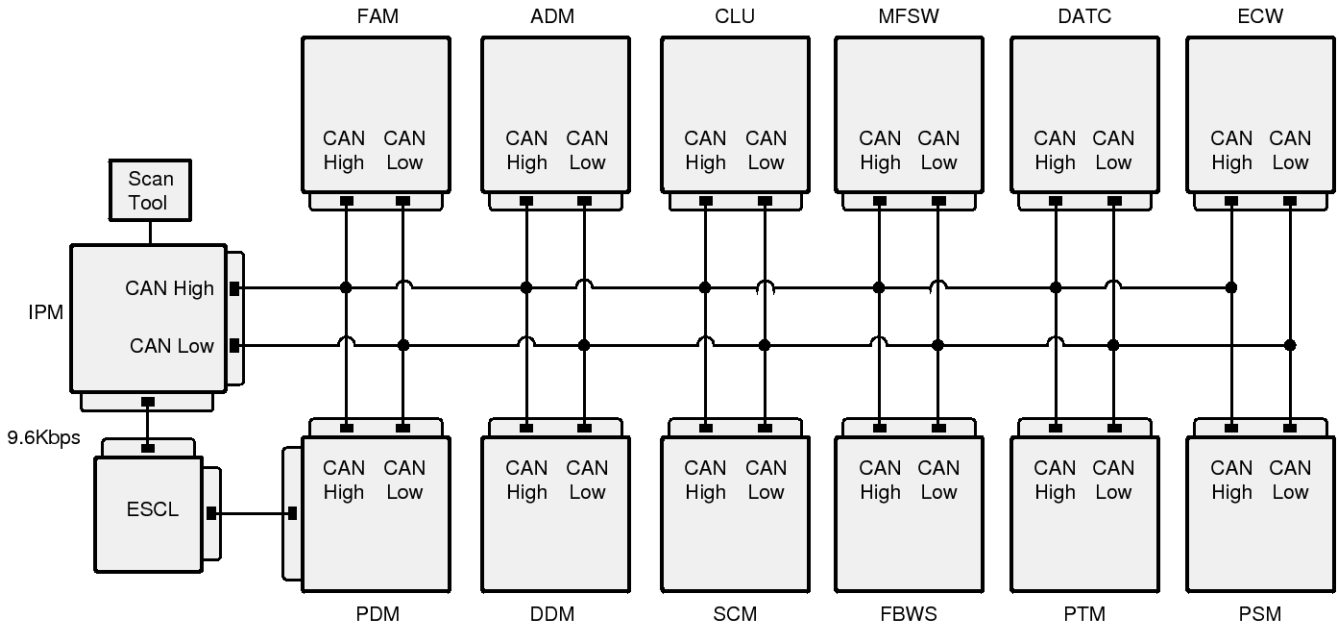
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,PDM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, PDM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

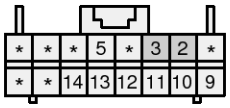



<ECW>



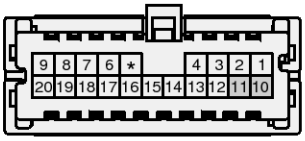
4. Low
5. High

<IPM>



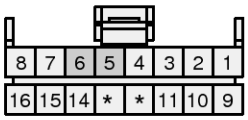
2 . Low
3. High

<PDM>



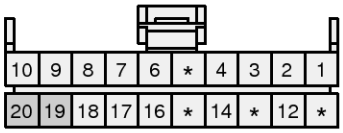
10. Low
11. High

<MFSW>



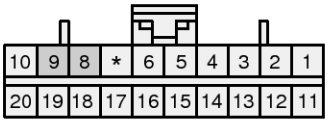
5. High
6. Low

<CLU>



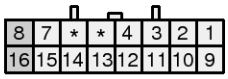
19. Low
20. High

<TILT & TELE>



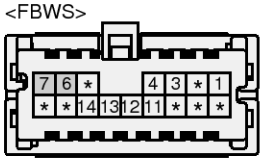
8. High
9. Low

<ADM>



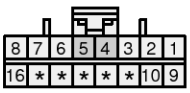
8. High
16. Low

<FBWS>



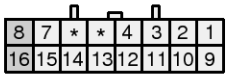
6. High
7. Low

<PSM>



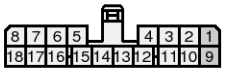
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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**Signal Waveform & Data**

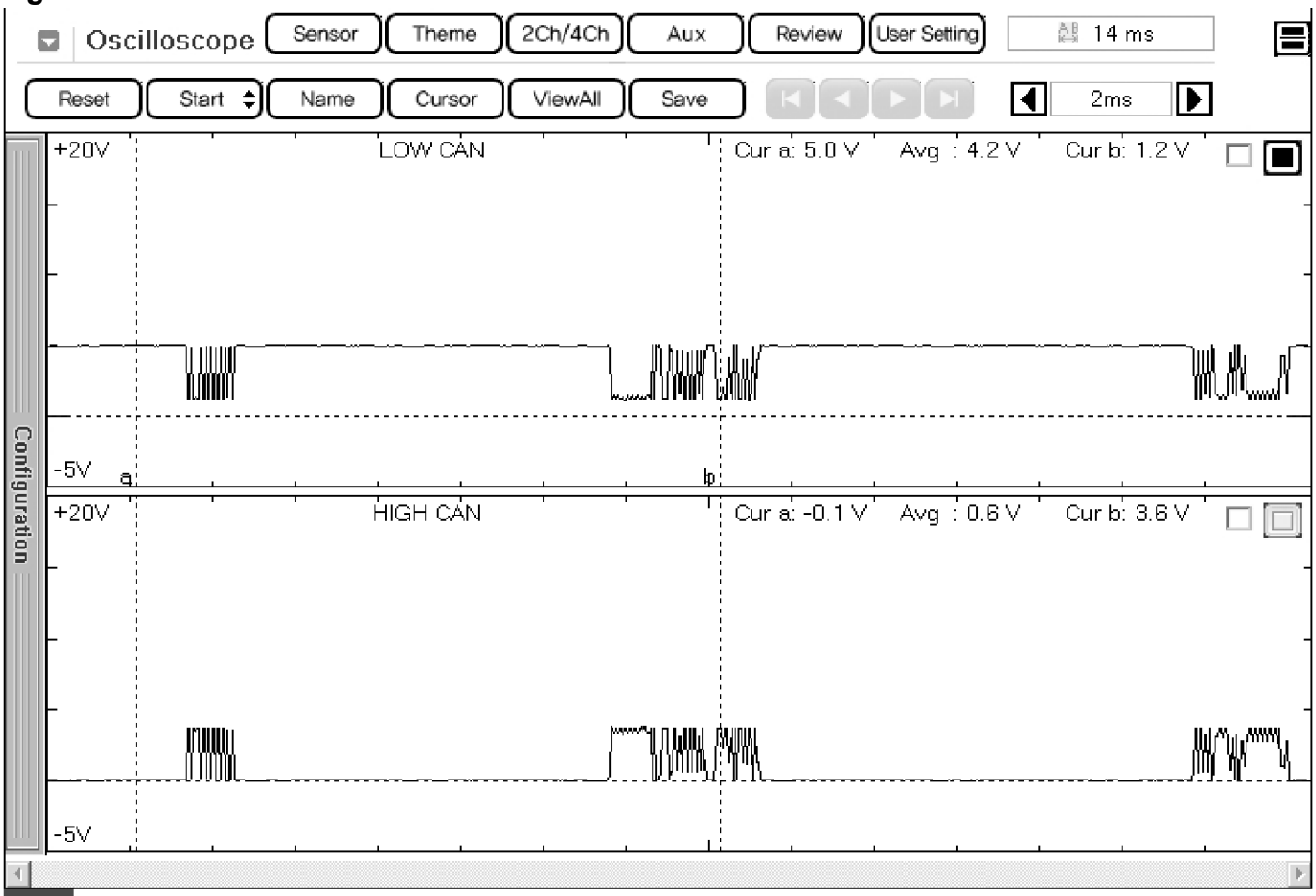



Fig.1

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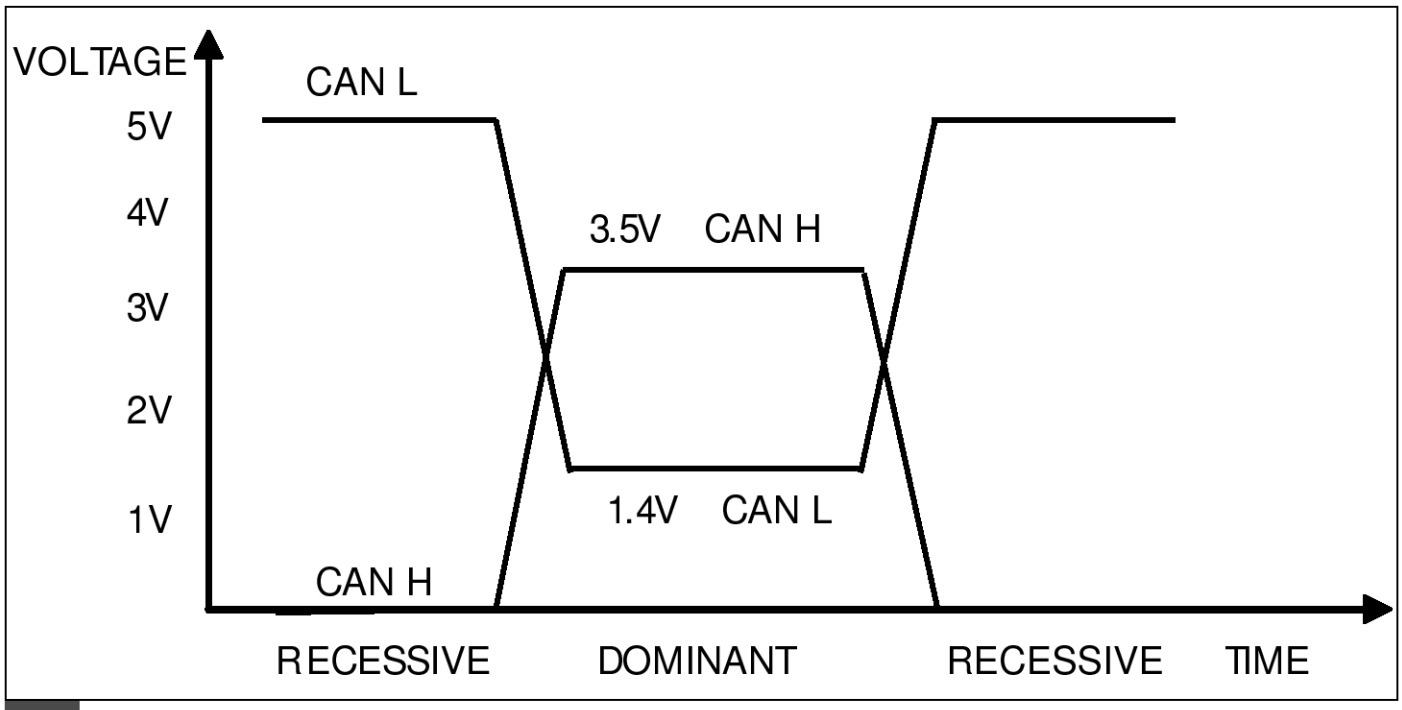



Fig.2

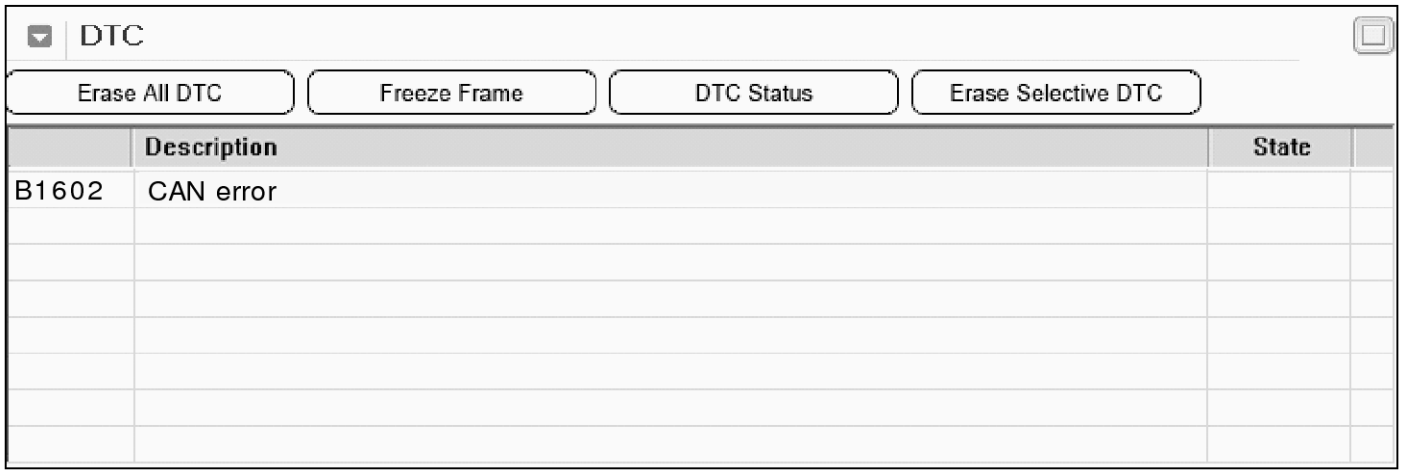
SBHBE9I12L

Fig.1) CAN Low/High Signal Waveform

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).




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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 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 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 "PSM Signal Circuit Inspection" procedure.

## PDM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PDM CAN High line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PDM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)
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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# B1603 CAN Communication Bus Off

## General Description

Refer to DTC B1602 : CAN Error.

## 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM 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 condition1. CAN High and Low Line short to ground coincident<br>1. CAN High and Low Line short to ground coincident<br>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

Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

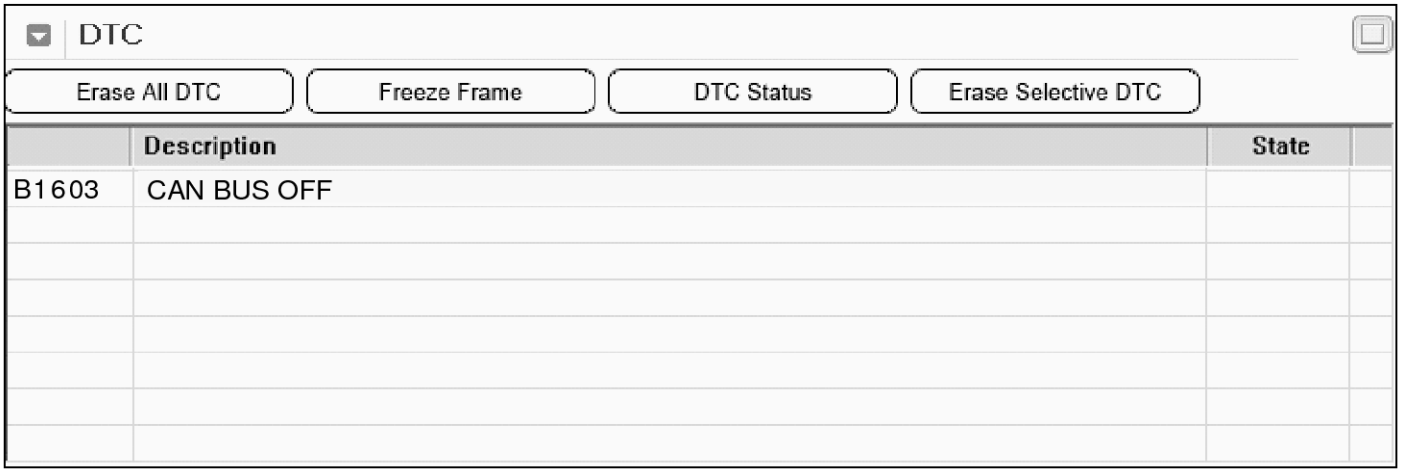
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## Scantool Data Analysis

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).




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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 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 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

Refer to DTC B1602 : CAN Error.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B1987 Sub Micom Failed

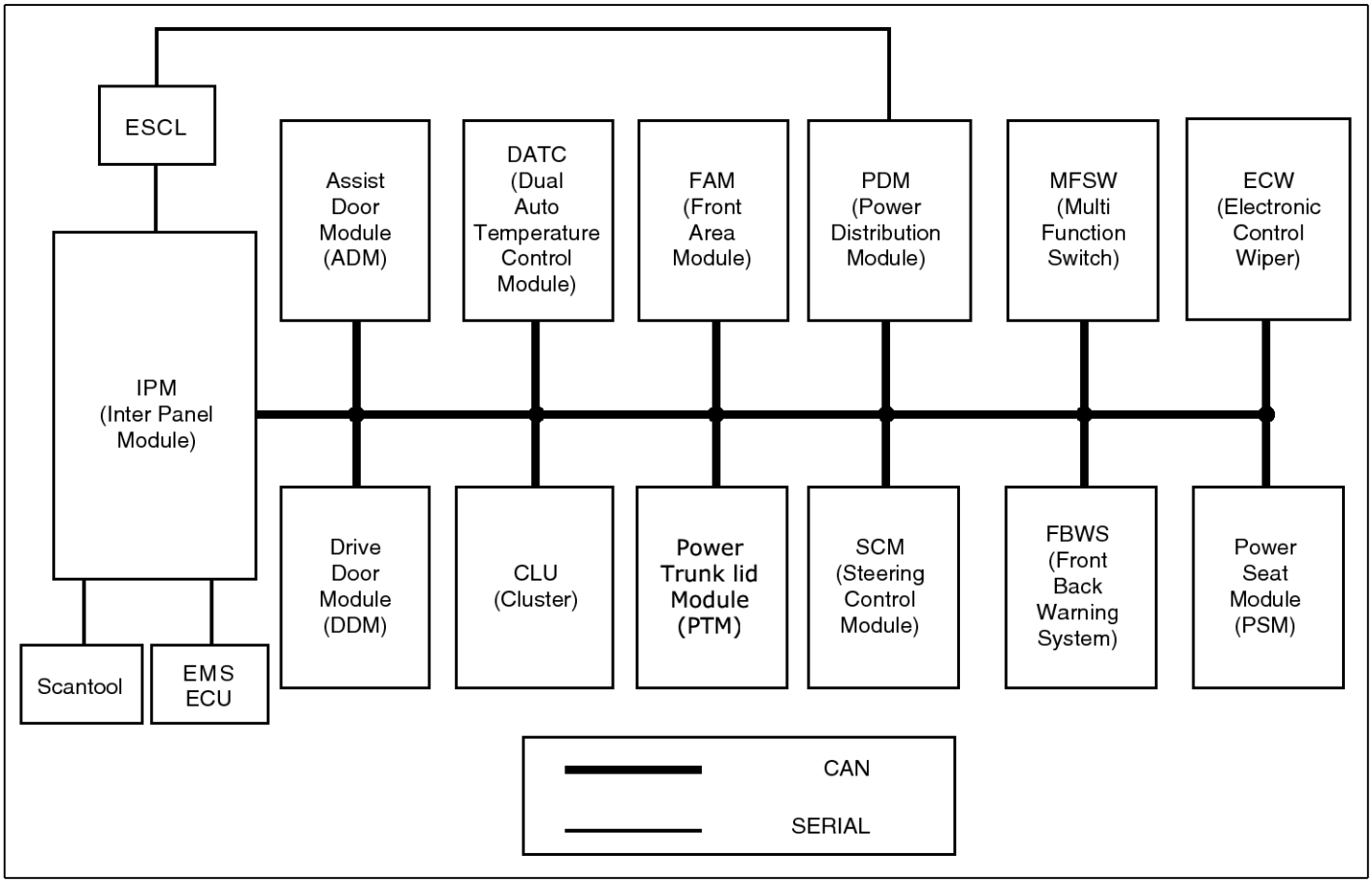
### General Description

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.)




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### DTC Description

This code reports the malfunction of NEC MCU inside PDM. This is the case which there is the NEC MCU communication error.

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### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • NEC MCU Communication Check | • Short to ground/power or open in communication circuit of NEC MCU inside PDM<br>• Replace PDM (In case It is unable to verify the 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

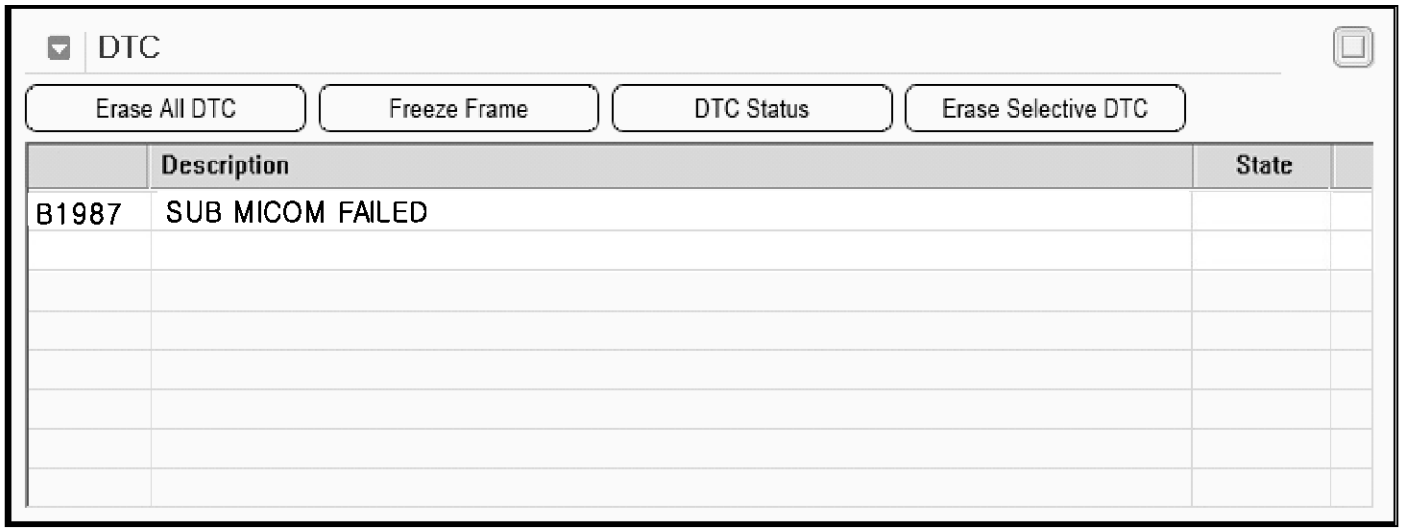
Refer to DTC B1602 : CAN Error.

### Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

### 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?

**YES** ▶ Go to next procedure.

**NO** ▶ 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 and Connector Inspection

Refer to DTC B1603 : CAN Communication Bus Off.

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### Component Inspection

Check internal errors of PDM

1. IG "OFF"
2. Replace PDM with a new one.
3. IG "ON" & ENG "OFF"
4. Disconnect CAN communication units one by one and monitor DTC to find the cause.
5. Is the code not reoccurred?

**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

Refer to DTC B1602 : CAN Error.

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# B1988 ESCL Battery Short Circuit To Battery

## General Description

Refer to DTC B1987 : Sub Micom Failed.

## 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

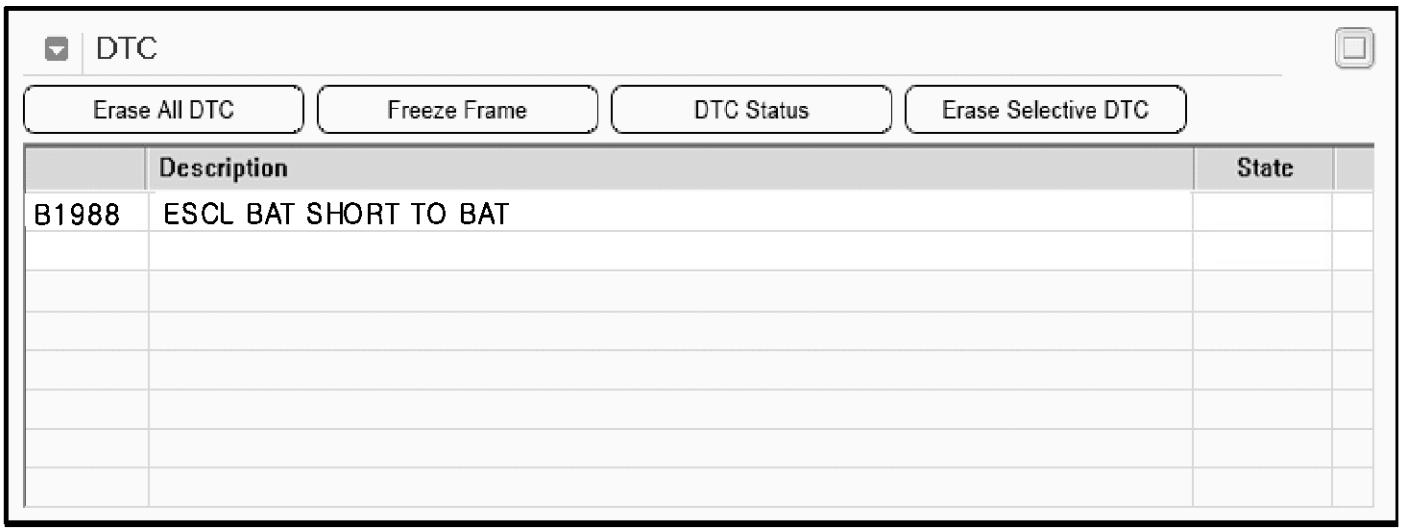
Refer to DTC B1989 : ESCL Ground Short Circuit To Battery.

## Signal Waveform & Data

Refer to DTC B1989 : ESCL Ground Short Circuit To Battery.

## 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?

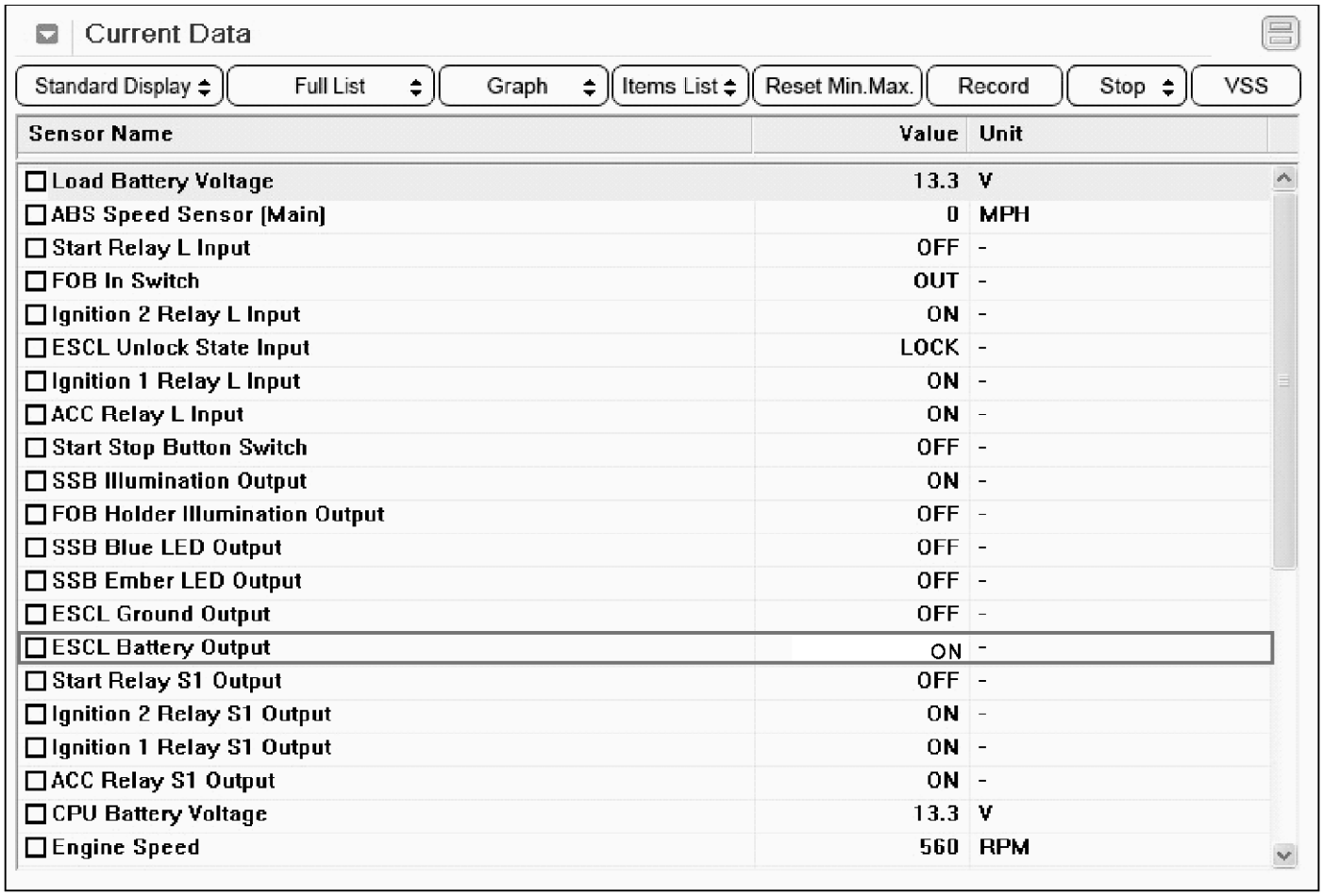
**YES** ▶ Go to next procedure.

**NO** ▶ 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.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of ESCL BATT.

**Specification :** OFF




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4. Is the service data within specifications?

**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

Refer to DTC B1989 : ESCL Ground Short Circuit To Battery.

## PDM Ground Circuit Inspection

Refer to DTC B1989 : ESCL Ground Short Circuit To Battery.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1989 ESCL Ground Short Circuit To Battery

## General Description

Refer to DTC B1987 : Sub Micom Failed.

## DTC Description

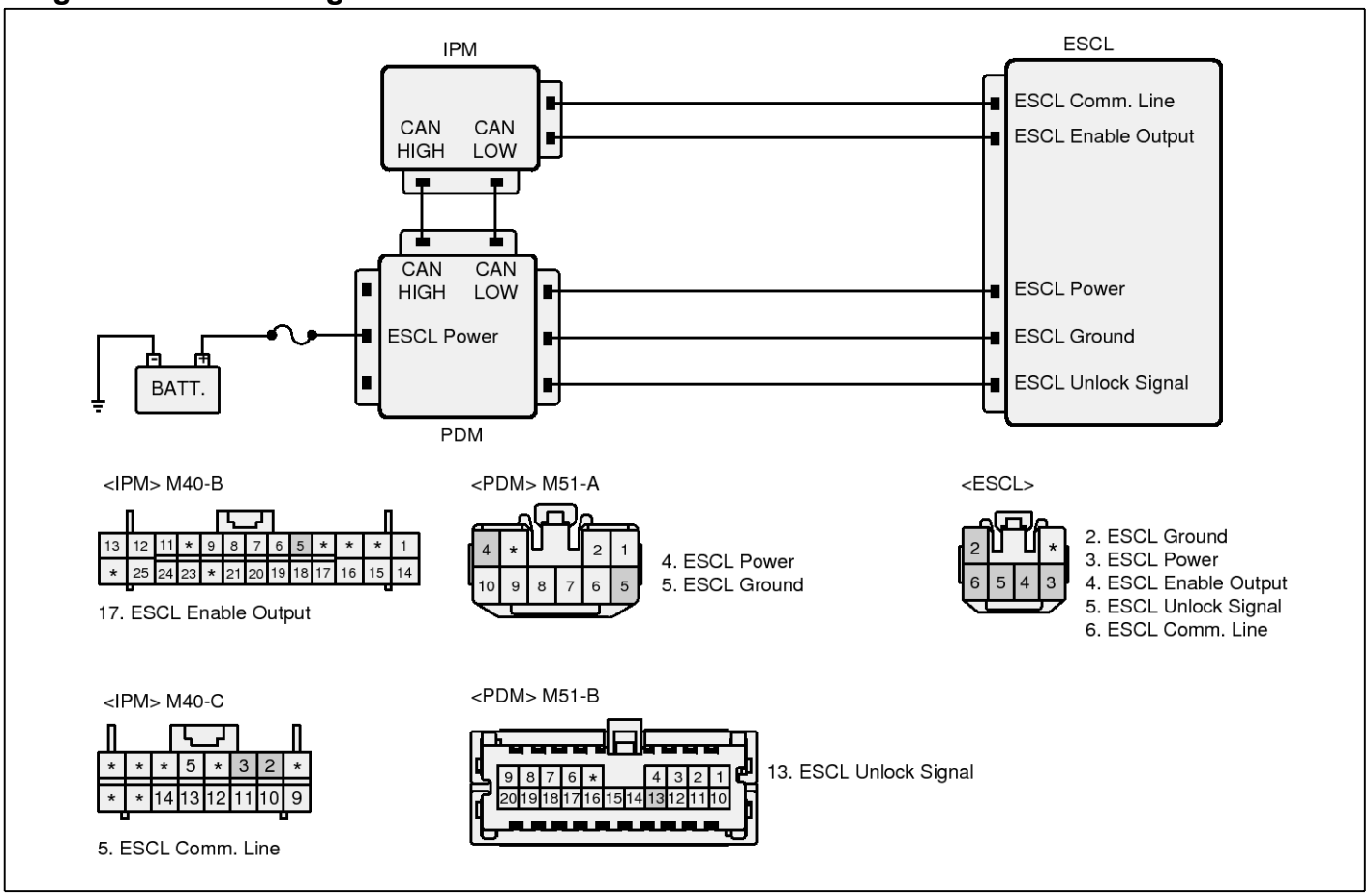
This code is outputted when ground circuit is shorted to battery.

(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 ground in ESCL power 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




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**Signal Waveform & Data**

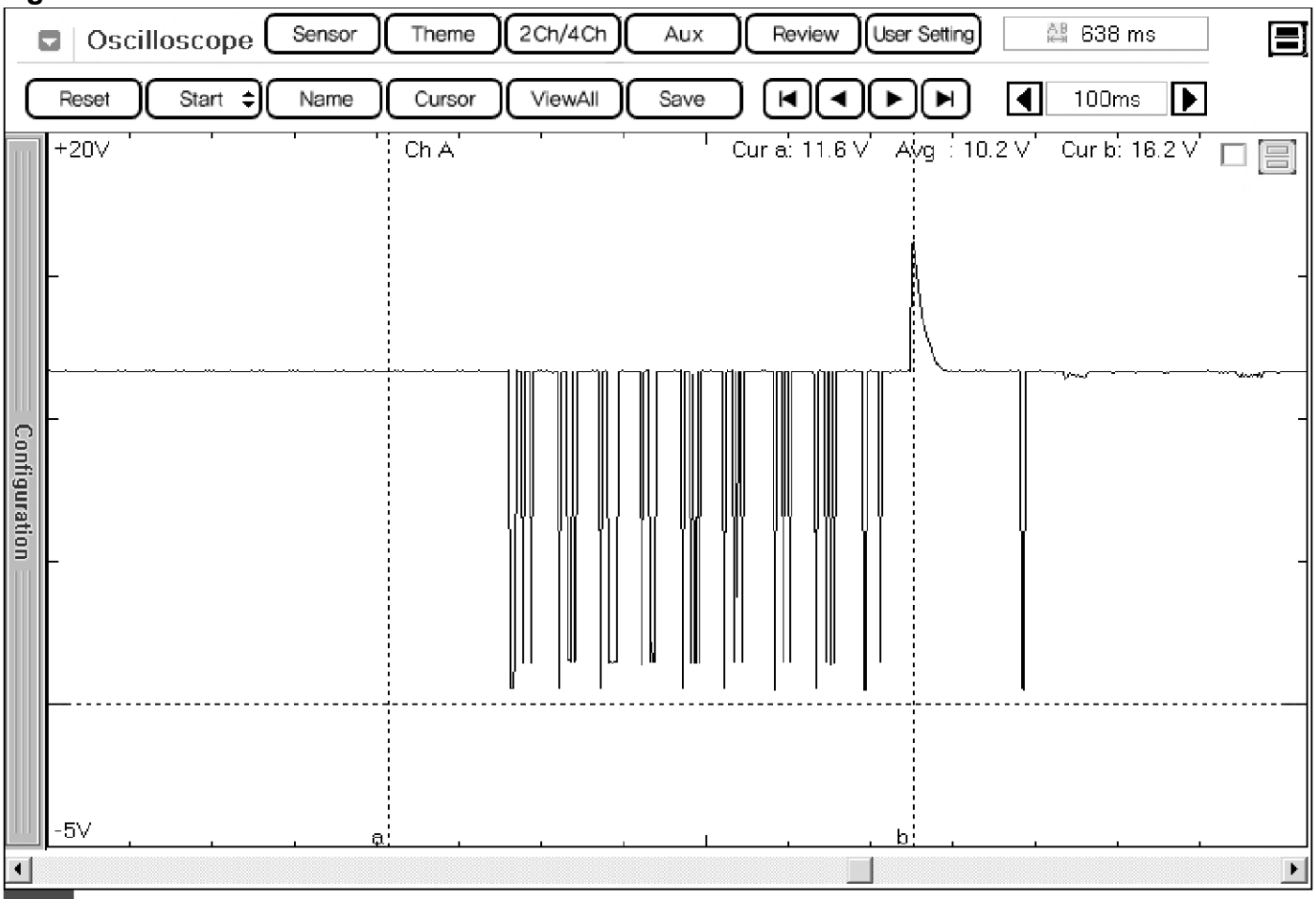



Fig.1

SBHBE9I14L

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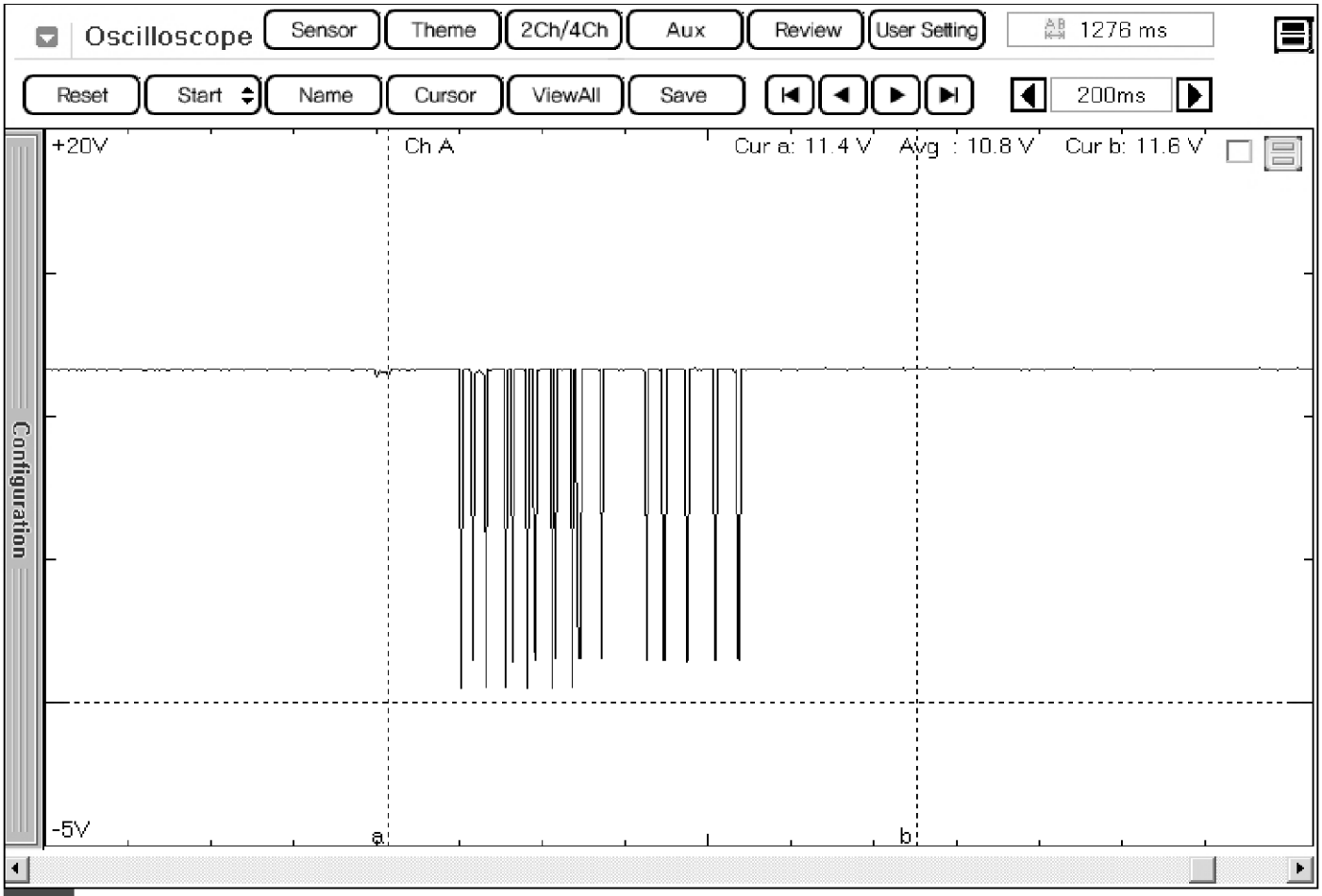



Fig.2

SBHBE9I15L

Fig.1) ESCL Data Signal Waveform(VOLT UNLOCK STATE)

Fig.2) ESCL Data Signal Waveform(VOLT LOCK STATE)

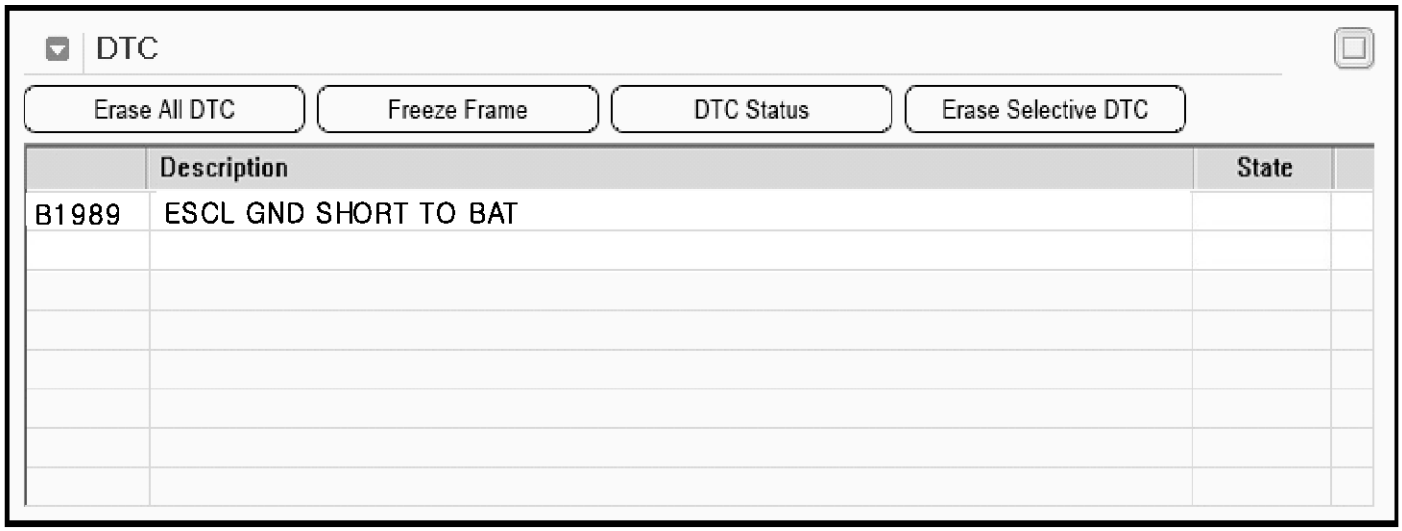
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## Scantool Data Analysis

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).




SBHBE9I16L

5. Is the same DTC occurred again?

**YES** ▶ Go to next procedure.

**NO** ▶ 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.

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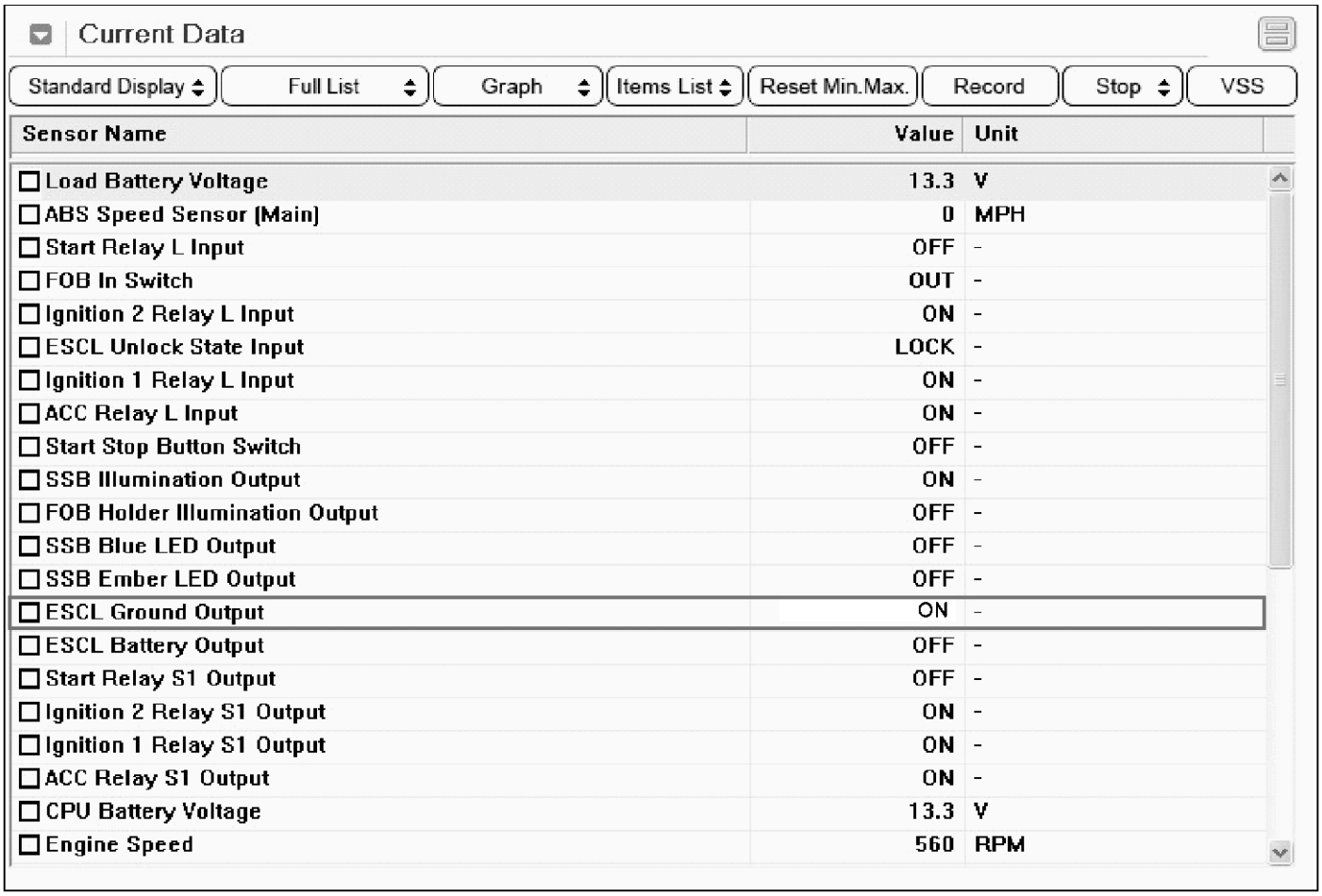
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## Service Data Analysis

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of ESCL GND.

**Specification :** OFF




| Sensor Name | Value | Unit |
|---|---|---|
| Load Battery Voltage | 13.3 | V |
| ABS Speed Sensor (Main) | 0 | MPH |
| Start Relay L Input | OFF | - |
| FOB In Switch | OUT | - |
| Ignition 2 Relay L Input | ON | - |
| ESCL Unlock State Input | LOCK | - |
| Ignition 1 Relay L Input | ON | - |
| ACC Relay L Input | ON | - |
| Start Stop Button Switch | OFF | - |
| SSB Illumination Output | ON | - |
| FOB Holder Illumination Output | OFF | - |
| SSB Blue LED Output | OFF | - |
| SSB Ember LED Output | OFF | - |
| ESCL Ground Output | ON | - |
| ESCL Battery Output | OFF | - |
| Start Relay S1 Output | OFF | - |
| Ignition 2 Relay S1 Output | ON | - |
| Ignition 1 Relay S1 Output | ON | - |
| ACC Relay S1 Output | ON | - |
| CPU Battery Voltage | 13.3 | V |
| Engine Speed | 560 | RPM |

SBHBE9I17L

4. Is the service data within specifications?

**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 "Component Inspection" procedure.

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## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ 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?

**YES** ▶ 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.

**NO** ▶ Repair as necessary and go to "Verification of Vehicle Repair".

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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# B1990 ESCL Battery Short Circuit To Ground

## General Description

Refer to DTC B1987 : Sub Micom Failed.

## DTC Description

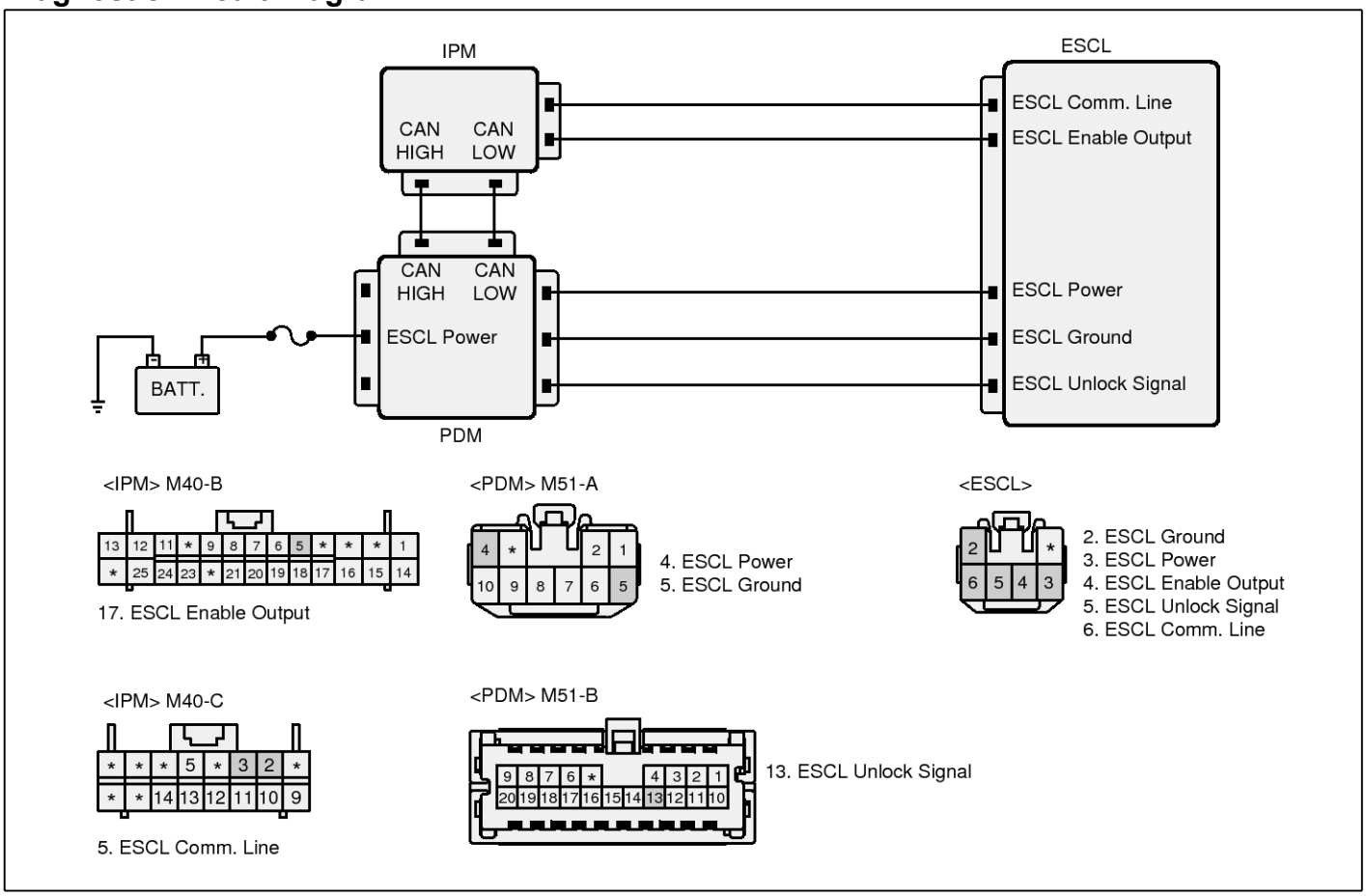
This code is outputted when power circuit is shorted to g-round.

(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 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




SBHBE9I02L

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**Signal Waveform & Data**

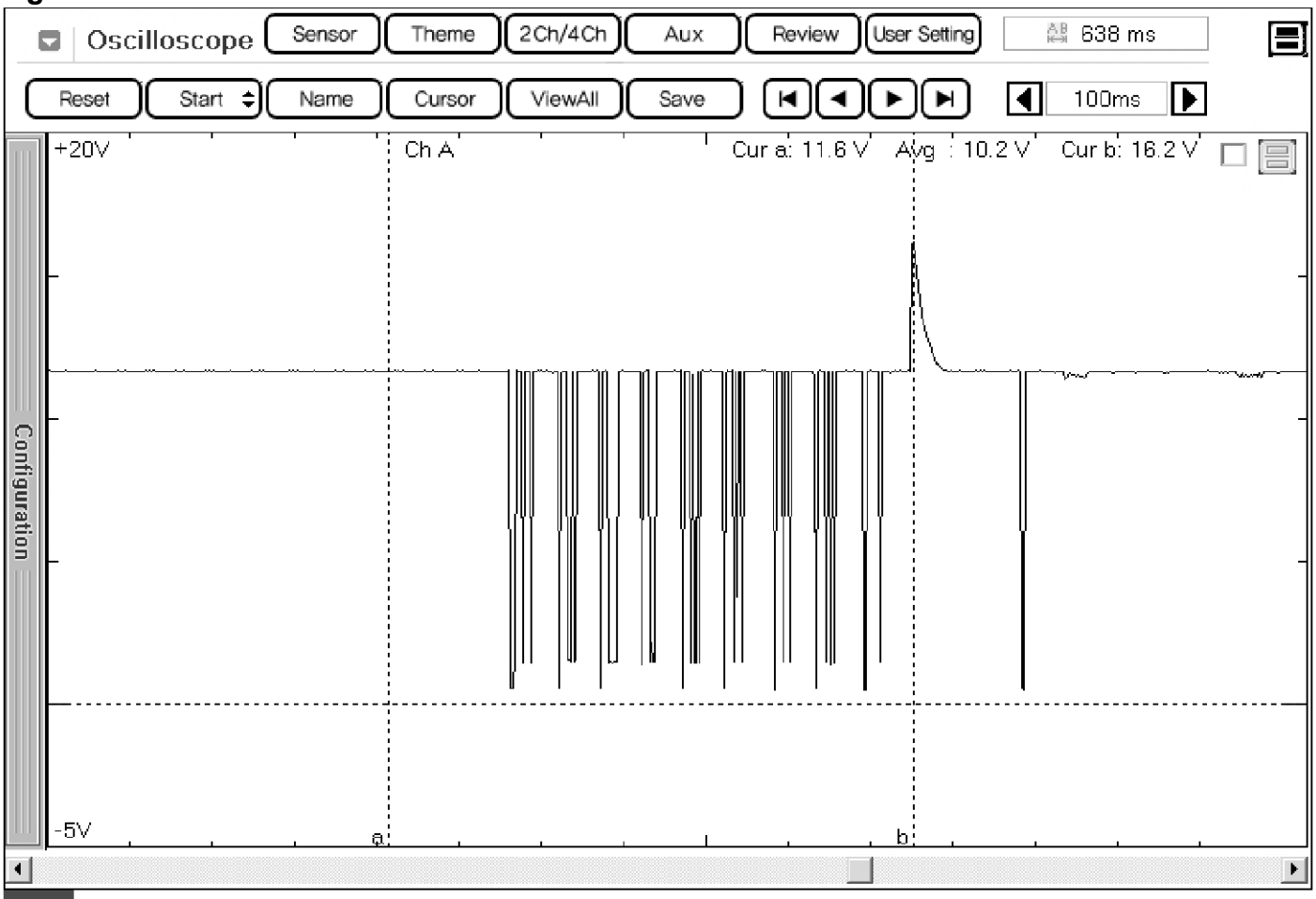



Fig.1

SBHBE9I14L

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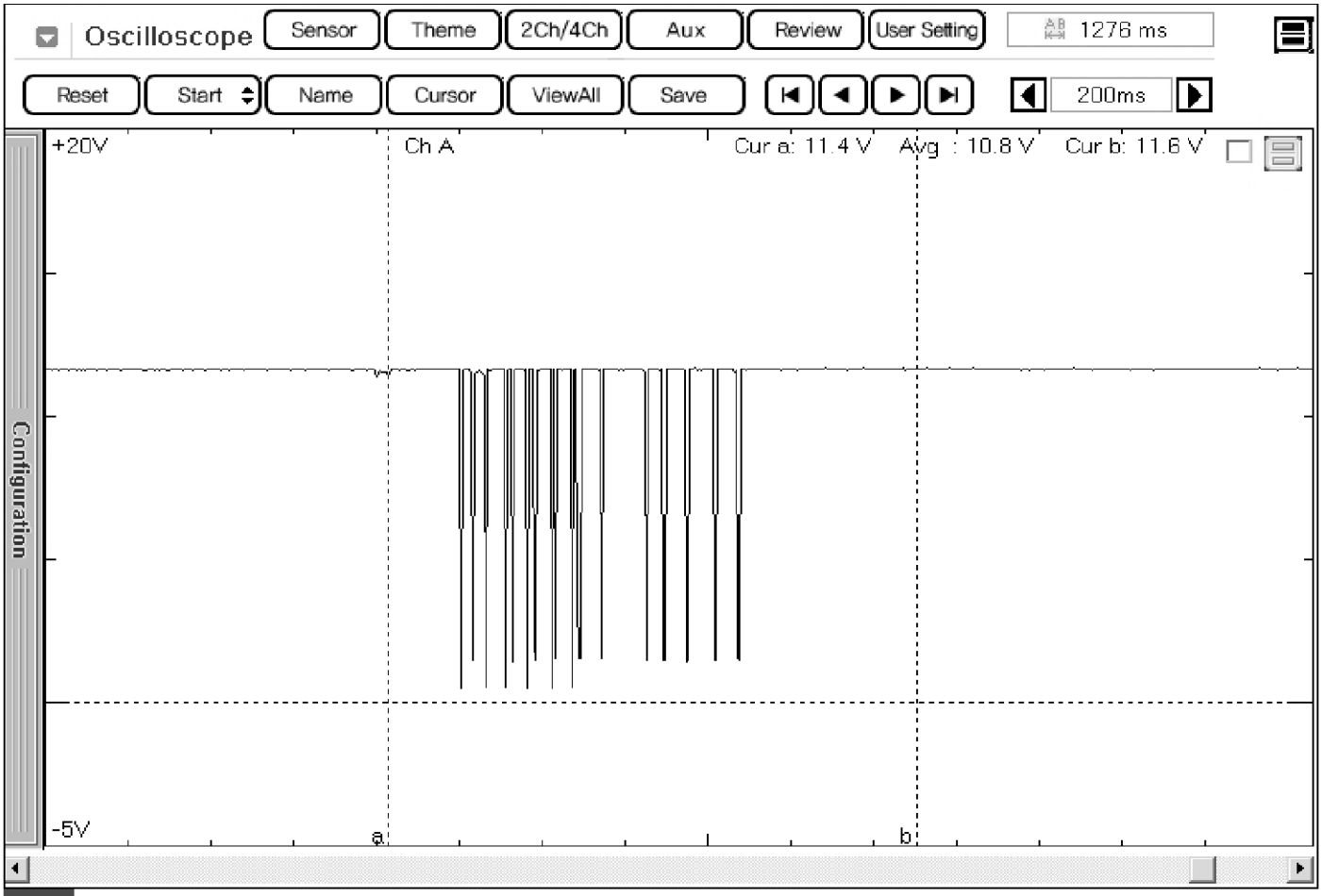



Fig.2

SBHBE9I15L

Fig.1) ESCL Data Signal Waveform(VOLT UNLOCK STATE)

Fig.2) ESCL Data Signal Waveform(VOLT LOCK STATE)

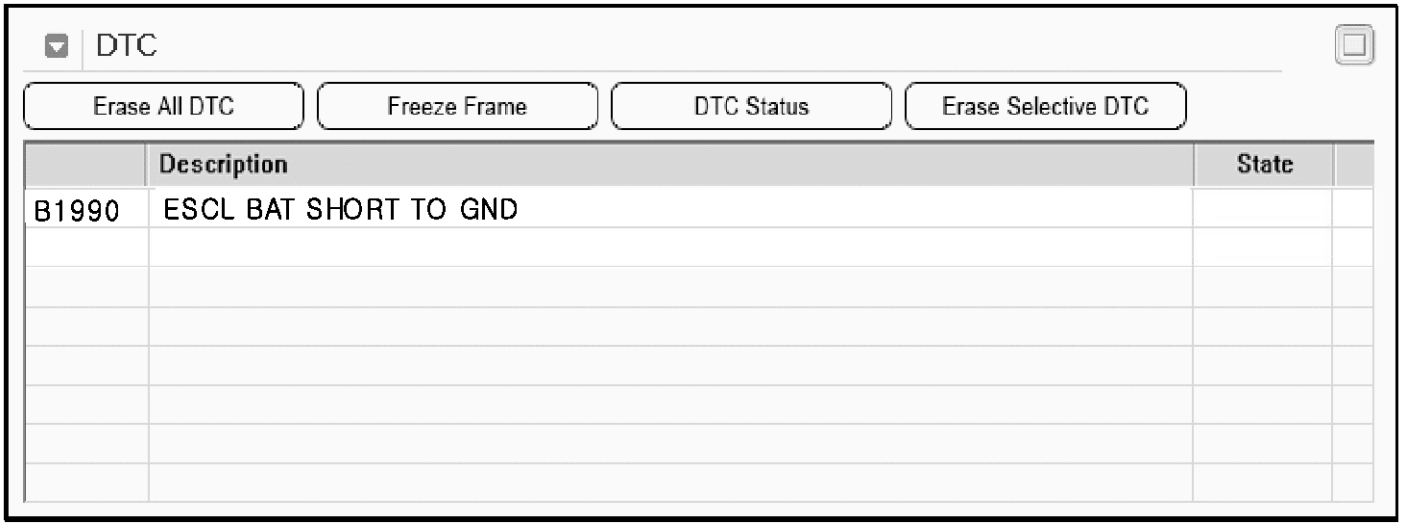
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## Scantool Data Analysis

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).




SBHBE9I20L

5. Is the same DTC occurred again?

**YES** ▶ Go to next procedure.

**NO** ▶ 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.

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## Service Data Analysis

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of ESCL BATT.

**Specification :** ON

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Load Battery Voltage | 13.3 | V |
| ABS Speed Sensor [Main] | 0 | MPH |
| Start Relay L Input | OFF | - |
| FOB In Switch | OUT | - |
| Ignition 2 Relay L Input | ON | - |
| ESCL Unlock State Input | LOCK | - |
| Ignition 1 Relay L Input | ON | - |
| ACC Relay L Input | ON | - |
| Start Stop Button Switch | OFF | - |
| SSB Illumination Output | ON | - |
| FOB Holder Illumination Output | OFF | - |
| SSB Blue LED Output | OFF | - |
| SSB Ember LED Output | OFF | - |
| ESCL Ground Output | OFF | - |
| ESCL Battery Output | ON | - |
| Start Relay S1 Output | OFF | - |
| Ignition 2 Relay S1 Output | ON | - |
| Ignition 1 Relay S1 Output | ON | - |
| ACC Relay S1 Output | ON | - |
| CPU Battery Voltage | 13.3 | V |
| Engine Speed | 560 | RPM |

SBHBE9I21L

4. Is the service data within specifications?

**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 "Component Inspection" procedure.

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## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ 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?

**YES** ▶ 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.

**NO** ▶ 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.

Refer to DTC B1602 : CAN Error.

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# B1991 Immobilizer TX Short Circuit To Ground

## General Description

Refer to DTC B1987 : Sub Micom Failed.

## 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

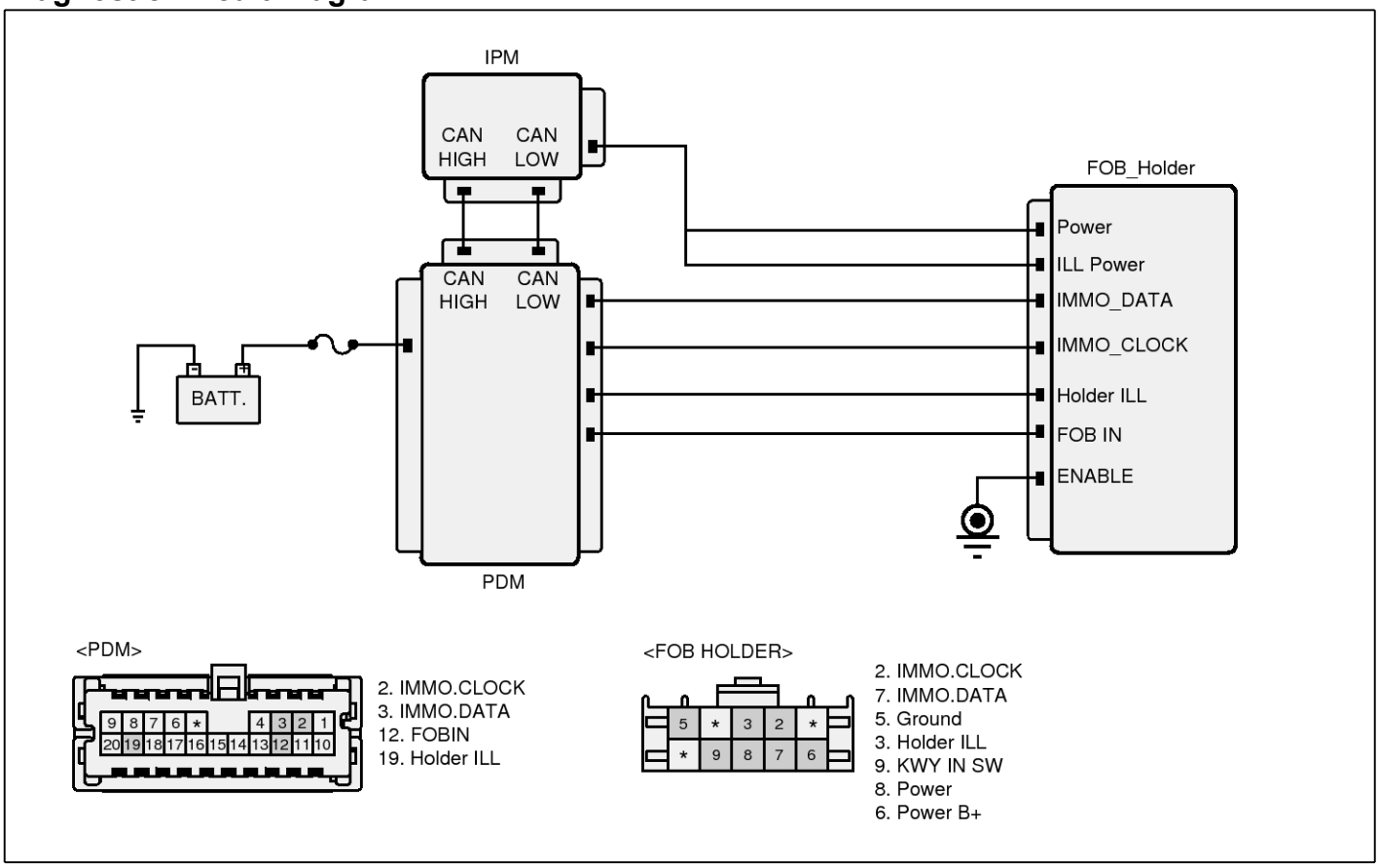
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Immobilizer data line check(by voltage monitoring) | • Short to ground in immobilizer data circuit |
| Enable Conditions | • The communication state between the fob and the fob holder when SSB button is pushed. (The fob 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) | |

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## Diagnostic Circuit Diagram




SBHBE9I03L

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**Signal Waveform & Data**

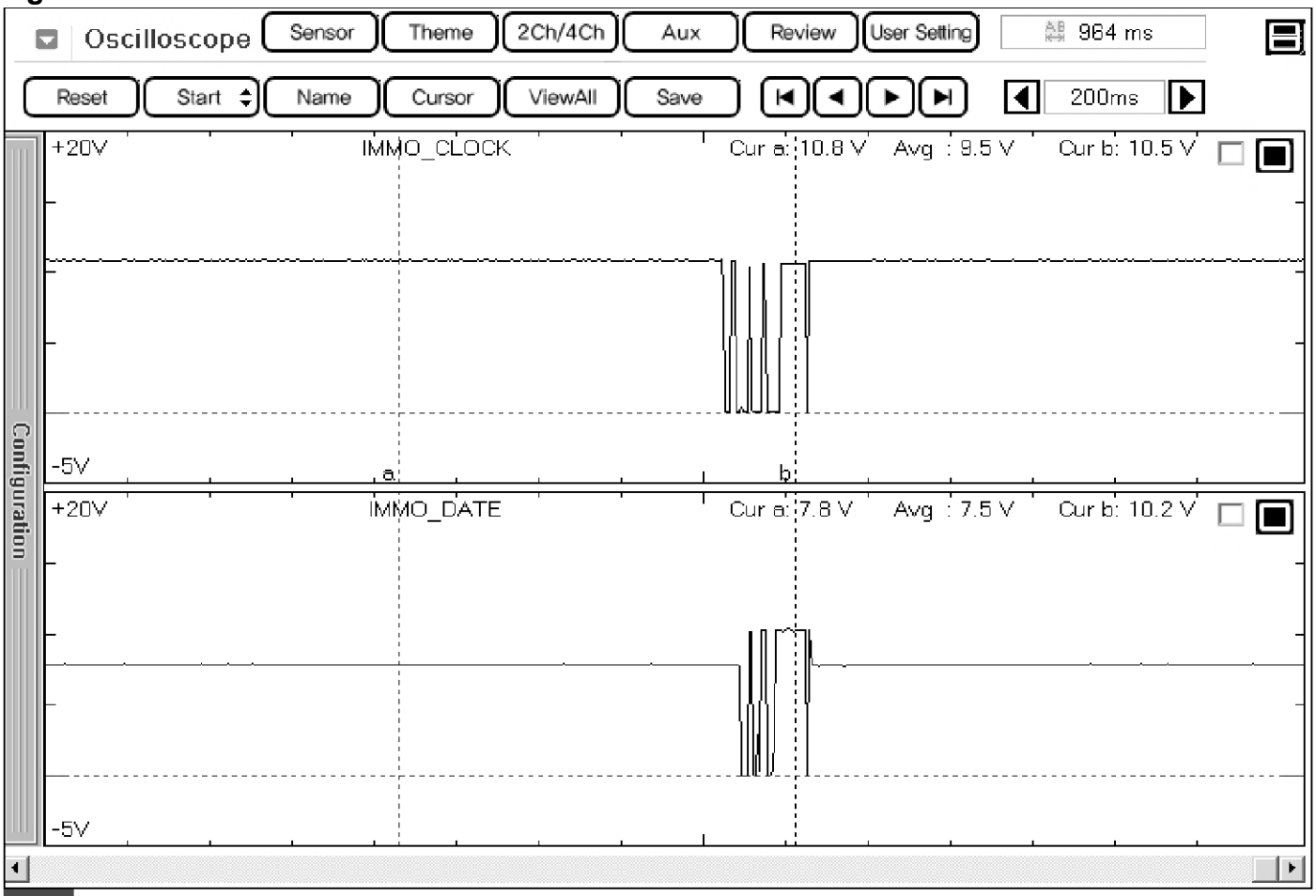



Fig.1

SBHBE9I22L

Fig.1) IMMO_CLOCK & IMMO_DATE signal waveform

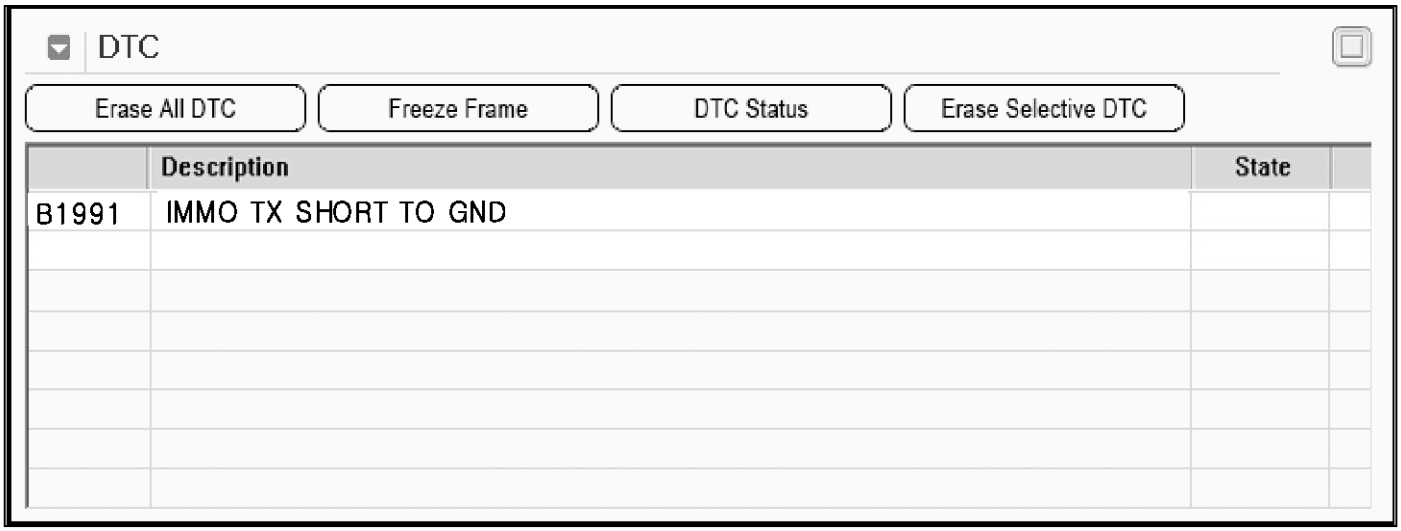
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### Scantool Data Analysis

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).




SBHBE9I23L

5. Is the same DTC occurred again?

**YES** ▶ Go to next procedure.

**NO** ▶ 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.

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## 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.)

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Load Battery Voltage | 13.3 | V |
| ABS Speed Sensor (Main) | 0 | MPH |
| Start Relay L Input | OFF | - |
| FOB In Switch | INSERT | - |
| Ignition 2 Relay L Input | ON | - |
| ESCL Unlock State Input | LOCK | - |
| Ignition 1 Relay L Input | ON | - |
| ACC Relay L Input | ON | - |
| Start Stop Button Switch | OFF | - |
| SSB Illumination Output | ON | - |
| FOB Holder Illumination Output | OFF | - |
| SSB Blue LED Output | OFF | - |
| SSB Ember LED Output | OFF | - |
| ESCL Ground Output | OFF | - |
| ESCL Battery Output | OFF | - |
| Start Relay S1 Output | OFF | - |
| Ignition 2 Relay S1 Output | ON | - |
| Ignition 1 Relay S1 Output | ON | - |
| ACC Relay S1 Output | ON | - |
| CPU Battery Voltage | 13.3 | V |
| Engine Speed | 560 | RPM |

SBHBE9I24L

4. Is the service data within specifications?

**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 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

4. Is the measured resistance within specifications?

**YES** ▶ 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.

**NO** ▶ Repair as necessary and go to "Verification of Vehicle Repair".

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

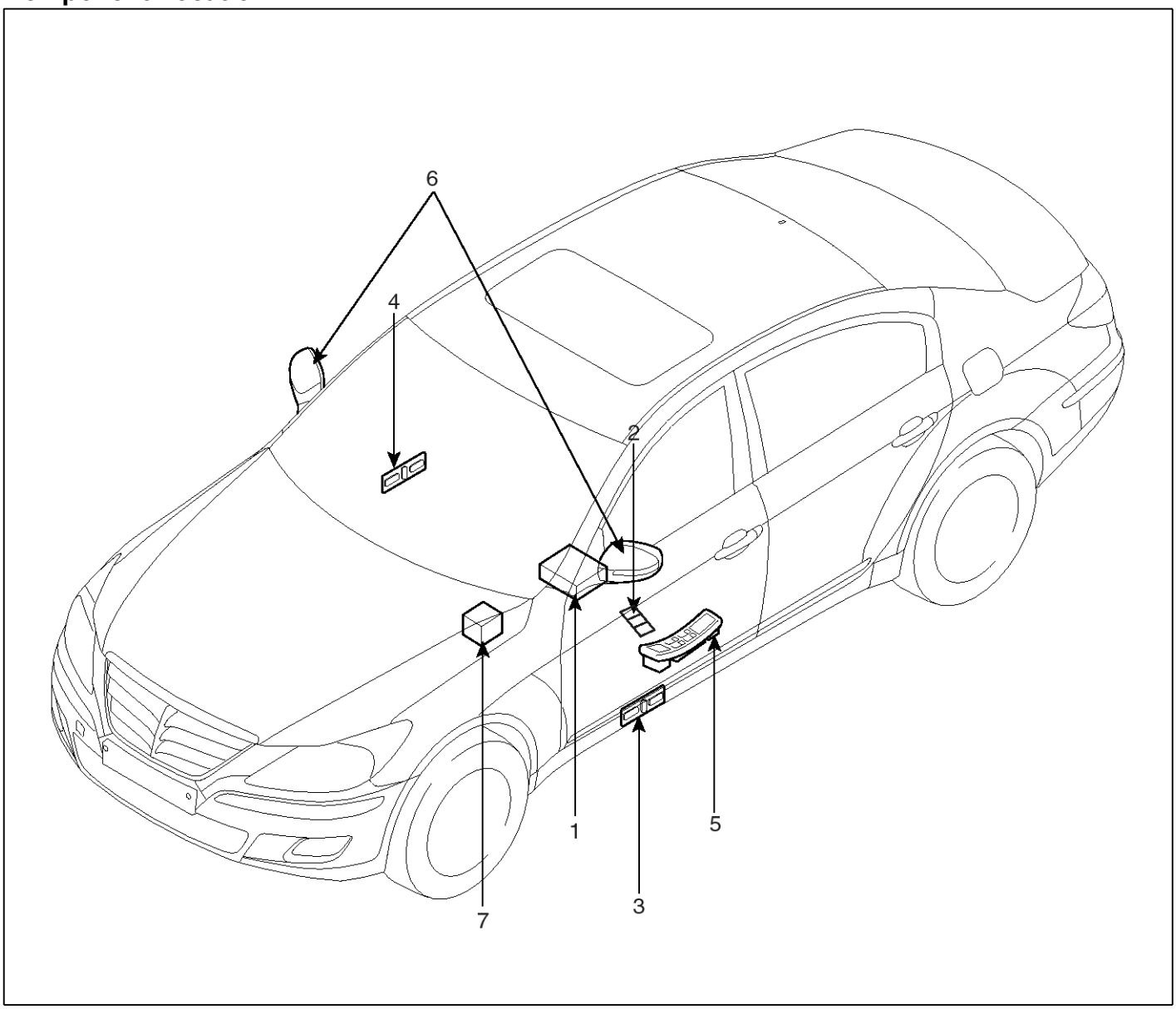
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# IMS (Integrated Memory System)

## Component Location




SBHBE8093D

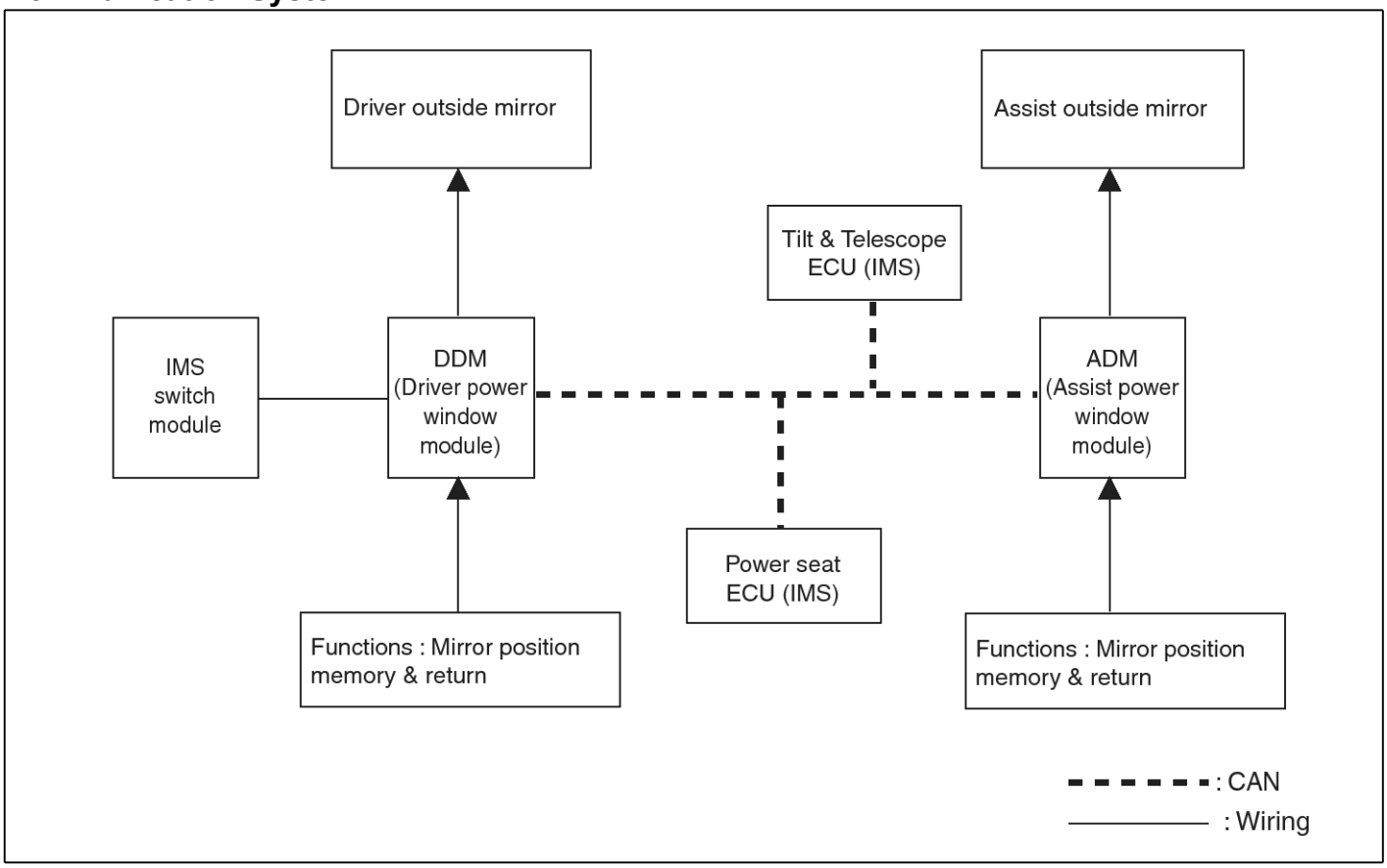
1. IMS
2. IMS Control switch
3. IMS Driver seat control
4. IMS Assist seat control
5. IMS Mirror control
6. Outside mirror
7. SCM (Tile-Telescope unit)

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## Communication System



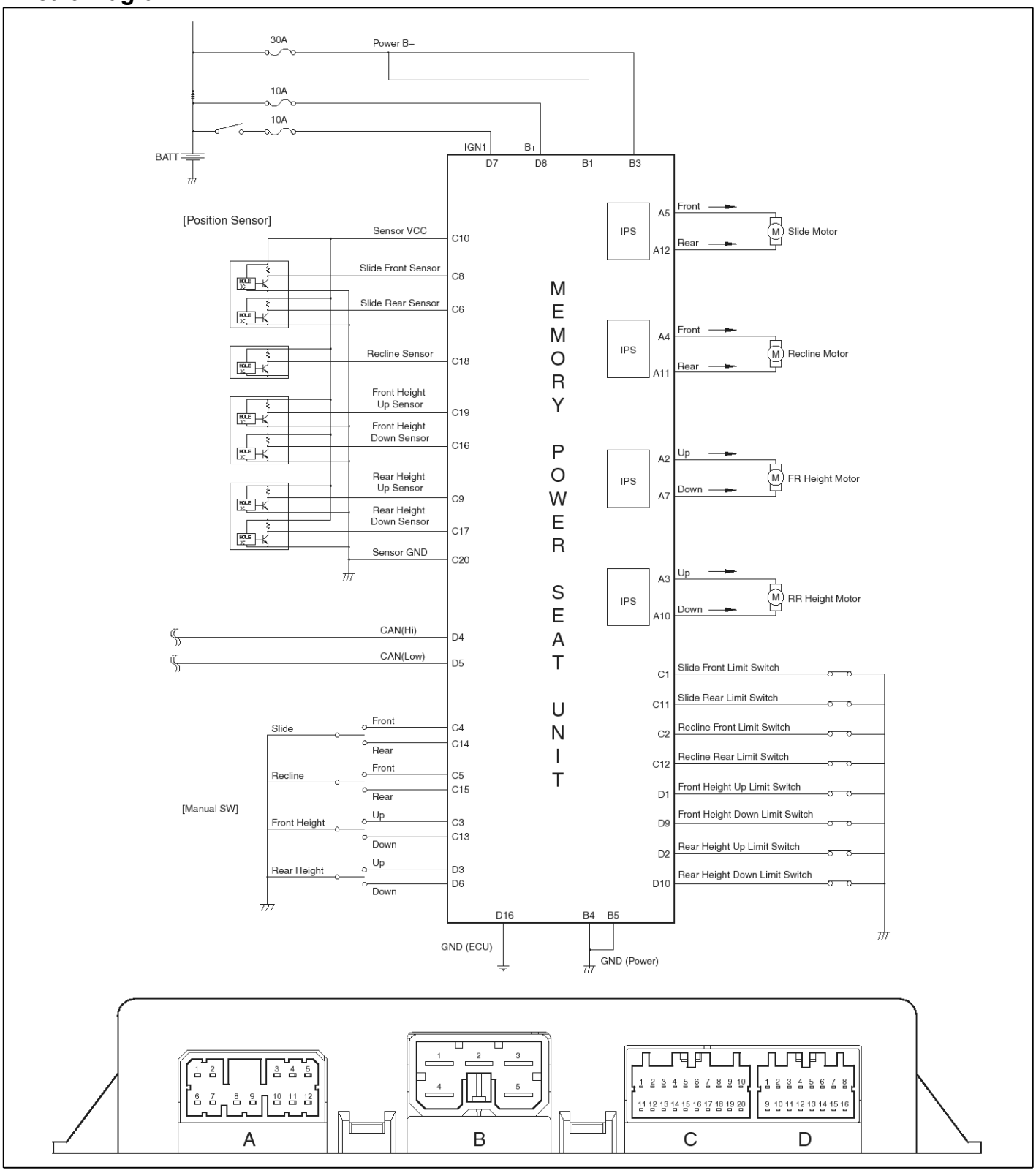

SENBE7102L

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## Circuit Diagram




SBHBE9059L

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## Description

Seat, steering column and mirror positions set by the driver are memorized in the IMS control unit by the position sensors. So, those positions can be returned to the memorized positions by the IMS control switch and keyless control even when the seat, steering column and mirror positions are changed. (This is called replay operation). In addition, LIN communication is performed between power seat control unit and power window. For the sake of safety, replay is prohibited during driving and replay operation can be stopped immediately.

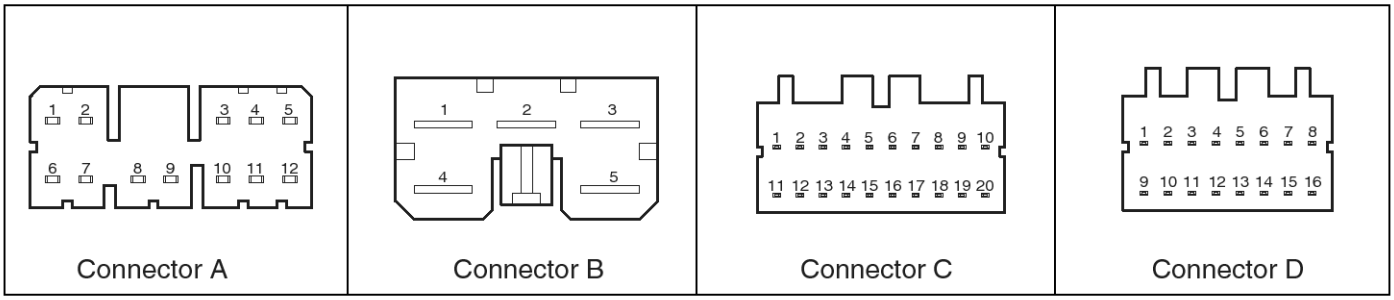
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## Inspection

### IMS Connectors




SBHBE9060L

### Connector Pin Name

| Pin | Connector A | Connector B | Connector C | Connector D |
|---|---|---|---|---|
| 1 | | Battery (power) | Slide front limit switch | Front heigh up limit switch |
| 2 | Front heigh motor up | | Recline front limit switch | Rear heigh up limit switch |
| 3 | Rear heigh motor up | Battery (power) | Front height up manual switch | Rear heigh up manual switch |
| 4 | Recline motor front | GND (power) | Slide front manual switch | CAN high |
| 5 | Slide motor front | GND (power) | Recline front manual switch | CAN low |
| 6 | - | | Slide rear sensor | Rear heigh down manual switch |
| 7 | Front heigh motor down | | - | IGN1 |
| 8 | - | | Slide front sensor | B+ |
| 9 | - | | Rear height up sensor | Front heigh down limit switch |
| 10 | Rear heigh motor down | | Sensor Vcc(seat) | Rear heigh down limit switch |
| 11 | Recline motor rear | | Slide rear limit switch | - |
| 12 | Slide motor rear | | Recline rear limit switch | - |
| 13 | | | Front height down manual switch | - |
| 14 | | | Slide rear manual switch | - |
| 15 | | | Recline rear manual switch | - |
| 16 | | | Front height down sensor | GND |
| 17 | | | Rearheight down sensor | |
| 18 | | | Recline sensor | |
| 19 | | | Front height up sensor | |
| 20 | | | Sensor GND | |

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**IMS Input/Output Specification**

| Pin | Designation | Input/Output | Remark |
|---|---|---|---|
| A2 | Seat FRT Height Up Motor | O | - |
| A3 | Seat RR Height Up Motor | O | - |
| A4 | Seat Rec FRT Motor | O | - |
| A5 | Seat Slide FRT Motor | O | - |
| A6 | - | - | - |
| A7 | Seat FRTHeightDown Motor | O | - |
| A8 | - | - | - |
| A9 | - | - | - |
| A10 | Seat RR Height Down Motor | O | - |
| A11 | Seat Rec RR Motor | O | - |
| A12 | Seat Slide RR Motor | O | - |
| B1 | Power VB | I | BAT |
| B2 | - | - | - |
| B3 | Power VB | I | BAT |
| B4 | GROUND1 | - | GND |
| B5 | GROUND2 | - | GND |
| C1 | Seat Slide FRT Limit SW | I | NORMAL CLOSE |
| C2 | Seat Rec FRT Limit SW | I | NORMAL CLOSE |
| C3 | Seat FRT Height UpSW | I | ON : GND |
| C4 | Seat Slide FRT SW | I | ON : GND |
| C5 | Seat Rec FRT SW | I | ON : GND |
| C6 | Slide RR Sensor | I | PULSE SIGNAL |
| C7 | Rec RR Sensor | I | PULSE SIGNAL |
| C8 | Slide FRT Sensor | I | PULSE SIGNAL |
| C9 | RR Height Up Sensor | I | PULSE SIGNAL |
| C10 | SENSOR VB | I | BAT |
| C11 | Seat Slide RR Limit SW | I | NORMAL CLOSE |
| C12 | Seat Rec RR Limit SW | I | NORMAL CLOSE |
| C13 | Seat FRT Height Down SW | I | ON : GND |
| C14 | Seat Slide RR SW | I | ON : GND |
| C15 | Seat Rec RR SW | I | ON : GND |
| C16 | FRT Height Down Sensor | I | PULSE SIGNAL |
| C17 | RR Height Down Sensor | I | PULSE SIGNAL |
| C18 | Rec FRT Sensor | I | PULSE SIGNAL |

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| Pin | Designation | Input/Output | Remark |
|---|---|---|---|
| C19 | FRT Height Up Sensor | I | PULSE SIGNAL |
| C20 | SENSOR GND | - | GND |
| D1 | Seat FRT Height Up Limit SW | I | NORMAL CLOSE |
| D2 | Seat RR Height Up Limit SW | I | NORMAL CLOSE |
| D3 | Seat RR Height Up SW | I | ON : GND |
| D4 | CAN Hi | I/O | - |
| D5 | CAN Low | I/O | - |
| D6 | Seat RR Height Down SW | I | ON : GND |
| D7 | IGN1 PSM | I | BAT |
| D8 | POWER VB | I | BAT |
| D9 | Seat FRT Height Down Limit SW | I | NORMAL CLOSE |
| D10 | Seat RR Height Down Limit SW | I | NORMAL CLOSE |
| D11 | - | - | - |
| D12 | - | - | - |
| D13 | - | - | - |
| D14 | - | - | - |
| D15 | - | - | - |
| D16 | ECU GND | - | GND |

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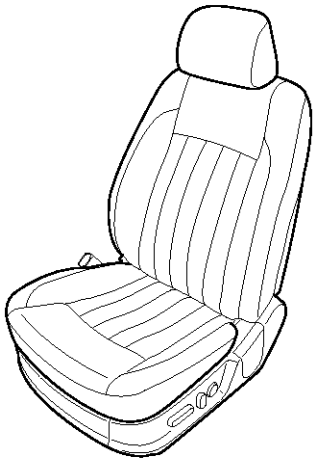
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## IMS (Integrated Memory System) module

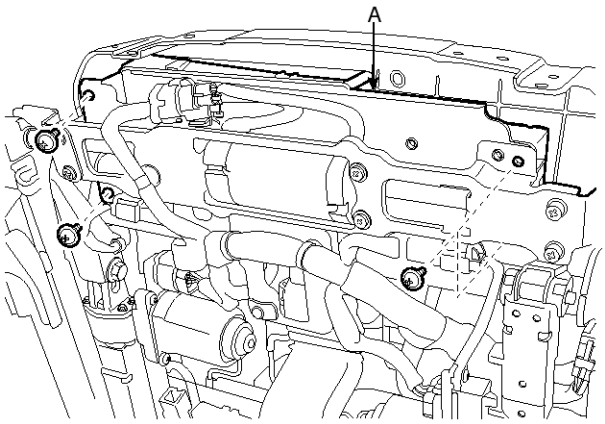
### Removal

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

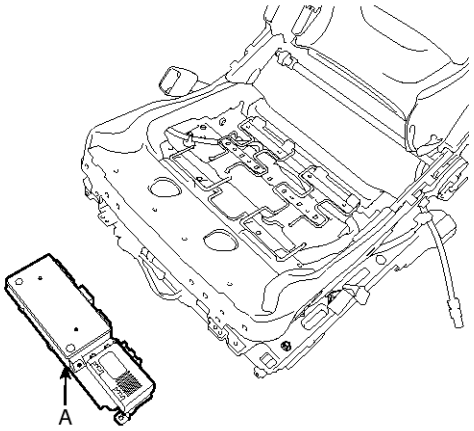


SBHBE8096D

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




SBHBE8097D




SBHBE8098D

### Installation

1. Reassemble the IMS module after connecting the connectors.
2. Reassemble the seats in the car.

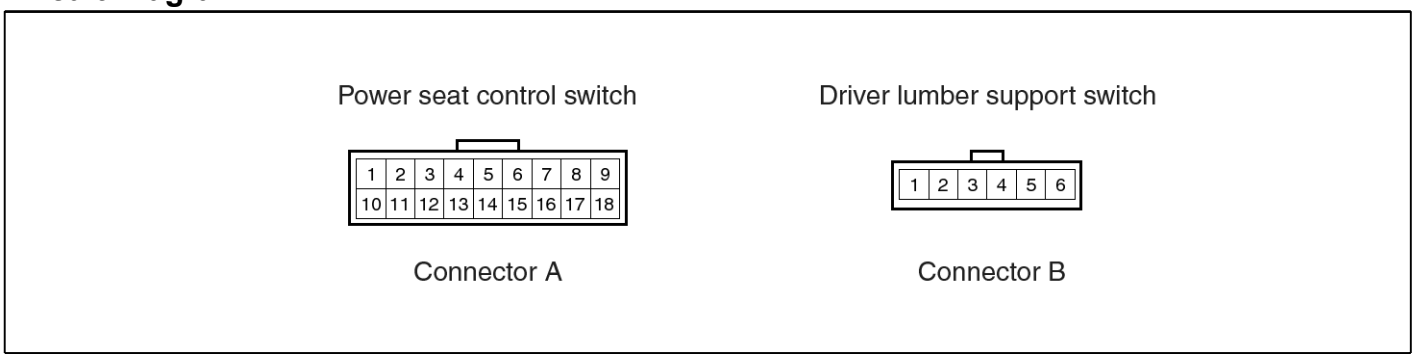
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## IMS Power Seat Control

### Circuit Diagram




SBHBE9061L

| Pin | Connector A | Connector B |
|---|---|---|
| 1 | Rear recline motor | B+ |
| 2 | B+ | Inflate upper bladder |
| 3 | - | Deflate upper bladder |
| 4 | - | Inflate lower bladder |
| 5 | Rear height limit motor down | Deflate lower bladder |
| 6 | Rear height limit motor up | Pump signal |
| 7 | - | |
| 8 | Rear slide motor | |
| 9 | Front slide motor | |
| 10 | - | |
| 11 | Front recline motor | |
| 12 | - | |
| 13 | - | |
| 14 | - | |
| 15 | Front height limit motor down | |
| 16 | - | |
| 17 | Front height limit motor up | |
| 18 | - | |

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## Description

Driver may choose and store the best seat position at the memory power seat unit using the memory switch and the position sensor, in order to restore the seat position at once.

There are CAN communication for data transmission and reception between the memory power seat unit and the driver side door module. The operation is inhibited for safety during driving.

### Feature

1. Manual operation of the seats by the manual switch. ( Manual operation)
2. Memory and regeneration operation of the seats by memory switch. (Memory and replay operation) : for 2 persons.
3. Auto memory upon the keyless LOCK and regeneration upon the UNLOCK. (Keyless memory and regeneration operation): for 2 persons.
4. Function description
   1) Driver power seat, sliding control, forward and backward
   2) Driver power seat, reclining control, forward and backward
   3) Driver power seat, height control, up and down

## Operation

### Manual Operation

1. Motor operation by the seat manual switch (Slide, reclining, front height and rear height control)
2. Seat position setting and 4-way simultaneous operation can be made by the manual switch operation.
3. Seat slide and reclining operation can be made directly in case of communication failure.

### Memory Registration

1. Data related to the registration are received through t he CAN communication from the power window main on the CAN line.
2. If any of the following conditions is met, memory permit status is released.

   When the ignition is OFF.

   When the manual switch is ON.
3. If 2 position switches are pressed ON simultaneously (within time interval of 50 ms) in memory registration, none of the switches are valid, and the first pressed switch is valid if the time interval is greater than 50 ms.
4. If the vehicle speed is over the limit speed of 3km/h or shift lever is at the position other than P, registration cannot be performed.
5. Registration can be revised without any limitation.
6. Memory will be cleared if the battery is removed.
7. If the memory registration is permitted (memory switch is ON), it sounds the buzzer.

### Memory Replay Operation

1. Data related to the memory replay are received through the CAN communication from the power window main on the CAN line.
2. Seat is set to the registered position as each position switch is pressed when the ignition is ON.
3. Memory replay will not be performed unless it is registered.
4. If the position switch is pressed while the memory replay is in operation, the final switch is effective. Though, if the switches are pressed within the time interval of 50 ms, replay will not be performed.
5. When the replay is in operation (position switch is ON ), buzzer will sounds once.
6. If any of the following conditions is met, replay is prohibited and operation will stop if it is in replay.

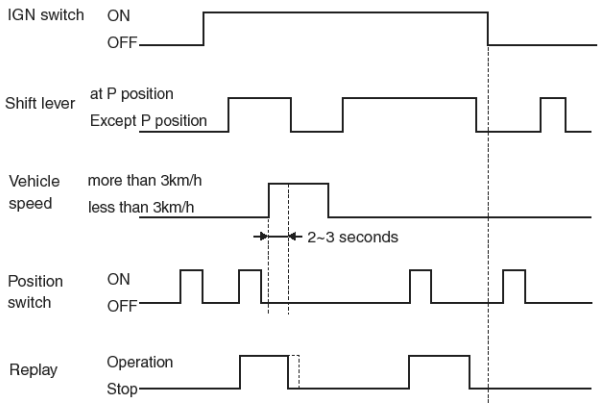
   When the ignition is OFF.

   When the "P" position switch is OFF (when the shift lever is at the position other than "P")

   When the vehicle speed is over 3 km/h (when it last more than 2 or 3 seconds)

   When the manual switch in relation to the seat is in operation. (Seat related replay operation stops)

   When the stop switch is ON.




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7. Control in reverse operation

   When the motor is driven reverse during the operation, it performs reverse operation after 60 ± 10 ms and 100 ± 10 ms from completing the current operation in slide, reclining and front/rear height respectively.

8. Determining operational priority

   In order to prevent overlapping of rushing current when the motor starts up, motor start-up is delayed for 1 00 ± 10 ms respectively and its operational priority is as follows.

   Slide > Reclining > Front height > Rear height

9. Sequential timer settings for motor start-up.

   Slide : 20 ± 2 seconds (in memory replay)

   Reclining : 35 ± 3 seconds (in memory replay)

   Front /Rear height : 10 ± 1 seconds

   ※ Slide, Reclining: It operates depending on the switch input time in manual switch input (direct drive type)

### Registration And Replay By The Keyless

1. Keyless registration operation
   1) Ignition ON and OFF positions are registered corresponding to the keyless codes.
   2) Keyless codes are determined by the keyless door lock operation.
2. Keyless replay operation
   1) Upon door unlock operation when the ignition is OFF, it automatically set the registered positions corresponding to the keyless code. However, seat slide is automatically set to the following positions .
   2) If any of the following conditions is met, keyless replay operation is prohibited and operation stops if it is in operation.
      - When the P position switch is OFF.
      - When the switch is in manual operation.
      - When the stop switch is ON.

### Buzzer Output

1. In case of memory permit status (memory switch is ON) : once
2. When memory registration is complete (position switch is ON) : twice
3. When the memory replay is in operation (position switch is ON) : once
4. When error is detected due to the sensor failure : 10 times

### Error Detection

1. If the sensor fluctuations of slide and front/rear height for one second after motor start-up are less than 6 pulses and 4 pulses respectively, and if the sensor fluctuation of reclining for 3.5 seconds is less than 50mV, it is determined that the harness is short or sensor is fail.
2. Countermeasure when error is detected.

   Stop the operation if it is in auto replay. Though, it should be operable manually. When the failure is completely repaired, it can be automatically adjusted from the stop of auto replay. If the position sensor senses the pulse from the position sensor by the manual operation, we judge it is complete. This is called stop release of automatic operation.

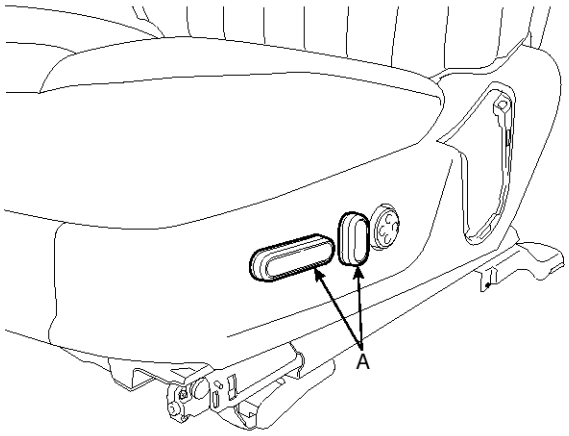
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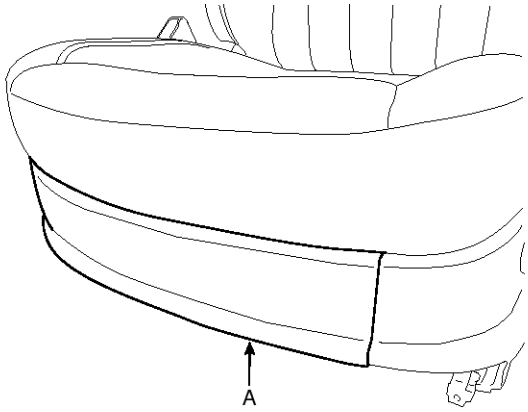
## Removal

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

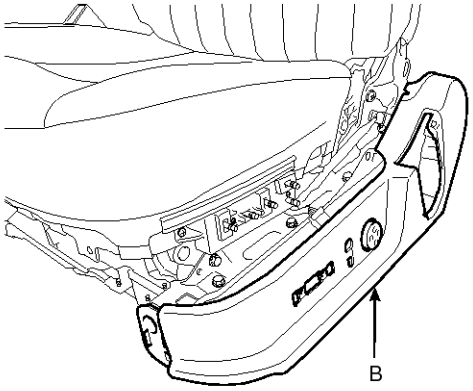



SBHBE8123D

3. After loosening the mounting screws and crip, then remove the seat cover (A) and recliner cover (B).

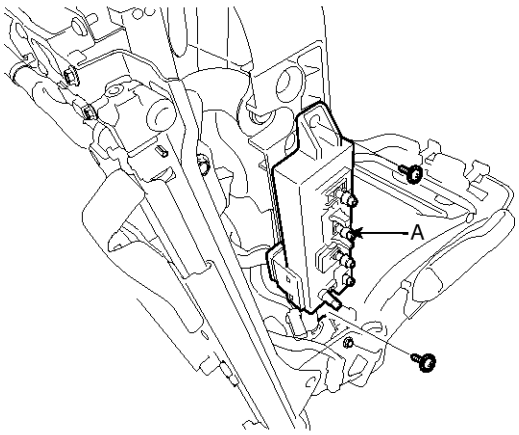



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4. Loosen the power seat control switch (A) screws(2EA ), then remove the connectors (2EA).



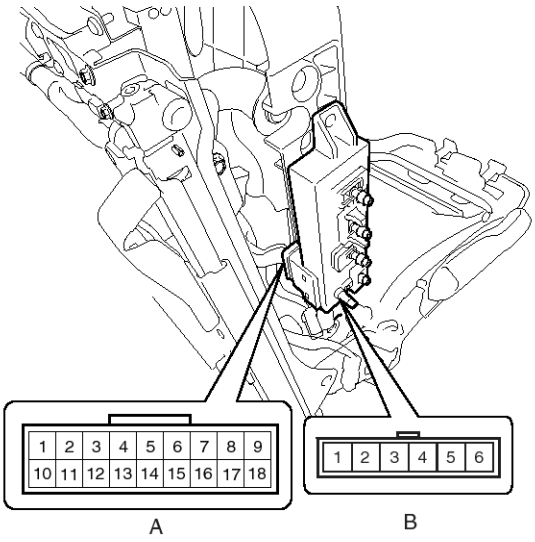

SBHBE8126D

## Installation

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

## Inspection

1. Remove the seat control switch.




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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.

Power seat connector switch A

| P/N | Height front | | Slide | | Height rear | | Recline | | Pin name |
|---|---|---|---|---|---|---|---|---|---|
| | UP | DOWN | FOR | BACK | UP | DOWN | FOR | BACK | |
| 2 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ⊕ |
| 9 | | | ○ | | | | | | Slide motor (forward) |
| 8 | | | | ○ | | | | | Slide motor (back) |
| 11 | | | | | | | ○ | | Recline motor (forward) |
| 1 | | | | | | | | ○ | Recline motor (back) |
| 17 | ○ | | | | | | | | Height front motor (up) |
| 15 | | ○ | | | | | | | Height front motor (down) |
| 6 | | | | | ○ | | | | Height rear motor (up) |
| 5 | | | | | | ○ | | | Height rear motor (down) |

Driver lumbar connector B

| ADJ. P/N | Inflate UPR & LWR | Deflate UPR & LWR | Inflate-UPR Deflate-LWR | Inflate UPR & LWR | Pin name |
|---|---|---|---|---|---|
| 1 | ○ ○ | ○ ○ | ○ ○ | ○ ○ | DC 12V |
| 2 | ○ | | ○ | | Inflate UPR-Bladder |
| 3 | | ○ | | ○ | Deflate UPR-Bladder |
| 4 | ○ | | | ○ | Inflate LWR-Bladder |
| 5 | | ○ | ○ | | Deflate LWR-Bladder |
| 6 | | | | | Pump Signal (DC 12V) |

SBHBE9062L

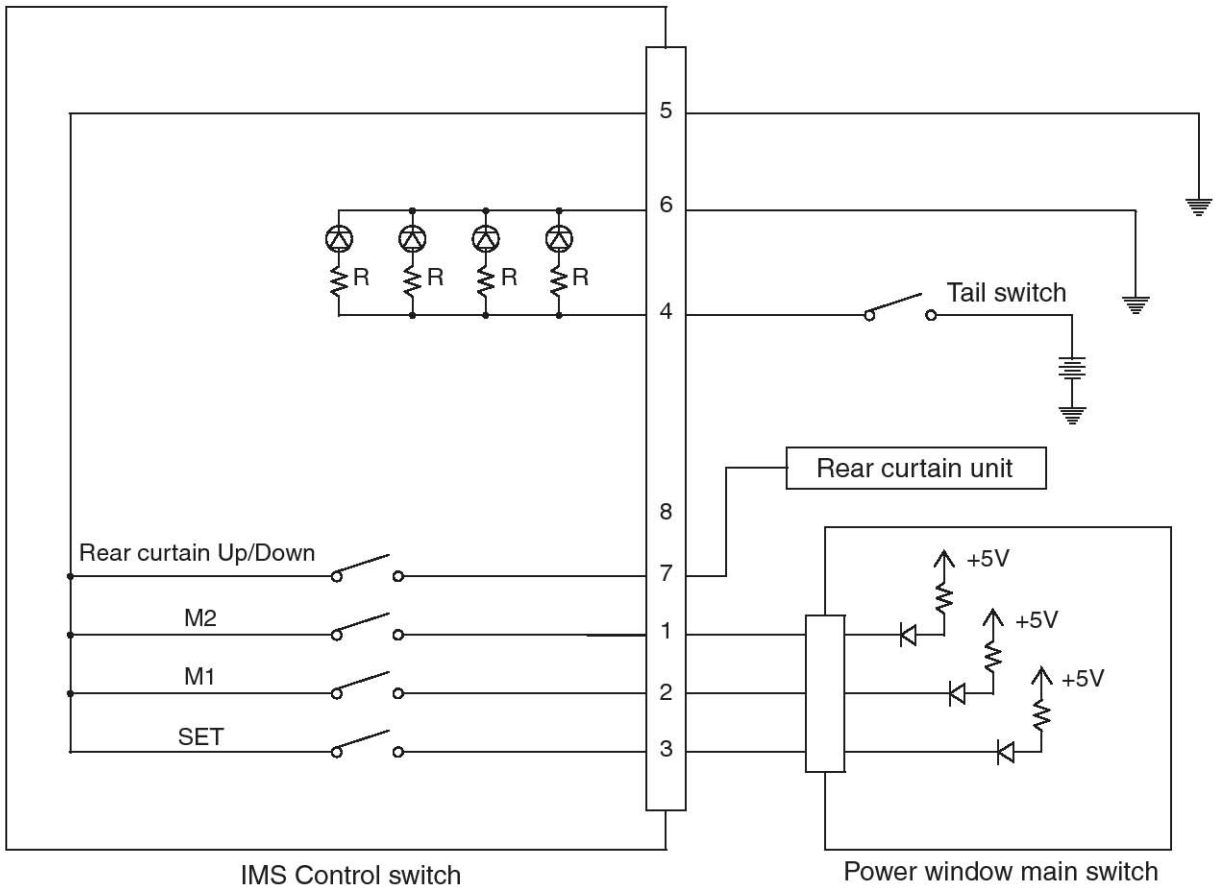
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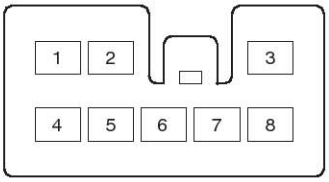


## IMS Control Switch

### Circuit Diagram




| No. | Specification |
|---|---|
| 1 | M2 switch |
| 2 | M1 switch |
| 3 | SET switch |
| 4 | ILL (LED) B+ |
| 5 | GND |
| 6 | LED GND |
| 7 | Rear curtain Up/Down |




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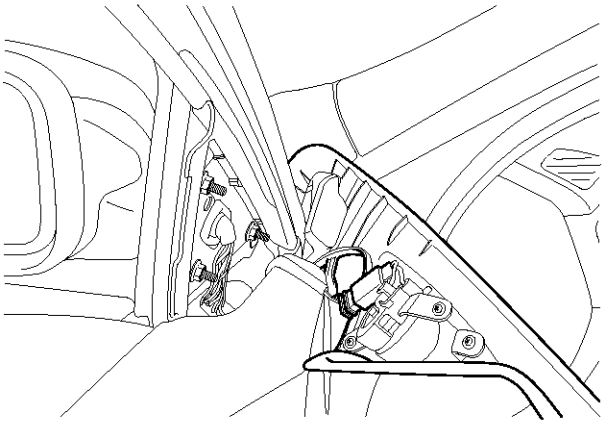
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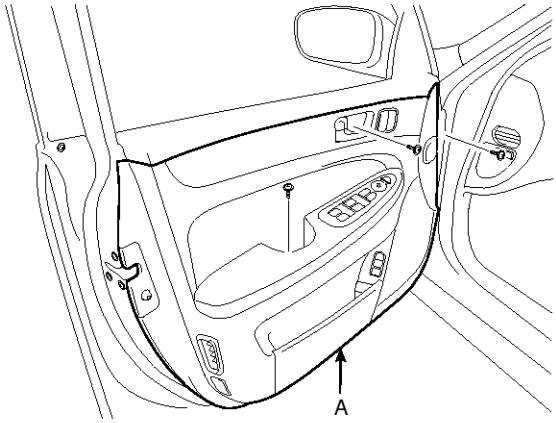


## Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel (A).
   (Refer to the Body group-front door)

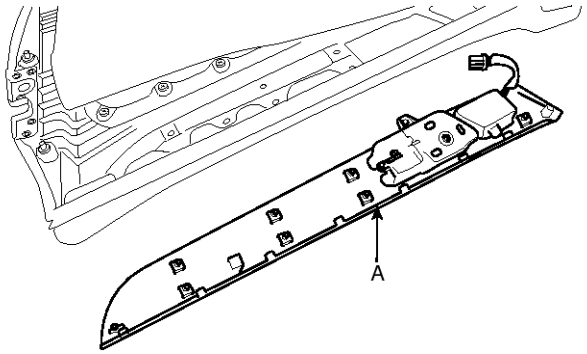


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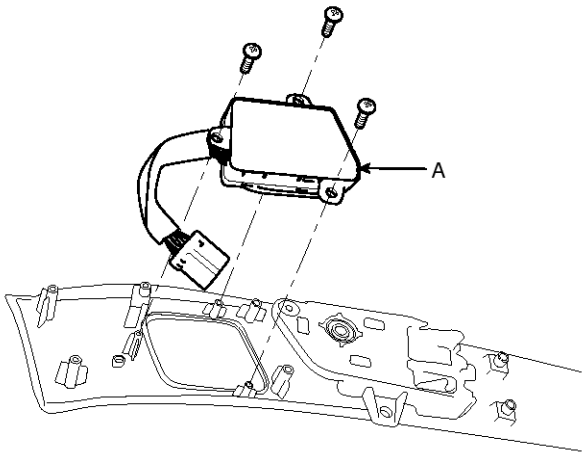

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3. Remove the door trim garnish (A) after removing the screws inside the door trim.




SBHBE8130D

4. After removing the mounting screws(3EA) and switch connector, then remove the IMS control switch.




SBHBE8131D

## Installation

1. Connect the connectors and reassemble the IMS co-ntrol switch.
2. Install the door trim garnish and door trim.
3. Connect the negative (-) battery terminal.

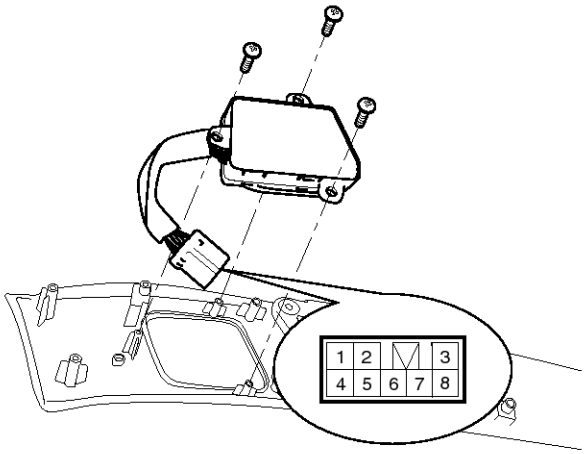
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## Inspection

1. Remove the IMS control switch.




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

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

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## IMS Tilt & Telescope Control

### Description

Driver may choose and store the best steering column position at the tilt & telescope unit using the memory switch and the position sensor, in order to restore the steering column position at once.

There are CAN communication for data transmission and reception between the memory power seat unit and the driver side door module. The operation is inhibited for safety during driving.

### Feature

1. Manual operation of the tilt & telescope by the manual switch. (Manual operation)
2. Memory and regeneration operation of the tilt & telescope by memory switch. (Memory and replay operation): for 2 persons.
3. Auto memory upon the keyless LOCK and regeneration upon the UNLOCK. (Keyless memory and regeneration operation): for 2 persons.

### Operation

#### Manual Operation

1. Motor operation by the manual switch (Tilt & telescope steering column tilt up & down, telescope forward & backward)
2. Manual switch operation auto stop by limit switch OFF.

#### Memory Registration

1. Data related to the registration are received through the CAN communication from DDM.
2. If any of the following conditions is met, memory permit status is released.

   When the ignition is OFF.

   When the manual switch is ON.
3. If 2 position switches are pressed ON simultaneously (within time interval of 50 ms) in memory registration, none of the switches are valid, and the first pressed switch is valid if the time interval is greater than 50 ms.
4. If the vehicle speed is over the limit speed of 3km/h or shift lever is at the position other than P, registration cannot be performed.
5. Registration can be revised without any limitation.
6. Memory will be cleared if the battery is removed.
7. If the memory registration is permitted (memory switch is ON), it sounds the buzzer.

#### Memory Replay Operation

1. Data related to the memory replay are received through the CAN communication from DDM.
2. Memory replay will not be performed unless it is registered.
3. If the position switch is pressed while the memory replay is in operation, the final switch is effective. Though, if the switches are pressed within the time interval of 50 ms, replay will not be performed.
4. When the replay is in operation (position switch is ON ), buzzer will sounds once.
5. If any of the following conditions is met, replay is prohibited and operation will stop if it is in replay.

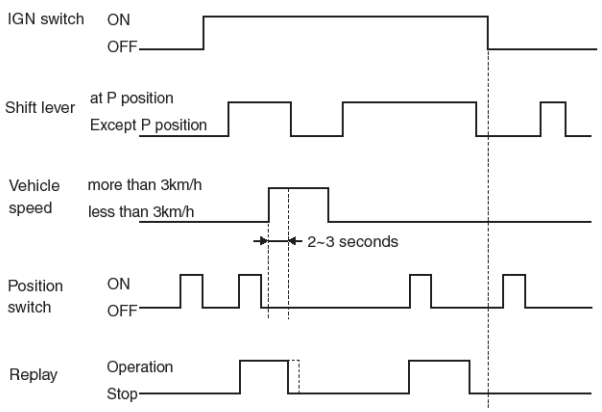
   When the ignition is OFF.

   When the "P" position switch is OFF (when the shift lever is at the position other than "P")

   When the vehicle speed is over 3 km/h (when it last more than 2 or 3 seconds)

   When the manual switch in relation to the tilt & telescope is in operation. (Tilt & telescope related replay operation stops)

   When the stop switch is ON.




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6. Determining operational priority

   In order to prevent overlapping of rushing current when the motor starts up, motor start-up is delayed for 100 ± 10 ms respectively and its operational priority is as follows.

   Tilt > Telescope

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### Registration And Relay By The Keyless

1. Keyless registration operation
   1) Ignition ON and OFF positions are registered corresponding to the keyless codes.
   2) Keyless codes are determined by the keyless door lock operation.
2. Keyless replay operation
   1) Upon door unlock operation when the ignition is OFF, it automatically set the registered positions corresponding to the keyless code.
   2) If any of the following conditions is met, keyless replay operation is prohibited and operation stops if it is in operation.
      - When the P position switch is OFF.
      - When the switch is in manual operation.
      - When the stop switch is ON.

### Buzzer Output

1. In case of memory permit status (memory switch is ON) : once
2. When memory registration is complete (position switch is ON) : twice
3. When the memory replay is in operation (position switch is ON) : once
4. When error is detected due to the sensor failure : 10 times

### Error Detection

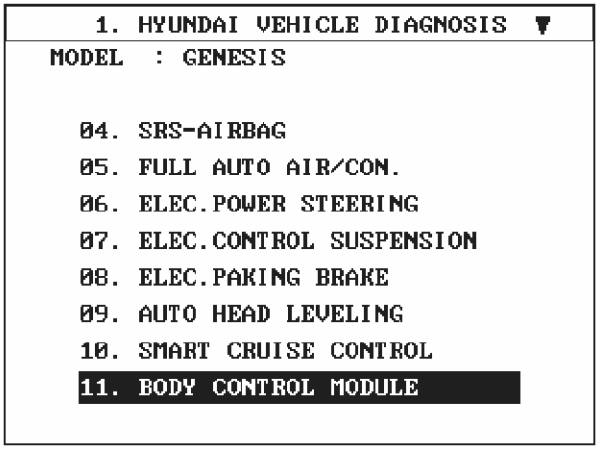
1. If the sensor fluctuations of tilt & telescope for one second after motor start-up are less than 4 pulses respectively (Limit switch ON/CLOSE), the harness is short or sensor is fail.
2. Countermeasure when error is detected.

   Stop the operation if it is in auto replay. Though, it should be operable manually. When the failure is completely repaired, it can be automatically adjusted from the stop of auto replay. If the position sensor senses the pulse from the position sensor by the manual operation (in case of sensor fluctuation for 1 seconds is greater than 4 pulses), we judge it is complete. This is called stop release of automatic operation.

## Inspection

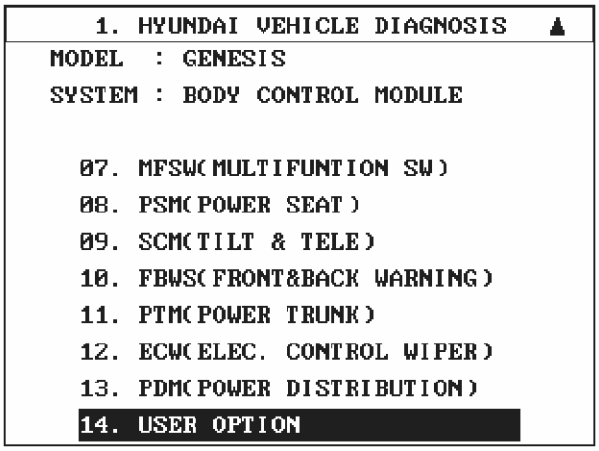
### Ims Mode Setting With Scan Tool

1. You can turn ON/OFF of IMS tilt & telescope control option with the user option program.
2. Select model and "body control module" menu.




SBHBE9065L

3. Select the "user option".



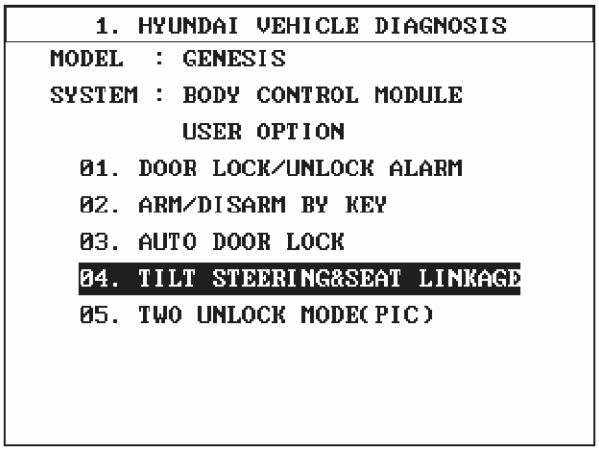

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4. Select the "Tilt steering & seat linkage".




SBHBE9067L

5. Select the On/Off option of IMS tilt & telescope control.
   - Seat installation state ON/OFF
   - Seat riding & getting off gearing ON/OFF
   - Column installation state ON/OFF
   - Column riding & getting off gearing ON/OFF

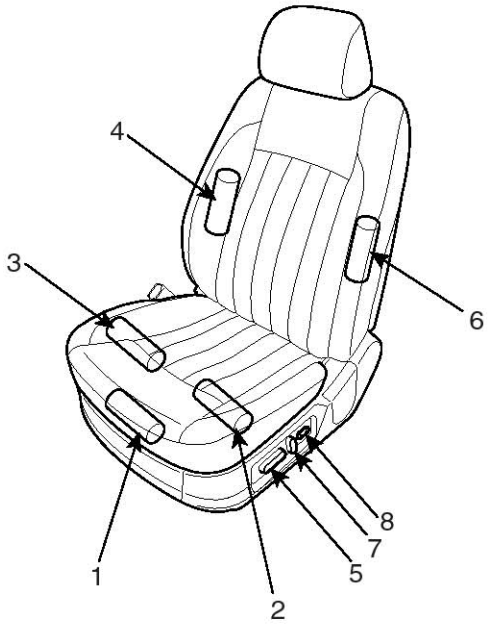
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# Seat Electrical

## Component Location




SBHB18001D

1. Slide motor
2. Height motor (front)
3. Height motor (rear)
4. Recline motor
5. Power seat switch
6. Lumbar support motor
7. Recline switch
8. Lumbar support switch

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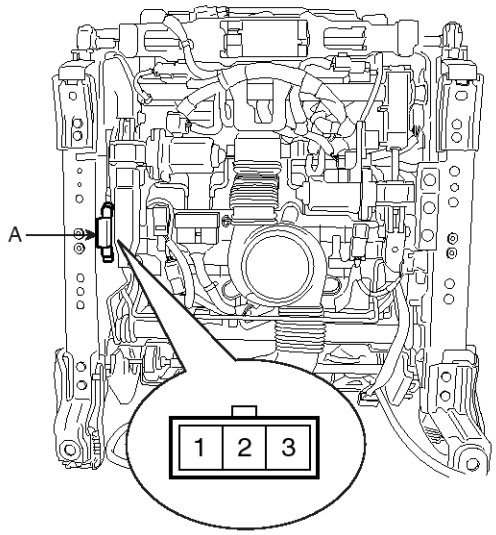


## Power Seat Motor

### 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.



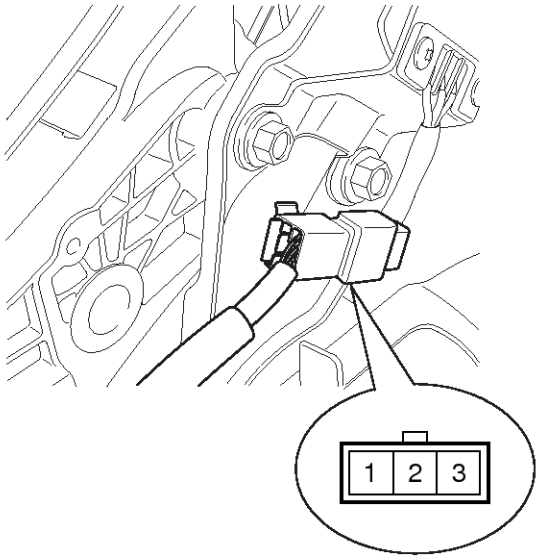

SBHB18002D

| Position / Terminal NO. | Front motor | Neutrality | Rear motor |
|---|---|---|---|
| 3 | ○ | ○ | |
| 1 | ○ | ○ | ○ |
| 2 | | ○ | ○ |

SBHBE9105L

#### 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.




SBHB18004D

| Position / Terminal NO. | Front motor | Neutrality | Rear motor |
|---|---|---|---|
| 3 | ○ | ○ | |
| 1 | ○ | ○ | ○ |
| 2 | | ○ | ○ |

SBHBE9105L

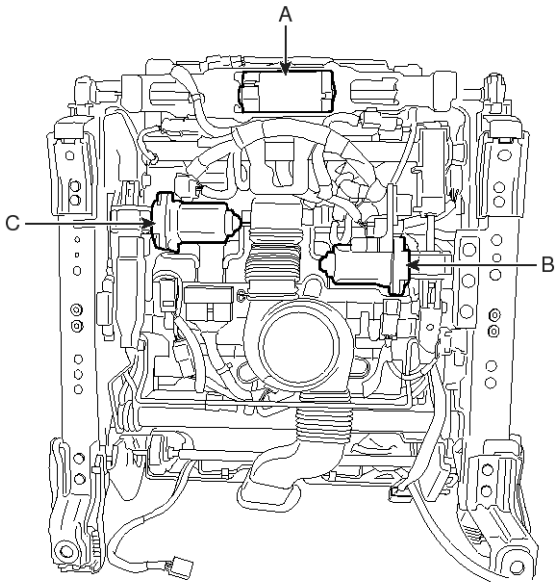
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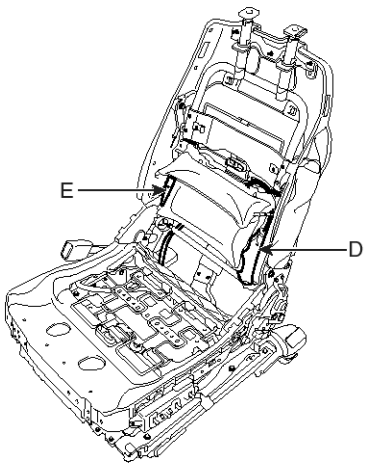


### Power Seat Motor

1. Disconnect the connectors for each motor.

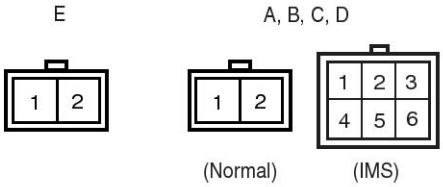



SBHB18005D




SBHB18006D

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.




SBHBE9106L

( ) : IMS

| Terminal NO. \ Position | | 1(2) | 2(5) |
|---|---|---|---|
| Slide motor A | Front ward | ⊕ | ⊖ |
| | Back ward | ⊖ | ⊕ |
| Front height motor B | Up | ⊖ | ⊕ |
| | Down | ⊕ | ⊖ |
| Rear height motor C | Up | ⊕ | ⊖ |
| | Down | ⊖ | ⊕ |
| Lumbar support motor D | Front ward | ⊖ | ⊕ |
| | Back ward | ⊕ | ⊖ |
| Recline motor E | Front ward | ⊕ | ⊖ |
| | Back ward | ⊖ | ⊕ |

SBHBE9107L

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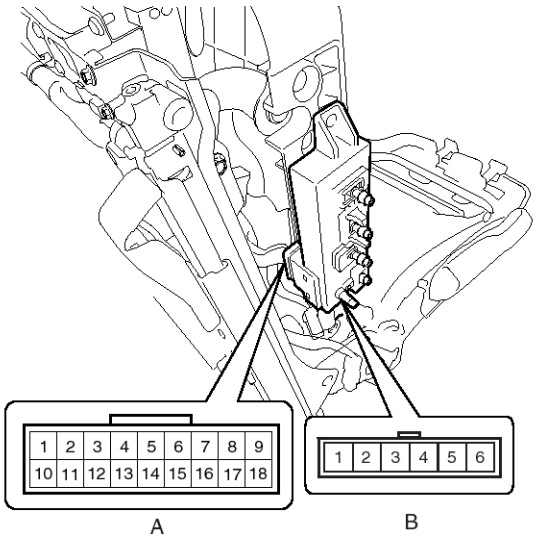
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## Power Seat Control Switch

### Inspection

With the power seat switch in each position, make sure t-hat continuity exists between the terminals below. If cont-inuity is not as specified, replace the power seat switch.




SBHB18009D

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Power seat connector switch A

| P/N | Height front | | Slide | | Height rear | | Recline | | Pin name |
|---|---|---|---|---|---|---|---|---|---|
| | UP | DOWN | FOR | BACK | UP | DOWN | FOR | BACK | |
| 2 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ⊕ |
| 9 | | | ○ | | | | | | Slide motor (forward) |
| 8 | | | | ○ | | | | | Slide motor (back) |
| 11 | | | | | | | ○ | | Recline motor (forward) |
| 1 | | | | | | | | ○ | Recline motor (back) |
| 17 | ○ | | | | | | | | Height front motor (up) |
| 15 | | ○ | | | | | | | Height front motor (down) |
| 6 | | | | | ○ | | | | Height rear motor (up) |
| 5 | | | | | | ○ | | | Height rear motor (down) |

Driver lumbar connector B

| ADJ. P/N | Inflate UPR & LWR | | Deflate UPR & LWR | | Inflate-UPR Deflate-LWR | | Inflate UPR & LWR | | Pin name |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | DC 12V |
| 2 | | ○ | | | ○ | | | | Inflate UPR-Bladder |
| 3 | | | ○ | | | | | ○ | Deflate UPR-Bladder |
| 4 | ○ | | | | | | ○ | | Inflate LWR-Bladder |
| 5 | | | | ○ | | ○ | | | Deflate LWR-Bladder |
| 6 | | | | | | | | | Pump Signal (DC 12V) |

SBHBE9062L

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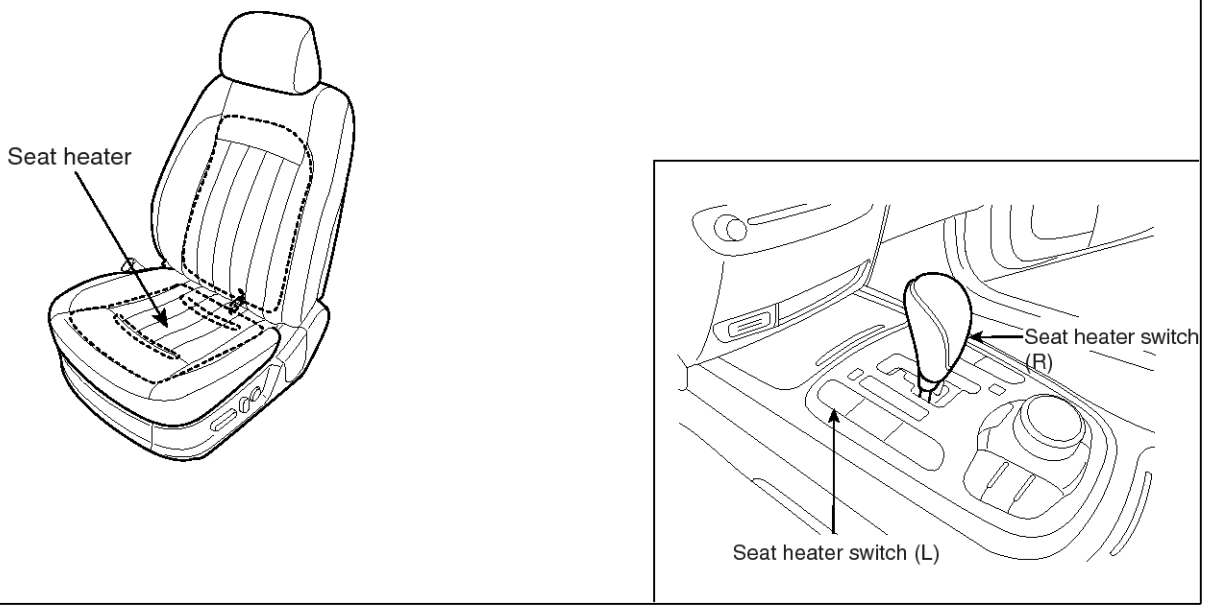
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## Seat Heater

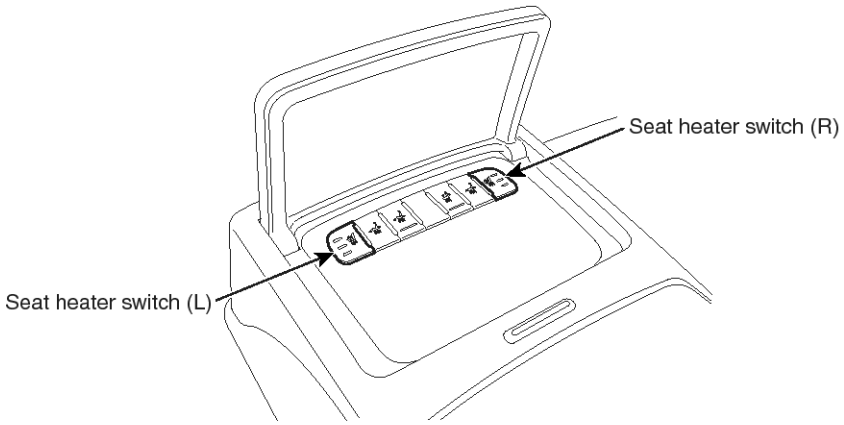
### Components

[Driver/Assist]




SBHBE9108L

[Rear seat]




SBHBE9109L

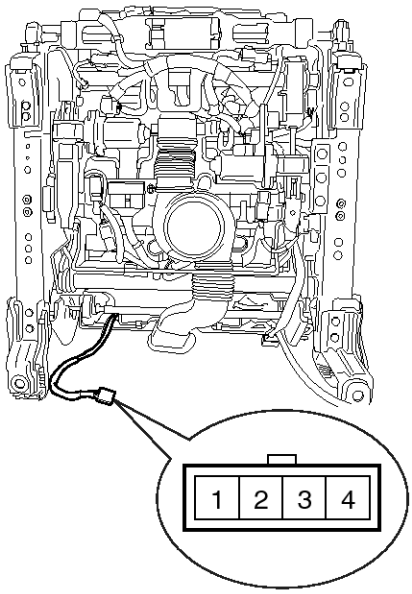
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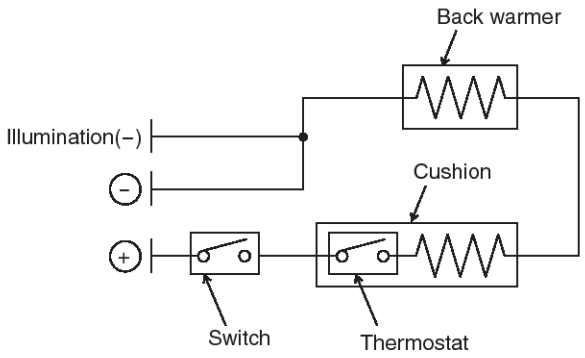
## Inspection

1. Check for continuity and measure the resistance between No.1 and NO.2 terminals.




SBHB18012D

**Standard value :**
Driver/Assist (Cushion+Back) : 1.48Ω ± 10%
Rear seat (Cushion+Back) : 1.85Ω ± 10%




ETRF441C

2. Operate the seat warmer after connecting the 3P connector, and then check the thermostat by measuring the temperature of seat surface.
3. Check for continuity between the terminals after disconnecting the 3P connector.

**Standard value :**
Position 1: Cushion=36±2°C, Back=40±2°C
Position 2: Cushion=40±2°C, Back=46±2°C
Position 3: Cushion=42±2°C, Back=52±2°C

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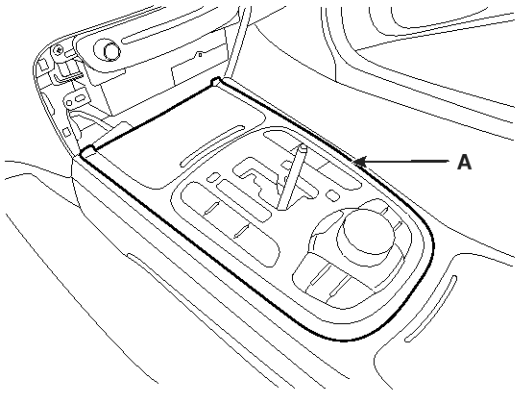


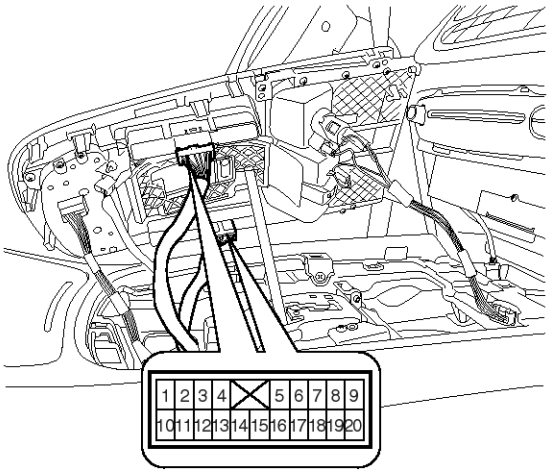
## Seat Heater Switch

### Inspection

#### Driver

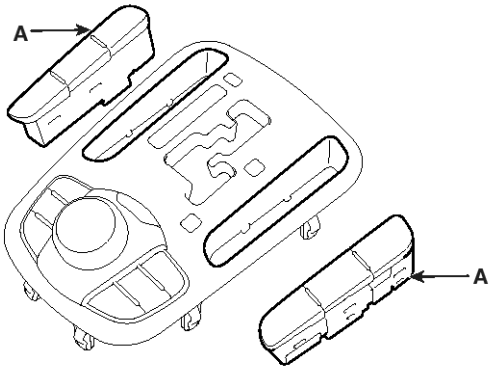
1. Disconnect the negative (-) battery terminal.
2. Remove the console upper cover (A) on the floor console and connectors after loosening the mounting clips. (Refer to the Body group - "Crash pad")




SBHB18023D

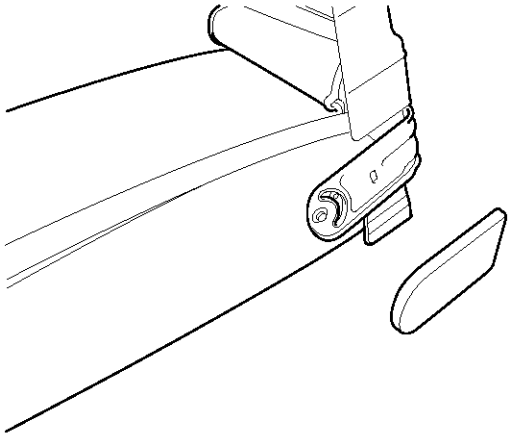
3. If the switch assembly is abnormal, replace the seat heater switch module (A).




