DTC Chart

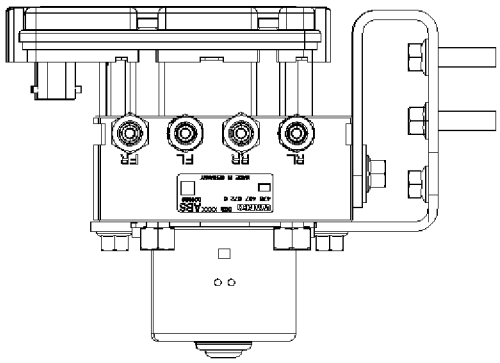
Number	DTC	Description
1	0000	Internal error
2	0001	Sensor Right Hand Front(Airgap)
3	0002	Sensor Left Hand Rear(Airgap)
4	0003	Sensor Left Hand Front(Airgap)
5	0004	Sensor Right Hand Rear(Airgap)
6	0009	Input Valve Right Hand Front(Short To Ubatt/Uvent)
7	000A	Output Valve Right Hand Front(Short To Ubatt/Uvent)
8	000B	Input Valve Left Hand Front(Short To Ubatt/Uvent)
9	000C	Output Valve Left Hand Front(Short To Ubatt/Uvent)
10	000D	Input Valve Right Hand Rear(Short To Ubatt/Uvent)
11	000E	Output Valve Right Hand Rear(Short To Ubatt/Uvent)
12	000F	Input Valve Left Hand Rear(Short To Ubatt/Uvent)
13	0010	Output Valve Left Hand Rear(Short To Ubatt/Uvent)
14	0011	Endurance Brake Relay(Short To Ubatt/Uvent)
15	0017	Sensor Right Hand Front(Impedance)
16	0018	Sensor Left Hand Rear(Impedance)
17	0019	Sensor Left Hand Front(Impedance)
18	001A	Sensor Right Hand Rear(Impedance)
19	001B	Input Valve Right Hand Front(Open Circuit)
20	001C	Output Valve Right Hand Front(Open Circuit)
21	001D	Input Valve Left Hand Front(Open Circuit)
22	001E	Output Valve Left Hand Front(Open Circuit)
23	001F	Input Valve Right Hand Rear(Open Circuit)
24	0020	Output Valve Right Hand Rear(Open Circuit)
25	0021	Input Valve Left Hand Rear(Open Circuit)
26	0022	Output Valve Left Hand Rear(Open Circuit)
27	0023	Endurance Brake Relay(Open Circuit)
28	0024	Brake Light Relay(Open Circuit)
29	0029	Input Valve Right Hand Front(Short To Ground)
30	002A	Output Valve Right Hand Front(Short To Ground)
31	002B	Input Valve Left Hand Front(Short To Ground)
32	002C	Output Valve Left Hand Front(Short To Ground)
33	002D	Input Valve Right Hand Rear(Short To Ground)
34	002E	Output Valve Right Hand Rear(Short To Ground)

Number	DTC	Description
35	002F	Input Valve Left Hand Rear(Short To Ground)
36	0030	Output Valve Left Hand Rear(Short To Ground)
37	0032	Endurance Brake Relay(Short To Ground)
38	0033	Brake Light Relay(Short To Ground)
39	0037	Valve Relay(Can't Switch Off)
40	0038	Valve Relay(Can't Switch On)
41	0039	Reference Ground Connection
42	003B	ABS Warning Light Bulb
43	003C	Brake Warning Light Bulb
44	003D	High Voltage
45	003F	Sensor Right Hand Front(Tire Combination)
46	0040	Sensor Left Hand Rear(Tire Combination)
47	0041	Sensor Left Hand Front(Tire Combination)
48	0042	Sensor Right Hand Rear(Tire Combination)
49	0043	Pump Motor Does Not Switch On
50	0044	Pump Motor Does Not Switch Off
51	0045	Pump Motor Does Not Turn
52	0046	Pump Motor Supply Voltage Missing
53	0047	Pump Motor Relay Voltage Missing
54	0049	Sensor Right Hand Front(No Trigger At All)
55	004A	Sensor Left Hand Rear(No Trigger At All)
56	004B	Sensor Left Hand Front(No Trigger At All)
57	004C	Sensor Right Hand Rear(No Trigger At All)
58	004D	J1939 Internal Error
59	004E	J1939 Bus
60	004F	J1939 Message
61	0050	Inlet Valve(Right Hand Front) Actuation Time Unplausible
62	0051	Inlet Valve(Left Hand Rear) Actuation Time Unplausible
63	0052	Inlet Valve(Left Hand Front) Actuation Time Unplausible
64	0053	Inlet Valve(Right Hand Rear) Actuation Time Unplausible
65	0054	Pole Wheel Right Hand Front(Cyclic Failure)
66	0055	Pole Wheel Left Hand Rear(Cyclic Failure)
67	0056	Pole Wheel Left Hand Front(Cyclic Failure)
68	0057	Pole Wheel Right Hand Rear(Cyclic Failure)
69	0058	Clamp Transistor Failure

Number	DTC	Description
70	0059	Pull Up Down Failure
71	005A	Sensor Right Hand Front(Signal Disturbed)
72	005B	Sensor Left Hand Rear(Signal Disturbed)
73	005C	Sensor Left Hand Front(Signal Disturbed)
74	005D	Sensor Right Hand Rear(Signal Disturbed)

0000 Internal error

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

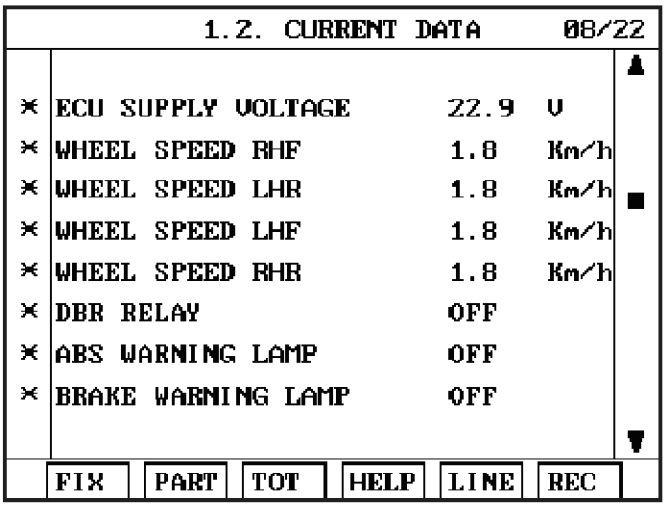
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

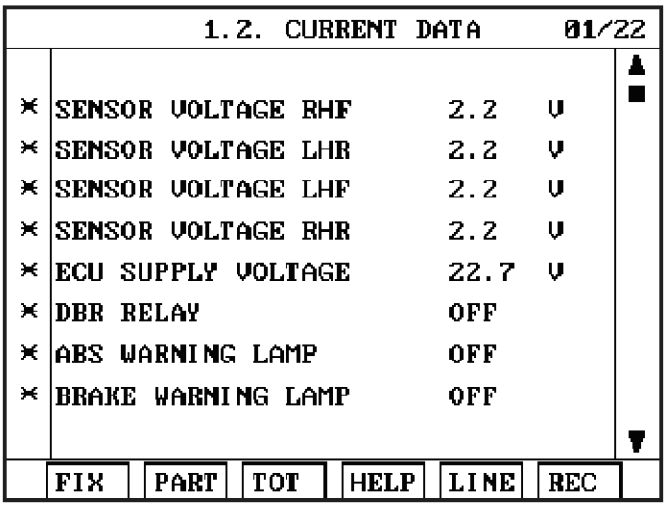
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

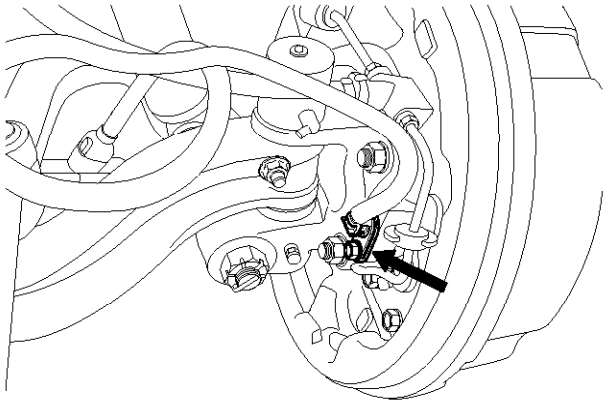
▶ Go to the applicable DTC procedure.

NO

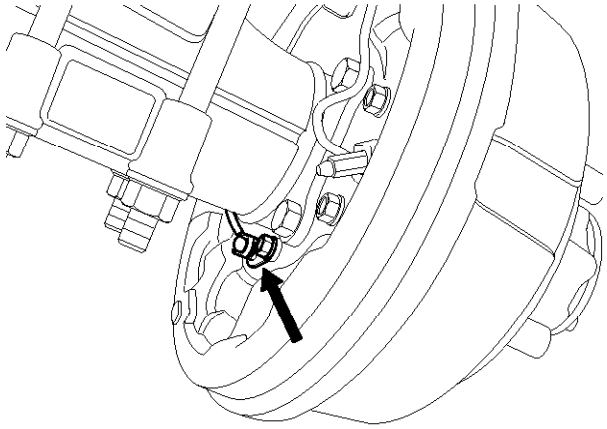
▶ System OK

0001 Sensor Right Hand Front(Airgap)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

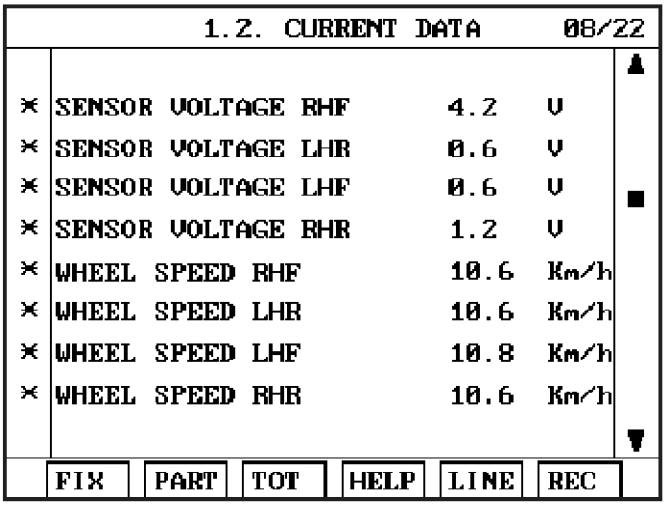
SPECIFICATION

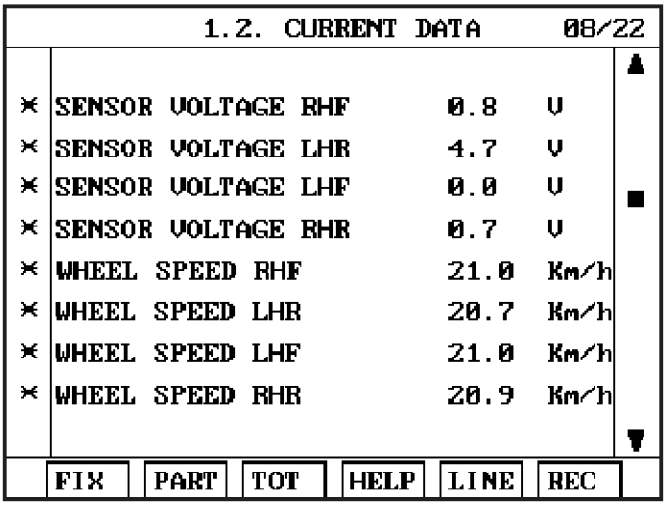
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of

Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand front when sensor connector.
3. Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).

   ■ Specification: 830 ~ 2,100 Ω (At 20℃)
4. Is the resistance measured within specification?

   YES

   ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

   ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

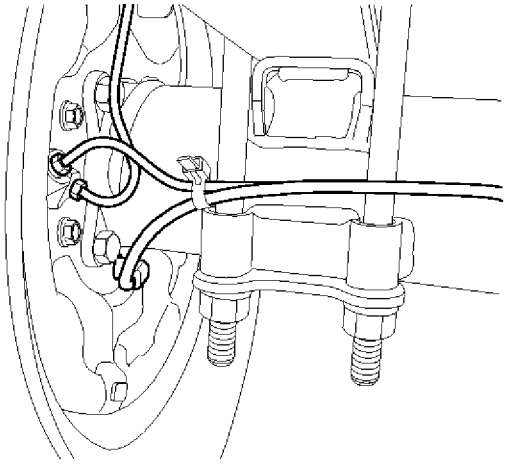
   ▶ Go to the applicable DTC procedure.

   NO

   ▶ System OK

0002 Sensor Left Hand Rear(Airgap)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

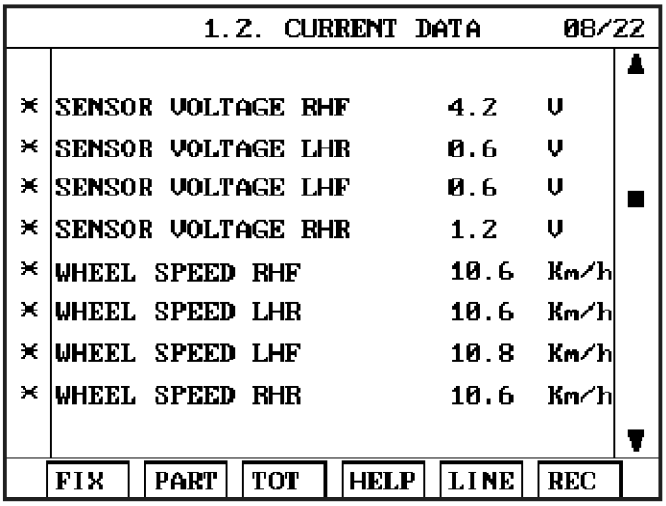
SPECIFICATION

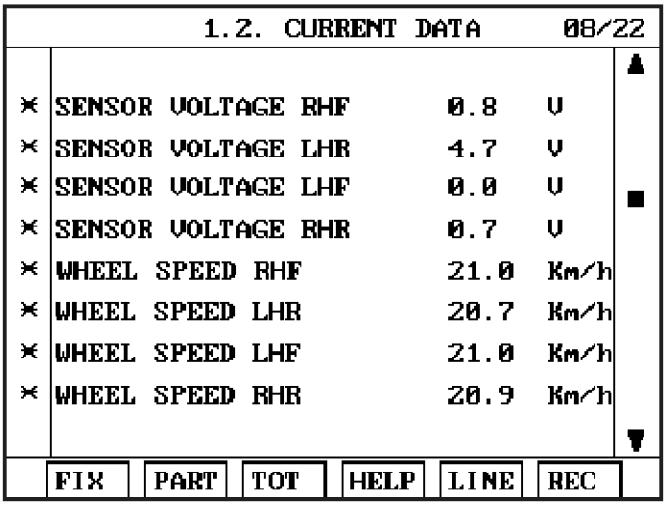
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand rear connector (C37).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).

   ■ Specification: 830 ~ 2100 Ω (At 20℃)
4. Is the resistance measured within specification?

   YES

   ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

   ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

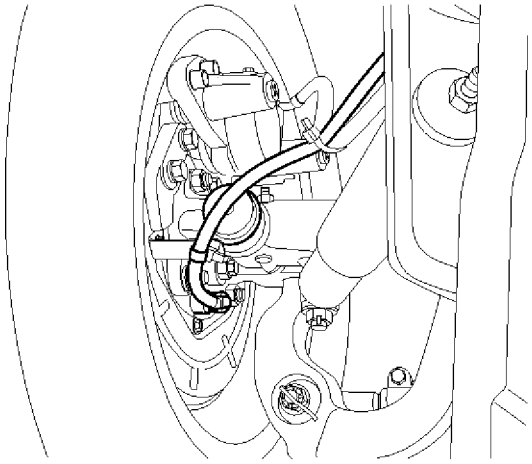
   ▶ Go to the applicable DTC procedure.

   NO

   ▶ System OK

0003 Sensor Left Hand Front(Airgap)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

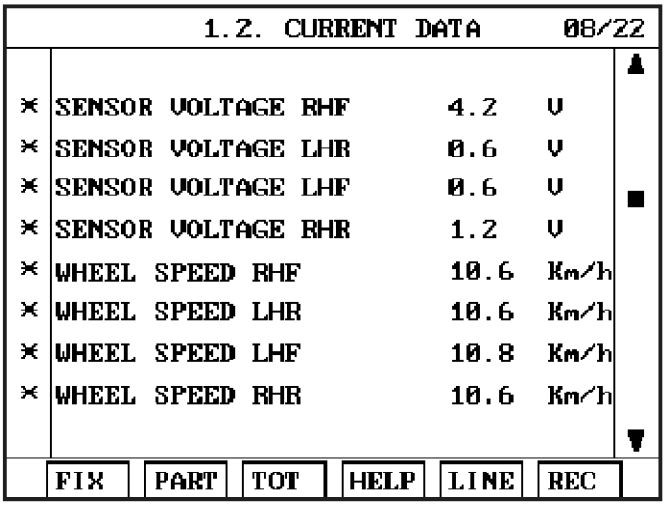
SPECIFICATION

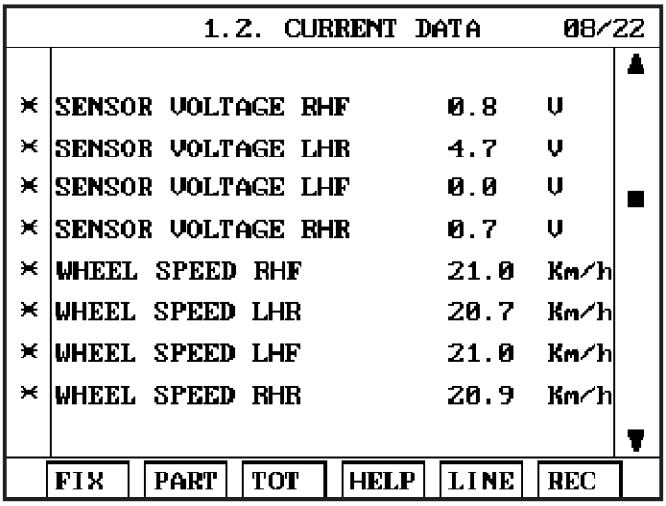
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand front connector (C31).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.

   ■ Specification: 830 ~ 2,100 Ω (At 20℃)
4. Is the resistance measured within specification?

   YES

   ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

   ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

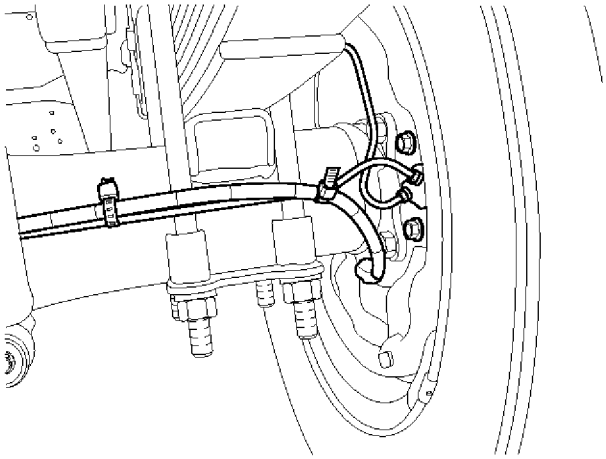
   ▶ Go to the applicable DTC procedure.

   NO

   ▶ System OK

0004 Sensor Right Hand Rear(Airgap)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

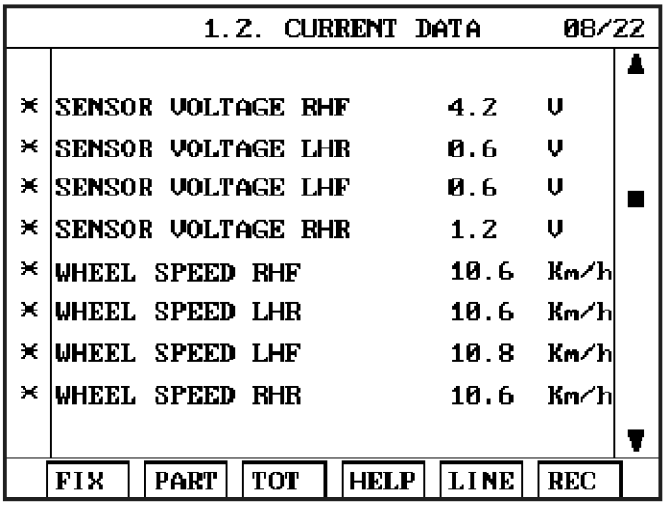
SPECIFICATION

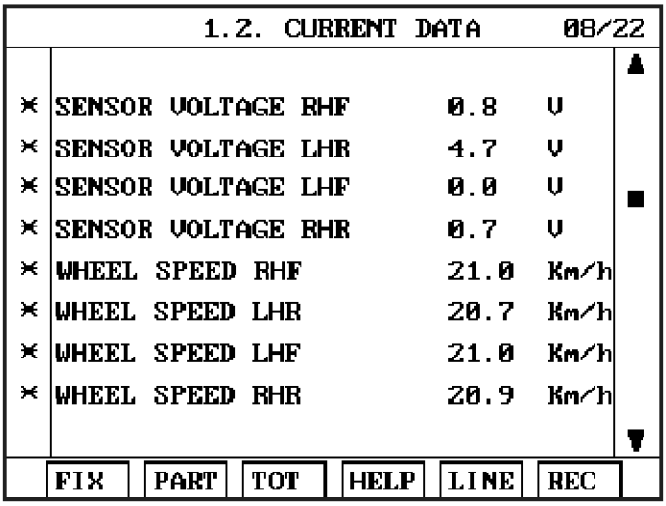
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand rear connector (C36).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
   ■ Specification: 830 ~ 2100 Ω (At 20℃)
4. Is the resistance measured within specification?

YES

▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

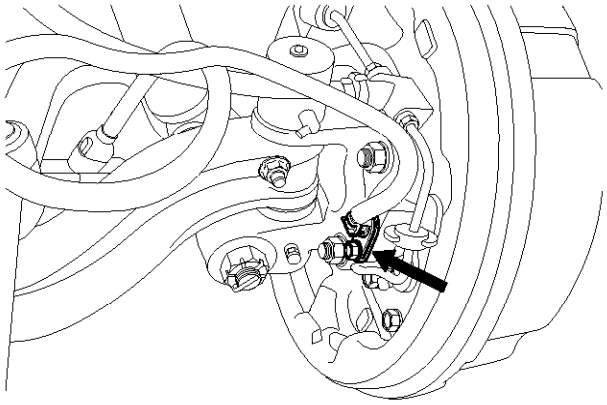
▶ Go to the applicable DTC procedure.

NO

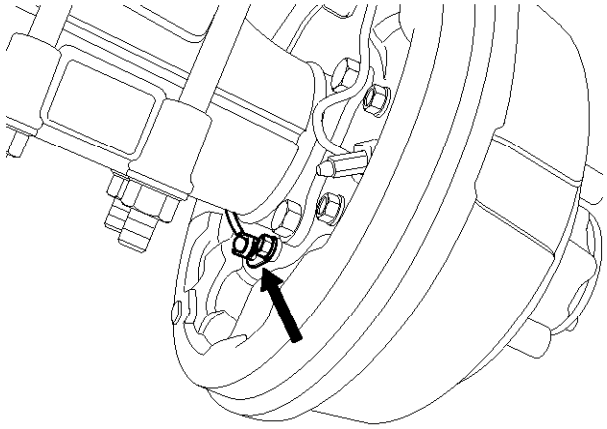
▶ System OK

0009 Input Valve Right Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

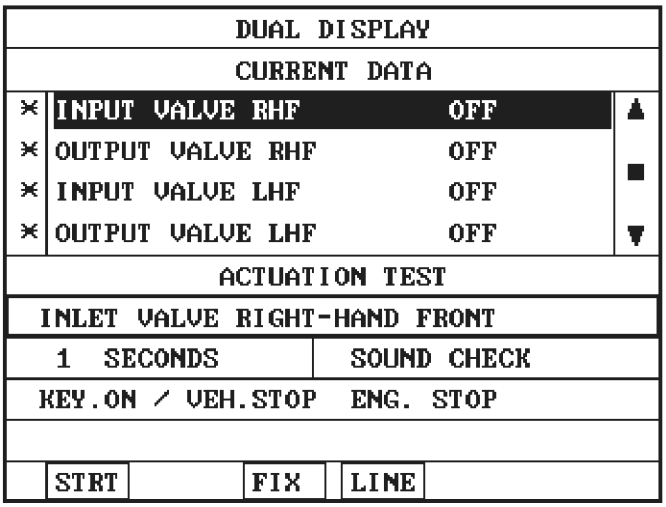
DTC DETECTING CONDITION

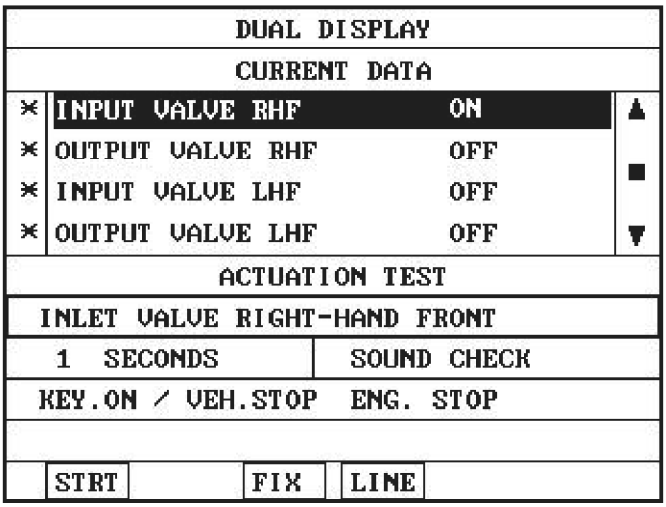
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9009L

Fig1) Right hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

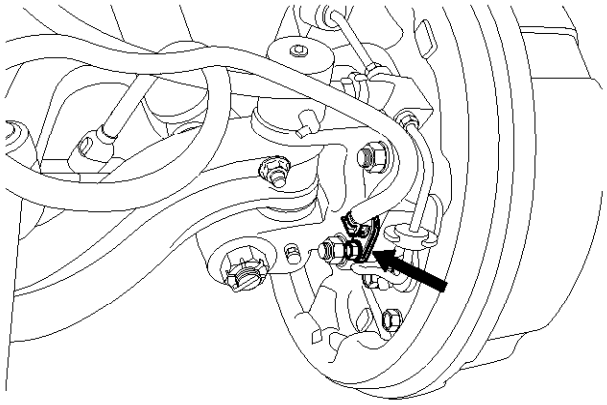
▶ Go to the applicable DTC procedure.

NO

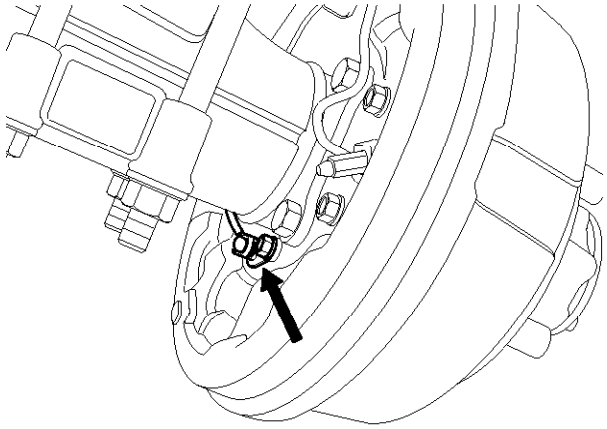
▶ System OK

000A Output Valve Right Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

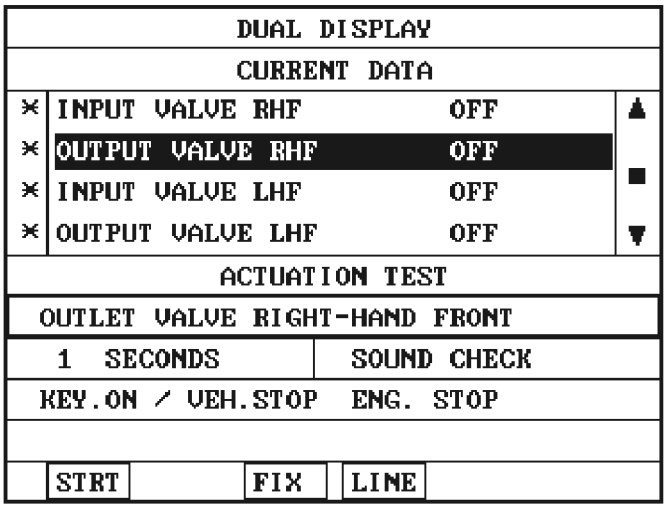
DTC DETECTING CONDITION

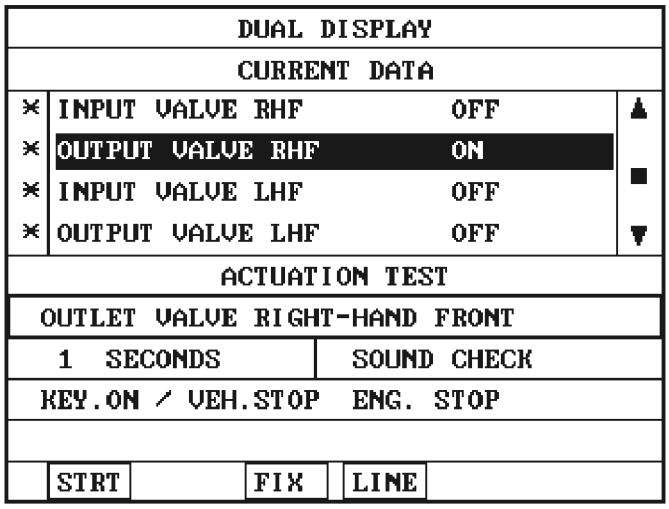
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9010L

Fig1) Right hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

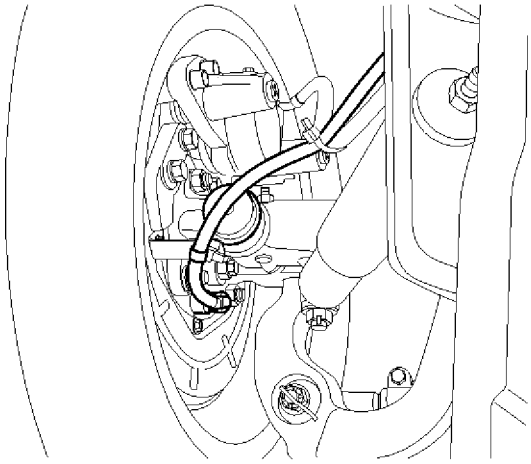
▶ Go to the applicable DTC procedure.

NO

▶ System OK

000B Input Valve Left Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

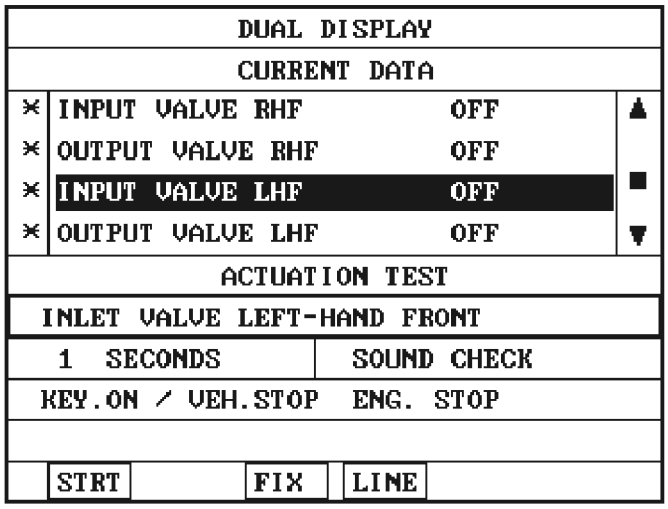
DTC DETECTING CONDITION

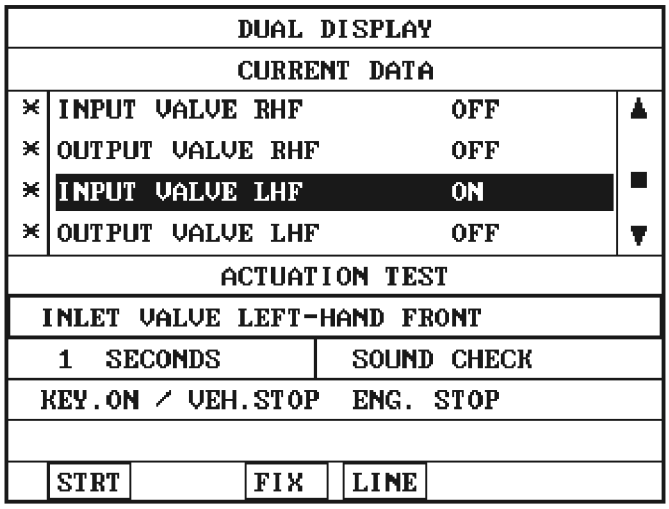
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the left hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9011L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

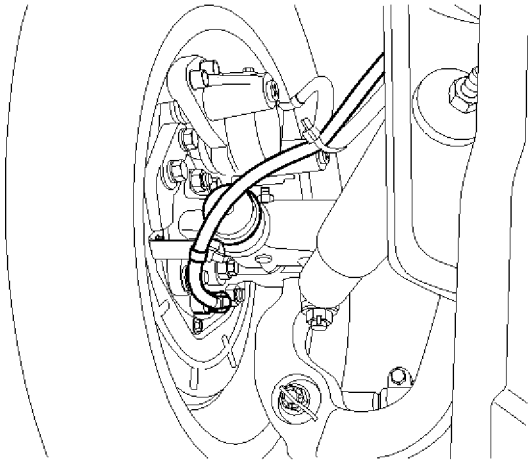
▶ Go to the applicable DTC procedure.