SBHBE8088D

#### Rear seat

1. Disconnect the negative (-) battery terminal.
2. Remove the arm rest and connector from the rear seat.

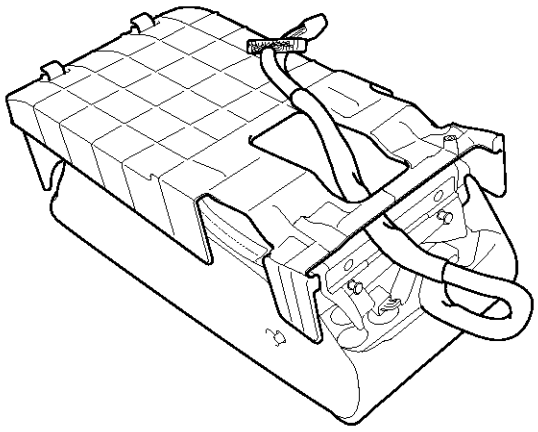


SBHBE8397D

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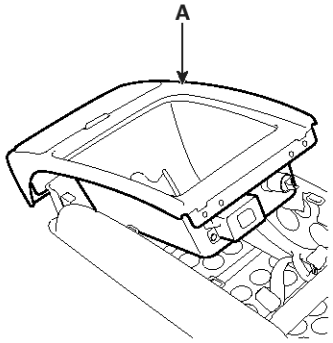
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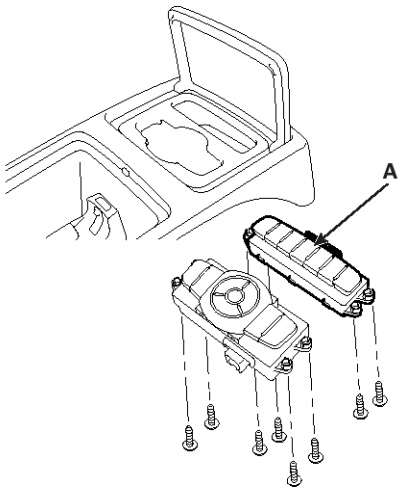
SBHB18024D

3. Remove the arm rest cover (A) after removing the screws.




SBHB18013D

4. Remove the seat heater switch (A) from arm rest cover.




SBHB18014D

5. If the switch assembly is abnormal, replace the seat heater switch module.

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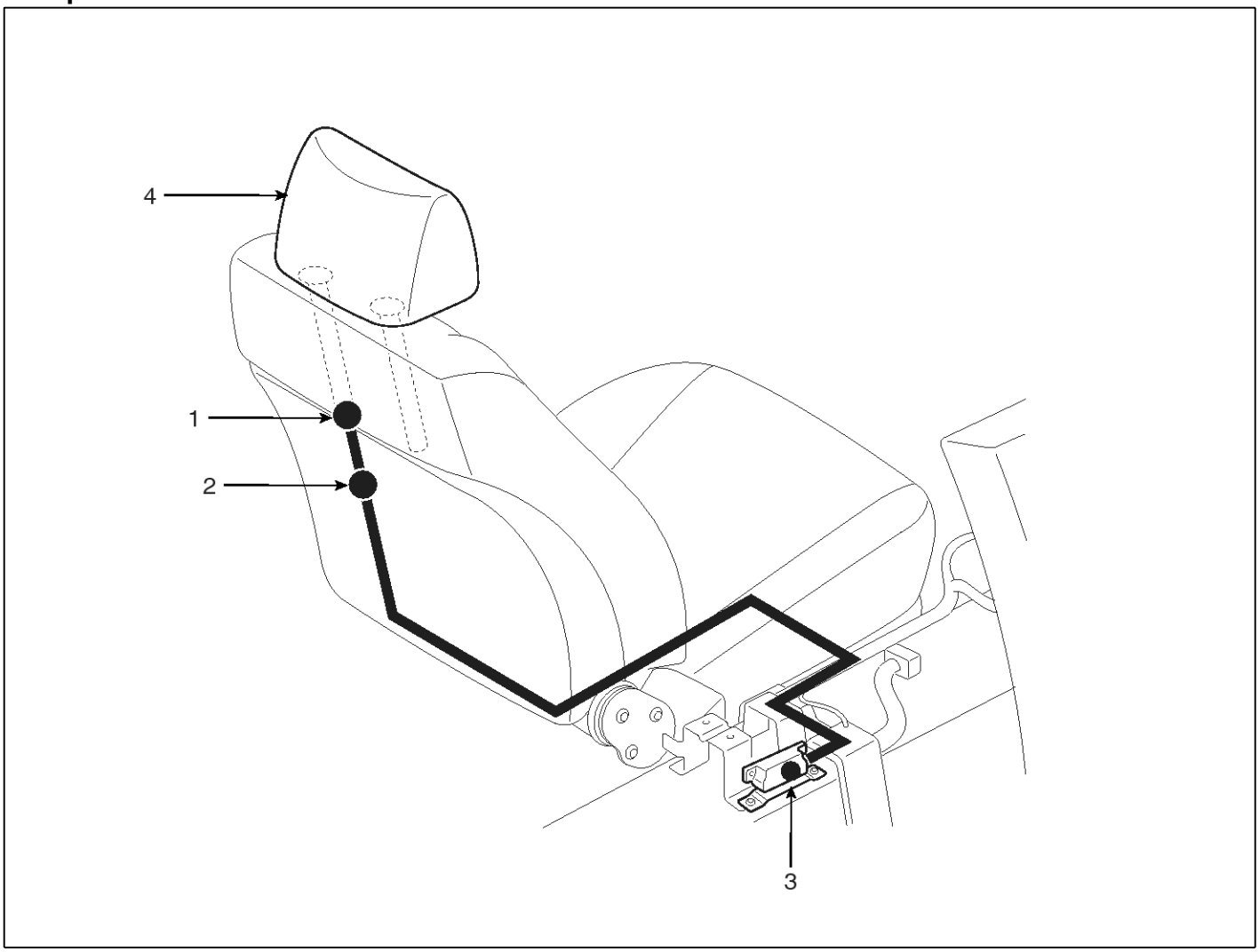
## Electronic Active Headrest

### Description

The electronic active headrest is designed to trigger the headrest forward and upward when impact sensor detects a rear (or front) impact.

This helps to prevent the driver's and front passenger's heads from moving backward and thus helps minimize neck injuries.

### Component location




SBHBE8309D

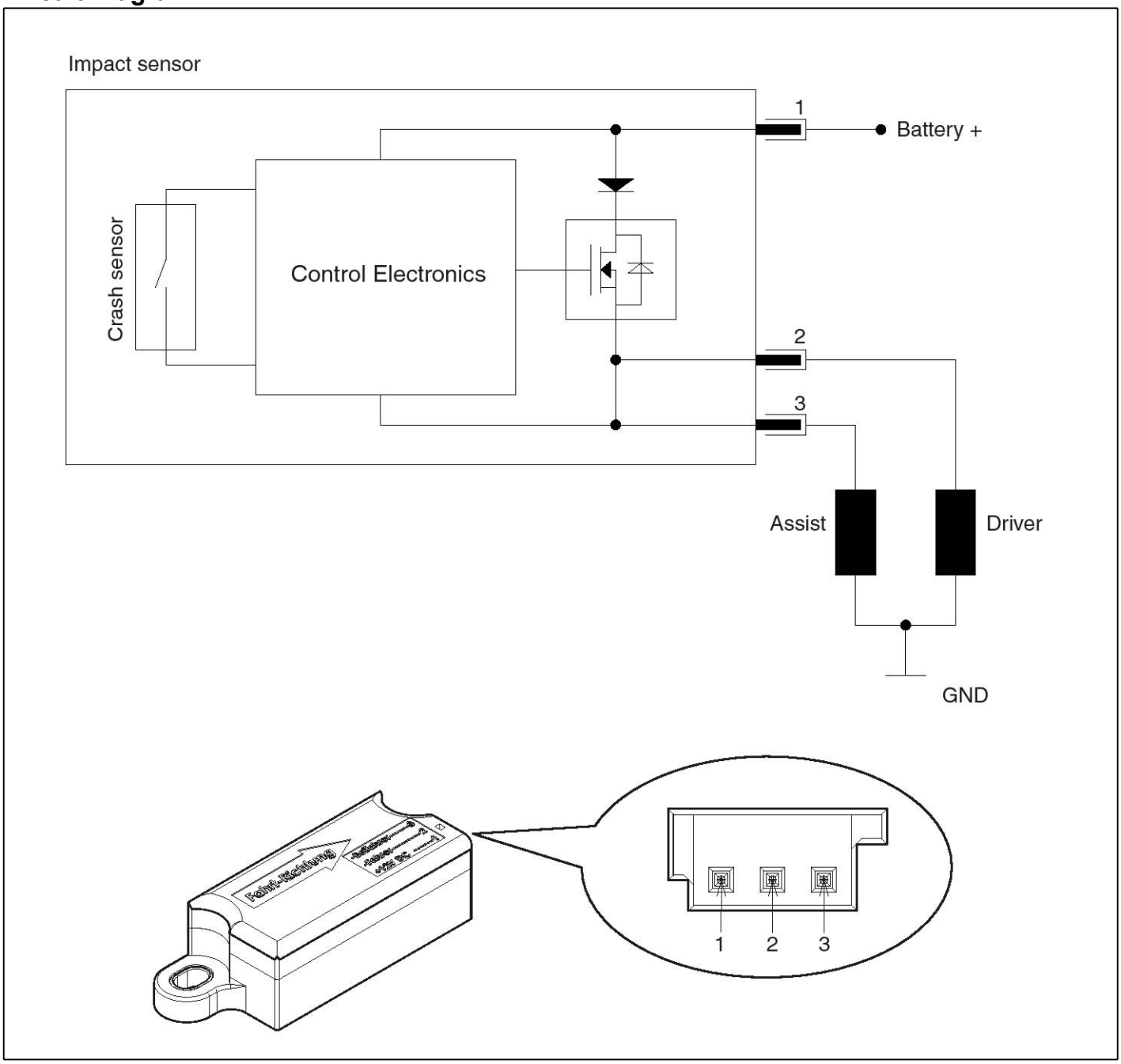
1. Active headrest connector
2. Elevator system connector
3. Impact sensor
4. Electronic active headrest

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## Circuit Diagram




SBHBE9006N

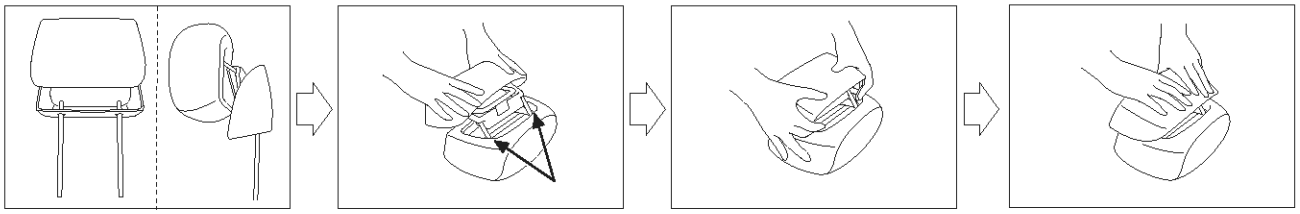
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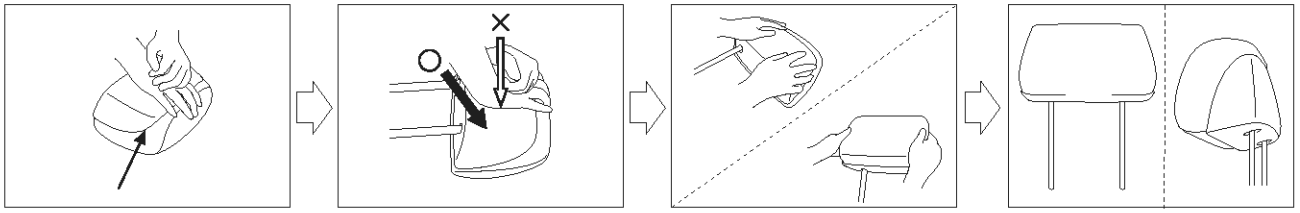


## Inspection

1. How to reassemble the Headrest which was released by rear (or front) Impact.



1. Remove the Headreat. (Active Headrest was released)
2. Turn over the headrest.
3. Push the crash handle to inside of the headrest with the finger.
4. Push the rear cover with pushing crash handle.



5. Push the headrest as like the picture.
6. Force the strong power direction of the arrow.
7. Assemble the rear cover and eliminate the wrinkle of the trim.
8. Assemble headrest into a seat.

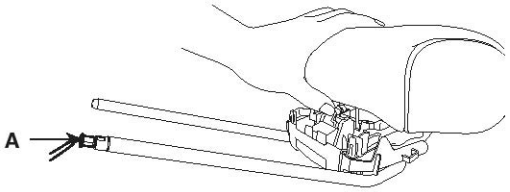
SBHBE9005N

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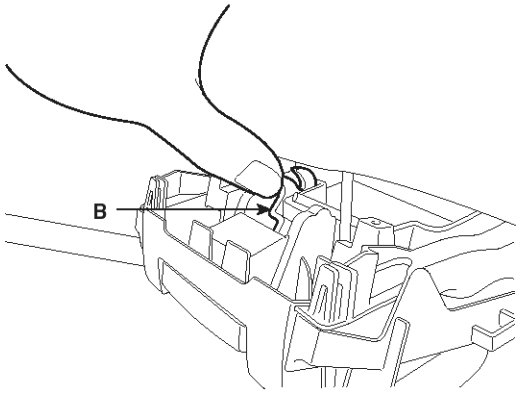
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2. How to unlock the trigger in case of trigger is locked.
   1) Normally, the trigger position is unlocking.
   2) If the position of Trigger is changed by outside impact or by hand, the trigger can't return to the unlocking position.
   3) For the change of the trigger position (locking → unlocking), Input the 12V. at connector (A) and push the trigger.

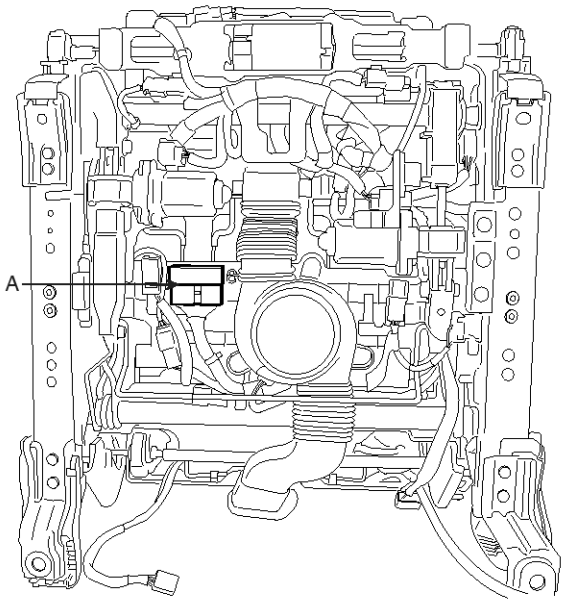



SBHB18075D




SBHB18076D

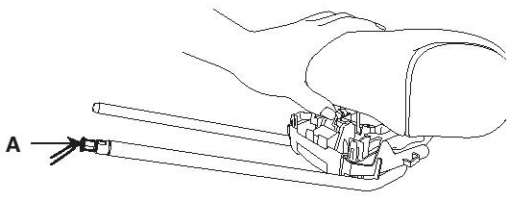
3. How to check whether installation is completed between the headrest and wiring connector.
   1) Check for continuity and measure the resistance between No.17 and NO.20 terminals.




SBHB18077D

**Standard value :** 2.1Ω ~ 2.7Ω

   2) If measured resistance between No.17 and NO.20 terminals is in standard value, please check the below items.
      - Measure the resistance of connector (A).




SBHB18075D

**Standard value :** 2.0Ω ~ 2.4Ω

      - Check for continuity between the wiring and elevator system connector after removing the back panel of seat.

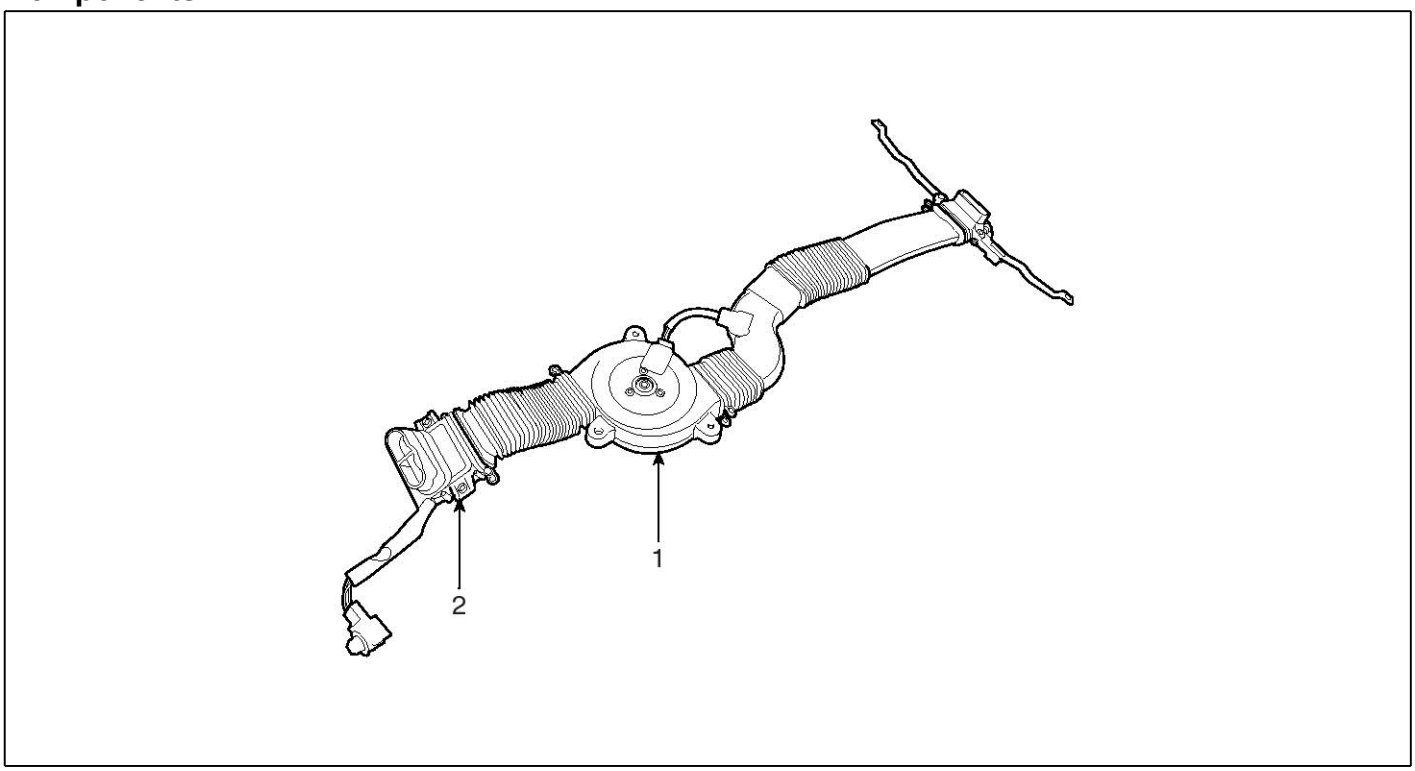
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## Climate Seat Unit

### Components




SBHB18078D

1. Climate control blower
2. Climate control TED

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## Description

Comparing with the seat heat function by the existing thermic rays, Climate Control Seat functions the heating,cooling, dehumidifying by using TED.

It inhales the indoor air through the blower installed at the seat cushion lower part, and supplies the air into the seat cushion and the seat back through the duct.

It heats or cools the air supplied from TED set up at the tip of the duct.

It sends a slight heated or cooled air throughout the seat surface through the air channel set up at seat cushion and seat back.

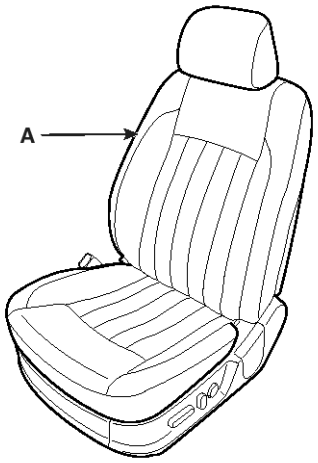
**NOTICE**

1. *TED is the exchange system with heat and electricity . It can be used anywhere in case of accomplishing heating and cooling at once, if necessary generation by using heating sources.*
2. *It is the next generation cooling system which can substitudes for the compressure cooling system.*

It can simply generate heating and cooling at once through the electric poles conversion, and also keep a steady temperature through cooling and heating an object between -30˚C and +150˚C.

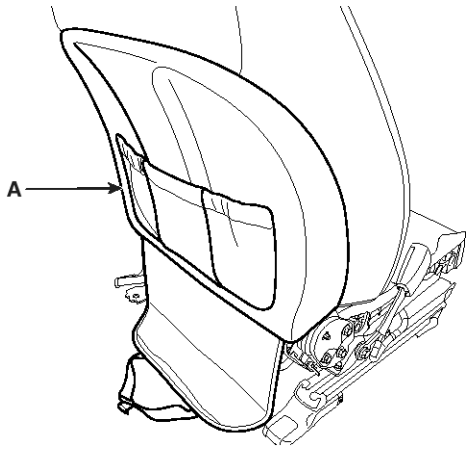
## Removal

1. Remove the front seat assembly (A) if the vehicle equipped with front climate control seat




SBHB18079D

2. Remove the seat back cover(A).



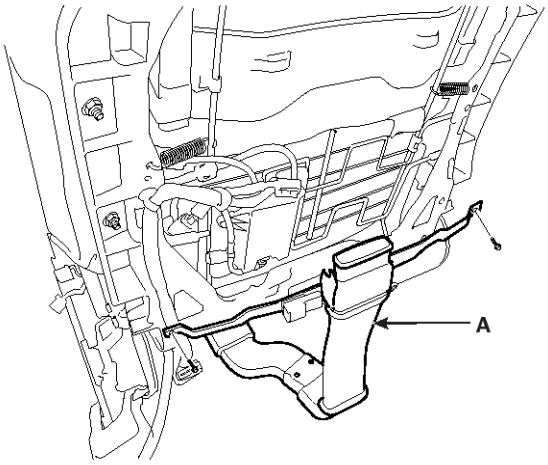

SBHB18080D

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3. Remove the front climate control seat assembly(A) after removing the connectors and screws.



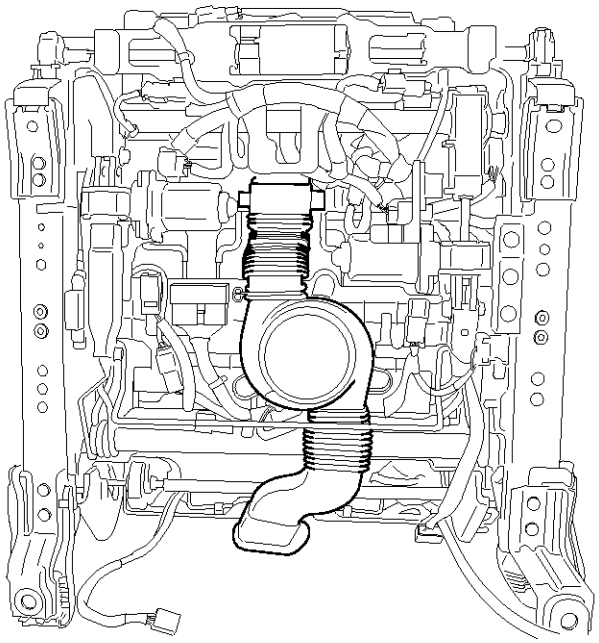

SBHB18081D

## Installation

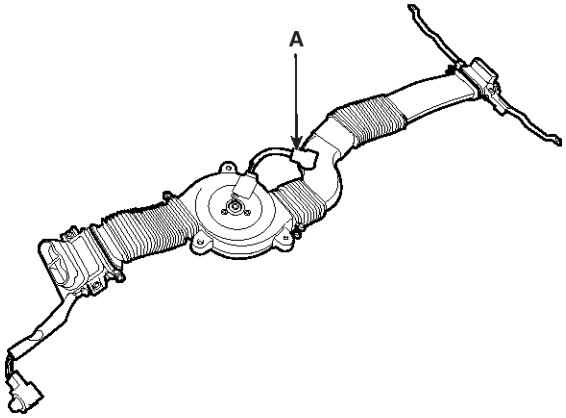
1. Install the connectors and climate control seat assembly.
2. Install the seat back cover.
3. Install the seat assembly and seat track cover.

## Inspection

1. If the fan is abnormal after checking the connector (A ), replace the climate control blower.



SBHB18082D




SBHB18083D

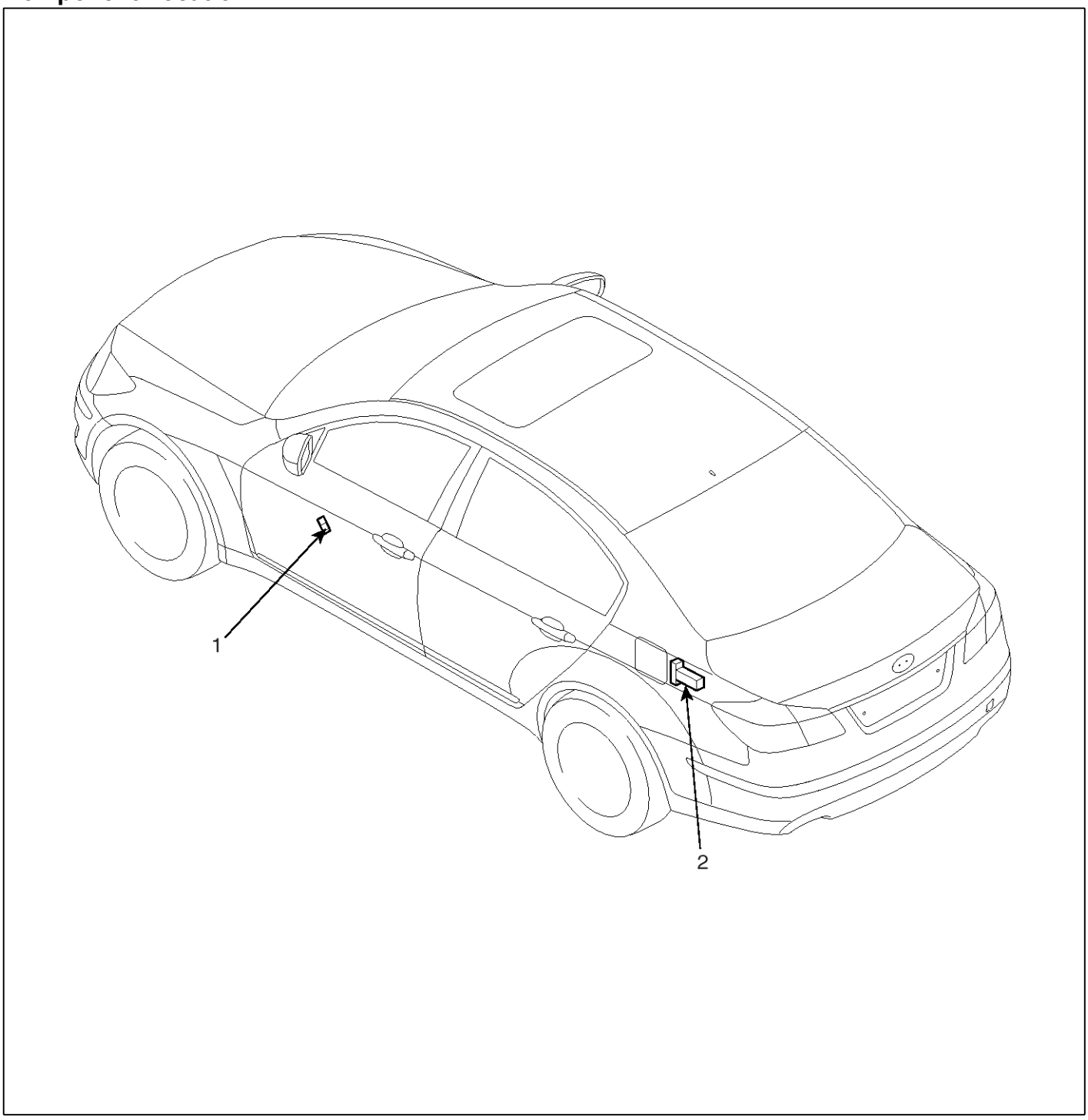
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# Fuel Filler Door

## Component Location




SBHBE8294D

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

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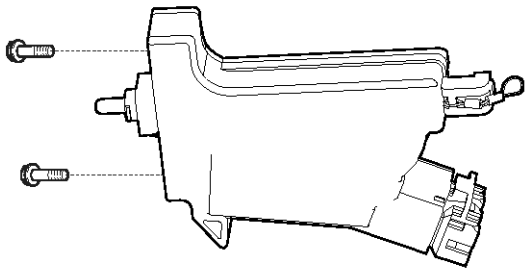


## Fuel Filler Door Release Actuator

### Inspection

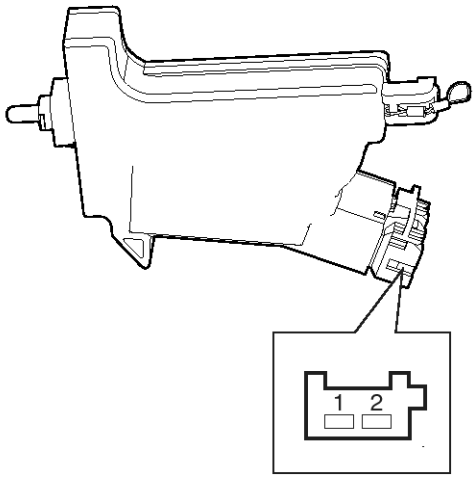
1. Remove the trunk room left trim.
2. Open the fuel filler door and remove the housing.

   **NOTICE**
   *Do not reuse the fuel filler door housing.*
3. Remove the connector and bolts (2EA).



SBHBE8295D

4. Check for continuity between terminal No.1 and No.2. If there is no continuity replace the fuel filler door opener.




SBHBE8296D

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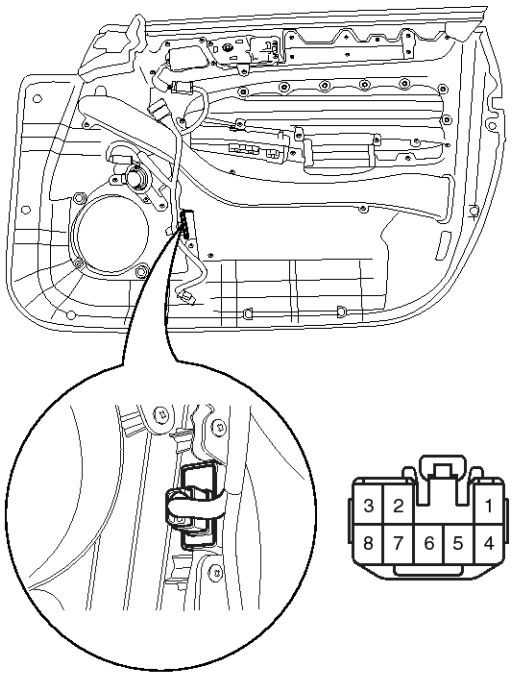
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## Fuel Filler Door Open Switch

### Inspection

1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Check the switch for continuity between the No. 1 and No. 8 terminals.
3. If the continuity is not as specified, replace the switch .




SBHBE8297D

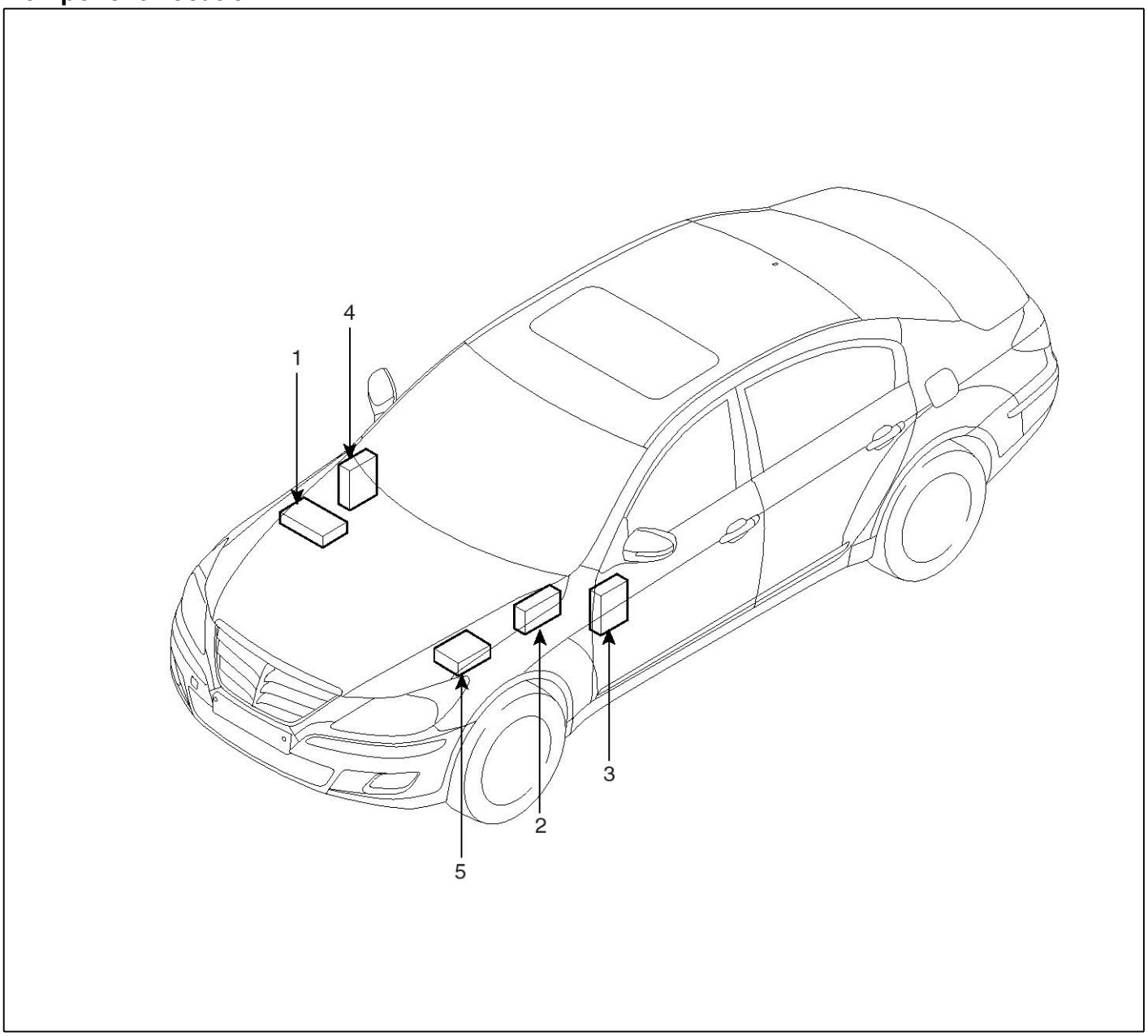
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# Fuses And Relays

## Component Location




SBHB18025D

1. Engine room junction box & FAM (Front Area Module)
2. IPM (Instrument Panel Module)
3. Passenger compartment relay box LH
4. Passenger compartment relay box RH
5. Fuse & relay box

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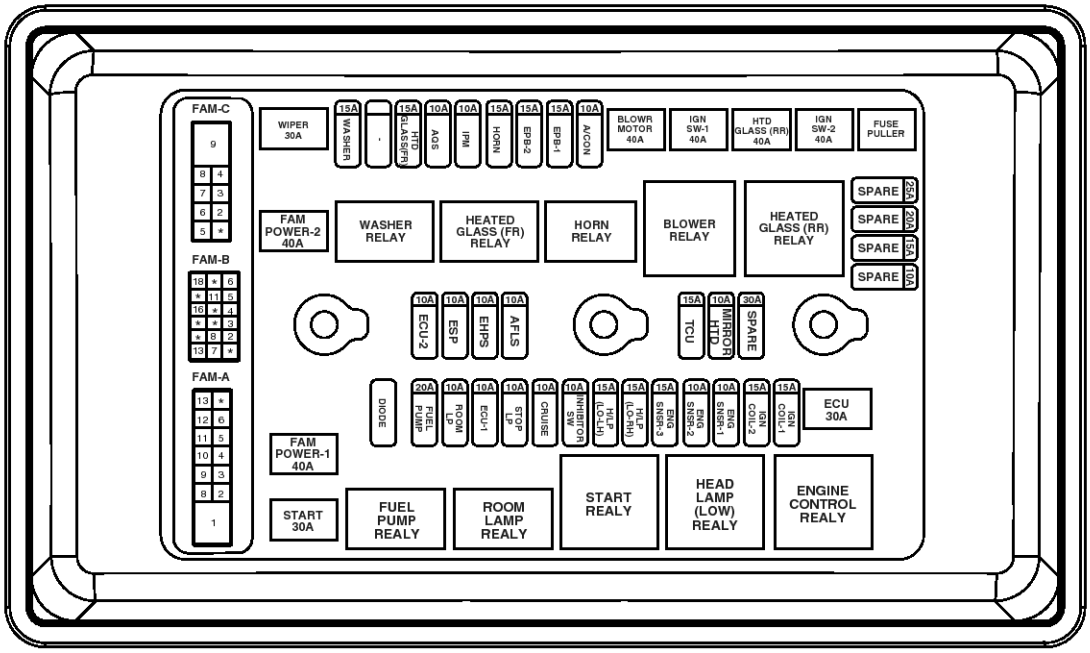


## Relay Box (Engine Compartment)

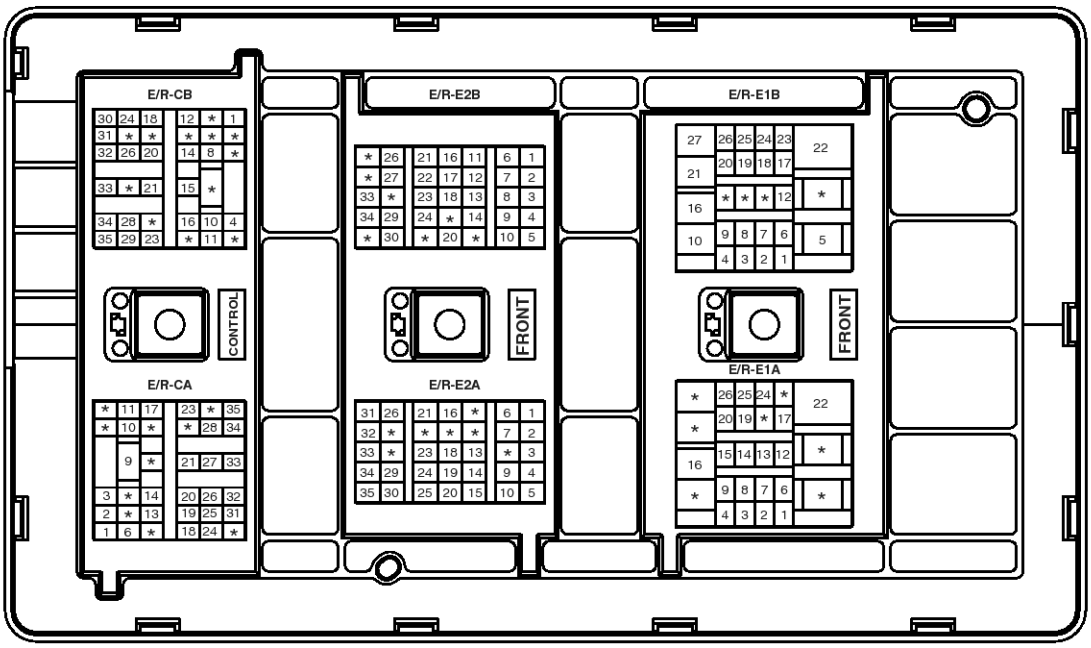
### Components

#### Engine Room Junction Box & FAM

< FRONT >




<REAR >




※ USE THE DESIGNATED FUSE AND RELAY ONLY

SBHBE9068L

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## CIRCUIT

| Description | | (A) | Circuit Protected |
|---|---|---|---|
| FUSIBLE LINK | WIPER | 30A | Electronic Control Wiper Module |
| | FAM POWER-1 | 40A | FAM |
| | FAM POWER-2 | 40A | FAM |
| | START | 30A | Start Relay |
| | ECU | 30A | Engine Control Relay |
| | BLOWER MOTOR | 40A | Blower Relay |
| | IGN SW-1 | 40A | Ignition Switch (IG 2, START) |
| | HTD GLASS (RR) | 40A | Heated Glass (RR) Relay |
| | IGN SW-2 | 40A | Ignition Switch (IG 1, ACC) |
| FUSE | A/CON | 10A | A/C Control Module |
| | EPB-1 | 15A | Electronic Parking Brake Module |
| | EPB-2 | 15A | Electronic Parking Brake Module |
| | HORN | 15A | Horn Relay |
| | IPM | 10A | IPM |
| | AQS | 10A | AQS Sensor, Electronic Control Wiper Module, Blower Relay, Head Lamp (Low) Relay |
| | HTD GLASS (FR) | 15A | Heated Glass (FR) Relay |
| | WASHER | 15A | Washer Relay |
| | MIRROR HTD | 10A | A/C Control Module, Power Outside Mirror & Mirror Folding Motor LH/RH |
| | TCU | 15A | TCM |
| | AFLS | 10A | Head Lamp LH/RH |
| | EHPS | 10A | EHPS Module |
| | ESP | 10A | ESP Control Module, Multipurpose Check Connector |
| | ECU-2 | 10A | ECM |
| | IGN COIL-1 | 15A | Ignition Coil #2,4,6 |
| | IGN COIL-2 | 15A | Ignition Coil #1,3,5, Condenser |
| | ENG SNSR-1 | 10A | ECM, Mass Air Flow Sensor, Oxygen Sensor #1,2,3,4 |
| | ENG SNSR-2 | 10A | Canister Purge Control Solenoid Valve, Variable Intake Manifold Valve, Oil Control Valve, ECM, Cooling Fan Relay, Immobilizer Module |
| | ENG SNSR-3 | 15A | ECM, Injector #1~#6, Fuel Pump Relay |
| | H/LP (LO-RH) | 15A | Head Lamp RH |
| | H/LP (LO-LH) | 15A | Head Lamp LH, ECM |
| | INHIBITOR SW | 10A | Transmission Range Switch |
| | CRUISE | 10A | Smart Cruise Control Module |
| | STOP LAMP | 10A | Stop Lamp Switch, Stop Lamp Relay, Generator |
| | ECU-1 | 10A | ECM, TCM |
| | ROOM LAMP | 10A | Room Lamp Relay |
| | FUEL PUMP | 20A | Fuel Pump Relay |

**USE THE DESIGNATED FUSE AND RELAY ONLY**

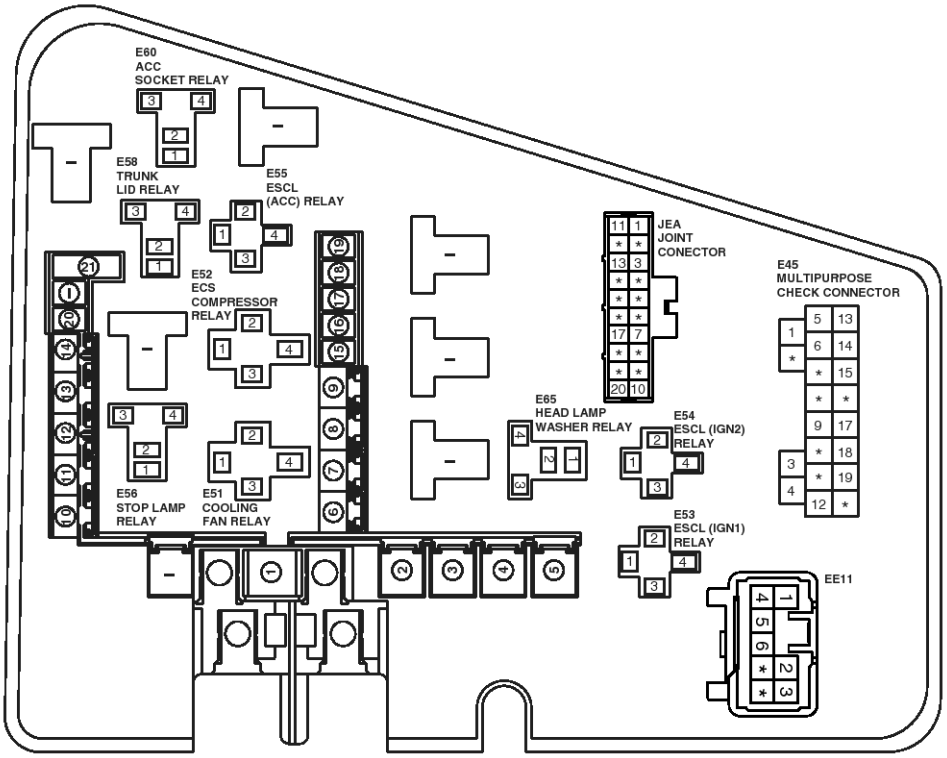
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## Fuse & Relay Box




| FUSE | NO | FUSE | (A) | Circuit Protected |
|---|---|---|---|---|
| FUSIBLE LINK | 1 | ALT | 200A | Generator |
| | 2 | I/P LH PWR | 60A | I/P Junction Box LH |
| | 3 | I/P RH PWR | 60A | I/P Junction Box RH |
| | 4 | COOLING | 60A | Cooling Fan Relay |
| | 5 | EHPS | 80A | EHPS Module |
| | 6 | AIR ECS | 40A | ECS Compressor Relay |
| | 7 | AMP-1 | 40A | AV JBL AMP |
| | 8 | AMP-2 | 30A | AMP |
| | 9 | ESCL(ACC) | 30A | ESCL (ACC) Relay |
| | 10 | ABS-1 | 30A | ESP Control Module, Multipurpose Check Connector |
| | 11 | ABS-2 | 30A | ESP Control Module, Multipurpose Check Connector |
| | 12 | ESCL(IGN1) | 30A | ESCL (ING 1) Relay |
| | 13 | ESCL(IGN2) | 30A | ESCL (ING 2) Relay |
| | 14 | P/SEAT FL | 30A | Driver Power Seat Relay Box, IMS Control Module, Driver Lumbar Support Switch |
| FUSE | 15 | H/LP WASHER | 20A | Head Lamp Washer Relay |
| | 16 | B/UP LP | 10A | - |
| | 17 | ACC SOCKET | 25A | ACC Socket Relay |
| | 18 | T/LID | 10A | Trunk Lid Relay |
| | 19 | DRL | 15A | - |
| | 20 | STOP LP | 10A | Stop Lamp Relay, Stop Lamp Switch, IPM |
| | 21 | B/UP LP | 10A | Rear Combination Lamp LH/RH (IN), Electro Chromic Mirror, Camera Module, Rear Curtain Module |

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## Inspection

### Power Relay (Type A)

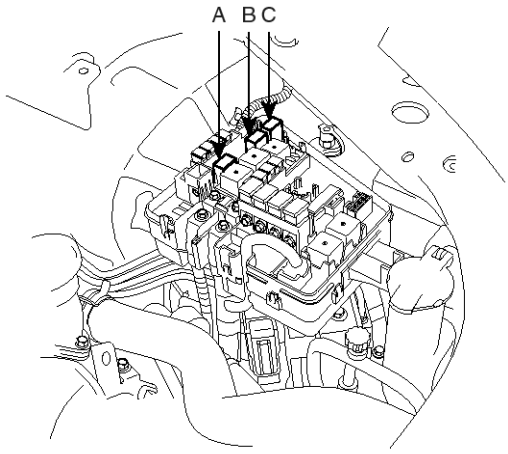
Check for continuity between the terminals.

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

A: Stop lamp relay

B: Trunk lid relay

C: ACC socket relay




SBHB18036D

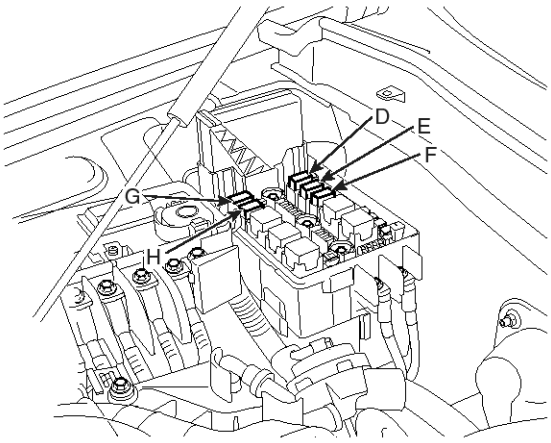
D: Washer relay

E: Heated glass relay (front)

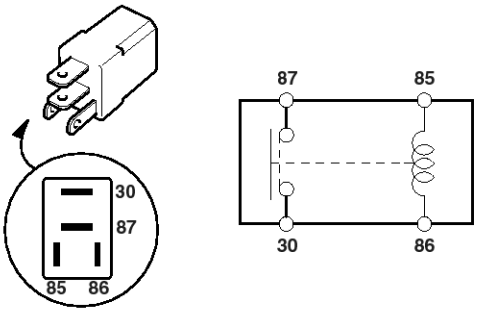
F: Horn relay

G: Fuel pump relay

H: Room lamp relay




SBHB18037D




SBHBE9081L

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

SCMBE6195L

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### Power Relay (Type C)

Check for continuity between the terminals.

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

A: ESCL (ACC) relay

B: ESC compressor relay

C: Cooling fan relay

D: ESCL (IG2) relay

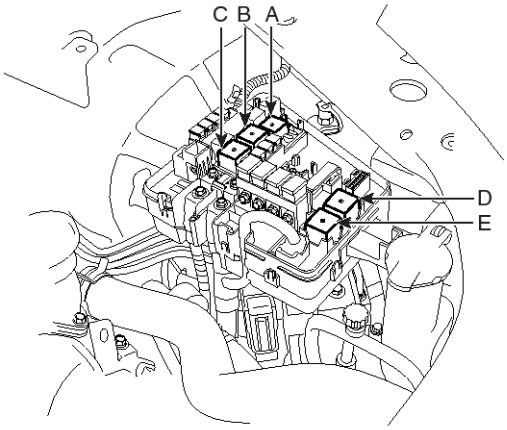
E: ESCL (IG1) relay

F: Blower relay

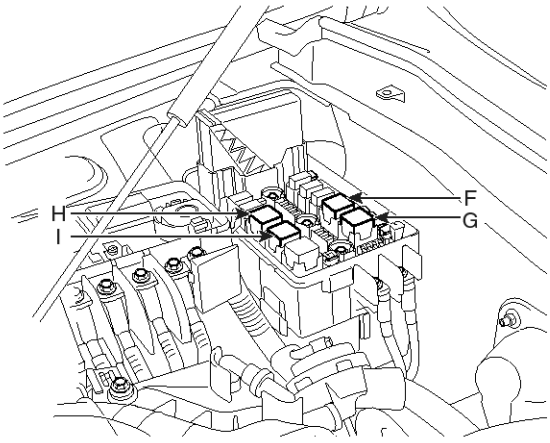
G: Heated glass relay (rear)

H: Start relay

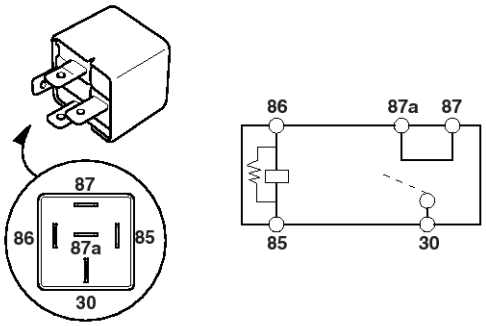
I: Head lamp (low) relay




SBHB18038D




SBHB18039D




SBHBE9083L

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

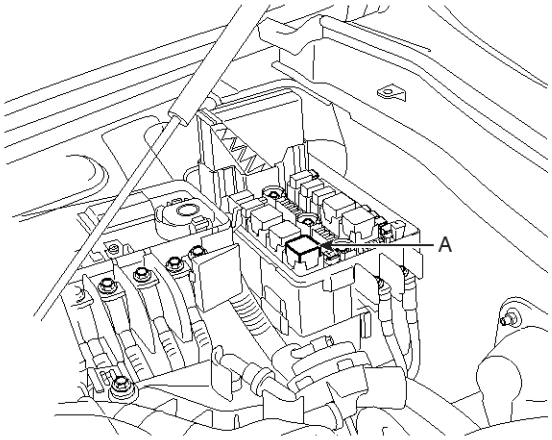
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### Power Relay (Type D)

Check for continuity between the terminals.

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

A: Engine control relay

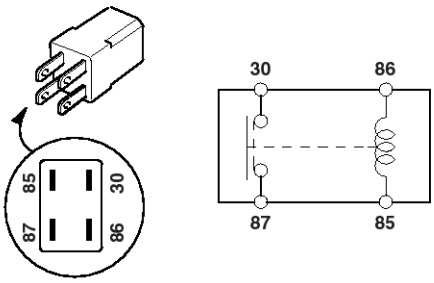



SBHB18035D

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SBHBE9082L

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

SCMBE6199L

### Fuse Inspection

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.

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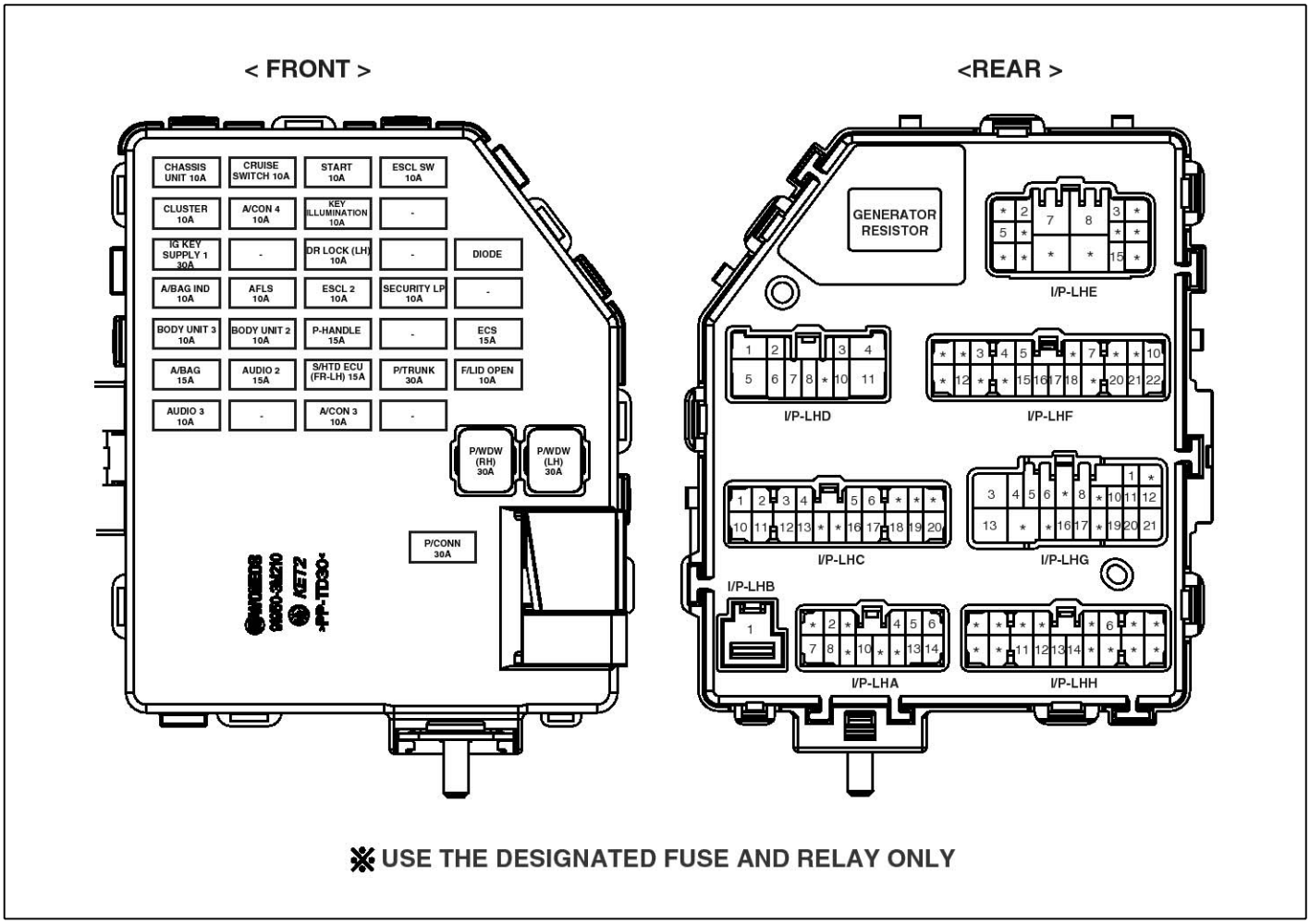
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## Relay Box (Passenger Compartment)

### Components

#### Passenger Compartment Relay Box LH




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## CIRCUIT

| Description | | (A) | Circuit Protected |
|---|---|---|---|
| FUSIBLE LINK | P/WDW (LH) | 30A | Driver Power Window Module, Rear Power Window Module LH |
| | P/WDW (RH) | 30A | Passenger Power Window Module, Rear Power Window Module RH |
| FUSE | CHASSIS UNIT | 10A | Console Switch LH/RH, ECS Control Module, Steering Angle Sensor, Key Lock Module |
| | CRUISE SWITCH | 10A | Multifunction Switch, Crash Pad Switch, A/C Control Module, Instrument Cluster, Rear Seat Warmer Module LH, Driver Seat Warmer Module Rear Seat Warmer Module RH, Passenger Seat Warmer Module, Passenger CCS Control Module, Driver CCS Control Module, Generator |
| | START | 10A | Transmission Range Switch |
| | ESCL SW | 10A | Fob Holder, Start Stop Button Switch |
| | CLUSTER | 10A | Instrument Cluster |
| | A/CON 4 | 10A | A/C Control Module |
| | KEY ILLUMINATION | 10A | Start Stop Button Switch, Door Warning Switch, Fob Holder, Key Solenoid |
| | IG KEY SUPPLY 1 | 30A | E/R Junction Box Fuse (INHIBITOR SW 10A, ECU-2 10A, EHPS 10A, CRUISE 10A, TCU 15A, ESP 10A, STOP LP 10A, AFLS 10A) |
| | DR LOCK (LH) | 10A | Driver Door Module |
| | A/BAG IND | 10A | Instrument Cluster |
| | AFLS | 10A | Auto Head Lamp Leveling Device Sensor, Adaptive Front Lighting Module, Head Lamp LH, Head Lamp RH |
| | ESCL 2 | 10A | PDM |
| | SECURITY LP | 10A | Data Link Connector, Auto Light Sensor & Security Indicator, Rear Door Module LH/RH |
| | BODY UNIT 3 | 10A | FAM, IPM, Tilt & Telescopic Module, PDM, Driver Door Module, Passenger Door Module, IMS Control Module, Multifunction Switch Electronic Parking Brake Module, Power Trunk Lid Control Module, Forward & Rear Parking Assist Control Module |
| | BODY UNIT 2 | 10A | FAM, Multifunction Switch, Tilt & Telescopic Module, Instrument Cluster, Driver Door Module, Passenger Door Module, Power Trunk Lid Control Module, IMS Control Module, Rear Curtain Module |
| | P/HANDLE | 15A | Tilt & Telescopic Module |
| | ECS | 15A | ECS Control Module |
| | A/BAG | 15A | SRS Control Module |
| | AUDIO 2 | 15A | Audio, Front Monitor, AV Head Module, Rear Monitor (With AV), Rear Audio Switch, Media Module (With AV) |
| | S/HTD ECU (FR-LH) | 15A | Driver CCS Control Module, Driver Seat Warmer Module (W/O CCS) |
| | P/TRUNK | 30A | Power Trunk Lid Control Module |
| | F/LID OPEN | 10A | Trunk Lid & Fuel Filler Door Switch |
| | AUDIO 3 | 10A | AV Head Module, Audio, Active Headrest Sensor Module |
| | A/CON 3 | 10A | RF Receiver, A/C Control Module |
| | P/CONN | 30A | I/P Junction Box LH Fuse (BODY UNIT 2 10A, A/CON 3 10A, AUDIO 2 15A) |

※ USE THE DESIGNATED FUSE AND RELAY ONLY

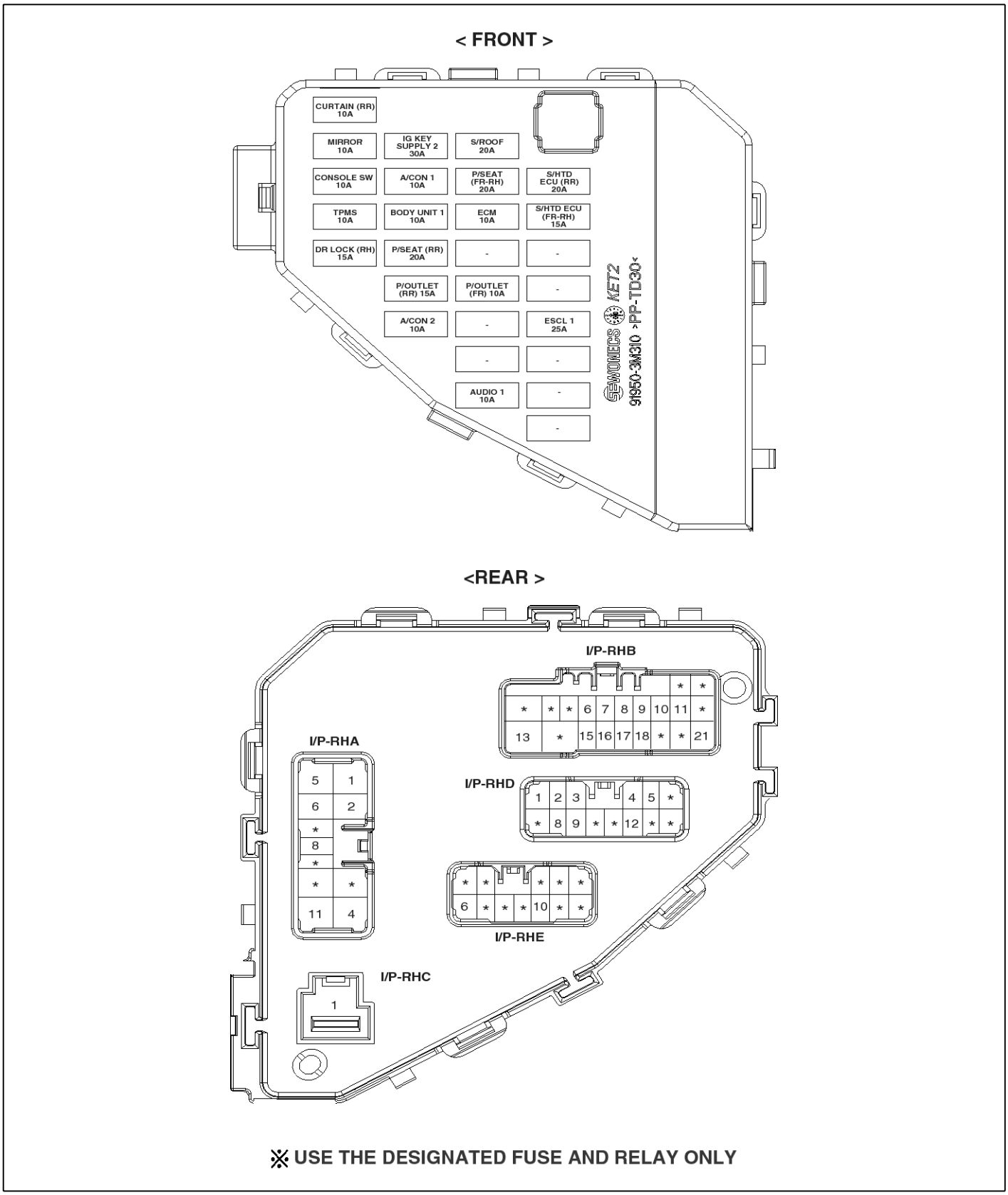
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## Passenger Compartment Relay Box RH




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**CIRCUIT**

| FUSE | (A) | Circuit Protected |
|---|---|---|
| CURTAIN (RR) | 10A | Rear Curtain Module |
| MIRROR | 10A | Driver Door Module, Passenger Door Module |
| IG KEY SUPPLY 2 | 30A | E/R Junction Box Fuse (AQS 10A, WASHER 15A) |
| S/ROOF | 20A | Overhead Console Lamp |
| CONSOLE SW | 10A | Console Switch LH/RH, Piezo Buzzer |
| A/CON 1 | 10A | Active Incar Sensor, A/C Control Module |
| P/SEAT (FR-RH) | 20A | Passenger Power Seat Relay Box |
| S/HTD ECU (RR) | 20A | Rear Seat Warmer Module LH/RH, Rear Power Seat Control Switch |
| TPMS | 10A | - |
| BODY UNIT 1 | 10A | Instrument Cluster, Rheostat, Driver CCS Control Module, Passenger CCS Control Module, PDM, IPM |
| ECM | 10A | Electro Chromic Mirror, Overhead Console Lamp, Rain Sensor, Rear Curtain Module, Camera Module |
| S/HTD ECU (FR-RH) | 15A | Passenger CCS Control Module, Passenger Seat Warmer Module |
| DR LOCK (RH) | 15A | Passenger Door Module |
| P/SEAT (RR) | 20A | Rear Power Seat Relay Box, Rear Slide Limit Switch LH |
| P/OUTLET (RR) | 15A | Rear Accessory Socket |
| P/OUTLET (FR) | 10A | ACC Socket Relay |
| A/CON 2 | 10A | A/C Control Module, IPM, PDM, Key Lock Module |
| ESCL 1 | 25A | PDM |
| AUDIO 1 | 10A | Audio, Camera Module, Rear Audio Switch, Front Monitor, Media Module, AV Head Module |

※ USE THE DESIGNATED FUSE AND RELAY ONLY

SBHBE9307L

## Fuse Inspection

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.

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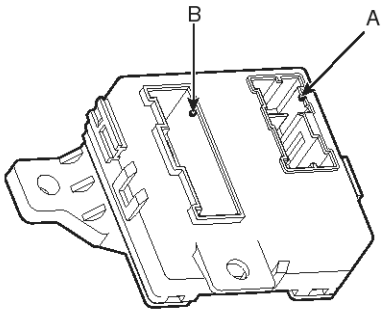
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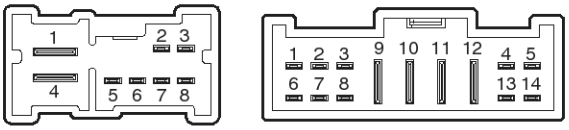
## PDM Relay Box

### Description

The PDM, which installed beside the audio head unit, is united with IG1, IG2, ACC and Sub start relay. This module receive signal from IPM and control relay(ACC/IG1/IG 2/ST).




SHMBE8181D




Connector A Connector B

SBHBE9074L

### Inspection

#### IG 1 Relay

Check for continuity between the terminals.

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

#### IG 2 Relay

Check for continuity between the terminals.

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

#### ACC Relay

Check for continuity between the terminals.

1. There should be continuity between the No.3 in the connector A and No.9 in the connector B terminals when power and ground are connected to the No.7 and No.8 in the connector B.
2. There should be no continuity between the No.3 in the connector A and No.9 in the connector B 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 in the connector B terminals when power and ground are connected to the No.4 and No.5 in the connector B.
2. There should be no continuity between the No.2 and No.3 in the connector B terminals when power is disconnected.

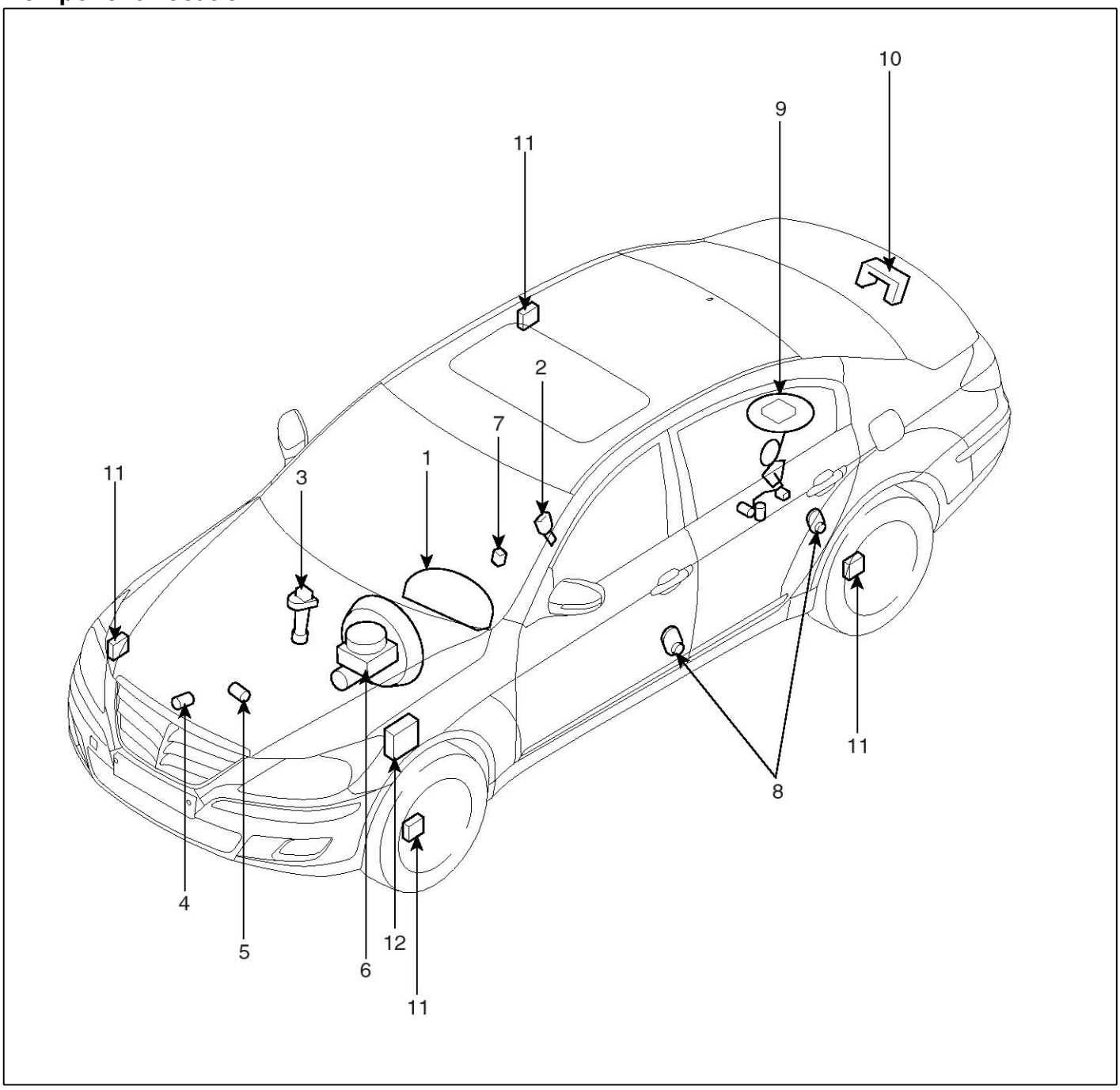
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# Indicators And Gauges

## Component Location




SBHBE8203D

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. Power trunk lid switch
11. Wheel speed sensor
12. ABS ECU

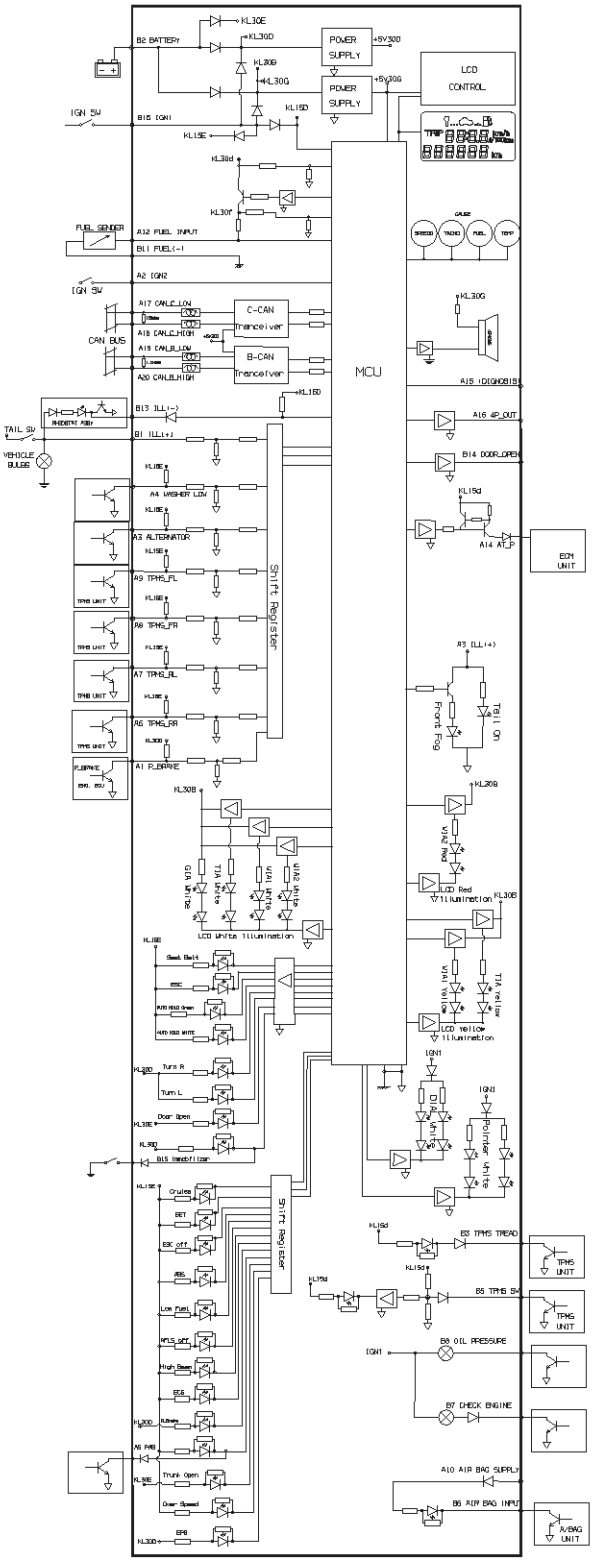
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## Instrument Cluster

### Circuit Diagram




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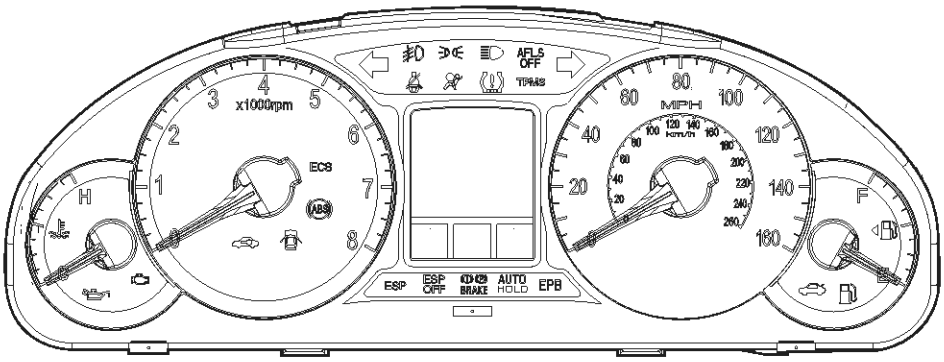
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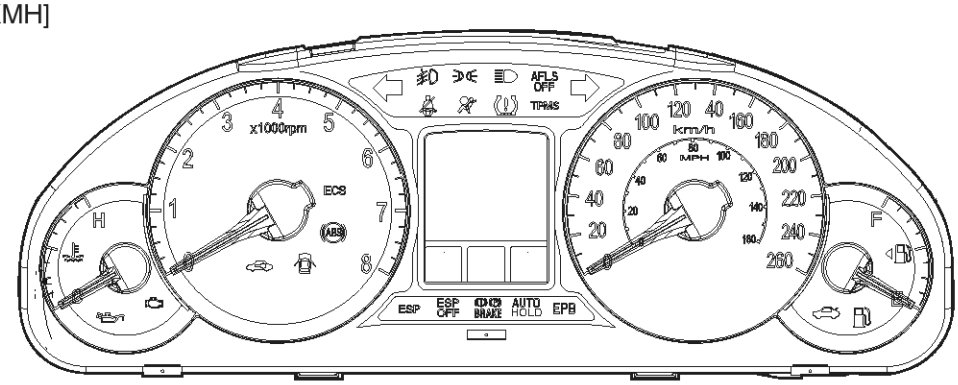
## Components

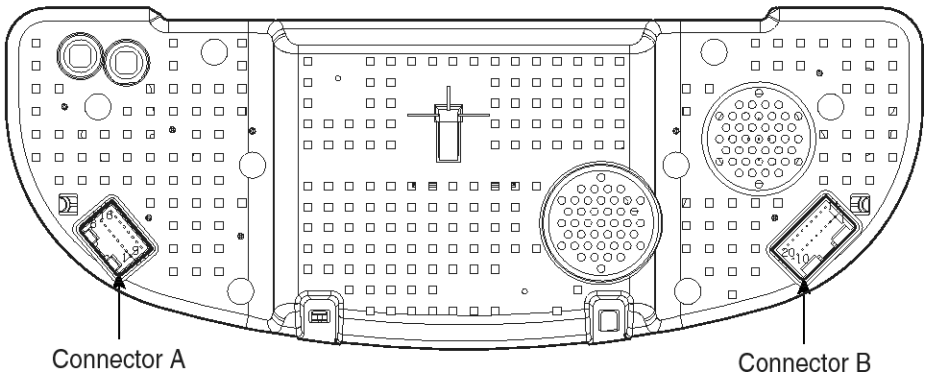
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[KMH]




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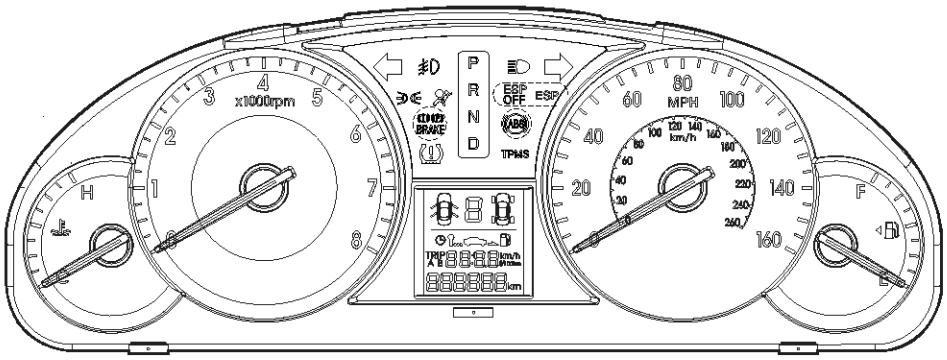
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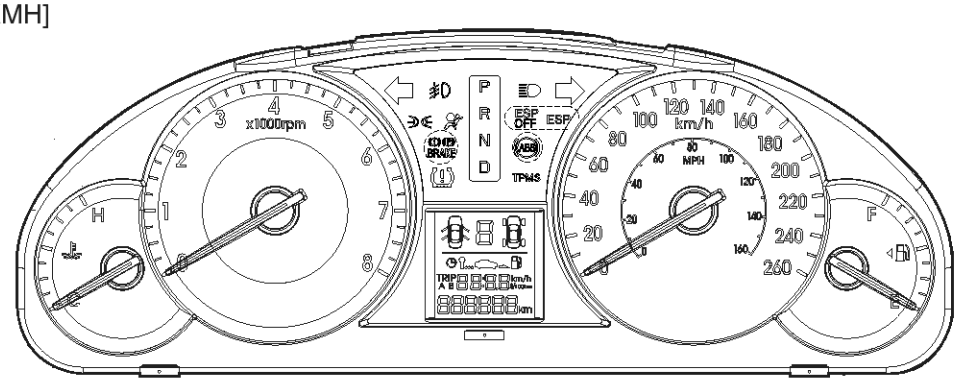


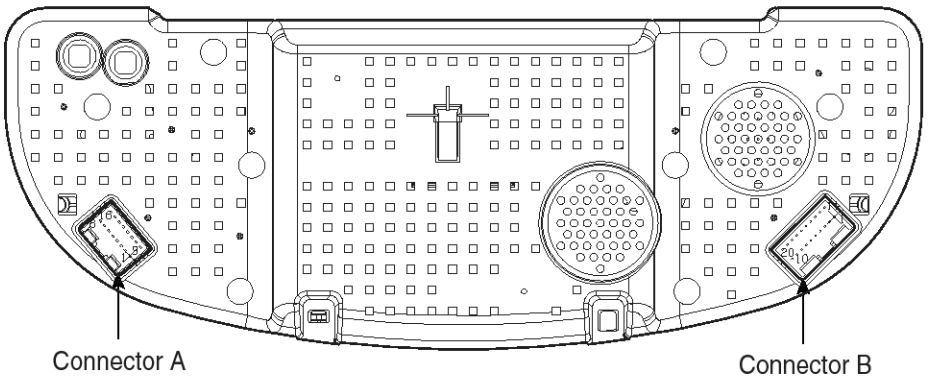
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[KMH]



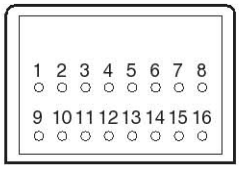

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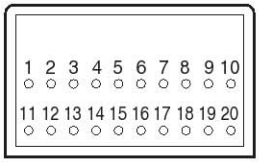
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**Cluster Connector Terminals**




Connector A




Connector B

| Pin | Description | Pin | Description |
|---|---|---|---|
| 1 | Illumination + | 1 | Parking brake |
| 2 | Battery | 2 | IGN 2 |
| 3 | TPMS | 3 | ALT |
| 4 | Power GND | 4 | Washer low |
| 5 | TPMS warning | 5 | - |
| 6 | Air bag input | 6 | TPMS rear RH |
| 7 | Check engine | 7 | TPMS rear LH |
| 8 | Oil pressure | 8 | TPMS front RH |
| 9 | - | 9 | TPMS front LH |
| 10 | - | 10 | Air bag supply |
| 11 | Fuel - | 11 | - |
| 12 | Signal GND | 12 | Fuel input |
| 13 | Illumination - | 13 | - |
| 14 | Door open | 14 | P |
| 15 | Immobilizer | 15 | Diagnosis |
| 16 | IGN 1 | 16 | 4P output |
| | | 17 | CAN low (chassis) |
| | | 18 | CAN high (chassis) |
| | | 19 | CAN low (body) |
| | | 20 | CAN high (body) |

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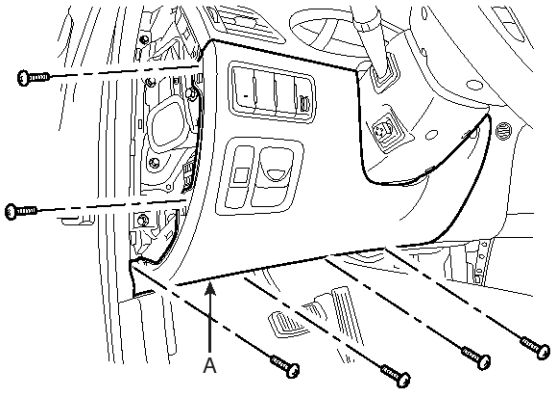
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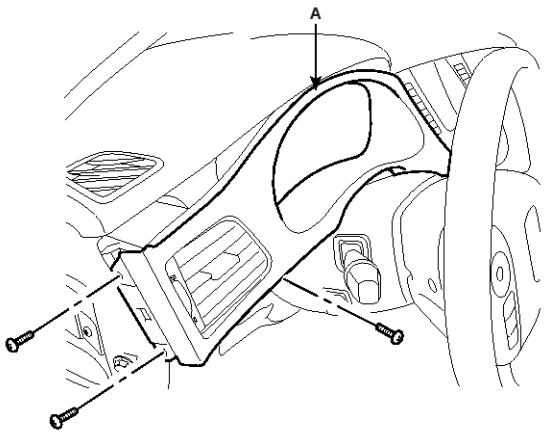
## Removal

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



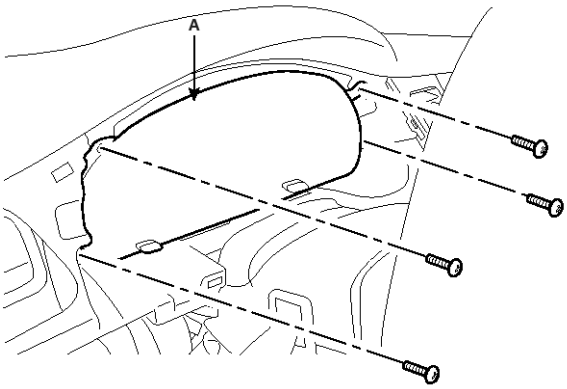

SBHBE8208D

3. Remove the cluster fascia panel (A) after removing the screws.



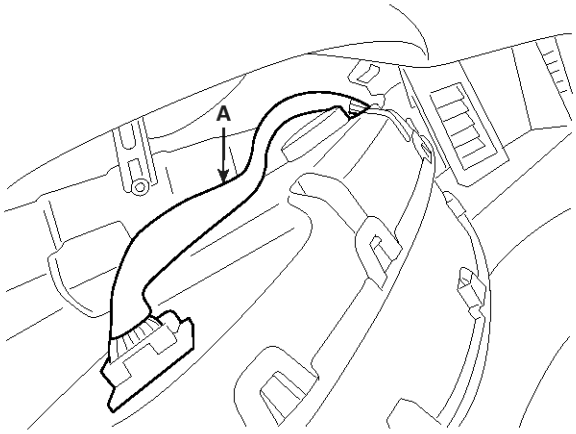

SBHBE8206D

4. Remove the cluster (A).




SBHBE8207D

5. Remove the connector (A).




SBHBE8216D

## Installation

1. Connect the connector and install the cluster.
2. Install the crash pad lower panel.

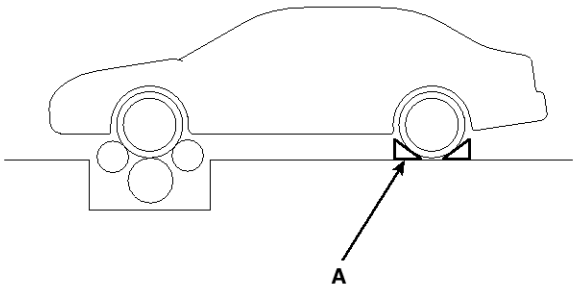
## Inspection

### Speedometer

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks 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.*




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[KPH]

| Velocity (km/h) | 20 | 40 | 60 | 80 | 100 |
|---|---|---|---|---|---|
| Tolerance (km/h) | +4.0<br>+0.4 | +4.8<br>+0.9 | +6.4<br>+1.4 | +7.6<br>+1.8 | +9.2<br>+2.4 |
| Velocity (km/h) | 120 | 140 | 160 | 180 | 200 |
| Tolerance (km/h) | +10.4<br>+3.0 | +11.6<br>+3.6 | +12.8<br>+4.0 | +13.8<br>+4.4 | +14.8<br>+4.8 |
| Velocity (km/h) | 220 | 240 | 260 | | |
| Tolerance (km/h) | +15.8<br>+5.2 | +16.8<br>+5.6 | +16.8<br>+6.0 | | |

[MPH]

| Velocity (MPH) | 10 | 20 | 40 | 60 | 80 |
|---|---|---|---|---|---|
| Tolerance (MPH) | +2.5<br>+0.2 | +3.0<br>+0.5 | +5.0<br>+0.8 | +6.2<br>+1.3 | +7.4<br>+1.8 |
| Velocity (MPH) | 100 | 120 | 140 | 160 | |
| Tolerance (MPH) | +8.6<br>+2.3 | +9.8<br>+2.8 | +10.2<br>+3.2 | +11.4<br>+4.0 | |

## 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**

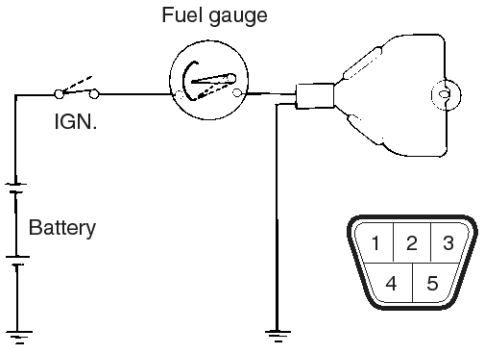
1. **Reversing the connections of the tachometer will damage the transistor and diodes inside.**
2. **When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.**

[Gasoline]

| Revolution (rpm) | 1,000 | 2,000 | 3,000 | 4,000 |
|---|---|---|---|---|
| Tolerance (rpm) | ±100 | ±100 | ±100 | ±100 |
| Revolution (rpm) | 5,000 | 6,000 | 7,000 | 8,000 |
| Tolerance (rpm) | ±100 | ±100 | ±100 | ±100 |

## Fuel Gauge

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




SBHBE9079L

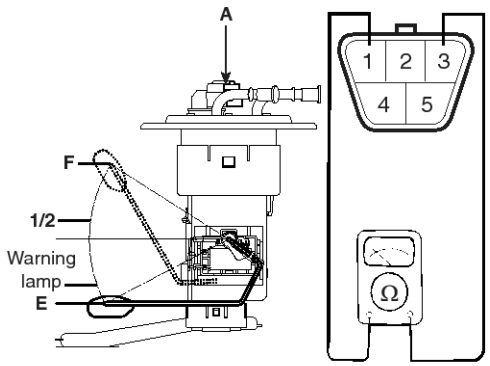
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### Main Fuel Gauge Sender

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




SBHBE9080L

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

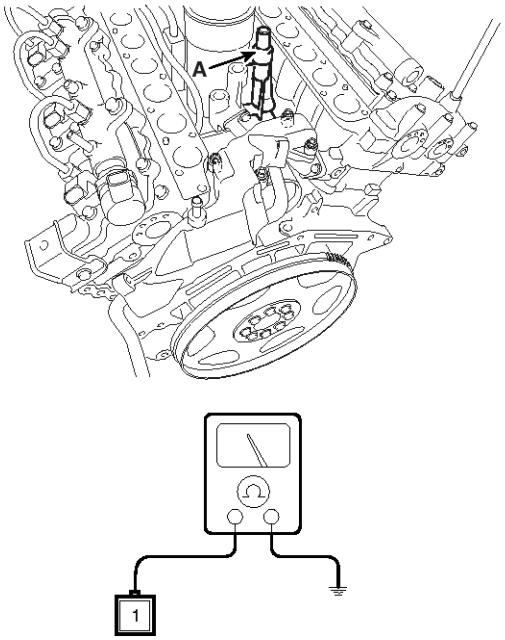
| Position | Resistance(Ω) |
|---|---|
| Sender (E) | 183 ± 2.5 |
| Warning lamp | 175 ± 2.5 |
| 1/2 | 99 ± 2.5 |
| Sender (F) | 15 ± 2 |

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

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

### Oil Pressure Switch

1. Check that there is continuity between the oil press switch terminal (A) and ground with the engine off.
2. Check that there is no continuity between the terminal and ground with the engine running.
3. If operation is not as specified, replace the switch.




SBHBE8209D

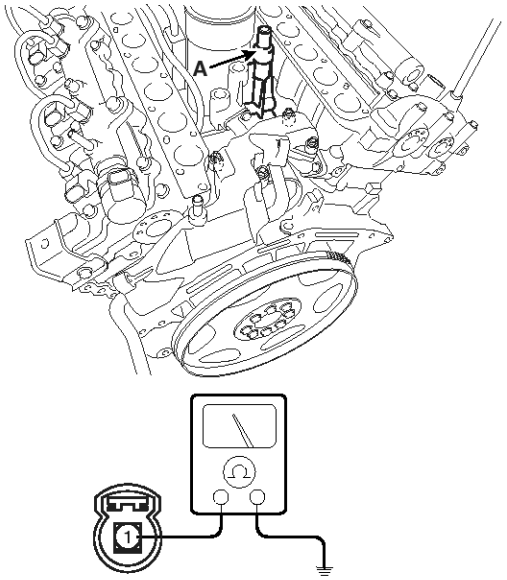
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### Oil Pressure Warning Lamp

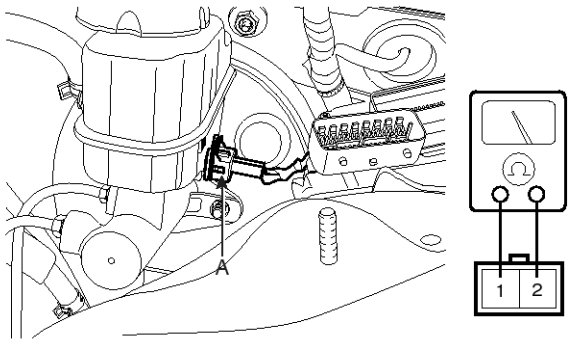
1. Disconnect the connector (A) from the warning switch and ground the terminal on the wire harness side connector.
2. Turn the ignition switch ON. Check that the warning lamp lights up. If the warning lamp doesn't light, test the bulb or inspect the wire harness.




SBHBE8210D

### 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.




SBHB18050D

### Brake Fluid Level Warning Lamp

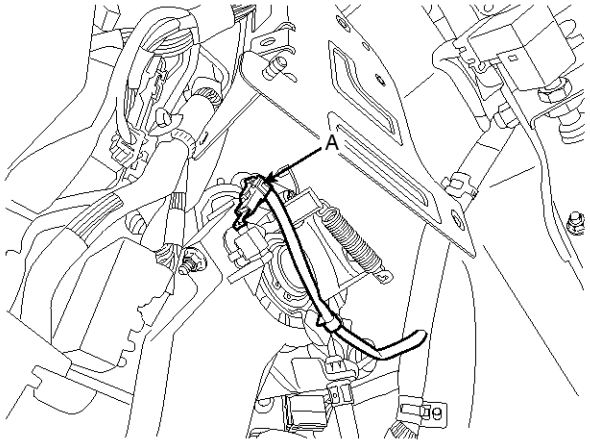
1. Ignition "ON"
2. Release the parking brake.
3. Remove the connector from the brake fluid level warning switch.
4. Ground the connector at the harness side.
5. Verify that the warning lamp lights.

### Parking Brake Switch

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

1. Check that there is continuity between the terminal and switch body with the switch ON (Lever is pulled).
2. Check that there is no continuity between the terminal and switch body with the switch OFF (Lever is released).

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




SBHB18051D

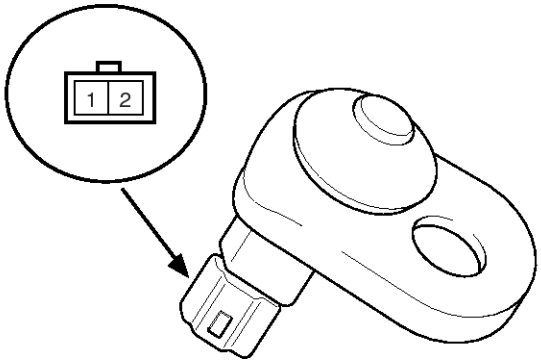
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### Door Switch

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




ATIE121Q

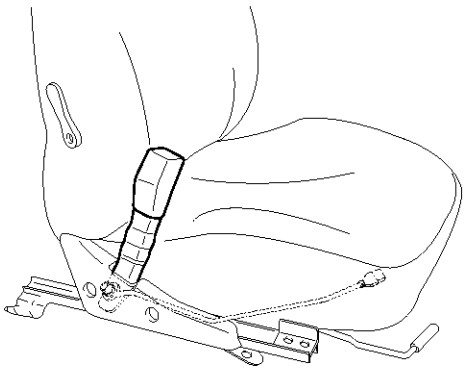
| Terminal / Position | 1 | 2 | Body (Ground) |
|---|---|---|---|
| Free (Door open) | ○ | ○ | ○ |
| Push (Door close) | | | |

ETQF180D

### Seat Belt Switch

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

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

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## Troubleshooting

| Symptom | Possible cause | Remedy |
|---|---|---|
| Speedometer does not operate | Cluster fuse (10A) blown | Check for short and replace fuse |
| | Speedometer faulty | Check speedometer |
| | Vehicle speed sensor faulty | Check vehicle speed sensor |
| | 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 |
| | 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 |
| | 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 |
| Open door warning lamp and trunk lid 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 |

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| Symptom | Possible cause | Remedy |
|---|---|---|
| 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 |

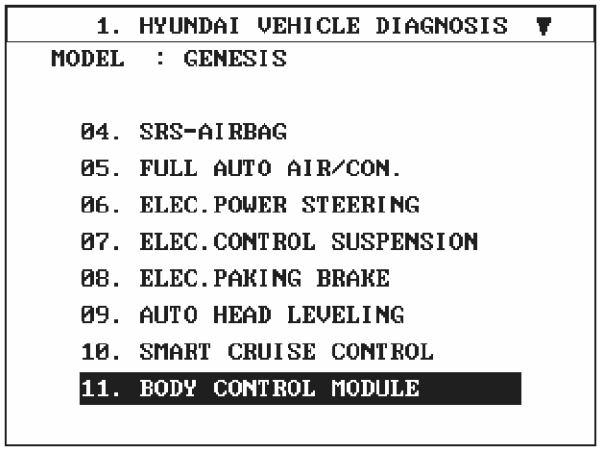
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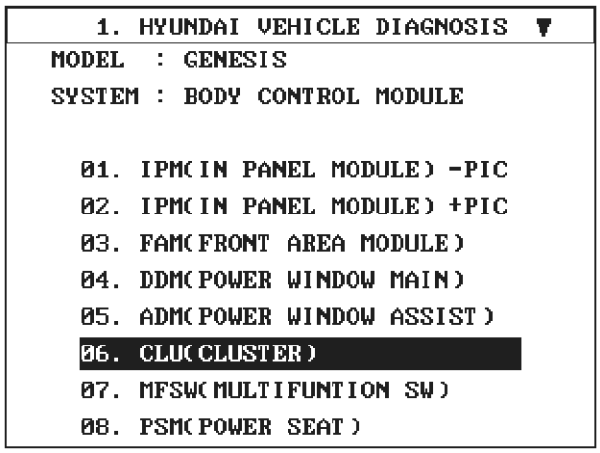
### Diagnosis With Scan Tool

1. It will be able to diagnose defects of cluster (CLU) with scan tool quickly. Scan tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select model and "BCU".



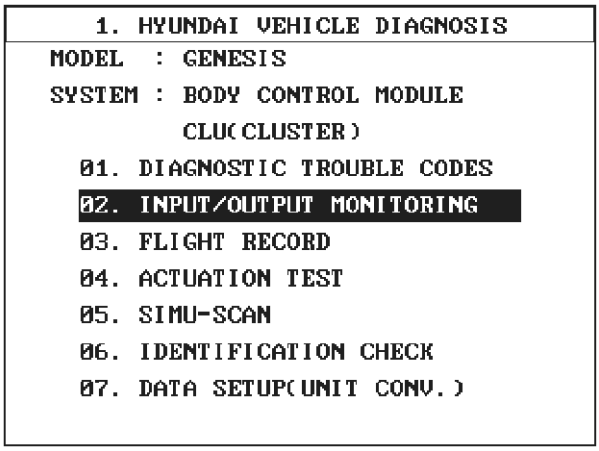

SBHBE9084L

3. Select the "CLU (Cluster)" to check.

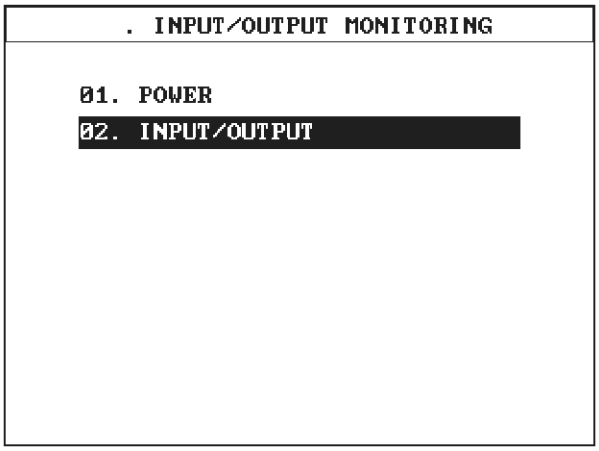



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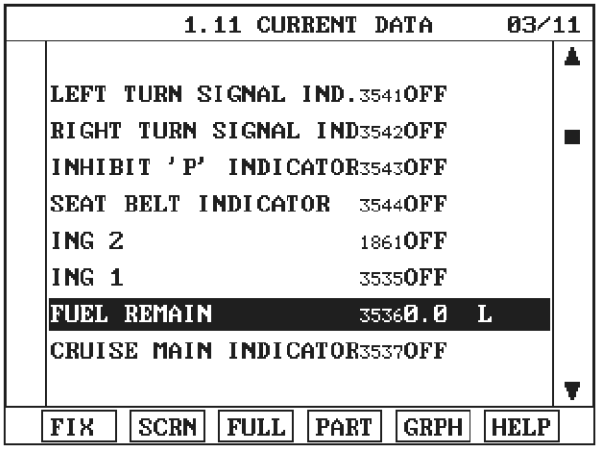
4. Select "Input/output monitoring", if you will check current data of cluster system. It provides input/output status of cluster.




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SBHBE9087L



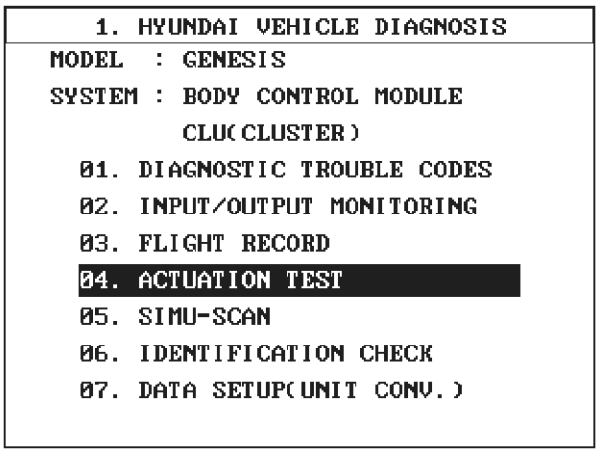

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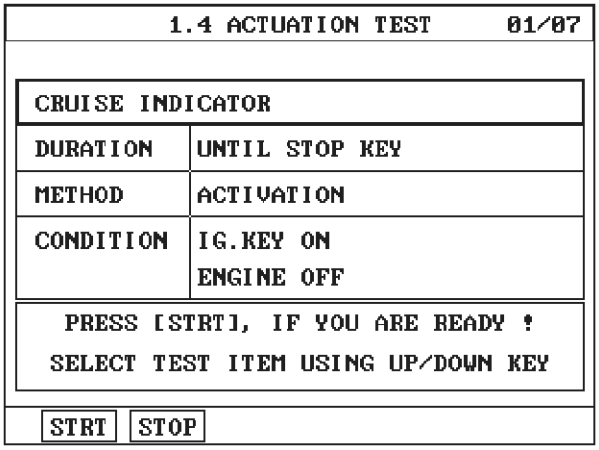
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5. If you will check the cluster operation forcefully, select "Actuation test".

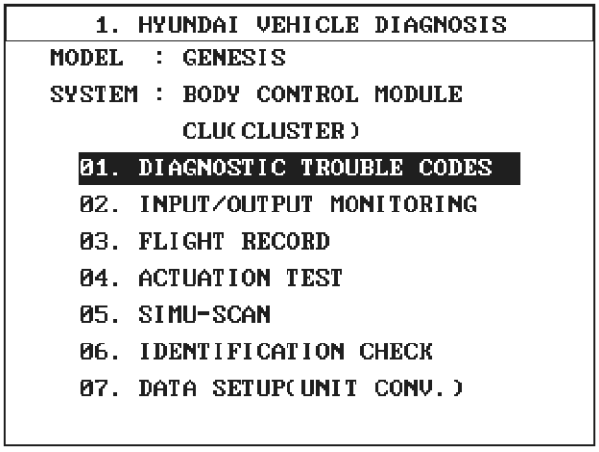



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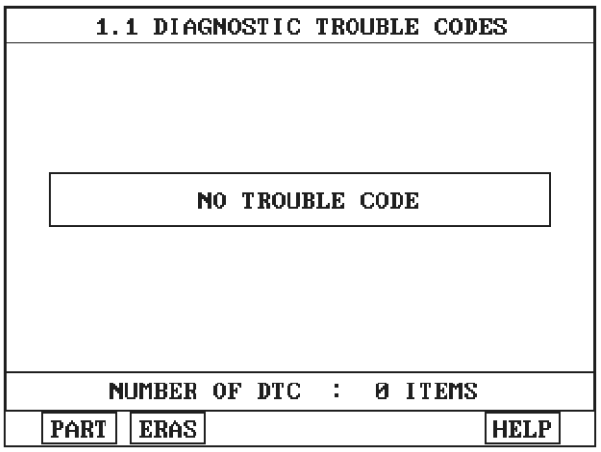



SBHBE9090L

6. To check the DTC of the each module, select "Diagnostic trouble codes"




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SBHBE9092L

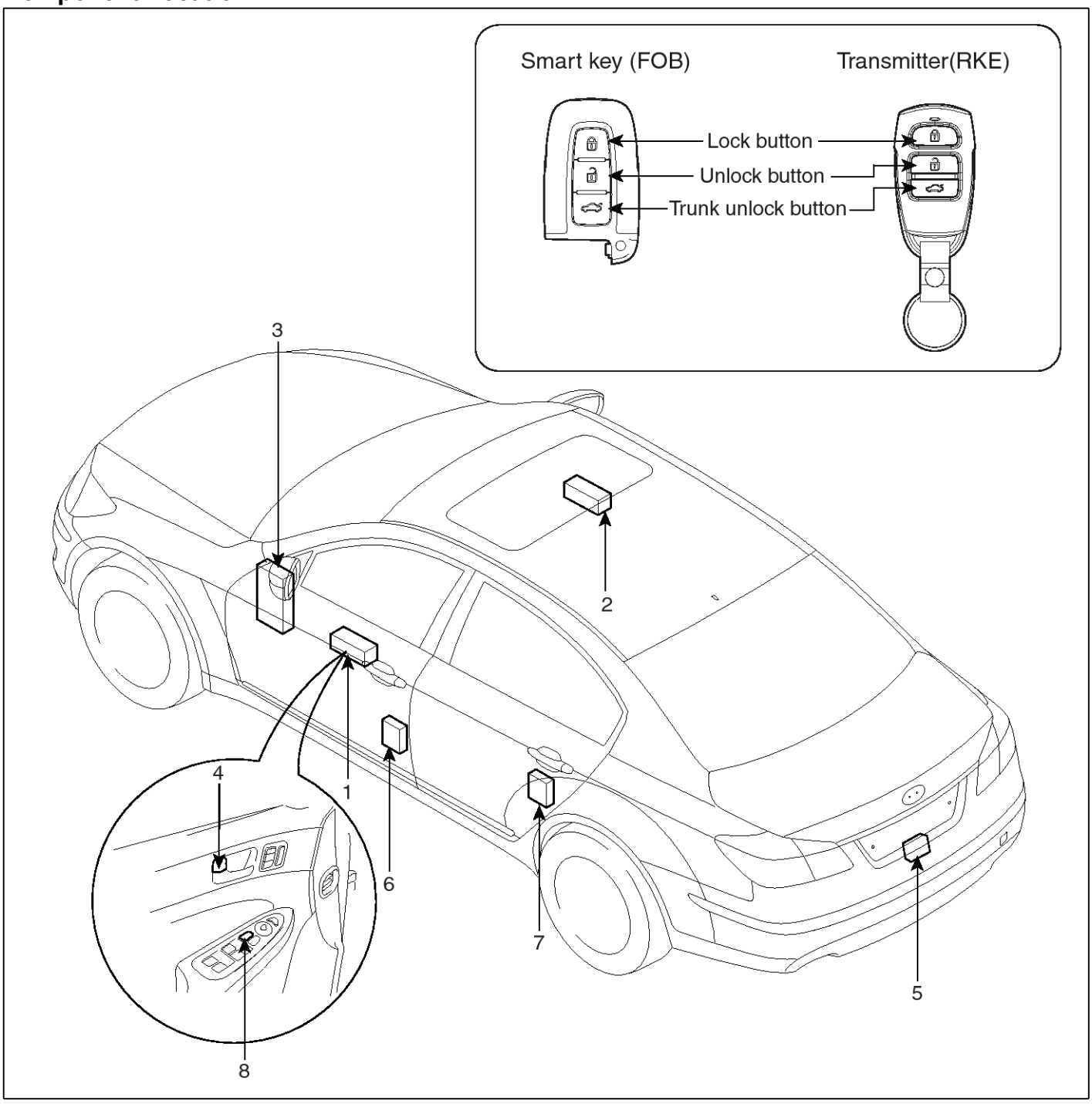
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# Power Door Locks

## Component Location




SBHBE9454L

1. DDM (Driver Door Module)
2. ADM (Assist Door Module)
3. IPM (Instrument Panel Module)
4. Door lock knob
5. Trunk lid release actuator
6. Front door lock actuator
7. Rear door lock actuator
8. Door lock switch

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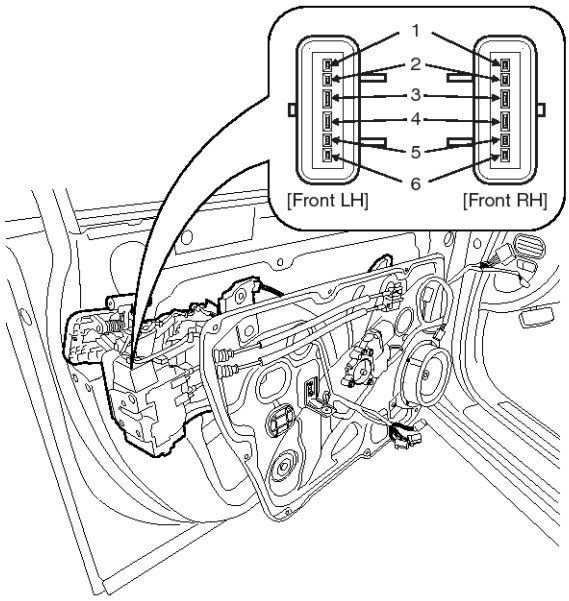


# Power Door Lock Actuators

## Inspection

### Front Door Lock Actuator Inspection

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.




SBHBE9051L

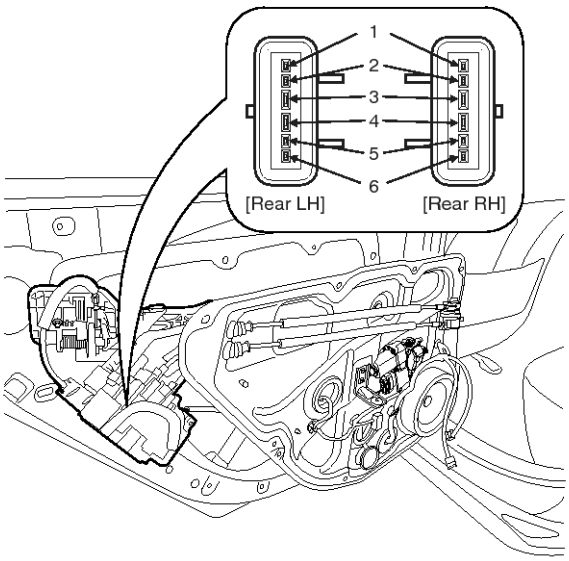
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

| Position \ Terminal | | 3 | 4 |
|---|---|---|---|
| Front left | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |
| Front right | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |

SBHBE9052L

### Rear Door Lock Actuator Inspection

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 6P connector from the actuator.




SBHBE9053L

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

| Position \ Terminal | | 3 | 4 |
|---|---|---|---|
| Rear left | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |
| Rear right | Lock | ⊕ | ⊖ |
| | Unlock | ⊖ | ⊕ |

SBHBE9054L

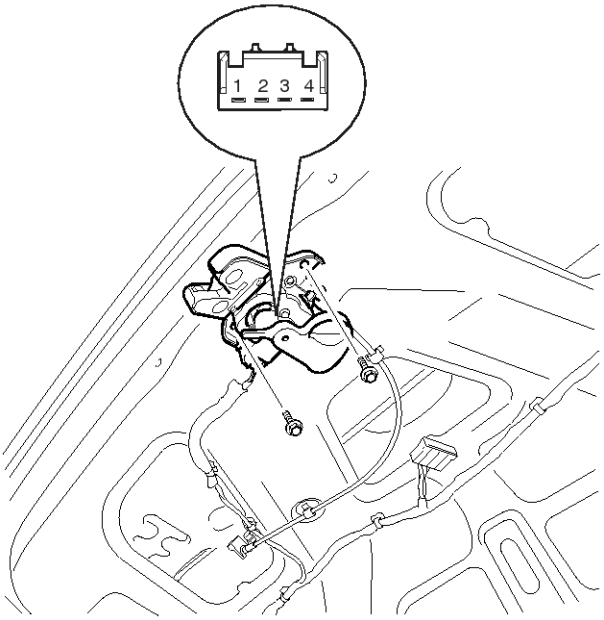
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### Trunk Lid Release Actuator Inspection

1. Remove the trunk lid trim panel. (Refer to the Body group-trunk lid)
2. Disconnect the 4P connector from the actuator.




SBHBE8481D

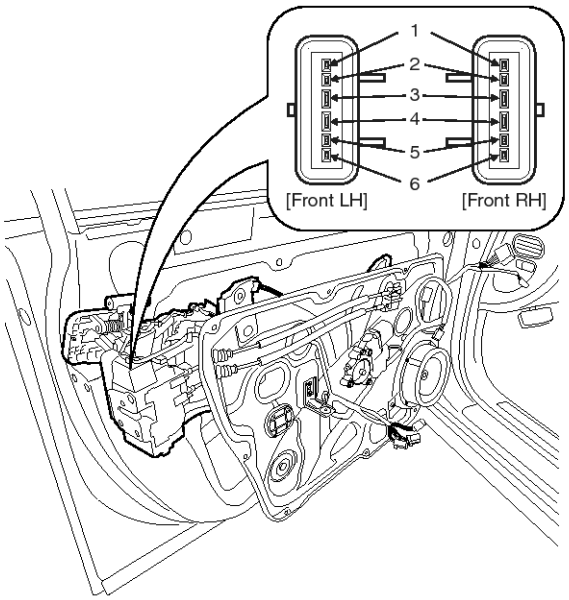
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

| Position \ Terminal | 3 | 1 |
|---|---|---|
| Close → Open | ⊕ | ⊖ |
| Open → Close | | |

SBHBE9055L

### Front Door Lock Switch Inspection

1. Remove the front door trim panel. (Refer to the Body group - front door)
2. Disconnect the 6P connector from the actuator.




SBHBE9051L

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

| Position \ Terminal | | 2 | 5 | 6 |
|---|---|---|---|---|
| Front left | Clock wise | ○ | ○ | |
| | Couter clock wise | ○ | | ○ |
| Front right | Clock wise | ○ | | ○ |
| | Couter clock wise | ○ | ○ | |

SBHBE9056L

| Position \ Terminal | | 1 | 2 |
|---|---|---|---|
| Front left | Unlock | ○ | ○ |
| Front right | Unlock | ○ | ○ |

SBHBE9057L

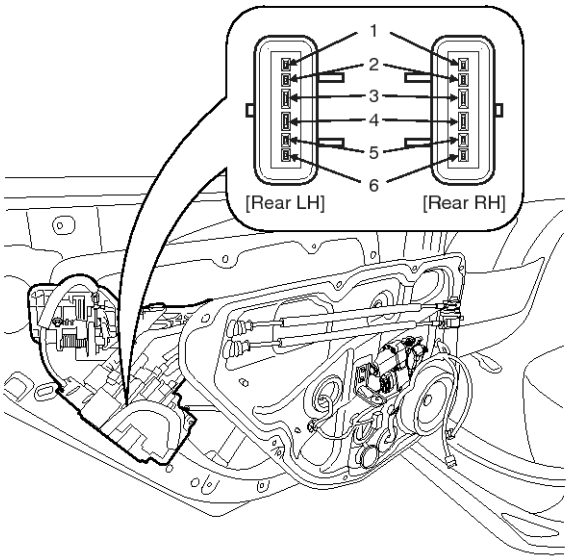
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### Rear Door Lock Switch Inspection

1. Remove the rear door trim panel. (Refer to the Body group - rear door)
2. Disconnect the 7P connector from the actuator.




SBHBE9053L

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

| Position \ Terminal | | 1 | 2 |
|---|---|---|---|
| Rear left | Unlock | ○ | ○ |
| Rear right | Unlock | ○ | ○ |

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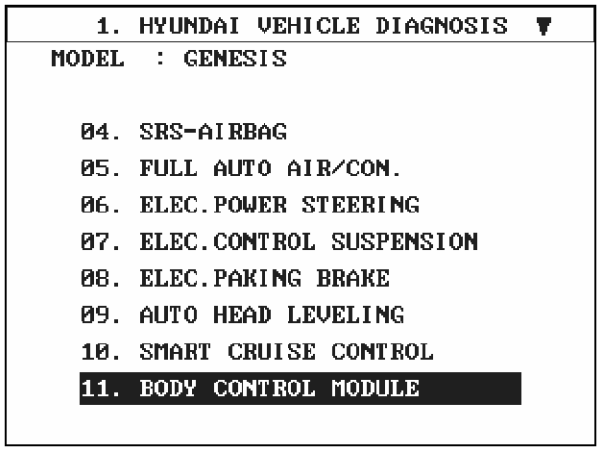


## Power Door Lock Switch

### Inspection

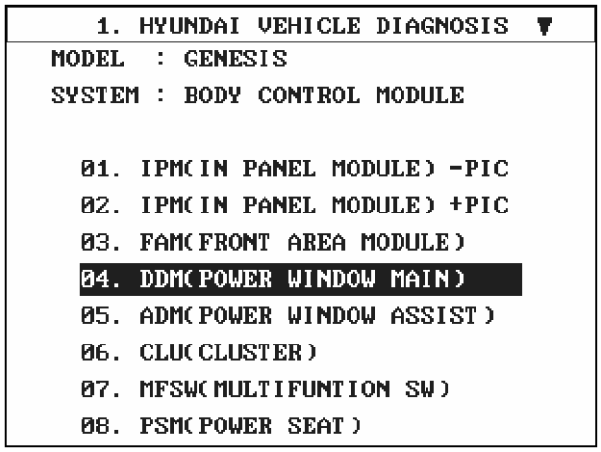
#### Diagnosis With Scan Tool

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



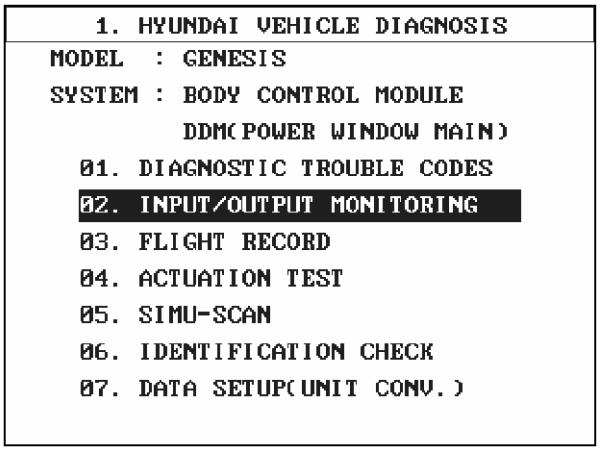

SBHBE9112L

3. Select the "DDM (Power window main)" to check.

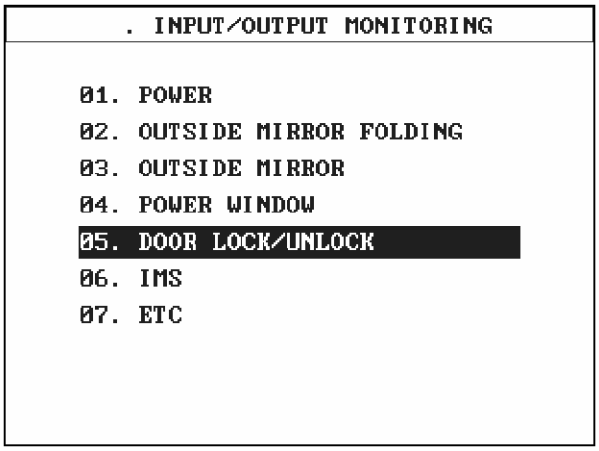



SBHBE9123L

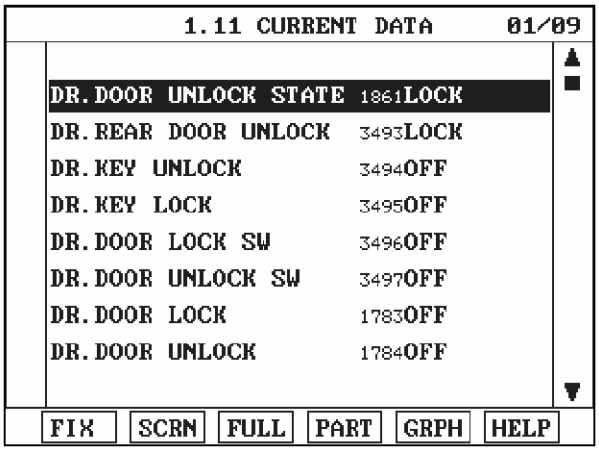
4. Select "Input/output monitoring", if you will check current data of power door lock system. It provides input/output status of DDM/ADM.




SBHBE9124L




SBHBE9125L



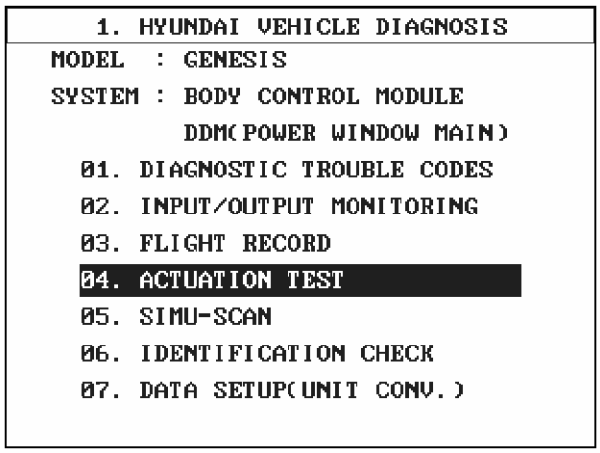

SBHBE9126L

https://autolibrary.ir

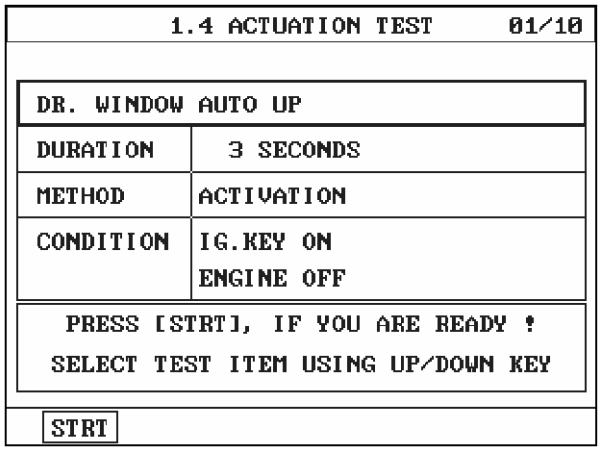
https://autolibrary.ir



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

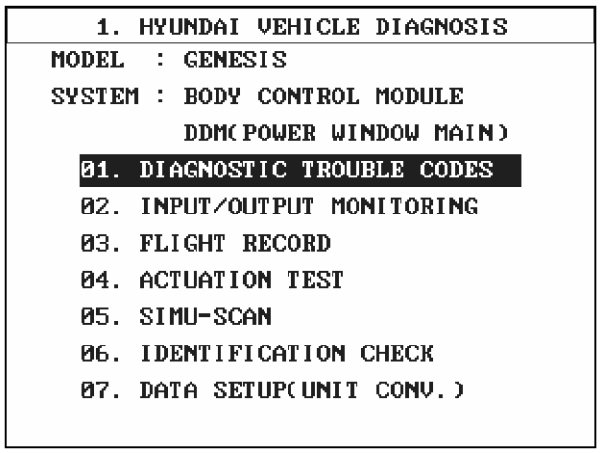



SBHBE9127L

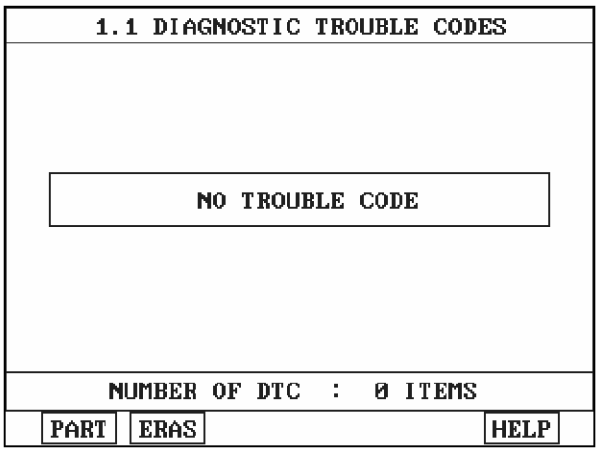



SBHBE9128L

6. To check the DTC of the DDM/AMD module, select " Diagnostic trouble codes"




SBHBE9129L

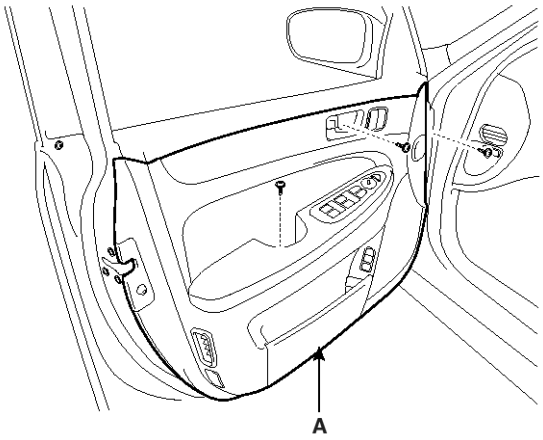



SBHBE9130L

## Removal

### Driver Door Lock Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim panel (A). (Refer to the Body group - front door)




SBHBE8361D

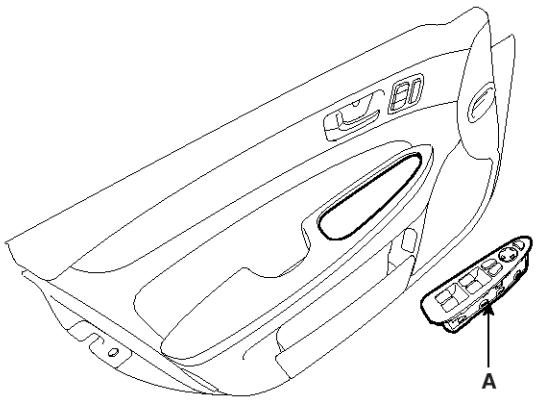
https://autolibrary.ir

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3. Remove the power door lock switch module (DDM) ( A) from the front door trim panel after disconnecting module connector.

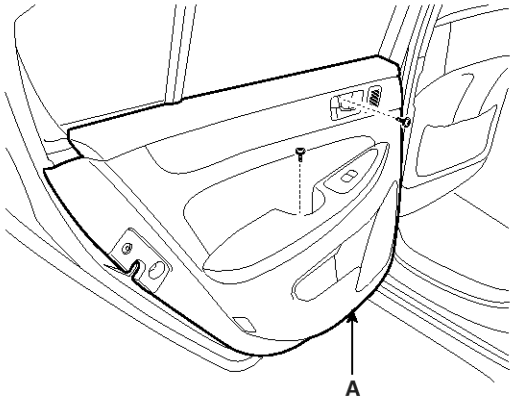
   Be careful not to damage the door module removing the clip.




SBHBE8362D

### Rear Door Lock Switch

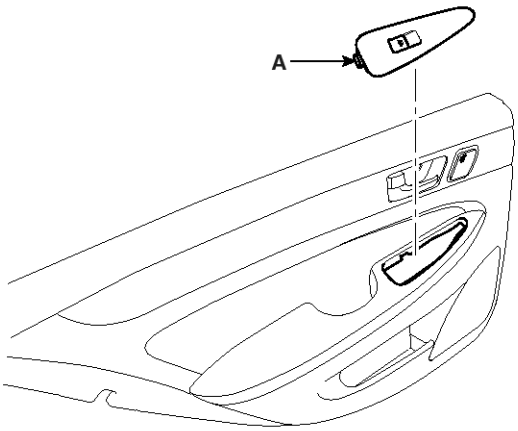
1. Disconnect the negative (-) battery terminal.
2. Remove the rear door trim panel (A). (Refer to the B-ody group - rear door)




SBHBE8363D

3. Remove the power door lock switch module (A) from the front door trim panel after disconnecting module connector.

   Be careful not to damage the door module removing the clip.




SBHBE8364D

## Installation

### Driver Door Lock Switch

1. Install the power door lock switch module on the front door trim panel.
2. Install the front door trim panel.
3. Connect the negative (-) battery terminal.

### Rear Door Lock Switch

1. Install the power door lock switch module on the rear door trim panel.
2. Install the rear door trim panel.
3. Connect the negative (-) battery terminal.

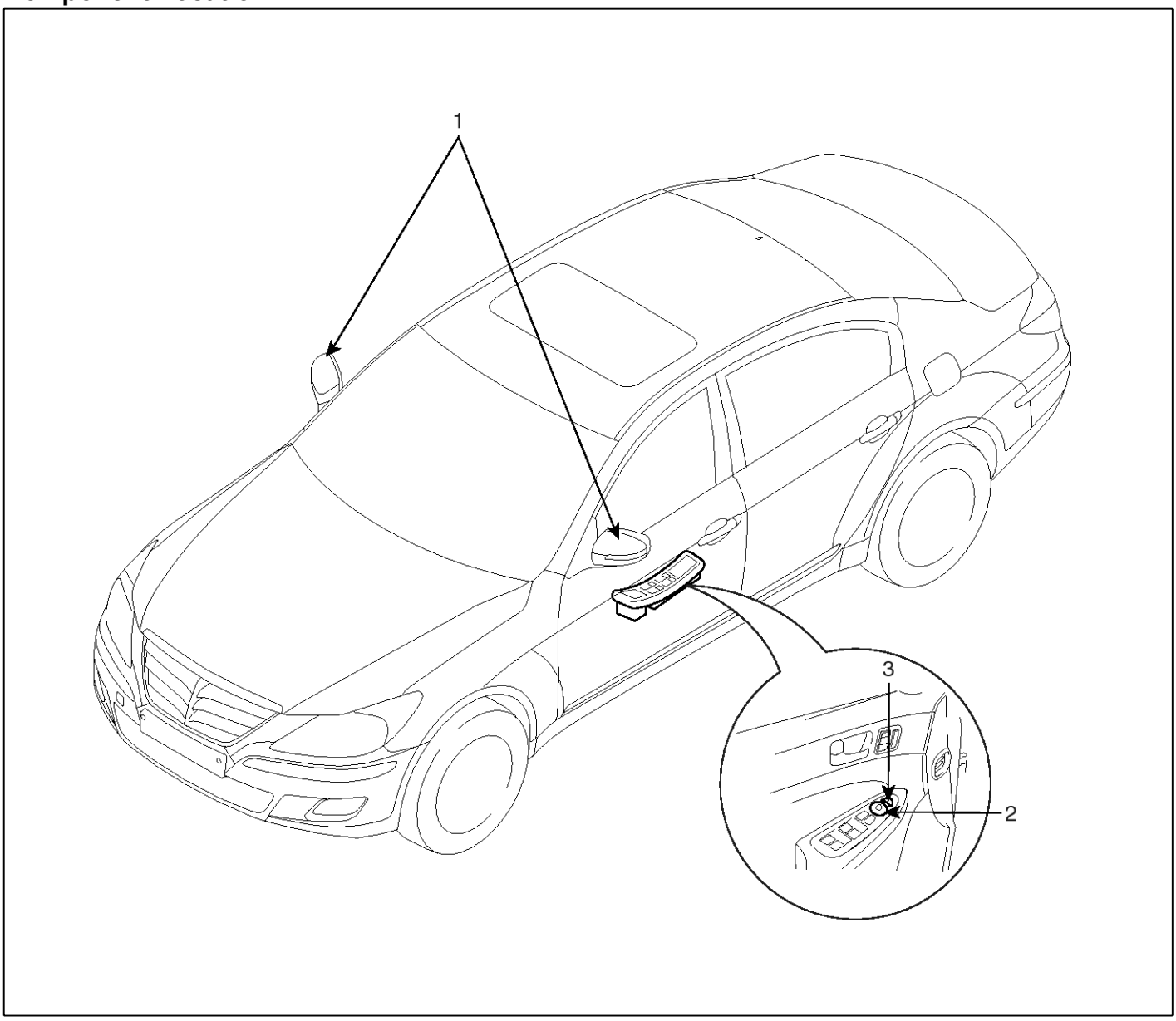
https://autolibrary.ir

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# Power Mirrors

## Component Location




SBHBE8374D

1. Power mirror
2. Power mirror switch

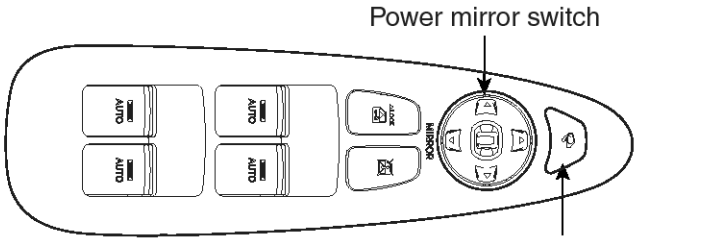
https://autolibrary.ir

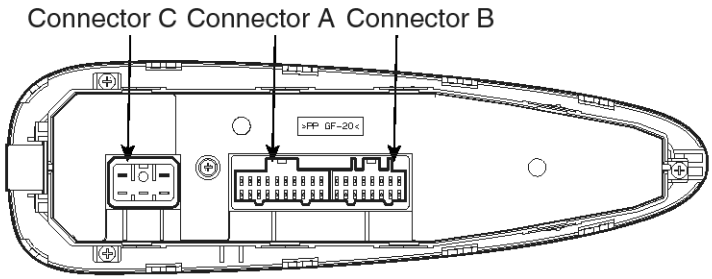
https://autolibrary.ir

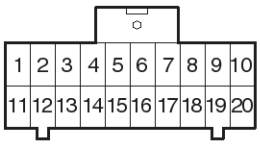


## Power Mirror Switch

### Components

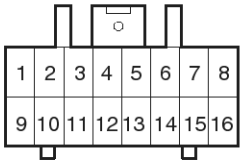


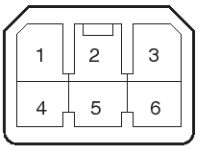

Connector A

| Pin | Description |
|---|---|
| 1 | Mirror sensor power |
| 2 | Mirror sensor V |
| 3 | Mirror sensor H |
| 4 | Mirror sensor GND |
| 5 | Mirror fold |
| 6 | Mirror unfold |
| 7 | Mirror H output |
| 8 | Mirror communication |
| 9 | Mirror V output |
| 10 | RL power window up DDM |
| 11 | RL power window down DDM |
| 12 | RR power window up DDM |
| 13 | RR power window down DDM |
| 14 | SET switch |
| 15 | P1 switch |
| 16 | P2 switch |
| 17 | Trunk open switch |
| 18 | Driver key lock |
| 19 | Driver key unlock |
| 20 | Local communication |




Connector B

| Pin | Description |
|---|---|
| 1 | GND 1 |
| 2 | Window up |
| 3 | Window down |
| 4 | Window enable |
| 5 | – |
| 6 | – |
| 7 | Battery |
| 8 | CAN high |
| 9 | Illumination + |
| 10 | Illumination – |
| 11 | Driver unlock state |
| 12 | RL unlock state |
| 13 | – |
| 14 | – |
| 15 | IGN1 DDM |
| 16 | CAN low |




Connector C

| Pin | Description |
|---|---|
| 1 | GND 2 |
| 2 | Mirror power |
| 3 | Driver door lock relay |
| 4 | Door lock power |
| 5 | Driver door unlock relay |

SBHBE9111L

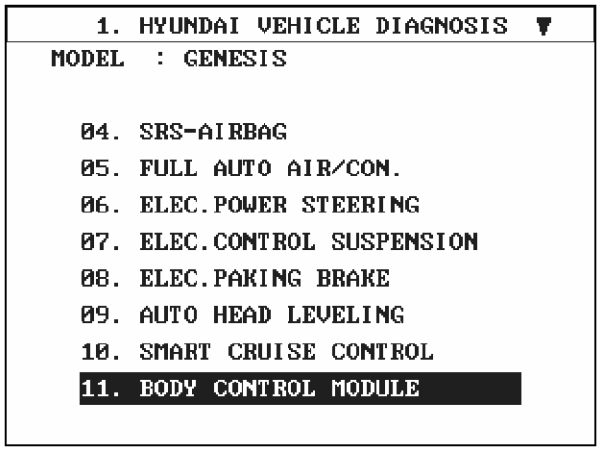
https://autolibrary.ir

https://autolibrary.ir



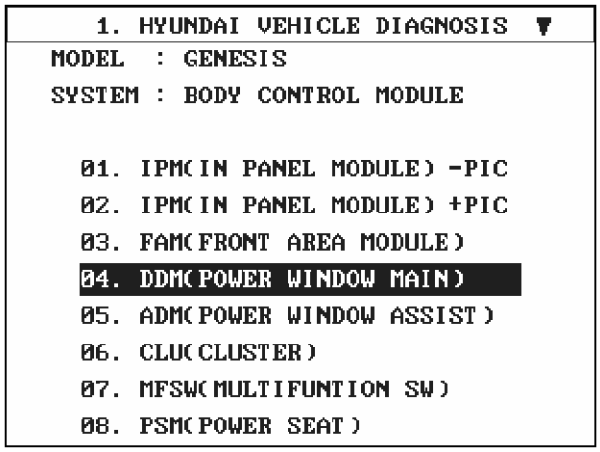
## Inspection

1. The DDM inputs can be checked using the scan tool.
2. To check the input value of door lock switch, select option "BODY CONTROL MODULE".



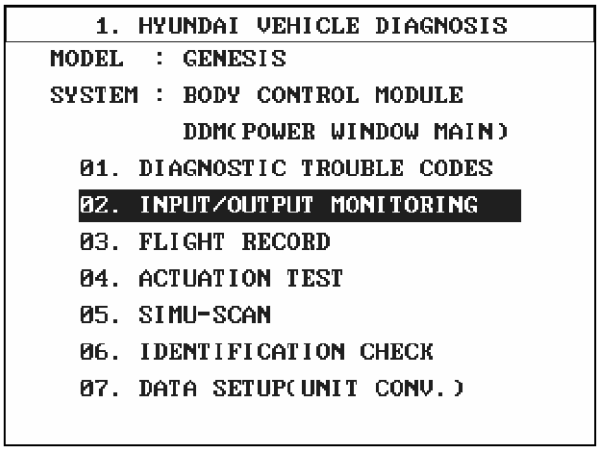

SBHBE9112L

3. Select option "DRIVER DOOR MODULE".

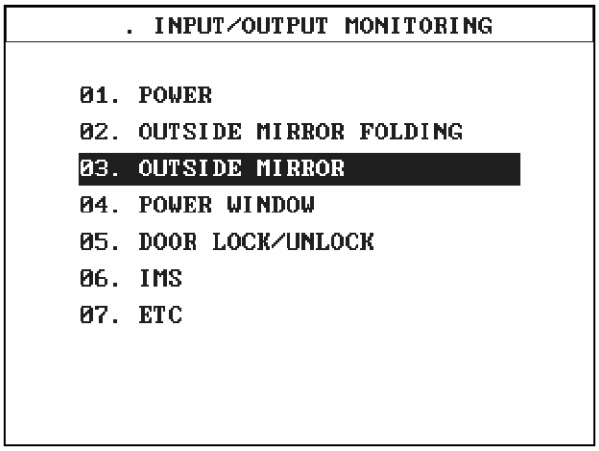



SBHBE9113L

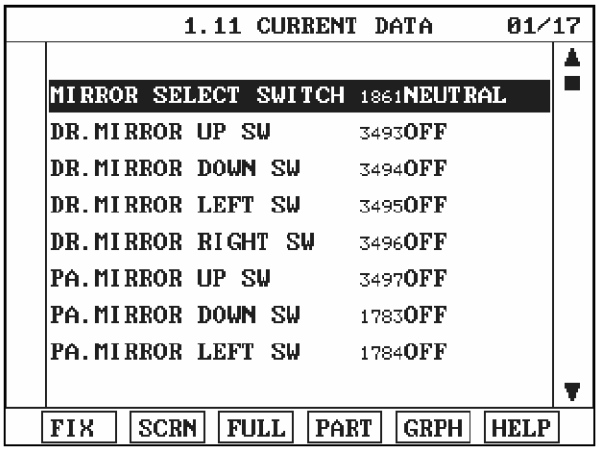
4. Select option "Input/Output monitoring".




SBHBE9114L




SBHBE9115L



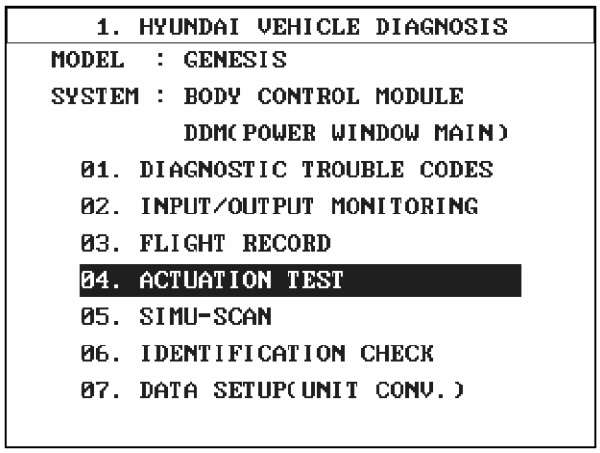

SBHBE9116L

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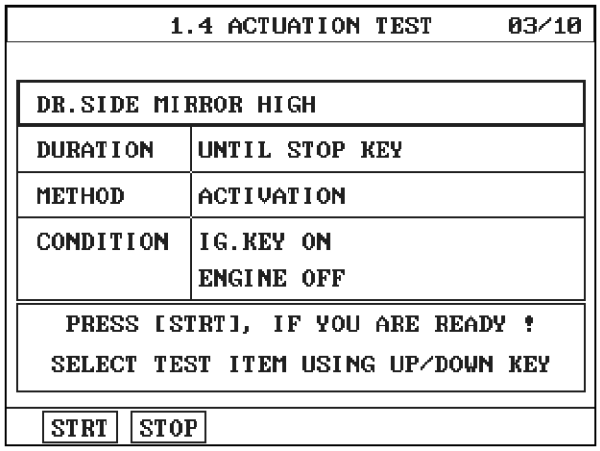
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5. To check the input value of door lock switch in force mode, select option "ACTUATION TEST".




SBHBE9117L

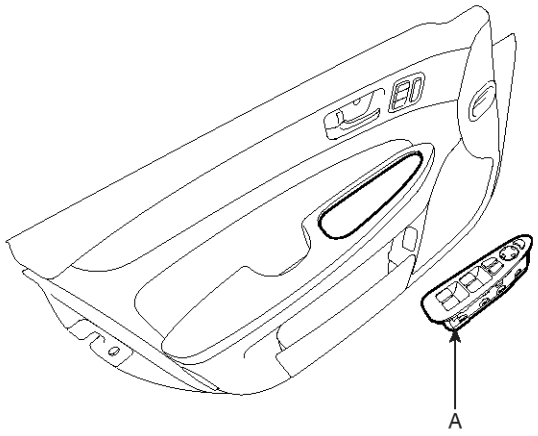



SBHBE9118L

## Removal

### Driver Door Lock Switch

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




SBHBE8375D

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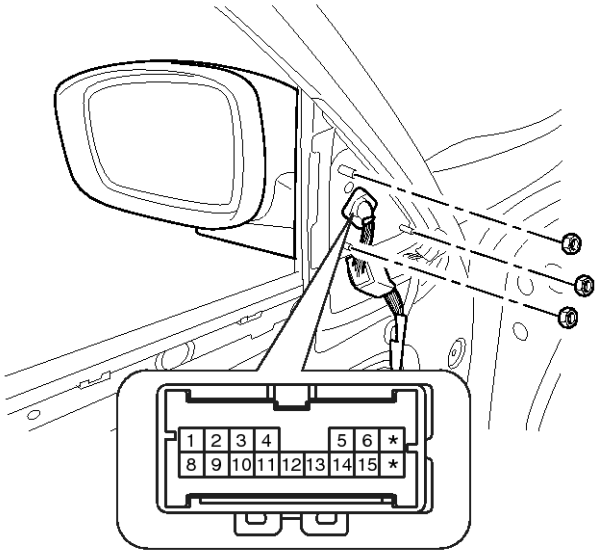
https://autolibrary.ir



## Power Door Mirror Actuator

### Inspection

1. Remove the front door quadrant inner cover. Take care not to damage fixing clips. (Refer to the Body group - front door)
2. Disconnect the power door mirror connector from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.




SBHBE8376D

| | DIR | 1 | 2 | 3 | B | GND | 13 | 12 |
|---|---|---|---|---|---|---|---|---|
| LH | UP | | ○ | ○ | ○ | ○ | ▲ | |
| | DOWN | | ○ | ○ | ○ | ○ | ▼ | |
| | RIGHT | ○ | | ○ | ○ | ○ | | ▲ |
| | LEFT | ○ | | ○ | ○ | ○ | | ▼ |
| RH | UP | | ○ | ○ | ○ | ○ | ▲ | |
| | DOWN | | ○ | ○ | ○ | ○ | ▼ | |
| | RIGHT | ○ | | ○ | ○ | ○ | | ▲ |
| | LEFT | ○ | | ○ | ○ | ○ | | ▼ |

▲ Increase Voltage
▼ Decrease Voltage

SBHBE9119L

### Mirror Heater

| Terminal / Position | 9 | 8 |
|---|---|---|
| Heater | ○ | ○ |

SBHBE9120L

### EC Function

| Terminal / Position | 14 | 15 |
|---|---|---|
| Mirror lamp | ⊕ | ⊖ |

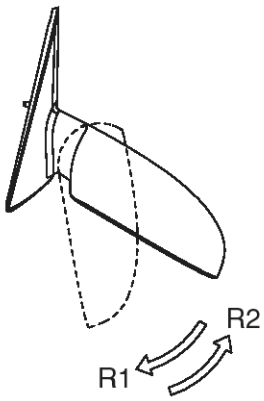
SBHBE9121L

### Turn Signal Lamp

| Terminal / Position | 6 | 8 |
|---|---|---|
| Turn signal lamp | ⊕ | ⊖ |

SBHBE9122L

### Fording Mirror




ETJA055B

| Terminal / Position | BAT (+) | GND (-) | 4 | 5 |
|---|---|---|---|---|
| Folding (R1) | ○ | | ○ | ○ |
| Unfolding (R2) | ○ | | | ○ |

SBHBE9470L

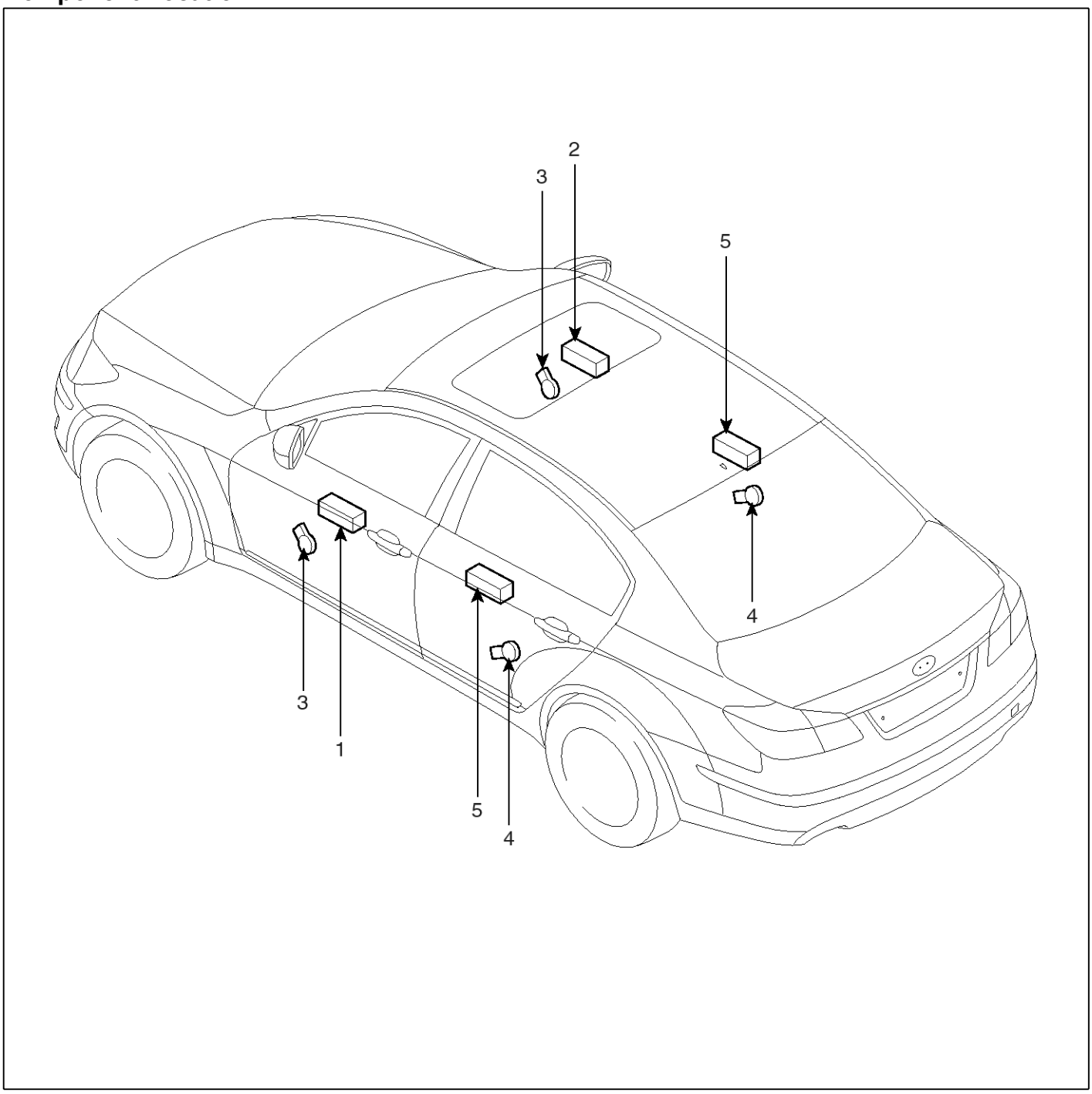
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# Power Windows

## Component Location




SBHBE8381D

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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## Function Of Safety Power Window

When driver door power window auto-up switch is operated, safety function is activated.

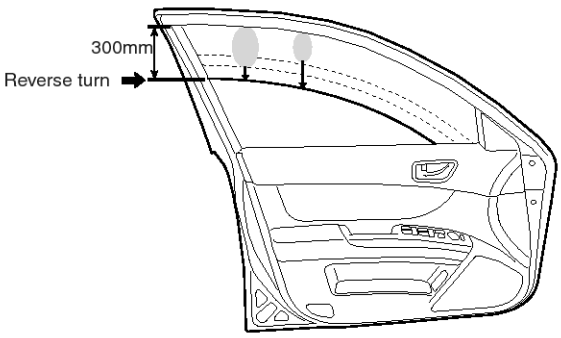
1. Safety function condition

   When detect the force of 100N (using the 10N/mm spring) during the window rising, window is reversed.

2. Length of window reversing (except holding the auto-up switch)

   - When detect the jamming during the 4mm ~ 250 mm from top of the door.

     → Window is reversed until 300mm from top of the door.

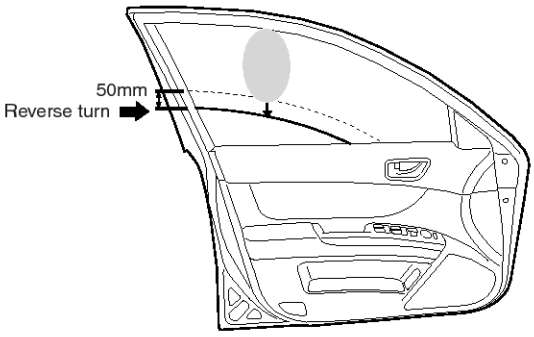



When detect the jamming during the 4mm~250mm from top of the door

ETRF320B

   - When detect the jamming over the 250mm from top of the door.

     → Window is reversed until 50mm from jamming position.




When detect the jamming over the 250mm from top of the door

ETRF320C

3. Length of window reversing (holding the auto-up switch)

   - When detect the jamming during holding the auto-up switch.

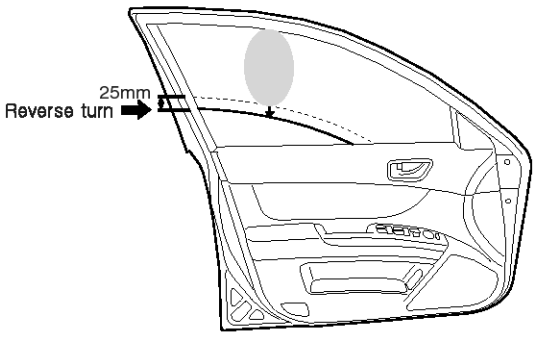
     → Window is reverse until 25mm from jamming position.

   - Auto-up function is not available during the 5 seconds from above condition.

     → When holding the auto-up switch, window is operated as a manual-up function. (Safety function is not activated.)

   - When holding the auto-up switch after 5 seconds from above condition.

     → Window is reverse until 25mm from jamming position.




When holding the auto-up switch

ETRF320D

4. Safety function is not available area

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

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### Initializing Method Of The Safety Power Window

1. Initializing of Battery Connection

   When the battery is not connected after disconnecting the battery, safety power window switch need the initializing.

   1) Power window operation before initializing
      - Manual-Up/Safety function is available
      - Auto-Up function is not available

        (When holding the auto-up/down switch, window is operated as a manual-up/down.)
   2) Initializing method

      Close the window in window open position, and holding the switch in window full close position over the 0.2 second.

      (If start the closing the window in window full close position, initializing could be failed.)
   3) If initialize the safety power window in jamming status, could occur below conditions.
      - Safety function is not available
   4) Position control

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

      **NOTICE**

      *Motor position is only valid if the system stays in normalized state. (see initialization force limitation).*
   5) Recall and storing the normalization information

      ECU records the normalization information into the specified location in Flash ROM. (as long as Flash ROM page is valid)
      - Storing conditions: 1 second after the motor stops
      - Recall conditions:

        Engine = on OR

        Power On Reset
   6) Switch signal filtering

      Debouncing time: 14ms

      T1, t2 and t3: Measured with signal that debouncing is done. In case T1 > 6ms, motor shall operate. In case T2 > 22ms, motor might operate in manual mode.

      When Auto up switch input is active, auto up mode is active till 300ms. After this and until switch is released, panic mode is enable. In the end when the switch is released, auto up mode is enabled again.

      The conditions for terminating the motor control by the (Semi) Auto Up/Down or Manual Up/Down:
      - Out of the operation voltage range OR
      - Thermal protection ON OR
      - Anti-pinch function OR
      - De-normalization OR
      - Engine = OFF OR
      - Other key input occurs

2. Thermal protection

   Software provides an algorithm in order to prevent the motor from thermal overheating under the specified conditions like the valid Flash ROM Data.

   After power on reset, the software thermal counter starts to count from the initial value. In case of motor running, software increases the thermal counter by using the motor heating characteristic, otherwise the thermal counter decreases by using the motor cooling characteristic.

   There exist 2 thermal protection limits. If the software thermal counter is over the first limit, the motor movement stops until the software thermal counter decrease to the release limit temperature value, but still allows the current movement to finish. If the software thermal counter is over the second limit (while motor running), the movement stops at once until the release temperature value is reached (reversing will not be interrupted by software thermal protection).

   The motor is able to continue to operate at least "15" cycles without a break under the above conditions and after thermal protection is activated, the motor turns to the operational condition within "35±5" seconds.

   Test starts with SW-thermal counter at the initial value.

   Cycle: Full closed → 1sec. rest → Full opened → 1sec. rest

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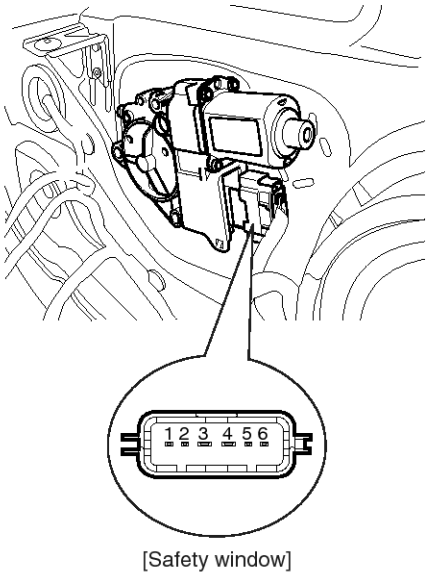


# Power Window Motor

## Inspection

### Front Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the front door trim. (Refer to the Body group-front door)
3. Disconnect the motor connector from the motor.




SBHBE9308L

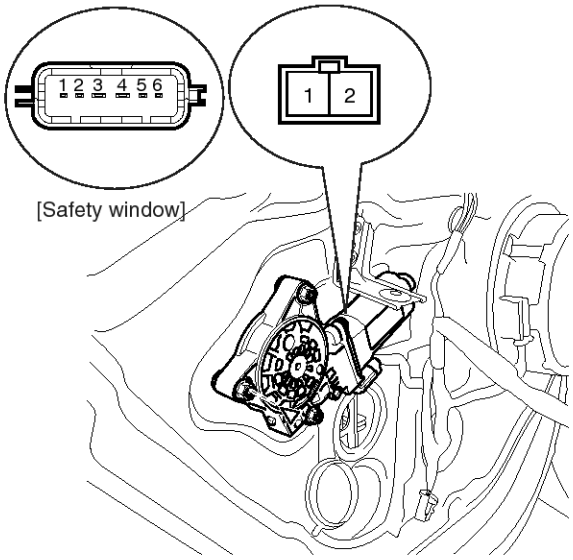
4. Connect the motor terminals directly to battery voltage (12V) and check that the motor operates smoothly. Next, reverse the polarity and check that the motor operates smoothly in the reverse direction. If the operation is abnormal, replace the motor.

| Position \ Terminal | | | 1 | 2 | 3 | 4 | 6 |
|---|---|---|---|---|---|---|---|
| Left | UP | Clockwise | ⊖ | ⊕ | ⊕ | ⊖ | ⊕ |
| | DOWN | Counter-clockwise | ⊕ | ⊖ | ⊕ | ⊖ | ⊖ |
| Right | DOWN | Clockwise | ⊖ | ⊕ | ⊕ | ⊖ | ⊕ |
| | UP | Counter-clockwise | ⊕ | ⊕ | ⊕ | ⊖ | ⊖ |

SBHBE9131L

### 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.




SBHBE9455L

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 | ⊖ | ⊕ |

SCMBE6272L

**[Satety Window]**

| Position \ Terminal | | | 1 | 3 | 4 | 6 |
|---|---|---|---|---|---|---|
| Left | UP | Clockwise | ⊖ | ⊕ | ⊕ | ⊕ |
| | DOWN | Counter-clockwise | ⊕ | ⊕ | ⊕ | ⊖ |
| Right | DOWN | Clockwise | ⊖ | ⊕ | ⊕ | ⊕ |
| | UP | Counter-clockwise | ⊕ | ⊕ | ⊕ | ⊖ |

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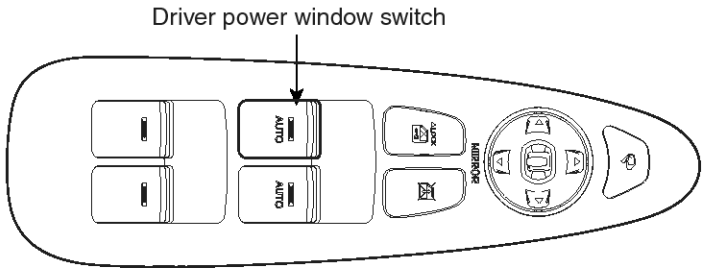
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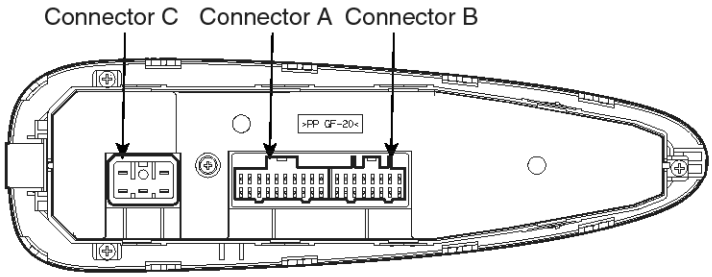


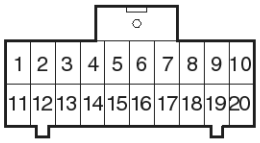
## Power Window Switch

### Components

### Power Window Main Switch

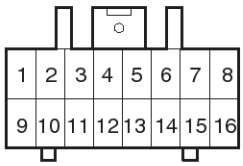


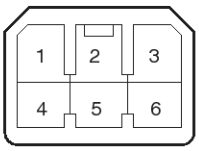

Connector A

| Pin | Description |
|---|---|
| 1 | Mirror sensor power |
| 2 | Mirror sensor V |
| 3 | Mirror sensor H |
| 4 | Mirror sensor GND |
| 5 | Mirror fold |
| 6 | Mirror unfold |
| 7 | Mirror H output |
| 8 | Mirror communication |
| 9 | Mirror V output |
| 10 | RL power window up DDM |
| 11 | RL power window down DDM |
| 12 | RR power window up DDM |
| 13 | RR power window down DDM |
| 14 | SET switch |
| 15 | P1 switch |
| 16 | P2 switch |
| 17 | Trunk open switch |
| 18 | Driver key lock |
| 19 | Driver key unlock |
| 20 | Local communication |




Connector B

| Pin | Description |
|---|---|
| 1 | GND 1 |
| 2 | Window up |
| 3 | Window down |
| 4 | Window enable |
| 5 | - |
| 6 | - |
| 7 | Battery |
| 8 | CAN high |
| 9 | Illumination + |
| 10 | Illumination - |
| 11 | Driver unlock state |
| 12 | RL unlock state |
| 13 | - |
| 14 | - |
| 15 | IGN1 DDM |
| 16 | CAN low |




Connector C

| Pin | Description |
|---|---|
| 1 | GND 2 |
| 2 | Mirror power |
| 3 | Driver door lock relay |
| 4 | Door lock power |
| 5 | Driver door unlock relay |

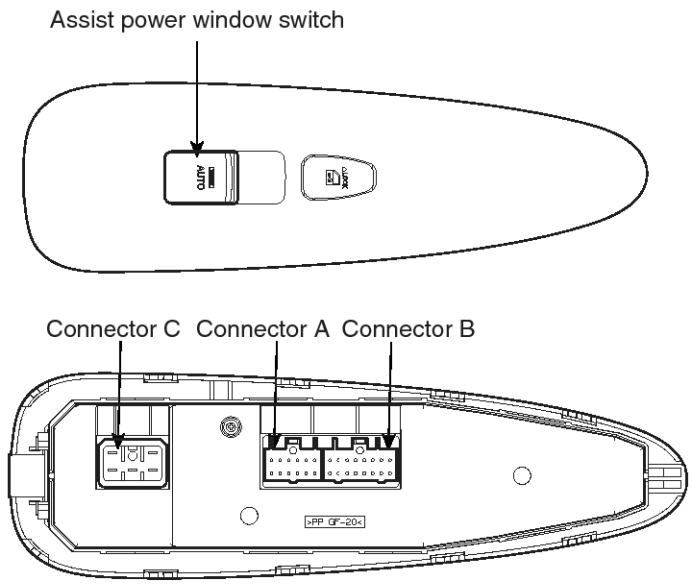
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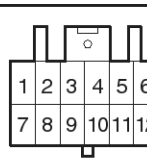
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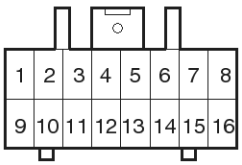
## Assist Power Window Switch



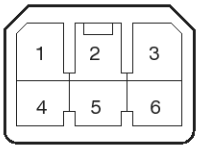

Connector A

| Pin | Description |
|---|---|
| 1 | Mirror sensor power |
| 2 | Mirror sensor V |
| 3 | Mirror sensor H |
| 4 | Mirror sensor GND |
| 5 | Mirror fold |
| 6 | Mirror unfold |
| 7 | Mirror H output |
| 8 | Mirror communication |
| 9 | Mirror V output |
| 10 | ESC output |




Connector B

| Pin | Description |
|---|---|
| 1 | GND 1 |
| 2 | Window up |
| 3 | Window down |
| 4 | Window enable |
| 5 | - |
| 6 | - |
| 7 | Battery |
| 8 | CAN high |
| 9 | Illumination + |
| 10 | Illumination - |
| 11 | Driver unlock state |
| 12 | Rear seat unlock state |
| 13 | - |
| 14 | - |
| 15 | IGN1 ADM |
| 16 | CAN low |




Connector C

| Pin | Description |
|---|---|
| 1 | GND 2 |
| 2 | Mirror power |
| 3 | Assist door lock relay |
| 4 | Door lock power |
| 5 | Driver door unlock relay |

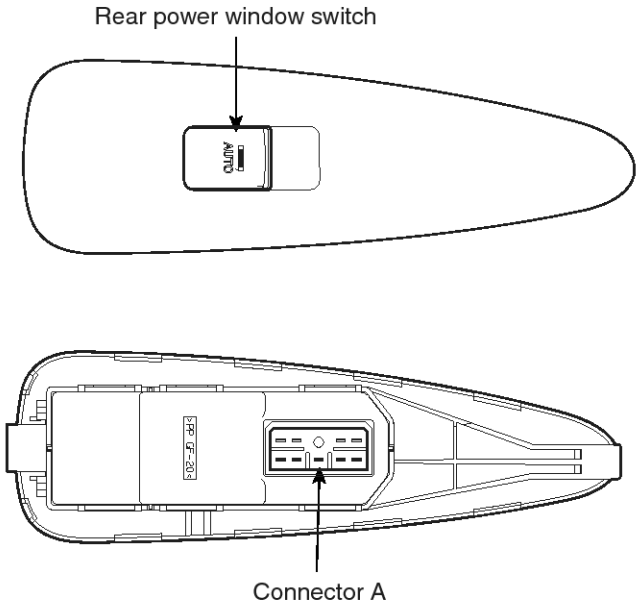
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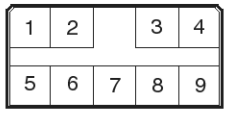
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## Rear Power Window Switch




Connector A

| Pin | Description |
|---|---|
| 1 | Power |
| 2 | Window up relay |
| 3 | Window down relay |
| 4 | GND 2 |
| 5 | Illumination + |
| 6 | Window up DDM |
| 7 | Window down DDM |
| 8 | Window enable DDM |
| 9 | Illumination - |

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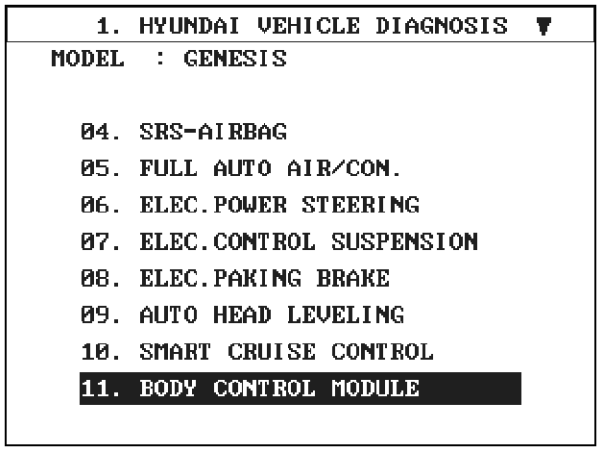
https://autolibrary.ir



## Inspection

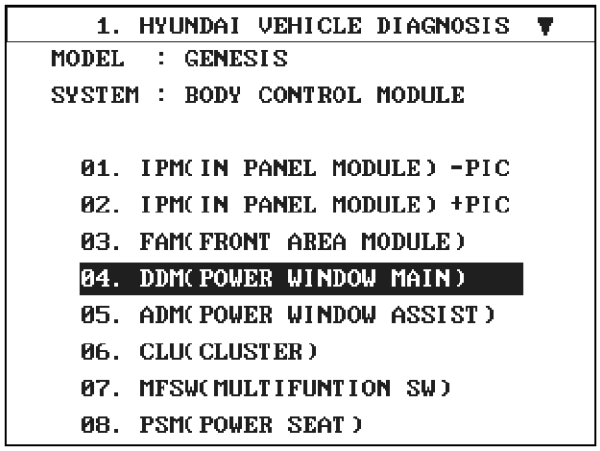
### Driver Power Window Switch

1. When checking the driver power window switch, select a vehicle type and "BODY CONTROL MODULE" menu.



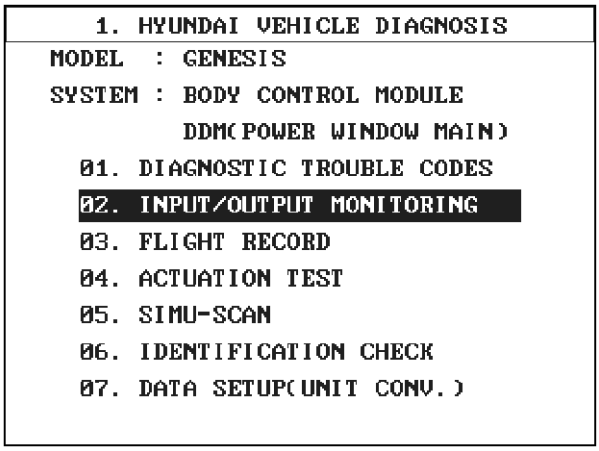

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2. Select "DRIVER DOOR MODULE(DDM)".

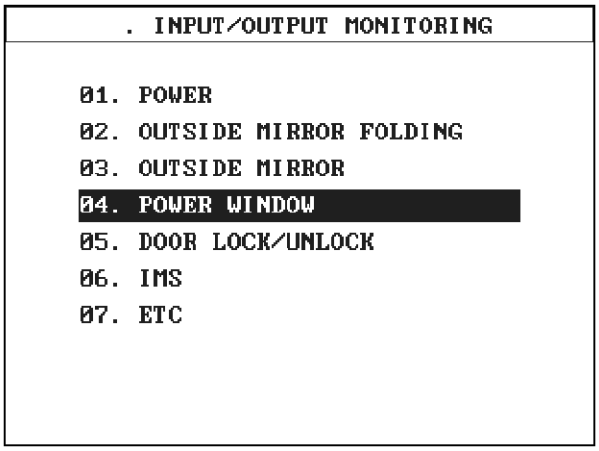



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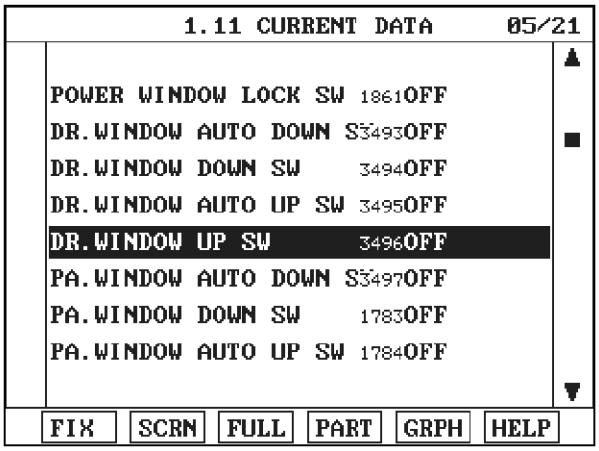
3. Select option "Input/Output monitoring".




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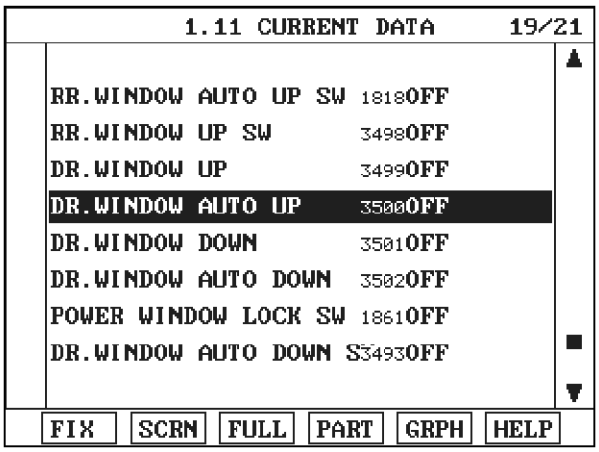



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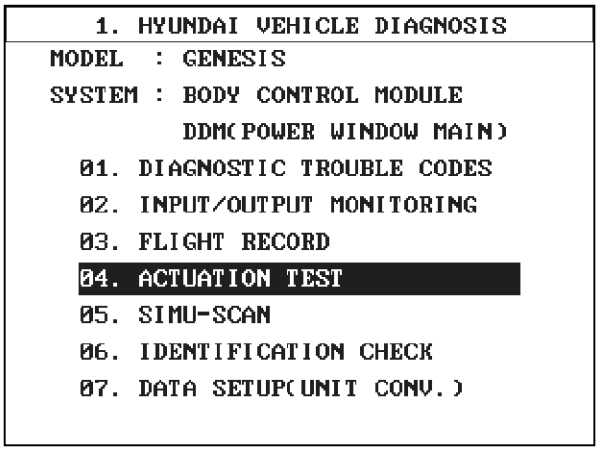
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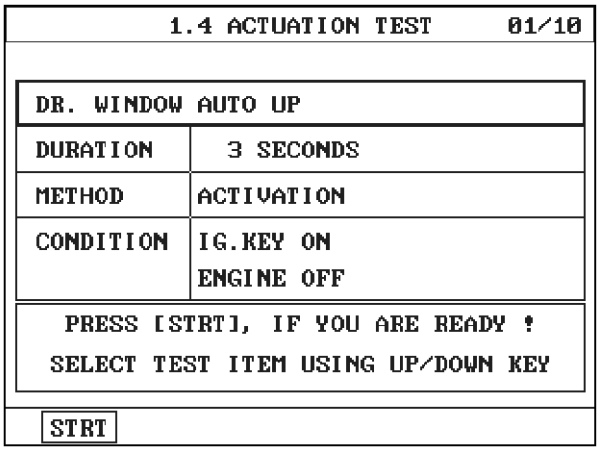



SBHBE9140L

4. To check the input value of power window switch in force mode, select option "ACTUATION TEST".



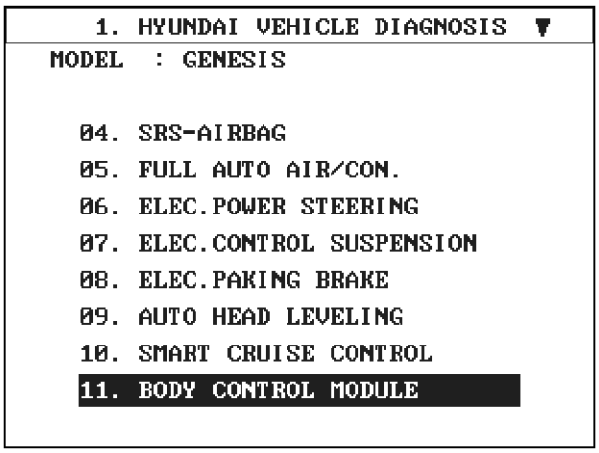

SBHBE9141L




SBHBE9142L

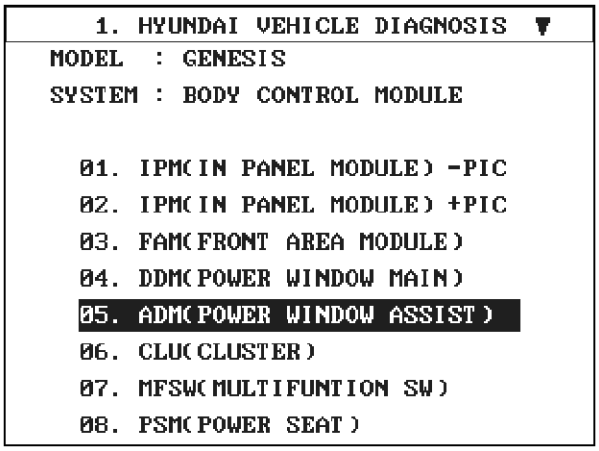
### Assist Power Window Switch

1. When checking the assist power window switch, select a vehicle type and "BODY CONTROL MODULE" menu.



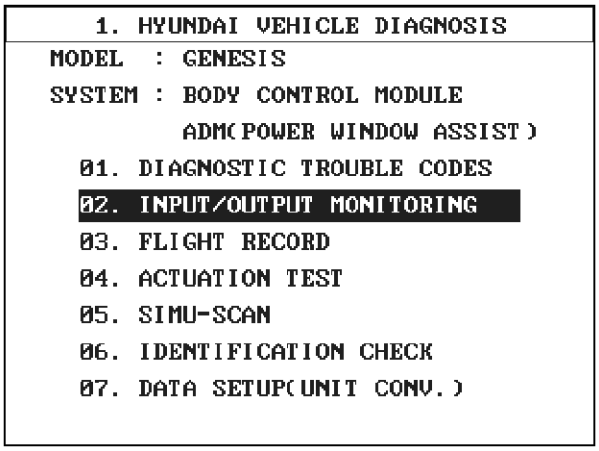

SBHBE9135L

2. Select "ASSIST DOOR MODULE(ADM)".




SBHBE9143L

3. Select option "Input/Output monitoring".

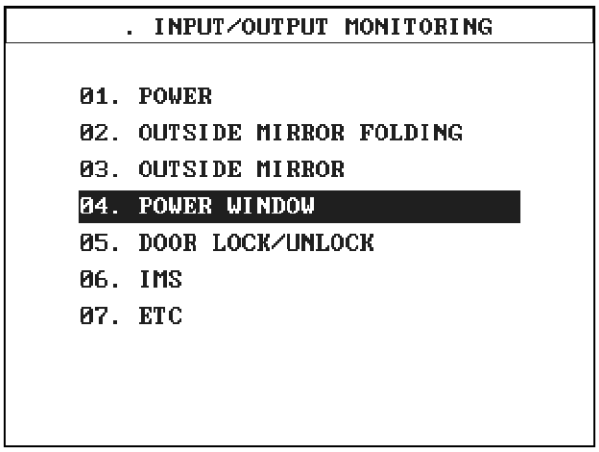



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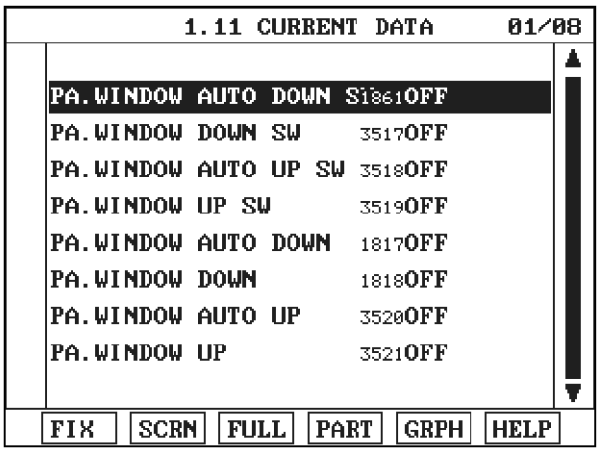
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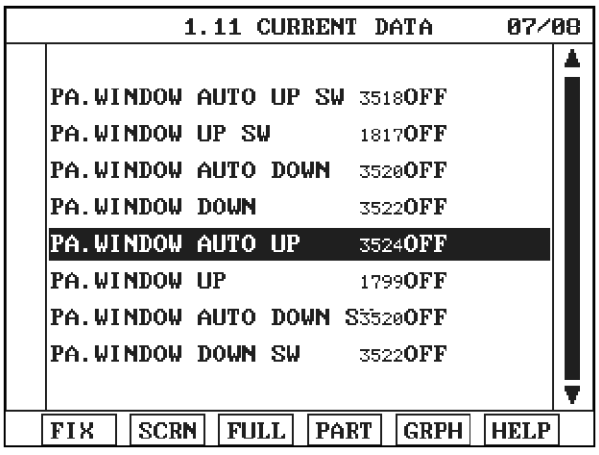
SBHBE9144L




SBHBE9138L

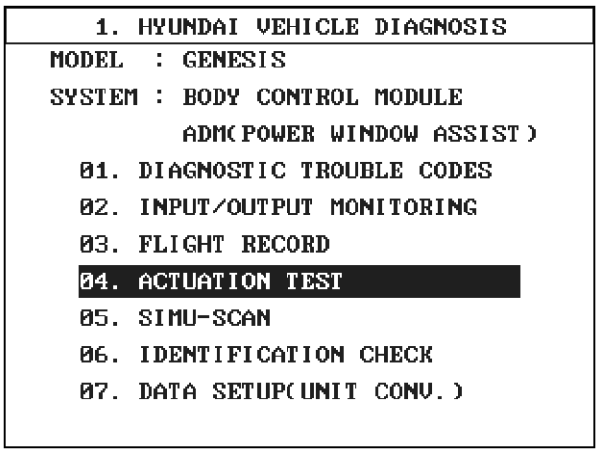



SBHBE9145L

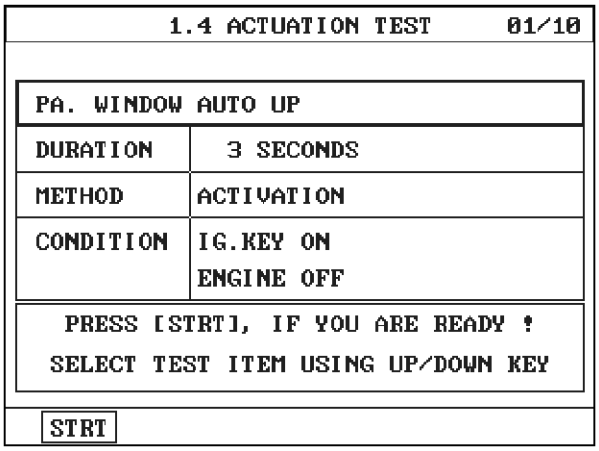



SBHBE9146L

4. To check the input value of power window switch in f-orce mode, select option "ACTUATION TEST".




SBHBE9147L




SBHBE9148L

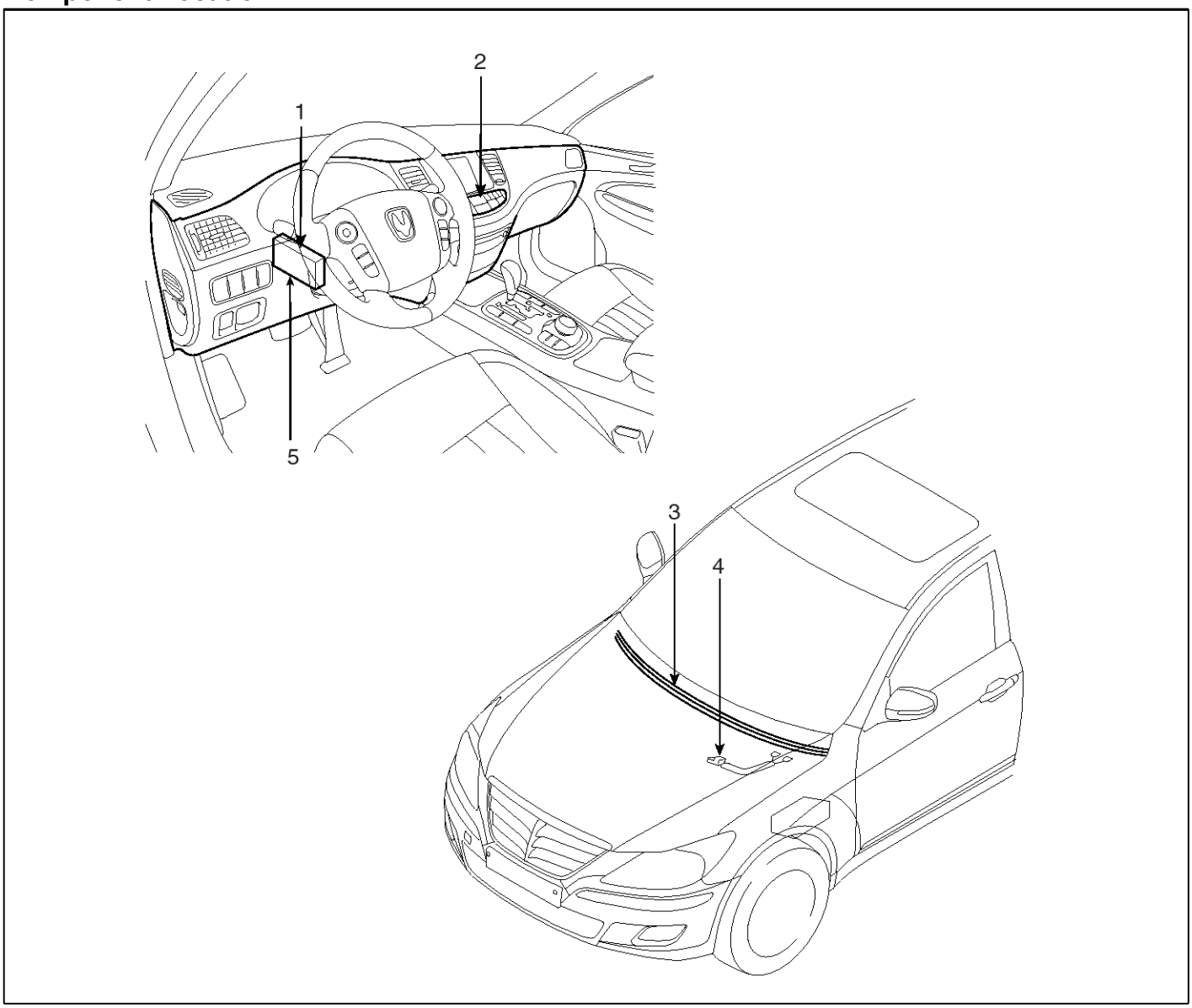
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# Windshield Deicer

## Component Location




SBHBE8365D

1. IPM (Instrument Panel Module)
2. Windshield deicer switch
3. Windshield deicer
4. Deicer connector
5. Windshield deicer relay (Built-in IPM)

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## Description

Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the l ower part of windshield, switch and relay. Body control module receives an input signal from the deicer switch, t- hen controls relay. Operating condition is the same that of rear window defogger system.

Since the generator "L" is switched ON, if the deicer swit- ch is ON, then deicer output is ON for 20 minutes.

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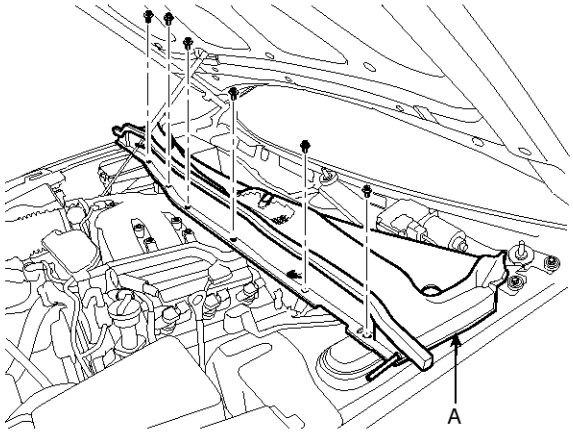
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## Windshield Deicer

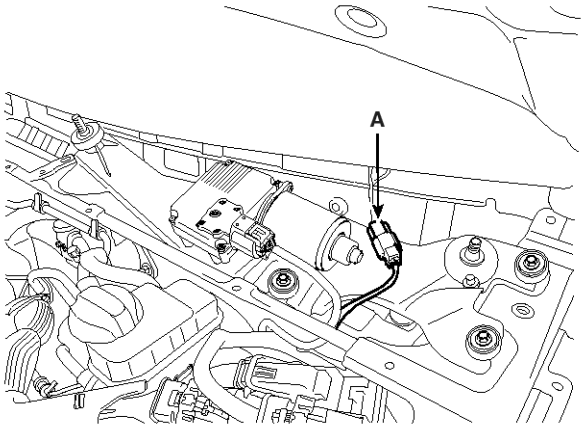
### Inspection

1. Remove the cowl top cover (A).(Refer to the Body group - wiper)



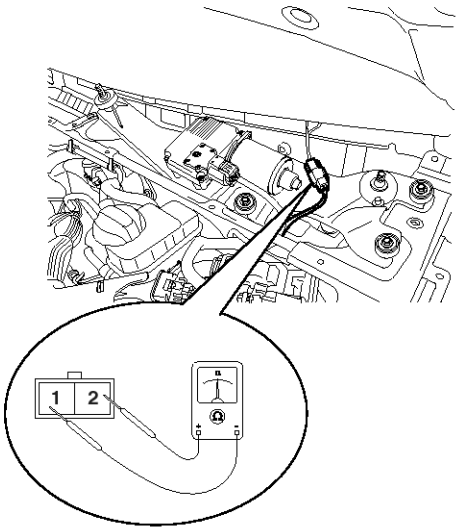

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2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.




SBHBE8367D

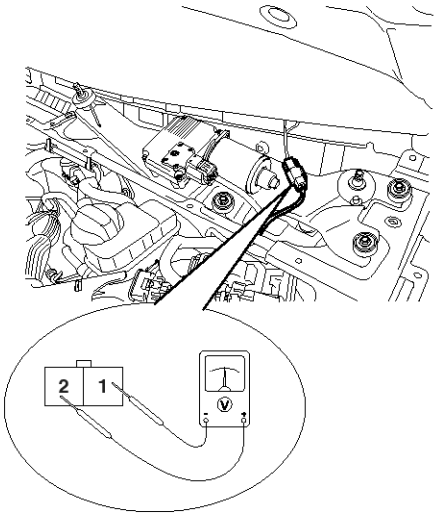
3. Check for continuity between the terminals of deicer lines.




SBHBE8368D

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

**OK:** approx. Battery voltage




SBHBE8369D

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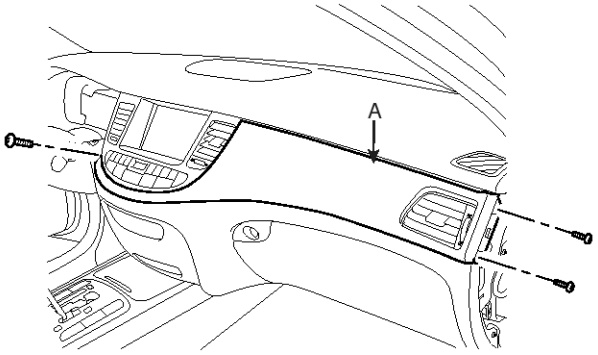
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## Windshield Deicer Switch

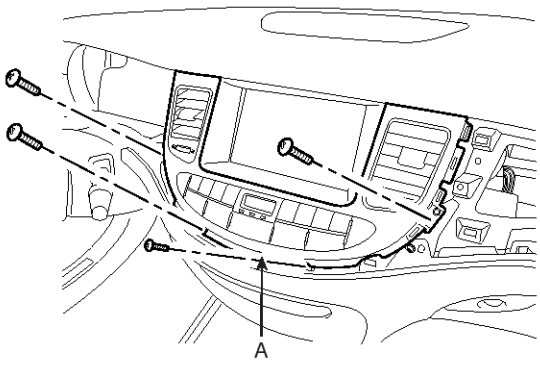
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (Refer to the Body group - Crash pad)
3. Remove the cluster fascia panel.
4. Remove the crash pad side garnish (A) after removing the screws.



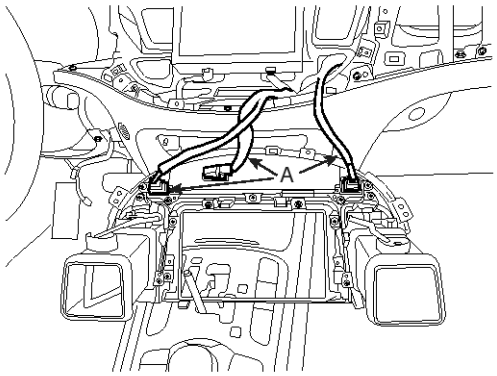

SBHBE8370D

5. Remove the center fascia panel (A) after removing the screws.



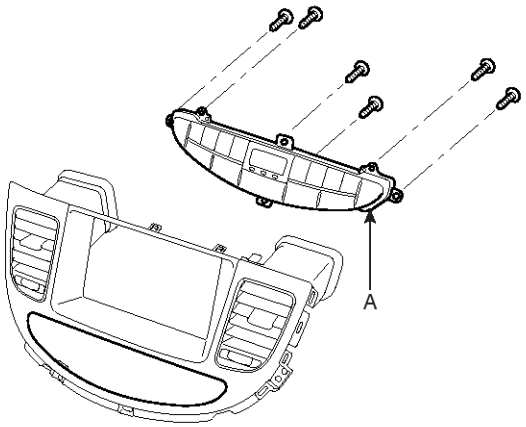

SBHBE8371D

6. Remove the connectors (A).




SBHBE8372D

7. Remove the screws and heater control unit keyboard (A).




SBHBE8373D

### Installation

1. Install the heater control unit keyboard after connecting the connectors.
2. Install the center fascia panel.
3. Install the crash pad side garnish, cluster fascia panel, crash pad lower panel.

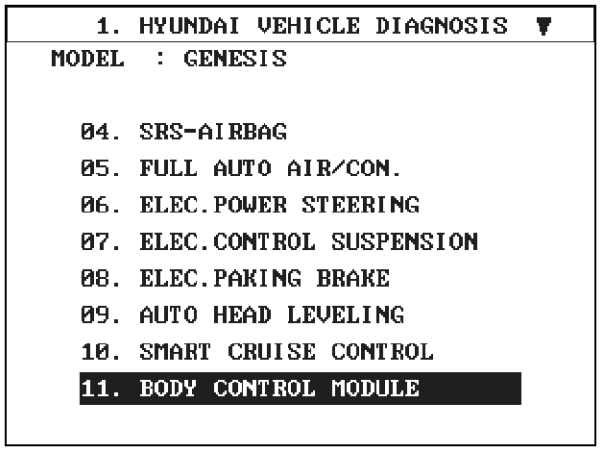
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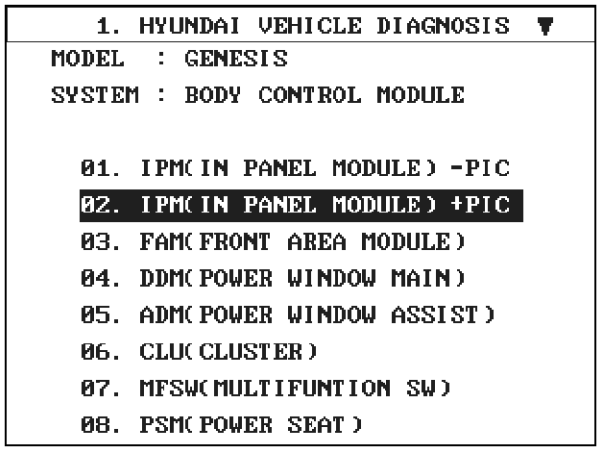


## Inspection

1. Check BCM input/output specification of windshield deicer switch using the scan tool. If the specification i s abnormal, replace the windshield deicer switch module.

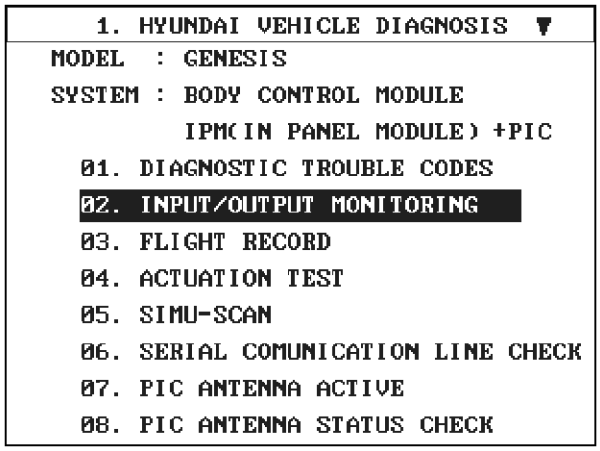



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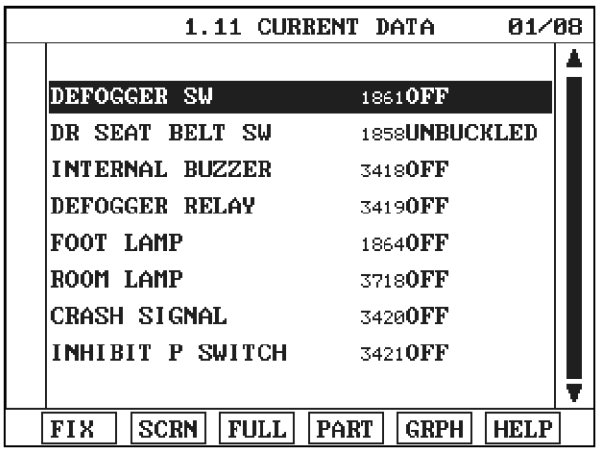



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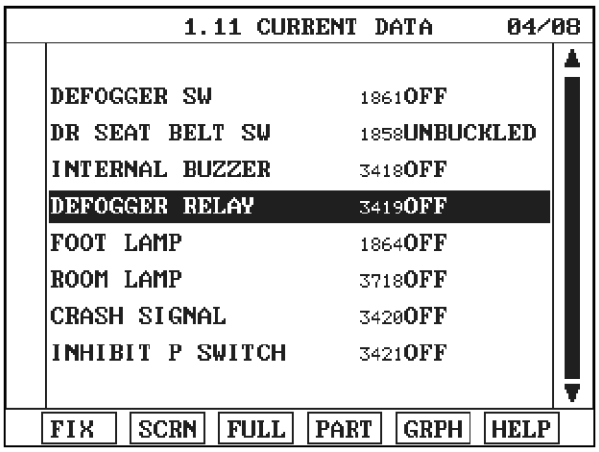
2. Select option "Input/output monitoring".




SBHBE9161L

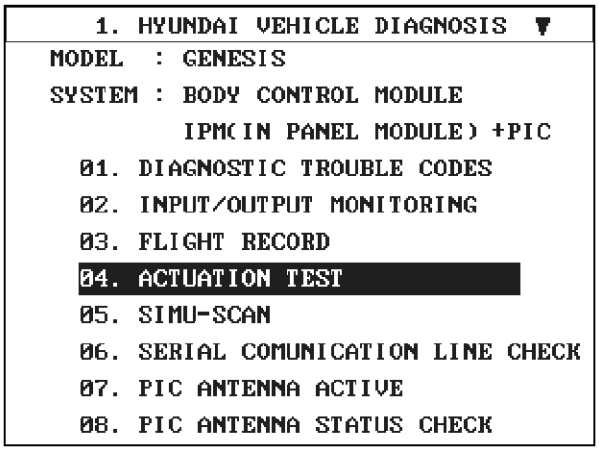



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3. To check the input value of windshield deicer switch i n force mode, select option "Actuation test".

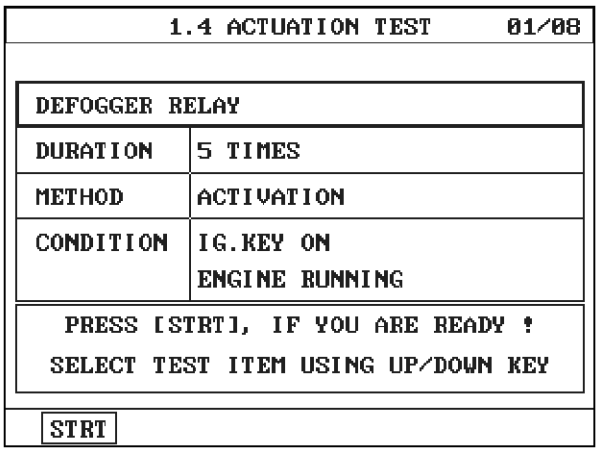



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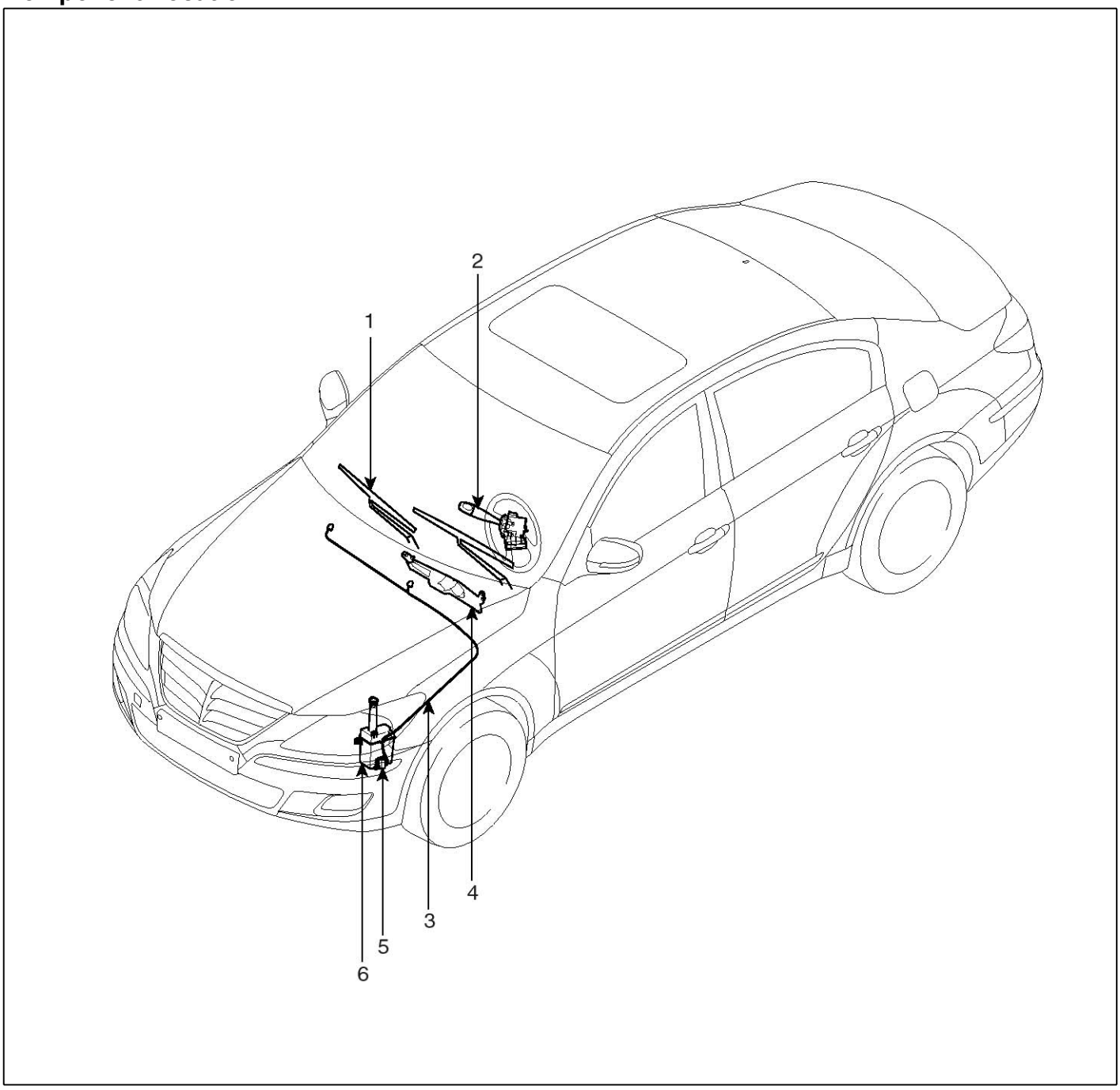
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# Windshield Wiper/Washer

## Component Location




SBHBE8051D

1. Windshield wiper arm & blade
2. Wiper & washer switch
3. Windshield washer hose
4. Windshield wiper motor & linkage
5. Washer motor
6. Washer reservoir

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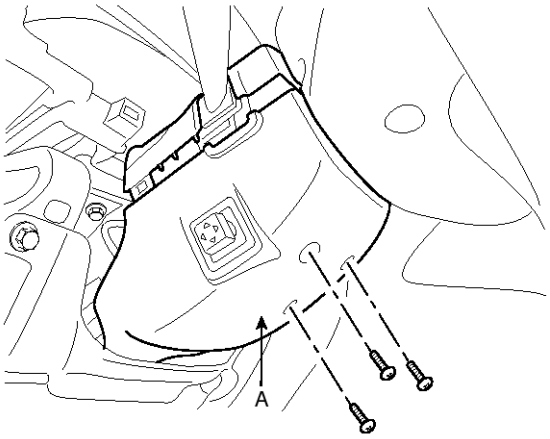
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## Windshield Wiper-Washer Switch

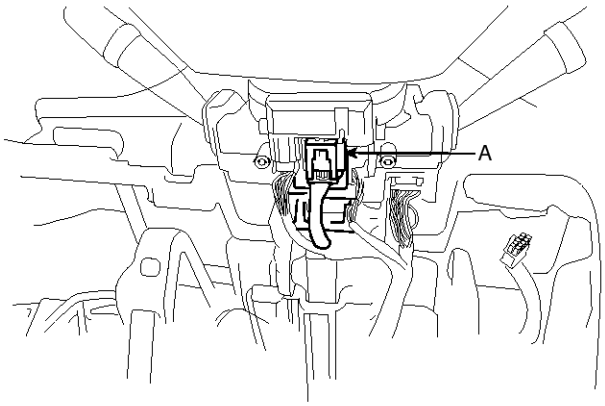
### Removal

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

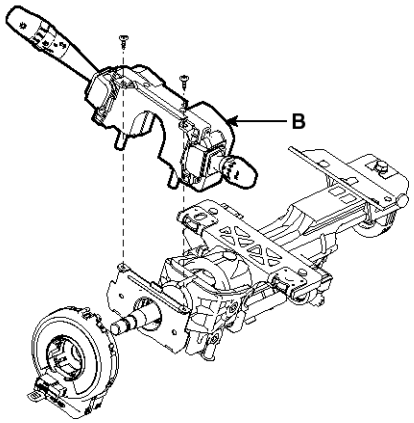



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2. Remove the multi function switch assembly (A) after disconnecting the connector and removing the screws (2EA).




SBHBE8107D




SBHBE8105D

### Installation

1. Install the multi function switch assembly after connecting the connectors.
2. Install the steering column upper and lower shrouds.

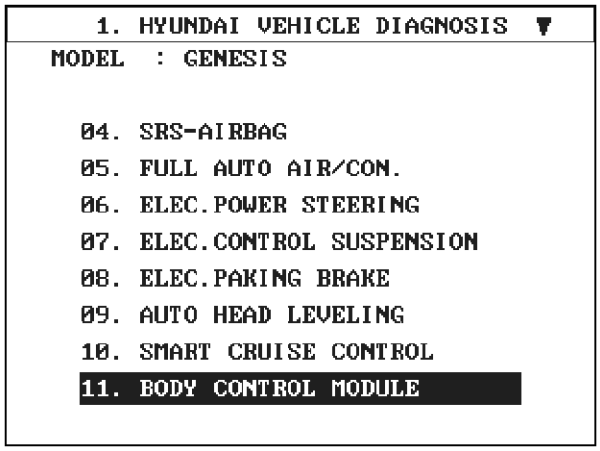
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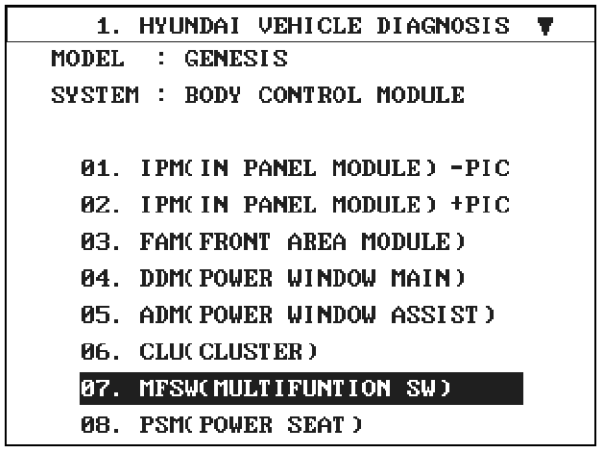


## Inspection

1. Check BCM input/output specification of windshield wiper/washer switch using the scan tool. If the specification is abnormal, replace the windshield deicer switch module.

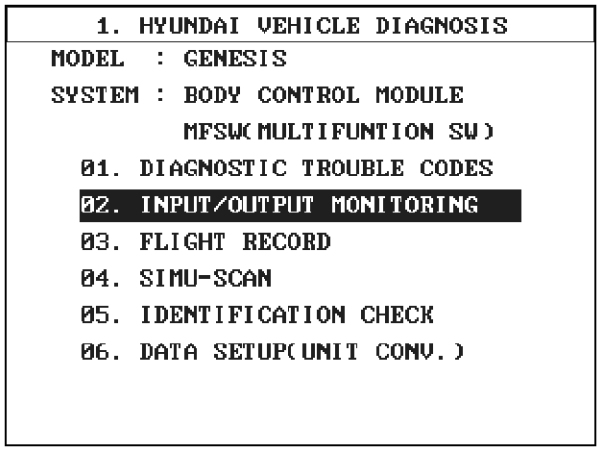



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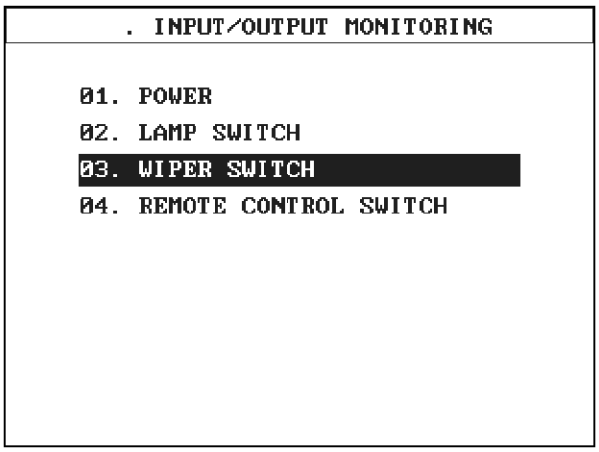



SBHBE9166L

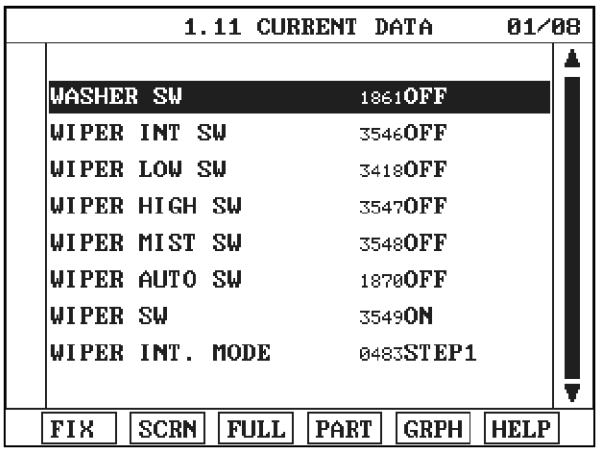
2. Select option "Input/output monitoring".



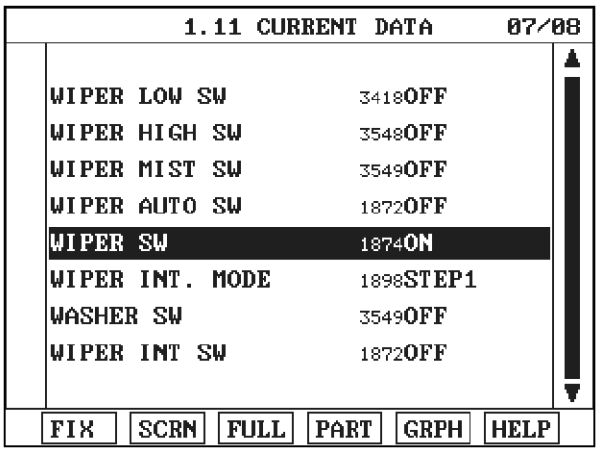

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SBHBE9168L




SBHBE9169L




SBHBE9170L

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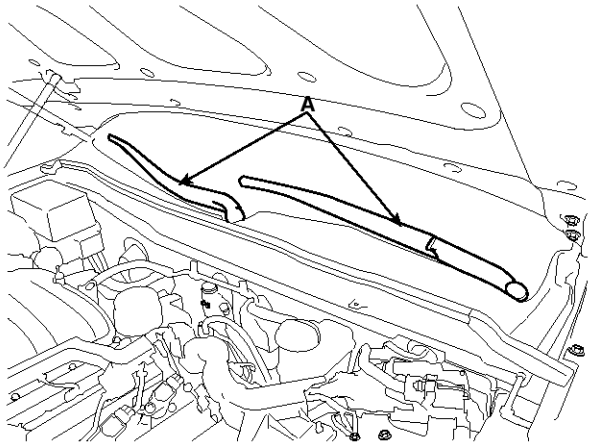


## Front Wiper Motor

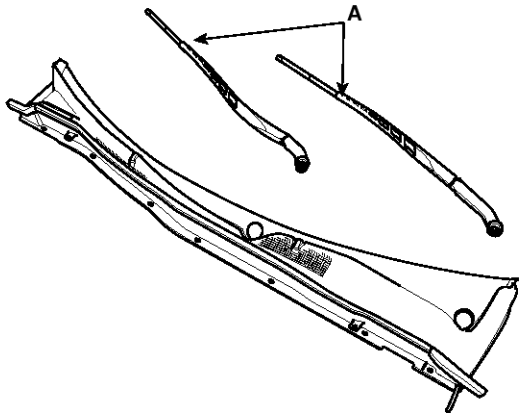
### Removal

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

**Tightening torque :**
27~31 Nm (2.8~3.2 kgf.m, 20~23 lb-ft)

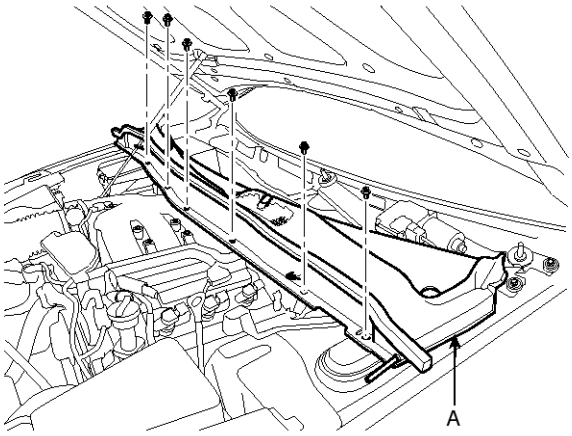



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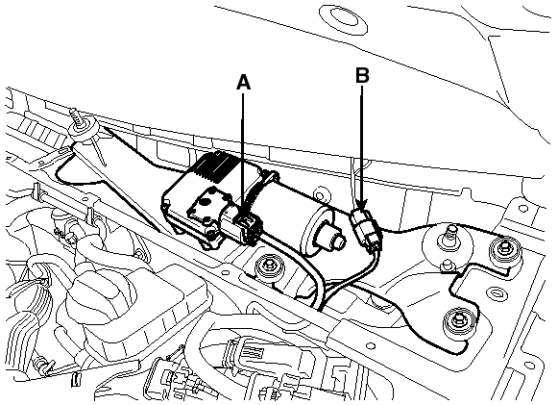
2. Remove the weather strip then remove the cowl top cover (A) after removing 6 clips.




SBHBE8053D

3. Remove the windshield wiper motor and linkage assembly after removing 4 bolts. Disconnect the wiper motor connector (A) and windshield deicer connector (B) from the wiper motor & linkage assembly.

**Tightening torque :**
7-11Nm (0.7-1.1, kgf.m, 5.0-7.9 lb-ft)




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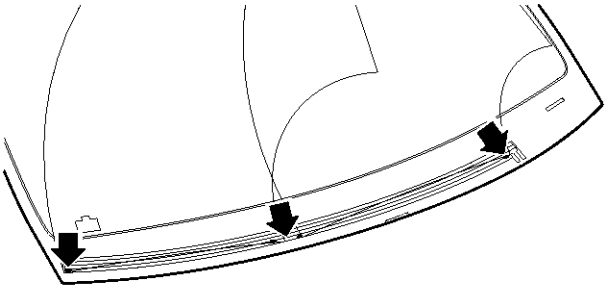
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## Installation

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



SBHBE8055D

**NOTICE**

*For your convenience, move the windshield wiper blades to the service position as follows;*

1. *Remove the key from the ignition switch.*
2. *Move the wiper switch to the single wiping position and hold the switch until the wiper arm is in the fully up position.*
3. *Raise the wiper arm.*
4. *Replace the blade assembly.*
5. *Return the wiper arm on the windshield.*
6. *Turn the ignition switch to the ON position.*
7. *Move the wiper switch to any position and then to the OFF position.*

**CAUTION**

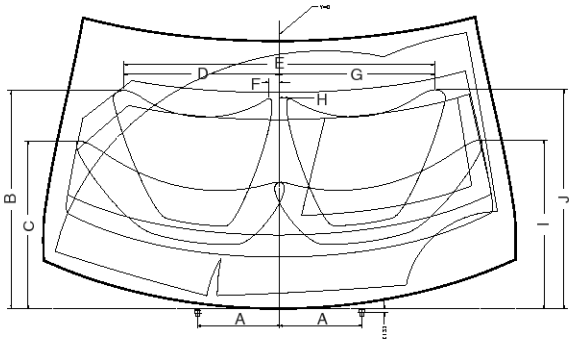
**Do not allow the wiper arm to fall against the windshield, since it may chip or crack the windshield.**

**CAUTION**

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

2. Set the washer nozzle on the specified spray position .

| Specified position | Distance [in (mm)] |
|---|---|
| A | 10.2 (260) |
| B | 27.1 (689) |
| C | 20.8 (530) |
| D | 17.0 (432) |
| E | 37.5 (954) |
| F | 1.25 (32) |
| G | 17.0 (432) |
| H | 1.25 (32) |
| I | 20.8 (530) |
| J | 27.1 (690) |




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# Front Washer Motor

## Removal

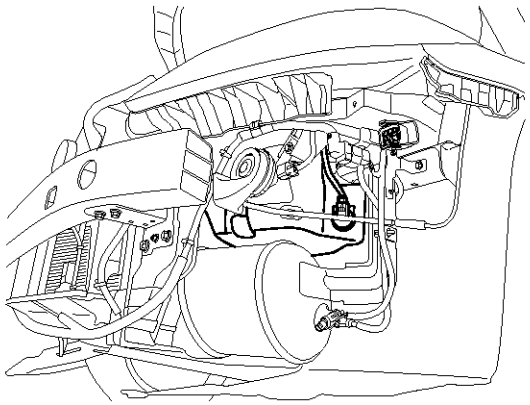
**CAUTION**

**a. When servicing the washer pump, be careful not to damage the washer pump seal.**

**b. Do not operate the washer pump before filling the washer reservoir.**

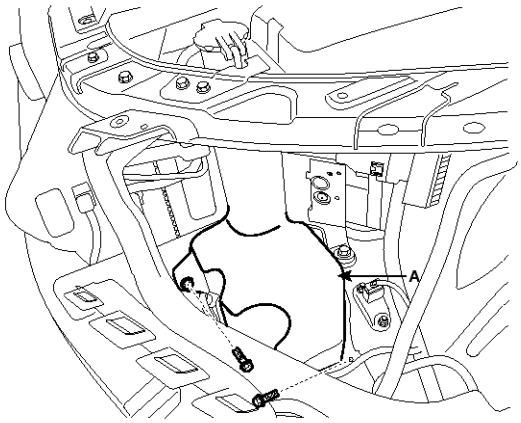
**Failure to do so could result in premature pump failure.**

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



SBHBE8110D

5. Remove the washer reservoir after removing 2 bolts.




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## Inspection

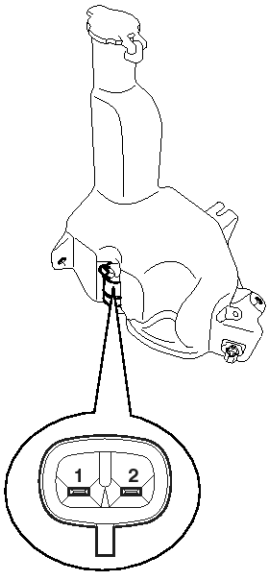
### Front Washer Motor

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

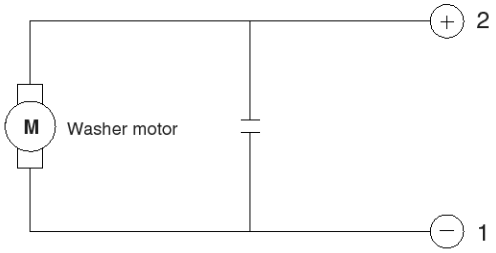
   **NOTICE**

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

2. Connect positive (+) battery cables to terminal 2 and negative (-) battery cables to terminal 1 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.




SBHBE9150L




[ Windshield washer motor ]

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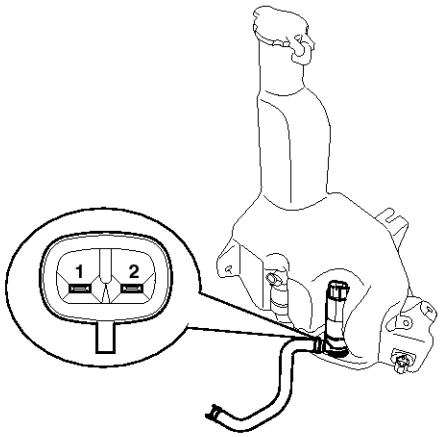


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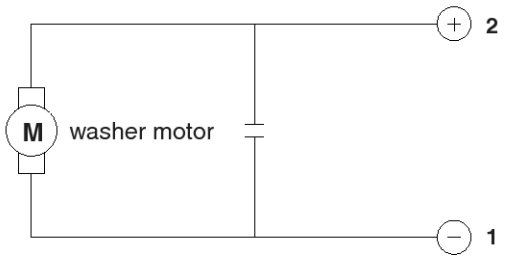
## Head Lamp Washer Motor

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

   **NOTICE**
   *Before filling the reservoir tank with water, check the filter for foreign material or contamination. if necessary, clean the filter.*
2. Connect positive (+) battery cables to terminal 2 and negative (-) battery cables to terminal 1 respectively.
3. Check that the motor operates normally and the washer motor runs and water sprays from the head lamp nozzles.
4. If they are abnormal, replace the washer motor.




SBHBE9171L




<Head lamp washer motor>

SBHBE9151L

## Installation

1. Install the washer reservoir.
2. Install the washer motor hose and connectors.
3. Install the front bumper cover.

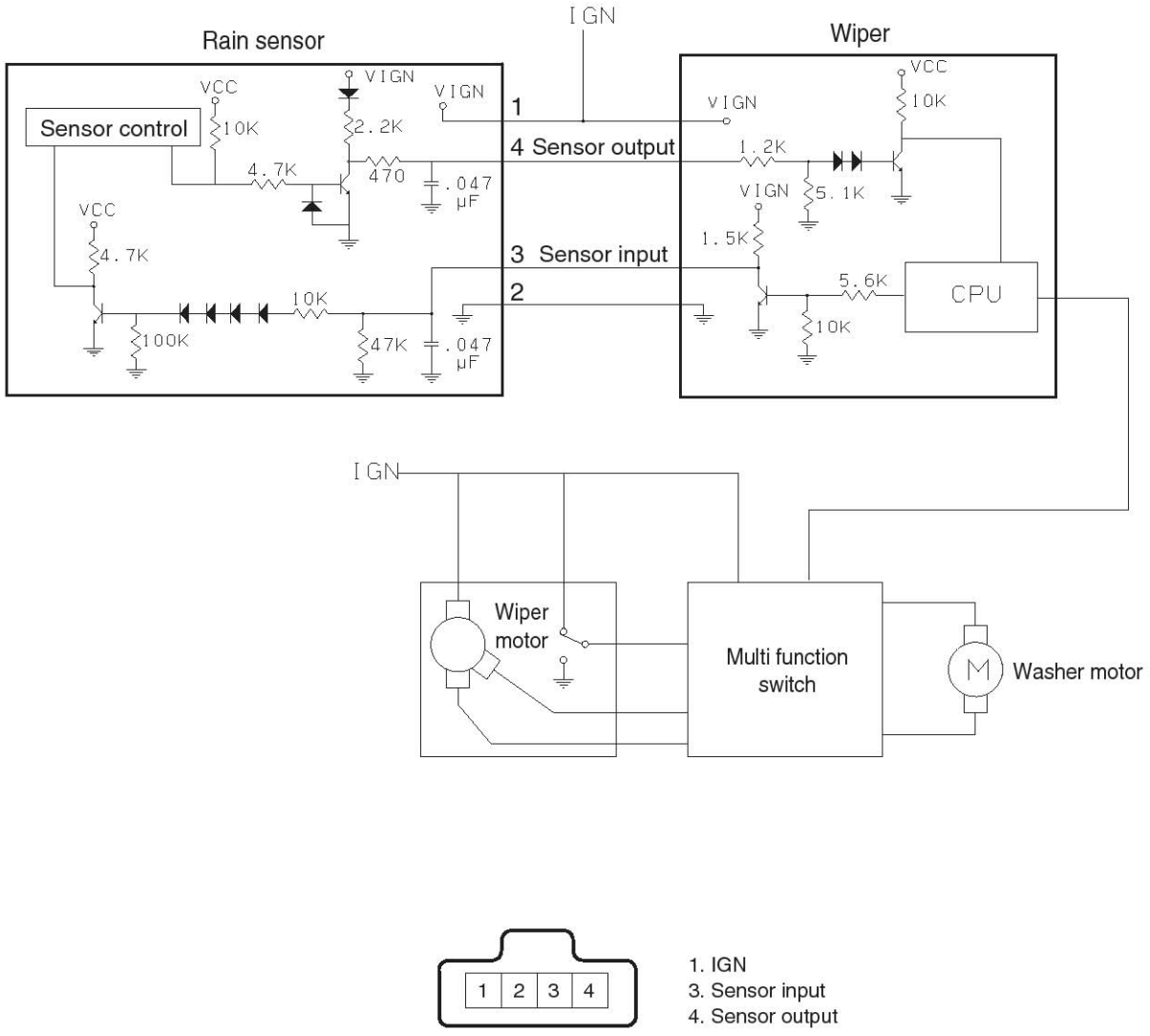
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## Rain Sensor

### Circuit Diagram




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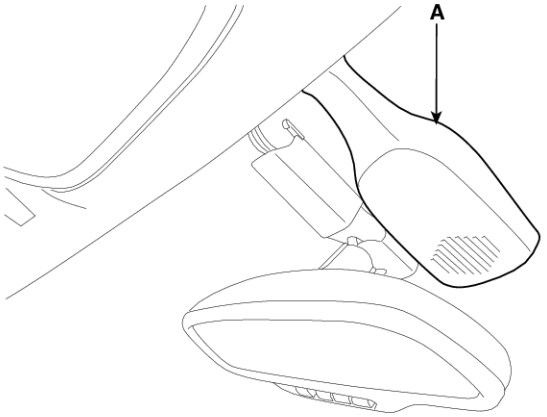
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## Description

The Rain sensing windshield wiper system is a wiper system that, in addition to providing normal wiper functions off, mist, manual low speed, manual high speed, and wash, provides automatic control of automatic intermittent automatic low, and automatic high speeds.

When the ignition key is in the ON position, the rain sensor (A) will be activated.




SBHBE8060D

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## Operating Modes - Rainsensing Windshield Wiper System

| MULTIFUNCTION SWITCH POSITION | RAINSENSOR OPERATING MODE | SENSOR ACTION |
|---|---|---|
| MIST | MIST | Mist is controlled by the column switch. The sensor has no affect on this function |
| OFF | OFF | If not already parked, wiper motor runs in low speed until blades are in the depressed park position. |
| AUTOMATIC<br>Automatic mode has 5 SENSITIVITY settings. | AUTOMATIC | AUTOMATIC<br>Automatic INT/speed control.<br>The sensitvity to raindrop accumulation on the windshield is set by the MULTIFUNCTION SWITCH sensitivity adjustment. |
| LOW SPEED | MANUAL | Wiper motor runs continuously in low speed, for example 45 wipes/minute.<br>The sensor has no affect on this function |
| HI SPEED | MANUAL | Wiper motor runs continuously in high speed, for example 60 wipes/minute.<br>The sensor has no affect on this function |
| WASH - DEMAND<br>WASHER SW ≥ 0.6 SEC | WASH | If washer sw on after 0.6 sec then wipes during 2.5 to 3.8 sec. The rain sensor enables the wipers and controls the after wipes. |
| WASH - DEMAND<br>WASHER SW < 0.6 SEC | WASH | If washer sw on less than 0.2 to 0.6 sec then once wipes |

### OFF Mode

With the wipe switch in the OFF position and the ignition switch in the ON positions, the Rainsensor is considered to be in "OFF" mode. In this mode, the sensor commands the wiper to be off.

The Rainsensor monitors the state of the windshield during OFF mode so that knowledge of the state of the windshield is present when the MULTIFUNCTION SWITCH is moved to any SENSITIVITY setting. This optimizes the performance of the sensor when moving from the OFF condition to an AUTOMATIC mode. The algorithm assumes the nominal sensitivity setting when in the OFF mode.

### Automatic Mode

When the MULTIFUNCTION SWITCH is moved to AUTO position and the ignition switch is in the RUN or ACCESSORY positions, the Rainsensor is considered to be in " AUTOMATIC" mode. Once a single "Instant wipe" has occurred, the wipers remain at "Innerwiper/park" untill the Rainsensor determines that the dwell time at that position is appropriate for the amount of precipitation on the windshield, considering the driver input from the switch SENSITIVITY setting. After the dwell time the Rainsensor provides input to the wiper motor to activate the wipers to clear the preciptation from the windshield.

### Automatic Int

For all AUTOMATIC INT operations the Rainsensor commands the wipers to operate in LOW SPEED for one wipe, followed by a variable dwell period in the inner wipe position.

### Automatic Low

AUTOMATIC LOW SPEED operation is utilized when the amount of precipitation imping on the windshield exceeds the AUTOMATIC INT TO AUTOMATIC LOW threshold. This threshold includes sufficient hysterisis to prevent cycling between AUTOMATIC INT and AUTOMATIC LOW SPEED operation with a steady amount of precipitation accumulation on the windshield.

### Automatic High

AUTOMATIC HIGH SPEED operation is utilized when the amount of precipitation imping on the windshield exceeds the AUTOMATIC LOW to AUTOMATIC HIGH threshold. This threshold includes sufficient hysterisis to prevent cycling between AUTOMATIC LOW to AUTOMATIC HIGH operation with a steady amount of precipitation accumulation on the windshield.

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### Wash Mode

The Rainsensor monitors the MULTIFUNCTION SWITCH to determine if the wash function is selected. Rainsensor enables the wiper motor to run in low speed during the wash mode and performs follow up wipes during 2.5 to 3.8 sec.

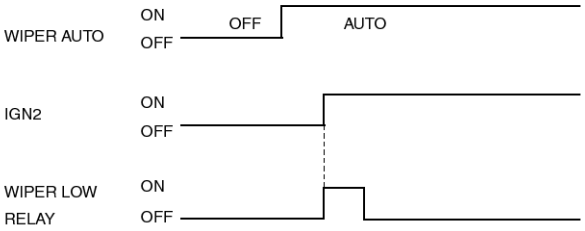
### Manual Mode

The Rainsensor determines when a manual mode such as manual low, Mist, Off or manual high is selected. The column switch performs these modes and the rain sensor has no affect.

## Inspection

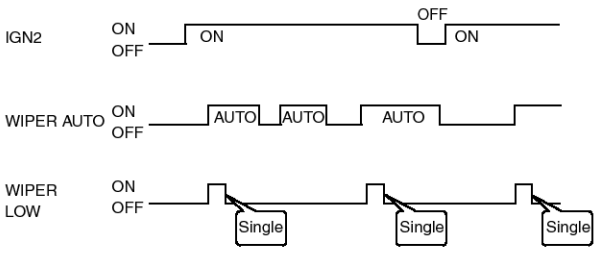
### Rain Sensing Wiper

1. In IGN2 ON state, if auto switch input (LIN communication) is ON then both wiper low relay and wiper high relay outputs are controlled by the rain sensor input signal.
2. If the wiper switch has been left in automatic mode with the vehicle ignition OFF, and then the vehicle ignition switch is turned on, a single wipe will be performed.



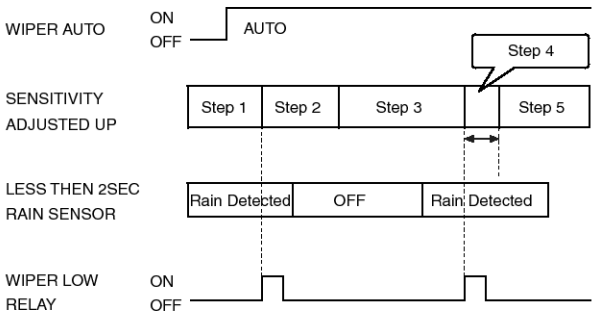

ETBF145E

3. A single wipe will be performed whenever rain has been detected (Rain Detected signal from Rain sensor ) and the wiper switch is moved to the AUTO position . But a single wipe will not be performed when the wiper switch is moved to the AUTO position and OFF signal is being received from Rain sensor. But if the wiper switch is moved to AUTO position for the first time since vehicle ignition switch is turned on then a single wipe will be performed regardless of Rain Detected or OFF signal.




ETBF145F

4. The drive may adjust the rain sensor performance by adjusting the sensitivity input. When in automatic mode, the BCM will perform a single wipe each time the sensitivity is adjusted upward to a more sensitive setting (downward more then one step). This single wipe will only be performed if Rain Detected signal is being received from the Rain sensor. If the sensitivity adjustment is adjusted upward more than one sensitivity, the BCM will only perform a single wipe unless the time between Increases is more than 2 seconds.




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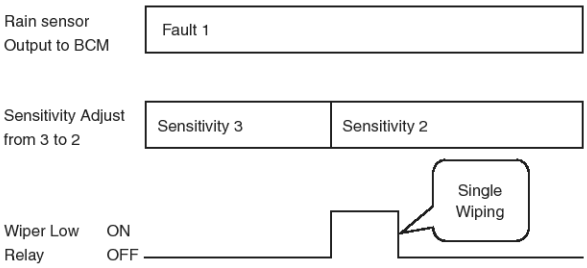


5. Fault strategy for the rain sensor

Rain Sensor Fault 1 - Internal Fault Detected

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 1. The confirmation delay for the failure is of 1 sec.

When this failure is detected, the wiper outputs are OFF and the wiper will also do a wipe in slow speed on the transition from sensitivity 3 to sensitivity 2 (Step 2 to 3) in order to signal the presence of this fault. If another sensitivity is set, the wiper won't make any additional wipe.

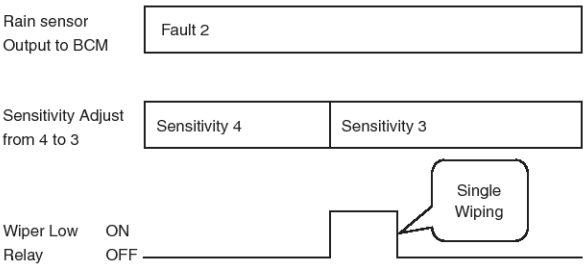



ETBF145H

Rain Sensor Fault 2 - Glass Attachment Fault Detected

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 2. The confirmation delay for the failure is of 1 s.

When this failure is detected, the wiper outputs are OFF and the wiper will also do a wipe on the transition from sensitivity 4 to sensitivity 3 (Step 1 to 2) in order to signal the presence of this fault. If another sensitivity is set, the wiper won't make any additional wipe.




ETBF145I

Rain Sensor Fault 3 - No Input Signal Present

This failure is detected when the wiper is in automatic mode and the input faulty rain sensor from the rain sensor has a duty cycle corresponding to Fault 3 or in case the duty cycle of the input faulty rain sensor is 0 % or 100%. The confirmation delay for the failure is of 1 s.

When this failure is detected, the wiper outputs are OFF.

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## Removal

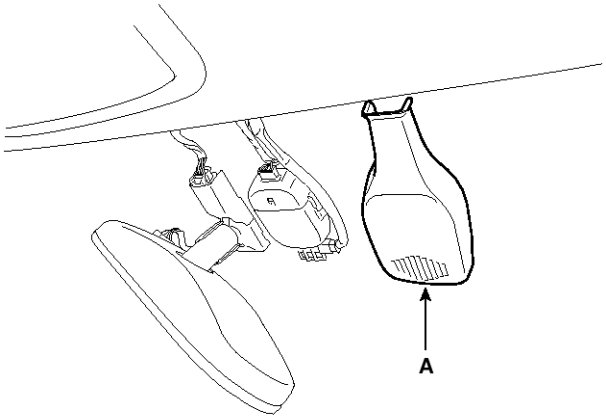
**CAUTION**

**The dust or foreign substance on the rain sensor have a bad effect upon the rain sensor capability,so protect the sensor surface with protection cover until installing the rain sensor to bracket for accurate function.**

**The coupling pad on the rain sensor surface has adherive strength, so the coupling pad could stick to the windshield by environment condition during the using time.**

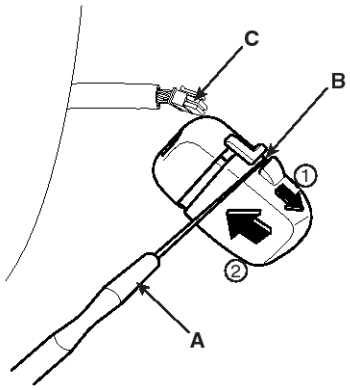
**If separate it by force, it could be damaged. So make sure to separate the rain sensor from the windshield carefully.**

1. Remove the rain sensor cover (A) first.




SBHBE8122D

2. Be careful not to damage the cover latch by applying excessive force. To remove the latch, pull aside the latch using the cover hole (B) with a small flat - blade screwdriver (A).




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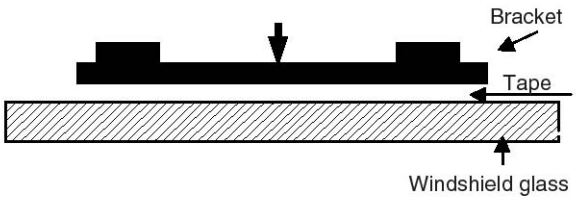
3. Remove the wiring harness connector (C) from sensor.
4. Rain sensor module is attached to the front windshield by glue replacing the front windshield, remove the rain sensor module from the existing front windshield and install on the new front windshield.

## Installation

**NOTICE**

- *In case of the windshield with reflection layer which reflects the infrared rays in sensing field, should install the rain sensor into the field removed the reflection layer.*
- *Install the rain sensor after some time and be care not to be settled the dust after installation.*

1. Install the rainsensor bracket to the windshield glass using the tape.




ETZE015I

**CAUTION**

**It is very important that the coupling pad pushes the windshield completely to stick to each other without bubbles.**

2. Connect the rainsensor connector, and then install the sensor cover.

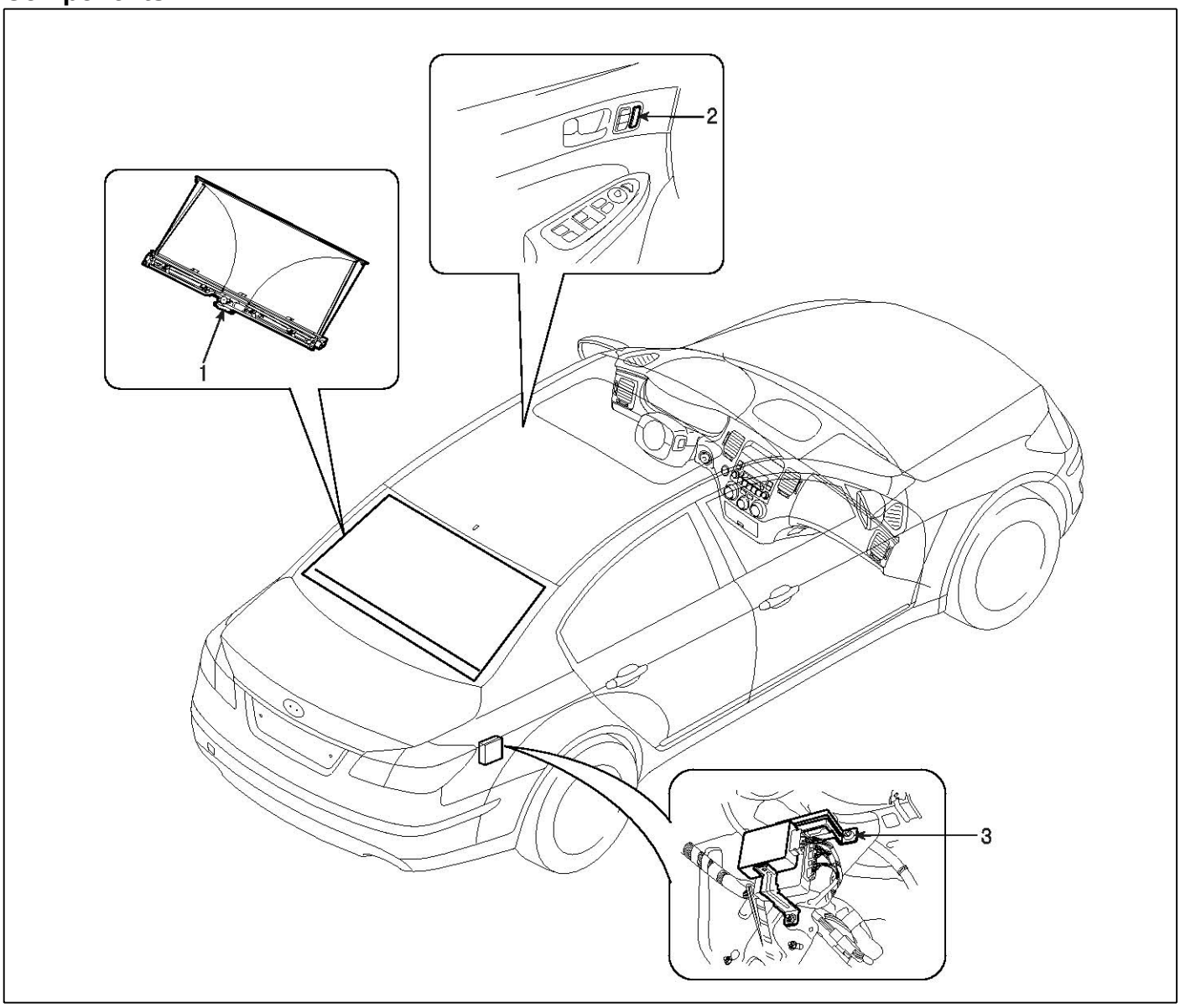
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# Rear Curtain System

## Components




SBHBE8019D

1. Rear curtain
2. Rear curtain switch
3. Rear curtain unit

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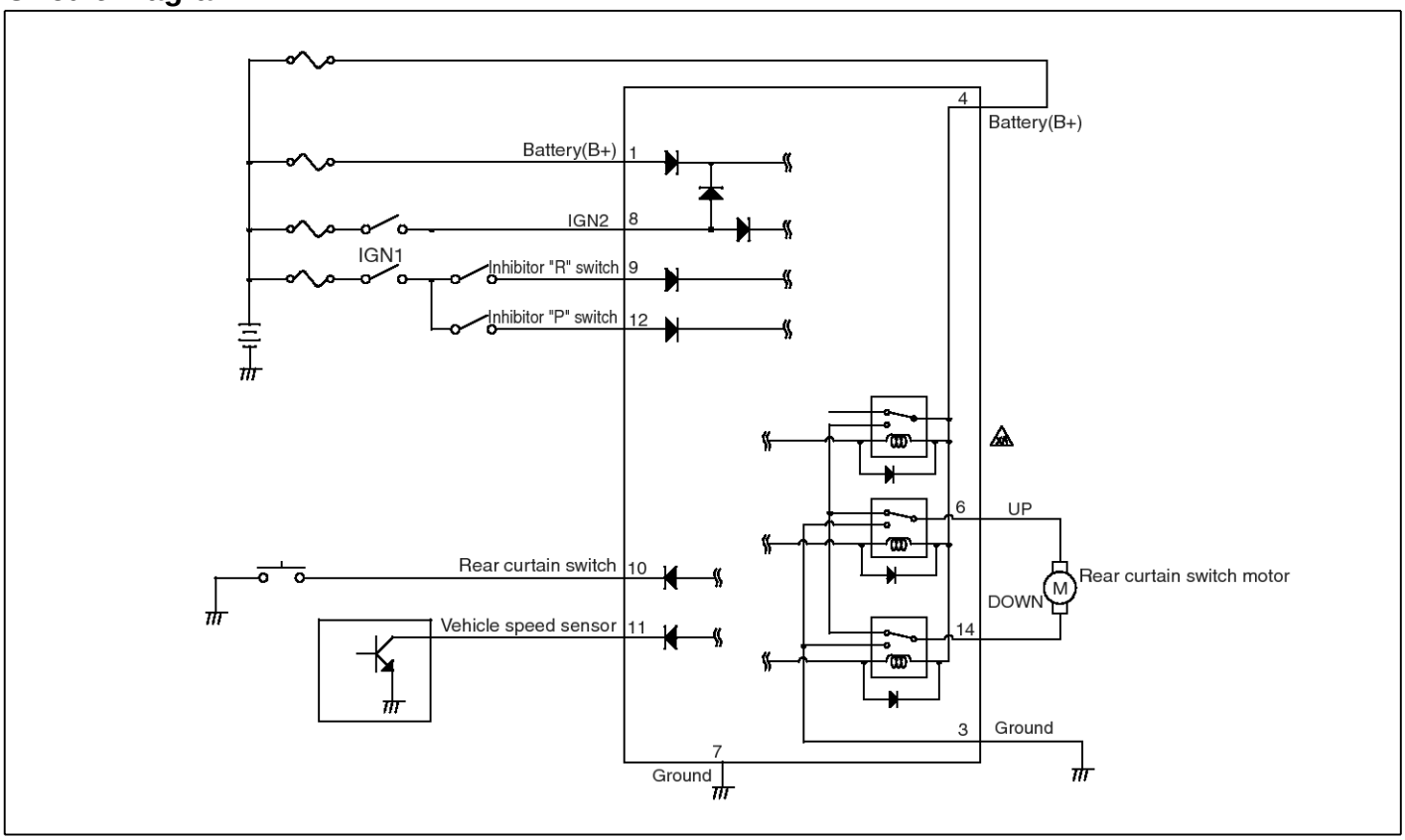
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## Description

You can up & down rear curtain automatically by pressing the rear curtain switch. Rear curtain protect passenger from a direct ray of light by covering rear glass.

## Circuit Diagram



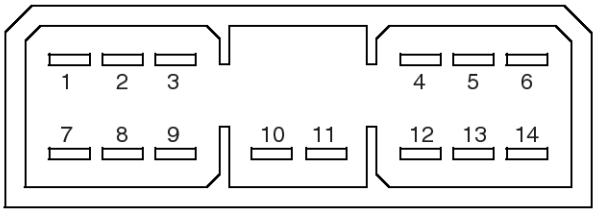

ETBF390A

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## Rear Curtain Unit Connector




KTCF390B

| PIN NO. | Connector | PIN NO. | Connector |
|---|---|---|---|
| 1 | B+ | 8 | IG2 |
| 2 | - | 9 | Inhibitor “R” switch |
| 3 | Power | 10 | Rear curtain switch |
| 4 | B+ | 11 | Vehicle speed sensor |
| 5 | - | 12 | Inhibitor “P” switch |
| 6 | Motor UP | 13 | - |
| 7 | Signal | 14 | Motor DOWN |

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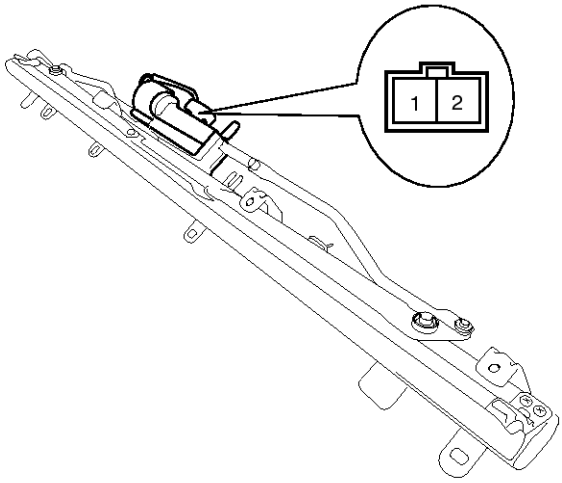
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## Rear Curtain

### Inspection

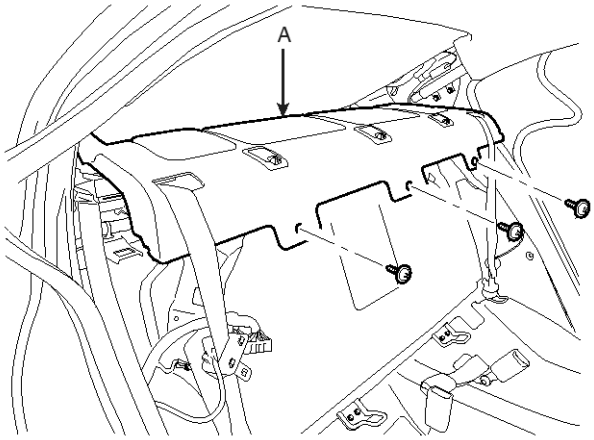
Connect the battery voltage and check the rear curtain motor rotation. If the motor does not operate properly, substitute with a known-good rear curtain motor and check for proper operation.




SBHBE8021D

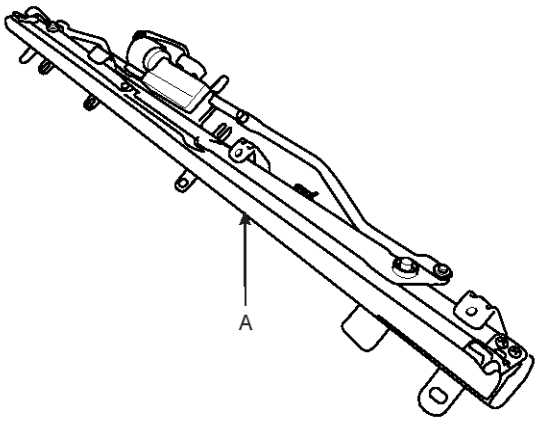
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the rear package tray (A) after removing the rear seat. (Refer to the Body group- interior trim)




SBHBE8022D

3. Remove the connector of the rear curtain and mounting bolts (6EA).
4. Remove the rear curtain (A) from the rear package trim.




SBHBE8023D

### Installation

1. Install the rear curtain and connector.
2. Install the rear package tray and rear seat.
3. Connect the negative (-) battery terminal.

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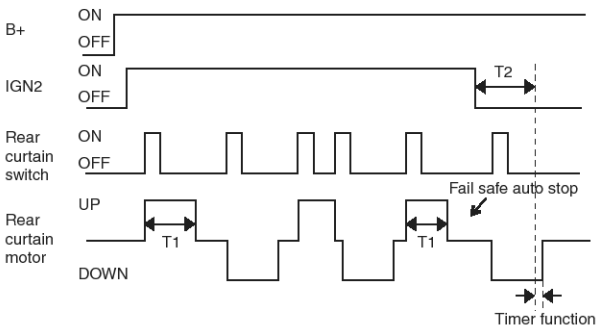


## Rear Curtain Unit

### Inspection

1. AUTO UP/AUTO DOWN function
   1) IGN ON, if you press the rear curtain switch, rear curtain motor operates the reverse direction of the before direction. (UP/DOWN)
   2) After replacing battery, if you operates rear curtain switch, rear curtain is operated auto up.
   3) If the switch input occurred during rear curtain auto up or auto down, rear curtain is operated to the reverse direction after making a pause.
   4) AUTO function stop when detect an excess current.
2. TIMER function
   1) It can be possible to operate rear curtain for 30 sec after IGN OFF.
   2) It can be possible to operate rear curtain operation by the end of motor operation although timer is finished during auto up/ down.
3. FAIL SAFE function

   If motor operation doesn't stop more than 10 sec after starting, motor is stopped by inner relay auto OFF.

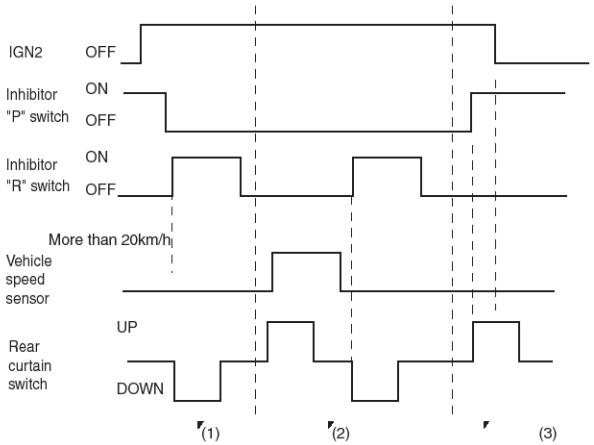



ETBF392B

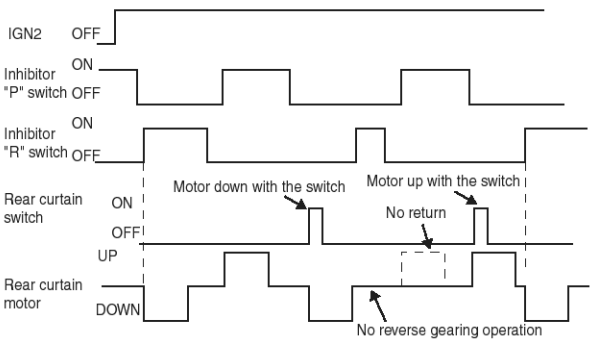
T1 : MAX 10 sec,

T2 : 30 sec.

4. RETROGRESSION GEARING function
   1) When, rear curtain motor IGN ON, rear curtain UP and shift lever "P" position, rear curtain motor linked with the signal makes auto down.
   2) When the vehicle speed is above 20 km/h from 1) condition, rear curtain motor linked with the signal makes auto up. Only, the motor does not operate below 20 km/h.
   3) When shift lever position will be changed from R to P from 1) condition, rear curtain motor linked with the signal makes auto up. Only, the case where the driver presses the knock-down switch is excepted.
   4) To the case where the driver presses the down switch from rear curtain up condition motor does not do a retrogression gearing operation and the up return operation due to a vehicle speed. After that, when driver presses the switch and the motor becomes auto up, the retrogression gearing operation is possible again.




ETBF392C




ETBF392D

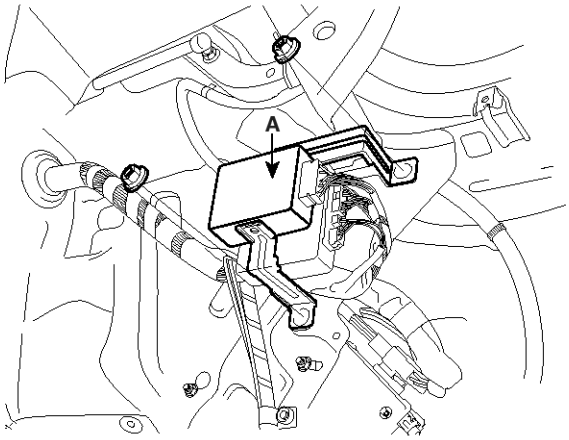
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## Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the right trunk trim. (Refer to the Body group - trunk)
3. Remove the rear curtain unit (A) after removing nuts ( 2EA) and connector.




SBHBE8024D

## Installation

1. Install the rear curtain unit and connector.
2. Install the rear right trunk trim.
3. Connect the negative (-) battery terminal.

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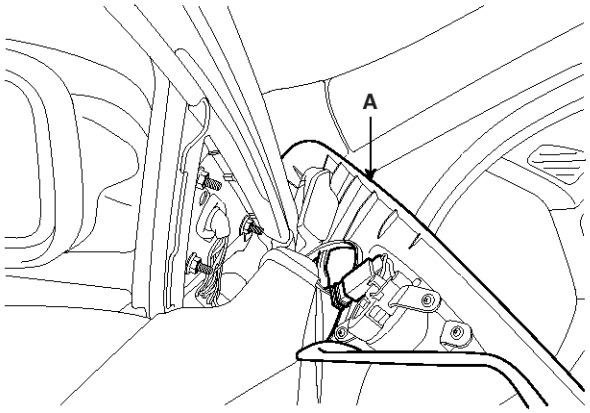
https://autolibrary.ir



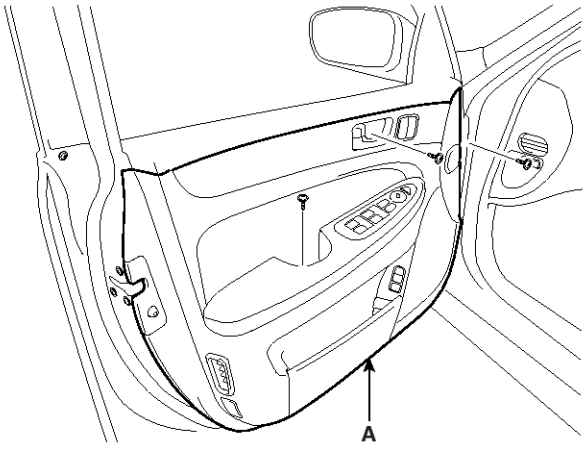
## Rear Curtain Switch

### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the door trim (A) after removing the screws. (Refer to the Body group- front door)

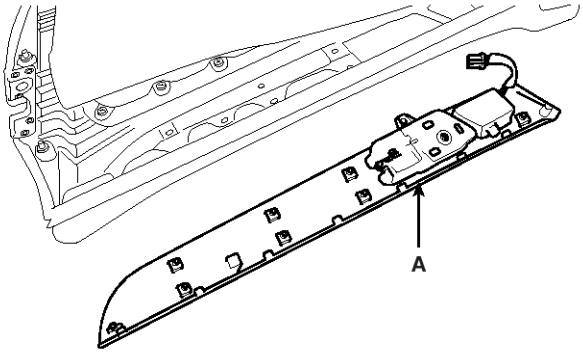



SBHBE8025D



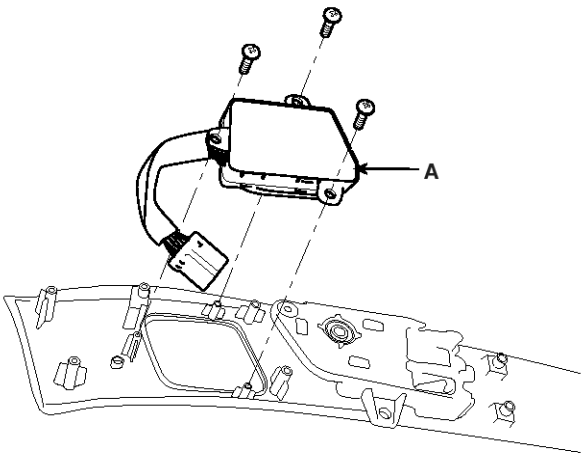

SBHBE8026D

3. Remove the door trim garnish (A) after removing the screws inside the door trim.




SBHBE8027D

4. Remove the rear curtain switch (A) after removing screws (3EA) and connector.




SBHBE8028D

### Installation

1. Install the rear curtain switch and connector.
2. Install the door trim garnish and door trim.
3. Connect the negative (-) battery terminal.

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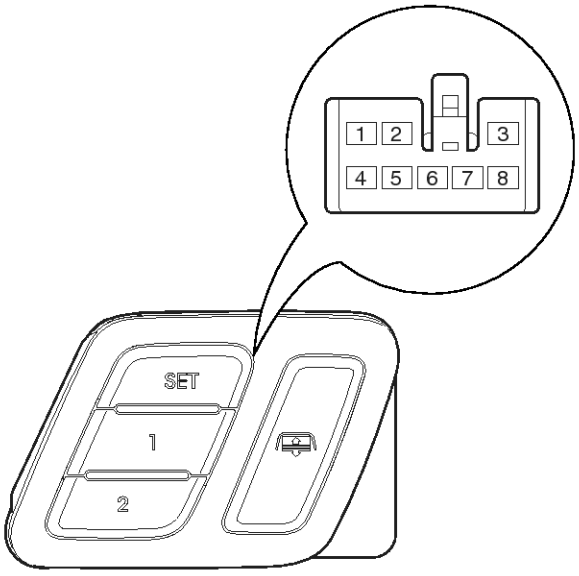
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## Inspection

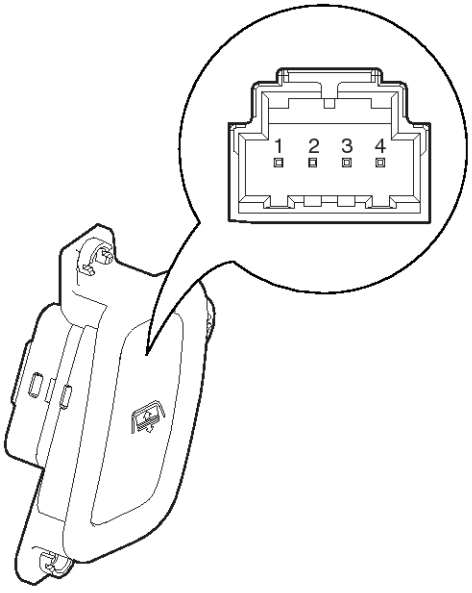
1. Check for continuity between the terminals. If the continuity is not as specified, replace the rear curtain switch.

**[IMS]**




SBHBE8029D

**[NON-IMS]**




SBHBE8104D

| Terminal / Position | 3 | 2 | 4 | 1 |
|---|---|---|---|---|
| ON | | Illumination | | |
| OFF | | | | |

SBHBE9153L

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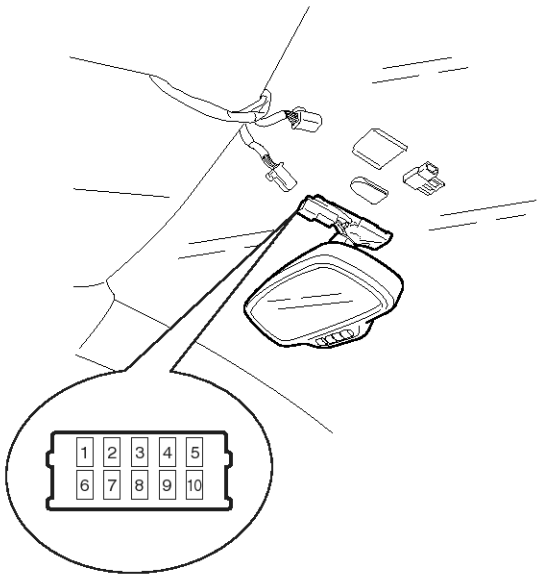


# Electro chromic Inside Rear View Mirror

## Description

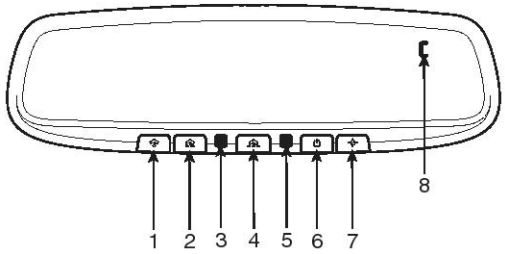
The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night , in order the user not to be dazzled by the light. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.

2. OEC (+)
6. Battery (+)
7. OEC (-)
8. GND
9. Reverse inhibit
10. IGN (12V)



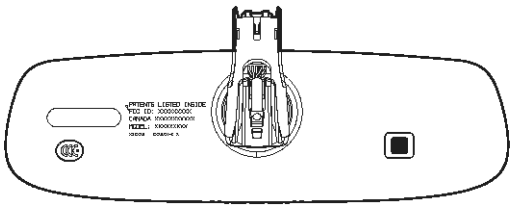

SBHBE8049D

1. The front looking 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.




SBHBE9154L

1. Channel 1 Button
2. Channel 2 Button
3. Status Indicator LED
4. Channel 3 Button
5. Rear Light Sensor
6. Dimming On/Off Button
7. Compass Control Button
8. Display



SBHBE9155L

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## Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicles traveling behind you. The auto-dimming function can be controlled by the Dimming ON/OFF Button :

1. Pressing and holding the Feature Control button for more than 3 but less than 6 seconds turns the auto-dimming function OFF which is indicated by the green Status Indicator LED turning off.
2. Pressing and holding the Feature Control button again for more than 3 but less than 6 seconds turns the auto-dimming function ON which is indicated by the green Status Indicator LED turning on.

**NOTICE**

*The mirror defaults to the "ON" position each time the vehicle is started.*

## Inspection

Check it by the procedure below to see if the function of the ECM is normal.

1. Turn the ignition key to the "ON" position.
2. Cover the front looking sensor to stop functioning.
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**

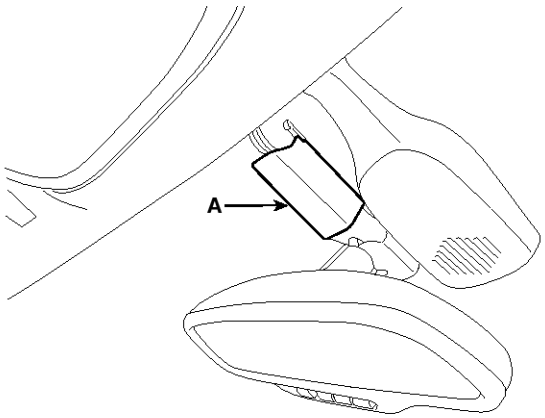
*If this test is performed in daytime, the ECM may be darkened as soon as the front looking sensor is covered.*

5. When the reverse gear is engaged, the ECM should not be darkened.

   When heading lights to both the front looking and rearward looking sensors, the ECM should not be darkened.

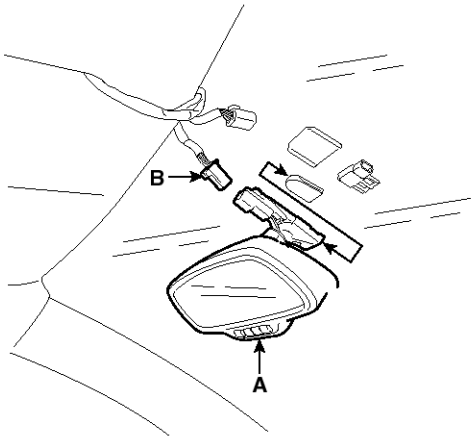
## Removal

1. Remove the mirror wiring cover (A).




SBHBE8132D

2. Remove the connector (B).
3. Push the inside rear view mirror base up to remove the inside rear view mirror assembly (A) after removing the screw.




SBHBE8133D

**CAUTION**

**Make sure the spring mounting bracket and mirror not to be damaged.**

## Installation

1. Install the mirror assembly.
2. Install the mirror wiring cover and connector.

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## Compass Mirror

### Description

The compass feature is designed to be integrated into an electro chromic 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**

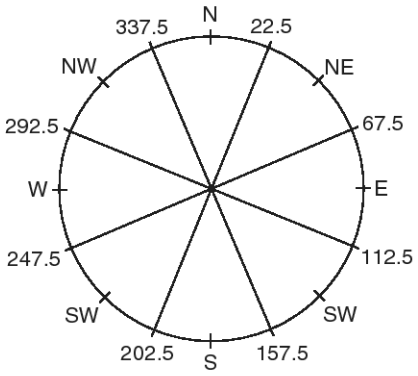
*There should be hysteresis at each switch point.*

*Switch points between the 8 cardinal directions, these switch points are ± 10°*

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ETQF241F

### Compass display interval

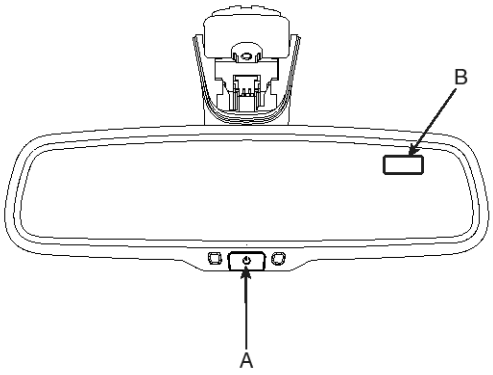
Compass display should be updated at every two seconds.

### Function

The compass can be turned ON and OFF and will remember the last state when the ignition is cycled. To turn the display feature ON/OFF :

1. Press and release the feature control button (A) to turn the display feature OFF.
2. Press and release the feature control button (A) again to turn the display back ON.

   Additional options can be set with press and hold sequences of the feature control button (A) and are detailed below.




ETQF241C

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 read "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 commpass 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.

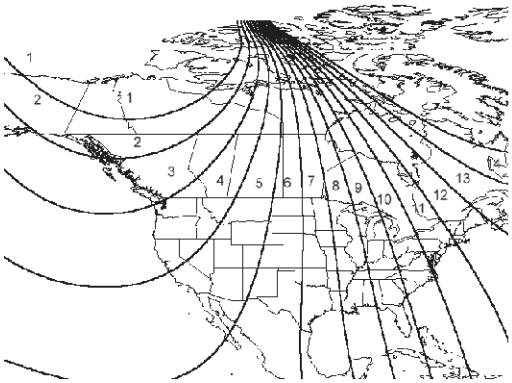
1. Press and hold the feature control button (A) for more than 9 seconds. When the compass memory is cleared, a "C" will appear in the display (B).
2. To calibrate the compass, drive the vehicle is 2 complete circles at less than 8 KPH (5 MPH).

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## Zone Map




NORTH AMERICA

SCMBE6376N

## Homelink

### Description

The HomeLink Wireless control system provides a convenient way to replace up to three hand-held radio-frequency (RF) transmitters with a single built-in device. This innovative feature will learn the radio frequency codes of most current transmitters to operate devices such as gate operators, garage door openers, entry door locks, security systems, even home lighting.

### Specification

| ITEM | DESCRIPTION | REMARK |
|---|---|---|
| Rated Voltage | DC 12V | Testing Voltage : 12.8V |
| Operating Voltage | 9 ~ 18V | Should be operation at limit rage |
| Operating Temperature | -30 ~ 85˚C | |
| Storage Temperature | -40 ~ 105˚C | |
| Operating Humidity | 95% | |
| Operating Current | 23 ~ 100mA | |
| Low power Mode | 4 ~ 16mA | |
| Reduce power Mode | 10 ~ 25mA | |
| Insulation Resistant | 100MΩ (500VM) | The case is exclude in EARTH |
| Dark current | 0.3mA MAX | |

### Learn & Transmit Specification

| Signal | Specification | | Remark |
|---|---|---|---|
| Learn RF Signal | Learning Frequency | 288-390 MHz | |
| | Learning Range | 0-1m | Between H/L & Drive seat |
| Transmit RF Signal | Transmission Frequency | 288-390 MHz | |
| | Transmission Range | 13m MIN | |
| | Output Power | 75.6dBμV/m MAX | Do as the FCC |

※ In case of OT(Original Transmitter) range < 80% of Transmission SPEC. It should be apply to transmission range for 80% of OT.

1. Follow the OT or OR(Original Receiver) about reception & transmission frequency.
2. Transmission Range means the distance from which the receiving device RF signal from HomeLink)
3. Reception Range means the distance within which the HomeLink can be trained with RF signal from OT.

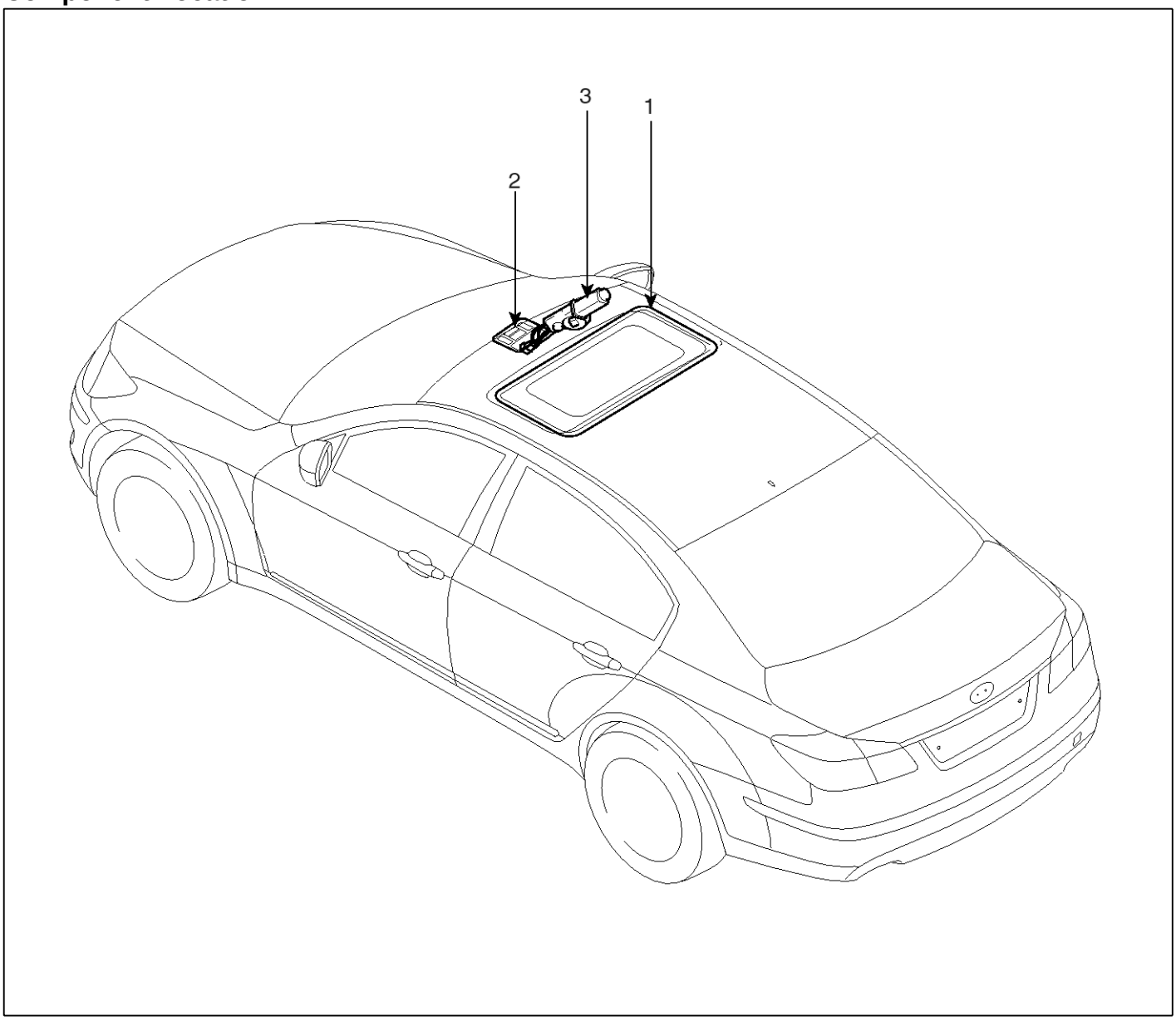
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# Sun Roof

## Component Location




SBHBE8042D

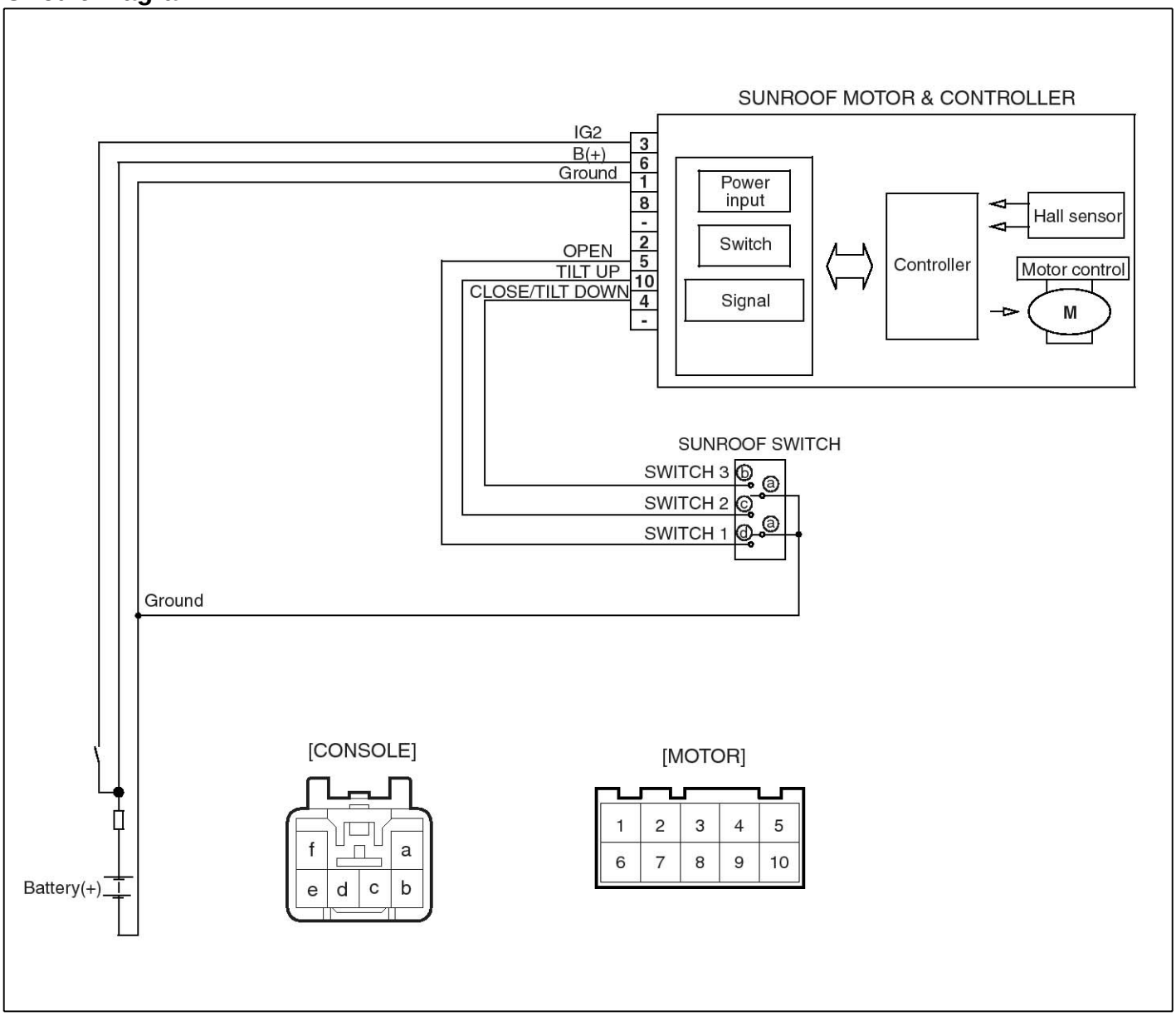
1. Sunroof
2. Sunroof switch
3. Sunroof motor & controller

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## Circuit Diagram




SBHBE9156L

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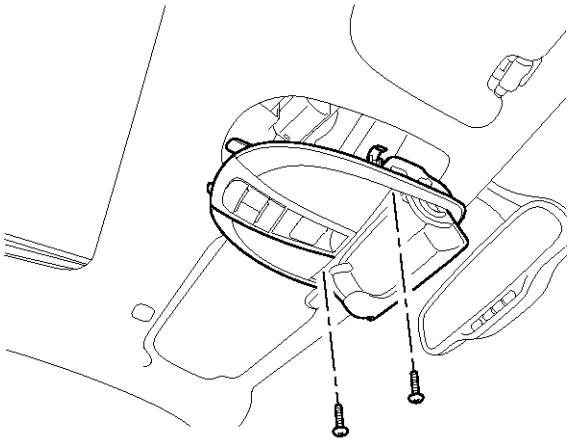
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## Sunroof Switch

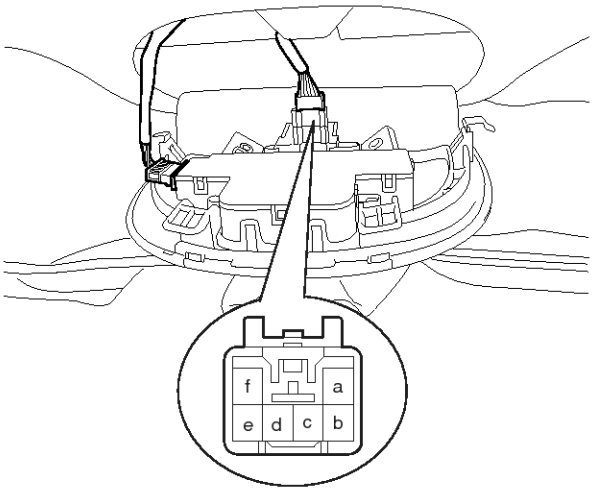
### Inspection

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 (6P), and then remove the overhead console lamp.