NO

▶ System OK

000C Output Valve Left Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

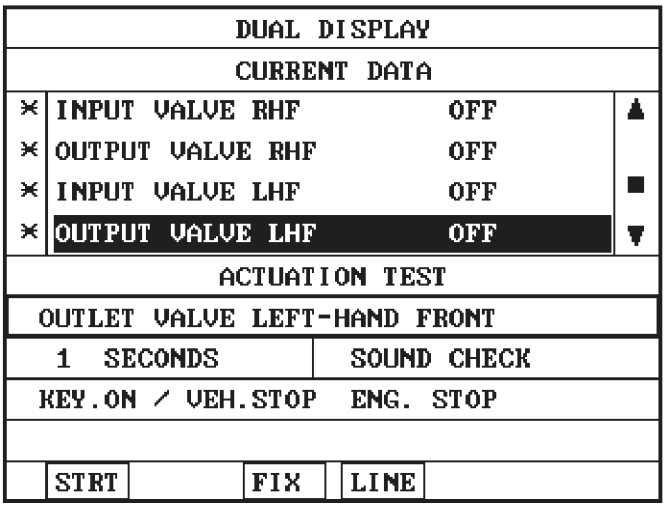
DTC DETECTING CONDITION

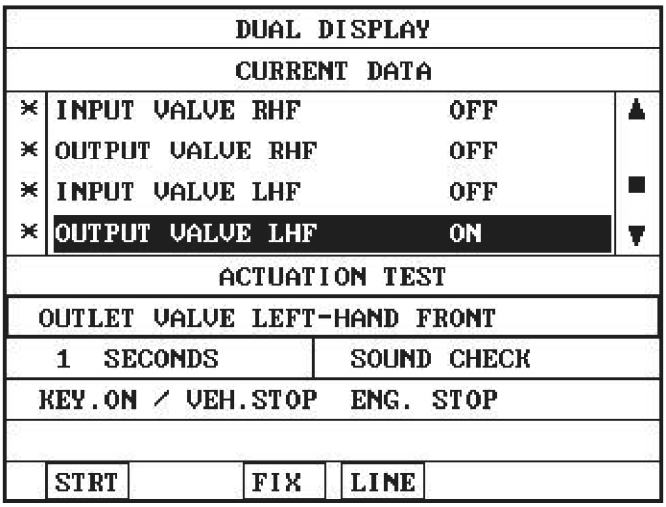
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the left hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9012L

Fig1) Left hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

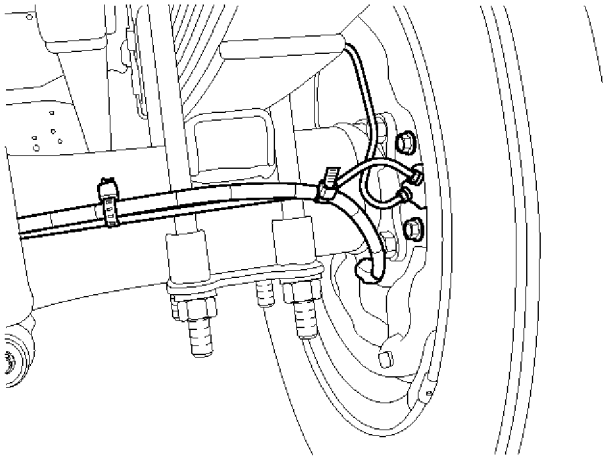
▶ Go to the applicable DTC procedure.

NO

▶ System OK

000D Input Valve Right Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

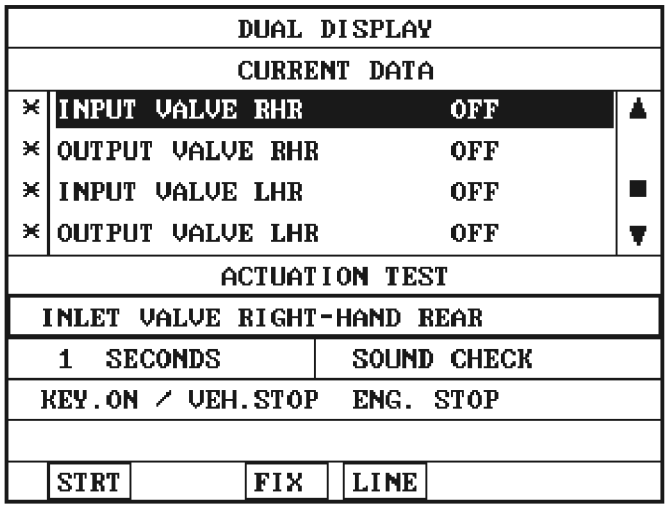
DTC DETECTING CONDITION

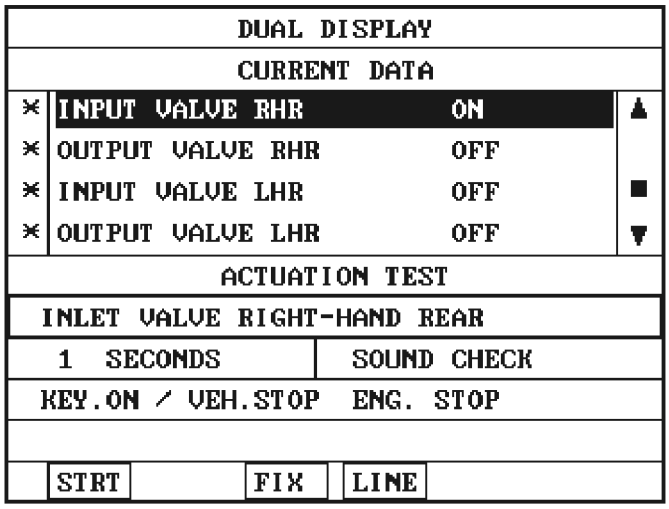
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9013L

Fig1) Right hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

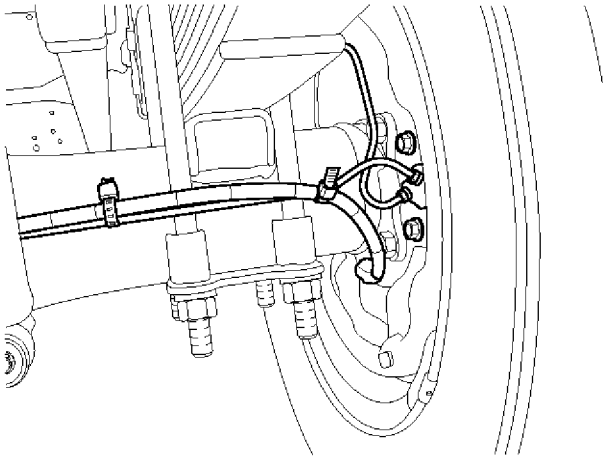
▶ Go to the applicable DTC procedure.

NO

▶ System OK

000E Output Valve Right Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

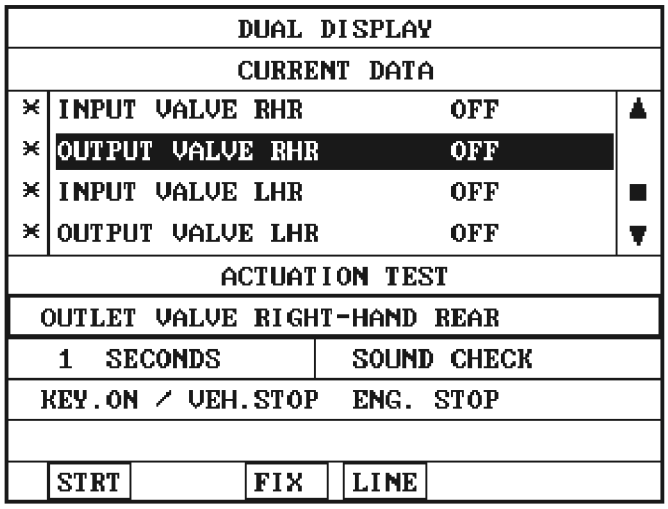
DTC DETECTING CONDITION

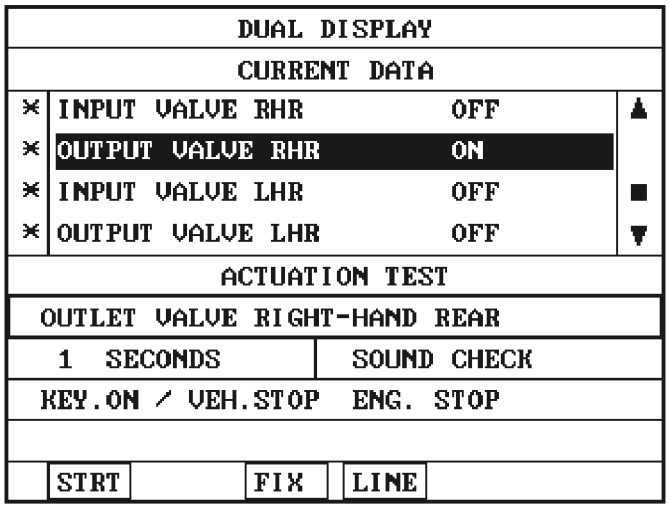
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9014L

Fig1) Right hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

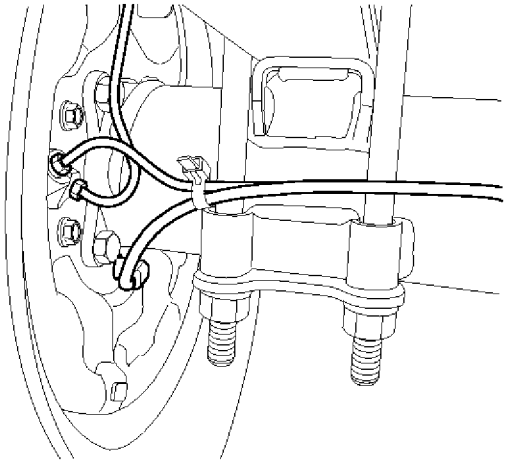
▶ Go to the applicable DTC procedure.

NO

▶ System OK

000F Input Valve Left Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

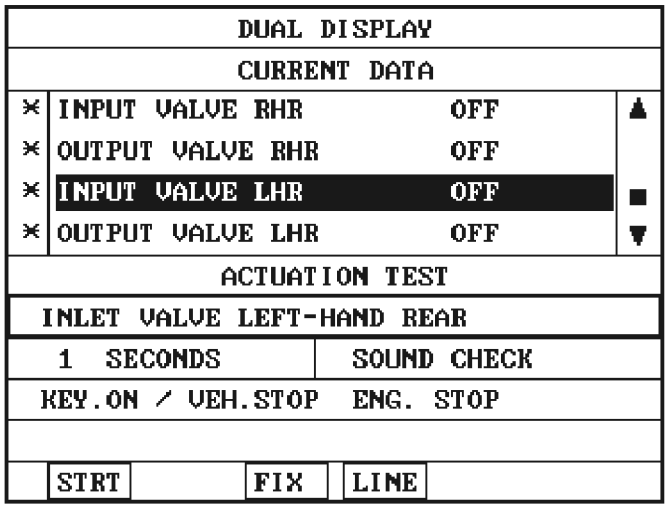
DTC DETECTING CONDITION

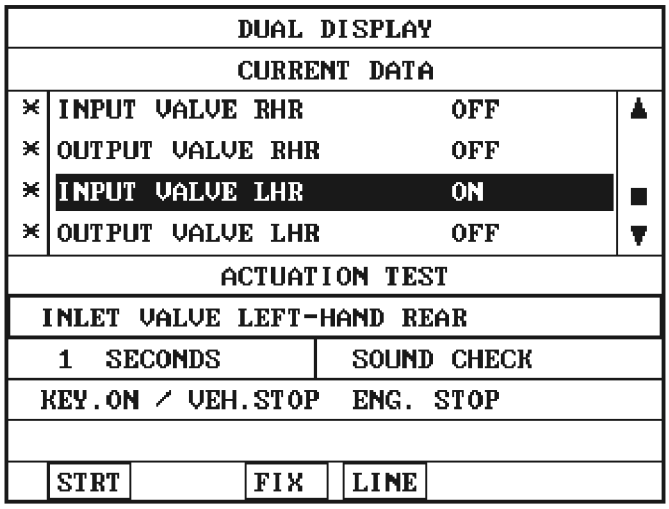
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the left hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9015L

Fig1) Left hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

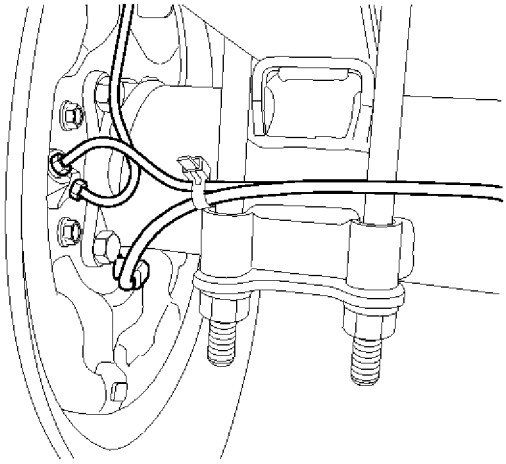
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0010 Output Valve Left Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

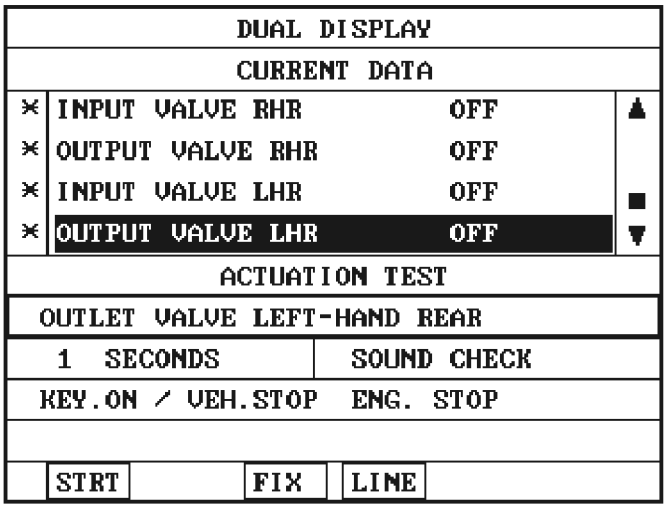
DTC DETECTING CONDITION

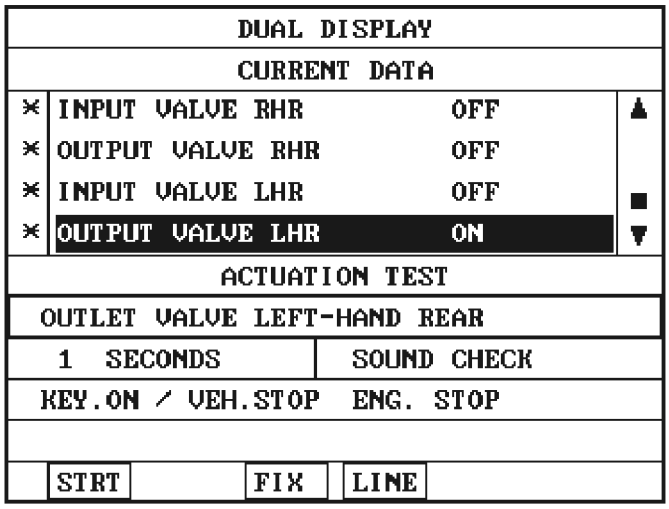
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9016L

Fig1) Left hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

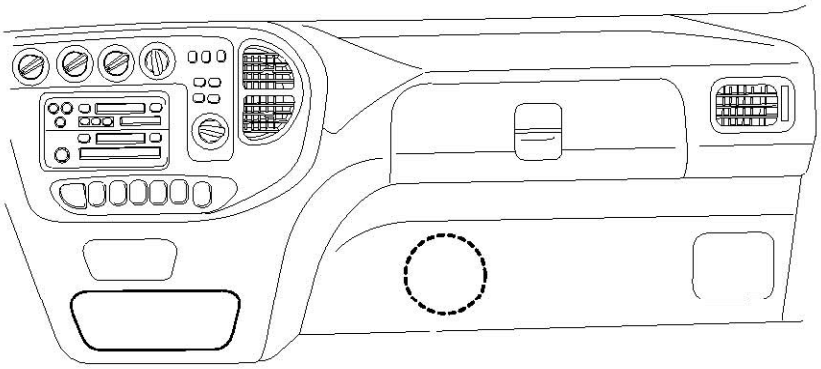
▶ Go to the applicable DTC procedure.

NO

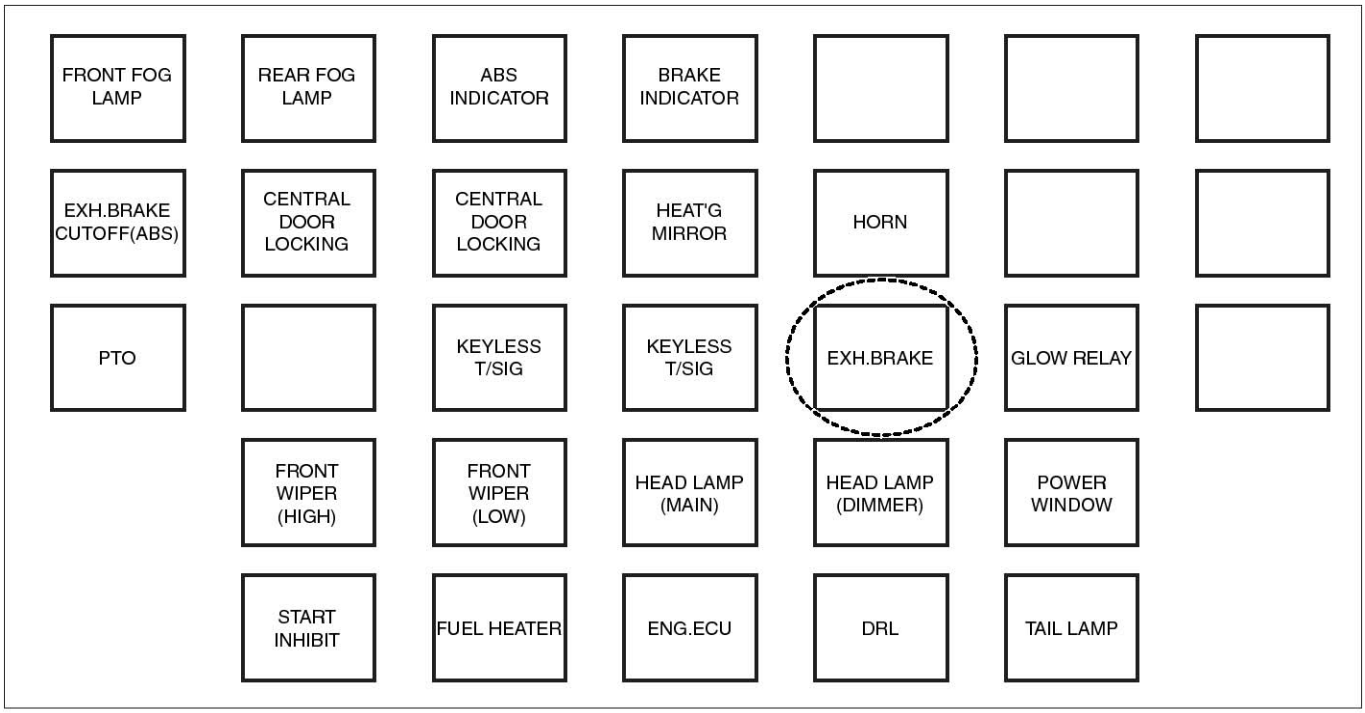
▶ System OK

0011 Endurance Brake Relay(Short To Ubatt/Uvent)

COMPONENT LOCATION



Relay



SUDWAB9003L

GENERAL DESCRIPTION

The Endurance Brake Relay (DBR) is a device with which ABS ECU forcefully disengages any third brake applied by the driver, such as a supplementary brake like endurance brake, during the operation of ABS, and is installed in vehicles of 2.5t or larger where both the endurance brake and ABS are applied. In case when ABS is operational on a very slippery road and when a skid occurs on the rear wheels not by the main brake but by endurance brake, ABS ECU cannot control the rear wheel. Therefore, this function is applied for smooth ABS control.

DTC DESCRIPTION

HECU continues to monitor the DBR control signal. If a short-circuit in the power source is detected in the DBR control line, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor connection of connector and wiring damage • Short to power of control circuit • Defective DBR relay
Enable Conditions	Ignition ON			
Threshold Value	When short to the control circuit of DBR relay is detected			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

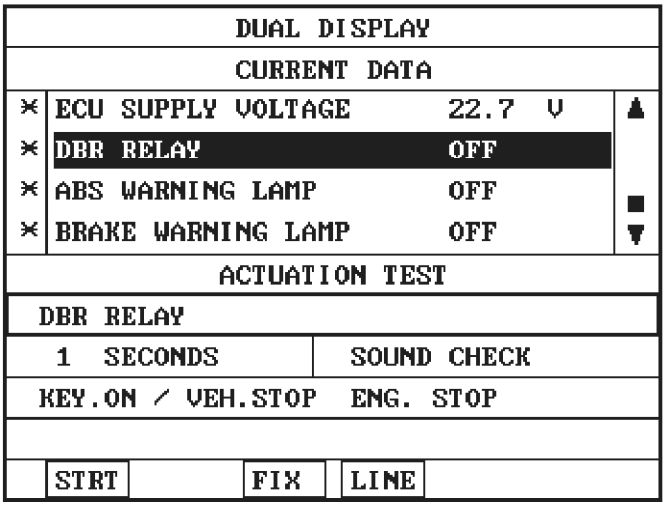
SPECIFICATION

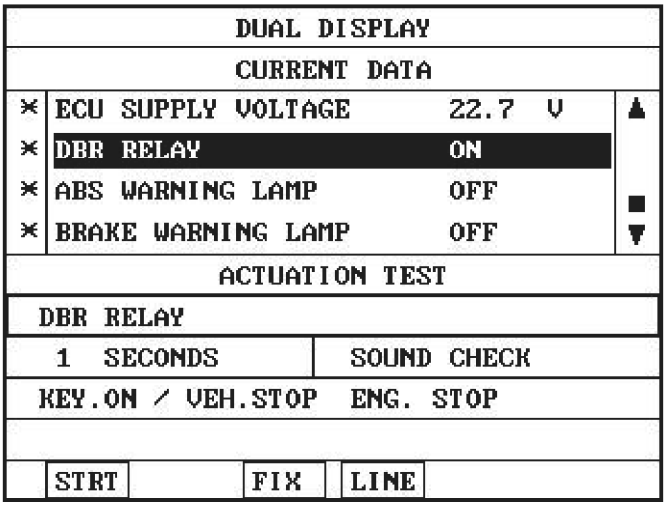
ABS relay coil resistance	200 ~ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test" on the scan tool.
4. Select the data “DBR relay” and perform actuation test.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9017L

5. Can you hear the activating sound from the DBR relay?

YES

▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair” procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the DBR relay connector (M15) and HECU connector (C60).
3. Measure the voltage between the terminal 3 of DBR relay (M15) and chassis ground.

   ■ Specification: Below 0~0.1 V
4. Is the voltage measured within specification?

YES

▶ Go to “Component Inspection” procedure.

NO

▶ Repair short to power between terminal of HECU and terminal of DBR relay control and go to “Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the DBR relay connector (M15).
3. Measure the resistance between terminals 3 and 5 of DBR relay component.

   ■ Specification: DBR relay coil resistance: 200 ~ 450 Ω (At 20℃)
4. Measure the resistance between terminals 1 and 4 of DBR relay while applying and cutting off B+ power to terminals 3 and 5 of DBR relay.

   ■ Specification

   Continuity (When applying power)

   Infinite (When cutting off power)
5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Replace the relay and go to "Verification of Vehicle Repair” procedure.

▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

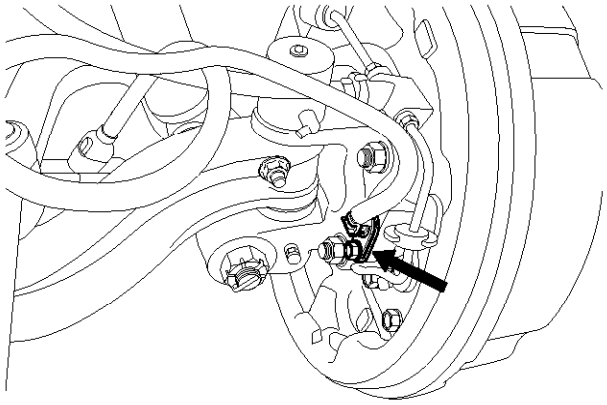
▶ Go to the applicable DTC procedure.

NO

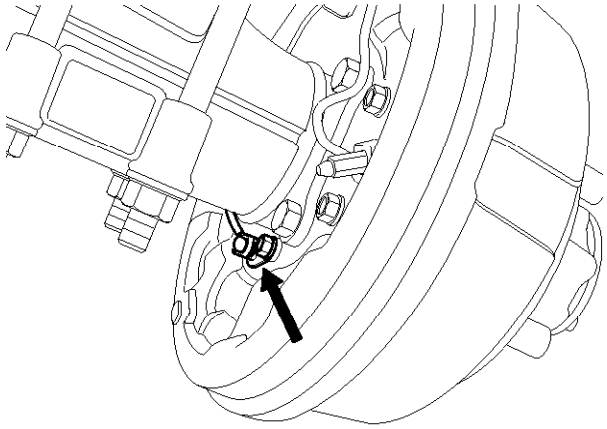
▶ System OK

0017 Sensor Right Hand Front(Impedance)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the front right wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Defective sensor wiring. • Defective sensor.
Enable Conditions	Ignition ON			
Threshold Value	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	No		
	MIL	Yes		

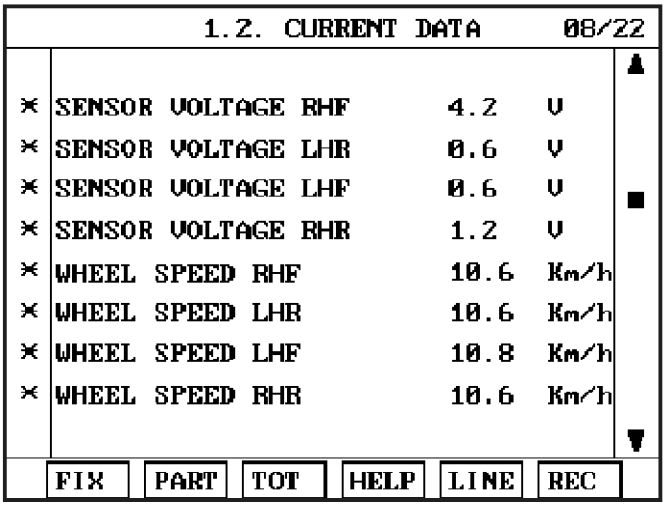
SPECIFICATION

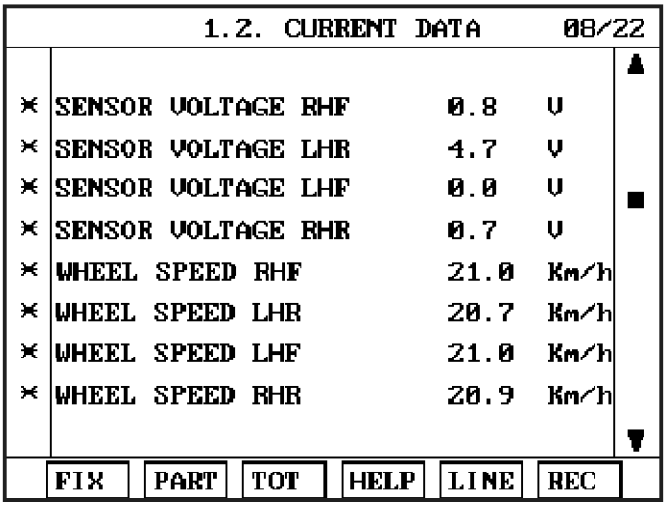
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 25 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C30).

   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

Signal (-) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 30 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C30).
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand front when sensor connector.
3. Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).
   ■ Specification: 830 ~ 2,100 Ω (At 20℃)
4. Is the resistance measured within specification?

YES

▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

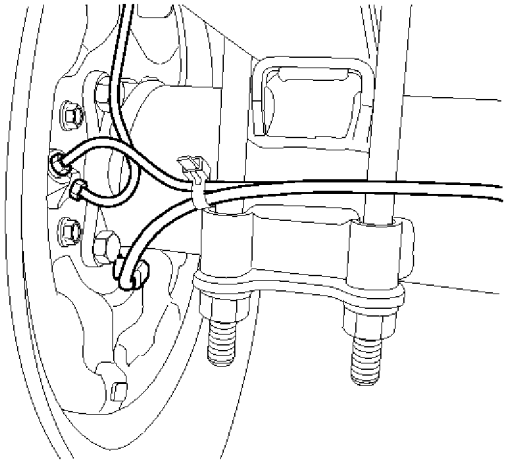
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0018 Sensor Left Hand Rear(Impedance)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the rear left wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Defective sensor wiring • Defective sensor
Enable Conditions	Ignition ON			
Threshold Value	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	No		
	MIL	Yes		

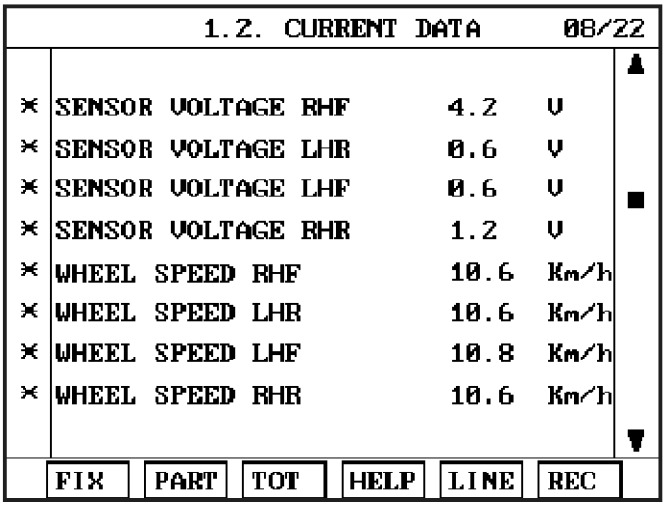
SPECIFICATION

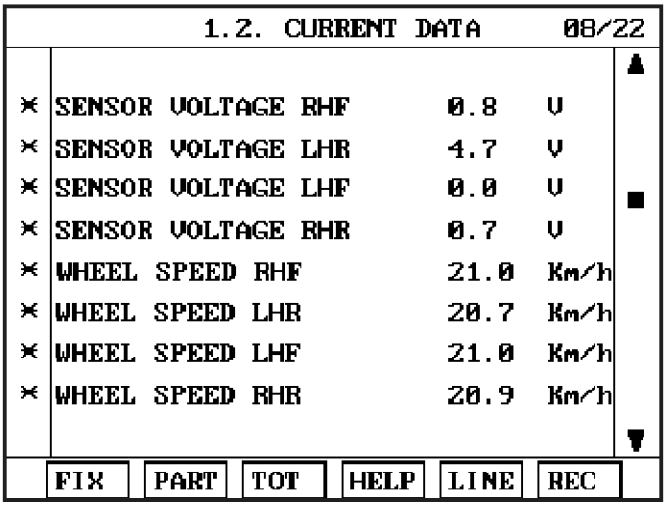
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 28 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C37).

   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

Signal (-) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 23 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C37).
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand rear connector (C37).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).
   ■ Specification: 830 ~ 2100 Ω (At 20℃)
4. Is the resistance measured within specification?

YES

▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

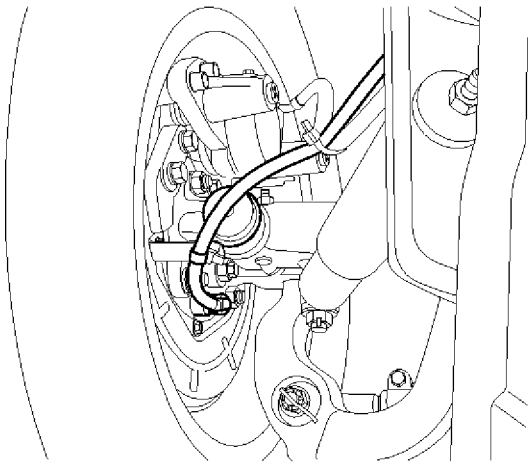
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0019 Sensor Left Hand Front(Impedance)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the front left wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Defective sensor wiring. • Defective sensor.
Enable Conditions	Ignition ON			
Threshold Value	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	No		
	MIL	Yes		

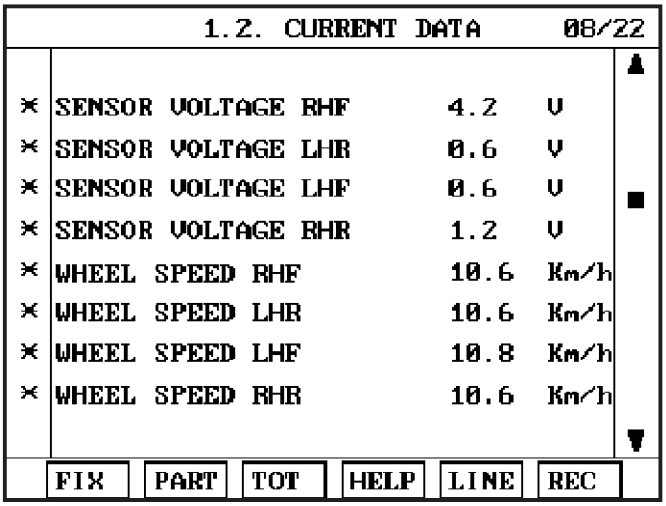
SPECIFICATION

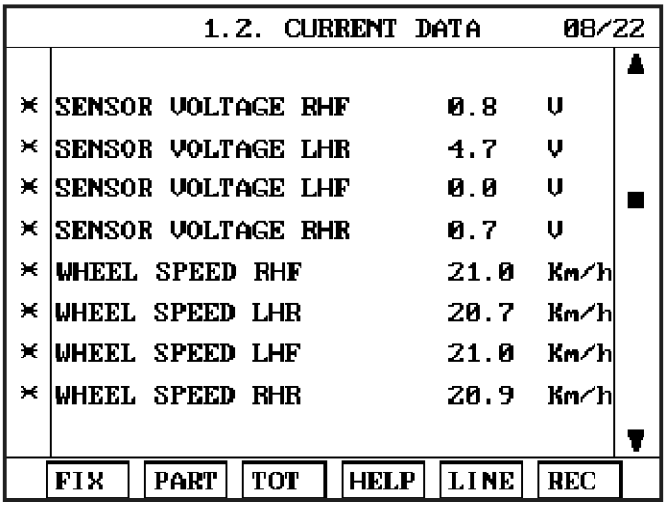
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 24 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C31).

   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

Signal (-) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 29 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C31).
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand front connector (C31).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.
   ■ Specification: 830 ~ 2,100 Ω (At 20℃)
4. Is the resistance measured within specification?

YES

▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

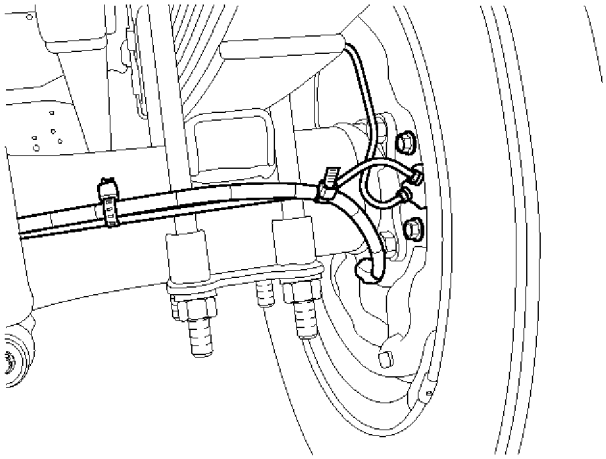
▶ Go to the applicable DTC procedure.