SBHBE8044D

3. Check for continuity between the terminals. If the continuity is not as specified, replace the sunroof switch .




[Switch side connector]

SBHBE9157L

| Position \ Terminal | a | b | c | d |
|---|---|---|---|---|
| Manual OPEN | ○ | | | ○ |
| Auto OPEN | ○ | | ○ | ○ |
| Manual CLOSE, Manual tilt DOWN | ○ | | ○ | |
| Auto CLOSE | ○ | ○ | ○ | |
| Manual tilt UP | ○ | ○ | | |

SBHBE9309L

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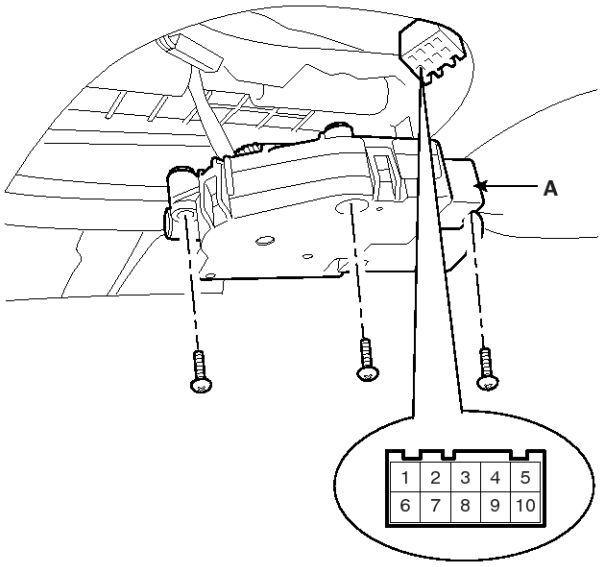
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## Sunroof Motor

### 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).




SBHBE9158L

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 | ⊕ | | | |

SBHBE9159L

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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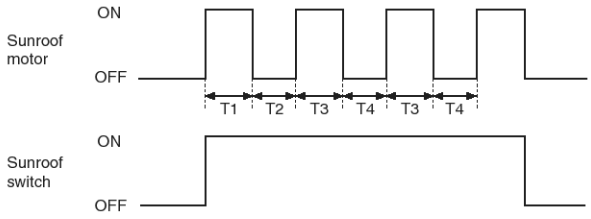
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### Protecting The Overheated Motor

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(1 8 ± 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

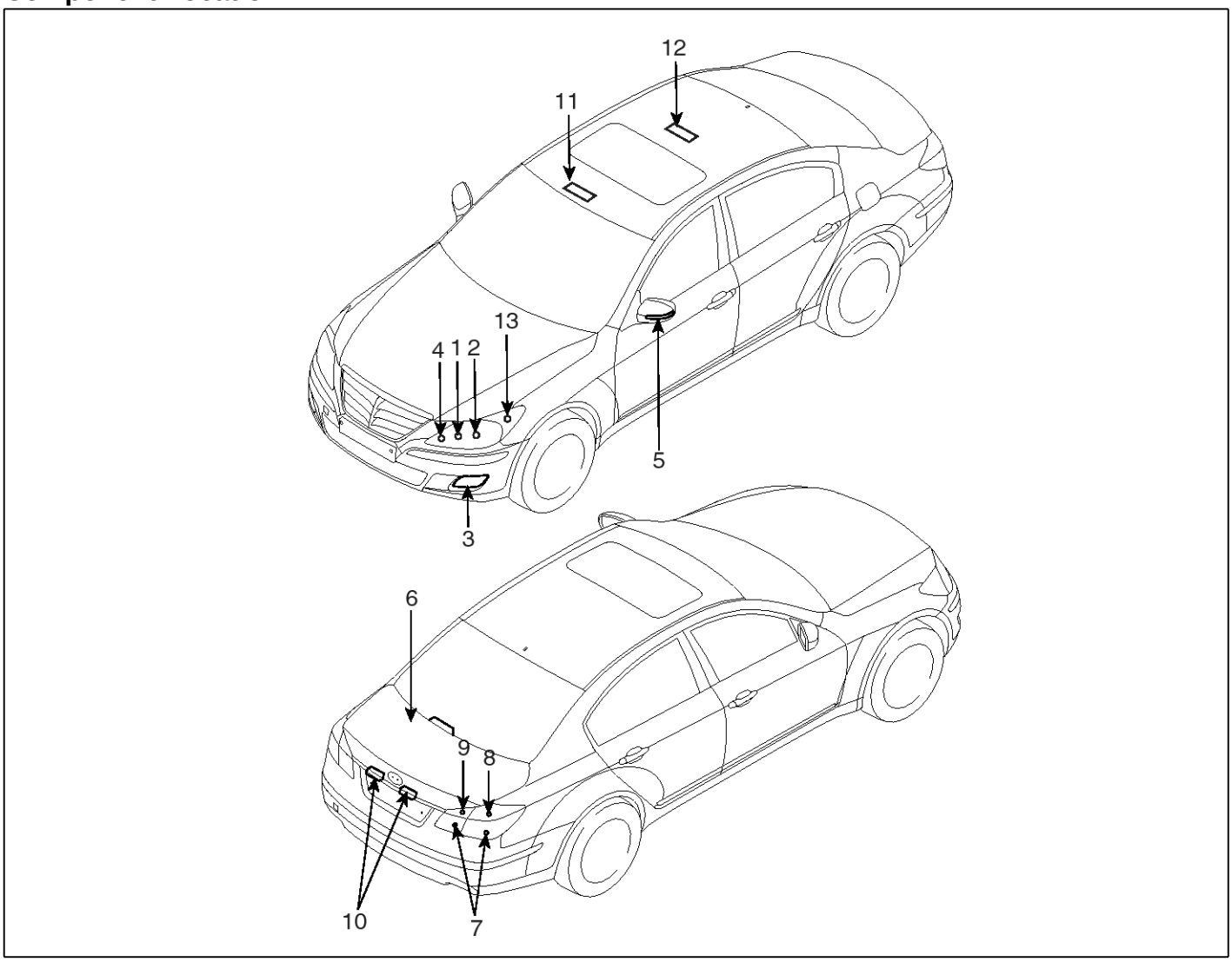
| Items | | Bulb Wattage (W) |
|---|---|---|
| FRONT | Head lamp (High) | 55 |
| | Head lamp (Low) | General : 55, HID : 35 |
| | Front turn signal lamp | 28 |
| | Front fog lamp | 35 |
| | Side marker | 5 |
| | Door mirror | LED |
| REAR | Rear stop/tail lamp (Outside) | LED |
| | Back up lamp | 16 |
| | Rear turn signal lamp | 21 |
| | License plate lamp | 5 |
| | High mounted stop lamp | LED |
| | Side marker | LED |
| ROOM | Room lamp (Center/Side) | LED |
| | Overhead console lamp | LED |
| | Foot lamp | 5 |
| | Glove box lamp | 5 |
| | Door courtesy lamp | 5 |

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## Component Location




SBHBE9331L

1. Head lamp (High)
2. Head lamp (Low)
3. Front fog lamp
4. Position lamp
5. Door mirror lamp
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. Front turn signal lamp

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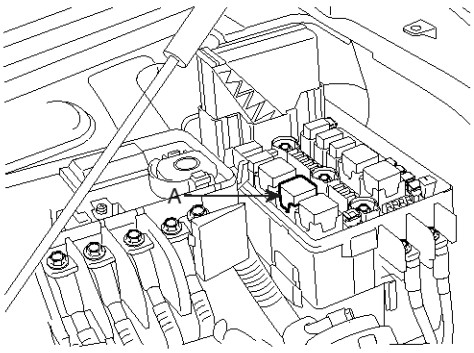


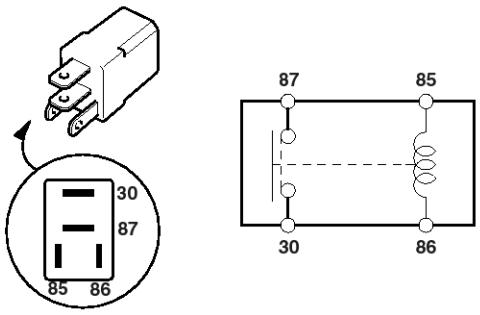
# Head Lamps

## Inspection

### Head Lamp Relay Inspection

1. Pull out the head lamp relay (Low) (A) from the engine compartment relay box.
   A : Head lamp(Low) relay




SBHBE8410D

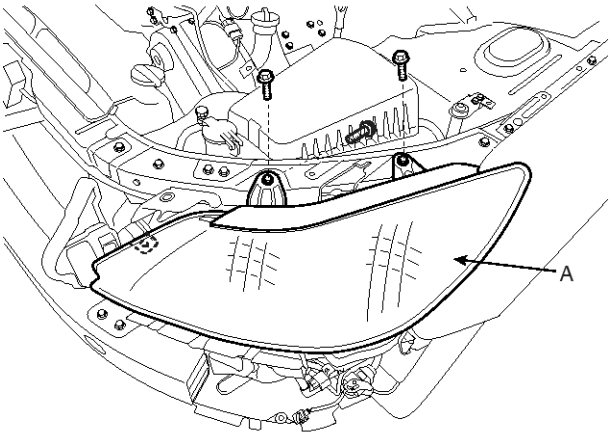
2. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.86 and No.85 terminals.
3. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.

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

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## Removal

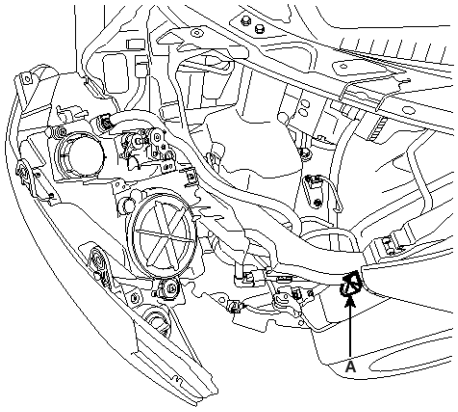
1. Disconnect the negative (-) battery terminal.
2. Loosen the mounting bolts(3EA) of head lamp. Remove the head lamp assembly(A) after disconnecting the lamp connectors.




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**NOTICE**

*Take care that retaining clip (A) is not to be damaged.*



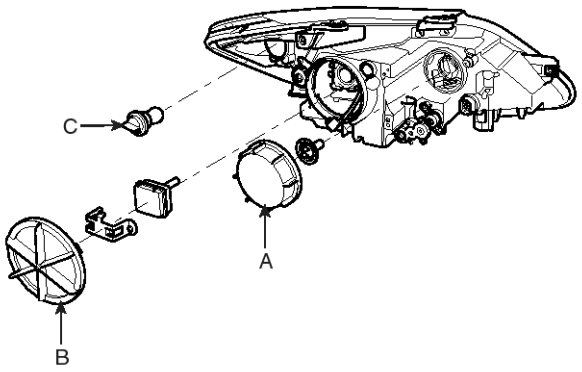

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3. Remove the bulb caps from the head lamp assembly.
   A : Head lamp high bulb cab
   B : Head lamp low bulb cab
   C : Turn signal bulb




SBHBE8409D

## Installation

1. Install the head lamp bulbs.
2. Install the head lamp bulb caps.
3. Install the head assembly after connecting the lamp connector.

## Adjustment

### Head Lamp Aiming Instructions

#### <Mechanical aiming>

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 :

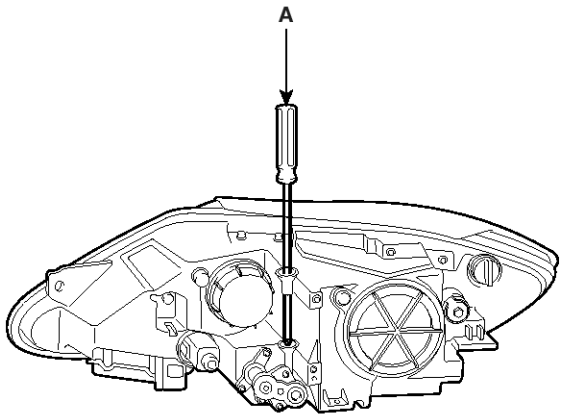
1. Inflate the tires to the specified pressure and remove any loads from the vehicle except the driver, spare tire, and tools.
2. The vehicle should be placed on a flat floor.
3. Draw vertical lines (Vertical lines passing through respective head lamp centers) and a horizontal line (Horizontal line passing through center of head lamps) on the screen.

### Head Lamp And Fog Lamp Aiming Point

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 adjustments to the lower beam using the adjusting wheel.

   A : Vertical adjustment(High/Low)




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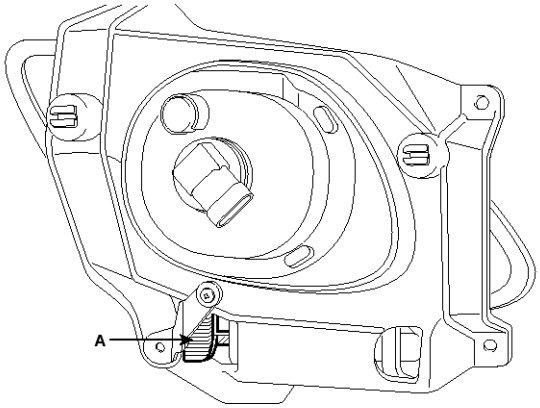
#### <AFLS aiming>

1. Using the scanner, do the AFLS calibration and Actuation test.
2. Turn on the headlamp low & Hi beam after engine is running.
3. Adjust the "mechanical aiming".

### 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).

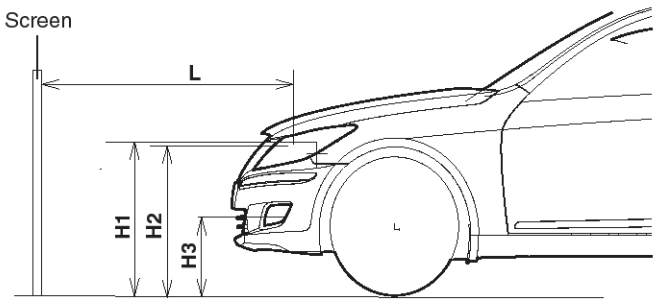


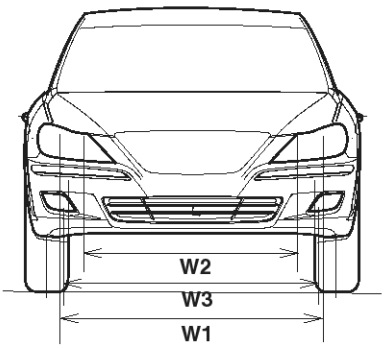

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H1 : Height between the head lamp bulb center and ground (Low beam)
H2 : Height between the head lamp bulb center and ground (High beam)
H3 : Height between the fog lamp bulb center and ground
W1 : Distance between the two head lamp bulbs centers (Low 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

SBHBE9173L

Unit : in (mm)

| Vehicle condition | H1 | H2 | H3 | W1 | W2 | W3 | L |
|---|---|---|---|---|---|---|---|
| Without driver | 27.2(693) | 26.6(676) | 14.8(377) | 55.7(1,416) | 45.6(1,158) | 58.9(1,496) | 118(3,000) |
| With driver | 26.8(682) | 26.1(665) | 14.4(366) | | | | |

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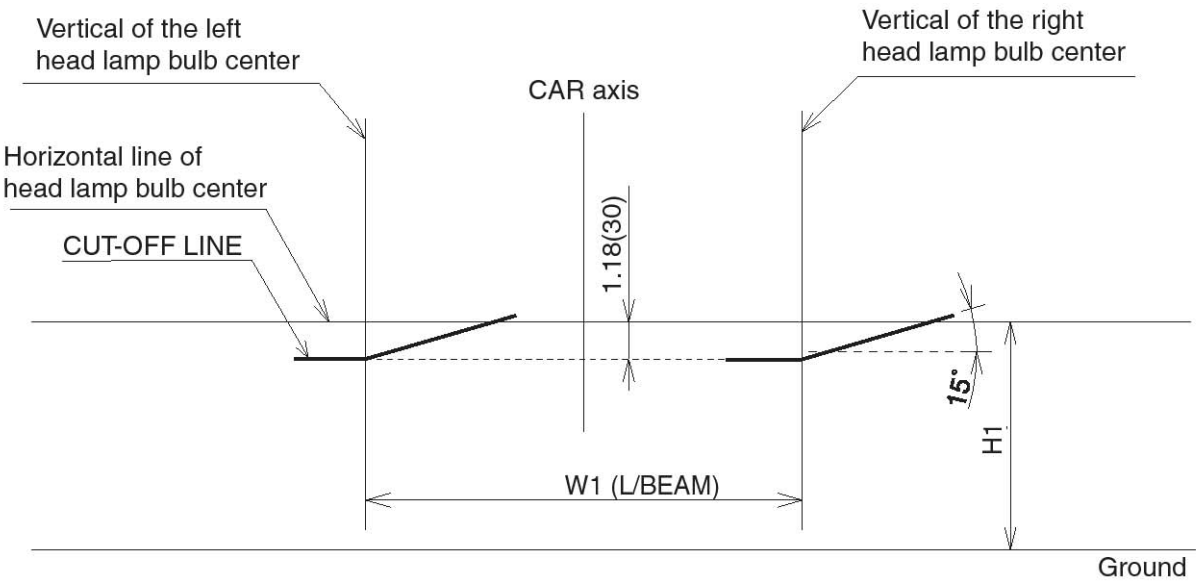


1. Turn the low beam on with driver.

   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)**

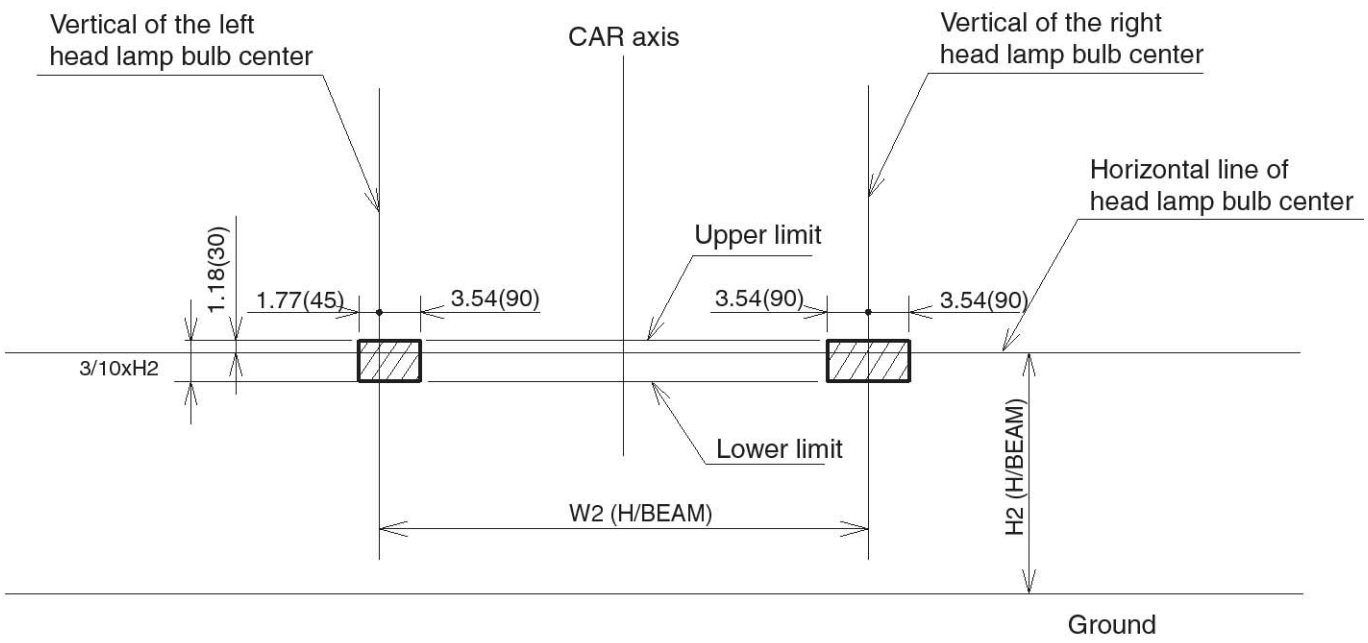
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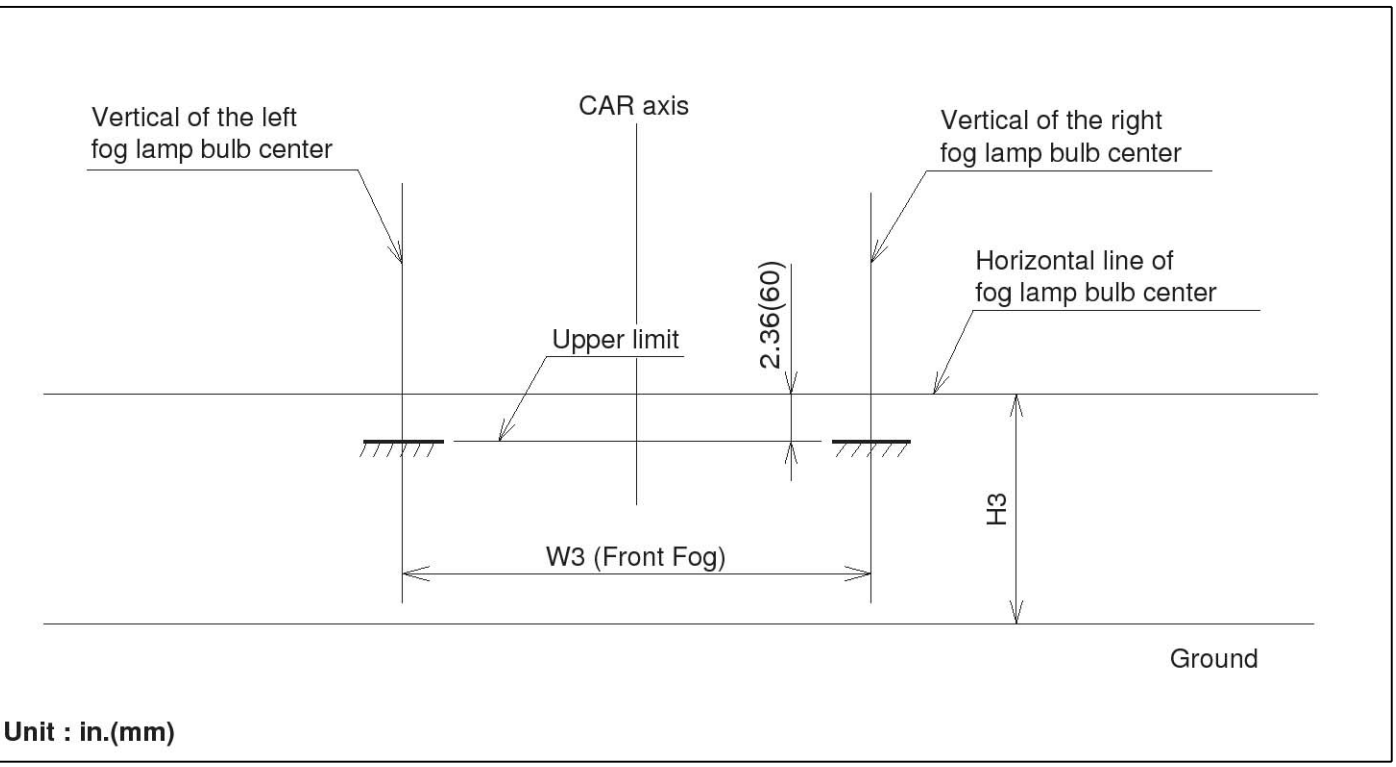
2. Turn the high beam on with driver.
   The hot point should be projected in the allowable range shown in the picture.




**Unit : in.(mm)**

SBHBE9472L

3. Turn the front fog lamp on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.




**Unit : in.(mm)**

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SFDBE8131L

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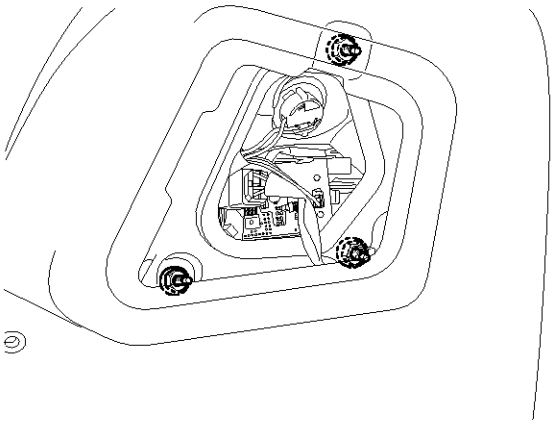


## Rear combination lamp

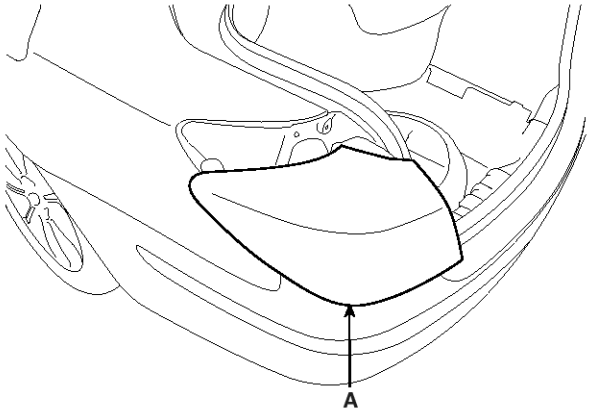
### Removal

#### Rear Combination Outside Lamp

1. Disconnect the negative (-) battery terminal.
2. Loose the nuts holding the rear combination lamp (outside) then disconnect the connector.

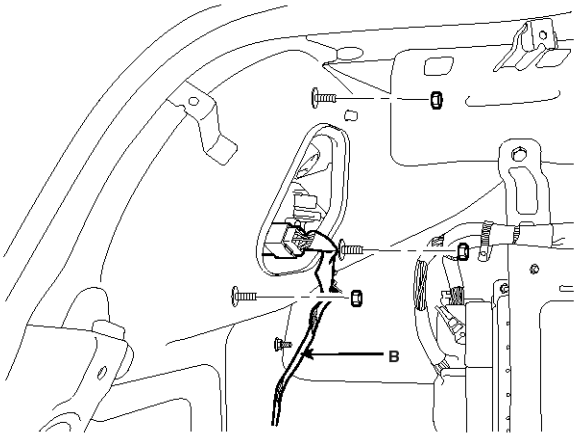


SBHBE8414D

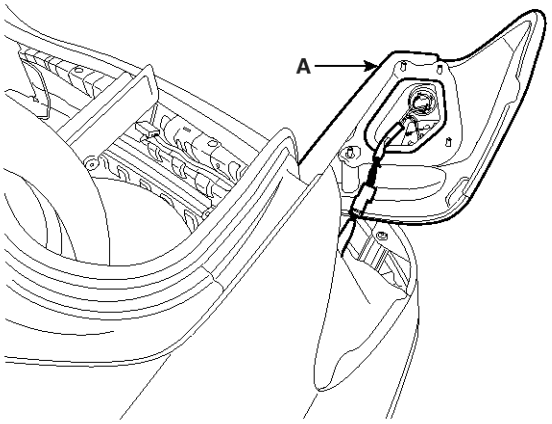



SBHBE8415D

3. Remove the outside rear combination lamp (A) and connector (B).

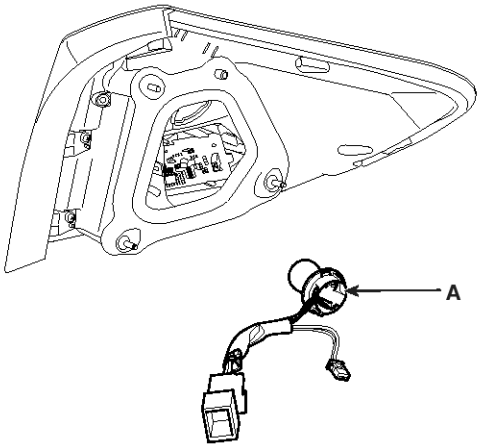



SBHBE8416D




SBHBE8417D

4. Replace the bulbs (A). (Replace the lamp assembly when the LED is out of order)




SBHBE8418D

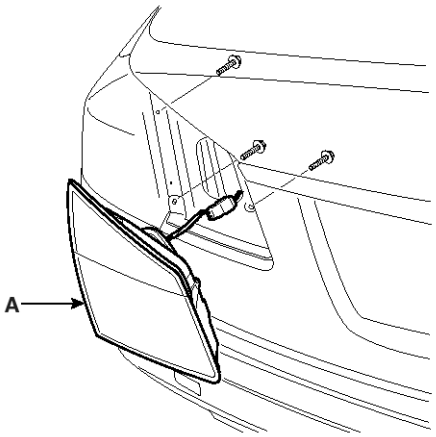
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### Rear Combination Inside Lamp

1. Disconnect the negative (-) battery terminal.
2. Loose the bolts holding the rear combination inside lamp (A) then disconnect the connector.




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3. Replace the bulbs. (Replace the lamp assembly when the LED is out of order)

## Installation

1. Install the rear combination outside lamp assembly.
2. Install the rear combination inside lamp assembly.

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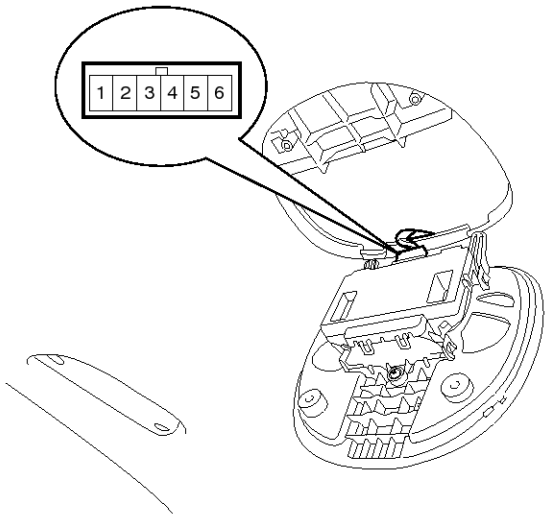
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## Room Lamp

### Inspection

1. Remove the room lamp assembly then check for continuity between terminals.



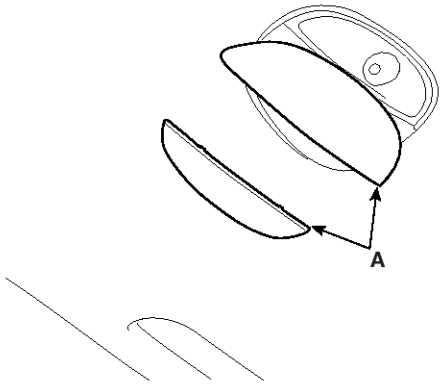

SBHBE8424D

| Terminal / Position | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Map lamp (L) | ○ | ○ | | |
| Map lamp (R) | ○ | ○ | | |
| Door | ○ | | ○ | ○ |
| Room | ○ | | | ○ |

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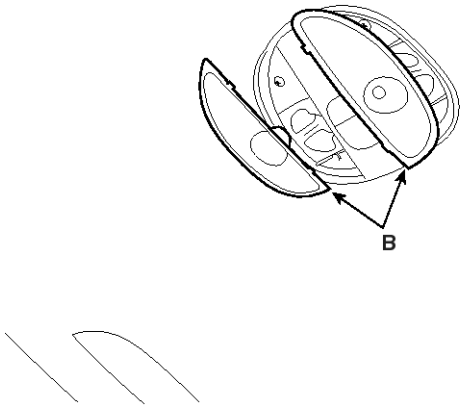
### Removal

1. Disconnect the negative (-) battery terminal.
2. Detach the lamp lens (A) from the room lamp with a flat-tip screwdriver.




SBHBE8420D

3. Remove the lamp reflector (A) from the room lamp with a flat-tip screwdriver



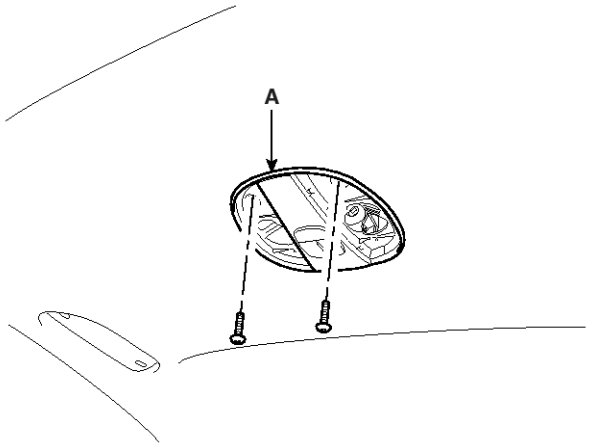

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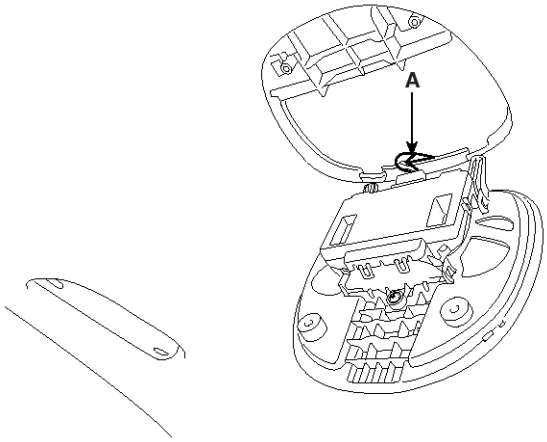


4. Remove the room lamp (A) after removing the screws .




SBHBE8422D

5. Replace the room lamp after removing the connector (A).




SBHBE8423D

## Installation

1. Connect the connector and install the room lamp.
2. Install the lamp reflector and lamp lens.

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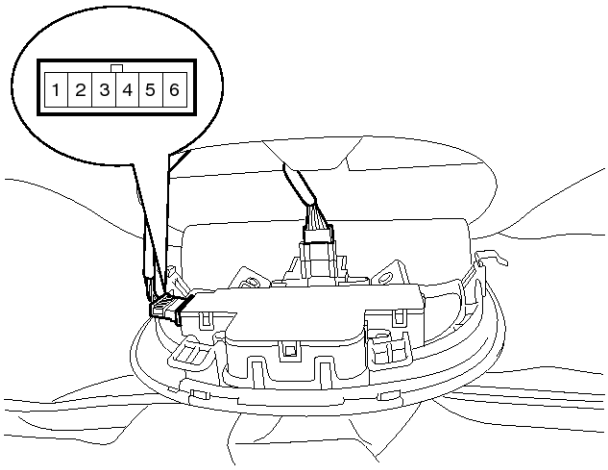
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## Overhead Console Lamp

### 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.



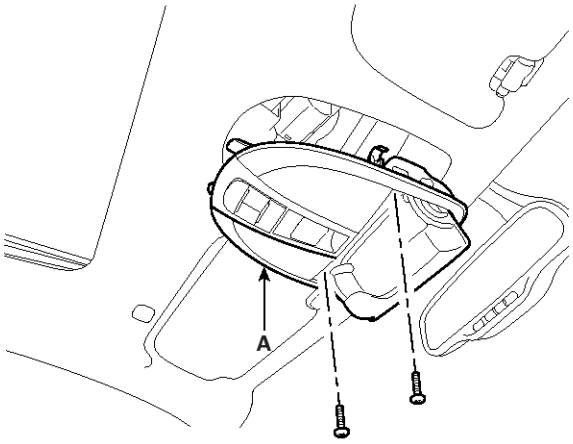

SBHBE8436D

| Terminal / Position | 3 | 2 | 1 |
|---|---|---|---|
| Map lamp (L) | | ○ | ○ |
| Map lamp (R) | | ○ | ○ |
| Mood | ○ | ○ | ○ |
| Room | ○ | ○ | ○ |

SBHBE9177L

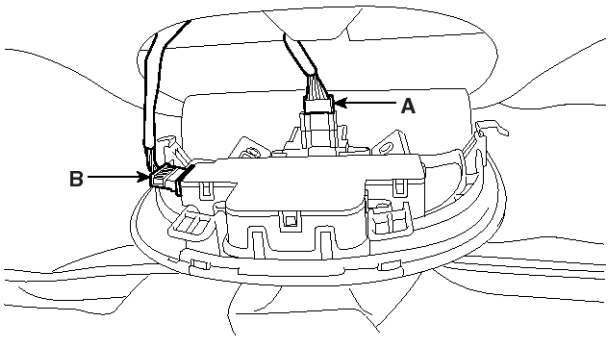
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the overhead console lamp(A) after loosening the overhead console lamp screw(2EA).




SBHBE8425D

3. Disconnect the sunroof switch connector (A) and lamp connector (B).




SBHBE8426D

### 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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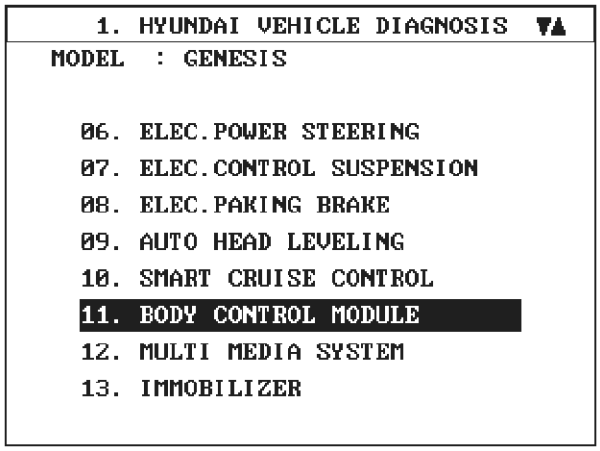
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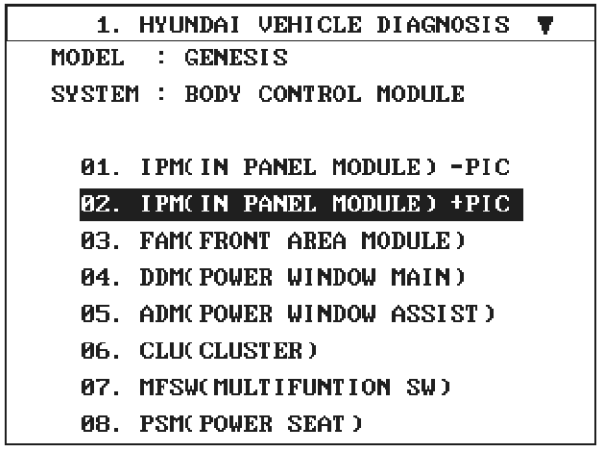
## Hazard Lamp Switch

### Inspection

1. Check BCM input/output specification of hazard lamp switch using the scan tool. If the specification is abnormal, replace the hazard switch module.

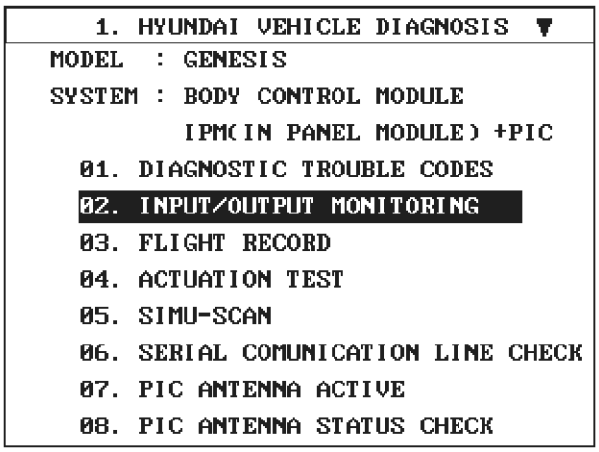



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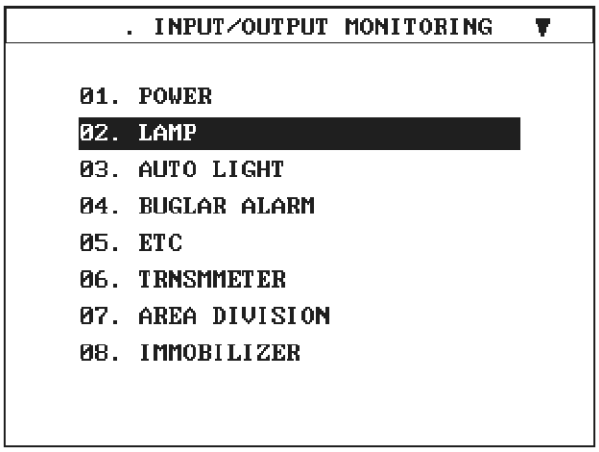



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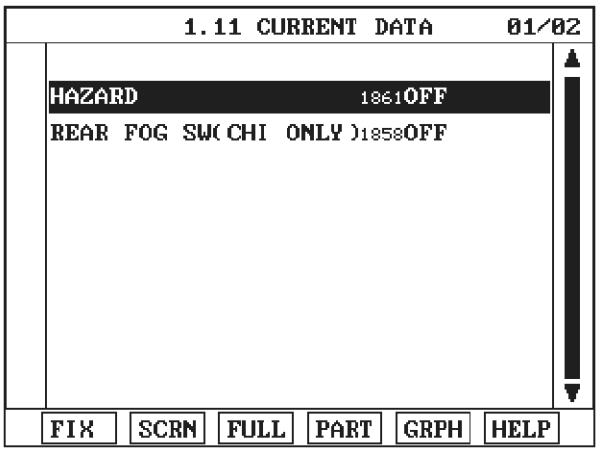
2. Select option "Input/output monitoring".




SBHBE9240L




SBHBE9241L




SBHBE9242L

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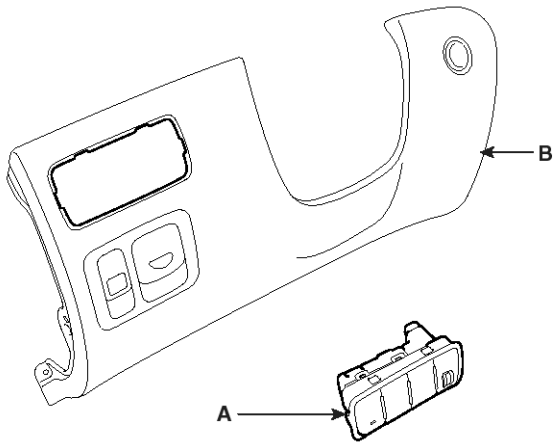
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## Rheostat

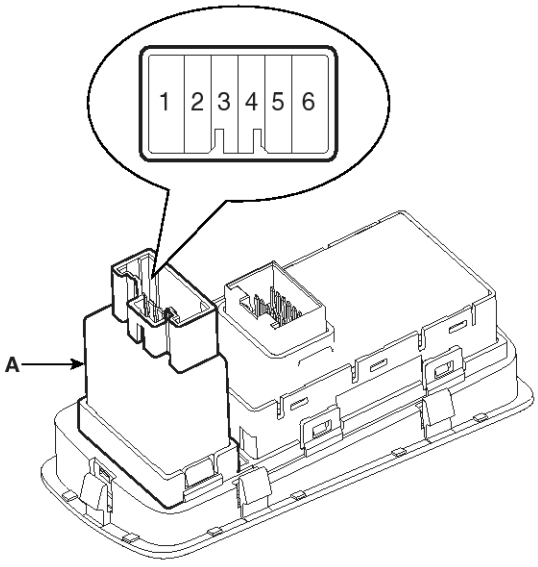
### Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the lower crash pad (B) switch assembly (A) by using the scraper and then disconnect the connectors.




SBHBE8427D

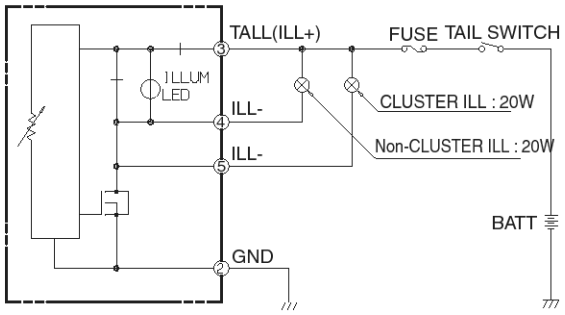
3. Remove the rheostat from lower crash pad switch assembly (A).




SBHBE8428D

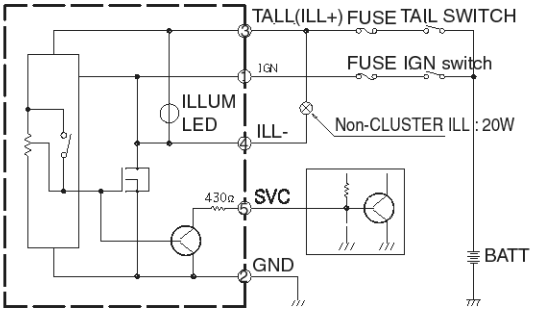
4. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.

**[Nomal]**




SENBE7475L

**[Super vision]**




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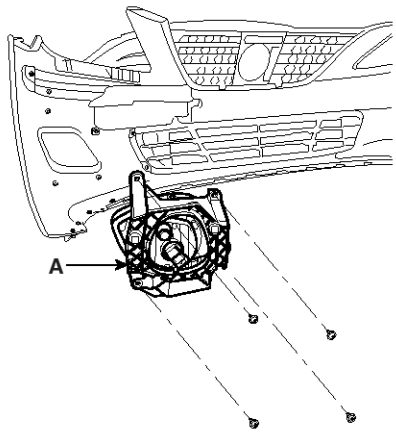
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## Front Fog Lamps

### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper cover.
3. Remove the front fog lamp assembly (A) after loosening screws (4EA).




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### Installation

1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front bumper cover.

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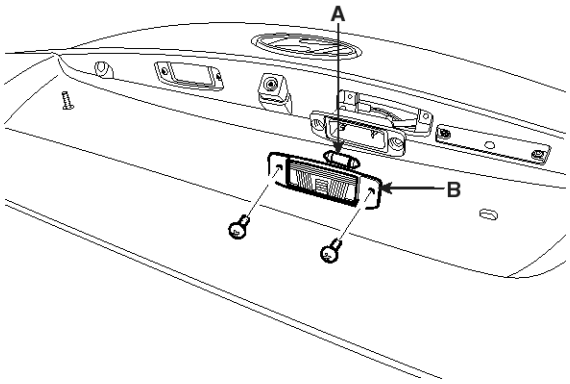
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## License Lamps

### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens (B) from the panel after loosening a screw (2EA).
3. Replace the bulb (A).




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### Installation

1. Install the bulb.
2. Install the license lamp lens.

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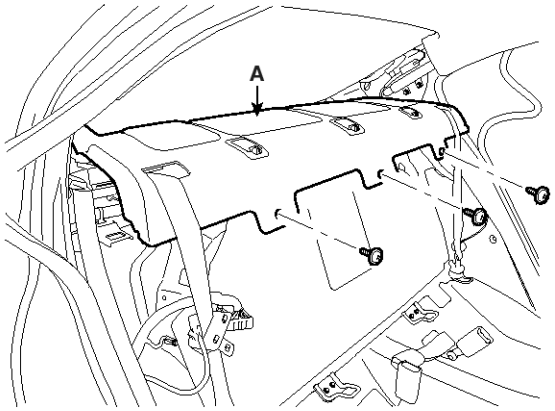


## High Mounted stop lamp

### Removal

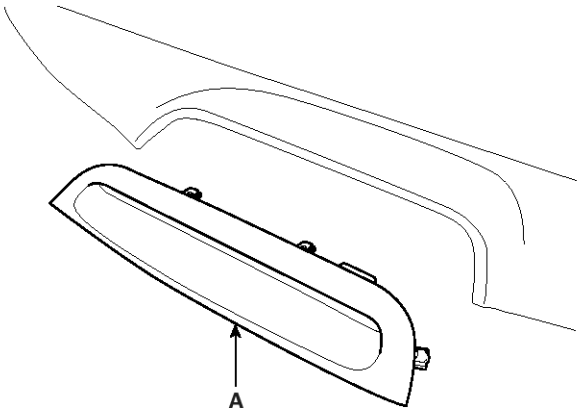
#### High Mounted Stop Lamp

1. Disconnect the negative (-) battery terminal.
2. Remove the rear package trim (A). (Refer to the Body group - Interior trim).




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3. Remove the high mounted stop lamp (A) after removing screws.




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### Installation

1. Install the high mounted stop lamp to the rear package trim.
2. Install the rear package trim.

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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 lamps do not light | Bulb burned out | Replace bulb |
| | 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 |

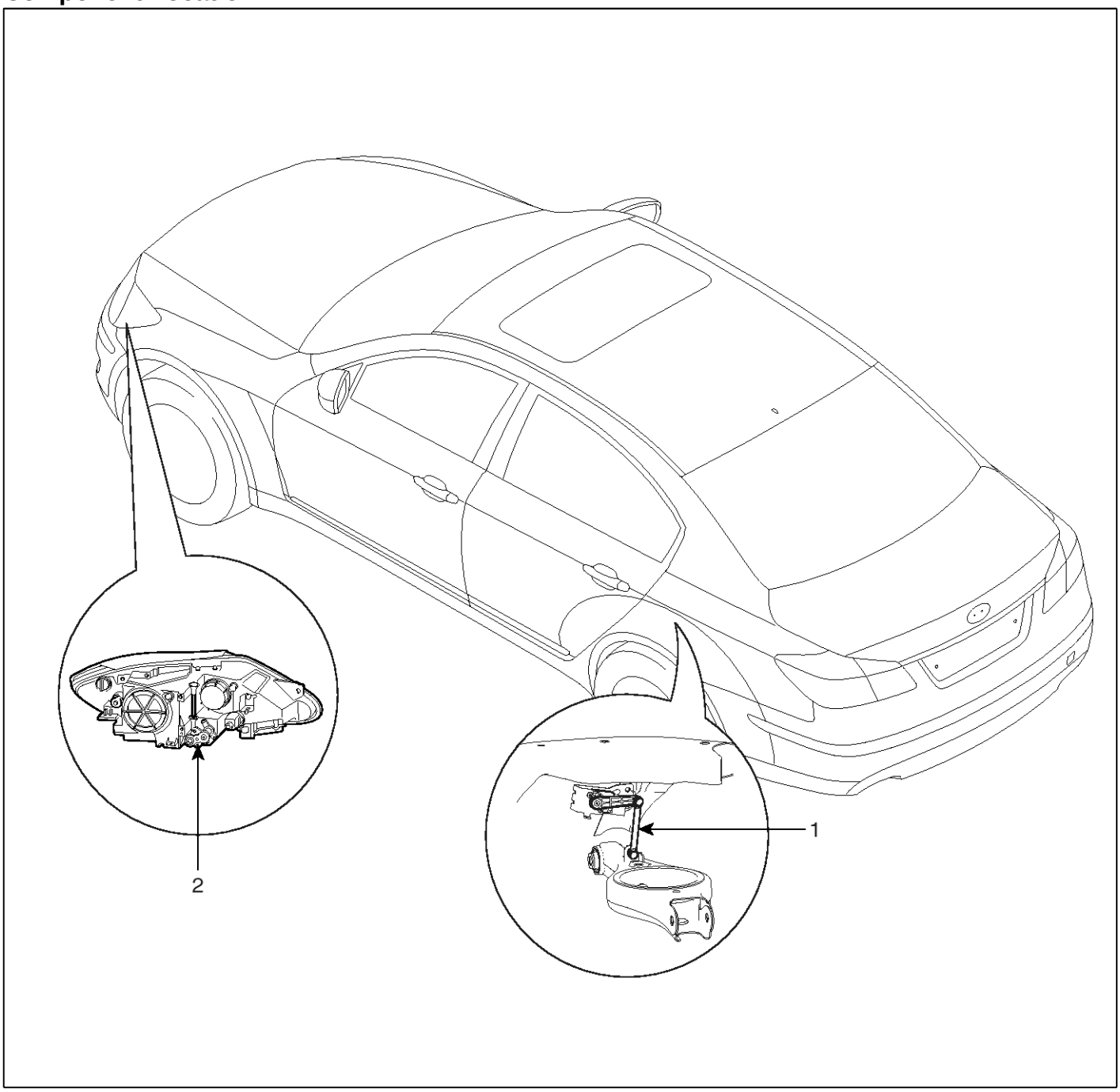
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# Head lamp leveling Device

## Component Location




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1. Head lamp leveling unit
2. Head lamp leveling actuator

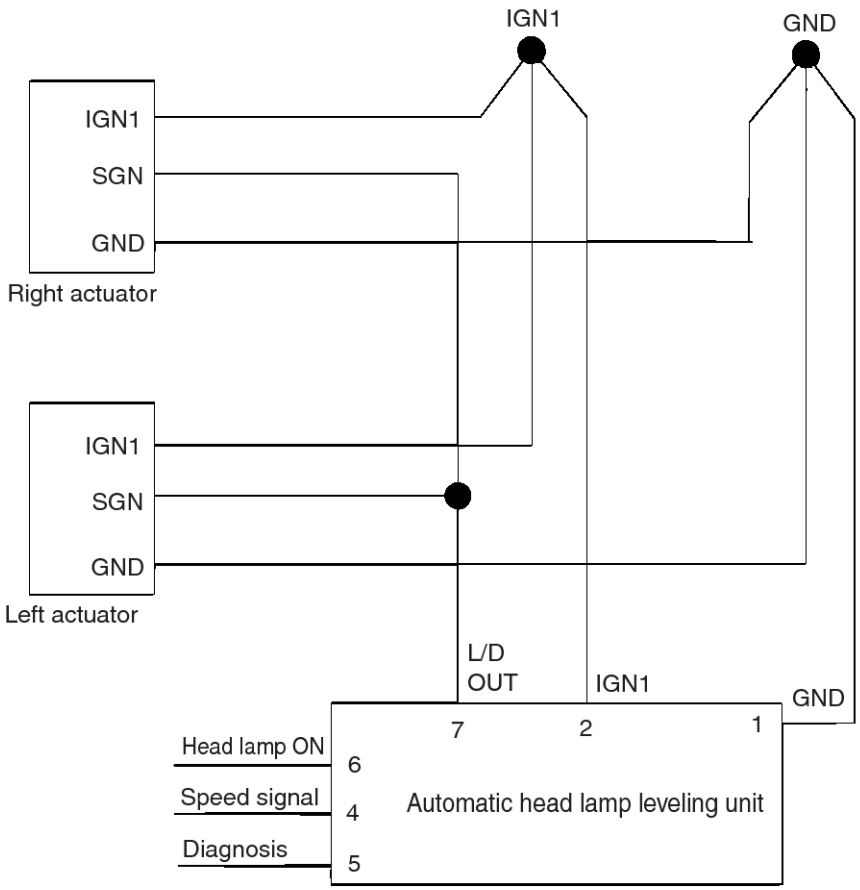
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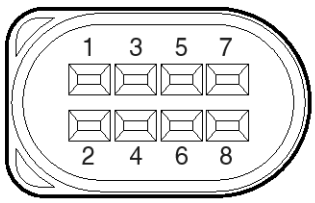
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## Auto Head lamp leveling Unit

### Circuit Diagram




PIN CONNECTION

| Terminal | Description |
|---|---|
| 1 | Ground |
| 2 | IGN1 |
| 3 | - |
| 4 | Speed signal |
| 5 | Diagnosis |
| 6 | Head lamp ON |
| 7 | Leveling actuator |
| 8 | - |

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SBHBE9178L

## Description

According to driving environment and loading state of vehicle, head lamp lighting direction is changed to keep the driver's visibility range and to protect the deriver's vision from glare, aiming at safety driving.

Sensor integrated ECU mounting on the rear center arm drives the actuator mounting on the head lamp since sensing the input signal following the vehicle's statical changes.

Head lamp beam is automatically operated by chassis tilt .

## Operation

### Operating Procedure

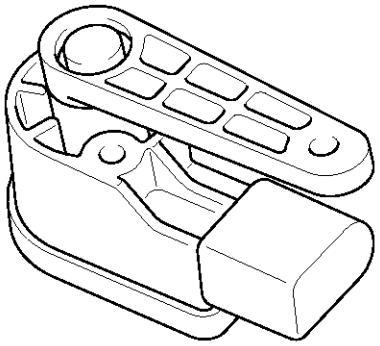
1. Suspension angle change resulted from vehicle's load change.
2. Sensor angle change.
3. Microprocessor calculates necessary head lamp angle change amount.
4. Sending a proper signal to head lamp levelling device and driving actuator.

### Operating Condition

1. Ignition on
2. Low beam on
3. On stop : If sensor lever change is 2° and above, head lamp is operated after max. 1.5 sec.
4. On driving : If vehicle velocity is over 4km/h, velocity change is not over 0.8-1.6km/h per second, and loading condition is changed, then head lamp is operated.

## Components

1. Auto head lamp leveling unit



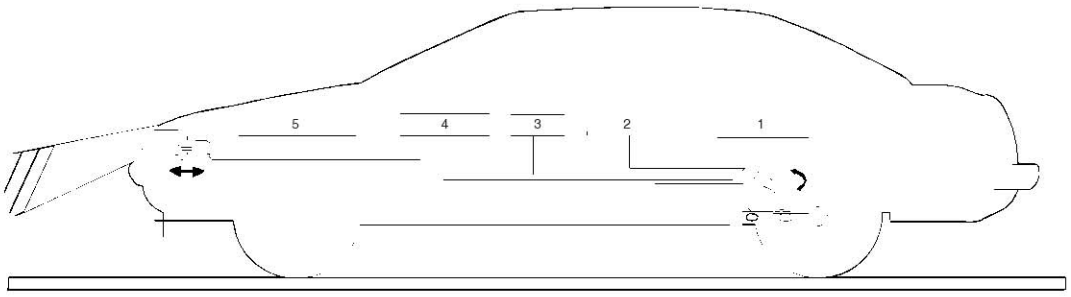
KTOF200A

   - Using a Micro-processor, percept the operation lever's mechanical angle change or speed signal.
   - As an actuator control device of inner control program, mounting on the rear center arm.
2. Actuator
   - Change the head lamp lighting direction up or down since automatic head lamp levelling unit sensing the input signal following the vehicle's statical changes.

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1. Automatic head lamp leveling unit
2. Speed signal (T/M)
3. Diagnosis
4. Head lamp ON
5. Actuator

LTCD150A

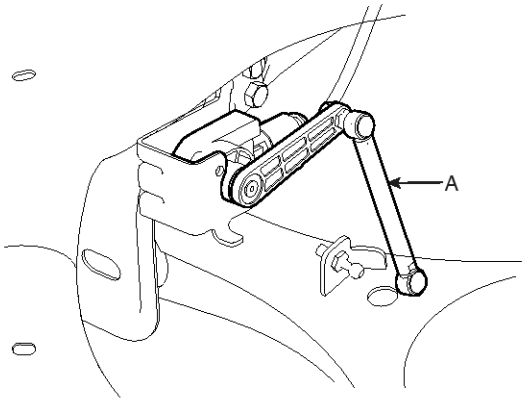
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## Removal

1. Remove the head lamp leveling unit linkage (A) from trailing arm.

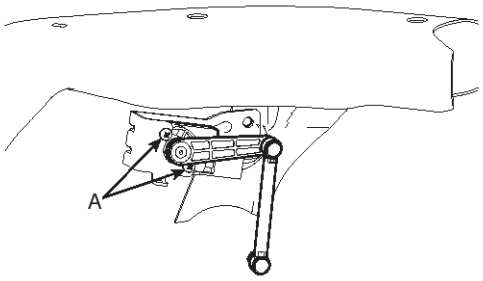



SBHBE8032D

2. Loosen the mounting bolts (3EA) of automatic head lamp leveling unit assembly.

**Torque :** 3-5 Nm (30~50 kg.cm)

3. Remove the head lamp leveling unit connector.
4. Remove the head lamp leveling unit assembly after removing the screws (2EA).




SBHBE8033D

## Installation

1. Connect the connector and install the head lamp leveling unit.
2. Install the head lamp leveling unit linkage.

## Inspection

1. Ignition "ON".
2. Turn on the head lamp switch.
3. Check for operation. If the aim of the head lamps changes smoothly when the head lamp leveling switch is turned.
4. If the operation does not work well, inspect the connector and terminals to be sure they are all making good contact.

   If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system.

   If the terminals look OK, go to step 5.
5. Substitute with a known-good head lamp assembly and check for proper operation.

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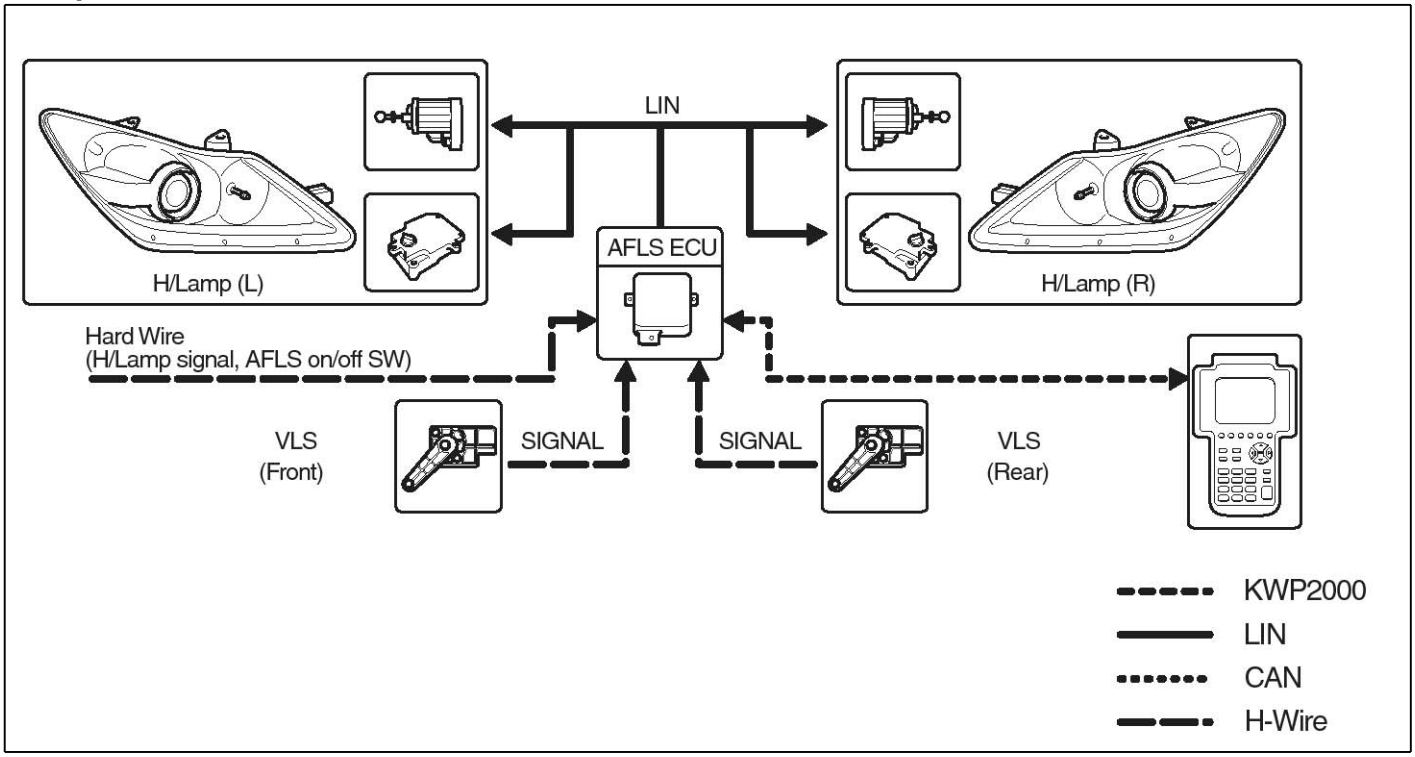


# Adaptive Front Lighting System

## Specifications

| Content | | Value |
|---|---|---|
| AFLS | Nominal Voltage | DC 13.5V |
| | Max Voltage | DC 18.5V |
| | Rated Voltage | DC 10~16V |
| | Operating Temperature | -40°C ~ +85°C |
| | Operating Current | MAX. 200mA |

## Components



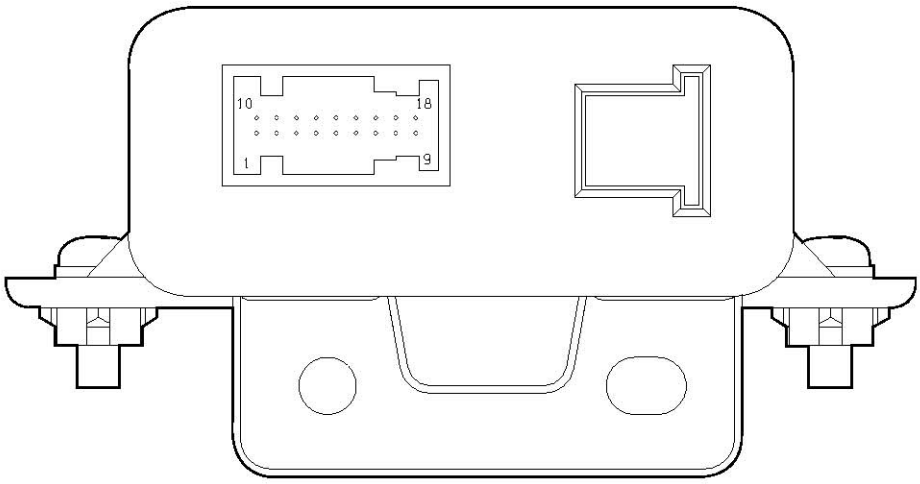

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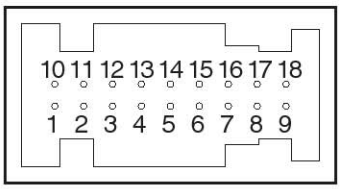
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## Circuit Diagram




| Pin | Designation | | Description |
|---|---|---|---|
| | Steel-suspension | Air-suspensio | |
| 1 | GND | GND | Supply GND |
| 2 | VLS +5V supply rear | - | +5V supply for external sensors(rear) |
| 3 | VLS GND rear | - | Supply GND for external sensors(rear) |
| 4 | H/L ON/OFF | H/L ON/OFF | headlamp switch status |
| 5 | - | | not connected |
| 6 | VLS signal rear | | Sensor input (signal from rear vehicle level sensor) |
| 7 | - | | not connected |
| 8 | (LIN BUS optionally) | (LIN BUS optionally) | LIN-bus optional (not used) |
| 9 | AFLS ON/OFF | AFLS ON/OFF | Switch for AFS activation |
| 10 | IGN 1 | IGN 1 | +12V supply |
| 11 | VLS +5V supply front | NC | +5V supply for external sensors(front) |
| 12 | VLS GND front | NC | Supply GND for external sensors(front) |
| 13 | CAN-L | CAN-L | CAN low |
| 14 | CAN-H | CAN-H | CAN high |
| 15 | VLS signal front | - | Sensor input (signal from front vehicle level sensor) |
| 16 | - | - | Not connected |
| 17 | LIN-BUS | LIN-BUS | LIN-bus optional (not used) |
| 18 | K-line | K-line | diagnostic line |

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## Description

### Adaptive Front-lighting System (AFLS)

AFLS(Adaptive Front-lighting System) is a headlamp orientation control system that takes into account both steering angle and vehicle speed to orient the headlamps to an angle that provides better nighttime visibility.

Variable conditions make beam pattern of running vehicle kaleidoscope.

### Component of AFLS

1. Input part : It is provided that information of speed sensor, height sensor and so on related to condition of vehicle.
2. Control part (AFLS Unit) : It controls Output part by analyzing/judging Input signal.
3. Output part : It drive Low beam of H/Lamp to upper/lower and left/right side optimum beam pattern according to output control signal of AFLS Unit.

### Main function of AFLS

| | Content | Description |
|---|---|---|
| 1 | Dynamic Bending (Swivelling) | • Providing optimum beam pattern in the curve road<br>1. Enhanced visibility in the curve road<br>2. Drive Low beam to left / right side |
| 2 | Automatic Leveling (Leveling) | • Compensating Low beam according to inclination of vehicle<br>1. Compensation according to static condition (Load)<br>2. Compensation according to dynamic condtion (Quick start, Sudden stop ) |
| 3 | Fail-safe | • Fail-safe reaction while detecting system failure and malfunction<br>1. Detecting signal / communication error for Swivelling<br>2. Detecting signal /communication error for Leveling<br>3. Detecting system failure |

### Advantage of AFLS

| | Content | Description |
|---|---|---|
| 1 | Enhanced stability | • Visibility Guarantee In case of curve road<br>• According to vehicle Speed/Steering angle, speed/angle of Swivel actuator is automatically controlled to provide optimum beam pattern<br>• Fail-safe reaction application for Driver on opposite side road<br>→In case error communication,automatically return initial position of Swivel actuator |
| 2 | Enhanced convenience | • AFLS operating application by driver's selection(AFLS Off switch)<br>• Providing Diagnostic function for detecting system failure and malfunction and check up data information (by using Diagnostic equipment )<br>• Reduced wiring-harness by Applying CAN/LIN communication in vehicle<br>• Fun Drving Function : Swivelling of Low beam<br>→ Increasing driver's pride |

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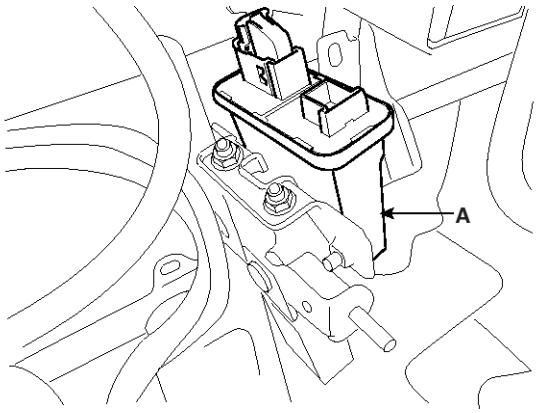
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## Operation

### Component

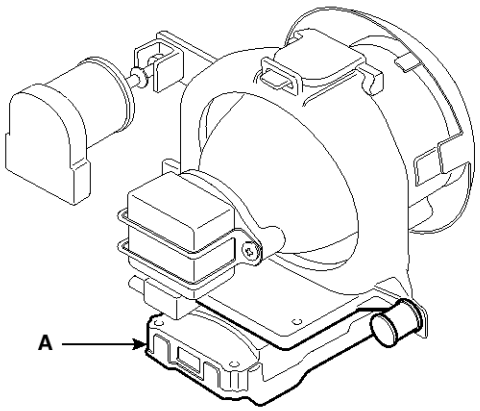
### AFLS Unit (A)




SBHBE8974D

1. General
   System initialization, In case of input Engine signal ( AFLS ECU, Levelling /Swivelling motor)
   Adaptation of AFLS OFF switch
   AFLS operate normally ,only under turning low beam switch on.
   Providing Tell-tale function of AFLS(display 'AFLS O-FF' on dashboard)
   In case of system failure, display blinking 'AFLS OFF' on dashboard.
2. Main function
   Swivelling function
   Levelling function
   Processing signal of Height sensor(Air suspension)

### Swivelling Actuator (A)




SBHBE8957D

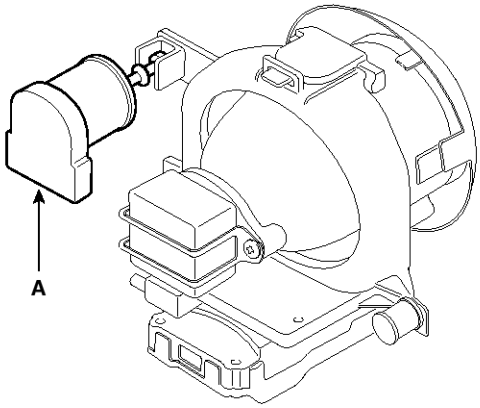
1. General
   communicate AFLS Unit through LIN protocol
   Robust control to Disturbance
   Doesn't work out of rated voltage range.
2. Main function & Rating
   Drive Low beam to left / right side
   Fail-safe function : In case of detecting malfunction or system failure , drive to secure position
   OperatingTemperature : -40℃ ~ 110℃
   gear ratio (150 : 1)
   Operating voltage : 10V ~ 16V
   Operating current : 100mA

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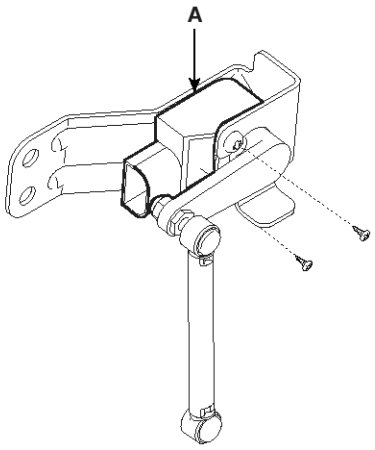
### Levelling Actuator (A)




SBHBE8958D

1. Main spec
   communicate AFLS Unit through LIN protocol
   Robust control to Disturbance
   Doesn't work out of rated voltage range.
2. Main function & Rating
   Drive Low beam to upper / lower
   Fail-safe function : In case of detecting malfunction or system failure , drive to secure position
   OperatingTemperature : -40℃ ~ 120℃
   Drive type : Micro step mode (1/16)
   Operating voltage : 10V ~ 16V
   Operating current : 100mA

### Height Sensor




SBHBE8978D

1. General
   Height Sensor connecting body & suspension measures inclination information from load condition.
   Vehicle having the Air-suspension system transmits inclination signal to AFLS ECU by using CAN protocol .
   Vehicle having the Steel-suspension system transmits inclination signal to AFLS ECU by using Hard-wire.
2. Rating
   Rated Voltage : 5V ± 5%
   Operating temperature : -40℃ ~ 125℃

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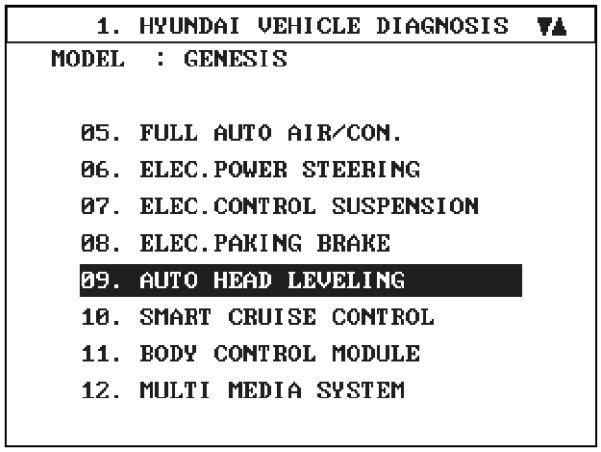
## Inspection

Initialization and diagnosis sequence by using diagnostic equipment

Below content summarize the procedure for A/S using Diagnostic equipment

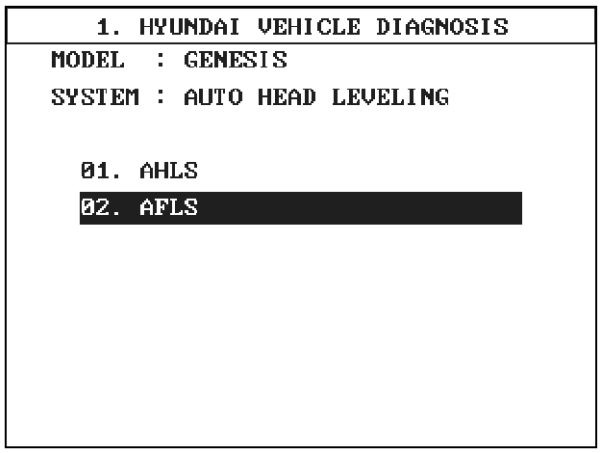
### Download parameter

1. Select "AFLS" menu after selecting "GENESIS" of vehicle lists.

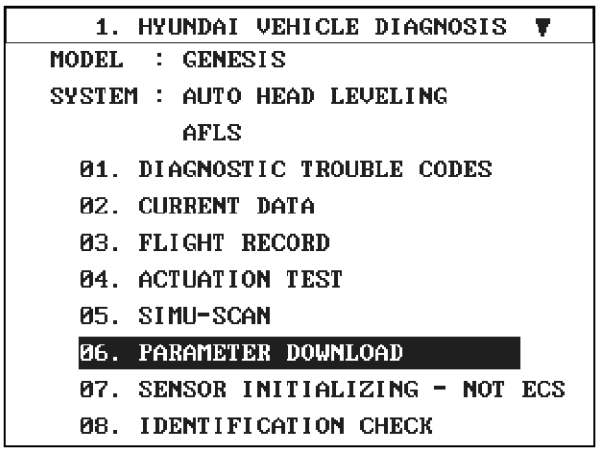



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2. Select "Parameter download" menu for define a characteristc of vehicle.

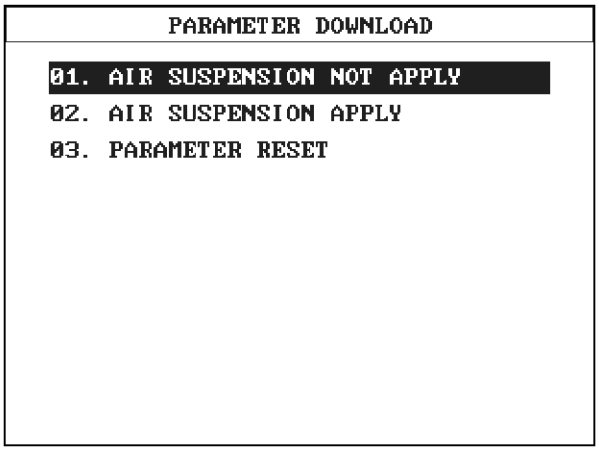



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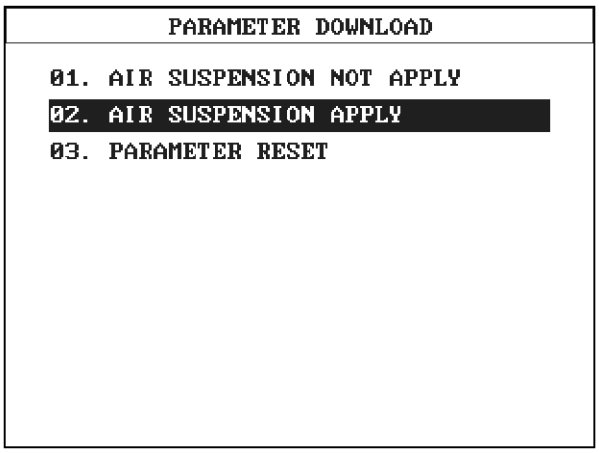

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3. Select "Air suspension not apply" if vehicle has a Steel suspension




SBHBE9314L

4. Select "Air suspension apply" if vehicle has a Air suspension



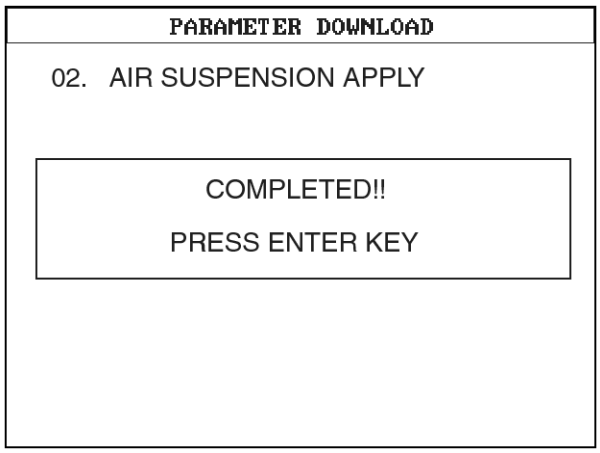

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5. When "Parameter download" is done,display belows.



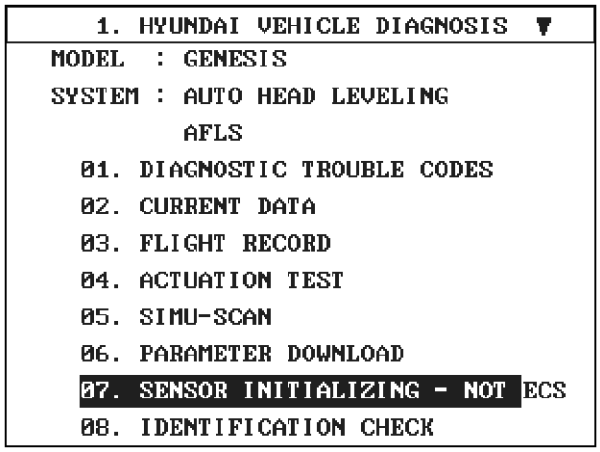

SBHBE9316L

### System calibration

**CAUTION**

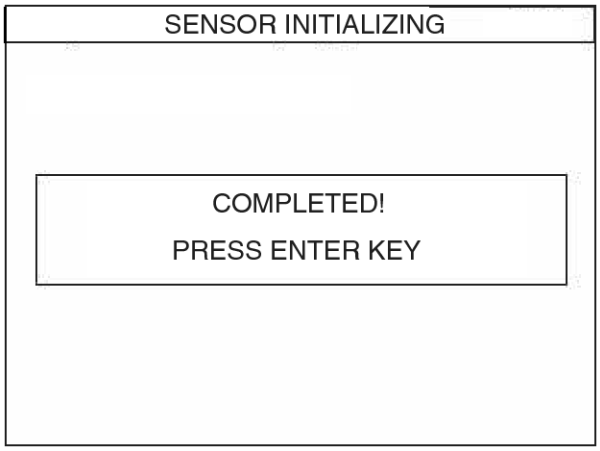
**This menu is applied only if vehicle has a Steel suspension**

1. Select "AFLS" menu after selecting "GENESIS" of car lists.
2. Select "Sensor initializing-Non ECS" if vehicle has a Steel suspension



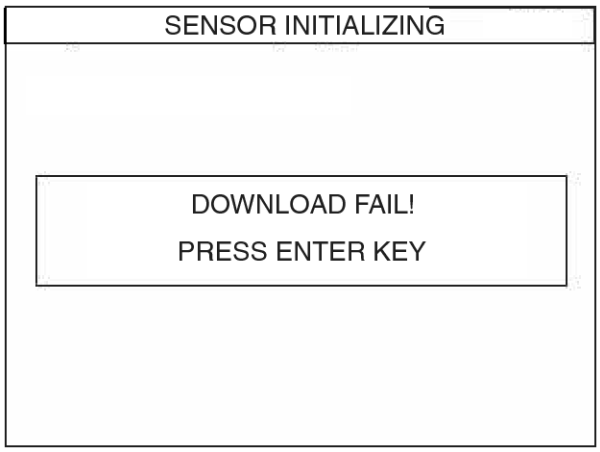

SBHBE9317L

3. When "System calibration" is done,display belows.




SBHBE9318L

4. When "System calibration" is not done,display belows .




SBHBE9319L

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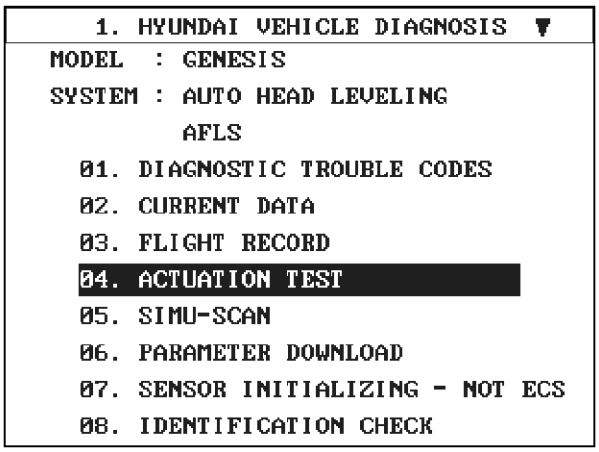
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### Actuator test

When it replace H/Lamp Unit, it necessarily check up by operating actuator test.

1. Select "AFLS" menu after selecting "GENESIS" of car lists.
2. Select "Actuator test"

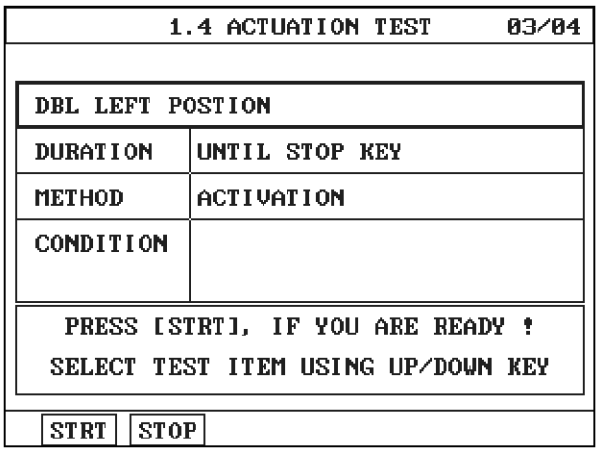



SBHBE9320L

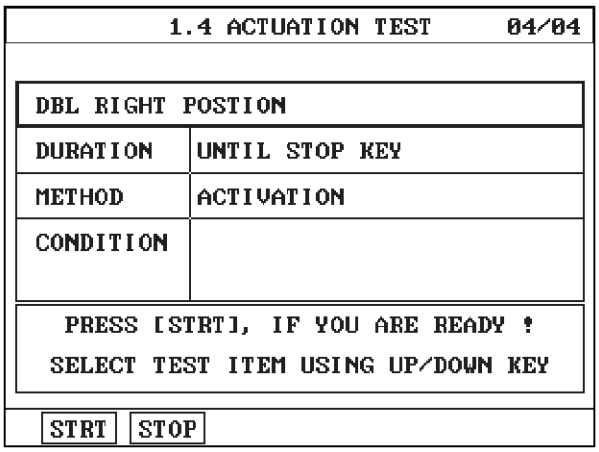
3. Select DBL or HLL test by using ▲ ▼ key
4. In case select BOTH DBL ACTUATOR DRIVE TO MAX POS(swivelling)

   In case select F1 key : drive to max position CCW direction (15˚)

   In case select F2 key : back to initial position




SBHBE9321L

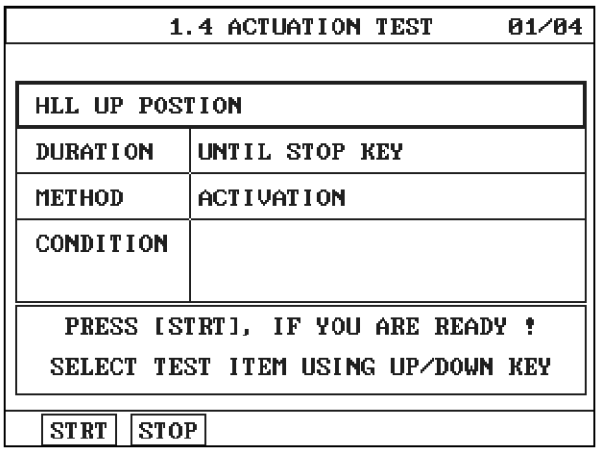



SBHBE9322L

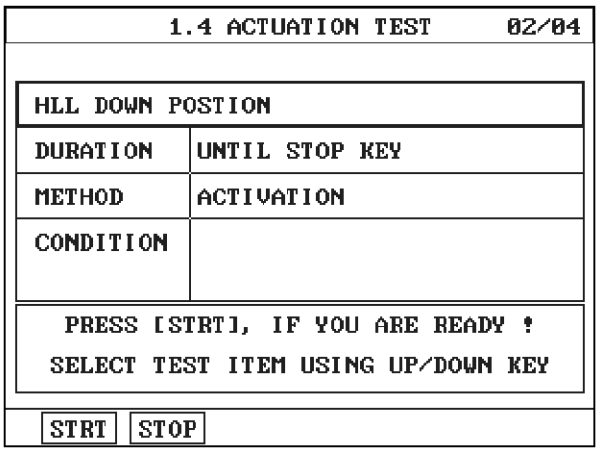
5. In case select BOTH DBL ACTUATOR DRIVE TO MAX POS (Leveling)

   In case select F1 key : drive to max position upper side

   In case select F2 key : back to initial position




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### AFLS Fail-safe function

If the error condition of AFLS occurred during system operation, the system have to fail-safe reaction for prevent dazzling of opposite side driver

### AFLS Fail-safe Index

| Part | | Content | Fail-safe Reaction | Tell-tale Result | Code |
|---|---|---|---|---|---|
| ECU | | ECU Hardware (A/D Converter fail) | 1) Levelling : staying in current POS<br>2) Swivelling : staying in current POS | - | B1621 |
| | | ECU Software (EEPROM/ROM fail) | 1) Levelling : staying in current POS<br>2) Swivelling : staying in current POS | | B1622 |
| | | Control Unit not initialized | 1) Levelling : drive to error POS (H-15)<br>2) Swivelling : drive to error POS (0°) | | B1637 |
| | | Parameter missing | 1) Levelling : drive to error POS (H-15)<br>2) Swivelling : drive to error POS (0°) | | B1661 |
| Levelling module fault | Right | Short circuit | 1) Right Levelling : staying in current POS<br>2) Left Levelling : drive to error POS (H-15)<br>3) Swivelling : Normal operation | - | B2401 |
| | | Over temperature | | | |
| | | LIN communication error | 1) Levelling : drive to error POS(H-15) (After )<br>Levelling : staying in current POS (Before)<br>2) Swivelling : Normal operation | | B1642 |
| | Left | Short circuit | 1) Left Levelling : staying in current POS<br>2) Right Levelling : drive to error POS(H-15)<br>3) Swivelling : Normal operation | - | B2400 |
| | | Over temperature | | | |
| | | LIN communication error | 1) Levelling : drive to error POS(H-15)(After)<br>Levelling : staying in current POS (Before)<br>2) Swivelling : Normal operation | | B1641 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Swivelling module fault | Right | Short circuit | | | 1) Right Swivelling : staying in current POS<br>2) Left Swivelling : drive to error POS(0°)<br>3) Right Levelling : drive to error POS(H-28)<br>4) Left Levelling : Normal operation | Tell-tale | B2326 |
| | | Over temperature | | | | | |
| | | Stall detected | | | | | |
| | | LIN coum-munication | LIN fault | Before | 1) Swivelling : staying in current POS<br>2) Lefvelling : drive to error POS(H-28) | | B1640 |
| | | | | After | 1) Swivelling : drive to error POS(0°)<br>2) Lefvelling : drive to error POS(H-28) | | |
| | | | DBL supply fault | Before | 1) Swivelling : staying in current POS<br>2) Lefvelling : drive to error POS(H-28) | | |
| | | | | After | 1) Right Swivelling : staying in current POS<br>2) Left Swivelling : drive to error POS(0°)<br>3) Lefvelling : drive to error POS(H-28) | | |
| | Left | Short circuit | | | 1) Left Swivelling : staying in current POS<br>2) Right Swivelling : drive to error POS(0°)<br>3) Left Levelling : drive to error POS(H-28)<br>4) Right Levelling : Normal operation | Tell-tale | B2325 |
| | | Over temperature | | | | | |
| | | Stall detected | | | | | |
| | | LIN coum-munication | LIN fault | Before | 1) Swivelling : staying in current POS<br>2) Lefvelling : drive to error POS(H-28) | | B1639 |
| | | | | After | 1) Swivelling : drive to error POS(0°)<br>2) Lefvelling : drive to error POS(H-28) | | |
| | | | DBL supply fault | Before | 1) Swivelling : staying in current POS<br>2) Lefvelling : drive to error POS(H-28) | | |
| | | | | After | 1) Left Swivelling : staying in current POS<br>2) Right Swivelling : drive to error POS(0°)<br>3) Lefvelling : drive to error POS(H-28) | | |
| AXLE sensor | Front & Rear | external(5V) Sensor power supply fault (short to ground or to Bat) | | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : Normal operation | - | B1905 |
| | Front | FREQ_LOWER , FREQ_UPPER | | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : Normal operation | | B1906 |
| | | Signal line open circuit | | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : Normal operation | | B1907 |
| | | Signal line short circuit | | | | | |
| | | Front sensor out of range | | | | | |
| | Front sen-sor out of range | FREQ_LOWER , FREQ_UPPER | | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : Normal operation | | B1908 |
| | | Signal line open circuit | | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : Normal operation | | B1909 |
| | | Signal line short circuit | | | | | |
| | | Front sensor out of range | | | | | |

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| | | | | | |
|---|---|---|---|---|---|
| Battery | battery voltage too high | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : staying in current POS(Before )<br>Swivelling : drive to error POS(0˚) | - | B1101 |
| | battery voltage too low | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : staying in current POS(Before )<br>Swivelling : drive to error POS(0˚) | | B1102 |
| LIN physical fault | Short circuit to battery or GND (physical fault) | Before | 1) Levelling : staying in current POS<br>2) Swivelling : staying in current POS | Tell-tale | B1636 |
| | | After | 1) Levelling : drive to error POS(H-28)<br>2) Swivelling : drive to error POS (0˚) | | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| CAN communication fault | Speed signal fault | speed signal invalid<br>supplying ECU not available on CAN | | 1) Levelling : slow dynamic mode<br>2) Swivelling : drive to error POS (0°) | - | B1220 |
| | Steering angle signal fault | Steering wheel sensor not O.K (signal invalid)<br>supplying ECU not available on CAN | | 1) Levelling : normal operation<br>2) Swivelling : drive to error POS (0°) | - | B1301 |
| | Gearbox signal fault | Reverse gear signal invalid<br>supplying ECU not available on CAN | | 1) Levelling : normal operation<br>2) Swivelling : drive to error POS (0°) | - | B1302 |
| | Accelator pedal signal fault | Accelator pedal signal invalid<br>supplying ECU not available on CAN | | 1) Levelling : Reduced performance<br>2) Swivelling : Normal operation | - | B1303 |
| | Engine state signal fault | Engine state signal invalid<br>supplying ECU not available on CAN | | 1) Levelling : Normal operation<br>2) Swivelling : Normal operation | - | B1304 |
| | Yaw rate signal fault | Yaw rate signal invalid<br>supplying ECU not available on CAN | | 1) Levelling : Normal operation<br>2) Swivelling : Reduced performance | - | B1305 |
| | Brake pedal signal fault | Brake signal invalid<br>supplying ECU not available on CAN | | 1) Levelling : Normal operation<br>2) Swivelling : Reduced performance | - | B1306 |
| | Air suspension ECU sensor signal invalid | invalid sensor value from air suspension ECU | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : Normal operation | - | B1307 |
| | Air suspension CAN signal time out | no CAN signal from air suspension | | 1) Levelling : drive to error POS(H-15)<br>2) Swivelling : Normal operation | - | B1638 |
| | CAN 'Bus off' fault | ECU is isolated from the CAN network | Air suspension | 1) Swivelling : drive to error POS(0°)<br>2) Levelling : drive to error POS(H-15) | - | B1603 |
| | | | Steel suspension | 1) Swivelling : drive to error POS(0°)<br>2) Levelling : slow dynamic mode | | |
| H/wire | AFLS switch fault | Open wire | | 1) Swivelling : Normal operation<br>2) Levelling : Normal operation | - | B1510 |
| | H/Lamp switch fault | Open wire | AFLS OFF S/W ON | 1) Swivelling : DBL activated<br>2) Levelling :HLL activated | - | B1592 |
| | | | AFLS OFF S/W ON | 1) Swivelling : DBL activated<br>2) Levelling : HLL activated | | |

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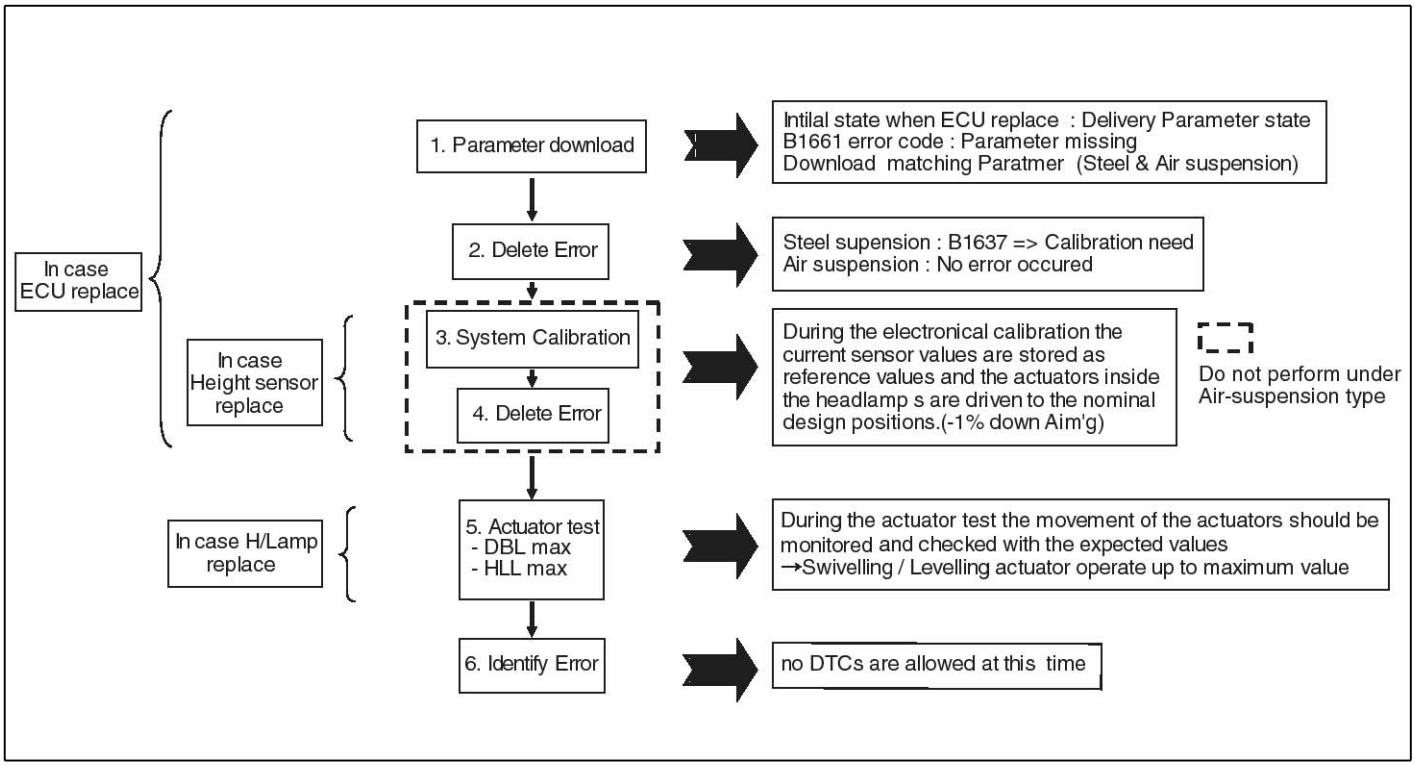


### AFLS Setting Procedure

When it replace AFLS ECU, H/Lamp Unit, Height sensor, it operates in setting procedure by using Diagnostic equipment following belows.

Parameter is composed of three state (Air-suspension,Steel-suspension,Delivery state)

When AFLS setting procedure operate, necessarily confirm suspension type and then download parameter.




SBHBE9100L

※ DTC : Diagnostic Trouble Code

DBL : Dynamic bending Light

HLL : Head Lamp Leveling

### Vehicle condition while AFLS setting

1. Vehicle on an even surface
2. No vehicle movement
3. Gear position in P & N
4. Ignition switched on & Engine RPM >500RPM
5. Diagnostic equipment connected
6. ALL ECUs on CAN mounted and activated
7. Battery voltage > 10.5 V ( ECU supply to be ensured)
8. Light switched
9. AFLS on (Don't push AFLS OFF switch )

### Action in case of download wrong parameter

1. In case Steel suspension vehicle downloaded Air- suspension parameter

   → B1638 (Air-Sus. CAN Signal Timeout) occurred
2. In case Air- suspension car downloaded Steel suspension parameter

   → B1907 (FRT Sensor signal Fault), B1909 (Rear Sensor signal Fault) occurred
3. Solution
   1. Download Delivery Parameter
   2. check up B1661(Parameter missing)
   3. Ignition OFF
   4. Ignition ON & Engine RPM > 500RPM
   5. Download matching Paratmer (Steel & Air suspension)

   ※In case download steel suspension parameter, Calibration have to operate up to setting procedure

## Troubleshooting

### AFLS DTC List

| NO | DTC code | Spec Discription |
|---|---|---|

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| | | |
|---|---|---|
| 1 | B1101 | Battery voltage high |
| 2 | B1102 | Battery voltage low |
| 3 | B1220 | Speed signal fault |
| 4 | B1301 | Steering angle signal fault |
| 5 | B1302 | Gearbox signal fault |
| 6 | B1303 | Accelator pedal signal fault |
| 7 | B1304 | Engine speed signal fault |
| 8 | B1305 | Yaw rate signal fault |
| 9 | B1306 | Brake pedal signal fault |
| 10 | B1307 | Air suspension ECU signal invalid |
| 11 | B1510 | AFLS OFF Switch Fault |
| 12 | B1592 | Headlamp switch fault |
| 13 | B1603 | CAN ‘Bus off‘ fault |
| 14 | B1621 | ECU Hardware fault |
| 15 | B1622 | ECU Software fault |
| 16 | B1636 | LIN fault |
| 17 | B1637 | Control unit not initialized |
| 18 | B1638 | Air suspension CAN signal timeout |
| 19 | B1639 | LIN fault DBL left |
| 20 | B1640 | LIN fault DBL right |
| 21 | B1641 | LIN fault HLL left |
| 22 | B1642 | LIN fault HLL right |
| 23 | B1661 | parameter missing |
| 24 | B1905 | Sensor power supply fault |
| 25 | B1906 | Front sensor PWM signal fault |
| 26 | B1907 | Front sensor signal fault |
| 27 | B1908 | Rear sensor PWM signal fault |
| 28 | B1909 | Rear sensor signal fault |
| 29 | B2325 | Swivel module fault left |
| 30 | B2326 | Swivel module Fault right |
| 31 | B2400 | Levelling motor fault left |
| 32 | B2401 | Levelling motor Fault right |

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## B1101 Battery Voltage High

### General Description

AFLS(Adaptive Front-Lighting System) provides driver with the best visibility by adjusting vertical direction of the headlamp. It consists of AFLS ECU, Leveling Actuator-Intelligent Stepper Motor, Swivel Actuator, Head lamp switch, Height sensor(not applied to ECS). For efficient operation of system, AFLS ECU check Battery voltage.Battery function is supply power to AFLS ECU and Actuators.

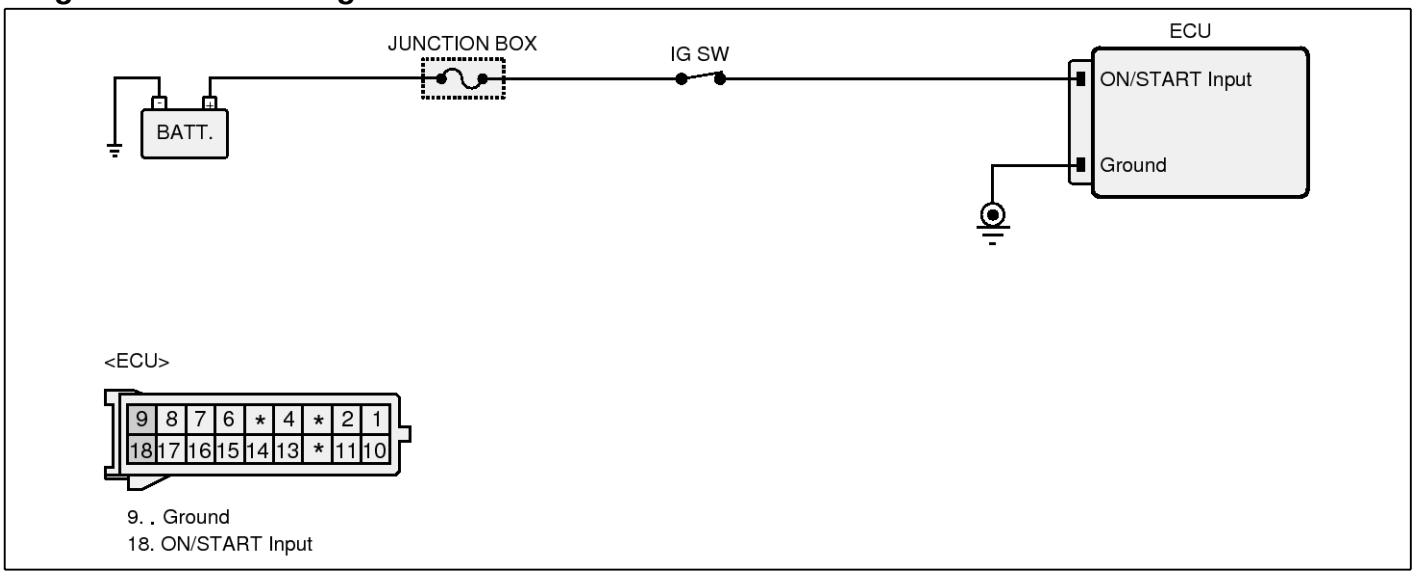
### DTC Description

AFLS ECU set this code If higher voltage input than available voltage to circuit, and discontinued operation in order to prevent from damage for internal motor coil of Actuator.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Voltage monitoring | • Faulty in power circuit<br>• Faulty in ground circuit<br>• over charge |
| Enable Conditions | • IG ON | |
| Threshold Value | • when battery voltage is above 16V | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling -1.5% down<br>Before initialization of Swivelling : stop at present position.<br>Operating Swivelling : move to 0° position. | |
| Check Lamp | • NO | |

### Diagnostic Circuit Diagram




SBHBE9C10L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Turn "ON" Engine and headlamp and defogger S/W.
3. Monitor the "Supply voltage" parameters on the scantool.
4. Keep the 2500 Engine rpm for 2 minutes and then confirm the output value.

**Specification :** below 16 [V]

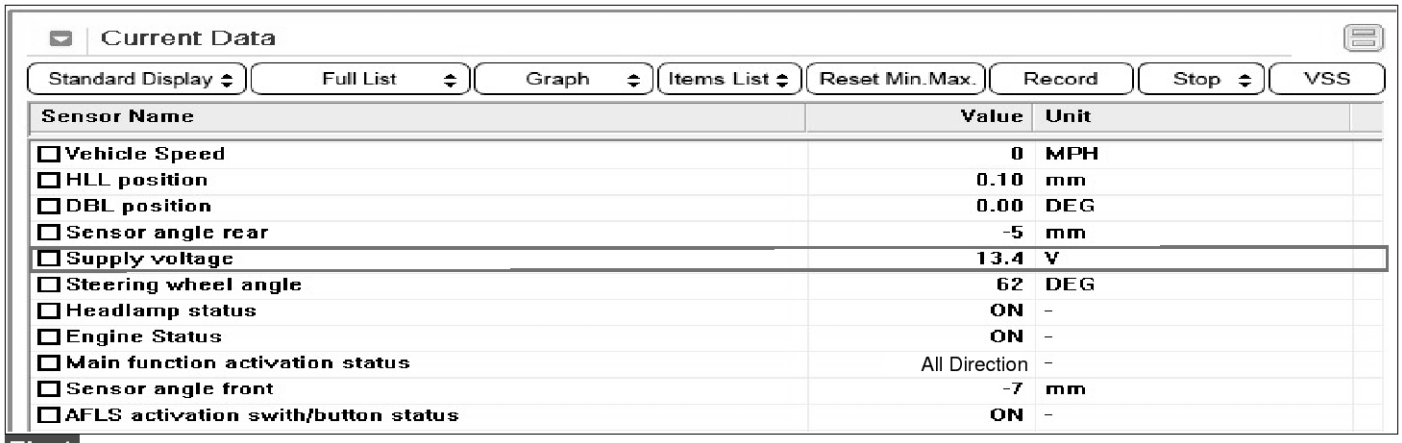



Fig.1

SBHBE9C30L

FIg1) Engine "ON"

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 "Inspection/Repair" procedure

## W/Harness 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 " Charging System Inspection" procedure.

## ■ Charging System Inspectio

1. Engine "ON"
2. Turn ON the all electrocity such as Head Lamp, defroster etc.
3. Measure voltage at battery at 2500 RPM.

**Specification:** below 16 [V]

4. Is the measured voltage within specifications ?

**YES** ▶ Go to "Power circuit Inspection" procedure.

**NO** ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration,or damage from battery to alternator and also check the charging system.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

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## Power circuit Inspection

1. Ignition "OFF"
2. Disconnect ECU connector
3. Engine "ON"
4. Measure voltage between ON/START Power terminal of ECU harness connector and chassis ground.

**Specification:** below 16 [V]

5. Is the measured voltage within specifications ?

**YES** ▶ Go to "Ground circuit inspection" procedure

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

## Ground circuit inspection

1. Ignition "OFF"
2. Disconnect ECU connector
3. Measure resistance between ground terminal of ECU harness connector and chassis ground.

**Specification :** below 1Ω

4. Is the measured resistance within specification ?

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

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

## Verification of Vehicle Repair

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

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
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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# B1102 Battery Voltage Low

## General Description

Refer to DTC B1101 : Battery Voltage High.

## DTC Description

AFLS ECU set this code If lower voltage input than available voltage to circuit, and discontinued operation in order to prevent from system malfunctioning.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Voltage monitoring | • Faulty in power circuit<br>• Faulty in ground circuit<br>• Faulty in battery |
| Enable Conditions | • IG ON | |
| Threshold Value | • Voltage < 10.5 [V] | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling -1.5% down<br>Before initialization of Swivelling : stop at present position.<br>Operating Swivelling : move to 0° position. | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B1101 : Battery Voltage High.

## Monitor Scantool Data

Refer to DTC B1101 : Battery Voltage High.

## W/Harness Inspection

Refer to DTC B1101 : Battery Voltage High.

## Power circuit Inspection

Refer to DTC B1101 : Battery Voltage High.

## Ground circuit inspection

Refer to DTC B1101 : Battery Voltage High.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1220 Vehicle Speed Sensor

### General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, atutomatic transaxle, ABS, TCS, ECS)AFLS ECU is input some informations(engine speed, steering angle sensor's signal, vehicle speed) in order to maintain optimum headlamp condition through CAN communication. AFLS ECU determine working or not and range performance and working speed to headlamp in according with wheel speed signal.

### DTC Description

AFLS ECU set this code If input value(wheel speed signal) is out of available range.

### DTC Detecting Condition

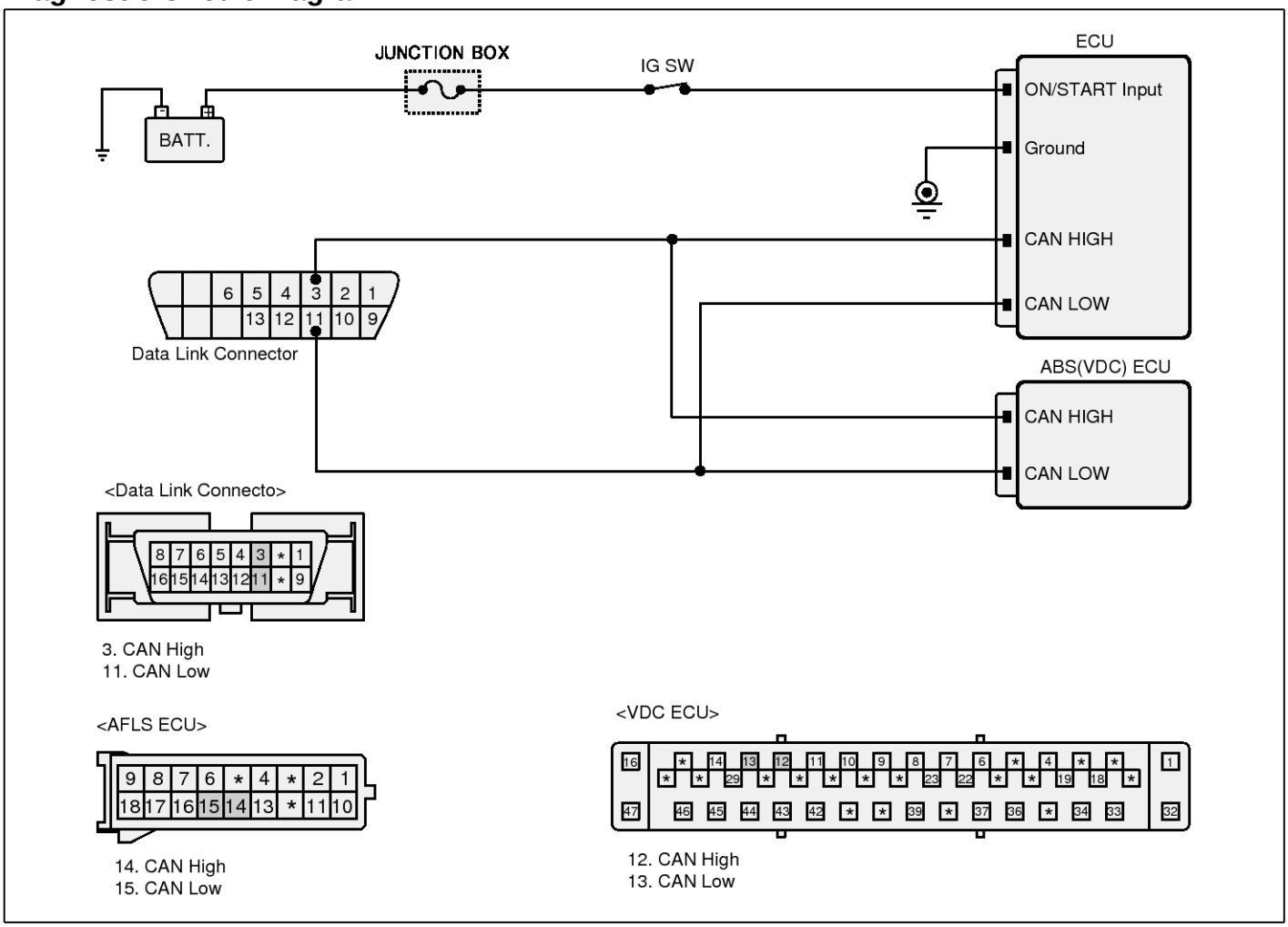
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit open/short<br>• Wheel speed sensor circuit open/short<br>• Faulty in Wheel speed sensor |
| Enable Conditions | • IG ON | |
| Threshold Value | • Wheel speed sensor signal is out of available range<br>CAN communication signal not output from ABS(VDC) | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling -1.5% down<br>Swivelling : move to 0˚ position | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram




SBHBE9C11L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine start and drive the vehicle on the road.
3. Monitor the "VSS" parameters on the scantool.(AFLS and ABS(VDC) Control)

**Specification :** Be changed according to driving condition.

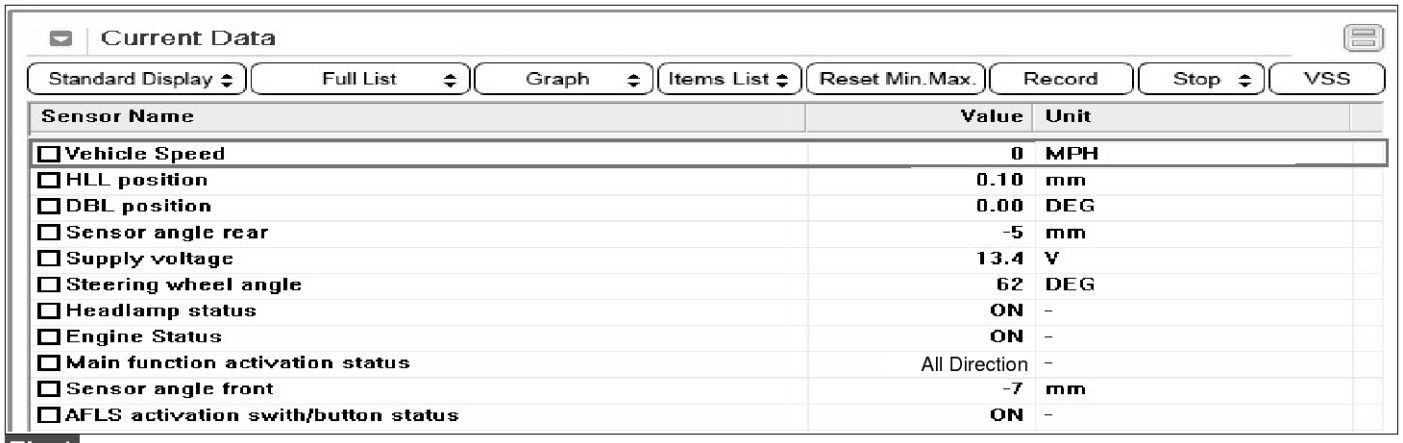



Fig.1

SBHBE9C31L

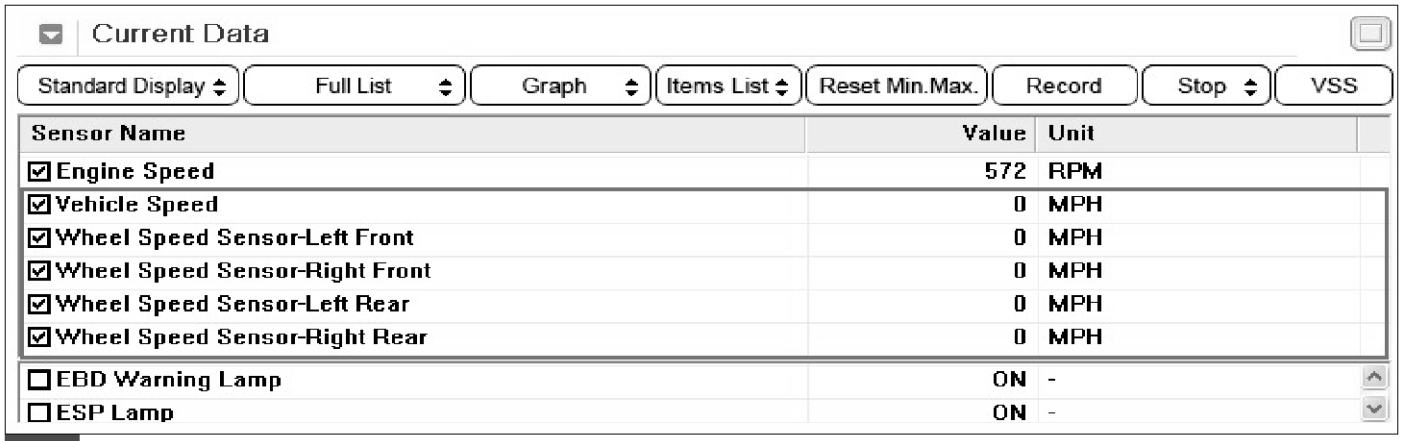



Fig.2

SBHBE9C32L

FIg1) Engine "ON"

FIg2) Engine "ON" - VDC

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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** ▶ Faulty in vehicle speed sensor.
- Check the Wheel speed sensor and ABS(VDC) system and go to "Verification of vehicle Repair" procedure.

▶ Faulty in only AFLS ECU signal
- Go to "Inspection/Repair" procedure

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## W/Harness 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 "CAN communication circuit inspection" procedure.

### ■ CAN communication circuit inspection (AFLS ECU ↔ ABS(VDC) ECU)

1. Ignition "OFF"
2. Disconnect AFLS-ECU connector and ABS(VDC) ECU connector
3. Measure the resistance between CAN-HIGH terminal of AFLS-ECU harness connector and CAN-HIGH terminal of ABS(VDC)ECU harness connector.
4. Measure the resistance between CAN-LOW terminal of AFLS-ECU harness connector and CAN-LOW terminal of ABS(VDC)ECU harness connector.

**Specification :** below 1Ω

5. Is the measured resistance within specification ?

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

**NO** ▶ Check for open/short in harness.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1301 Steering angle signal fault

### General Description

Steering angle sensor is installed under the clock spring. Steering angle sensor input to AFLS ECU uses CAN communication in order to measure for speed of steering wheel's operation and angel.Steering angle sensor is composed with main gear and sub gear1, sub gear2 to determine for rotation direction.According to rotation of steering wheel, If the main gear rotate, sub gear1 and sub gear2 be retated. Steering angle sensor calculate rotation angle use MR effect of magnetic that installed in sub gear and different gear ratio sub gear1 and sub gear2. AFLS( Adaptive Front-Lighting System) provides driver with the best visibility uses steering angle sensor's signal.

### DTC Description

AFLS ECU set this code If input value(steering angle sensor's signal) is out of available range.

### DTC Detecting Condition

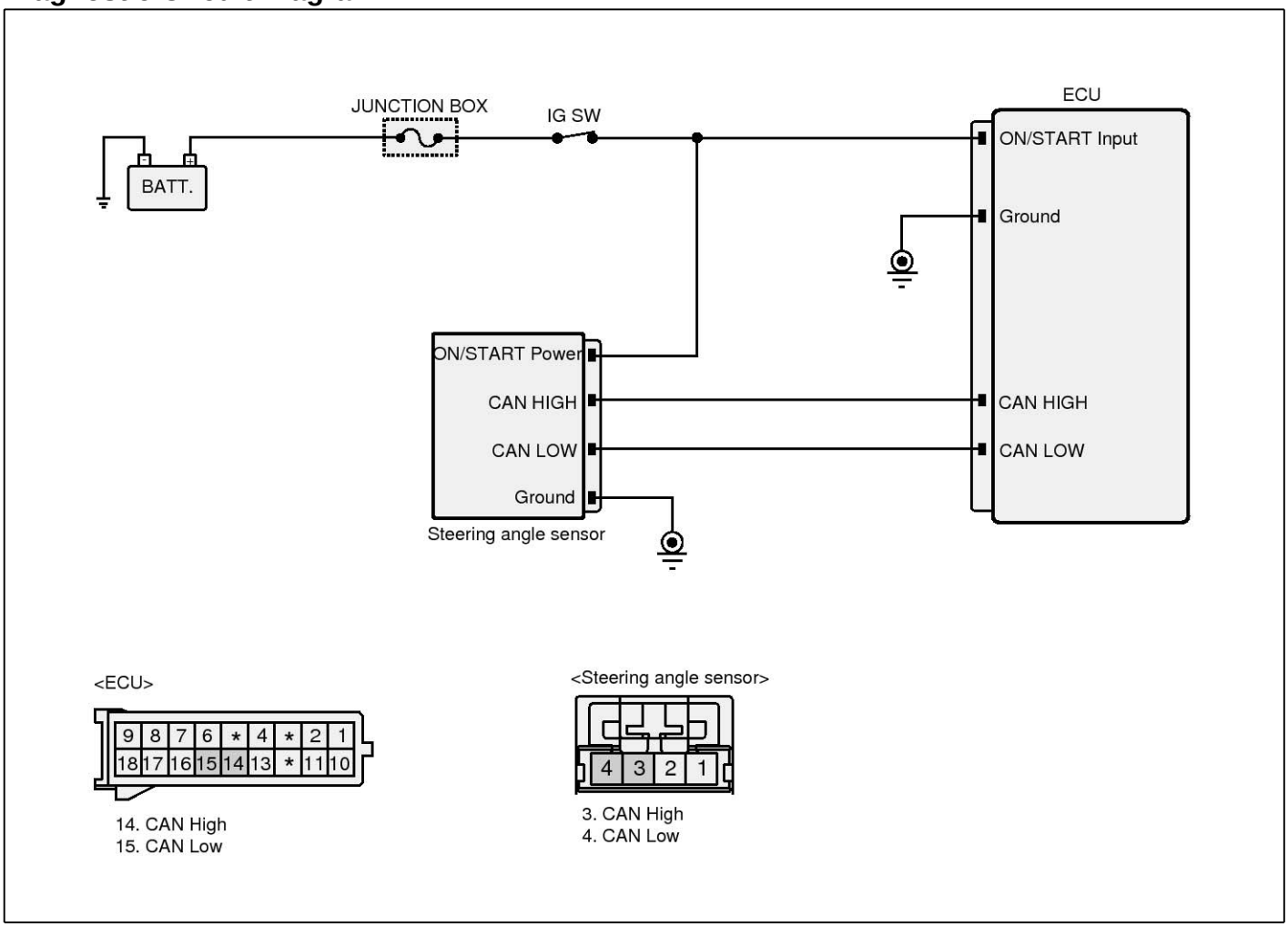
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit open<br>• Faulty in steering angle sensor |
| Enable Conditions | • IG ON | |
| Threshold Value | • Sreering angle sensor signal is out of available range CAN communication signal not output from Sreering angle sensor | |
| Detecting time | • 200ms | |
| Fail Safe | • Leveling -1.5% down<br>Swivelling : move to 0˚ position | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram




SBHBE9C12L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Turn the steering wheel to the left or right.
4. Monitor the "Steering angle sensor" parameters on the scantool.

   (Check the data of steering angle sensor with EHPS, VDC system and confirm output values related to CAN communication.)

**Specification :** If the parameters are changed according to wheel position during steering the wheel(-126 ~ 127)

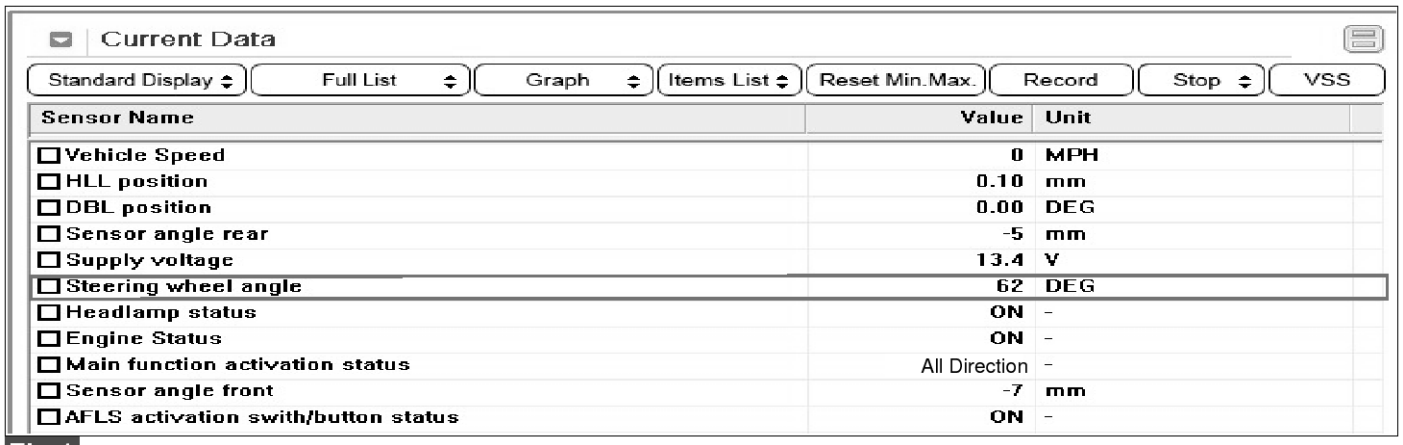



Fig.1

SBHBE9C33L

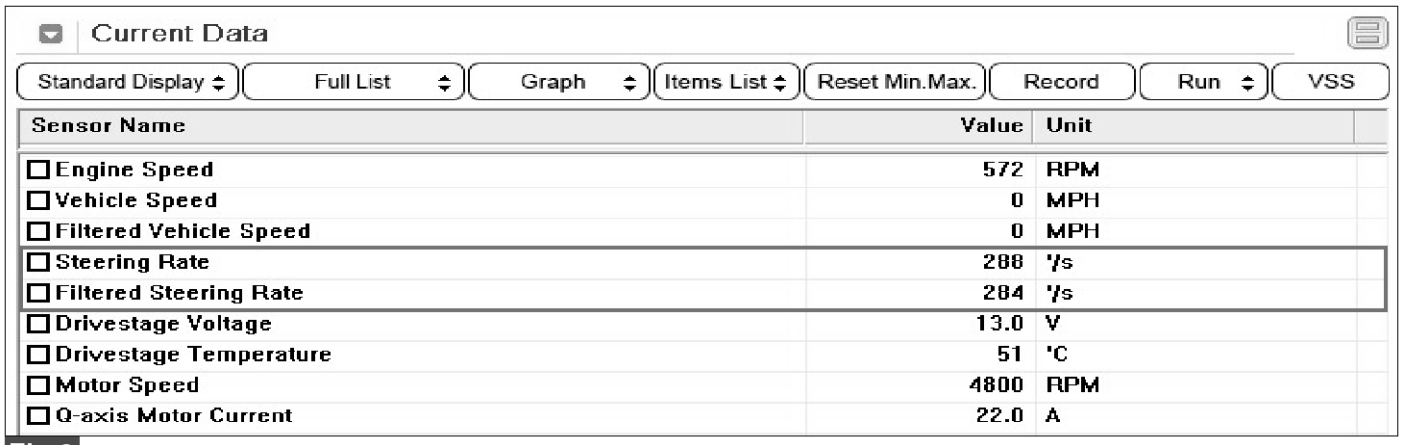



Fig.2

SBHBE9C34L

Fig 1) Engine "ON"

Fig 2) Engine "ON" -EHPS

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5. Steering angle sensor signal is changed according to steering wheel?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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** ▶Faulty in sensor related to CAN communication (ECS,EHPS,VDC ).
- Check the CAN communication circuit and go to "Verification of vehicle Repair" procedure.

▶ Faulty in steering sensor signal(included in ECS,EHPS,VDC system that use steering angle sensor).
- Substitute with a known - good steering angle sensor and check for proper operation. If the problem is corrected, replace steering angle sensor and go to "Verification of Vehicle Repair" procedure.

▶ Faulty in only AFLS ECU signal
- Go to "Inspection/Repair" procedure

## W/Harness 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 "CAN communication circuit inspection" procedure.

### ■ CAN communication circuit inspection (AFLS ECU ↔ Steering angle sensor)

1. Ignition "OFF"
2. Disconnect Steering angle sensor connector and AFLS ECU connector
3. Measure the resistance between CAN-HIGH terminal of Steering angle sensor harness connector and CAN -HIGH terminal of AFLS ECU harness connector.
4. Measure the resistance between CAN-LOW terminal of Steering angle sensor harness connector and CAN -LOW terminal of AFLS ECU harness connector.

**Specification :** below 1Ω

5. Is the measured resistance within specification ?

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

**NO** ▶ Check for open/short in harness.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1302 Gearbox Signal Fault-CAN Signal

### General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, atutomatic transaxle, ABS, TCS, ECS)AFLS ECU is input some informations(engine speed, steering angle sensor's signal, vehicle speed) in order to maintain optimum headlamp condition through CAN communication. AFLS ECU determine working or not to headlamp in according with gear position signal.(not working in Reverse)

### DTC Description

AFLS ECU set this code If input value(gear position signal) is out of available range.

### DTC Detecting Condition

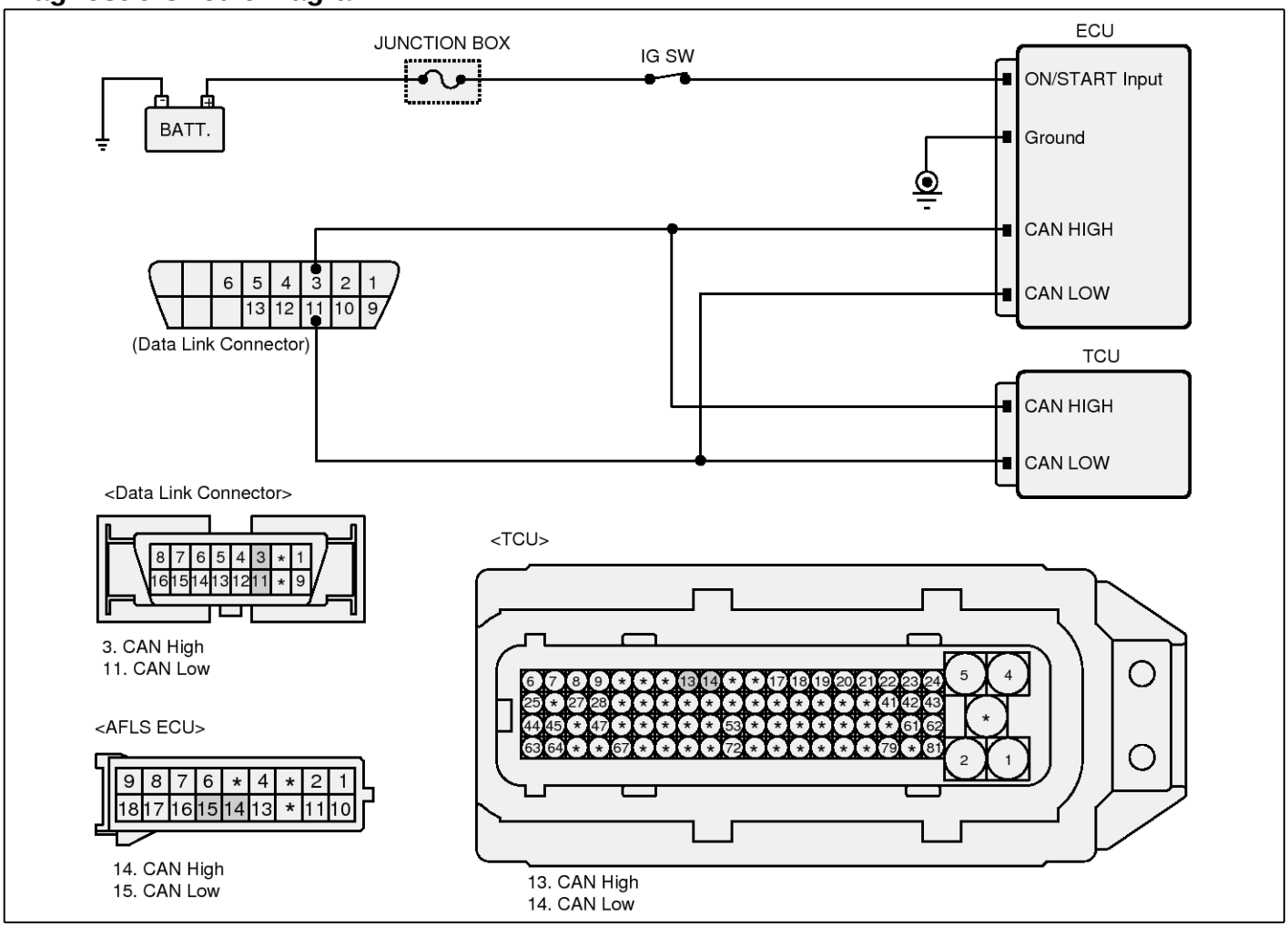
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit Open/Short<br>• Faulty TCU |
| Enable Conditions | • IG ON | |
| Threshold Value | • Gear position signal is out of available range<br>CAN communication signal not output from TCU | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling : normal operation.<br>Swivelling : move to 0° position | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram




SBHBE9C13L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Monitor the "Gearbox signal" parameters on the scantool. (TCU's current data)

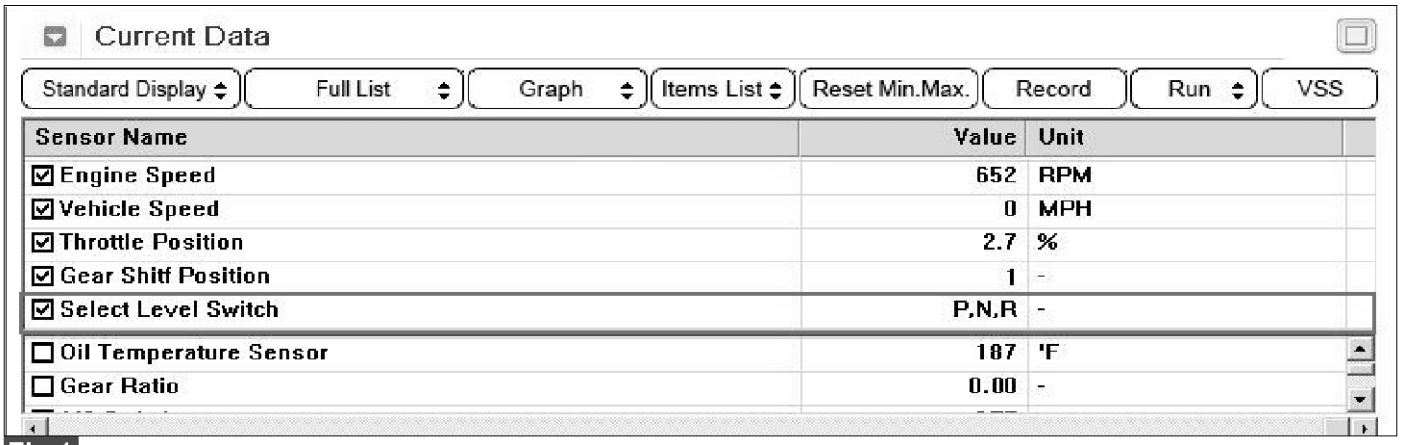



Fig.1

SBHBE9C35L

FIg1) Engine "ON"(TCU's current data)

4. Is parameter displayed within specifications?

**YES** ▶ Go to "Inspection/Repair" procedure

**NO** ▶ Gear position signal is out of available range.
- Check the A/T system and Go to "Verification of vehicle Repair" procedure ".

## W/Harness Inspection

Refer to DTC B1220 : Vehicle Speed Sensor.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1303 Accelerator Pedal Position Signal Error

## General Description

Refer to DTC B1302 : Gearbox Signal Fault-CAN Signal.

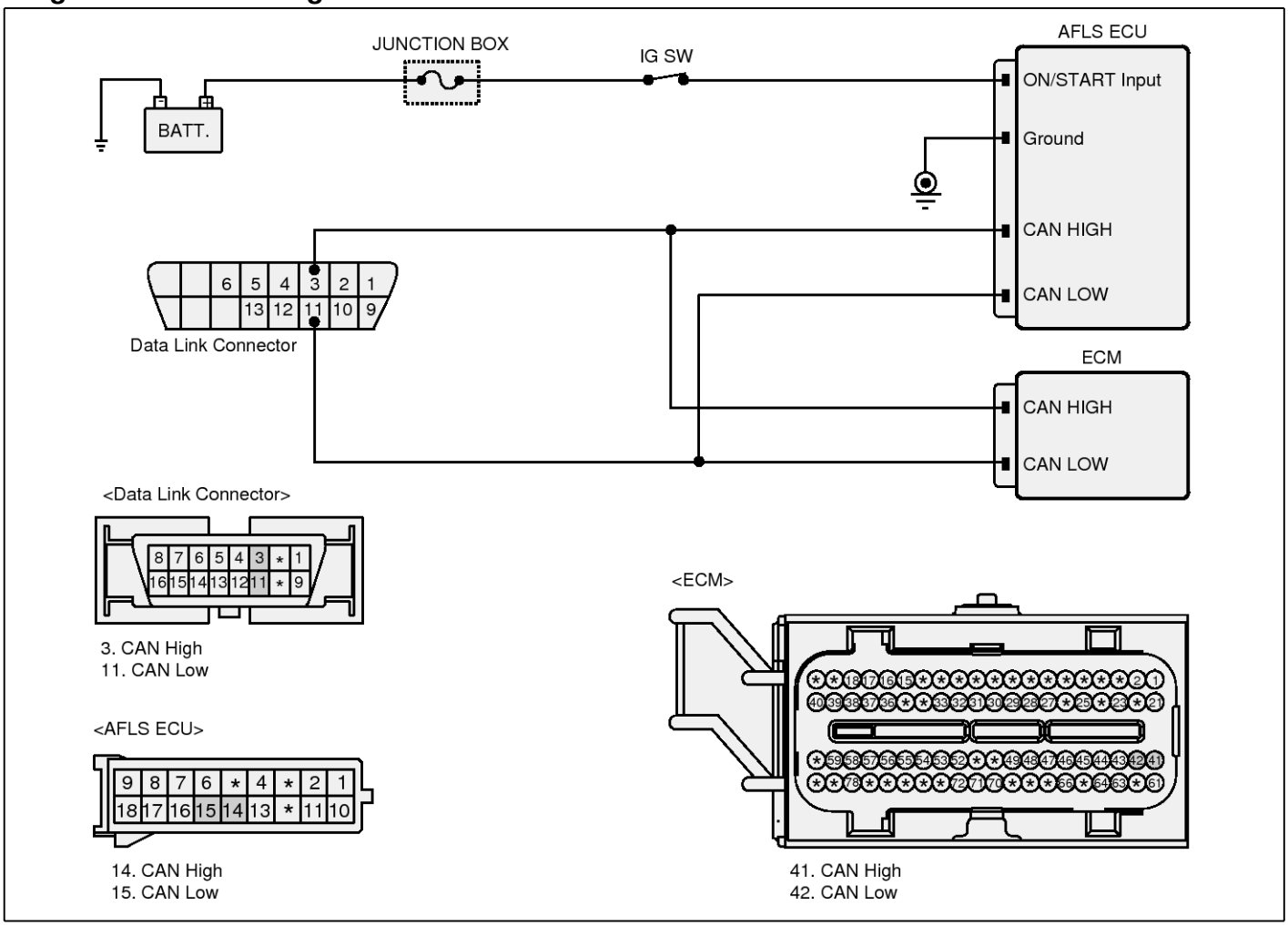
## DTC Description

AFLS ECU set this code If input value(APS signal) is out of available range.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit Open/Short<br>APS circuit Open/Short<br>• Faulty APS<br>• Faulty ECM |
| Enable Conditions | • IG ON | |
| Threshold Value | • APS signal is out of available range<br>CAN communication signal not output from Engine EC-U | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling : performance decline.<br>Swivelling : normal operation. | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram




SBHBE9C14L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. IG KEY "ON" & ENG "OFF"
3. Monitor the "TPS" parameters on the scantool.(ECM's current data)

**Specification :** APS1 : 0V ~ 5V (APS2: 0V~2.5V)

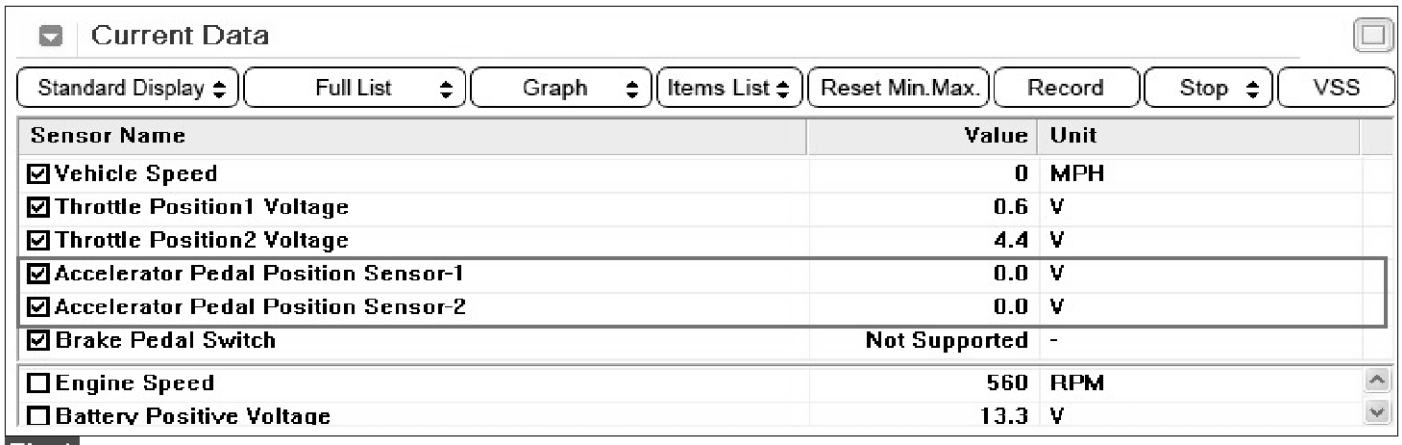



Fig.1

SBHBE9C36L

FIg1) ENG "ON"(ECM's current data)

4. Is parameter displayed within specifications?

**YES** ▶ Go to "Inspection/Repair" procedure

**NO** ▶ APS signal is out of available range.
- Check the Engine ECU and APS system and Go to "Verification of vehicle Repair" procedure ".

## W/Harness Inspection

Refer to DTC B1220 : Vehicle Speed Sensor.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1304 Engine state signal fault

## General Description

Refer to DTC B1302 : Gearbox Signal Fault-CAN Signal.

## DTC Description

AFLS ECU set this code If input value(engine speed) is out of available range.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit Open/Short<br>• Faulty ECM |
| Enable Conditions | • IG ON | |
| Threshold Value | • Engine r.p.m is out of available range.<br>CAN communication signal not output from Engine EC-U | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling : normal operation.<br>Swivelling : normal operation. | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B1303 : Accelerator Pedal Position Signal Error.

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)..
2. ENG "ON"
3. Monitor the "RPM" parameters on the scantool..
   (AFLS and ECM's current data)

**Specification :** 500rpm above → ON

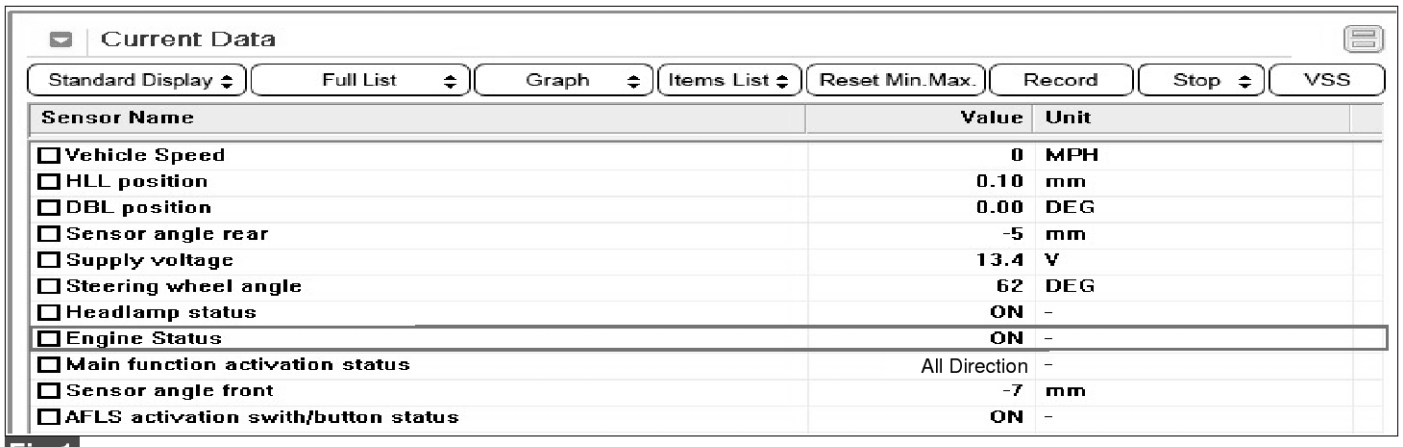



Fig.1

SBHBE9C38L

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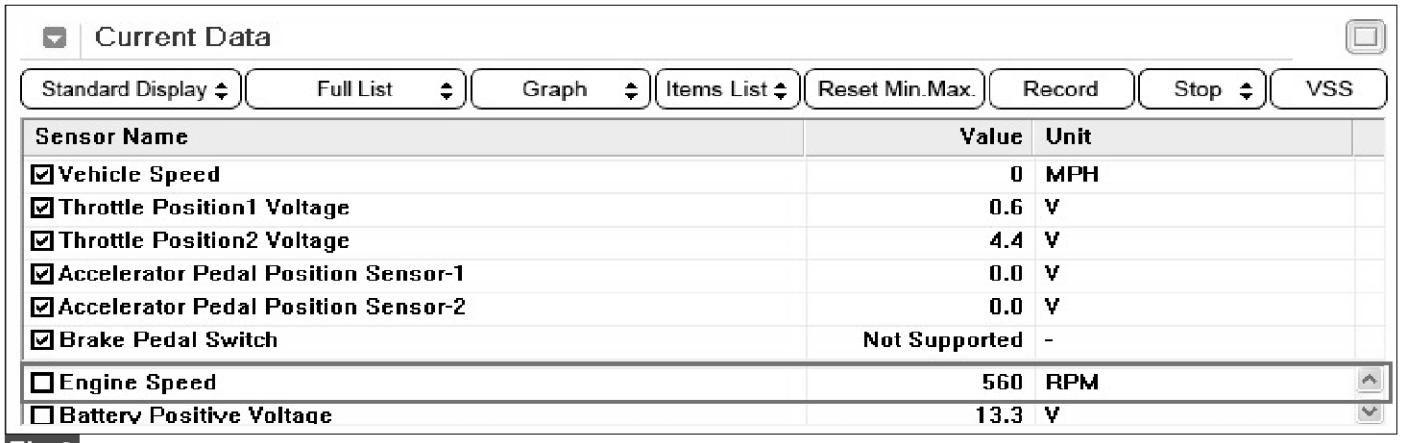



Fig.2

SBHBE9C39L

FIg1) ENG "ON"(ECM's current data)

FIg2) Engine "ON"(ECM's current data)

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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** ▶ Engine r.p.m is out of available range(included in ECU output)
- Check the Engine ECU system and Go to "Verification of vehicle Repair" procedure ".