NO

▶ System OK

001A Sensor Right Hand Rear(Impedance)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the rear right wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Defective sensor wiring. • Defective sensor.
Enable Conditions	Ignition ON			
Threshold Value	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	No		
	MIL	Yes		

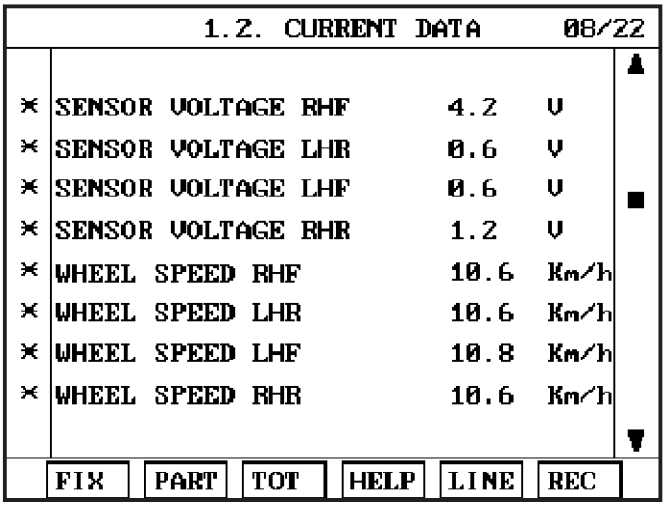
SPECIFICATION

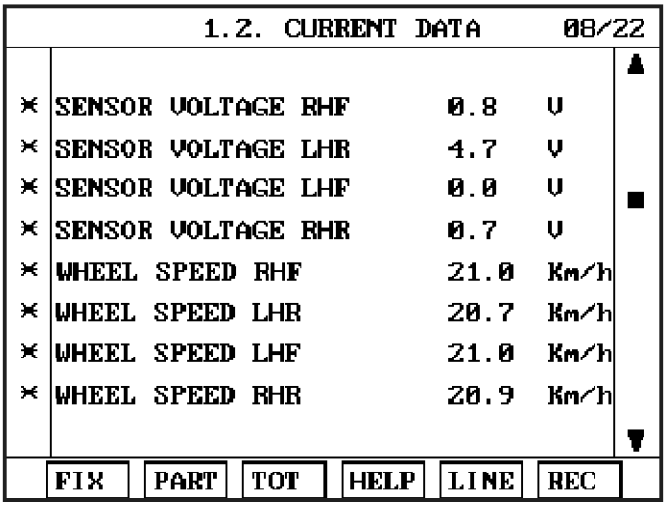
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 22 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C36).

   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

Signal (-) Open Inspection

1. Disconnect the HECU connector and the wheel speed sensor connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Measure the resistance between the terminal 27 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C36).
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand rear connector (C36).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
   ■ Specification: 830 ~ 2100 Ω (At 20℃)
4. Is the resistance measured within specification?

YES

▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis.Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

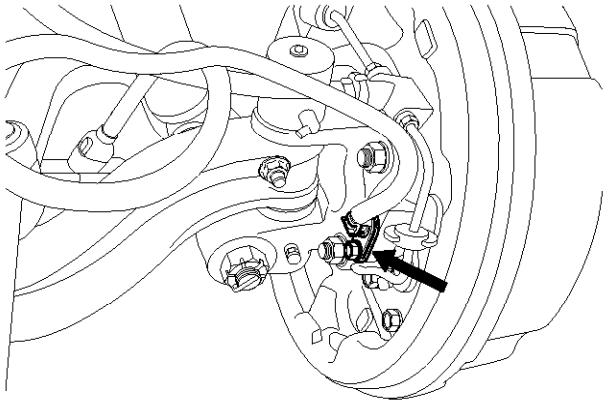
▶ Go to the applicable DTC procedure.

NO

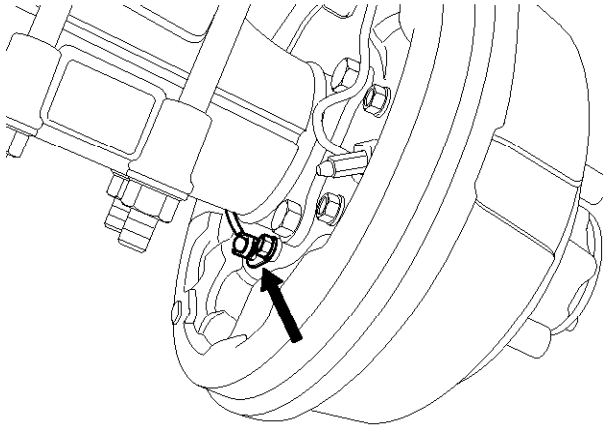
▶ System OK

001B Input Valve Right Hand Front(Open Circuit)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

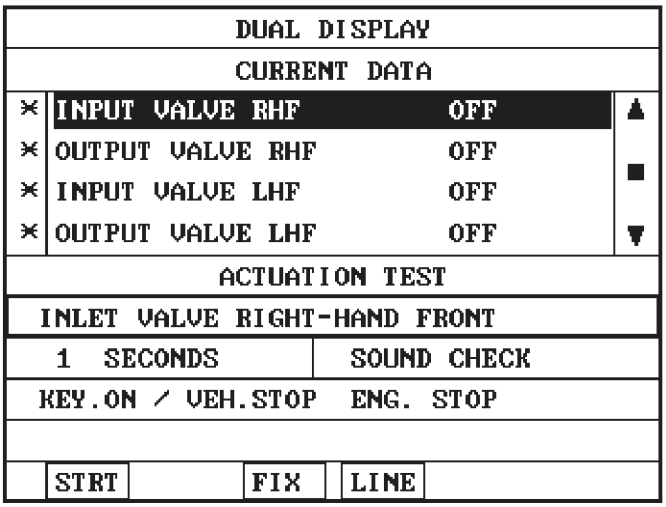
DTC DETECTING CONDITION

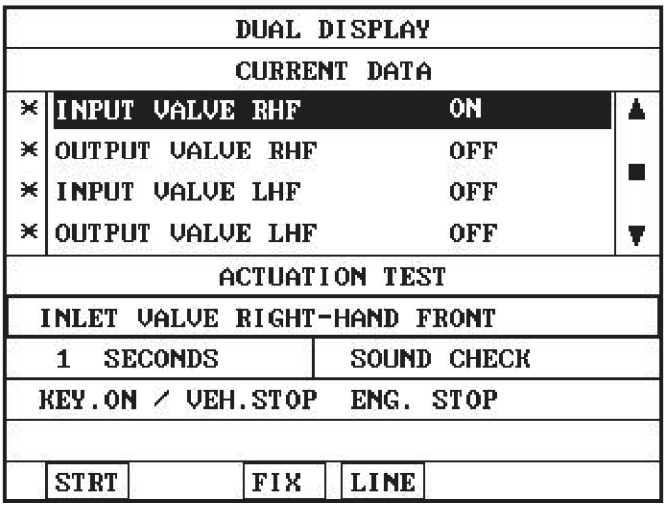
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9018L

Fig1) Right hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

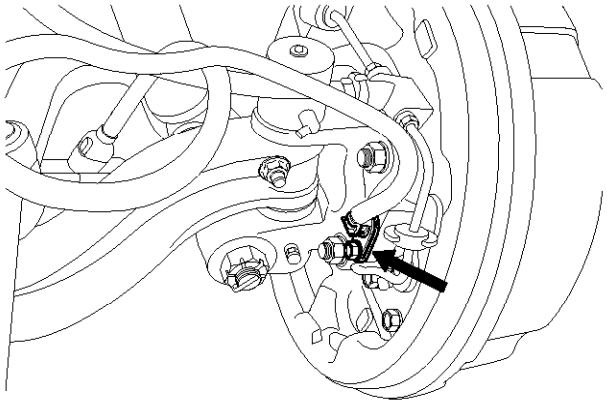
▶ Go to the applicable DTC procedure.

NO

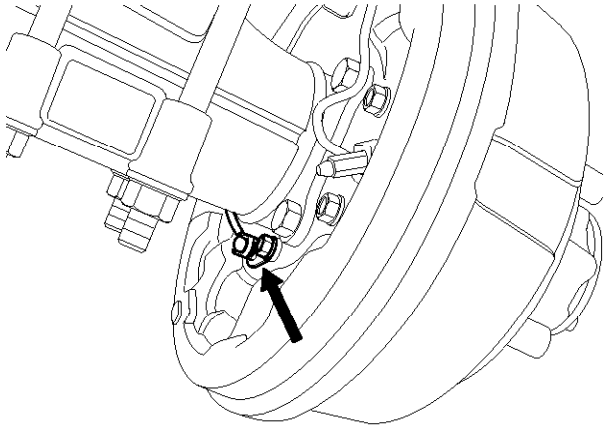
▶ System OK

001C Output Valve Right Hand Front(Open Circuit)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

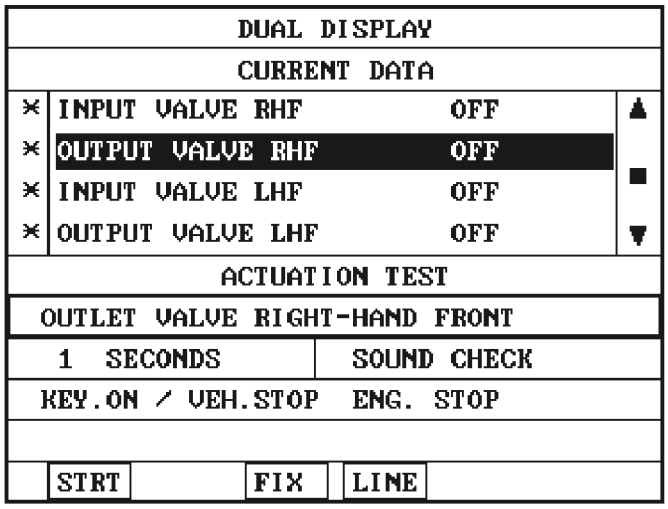
DTC DETECTING CONDITION

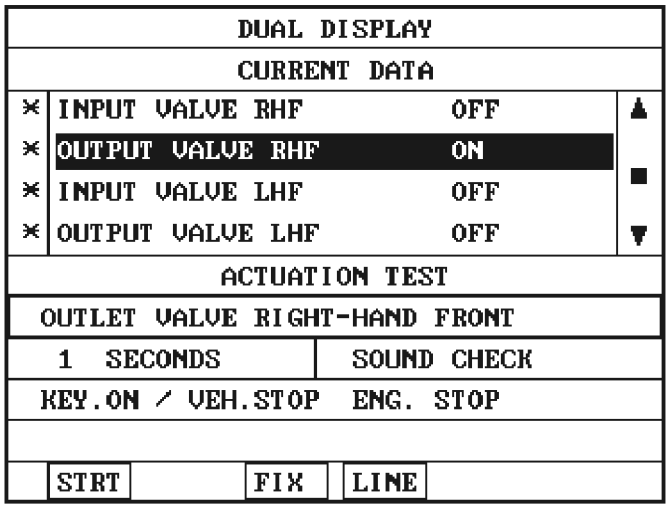
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9019L

Fig1) Right hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

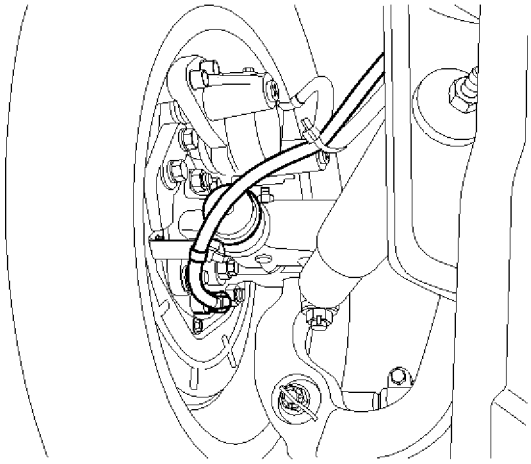
▶ Go to the applicable DTC procedure.

NO

▶ System OK

001D Input Valve Left Hand Front(Open Circuit)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

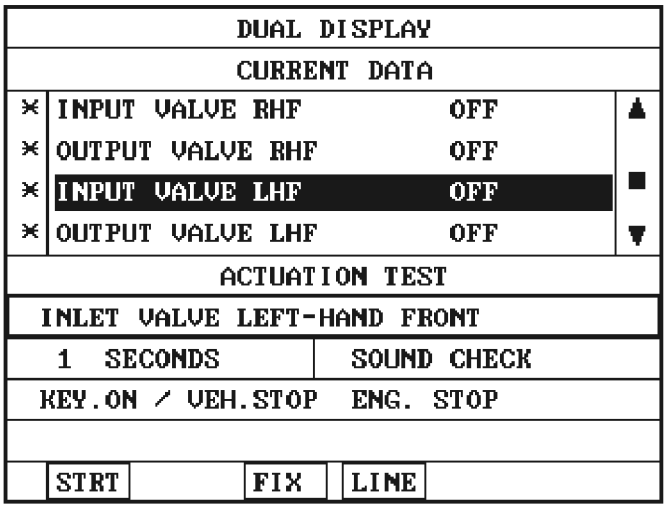
DTC DETECTING CONDITION

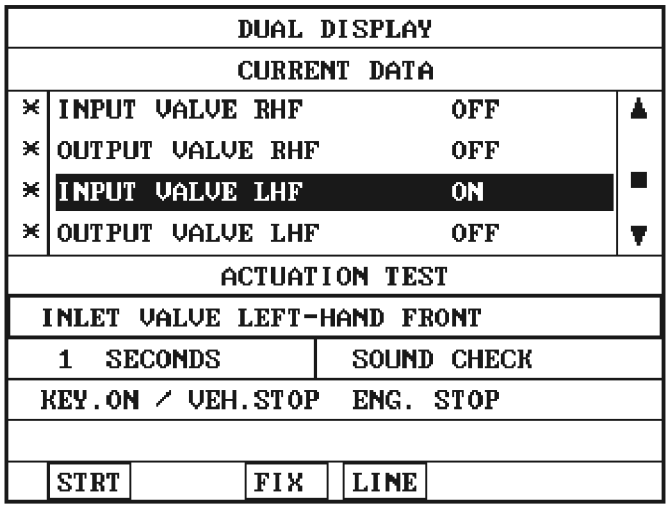
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9020L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

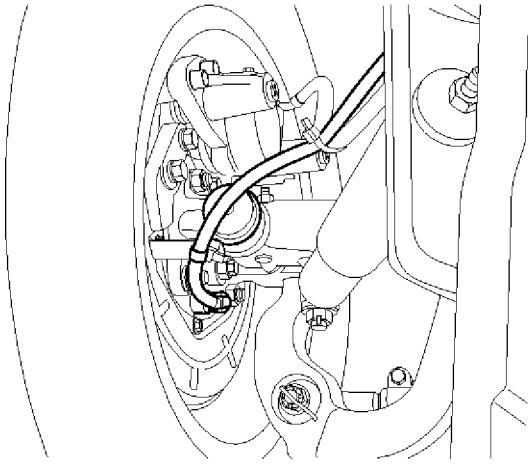
▶ Go to the applicable DTC procedure.

NO

▶ System OK

001E Output Valve Left Hand Front(Open Circuit)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

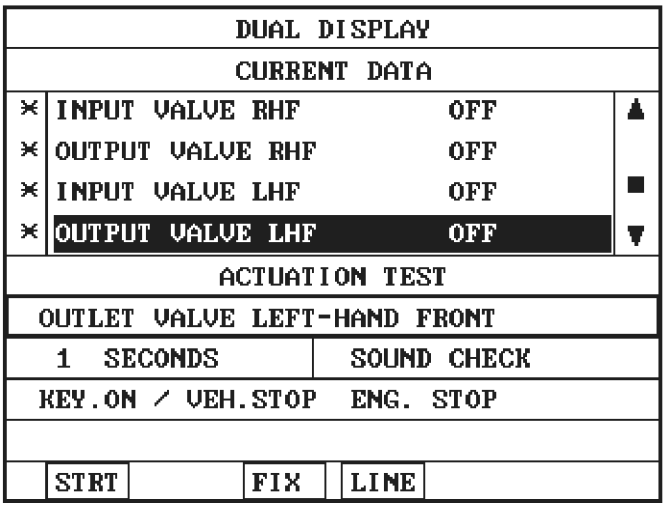
DTC DETECTING CONDITION

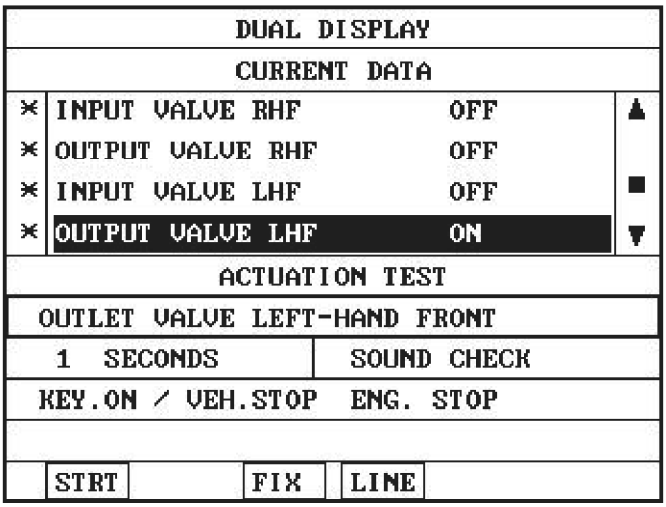
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9021L

Fig1) Left hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis.Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

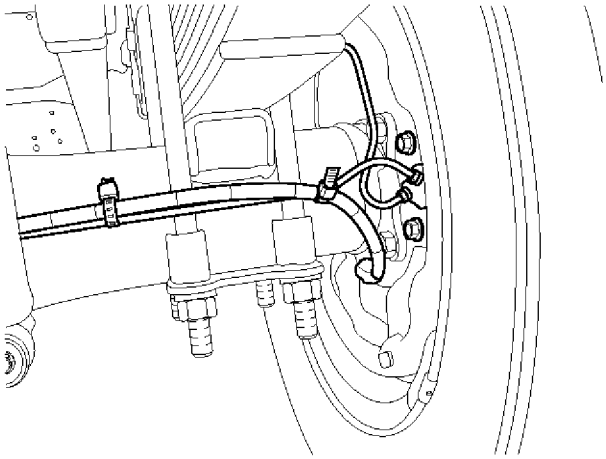
▶ Go to the applicable DTC procedure.

NO

▶ System OK

001F Input Valve Right Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

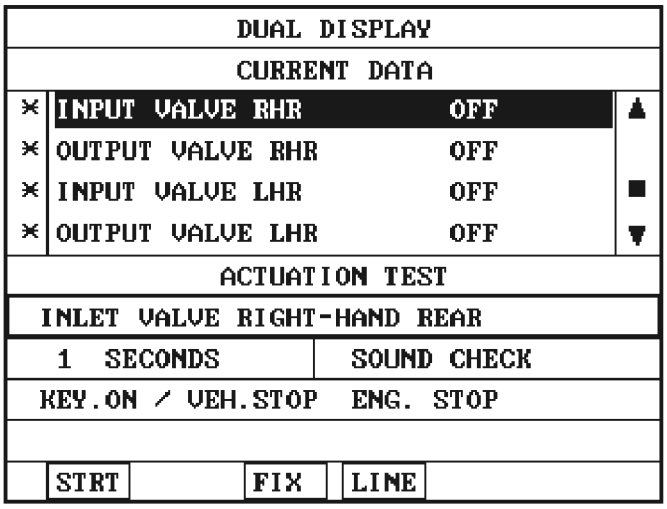
DTC DETECTING CONDITION

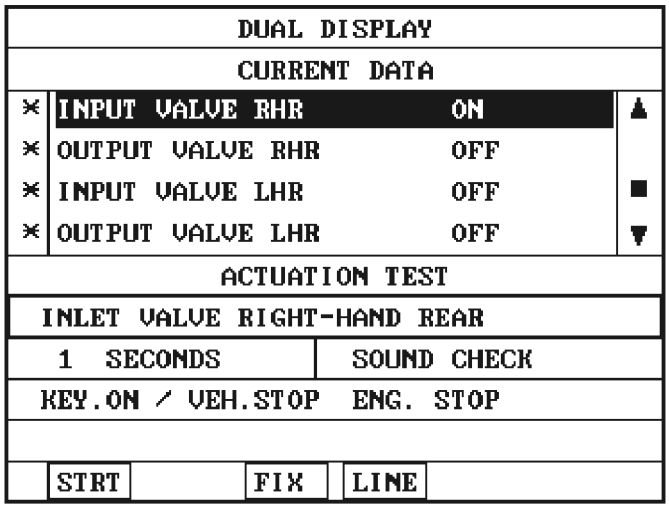
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9022L

Fig1) Right hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

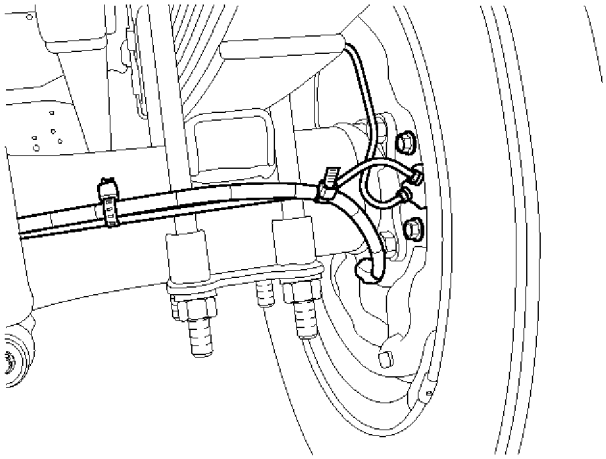
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0020 Output Valve Right Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

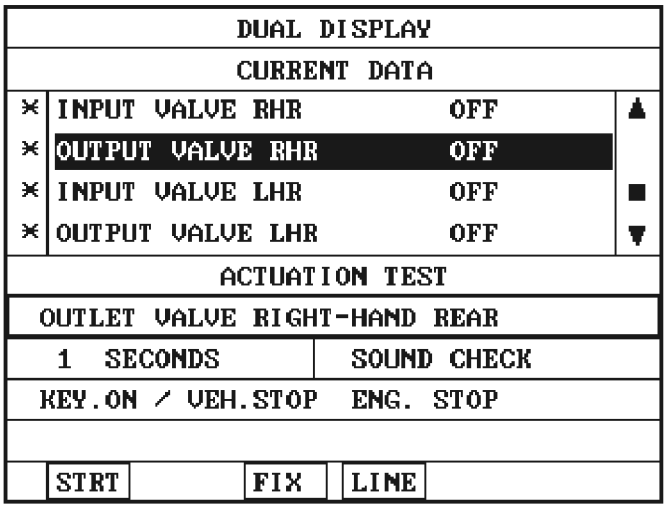
DTC DETECTING CONDITION

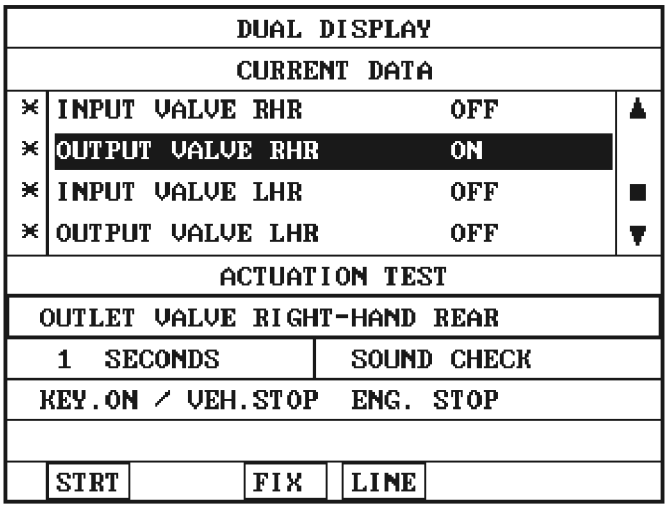
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9023L

Fig1) Right hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

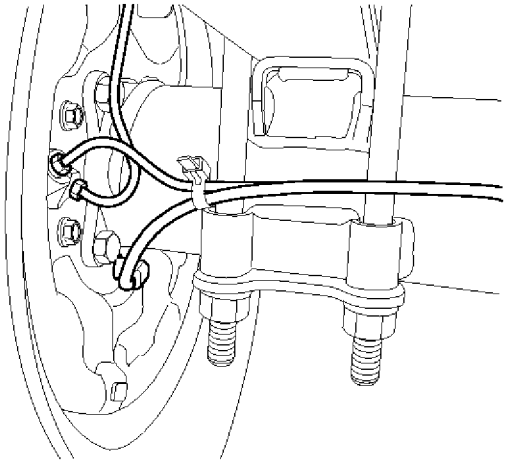
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0021 Input Valve Left Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

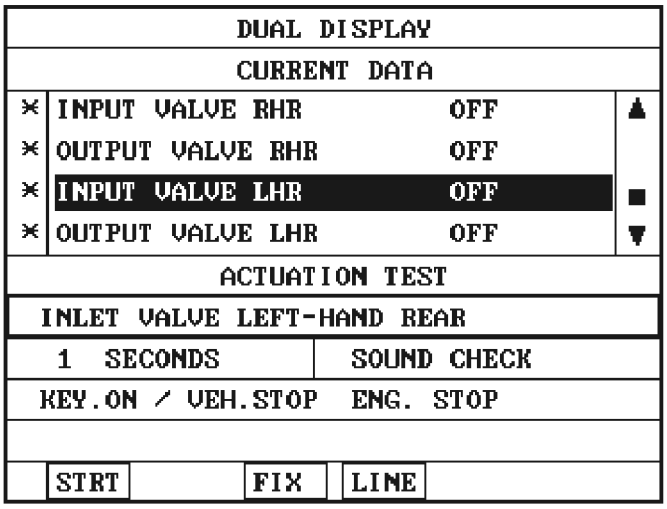
DTC DETECTING CONDITION

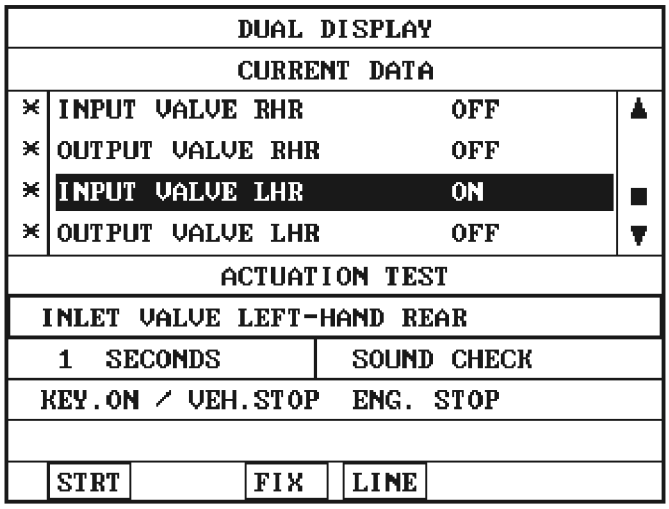
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9024L

Fig1) Left hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

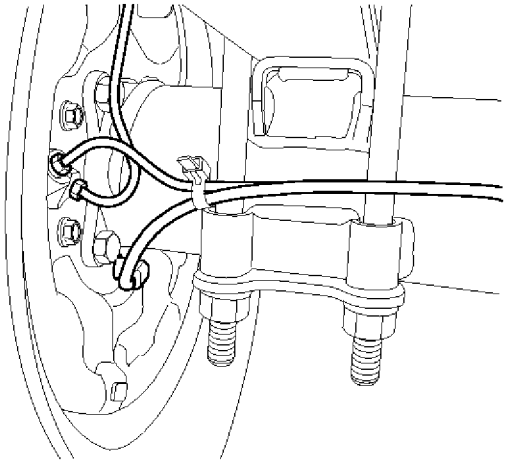
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0022 Output Valve Left Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

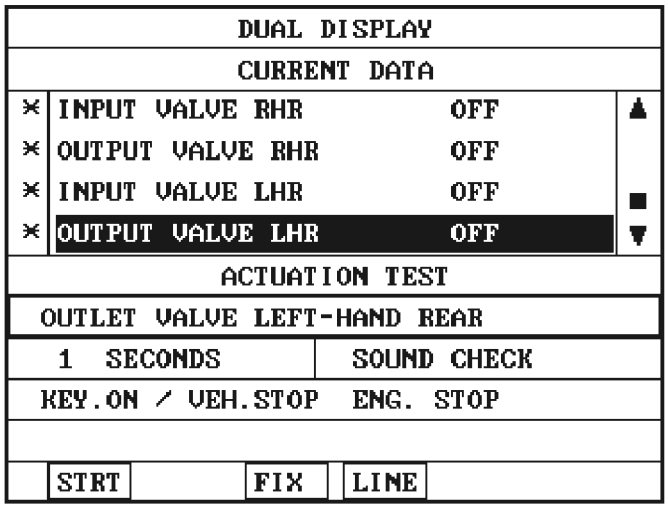
DTC DETECTING CONDITION

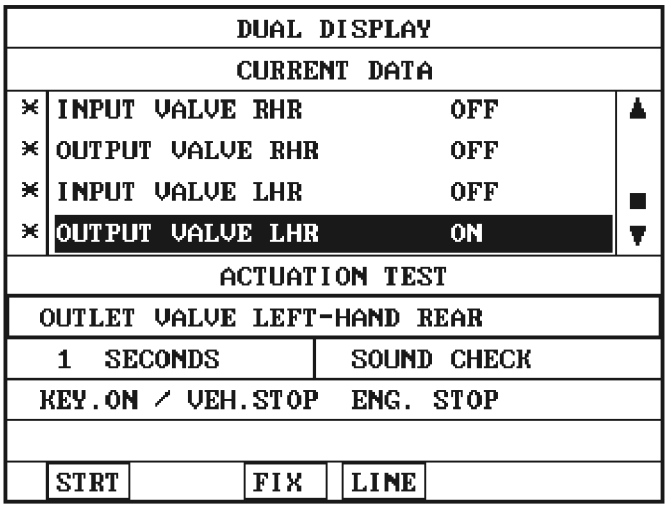
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9025L

Fig1) Left hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

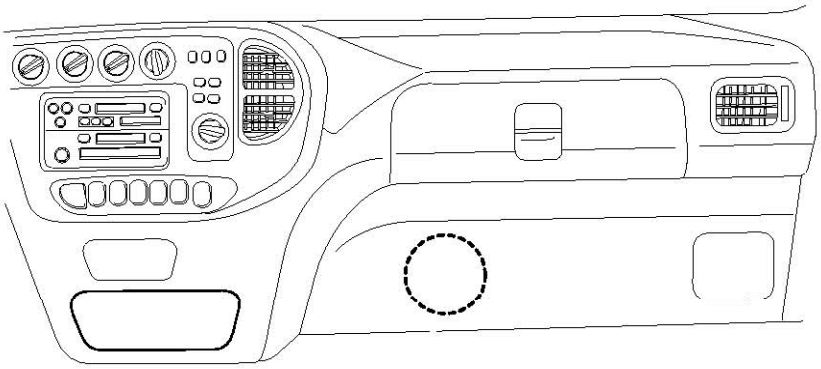
▶ Go to the applicable DTC procedure.

NO

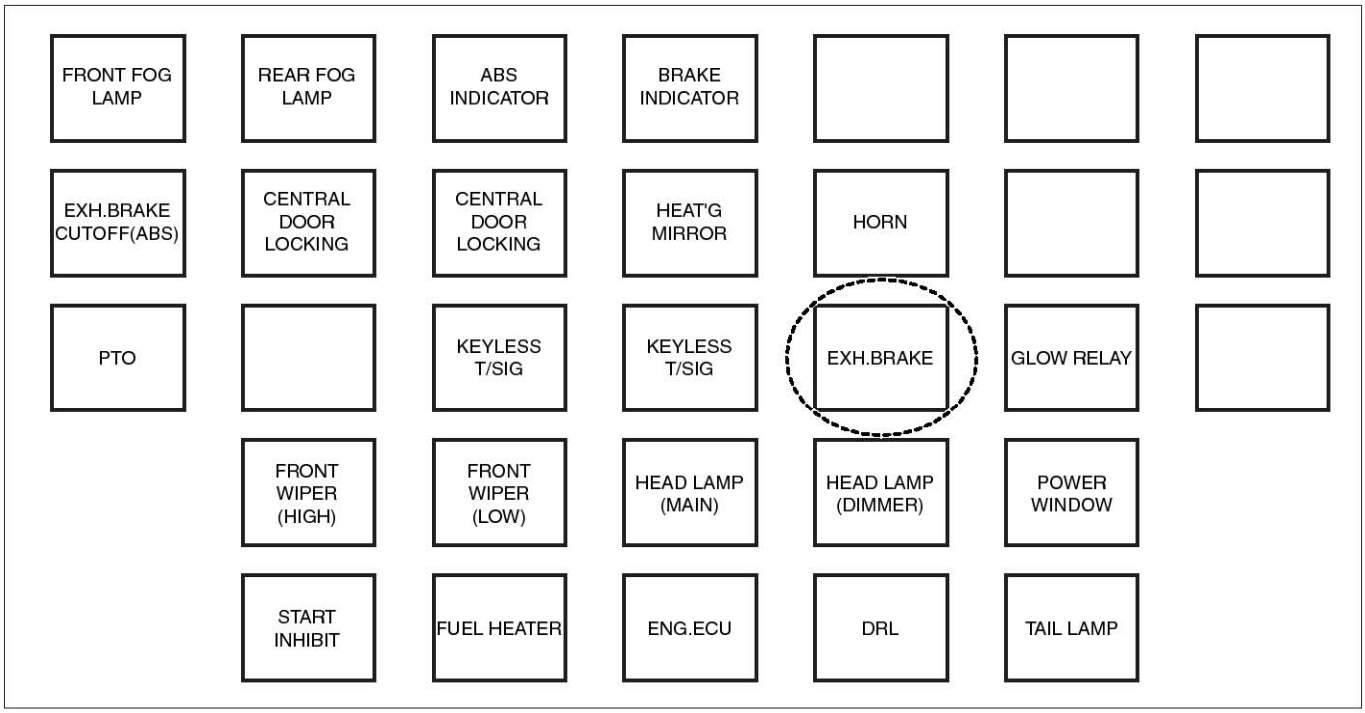
▶ System OK

0023 Endurance Brake Relay(Open Circuit)

COMPONENT LOCATION



Relay



SUDWAB9003L

GENERAL DESCRIPTION

The Endurance Brake Relay (DBR) is a device with which ABS ECU forcefully disengages any third brake applied by the driver, such as a supplementary brake like endurance brake, during the operation of ABS, and is installed in vehicles of 2.5t or larger where both the endurance brake and ABS are applied. In case when ABS is operational on a very slippery road and when a skid occurs on the rear wheels not by the main brake but by endurance brake, ABS ECU cannot control the rear wheel. Therefore, this function is applied for smooth ABS control.

DTC DESCRIPTION

HECU continues to monitor the DBR control signal. If a short-circuit in the power source is detected in the DBR control line, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor contact of connector and wiring damage. • Open of power of control circuit. • Defective DBR relay.
Enable Conditions	Ignition ON			
Threshold Value	When the ABS relay control circuit is open			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

SPECIFICATION

ABS relay coil resistance	200 ~ 450Ω (At 20℃)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test" on the scan tool.
4. Select the data “DBR relay” and perform actuation test.

   ■ Specification: Normal if the activating sound is heard.
5. Can you hear the activating sound from the DBR relay?

   YES

   ▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

   ▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Short to Control Power Inspection

1. Turn the ignition OFF.
2. Disconnect the DBR relay (M15) and HECU connector (C60).
3. Measure the resistance between the terminal 3 of DBR relay harness connector (M15) and terminal 2 of HECU harness connector (C60).

   ■ Specification: Continuity
4. Is the resistance measured within specification?

   YES

   ▶ Go to “Component Inspection” procedure.

   NO

   ▶ Repair short to control power between terminal of HECU harness connector and terminal of DBR relay harness connector and go to “Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the DBR relay connector (M15).
3. Measure the resistance between terminals 3 and 5 of DBR relay component.

   ■ Specification: DBR relay coil resistance: 200 ~ 450 Ω (At 20℃)
4. Measure the resistance between terminals 1 and 4 while applying and cutting off B+ power to terminals 3 and 5 of DBR relay.

   ■ Specification

   Continuity (When applying power)

   Infinite (When cutting off power)
5. Is the resistance measured within specification?

   YES

   ▶ Go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.

   ▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

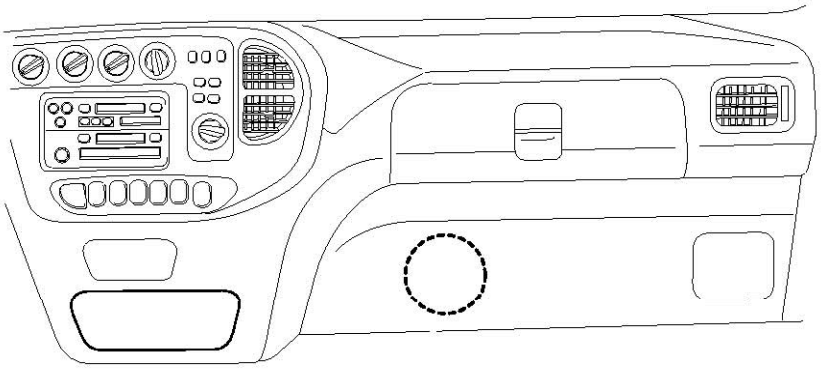
   ▶ Go to the applicable DTC procedure.

   NO

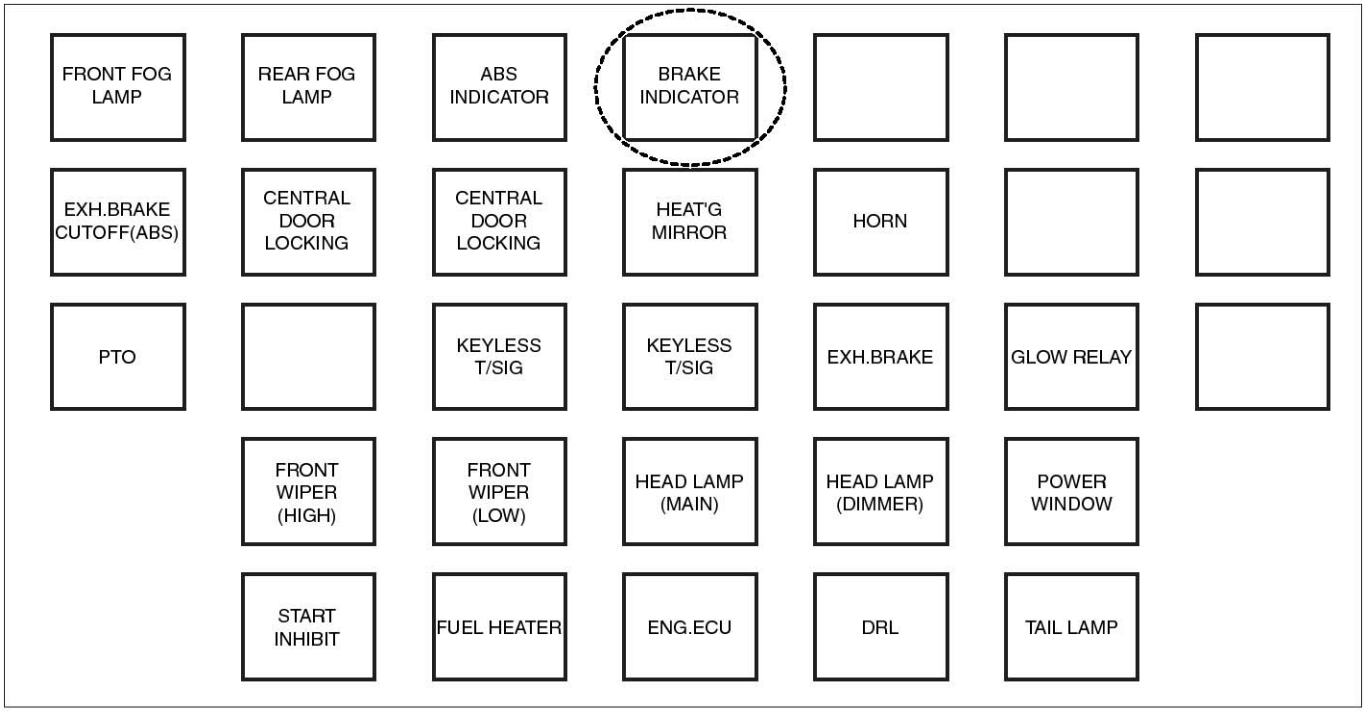
   ▶ System OK

0024 Brake Light Relay(Open Circuit)

COMPONENT LOCATION



Relay



SUDWAB9004L

GENERAL DESCRIPTION

Stop lamp relay is a relay that controls brakes, etc.

DTC DESCRIPTION

HECU continues to monitor the relay control signals, such as brakes. In case of a short-circuit being detected in relay control lines such as brakes, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor contact of connector and wiring damage. • Open of power of control circuit. • Defective brake light control relay.
Enable Conditions	Ignition ON			
Threshold Value	When the brake light relay control circuit is open			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No		
	Fuel Limit	Yes		
	MIL	Yes		

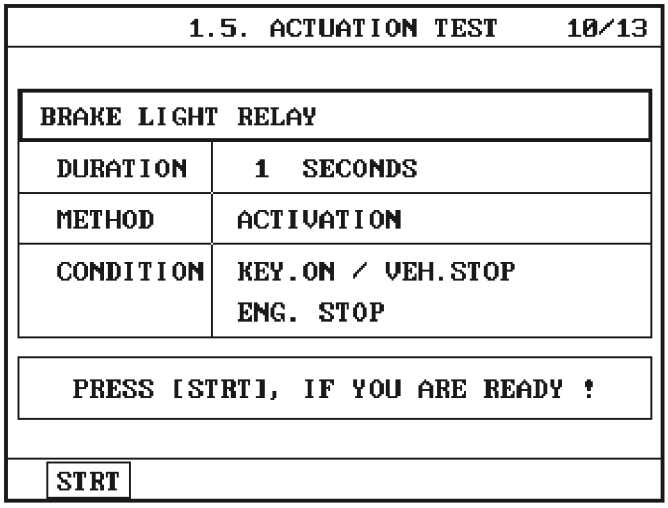
SPECIFICATION

Brake light relay coil resistance	200 ~ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test" on the scan tool.
4. Select the data “Brake light relay” and perform actuation test.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9027L

5. Can you hear the activating sound from the brake light relay?

YES

▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair” procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Short to Control Power Inspection

1. Turn the ignition OFF.
2. Disconnect the brake light relay (M102) and HECU connector (C60).
3. Measure the resistance between the terminal 3 of brake light relay harness connector (M102) and terminal 20 of HECU harness connector (C60).

■ Specification: Continuity

4. Is the resistance measured within specification?

YES

▶ Go to “Component Inspection” procedure.

NO

▶ Repair short to control power between terminal of HECU harness connector and terminal of brake light relay control harness connector and go to “Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the brake light relay connector (M102).
3. Measure the resistance between terminals 3 and 5 of ABS relay component.

■ Specification: Brake light relay coil resistance: 200 ~ 450 Ω (At 20℃)

4. Measure the resistance between terminals 1 and 4 of brake light relay while applying and cutting off B+ power to terminals 3 and 5 of ABS light relay.

■ Specification:

Continuity (When applying power)

Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Replace the relay and go to "Verification of Vehicle Repair” procedure.

▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

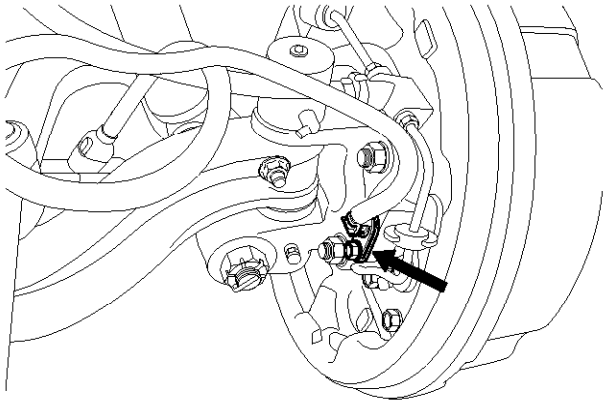
▶ Go to the applicable DTC procedure.

NO

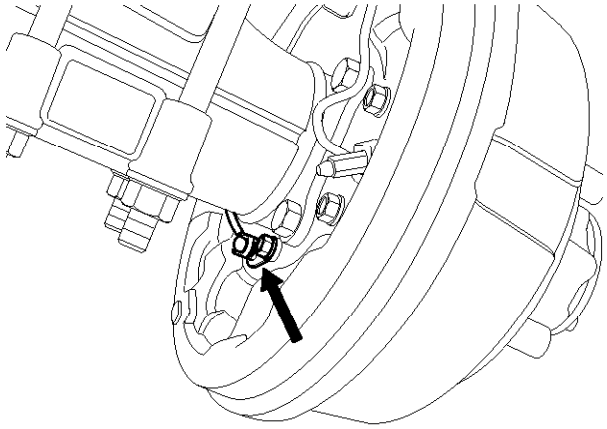
▶ System OK

0029 Input Valve Right Hand Front(Short To Ground)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

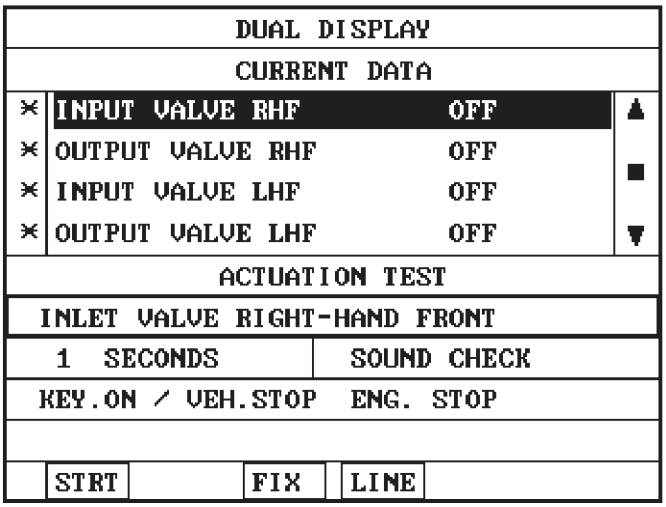
DTC DETECTING CONDITION

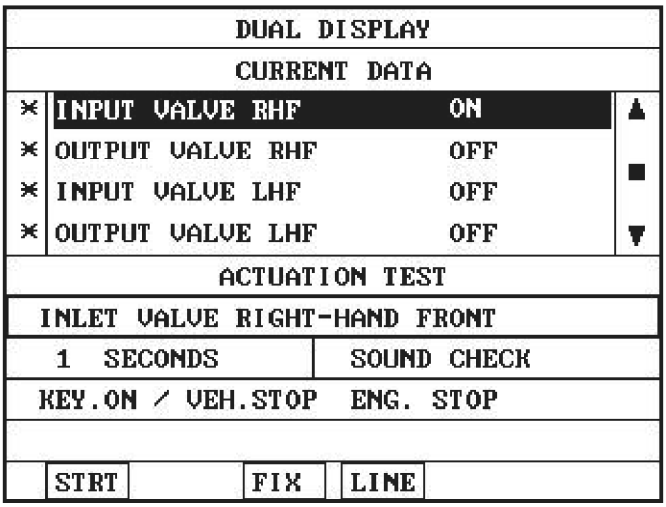
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the right hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9028L

Fig1) Right hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

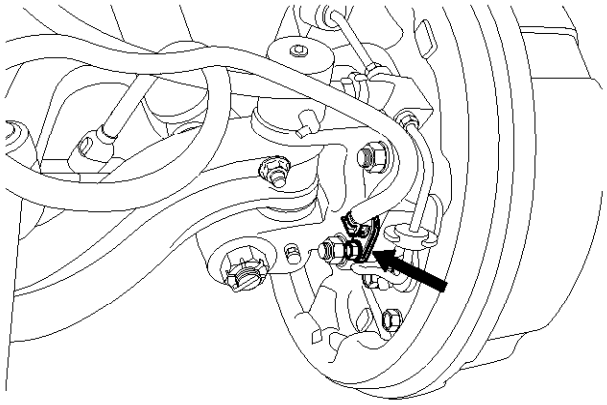
▶ Go to the applicable DTC procedure.

NO

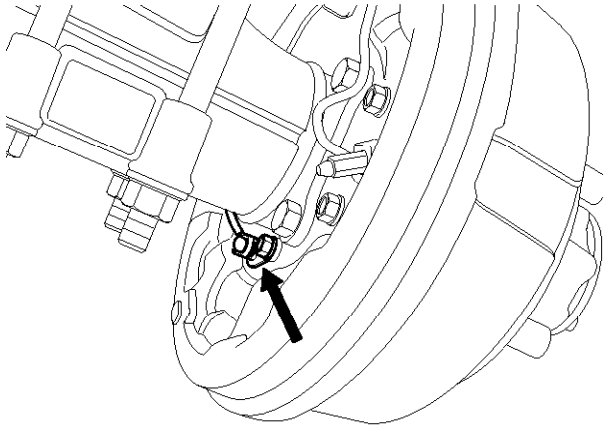
▶ System OK

002A Output Valve Right Hand Front(Short To Ground)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

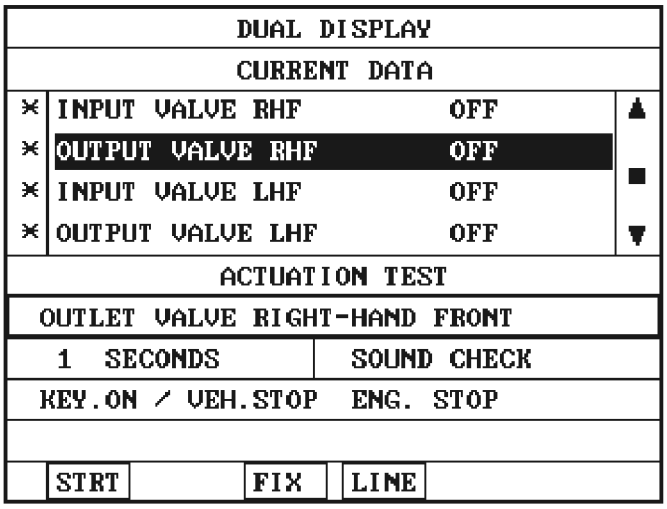
DTC DETECTING CONDITION

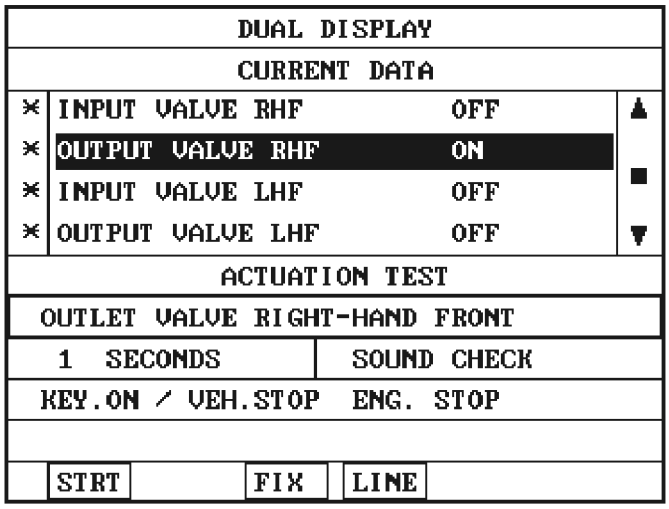
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9029L

Fig1) Right hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

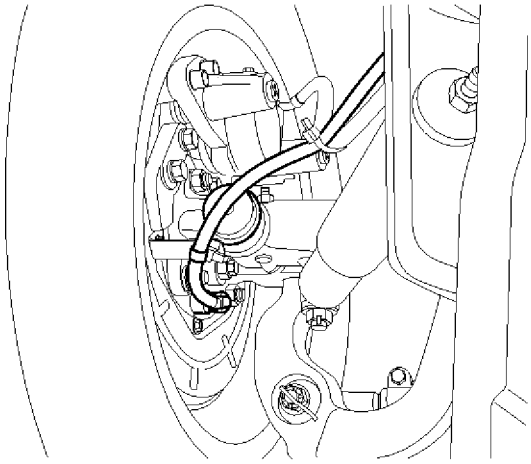
▶ Go to the applicable DTC procedure.

NO

▶ System OK

002B Input Valve Left Hand Front(Short To Ground)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

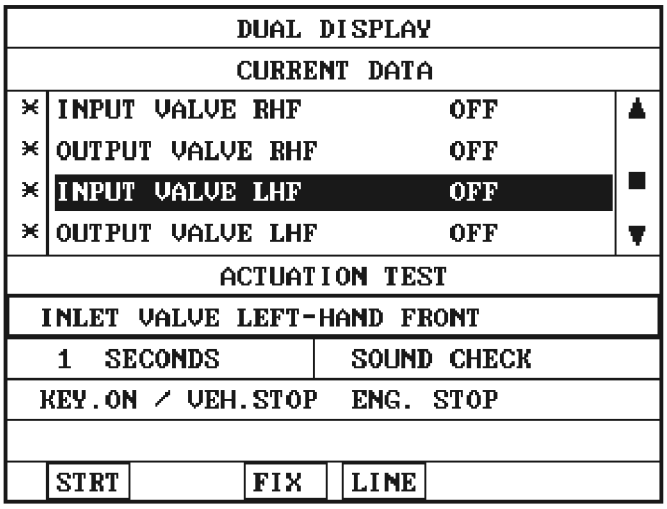
DTC DETECTING CONDITION

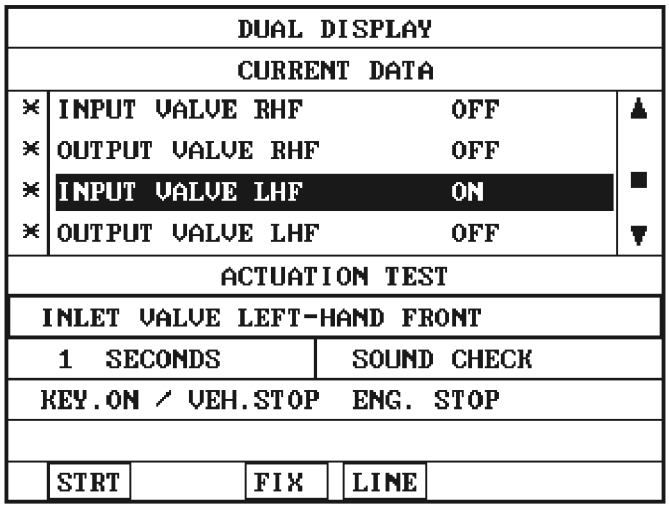
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9030L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

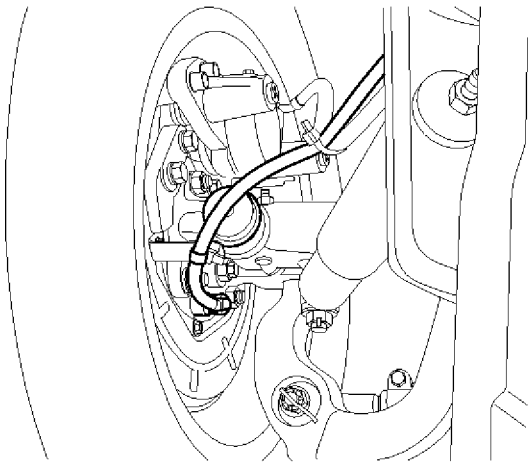
▶ Go to the applicable DTC procedure.

NO

▶ System OK

002C Output Valve Left Hand Front(Short To Ground)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

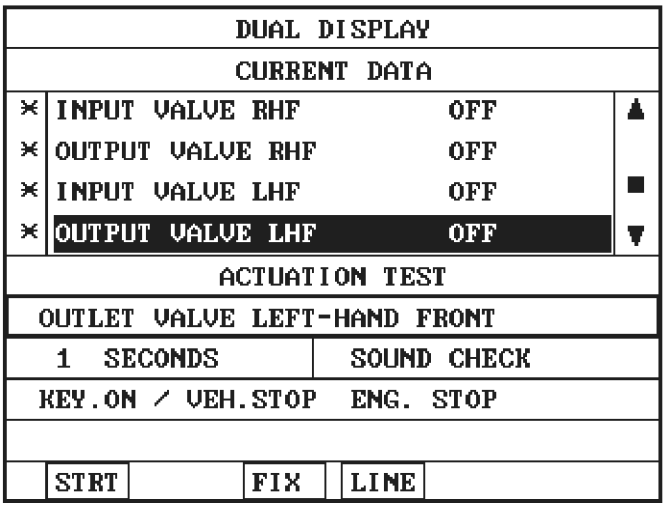
DTC DETECTING CONDITION

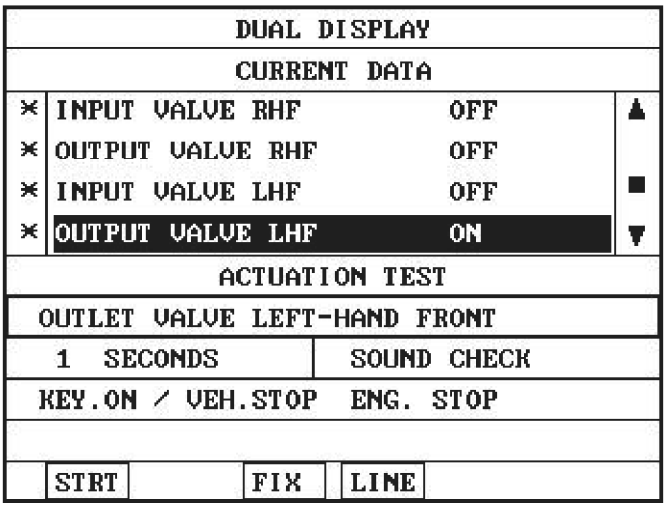
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand front outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9031L

Fig1) Left hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

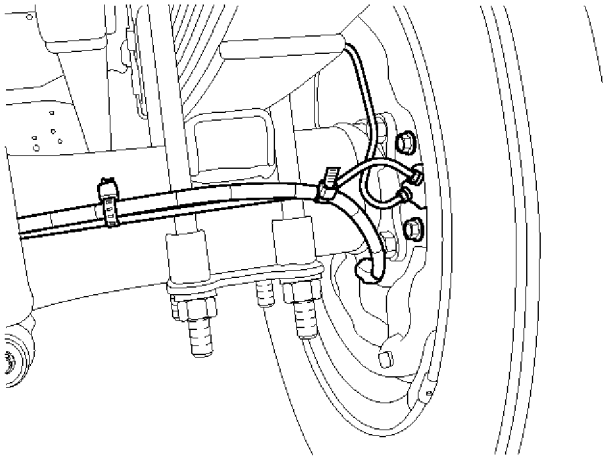
▶ Go to the applicable DTC procedure.

NO

▶ System OK

002D Input Valve Right Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

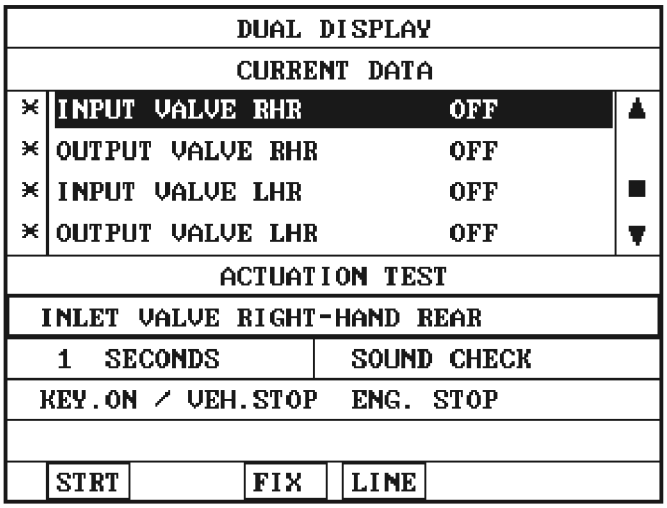
DTC DETECTING CONDITION

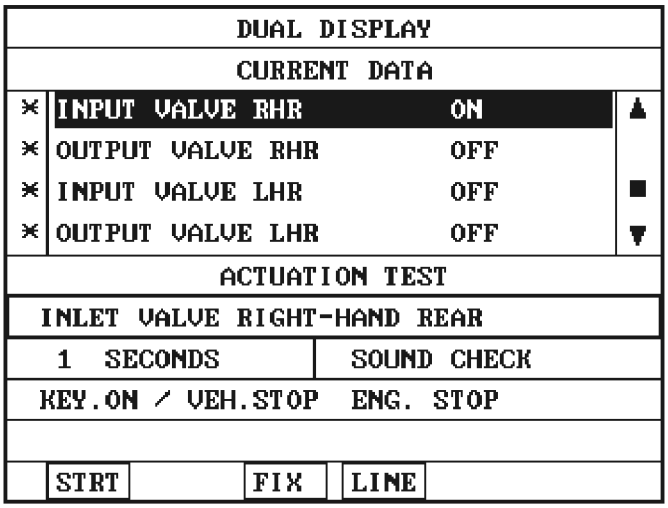
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9032L

Fig1) Right hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

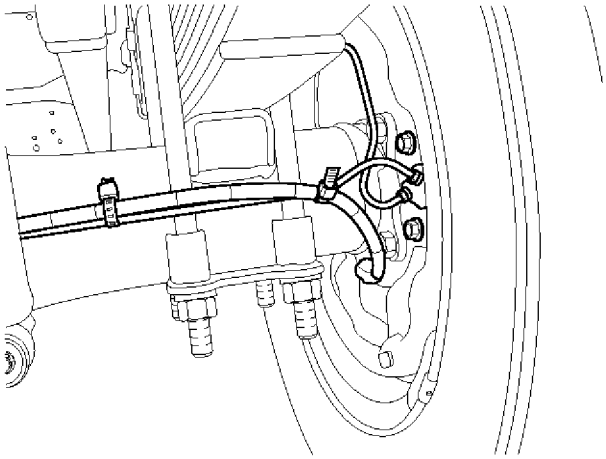
▶ Go to the applicable DTC procedure.

NO

▶ System OK

002E Output Valve Right Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

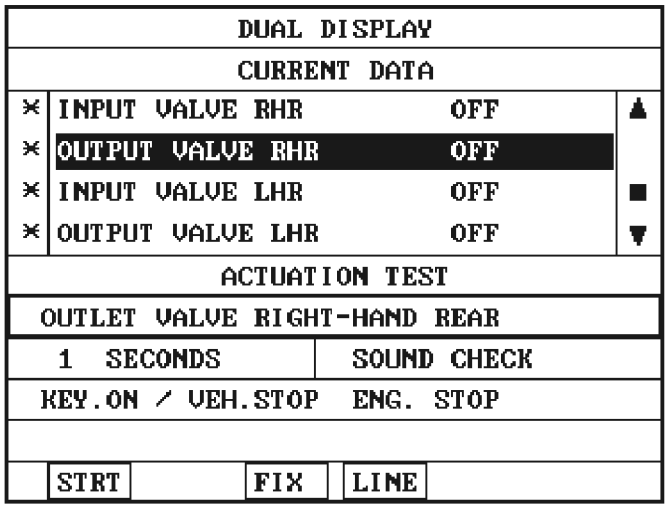
DTC DETECTING CONDITION

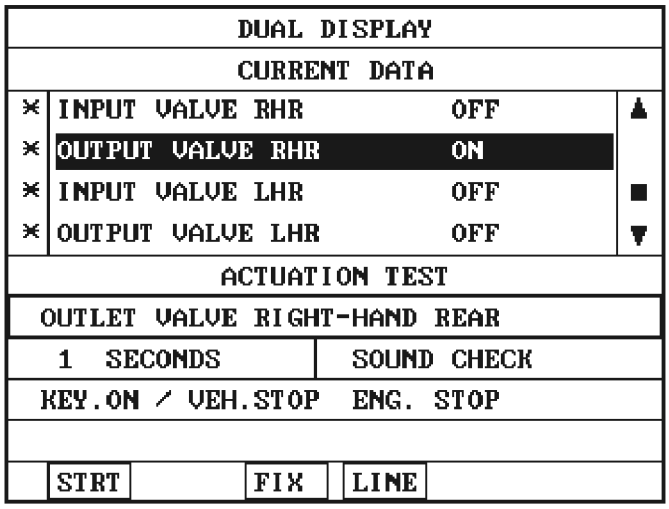
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9033L

Fig1) Right hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

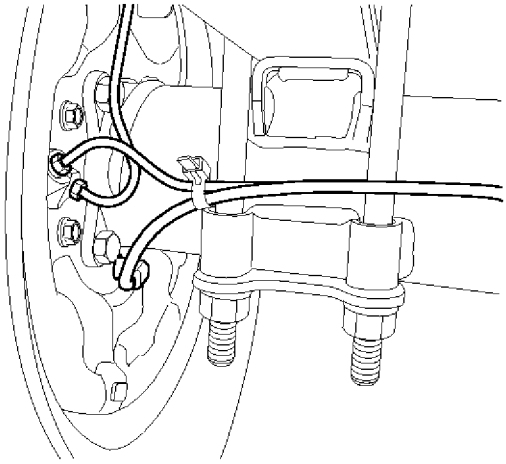
▶ Go to the applicable DTC procedure.

NO

▶ System OK

002F Input Valve Left Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

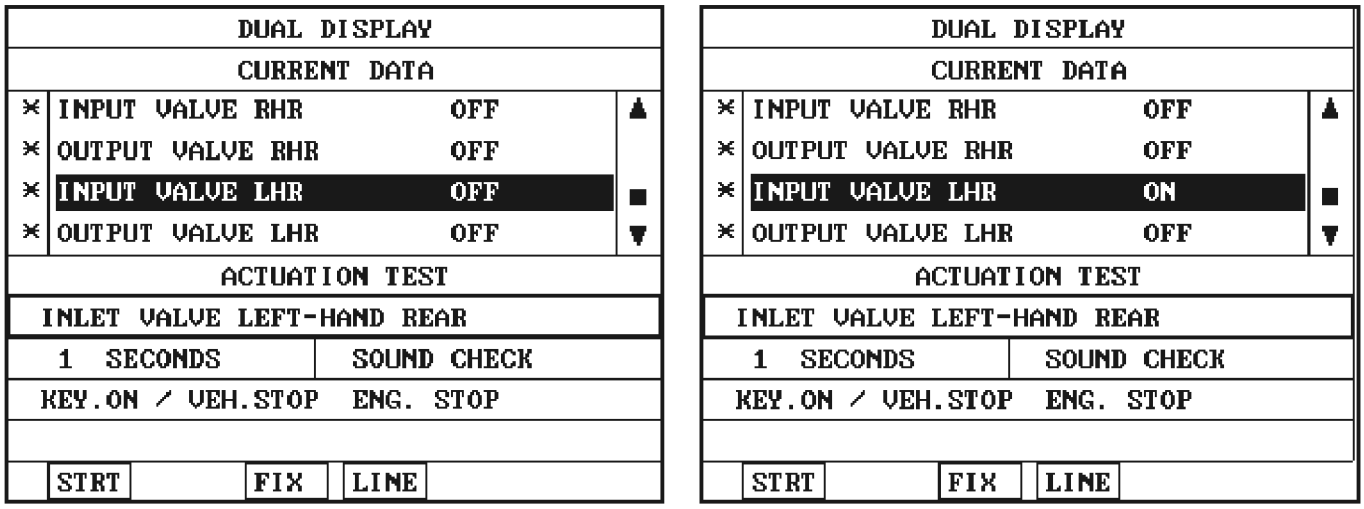
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9034L

Fig1) Left hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

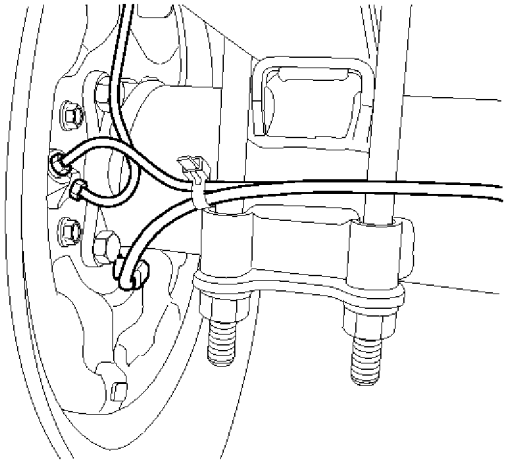
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0030 Output Valve Left Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

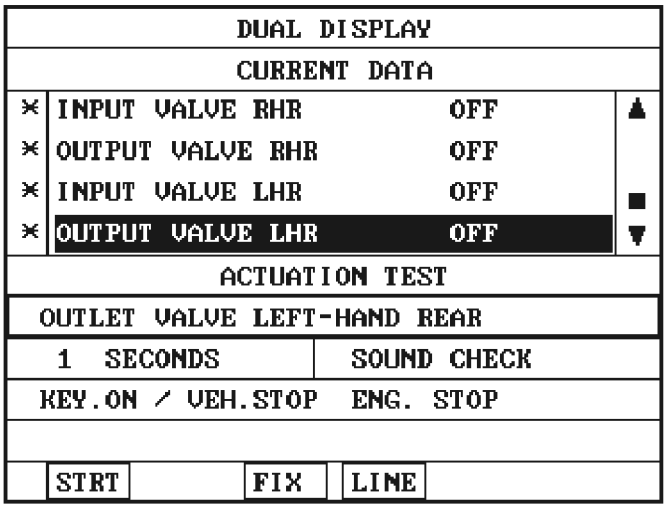
DTC DETECTING CONDITION

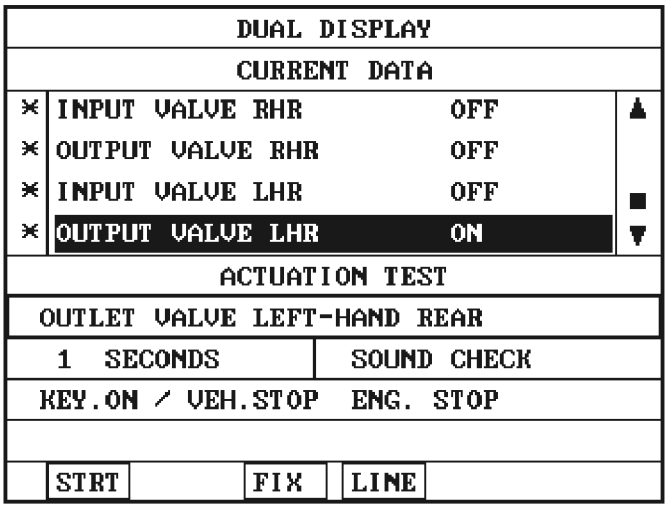
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the left hand rear outlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9035L

Fig1) Left hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

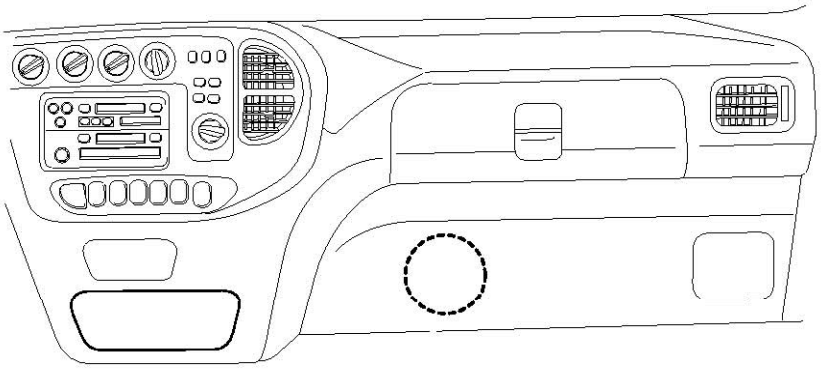
▶ Go to the applicable DTC procedure.