▶ Faulty in only AFLS ECU signal
- Go to "Inspection/Repair" procedure

## W/Harness Inspection

Refer to DTC B1220 : Vehicle Speed Sensor.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1305 Yaw Rate Sensor Signal Fault

## General Description

Refer to DTC B1303 : Accelerator Pedal Position Signal Error.

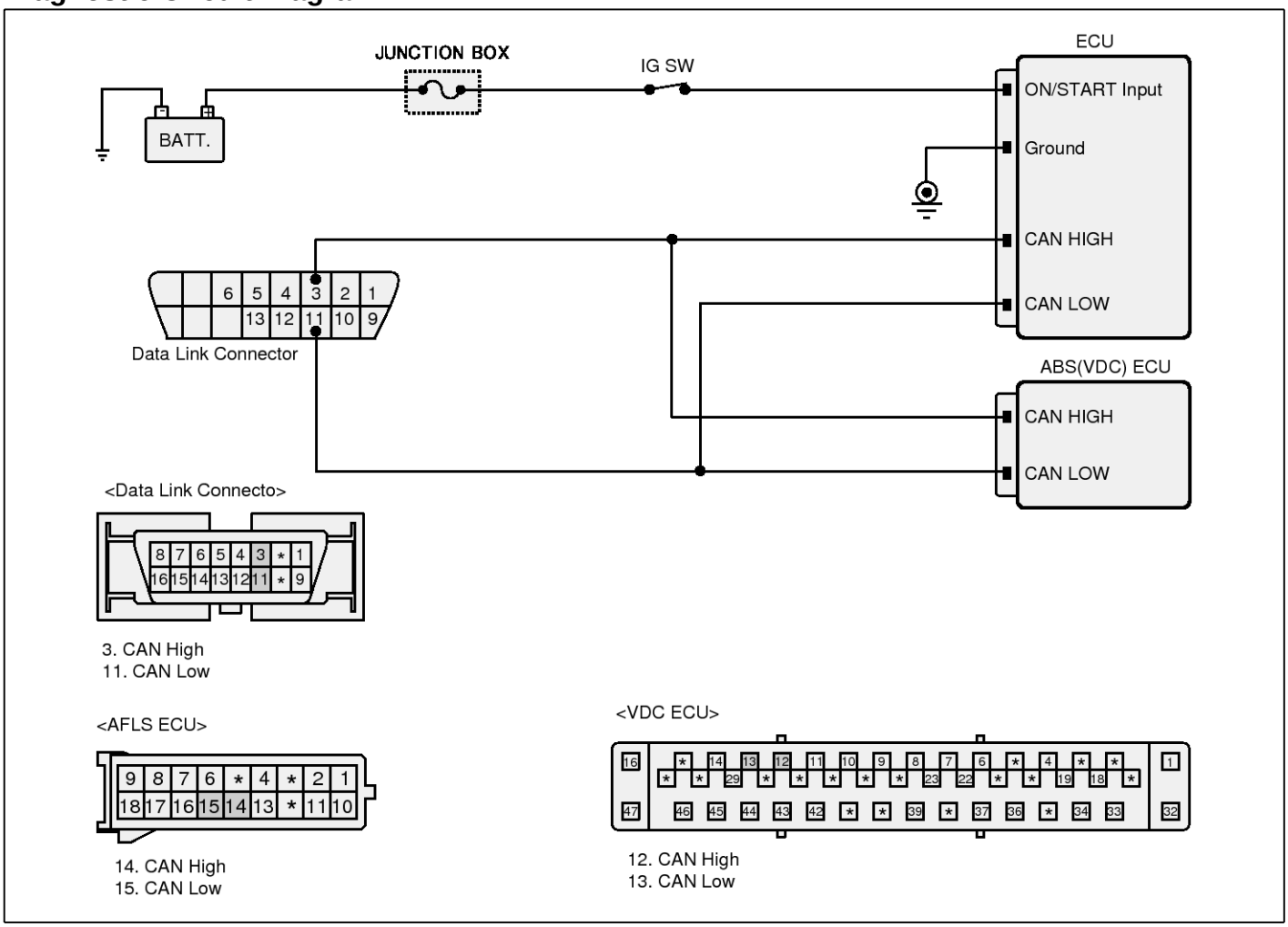
## DTC Description

AFLS ECU set this code If input value(yaw rate sensor's signal) is out of available range.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit Open/Short<br>• Yaw rate circuit Open/Short<br>• Faulty Yaw rate |
| Enable Conditions | • IG ON | |
| Threshold Value | • Yaw rate sensor output not available value.<br>CAN communication signal not output from VDC ECU | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling : performance decline.<br>Swivelling : normal operation. | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram




SBHBE9C11L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. ENG "ON"
3. Monitor the "Yaw rate" parameters on the scantool.( VDC's current data)

**Specification :** below 0G

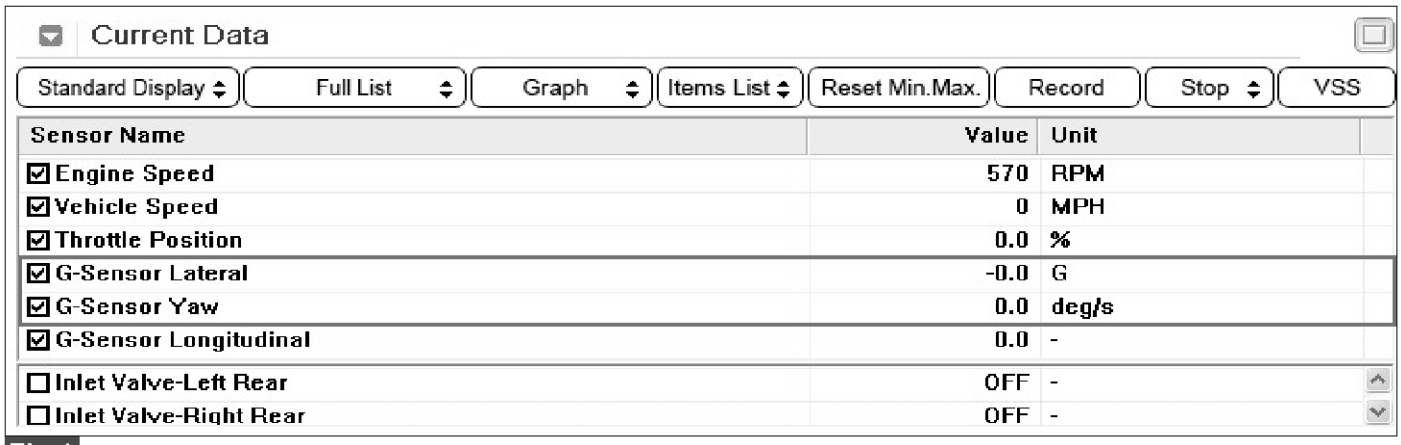



Fig.1

SBHBE9C40L

FIg1) Engine "ON" - (VDC's current data)

4. Is parameter displayed within specifications?

**YES** ▶ Go to "Inspection/Repair" procedure

**NO** ▶ When Yaw rate sensor output not available signal, check the VDC system and then go to " Verification of Vehicle Repair" procedure.

## W/Harness Inspection

Refer to DTC B1220 : Vehicle Speed Sensor.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1306 Brake pedal signal fault

## General Description

Refer to DTC B1302 : Gearbox Signal Fault-CAN Signal.

## DTC Description

AFLS ECU set this code If input value(brake switch signal) is out of available range.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit Open/Short<br>• Brake S/W circuit Open/Short<br>• Faulty ECM |
| Enable Conditions | • IG ON | |
| Threshold Value | • Brake S/W output not available value.<br>CAN communication signal not output from Engine ECU | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling : performance decline.<br>Swivelling : normal operation. | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B1304 : Engine state signal fault.

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. ENG "ON"
3. Monitor the "Brake pedal signal" parameters on the scantool.(ECM's current data)

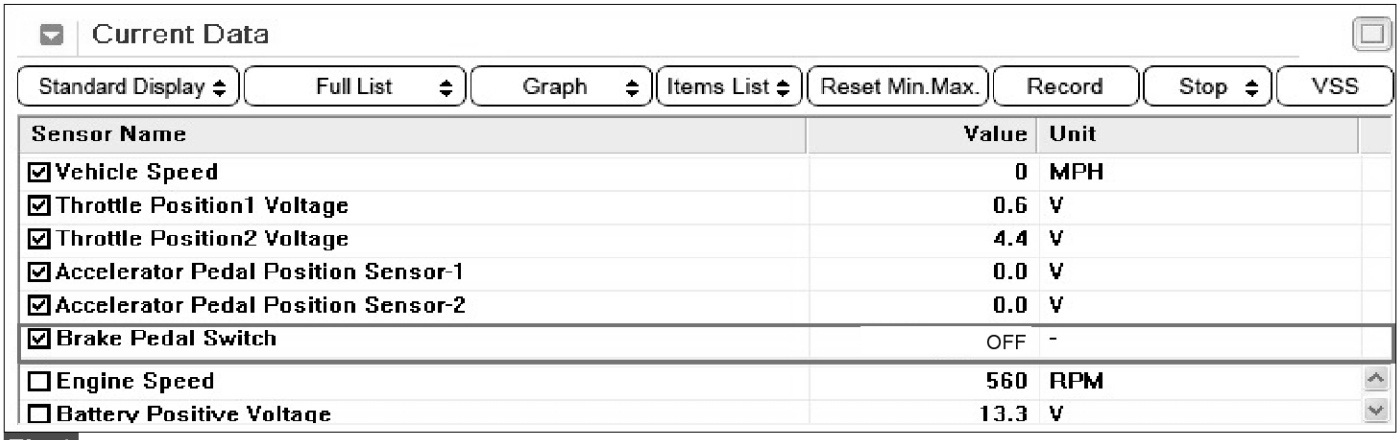



Fig.1

SBHBE9C41L

FIg1) ENG "ON"(ECM's current data)

4. Is parameter displayed within specifications?

**YES** ▶ Go to "Inspection/Repair" procedure

**NO** ▶ When Brake S/W output not available signal , check the Engine system and then go to "Verification of Vehicle Repair" procedure.

## W/Harness Inspection

Refer to DTC B1220 : Vehicle Speed Sensor.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1307 Air suspension ECU sensor signal invalid

### General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, atutomatic transaxle, ABS, TCS, ECS)AFLS ECU is input some informations(engine speed, steering angle sensor's signal, vehicle speed) in order to maintain optimum headlamp condition through CAN communication. AFLS ECU drive Leveling Actuator-Intelligent Stepper Motor to control headlamp by height sensor's signal.

### DTC Description

AFLS ECU set this code If input value(height sensor's signal) is out of available range.

### DTC Detecting Condition

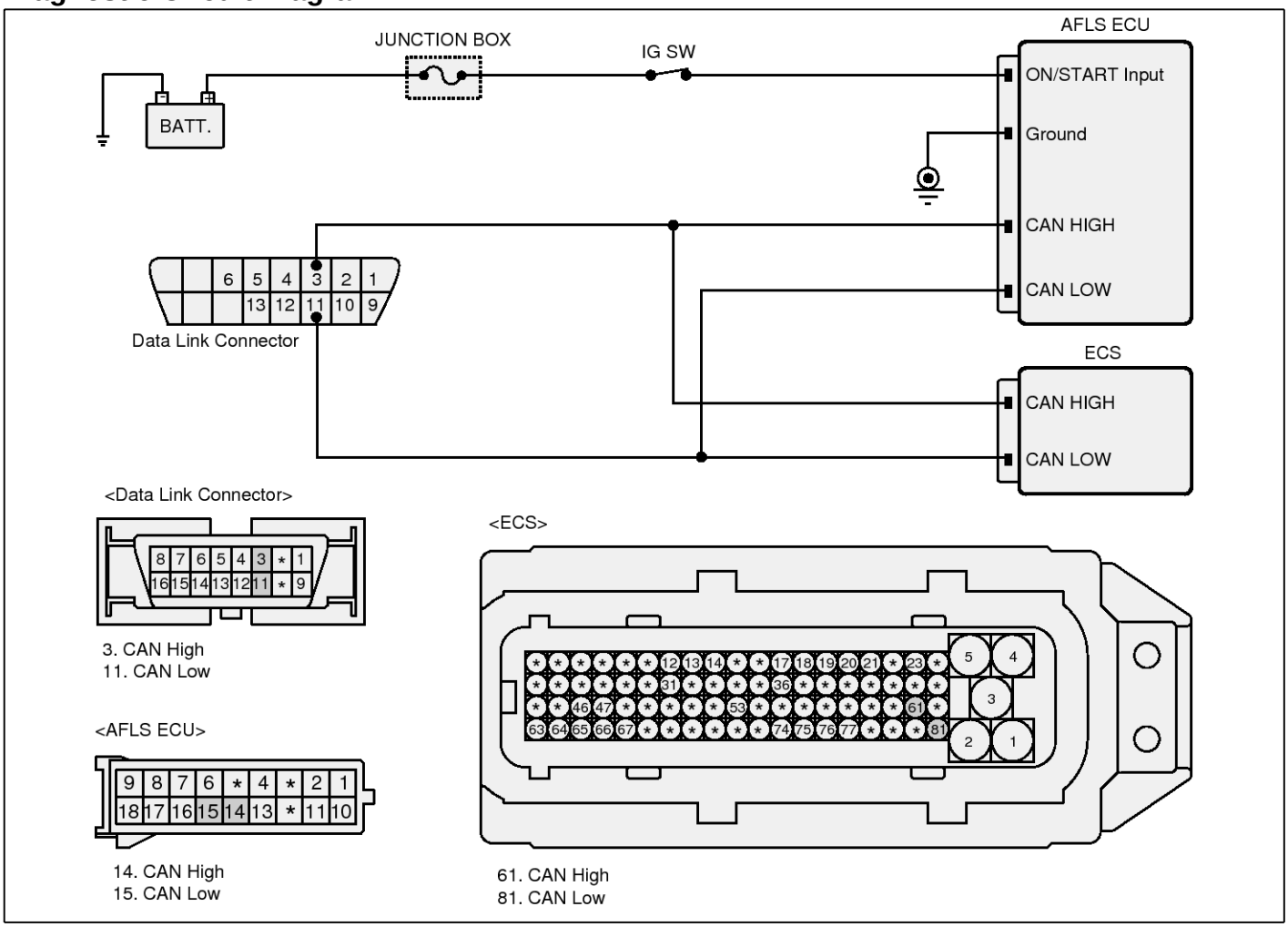
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Height sensor circuit Open/Short<br>• Faulty ECS ECU |
| Enable Conditions | • IG ON | |
| Threshold Value | • Height sensor output not available value.<br>Faulty in ECS CAN communication circuit. | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling : performance decline.<br>Swivelling : normal operation. | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram




SBHBE9C15L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "Sensor angle front, Sensor angle rear" parameters on the scantool.(AFLS and ECS's current data)

**Specification :** below -128 ~ +125 mm

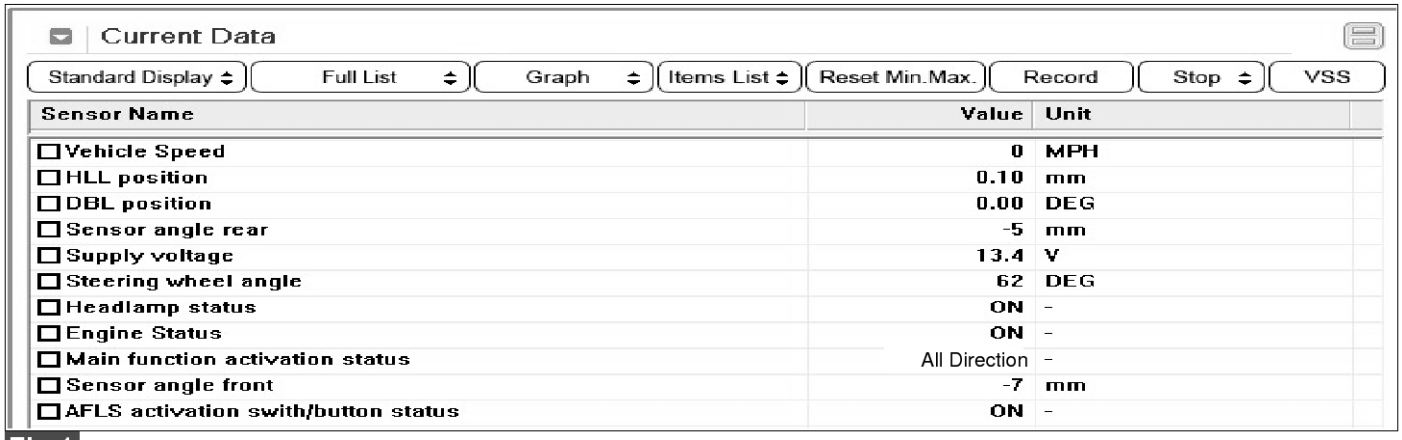



Fig.1

SBHBE9C42L

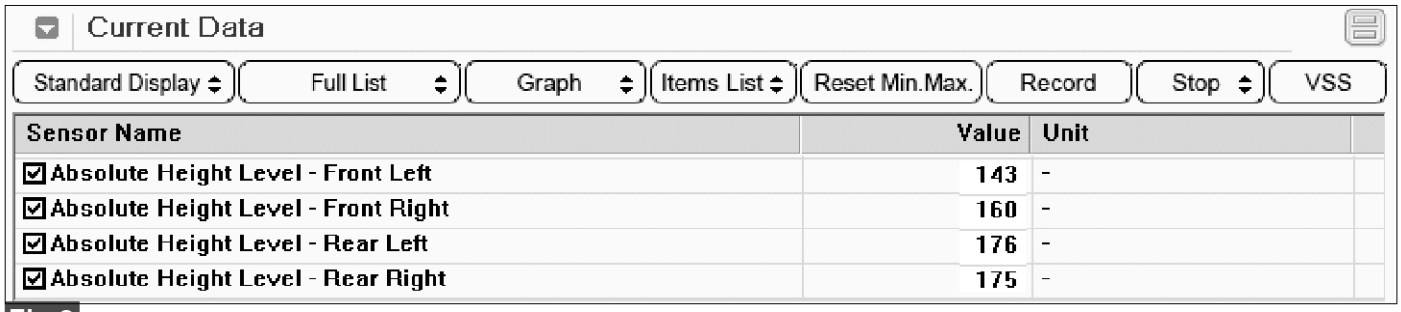



Fig.2

SBHBE9C43L

FIg1) Engine "ON"

FIg2) Engine "ON" - (ECS's current data)

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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** ▶ Faulty in height sensor signal(included in ECS ECU signal)
- Check the ECS system and Go to "Verification of vehicle Repair" procedure ".(Refer to ECS system))

▶ Faulty in only AFLS ECU signal
- Go to "Inspection/Repair" procedure

## W/Harness Inspection

Refer to DTC B1220 : Vehicle Speed Sensor.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1510 AFLS switch/button fault

## General Description

Refer to DTC B1101 : Battery Voltage High.

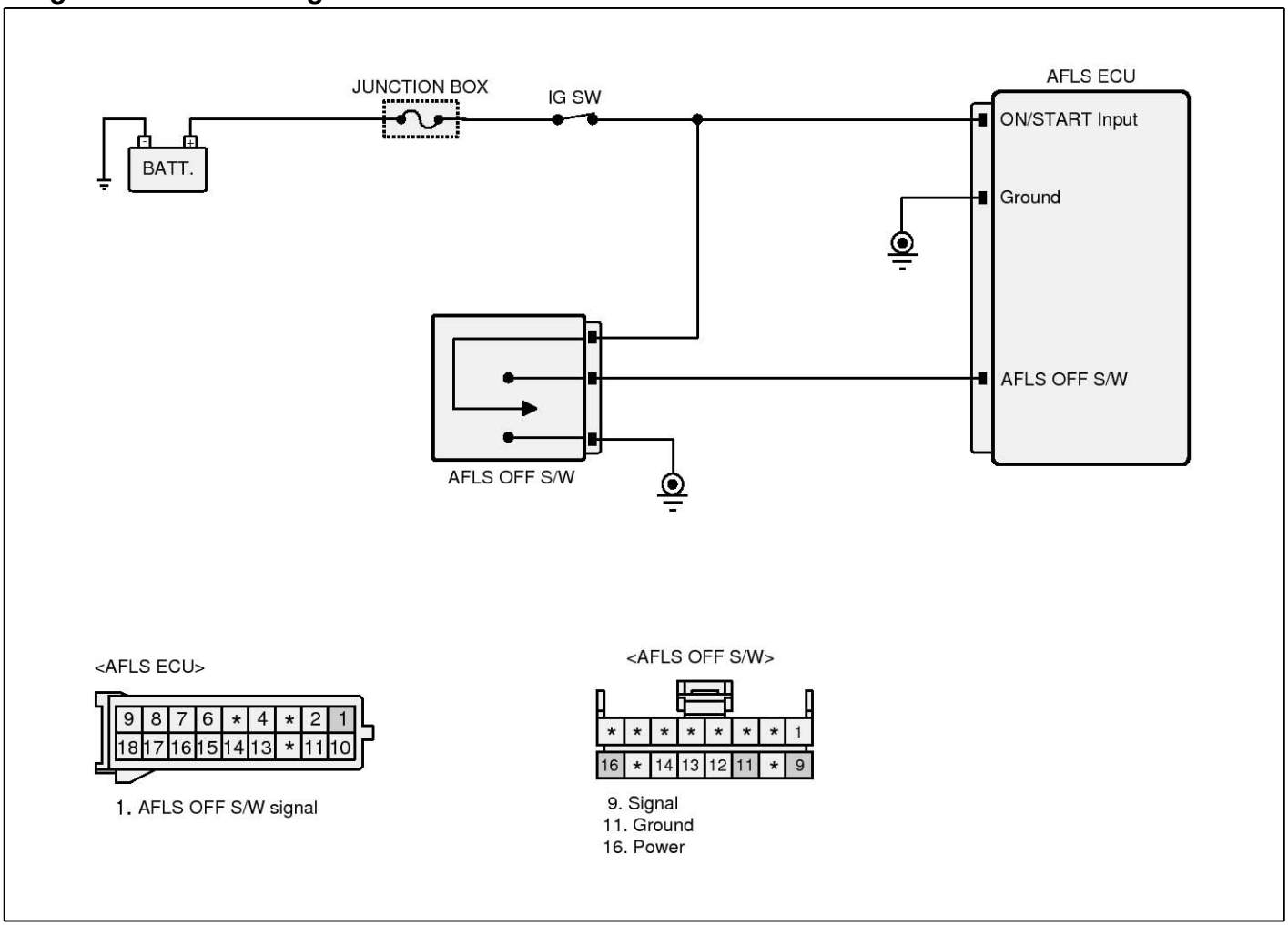
## DTC Description

he AFLS ECU sets DTC B1510 if there is open circuit ( when a not allowed voltage,from 2V to 6V,is detected at AFLS OFF signal input for a duration of 2 seconds) in A-FLS OFF signal line.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Open circuit in AFLS OFF switch signal<br>• Faulty AFLS OFF switch |
| Enable Conditions | • IG ON | |
| Threshold Value | • signal voltage : 2V~6V | |
| Detecting time | • 1sec. | |
| Fail Safe | • Leveling : normal operation<br>Swiveling : normal operation | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram




SBHBE9C16L

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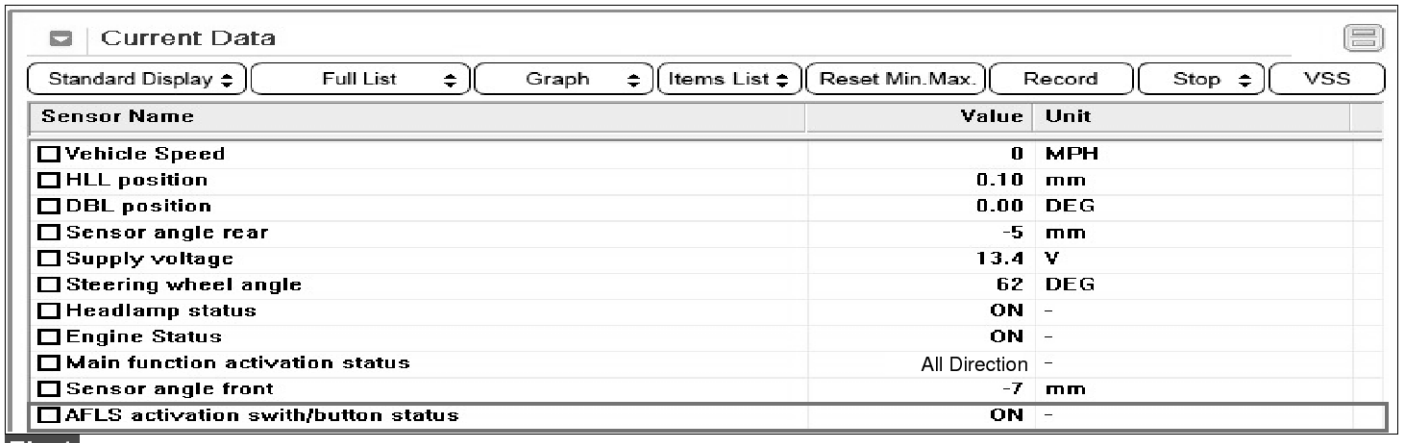
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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "AFLS OFF S/W" parameters on the scantool.

**Specification :** Operation S/W → OFF, Not operation S/W → ON




| Sensor Name | Value | Unit |
|---|---|---|
| Vehicle Speed | 0 | MPH |
| HLL position | 0.10 | mm |
| DBL position | 0.00 | DEG |
| Sensor angle rear | -5 | mm |
| Supply voltage | 13.4 | V |
| Steering wheel angle | 62 | DEG |
| Headlamp status | ON | - |
| Engine Status | ON | - |
| Main function activation status | All Direction | - |
| Sensor angle front | -7 | mm |
| AFLS activation swith/button status | ON | - |

Fig.1

SBHBE9C44L

FIg1) Engine "ON"

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Power Circuit Inspection" procedure.

## Power Circuit Inspection

### ■ Check Open power circuit

1. Ignition "OFF"
2. Disconnect AFLS OFF S/W connector.
3. Ignition "ON"
4. Measure voltage between power terminal of AFLS OFF S/W harness connector and and chassis ground .

**Specification :** B+

5. Is "voltage" display near the specified value?

**YES** ▶ Go to "Signal circuit Inspection" procedure.

**NO** ▶ Check for open/short in harness.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Signal circuit Inspection

### ■ Check Open signal circuit

1. Ignition "OFF"
2. Disconnect AFLS OFF S/W connector.
3. Ignition "ON"
4. Measure voltage between signal terminal of AFLS OFF S/W harness connector and and chassis ground .

**Specification :** below 4V

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5. Is "voltage" display near the specified value?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Check for open/short in harness.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Component inspection

1. Ignition "OFF"
2. Connect AFLS OFF S/W connector.
3. Ignition "ON"
4. Measure voltage for AFLS OFF, When switch "ON" and "OFF".

**Specification :** switch "ON" approx, 0V, switch "OFF": B+

5. Is "voltage" display near the specified value?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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** ▶ Substitute with a known - good AFLS OFF S/W and check for proper operation. If the problem is corrected, replace AFLS OFF S/W and go to "Verification of Vehicle Repair" procedure .

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1592 Head lamp Switch Fault

### General Description

AFLS(Adaptive Front-Lighting System) provides driver with the best visibility by adjusting vertical direction of the headlamp. It consists of AFLS ECU, Leveling Actuator-Intelligent Stepper Motor, Swivel Actuator, Head lamp switch, Height sensor(not applied to ECS). For efficient operation of system, AFLS ECU check Battery voltage.Battery function is supply power to AFLS ECU and Actuators. AFLS ECU detect to headlamp signal that controlled by multi-function switch in order to decide headlamp operation.

### DTC Description

The AFLS ECU sets DTC B1592 if there is open circuit ( when a not allowed voltage,from 2V to 6V,is detected at light signal input for a duration of 2 seconds) in light signal line.

### DTC Detecting Condition

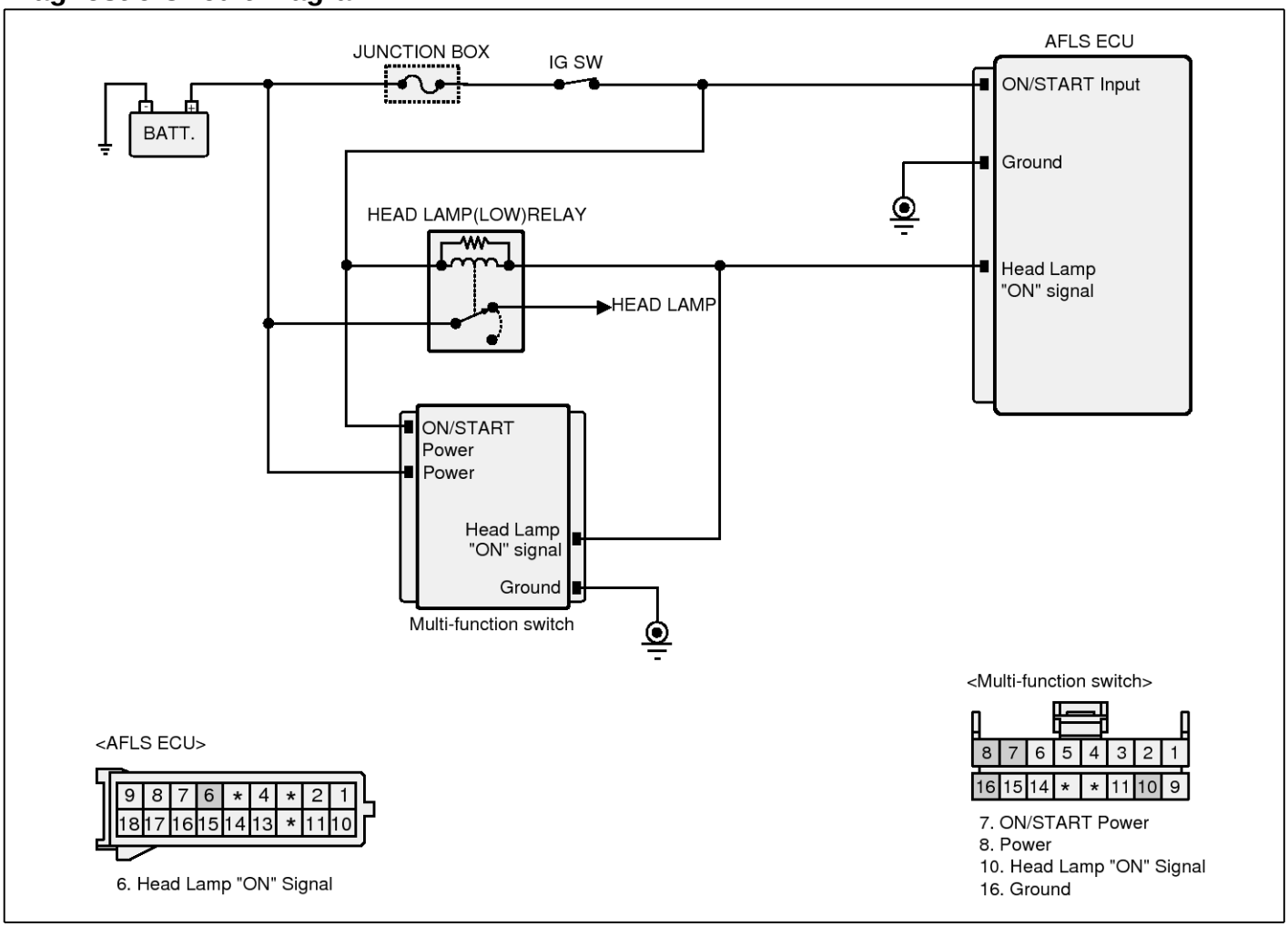
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Open circuit in Headlamp switch<br>• Faulty Headlamp switch |
| Enable Conditions | • IG ON | |
| Threshold Value | • signal voltage : 2V~6V | |
| Detecting time | • 1sec. | |
| Fail Safe | • AFLS 0FF S/W ON - Leveling : Working properly<br>Swiveling : not working<br>• FLS OFF S/W OFF - Leveling Working properly<br>Swiveling not working | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram




SBHBE9C17L

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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "Headlamp switch" parameters on the scantool.

**Specification :** Operation S/W → ON, Not operation S/W → OFF

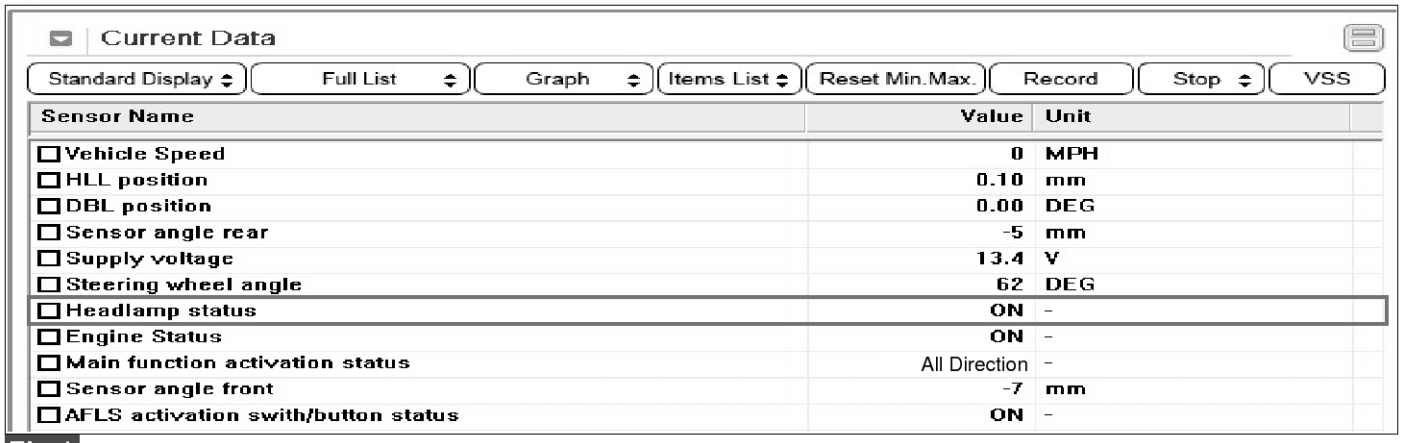



Fig.1

SBHBE9C45L

FIg1) Engine "ON"

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Signal Circuit Inspection" procedure.

## Signal Circuit Inspection

### ■ Check Open signal circuit

1. Ignition "OFF"
2. Disconnect Multi-function switch connector and head lamp(low) relay.
3. Ignition "ON"
4. Measure voltage between Head lamp switch signal terminal of Multi-function switch harness connector and and chassis ground.
5. Measure voltage between Head lamp switch signal terminal of head lamp(low) relay harness connector and and chassis ground.

**Specification :** below 4V

6. Is "voltage" display near the specified value?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Check for open/short in harness.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

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## Component inspection

### ■ Head lamp(LOW) Relay Check

1. Ignition "OFF"
2. Disconnect Multi-function switch connector.
3. Ignition "ON"
4. Measure voltage between Head lamp switch signal terminal of Multi-function switch harness connector and and chassis ground.

**Specification :** B+

5. Is "voltage" display near the specified value?

**YES** ▶ Go to "Multi-function switch Check" procedure.

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

### ■ Multi-function switch Check

1. Ignition "OFF"
2. Connect Multi-function switch connector.
3. Ignition "ON"
4. Measure voltage for headlamp switch, When switch " ON" and "OFF".

**Specification :** switch "ON" approx, 0V, switch "OFF": B+

5. Is "voltage" display near the specified value?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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** ▶ Substitute with a known - good Multi-function switch and check for proper operation. If the problem is corrected, replace Multi-function switch and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1603 CAN Communication Bus Off

### General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, atutomatic transaxle, ABS, TCS, ECS)AFLS ECU is input some informations(engine speed, steering angle sensor's signal, vehicle speed) in order to maintain optimum headlamp condition through CAN communication.

### DTC Description

When the AFLS ECU cannot read the data from the ECM through the CAN-BUS line, the AFLS ECU sets this code. CAN-BUS circuit malfunctioning or ECM can be a posssible cause of this DTC.

### DTC Detecting Condition

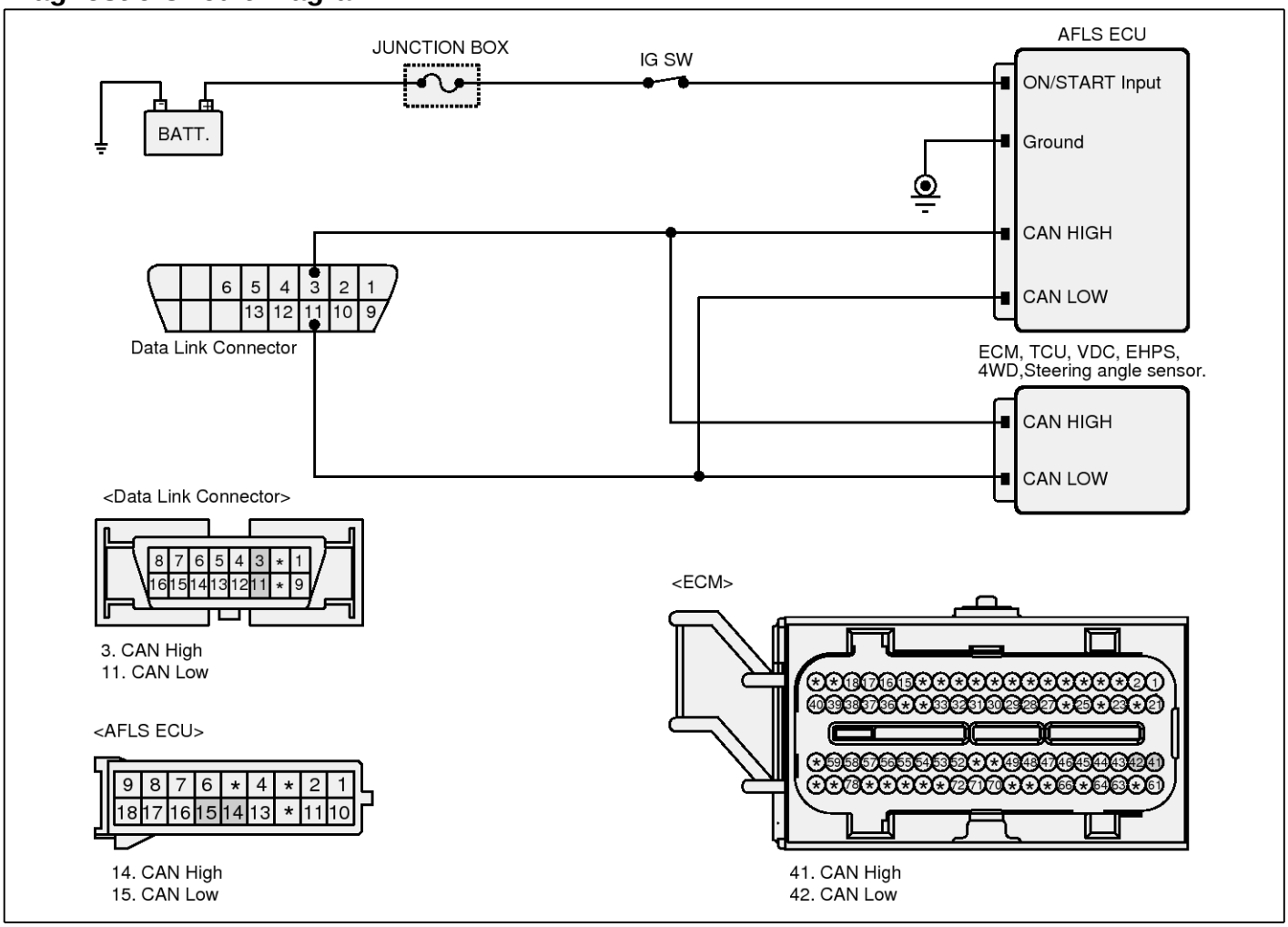
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Faulty in CAN communication dircuit.<br>• Faulty in CAN communication module. |
| Enable Conditions | • IG ON | |
| Threshold Value | • Faulty in CAN communication circuit. | |
| Detecting time | • 200ms | |
| Fail Safe | • Leveling -1.5% down<br>Swivelling move to 0˚ position | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram

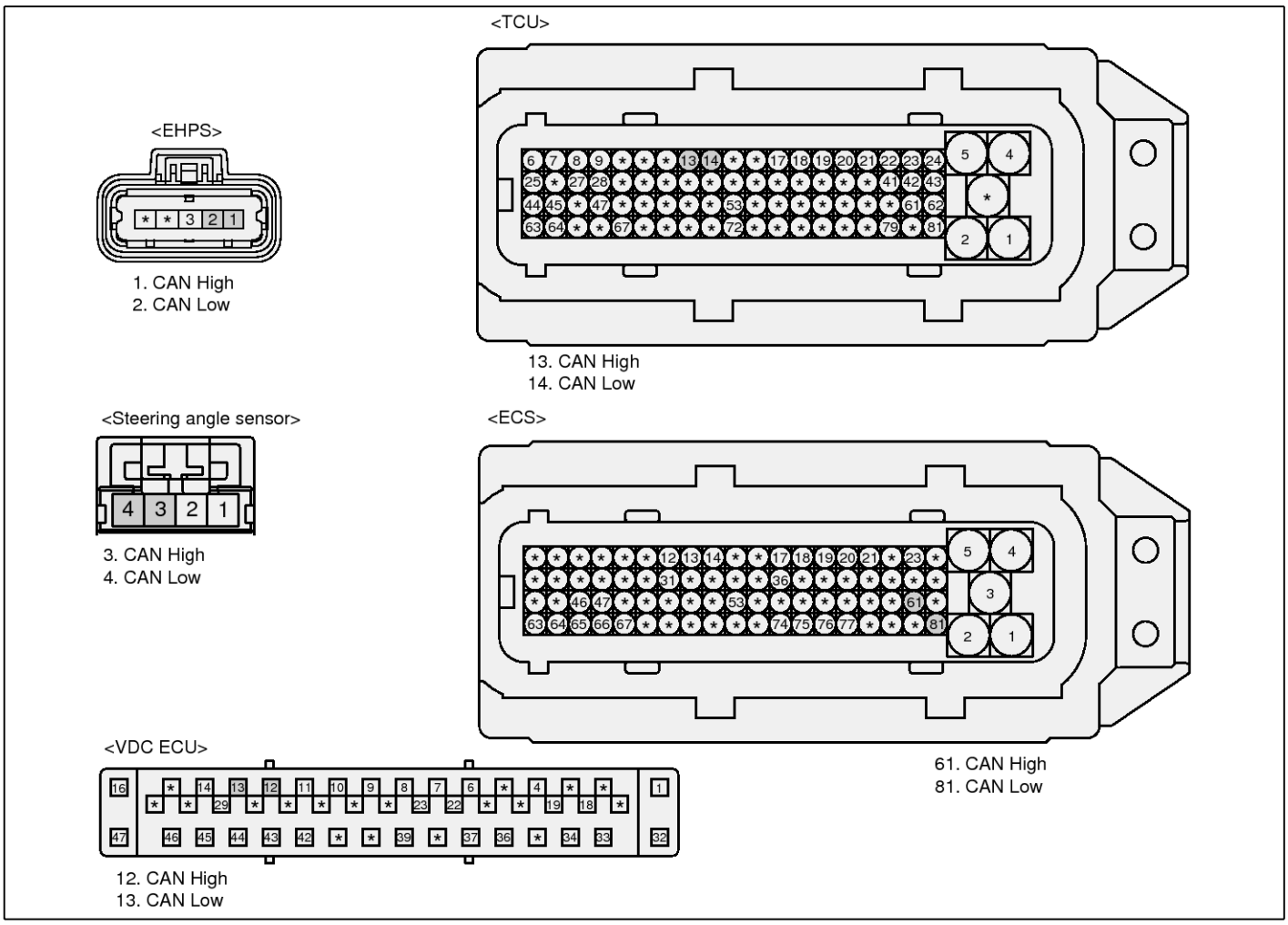



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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "CAN" parameters on the scantool.
   (Check the data of AFLS with TCU,ECM,VDC system and confirm output values related to CAN communication.)

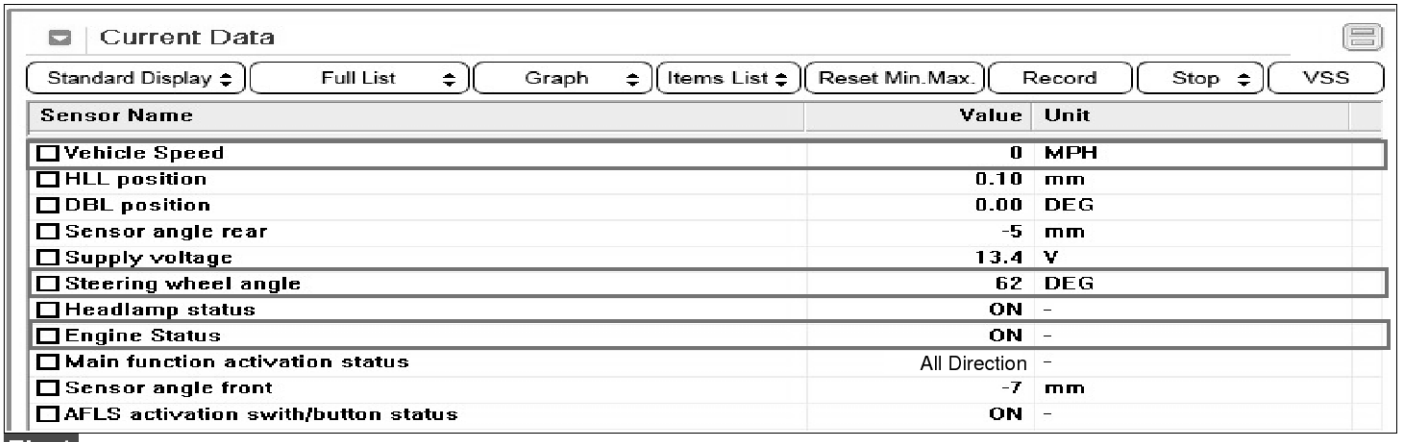



Fig.1

SBHBE9C46L

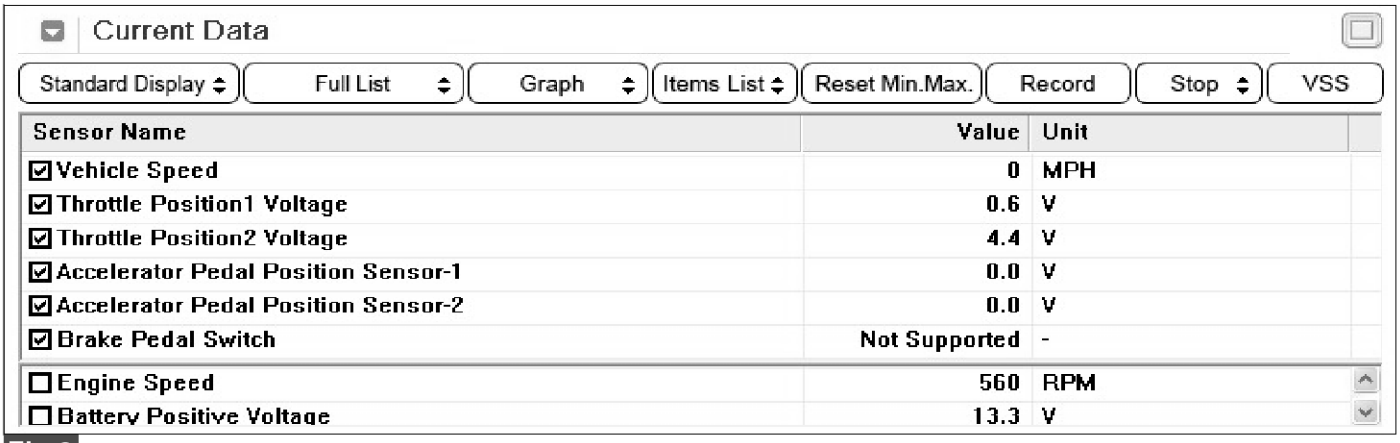



Fig.2

SBHBE9C47L

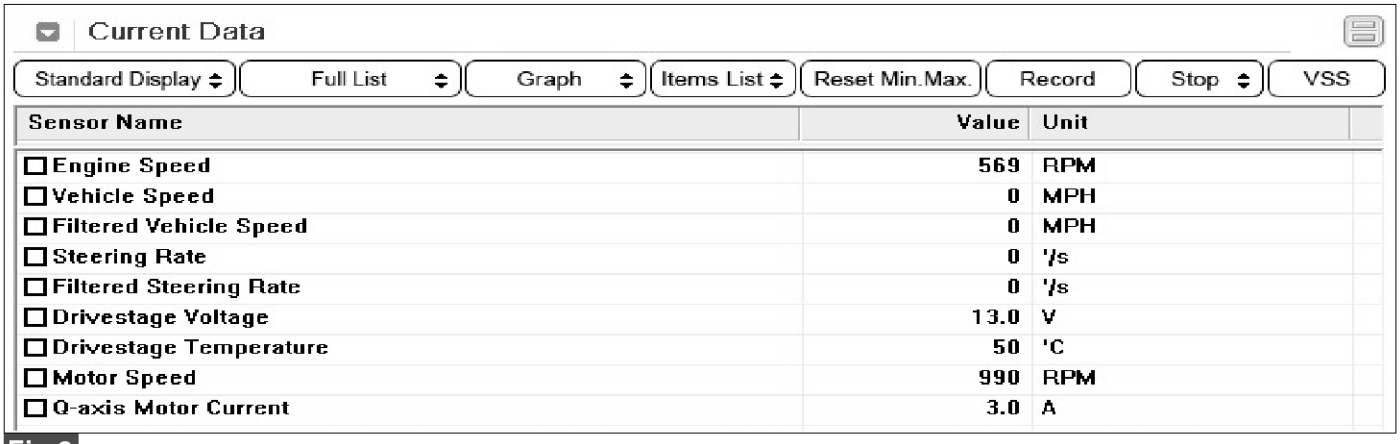



Fig.3

SBHBE9C48L

FIg1) Engine "ON"

FIg2) Engine "ON" - (ECM's current data)

FIg3) Engine "ON" - (EHPS's current data)

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4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure ..

## W/Harness 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 "CAN communication circuit inspection" procedure.

## CAN communication circuit inspection

### ■ Check CAN BUS Short to Ground

1. Ignition "OFF"
2. Disconnect CAN communication modules.(AFLS ECU,ECM, TCU, VDC ECU, EHPS, ECS,4WD,steering angle sensor)
3. Measure the resistance between CAN-HIGH terminal of DLC harness connector and and chassis ground
4. Measure the resistance between CAN-LOW terminal of DLC harness connector and and chassis ground

**Specification :** Discontinuity ( Infinite Ω )

5. Is the measured resistance within specification ?

**YES** ▶ Go to "Check CAN BUS Short to battery".

**NO** ▶ Repair short to ground in circuit and go to " Verification of Vehicle Repair".

### ■ Check CAN BUS Short to battery

1. Ignition "OFF"
2. Disconnect CAN communication modules.(AFLS ECU,ECM, TCU, VDC ECU, EHPS, ECS,4WD,steering angle sensor) .
3. Ignition "ON"
4. Measure the voltage between CAN-HIGH terminal of DLC harness connector and and chassis ground
5. Measure the voltage between CAN-LOW terminal of DLC harness connector and and chassis ground

**Specification :** below 0V

6. Is "voltage" display near the specified value?

**YES** ▶ Go to "Check CAN BUS Open".

**NO** ▶ Repair short to battery and go to "Verification of Vehicle Repair".

### ■ Check CAN BUS Open

1. Ignition "OFF"
2. Disconnect CAN communication modules.(AFLS ECU,ECM, TCU, VDC ECU, EHPS, ECS,4WD,steering angle sensor) .
3. Check continuity between CAN-HIGH terminal of DLC harness connector and CAN HIGH terminal of each module.
4. Check continuity between CAN-LOW terminal of DLC harness connector and CAN LOW terminal of each module.

**Specification :** Continuity(below 1.0Ω )

5. Is the measured resistance within specification ?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Repair open in CAN BUS and go to "Verification of Vehicle Repair".

## Component inspection

### ■ Check CAN communication waveform generation

1. Ignition "OFF"
2. Disconnect CAN communication modules.(AFLS ECU,ECM, TCU, VDC ECU, EHPS, ECS,4WD,steering angle sensor) .
3. Connect 2 channel scope to DLC CAN HIGH terminal and CAN LOW termina.

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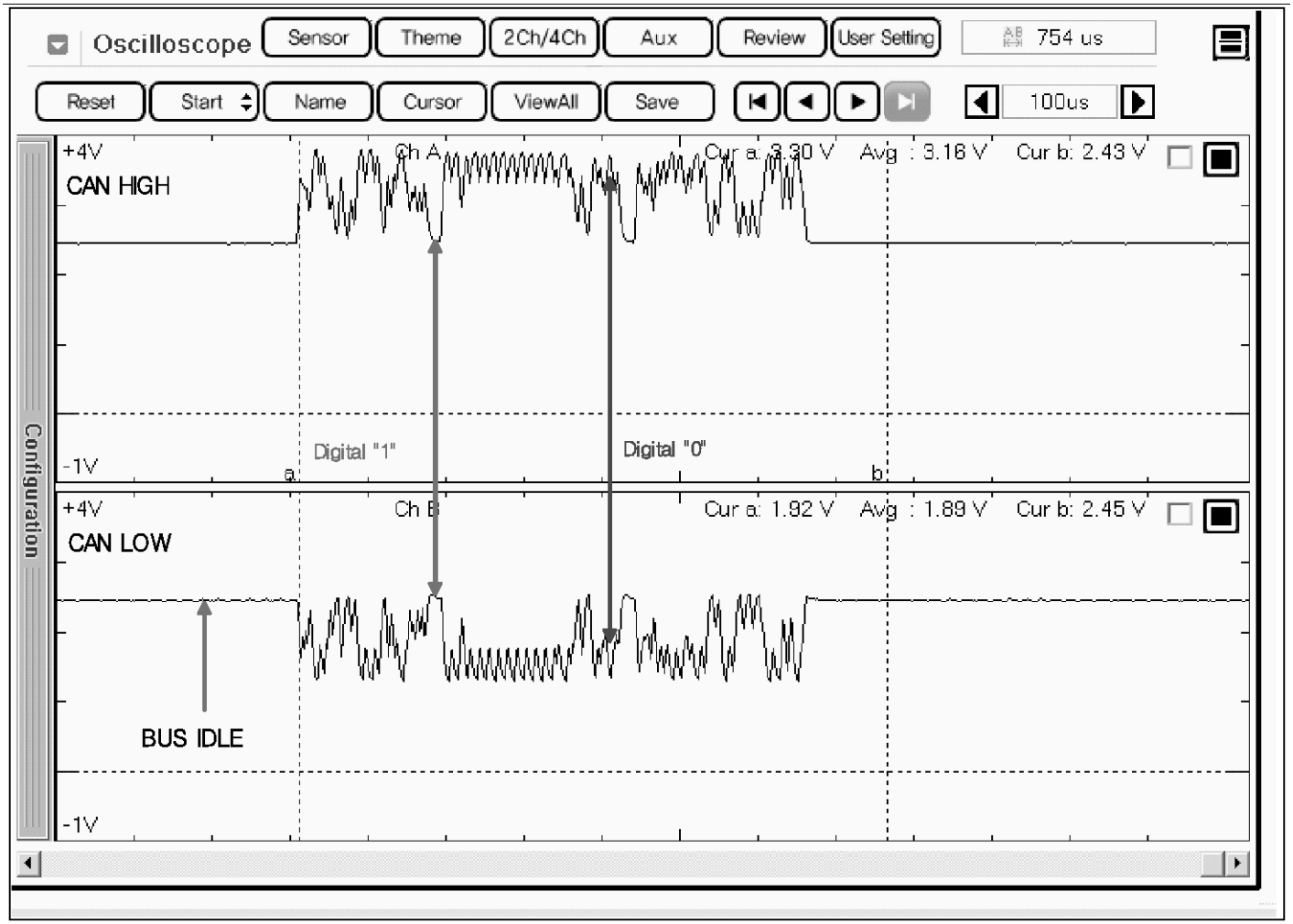
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4. IG KEY "ON" after connecting only AFLS ECU to CAN BUS.

   (IG KEY "ON" after connecting only "the Control Module(s) to be checked" to CAN BUS.)

**Specification**




SBHBE9C49L

5. Does correct waveform generate from each module?

**YES** ▶ Replace the module which generates poor communication waveform, and go to "Verification of Vehicle Repair".

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

Refer to DTC B1101 : Battery Voltage High.

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# B1621 ECU Hardware Error

## General Description

AFLS(Adaptive Front-Lighting System) provides driver with the best visibility by adjusting vertical direction of the headlamp. For efficient operation of system, some informations that the vehicle speed, steering angle signal, brake switch signal, gear position are input to AFLS ECU through the CAN communication. and also AFLS ECU drive actuators in order to adjusting headlamp through the LIN communication.

## DTC Description

ECU sets this code, If error detected in A/D convertor.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • ECU H/W monitoring | • AFLS ECU |
| Enable Conditions | • IG ON | |
| Threshold Value | • Faulty in ECU hardware (A/D converter Fail) | |
| Detecting time | • 3sec. | |
| Fail Safe | • Leveling : stop at present status.<br>Swiveling : stop at present status. | |
| Check Lamp | • NO | |

## W/Harness 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 "Component inspection" procedure.

## Component inspection

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Clear the DTC
4. Ignition "OFF"
5. Engine "ON" and Head lamp"ON"
6. Connect scantool and selet "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.
7. Is the DTC B1621 present?

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

* REFERENCE*

Download correct parameter When ECU replace.

In case of not supplied to Air-suspension vehicle, perform the initialization after downloading corrcet parameter.

* Vehicle condition

1) CAN communication is normal status
2) Vehicle speed ≤ 5km/h
3) Engine r.p.m > 500rpm
4) Connect scan-tool
5) CAN communication is normal status
6) Battery voltage > 10.5V

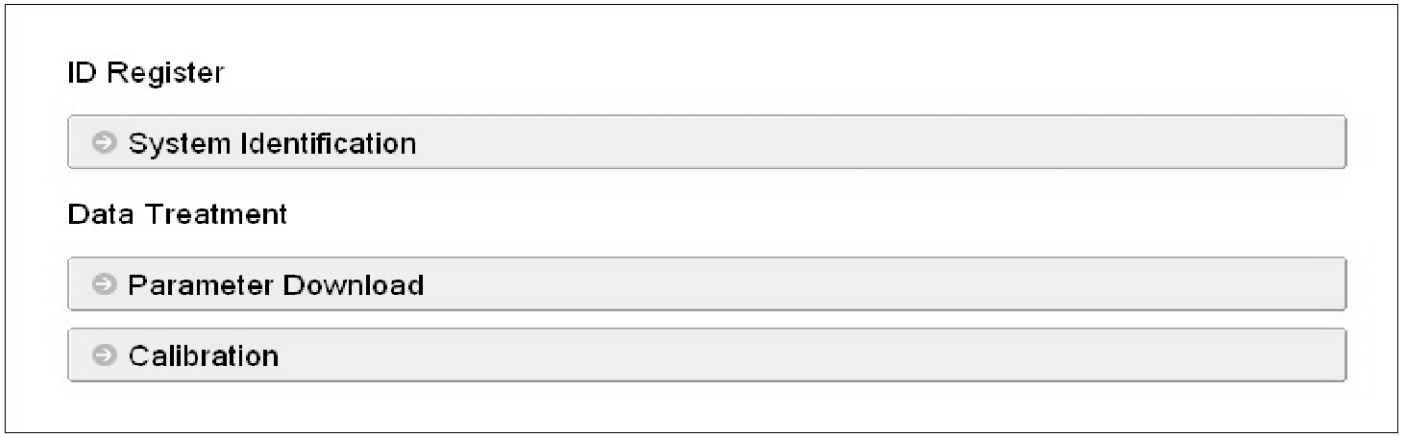
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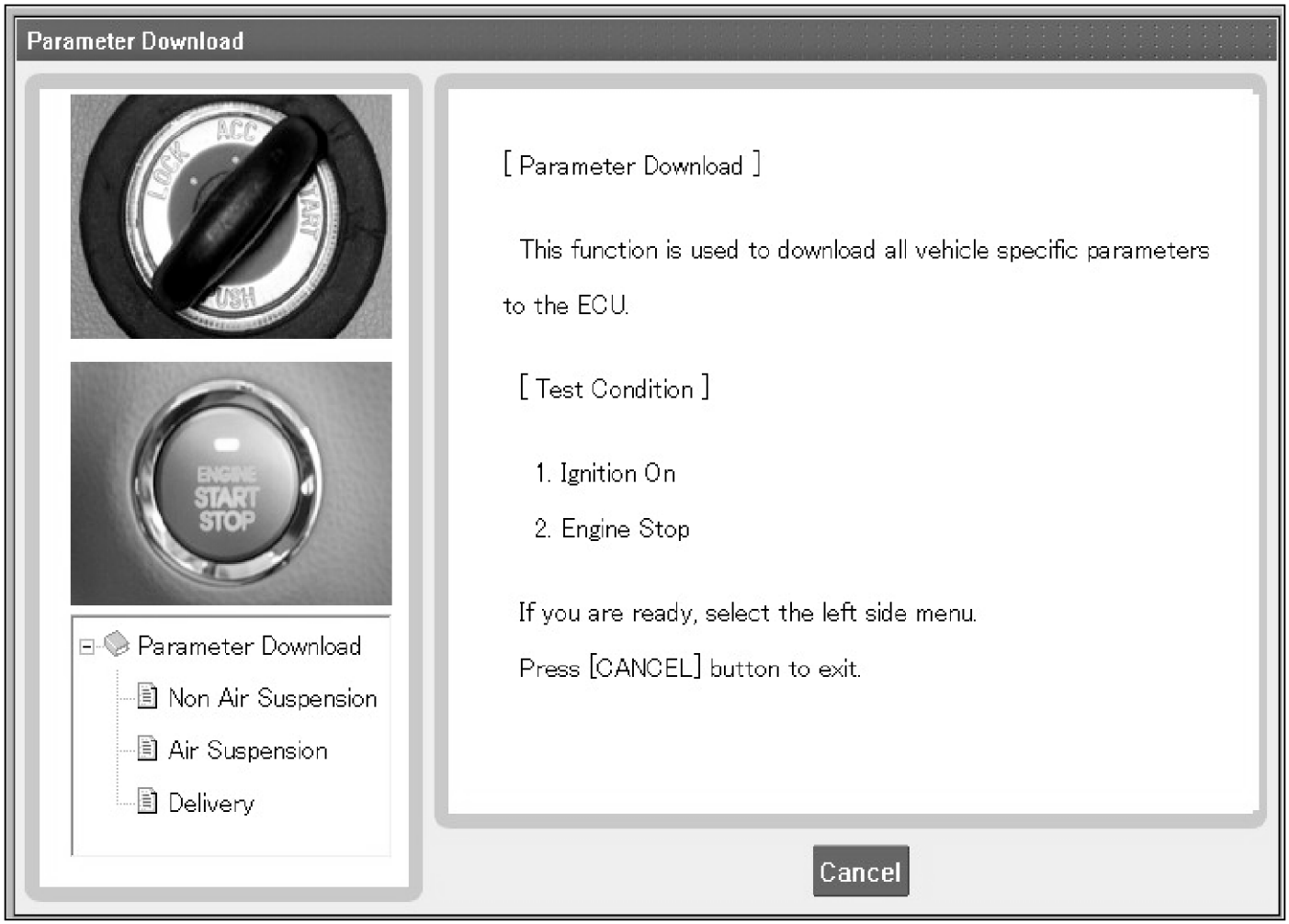
7) Headlamp S/W ON, AFLS ON

① Select the Parameter Download




SBHBE9C50L

② Select the Parameter Download.

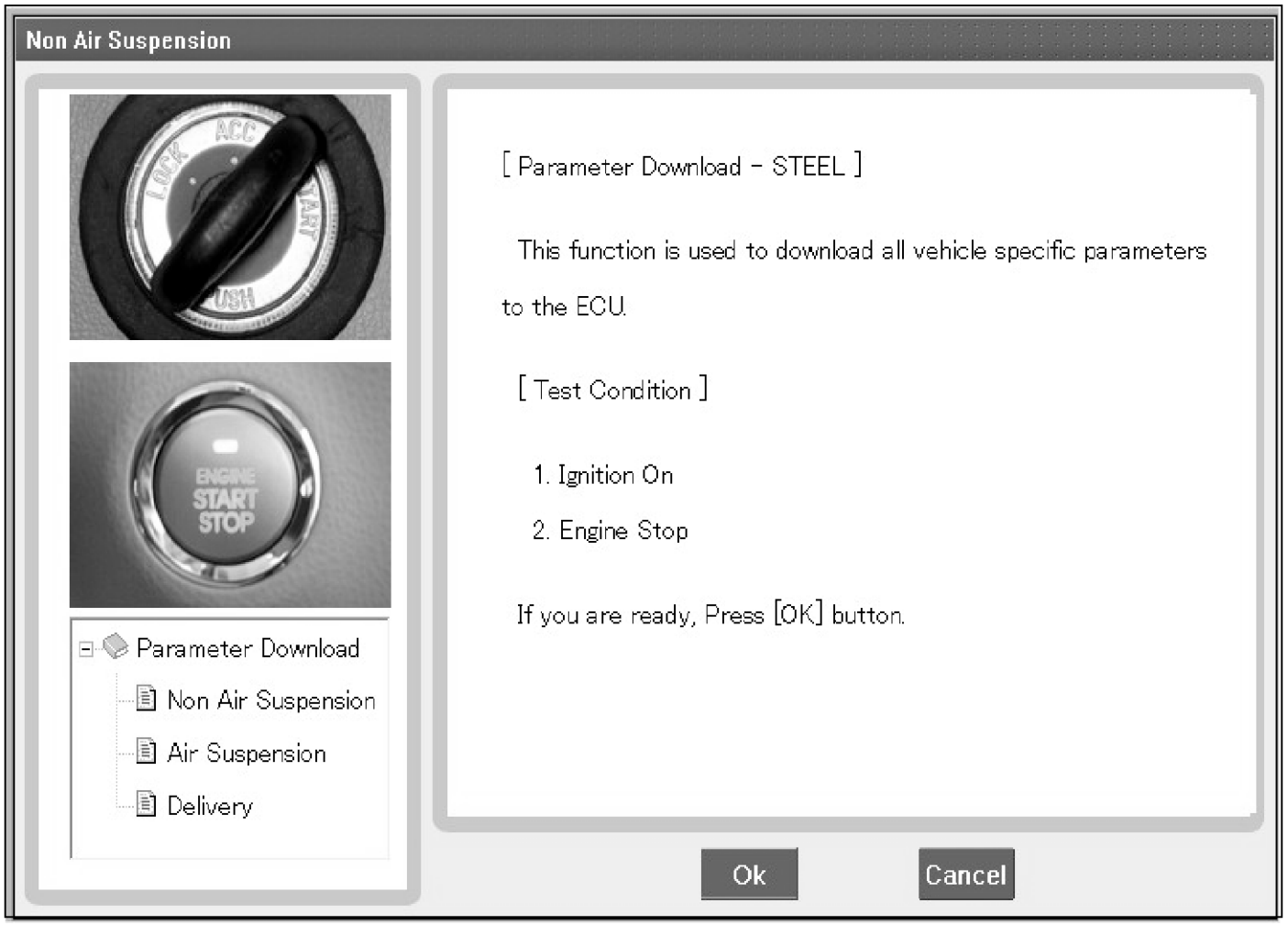



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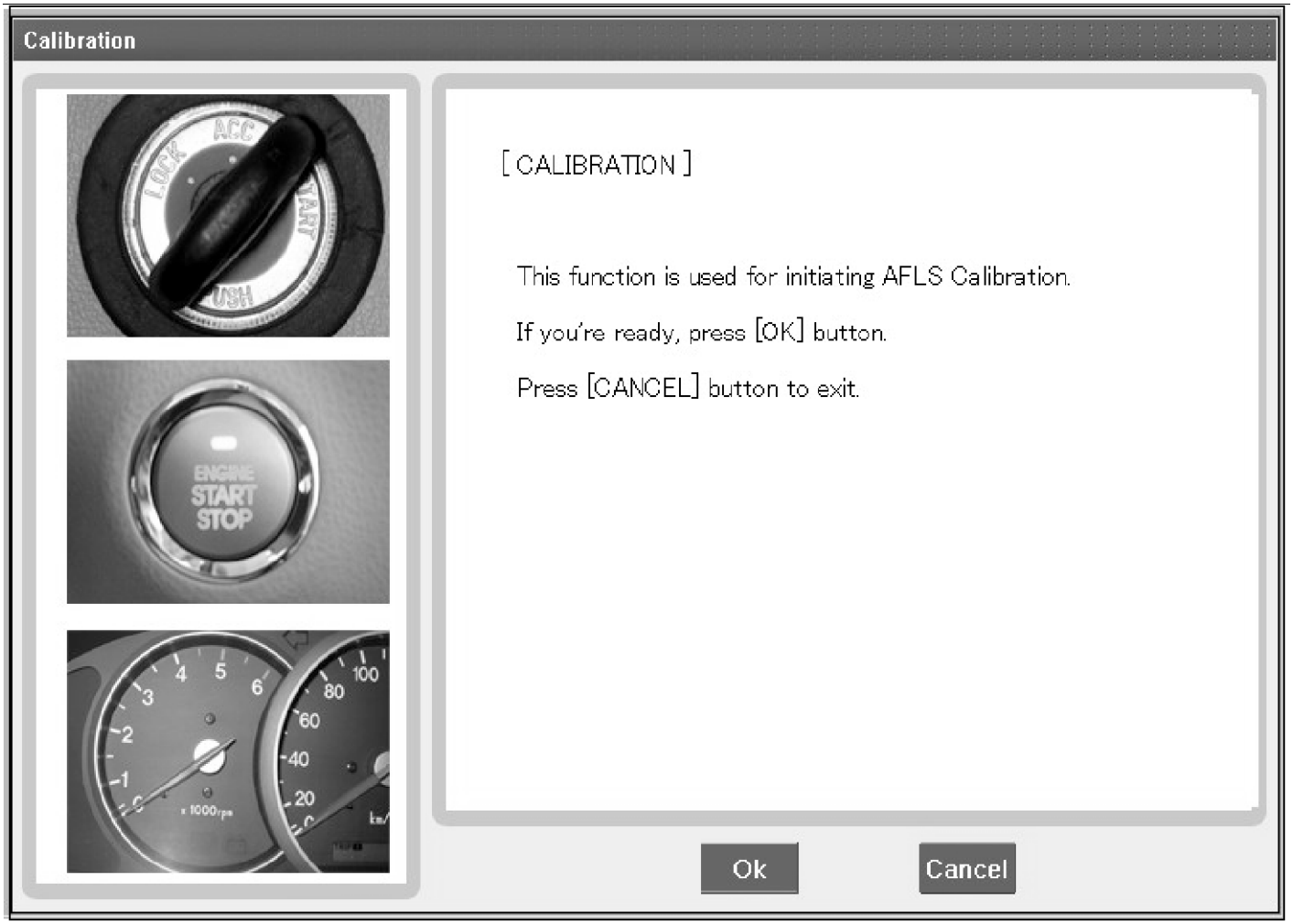

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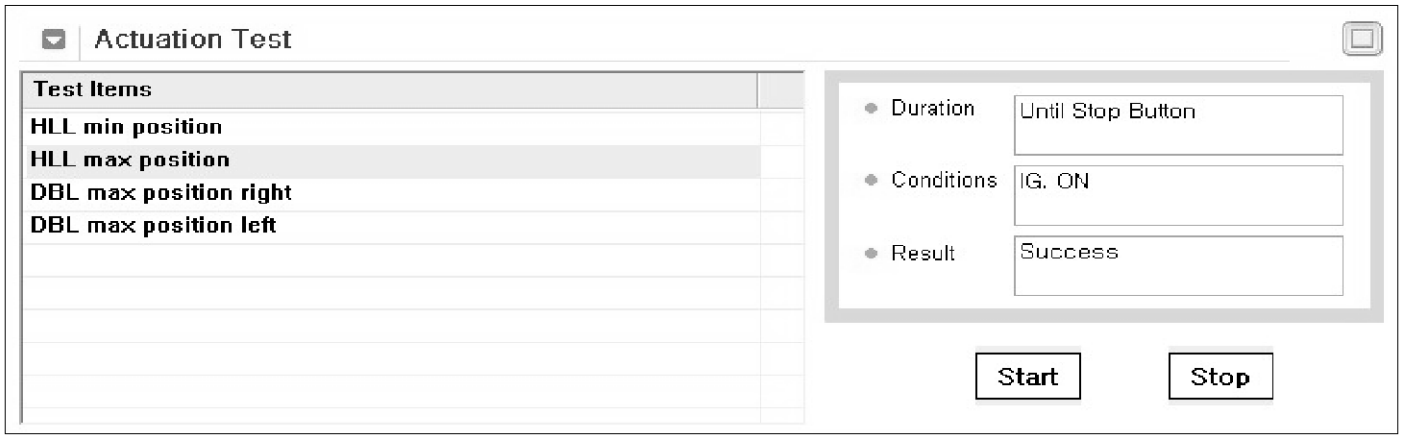
③ Select the CALIBRATION(W/O ECS)




SBHBE9C53L

④ Clear "DTC"

⑤ Confirm the Headlamp movement through the Actuation Test.




SBHBE9C54L

⑥ Confirm the "DTC" and "Service data"

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1622 ECU Software Error

### General Description

ECU check the internal circuit of ECU( RAM, ROM, EEP-ROM, ALU) in order to prevent from malfunctioning.

### DTC Description

ECU sets this code, If error detected in RAM or ROM.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • ECU H/W monitoring | • AFLS ECU |
| Enable Conditions | • IG ON | |
| Threshold Value | • Faulty in ECU software(EEPROM/ROM Fail) | |
| Detecting time | • 3sec. | |
| Fail Safe | • Leveling : stop at present status.<br>Swiveling : stop at present status. | |
| Check Lamp | • NO | |

### W/Harness Inspection

Refer to DTC B1621 : ECU Hardware Error.

### Component inspection

Refer to DTC B1621 : ECU Hardware Error.

### Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1636 LIN Communication Error Fault

## General Description

LIN (Local Interconnect Network) isdirect communication system to low-cost for electric system of vehicle.height sensor signal, vehicle speed, steering angle sensor signal are input to AFLS ECU to find out of headlamp position and AFLS ECU drive actuators through LIN communication.AFLS(Adaptive Front-Lighting System) drive Leveling Actuator-Intelligent Stepper Motor for adjusting up and down, and Swivel Actuator for adjusting right and left side.

## DTC Description

AFLS ECU set this code If LIN communication line short to battery or ground.almost cause of this DTC is LIN communication line or faulty headlamp.

## DTC Detecting Condition

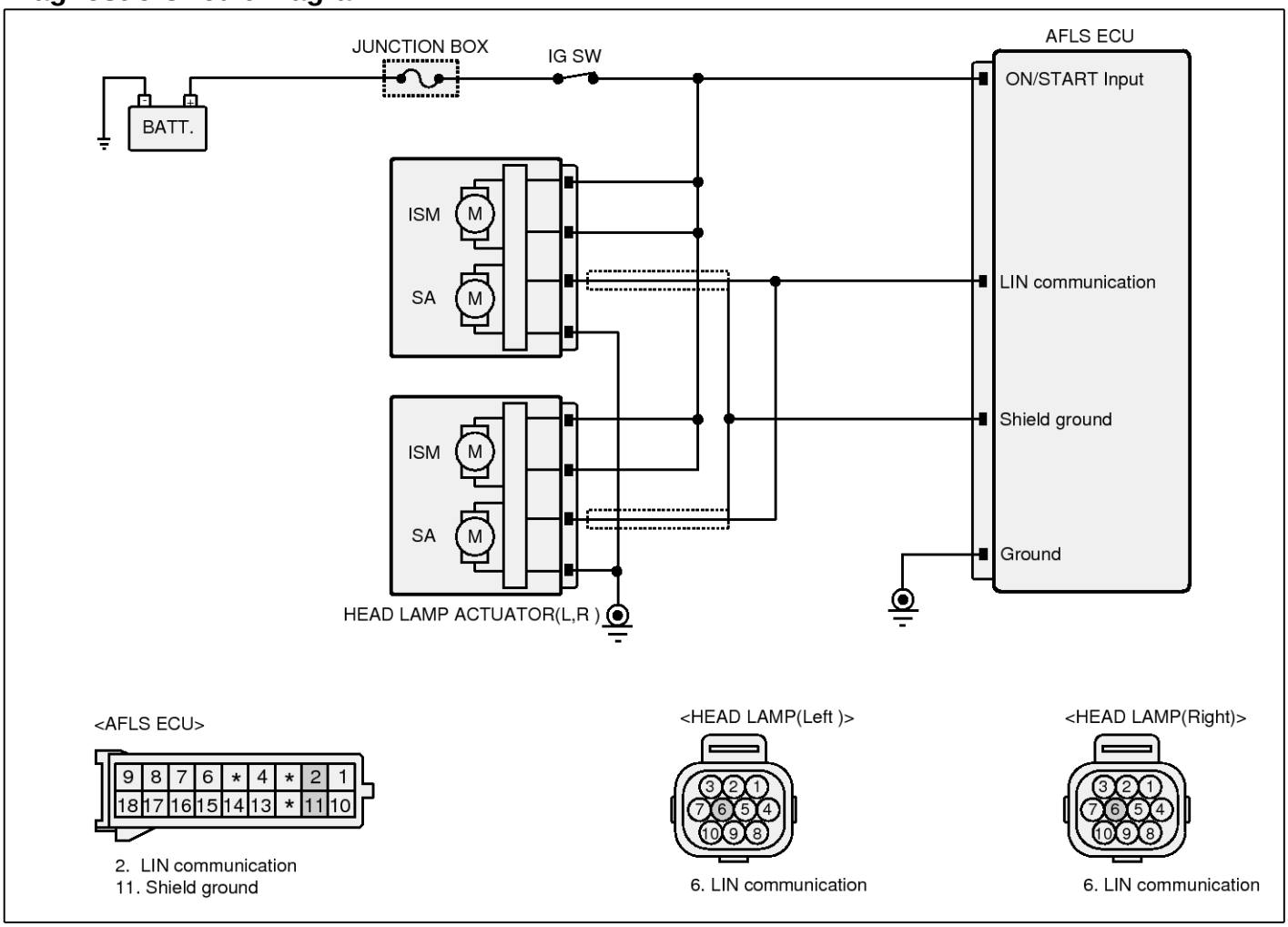
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • LIN communication circuit open<br>• Faulty in Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • LIN communication circuit short to battery or short to ground. | |
| Detecting time | • 1sec. | |
| Fail Safe | • Before initialization - Swivelling : stop at present status<br>. Levelling : stop at present status.<br>• After initialization - Leveling -2.8% down<br>Swivelling move to 0° position | |
| Check Lamp | • AFLS OFF lamp blinks | |

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## Diagnostic Circuit Diagram




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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

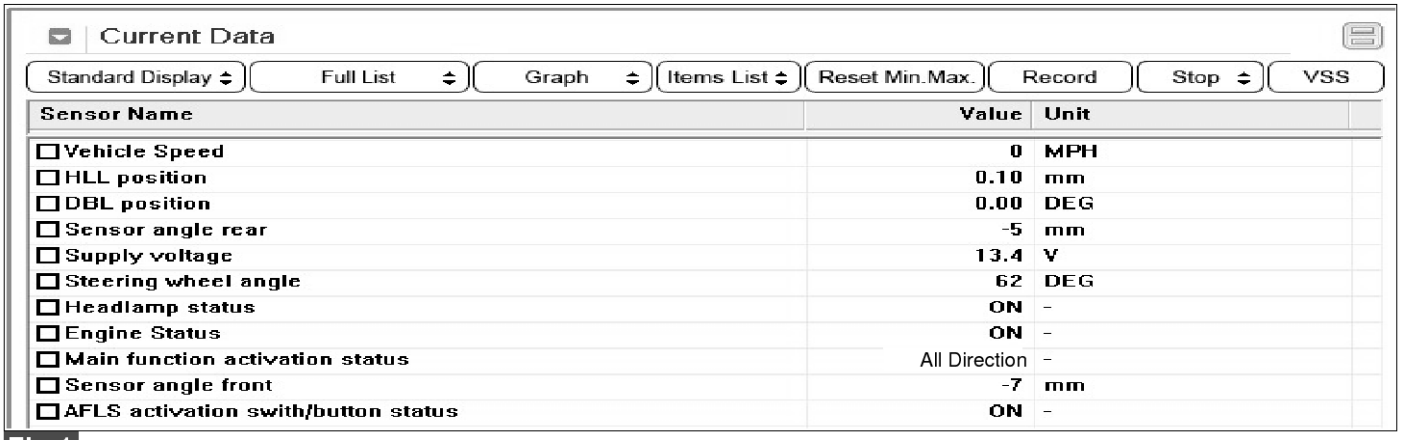



Fig.1

SBHBE9C42L

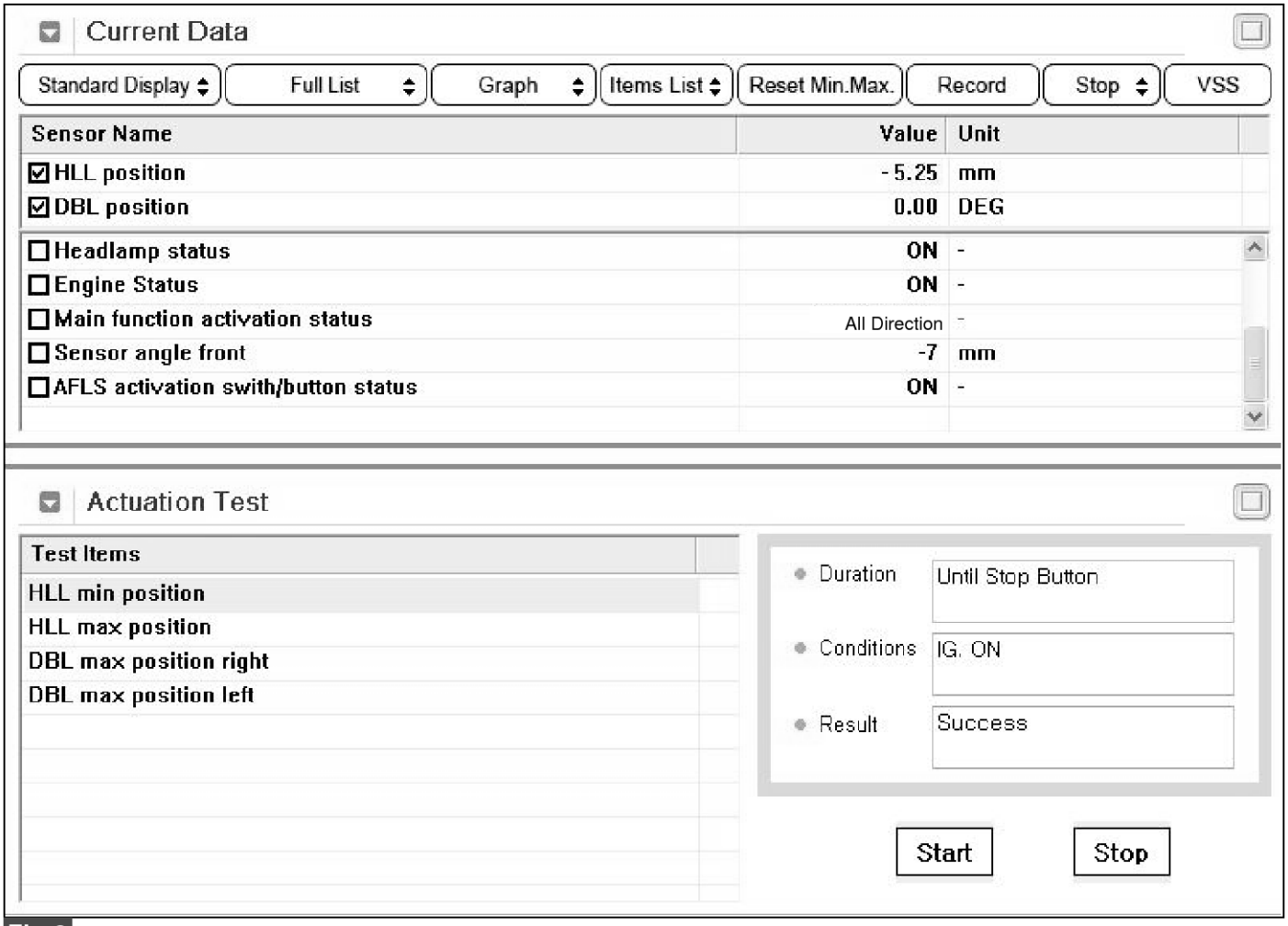



Fig.2

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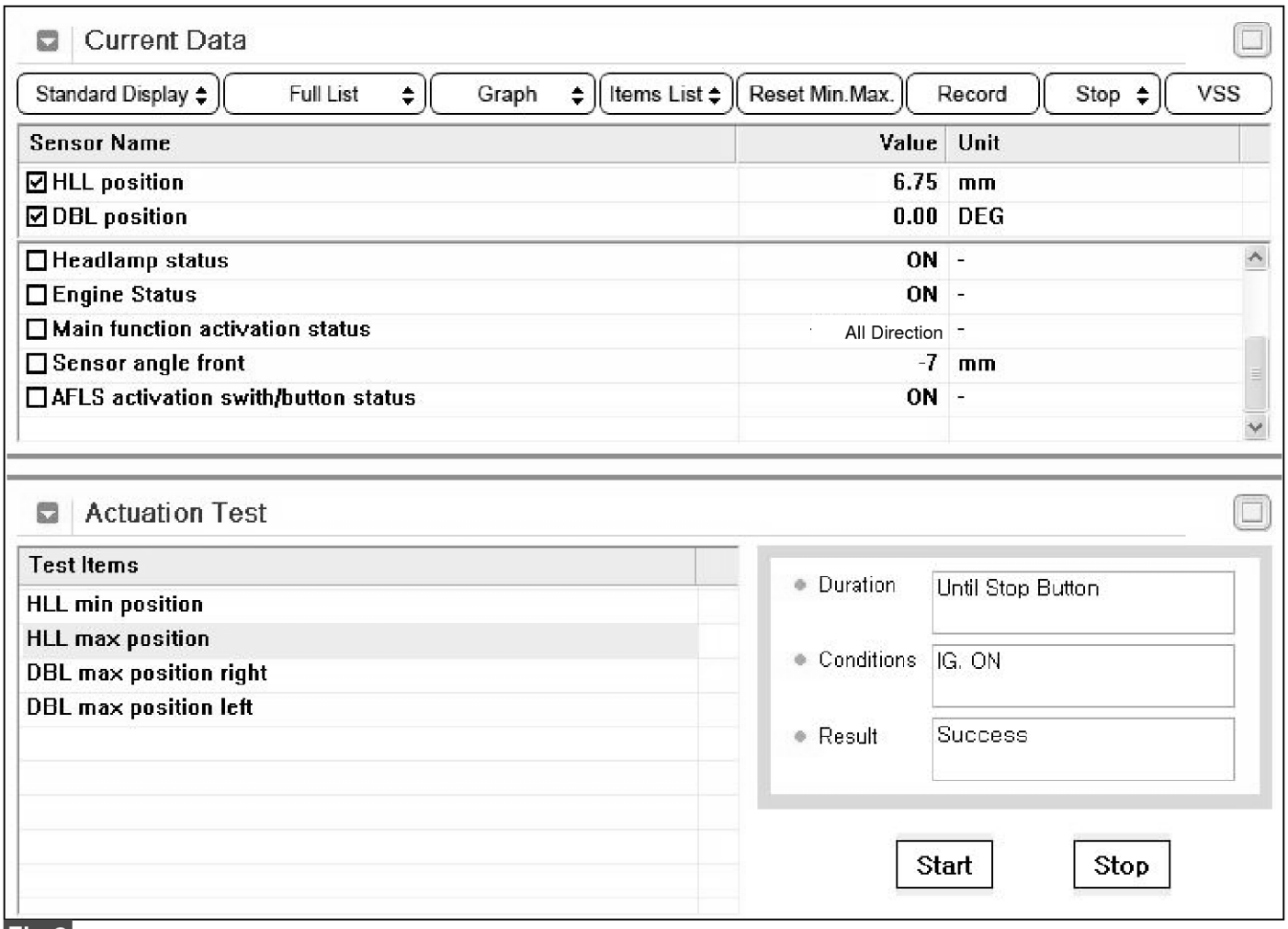



Fig.3

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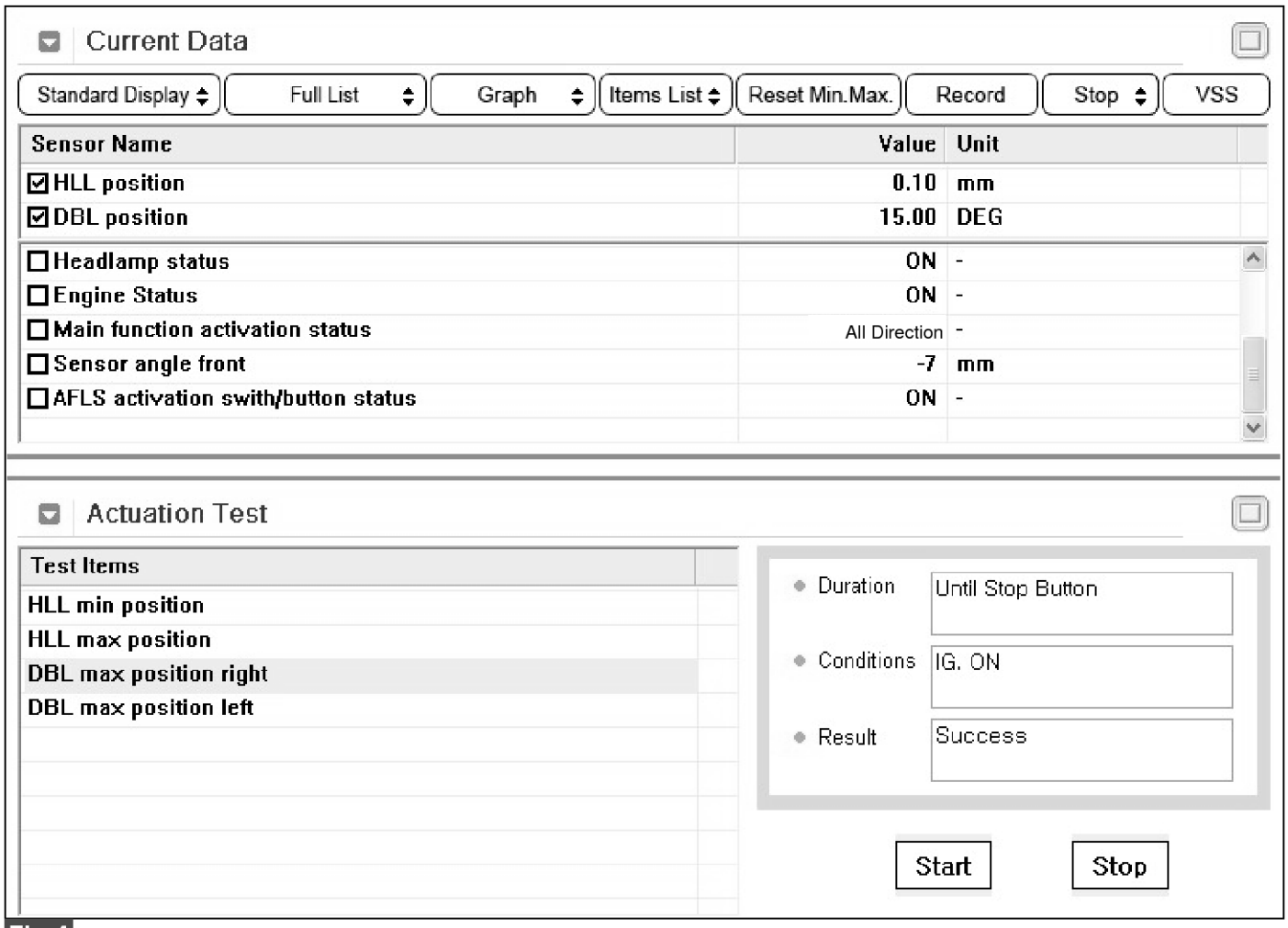



Fig.4

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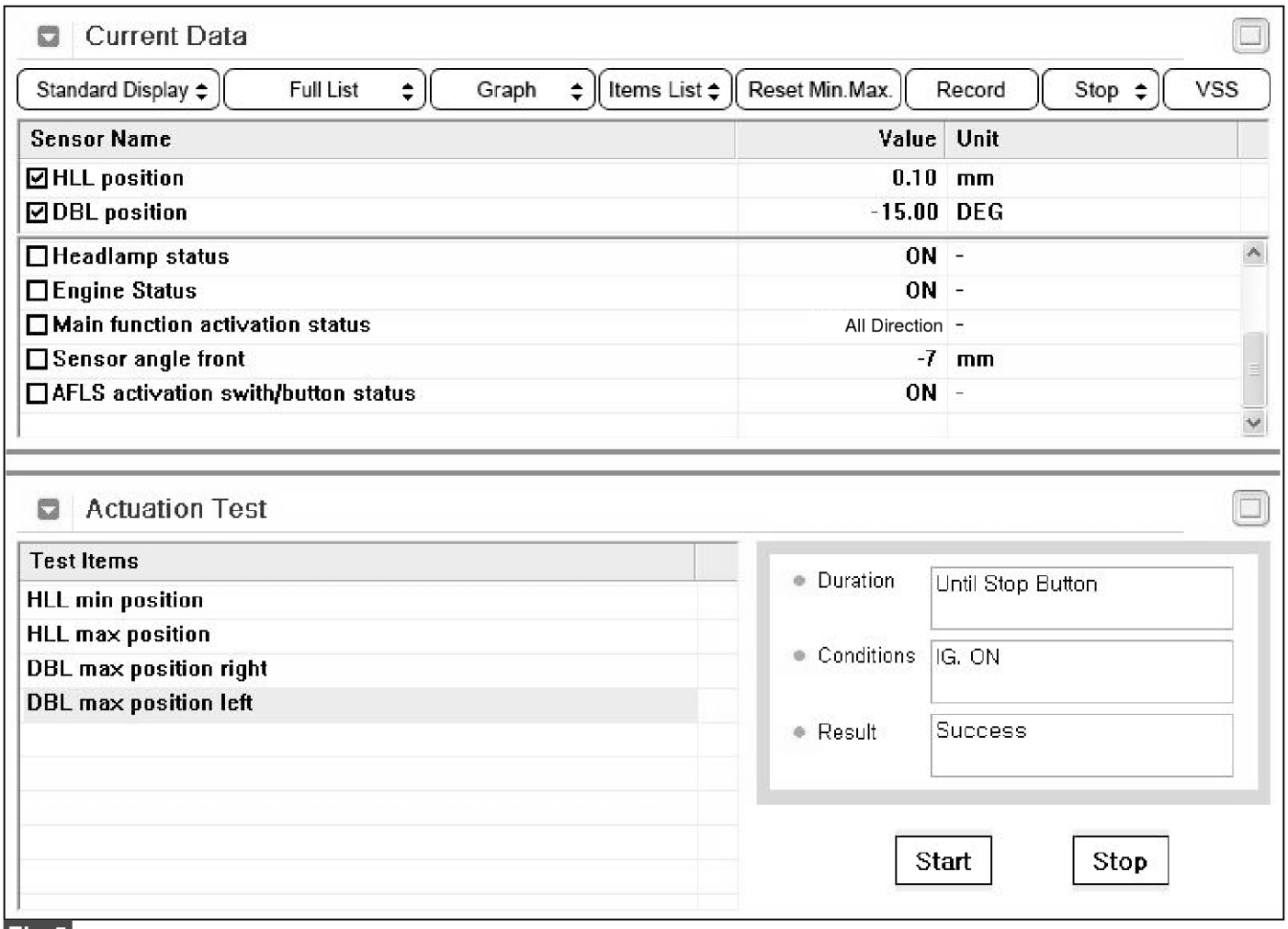



Fig.5

SBHBE9C58L

Fig 1) Engine "ON"

Fig 2) Actuation Test - HLL DOWN POSTION

Fig 2) Actuation Test - HLL UP POSTION

Fig 4) Actuation Test - DBL RIGHT POSTION

Fig 5) Actuation Test - DBL LEFT POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "LIN communication circuit inspection" procedure.

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### ■ LIN communication circuit inspection

1. Ignition "OFF"
2. Disconnect head lamp connector.
3. Ignition "ON"
4. Measure voltage between headlamp's LIN communication of wiring side and chassis ground.

**Specification :** below 1.3V

5. Is "voltage" display near the specified value?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Check for open/short in harness.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Component inspection

1. Substitute with a known - good head lamp and check for proper operation.
2. Is normal status after replace Headlamp?

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

Refer to DTC B1101 : Battery Voltage High.

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## B1637 System Not Initialized

### General Description

The ECU store height sensor's value to deactivation memory inside ECU,When the ECU initializing a height sensor.The ECU reinstitute a present height sensor's value to "zero" and reflect for the operation levelling control by reinstituted height sensor's value.

### DTC Description

B1637 code is request code for initialzing of height sensor after parameter downloading for not applied to air suspension.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • perform sensor initialization |
| Enable Conditions | • IG ON | |
| Threshold Value | • not perform sensor initialization | |
| Detecting time | • 2sec. | |
| Fail Safe | • Leveling -1.5% down<br>move to Swivelling 0˚ | |
| Check Lamp | • NO | |

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. perform sensor initialization.

   * REFERENCE*

   Perform the initializing after replace "Height sensor"

   * Vehicle condition

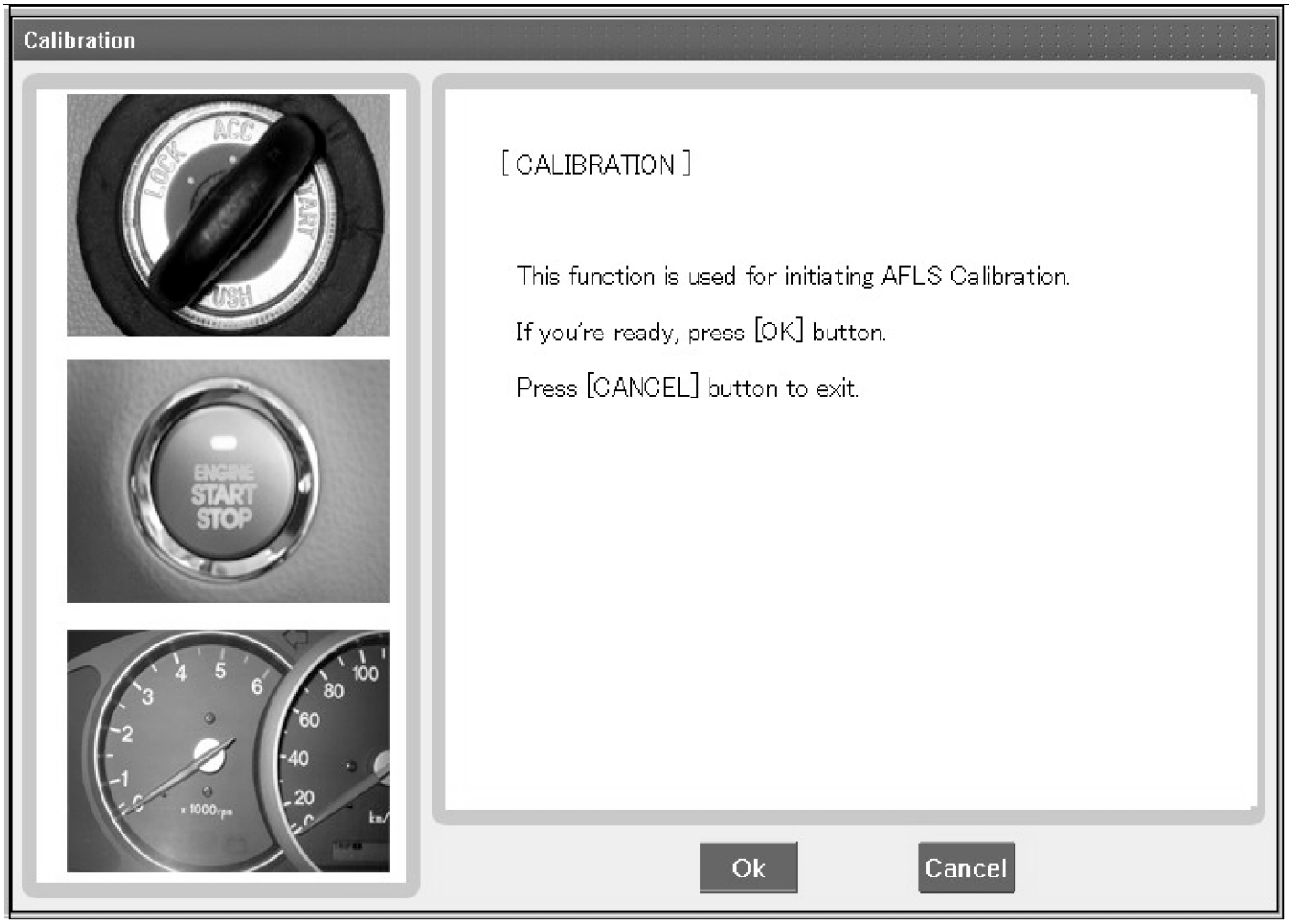
   1) Park at lever land
   2) Vehicle speed ≤ 5km/h
   3) Engine r.p.m > 500rpm
   4) Connect scan-tool
   5) CAN communication is normal status
   6) Battery voltage > 10.5V
   7) Headlamp S/W ON, AFLS ON

      ① Select the CALIBRATION

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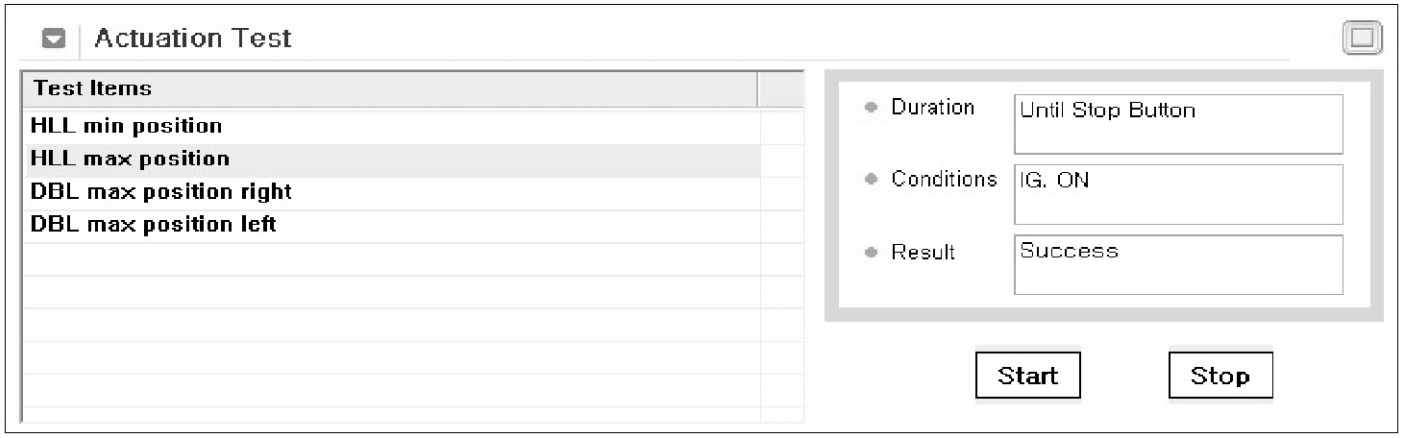
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② Confirm the Headlamp movement through the Actuation Test.



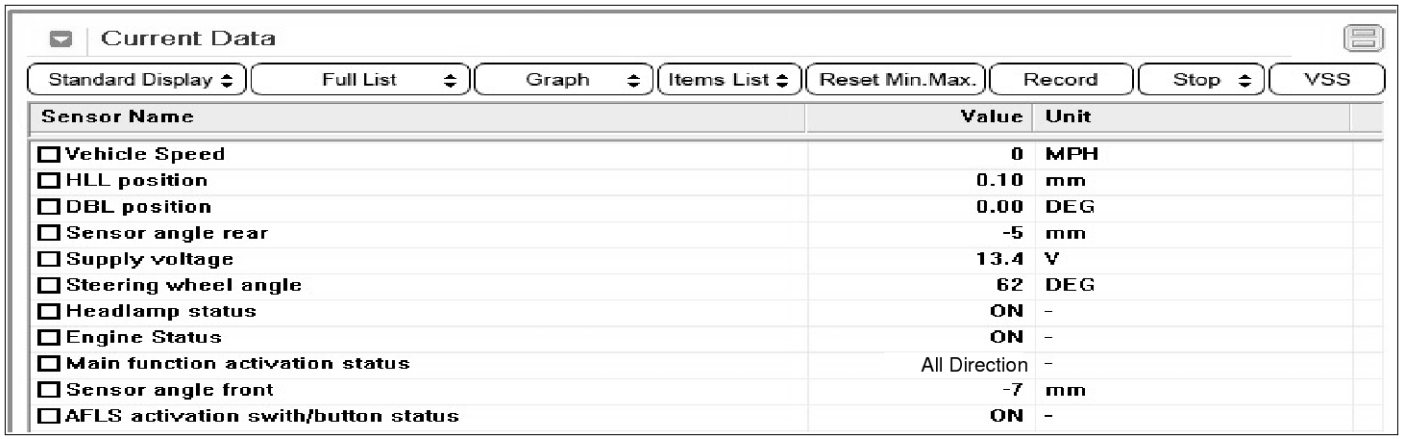

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③ Confirm the "DTC" and "Service data"




| Sensor Name | Value | Unit |
|---|---|---|
| Vehicle Speed | 0 | MPH |
| HLL position | 0.10 | mm |
| DBL position | 0.00 | DEG |
| Sensor angle rear | -5 | mm |
| Supply voltage | 13.4 | V |
| Steering wheel angle | 62 | DEG |
| Headlamp status | ON | - |
| Engine Status | ON | - |
| Main function activation status | All Direction | - |
| Sensor angle front | -7 | mm |
| AFLS activation swith/button status | ON | - |

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4. Is parameter displayed within specifications?

**YES** ▶ Go to "Verification of Vehicle Repair" procedure.

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

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1638 CAN time-out Air Suspension

## General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, atutomatic transaxle, ABS, TCS, ECS)AFLS ECU is input some informations(engine speed, steering angle sensor's signal, vehicle speed) in order to maintain optimum headlamp condition through CAN communication. ECS ECU decide for vehicle's slope uses height sensor's sognal and this signal input to AFLS ECU through the CAN communication.AFLS(Adaptive Front-Lighting System) ECU provides best visibility with height sensor's signal by adjusting vertical direction of the headlamp.

## DTC Description

AFLS ECU set this code If the CAN communication signal is not input from ECS ECU

## DTC Detecting Condition

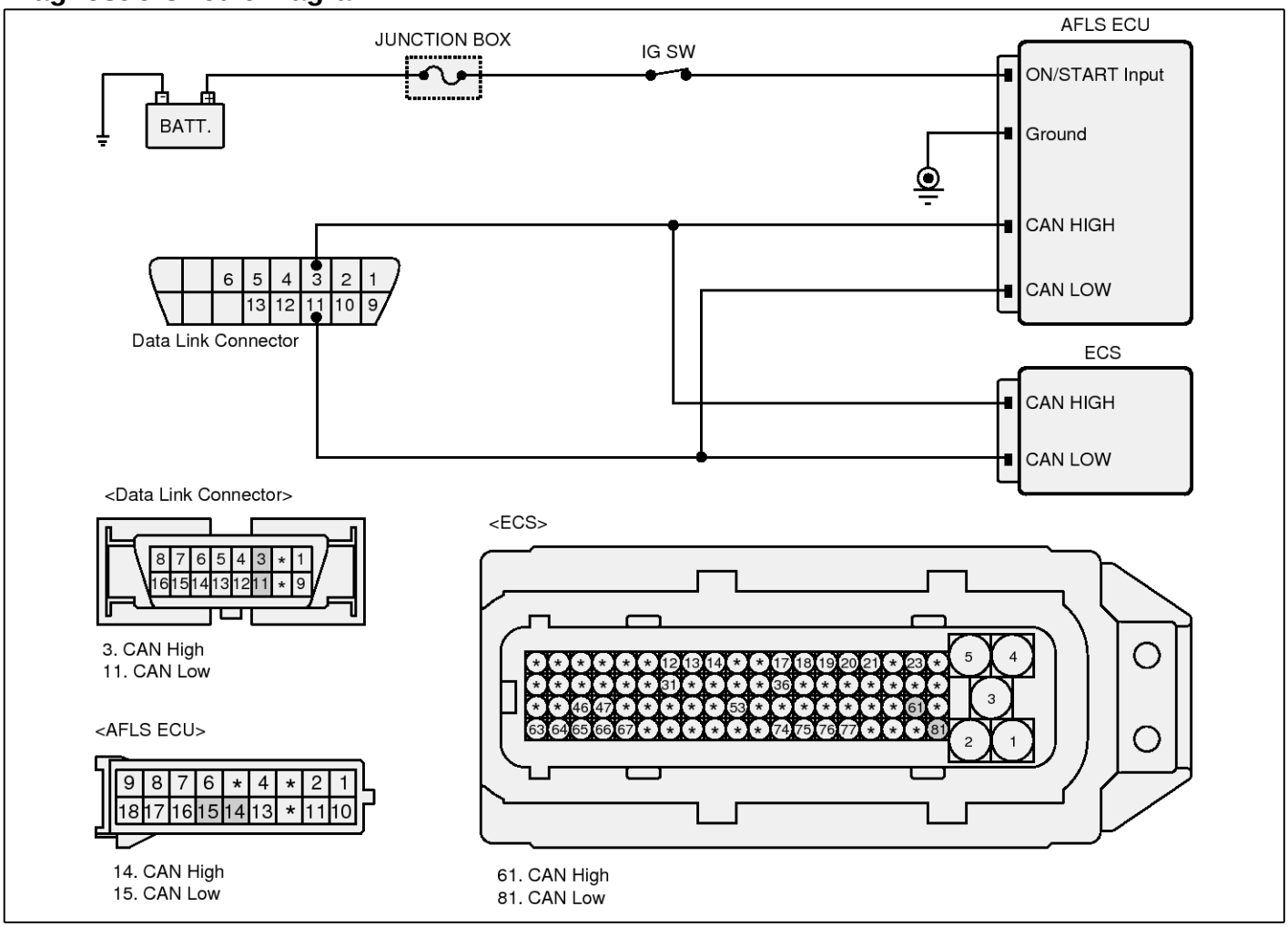
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • CAN communication circuit Open/Short<br>• Faulty ECS ECU |
| Enable Conditions | • IG ON | |
| Threshold Value | • CAN communication signal of ECS is not output | |
| Detecting time | • 2sec. | |
| Fail Safe | • Leveling -1.5% down<br>move to Swivelling 0˚ | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram




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## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "Sensor angle front, Sensor angle rear" parameters on the scantool.
   .(AFLS and ECS's current data)

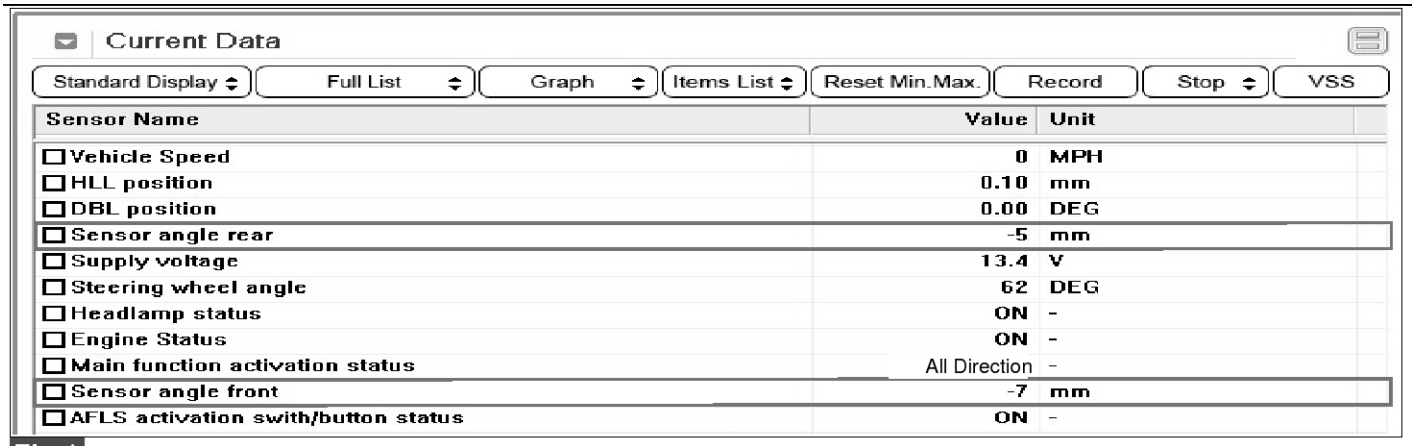



Fig.1

SBHBE9C59L

FIg1) Engine "ON"

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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** ▶ Faulty in height sensor signal(included in ECS ECU signal)
- Check the ECS system and Go to "Verification of vehicle Repair" procedure ".(Refer to ECS system)
▶ Faulty in only AFLS ECU signal
- Go to "Inspection/Repair" procedure

## W/Harness 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 "CAN communication circuit inspection" procedure.

### ■ CAN communication circuit inspection (AFLS ECU ↔ ECS ECU)

1. Ignition "OFF"
2. Disconnect ECS ECU connector and AFLS ECU connector
3. Measure the resistance between CAN-HIGH terminal of ECS ECU harness connector and CAN-HIGH terminal of AFLS ECU harness connector.
4. Measure the resistance between CAN-LOW terminal of ECS ECU harness connector and CAN-LOW terminal of AFLS ECU harness connector.

**Specification :** below 1Ω

5. Is the measured resistance within specification ?

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

**NO** ▶ Check for open/short in harness.
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1639 LIN communication error DBL left

### General Description

Refer to DTC B1636 : LIN Communication Error Fault.

### DTC Description

AFLS ECU set this code If critcal faulty in LIN communication for Swivel Actuator of left side headlamp.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • LIN communication circuit open<br>• Faulty in Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • LIN communication(Left side) error of Swivel Actuator | |
| Detecting time | • 1sec | |
| Fail Safe | • Leveling -2.8% down<br>Before Swivelling initialization : stop at present status.<br>After Swivelling initialization : move to 0˚ position | |
| Check Lamp | • AFLS OFF lamp blinks | |

### Diagnostic Circuit Diagram

Refer to DTC B1636 : LIN Communication Error Fault.

### Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

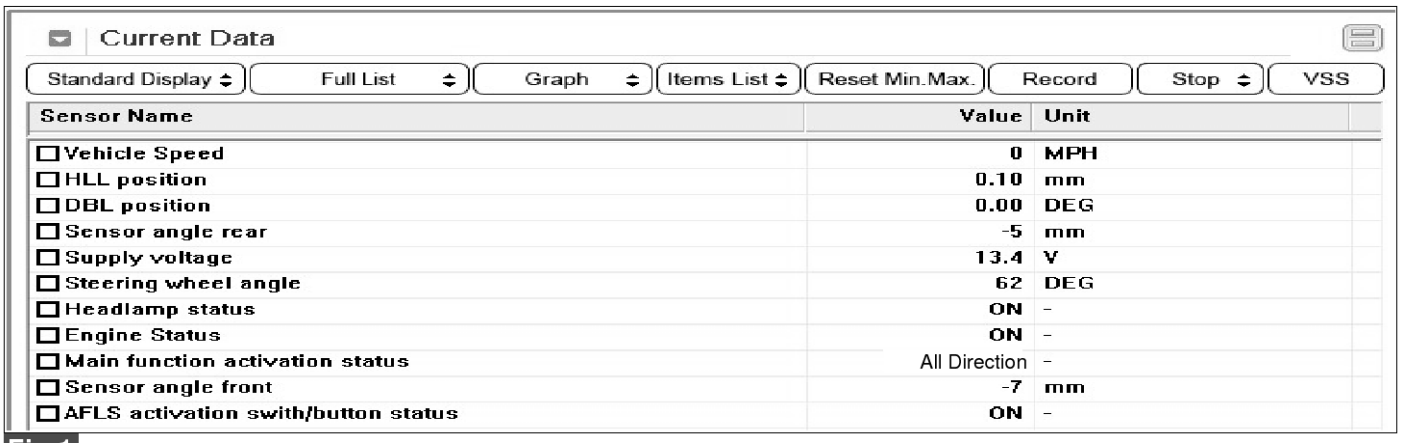



Fig.1

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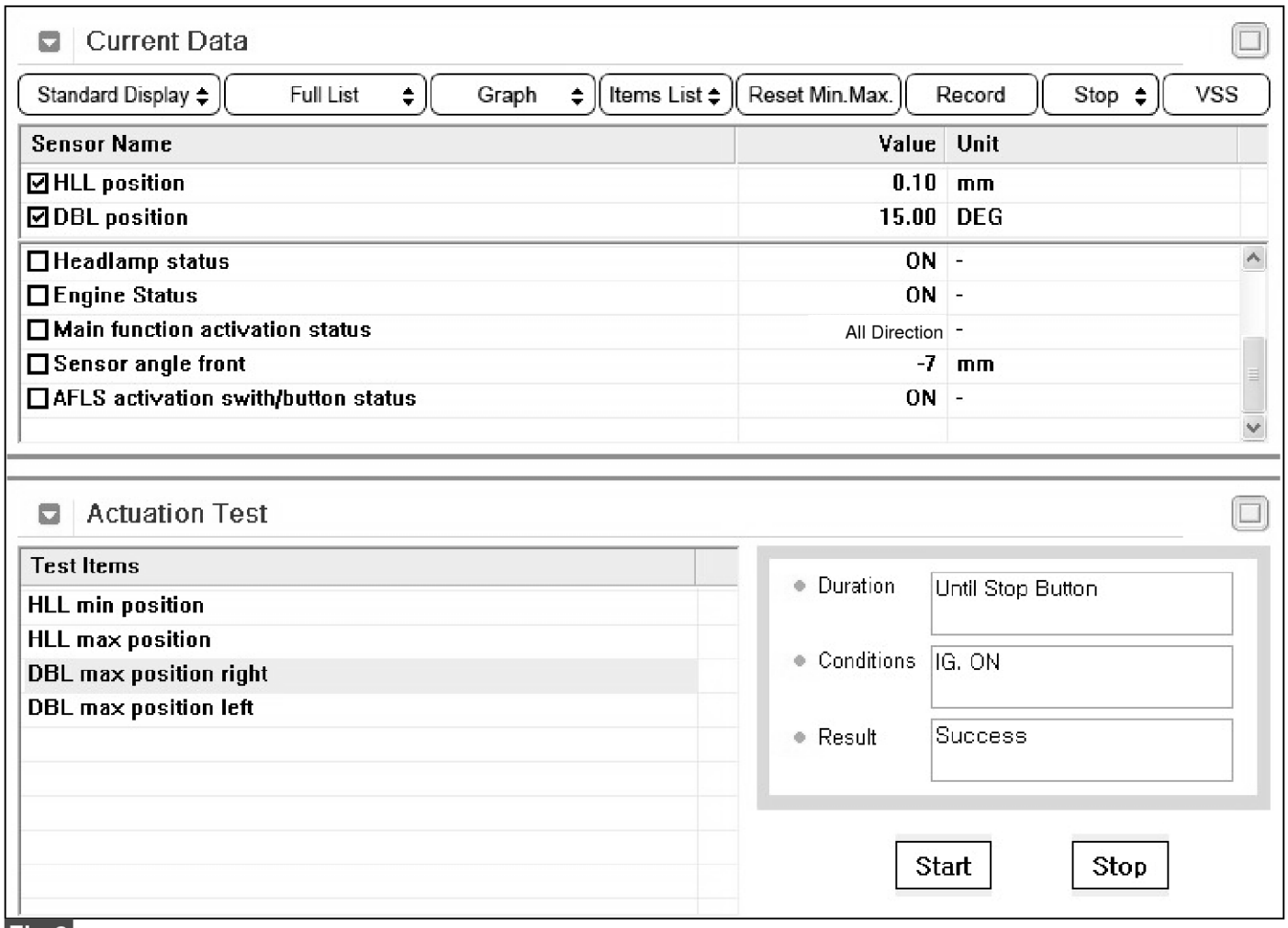



Fig.2

SBHBE9C60L

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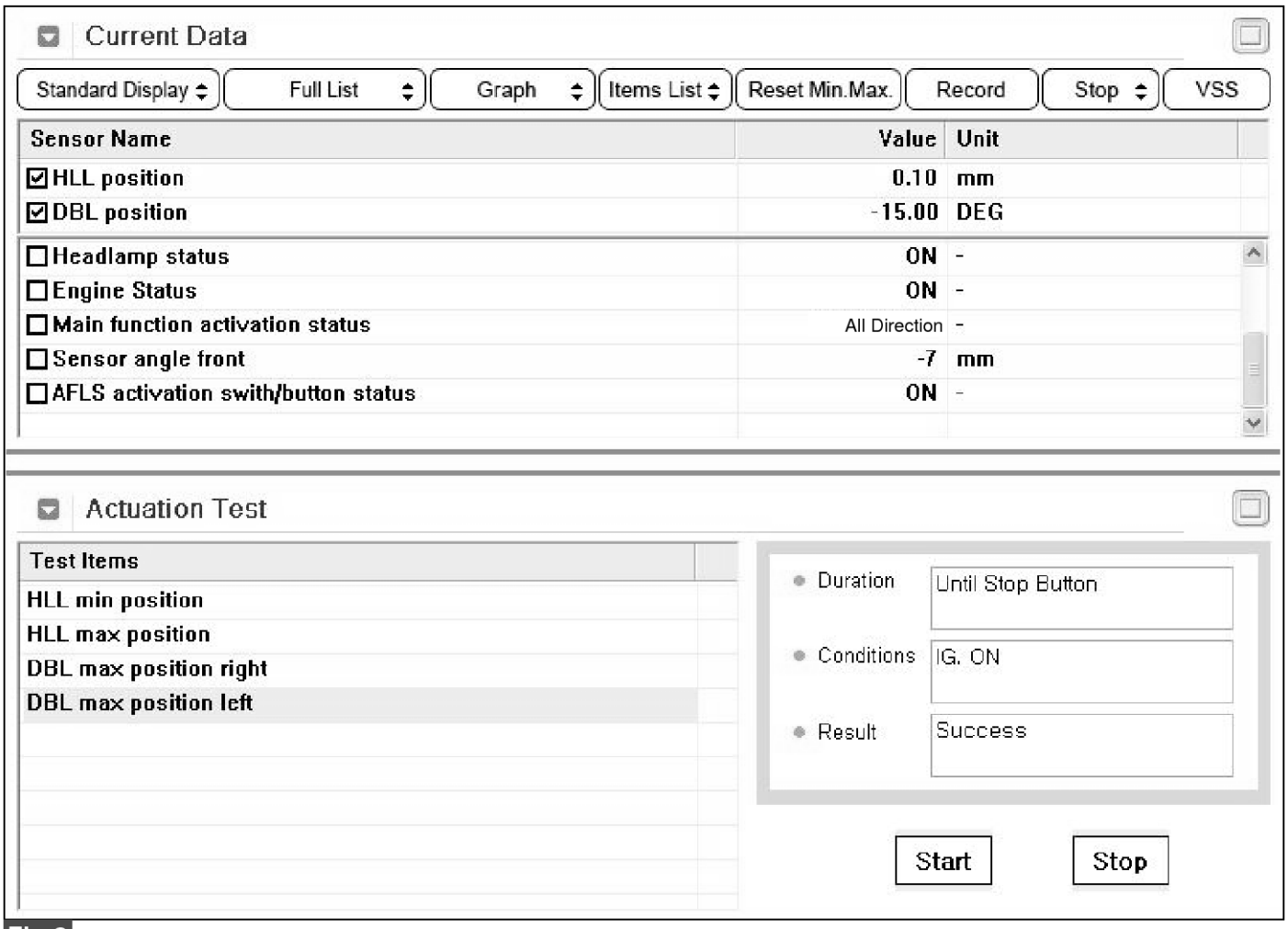



Fig.3

SBHBE9C61L

Fig 1) Engine "ON"

Fig 2) Actuation Test - DBL RIGHT POSTION

Fig 3) Actuation Test - DBL LEFT POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Component inspection" procedure.

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### Component inspection

1. Substitute with a known - good head lamp and check for proper operation.
2. Is normal status after replace Headlamp?

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

Refer to DTC B1101 : Battery Voltage High.

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## B1640 LIN communication error DBL right

### General Description

Refer to DTC B1636 : LIN Communication Error Fault.

### DTC Description

AFLS ECU set this code If critcal faulty in LIN communication for Swivel Actuator of right side headlamp.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • LIN communication circuit open<br>• Faulty in Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • LIN communication(Right side) error of Swivel Actuator | |
| Detecting time | • 1sec | |
| Fail Safe | • Leveling -2.8% down<br>Before Swivelling initialization : stop at present status.<br>After Swivelling initialization : move to 0° position | |
| Check Lamp | • AFLS OFF lamp blinks | |

### Diagnostic Circuit Diagram

Refer to DTC B1636 : LIN Communication Error Fault.

### Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

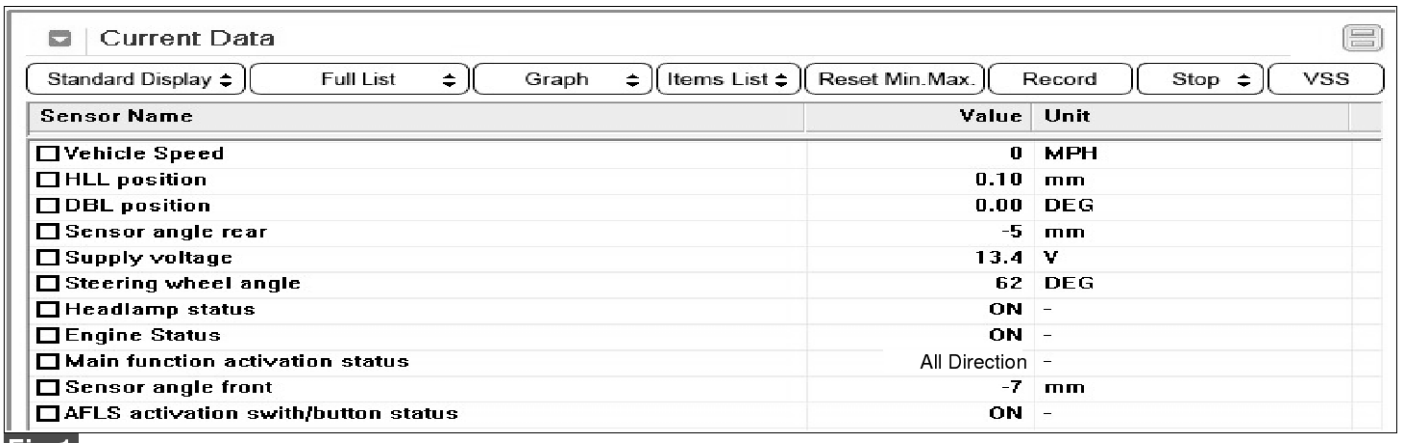



Fig.1

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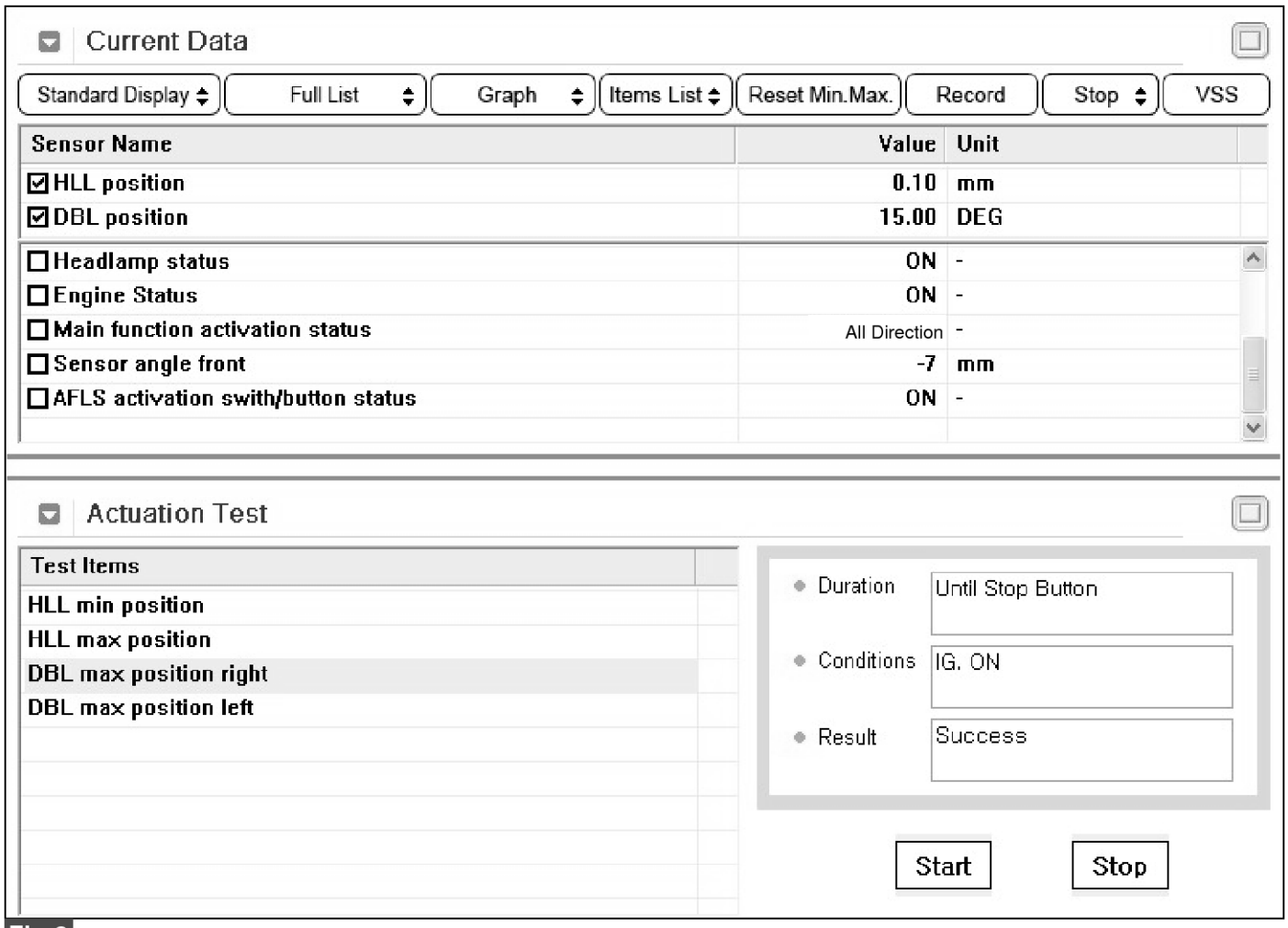



Fig.2

SBHBE9C60L

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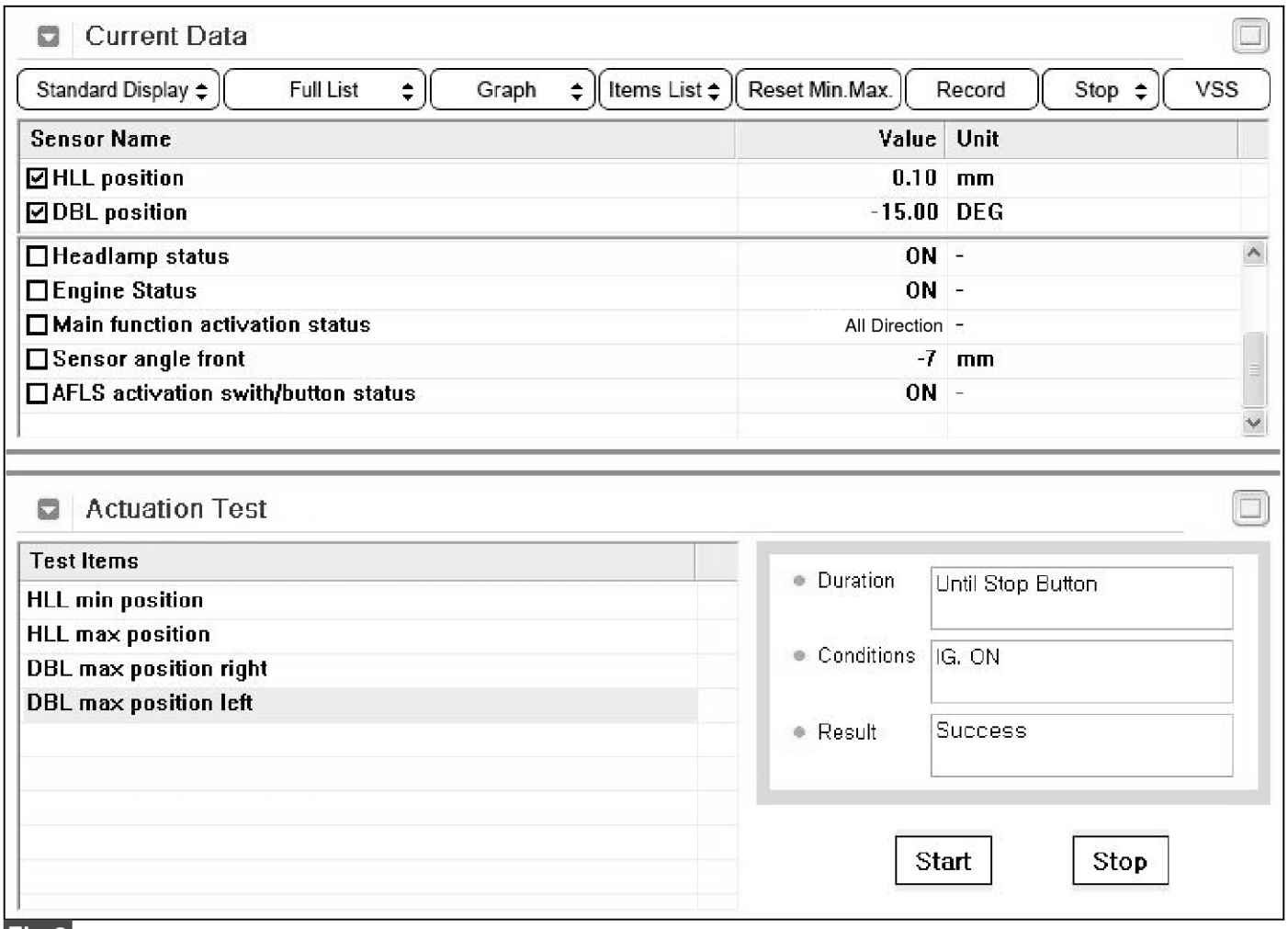



Fig.3

SBHBE9C61L

Fig 1) Engine "ON"

Fig 2) Actuation Test - DBL RIGHT POSTION

Fig 3) Actuation Test - DBL LEFT POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Component inspection" procedure.

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### Component inspection

1. Substitute with a known - good head lamp and check for proper operation.
2. Is normal status after replace Headlamp?

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

Refer to DTC B1101 : Battery Voltage High.

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# B1641 LIN communication error LWR left

## General Description

Refer to DTC B1636 : LIN Communication Error Fault.

## DTC Description

AFLS ECU set this code If critcal faulty in LIN communication for ISM(Intelligent Stepper Motor) of left side headlamp.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • LIN communication circuit open<br>• Faulty in Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • LIN communication(Left side) error of ISM(Intelligent Stepper Motor) | |
| Detecting time | • 1sec | |
| Fail Safe | • Swivelling : normal operation<br>Before Left Levelling initialization : stop at present status.<br>After Left Levelling initialization : -1.5% down Right Levelling : -1.5% down | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B1636 : LIN Communication Error Fault.