NO

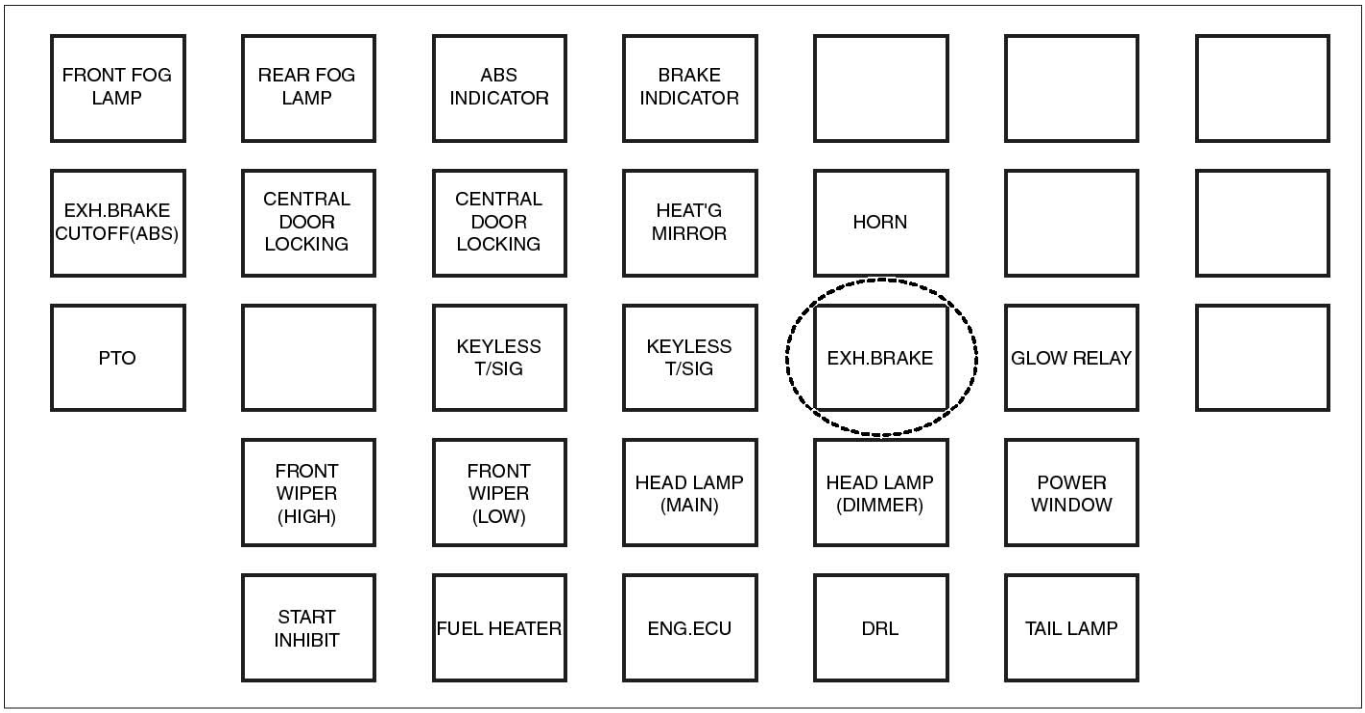
▶ System OK

0032 Endurance Brake Relay(Short To Ground)

COMPONENT LOCATION



Relay



SUDWAB9003L

GENERAL DESCRIPTION

The Endurance Brake Relay (DBR) is a device with which ABS ECU forcefully disengages any third brake applied by the driver, such as a supplementary brake like endurance brake, during the operation of ABS, and is installed in vehicles of 2.5t or larger where both the endurance brake and ABS are applied. In case when ABS is operational on a very slippery road and when a skid occurs on the rear wheels not by the main brake but by endurance brake, ABS ECU cannot control the rear wheel. Therefore, this function is applied for smooth ABS control.

DTC DESCRIPTION

HECU continues to monitor the DBR control signal. If a short-circuit in the power source is detected in the DBR control line, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor connection of connector and wiring damage. • Short to ground of control circuit. • Defective ABS control relay.
Enable Conditions	Ignition ON			
Threshold Value	When short to the control circuit of ABS relay is detected			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

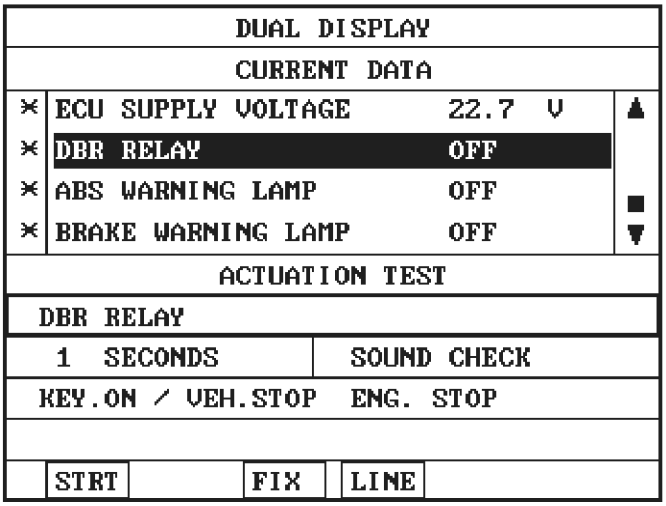
SPECIFICATION

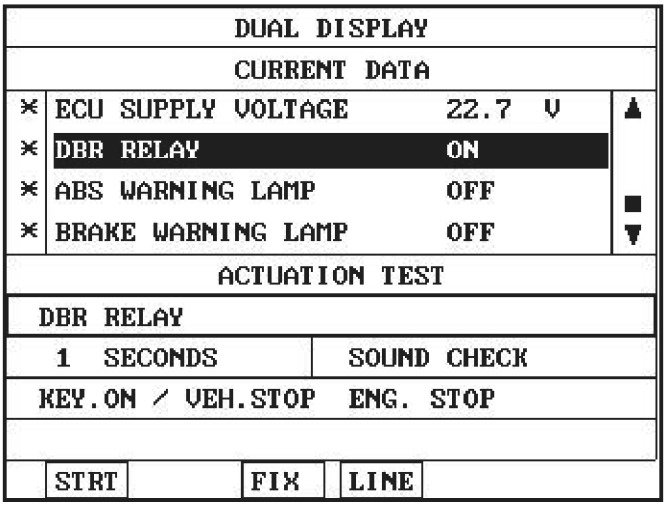
DBR relay coil resistance	200 ~ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test" on the scan tool.
4. Select the data “DBR relay” and perform actuation test.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9036L

5. Can you hear the activating sound from the DBR relay?

YES

▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair” procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Control Short to Ground Inspection

1. Turn the ignition OFF.
2. Disconnect the DBR relay connector (M15) and HECU connector (C60).
3. Measure the resistance between the terminal 3 of DBR relay harness connector (M15) and chassis ground.

■ Specification: Infinite

4. Is the resistance measured within specification?

YES

▶ Go to “Component Inspection” procedure.

NO

▶ Repair short to ground between terminal of HECU harness connector and terminal of DBR relay control and go to “Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the DBR relay connector (M15).
3. Measure the resistance between terminals 3 and 5 of DBR relay component.

■ Specification: DBR relay coil resistance: 200 ~ 450 Ω (At 20℃)

4. Measure the resistance between terminals 1 and 4 of DBR relay while applying and cutting off B+ power to terminals 3 and 5 of DBR relay.

■ Specification:

Continuity (When applying power)

Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Replace the relay and go to "Verification of Vehicle Repair” procedure.

▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

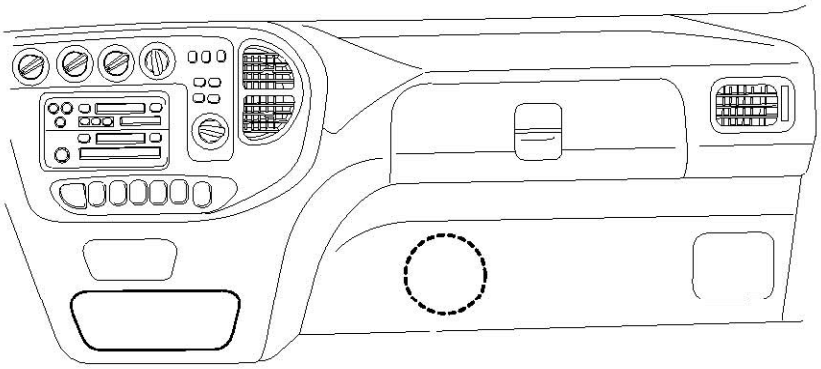
▶ Go to the applicable DTC procedure.

NO

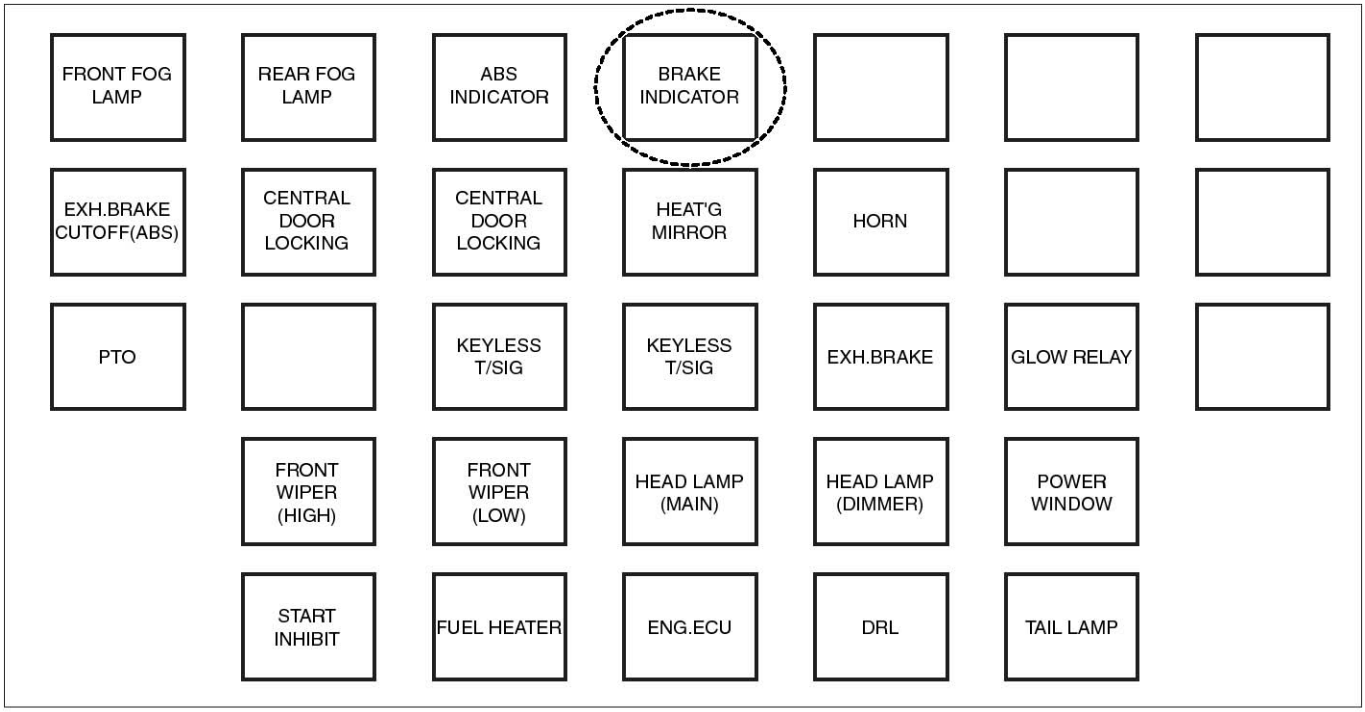
▶ System OK

0033 Brake Light Relay(Short To Ground)

COMPONENT LOCATION



Relay



SUDWAB9004L

GENERAL DESCRIPTION

Stop lamp relay is a relay that controls brakes, etc.

DTC DESCRIPTION

HECU continues to monitor the relay control signals, such as brakes. In case of a short-circuit being detected in relay control lines such as brakes, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor contact of connector and wiring damage. • Short to ground of control circuit. • Defective brake light relay.
Enable Conditions	Ignition ON			
Threshold Value	When the brake light relay control circuit is short			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

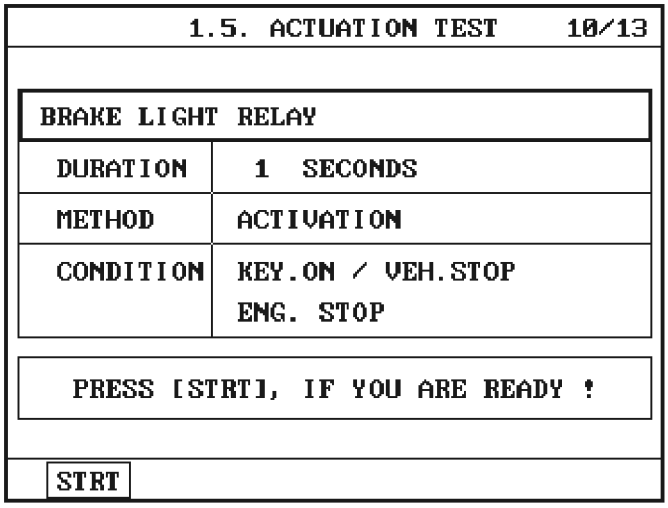
SPECIFICATION

Brake light relay coil resistance	200 ~ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test" on the scan tool.
4. Select the data “Brake light relay” and perform actuation test.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9037L

5. Can you hear the activating sound from the brake light relay?

YES

▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair” procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Short to Control Power Inspection

1. Turn the ignition OFF.
2. Disconnect the brake light relay (M102) and HECU connector (C60).
3. Measure the resistance between the terminal 3 of brake light relay harness connector (M102) and chassis ground.

   ■ Specification: Infinite
4. Is the resistance measured within specification?

YES

▶ Go to “Component Inspection” procedure.

NO

▶ Repair short to control circuit between terminal of HECU harness connector and terminal of brake light relay control harness and go to “Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the brake light relay connector (M102).
3. Measure the resistance between terminals 3 and 5 of ABS light relay component.

   ■ Specification: Brake light relay coil resistance: 200 ~ 450 Ω (At 20℃)
4. Measure the resistance between terminals 1 and 4 of brake light relay while applying and cutting off B+ power to terminals 3 and 5 of ABS light relay.

   ■ Specification:

   Continuity (When applying power)

   Infinite (When cutting off power)
5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Replace the relay and go to "Verification of Vehicle Repair” procedure.

▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

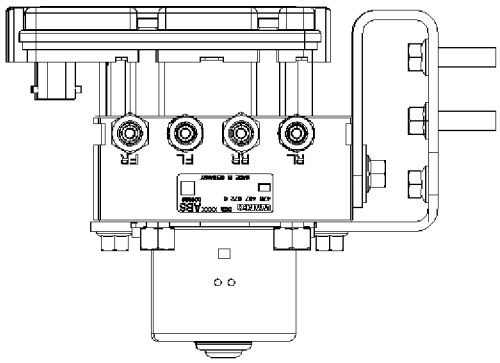
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0037 Valve Relay(Can't Switch Off)

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

HECU supplies the battery voltage to all solenoid valves through the valve relay controlled by ECU. All solenoid valves and valve relay are installed in HECU.

DTC DESCRIPTION

HECU determines whether the switch that operates the valve relay is turned on/off while the power to the system is on. If the switch OFF does not work, a fail code is output.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	Valve relay switch is not turned OFF.			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Control Power Inspection

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Turn the ignition ON. Leave the engine OFF.
4. Measure the voltage between the terminal 17 of HECU harness connector (C60) and chassis ground.

   ■ Specification: Battery voltage

YES

▶ Go to “Ground Circuit Inspection” procedure.

NO

▶ Check the fuse 30A. If it is burnt, replace it. When the fuse is normal, check open of terminal 17 of ABS control module harness connector and short to ground. Repair it if there is any problem and go to “Verification of Vehicle Repair” procedure.

GROUND CIRCUIT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Measure the resistance between the terminals 18, 19 of HECU harness connector (C60) and chassis ground.
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to “Component Inspection” procedure.

NO

▶ Check open or poor contact between the solenoid valve ground of ABS control module harness connector and chassis ground. And go to "Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

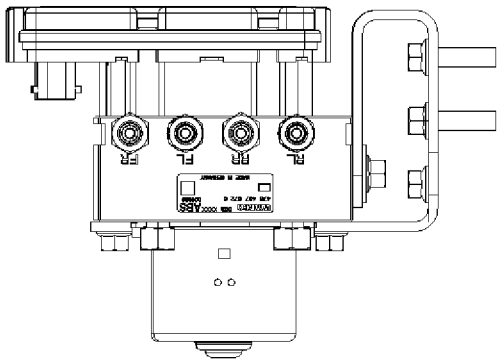
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0038 Valve Relay(Can't Switch On)

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

HECU supplies the battery voltage to all solenoid valves through the valve relay controlled by ECU. All solenoid valves and valve relay are installed in HECU.

DTC DESCRIPTION

HECU determines whether the switch that operates the valve relay is turned on/off while the power to the system is on. If the switch ON does not work, a fail code is output.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	Valve relay switch is not turned ON.			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Control Power Inspection

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Turn the ignition ON. Leave the engine OFF.
4. Measure the voltage between the terminal 17 of HECU harness connector (C60) and chassis ground.

   ■ Specification: Battery voltage

YES

▶ Go to “Ground Circuit Inspection” procedure.

NO

▶ Check the fuse 30A. If it is burnt, replace it. When the fuse is normal, check open of terminal 17 of ABS control module harness connector and short to ground. Repair it if there is any problem and go to “Verification of Vehicle Repair” procedure.

GROUND CIRCUIT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Measure the resistance between the terminals 18, 19 of HECU harness connector (C60) and chassis ground.
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to “Component Inspection” procedure.

NO

▶ Check open or poor contact between the solenoid valve ground of ABS control module harness connector and chassis ground. And go to "Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

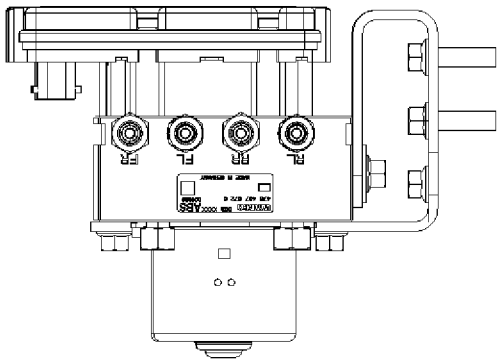
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0039 Reference Ground Connection

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

It is used as a ground connection to find out the basic value of the ground connection of HECU.

DTC DESCRIPTION

If the difference between the ground connection of HECU and that of the reference is more than -1.6 V and smaller than 1.0 V, a fail code is output.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	Difference between ECU ground and reference should be higher than -1.6 V and lower than 1.0 V			
Diagnosis Time	Below 500 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

GROUND CIRCUIT INSPECTION

1. Turn the ignition OFF.
2. Measure the resistance between the terminals 6 of HECU harness connector (C60) and chassis ground.

   ■ Specification: Continuity
3. Is the resistance measured within specification?

YES

▶ Replace with a known-good HECU. If there is no

problem, replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair open between the reference ground of ABS control module harness connector and chassis ground and check poor contact. If there is any problem repair poor contact. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

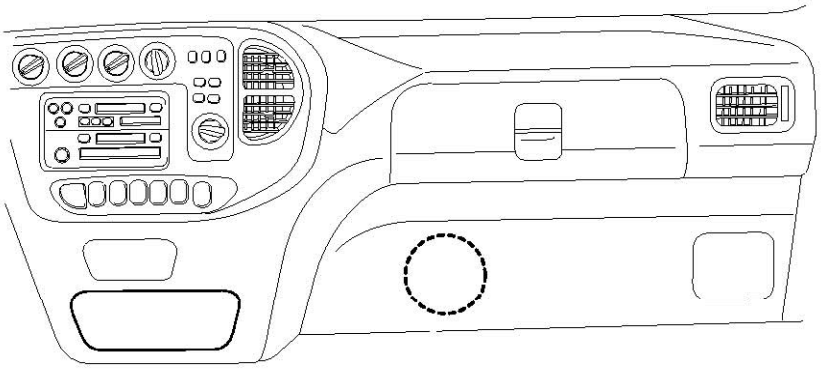
   ▶ Go to the applicable DTC procedure.

   NO

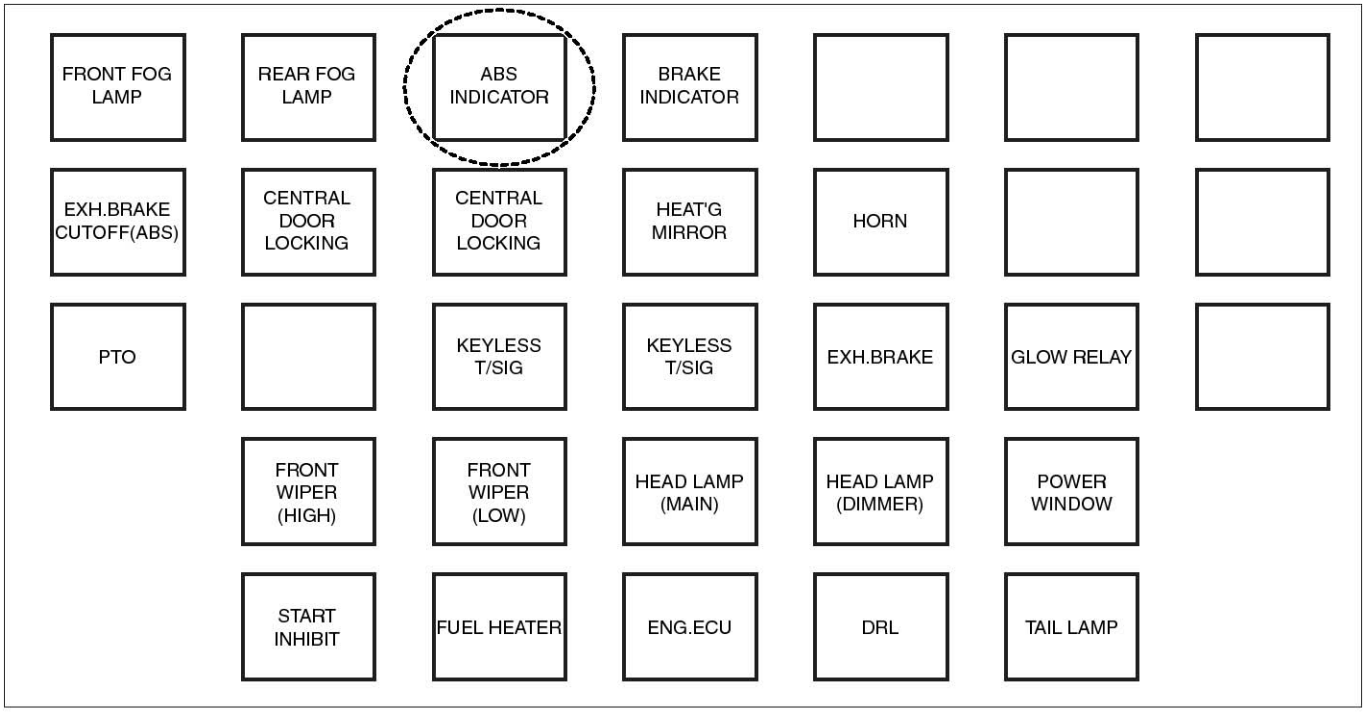
   ▶ System OK

003B ABS Warning Light Bulb

COMPONENT LOCATION



Relay



SUDWAB9005L

GENERAL DESCRIPTION

The ABS warning light, which is installed in the dashboard, is turned on to notify the driver when ABS control is malfunctioning and requires repairing.

DTC DESCRIPTION

HECU outputs a fail code when the ABS warning light is not turned on.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor connection of connector and wiring damage. • Open of control circuit. • Defective ABS warning lamp relay.
Enable Conditions	Ignition ON			
Threshold Value	ABS warning lamp does not work.			
Diagnosis Time	5,000 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

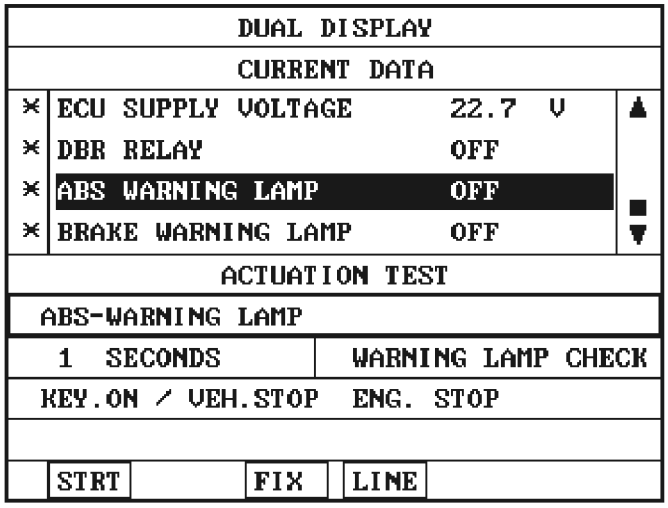
SPECIFICATION

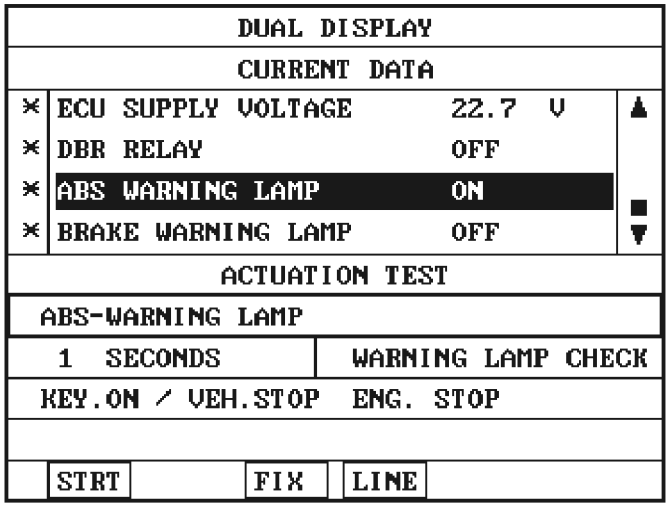
ABS warning lamp relay coil resistance	200 ~ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test".
4. Select "ABS warning lamp" and perform actuation test..

   ■ Specification: Normal if the warning lamp in the gauge comes on.





SUDWAB9038L

5. Does the warning lamp in the gauge come on?

YES

▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Control Circuit inspection

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Turn the ignition ON. Leave the engine OFF.
4. Ground the terminal 21 of HECU harness connector (C60) to chassis ground.
5. Does the ABS warning lamp come on?

YES

▶ Go to "Control Open Inspection" procedure.

NO

▶ Remove the gauge panel and check the bulb condition of ABS warning lamp.

▶ Replace the bulb if necessary. If normal, check open circuit between meter fuse and warning lamp.

▶ Repair it as necessary. Go to "Verification of Vehicle Repair” procedure.

Control Open Inspection

1. Turn the ignition OFF.
2. Disconnect the ABS warning lamp relay (M101) and HECU (C60).
3. Measure the resistance between the terminal 3 of relay harness connector (M101) and the terminal 21 of HECU harness connector (C60).

   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open circuit between the terminal 3 of relay harness connector (M101) and the terminal 21 of HECU harness connector (C60) and go to "Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the ABS warning lamp relay connector (M101).
3. Measure the resistance between terminals 3 and 5 of ABS warning lamp relay component.

   ■ Specification: ABS warning lamp relay coil resistance: 200 ~ 450 Ω (At 20℃)
4. Measure the resistance between terminals 1 and 4 of ABS warning lamp relay while applying and cutting off B+ power to terminals 3 and 5 of ABS warning lamp relay.

   ■ Specification:

   Continuity (When applying power)

   Infinite (When cutting off power)
5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Replace the relay and go to "Verification of Vehicle Repair” procedure.

▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

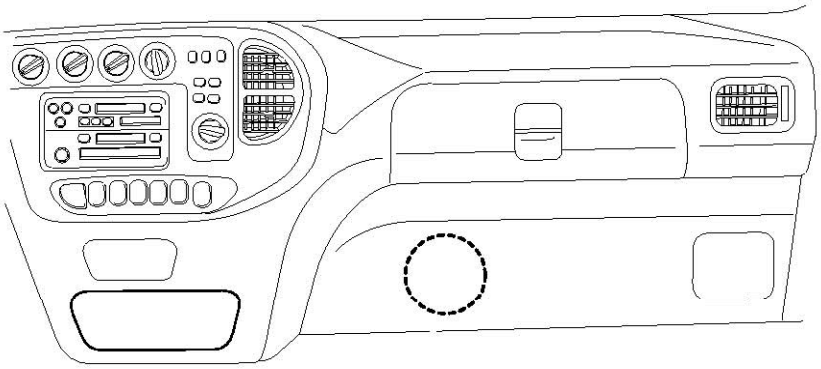
▶ Go to the applicable DTC procedure.

NO

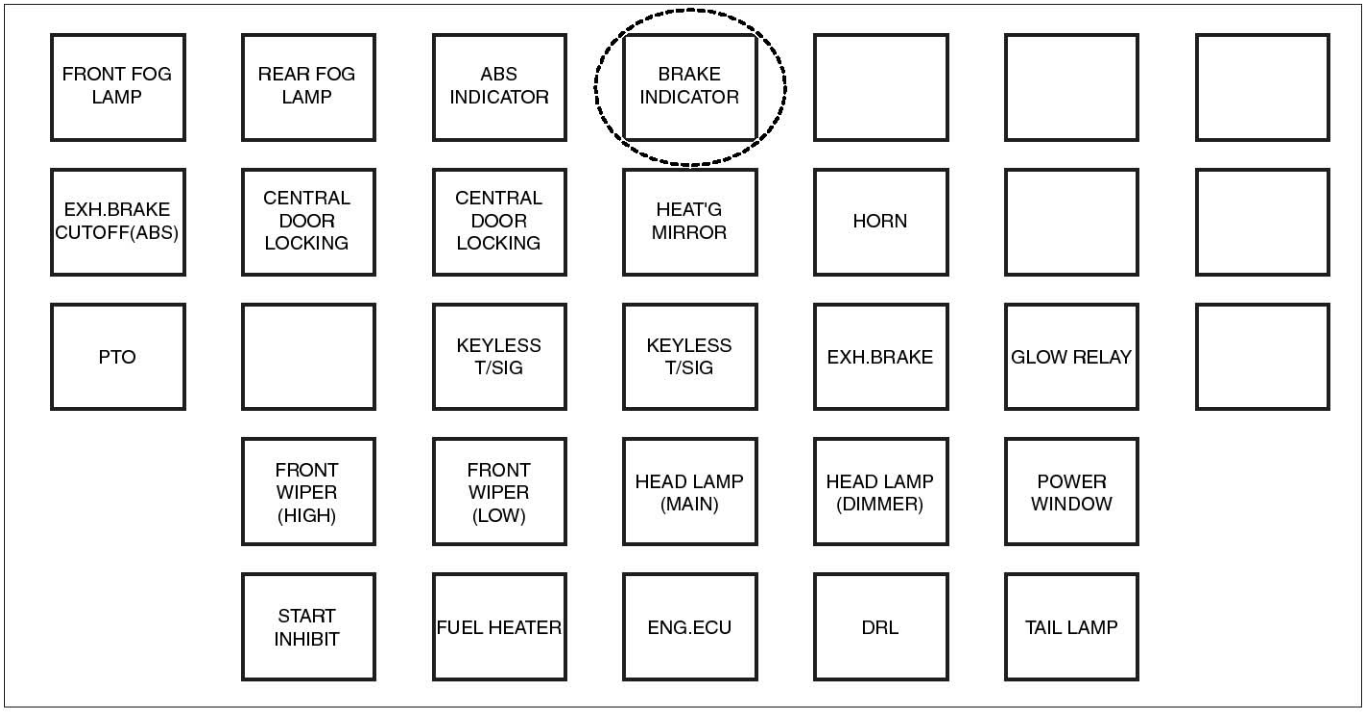
▶ System OK

003C Brake Warning Light Bulb

COMPONENT LOCATION



Relay



SUDWAB9004L

GENERAL DESCRIPTION

The BRAKE warning light, which is installed in the dashboard, is turned on to notify the driver when the vehicle is abnormal and requires repairing.