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

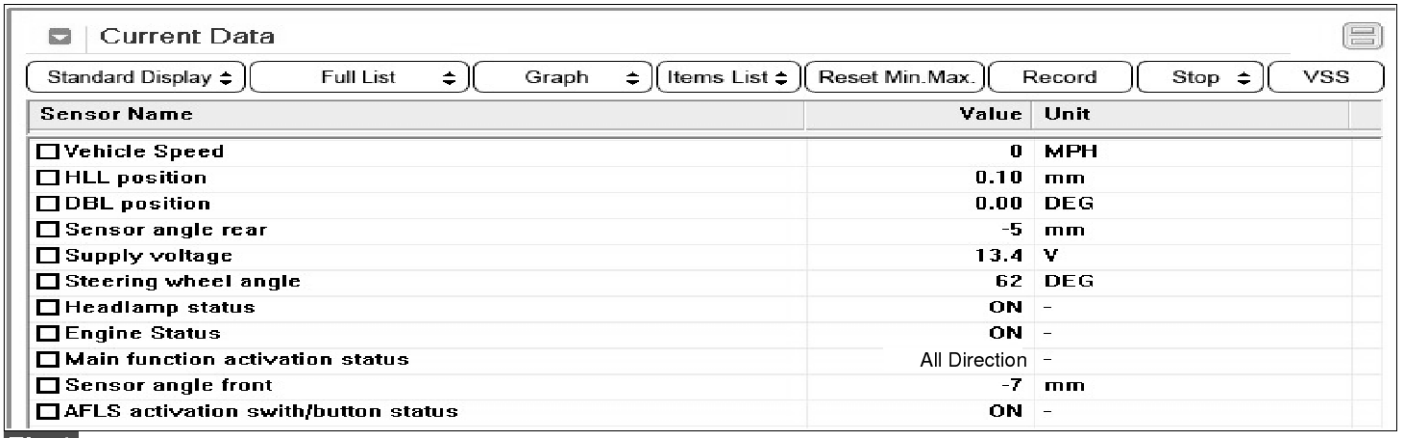



Fig.1

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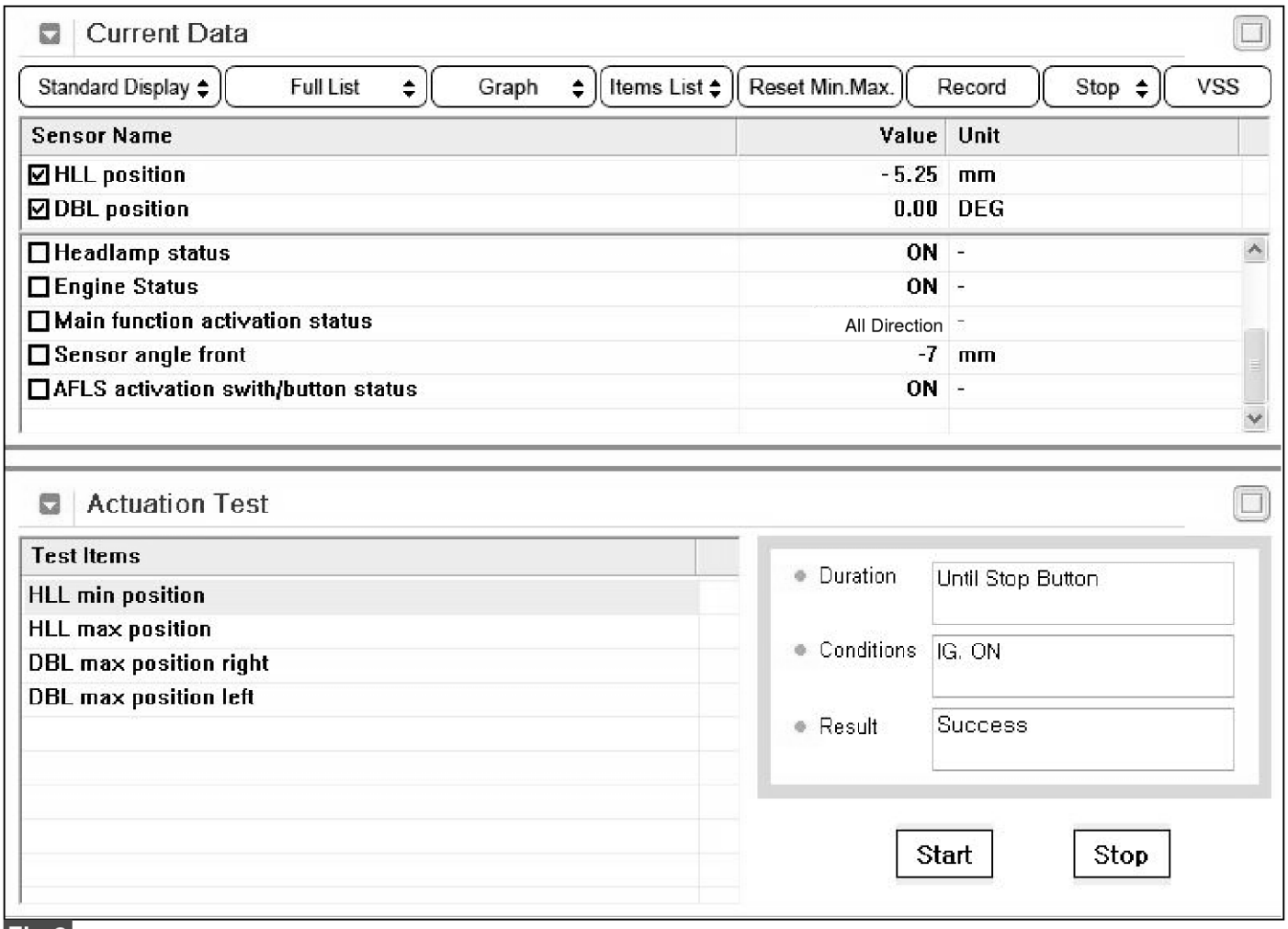



Fig.2

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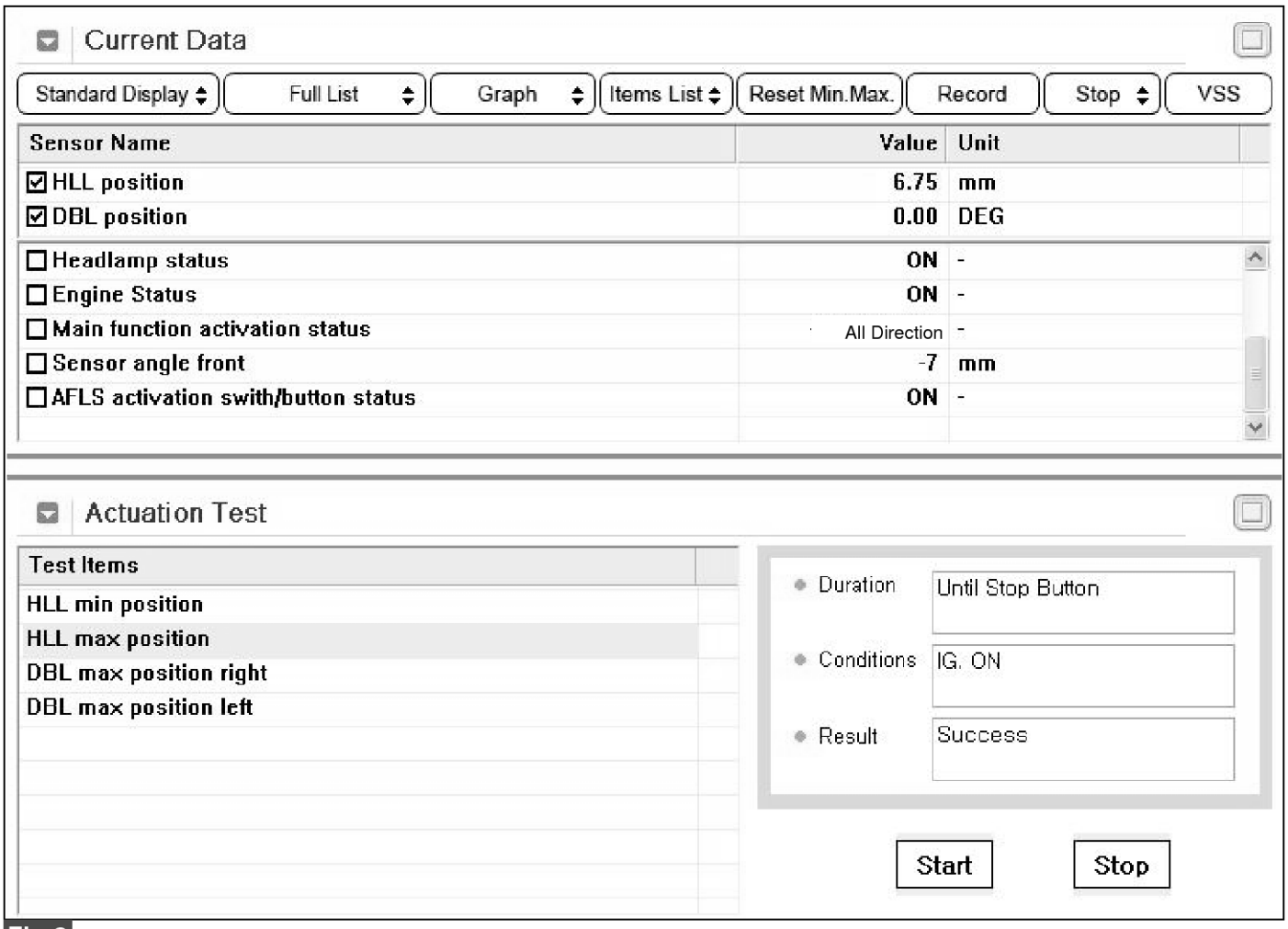



Fig.3

SBHBE9C56L

Fig 1) Engine "ON"

Fig 2) Actuation Test - HLL DOWN POSTION

Fig 3) Actuation Test - HLL UP POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. T-horoughly check connectors for looseness, po-or connection, bending, corrosion, contaminati-on, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure

**NO** ▶ Go to " Inspection/Repair " procedure .

## W/Harness Inspection

Refer to DTC B1640 : LIN communication error DBL right .

## Component inspection

Refer to DTC B1640 : LIN communication error DBL right .

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1642 LIN communication error LWR right

## General Description

Refer to DTC B1636 : LIN Communication Error Fault.

## DTC Description

AFLS ECU set this code If critcal faulty in LIN communication for ISM(Intelligent Stepper Motor) of right side headlamp.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • LIN communication circuit open<br>• Faulty in Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • LIN communication(Right side) error of ISM(Intelligent Stepper Motor) | |
| Detecting time | • 1sec | |
| Fail Safe | • Swivelling : normal operation<br>Before Left Levelling initialization : stop at present status.<br>After Left Levelling initialization : -1.5% down Right Levelling : -1.5% down | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B1636 : LIN Communication Error Fault.

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

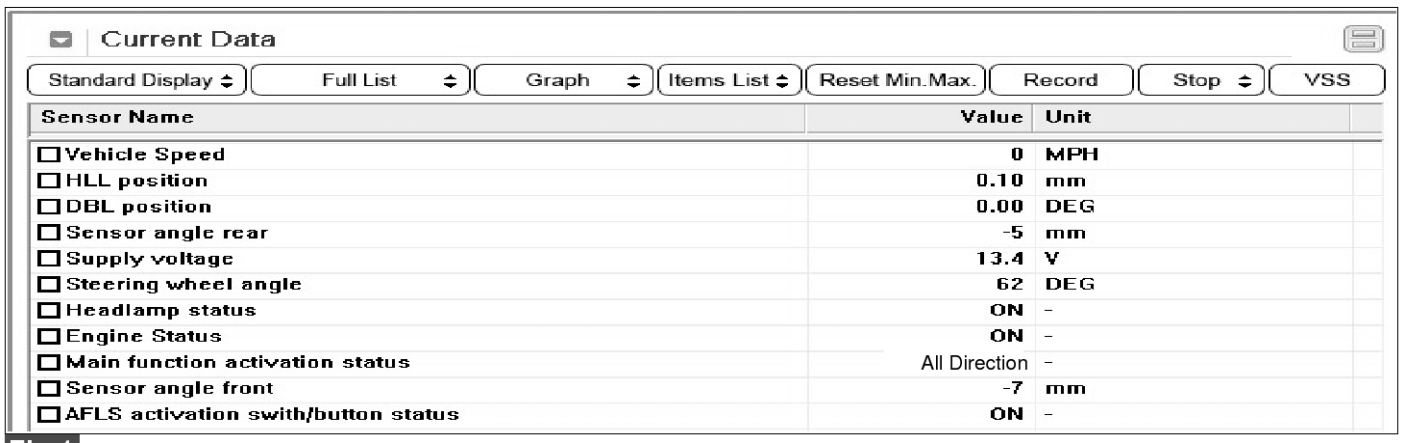



Fig.1

SBHBE9C42L

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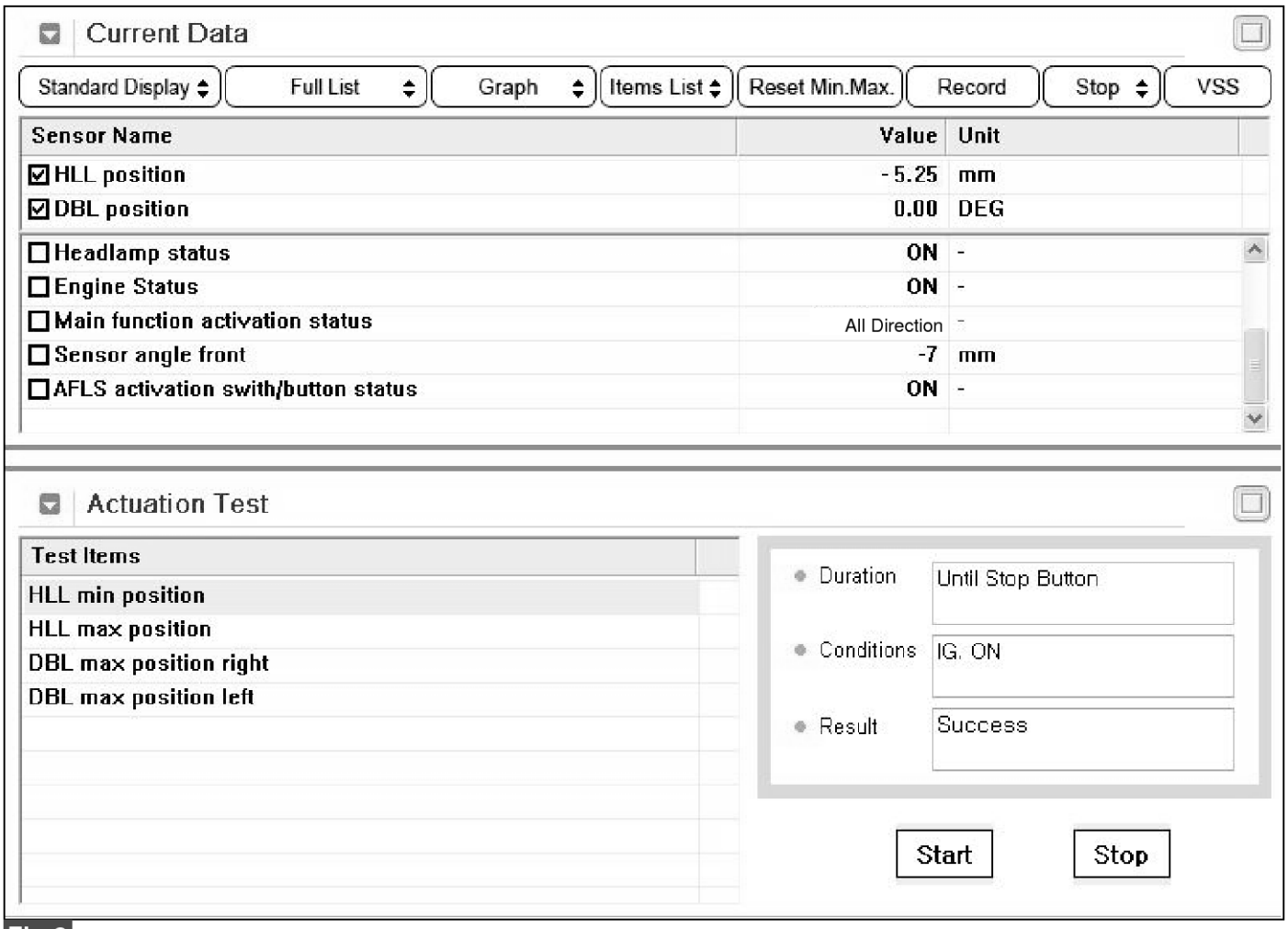



Fig.2

SBHBE9C55L

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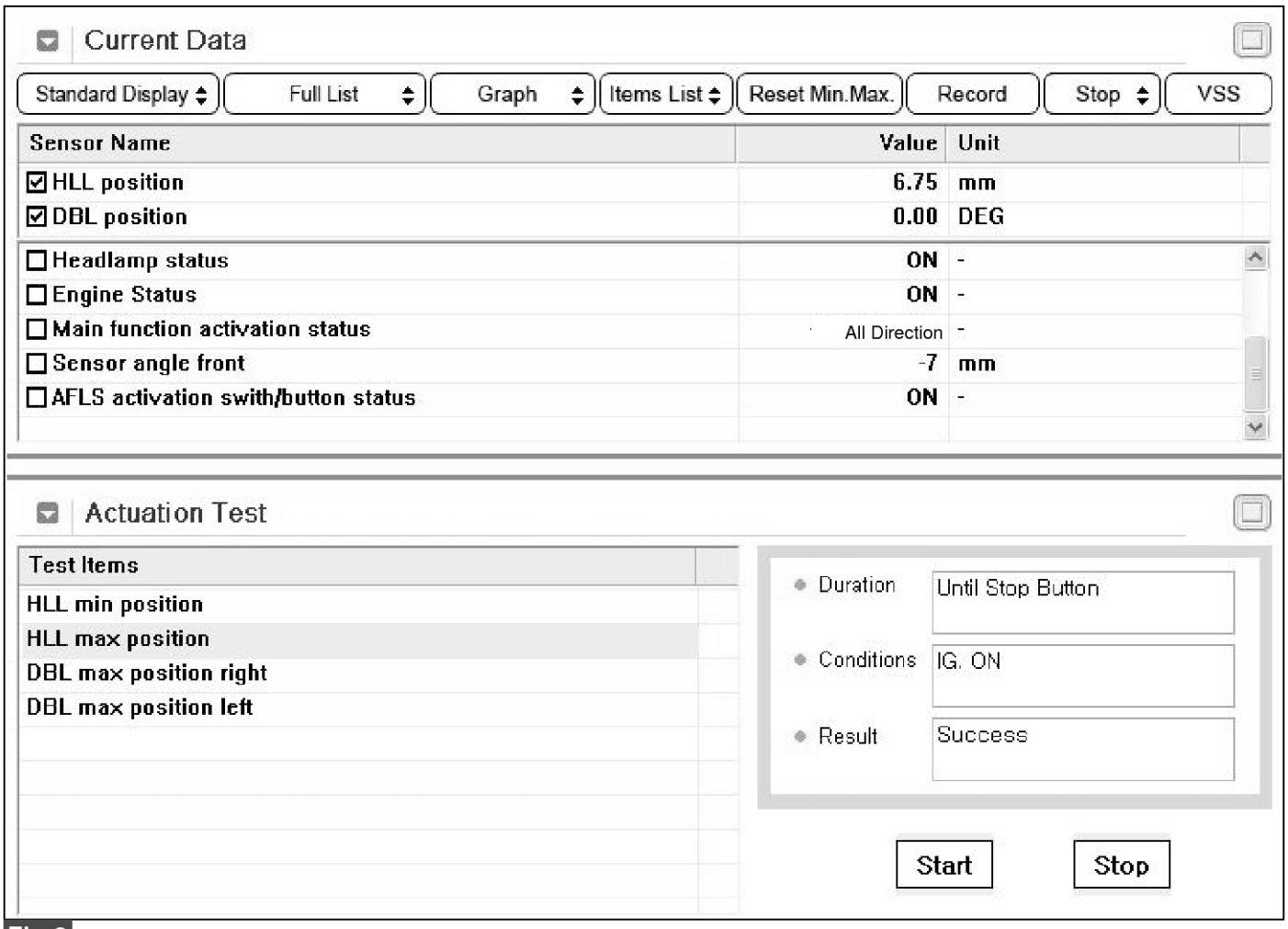



Fig.3

SBHBE9C56L

Fig 1) Engine "ON"

Fig 2) Actuation Test - HLL DOWN POSTION

Fig 3) Actuation Test - HLL UP POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. T-horoughly check connectors for looseness, po-or connection, bending, corrosion, contaminati-on, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure

**NO** ▶ Go to " Inspection/Repair " procedure .

## W/Harness Inspection

Refer to DTC B1640 : LIN communication error DBL right .

## Component inspection

Refer to DTC B1640 : LIN communication error DBL right .

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1661 Parameter Fault And Missing

### General Description

AFLS ECU is installed with not input information about s-uspension's type. When AFLS ECU replace, AFLS ECU have to download correct parameter of suspension's info-rmation in accordance with suspension's type. If AFLS E-CU download incorrect parameter, IG KEY "OFF" → "ON " after performing parameter initialization and then redo-wnload to correct parameter.

### DTC Description

B1637 code is not download correct parameter to AFLS ECU

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • download to correct parameter. |
| Enable Conditions | • IG ON | |
| Threshold Value | • initialization status | |
| Detecting time | • 2sec | |
| Fail Safe | • Levelling :1.5% down<br>Swivelling : normal operation | |
| Check Lamp | • NO | |

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Confirm the ECU type and then download to correct parameter.

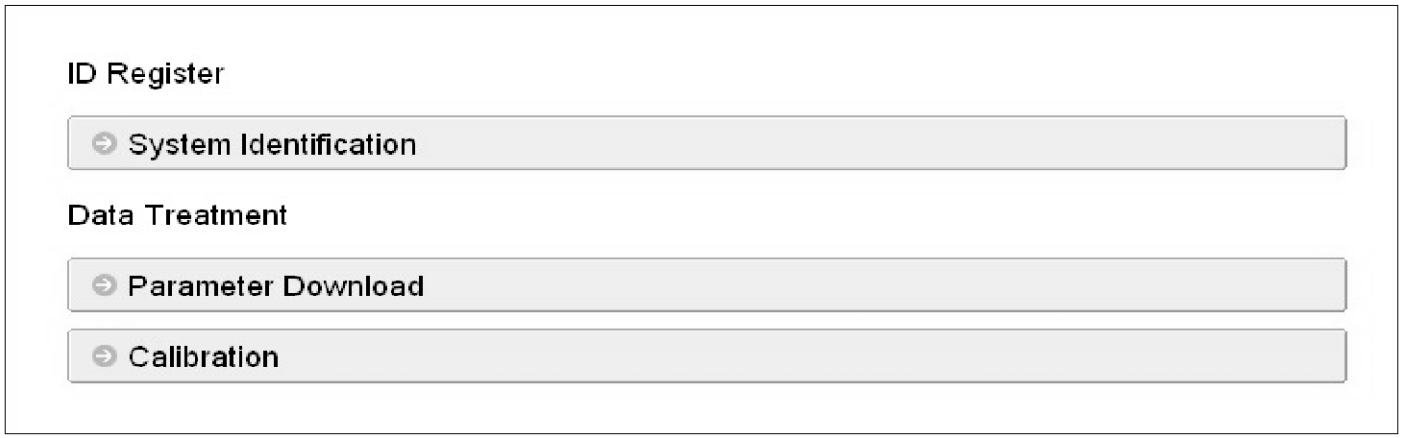
   * REFERENCE*

   Perform the initializing after replace "Height sensor"

   * Vehicle condition

   1) Park at lever land
   2) Vehicle speed ≤ 5km/h
   3) Engine r.p.m > 500rpm
   4) Connect scan-tool
   5) CAN communication is normal status
   6) Battery voltage > 10.5V
   7) Headlamp S/W ON, AFLS ON

      ① Select the Parameter Download



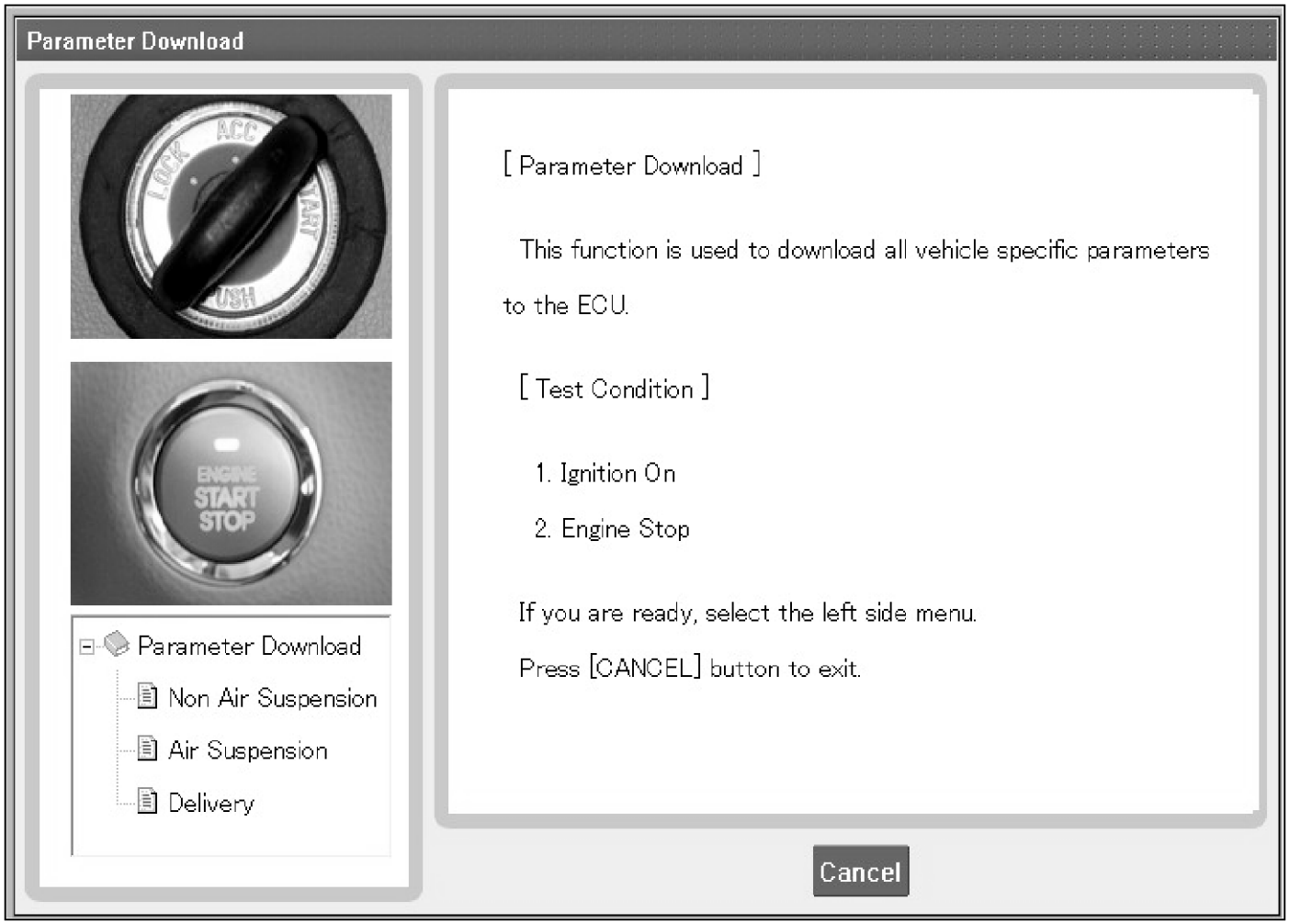

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② Select the Parameter Download.

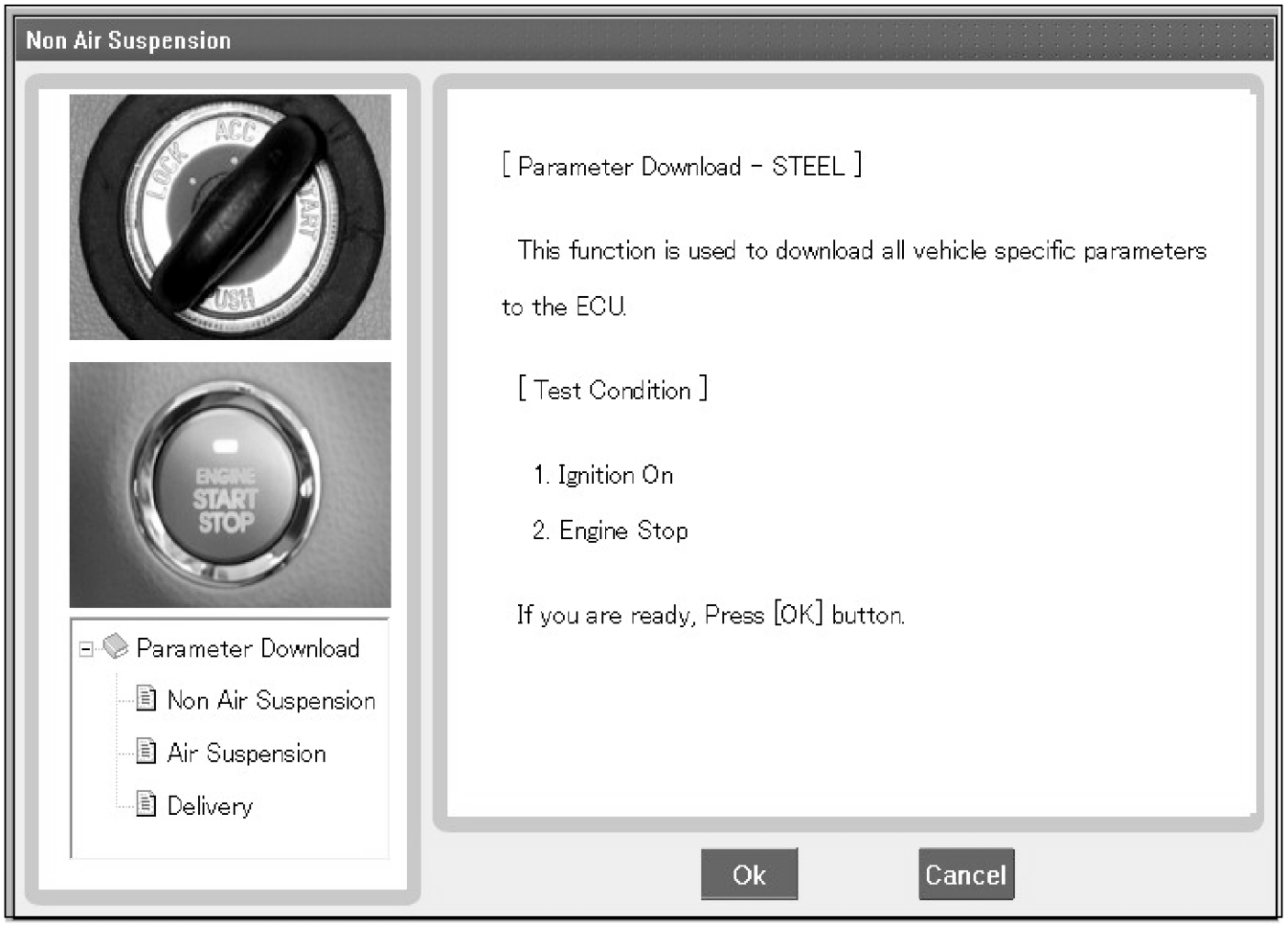



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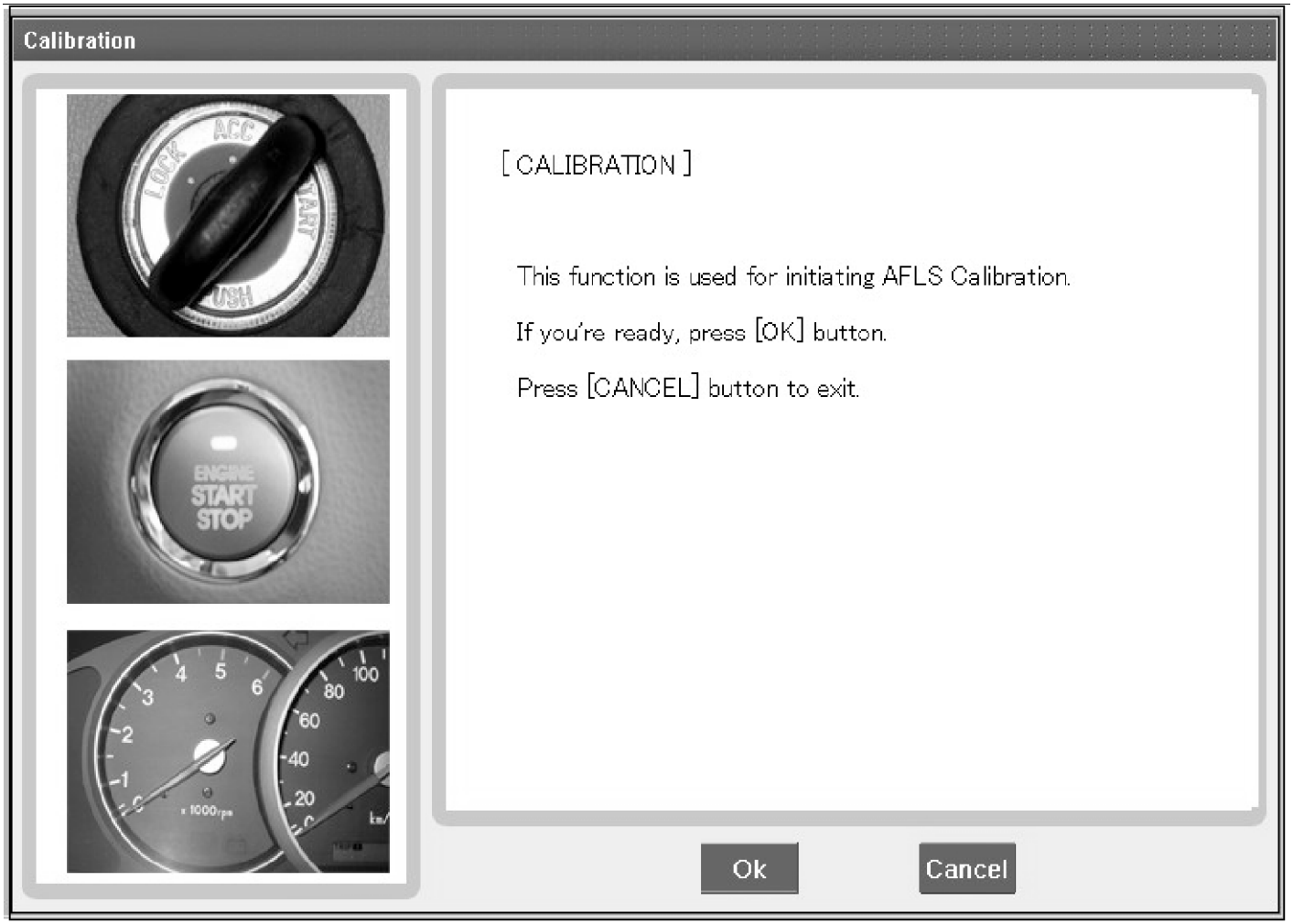

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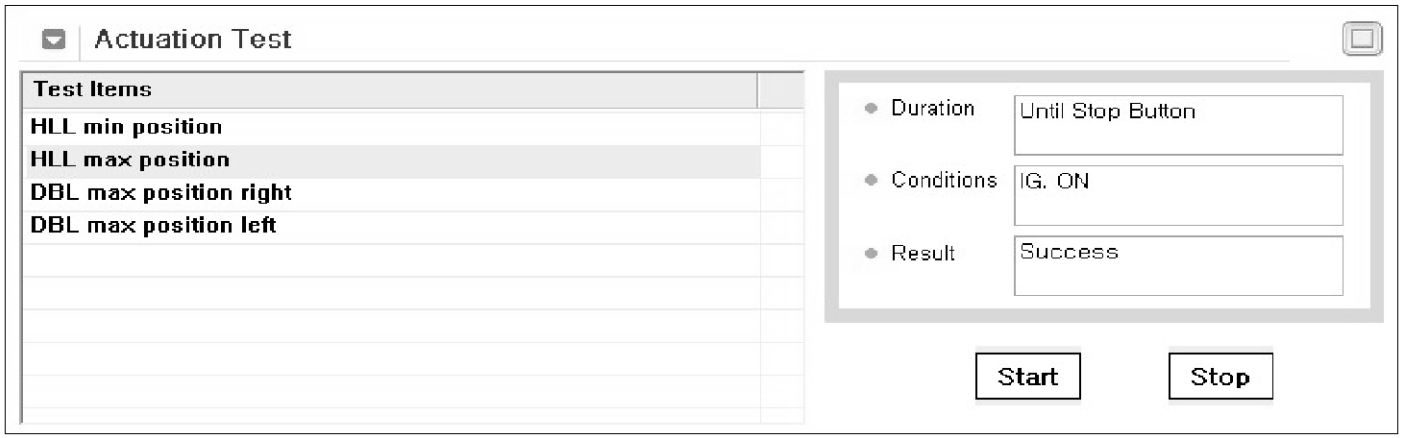
③ Select the CALIBRATION(W/O ECS)




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④ Clear "DTC"

⑤ Confirm the Headlamp movement through the Actuation Test.




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⑥ Confirm the "DTC" and "Service data"

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4. Is parameter displayed within specifications?

**YES** ▶ Go to "Verification of Vehicle Repair" procedure.

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

### Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1905 Sensor Power Supply Fault

### General Description

AFLS(Adaptive Front-Lighting System) provides driver with the best visibility by adjusting vertical direction of the headlamp. AFLS(Adaptive Front-Lighting System) drive Leveling Actuator-Intelligent Stepper Motor for adjusting up and down, and Swivel Actuator for adjusting right and left side. It consists of AFLS ECU, Leveling Actuator-Intelligent Stepper Motor, Swivel Actuator, Head lamp switch, Height sensor(not applied to ECS). Height sensor input information of vehicle's altitude to AFLS ECU. Height sensor consists of rotor, stator, PCB coil, sensor lever.The height sensor is not-contact point type sensor use lever's movements angle that measure formed the magnetic field at around stator by rotator's revolution.

### DTC Description

AFLS ECU set this code If Power supply of height sensor short to Battery or short to Ground.

### DTC Detecting Condition

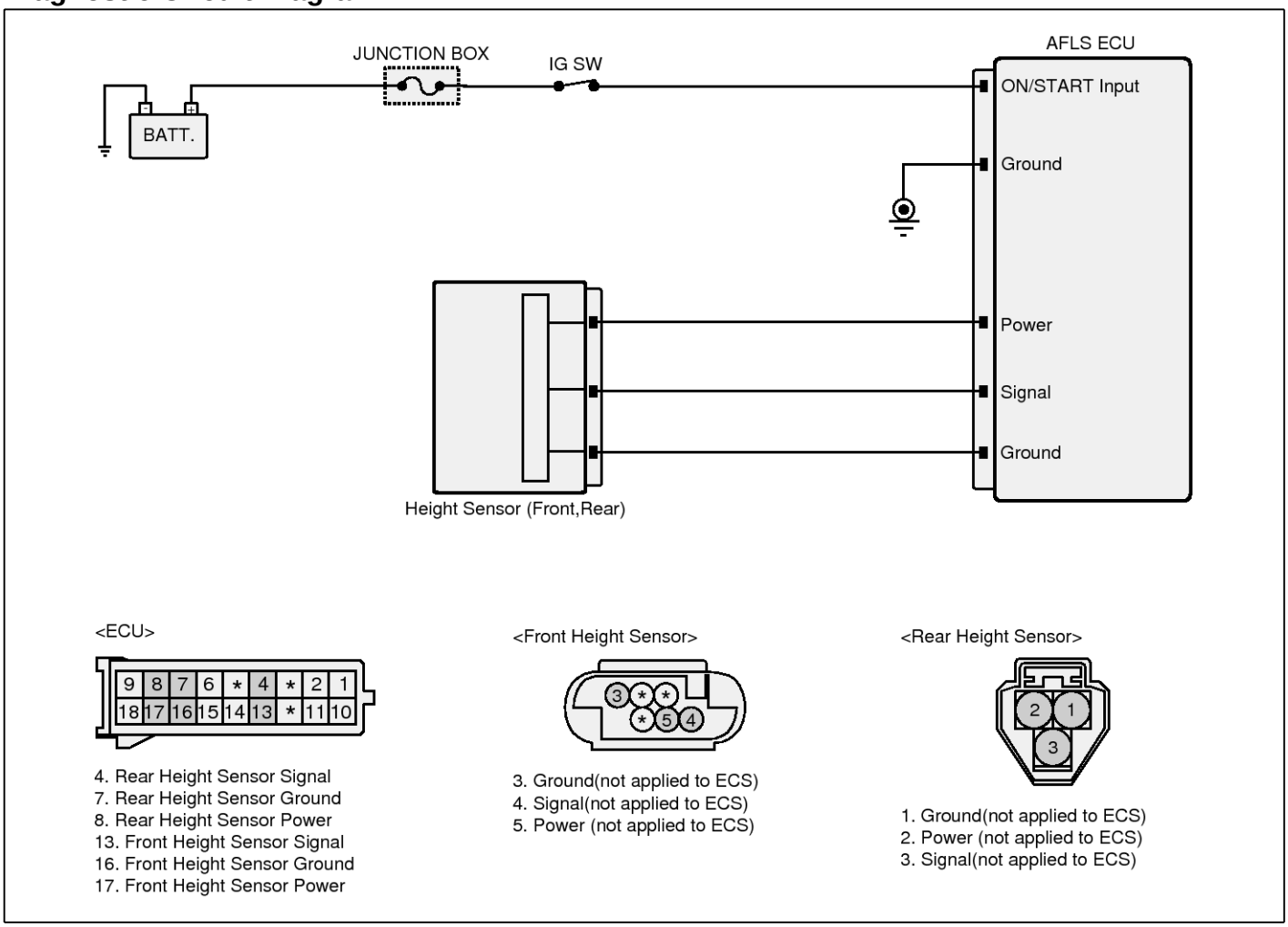
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Power circuit of Height sensor short<br>• Faulty in Height sensor<br>• Faulty in AFLS ECU |
| Enable Conditions | • IG ON | |
| Threshold Value | • Power circuit short to ground or sbattery | |
| Detecting time | • 1sec | |
| Fail Safe | • Levelling :1.5% down<br>Swivelling : normal operation | |
| Check Lamp | • NO | |

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## Diagnostic Circuit Diagram




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## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "Sensor angle front, Sensor angle rear" parameters on the scantool

**Specification :** below -128 ~ +125 mm

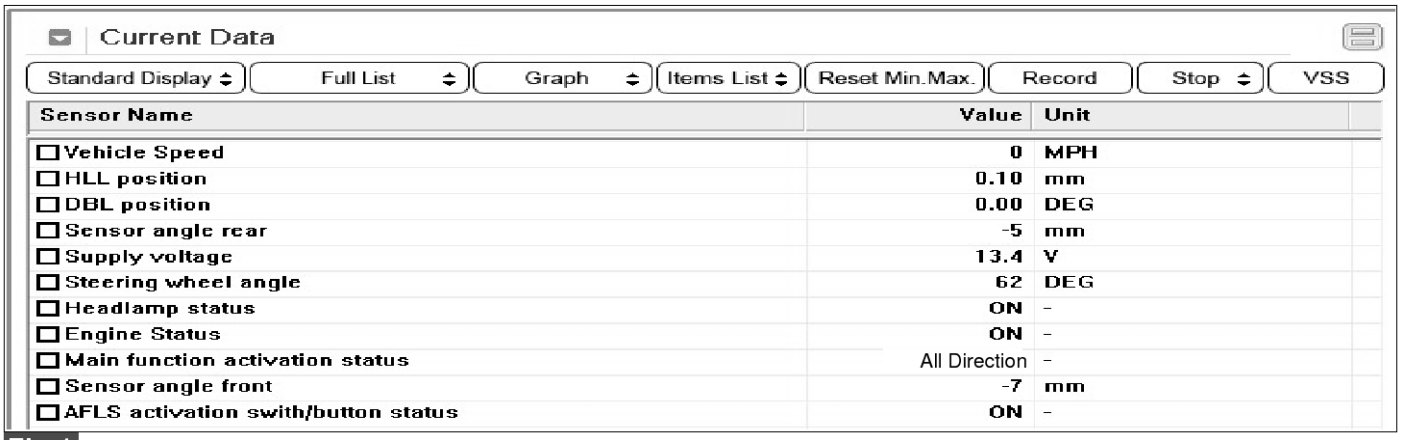



Fig.1

SBHBE9C42L

Fig 1) Engine "ON"

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Power Circuit Inspection" procedure.

## Power Circuit Inspection

### ■ Check voltage power circuit

1. Ignition "OFF"
2. Disconnect front height sensor connector and rear height sensor connector.
3. Ignition "ON"
4. Measure the voltage between front height sensor's power circuit of connector side and chassis ground.

   Measure the voltage between rear height sensor's power circuit of connector side and chassis ground.

**Specification :** below 5V

5. Is "voltage" display near the specified value?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ When the normal range output for battery voltage ☞ Go to "Check Short to battery"
▶ When the lower voltage output than normal range for battery voltage ☞ Go to "Check Short to Ground"

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### ■ Check Short to battery

1. Ignition "OFF"
2. Disconnect front height sensor connector and rear height sensor connector and AFLS ECU connector.
3. Ignition "ON"
4. Measure the voltage between front height sensor's power circuit of connector side and chassis ground.

   Measure the voltage between rear height sensor's power circuit of connector side and chassis ground.

**Specification :** below 0V

5. Is "voltage" display near the specified value?

**YES** ▶ If the circuit is insulated well and the sensor power supply from ECU is high, replace ECU and go to "Verification of Vehicle Repair".

**NO** ▶ Repair short to battery and go to "Verification of Vehicle Repair".

### ■ Check Short to Ground

1. Ignition "OFF"
2. Disconnect front height sensor connector and rear height sensor connector and AFLS ECU connector.
3. Measure the resistance between front height sensor's power circuit of connector side and chassis ground.

   Measure the resistance between rear height sensor's power circuit of connector side and chassis ground.

**specification :** Discontinuity ( Infinite Ω )

4. Is the measured resistance within specification ?

**YES** ▶ If the circuit is insulated well and the sensor power supply from ECM is low, replace ECM and go to "Verification of Vehicle Repair".

**NO** ▶ Repair short to battery and go to "Verification of Vehicle Repair".

### Component inspection

1. Ignition "OFF"
2. Disconnect front height sensor connector and rear height sensor connector .
3. Check that sensor connector power supply is within the specification after turning IG KEY "ON".
4. Connect front height sensor connector and front height sensor connector.
5. Measure the voltage of power circuit of each sensor with all connector connected.

**specification :** Output vlotage is not changed When front height sensor,rear height sensor connecting.

( If the change of sensor power supply occur as connecting sensor connector, this means the occurrence of short inside of sensor.)

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

* REFERENCE*

Perform the initializing after replace "Height sensor"

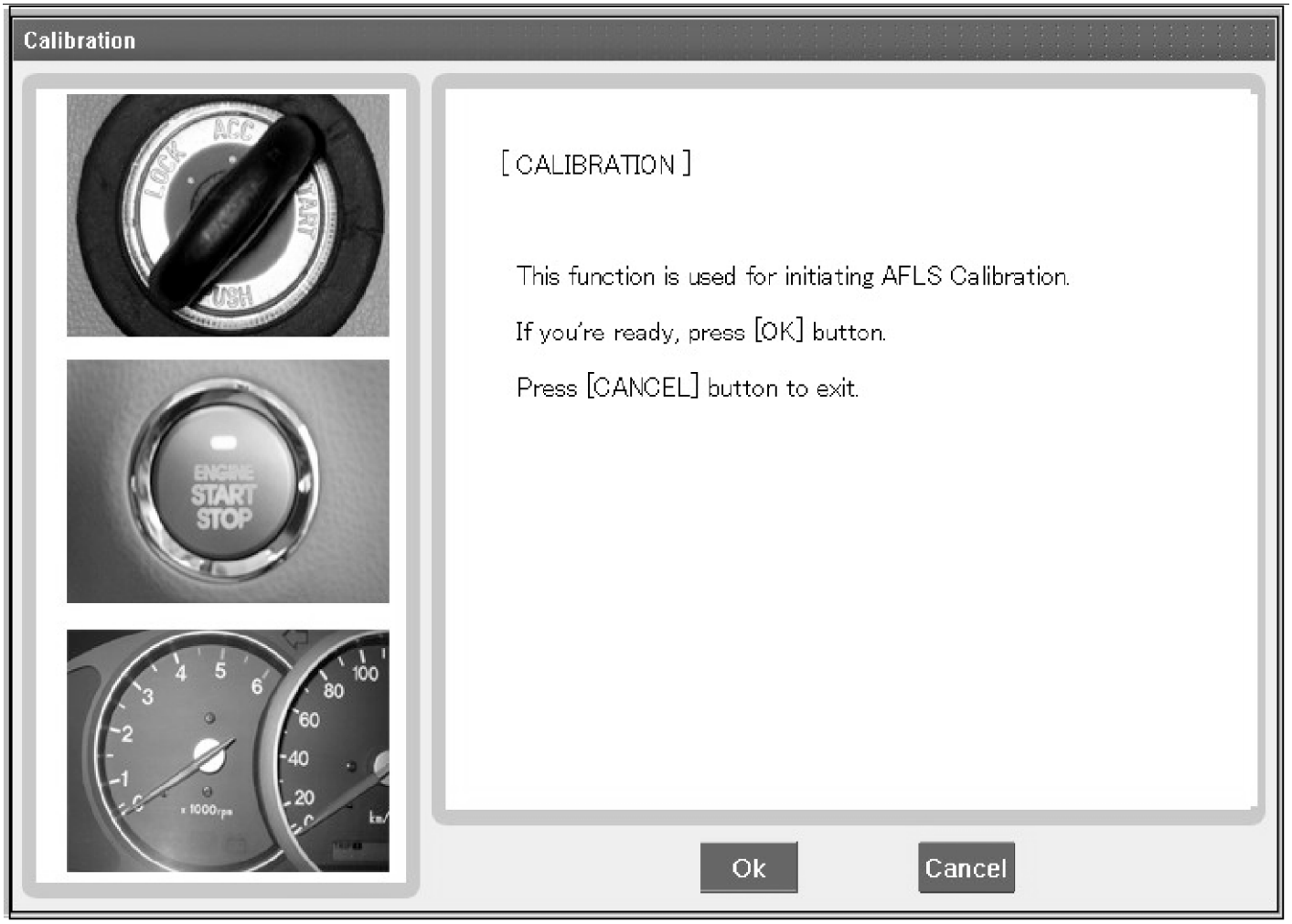
* Vehicle condition

1) Park at lever land
2) Vehicle speed ≤ 5km/h
3) Engine r.p.m > 500rpm
4) Connect scan-tool
5) CAN communication is normal status
6) Battery voltage > 10.5V
7) Headlamp S/W ON, AFLS ON
   ① Select the CALIBRATION

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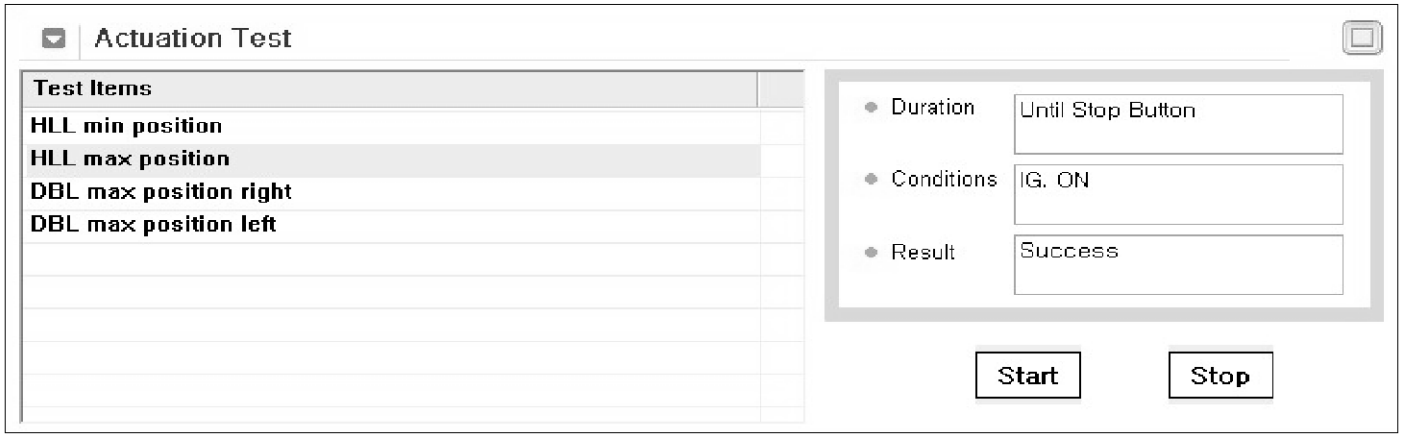
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② Confirm the Headlamp movement through the Actuation Test.




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③ Confirm the "DTC" and "Service data"

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Vehicle Speed | 0 | MPH |
| HLL position | 0.10 | mm |
| DBL position | 0.00 | DEG |
| Sensor angle rear | -5 | mm |
| Supply voltage | 13.4 | V |
| Steering wheel angle | 62 | DEG |
| Headlamp status | ON | - |
| Engine Status | ON | - |
| Main function activation status | All Direction | - |
| Sensor angle front | -7 | mm |
| AFLS activation swith/button status | ON | - |

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## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B1906 Front sensor PWM signal fault

### General Description

AFLS(Adaptive Front-Lighting System) provides driver with the best visibility by adjusting vertical direction of the headlamp. AFLS(Adaptive Front-Lighting System) drive Leveling Actuator-Intelligent Stepper Motor for adjusting up and down, and Swivel Actuator for adjusting right and left side. It consists of AFLS ECU, Leveling Actuator-Intelligent Stepper Motor, Swivel Actuator, Head lamp switch, Height sensor(not applied to ECS). Height sensor input information of vehicle's altitude to AFLS ECU. Height sensor consists of rotor, stator, PCB coil, sensor lever.The height sensor is not-contact point type sensor use lever's movements angle that measure formed the magnetic field at around stator by rotator's revolution.

### DTC Description

AFLS ECU set this code If input value of front height sensor out of available range.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Faulty in Front height sensor |
| Enable Conditions | • IG ON | |
| Threshold Value | • Input value ≠ 800Hz ± 20% | |
| Detecting time | • 5sec | |
| Fail Safe | • Levelling :1.5% down<br>Swivelling : normal operation | |
| Check Lamp | • NO | |

### Diagnostic Circuit Diagram

Refer to DTC B1905 : Sensor Power Supply Fault.

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## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "Sensor angle front, Sensor angle rear" parameters on the scantool

**Specification :** below -128 ~ +125 mm

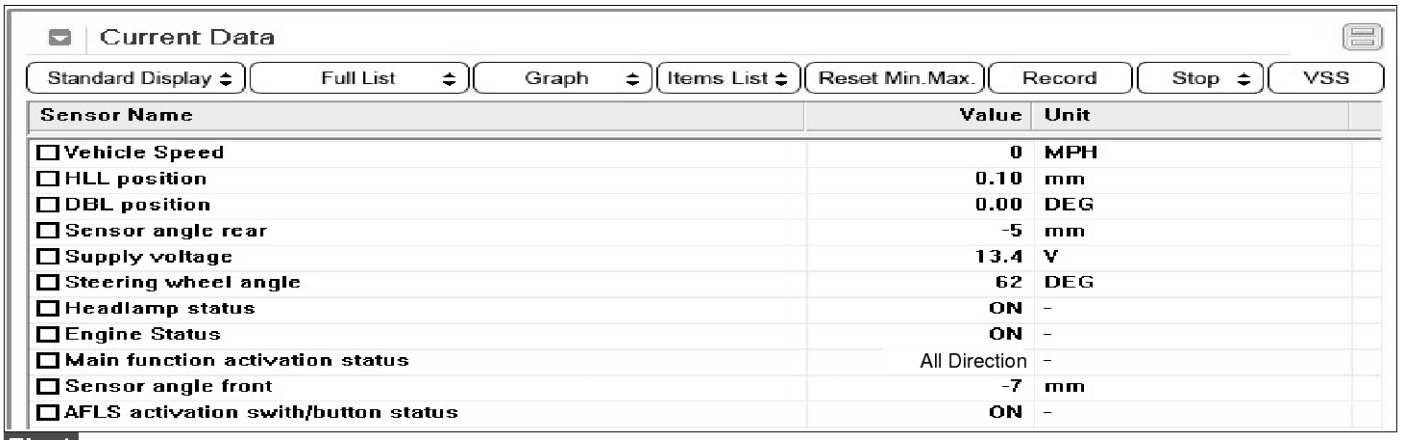



Fig.1

SBHBE9C42L

Fig 1) Engine "ON"

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 "Component inspection" procedure.

## Component inspection

### ■ Height sensor linkage checking.

1. Check the separation or faulty assemblage of linkage of heightsensor with the vehicle lifted .
2. Has the problem found ?.

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

**NO** ▶ Go to "Height sensor Inspection" procedure.

### ■ Height sensor Inspection

1. Engine "ON" and Head lamp"ON"
2. Lift the vehicle.
3. Disconnect the linkage of height sensor.
4. Monitor the ""Height sensor"" parameter on the Scantool while moving linkage vertically .

**Specification :**Output value is changed according to changing of linkage.

**YES** ▶ Clear the DTC and go to "Verification Vehicle Repair" procedure.

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

* REFERENCE*

Perform the initializing after replace "Height sensor"

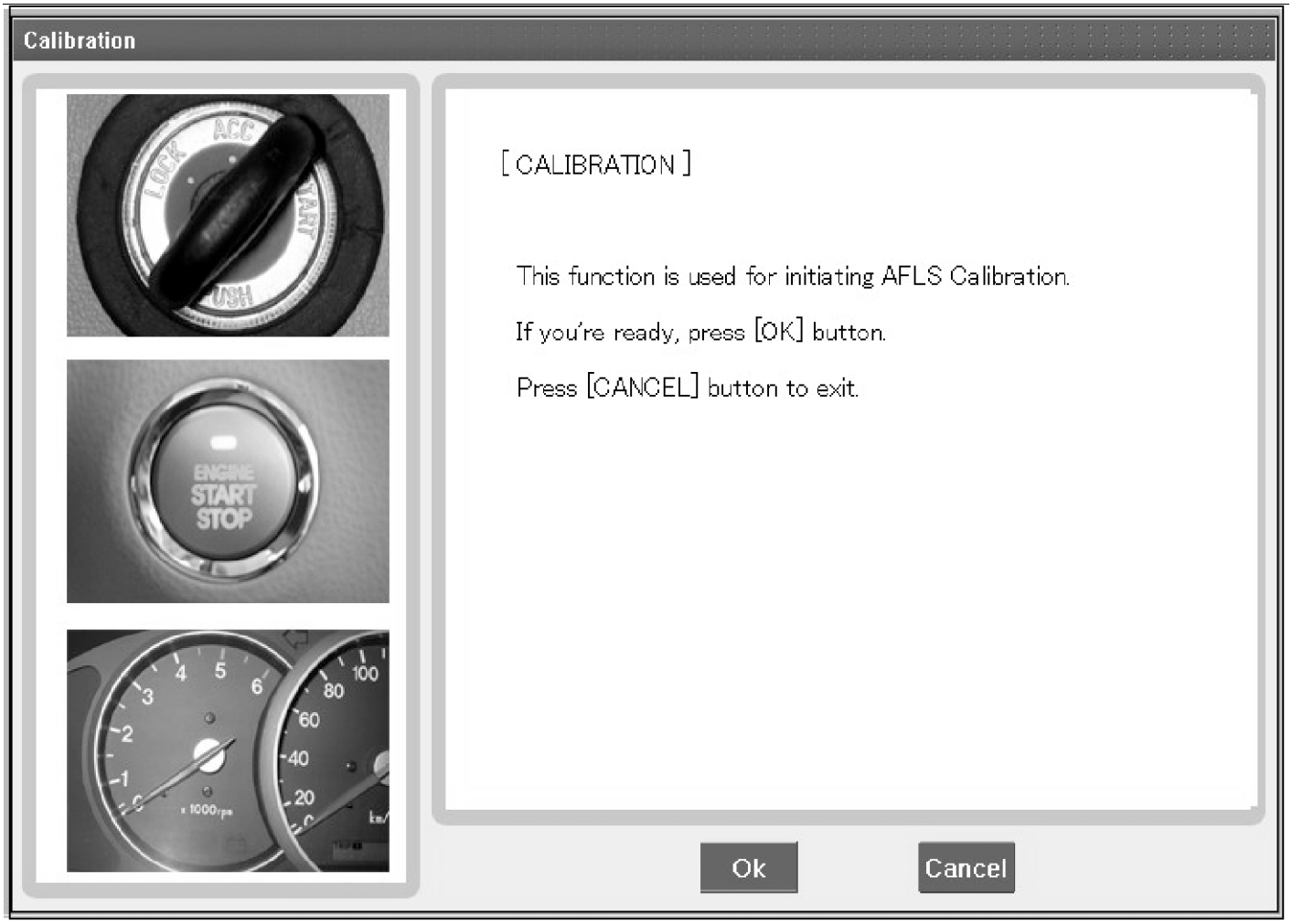
* Vehicle condition

1) Park at lever land
2) Vehicle speed ≤ 5km/h
3) Engine r.p.m > 500rpm
4) Connect scan-tool
5) CAN communication is normal status
6) Battery voltage > 10.5V
7) Headlamp S/W ON, AFLS ON
   ① Select the CALIBRATION

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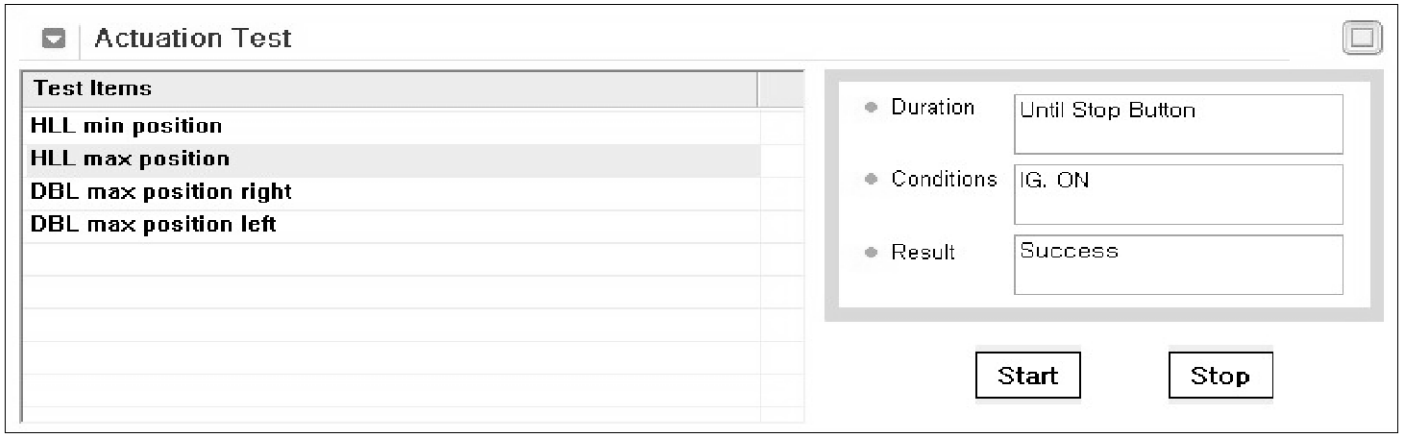
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② Confirm the Headlamp movement through the Actuation Test.




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③ Confirm the "DTC" and "Service data"

Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Vehicle Speed | 0 | MPH |
| HLL position | 0.10 | mm |
| DBL position | 0.00 | DEG |
| Sensor angle rear | -5 | mm |
| Supply voltage | 13.4 | V |
| Steering wheel angle | 62 | DEG |
| Headlamp status | ON | - |
| Engine Status | ON | - |
| Main function activation status | All Direction | - |
| Sensor angle front | -7 | mm |
| AFLS activation swith/button status | ON | - |

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## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1907 Front sensor signal fault

## General Description

Refer to DTC B1906 : Front sensor PWM signal fault.

## DTC Description

AFLS ECU set this code If front height sensor signal wiring harness open or short to battery or input value is out of available range. and also incorrect information input for suspension's type can be caused B1907 thus perform the daignostic procedure after checking suspension's type.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Front height sensor open/short<br>• Front height sensor incorrect install<br>• Faulty in Front height sensor |
| Enable Conditions | • IG ON | |
| Threshold Value | • Open signal<br>• short to battery(+5V or B+)<br>• Exceed cognizance range of sensor( ± 54° ) | |
| Detecting time | • 1sec | |
| Fail Safe | • Levelling :1.5% down<br>Swivelling : normal operation | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B1905 : Sensor Power Supply Fault.

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "Sensor angle front, Sensor angle rear" parameters on the scantool

**Specification :** below -128 ~ +125 mm

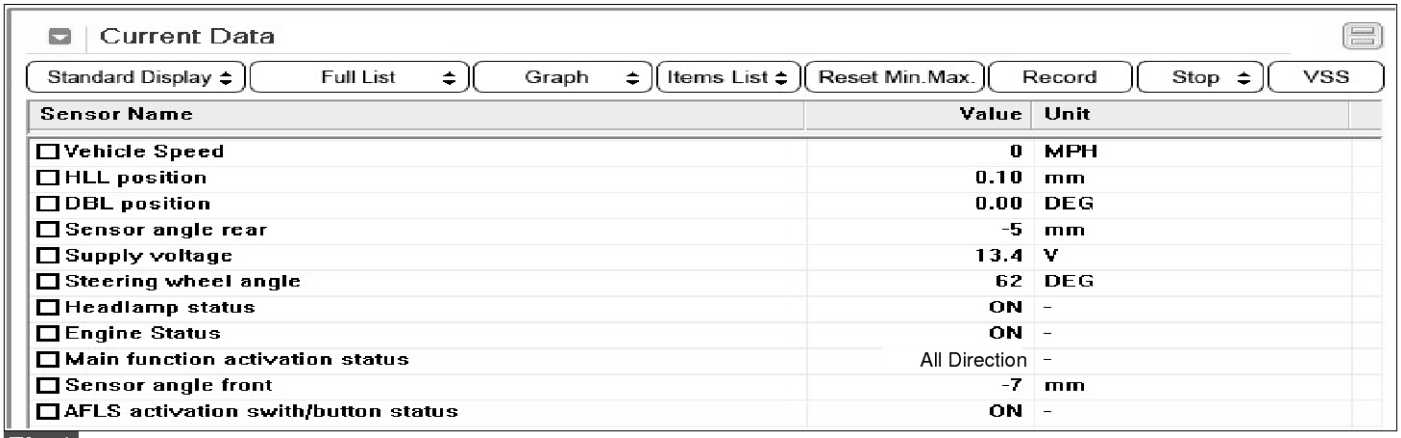



Fig.1

SBHBE9C42L

Fig 1) Engine "ON"

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4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Signal circuit Inspection" procedure.

## Signal circuit Inspection

### ■ Check Short to battery

1. Ignition "OFF"
2. Disconnect Front height sensor connector.
3. Ignition "ON"
4. Measure the voltage between Front height sensor's signal wiring of wiring harness side and chassis ground.

**Specification :** below 5V

5. Is "voltage" display near the specified value?

**YES** ▶ Go to "Check short between power circuit and signal circuit"

**NO** ▶ Repair short to battery and go to "Verification of Vehicle Repair".

### ■ Check short between power circuit and signal circuit

1. Ignition "OFF"
2. Disconnect Front height sensor connector and ECU connector.
3. Measure the resistance between Front height sensor's signal wiring of wiring harness side and Power terminal.

**Specification :** Discontinuity (Infinite Ω )

4. Is the measured resistance within specification ?

**YES** ▶ Go to "Ground circuit Inspection" procedure.

**NO** ▶ Repair short between power circuit and signal circuit and go to "Verification of Vehicle Repair".

## Ground circuit Inspection

### ■ Check open in ground circuit

1. Ignition "OFF"
2. Disconnect Front height sensor connector and ECU connector.
3. Measure the resistance between Front height sensor's ground wiring of wiring harness side and chassis ground.

**Specification :** below 1Ω

4. Is the measured resistance within specification ?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Repair open in ground circuit and go to "Verification of Vehicle Repair".

## Component inspection

Refer to DTC B1906 : Front sensor PWM signal fault.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1908 Rear sensor PWM signal fault

## General Description

Refer to DTC B1906 : Front sensor PWM signal fault.

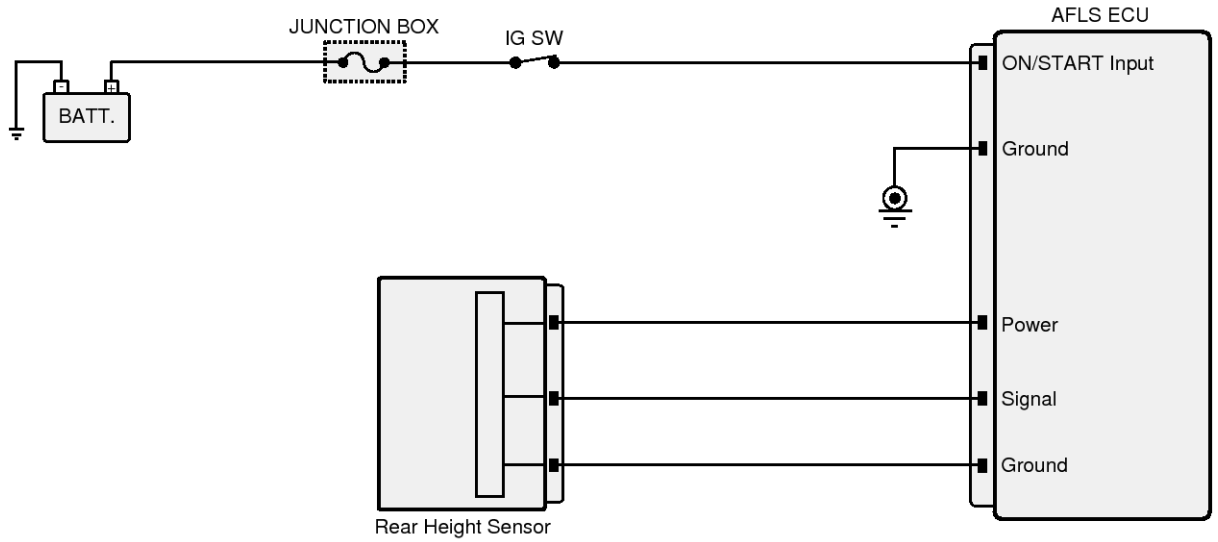
## DTC Description

AFLS ECU set this code If input value of rear height sensor out of available range.

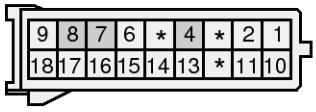
## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Faulty in Rear height sensor |
| Enable Conditions | • IG ON | |
| Threshold Value | • Input value ≠ 800Hz ± 20% | |
| Detecting time | • 5sec | |
| Fail Safe | • Levelling :1.5% down<br>Swivelling : normal operation | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

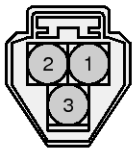



<AFLS ECU>




4. Rear Height Sensor Signal
7. Rear Height Sensor Ground
8. Rear Height Sensor Power

<Rear Height Sensor>




1. Ground(not applied to ECS)
2. Power (not applied to ECS)
3. Signal(not applied to ECS)

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## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON" and Head lamp"ON"
3. Monitor the "Sensor angle front, Sensor angle rear" parameters on the scantool

**Specification :** below -128 ~ +125 mm

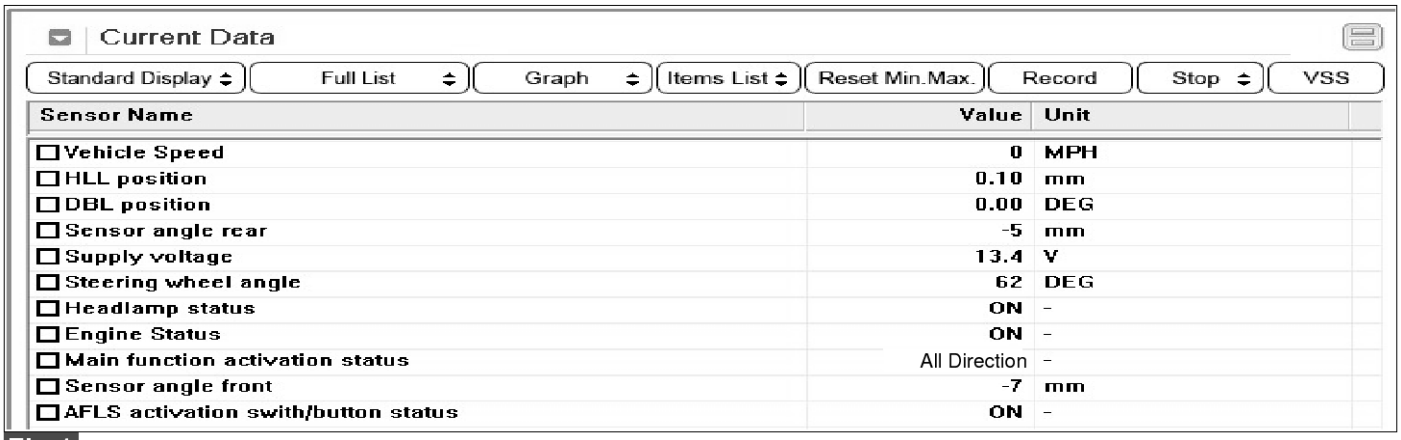



Fig.1

SBHBE9C42L

Fig 1) Engine "ON"

4. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 "Component inspection" procedure.

## Component inspection

Refer to DTC B1906 : Front sensor PWM signal fault.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B1909 Rear sensor signal fault

## General Description

Refer to DTC B1906 : Front sensor PWM signal fault.

## DTC Description

AFLS ECU set this code If rear height sensor signal wiring harness open or short to battery or input value is out of available range. and also incorrect information input for suspension's type can be caused B1909 thus perform the daignostic procedure after checking suspension's type.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Rear height sensor open/short<br>• Rear height sensor incorrect install<br>• Faulty in Rear height sensor |
| Enable Conditions | • IG ON | |
| Threshold Value | • Open signal<br>• short to battery(+5V or B+)<br>• Exceed cognizance range of sensor( ± 54° ) | |
| Detecting time | • 1sec | |
| Fail Safe | • Levelling :1.5% down<br>Swivelling : normal operation | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B1908 : Rear sensor PWM signal fault.

## Monitor Scantool Data

Refer to DTC B1907 : Front sensor signal fault.

## W/Harness Inspection

Refer to DTC B1907 : Front sensor signal fault.

## Signal circuit Inspection

### ■ Check Short to battery

1. Ignition "OFF"
2. Disconnect Front height sensor connector.
3. Ignition "ON"
4. Measure the voltage between Rear height sensor's signal wiring of wiring harness side and chassis ground.

**Specification :** below 5V

5. Is "voltage" display near the specified value?

**YES** ▶ Go to "Check short between power circuit and signal circuit"

**NO** ▶Repair short to battery and go to "Verification of Vehicle Repair".

### ■ Check short between power circuit and signal circuit

1. Ignition "OFF"
2. Disconnect Rear height sensor connector and ECU connector.
3. Measure the resistance between Rear height sensor's signal wiring of wiring harness side and Power terminal.

**Specification :** Discontinuity (Infinite Ω )

4. Is the measured resistance within specification ?

**YES** ▶ Go to "Ground circuit Inspection" procedure.

**NO** ▶ Repair short between power circuit and signal circuit and go to "Verification of Vehicle Repair".

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## Ground circuit Inspection

### ■ Check open in ground circuit

1. Ignition "OFF"
2. Disconnect Rear height sensor connector and ECU connector.
3. Measure the resistance between Rear height sensor's ground wiring of wiring harness side and chassis ground.

**Specification :** below 1Ω

4. Is the measured resistance within specification ?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Repair open in ground circuit and go to "Verification of Vehicle Repair".

## Component inspection

Refer to DTC B1906 : Front sensor PWM signal fault.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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## B2325 Swivel module fault left

### General Description

LIN (Local Interconnect Network) isdirect communication system to low-cost for electric system of vehicle.height sensor signal, vehicle speed, steering angle sensor signal are input to AFLS ECU to find out of headlamp position and AFLS ECU drive actuators through LIN communication.AFLS(Adaptive Front-Lighting System) drive Leveling Actuator-Intelligent Stepper Motor for adjusting up and down, and Swivel Actuator for adjusting right and left side.

### DTC Description

AFLS ECU set this code If critical faulty in left side swivel actuator and AFLS OFF lamp is flickered.

### DTC Detecting Condition

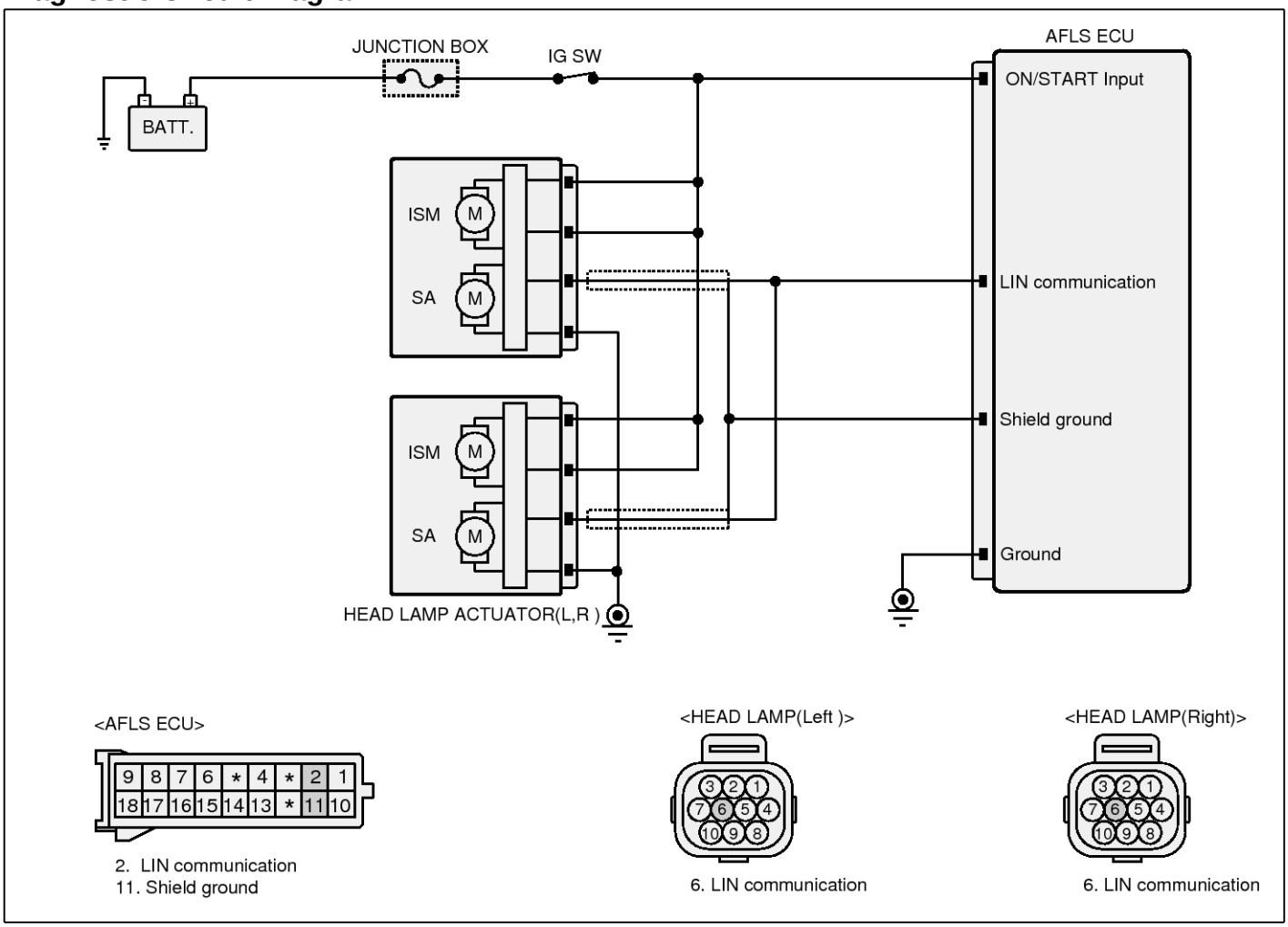
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Power circuit short/open<br>• Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • internal circuit Short<br>• Temperature rising over the 155℃<br>• Stall status by mechanical interference<br>• Belos 10.5V | |
| Detecting time | • 1sec | |
| Fail Safe | • Left Swivelling : stop with persent status<br>Right Swivelling : move to 0° position<br>Left Levelling : - 2.8% down<br>Rihgt Levelling : normal operation | |
| Check Lamp | • AFLS OFF lamp blinks | |

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## Diagnostic Circuit Diagram




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### Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

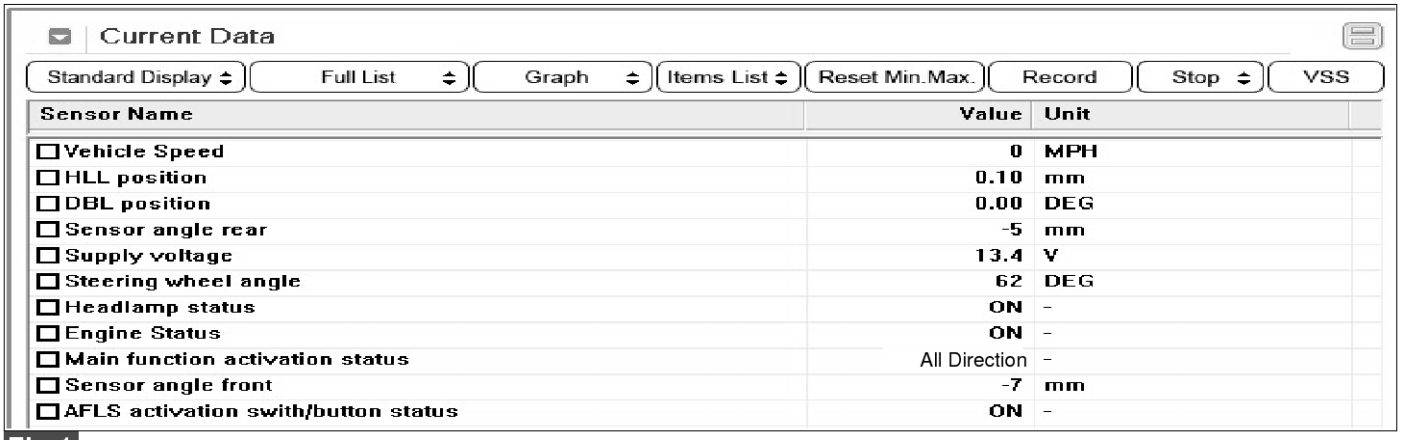



Fig.1

SBHBE9C42L

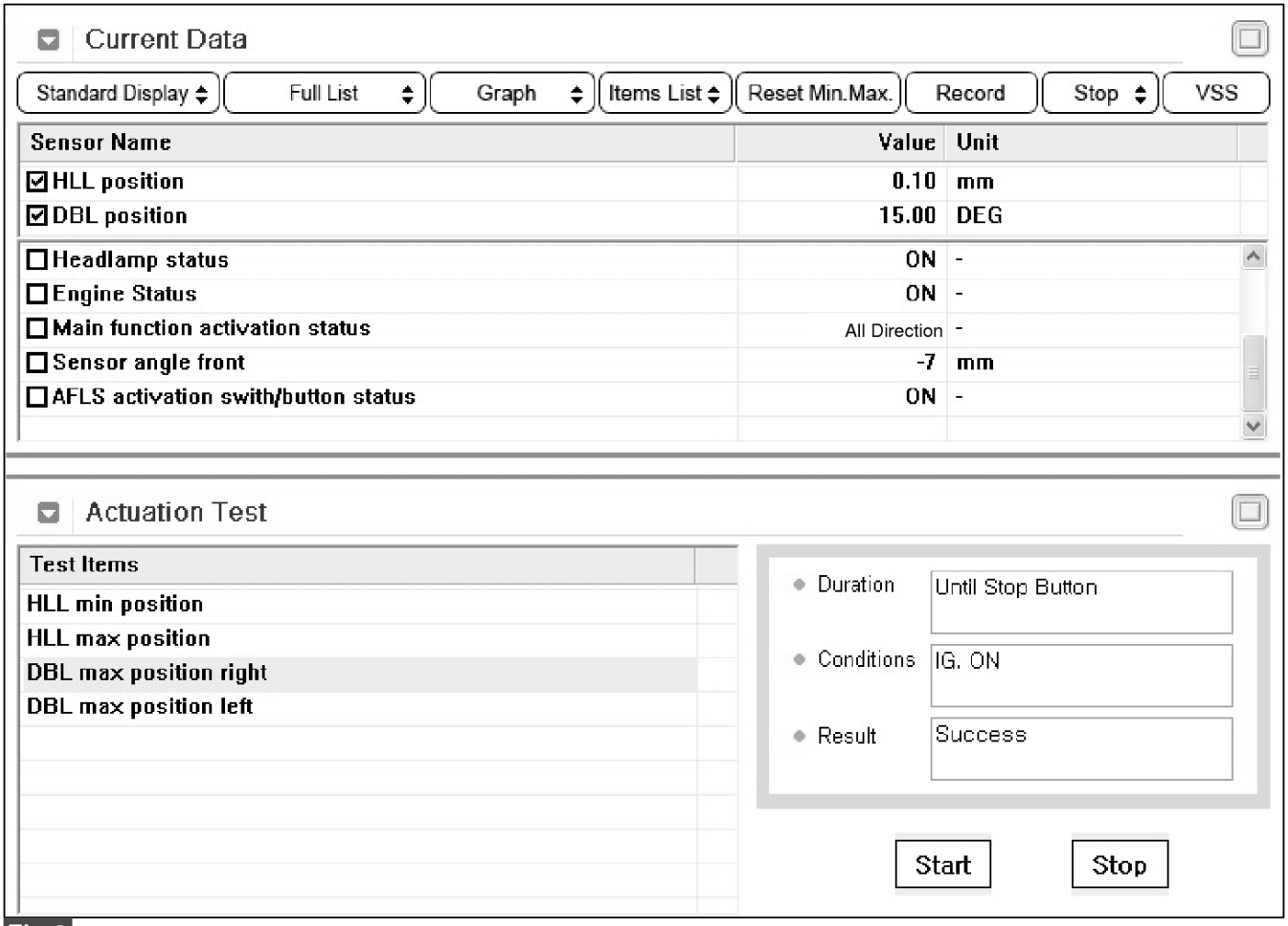



Fig.2

SBHBE9C60L

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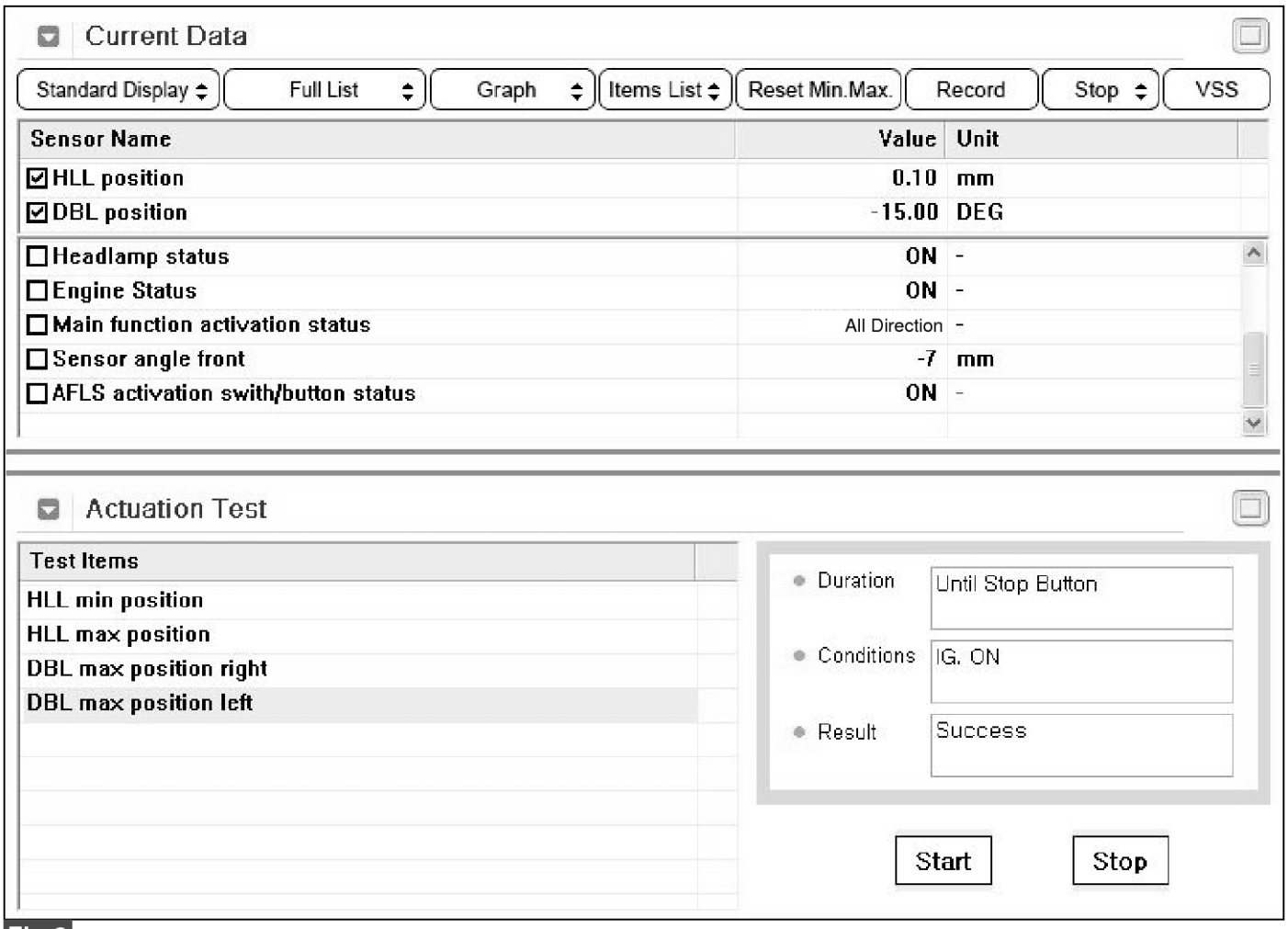



Fig.3

SBHBE9C61L

Fig 1) Engine "ON"

Fig 2) Actuation Test - DBL RIGHT POSTION

Fig 3) Actuation Test - DBL LEFT POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Component inspection" procedure.

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## Component inspection

1. Substitute with a known - good head lamp and check for proper operation..
2. Is normal status after replace Headlamp?

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

Refer to DTC B1101 : Battery Voltage High.

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## B2326 Swivel module fault right

### General Description

Refer to DTC B2325 : Swivel module fault left.

### DTC Description

AFLS ECU set this code If critical faulty in right side swivel actuator and AFLS OFF lamp is flickered.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Power circuit short/open<br>• Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • internal circuit Short<br>• Temperature rising over the 155℃<br>• Stall status by mechanical interference<br>• Belos 10.5V | |
| Detecting time | • 1sec | |
| Fail Safe | • Left Swivelling : stop with persent status<br>Right Swivelling : move to 0˚ position<br>Left Levelling : - 2.8% down<br>Rihgt Levelling : normal operation | |
| Check Lamp | • AFLS OFF lamp blinks | |

### Diagnostic Circuit Diagram

Refer to DTC B2325 : Swivel module fault left.

### Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

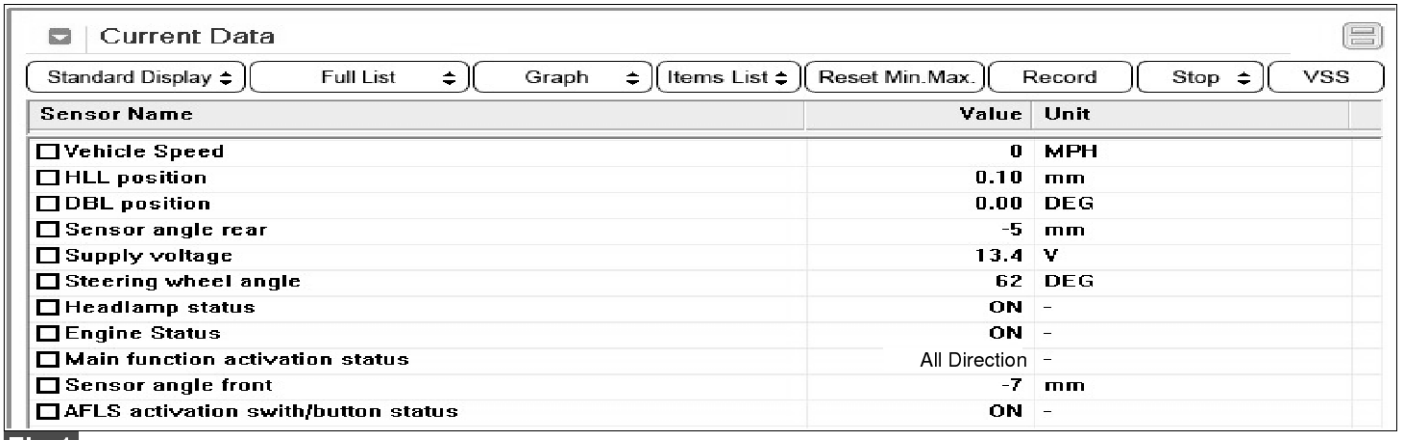



Fig.1

SBHBE9C42L

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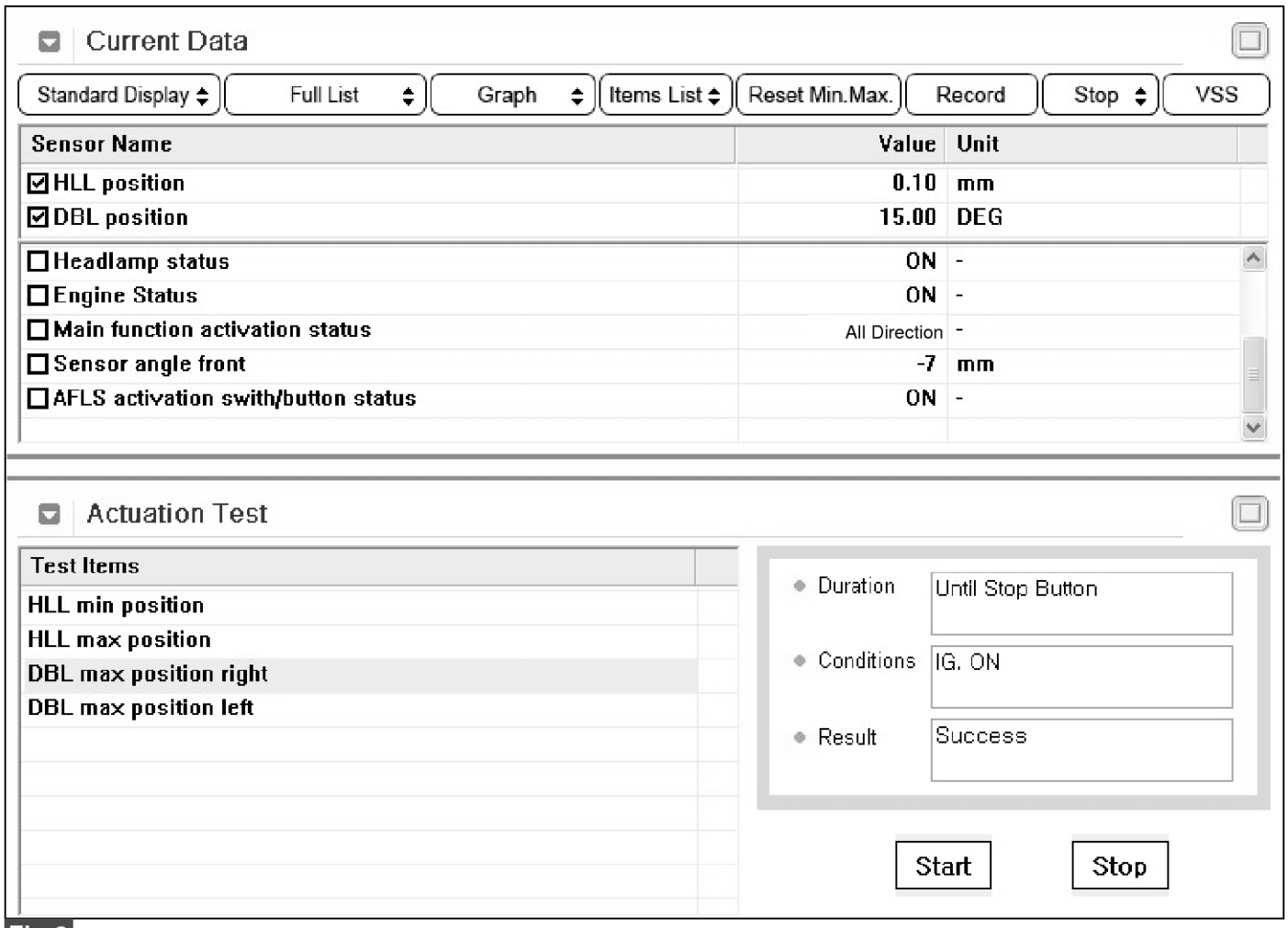



Fig.2

SBHBE9C60L

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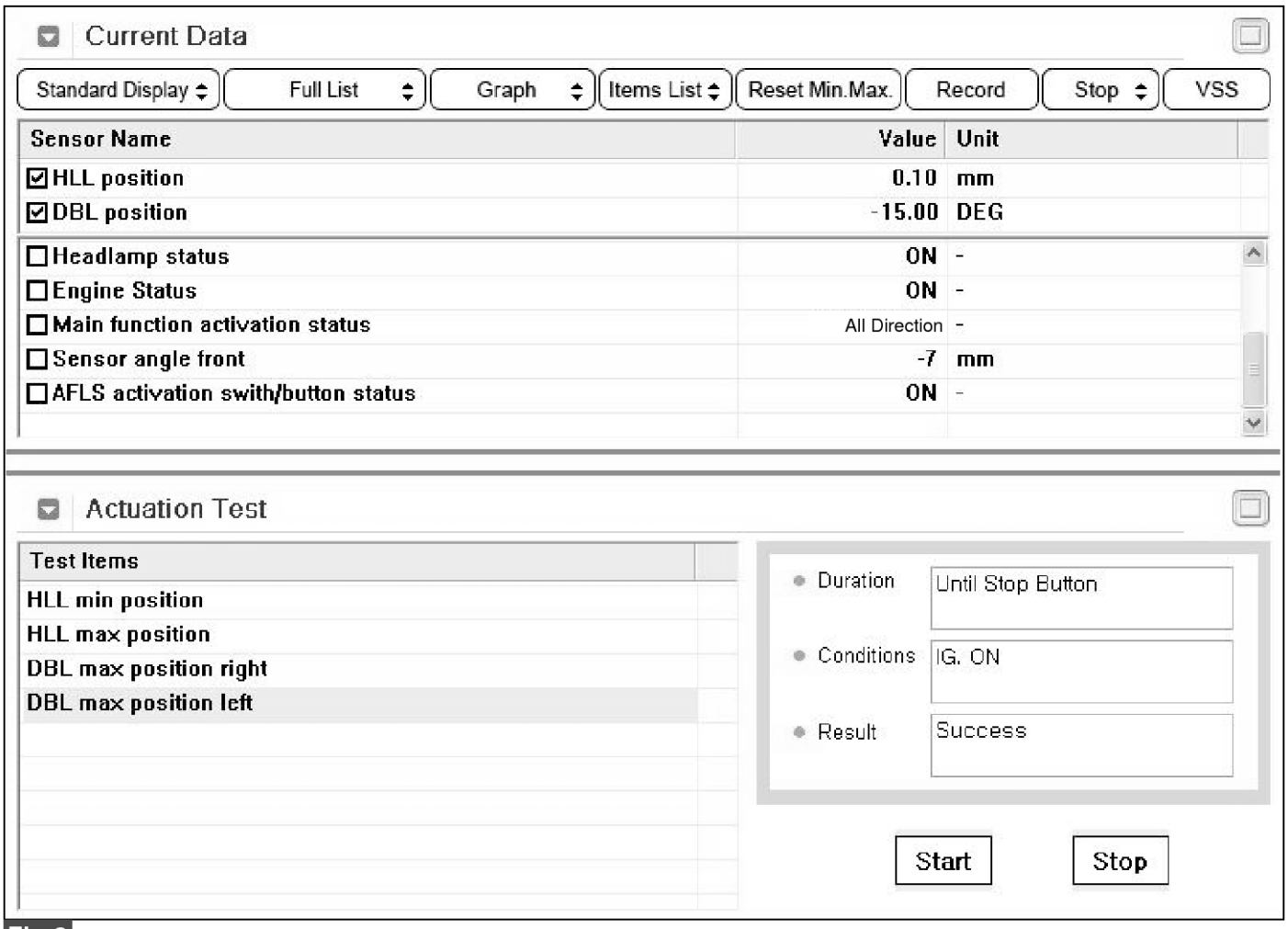



Fig.3

SBHBE9C61L

Fig 1) Engine "ON"

Fig 2) Actuation Test - DBL RIGHT POSTION

Fig 3) Actuation Test - DBL LEFT POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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 " Inspection/Repair " procedure .

## W/Harness 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 "Component inspection" procedure.

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### Component inspection

1. Substitute with a known - good head lamp and check for proper operation..
2. Is normal status after replace Headlamp?

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

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. 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

Refer to DTC B1101 : Battery Voltage High.

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# B2400 Levelling motor fault left

## General Description

Refer to DTC B2325 : Swivel module fault left.

## DTC Description

AFLS ECU set this code If mechanically faulty in ISM of left side headlamp.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • internal circuit Short<br>• Temperature rising over the 155℃ | |
| Detecting time | • 1sec | |
| Fail Safe | • Swivelling operation is normal<br>left Levelling : stop with persent status<br>right Levelling : operation is normal | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B2325 : Swivel module fault left.

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Main function activation status, HLL position, DBL position" parameter on the scan-tool.
4. Check the operation of "HLL position and DBL position" use Actuation test.

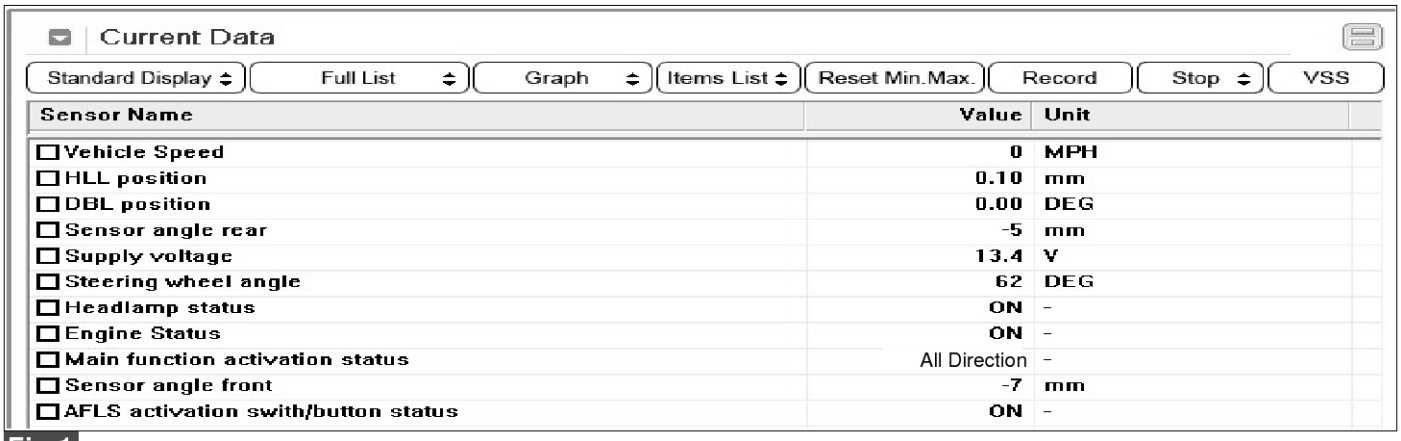



Fig.1

SBHBE9C42L

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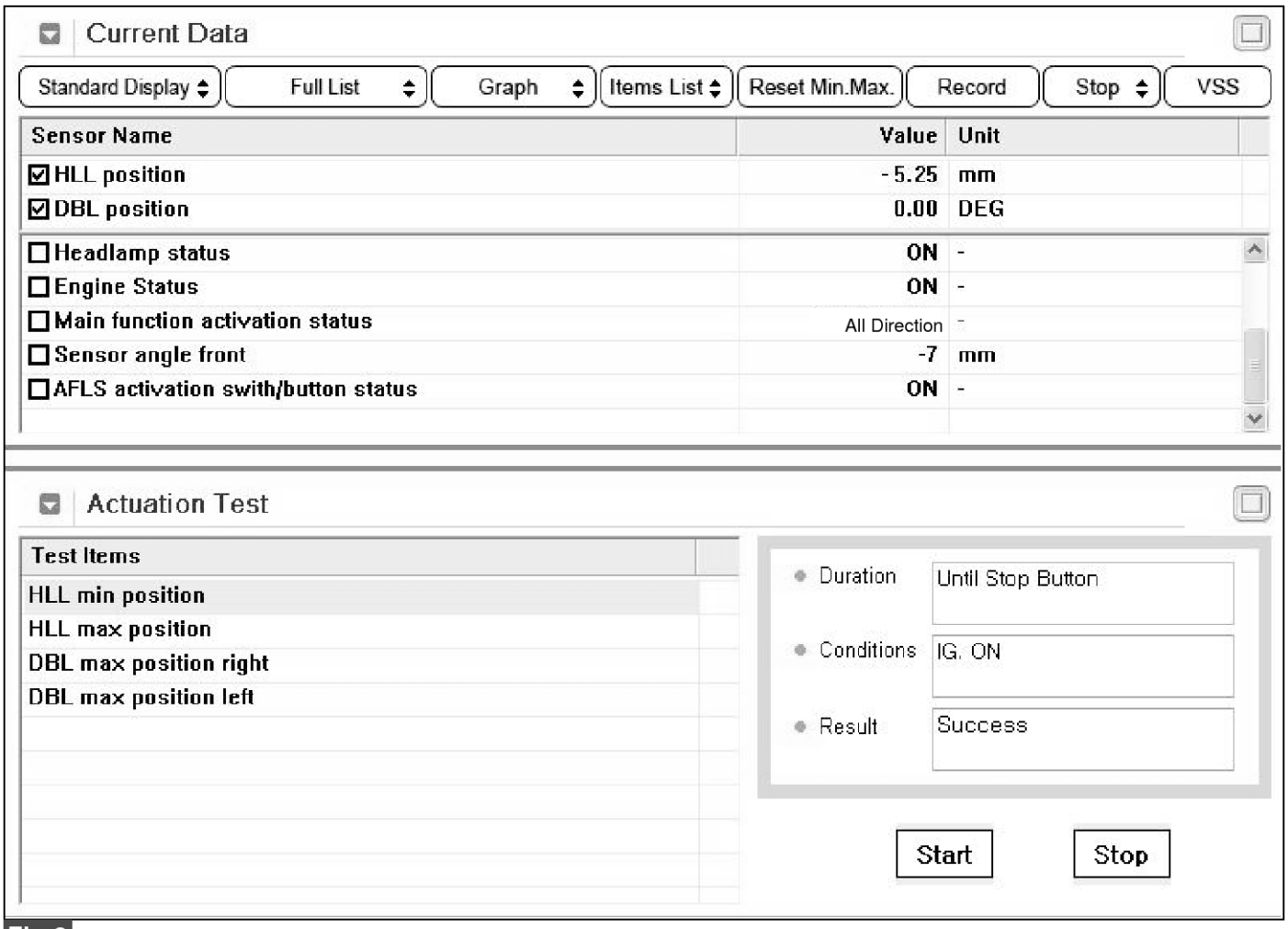



Fig.2

SBHBE9C55L

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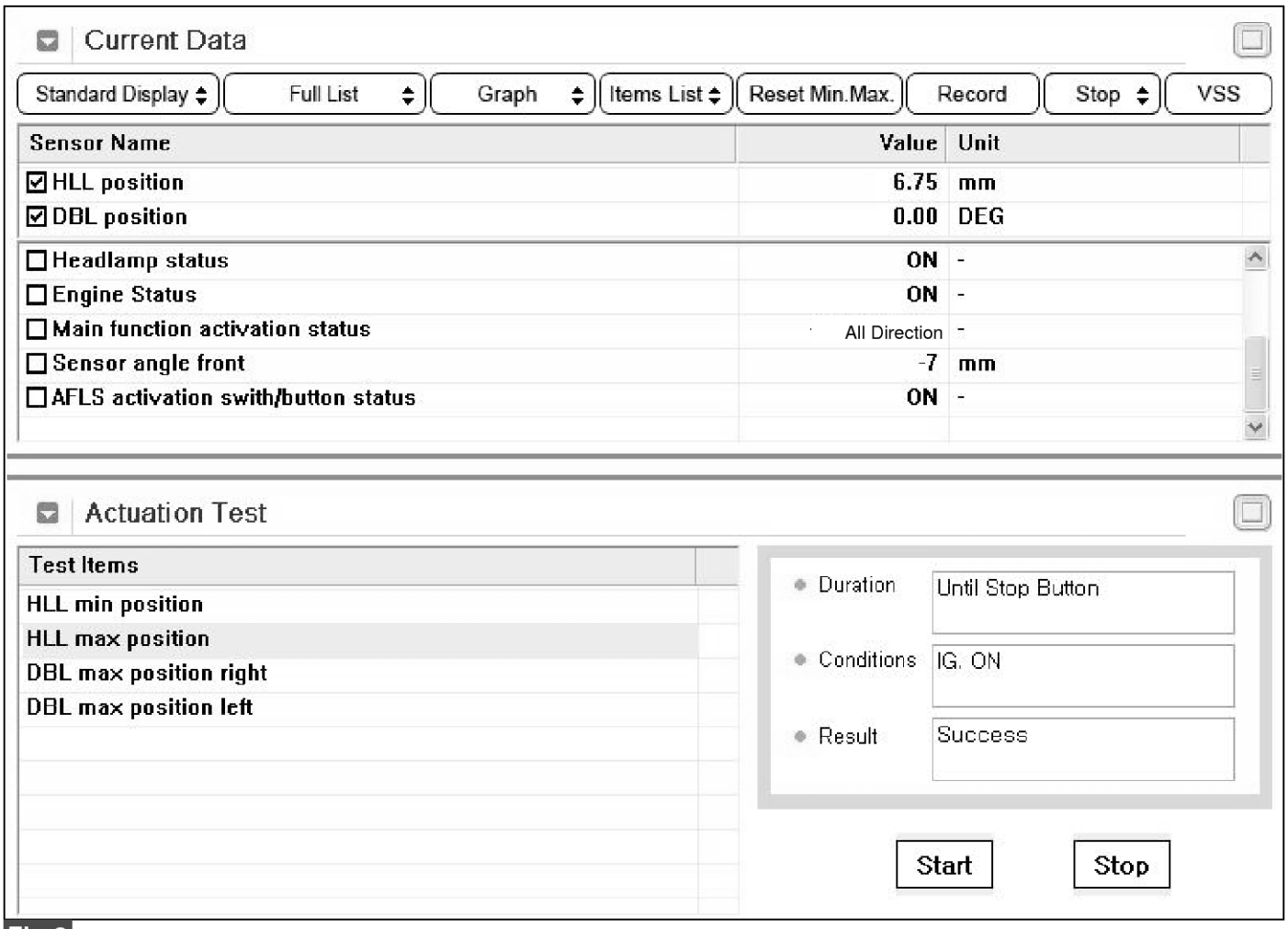



Fig.3

SBHBE9C56L

Fig 1) Engine "ON"

Fig 2) Actuation Test - HLL DOWN POSTION

Fig 3) Actuation Test - HLL UP POSTION

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or ECU's connector or was repaired and ECU memory was not cleared. T-horoughly check connectors for looseness, po-or connection, bending, corrosion, contaminati-on, deterioration, or damage. Repair or replace as necessary and go to "Verification of vehicle Repair" procedure

**NO** ▶ Go to " Inspection/Repair " procedure ..

## W/Harness Inspection

Refer to DTC B2326 : Swivel module fault right.

## Component inspection

Refer to DTC B2326 : Swivel module fault right.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# B2401 Levelling motor fault right

## General Description

Refer to DTC B2325 : Swivel module fault left.

## DTC Description

AFLS ECU set this code If mechanically faulty in ISM of right side headlamp.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal monitoring | • Headlamp |
| Enable Conditions | • IG ON | |
| Threshold Value | • internal circuit Short<br>• Temperature rising over the 155℃ | |
| Detecting time | • 1sec | |
| Fail Safe | • Swivelling operation is normal<br>left Levelling : stop with persent status<br>right Levelling : operation is normal | |
| Check Lamp | • NO | |

## Diagnostic Circuit Diagram

Refer to DTC B2325 : Swivel module fault left.

## Monitor Scantool Data

Refer to DTC B2400 : Levelling motor fault left.

## W/Harness Inspection

Refer to DTC B2326 : Swivel module fault right.

## Component inspection

Refer to DTC B2326 : Swivel module fault right.

## Verification of Vehicle Repair

Refer to DTC B1101 : Battery Voltage High.

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# Adaptive Front Lighting System

## Description

### AFLS Unit(ECU)

AFLS located in Cockpit Module is provided information of vehicle (steering wheel signal,vehicle speed, inclination of vehicle).

Based on provided information , it calculates algorithm and adjust Low beam of H/Lamp.

It transmits driving information by using LIN protocol, it is operated in Fail-safe reaction mode In case system failure occurred.

### Swivelling Actuator

Swivelling actuator inside H/Lamp is provided driving information of left / right side by using LIN protocol from AFLS Unit(ECU).

It dirve to control position by using step motor.

In case of system failure, it provides function to back to initial position(center) .

### Levelling Actuator

Levelling actuator inside H/Lamp is provided driving information of upper / lower by using LIN protocol from AFLS Unit(ECU)

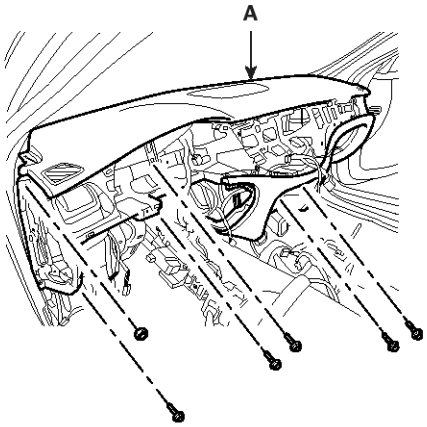
It dirve to control position by using step motor.

In case of system failure, it provides function to lower to -2.8% or -1.5% position.

## Removal

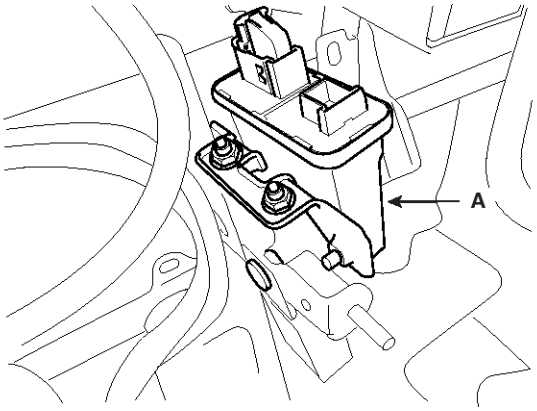
### AFLS Unit

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




SBHBE8973D

3. Remove the AFLS unit(A) after removing connector and nuts(2EA).




SBHB18100D

## Installation

### AFLS Unit

1. Install the AFLS unit after connecting the connector.
2. Install the main crash pad. (Refer to the Body group - "Main crash pad")
3. Connect the negative (-) battery terminal.

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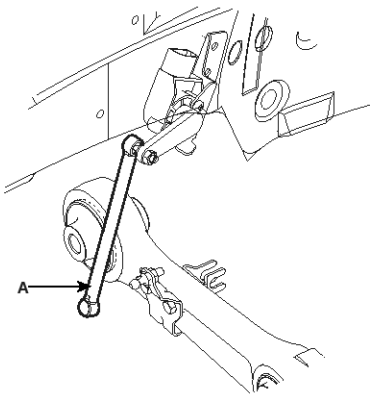
## Height Sensor

### Removal

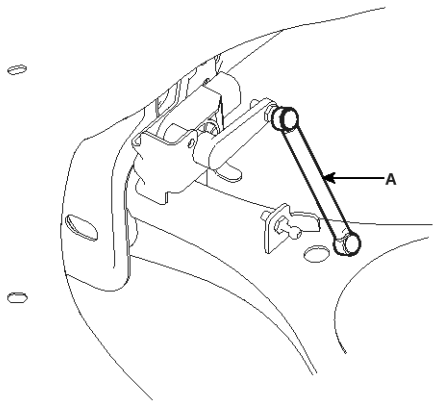
#### Height Sensor

1. Disconnect the negative (-) battery terminal.
2. Remove the height sensor linkage (A) installed on the front axle and rear axle.

   (Number of height sensor : Air suspension - 4EA, Non-air suspension - 2EA)

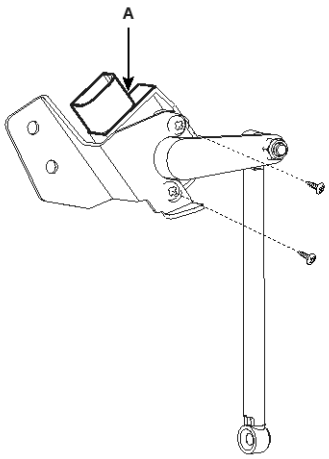



SBHBE8975D

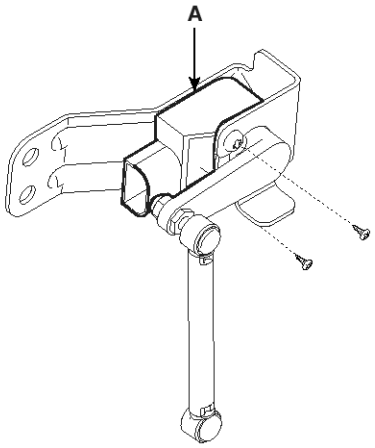



SBHBE8976D

3. Remove the height sensor assembly after disconnecting the connector.
4. Remove the height sensor unit (A) after removing screws(2EA).




SBHBE8977D




SBHBE8978D

### Installation

#### Height Sensor

1. Install the height sensor unit.
2. Install the height sensor assembly after connecting the connector.
3. Install the height sensor linkage on the front axle and rear axle.
4. Connect the negative (-) battery terminal.

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# Auto Lighting Control System

## Specifications

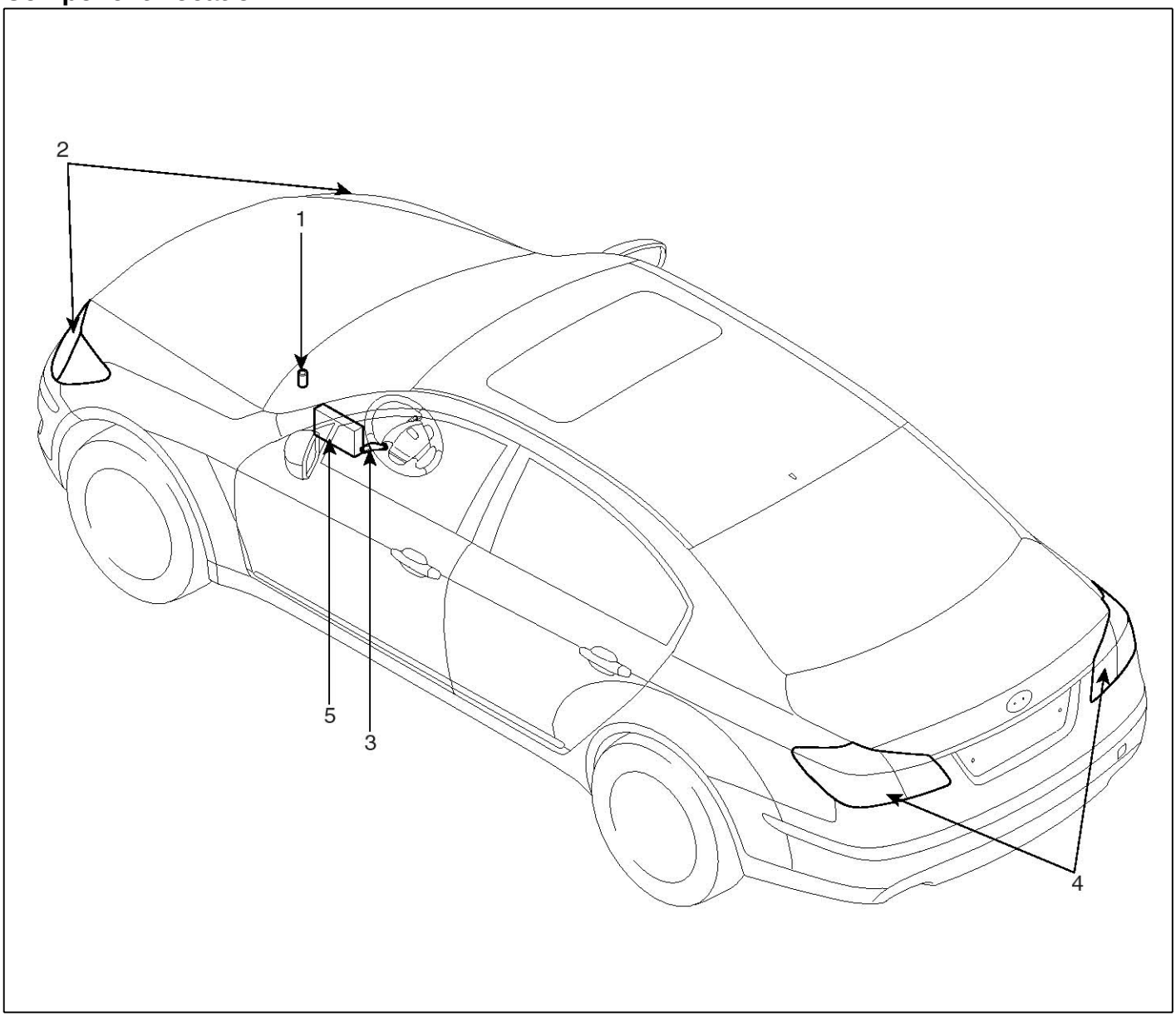
| Items | | Specifications |
|---|---|---|
| Rated voltage | | 5V |
| Load | | Max. 1mA (Relay load) |
| Detection illuminations | Tail lamp | ON : 1.77 ±0.08 (V) |
| | | OFF : 3.47 ±0.1 (V) |
| | Head lamp | ON : 0.61 ±0.06 (V) |
| | | OFF : 1.00 ±0.06 (V) |

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## Component Location




SBHBE8039D

1. Auto light sensor
2. Head lamps
3. Lighting switch (Auto)
4. Tail lamps
5. IPM (Instrument Panel Module)

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## 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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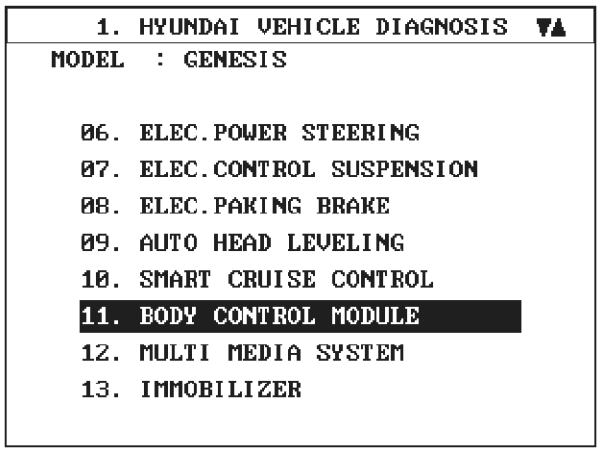
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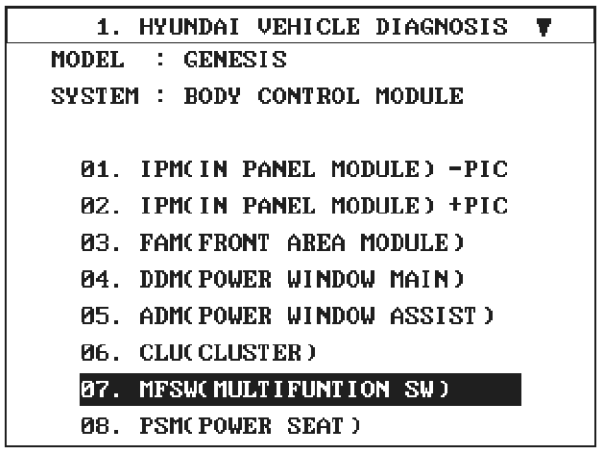
## Auto Light Switch

### Inspection

1. Multifunction switch operates head lamps and wiper by communicating with BCM through LIN communication.
2. Check BCM input/output value of each position of multifunction switch when you inspect the module whether faulty or not.
3. Select model and BCM menu.

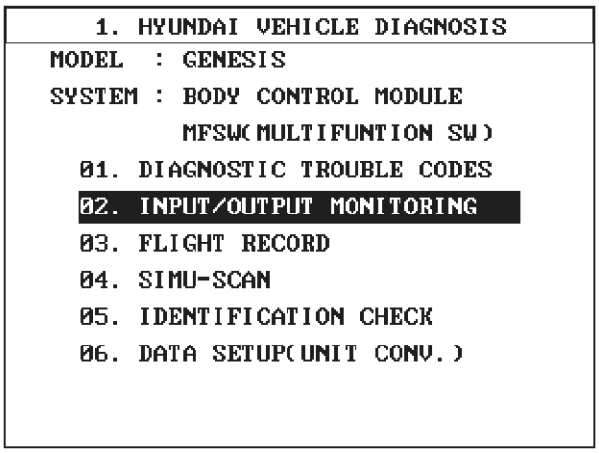



SBHBE9179L



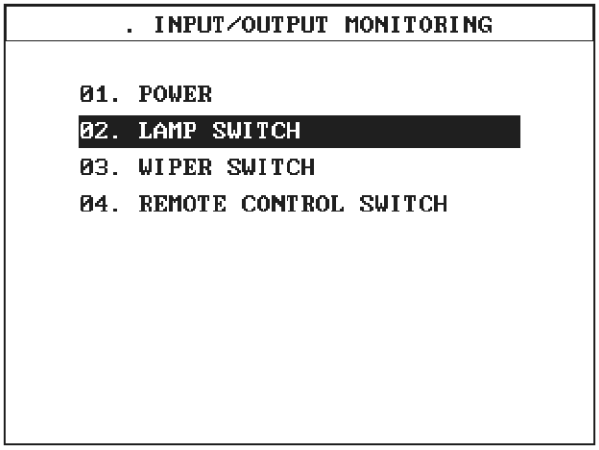

SBHBE9180L

4. Select "Input/Output monitoring" and "Lamp switch". Check auto light & wiper value.

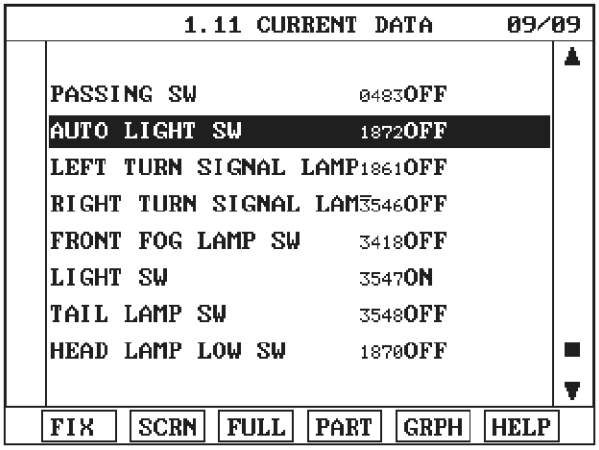



SBHBE9181L

5. Check input/output value of auto light.




SBHBE9182L




SBHBE9183L

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## Auto Light Sensor

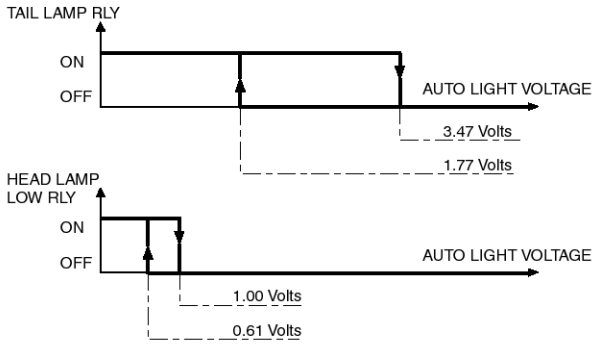
### Inspection

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.

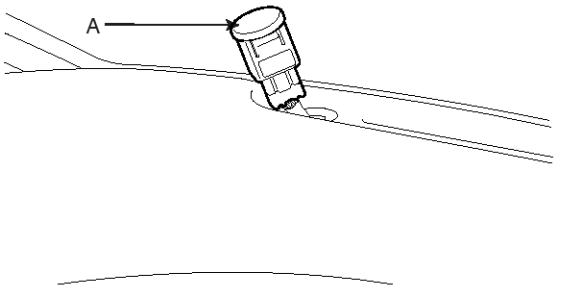



ETBF145K

| | Tail lamp | Head lamp |
|---|---|---|
| ON | 1.77 ± 0.08[V] | 0.61 ± 0.06[V] |
| OFF | 3.47 ± 0.10[V] | 1.00 ± 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.




SBHBE8041D

3. Remove the auto light connector.

### Installation

1. Install the auto light sensor and connector.

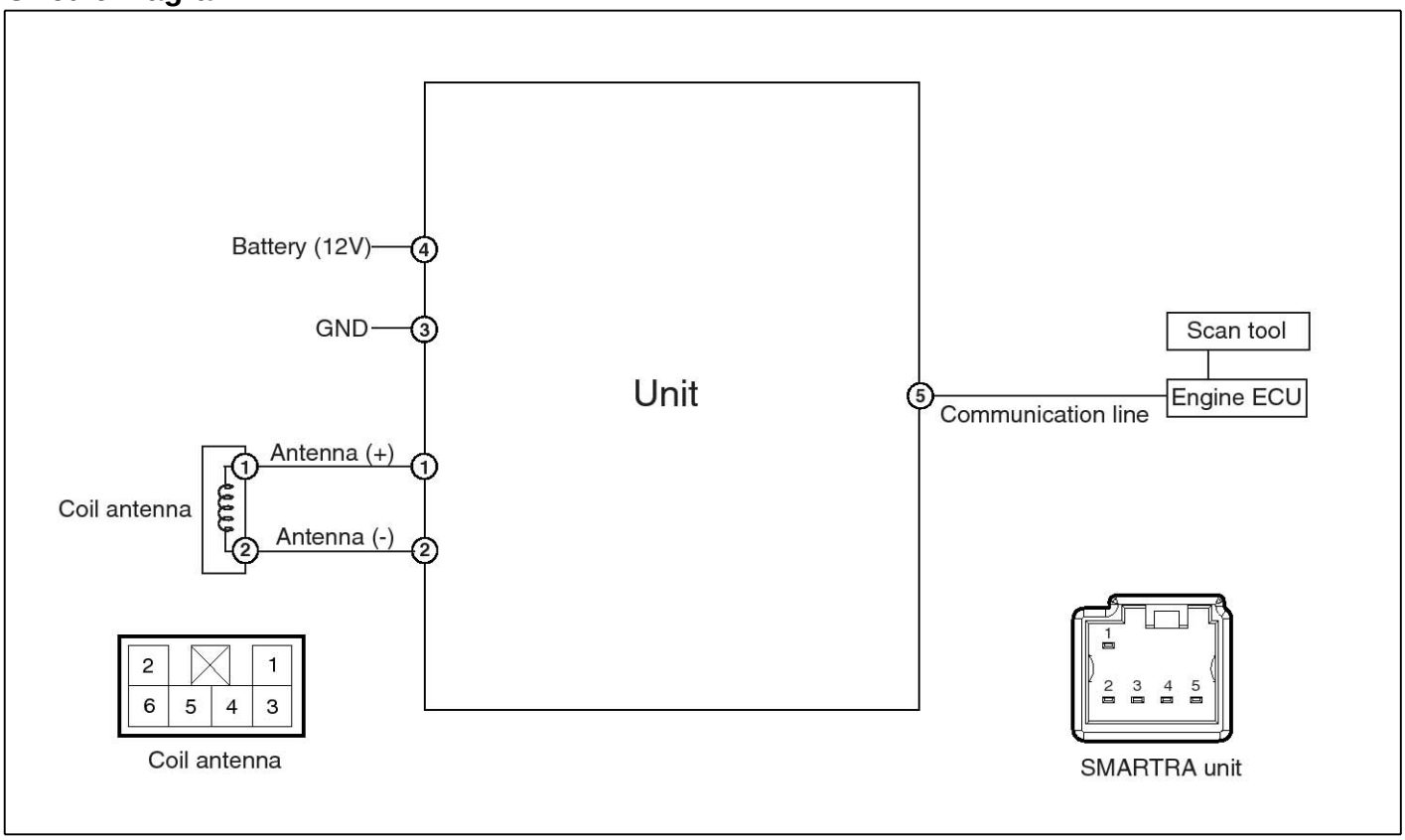
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# Immobilizer System

## Circuit Diagram




SEDBE7543L

## Description

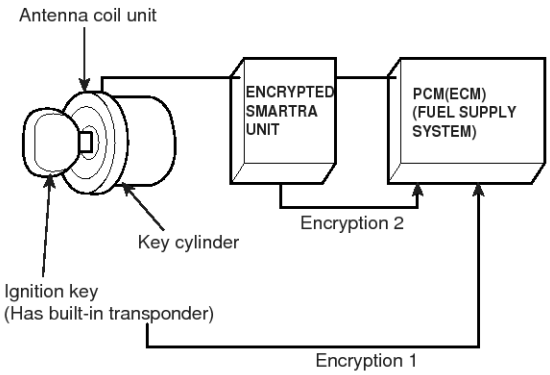
The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. Encrypted SMARTRA type immobilizer
   - The SMARTRA system consists of a passivie 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 Hyundai motor service station.

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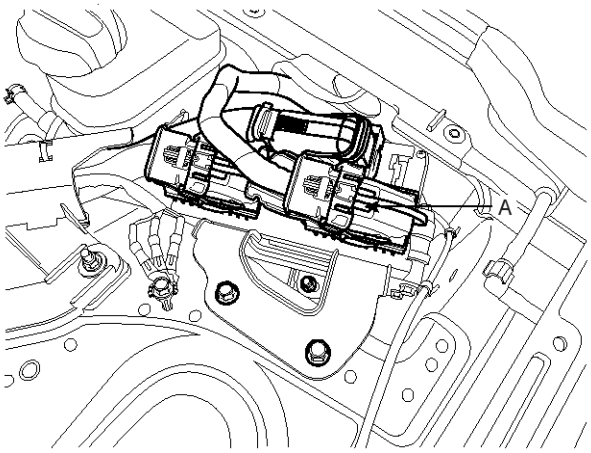

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## Components Operations

### PCM (Power Train Control Module)

1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM).

   ERN (Encrypted Randorn Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.



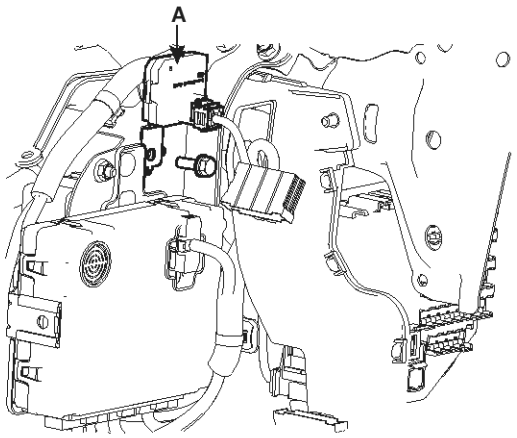

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### Encrypted SMARTRA Unit (A)

The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar.

The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.

The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.




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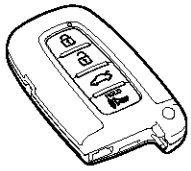
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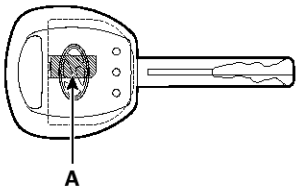
### Transponder (Built-in Keys)

The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.

[SMK type]



[Key type]



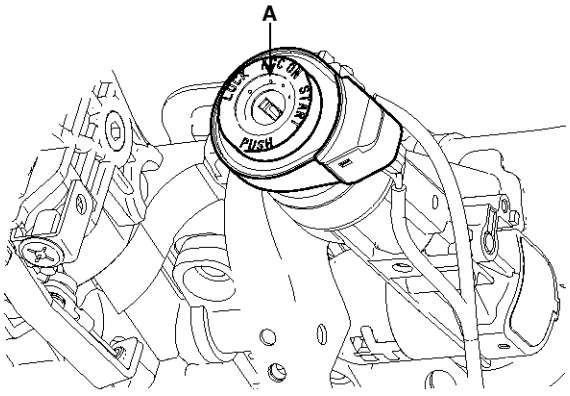

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### Antenna Coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder .
- The antenna coil sends transponder signal to the SMARTRA.

  It is located directly in front of the steering handle lock.




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### Teaching Procedures

1. Key Teaching Procedure

   Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehicle owner.

   The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" PCM(ECM) stores the vehicle specific data and the key teaching can be started. The "learnt " PCM(ECM) compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.

   If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.

   The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

   If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).

   The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the PCM(ECM). This rejects the key and a message is sent to the tester.

   The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be invalid.

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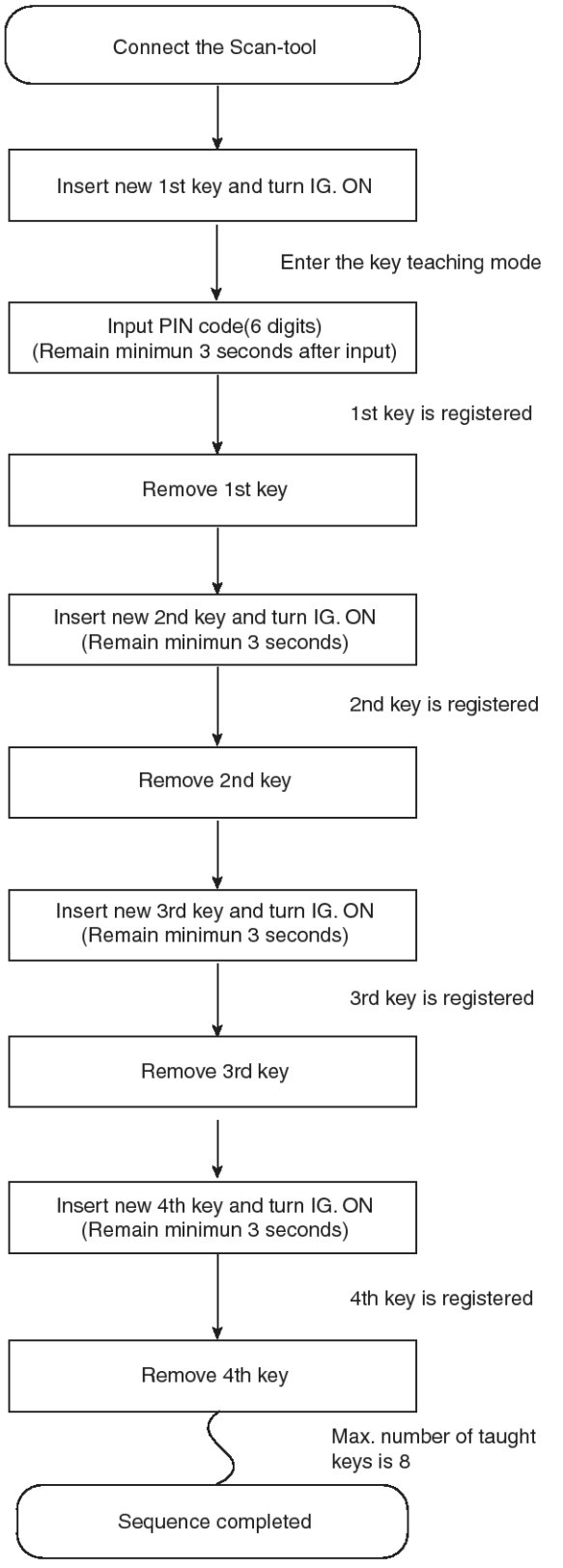
The maximum number of taught keys is 8

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 regists at the same time.*



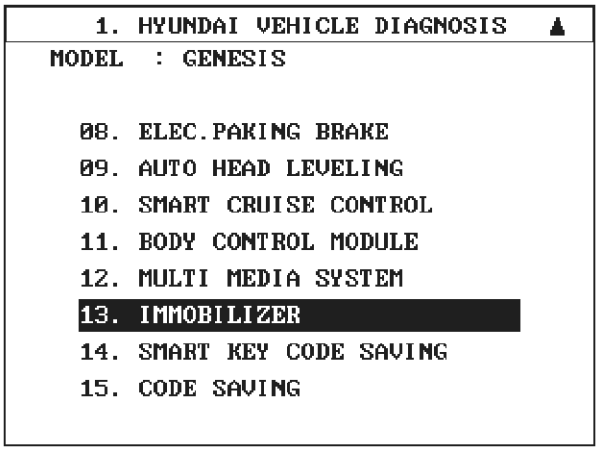

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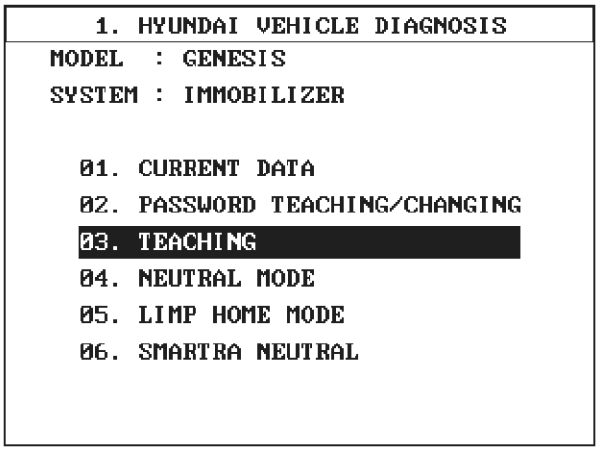
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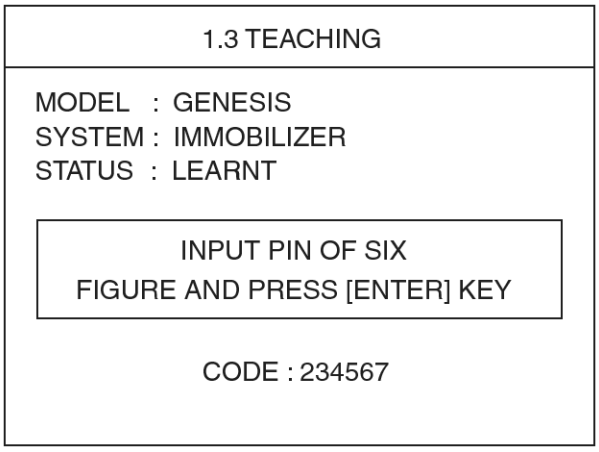
1) PCM(ECM) learnt status.



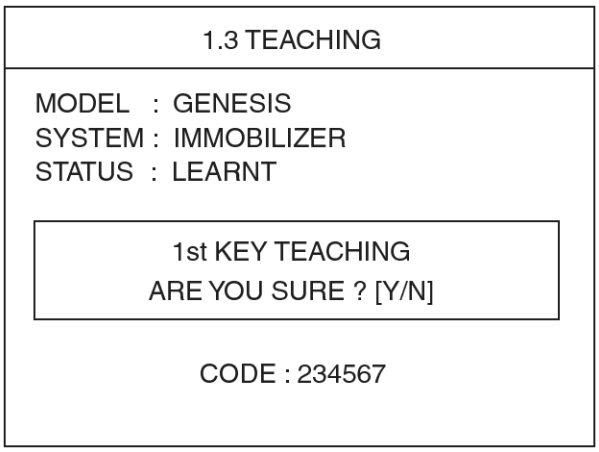

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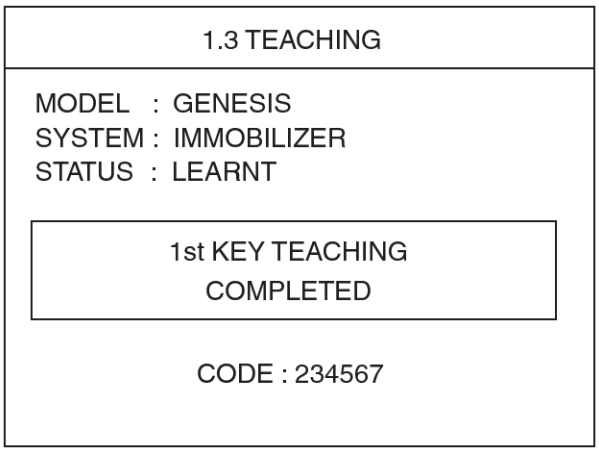

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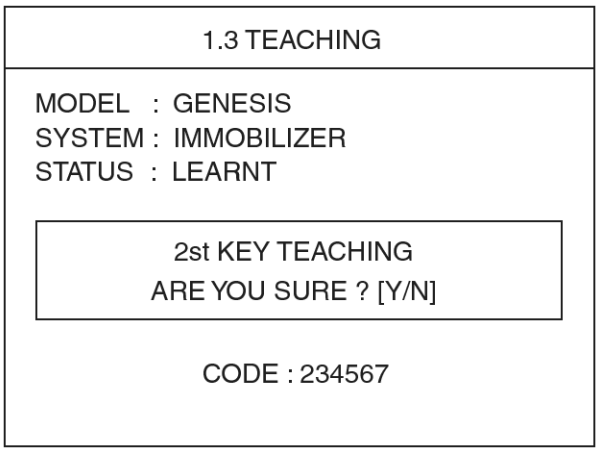

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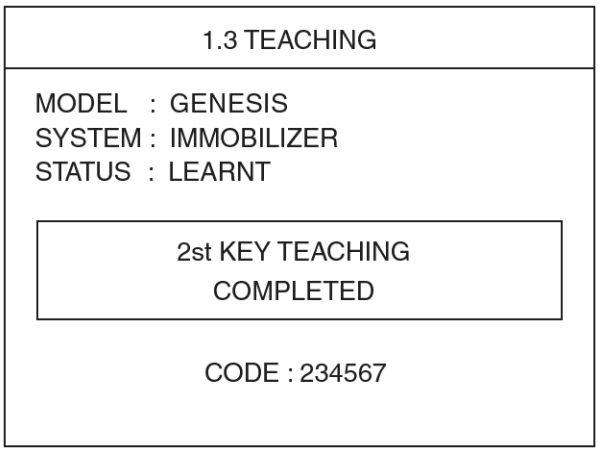



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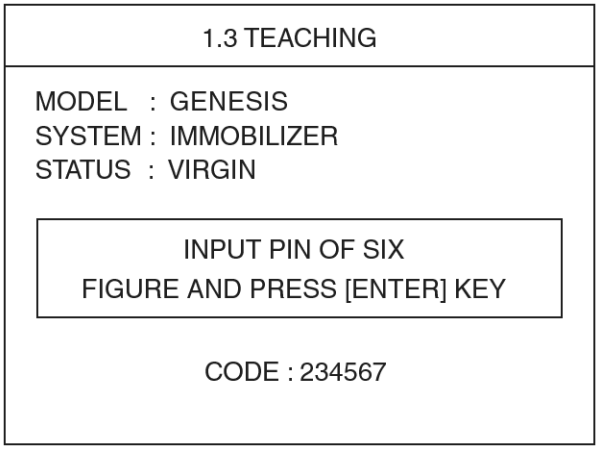



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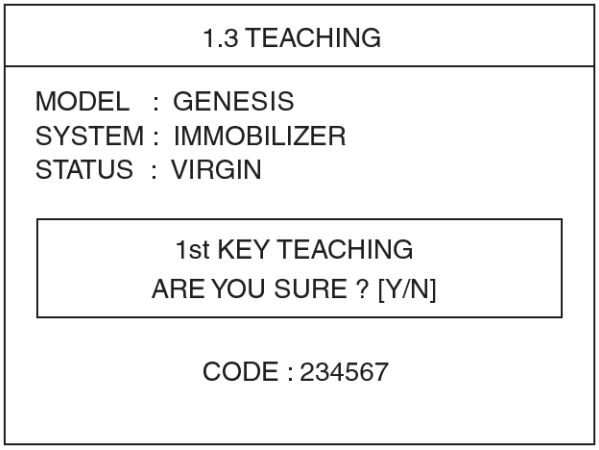
2) PCM(ECM) virgin status.

After replacing new "PCM(ECM)" scantool displays that PCM(ECM) is virgin status in Key Teaching mode.

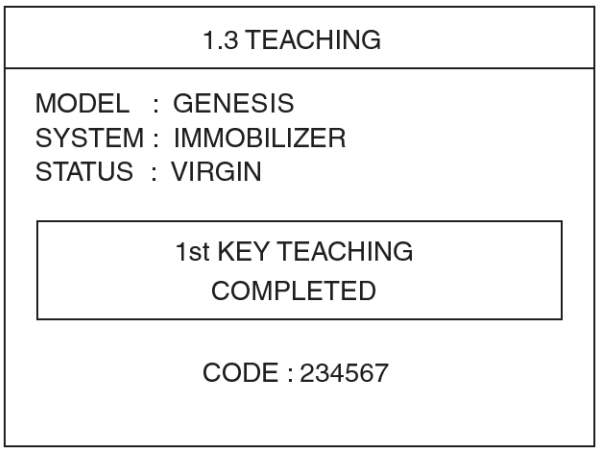
"VIRGIN" status means that PCM(ECM) has not matched any PIN code before.



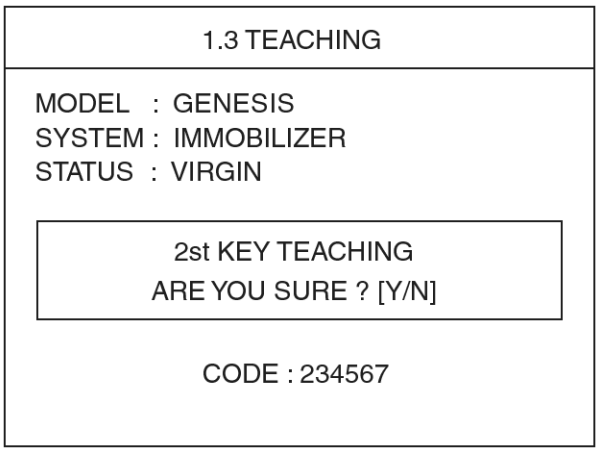

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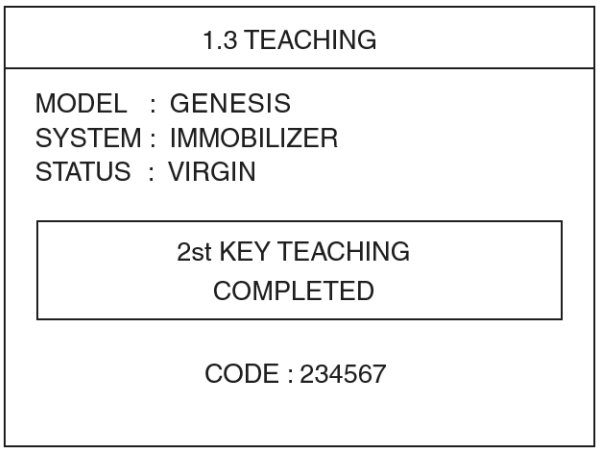

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2. User Password Teaching Procedure

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

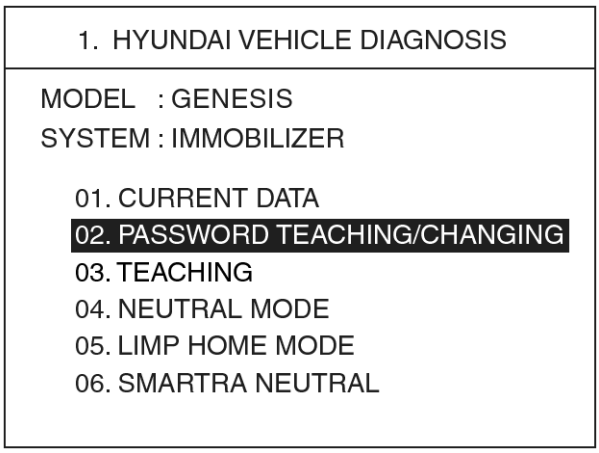
The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to an PCM(ECM), the status of the password is "virgin" No limp home function is possible.

The teaching is started by ignition on, with a valid key (learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

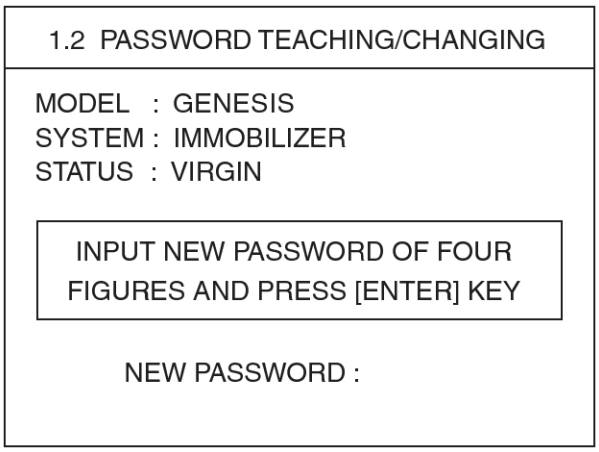
The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

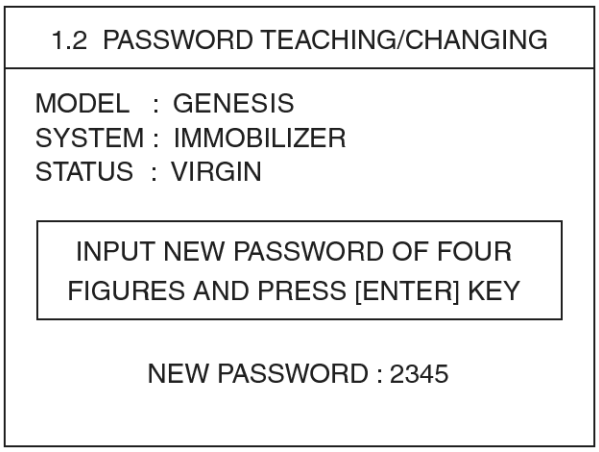
1) User password teaching



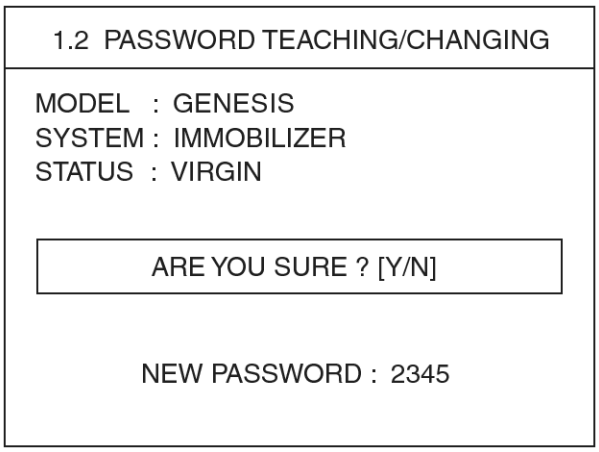

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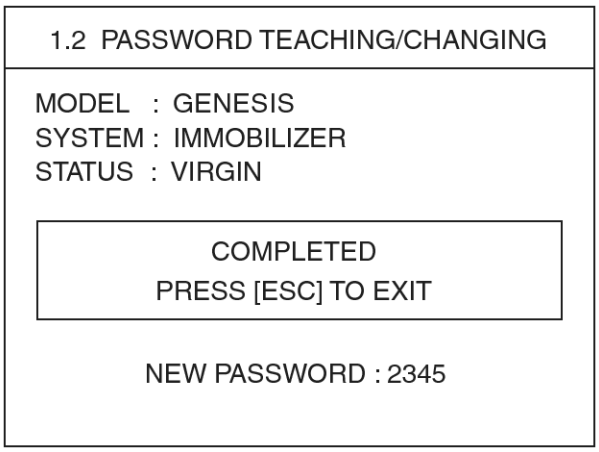



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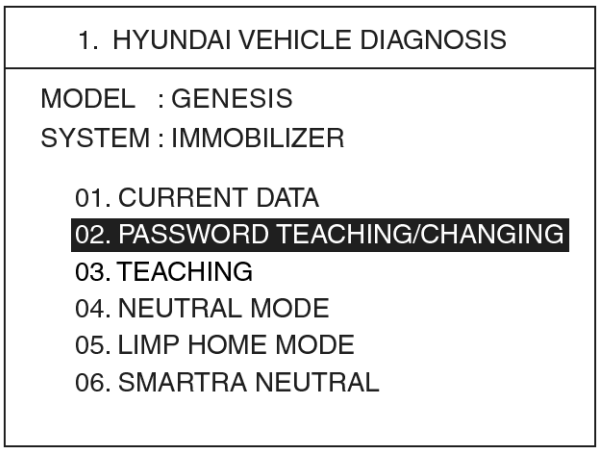




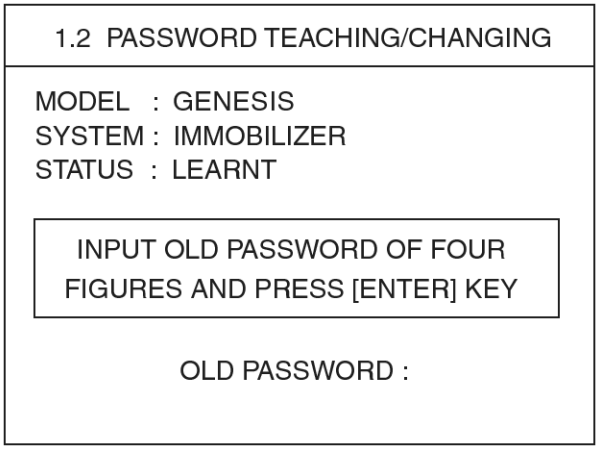

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※ In case of putting wrong password, retry from first step after 10 seconds.

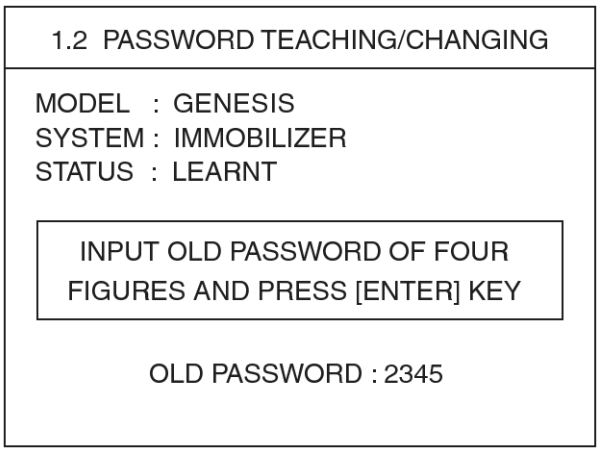
2) User password changing



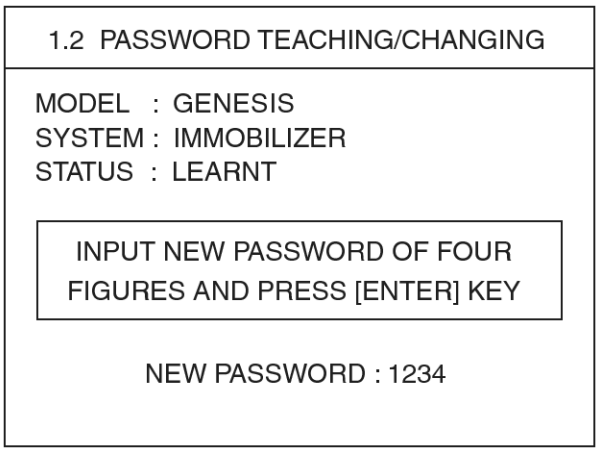

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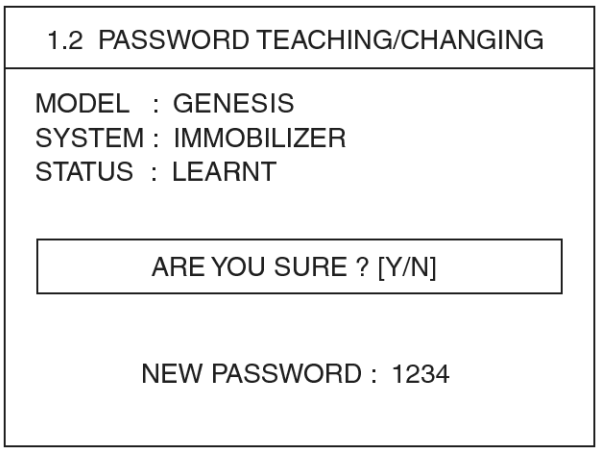

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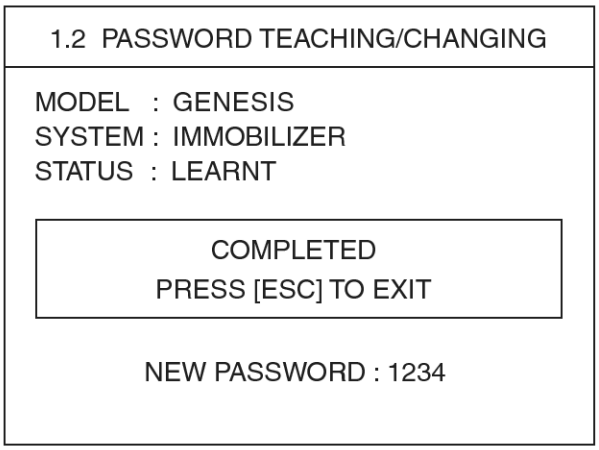



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## Limp Home Function

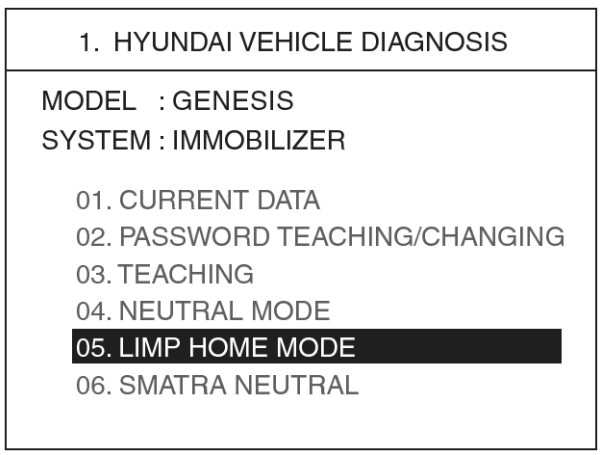
1. LIMP HOME BY TESTER

   If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home 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.

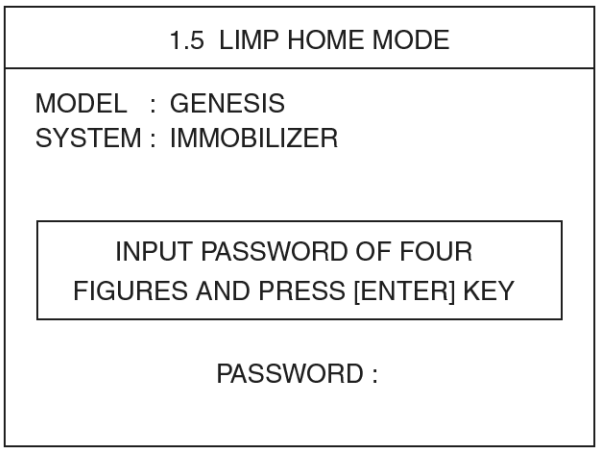
   The user password can be sent to the PCM(ECM) via the special tester menu.

   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.

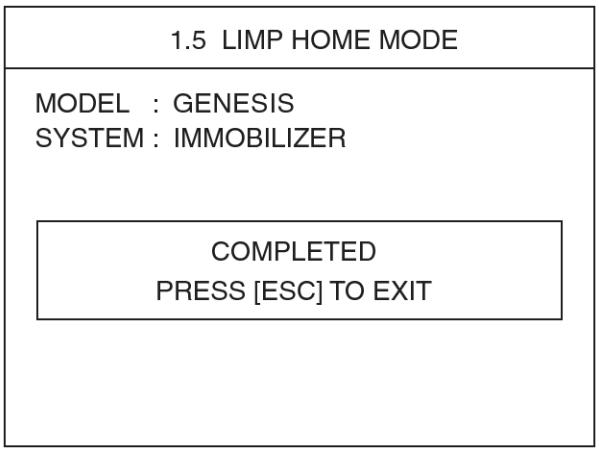
   If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour. Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the PCM (ECM), the timer starts again for one hour.



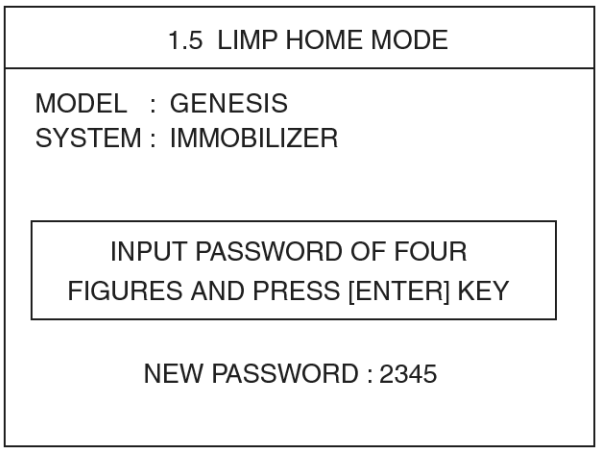

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SBHBE9215L




SBHBE9216L




SBHBE9217L

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 us-

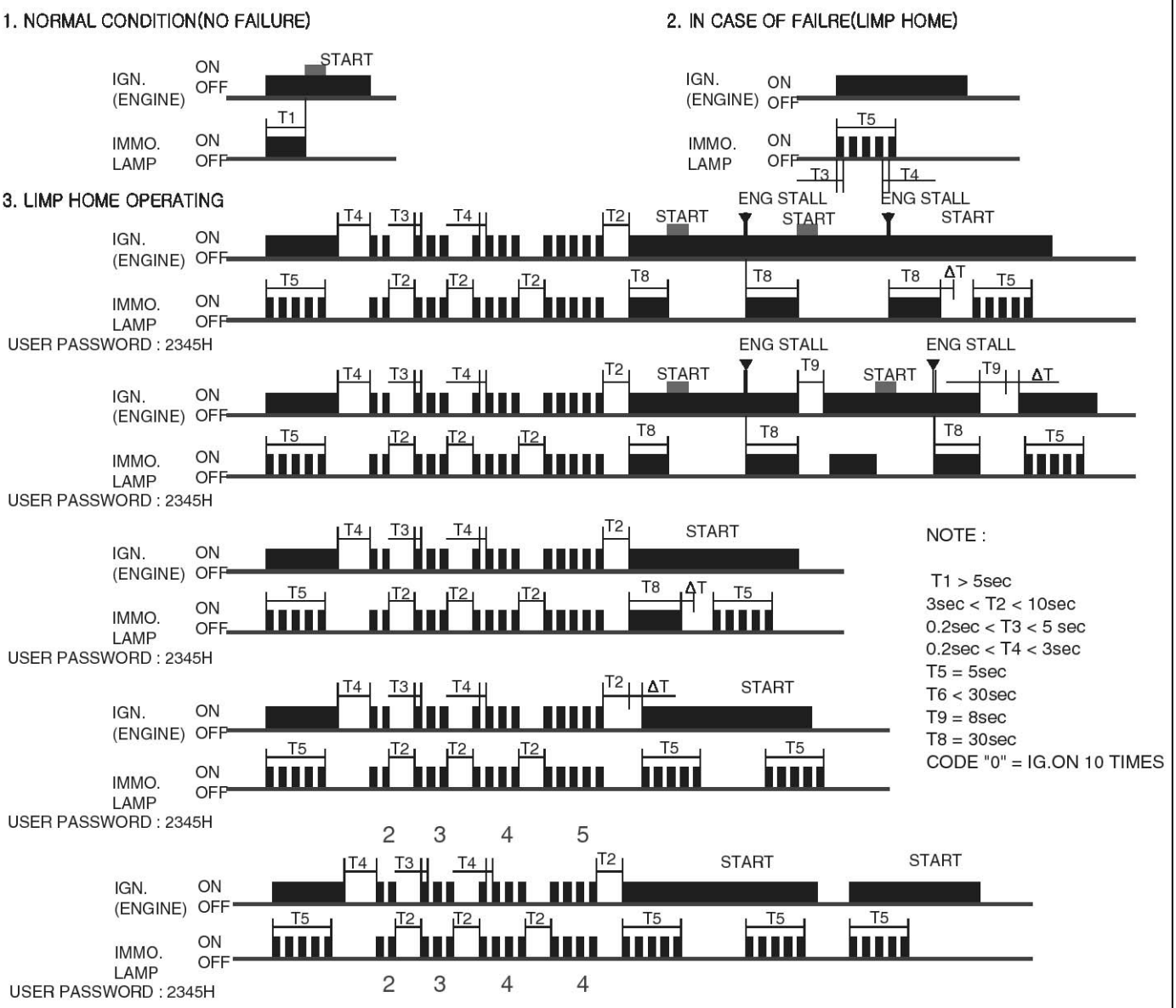
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er password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.




LTIF740N

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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 | YES |

### Replacement Of Ecm And Smartra

In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))

When installing PCM(ECM) of car "A" on car "B"
※ All non-virgin PCM(ECM)`s need to be neutralized before installing on the other vehicles.
↓
Neutralize the PCM(ECM) of car "A"
↓
Installing the PCM(ECM) of car "A" on car "B"
↓
Register the keys with the PIN code of car "B"
↓
Register additional keys (Maximum of keys)
※ All phases of key registration should be completed in under 10 seconds
↓
Registration completed

ETBF746A

2. Things to remember before a replacement (Keys & Additional registration)

Replace keys & additional registration
※ **You must know the PIN code before executing this procedure**
↓
Turn the key to the IG ON position
↓
Initialize the PCM(ECM) (Under the Neutral Mode)
↓
Insert the key you want to register and turn it to the IG ON position
↓
Register the key (Under the Teaching Mode)
↓
Register additional keys (Maximum of 4 keys)
※ All phases of key registration should be completed in under 10 seconds
↓
Registration completed

ETBF746B

**NOTICE**

1. *When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.*
2. *When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.*

   *(Note that key #2 must be used within 10 seconds of removing key #1)*
3. *When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.*

   *The engine cannot be started even with the registered key #1.*
4. *When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.*

   *Always remember the 10 seconds zone.*
5. *If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.*
6. *Be cautious not to overlap the transponder areas .*
7. *Problems can occur at key registration or vehicle starting if the transponders should overlap.*

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### Neutralising Of ECM

The PCM(ECM) can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).

The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.

This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys.

(Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner. If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

**NOTICE**

- *Neutralizing setting condition*
  - *In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"*
  - *Input correct PIN code by scanner.*
  - *Neutralizing meaning .*

    *: PIN code (6) & user password (4) deletion.*

    *: Locking of ECM (except key teaching permission)*
- *Neutralizing meaning:*
  - *PIN Code(6) & User P/Word(4) deletion*
  - *Locking of EMS(except Key Learning permission)*

| Function / EMS | Engine Running | | | Learning | |
|---|---|---|---|---|---|
| | Learnt Key | Limp home | Twice Ignition | Key | User Password |
| Neutral | No | No | No | Yes | No |

SFDBE8407L

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : GENESIS
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL

SBHBE9207L

1.4 EMS NEUTRAL

MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNT

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

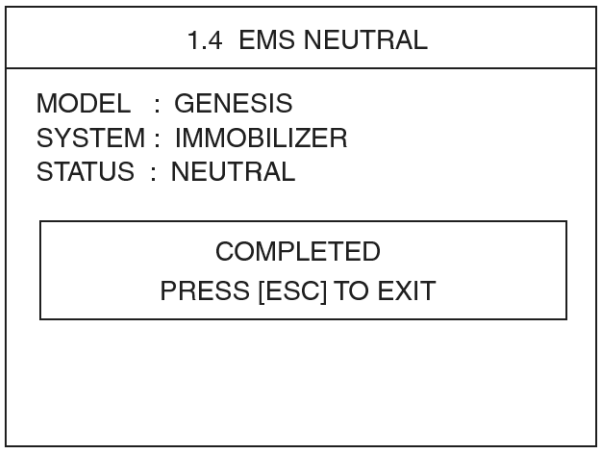
CODE : 234567

SBHBE9208L

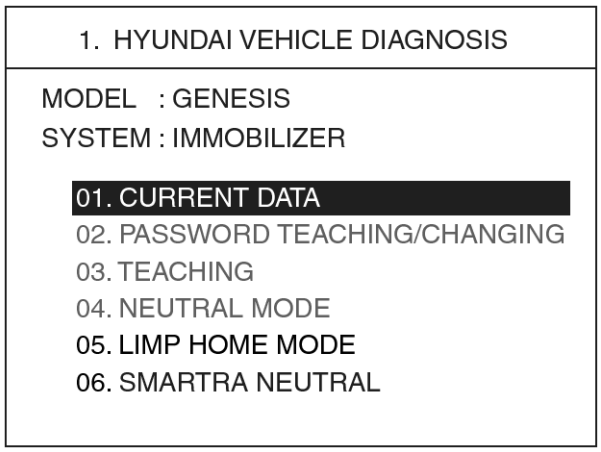
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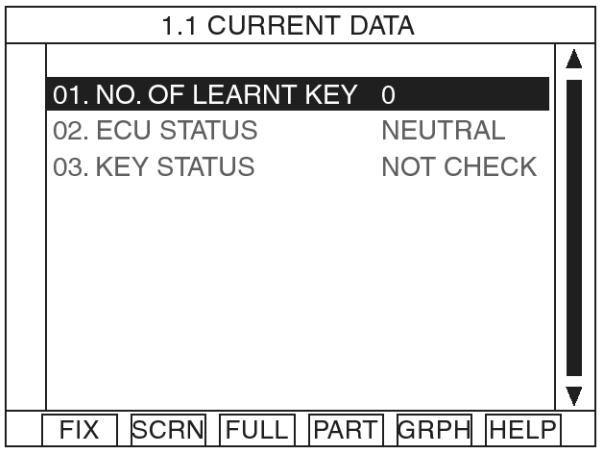





SBHBE9209L




SBHBE9210L




SEDBE7577L

### 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 G-ST, SMARTRA can be neutralized.The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST.

In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".

In case of chaging the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning the key of vehicle password, it can be used.

If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

**NOTICE**

- *Neutralizing Setting condition :*
  - *In case of "SMARTRA status", "Learnt"*
  - *Input correct Pin code by tester*
- *Neutralizing meaning :*
  - *Vehicle password(DPN Code) & SEK Code deletion.*
  - *Permission of New DPN Learning.*

| Function / SMARTRA | Engine Running | | | Learning | |
|---|---|---|---|---|---|
| | Learnt Key | Limp home | Twice Ignition | Key | User Password |
| Neutral | No | Yes (EMS learnt) | No | Yes | No |

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1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : GENESIS
SYSTEM : IMMOBILIZER

01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL

SBHBE9211L

1.6 SMARTRA3 NEUTRAL

MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNT

INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY

CODE : 234567

SBHBE9212L

1.6 SMARTRA3 NEUTRAL

MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : NEUTRAL

COMPLETED
PRESS [ESC] TO EXIT

SBHBE9213L

1.1 CURRENT DATA

01. NO. OF LEARNT KEY 0
02. EMS STATUS
03. KEY STATUS VIRGIN
04. SMARTRA3 STATRS

FIX SCRN FULL PART GRPH HELP

SFDBE8412L

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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<br>2. Transponder transport data has been changed. | P1674<br>(Transponder status error) |
| Transponder key fault | 1. Transponder programming error | P1675<br>(Transponder programming error) |
| SMARTRA fault | 1. Invalid message from SMARTRA to PCM(ECM) | P1676<br>(SMARTRA message error) |
| SMARTRA fault | 1. Virgin SMARTRA at learnt EMS<br>2. Neutral SMARTRA at learnt EMS<br>3. Incorect the Authentication of EMS and SMARTRA<br>4. Locking of SMARTRA | P169A<br>(SMARTRA Authentication fail) |
| SMARTRA fault | 1. No response from SMARTRA<br>2. Antenna coil error<br>3. Communication line error (Open/Short etc.)<br>4. Invalid message from SMARTRA to PCM(ECM) | P1690<br>(SMARTRA no response) |
| Antenna coil fault | 1. Antenna coil open/short circuit | P1691<br>(Antenna coil error) |
| Immobilizer indicator lamp fault | 1. Immobilizer indicator lamp error (Cluster) | P1692<br>(Immobilizer lamp error) |
| Transponder key fault | 1. Corrupted data from transponder<br>2. More than one transponder in the magnetic field (Antenna coil)<br>3. No transponder (Key without transponder) in the magnetic field (Antenna coil) | P1693<br>(Transponder no response error/invalid response) |
| PCM(ECM) fault | 1. Request from PCM(ECM) is invalid<br>(Protocol layer violation- Invalid request, check sum error etc.) | P1694<br>(PCM(ECM) message error) |
| PCM(ECM) internal permanent memory (EEPROM) fault | 1. PCM(ECM) internal permanent memory (EEPROM) fault<br>2. Invalid write operation to permanent memory (EEPROM) | P1695<br>(PCM(ECM) memory error) |
| Invalid key fault | 1. Virgin transponder at PCM(ECM) status "Learnt"Learnt (Invalid) Transponder at PCM(ECM) status "Learnt"(Authentication fail) | P1696<br>(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<br>(Twice IG ON over trial) |

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**Immo DTC List**

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | P1610 | Non-Immobilizer-EMS connected to an Immobilizer |
| 2 | P1674 | Transponder status error |
| 3 | P1675 | Transponder programming error |
| 4 | P1676 | SMARTRA message error |
| 5 | P1690 | SMARTRA no response |
| 6 | P1691 | Immobilizer-Antenna Coil Error |
| 7 | P1692 | Immobilizer Indicator Lamp Error |
| 8 | P1693 | Immobilizer-Transponder Error |
| 9 | P1694 | EMS message error |
| 10 | P1695 | EMS memory error |
| 11 | P1696 | TransponderAuthentication fail |
| 12 | P1699 | Immobilizer-Twice Overtrial |
| 13 | P169A | SMARTRA Authentication Fail |

**Button Engine Start System**

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | P1676 | SMARTRA message error |
| 2 | P1690 | SMARTRA no response |
| 3 | P1696 | Authentication fail |
| 4 | P1699 | Twice overtrial |

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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 E-MS can decode the secret code stored in the SMARTRA 3.

The EMS carries out the immobilizer function, the SMAT-RA3 management and the key management. The immob-ilizer 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 communic-ates the encoded messages to the SMARTRA3 via a de-dicated communication line and confirms the key with the SMARTRA3.

The EMS related to immobilizer has the 3 kinds of softw-are. At the first IGN on, the EMS concludes the software of each option (smart key, non-encoded SMARTRA3, en-coded SMARTRA3) by communication. It is called “The autodection for EMS”The EMS keeps the previous option before being neural 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

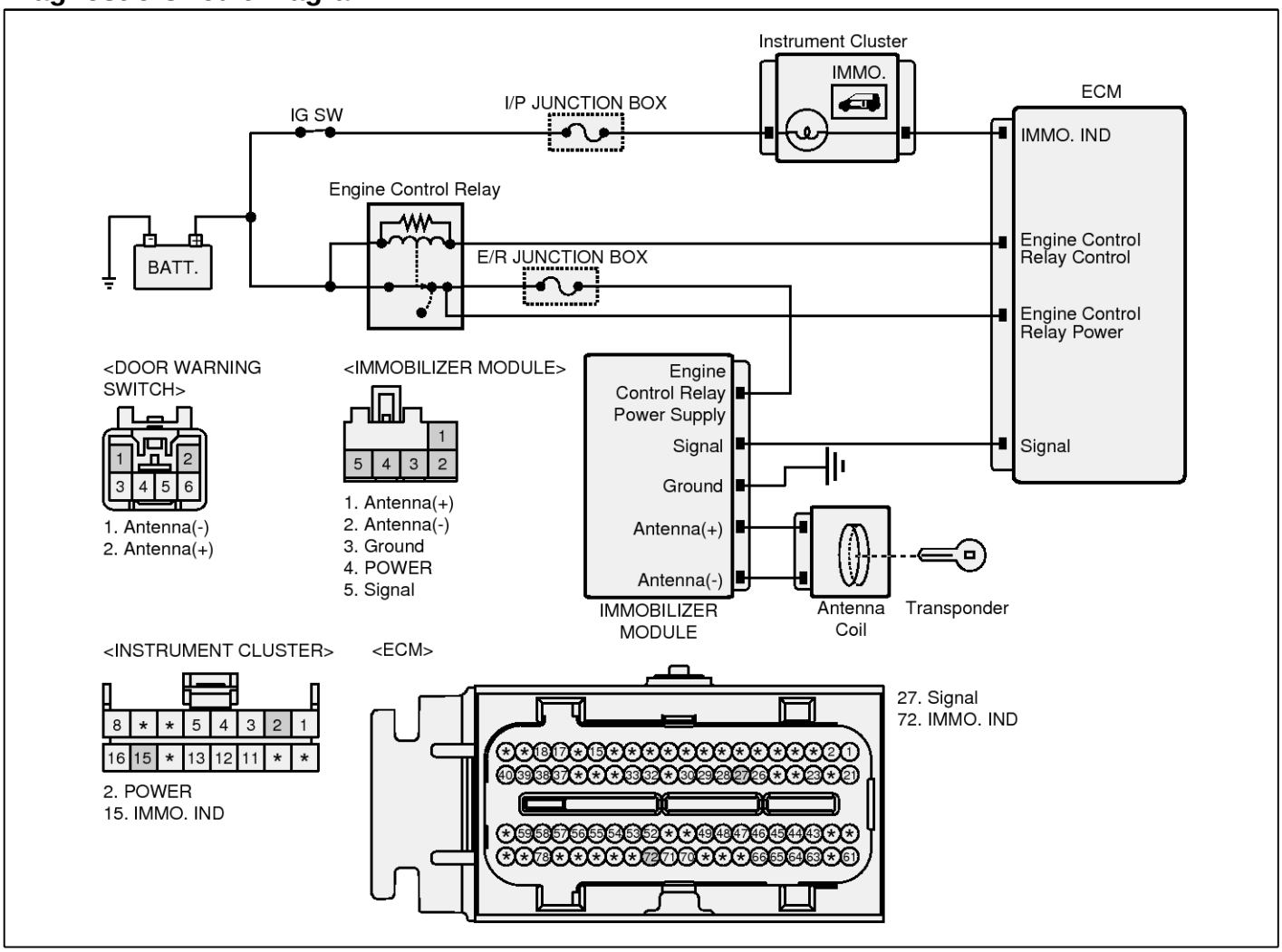
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • - | • Invalid PCM/ECM |
| Enable Conditions | • IG ON | |
| Threshold value | • Non Immobilizer PCM/ECM connected | |
| Detecting time | • Immediately | |
| FAIL SAFE | • - | |

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## Diagnostic Circuit Diagram




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## Monitor Scantool Data

1. Check status
   1) IGN "ON" & Engine "OFF"
   2) Monitor the "ECM Status" Parameter on the Scantool.

**Specification :** 'LEARNT'

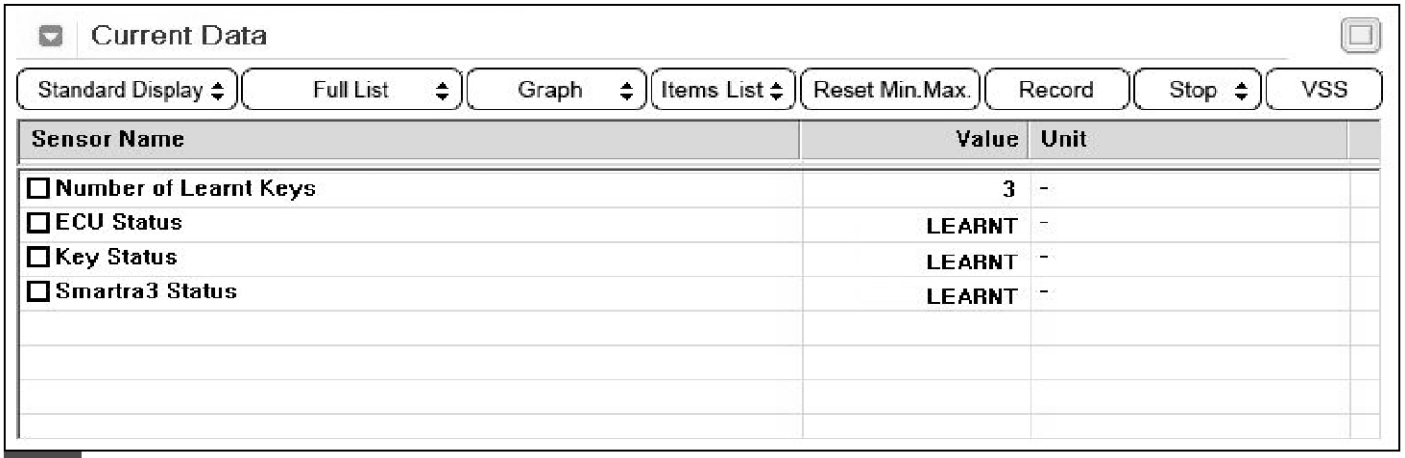



Fig.1

SBHBE9B02L

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 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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# 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 SMARTRA 3) 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 t he 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 registered(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.<br>※ 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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## 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'

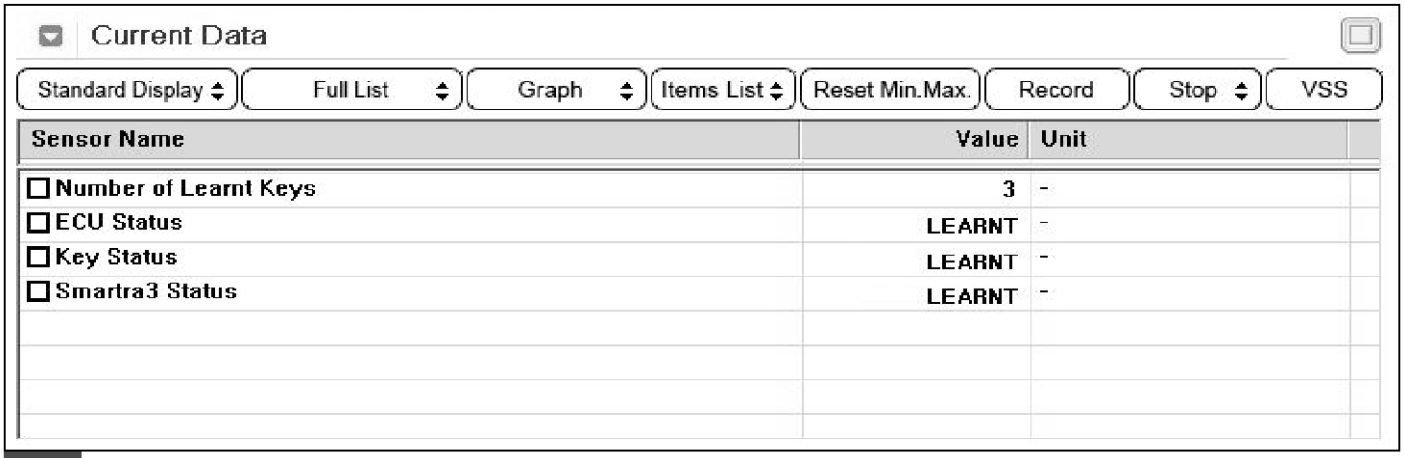



Fig.1

SBHBE9B02L

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) 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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# P1675 Immobilizer-Transponder Programming Error

## General Description

Refer to DTC P1674 : Immobilizer-Transponder status Error.

## 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.<br>※ Invalid characteristic data<br>※ 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## Monitor Scantool Data

Refer to DTC P1674 : Immobilizer-Transponder status Error.

## 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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 SMARTRA 3.
   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

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • - | • Faulty SMARTRA |
| Enable Conditions | • IG ON | |
| Threshold value | • - | |
| Detecting time | • - | |
| FAIL SAFE | • - | |

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## Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## 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'

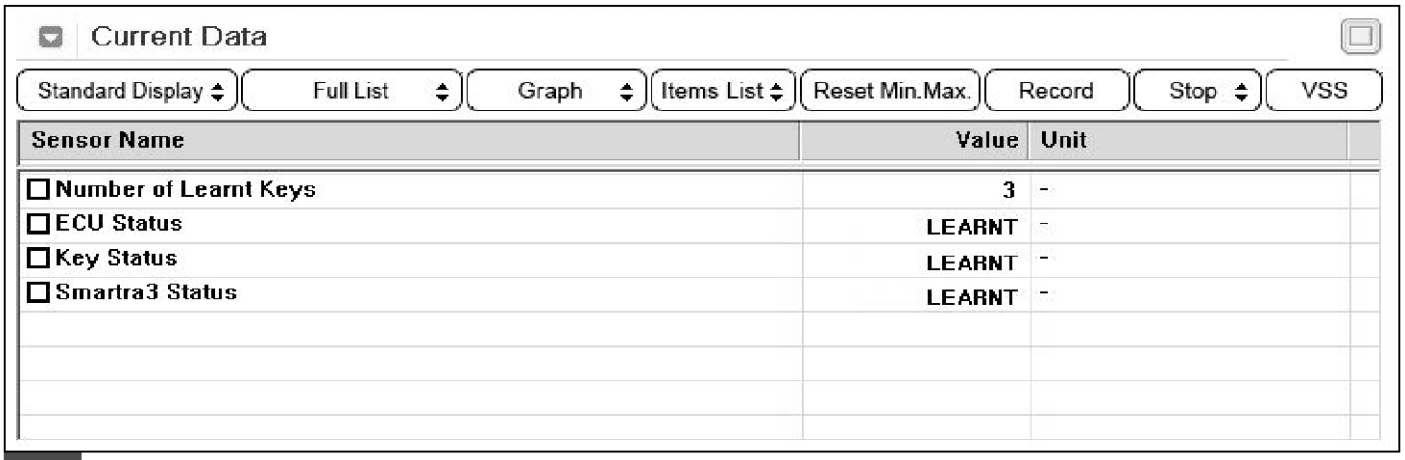



Fig.1

SBHBE9B02L

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 "Check SMARTRA" procedure.

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## 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. OrIt 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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# P169A Immobilizer-SMARTRA Authentication Fail

## General Description

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## DTC Description

The PCM/ECM sets DTC P169A if authentication between PCM/ECM and SMARTRA has failed.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • - | • Locking of SMARTRA |
| Enable Conditions | • IG ON | |
| Threshold value | • Virgin SMARTRA at Learnt EMS<br>• Neutral SMARTRA at Learnt EMS<br>• Incorect the Authetication of EMS and SMARTRA<br>• Locking of SMARTRA | |
| Detecting time | • - | |

## Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## Monitor Scantool data

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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# P1690 Immobilizer-Smartra No Response

## General Description

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## DTC Description

The ECM sets DTC P1690 if there's No Response from SMARTRA.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • - | • Open Circuit in signal harness<br>• Short Circuit in signal harness<br>• Faulty SMARTRA |
| Enable Conditions | • IG ON | |
| Threshold value | • - | |
| Detecting time | • - | |
| FAIL SAFE | • - | |

## Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## 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'

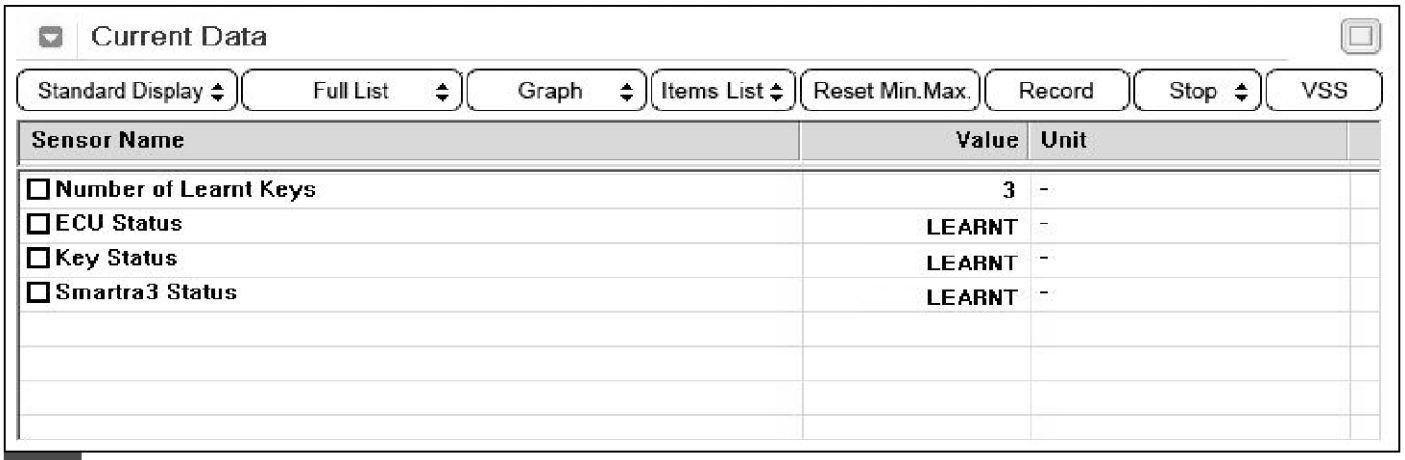



Fig.1

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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 "Inspection & Repair" procedure

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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

## 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.

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3) Ignition "ON" & Engine "OFF"
4) Measure voltage between signal terminal of SMARTRA harness connector and chassis 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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<br>• Short Circuit in antenna coil<br>• Faulty antenna coil |
| Enable Conditions | • IG ON | |
| Threshold value | • - | |
| Detecting time | • - | |
| FAIL SAFE | • - | |

## Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## 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'

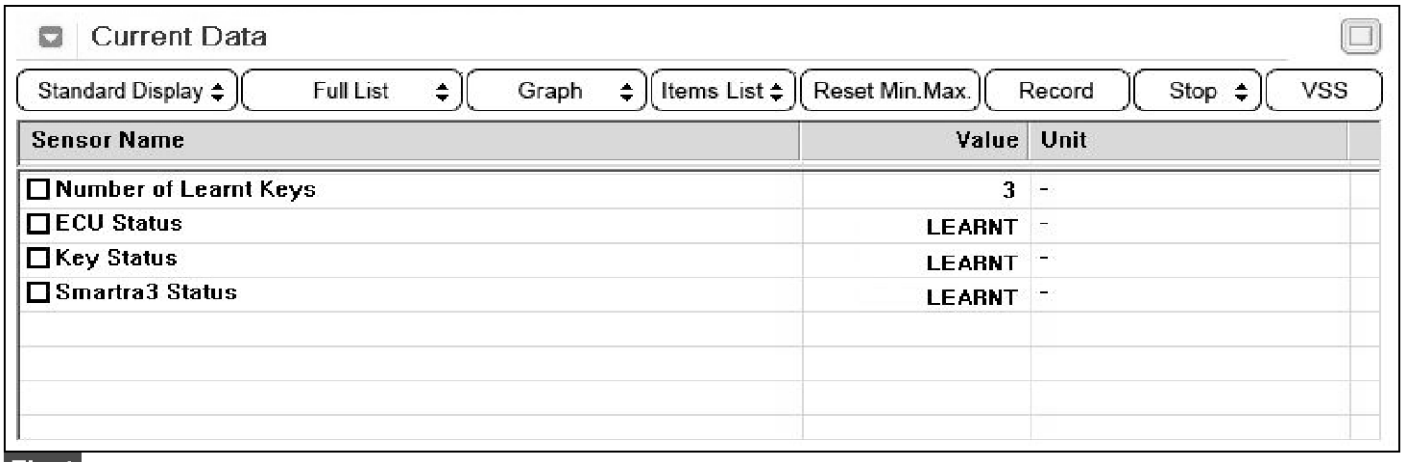



Fig.1

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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.

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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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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.<br>• Open/Short in control harness<br>• Faulty PCM/ECM |
| Enable Conditions | • IG ON | |
| Threshold value | • Short to GND, Wiring open | |
| Detecting time | • - | |
| FAIL SAFE | • - | |

## Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## 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

### ■ 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

**NO** ▶Check for open or short in harness. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

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## Visual/Physical Inspection

### ■ 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

### ■ 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 looseness, 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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## P1693 Immobilizer-Transponder Error

### General Description

Refer to DTC P1675 : Immobilizer-Transponder Programming Error.

### 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<br>• More than one TP in the magnetic field<br>• No TP(Key without TP) in the magnetic field |
| Enable Conditions | • IG ON | |
| Threshold value | • - | |
| Detecting time | • - | |
| FAIL SAFE | • - | |

### Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

### 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'

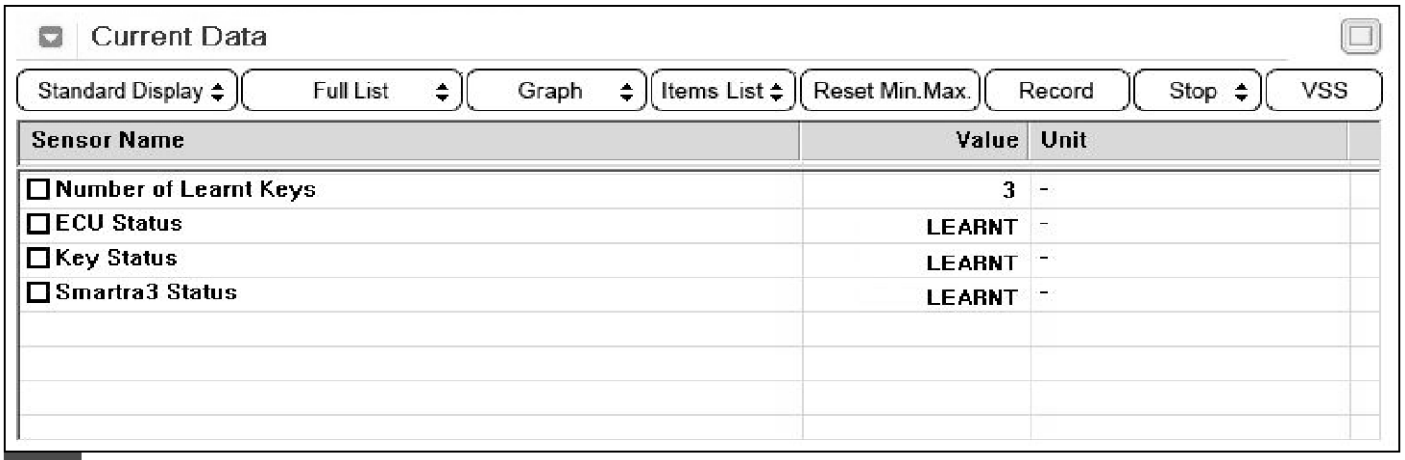



Fig.1

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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.

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## 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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. T-he 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<br>※ Protocol layer violation<br>- Invalid request<br>- Check sum error |
| Enable Conditions | • IG ON | |
| Threshold value | • - | |
| Detecting time | • - | |
| FAIL SAFE | • - | |

## Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## Monitor Scantool Data

1. Check status
   1) IG "ON" & Engine "OFF"
   2) Monitor the "ECU, KEY and Smartra STATUS' P-arameter on the Scantool.

**Specification :** 'LEARNT'

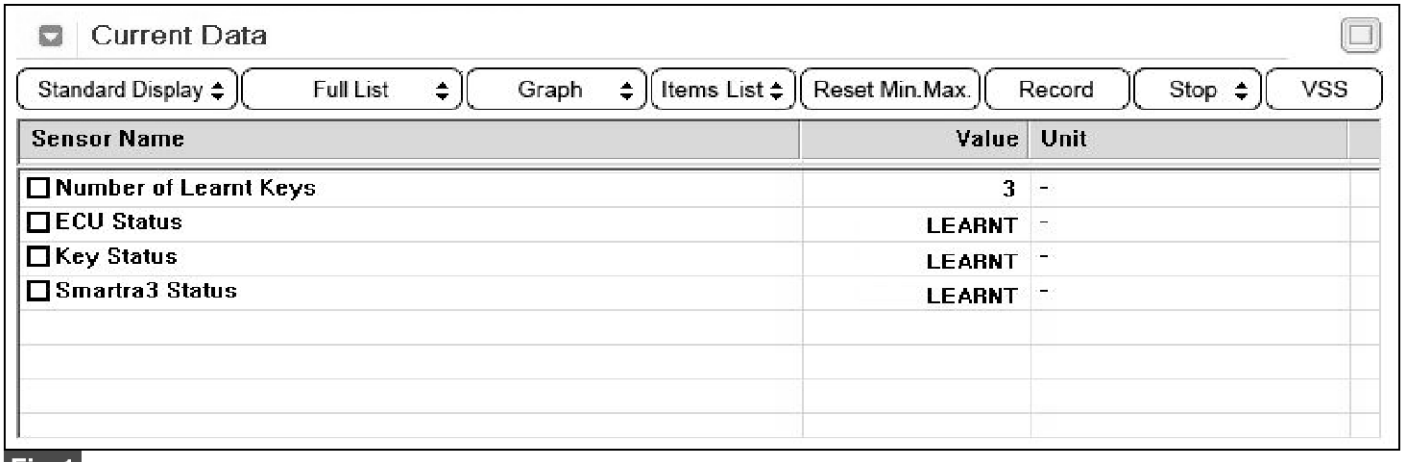



Fig.1

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Fig1) This data show that 3 keys have been taug-ht, ECU has been learnt, Key in key cylinder has been learnt and SMARTRA3 has been learnt

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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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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'

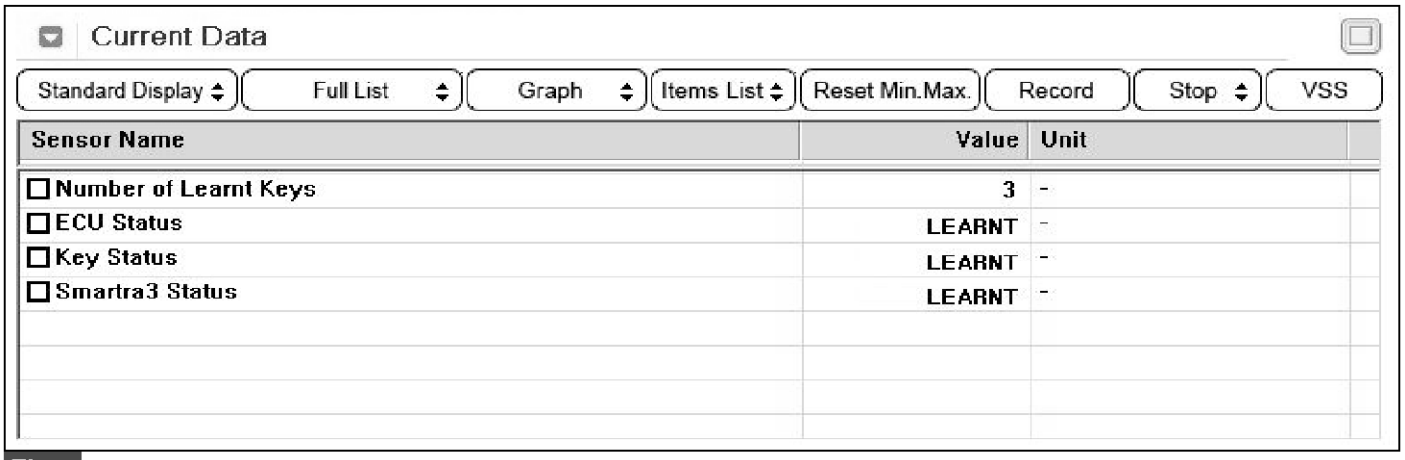



Fig.1

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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

Refer to DTC P1694 : Immobilizer-EMS Message Error.

## Verification of Vehicle Repair

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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## P1696 Immobilizer-Authentication Fail

### General Description

Refer to DTC P1675 : Immobilizer-Transponder Programming Error.

### 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”<br>• Learnt(Invalid) TP at PCM/ECM status “Learnt” | |
| Detecting time | • Immediately | |
| FAIL SAFE | • - | |

### Diagnostic Circuit Diagram

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

### 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'

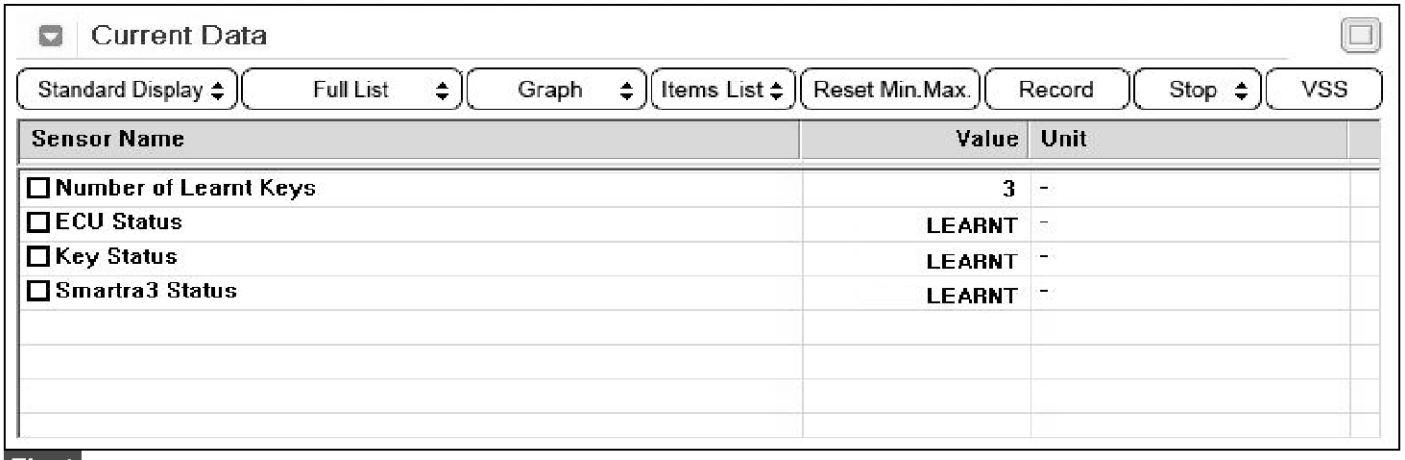



Fig.1

SBHBE9B02L

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.

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## 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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

## 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'

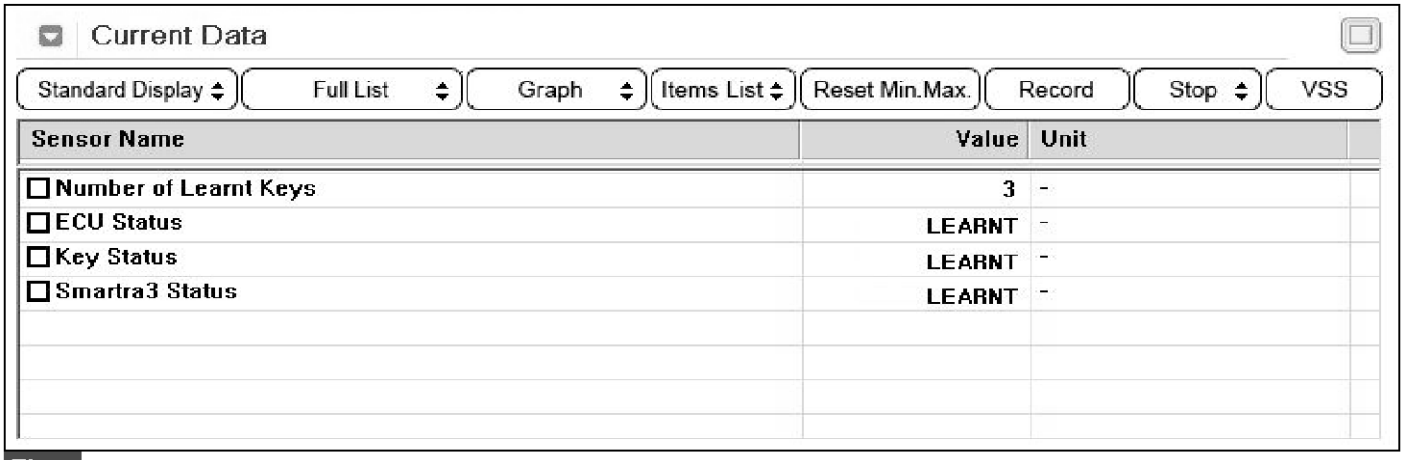



Fig.1

SBHBE9B02L

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

Refer to DTC P1610 : Non-Immobilizer-EMS Connected to an Immobilizer.

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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, integrated in IPM, 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, integrated in IPM, and ECM starts from wake-up signal from ECM.

2. After receiving wake-up signal from ECM, Smart Key ECM, which is integrated in IPM, 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 mormal 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, including the information Smart Key ECM in learnt mode and the PIN code.

## DTC Description

This ATC is set after Engine ECM seuds Wake-up signal, if response signal from IPM(Smart key ECM is Metgrated in it) is abnormal structure or is not valid message during Engine ECM Communication.

## DTC Detecting Condition

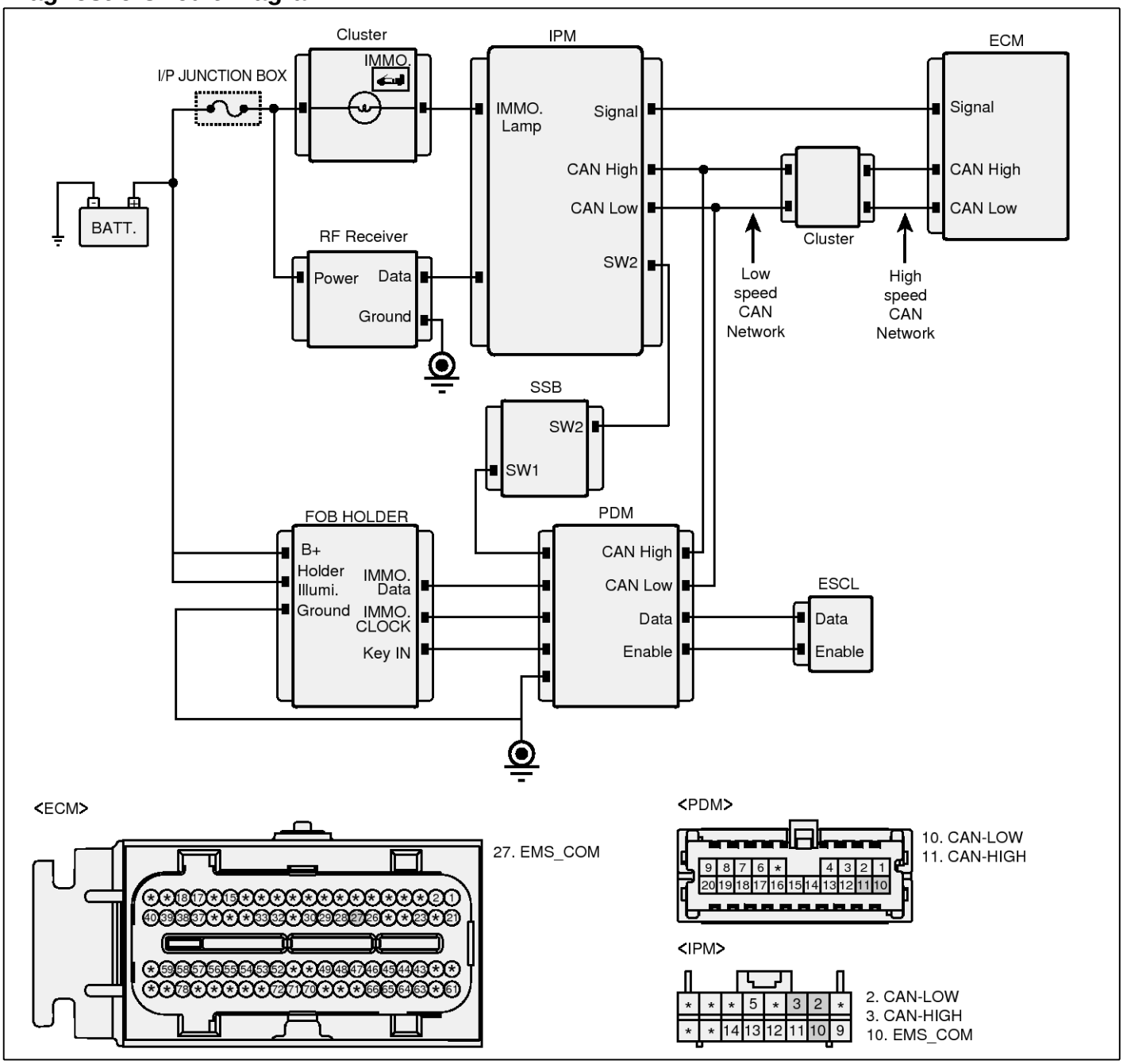
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| Enable Conditions | • IG ON | • Smart Key ECM(integrated in IPM) |
| Detecting time | • 1.5 seconds | |
| Threshold value | • Data error or timing error<br>1. Data error : Head value error, checksum value error, Smart Key status unknown error<br>2. Timing Error : : There is no valid message during Engine ECM communication | |

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## Diagnostic Circuit Diagram




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## Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF".
2. Erase DTC after connecting Scantool.
3. Check IPM status if DTC is retrieved.

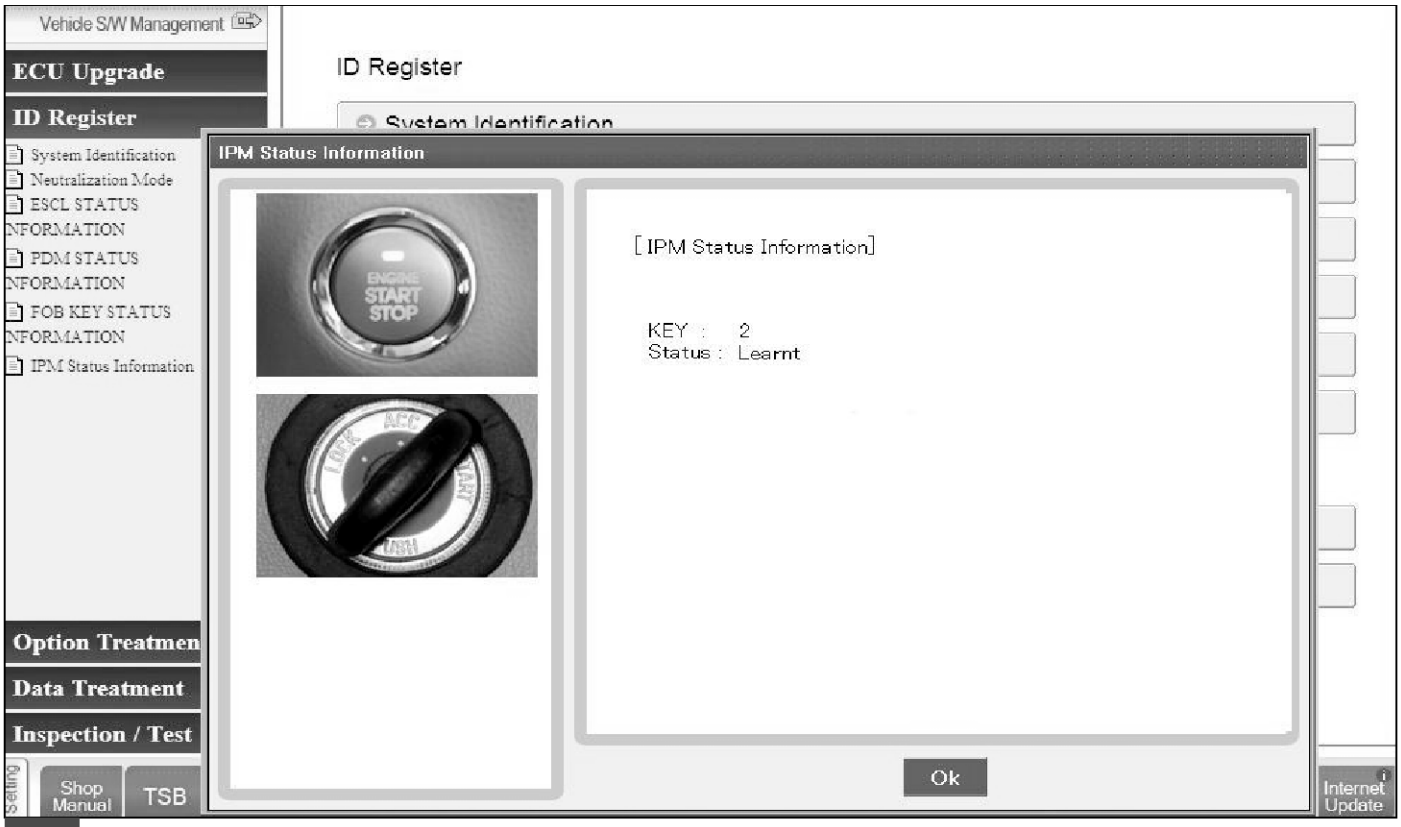



FIG.1

SBHBE9BA1L

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 (Integrated in IPM) learnt status ?

**YES** ▶ Fault is intermittent caused by poor contact in Smart 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.

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## Component Inspection

Check Smart Key ECM(Integrated in IPM) insepction

1. IG KEY "ON" & Engine "OFF"
2. Neutralize smart key ECM(Integrated in IPM) with scantool.
3. Perform key teaching procedure for smart key ECM(Integrated in IPM) with scantool.

**⚠CAUTION**
**Pin code must be prepared to Neutralize Smart Key ECM and to perform key teaching procedure.**

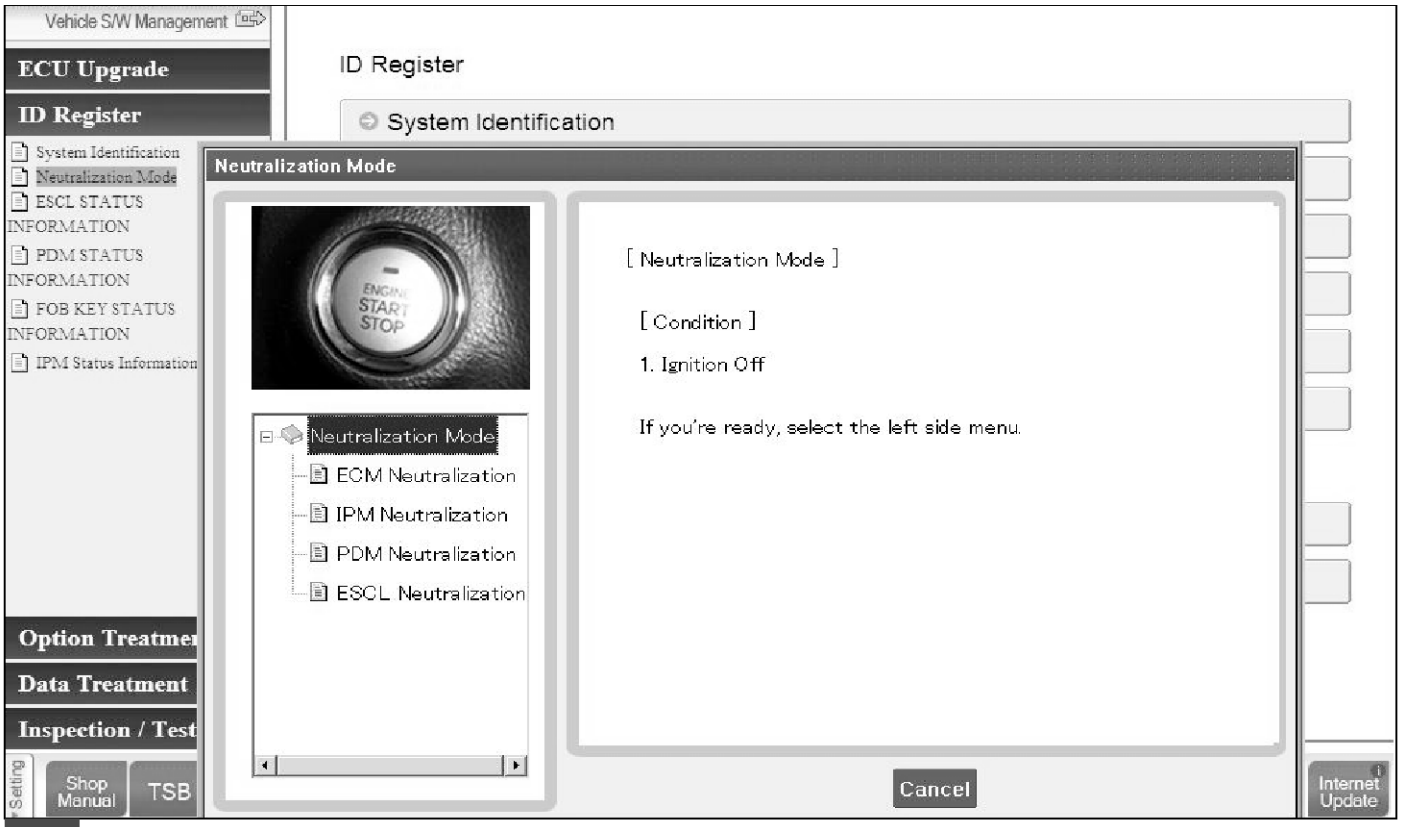



FIG.1

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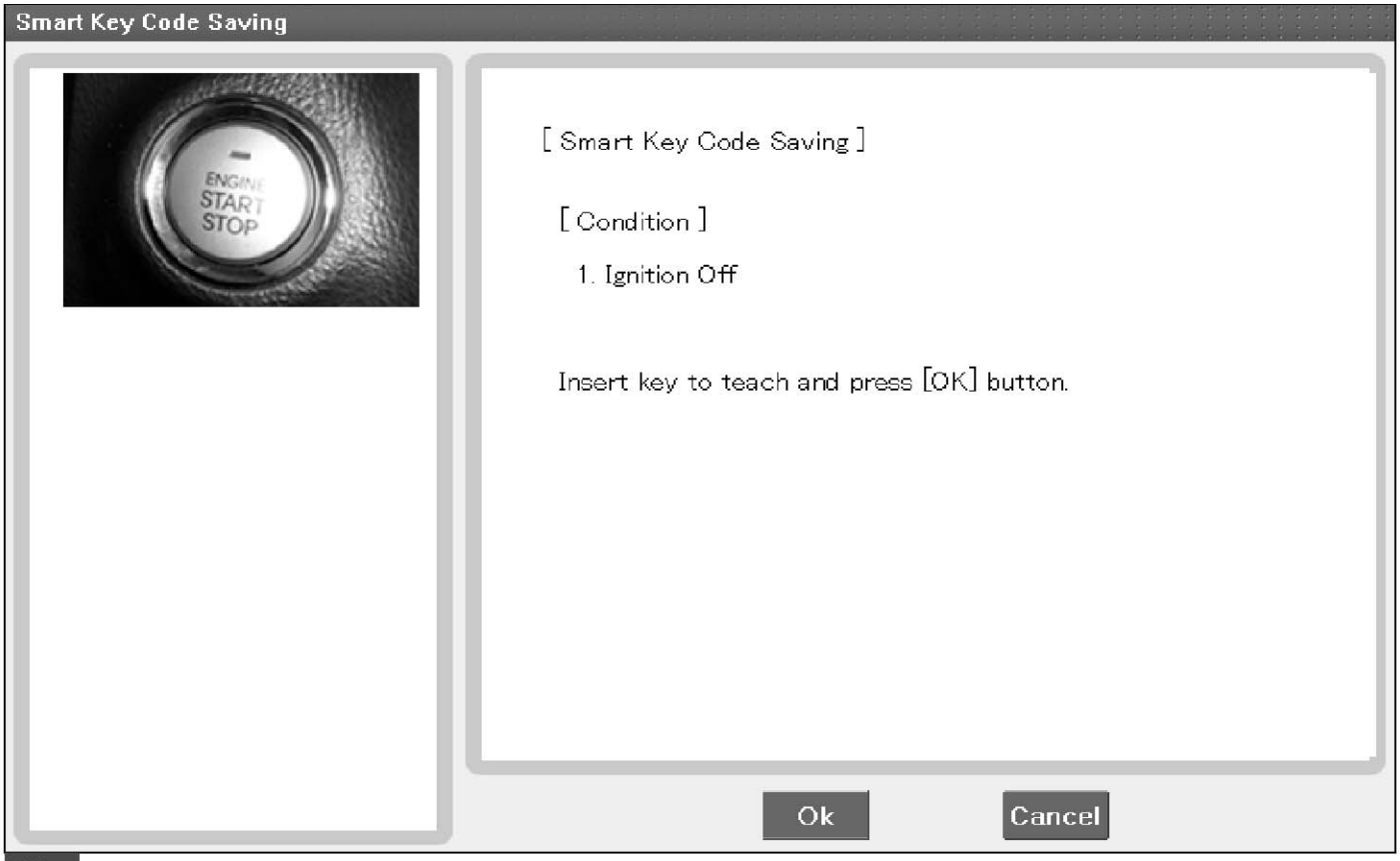



FIG.2

SBHBE9BA3L

Fig.1) neutralization

Fig.2) Key Teaching

4. Is the neutralization of Smart Key ECM, Engine ECM and key teaching normal ?

**YES** ▶ Fault is intermittent caused by poor contact in Smart ECM(Integrated in IPM) 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 (integrated in IPM), 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 scantool (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 neutralied status.*

■ *It is possible to acess to All of the learning procedue only with scantool. 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 scantool that makes registering all of the component.In case of replacing each module, New registration should be done with scantool)*

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● *IPM Learning*

*1. Before learning procedure for FOB Key, PDM or ESCL, IPM should be registered PIN code first.*

*2. In case of replacing IPM, All of the keys should be newly registered again.*

*3. In case that IPM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.4. If the battery is discharged while 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 shott off and previous PIN is used for communication with PDM and IPM*

● *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 scantool and check "ECM status and Smartkey ECM status,which is in the IPM'
2. selet "Diagnostic Trouble Codes(DTCs)" mode and then clear DTC.
3. Operate the vehicle and monitor the DTC on the scantool
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

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## DTC Description

DTC P1676 is set if the conditon is met as follows : Although Engine ECM sends wake up signal to Smart Key ECM(Integrated in IPM), Engine ECM has not received any signals related starting engine.

## DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| Enable Conditions | • IG ON | • Open or short in circuit<br>• Faulty Smart Key ECM (integrated in IPM) |
| Detecting time | • 1.5 seconds | |
| Threshold value | • No response form Smart Key ECM ( Communication line error -Open or short) | |

## Diagnostic Circuit Diagram

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF".
2. Erase DTC after connecting Scantool.
3. Check IPM status parameter if DTC is retrieved

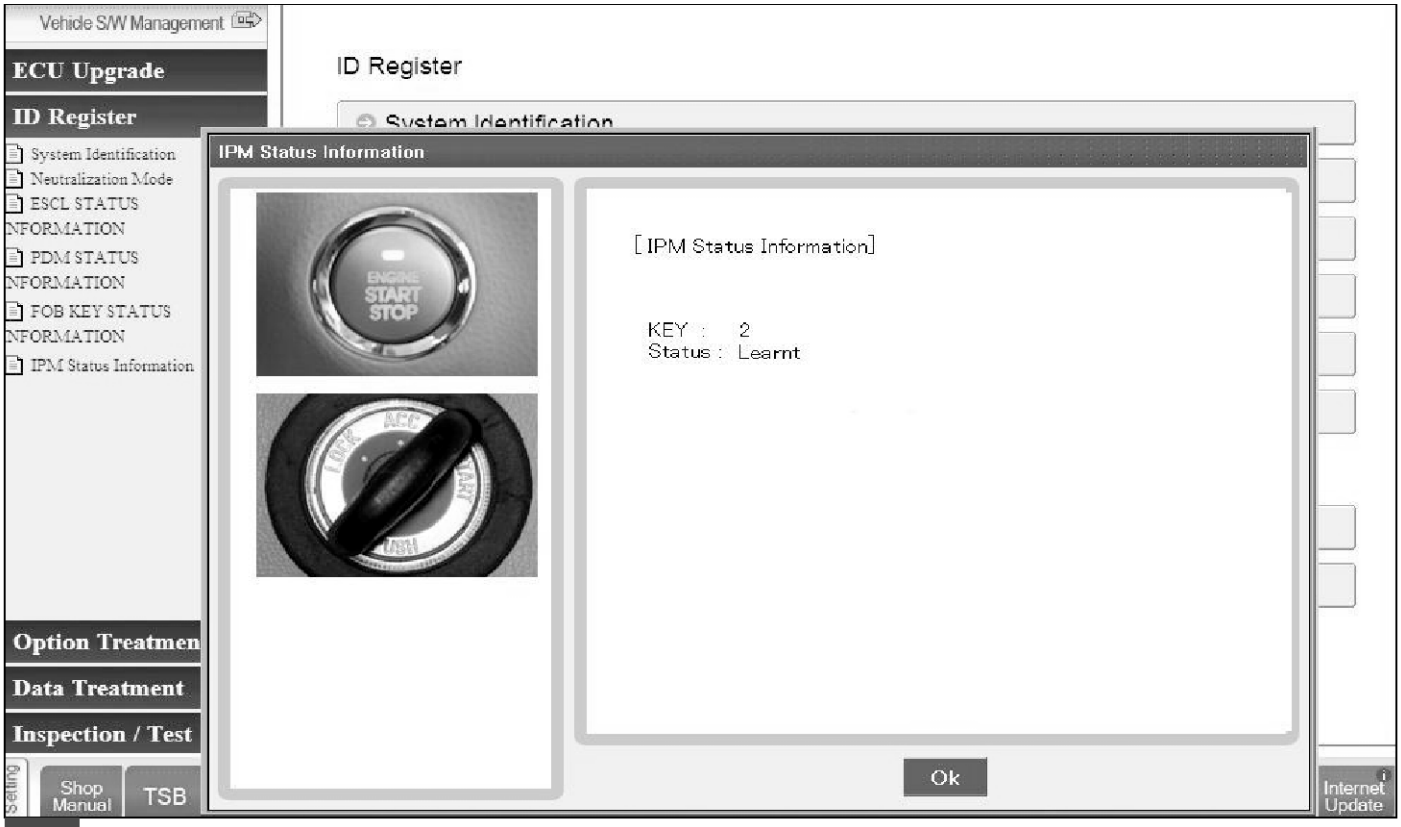



FIG.1

SBHBE9BA1L

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 (Integrated in IPM) learnt ?

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**YES** ▶ Fault is intermittent caused by poor contact in Smart 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 ?

**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

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## Verification of Vehicle Repair

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

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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, FOB key is inserted in FOB holder, 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 P696.

## DTC Detecting Condition

| 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)<br>- No DTC P1676 but wrong VIN or MIN | |

## Diagnostic Circuit Diagram

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

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## Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF".
2. Erase DTC after connecting Scantool.
3. Check IPM status if DTC is retrieved.

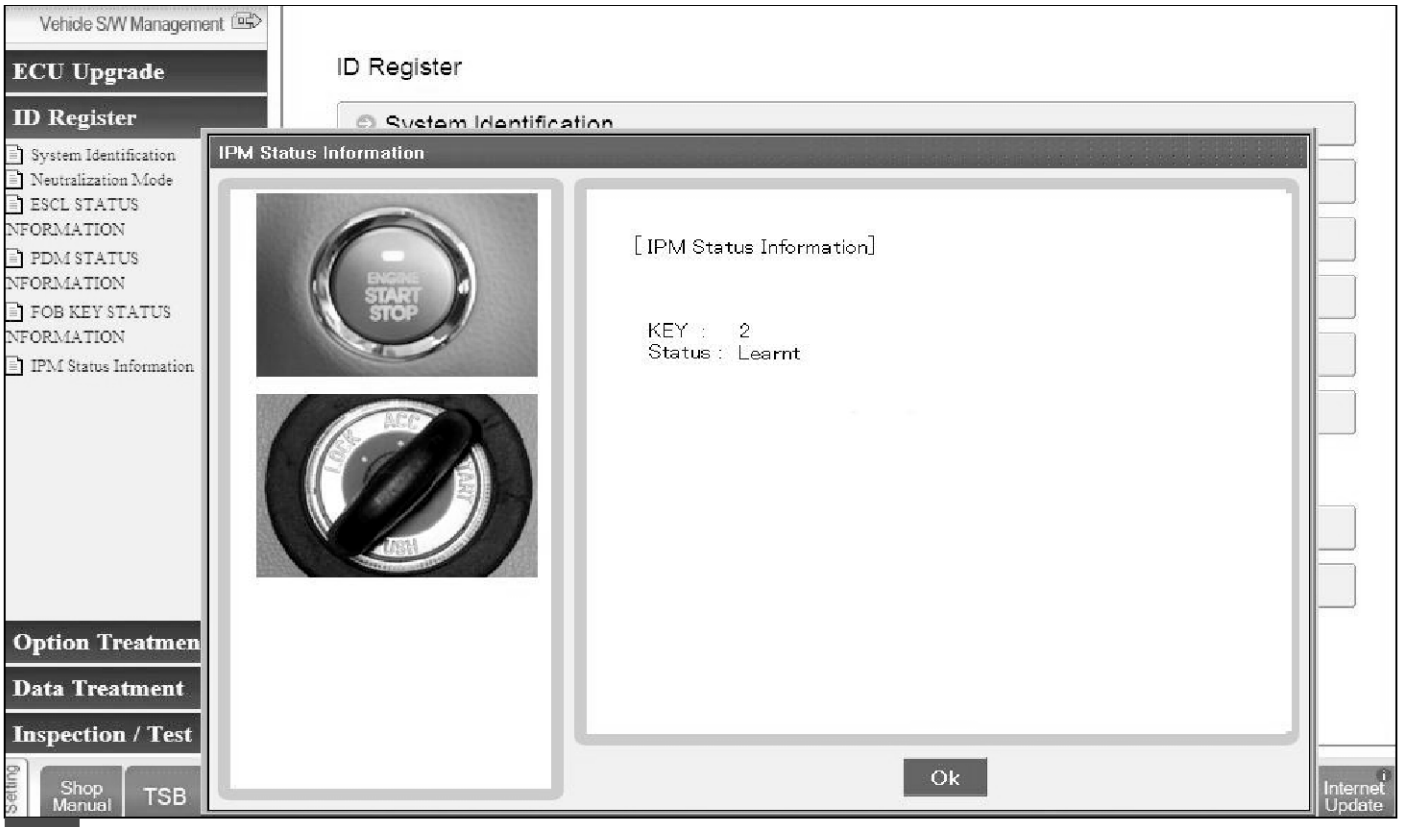



FIG.1

SBHBE9BA1L

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 (Integrated in IPM) learnt status ?

**YES** ▶ Fault is intermittent caused by poor contact in Smart 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

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## Verification of Vehicle Repair

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

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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 inimum 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

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

## Monitor Scantool Data

1. IG KEY "ON" & Engine "OFF".
2. Connect scantool 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)*

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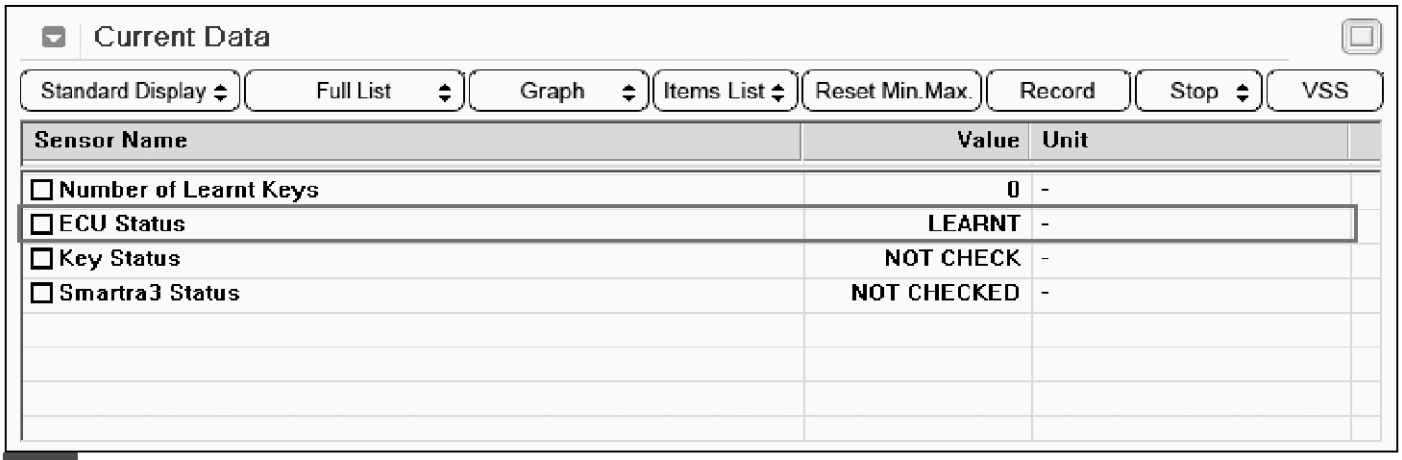



Fig.1

SBHBE9BA4L

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 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 (integrated in IPM), 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 scantool (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 neutralied status.*

■ *It is possible to acess to All of the learning procedue only with scantool. 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 scantool that makes registering all of the component.In case of replacing each module, New registration should be done with scantool)*

● *IPM Learning*

*1. Before learning procedure for FOB Key, PDM or ESCL, IPM should be registered PIN code first.*

*2. In case of replacing IPM, All of the keys should be newly registered again.*

*3. In case that IPM receives 3 times with wrong PIN, It is not allowed for neutralization and Key Teaching for 1 hour.4. If the battery is discharged while 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 shott off and previous PIN is used for communication with PDM and IPM*

● *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

Refer to DTC P1676 : Immobilizer-Smartra Message Error.

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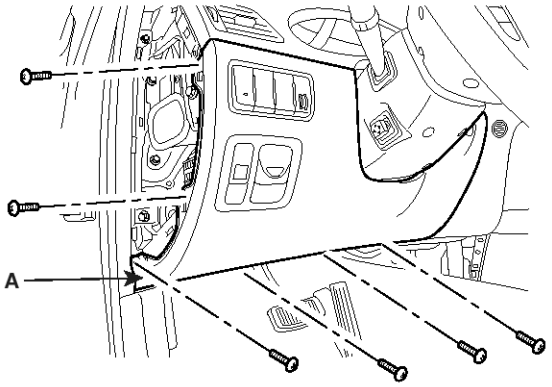
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## Immobilizer Control Unit

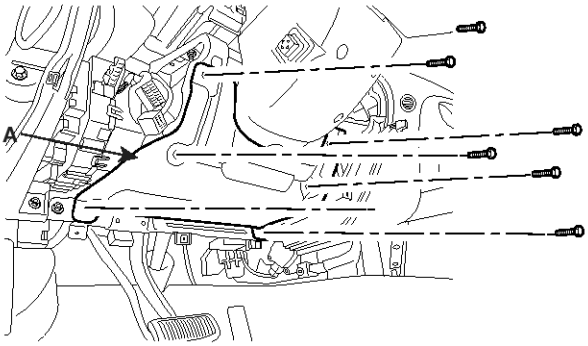
### Removal

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



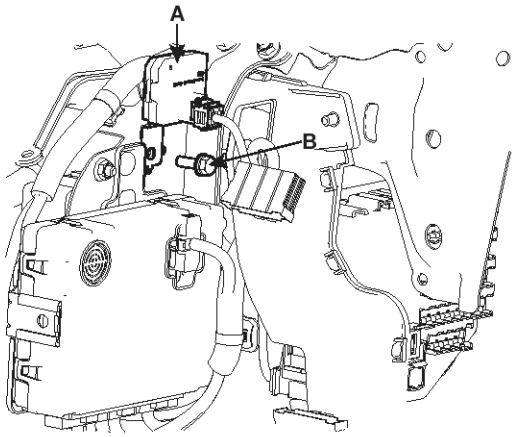

SBHBE8089D

3. Remove the reinforcing panel (A).




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4. Disconnect the 5P connector of the SMARTRA unit a-nd then remove the SMARTRA unit (A) after looseni-ng a nut (B).




SBHBE8063D

### Installation

1. Install the immobilizer control unit after connecting th-e unit connector.
2. Install the reforcing panel.
3. Install the crash pad lower panel.

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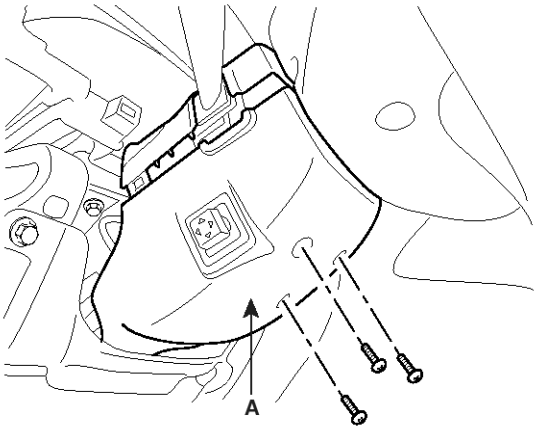
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## Antenna Coil

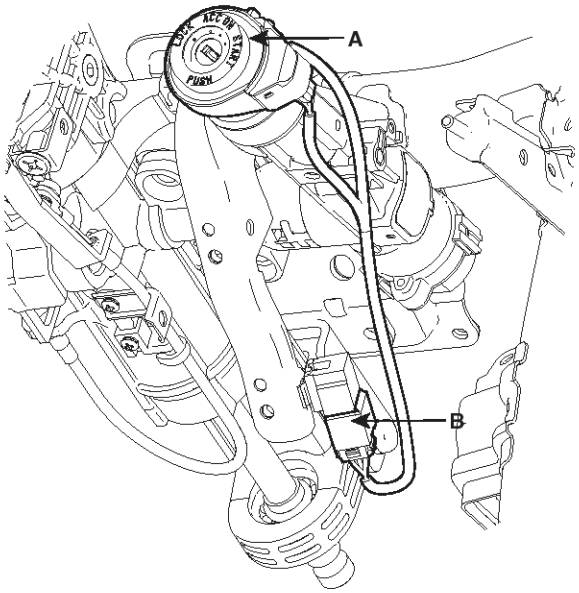
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering clumn upper(A) and lower(B) shrouds. (Refer to the ST group - "Steering column and shaft").




SBHBE8091D

3. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.




SBHBE8092D

### Installation

1. Install the coil antenna and connect the 6P connector .
2. Install the steering column upper and lower shrouds.

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# Front / Rear Parking Assist System

## Front / Rear Parking Assist System Control Unit

### Specifications

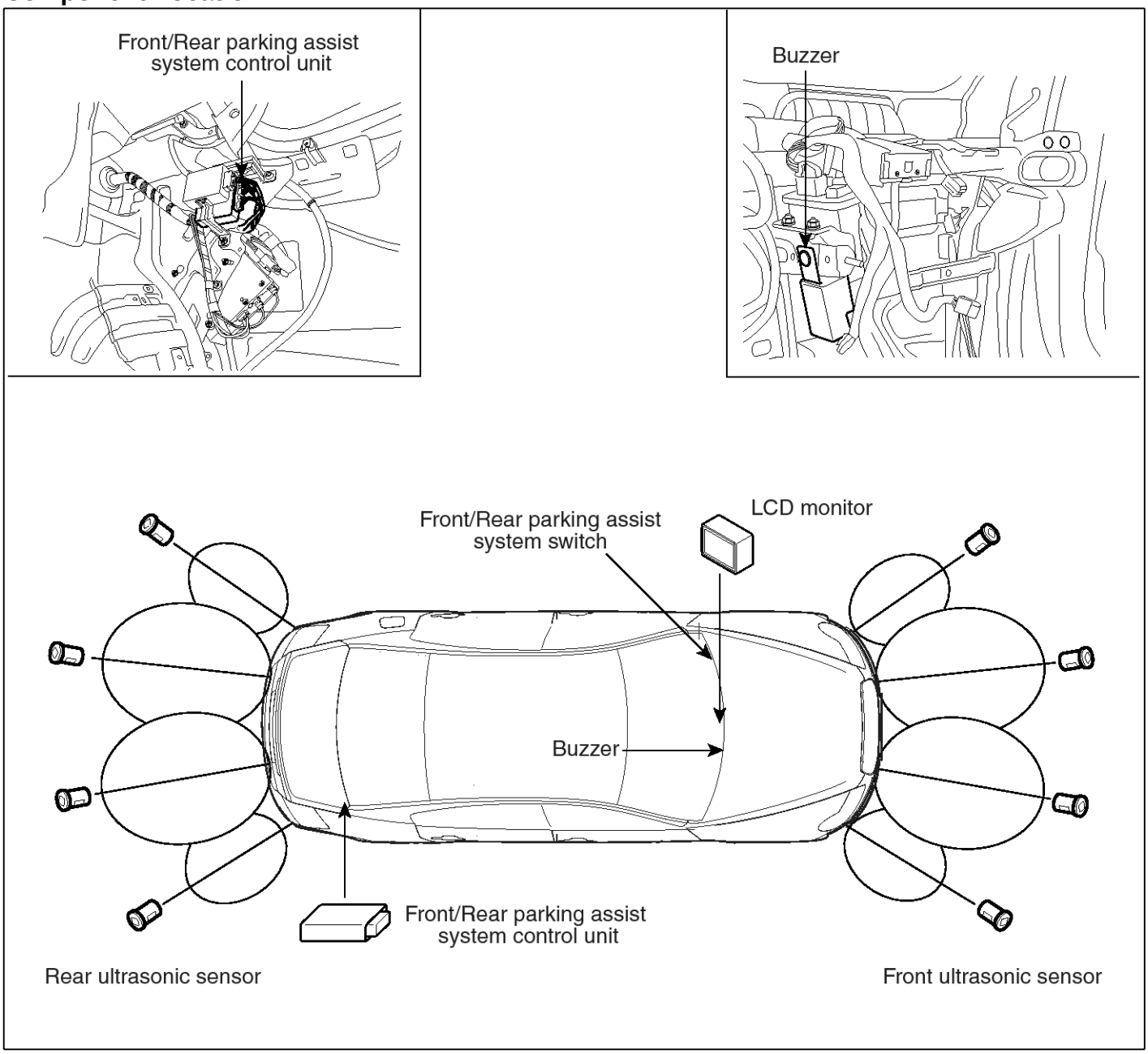
| Item | | Specification |
|---|---|---|
| Rear parking assist system control unit | Voltage rating | DC 12V |
| | Operation voltage | DC 9 ~ 16 V |
| | Operation temperature | -30˚C ~ + 75˚C |
| | Operation current | MAX 600 mA |
| | Operation frequency | 50 ± 5 KHz |
| | Detective method | Direct and indirect detection |
| Ultrasonic sensor | Voltage rating | DC 8 V |
| | Detecting range | 40 cm ~ 120 cm |
| | Operation voltage | DC 7 ~ 9 V |
| | Operation current | MAX 20 mA |
| | Operation temperature | -30˚C ~ + 75˚C |
| | Beam width | Horizontal : 60±5˚(70cm), Vertical : 40±5˚(50cm) |
| | Operation frequency | 50 ± 5 KHz |
| | Number of sensors | 8 (front :4, rear : 4) |
| Piezo buzzer | Voltage rating | DC 12 V |
| | Operation voltage | DC 9 ~ 16 V |
| | Operation temperature | -30˚C ~ + 80˚C |
| | Operation temperature | -40˚C ~ + 85˚C |
| | Operation current | MAX 60 mA |
| | Sound, tone | Oscillation frequency : 2.0±0.5 KHz |
| | | Sound level : MIN 65 dB (DC 13V, 1m) |

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## Component Location




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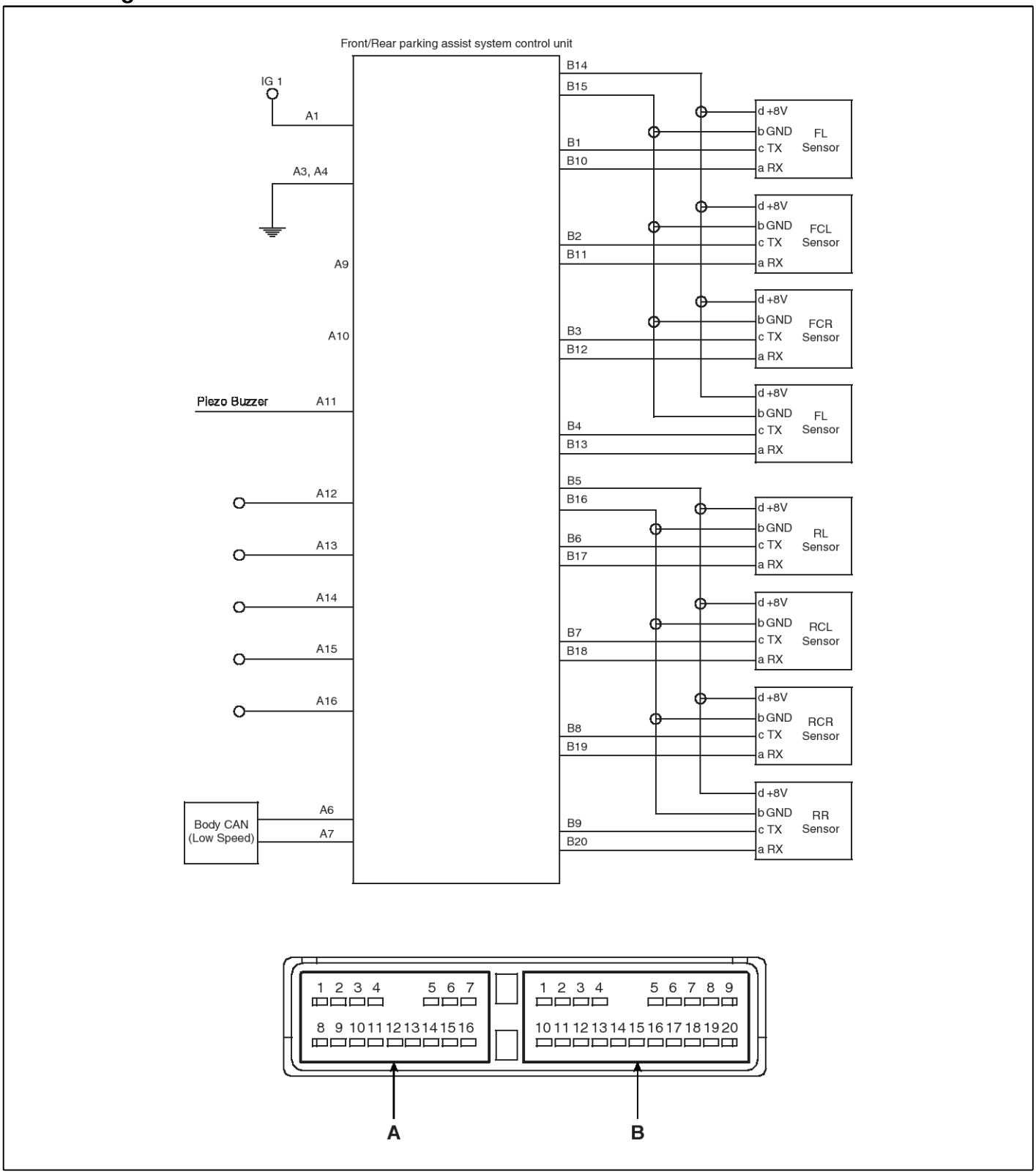
- First alarm : Object comes near to the sensor located at the rear of vehicle, within 81~120cm±15cm
- Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41~80cm±10cm
- Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm±10cm

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## Circuit Diagram

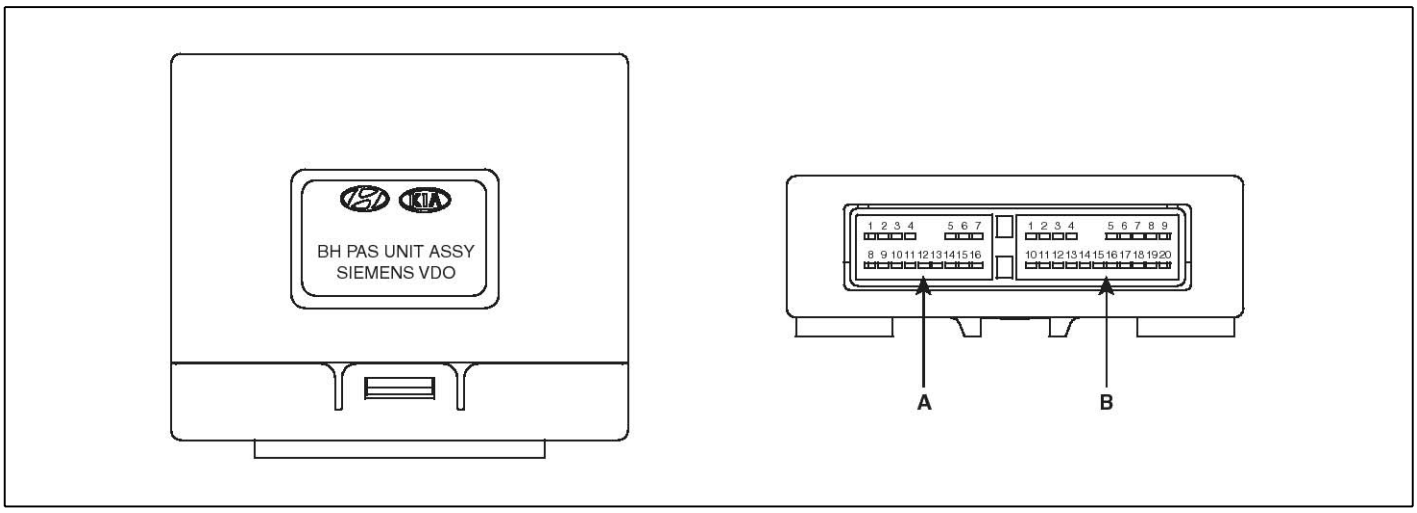



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SBHBE9220L

**Pin configuration**

| 20 pin connector (B) | | 16 pin connector (A) | |
|---|---|---|---|
| **Pin** | **Description** | **Pin** | **Description** |
| 1 | Front left Tx | 1 | Power |
| 2 | Front left center Tx | 2 | - |
| 3 | Front right center Tx | 3 | GND |
| 4 | Front right Tx | 4 | GND |
| 5 | Power sensor rear | 5 | - |
| 6 | Rear left Tx | 6 | CAN high |
| 7 | Rear left center Tx | 7 | CAN low |
| 8 | Rear right center Tx | 8 | - |
| 9 | Rear right Tx | 9 | - |
| 10 | Front left Rx | 10 | - |
| 11 | Front left center Rx | 11 | Buzzer |
| 12 | Front right center Rx | 12 | FBWS switch |
| 13 | Front right Rx | 13 | Camera switch |
| 14 | Power sensor front | 14 | Camera position switch |
| 15 | GND sensor front | 15 | - |
| 16 | GND sensor rear | 16 | - |
| 17 | Rear left Rx | | |
| 18 | Rear left center Rx | | |
| 19 | Rear right center Rx | | |
| 20 | Rear right Rx | | |

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## Description

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, back warning system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm) .

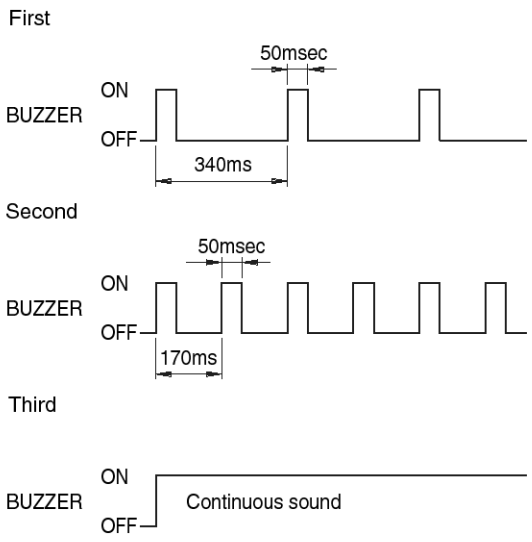
## Alarm Range

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.

First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm

Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm

Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm




LTKG976C

**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.*

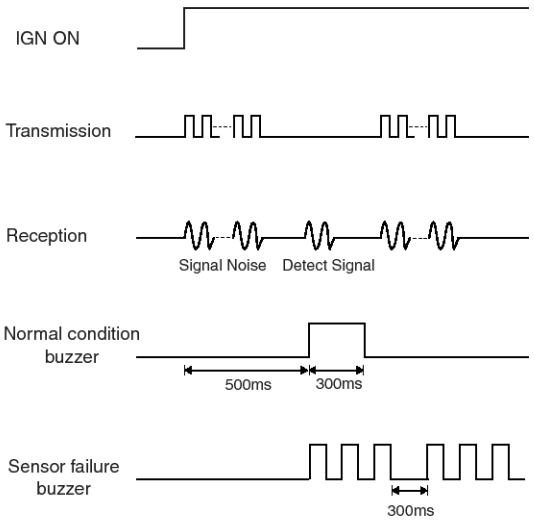
   *For moving target, maximum operation speed shall be target approach speed of 10km/h.*
4. *When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.*
5. *False alarm, or failure of the alarm to trigger may occur in the following conditions.*
   - *Irregular 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.*

## 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.




LTKG760B

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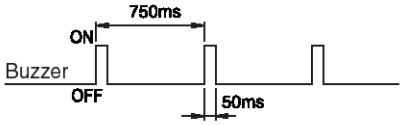


2. DIAGNOSIS MODE

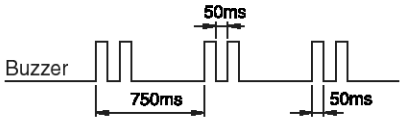
Switch on diagnosis mode upon system failure.

In case of system failure, then it indicates the failed point as follows.

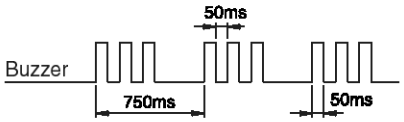
(1) Left sensor failure buzzer



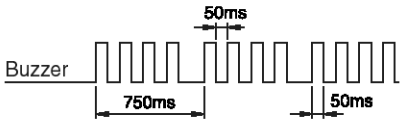

(2) Left center sensor failure buzzer




(3) Right center sensor failure buzzer




(4) Right sensor failure buzzer




SBHBE9221L

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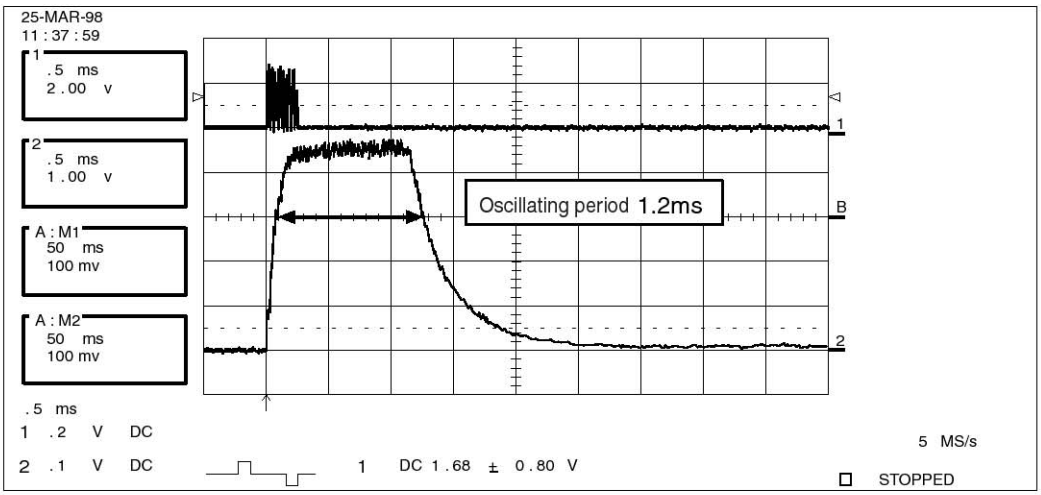


### Sensor Connection Checking

Transmit ultrasonic wave to the sensors, boost input signal, and detect wave.

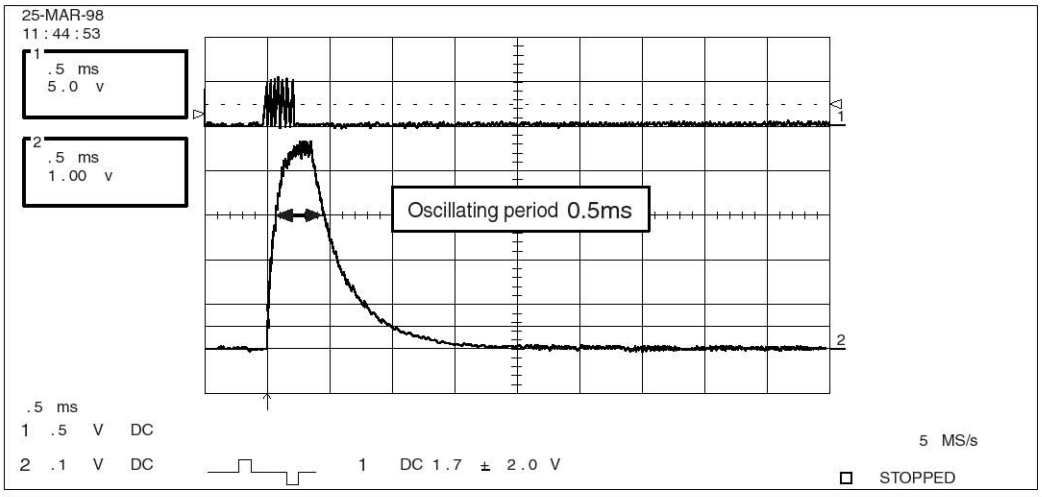
Waveform will be found, oscillating for a certain period of time.

1. Waveform for a normal sensor connection




BTKG230F

2. Waveform for a failed sensor connection




BTKG230G

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**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. Right sensor failure : beep beep-beep beep-beep beep

c. Rear-right sensor failure : beep beep beep-beep beep beep-beep beep beep

d. Right side sensor failure : beep beep beep beep-beep beep beep beep-beep beep beep beep

**Warning**

1. Range detected by back sensors is limited.

   Watch back before reversing

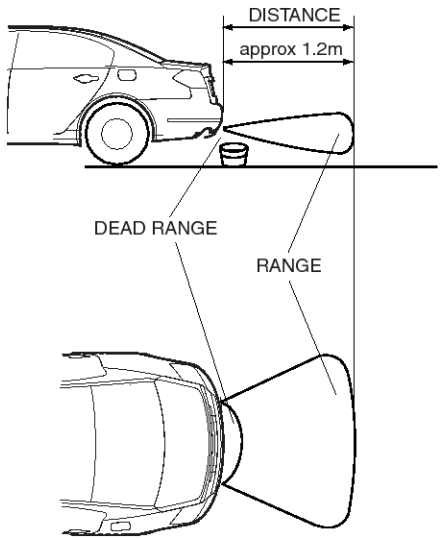
2. There is a blind spot below the bumper. Low objects ( for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.

3. Besides there are some materials unable to be detected even in detection range as follows.

   1) Needles, ropes, rods, or other thin objects.

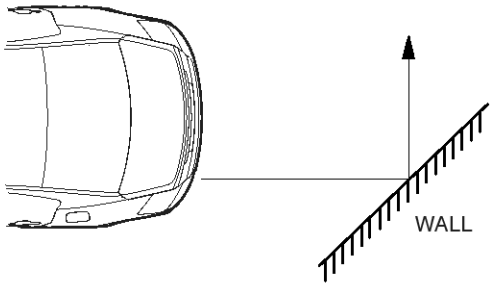
   2) Cotton, snow and other material absorbing ultrasonic wave

      (for example, fire extinguisher device covered with snow)



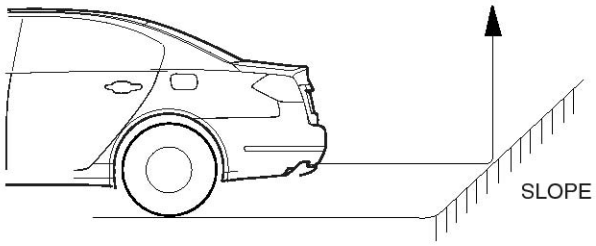

SBHBE9222L

4. Reversing toward the sloped walls.




SBHBE9223L

5. Reversing toward the sloped terrain.




SBHBE9224L

6. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Always visually check the area behind the vehicle before backing up.

   The sensors cannot discriminate between materials.

7. Sensors may not operate correctly in the below conditions.

   Ensure sensors are clean from mud or dirt

   1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water.

      Do not wipe or scrape sensor with a rod or a hard object.

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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

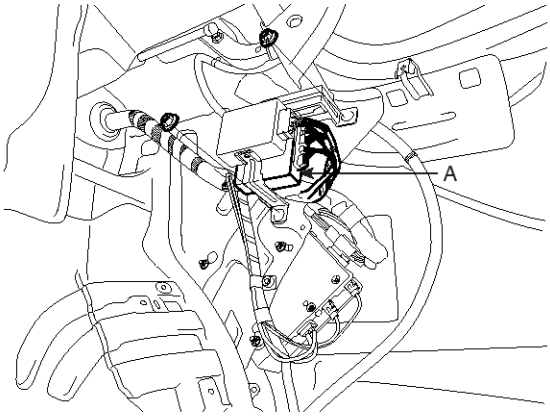
8. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.
9. Be careful not to apply shock during sensor installation on the transmission or reception unit.
10. When adding electrical devices or modifying 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.

## Removal

1. Remove the rear right luggage side trim of the trunk ( Refer to the Body group - "Interior trim")
2. Loosen the mounting nuts and remove the rear parking assist system control unit (A) from the quarter panel.




SBHBE8004D

## Installation

1. Reassemble the rear parking assist system control module.
2. Reassemble the rear right luggage side trim of trunk.

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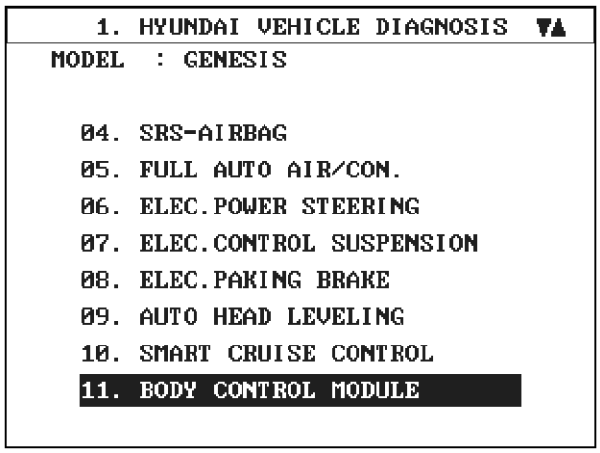
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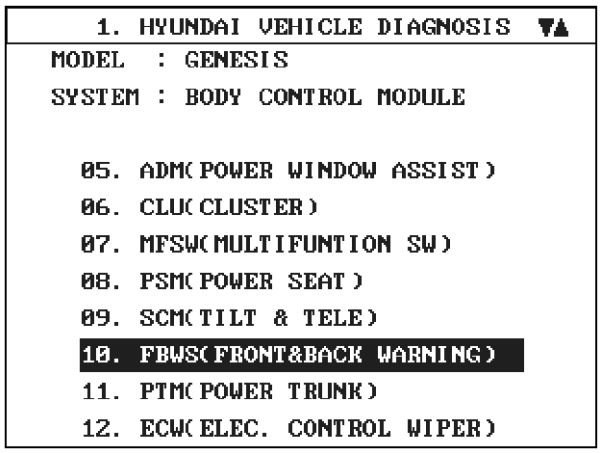
## Inspection

### Diagnosis With Scan Tool

1. It will be able to diagnose defects of front/rear parking assist system with scan tool quickly. Scan tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select model and "Body control unit" and "FBWS".

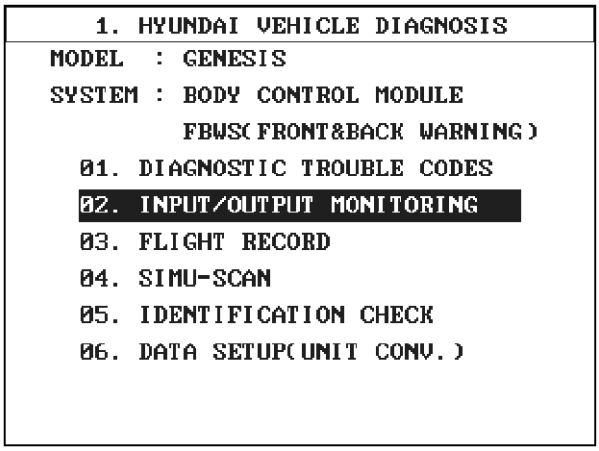



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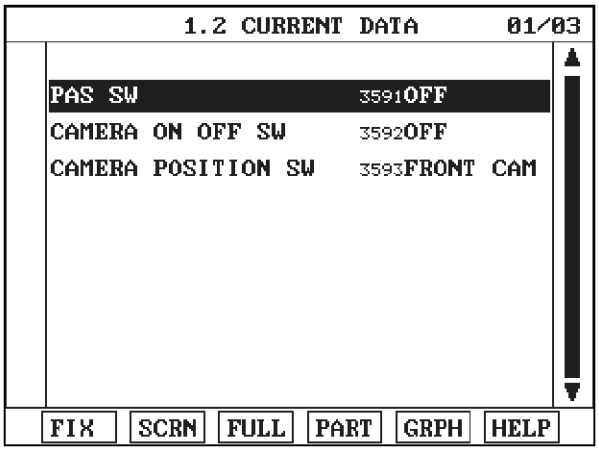



SBHBE9326L

3. Select "Input/output monitoring", if you will check current data of FBWS system. It provides input/output status of FBWS.

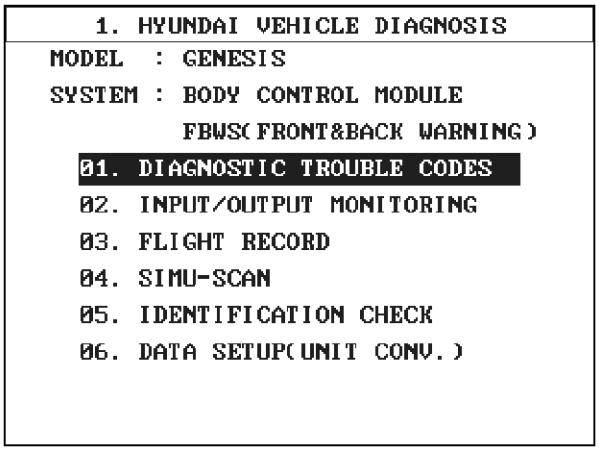



SBHBE9327L




SBHBE9328L

4. To check the DTC of the FBWS module, select "Diagnostic trouble codes"




SBHBE9329L

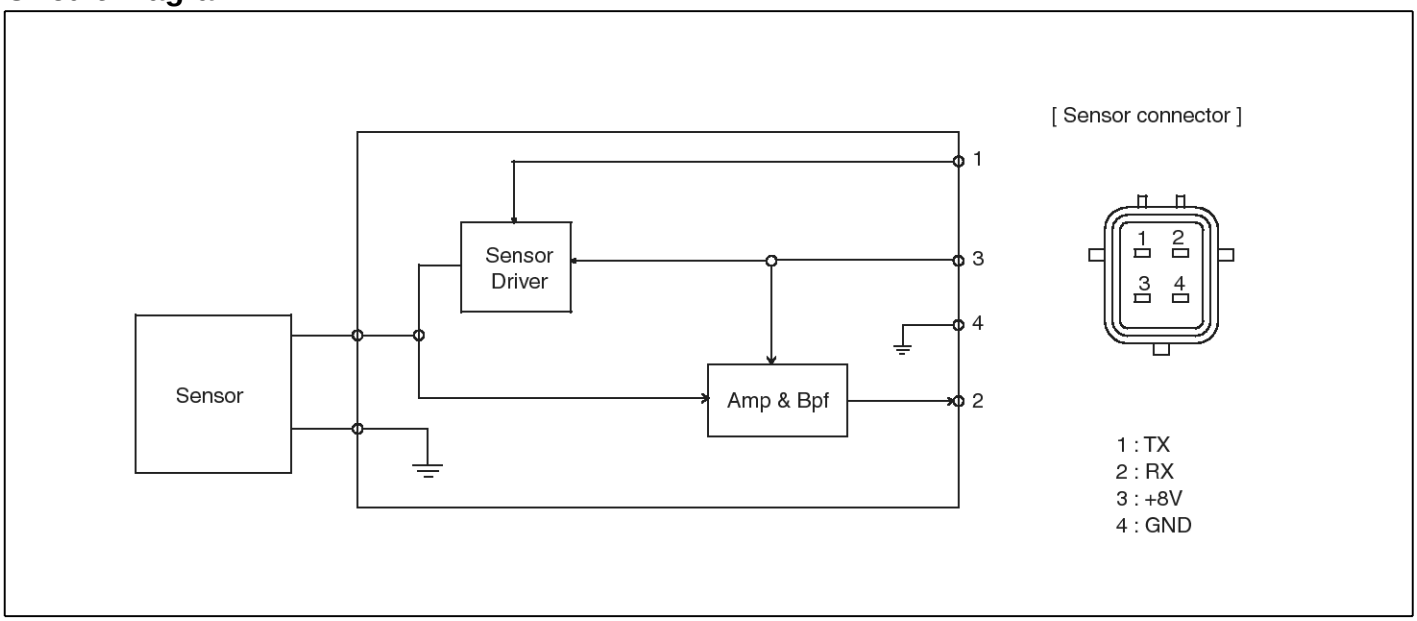
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## Parking Assist Sensor

### Circuit Diagram




SBHBE9225L

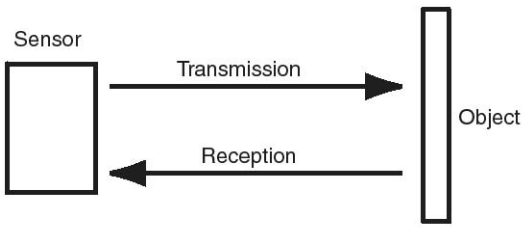
### Operation

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

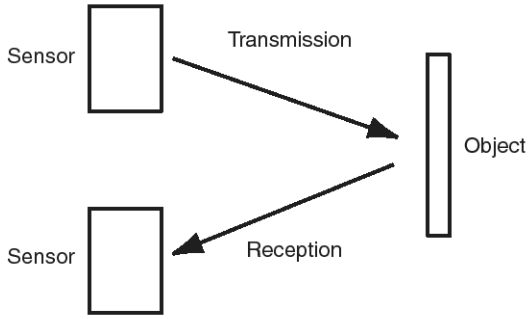
Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

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

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**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.

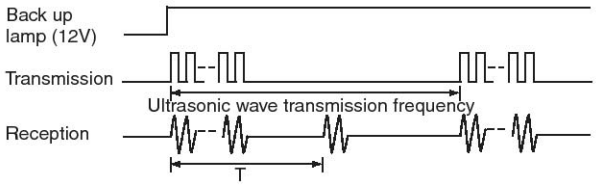
The propagation speed formula of ultrasonic wave in air is following :

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

ETRF762C

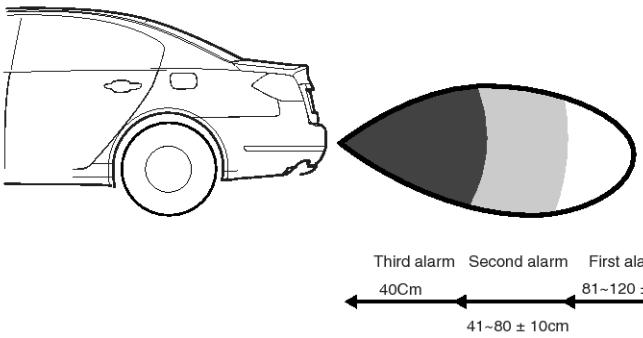
https://autolibrary.ir

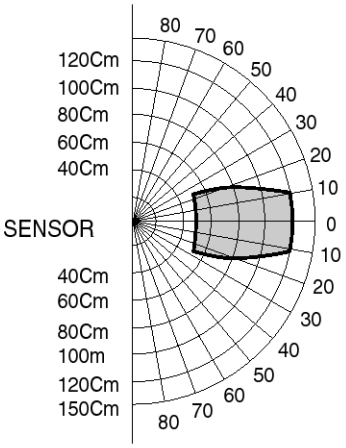
https://autolibrary.ir



## Sensor detection range

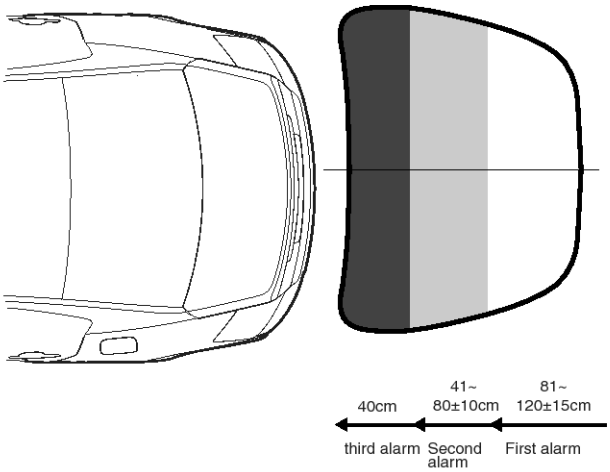
[Vertical range]

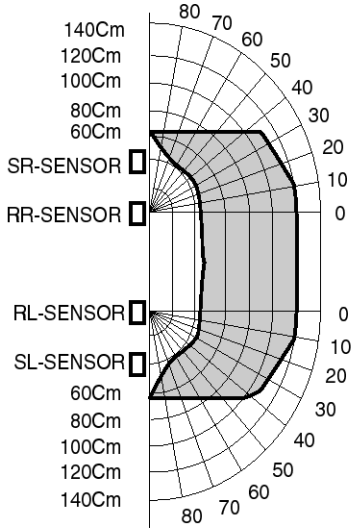



1. Distance tolerance(Messured at the front of sensor)
   - 81~120cm : ±15cm
   - 41~80cm : ±10cm
   - 40cm : ±10Cm
2. Detection tolerance
   - At 40cm :45˚ ± 15˚
   - At 80cm : 30˚ ± 15˚
   - At 120cm : 20˚ ± 15˚
3. At nearer distance than 40cm detection may occur.
4. Measurement condition : Room temperature (20℃), 90mm diameter, 3m 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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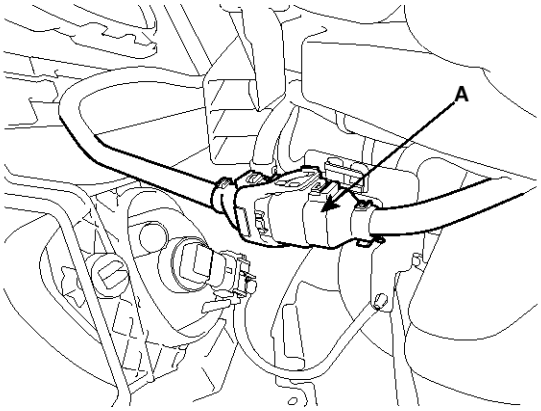


**NOTICE**

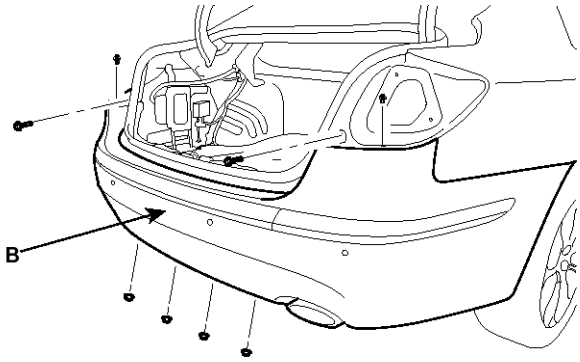
1. *14cm (Diameter) plastic rod is used for the test target.*
2. *The test result may differ by a different target object.*
3. *Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.*
4. *The following object may not be detected.*
   - *Sharp object or thin object like rope.*
   - *Cotton, sponge, snow or other materials absorbing sonic wave.*
   - *Smaller objects than 14cm (Diameter), 1m length.*

## Removal

1. Remove the rear bumper (B) after removing the connector (A). (Refer to the Body group - Rear bumper)

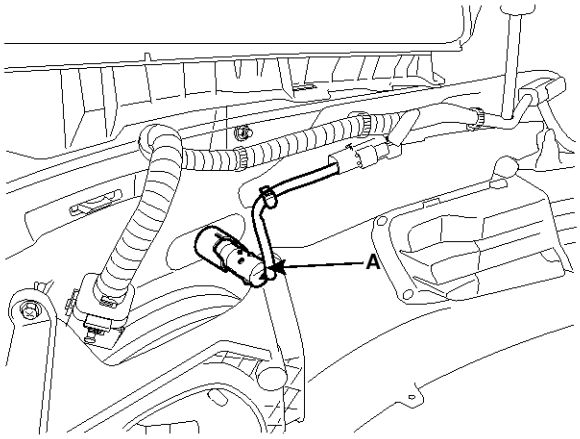



SBHBE8116D

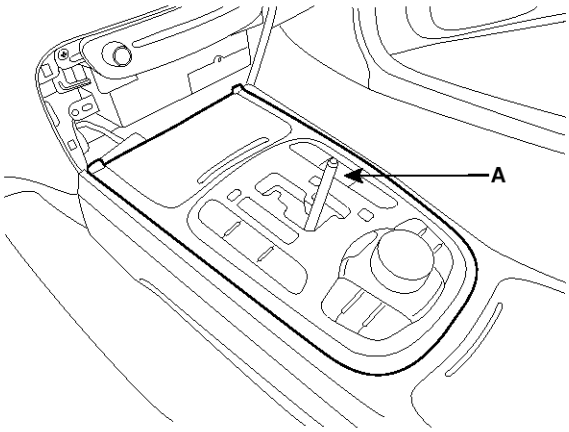



SBHBE8117D

2. Disconnect the sensor connector at the inside of the rear bumper, and then remove the sensor (A) from the housing.




SBHBE8118D




SBHBE8119D

**CAUTION**

**Be careful not to damage the sensor housing.**

## Installation

1. Connect the connector, and then install the sensor.
2. Install the rear bumper.

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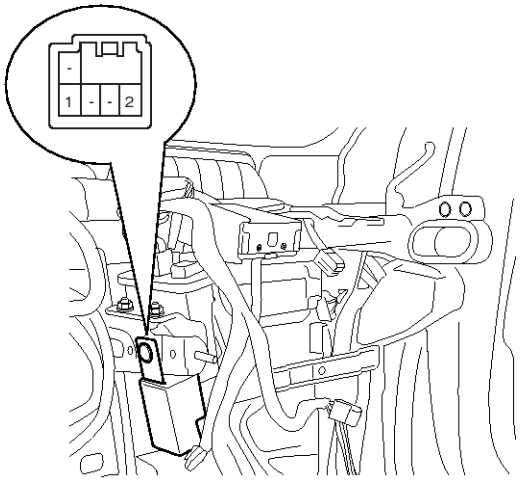
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## Buzzer

### Inspection

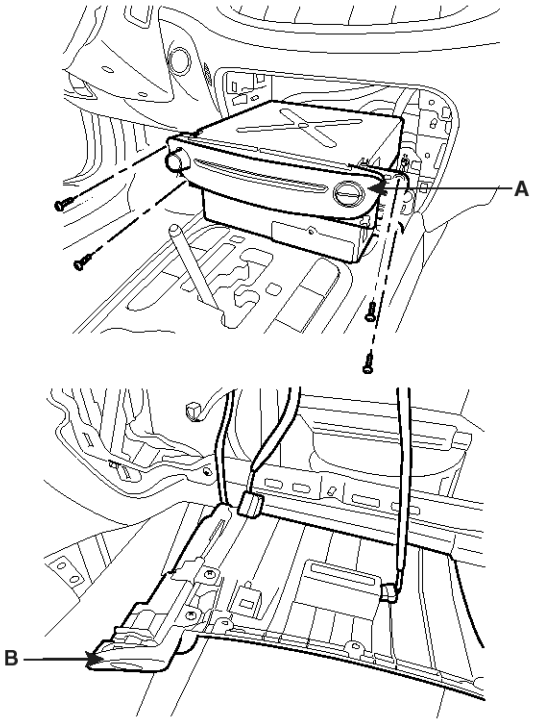
Test the buzzer by connecting battery voltage to the 1 terminal and ground the 2 terminal. The buzzer should make a sound. If the buzzer fails to make a sound, replace it .




SBHBE8006D

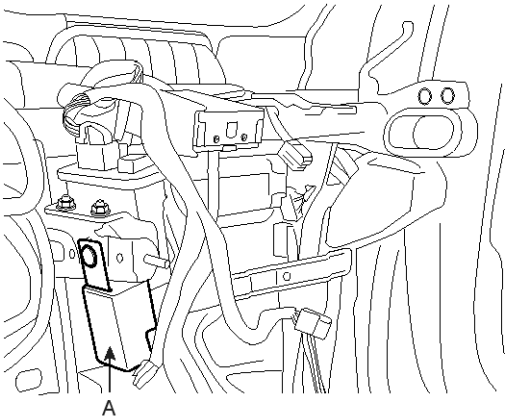
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the audio head unit (A) and glove box (B). ( Refer to the Body group - Audio, Glove box)




SBHBE8007D

3. Remove the buzzer (A) after removing the connector and nut.




SBHBE8008D

### Installation

1. Install the buzzer and connector.
2. Install the audio head unit and glove box.

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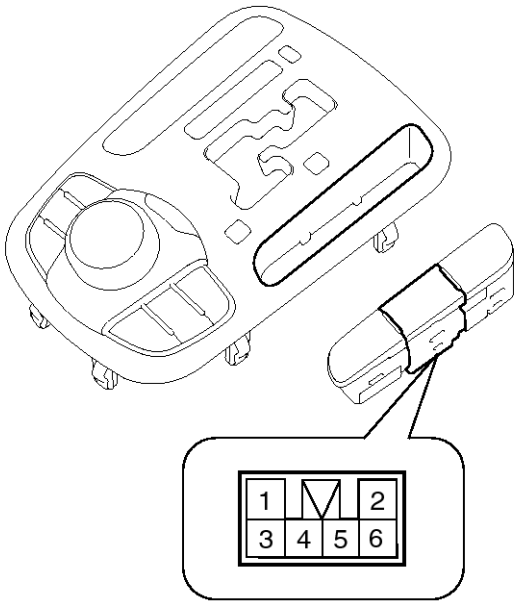
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## Front Rear Parking Assist System Switch

### Inspection

1. Check for continuity between the terminals. If continuity is not specified, replace the switch.



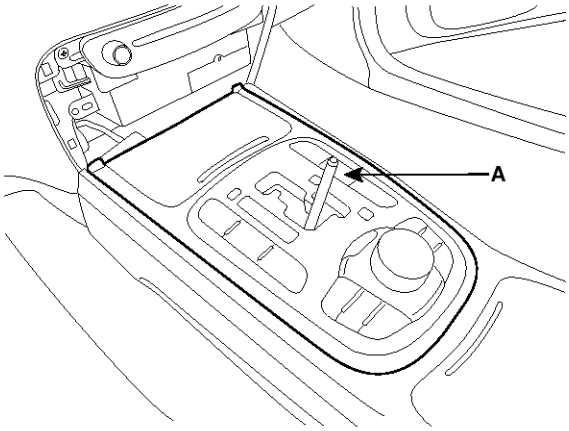

SBHBE8011D

| Terminal / Position | 3 | 4 | 1 | 5 | 2 |
|---|---|---|---|---|---|
| ON | | | | | |
| OFF | | | | | |

SBHBE9227L

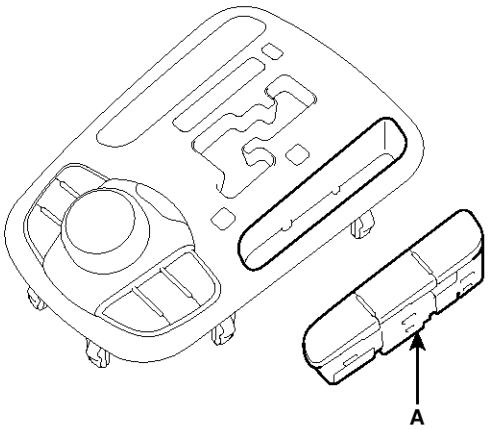
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the console under cover (A). (Refer to the Body group - Console)




SBHBE8119D

3. Remove the connector and switch assembly (A).




SBHBE8120D

### Installation

1. Install the connector and switch assembly.
2. Install the console under cover.
3. Connect the negative (-) battery terminal.