DTC DESCRIPTION

HECU outputs a fail code when the break warning light is not turned on even though the vehicle is in the conditions in which the light should be on.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Poor connection of connector and wiring damage. • Open of control circuit. • Defective brake warning lamp relay.
Enable Conditions	Ignition ON			
Threshold Value	ABS warning lamp does not work.			
Diagnosis Time	5,000 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

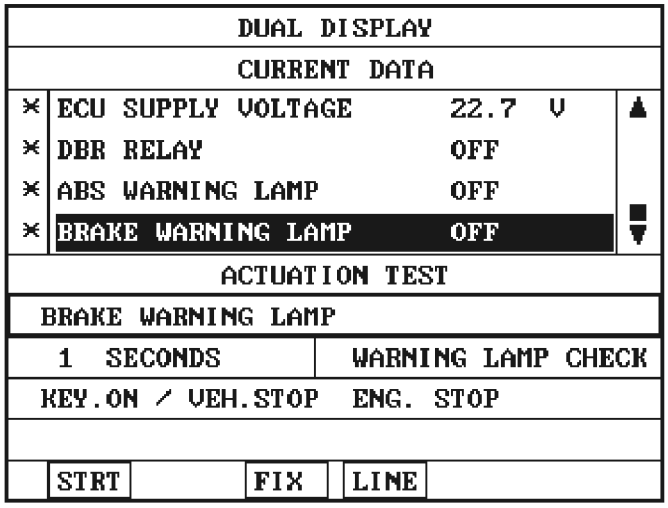
SPECIFICATION

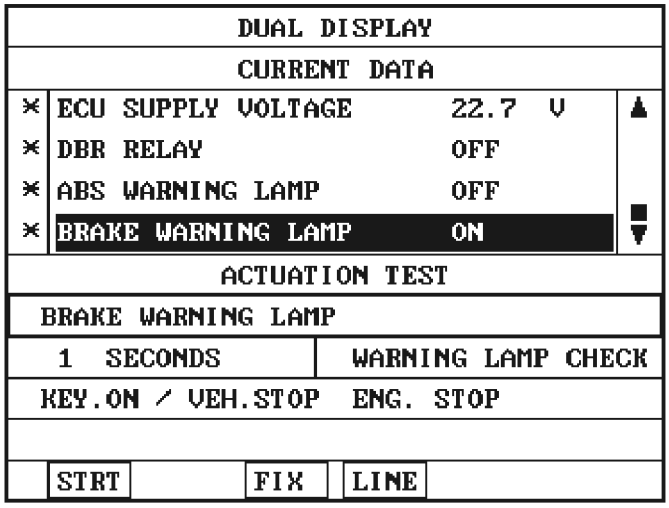
Brake warning lamp relay coil resistance	200 ~ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON. Leave the engine OFF.
3. Select the data "Actuation test".
4. Select "Brake warning lamp" and perform actuation test.

   ■ Specification: Normal if the warning lamp in the gauge comes on.





SUDWAB9039L

5. Does the warning lamp in the gauge come on?

YES

▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to next procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Control Circuit inspection

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Turn the ignition ON. Leave the engine OFF.
4. Ground the terminal 21 of HECU harness connector (C60) to chassis ground.
5. Does the brake warning lamp come on?

YES

▶ Go to "Control Open Inspection" procedure.

NO

▶ Remove the gauge panel and check the bulb condition of brake warning lamp.

▶ Replace the bulb if necessary. If normal, check open circuit between meter fuse and warning lamp.

▶ Repair it as necessary. Go to "Verification of Vehicle Repair” procedure.

Control Open Inspection

1. Turn the ignition OFF.
2. Disconnect the brake warning lamp relay (M102) and HECU (C60).
3. Measure the resistance between the terminal 3 of relay connector (M102) and the terminal 21 of HECU harness connector (C60).

   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open circuit between terminal of HECU harness connector and terminal of brake warning lamp relay control harness connector and go to "Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the brake warning lamp relay connector (M102).
3. Measure the resistance between terminals 3 and 5 of brake warning lamp relay component.

   ■ Specification: Brake warning lamp relay coil resistance: 200 ~ 450 Ω (At 20℃)
4. Measure the resistance between terminals 1 and 4 while applying and cutting off B+ power to terminals 3 and 5 of brake warning lamp relay.

   ■ Specification:

   Continuity (When applying power)

   Infinite (When cutting off power)
5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Replace the relay and go to "Verification of Vehicle Repair” procedure.

▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

▶ Go to the applicable DTC procedure.

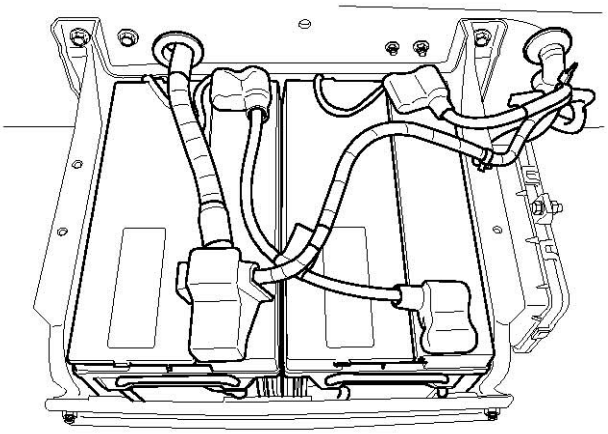
NO

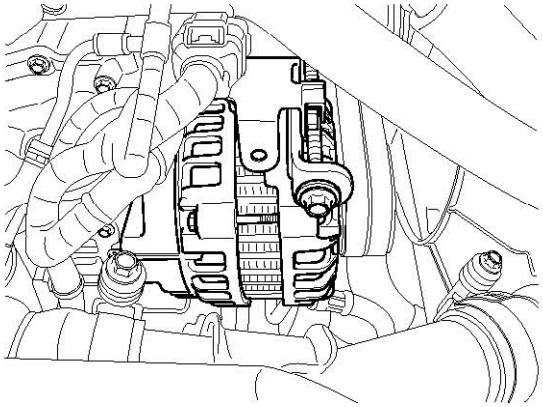
▶ System OK

003D High Voltage

COMPONENT LOCATION

Battery & Charging system





SUDWAB9006L

GENERAL DESCRIPTION

The battery voltage of a normal vehicle fluctuates between 23.5 V and 28.5 V.

DTC DESCRIPTION

Particularly, the voltage fluctuation is closely related to the pump and solenoids related to ABS, and HECU monitors such a battery voltage change.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Alternator • Battery
Enable Conditions	Ignition ON			
Threshold Value	Voltage is higher than 32 V in 24 V HECU.			
Diagnosis Time	Below 500 ms			
Fail Safe	Fuel Cut	No	• The ABS function works normally.	
	Fuel Limit	Yes		
	MIL	Yes		

SPECIFICATION

Regulator temperature(℃)	Regulating voltage(V)
20 ~ 30	27.5~28.5 V

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Alternator Connector Supply Power Inspection

1. Leave the alternator connector connected.
2. Turn the ignition ON. Leave the engine ON.
3. Measure the voltage of terminal 1 of alternator connector.

   ■ Specification: Charging voltage B+ V
4. Is the voltage measured within specification?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Go to "Alternator B+ Cable Voltage Drop Inspection" procedure.

Alternator B+ Cable Voltage Drop Inspection

1. Run the engine.
2. Measure the voltage drop between the terminal of alternator B+ and the terminal of battery B+. (Connect terminal + (positive) of multi-meter to terminal B+ of alternator, terminal - (negative) of multi-meter to terminal B+ of battery.)

   ■ Specification: Within 200 mV
3. Is the voltage drop measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check the corrosion and degradation of alternator B+ cable terminal and replace the cable as necessary.

COMPONENT INSPECTION

Alternator Charging Voltage Inspection

1. Turn the ignition OFF. Leave the engine OFF.
2. Check the belt tension of alternator.
3. Check battery terminal, fusible link, alternator B+ terminal for looseness and corrosion.
4. Start the engine.
5. Operate electric system such as head lamp, hot-wire, blower motor etc.
6.

   ■ Specification:

Regulator temperature(℃)	Regulating voltage(V)
20 ~ 30	25.5~26.5 V

   Measure battery voltage at engine 750 rpm or higher.
7. Is the voltage measured within specification?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the regulator 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

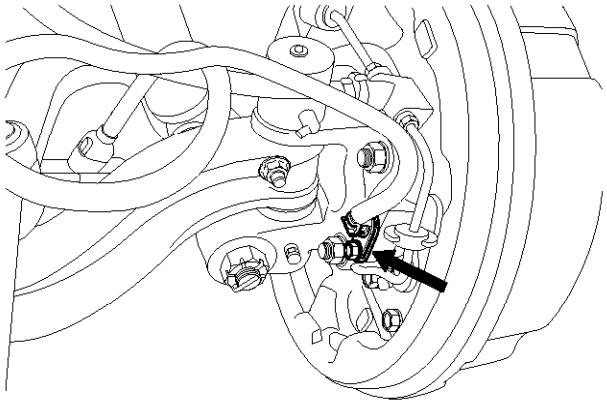
▶ Go to the applicable DTC procedure.

NO

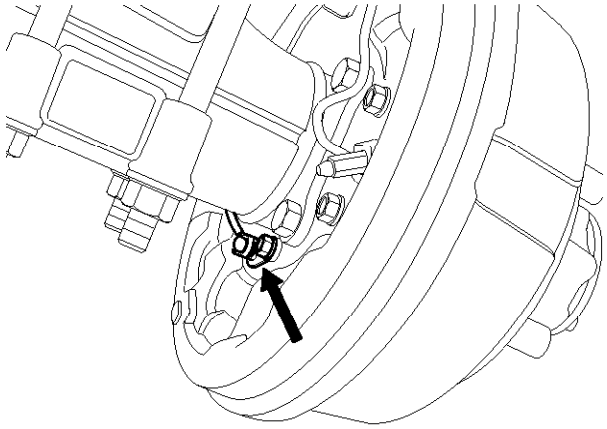
▶ System OK

003F Sensor Right Hand Front(Tire Combination)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check that tire size is within specification range. • Check the number of teeth on tone rings.
Enable Conditions	Ignition ON			
Threshold Value	Tire alignment correction factor > 20%			
Diagnosis Time	Below 5 minutes			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.
5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Check Tire Size

1. Turn the ignition OFF.
2. Check tires and wheel size.
3. Are tires installed within specification?

YES

▶ Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

1. Turn the ignition OFF.
2. Check the number of teeth on right hand front tone ring.
3. Is the number of tone wheel correct?

YES

▶ Go to "Verification of Vehicle Repair” procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

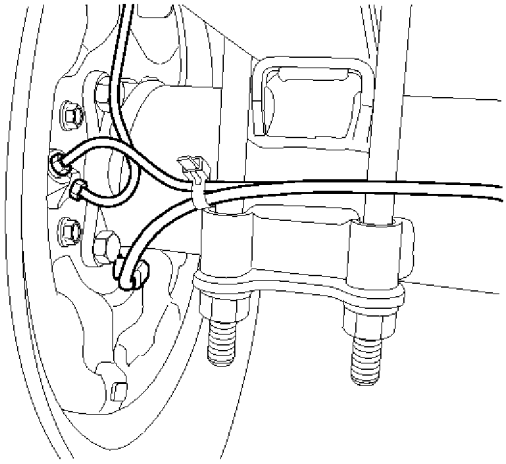
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0040 Sensor Left Hand Rear(Tire Combination)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check that tire size is within specification range. • Check the number of teeth on tone rings.
Enable Conditions	Ignition ON			
Threshold Value	Tire alignment correction factor>20%			
Diagnosis Time	Below 5 minutes			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

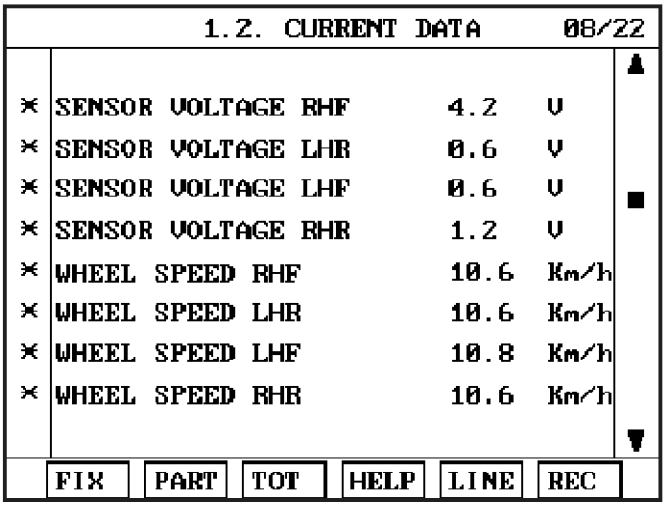
SPECIFICATION

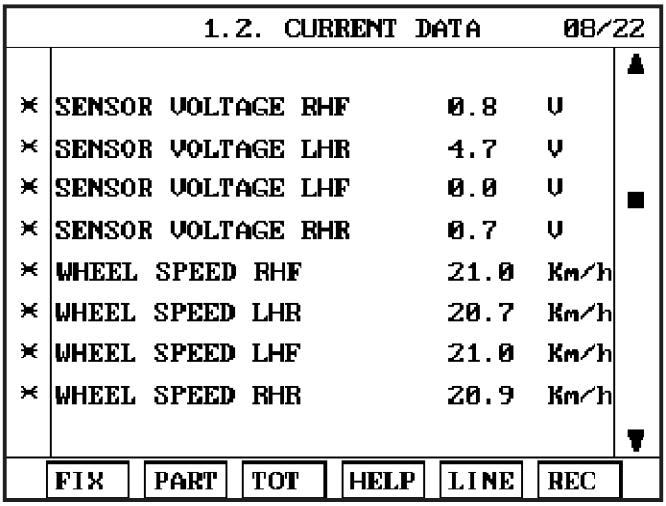
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Check tires and wheel size.
3. Are tires installed within specification?

YES

▶ Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

1. Turn the ignition OFF.
2. Check the number of teeth on left hand rear tone ring.
3. Is the number of tone wheel correct?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one 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 the scan tool and perform the self diagnosis.Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

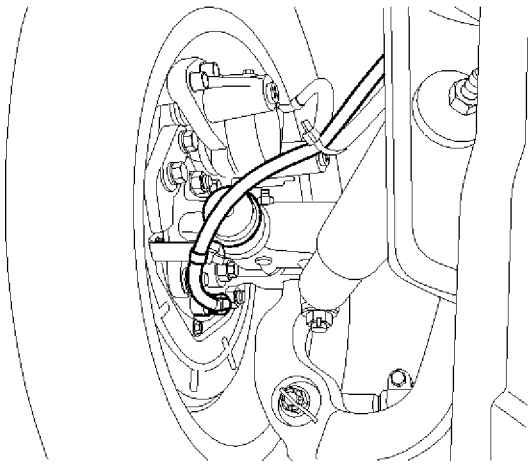
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0041 Sensor Left Hand Front(Tire Combination)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

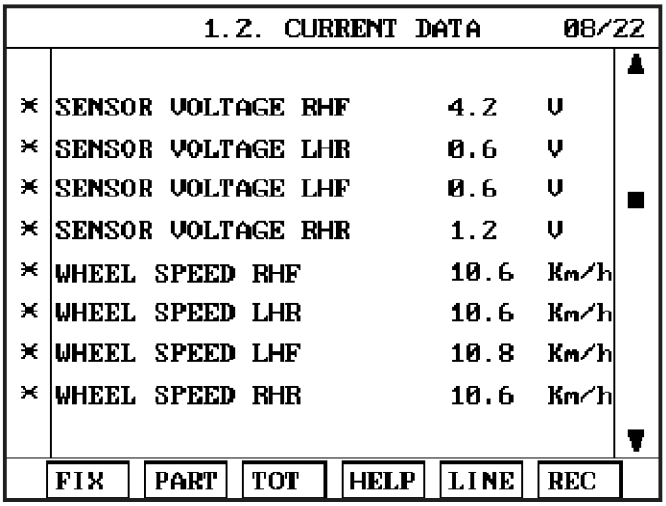
DTC DETECTING CONDITION

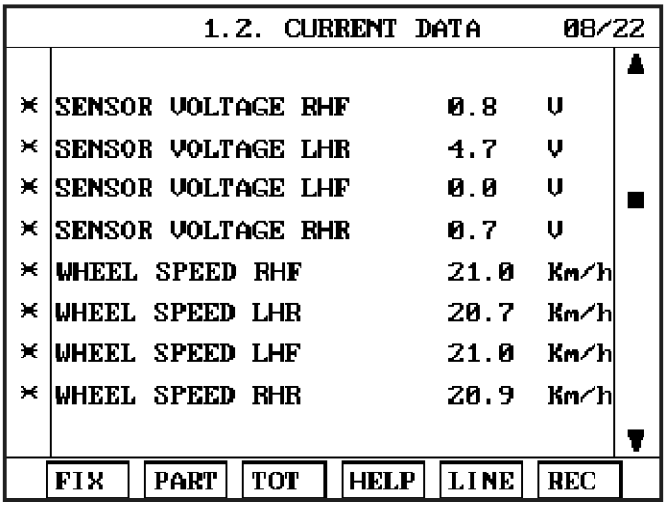
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check that tire size is within specification range. • Check the number of teeth on tone rings.
Enable Conditions	Ignition ON			
Threshold Value	Tire alignment correction factor>20%			
Diagnosis Time	Below 5 minutes			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Check tires and wheel size.
3. Are tires installed within specification?

YES

▶ Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

1. Turn the ignition OFF.
2. Check the number of teeth on left hand rear tone ring.
3. Is the number of tone wheel correct?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

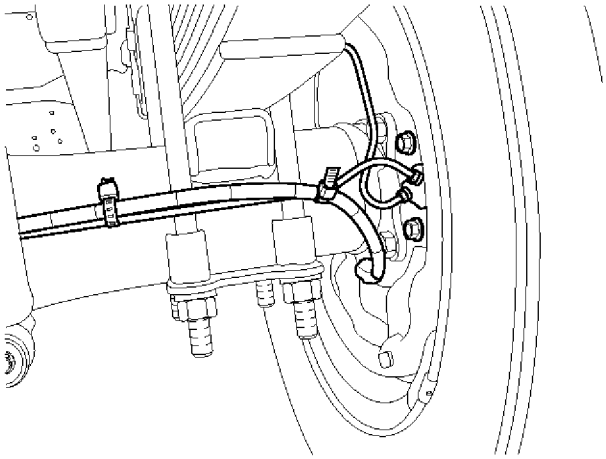
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0042 Sensor Right Hand Rear(Tire Combination)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check that tire size is within specification range. • Check the number of teeth on tone rings.
Enable Conditions	Ignition ON			
Threshold Value	Tire alignment correction factor>20%			
Diagnosis Time	Below 5 minutes			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

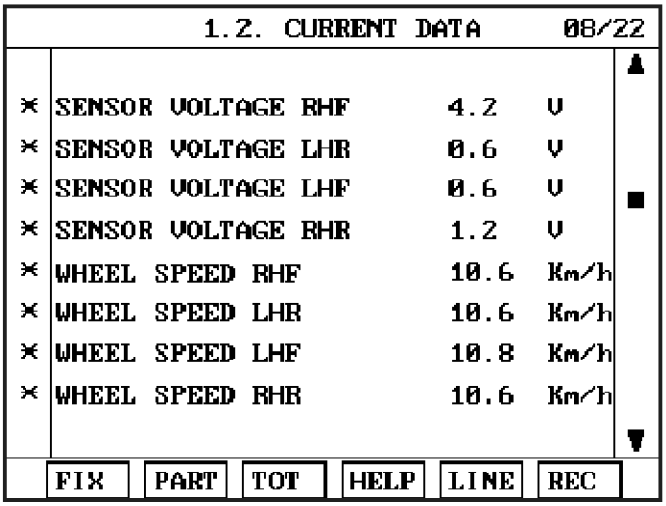
SPECIFICATION

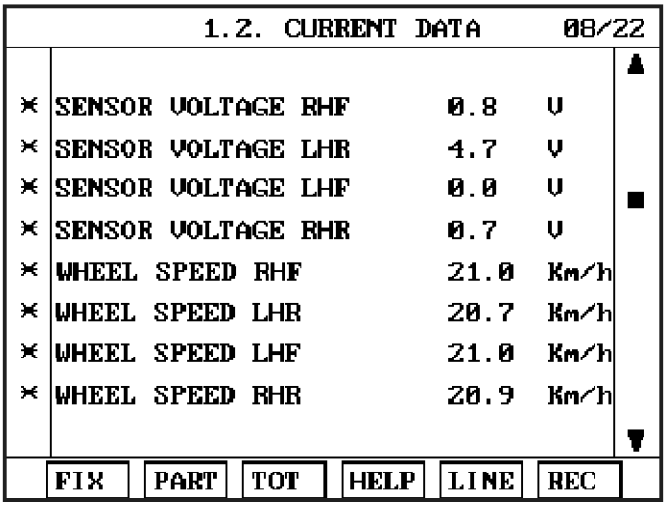
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Turn the ignition OFF.
2. Check tires and wheel size.
3. Are tires installed within specification?

YES

▶ Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

1. Turn the ignition OFF.
2. Check the number of teeth on right hand rear tone ring.
3. Is the number of tone wheel correct?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

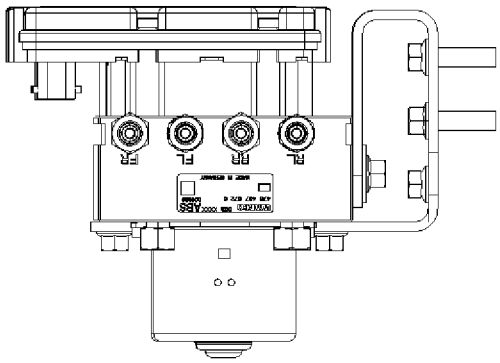
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0043 Pump Motor Does Not Switch On

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

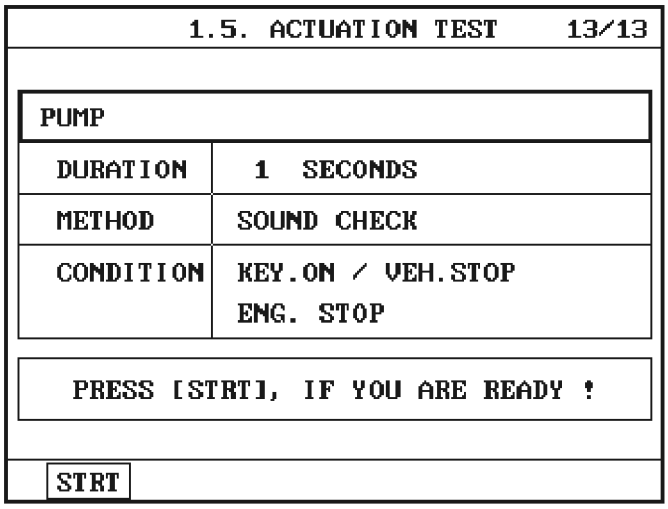
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the pump motor in HECU does not work			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test"
4. Check the pump motor for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9040L

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

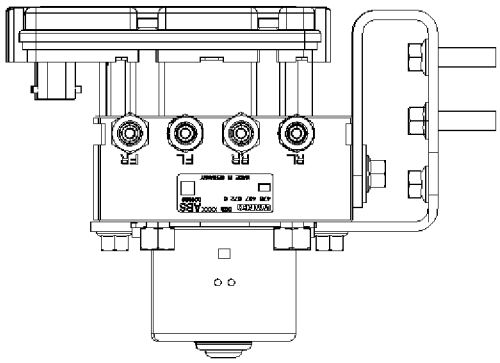
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0044 Pump Motor Does Not Switch Off

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

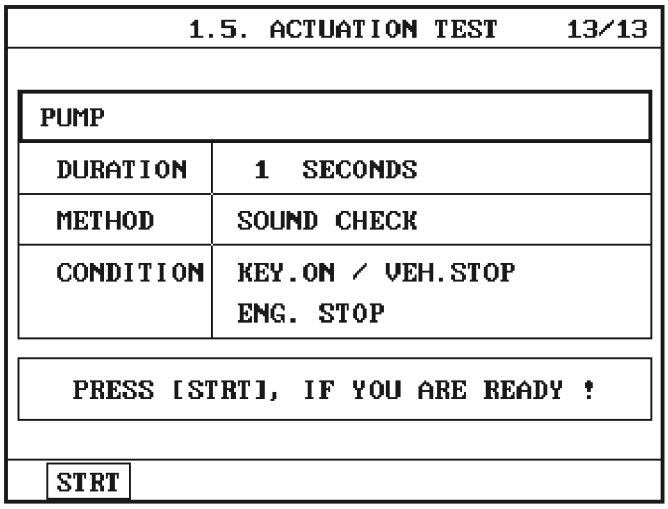
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the pump motor in HECU will not stop			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the pump motor for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9041L

5. Does the valve activate normally?

   YES

   ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

   ▶ And go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

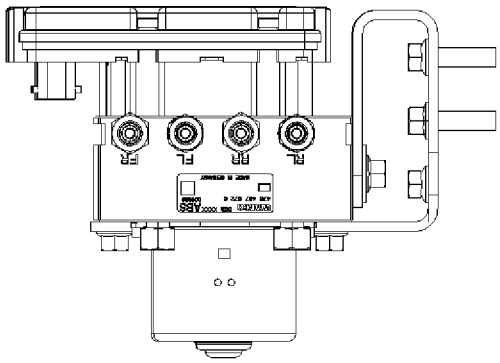
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0045 Pump Motor Does Not Turn

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

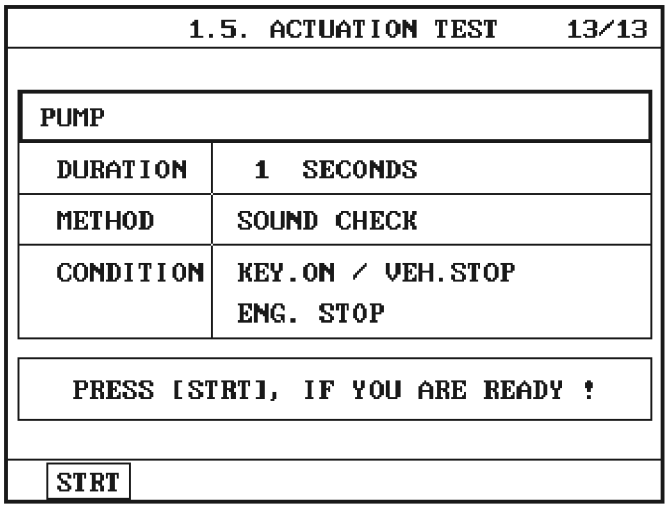
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the pump motor in HECU does not work			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the pump motor for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9042L

5. Does the valve activate normally?

   YES

   ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

   ▶ And go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

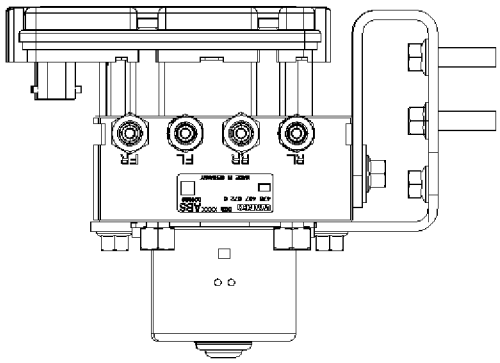
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0046 Pump Motor Supply Voltage Missing

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

HECU supplies the battery voltage to all solenoid valves through the valve relay controlled by ECU. All solenoid valves and valve relay are installed in HECU.

DTC DESCRIPTION

HECU monitors the incoming system power, and if the pump motor does not function due to no power, it outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU. • Poor contact in connector or wiring damage.
Enable Conditions	Ignition ON			
Threshold Value	When there is no power in pump motor			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

CONTROL CIRCUIT INSPECTION

Control Circuit inspection

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Turn the ignition ON. Leave the engine OFF.
4. Measure the voltage between the terminal 16 of HECU connector (C60) and chassis ground.

   ■ Specification: Battery voltage
5. Is the voltage measured within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Check the fuse 30A. If it is burnt, replace it. When the fuse is normal, check open circuit between terminal (+) of battery and terminal 16 of HECU connector (C60) and short to ground. Repair if there is any problem and go to “Verification of Vehicle Repair” procedure.

GROUND CIRCUIT INSPECTION

1. Turn the ignition OFF.
2. Disconnect the HECU connector (C60).
3. Measure the resistance between the terminals 18, 19 of HECU harness connector (C60) and chassis ground.
   ■ Specification: Continuity
4. Is the resistance measured within specification?

YES

▶ Go to “Component Inspection” procedure.

NO

▶ Check open or poor contact between the solenoid valve ground of HECU harness connector and chassis ground. And go to "Verification of Vehicle Repair” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

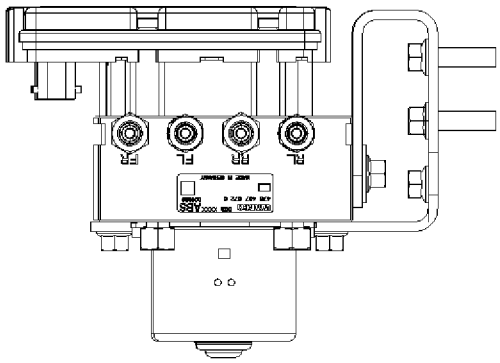
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0047 Pump Motor Relay Voltage Missing

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

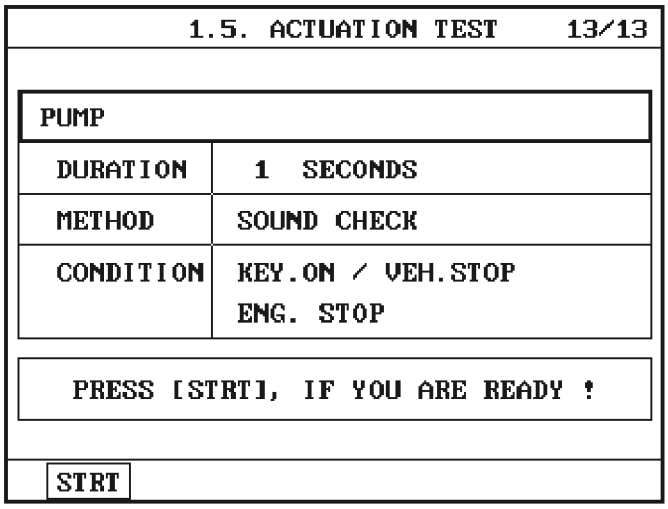
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the pump motor in HECU does not work			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the pump motor for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.



SUDWAB9043L

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

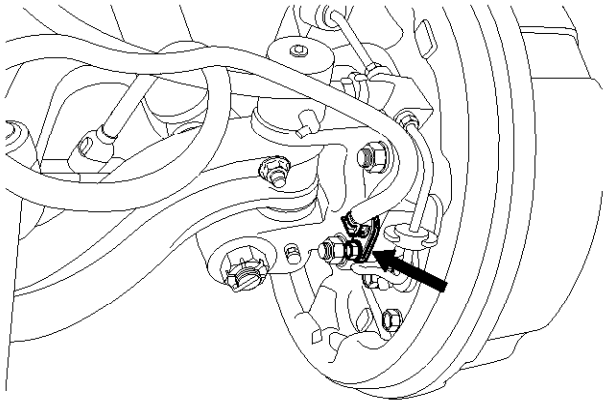
▶ Go to the applicable DTC procedure.

NO

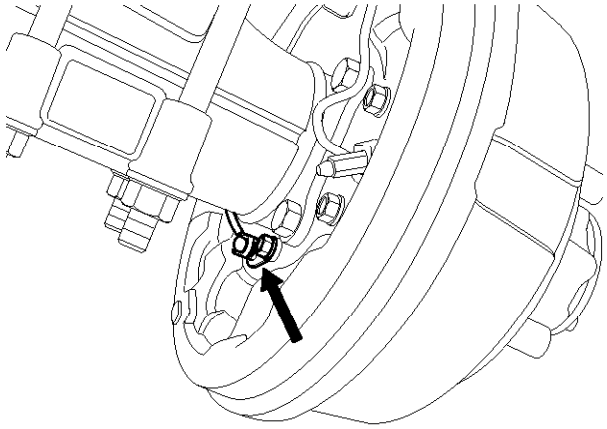
▶ System OK

0049 Sensor Right Hand Front(No Trigger At All)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0kph.Air gap 0.2 ~ 1.7mm			
Diagnosis Time	1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

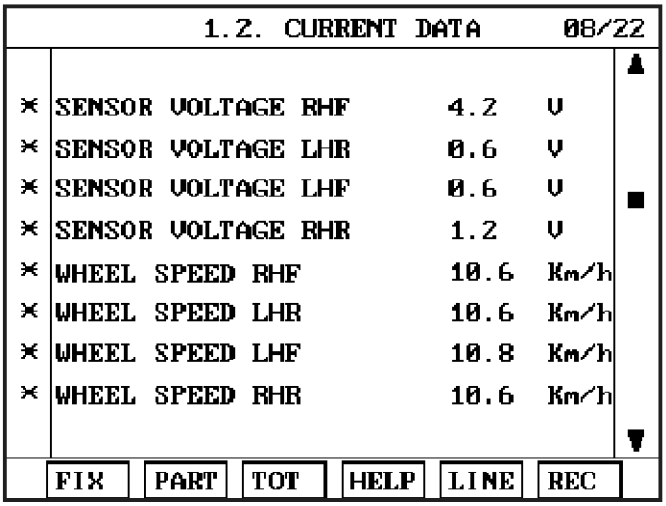
SPECIFICATION

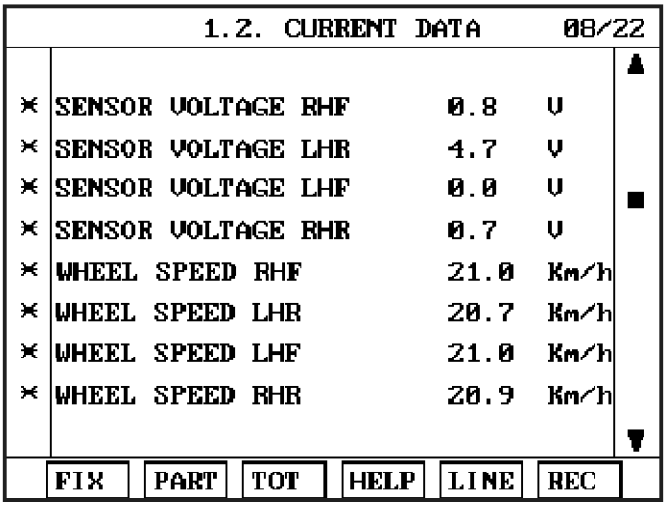
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of

Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand front when sensor connector.
3. Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).

   ■ Specification: 830 ~ 2,100 Ω (At 20℃)
4. Is the resistance measured within specification?

   YES

   ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

   ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

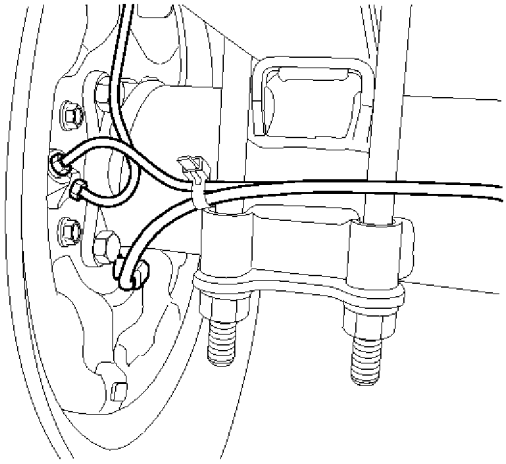
   ▶ Go to the applicable DTC procedure.

   NO

   ▶ System OK

004A Sensor Left Hand Rear(No Trigger At All)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0 kph.Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

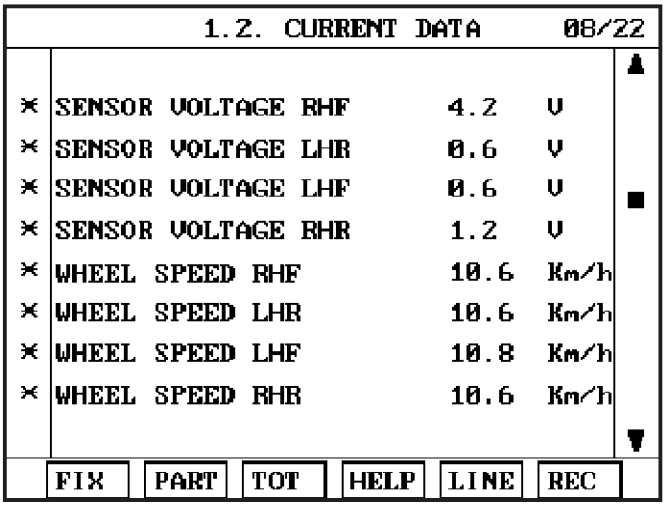
SPECIFICATION

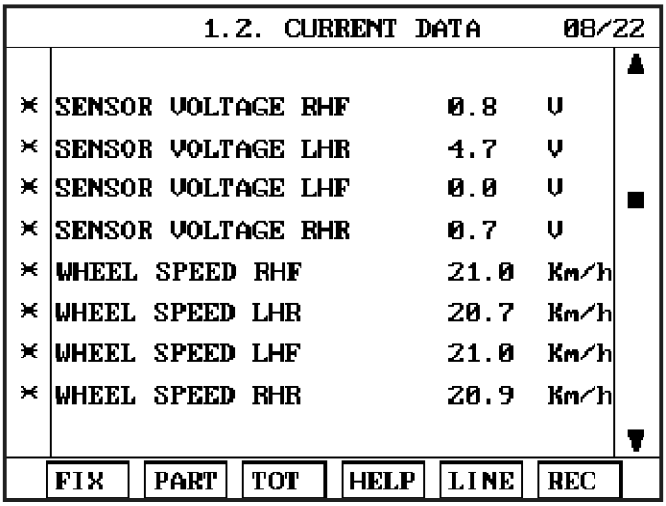
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand rear connector (C37).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).

   ■ Specification: 830 ~ 2100 Ω (At 20℃)
4. Is the resistance measured within specification?

   YES

   ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

   ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

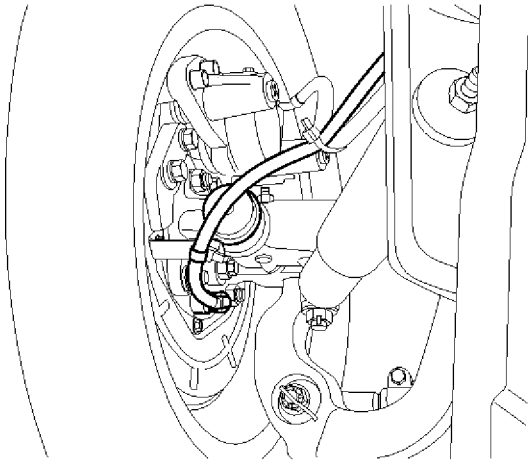
   ▶ Go to the applicable DTC procedure.

   NO

   ▶ System OK

004B Sensor Left Hand Front(No Trigger At All)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

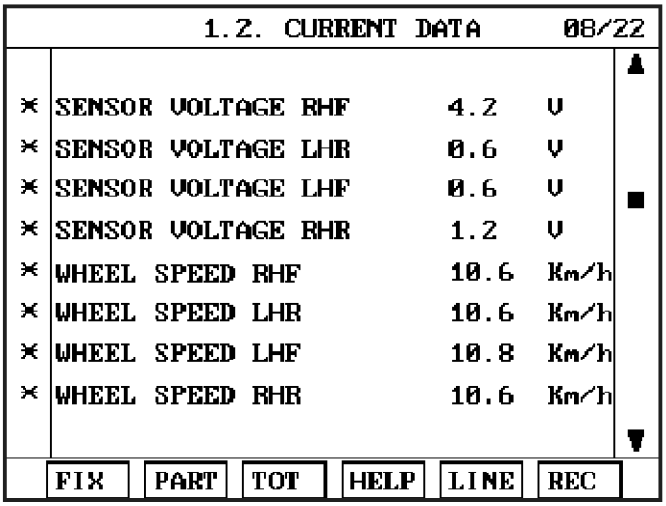
SPECIFICATION

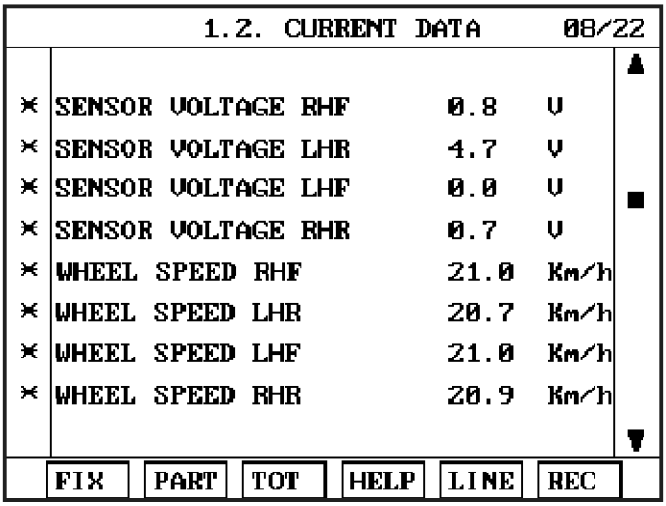
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the left hand front connector (C31).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.

   ■ Specification: 830 ~ 2,100 Ω (At 20℃)
4. Is the resistance measured within specification?

   YES

   ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

   ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

   NO

   ▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

   YES

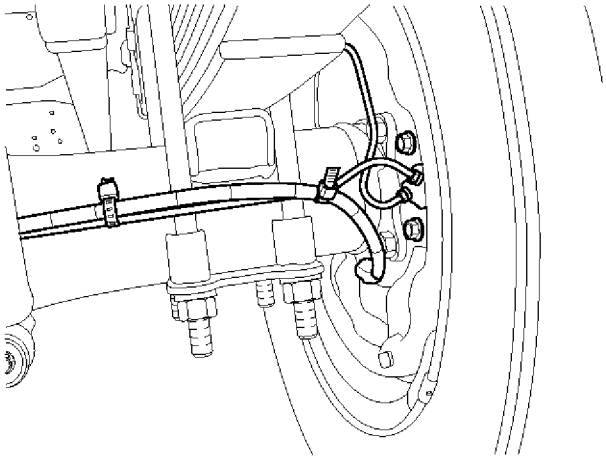
   ▶ Go to the applicable DTC procedure.

   NO

   ▶ System OK

004C Sensor Right Hand Rear(No Trigger At All)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 15.0 kph. Air gap 0.2 ~ 1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

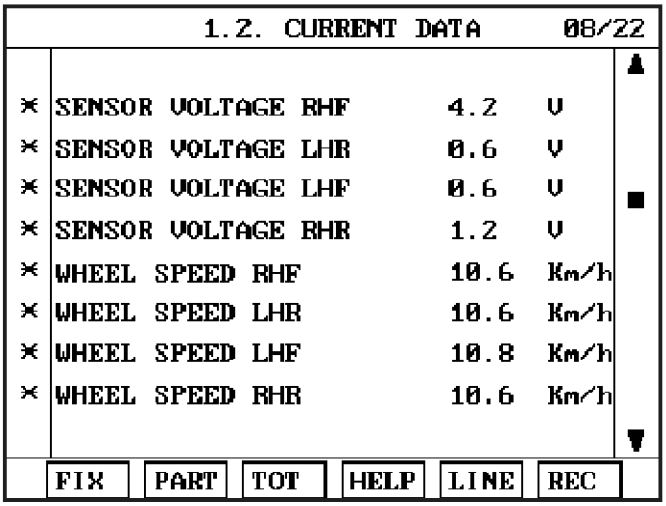
SPECIFICATION

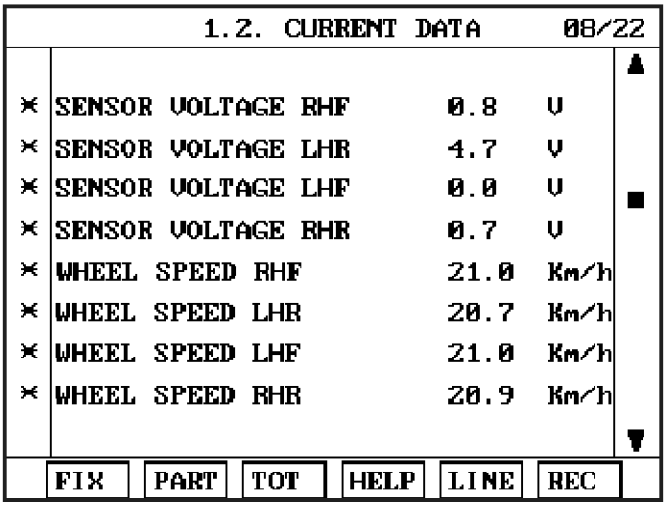
Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

1. Turn the ignition OFF.
2. Disconnect the right hand rear connector (C36).
3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
   ■ Specification: 830 ~ 2100 Ω (At 20℃)
4. Is the resistance measured within specification?

YES

▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.

▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

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

1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

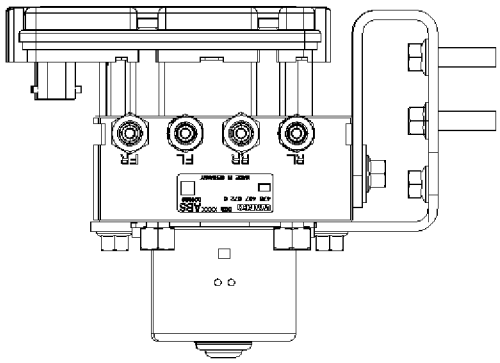
▶ Go to the applicable DTC procedure.

NO

▶ System OK

004D J1939 Internal Error

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

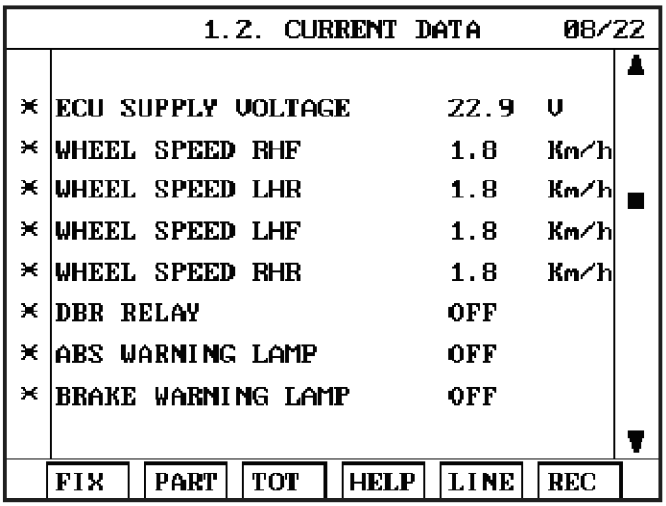
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

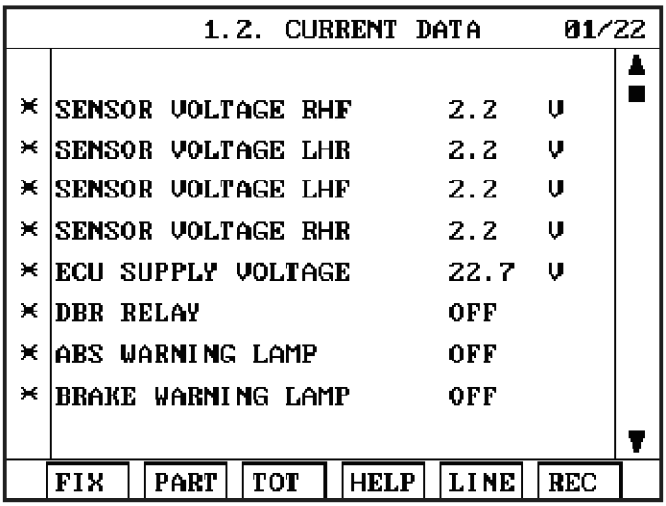
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

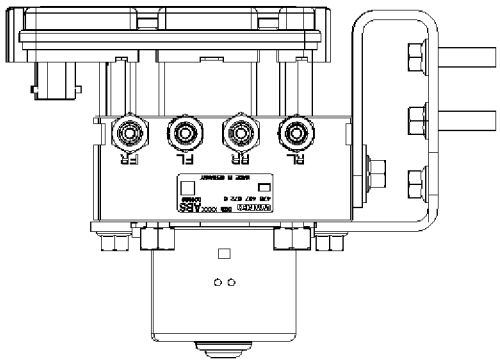
▶ Go to the applicable DTC procedure.

NO

▶ System OK

004E J1939 Bus

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

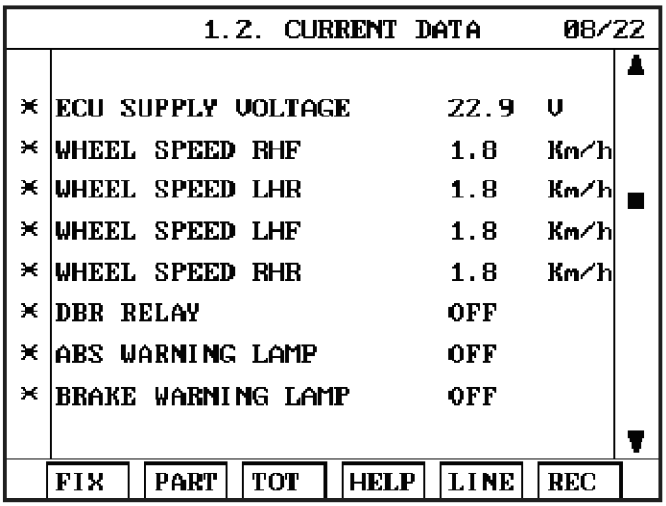
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

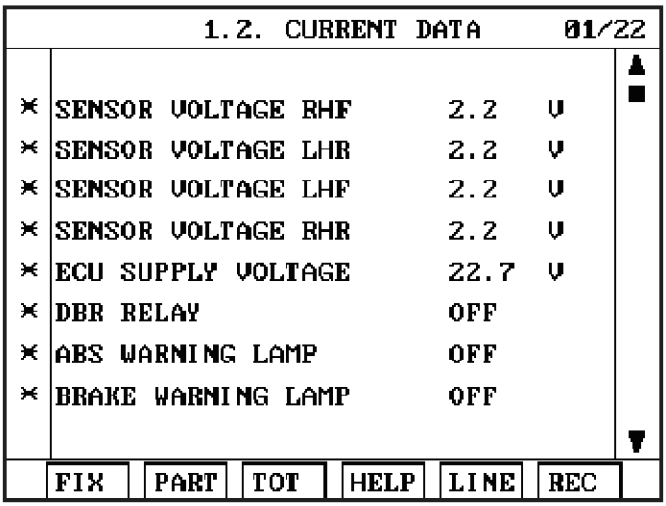
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

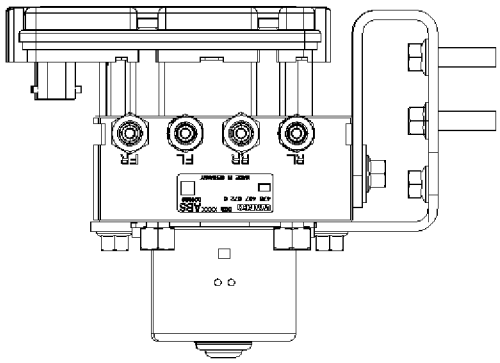
▶ Go to the applicable DTC procedure.

NO

▶ System OK

004F J1939 Message

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

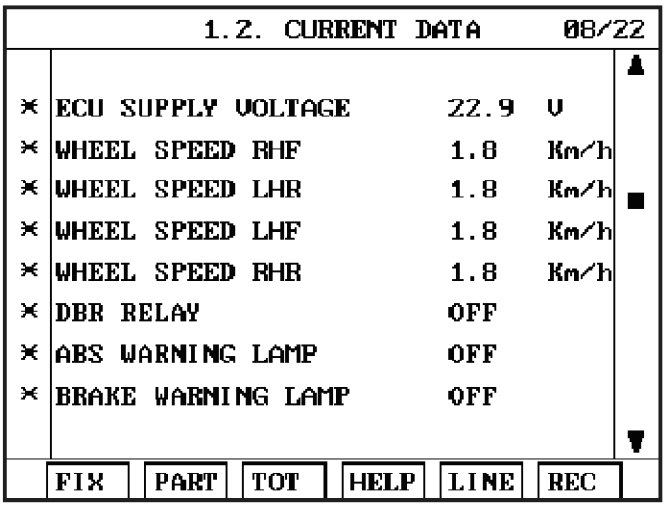
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

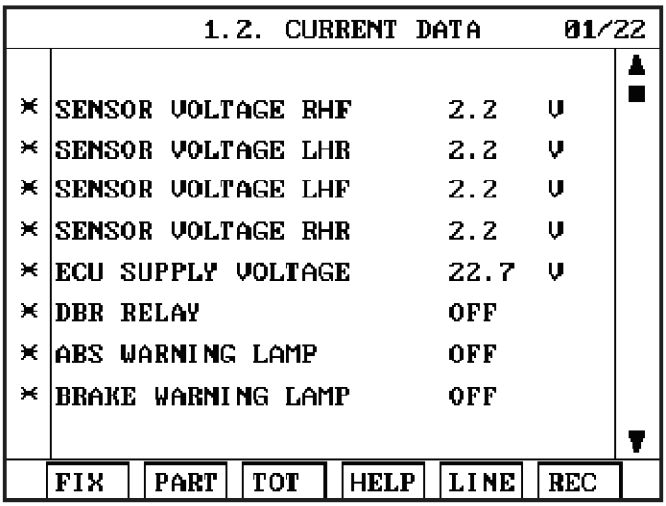
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

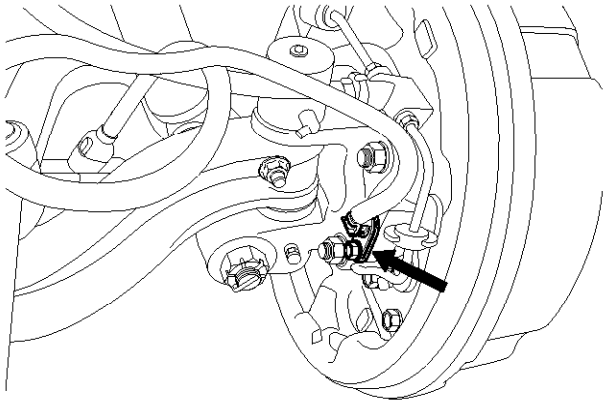
▶ Go to the applicable DTC procedure.

NO

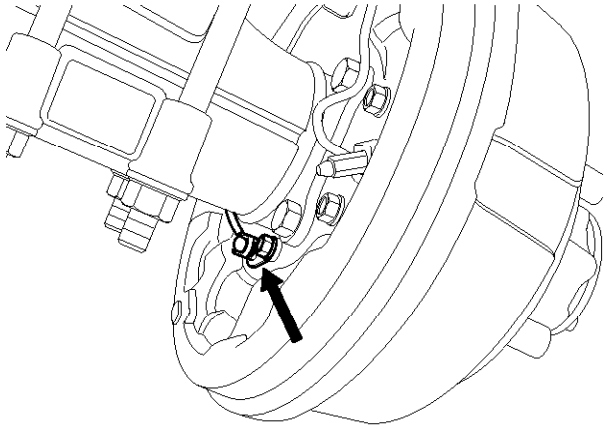
▶ System OK

0050 Inlet Valve(Right Hand Front) Actuation Time Unplausible

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

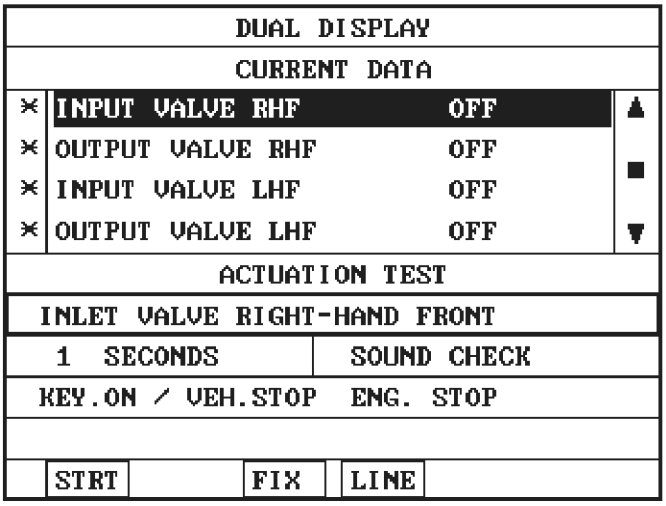
DTC DETECTING CONDITION

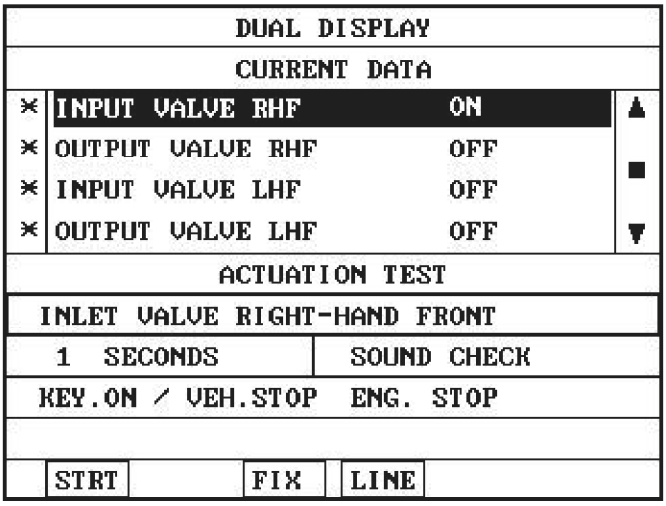
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	.When the HECU detects malfunction in the control system.Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9044L

Fig1) Right hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

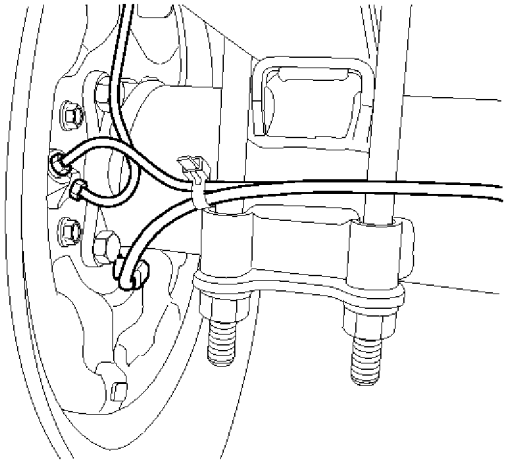
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0051 Inlet Valve(Left Hand Rear) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

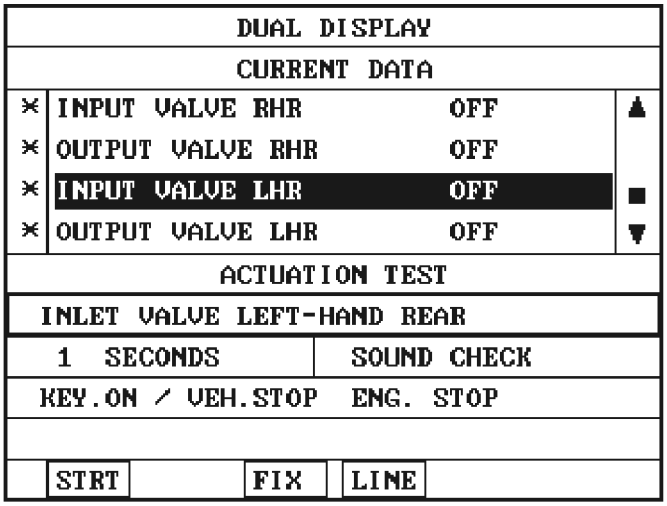
DTC DETECTING CONDITION

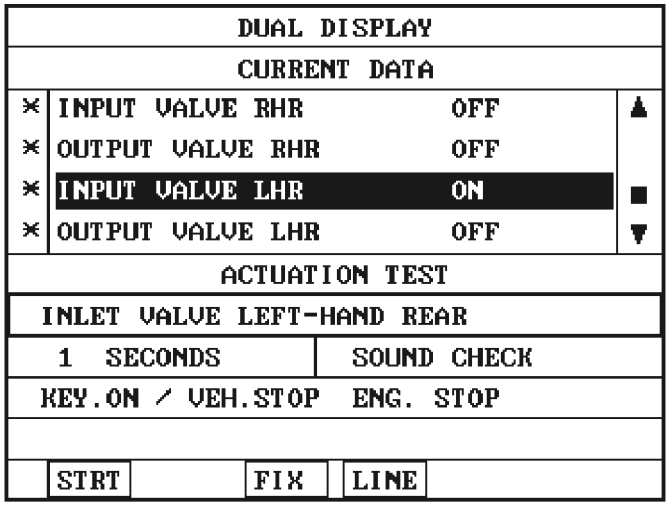
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system.Air gap : 0.2 ~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9045L

Fig1) Left hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

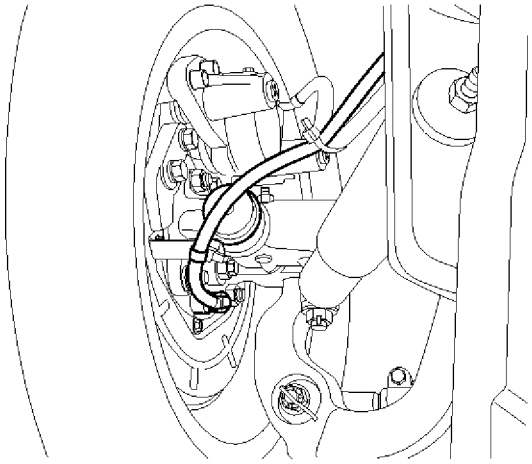
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0052 Inlet Valve(Left Hand Front) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

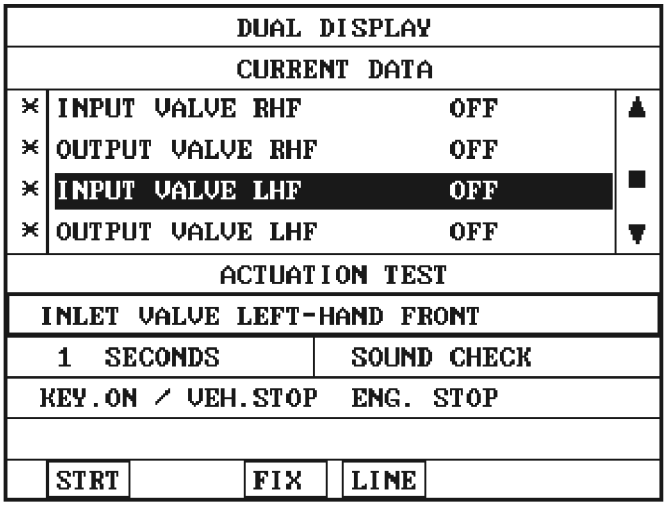
DTC DETECTING CONDITION

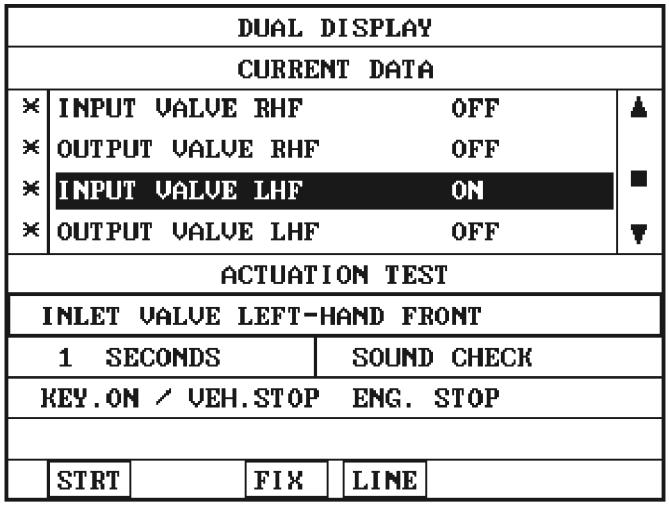
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system.Air gap : 0.2 ~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the left hand front inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9046L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

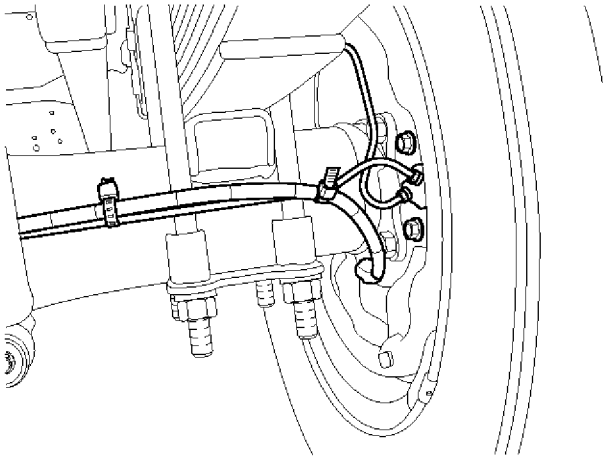
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0053 Inlet Valve(Right Hand Rear) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

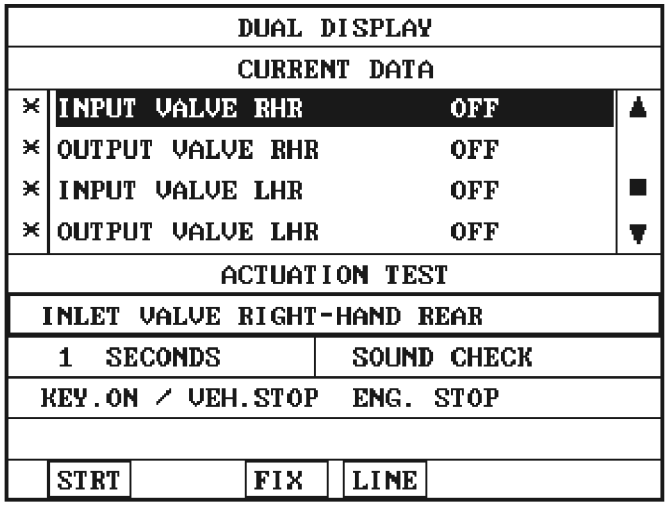
DTC DETECTING CONDITION

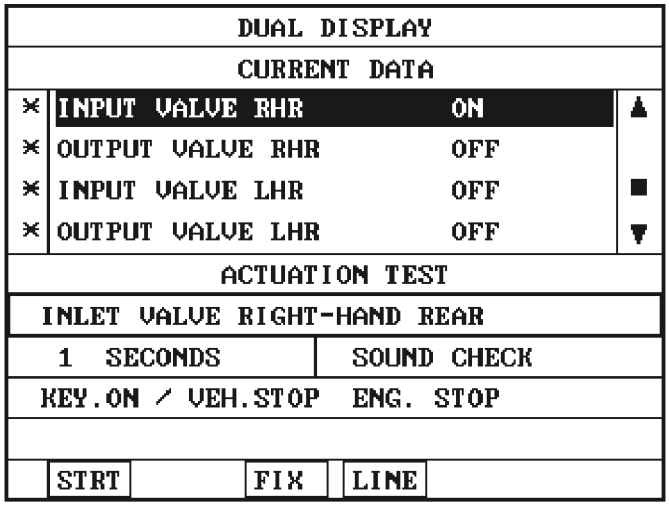
Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system.Air gap : 0.2 ~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect the scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Select the data "Actuation test".
4. Check the right hand rear inlet valve for operation when activating the actuator.

   ■ Specification: Normal if the activating sound is heard.





SUDWAB9022L

Fig1) Right hand rear inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

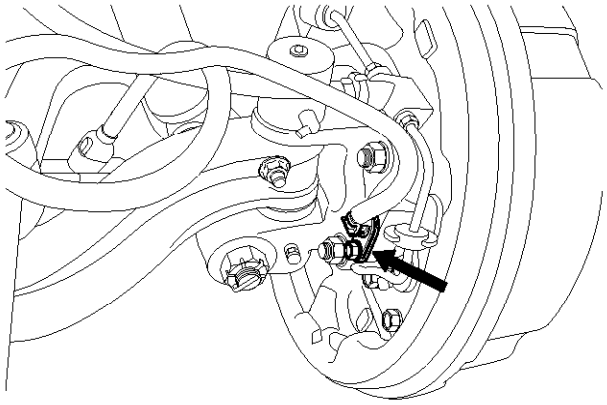
▶ Go to the applicable DTC procedure.