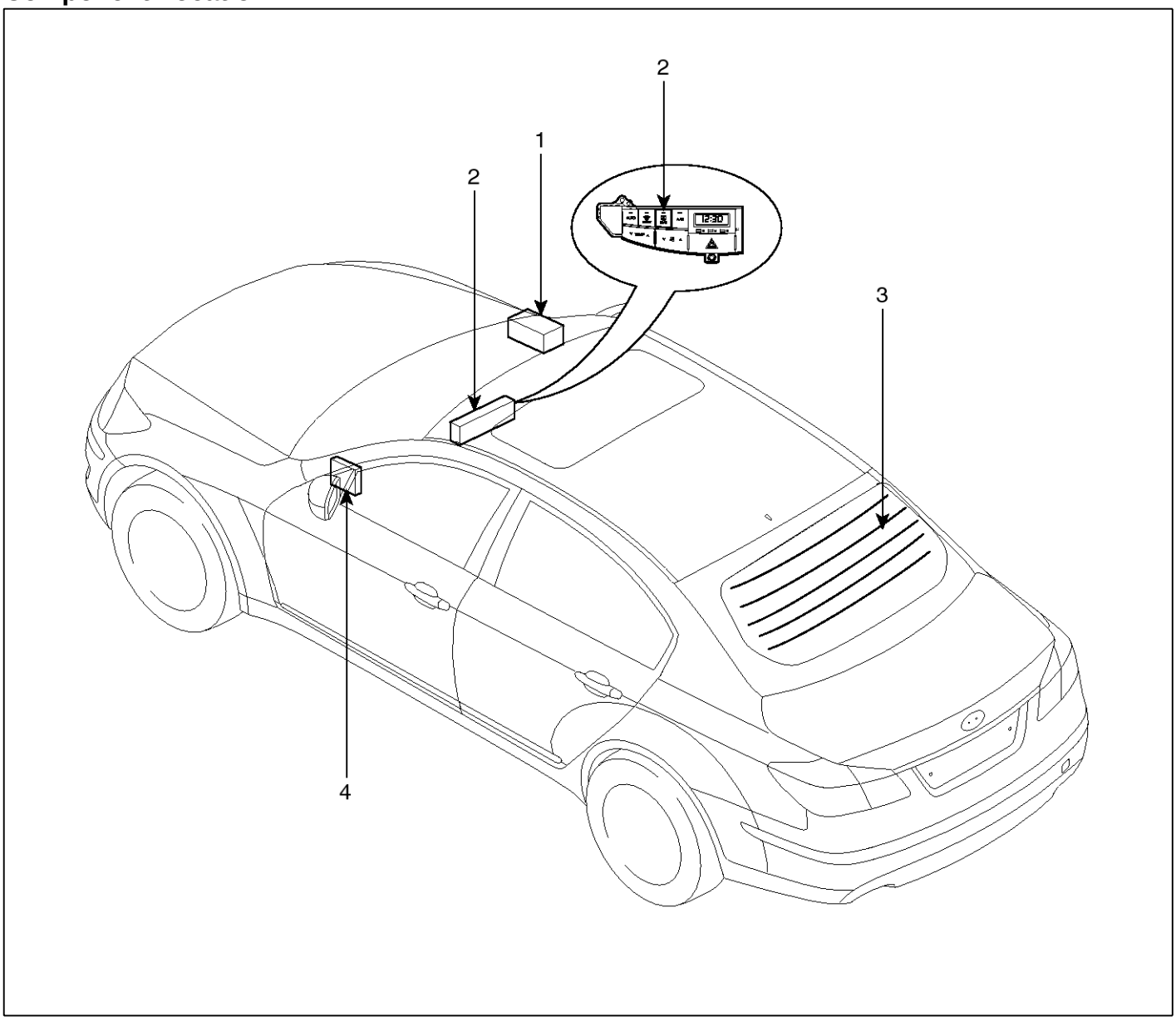
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# Rear Glass Defogger

## Component Location




SBHBE8947D

1. Engine room relay box (Rear glass defogger)
2. Rear glass defogger switch (A/C controller)
3. Rear glass defogger
4. IPM (Instrument Panel Module)

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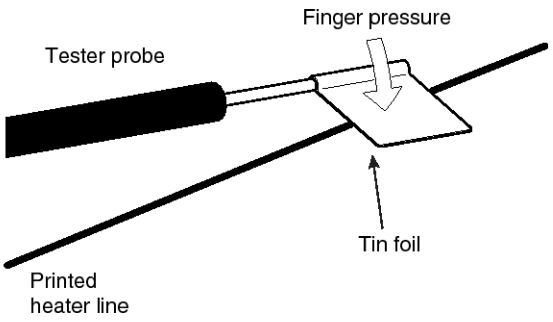


## Rear Glass Defogger Printed Heater

### Inspection

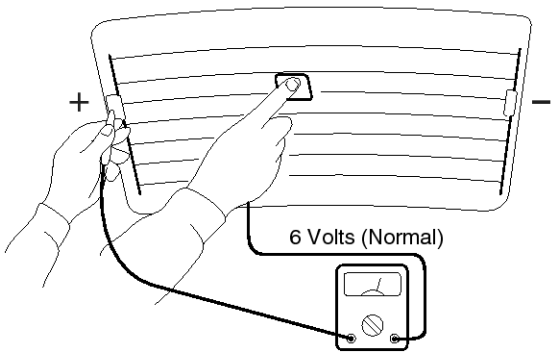
**⚠CAUTION**

**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.**



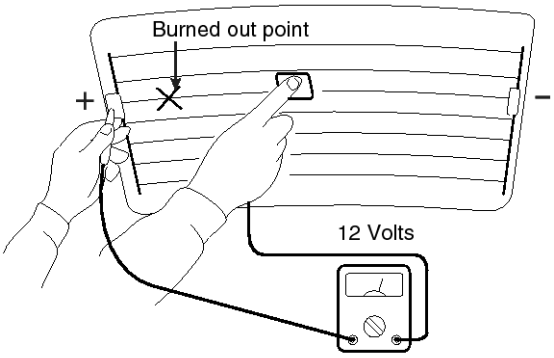

ETA9165A

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.



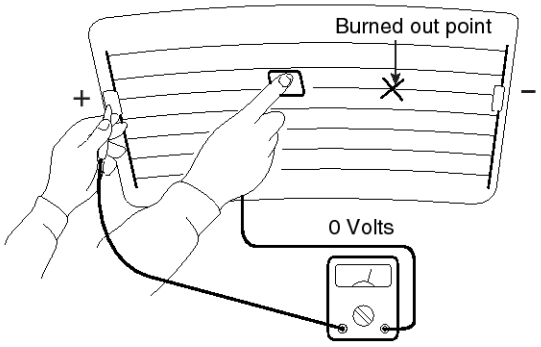

ETA9165B

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.



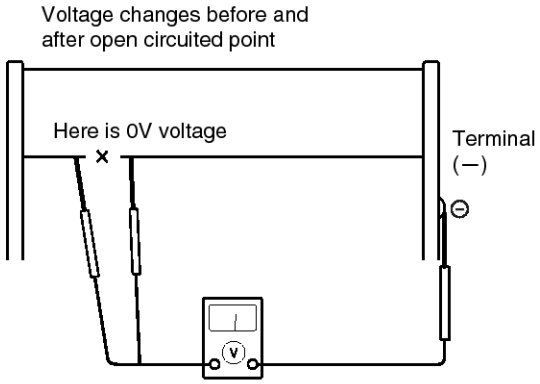

ETA9165D

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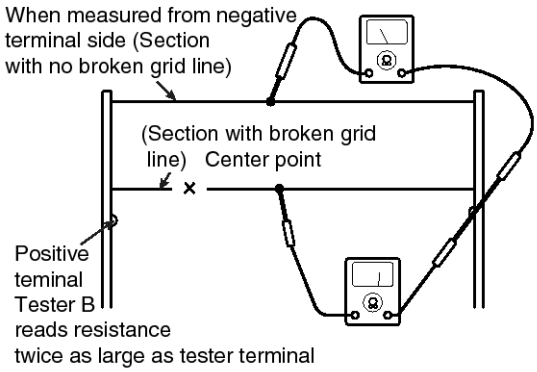


4. To check for open circuits, slowly move the test lead in the direction that the open circuit seems to exist. Try to find a point where a voltage is generated or changes to 0V. The point where the voltage has changed is the open-circuit point.




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.



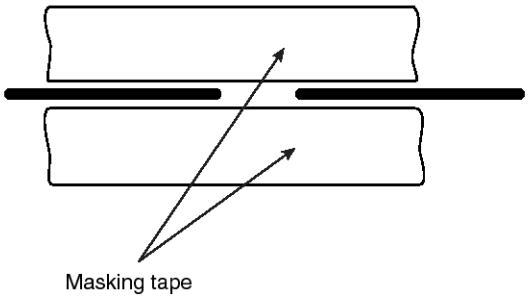

ETA9165F

**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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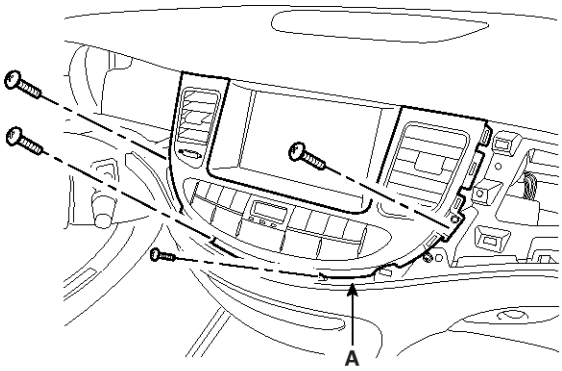
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## Rear Glass Defogger Switch

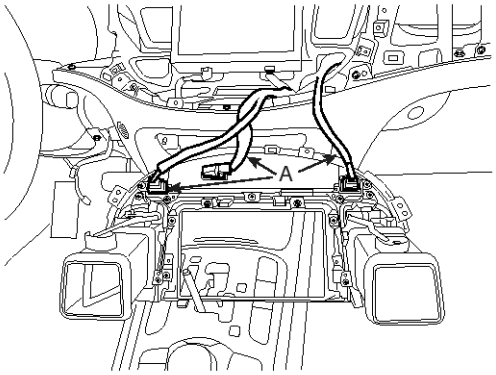
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the center fascia panel (A) after removing the screws. (Refer to the Body group - crash pad))



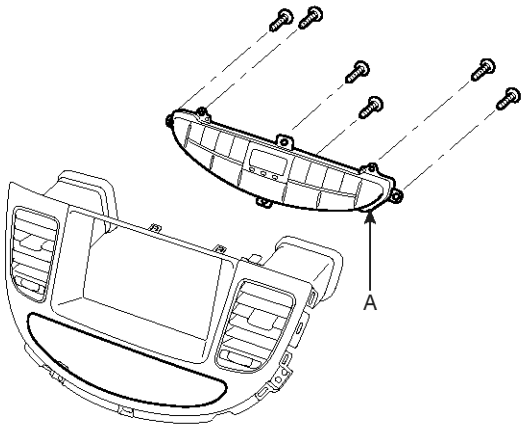

SBHBE8948D

3. Remove the connector (A).




SBHBE8372D

4. Remove the heater controller (A) after removing the screws.



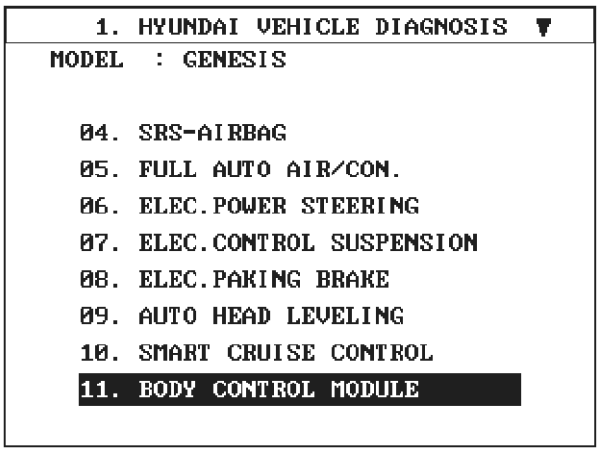

SBHBE8373D

### Installation

1. Install the heater controller and connector.
2. Install the center fascia panel.

### Inspection

1. The rear window defogger switch inputs can be checked using the scan tool.
2. To check the input value of rear window defogger switch, select option "BODY CONTROL MODULE".

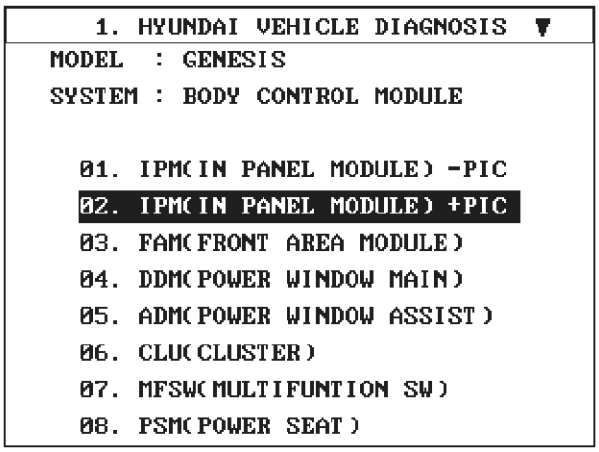



SBHBE9230L

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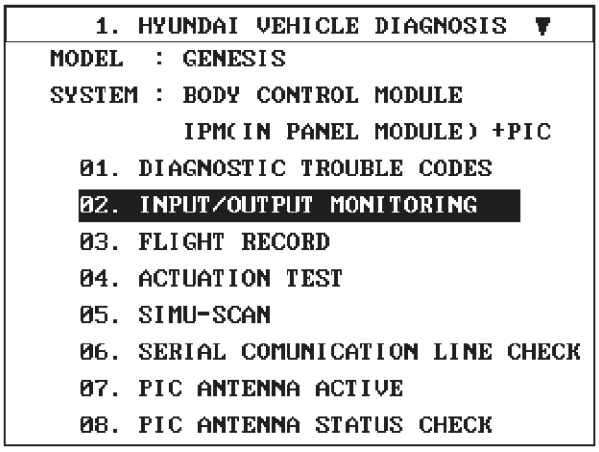
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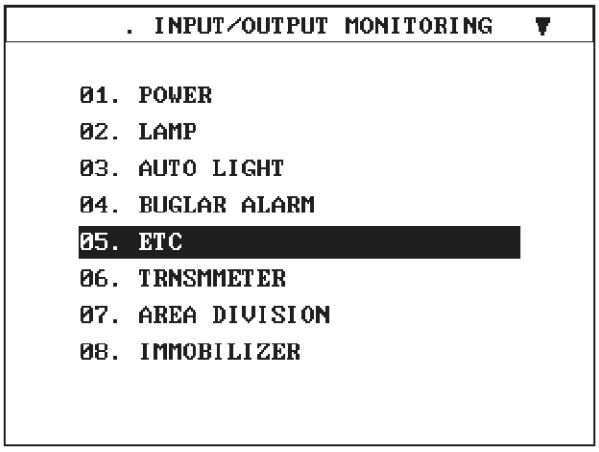



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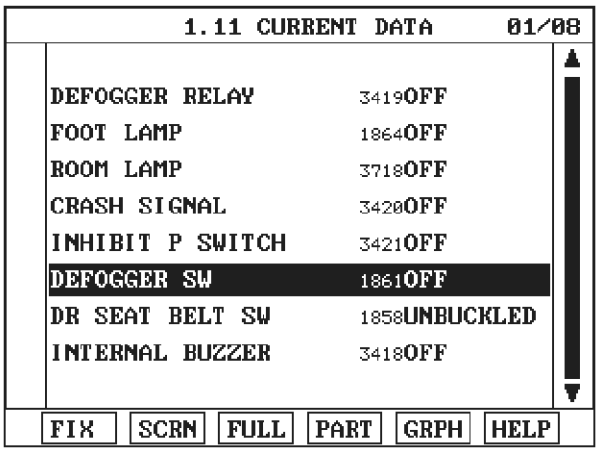
3. Select option "Input/output monitoring".




SBHBE9232L

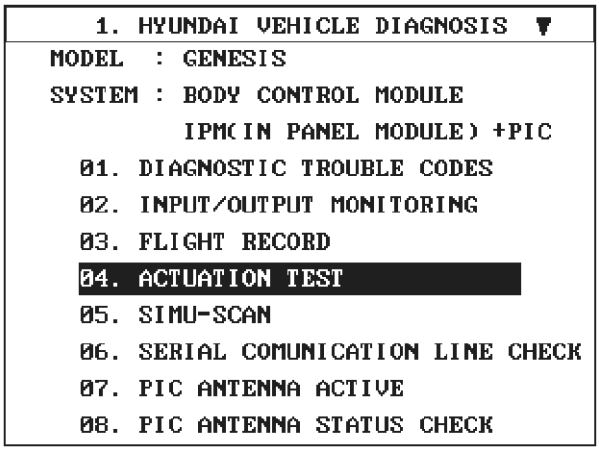



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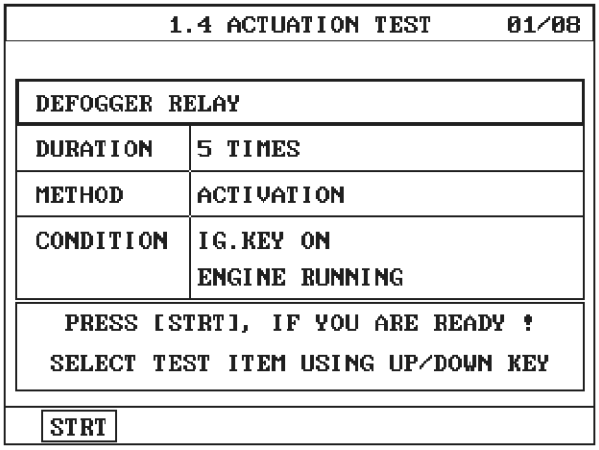



SBHBE9234L

4. To check the input value of rear window defogger switch in force mode, select option "ACTUATION TEST" .




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SBHBE9236L

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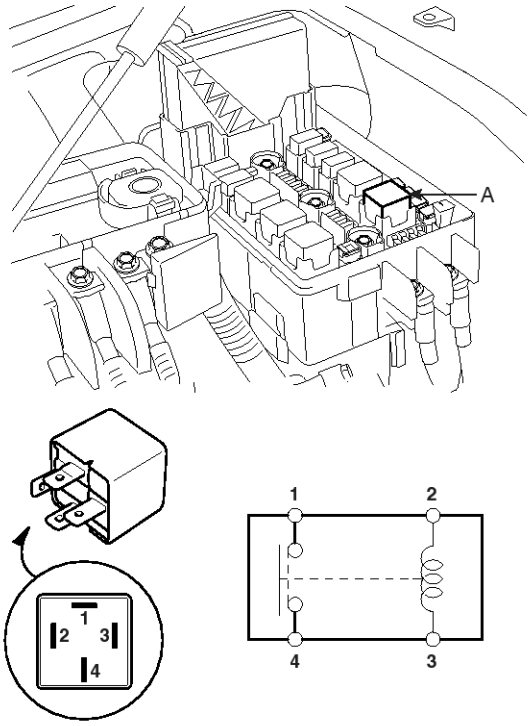
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## Rear Glass Defogger Relay

### Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the rear glass defogger relay (A) from the e-ngine room relay box.
3. There should be continuity between the No.1 and No. 4 terminals when power and ground are connected to the No.2 and No.3 in the relay.
4. There should be no continuity between the No.1 and No.4 terminals when power is disconnected.




SBHBE8952D

| Terminal / Power | 2 | 3 | 1 | 4 |
|---|---|---|---|---|
| Disconnected | ○ | ○ | | |
| Connected | ⊖ | ⊕ | ○ | ○ |

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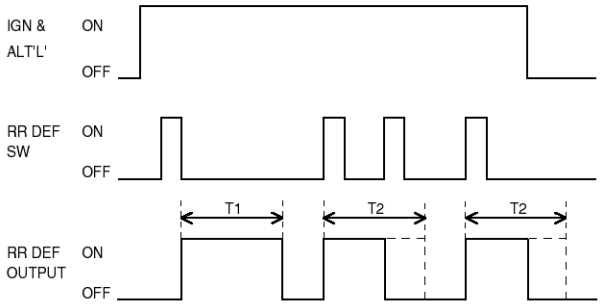


## Rear Glass Defogger Timer

### Inspection

While operating the components, check whether the operations are normal as shown in the timing chart.

1. Once ALT "L" is ON, if the defogger is switched ON, the defogger will stay ON for 20 minutes duration.
2. If defogger switch is pressed again (see Step 1), or if ignition is switched OFF, the defogger will shut OFF.




LTGE141J

T1 : 20 ± 1 min.

T2 : MAX 20 ± 1 min.

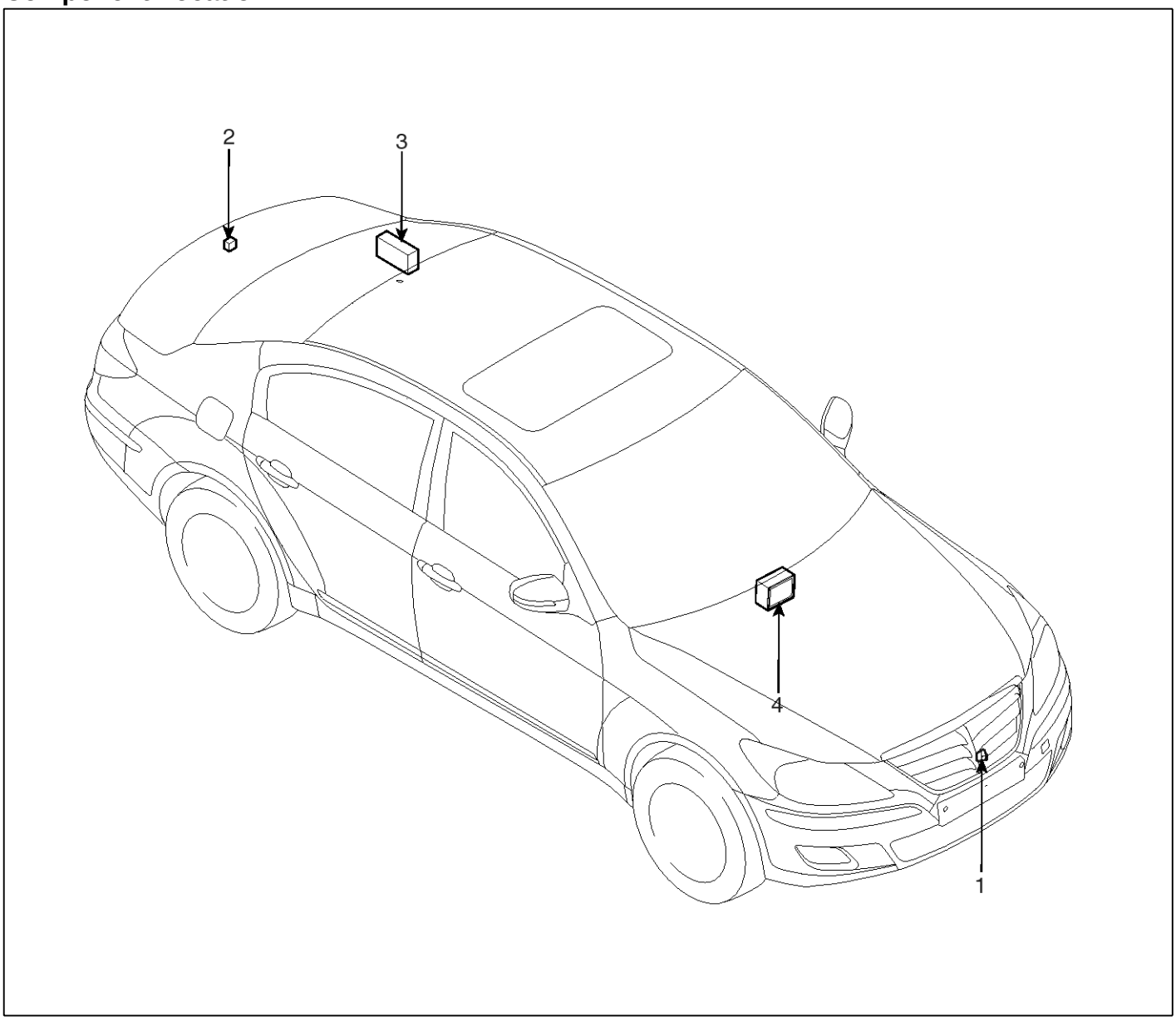
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# Front Back view camera System

## Component Location




SBHBE8013D

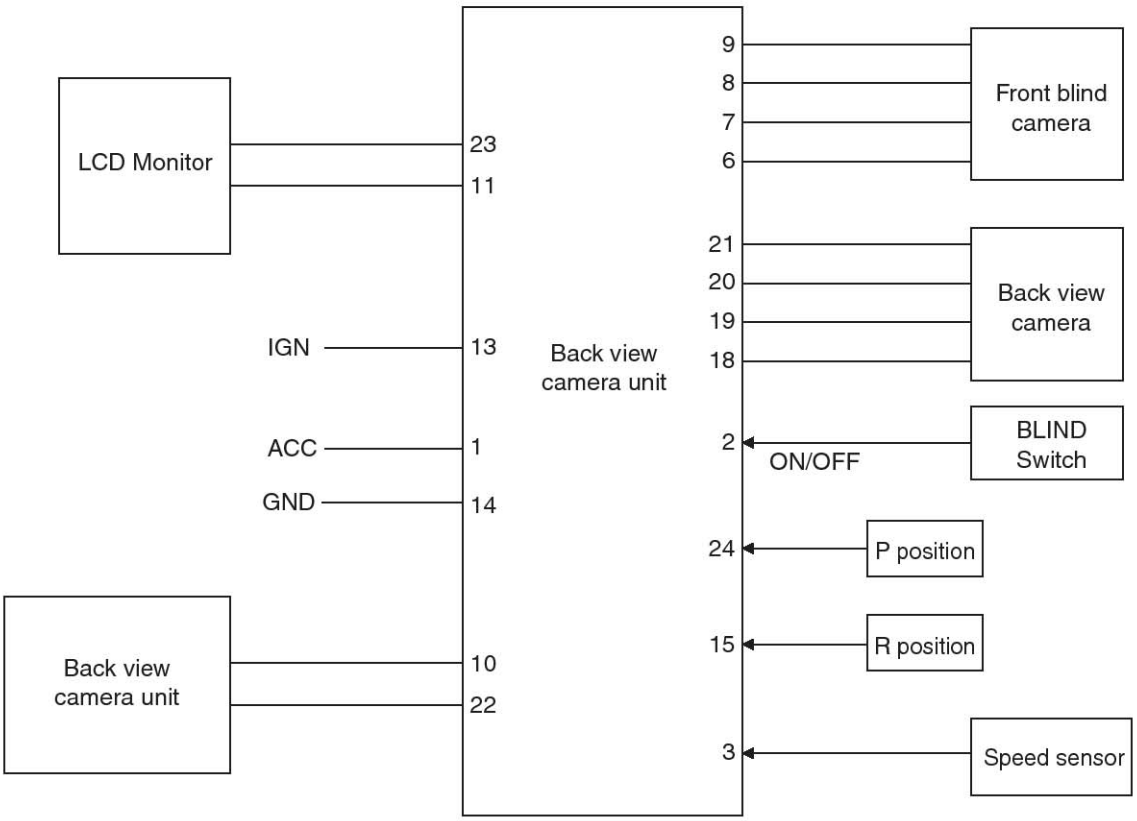
1. Front blind camera
2. Back view camera
3. Front back view camera unit
4. LCD monitor

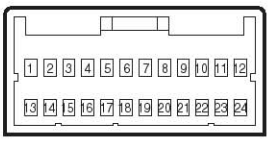
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## Circuit Diagram




| Pin | Description | Pin | Description |
|---|---|---|---|
| 1 | ACC | 13 | IGN 2 |
| 2 | BLIND switch | 14 | GND |
| 3 | Speed pulse | 15 | R position |
| 4 | - | 16 | - |
| 5 | - | 17 | - |
| 6 | Front blind camera GND | 18 | Back view camera GND |
| 7 | Front blind camera on | 19 | Back view camera on |
| 8 | Front blind camera Video in | 20 | Back view camera video in |
| 9 | Front blind camera GND | 21 | Back view camera video GND |
| 10 | Camera REQ | 22 | Back/Front |
| 11 | Video out | 23 | Video GND |
| 12 | - | 24 | P position |

SBHBE9229L

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## Description

Front blind camera is a supplemental system that shows blind spot in front of the vehicle through the AV monitor.

The front blind camera will operate when you push the button and shift the transaxle into N(Neutral) or D(Drive) while driving less then 10km/h. After the vehicle stops for 4 minutes with the transaxle in N(Neutral) or D(Drive), it will bring up the previous screen.

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 while backing-up.

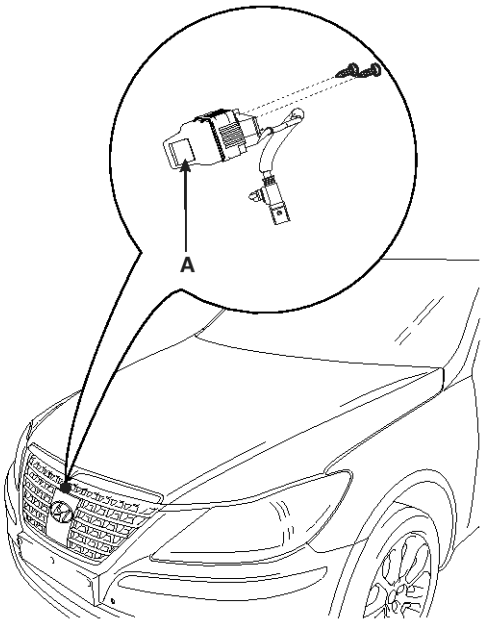
**WARNING**

**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

### Front blind camera

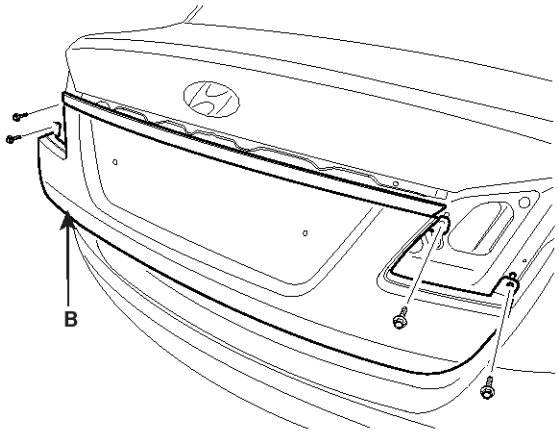
1. Remove the front bumper cover. (Refer to the Body group - Front bumper)
2. Remove the front blind camera (A) after removing the connector (4P) and screws (2EA).




SBHBE8015D

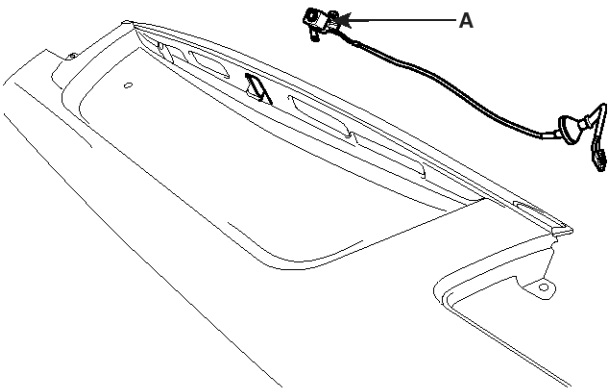
### Back View Camera

1. Remove the screws, clip and trunk lid trim in the trunk . (Refer to the Body group - Trunk lid)
2. Remove the trunk lid panel (B).




SBHBE8134D

3. Remove the back view camera (A) after removing the connector and screws (2EA).




SBHBE8016D

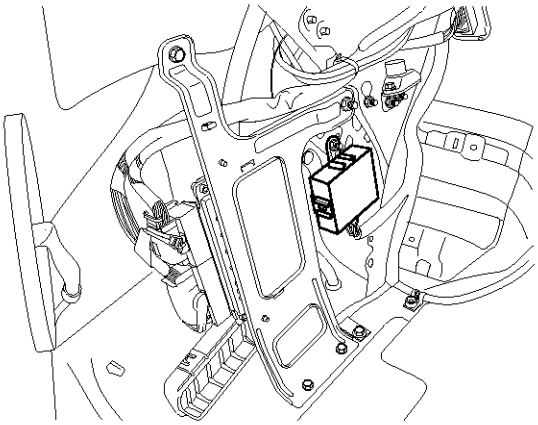
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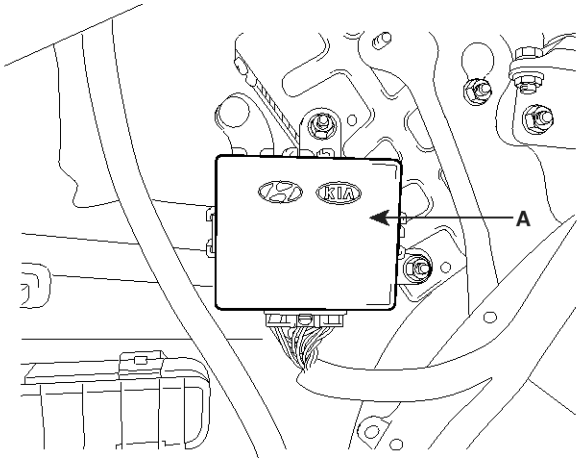
### Front Back View Camera Unit

1. Disconnect the negative (-) battery terminal.
2. Remove the trunk left trim in the trunk. (Refer to the Body group - Trunk)



SBHBE8017D

3. Remove the front back view camera unit (A) after removing the nuts (2EA) and connector.




SBHBE8018D

## Installation

### Front blind camera

1. Install the front blind camera.
2. Install the front bumper cover.

### Back view camera

1. Install the back view camera.
2. Install the trunk lid panel and trim.

### Front Back view camera unit

1. Install the front back view camera unit.
2. Install the trunk left trim in the trunk.

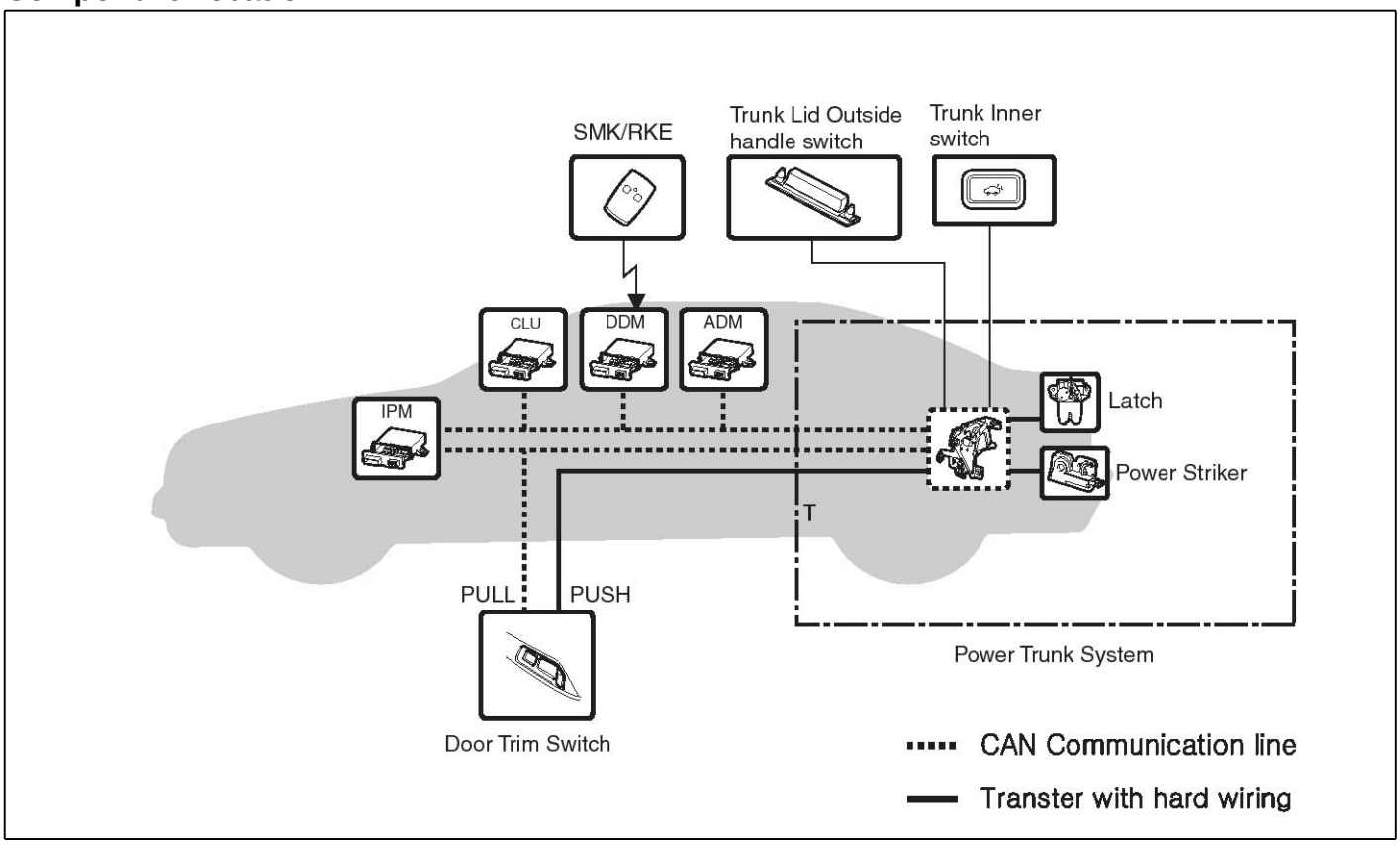
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# Power Trunk Module

## Component Location




SBHBE9457L

## Description

Power Trunk Lid (PTL) System : It is automatically opens and closes a vehicle's trunk lid and cinches the latch with the press of a button, and also can be easily operated, using an interior switch or a remote keyless entry device.

### Trunk position and direction

The PTL System will measure the Trunk Position via a integrated hall sensor inside the drive unit motor. The moving direction of trunk lid will be detected by analyze the current direction of the motor. The hall sensor counting (position detection) is active during power operation mode and during manual mode.

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### Drive motor power control

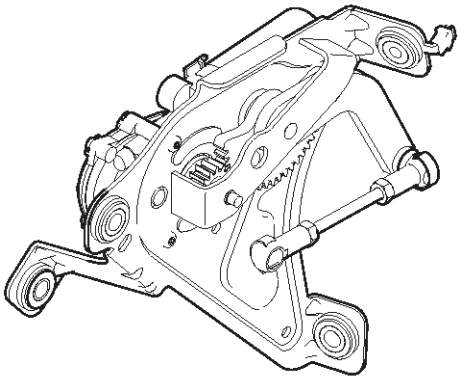
The drive motor power will be controlled by using a PWM (power motor) with a frequency of 20 kHz. Depending on the expected and the actual trunk lid speed, the ECU will adjust the power motor to achieve the requested opening and closing speed.

### Trunk speed control

For controlling the trunk lid speed overcoming aging, temperature effects and vehicle inclination a regulation is included. The regulation is comparing the actual motor speed with the requested motor speed. Depending on the comparison result, the speed will be adjusted, buy increasing or decreasing the power motor.

### System Components

1. PTL Drive Unit

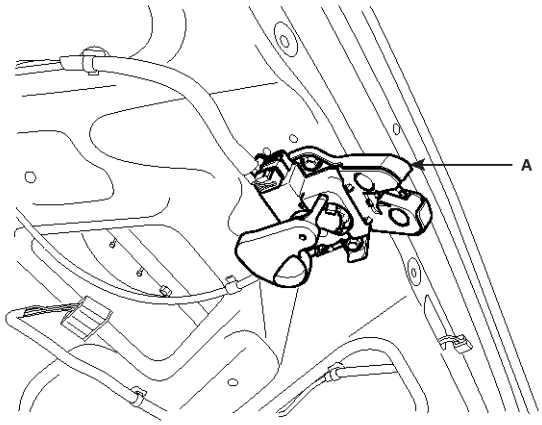


SBHBE8981D

Power tailgate drive unit consists of motor & driven gear, PTL module, PTL motor and drive arm.

PTG drive unit is located in rear left trunk trim. PTG drive unit opens and closes the trunk connected push rod automatically.

2. Power latch (A)

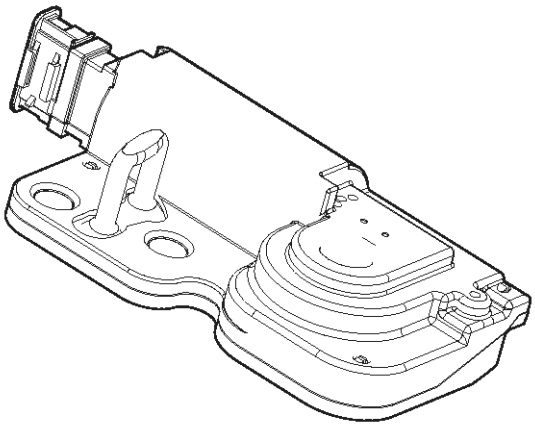



SBHBE8982D

Trunk opened by actuator after releases of latch's lock.

Built in the Micro switch for monitoring the latch lock & unlock status.

3. Power Striker

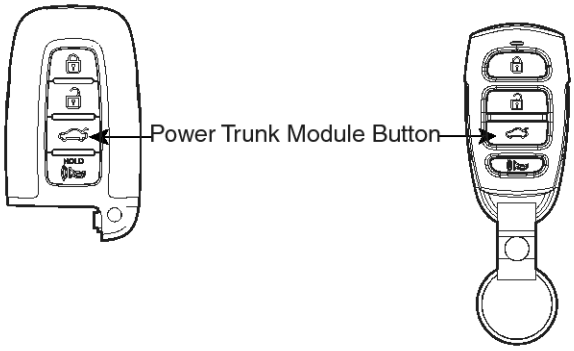


SBHBE8983D

By using actuator cinching the striker to go down strongly when the trunk is closed by motor.

Built in the micro switch for monitoring the striker's position.

4. SMK(Smart key) & RKE(Remote keyless entry)




SBHBE9458L

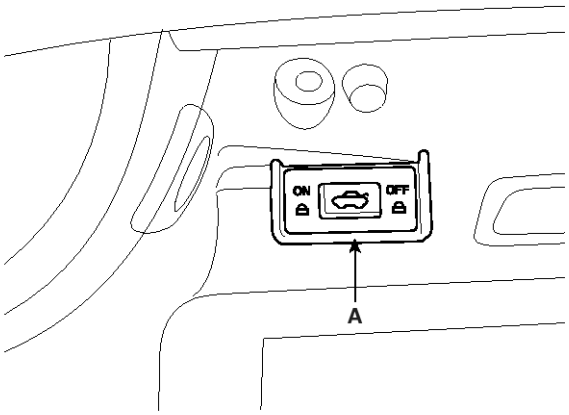
Push the power trunk lid open (A) of the SMK or RKE more than 0.5s to open the power trunk. Power Open operation shall be reversed when an additional Open/Close signal is received during power opening.

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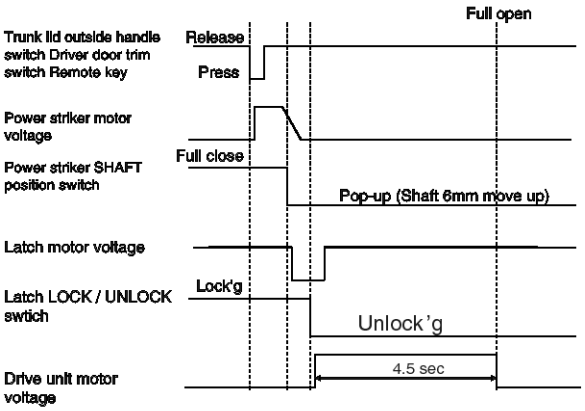
5. Trunk inner switch (A)




SBHBE8850D

## Operation

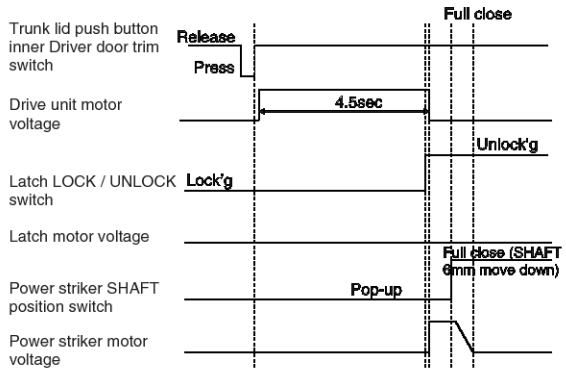
### Opening Procedure:




SBHBE9459L

1. Request to open by:
   - Open Switch Trunk Lid Outside (wire)
   - Open Switch Door trim (via CAN from DDM)
   - Remote Key (via CAN from IPM)
2. Power striker move into open position.
3. Elatch move into open position.
4. Actuation unit will be switched on by PTM into open direction.
5. Speed will be measured by hall sensor.
   - If speed is to slow → PTM increase the power
   - If speed is to fast → PTM decrease the power
   - If the time between the Hallsignals are to big the PTM will detect an obstacle and reverse the moving direction of the trunklid for about 50 mm.
6. Opening angle will be measured by counting the Hall pulses.
7. If opening position is arrived the actuation unit will be switched off by PTM.

### Closing Procedure:




SBHBE9460L

1. Request to closing by:
   - Close Switch Trunk Lid inside (wire)
   - Close Switch Door trim (wire)
2. Actuation unit will be switched on by PTM into close direction.
3. Opening angle will be measured by counting the hall pulses.
4. Speed will be measured by hall sensor.
   - If speed is to slow → PTM increase the Power
   - If speed is to fast → PTM decrease the Power
   - If the time between the Hallsignals are to big the PTM will detect an obstacle and reverse the moving direction of the trunklid.
5. Mechanical closing of e-latch when e-latch contacts striker
6. PTM detect the closed postion of e-latch and switch the actuation unit off.
7. Power striker move into closed position.

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### Operating Logic

The PTL system and its PTM module is integrated in the CAN vehicle network. Depending on the status of the signals the PTL system will decide to operate or not. The summary of the signals and the related operations is shown below table.

| | Switches | | | | Validation signals (x: don't care) | | | |
|---|---|---|---|---|---|---|---|---|
| | SW(switch) name | While Operation [yes / no] | Action | Switch status | IGN Key insert | Door Lock state | Vehicle speed | Arming |
| | | | | | C_IGNSW 1:key in 0:key off | (see Note 1) 1:lock 0:unlock | C_3km 1:> 3kmh 0:< 3kmh | C_BAState1 1:arm 0:disarm |
| Wiring | SW Trunk Inner | Yes | stop | pressed | x | x | x | x |
| | SW Trunk Inner | No | close | released | x | x | 0 | x |
| | SW Door Trim Close | No | close | pressed | x | x | 0 | 0 |
| | SW Door Trim Close | Yes | stop | released | x | x | x | x |
| | SW Door Trim Close | Yes | stop | pressed | x | x | x | x |
| | SW Trunk Outer | Yes | stop | pressed | x | x | x | x |
| | SW Trunk Outer | No | open | pressed | x | 0 | 0 | 0 |
| CAN | Remote Control | Yes | stop | pressed | x | x | x | x |
| | Remote Control | No | open | pressed | 0 | x | 0 | x |
| | SW Door Trim Open | Yes | stop | pressed | x | x | x | x |
| | SW Door Trim Open | No | open | pressed | x | x | 0 | 0 |

- All above cases are based on Trunk Main-Switch ON.
- In case the Trunk Main-Switch is OFF, the system will not operate automatically.
- If the Trunk-Main Switch will be switched OFF during the operation, the operation cycle will finish.
- All combinations that are not listed in the above table, the system will not take any action.
- All switches will be monitor with a de-bounce time of 30ms.

**(Note 1)**

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| **Door Lock state**<br>1||2||3||4<br>(1:lock; 0:unlock) | **1=Driver Door unlock state**<br>1:unlock; 0:lock | **2=Assistant Door unlock state**<br>1:unlock; 0:lock | **3=RL Door unlock state**<br>1:unlock; 0:lock | **4=RR Door unlock state**<br>1:unlock; 0:lock |
|---|---|---|---|---|
| 0 | 1 | x | x | x |
| 0 | x | 1 | x | x |
| 0 | x | x | 1 | x |
| 0 | x | x | x | 1 |
| 1 | 0 | 0 | 0 | 0 |

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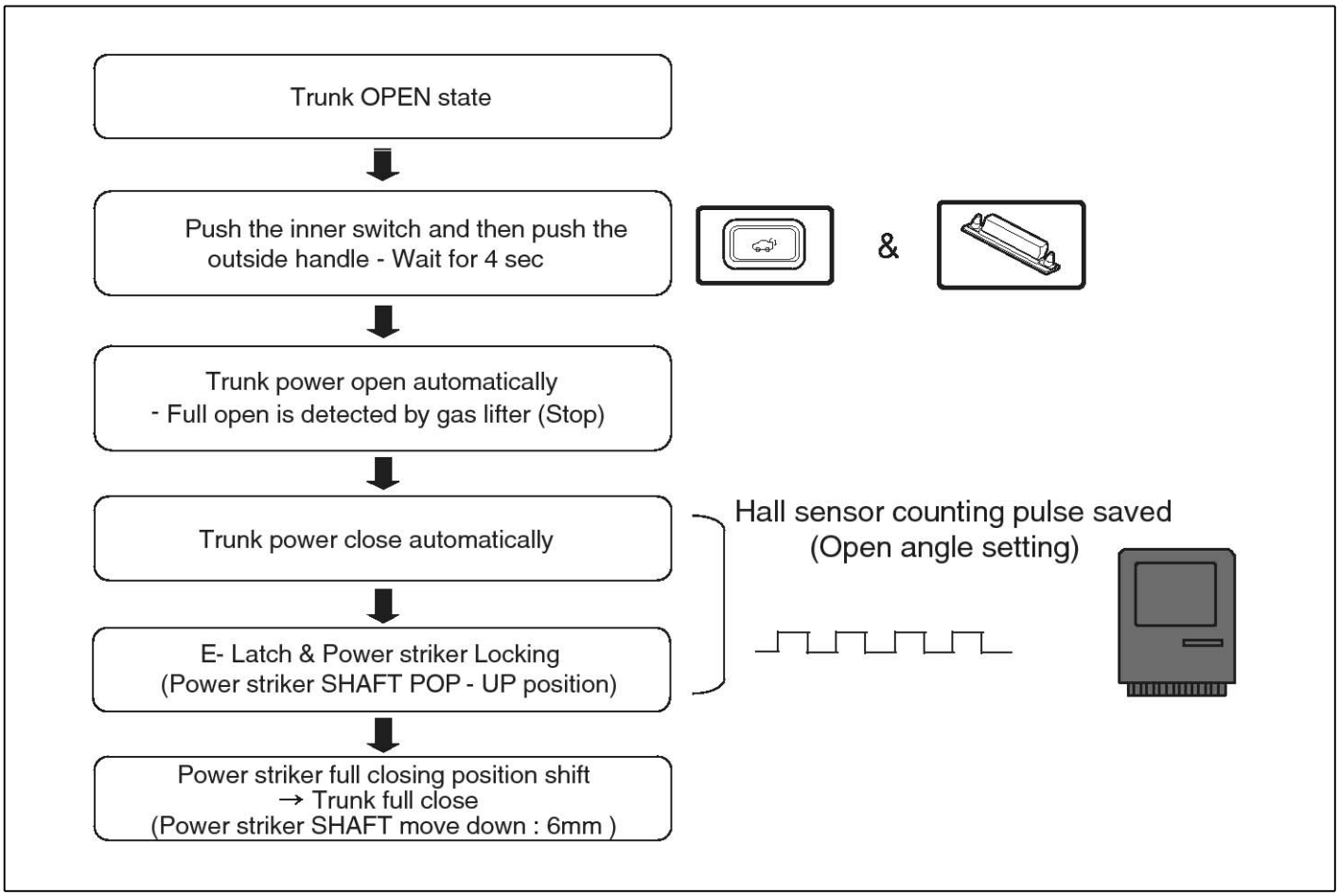


## Inspection

### System Parameterization

of the system has to be performed to find the amount of pulses needed to open the trunk. Due to tolerances not every car is equal. Therefore the calibration is needed for each vehicle. Parameterization is started by pressing Trunk Inner switch and Trunk Outer switch at the same time for approx. 4 seconds. The trunk then will open until a blocking event is detected (normally full open position) and then close until it reaches the latch. During closing the HALL pulses are counted to know the travel distance. This value is stored into EEPROM.

This value has to be inside a defined tolerance to be considered as valid. If the value is outside of the tolerance parameterization was not completed successfully. Parameterization has to be done to find the full open position of a vehicle. It has to be done for each vehicle at least once . The sequence is started by pressing Trunk Inner switch and Trunk Outer switch at the same time. The trunk will then open until it is blocked. Then it will close until the latch reaches the power striker. During this closing the HALL pulses from the motor are counted. When the latch is closed the counter of the HALL pulses must have a value that is equal to a default value with a certain tolerance around it to complete the parameterization successfully. If the HALL pulse counter is outside the tolerance value the parameterization has notcompleted successfully. In case of a successful parameterization the new value for the full open position is stored intoEEPROM.




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### System Initialization

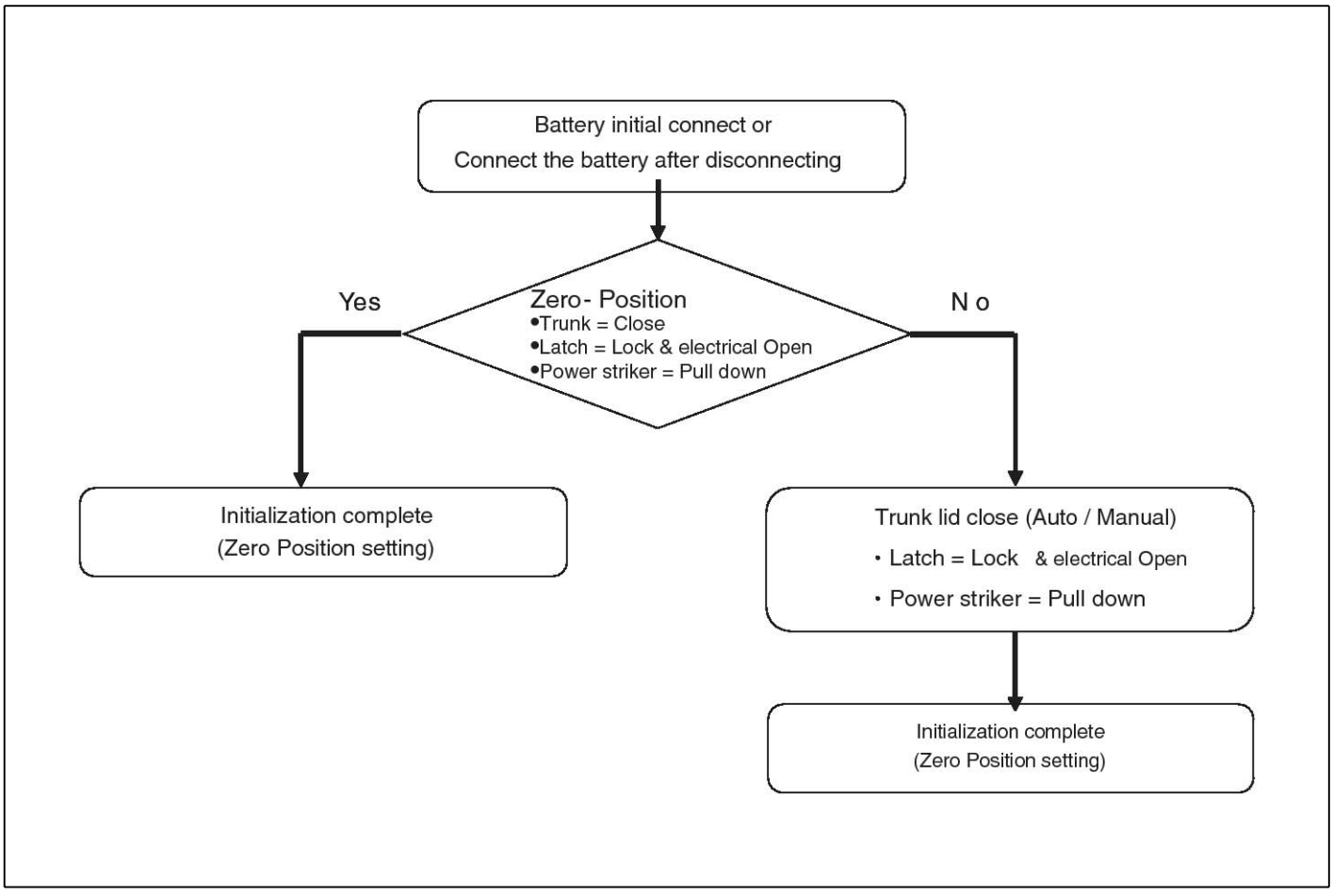
System initialization is necessary to find the closed (0-P-osition) of the trunk-lid.

After Battery Power is on (Power-on stage) a initialization has to be done to find the closed trunk-lid position. After power-on the latch status is checked. If the latch is close-d, it is assumed that the trunk lid is also closed. Therefor-e the trunk lid position is set to zero and initialization is fi-nished. If the latch is opened it is assumed that the trunk lid is not closed. The power striker will be run into open position and the inner switch lamp will be switched on.

The next state is STOP. From this state the trunk can op-erate like in normal behavior – except the trunk lid speed is constant and the blocking margin is also constant (and higher than in normal operation).

After the trunk lid has reached the closed latch position, the initialization process is finished.

A blocking event in case of a not initialized trunk leads to state OPEN. During this operation the system is using th-e same default values like in the parameterization mode. The regulation and the blocking detection are active. The trunk can be opened / closed electrically or manually. Ho-wever if the latch reaches the power striker the state is s-witched to LOCKED and the trunk status will be set to ini-tialized.




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## Troubleshooting

### Diagnosis And Testing - Power Trunk Lid System

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

The most reliable, efficient, and accurate means to diagnose the power trunk lid system requires the use of a scan tool and the proper Body Diagnostic Procedures manual. The scan tool can be used to observe current switch status recorded in the power trunk lid control module to help the technician diagnose an inoperative switch.

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

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

| NO | Item | Specification description | Output |
|---|---|---|---|
| | | | Form |
| 1 | A_VBAT | Bat Voltage on PTM | Voltage(V) |
| 2 | Hall SNSR power voltage | Hall sensor voltage PTM input | |
| 3 | LED ON/OFF | Vbatt Power (between 9.0v and 16v) | ON/OFF |
| 4 | Trunk Lid Latch SW | Trunk main Switch | |
| 5 | P_Striker_SW | Trunk Lid outside Handle switch | |
| 6 | Trunk_DR_Trim_Close SW | Trunk Inner Push Button | |
| 7 | Trunk_INR_Push Button | Trunk Door Trim Close | |
| 8 | Trunk Lid O/S HDL SW | Power Striker Switch | |
| 9 | Trunk main SW | Trunk Lid Latch Switch | |
| 10 | Vbatt Power Voltage in Range | LED On/Off | |
| 11 | Drive Motor Operating Voltage | Drive motor Open/Close voltage PTM output | Voltage(V) |
| 12 | Power Striker Operating Voltage | Power Striker motor Pop-up/Close Voltage PTM output | |
| 13 | Trunk Lid Position | Current Trunk position in counter | % |
| 14 | Unknown Trunk Lid Position Flag | Learn ProcessComplete Status | ON/OFF |
| 15 | Learn Process Complete Status | Unknown Trunk Lid Position Flag | ON/OFF |
| 16 | Most recent close time (P/Strikeer) | Most recent close time | ms |
| 17 | 2ND Most recent close Time (P/Strikeer) | 2ND Most recent close time | |

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**PTM DTC List**

| NO | DTC code | Spec Discription |
|---|---|---|
| 1 | B1602 | CAN Error |
| 2 | B1603 | CAN Bus Off |
| 6 | B1621 | ECU Checksum Err |
| 5 | B2458 | P/striker Motor & Switch Err |
| 4 | B2459 | Latch Motor & Switch Err |
| 3 | B2460 | Drive Motor & Hall Sensor Err |

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## B1602 CAN Error

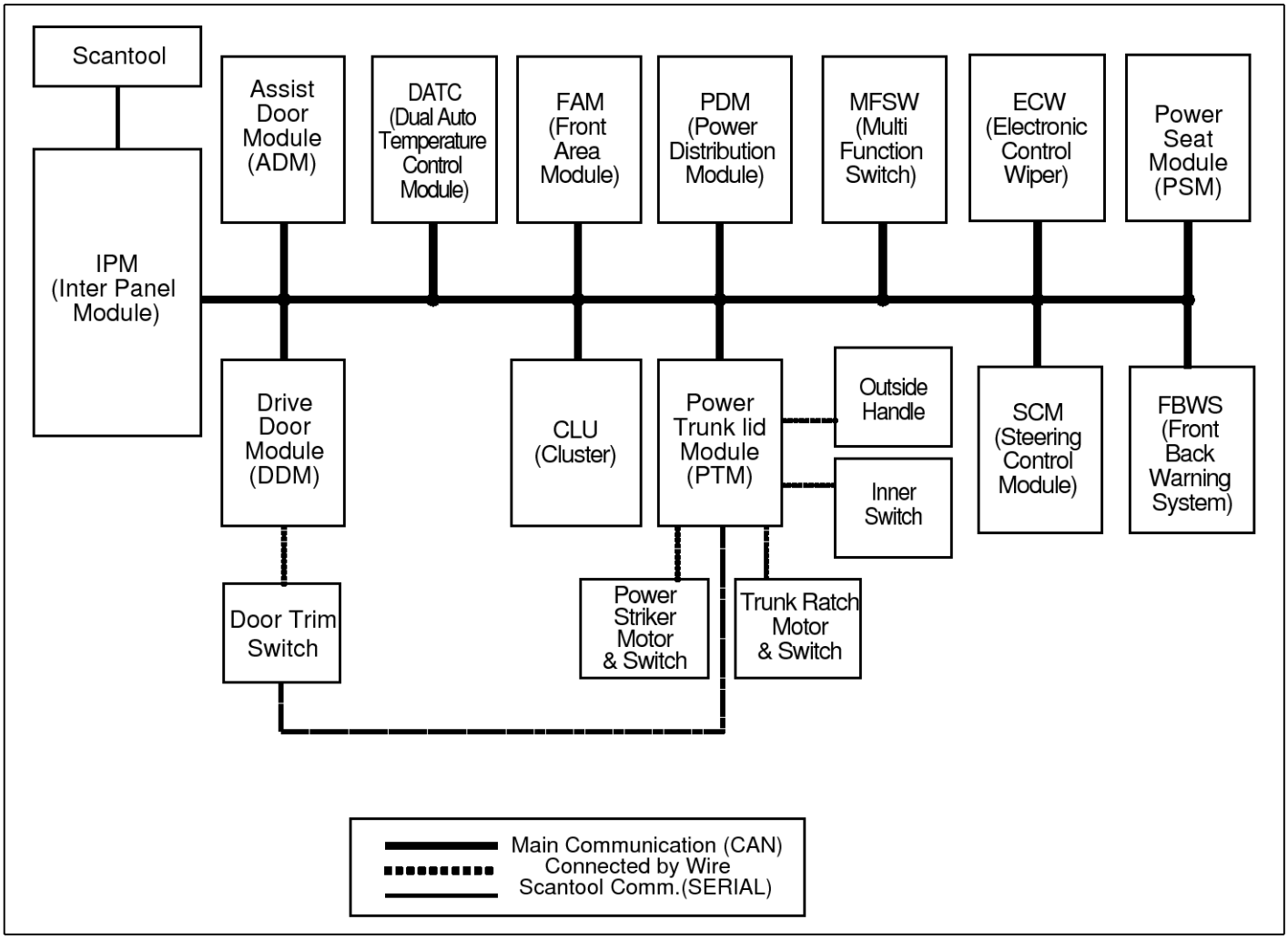
### General Description

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.)




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## DTC Description

| Type | Condition | Remark |
|---|---|---|
| 1 | CANH Circuit Open | B1602 is presented when IC detects one of errors among 7 types under normal communication condition.<br>According to operation condition, some of module which are connected to CAN line may not detect B1602.<br>Also, B1603 can be detected together. |
| 2 | CANL Circuit Open | |
| 3 | CANH Circuit Short to Power | |
| 4 | CANL Circuit Short to Power | |
| 5 | CANH Circuit Short to Ground | |
| 6 | CANL Circuit Short to Ground | |
| 7 | CANH and CANL Short to each other | |

## DTC Detecting Condition

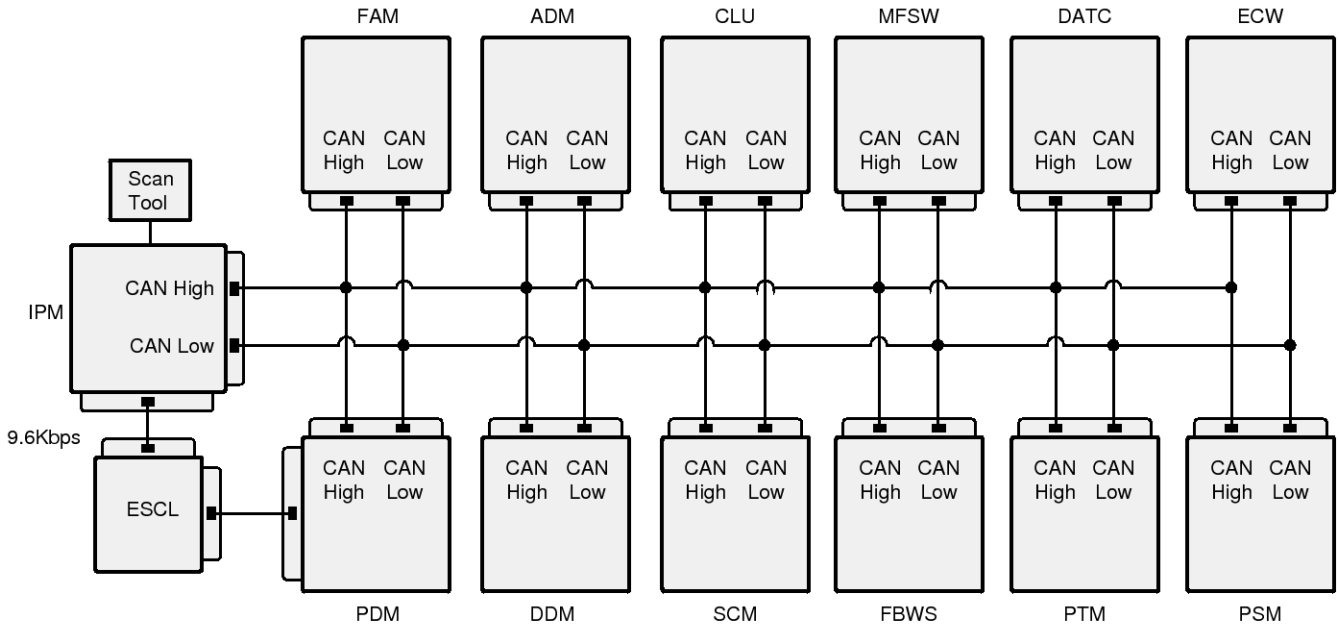
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • CAN Communication Check | • IPM,PTM are not Sleep condition<br>1. CAN High Line short to battery<br>2. CAN Low Line short to battery<br>3. CAN High Line short to ground<br>4. CAN Low Line short to ground<br>5. CAN High and Low line short to each other<br>6. CAN High Line short to 5V power<br>7. CAN High Line open<br>8. CAN Low Line open<br>⚠**CAUTION**<br>**Under Sleep condition, CAN High Line is 0V and CAN Low Line is battery voltage.** |
| Enable Conditions | • IPM, PTM power on<br>(Under normal communication) | |
| Threshold Value | • CAN high : 0V or B+<br>• CAN low : 0V or B+ | |
| Diagnostic Time | • 2 sec | |
| DTC Erasing Time | • DTC is erased immediately after trouble fixed | |

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## Diagnostic Circuit Diagram

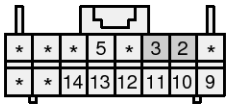



<ECW>



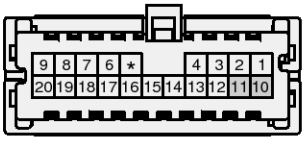
4. Low
5. High

<IPM>



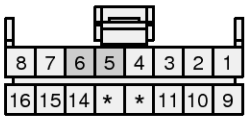
2 . Low
3. High

<PDM>



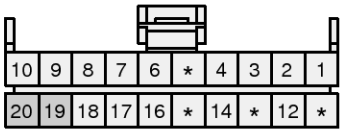
10. Low
11. High

<MFSW>



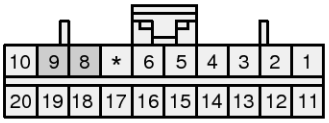
5. High
6. Low

<CLU>



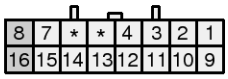
19. Low
20. High

<TILT & TELE>



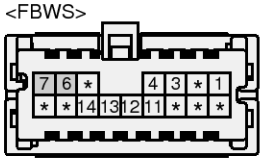
8. High
9. Low

<ADM>



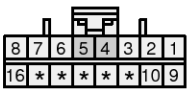
8. High
16. Low

<FBWS>



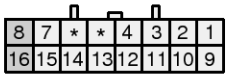
6. High
7. Low

<PSM>



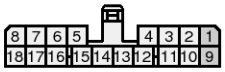
4. High
5. Low

<DDM>



8. High
16. Low

<PTM>



1. Low
9. High

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## Signal Waveform & Data

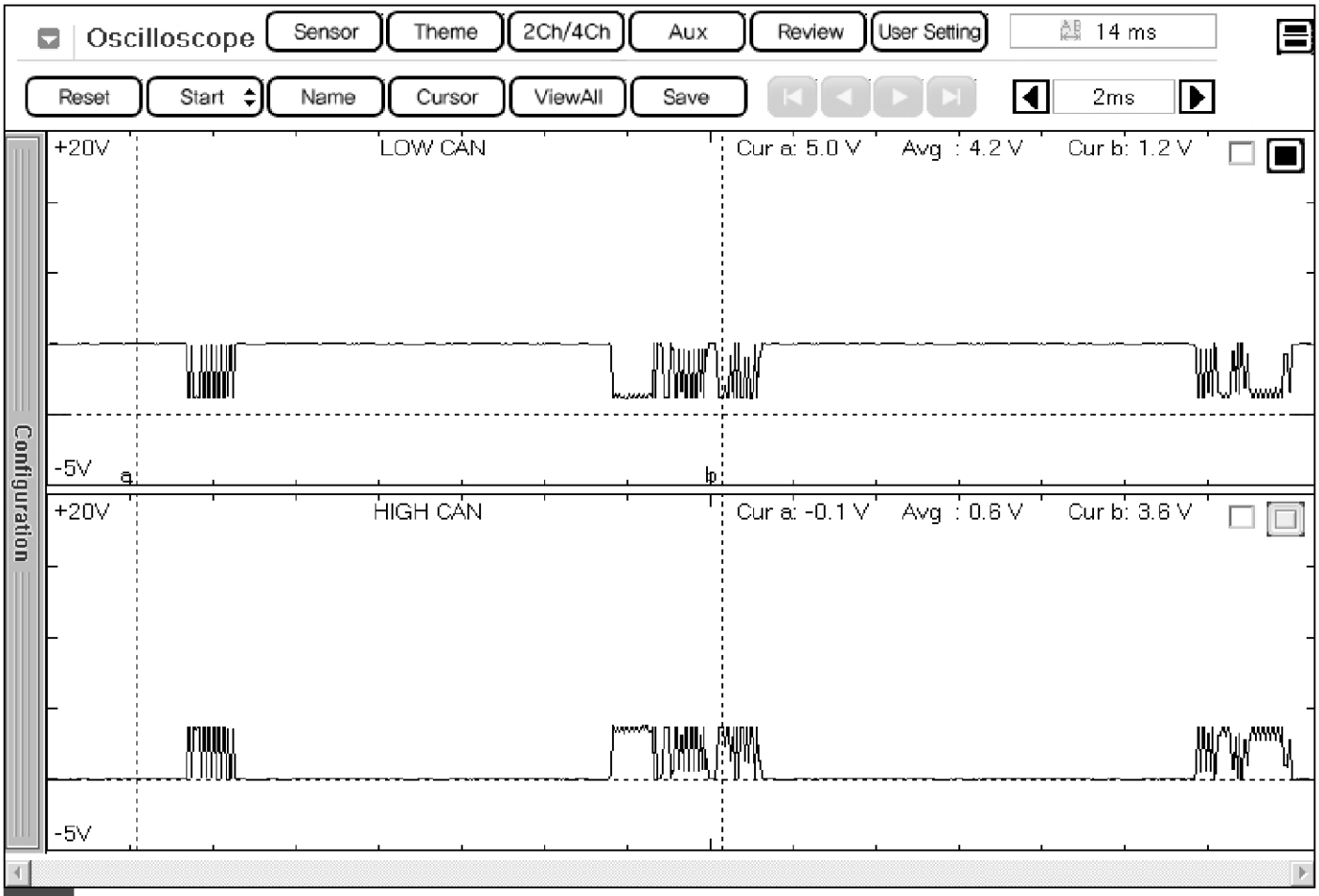



Fig.1

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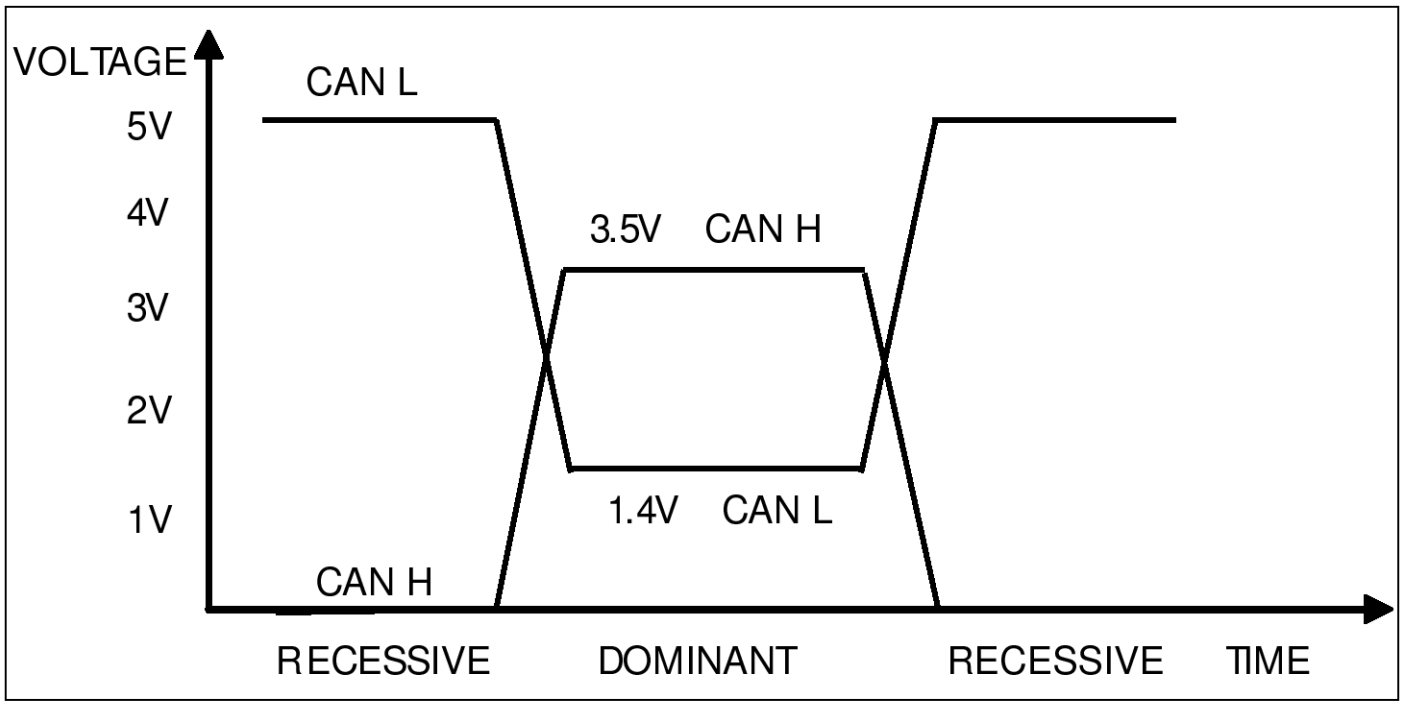



Fig.2

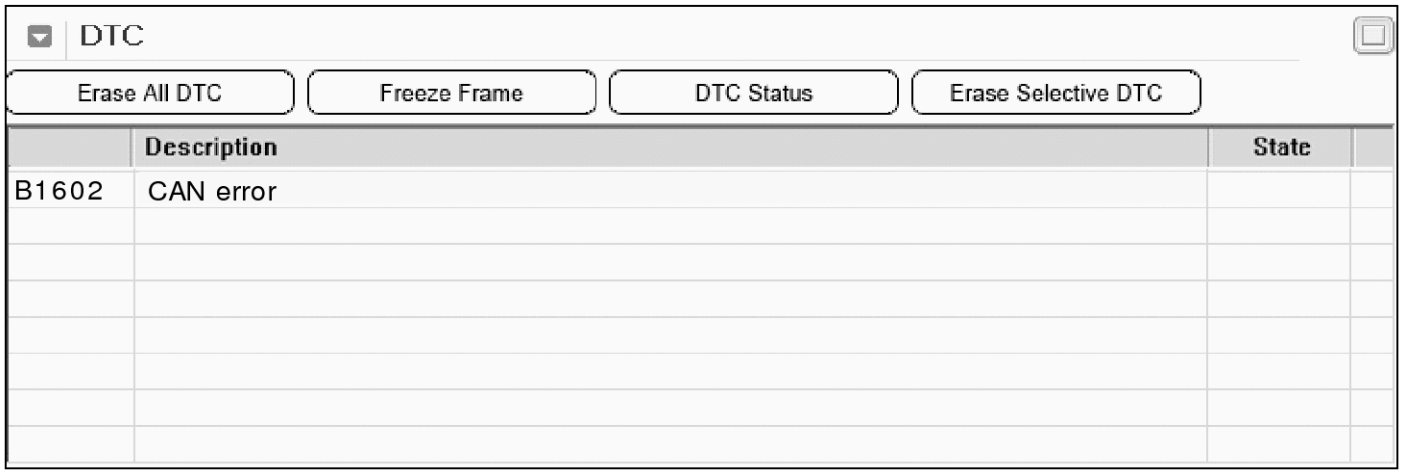
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Fig.1) CAN Low/High Signal Waveform

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).




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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 PTM's connector or was repaired and PTM 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 "PTM Signal Circuit Inspection" procedure.

## PTM Signal Circuit Inspection

1. Check CAN High Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PTM CAN High line.

**Specification :** Refer to "Signal Waveform & Data"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "CAN Low Line Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check CAN Low Line
   1) IG "ON" & ENG "OFF"
   2) After connect GDS, select "Oscilloscope" mode.
   3) Measure the signal waveform on PTM CAN Low line.

**Specification :** Refer to "Signal Waveform"

   4) Does the measured signal waveform follow the specification?

**YES** ▶ Go to "Component Inspection" procedure.

**NO** ▶ Check short to battery or ground. Repair as necessary and 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), 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)
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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# B1603 CAN Communication Bus Off

## General Description

Refer to DTC B1602 : CAN Error.

## 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), 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))

Case1: After short between ADM CAN Low Line and High Line, short to ground together.

Case2: After short between ADM 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,PTM are not Sleep condition1. CAN High and Low Line short to ground coincident<br>1. CAN High and Low Line short to ground coincident<br>2. CAN High and Low Line short to battery coincident |
| Enable Conditions | • IPM, PTM 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

Refer to DTC B1602 : CAN Error.

## Signal Waveform & Data

Refer to DTC B1602 : CAN Error.

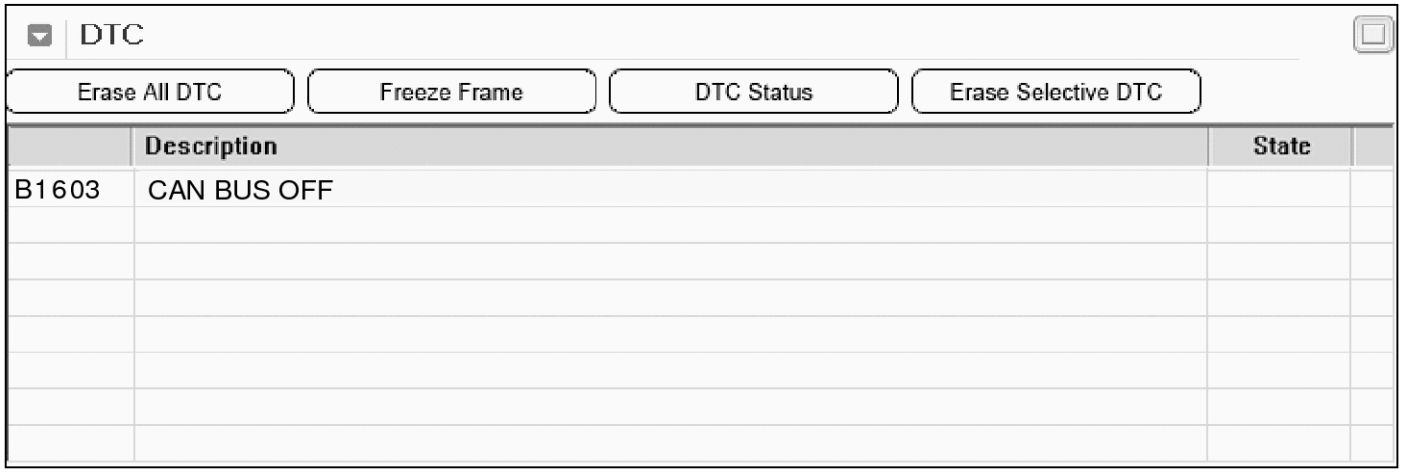
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## Scantool Data Analysis

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).




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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 PTM's connector or was repaired and PTM 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), 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)
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

Refer to DTC B1602 : CAN Error.

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## B1621 ECU Check Sum Error

### General Description

The motor of PTM(Power Trunk Lid Module) consists of Drive Motor, Trunk Latch Motor, and Power Striker Motor . Therefore, It is available to open trunk by mechanical power. Opening is controlled by Trunk Lid Outside Handle, Door Trim Pull Switch, or Remote Controller. Closing is controlled by Inner Switch or Door Trim Push Switch. Opening or closing the rid by mechanical power is performed by hinge's rotation which is controlled by rod(This rod is consists of Sector Gear linked to Drive Motor Gear).

The motor speed is monitored by Hall IC. This value is used to control the driving power. The power is up when the speed is slower than the specific value and the power is down when the speed is faster than the specific value. Besides, the trunk lid is controlled in the counter direction when there is long interval between signals from Hall IC. Because It is assumed that there is obstacle or interference.

PTM consists of Micro-processor, several chip-sets, and IC & SMT elements. Among these components, CPU which controls others and Micro-processor which memorizes information can be exposed to physical defects rarely.

Refer to DTC B1602 : CAN Error.

### DTC Description

This code is outputted when there is error of Check Sum Flash Memory, Check Sum RAM, or Check Sum EEPROM internal PTM.

### DTC Detecting Condition

| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal Voltage Check | • Faulty PTM |
| Enable Conditions | • IG ON<br>• Engine running | |
| Threshold Value | • PTM internal error | |
| Diagnostic Time | • Immediately (The present error) | |
| DTC Erasing Time | • Erase the present DTC in the moment of Wake-up after Sleep or trouble fixed. (The present DTC → The past DTC) | |
| Limp Home Mode | • It is available to operate by hand-operated. | |

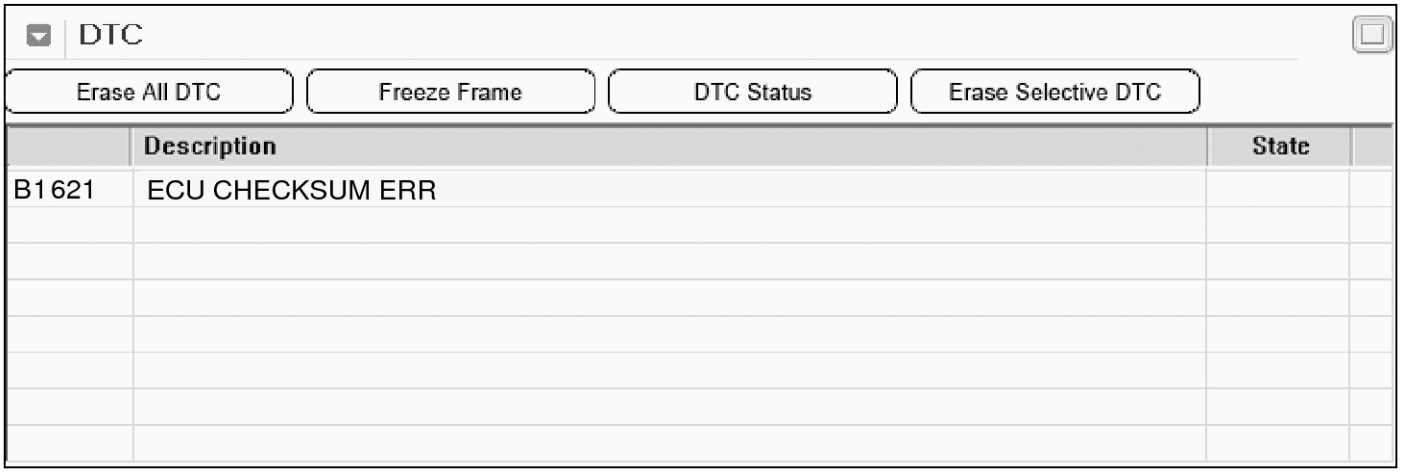
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## Scantool Data Analysis

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).




SBHBE9D16L

5. Is the same DTC occurred again?

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

**NO** ▶ Fault is intermittent caused by poor contact in the PTM's connector or was repaired and PTM 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.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B2458 Power Striker Motor and Switch Error

### General Description

The motor of PTM(Power Trunk Lid Module) consists of Drive Motor, Trunk Latch Motor, and Power Striker Motor . Therefore, It is available to open trunk by mechanical power. Opening is controlled by Trunk Lid Outside Handle, Door Trim Pull Switch, or Remote Controller. Closing is controlled by Inner Switch or Door Trim Push Switch. Opening or closing the rid by mechanical power is performed by hinge's rotation which is controlled by rod(This rod is consists of Sector Gear linked to Drive Motor Gear).

The motor speed is monitored by Hall IC. This value is used to control the driving power. The power is up when the speed is slower than the specific value and the power is down when the speed is faster than the specific value. Besides, the trunk lid is controlled in the counter direction when there is long interval between signals from Hall IC. Because It is assumed that there is obstacle or interference.

In case the Power Striker runs into LOCK, It is 'PULL DOWN'. And in case the Power Striker runs into UNLOCK, It is 'PULL UP'. The Power Striker Motor is equipped for tightening the trunk rid with the weather strip for prevention of water leakage.

Refer to DTC B1602 : CAN Error.

### DTC Description

This code is outputted when there is the fixed switch signal(ON/OFF) while PTM operates the trunk rid.

In case of no Power Striker Motor working and abnormal signal : faulty motor, short/open on motor circuit.

In case of Power Striker Motor working but abnormal signal : faulty switch, or short/open on switch circuit.

### DTC Detecting Condition

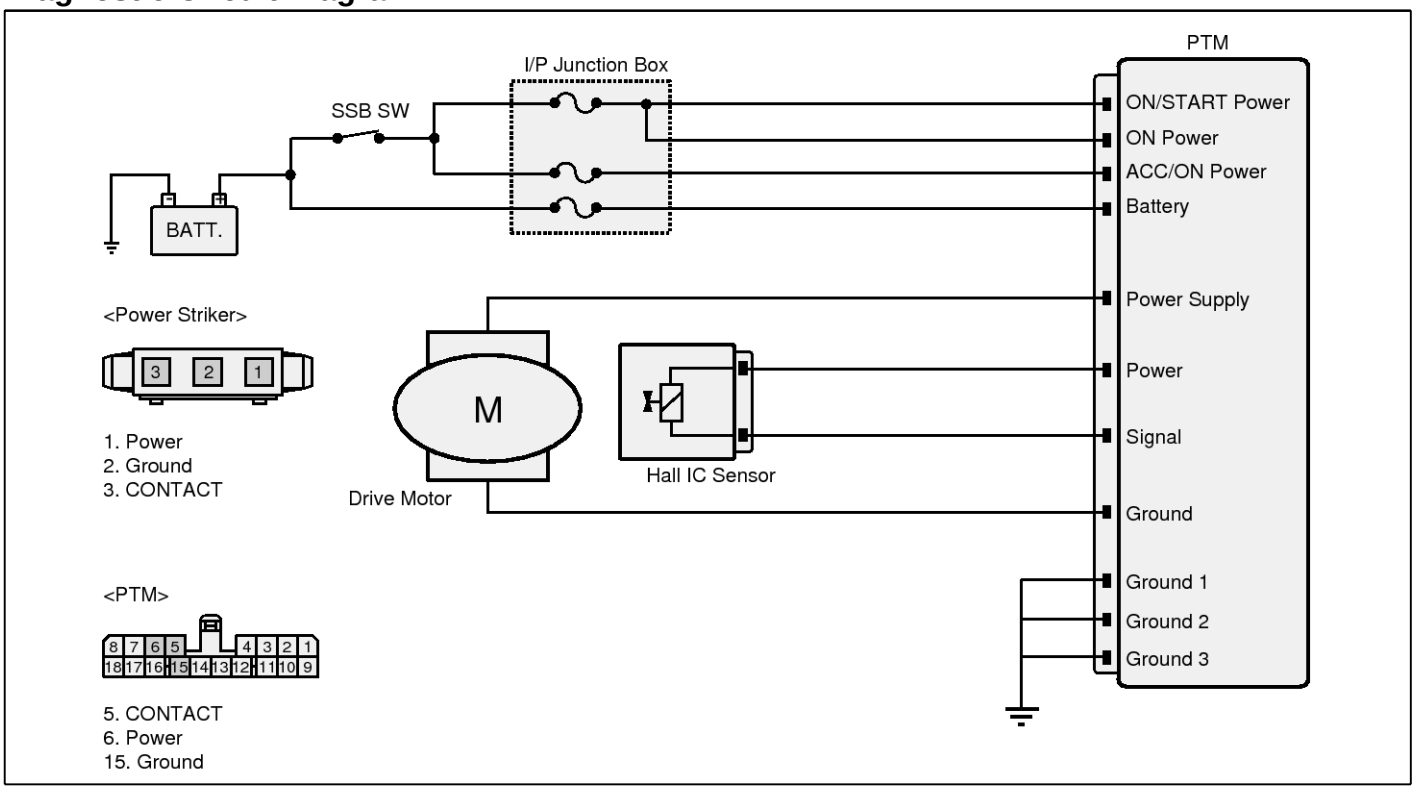
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal Voltage Check | • Short to battery, short to ground, open or poor contact on Power Striker Motor circuit<br>• Short to battery, short to ground, open or poor contact on Power Striker Switch circuit<br>• Faulty motor<br>• Faulty switch<br>• Blown fuse<br>• Faulty PTM<br>(These troubles may lead the counter direction movement of the trunk lid) |
| Enable Conditions | • IG ON<br>• After trunk open, latch is repeated Lock/Unlock mechanically. | |
| Threshold Value | • In case of faulty Power Striker Motor<br>- No work of the Power Striker Shaft<br>- No change of the Power Striker Motor operating voltage<br>• In case of faulty switch<br>- No change of the Power Striker Motor Switch signal ( Full Close/Pop-up)<br>- Power Striker Shaft stops after repeats Up & Down around 3~4 times. | |
| Diagnostic Time | • Erase the present DTC in the moment of Wake-up after Sleep or trouble fixed. (The present DTC → The past DTC) | |
| DTC Erasing Time | • 3 times in sequential (Present DTC) | |
| Limp Home Mode | • It is available to operate by hand-operated (Except motor stuck) | |

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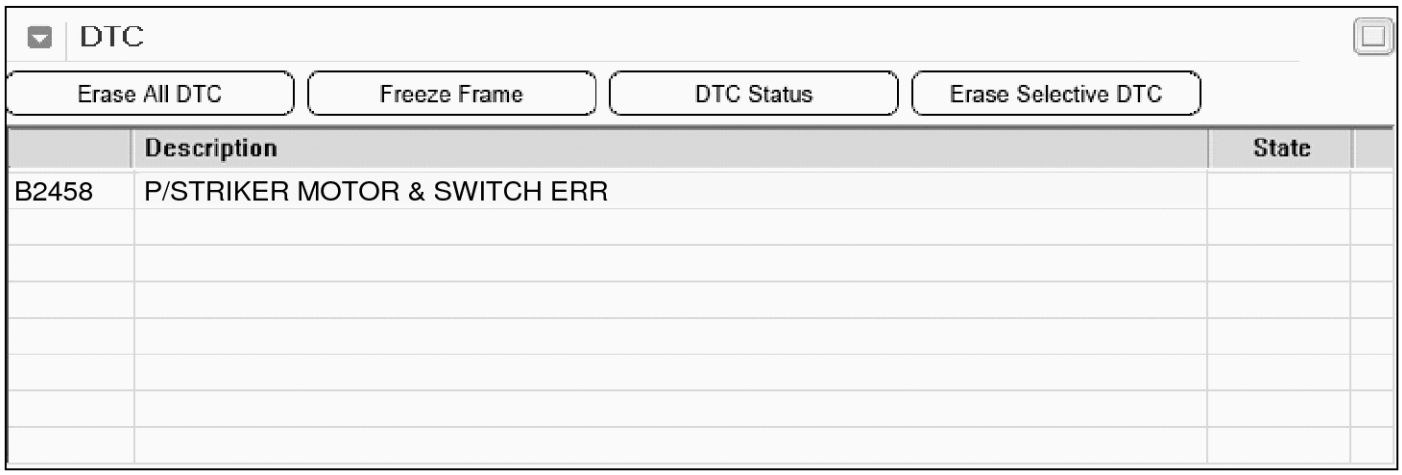
## Diagnostic Circuit Diagram




SBHBE9D02L

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or PTM's connector or was repaired and PTM 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 next procedure.

## Power Striker Motor & Switch Signal Circuit Inspection

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of "Power Striker Motor Operation Voltage and Power Striker Switch" with the hand-operated opening and closing of the trunk rid.

**Specification :** Power Striker Motor Operation Voltage : Approx. 12V
Power Striker Switch : Full Close(In case of lock control), Pop-up (In case of unlock control)

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Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Logic Voltage | 13.20 | V |
| Hall Sensor Power Voltage | 12.32 | V |
| Battery Power Voltage | IN RANGE | - |
| Trunk Main Switch | ON | - |
| Trunk LID Outside Handle Switch | Not Press | - |
| Trunk INR Push Button Switch | Not Press | - |
| Trunk Door Trim Close Switch | Not Press | - |
| Power Striker Switch | POP-UP | - |
| Trunk LID Latch Switch | UNLOCK | - |
| LED Lamp | ON | - |
| Driver Motor Operating Voltage | 0.00 | V |
| Power Striker Operating Voltage | 12.6 | V |
| Trunk LID Position | 2.0 | % |
| Learn Process Complete Status | COMPLETED | - |
| Unknown Trunk LID Position Flag | UNKNOWN | - |
| 1st Most P/Striker Full Down Time | 5 | mS |
| 2nd Most P/Striker Full Down Time | 0 | mS |

SBHBE9D18L

4. Are service data within specifications?

**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 short or open on the circuits of Power Striker Motor & Switch.
▶ If there is no something wrong on the circuits of Power Striker Motor & Switch, Substitute with a known - good Power Striker Motor & Switch ASS'Y and check for proper operation.
If the problem is corrected, replace the units and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B2459 Latch Motor and Switch Error

### General Description

The motor of PTM(Power Trunk Lid Module) consists of Drive Motor, Trunk Latch Motor, and Power Striker Motor . Therefore, It is available to open trunk by mechanical power. Opening is controlled by Trunk Lid Outside Handle, Door Trim Pull Switch, or Remote Controller. Closing is controlled by Inner Switch or Door Trim Push Switch. Opening or closing the rid by mechanical power is performed by hinge's rotation which is controlled by rod(This rod is consists of Sector Gear linked to Drive Motor Gear).

The motor speed is monitored by Hall IC. This value is used to control the driving power. The power is up when the speed is slower than the specific value and the power is down when the speed is faster than the specific value. Besides, the trunk lid is controlled in the counter direction when there is long interval between signals from Hall IC. Because It is assumed that there is obstacle or interference.

PTM judges whether the trunk Latch locks or unlocks the trunk rid by operating the trunk latch motor.

Refer to DTC B1602 : CAN Error.

### DTC Description

This code is outputted when there is the fixed switch signal(ON/OFF) while PTM operates the trunk rid.

In case of no Trunk Latch Motor working and abnormal signal : faulty motor, short/open on motor circuit.

In case of Trunk Latch Motor working but abnormal signal : faulty switch, or short/open on switch circuit.

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## DTC Detecting Condition

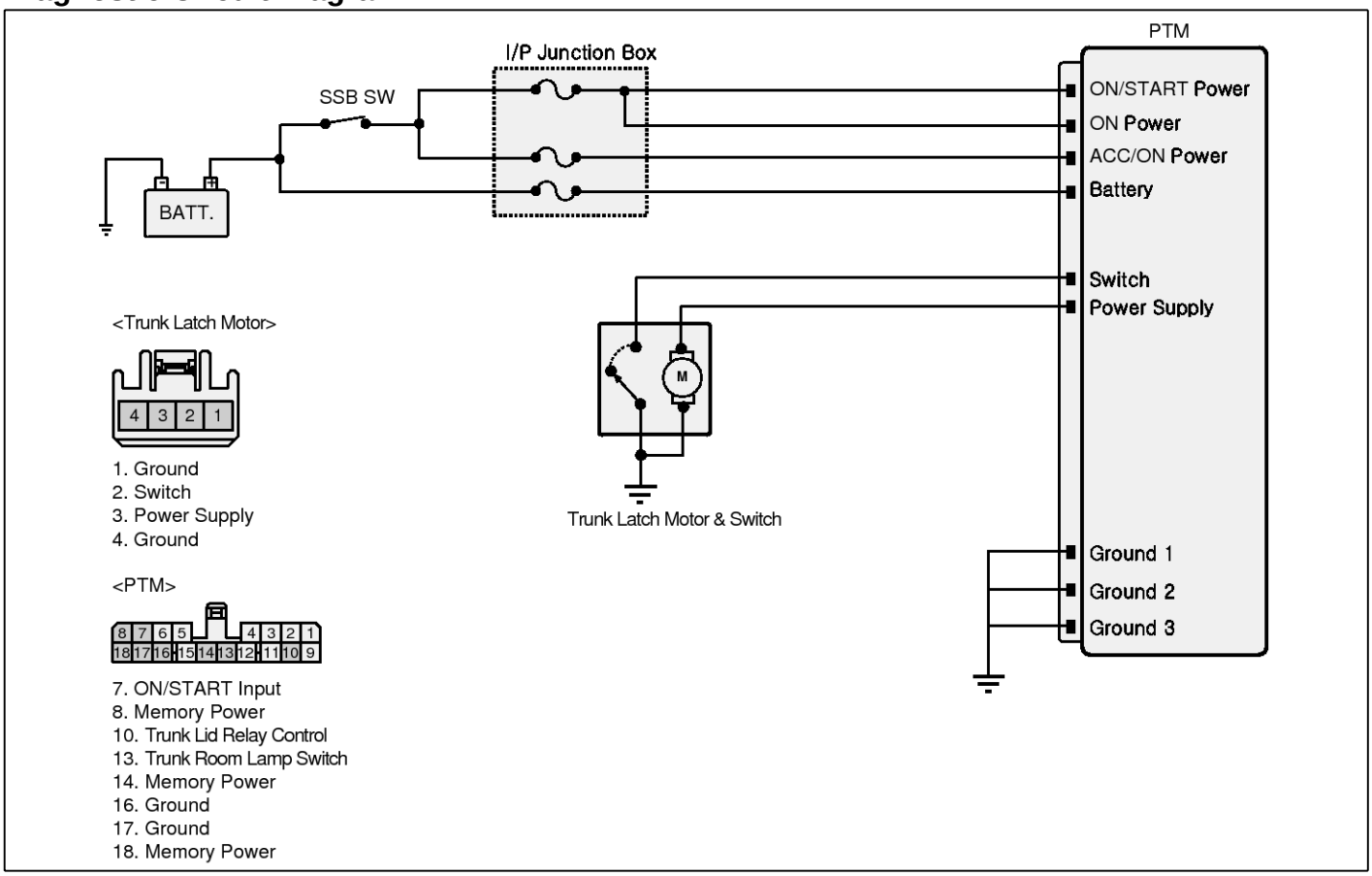
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal Voltage Check | • Short to battery, short to ground, open or poor contact on Latch Motor circuit<br>• Short to battery, short to ground, open or poor contact on Latch Switch circuit<br>• Faulty motor<br>• Faulty switch<br>• Blown fuse<br>• Faulty PTM<br>(These troubles may lead the counter direction movement of the trunk lid) |
| Enable Conditions | • IG ON<br>• In case of faulty Latch Motor<br>- Lock latch mechanically after open trunk<br>→ Power Striker Full Down(Lock) → Push the Outside Switch<br>• In case of faulty switch<br>- Repeat Lock/Unlock by the Emergency handle manually. | |
| Threshold Value | • In case of faulty Latch Motor<br>- It is disable to unlock latch after Power Striker Shaft Pop up(Unlock)<br>• In case of faulty switch<br>- There is no signal change of the latch switch (Lock/Unlock)<br>- There is no movement of the Power Striker Shaft (Pop Up & Down) | |
| Diagnostic Time | • 3 times in sequential (Present DTC) | |
| DTC Erasing Time | • Erase the present DTC in the moment of Wake-up after Sleep or trouble fixed. (The present DTC → The past DTC) | |
| Limp Home Mode | • It is available to operate by hand-operated (Except motor stuck) | |

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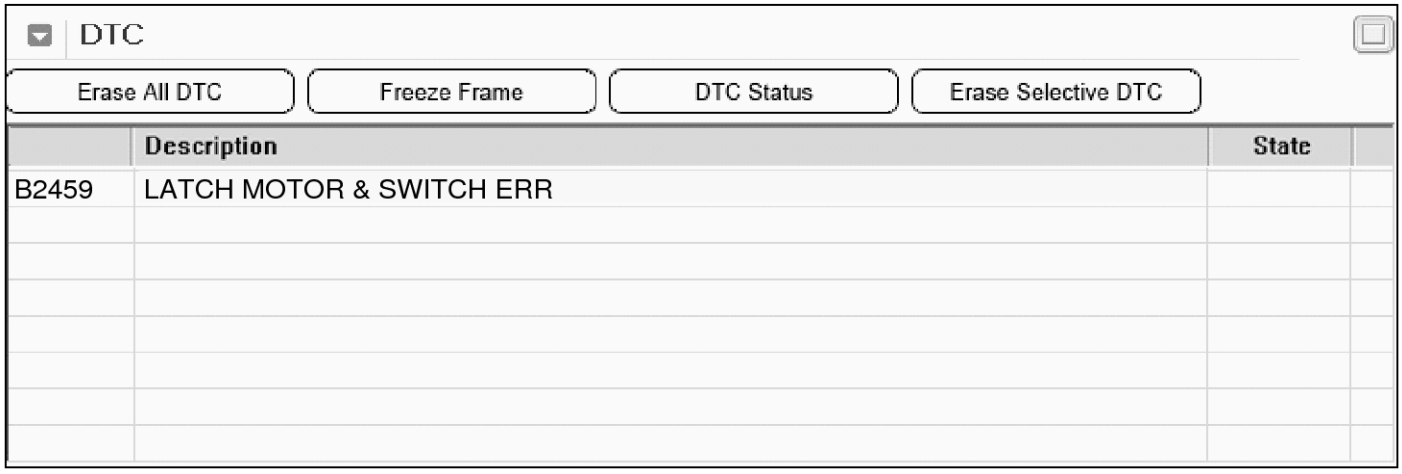
## Diagnostic Circuit Diagram




SBHBE9D03L

## 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?

**YES** ▶ Go to next procedure.

**NO** ▶ Fault is intermittent caused by poor contact in the sensor's and/or PTM's connector or was repaired and PTM 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 next procedure.

## Trunk Latch Motor & Switch Signal Circuit Inspection

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of "Trunk Lid Latch Switch" with the hand-operated opening and closing of the trunk rid.

**Specification :** Lock (In case of lock control) , Unlock (In case of unlock control)

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Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Logic Voltage | 13.20 | V |
| Hall Sensor Power Voltage | 12.32 | V |
| Battery Power Voltage | IN RANGE | - |
| Trunk Main Switch | ON | - |
| Trunk LID Outside Handle Switch | Not Press | - |
| Trunk INR Push Button Switch | Not Press | - |
| Trunk Door Trim Close Switch | Not Press | - |
| Power Striker Switch | POP-UP | - |
| Trunk LID Latch Switch | UNLOCK | - |
| LED Lamp | ON | - |
| Driver Motor Operating Voltage | 0.00 | V |
| Power Striker Operating Voltage | 0.00 | V |
| Trunk LID Position | 2.0 | % |
| Learn Process Complete Status | COMPLETED | - |
| Unknown Trunk LID Position Flag | UNKNOWN | - |
| 1st Most P/Striker Full Down Time | 5 | mS |
| 2nd Most P/Striker Full Down Time | 0 | mS |

SBHBE9D20L

4. Are service data within specifications?

**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 short or open on the circuits of Trunk Latch Motor & Switch.
▶ If there is no something wrong on the circuits of Trunk Latch Motor & Switch, Substitute with a known - good Trunk Latch Motor & Switch ASS'Y and check for proper operation.
If the problem is corrected, replace the units and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

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## B2460 Drive Motor and Hall Sensor Error

### General Description

The motor of PTM(Power Trunk Lid Module) consists of Drive Motor, Trunk Latch Motor, and Power Striker Motor . Therefore, It is available to open trunk by mechanical power. Opening is controlled by Trunk Lid Outside Handle, Door Trim Pull Switch, or Remote Controller. Closing is controlled by Inner Switch or Door Trim Push Switch. Opening or closing the rid by mechanical power is performed by hinge's rotation which is controlled by rod(This rod is consists of Sector Gear linked to Drive Motor Gear).

The motor speed is monitored by Hall IC. This value is used to control the driving power. The power is up when the speed is slower than the specific value and the power is down when the speed is faster than the specific value. Besides, the trunk lid is controlled in the counter direction when there is long interval between signals from Hall IC. Because It is assumed that there is obstacle or interference.

Refer to DTC B1602 : CAN Error.

### DTC Description

This code is outputted when there is abnormal signal from the hall IC sensor.

Case1 : There is no pulse signal by no motor working because of faulty Drive Motor, damaged components inside Drive Motor, or short/open in circuit.

Case 2 : There is no pulse signal because of faulty Hall IC or short/open in circuit.

### DTC Detecting Condition

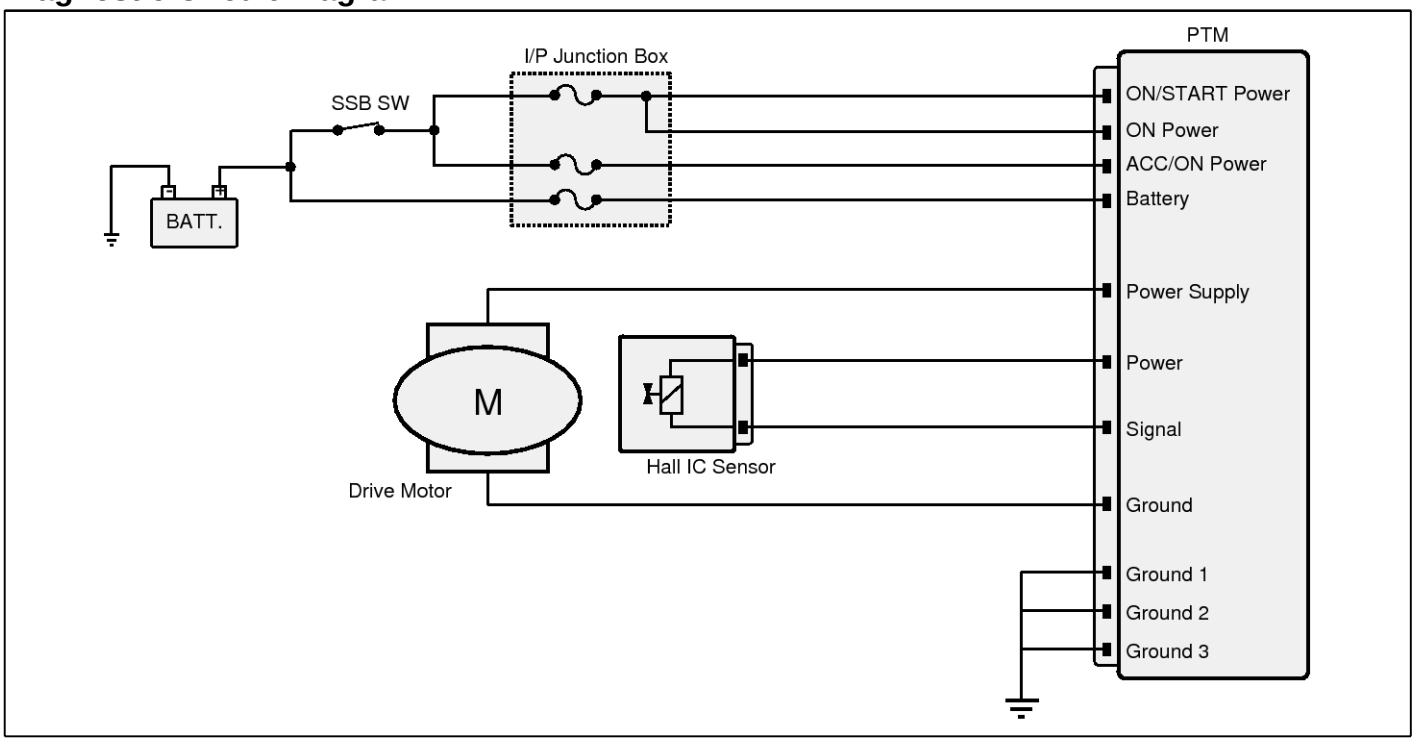
| Item | Detecting Condition | Possible Cause |
|---|---|---|
| DTC Strategy | • Signal Voltage Check | • Short to battery/ground, open or poor contact on Drive Motor circuit<br>• Short to battery/ground, open or poor contact on Hall IC Sensor circuit<br>• Faulty Drive Motor and the related components<br>• Faulty Hall IC Sensor<br>• Blown fuse<br>• Faulty PTM<br>(These troubles may lead the counter direction movement of the trunk lid) |
| Enable Conditions | • IG ON<br>• In case of faulty Drive Motor<br>When the trunk is opening or closing by mechanical power (By pushing the local switch)<br>• In case of faulty Hall IC Sensor<br>- When the trunk is opening or closing by the hand-operated working | |
| Threshold Value | • Faulty Drive Motor<br>- The fixed signal due to no motor working<br>• Faulty Hall IC Sensor<br>- The fixed signal (The steady voltage between 5V and 10V) | |
| Diagnostic Time | • 3 times in sequential (Present DTC) | |
| DTC Erasing Time | • Erase the present DTC in the moment of Wake-up after Sleep or trouble fixed. (The present DTC → The past DTC) | |
| Limp Home Mode | • It is available to operate by hand-operated (Except motor stuck) | |

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## Diagnostic Circuit Diagram




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## Signal Waveform & Data

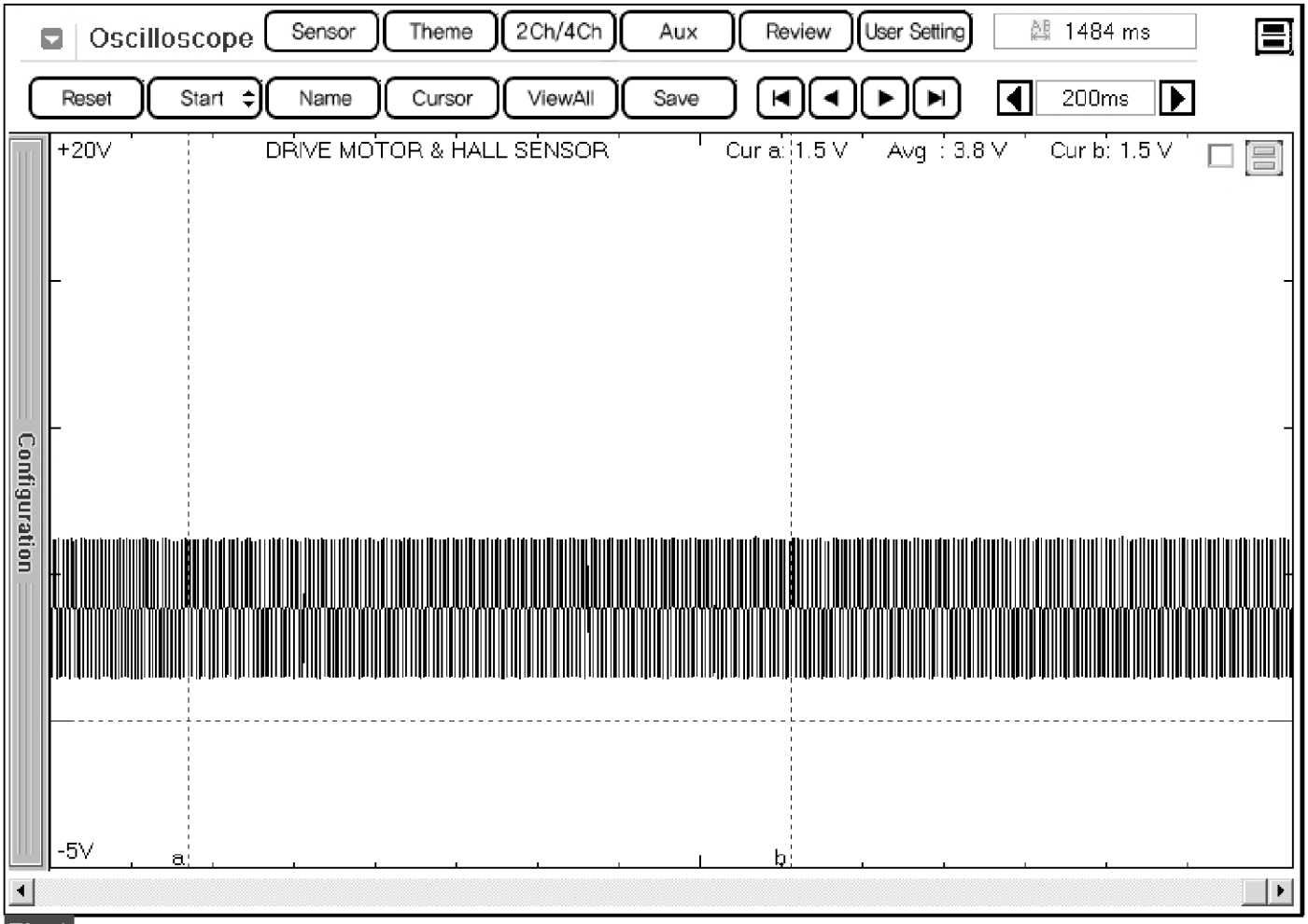



Fig.1

SBHBE9D21L

Fig.1) The signal waveform of Drive Motor & Hall Sensor during operation

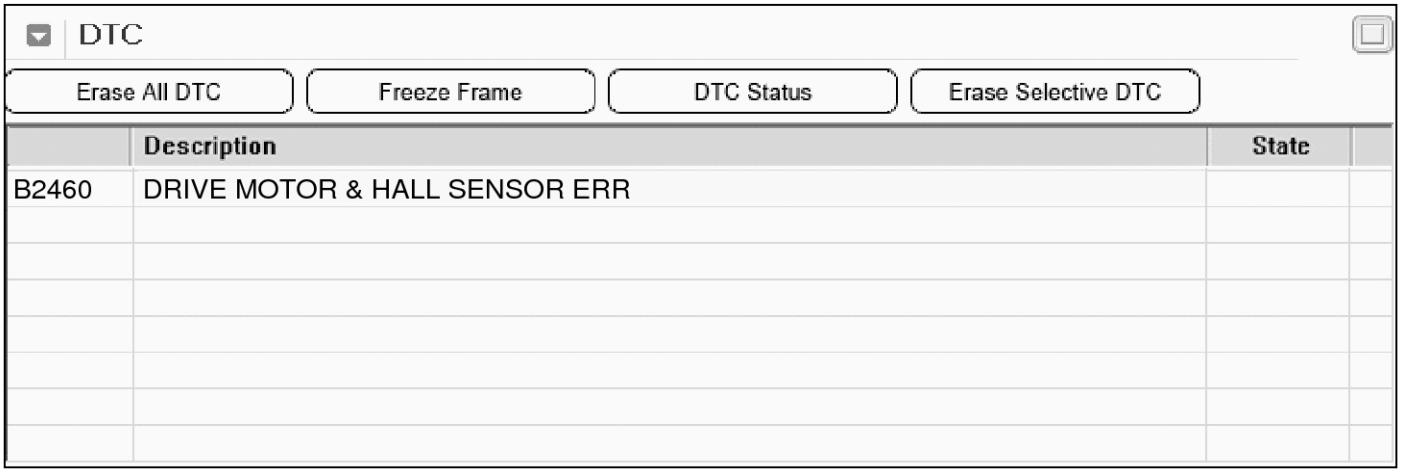
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## Scantool Data Analysis

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).




SBHBE9D22L

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 PTM's connector or was repaired and PTM 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 next procedure.

## Drive Motor & Hall Sensor Signal Circuit Inspection

1. IG "OFF" and connect GDS.
2. IG "ON" and select "Current Data" menu.
3. Check the service data of "Trunk Lid Latch Switch" with the hand-operated opening and closing of the trunk rid.

**Specification :** Approx. 12V

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Current Data

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

| Sensor Name | Value | Unit |
|---|---|---|
| Battery Logic Voltage | 13.20 | V |
| Hall Sensor Power Voltage | 12.32 | V |
| Battery Power Voltage | IN RANGE | - |
| Trunk Main Switch | ON | - |
| Trunk LID Outside Handle Switch | Not Press | - |
| Trunk INR Push Button Switch | Not Press | - |
| Trunk Door Trim Close Switch | Not Press | - |
| Power Striker Switch | POP-UP | - |
| Trunk LID Latch Switch | UNLOCK | - |
| LED Lamp | ON | - |
| Driver Motor Operating Voltage | 12.26 | V |
| Power Striker Operating Voltage | 0.00 | V |
| Trunk LID Position | 2.0 | % |
| Learn Process Complete Status | COMPLETED | - |
| Unknown Trunk LID Position Flag | UNKNOWN | - |
| 1st Most P/Striker Full Down Time | 5 | mS |
| 2nd Most P/Striker Full Down Time | 0 | mS |

SBHBE9D23L

4. Are service data within specifications?

**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 short or open on the circuits of Drive Motor & Hall Sensor.
▶ If there is no something wrong on the circuits of Drive Motor & Hall Sensor, Substitute with a known - good Drive Motor & Hall Sensor ASS'Y and check for proper operation.
If the problem is corrected, replace the unit and go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

Refer to DTC B1602 : CAN Error.

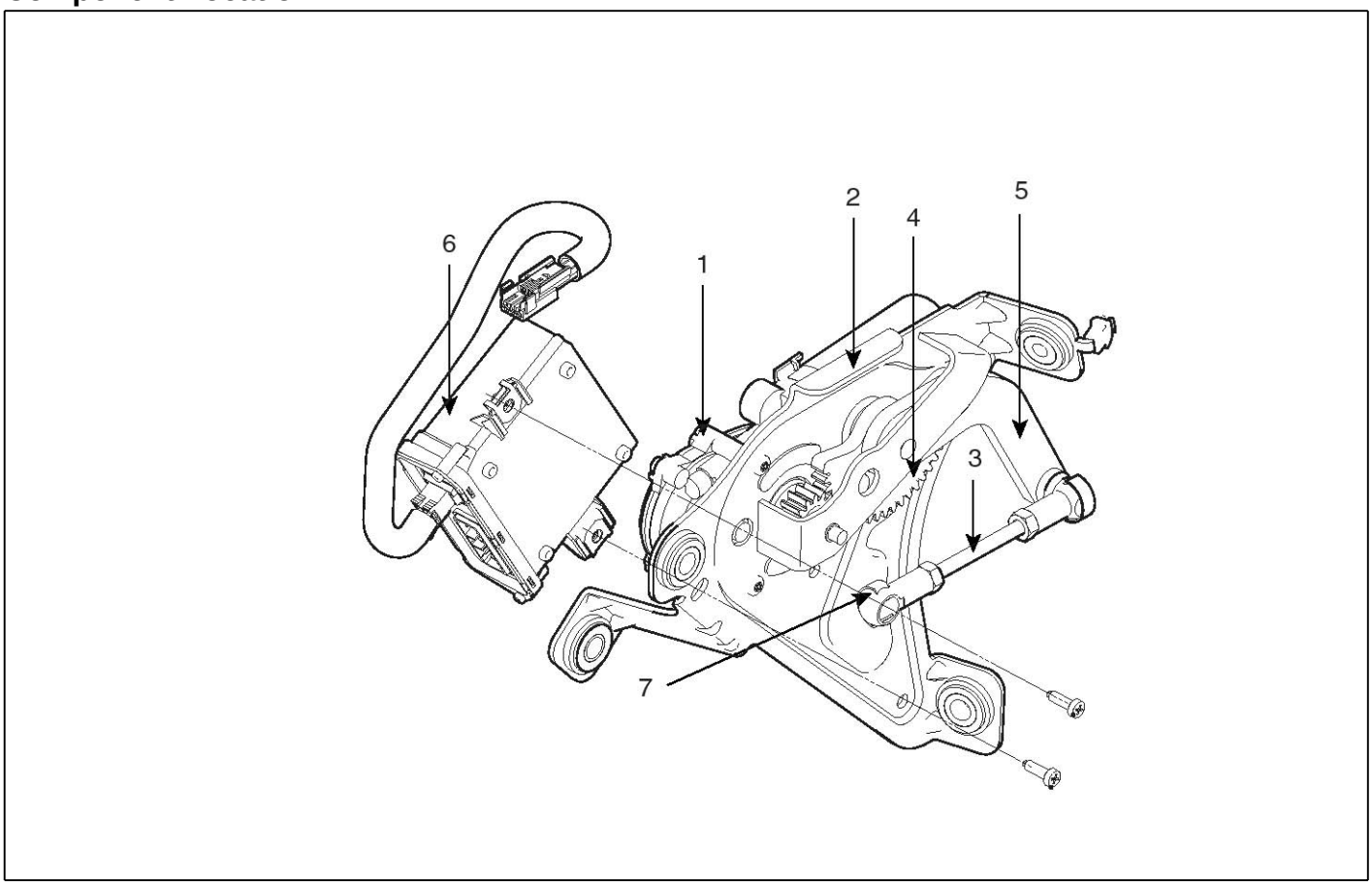
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## Power Trunk Module Drive Unit

### Component Location




SBHBE8985D

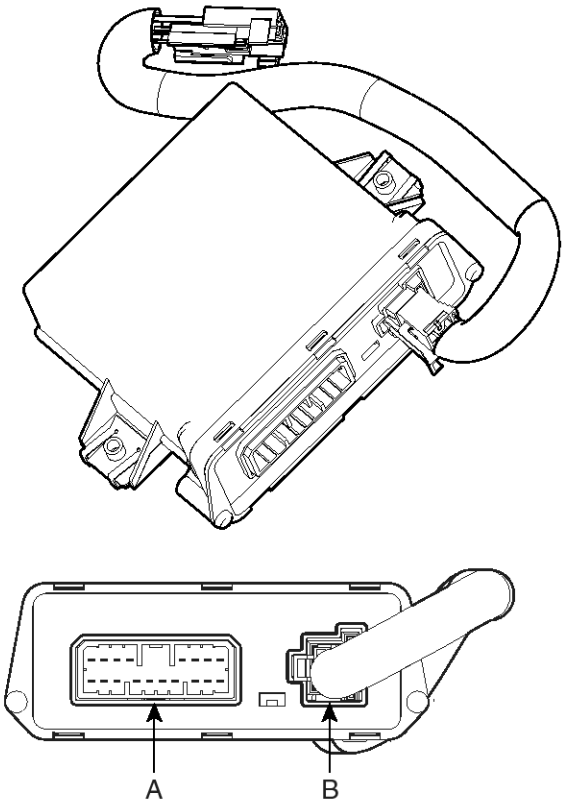
1. Gear motor
2. Drive bracket
3. Push rod
4. Gear
5. Drive arm
6. Power trunk module control unit
7. Push rod pin

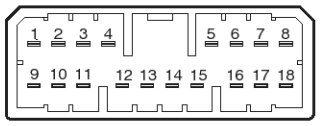
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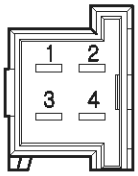


## Circuit Diagram




| Connector A | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | CAN Low | 10 | Latch actuation |
| | 2 | Trunk lid switch inside | 11 | GND signal |
| | 3 | Trunk lid switch outside | 12 | Lamp trunk lid inside switch |
| | 4 | Door trim switch close | 13 | Latch contact |
| | 5 | Striker contact | 14 | Battery signal |
| | 6 | Striker power | 15 | Power striker GND |
| | 7 | IGN | 16 | Power GND |
| | 8 | Battery power | 17 | Power GND |
| | 9 | CAN High | 18 | Battery power |



| Connector B | Pin | Description | Pin | Description |
|---|---|---|---|---|
|  | 1 | Hall signal | 3 | Hall power |
| | 2 | Trunk drive motor + | 4 | Trunk drive motor - |



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## Removal

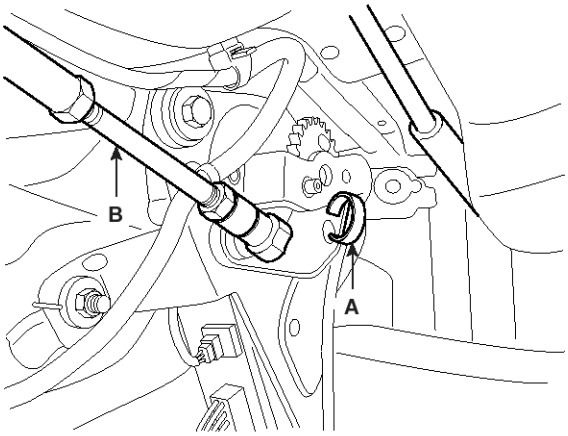
**CAUTION**

- **When removing and installing the trunk lid, an assistant is necessary.**
- **Take care not to be closed the trunk when removing the push rod.**
- **Wear gloves to protect hands from injury.**

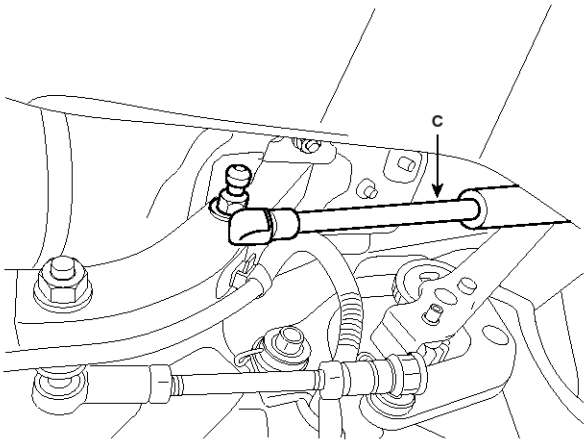
1. Disconnect the negative (-) battery terminal.
2. Remove the left trunk trim in the trunk. (Refer to the Body group - Trunk)
3. Remove the power trunk connecting rod (B) after removing the push rod pin (A).

**NOTICE**

- *Only remove the gas lifter when removing the whole trunk assembly.*



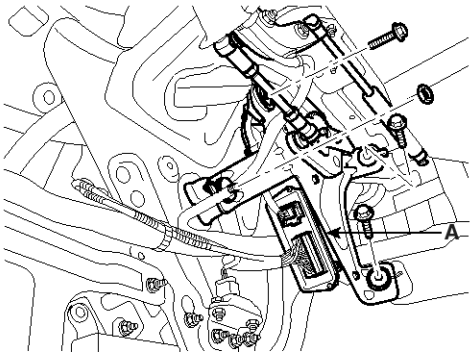

SBHBE8986D




SBHBE8851D

4. Remove the power trunk module & drive unit (A) after removing the bolts, nut and connector.

**Tightening torque :**
22~27 Nm (2.2~2.7 kgf.m, 15.9~19.5 lb-ft)




SBHBE8987D

## Installation

1. Install the power trunk module & drive unit.
2. Install the push rod to the ball joint.
3. Connect the connector (18P).
4. Install the left trunk trim.
5. Connect the negative (-) battery terminal and check the power trunk module correctly.

**NOTICE**

- *Connect the connectors tightly.*
- *Check the power trunk lid for normal operation correctly.*

**WARNING**

- **A lost drive unit mounting bolt in the vehicle may make a noise.**
- **Don't operate the power trunk lid when a push rod is removed.**
- **A learn cycle must be performed whenever the power is removed.**
- **Check the normal operating whenever a power tailgate component is removed or replaced. If the chime sound is heard, check the DTC, wiring harness and cable connections.**

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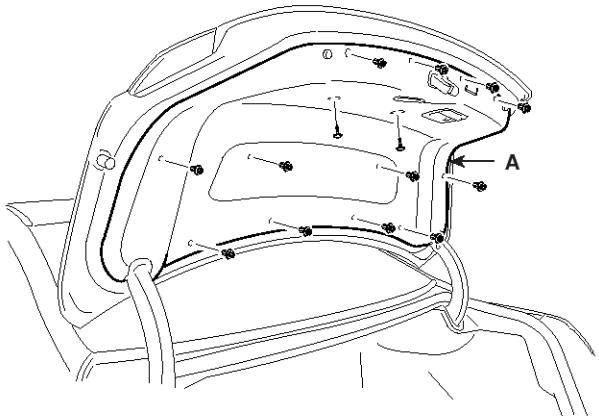
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## Power Latch

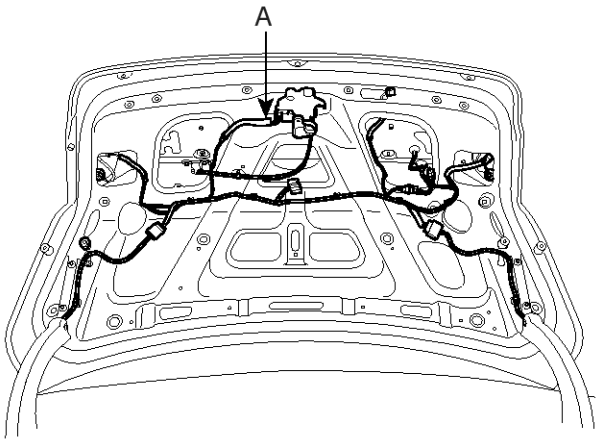
### Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the trunk trim (A) in the trunk. (Refer to the Body group - Trunk)



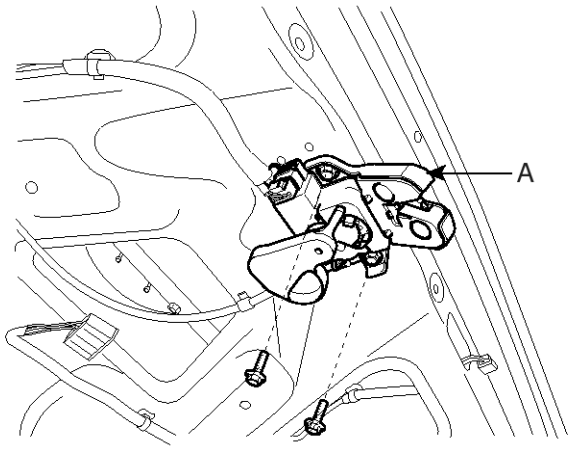

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3. Disconnect the actuator connector (4P) (A).




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4. Remove the power latch (A) after removing the bolts ( 2EA) and connector.




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### Installation

1. Install the power latch and connector.
2. Install the trunk trim.
3. Connect the negative (-) battery terminal and check t- he power trunk module correctly.

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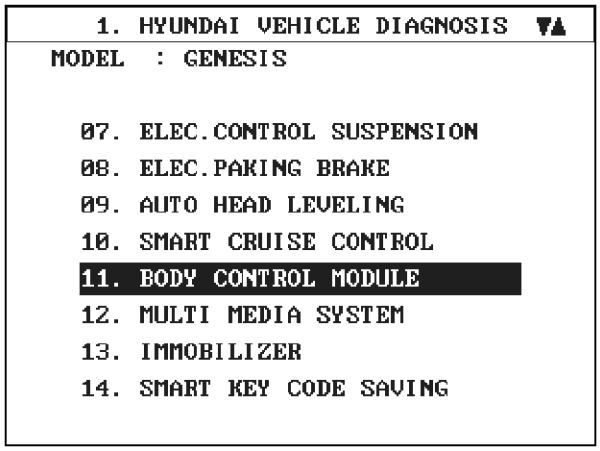
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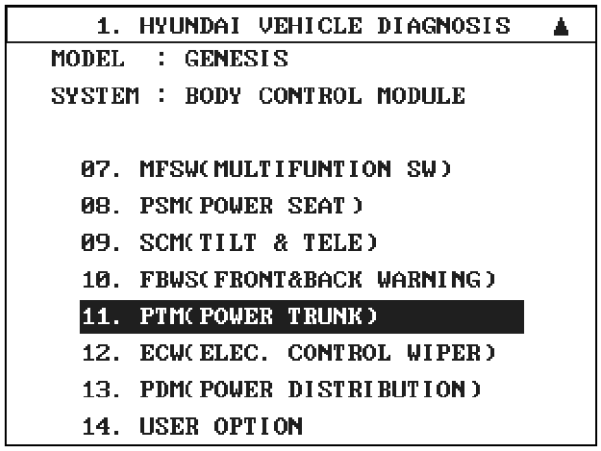
## Inspection

### Power Trunk Lid Inspection With Scan Tool

1. Check the power trunk module input/output value by using the diagnostic tool. If the operation of power trunk module is abnormal, replace power trunk drive unit.

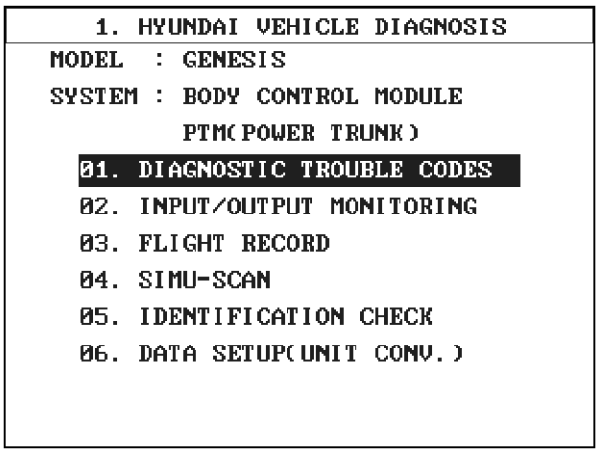



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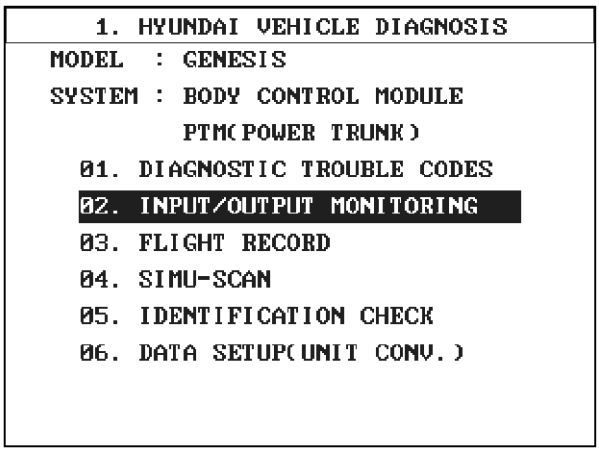

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2. To check the DTC of the multifunction switch, select " DIAGNOSTIC TROUBLE CODES"

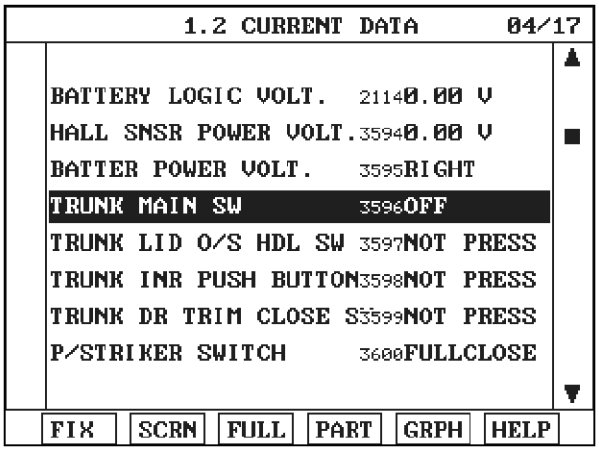



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3. Select "Input/output monitoring".




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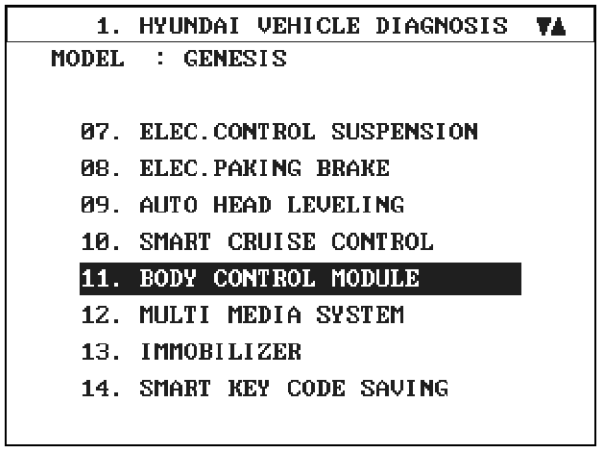


## Power Striker

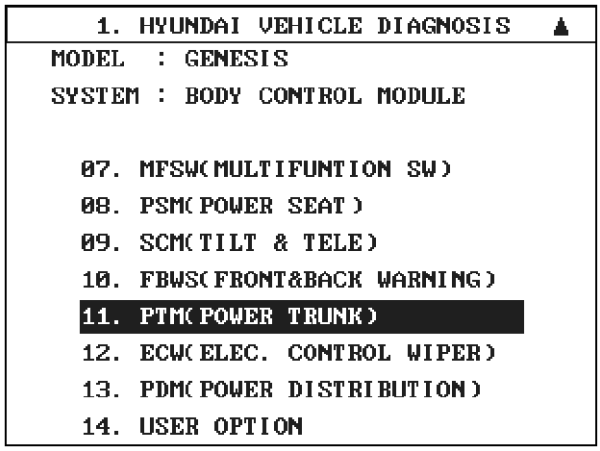
### Inspection

#### Power Trunk Lid Inspection With Scan Tool

1. Check the power trunk module input/output value by using the diagnostic tool. If the operation of power trunk module is abnormal, replace power trunk drive unit.

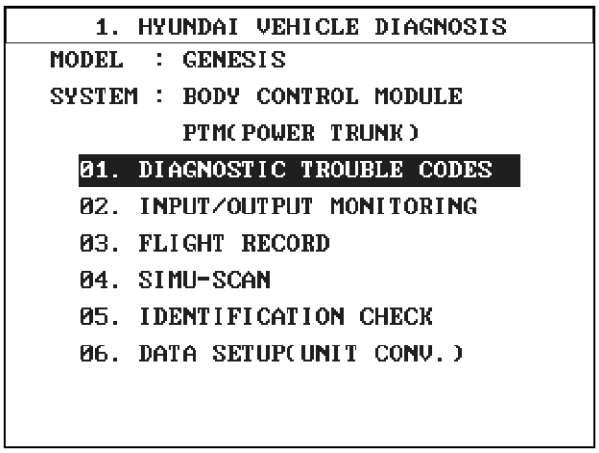



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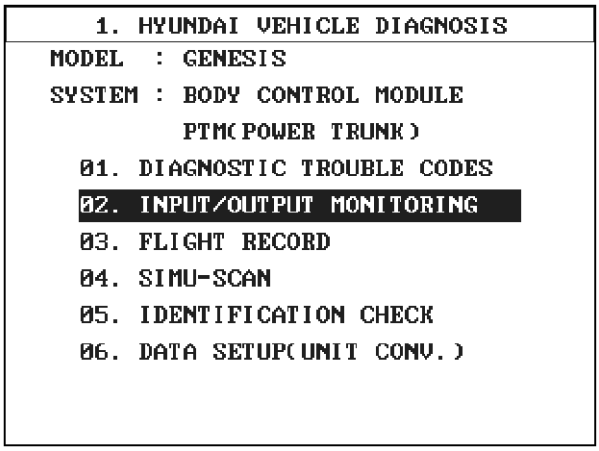

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2. To check the DTC of the multifunction switch, select " DIAGNOSTIC TROUBLE CODES"

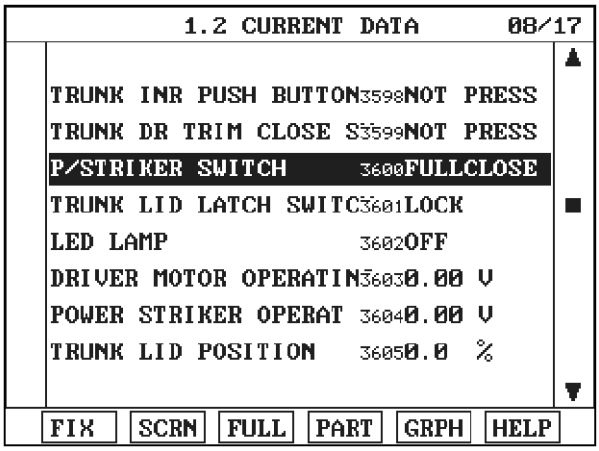



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3. Select "Input/output monitoring".




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SBHBE9469L

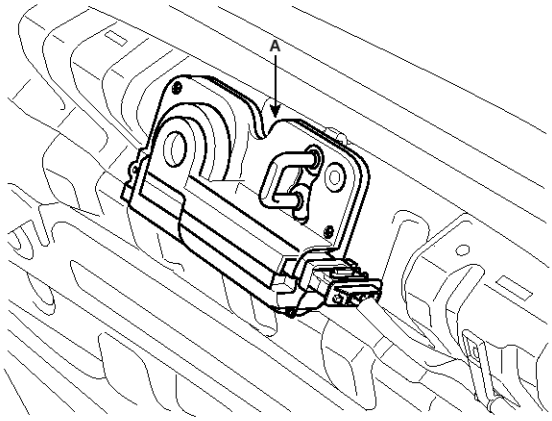
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## Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the trunk trim in the trunk. (Refer to the Body group - Trunk)
3. Remove the power striker (A) after removing the bolts and connector.




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## Installation

1. Install the power striker and connector.
2. Install the trunk trim.
3. Connect the negative (-) battery terminal and check t-he power trunk module correctly.

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