NO

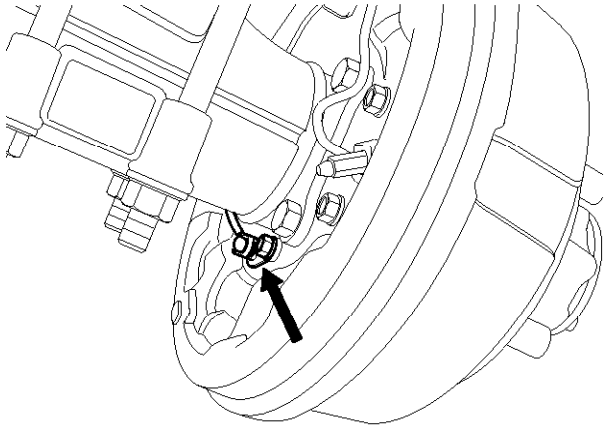
▶ System OK

0054 Pole Wheel Right Hand Front(Cyclic Failure)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

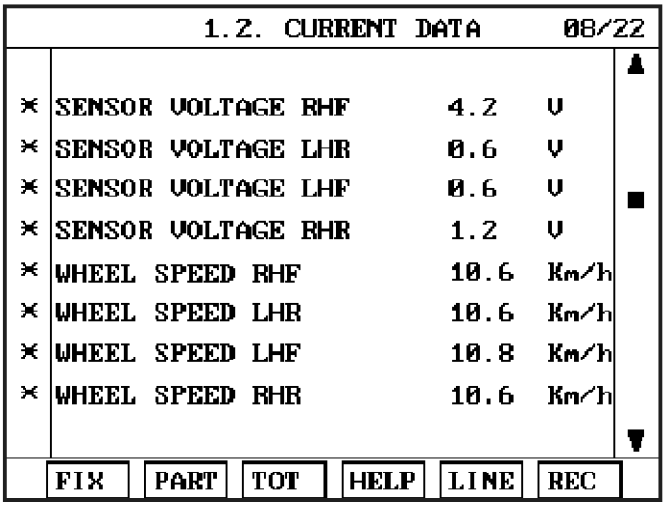
SPECIFICATION

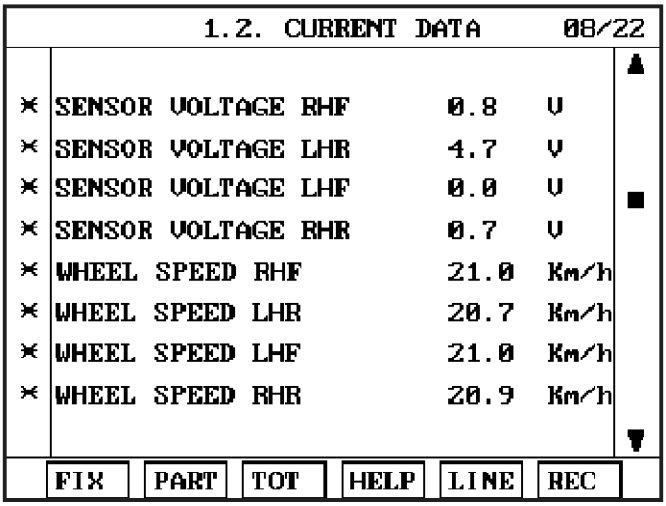
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand front tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

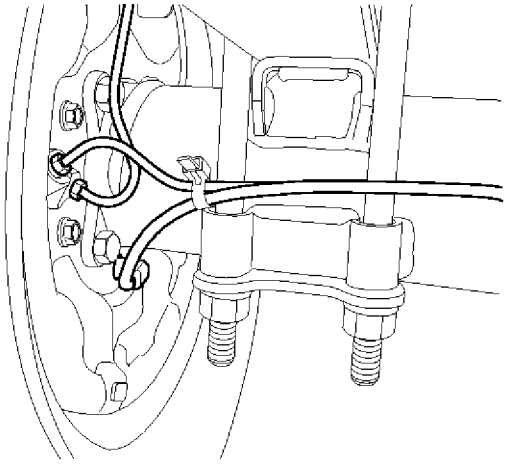
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0055 Pole Wheel Left Hand Rear(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

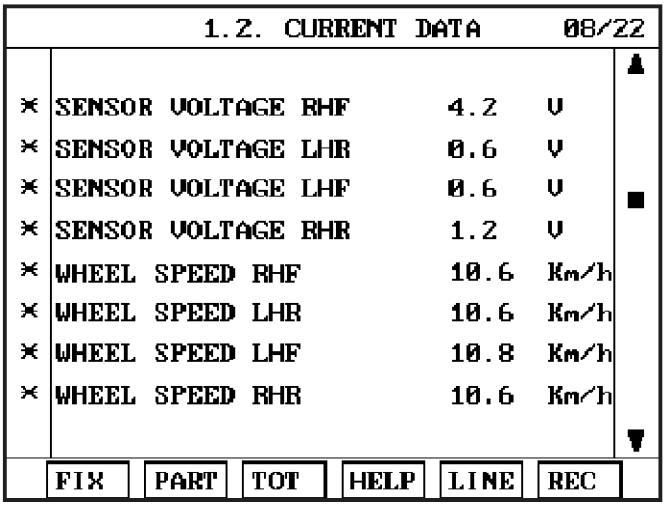
SPECIFICATION

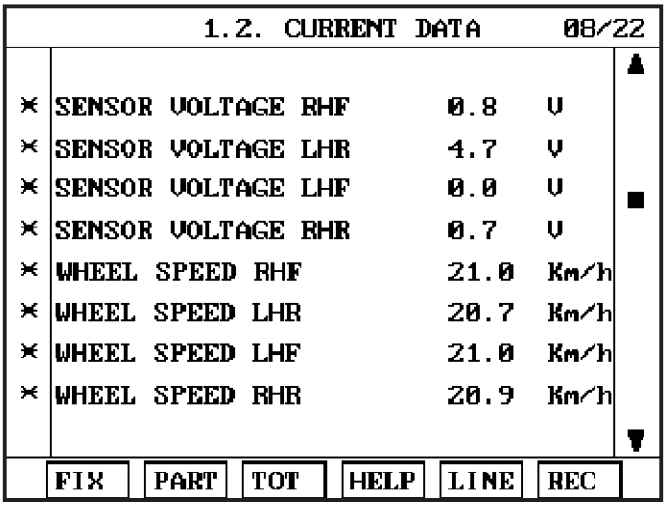
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand rear tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

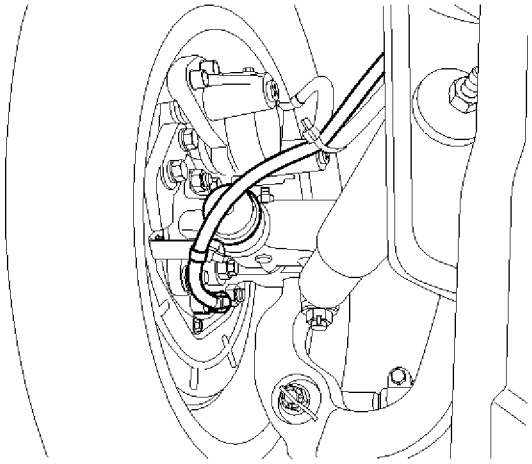
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0056 Pole Wheel Left Hand Front(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

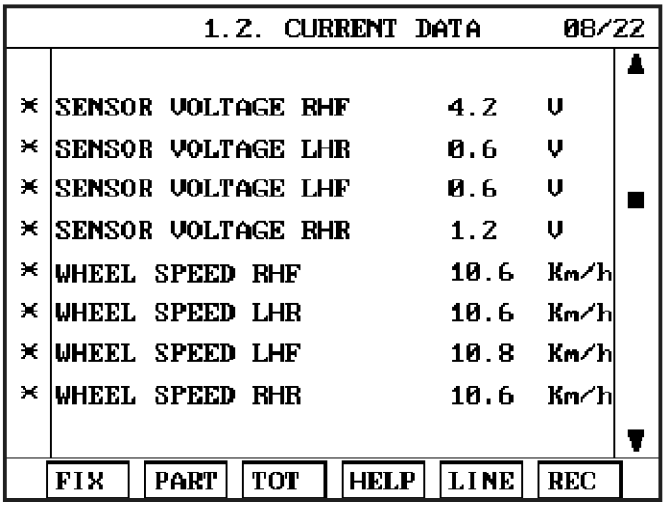
SPECIFICATION

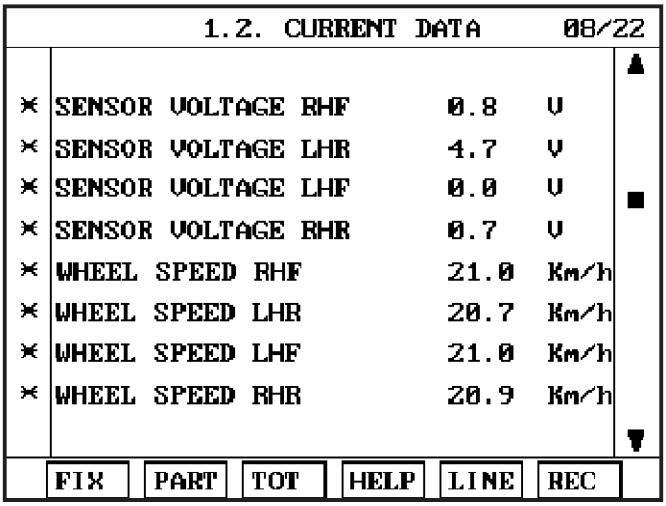
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand front tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand front tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

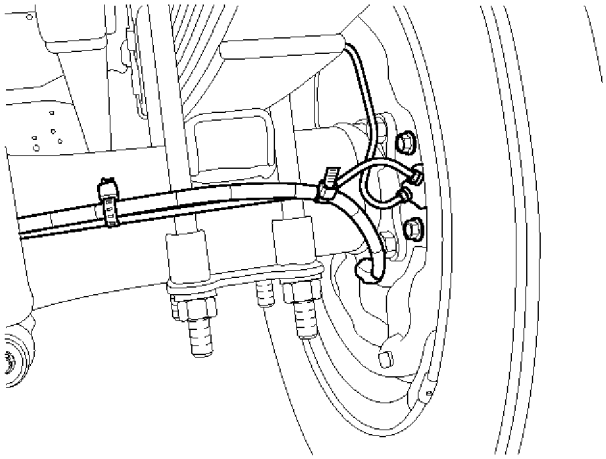
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0057 Pole Wheel Right Hand Rear(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2~1.7 mm			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

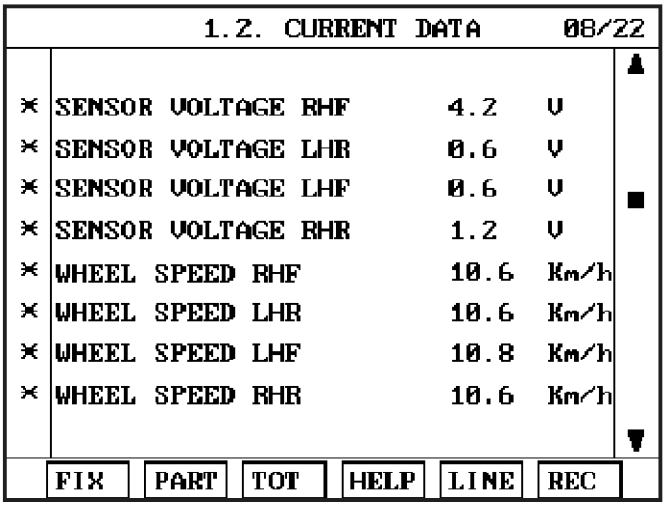
SPECIFICATION

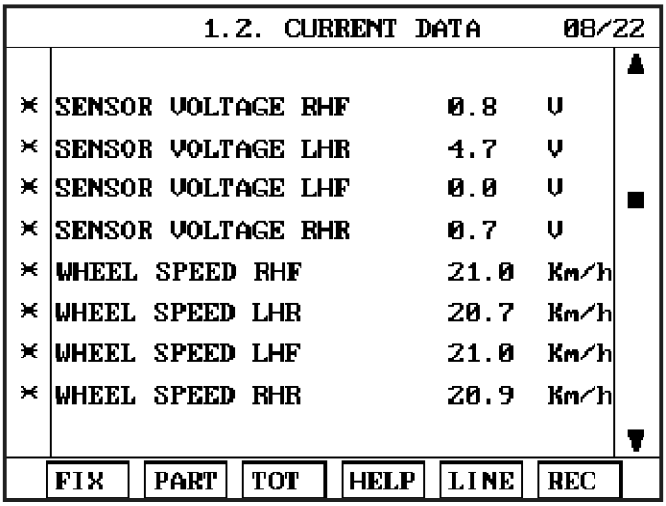
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand rear tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand rear tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

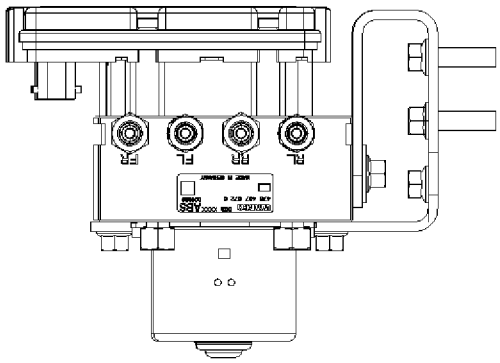
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0058 Clamp Transistor Failure

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

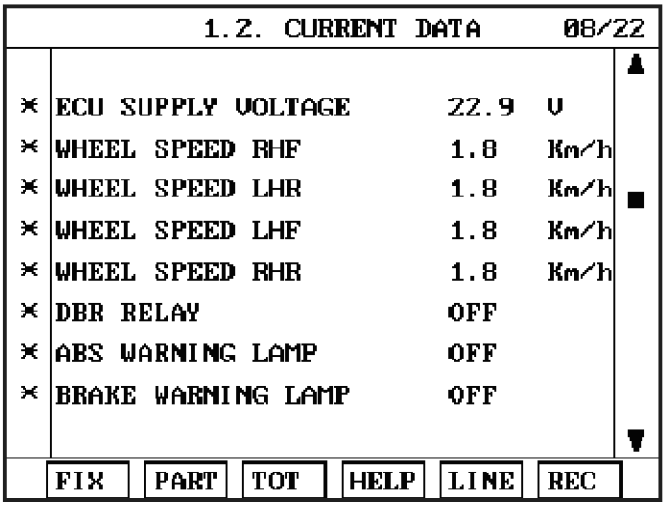
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

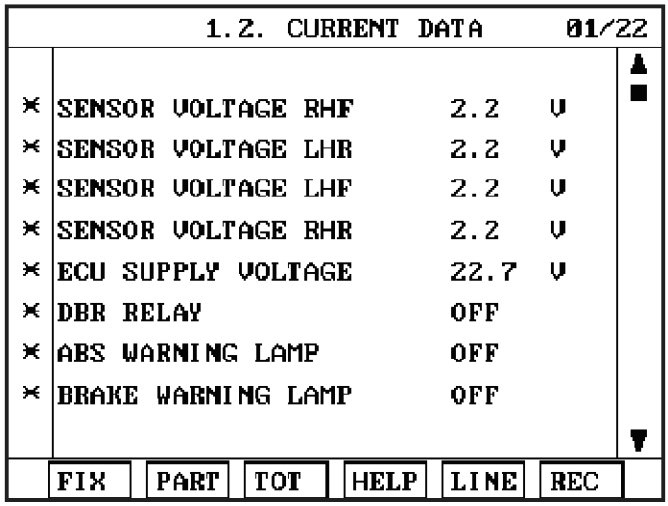
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

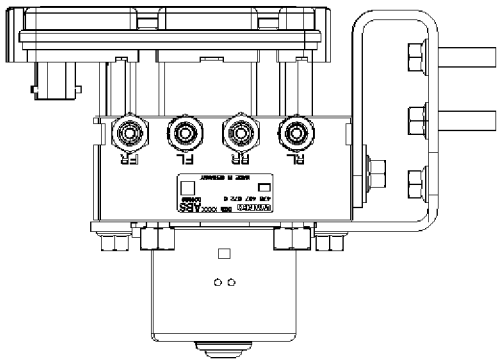
▶ Go to the applicable DTC procedure.

NO

▶ System OK

0059 Pull Up Down Failure

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and a failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

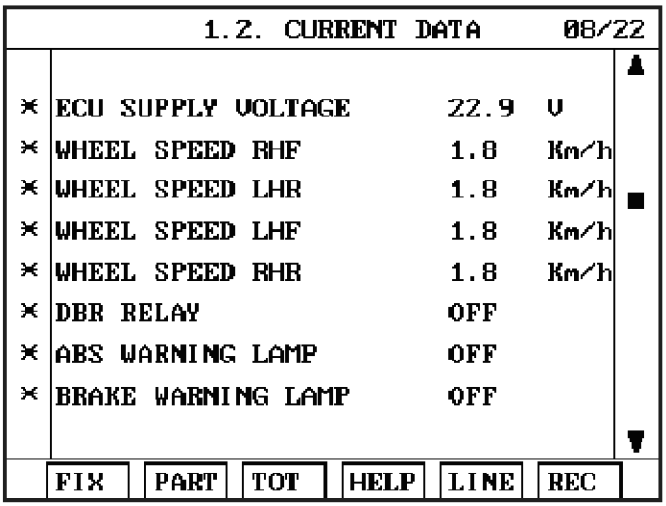
HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

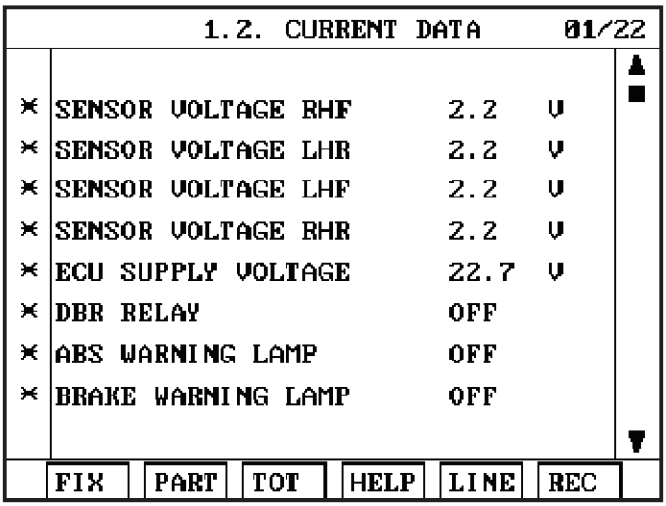
DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Replace ECU.
Enable Conditions	Ignition ON			
Threshold Value	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS disabled	
	Fuel Limit	Yes		
	MIL	Yes		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.
2. Turn the ignition ON.
3. Monitor the service data on the scan tool.





SUDWAB9007L

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

   YES

   ▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

   NO

   ▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

1. Start the engine.
2. Drive the vehicle with approx. 15km/h or higher.
3. Turn the ignition ON. Leave the engine OFF.
4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to “Verification of Vehicle Repair” procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

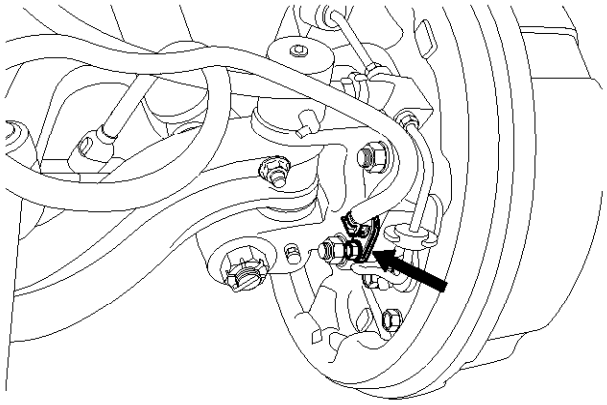
▶ Go to the applicable DTC procedure.

NO

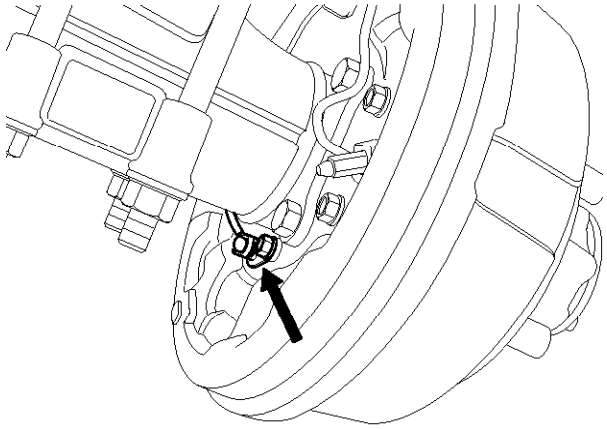
▶ System OK

005A Sensor Right Hand Front(Signal Disturbed)

COMPONENT LOCATION



Front wheel speed sensor



Rear wheel speed sensor

SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the front right wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

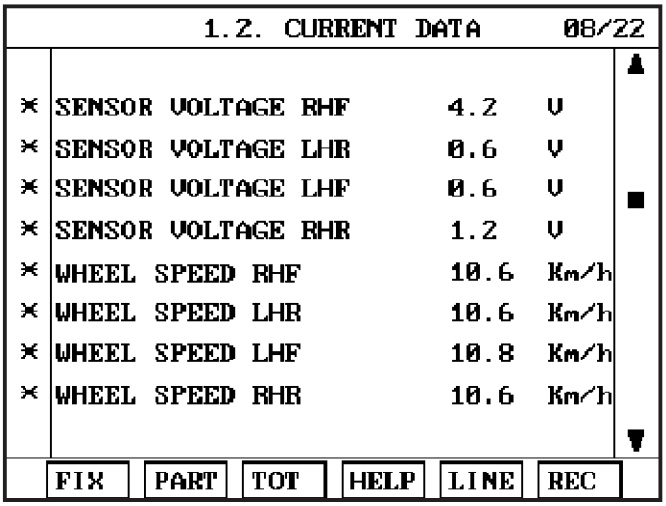
SPECIFICATION

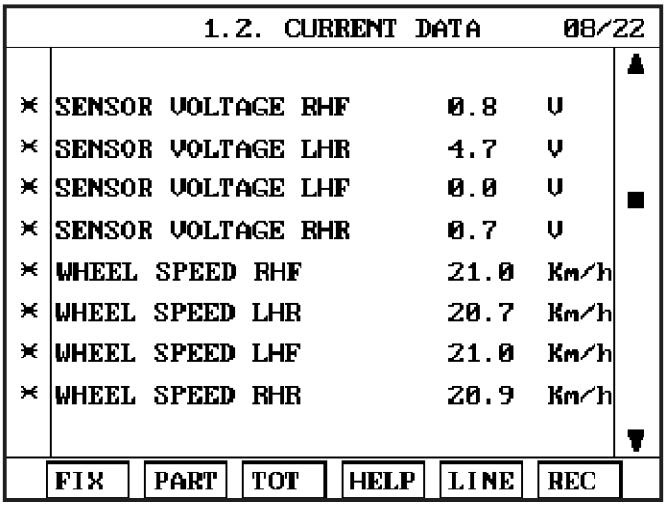
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand front tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the right hand front brake.
3. Is the condition of the brake normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of the vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

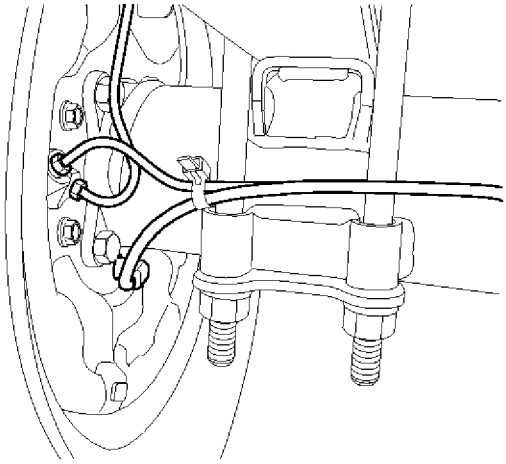
▶ Go to the applicable DTC procedure.

NO

▶ System OK

005B Sensor Left Hand Rear(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the rear left wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

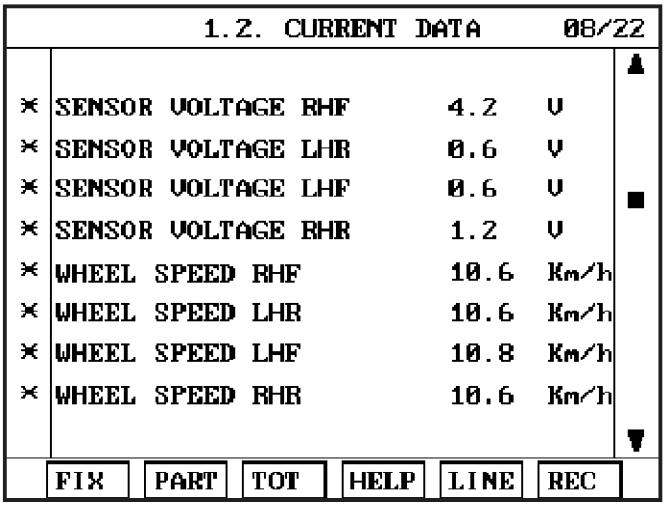
SPECIFICATION

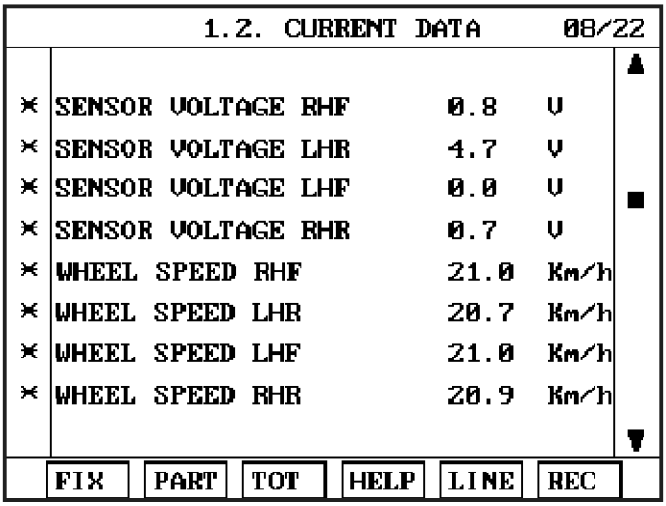
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand rear tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the left hand rear brake.
3. Is the condition of the brake normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of the vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

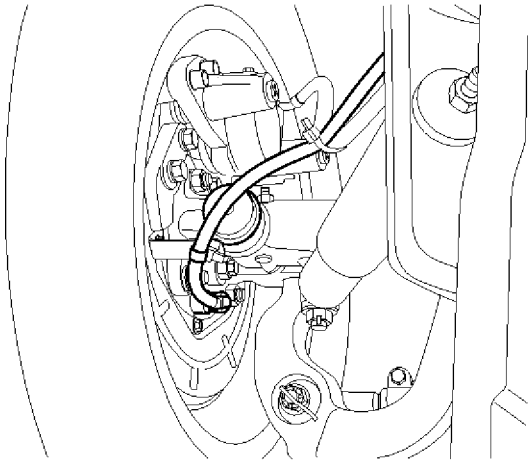
▶ Go to the applicable DTC procedure.

NO

▶ System OK

005C Sensor Left Hand Front(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the front left wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel	
	Fuel Limit	Yes		
	MIL	Yes		

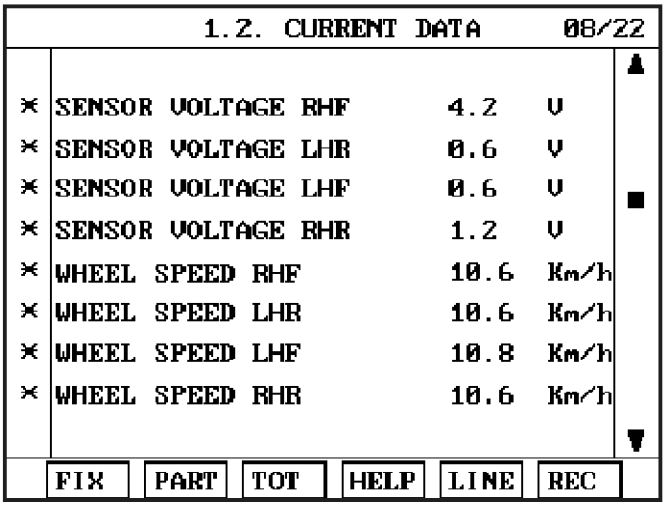
SPECIFICATION

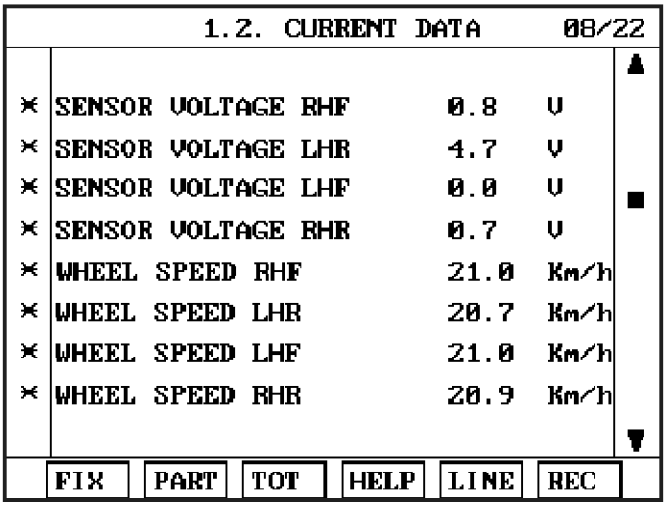
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed LHF" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to “Terminal & Connector Inspection” procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to “Verification of Vehicle Repair” procedure.

NO

▶ Go to “Signal Circuit Inspection” procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between left hand front tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair” procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair” procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on left hand front tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the left hand front brake.
3. Is the condition of the brake normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of the vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

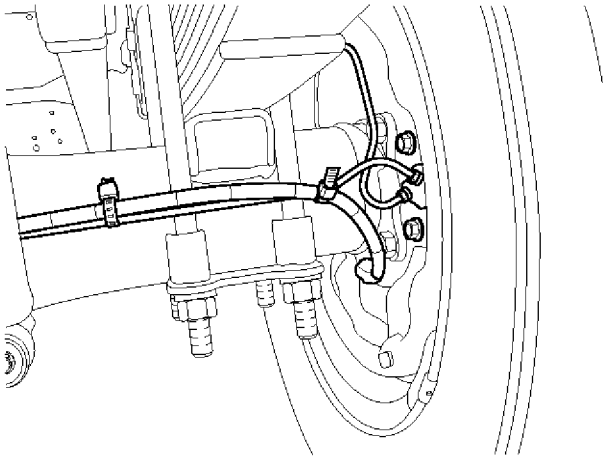
▶ Go to the applicable DTC procedure.

NO

▶ System OK

005D Sensor Right Hand Rear(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the rear right wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			• Check air gap. • Check bearing play and tone ring run out. • Check tone ring for damage. • Brake chatter.
Enable Conditions	Ignition ON			
Threshold Value	.Vehicle speed > 5.0 kph			
Diagnosis Time	Below 1,000 ms			
Fail Safe	Fuel Cut	No	• ABS function temporarily disabled for concerned wheel.	
	Fuel Limit	Yes		
	MIL	Yes		

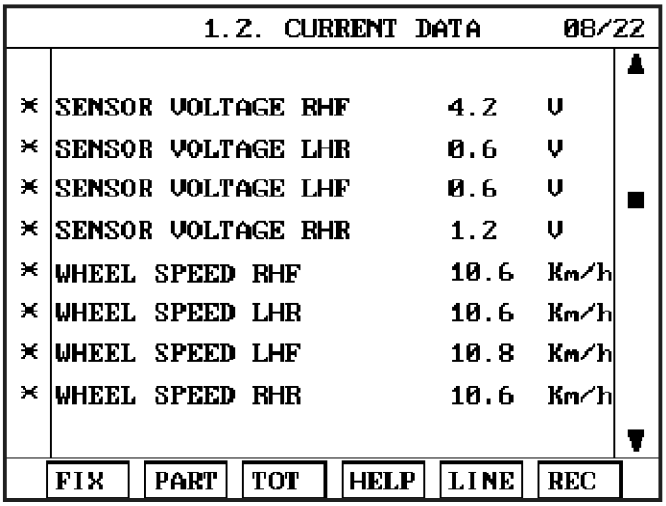
SPECIFICATION

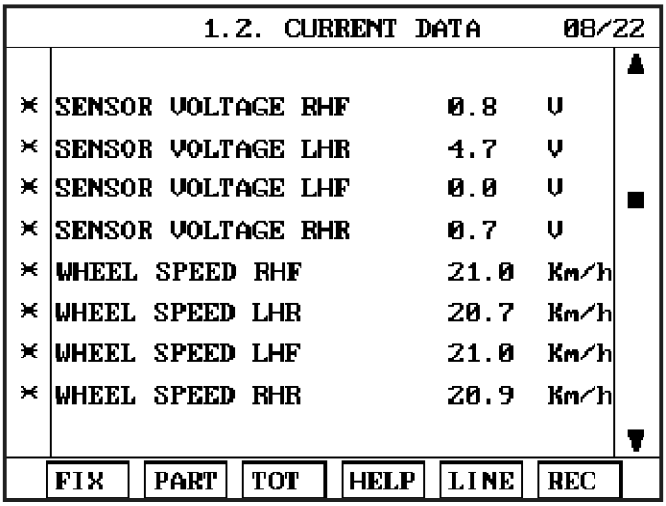
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

1. Start the engine.
2. Connect the scan tool to the self-diagnosis connector. Select the service data.
3. Drive the vehicle straight at a constant speed in the normal road surface.
4. Monitor the data "Wheel speed RHR" parameter on the scan tool.

   ■ Specification: Normal if its speed is nearly in accordance with the speed in the gauge.





SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

▶ Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Terminal & Connector Inspection" procedure.

TERMINAL & 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, bent, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

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

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

1. Turn the ignition OFF.
2. Check the air gap between right hand rear tone wheel and wheel sensor with a thickness gauge.

   ■ Specification: 0.2~1.7 mm
3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.

▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

1. Turn the ignition OFF.
2. Check the number of teeth on right hand rear tone ring.
3. Is the number of teeth normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of vehicle.

▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

1. Turn the ignition OFF.
2. Check the pad and drum of the right hand rear brake.
3. Is the condition of the brake normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair it or replace with known-good one and check the condition of the vehicle.

▶ If normal, replace with new one. 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 the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
3. Drive the vehicle under conditions noted in failure records.
4. Check that there are any DTCs by performing self diagnosis with the scan tool.
5. Did the DTC return?

YES

▶ Go to the applicable DTC procedure.

NO

▶ System OK